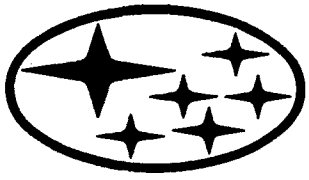
SUBARU

SVX

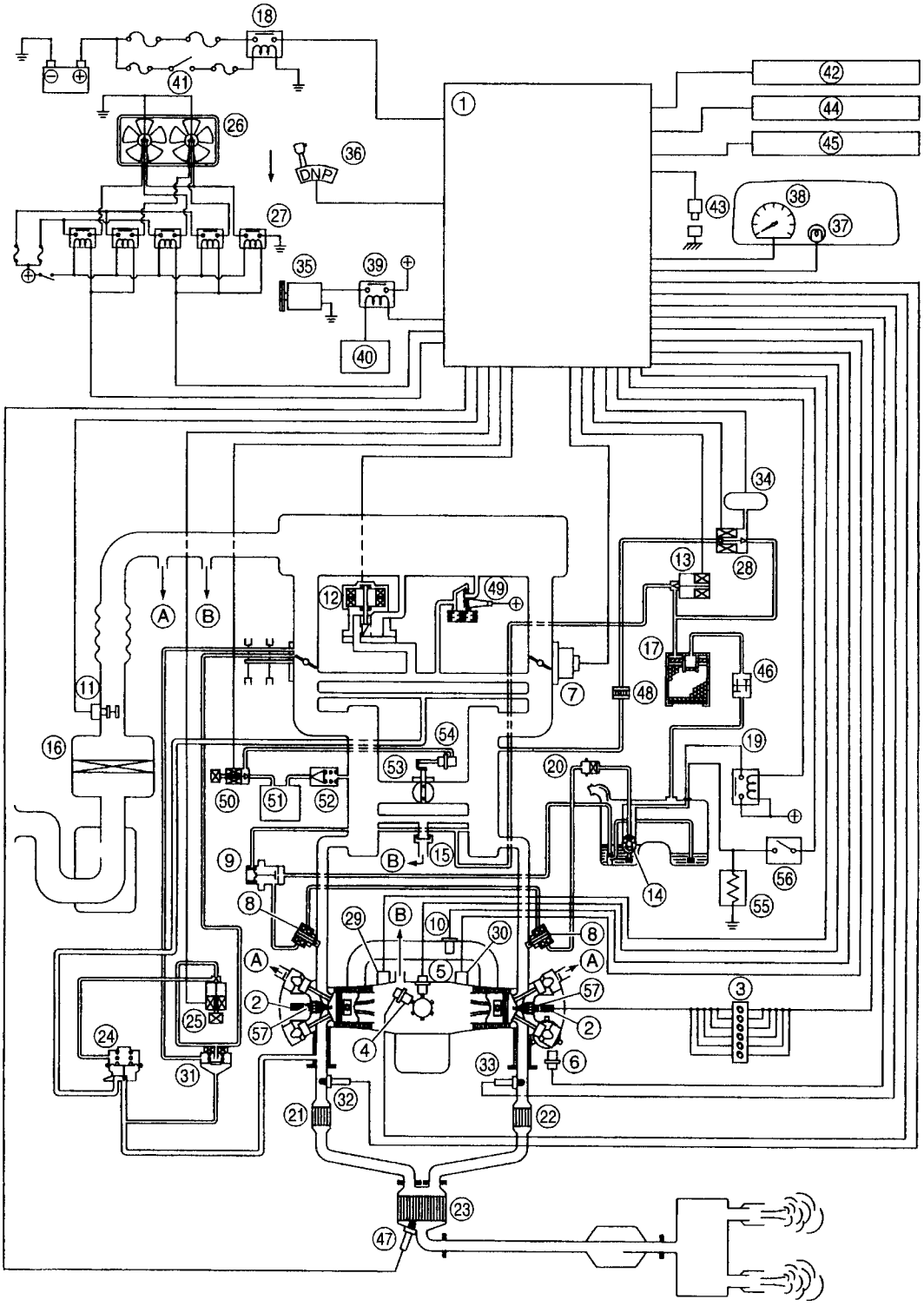
1992

Precaution for Supplemental Restraint System "Airbag"
The Supplemental Restraint System "Airbag" helps to reduce the risk or severity of injury to the driver in a frontal collision.
The Supplemental Restraint System consists of an airbag module (located in the center of the steering wheel), sensors, a control unit, warning light, wiring harness and spiral cable.
Information necessary to service the safety is included in the "5-5. SUPPLEMENTAL RESTRAINT SYSTEM" of this Service Manual.
WARNING:
- To avoid rendering the Airbag system inoperative, which could lead to personal injury or death in the event of a severe frontal collision, all maintenance must be performed by an authorized SVX dealer.
- Improper maintenance, including incorrect removal and installation of the Airbag system, can lead to personal injury caused by unintentional activation of the Airbag system.
- All Airbag system electrical wiring harnesses and connectors are covered with yellow outer insulation. Do not use electrical test equipment on any circuit related to the Supplemental Restraint System "Airbag".



1. General

● The Multipoint Fuel Injection (MFI) system is a system that supplies the optimum air-fuel mixture to the engine for all the various operating conditions through the use of the latest electronic technology.
With this system fuel, which is pressurized at a constant pressure, is injected into the intake air port of the cylinder head. The injection quantity of fuel is controlled by an intermittent injection system where the electro-magnetic injection valve (fuel injector) opens only for a short period of time, depending on the quantity of air required for one cycle of operation. In actual operation, the injection quantity is determined by the duration of an electric pulse applied to the fuel injector and this permits simple, yet highly precise metering of the fuel.
● Further, all the operating conditions of the engine are converted into electric signals, and this results in additional features of the system, such as improved adaptability, easier addition of compensating element, etc.
The MFI system also has the following features:
1) Reduced emission of harmful exhaust gases.
2) Reduced fuel consumption.
3) Increased engine output.
4) Superior acceleration and deceleration.
5) Superior startability and warm-up performance in cold weather since compensation is made for coolant and intake air temperature.



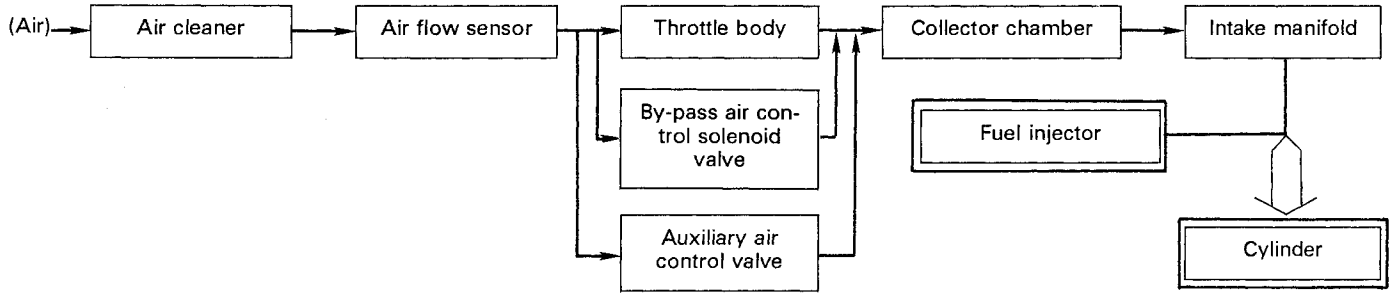
D2M0744A

① Engine control module (ECM)
② Ignition coil
③ Ignitor
④ Crankshaft position sensor 1
⑤ Crankshaft position sensor 2
⑥ Camshaft position sensor
⑦ Throttle position sensor
⑧ Fuel injectors
⑨ Pressure regulator
⑩ Engine coolant temperature sensor
⑪ Mass air flow sensor
⑫ Idle air control solenoid valve
⑬ Purge control solenoid valve
⑭ Fuel pump
⑮ PCV valve
⑯ Air cleaner
⑰ Canister
⑱ Main relay
⑲ Fuel pump relay
⑳ Fuel filter
㉑ Front catalytic converter (RH)
㉒ Front catalytic converter (LH)
㉓ Rear catalytic converter
㉔ EGR valve
㉕ EGR control solenoid valve
㉖ Radiator fan
㉗ Radiator fan relay
㉘ Pressure sources switching solenoid valve
㉙ Knock sensor 1
㉚ Knock sensor 2
㉛ Back-pressure transducer (BPT)
㉜ Front oxygen sensor 1 (RH)
㉝ Front oxygen sensor 2 (LH)
㉞ Pressure sensor
㉟ A/C compressor
㊱ Inhibitor switch
㊲ CHECK ENGINE malfunction indicator lamp (MIL)
㊳ Tachometer
㊴ A/C relay
㊵ A/C control module
㊶ Ignition switch
㊷ Transmission control module (TCM)
㊸ Vehicle speed sensor 2
㊹ Data link connector (For Subaru select monitor)
㊺ Data link connector (For Subaru select monitor and OBD-II general scan tool)
㊻ Two-way valve
㊼ Rear oxygen sensor
㊽ Filter
㊾ Auxiliary air control valve
㊿ Induction control solenoid valve
(51) Vacuum tank
(52) Check valve
(53) Induction control valve
(54) Induction valve diaphragm
(55) Resistor
(56) Fuel pump modulator
(57) Spark plug

2. Air Line

1. GENERAL

Air which is drawn in and filtered by the air cleaner is metered and sent to throttle body via the air intake boot. From the throttle body, the air is regulated by the open-close operation of the throttle valve and is delivered to the collector chamber and the intake manifold. It is then distributed to the respective cylinders to mix with fuel injected by the fuel injectors. Thus, the air-fuel mixture is delivered into the cylinder. Part of the air branched at the upstream of the throttle body is sent to the by-pass air control solenoid valve which regulates engine idle speed.



2. AIR FLOW SENSOR

The MPFI system employs a hot-film type air flow sensor.

This air flow sensor converts the amount of intake air into an electric signal by utilizing the heat transfer phenomenon between the incoming air and heating resistor located in the air intake.

The features of this air flow sensor type are as follows:

1) High-altitude compensation is automatically made.
2) Quick response.
3) There are no moving parts.
4) It is compact.

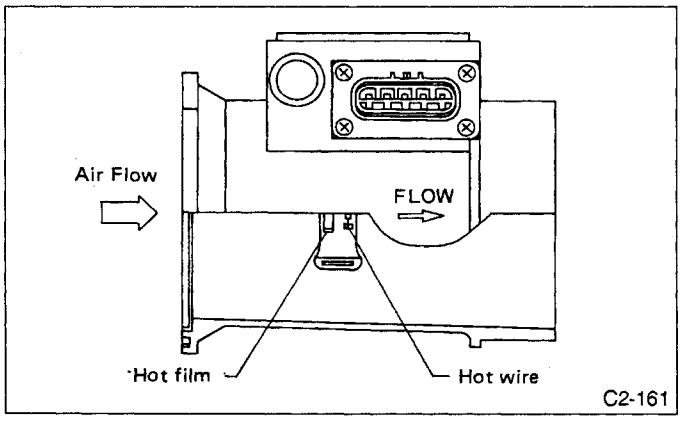


Fig. 2

3. THROTTLE BODY

In response to the depressing stroke of the throttle pedal, the throttle body opens/closes its valve to regulate the air volume to be taken in the combustion chamber.
During idling, the throttle valve is almost fully closed and the air flow through the throttle body is less than that passing through the carburetor.
More than half of the air necessary for idling is supplied to the intake manifold via the by-pass air control solenoid valve.
And the by-pass air control solenoid valve properly controls the number of revolutions in idling, so it does not need to be adjusted.

4. THROTTLE SENSOR

This throttle sensor is provided with a potentiometer.
The throttle sensor converts the opening of the throttle valve into an electric signal, and sends it to the ECU.
Using this signal, the ECU precisely controls the air-fuel ratio during acceleration and deceleration as well as idling.

5. BY-PASS AIR CONTROL SOLENOID VALVE

The ECU controls the duty control valve in the by-pass air control solenoid valve to bring the operating engine speed as close to preset idle speed as possible.

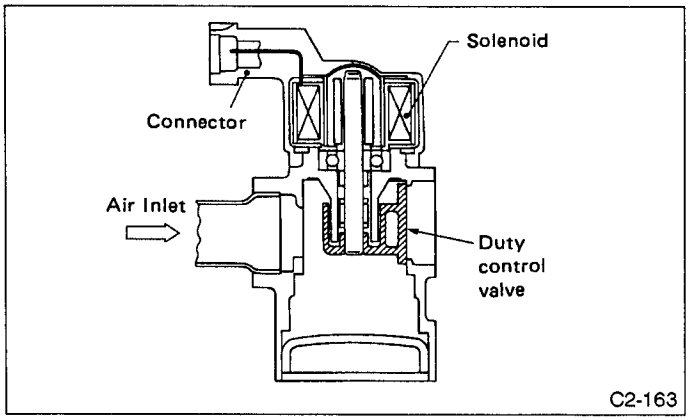


Fig. 3

6. AUXILIARY AIR CONTROL VALVE

Auxiliary air control valve consists of a bimetal, coil heater and rotary valve. This valve supplies by-pass air only when engine is cooled.

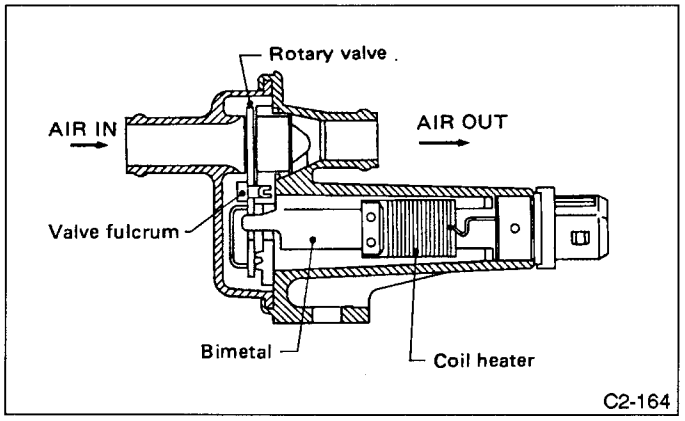


Fig. 4

7. COLLECTOR

The collector is the passage for distributing the intake air into each cylinder. It has the induction control valve built in, and the air-induction is controlled by its operation.

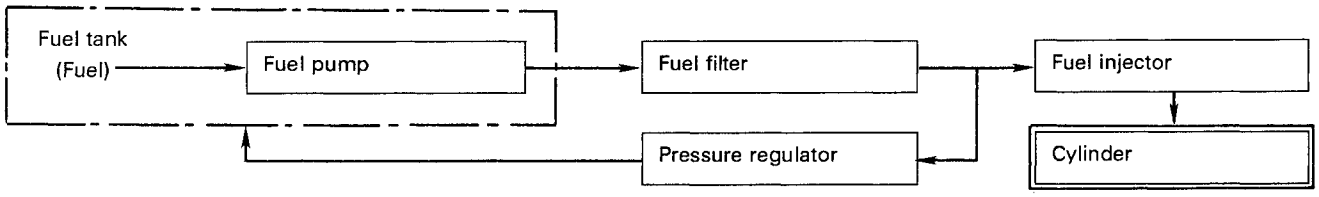
3. Fuel Line

1. GENERAL

Fuel pressurized by the fuel pump built into the fuel tank is delivered to fuel injectors by way of the fuel pipe and fuel filter. Fuel is regulated to the optimum pressure level by the pressure regulator on the way to the injectors.

From the injectors, fuel is injected into the intake manifold where it is mixed with intake air, and is then delivered to the respective cylinders.

Fuel injection timing and the amount of fuel injected is regulated by the ECU.



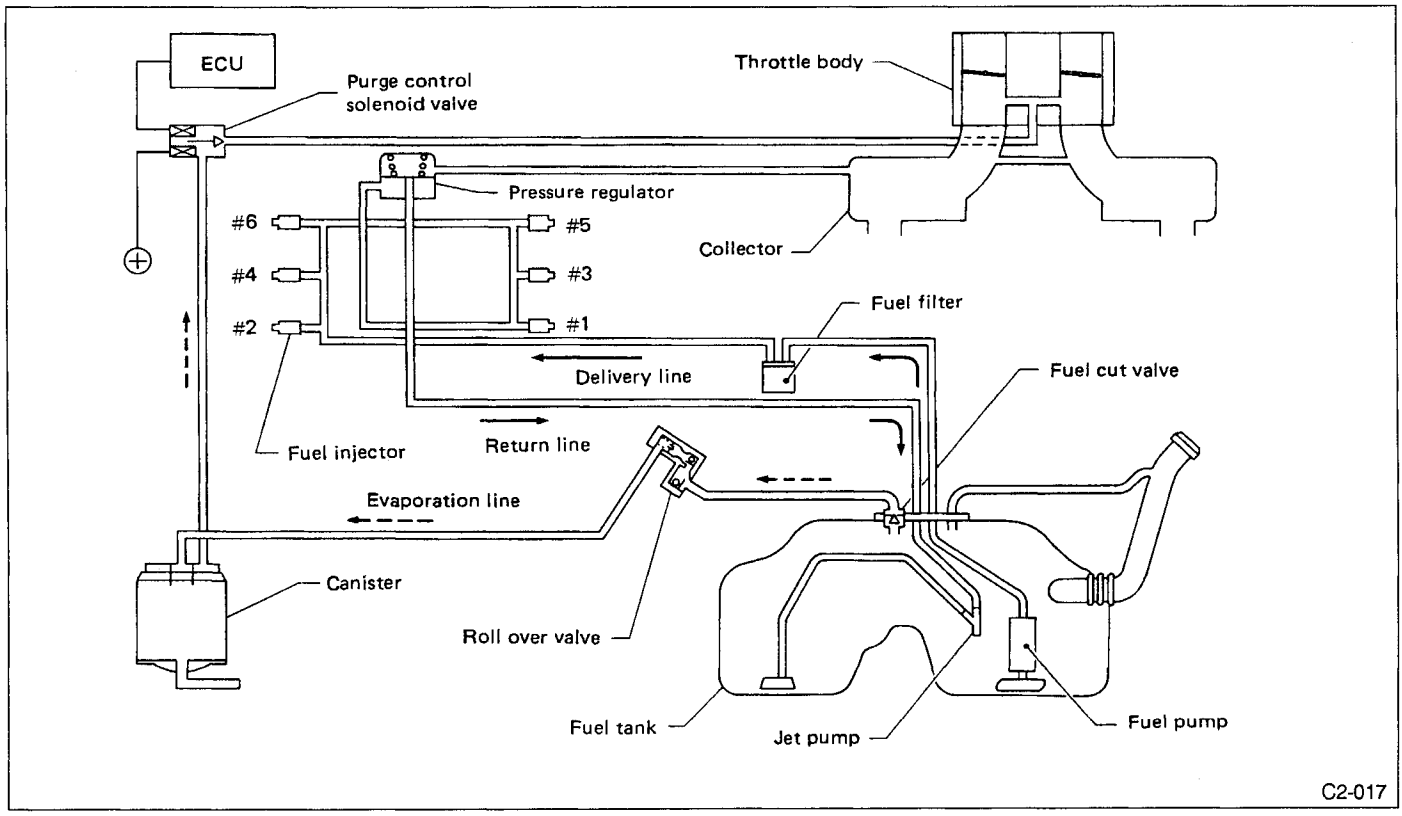


Fig. 5

2. PRESSURE REGULATOR

The pressure regulator is divided into the fuel chamber and the spring chamber by the diaphragm as illustrated below. Fuel is fed to the fuel chamber through the fuel inlet connected with the injector. A difference in pressure between the fuel chamber and the spring chamber connected with the intake manifold causes the diaphragm to be pushed down, and fuel is fed back to the fuel tank through the return line.

By returning fuel so as to balance the above pressure difference and the spring force, the fuel pressure is kept at a constant level 250.1 kPa (2.55 kg/cm^2, 36.3 psi) against the intake manifold pressure.

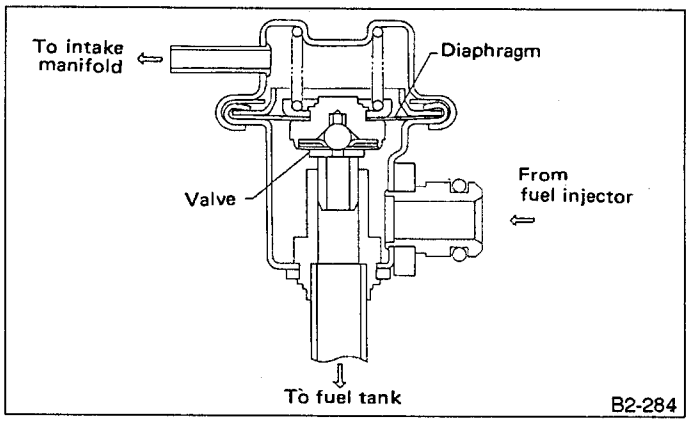


Fig. 6

3. FUEL INJECTOR

The MPFI system employs a gallery type (side-feed type) fuel injector.

The gallery type fuel injector is installed in the fuel pipe to allow cooling of the injector by the fuel.

The features of this type of fuel injector are as follows:

1) High heat resistance
2) Low driving noise
3) Easy to service
4) Small size

The fuel injector injects fuel according to the valve open signal received from the ECU.

The nozzle is attached on the top of the fuel injector. The needle valve is lifted by the solenoid coil through the plunger on arrival of the valve open signal.

Since the injector opening, the lifted level of valve and the regulator-controlled fuel pressure are kept constant, the amount of fuel to be injected can be controlled only by the valve open signal from the ECU.

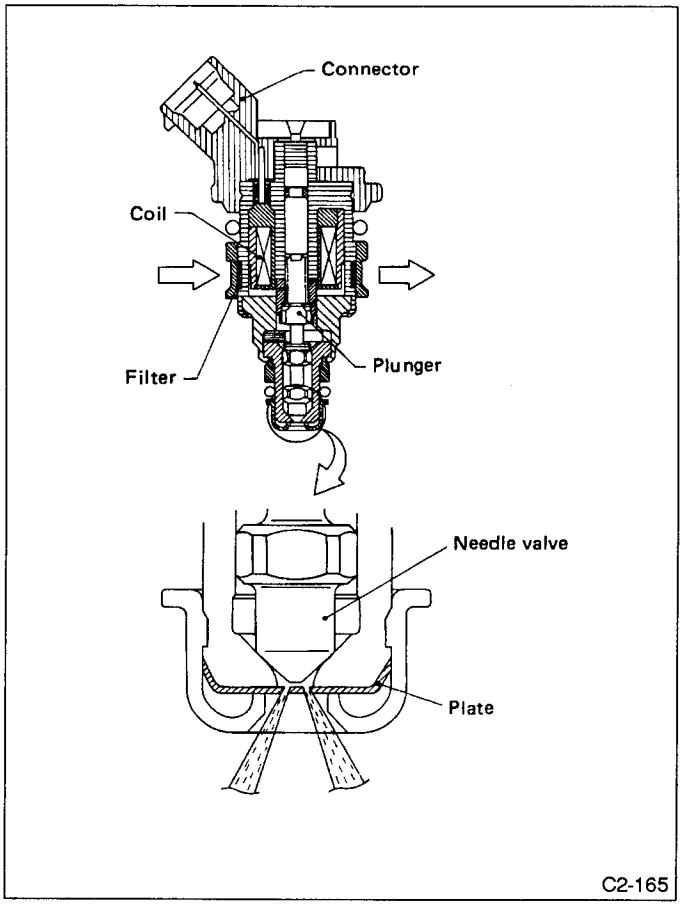
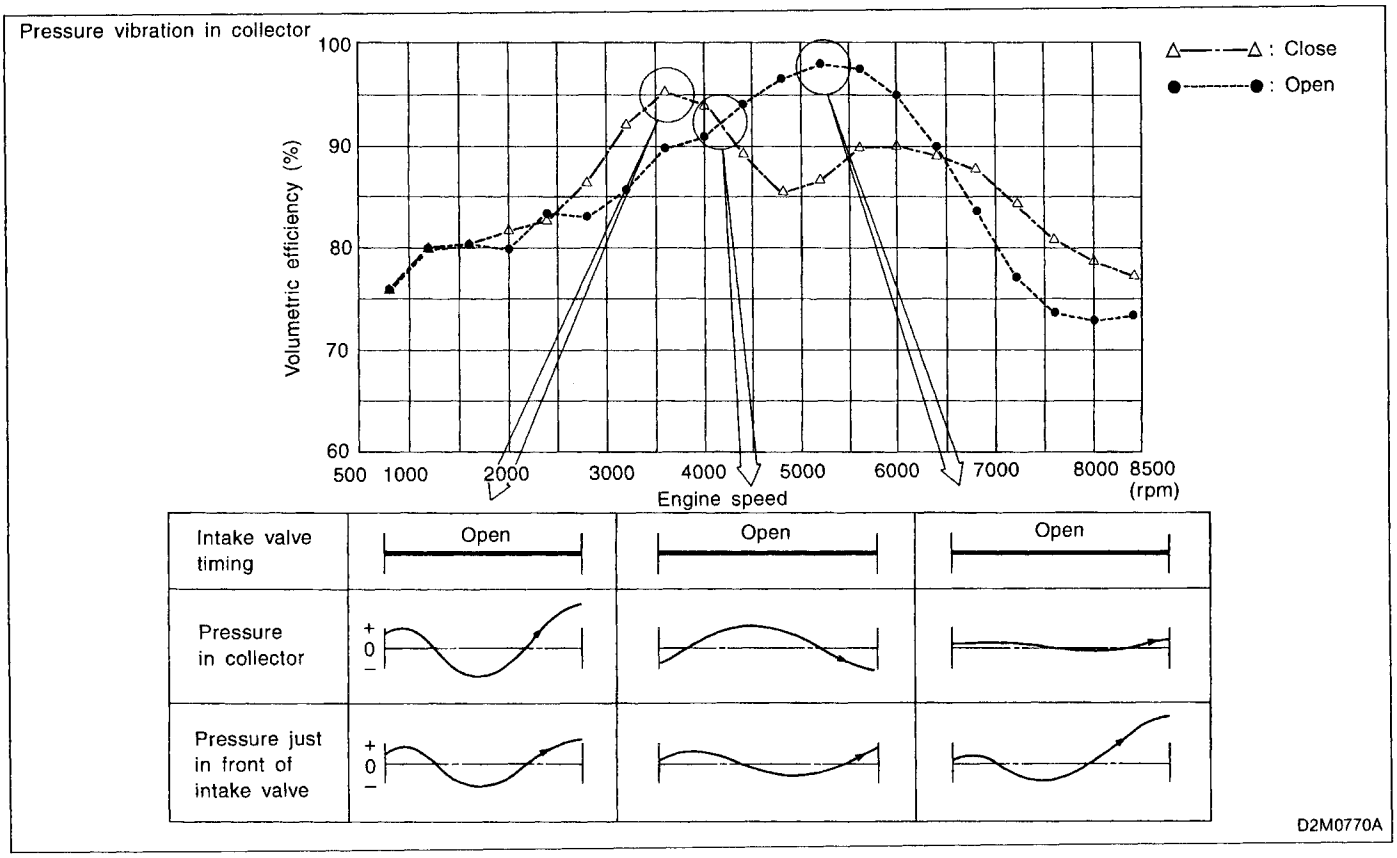


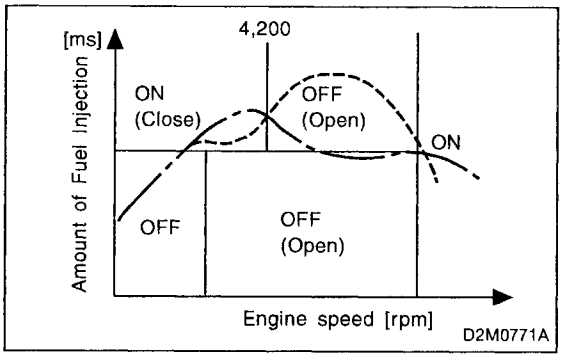
Fig. 7

4. Induction Control System

1. GENERAL

- The induction control system opens and closes the induction control valve to change the intake air flow rate according to engine operation, thereby increasing the amount of air introduced in the cylinders.
This increase in the amount of air is generally referred to as the "high" charging efficiency.
- The induction control system consists of the following parts:
  - ECM
  - Induction control solenoid valve (turns the vacuum applied to the diaphragm ON or OFF).
  - Induction control valve (installed in collector chamber)
  - Diaphragm (to open/close induction control valve)
  - Vacuum tank
  - Check valve





● The induction control valve operates on the intake manifold pressure transmitted to the diaphragm. The intake manifold pressure is controlled by opening/closing the induction control solenoid valve which is determined by the ECM according to the engine speed and amount of fuel injection.

2. FUNCTION

<Engine at standstill>

● While the engine is off, vacuum pressure is not applied to the diaphragm. The induction control valve is open.

<Engine idling>

● While the engine is idling, no signal is sent from the ECM. The induction control valve is open.

<Engine operating at low speeds>

● The induction control valve is open with engine operating under light loads.

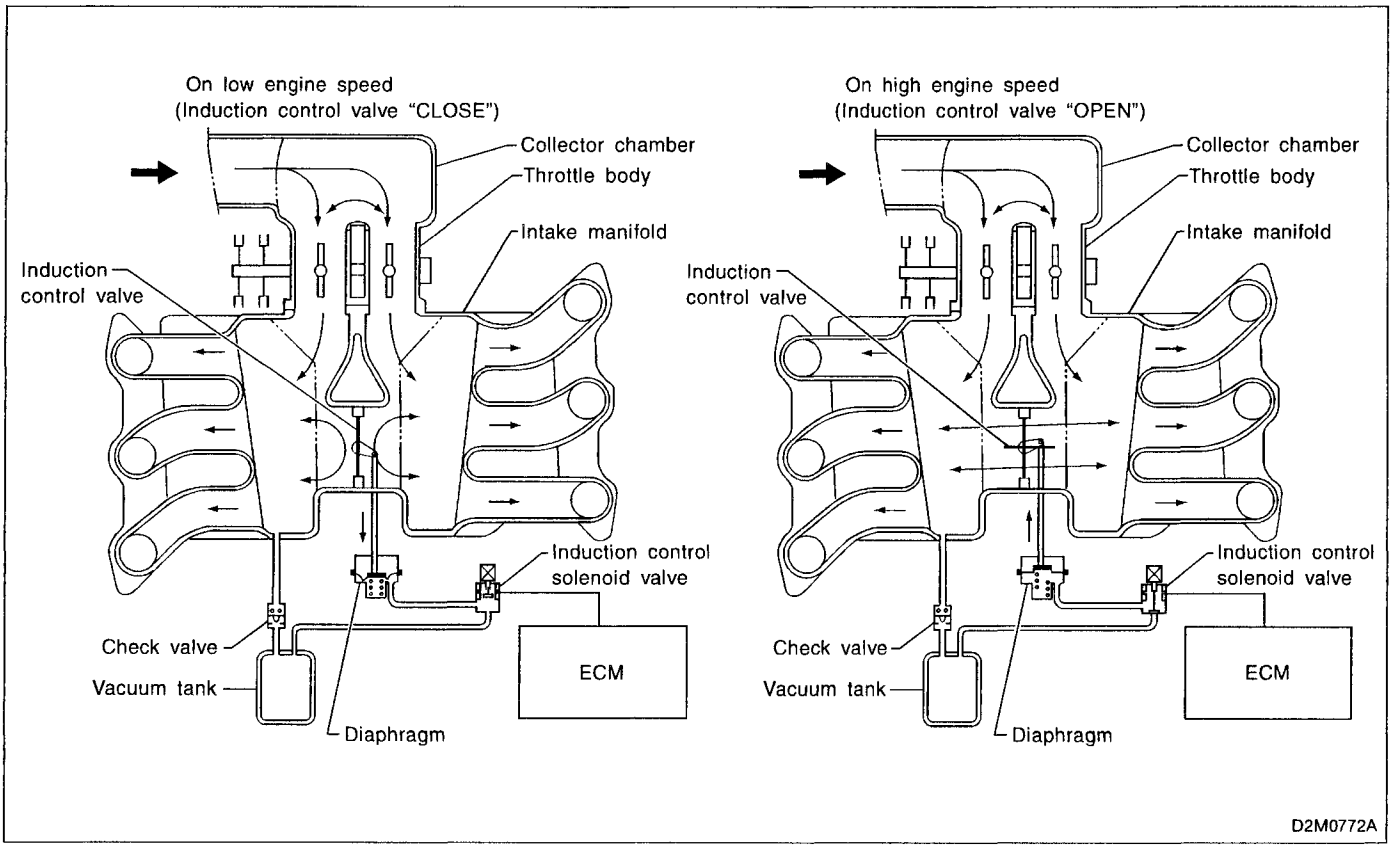
● As load increases, the engine picks up speed and then operates in the intermediate speed range. At this point, the induction control valve closes, allowing the left and right collector chamber intake air passages to operate independently of each other.

<Engine operating at intermediate speeds (2,300 — 4,200 rpm)>

● The induction control system receives a signal from the ECM. At this point, the induction control solenoid valve turns on (opens). Intake manifold vacuum pressure will then act on the diaphragm, closing the induction control valve. Now, even when the intake manifold vacuum pressure is decreased with changes in engine conditions, the check valve is closed, constantly maintaining vacuum pressure inside the vacuum tank. The induction control valve is also closed.

<Engine operating at high speeds>

● The induction control valve receives a signal from the ECM, turning off (closing) the induction control solenoid valve. At this point, atmospheric pressure from the solenoid valve end acts on the diaphragm, moving the induction control valve back. The induction control valve will then open, connecting the left and right collector chamber air passages.


On low engine speed
(Induction control valve "CLOSE")
Collector chamber
Throttle body
Intake manifold
Induction control valve
Induction control solenoid valve
Check valve
Vacuum tank
ECM
Diaphragm
On high engine speed
(Induction control valve "OPEN")
Collector chamber
Throttle body
Intake manifold
Induction control valve
Induction control solenoid valve
Check valve
Vacuum tank
ECM
Diaphragm
D2M0772A

5. Sensor and Switch

1. O_2 SENSOR

The O_2 sensor is used to sense oxygen concentration in the exhaust gas. If the fuel ratio is leaner than the stoichiometric ratio in the mixture (i.e. excessive amount of air), the exhaust gas contains more oxygen. To the contrary, if the fuel ratio is richer than the stoichiometric ratio, the exhaust gas contains hardly any oxygen.

Therefore, examination of the oxygen concentration in exhaust gas makes it possible to show whether the air/fuel ratio is leaner or richer than the stoichiometric ratio.

The O_2 sensor has a zirconia tube (ceramic) which generates voltage if there is a difference in oxygen concentration between the inside and outside of the tube. Platinum is coated on the inside and outside of the zirconia tube for the purpose of catalysis and electrode provision. The hexagon screw on the outside is grounded to the exhaust pipe, and the inside is connected to the ECU through the harness.

A ceramic heater is employed to improve performance at low temperature.

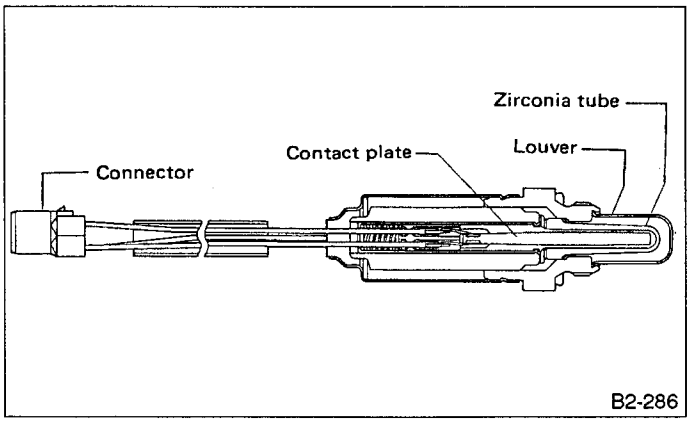


Fig. 11

When rich air-fuel mixture is burnt in the cylinder, the oxygen in the exhaust gases reacts almost completely through the catalytic action of the platinum coating on the surface of the zirconia tube. This results is a very large difference in the oxygen concentration between the inside and outside, and the electromotive force generated is large.

When a lean air-fuel mixture is burnt in the cylinder, oxygen remains in the exhaust gases even after the catalytic action, and this results in a small difference in the oxygen concentration. The electromotive force is very small.

The difference in oxygen concentration changes greatly in the vicinity of the optimum air-fuel ratio, and hence the change in the electromotive force is also large. By inputting this information into the MPFI control unit, the air-fuel ratio of the supplied mixture can be determined easily. The O_2 sensor does not generate much electromotive force when the temperature is low. The characteristics of the electromotive force stabilize at temperature of approximately 300 to 400°C (572 to 752°F).

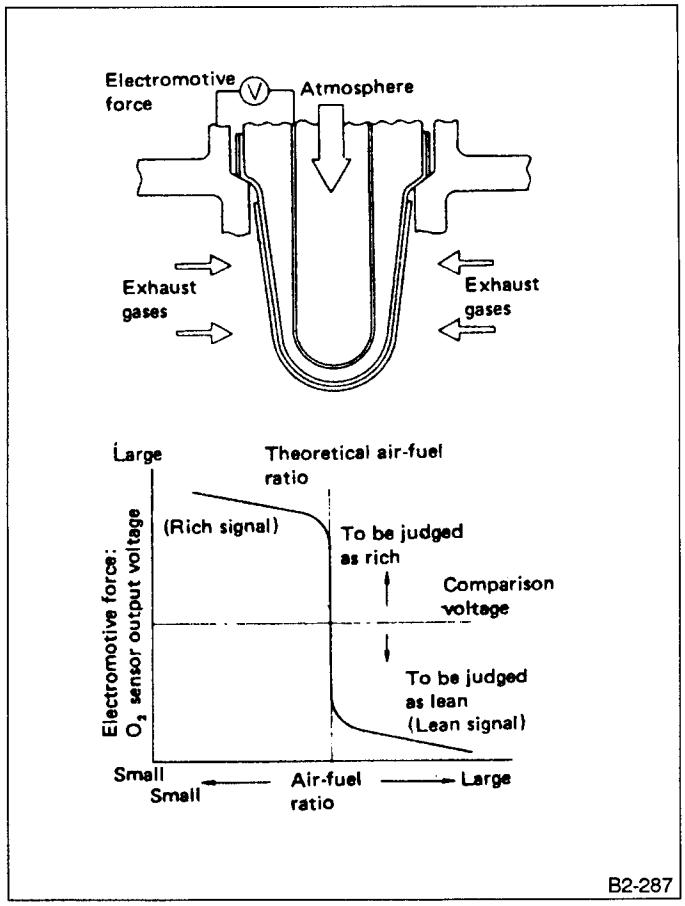


Fig. 12

2. WATER TEMPERATURE SENSOR

The water temperature sensor is located on the water pipe which is made of aluminum alloy. Its thermistor changes resistance with respect to temperature. A water temperature signal converted into resistance is transmitted to the ECU to control the amount of fuel injection, ignition timing, purge control solenoid valve, etc.

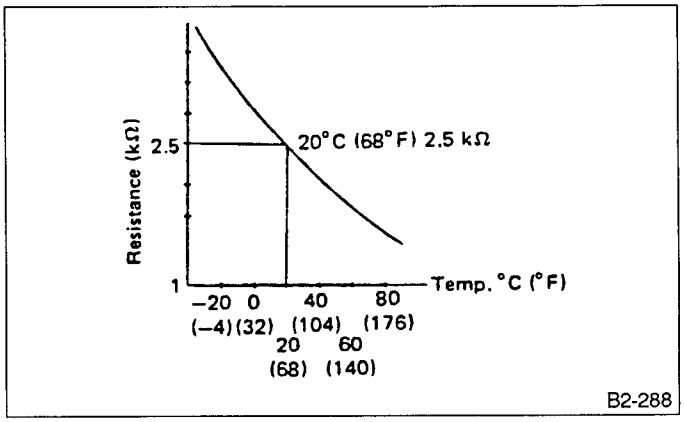


Fig. 13

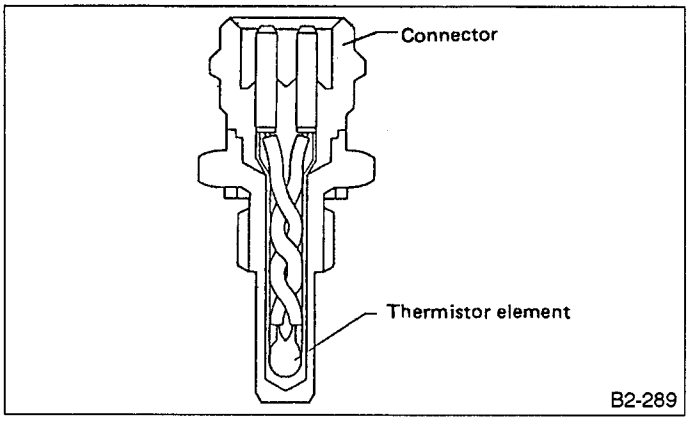


Fig. 14

3. KNOCK SENSOR

The knock sensor is installed on the cylinder block, and senses knocking signals from each cylinder.
This knock sensor is a piezo-electric type which converts knocking vibrations into electric signals.
It consists of a piezo-electric element, weight, and case. If knocking occurs in the engine, the weight in the case moves causing the piezo-electric element to generate a voltage.

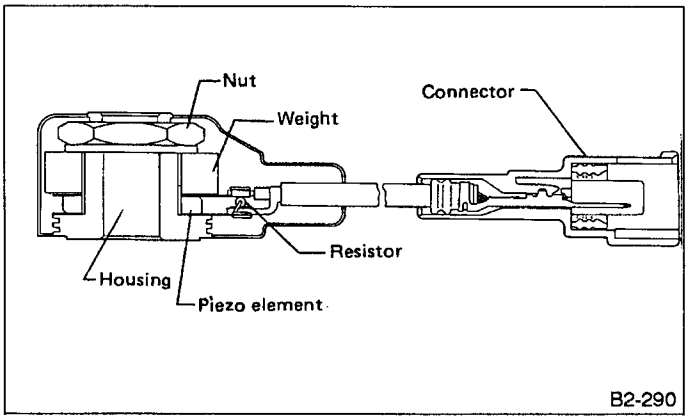


Fig. 15

4. CRANK ANGLE SENSOR 1

The crank angle sensor is installed on the oil pump, located in the front center portion of the cylinder block, to detect the crank angle position. It is designed so that the ECU accurately reads the number of pulses which occur when protrusions provided at the perimeter of the crank sprocket (rotating together with the crankshaft) cross the crank angle sensor.
The crank angle sensor is a molded type which consists of a magnet, pick-ups, coil, terminals, etc.

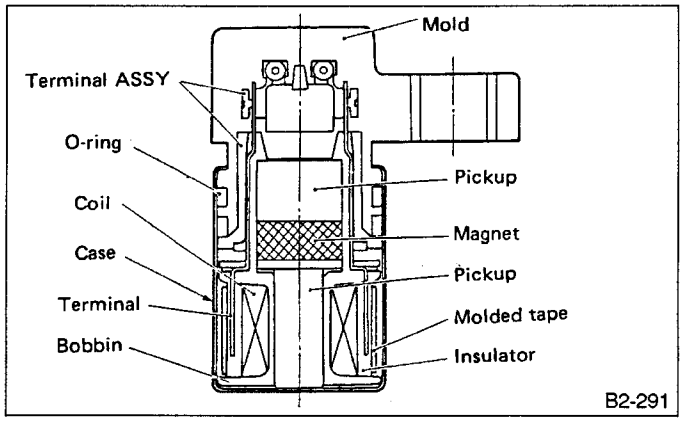


Fig. 16

Function

The crank sprocket which is used with crank angle sensor 1, is provided with twelve protrusions. Crank rotation causes these protrusions to cross crank angle sensor 1 so that magnetic fluxes in the coil change with the change in air gap between the sensor pickup and the sprocket. The change in air gap induces an electromotive force which is transmitted to ECU. ECU detects every 30° of the crank angle.

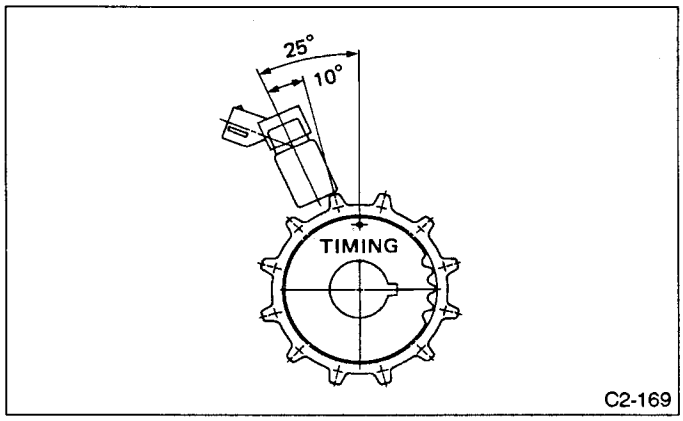


Fig. 17

5. CRANK ANGLE SENSOR 2

The crank sprocket which is used for crank angle sensor 2, is provided with six protrusions. As the crank sprocket rotates as crank shaft the ECU detects that each cylinder is divided into two grounds the #3-#2-#5, #4-#1-#6).

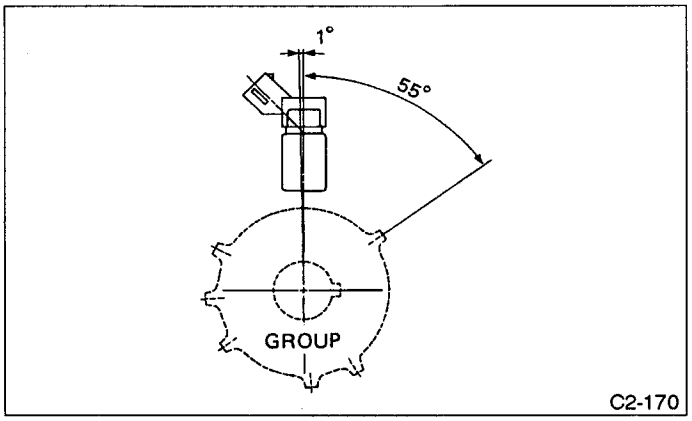


Fig. 18

6. CAM ANGLE SENSOR

Cam angle sensor is located on the left-hand camshaft support. The back of LH cam sprocket is provided with one protrusion. As the cam shaft sprocket rotates a half crank sprocket speed, cam angle sensor emits a signal to the ECU whenever engine rotates two revolutions. The ECU detects the compression top dead center of each cylinder with the crank angle sensor 2 signal which is accompanied with the cam angle sensor signal.

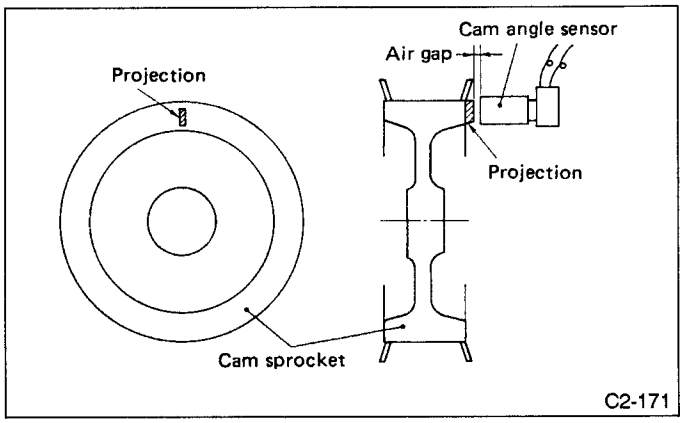
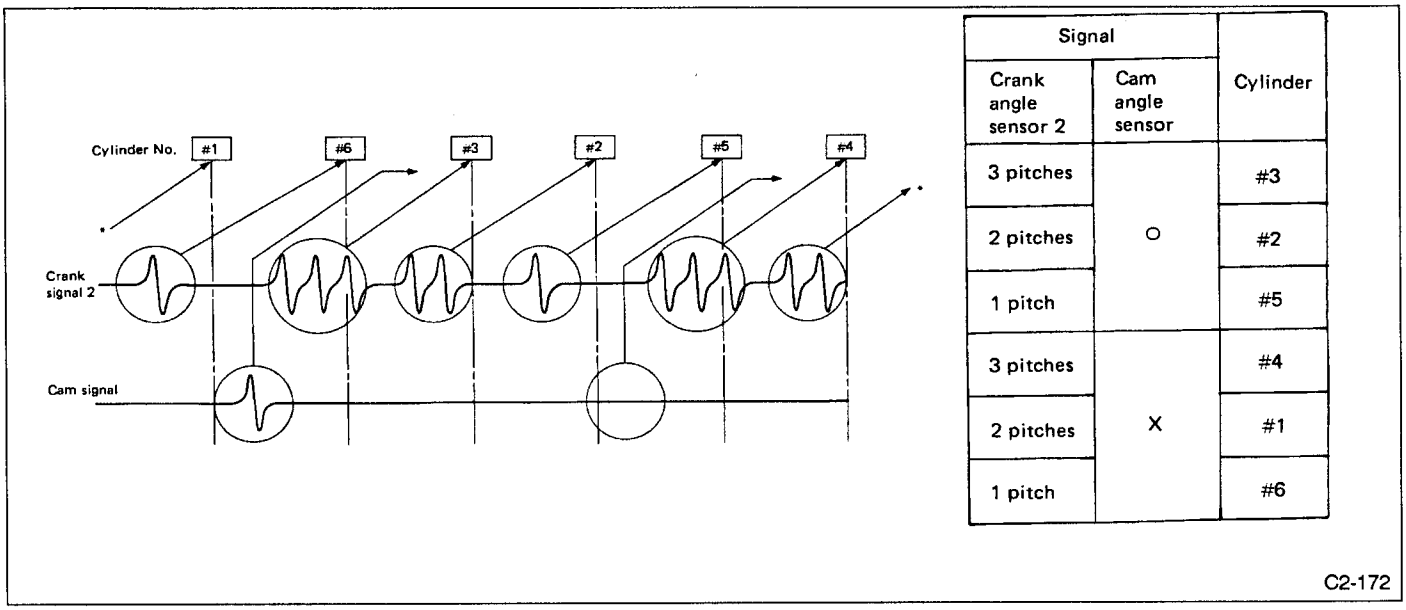


Fig. 19

7. HOW TO DETECT EACH CYLINDER

The crank angle sensor 2 issues signals in the order of 3-pitches, 2-pitches, and 1-pitch, and the cam angle sensor issues one signal for every two crankshaft rotations. Then, the ECU knows which cylinder will reach the compression top dead center next according to the combination of the signals issued from both sensors.



Signal		Cylinder
Crank angle sensor 2	Cam angle sensor	
3 pitches	O	#3
2 pitches		#2
1 pitch		#5
3 pitches	X	#4
2 pitches		#1
1 pitch		#6

Fig. 20

6. Control System

1. GENERAL

The ECM receives signals sent from various sensors and switches to judge the engine operating condition and emits output signals to provide the optimum control and/or functioning of various systems.
Major items governed by the ECM are as follows:

- Fuel injection control
- Ignition system control
- By-pass air control (idle speed control)
- EGR control
- Canister purge control
- Radiator fan control
- Engine torque control
- A/C system control
- Fuel pump control
- Self-diagnosis function

2. INPUT AND OUTPUT SIGNALS

	Unit	Function
Input signal	Air flow sensor	Detects amount of intake air.
	Throttle sensor	Detects throttle position.
	O_2 sensor 1	Detects the density of O_2 in exhaust gases.
	O_2 sensor 2	
	Crank angle sensor 1	Detects engine speed.
	Crank angle sensor 2	Detects the relative cylinder position.
	Cam angle sensor	
	Water temperature sensor	Detects coolant temperature.
	Knock sensor 1	Detects engine knocking for all cylinders.
	Knock sensor 2	
	Vehicle speed sensor	Detects vehicle speed.
	Atmospheric pressure sensor	Detects atmospheric pressure.
	Ignition switch	Detects ignition switch operation.
	Starter switch	Detects the condition of engine cranking.
	Inhibitor switch	Detects shift position.
	A/C switch	Detects ON-OFF operation of A/C switch.
Output signal	Fuel injector	Inject fuel.
	Ignition signal	Turn primary ignition current ON or OFF.
	Fuel pump relay	Turn fuel pump relay ON or OFF.
	A/C control relay	Turn A/C control relay ON or OFF.
	Radiator fan control relay	Turns radiator fan control relay ON or OFF.
	Induction control solenoid valve	Controls Induction control valve.
	By-pass air control solenoid valve	Adjusts amount of by-pass air through throttle valve.
	EGR solenoid valve	Controls EGR valve.
	Purge control solenoid valve	Controls canister purge control solenoid valve.
	CHECK ENGINE light	Indicates trouble.

3. FUEL INJECTION CONTROL

ECU receives signals emitted from various sensors to control the amount of fuel injected and the fuel injection timing. Sequential fuel injection control is utilized over the entire engine operating range except during standing starts.

As for injection timing, the ECU controls the starting of injection with leading to the signal emitted from crank angle sensor 1.

The starting of injection is changed between BTDC 50° (deg) and BTDC 10° (deg) under various conditions.

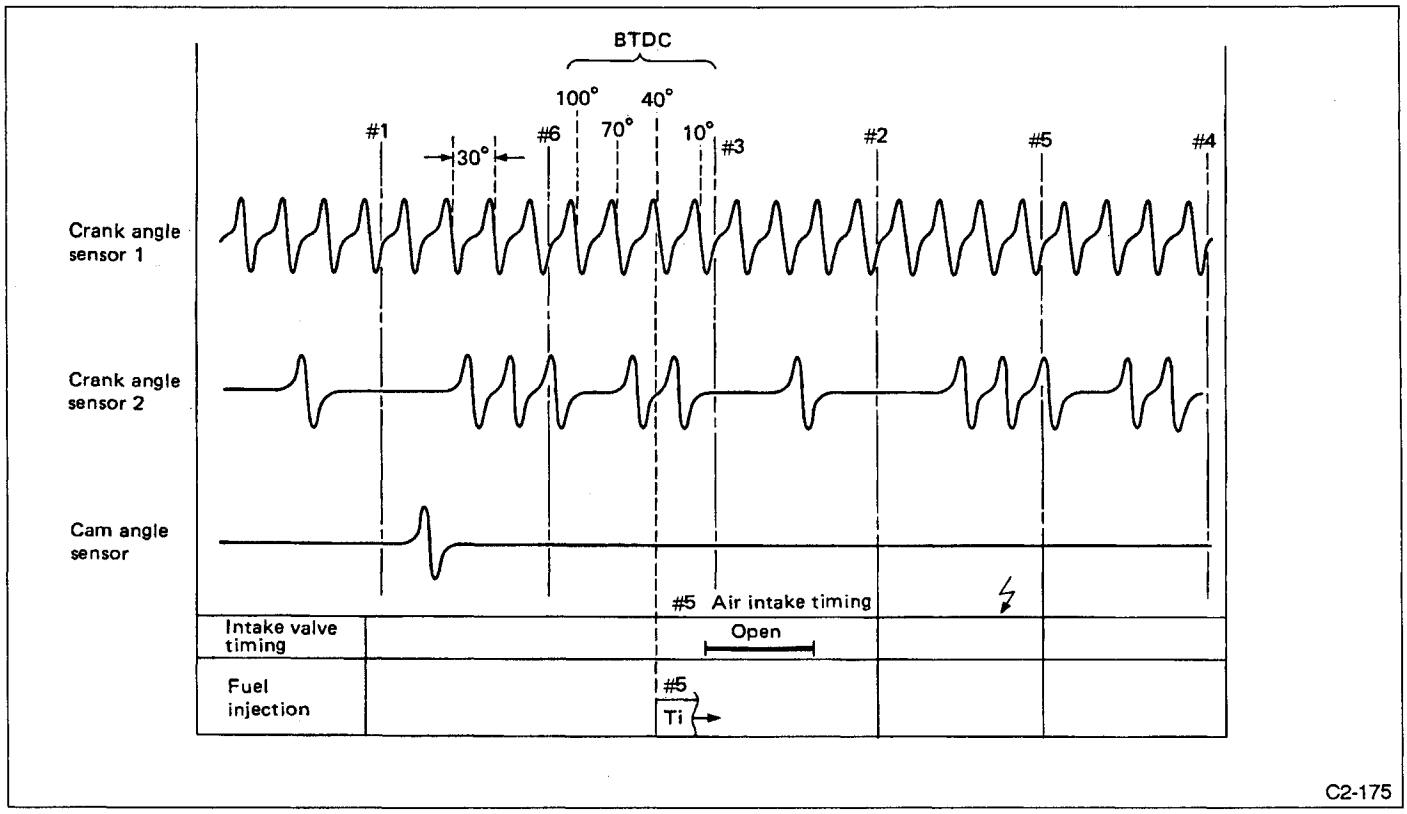


Fig. 21

The amount of fuel injected by the injector valve is dependent upon the length of time it remains open. The optimum fuel injection timing is determined by transmitting a signal to the injector from the ECU according to varying engine operations. Feedback control is also accomplished by means of a learning control. As a result, the fuel injection control system is highly responsive and accurate in design and structure.

The sequential fuel injection system is designed so that fuel is injected at a specific time to provide maximum air intake efficiency for each cylinder. In other words, fuel injection is completed just before the intake valve begins to open.

1) Fuel injection characteristics

Fuel injection timing is basically expressed as indicated below:

(1) During engine starts:
Duration of fuel injection
= Duration of fuel injection during engine starts

(2) During normal operation:
Basic duration of fuel injection x correction factor + voltage correction time

- Basic duration of fuel injection ..... The basic length of time fuel is injected. This is determined by two factors—-the amount of intake air detected by the air flow sensor and the engine speed (rpm) monitored by the crank angle sensor.
- Duration of fuel injection during engine starts ..... Determined according to the engine coolant temperature detected by a signal emitted from the water temperature sensor to improve starting ability.
- Voltage correction time ..... Compensates for the fuel injector's time lag affected by the battery voltage.

2) Correction coefficients

Correction coefficients are used to correct the basic duration of fuel injection so that the air-fuel ratio meets the requirements of varying engine operations.

These correction coefficients are classified as follows:

(1) Air-fuel ratio coefficient:
Allotted to provide the optimum air-fuel ratio in relation to engine speed and the basic amount of fuel injected.

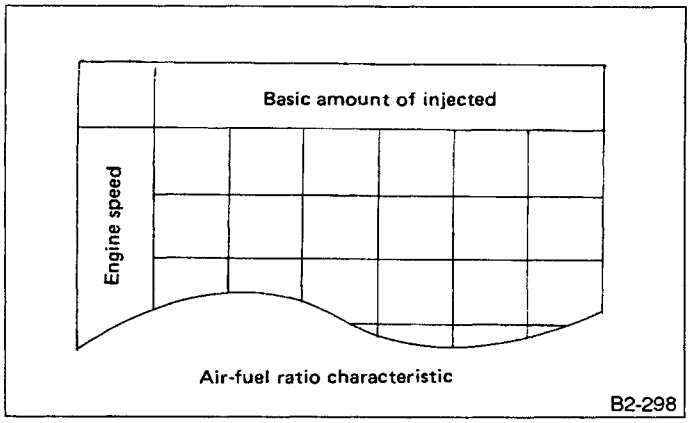


Fig. 22

(2) Start increment coefficient:
Increases the amount of fuel injected only when cranking the engine, which improves starting ability.

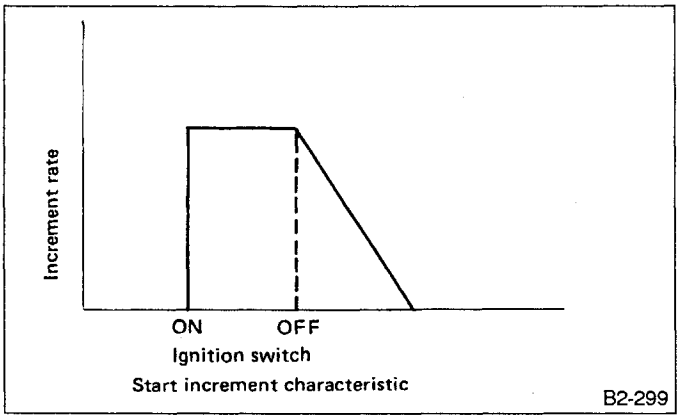


Fig. 23

(3) Water temperature increment coefficient:
Used to increase the amount of fuel injected in relation to a signal emitted from the water temperature sensor for easier starting of a cold engine. The lower the water temperature, the greater the increment rate.

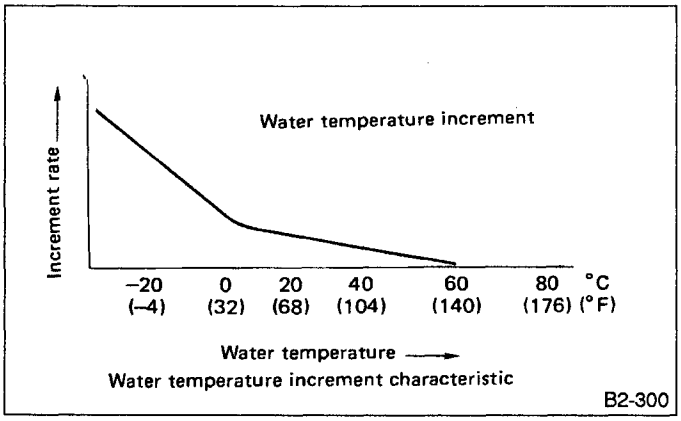


Fig. 24

(4) After-start increment coefficient:
Increases the amount of fuel injected for a certain period of time immediately after the engine starts to stabilize engine operation.

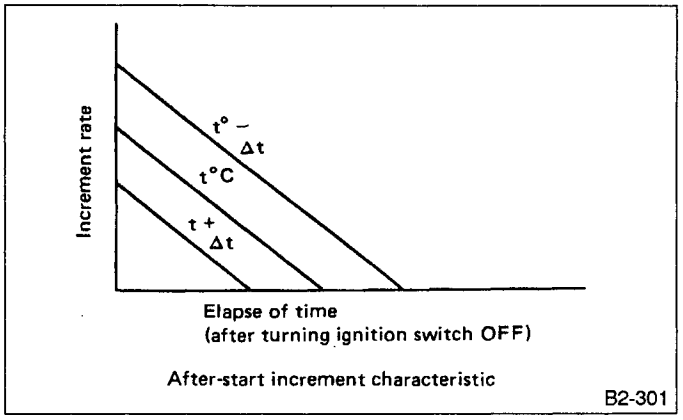


Fig. 25

(5) Full increment coefficient:
Increases the amount of fuel injected by a signal emitted from the throttle sensor in relation to a signal emitted from the air flow sensor.

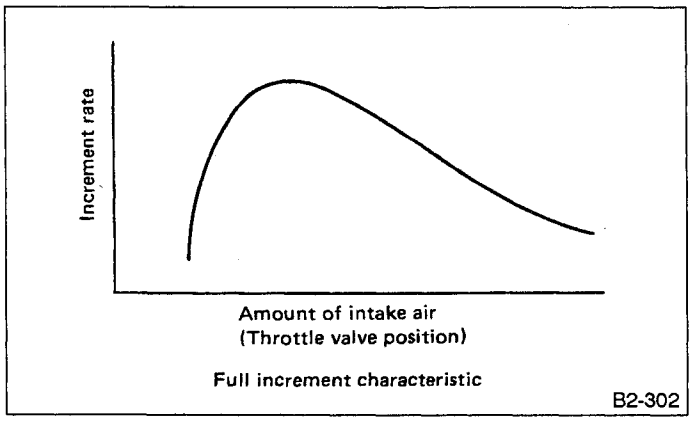


Fig. 26

(6) Acceleration increment coefficient:
Compensates for time lags of air flow measurement and/or fuel injection during acceleration to provide quick response.

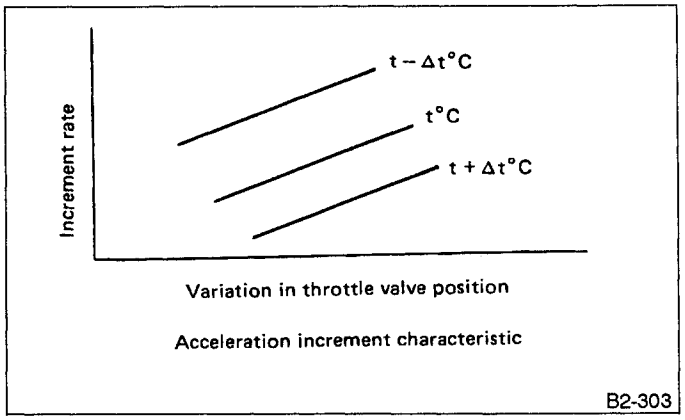


Fig. 27

3) Air-fuel ratio feedback coefficient "alpha"
This feedback coefficient utilizes the O_2 sensor's electromotive force (voltage) as a signal to be entered into the ECU. When low voltage is entered, the ECU judges it as a lean mixture, and when high voltage is entered, it is judged as a rich mixture. In other words, when the air-fuel ratio is richer than the theoretical air-fuel ratio, the amount of fuel injected is decreased. When it is leaner, the amount of fuel injected is increased. In this way, the air-fuel ratio is compensated so that it comes as close to the theoretical air-fuel ratio as possible on which the three-way catalyst acts most effectively. (CO, HC and NOx are also reduced when the air-fuel ratio is close to theoretical air-fuel ratio.)

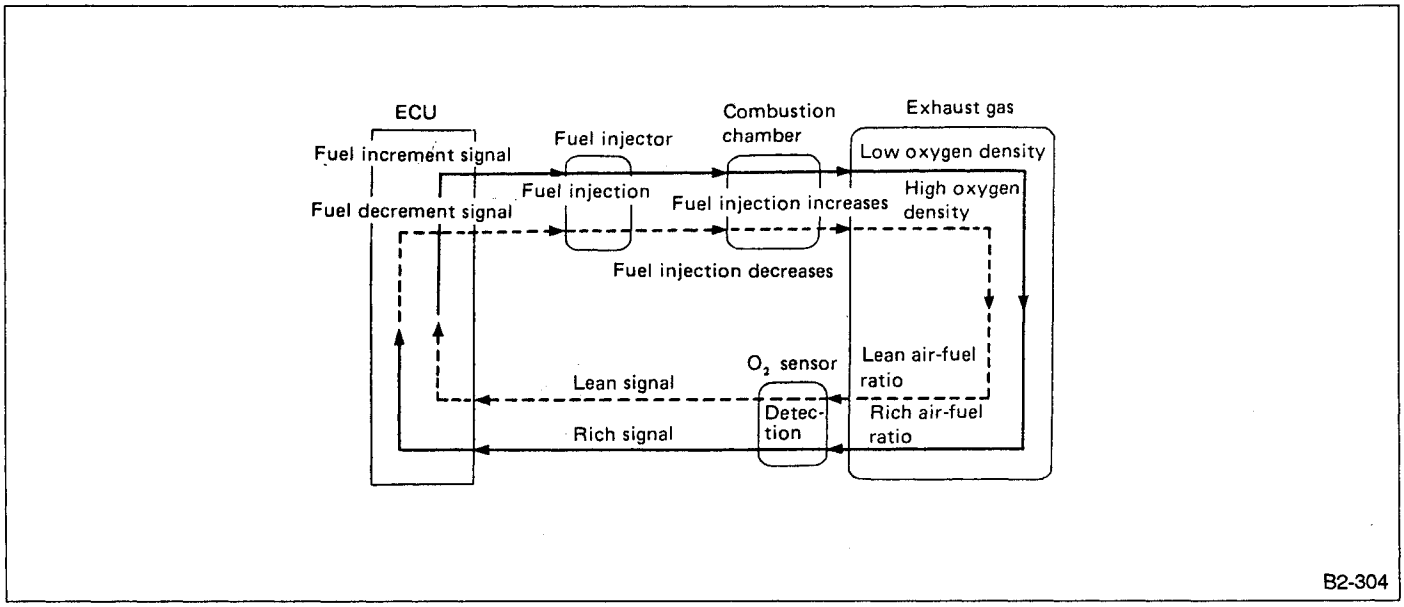
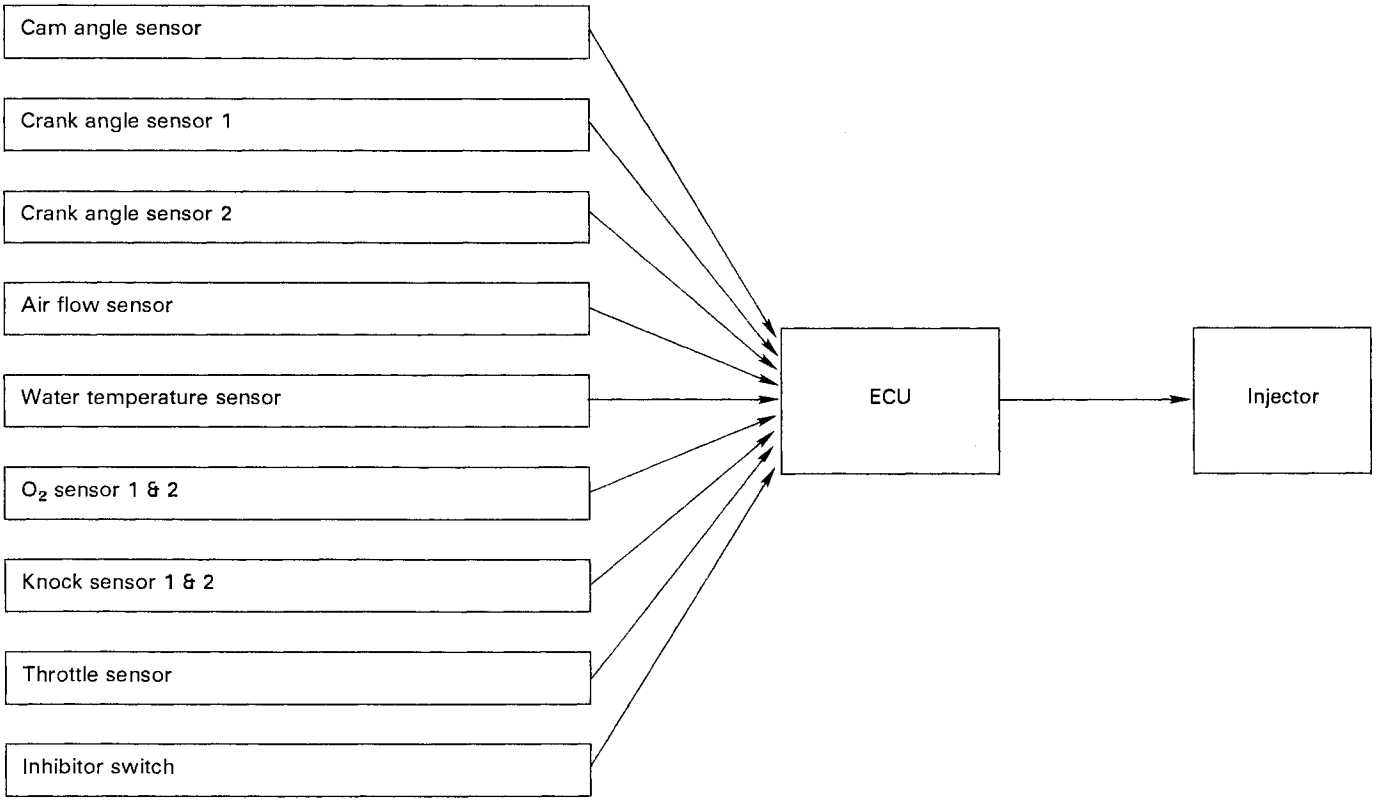


Fig. 28

4) Learning control system

In a conventional air-fuel feedback control system, the basic amount of fuel injected (according to engine speed and various loads) is stored in the memory. After the ECU receives a signal emitted from the O_2 sensor, the basic amount of fuel injected is corrected so that it is close to the theoretical air-fuel ratio. This means that the greater the air-fuel ratio is corrected, the lesser the control accuracy.

In Subaru engines, however, an air-fuel ratio learning control system constantly memorizes the amount of correction required in relation to the basic amount of fuel to be injected (the basic amount of fuel injected is determined after several cycles of fuel injection), so that the correction affected by feedback control is minimized. Thus, quick response and accurate control of variations in air-fuel ratio, sensors' and actuators' characteristics during operation, as well as in the air-fuel ratio with the time of engine operation, are achieved. In addition, accurate control contributes much to stability of exhaust gases and driving performance.



4. IGNITION SYSTEM CONTROL

This ignition system is a direct ignition system which is composed of an ECU, six ignition coils, two knock sensors and other sensors. Six ignition coils are directly mounted to the spark plugs of the respective cylinders. This results in a reduced energy loss because no high tension cords are needed.

One knock sensor is installed on the left cylinder block, and another on the right cylinder block, thus ensuring accurate digital engine knock control.

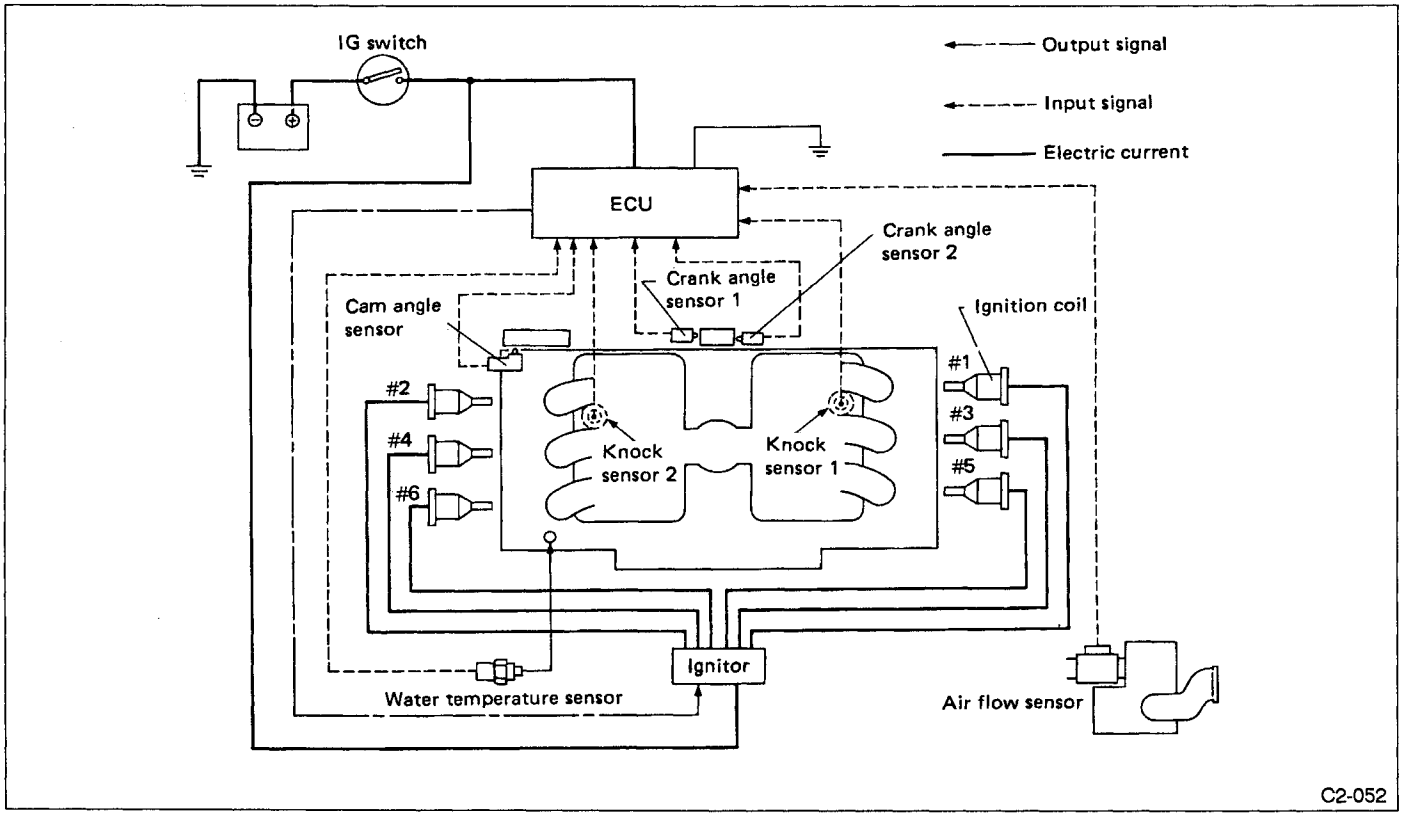


Fig. 29

ECU determines the ignition timing based on the signal from crank angle sensor 1, and sends the signal for igniter so as to spark the cylinder which is judged at compression top dead center based on the signal from crank angle sensor 2 and cam angle sensor.

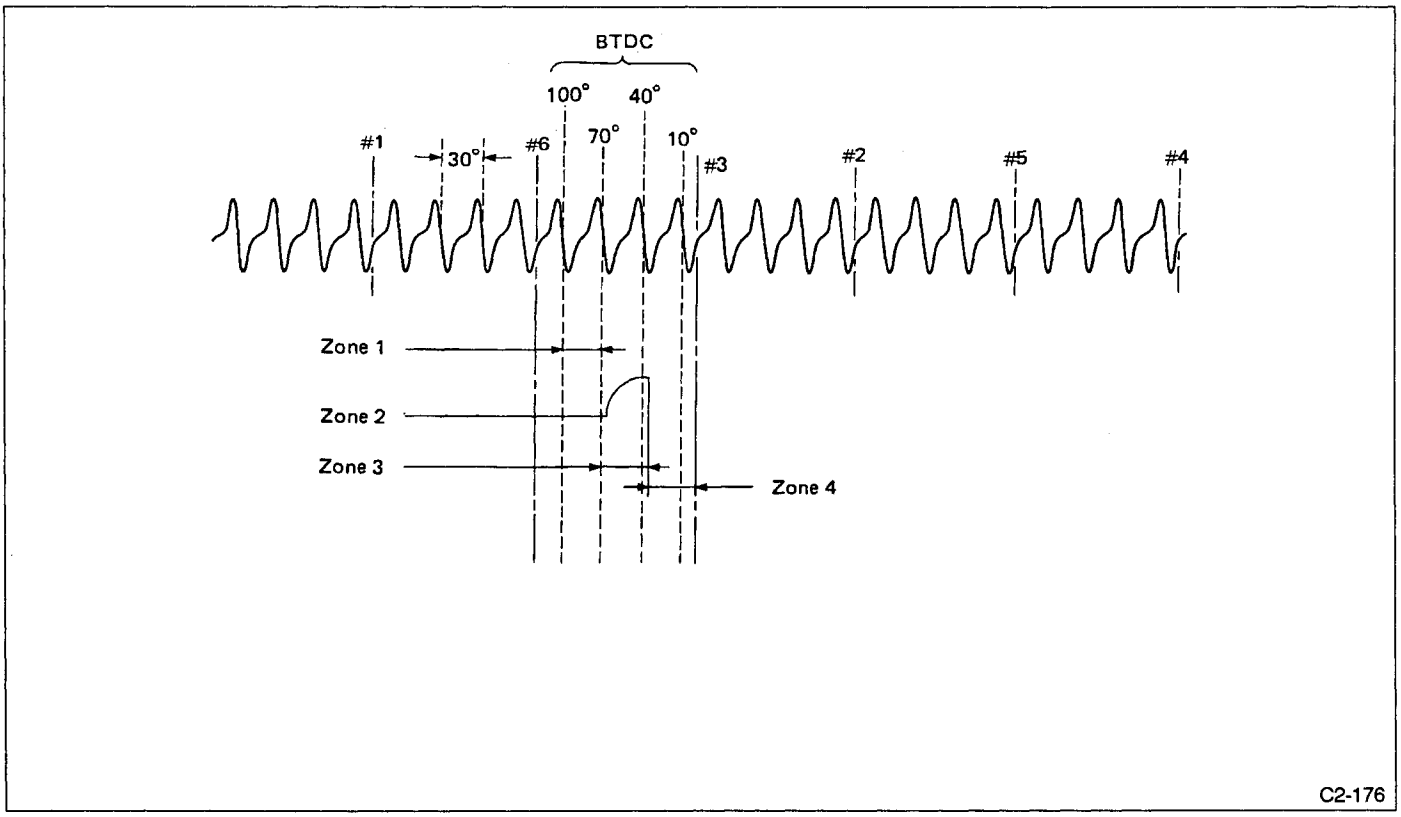


Fig. 30

When engine speed is low, the ECU sends out the ignition signal in synchronization with the 10 deg signal.

Zone. 1: Judge engine speed with angular velocity.
Zone. 2: Dowel-set with 70° signal.
Zone. 3: Ignition timing determined by ECU.
Zone. 4: Actual ignition timing.

5. BY-PASS AIR CONTROL (IDLE SPEED CONTROL)

The ECU controls the operation of by-pass air control solenoid valve and auxiliary air control valve based on the signal from crank angle sensor 1, throttle sensor, vehicle speed sensor 2, water temperature sensor, ignition switch, A/C switch and inhibitor switch, etc. When coolant temperature is cold, the amount of by-pass air is controlled by auxiliary air control valve and by-pass air control solenoid valve. When coolant temperature is hot, it is controlled by only by-pass air control solenoid valve.

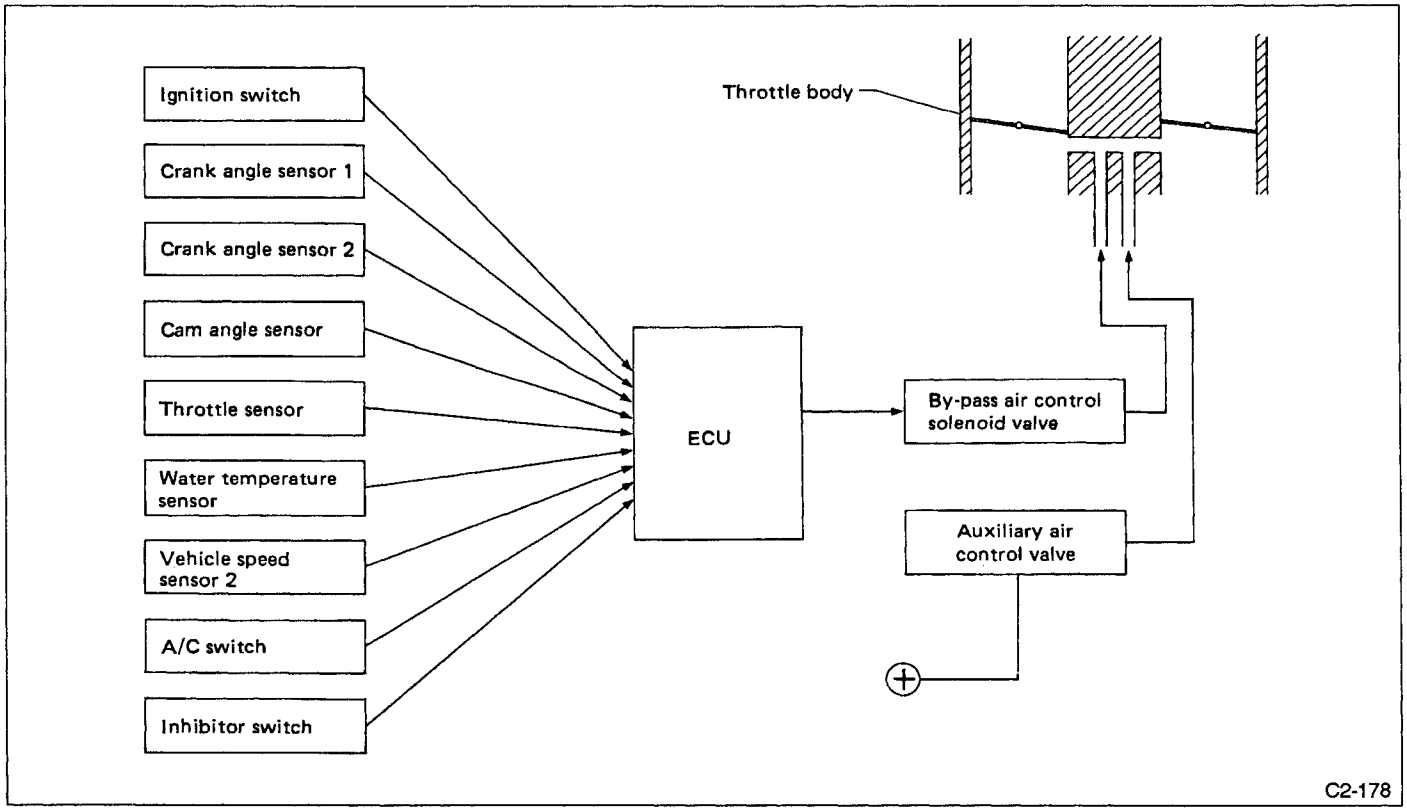


Fig. 31

6. EGR CONTROL

The EGR system is composed of an EGR valve, EGR solenoid valve, EGR vacuum controller, ECU, etc. The exhaust gas is recirculated when the EGR solenoid valve opens to allow the intake manifold pressure to be transmitted to the EGR valve.

ECU controls the EGR solenoid valve based on the signals sent from the water temperature sensor, O_2 sensors 1 and 2, crank angle sensor 1, etc.

Refer to C.2-1 Section 8.

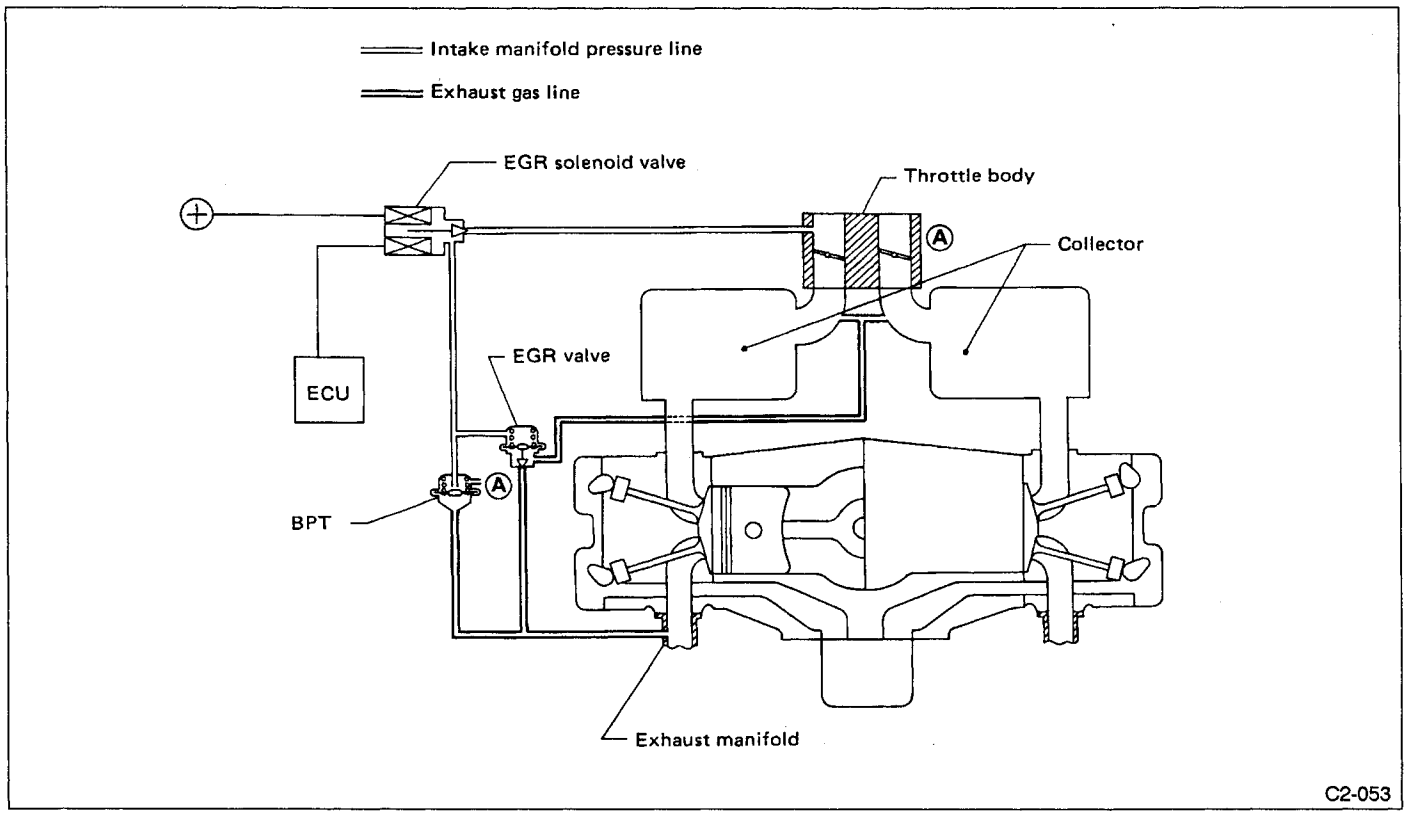


Fig. 32

7. CANISTER PURGE CONTROL

ECU receives signals emitted from water temperature sensor, vehicle speed sensor 2 and crank angle sensor 1 to control purge control solenoid valve.

Canister purge takes place during operation of the vehicle except under certain conditions (during idle, etc.).

Refer to C.2-1 Section 9.

8. RADIATOR FAN CONTROL

The radiator fan operation has four steps: off (OFF), low (Lo), medium (MD), and high (HI) to reduce noise and load.

The operating condition of the radiator fan is determined by the combination of signals sent from the A/C switch, A/C trinary switch, vehicle speed sensor 2 and water temperature sensor.

A/C switch	Vehicle speed X O 10(6) 20(12) Unit: km/h (mph)	Water temperature X O 89(192) 95(203) Unit: °C (°F)	A/C trinary switch X O 13 16 Unit: kg/cm²	ECU output signal Fan relay NO.		Operation of radiator fan	
				No. 1	No. 2	Main fan (RH)	Sub fan (LH)
O	X	X	X	—	•	LO	LO
			O	•	—	MD	MD
		O	X	•	—	MD	MD
			O	•	•	HI	HI
	O	X	X	—	•	LO	LO
			O	•	•	HI	HI
		O	X	•	•	HI	HI
			O	•	•	HI	HI
X	X	X		—	—	OFF	OFF
		O		—	•	LO	LO
	O	X		—	—	OFF	OFF
		O		•	—	MD	MD

O: Signal ON X: signal OFF

9. ENGINE TORQUE CONTROL

In order to reduce gear shift shocks and protect transmission gears, engine torque is controlled shifting up under heavy loads or when the transmission is in the manual mode.

10. A/C SYSTEM CONTROL

The ECU controls ON/OFF of the air conditioning (A/C) system. In addition, it controls the amount of electric current sent to the NC compressor, thereby controlling the quantity of refrigerant sent out by the compressor. When the A/C switch is set to ON when the coolant temperature is high, the refrigerant delivery quantity is reduced to lower the coolant temperature, thereby protecting the engine itself. The same control system is adopted to smooth engine speed variations when the A/C switch is turned ON or OFF.

11. FUEL PUMP CONTROL

- The ECM receives an input signal emitted from the crankshaft position sensor and ignition switch, and turns the fuel pump relay ON or OFF to control fuel pump operation.

To improve safety, the fuel pump will stop if the engine stalls with the ignition switch ON.

- When the fuel pump operating voltage is maintained at a constant level, the fuel pump also operates at a constant speed regardless of engine rpm. In the low engine speed range, much more fuel is discharged from the fuel pump than the amount of fuel injected from the fuel injectors. At this point, evaporation gases are produced inside the fuel tank. To decrease fuel discharged from the fuel pump when fuel consumption is reduced in the low engine speed range, the fuel pump modulator and resistor monitor are adopted to control the fuel pump.

7. Self-diagnosis System

1. GENERAL

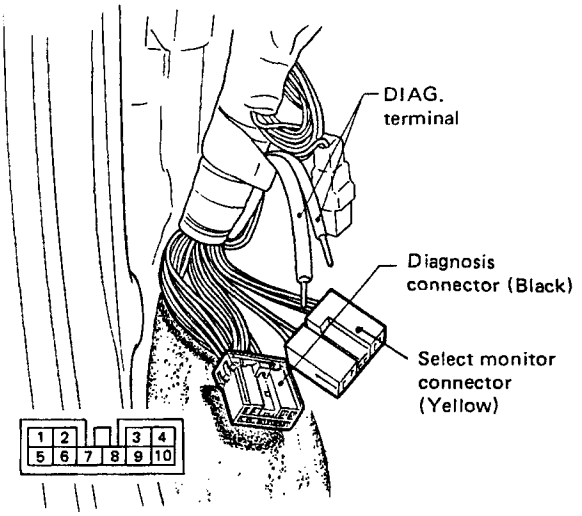
The self-diagnosis system detects and indicates a fault in various inputs and outputs of the complex electronic control. The warning light (CHECK ENGINE light) on the instrument panel indicates occurrence of a fault or trouble.

Further, against such a failure or sensors as may disable the drive, the fail-safe function is provided to ensure the minimal driveability.

2. FUNCTION OF SELF-DIAGNOSIS

The self-diagnosis function has four modes: U-check mode, Read memory mode, D-check mode and Clear memory mode. Two terminals (Read memory and Test mode) and light (CHECK ENGINE light) are used. The DIAG. terminals are for mode selection and the light monitors the type of problem.

- Relationship between modes and connectors



1 Test mode of MPFI
2 Read memory of MPFI
3 Clear memory of SRS
4 —
5 Test mode of power steering
6 Read memory of power steering
7 Diagnosis of power steering
8 Diagnosis of passive belt
9 Diagnosis of SRS
10 Ground

C2-180

Fig. 33

Mode	Engine	Read memory terminal	Test mode terminal
U-check	Ignition ON	DISCONNECT	DISCONNECT
Read memory	Ignition ON	CONNECT	DISCONNECT
D-check	Ignition ON (engine on)	DISCONNECT	CONNECT
Clear memory	Ignition ON (engine on)	CONNECT	CONNECT

- U-check mode

The U-check is a user-oriented mode in which only the MPFI components necessary for start-up and drive are diagnosed. On occurrence of a fault, the warning light (CHECK ENGINE light) is lighted to indicate to the user that the dealer's inspection is necessary. The diagnosis of other parts which do not give significant adverse effect to start-up and drive are excluded from this mode in order to avoid unnecessary uneasiness to be taken by the user.

- Read memory mode

This mode is used by the dealer to read past problems (even when the vehicle's monitor light are off). It is most effective in detecting poor contact or loose connections of connectors, harnesses, etc.

- D-check mode

This mode is used by the dealer to check the entire MPFI system and detect faulty parts.

- Clear memory mode

This mode is used by the dealer to clear the trouble code from the memory after the affected part is repaired.

After checking on each mode, reinstall DIAG. terminal to wire harness with tape.

3. BASIC OPERATION OF SELF-DIAGNOSIS SYSTEM

- **No TROUBLE '**

Mode	Read memory terminal	Test mode terminal	Condition	CHECK ENGINE light
U-check	X	X	Ignition switch ON (Engine OFF)	ON
			Engine ON	OFF
Read memory	O	X	Ignition switch ON (Engine OFF)	Blink
			Engine ON	
D-check	X	O	Ignition switch ON (Engine OFF)	ON
			Engine ON	Vehicle specification code → Blink*
Clear memory	O	O	Ignition switch ON (Engine OFF)	ON
			Engine ON	Vehicle specification code → Blink

- **TROUBLE**

Mode	Read memory terminal	Test mode terminal	Condition	CHECK ENGINE light
U-check	X	X	Ignition switch ON	ON
Read memory	O	X	Ignition switch ON (Engine OFF)	Trouble code (memory)
			Engine ON	ON
D-check	X	O	Engine ON	Trouble code**
Clear memory	O	O	Engine ON	Trouble code**

* When the engine operates at a speed greater than 2,000 rpm for more than 40 seconds, the check engine light blinks. However, when all check items check out "O.K.'," even before the 40 seconds is reached, the check engine light blinks.

** When the engine operates at a speed greater than 2,000 rpm for more than 40 seconds, a trouble code is emitted.

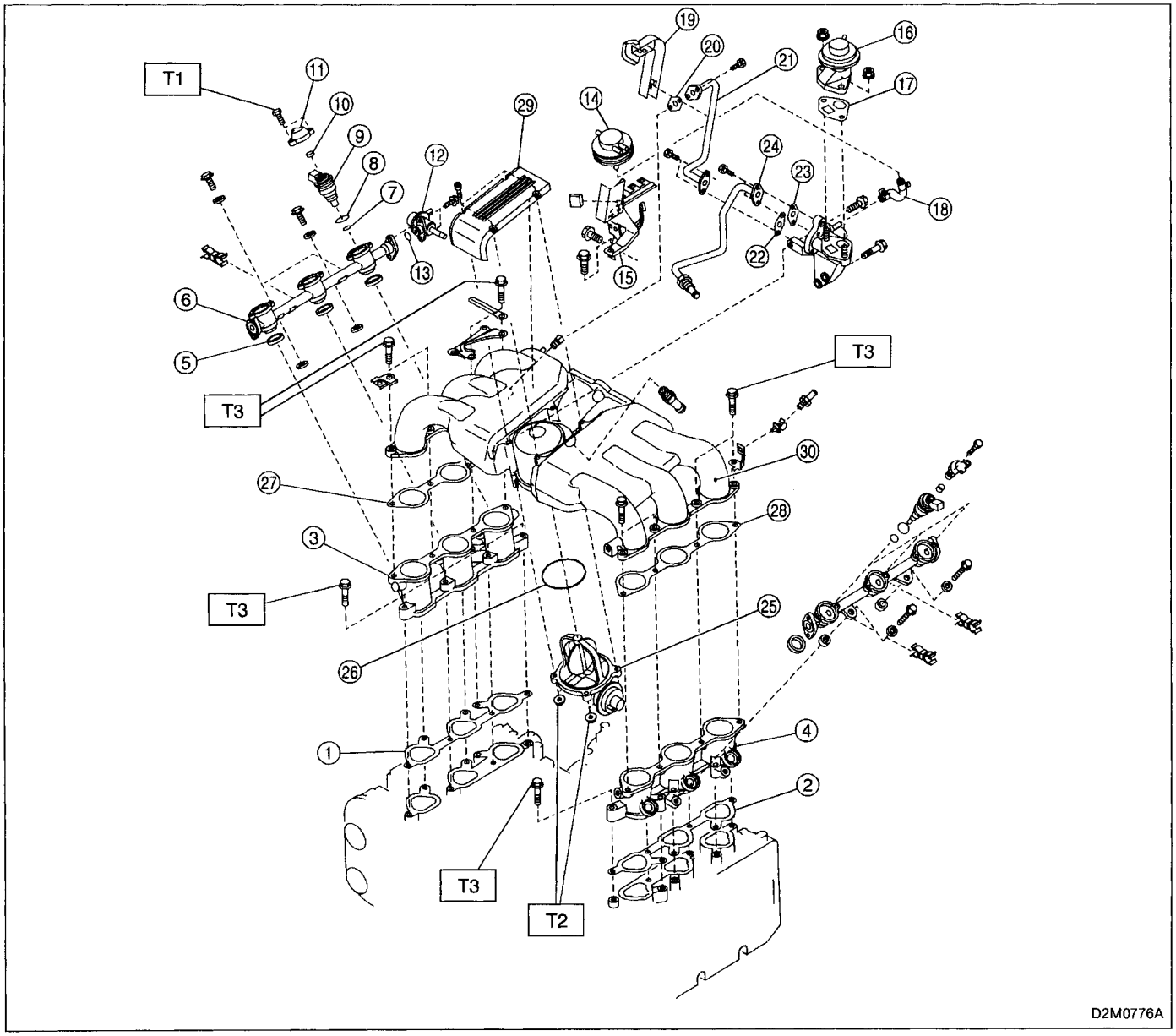
4. FAIL-SAFE FUNCTION

For the part which has been judged faulty in the self-diagnosis, the ECU generates the associated pseudo signal (only when convertible to electric signal) and carries out the computational processing. In this fashion, the fail-safe function is performed.

5. TROUBLE CODES AND FAIL-SAFE OPERATION

Trouble code	Item	Contents of diagnosis	Fail- safe operation
11	Crank angle sensor 1	No signal entered from crank angle sensor 1 more than 3 seconds on start switch ON.	—
12	Starter switch	Abnormal signal emitted from ignition switch.	Turns starter switch signal OFF.
13	Cam angle sensor	No signal entered from cam angle sensor, but signal entered from crank angle sensor 1.	—
14	Injector #1	Fuel injector inoperative. (Abnormal signal emitted from monitor circuit.)	—
15	Injector #2		
16	Injector #3		
17	Injector #4		
18	Injector #5		
19	Injector #6		
21	Water temperature sensor	Abnormal signal emitted from water temperature sensor.	Adjusts water to a specific temperature. Maintains radiator fan "ON" to prevent overheating.
22	Knock sensor 1 (RH)	Abnormal voltage produced in knock sensor monitor circuit.	Sets regular fuel map and retards ignition timing by 5°.
23	Air flow sensor	Abnormal voltage input entered from air flow sensor.	Controls the amount of fuel (injected) in relation to engine speed and throttle sensor or position.
24	By-pass air control solenoid valve	By-pass air control solenoid valve inoperated. (Abnormal signal produced in monitor circuit.)	Prevents abnormal engine speed using "fuel cut" in relation engine speed, vehicle speed and throttle sensor position.
28	Knock sensor 2 (LH)	Abnormal voltage produced in knock sensor monitor circuit.	Sets regular fuel map and retards ignition timing by 5°.
29	Crank angle sensor 2	No signal entered from crank angle sensor 1, but two signals entered from cam angle sensor.	—
31	Throttle sensor	Abnormal voltage input entered from throttle sensor.	Sets throttle sensor's voltage output to fixed value.
32	O_2 sensor 1 (RH)	O_2 sensor 1 inoperative.	—
33	Vehicle speed sensor 2	Abnormal voltage input entered from vehicle speed sensor 2.	Sets vehicle speed signal to a fixed value.
34	EGR solenoid valve	EGR solenoid valve inoperative.	—
35	Purge control solenoid valve	Purge control solenoid valve inoperative.	—
37	O_2 sensor 2 (LH)	O_2 sensor 2 inoperative.	—
38	Engine torque control	Wiring harness between ECU and TCU is in short circuit.	—
41	A/F learning control	Faulty learning control function.	—
45	Atmospheric pressure sensor	Faulty atmospheric pressure sensor build in ECU.	—
51	Neutral switch	Abnormal signal entered from inhibitor switch.	—
52	Parking switch	Abnormal signal entered from parking switch.	—
55	EGR gas temperature sensor (CAL.)	Abnormal signal emitted from EGR gas temperature sensor.	—
56	EGR system (CAL.)	EGR valve open/close stick, EGR hose disconnect or exhaust pressure control valve damaged.	—

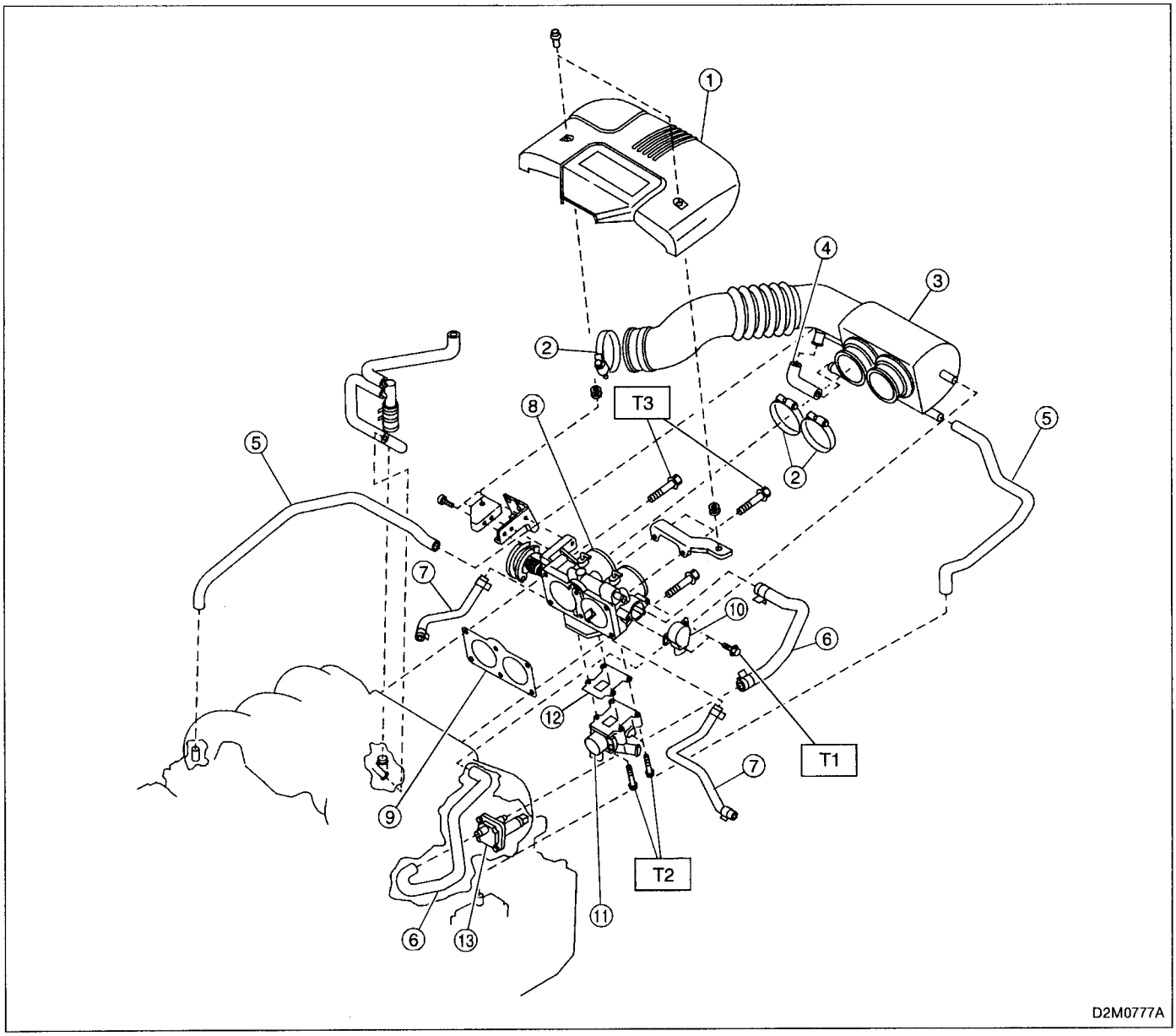
1. Intake Manifold and Collector



① Intake manifold gasket RH
② Intake manifold gasket LH
③ Intake manifold RH
④ Intake manifold LH
⑤ Fuel injector pipe insulator
⑥ Fuel injector pipe
⑦ O-ring A
⑧ O-ring B
⑨ Fuel injector
⑩ Insulator
⑪ Fuel injector cap
⑫ Pressure regulator
⑬ O-ring
⑭ BPT
⑮ BPT holder bracket
⑯ EGR valve
⑰ Gasket
⑱ EGR vacuum hose
⑲ EGR pipe insulator
⑳ Gasket
㉑ EGR pipe A
㉒ Gasket
㉓ Gasket
㉔ EGR pipe B
㉕ Induction control valve and diaphragm
㉖ O-ring
㉗ Collector chamber gasket RH
㉘ Collector chamber gasket LH
㉙ Collector cover
㉚ Collector chamber

Tightening torque: N·m (kg-m, ft-lb)
T1: 3.4 ± 0.5 (0.35 ± 0.05, 2.5 ± 0.4)
T2: 16 ± 1.5 (1.6 ± 0.15, 11.6 ± 1.1)
T3: 25 ± 2 (2.5 ± 0.2, 18.1 ± 1.4)

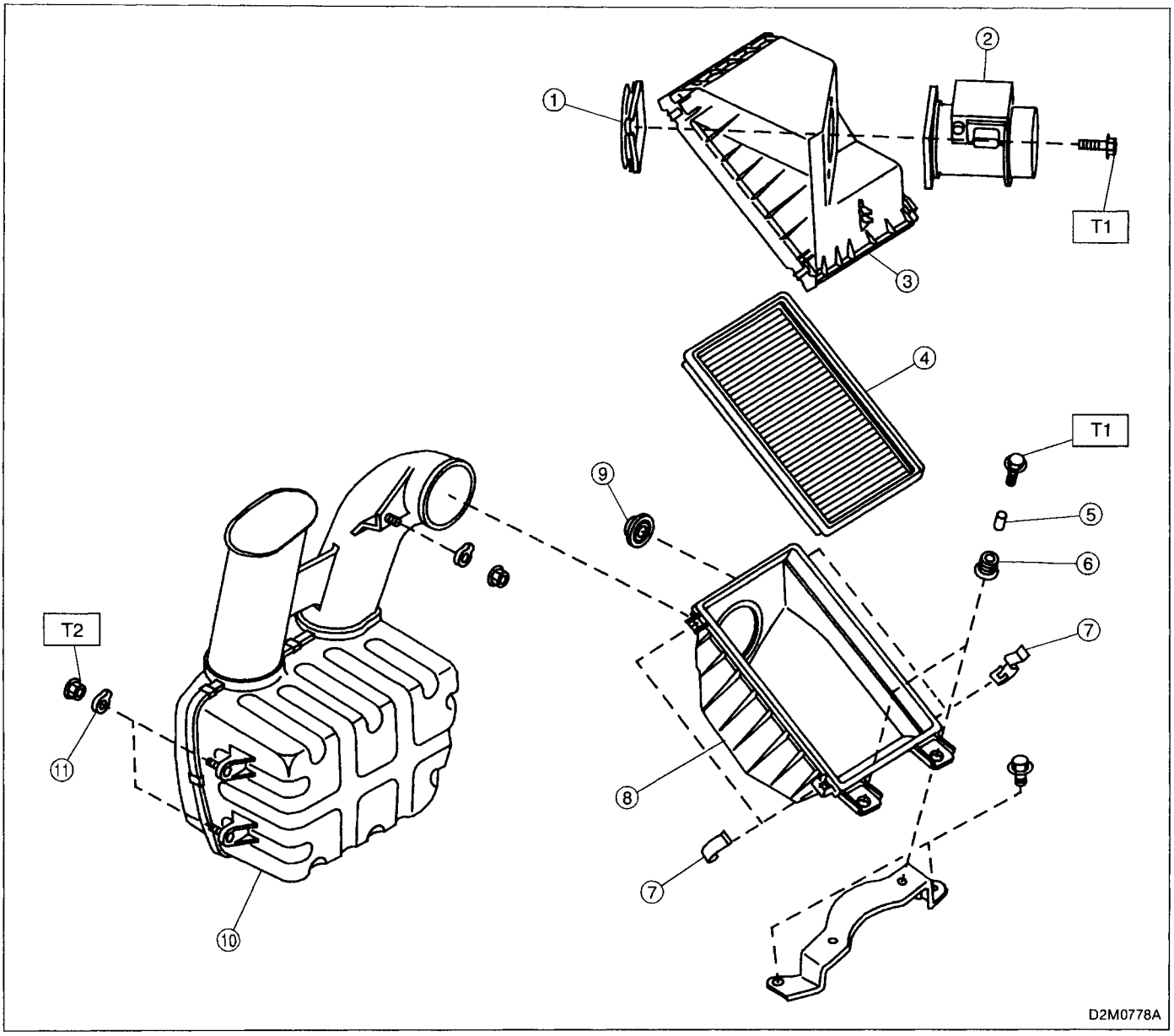
2. Air Intake Boot and Throttle Body



① Collector cover
② Clamp
③ Air intake boot
④ By-pass hose
⑤ PCV hoses
⑥ Air by-pass hoses
⑦ Engine coolant hoses
⑧ Throttle body
⑨ Gasket
⑩ Throttle position sensor
⑪ ISC valve
⑫ Gasket
⑬ Auxiliary air control valve

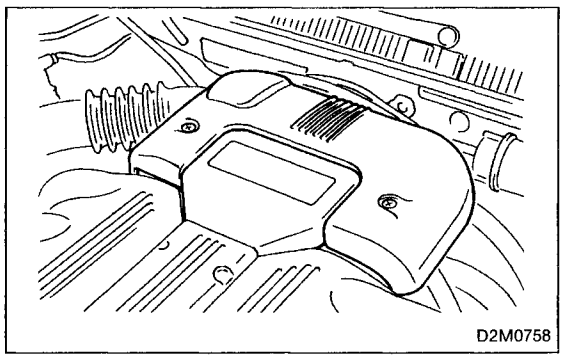
Tightening torque: N·m (kg-m, ft-lb)
T1: 2.2 ± 0.2 (0.22 ± 0.02, 1.6 ± 0.1)
T2: 6.4 ± 0.5 (0.65 ± 0.05, 4.7 ± 0.4)
T3: 22 ± 2 (2.2 ± 0.2, 15.9 ± 1.4)

3. Air Cleaner



① Mass air flow sensor bracket
② Mass air flow sensor ASSY
③ Air cleaner upper cover
④ Air cleaner element
⑤ Spacer
⑥ Bush
⑦ Clip
⑧ Air cleaner case
⑨ Cushion rubber
⑩ Resonator chamber ASSY
⑪ Clip

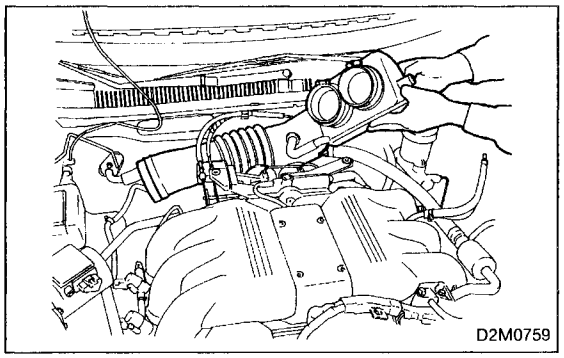
Tightening torque: N·m (kg-m, ft-lb)
T1: 7.4±2.0 (0.75±0.2, 5.4±1.4)
T2: 33±10 (3.4±1.0, 25±7)


D2M0758

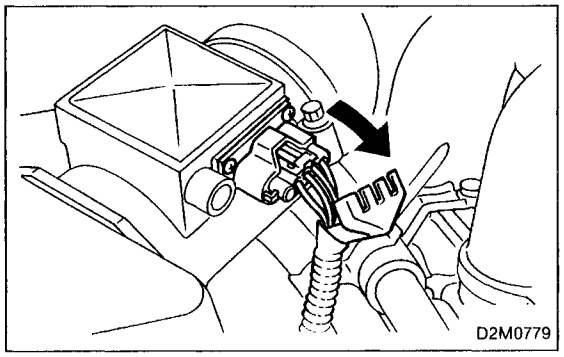
1. Air Cleaner and Air Intake Duct

A: REMOVAL AND INSTALLATION

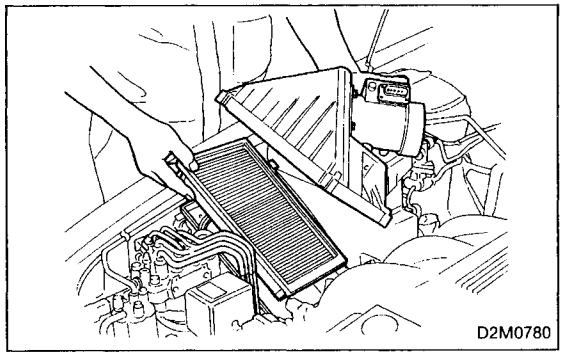
1) Remove collector cover.


D2M0759

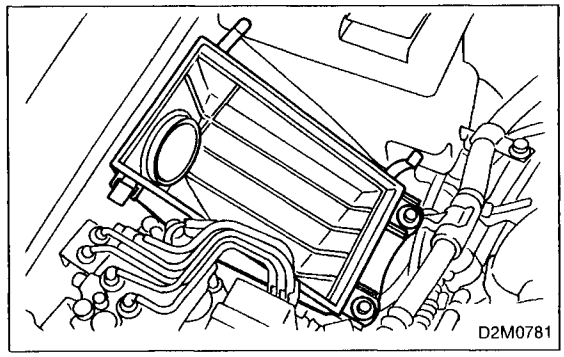
2) Loosen clamps which connect air intake duct to throttle body and mass air flow sensor.
3) Remove air intake duct.


D2M0779

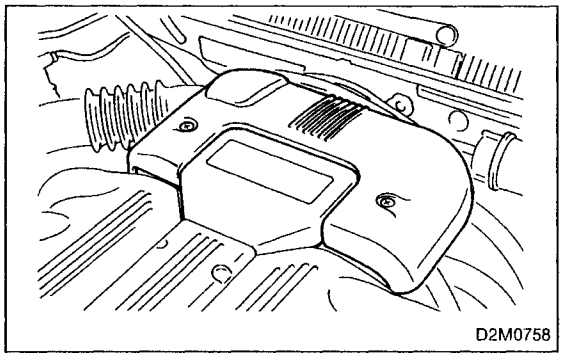
4) Slide connector cover out from mass air flow sensor connector.
5) Disconnect connector from mass air flow sensor.


D2M0780

6) Remove clips on air cleaner upper cover.
7) Remove air cleaner element.


D2M0781

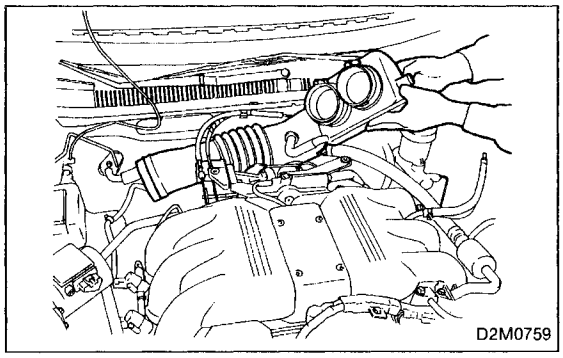
8) Remove air cleaner lower case.
9) Installation is in the reverse order of removal.


D2M0758

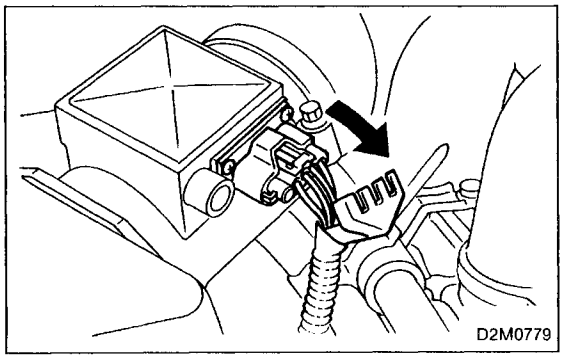
2. Mass Air Flow Sensor

A: REMOVAL AND INSTALLATION

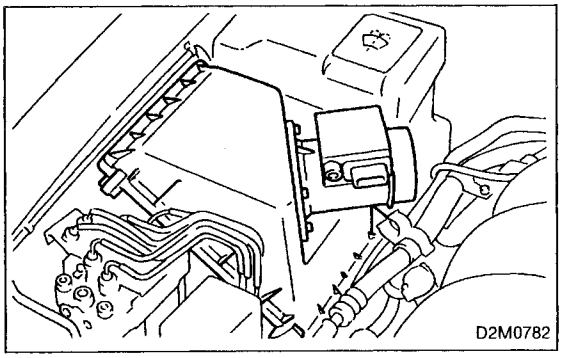
1) Remove collector cover.


D2M0759

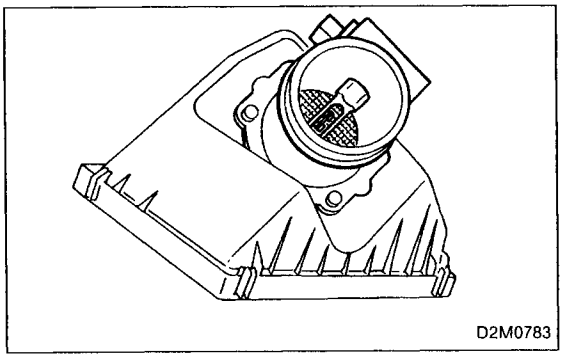
2) Loosen clamps which connect air intake duct to throttle body and mass air flow sensor.
3) Remove air intake duct.


D2M0779

4) Slide connector cover out from mass air flow sensor connector.
5) Disconnect connector from mass air flow sensor.

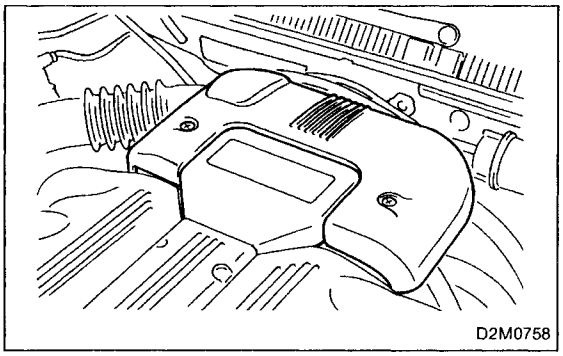

D2M0782

6) Remove air cleaner upper cover.


D2M0783

7) Remove mass air flow sensor from air cleaner upper cover.
8) Installation is in the reverse order of removal.

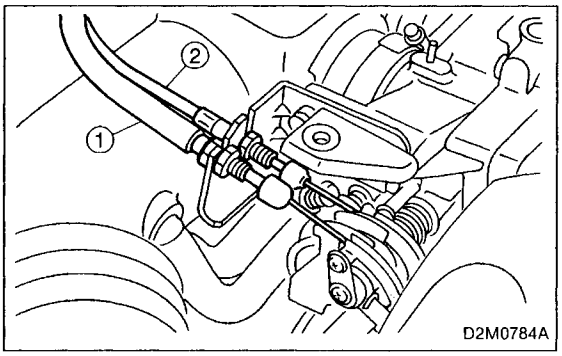
Tightening torque:
7.4 ± 2.0 N·m (0.75 ± 0.2 kg-m, 5.4 ± 1.4 ft-lb)


D2M0758

3. Throttle Body

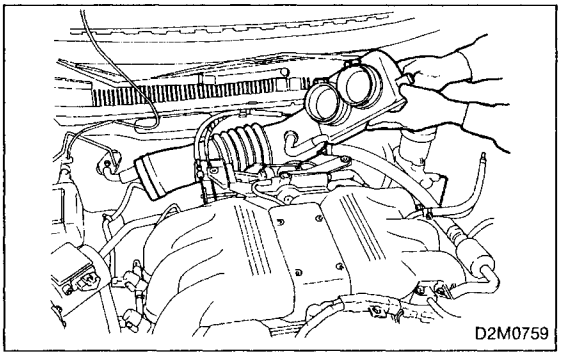
A: REMOVAL AND INSTALLATION

1) Remove collector cover.

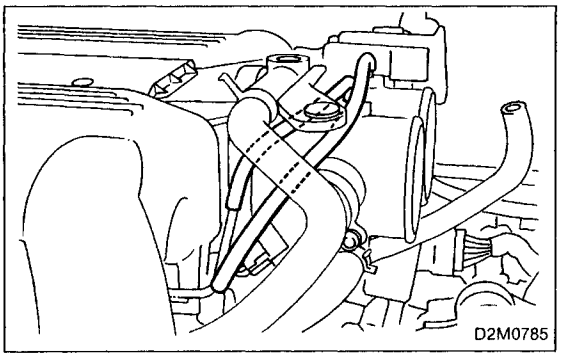


D2M0784A

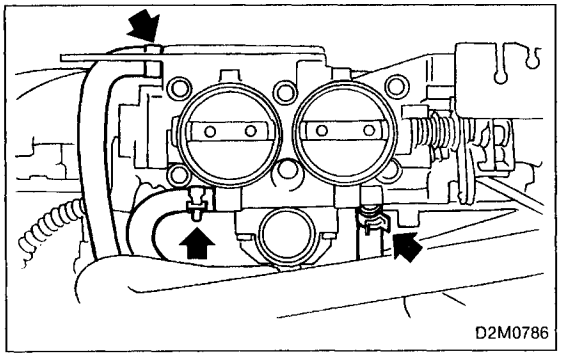
2) Disconnect cruise control cable ①.
3) Disconnect accelerator cable ②.


D2M0759

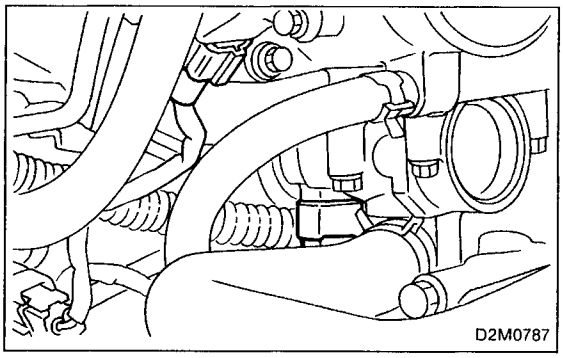
4) Loosen clamps which connect air intake duct to throttle body and mass air flow sensor.
5) Remove air intake duct.


D2M0785

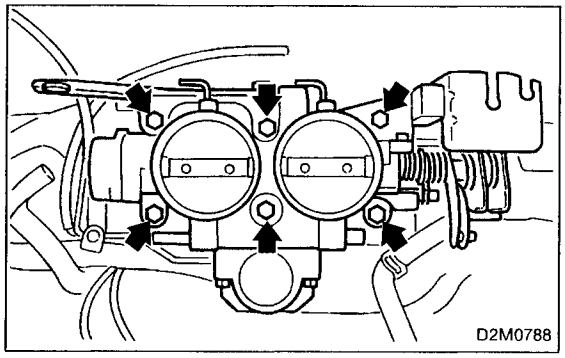
6) Disconnect vacuum hoses from throttle body.


D2M0786

7) Disconnect engine coolant hoses and air hose from throttle body.



8) Disconnect connectors from throttle position sensor and idle air control solenoid valve.



9) Remove bolts which install throttle body to collector chamber.
10) Installation is in the reverse order of removal.

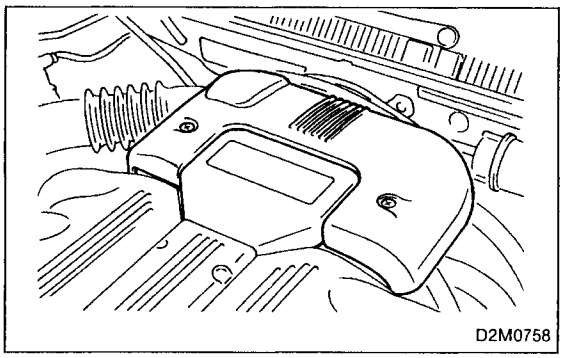
CAUTION:
Replace gasket with a new one.

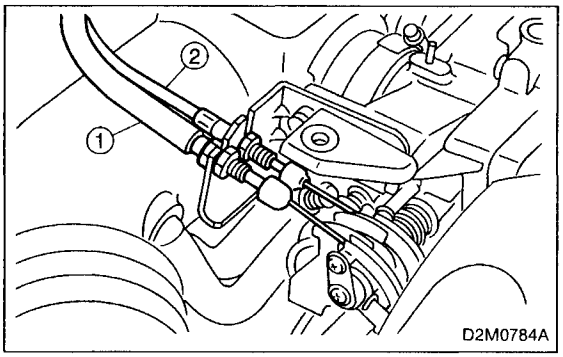
Tightening torque:
22 ± 2 N·m (2.2 ± 0.2 kg-m, 15.9 ± 1.4 ft-lb)

4. Collector Chamber

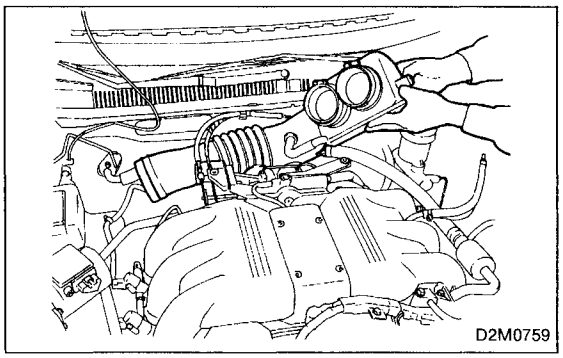
A: REMOVAL

1) Release fuel pressure. <Ref. to 2-8 [W1A0].☆1>
2) Remove collector cover.

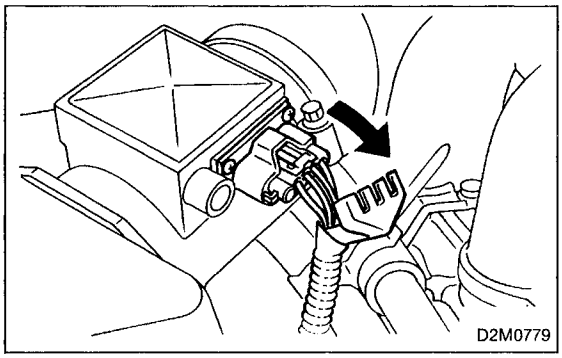




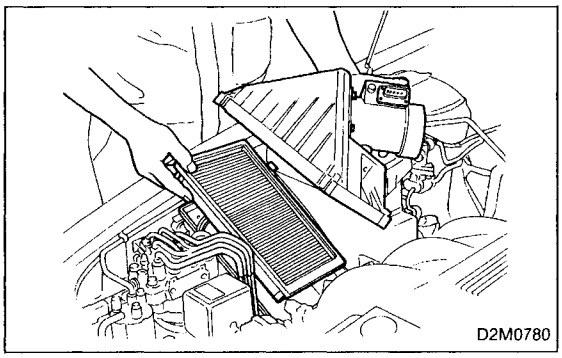
3) Disconnect cruise control cable ①.
4) Disconnect accelerator cable ②.



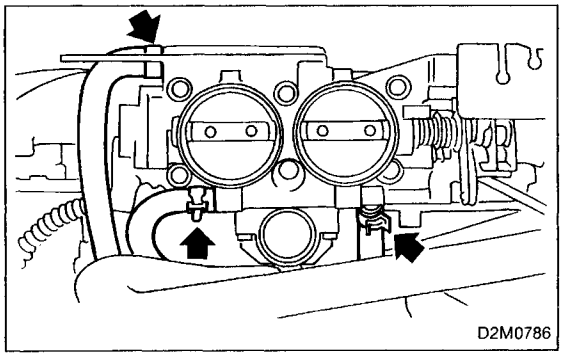
5) Loosen clamps which connect air intake duct to throttle body and mass air flow sensor.
6) Remove air intake duct.



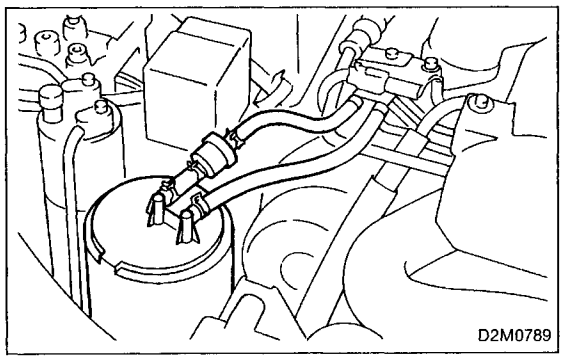
7) Slide connector cover out from mass air flow sensor connector.
8) Disconnect connector from mass air flow sensor.



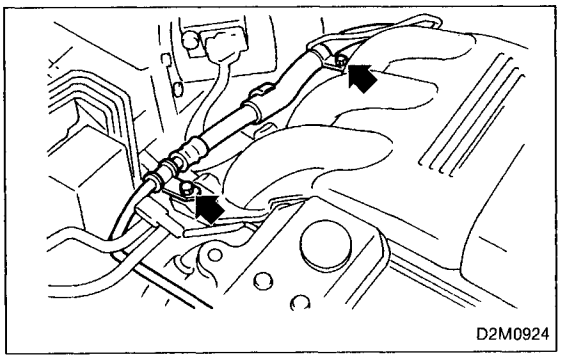
9) Remove clips on air cleaner upper cover.
10) Remove air cleaner element.



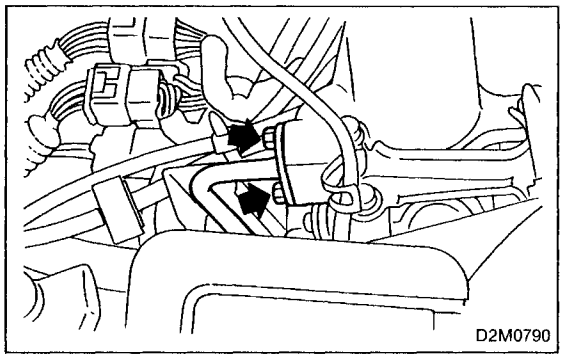
11) Disconnect vacuum hoses;
(1) from pressure sources switching solenoid valve.
(2) from BPT.
(3) from pressure regulator.
12) Disconnect PCV hose from collector chamber.
13) Disconnect engine coolant hoses and air hose from throttle body.



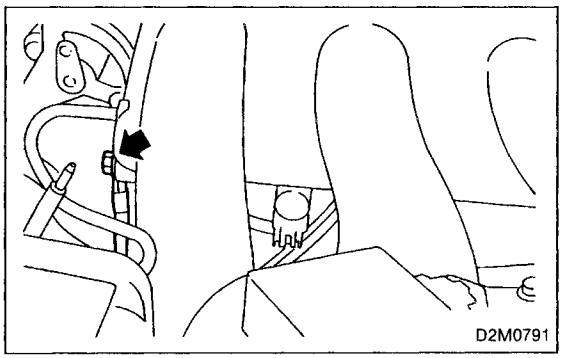
14) Disconnect canister hoses from evaporation pipes.



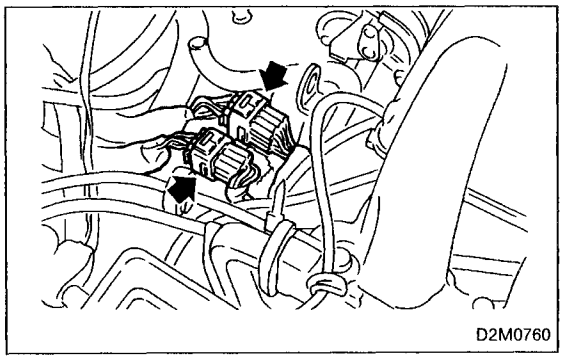
15) Remove bolts which install power steering hose bracket to collector chamber, then position the hose away from collector chamber.



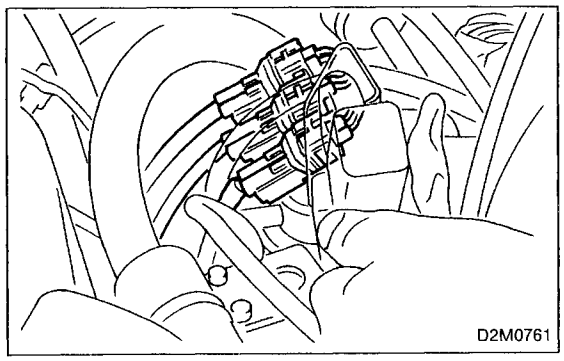
16) Remove EGR pipe cover, then remove bolts which install EGR pipe to collector chamber.



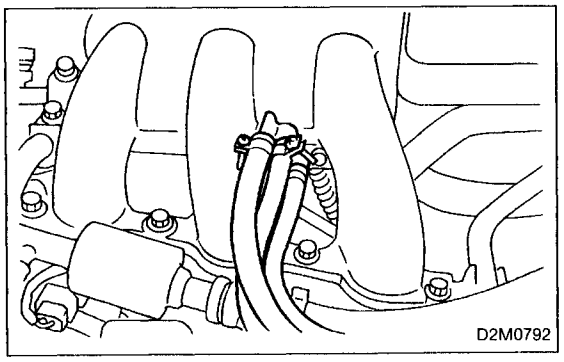
17) Remove engine ground wire from collector chamber.



18) Disconnect engine harness connectors from bulkhead harness connectors.

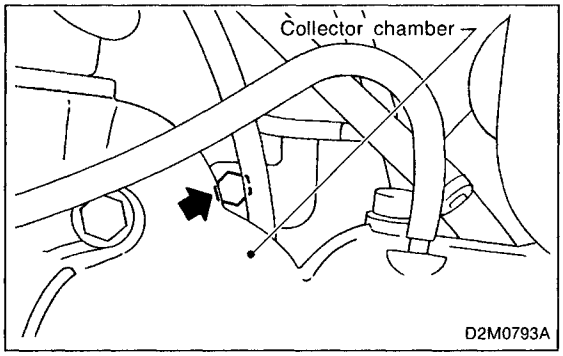


19) Disconnect ignition coil connectors (engine RH).
20) Disconnect connectors from fuel injectors, auxiliary air control valve, and power steering switch.

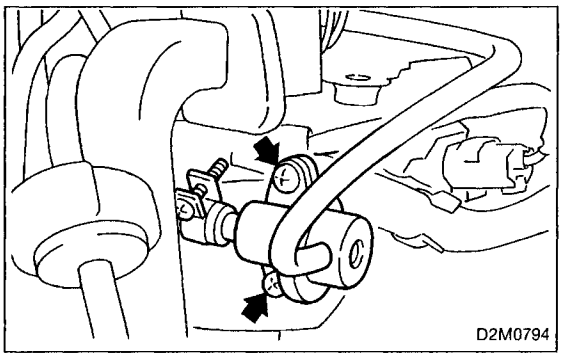


21) Disconnect fuel hoses from pipes.

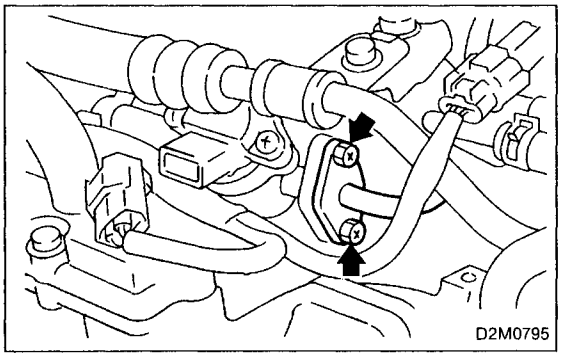
WARNING:
Catch fuel from hoses in a container.



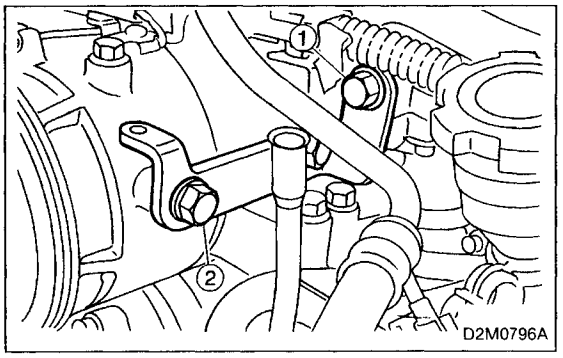
22) Remove bolt which installs fuel pipe to cylinder block.



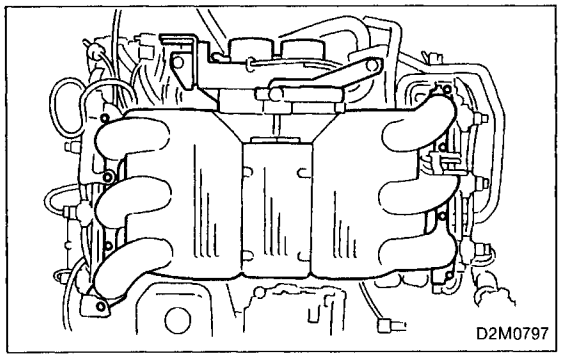
23) Remove pressure regulator from fuel injector pipe.



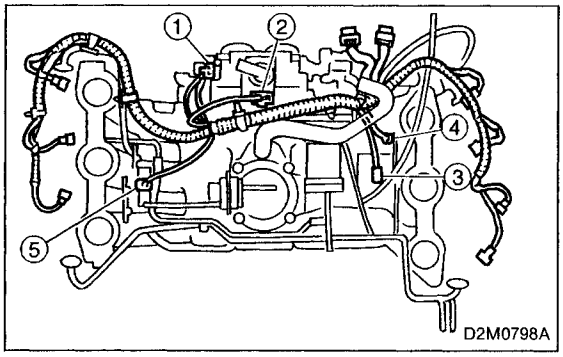
24) Remove bolts which install fuel pipes to fuel injector pipes.



25) Remove bolt ① which installs A/C bracket to collector chamber, then loosen bolt ②.

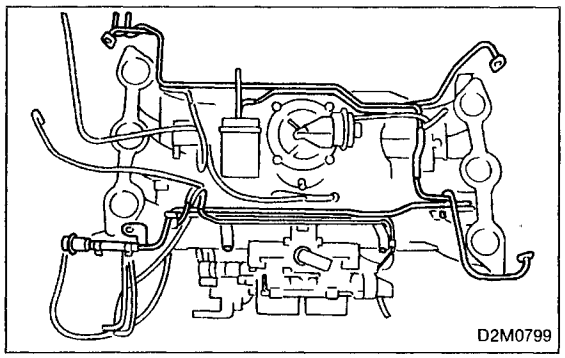


26) Remove bolts which hold collector chamber onto intake manifolds.
27) Remove collector chamber from intake manifolds.

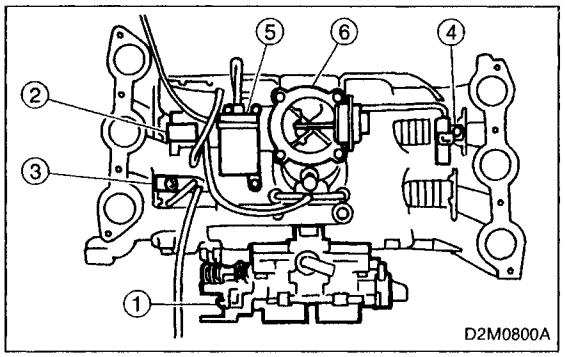


B: DISASSEMBLY

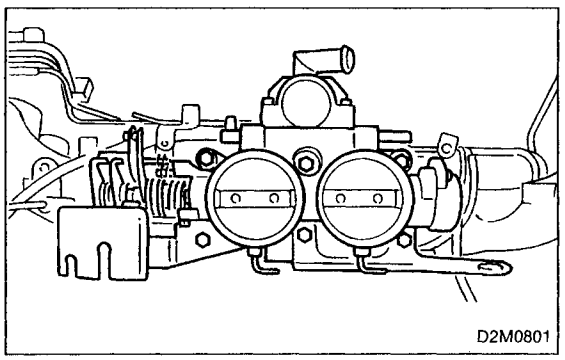
1) Disconnect connectors as follows:
   (1) Throttle position sensor
   (2) Idle air control solenoid valve
   (3) Purge control solenoid valve
   (4) EGR solenoid valve
   (5) Induction control solenoid valve
2) Remove harness bands.
3) Remove engine harness from collector chamber.



4) Remove bolts which install fuel pipes to collector chamber, then remove fuel pipes.



5) Remove other parts from collector chamber.
   (1) Throttle body
   (2) Purge control solenoid valve
   (3) EGR solenoid valve
   (4) Induction control solenoid valve
   (5) Vacuum tank
   (6) Induction control valve and diaphragm

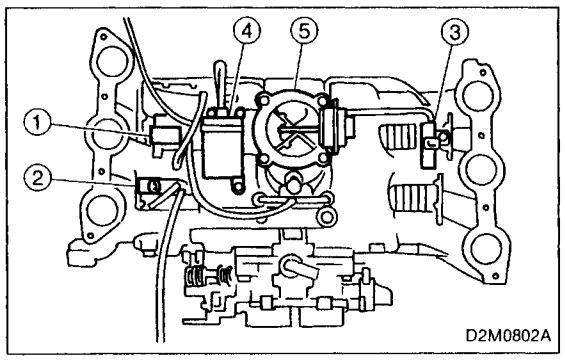


C: ASSEMBLY

1) Install throttle body to collector chamber.

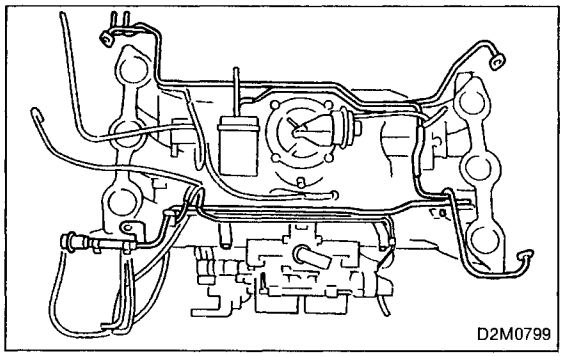
CAUTION:
Replace gasket with a new one.

Tightening torque:
22 ± 2 N·m (2.2 ± 0.2 kg-m, 15.9 ± 1.4 ft-lb)

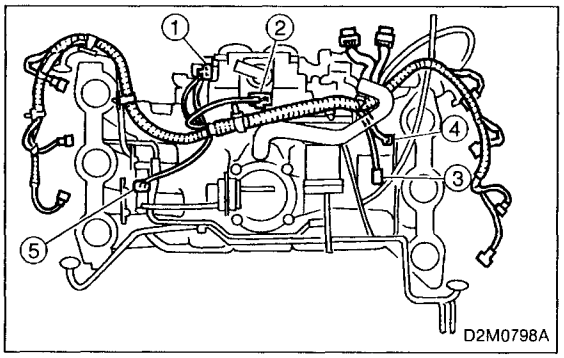


2) Assemble the parts onto collector chamber.
   (1) Purge control solenoid valve
   (2) EGR solenoid valve
   (3) Induction control solenoid valve
   (4) Vacuum tank
   (5) Induction control valve and diaphragm

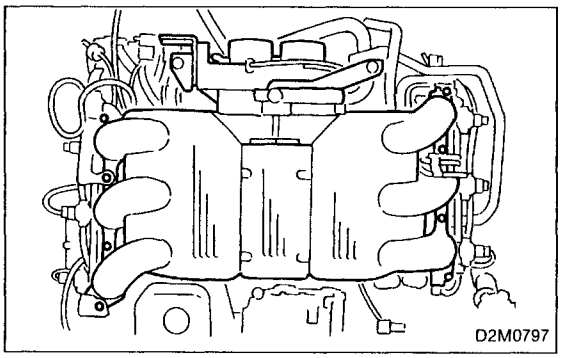
Tightening torque:
16 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)



3) Install fuel pipes to collector chamber.



4) Attach engine harness to collector chamber.
5) Connect connectors as follows:
   (1) Throttle position sensor
   (2) Idle air control solenoid valve
   (3) Purge control solenoid valve
   (4) EGR solenoid valve
   (5) Induction control solenoid valve
6) Secure engine harness with harness bands.

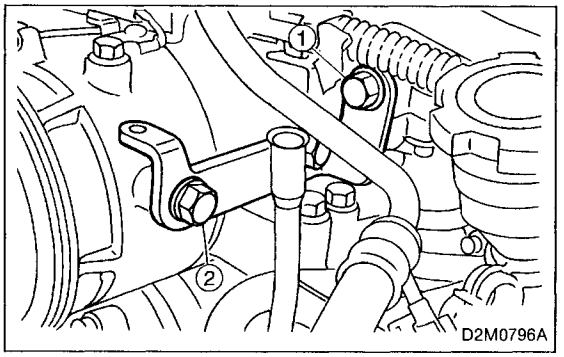


D: INSTALLATION

CAUTION:
Replace gaskets with new ones.

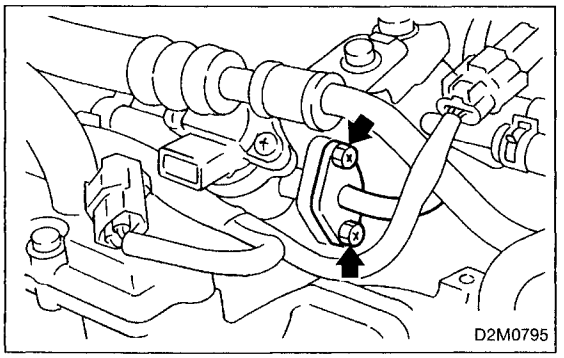
1) Install collector chamber to intake manifolds.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)



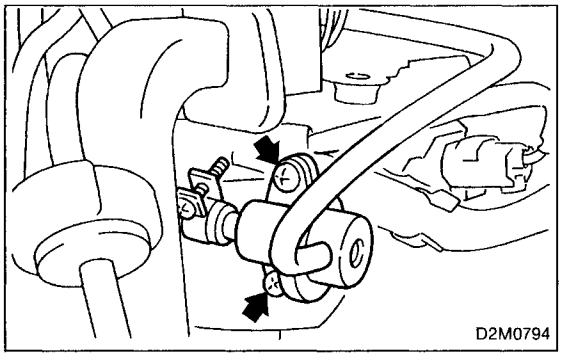
2) Install A/C bracket to collector chamber and tighten bolts ① and ②.

Tightening torque:
35 ± 4 N·m (3.6 ± 0.4 kg-m, 26.0 ± 2.9 ft-lb)



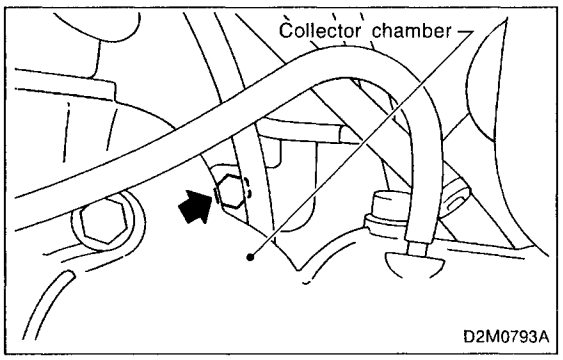
3) Install and tighten bolts which connect fuel pipes to fuel injector pipes.

Tightening torque:
2.7 ± 0.2 N·m (0.28 ± 0.025 kg-m, 2.0 ± 0.2 ft-lb)



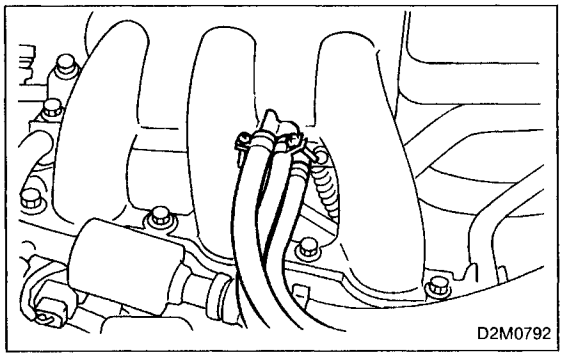
4) Install pressure regulator to fuel injector pipe.

Tightening torque:
3.4 ± 0.5 N·m (0.35 ± 0.05 kg-m, 2.5 ± 0.4 ft-lb)

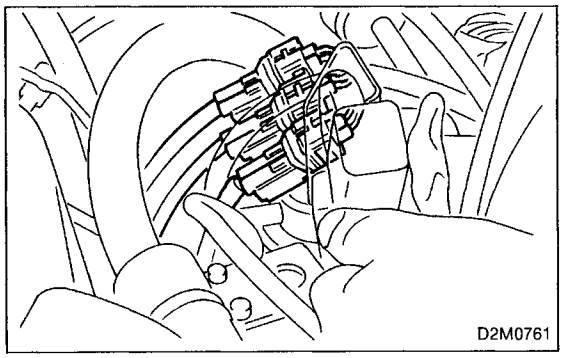


5) Install bolt which holds fuel pipe on cylinder block.

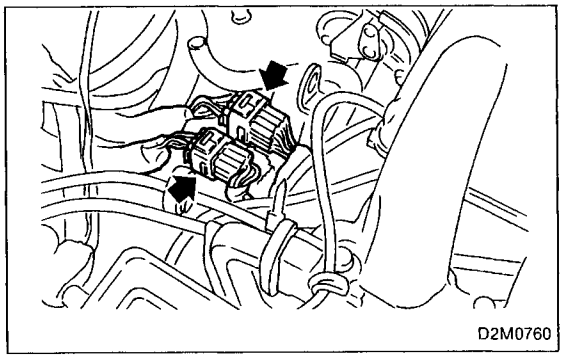
Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)



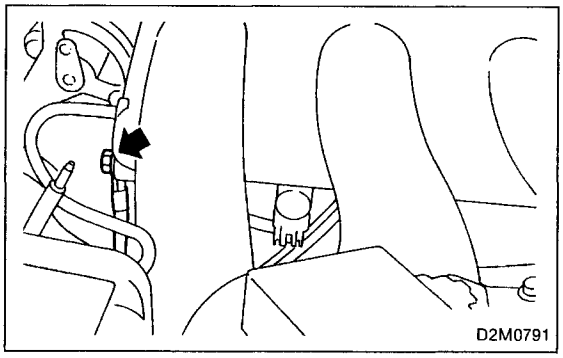
6) Connect fuel hoses.



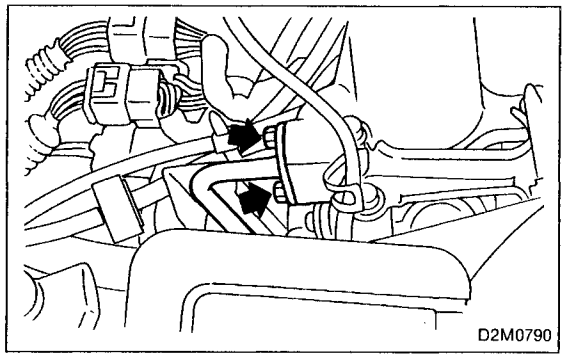
7) Connect connectors to fuel injectors, auxiliary air control valve, and power steering switch.
8) Connect ignition coil connectors.



9) Connect engine harness connectors to bulkhead harness connectors.



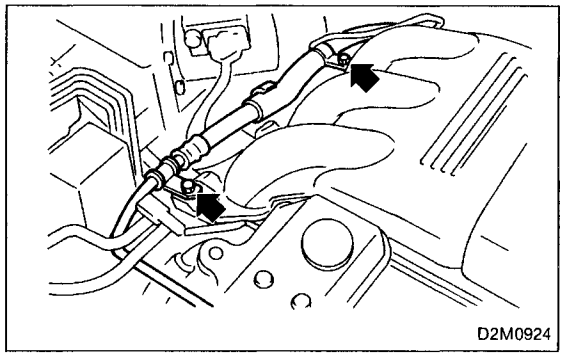
10) Install engine ground wire to collector chamber.



11) Install bolts which connect EGR pipe to collector chamber.

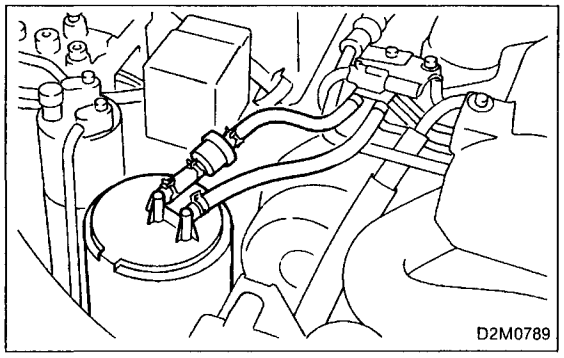
Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)

12) Install EGR pipe cover.

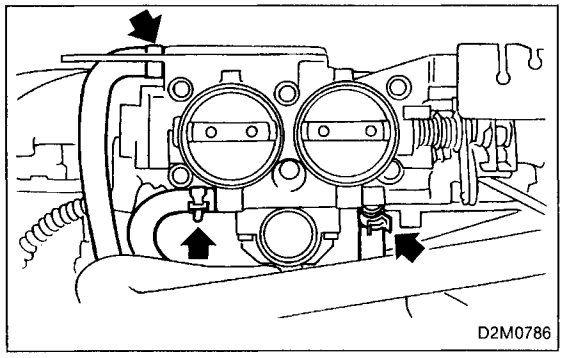


13) Install power steering hose bracket to collector chamber.

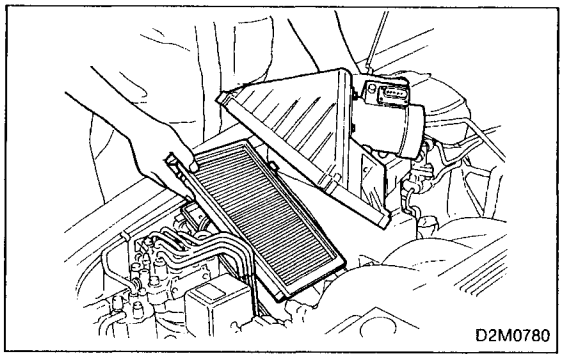
Tightening torque:
13 ± 3 N·m (1.3 ± 0.3 kg-m, 9.4 ± 2.2 ft-lb)



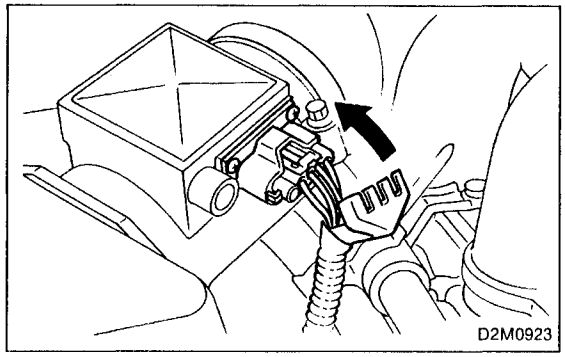
14) Connect canister hoses to evaporation pipes.



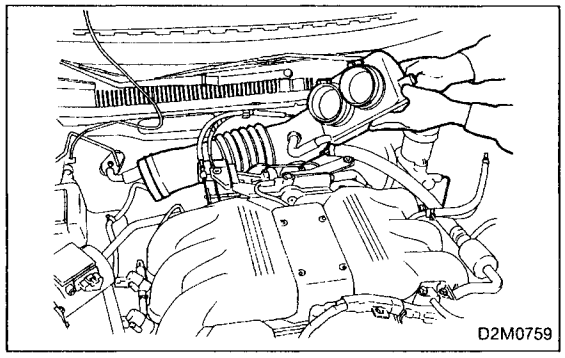
15) Connect engine coolant hoses and air hose to throttle body.
16) Connect PCV hose to collector chamber.
17) Connect vacuum hoses;
(1) to pressure sources switching solenoid valve.
(2) to BPT.
(3) to pressure regulator.



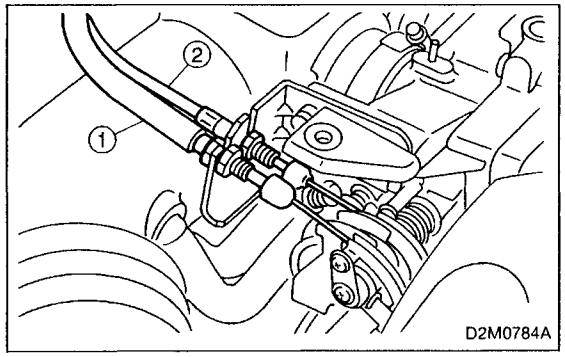
18) Install air cleaner element.
19) Install air cleaner upper cover and fasten clips.



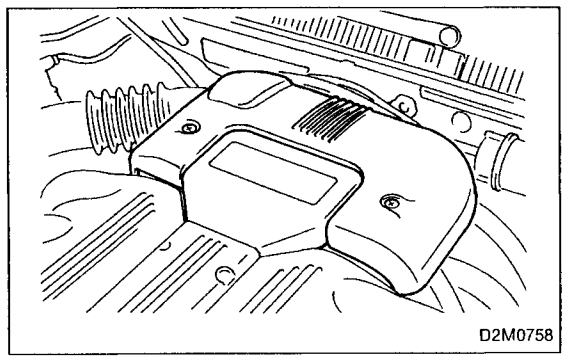
20) Connect connector to mass air flow sensor.
21) Attach cover to mass air flow sensor connector.



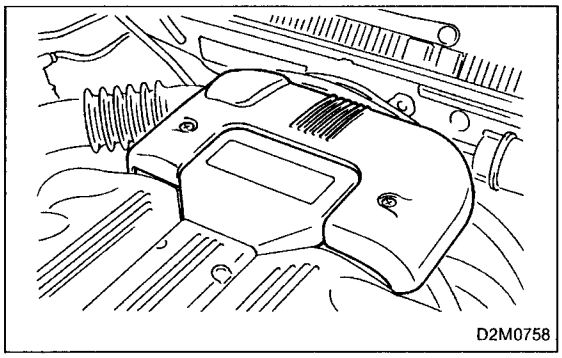
22) Install air intake duct, and tighten it with clamps.



23) Connect accelerator cable ②.
24) Connect cruise control cable ①.



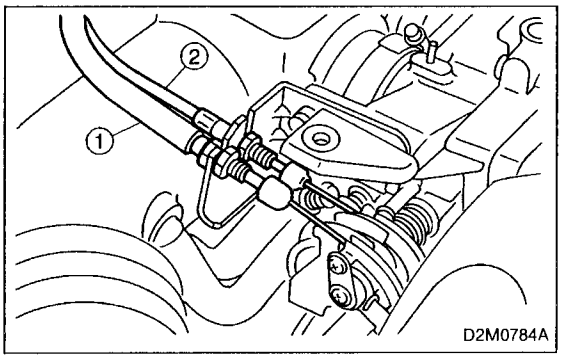
25) Install collector cover.


D2M0758

5. Collector Chamber and Intake Manifold Assembly

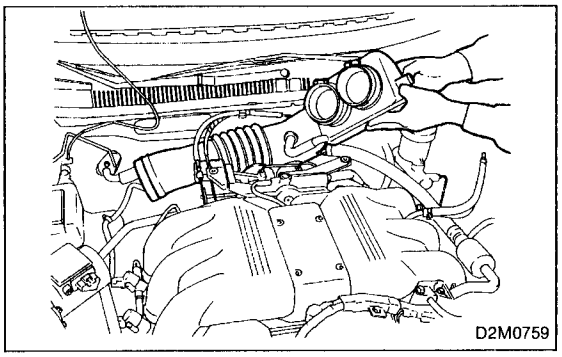
A: REMOVAL

1) Release fuel pressure. <Ref. to 2-8 [W1A0].☆1 >
2) Remove collector cover.

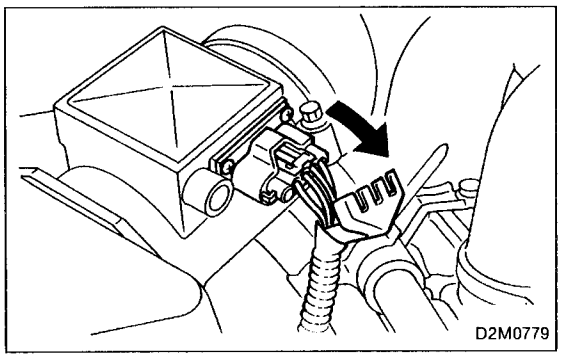


D2M0784A

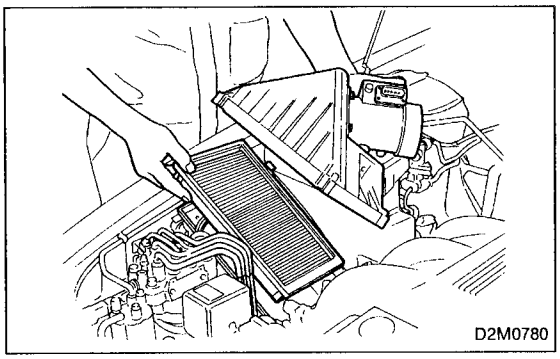
3) Disconnect cruise control cable ①.
4) Disconnect accelerator cable ②.


D2M0759

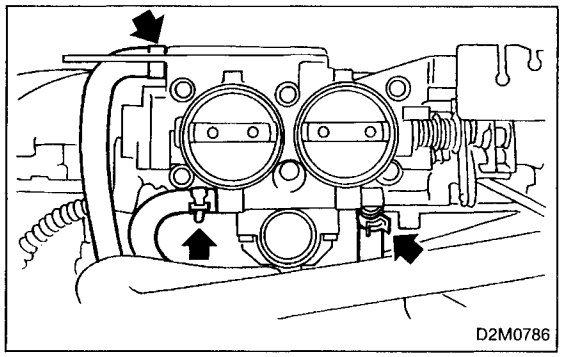
5) Loosen clamps which connect air intake duct to throttle body and mass air flow sensor.
6) Remove air intake duct.


D2M0779

7) Slide connector cover out from mass air flow sensor connector.
8) Disconnect connector from mass air flow sensor.

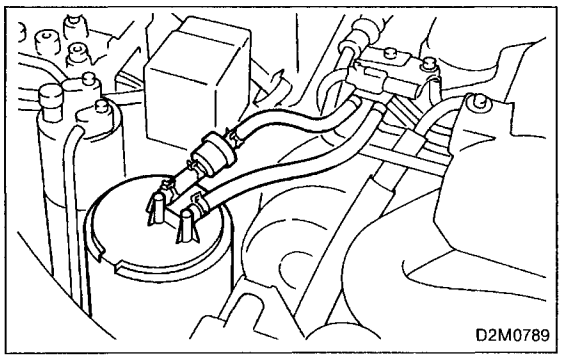

D2M0780

9) Remove clips on air cleaner upper cover.
10) Remove air cleaner element.

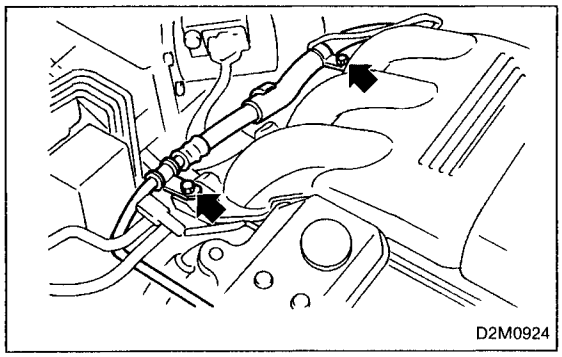


11) Disconnect vacuum hoses as follows:
(1) Disconnect auxiliary air control valve hose from throttle body.
(2) Disconnect PCV hose from collector chamber.
(3) Disconnect blow-by hose from cylinder head cover RH.
(4) Disconnect EGR control hoses from intake manifold.
(5) Disconnect brake booster hose from intake manifold.

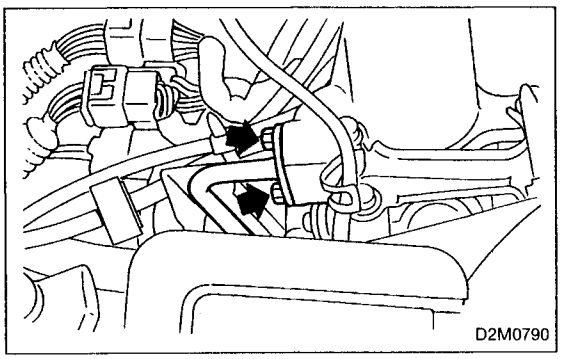
12) Disconnect engine coolant hoses and air hose from throttle body.



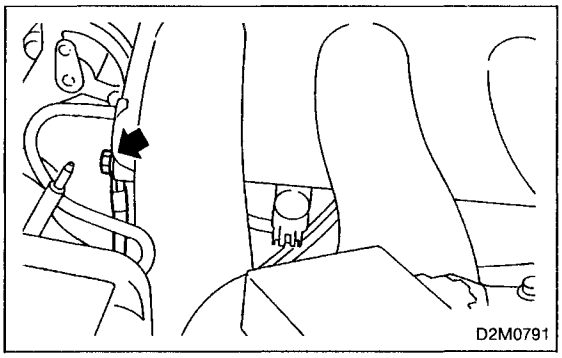
13) Disconnect canister hoses from evaporation pipes.



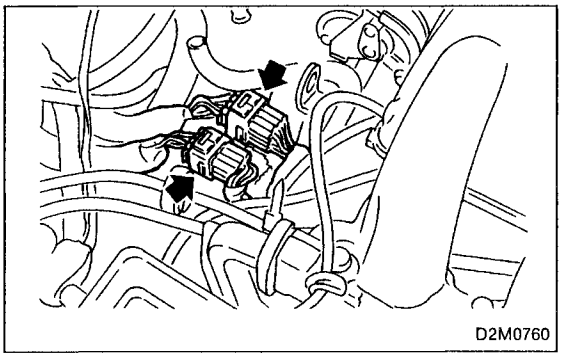
14) Remove bolts which install power steering hose bracket to collector chamber, then position the hose away from collector chamber.



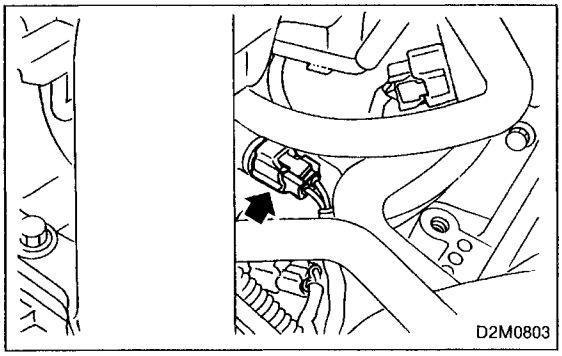
15) Remove EGR pipe cover, then remove bolts which install EGR pipe to collector chamber.



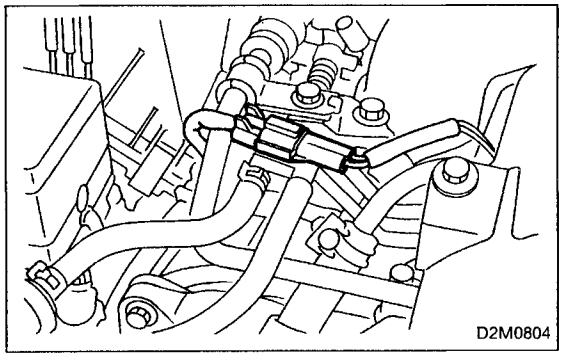
16) Remove engine ground wire from collector chamber.



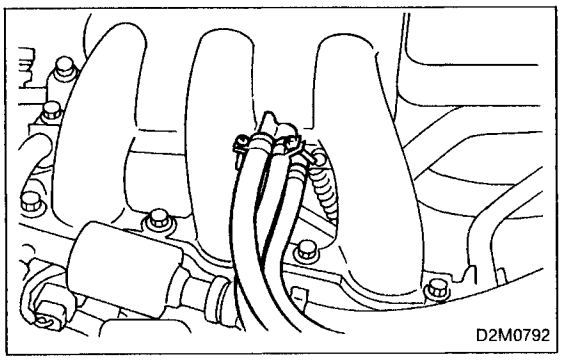
17) Disconnect engine harness connectors from bulkhead harness connectors.
18) Remove bulkhead harness connectors from bracket.



19) Disconnect connector from auxiliary air control valve.

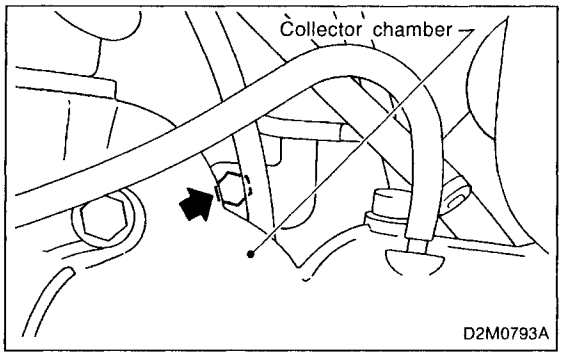


20) Disconnect power steering switch connector.

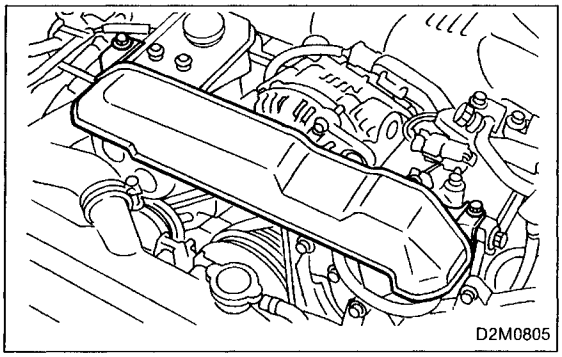


21) Disconnect fuel hoses from pipes.

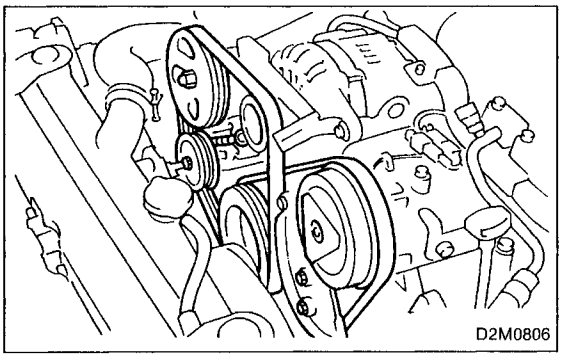
WARNING:
Catch fuel from hoses in a container.



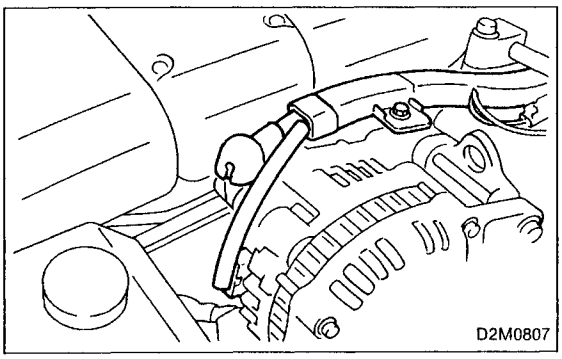
22) Remove bolt which installs fuel pipe to cylinder block.



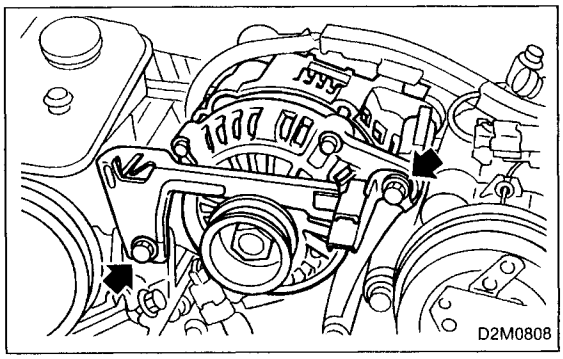
23) Remove V-belt cover.



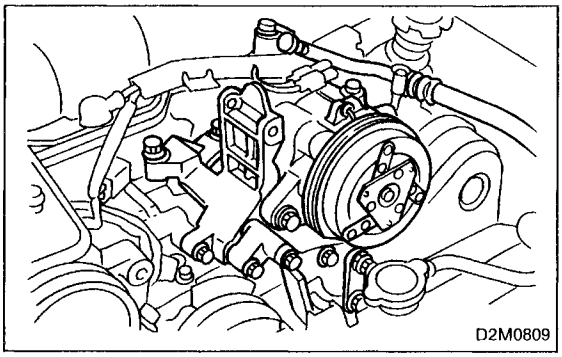
24) Remove V-belts from generator and A/C compressor.



25) Disconnect connectors from generator.

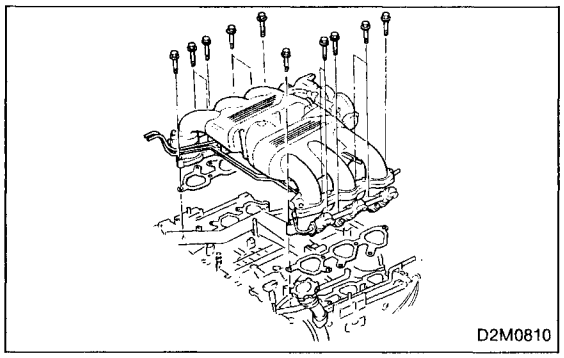


26) Remove bolts which install generator to bracket, then remove generator.



27) Remove A/C compressor with bracket, and move A/C compressor forward to facilitate removal of intake manifold mounting bolts.

CAUTION:
When moving A/C compressor, take care not to overstretch the pipes and hoses.



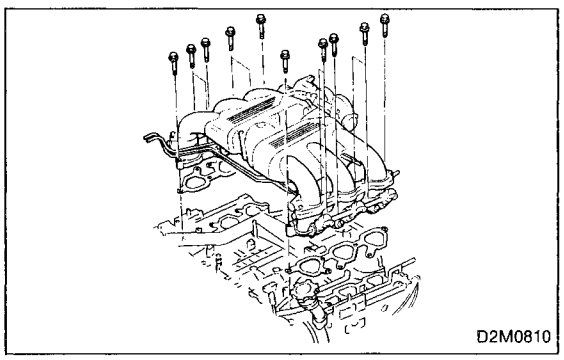
28) Remove bolts which hold intake manifolds onto cylinder heads.
29) Remove collector chamber and intake manifold assembly from cylinder heads.

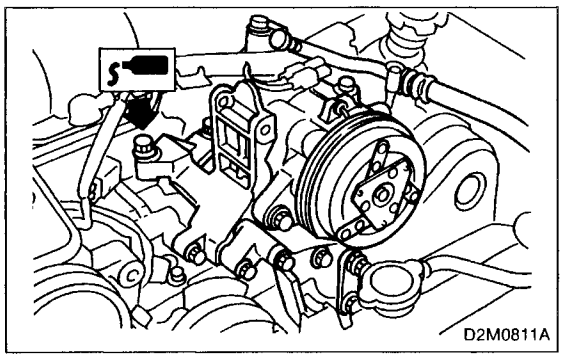
B: INSTALLATION

CAUTION:
Replace gaskets with new ones.

1) Install collector chamber and intake manifold assembly onto cylinder heads.

Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)



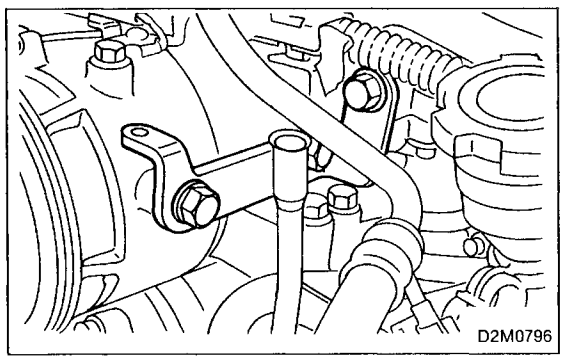


2) Install A/C compressor and bracket onto cylinder block.

CAUTION:
Before installation, apply fluid packing to the bolt threads as shown in the figure.

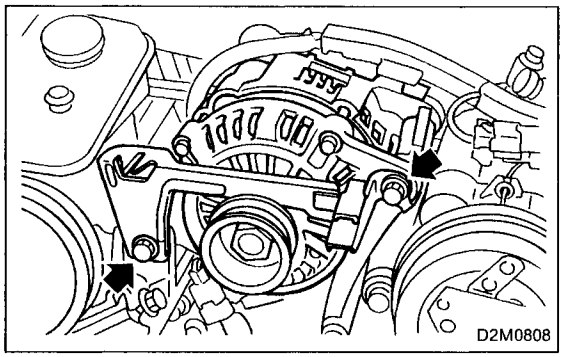
Fluid packing:
THREE BOND 1344 or equivalent

Tightening torque:
35 ± 4 N·m (3.6 ± 0.4 kg-m, 26.0 ± 2.9 ft-lb)



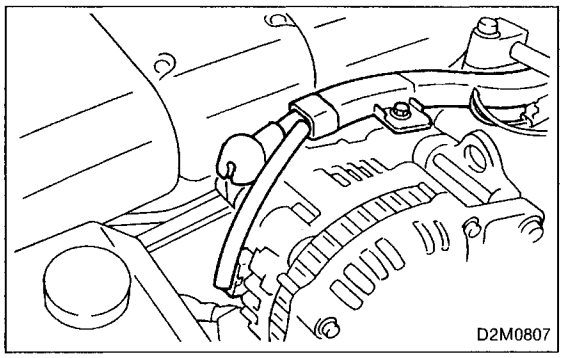
3) Install A/C bracket to collector chamber.

Tightening torque:
35 ± 4 N·m (3.6 ± 0.4 kg-m, 26.0 ± 2.9 ft-lb)

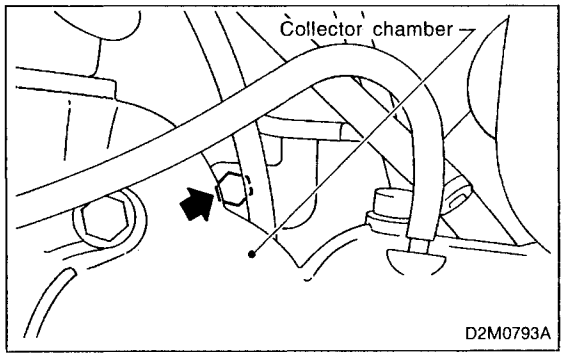


4) Install generator.

Tightening torque:
35 ± 4 N·m (3.6 ± 0.4 kg-m, 26.0 ± 2.9 ft-lb)

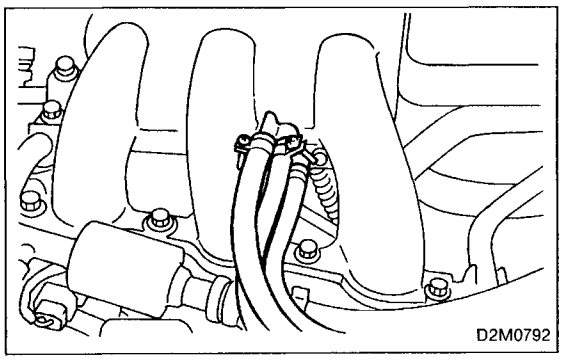


5) Connect connectors to generator.

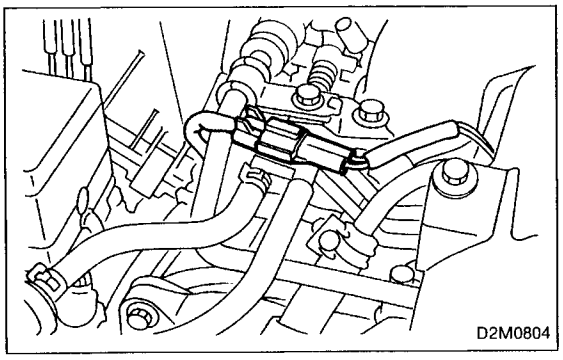


6) Install bolt which holds fuel pipe on cylinder block.

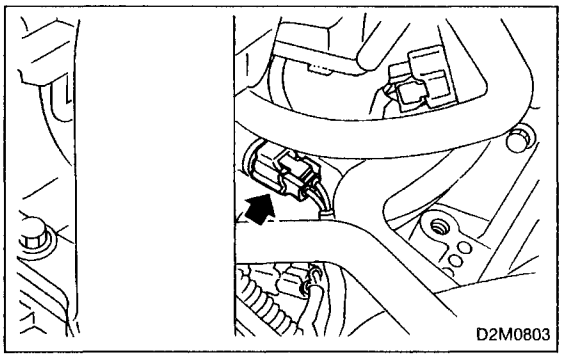
Tightening torque:
25 ± 2 N·m (2.5 ± 0.2 kg-m, 18.1 ± 1.4 ft-lb)



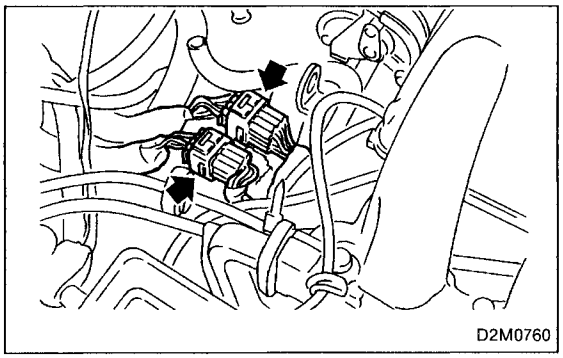
7) Connect fuel hoses.



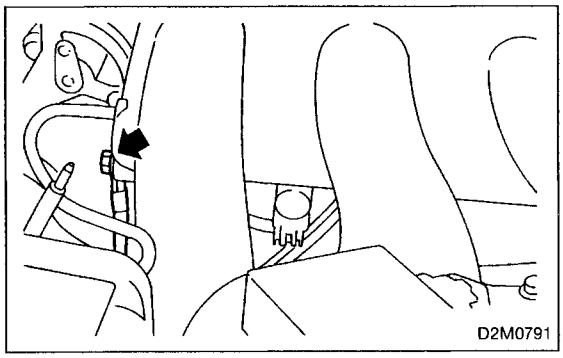
8) Connect power steering switch connector.



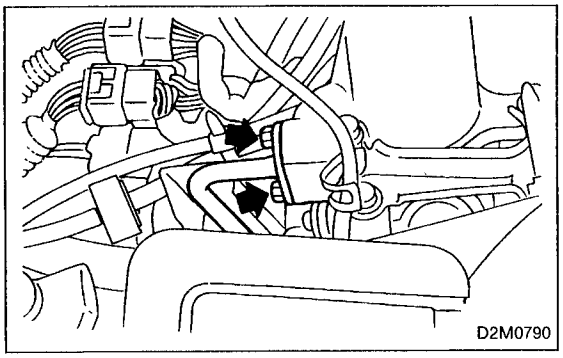
9) Connect connector to auxiliary air control valve.



10) Install bulkhead harness connectors to bracket.
11) Connect engine harness connectors to bulkhead harness connectors.



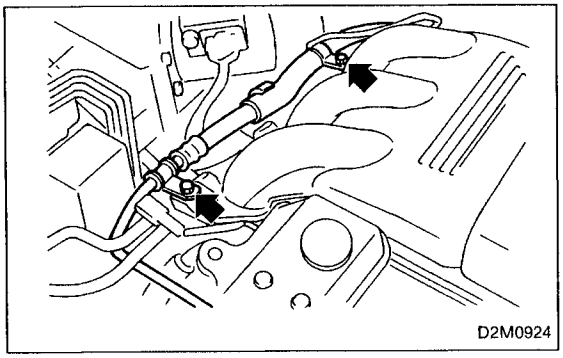
12) Install engine ground wire to collector chamber.



13) Install bolts which connect EGR pipe to collector chamber.

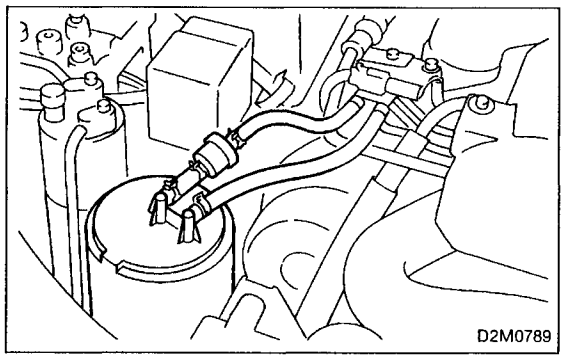
Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)

14) Install EGR pipe cover.

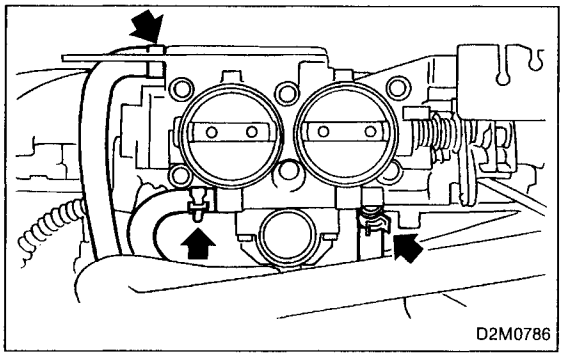


15) Install power steering hose bracket to collector chamber.

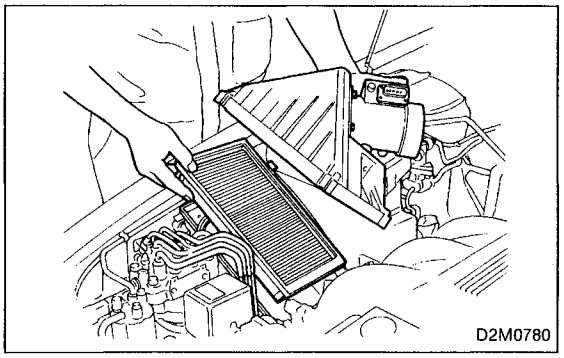
Tightening torque:
13 ± 3 N·m (1.3 ± 0.3 kg-m, 9.4 ± 2.2 ft-lb)



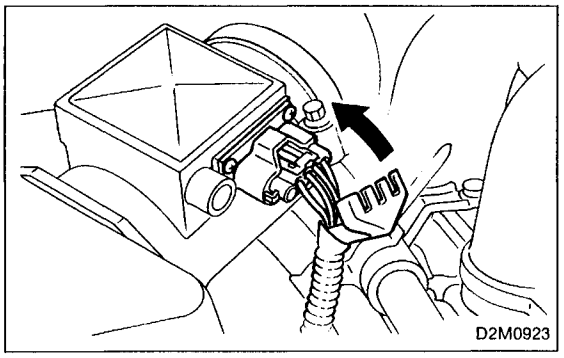
16) Connect canister hoses to evaporation pipes.



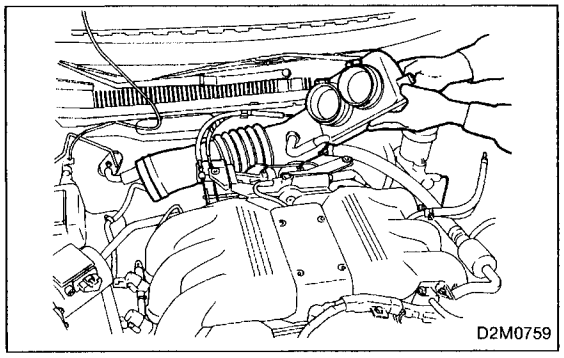
17) Connect engine coolant hoses and air hose to throttle body.
18) Connect vacuum hoses as follows:
(1) Connect auxiliary air control valve hose to throttle body.
(2) Connect PCV hose to collector chamber.
(3) Connect blow-by hose to cylinder head cover RH.
(4) Connect EGR control hoses to intake manifold.
(5) Connect brake booster hose to intake manifold.



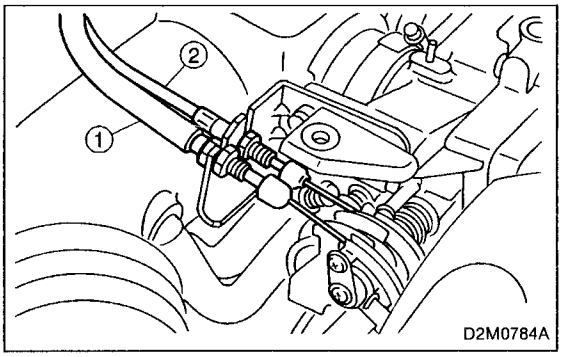
19) Install air cleaner element.
20) Install air cleaner upper cover and secure it with clips.



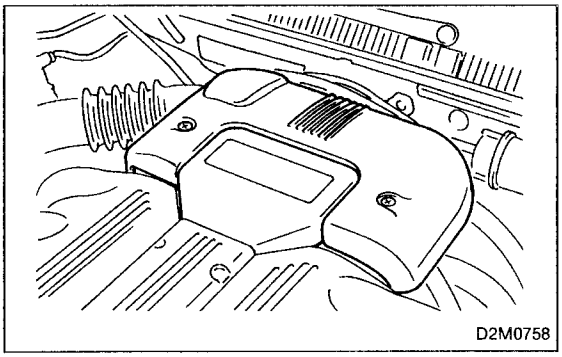
21) Connect connector to mass air flow sensor.
22) Attach cover to mass air flow sensor connector.



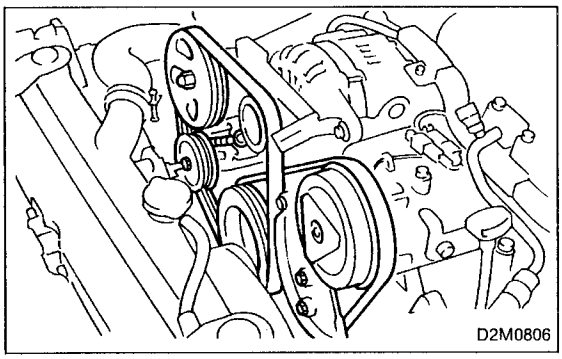
23) Install air intake duct, and tighten it with clamps.



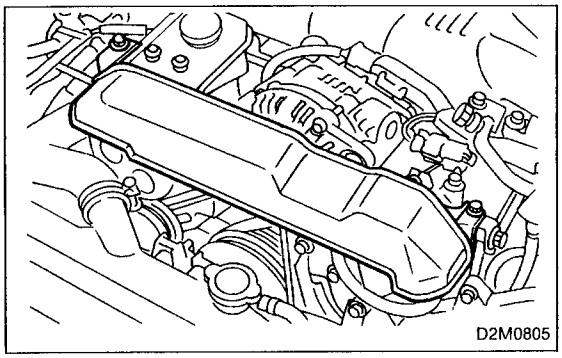
24) Connect accelerator cable ②.
25) Connect cruise control cable ①.



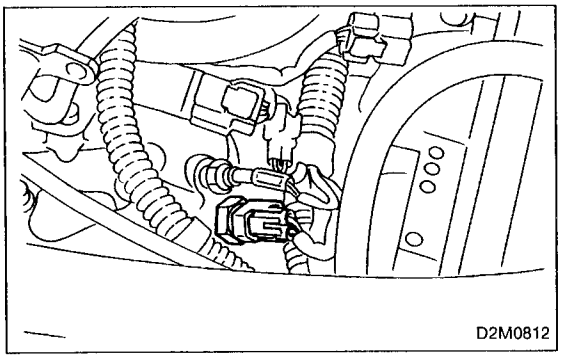
26) Install collector cover.



27) Install V-belts to A/C compressor and generator.
28) Adjust the belt tension. <Ref. to 1-5 [01A0].☆1>



29) Install V-belt cover.



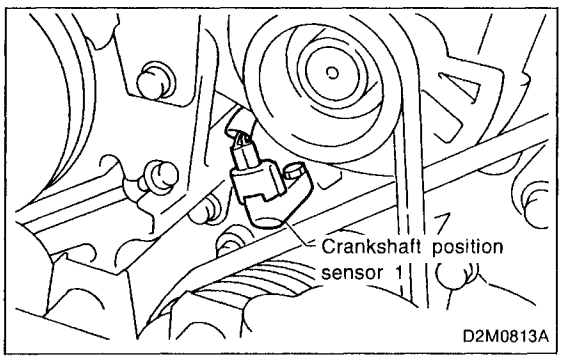
6. Engine Coolant Temperature Sensor

A: REMOVAL AND INSTALLATION

1) Disconnect connector from engine coolant temperature sensor.

2) Remove engine coolant temperature sensor.
3) Installation is in the reverse order of removal.

Tightening torque:
25 ± 3 N·m (2.5 ± 0.3 kg-m, 18.1 ± 2.2 ft-lb)

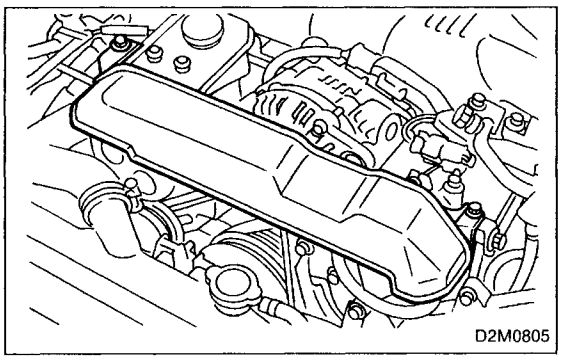


7. Crankshaft Position Sensor 1

A: REMOVAL AND INSTALLATION

1) Disconnect connector from crankshaft position sensor 1.
2) Remove bolt which installs crankshaft position sensor 1 to cylinder block, then remove sensor.
3) Installation is in the reverse order of removal.

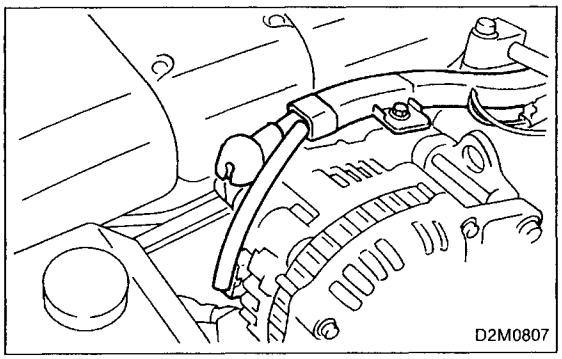
Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)



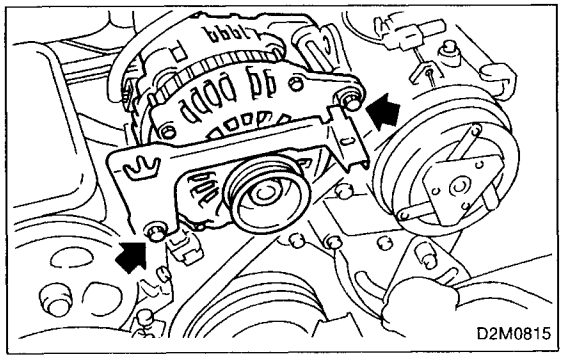
8. Crankshaft Position Sensor 2

A: REMOVAL AND INSTALLATION

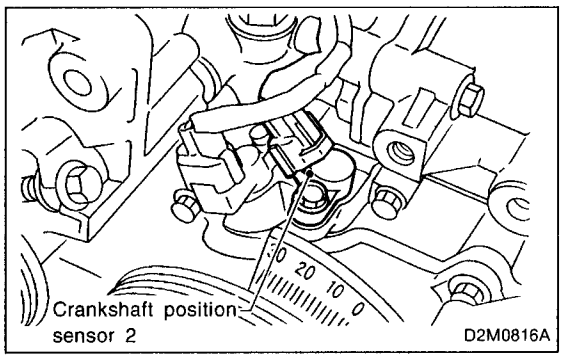
1) Remove V-belt cover.



2) Remove V-belt from generator.
3) Disconnect connectors from generator.



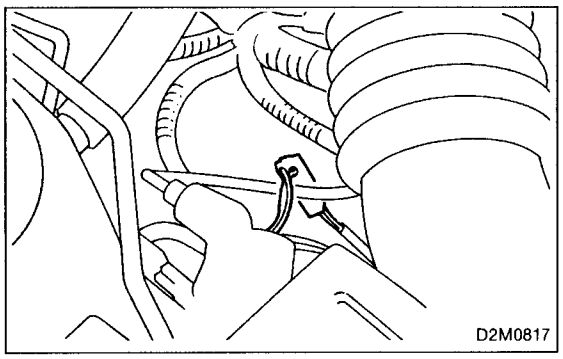
4) Remove bolts which install generator to bracket, then remove generator.



5) Disconnect connector from crankshaft position sensor 2.
6) Remove bolt which installs crankshaft position sensor 2 to cylinder block, then remove sensor.
7) Installation is in the reverse order of removal.

Tightening torque:
Crankshaft position sensor 2:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)
Generator:
35 ± 4 N·m (3.6 ± 0.4 kg-m, 26.0 ± 2.9 ft-lb)

NOTE:
During V-belt installation, adjust the belt tension. <Ref. to 1-5 [01A0].☆1>

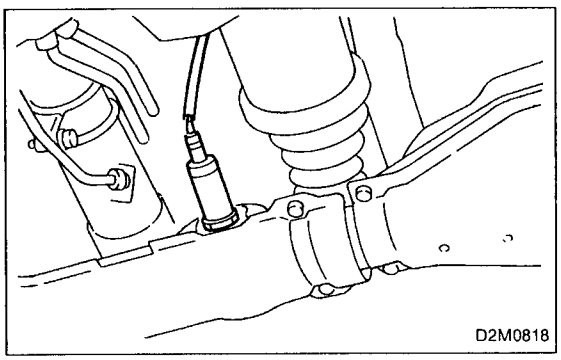


9. Front Oxygen Sensor 1 (RH)

A: REMOVAL

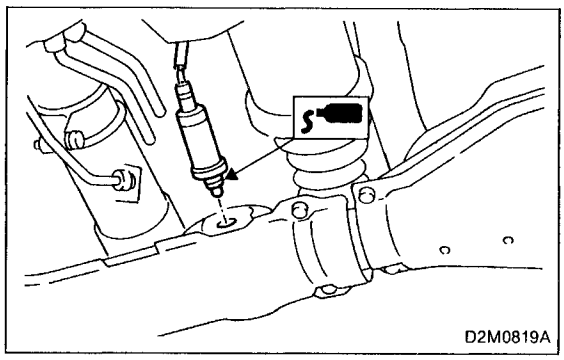
1) Disconnect front oxygen sensor 1 connector.
2) Lift-up the vehicle.
3) Apply SUBARU CRC or its equivalent to threaded portion of front oxygen sensor 1, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)



4) Remove front oxygen sensor 1.

CAUTION:
When removing oxygen sensor, do not force it, especially when exhaust pipe is cold, otherwise exhaust pipe may be damaged.

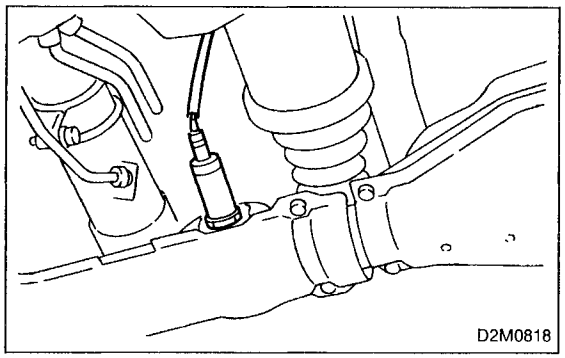


B: INSTALLATION

1) Before installing front oxygen sensor 1, apply anti-seize compound only to threaded portion to make the next removal easier.

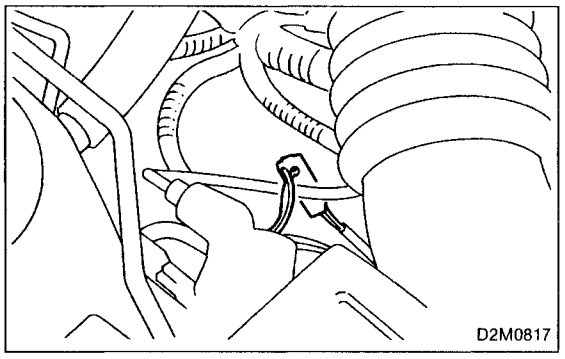
Anti-seize compound:
SS-30 by JET LUBE

CAUTION:
Never apply anti-seize compound to protector of front oxygen sensor.

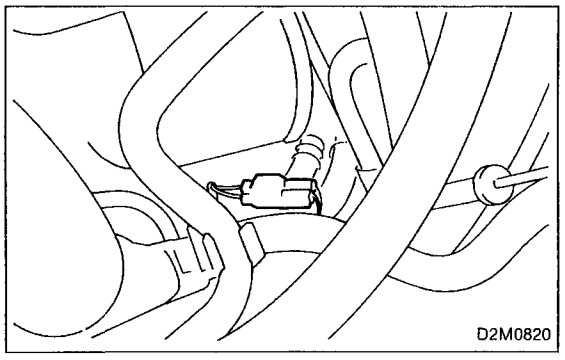


2) Install front oxygen sensor 1.

Tightening torque:
21 ± 3 N·m (2.1 ± 0.3 kg-m, 15.2 ± 2.2 ft-lb)



3) Lower the vehicle.
4) Connect front oxygen sensor 1 connector.

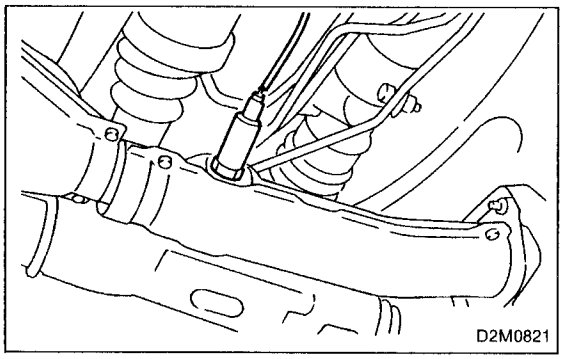


10. Front Oxygen Sensor 2 (LH)

A: REMOVAL

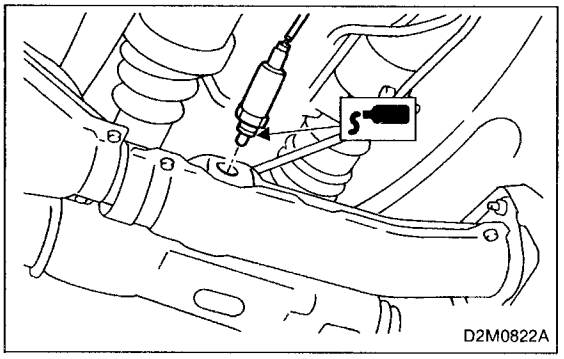
1) Disconnect front oxygen sensor 2 connector.
2) Lift-up the vehicle.
3) Apply SUBARU CRC or its equivalent to threaded portion of front oxygen sensor 2, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)



4) Remove front oxygen sensor 2.

CAUTION:
When removing oxygen sensor, do not force it, especially when exhaust pipe is cold, otherwise exhaust pipe may be damaged.

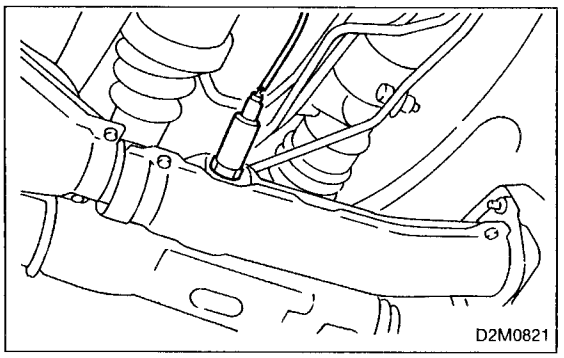


B: INSTALLATION

1) Before installing front oxygen sensor 2, apply anti-seize compound only to threaded portion to make the next removal easier.

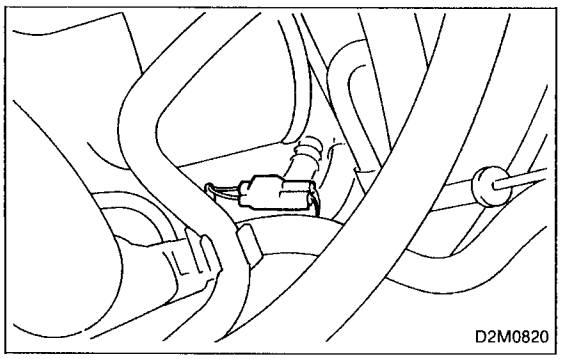
Anti-seize compound:
SS-30 by JET LUBE

CAUTION:
Never apply anti-seize compound to protector of front oxygen sensor.

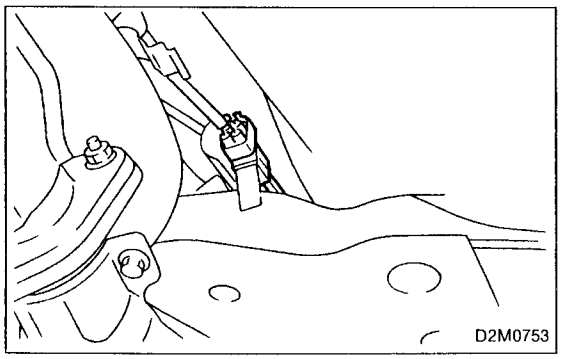


2) Install front oxygen sensor 2.

Tightening torque:
21 ± 3 N·m (2.1 ± 0.3 kg-m, 15.2 ± 2.2 ft-lb)



3) Lower the vehicle.
4) Connect front oxygen sensor 2 connector.



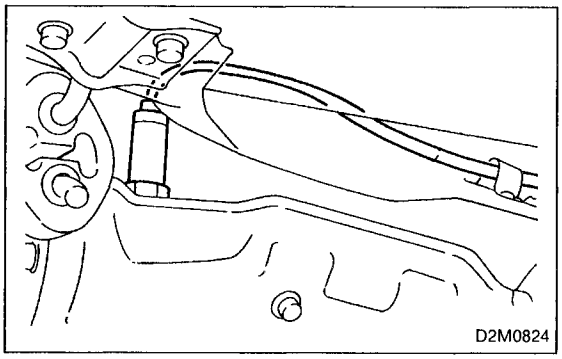
11. Rear Oxygen Sensor

A: REMOVAL

1) Lift-up the vehicle.
2) Disconnect rear oxygen sensor connector.

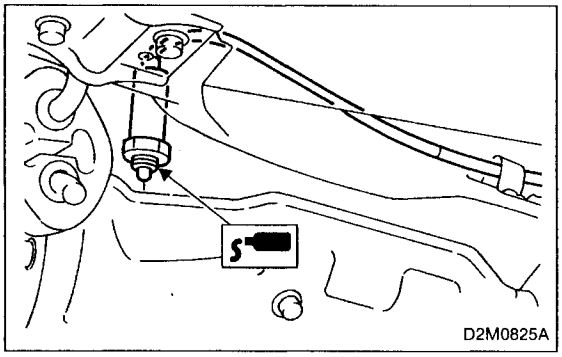
3) Apply SUBARU CRC or its equivalent to threaded portion of rear oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)



4) Remove rear oxygen sensor.

CAUTION:
When removing oxygen sensor, do not force it, especially when exhaust pipe is cold, otherwise exhaust pipe may be damaged.

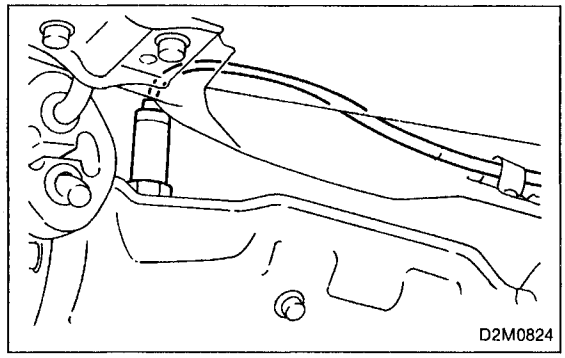


B: INSTALLATION

1) Before installing rear oxygen sensor, apply anti-seize compound only to threaded portion to make the next removal easier.

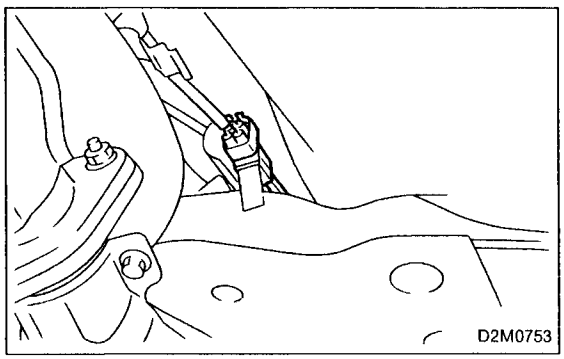
Anti-seize compound:
SS-30 by JET LUBE

CAUTION:
Never apply anti-seize compound to protector of rear oxygen sensor.

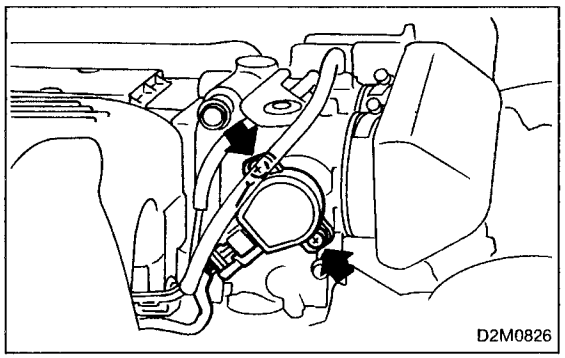


2) Install rear oxygen sensor.

Tightening torque:
21 ± 3 N·m (2.1 ± 0.3 kg-m, 15.2 ± 2.2 ft-lb)



3) Connect rear oxygen sensor connector.



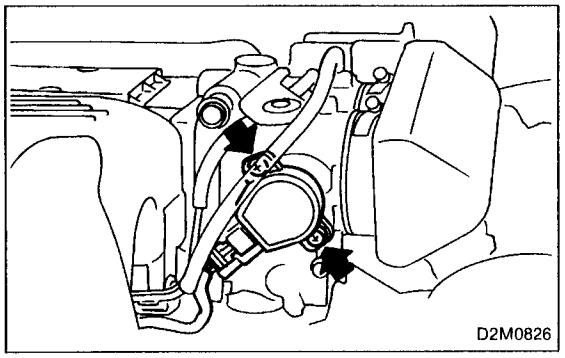
12. Throttle Position Sensor

A: REMOVAL AND INSTALLATION

1) Disconnect connector from throttle position sensor.
2) Remove throttle position sensor holding screws, and remove it.
3) Installation is in the reverse order of removal.

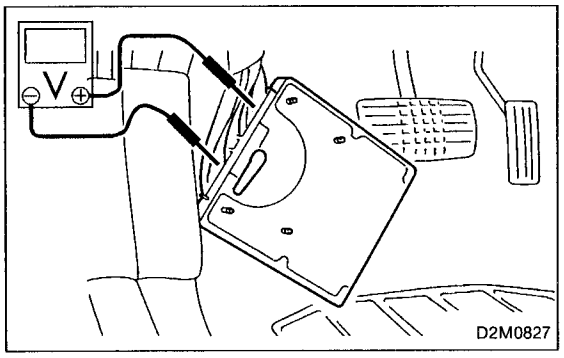
Tightening torque:
2.2 ± 0.2 N·m (0.22 ± 0.02 kg-m, 1.6 ± 0.1 ft-lb)

CAUTION:
When installing throttle position sensor, adjust to the specified data.



B: ADJUSTMENT

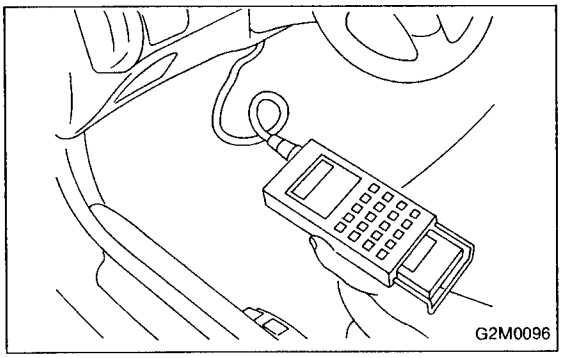
1) Turn ignition switch to OFF.
2) Loosen throttle position sensor holding screws.



3) When using voltage meter;
   (1) Take out ECM.
   (2) Turn ignition switch to ON.
   (3) Adjust throttle position sensor so that signal voltage to ECM may be in specification.

Connector & terminal	***/ Specified voltage***
(B59) No. 6 — No. 20	***/ 0.45 — 0.55 V***
	[Fully closed.]

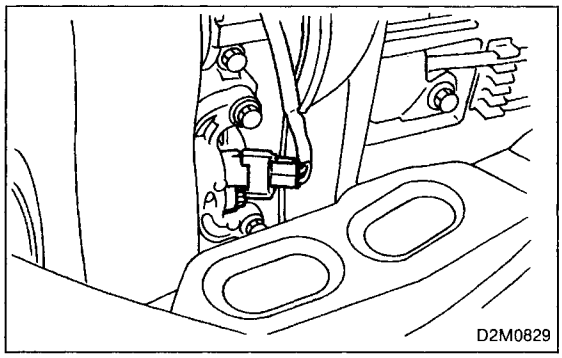
   (4) Tighten throttle position sensor holding screws.



4) When using Subaru Select Monitor;
   (1) Connect Subaru Select Monitor to the data link connector.
   (2) Turn ignition switch to ON and SSM switch to ON.
   (3) Select mode "F10".
   (4) Adjust throttle position sensor to specified data.

Condition	***/ Specified data.***
Throttle fully closed	***/ 0.50 V***

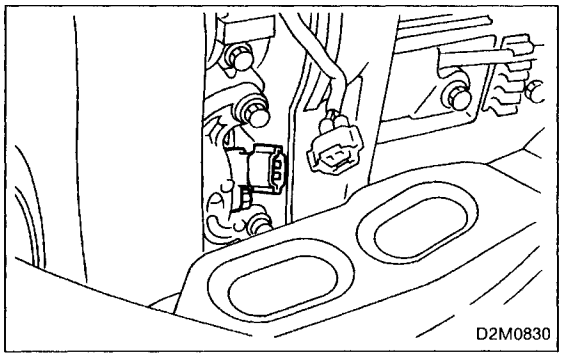
   (5) Tighten throttle position sensor holding screws.



13. Camshaft Position Sensor

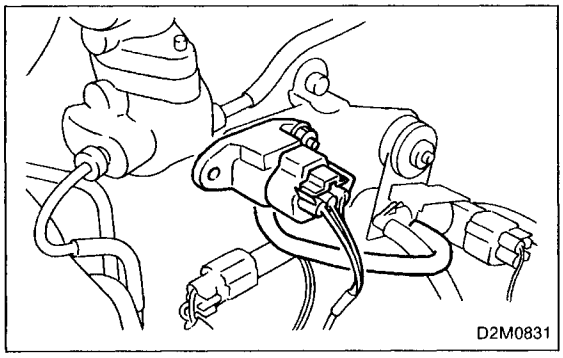
A: REMOVAL AND INSTALLATION

1) Remove battery and battery tray.
2) Disconnect connector from camshaft position sensor.



3) Remove camshaft position sensor from camshaft support LH.
4) Installation is in the reverse order of removal.

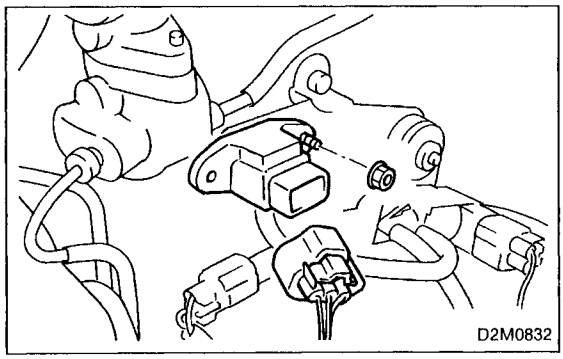
Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)



14. Pressure Sensor

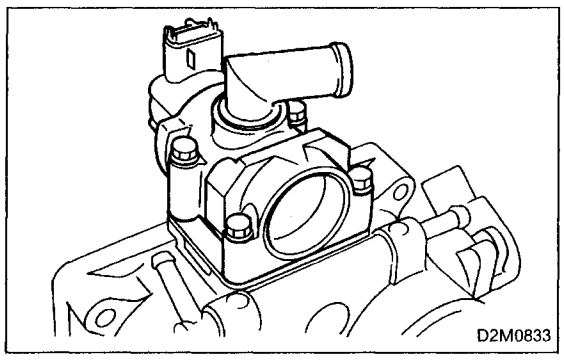
A: REMOVAL AND INSTALLATION

1) Disconnect connector from pressure sensor.
2) Disconnect hose from pressure sensor.



3) Remove pressure sensor from bracket.
4) Installation is in the reverse order of removal.

Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)



15. Idle Air Control Solenoid Valve

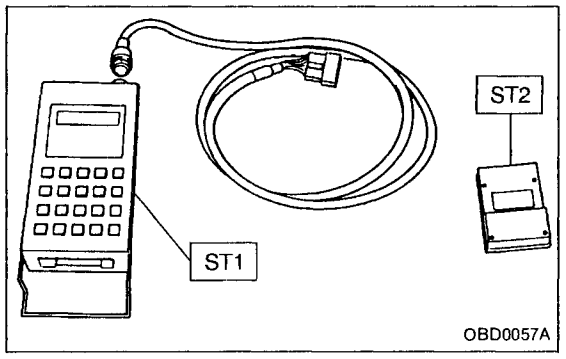
A: REMOVAL AND INSTALLATION

1) Remove throttle body. <Ref. to 2-7 [W3A0].☆5>
2) Remove screws which install idle air control solenoid valve to throttle body.
3) Remove idle air control solenoid valve from throttle body.

4) Installation is in the reverse order of removal.

CAUTION:
Replace gasket with a new one.

Tightening torque:
6.4±0.5 N·m (0.65±0.05 kg-m, 4.7±0.4 ft-lb)



B: CLEANING

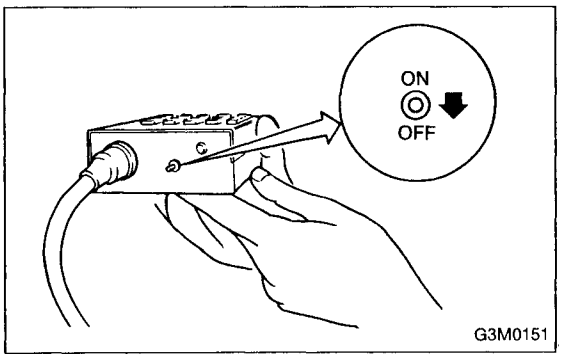
NOTE:
- Hunting at start time or abnormal idle condition may indicate soiled idle air control solenoid valve. In such a case, clean idle air control solenoid valve.
- Two people are required to clean the idle air control solenoid valve.

1) Prepare Subaru select monitor and cartridge.

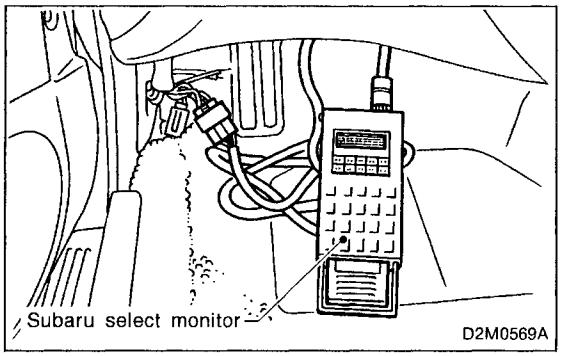
ST1 498307500 SELECT MONITOR KIT
ST2 498346000 CARTRIDGE

2) Prepare cleaner.

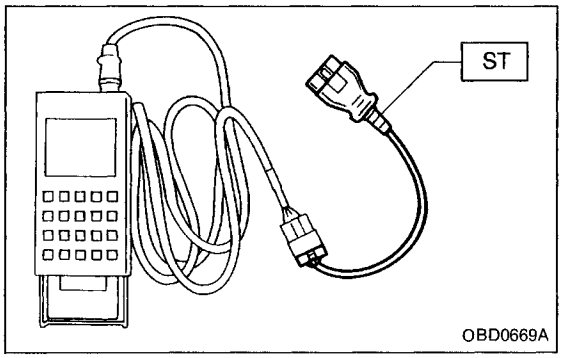
Cleaner:
- ***Part No. 1050002 GM Top Engine Cleaner***
- ***Part No. X66-A AC Delco Carburetor Tune-up Conditioner***



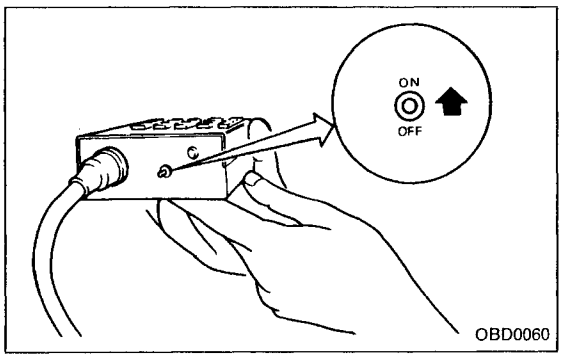
3) Turn ignition switch and select monitor switch to OFF.



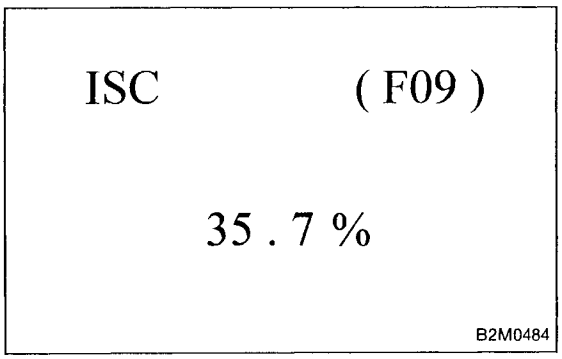
4) Insert cartridge into Subaru select monitor.
5) Connect Subaru select monitor to data link connector.
● Using data link connector for Subaru select monitor only;
(1) Remove the A pillar lower trim of driver side front pillar.
(2) Connect Subaru select monitor to data link connector.



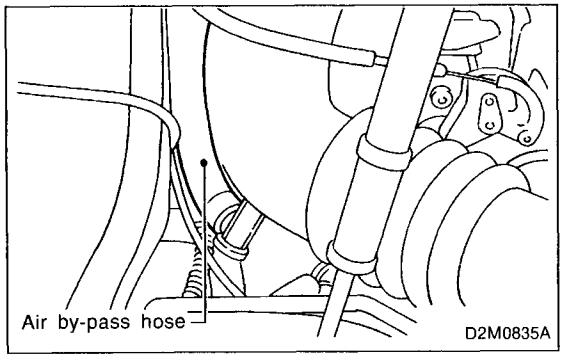
● When using data link connector for Subaru select monitor and OBD-II general scan tool, connect ST to Subaru select monitor cable.
ST 498357200 ADAPTER CABLE



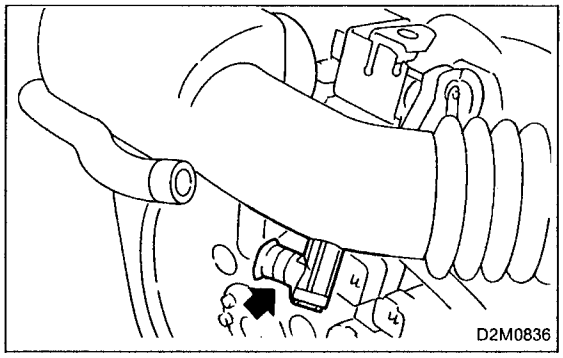
6) Start and warm-up the engine until radiator fan operates.
NOTE:
Ensure the selector lever is placed in the "P" position before starting.
7) Leave the engine under no load (radiator fan, A/C, headlights and accessories switches are all OFF) for at least one minute.
8) Turn Subaru select monitor switch to ON.



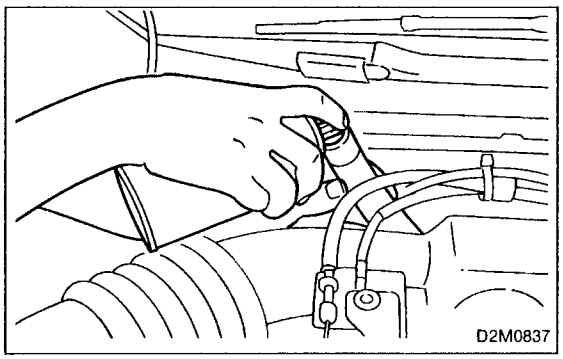
9) Read data on Subaru select monitor.
● Subaru select monitor
Designate mode using function key.
Function mode: F09
● Idle air control solenoid valve duty ratio is shown on display.



10) Disconnect air by-pass hose from air intake boot.
NOTE:
Depress the accelerator pedal as required to prevent engine stall while removing the air by-pass hose.


D2M0836

11) Using suitable tape, block the air by-pass hose connection of the air intake boot.


D2M0837

12) While operating the engine in the 1,500 — 2,000 rpm range, spray the cleaner from the air by-pass hose on the idle air control valve for 10 seconds.

NOTE:
During cleaner application, depress the accelerator pedal as required to prevent engine stall.

Cleaner:

- ***Part No. 1050002 GM Top Engine Cleaner***
- ***Part No. X66-A AC Delco Carburetor Tune-up Conditioner***

13) Shut off the engine and allow it to stand for 3 minutes.
14) Restart the engine and maintain it in the 1,500 — 2,000 rpm range. Spray the cleaner again from the air by-pass hose on the idle air control valve for additional 10 seconds.

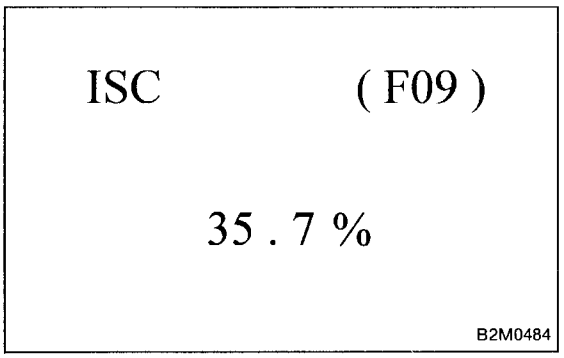
NOTE:
During cleaner application, depress the accelerator pedal as required to prevent engine stall.

Cleaner:

- ***Part No. 1050002 GM Top Engine Cleaner***
- ***Part No. X66-A AC Delco Carburetor Tune-up Conditioner***

15) Connect air by-pass hose to air intake boot.
16) Operate the engine in the 1,000 — 2,000 rpm range for 5 minutes, making sure white smoke is no longer emitted from the muffler.

NOTE:
If white smoke is still emitted from the muffler, race the engine until it no longer appears.



17) After the engine has warmed up, read the idle air control solenoid valve duty ratio using Subaru select monitor. At this point, the engine must be under no load (radiator fan, A/C, headlights and accessories switches are all OFF).

- Subaru select monitor

Designate mode using function key.

Function mode: F09

18) Check that the duty ratio obtained after cleaning has reduced to a minimum of 3% less than the reading achieved before cleaning.

NOTE:
If the duty ratio has not decreased by a minimum of 3%, repeat cleaning operation.

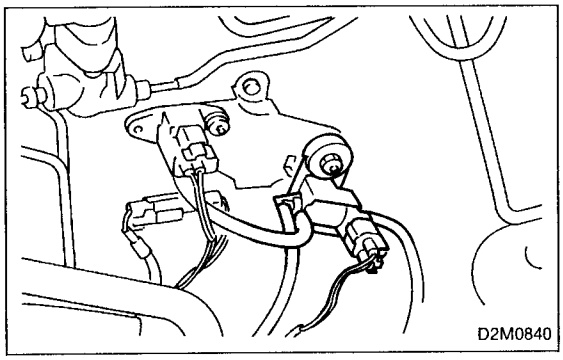
19) Stop and restart the engine. Using Subaru select monitor, read the idle air control solenoid valve duty ratio.

- Subaru select monitor

Designate mode using function key.

Function mode: F09

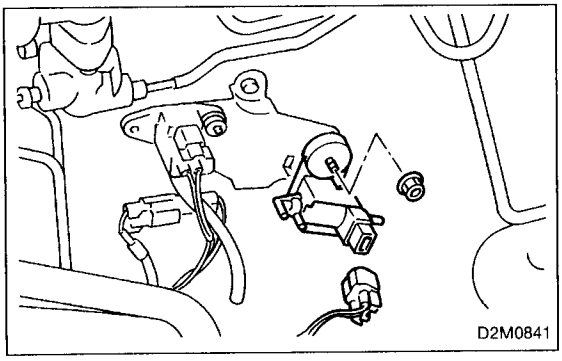
20) Check the duty ratio. If it is the same value as that outlined in step 17) above, cleaning operation is no longer required.



16. Pressure Sources Switching Solenoid Valve

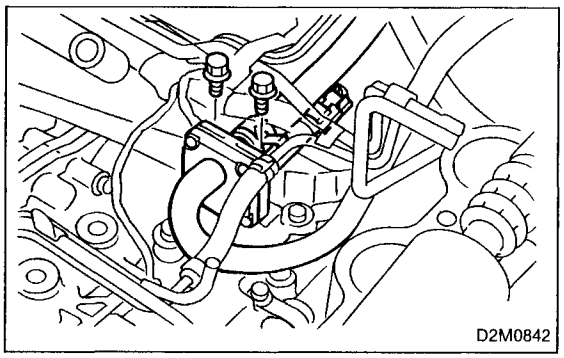
A: REMOVAL AND INSTALLATION

1) Disconnect connector from pressure sources switching solenoid valve.
2) Disconnect hoses from pressure sources switching solenoid valve.



3) Remove pressure sources switching solenoid valve from bracket.
4) Installation is in the reverse order of removal.

Tightening torque:
6.4 ± 0.5 N·m (0.65 ± 0.05 kg-m, 4.7 ± 0.4 ft-lb)



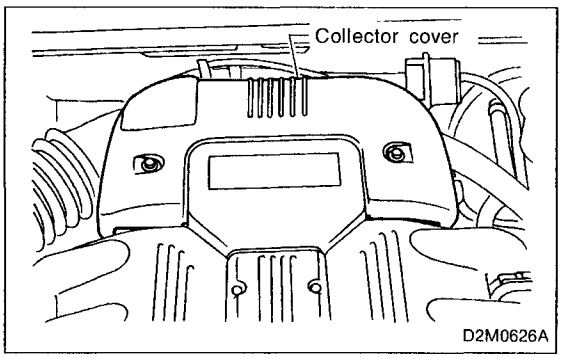
17. Auxiliary Air Control Valve

A: REMOVAL AND INSTALLATION

1) Remove collector chamber from intake manifold. <Ref. to 2-7 [W4A0].☆5>
2) Disconnect connector from auxiliary air control valve.
3) Disconnect hoses from auxiliary air control valve.
4) Remove bolts which install auxiliary air control valve onto cylinder block, then remove auxiliary air control valve.

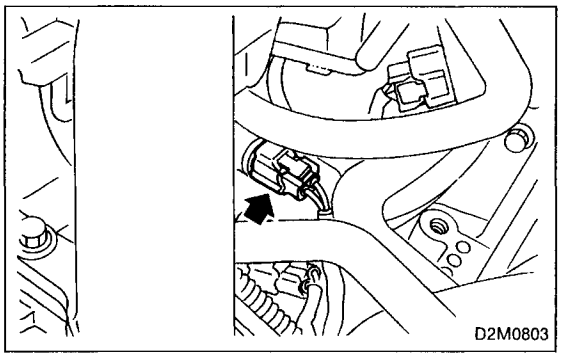
5) Installation is in the reverse order of removal.

Tightening torque:
16 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)

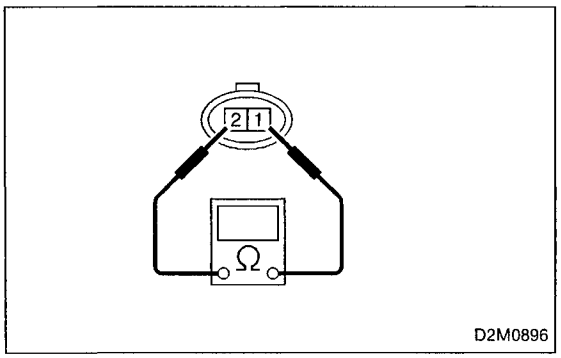


B: INSPECTION

1) Turn ignition switch to OFF.
2) Remove collector cover.



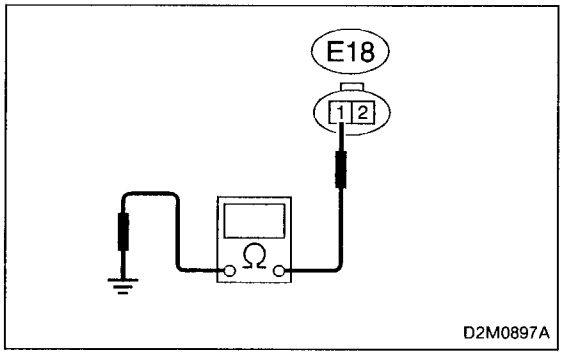
3) Disconnect connector from auxiliary air control valve.



4) Measure resistance between auxiliary air control valve connector terminals.

Terminals / Specified data:
No. 1 — No. 2 / Other than zero (0) or inifinity (∞)

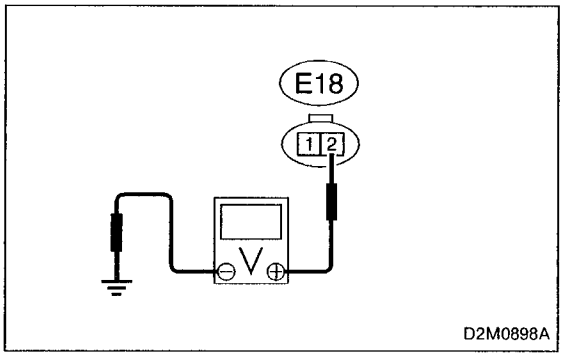
NOTE:
If the resistance is zero (0) or infinity (∞), replace the auxiliary air control valve with a new one.



5) Measure resistance of harness between auxiliary air control valve connector and engine ground.

Connector & terminal / Specified data:
(E18) No. 1 — Engine ground / 5 Ω, or less

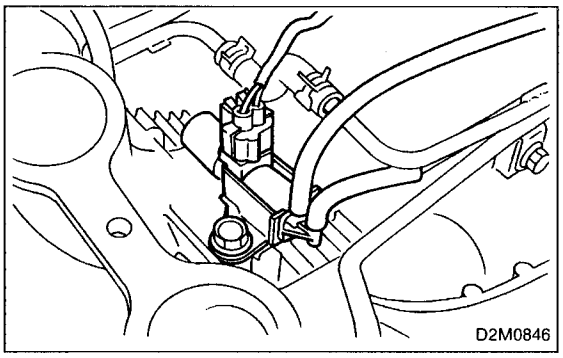
NOTE:
If the resistance is infinity (∞) or greater than 5 Ω, repair open circuit in harness between auxiliary air control valve connector and engine ground or poor contact in its terminal.



6) Turn ignition switch to ON.
7) Measure voltage between auxiliary air control valve connector and engine ground.

Connector & terminal / Specified data:
(E18) No. 2 (+) — Engine ground (–)
/ 10 V, or more

NOTE:
If the voltage is 0 V or lower than 10 V, repair open or short circuit in power supply line or poor contact in its connector.



18. Induction Control Solenoid Valve

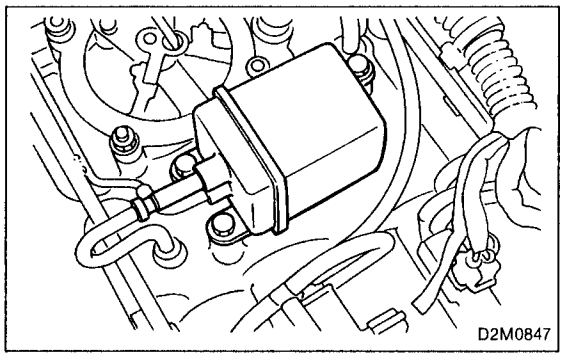
A: REMOVAL AND INSTALLATION

1) Remove collector chamber from intake manifold. <Ref. to 2-7 [W4A0].☆5>
2) Disconnect connector from induction control solenoid valve.
3) Disconnect hoses from induction control solenoid valve.
4) Remove bolt which installs induction control solenoid valve onto collector chamber, then remove induction control solenoid valve.

NOTE:
This figure shows the rear side of collector chamber.

5) Installation is in the reverse order of removal.

Tightening torque:
16 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)



19. Vacuum Tank

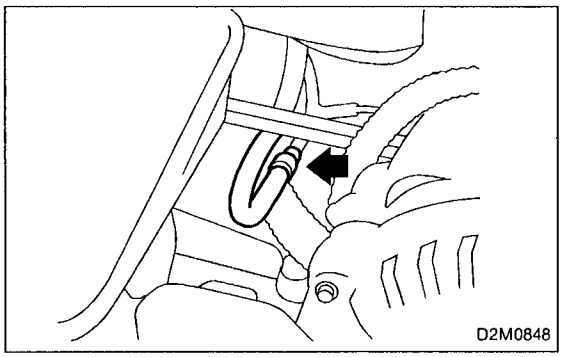
A: REMOVAL AND INSTALLATION

1) Remove collector chamber from intake manifold. <Ref. to 2-7 [W4A0].☆5>
2) Disconnect vacuum hoses from vacuum tank.
3) Remove bolts which install vacuum tank onto collector chamber, then remove vacuum tank.

NOTE:
This figure shows the rear side of collector chamber.

4) Installation is in the reverse order of removal.

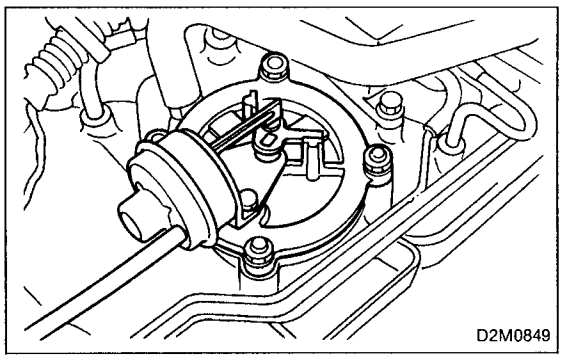
Tightening torque:
16 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)



20. Check Valve

A: REMOVAL AND INSTALLATION

1) Disconnect vacuum hoses and check valve as a unit.
2) Disassemble check valve from vacuum hoses.
3) Installation is in the reverse order of removal.



21. Induction Control Valve and Diaphragm

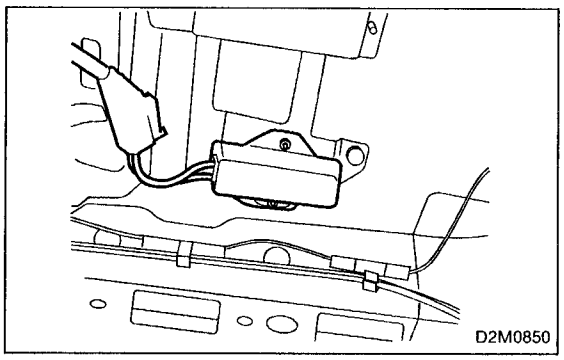
A: REMOVAL AND INSTALLATION

1) Remove collector chamber from intake manifold. <Ref. to 2-7 [W4A0].☆5>
2) Disconnect vacuum hose from induction valve diaphragm.
3) Remove nuts which install induction control valve onto collector chamber, then remove induction control valve and diaphragm as a unit.

NOTE:
This figure shows the rear side of collector chamber.

4) Installation is in the reverse order of removal.

Tightening torque:
16 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)

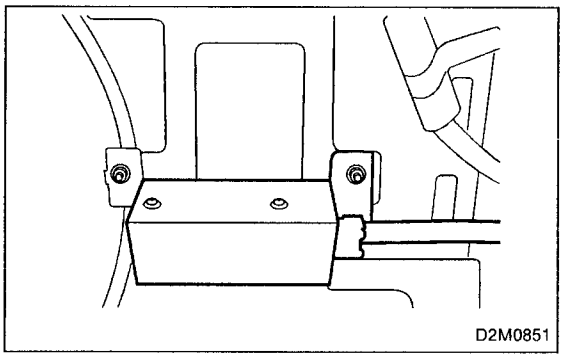

D2M0850

22. Resistor

A: REMOVAL AND INSTALLATION

1) Remove trunk side trims.
2) Remove trunk upper trim.
3) Disconnect connector from resistor.
4) Remove resistor.
5) Installation is in the reverse order of removal.

Tightening torque:
7.4 ± 2.0 N·m (0.75 ± 0.2 kg-m, 5.4 ± 1.4 ft-lb)

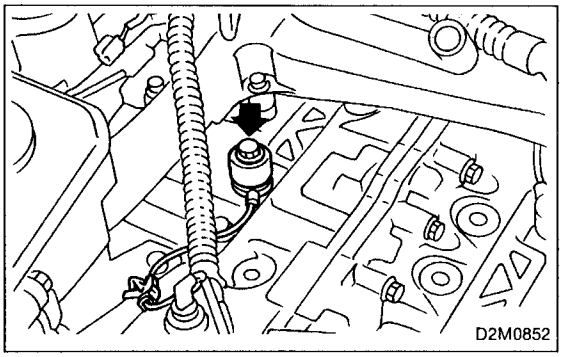

D2M0851

23. Fuel Pump Modulator

A: REMOVAL AND INSTALLATION

1) Remove trunk side trims.
2) Remove trunk upper trim.
3) Disconnect connector from fuel pump modulator.
4) Remove fuel pump modulator.
5) Installation is in the reverse order of removal.

Tightening torque:
7.4 ± 2.0 N·m (0.75 ± 0.2 kg-m, 5.4 ± 1.4 ft-lb)

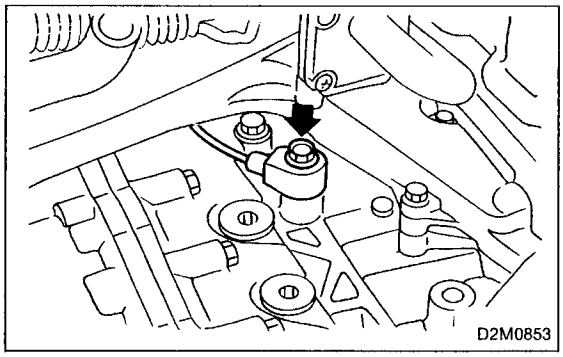

D2M0852

24. Knock Sensor 1 (RH)

A: REMOVAL AND INSTALLATION

1) Remove collector chamber from intake manifold. <Ref. to 2-7 [W4A0].☆5>
2) Disconnect connector of knock sensor 1.
3) Remove bolt which installs knock sensor 1 onto cylinder block, then remove knock sensor 1.
4) Installation is in the reverse order of removal.

Tightening torque:
16 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)

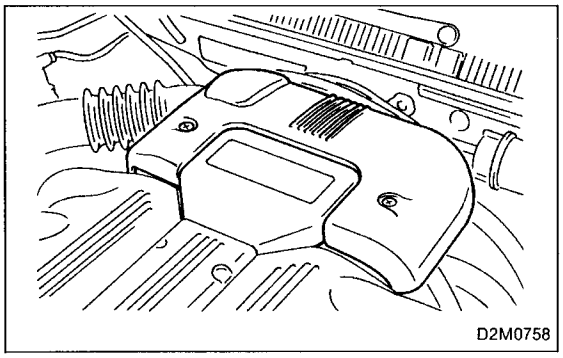


25. Knock Sensor 2 (LH)

A: REMOVAL AND INSTALLATION

1) Remove collector chamber from intake manifold. <Ref. to 2-7 [W4A0].☆5>
2) Disconnect connector of knock sensor 2.
3) Remove bolt which installs knock sensor 2 onto cylinder block, then remove knock sensor 2.
4) Installation is in the reverse order of removal.

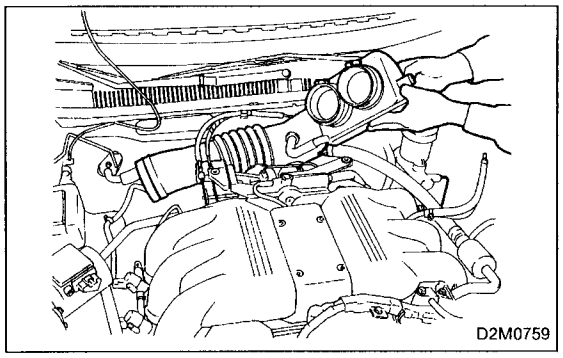
Tightening torque:
16 ± 1.5 N·m (1.6 ± 0.15 kg-m, 11.6 ± 1.1 ft-lb)



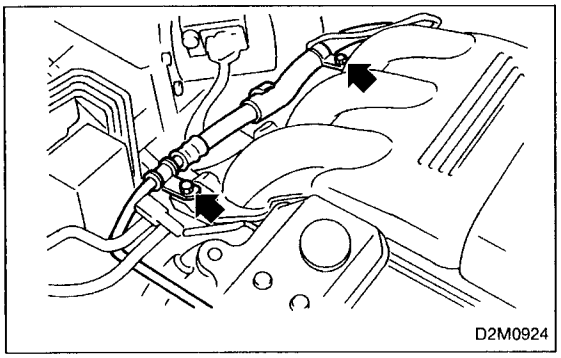
26. Fuel Injector

A: REMOVAL AND INSTALLATION

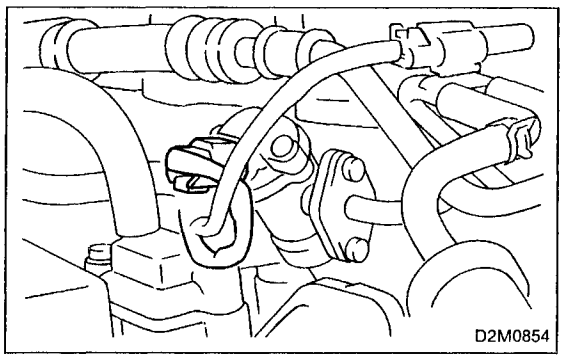
1) Release fuel pressure. <Ref. to 2-8 [W1A0].☆1>
2) Remove collector cover.



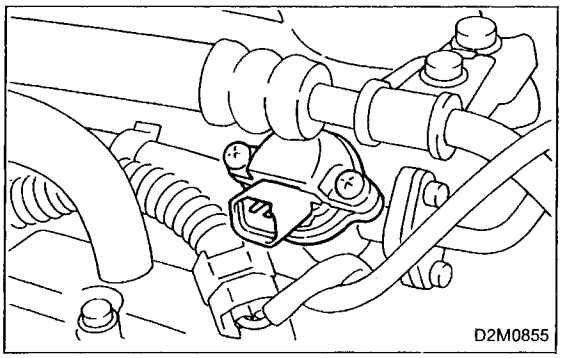
3) Loosen clamps which connect air intake duct to throttle body and mass air flow sensor.
4) Remove air intake duct.



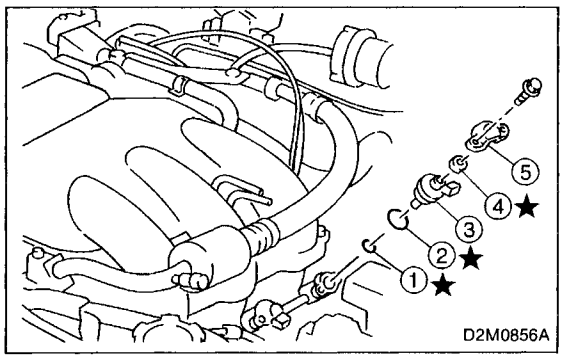
5) Remove bolts which install power steering hose bracket to collector chamber, then position the hose away from collector chamber.



6) Disconnect connectors from each fuel injector.



7) Remove screws which hold fuel injector to fuel injector pipe.



8) Remove fuel injector.
   (1) O-ring B
   (2) O-ring A
   (3) Injector body
   (4) Insulator
   (5) Fuel injector cap

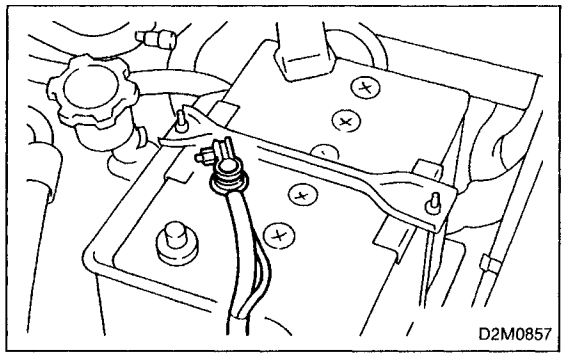
CAUTION:
- **Do not attempt to pry injectors with a screwdriver or similar tool.**
- **Do not pinch injector pin with pliers.**

NOTE:
If the injector is difficult to remove by hand, remove injector and fuel pipe as a unit, and push injector out from the back.

9) Installation is in the reverse order of removal.

CAUTION:
Replace O-rings and insulator with new ones.

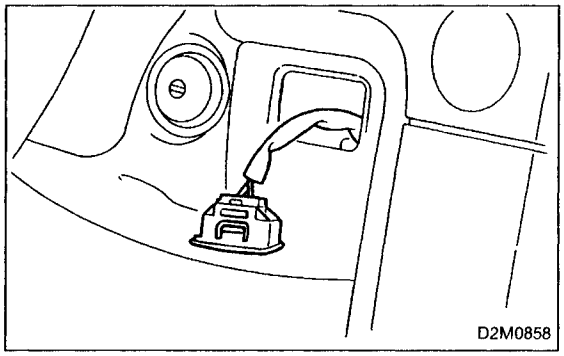
Tightening torque:
Fuel injector:
3.4±0.5 N·m (0.35±0.05 kg-m, 2.5±0.4 ft-lb)
Power steering hose bracket:
13±3 N·m (1.3±0.3 kg-m, 9.4±2.2 ft-lb)



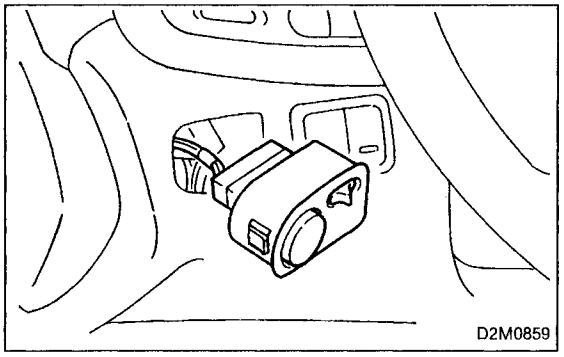
27. Engine Control Module

A: REMOVAL AND INSTALLATION

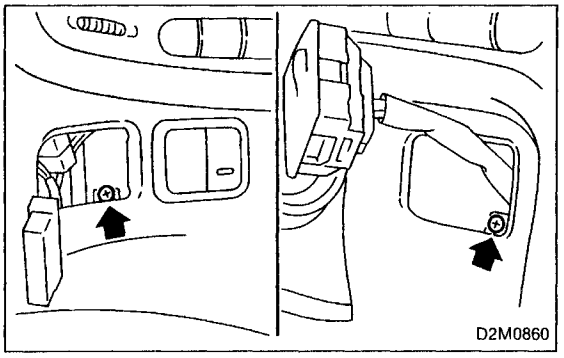
1) Disconnect battery ground cable.



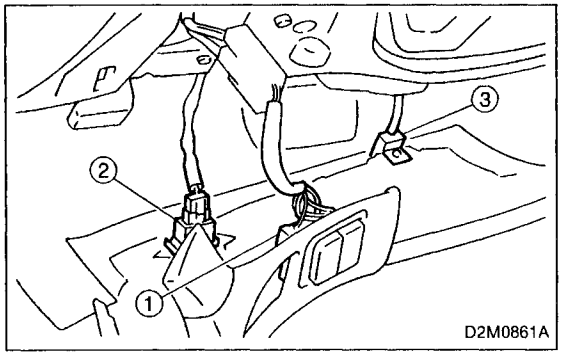
2) Pull out the data link connector from lower cover panel.



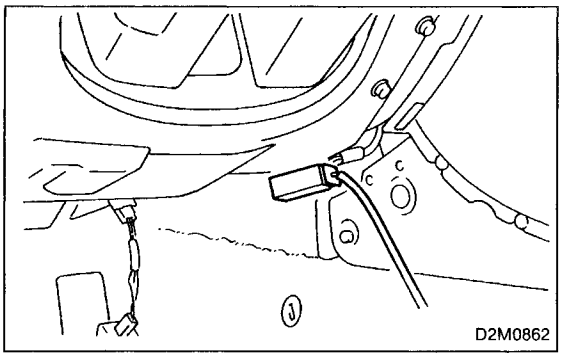
3) Pull out the remote control rearview mirror switch, and disconnect connector from it.



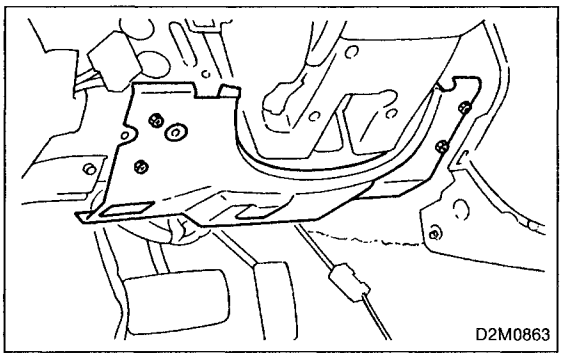
4) Remove bolts which install lower cover panel.
5) Lower the panel.



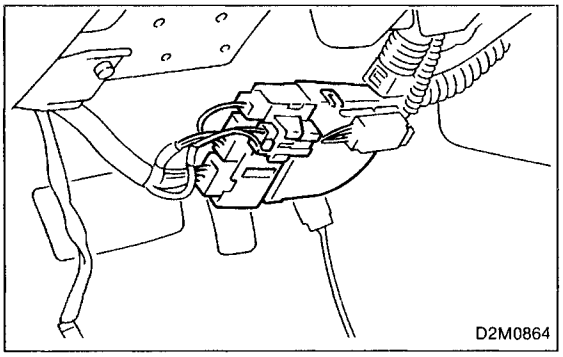
6) Disconnect connectors as follows:
   (1) Parking light switch
   (2) Wiper mode switch
   (3) Foot light
7) Remove lower cover panel.



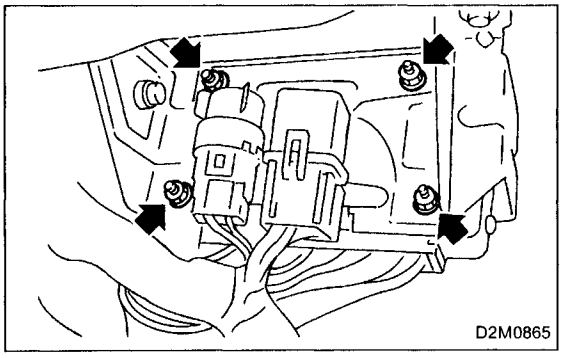
8) Remove data link connector from knee protector.



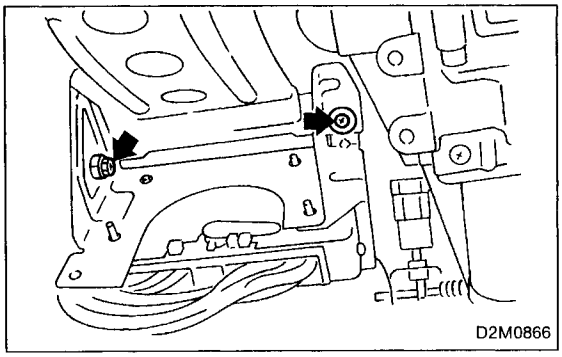
9) Remove knee protector.



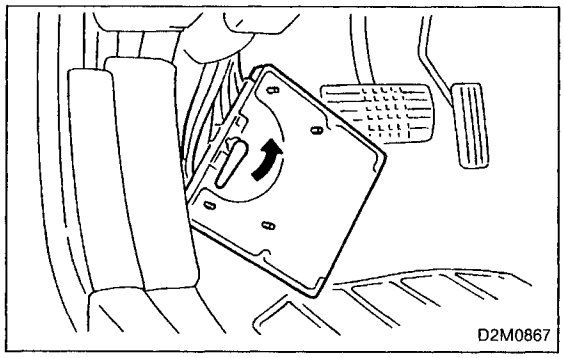
10) Disconnect connectors from harness spool.



11) Remove nuts which hold the ECM.
12) Remove the bracket of main relay and fuel pump relay.



13) Remove bolts which install ECM.
14) Pull down ECM and TCM as a unit.



15) Release the lock of ECM connector, and disconnect it.
16) Take out ECM.
17) Installation is in the reverse order of removal.

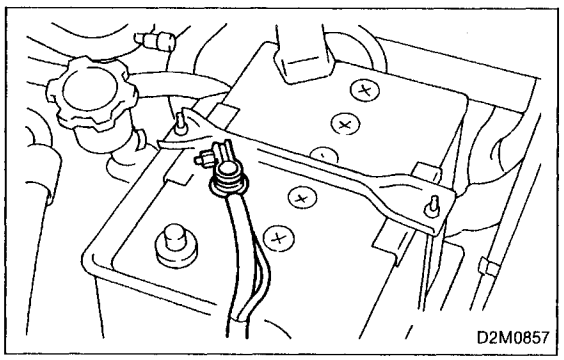
CAUTION:
Make sure that the lock of ECM connector is engaged completely.

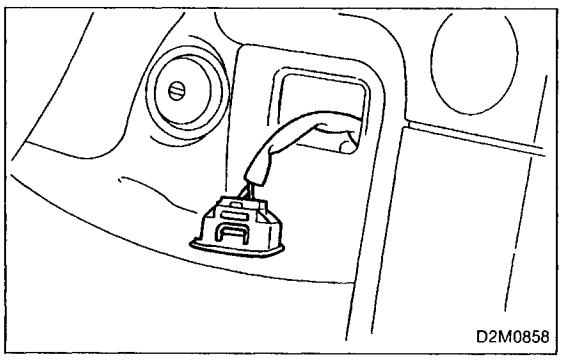
Tightening torque:
ECM:
7.4 ± 2.0 N·m (0.75 ± 0.2 kg-m, 5.4 ± 1.4 ft-lb)

28. Main Relay and Fuel Pump Relay

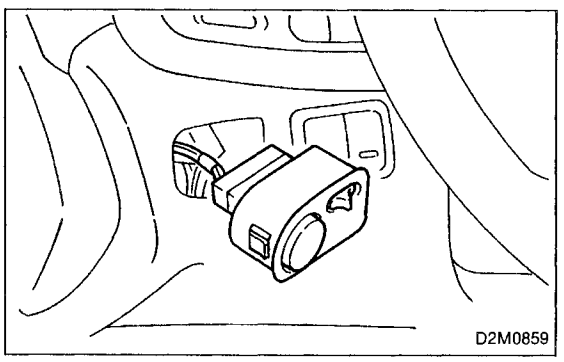
A: REMOVAL AND INSTALLATION

1) Disconnect battery ground cable.

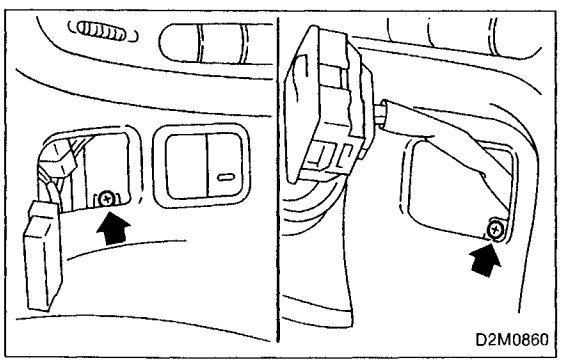




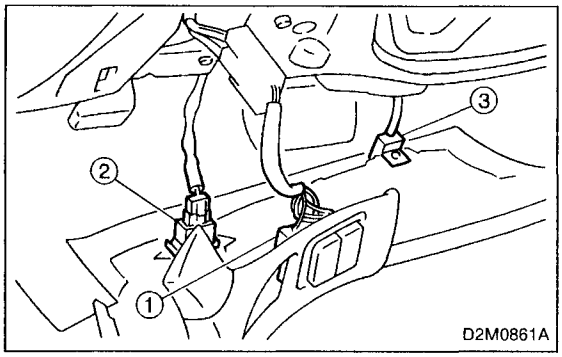
2) Pull out the data link connector from lower cover panel.



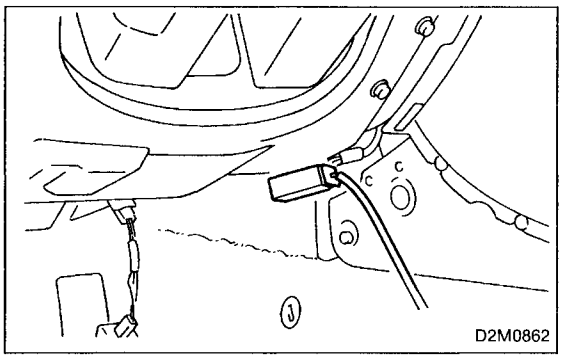
3) Pull out the remote control rearview mirror switch, and disconnect connector from it.



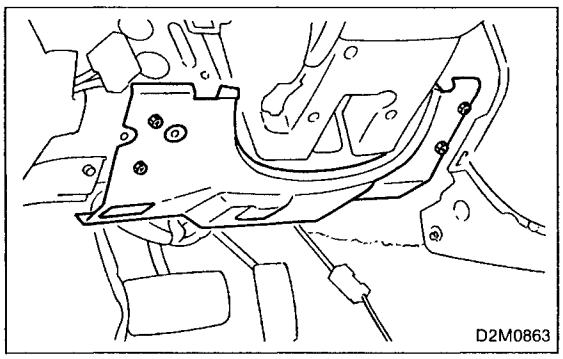
4) Remove bolts which install lower cover panel.
5) Lower the panel.



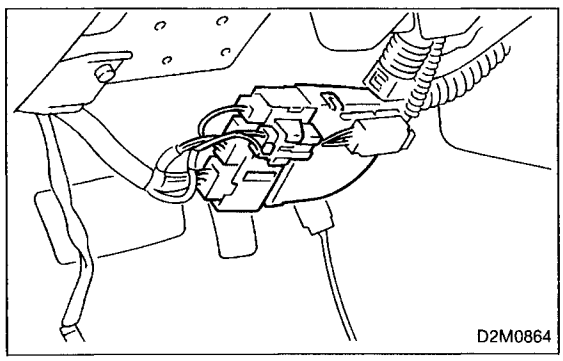
6) Disconnect connectors as follows:
   (1) Parking light switch
   (2) Wiper mode switch
   (3) Foot light
7) Remove lower cover panel.



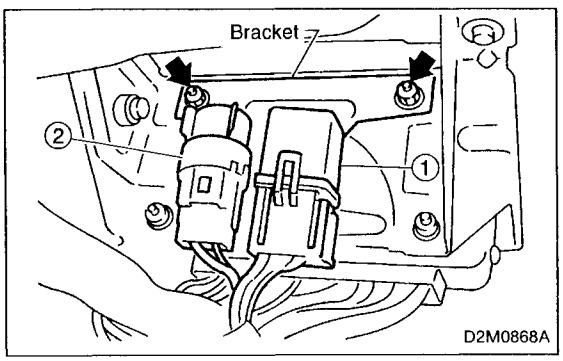
8) Remove data link connector from knee protector.



9) Remove knee protector.



10) Disconnect connectors from harness spool.



11) Remove nuts which hold the bracket of main relay ① and fuel pump relay ②.
12) Lower the bracket, and disconnect connectors from main relay and fuel pump relay.
13) Remove main relay and fuel pump relay.
14) Installation is in the reverse order of removal.

Tightening torque:
Main relay and fuel pump relay bracket:
7.4 ± 2.0 N·m (0.75 ± 0.2 kg-m, 5.4 ± 1.4 ft-lb)