

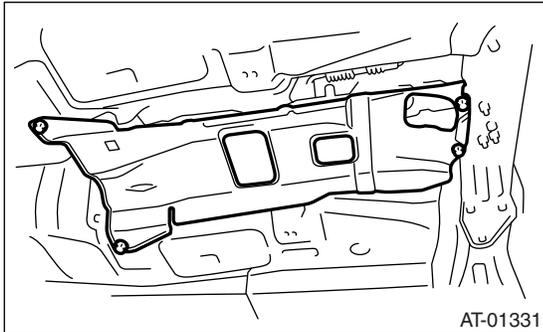
Rear Differential (VA-type)

DIFFERENTIALS

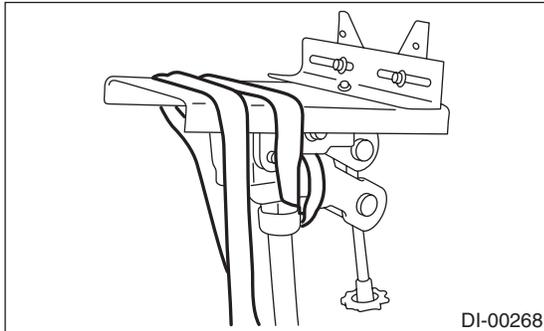
5. Rear Differential (VA-type)

A: REMOVAL

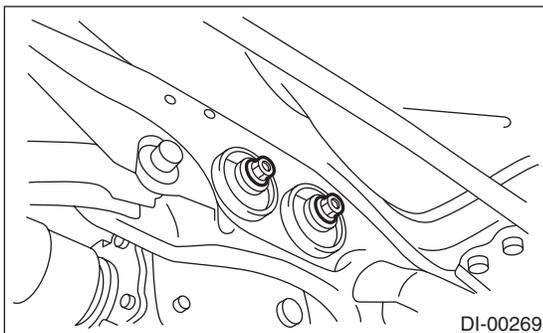
- 1) Disconnect the ground cable from battery.
- 2) Move the select lever or gear shift lever to neutral.
- 3) Loosen the wheel nuts.
- 4) Release the parking brake.
- 5) Jack-up the vehicle and support it with rigid racks.
- 6) Remove the rear wheels.
- 7) Remove the rear exhaust pipe and muffler.
- 8) Remove the heat shield cover.



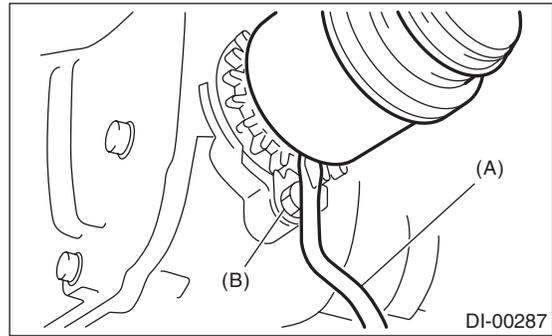
- 9) Remove the propeller shaft.
<Ref. to DS-10, REMOVAL, Propeller Shaft.>
- 10) Prepare the transmission jack and band.



- 11) Loosen the self-locking nuts which hold the rear differential to rear crossmember.

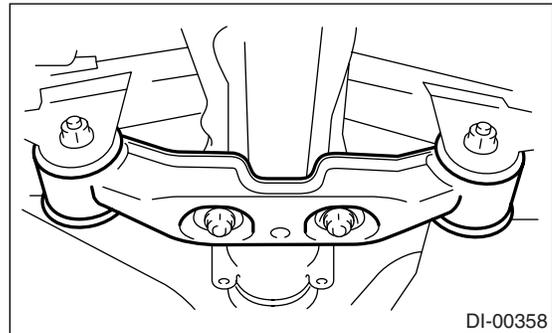


- 12) Remove the DOJ of rear drive shaft from rear differential.

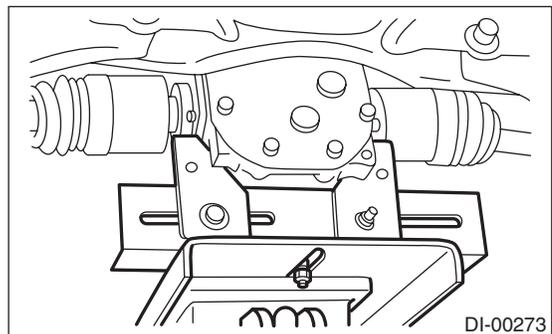


- (A) Tire lever
(B) Bolt

- 13) Remove the nuts which hold the rear differential front member.



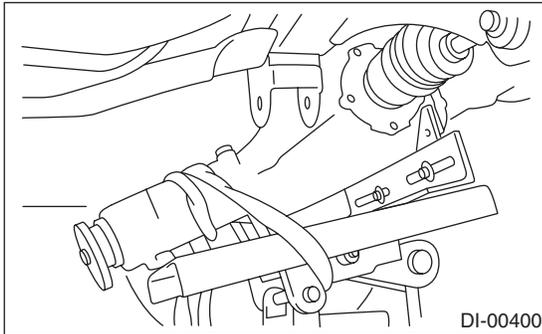
- 14) Support the rear differential with transmission jack.



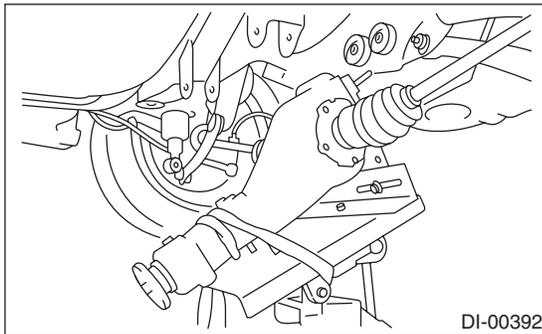
- 15) Remove the rear differential front member.
- 16) Secure the rear differential using band.
- 17) Remove the self-locking nuts which hold the rear differential to rear crossmember.
- 18) Remove the rear differential stud bolt from rear crossmember bushing.

NOTE:

When removing the stud bolt, carefully adjust the angle and location of transmission jack and jack stand, if necessary.



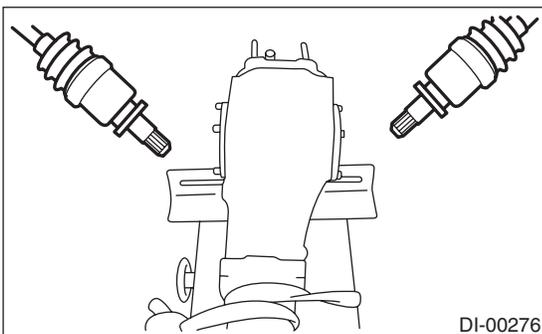
19) Lower the transmission jack stand after removing the rear differential stud bolt from rear cross-member. Rear drive shaft should not come into contact with lateral link bolt.



20) Pull out the axle shaft from rear differential.

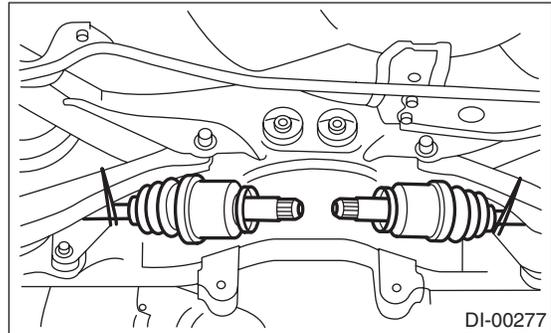
NOTE:

If it is difficult to remove the axle shaft from rear differential, remove it using tire lever.

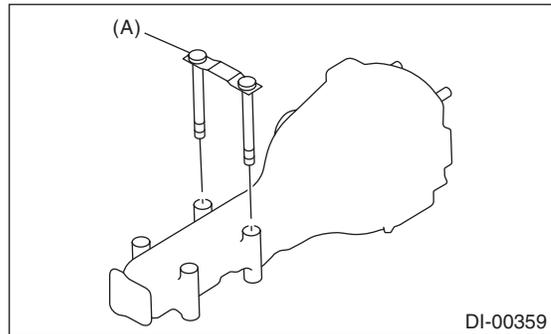


21) Lower the transmission jack.

22) Secure the rear drive shaft to lateral link using wire.



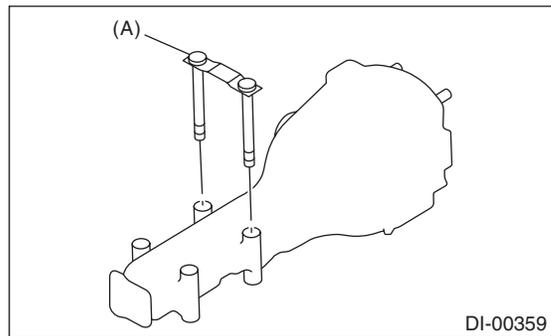
23) Remove the rear differential member plate from rear differential.



(A) Rear differential member plate

B: INSTALLATION

1) Insert the rear differential member plate into rear differential.



(A) Rear differential member plate

2) Set the rear differential to transmission jack.

NOTE:

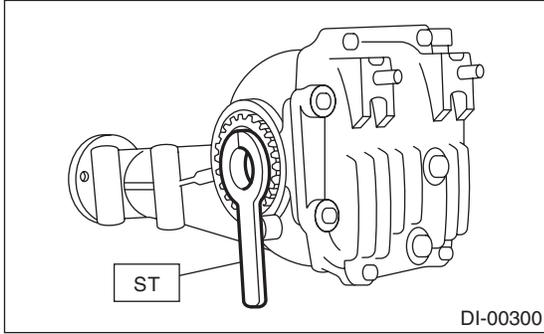
Secure the rear differential to transmission jack using band.

3) Install the ST to rear differential.

Rear Differential (VA-type)

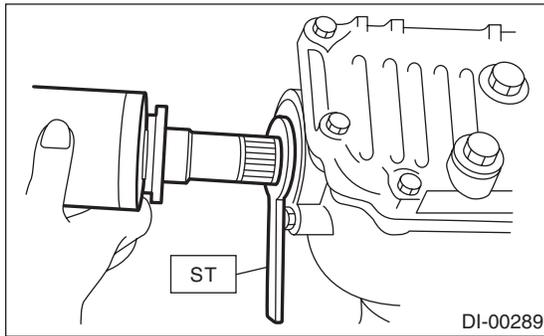
DIFFERENTIALS

ST 28099PA090 OIL SEAL PROTECTOR



4) Insert the spline shaft until the spline portion comes inside the side oil seal.

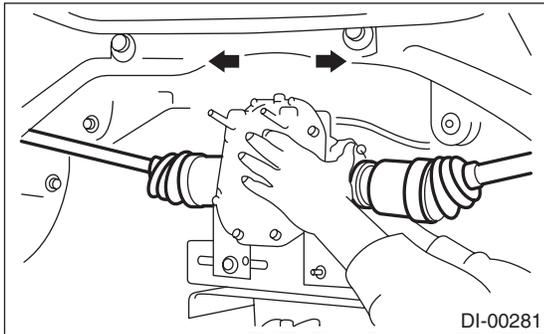
ST 28099PA090 OIL SEAL PROTECTOR



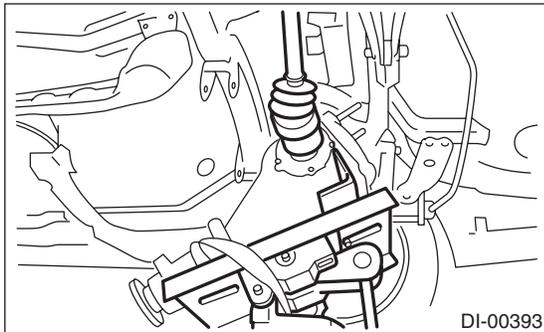
5) Remove ST from rear differential.

ST 28099PA090 OIL SEAL PROTECTOR

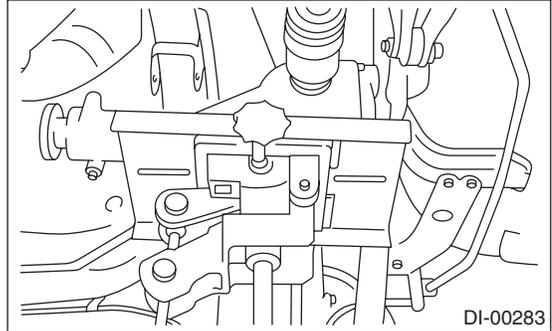
6) Push the rear differential to insert the axle shaft into rear differential.



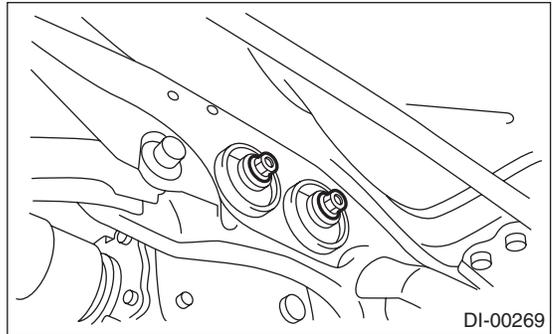
7) Adjust the transmission jack, if necessary, and insert the rear differential stud bolt into rear cross-member bushing properly.



8) After inserting the rear differential stud bolt into rear crossmember bushing, lift up the transmission jack and align the rear differential to the height of rear differential.



9) Tighten a new self-locking nut temporarily to rear crossmember.



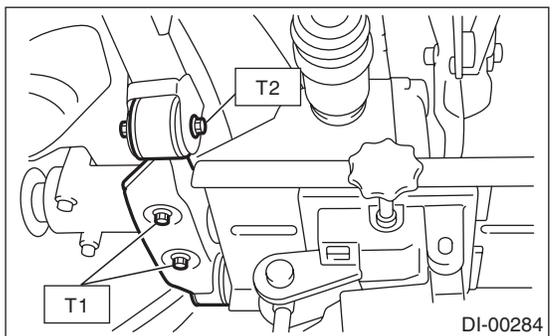
10) Remove the band from rear differential. Lift up the rear differential until the rear differential is left from the transmission jack.

11) Install the rear differential front member with a new self-locking nut.

Tightening torque:

T1: 65 N·m (6.6 kgf-m, 48 ft-lb)

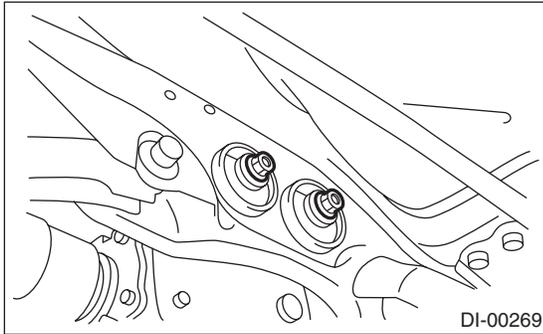
T2: 110 N·m (11.2 kgf-m, 81 ft-lb)



12) Tighten the self-locking nut.

Tightening torque:

70 N·m (7.1 kgf-m, 51 ft-lb)



- 13) Lower the transmission jack.
- 14) Install the propeller shaft.
<Ref. to DS-11, INSTALLATION, Propeller Shaft.>
- 15) Install the heat shield cover.
- 16) Install the rear exhaust pipe and muffler.

C: DISASSEMBLY

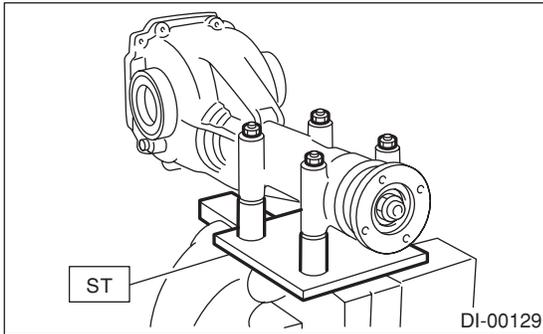
1. VA1-TYPE

To detect the real cause of trouble, inspect the following items before disassembling.

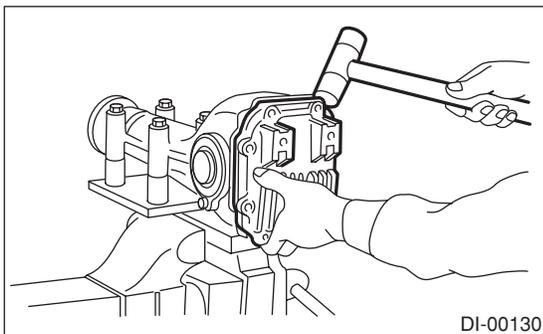
- Tooth contact and backlash between hypoid driven gear and drive pinion
- Hypoid driven gear runout on its back surface
- Total preload of drive pinion

1) Set the ST on vise and install the differential assembly to ST.

ST 398217700 ATTACHMENT



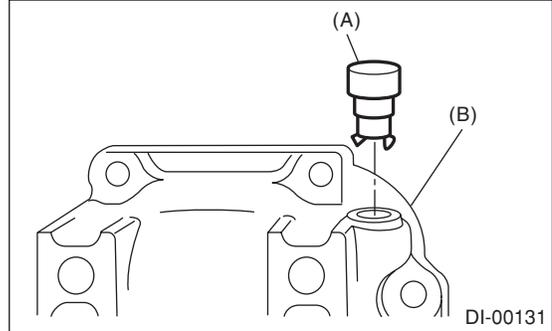
- 2) Drain the gear oil by removing plug.
- 3) Remove the rear cover by loosening retaining bolts.



4) Remove the air breather cap.

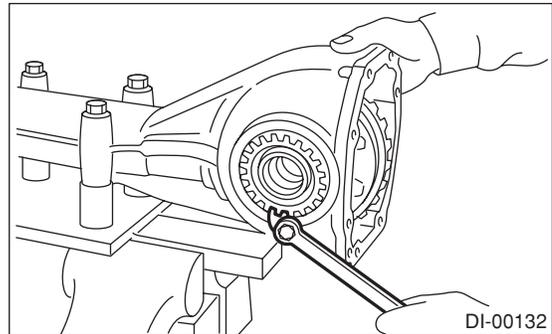
NOTE:

- Do not attempt to remove the air breather cap unless necessary.
- When removing the air breather cap, replace it with a new one.

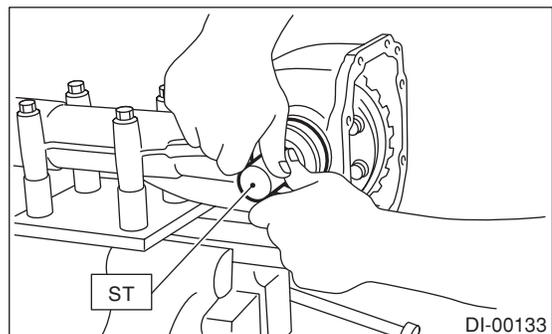


- (A) Air breather cap
- (B) Rear cover

5) Remove the lock plate RH and LH.



6) Remove the holder RH and LH with ST.
ST 499785500 WRENCH ASSY



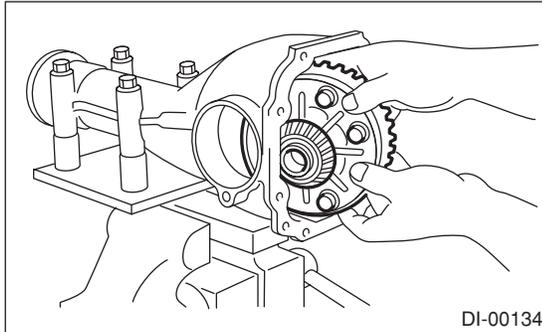
7) Pull out the differential case assembly from differential carrier.

Rear Differential (VA-type)

DIFFERENTIALS

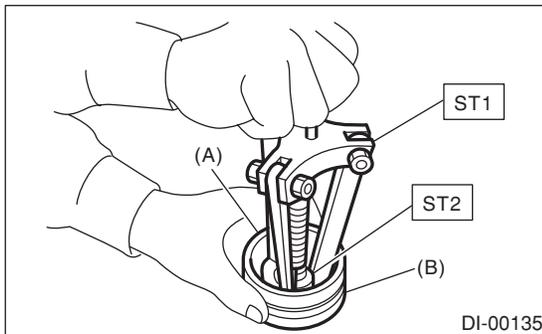
NOTE:

Be careful not to hit the teeth against the case.



8) Remove the bearing race from holder RH and LH with ST1 and ST2.

ST1 499705401 PULLER ASSY
ST2 499705404 SEAT

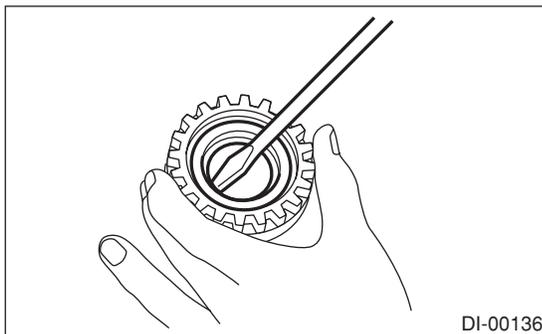


- (A) Bearing race
- (B) Holder

9) Remove the oil seal from holder RH and LH using screwdriver.

NOTE:

Perform this operation only when changing oil seal.

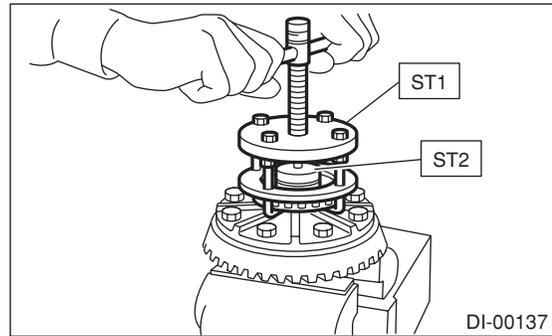


10) Extract the bearing cone with ST1 and ST2.

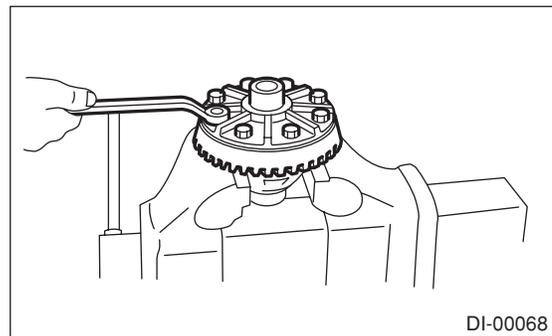
NOTE:

- Do not attempt to disassemble the parts unless necessary.
- Set the puller so that its claws catch the edge of the bearing cone.
- Never mix up the bearing races RH and LH and cones.

ST1 899524100 PULLER SET
ST2 399520105 SEAT



11) Remove the hypoid driven gear by loosening hypoid driven gear bolts.

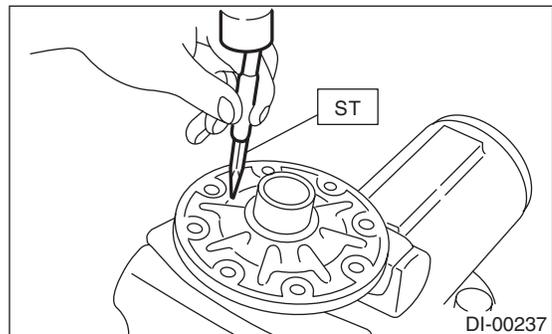


12) Drive out the pinion shaft lock pin from hypoid driven gear side.

NOTE:

The lock pin is staked at the pin hole end on the differential case. do not drive it out forcibly before unstaking it.

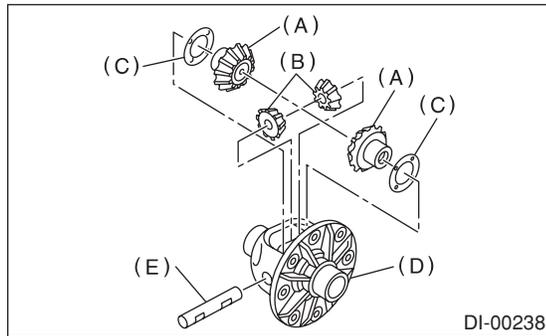
ST 899904100 STRAIGHT PIN REMOVER



13) Draw out the pinion mate shaft and remove pinion mate gears, side gears and thrust washers.

NOTE:

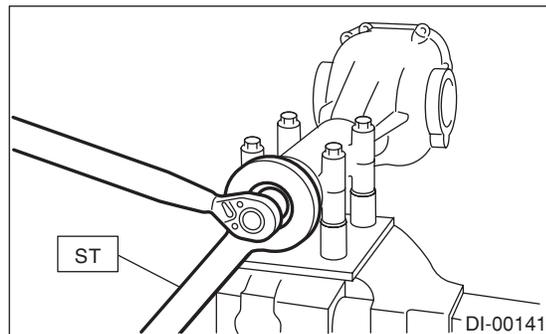
The gears should be marked or kept separated RH and LH, and front and rear as well as thrust washers.



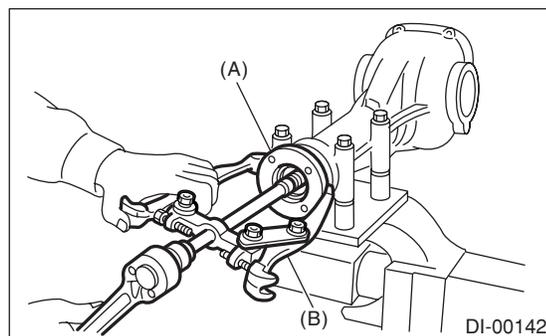
- (A) Side gear
- (B) Pinion mate gear
- (C) Thrust washer
- (D) Differential case
- (E) Pinion mate shaft

14) Support the companion flange with ST and remove self-locking nut.

ST 498427200 FLANGE WRENCH



15) Extract the companion flange with a puller.



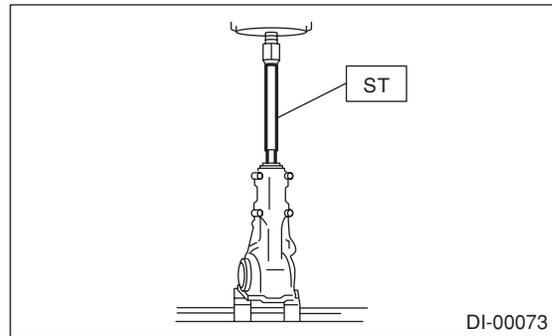
- (A) Companion flange
- (B) Puller

16) Press the end of drive pinion shaft and extract it together with rear bearing cone, pinion height adjusting washer and washer.

NOTE:

Hold the drive pinion so as not to drop it.

ST 398467700 DRIFT

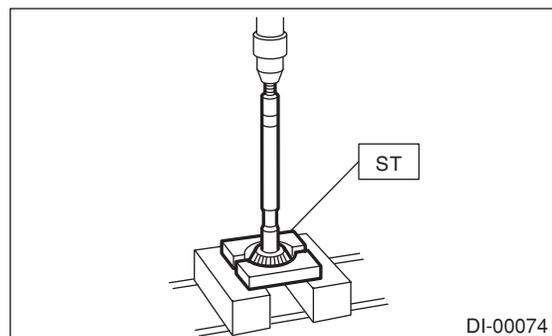


17) Remove the rear bearing cone from drive pinion by supporting the cone with ST.

NOTE:

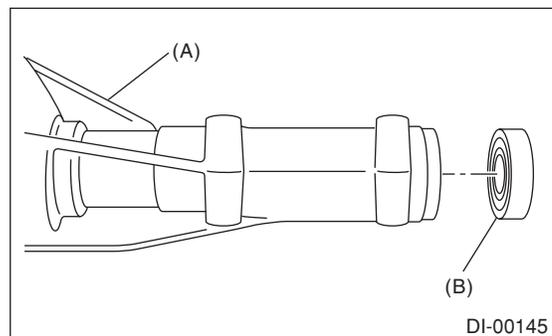
Place the replacer so that its center-recessed side faces the pinion gear.

ST 498515500 REPLACER



18) Remove the front oil seal from differential carrier using ST.

ST 398527700 PULLER SET



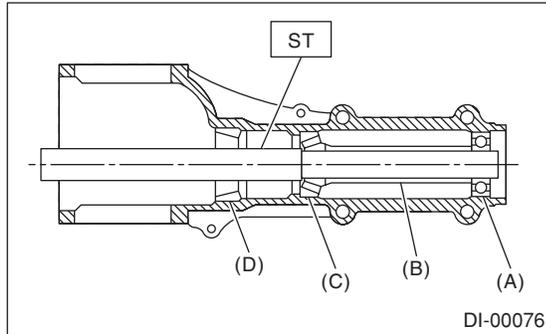
- (A) Differential carrier
- (B) Front oil seal

19) Remove the pilot bearing together with front bearing cone and collar using ST.

Rear Differential (VA-type)

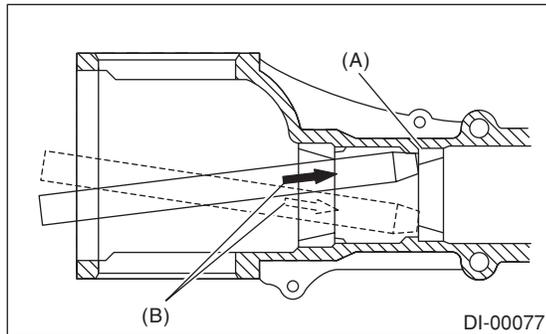
DIFFERENTIALS

ST 398467700 DRIFT



- (A) Pilot bearing
- (B) Collar
- (C) Front bearing
- (D) Rear bearing cup

20) When replacing the bearings, hit out the front bearing cup and rear bearing cup in this order out of case by using a brass bar.



- (A) 2 cutouts along diagonal lines
- (B) Hit out alternately with brass bar

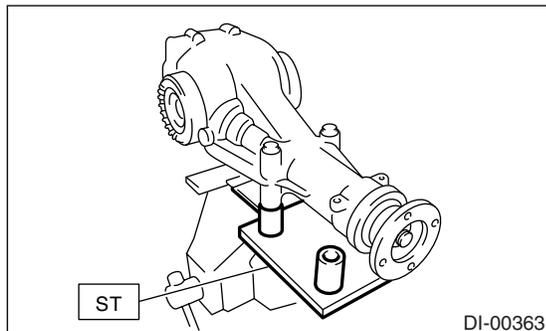
2. VA2-TYPE

To detect the real cause of trouble, inspect the following items before disassembling.

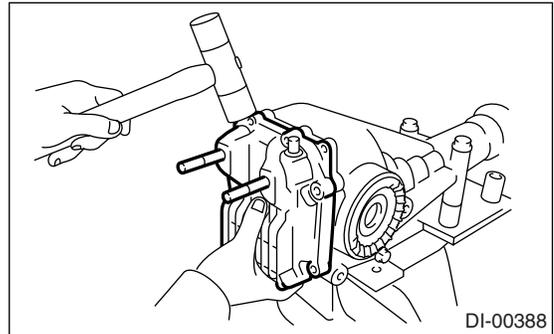
- Tooth contact and backlash between hypoid driven gear and drive pinion
- Hypoid driven gear runout on its back surface
- Total preload of drive pinion

1) Set the ST on vise and install the differential assembly to ST.

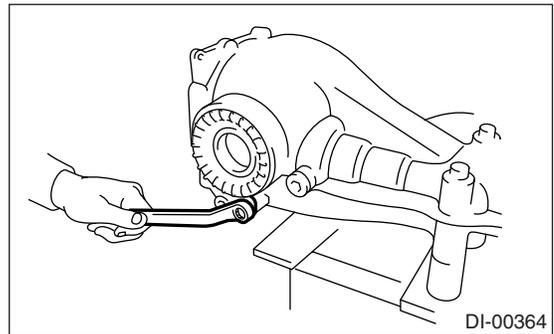
ST 398217700 ATTACHMENT



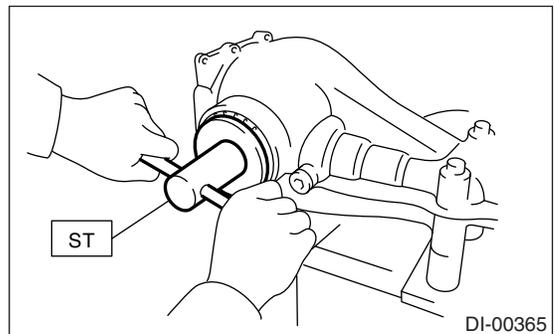
- 2) Drain the gear oil by removing plug.
- 3) Remove the rear cover by loosening retaining bolts.



- 4) Remove the lock plate RH and LH.



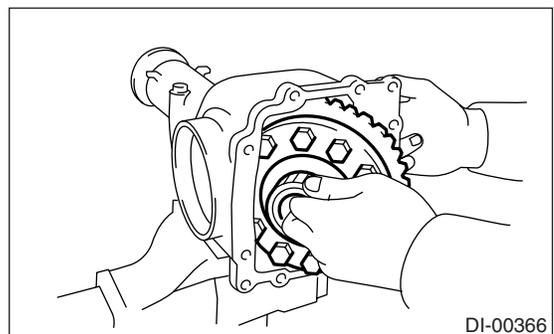
- 5) Remove the holder RH and LH with ST.
- ST 18630AA010 WRENCH



- 6) Pull out the differential case assembly from differential carrier.

NOTE:

Be careful not to hit the teeth against the case.

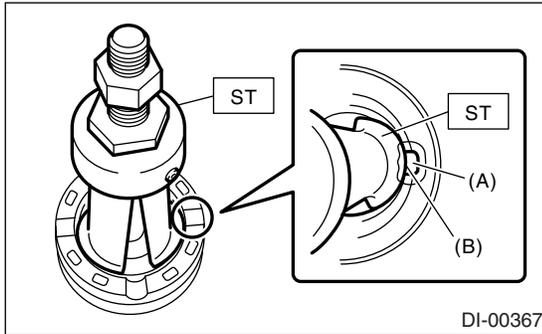


7) Remove the bearing race from holder RH and LH with ST1 and press.

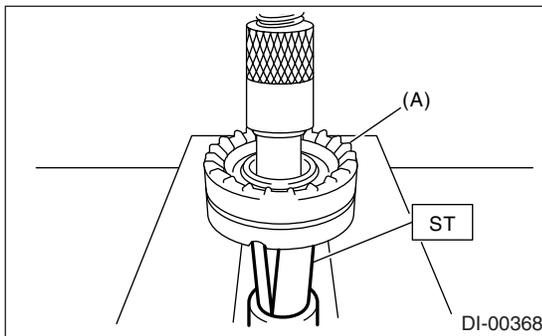
ST 18758AA000 PULLER

NOTE:

- Make sure the bolt of puller turn manually.
- Set the puller so that its claws catch the groove of holder.



- (A) Groove
- (B) Claw

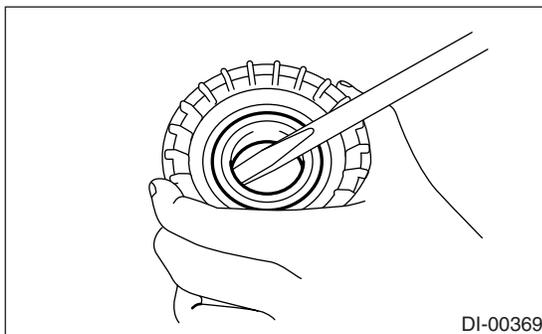


- (A) Holder

8) Remove the oil seal from holder RH and LH using screwdriver.

NOTE:

Perform this operation only when changing oil seal.



9) Extract the bearing cone with ST1, ST2 and ST3.

NOTE:

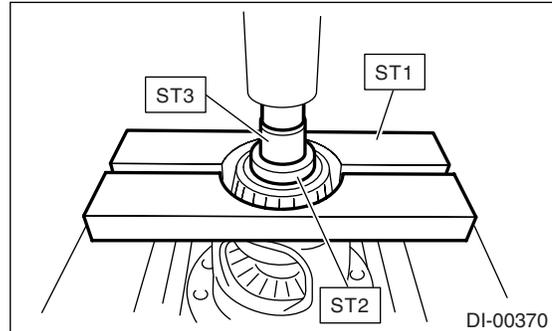
- Do not attempt to disassemble the parts unless necessary.

- Never mix up the bearing races RH and LH and cones.

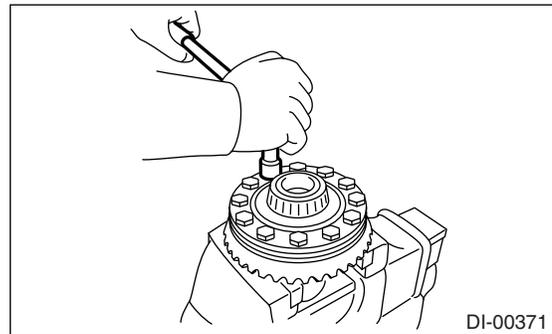
ST1 498077000 REMOVER

ST2 399520105 SEAT

ST3 899864100 REMOVER

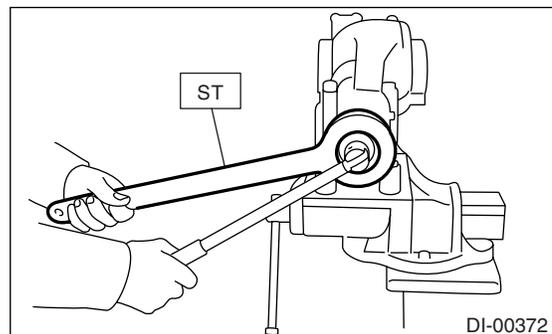


10) Remove the hypoid driven gear by loosening hypoid driven gear bolts.



11) Support the companion flange with ST and remove self-locking nut.

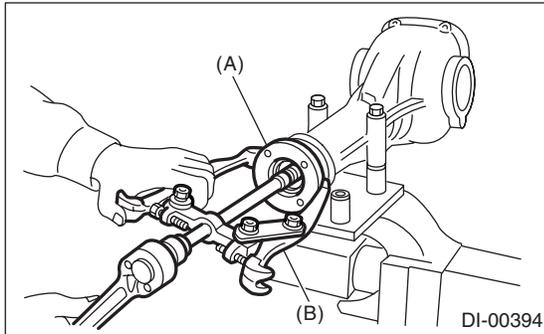
ST 498427200 FLANGE WRENCH



Rear Differential (VA-type)

DIFFERENTIALS

12) Extract the companion flange with a puller.



(A) Companion flange
(B) Puller

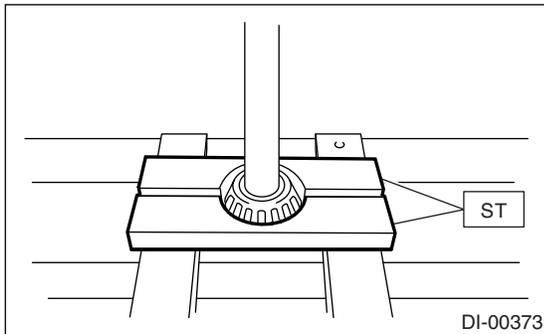
13) Removes the drive pinion shaft.

14) Remove the rear bearing cone from drive pinion by supporting cone with ST.

NOTE:

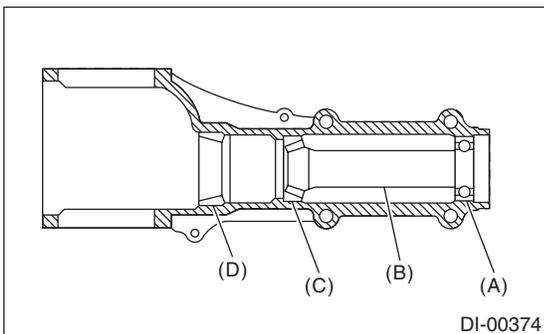
Place the replacer so that its center-recessed side faces the pinion gear.

ST 398517700 REPLACER



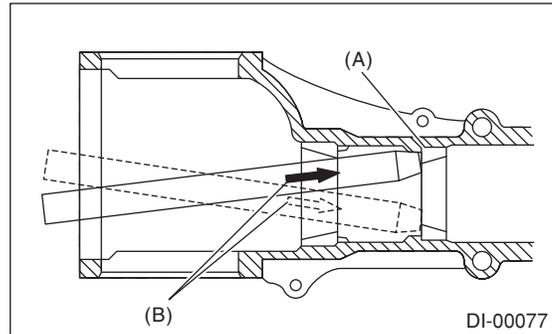
15) Remove the front oil seal from differential carrier using screwdriver.

16) Remove the pilot bearing, front bearing cone and collar.



(A) Pilot bearing
(B) Collar
(C) Front bearing
(D) Rear bearing cup

17) When replacing the bearings, hit out the front bearing cup and rear bearing cup in this order out of case by using a brass bar.



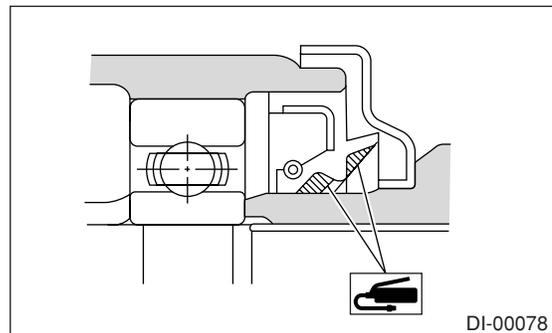
(A) 2 cutouts along diagonal lines
(B) Hit out alternately with brass bar

D: ASSEMBLY

1. VA1-TYPE

NOTE:

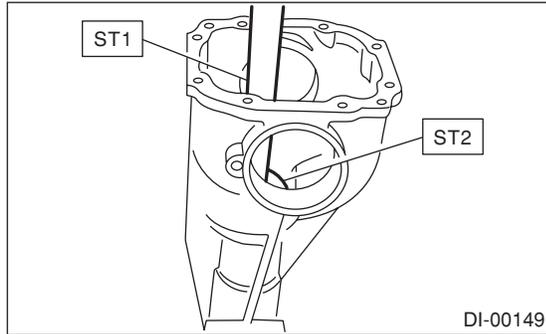
- Assemble in the reverse order of disassembly.
- Check and adjust each part during assembly.
- Use a new gasket.
- Keep the shims and washers in order, so that they are not improperly installed.
- Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
- Apply gear oil when installing the bearings and thrust washers.
- Be careful not to mix up the bearing races RH and LH.
- Replace the oil seal with a new one at every disassembly. Apply grease to the lips when installing the oil seal.
- Be careful not to mix up the differential oil seal RH and LH.



1) Adjusting preload for front and rear bearings: Adjust the bearing preload with collar and washer between front and rear bearings. Pinion height adjusting washer are not affected by this adjustment. The adjustment must be carried out without oil seal inserted.

(1) Install the rear bearing race into differential carrier with ST1 and ST2.

ST1 398477701 HANDLE
ST2 398477702 DRIFT



(2) Install the front bearing race to differential carrier using ST1 and ST2.

ST1 398477701 HANDLE
ST2 498447110 DRIFT

(3) Insert the front bearing cone.

NOTE:

Use new front bearing cone.

(4) Measure and record the thickness of pinion height adjusting washer.

NOTE:

If tooth contact (drive pinion, hypoid driven gear) is normal in the inspection before disassembling, verify that the washer is not deformed, and then re-use the used washer.

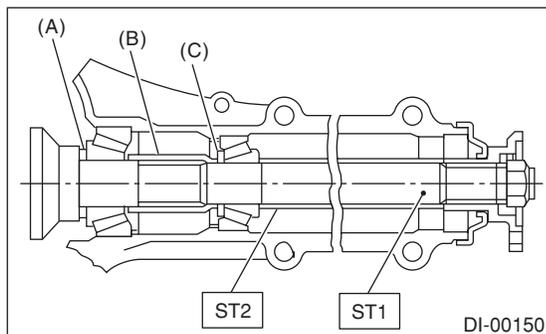
(5) Insert the ST1 into the case with pinion height adjusting washer and rear bearing cone fitted onto it.

NOTE:

Use new rear bearing cone.

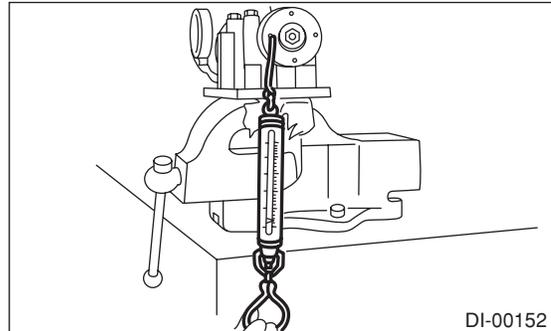
(6) Install the preload adjusting collar and washer, front bearing cone, ST2, companion flange, and washer and self-locking nut.

ST1 498447150 DUMMY SHAFT
ST2 32285AA000 DUMMY COLLAR



- (A) Pinion height adjusting washer
- (B) Preload adjusting collar
- (C) Preload adjusting washer

(7) Turn the ST1 with hand to make it seated, and tighten the self-locking nut while measuring the preload with spring balance. Select the preload adjusting washer and collar so that the specified preload is obtained when nut is tightened to the specified torque.



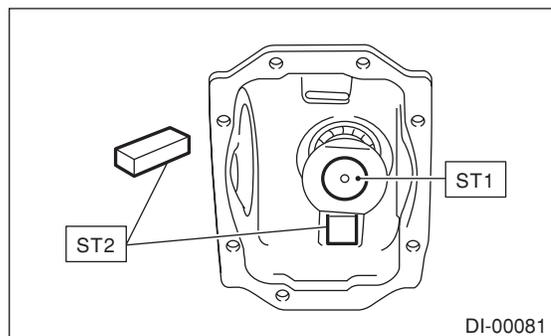
NOTE:

- Use a new self-locking nut.
- Be careful not to give excessive preload.
- When tightening the self-locking nut, lock ST1 with ST2 as shown in the figure.
- Measure the preload in direction of tangent to flange.

ST1 498447150 DUMMY SHAFT
ST2 398507704 BLOCK

Tightening torque:

191 N·m (19.5 kgf·m, 141 ft·lb)



Drive pinion bearing preload

For new bearing:
12.7 — 32.2 N (1.3 — 3.3 kgf, 2.9 — 7.3 lb)
Measure at companion flange bolt hole

Rear Differential (VA-type)

DIFFERENTIALS

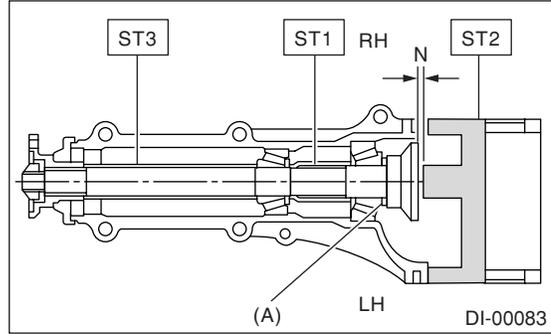
Preload adjusting washer	Part No.	Thickness mm (in)
	38336AA000	1.500 (0.0591)
	38336AA120	1.513 (0.0596)
	38336AA010	1.525 (0.0600)
	38336AA130	1.538 (0.0606)
	38336AA020	1.550 (0.0610)
	38336AA140	1.563 (0.0615)
	38336AA030	1.575 (0.0620)
	38336AA150	1.588 (0.0625)
	38336AA040	1.600 (0.0630)
	38336AA160	1.613 (0.0635)
	38336AA050	1.625 (0.0640)
	38336AA170	1.638 (0.0645)
	38336AA060	1.650 (0.0650)
	38336AA180	1.663 (0.0655)
	38336AA070	1.675 (0.0659)
	38336AA190	1.688 (0.0665)
	38336AA080	1.700 (0.0669)
	38336AA200	1.713 (0.0674)
	38336AA090	1.725 (0.0679)
38336AA210	1.738 (0.0684)	
38336AA100	1.750 (0.0689)	
38336AA220	1.763 (0.0694)	
38336AA110	1.775 (0.0699)	
Preload adjusting collar	Part No.	Length mm (in)
	32288AA040	52.3 (2.059)
	32288AA050	52.5 (2.067)
	31454AA100	52.6 (2.071)
	32288AA060	52.7 (2.075)
	31454AA110	52.8 (2.079)
	32288AA070	52.9 (2.083)
	31454AA120	53.0 (2.087)
	32288AA080	53.1 (2.091)
	32288AA090	53.3 (2.098)

2) Adjusting drive pinion height:
Adjust the drive pinion height with washer installed between the rear bearing cone and the back of pinion gear.

(1) Install the ST2.

ST1 498447150 DUMMY SHAFT
ST2 498505501 DIFFERENTIAL CARRIER GAUGE

ST3 32285AA000 DUMMY COLLAR



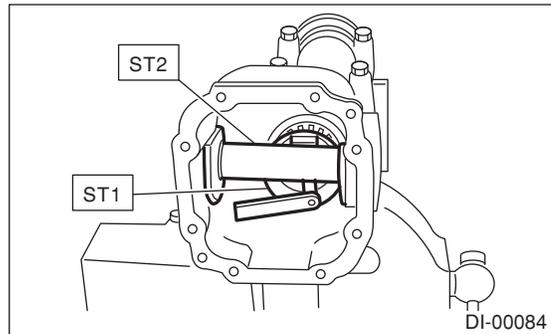
(A) Pinion height adjusting washer

(2) Measure the clearance N between the end of ST2 and the end surface of ST1 by using a thickness gauge.

NOTE:

Make sure there is no clearance between the case and ST2.

ST1 498447150 DUMMY SHAFT
ST2 498505501 DIFFERENTIAL CARRIER GAUGE



(3) Obtain the thickness of pinion height adjusting washer to be inserted from the following formula, and replace the temporarily installed washer with this one.

NOTE:

Adjust it using the 1 — 3 washers.

$$T = T_o + N - 0.05 \text{ mm (0.0020 in)}$$

T	Thickness of pinion height adjusting washer mm (in)	
T _o	Thickness of washer temporarily inserted mm (in)	
N	Clearance of thickness gauge mm (in)	
Memo:		

(Example of calculation)

$$T_o = 0.15 \text{ mm (0.0059 in)}$$

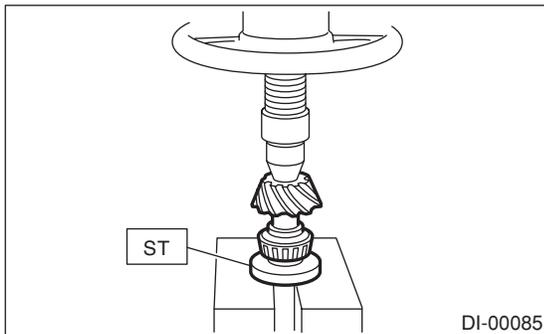
$$N = 0.1 \text{ mm (0.0039 in)}$$

$T = 0.15 \text{ mm (0.0059 in)} + 0.1 \text{ mm (0.0039 in)} - 0.05 \text{ mm (0.0020 in)} = 0.2 \text{ mm (0.0079 in)}$
 Result: Thickness = 0.2 mm (0.0079 in)
 Therefore use the pinion height adjusting washer of part number 32295AA220.

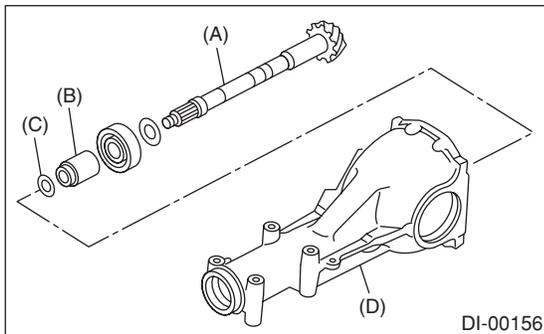
Pinion height adjusting washer	
Part No.	Thickness mm (in)
32295AA200	0.150 (0.0059)
32295AA210	0.175 (0.0069)
32295AA220	0.200 (0.0079)
32295AA230	0.225 (0.0089)
32295AA240	0.250 (0.0098)
32295AA250	0.275 (0.0108)

3) Install the selected pinion height adjusting washer on drive pinion, and press the rear bearing cone into position with ST.

ST 498175500 INSTALLER



4) Insert the drive pinion into differential carrier, install the selected bearing preload adjusting collar and washer.

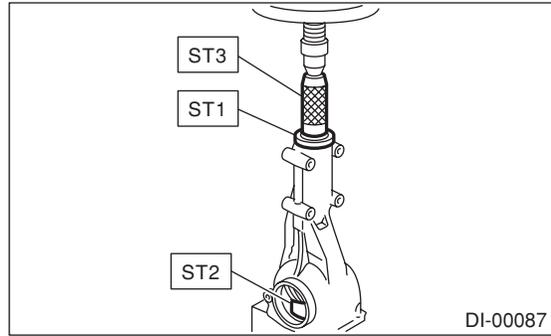


- (A) Drive pinion
- (B) Bearing preload adjusting collar
- (C) Bearing preload adjusting washer
- (D) Differential carrier

5) Press-fit the front bearing cone into carrier with ST1, ST2 and ST3.

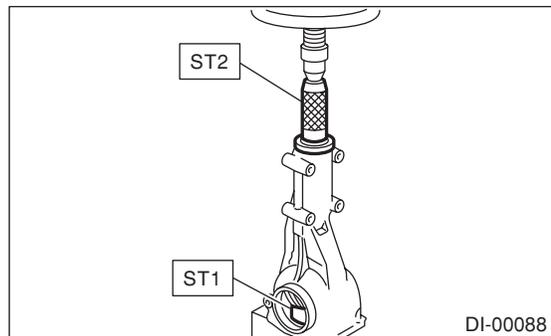
ST1 32285AA000 DUMMY COLLAR
 ST2 399780104 WEIGHT

ST3 899580100 INSTALLER



6) Insert the collar, then press-fit the pilot bearing with ST1 and ST2.

ST1 399780104 WEIGHT
 ST2 899580100 INSTALLER

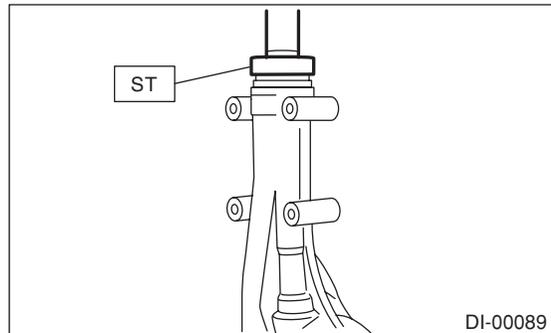


7) Fit a new oil seal with ST.

NOTE:

- Press-fit until end of oil seal is 1 mm (0.0394 in) inward from end of carrier.
- Apply grease to the oil seal lips.

ST 498447120 INSTALLER



8) Press-fit the companion flange with ST1 and ST2.

NOTE:

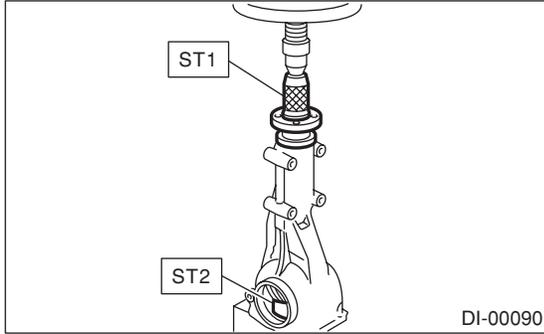
Be careful not to damage the bearing.

ST1 899874100 INSTALLER

Rear Differential (VA-type)

DIFFERENTIALS

ST2 399780104 WEIGHT

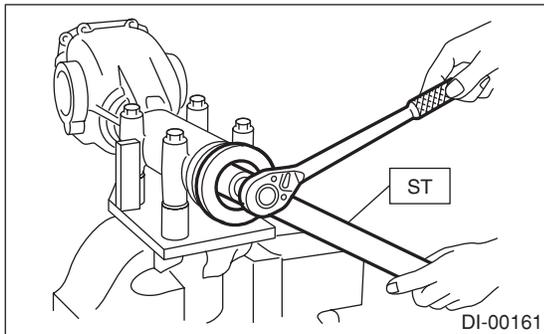


9) Install a new self-locking nut, and secure the companion flange using ST, and tighten the nut.

ST 498427200 FLANGE WRENCH

Tightening torque:

191 N·m (19.5 kgf·m, 141 ft·lb)



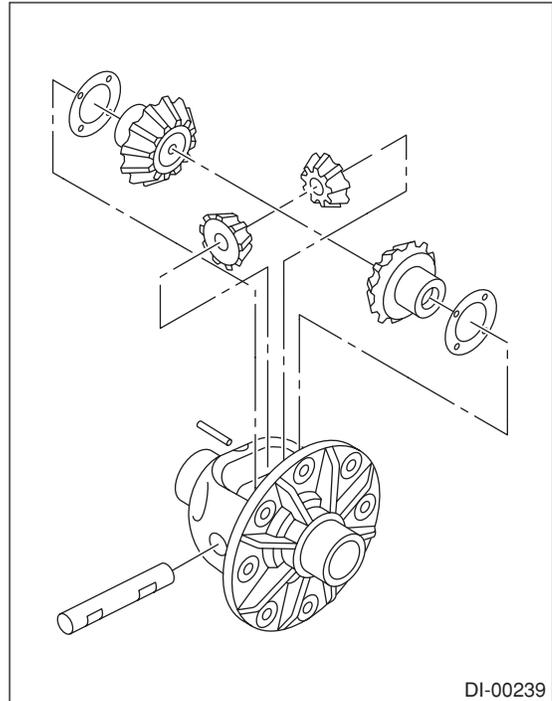
10) Assembling differential case

Install the side gears and pinion mate gears, with their thrust washers and pinion mate shaft, into differential case.

NOTE:

- Apply gear oil to both sides of the washer and the side gear shaft before installing.

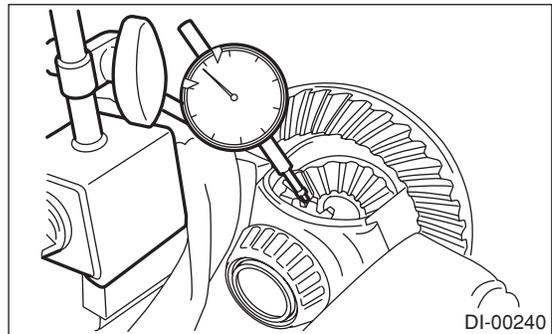
- Insert the pinion mate shaft into the differential case by aligning the lock pin holes.



(1) Measure the side gear backlash.

Side gear backlash:

0.05 — 0.15 mm (0.0020 — 0.0059 in)



(2) Adjust the side gear backlash as specified by selecting side gear thrust washer.

Side gear thrust washer	
Part No.	Thickness mm (in)
803135011	0.925 — 0.950 (0.0364 — 0.0374)
803135012	0.950 — 0.975 (0.0374 — 0.0384)
803135013	0.975 — 1.000 (0.0384 — 0.0394)
803135014	1.000 — 1.025 (0.0394 — 0.0404)
803135015	1.025 — 1.050 (0.0404 — 0.0413)

(3) Check the condition of rotation after applying oil to the gear tooth surfaces and thrust surfaces.

(4) After inserting the pinion shaft lock pin into differential case, stake the both sides of the hole to prevent pin from falling off.

11) Install the hypoid driven gear on differential case.

NOTE:

- Before installing bolts, apply Lock Tite to bolt threads.

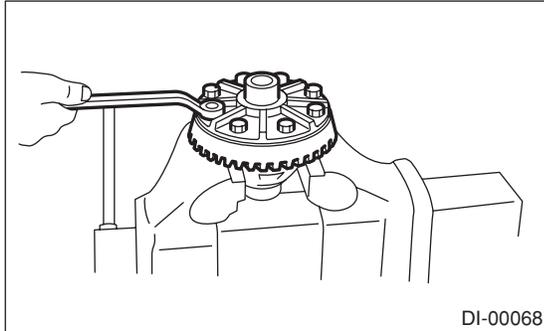
Lock Tite:

THREE BOND 1324 (Part No. 004403042)

- Tighten diagonally while tapping the bolt heads.

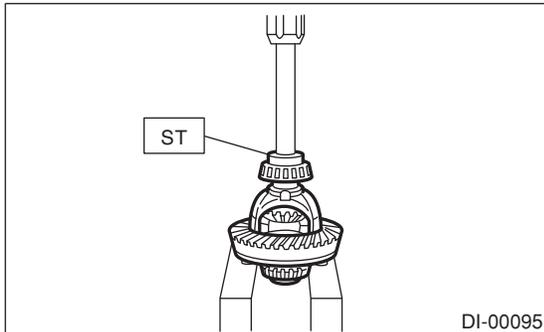
Tightening torque:

62 N·m (6.3 kgf-m, 45.6 ft-lb)



12) Press the side bearing into differential case using ST.

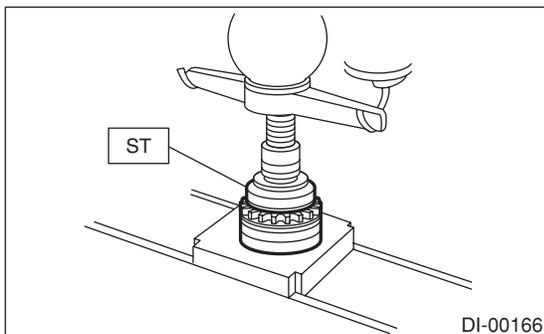
ST 498485400 DRIFT



13) Assemble holders.

(1) Install the oil seal into holder RH and LH.

ST 498447100 INSTALLER

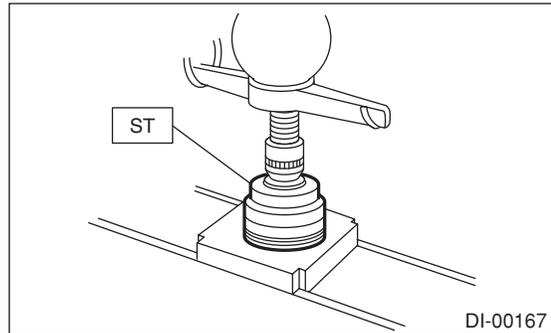


(2) Install the bearing race into holder RH and LH.

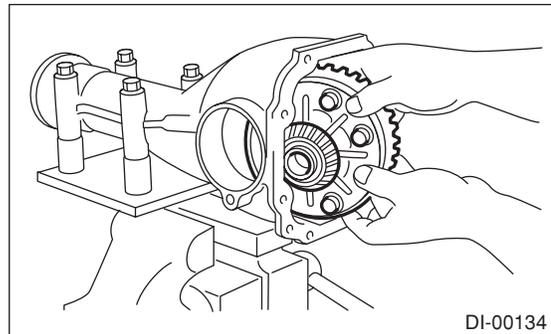
ST 398477702 DRIFT

CAUTION:

Make sure that the oil seal, bearing outer race and cone are properly assembled.



(3) Install the differential assembly into differential carrier in the reverse order of disassembly.

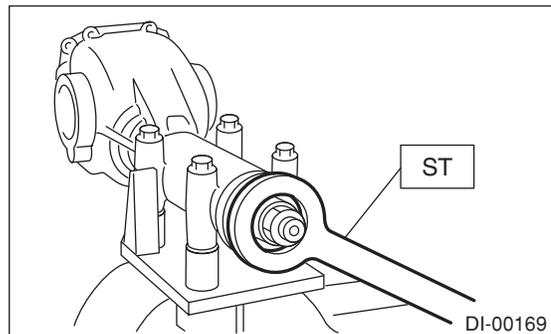


(4) Temporarily tighten the side holder RH and LH in differential carrier to install.

14) Perform the backlash adjustment between the hypoid driven gear and drive pinion, and preload adjustment of differential side bearing.

(1) Turn the drive pinion with ST for better fitting of differential side bearing.

ST 498427200 FLANGE WRENCH

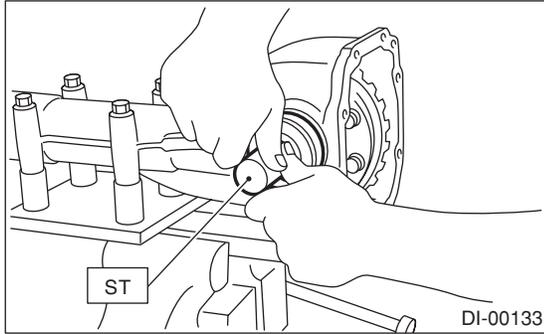


(2) Screw in the side holder LH until light contact is made with ST.

Rear Differential (VA-type)

DIFFERENTIALS

ST 499785500 WRENCH

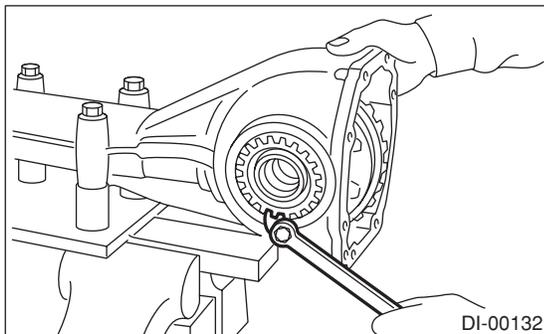


(3) Back off the side (hypoid driven gear side) holder approx. 1 1/2 teeth of holder, and tighten the other side holder by approx. 2 teeth (approx. 1 1/2 + 1/2 teeth). [Back off amount of side (hypoid driven gear side) holder + 1/2 tooth.] This + 1/2 tooth gives preload.

(4) Temporarily tighten the lock plate.

NOTE:

Turn over the lock plate to displace the holder 1/2 tooth.



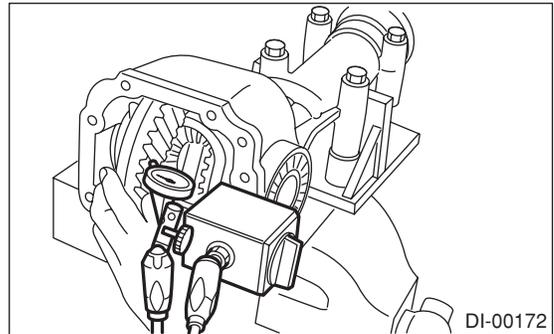
(5) Measure the hypoid driven gear-to-drive pinion backlash. Set the magnet base on differential carrier. Align the contact point of dial gauge with tooth face of hypoid driven gear, and move hypoid driven gear while holding drive pinion still. Read the value indicated on dial gauge.

NOTE:

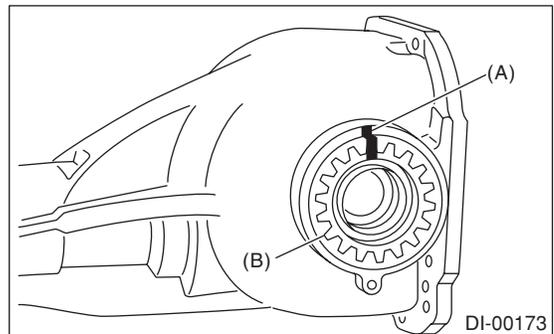
If measured backlash is not within specified range, repeat the procedures for pinion driven gear set backlash adjustment and differential side bearing preload adjustment.

Backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)



15) Draw a matching mark on both differential carrier and holder. Remove the holder side at a time. Replace in the original position after inserting an O-ring and applying grease to threaded portion.



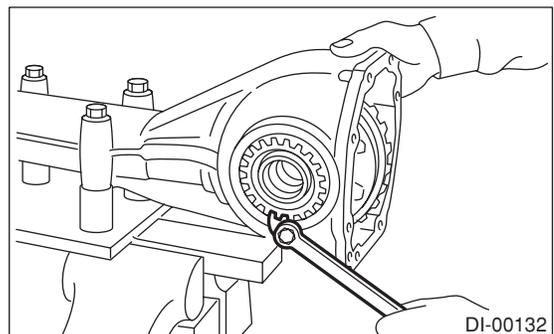
(A) Alignment mark

(B) Holder

16) Tighten the bolt of lock plate to specified torque.

Tightening torque:

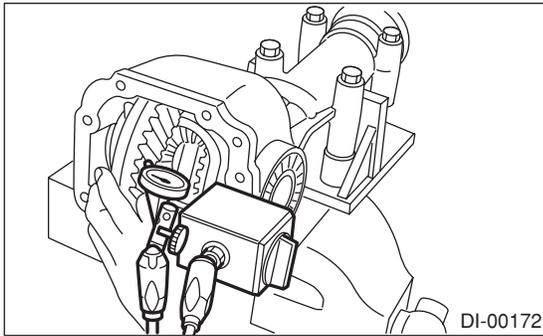
25 N·m (2.5 kgf-m, 18.1 ft-lb)



17) Recheck the hypoid driven gear to pinion backlash.

Backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)



18) Checking and adjusting the tooth contact of hypoid driven gear

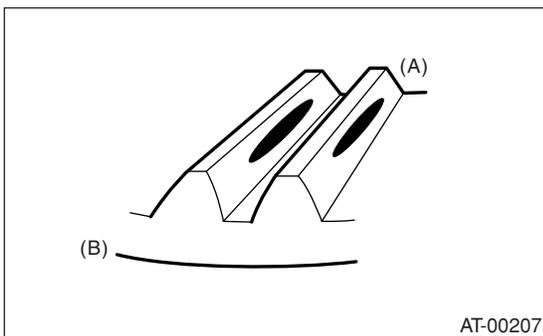
- (1) Apply an even coat of red lead on both sides of three or four teeth on the hypoid driven gear. Check the contact pattern after rotating the hypoid driven gear several revolutions back and forth until a definite contact pattern appears on the hypoid driven gear.
- (2) When the contact pattern is incorrect, readjust.

NOTE:

Be sure to wipe off red lead completely after adjustment is completed.

- Correct tooth contact

Checking item: Tooth contact pattern is slightly shifted toward to toe side under no-load rotation. [When loaded, contact pattern moves toward heel.]

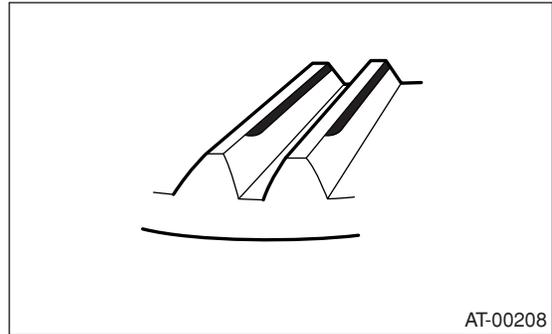


- (A) Toe side
- (B) Heel side

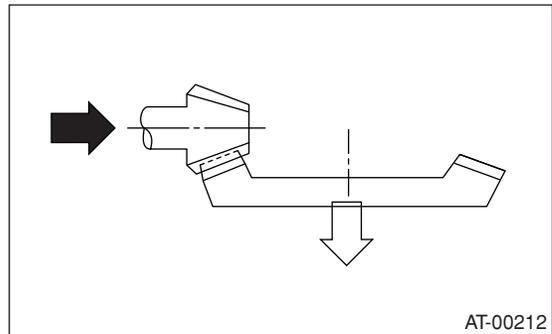
- Face contact

Checking item: Backlash is too large.

Contact pattern



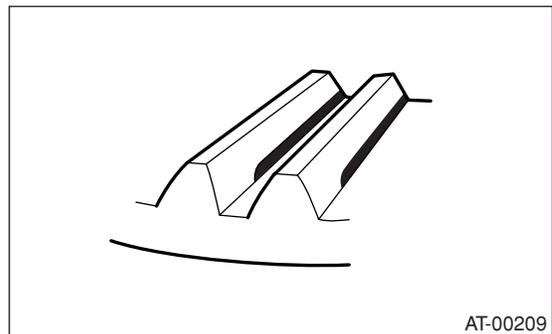
Corrective action: Increase thickness of drive pinion height adjusting washer in order to bring drive pinion close to hypoid driven gear.



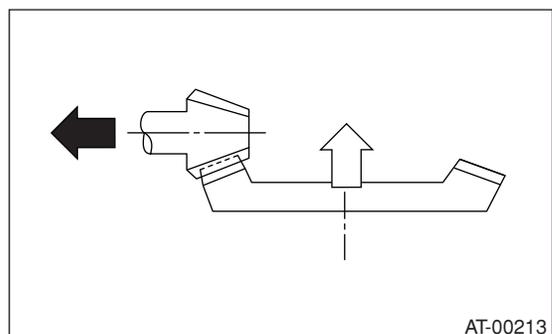
- Flank contact

Checking item: Backlash is too small.

Contact pattern



Corrective action: Reduce thickness of drive pinion height adjusting washer in order to bring drive pinion away from hypoid driven gear.



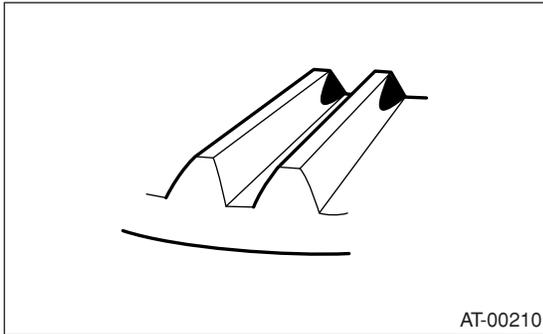
Rear Differential (VA-type)

DIFFERENTIALS

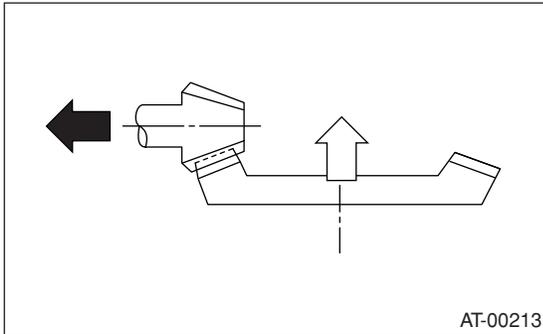
- Toe contact (inside end contact)

Checking item: Contact areas is small

Contact pattern



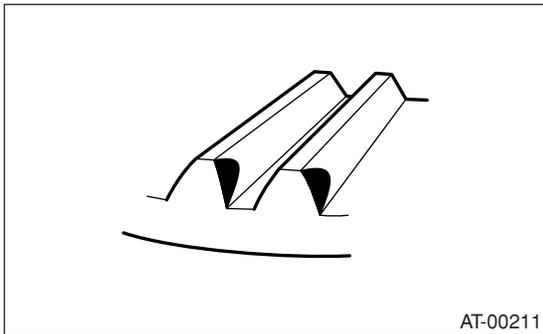
Corrective action: Reduce thickness of drive pinion height adjusting washer in order to bring drive pinion away from hypoid driven gear.



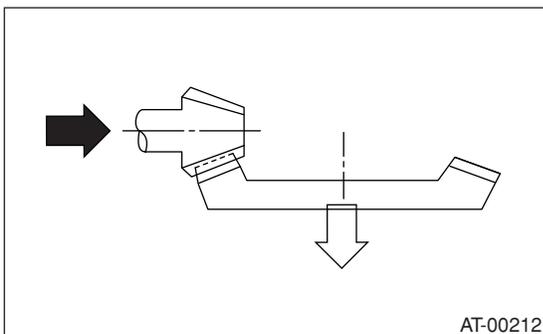
- Heel contact (outside end contact)

Checking item: Contact areas is small

Contact pattern



Corrective action: Increase thickness of drive pinion height adjusting washer in order to bring drive pinion close to hypoid driven gear.

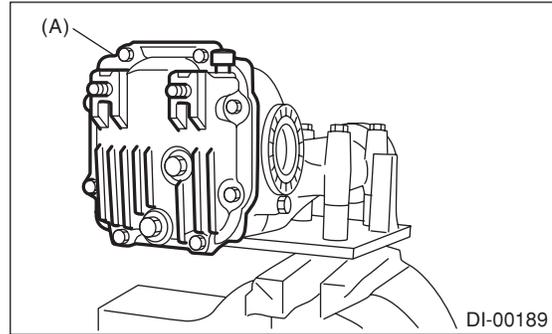


19) If proper tooth contact is not obtained, once again adjust the drive pinion height and the differential side bearing preload (already mentioned) and the hypoid gear backlash.

20) Install the new gasket and rear cover to differential carrier and tighten the bolts to specified torque.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

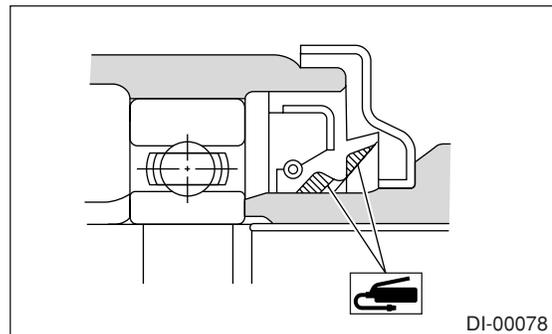


(A) Rear cover

2. VA2-TYPE

NOTE:

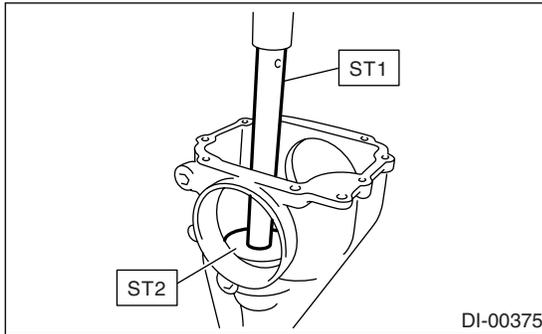
- Assemble in the reverse order of disassembly.
- Check and adjust each part during assembly.
- Use a new gasket.
- Keep the shims and washers in order, so that they are not improperly installed.
- Thoroughly clean the surfaces on which the shims, washers and bearings are to be installed.
- Apply gear oil when installing the bearings and thrust washers.
- Be careful not to mix up the bearing races RH and LH.
- Replace the oil seal with a new one at every disassembly. Apply grease to the lips when installing the oil seal.
- Be careful not to mix up the differential oil seal RH and LH.



1) Adjusting preload for front and rear bearings:
Adjust the bearing preload with collar and washer between front and rear bearings. Pinion height adjusting washer are not affected by this adjustment. The adjustment must be carried out without oil seal inserted.

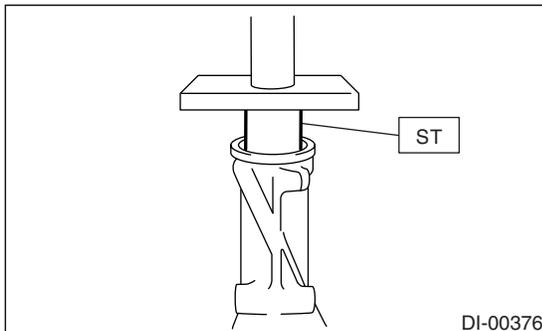
(1) Install the rear bearing race into differential carrier with ST1 and ST2.

ST1 398477701 HANDLE
ST2 398477703 DRIFT 2



(2) Using the ST, install the front bearing race to the differential carrier.

ST 499277200 INSTALLER



(3) Insert the front bearing cone.

NOTE:

Use new front bearing cone.

(4) Measure and record the thickness of pinion adjusting washer.

NOTE:

If tooth contact (drive pinion, hypoid driven gear) is normal in the inspection before disassembling, verify that the washer is not deformed, and then re-use the used washer.

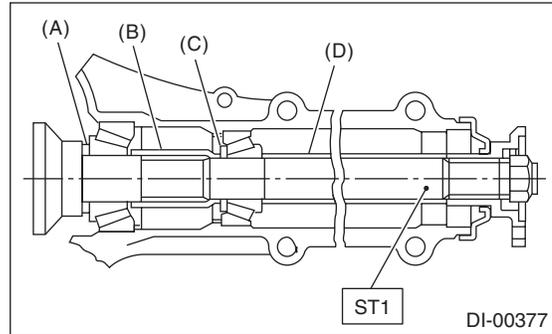
(5) Insert the ST1 into carrier with pinion height adjusting washer and rear bearing cone fitted onto it.

NOTE:

Use new rear bearing cone.

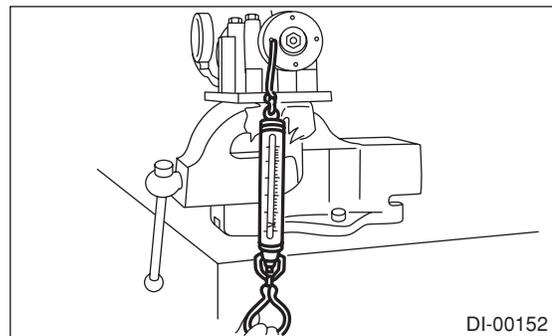
(6) Install the preload adjusting collar and washer, front bearing cone, collar, companion flange, and washer and self-locking nut.

ST1 18678AA000 DUMMY SHAFT



- (A) Pinion height adjusting washer
- (B) Preload adjusting collar
- (C) Preload adjusting washer
- (D) Collar

(7) Turn the ST1 with hand to make it seated, and tighten the self-locking nut while measuring the preload with spring balance. Select the preload adjusting washer and collar so that the specified preload is obtained when nut is tightened to the specified torque.



NOTE:

- Use a new self-locking nut.
- Be careful not to give excessive preload.
- When tightening the self-locking nut, lock companion flange with ST2 as shown in the figure.
- Measure the preload in direction of tangent to flange.

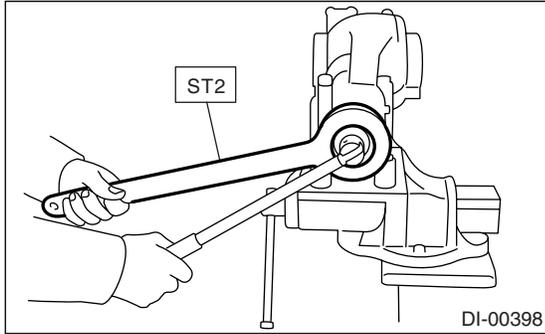
ST1 18678AA000 DUMMY SHAFT
ST2 498427200 FLANGE WRENCH

Rear Differential (VA-type)

DIFFERENTIALS

Tightening torque:

191 N·m (19.5 kgf·m, 141 ft·lb)



Drive pinion bearing preload
12.7 — 32.4 N (1.3 — 3.3 kgf, 2.9 — 7.3 lb)
(at companion flange bolt hole)

	Part No.	Thickness mm (in)
	Preload adjusting washer	38336AA430
38336AA440		1.513 (0.0596)
38336AA450		1.525 (0.0600)
38336AA460		1.538 (0.0606)
38336AA470		1.550 (0.0610)
38336AA480		1.563 (0.0615)
38336AA490		1.575 (0.0620)
38336AA500		1.588 (0.0625)
38336AA510		1.600 (0.0630)
38336AA520		1.613 (0.0635)
38336AA530		1.625 (0.0640)
38336AA540		1.638 (0.0645)
38336AA550		1.650 (0.0650)
38336AA560		1.663 (0.0655)
38336AA570		1.675 (0.0659)
38336AA580		1.688 (0.0665)
38336AA590		1.700 (0.0669)
38336AA600		1.713 (0.0674)
38336AA610		1.725 (0.0679)
38336AA620		1.738 (0.0684)
38336AA630	1.750 (0.0689)	
38336AA640	1.763 (0.0694)	
38336AA650	1.775 (0.0699)	
Preload adjusting collar	Part No.	Length mm (in)
	31454AA250	51.05 (2.010)
	31454AA260	51.25 (2.018)
	31454AA270	51.35 (2.022)
	31454AA280	51.45 (2.026)
	31454AA290	51.55 (2.030)
	31454AA300	51.65 (2.033)
	31454AA310	51.75 (2.037)
	31454AA320	51.85 (2.041)
31454AA330	52.05 (2.049)	

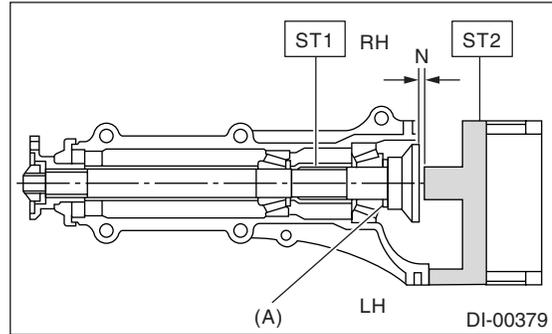
2) Adjusting drive pinion height:

Adjust the drive pinion height with washer installed between the rear bearing cone and the back of pinion gear.

(1) Install the ST2.

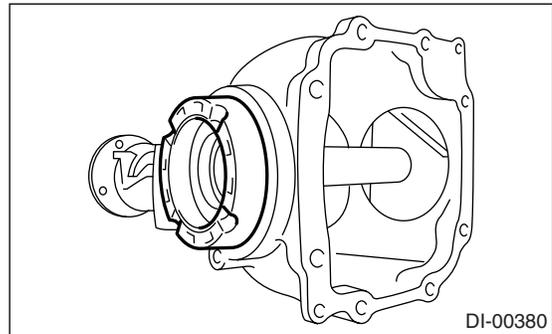
ST1 18678AA000 DUMMY SHAFT

ST2 18831AA010 DIFFERENTIAL CARRIER GAUGE



(A) Pinion height adjusting washer

(2) Install the side holder LH to the left side of differential carrier in reverse direction.



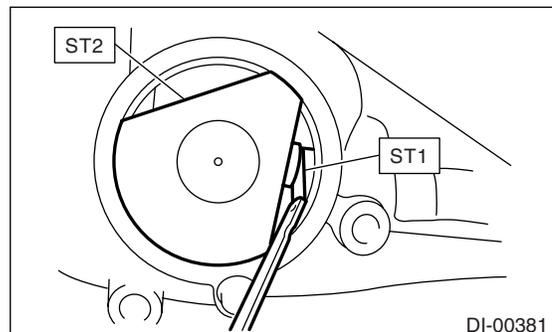
(3) Measure the clearance N between the end of ST2 and the end surface of ST1 by using a thickness gauge.

NOTE:

Make sure there is no clearance between the case and ST2.

ST1 18678AA000 DUMMY SHAFT

ST2 18831AA010 DIFFERENTIAL CARRIER GAUGE



(4) Obtain the thickness of pinion height adjusting washer to be inserted from the following formula, and replace the temporarily installed washer with this one.

NOTE:

Adjust it using the 1 — 3 washers.
 $T = T_o + N - 0.05 \text{ mm (0.0020 in)}$

T	Thickness of pinion height adjusting washer mm (in)	
T _o	Thickness of washer temporarily inserted mm (in)	
N	Clearance of thickness gauge mm (in)	
Memo:		

(Example of calculation)

T_o = 0.15 mm (0.0059 in)

N = 0.1 mm (0.0039 in)

$T = 0.15 \text{ mm (0.0059 in)} + 0.1 \text{ mm (0.0039 in)} - 0.05 \text{ mm (0.0020 in)} = 0.2 \text{ mm (0.0079 in)}$

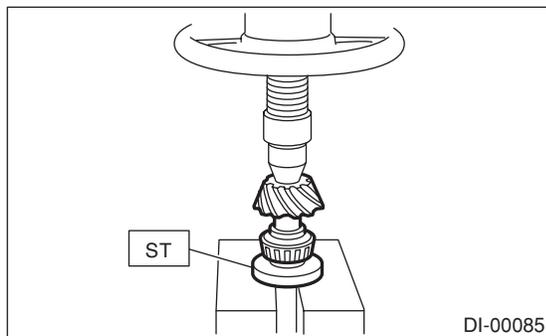
Result: Thickness = 0.2 mm

Therefore use the pinion height adjusting washer of part number 32295AA370.

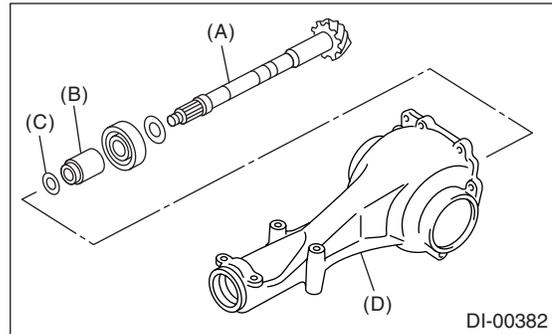
Pinion height adjusting washer	
Part No.	Thickness mm (in)
32295AA350	0.150 (0.0059)
32295AA360	0.175 (0.0069)
32295AA370	0.200 (0.0079)
32295AA380	0.225 (0.0089)
32295AA390	0.250 (0.0098)
32295AA400	0.275 (0.0108)

3) Install the selected pinion height adjusting washer on drive pinion, and press the rear bearing cone into position with ST.

ST 398177700 INSTALLER



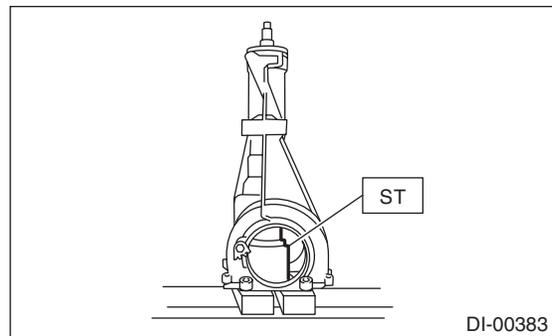
4) Insert the drive pinion into differential carrier, install the previously selected bearing preload adjusting collar and washer.



- (A) Drive pinion
- (B) Bearing preload adjusting collar
- (C) Bearing preload adjusting washer
- (D) Differential carrier

5) Set ST and differential carrier to the press and install the front bearing cone.

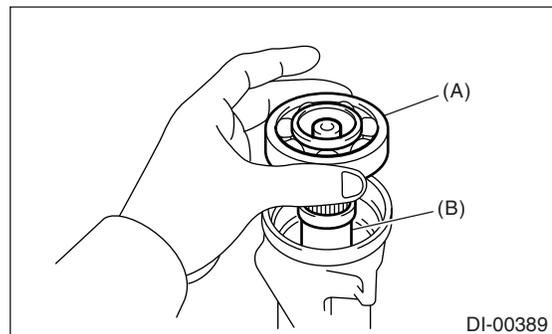
ST 399780104 WEIGHT



NOTE:

Set the carrier to the press until the companion flange is installed.

6) Insert the collar, then install the pilot bearing.



- (A) Pilot bearing
- (B) Collar

7) Fit a new oil seal with ST.

NOTE:

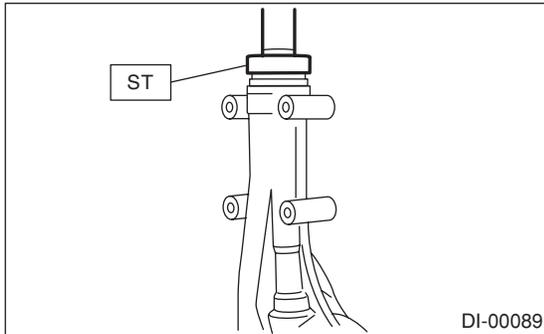
- Press-fit until end of oil seal is 1 mm (0.04 in) inward from end of carrier.

Rear Differential (VA-type)

DIFFERENTIALS

- Apply grease to the oil seal lips.

ST 499277200 INSTALLER

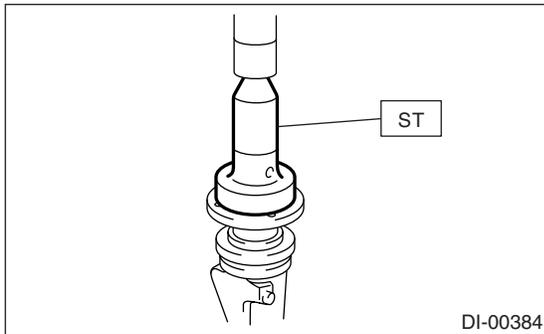


8) Press-fit the companion flange with ST.

NOTE:

- Be careful not to damage the bearing.

ST 899874100 INSTALLER

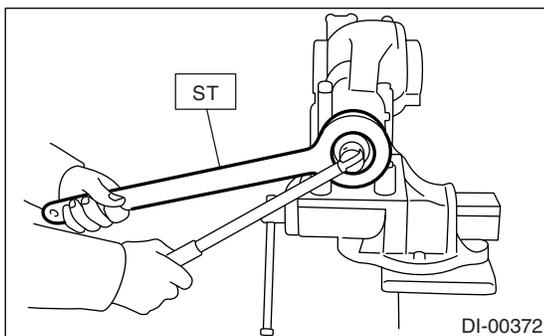


9) Install a new self-locking nut, and secure the companion flange using ST, and tighten the nut.

ST 498427200 FLANGE WRENCH

Tightening torque:

191 N·m (19.5 kgf·m, 141 ft·lb)



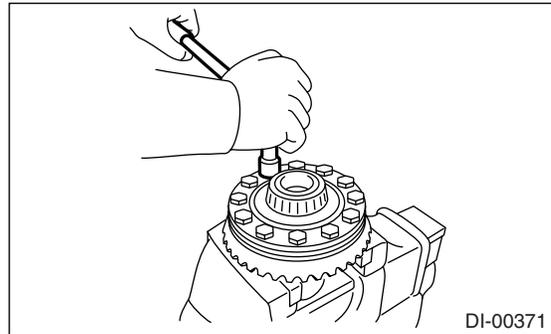
10) Install the hypoid driven gear on differential case.

NOTE:

- Tighten diagonally while tapping the bolt heads.
- Set a cushioning such as wooden block, aluminum plate or shop cloth between vise and differential case if the side gear comes into contact with vise.

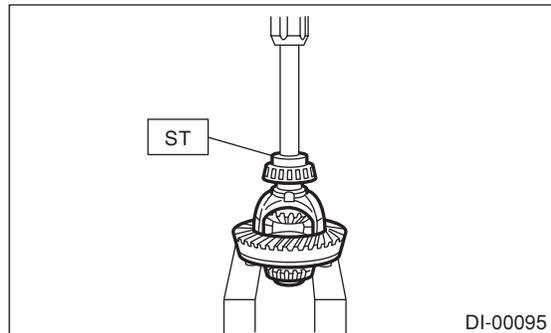
Tightening torque:

62 N·m (6.3 kgf·m, 45.6 ft·lb)



11) Press the side bearing into differential case using ST.

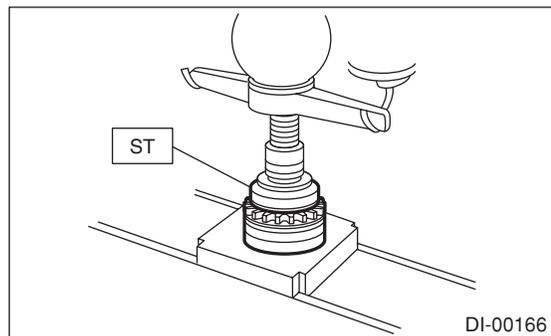
ST 398487700 DRIFT



12) Assemble holders.

(1) Install the new oil seal into holder RH and LH.

ST 498447100 INSTALLER

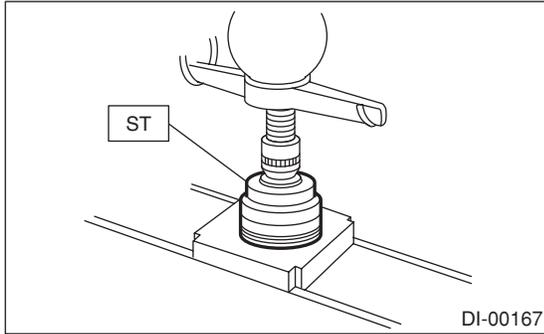


(2) Install the bearing race into holder RH and LH.

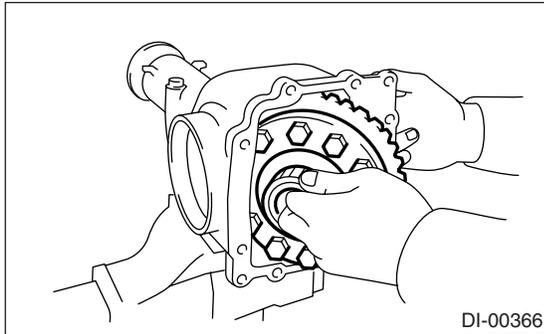
ST 398177700 INSTALLER

CAUTION:

Make sure that the oil seal, bearing outer race and cone are properly assembled.



(3) Install the differential assembly into differential carrier in the reverse order of disassembly.

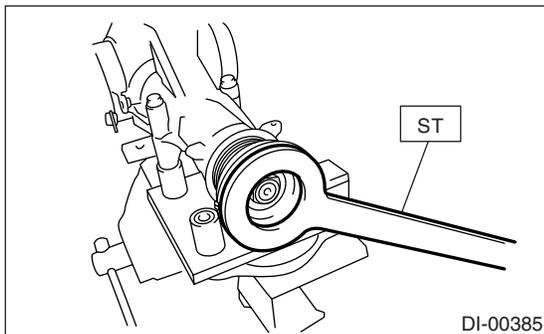


(4) Temporarily tighten the side holder RH and LH in differential carrier to install.

13) Perform the backlash adjustment between the hypoid driven gear and drive pinion, and preload adjustment of differential side bearing.

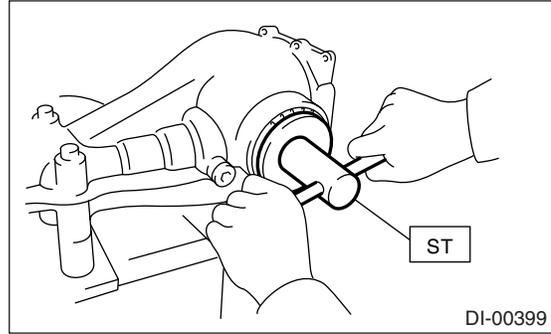
(1) Turn the drive pinion with ST for better fitting of differential side bearing.

ST 498427200 FLANGE WRENCH



(2) Screw in the side holder LH until light contact is made with ST.

ST 18630AA010 WRENCH



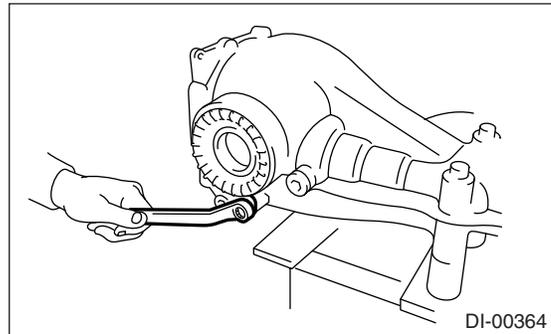
(3) Back off the side (hypoid driven gear side) holder approx. 1 1/2 teeth of holder, and tighten the other side holder by approx. 2 teeth (approx. 1 1/2 + 1/2 teeth). [Back off amount of side (hypoid driven gear side) holder + 1/2 tooth.]

This + 1/2 tooth gives preload.

(4) Temporarily tighten the lock plate.

NOTE:

Turn over the lock plate to displace the holder 1/2 tooth.



(5) Measure the hypoid driven gear-to-drive pinion backlash. Set the magnet base on differential carrier. Align the contact point of dial gauge with tooth face of hypoid driven gear, and move hypoid driven gear while holding drive pinion still. Read the value indicated on dial gauge.

NOTE:

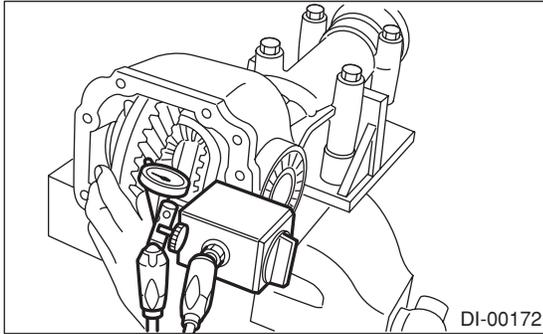
If measured backlash is not within specified range, repeat the procedures for pinion driven gear set backlash adjustment and differential side bearing preload adjustment.

Rear Differential (VA-type)

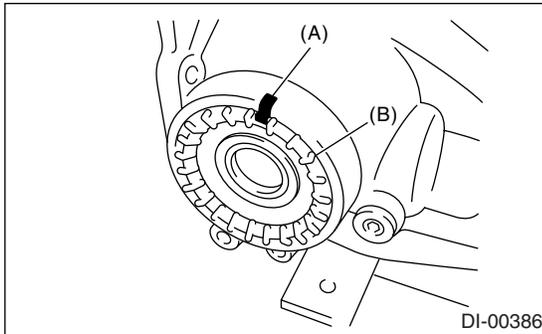
DIFFERENTIALS

Backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)



14) Draw a matching mark on both differential carrier and holder. Remove the holder side at a time. Replace in the original position after inserting an O-ring and applying grease to threaded portion.



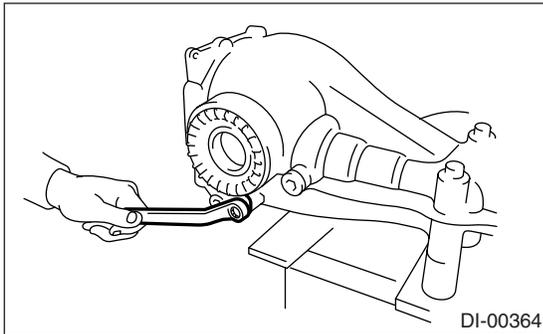
(A) Alignment mark

(B) Holder

15) Tighten the bolt of lock plate to specified torque.

Tightening torque:

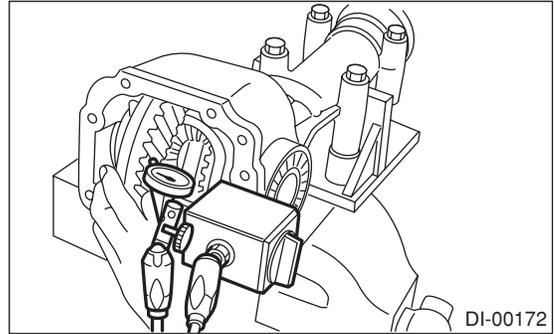
25 N·m (2.5 kgf·m, 18.1 ft·lb)



16) Recheck the hypoid driven gear to pinion backlash.

Backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)



17) Checking and adjusting the tooth contact of hypoid driven gear

(1) Apply an even coat of red lead on both sides of three or four teeth on the hypoid driven gear. Check the contact pattern after rotating the hypoid driven gear several revolutions back and forth until a definite contact pattern appears on the hypoid driven gear.

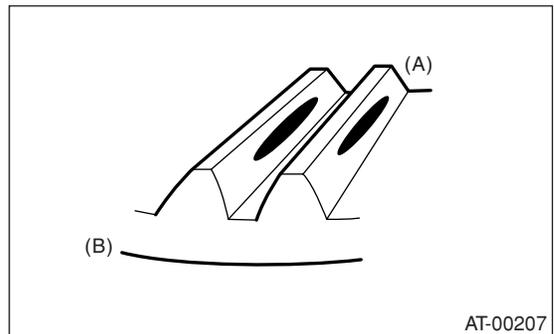
(2) When the contact pattern is incorrect, readjust.

NOTE:

Be sure to wipe off red lead completely after adjustment is completed.

- Correct tooth contact

Checking item: Tooth contact pattern is slightly shifted toward toe side under no-load rotation. [When loaded, contact pattern moves toward heel.]



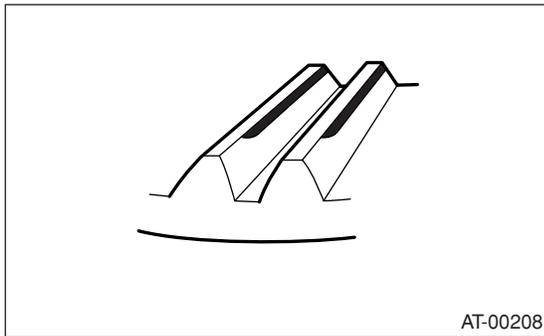
(A) Toe side

(B) Heel side

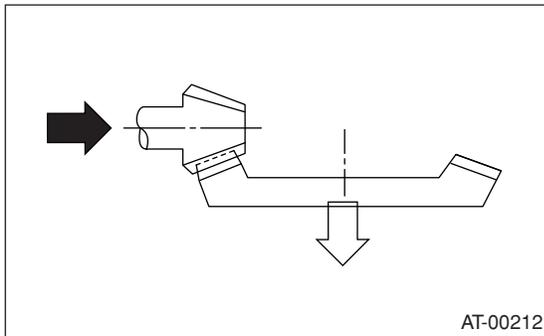
- Face contact

Checking item: Backlash is too large.

Contact pattern



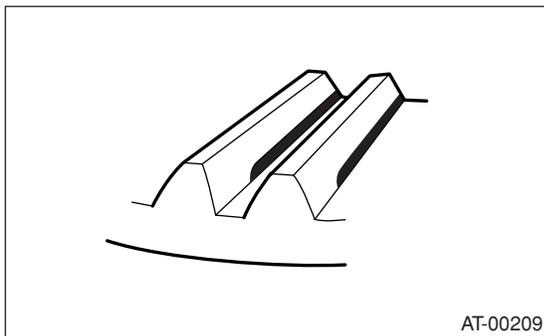
Corrective action: Increase thickness of drive pinion height adjusting washer in order to bring drive pinion close to hypoid driven gear.



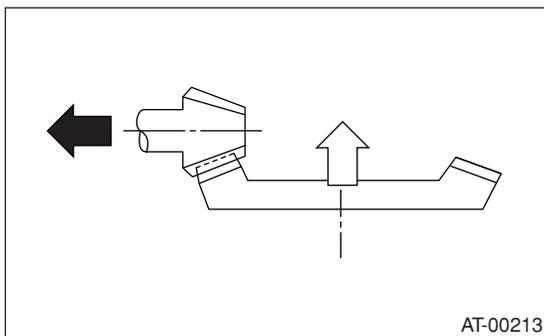
- Flank contact

Checking item: Backlash is too small.

Contact pattern



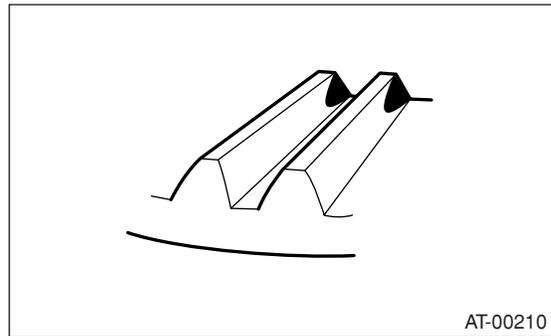
Corrective action: Reduce thickness of drive pinion height adjusting washer in order to bring drive pinion away from hypoid driven gear.



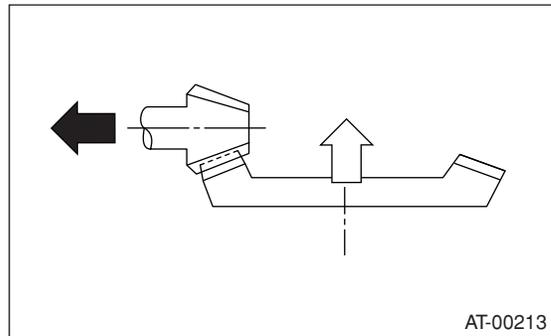
- Toe contact (inside end contact)

Checking item: Contact areas is small

Contact pattern



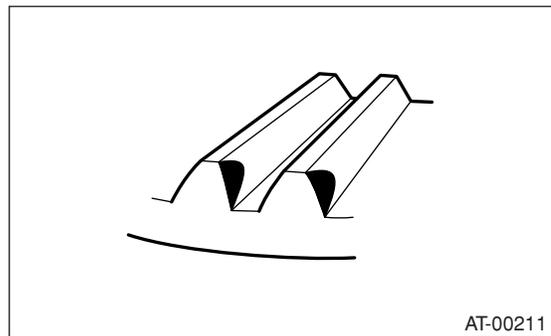
Corrective action: Reduce thickness of drive pinion height adjusting washer in order to bring drive pinion away from hypoid driven gear.



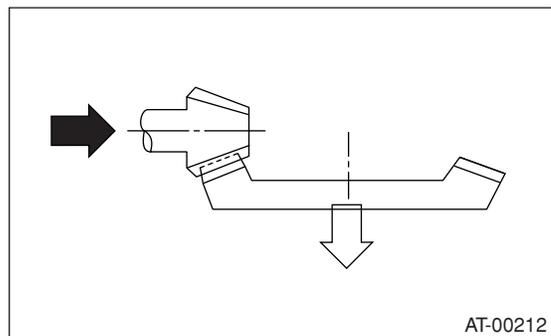
- Heel contact (outside end contact)

Checking item: Contact areas is small

Contact pattern



Corrective action: Increase thickness of drive pinion height adjusting washer in order to bring drive pinion close to hypoid driven gear.



Rear Differential (VA-type)

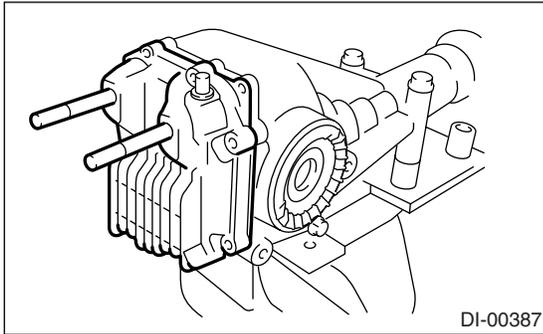
DIFFERENTIALS

18) If proper tooth contact is not obtained, once again adjust the drive pinion height and the differential side bearing preload (already mentioned) and the hypoid gear backlash.

19) Install the new gasket and rear cover to differential carrier and tighten the bolts to specified torque.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



E: INSPECTION

Wash all the disassembled parts clean, and examine them for wear, damage and other defects. Repair or replace the defective parts as necessary.

1) Hypoid driven gear and drive pinion

- If abnormal tooth contact is evident, find out the cause and adjust to give correct tooth contact. Replace the gear if excessively worn or incapable of adjustment.

- If crack, score or seizure is evident, replace as a set. Slight damage of tooth can be corrected by oil stone or the like.

2) Side gear and pinion mate gear

- Replace if crack, score or other defects are evident on tooth surface.

- Replace if thrust washer contacting surface is worn or seized. Slight damage of the surface can be corrected by oil stone or the like.

3) Bearings

Replace if seizure, peeling, wear, rust, dragging during rotation, noise or other defect is evident.

4) Thrust washers of side gear and pinion mate gear:

Replace if seizure, flaw, abnormal wear or other defect is evident.

5) Oil seal

Replace if deformed or damaged, and at every disassembling.

6) Differential carrier

Replace if the bearing bores are worn or damaged.

7) Differential case

Replace if its sliding surfaces are worn or cracked.

8) Companion flange

Replace if the oil seal lip contacting surfaces have flaws.

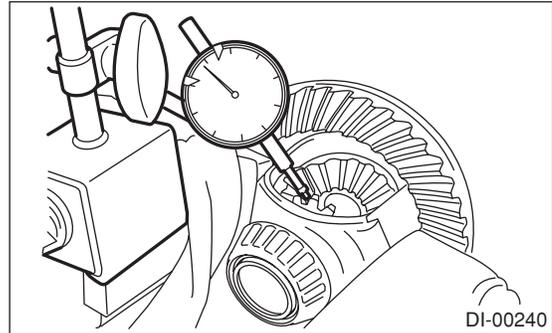
1. SIDE GEAR BACKLASH

Using a dial gauge, check the backlash of the side gear. (VA1-type only)

Side gear backlash:

0.05 — 0.15 mm (0.0020 — 0.0059 in)

If the side gear backlash is not within the specification, adjust it as specified by selecting side gear thrust washer.



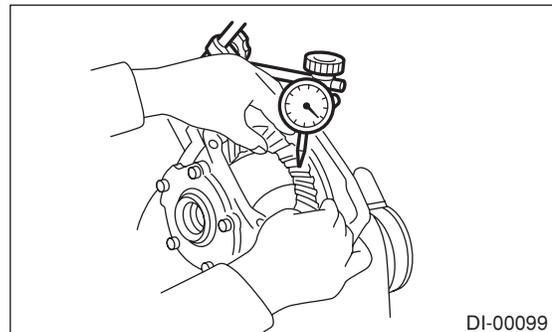
2. HYPOID DRIVEN GEAR BACKLASH

Using a dial gauge, check the backlash of hypoid driven gear.

Hypoid driven gear backlash:

0.10 — 0.15 mm (0.0039 — 0.0059 in)

If the hypoid driven gear backlash is not within the specification, adjust the side bearing preload or repair if necessary.



3. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

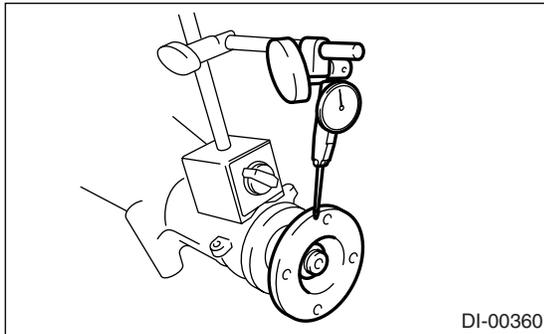
Inspect the tooth contact between hypoid driven gear and drive pinion. <Ref. to DI-52, ASSEMBLY, Rear Differential (VA-type).>

4. COMPANION FLANGE

1) If rust or dirt is attached to the companion flange, remove them.

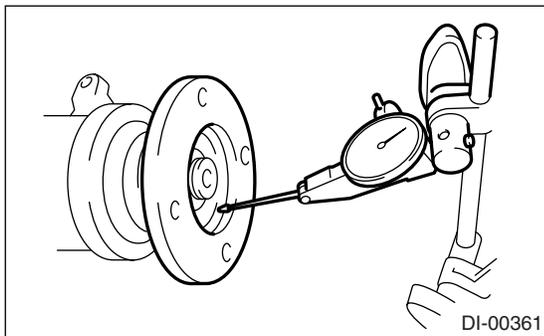
2) Set a dial gauge at a companion flange surface (mating surface of propeller shaft and companion flange), and then measure the companion flange runout.

Limit of runout:
0.08 mm (0.003 in)



3) Set the gauge inside of the companion flange, and measure the runout.

Limit of runout:
0.08 mm (0.003 in)



4) If either runout exceeds the limit, move the phase of companion flange and drive pinion 90° each, and find the point that the runout is within the limit.

5) If the runout exceeds the limit after changing the phase, replace the companion flange and recheck the runout.

6) If the runout exceeds the limit after replacing the companion flange, the drive pinion may be assembled incorrectly or bearing is faulty.

F: ADJUSTMENT

1. SIDE GEAR BACKLASH

Adjust the side gear backlash. (VA1-type)
 <Ref. to DI-52, ASSEMBLY, Rear Differential (VA-type).>

2. HYPOID DRIVEN GEAR BACKLASH

Adjust hypoid driven gear backlash.
 <Ref. to DI-52, ASSEMBLY, Rear Differential (VA-type).>

3. TOOTH CONTACT BETWEEN HYPOID DRIVEN GEAR AND DRIVE PINION

Adjust the tooth contact between hypoid driven gear and drive pinion gear.
 <Ref. to DI-52, ASSEMBLY, Rear Differential (VA-type).>