

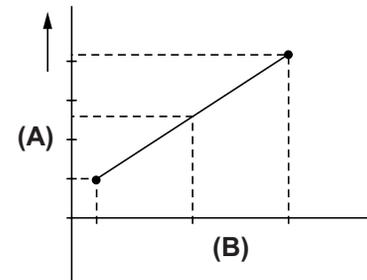
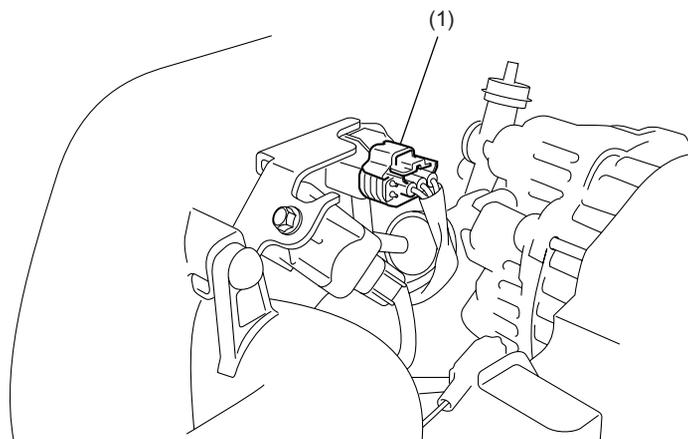
**2. Air Line**

**A: GENERAL**

The air filtered by the air cleaner enters the throttle body where it is regulated in the volume by the throttle valve and then enters the intake manifold. It is then distributed to each cylinder where the air is mixed with fuel injected by the injector.

**B: MANIFOLD ABSOLUTE PRESSURE SENSOR**

The manifold absolute pressure sensor is attached to the intake manifold, and continuously sends to the engine control module (ECM) voltage signals that are proportional to intake manifold absolute pressures. The ECM controls the fuel injection and ignition timing based on the intake manifold absolute pressure signals in addition to other signals from many sensors and other control modules.



FU-01239

(1) Manifold absolute pressure sensor

(A) Output voltage

(B) Absolute pressure

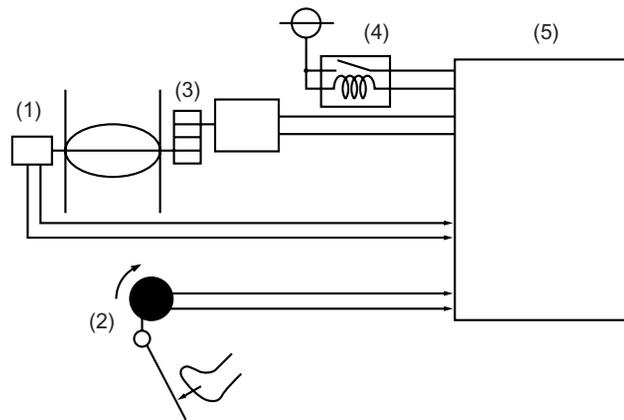
## AIR LINE

FUEL INJECTION (FUEL SYSTEM)

---

### C: ELECTRONIC CONTROL THROTTLE SYSTEM

- The electronic control throttle system consists of an accelerator pedal position sensor mounted on the accelerator pedal, a throttle position sensor and a throttle motor mounted on the throttle body, and the ECM which controls these devices.
- The movement of the accelerator pedal is converted into electrical signals by the accelerator pedal position sensor and sent to the ECM. Based on these signals the ECM controls the throttle motor to open and close the throttle valve.
- Idling control is now performed by the electronic control throttle system in place of the idle air control solenoid valve.



FU-01230

- |  |                                       |
|--|---------------------------------------|
| (1) Throttle position sensor             | (4) Electronic control throttle relay |
| (2) Accelerator pedal position sensor    | (5) ECM                               |
| (3) Electronic control throttle assembly |                                       |

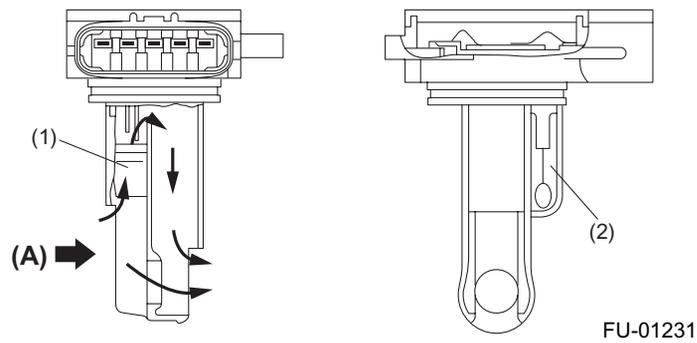
## AIR LINE

FUEL INJECTION (FUEL SYSTEM)

### D: MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR

The mass air flow and the intake air temperature sensors are integrated into a single unit. The unit is mounted on the air cleaner case and measures the amount as well as the temperature of the intake air.

The measured amount and temperature are converted into electrical signals and sent to the ECM. The ECM uses these signals to control injection and ignition timing as well as the fuel injection amount.



- (1) Mass air flow sensor
- (2) Intake air temperature sensor

**(A)** Air

FU(H4DOTC)-5

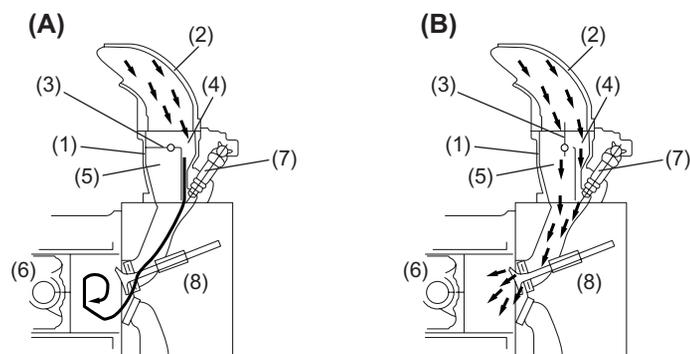
## AIR LINE

### FUEL INJECTION (FUEL SYSTEM)

---

#### E: TUMBLE GENERATOR VALVE

- A tumble generator valve is provided on each engine bank, between the intake manifold and intake air ports. The right bank tumble generator valve has butterfly valves for the #1 and #3 cylinders and the left bank tumble generator valve has those for the #2 and #4 cylinders. The two butterfly valves in each tumble generator valve are fitted on a single shaft that is driven by an actuator.
- The tumble generator valves are controlled by the ECM according to the coolant temperature and the time elapsed after start of the engine. When the engine is started, the butterfly valves are moved to the closing ends. In this state, the intake air flows at very high speeds passing through narrowed passages in the directions determined by the individual intake air ports in the cylinder head. This creates tumbling air motions in the cylinders, which enables lean mixtures to be ignited and thus harmful exhaust emissions to be reduced during engine start. The tumble generator valves are fully open when the engine is operating at an ordinary driving speed, allowing intake air to flow without being changed in direction and velocity.



FU-01232

**(A)** When closed

**(B)** When wide open

(1) Tumble generator housing

(2) Intake manifold

(3) Tumble generator valve

(4) Tumble generating air passage

(5) Intake main air passage

(6) Piston

(7) Injector

(8) Cylinder head