

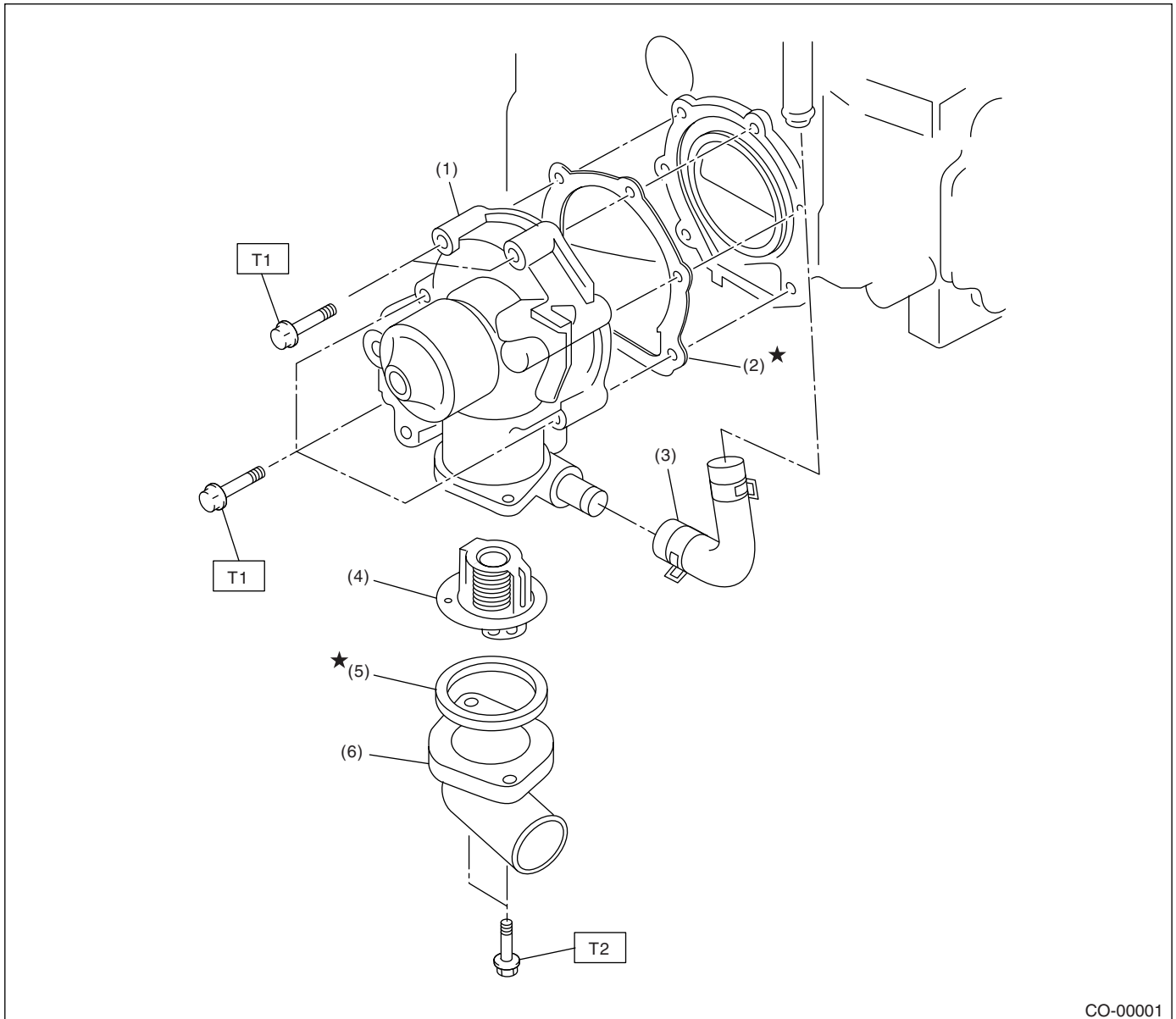
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COOLING

1. General Description

A: SPECIFICATIONS

Cooling system			Electric fan + Forced engine coolant circulation system			
Total engine coolant capacityℓ (US qt, Imp qt)			AT model: Approx. 6.9 (7.29, 6.07) MT model: Approx. 7.0 (7.4, 6.2)			
Water pump	Type		Centrifugal impeller type			
	Discharge performance I	Discharge		20 ℓ (5.3 US gal, 4.4 Imp gal)/min.		
		Pump speed — Discharge pressure		760 rpm — 2.9 kPa (0.3 mAq)		
		Engine coolant temperature		85°C (185°F)		
	Discharge performance II	Discharge		100 ℓ (26.4 US gal, 22.0 Imp gal)/min.		
		Pump speed — Discharge pressure		3,000 rpm — 49.0 kPa (5.0 mAq)		
		Engine coolant temperature		85°C (185°F)		
	Discharge performance III	Discharge		200 ℓ (52.8 US gal, 44.0 Imp gal)/min.		
		Pump speed — Discharge pressure		6,000 rpm — 225.4 kPa (23.0 mAq)		
		Engine coolant temperature		85°C (185°F)		
	Impeller diameter		76 mm (2.99 in)			
	Number of impeller vanes		8			
	Pump pulley diameter		60 mm (2.36 in)			
	Clearance between impeller and case	Standard		0.5 — 0.7 mm (0.020 — 0.028 in)		
Limit		1.0 mm (0.039 in)				
“Thrust” runout of impeller end			0.5 mm (0.020 in)			
Thermostat	Type		Wax pellet type			
	Starts to open		76 — 80°C (169 — 176°F)			
	Fully opened		91°C (196°F)			
	Valve lift		9.0 mm (0.354 in) or more			
	Valve bore		35 mm (1.38 in)			
Radiator fan	Motor	Main fan		70 W		
		Sub fan		70 W		
	Fan diameter × Blade		320 mm (12.60 in) × 5 (main fan) 320 mm (12.60 in) × 7 (sub fan)			
Radiator	Type		Down flow, pressure type			
	Core dimensions	Width × Height × Thickness		691.5 × 340 × 16 mm (27.22 × 13.39 × 0.63 in)		
	Pressure range in which cap valve is open		Above: 108±15 kPa (1.1±0.15 kg/cm ² , 16±2 psi) Below: −1.0 to −4.9 kPa (−0.01 to −0.05 kg/cm ² , −0.1 to −0.7 psi)			
	Fins		Corrugated fin type			
Reservoir tank	Capacity		0.5 ℓ (0.5 US qt, 0.4 Imp qt)			

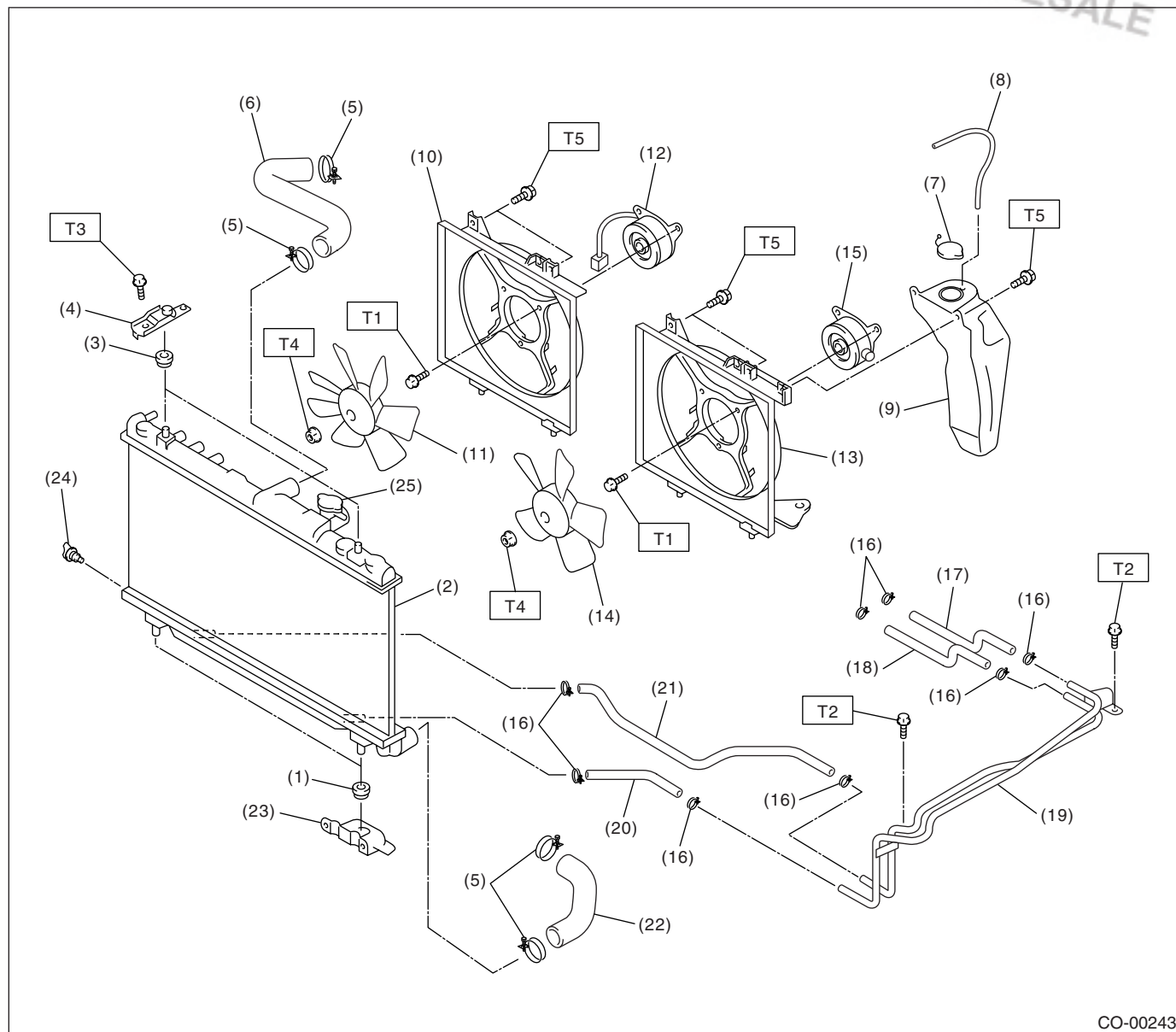
B: COMPONENT**1. WATER PUMP**

CO-00001

(1) Water pump ASSY	(5) Gasket
(2) Gasket	(6) Thermostat cover
(3) Heater by-pass hose	
(4) Thermostat	

Tightening torque: N·m (kgf-m, ft-lb)**T1: First 12 (1.2, 8.7)
Second 12 (1.2, 8.7)****T2: 6.5 (0.66, 4.8)**

2. RADIATOR AND RADIATOR FAN



CO-00243

(1) Radiator lower cushion	(12) Radiator sub fan motor	(23) Radiator lower bracket
(2) Radiator	(13) Radiator main fan shroud	(24) Radiator drain plug
(3) Radiator upper cushion	(14) Radiator main fan	(25) Radiator cap
(4) Radiator upper bracket	(15) Radiator main fan motor	
(5) Clamp	(16) ATF hose clamp (AT model)	
(6) Radiator inlet hose	(17) ATF inlet hose A (AT model)	
(7) Engine coolant reservoir tank cap	(18) ATF outlet hose A (AT model)	
(8) Overflow hose	(19) ATF pipe (AT model)	
(9) Engine coolant reservoir tank	(20) ATF inlet hose B (AT model)	
(10) Radiator sub fan shroud	(21) ATF outlet hose B (AT model)	
(11) Radiator sub fan	(22) Radiator outlet hose	

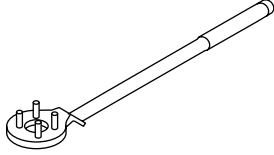
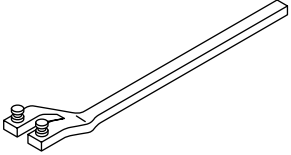
Tightening torque: N·m (kgf-m, ft-lb)**T1: 4.4 (0.45, 3.3)****T2: 12 (1.2, 8.7)****T3: 18 (1.8, 13.0)****T4: 3.4 (0.35, 2.5)****T5: 4.9 (0.50, 3.6)**

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.

- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

D: PREPARATION TOOL**1. SPECIAL TOOLS**

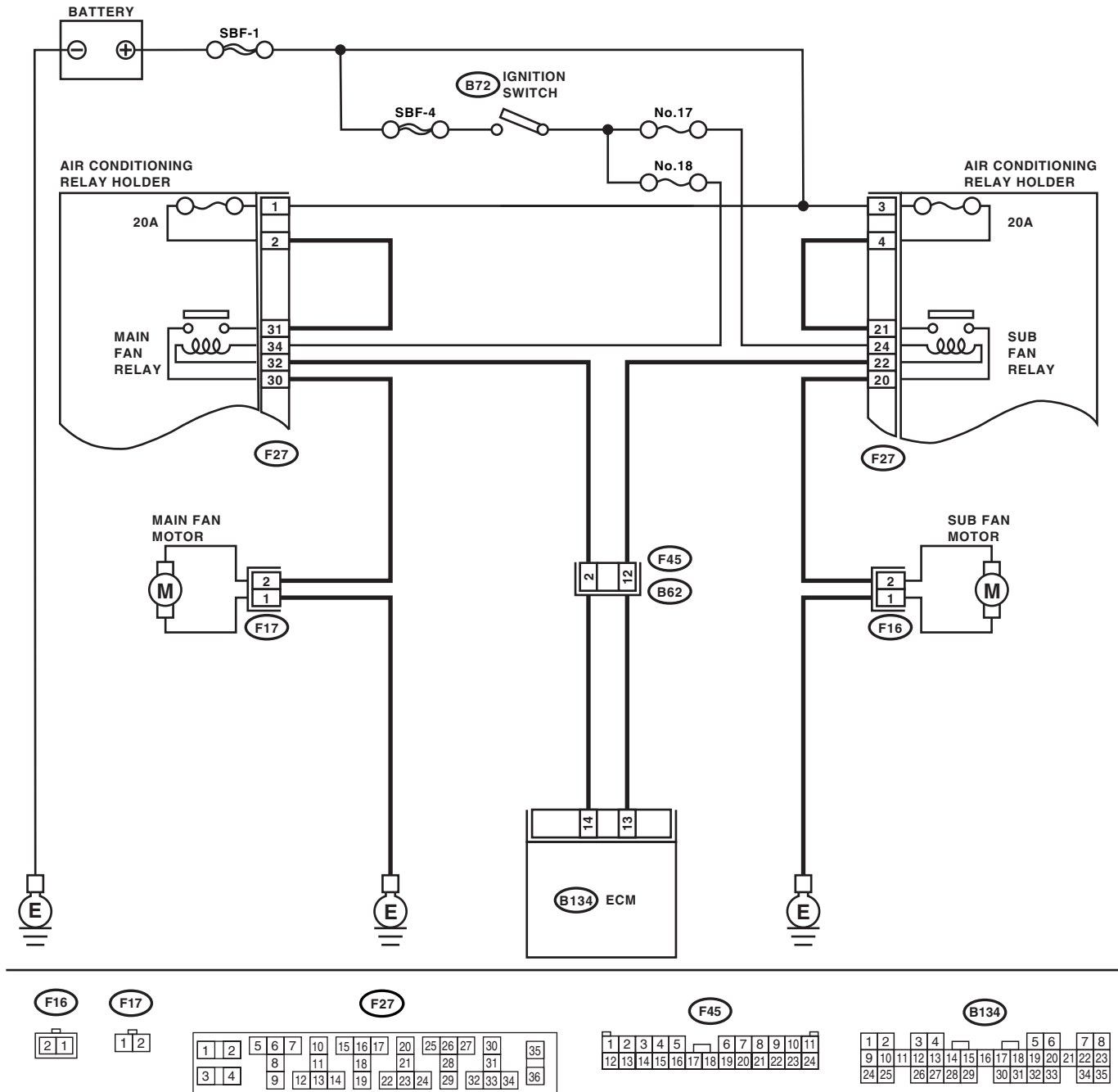
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	49 9977100	CRANK PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt. (2.5 L model)
 ST18231AA010	18231AA010	CAMSHAFT SPROCKET WRENCH	• Used for removing and installing camshaft sprocket. • Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.

Radiator Main Fan System

COOLING

2. Radiator Main Fan System

A: WIRING DIAGRAM



CO-00240

B: INSPECTION

DETECTING CONDITION:

- Engine coolant temperature is above 96°C (205°F).
- Vehicle speed is below 19 km/h (12 MPH).

TROUBLE SYMPTOM:

- Radiator main fan does not rotate under the above conditions.

Step	Check	Yes	No
1 CHECK POWER SUPPLY TO MAIN FAN MOTOR. CAUTION: Be careful not to overheat the engine during repair. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from main fan motor. 3) Start the engine, and warm it up until engine coolant temperature increases over 96°C (205°F). 4) Stop the engine and turn ignition switch to ON. 5) Measure the voltage between main fan motor connector and chassis ground. Connector & terminal (F17) No. 2 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 5.
2 CHECK GROUND CIRCUIT OF MAIN FAN MOTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between main fan motor connector and chassis ground. Connector & terminal (F17) No. 1 — Chassis ground:	Is the resistance less than 5 Ω?	Go to step 3.	Repair the open circuit in harness between main fan motor connector and chassis ground.
3 CHECK POOR CONTACT. Check poor contact in main fan motor connector.	Is there poor contact in main fan motor connector?	Repair the poor contact in main fan motor connector.	Go to step 4.
4 CHECK MAIN FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 2, and ground (-) terminal to terminal No. 1 of main fan motor connector.	Does the main fan rotate?	Repair the poor contact in main fan motor connector.	Replace the main fan motor with a new one.
5 CHECK POWER SUPPLY TO MAIN FAN RELAY. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay from A/C relay holder. 3) Measure the voltage between main fan relay terminal and chassis ground. Connector & terminal (F27) No. 31 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 6.	Go to step 7.
6 CHECK POWER SUPPLY TO MAIN FAN RELAY. 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay terminal and chassis ground. Connector & terminal (F27) No. 34 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 10.	Go to step 9.
7 CHECK 20 A FUSE. 1) Remove the 20 A fuse from A/C relay holder. 2) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 8.

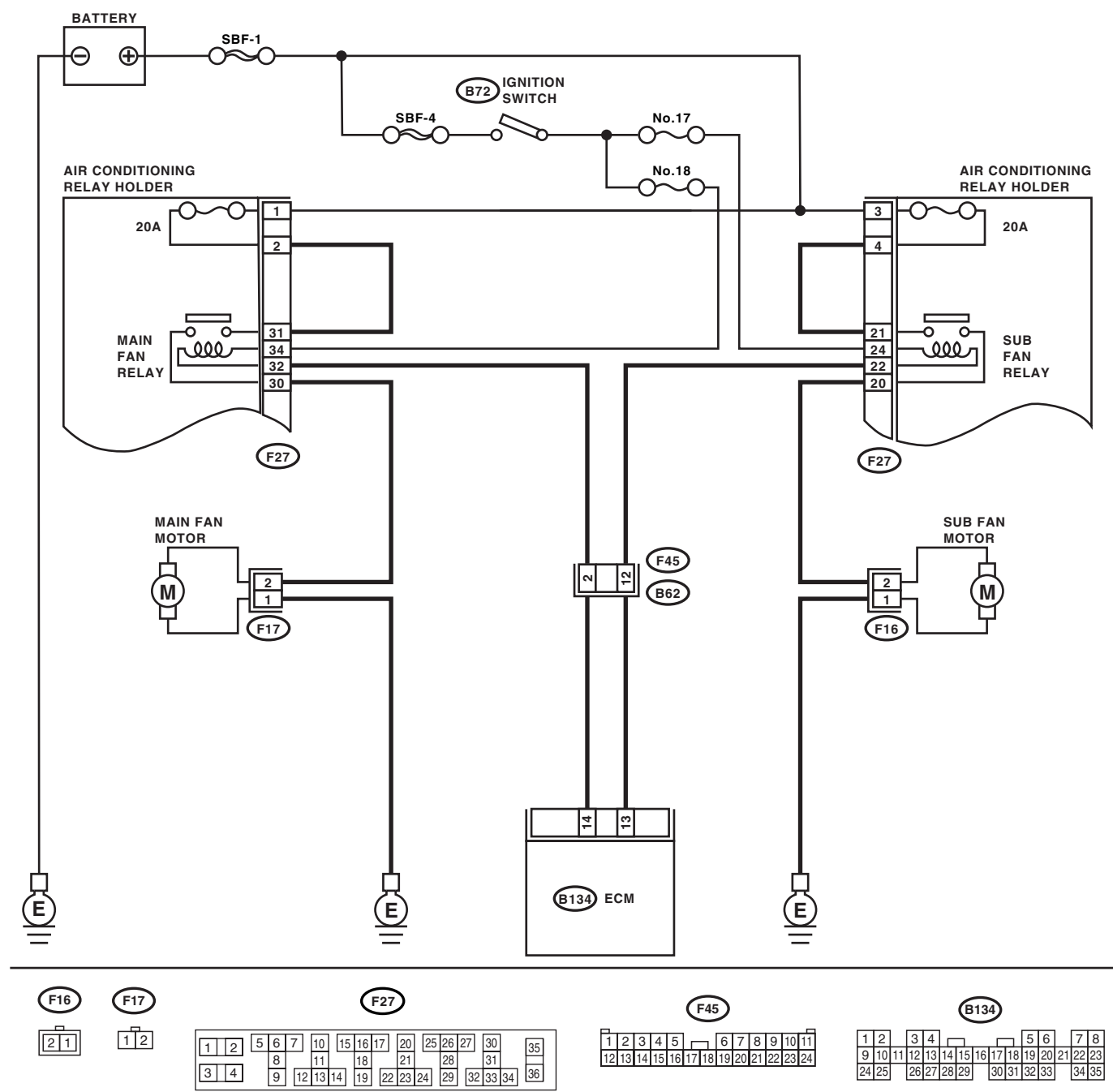
Radiator Main Fan System

COOLING

Step		Check	Yes	No
8	CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL. Measure the voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. Connector & terminal (F27) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair the open circuit in harness between 20 A fuse and main fan relay terminal.	Repair the open circuit in harness between main fuse box connector and 20 A fuse terminal.
9	CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 18 from joint box. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the open circuit in harness between main fan relay and ignition switch.
10	CHECK MAIN FAN RELAY. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay. 3) Measure the resistance of main fan relay. Terminals No. 30 — No. 31:	Is the resistance more than 1 MΩ?	Go to step 11.	Replace the main fan relay.
11	CHECK MAIN FAN RELAY. 1) Connect the battery to terminals No. 32 and No. 34 of main fan relay. 2) Measure the resistance of main fan relay. Terminals No. 30 — No. 31:	Is the resistance less than 1 Ω?	Go to step 12.	Replace the main fan relay.
12	CHECK HARNESS BETWEEN MAIN FAN RELAY TERMINAL AND MAIN FAN MOTOR CONNECTOR. Measure the resistance of harness between main fan motor connector and main fan relay terminal. Connector & terminal (F17) No. 2 — (F27) No. 30:	Is the resistance less than 1 Ω?	Go to step 13.	Repair the open circuit in harness between main fan motor connector and main fan relay terminal.
13	CHECK HARNESS BETWEEN MAIN FAN RELAY AND ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between main fan relay connector and ECM connector. Connector & terminal (F27) No. 32 — (B134) No. 14:	Is the resistance less than 1 Ω?	Go to step 14.	Repair the open circuit in harness between main fan relay and ECM.
14	CHECK POOR CONTACT. Check poor contact in connector between main fan and ECM.	Is there poor contact in connector between main fan motor and ECM?	Repair the poor contact connector.	Verify the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-36, Read Diagnostic Trouble Code (DTC).>

3. Radiator Sub Fan System

A: WIRING DIAGRAM



Radiator Sub Fan System

COOLING

B: INSPECTION

NOTE:

System for A/C equipped models only.

DETECTING CONDITION:

Condition (1):

- Engine coolant temperature is below 95°C (203°F).
- A/C switch is turned ON.
- Vehicle speed is below 19 km/h (12 MPH).

Condition (2):

- Engine coolant temperature is above 100°C (212°F).
- A/C switch is turned OFF.
- Vehicle speed is below 19 km/h (12 MPH).

TROUBLE SYMPTOM:

- Radiator sub fan does not rotate under conditions (1) and (2) above.

Step	Check	Yes	No
1 CHECK POWER SUPPLY TO SUB FAN MOTOR. CAUTION: Be careful not to overheat the engine during repair. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from sub fan motor and main fan motor. 3) Start the engine, and warm it up until engine coolant temperature increases over 100°C (212°F). 4) Stop the engine and turn ignition switch to ON. 5) Measure the voltage between sub fan motor connector and chassis ground. Connector & terminal (F16) No. 2 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 5.
2 CHECK GROUND CIRCUIT OF SUB FAN MOTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between sub fan motor connector and chassis ground. Connector & terminal (F16) No. 1 — Chassis ground:	Is the resistance less than 5 Ω?	Go to step 3.	Repair the open circuit in harness between sub fan motor connector and chassis ground.
3 CHECK POOR CONTACT. Check poor contact in sub fan motor connector.	Is there poor contact in sub fan motor connector?	Repair the poor contact in sub fan motor connector.	Go to step 4.
4 CHECK SUB FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 2, and ground (-) terminal to terminal No. 1 of sub fan motor connector.	Does the sub fan rotate?	Repair the poor contact in sub fan motor connector.	Replace the sub fan motor with a new one.
5 CHECK POWER SUPPLY TO SUB FAN RELAY. 1) Turn the ignition switch to OFF. 2) Remove the sub fan relay from A/C relay holder. 3) Measure the voltage between sub fan relay terminal and chassis ground. Connector & terminal (F27) No. 21 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 6.	Go to step 7.

Radiator Sub Fan System

COOLING

Step	Check	Yes	No
6 CHECK POWER SUPPLY TO SUB FAN RELAY. 1) Turn the ignition switch to ON. 2) Measure the voltage between sub fan relay terminal and chassis ground. Connector & terminal (F27) No. 24 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 10.	Go to step 9.
7 CHECK 20 A FUSE. 1) Remove the 20 A fuse from A/C relay holder. 2) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 8.
8 CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL. Measure the voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. Connector & terminal (F27) No. 3 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair the open circuit in harness between 20 A fuse and sub fan relay terminal.	Repair the open circuit in harness between main fuse box connector and 20 A fuse terminal.
9 CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 17 from joint box. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the open circuit in harness between sub fan relay and ignition switch.
10 CHECK SUB FAN RELAY. 1) Turn the ignition switch to OFF. 2) Measure the resistance of sub fan relay. Terminals No. 20 — No. 21:	Is the resistance more than 1 MΩ?	Go to step 11.	Replace the sub fan relay.
11 CHECK SUB FAN RELAY. 1) Connect the battery to terminals No. 22 and No. 24 of sub fan relay. 2) Measure the resistance of sub fan relay. Terminals No. 20 — No. 21:	Is the resistance less than 1 Ω?	Go to step 12.	Replace the sub fan relay.
12 CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR. Measure the resistance of harness between sub fan motor connector and sub fan relay terminal. Connector & terminal (F16) No. 2 — (F27) No. 20:	Is the resistance less than 1 Ω?	Go to step 13.	Repair the open circuit in harness between sub fan motor and sub fan relay connector.
13 CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between sub fan relay connector and ECM connector. Connector & terminal (F27) No. 22 — (B134) No. 13:	Is the resistance less than 1 Ω?	Go to step 14.	Repair the open circuit in harness between sub fan relay and ECM.
14 CHECK POOR CONTACT. Check poor contact in connector between sub fan and ECM.	Is there poor contact in connector between sub fan motor and ECM?	Repair the poor contact connector.	Verify the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-36, Read Diagnostic Trouble Code (DTC).>

4. Engine Coolant

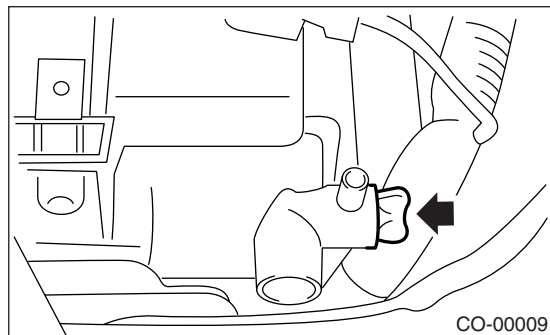
A: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

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

NOTE:

Remove the radiator cap so that engine coolant will drain faster.



- 4) Install the drain plug.

2. FILLING OF ENGINE COOLANT

- 1) Fill engine coolant into the radiator up to filler neck position.

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

AT model:

Approx. 6.9 ℓ (7.29 US qt, 6.07 Imp qt)

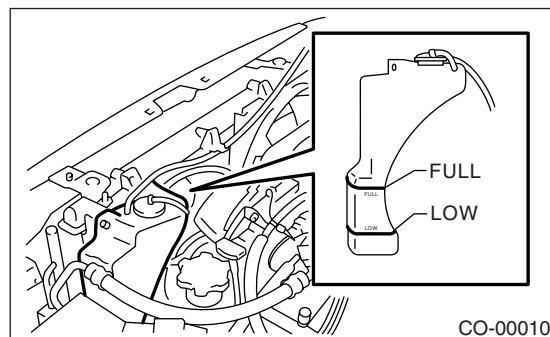
MT model:

Approx. 7.0 ℓ (7.4 US qt, 6.2 Imp qt)

NOTE:

The SUBARU Genuine Coolant containing anti-freeze and anti-rust agents is especially made for SUBARU engine, which has an aluminum crank-case. Always use SUBARU Genuine Coolant, since other coolant may cause corrosion.

- 2) Fill engine coolant into the reservoir tank up to Full level.



- 3) Warm-up the engine completely for more than 5 minutes at 2,000 to 3,000 rpm.

- 4) If the engine coolant level drops in radiator, add engine coolant to filler neck position.
- 5) If the engine coolant level drops from Full level of reservoir tank, add engine coolant to Full level.
- 6) Attach the radiator cap and reservoir tank cap properly.

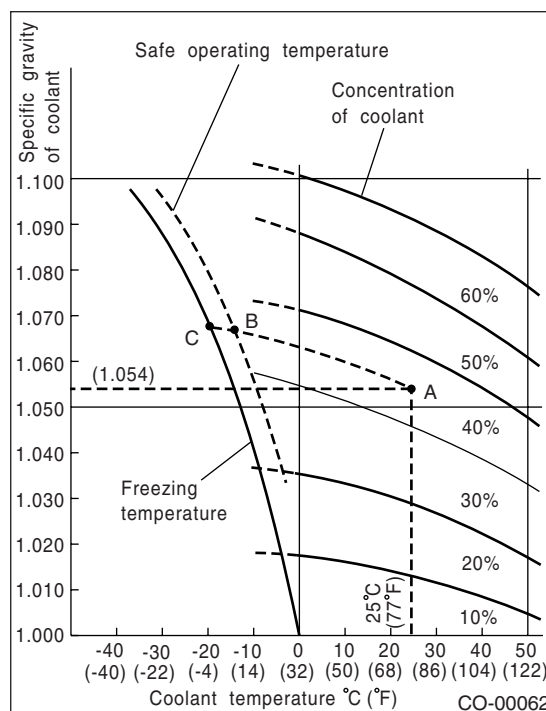
B: INSPECTION

1. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

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

[Example]

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



2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

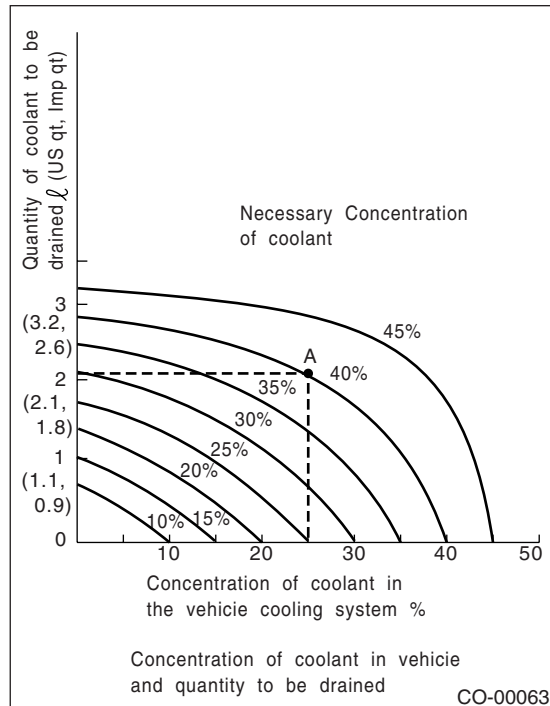
To adjust the concentration of the coolant according to temperature, find the proper fluid concentration in the above diagram and replace the necessary amount of coolant with an undiluted solution of SUBARU genuine coolant (concentration 50%).

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

[Example]

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

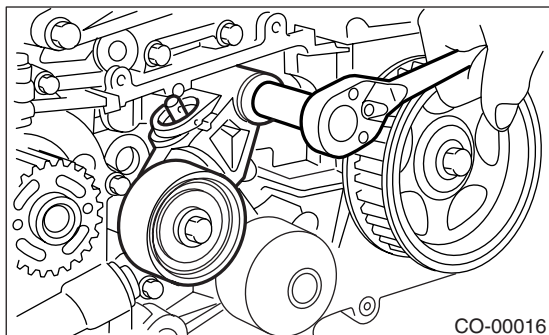
If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.



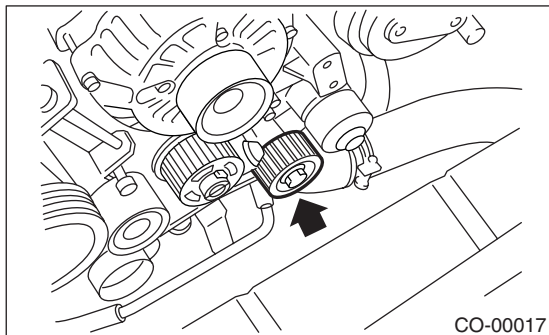
5. Water Pump

A: REMOVAL

- 1) Remove the radiator. <Ref. to CO(H4SO)-18, REMOVAL, Radiator.>
- 2) Remove the V-belts.
<Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- 3) Remove the timing belt.
<Ref. to ME(H4SO)-44, TIMING BELT, REMOVAL, Timing Belt Assembly.>
- 4) Remove the automatic belt tension adjuster.



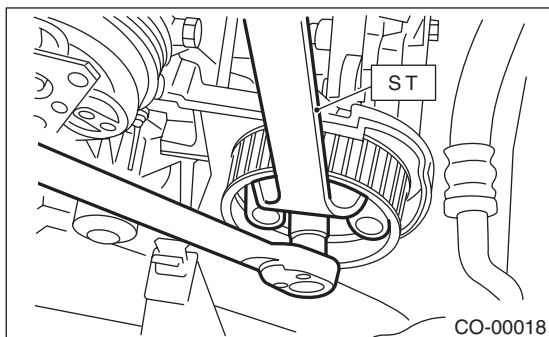
- 5) Remove the belt idler No. 2.



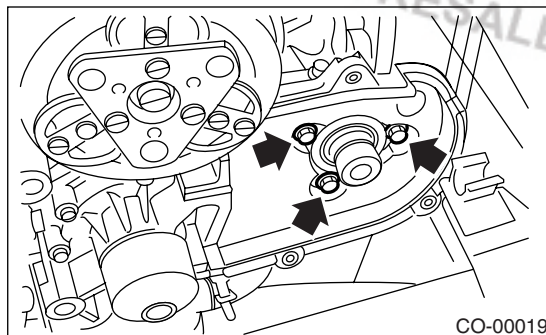
- 6) Remove the camshaft sprocket (LH) by using ST.
ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:

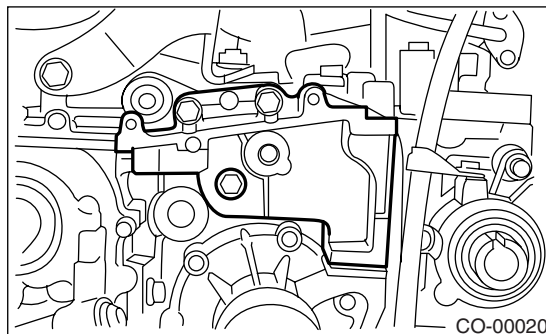
Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.



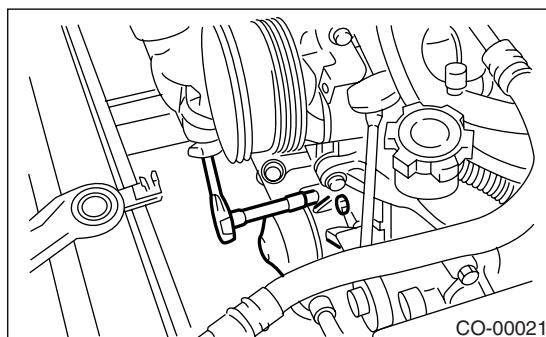
- 7) Remove the belt cover No. 2 (LH).



- 8) Remove the tensioner bracket.



- 9) Disconnect the hose from water pump.
- 10) Remove the water pump.



B: INSTALLATION

- 1) Install the water pump onto cylinder block (LH).

NOTE:

- Replace the gasket with a new one.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in the figure.

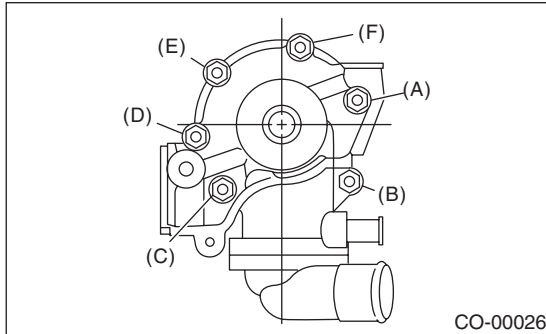
Tightening torque:

First:

12 N·m (1.2 kgf-m, 8.7 ft-lb)

Second:

12 N·m (1.2 kgf-m, 8.7 ft-lb)

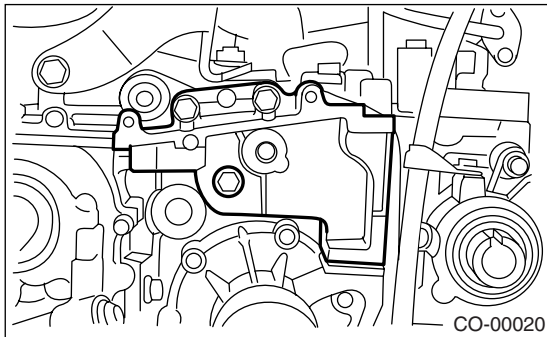


CO-00026

- 2) Connect the hose to water pump.
- 3) Install the tensioner bracket.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

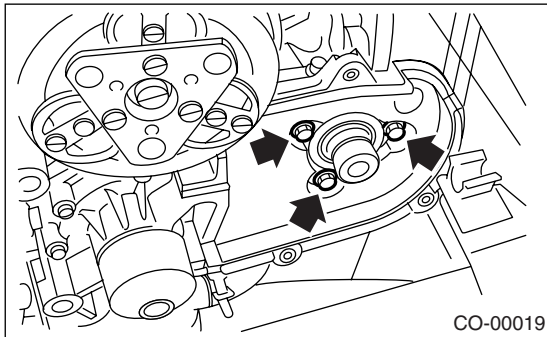


CO-00020

- 4) Install the belt cover No. 2 (LH).

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



CO-00019

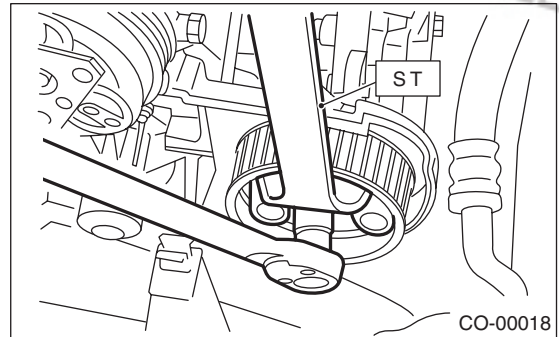
- 5) Install the camshaft sprockets (LH) by using ST. ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:

Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.

Tightening torque:

78 N·m (8.0 kgf-m, 57.9 ft-lb)

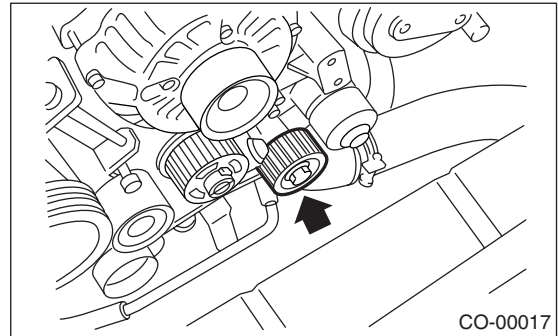


CO-00018

- 6) Install the belt idler No. 2.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)



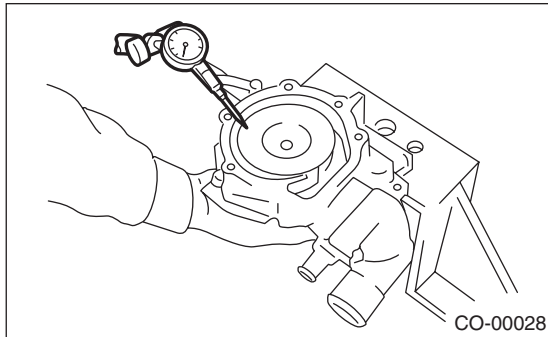
CO-00017

- 7) Install the automatic belt tension adjuster whose tension rod is held with pin. <Ref. to ME(H4SO)-45, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt Assembly.>
- 8) Install the timing belt. <Ref. to ME(H4SO)-46, TIMING BELT, INSTALLATION, Timing Belt Assembly.>
- 9) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>
- 10) Install the radiator. <Ref. to CO(H4SO)-19, INSTALLATION, Radiator.>

C: INSPECTION

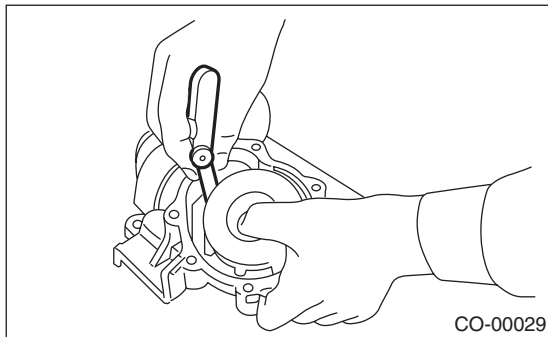
- 1) Check the water pump bearing for smooth rotation.
- 2) Check the water pump pulley for abnormalities.
- 3) Using a dial gauge, measure the impeller runout in thrust direction while rotating the pulley.

“Thrust” runout limit:
0.5 mm (0.020 in)



4) Check the clearance between impeller and pump case.

Clearance between impeller and pump case:
Standard
0.5 — 0.7 mm (0.020 — 0.028 in)
Limit
1.0 mm (0.039 in)

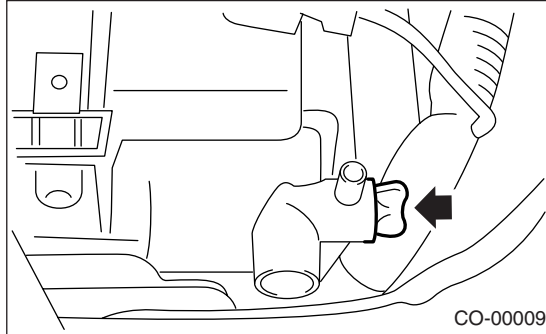


5) After water pump installation, check the pulley shaft for engine coolant leaks. If leaks are noted, replace the water pump assembly.

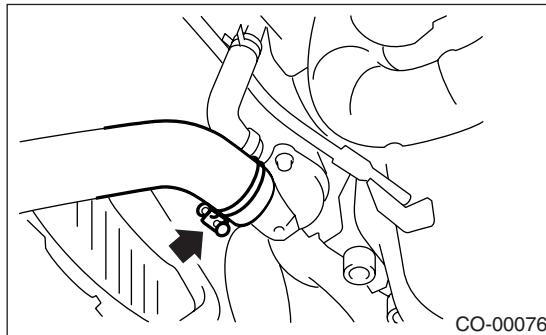
6. Thermostat

A: REMOVAL

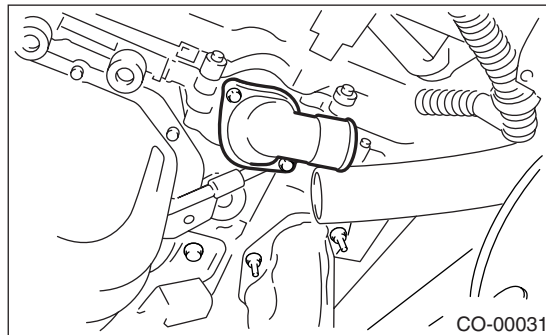
- 1) Set the vehicle on a lift.
- 2) Lift-up the vehicle.
- 3) Remove the under cover.
- 4) Drain the engine coolant completely. <Ref. to CO(H4SO)-12, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



- 5) Disconnect the radiator outlet hose from thermostat cover.



- 6) Remove the thermostat cover and gasket, and then pull out the thermostat.



B: INSTALLATION

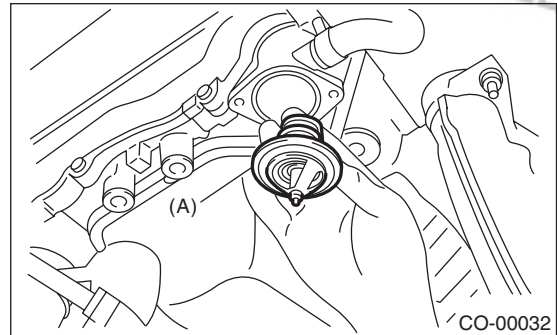
- 1) Install the thermostat in water pump, and then install the thermostat cover together with a gasket.

NOTE:

- When reinstalling the thermostat, use a new gasket.
- The thermostat must be installed with the jiggle pin (A) facing to front side.

Tightening torque:

6.5 N·m (0.65 kgf-m, 4.7 ft-lb)



- 2) Fill engine coolant. <Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

Replace the thermostat if the valve does not close completely at an ambient temperature or if the following test shows unsatisfactory results.

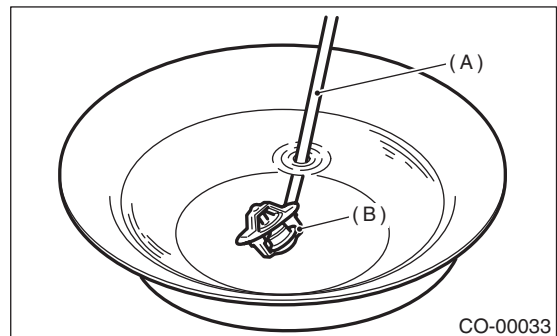
Immerse the thermostat and thermometer in water. Raise water temperature gradually, and measure the temperature and valve lift when the valve begins to open and when the valve is fully opened. During the test, agitate the water for even temperature distribution. The measurement should be to the specification.

Starts to open:

76 — 80°C (169 — 176°F)

Fully opens:

91°C (196°F)



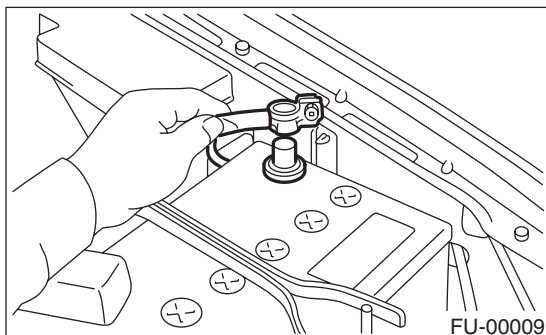
(A) Thermometer

(B) Thermostat

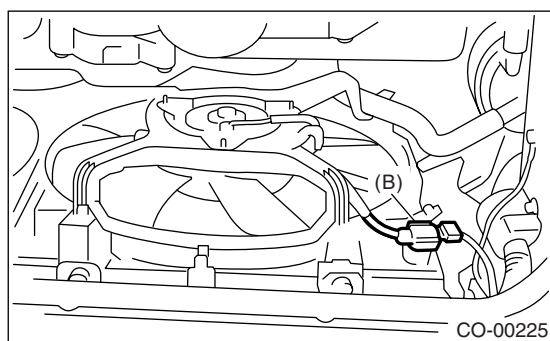
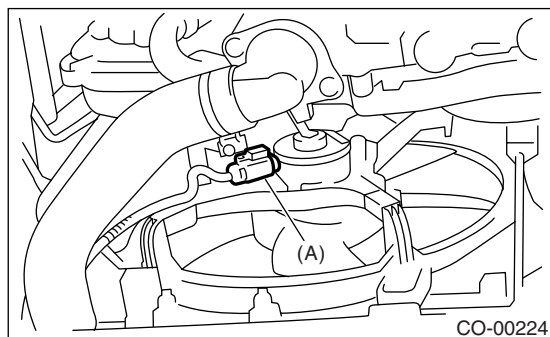
7. Radiator

A: REMOVAL

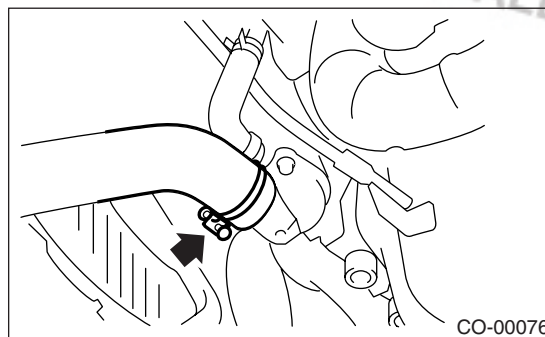
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



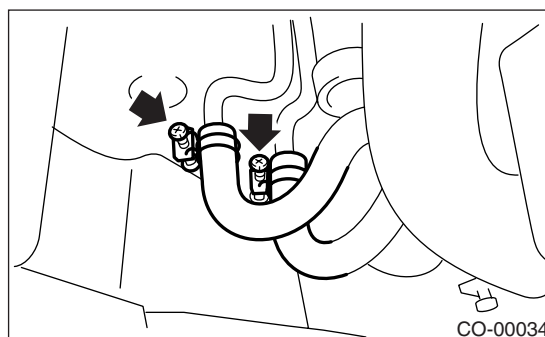
- 3) Lift-up the vehicle.
- 4) Remove the under cover.
- 5) Drain the engine coolant completely. <Ref. to CO(H4SO)-12, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 6) Disconnect the connectors of radiator main fan motor (A) and sub fan motor (B).



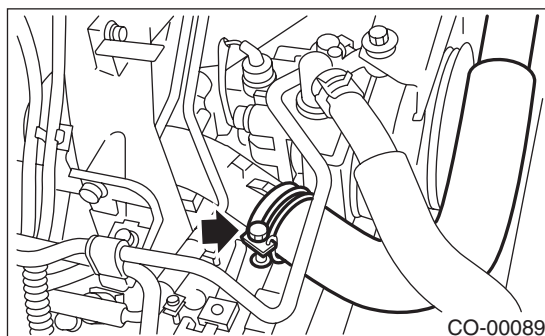
- 7) Disconnect the radiator outlet hose from water pump.



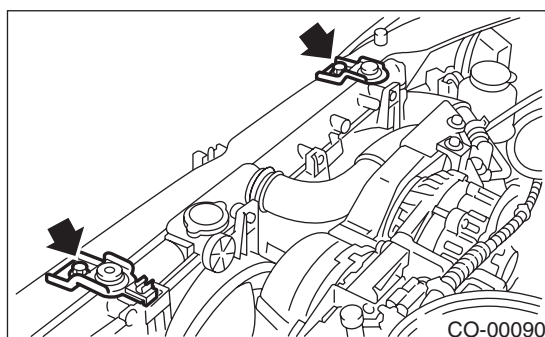
- 8) Disconnect the ATF cooler hoses from ATF pipe. (AT model) Plug the openings in the hose and radiator with caps in order to prevent ATF from leaking.



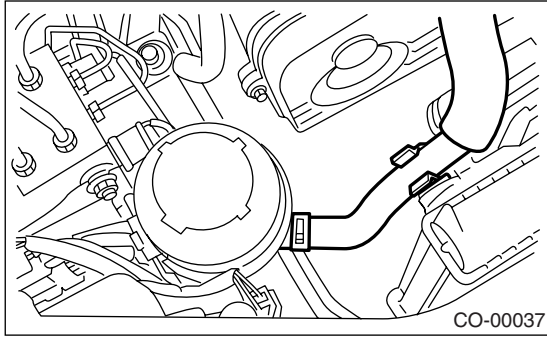
- 9) Lower the vehicle.
- 10) Disconnect the overflow hose.
- 11) Remove the reservoir tank. <Ref. to CO(H4SO)-24, REMOVAL, Reservoir Tank.>
- 12) Remove the air intake duct.
- 13) Disconnect the radiator inlet hose from engine.



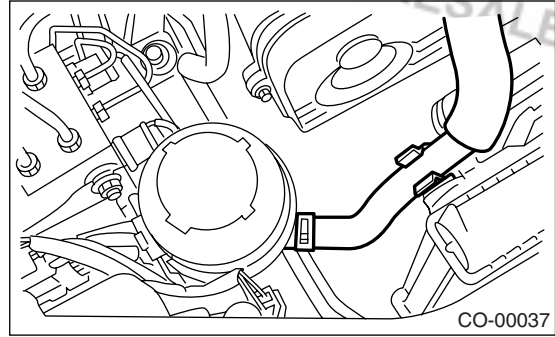
- 14) Remove the radiator upper brackets.



- 15) Detach the power steering hose from clip on radiator.



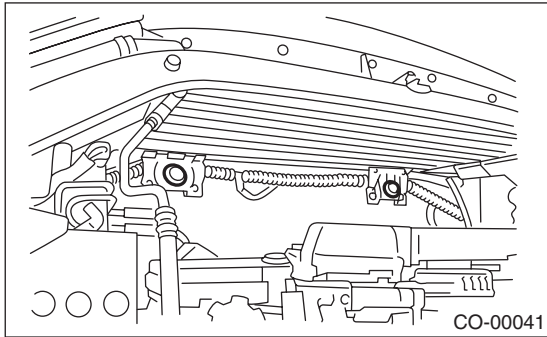
- 4) Attach the power steering hose to radiator.



- 16) Lift the radiator up and away from the vehicle.

B: INSTALLATION

- 1) Attach the radiator lower cushions to holes on the radiator lower bracket.



- 2) Install the radiator to vehicle.

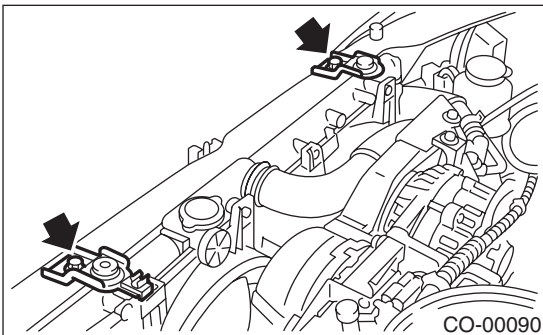
NOTE:

Fit the pins on lower side of radiator into the cushions on the body side.

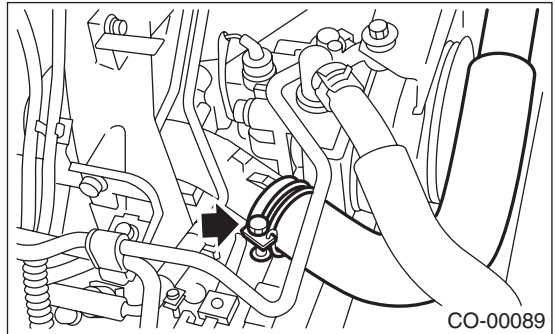
- 3) Install the radiator upper brackets, and then tighten the bolts.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



- 5) Connect the radiator inlet hose.



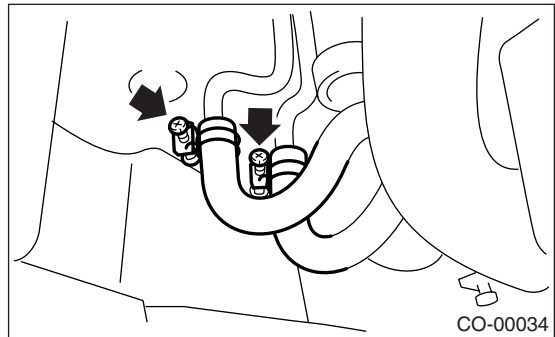
- 6) Install the air intake duct.

- 7) Install the reservoir tank.

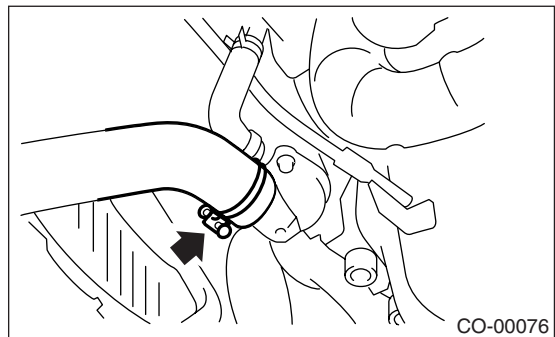
- 8) Connect the overflow hose.

- 9) Lift-up the vehicle.

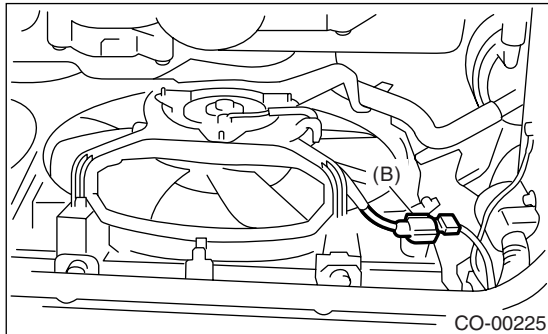
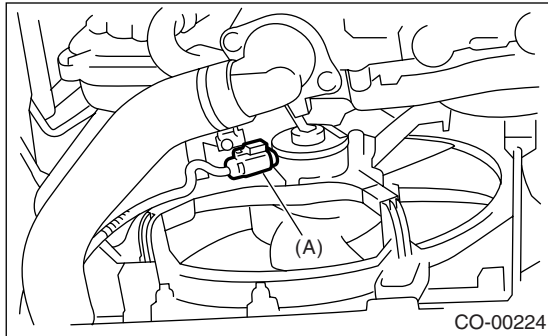
- 10) Connect the ATF cooler hoses. (AT model)



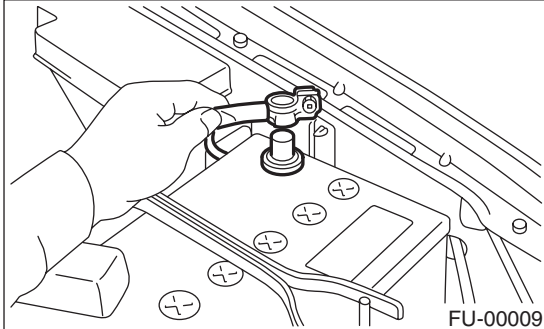
- 11) Connect the radiator outlet hose.



- 12) Connect the connectors to radiator main fan motor (A) and sub fan motor (B).



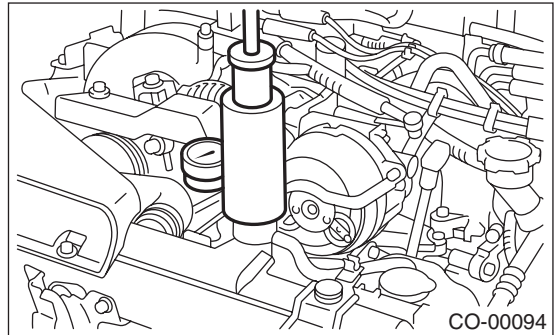
- 13) Install the under cover.
 14) Lower the vehicle.
 15) Connect the battery ground cable to battery.



- 16) Fill engine coolant. <Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
 17) Check the ATF level. <Ref. to 4AT-30, INSPECTION, Automatic Transmission Fluid.>

C: INSPECTION

- 1) Remove the radiator cap, top off radiator, and then attach the tester to radiator in place of cap.



- 2) Apply a pressure of 157 kPa (1.6 kg/cm², 23 psi) to the radiator to check if:

- (1) Engine coolant leaks at/around radiator.
- (2) Engine coolant leaks at/around hoses or connections.

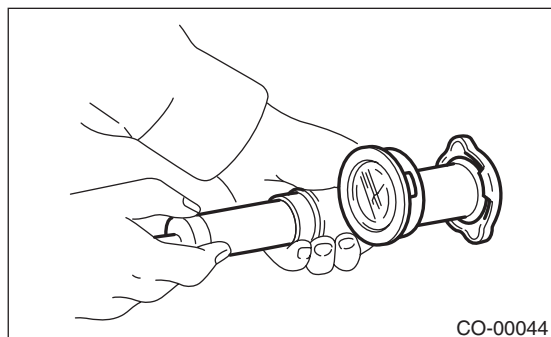
CAUTION:

- Engine should be turned off.
- Wipe engine coolant from check points in advance.
- Be careful to prevent engine coolant from spurting out when removing the tester.
- Be careful also not to deform the filler neck of radiator when installing or removing tester.

8. Radiator Cap

A: INSPECTION

1) Attach the radiator cap to tester.



2) Increase the pressure until tester gauge pointer stops. Radiator cap is functioning properly if it holds the service limit pressure for 5 to 6 seconds.

Standard pressure:

93 — 123 kPa (0.95 — 1.25 kg/cm², 14 — 18 psi)

Service limit pressure:

83 kPa (0.85 kg/cm², 12 psi)

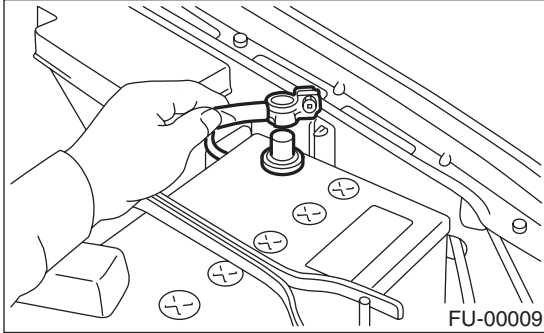
CAUTION:

Be sure to remove foreign matter and rust from the cap in advance otherwise, results of pressure test will be incorrect.

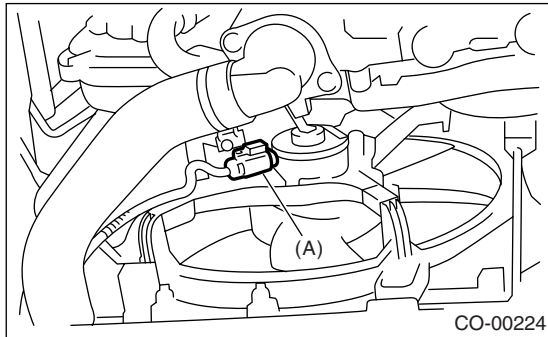
9. Radiator Main Fan and Fan Motor

A: REMOVAL

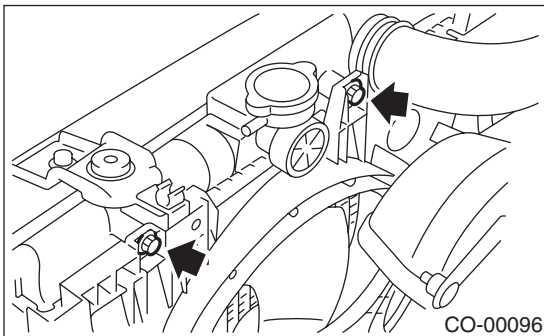
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



- 3) Lift-up the vehicle.
- 4) Remove the under cover.
- 5) Disconnect the connector of main fan motor (A).



- 6) Remove the ATF hose from clip of radiator main fan motor assembly. (AT model)
- 7) Lower the vehicle.
- 8) Disconnect the overflow hose.
- 9) Remove the reservoir tank. <Ref. to CO(H4SO)-24, REMOVAL, Reservoir Tank.>
- 10) Remove the bolts which secure the radiator main fan shroud to radiator.



- 11) Remove the radiator fan motor assembly.

B: INSTALLATION

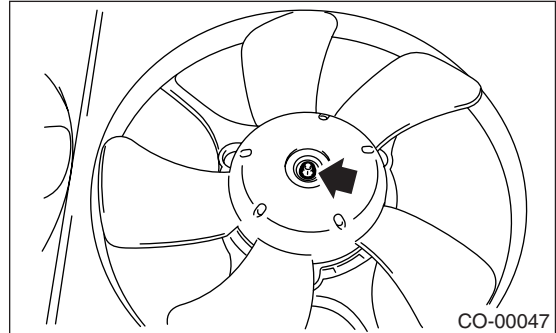
Install in the reverse order of removal.

NOTE:

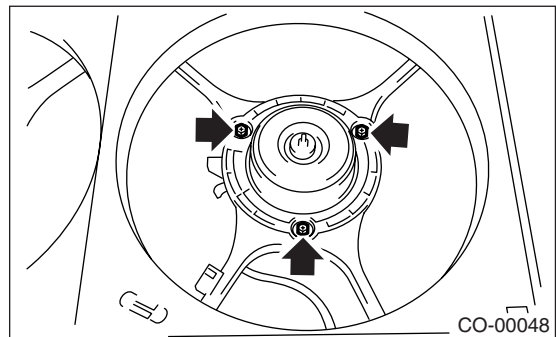
- If it is difficult to install the radiator main fan motor assembly, first loosen the bolts which hold the radiator sub fan motor assembly.
- Refer to COMPONENT for tightening torque. <Ref. to CO(H4SO)-3, COMPONENT, General Description.>

C: DISASSEMBLY

- 1) Remove the nut which holds the fan itself onto fan motor and shroud assembly.



- 2) Remove the bolts which install the fan motor.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

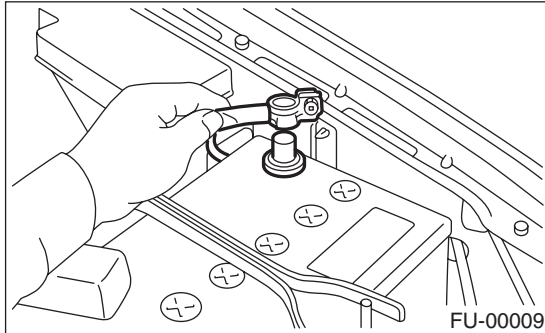
NOTE:

- Refer to COMPONENT for tightening torque. <Ref. to CO(H4SO)-3, COMPONENT, General Description.>

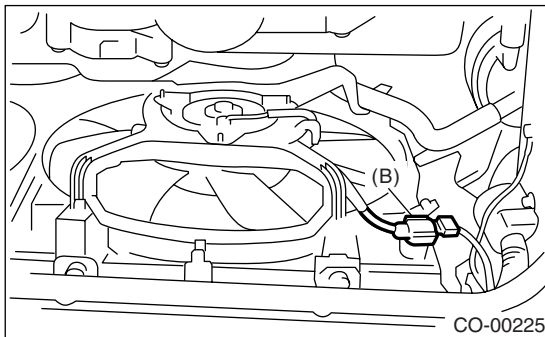
10. Radiator Sub Fan and Fan Motor

A: REMOVAL

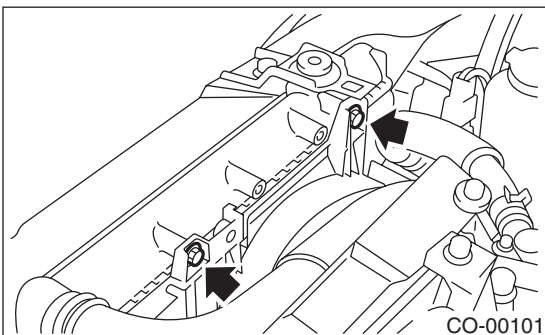
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



- 3) Lift-up the vehicle.
- 4) Remove the under cover.
- 5) Disconnect the connector of sub fan motor (B).



- 6) Remove the ATF hose from clips of radiator sub fan motor assembly. (AT model)
- 7) Lower the vehicle.
- 8) Remove the air intake duct.
- 9) Remove the bolts which hold the radiator sub fan shroud to radiator.



- 10) Remove the radiator sub fan motor assembly through the under side of vehicle.

B: INSTALLATION

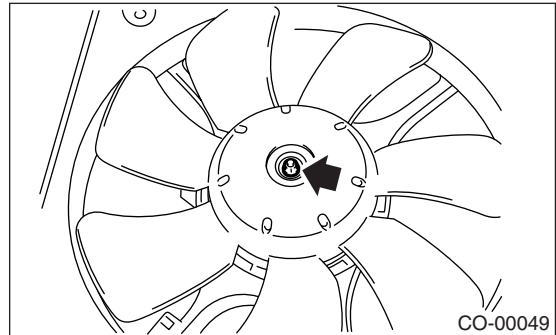
Install in the reverse order of removal.

NOTE:

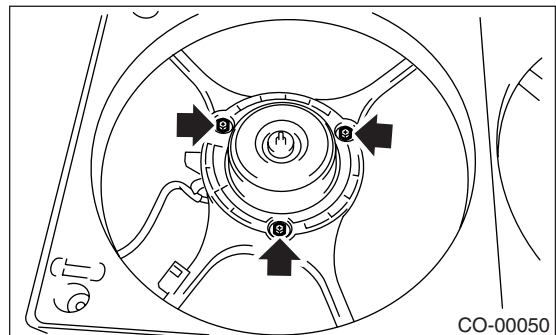
Refer to COMPONENT for tightening torque. <Ref. to CO(H4SO)-3, COMPONENT, General Description.>

C: DISASSEMBLY

- 1) Remove the clip which holds the motor connector onto shroud.
- 2) Remove the nut which holds the fan itself onto fan motor.



- 3) Remove the bolts which install the fan motor onto shroud.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

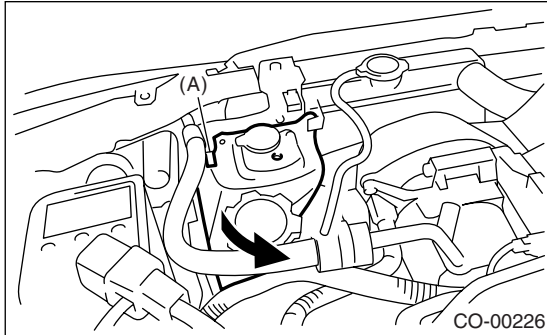
NOTE:

Refer to COMPONENT for tightening torque. <Ref. to CO(H4SO)-3, COMPONENT, General Description.>

11. Reservoir Tank

A: REMOVAL

- 1) Disconnect the overflow hose from the radiator filler neck position.
- 2) Pressing the pawl (A), remove the reservoir tank by pulling in the direction indicated by the arrow.



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

Make sure the engine coolant level is between full and low.

12.Engine Cooling System Trouble in General

A: INSPECTION

Trouble	Possible cause	Corrective action
Over-heating	a. Insufficient engine coolant	Replenish the engine coolant, inspect for leakage, and repair.
	b. Loose timing belt	Repair or replace the timing belt tensioner.
	c. Oil on timing belt	Replace.
	d. Malfunction of thermostat	Replace.
	e. Malfunction of water pump	Replace.
	f. Clogged engine coolant passage	Clean.
	g. Improper ignition timing	Inspect and repair the ignition control system. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean or repair, or replace.
	i. Improper engine oil in engine coolant	Replace the engine coolant.
	j. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>
	k. Excessive back pressure in exhaust system	Clean or replace.
	l. Insufficient clearance between piston and cylinder	Adjust or replace.
	m. Slipping clutch	Repair or replace.
	n. Dragging brake	Adjust.
	o. Defective thermostat	Replace.
	p. Malfunction of radiator fan	Inspect the radiator fan relay, engine coolant temperature sensor or radiator motor and replace there.
Over-cooling	a. Atmospheric temperature extremely low	Partly cover the radiator front area.
	b. Defective thermostat	Replace.
Engine coolant leaks	a. Loosened or damaged connecting units on hoses	Repair or replace.
	b. Leakage from water pump	Replace.
	c. Leakage from water pipe	Repair or replace.
	d. Leakage around cylinder head gasket	Retighten the cylinder head bolts or replace gasket.
	e. Damaged or cracked cylinder head and crankcase	Repair or replace.
	f. Damaged or cracked thermostat case	Repair or replace.
	g. Leakage from radiator	Repair or replace.
Noise	a. Defective timing belt	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace the water pump.
	d. Defective water pump mechanical seal	Replace the water pump.

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EMISSION CONTROL

(AUX. EMISSION CONTROL DEVICES)

1. General Description

A: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

2. Front Catalytic Converter

A: REMOVAL

Front and rear catalytic converters and center exhaust pipe are integrated into one unit; therefore, the removal procedure is the same as that for center exhaust pipe. <Ref. to EX(H4SO)-7, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

Front and rear catalytic converters and center exhaust pipe are integrated into one unit; therefore, the installation procedure is the same as that for center exhaust pipe. <Ref. to EX(H4SO)-7, INSTALLATION, Center Exhaust Pipe.>

C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.

Rear Catalytic Converter

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

3. Rear Catalytic Converter

A: REMOVAL

Front and rear catalytic converters and center exhaust pipe are integrated into one unit; therefore, the removal procedure is the same as that for front catalytic converter. <Ref. to EX(H4SO)-7, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

Front and rear catalytic converters and center exhaust pipe are integrated into one unit; therefore, the installation procedure is the same as that for front catalytic converter. <Ref. to EX(H4SO)-7, INSTALLATION, Center Exhaust Pipe.>

C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.

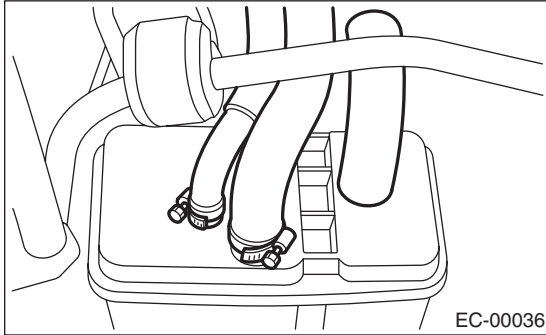
Canister

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

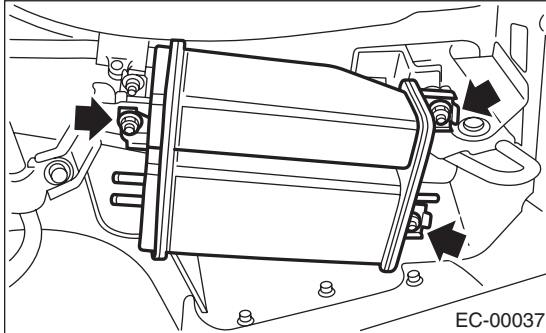
4. Canister

A: REMOVAL

- 1) Lift up the vehicle.
- 2) Loosen the two clamps which hold two canister hoses, and disconnect the evaporation hose from canister.



- 3) Remove the canister from body.

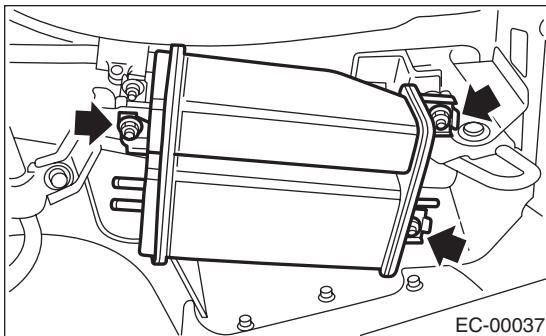


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

23 N·m (2.3 kgf-m, 17 ft-lb)



C: INSPECTION

Make sure the canister and canister hoses are not cracked or loose.

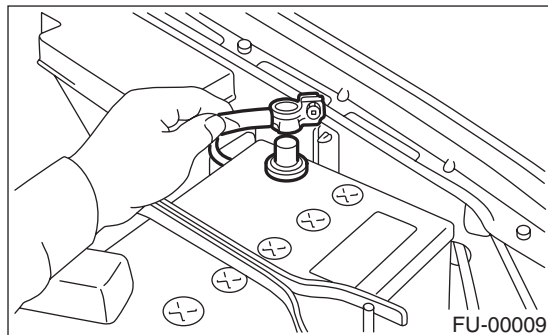
Purge Control Solenoid Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

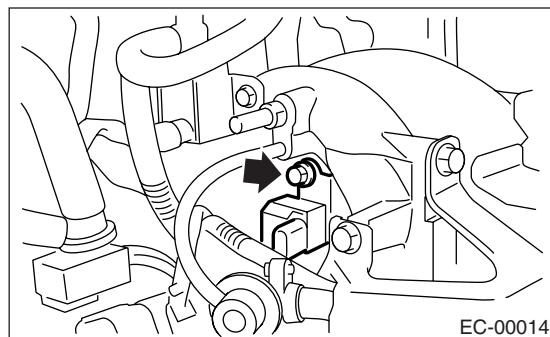
5. Purge Control Solenoid Valve

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector and hoses from purge control solenoid valve, and then remove the purge control solenoid valve.

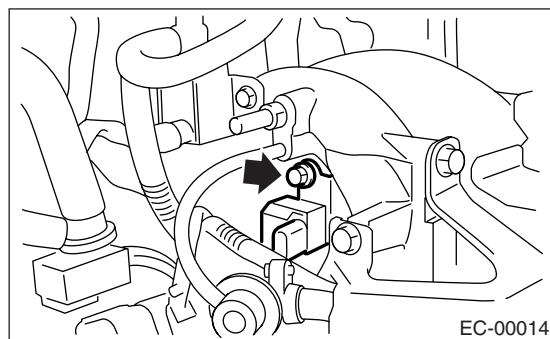


B: INSTALLATION

Install in the reverse order of removal.

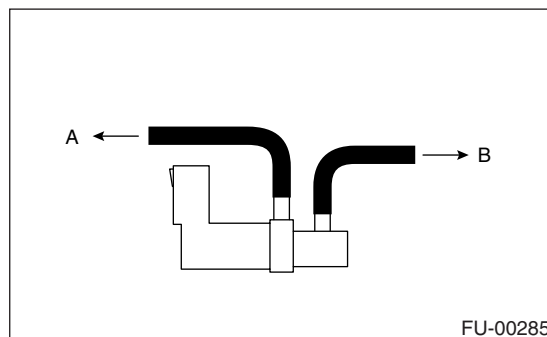
Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)



NOTE:

Connect the evaporation hose as shown in the following figure.



(A) To fuel pipe

(B) To intake manifold

C: INSPECTION

Make sure the hoses are not cracked or loose.

Fuel Level Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

6. Fuel Level Sensor

A: REMOVAL

For removal procedure, refer to "FU" section. <Ref. to FU(H4SO)-57, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION

For installation procedure, refer to "FU" section. <Ref. to FU(H4SO)-57, INSTALLATION, Fuel Level Sensor.>

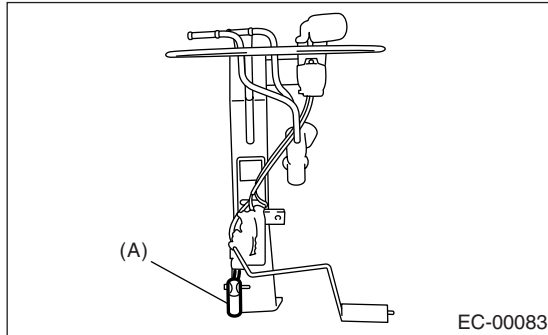
Fuel Temperature Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

7. Fuel Temperature Sensor

A: REMOVAL

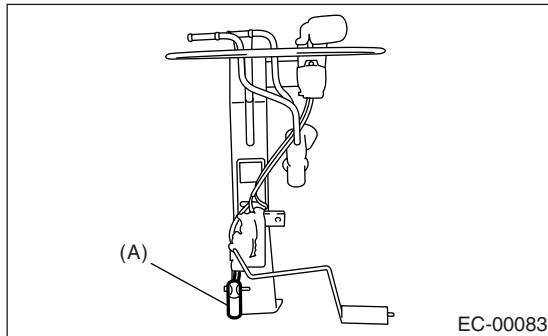
Fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, the removal procedure is the same as that for fuel level sensor.
<Ref. to FU(H4SO)-57, REMOVAL, Fuel Level Sensor.>



(A) Fuel temperature sensor

B: INSTALLATION

Fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, the installation procedure is the same as that for fuel level sensor.
<Ref. to FU(H4SO)-57, INSTALLATION, Fuel Level Sensor.>



(A) Fuel temperature sensor

Fuel Sub Level Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

8. Fuel Sub Level Sensor

A: REMOVAL

For removal procedure, refer to "FU" section. <Ref. to FU(H4SO)-58, REMOVAL, Fuel Sub Level Sensor.>

B: INSTALLATION

For installation procedure, refer to "FU" section. <Ref. to FU(H4SO)-58, INSTALLATION, Fuel Sub Level Sensor.>

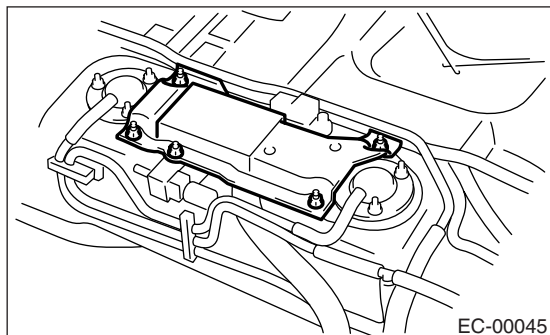
Fuel Tank Pressure Sensor

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

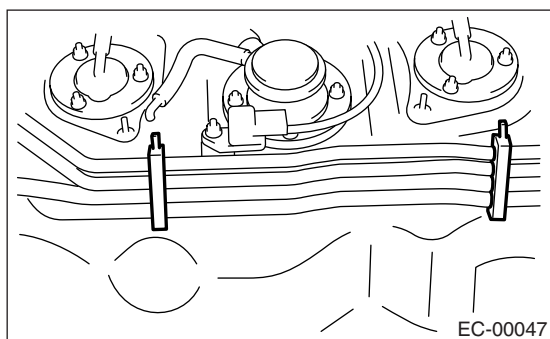
9. Fuel Tank Pressure Sensor

A: REMOVAL

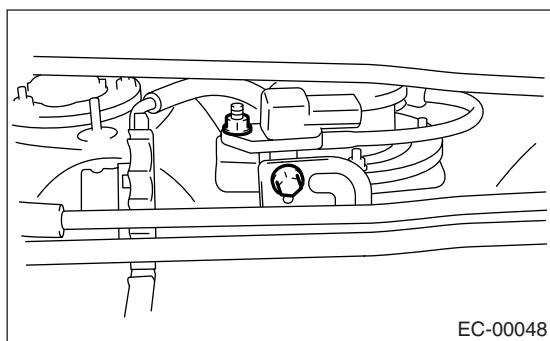
- 1) Remove the fuel tank. <Ref. to FU(H4SO)-48, REMOVAL, Fuel Tank.>
- 2) Remove the protector cover.



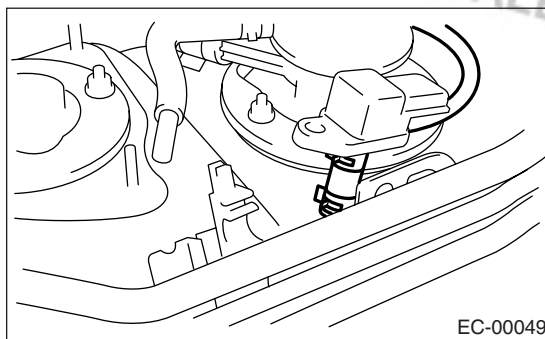
- 3) Disconnect the connector from fuel tank pressure sensor.
- 4) Release the clips which hold the fuel pipes onto fuel tank.



- 5) Remove the nuts and bolts which install the fuel tank pressure sensor on bracket.



- 6) Disconnect the pressure hose from fuel tank pressure sensor.

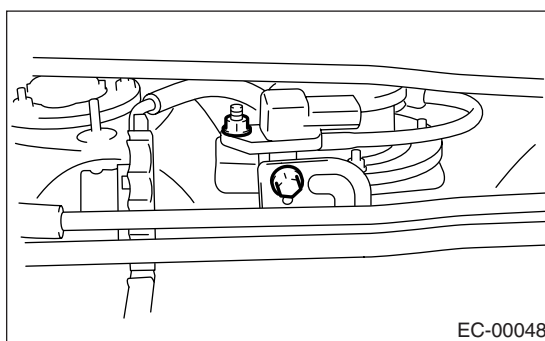


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

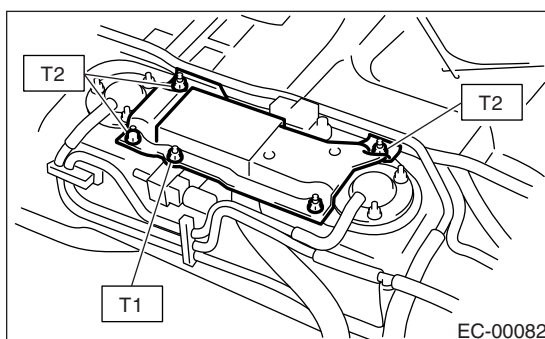
7.4 N·m (0.75 kgf-m, 5.4 ft-lb)



Tightening torque:

T1: 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)

T2: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



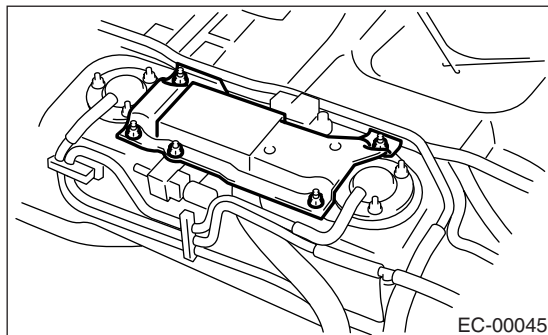
C: INSPECTION

Make sure the hoses are not cracked or loose.

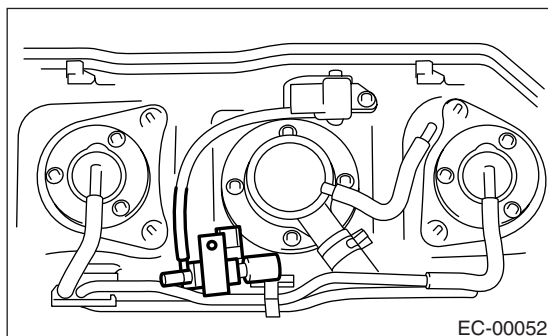
10. Fuel Tank Sensor Control Valve

A: REMOVAL

- 1) Remove the fuel tank. <Ref. to FU(H4SO)-48, REMOVAL, Fuel Tank.>
- 2) Remove the protector cover.



- 3) Disconnect the connector from fuel tank sensor control valve.
- 4) Disconnect the hose, and then remove the fuel tank sensor control valve.



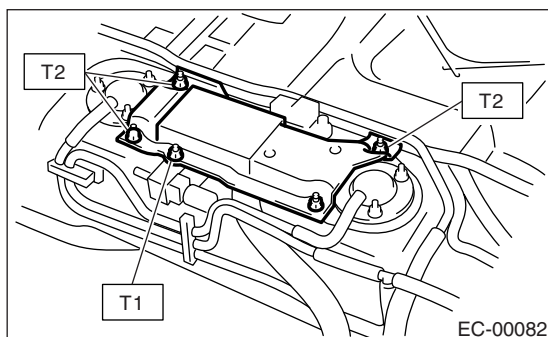
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

T1: 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)

T2: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

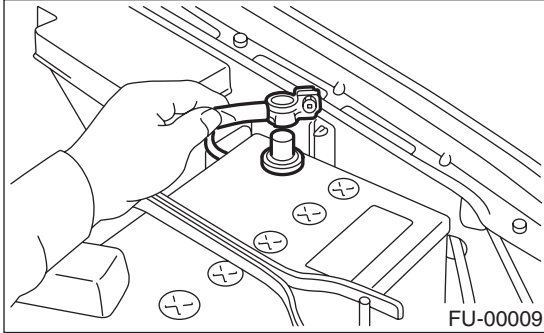
Pressure Control Solenoid Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

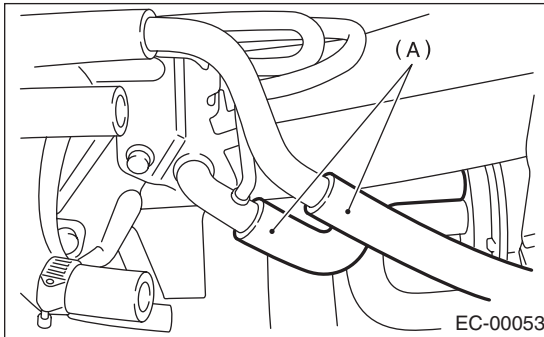
11. Pressure Control Solenoid Valve

A: REMOVAL

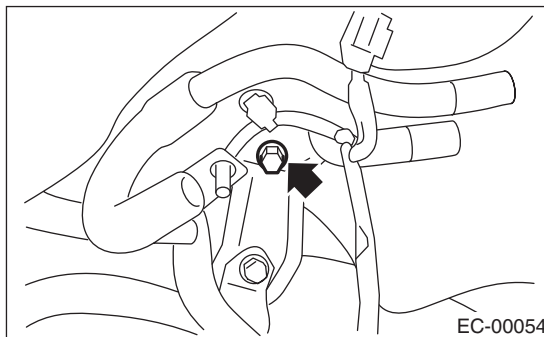
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



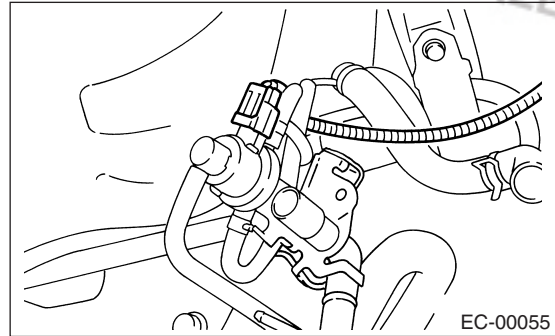
- 3) Lift up the vehicle.
- 4) Remove the canister. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>
- 5) Disconnect the evaporation hoses (A) from joint pipes.



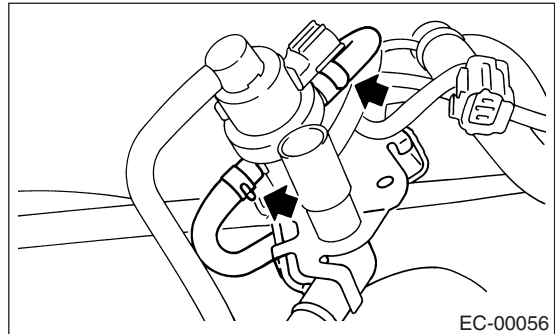
- 6) Remove the bolt which installs the pressure control solenoid valve holding bracket on body.



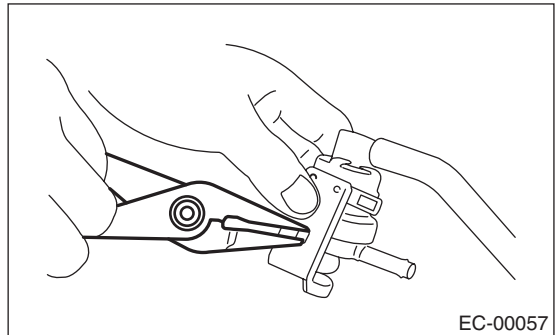
- 7) Disconnect the connector from pressure control solenoid valve.



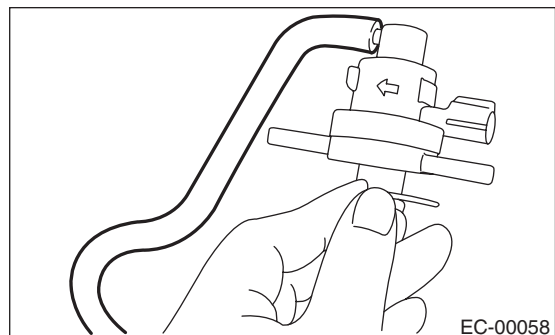
- 8) Disconnect the two evaporation hoses from pressure control solenoid valve.
- 9) Remove the pressure control solenoid valve with bracket.



- 10) Remove the pressure control solenoid valve from bracket.



- 11) Disconnect the vacuum hose from pressure control solenoid valve.



Pressure Control Solenoid Valve

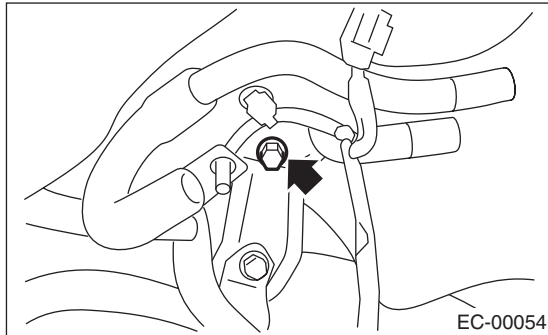
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

17.6 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

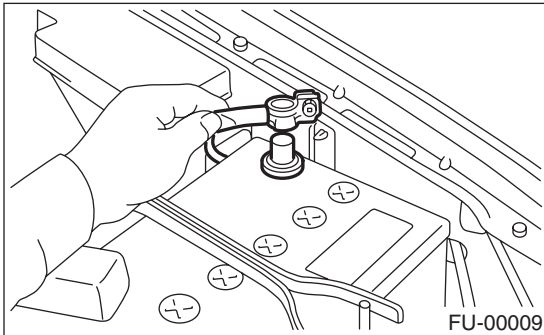
Drain Filter

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

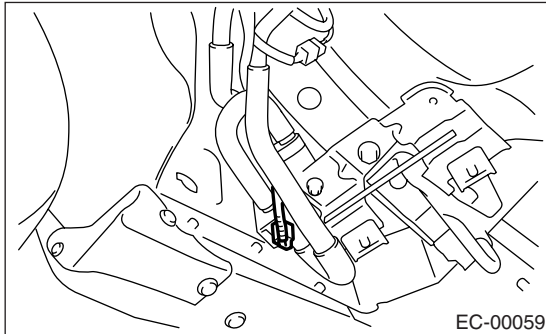
12.Drain Filter

A: REMOVAL

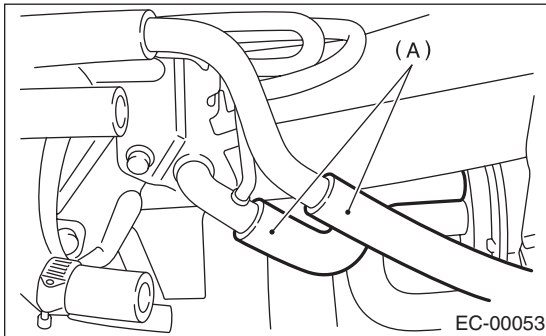
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



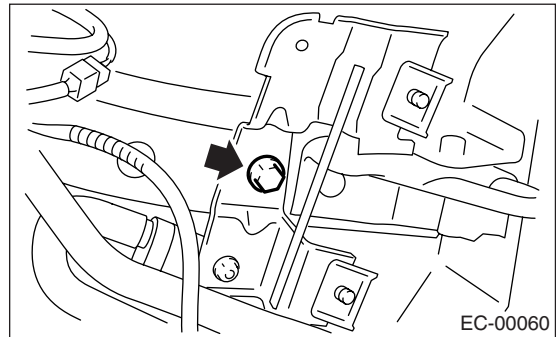
- 3) Lift up the vehicle.
- 4) Remove the canister. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>
- 5) Disconnect the connector from drain valve.



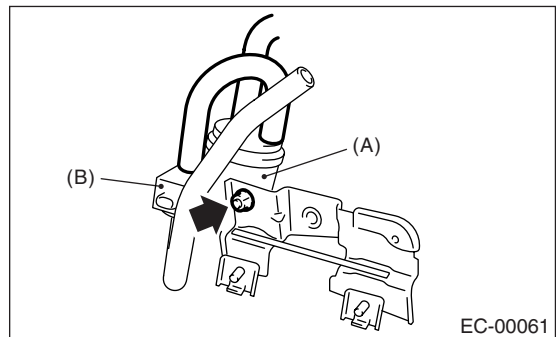
- 6) Disconnect the evaporation hoses (A) from joint pipes.



- 7) Remove the bolt which installs the drain filter and drain valve brackets on body, and remove them as a unit.



- 8) Disconnect the evaporation hoses from drain filter.
- 9) Remove the nuts, and then remove the drain filter.



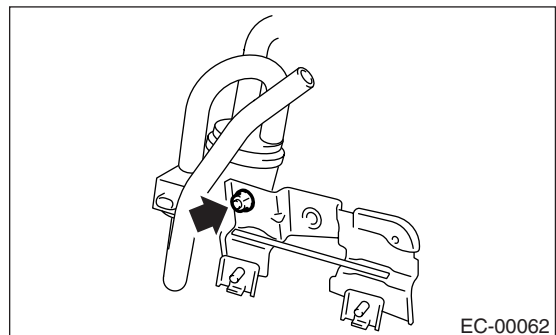
- (A) Drain filter
(B) Drain valve

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

23 N·m (2.3 kgf-m, 16.6 ft-lb)

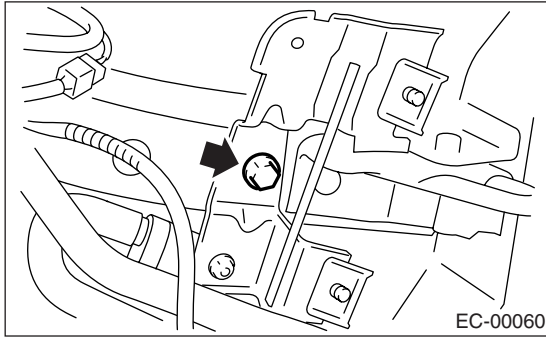


Drain Filter

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)



C: INSPECTION

- 1) Make sure all hoses are installed correctly.
- 2) Make sure the hoses are not cracked or loose.

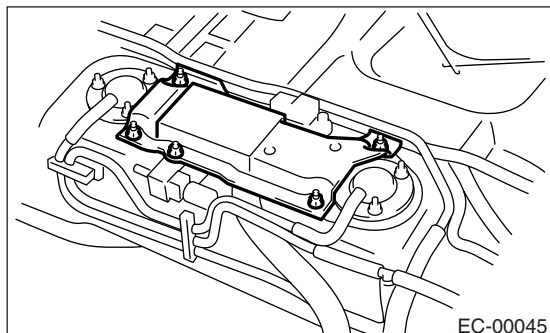
Vent Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

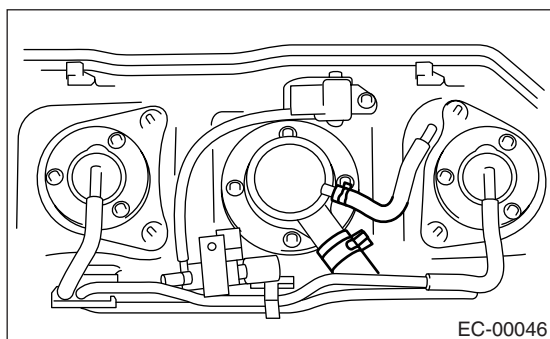
13.Vent Valve

A: REMOVAL

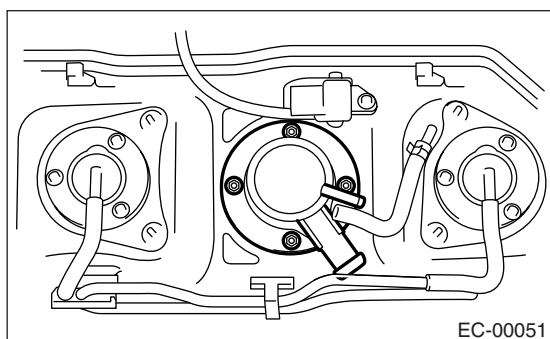
- 1) Remove the fuel tank. <Ref. to FU(H4SO)-48, REMOVAL, Fuel Tank.>
- 2) Remove the protector cover.



- 3) Remove the clips, and disconnect the hoses from vent valve.



- 4) Remove the nuts, and then remove the vent valve.



B: INSTALLATION

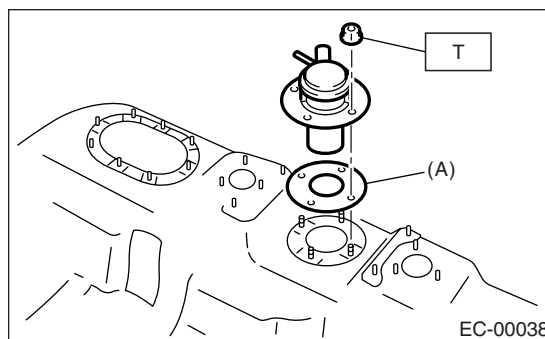
Install in the reverse order of removal.

NOTE:

Replace the rubber seat with a new one.

Tightening torque:

T: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

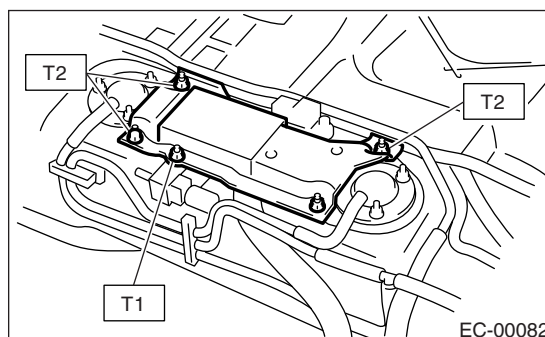


(A) Rubber seat

Tightening torque:

T1: 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)

T2: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

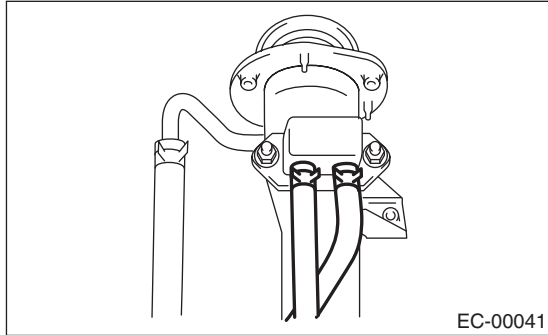
Shut Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

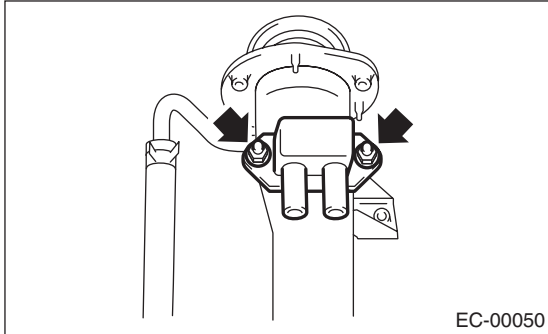
14. Shut Valve

A: REMOVAL

- 1) Remove the fuel filler pipe.
<Ref. to FU(H4SO)-51, REMOVAL, Fuel Filler Pipe.>
- 2) Disconnect the evaporation hoses from shut valve.



- 3) Remove the shut valve from fuel filler pipe.

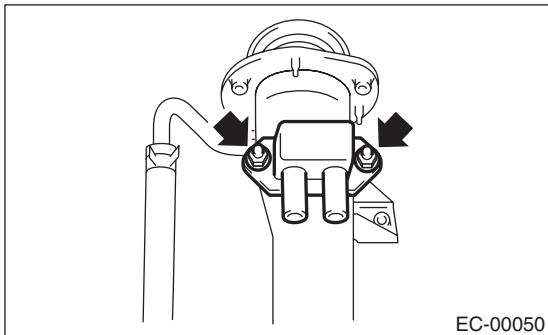


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

4.5 N·m (0.46 kgf-m, 3.3 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

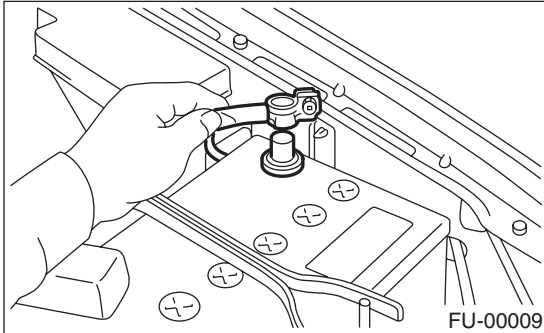
Drain Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

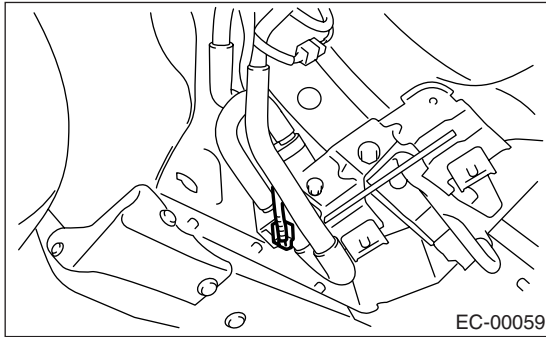
15.Drain Valve

A: REMOVAL

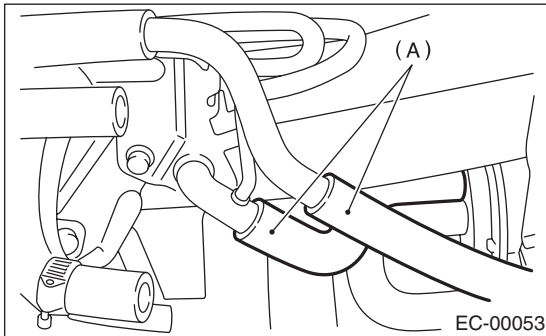
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from battery.



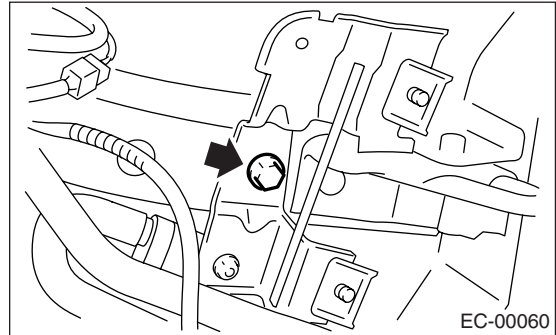
- 3) Lift up the vehicle.
- 4) Remove the canister. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>
- 5) Disconnect the connector from drain valve.



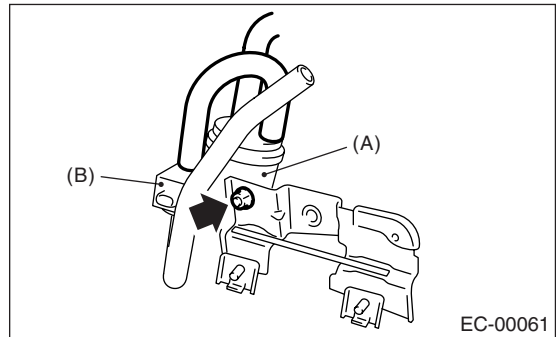
- 6) Disconnect the evaporation hoses (A) from joint pipes.



- 7) Remove the bolt which installs the drain filter and drain valve brackets on body, and remove them as a unit.



- 8) Disconnect the evaporation hoses from drain valve.
- 9) Remove the nuts, and then remove the drain valve.



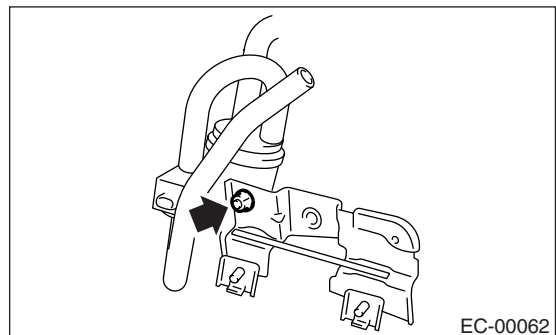
- (A) Drain filter
(B) Drain valve

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

23 N·m (2.3 kgf-m, 16.6 ft-lb)

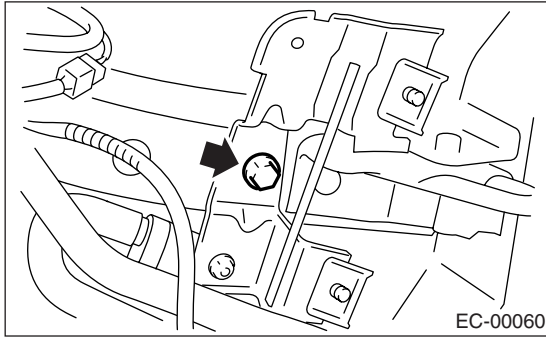


Drain Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)



C: INSPECTION

- 1) Make sure all hoses are installed correctly.
- 2) Make sure the hoses are not cracked or loose.

Drain Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

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ENGINE (DIAGNOSTICS)

1. Basic Diagnostic Procedure

A: PROCEDURE

1. ENGINE

Step	Check	Yes	No
1 CHECK ENGINE START FAILURE. 1) Ask the customer when and how the trouble occurred using the check list for interview. <Ref. to EN(H4SO)(diag)-4, CHECK, Check List for Interview.> 2) Start the engine.	Does the engine start?	Go to step 2.	Inspection using "Diagnostics for Engine Start Failure". <Ref. to EN(H4SO)(diag)-56, Diagnostics for Engine Starting Failure.>
2 CHECK ILLUMINATION OF MALFUNCTION INDICATOR LIGHT.	Does malfunction indicator light illuminate?	Go to step 3.	Inspection using "General Diagnostics Table". <Ref. to EN(H4SO)(diag)-304, INSPECTION, General Diagnostic Table.>
3 CHECK INDICATION OF DTC ON DISPLAY. 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor or the OBD-II general scan tool to data link connector. 3) Turn the ignition switch to ON and the Subaru Select Monitor or OBD-II general scan tool switch to ON. 4) Read the DTC on the Subaru Select Monitor or OBD-II general scan tool.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC?	Record the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> Go to step 4.	Repair the related parts. NOTE: If DTC is not shown on display although the malfunction indicator light illuminates, perform diagnostics of malfunction indicator light circuit or combination meter. <Ref. to EN(H4SO)(diag)-47, Malfunction Indicator Light.>
4 PERFORM THE DIAGNOSIS. 1) Perform the clear memory mode. <Ref. to EN(H4SO)(diag)-44, Clear Memory Mode.> 2) Perform the inspection mode. <Ref. to EN(H4SO)(diag)-37, Inspection Mode.>	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC?	Inspect using "Diagnostics Procedure with Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-78, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Complete the diagnosis.

2. AUTOMATIC TRANSMISSION

When the DTC about automatic transmission is shown on display, carry out the following basic check. After that, carry out the replacement or repair work.

- 1) ATF level check <Ref. to 4AT-30, Automatic Transmission Fluid.>
- 2) Differential gear oil level check <Ref. to 4AT-31, Differential Gear Oil.>
- 3) ATF leak check <Ref. to 4AT-30, Automatic Transmission Fluid.>
- 4) Differential gear oil leak check <Ref. to 4AT-31, Differential Gear Oil.>
- 5) Stall test <Ref. to 4AT-33, Stall Test.>
- 6) Line pressure test <Ref. to 4AT-35, Line Pressure Test.>
- 7) Transfer clutch pressure test <Ref. to 4AT-36, Transfer Clutch Pressure Test.>
- 8) Time lag test <Ref. to 4AT-34, Time Lag Test.>
- 9) Road test <Ref. to 4AT-32, Road Test.>
- 10) Shift characteristics <Ref. to 4AT-36, Transfer Clutch Pressure Test.>

Check List for Interview

ENGINE (DIAGNOSTICS)

2. Check List for Interview

A: CHECK

1. CHECK LIST No. 1

Check the following items when problem has occurred.

NOTE:

Use copies of this page for interviewing customers.

Customer's name		Engine No.	
Date of sale		Fuel brand	
Date of repair		Odometer reading	km
VIN No.			miles
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Various/Others:		
Outdoor temperature	°C (°F)		
	☐ Hot ☐ Warm ☐ Cool ☐ Cold		
Place	☐ Highway ☐ Suburbs ☐ Inner city ☐ Uphill ☐ Downhill ☐ Rough road ☐ Others:		
Engine temperature	☐ Cold ☐ Warming-up ☐ After warming-up ☐ Any temperature ☐ Others:		
Engine speed	rpm		
Vehicle speed	MPH		
Driving conditions	☐ Not affected ☐ At starting ☐ While idling ☐ At racing ☐ While accelerating ☐ While cruising ☐ While decelerating ☐ While turning (RH/LH)		
Headlight	☐ ON / ☐ OFF	Rear defogger	☐ ON / ☐ OFF
Blower	☐ ON / ☐ OFF	Radio	☐ ON / ☐ OFF
A/C compressor	☐ ON / ☐ OFF	CD/Cassette	☐ ON / ☐ OFF
Radiator fan	☐ ON / ☐ OFF	Car phone	☐ ON / ☐ OFF
Front wiper	☐ ON / ☐ OFF	CB	☐ ON / ☐ OFF
Rear wiper	☐ ON / ☐ OFF		

Check List for Interview

ENGINE (DIAGNOSTICS)

2. CHECK LIST No. 2

Check the following items about the vehicle's state when malfunction indicator light turns on.

NOTE:

Use copies of this page for interviewing customers.

a) Other warning lights or indicators turn on. ☐ Yes / ☐ No
☐ Low fuel warning light ☐ Charge indicator light ☐ AT diagnostics indicator light ☐ ABS warning light ☐ Engine oil pressure warning light
b) Fuel level
• Lack of gasoline: ☐ Yes / ☐ No • Indicator position of fuel gauge:
c) Intentional connecting or disconnecting of harness connectors or spark plug cords: ☐ Yes / ☐ No
• What:
d) Intentional connecting or disconnecting of hoses: ☐ Yes / ☐ No
• What:
e) Installing of parts other than genuine parts: ☐ Yes / ☐ No
• What: • Where:
f) Occurrence of noise: ☐ Yes / ☐ No
• From where: • What kind:
g) Occurrence of smell: ☐ Yes / ☐ No
• From where: • What kind:
h) Intrusion of water into engine compartment or passenger compartment: ☐ Yes / ☐ No
i) Troubles occurred
☐ Engine does not start. ☐ Engine stalls during idling. ☐ Engine stalls while driving. ☐ Engine speed decreases. ☐ Engine speed does not decrease. ☐ Rough idling ☐ Poor acceleration ☐ Back fire ☐ After fire ☐ No shift ☐ Excessive shift shock

3. General Description

A: CAUTION

1) Airbag system wiring harness is routed near the ECM, main relay and fuel pump relay.

CAUTION:

- All airbag system wiring harness and connectors are colored yellow. Do not use electrical test equipment on these circuit.
- Be careful not to damage the airbag system wiring harness when servicing the ECM, TCM, main relay and fuel pump relay.

2) Never connect the battery in reverse polarity.

- The ECM will be destroyed instantly.
- The fuel injector and other part will be damaged in just a few minutes more.

3) Do not disconnect the battery terminals while the engine is running.

A large counter electromotive force will be generated in the generator, and this voltage may damage electronic parts such as ECM, etc.

4) Before disconnecting the connectors of each sensor and the ECM, be sure to turn OFF the ignition switch.

5) Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

6) Before removing the ECM from the located position, disconnect two cables on battery.

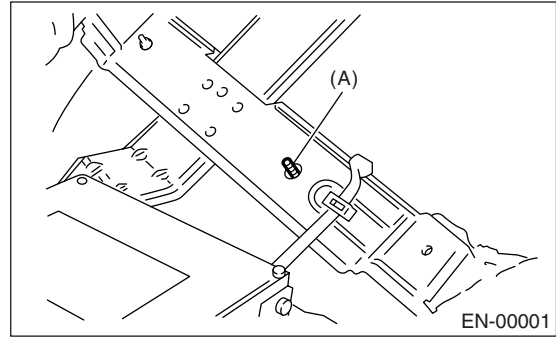
Otherwise, the ECM may be damaged.

CAUTION:

When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on fuel injection system.

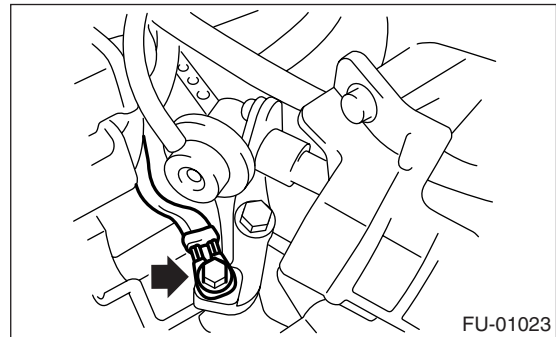
7) The connectors to each sensor in the engine compartment and the harness connectors on the engine side and body side are all designed to be waterproof. However, it is still necessary to take care not to allow water to get into the connectors when washing the vehicle, or when servicing the vehicle on a rainy day.

8) Use ECM mounting stud bolts at the body side grounding point when measuring voltage and resistance inside the passenger compartment.

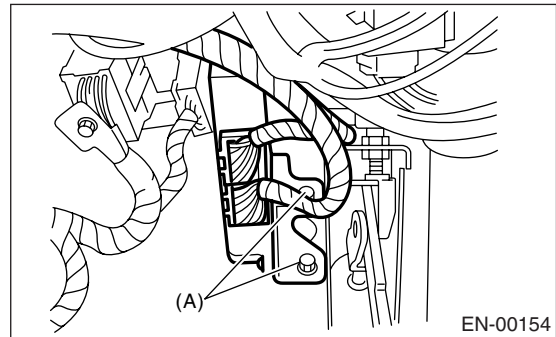


(A) Stud bolt

9) Use engine grounding terminal or engine proper as the grounding point to the body when measuring voltage and resistance in the engine compartment.



10) Use TCM mounting stud bolts at the body side grounding point when measuring voltage and resistance inside the passenger compartment.



(A) Stud bolt

11) Every MFI-related part is a precision part. Do not drop them.

12) Observe the following cautions when installing a radio in MFI equipped models.

CAUTION:

- The antenna must be kept as far apart as possible from the control unit. (The ECM is located under the steering column, inside of the instrument panel lower trim panel.)
- The antenna feeder must be placed as far apart as possible from the ECM and MFI harness.
- Carefully adjust the antenna for correct matching.
- When mounting a large power type radio, pay special attention to the three items above mentioned.
- Incorrect installation of the radio may affect the operation of the ECM.

13) Before disconnecting the fuel hose, disconnect the fuel pump connector and crank the engine for more than five seconds to release pressure in the fuel system. If engine starts during this operation, run it until it stops.

14) Problems in the electronic-controlled automatic transmission may be caused by failure of the engine, the electronic control system, the transmission proper, or by a combination of these. These three causes must be distinguished clearly when performing diagnostics.

15) Diagnostics should be conducted by rotating with simple, easy operations and proceeding to complicated, difficult operations. The most important thing in diagnostics is to understand the customer's complaint, and distinguish between the three causes.

16) In AT models, do not continue the stall for more than five seconds at a time (from closed throttle, fully open throttle to stall engine speed).

17) On models with ABS, when performing driving test in jacked-up or lifted-up position, sometimes the warning light may be lit, but this is not a malfunction of the system. The reason for this is the speed difference between the front and rear wheels. After diagnosis of engine control system, perform the ABS memory clearance procedure of self-diagnosis system.

B: INSPECTION

Before performing diagnostics, check the following items which might affect engine problems:

1. BATTERY

1) Measure battery voltage and specific gravity of electrolyte.

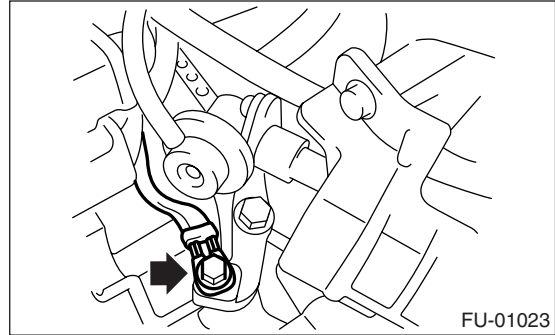
Standard voltage: 12 V

Specific gravity: Above 1.260

2) Check the condition of the main and other fuses, and harnesses and connectors. Also check for proper grounding.

2. ENGINE GROUNDING

Make sure the engine grounding terminal is properly connected to the engine.



C: NOTE

1. DESCRIPTION

- The on-board diagnostics (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic control. Malfunction indicator light in the combination meter 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.
- The OBD system incorporated with the vehicles within this engine family complies with Section 1968.1, California Code of Regulations (OBD-II regulation). The OBD system monitors the components and the system malfunction listed in Engine Section which affects on emissions.
- When the system decides that a malfunction occurs, malfunction indicator light illuminates. At the same time of the malfunction indicator light illumination or blinking, a DTC and a freeze frame engine conditions are stored into on-board computer.
- The OBD system stores freeze frame engine condition data (engine load, engine coolant temperature, fuel trim, engine speed and vehicle speed, etc.) into on-board computer when it detects a malfunction first.
- If the OBD system detects the various malfunctions including the fault of fuel trim or misfire, the OBD system first stores freeze frame engine conditions about the fuel trim or misfire.
- When the malfunction does not occur again for three consecutive driving cycles, malfunction indicator light is turned off, but DTC remains at on-board computer.
- The OBD-II system is capable of communication with a general scan tool (OBD-II general scan tool) formed by ISO 9141 CARB.

General Description

ENGINE (DIAGNOSTICS)

- The OBD-II diagnostics procedure is different from the usual diagnostics procedure. When troubleshooting the models with OBD-II, connect Subaru Select Monitor or the OBD-II general scan tool to the vehicle.

2. ENGINE AND EMISSION CONTROL SYSTEM

- 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 passage 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 large improved adaptability, easier addition of compensating element, etc.

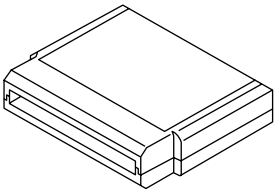
The MFI system also has the following features:

- Reduced emission of harmful exhaust gases.
- Reduction in fuel consumption.
- Increased engine output.
- Superior acceleration and deceleration.
- Superior startability and warm-up performance in cold weather since compensation is made for coolant and intake air temperature.

3. AUTOMATIC TRANSMISSION AND ELECTRONIC-HYDRAULIC CONTROL SYSTEM

The electronic-hydraulic control system consists of various sensors and switches, the TCM and the hydraulic controller including solenoid valves. The system controls the transmission proper including shift control, lock-up control, overrunning clutch control, line pressure control and shift timing control. It also controls the AWD transfer clutch. In other words, the system detects various operating conditions from various input signals and sends output signals to shift solenoids 1, 2 and low clutch timing solenoid and 2-4 brake timing solenoid, line pressure duty solenoid, lock-up duty solenoid, transfer duty solenoid and 2-4 brake duty solenoid (a total of eight solenoids).

D: PREPARATION TOOL

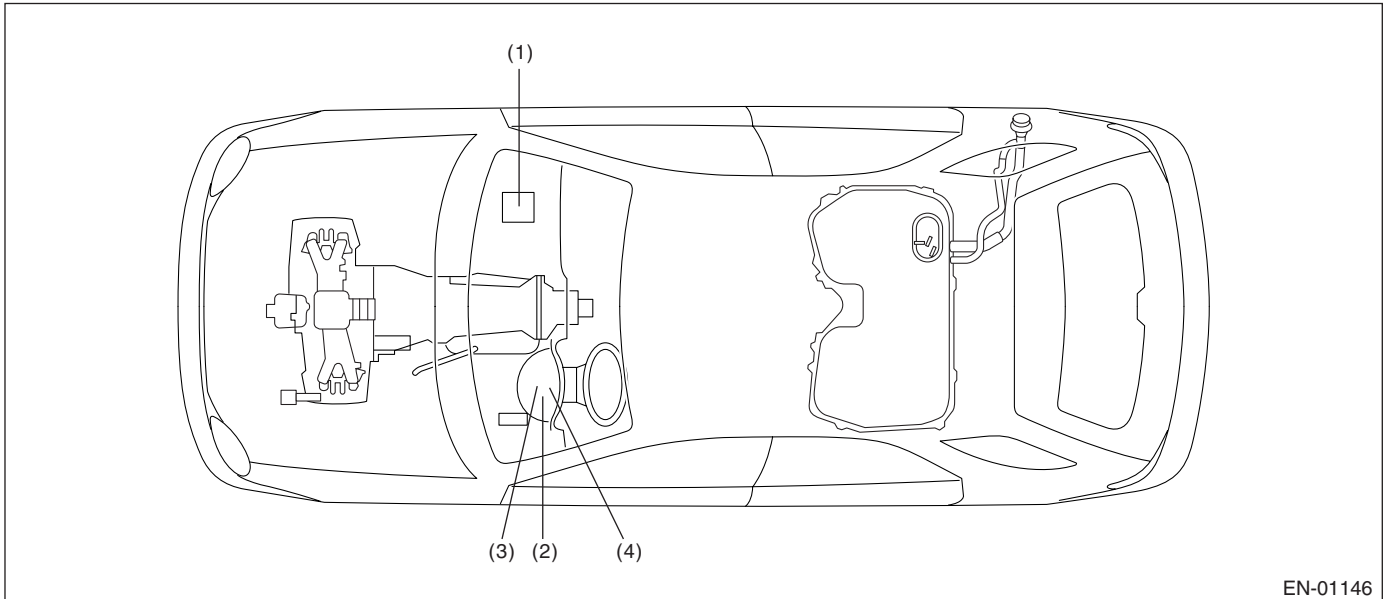
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA230	24082AA230	CARTRIDGE	Troubleshooting for electrical systems.
 ST22771AA030	22771AA030	SUBARU SELECT MONITOR KIT	Troubleshooting for electrical systems.

4. Electrical Components Location

A: LOCATION

1. ENGINE

• MODULE

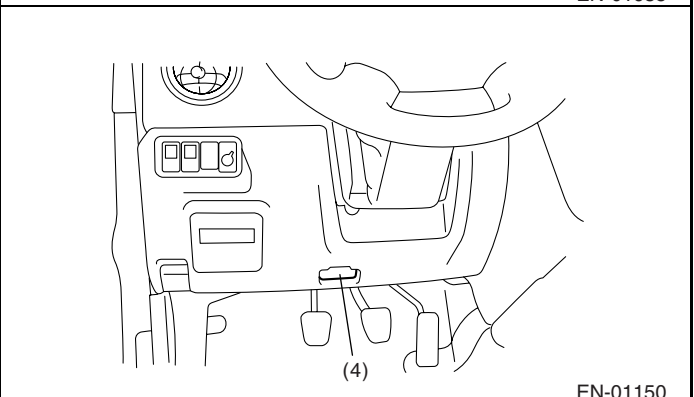
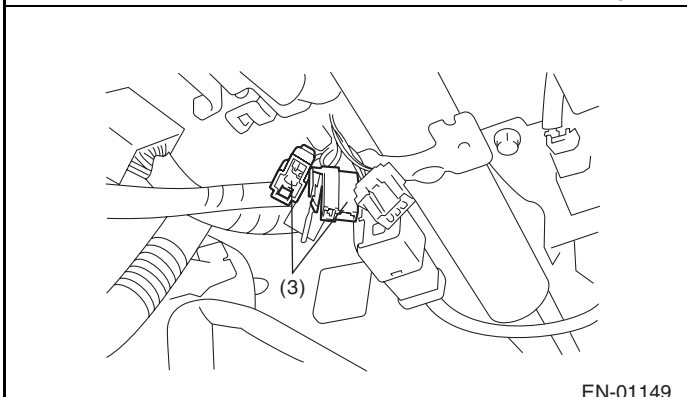
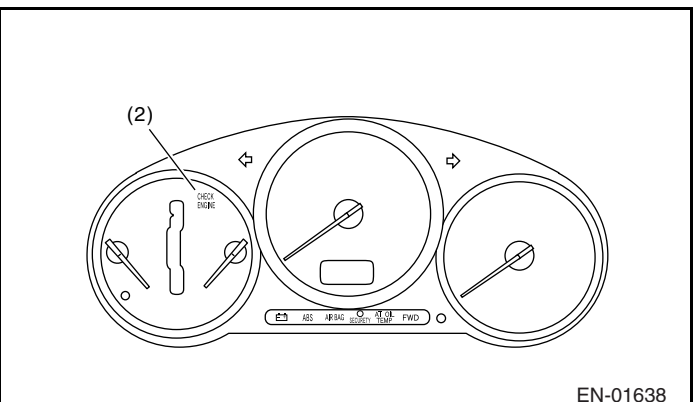
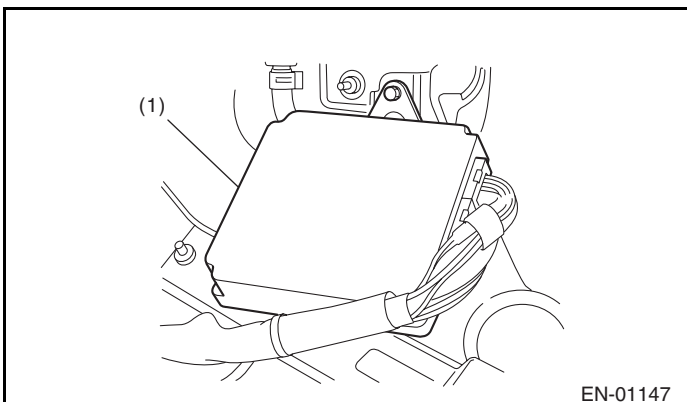


(1) Engine control module (ECM)

(3) Test mode connector

(4) Data link connector

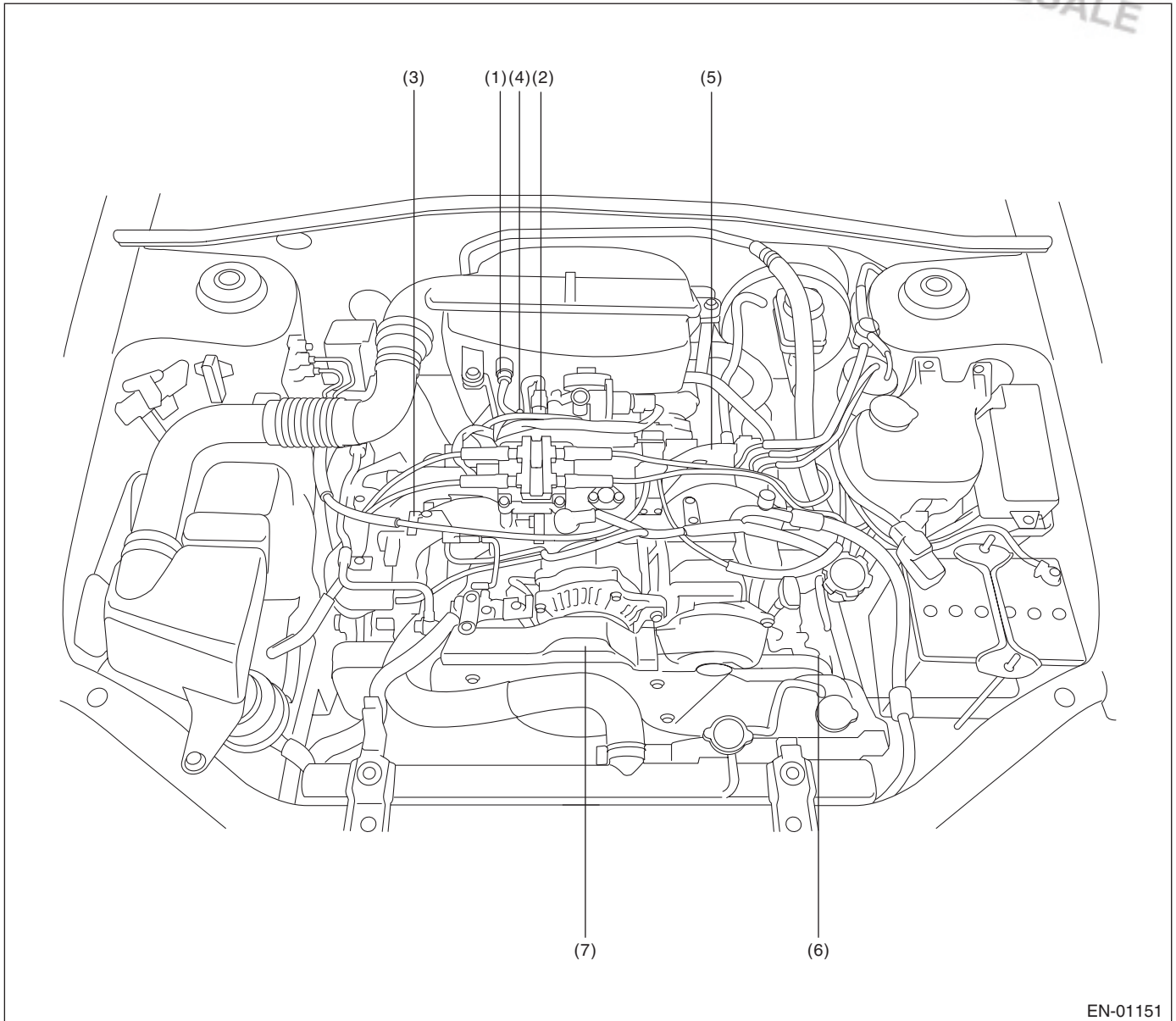
(2) Malfunction indicator light



Electrical Components Location

ENGINE (DIAGNOSTICS)

• SENSOR



EN-01151

(1) Intake air temperature sensor	(4) Throttle position sensor	(6) Camshaft position sensor
(2) Manifold absolute pressure sensor	(5) Knock sensor	(7) Crankshaft position sensor
(3) Engine coolant temperature sensor		

Electrical Components Location

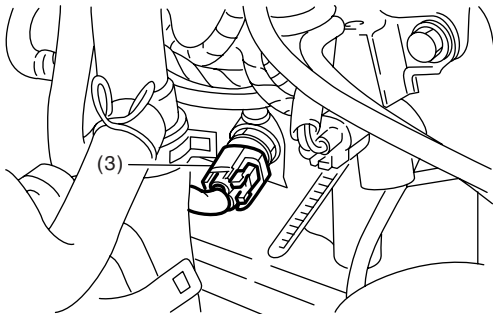
ENGINE (DIAGNOSTICS)



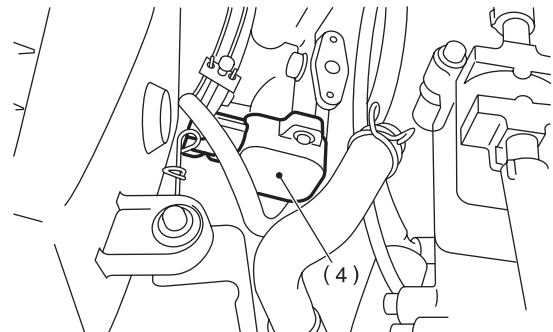
EN-00006



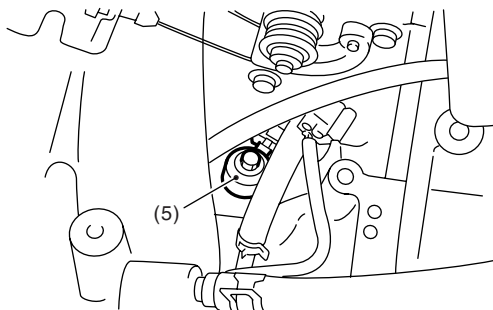
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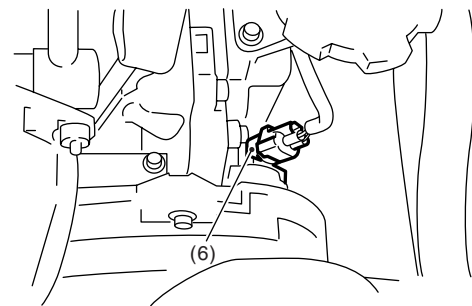
EN-00008



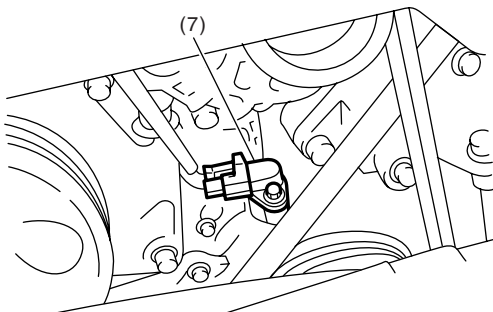
EN-00161



EN-00010



EN-00011

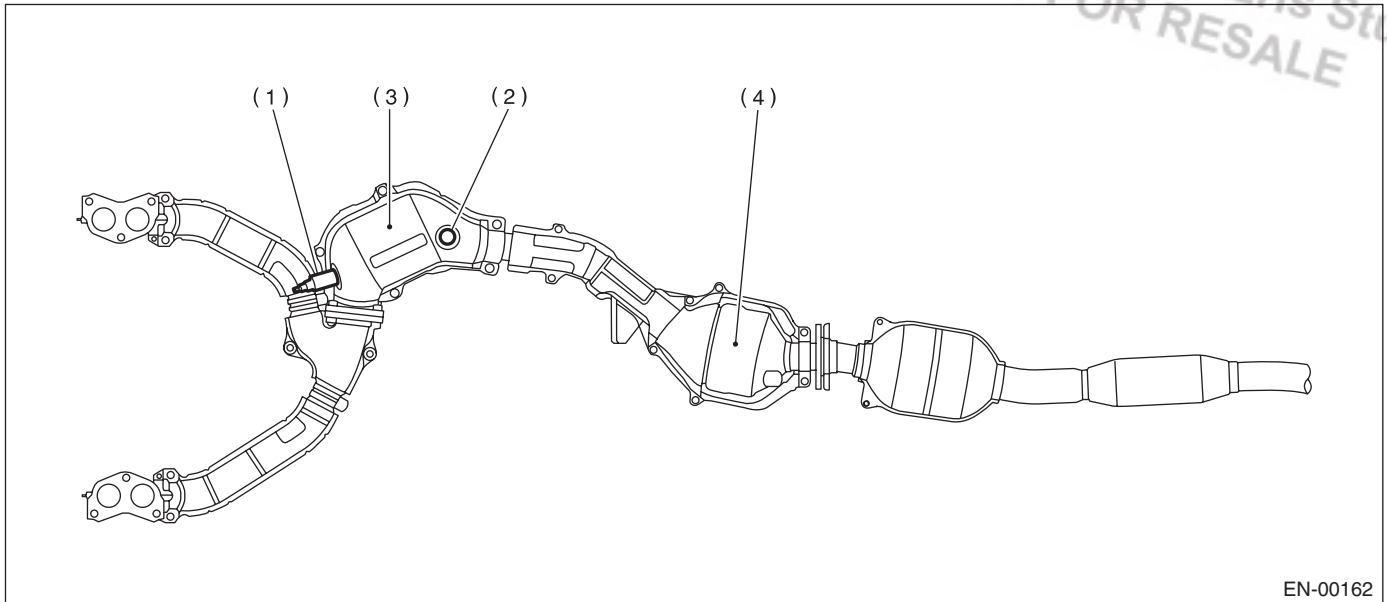


EN-00012

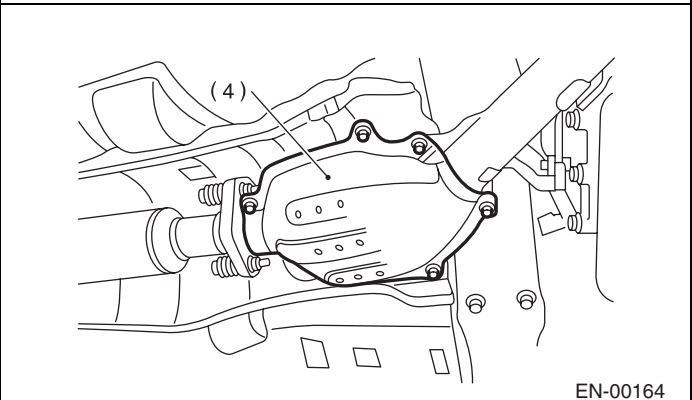
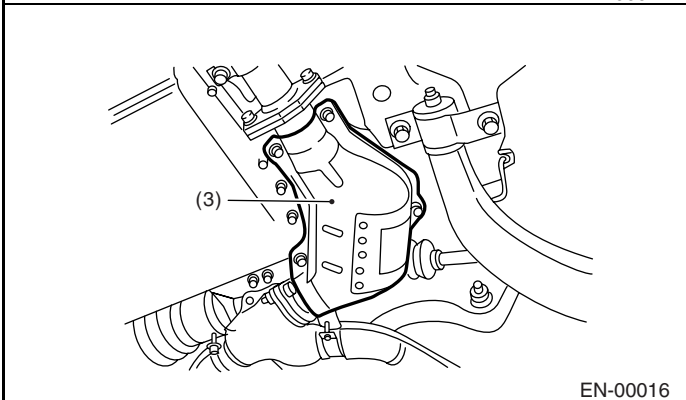
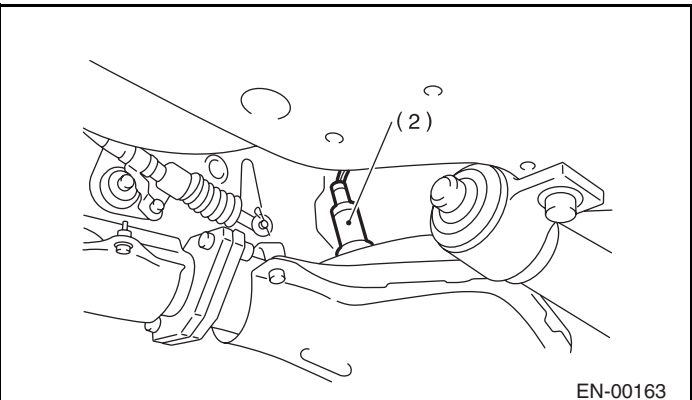
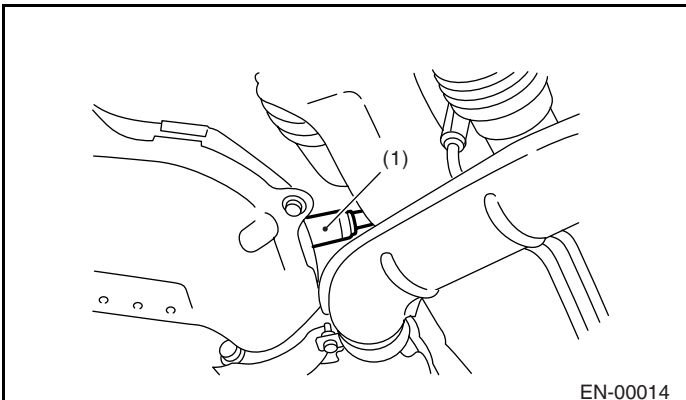
SUBARU.

Electrical Components Location

ENGINE (DIAGNOSTICS)

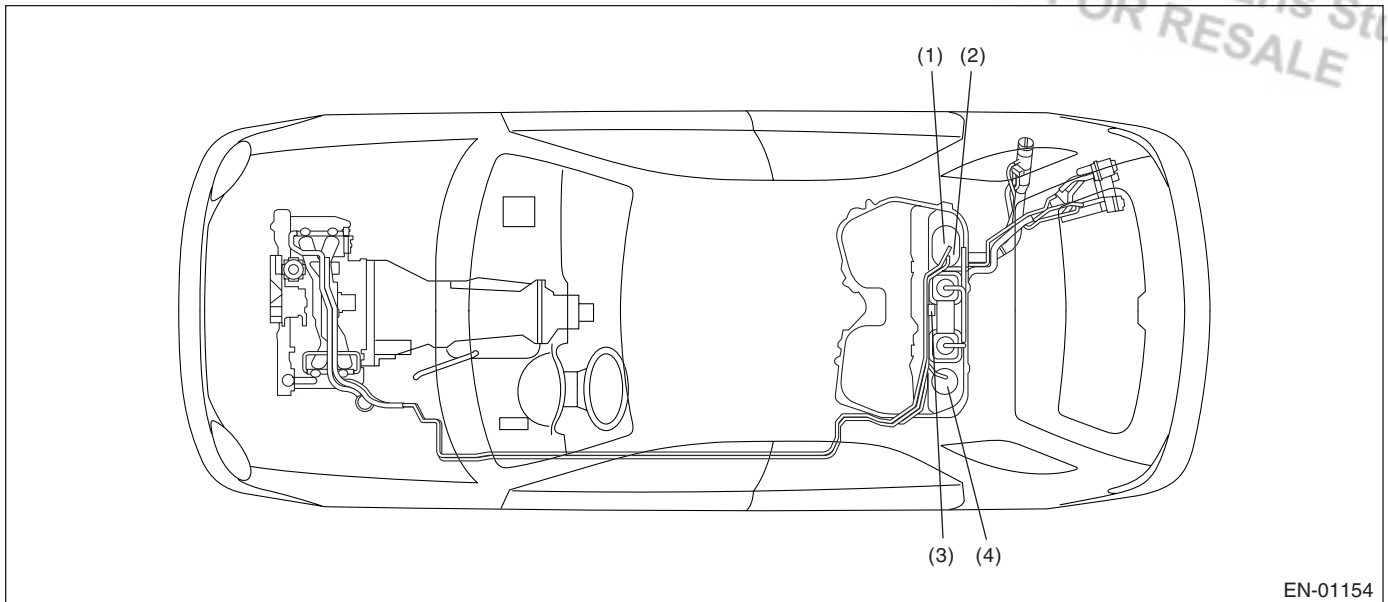


- (1) Front oxygen (A/F) sensor (3) Front catalytic converter (4) Rear catalytic converter
(2) Rear oxygen sensor



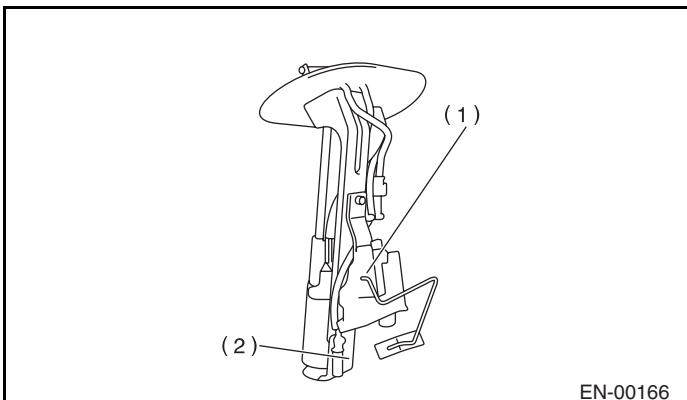
Electrical Components Location

ENGINE (DIAGNOSTICS)

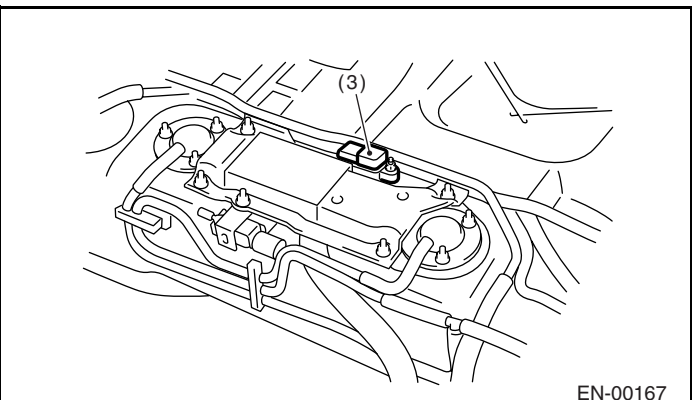


EN-01154

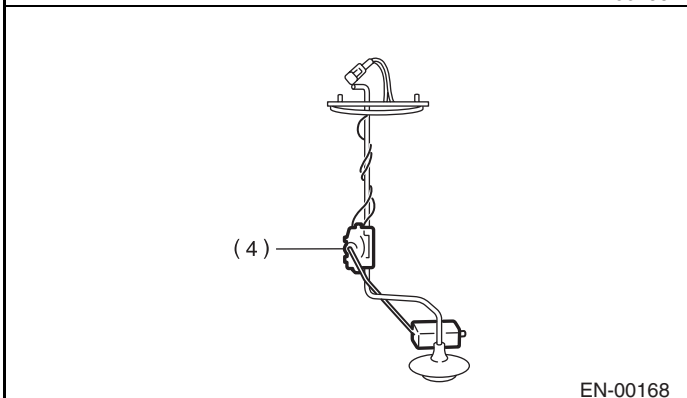
- (1) Fuel level sensor
- (2) Fuel temperature sensor
- (3) Fuel tank pressure sensor
- (4) Fuel sub level sensor



EN-00166



EN-00167



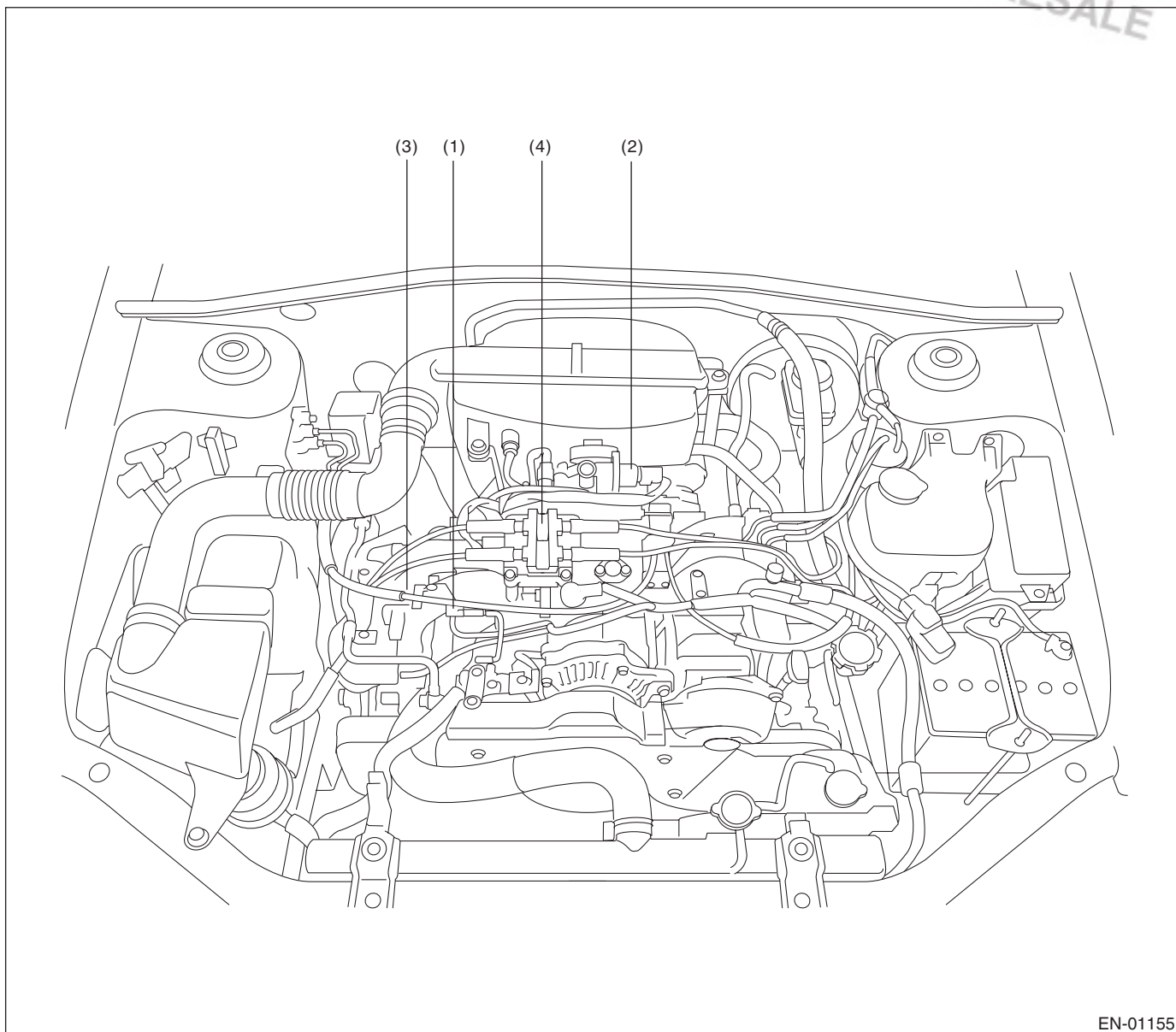
EN-00168

SUBARU.

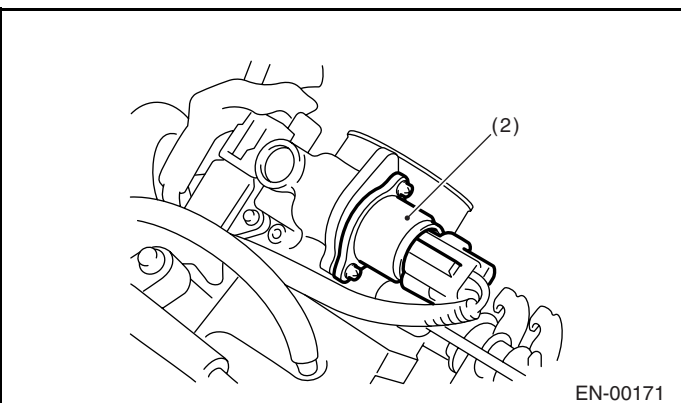
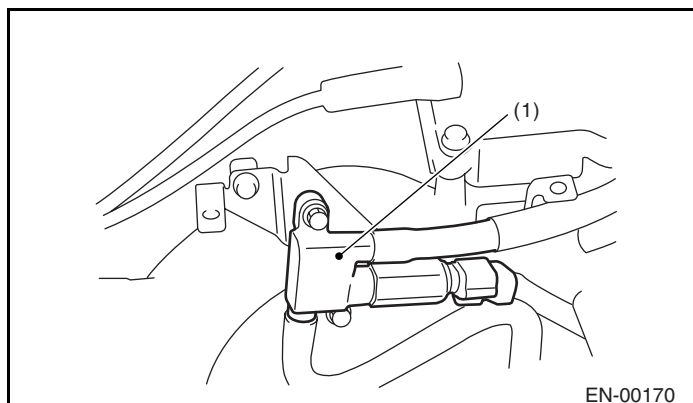
Electrical Components Location

ENGINE (DIAGNOSTICS)

• SOLENOID VALVE, EMISSION CONTROL SYSTEM PARTS AND IGNITION SYSTEM PARTS

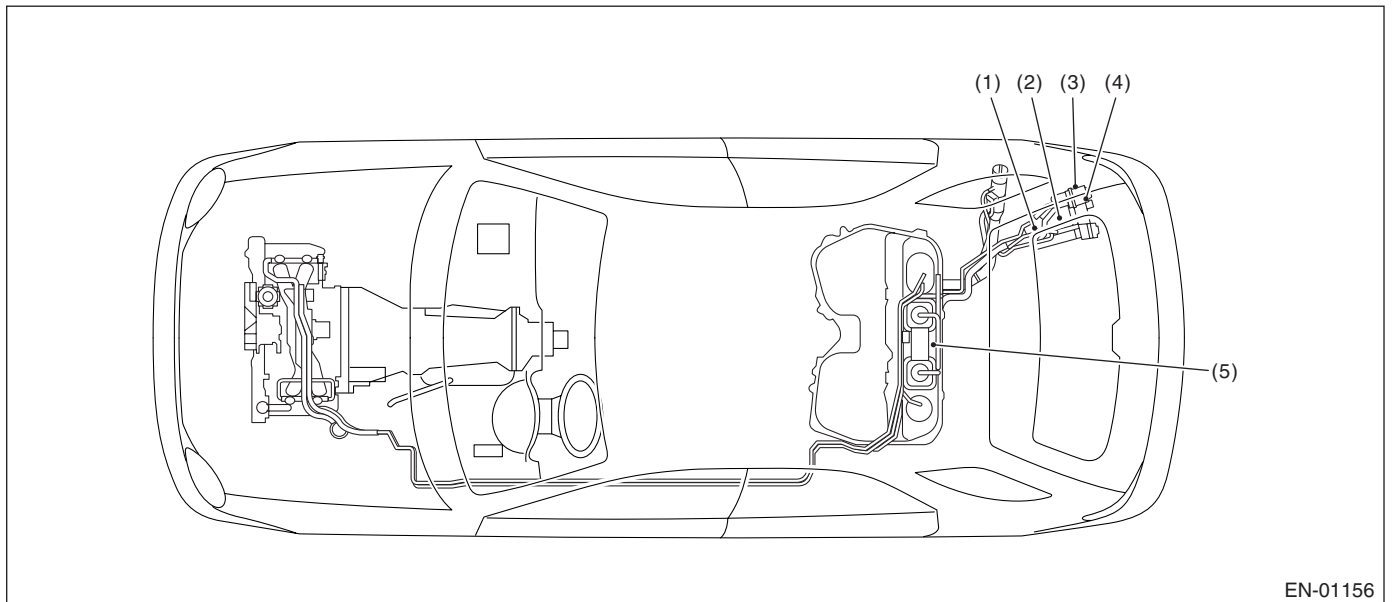
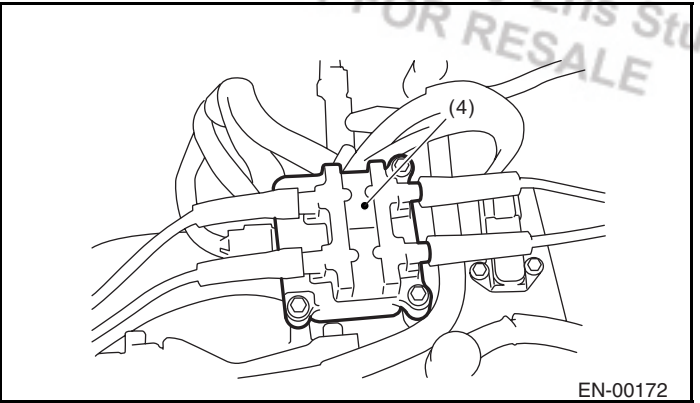
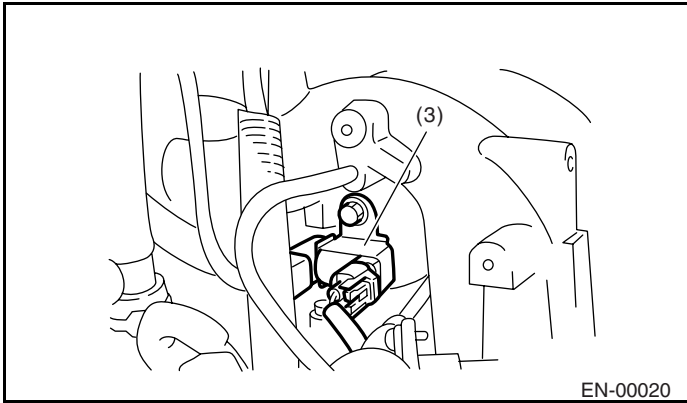


- (1) Air assisted injector solenoid valve (3) Purge control solenoid valve (4) Ignition coil & ignitor ASSY
(2) Idle air control solenoid valve



Electrical Components Location

ENGINE (DIAGNOSTICS)



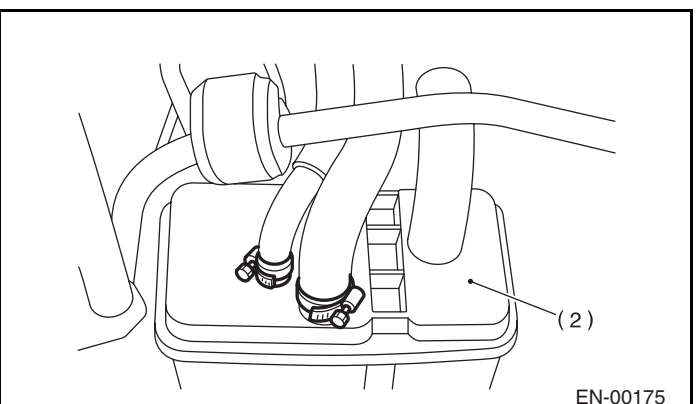
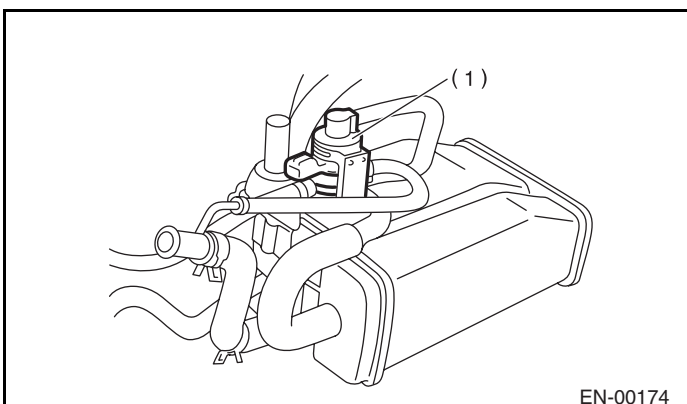
(1) Pressure control solenoid valve

(3) Drain valve

(5) Fuel tank sensor control valve

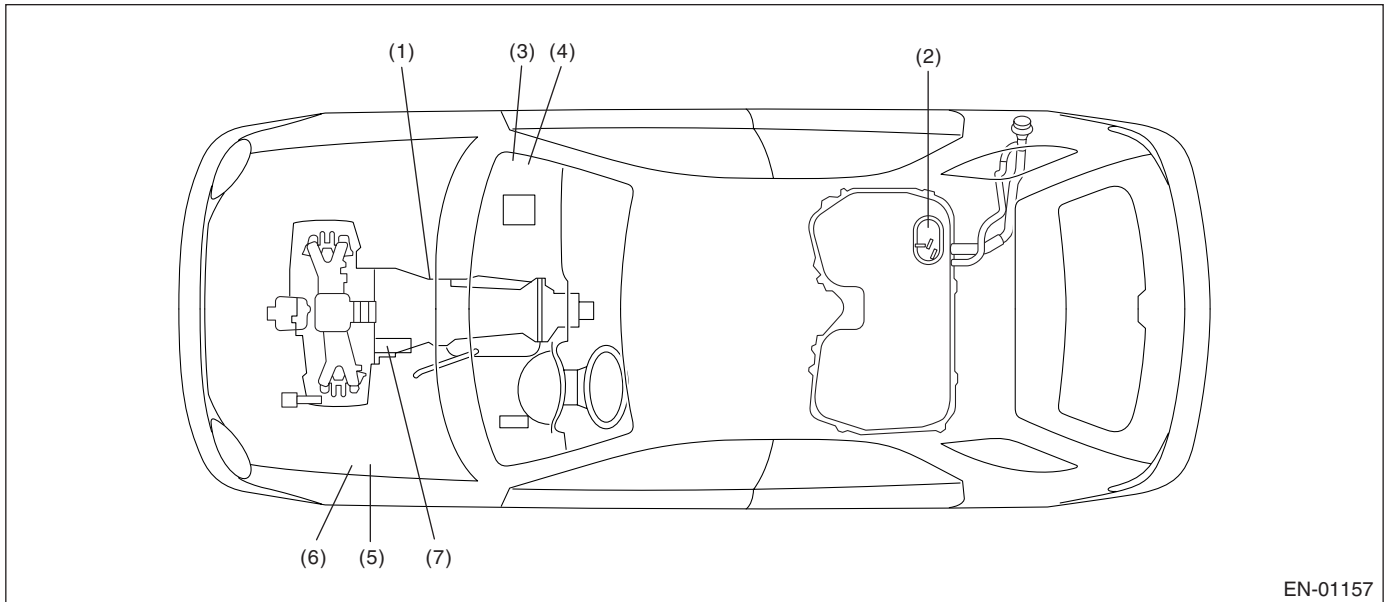
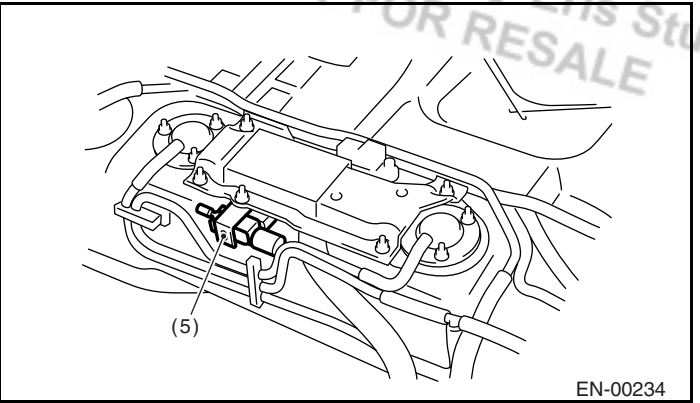
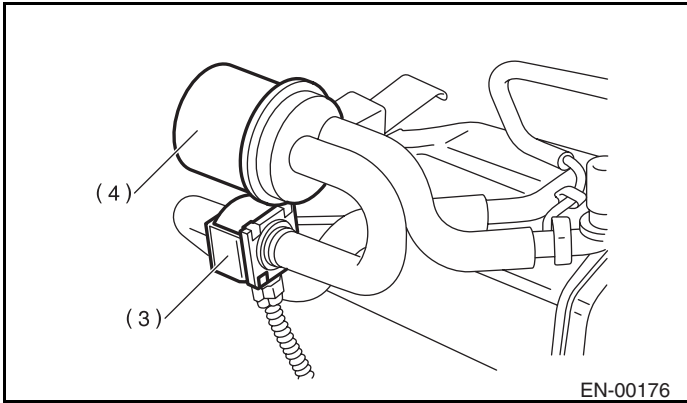
(2) Canister

(4) Drain filter

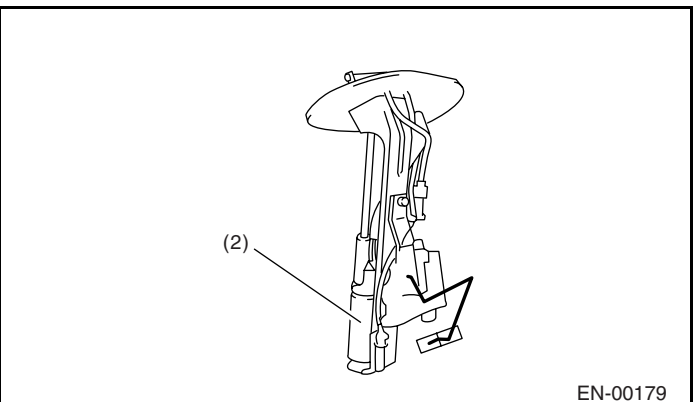
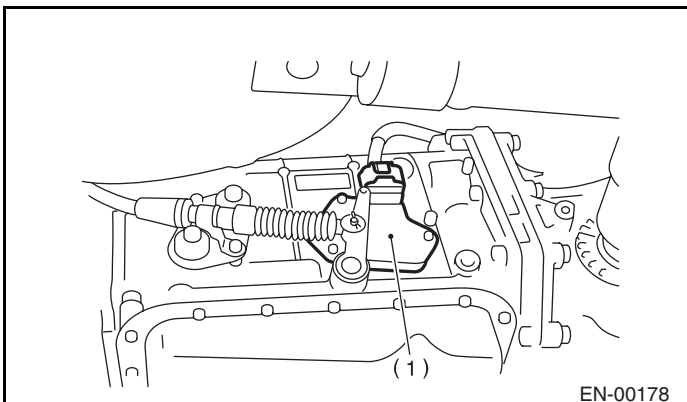


Electrical Components Location

ENGINE (DIAGNOSTICS)

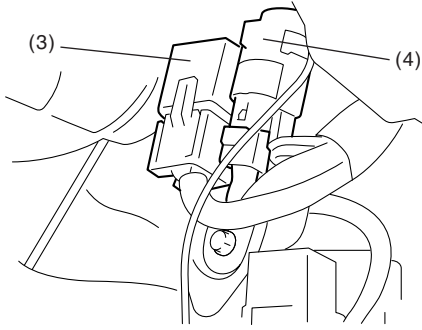


(1) Inhibitor switch	(4) Fuel pump relay	(7) Starter
(2) Fuel pump	(5) Radiator main fan relay	
(3) Main relay	(6) Radiator sub fan relay	

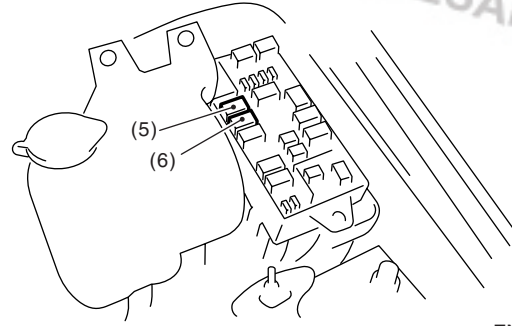


Electrical Components Location

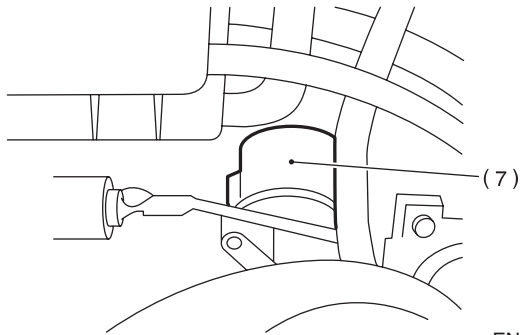
ENGINE (DIAGNOSTICS)



EN-01158



EN-01639



EN-00181

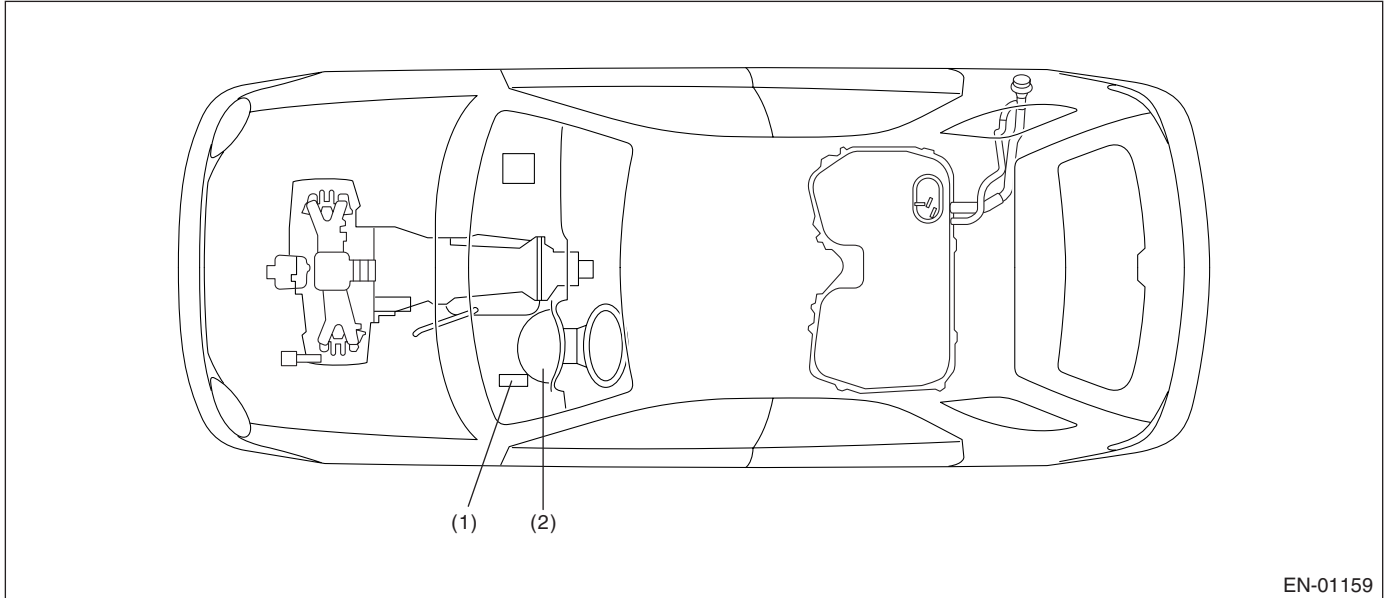
SUBARU.

Electrical Components Location

ENGINE (DIAGNOSTICS)

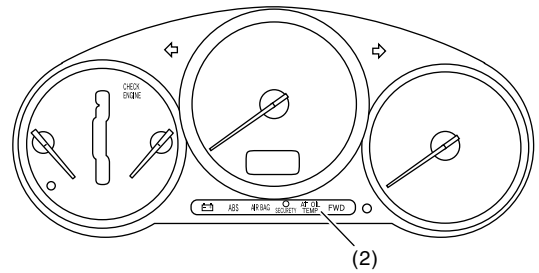
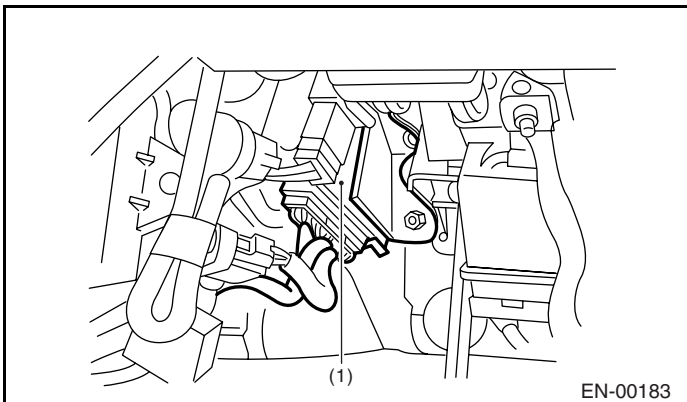
2. TRANSMISSION

• MODULE

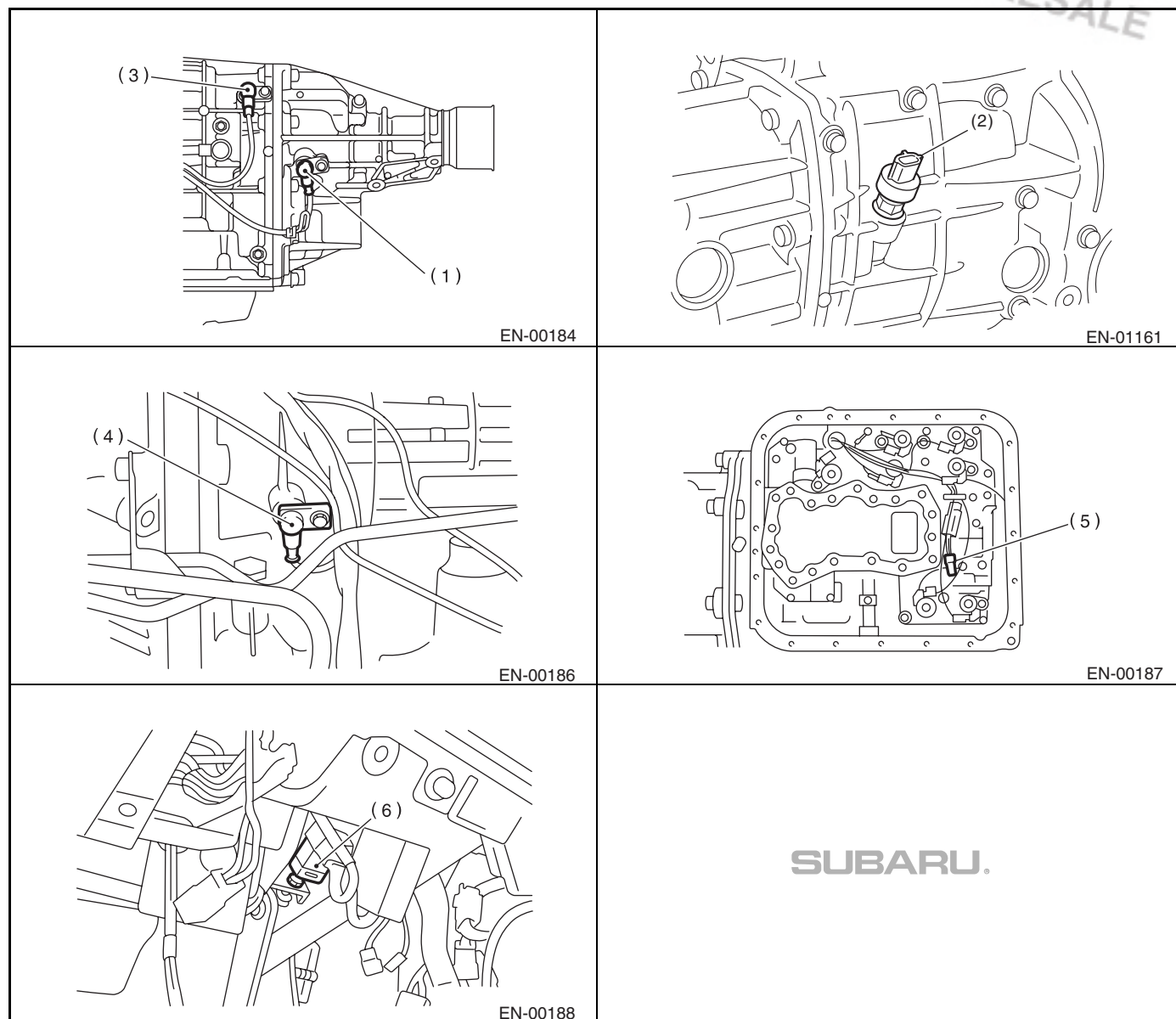


(1) Transmission control module (TCM) (AT model)

(2) AT diagnostic indicator light (AT model)



• SENSOR



- (1) Rear vehicle speed sensor (AT model)
- (2) Front vehicle speed sensor (MT model)

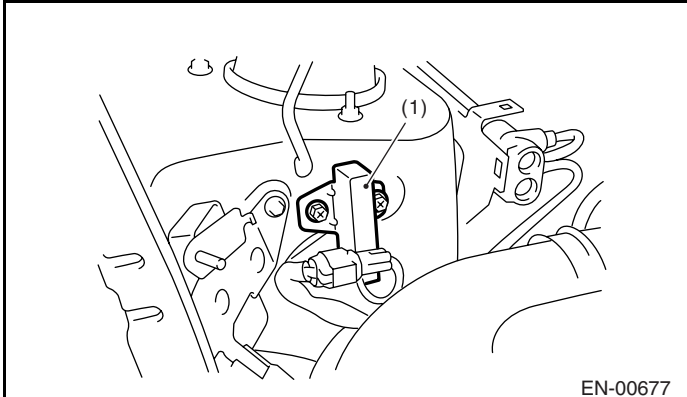
- (3) Front vehicle speed sensor (AT model)
- (4) Torque converter turbine speed sensor

- (5) ATF temperature sensor (AT model)
- (6) Brake light switch

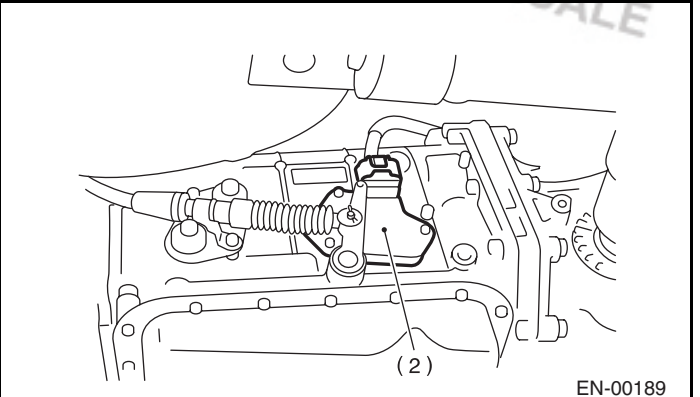
Electrical Components Location

ENGINE (DIAGNOSTICS)

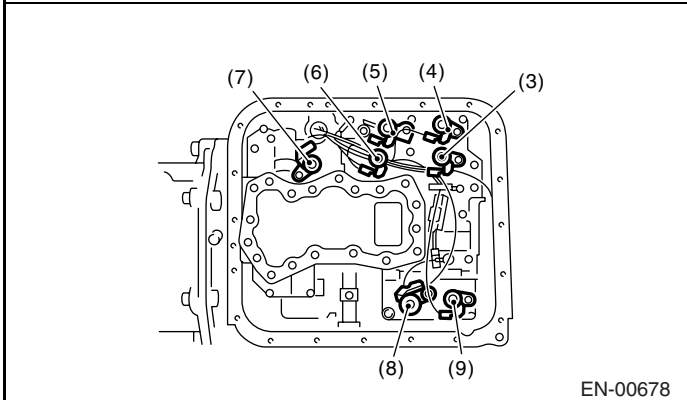
• SOLENOID VALVE AND SWITCH (AT MODELS)



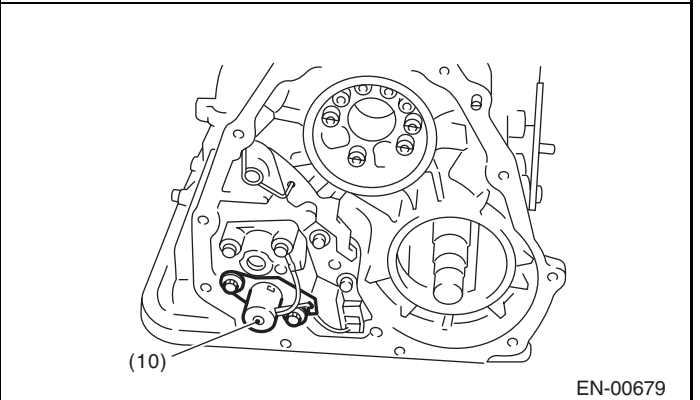
EN-00677



EN-00189



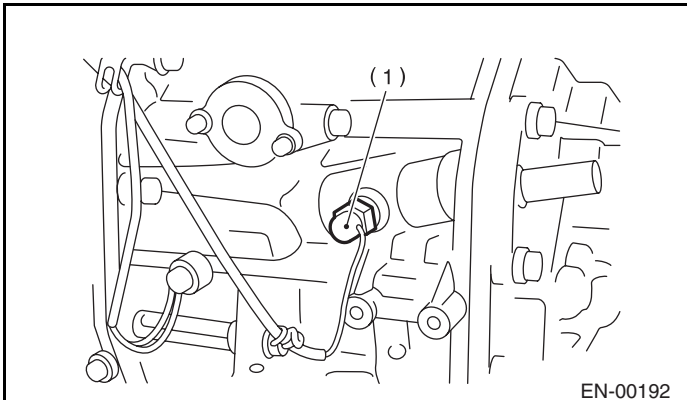
EN-00678



EN-00679

(1) Dropping resistor	(5) Line pressure duty solenoid	(8) 2-4 brake duty solenoid
(2) Inhibitor switch	(6) Low clutch timing solenoid valve	(9) 2-4 brake timing solenoid valve
(3) Shift solenoid valve 1	(7) Lock up duty solenoid	(10) Transfer duty solenoid
(4) Shift solenoid valve 2		

• SOLENOID VALVE AND SWITCH (MT MODELS)



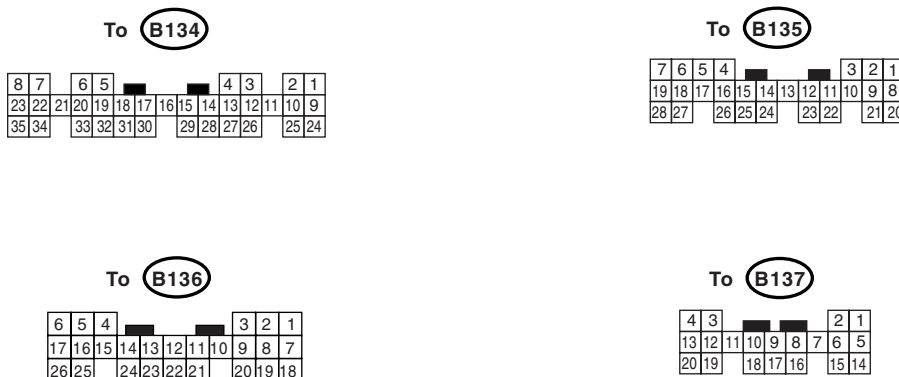
EN-00192



- (1) Neutral position switch

5. Engine Control Module (ECM) I/O Signal

A: ELECTRICAL SPECIFICATION



EN-01641

Content		Con- nector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Crank- shaft posi- tion sensor	Signal (+)	B135	7	0	-7 to +7	Sensor output waveform
	Signal (-)	B135	17	0	0	—
	Shield	B135	28	0	0	—
Camshaft position sensor	Signal (+)	B135	6	0	-7 to +7	Sensor output waveform
	Signal (-)	B135	18	0	0	—
	Shield	B135	28	0	0	—
Throttle position sensor	Signal	B135	13	Fully closed: 0.2 — 1.0 Fully opened: 4.2 — 4.7		—
	Power supply	B135	3	5	5	—
	GND (sensor)	B135	19	0	0	—
Rear oxy- gen sen- sor	Signal	B135	14	0	0 — 0.9	—
	Shield	B137	15	0	0	—
	GND (sensor)	B135	19	0	0	—
Front oxy- gen (A/F) sensor heater	Signal 1	B136	6	0 — 1.0	0 — 1.0	—
	Signal 2	B136	17	0 — 1.0	0 — 1.0	—
Rear oxygen sensor heater signal		B136	4	0 — 1.0	0 — 1.0	—
Engine coolant tempera- ture sen- sor	Signal	B135	12	1.0 — 1.4	1.0 — 1.4	After warm-up the engine.
	GND (sensor)	B135	19	0	0	After warm-up the engine.
Vehicle speed signal		B137	10	0 or 5	0 or 5	“5” and “0” are repeatedly dis- played when vehicle is driven.
Starter switch		B136	20	0	0	Cranking: 8 — 14

Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Content		Con- nector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
A/C switch		B136	11	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
Ignition switch		B136	10	10 — 13	13 — 14	—
Neutral position switch	MT	B136	21	ON: 12±0.5 OFF: 0		Switch is ON when gear is in neutral position.
	AT	B136	21	ON: 0 OFF: 12±0.5		Switch is ON when shift is in “N” or “P” position.
Test mode connector		B136	3	5	5	When connected: 0
Knock sensor	Signal	B135	16	2.8	2.8	—
	Shield	B135	27	0	0	—
Back-up power supply		B135	9	10 — 13	13 — 14	Ignition switch “OFF”: 10 — 13
Control unit power sup- ply		B135	1	10 — 13	13 — 14	—
		B135	2	10 — 13	13 — 14	—
Sensor power supply		B135	3	5	5	—
Ignition control	#1, #2	B134	33	0	1 — 3.4	Waveform
	#3, #4	B134	32	0	1 — 3.4	Waveform
Fuel injec- tor	#1	B134	34	10 — 13	1 — 14	Waveform
	#2	B134	23	10 — 13	1 — 14	Waveform
	#3	B134	22	10 — 13	1 — 14	Waveform
	#4	B134	8	10 — 13	1 — 14	Waveform
Idle air control solenoid valve	Signal 1	B134	20	—	1 — 13	Waveform
	Signal 2	B134	6	—	1 — 13	Waveform
	Signal 3	B134	5	—	1 — 13	Waveform
	Signal 4	B134	19	—	1 — 13	Waveform
Fuel pump relay control		B134	11	ON: 0.5 or less OFF: 10 — 13	0.5 or less	—
A/C relay control		B134	9	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	—
Radiator main fan relay control		B134	14	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	—
Radiator sub fan relay control		B134	13	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	Models with A/C
Self-shutoff control		B136	12	10 — 13	13 — 14	—
Malfunction indicator light		B134	28	—	—	Light “ON”: 1 or less Light “OFF”: 10 — 14
Engine speed output		B134	10	—	0 — 13, or more	Waveform
Torque control 1 signal		B136	1	5	5	—
Torque control 2 signal		B136	18	5	5	—
Torque control cut sig- nal		B136	15	8	8	—
Purge control solenoid valve		B134	29	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Air assisted injector solenoid valve		B134	12	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Power steering switch		B136	9	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Fuel tank sensor control valve		B134	1	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 10 — 13	—
Fuel temperature sen- sor		B137	5	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (75°F)
Fuel level sensor		B135	25	0.12 — 4.75	0.12 — 4.75	—

Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Content		Con- nector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Fuel tank pressure sensor	Signal	B135	26	2.3 — 2.7	2.3 — 2.7	The valve obtained after the fuel filler cap was removed once and recapped.
	Power supply	B135	3	5	5	—
	GND (sensor)	B135	19	0	0	—
Pressure control sole- noid valve		B134	4	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Drain valve		B134	3	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
AT diagnosis input sig- nal		B137	19	Less than 1 ↔ More than 4	Less than 1 ↔ More than 4	Waveform
Small light switch		B137	20	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Blower fan switch		B137	13	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Rear defogger switch		B137	4	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Front oxygen (A/F) sen- sor signal 1		B136	13	—	2.05 — 2.25	—
Front oxygen (A/F) sen- sor signal 2		B136	22	—	1.75 — 1.95	—
Front oxygen (A/F) sen- sor shield		B135	23	0	0	—
Manifold absolute pres- sure sensor		B135	15	4.0 — 4.8	1.1 — 1.9	—
Intake air temperature sensor		B137	6	3.15 — 3.33	3.15 — 3.33	Intake air temperature: 25°C (75°F)
SSM/GST communica- tion line		B137	16	Less than 1 ↔ More than 4	Less than 1 ↔ More than 4	—
GND (sensors)		B135	19	0	0	—
GND (injectors)		B134	35	0	0	—
GND (ignition system)		B136	26	0	0	—
GND (power supply)		B134	7	0	0	—
GND (control systems)		B137	14	0	0	—
		B135	21	0	0	—
GND (oxygen sensor heater 1)		B136	5	0	0	—
GND (oxygen sensor heater 2)		B136	16	0	0	—

6. Engine Condition Data

A: ELECTRICAL SPECIFICATION

Content	Specified data
Engine load	1.6 — 2.9 (%): Idling
	6.4 — 12.8 (%): 2,500 rpm racing

Measuring condition:

- After the engine is warmed-up.
- Gear position is in “N” or “P” range.
- A/C is turned OFF.
- All accessory switches are turned OFF.

7. Transmission Control Module (TCM) I/O Signal

A: ELECTRICAL SPECIFICATION

For electrical specification of TCM I/O signal, refer to 4AT section. <Ref. to 4AT(diag)-11, ELECTRICAL SPECIFICATION, Transmission Control Module (TCM) I/O Signal.>

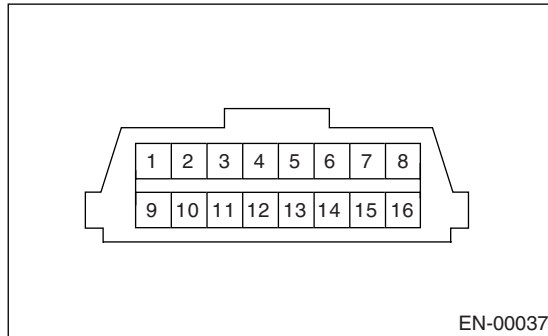
8. Data Link Connector

A: NOTE

This connector is used both for OBD-II general scan tools and the Subaru Select Monitor.

CAUTION:

Do not connect any scan tools other than the OBD-II general scan tools and the Subaru Select Monitor, because the circuit for the Subaru Select Monitor may be damaged.



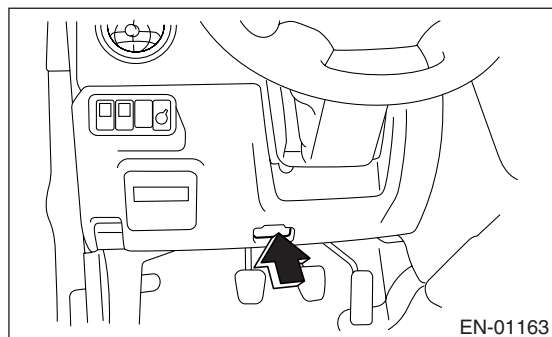
Terminal No.	Contents	Terminal No.	Contents
1	Power supply	9	Blank
2	Blank	10	Subaru Select Monitor signal
3	Blank	11	Blank
4	Blank	12	Ground
5	Blank	13	Ground
6	Test mode check signal 1	14	Blank
7	Blank	15	Blank
8	Test mode check signal 2	16	Blank

9. OBD-II General Scan Tool

A: OPERATION

1. HOW TO USE OBD-II GENERAL SCAN TOOL

- 1) Prepare a general scan tool (OBD-II general scan tool) required by SAE J1978.
- 2) Open the cover and connect the OBD-II general scan tool to data link connector located in the lower portion of instrument panel (on the driver's side).



- 3) Using the OBD-II general scan tool, call up DTC and freeze frame data.

OBD-II general scan tool functions consist of:

- (1) MODE \$01: Current powertrain diagnostic data
- (2) MODE \$02: Powertrain freeze frame data
- (3) MODE \$03: Emission-related powertrain DTC
- (4) MODE \$04: Clear/Reset emission-related diagnostic information
- (5) MODE \$06: Request on-board monitoring test results for non-continuously monitored systems
- (6) MODE \$07: Request on-board monitoring test results for continuously monitored systems
- (7) MODE \$09: Request vehicle information

Read out the data according to repair procedures. (For detailed operation procedures, refer to the OBD-II General Scan Tool Operation Manual.)

NOTE:

For details concerning DTC, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>

2. MODE \$01 (CURRENT POWERTRAIN DIAGNOSTIC DATA)

Refers to data denoting the current operating condition of analog input/output, digital input/output and/or the powertrain system.

A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
01	Number of emission-related powertrain DTC and malfunction indicator light status and diagnosis support information	—
03	Fuel system control status	—
04	Calculated engine load value	%
05	Engine coolant temperature	°C
06	Short term fuel trim	%
07	Long term fuel trim	%
0B	Intake manifold absolute pressure	kPa
0C	Engine revolution	rpm
0D	Vehicle speed	km/h
0E	Ignition timing advance	°
0F	Intake air temperature	°C
10	Air flow rate from mass air flow sensor	g/sec
11	Throttle valve absolute opening angle	%
13	Check whether oxygen sensor is installed.	—
15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor	V and %
1C	Supporting OBD system	—
24	A/F value and A/F sensor output voltage	— and V

NOTE:

Refer to OBD-II general scan tool manufacturer's instruction manual to access generic OBD-II PIDs (MODE \$01).

3. MODE \$02 (POWERTRAIN FREEZE FRAME DATA)

Refers to data denoting the operating condition when trouble is sensed by the on-board diagnosis system. A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
02	DTC that caused CARB required freeze frame data storage	—
03	Fuel system control status	—
04	Calculated engine load value	%
05	Engine coolant temperature	°C
06	Short term fuel trim	%
07	Long term fuel trim	%
0B	Intake manifold absolute pressure	kPa
0C	Engine revolution	rpm
0D	Vehicle speed	km/h
0E	Ignition timing advance	°
0F	Intake air temperature	°C
10	Air flow rate from mass air flow sensor	g/sec
11	Throttle valve opening angle	%

NOTE:

Refer to OBD-II general scan tool manufacturer's instruction manual to access freeze frame data (MODE \$02).

4. MODE \$03 (EMISSION-RELATED POWERTRAIN DIAGNOSTIC TROUBLE CODE (DTC))

Refer to Read Diagnostic Trouble Code (DTC) for information about data denoting emission-related powertrain DTC. <Ref. to EN(H4SO)(diag)-36, Read Diagnostic Trouble Code (DTC).>

5. MODE \$04 (CLEAR/RESET EMISSION-RELATED DIAGNOSTIC INFORMATION)

Refers to the mode used to clear or reset emission-related diagnostic information (OBD-II trouble diagnostic information).

NOTE:

Refer to OBD-II general scan tool manufacturer's instruction manual to clear or reset emission-related diagnostic information (MODE \$04).

6. MODE \$06

Refer to test value of troubleshooting and data of test limit on support data bit sequence table. List of support data is shown in the following table.

TID	CID	Test value & Test limit	Unit
\$01	\$01	Catalyst system efficiency below threshold	—
\$02	\$81	Exhaust gas recirculation control circuit range/performance	mmHg
	\$02		
\$03	\$81	Evaporative emission control system (CPC open malfunction)	—
	\$02	Evaporative emission control system small leak	pa
	\$03	Evaporative emission control system small leak (Immediate normality judgment)	pa
	\$04	Evaporative emission control system large leak	pa
	\$05	Evaporative emission control system very small leak (Immediate normality judgment)	pa
	\$06	Evaporative emission control system very small leak	pa
\$05	\$01	O ₂ sensor circuit slow response (Bank 1 Sensor 1) Lean → Rich	millisecond
	\$02	O ₂ sensor circuit slow response (Bank 1 Sensor 1) Rich → Lean	
\$06	\$81	O ₂ sensor circuit (Bank 1 Sensor 2) <\$81 or \$02>	V
	\$02		
\$07	\$01	O ₂ sensor circuit slow response (Bank 1 Sensor 2)	second
\$0B	\$81	O ₂ sensor heater circuit (Bank 1 Sensor 2) <\$81 or \$02>	W
	\$02		
\$0C	\$01	Coolant thermostat (Coolant temperature below thermostat regulating temperature)	°C
\$0D	\$01	Evaporative emission control system vent control circuit range/performance	Pa
	\$82		

7. MODE \$07

Refer to data of DTC (pending code) for troubleshooting result about emission in first time.

8. MODE \$09

Refer to data of vehicle specification (VIN, calibration ID, etc.).

10. Subaru Select Monitor

A: OPERATION

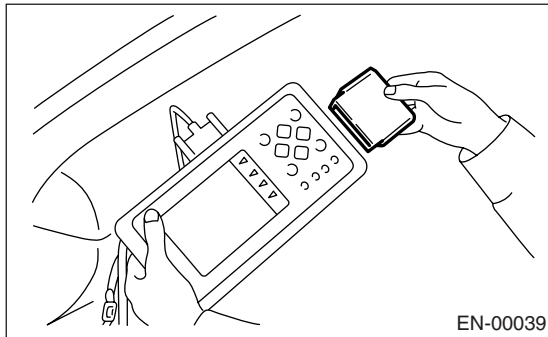
1. HOW TO USE SUBARU SELECT MONITOR

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>



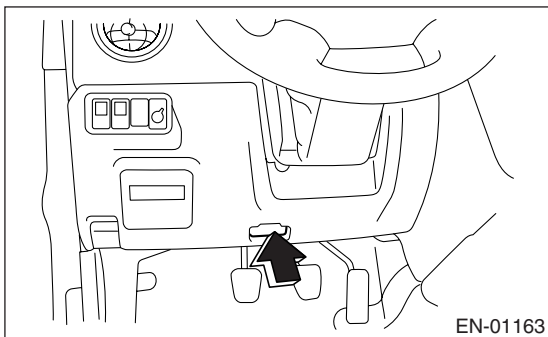
2) Connect the diagnosis cable to Subaru Select Monitor.

3) Insert the cartridge into Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>



4) Connect the Subaru Select Monitor to data link connector.

(1) Data link connector located in the lower portion of instrument panel (on driver's side).

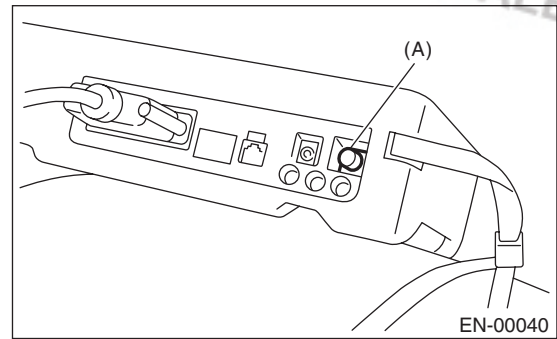


(2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect scan tools except for Subaru Select Monitor and OBD-II general scan tool.

5) Turn the ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



(A) Power switch

6) Using the Subaru Select Monitor, call up DTC and various data, then record them.

2. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (NORMAL MODE)

Refer to Read Diagnostic Trouble Code (DTC) for information about how to indicate DTC. <Ref. to EN(H4SO)(diag)-36, Read Diagnostic Trouble Code (DTC).>

3. READ DIAGNOSTIC TROUBLE CODE (DTC) FOR ENGINE (OBD MODE)

Refer to Read Diagnostic Trouble Code (DTC) for information about how to indicate DTC. <Ref. to EN(H4SO)(diag)-36, Read Diagnostic Trouble Code (DTC).>

4. READ CURRENT DATA FOR ENGINE (NORMAL MODE)

- 1) On «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
 - 2) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
 - 3) Press the [YES] key after the information of engine type is displayed.
 - 4) On «Engine Diagnosis» display screen, select the {Current Data Display & Save} and press the [YES] key.
 - 5) On «Data Display Menu» display screen, select the {Data Display} and press the [YES] key.
 - 6) Using the scroll key, move the display screen up or down until the desired data is shown.
- A list of support data is shown in the following table.

Contents	Display	Unit of measure
Battery voltage	Battery Voltage	V
Vehicle speed signal	Vehicle Speed	km/h or MPH
Engine speed signal	Engine Speed	rpm
Engine coolant temperature signal	Coolant Temp.	°C or °F
Ignition timing signal	Ignition Timing	deg
Throttle position signal	Throttle Opening Angle	%
Throttle position signal	Throttle Sensor Voltage	V
Injection pulse width	Fuel Injection #1 Pulse	ms
Idle air control signal	ISC Valve Step	STEP
Engine load data	Engine Load	%
Front oxygen (A/F) sensor output signal	A/F Sensor #1	—
Front oxygen (A/F) sensor resistance	A/F Sensor #1 Resistance	ohm
Rear oxygen sensor output signal	Rear O ₂ Sensor	V
Short term fuel trim	A/F Correction #1	%
Knock sensor signal	Knocking Correction	deg
Atmospheric absolute pressure signal	Atmosphere Pressure	mmHg, kPa, inHg or psi
Intake manifold relative pressure signal	Mani. Relative Pressure	mmHg, kPa, inHg or psi
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg, kPa, inHg or psi
A/F correction (short term fuel trim) by rear oxygen sensor	A/F Correction #3	%
Long term whole fuel trim	A/F Learning #1	%
Front oxygen (A/F) sensor heater current	Front O ₂ Heater #1	A
Rear oxygen sensor heater current	Rear O ₂ Heater Current	A
Canister purge control solenoid valve duty ratio	CPC Valve Duty Ratio	%
Fuel level signal	Fuel Level	V
Fuel temperature signal	Fuel Temp	°C or °F
Fuel tank pressure signal	Fuel Tank Pressure	mmHg or kPa or inHg or psi
Intake air temperature signal	Intake Air Temp.	°C or °F
Learned ignition timing	Learned Ignition Timing	deg
Ignition switch signal	Ignition Switch	ON or OFF
Test mode connector signal	Test Mode Signal	ON or OFF
Neutral position switch signal	Neutral Position Switch	ON or OFF
Air conditioning switch signal	A/C Switch	ON or OFF
Air conditioning signal	A/C Compressor Signal	ON or OFF
Radiator main fan relay signal	Radiator Fan Relay #1	ON or OFF
Fuel pump relay signal	Fuel Pump Relay	ON or OFF
Knocking signal	Knocking Signal	ON or OFF
Radiator sub fan relay signal	Radiator Fan Relay #2	ON or OFF
Power steering switch signal	P/S Switch	ON or OFF
Engine torque control signal #1	Torque Control Signal #1	ON or OFF
Engine torque control signal #2	Torque Control Signal #2	ON or OFF
Engine torque control permission signal	Torque Permission Signal	ON or OFF

Subaru Select Monitor

ENGINE (DIAGNOSTICS)

Contents	Display	Unit of measure
Rear oxygen sensor rich signal	Rear O ₂ Rich Signal	ON or OFF
Starter switch signal	Starter Switch Signal	ON or OFF
Idle switch signal	Idle Switch Signal	ON or OFF
Crankshaft position sensor signal	Crankshaft Position Sig.	ON or OFF
Camshaft position sensor signal	Camshaft Position Sig.	ON or OFF
Rear defogger switch signal	Rear Defogger Switch	ON or OFF
Blower fan switch signal	Blower Fan Switch	ON or OFF
Small light switch signal	Light Switch	ON or OFF
Air assisted injector solenoid valve signal	Assist Air Sol. Valve	ON or OFF
AT/MT identification terminal	AT Model ID Signal	ON or OFF
Pressure control solenoid valve signal	PCV Solenoid Valve	ON or OFF
Vent control solenoid valve signal	Vent. Solenoid Valve	ON or OFF
Fuel tank sensor control valve signal	Tank Sensor Cntl Valve	ON or OFF

NOTE:

For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

5. READ CURRENT DATA FOR ENGINE (OBD MODE)

- 1) On «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
 - 2) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
 - 3) Press the [YES] key after the information of engine type is displayed.
 - 4) On «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
 - 5) On «OBD Menu» display screen, select the {Current Data Display & Save} and press the [YES] key.
 - 6) On «Data Display Menu» display screen, select the {Data Display} and press the [YES] key.
 - 7) Using the scroll key, move the display screen up or down until the desired data is shown.
- A list of support data is shown in the following table.

Contents	Display	Unit of measure
Number of DTC	Number of DTC	—
Malfunction indicator light status	MI (MIL)	ON or OFF
Monitoring test of misfire	Misfire monitoring	Complete or incomplete
Monitoring test of fuel system	Fuel system monitoring	Complete or incomplete
Monitoring test of comprehensive component	Component monitoring	Complete or incomplete
Test of catalytic converter	Catalyst Diagnosis	Complete or incomplete
Test of heated catalytic converter	Heated catalyst	No support
Test of evaporative emission purge control system	Evaporative purge system	Complete or incomplete
Test of secondary air system	Secondary air system	No support
Test of air conditioning system refrigerant	A/C system refrigerant	No support
Test of oxygen sensor	Oxygen sensor	Complete or incomplete
Test of oxygen sensor heater	O ₂ Heater Diagnosis	Complete or incomplete
Test of EGR system	EGR system	No support
Air fuel ratio control system for bank 1	Fuel System for Bank 1	—
Engine load data	Calculated load value	%
Engine coolant temperature signal	Coolant Temp.	°C or °F
Short term fuel trim by front oxygen (A/F) sensor	Short term fuel trim B1	%
Long term fuel trim by front oxygen (A/F) sensor	Long term fuel trim B1	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg, kPa, inHg or psi
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH
Ignition timing advance for #1 cylinder	Ignition timing adv. #1	°
Intake air temperature signal	Intake Air Temp.	°C or °F
Intake air amount	Mass Air Flow	g/s

Contents	Display	Unit of measure
Throttle position signal	Throttle Opening Angle	%
Rear oxygen sensor output signal	Oxygen Sensor #12	V
Air fuel ratio correction by rear oxygen sensor	Short term fuel trim #12	%
On-board diagnostic system	OBD System	—
A/F sensor check	A/F sensor	—
A/F sensor #11	A/F sensor #11	—
A/F sensor #11	A/F sensor #11	V

NOTE:

For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

6. READ FREEZE FRAME DATA FOR ENGINE (OBD MODE)

- 1) On «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
 - 2) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
 - 3) Press the [YES] key after the information of engine type is displayed.
 - 4) On «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
 - 5) On «OBD Menu» display screen, select the {Freeze Frame Data} and press the [YES] key.
- A list of support data is shown in the following table.

Contents	Display	Unit of measure
DTC for freeze frame data	Freeze frame data	DTC
Air fuel ratio control system for bank 1	Fuel system for Bank1	ON or OFF
Engine load data	Engine Load	%
Engine coolant temperature signal	Coolant Temp.	°C or °F
Short term fuel trim by front oxygen (A/F) sensor	Short term fuel trim B1	%
Long term fuel trim by front oxygen (A/F) sensor	Long term fuel trim B1	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg, kPa, inHg or psi
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH
Ignition timing signal	Ignition Timing	°
Intake air volume	Mass Air Flow	g/sec
Intake air temperature signal	Intake Air Temp	°C
Throttle position signal	Throttle Opening Angle	%

NOTE:

For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

7. LED OPERATION MODE FOR ENGINE

- 1) On «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
 - 2) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
 - 3) Press the [YES] key after the information of engine type is displayed.
 - 4) On «Engine Diagnosis» display screen, select the {Current Data Display & Save} and press the [YES] key.
 - 5) On «Data Display Menu» display screen, select the {Data & LED Display} and press the [YES] key.
 - 6) Using the scroll key, move the display screen up or down until the desired data is shown.
- A list of support data is shown in the following table.

Contents	Display	Message	LED "ON" requirements
Ignition switch signal	Ignition Switch	ON or OFF	When ignition switch is turned ON.
Test mode connector signal	Test Mode Signal	ON or OFF	When test mode connector is connected.
Neutral position switch signal	Neutral Position Switch	ON or OFF	When neutral position signal is entered.
Air conditioning switch signal	A/C Switch	ON or OFF	When air conditioning switch is turned ON.
Air conditioning relay signal	A/C Relay	ON or OFF	When air conditioning relay is in function.
Radiator main fan relay signal	Radiator Fan Relay #1	ON or OFF	When radiator main fan relay is in function.
Fuel pump relay signal	Fuel Pump Relay	ON or OFF	When fuel pump relay is in function.
Knocking signal	Knocking Signal	ON or OFF	When knocking signal is entered.
Radiator sub fan relay signal	Radiator Fan Relay #2	ON or OFF	When radiator sub fan relay is in function.
Engine torque control signal #1	Torque Control Signal #1	ON or OFF	When engine torque control signal 1 is entered.
Engine torque control signal #2	Torque Control Signal #2	ON or OFF	When engine torque control signal 2 is entered.
Engine torque control permission signal	Torque Control Permit	ON or OFF	When engine torque control permission signal is entered.
Rear oxygen sensor rich signal	Rear O ₂ Rich Signal	ON or OFF	When rear oxygen sensor mixture ratio is rich.
Starter switch signal	Starter Switch Signal	ON or OFF	When starter switch signal is entered.
Idle switch signal	Idle Switch Signal	ON or OFF	When idle switch signal is entered.
Crankshaft position sensor signal	Crankshaft Position Sig.	ON or OFF	When crankshaft position sensor signal is entered.
Camshaft position sensor signal	Camshaft Position Sig.	ON or OFF	When camshaft position sensor signal is entered.
Power steering switch signal	P/S Switch	ON or OFF	When power steering switch signal is entered.
Rear defogger switch signal	Rear Defogger Switch	ON or OFF	When rear defogger switch is turned ON.
Blower fan switch signal	Blower Fan Switch	ON or OFF	When blower fan switch is turned ON.
Small light switch signal	Light Switch	ON or OFF	When small light switch is turned ON.
Air assist injector solenoid valve signal	Assist Air Sol. Valve	ON or OFF	When air assist injector solenoid valve signal is input.
AT/MT identification terminal	AT Model ID Signal	ON or OFF	ON when vehicle is AT.
Pressure control solenoid valve signal	PCV Solenoid Valve	ON or OFF	When pressure control valve signal is entered.
Vent control solenoid valve signal	Vent Solenoid Valve	ON or OFF	When vent control valve signal is entered.
Fuel tank sensor control valve signal	Tank Sensor Cntl Valve	ON or OFF	When fuel tank sensor control signal entered.

NOTE:

For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

8. READ CURRENT DATA FOR AT

- 1) On «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
 - 2) On «System Selection Menu» display screen, select the {Transmission Control System} and press the [YES] key.
 - 3) Press the [YES] key after the information of transmission type is displayed.
 - 4) On «Transmission Diagnosis» display screen, select the {Current Data Display & Save} and press the [YES] key.
 - 5) On «Data Display Menu» display screen, select the {Data Display} and press the [YES] key.
 - 6) Using the scroll key, move the display screen up or down until the desired data is shown.
- A list of support data is shown in the following table.

Contents	Display	Unit of measure
Battery voltage	Battery Voltage	V
Rear vehicle speed sensor signal	Vehicle Speed #1	km/h or MPH
Front vehicle speed sensor signal	Vehicle Speed #2	km/h or MPH
Engine speed signal	Engine Speed	rpm
Automatic transmission fluid temperature signal	ATF Temp.	°C or °F
Throttle position signal	Throttle Sensor Voltage	V
Gear position	Gear Position	—
Line pressure control duty ratio	Line Pressure Duty Ratio	%
Lock up clutch control duty ratio	Lock Up Duty Ratio	%
Transfer clutch control duty ratio	Transfer Duty Ratio	%
Power supply for throttle position sensor	Throttle Sensor Power	V
Torque converter turbine speed signal	AT Turbine Speed	rpm
2-4 brake timing pressure control duty ratio	2-4B Duty Ratio	%
Manifold absolute pressure sensor voltage	Mani. Pressure Voltage	V
2 wheel drive switch signal	2WD Switch	ON or OFF
Kick down switch signal	Kick Down Switch	ON or OFF
Stop light switch signal	Stop light Switch	ON or OFF
Anti lock brake system signal	ABS Signal	ON or OFF
Cruise control system signal	Cruise Control Signal	ON or OFF
Neutral/Parking range signal	N/P Range Signal	ON or OFF
Reverse range signal	R Range Signal	ON or OFF
Drive range signal	D Range Signal	ON or OFF
3rd range signal	3rd Range Signal	ON or OFF
2nd range signal	2nd Range Signal	ON or OFF
1st range signal	1st Range Signal	ON or OFF
Shift control solenoid A	Shift Solenoid #1	ON or OFF
Shift control solenoid B	Shift Solenoid #2	ON or OFF
Torque control output signal #1	Torque Control Signal #1	ON or OFF
Torque control output signal #2	Torque Control Signal #2	ON or OFF
Torque control cut signal	Torque Control Cut Sig.	ON or OFF
2-4 brake timing control solenoid valve	2-4 Brake Timing Sol.	ON or OFF
Low clutch timing control solenoid valve	Low Clutch Timing Sol.	ON or OFF
Automatic transmission diagnosis indicator light	AT Diagnosis light	ON or OFF

NOTE:

For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

11. Read Diagnostic Trouble Code (DTC)

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
- 2) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
- 3) Press the [YES] key after the information of engine type is displayed.
- 4) On «Engine Diagnosis» display screen, select the {Diagnostic Code(s) Display} and press the [YES] key.
- 5) On «Diagnostic Code(s) Display» display screen, select the {Current Diagnostic Code(s)} or {History Diagnostic Code(s)} and press the [YES] key.

NOTE:

- For detailed operation procedure, refer to SUBARU SELECT MONITOR OPERATION MANUAL.
- For details concerning DTC, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>

2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
- 2) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
- 3) Press the [YES] key after the information of engine type is displayed.
- 4) On «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
- 5) On «OBD Menu» display screen, select the {Diagnosis Code(s) Display} and press the [YES] key.
- 6) Make sure that a DTC is shown on display screen.

NOTE:

- For detailed operation procedure, refer to SUBARU SELECT MONITOR OPERATION MANUAL.
- For details concerning DTC, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>

3. OBD-II GENERAL SCAN TOOL

Refers to data denoting emission-related powertrain DTC.

For details concerning DTC, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>

NOTE:

Refer to OBD-II general scan tool manufacturer's instruction manual to access emission-related powertrain DTC (MODE \$03).

12. Inspection Mode

A: OPERATION

Carry out trouble diagnosis shown in the following DTC table.

When performing trouble diagnosis which is not shown in the DTC table, refer to the next item Drive cycle.

<Ref. to EN(H4SO)(diag)-42, Drive Cycle.>

DTC	Item
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)
P0066	Air Assisted Injector Control Circuit or Circuit Low
P0068	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance Problem
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input
P0112	Intake Air Temperature Circuit Low Input
P0113	Intake Air Temperature Circuit High Input
P0117	Engine Coolant Temperature Circuit Low Input
P0118	Engine Coolant Temperature Circuit High Input
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input
P0129	Atmospheric Pressure Sensor Circuit Range/Performance
P0130	O ₂ Sensor Circuit (Bank 1 Sensor 1)
P0131	O ₂ Sensor Circuit Low Voltage (Bank 1 Sensor 1)
P0132	O ₂ Sensor Circuit High Voltage (Bank 1 Sensor 1)
P0134	O ₂ Sensor Circuit No Activity Detected (Bank 1 Sensor 1)
P0137	O ₂ Sensor Circuit Low Voltage (Bank 1 Sensor 2)
P0138	O ₂ Sensor Circuit High Voltage (Bank 1 Sensor 2)
P0182	Fuel Temperature Sensor "A" Circuit Low Input
P0183	Fuel Temperature Sensor "A" Circuit High Input
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)
P0335	Crankshaft Position Sensor "A" Circuit
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)
P0341	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)
P0447	Evaporative Emission Control System Vent Control Circuit Open
P0448	Evaporative Emission Control System Vent Control Circuit Shorted
P0452	Evaporative Emission Control System Pressure Sensor Low Input
P0453	Evaporative Emission Control System Pressure Sensor High Input
P0458	Evaporative Emission Control System Purge Control Valve Circuit Low
P0462	Fuel Level Sensor Circuit Low Input
P0463	Fuel Level Sensor Circuit High Input
P0502	Vehicle Speed Sensor Circuit Low Input
P0503	Vehicle Speed Sensor Intermittent/Erratic/High
P0512	Starter Request Circuit
P0519	Idle Control System Malfunction (Fail-Safe)
P0565	Cruise Control On Signal
P0604	Internal Control Module Random Access Memory (RAM) Error
P0691	Cooling Fan 1 Control Circuit Low
P0703	Torque Converter/Brake Switch "B" Circuit

Inspection Mode

ENGINE (DIAGNOSTICS)

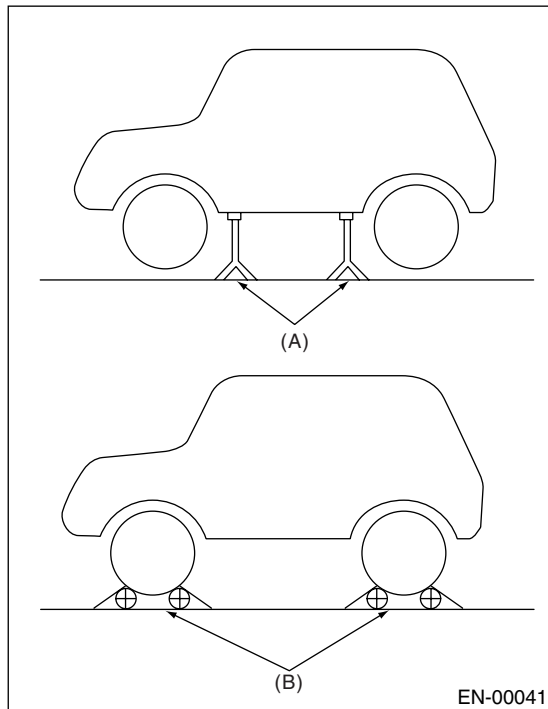
DTC	Item
P0705	Transmission Range Sensor Circuit (PRNDL Input)
P0710	Transmission Fluid Temperature Sensor Circuit
P0716	Torque Converter Turbine Speed Sensor
P0720	Output Speed Sensor Circuit
P0726	Engine Speed Input Circuit Range/Performance
P0731	Gear 1 Incorrect Ratio
P0732	Gear 2 Incorrect Ratio
P0733	Gear 3 Incorrect Ratio
P0734	Gear 4 Incorrect Ratio
P0741	Torque Converter Clutch Circuit Performance or Stuck Off
P0743	Torque Converter Clutch Circuit Electrical
P0748	Pressure Control Solenoid "A" Electrical
P0753	Shift Solenoid "A" Electrical
P0758	Shift Solenoid "B" Electrical
P0771	Low Clutch Timing Solenoid
P0778	Pressure Control Solenoid "B" Electrical
P0785	Shift/Timing Solenoid
P0851	Neutral Switch Input Circuit Low
P0852	Neutral Switch Input Circuit High
P0864	TCM Communication Circuit Range/Performance
P0865	TCM Communication Circuit Low
P0866	TCM Communication Circuit High
P1110	Atmospheric Pressure Sensor Circuit Malfunction (Low Input)
P1111	Atmospheric Pressure Sensor Circuit Malfunction (High Input)
P1134	A/F Sensor Micro-computer Problem
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low
P1420	Fuel Tank Pressure Control Solenoid Valve Circuit High
P1446	Fuel Tank Sensor Control Valve Circuit Low
P1447	Fuel Tank Sensor Control Valve Circuit High
P1510	ISC Solenoid Valve Signal #1 Circuit Malfunction (Low Input)
P1511	ISC Solenoid Valve Signal #1 Circuit Malfunction (High Input)
P1512	ISC Solenoid Valve Signal #2 Circuit Malfunction (Low Input)
P1513	ISC Solenoid Valve Signal #2 Circuit Malfunction (High Input)
P1514	ISC Solenoid Valve Signal #3 Circuit Malfunction (Low Input)
P1515	ISC Solenoid Valve Signal #3 Circuit Malfunction (High Input)
P1516	ISC Solenoid Valve Signal #4 Circuit Malfunction (Low Input)
P1517	ISC Solenoid Valve Signal #4 Circuit Malfunction (High Input)
P1518	Starter Switch Circuit Low Input
P1560	Back-up Voltage Circuit Malfunction
P1698	Engine Torque Control Cut Signal Circuit Low Input
P1699	Engine Torque Control Cut Signal Circuit High Input
P1700	Throttle Position Sensor
P1711	Engine Torque Control Signal 1 Circuit Malfunction
P1712	Engine Torque Control Signal 2 Circuit Malfunction

1. PREPARATION FOR THE INSPECTION MODE

- 1) Make sure the fuel remains approx. half amount [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)] and the battery voltage is 12 V or more.
- 2) Raise the vehicle using a garage jack and place on safety stands or drive the vehicle onto free rollers.

WARNING:

- Before raising the vehicle, ensure the parking brake is applied.
- Do not use a pantograph jack in place of a safety stand.
- Secure a rope or wire to the front and rear towing or tie-down hooks to prevent the lateral runout of front wheels.
- Do not abruptly depress/release the clutch pedal or accelerator pedal during works even when engine is operating at low speeds since this may cause vehicle to jump off free rollers.
- In order to prevent the vehicle from slipping due to vibration, do not place any wooden blocks or similar items between the safety stands and the vehicle.
- Since the rear wheels will also rotate, do not place anything near them. Also, make sure nobody goes in front of the vehicle.

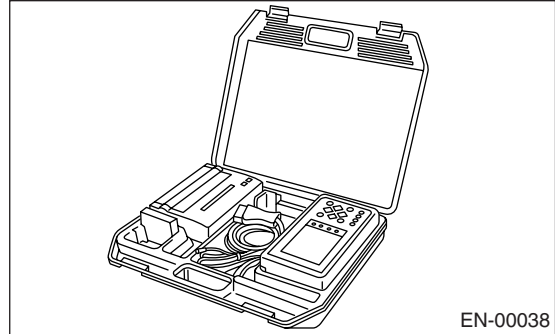


EN-00041

- (A) Safety stand
(B) Free rollers

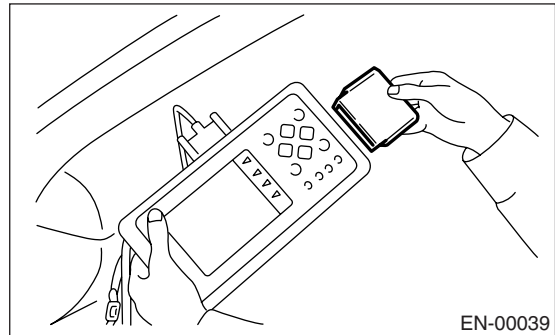
2. SUBARU SELECT MONITOR

- 1) After clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4SO)(diag)-44, Clear Memory Mode.>
- 2) Warm up the engine.
- 3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>



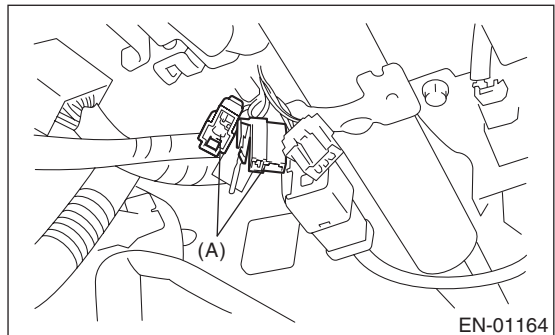
EN-00038

- 4) Connect the diagnosis cable to Subaru Select Monitor.
- 5) Insert the cartridge into Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>



EN-00039

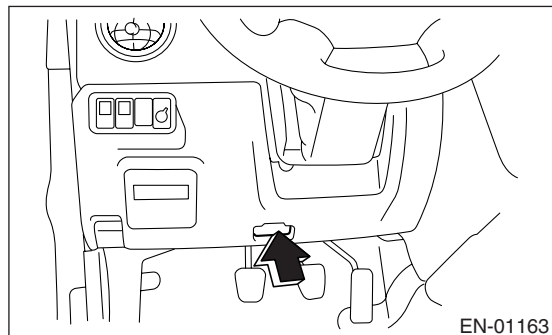
- 6) Connect the test mode connector (A) at the lower portion of instrument panel (on driver's side).



EN-01164

- 7) Connect the Subaru Select Monitor to data link connector.

- (1) Data link connector is located in the lower portion of the instrument panel (on the driver's side).

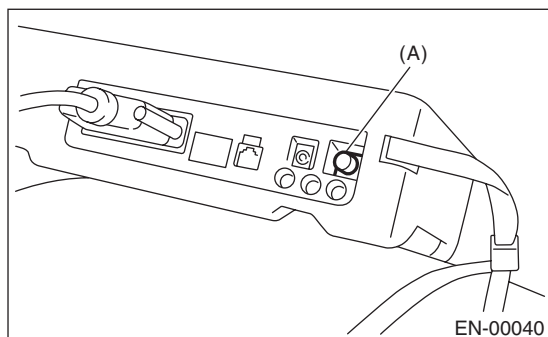


- (2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect the scan tools except for Subaru Select Monitor and OBD-II general scan tool.

- 8) Turn the ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



(A) Power switch

- 9) On «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
- 10) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
- 11) Press the [YES] key after the information of engine type is displayed.
- 12) On «Engine Diagnosis» display screen, select the {Dealer Check Mode Procedure} and press the [YES] key.
- 13) When the "Perform Inspection (Dealer Check) Mode?" is shown on display screen, press the [YES] key.
- 14) Perform subsequent procedures as instructed on display screen.
 - If trouble still remains in memory, the corresponding DTC appears on display screen.

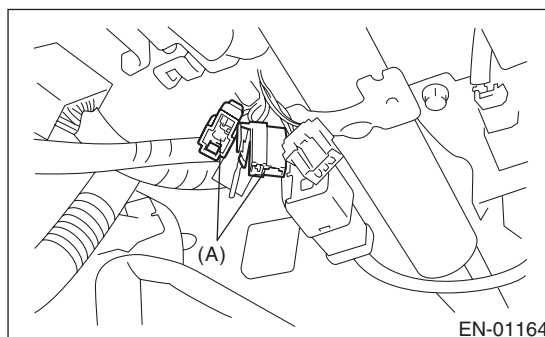
NOTE:

- For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.

- For details concerning the DTC, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>
- Release the parking brake.
- The speed difference between front and rear wheels may light either the ABS warning light, but this indicates no malfunctions. When the engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system.

3. OBD-II GENERAL SCAN TOOL

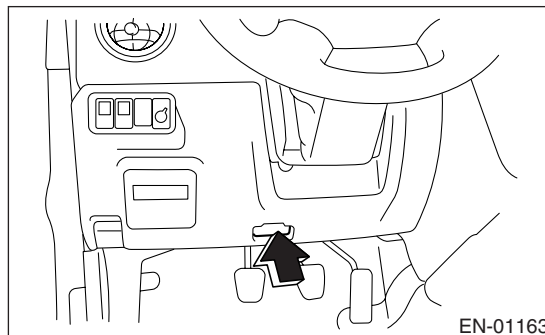
- 1) After clearing memory, check for any remaining unresolved trouble data: <Ref. to EN(H4SO)(diag)-44, Clear Memory Mode.>
- 2) Warm up the engine.
- 3) Connect the test mode connector (A) at the lower side of instrument panel (on the driver's side).



- 4) Connect the OBD-II general scan tool to its data link connector.

CAUTION:

Do not connect the scan tools except for Subaru Select Monitor and OBD-II general scan tool.



- 5) Start the engine.

NOTE:

- Ensure the selector lever is placed in "P" position before starting. (AT models)
 - Depress the clutch pedal when starting engine. (MT models)
- 6) Using the selector lever or shift lever, turn the "P" position switch and "N" position switch to ON.

- 7) Depress the brake pedal to turn brake switch ON. (AT models)
- 8) Keep the engine speed in 2,500 — 3,000 rpm range for 40 seconds.
- 9) Place the selector lever or shift lever in “D” position (AT models) or “1st” gear (MT models) and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

NOTE:

- On AWD vehicles, release the parking brake.
- The speed difference between front and rear wheels may light ABS warning light, but this indicates no malfunctions. When the engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis system.

- 10) Using the OBD-II general scan tool, check for DTC and record the result(s).

NOTE:

- For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.
- For details concerning DTC, refer to the List of Diagnostic Trouble Code (DTC).

<Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>

13. Drive Cycle

A: OPERATION

There are three drive patterns for the trouble diagnosis. Driving in the specified pattern allows to diagnose malfunctioning items listed below. After the malfunctioning items listed below are repaired, always check whether they correctly resume their functions by driving in the required drive pattern.

1. PREPARATION FOR DRIVE CYCLE

- 1) Make sure that the fuel remains approx. half amount [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)], and battery voltage is 12 V or more.
- 2) After performing the diagnostics and cleaning memory, check for any remaining unresolved trouble data. <Ref. to EN(H4SO)(diag)-44, Clear Memory Mode.>
- 3) Separate the test mode connector.

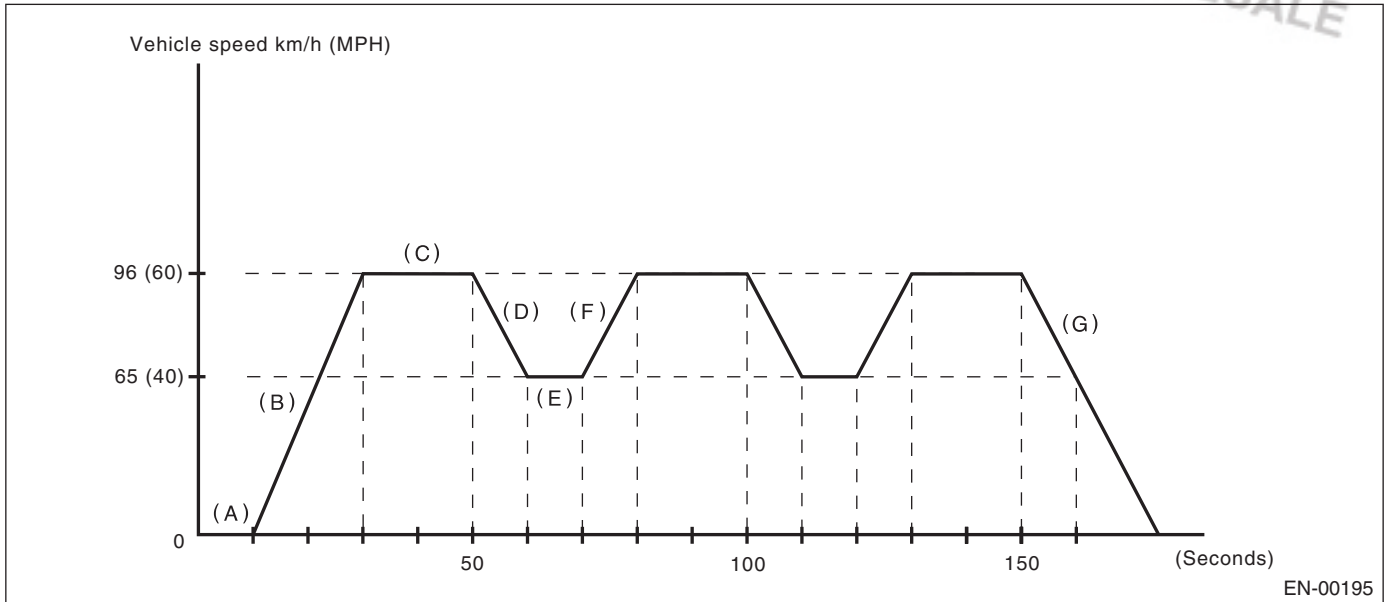
NOTE:

- Except for the water temperature specified items at starting, the diagnosis is carried out after engine warm up.
- Carry out the diagnosis which is marked * on DTC twice, then, after finishing first diagnosis, stop the engine and do second time at the same condition.

2. AFTER RUNNING 20 MINUTES AT 80 KM/H (50 MPH), IDLE ENGINE FOR 1 MINUTE.

DTC	Item	Condition
P0067	Air Assisted Injector Control Circuit High	Coolant temperature at start is less than 60°C (140°F).
*P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	Coolant temperature at start is less than 20°C (68°F).
*P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	—
*P0133	O ₂ Sensor Circuit Slow Response (Bank 1 Sensor 1)	—
*P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	—
*P0420	Catalyst System Efficiency Below Threshold (Bank 1)	—
*P0442	Evaporative Emission Control System Leak Detected (small leak)	—
*P0451	Evaporative Emission Control System Pressure Sensor Range/Performance	—
*P0456	Evaporative Emission Control System Leak Detected (very small leak)	—
*P0457	Evaporative Emission Control System Leak Detected (fuel cap loose/off)	—
*P0459	Evaporative Emission Control System Purge Control Valve Circuit High	—
*P0461	Fuel Level Sensor Circuit Range/Performance	—
*P0692	Cooling Fan 1 Control Circuit High	—
P1137	O ₂ Sensor Circuit (Bank1 Sensor1)	—
P1443	Vent Control Solenoid Valve Function Problem	—
*P1448	Fuel Tank Sensor Control Valve Range/Performance Problem	—
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	—
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	—

3. DRIVE ACCORDING TO THE FOLLOWING DRIVE PATTERN



(A) Idle engine for 1 minute.	(D) Decelerate with fully closed throttle to 65 km/h (40 MPH).	(F) Accelerate to 96 km/h (60 MPH) within 10 seconds.
(B) Accelerate to 96 km/h (60 MPH) within 20 seconds.	(E) Drive vehicle at 65 km/h (40 MPH) for 10 seconds.	(G) Stop vehicle with throttle fully closed.
(C) Drive vehicle at 96 km/h (60 MPH) for 20 seconds.		

DTC	Item	Condition
*P0065	Air Assisted Injector Control Range/Performance	—
*P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	—
*P0139	O ₂ Sensor Circuit Slow Response (Bank 1 Sensor 2)	—
*P0301	Cylinder 1 Misfire Detected	Diagnosis frequency is different from misfire ratio.
*P0302	Cylinder 2 Misfire Detected	Diagnosis frequency is different from misfire ratio.
*P0303	Cylinder 3 Misfire Detected	Diagnosis frequency is different from misfire ratio.
*P0304	Cylinder 4 Misfire Detected	Diagnosis frequency is different from misfire ratio.

4. TEN MINUTES IDLING

NOTE:

Drive the vehicle at 10 km/h (6 MPH) or more before diagnosis.

DTC	Item	Condition
*P0111	Intake Air Temperature Circuit Range/Performance	Coolant temperature at start is less than 30°C (86°F).
*P0171	System Too Lean (Bank 1)	
*P0172	System Too Rich (Bank 1)	
*P0464	Fuel Level Sensor Circuit Intermittent	
*P0483	Cooling Fan Rationality Check	
*P0506	Idle Control System RPM Lower Than Expected	
*P0507	Idle Control System RPM Higher Than Expected	

14. Clear Memory Mode

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

- 1) On «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
- 2) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
- 3) Press the [YES] key after the information of engine type is displayed.
- 4) On «Engine Diagnosis» display screen, select the {Clear Memory} and press the [YES] key.
- 5) When the 'Done' and 'Turn Ignition Switch OFF' are shown on display screen, turn the ignition switch to OFF, and then turn the Subaru Select Monitor to OFF.

NOTE:

- After the memory has been cleared, the idle air control solenoid valve must be initialized. To do this, turn the ignition switch to ON position. Wait 3 seconds before starting the engine.
- For detailed operation procedure, refer to SUBARU SELECT MONITOR OPERATION MANUAL.

2. SUBARU SELECT MONITOR (OBD MODE)

- 1) On «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
- 2) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
- 3) Press the [YES] key after the information of engine type is displayed.
- 4) On «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
- 5) On «OBD Menu» display screen, select the {4. Diagnosis Code(s) Cleared} and press the [YES] key.
- 6) When the 'Clear Diagnostic Code?' is shown on the display screen, press the [YES] key.
- 7) Turn the Subaru Select Monitor and ignition switch to OFF.

NOTE:

- After the memory has been cleared, the idle air control solenoid valve must be initialized. To do this, turn the ignition switch to ON position. Wait 3 seconds before starting the engine.
- For detailed operation procedure, refer to SUBARU SELECT MONITOR OPERATION MANUAL.

3. OBD-II GENERAL SCAN TOOL

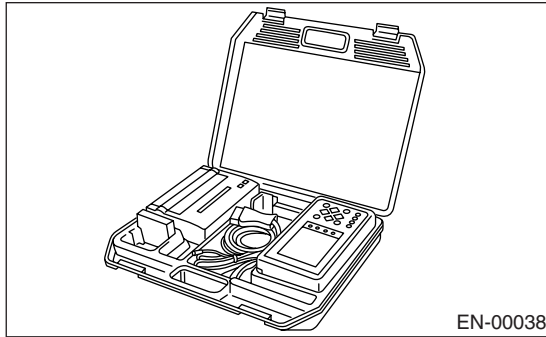
For clear memory procedures using the OBD-II general scan tool, refer to OBD-II General Scan Tool Instruction Manual.

After the memory has been cleared, the idle air control solenoid valve must be initialized. To do this, turn the ignition switch to ON position. Wait 3 seconds before starting the engine.

15. Compulsory Valve Operation Check Mode

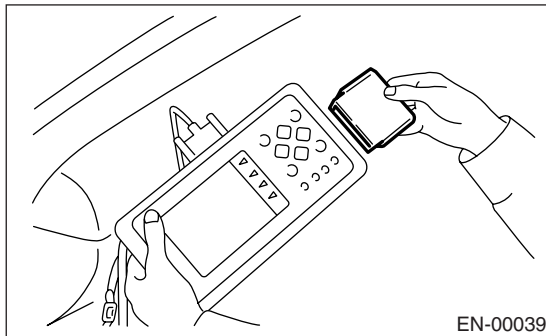
A: OPERATION

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>

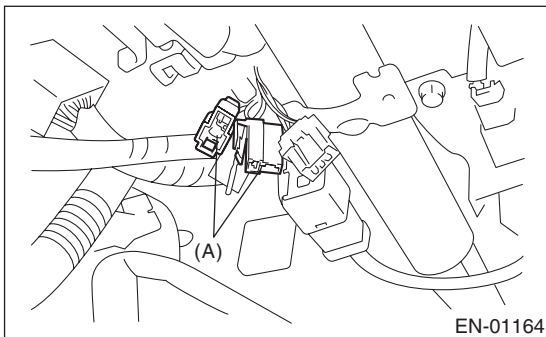


2) Connect the diagnosis cable to Subaru Select Monitor.

3) Insert the cartridge into Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>

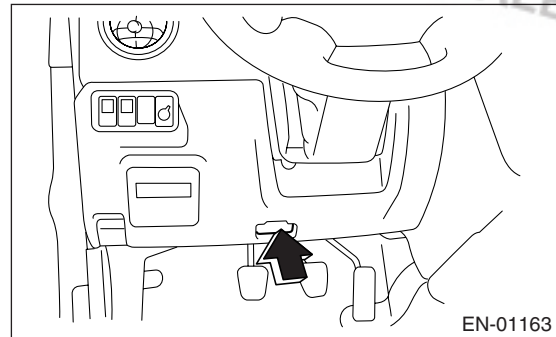


4) Connect the test mode connector (A) at the lower portion of instrument panel (on driver's side).



5) Connect the Subaru Select Monitor to data link connector.

(1) Data link connector is located in the lower portion of instrument panel (on driver's side).

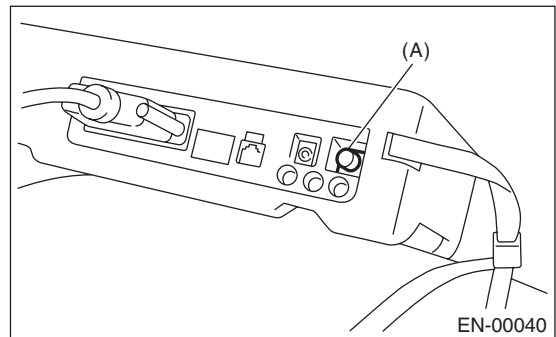


(2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect scan tools except for Subaru Select Monitor and OBD-II general scan tool.

6) Turn the ignition switch to ON (engine OFF) and Subaru Select Monitor switch to ON.



(A) Power switch

7) On «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.

8) On «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.

9) Press the [YES] key after the information of engine type is displayed.

10) On «Engine Diagnosis» display screen, select the {System Operation Check Mode} and press the [YES] key.

11) On «System Operation Check Mode» display screen, select the {Actuator ON/OFF Operation} and press the [YES] key.

12) Select the desired compulsory actuator on the «Actuator ON/OFF Operation» display screen and press the [YES] key.

13) Pressing the [NO] key completes the compulsory operation check mode. The display will then return to the «Actuator ON/OFF Operation» screen.

Compulsory Valve Operation Check Mode

ENGINE (DIAGNOSTICS)

- A list of support data is shown in the following table.

Contents	Display
Compulsory fuel pump relay operation check	Fuel Pump Relay
Compulsory radiator fan relay operation check	Radiator Fan Relay
Compulsory air conditioning relay operation check	A/C Compressor Relay
Compulsory purge control solenoid valve operation check	CPC Solenoid Valve
Compulsory air assist injector solenoid valve operation check	AAI Solenoid Valve
Compulsory pressure control solenoid valve operation check	PCV Solenoid Valve
Compulsory air assist vent control solenoid valve operation check	Vent Control Solenoid Valve
Compulsory fuel tank sensor control solenoid valve operation check	Fuel Tank Sensor Control Valve

NOTE:

- The following parts will be displayed but not functional because they are not installed on vehicle.

Display
Turbocharger Wastegate Solenoid
ASV Solenoid Valve
FICD Solenoid
Pressure Switching Sol. 1
Pressure Switching Sol. 2
Turbocharger Wastegate Solenoid

- For detailed operation procedure, refer to SUBARU SELECT MONITOR OPERATION MANUAL.

16. Malfunction Indicator Light

A: PROCEDURE

1. Activation of malfunction indicator light. <Ref. to EN(H4SO)(diag)-48, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.>
↓
2. Malfunction indicator light does not come on. <Ref. to EN(H4SO)(diag)-49, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON., Malfunction Indicator Light.>
↓
3. Malfunction indicator light does not go off. <Ref. to EN(H4SO)(diag)-51, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF., Malfunction Indicator Light.>
↓
4. Malfunction indicator light does not blink at a cycle of 3 Hz. <Ref. to EN(H4SO)(diag)-52, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK AT A CYCLE OF 3 HZ., Malfunction Indicator Light.>
↓
5. Malfunction indicator light remains blinking at a cycle of 3 Hz. <Ref. to EN(H4SO)(diag)-54, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING AT A CYCLE OF 3 HZ., Malfunction Indicator Light.>

Malfunction Indicator Light

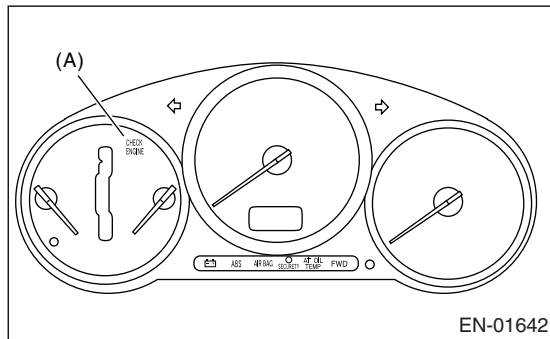
ENGINE (DIAGNOSTICS)

B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

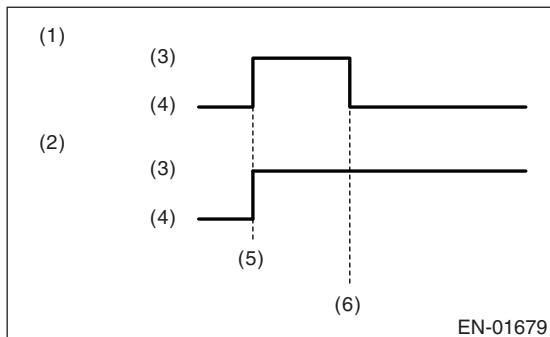
1) When the ignition switch is turned to ON (engine off), the malfunction indicator light (A) in the combination meter illuminates.

NOTE:

If the malfunction indicator light does not illuminate, perform diagnostics of the malfunction indicator light circuit or the combination meter circuit. <Ref. to EN(H4SO)(diag)-49, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON., Malfunction Indicator Light.>

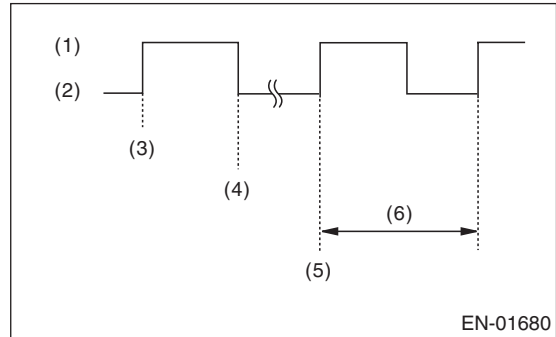


2) After starting the engine, the malfunction indicator light goes out. If it does not, either the engine or the emission control system is malfunctioning.



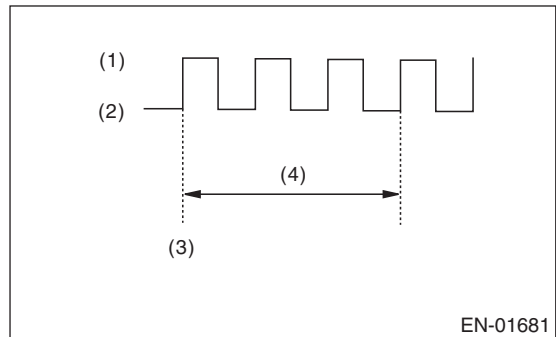
- (1) No trouble
- (2) Trouble occurs
- (3) ON
- (4) OFF
- (5) Ignition switch ON
- (6) Engine start

3) If the diagnosis system senses a misfire which could damage the catalyzer, the malfunction indicator light will blink at a cycle of 1 Hz.



- (1) ON
- (2) OFF
- (3) Ignition switch ON
- (4) Engine start
- (5) Misfire start
- (6) 1 second

4) When the ignition switch is turned to ON (engine off) or to "START" with test mode connector connected, the malfunction indicator light blinks at a cycle of 3 Hz.



- (1) ON
- (2) OFF
- (3) Ignition switch ON
- (4) 1 second

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

C: MALFUNCTION INDICATOR LIGHT DOES NOT COME ON.

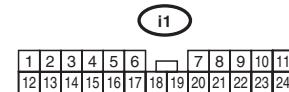
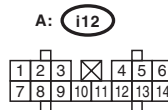
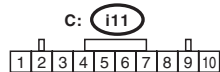
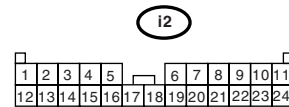
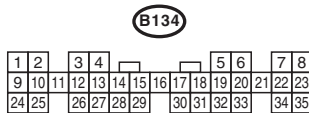
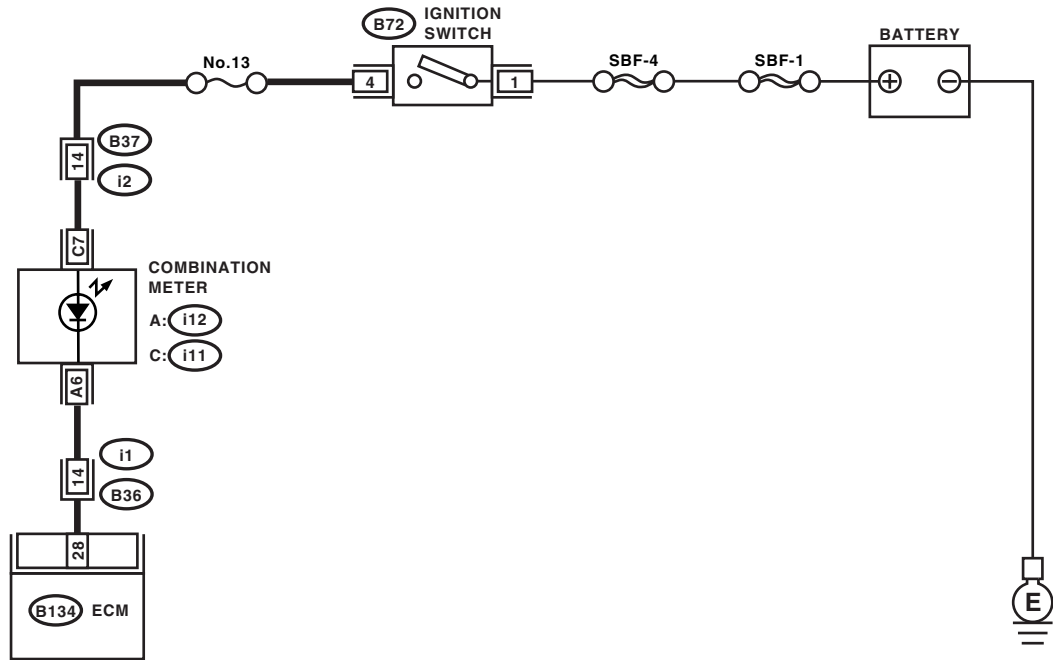
DIAGNOSIS:

The malfunction indicator light circuit is open or shorted.

TROUBLE SYMPTOM:

When the ignition switch is turned ON (engine OFF), malfunction indicator light does not come on.

WIRING DIAGRAM:



EN-01643

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 28 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 4.	Go to step 2.
2 CHECK POOR CONTACT. Check poor contact by shaking or pulling ECM connector and harness.	Does the malfunction indicator light illuminate?	Repair poor contact in ECM connector.	Go to step 3.
3 CHECK ECM CONNECTOR. Check the ECM connector connection.	Is the ECM connector correctly connected?	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Repair connection of ECM connector.
4 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Remove the combination meter. <Ref. to IDI-10, Combination Meter Assembly.> 3) Disconnect the connector from ECM and combination meter. 4) Measure the resistance of harness between ECM and combination meter connector. Connector & terminal (B134) No. 28 — (i12) No. 6:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and combination meter connector • Poor contact in coupling connector
5 CHECK POOR CONTACT. Check poor contact in combination meter connector.	Is there poor contact in combination meter connector?	Repair poor contact in combination meter connector.	Go to step 6.
6 CHECK HARNESS BETWEEN COMBINATION METER AND IGNITION SWITCH CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between combination meter connector and chassis ground. Connector & terminal (i11) No. 7 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Replace the combination meter circuit board. <Ref. to IDI-10, Combination Meter Assembly.>	Check the following and repair if necessary. NOTE: • Blown out fuse (No. 13). • Open or short circuit in harness between fuse (No. 13) and battery terminal • Poor contact in ignition switch connector

D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF.

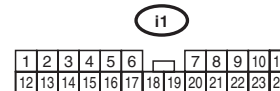
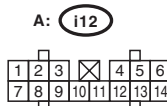
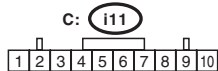
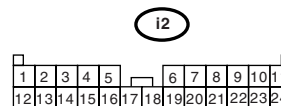
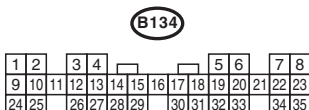
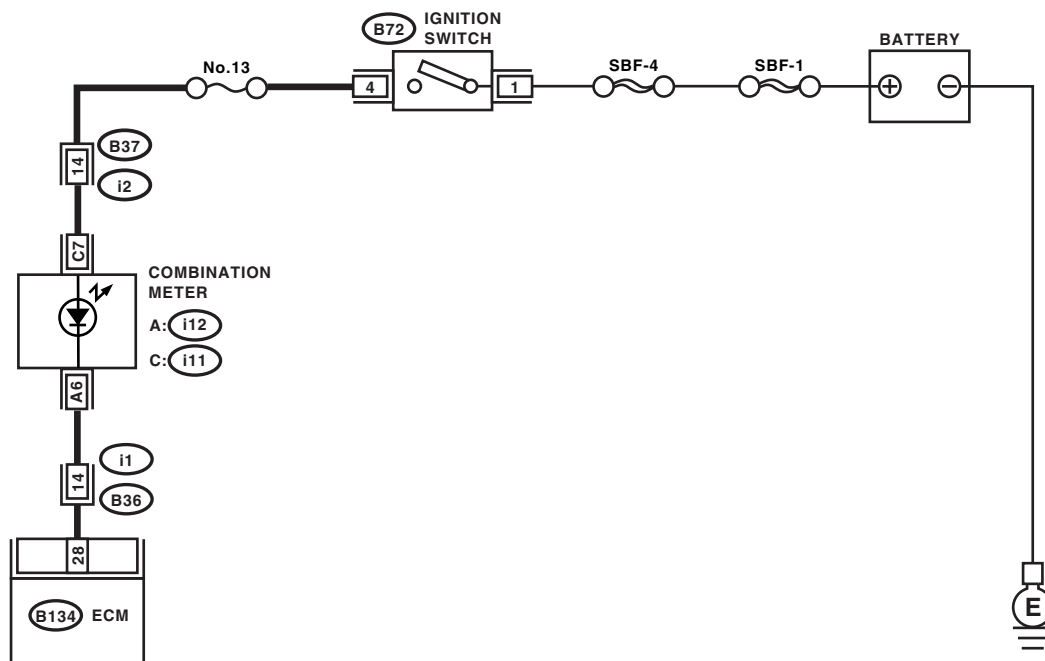
DIAGNOSIS:

The malfunction indicator light circuit is shorted.

TROUBLE SYMPTOM:

Although malfunction indicator light comes on when the engine runs, DTC is not shown on Subaru select monitor or OBD-II general scan tool display.

WIRING DIAGRAM:



EN-01643

Step	Check	Yes	No
1	CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Turn the ignition switch to ON.	Dose the malfunction indicator light illuminate? Repair short circuit in harness between combination meter and ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

E: MALFUNCTION INDICATOR LIGHT DOES NOT BLINK AT A CYCLE OF 3 Hz.

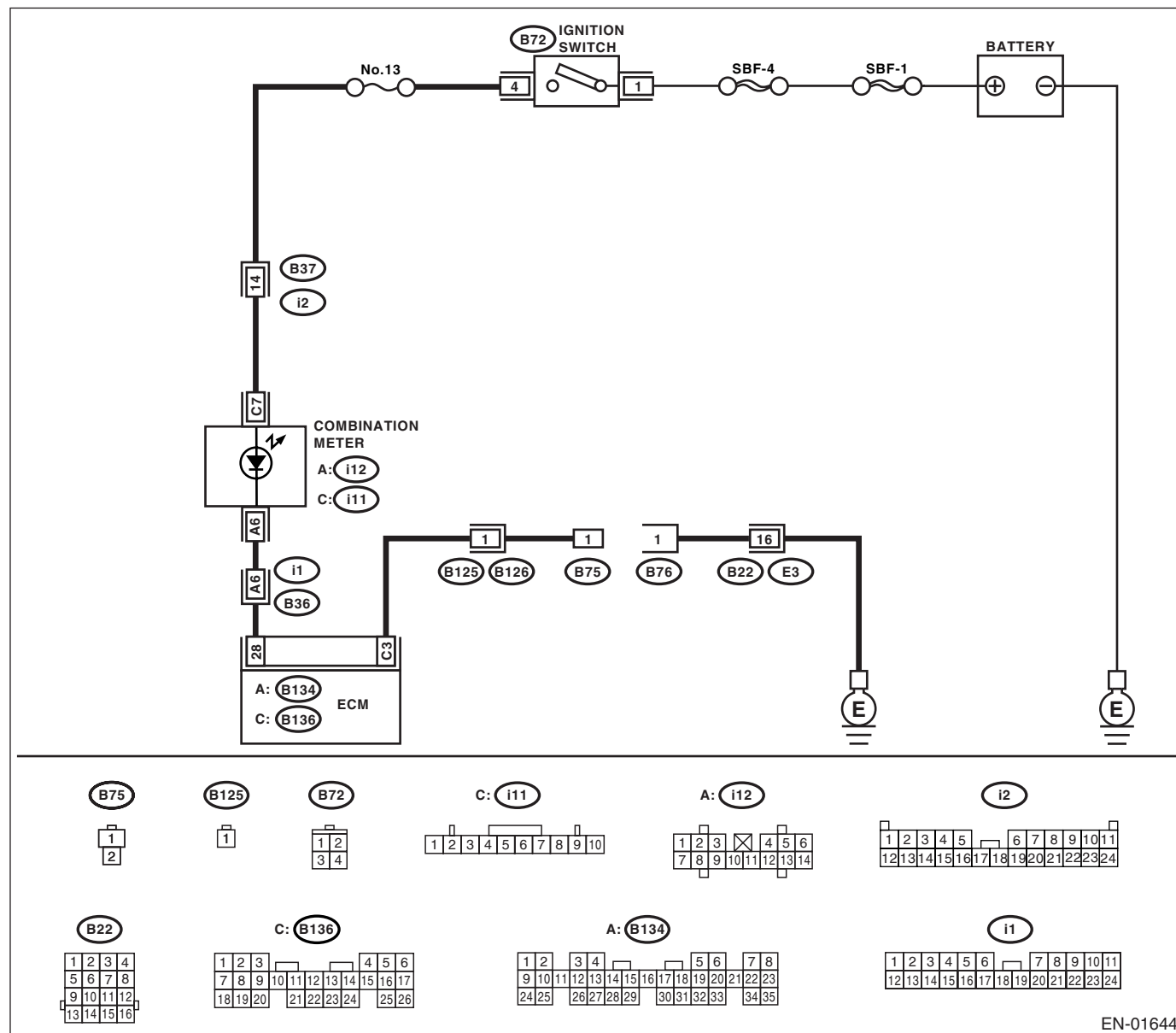
DIAGNOSIS:

- The malfunction indicator light circuit is open or shorted.
- Test mode connector circuit is in open.

TROUBLE SYMPTOM:

When in inspection mode, malfunction indicator light does not blink at a cycle of 3 Hz.

WIRING DIAGRAM:



EN-01644

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK STATUS OF MALFUNCTION INDICATOR LIGHT. 1) Turn the ignition switch to OFF. 2) Disconnect the test mode connector. 3) Turn the ignition switch to ON. (engine OFF)	Dose the malfunction indicator light illuminate?	Go to step 2.	Repair the malfunction indicator light circuit. <Ref. to EN(H4SO)(diag)-49, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON., Malfunction Indicator Light.>
2 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Turn the ignition switch to ON.	Dose the malfunction indicator light illuminate?	Repair ground short circuit in harness between combination meter and ECM connector.	Go to step 3.
3 CHECK HARNESS BETWEEN TEST MODE CONNECTOR AND CHASSIS GROUND. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between test mode connector and chassis ground. <i>Connector & terminal (B76) No. 1 — Chassis ground:</i>	Is the resistance less than 1 Ω ?	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between test mode connector and chassis ground
4 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Go to step 5.
5 CHECK HARNESS BETWEEN ECM AND TEST MODE CONNECTOR. 1) Connect the test mode connector. 2) Measure the resistance of harness between ECM and chassis ground. <i>Connector & terminal (B136) No. 3 — Chassis ground:</i>	Is the resistance less than 1 Ω ?	Go to step 6.	Repair open circuit in harness between ECM and test mode connector.
6 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

F: MALFUNCTION INDICATOR LIGHT REMAINS BLINKING AT A CYCLE OF 3 Hz.

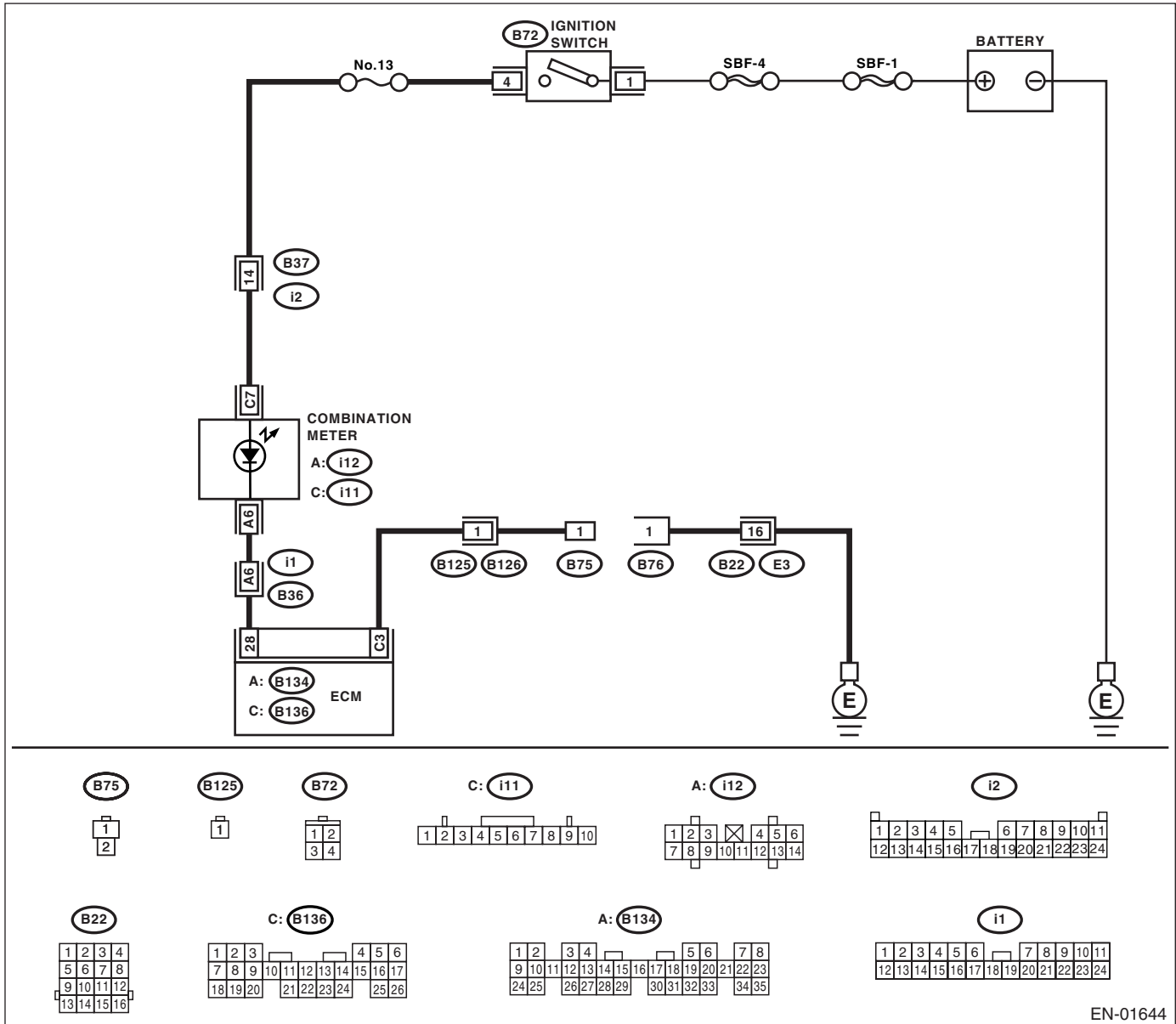
DIAGNOSIS:

Test mode connector circuit is shorted.

TROUBLE SYMPTOM:

Malfunction indicator light blinks at a cycle of 3 Hz when the ignition switch is turned to ON.

WIRING DIAGRAM:



EN-01644

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK TEST MODE CONNECTOR. 1) Disconnect the test mode connector. 2) Turn the ignition switch to ON.	Dose the malfunction indicator light blink?	Go to step 2.	System is in good order. NOTE: Malfunction indicator light blinks at a cycle of 3 Hz when test mode connector is connected.
2 CHECK HARNESS BETWEEN ECM CONNECTOR AND ENGINE GROUNDING TERMINAL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 3 — Chassis ground:	Is the resistance less than 5 Ω ?	Repair short circuit in harness between ECM and test mode connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

17. Diagnostics for Engine Starting Failure

A: PROCEDURE

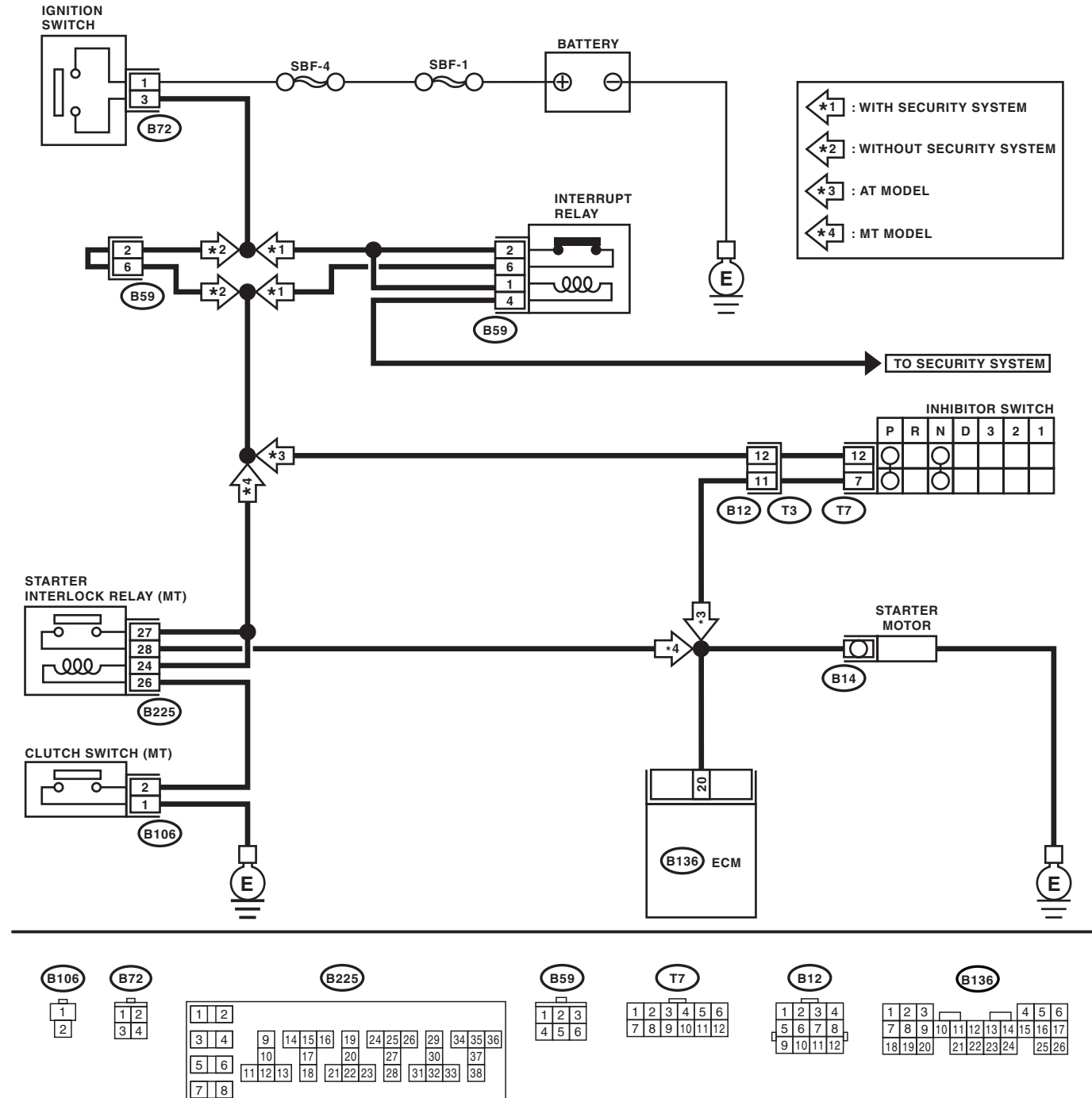
1. Inspection of starter motor circuit. <Ref. to EN(H4SO)(diag)-57, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
2. Inspection of ECM power supply and ground line. <Ref. to EN(H4SO)(diag)-60, CONTROL MODULE POWER SUPPLY AND GROUND LINE, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ignition control system. <Ref. to EN(H4SO)(diag)-63, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
4. Inspection of fuel pump circuit. <Ref. to EN(H4SO)(diag)-66, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel injector circuit. <Ref. to EN(H4SO)(diag)-69, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

B: STARTER MOTOR CIRCUIT

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK BATTERY. Check the battery voltage.	Is the voltage more than 12 V?	Go to step 2.	Charge or replace the battery.
2	CHECK INPUT SIGNAL FOR STARTER MOTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter motor. 3) Turn the ignition switch to ST. 4) Measure the power supply voltage between starter motor connector terminal and engine ground. Connector & terminal (B14) No. 1 (+) — Engine ground (-): NOTE: • On AT models, place the select lever in the "P" or "N" range. • On MT models, depress the clutch pedal.	Is the voltage more than 10 V?	Go to step 3.	Go to step 4.
3	CHECK GROUND CIRCUIT OF STARTER MOTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the terminal from starter motor. 3) Measure the resistance of ground cable between ground cable terminal and engine ground.	Is the resistance less than 5 Ω ?	Check the starter motor. <Ref. to SC(H4SO)-7, Starter.>	Repair open circuit of ground cable.
4	CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR. 1) Disconnect the connector from ignition switch. 2) Measure the power supply voltage between ignition switch connector and chassis ground. Connector & terminal (B72) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 5.	Repair open circuit in harness between ignition switch and battery, and check fuse SBF No. 4 and SBF No. 1.
5	CHECK IGNITION SWITCH. 1) Disconnect the connector from ignition switch. 2) Measure the resistance between ignition switch terminals while turning ignition switch to the "ST" position. Terminals No. 1 — No. 3:	Is the resistance less than 5 Ω ?	Go to step 6.	Replace the ignition switch.
6	CHECK TRANSMISSION TYPE.	Is the target AT model?	Go to step 7.	Go to step 9.
7	CHECK INPUT VOLTAGE OF INHIBITOR SWITCH. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from inhibitor switch. 3) Connect the connector to ignition switch. 4) Measure the input voltage between inhibitor switch connector terminal and engine ground while turning ignition switch to ST. Connector & terminal (B12) No. 12 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 8.	Repair open or ground short circuit in harness between inhibitor switch and ignition switch. NOTE: Check security system (if equipped). <Ref. to SL-20, Security System.>

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK INHIBITOR SWITCH. 1) Place the select lever in the "P" or "N" range. 2) Measure the resistance between inhibitor switch terminals. Connector & terminal (T3) No. 11 — No. 12:	Is the resistance less than 1 Ω ?	Repair open or ground short circuit in harness between inhibitor switch and starter motor.	Replace the inhibitor switch. <Ref. to 4AT-46, Inhibitor Switch.>
9 CHECK INPUT VOLTAGE OF STARTER INTERLOCK RELAY. 1) Turn ignition switch to OFF. 2) Disconnect the connector from starter interlock relay. 3) Connect the connector to ignition switch. 4) Measure the input voltage between starter interlock relay connector and chassis ground while turning ignition switch to ST. Connector & terminal (B225) No. 24 (+) — Chassis ground (-): (B225) No. 27 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 10.	Repair open or short circuit to ground in harness between starter interlock relay and ignition switch. NOTE: Check security system (if equipped). <Ref. to SL-20, Security System.>
10 CHECK STARTER INTERLOCK RELAY. 1) Connect the battery to starter interlock relay terminals No. 26 and No. 24. 2) Measure the resistance between starter interlock relay terminals. Terminals No. 27 — No. 28:	Is the resistance less than 1 Ω ?	Go to step 11.	Replace the starter interlock relay.
11 CHECK GROUND CIRCUIT OF CLUTCH SWITCH. 1) Disconnect the connector from clutch switch. 2) Measure the resistance between clutch switch connector and chassis ground. Connector & terminal (B106) No. 1 — Chassis ground:	Is the resistance less than 1 Ω ?	Go to step 12.	Repair open circuit of ground cable.
12 CHECK CLUTCH SWITCH. Measure the resistance between clutch switch terminals while depressing the clutch pedal. Terminals No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Go to step 13.	Replace the clutch switch. <Ref. to CL-28, Clutch Switch.>
13 CHECK CLUTCH SWITCH CIRCUIT. 1) Connect the connector to clutch switch. 2) Measure the resistance between starter interlock relay connector and chassis ground while depressing the clutch pedal. Connector & terminal (B225) No. 26 (+) — Chassis ground (-):	Is the resistance less than 1 Ω ?	Repair short circuit to ground in harness between starter interlock relay and starter motor.	Repair open circuit in harness between starter interlock relay and clutch switch.

Diagnostics for Engine Starting Failure

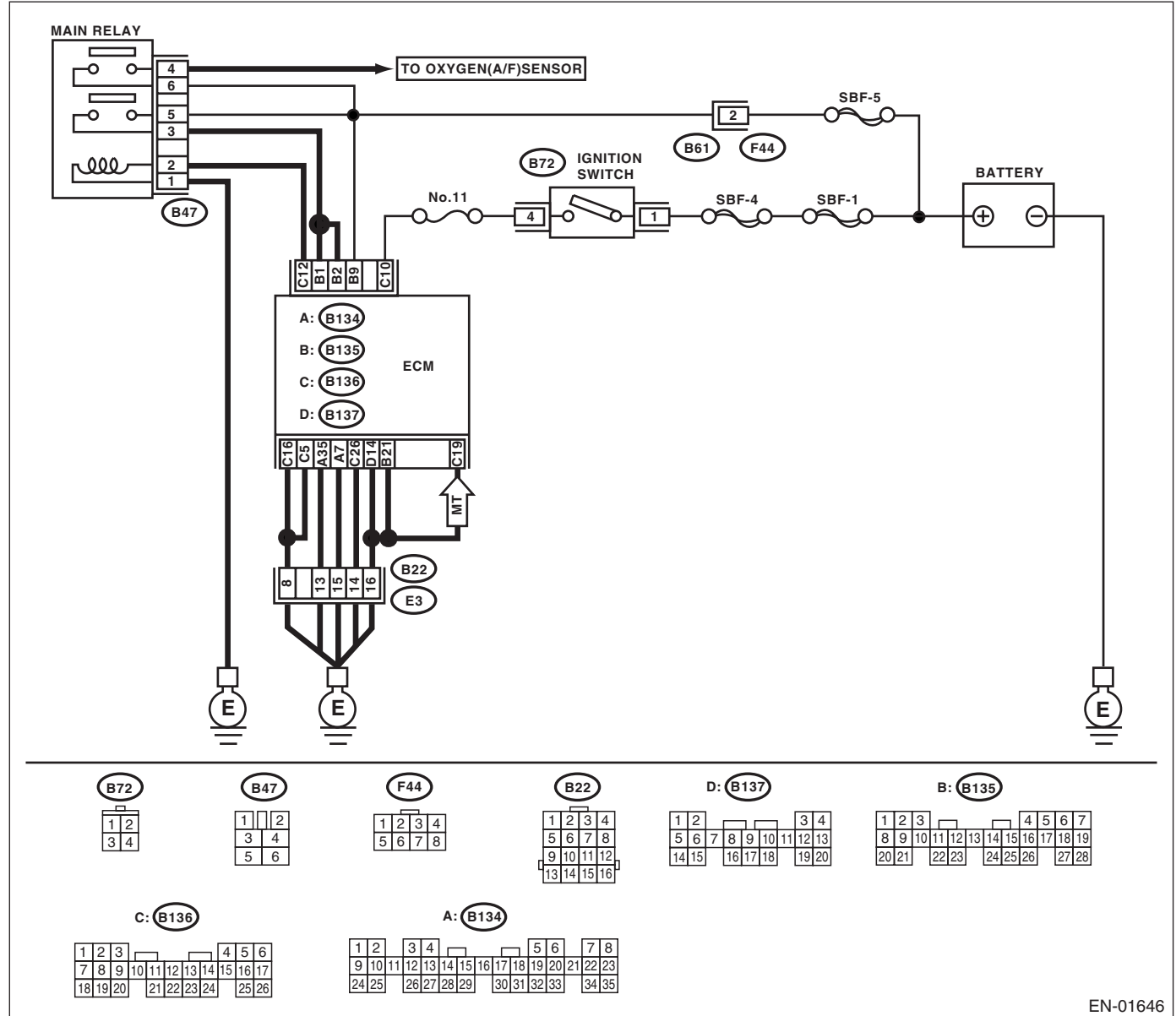
ENGINE (DIAGNOSTICS)

C: CONTROL MODULE POWER SUPPLY AND GROUND LINE

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01646

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK MAIN RELAY. 1) Turn the ignition switch to OFF. 2) Remove the main relay. 3) Connect the battery to main relay terminals No. 1 and No. 2. 4) Measure the resistance between main relay terminals. Terminals No. 3 — No. 5: No. 4 — No. 6:	Is the resistance less than 10 Ω ?	Go to step 2.	Replace the main relay.
2	CHECK GROUND CIRCUIT OF ECM. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B134) No. 7 — Chassis ground: (B134) No. 35 — Chassis ground: (B135) No. 21 — Chassis ground: (B136) No. 5 — Chassis ground: (B136) No. 16 — Chassis ground: (B136) No. 26 — Chassis ground: (B137) No. 14 — Chassis ground: (B136) No. 19 — Chassis ground: (MT model)	Is the resistance less than 5 Ω ?	Go to step 3.	Repair open circuit in harness between ECM connector and engine grounding terminal.
3	CHECK INPUT VOLTAGE OF ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 9 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 4.	Repair open or ground short circuit of power supply circuit.
4	CHECK INPUT VOLTAGE OF ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 10 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 5.	Repair open or ground short circuit of power supply circuit.
5	CHECK HARNESS BETWEEN ECM AND MAIN RELAY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between ECM and chassis ground. Connector & terminal (B136) No. 12 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 6.	Repair ground short circuit in harness between ECM connector and main relay connector, then replace the ECM.
6	CHECK OUTPUT VOLTAGE FROM ECM. 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 12 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 7.	Replace the ECM.
7	CHECK INPUT VOLTAGE OF MAIN RELAY. Check the voltage between main relay connector and chassis ground. Connector & terminal (B47) No. 2 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 8.	Repair open circuit in harness between ECM connector and main relay connector.

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

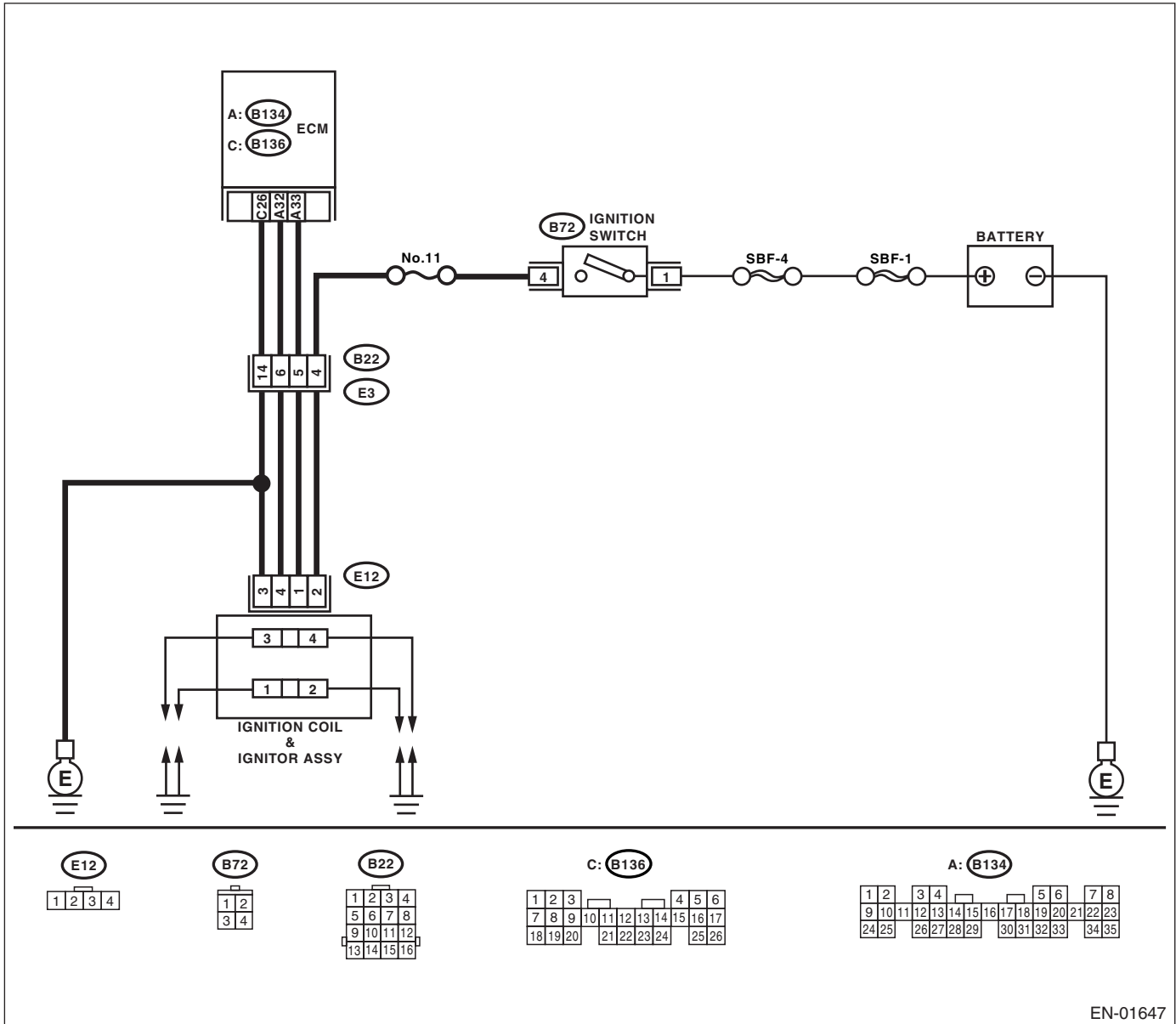
Step		Check	Yes	No
8	CHECK GROUND CIRCUIT OF MAIN RELAY. 1) Turn the ignition switch to OFF. 2) Measure the resistance between main relay connector and chassis ground. Connector & terminal (B47) No. 1 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 9.	Repair open circuit between main relay and chassis ground.
9	CHECK INPUT VOLTAGE OF MAIN RELAY. Measure the voltage between main relay connector and chassis ground. Connector & terminal (B47) No. 5 (+) — Chassis ground (-): (B47) No. 6 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 10.	Repair open or ground short circuit in harness of power supply circuit.
10	CHECK INPUT VOLTAGE OF ECM. 1) Connect the main relay connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 1 (+) — Chassis ground (-): (B135) No. 2 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Check ignition control system. <Ref. to EN(H4SO)(diag)-63, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair open or ground short circuit in harness between ECM connector and main relay connector.

D: IGNITION CONTROL SYSTEM

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01647

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK IGNITION SYSTEM FOR SPARKS. 1) Remove the plug cord cap from each spark plug. 2) Install the new spark plug on plug cord cap. CAUTION: Do not remove the spark plug from engine. 3) Contact the spark plug's thread portion on engine. 4) While opening the throttle valve fully, crank the engine to check that spark occurs at each cylinder.	Does spark occur at each cylinder?	Check fuel pump system. <Ref. to EN(H4SO)(diag)-66, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 2.
2 CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL & IGNITOR ASSY. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition coil & ignitor ASSY. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between ignition coil & ignitor ASSY connector and engine ground. Connector & terminal (E12) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor ASSY, and ignition switch connector • Poor contact in coupling connectors
3 CHECK HARNESS OF IGNITION COIL & IGNITOR ASSY GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between ignition coil & ignitor ASSY connector and engine ground. Connector & terminal (E12) No. 3 — Engine ground:	Is the resistance less than 5 Ω ?	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor ASSY connector and engine grounding terminal
4 CHECK IGNITION COIL & IGNITOR ASSY. 1) Remove the spark plug cords. 2) Measure the resistance between spark plug cord contact portions to check secondary coil. Terminals No. 1 — No. 2: No. 3 — No. 4:	Is the resistance 10 — 15 k Ω ?	Go to step 5.	Replace the ignition coil & ignitor ASSY. <Ref. to IG(H4SO)-7, Ignition Coil & Ignitor ASSY.>
5 CHECK INPUT SIGNAL FOR IGNITION COIL & IGNITOR ASSY. 1) Connect the connector to ignition coil & ignitor ASSY. 2) Check if voltage varies synchronously with engine speed when cranking, while monitoring voltage between ignition coil & ignitor ASSY connector and engine ground. Connector & terminal (E12) No. 1 (+) — Engine ground (-): (E12) No. 4 (+) — Engine ground (-):	Does the voltage vary more than 10 V?	Go to step 6.	Replace the ignition coil & ignitor ASSY. <Ref. to IG(H4SO)-7, Ignition Coil & Ignitor ASSY.>

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from ignition coil & ignitor ASSY. 4) Measure the resistance of harness between ECM and ignition coil & ignitor ASSY connector. Connector & terminal (B134) No. 33 — (E12) No. 1: (B134) No. 32 — (E12) No. 4:	Is the resistance less than 1 Ω ?	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and ignition coil & ignitor ASSY connector • Poor contact in coupling connector
7 CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSY CONNECTOR. Measure the resistance of harness between ECM and engine ground. Connector & terminal: (B134) No. 33 — Engine ground: (B134) No. 32 — Engine ground:	Is the resistance more than 1 M Ω ?	Go to step 8.	Repair ground short circuit in harness between ECM and ignition coil & ignitor ASSY connector.
8 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Check fuel pump circuit. <Ref. to EN(H4SO)(diag)-66, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>

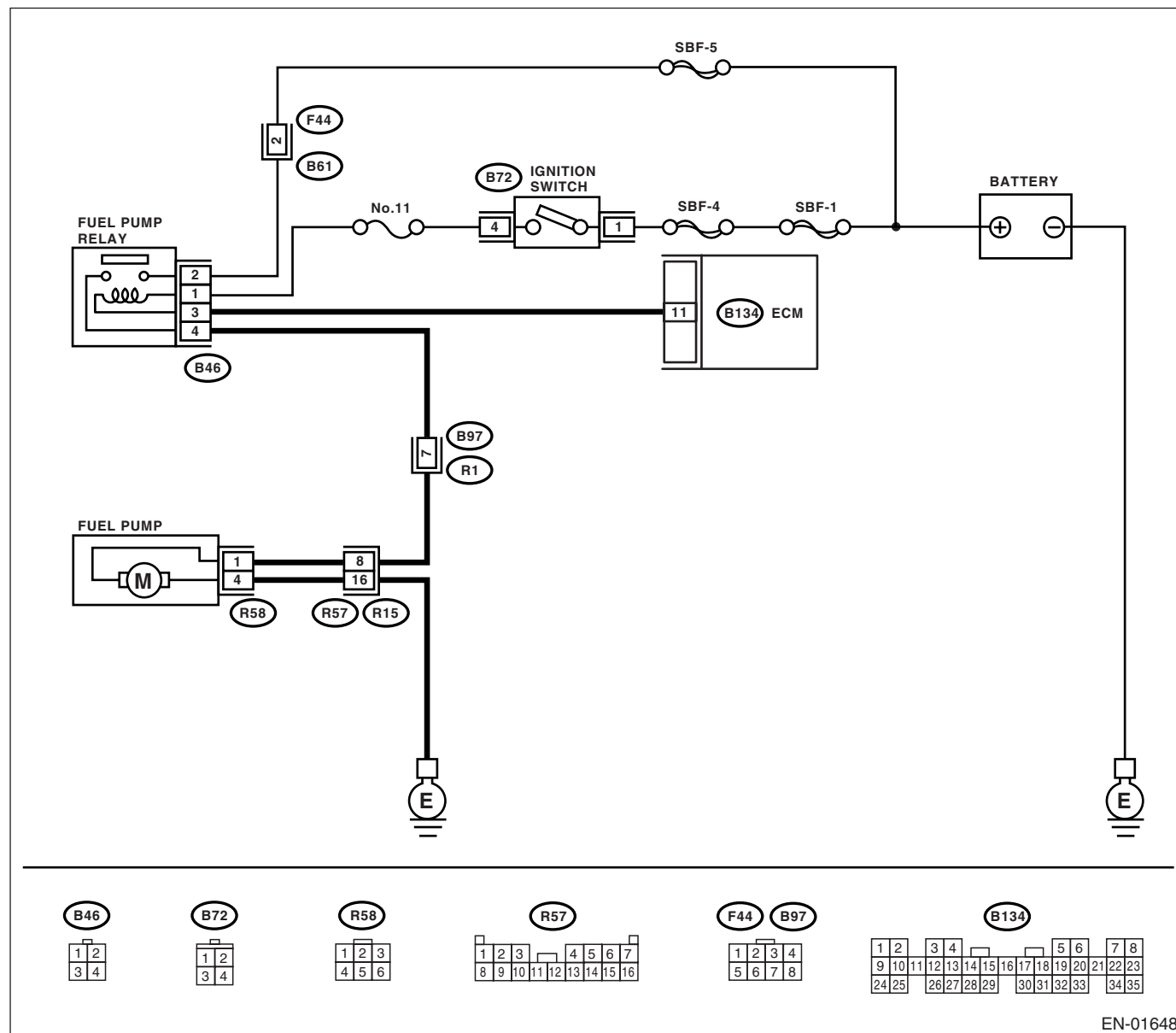
ENGINE (DIAGNOSTICS)

E: FUEL PUMP CIRCUIT

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATING SOUND OF FUEL PUMP. Make sure that fuel pump is in operation for two seconds when turning the ignition switch to ON. NOTE: Fuel pump operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the fuel pump produce operating sound?	Check fuel injector circuit. <Ref. to EN(H4SO)(diag)-69, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 2.
2 CHECK GROUND CIRCUIT OF FUEL PUMP. 1) Turn the ignition switch to OFF. 2) Remove the fuel pump access hole lid. 3) Disconnect the connector from fuel pump. 4) Measure the resistance of harness connector between fuel pump and chassis ground. Connector & terminal (R58) No. 4 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between fuel pump connector and chassis grounding terminal • Poor contact in coupling connector
3 CHECK POWER SUPPLY TO FUEL PUMP. 1) Turn the ignition switch to ON. 2) Measure the voltage of power supply circuit between fuel pump connector and chassis ground. Connector & terminal (R58) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Replace the fuel pump. <Ref. to FU(H4SO)-55, Fuel Pump.>	Go to step 4.
4 CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness connector between fuel pump and fuel pump relay. Connector & terminal (R58) No. 1 — (B46) No. 4:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between fuel pump connector and chassis grounding terminal • Poor contact in coupling connectors
5 CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR. Measure the resistance of harness between fuel pump and fuel pump relay connector. Connector & terminal (R58) No. 1 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 6.	Repair short circuit in harness between fuel pump and fuel pump relay connector.

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

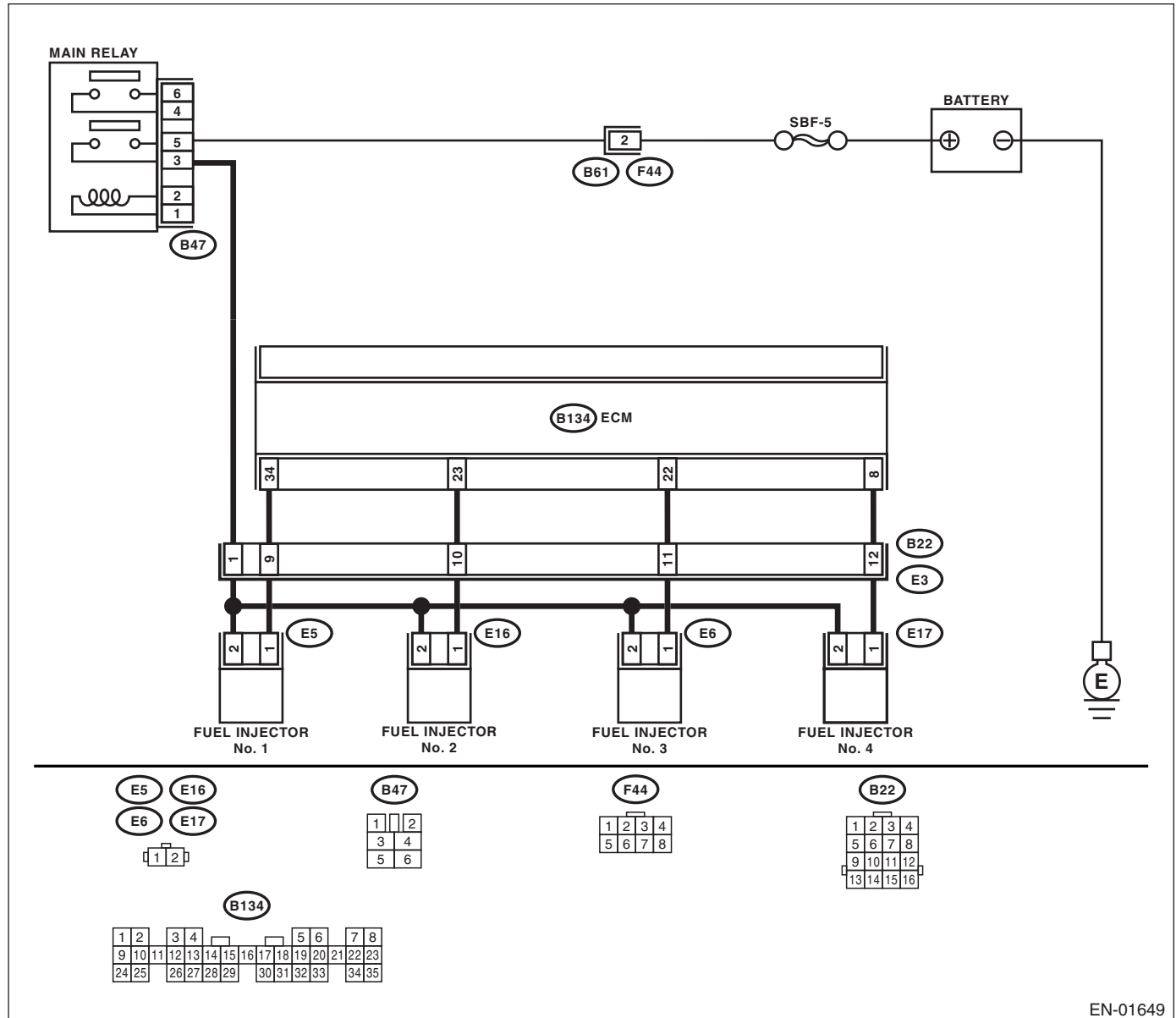
Step		Check	Yes	No
6	CHECK FUEL PUMP RELAY. 1) Disconnect the connectors from fuel pump relay and main relay. 2) Remove the fuel pump relay and main relay with bracket. 3) Connect the battery to fuel pump relay connector terminals No. 1 and No. 3. 4) Measure the resistance between connector terminals of fuel pump relay. Terminals No. 2 — No. 4:	Is the resistance less than 10 Ω ?	Go to step 7.	Replace the fuel pump relay. <Ref. to FU(H4SO)-46, Fuel Pump Relay.>
	CHECK HARNESS BETWEEN ECM AND FUEL PUMP RELAY CONNECTOR. 1) Disconnect the connectors from ECM. 2) Measure the resistance of harness between ECM and fuel pump relay connector. Connector & terminal (B134) No. 11 — (B46) No. 3:			
	CHECK POOR CONTACT. Check poor contact in ECM connector.			
7	CHECK HARNESS BETWEEN ECM AND FUEL PUMP RELAY CONNECTOR. 1) Disconnect the connectors from ECM. 2) Measure the resistance of harness between ECM and fuel pump relay connector. Connector & terminal (B134) No. 11 — (B46) No. 3:	Is the resistance less than 1 Ω ?	Go to step 8.	Repair open circuit in harness between ECM and fuel pump relay connector.
8	CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Check fuel injector circuit. <Ref. to EN(H4SO)(diag)-69, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

F: FUEL INJECTOR CIRCUIT

CAUTION:

- Check or repair only faulty parts.
- After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01649

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATION OF EACH FUEL INJECTOR. While cranking the engine, check that each fuel injector emits "operating" sound. Use a sound scope or attach a screwdriver to the injector for this check.	Dose the fuel injector operate?	Check the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.>	Go to step 2.
2 CHECK POWER SUPPLY TO EACH FUEL INJECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between the fuel injector terminal and engine ground. Connector & terminal #1 (E5) No. 2 (+) — Engine ground (-): #2 (E16) No. 2 (+) — Engine ground (-): #3 (E6) No. 2 (+) — Engine ground (-): #4 (E17) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and fuel injector connector • Poor contact in main relay connector • Poor contact in coupling connector (B22) • Poor contact in fuel injector connector
3 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and fuel injector connector. Connector & terminal #1 (B134) No. 34 — (E5) No. 1: #2 (B134) No. 23 — (E16) No. 1: #3 (B134) No. 22 — (E6) No. 1: #4 (B134) No. 8 — (E17) No. 1:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel injector connector • Poor contact in coupling connector
4 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR. Measure the resistance of harness between ECM and fuel injector connector. Connector & terminal #1 (B134) No. 34 — Chassis ground: #2 (B134) No. 23 — Chassis ground: #3 (B134) No. 22 — Chassis ground: #4 (B134) No. 8 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair ground short circuit in harness between ECM and fuel injector connector.
5 CHECK EACH FUEL INJECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between each fuel injector terminals. Terminals No. 1 — No. 2:	Is the resistance 5 — 20 Ω ?	Go to step 6.	Replace the faulty fuel injector.
6 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Inspection using "General Diagnostic Table". <Ref. to EN(H4SO)(diag)-304, INSPECTION, General Diagnostic Table.>

List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

18. List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Index
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-78, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-80, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-83, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-85, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-88, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0065	Air Assisted Injector Control Range/Performance	<Ref. to EN(H4SO)(diag)-90, DTC P0065 AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0066	Air Assisted Injector Control Circuit or Circuit Low	<Ref. to EN(H4SO)(diag)-92, DTC P0066 AIR ASSISTED INJECTOR CONTROL CIRCUIT OR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0067	Air Assisted Injector Control Circuit High	<Ref. to EN(H4SO)(diag)-94, DTC P0067 AIR ASSISTED INJECTOR CONTROL CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0068	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance Problem	<Ref. to EN(H4SO)(diag)-96, DTC P0068 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to EN(H4SO)(diag)-98, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to EN(H4SO)(diag)-101, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0111	Intake Air Temperature Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-104, DTC P0111 INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake Air Temperature Circuit Low Input	<Ref. to EN(H4SO)(diag)-106, DTC P0112 INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0113	Intake Air Temperature Circuit High Input	<Ref. to EN(H4SO)(diag)-108, DTC P0113 INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine Coolant Temperature Circuit Low Input	<Ref. to EN(H4SO)(diag)-111, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine Coolant Temperature Circuit High Input	<Ref. to EN(H4SO)(diag)-113, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-116, DTC P0121 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	<Ref. to EN(H4SO)(diag)-118, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	<Ref. to EN(H4SO)(diag)-121, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to EN(H4SO)(diag)-123, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to EN(H4SO)(diag)-125, DTC P0128 COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0129	Atmospheric Pressure Sensor Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-126, DTC P0129 ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0130	O ₂ Sensor Circuit (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-127, DTC P0130 O ₂ SENSOR CIRCUIT (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O ₂ Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-130, DTC P0131 O ₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0132	O ₂ Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-132, DTC P0132 O ₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0133	O ₂ Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-134, DTC P0133 O ₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0134	O ₂ Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-136, DTC P0134 O ₂ SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0137	O ₂ Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-138, DTC P0137 O ₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0138	O ₂ Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-141, DTC P0138 O ₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0139	O ₂ Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-144, DTC P0139 O ₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System too Lean (Bank 1)	<Ref. to EN(H4SO)(diag)-145, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0172	System too Rich (Bank 1)	<Ref. to EN(H4SO)(diag)-146, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-148, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0182	Fuel Temperature Sensor "A" Circuit Low Input	<Ref. to EN(H4SO)(diag)-150, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0183	Fuel Temperature Sensor "A" Circuit High Input	<Ref. to EN(H4SO)(diag)-152, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder 1 Misfire Detected	<Ref. to EN(H4SO)(diag)-154, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 Misfire Detected	<Ref. to EN(H4SO)(diag)-154, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0303	Cylinder 3 Misfire Detected	<Ref. to EN(H4SO)(diag)-154, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 Misfire Detected	<Ref. to EN(H4SO)(diag)-155, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-162, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-164, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0335	Crankshaft Position Sensor "A" Circuit	<Ref. to EN(H4SO)(diag)-166, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-168, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-170, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0341	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-172, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to EN(H4SO)(diag)-175, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0442	Evaporative Emission Control System Leak Detected (small leak)	<Ref. to EN(H4SO)(diag)-176, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to EN(H4SO)(diag)-180, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to EN(H4SO)(diag)-183, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0451	Evaporative Emission Control System Pressure Sensor Range/Performance	<Ref. to EN(H4SO)(diag)-185, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to EN(H4SO)(diag)-187, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to EN(H4SO)(diag)-190, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0456	Evaporative Emission Control System Leak Detected (very small leak)	<Ref. to EN(H4SO)(diag)-193, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0457	Evaporative Emission Control System Leak Detected (fuel cap loose/off)	<Ref. to EN(H4SO)(diag)-196, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0458	Evaporative Emission Control System Purge Control Valve Circuit Low	<Ref. to EN(H4SO)(diag)-200, DTC P0458 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0459	Evaporative Emission Control System Purge Control Valve Circuit High	<Ref. to EN(H4SO)(diag)-203, DTC P0459 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0461	Fuel Level Sensor Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-205, DTC P0461 FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0462	Fuel Level Sensor Circuit Low Input	<Ref. to EN(H4SO)(diag)-207, DTC P0462 FUEL LEVEL SENSOR CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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P0463	Fuel Level Sensor Circuit High Input	<Ref. to EN(H4SO)(diag)-210, DTC P0463 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to EN(H4SO)(diag)-213, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0483	Cooling Fan Rationality Check	<Ref. to EN(H4SO)(diag)-214, DTC P0483 COOLING FAN RATIONALITY CHECK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0502	Vehicle Speed Sensor Circuit Low Input	<Ref. to EN(H4SO)(diag)-216, DTC P0502 VEHICLE SPEED SENSOR CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	<Ref. to EN(H4SO)(diag)-217, DTC P0503 VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0506	Idle Control System RPM Lower Than Expected	<Ref. to EN(H4SO)(diag)-219, DTC P0506 IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0507	Idle Control System RPM Higher Than Expected	<Ref. to EN(H4SO)(diag)-221, DTC P0507 IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter Request Circuit	<Ref. to EN(H4SO)(diag)-222, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0519	Idle Control System Malfunction (Fail-Safe)	<Ref. to EN(H4SO)(diag)-225, DTC P0519 IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0565	Cruise Control On Signal	<Ref. to EN(H4SO)(diag)-227, DTC P0565 CRUISE CONTROL ON SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to EN(H4SO)(diag)-229, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0691	Cooling Fan 1 Control Circuit Low	<Ref. to EN(H4SO)(diag)-230, DTC P0691 COOLING FAN 1 CONTROL CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0692	Cooling Fan 1 Control Circuit High	<Ref. to EN(H4SO)(diag)-233, DTC P0692 COOLING FAN 1 CONTROL CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0703	Torque Converter/Brake Switch "B" Circuit	<Ref. to EN(H4SO)(diag)-236, DTC P0703 TORQUE CONVERTER/BRAKE SWITCH "B" CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0705	Transmission Range Sensor Circuit (PRNDL Input)	<Ref. to EN(H4SO)(diag)-238, DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0710	Transmission Fluid Temperature Sensor Circuit	<Ref. to EN(H4SO)(diag)-238, DTC P0710 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0716	Torque Converter Turbine Speed Sensor	<Ref. to EN(H4SO)(diag)-238, DTC P0716 OUTPUT/TURBINE SPEED SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0720	Output Speed Sensor Circuit	<Ref. to EN(H4SO)(diag)-238, DTC P0720 OUTPUT SPEED SENSOR CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0726	Engine Speed Input Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-238, DTC P0726 ENGINE SPEED INPUT CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0731	Gear 1 Incorrect Ratio	<Ref. to EN(H4SO)(diag)-238, DTC P0731 GEAR 1 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0732	Gear 2 Incorrect Ratio	<Ref. to EN(H4SO)(diag)-238, DTC P0732 GEAR 2 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0733	Gear 3 Incorrect Ratio	<Ref. to EN(H4SO)(diag)-238, DTC P0733 GEAR 3 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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P0734	Gear 4 Incorrect Ratio	<Ref. to EN(H4SO)(diag)-239, DTC P0734 GEAR 4 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	<Ref. to EN(H4SO)(diag)-240, DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0743	Torque Converter Clutch Circuit Electrical	<Ref. to EN(H4SO)(diag)-242, DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0748	Pressure Control Solenoid "A" Electrical	<Ref. to EN(H4SO)(diag)-242, DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0753	Shift Solenoid "A" Electrical	<Ref. to EN(H4SO)(diag)-242, DTC P0753 SHIFT SOLENOID "A" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0758	Shift Solenoid "B" Electrical	<Ref. to EN(H4SO)(diag)-242, DTC P0758 SHIFT SOLENOID "B" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0771	Shift Solenoid "E" Performance or Stuck Off	<Ref. to EN(H4SO)(diag)-242, DTC P0771 SHIFT SOLENOID "E" PERFORMANCE OR STUCK OFF, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0778	Pressure Control Solenoid "B" Electrical	<Ref. to EN(H4SO)(diag)-242, DTC P0778 PRESSURE CONTROL SOLENOID "B" ELECTRICAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0785	Shift/Timing Solenoid	<Ref. to EN(H4SO)(diag)-242, DTC P0785 SHIFT/TIMING SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Neutral Switch Input Circuit Low	<Ref. to EN(H4SO)(diag)-243, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to EN(H4SO)(diag)-245, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Neutral Switch Input Circuit High	<Ref. to EN(H4SO)(diag)-247, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).> <Ref. to EN(H4SO)(diag)-250, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0864	TCM Communication Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-253, DTC P0864 TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0865	TCM Communication Circuit Low	<Ref. to EN(H4SO)(diag)-255, DTC P0865 TCM COMMUNICATION CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0866	TCM Communication Circuit High	<Ref. to EN(H4SO)(diag)-257, DTC P0866 TCM COMMUNICATION CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1110	Atmospheric Pressure Sensor Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-259, DTC P1110 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1111	Atmospheric Pressure Sensor Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-259, DTC P1111 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1134	A/F Sensor Micro-computer Problem	<Ref. to EN(H4SO)(diag)-260, DTC P1134 A/F SENSOR MICRO-COMPUTER PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1137	O ₂ Sensor Circuit (Lamda=1) (Bank1 Sensor1)	<Ref. to EN(H4SO)(diag)-262, DTC P1137 O ₂ SENSOR CIRCUIT (LAMDA=1) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to EN(H4SO)(diag)-265, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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P1420	Fuel Tank Pressure Control Solenoid Valve Circuit High	<Ref. to EN(H4SO)(diag)-268, DTC P1420 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to EN(H4SO)(diag)-270, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1446	Fuel Tank Sensor Control Valve Circuit Low	<Ref. to EN(H4SO)(diag)-272, DTC P1446 FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1447	Fuel Tank Sensor Control Valve Circuit High	<Ref. to EN(H4SO)(diag)-275, DTC P1447 FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1448	Fuel Tank Sensor Control Valve Range/Performance Problem	<Ref. to EN(H4SO)(diag)-277, DTC P1448 FUEL TANK SENSOR CONTROL VALVE RANGE/PERFORMANCE PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1510	ISC Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-279, DTC P1510 ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1511	ISC Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-279, DTC P1511 ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1512	ISC Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-279, DTC P1512 ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1513	ISC Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-279, DTC P1513 ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1514	ISC Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-279, DTC P1514 ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1515	ISC Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-279, DTC P1515 ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1516	ISC Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-280, DTC P1516 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1517	ISC Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-282, DTC P1517 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1518	Starter Switch Circuit Low input	<Ref. to EN(H4SO)(diag)-283, DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-up Voltage Circuit Malfunction	<Ref. to EN(H4SO)(diag)-286, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1698	Engine Torque Control Cut Signal Circuit Low Input	<Ref. to EN(H4SO)(diag)-288, DTC P1698 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1699	Engine Torque Control Cut Signal Circuit High Input	<Ref. to EN(H4SO)(diag)-290, DTC P1699 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1700	Throttle Position Sensor	<Ref. to 4AT(diag)-46, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1711	Engine Torque Control Signal 1 Circuit Malfunction	<Ref. to EN(H4SO)(diag)-292, DTC P1711 ENGINE TORQUE CONTROL SIGNAL 1 CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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DTC	Item	Index
P1712	Engine Torque Control Signal 2 Circuit Malfunction	<Ref. to EN(H4SO)(diag)-294, DTC P1712 ENGINE TORQUE CONTROL SIGNAL 2 CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to EN(H4SO)(diag)-296, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to EN(H4SO)(diag)-300, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

: DTC with can be detected only on OBD mode. <Ref. to EN(H4SO)(diag)-36, Read Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

19. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

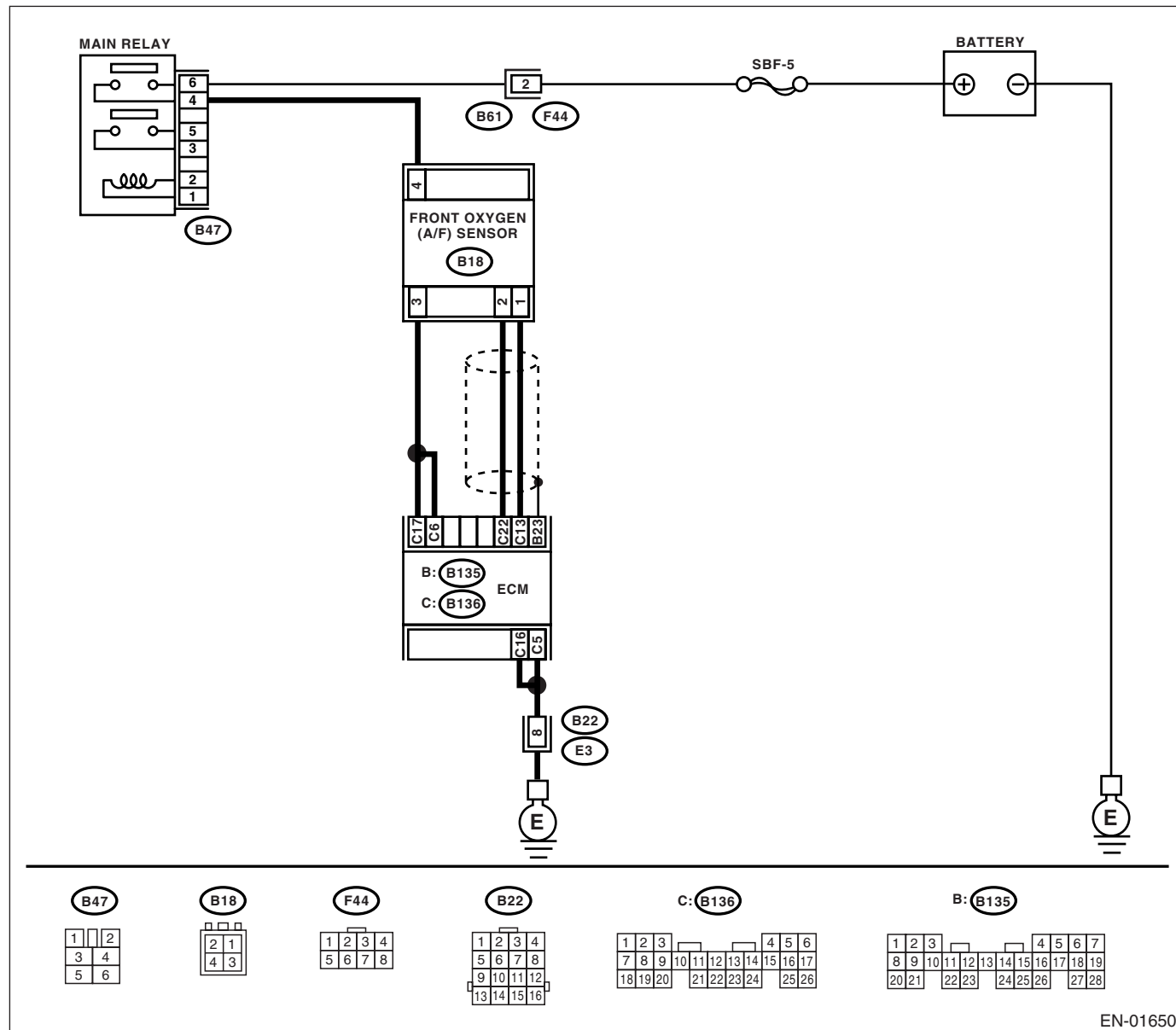
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-8, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, Inspection Mode.>.

WIRING DIAGRAM:



EN-01650

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. 1) Start the engine and warm-up engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 4) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. Connector & terminal (B136) No. 6 — (B18) No. 3: (B136) No. 17 — (B18) No. 3:	Is the resistance less than 1 Ω ?	Go to step 2.	Repair the open circuit in harness between ECM and front oxygen (A/F) sensor connector.
2 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. Connector & terminal (B136) No. 13 — (B18) No. 1: (B136) No. 22 — (B18) No. 2:	Is the resistance less than 1 Ω ?	Go to step 3.	Repair the open circuit in harness between main relay and front oxygen (A/F) sensor connector.
3 CHECK HARNESS BETWEEN MAIN RELAY AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. Measure the resistance of harness between main relay and front oxygen (A/F) sensor connector. Connector & terminal (B47) No. 4 — (B18) No. 4:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit in harness between main relay and front oxygen (A/F) sensor connector.
4 CHECK FRONT OXYGEN (A/F) SENSOR. Measure the resistance between front oxygen (A/F) sensor connector terminals. Terminals No. 3 — No. 4:	Is the resistance less than 5 Ω ?	Go to step 5.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-40, Front Oxygen (A/F) Sensor.>
5 CHECK POOR CONTACT. Check the poor contact in ECM and front oxygen (A/F) sensor connector.	Is there poor contact in ECM or front oxygen (A/F) sensor connector?	Repair the poor contact in ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-40, Front Oxygen (A/F) Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

B: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

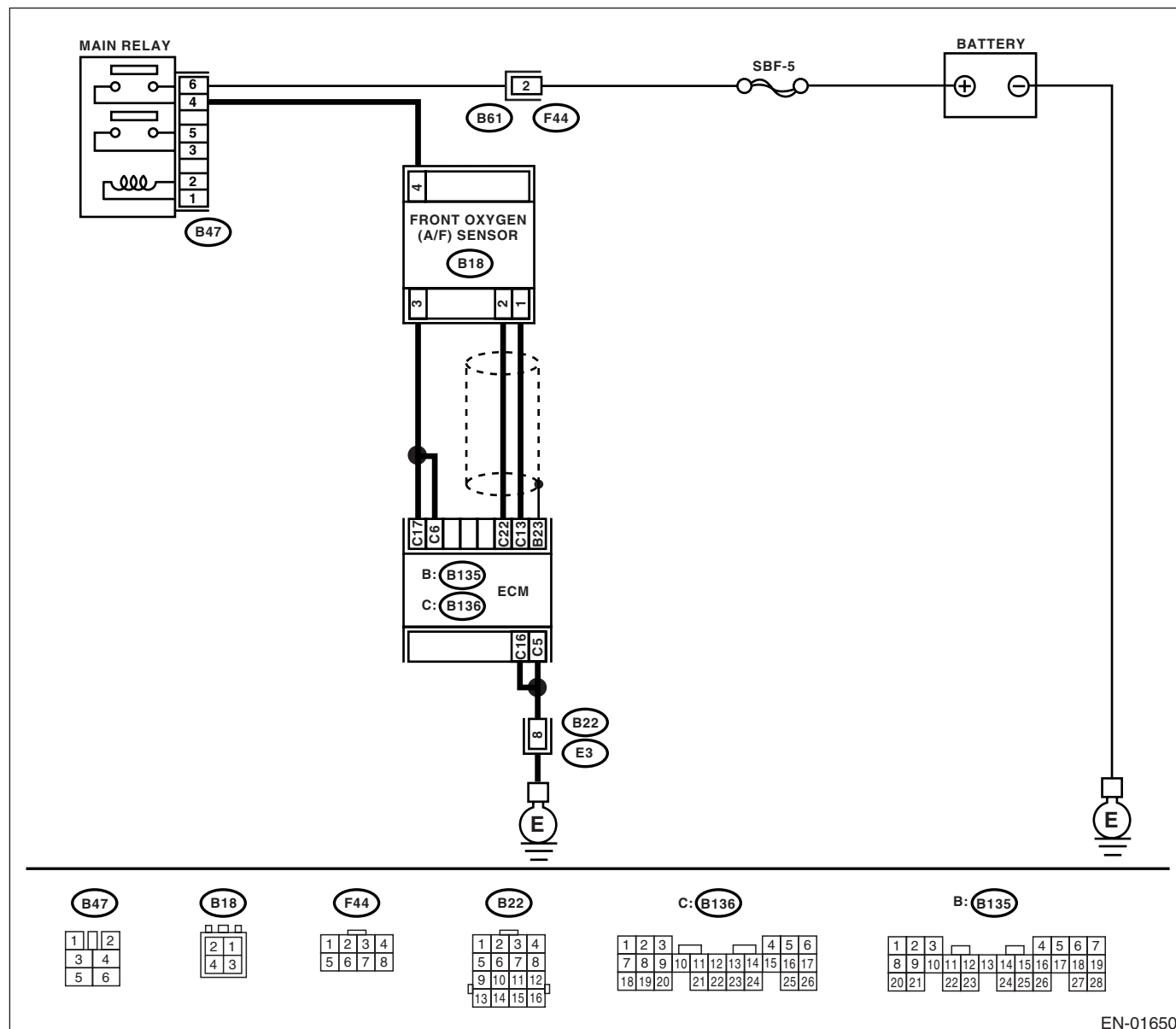
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-10, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01650

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool display DTC P0031 and P0037 at the same time?	Go to step 2.	Go to step 5.
2 CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between front oxygen (A/F) sensor connector and engine ground. Connector & terminal (B18) No. 4 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 3.	Repair power supply line. NOTE: In this case, repair the following: • Open circuit in harness between main relay and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in main relay connector
3 CHECK GROUND CIRCUIT OF ECM. Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 5 — Chassis ground: (B136) No. 16 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine ground terminal • Poor contact in ECM connector Poor contact in coupling connector
4 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the current more than 0.2 A?	Repair poor contact in connector. NOTE: In this case, repair the following: • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector	Go to step 5.
5 CHECK INPUT SIGNAL FROM ECM. 1) Start and idle the engine. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 6 (+) — Chassis ground (-): (B136) No. 17 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 7.	Go to step 6.
6 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 6 (+) — Chassis ground (-): (B136) No. 17 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Go to step 7.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK FRONT OXYGEN (A/F) SENSOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between front oxygen (A/F) sensor connector terminals. Terminals No. 3 — No. 4:	Is the resistance less than 10 Ω ?	Repair harness and connector. NOTE: In this case, repair the following: • Open or ground short circuit in harness between front oxygen (A/F) sensor and ECM connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-40, Front Oxygen (A/F) Sensor.>

C: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

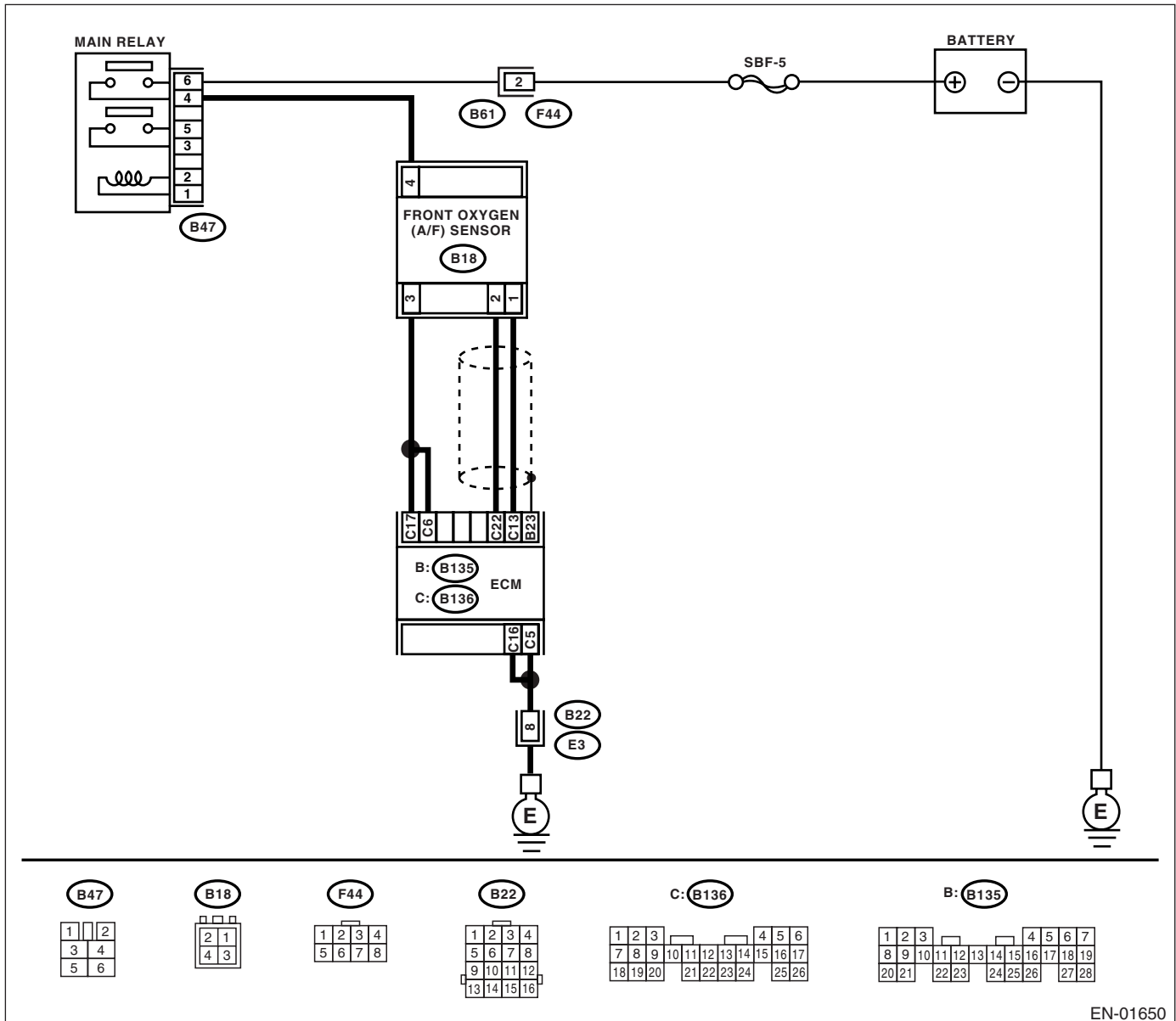
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-12, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01650

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 6 (+) — Chassis ground (-): (B136) No. 17 (+) — Chassis ground (-):	Is the voltage more than 8 V?	Go to step 2.	Go to step 3.
2 CHECK FRONT OXYGEN (A/F) SENSOR HEATER CURRENT. 1) Turn the ignition switch to OFF. 2) Repair the battery short circuit in harness between ECM and front oxygen (A/F) sensor connector. 3) Turn the ignition switch to ON. 4) Read the data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or the OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the current more than 2.3 A?	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	END
3 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 6 (+) — Chassis ground (-): (B136) No. 17 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.	END

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

D: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

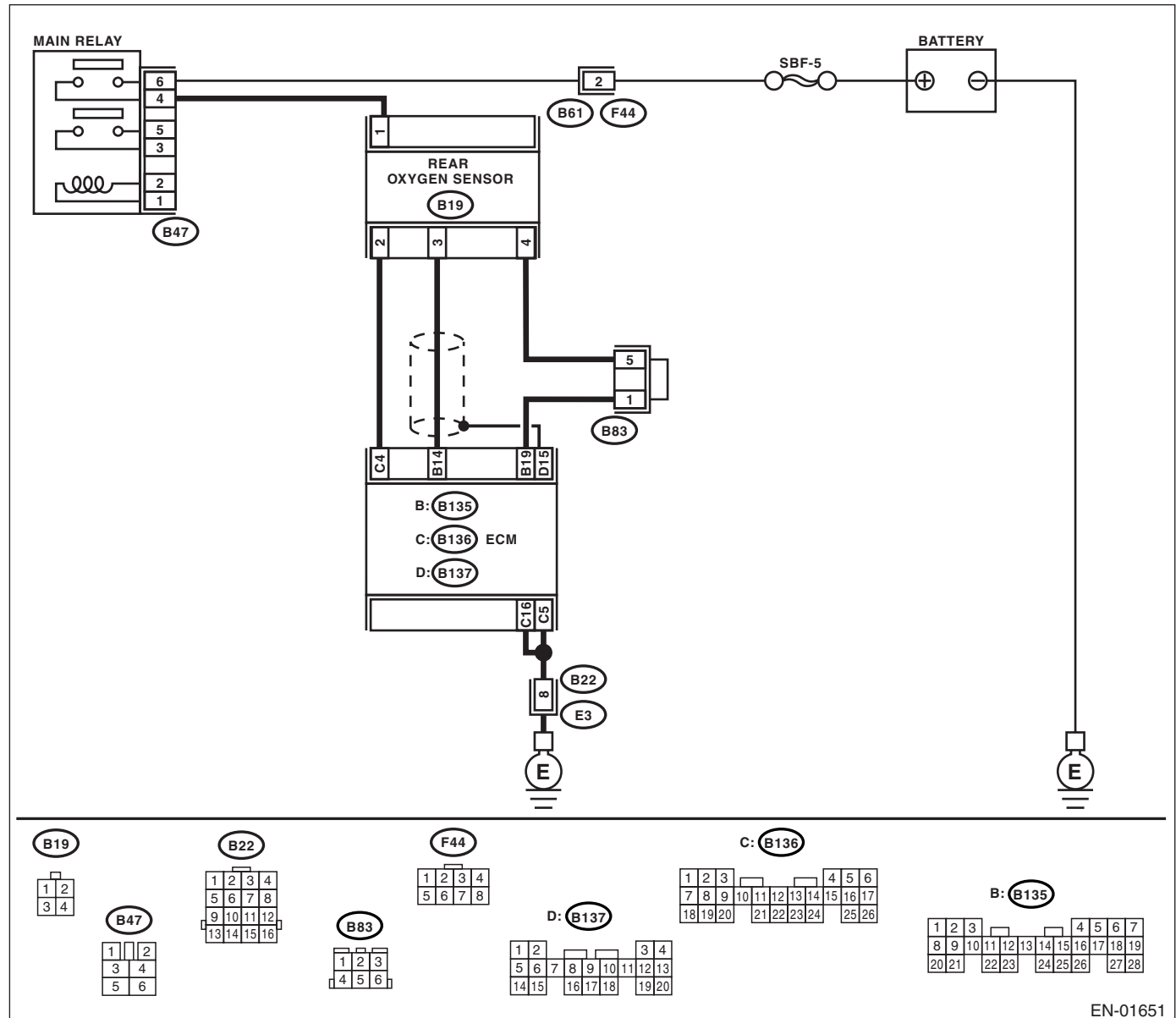
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-14, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01651

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK GROUND CIRCUIT OF ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 5 — Chassis ground: (B136) No. 16 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 2.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine ground terminal • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of rear oxygen sensor heater current using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the current more than 0.2 A?	Repair the connector. NOTE: In this case, repair the following: • Poor contact in rear oxygen sensor connector • Poor contact in rear oxygen sensor connecting harness connector • Poor contact in ECM connector	Go to step 3.
3 CHECK OUTPUT SIGNAL FROM ECM. 1) Start and idle the engine. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 4 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 6.	Go to step 4.
4 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 4 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Go to step 5.
5 CHECK OUTPUT SIGNAL FROM ECM. 1) Disconnect the connector from rear oxygen sensor. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 4 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Repair battery short circuit in harness between ECM and rear oxygen sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POWER SUPPLY TO REAR OXYGEN SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor connector and engine ground or chassis ground. Connector & terminal (B19) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 7.	Repair power supply line. NOTE: In this case, repair the following: • Open circuit in harness between main relay and rear oxygen sensor connector • Poor contact in rear oxygen sensor connector • Poor contact in coupling connector
7 CHECK REAR OXYGEN SENSOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between rear oxygen sensor connector terminals. Terminals No. 1 — No. 2:	Is the resistance less than 30 Ω ?	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector • Poor contact in coupling connector	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-42, Rear Oxygen Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

E: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

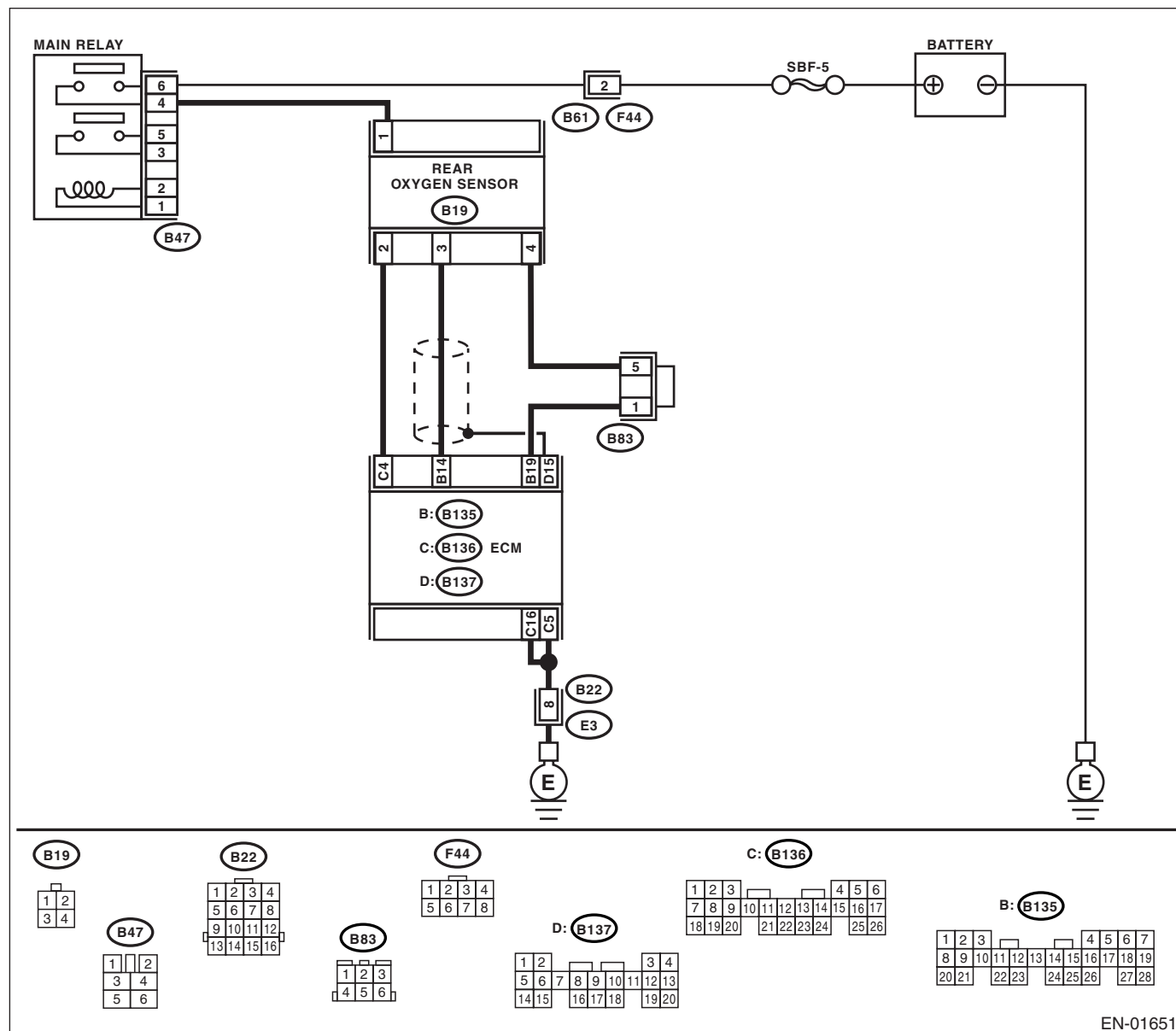
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-16, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01651

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 4 (+) — Chassis ground (-):	Is the voltage more than 8 V?	Go to step 2.	Go to step 3.
2 CHECK CURRENT DATA. 1) Turn the ignition switch to OFF. 2) Repair the battery short circuit in harness between ECM and rear oxygen sensor connector. 3) Turn the ignition switch to ON. 4) Read the data of rear oxygen sensor heater current using Subaru Select Monitor or the OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the current more than 7 A?	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	END
3 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	END

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

F: DTC P0065 AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-18, DTC P0065 AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

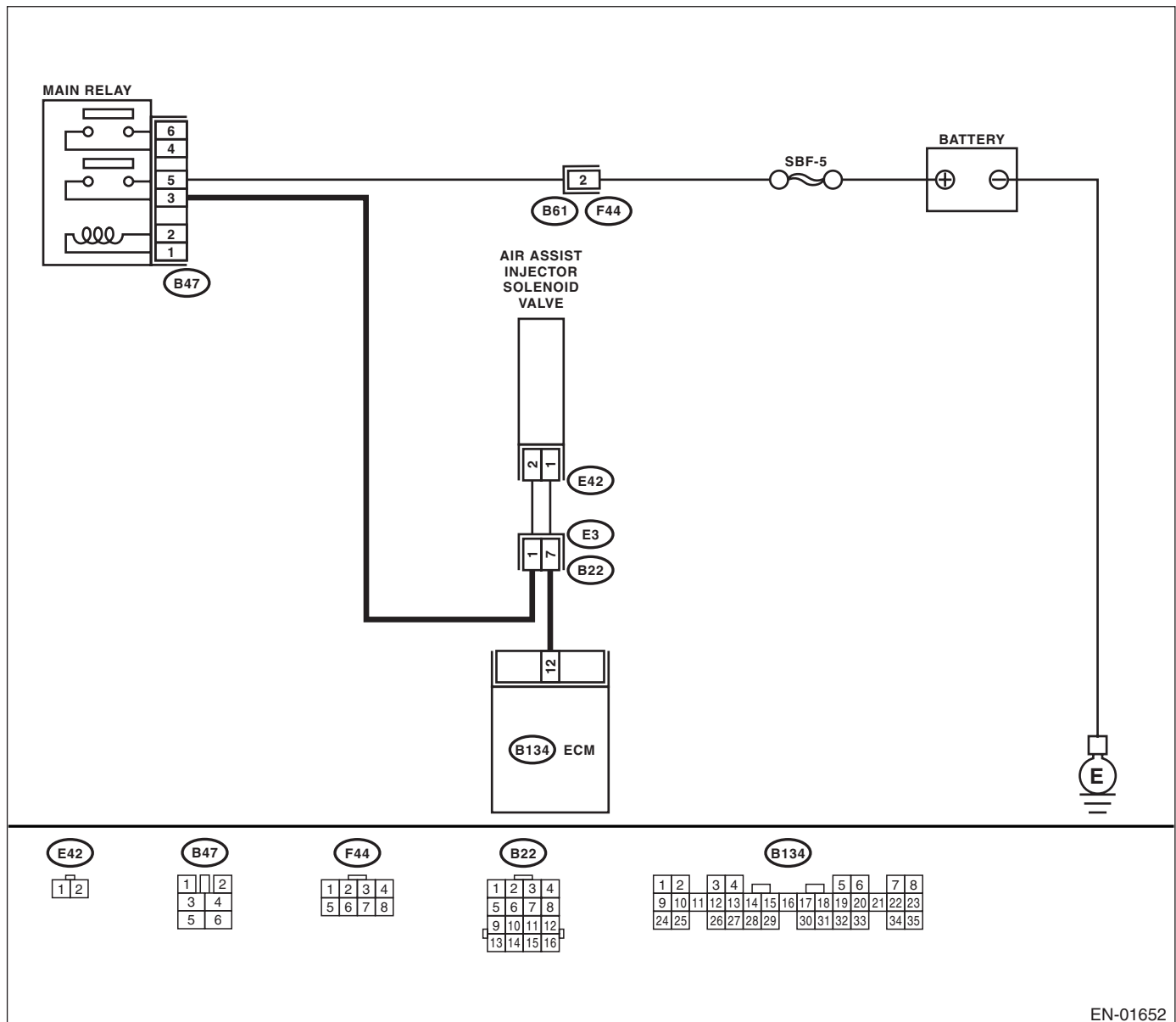
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>

WIRING DIAGRAM:



EN-01652

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK AIR ASSISTED INJECTOR SOLENOID VALVE OPERATION. 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) Operate the air assisted injector solenoid valve. NOTE: Air assisted injector solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Does air assisted injector solenoid valve operate?	Go to step 3.	Replace the air assisted injector solenoid valve. <Ref. to FU(H4SO)-33, Air Assist Injector Solenoid Valve.>
3 CHECK AIR BYPASS HOSES. Use your mouth to blow through the air bypass hose to make sure that there is a smooth air flow (no clogging).	Is there damage or clog at air bypass hose?	Repair or replace the air bypass hoses.	Go to step 4.
4 CHECK FUEL INJECTOR. 1) Turn ignition switch to OFF. 2) Remove the fuel injector. <Ref. to FU(H4SO)-34, REMOVAL, Fuel Injector.> 3) Check for clogged fuel injectors.	Is the fuel injector clogged?	Replace the fuel injector. <Ref. to FU(H4SO)-37, INSTALLATION, Fuel Injector.>	Replace the air assisted injector solenoid valve. <Ref. to FU(H4SO)-33, Air Assist Injector Solenoid Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

G: DTC P0066 AIR ASSISTED INJECTOR CONTROL CIRCUIT OR CIRCUIT LOW

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-21, DTC P0066 AIR ASSISTED INJECTOR CONTROL CIRCUIT OR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

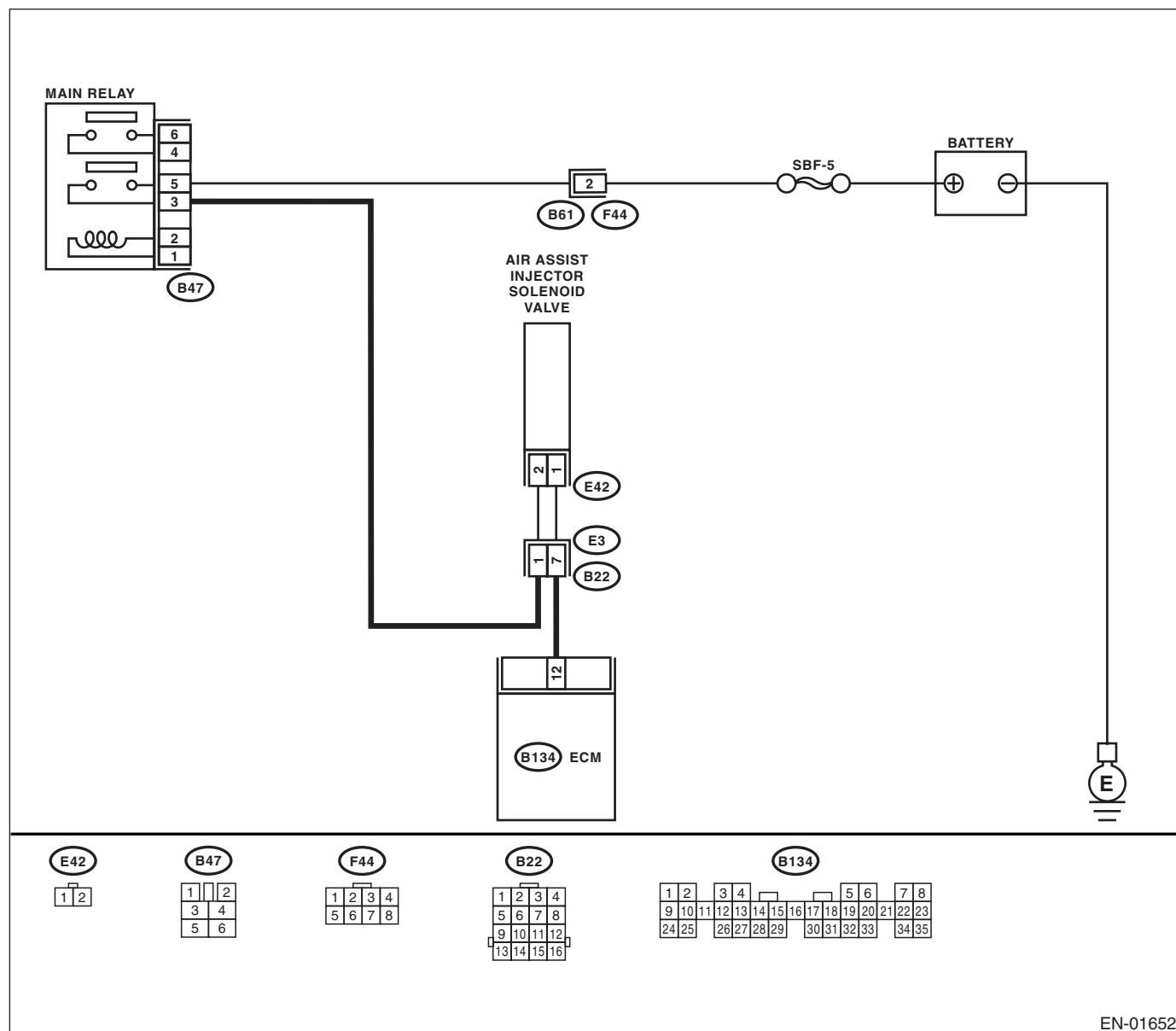
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01652

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. Connector & terminal (B134) No. 12 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair poor contact in ECM connector.	Go to step 2.
2 CHECK POWER SUPPLY TO AIR ASSIST INJECTOR SOLENOID VALVE. 1) Turn ignition switch to OFF. 2) Disconnect connector from air assist injector solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between air assist injector solenoid valve and engine ground. Connector & terminal (E42) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between air assist injector solenoid valve and main relay connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN ECM AND AIR ASSIST INJECTOR SOLENOID VALVE CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Measure resistance of harness between ECM and air assist injector solenoid valve connector. Connector & terminal (B134) No. 12 — (E42) No. 1:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and air assist injector solenoid valve connector • Poor contact in coupling connector
4 CHECK HARNESS BETWEEN ECM AND AIR ASSIST INJECTOR SOLENOID VALVE CONNECTOR. Measure resistance of harness between ECM and chassis ground. Connector & terminal (B134) No. 12 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair ground short circuit in harness between ECM and air assist injector solenoid valve connector.
5 CHECK POOR CONTACT. Check poor contact in ECM and air assist injector solenoid valve connectors.	Is there poor contact in ECM and air assist injector solenoid valve connectors?	Repair poor contact in ECM and air assist injector solenoid valve connectors.	Replace air assist injector solenoid valve. <Ref. to FU(H4SO)-33, Air Assist Injector Solenoid Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

H: DTC P0067 AIR ASSISTED INJECTOR CONTROL CIRCUIT HIGH

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-23, DTC P0067 AIR ASSISTED INJECTOR CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

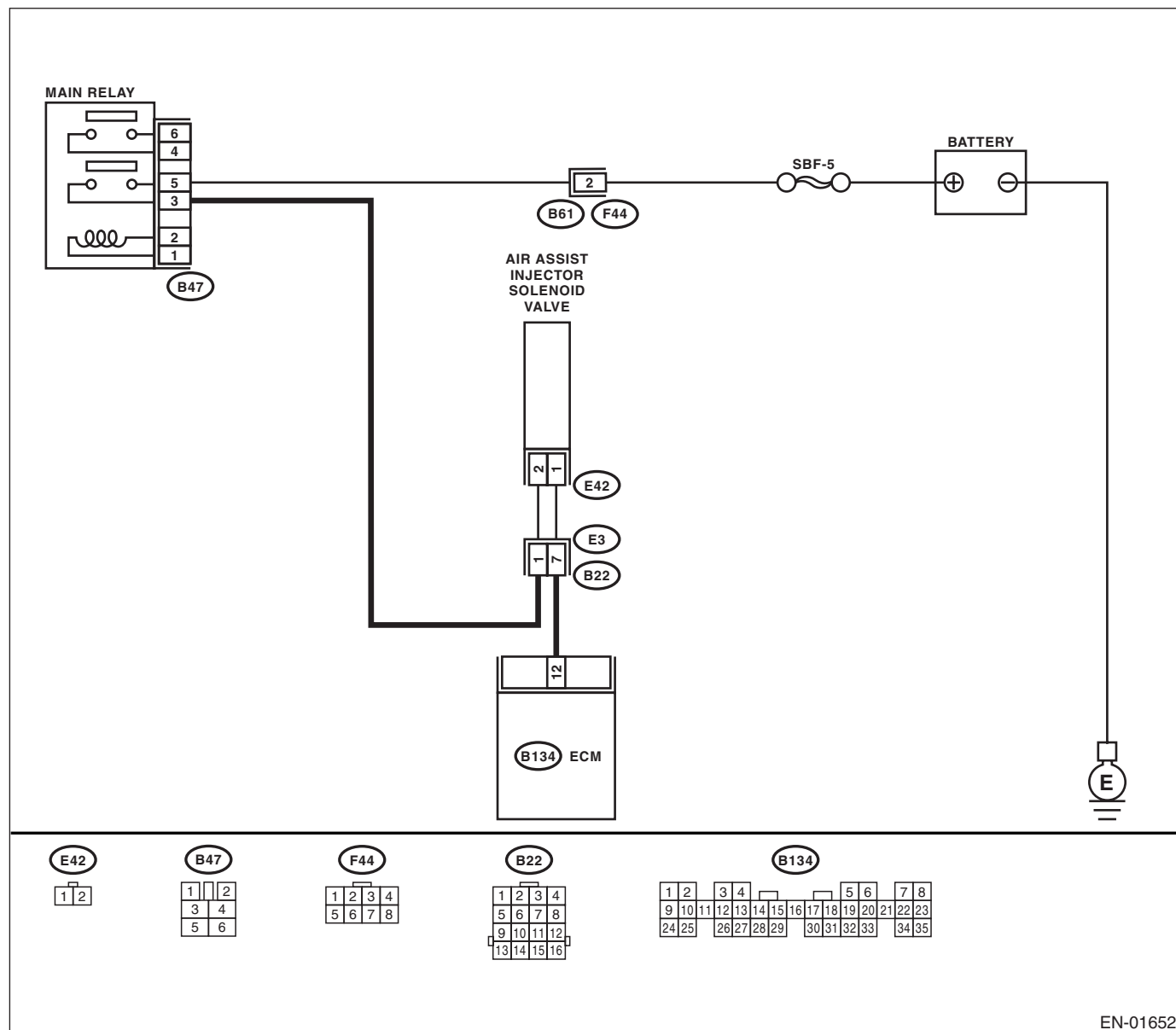
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01652

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure voltage between ECM and chassis ground. Connector & terminal (B134) No. 12 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 3.
2 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to OFF. 2) Disconnect connector from air assist injector solenoid valve. 3) Turn ignition switch to ON. 4) Measure voltage between ECM and chassis ground. Connector & terminal (B134) No. 12 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and air assist injector solenoid valve connector. After repair, replace ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Replace air assist injector solenoid valve <Ref. to FU(H4SO)-33, Air Assist Injector Solenoid Valve.> and ECM <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>
3 CHECK OUTPUT SIGNAL FROM ECM. Measure voltage between ECM and chassis ground. Connector & terminal (B134) No. 12 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair battery short circuit in harness between ECM and air assist injector solenoid valve connector. After repair, replace ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

I: DTC P0068 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE PROBLEM

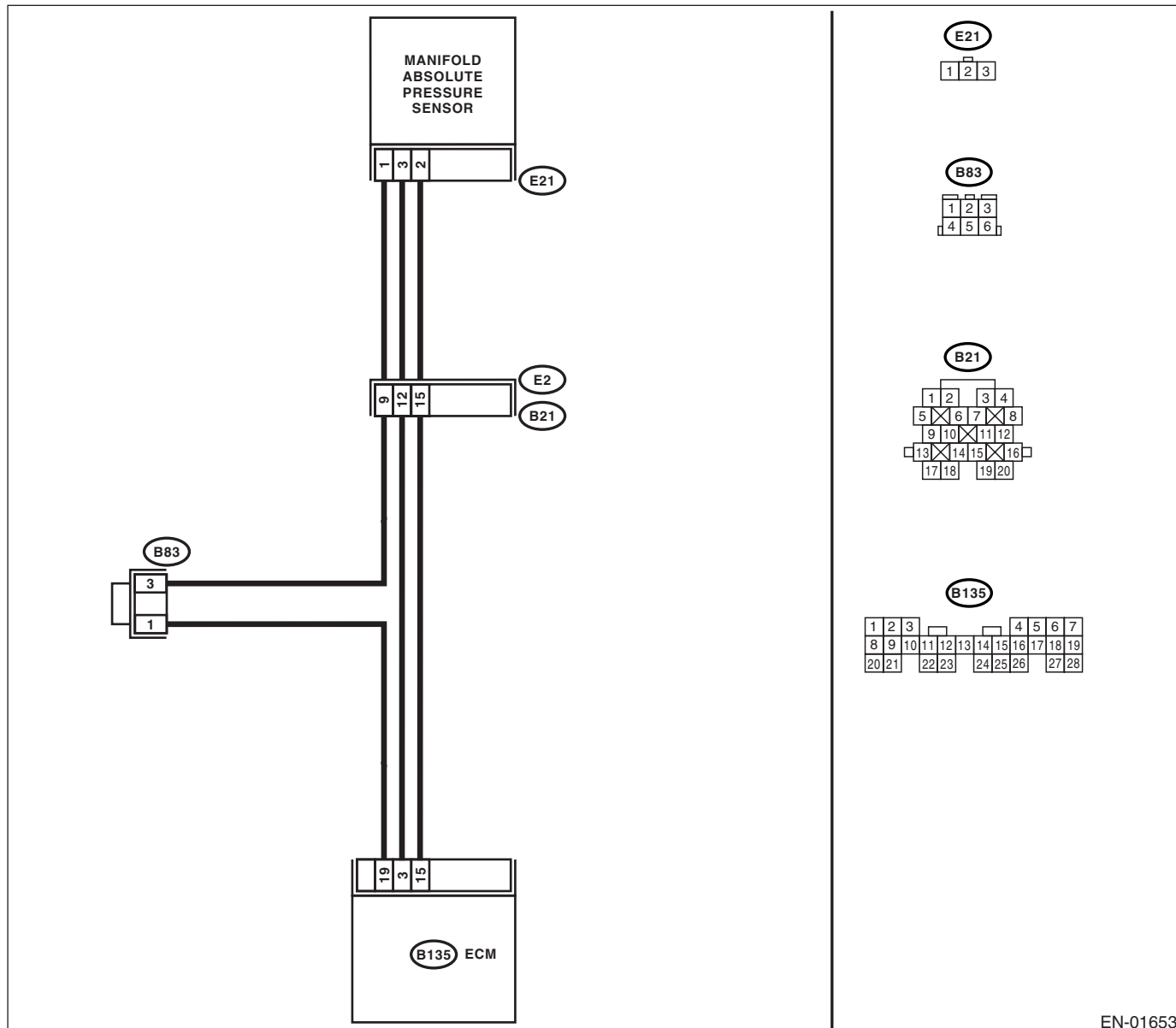
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-25, DTC P0068 MANIFOLD PRESSURE SENSOR RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01653

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK AIR INTAKE SYSTEM.	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair air intake system.	Go to step 3.
3 CHECK PRESSURE SENSOR. 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the selector lever or shift lever in "P" or "N" position. 3) Turn the A/C switch to OFF. 4) All accessory switches OFF. 5) Read the data of intake manifold pressure sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Ignition ON: Is the measured value 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg)? Idling: Is the measured value 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg)?	Go to step 4.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-30, Manifold Absolute Pressure Sensor.>
4 CHECK THROTTLE POSITION. Read the data of throttle position signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the measured value less than 5% when throttle is fully closed?	Go to step 5.	Adjust or replace the throttle position sensor. <Ref. to FU(H4SO)-28, Throttle Position Sensor.>
5 CHECK THROTTLE POSITION.	Is the measured value more than 85% when throttle is wide open?	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-30, Manifold Absolute Pressure Sensor.>	Replace the throttle position sensor. <Ref. to FU(H4SO)-28, Throttle Position Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

J: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

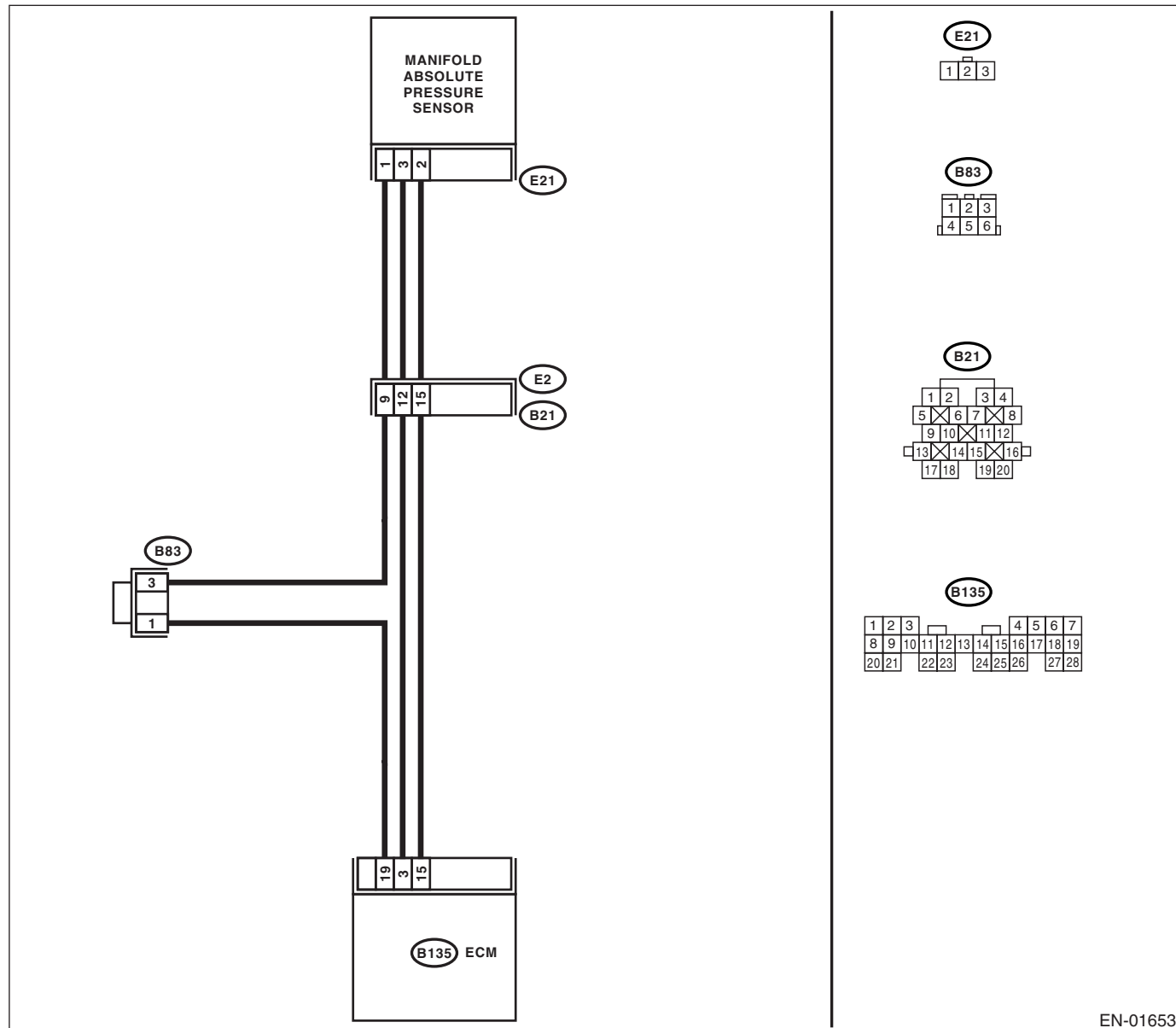
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-27, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01653

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the measured value less than 13.3 kPa (100 mmHg, 3.94 inHg)?	Go to step 3.	Go to step 2.
2 CHECK POOR CONTACT. Check poor contact in ECM and manifold absolute pressure sensor connector.	Is there poor contact in ECM or manifold absolute pressure sensor connector?	Repair poor contact in ECM or manifold absolute pressure sensor connector.	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time.
3 CHECK OUTPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 5.	Go to step 4.
4 CHECK OUTPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 15 (+) — Chassis ground (-):	Is the voltage less than 0.2 V?	Go to step 7.	Go to step 6.
6 CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR) Read the data of atmospheric absolute pressure signal using Subaru Select Monitor. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.>	Is the measured value more than 13.3 kPa (100 mmHg, 3.94 inHg) by shaking the harness and connector of ECM?	Repair poor contact in ECM connector.	Go to step 7.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK HARNESS BETWEEN MANIFOLD ABSOLUTE PRESSURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between manifold absolute pressure sensor connector and engine ground. Connector & terminal (E21) No. 3 (+) — Engine ground (-):	Is the voltage more than 4.5 V?	Go to step 8.	Repair open circuit in harness between ECM and manifold absolute pressure sensor connector.
8 CHECK HARNESS BETWEEN MANIFOLD ABSOLUTE PRESSURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector. Connector & terminal (B135) No. 19 — (E21) No. 1:	Is the resistance less than 1 Ω ?	Go to step 9.	Repair open circuit in harness between ECM and manifold absolute pressure sensor connector.
9 CHECK POOR CONTACT. Check poor contact in manifold absolute pressure sensor connector.	Is there poor contact in manifold absolute pressure sensor connector?	Repair poor contact in manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-30, Manifold Absolute Pressure Sensor.>

K: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

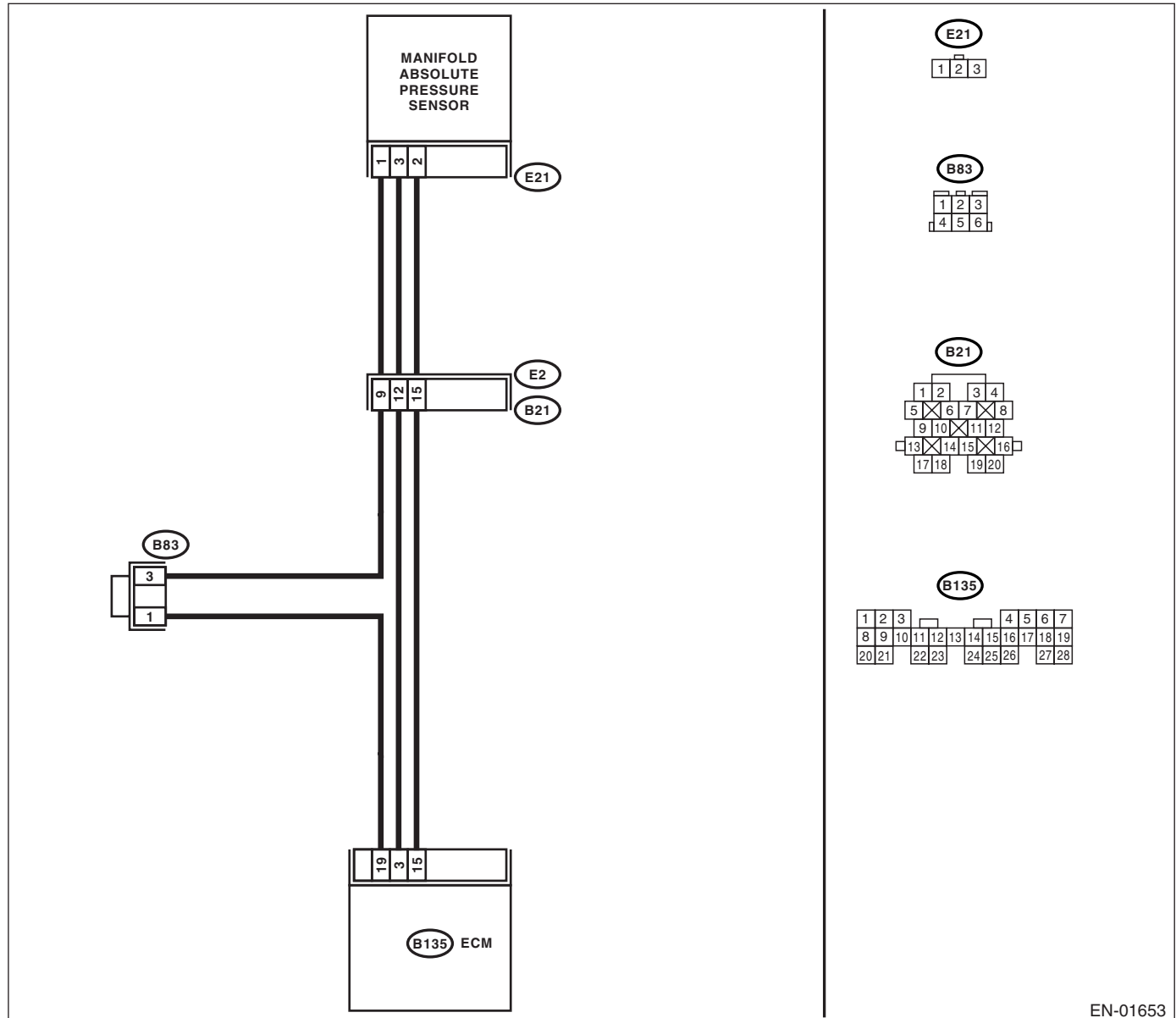
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-29, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01653

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the measured value more than 119.5 kPa (896.5 mmHg, 35.29 inHg)?	Go to step 10.	Go to step 2.
2	CHECK OUTPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 4.	Go to step 3.
3	CHECK OUTPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 15 (+) — Chassis ground (-):	Is the voltage less than 0.2 V?	Go to step 6.	Go to step 5.
5	CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR) Read the data of atmospheric absolute pressure signal using Subaru Select Monitor. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.>	Is the measured value more than 13.3 kPa (100 mmHg, 3.94 inHg) by shaking the harness and connector of ECM?	Repair poor contact in ECM connector.	Go to step 6.
6	CHECK HARNESS BETWEEN MANIFOLD ABSOLUTE PRESSURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between manifold absolute pressure sensor connector and engine ground. Connector & terminal (E21) No. 3 (+) — Engine ground (-):	Is the voltage more than 4.5 V?	Go to step 7.	Repair open circuit in harness between ECM and manifold absolute pressure sensor connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK HARNESS BETWEEN MANIFOLD ABSOLUTE PRESSURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector. Connector & terminal (B135) No. 15 — (E21) No. 2:	Is the resistance less than 1 Ω ?	Go to step 8.	Repair open circuit in harness between ECM and manifold absolute pressure sensor connector.
8 CHECK HARNESS BETWEEN MANIFOLD ABSOLUTE PRESSURE SENSOR AND ECM CONNECTOR. Measure the resistance of harness between ECM and manifold absolute pressure sensor connector. Connector & terminal (B135) No. 19 — (E21) No. 1:	Is the resistance less than 1 Ω ?	Go to step 9.	Repair open circuit in harness between ECM and manifold absolute pressure sensor connector.
9 CHECK POOR CONTACT. Check poor contact in manifold absolute pressure sensor connector.	Is there poor contact in manifold absolute pressure sensor connector?	Repair poor contact in manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-30, Manifold Absolute Pressure Sensor.>
10 CHECK HARNESS BETWEEN MANIFOLD ABSOLUTE PRESSURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF and Subaru Select Monitor or the OBD-II general scan tool switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Turn the ignition switch to ON and Subaru Select Monitor or the OBD-II general scan tool switch to ON. 4) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the measured value more than 119.5 kPa (896.5 mmHg, 35.29 inHg)?	Repair battery short circuit in harness between ECM and manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-30, Manifold Absolute Pressure Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

L: DTC P0111 INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-31, DTC P0111 INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

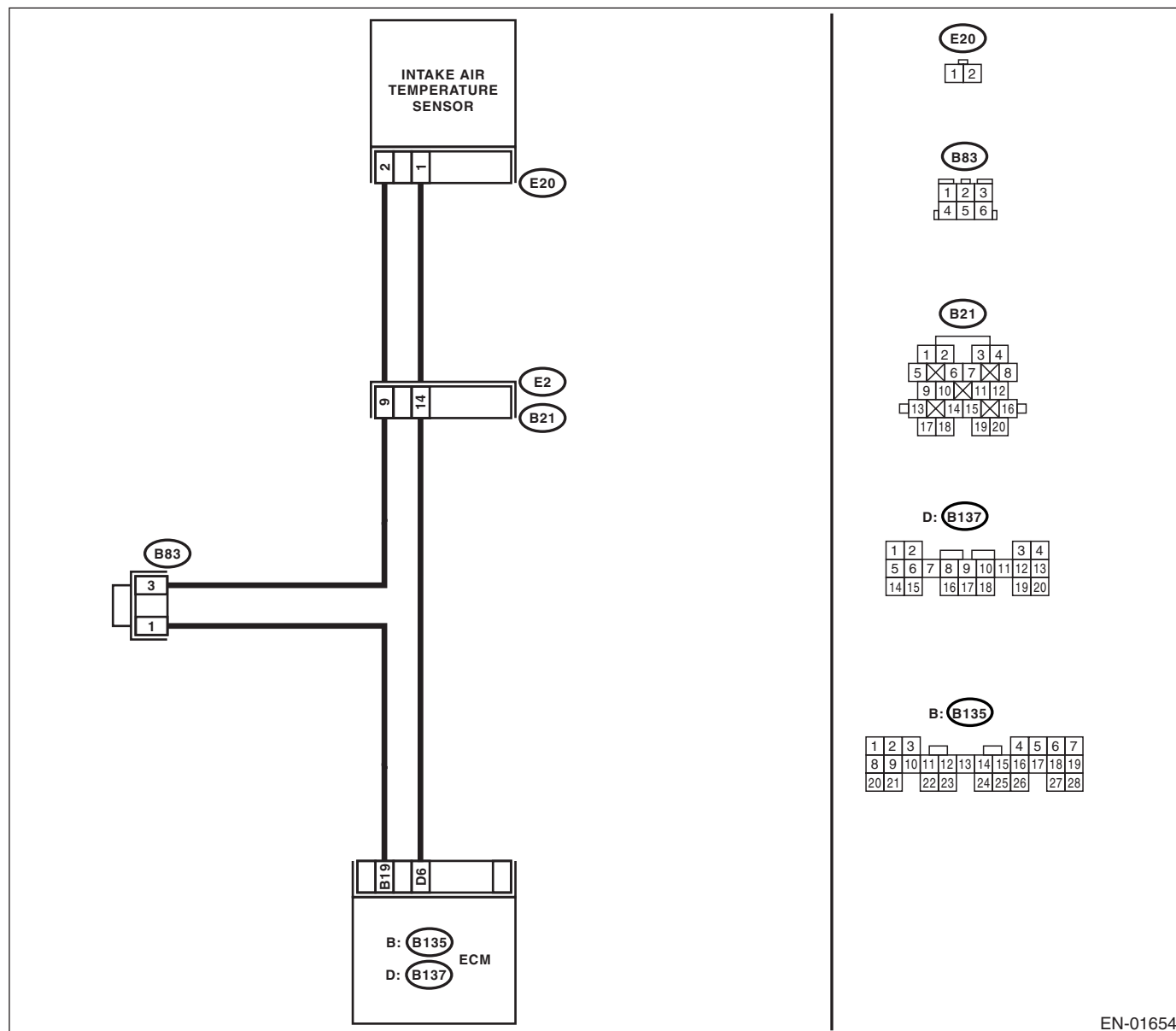
TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01654

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0111.	Replace the intake air temperature sensor. <Ref. to FU(H4SO)-31, Intake Air Temperature Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

M: DTC P0112 INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-33, DTC P0112 INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

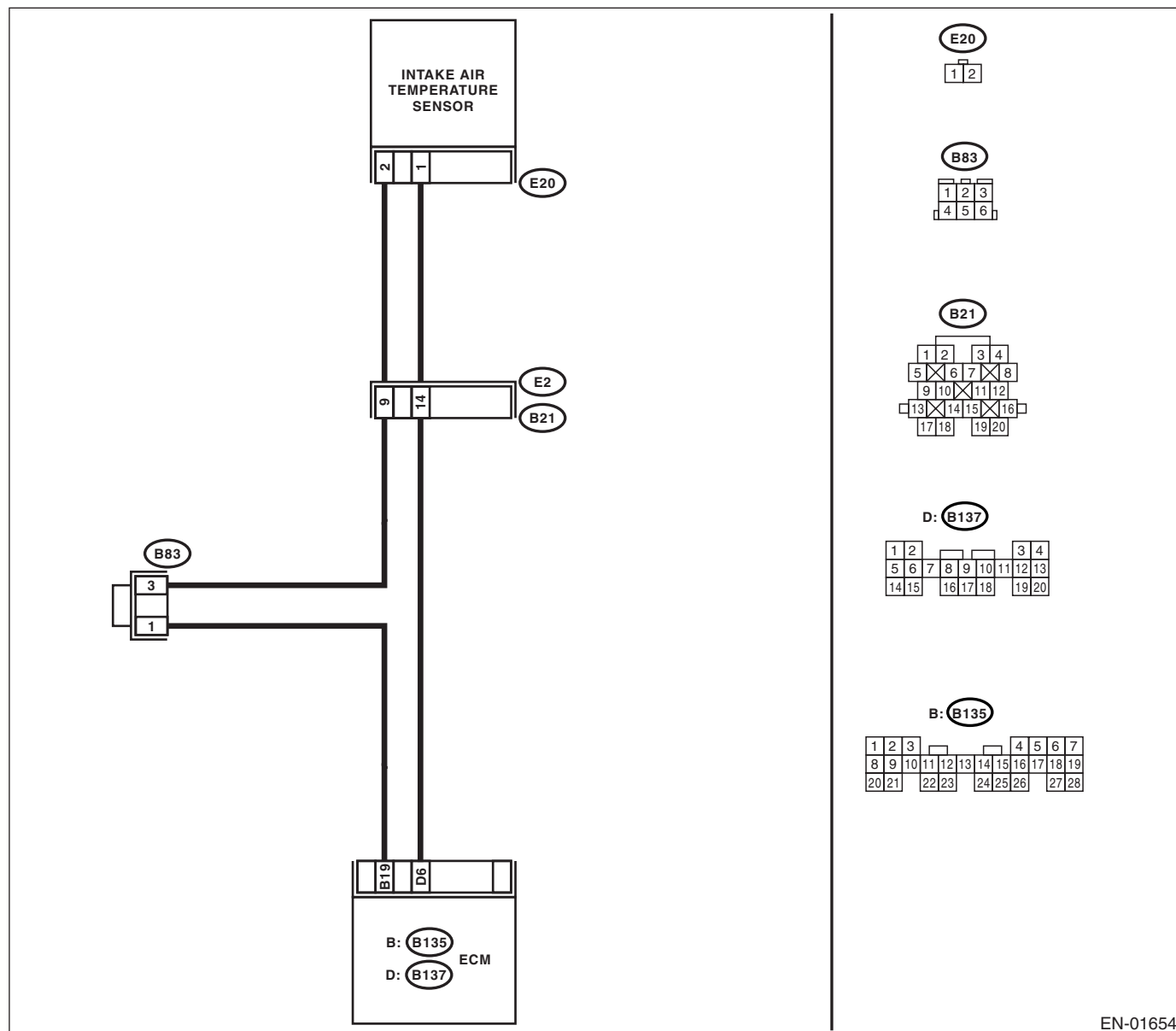
TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01654

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the intake air temperature more than 120°C (248°F)?	Go to step 2.	Repair poor contact. NOTE: In this case, repair the following: • Poor contact in intake air temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from intake air temperature sensor. 3) Turn the ignition switch to ON. 4) Read the data of intake air temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the intake air temperature less than -40°C (-40°F)?	Replace the intake air temperature sensor. <Ref. to FU(H4SO)-31, Intake Air Temperature Sensor.>	Repair ground short circuit in harness between intake air temperature sensor and ECM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

N: DTC P0113 INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-35, DTC P0113 INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

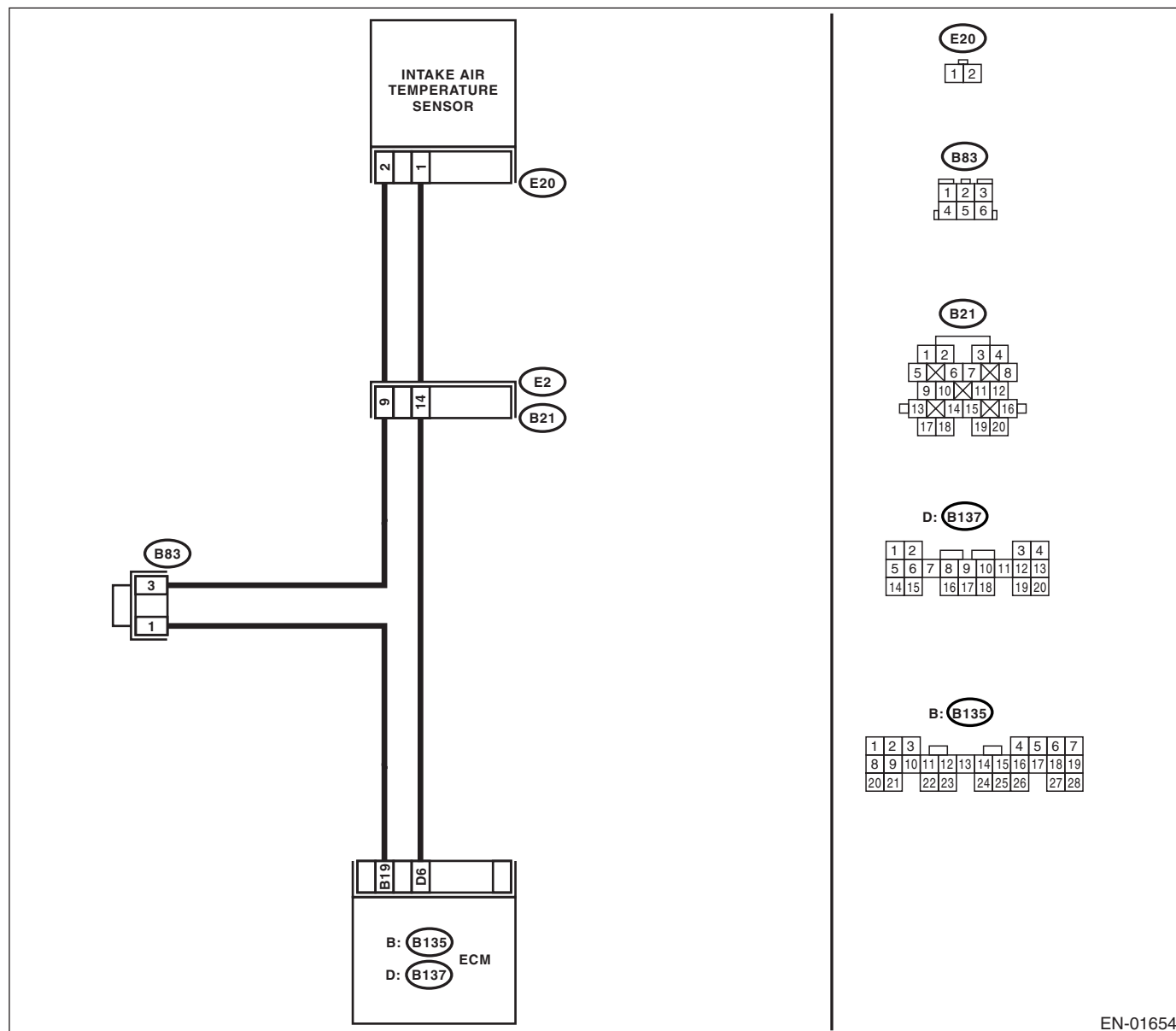
TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01654

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or the OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedure, refer to the OBD-II General Scan Tool Instruction Manual.	Is the intake air temperature less than -40°C (-40°F)?	Go to step 2.	Repair poor contact. NOTE: In this case, repair the following: • Poor contact in intake air temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from intake air temperature sensor. 3) Measure the voltage between intake air temperature and manifold absolute pressure sensor connector and engine ground. Connector & terminal (E20) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between intake air temperature sensor and ECM connector.	Go to step 3.
3 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between intake air temperature sensor connector and engine ground. Connector & terminal (E20) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between intake air temperature sensor and ECM connector.	Go to step 4.
4 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. Measure the voltage between intake air temperature sensor connector and engine ground. Connector & terminal (E20) No. 1 (+) — Engine ground (-):	Is the voltage more than 3 V?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between intake air temperature sensor and ECM connector • Poor contact in intake air temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between intake air temperature sensor connector and engine ground. Connector & terminal (E20) No. 2 — Engine ground:	Is the resistance less than 5 Ω ?	Replace the intake air temperature sensor. <Ref. to FU(H4SO)-31, Intake Air Temperature Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between intake air temperature sensor and ECM connector • Poor contact in intake air temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector

O: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-37, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

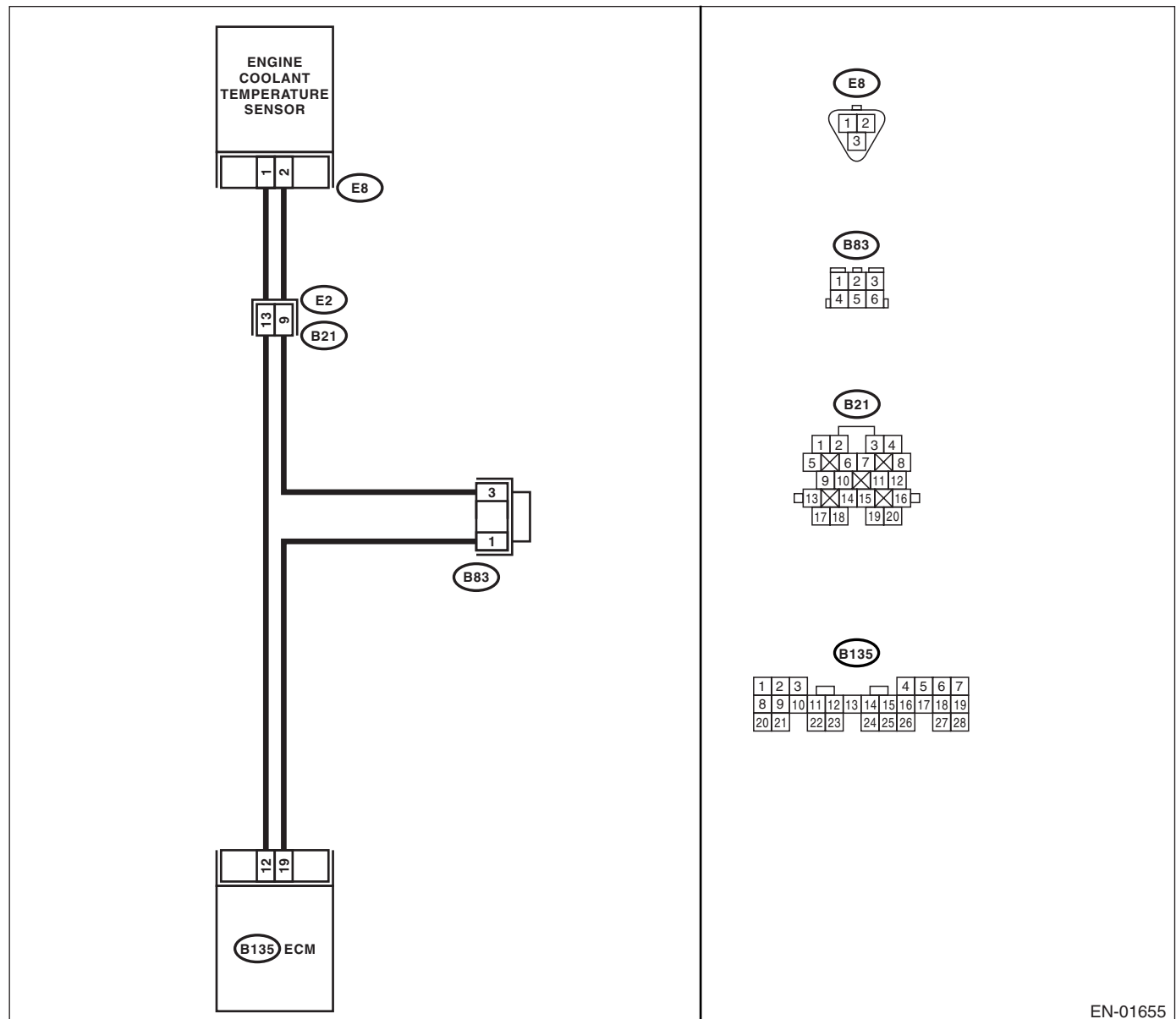
TROUBLE SYMPTOM:

- Hard to start
- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01655

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the engine coolant temperature more than 150°C (302°F)?	Go to step 2.	Repair poor contact.
				NOTE: In this case, repair the following: • Poor contact in engine coolant temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2	CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from engine coolant temperature sensor. 3) Turn the ignition switch to ON. 4) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the engine coolant temperature less than -40°C (-40°F)?	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-24, Engine Coolant Temperature Sensor.>	Repair ground short circuit in harness between engine coolant temperature sensor and ECM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

P: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-39, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

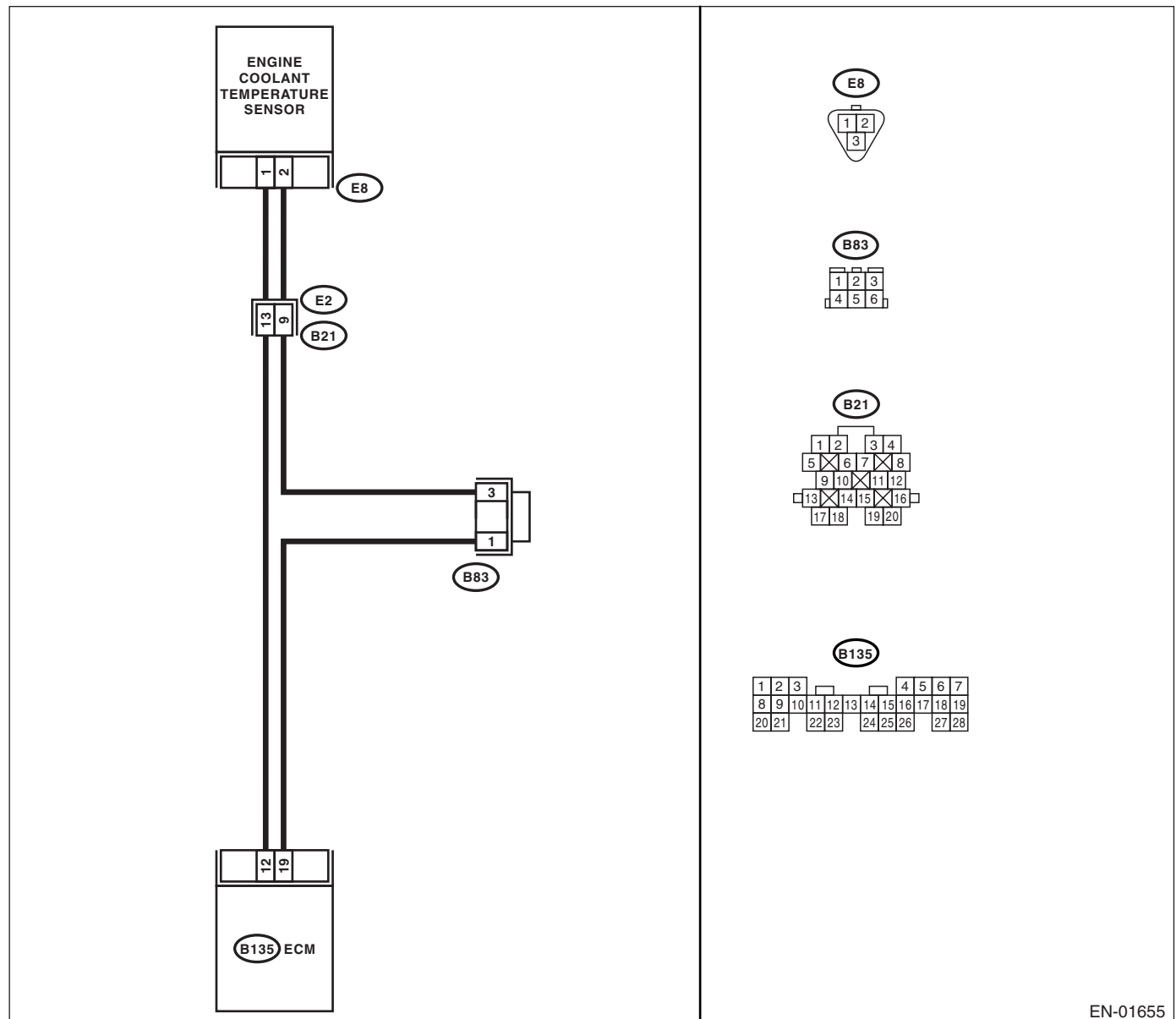
TROUBLE SYMPTOM:

- Hard to start
- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01655

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the engine coolant temperature less than -40°C (-40°F)?	Go to step 2.	Repair poor contact. NOTE: In this case, repair the following: • Poor contact in engine coolant temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from engine coolant temperature sensor. 3) Measure the voltage between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and engine coolant temperature sensor connector.	Go to step 3.
3 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and engine coolant temperature sensor connector.	Go to step 4.
4 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. Measure the voltage between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 1 (+) — Engine ground (-):	Is the voltage more than 4 V?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine coolant temperature sensor connector • Poor contact in engine coolant temperature sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 2 — Engine ground:	Is the resistance less than 5 Ω ?	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-24, Engine Coolant Temperature Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine coolant temperature sensor connector • Poor contact in engine coolant temperature sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Q: DTC P0121 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-41, DTC P0121 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

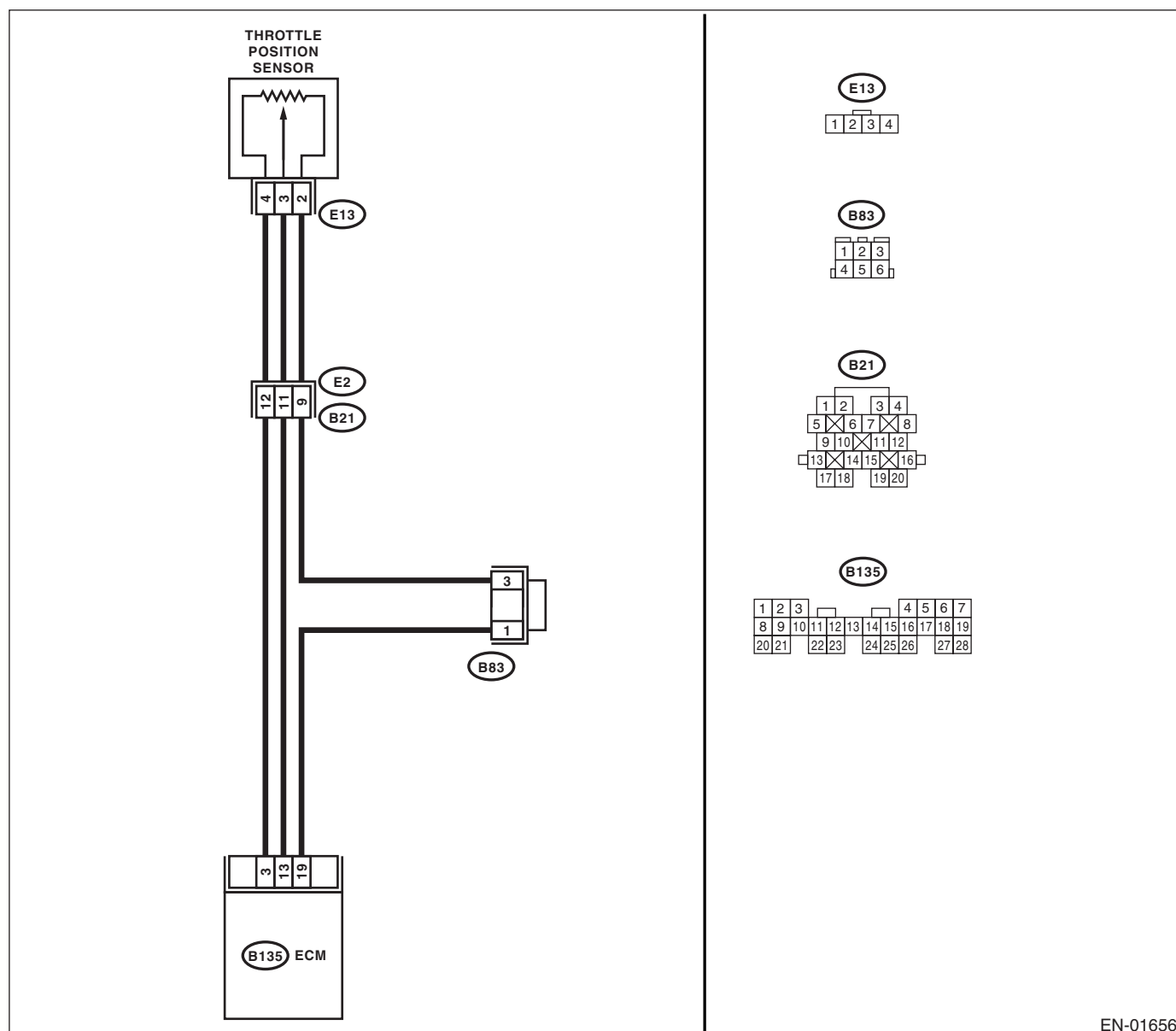
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01656

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0121.	Replace the throttle position sensor. <Ref. to FU(H4SO)-28, Throttle Position Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

R: DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-43, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

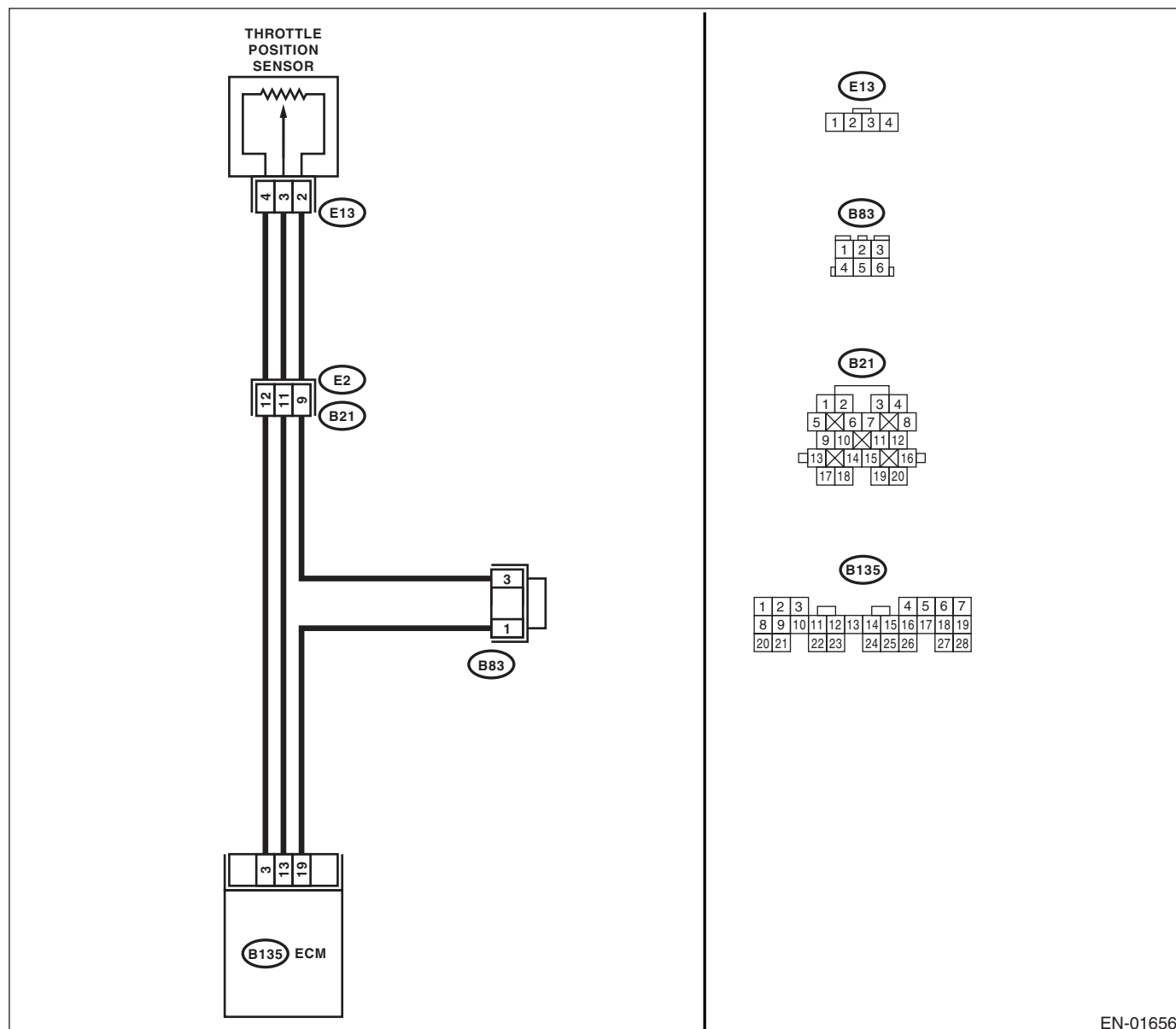
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01656

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of throttle position sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the voltage less than 0.1 V?	Go to step 2.	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause. NOTE: In this case, repair the following: • Poor contact in throttle position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK OUTPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground while throttle valve is fully closed. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 4.	Go to step 3.
3 CHECK OUTPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 13 (+) — Chassis ground (-):	Is the voltage more than 0.1 V?	Go to step 6.	Go to step 5.
5 CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 13 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Go to step 6.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from throttle position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between throttle position sensor connector and engine ground. Connector & terminal (E13) No. 4 (+) — Engine ground (-):	Is the voltage more than 4.5 V?	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between throttle position sensor and ECM connector • Poor contact in throttle position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector
7 CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between ECM connector and throttle position sensor connector. Connector & terminal (B135) No. 13 — (E13) No. 3:	Is the resistance less than 1 Ω ?	Go to step 8.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between throttle position sensor and ECM connector • Poor contact in ECM connector • Poor contact in throttle position sensor connector • Poor contact in coupling connector
8 CHECK HARNESS BETWEEN ECM AND THROTTLE POSITION SENSOR CONNECTOR. Measure the resistance of harness between throttle position sensor connector and engine ground. Connector & terminal (E13) No. 3 — Engine ground:	Is the resistance more than 1 M Ω ?	Go to step 9.	Repair ground short circuit in harness between throttle position sensor and ECM connector.
9 CHECK POOR CONTACT. Check poor contact in throttle position sensor connector.	Is there poor contact in throttle position sensor connector?	Repair poor contact in throttle position sensor connector.	Replace the throttle position sensor. <Ref. to FU(H4SO)-28, Throttle Position Sensor.>

S: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-45, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

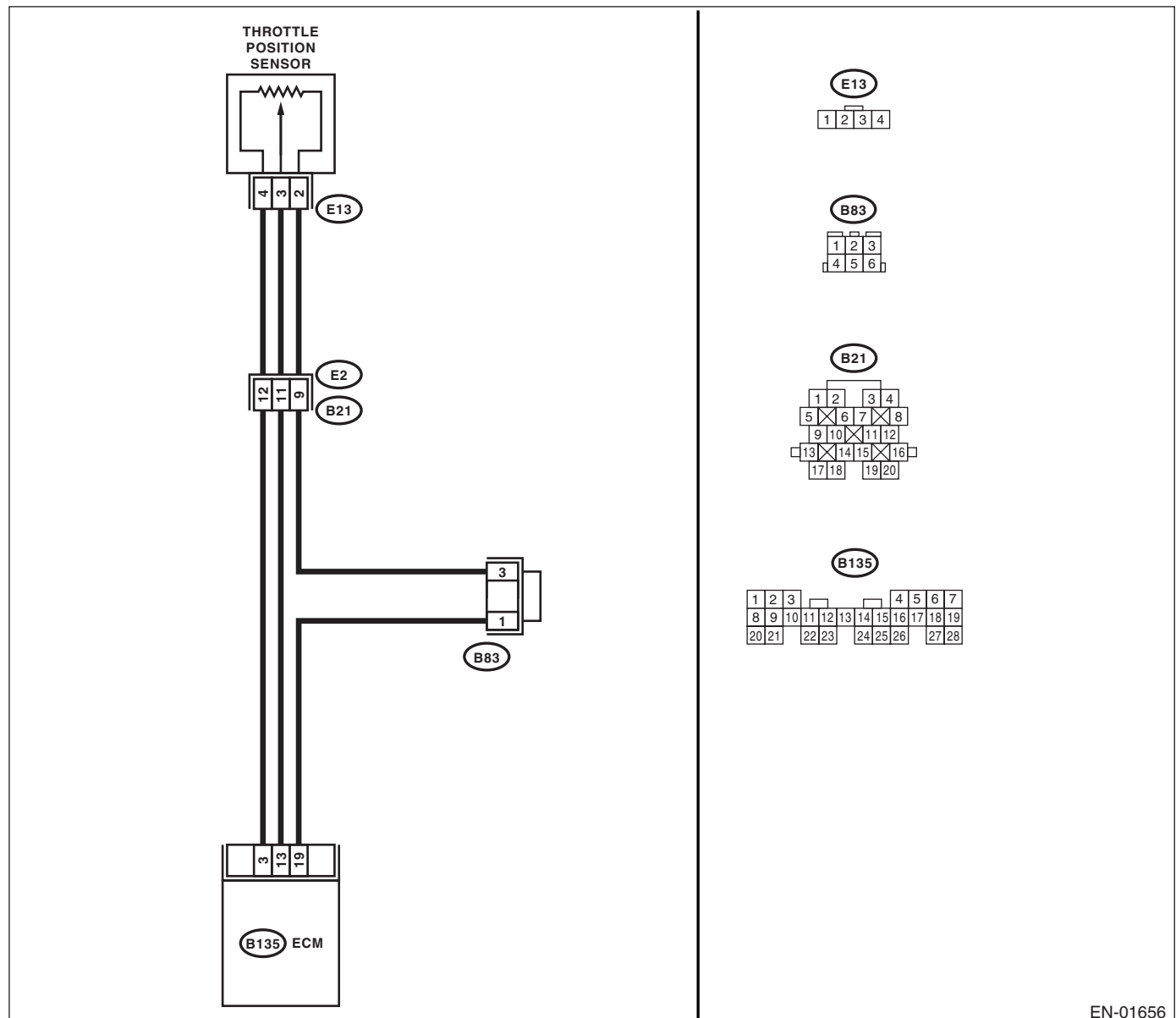
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01656

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of throttle position sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the voltage more than 4.9 V?	Go to step 2.	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause. NOTE: In this case, repair the following: • Poor contact in throttle position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK HARNESS BETWEEN THROTTLE POSITION SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from throttle position sensor. 3) Measure the resistance of harness between throttle position sensor connector and engine ground. Connector & terminal (E13) No. 2 — Engine ground:	Is the resistance less than 5 Ω ?	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between throttle position sensor and ECM connector • Poor contact in coupling connector • Poor contact in joint connector
3 CHECK HARNESS BETWEEN THROTTLE POSITION SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between throttle position sensor connector and engine ground. Connector & terminal (E13) No. 3 (+) — Engine ground (-):	Is the voltage more than 4.9 V?	Repair battery short circuit in harness between throttle position sensor and ECM connector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Replace the throttle position sensor. <Ref. to FU(H4SO)-28, Throttle Position Sensor.>

T: DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-47, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

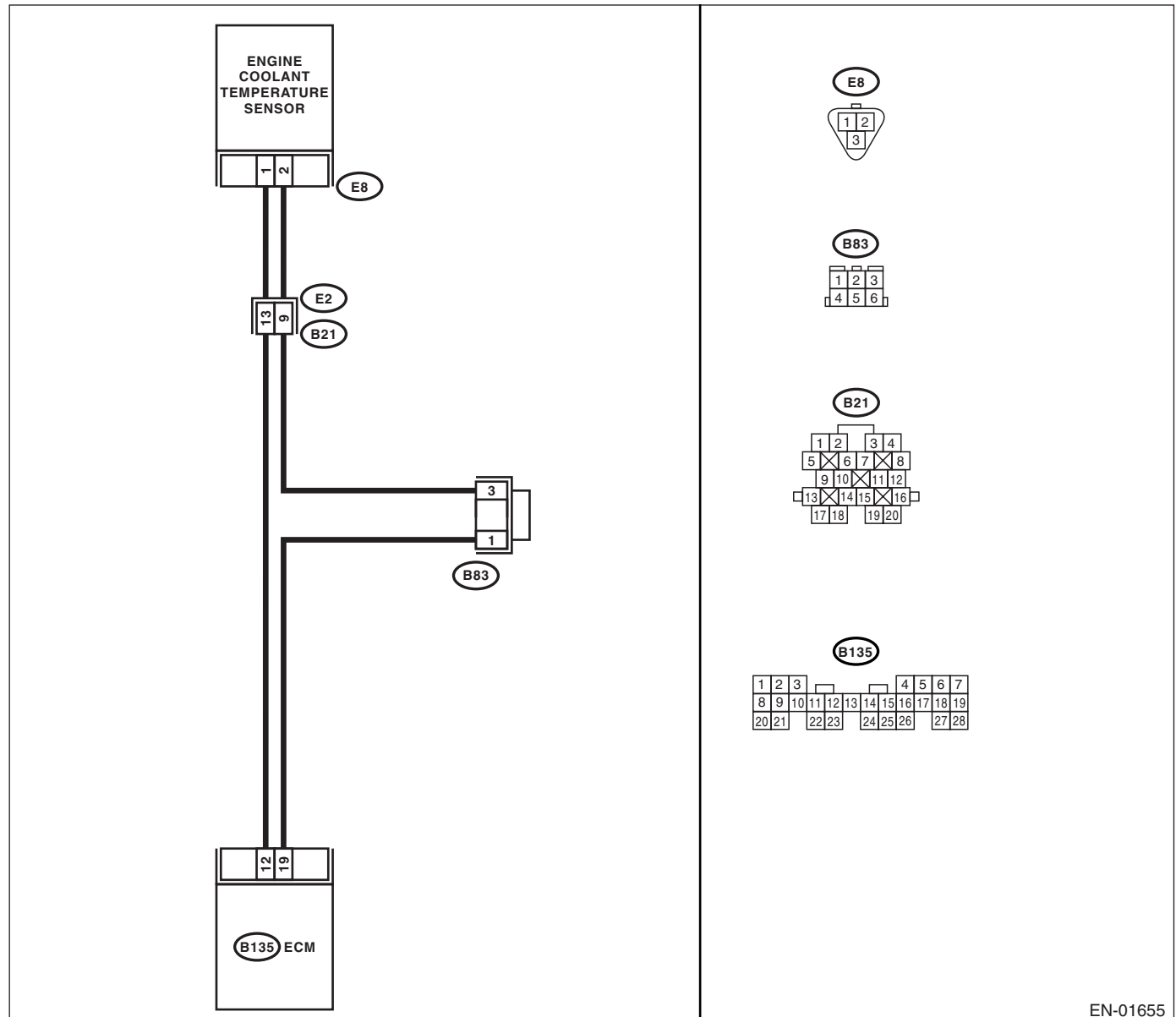
TROUBLE SYMPTOM:

Engine would not return to idling.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01655

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0125.	Go to step 2.
2 CHECK THERMOSTAT.	Does the thermostat remain opened?	Replace the thermostat. <Ref. to CO(H4SO)-17, Thermostat.>	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-24, Engine Coolant Temperature Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

U: DTC P0128 COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-48, DTC P0128 COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Thermostat remains open.

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>

Step	Check	Yes	No
1 CHECK VEHICLE CONDITION.	Was the vehicle driven or idled with the engine partially submerged under water?	In this case, it is not necessary to inspect DTC P0128.	Go to step 2.
2 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 3.
3 CHECK ENGINE COOLANT.	Are coolant level and mixture ratio of cooling water to anti-freeze solution correct?	Go to step 4.	Replace the engine coolant. <Ref. to CO(H4SO)-12, REPLACEMENT.>
4 CHECK RADIATOR FAN. 1) Start the engine. 2) Check radiator fan operation.	Does the radiator fan continuously rotate for more than 3 minutes during idling?	Repair radiator fan circuit. <Ref. to CO(H4SO)-22, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-23, Radiator Sub Fan and Fan Motor.>	Replace the thermostat. <Ref. to CO(H4SO)-17, Thermostat.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

V: DTC P0129 ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-50, DTC P0129 BAROMETRIC PRESSURE TOO LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: It is not necessary to inspect DTC P0129.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

W: DTC P0130 O₂ SENSOR CIRCUIT (BANK 1 SENSOR 1)

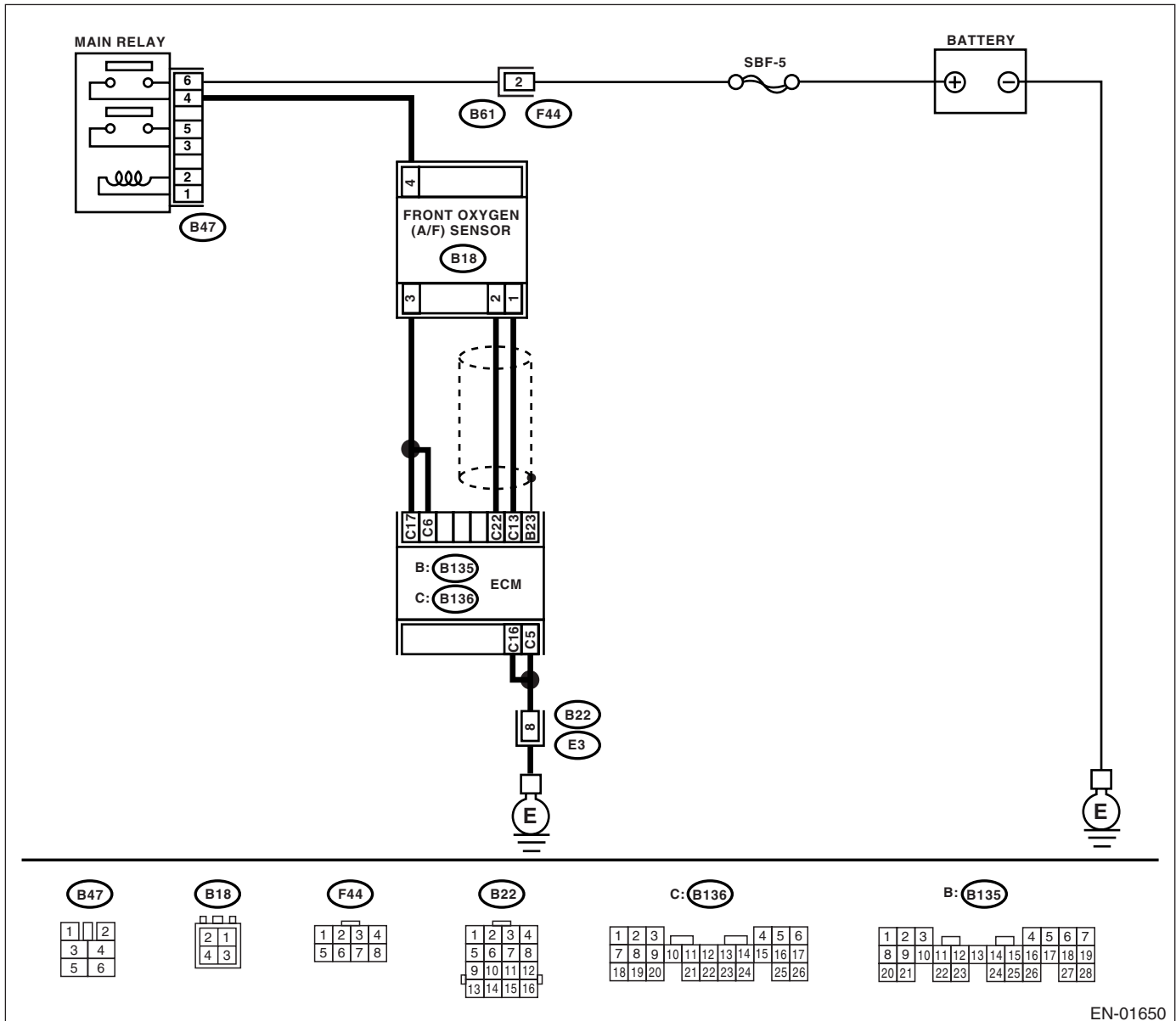
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-51, DTC P0130 O₂ SENSOR CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01650

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK FRONT OXYGEN (A/F) SENSOR DATA. 1) Start the engine. 2) While observing the Subaru Select Monitor or OBD-II general scan tool screen, warm-up the engine until coolant temperature is above 70°C (160°F). If the engine is already warmed-up, operate at idle speed for at least 1 minute. 3) Read the data of front oxygen (A/F) sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the voltage 0.85 — 1.15 V?	Go to step 3.	Go to step 4.
3 CHECK FRONT OXYGEN (A/F) SENSOR DATA. 1) Race the engine at speeds from idling to 5,000 rpm for a total of 5 cycles. 2) Read the data of front oxygen (A/F) sensor signal during racing using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Air fuel ratio is rich at normal condition or during racing. • To increase engine speed to 5,000 rpm, slowly depress accelerator pedal, taking approximately 5 seconds, and quickly release accelerator pedal to decrease engine speed.	Is the voltage more than 1.1 V?	Go to step 6.	Go to step 4.
4 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and front oxygen (A/F) sensor connector. 3) Measure the resistance between ECM and front oxygen (A/F) sensor. Connector & terminals (B136) No. 13 — (B18) No. 1: (B136) No. 22 — (B18) No. 2:	Is the resistance less than 5 Ω?	Go to step 5.	Repair open circuit between ECM and front oxygen (A/F) sensor.
5 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR. Measure the resistance between ECM and chassis ground. Connector & terminals (B136) No. 13 — Chassis ground: (B136) No. 22 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 6.	Repair ground short circuit between ECM and front oxygen (A/F) sensor.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK EXHAUST SYSTEM. Check exhaust system parts. NOTE: Check the following items. • Loose installation of portions • Damage (crack, hole etc.) of parts • Looseness of front oxygen (A/F) sensor • Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	Is there a fault in exhaust system?	Repair or replace faulty parts.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-40, Front Oxygen (A/F) Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

X: DTC P0131 O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

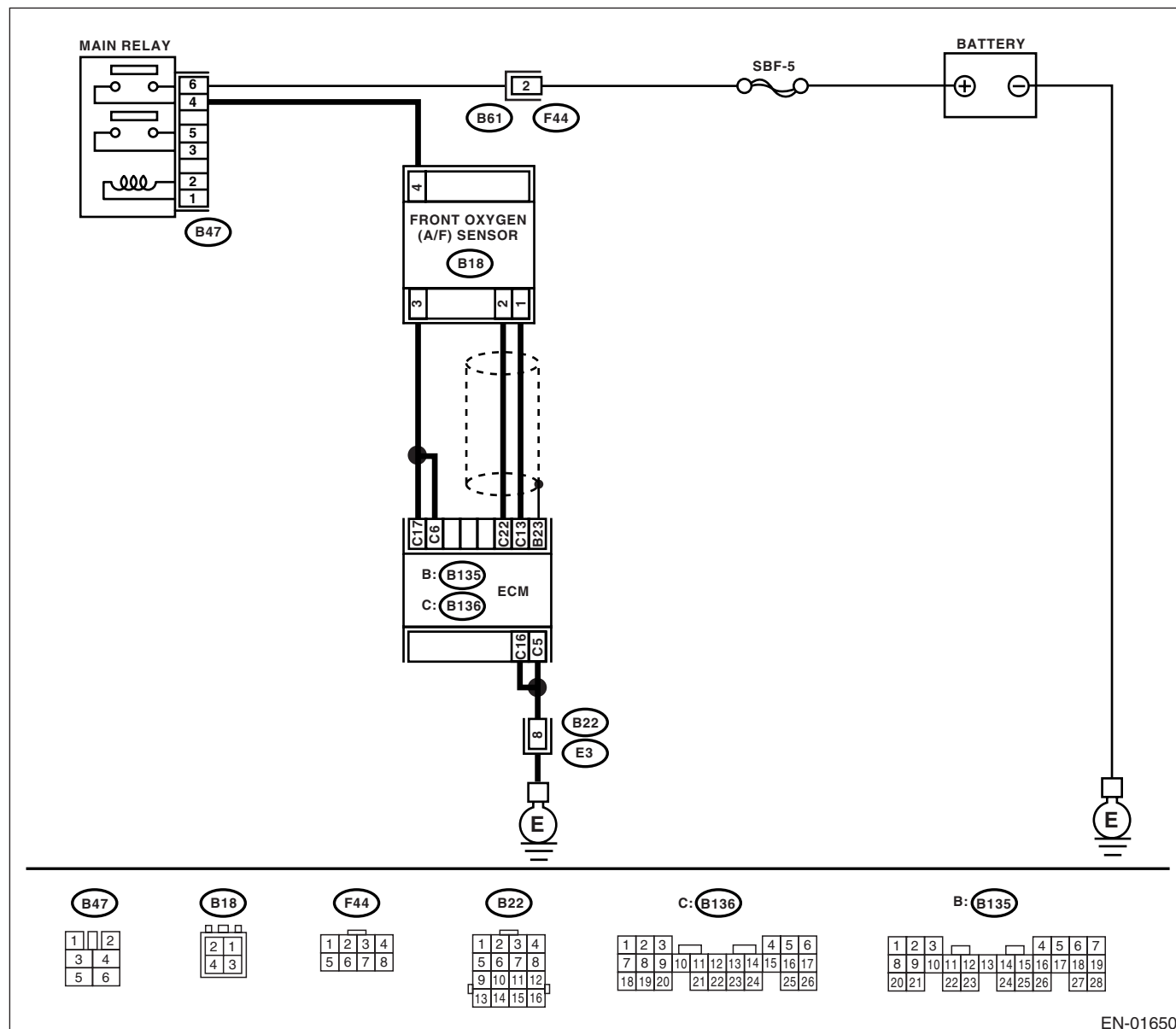
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-53, DTC P0131 O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01650

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor connector. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. Connector & terminal (B136) No. 13 — Chassis ground: (B136) No. 22 — Chassis ground:	Is the resistance more than 1 MΩ?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-40, Front Oxygen (A/F) Sensor.>	Repair ground short circuit in harness between ECM and front oxygen (A/F) sensor connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Y: DTC P0132 O₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

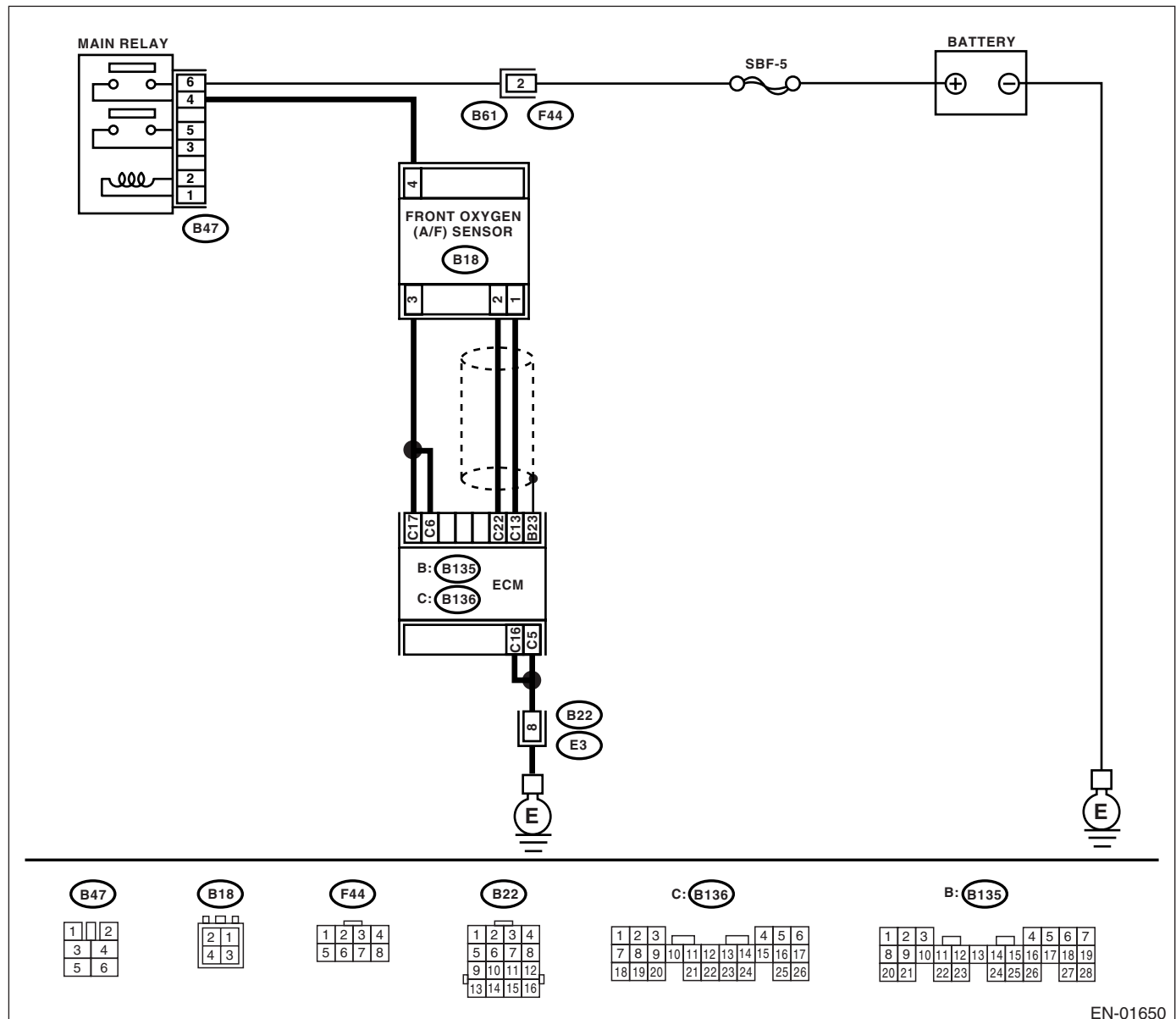
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-55, DTC P0132 O₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01650

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. 1) Turn the ignition switch to ON. 2) Disconnect the connectors from front oxygen (A/F) sensor. 3) Measure the voltage of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 13 (+) — Chassis ground (-): (B136) No. 22 (+) — Chassis ground (-):	Is the voltage more than 8 V?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-40, Front Oxygen (A/F) Sensor.>	Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Z: DTC P0133 O₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

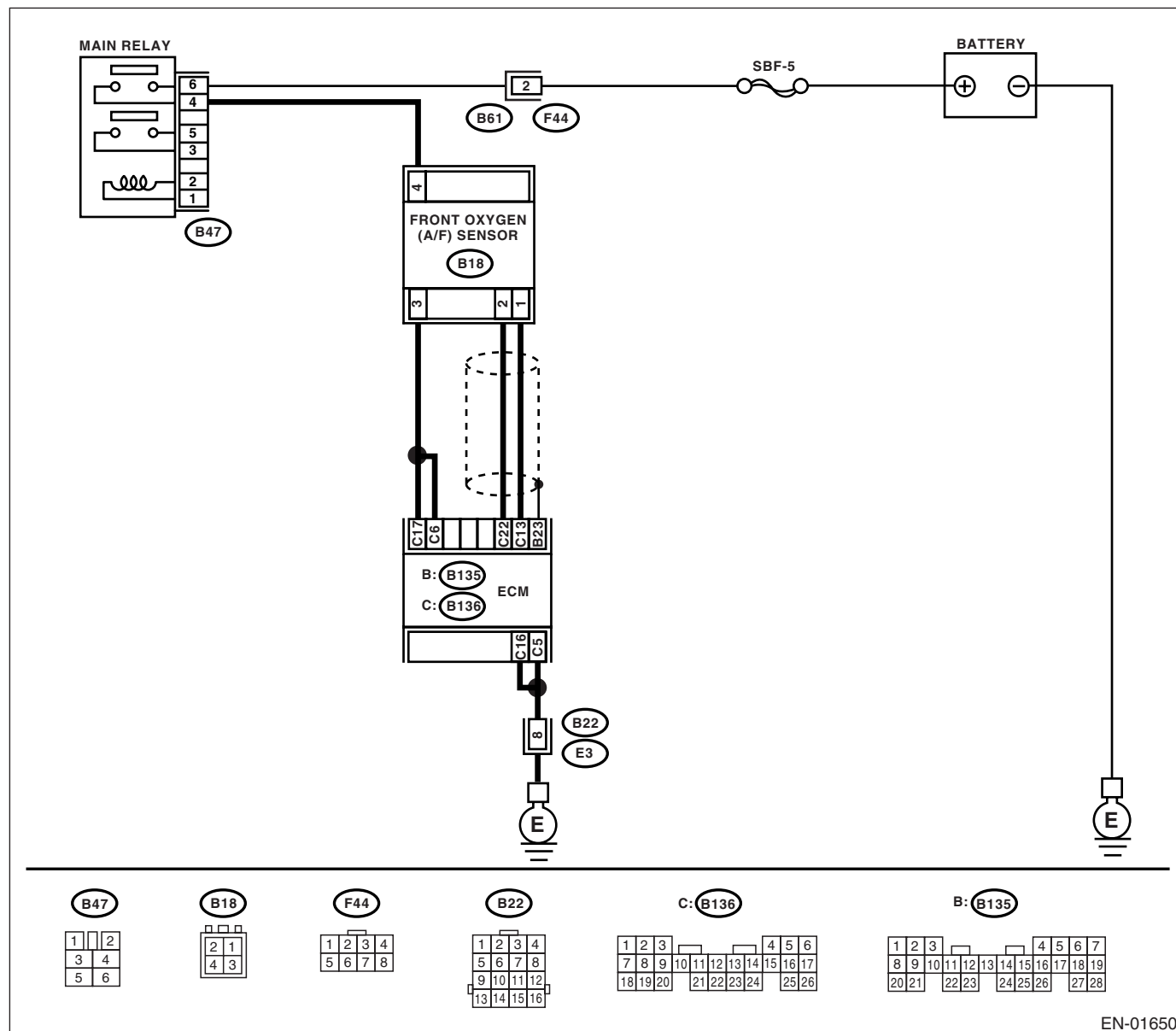
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-57, DTC P0133 O₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01650

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0133.	Go to step 2.
2 CHECK EXHAUST SYSTEM. NOTE: Check the following items. • Loose installation of front portion of exhaust pipe onto cylinder heads • Loose connection between front exhaust pipe and front catalytic converter • Damage of exhaust pipe resulting in a hole	Is there a fault in exhaust system?	Repair exhaust system.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-40, Front Oxygen (A/F) Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AA:DTC P0134 O₂ SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

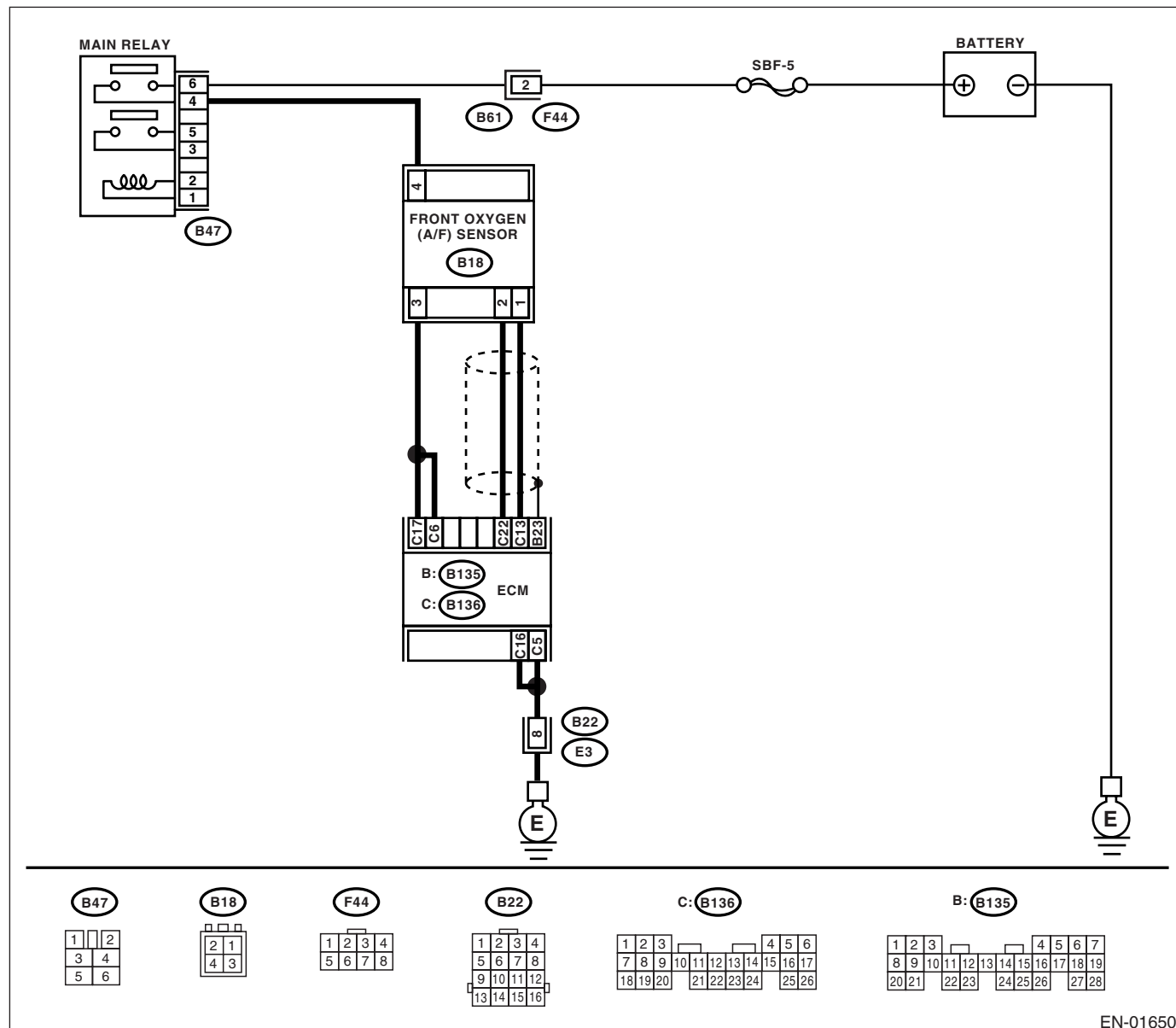
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-61, DTC P0134 O₂ SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor connector. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. Connector & terminal (B136) No. 13 — (B18) No. 1: (B136) No. 22 — (B18) No. 2:	Is the resistance less than 1 Ω ?	Go to step 2.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in ECM connector
2 CHECK POOR CONTACT. Check poor contact in front oxygen (A/F) sensor connector.	Is there poor contact in front oxygen (A/F) sensor connector?	Repair poor contact in front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-40, Front Oxygen (A/F) Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AB:DTC P0137 O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

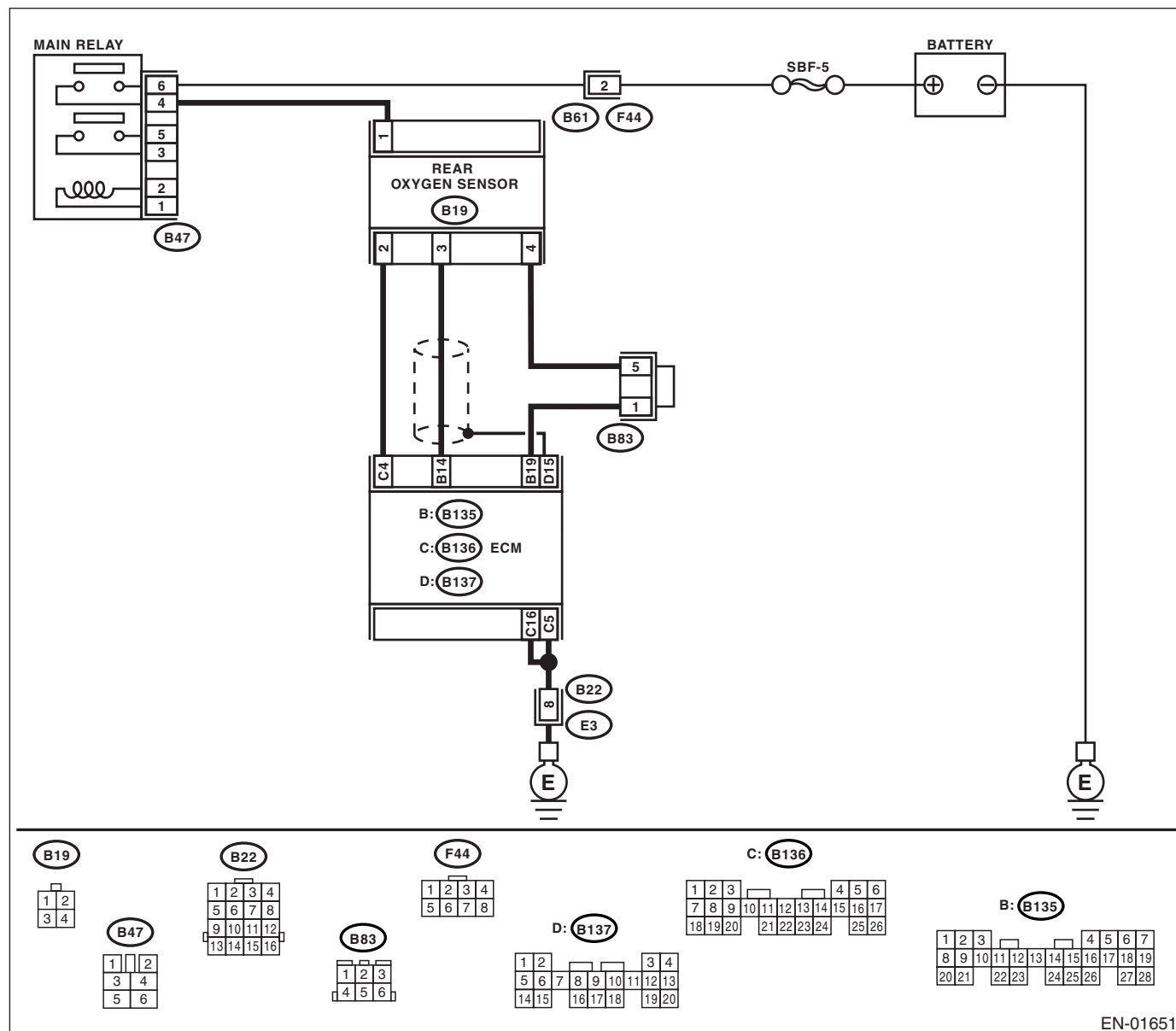
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-63, DTC P0137 O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01651

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0137.	Go to step 2.
2 CHECK REAR OXYGEN SENSOR DATA. 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and keep the engine speed at 5,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the voltage 490 mV?	Go to step 5.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. Connector & terminal (B135) No. 14 — (B19) No. 3: (B135) No. 19 — (B19) No. 4:	Is the resistance more than 3 Ω?	Repair open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 4.
4 CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor harness connector and engine ground or chassis ground. Connector & terminal (B19) No. 3 (+) — Engine ground (-):	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-42, Rear Oxygen Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK EXHAUST SYSTEM. Check exhaust system parts. NOTE: Check the following items. • Loose installation of portions • Damage (crack, hole etc.) of parts • Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	Is there a fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-42, Rear Oxygen Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AC:DTC P0138 O₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

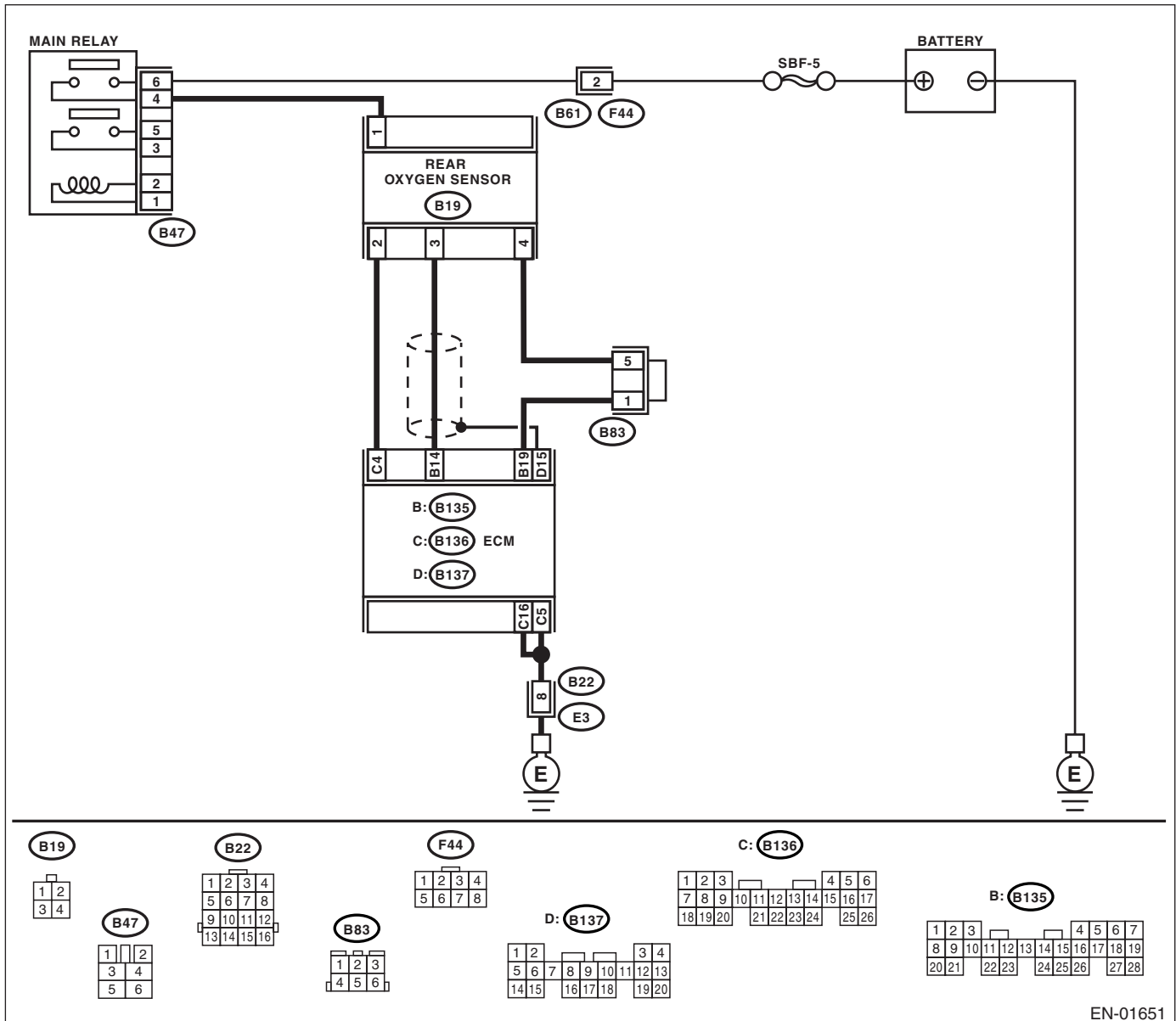
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-65, DTC P0138 O₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01651

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0138.	Go to step 2.
2 CHECK REAR OXYGEN SENSOR DATA. 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and immediately decrease the engine speed from 5,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the voltage 250 mV?	Go to step 5.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. Connector & terminal (B135) No. 14 — (B19) No. 3: (B135) No. 19 — (B19) No. 4:	Is the resistance more than 3 Ω?	Repair open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 4.
4 CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor harness connector and engine ground or chassis ground. Connector & terminal (B19) No. 3 (+) — Engine ground (-):	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-42, Rear Oxygen Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK EXHAUST SYSTEM. Check exhaust system parts. NOTE: Check the following items. • Loose installation of portions • Damage (crack, hole etc.) of parts • Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	Is there a fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-42, Rear Oxygen Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AD:DTC P0139 O₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

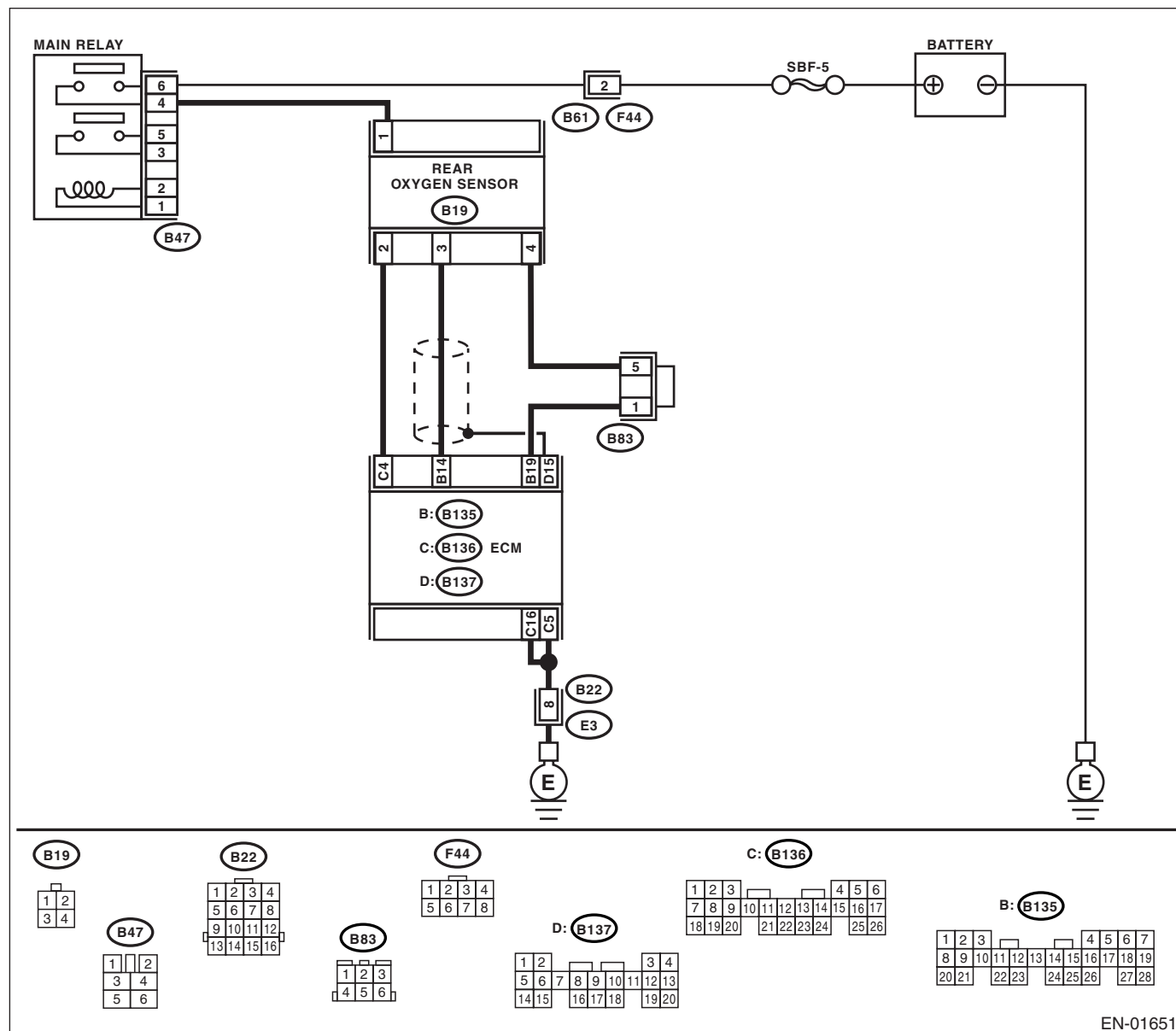
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-67, DTC P0139 O₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01651

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0139.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-42, Rear Oxygen Sensor.>

AE:DTC P0171 SYSTEM TOO LEAN (BANK 1)

Refer to DTC P0172 for diagnostic procedure. <Ref. to EN(H4SO)(diag)-146, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AF:DTC P0172 SYSTEM TOO RICH (BANK 1)

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-73, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Step	Check	Yes	No	
1	CHECK EXHAUST SYSTEM.	Are there holes or loose bolts on exhaust system?	Repair exhaust system.	Go to step 2.
2	CHECK AIR INTAKE SYSTEM.	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair air intake system.	Go to step 3.
3	CHECK PURGE CONTROL SOLENOID VALVE OR PRESSURE CONTROL SOLENOID VALVE.	Is the purge control solenoid valve or pressure control solenoid valve stuck?	Replace the purge control solenoid valve or pressure control solenoid valve.	Go to step 4.
4	CHECK FUEL PRESSURE. Warning: • Place “NO FIRE” signs near the working area. • Be careful not to spill fuel on the floor. 1) Release fuel pressure. (1)Disconnect the connector from fuel pump relay. (2)Start the engine and run it until it stalls. (3)After the engine stalls, crank it for five more seconds. (4)Turn the ignition switch to OFF. 2) Connect the connector to fuel pump relay. 3) Disconnect the fuel delivery hose from fuel filter, and connect fuel pressure gauge. 4) Install the fuel filler cap. 5) Start the engine and idle while gear position is neutral. 6) Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. Warning: Before removing the fuel pressure gauge, release fuel pressure. NOTE: If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the fuel pressure 284 — 314 kPa (2.9 — 3.2 kg/cm ² , 41 — 46 psi)?	Go to step 5.	Repair the following items. Fuel pressure too high • Clogged fuel return line or bent hose Fuel pressure too low • Improper fuel pump discharge • Clogged fuel supply line

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
5	CHECK FUEL PRESSURE. After connecting the pressure regulator vacuum hose, measure fuel pressure. Warning: Before removing the fuel pressure gauge, release fuel pressure. NOTE: - If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. - If out of specification as measured at this step, check or replace pressure regulator and pressure regulator vacuum hose.	Is the fuel pressure 206 — 235 kPa (2.1 — 2.4 kg/cm ² , 30 — 34 psi)?	Go to step 6.	Repair the following items. Fuel pressure too high - Faulty pressure regulator - Clogged fuel return line or bent hose Fuel pressure too low - Faulty pressure regulator - Improper fuel pump discharge - Clogged fuel supply line
6	CHECK ENGINE COOLANT TEMPERATURE SENSOR. 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the engine coolant temperature 70 — 100°C (158 — 212°F)?	Go to step 7.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-24, Engine Coolant Temperature Sensor.>
7	CHECK PRESSURE SENSOR SIGNAL. 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the select lever in "N" or "P" range. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read the data of pressure sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Idling: Is the measured value 24.0 — 41.3 kPa (180 — 310 mmHg, 7.09 — 12.20 inHg), Ignition ON: Is the measured value 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg)?	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace the Pressure sensor. <Ref. to FU(H4SO)-30, Manifold Absolute Pressure Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AG:DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE

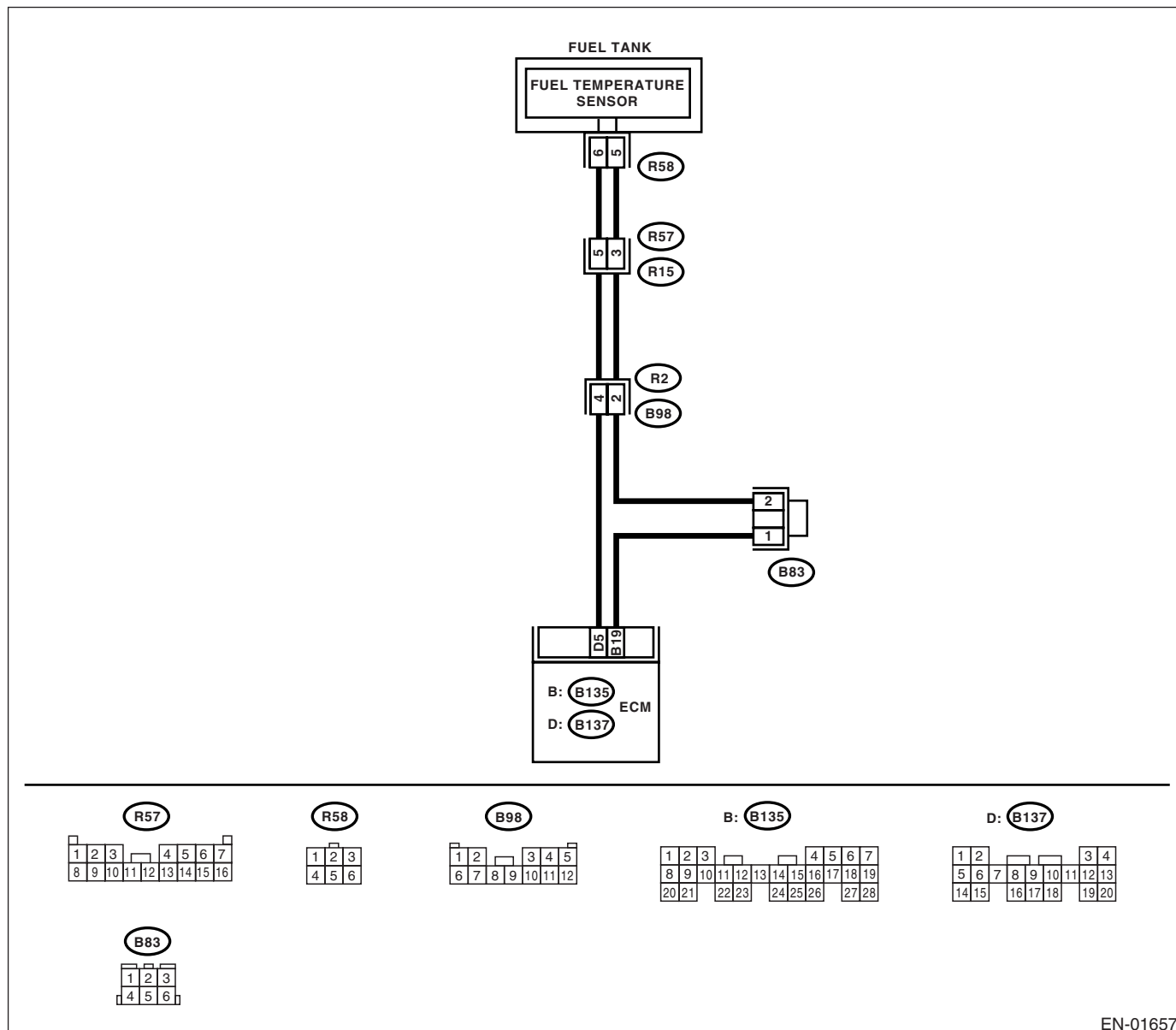
DTC DETECTING CONDITION:

- Fault occurs in two consecutive driving cycles
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-75, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01657

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0181.	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-8, Fuel Temperature Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AH:DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT

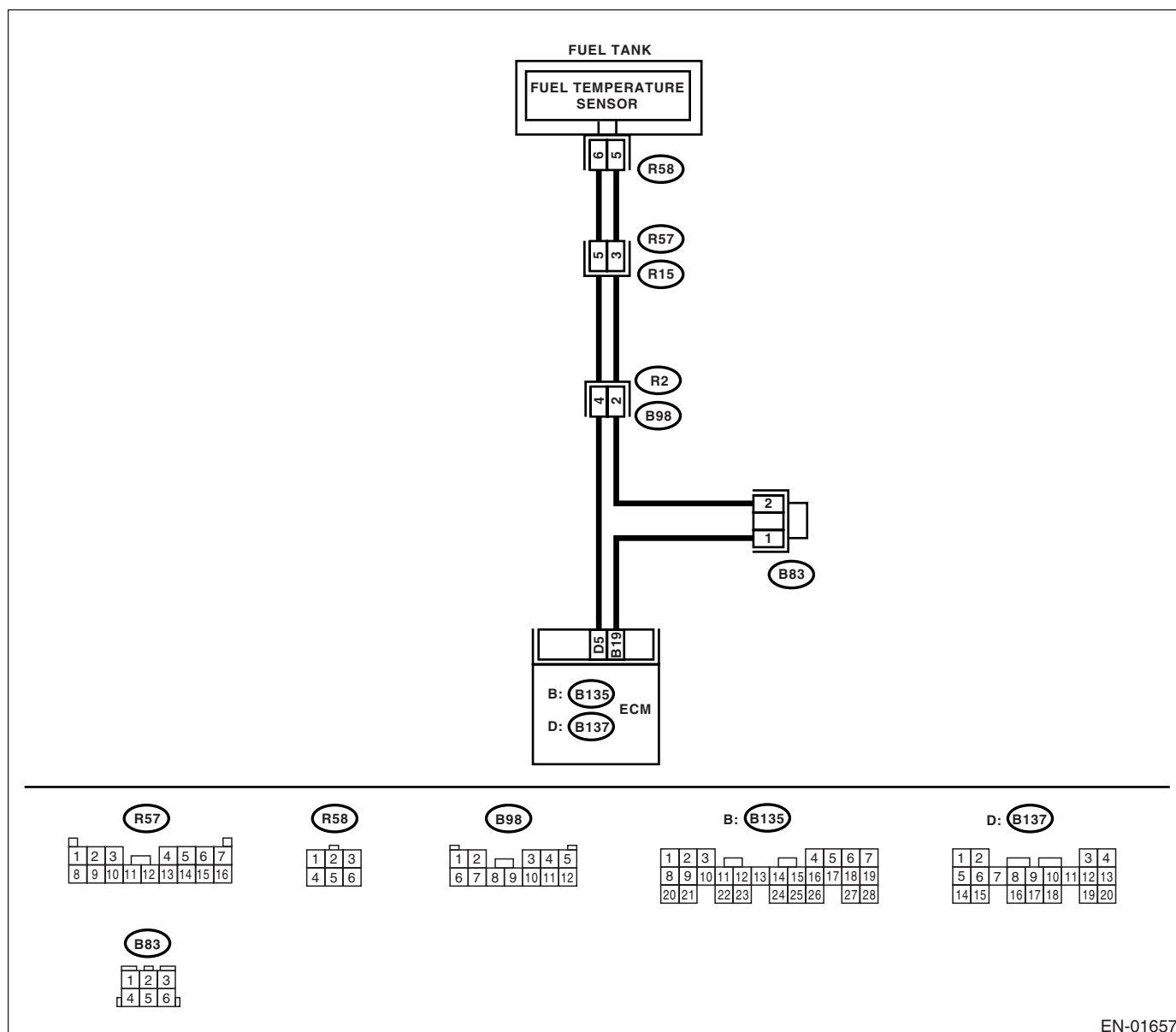
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-77, DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01657

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the fuel temperature 150°C (302°F)?	Go to step 2.	The malfunction indicator light may light up, however, the circuit is returned to the normal status at the moment.
		Is the fuel temperature -40°C (-40°F)?	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-8, Fuel Temperature Sensor.>	Repair short circuit to ground in harness between fuel pump and ECM connector.
2	CHECK CURRENT DATA. 1) Turn ignition switch to OFF. 2) Remove the access hole lid. 3) Disconnect the connector from fuel pump. 4) Turn ignition switch to ON. 5) Read the data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the fuel temperature -40°C (-40°F)?	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-8, Fuel Temperature Sensor.>	Repair short circuit to ground in harness between fuel pump and ECM connector.
		Is the fuel temperature -40°C (-40°F)?	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-8, Fuel Temperature Sensor.>	Repair short circuit to ground in harness between fuel pump and ECM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AI: DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT

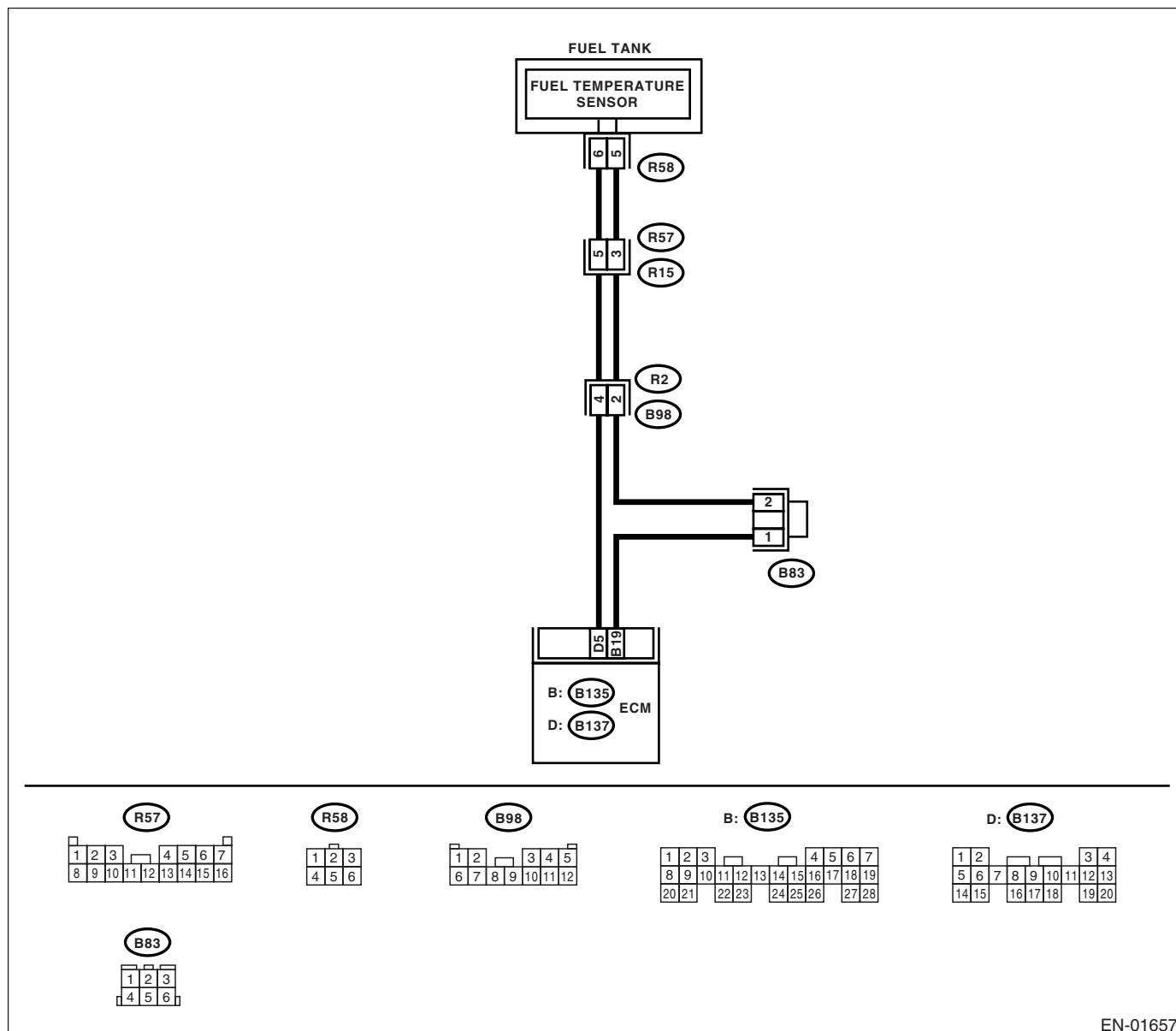
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-79, DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of fuel temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the fuel temperature -40°C (-40°F)?	Go to step 2.	Repair poor contact. NOTE: In this case, repair the following: • Poor contact in fuel pump connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Remove the access hole lid. 3) Disconnect the connector from fuel pump. 4) Measure the voltage between fuel pump connector and chassis ground. Connector & terminal (R58) No. 6 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair short circuit to battery in harness between ECM and fuel pump connector.	Go to step 3.
3 CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to ON. 2) Measure the voltage between fuel pump connector and chassis ground. Connector & terminal (R58) No. 6 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair short circuit to battery in harness between ECM and fuel pump connector.	Go to step 4.
4 CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR. Measure the voltage between fuel pump connector and chassis ground. Connector & terminal (R58) No. 6 (+) — Chassis ground (-):	Is the voltage more than 4 V?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel pump connector • Poor contact in fuel pump connector • Poor contact in ECM connector • Poor contact in coupling connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between fuel pump connector and ECM. Connector & terminal (R58) No. 5 — (B135) No. 19:	Is the resistance less than 1 Ω ?	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-8, Fuel Temperature Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel pump connector • Poor contact in fuel pump connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector

AJ:DTC P0301 CYLINDER 1 MISFIRE DETECTED

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-155, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AK:DTC P0302 CYLINDER 2 MISFIRE DETECTED

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-155, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AL:DTC P0303 CYLINDER 3 MISFIRE DETECTED

NOTE:

For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-155, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

ENGINE (DIAGNOSTICS)

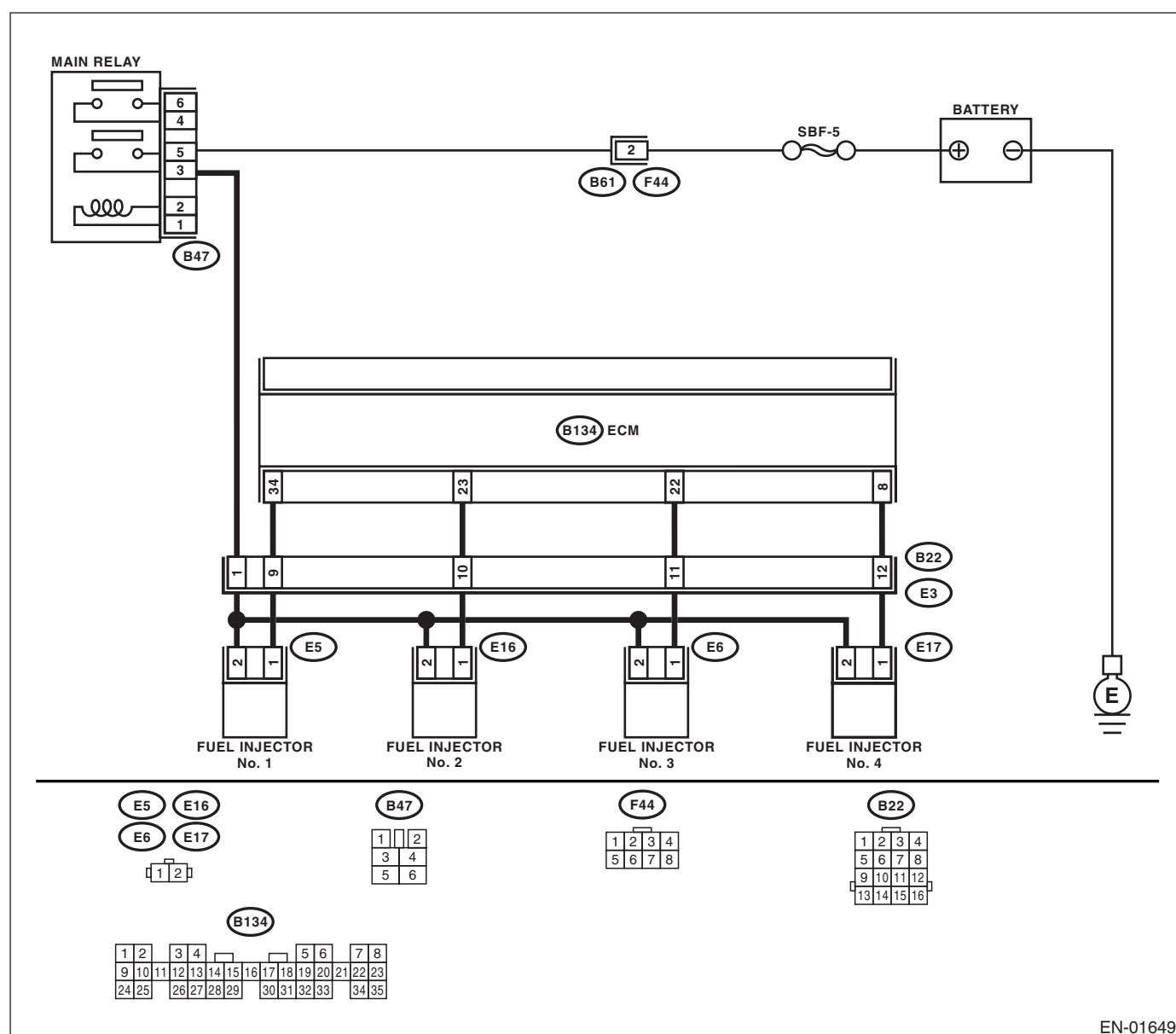
DTC DETECTING CONDITION:

- TROUBLE SYMPTOM:**

- CAUTION:**

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0301, P0302, P0303 and P0304.	Go to step 2.
2 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground on faulty cylinders. Connector & terminal #1 (B134) No. 34 (+) — Chassis ground (-): #2 (B134) No. 23 (+) — Chassis ground (-): #3 (B134) No. 22 (+) — Chassis ground (-): #4 (B134) No. 8 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 7.	Go to step 3.
3 CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between ECM connector and engine ground on faulty cylinders. Connector & terminal #1 (E5) No. 1 — Engine ground: #2 (E16) No. 1 — Engine ground: #3 (E6) No. 1 — Engine ground: #4 (E17) No. 1 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 4.	Repair ground short circuit in harness between fuel injector and ECM connector.
4 CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR. Measure the resistance of harness connector between ECM connector and fuel injector on faulty cylinders. Connector & terminal #1 (B134) No. 34 — (E5) No. 1: #2 (B134) No. 23 — (E16) No. 1: #3 (B134) No. 22 — (E6) No. 1: #4 (B134) No. 8 — (E17) No. 1:	Is the resistance less than 1 Ω?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel injector connector • Poor contact in coupling connector
5 CHECK FUEL INJECTOR. Measure the resistance between fuel injector terminals on faulty cylinder. Terminals No. 1 — No. 2:	Is the resistance 5 — 20 Ω?	Go to step 6.	Replace the faulty fuel injector. <Ref. to FU(H4SO)-34, Fuel Injector.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POWER SUPPLY LINE. 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. Connector & terminal #1 (E5) No. 2 (+) — Engine ground (-): #2 (E16) No. 2 (+) — Engine ground (-): #3 (E6) No. 2 (+) — Engine ground (-): #4 (E17) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair poor contact in all connectors in fuel injector circuit.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and fuel injector connector on faulty cylinders • Poor contact in coupling connector • Poor contact in main relay connector • Poor contact in fuel injector connector on faulty cylinders
7 CHECK HARNESS BETWEEN FUEL INJECTOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinder. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground on faulty cylinders. Connector & terminal #1 (B134) No. 34 (+) — Chassis ground (-): #2 (B134) No. 23 (+) — Chassis ground (-): #3 (B134) No. 22 (+) — Chassis ground (-): #4 (B134) No. 8 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and fuel injector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 8.
8 CHECK FUEL INJECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. Terminals No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Replace the faulty fuel injector <Ref. to FU(H4SO)-34, Fuel Injector.> and ECM <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 9.
9 CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten camshaft position sensor or crankshaft position sensor.	Go to step 10.
10 CHECK CRANKSHAFT SPROCKET. Remove the timing belt cover.	Is the crankshaft sprocket rusted or does it have broken teeth?	Replace the crankshaft sprocket. <Ref. to ME(H4SO)-51, Crankshaft Sprocket.>	Go to step 11.
11 CHECK INSTALLATION CONDITION OF TIMING BELT. Turn the crankshaft using ST, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block. ST 499987500 CRANKSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair installation condition of timing belt. <Ref. to ME(H4SO)-44, Timing Belt Assembly.>	Go to step 12.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
12	CHECK FUEL LEVEL.	Is the fuel meter indication higher than the "Lower" level?	Go to step 13.	Replenish fuel so fuel meter indication is higher than the "Lower" level. After replenishing fuel, Go to step 13.
13	CHECK STATUS OF MALFUNCTION INDICATOR LIGHT. 1) Clear the memory using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-44, Clear Memory Mode.> 2) Start the engine, and drive the vehicle more than 10 minutes.	Does the malfunction indicator light illuminate or blink?	Go to step 16.	Go to step 14.
14	CHECK CAUSE OF MISFIRE DIAGNOSED.	Was the cause of misfire identified when the engine is running? Ex. Disconnection of spark plug cord.	Finish diagnostics operation, if the engine has no abnormality.	Go to step 15.
15	CHECK FOR POOR CONTACT.	Is there poor contact in the ignition coil, fuel injector, ECM and coupling connector?	Repair poor contact.	Contact your SOA Service Center after checking followings. NOTE: In this case, check the following: • Condition of fuel • Fuel additive used or not • Visually check spark plug • Visually check spark plug cord • Condition of engine oil
16	CHECK AIR INTAKE SYSTEM.	Is there a fault in air intake system?	Repair air intake system. NOTE: Check the following items: • Are there air leaks or air suction caused by loose or dislocated nuts and bolts? • Are there cracks or any disconnection of hoses?	Go to step 17.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
17 CHECK MISFIRE SYMPTOM. 1) Turn the ignition switch to ON. 2) Read the DTC. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Operation Manual. NOTE: Perform diagnosis according to the items listed below.	Does the Subaru Select Monitor or OBD-II general scan tool display only one DTC?	Go to step 22 .	Go to step 18 .
18 CHECK DTC ON DISPLAY. Is any other DTC displayed?	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0301 and P0302?	Go to step 23 .	Go to step 19 .
19 CHECK DTC ON DISPLAY. Is any other DTC displayed?	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0303 and P0304?	Go to step 24 .	Go to step 20 .
20 CHECK DTC ON DISPLAY. Is any other DTC displayed?	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0301 and P0303?	Go to step 25 .	Go to step 21 .
21 CHECK DTC ON DISPLAY. Is any other DTC displayed?	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0302 and P0304?	Go to step 26 .	Go to step 27 .
22 ONLY ONE CYLINDER	Is there a fault in that cylinder?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Spark plug cord • Fuel injector • Compression ratio	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-145, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
23 GROUP OF #1 AND #2 CYLINDERS	Are there faults in #1 and #2 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. • Spark plugs • Fuel injectors • Ignition coil • Compression ratio • If no abnormal is discovered, check for "IGNITION CONTROL SYSTEM" of #1 and #2 cylinders side. <Ref. to EN(H4SO)(diag)-63, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-145, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24 GROUP OF #3 AND #4 CYLINDERS	Are there faults in #3 and #4 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. • Spark plugs • Fuel injectors • Ignition coil • If no abnormal is discovered, check for "IGNITION CONTROL SYSTEM" of #3 and #4 cylinders side. <Ref. to EN(H4SO)(diag)-63, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-145, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
25 GROUP OF #1 AND #3 CYLINDERS	Are there faults in #1 and #3 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plugs • Fuel injectors • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-145, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
26	GROUP OF #2 AND #4 CYLINDERS	Are there faults in #2 and #4 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plugs • Fuel injectors • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-145, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
27	CYLINDER AT RANDOM	Is the engine idle rough?	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-145, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Repair or replace faulty parts. NOTE: Check the following items. • Spark plugs • Fuel injectors • Compression ratio

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AN:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-87, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

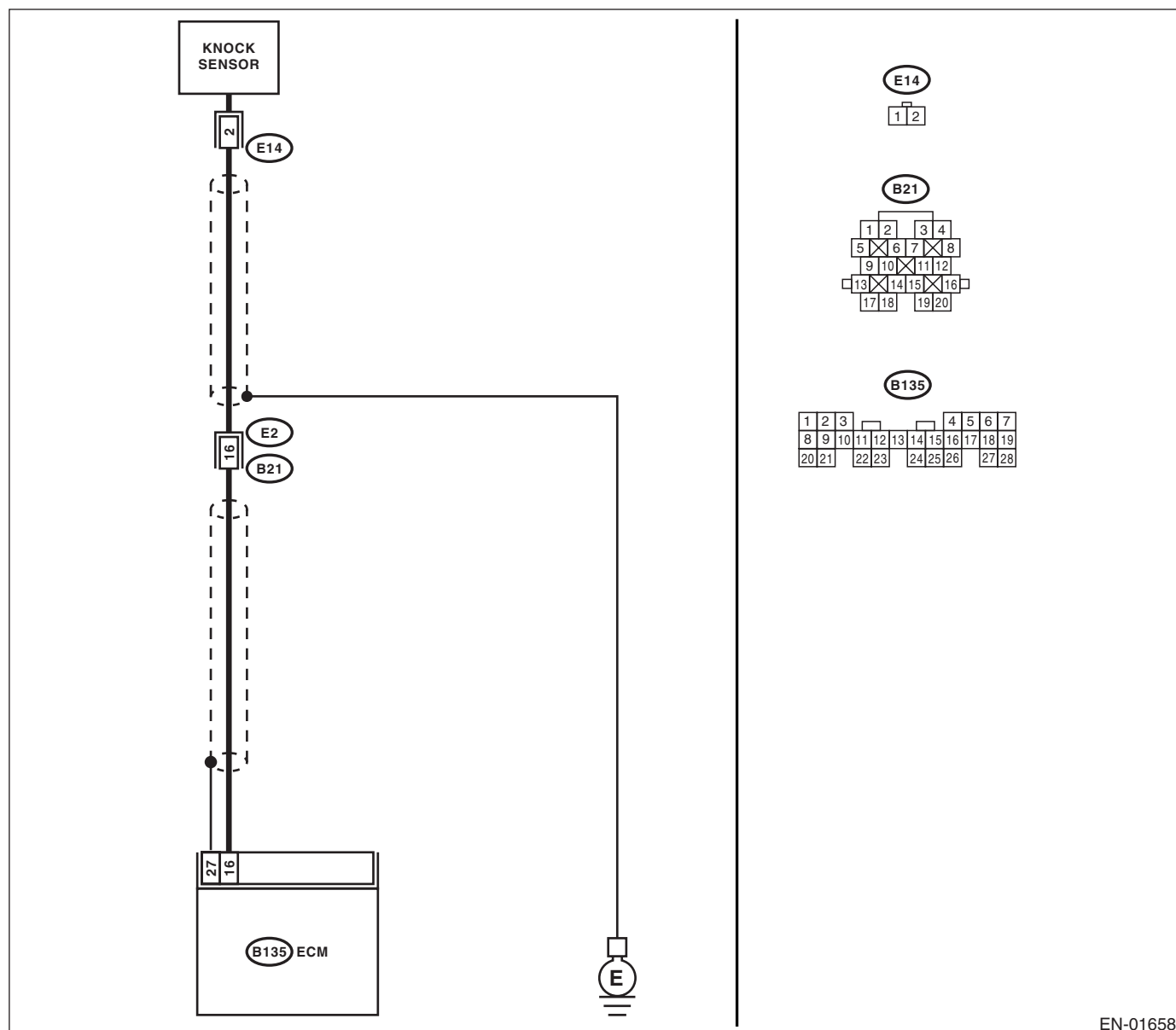
TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01658

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM harness connector and chassis ground. Connector & terminal (B135) No. 16 — Chassis ground:	Is the resistance more than 700 k Ω ?	Go to step 2.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between knock sensor and ECM connector • Poor contact in knock sensor connector • Poor contact in coupling connector
2 CHECK KNOCK SENSOR. 1) Disconnect the connector from knock sensor. 2) Measure the resistance between knock sensor connector terminal and engine ground. Terminals No. 2 — Engine ground:	Is the resistance more than 700 k Ω ?	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Poor contact in knock sensor connector
3 CHECK CONDITION OF KNOCK SENSOR INSTALLATION.	Is the knock sensor installation bolt tightened securely?	Replace the knock sensor. <Ref. to FU(H4SO)-27, Knock Sensor.>	Tighten knock sensor installation bolt securely.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AO:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-89, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

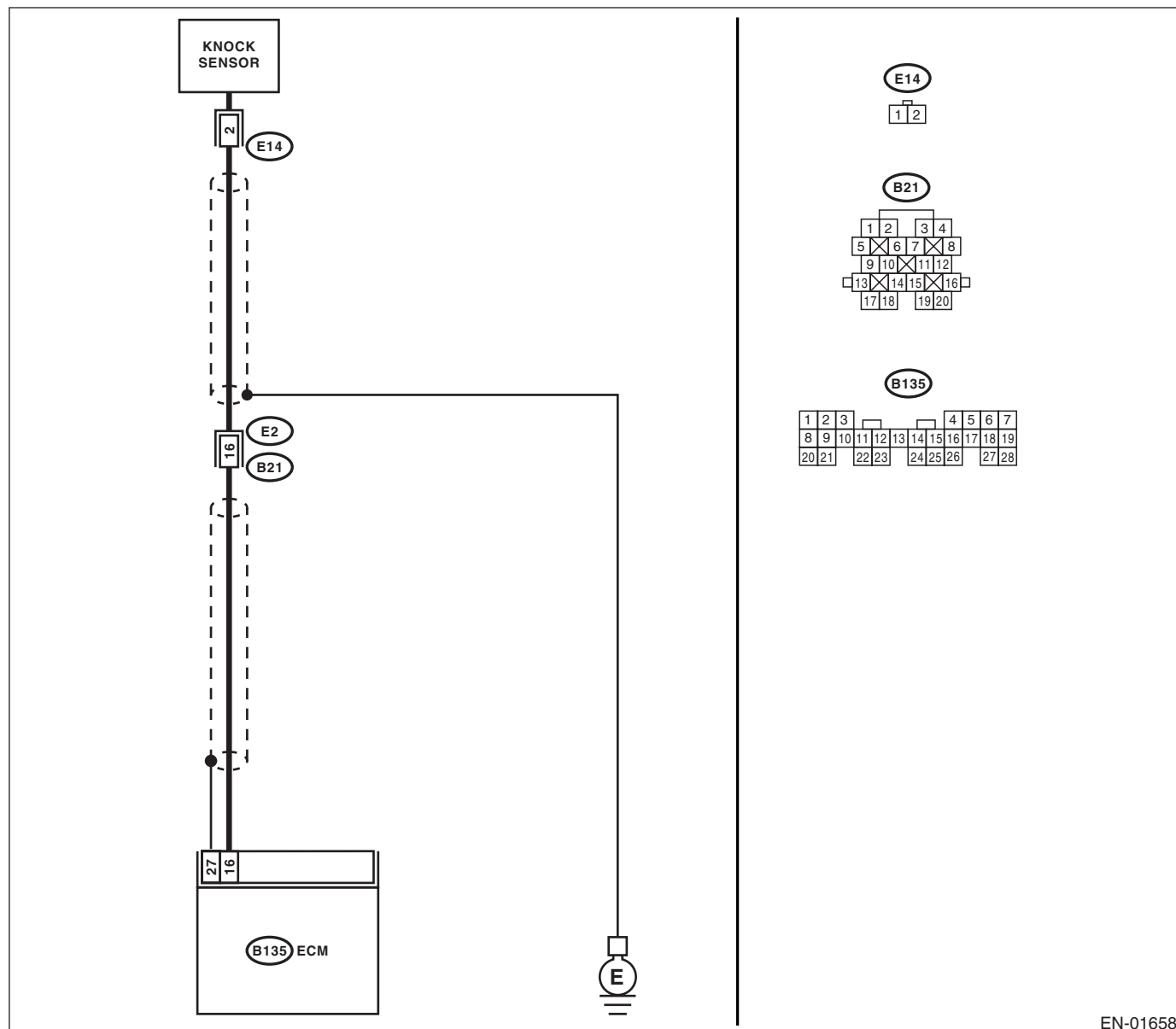
TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01658

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR. Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B135) No. 16 — Chassis ground:	Is the resistance less than 400 k Ω ?	Go to step 2.	Go to step 3.
2 CHECK KNOCK SENSOR. 1) Disconnect the connector from knock sensor. 2) Measure the resistance between knock sensor connector terminal and engine ground. Terminals No. 2 — Engine ground:	Is the resistance less than 400 k Ω ?	Replace the knock sensor. <Ref. to FU(H4SO)-27, Knock Sensor.>	Repair ground short circuit in harness between knock sensor connector and ECM connector. NOTE: The harness between both connectors is shielded. Repair short circuit of harness together with shield.
3 CHECK INPUT SIGNAL FOR ECM. 1) Connect the connectors to ECM and knock sensor. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 16 (+) — Chassis ground (-):	Is the voltage more than 2 V?	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. (However, the possibility of poor contact still remains.) NOTE: In this case, repair the following: • Poor contact in knock sensor connector • Poor contact in ECM connector • Poor contact in coupling connector	Repair poor contact in ECM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AP:DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-91, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

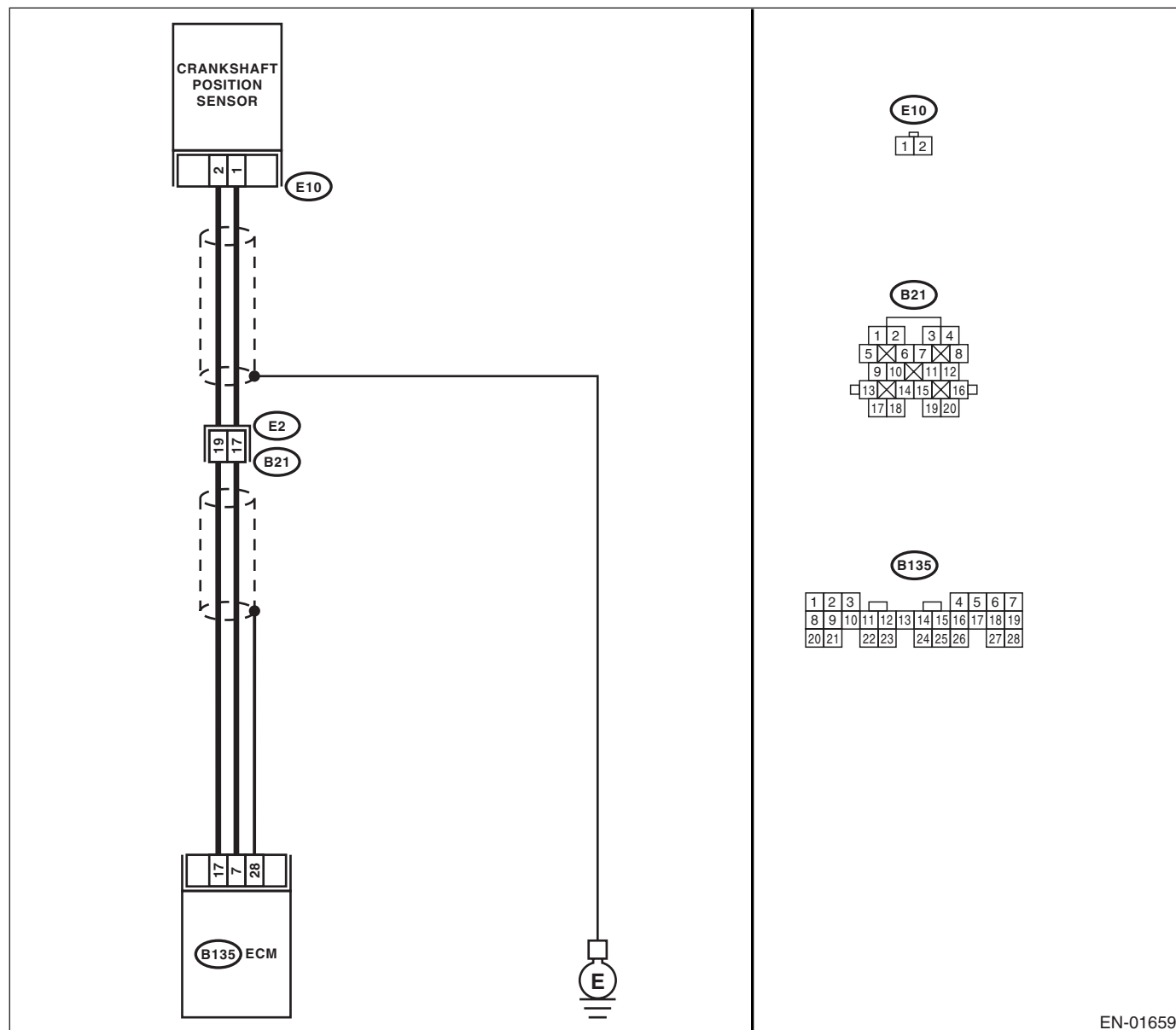
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01659

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from crankshaft position sensor. 3) Measure the resistance of harness between crankshaft position sensor connector and engine ground. Connector & terminal (E10) No. 1 — Engine ground:	Is the resistance more than 100 k Ω ?	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between crankshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector	Go to step 2.
2 CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between crankshaft position sensor connector and engine ground. Connector & terminal (E10) No. 1 — Engine ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between crankshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair ground short circuit in harness together with shield.	Go to step 3.
3 CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between crankshaft position sensor connector and engine ground. Connector & terminal (E10) No. 2 — Engine ground:	Is the resistance less than 5 Ω ?	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between crankshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector
4 CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 5.	Tighten crankshaft position sensor installation bolt securely.
5 CHECK CRANKSHAFT POSITION SENSOR. 1) Remove the crankshaft position sensor. 2) Measure the resistance between connector terminals of crankshaft position sensor. Terminals No. 1 — No. 2:	Is the resistance 1 — 4 k Ω ?	Repair poor contact in crankshaft position sensor connector.	Replace the crankshaft position sensor. <Ref. to FU(H4SO)-25, Crankshaft Position Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AQ:DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-93, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

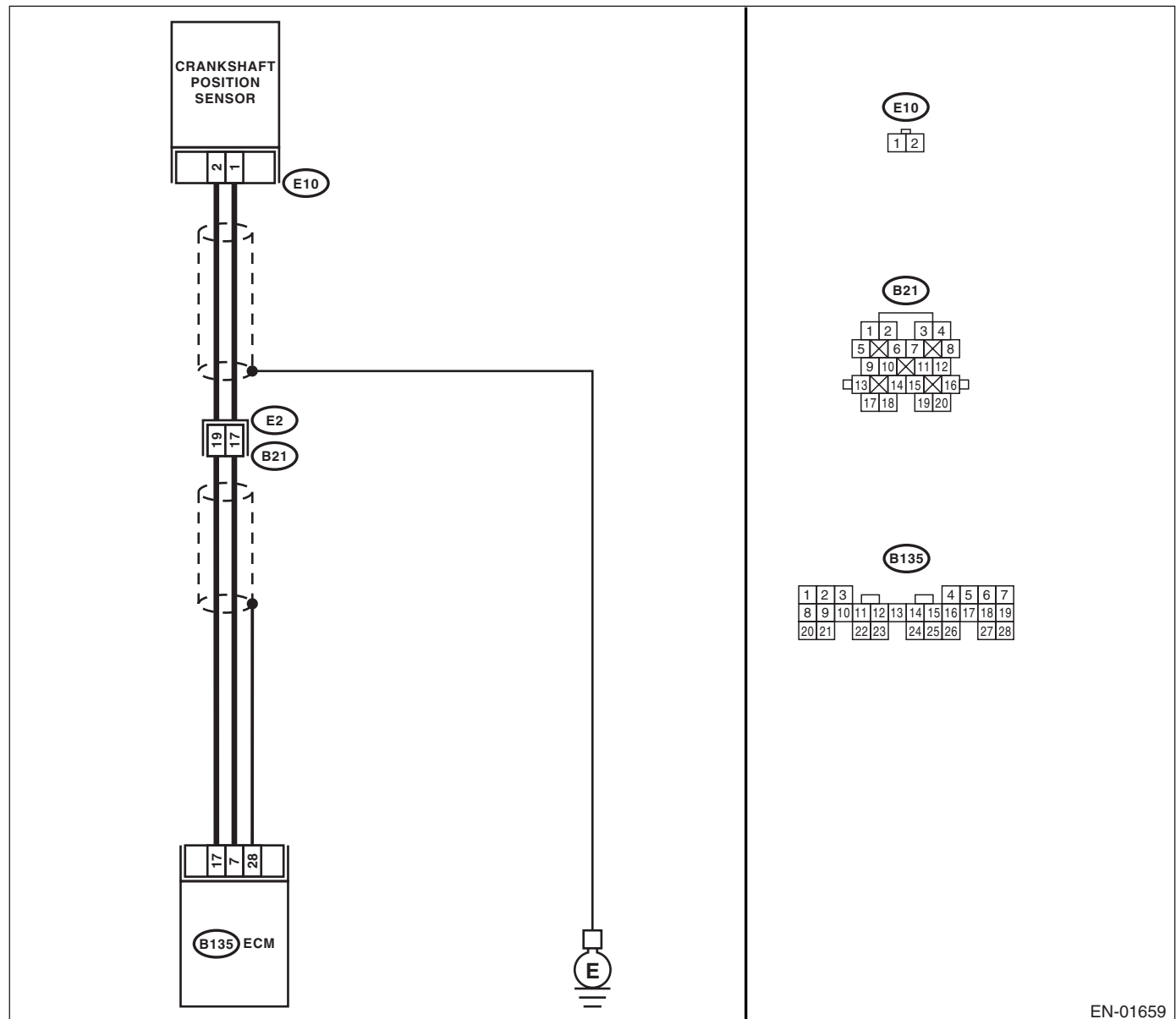
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01659

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK CONDITION OF CRANKSHAFT POSITION SENSOR. Turn the ignition switch to OFF.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 3.	Tighten crankshaft position sensor installation bolt securely.
3 CHECK CRANKSHAFT SPROCKET. Remove the timing belt cover.	Are crankshaft sprocket teeth cracked or damaged?	Replace the crankshaft sprocket. <Ref. to ME(H4SO)-51, Crankshaft Sprocket.>	Go to step 4.
4 CHECK INSTALLATION CONDITION OF TIMING BELT. Turn the crankshaft using ST, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block. ST 499987500 CRANKSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair installation condition of timing belt. <Ref. to ME(H4SO)-44, Timing Belt Assembly.>	Replace the crankshaft position sensor. <Ref. to FU(H4SO)-25, Crankshaft Position Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AR:DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-96, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

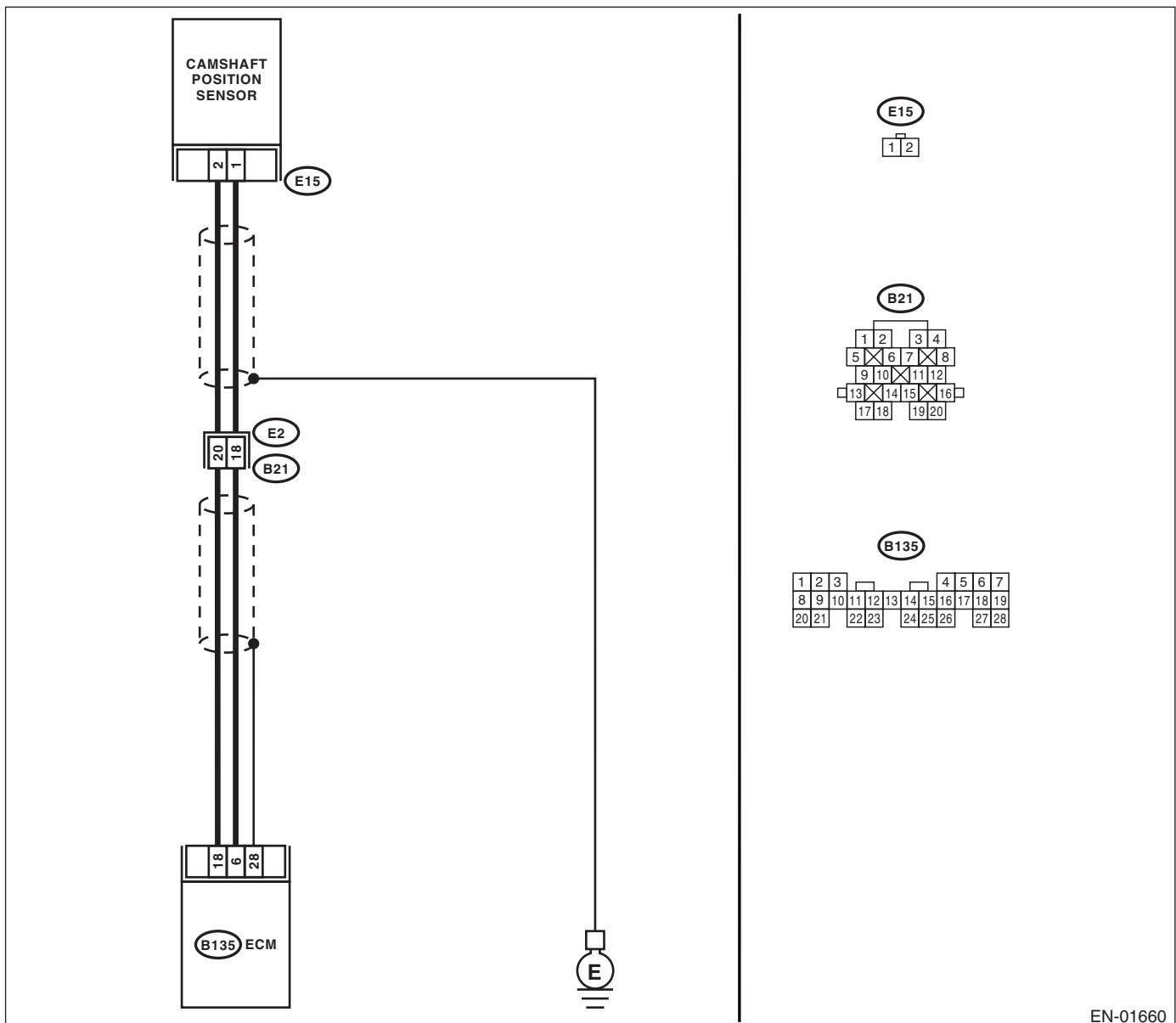
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01660

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 1 — Engine ground:	Is the resistance more than 100 k Ω ?	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector	Go to step 2.
2 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 1 — Engine ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between camshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair ground short circuit in harness together with shield.	Go to step 3.
3 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 2 — Engine ground:	Is the resistance less than 5 Ω ?	Go to step 4.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector
4 CHECK CONDITION OF CAMSHAFT POSITION SENSOR.	Is the camshaft position sensor installation bolt tightened securely?	Go to step 5.	Tighten camshaft position sensor installation bolt securely.
5 CHECK CAMSHAFT POSITION SENSOR. 1) Remove the camshaft position sensor. 2) Measure the resistance between connector terminals of camshaft position sensor. Terminals No. 1 — No. 2:	Is the resistance 1 — 4 k Ω ?	Repair poor contact in camshaft position sensor connector.	Replace the camshaft position sensor. <Ref. to FU(H4SO)-26, Camshaft Position Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AS:DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-98, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

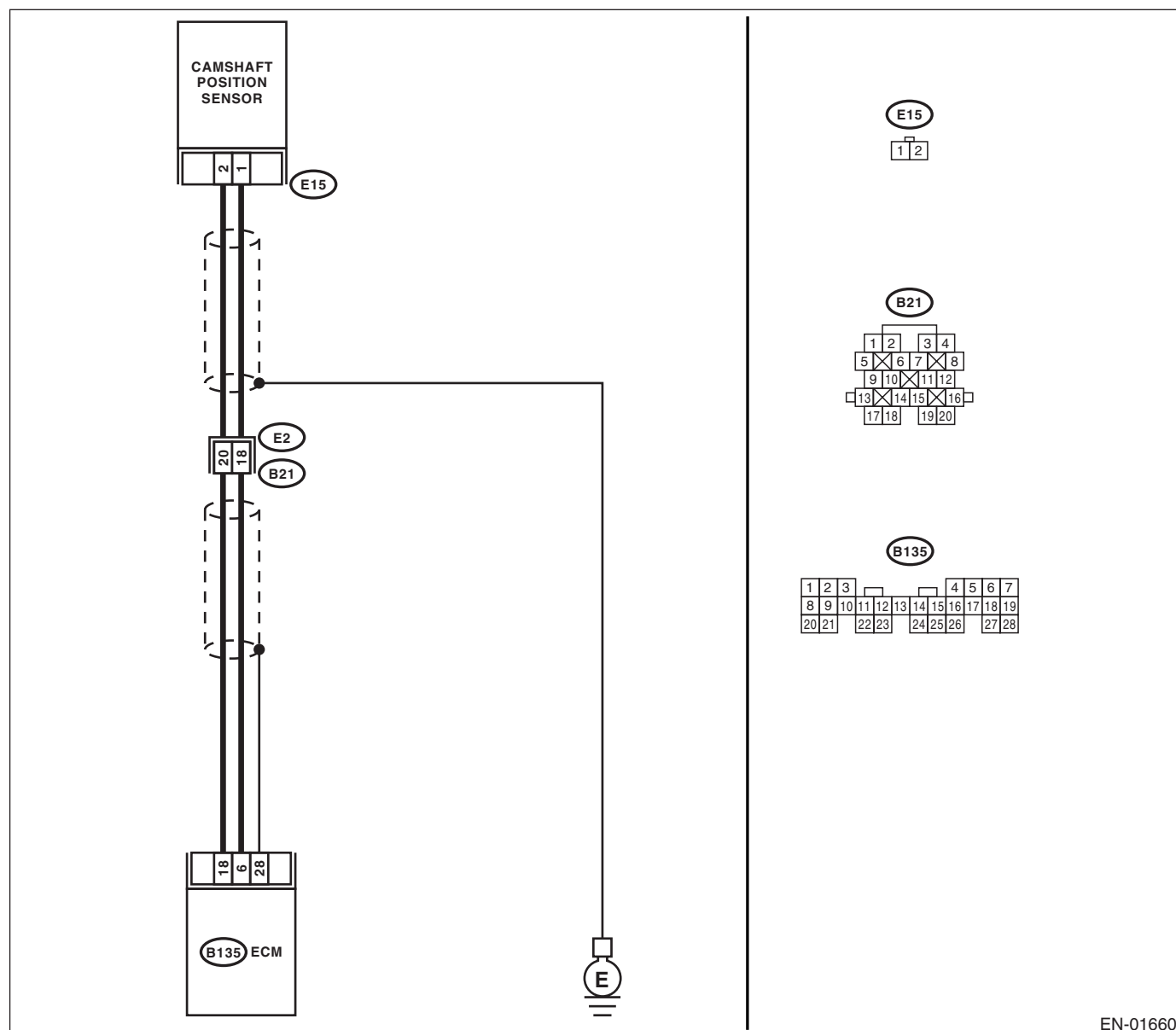
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01660

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 1 — Engine ground:	Is the resistance more than 100 kΩ?	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector	Go to step 3.
3 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 1 — Engine ground:	Is the resistance less than 10 Ω?	Repair ground short circuit in harness between camshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair ground short circuit in harness together with shield.	Go to step 4.
4 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E15) No. 2 — Engine ground:	Is the resistance less than 5 Ω?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector
5 CHECK CONDITION OF CAMSHAFT POSITION SENSOR.	Is the camshaft position sensor installation bolt tightened securely?	Go to step 6.	Tighten camshaft position sensor installation bolt securely.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK CAMSHAFT POSITION SENSOR. 1) Remove the camshaft position sensor. 2) Measure the resistance between connector terminals of camshaft position sensor. Terminals No. 1 — No. 2:	Is the resistance 1 — 4 kΩ?	Go to step 7.	Replace the camshaft position sensor. <Ref. to FU(H4SO)-26, Camshaft Position Sensor.>
7 CHECK CONDITION OF CAMSHAFT POSITION SENSOR. Turn the ignition switch to OFF.	Is the camshaft position sensor installation bolt tightened securely?	Go to step 8.	Tighten camshaft position sensor installation bolt securely.
8 CHECK CAMSHAFT SPROCKET. Remove the timing belt cover. <Ref. to ME(H4SO)-43, Timing Belt Cover.>	Are camshaft sprocket teeth cracked or damaged?	Replace the camshaft sprocket. <Ref. to ME(H4SO)-49, Camshaft Sprocket.>	Go to step 9.
9 CHECK INSTALLATION CONDITION OF TIMING BELT. Turn the camshaft using ST, and align alignment mark on camshaft sprocket with alignment mark on timing belt cover LH. ST 499987500 CAMSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair installation condition of timing belt. <Ref. to ME(H4SO)-44, Timing Belt Assembly.>	Replace the camshaft position sensor. <Ref. to FU(H4SO)-26, Camshaft Position Sensor.>

AT:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-100, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

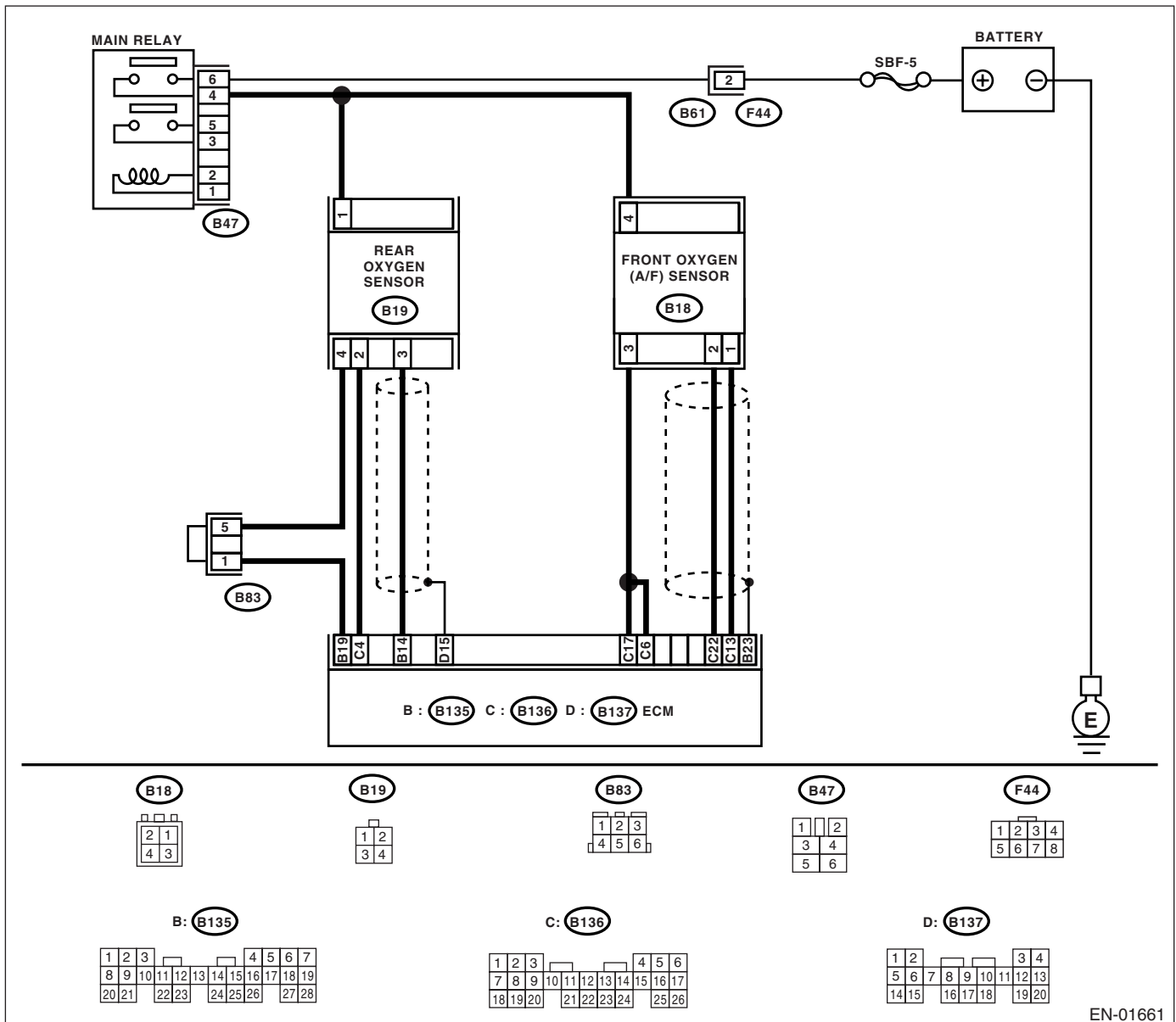
TROUBLE SYMPTOM:

- Engine stalls.
- Idle mixture is out of specifications.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01661

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0420.	Go to step 2.
2 CHECK EXHAUST SYSTEM. Check for gas leaks or air suction caused by loose or dislocated nuts and bolts, and open hole at exhaust pipes. NOTE: Check the following positions. • Between cylinder head and front exhaust pipe • Between front exhaust pipe and front catalytic converter • Between front catalytic converter and rear catalytic converter	Is there a fault in exhaust system?	Repair or replace the exhaust system. <Ref. to EX(H4SO)-2, General Description.>	Go to step 3.
3 CHECK CATALYTIC CONVERTER.	Is there damage at rear face or front face of front catalyst?	Replace the catalytic converter. <Ref. to EC(H4SO)-3, Front Catalytic Converter.>	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

AU:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-105, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Fuel odor
- There is a hole of more than 1.0 mm (0.04 in) dia. in evaporation system or fuel tank.

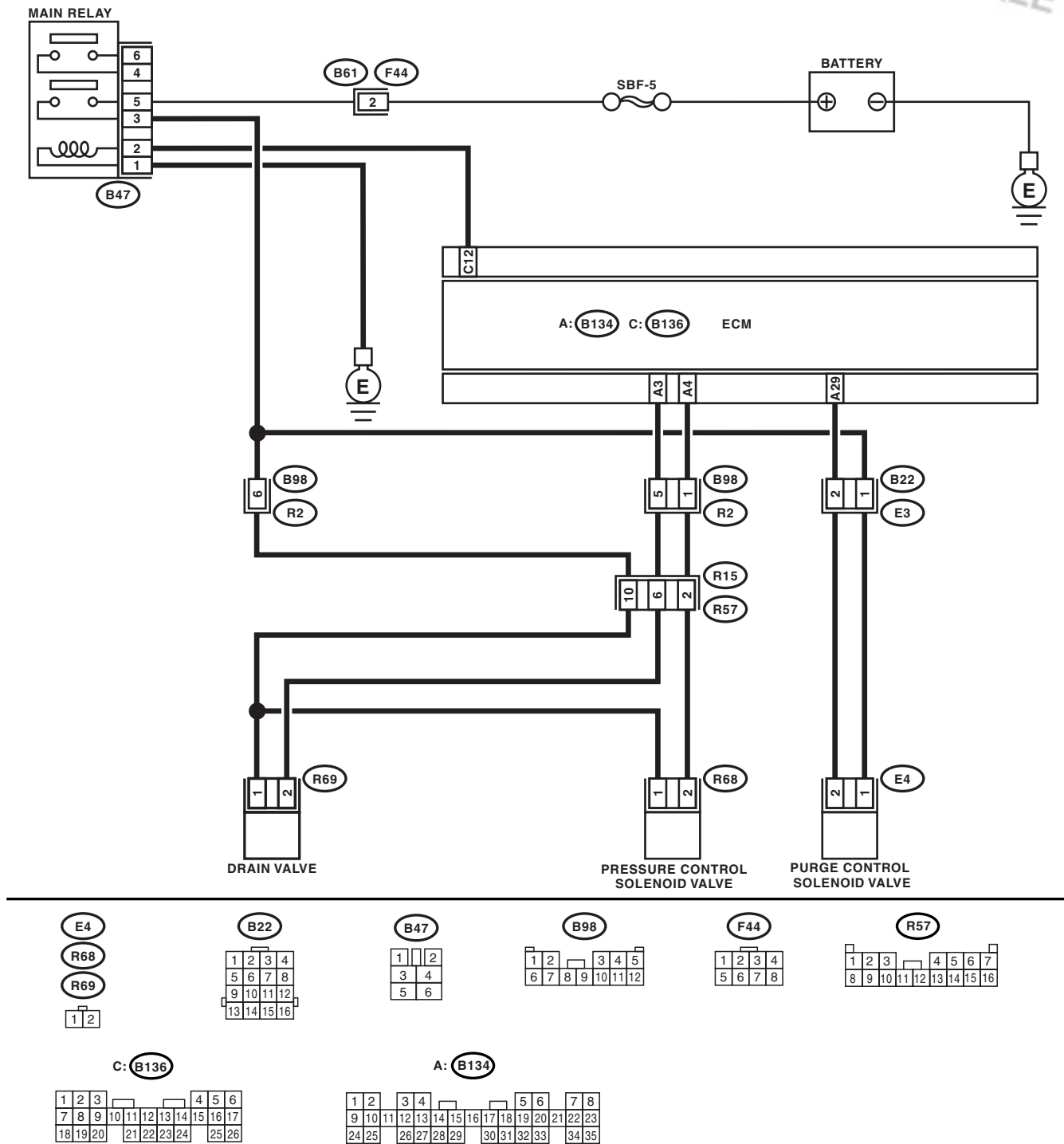
CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-01662

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK FUEL FILLER CAP. 1) Turn ignition switch to OFF. 2) Check the fuel filler cap. NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 3.	Tighten fuel filler cap securely.
3 CHECK FUEL FILLER CAP.	Is the fuel filler cap SUBARU genuine?	Go to step 4.	Replace with a SUBARU genuine fuel filler cap.
4 CHECK FUEL FILLER PIPE PACKING.	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-51, Fuel Filler Pipe.>	Go to step 5.
5 CHECK DRAIN VALVE. 1) Connect the test mode connector. 2) Turn ignition switch to ON. 3) Operate the drain valve. NOTE: Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 6.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>
6 CHECK PURGE CONTROL SOLENOID VALVE. Operate the purge control solenoid valve. NOTE: Purge control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 7.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
7 CHECK PRESSURE CONTROL SOLENOID VALVE. Operate the pressure control solenoid valve. NOTE: Pressure control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 8.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE. Turn ignition switch to OFF.	Is there a hole of more than 1.0 mm (0.04 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4SO)-62, Fuel Delivery, Return and Evaporation lines.>	Go to step 9 .
9 CHECK CANISTER.	Is the canister damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step 10 .
10 CHECK FUEL TANK. Remove the fuel tank. <Ref. to FU(H4SO)-48, Fuel Tank.>	Is the fuel tank damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H4SO)-48, Fuel Tank.>	Go to step 11 .
11 CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.	Are there holes of more than 1.0 mm (0.04 in) dia., cracks, clogging, disconnections or bend of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AV:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

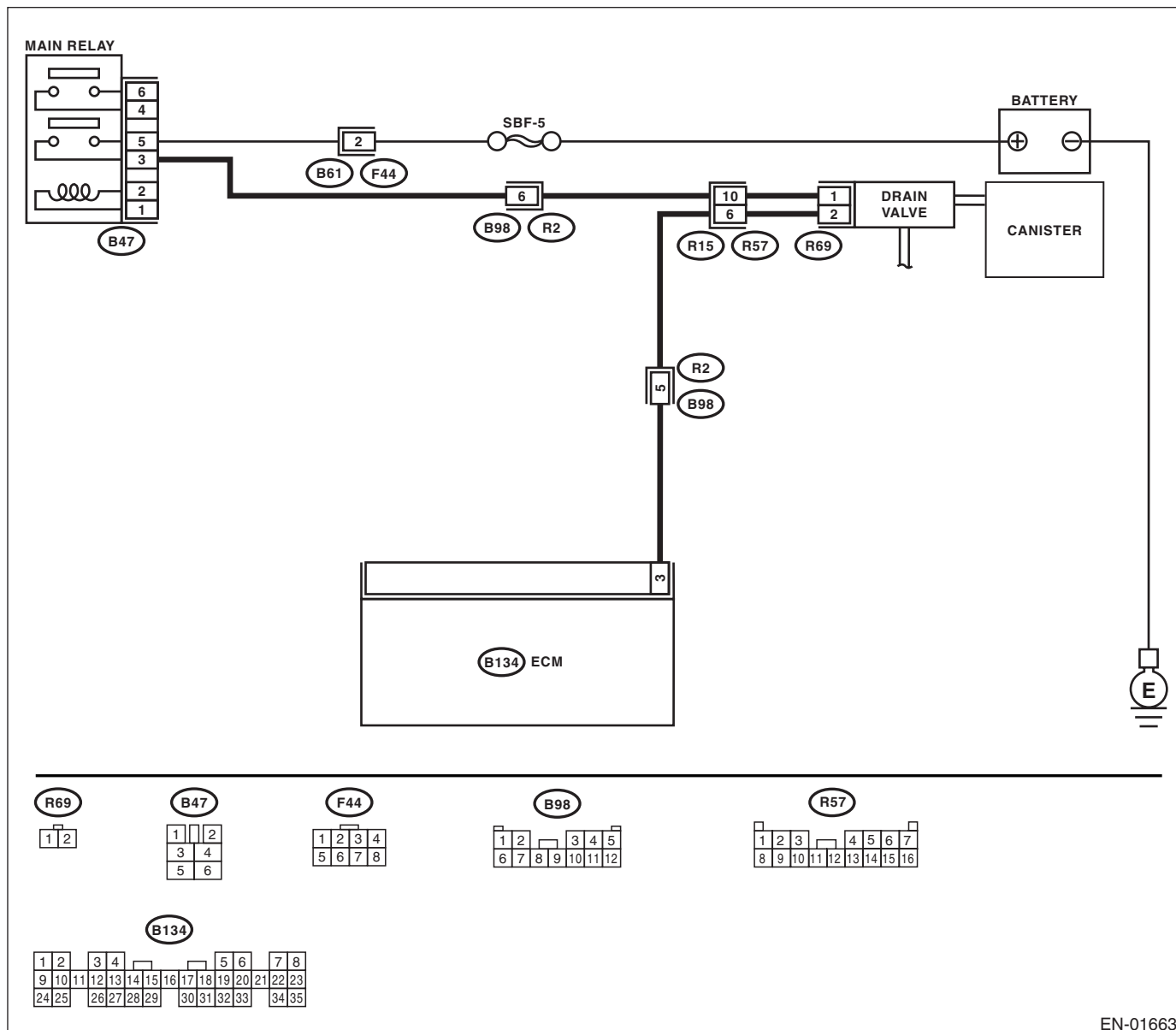
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-130, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01663

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 3.
2 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	The malfunction indicator light may light up, however, the circuit is returned to the normal status at the moment. (However, the possibility of poor contact still remains.) NOTE: In this case, repair the following: • Poor contact in drain valve connector • Poor contact in ECM connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from drain valve and ECM. 3) Measure the resistance of harness between drain valve connector and chassis ground. Connector & terminal (R69) No. 2 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 4.	Repair short circuit to ground in harness between ECM and drain valve connector.
4 CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR. Measure the resistance of harness between ECM and drain valve connector. Connector & terminal (B134) No. 3 — (R69) No. 2:	Is the resistance less than 1 Ω?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and drain valve connector • Poor contact in coupling connector
5 CHECK DRAIN VALVE. Measure the resistance between drain valve terminals. Terminals No. 1 — No. 2:	Is the resistance 10 — 100 Ω?	Go to step 6.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POWER SUPPLY TO DRAIN VALVE. 1) Turn ignition switch to ON. 2) Measure the voltage between drain valve and chassis ground. Connector & terminal (R69) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and drain valve • Poor contact in coupling connector • Poor contact in main relay connector
7 CHECK FOR POOR CONTACT. Check for poor contact in drain valve connector.	Is there poor contact in drain valve connector?	Repair poor contact in drain valve connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

AW:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

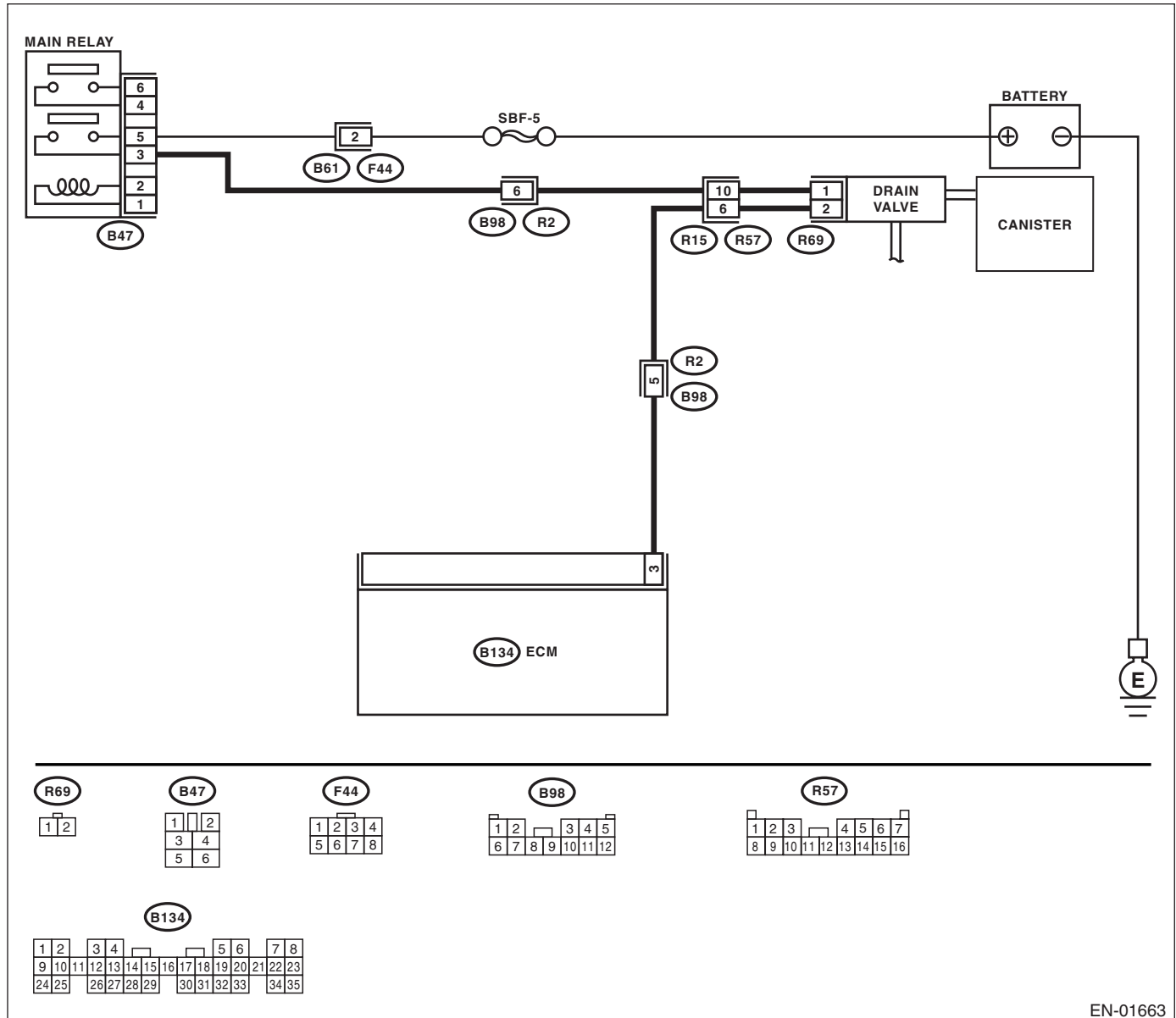
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-132, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01663

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating the drain valve, measure voltage between ECM and chassis ground. NOTE: Drain valve operation can be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.> Connector & terminal (B134) No. 3 (+) — Chassis ground (-):	Is the voltage 0 — 10 V?	Go to step 2.	The malfunction indicator light may light up, however, the circuit is returned to the normal status at the moment. In this case, repair poor contact in ECM connector.
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 4.	Go to step 3.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>
4 CHECK HARNESS BETWEEN DRAIN VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from drain valve. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 3 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair short circuit to battery in harness between ECM and drain valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 5.
5 CHECK DRAIN VALVE. 1) Turn ignition switch to OFF. 2) Measure the resistance between drain valve terminals. Terminals No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Replace the drain valve <Ref. to EC(H4SO)-18, Drain Valve.> and ECM <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>.	Go to step 6.
6 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

AX:DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE

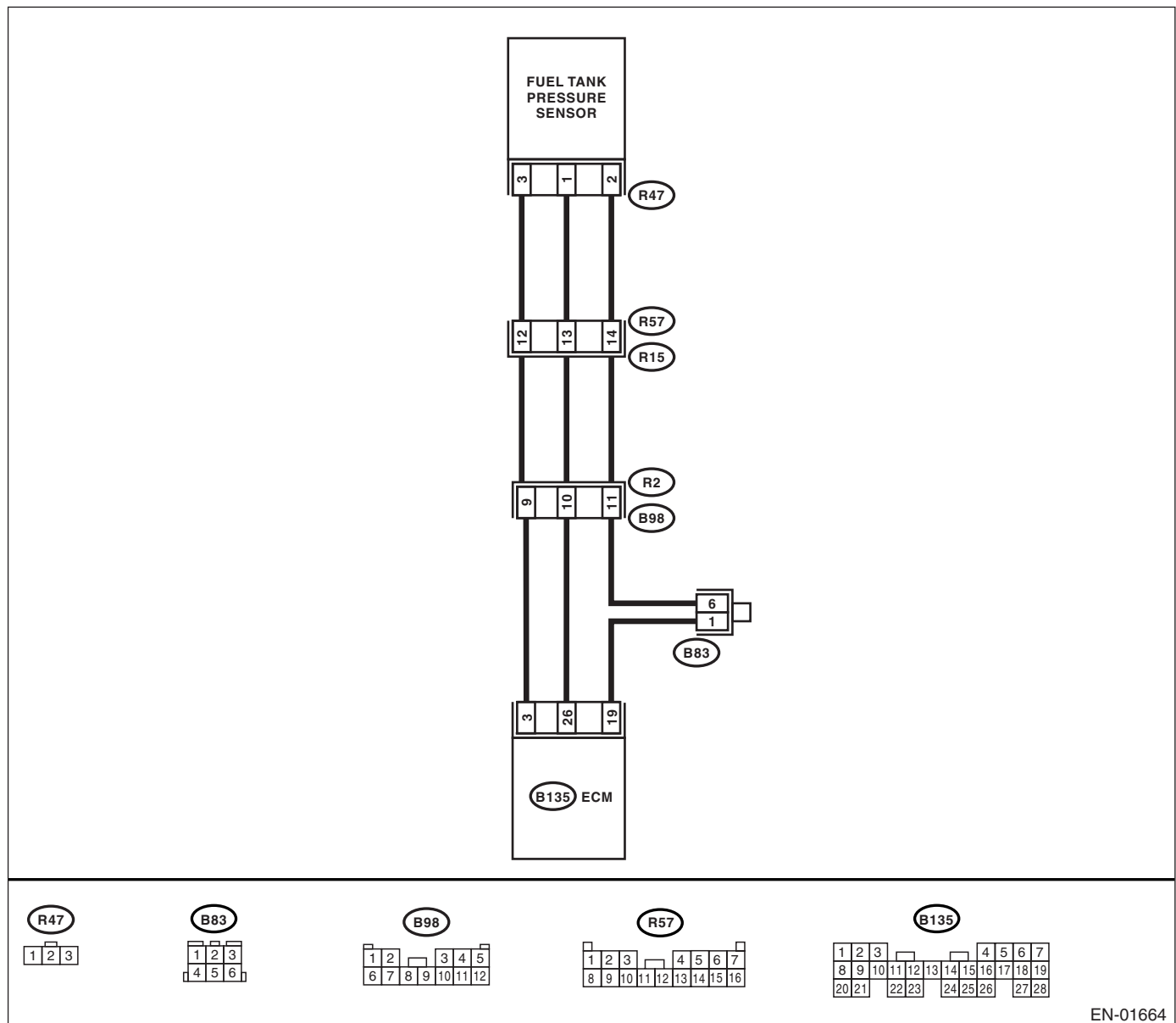
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-134, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01664

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2 .
2 CHECK FUEL FILLER CAP. 1) Turn ignition switch to OFF. 2) Open the fuel flap.	Is the fuel filler cap tightened securely?	Go to step 3 .	Tighten fuel filler cap securely.
3 CHECK PRESSURE/VACUUM LINE. NOTE: Check the following items. • Disconnection, leakage and clogging of the vacuum hoses and pipes between fuel tank pressure sensor and fuel tank • Disconnection, leakage and clogging of air ventilation hoses and pipes between fuel filler pipe and fuel tank	Is there a fault in pressure/vacuum line?	Repair or replace the hoses and pipes.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-10, Fuel Tank Pressure Sensor.>

AY:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

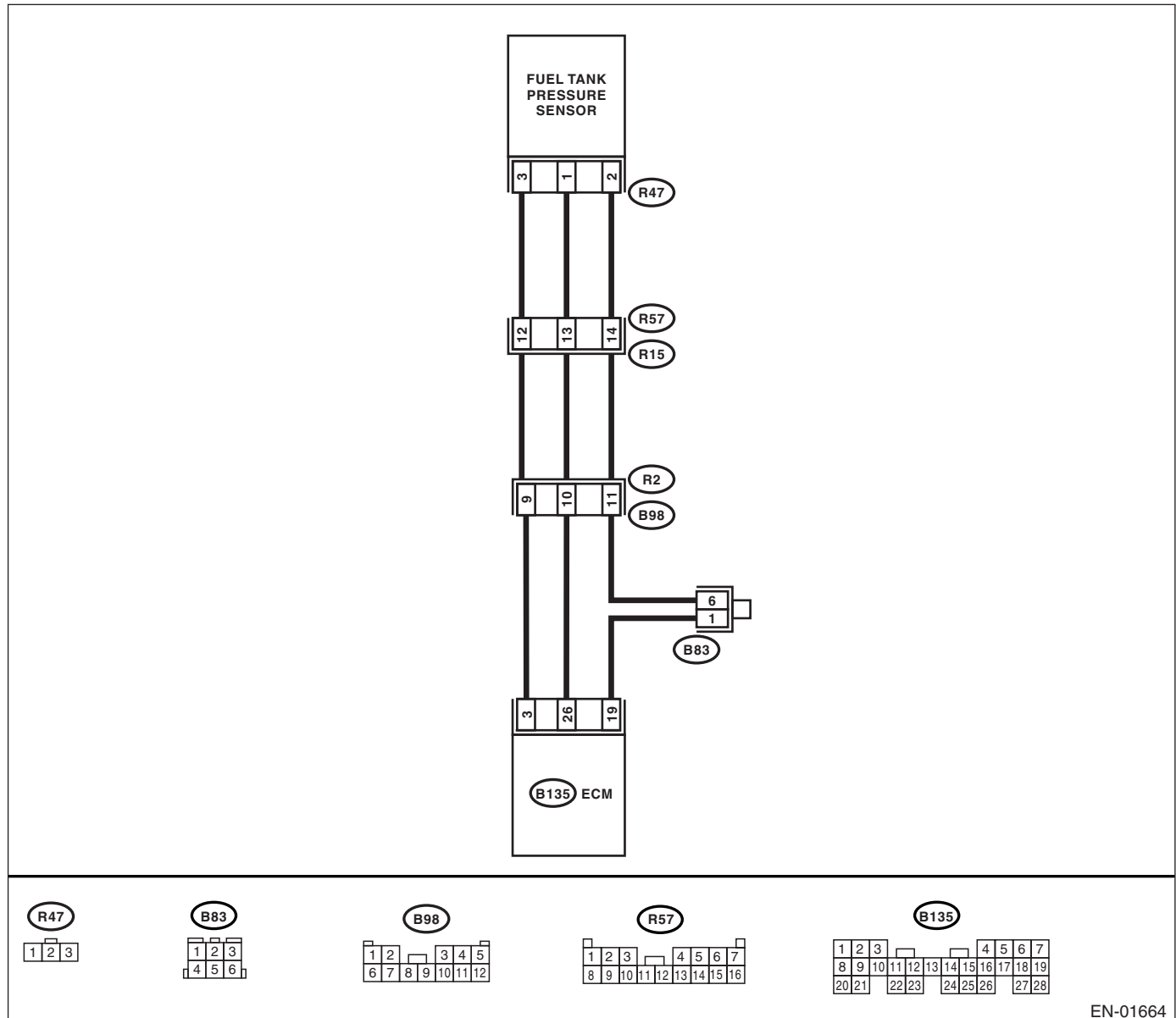
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-137, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01664

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK CURRENT DATA. 1) Turn ignition switch to OFF. 2) Remove the fuel filler cap. 3) Install the fuel filler cap. 4) Turn ignition switch to ON. 5) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor or the OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the measured value less than -2.8 kPa (-21.0 mmHg, -0.827 inHg)?	Go to step 2.	The malfunction indicator light may light up, however, the circuit is returned to the normal status at the moment.
2	CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 4.	Go to step 3.
3	CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 26 (+) — Chassis ground (-):	Is the voltage less than 0.2 V?	Go to step 6.	Go to step 5.
5	CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.>	Does the measured value change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Go to step 6.
6	CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Remove the rear seat cushion. 3) Separate rear wiring harness and fuel tank cord. 4) Turn ignition switch to ON. 5) Measure the voltage between rear wiring harness connector and chassis ground. Connector & terminal (R15) No. 12 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and rear wiring harness connector • Poor contact in coupling connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and rear wiring harness connector. Connector & terminal (B135) No. 19 — (R15) No. 14:	Is the resistance less than 1 Ω ?	Go to step 8.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and rear wiring harness connector • Poor contact in coupling connector • Poor contact in joint connector
8 CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. Measure the resistance of harness between rear wiring harness connector and chassis ground. Connector & terminal (R15) No. 14 (+) — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 9.	Repair short circuit to ground in harness between ECM and rear wiring harness connector.
9 CHECK FUEL TANK CORD. 1) Disconnect the connector from fuel tank pressure sensor. 2) Measure the resistance of fuel tank cord. Connector & terminal (R57) No. 12 — (R47) No. 3:	Is the resistance less than 1 Ω ?	Go to step 10.	Repair open circuit in fuel tank cord.
10 CHECK FUEL TANK CORD. Measure the resistance of fuel tank cord. Connector & terminal (R57) No. 14 — (R47) No. 2:	Is the resistance less than 1 Ω ?	Go to step 11.	Repair open circuit in fuel tank cord.
11 CHECK FUEL TANK CORD. Measure the resistance of harness between fuel tank pressure sensor connector and engine ground. Connector & terminal (R47) No. 1 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 12.	Repair short circuit to ground in fuel tank cord.
12 CHECK FOR POOR CONTACT. Check for poor contact in fuel tank pressure sensor connector.	Is there poor contact in fuel tank pressure sensor connector?	Repair poor contact in fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-10, Fuel Tank Pressure Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AZ:DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

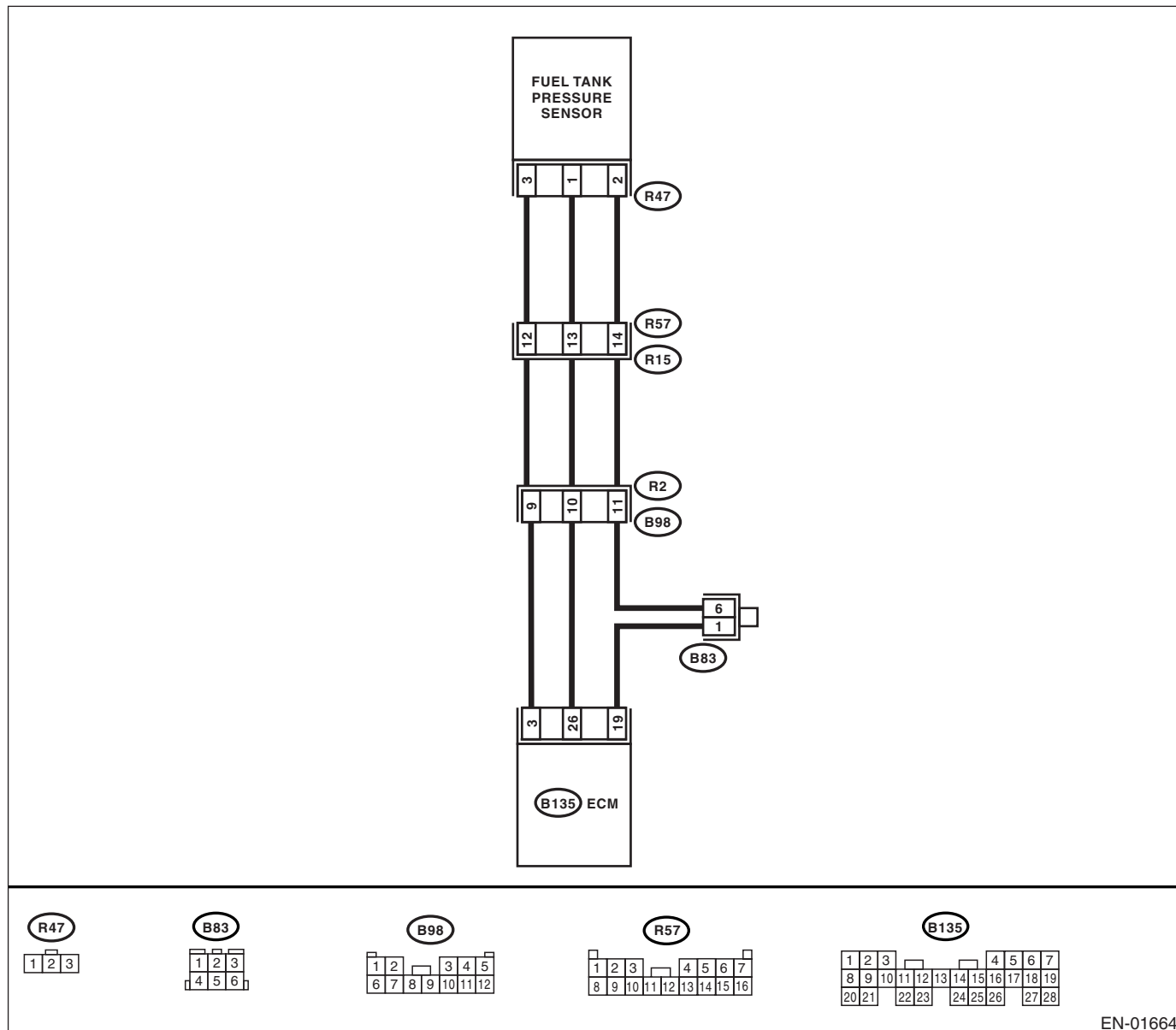
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-139, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01664

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Turn ignition switch to OFF. 2) Remove the fuel filler cap. 3) Install the fuel filler cap. 4) Turn ignition switch to ON. 5) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor or the OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the measured value more than 2.8 kPa (21.0 mmHg, 0.827 inHg)?	Go to step 11.	Go to step 2.
2 CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 4.	Go to step 3.
3 CHECK POWER SUPPLY TO FUEL TANK PRESSURE SENSOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 3 (+) — Chassis ground (-):	Does the voltage change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>
4 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 26 (+) — Chassis ground (-):	Is the voltage less than 0.2 V?	Go to step 6.	Go to step 5.
5 CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.>	Does the measured value change by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Go to step 6.
6 CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Remove the rear seat cushion. 3) Separate rear wiring harness and fuel tank cord. 4) Turn ignition switch to ON. 5) Measure the voltage between rear wiring harness connector and chassis ground. Connector & terminal (R15) No. 12 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and rear wiring harness connector • Poor contact in coupling connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK HARNESS BETWEEN ECM AND COUPLING CONNECTOR IN REAR WIRING HARNESS. 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and rear wiring harness connector. Connector & terminal (B135) No. 26 — (R15) No. 13: (B135) No. 19 — (R15) No. 14:	Is the resistance less than 1 Ω ?	Go to step 8.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and rear wiring harness connector • Poor contact in coupling connector
8 CHECK FUEL TANK CORD. 1) Disconnect the connector from fuel tank pressure sensor. 2) Measure the resistance of fuel tank cord. Connector & terminal (R57) No. 13 — (R47) No. 1:	Is the resistance less than 1 Ω ?	Go to step 9.	Repair open circuit in fuel tank cord.
9 CHECK FUEL TANK CORD. Measure the resistance of fuel tank cord. Connector & terminal (R57) No. 14 — (R47) No. 2:	Is the resistance less than 1 Ω ?	Go to step 10.	Repair open circuit in fuel tank cord.
10 CHECK FOR POOR CONTACT. Check for poor contact in fuel tank pressure sensor connector.	Is there poor contact in fuel tank pressure sensor connector?	Repair poor contact in fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-10, Fuel Tank Pressure Sensor.>
11 CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from fuel tank pressure sensor. 3) Turn ignition switch to ON. 4) Read the data of fuel tank pressure sensor signal using Subaru Select Monitor or the OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the measured value more than 2.8 kPa (21.0 mmHg, 0.827 inHg)?	Repair short circuit to battery in harness between ECM and fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-10, Fuel Tank Pressure Sensor.>

BA:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-140, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Fuel odor
- There is a hole of more than 0.5 mm (0.020 in) dia. in evaporation system or fuel tank.

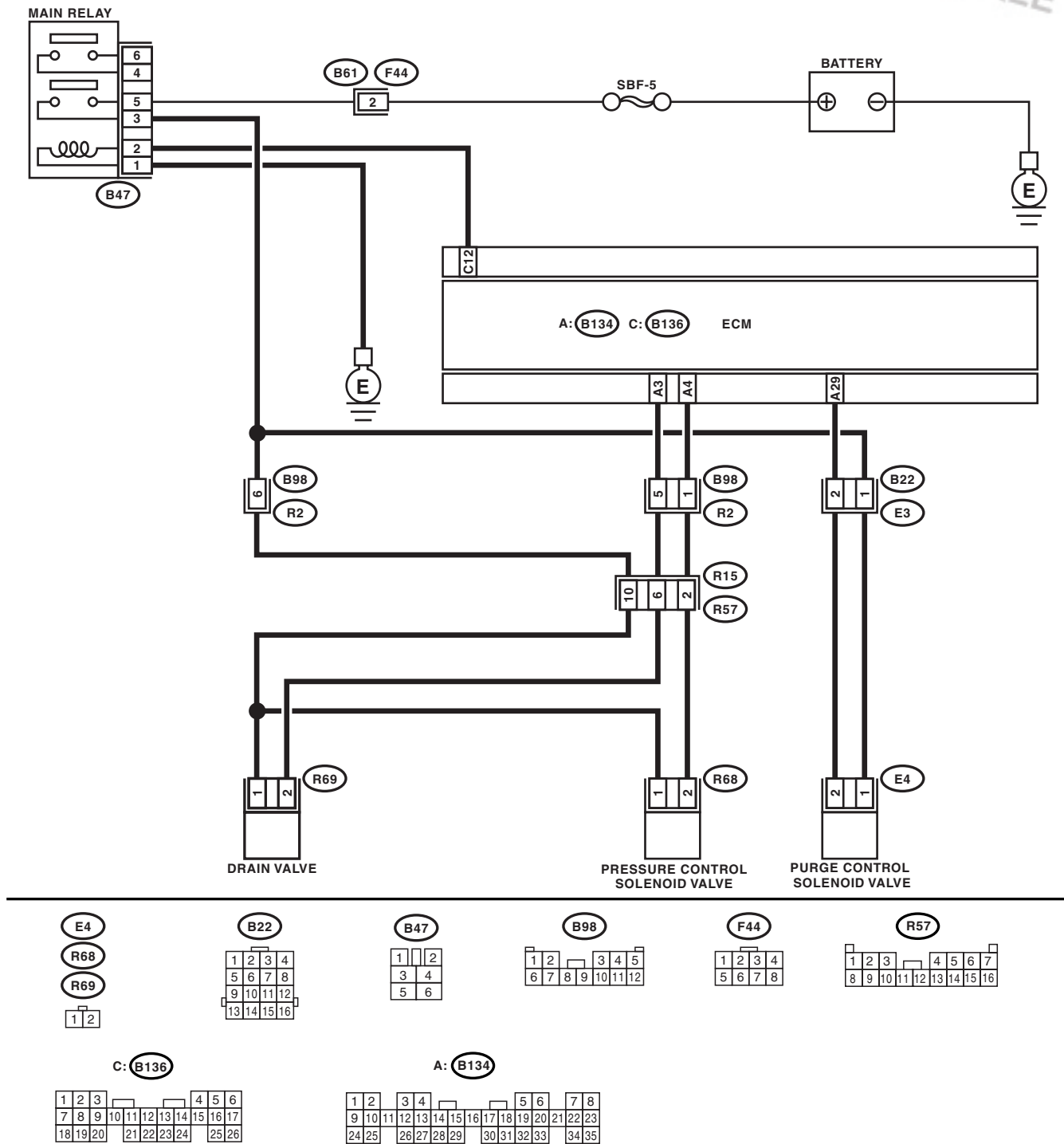
CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-01662

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK FUEL FILLER CAP. 1) Turn ignition switch to OFF. 2) Check the fuel filler cap. NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 3.	Tighten fuel filler cap securely.
3 CHECK FUEL FILLER CAP.	Is the fuel filler cap SUBARU genuine?	Go to step 4.	Replace with a SUBARU genuine fuel filler cap.
4 CHECK FUEL FILLER PIPE PACKING.	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-51, Fuel Filler Pipe.>	Go to step 5.
5 CHECK DRAIN VALVE. 1) Connect the test mode connector. 2) Turn ignition switch to ON. 3) Operate the drain valve. NOTE: Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 6.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>
6 CHECK PURGE CONTROL SOLENOID VALVE. Operate the purge control solenoid valve. NOTE: Purge control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 7.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
7 CHECK PRESSURE CONTROL SOLENOID VALVE. Operate the pressure control solenoid valve. NOTE: Pressure control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 8.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE. Turn ignition switch to OFF.	Is there a hole of more than 0.5 mm (0.020 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4SO)-62, Fuel Delivery, Return and Evaporation lines.>	Go to step 9.
9 CHECK CANISTER.	Is the canister damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step 10.
10 CHECK FUEL TANK. Remove the fuel tank. <Ref. to FU(H4SO)-48, Fuel Tank.>	Is the fuel tank damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H4SO)-48, Fuel Tank.>	Go to step 11.
11 CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.	Are there holes of more than 0.5 mm (0.020 in) dia., cracks, clogging, disconnections or bend of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

BB:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-140, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Fuel odor
- Fuel filler cap is loose or not installed.

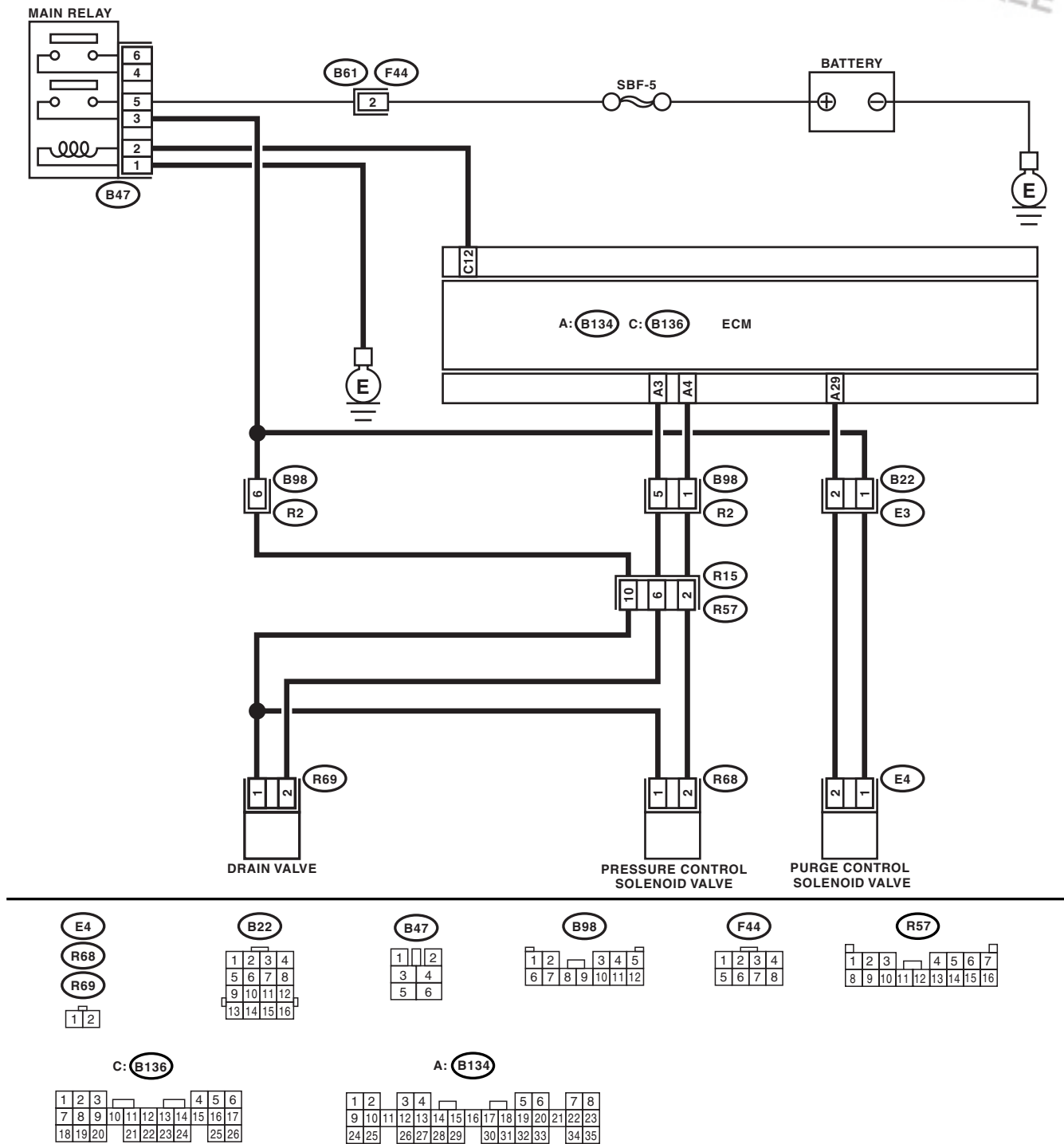
CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-01662

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK FUEL FILLER CAP. 1) Turn ignition switch to OFF. 2) Check the fuel filler cap. NOTE: The DTC is stored in memory if fuel filler cap is or was loose or if the cap chain was caught while tightening.	Is the fuel filler cap tightened securely?	Go to step 3.	Tighten fuel filler cap securely.
3 CHECK FUEL FILLER CAP.	Is the fuel filler cap SUBARU genuine?	Go to step 4.	Replace with a SUBARU genuine fuel filler cap.
4 CHECK FUEL FILLER PIPE PACKING.	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-51, Fuel Filler Pipe.>	Go to step 5.
5 CHECK DRAIN VALVE. 1) Connect the test mode connector. 2) Turn ignition switch to ON. 3) Operate the drain valve. NOTE: Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step 6.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>
6 CHECK PURGE CONTROL SOLENOID VALVE. Operate the purge control solenoid valve. NOTE: Purge control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step 7.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
7 CHECK PRESSURE CONTROL SOLENOID VALVE. Operate the pressure control solenoid valve. NOTE: Pressure control solenoid valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step 8.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK CANISTER.	Is the canister damaged?	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step 9 .
9 CHECK FUEL TANK. Remove the fuel tank. <Ref. to FU(H4SO)-48, Fuel Tank.>	Is the fuel tank damaged?	Repair or replace the fuel tank. <Ref. to FU(H4SO)-48, Fuel Tank.>	Go to step 10 .
10 CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.	Are there holes of more than 0.5 mm (0.020 in) dia., cracks, clogging or disconnections of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BC:DTC P0458 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-141, DTC P0458 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

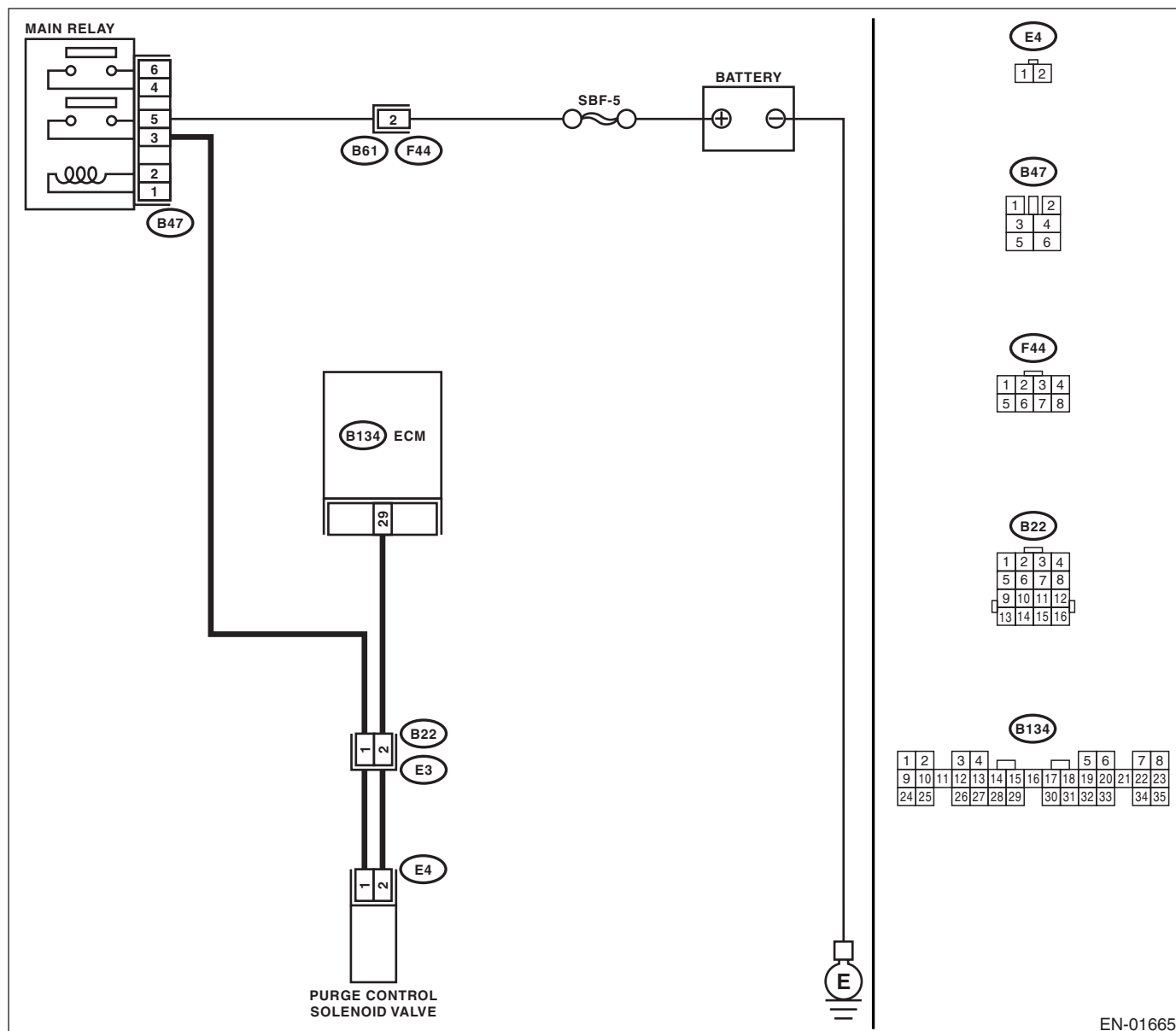
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01665

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 29 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Go to step 2.
2 CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from purge control solenoid valve and ECM. 3) Measure the resistance of harness between purge control solenoid valve connector and engine ground. Connector & terminal (E4) No. 2 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 3.	Repair ground short circuit in harness between ECM and purge control solenoid valve connector.
3 CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. Measure the resistance of harness between ECM and purge control solenoid valve of harness connector. Connector & terminal (B134) No. 29 — (E4) No. 2:	Is the resistance less than 1 Ω?	Go to step 4.	Repair open circuit in harness between ECM and purge control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and purge control solenoid valve connector • Poor contact in coupling connector
4 CHECK PURGE CONTROL SOLENOID VALVE. 1) Remove the purge control solenoid valve. 2) Measure the resistance between purge control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance 10 — 100 Ω?	Go to step 5.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.>
5 CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE. 1) Turn the ignition switch to ON. 2) Measure the voltage between purge control solenoid valve and engine ground. Connector & terminal (E4) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 6.	Repair open circuit in harness between main relay and purge control solenoid valve connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POOR CONTACT. Check poor contact in purge control solenoid valve connector.	Is there poor contact in purge control solenoid valve connector?	Repair poor contact in purge control solenoid valve connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

BD:DTC P0459 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-143, DTC P0459 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

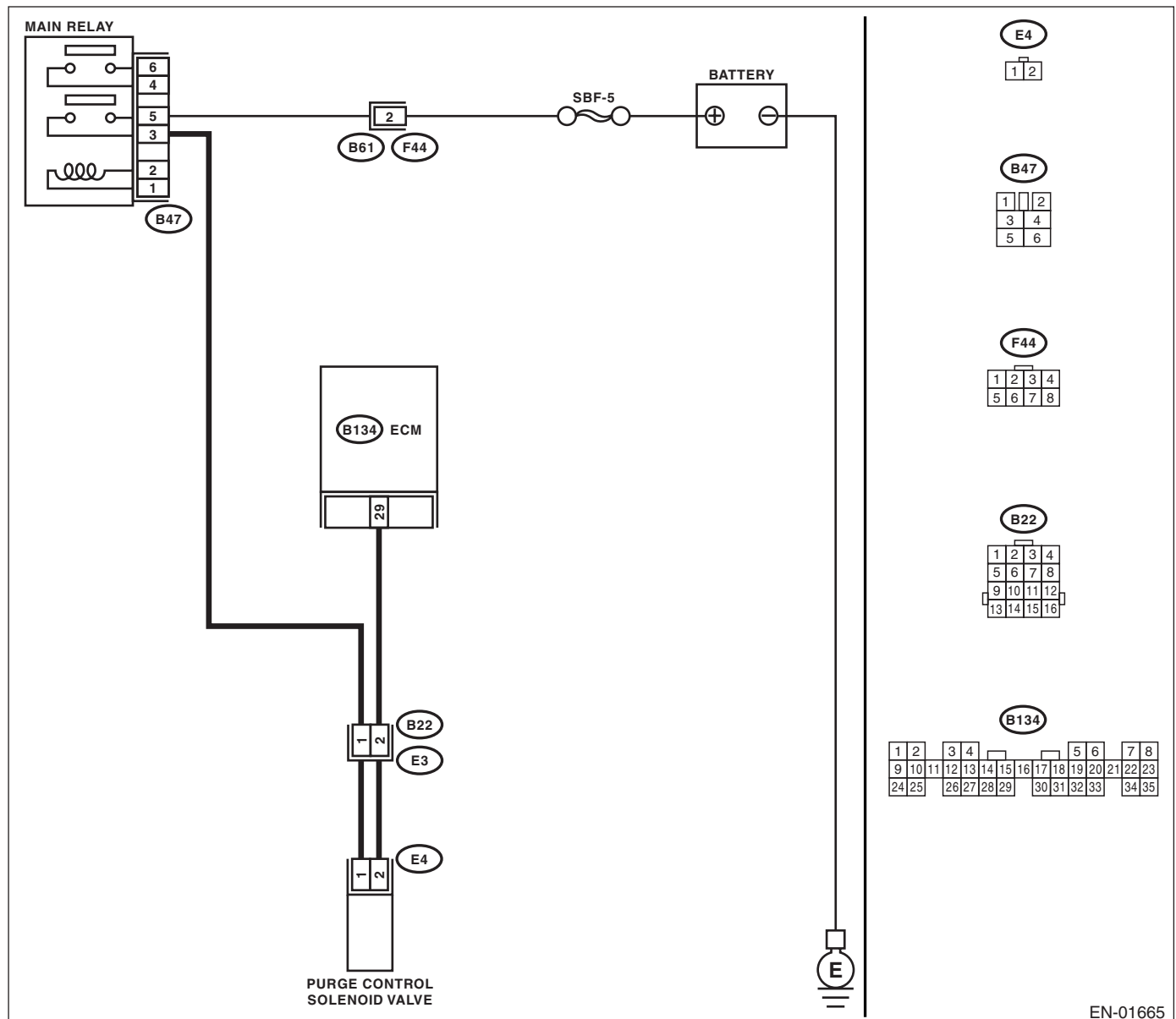
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn the ignition switch to ON. 4) While operating the purge control solenoid valve, measure voltage between ECM and chassis ground. NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.> Connector & terminal (B134) No. 29 (+) — Chassis ground (-):	Is the voltage 0 — 10 V?	Go to step 2.	Even if malfunction indicator light light up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.
	CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 29 (+) — Chassis ground (-):			
	CHECK POOR CONTACT. Check poor contact in ECM connector.			
	CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from purge control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 29 (+) — Chassis ground (-):			
	CHECK PURGE CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve terminals. Terminals No. 1 — No. 2:			
	CHECK POOR CONTACT. Check poor contact in ECM connector.			
2	CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 29 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 4.	Go to step 3.
3	CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>
4	CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from purge control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 29 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and purge control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 5.
5	CHECK PURGE CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Replace the purge control solenoid valve <Ref. to EC(H4SO)-6, Purge Control Solenoid Valve.> and ECM <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 6.
6	CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BE:DTC P0461 FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE

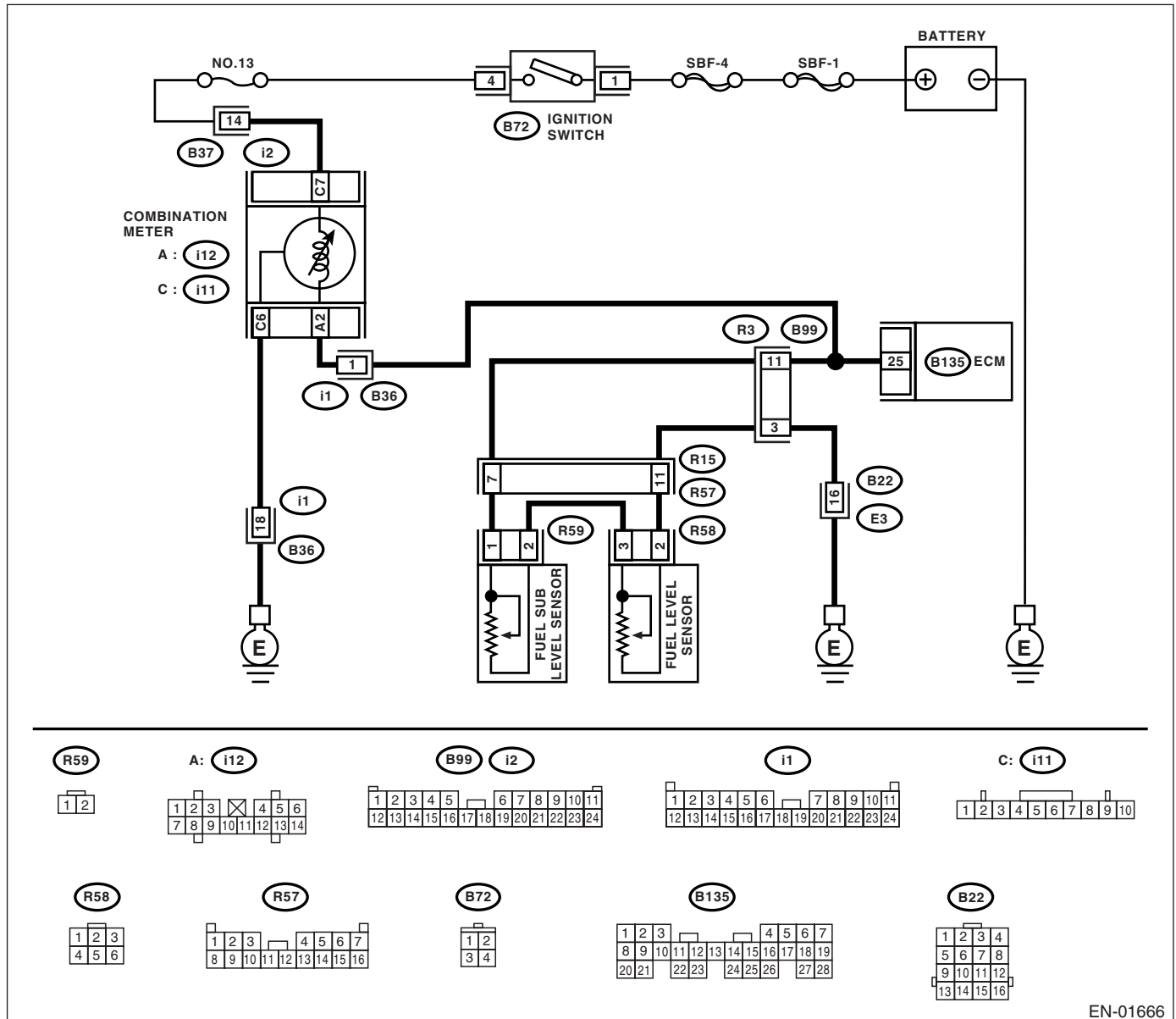
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-145, DTC P0461 FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01666

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect this trouble.	Replace the fuel level sensor <Ref. to FU(H4SO)-57, Fuel Level Sensor.> and fuel sub level sensor. <Ref. to FU(H4SO)-57, Fuel Level Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BF:DTC P0462 FUEL LEVEL SENSOR CIRCUIT LOW INPUT

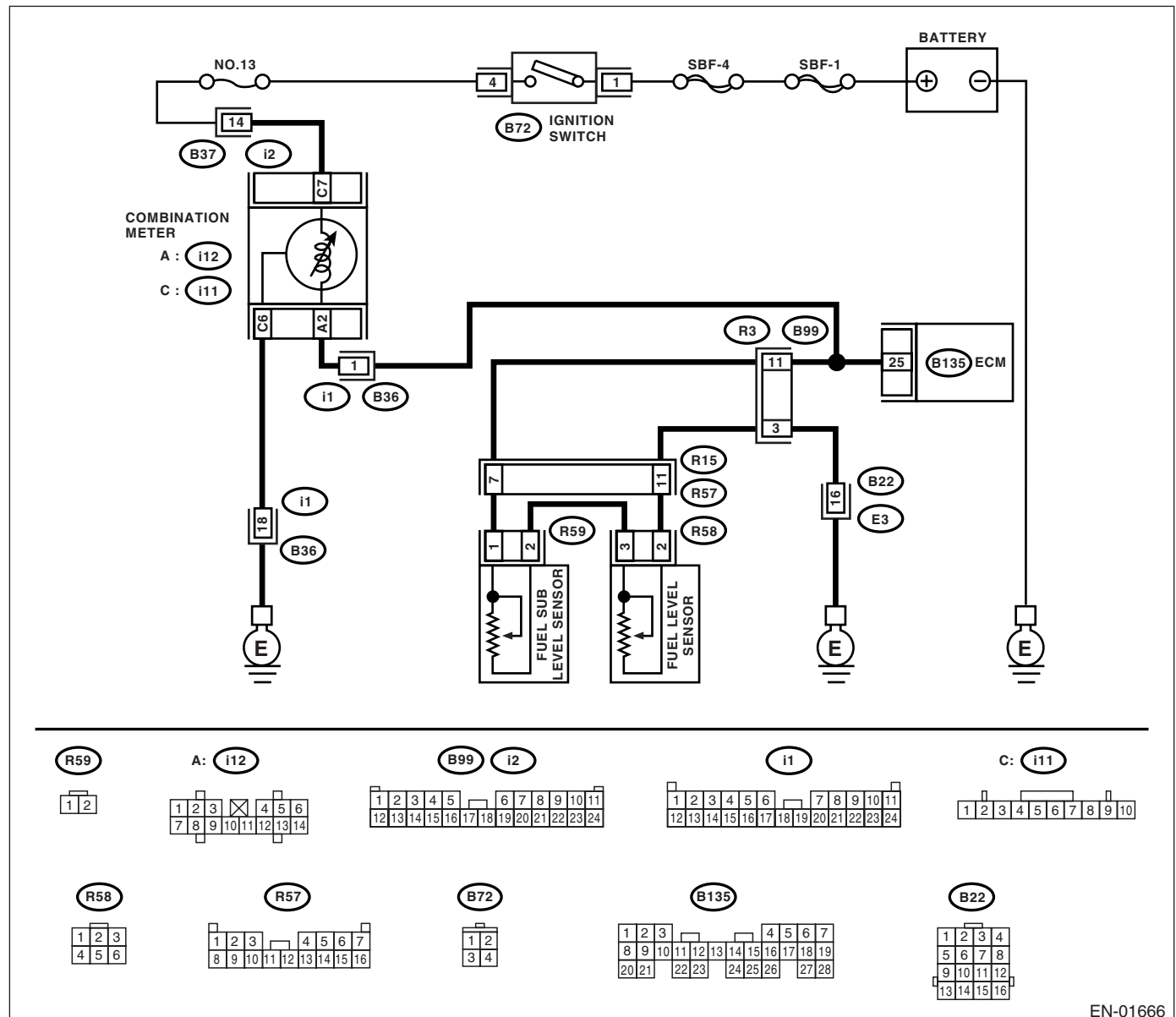
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-147, DTC P0462 FUEL LEVEL SENSOR CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01666

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SPEEDOMETER AND TACHOMETER OPERATION IN COMBINATION METER.	Does the speedometer and tachometer operate normally?	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-3, Combination Meter System.>
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn the ignition switch to ON. (Engine OFF) 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 25 (+) — Chassis ground (-):	Is the voltage less than 0.12 V?	Go to step 4.	Go to step 3.
3 CHECK INPUT SIGNAL FOR ECM. (USING SUBARU SELECT MONITOR.) Read the data of fuel level sensor signal using Subaru Select Monitor. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.>	Is the voltage less than 0.12 V by shaking the harness and connector of ECM?	Repair poor contact in ECM connector.	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause. NOTE: In this case, repair the following: • Poor contact in combination meter connector • Poor contact in ECM connector • Poor contact in coupling connectors
4 CHECK INPUT VOLTAGE OF ECM. 1) Turn the ignition switch to OFF. 2) Separate fuel tank cord connector (R57) and rear wiring harness connector (R15). 3) Turn the ignition switch to ON. 4) Measure the voltage of harness between ECM connector and chassis ground. Connector & terminal (B135) No. 25 (+) — Chassis ground (-):	Is the voltage more than 0.12 V?	Go to step 5.	Go to step 6.
5 CHECK HARNESS BETWEEN ECM AND COMBINATION METER. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from connector (i12) and ECM connector. 3) Measure the resistance between ECM and chassis ground. Connector & terminal (B135) No. 25 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 7.	Repair ground short circuit in harness between ECM and combination meter connector.
6 CHECK HARNESS BETWEEN ECM AND COMBINATION METER. Measure the resistance between ECM and combination meter connector. Connector & terminal (B135) No. 25 — (i12) No. 2:	Is the resistance less than 10 Ω?	Repair or replace the combination meter. <Ref. to IDI-3, Combination Meter System.>	Repair open circuit between ECM and combination meter connector. NOTE: In this case, repair the following: Poor contact in coupling connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK FUEL TANK CORD. 1) Turn ignition switch to OFF. 2) Disconnect the connector from fuel sub level sensor. 3) Measure the resistance between fuel sub level sensor and chassis ground. Connector & terminal (R59) No. 1 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 8.	Repair short circuit to ground in fuel tank cord.
8 CHECK FUEL TANK CORD. 1) Disconnect the connector from fuel pump assembly. 2) Measure the resistance between fuel pump assembly and chassis ground. Connector & terminal (R59) No. 2 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 9.	Repair ground short circuit in fuel tank cord.
9 CHECK FUEL LEVEL SENSOR. 1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-55, Fuel Pump.> 2) Measure the resistance between fuel level sensor and terminals with its float set to the full position. Terminals No. 3 — No. 2:	Is the resistance 0.5 — 2.5 Ω?	Go to step 10.	Replace the fuel level sensor.
10 CHECK FUEL SUB LEVEL SENSOR. 1) Remove the fuel sub level sensor. <Ref. to FU(H4SO)-58, Fuel Sub Level Sensor.> 2) Measure the resistance between fuel sub level sensor and terminals with its float set to the full position. Terminals No. 1 — No. 2:	Is the resistance 0.5 — 2.5 Ω?	Repair poor contact in harness between ECM and combination meter connector.	Replace the fuel sub level sensor.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BG:DTC P0463 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT

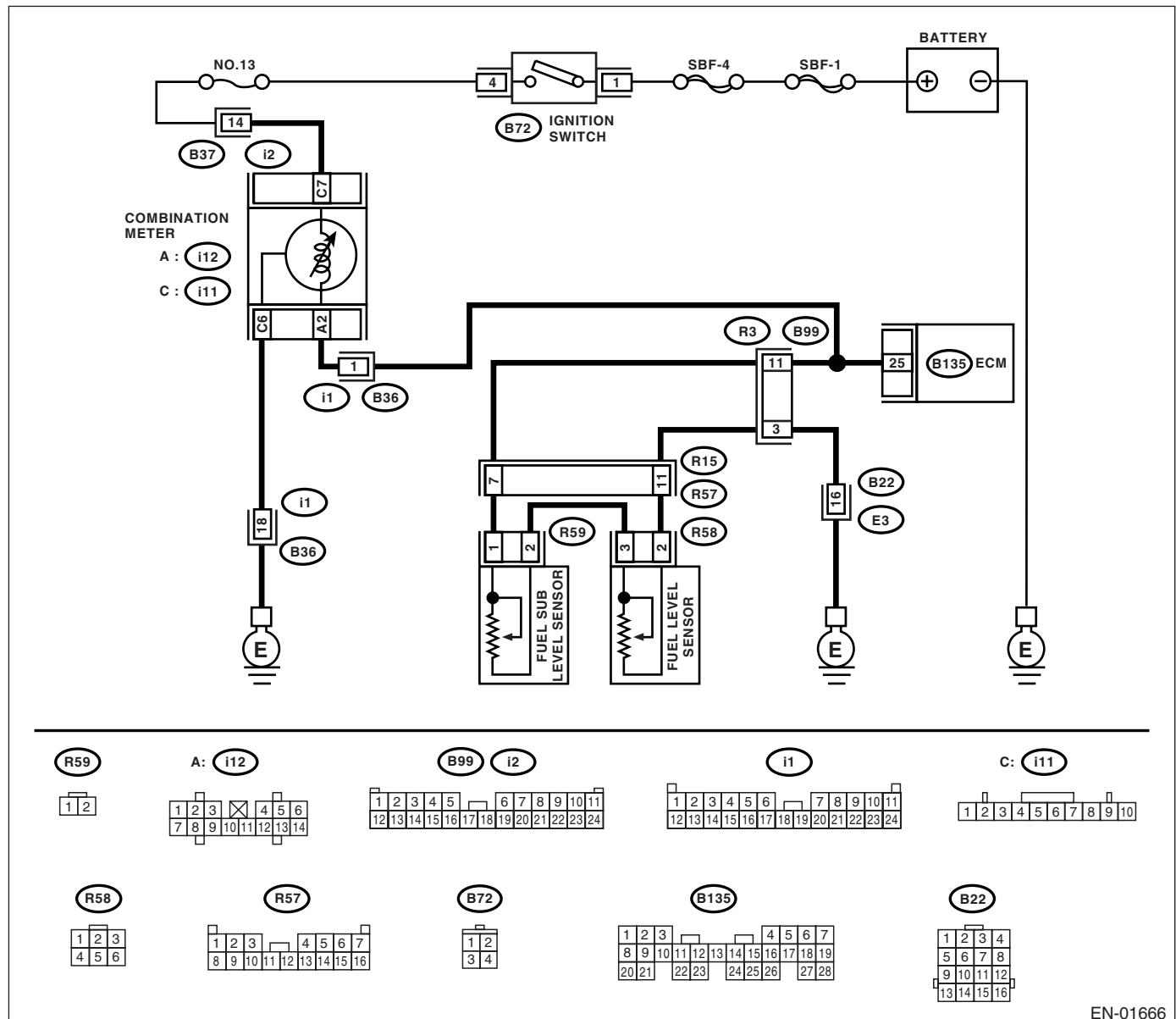
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-149, DTC P0463 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01666

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SPEEDOMETER AND TACHOMETER OPERATION IN COMBINATION METER.	Does the speedometer and tachometer operate normally?	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-3, Combination Meter System.>
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn the ignition switch to ON. (Engine OFF) 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 25 (+) — Chassis ground (-):	Is the voltage more than 4.75 V?	Go to step 3.	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause. NOTE: In this case, repair the following: • Poor contact in fuel pump connector • Poor contact in coupling connector
3 CHECK INPUT VOLTAGE OF ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the combination meter connector (i12) and ECM connector. 3) Turn the ignition switch to ON. 4) Measure the voltage of harness between ECM and chassis ground. Connector & terminal (B135) No. 25 (+) — Chassis ground (-):	Is the voltage more than 4.75 V?	Go to step 4.	Repair battery short circuit between ECM and combination meter connector.
4 CHECK HARNESS BETWEEN ECM AND FUEL TANK CORD. 1) Turn the ignition switch to OFF. 2) Separate fuel tank cord connector (R57) and rear wiring harness connector (R15). 3) Measure the resistance between ECM and fuel tank cord. Connector & terminal (B135) No. 25 — (R15) No. 7:	Is the resistance less than 5 Ω ?	Go to step 5.	Repair open circuit between ECM and fuel tank cord.
5 CHECK HARNESS BETWEEN FUEL TANK CORD AND CHASSIS GROUND. Measure the resistance between fuel tank cord and chassis ground. Connector & terminal (R15) No. 11 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 6.	Repair open circuit between fuel tank cord and chassis ground. NOTE: In this case, repair the following: Poor contact in coupling connectors
6 CHECK FUEL TANK CORD. 1) Disconnect the connector from fuel level sensor. 2) Measure the resistance between fuel level sensor and coupling connector. Connector & terminal (R57) No. 11 — (R58) No. 2:	Is the resistance less than 10 Ω ?	Go to step 7.	Repair open circuit between coupling connector and fuel level sensor.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
7	CHECK FUEL TANK CORD. 1) Disconnect the connector from fuel sub level sensor. 2) Measure the resistance between fuel level sensor and fuel sub level sensor. Connector & terminal (R58) No. 3 — (R59) No. 2:	Is the resistance less than 10 Ω ?	Go to step 8.	Repair open circuit between fuel level sensor and fuel sub level sensor.
8	CHECK FUEL TANK CORD. Measure the resistance between fuel level sensor and coupling connector. Connector & terminal (R57) No. 7 — (R59) No. 1:	Is the resistance less than 10 Ω ?	Go to step 9.	Repair open circuit between coupling connector and fuel level sensor.
9	CHECK FUEL LEVEL SENSOR. 1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-55, Fuel Pump.> 2) While moving the fuel level sensor float up and down, measure resistance between fuel level sensor terminals. Terminals No. 3 — No. 2:	Is the resistance more than 54.5 Ω ?	Replace the fuel level sensor. <Ref. to FU(H4SO)-57, Fuel Level Sensor.>	Go to step 10.
10	CHECK FUEL SUB LEVEL SENSOR. 1) Remove the fuel sub level sensor. <Ref. to FU(H4SO)-58, Fuel Sub Level Sensor.> 2) While moving the fuel sub level sensor float up and down, measure resistance between fuel sub level sensor terminals. Terminals No. 1 — No. 2:	Is the resistance more than 41.5 Ω ?	Replace the fuel sub level sensor. <Ref. to FU(H4SO)-58, Fuel Sub Level Sensor.>	Replace the combination meter. <Ref. to IDI-10, Combination Meter Assembly.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BH:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

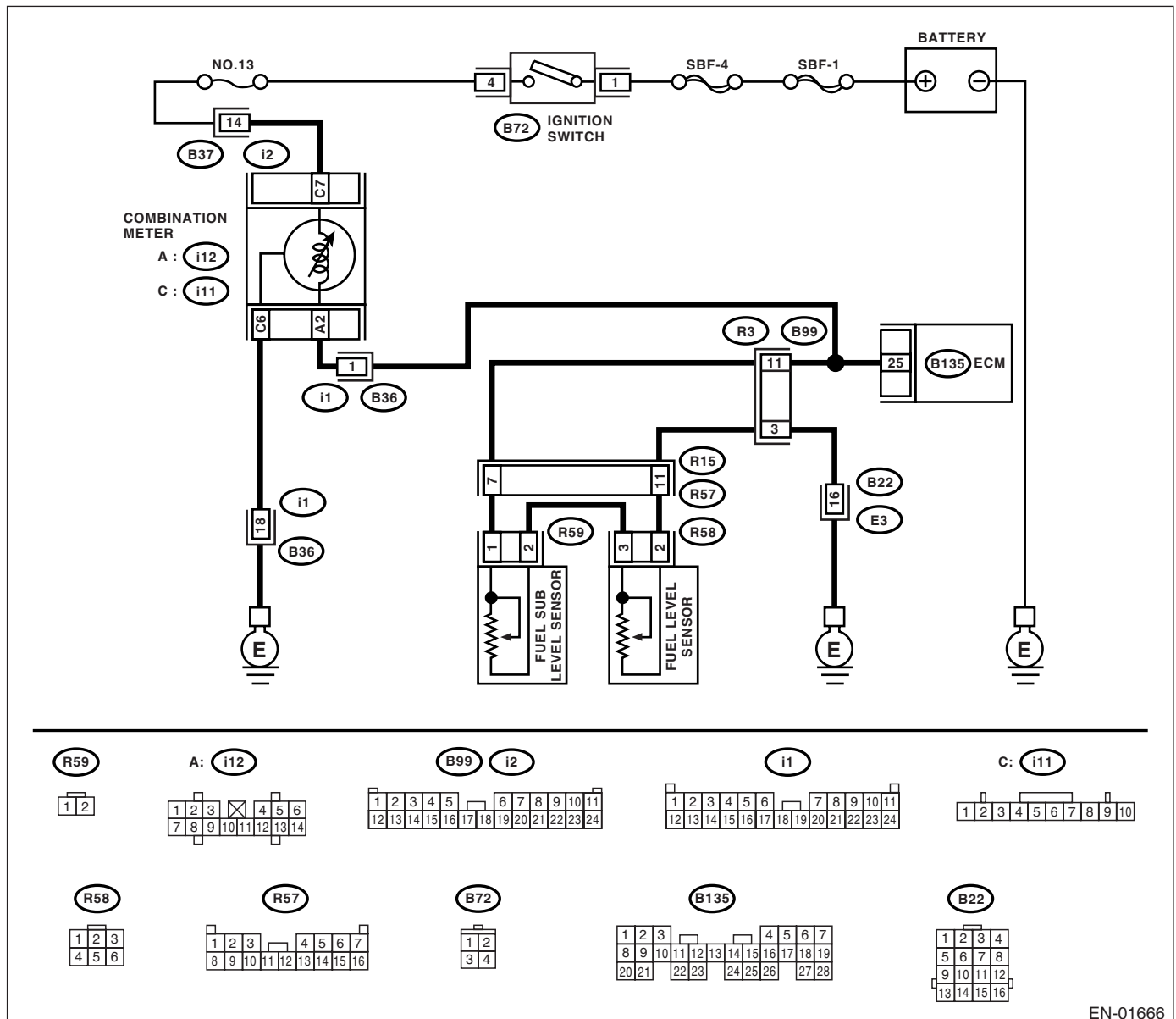
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-151, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01666

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC P0462 or P0463 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK FUEL LEVEL SENSOR. 1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-55, Fuel Pump.> 2) While moving the fuel level sensor float up and down, make sure that the resistance between fuel level sensor terminals changes smoothly. Terminals No. 3 — No. 2:	Does the resistance change smoothly?	Go to step 3.	Replace the fuel level sensor. <Ref. to FU(H4SO)-57, Fuel Level Sensor.>
3 CHECK FUEL SUB LEVEL SENSOR. 1) Remove the fuel sub level sensor. <Ref. to FU(H4SO)-57, Fuel Level Sensor.> 2) While moving the fuel sub level sensor float up and down, make sure that the resistance between fuel level sensor terminals changes smoothly. Terminals No. 1 — No. 2:	Does the resistance change smoothly?	Repair poor contact in ECM, combination meter and coupling connectors.	Replace the fuel sub level sensor. <Ref. to FU(H4SO)-57, Fuel Level Sensor.>

BI: DTC P0483 COOLING FAN RATIONALITY CHECK

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-154, DTC P0483 COOLING FAN RATIONALITY CHECK, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Occurrence of noise
- Overheating

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

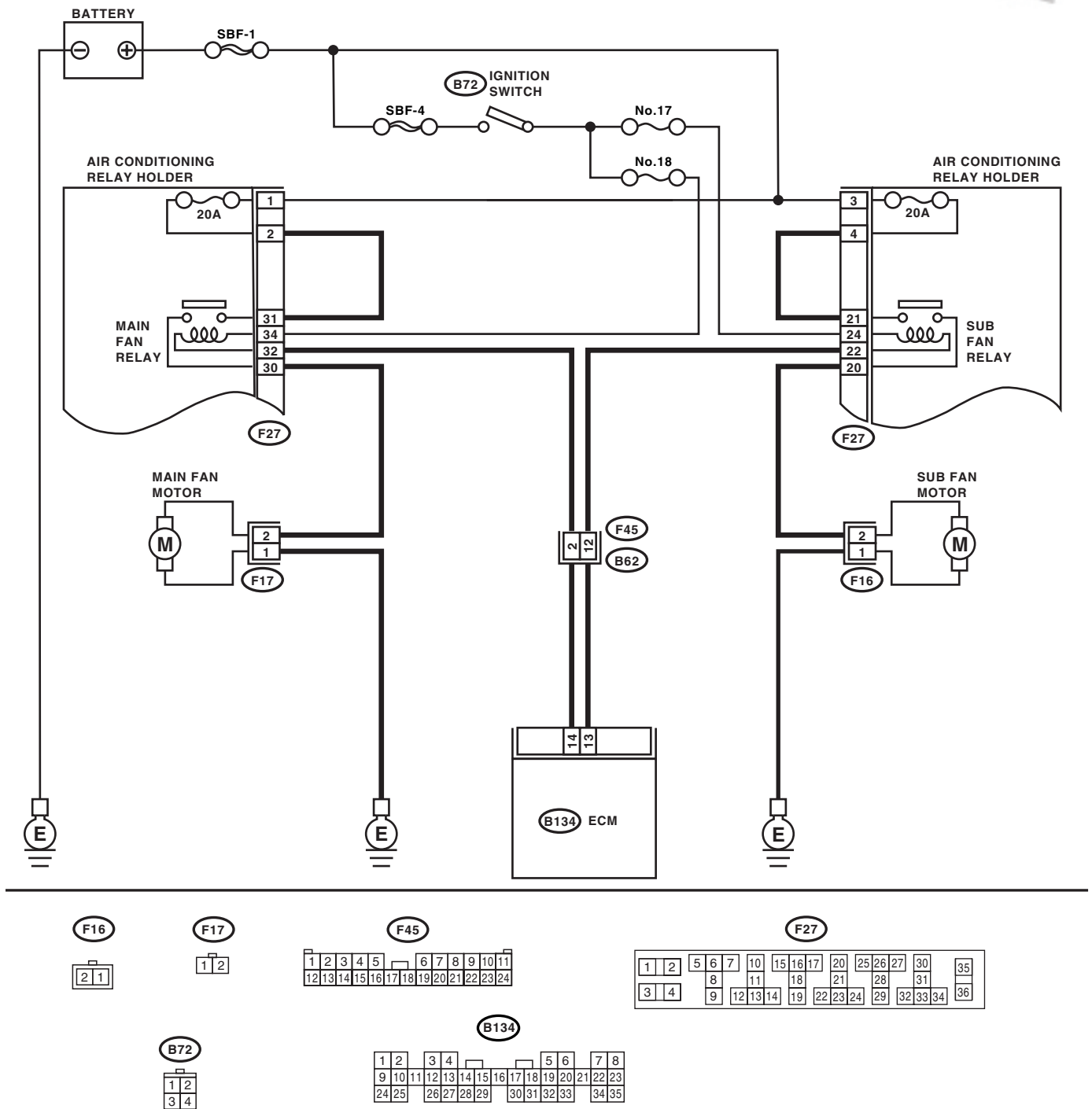
NOTE:

If the vehicle, with the engine idling, is placed very close to a wall or another vehicle, preventing normal cooling function, the OBD system may detect malfunction.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-01667

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Check radiator fan and fan motor. <Ref. to CO(H4SO)-22, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-23, Radiator Sub Fan and Fan Motor.>

BJ:DTC P0502 VEHICLE SPEED SENSOR CIRCUIT LOW INPUT

NOTE:

For the diagnostic procedure, refer to DTC P0503. <Ref. to EN(H4SO)(diag)-217, DTC P0503 VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BK:DTC P0503 VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH

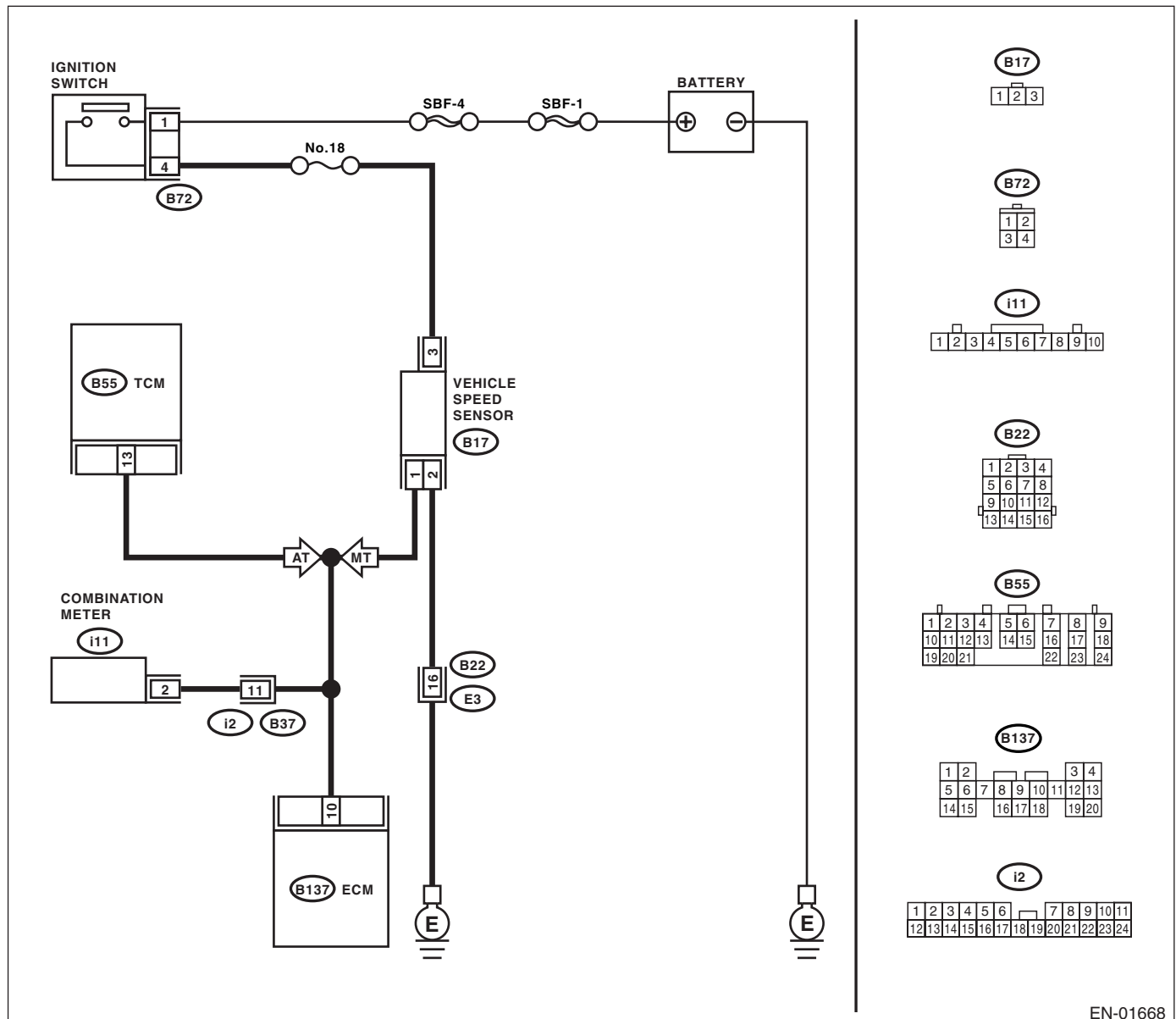
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-157, DTC P0503 VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01668

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK TRANSMISSION TYPE.	Is the target AT model?	Go to step 2.	Go to step 3.
2	CHECK DTC P0720 ON DISPLAY.	Does the Subaru Select Monitor or OBD-II general scan tool indicate DTC P0720?	Check front vehicle speed sensor signal circuit. <Ref. to 4AT(diag)-52, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Go to step 3.
3	CHECK SPEEDOMETER OPERATION IN COMBINATION METER.	Does the speedometer operate normally?	Go to step 4.	Check speedometer and vehicle speed sensor. <Ref. to IDI-14, Speedometer.> and <Ref. to 4AT-49, Front Vehicle Speed Sensor.> and <Ref. to 4AT-53, Rear Vehicle Speed Sensor.> and <Ref. to 4AT-54, Torque Converter Turbine Speed Sensor.>
4	CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from combination meter. 3) Measure the resistance between ECM and combination meter. Connector & terminal (B137) No. 10 — (i11) No. 2:	Is the resistance less than 10 Ω?	Repair poor contact in ECM connector.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and combination meter connector • Poor contact in ECM connector • Poor contact in combination meter connector • Poor contact in coupling connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BL:DTC P0506 IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-158, DTC P0506 IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

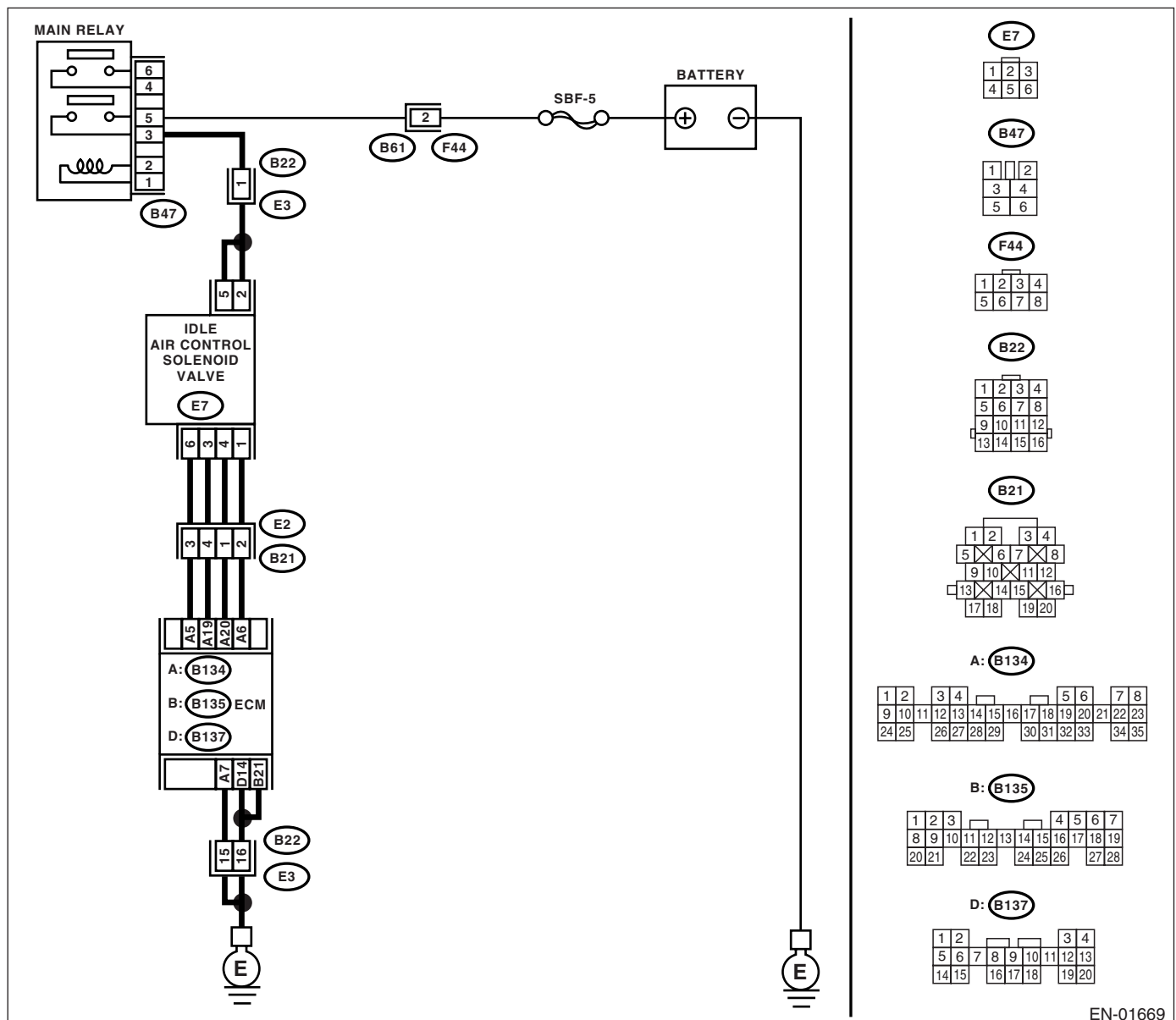
TROUBLE SYMPTOM:

- Engine is difficult to start.
- Engine does not start.
- Erroneous idling
- Engine stalls.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01669

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0506.	Go to step 2.
2	CHECK AIR BY-PASS LINE. 1) Turn the ignition switch to OFF. 2) Remove the idle air control solenoid valve from throttle body. <Ref. to FU(H4SO)-32, REMOVAL, Idle Air Control Solenoid Valve.> 3) Remove the throttle body from intake manifold. <Ref. to FU(H4SO)-12, REMOVAL, Throttle Body.> 4) Using an air gun, force air into the idle air control solenoid valve installation area. Confirm that forced air subsequently escapes from throttle body interior.	Does air flow out?	Replace the idle air control solenoid valve. <Ref. to FU(H4SO)-32, INSTALLATION, Idle Air Control Solenoid Valve.>	Replace the throttle body. <Ref. to FU(H4SO)-12, INSTALLATION, Throttle Body.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BM:DTC P0507 IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-160, DTC P0507 IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

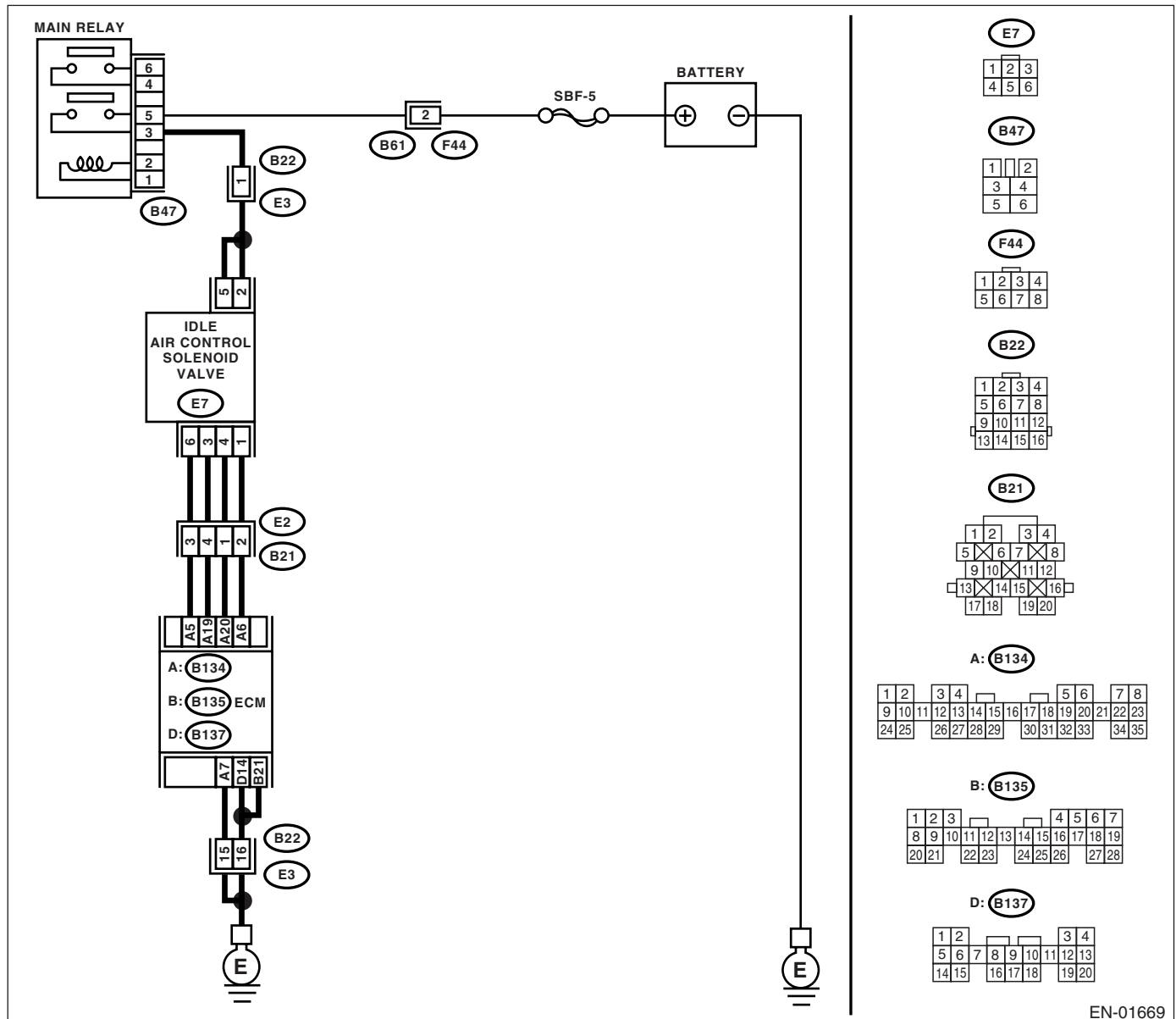
TROUBLE SYMPTOM:

Engine keeps running at higher revolution than specified idling revolution.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01669

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0507.	Go to step 2.
2 CHECK AIR INTAKE SYSTEM. 1) Turn the ignition switch to ON. 2) Start the engine, and idle it. 3) Check the following items. • Loose installation of intake manifold, idle air control solenoid valve and throttle body • Cracks of intake manifold gasket, idle air control solenoid valve gasket and throttle body gasket • Disconnections of vacuum hoses	Is there a fault in air intake system?	Repair air suction and leaks.	Go to step 3.
3 CHECK THROTTLE CABLE.	Is throttle cable play correct?	Go to step 4.	Adjust throttle cable. <Ref. to SP(H4SO)-6, INSTALLATION, Accelerator Control Cable.>
4 CHECK AIR BY-PASS LINE. 1) Turn the ignition switch to OFF. 2) Remove the idle air control solenoid valve from throttle body. <Ref. to FU(H4SO)-32, REMOVAL, Idle Air Control Solenoid Valve.> 3) Confirm that there are no foreign particles in air by-pass line.	Is air by-pass line clogged by foreign particles?	Remove foreign particles from air by-pass line.	Replace the idle air control solenoid valve. <Ref. to FU(H4SO)-32, INSTALLATION, Idle Air Control Solenoid Valve.>

BN:DTC P0512 STARTER REQUEST CIRCUIT

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-162, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Failure of engine to start

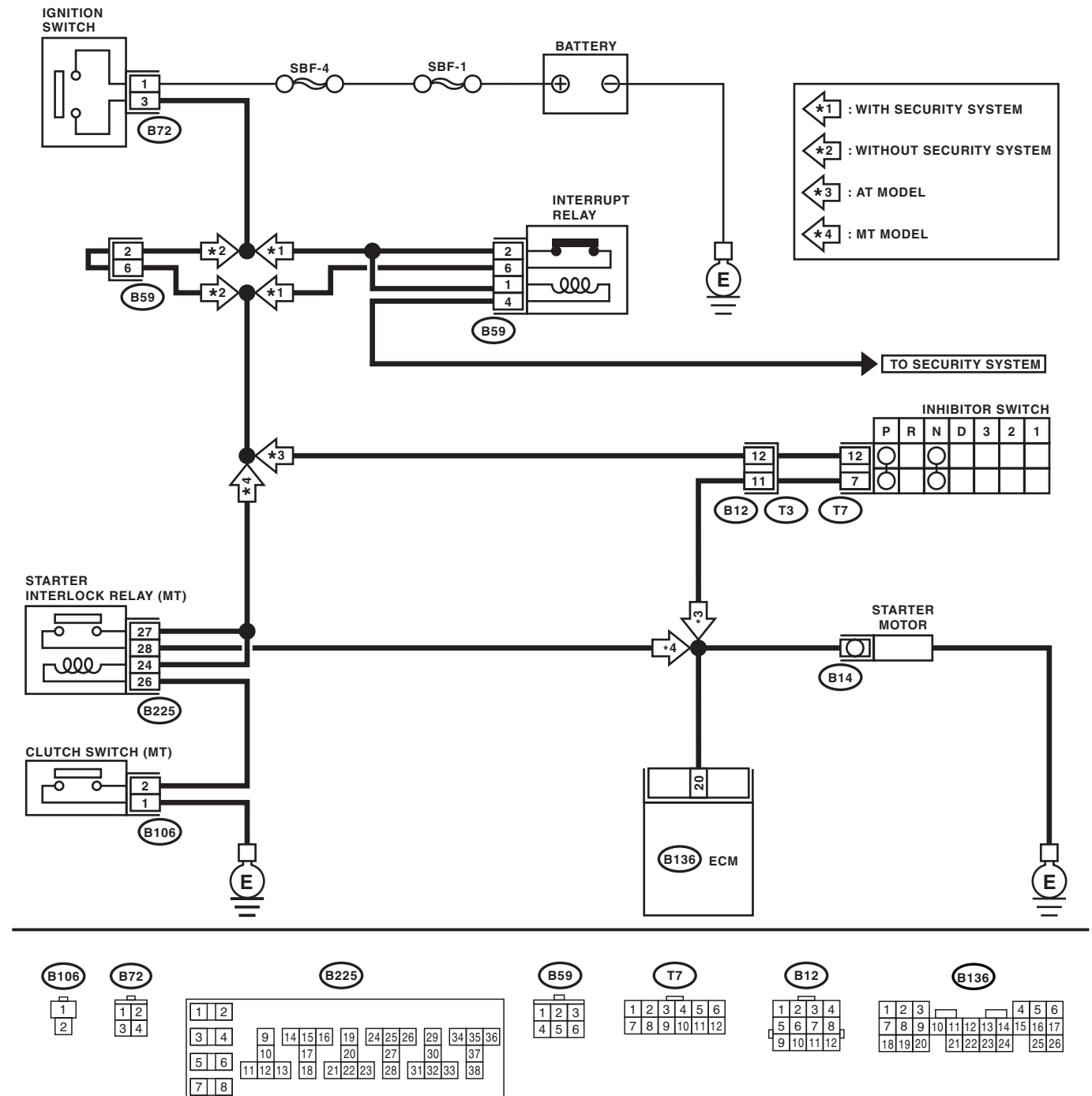
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-01645

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATION OF STARTER MOTOR. Turn the ignition switch to ON. NOTE: Place the inhibitor switch in each position. (AT model) Depress or release the clutch pedal. (MT model)	Dose the starter motor operate?	Repair battery short circuit in starter motor circuit.	Check starter motor circuit. <Ref. to EN(H4SO)(diag)-57, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BO:DTC P0519 IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-163, DTC P0519 IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

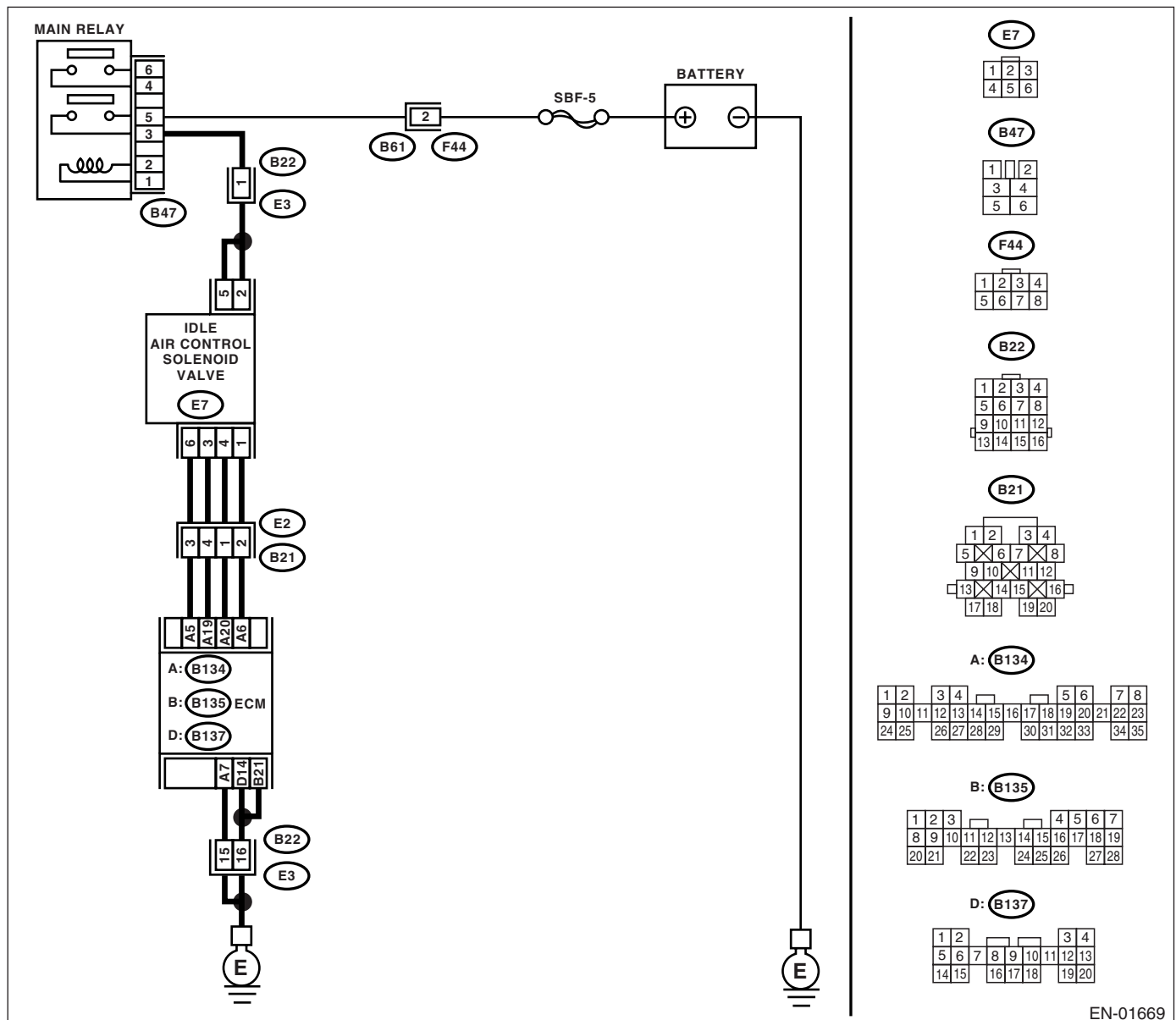
TROUBLE SYMPTOM:

Engine keeps running at higher revolution than specified idling revolution.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01669

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0519.	Go to step 2.
2 CHECK AIR INTAKE SYSTEM. 1) Turn the ignition switch to ON. 2) Start the engine, and idle it. 3) Check the following items. • Loose installation of intake manifold, idle air control solenoid valve and throttle body • Cracks of intake manifold gasket, idle air control solenoid valve gasket and throttle body gasket • Disconnections of vacuum hoses	Is there a fault in air intake system?	Repair air suction and leaks.	Go to step 3.
3 CHECK THROTTLE CABLE.	Is throttle cable play correct?	Go to step 4.	Adjust throttle cable. <Ref. to SP(H4SO)-6, INSTALLATION, Accelerator Control Cable.>
4 CHECK AIR BY-PASS LINE. 1) Turn the ignition switch to OFF. 2) Remove the idle air control solenoid valve from throttle body. <Ref. to FU(H4SO)-32, Idle Air Control Solenoid Valve.> 3) Confirm that there are no foreign particles in air by-pass line.	Is air by-pass line clogged by foreign particles?	Remove foreign particles from air by-pass line.	Replace the idle air control solenoid valve. <Ref. to FU(H4SO)-32, Idle Air Control Solenoid Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BP:DTC P0565 CRUISE CONTROL ON SIGNAL

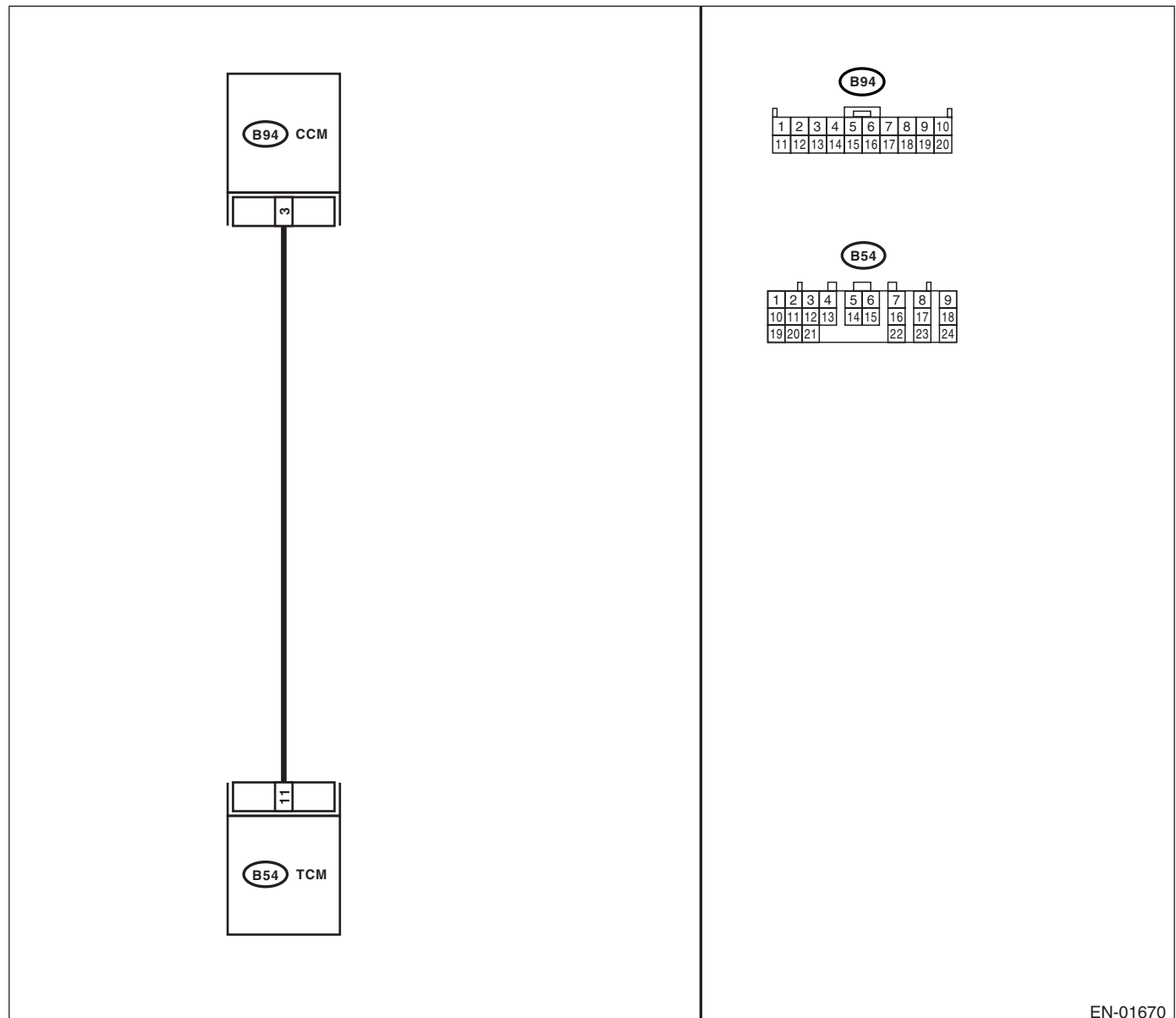
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-164, DTC P0565 CRUISE CONTROL ON SIGNAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01670

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK HARNESS BETWEEN TCM AND CCM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from TCM and CCM. 3) Measure the resistance of harness between TCM and CCM connector. Connector & terminal (B54) No. 11— (B94) No. 3:	Is the resistance less than 1 Ω ?	Go to step 2.	Repair open circuit in harness between TCM and CCM connector.
2	CHECK HARNESS BETWEEN TCM AND CCM CONNECTOR. Measure the resistance of harness between TCM and chassis ground. Connector & terminal (B54) No. 11 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 3.	Repair short circuit in harness between TCM and CCM connector.
3	CHECK INPUT SIGNAL FOR TCM. 1) Connect the connector to TCM and CCM. 2) Lift-up the vehicle or set the vehicle on free rollers. CAUTION: On AWD models, raise all wheels off ground. 3) Start the engine. 4) Turn the cruise control main switch to ON. 5) Increase vehicle speed to 50 km/h (31 MPH). 6) Turn the cruise control command switch to ON. 7) Measure the voltage between TCM and chassis ground. Connector & terminal (B54) No. 11 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 4.	Check cruise control command switch circuit. <Ref. to CC-7, INSPECTION, Cruise Control Command Switch.>
4	CHECK POOR CONTACT. Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Replace the TCM. <Ref. to 4AT-67, Transmission Control Module (TCM).>

BQ:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-165, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

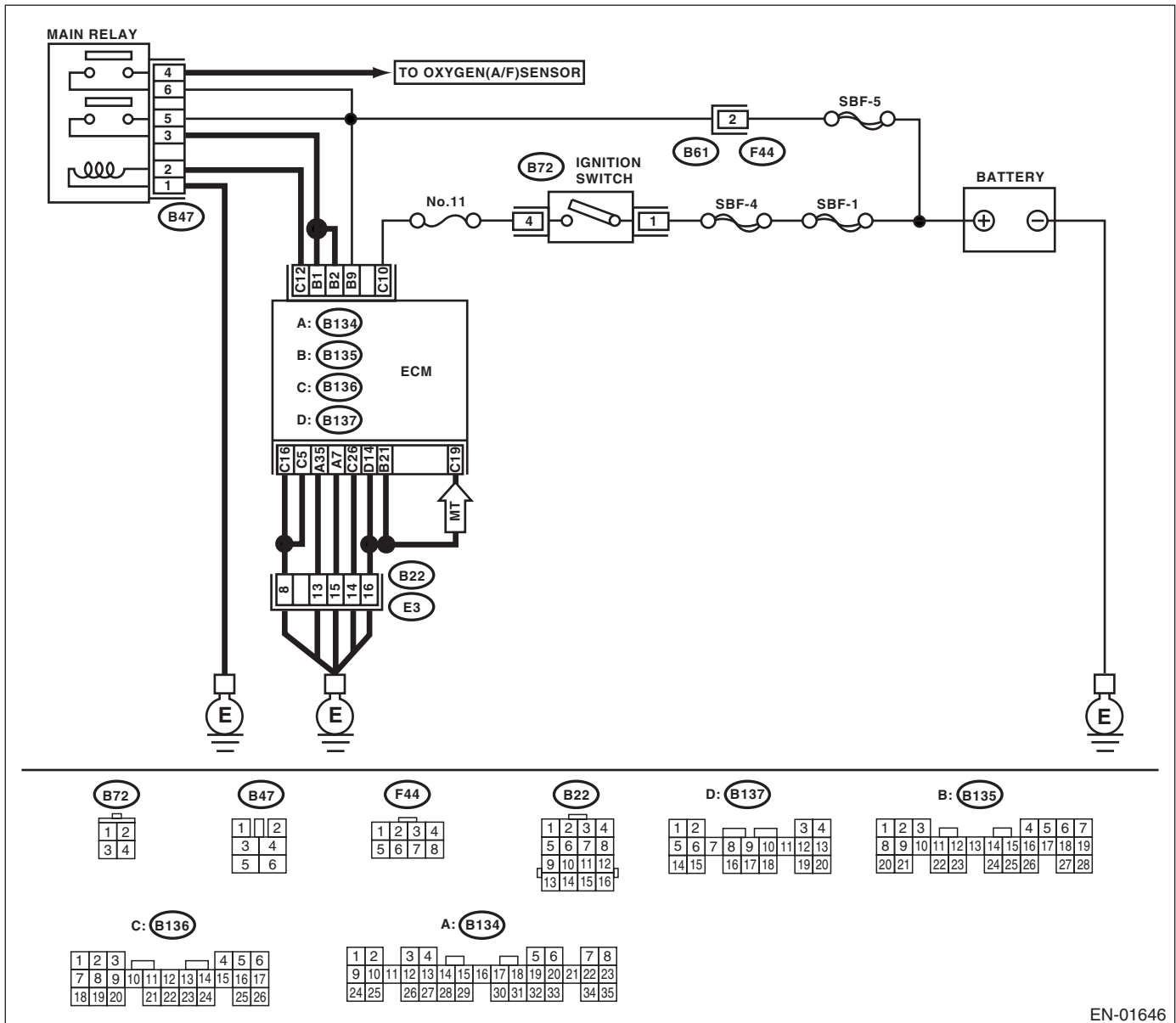
TROUBLE SYMPTOM:

- Engine does not start.
- Engine stalls.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01646

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check the relevant DTC using the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	A temporary poor contact occurs.

BR:DTC P0691 COOLING FAN 1 CONTROL CIRCUIT LOW

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-166, DTC P0691 COOLING FAN 1 CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Radiator fan does not operate properly.
- Overheating

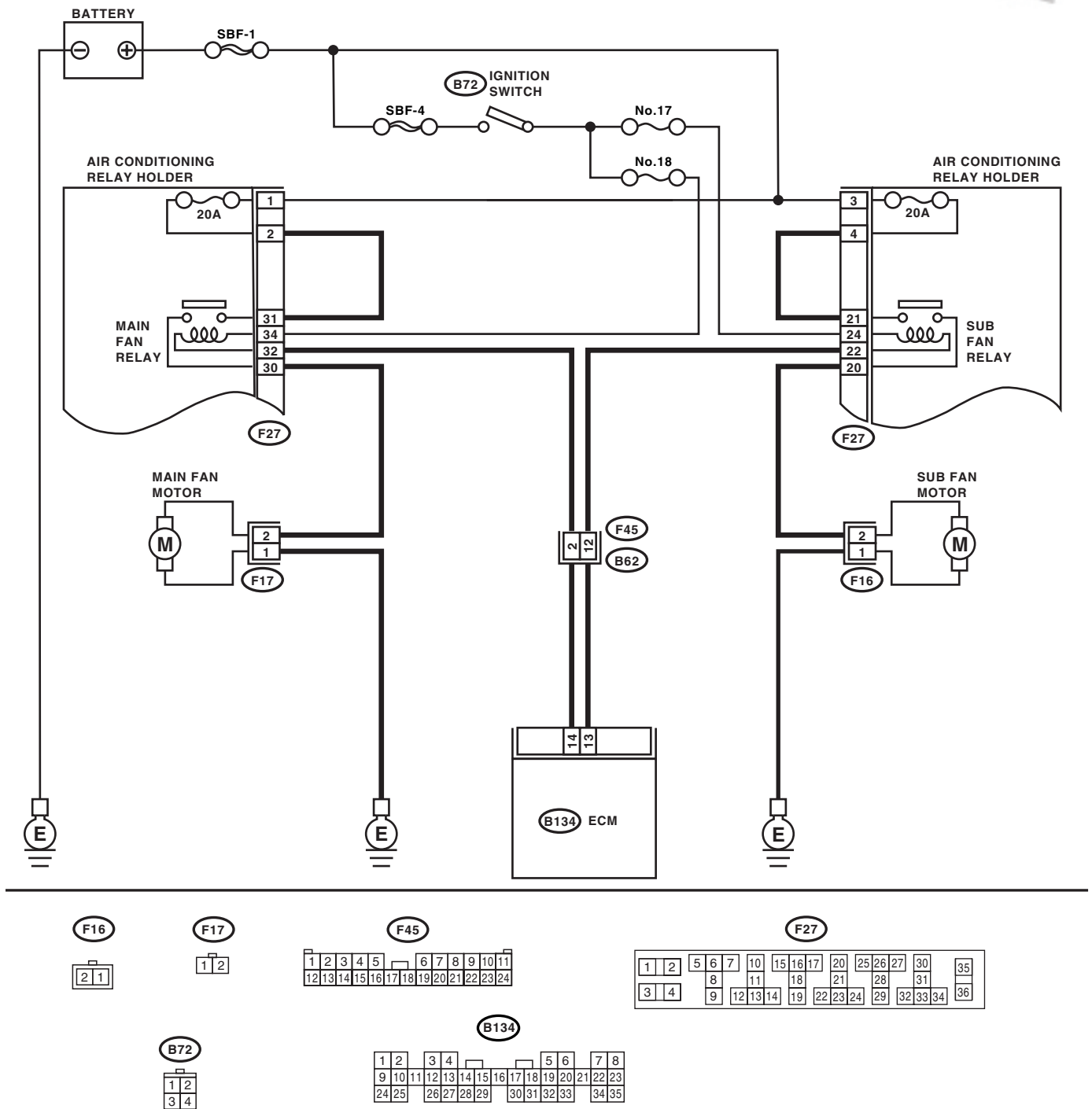
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-01667

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn the ignition switch to ON. 4) While operating the radiator fan relay, measure voltage between ECM terminal and ground. NOTE: Radiator fan relay operation can be executed using Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> Connector & terminal (B134) No. 13 (+) — Chassis ground (-): (B134) No. 14 (+) — Chassis ground (-):	Is the voltage 0 — 10 V?	Repair poor contact in ECM connector.	Go to step 2.
2 CHECK GROUND SHORT CIRCUIT IN RADIATOR FAN RELAY CONTROL CIRCUIT. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B134) No. 13 — Chassis ground: (B134) No. 14 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in radiator fan relay control circuit.	Go to step 3.
3 CHECK POWER SUPPLY FOR RELAY. 1) Remove the radiator fan relay from A/C relay holder. 2) Turn the ignition switch to ON. 3) Measure the voltage between fuse and relay box (F/B) connector and chassis ground. Connector & terminal (F27) No. 24 (+) — Chassis ground (-): (F27) No. 34 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 4.	Repair open circuit in harness between ignition switch and fuse and relay box (F/B) connector.
4 CHECK RADIATOR FAN RELAY. 1) Turn the ignition switch to OFF. 2) Measure the resistance between radiator fan relay terminals. Terminals No. 22 — No. 24: No. 32 — No. 34:	Is the resistance 87 — 107 Ω ?	Go to step 5.	Replace the radiator fan relay.
5 CHECK OPEN CIRCUIT IN RADIATOR FAN RELAY CONTROL CIRCUIT. Measure the resistance of harness between ECM and radiator fan relay connector. Connector & terminal (B134) No. 14 — (F27) No. 32: (B134) No. 13 — (F27) No. 22:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and radiator fan relay connector • Poor contact in coupling connector
6 CHECK POOR CONTACT. Check poor contact in ECM or radiator fan relay connector.	Is there poor contact in ECM or radiator fan relay connector?	Repair poor contact in ECM or radiator fan relay connector.	Contact SOA Service Center.

BS:DTC P0692 COOLING FAN 1 CONTROL CIRCUIT HIGH

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-167, DTC P0692 COOLING FAN 1 CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Radiator fan does not operate properly.
- Overheating

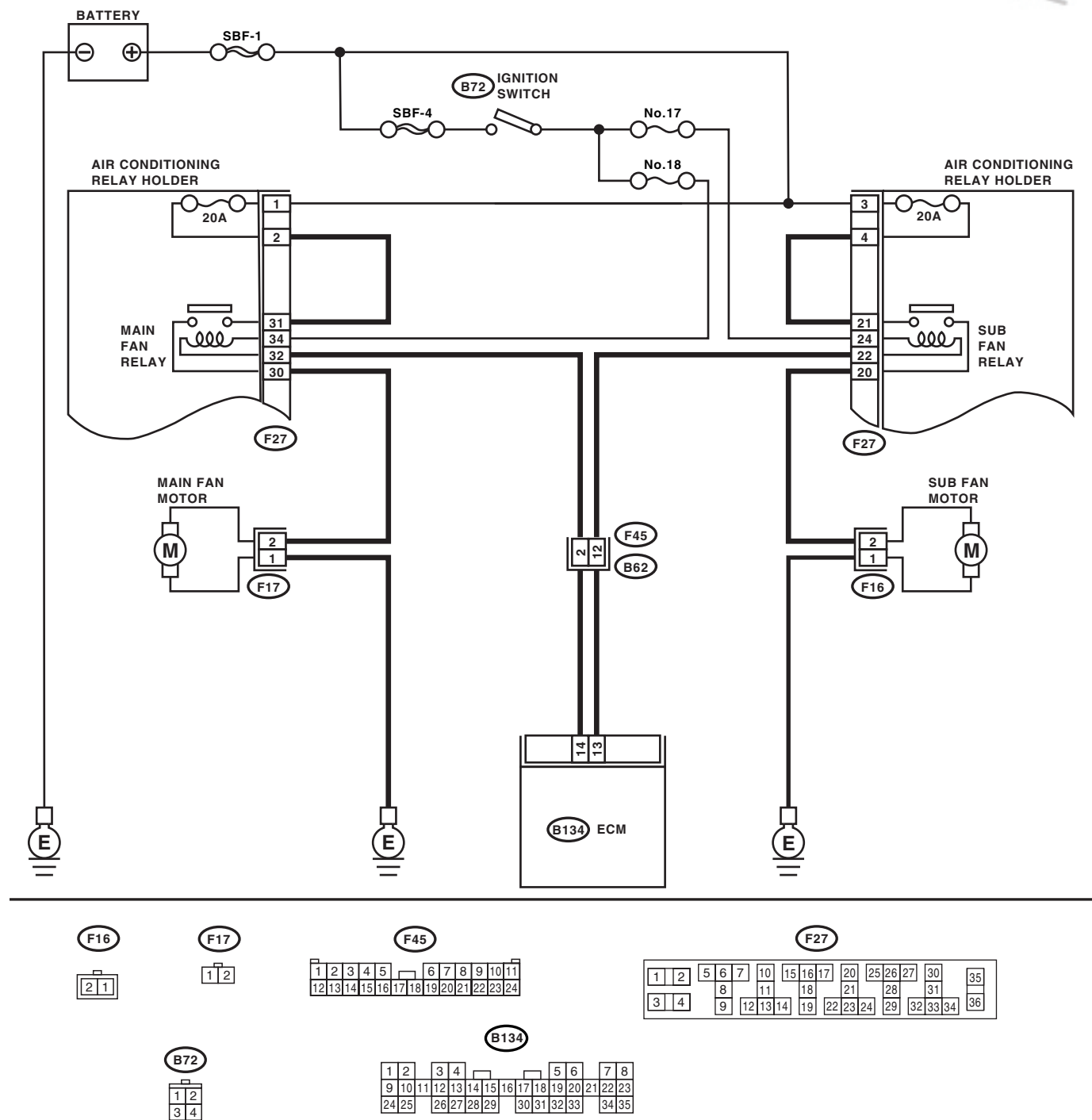
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-01667

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn the ignition switch to ON. 4) While operating the radiator fan relay, measure voltage between ECM and chassis ground. NOTE: Radiator fan relay operation can be executed using Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.> Connector & terminal (B134) No. 14 (+) — Chassis ground (-): (B134) No. 13 (+) — Chassis ground (-):	Is the voltage 0 — 10 V?	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. In this case, repair poor contact in ECM connector.	Go to step 2.
2 CHECK SHORT CIRCUIT IN RADIATOR FAN RELAY CONTROL CIRCUIT. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay and sub fan relay. (with A/C models) 3) Disconnect the test mode connector. 4) Turn the ignition switch to ON. 5) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 14 (+) — Chassis ground (-): (B134) No. 13 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in radiator fan relay control circuit. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 3.
3 CHECK MAIN FAN RELAY. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay. 3) Measure the resistance between main fan relay terminals. Terminals No. 30 — No. 31:	Is the resistance less than 1 Ω ?	Replace the main fan relay and ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 4.
4 CHECK SUB FAN RELAY. 1) Remove the sub fan relay. 2) Measure the resistance between sub fan relay terminals. Terminals No. 20 — No. 21:	Is the resistance less than 1 Ω ?	Replace the sub fan relay and ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 5.
5 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BT:DTC P0703 TORQUE CONVERTER/BRAKE SWITCH “B” CIRCUIT

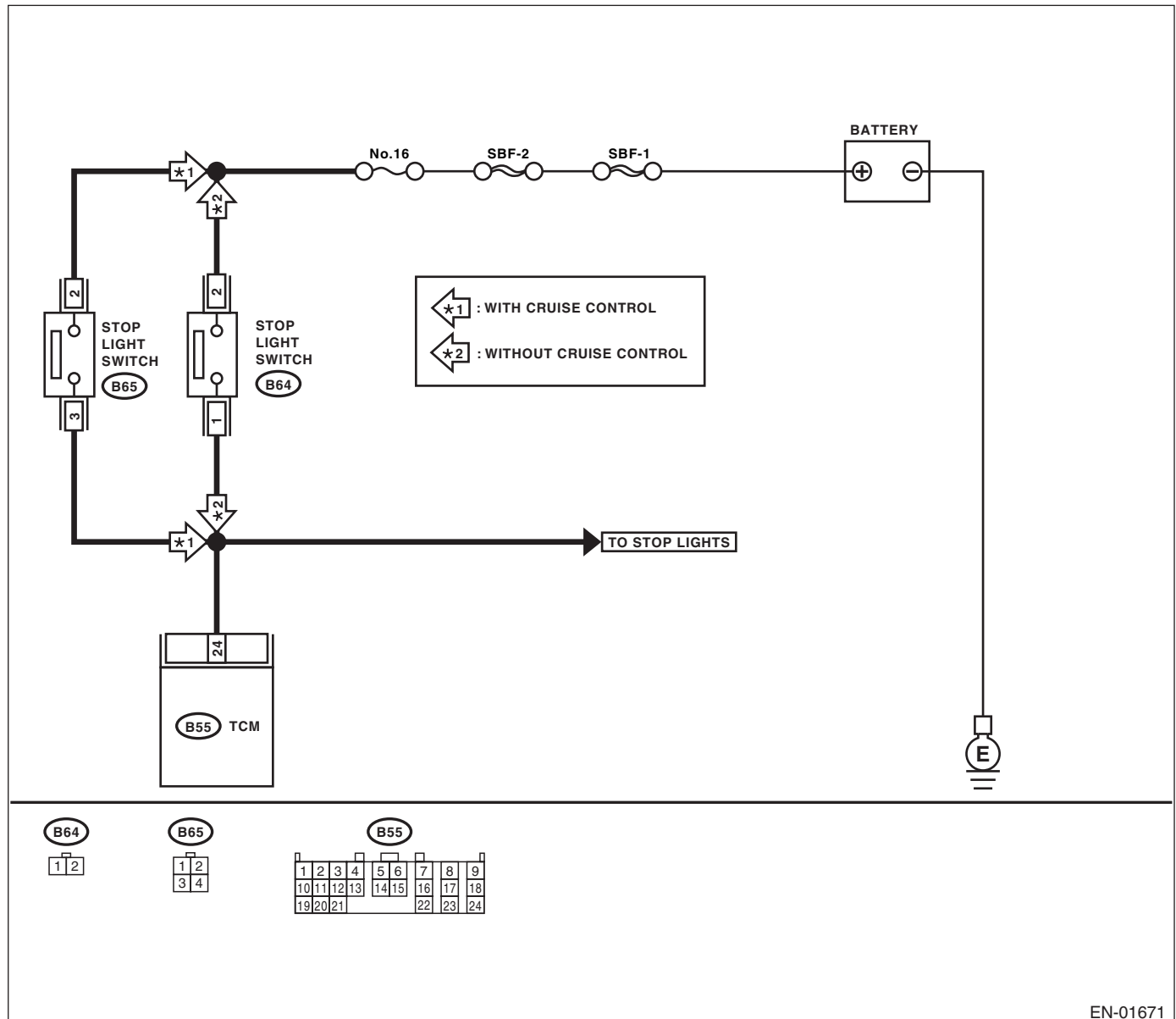
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-168, DTC P0703 TORQUE CONVERTER/BRAKE SWITCH “B” CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATION OF BRAKE LIGHT.	Does the brake light illuminate when depressing the brake pedal?	Go to step 2.	Repair or replace the brake light circuit.
2 CHECK HARNESS BETWEEN TCM AND BRAKE LIGHT SWITCH CONNECTOR. 1) Disconnect the connectors from TCM and brake light switch. 2) Measure the resistance of harness between TCM and brake light switch connector. Connector & terminal Without cruise control (B55) No. 24 — (B64) No. 1: With cruise control (B55) No. 24 — (B65) No. 3:	Is the resistance less than 1 Ω ?	Go to step 3.	Repair or replace the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between TCM and brake light switch connector • Poor contact in TCM connector • Poor contact in brake light switch connector
3 CHECK HARNESS BETWEEN TCM AND BRAKE LIGHT SWITCH CONNECTOR. Measure the resistance of harness between TCM and chassis ground. Connector & terminal (B55) No. 24 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 4.	Repair ground short circuit in harness between TCM and brake light switch connector.
4 CHECK INPUT SIGNAL FOR TCM. 1) Connect the connectors to TCM and brake light switch. 2) Measure the voltage between TCM and chassis ground. Connector & terminal (B55) No. 24 (+) — Chassis ground (-):	Is the voltage less than 1 V when releasing the brake pedal?	Go to step 5.	Adjust or replace the brake light switch. <Ref. to LI-7, STOP LIGHT SWITCH, INSPECTION, Stop Light System.>
5 CHECK INPUT SIGNAL FOR TCM. Measure the voltage between TCM and chassis ground. Connector & terminal (B55) No. 24 (+) — Chassis ground (-):	Is the voltage more than 10 V when depressing the brake pedal?	Go to step 6.	Adjust or replace the brake light switch. <Ref. to LI-7, STOP LIGHT SWITCH, INSPECTION, Stop Light System.>
6 CHECK POOR CONTACT. Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Replace the TCM. <Ref. to 4AT-67, Transmission Control Module (TCM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BU:DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT)

GENERAL DESCRIPTION <Ref. to GD(H4SO)-169, DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-104, CHECK INHIBITOR SWITCH, Diagnostic Procedure without Diagnostic Trouble Code (DTC).>

BV:DTC P0710 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT

GENERAL DESCRIPTION <Ref. to GD(H4SO)-170, DTC P0710 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-43, DTC 27 ATF TEMPERATURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BW:DTC P0716 OUTPUT/TURBINE SPEED SENSOR CIRCUIT RANGE/PERFORMANCE

GENERAL DESCRIPTION <Ref. to GD(H4SO)-171, DTC P0716 INPUT/TURBINE SPEED SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-57, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BX:DTC P0720 OUTPUT SPEED SENSOR CIRCUIT

GENERAL DESCRIPTION <Ref. to GD(H4SO)-172, DTC P0720 OUTPUT SPEED SENSOR CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-52, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BY:DTC P0726 ENGINE SPEED INPUT CIRCUIT RANGE/PERFORMANCE

GENERAL DESCRIPTION <Ref. to GD(H4SO)-173, DTC P0726 ENGINE SPEED INPUT CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-39, DTC 11 ENGINE SPEED SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BZ:DTC P0731 GEAR 1 INCORRECT RATIO

NOTE:

For the diagnostic procedure, refer to DTC P0734. <Ref. to EN(H4SO)(diag)-239, DTC P0734 GEAR 4 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CA:DTC P0732 GEAR 2 INCORRECT RATIO

NOTE:

For the diagnostic procedure, refer to DTC P0734. <Ref. to EN(H4SO)(diag)-239, DTC P0734 GEAR 4 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CB:DTC P0733 GEAR 3 INCORRECT RATIO

NOTE:

For the diagnostic procedure, refer to DTC P0734. <Ref. to EN(H4SO)(diag)-239, DTC P0734 GEAR 4 INCORRECT RATIO, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CC:DTC P0734 GEAR 4 INCORRECT RATIO

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-177, DTC P0734 GEAR 4 INCORRECT RATIO, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Shift point too high or too low; engine brake not effected in “3” range; excessive shift shock; excessive tight corner “braking”

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect relevant DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK THROTTLE POSITION SENSOR CIRCUIT. Check throttle position sensor circuit. <Ref. to 4AT(diag)-46, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any trouble in throttle position sensor circuit?	Repair or replace the throttle position sensor circuit.	Go to step 3.
3 CHECK FRONT VEHICLE SPEED SENSOR CIRCUIT. Check front vehicle speed sensor circuit. <Ref. to 4AT(diag)-52, DTC 33 FRONT VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any trouble in front vehicle speed sensor circuit?	Repair or replace the front vehicle speed sensor circuit.	Go to step 4.
4 CHECK TORQUE CONVERTER TURBINE SPEED SENSOR CIRCUIT. Check torque converter turbine speed sensor circuit. <Ref. to 4AT(diag)-57, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any trouble in torque converter turbine speed sensor circuit?	Repair or replace the torque converter turbine speed sensor circuit.	Go to step 5.
5 CHECK POOR CONTACT. Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Go to step 6.
6 CHECK MECHANICAL TROUBLE. Check mechanical trouble in automatic transmission.	Is there any mechanical trouble in automatic transmission?	Repair or replace the automatic transmission. <Ref. to 4AT-32, INSPECTION, Road Test.>	Replace the TCM. <Ref. to 4AT-67, Transmission Control Module (TCM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CD:DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-178, DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- No lock-up (after engine warm-up)
- No shift or excessive tight corner “braking”

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK LOCK-UP DUTY SOLENOID CIRCUIT. Check lock-up duty solenoid circuit. <Ref. to 4AT(diag)-87, DTC 77 LOCK-UP DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any trouble in lock-up duty solenoid circuit?	Repair or replace the lock-up duty solenoid circuit.	Go to step 3.
3 CHECK THROTTLE POSITION SENSOR CIRCUIT. Check throttle position sensor circuit. <Ref. to 4AT(diag)-46, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any trouble in throttle position sensor circuit?	Repair or replace the throttle position sensor circuit.	Go to step 4.
4 CHECK TORQUE CONVERTER TURBINE SPEED SENSOR CIRCUIT. Check torque converter turbine speed sensor circuit. <Ref. to 4AT(diag)-57, DTC 36 TORQUE CONVERTER TURBINE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any trouble in torque converter turbine speed sensor circuit?	Repair or replace the torque converter turbine speed sensor circuit.	Go to step 5.
5 CHECK ENGINE SPEED INPUT CIRCUIT. Check engine speed input circuit. <Ref. to 4AT(diag)-39, DTC 11 ENGINE SPEED SIGNAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any trouble in engine speed input circuit?	Repair or replace the engine speed input circuit.	Go to step 6.
6 CHECK INHIBITOR SWITCH CIRCUIT. Check inhibitor switch circuit. <Ref. to 4AT(diag)-104, CHECK INHIBITOR SWITCH, Diagnostic Procedure without Diagnostic Trouble Code (DTC).>	Is there any trouble in inhibitor switch circuit?	Repair or replace the inhibitor switch circuit.	Go to step 7.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
7	CHECK BRAKE LIGHT SWITCH CIRCUIT. Check brake light switch circuit. <Ref. to 4AT(diag)-103, CHECK BRAKE SWITCH, Diagnostic Procedure without Diagnostic Trouble Code (DTC).>	Is there any trouble in brake light switch circuit?	Repair or replace the brake light switch circuit.	Go to step 8.
8	CHECK ATF TEMPERATURE SENSOR CIRCUIT. Check ATF temperature sensor circuit. <Ref. to 4AT(diag)-43, DTC 27 ATF TEMPERATURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Is there any trouble in ATF temperature sensor circuit?	Repair or replace the ATF temperature sensor circuit.	Go to step 9.
9	CHECK POOR CONTACT. Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Go to step 10.
10	CHECK MECHANICAL TROUBLE. Check mechanical trouble in automatic transmission.	Is there any mechanical trouble in automatic transmission?	Repair or replace the automatic transmission. <Ref. to 4AT-32, INSPECTION, Road Test.>	Replace the TCM. <Ref. to 4AT-67, Transmission Control Module (TCM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CE:DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL

GENERAL DESCRIPTION <Ref. to GD(H4SO)-179, DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-87, DTC 77 LOCK-UP DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CF:DTC P0748 PRESSURE CONTROL SOLENOID “A” ELECTRICAL

GENERAL DESCRIPTION <Ref. to GD(H4SO)-180, DTC P0748 PRESSURE CONTROL SOLENOID “A” ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-78, DTC 75 LINE PRESSURE DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CG:DTC P0753 SHIFT SOLENOID “A” ELECTRICAL

GENERAL DESCRIPTION <Ref. to GD(H4SO)-181, DTC P0753 SHIFT SOLENOID “A” ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-65, DTC 71 SHIFT SOLENOID 1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CH:DTC P0758 SHIFT SOLENOID “B” ELECTRICAL

GENERAL DESCRIPTION <Ref. to GD(H4SO)-182, DTC P0758 SHIFT SOLENOID “B” ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-68, DTC 72 SHIFT SOLENOID 2, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CI: DTC P0771 SHIFT SOLENOID “E” PERFORMANCE OR STUCK OFF

GENERAL DESCRIPTION <Ref. to GD(H4SO)-183, DTC P0771 SHIFT SOLENOID “E” PERFORMANCE OR STUCK OFF, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-71, DTC 73 LOW CLUTCH TIMING SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CJ:DTC P0778 PRESSURE CONTROL SOLENOID “B” ELECTRICAL

GENERAL DESCRIPTION <Ref. to GD(H4SO)-184, DTC P0778 PRESSURE CONTROL SOLENOID “B” ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-83, DTC 76 2-4 BRAKE DUTY SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CK:DTC P0785 SHIFT/TIMING SOLENOID

GENERAL DESCRIPTION <Ref. to GD(H4SO)-185, DTC P0785 SHIFT/TIMING SOLENOID, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-74, DTC 74 2-4 BRAKE TIMING SOLENOID, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CL:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-186, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

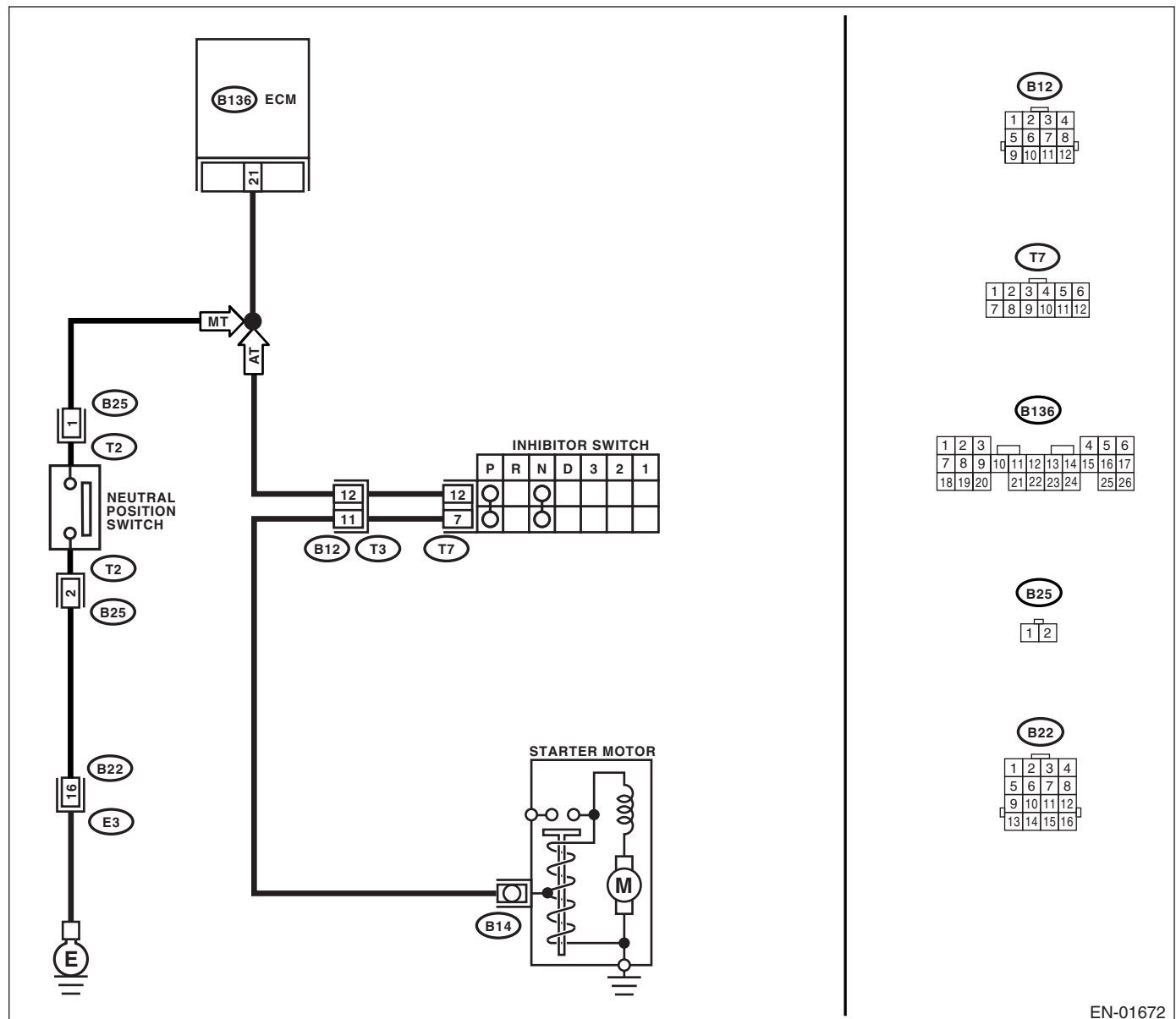
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC P0705 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn the ignition switch to ON. 2) Place the select lever except for "N" and "P" ranges. 3) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-):	Is the voltage 4.5 — 5.5 V?	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND TRANSMISSION HARNESS CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and transmission harness connector (T3). 3) Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 21 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 4.	Repair ground short circuit in harness between ECM and transmission harness connector.
4 CHECK TRANSMISSION HARNESS CONNECTOR. 1) Disconnect the connector from inhibitor switch. 2) Measure the resistance of harness between transmission harness connector and engine ground. Connector & terminal (T3) No. 12 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 5.	Repair ground short circuit in harness between transmission harness and inhibitor switch connector.
5 CHECK INHIBITOR SWITCH. Measure the resistance between inhibitor switch connector the receptacle's terminals in select lever except for "N" and "P" range. Terminals No. 7 — No. 12:	Is the resistance more than 1 MΩ?	Go to step 6.	Replace the inhibitor switch. <Ref. to 4AT-46, Inhibitor Switch.>
6 CHECK SELECTOR CABLE CONNECTION.	Is there any fault in selector cable connection to inhibitor switch?	Repair selector cable connection. <Ref. to CS-26, INSPECTION, Select Cable.>	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CM:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL)

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-186, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

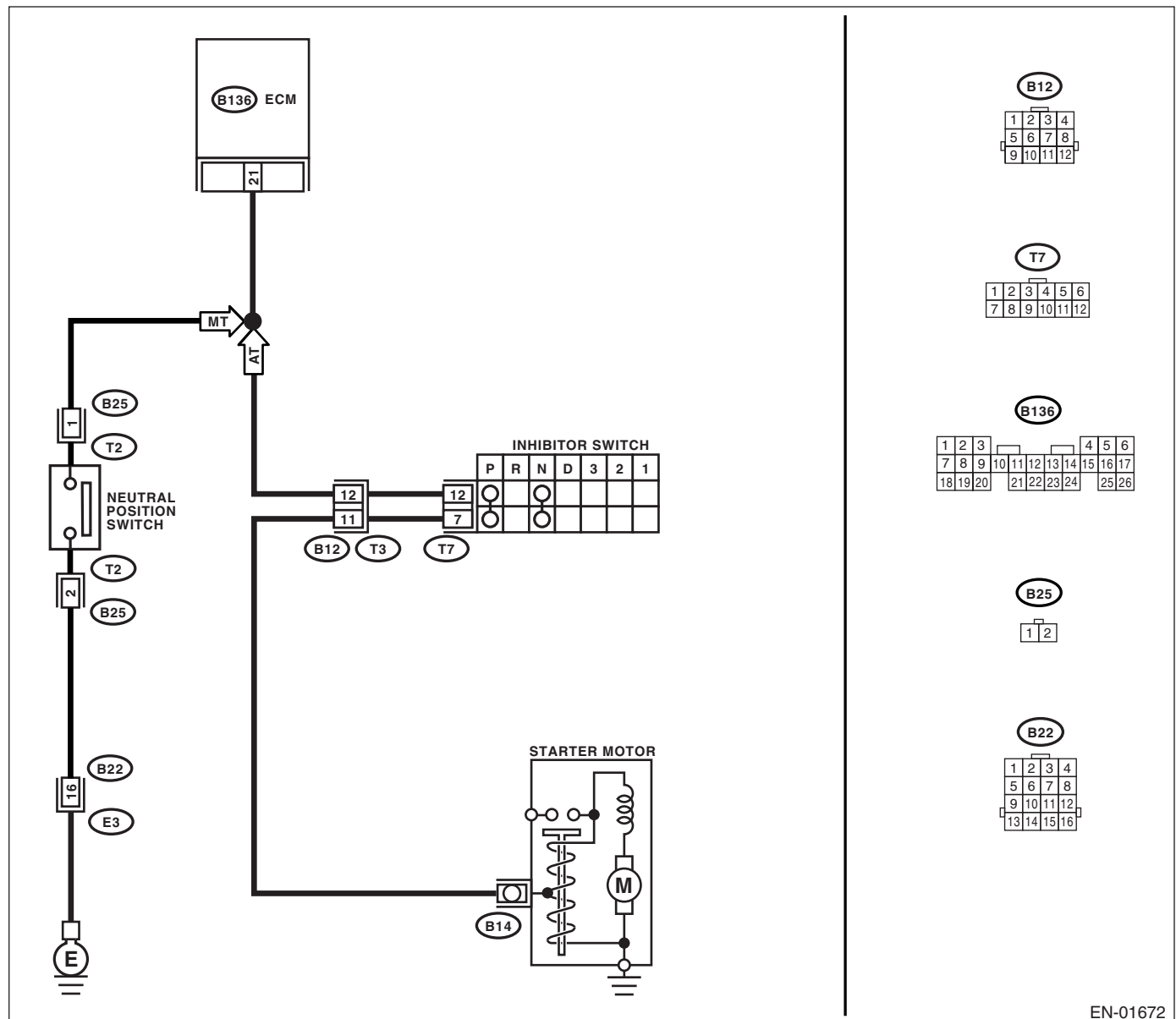
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01672

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK INPUT SIGNAL FOR ECM. 1) Turn the ignition switch to ON. 2) Place the shift lever in neutral. 3) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 4.
2	CHECK INPUT SIGNAL FOR ECM. 1) Place the shift lever in a position except for neutral. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 3.	Go to step 4.
3	CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Contact SOA Service Center.
4	CHECK NEUTRAL POSITION SWITCH. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from transmission harness. 3) Place the shift lever in neutral. 4) Measure the resistance between transmission harness and connector terminals. Connector & terminal (T2) No. 1 — No. 2:	Is the resistance more than 1 MΩ?	Go to step 5.	Repair short circuit in transmission harness or replace neutral position switch.
5	CHECK NEUTRAL POSITION SWITCH. 1) Place the shift lever in a position except for neutral. 2) Measure the resistance between transmission harness connector terminals. Connector & terminal (T2) No. 1 — No. 2:	Is the resistance less than 1 Ω?	Go to step 6.	Repair short circuit in transmission harness or replace neutral position switch.
6	CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR. Measure the resistance between ECM and chassis ground. Connector & terminal (B136) No. 21 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 7.	Repair ground short circuit in harness between ECM and transmission harness connector.
7	CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and transmission harness connector. Connector & terminal (B136) No. 21 — (B25) No. 1:	Is the resistance less than 1 Ω?	Go to step 8.	Repair open circuit in harness between ECM and transmission harness connector.
8	CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR. Measure the resistance of harness between transmission harness connector and engine ground. Connector & terminal (B25) No. 2 — Engine ground:	Is the resistance less than 5 Ω?	Go to step 9.	Repair open circuit between transmission harness connector and engine ground terminal.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
9	CHECK POOR CONTACT. Check poor contact in transmission harness connector.	Repair poor contact in transmission harness connector.	Contact SOA Service Center.

CN:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-188, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

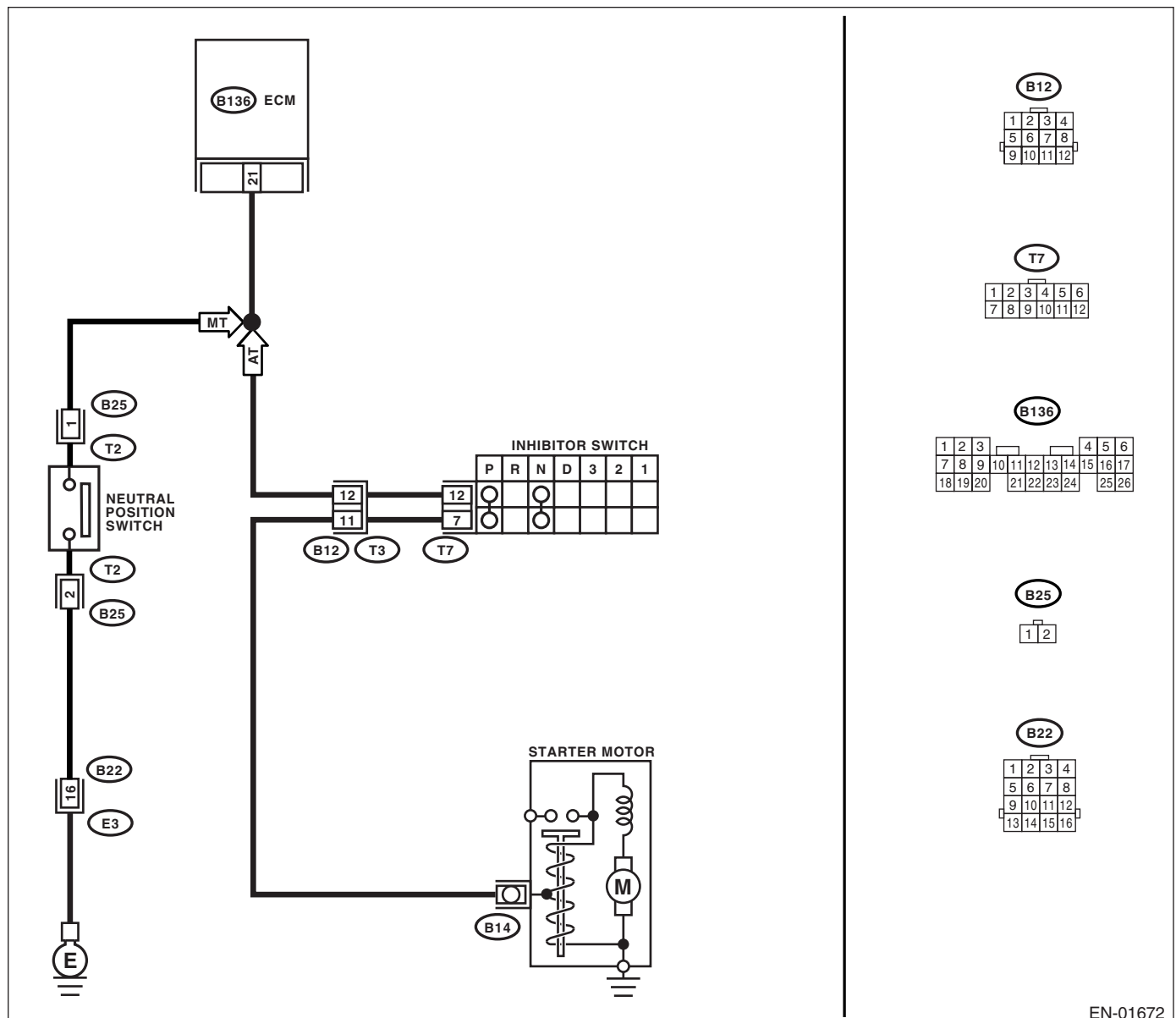
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01672

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground in select lever "N" and "P" ranges. Connector & terminal (B136) No. 21 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 3.	Go to step 5.
3 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground in select lever except for "N" and "P" ranges. Connector & terminal (B136) No. 21 (+) — Chassis ground (-):	Is the voltage 4.5 — 5.5 V?	Go to step 4.	Go to step 5.
4 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and inhibitor switch connector.	Go to step 6.
6 CHECK HARNESS BETWEEN ECM AND INHIBITOR SWITCH CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and inhibitor switch. 3) Measure the resistance of harness between ECM and inhibitor switch connector. Connector & terminal (B136) No. 21 — (T7) No. 12:	Is the resistance less than 1 Ω ?	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and inhibitor switch connector • Poor contact in coupling connector • Poor contact in inhibitor switch connector • Poor contact in ECM connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK INHIBITOR SWITCH GROUND LINE. Measure the resistance of harness between inhibitor switch connector and engine ground. Connector & terminal (T7) No. 12 — Engine ground:	Is the resistance less than 5 Ω ?	Go to step 8 .	Repair open circuit in harness between inhibitor switch connector and starter motor ground line. NOTE: In this case, repair the following: • Open circuit in harness between inhibitor switch connector and starter motor ground line • Poor contact in starter motor connector • Poor contact in starter motor ground • Starter motor
8 CHECK INHIBITOR SWITCH. Measure the resistance between inhibitor switch connector receptacle's terminals in select lever "N" and "P" ranges. Terminals No. 7 — No. 12:	Is the resistance less than 1 Ω ?	Go to step 9 .	Replace the inhibitor switch. <Ref. to 4AT-46, Inhibitor Switch.>
9 CHECK SELECTOR CABLE CONNECTION.	Is there any fault in selector cable connection to inhibitor switch?	Repair selector cable connection. <Ref. to CS-26, INSPECTION, Select Cable.>	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CO:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL)

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-188, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

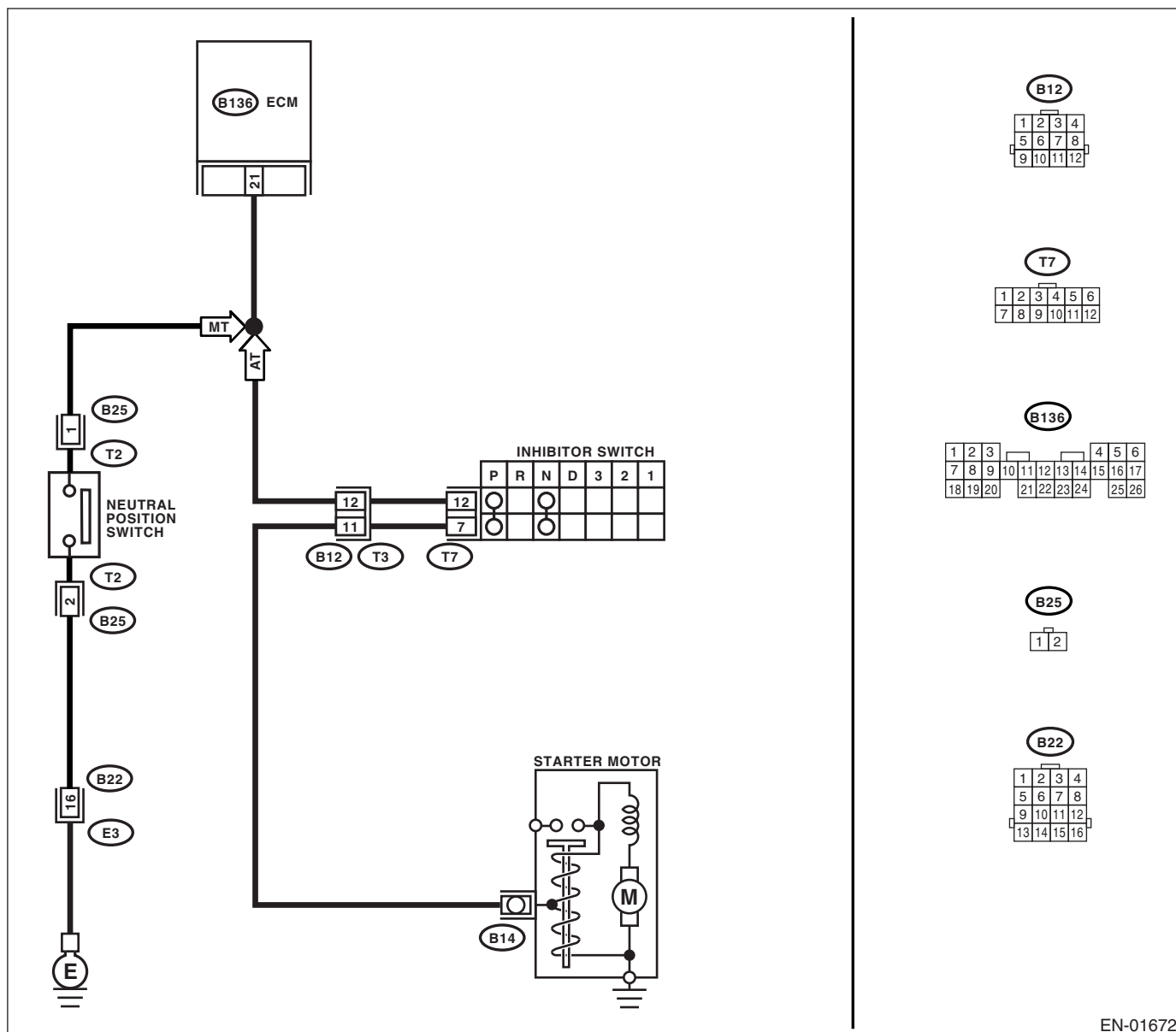
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Place the shift lever in neutral. 3) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-):	Is the voltage more than 5 V?	Go to step 2.	Go to step 4.
2 CHECK INPUT SIGNAL FOR ECM. 1) Place the shift lever in a position except for neutral. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 21 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 3.	Go to step 5.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4 CHECK NEUTRAL SWITCH. 1) Place the shift lever in a position except for neutral. 2) Measure the resistance between transmission harness connector terminals. Connector & terminal (T2) No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair open circuit in transmission harness or replace neutral switch.
5 CHECK HARNESS BETWEEN ECM AND NEUTRAL SWITCH CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and transmission harness connector. Connector & terminal (B136) No. 21 — (B25) No. 1:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair open circuit in harness between ECM and transmission harness connector.
6 CHECK HARNESS BETWEEN ECM AND NEUTRAL SWITCH CONNECTOR. Measure the resistance of harness between transmission harness connector and engine ground. Connector & terminal (B25) No. 2 — Engine ground:	Is the resistance less than 5 Ω ?	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between transmission harness connector and engine ground. • Poor contact in coupling connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

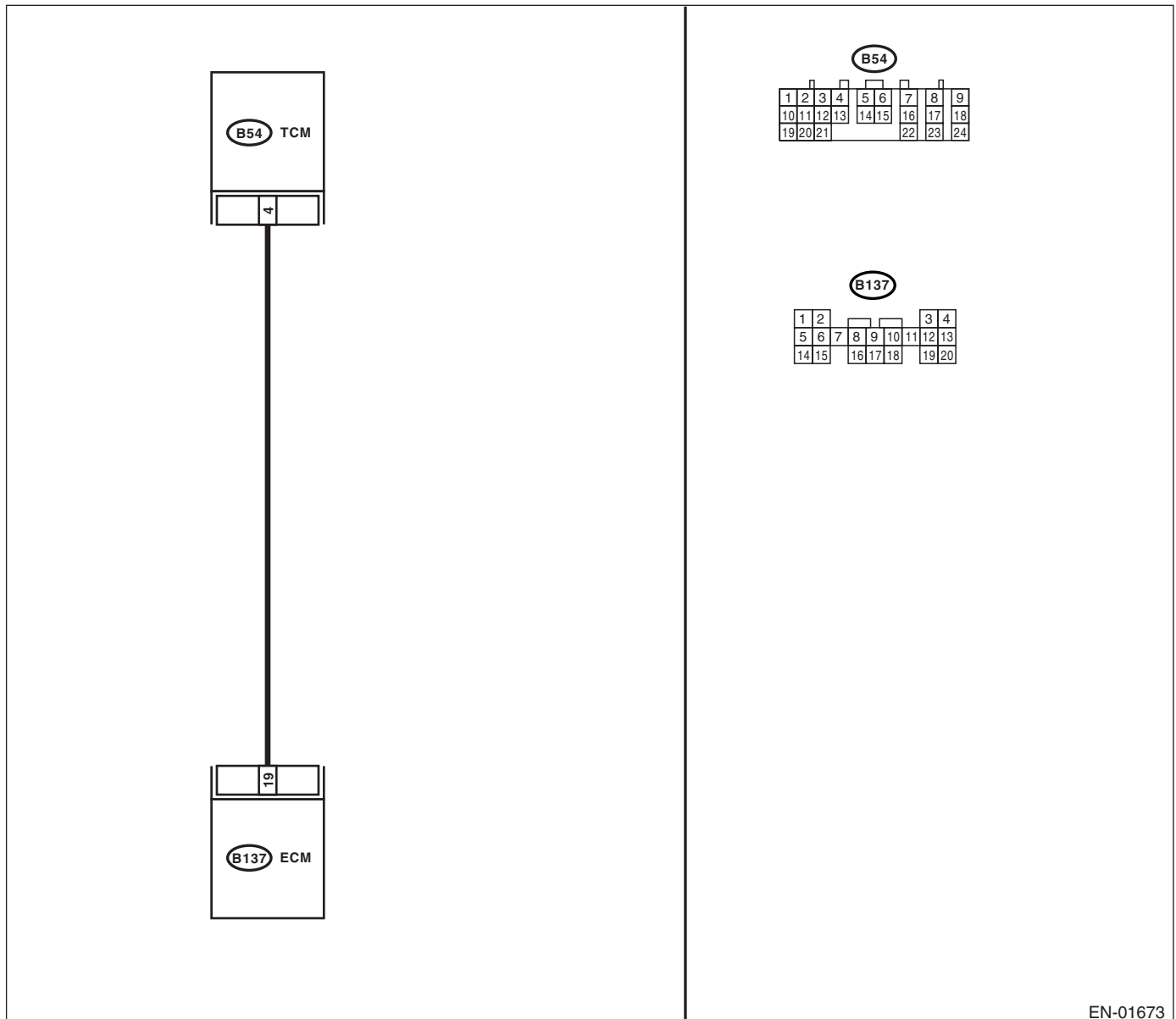
Step	Check	Yes	No
7 CHECK FOR POOR CONTACT. Check for poor contact in transmission harness connector.	Is there a poor contact in the transmission harness connector?	Repair poor contact in transmission harness connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

CP:DTC P0864 TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE**DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-190, DTC P0864 TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:

EN-01673

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

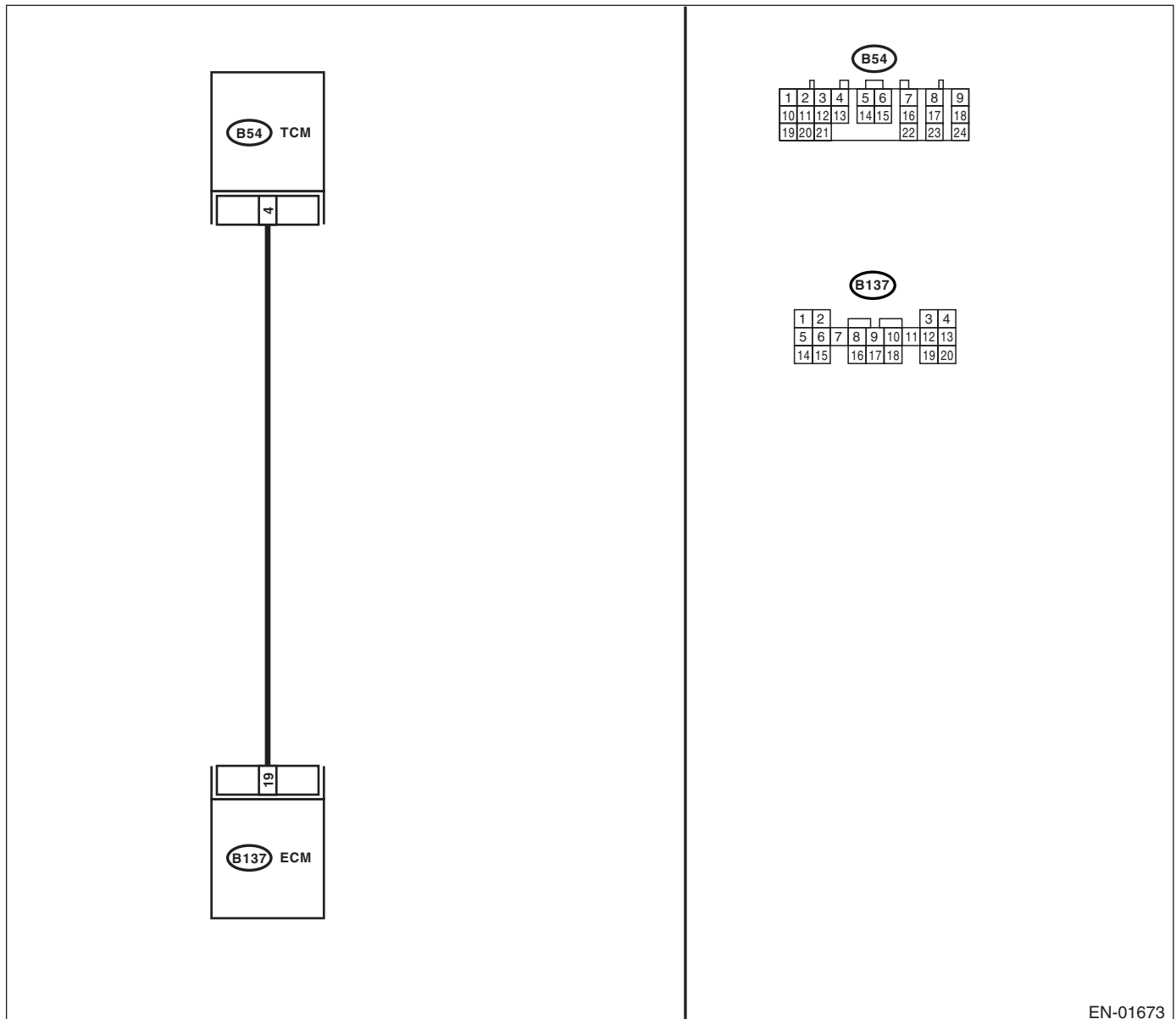
Step	Check	Yes	No
1 CHECK DRIVING CONDITION. 1) Start and warm-up the engine until the radiator fan makes one complete rotation. 2) Drive the vehicle.	Is the AT shift control functioning properly?	Go to step 2.	Replace the TCM. <Ref. to 4AT-67, Transmission Control Module (TCM).>
2 CHECK ACCESSORY.	Are car phone and/or CB installed on vehicle?	Repair grounding line of car phone or CB system.	Replace the TCM. <Ref. to 4AT-67, Transmission Control Module (TCM).>

CQ:DTC P0865 TCM COMMUNICATION CIRCUIT LOW**DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-191, DTC P0865 TCM COMMUNICATION CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:

EN-01673

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 19 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 2.	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. NOTE: In this case, repair the following: • Poor contact in ECM connector • Poor contact in TCM connector
2	CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and TCM. 3) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B137) No. 19 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 3.	Repair ground short circuit in harness between ECM and TCM connector.
3	CHECK OUTPUT SIGNAL FOR ECM. 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 19 (+) — Chassis ground (-):	Is the voltage more than 5 V?	Go to step 4.	Repair poor contact in ECM connector.
4	CHECK DTC FOR AUTOMATIC TRANSMISSION. Read the DTC for automatic transmission. <Ref. to 4AT(diag)-24, Read Diagnostic Trouble Code (DTC).>	Does the DTC appear for automatic transmission?	Check DTC for automatic transmission. <Ref. to 4AT(diag)-39, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Replace the TCM. <Ref. to 4AT-67, Transmission Control Module (TCM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CR:DTC P0866 TCM COMMUNICATION CIRCUIT HIGH

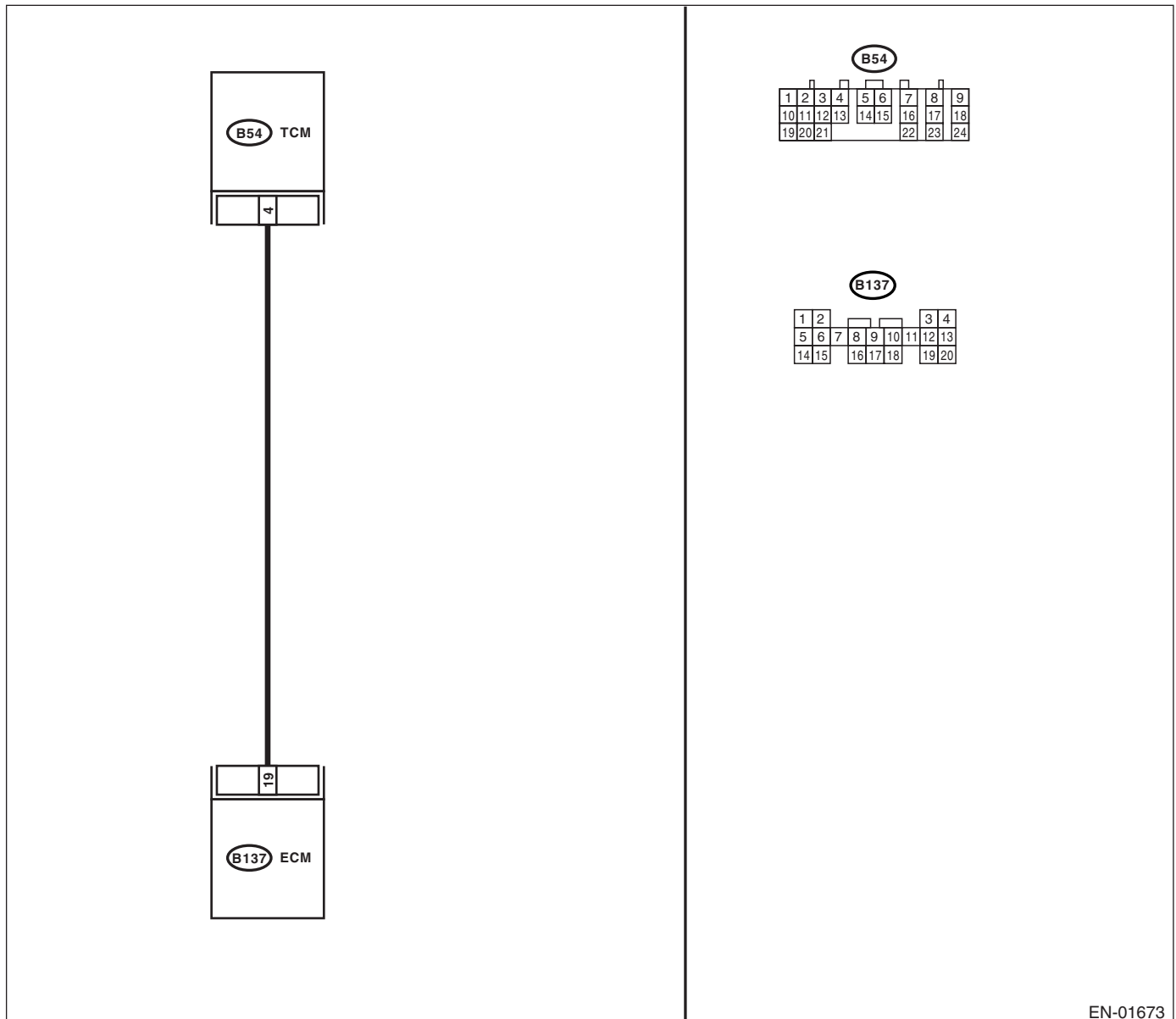
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-192, DTC P0866 TCM COMMUNICATION CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 19 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and TCM connector.	Go to step 2.
2 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B137) No. 19 (+) — Chassis ground (-):	Is the voltage more than 4 V?	Go to step 5.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B137) No. 19 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Repair poor contact in ECM connector.	Go to step 4.
4 CHECK OUTPUT SIGNAL FROM ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 19 (+) — Chassis ground (-):	Is the voltage 1 — 4 V?	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. NOTE: In this case, repair the following: • Poor contact in ECM connector • Poor contact in TCM connector	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
5 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the voltage between TCM and chassis ground. Connector & terminal (B54) No. 4 (+) — Chassis ground (-):	Is the voltage more than 4 V?	Go to step 6.	Repair open circuit in harness between ECM and TCM connector.
6 CHECK POOR CONTACT. Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Check TCM power supply line and grounding line.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CS:DTC P1110 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-193, DTC P1110 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: It is not necessary to inspect DTC P1110.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

CT:DTC P1111 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-194, DTC P1111 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: It is not necessary to inspect DTC P1111.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CU:DTC P1134 A/F SENSOR MICRO-COMPUTER PROBLEM

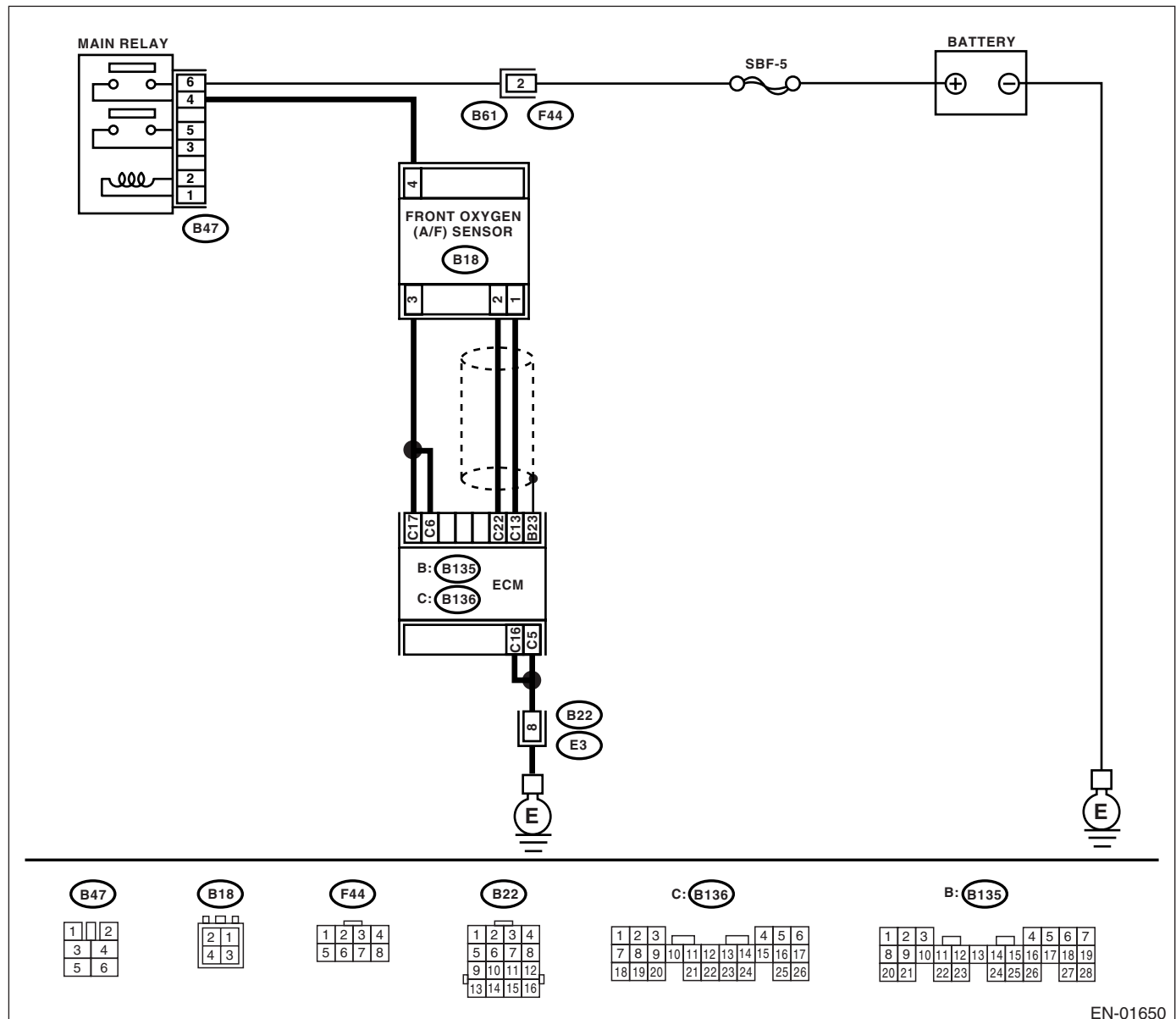
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-195, DTC P1134 A/F SENSOR MICRO-COMPUTER PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, Inspection Mode.>.

WIRING DIAGRAM:



EN-01650

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: It is not necessary to inspect DTC P1134.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CV:DTC P1137 O₂ SENSOR CIRCUIT (LAMDA=1) (BANK1 SENSOR1)

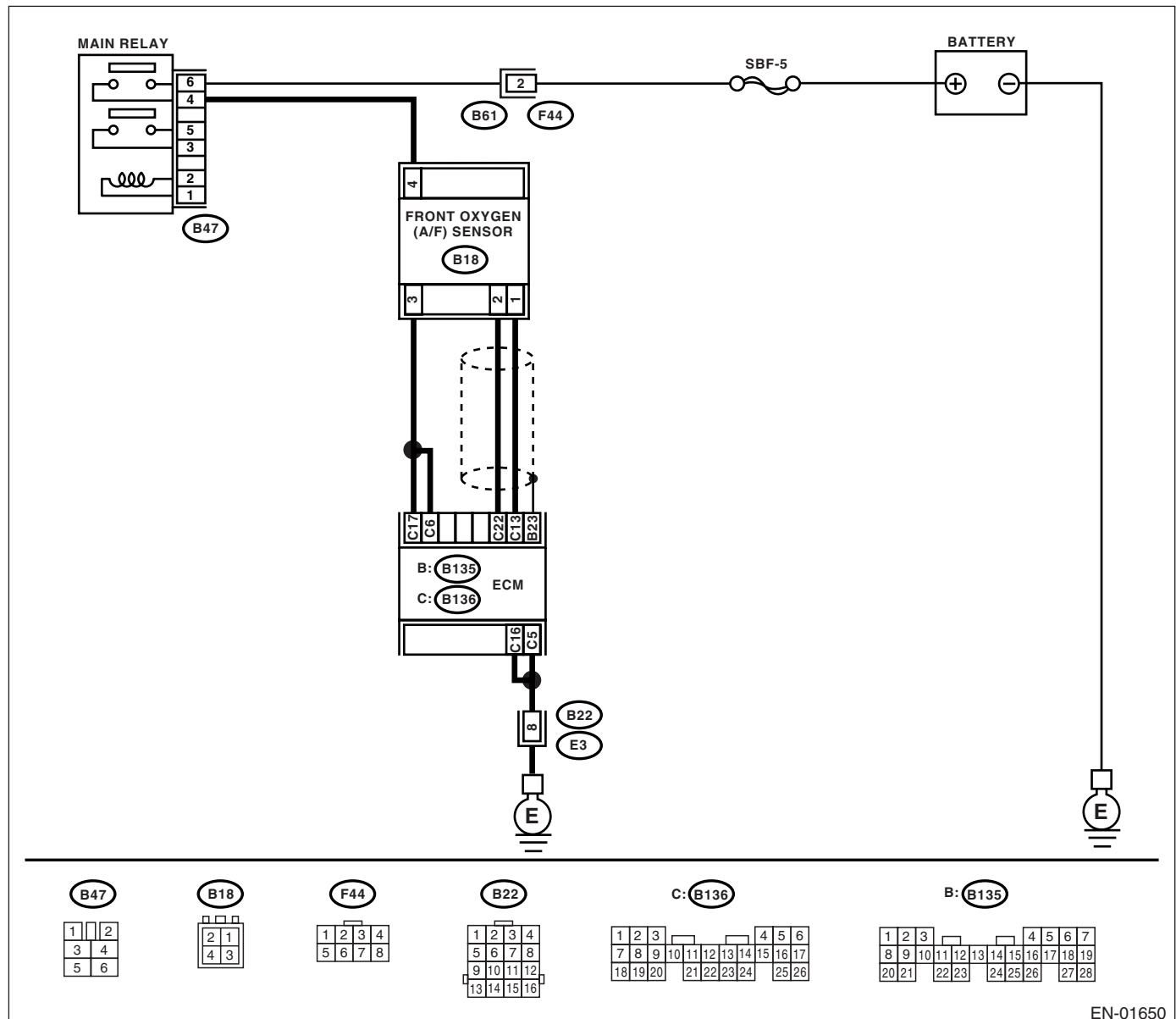
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-197, DTC P1137 O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01650

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK FRONT OXYGEN (A/F) SENSOR DATA. 1) Start the engine. 2) While observing the Subaru Select Monitor or OBD-II general scan tool screen, warm-up the engine until coolant temperature is above 70°C (160°F). If the engine is already warmed-up, operate at idle speed for at least 1 minute. 3) Read the data of front oxygen (A/F) sensor signal during idling using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the voltage 0.85 — 1.15 V?	Go to step 3.	Go to step 4.
3 CHECK FRONT OXYGEN (A/F) SENSOR DATA. Race the engine at speeds from idling to 5,000 rpm for a total of 5 cycles. NOTE: • Air fuel ratio is rich at normal condition or during racing. • To increase engine speed to 5,000 rpm, slowly depress accelerator pedal, taking approximately 5 seconds, and quickly release accelerator pedal to decrease engine speed.	Is the voltage more than 1.1 V?	Go to step 6.	Go to step 4.
4 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and front oxygen (A/F) sensor connector. 3) Measure the resistance between ECM and front oxygen (A/F) sensor. Connector & terminals (B136) No. 13 — (B18) No. 1: (B136) No. 22 — (B18) No. 2:	Is the resistance less than 1 Ω?	Go to step 5.	Repair open circuit between ECM and front oxygen (A/F) sensor.
5 CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR. Measure the resistance between ECM and chassis ground. Connector & terminals (B136) No. 13 — Chassis ground: (B136) No. 22 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 6.	Repair ground short circuit between ECM and front oxygen (A/F) sensor.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

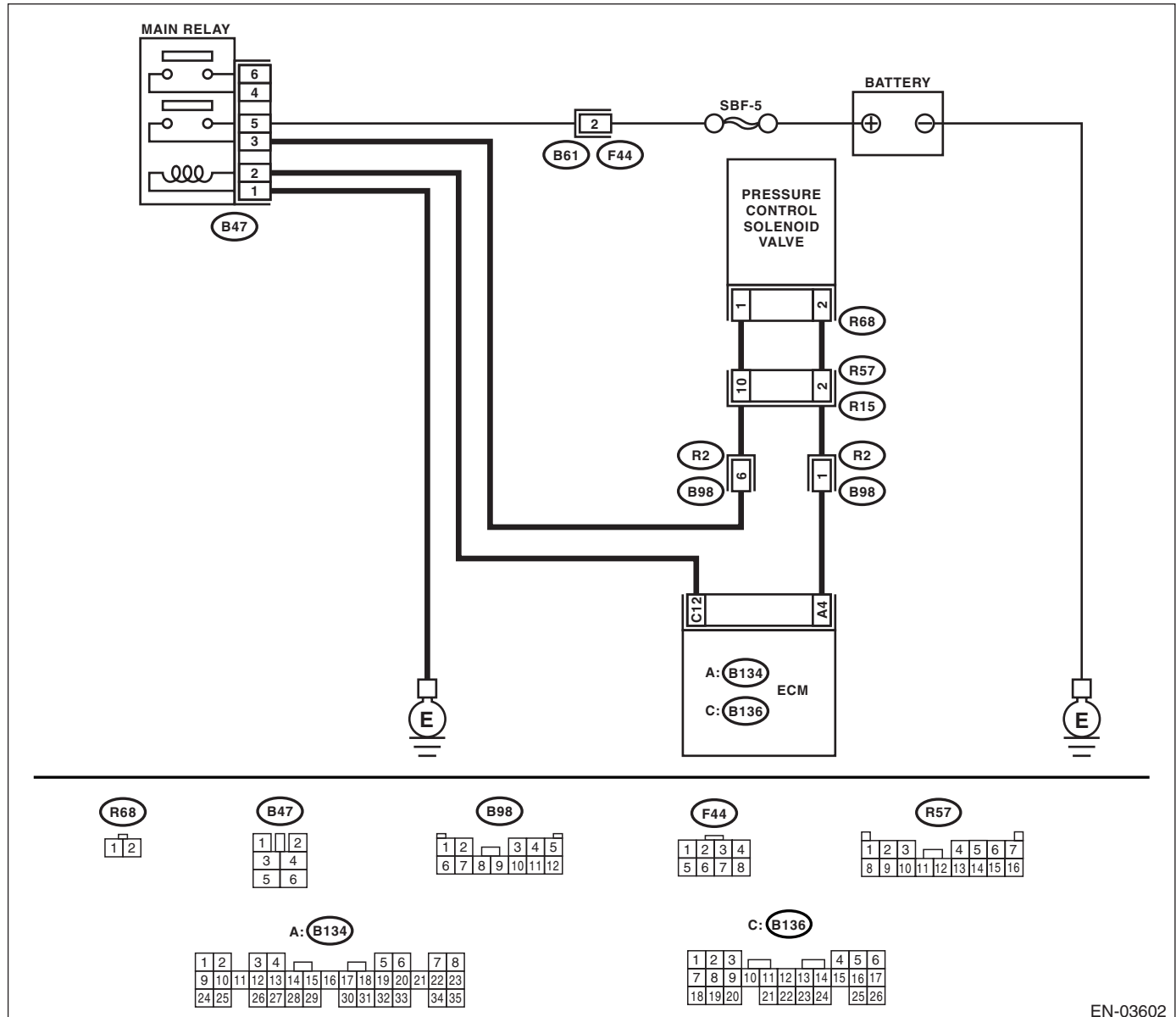
Step	Check	Yes	No
6 CHECK EXHAUST SYSTEM. Check exhaust system parts. NOTE: Check the following items. • Loose installation of portions • Damage (crack, hole etc.) of parts • Looseness of front oxygen (A/F) sensor • Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	Is there a fault in exhaust system?	Repair or replace faulty parts.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-40, Front Oxygen (A/F) Sensor.>

CW:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW**DTC DETECTING CONDITION:**

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-199, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct **CLEAR MEMORY MODE** <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and **INSPECTION MODE** <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 4 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 3.
2	CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
3	CHECK HARNESS BETWEEN PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from pressure control solenoid valve and ECM. 3) Measure the resistance of harness between pressure control solenoid valve connector and chassis ground. Connector & terminal (R68) No. 2 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair short circuit to ground in harness between ECM and pressure control solenoid valve connector.	Go to step 4.
4	CHECK HARNESS BETWEEN PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR. Measure the resistance of harness between ECM and pressure control solenoid valve connector. Connector & terminal (B134) No. 4 — (R68) No. 2:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and pressure control solenoid valve connector • Poor contact in coupling connector
5	CHECK PRESSURE CONTROL SOLENOID VALVE. Measure the resistance between pressure control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance 10 — 100 Ω ?	Go to step 6.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POWER SUPPLY TO PRESSURE CONTROL SOLENOID VALVE. 1) Turn ignition switch to ON. 2) Measure the voltage between pressure control solenoid valve and chassis ground. Connector & terminal (R68) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and pressure control solenoid valve connector • Poor contact in coupling connector • Poor contact in main relay connector
7 CHECK FOR POOR CONTACT. Check for poor contact in pressure control solenoid valve connector.	Is there poor contact in pressure control solenoid valve connector?	Repair poor contact in pressure control solenoid valve connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CX:DTC P1420 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT HIGH

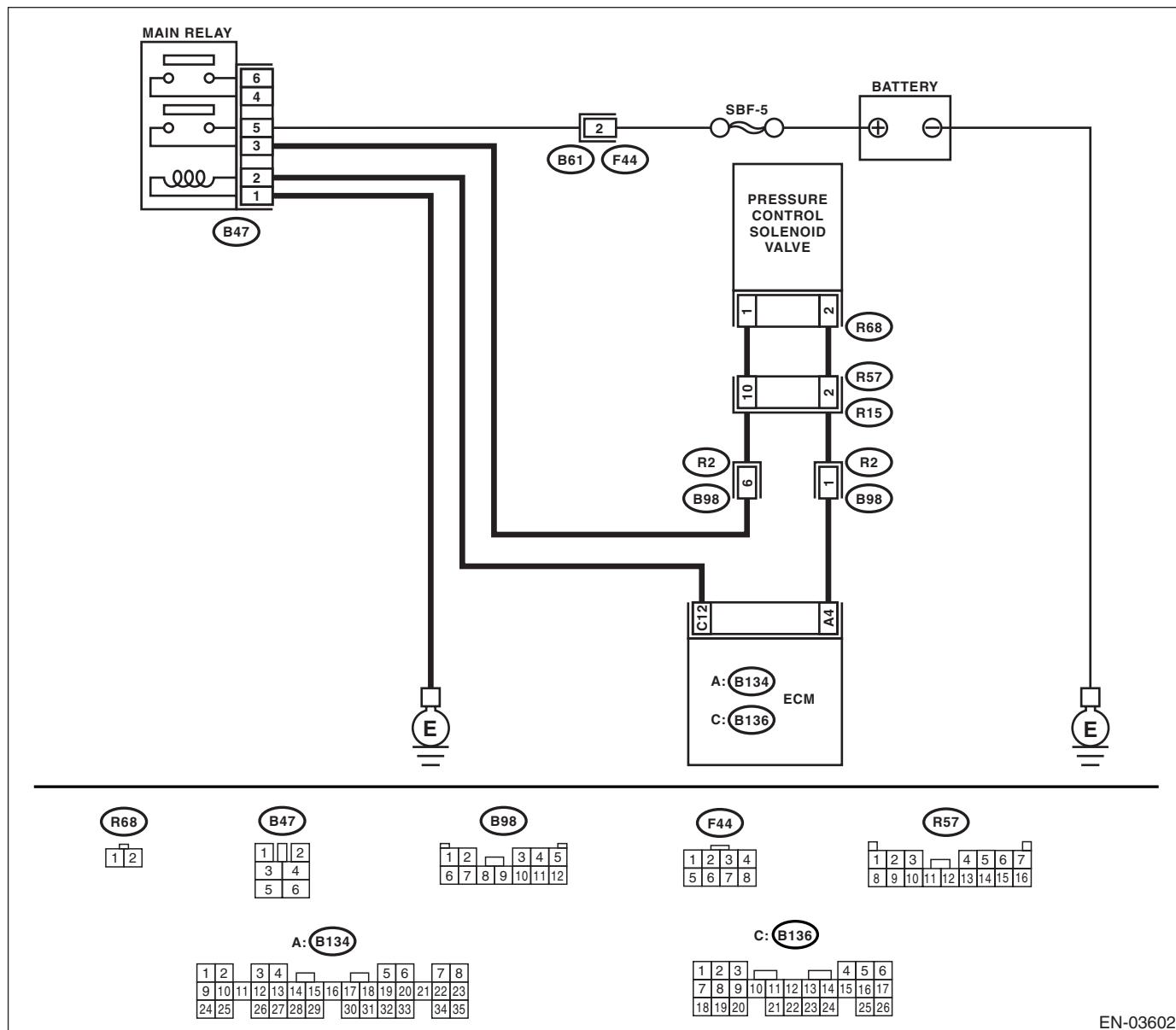
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-201, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating the pressure control solenoid valve, measure voltage between ECM and chassis ground. NOTE: Pressure control solenoid valve operation can be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.> Connector & terminal (B134) No. 4 (+) — Chassis ground (-):	Is the voltage 0 — 10 V?	Go to step 2.	The malfunction indicator light may light up, however, the circuit is returned to the normal status at the moment. In this case, repair poor contact in ECM connector.
2 CHECK INPUT SIGNAL FOR ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 4 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 4.	Go to step 3.
3 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>
4 CHECK HARNESS BETWEEN PRESSURE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from pressure control solenoid valve. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 4 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair short circuit to battery in harness between ECM and pressure control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 5.
5 CHECK PRESSURE CONTROL SOLENOID VALVE. 1) Turn ignition switch to OFF. 2) Measure the resistance between pressure control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Replace the pressure control solenoid valve <Ref. to EC(H4SO)-12, Pressure Control Solenoid Valve.> and the ECM <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 6.
6 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CY:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-202, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

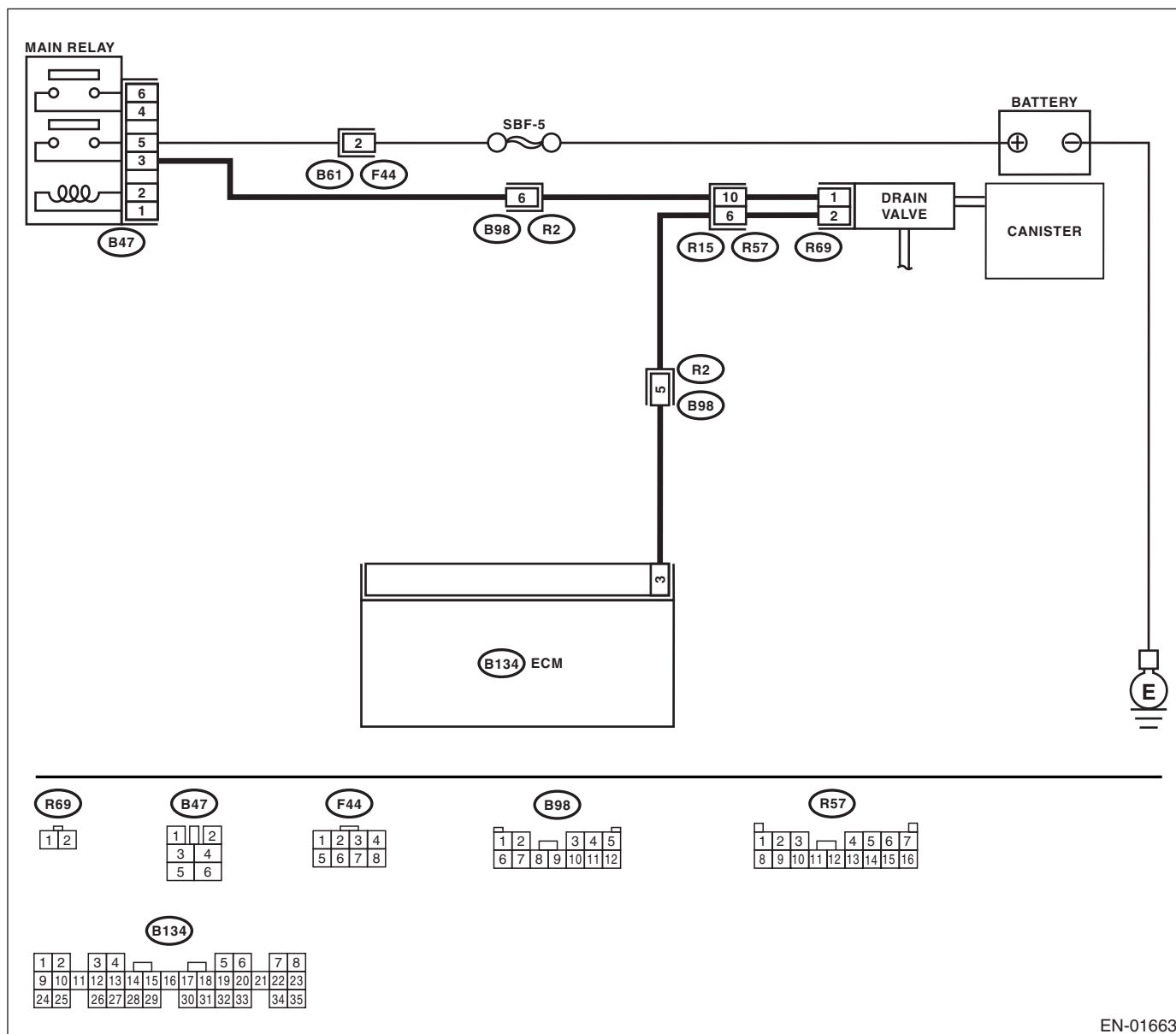
TROUBLE SYMPTOM:

Improper fuel supply

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01663

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK VENT LINE HOSES. Check the following items. • Clogging of vent hoses between canister and drain valve • Clogging of vent hose between drain valve and air filter • Clogging of drain filter	Is there a fault in vent line?	Repair or replace faulty parts.	Go to step 3.
3 CHECK DRAIN VALVE OPERATION. 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) Operate the drain valve. NOTE: Drain valve operation can also be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-45, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace the drain valve. <Ref. to EC(H4SO)-18, Drain Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

CZ:DTC P1446 FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW

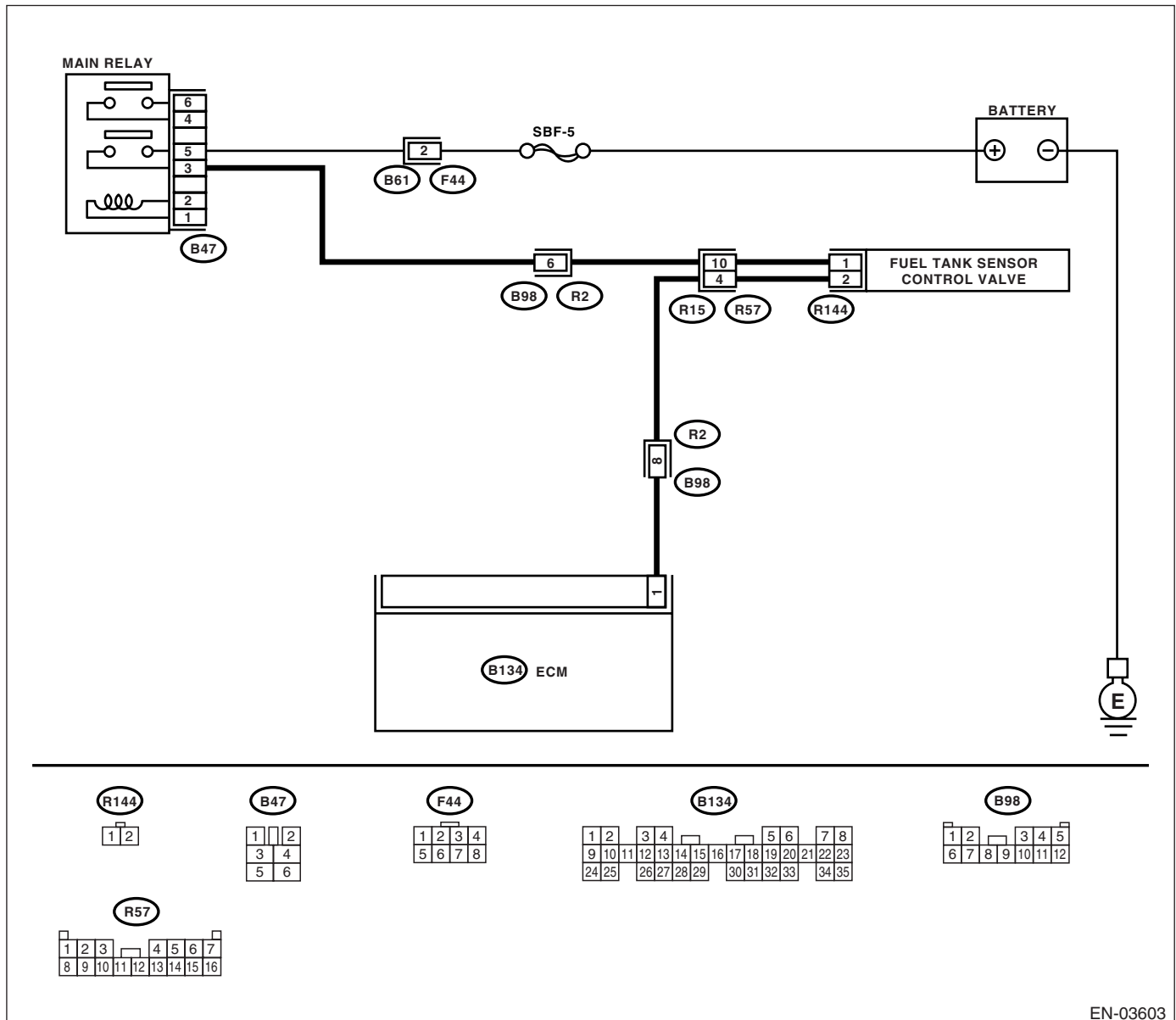
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-203, DTC P1446 FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-03603

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Go to step 3.
2 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	The malfunction indicator light may light up, however, the circuit is returned to the normal status at the moment. (However, the possibility of poor contact still remains.) NOTE: In this case, repair the following: • Poor contact in fuel tank sensor control valve connector • Poor contact in ECM connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN FUEL TANK SENSOR CONTROL VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connectors from fuel tank sensor control valve and ECM. 3) Measure the resistance of harness between fuel tank sensor control valve connector and chassis ground. Connector & terminal (R144) No. 2 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 4.	Repair short circuit to ground in harness between ECM and fuel tank sensor control valve connector.
4 CHECK HARNESS BETWEEN FUEL TANK SENSOR CONTROL VALVE AND ECM CONNECTOR. Measure the resistance of harness between ECM and fuel tank sensor control valve connector. Connector & terminal (B134) No. 1 — (R144) No. 2:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel tank sensor control valve connector • Poor contact in coupling connector
5 CHECK FUEL TANK SENSOR CONTROL VALVE. Measure the resistance between fuel tank sensor control valve terminals. Terminals No. 1 — No. 2:	Is the resistance 10 — 100 Ω ?	Go to step 6.	Replace the fuel tank sensor control valve. <Ref. to EC(H4SO)-18, Drain Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK POWER SUPPLY TO FUEL TANK SENSOR CONTROL VALVE. 1) Turn ignition switch to ON. 2) Measure the voltage between fuel tank sensor control valve and chassis ground. Connector & terminal (R144) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 7.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and fuel tank sensor control valve • Poor contact in coupling connector • Poor contact in main relay connector
7 CHECK FOR POOR CONTACT. Check for poor contact in fuel tank sensor control valve connector.	Is there poor contact in fuel tank sensor control valve connector?	Repair poor contact in fuel tank sensor control valve connector.	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DA:DTC P1447 FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH

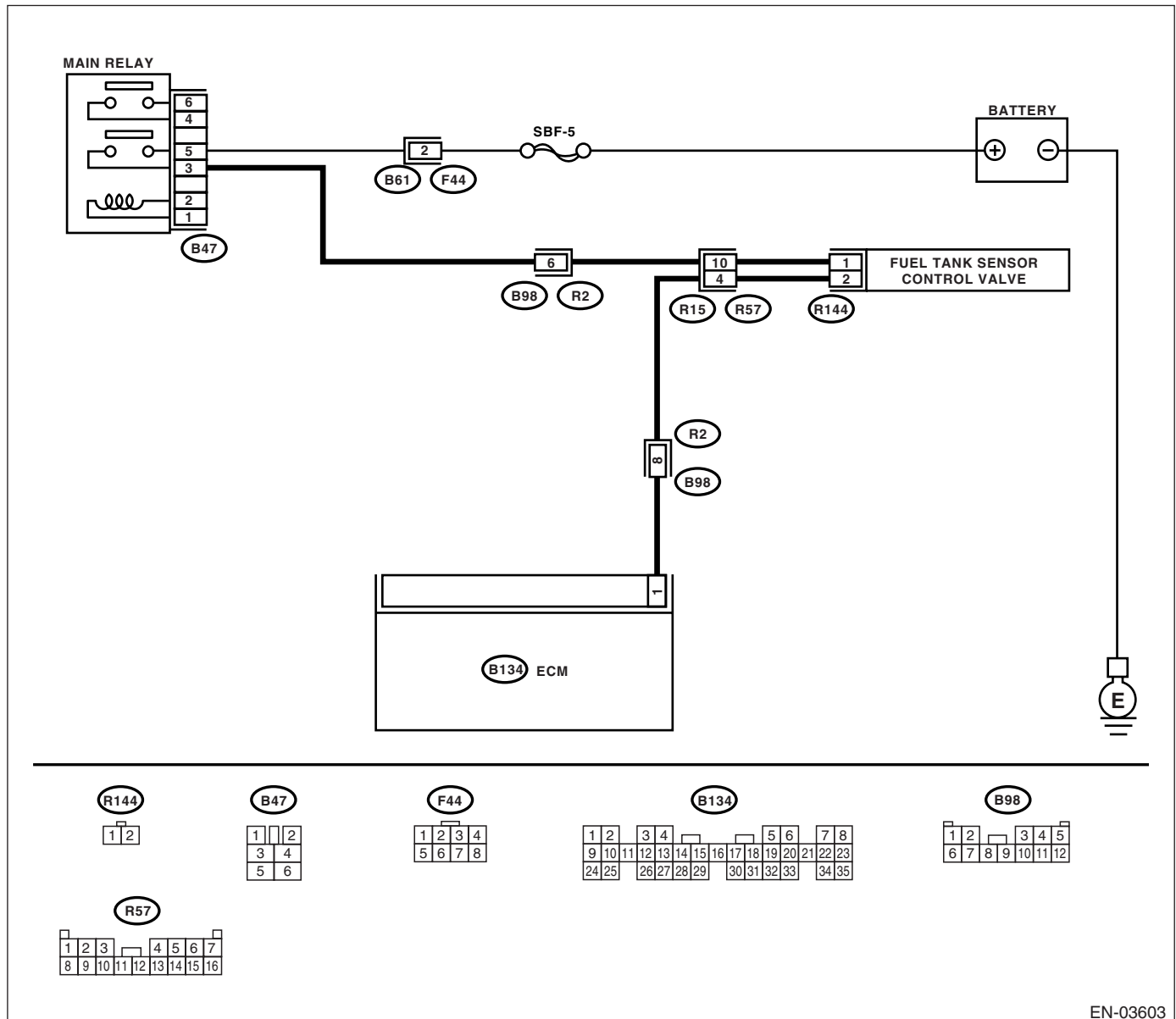
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-205, DTC P1447 FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-03603

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 3.	Go to step 2.
2 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>
3 CHECK HARNESS BETWEEN FUEL TANK SENSOR CONTROL VALVE AND ECM CONNECTOR. 1) Turn ignition switch to OFF. 2) Disconnect the connector from fuel tank sensor control valve. 3) Turn ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair short circuit to battery in harness between ECM and fuel tank sensor control valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Go to step 4.
4 CHECK FUEL TANK SENSOR CONTROL VALVE. 1) Turn ignition switch to OFF. 2) Measure the resistance between fuel tank sensor control valve terminals. Terminals No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Replace the fuel tank sensor control valve <Ref. to EC(H4SO)-18, Drain Valve.> and the ECM <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>.	Go to step 5.
5 CHECK FOR POOR CONTACT. Check for poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

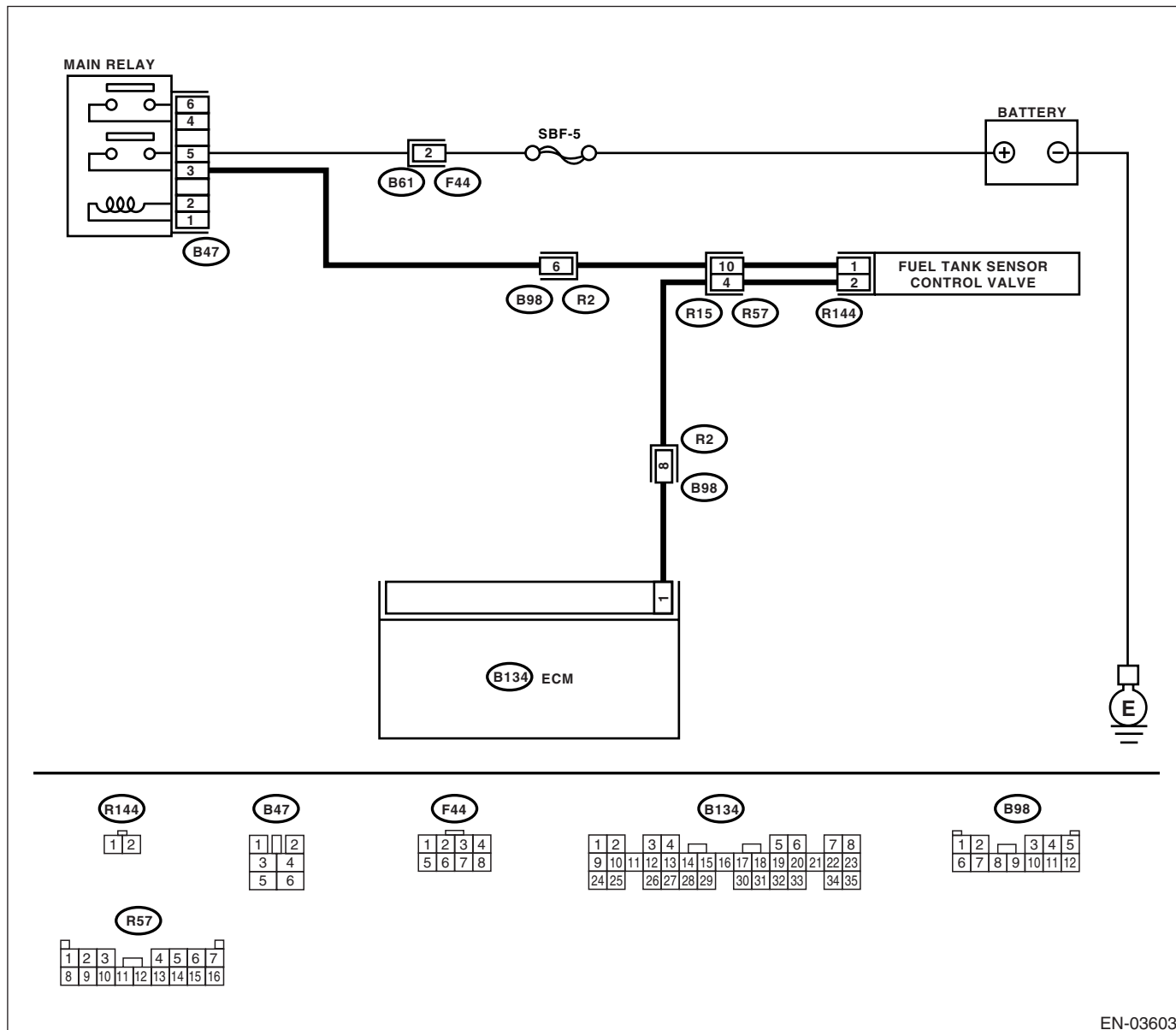
ENGINE (DIAGNOSTICS)

DTC DETECTING CONDITION:

- CAUTION:**

After repair or replacement of faulty parts, conduct CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK FUEL FILLER CAP. 1) Turn ignition switch to OFF. 2) Open the fuel flap.	Is the fuel filler cap tightened securely?	Go to step 3.	Tighten fuel filler cap securely.
3 CHECK EVAPORATIVE EMISSION LINE. NOTE: Check the following items. • Disconnection, leakage and clogging of hoses between fuel tank pressure sensor and fuel tank. • Disconnection, leakage and clogging of hoses and pipes between fuel filler pipe and fuel tank.	Is there any trouble in evaporation line?	Repair the hoses and pipes.	Replace the fuel tank pressure sensor.

**DC:DTC P1510 ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION
(LOW INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1516. <Ref. to EN(H4SO)(diag)-280, DTC P1516 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**DD:DTC P1511 ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION
(HIGH INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1517. <Ref. to EN(H4SO)(diag)-282, DTC P1517 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**DE:DTC P1512 ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION
(LOW INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1516. <Ref. to EN(H4SO)(diag)-280, DTC P1516 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**DF:DTC P1513 ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION
(HIGH INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1517. <Ref. to EN(H4SO)(diag)-282, DTC P1517 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**DG:DTC P1514 ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION
(LOW INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1516. <Ref. to EN(H4SO)(diag)-280, DTC P1516 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

**DH:DTC P1515 ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION
(HIGH INPUT)**

NOTE:

For the diagnostic procedure, refer to DTC P1517. <Ref. to EN(H4SO)(diag)-282, DTC P1517 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DI: DTC P1516 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-222, DTC P1516 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

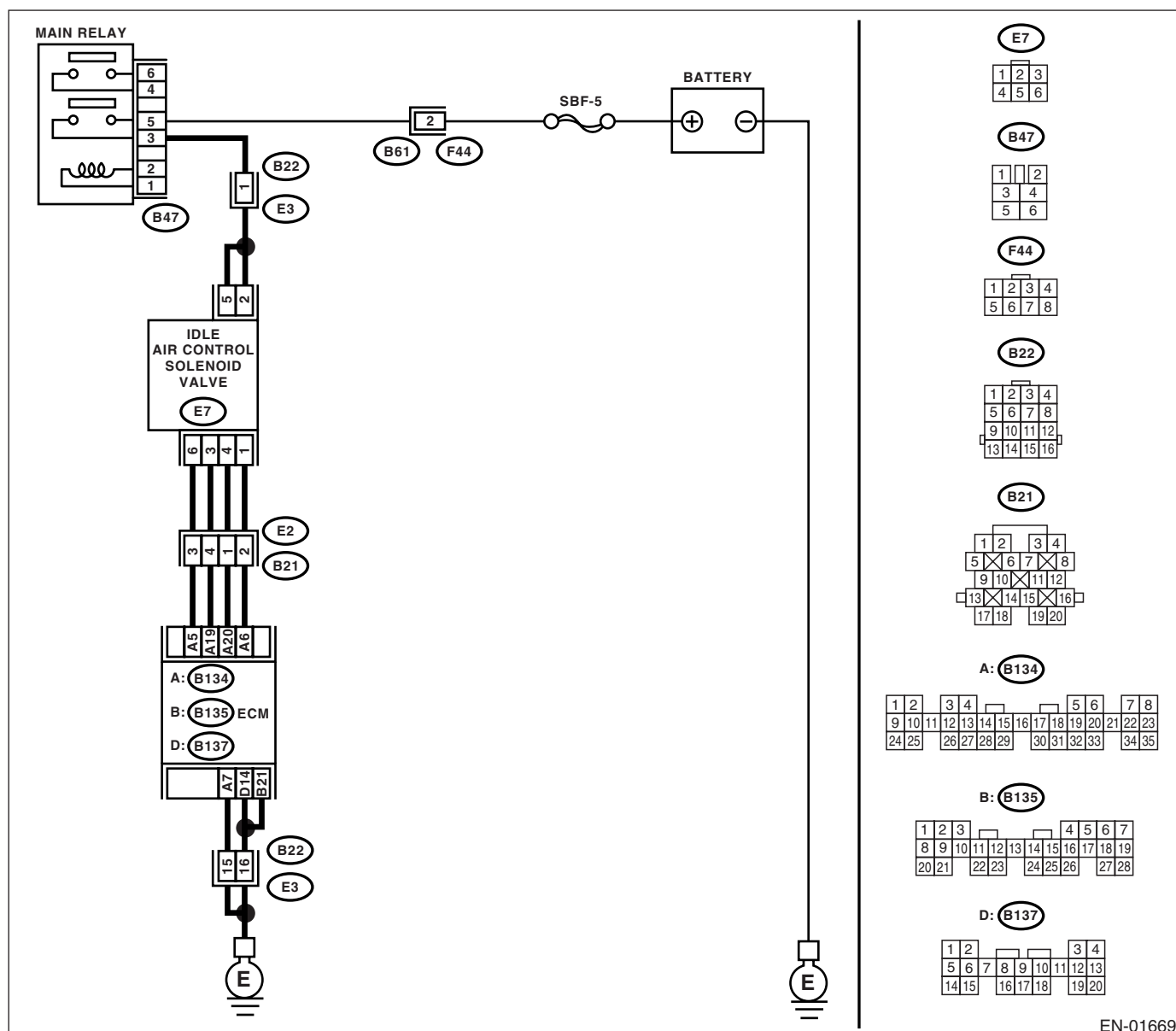
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Engine breathing

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01669

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK POWER SUPPLY TO IDLE AIR CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from idle air control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between idle air control solenoid valve connector and engine ground. Connector & terminal (E7) No. 2 (+) — Engine ground (-): (E7) No. 5 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 2.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between idle air control solenoid valve and main relay connector • Poor contact in coupling connector
2 CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between ECM and idle air control solenoid valve connector. Connector & terminal DTC P1510; (B134) No. 20 — (E7) No. 4: DTC P1512; (B134) No. 6 — (E7) No. 1: DTC P1514; (B134) No. 5 — (E7) No. 6: DTC P1516; (B134) No. 19 — (E7) No. 3:	Is the resistance less than 1 Ω ?	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and idle air control solenoid valve connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance between ECM connector and chassis ground. Connector & terminal DTC P1510; (B134) No. 20 — Chassis ground: DTC P1512; (B134) No. 6 — Chassis ground: DTC P1514; (B134) No. 5 — Chassis ground: DTC P1516; (B134) No. 19 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 4.	Repair ground short circuit in harness between ECM and idle air control solenoid valve connector.
4 CHECK POOR CONTACT. Check poor contact in ECM connector and idle air control solenoid valve connector.	Is there poor contact in ECM connector or idle air control solenoid valve connector?	Repair poor contact in ECM connector or idle air control solenoid valve connector.	Replace the idle air control solenoid valve. <Ref. to FU(H4SO)-32, Idle Air Control Solenoid Valve.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DJ:DTC P1517 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-224, DTC P1517 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

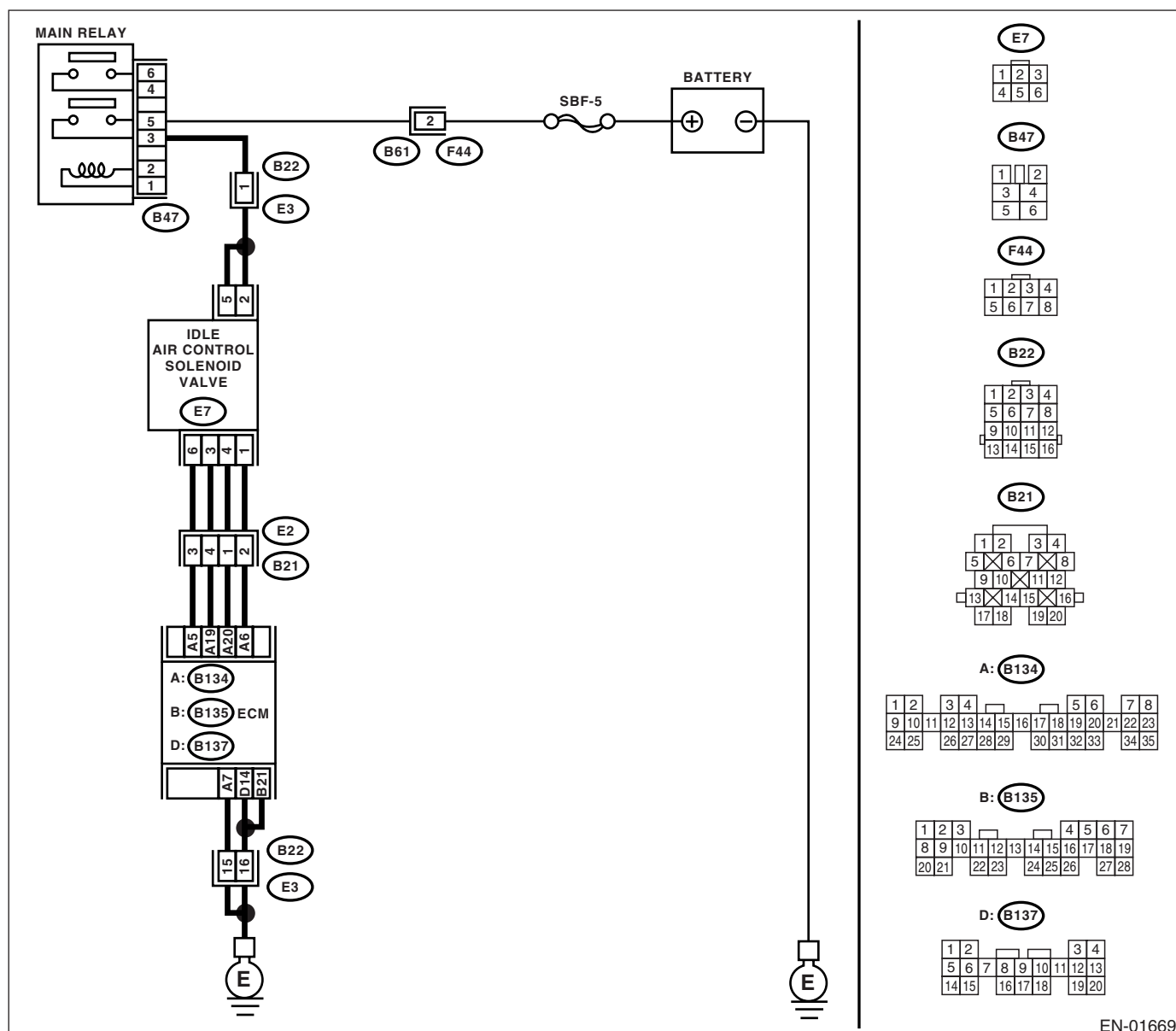
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Engine breathing

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01669

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check the DTC using the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK GROUND CIRCUIT FOR ECM. 1) Turn the ignition switch to OFF. 2) Measure the resistance between ECM connector and chassis ground. Connector & terminal (B134) No. 7 — Chassis ground: (B137) No. 14 — Chassis ground: (B135) No. 21 — Chassis ground:	Is the resistance less than 5 Ω?	Go to step 3.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM connector and engine ground terminal • Poor contact in ECM connector • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN ECM AND IDLE AIR CONTROL SOLENOID VALVE CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from idle air control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. Connector & terminal DTC P1511; (B134) No. 20 (+) — Chassis ground (-): DTC P1513; (B134) No. 6 (+) — Chassis ground (-): DTC P1515; (B134) No. 5 (+) — Chassis ground (-): DTC P1517; (B134) No. 19 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and idle air control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>

DK:DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-226, DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Failure of engine to start

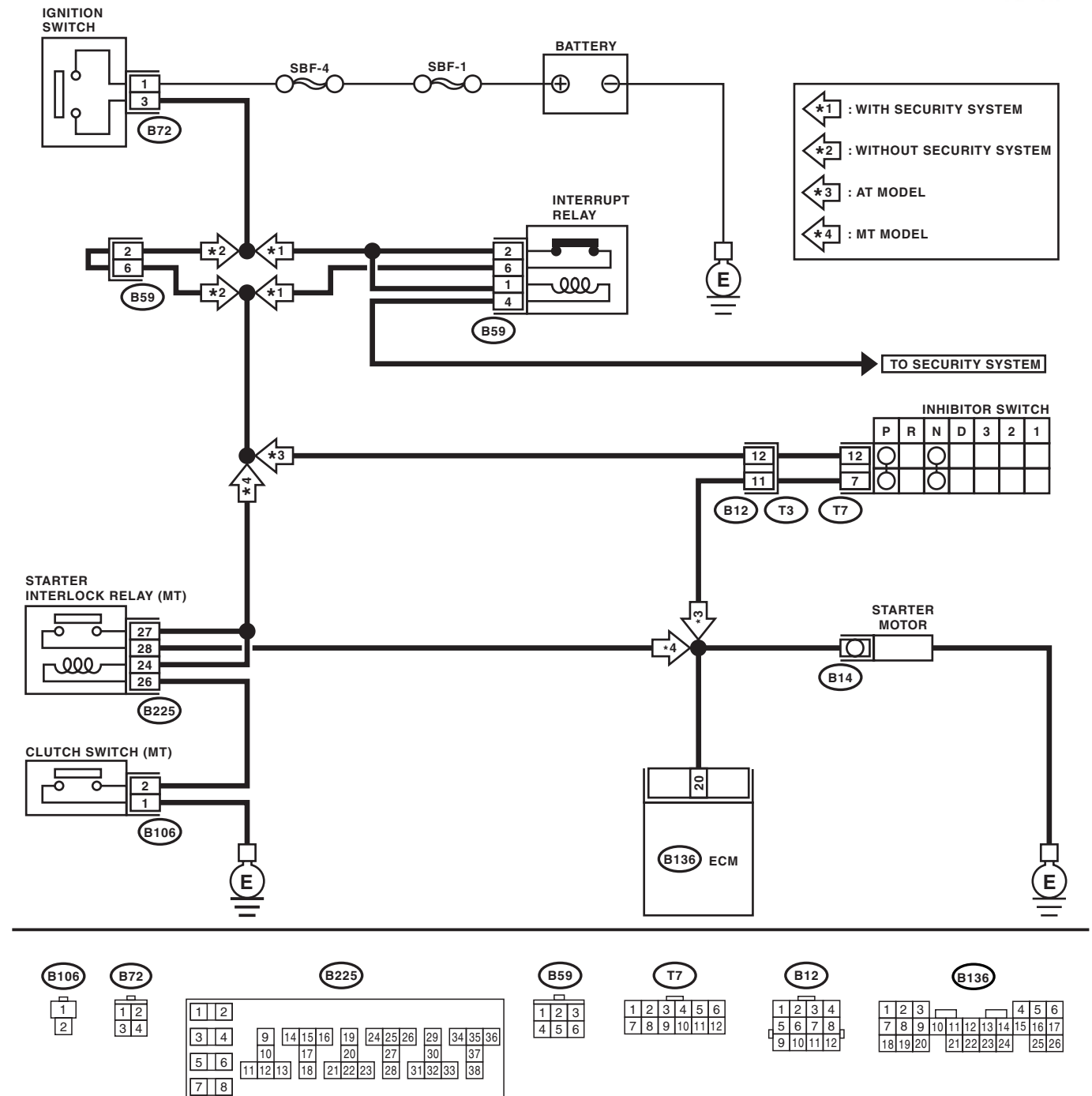
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-01645

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATION OF STARTER MOTOR. Place the inhibitor switch in the "P" or "N" range. (AT model) Depress the clutch pedal. (MT model)	Does the starter motor operate when ignition switch is turned to "ST"?	Repair harness and connector. NOTE: In this case, repair the following: • Open or ground short circuit in harness between ECM and starter motor connector. • Poor contact in ECM connector.	Check starter motor circuit. <Ref. to EN(H4SO)(diag)-57, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DL:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

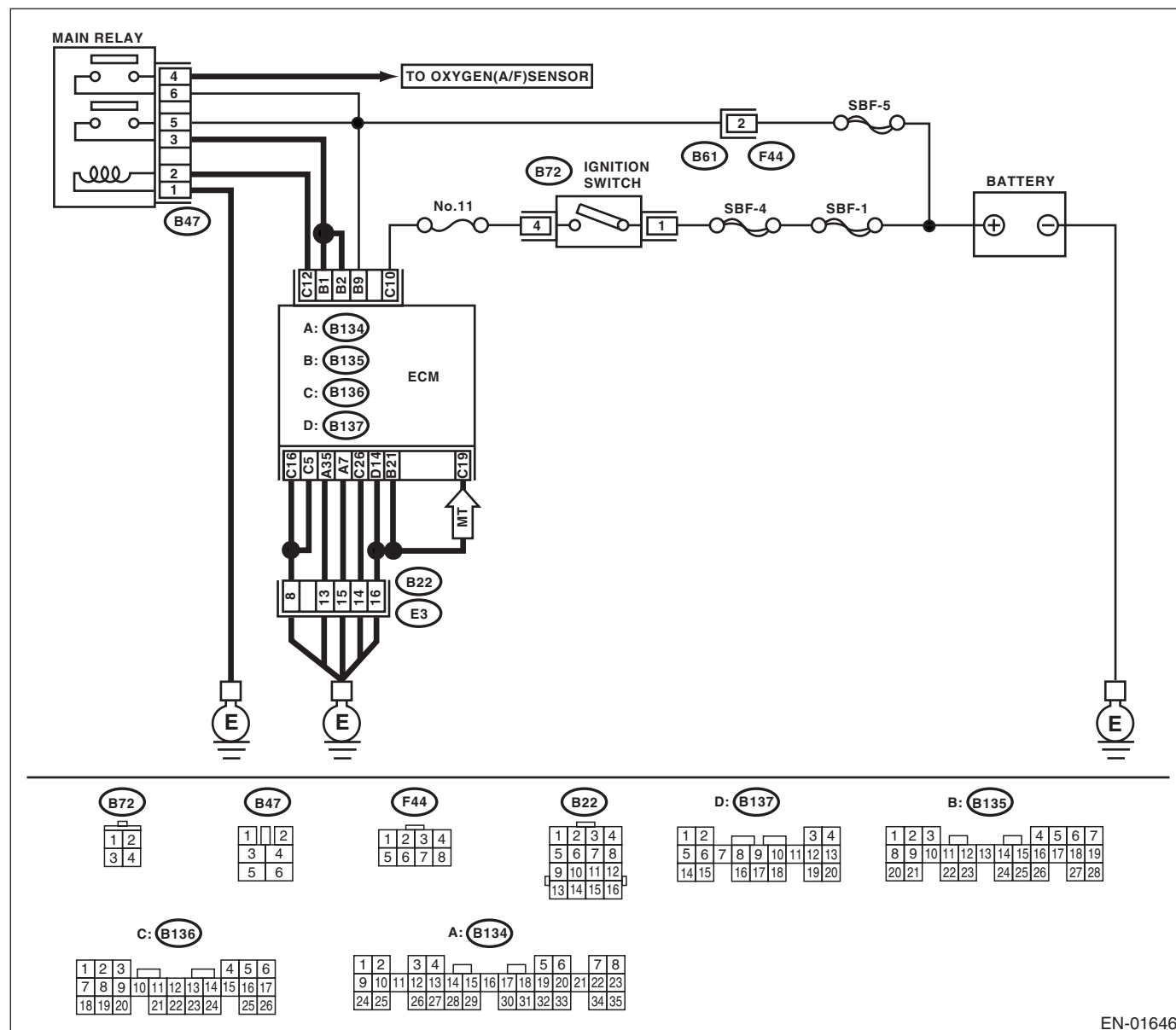
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-227, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01646

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 9 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair poor contact in ECM connector.	Go to step 2.
2 CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B135) No. 9 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair ground short circuit in harness between ECM connector and battery terminal.	Go to step 3.
3 CHECK FUSE SBF-5.	Is the fuse blown out?	Replace the fuse.	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and battery • Poor contact in ECM connector • Poor contact in battery terminal

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

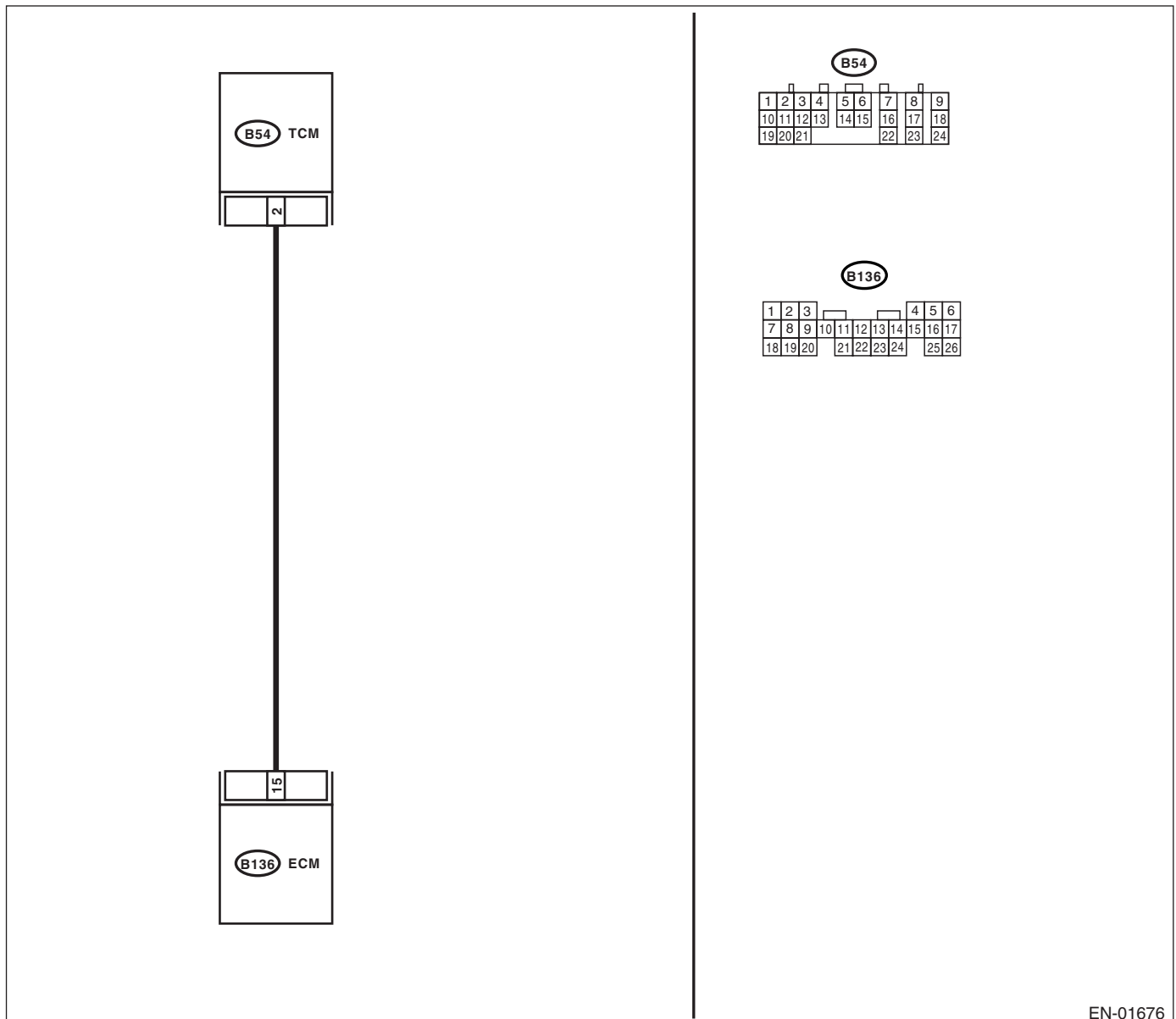
DM:DTC P1698 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT LOW INPUT DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-228, DTC P1698 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01676

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Start the engine, and warm-up the engine. 2) Turn the ignition switch to OFF. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 15 (+) — Chassis ground (-):	Is the voltage more than 3 V?	Repair poor contact in ECM connector.	Go to step 2.
2 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and TCM. 3) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B136) No. 15 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 3.	Repair ground short circuit in harness between ECM and TCM connector.
3 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the resistance of harness between ECM and TCM connector. Connector & terminal (B136) No. 15 — (B54) No. 2:	Is the resistance less than 1 Ω?	Repair poor contact in ECM or TCM connector.	Repair open circuit in harness between ECM and TCM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

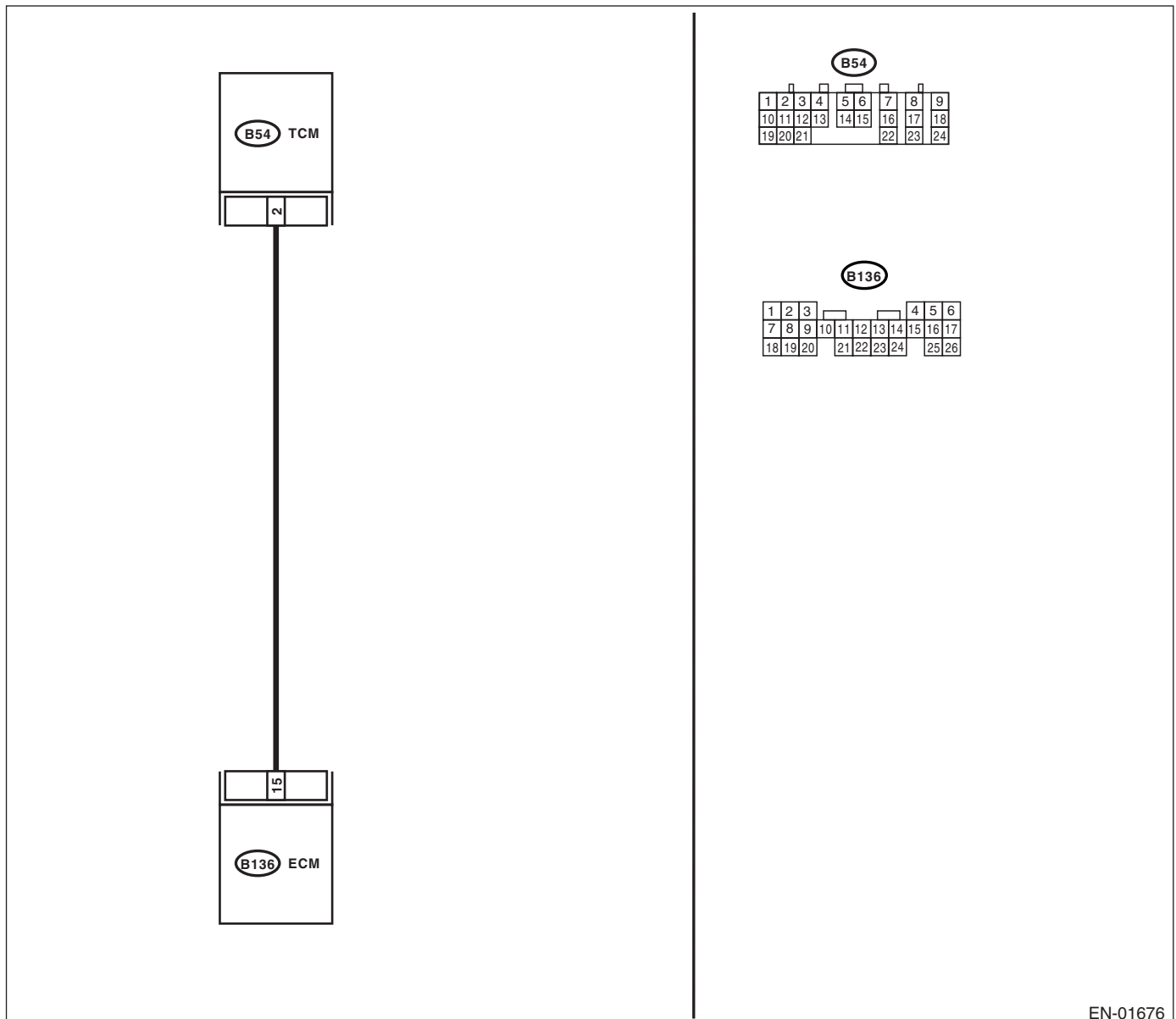
DN:DTC P1699 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT HIGH INPUT DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-229, DTC P1699 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01676

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Start the engine, and warm-up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connector from TCM. 4) Turn the ignition switch to ON. 5) Measure the voltage between ECM and chassis ground. <i>Connector & terminal</i> <i>(B136) No. 15 (+) — Chassis ground (-):</i>	Is the voltage less than 3 V?	Go to step 2.	Repair battery short circuit in harness between ECM and TCM connector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>
2 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. <i>Connector & terminal</i> <i>(B136) No. 15 (+) — Chassis ground (-):</i>	Is the voltage more than 10 V by shaking the harness and connector of ECM?	Repair battery short circuit in harness between ECM and TCM connector. After repair, replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

DO:DTC P1700 THROTTLE POSITION SENSOR CIRCUIT MALFUNCTION FOR AT

GENERAL DESCRIPTION <Ref. to GD(H4SO)-230, DTC P1700 THROTTLE POSITION SENSOR CIRCUIT MALFUNCTION FOR AT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

NOTE:

Refer to AT-section for diagnostic procedure. <Ref. to 4AT(diag)-46, DTC 31 THROTTLE POSITION SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DP:DTC P1711 ENGINE TORQUE CONTROL SIGNAL 1 CIRCUIT MALFUNCTION

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-232, DTC P1711 ENGINE TORQUE CONTROL SIGNAL #1 CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

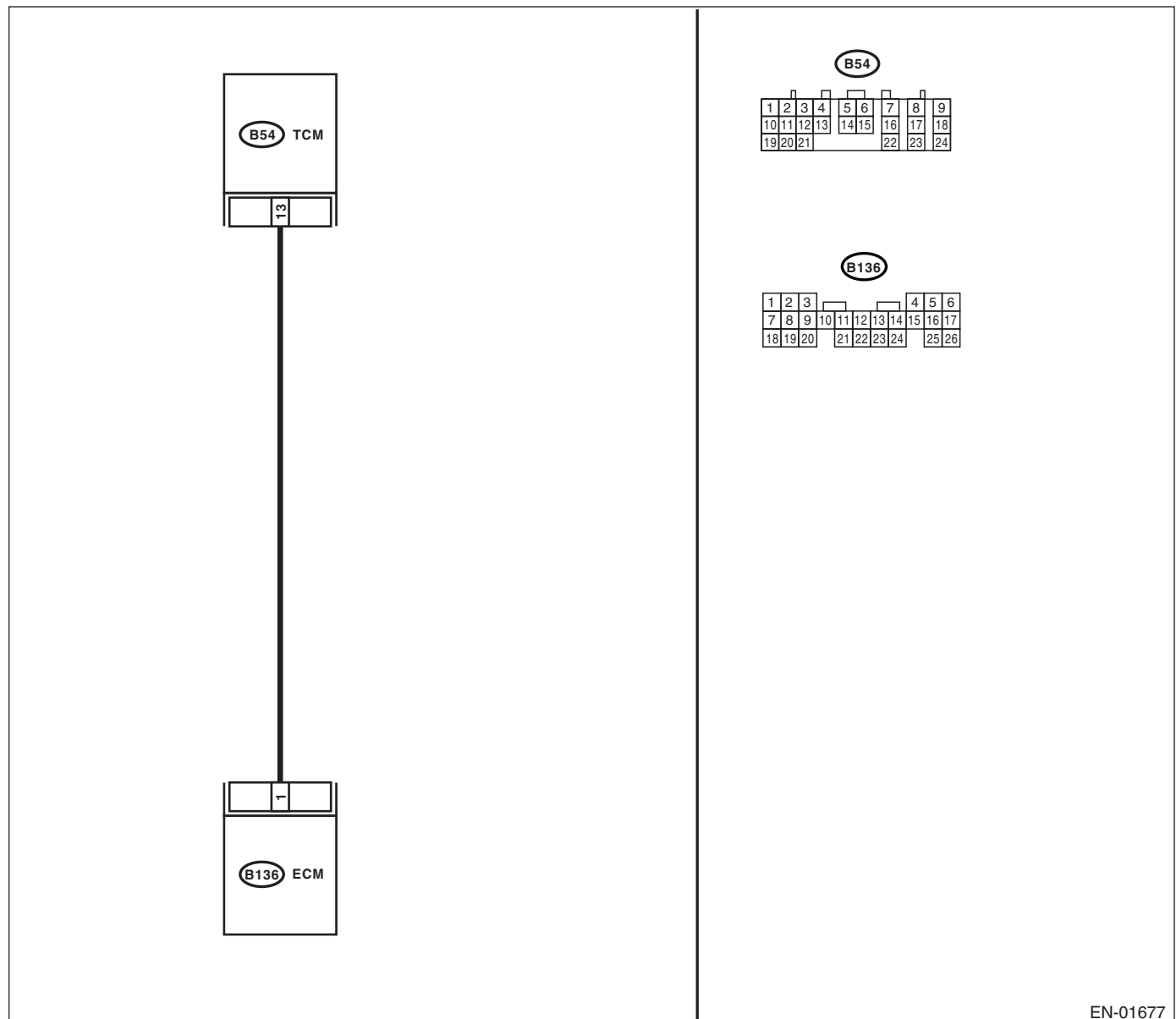
TROUBLE SYMPTOM:

Excessive shift shock

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01677

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FOR ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 1 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 2.	Go to step 4.
2 CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and TCM connector.	Go to step 3.
3 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>
4 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and TCM. 3) Measure the resistance of harness between ECM and TCM connector. Connector & terminal (B136) No. 1 — (B54) No. 13:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair open circuit in harness between ECM and TCM connector.
5 CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B136) No. 1 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 6.	Repair ground short circuit in harness between ECM and TCM connector.
6 CHECK POOR CONTACT. Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Replace the TCM. <Ref. to 4AT-67, Transmission Control Module (TCM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DQ:DTC P1712 ENGINE TORQUE CONTROL SIGNAL 2 CIRCUIT MALFUNCTION

DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-233, DTC P1712 ENGINE TORQUE CONTROL SIGNAL #2 CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

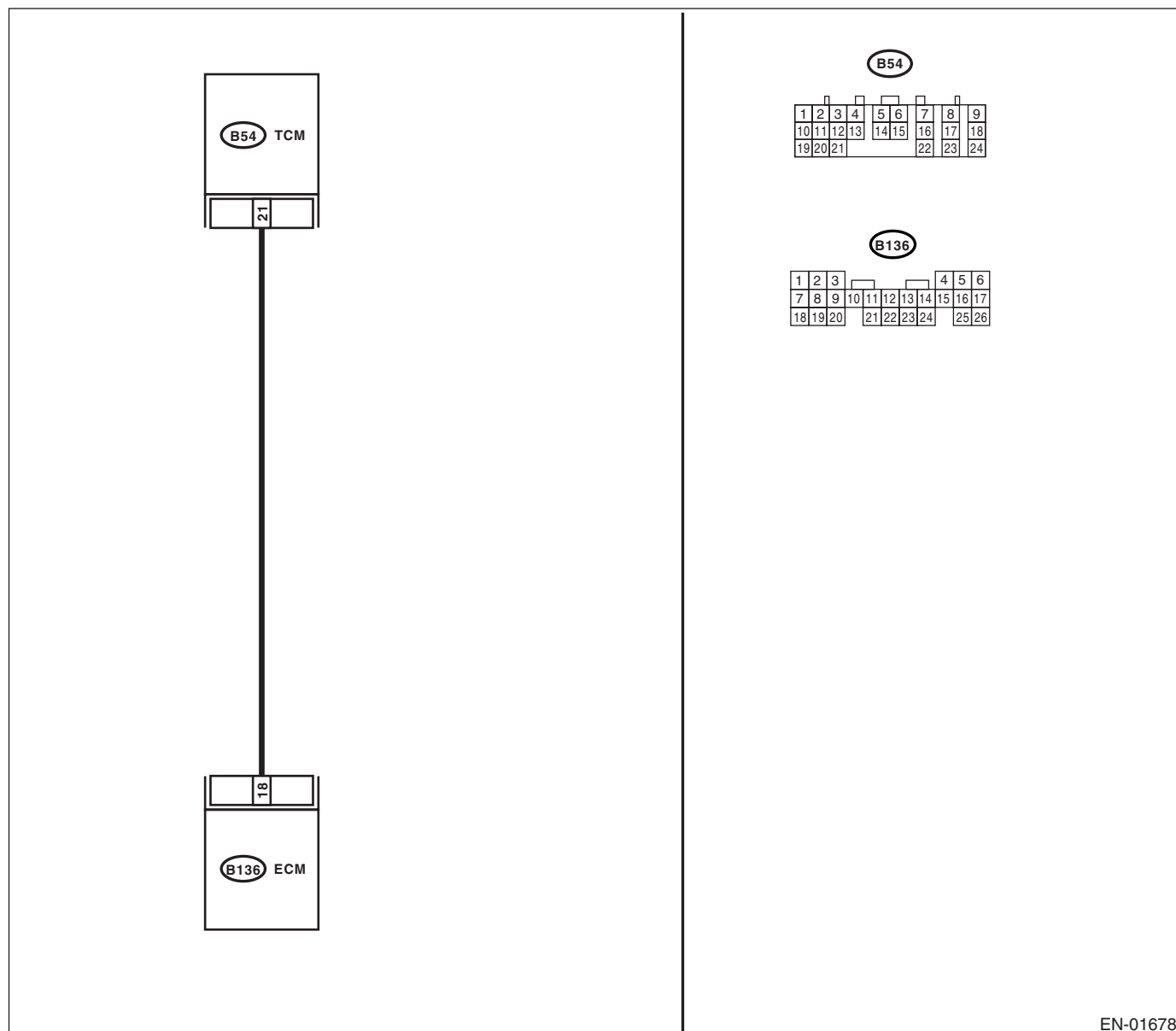
TROUBLE SYMPTOM:

Excessive shift shock

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01678

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
1	CHECK INPUT SIGNAL FOR ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 18 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 2.	Go to step 4.
2	CHECK INPUT SIGNAL FOR ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 18 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair battery short circuit in harness between ECM and TCM connector.	Go to step 3.
3	CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-44, Engine Control Module (ECM).>
4	CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and TCM. 3) Measure the resistance of harness between ECM and TCM connector. Connector & terminal (B136) No. 18 — (B54) No. 21:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair open circuit in harness between ECM and TCM connector.
5	CHECK HARNESS BETWEEN ECM AND TCM CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B136) No. 18 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 6.	Repair ground short circuit in harness between ECM and TCM connector.
6	CHECK POOR CONTACT. Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Replace the TCM. <Ref. to 4AT-67, Transmission Control Module (TCM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DR:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

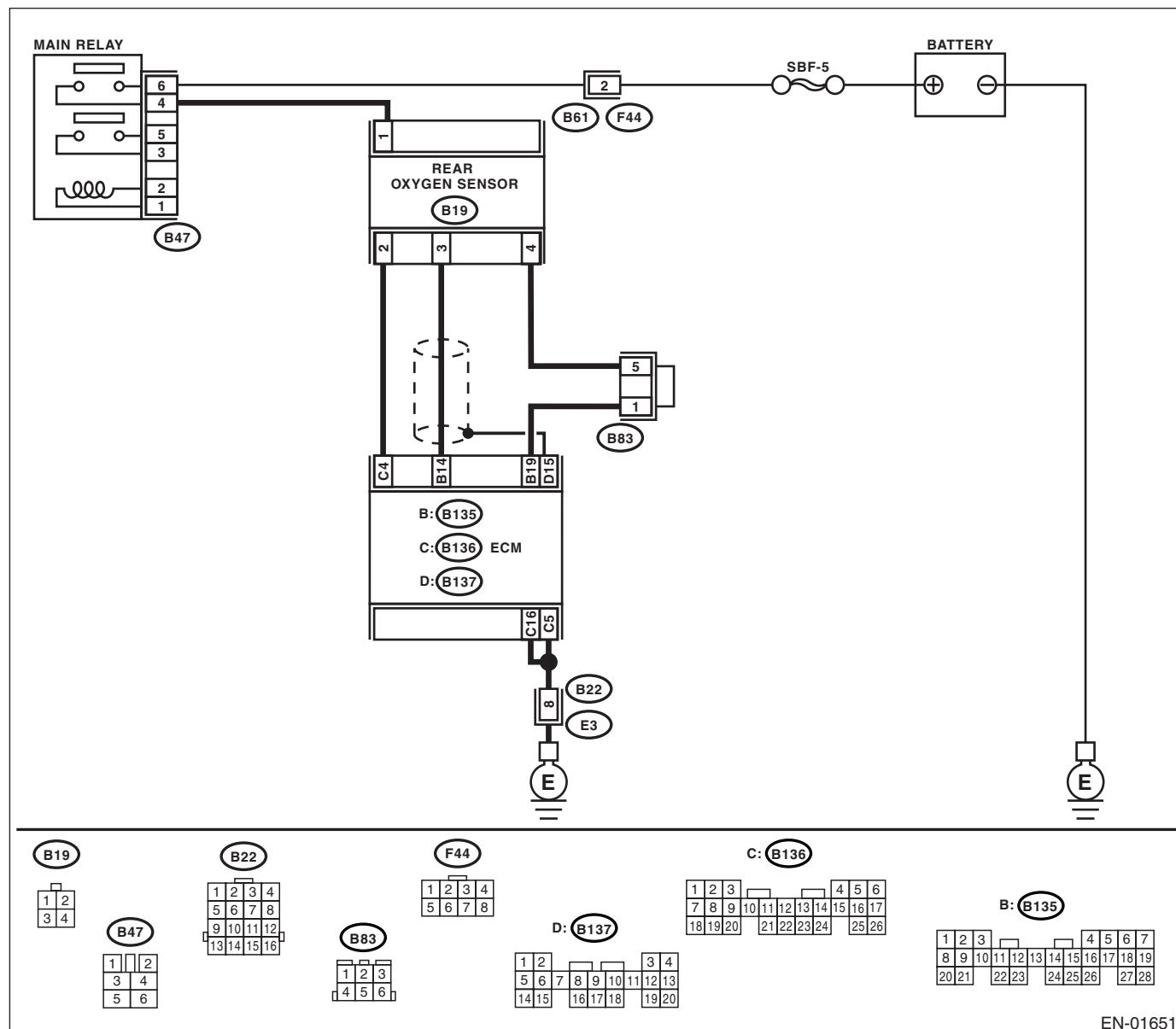
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-234, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01651

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0137.	Go to step 2.
2 CHECK REAR OXYGEN SENSOR DATA. 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and keep the engine speed at 5,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the voltage 490 mV?	Go to step 5.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. Connector & terminal (B135) No. 14 — (B19) No. 3: (B135) No. 19 — (B19) No. 4:	Is the resistance more than 3 Ω?	Repair open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 4.
4 CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor harness connector and engine ground or chassis ground. Connector & terminal (B19) No. 3 (+) — Engine ground (-):	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-42, Rear Oxygen Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK EXHAUST SYSTEM. Check exhaust system parts. NOTE: Check the following items. • Loose installation of portions • Damage (crack, hole etc.) of parts • Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	Is there a fault in exhaust system?	Repair or replace faulty parts.	Go to step 6.
6 CHECK AIR INTAKE SYSTEM.	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair air intake system.	Go to step 7.
7 CHECK PURGE CONTROL SOLENOID VALVE OR PRESSURE CONTROL SOLENOID VALVE.	Is the purge control solenoid valve or pressure control solenoid valve stuck?	Replace the purge control solenoid valve or pressure control solenoid valve.	Go to step 8.
8 CHECK FUEL PRESSURE. Warning: • Place "NO FIRE" signs near the working area. • Be careful not to spill fuel on the floor. 1) Release fuel pressure. (1) Disconnect the connector from fuel pump relay. (2) Start the engine and run it until it stalls. (3) After the engine stalls, crank it for five more seconds. (4) Turn the ignition switch to OFF. 2) Connect the connector to fuel pump relay. 3) Disconnect the fuel delivery hose from fuel filter, and connect fuel pressure gauge. 4) Install the fuel filler cap. 5) Start the engine and idle while gear position is neutral. 6) Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. Warning: Before removing the fuel pressure gauge, release fuel pressure. NOTE: If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the fuel pressure 284 — 314 kPa (2.9 — 3.2 kg/cm ² , 41 — 46 psi)?	Go to step 9.	Repair the following items. Fuel pressure too high • Clogged fuel return line or bent hose Fuel pressure too low • Improper fuel pump discharge • Clogged fuel supply line

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step		Check	Yes	No
9	CHECK FUEL PRESSURE. After connecting the pressure regulator vacuum hose, measure fuel pressure. Warning: Before removing the fuel pressure gauge, release fuel pressure. NOTE: - If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. - If out of specification as measured at this step, check or replace pressure regulator and pressure regulator vacuum hose.	Is the fuel pressure 206 — 235 kPa (2.1 — 2.4 kg/cm ² , 30 — 34 psi)?	Go to step 10.	Repair the following items. Fuel pressure too high - Faulty pressure regulator - Clogged fuel return line or bent hose Fuel pressure too low - Faulty pressure regulator - Improper fuel pump discharge - Clogged fuel supply line
10	CHECK ENGINE COOLANT TEMPERATURE SENSOR. 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the engine coolant temperature 70 — 100°C (158 — 212°F)?	Go to step 11.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-24, Engine Coolant Temperature Sensor.>
11	CHECK PRESSURE SENSOR SIGNAL. 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the select lever in "N" or "P" range. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read the data of pressure sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Idling: Is the measured value 24.0 — 41.3 kPa (180 — 310 mmHg, 7.09 — 12.20 inHg), Ignition ON: Is the measured value 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg)?	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace the Pressure sensor. <Ref. to FU(H4SO)-30, Manifold Absolute Pressure Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DS:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

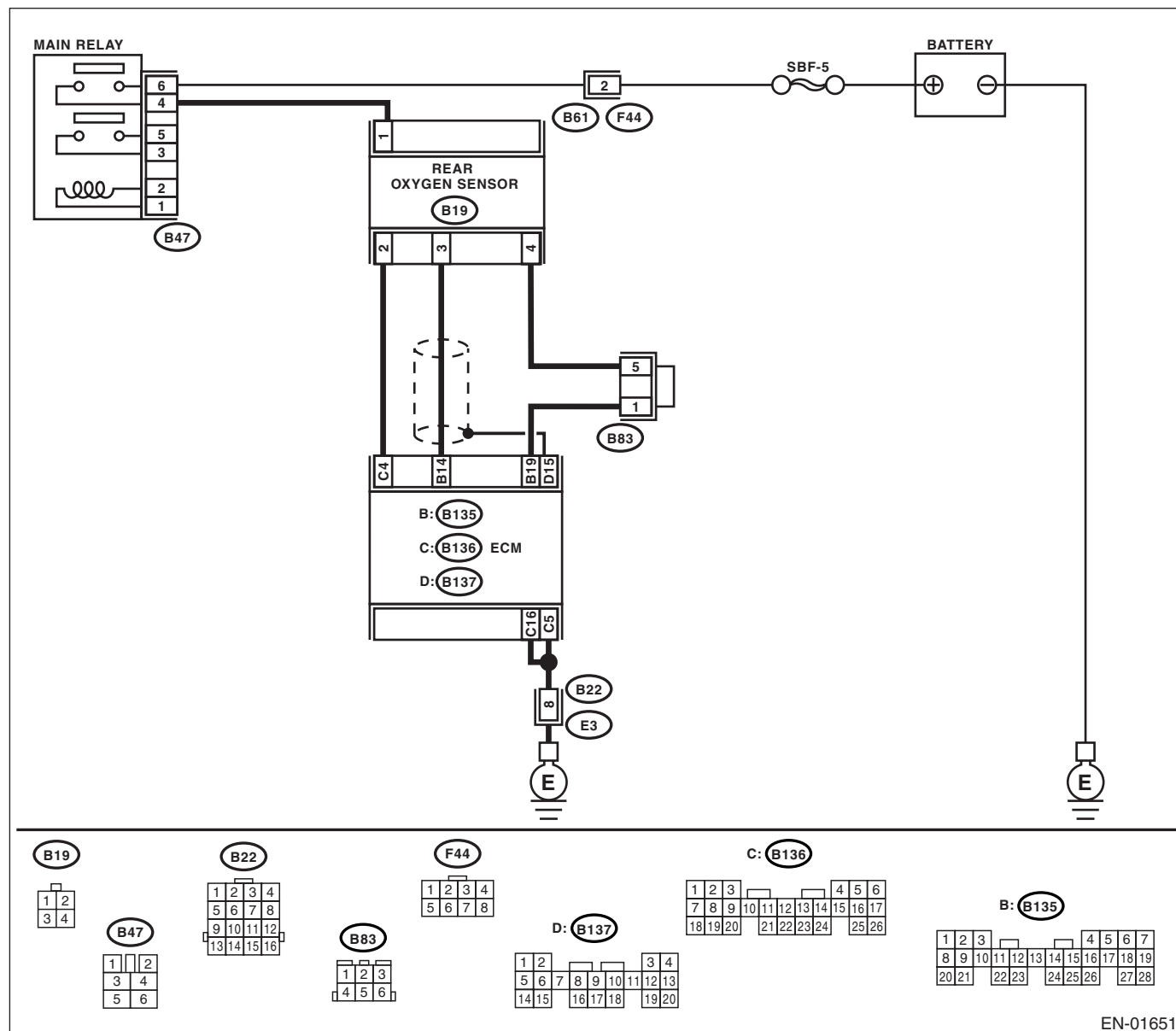
DTC DETECTING CONDITION:

- Two consecutive driving cycles with fault
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-236, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.>.

WIRING DIAGRAM:



EN-01651

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-71, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0138.	Go to step 2.
2 CHECK REAR OXYGEN SENSOR DATA. 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and immediately decrease the engine speed from 5,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> • OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the voltage 250 mV?	Go to step 5.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. Connector & terminal (B135) No. 14 — (B19) No. 3: (B135) No. 19 — (B19) No. 4:	Is the resistance more than 3 Ω?	Repair open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 4.
4 CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor harness connector and engine ground or chassis ground. Connector & terminal (B19) No. 3 (+) — Engine ground (-):	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-42, Rear Oxygen Sensor.>	Repair harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK EXHAUST SYSTEM. Check exhaust system parts. NOTE: Check the following items. • Loose installation of portions • Damage (crack, hole etc.) of parts • Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	Is there a fault in exhaust system?	Repair or replace faulty parts.	Go to step 6.
6 CHECK AIR INTAKE SYSTEM.	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair air intake system.	Go to step 7.
7 CHECK PURGE CONTROL SOLENOID VALVE OR PRESSURE CONTROL SOLENOID VALVE.	Is the purge control solenoid valve or pressure control solenoid valve stuck?	Replace the purge control solenoid valve or pressure control solenoid valve.	Go to step 8.
8 CHECK FUEL PRESSURE. Warning: • Place "NO FIRE" signs near the working area. • Be careful not to spill fuel on the floor. 1) Release fuel pressure. (1) Disconnect the connector from fuel pump relay. (2) Start the engine and run it until it stalls. (3) After the engine stalls, crank it for five more seconds. (4) Turn the ignition switch to OFF. 2) Connect the connector to fuel pump relay. 3) Disconnect the fuel delivery hose from fuel filter, and connect fuel pressure gauge. 4) Install the fuel filler cap. 5) Start the engine and idle while gear position is neutral. 6) Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. Warning: Before removing the fuel pressure gauge, release fuel pressure. NOTE: If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the fuel pressure 284 — 314 kPa (2.9 — 3.2 kg/cm ² , 41 — 46 psi)?	Go to step 9.	Repair the following items. Fuel pressure too high • Clogged fuel return line or bent hose Fuel pressure too low • Improper fuel pump discharge • Clogged fuel supply line

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

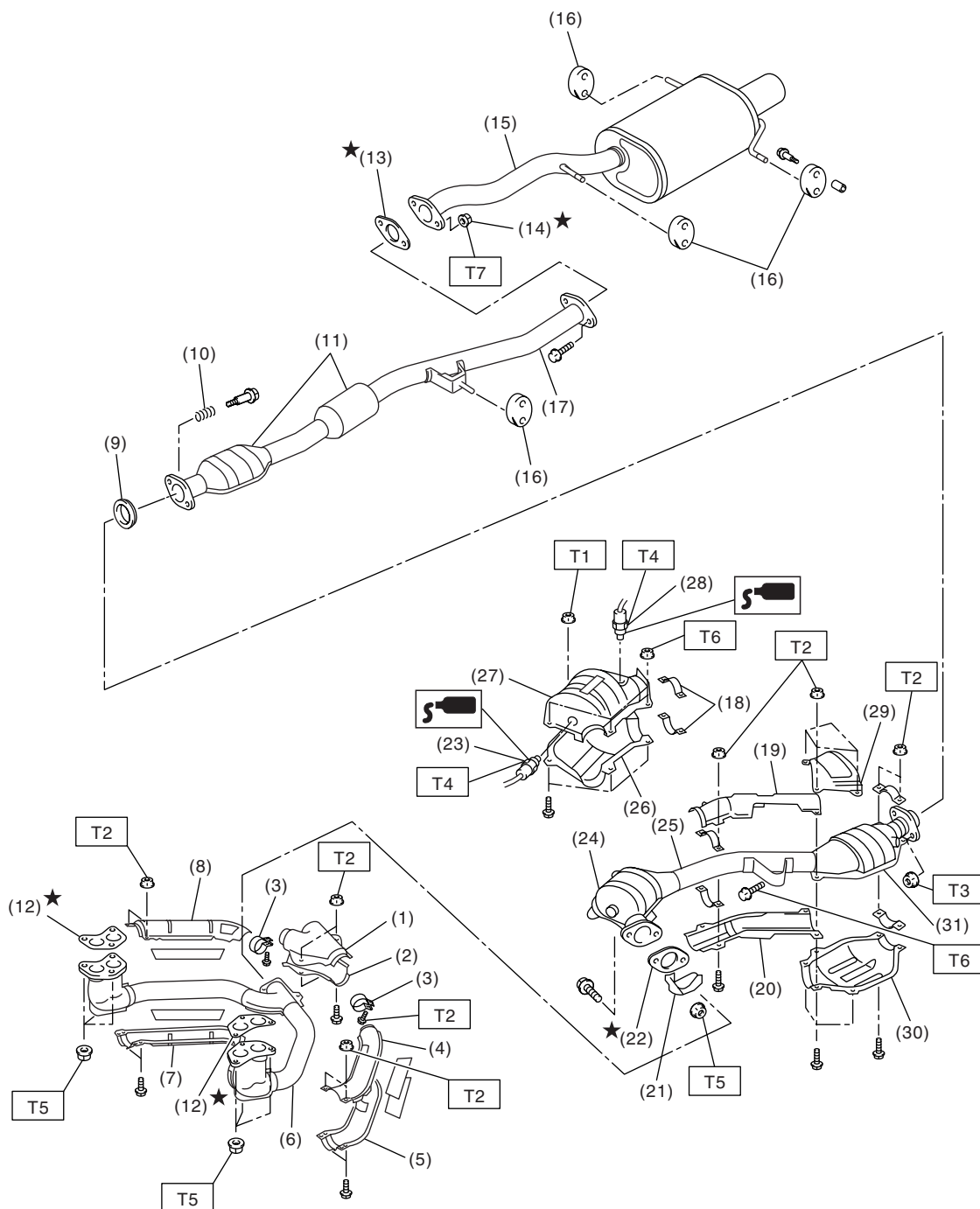
Step		Check	Yes	No
9	CHECK FUEL PRESSURE. After connecting the pressure regulator vacuum hose, measure fuel pressure. Warning: Before removing the fuel pressure gauge, release fuel pressure. NOTE: - If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. - If out of specification as measured at this step, check or replace pressure regulator and pressure regulator vacuum hose.	Is the fuel pressure 206 — 235 kPa (2.1 — 2.4 kg/cm ² , 30 — 34 psi)?	Go to step 10.	Repair the following items. Fuel pressure too high - Faulty pressure regulator - Clogged fuel return line or bent hose Fuel pressure too low - Faulty pressure regulator - Improper fuel pump discharge - Clogged fuel supply line
10	CHECK ENGINE COOLANT TEMPERATURE SENSOR. 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Is the engine coolant temperature 70 — 100°C (158 — 212°F)?	Go to step 11.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-24, Engine Coolant Temperature Sensor.>
11	CHECK PRESSURE SENSOR SIGNAL. 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the select lever in "N" or "P" range. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read the data of pressure sensor signal using Subaru Select Monitor or OBD-II general scan tool. NOTE: - Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-30, Subaru Select Monitor.> - OBD-II general scan tool For detailed operation procedures, refer to the OBD-II General Scan Tool Instruction Manual.	Idling: Is the measured value 24.0 — 41.3 kPa (180 — 310 mmHg, 7.09 — 12.20 inHg), Ignition ON: Is the measured value 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg)?	Contact SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace the Pressure sensor. <Ref. to FU(H4SO)-30, Manifold Absolute Pressure Sensor.>

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EXHAUST

1. General Description

A: COMPONENT



General Description

EXHAUST

(1) Front exhaust pipe upper cover	(15) Muffler	(28) Rear oxygen sensor
(2) Front exhaust pipe lower cover	(16) Cushion rubber	(29) Rear catalytic converter upper cover
(3) Clamp	(17) Rear exhaust pipe	(30) Rear catalytic converter lower cover
(4) Front exhaust pipe upper cover LH	(18) Clamp	(31) Rear catalytic converter
(5) Front exhaust pipe lower cover LH	(19) Center exhaust pipe upper cover	
(6) Front exhaust pipe	(20) Center exhaust pipe lower cover	
(7) Front exhaust pipe lower cover RH	(21) Protector	
(8) Front exhaust pipe upper cover RH	(22) Gasket	
(9) Gasket	(23) Front oxygen (A/F) sensor	
(10) Spring	(24) Front catalytic converter	
(11) Chamber	(25) Center exhaust pipe	
(12) Gasket	(26) Front catalytic converter lower cover	
(13) Gasket	(27) Front catalytic converter upper cover	
(14) Self-locking nut		

Tightening torque: N·m (kgf-m, ft-lb)

T1: 8 (0.8, 5.8)

T2: 13 (1.3, 9.4)

T3: 18 (1.8, 13.0)

T4: 21 (2.1, 15.2)

T5: 30 (3.1, 22.4)

T6: 35 (3.6, 26.0)

T7: 48 (4.9, 35.4)

B: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

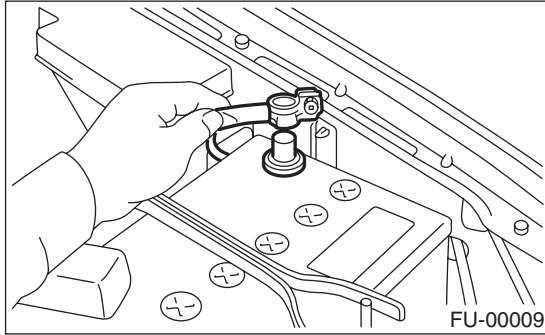
Front Exhaust Pipe

EXHAUST

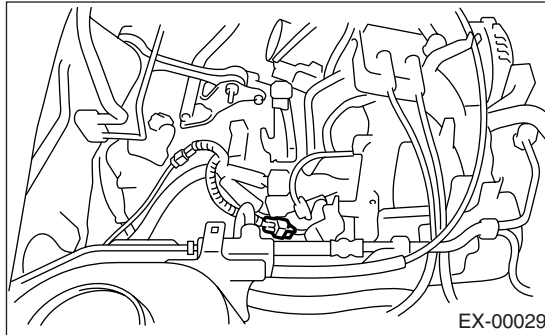
2. Front Exhaust Pipe

A: REMOVAL

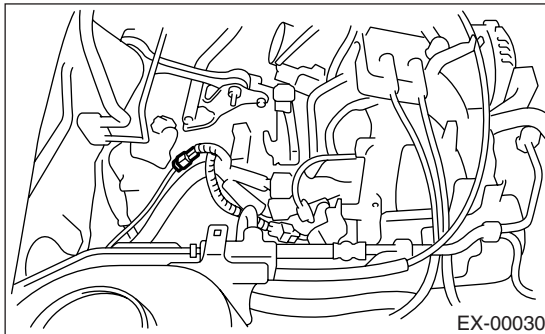
1) Disconnect the ground cable from battery.



2) Disconnect the front oxygen (A/F) sensor connector.



3) Disconnect the rear oxygen sensor connector.

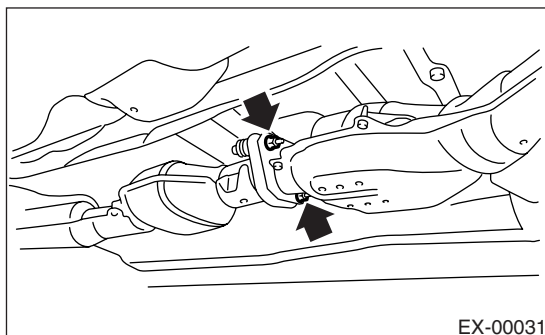


4) Lift-up the vehicle.

5) Separate the front and center exhaust pipe assembly and rear exhaust pipe.

CAUTION:

Be careful, the exhaust pipe is hot.

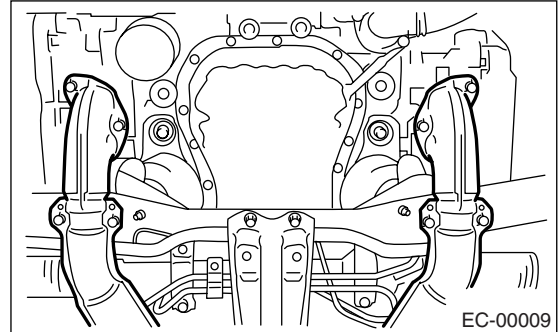


6) Remove the under cover.

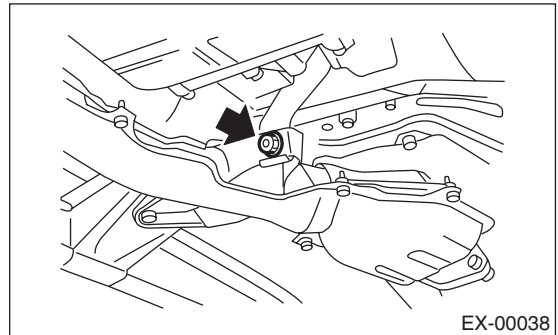
7) Remove the nuts which hold the front exhaust pipe onto cylinder heads.

CAUTION:

Be careful not to pull down the front and center exhaust pipe assembly.



8) Remove the bolt which installs the front and center exhaust pipe assembly to hanger bracket.



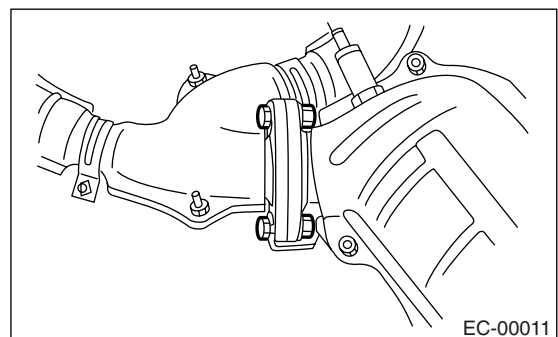
9) Remove the front and center exhaust pipe assembly from vehicle.

CAUTION:

- Be careful not to let the front and center exhaust pipe assembly fall off when removing as it is quite heavy.

- After removing the front and center exhaust pipe assembly, do not apply excessive pulling force on the rear exhaust pipe.

10) Separate the front exhaust pipe from center exhaust pipe.



11) Remove the front oxygen (A/F) sensor and the rear oxygen sensor. <Ref. to FU(H4SO)-40, REMOVAL, Front Oxygen (A/F) Sensor.> and <Ref. to FU(H4SO)-42, REMOVAL, Rear Oxygen Sensor.>.

B: INSTALLATION

1) Install the front oxygen (A/F) sensor and the rear oxygen sensor. <Ref. to FU(H4SO)-40, INSTALLATION, Front Oxygen (A/F) Sensor.> and <Ref. to FU(H4SO)-42, INSTALLATION, Rear Oxygen Sensor.>.

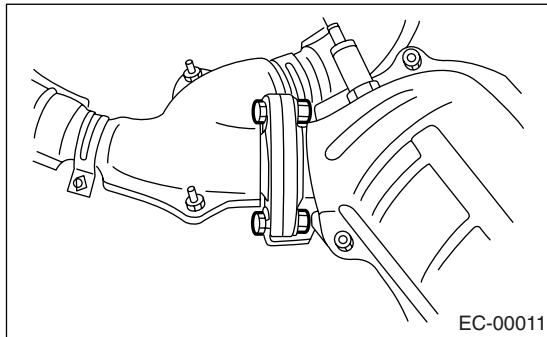
2) Install the front exhaust pipe to center exhaust pipe.

NOTE:

Replace the gaskets with new ones.

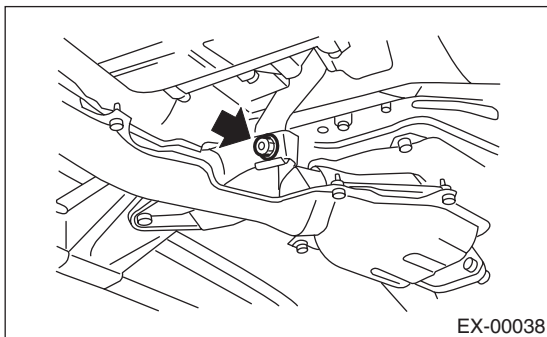
Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)



3) Install the front and center exhaust pipe assembly to vehicle.

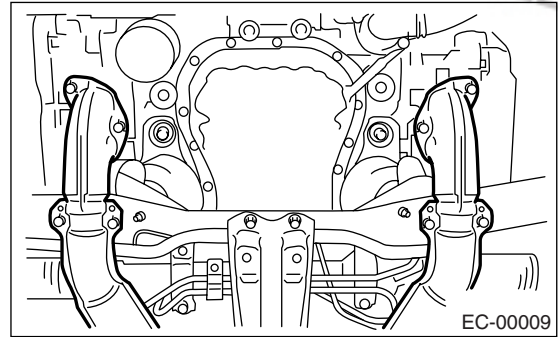
4) Temporarily tighten the bolt which installs the front and center exhaust pipe assembly to hanger bracket.



5) Tighten the nuts which hold the front exhaust pipe onto cylinder heads.

Tightening torque:

30 N·m (3.1 kgf-m, 22.4 ft-lb)

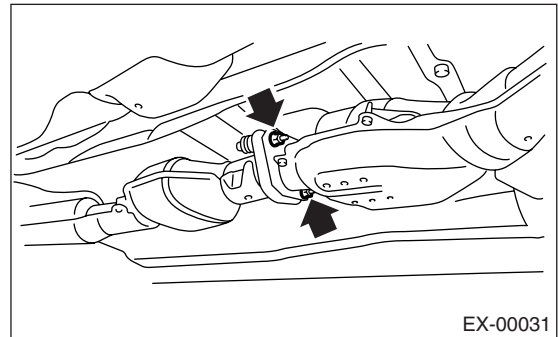


6) Install the under cover.

7) Tighten the bolts which install the front and center exhaust pipe assembly to rear exhaust pipe.

Tightening torque:

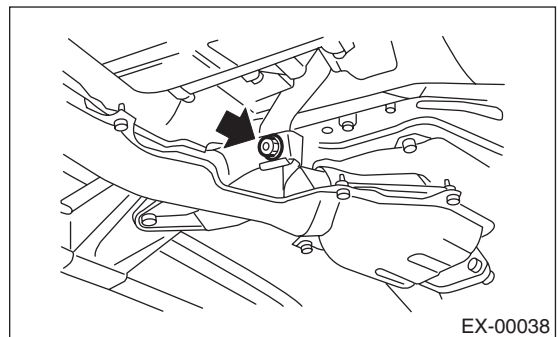
18 N·m (1.8 kgf-m, 13.0 ft-lb)



8) Tighten the bolt which holds the front and center exhaust pipe assembly to hanger bracket.

Tightening torque:

35 N·m (3.6 kgf-m, 26.0 ft-lb)

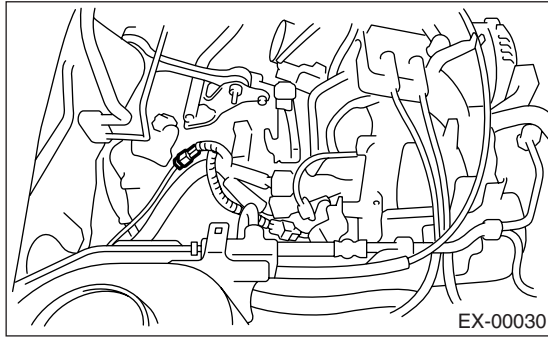


9) Lower the vehicle.

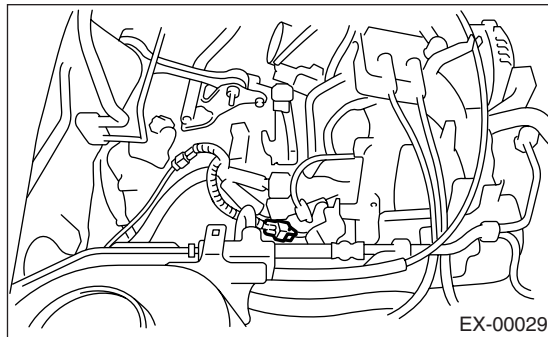
Front Exhaust Pipe

EXHAUST

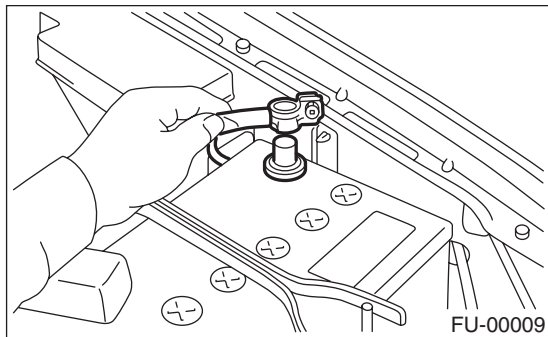
10) Connect the rear oxygen sensor connector.



11) Connect the front oxygen (A/F) sensor connector.



12) Connect the battery ground cable to battery.



C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.

3. Center Exhaust Pipe

A: REMOVAL

After removing the center and front exhaust pipes as one unit, separate them. Refer to the procedure for removing the front exhaust pipe. <Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>

B: INSTALLATION

Install the center exhaust pipe and front exhaust pipe as one unit. Refer to the procedure for installing the front exhaust pipe. <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.

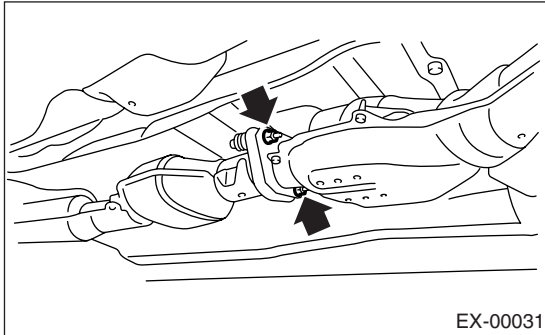
4. Rear Exhaust Pipe

A: REMOVAL

1) Separate the rear exhaust pipe from center exhaust pipe.

CAUTION:

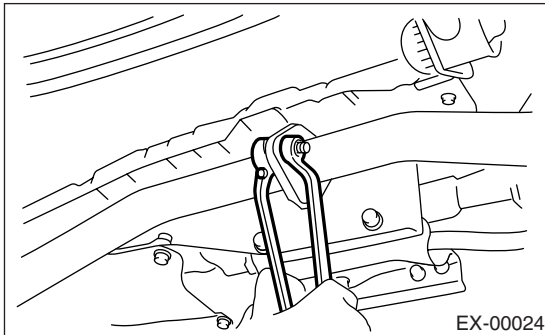
Be careful, the exhaust pipe is hot.



2) Separate the rear exhaust pipe from muffler.

CAUTION:

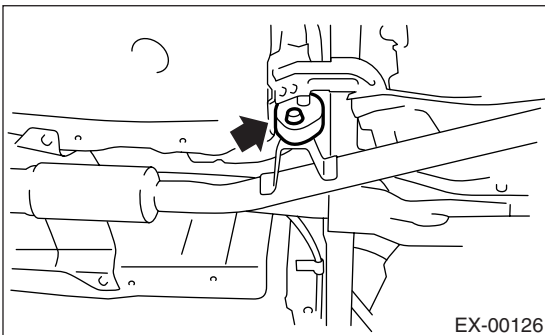
Be careful not to pull down the rear exhaust pipe.



3) Apply a coat of SUBARU CRC to the mating area of cushion rubbers in advance.

SUBARU CRC (Part No. 004301003)

4) Remove the rear exhaust pipe bracket from cushion rubber.

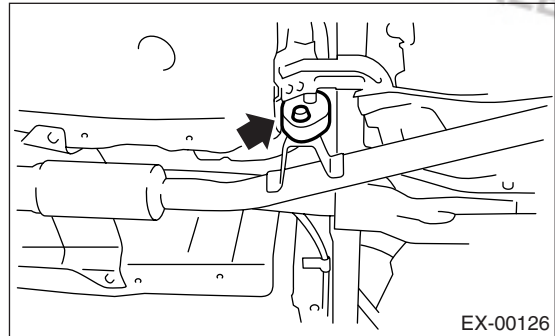


B: INSTALLATION

1) Apply a coat of SUBARU CRC to the mating area of cushion rubbers in advance.

SUBARU CRC (Part No. 004301003)

2) Install the rear exhaust pipe bracket to cushion rubber.



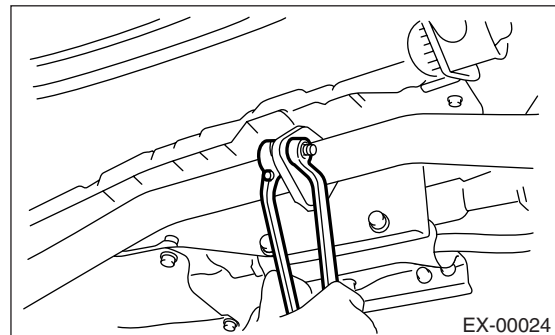
3) Install the rear exhaust pipe to muffler.

NOTE:

Replace the gaskets and self-locking nuts with new ones.

Tightening torque:

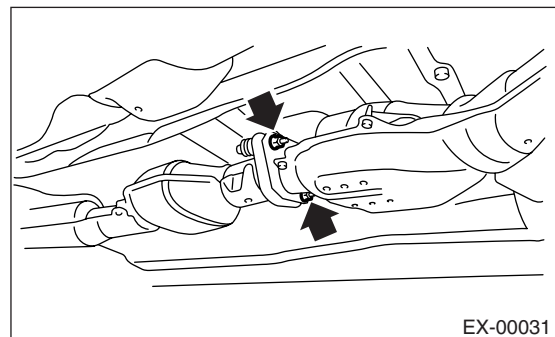
48 N·m (4.9 kgf-m, 35.4 ft-lb)



4) Install the rear exhaust pipe to center exhaust pipe.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION

1) Make sure there are no exhaust leaks from connections and welds.

2) Make sure there are no holes or rusting.

3) Make sure the cushion rubber is not worn or cracked.

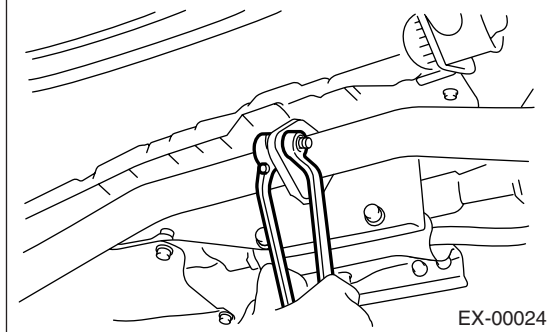
5. Muffler

A: REMOVAL

1) Separate the muffler from rear exhaust pipe.

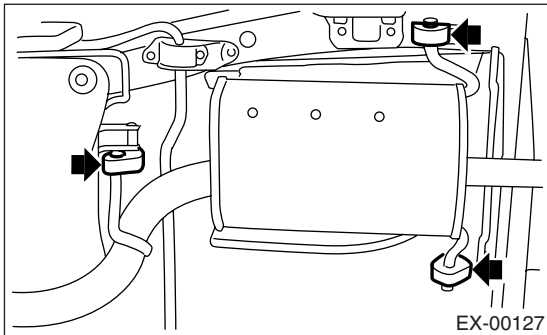
CAUTION:

Be careful, the exhaust pipe is hot.



2) Apply a coat of SUBARU CRC to the mating area of cushion rubbers in advance.

SUBARU CRC (Part No. 004301003)



3) Remove the front, right and left cushion rubber, and detach the muffler assembly.

B: INSTALLATION

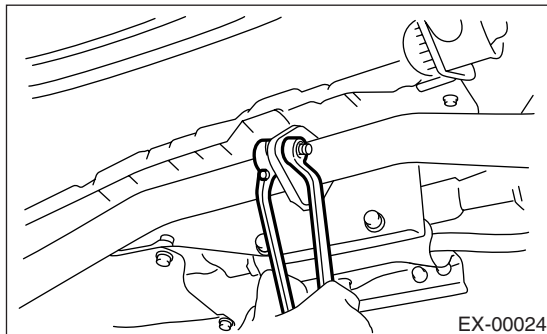
Install in the reverse order of removal.

NOTE:

Replace the gasket and self-locking nuts with new ones.

Tightening torque:

48 N·m (4.9 kgf·m, 35.4 ft-lb)



C: INSPECTION

- 1) Make sure there are no exhaust leaks from connections and welds.
- 2) Make sure there are no holes or rusting.
- 3) Make sure the cushion rubber is not worn or cracked.

EXHAUST

Muffler

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NOT FOR RESALE

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NOT FOR RESALE

FUEL INJECTION (FUEL SYTEMS)

General Description

FUEL INJECTION (FUEL SYSTEMS)

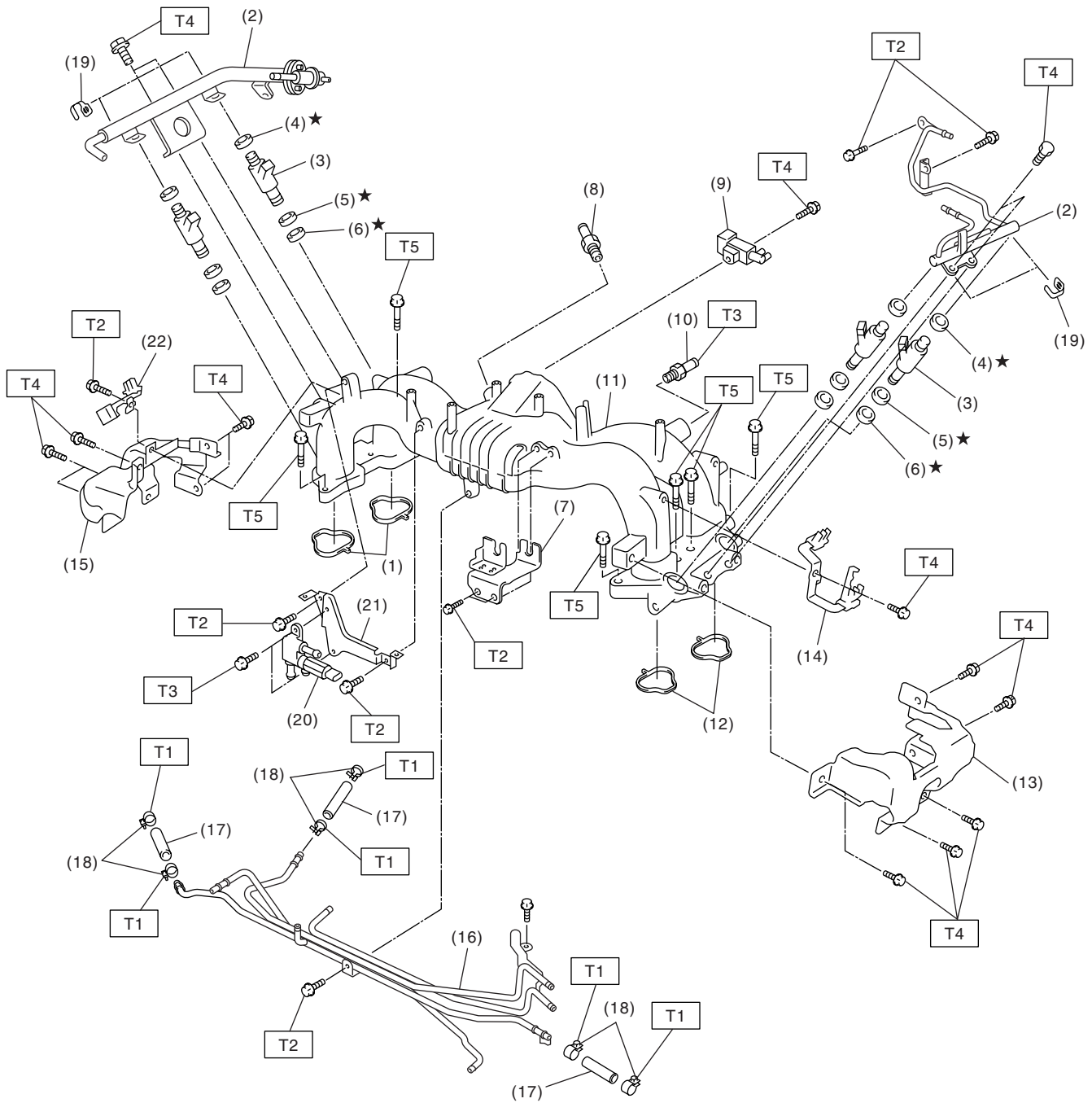
1. General Description

A: SPECIFICATIONS

Item		Specification
Fuel tank	Capacity	60 ℓ (15.9 US gal, 13.2 Imp gal)
	Location	Under rear seat
Fuel pump	Type	Impeller
	Shutoff discharge pressure	370 — 677 kPa (3.77 — 6.9 kg/cm ² , 53.6 — 98 psi)
	Discharge flow	More than 65 ℓ (17.2 US gal, 14.3 Imp gal)/h [12 V at 300 kPa (3.06 kg/cm ² , 43.5 psi)]
Fuel filter		Cartridge type

B: COMPONENT

1. INTAKE MANIFOLD



FU-01020

General Description

FUEL INJECTION (FUEL SYSTEMS)

(1) Intake manifold gasket RH	(11) Intake manifold	(21) Air assist injector solenoid valve bracket
(2) Fuel injector pipe	(12) Intake manifold gasket LH	(22) Plug cord holder RH
(3) Fuel injector	(13) Fuel pipe protector LH	
(4) O-ring	(14) Plug cord holder LH	
(5) O-ring	(15) Fuel pipe protector RH	
(6) O-ring	(16) Fuel pipe assembly	
(7) Plug	(17) Fuel hose	
(8) Nipple	(18) Clip	
(9) Purge control solenoid valve	(19) Clip	
(10) Nipple	(20) Air assist injector solenoid valve	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1.5 (0.15, 1.1)

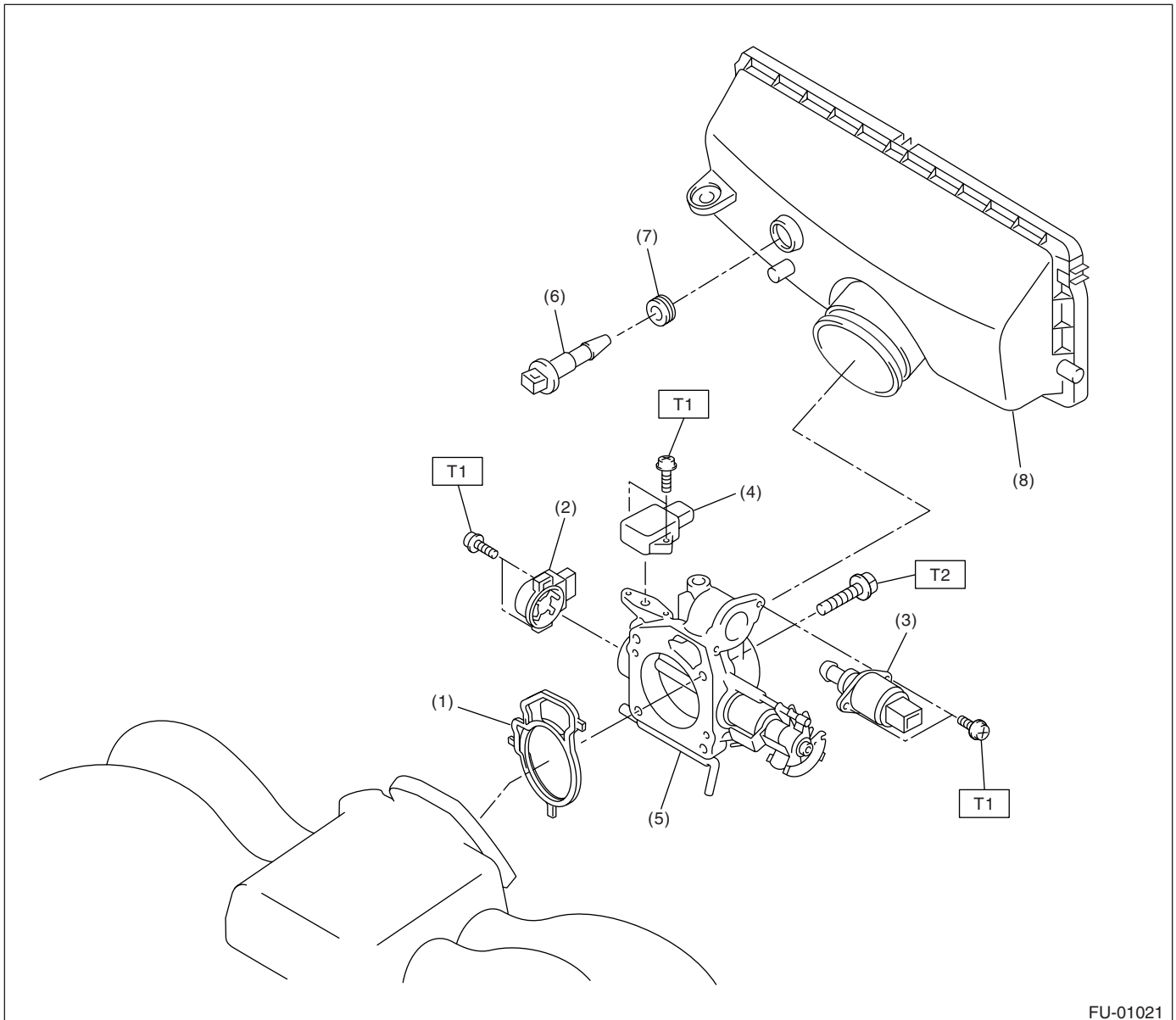
T2: 5.0 (0.51, 3.7)

T3: 17 (1.7, 12.5)

T4: 19 (1.9, 13.7)

T5: 25 (2.5, 18.1)

2. AIR INTAKE SYSTEM



FU-01021

(1) Gasket	(5) Throttle body
(2) Throttle position sensor	(6) Intake air temperature sensor
(3) Idle air control solenoid valve	(7) Grommet
(4) Manifold absolute pressure sensor	(8) Air cleaner case

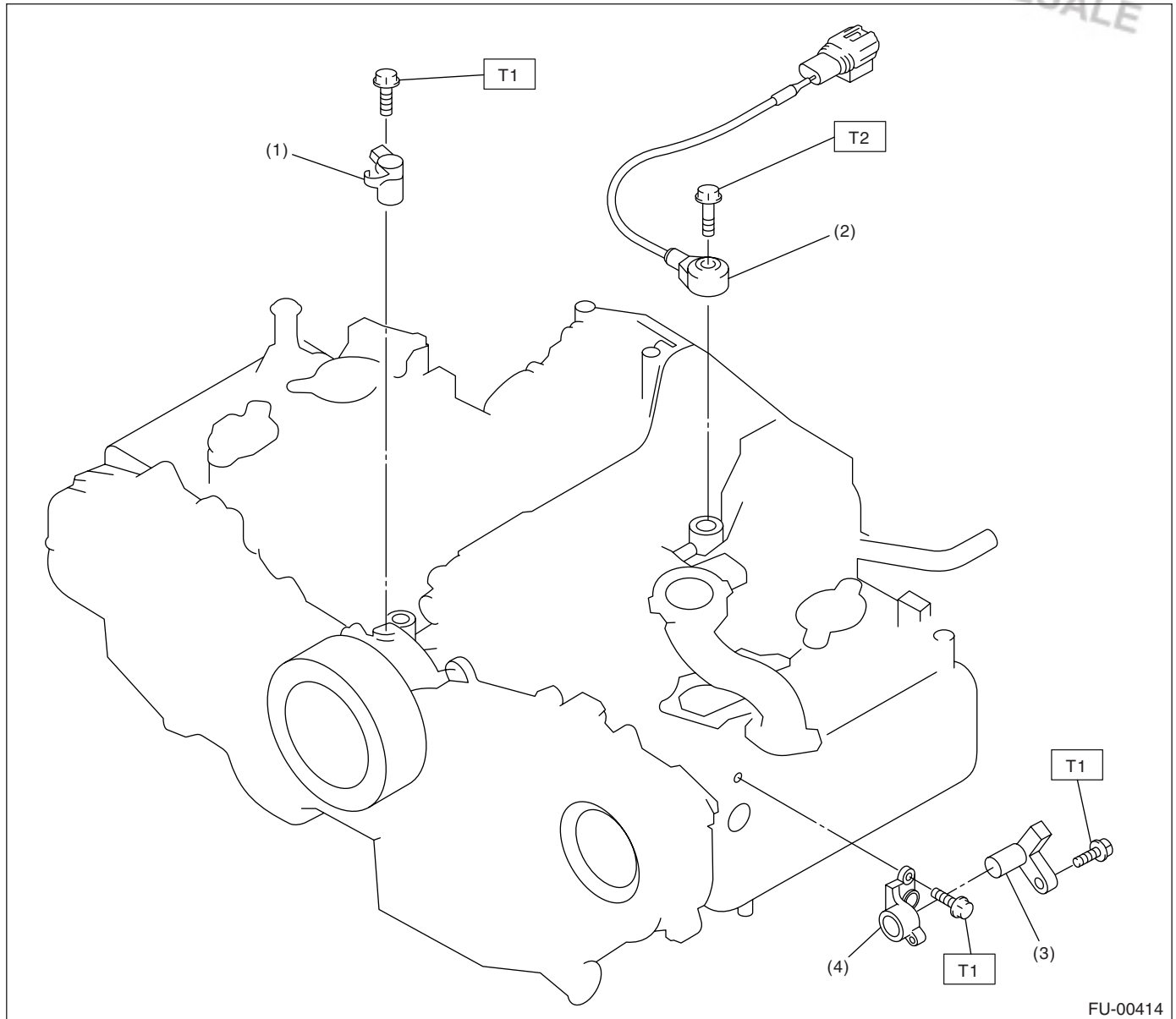
Tightening torque: N·m (kgf-m, ft-lb)

T1: 1.6 (0.16, 1.2)

T2: 22 (2.2, 15.9)

FU(H4SO)-4

3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



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

- (4) Camshaft position sensor support

Tightening torque: N·m (kgf-m, ft-lb)

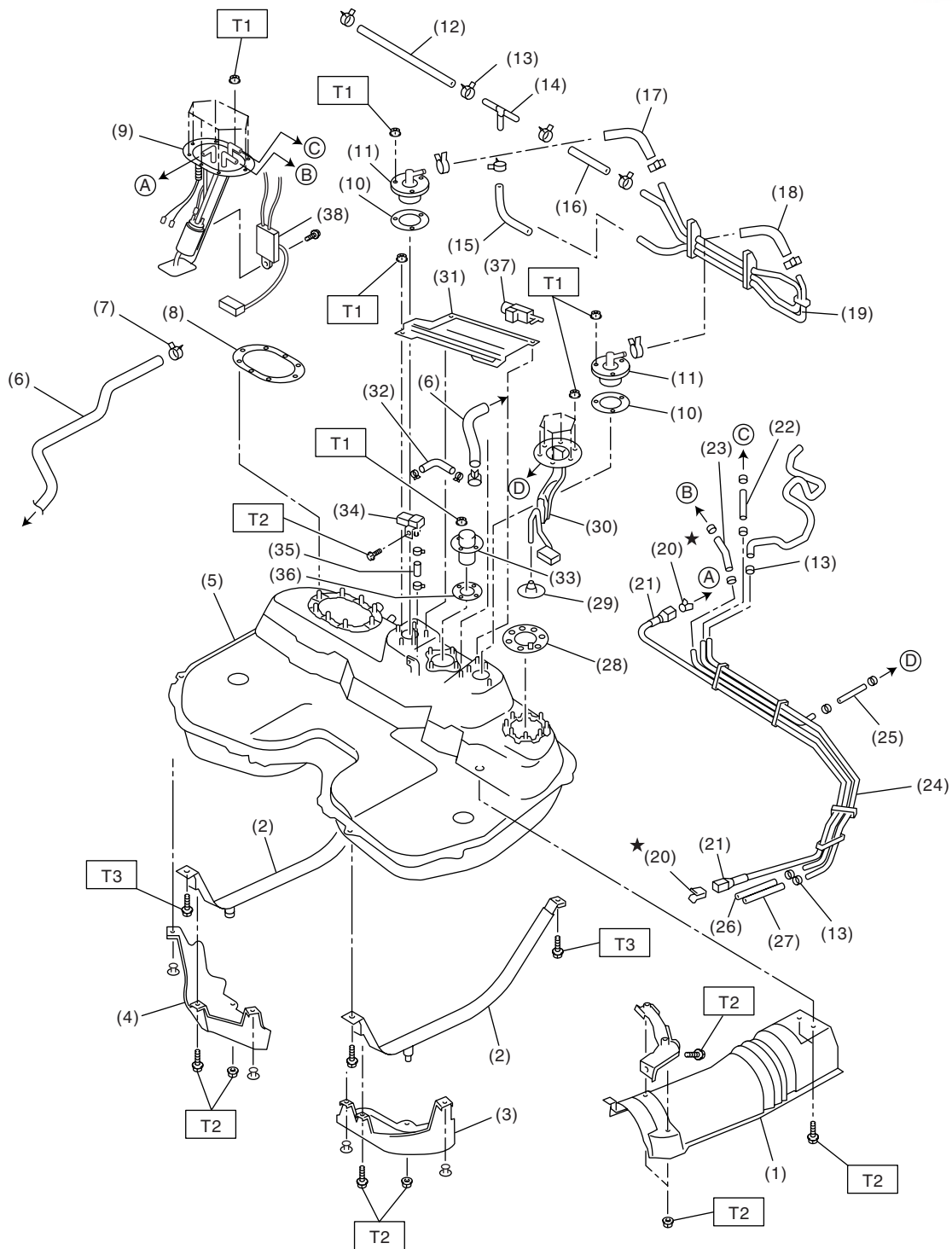
T1: 6.4 (0.65, 4.7)

T2: 24 (2.4, 17.4)

General Description

FUEL INJECTION (FUEL SYSTEMS)

4. FUEL TANK



FU-01030

FU(H4SO)-6

General Description

FUEL INJECTION (FUEL SYSTEMS)

(1) Heat shield cover	(16) Evaporation hose B	(31) Protector cover
(2) Fuel tank band	(17) Evaporation hose D	(32) Vent valve hose
(3) Protector LH	(18) Evaporation hose E	(33) Vent valve
(4) Protector RH	(19) Evaporation pipe assembly	(34) Fuel tank pressure sensor
(5) Fuel tank	(20) Retainer	(35) Fuel tank pressure sensor hose
(6) Canister hose A	(21) Quick connector	(36) Vent valve gasket
(7) Clamp	(22) Jet pump hose A	(37) Fuel tank sensor control valve
(8) Fuel pump gasket	(23) Fuel return hose A	(38) Fuel level sensor
(9) Fuel pump assembly	(24) Fuel pipe assembly	
(10) Fuel cut valve gasket	(25) Jet pump hose B	
(11) Fuel cut valve	(26) Fuel return hose B	
(12) Evaporation hose A	(27) Evaporation hose F	
(13) Clip	(28) Fuel sub level sensor gasket	
(14) Joint pipe	(29) Jet pump filter	
(15) Evaporation hose C	(30) Fuel sub level sensor	

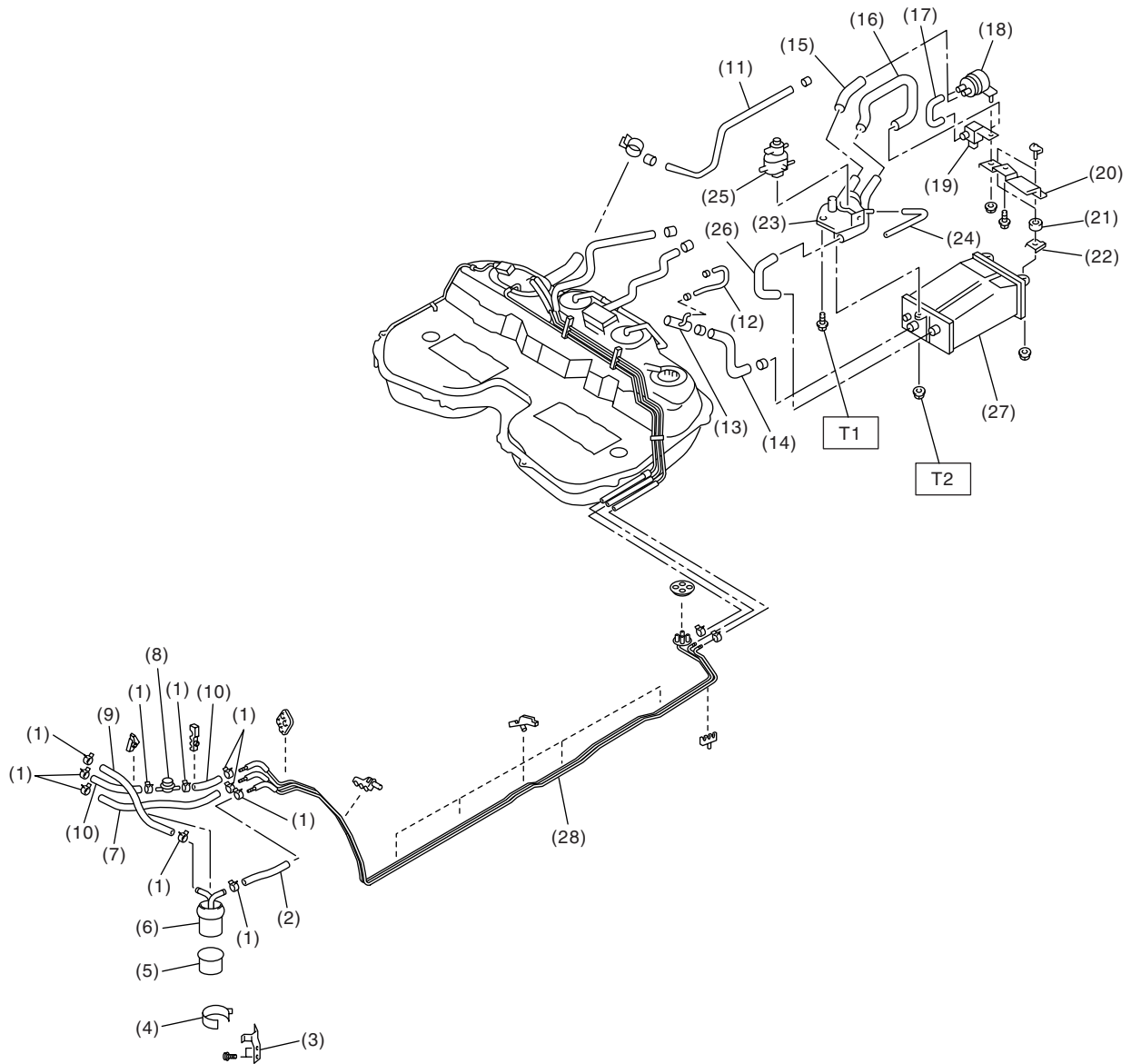
Tightening torque: N·m (kgf-m, ft-lb)

T1: 4.4 (0.45, 3.3)

T2: 7.4 (0.75, 5.4)

T3: 33 (3.4, 25)

5. FUEL LINE



FU-00250

General Description

FUEL INJECTION (FUEL SYSTEMS)

(1) Clip	(12) Evaporation hose B
(2) Fuel delivery hose A	(13) Joint pipe
(3) Fuel filter bracket	(14) Canister hose A
(4) Fuel filter holder	(15) Drain filter hose A
(5) Fuel filter cup	(16) Drain valve hose
(6) Fuel filter	(17) Drain filter hose B
(7) Evaporation hose	(18) Drain filter
(8) Fuel damper	(19) Drain valve
(9) Fuel delivery hose B	(20) Canister upper bracket
(10) Fuel return hose	(21) Cushion rubber
(11) Evaporation hose A	(22) Canister lower bracket

- | |
|--------------------------------------|
| (23) Canister holder |
| (24) Evaporation hose C |
| (25) Pressure control solenoid valve |
| (26) Canister hose B |
| (27) Canister |
| (28) Fuel pipe assembly |

Tightening torque: N·m (kgf-m, ft-lb)

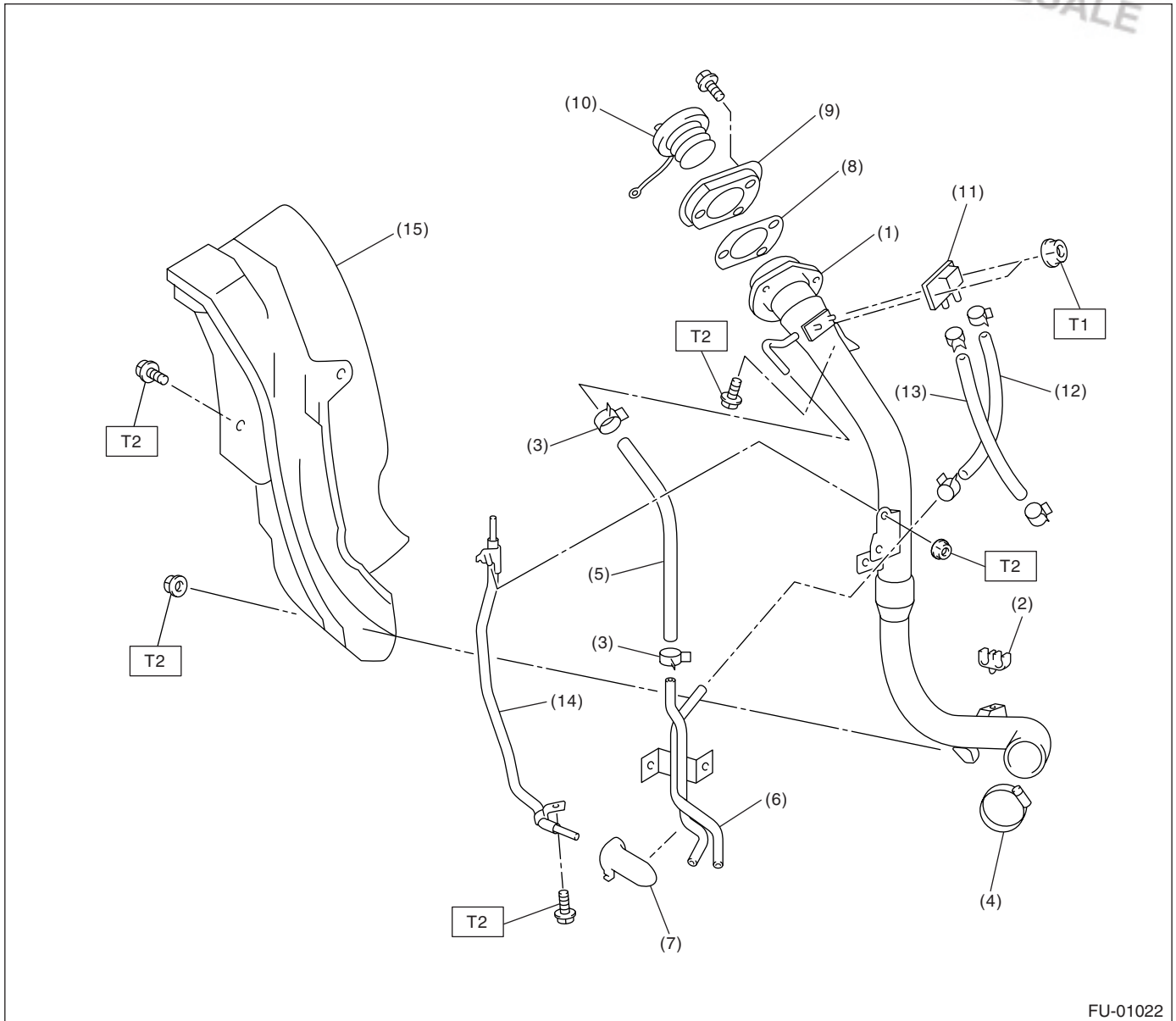
T1: 25 (2.5, 18.1)

T2: 23 (2.3, 16.6)

General Description

FUEL INJECTION (FUEL SYSTEMS)

6. FUEL FILLER PIPE



- (1) Fuel filler pipe ASSY
- (2) Evaporation hose holder
- (3) Clamp
- (4) Clamp
- (5) Evaporation hose A
- (6) Evaporation pipe
- (7) Evaporation pipe holder

- (8) Filler pipe packing
- (9) Filler ring
- (10) Filler cap
- (11) Shut valve
- (12) Evaporation hose B
- (13) Evaporation hose C
- (14) Joint pipe

- (15) Fuel filler pipe protector

Tightening torque: N·m (kgf·m, ft·lb)

T1: 4.4 (0.45, 3.3)

T2: 7.5 (0.76, 5.53)

General Description

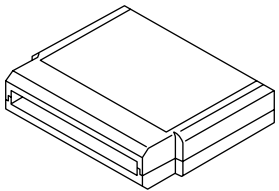
FUEL INJECTION (FUEL SYSTEMS)

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.

- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Place "NO FIRE" signs near the working area.
- Be careful not to spill fuel on the floor.

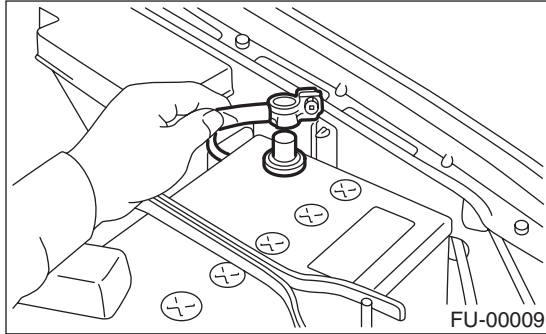
D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA230	24082AA230	CARTRIDGE	Troubleshooting for electrical systems.
 ST22771AA030	22771AA030	SUBARU SELECT MONITOR KIT	Troubleshooting for electrical systems.

2. Throttle Body

A: REMOVAL

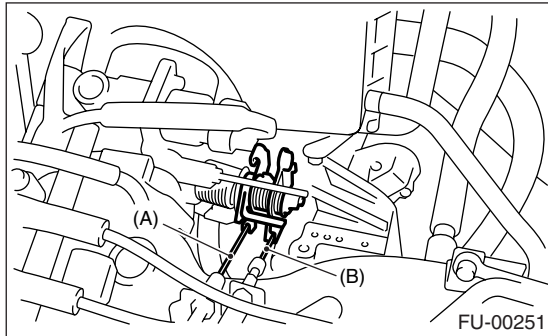
1) Disconnect the ground cable from battery.



2) Remove the air cleaner case. <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>

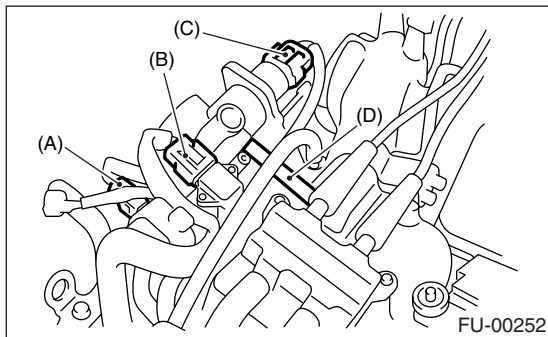
3) Disconnect the accelerator cable (A).

4) Disconnect the cruise control cable (B). (Model with cruise control)



5) Disconnect the connectors from idle air control solenoid valve, throttle position sensor and manifold absolute pressure sensor.

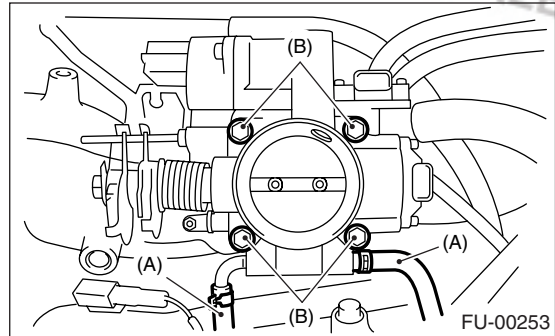
6) Disconnect the air by-pass hose from the throttle body.



- (A) Throttle position sensor
- (B) Manifold absolute pressure sensor
- (C) Idle air control solenoid valve
- (D) Air by-pass hose

7) Disconnect the engine coolant hoses (A) from the throttle body.

8) Remove the bolts (B) which install throttle body to the intake manifold.



B: INSTALLATION

1) Install in the reverse order of removal.

NOTE:

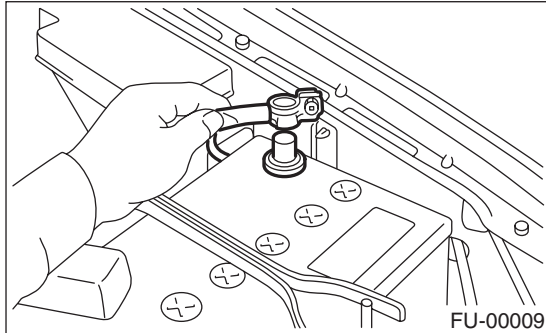
For tightening torque, refer to "COMPONENT". <Ref. to FU(H4SO)-3, COMPONENT, General Description.>

2) Adjust the accelerator cable play. <Ref. to SP(H4SO)-6, INSTALLATION, Accelerator Control Cable.>

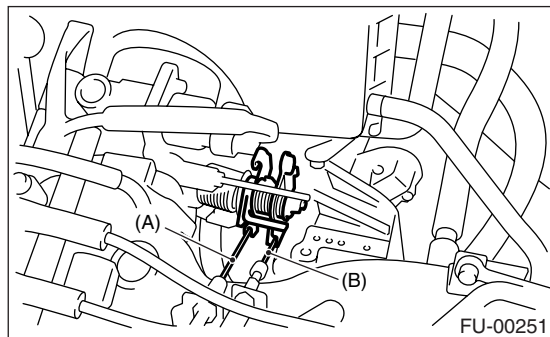
3. Intake Manifold

A: REMOVAL

- 1) Release fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Open the fuel flap lid, and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.



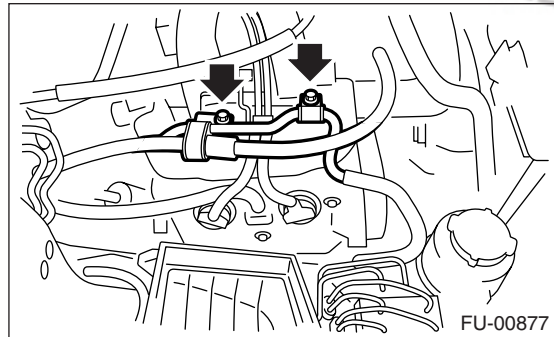
- 4) Remove the air intake duct and air cleaner case. <Ref. to IN(H4SO)-6, REMOVAL, Air Intake Duct.> A <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>
- 5) Disconnect the accelerator cable (A).
- 6) Disconnect the cruise control cable (B). (vehicles with cruise control)



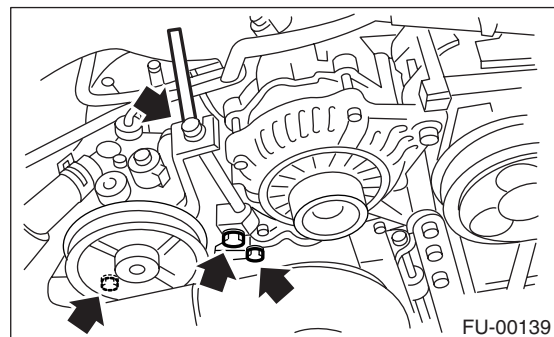
- 7) Remove the power steering pump and reservoir tank from bracket.
 - (1) Remove the resonator chamber. <Ref. to IN(H4SO)-7, REMOVAL, Resonator Chamber.>
 - (2) Remove the front side V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
 - (3) Remove the bolts which hold power steering pipes onto the intake manifold protector.

NOTE:

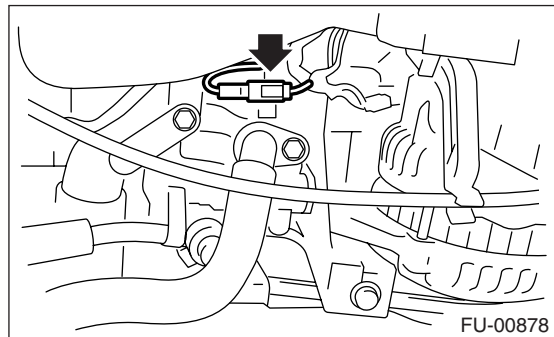
Do not disconnect the power steering hose.



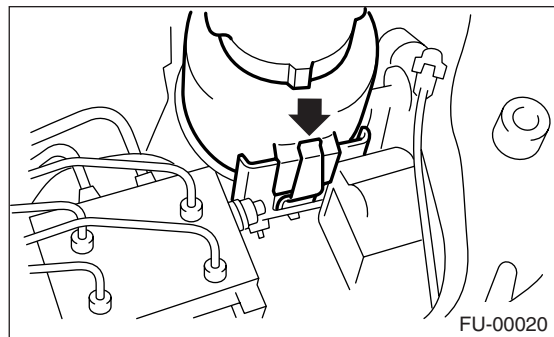
- (4) Remove the bolts which install power steering pump bracket.



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



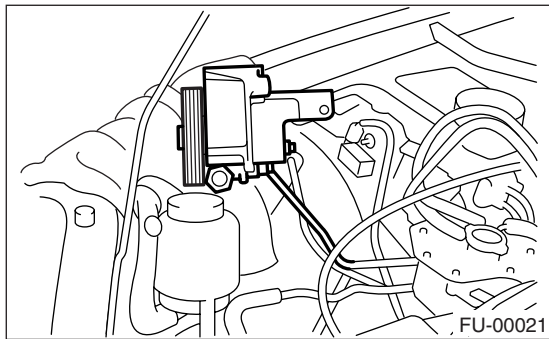
- (6) Remove the reservoir tank from the bracket by pulling it upwards.



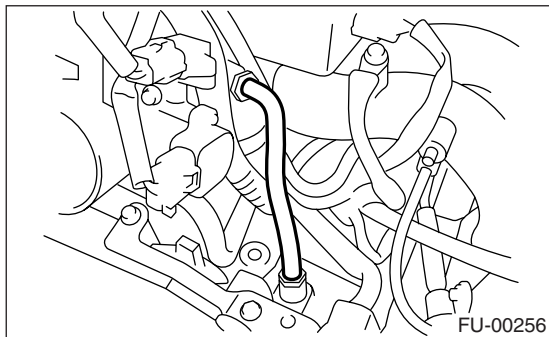
Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

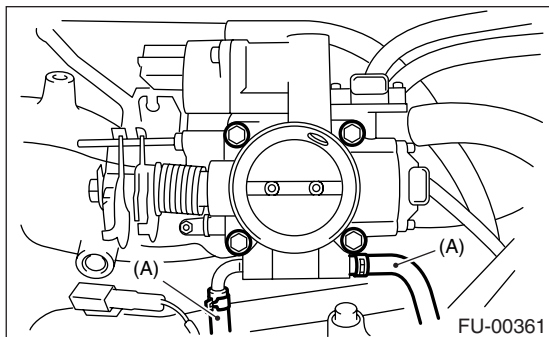
- (7) Place the power steering pump on the right side wheel apron.



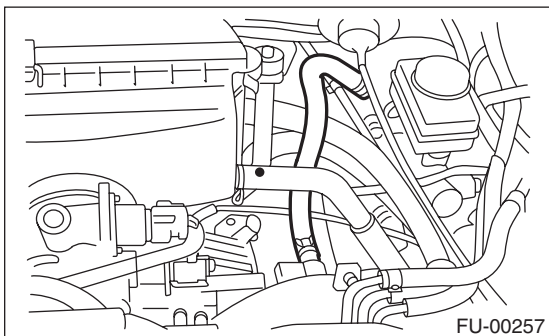
- 8) Disconnect the spark plug cords from the spark plugs.
9) Disconnect the PCV hose from the intake manifold.



- 10) Disconnect the engine coolant hoses (A) from the throttle body.



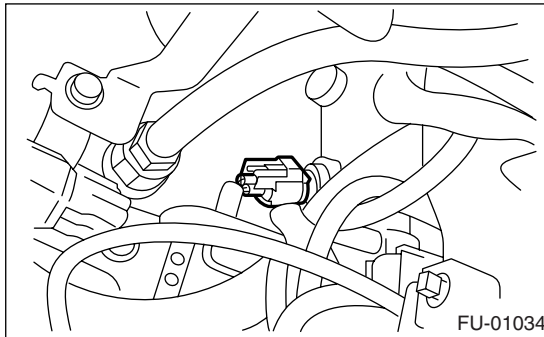
- 11) Disconnect the brake booster hose.



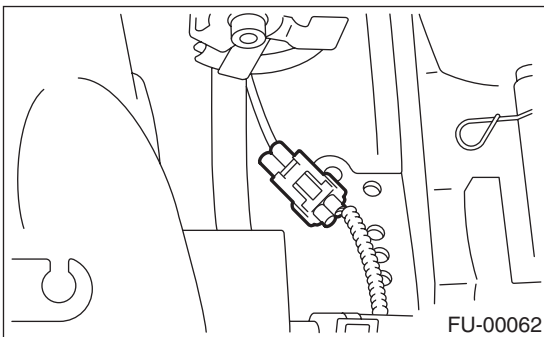
- 12) Remove the air cleaner case stay RH and engine harness bracket, and disconnect the engine harness connectors from the bulkhead harness connectors.



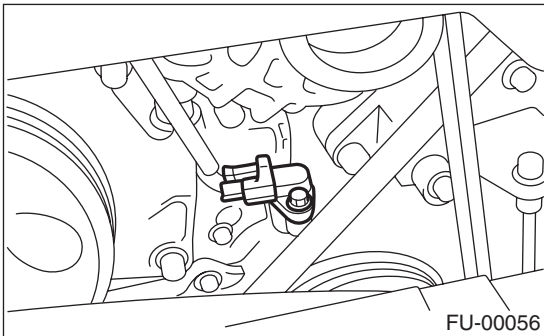
- 13) Disconnect the connector from engine coolant temperature sensor.



- 14) Disconnect the knock sensor connector.



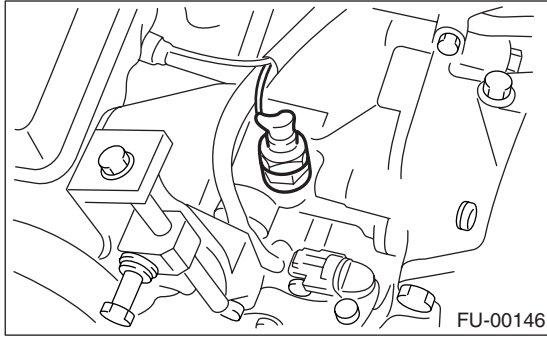
- 15) Disconnect the connector from crankshaft position sensor.



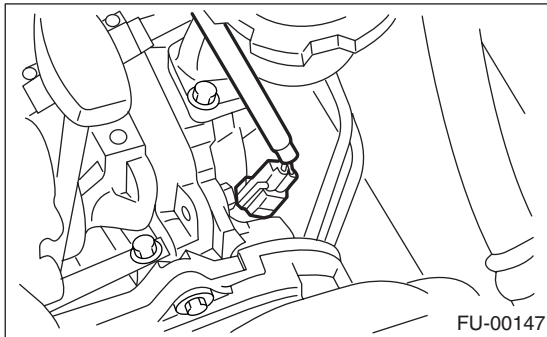
Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

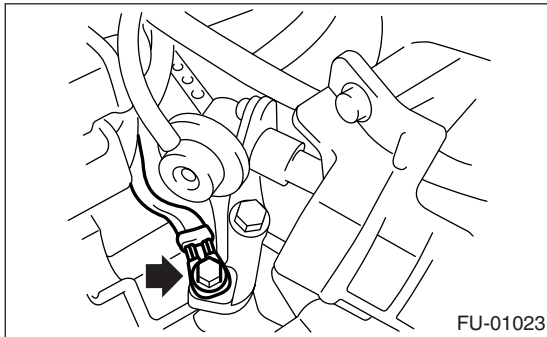
16) Disconnect the connector from oil pressure switch.



17) Disconnect the connector from the camshaft position sensor.



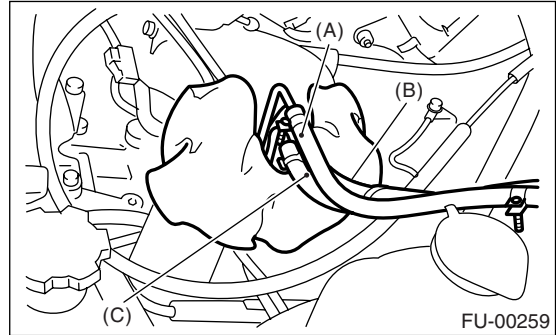
18) Disconnect the engine ground terminal from ground stay.



19) Disconnect the fuel hoses from the fuel pipes.

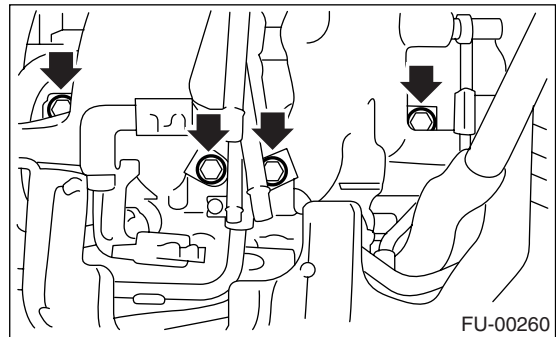
WARNING:

- Do not spill fuel.
- Catch fuel from hoses in a container or cloth.



- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

20) Remove the bolts which hold intake manifold onto the cylinder heads.



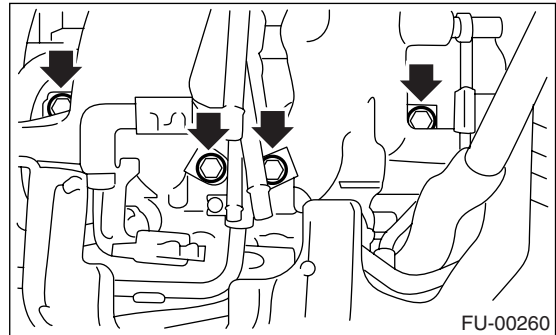
21) Remove the intake manifold.

B: INSTALLATION

1) Install the intake manifold onto the cylinder heads.

Tightening torque:

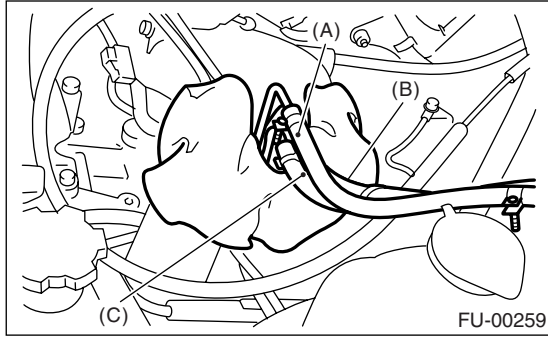
25 N·m (2.5 kgf-m, 18.1 ft-lb)



Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

2) Connect the fuel hoses.

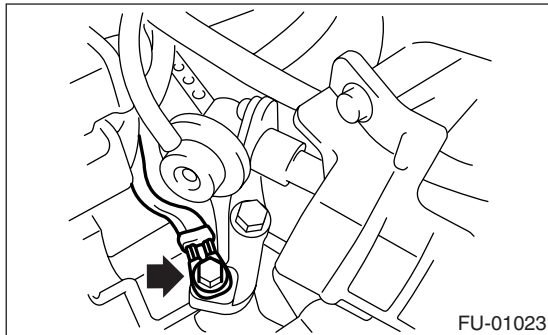


- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

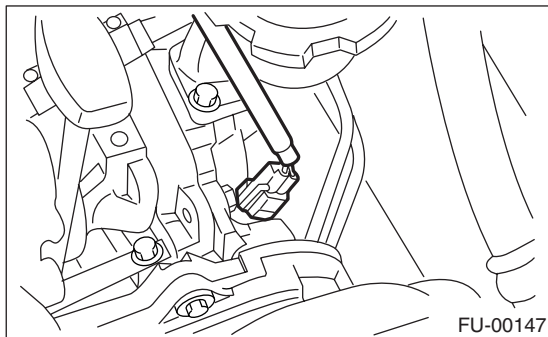
3) Connect the engine ground terminal to ground stay.

Tightening torque:

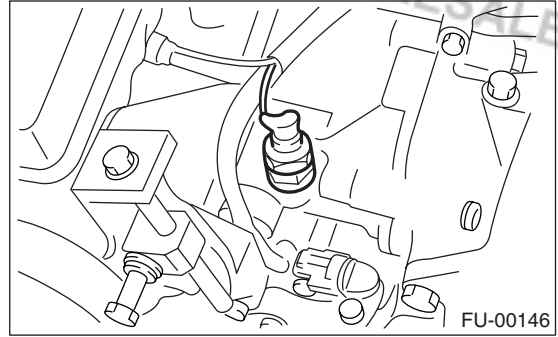
19 N·m (1.9 kgf-m, 13.7 ft-lb)



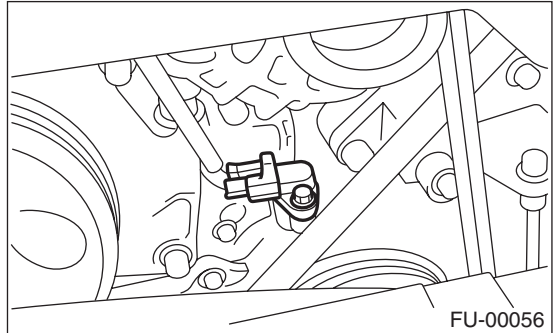
4) Connect the connector to the camshaft position sensor.



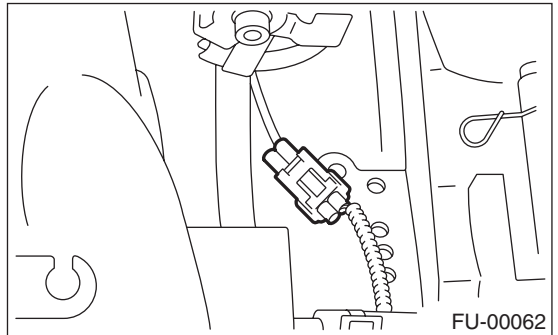
5) Connect the connector to the oil pressure switch.



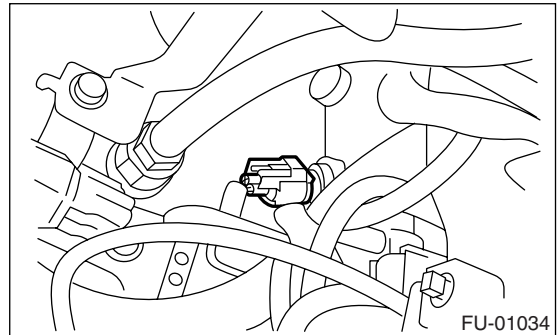
6) Connect the connector to the crankshaft position sensor.



7) Connect the knock sensor connector.



8) Connect the connectors to the engine coolant temperature sensor.



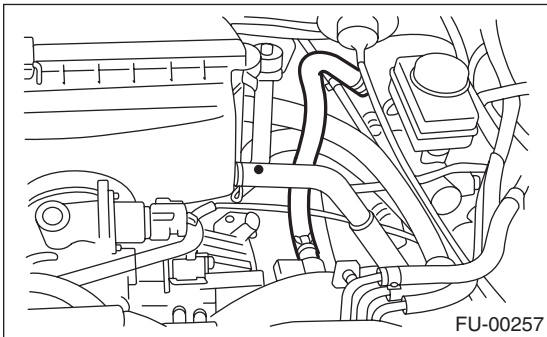
Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

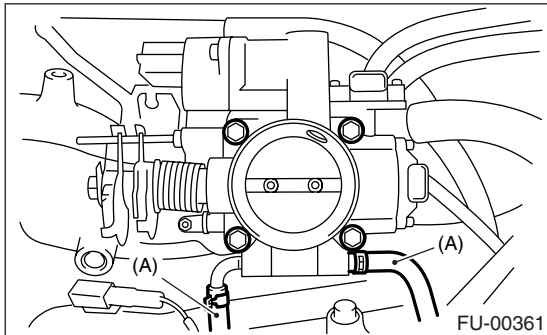
9) Install the air cleaner case stay RH and engine harness bracket, and connect the engine harness connectors to the bulkhead connectors.



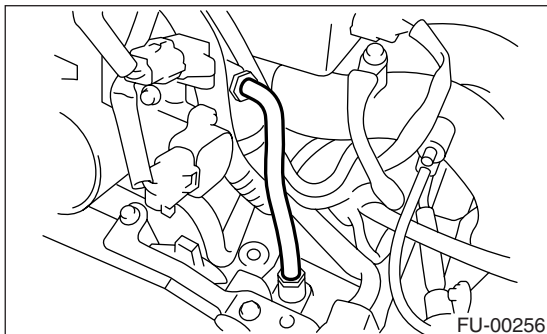
10) Connect the brake booster hose.



11) Connect the engine coolant hose (A) to the throttle body.



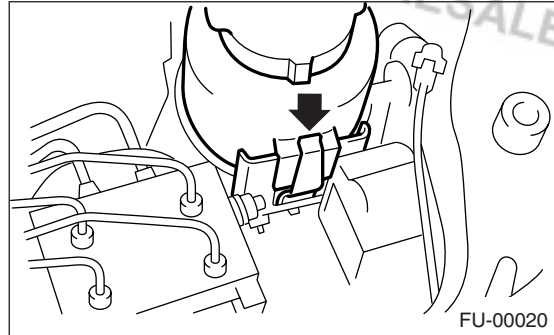
12) Connect the PCV hose to the intake manifold.



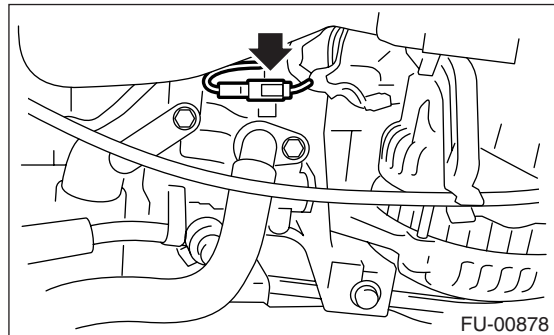
13) Connect the spark plug cords to the spark plugs.

14) Install the power steering pump and reservoir tank to bracket.

(1) Install the reservoir tank to bracket.



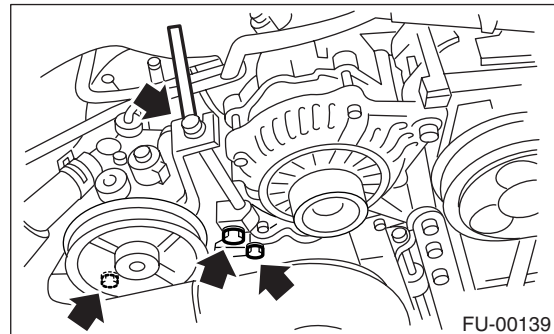
(2) Connect the connector to the power steering pump switch.



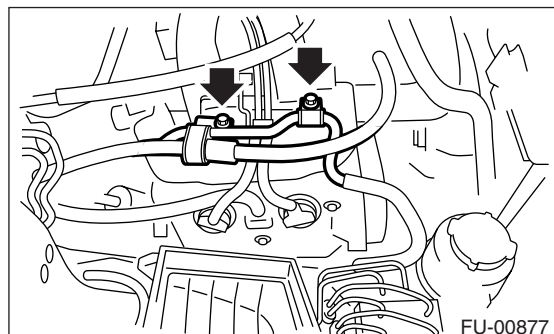
(3) Tighten the bolts which install power steering pump bracket.

Tightening torque:

22 N·m (2.2 kgf-m, 15.9 ft-lb)



(4) Install the power steering pipes onto the right side intake manifold protector.



(5) Install the front side V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

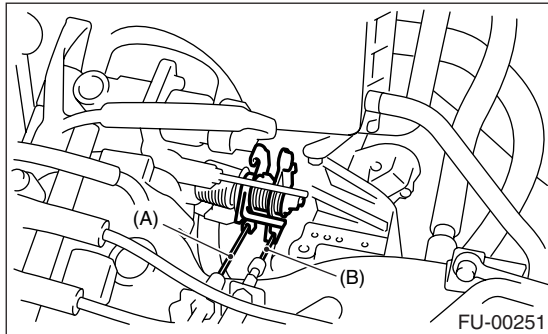
Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

(6) Install the resonator chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Resonator Chamber.>

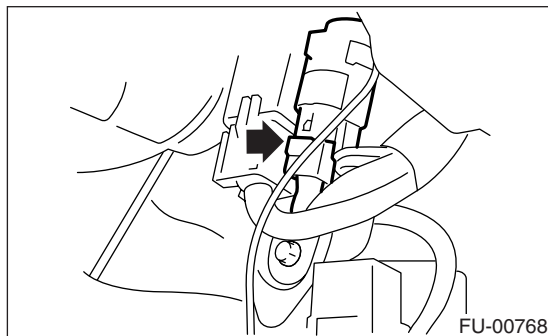
15) Connect the accelerator cable (A).

16) Connect the cruise control cable (B). (Model with cruise control)

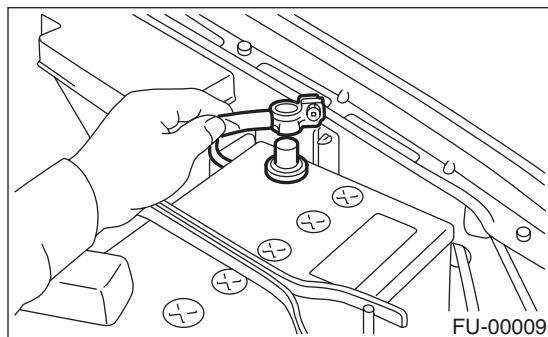


17) Install the air intake duct and air cleaner case. <Ref. to IN(H4SO)-6, INSTALLATION, Air Intake Duct.>, <Ref. to IN(H4SO)-5, INSTALLATION, Air Cleaner Case.>

18) Connect the connector to the fuel pump relay.



19) Connect the battery ground cable to battery.



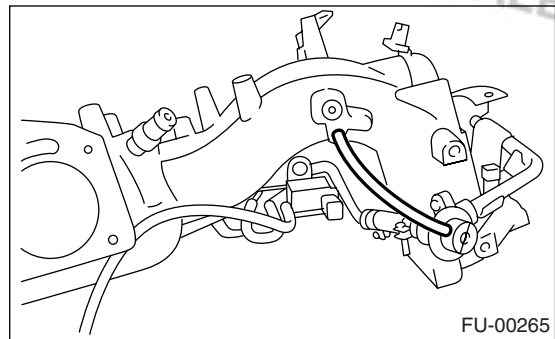
C: DISASSEMBLY

1) Remove the ignition coil & ignitor ASSY. <Ref. to IG(H4SO)-7, REMOVAL, Ignition Coil & Ignitor ASSY.>

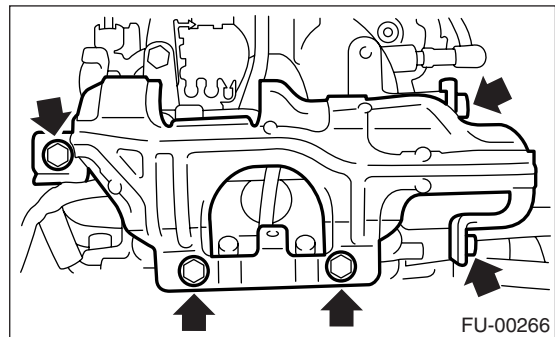
2) Remove the throttle body. <Ref. to FU(H4SO)-12, REMOVAL, Throttle Body.>

3) Remove the air assist injector solenoid valve from the intake manifold. <Ref. to FU(H4SO)-33, REMOVAL, Air Assist Injector Solenoid Valve.>

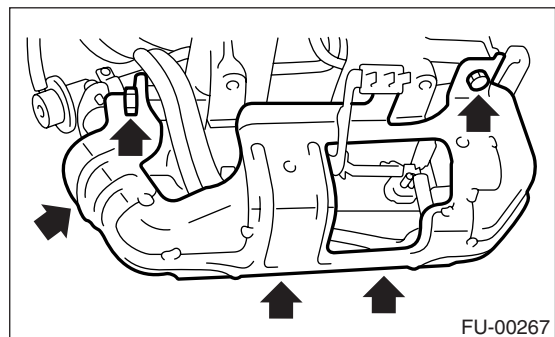
4) Disconnect the pressure regulator vacuum hose from the intake manifold.



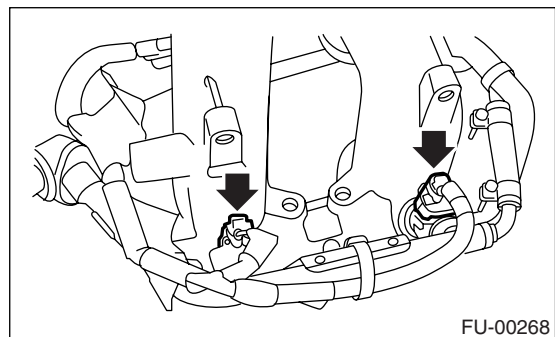
5) Remove the fuel pipe protector LH.



6) Remove the fuel pipe protector RH.



7) Disconnect the connectors from the fuel injectors.

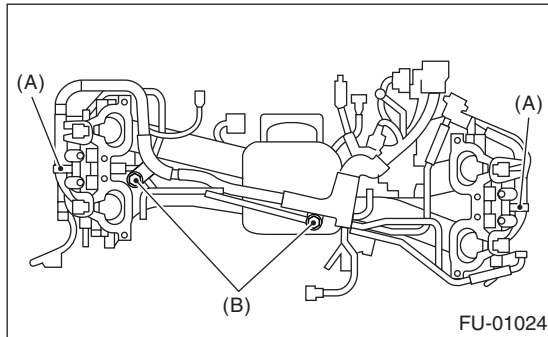


8) Disconnect the purge control solenoid valve. <Ref. to EC(H4SO)-6, REMOVAL, Purge Control Solenoid Valve.>

Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

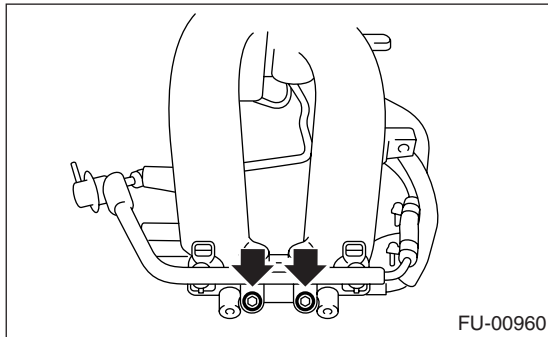
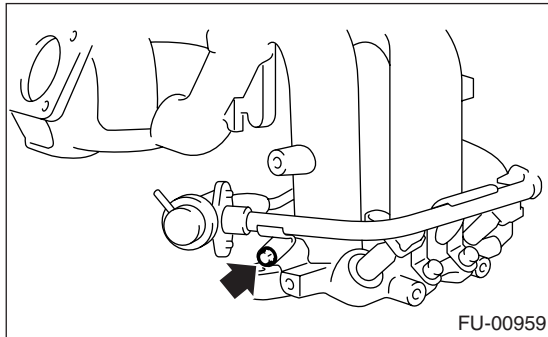
9) Remove the harness bands (A) and bolts (B) which hold the engine harness onto intake manifold.



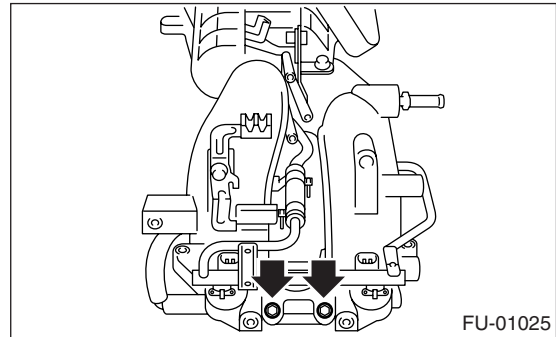
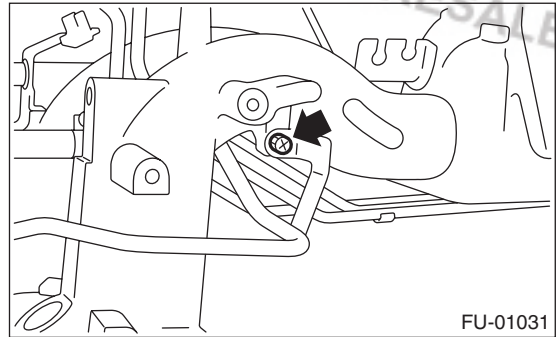
10) Remove the engine harness from the intake manifold.

11) Remove the bolt which installs injector pipe on the intake manifold as shown in figure.

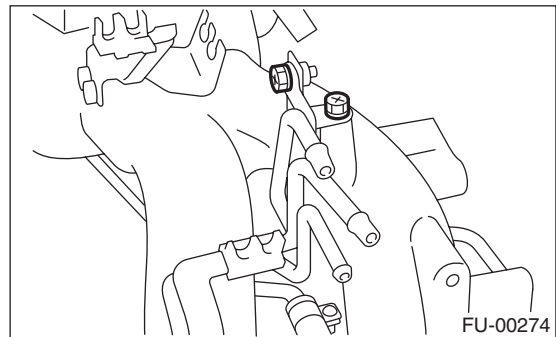
• RH SIDE



• LH SIDE

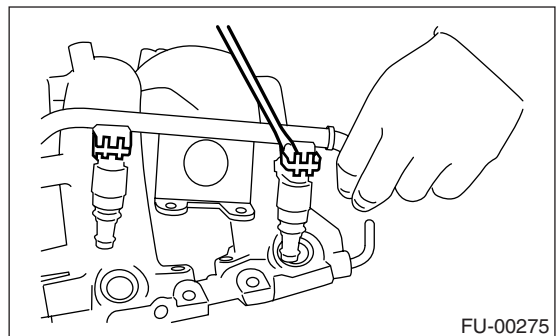


12) Remove the two bolts which hold fuel pipes on the left side of intake manifold.



13) Remove the fuel injector.

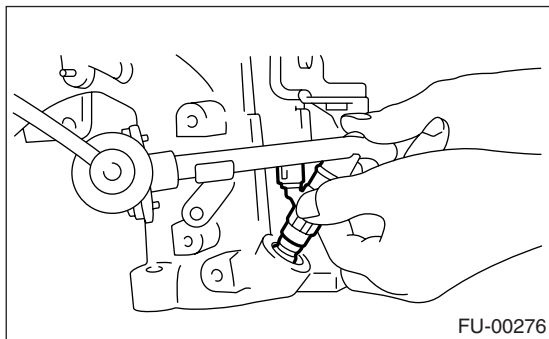
(1) Remove the fuel injector securing clip.



Intake Manifold

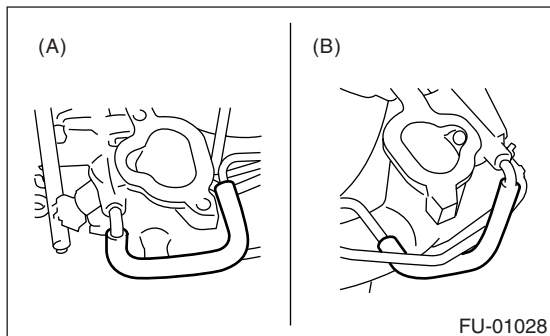
FUEL INJECTION (FUEL SYSTEMS)

- (2) Remove the fuel injector while lifting up the fuel injector pipe.



FU-00276

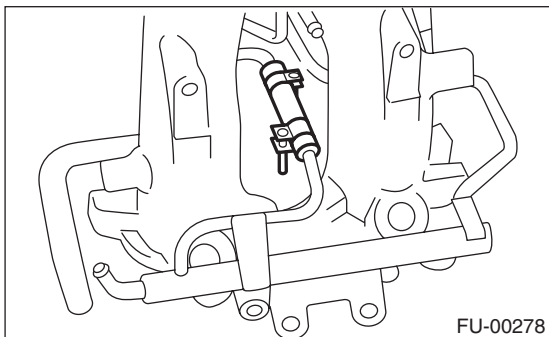
- 14) Disconnect the air by-pass hoses from the intake manifold.



FU-01028

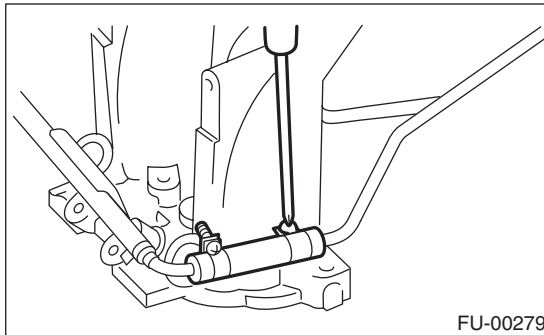
- (A) LH side
(B) RH side

- 15) Loosen the clamp which holds the fuel injector pipe LH to fuel hose, and then remove the fuel injector pipe LH from fuel hose.



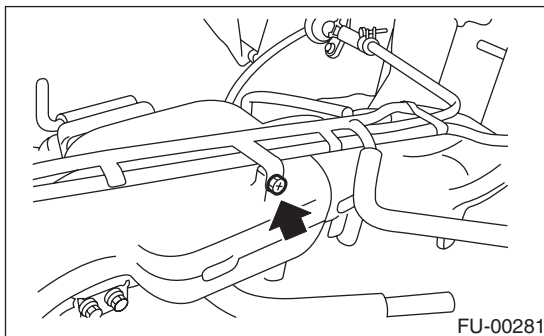
FU-00278

- 16) Loosen the clamp which holds the fuel injector pipe RH to fuel hose, and then remove the fuel injector pipe RH from fuel hose.



FU-00279

- 17) Remove the fuel injector pipe.
18) Remove the bolt which installs the fuel pipes on the intake manifold.



FU-00281

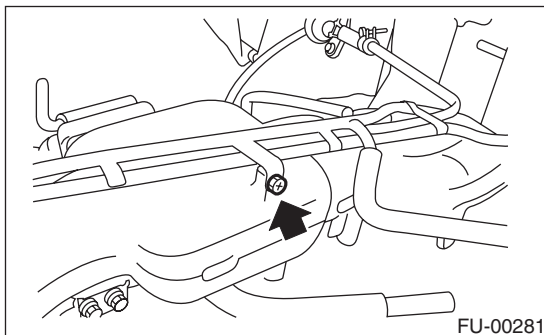
- 19) Remove the fuel pipe assembly and pressure regulator, from the intake manifold.

D: ASSEMBLY

- 1) Install the fuel pipe assembly and pressure regulator to the intake manifold.
2) Tighten the bolt which installs the fuel pipes on the intake manifold.

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



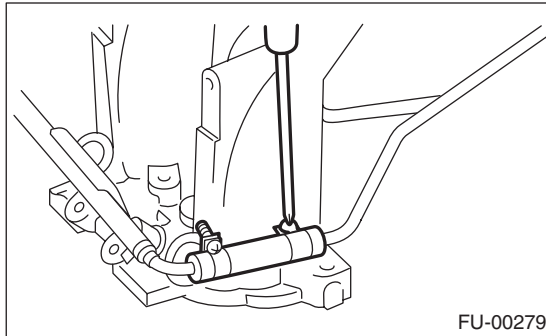
FU-00281

- 3) Install the fuel injector pipe.

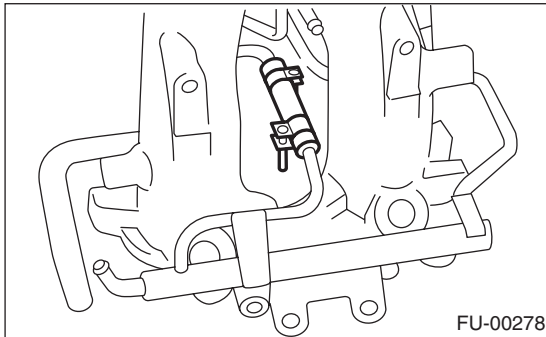
Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

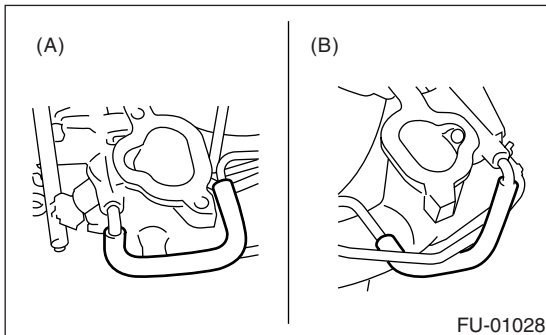
- 4) Connect the fuel injector pipe RH to fuel hose, and then tighten the clamp screw.



- 5) Connect the fuel injector pipe LH to fuel hose, and then tighten the clamp screw.



- 6) Connect the air by-pass hoses.

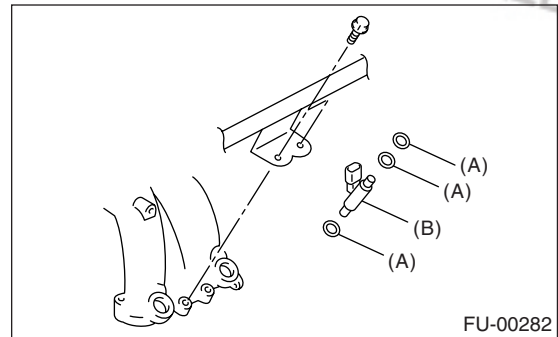


- (A) LH side
(B) RH side

- 7) Install the fuel injectors.

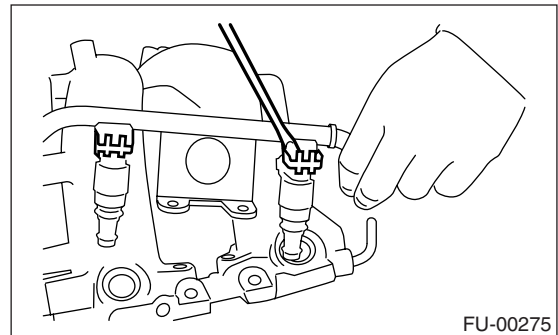
NOTE:

- Replace the O-rings with new ones.



- (A) O-ring
(B) Fuel injector

- Do not forget to install the fuel injector securing clip.

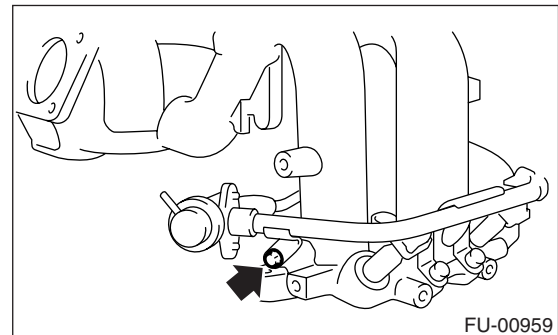


- 8) Tighten the bolt which installs the injector pipe on the intake manifold.

• RH SIDE

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

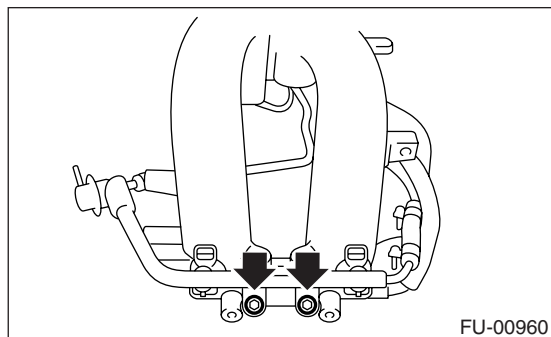


Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

Tightening torque:

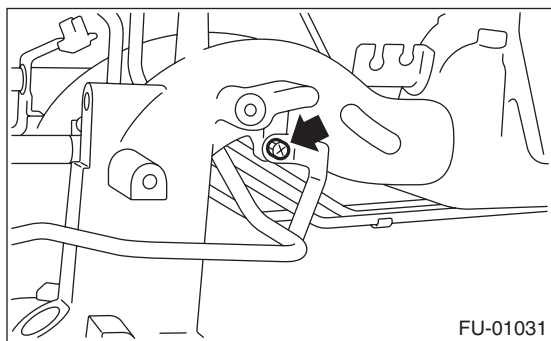
19 N·m (1.9 kgf-m, 13.7 ft-lb)



• LH SIDE

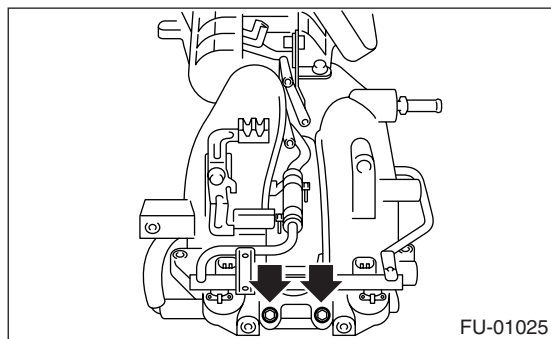
Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



Tightening torque:

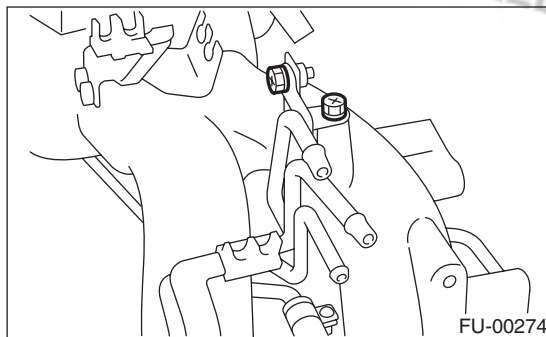
19 N·m (1.9 kgf-m, 13.7 ft-lb)



9) Tighten the two bolts which install the fuel pipes on intake manifold.

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

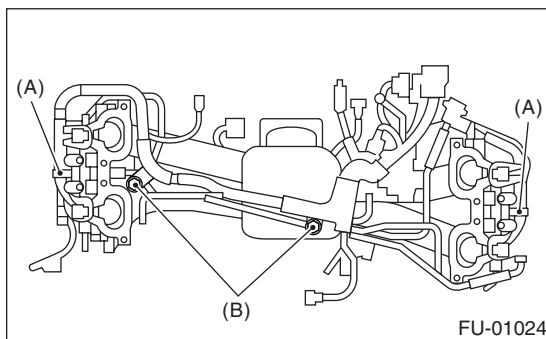


10) Install the engine harness onto the intake manifold.

11) Hold the engine harness by harness band (A) and bolts (B).

Tightening torque:

16 N·m (1.6 kgf-m, 11.8 ft-lb)

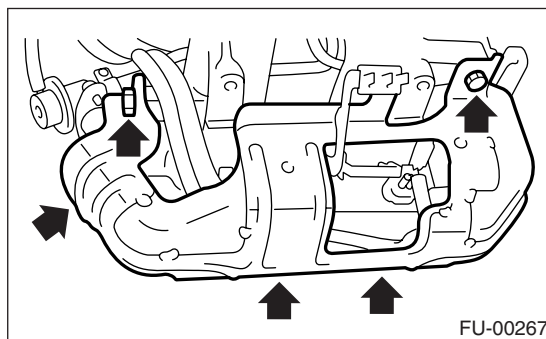


12) Connect the connector to fuel injector

13) Install the fuel pipe protector RH.

Tightening torque:

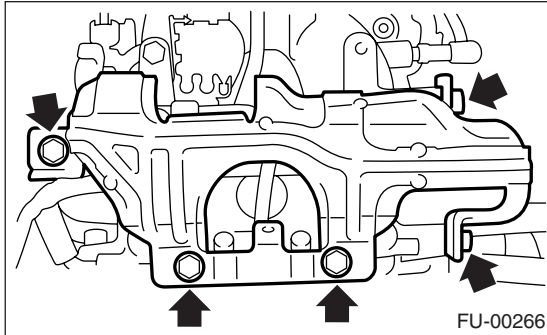
19 N·m (1.9 kgf-m, 13.7 ft-lb)



14) Install the fuel pipe protector LH.

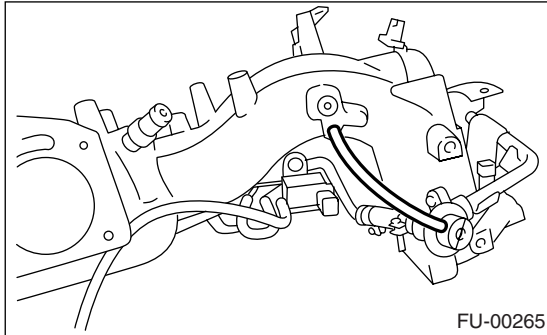
Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



15) Install the purge control solenoid valve. <Ref. to EC(H4SO)-6, INSTALLATION, Purge Control Solenoid Valve.>

16) Connect the pressure regulator vacuum hose to the intake manifold.



17) Install the air assist injector solenoid valve to the bracket. <Ref. to FU(H4SO)-33, INSTALLATION, Air Assist Injector Solenoid Valve.>

18) Install the throttle body to the intake manifold. <Ref. to FU(H4SO)-12, INSTALLATION, Throttle Body.>

19) Install the ignition coil & ignitor ASSY. <Ref. to IG(H4SO)-7, INSTALLATION, Ignition Coil & Ignitor ASSY.>

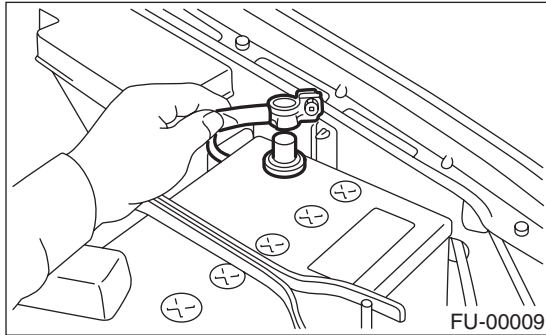
E: INSPECTION

Make sure the fuel pipe and fuel hoses are not cracked and that connections are tight.

4. Engine Coolant Temperature Sensor

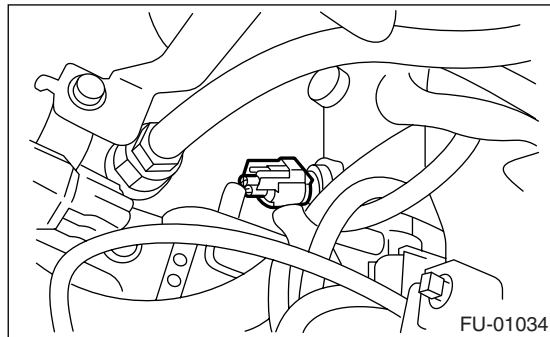
A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Remove the air intake duct and air cleaner assembly. <Ref. to IN(H4SO)-6, REMOVAL, Air Intake Duct.>, <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>

- 3) Disconnect the connector from engine coolant temperature sensor.



- 4) Remove the engine coolant temperature sensor.

B: INSTALLATION

Install in the reverse order of removal.

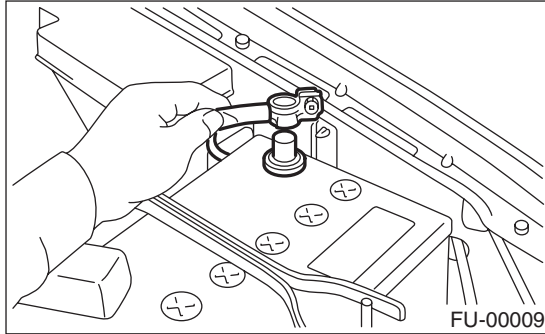
Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

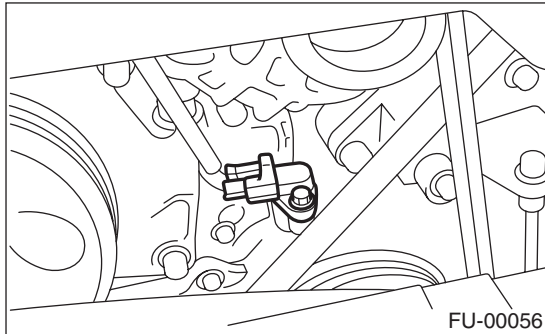
5. Crankshaft Position Sensor

A: REMOVAL

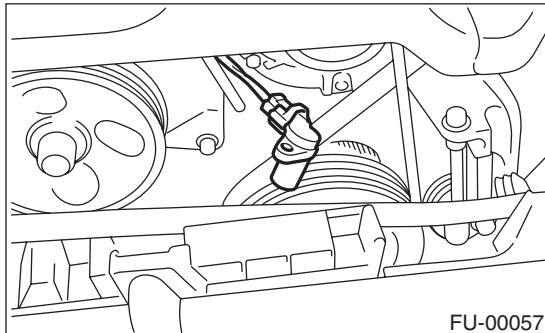
1) Disconnect the ground cable from battery.



2) Remove the bolt which install crankshaft position sensor to the cylinder block.



3) Remove the crankshaft position sensor, and disconnect the connector from the sensor.



B: INSTALLATION

Install in the reverse order of removal.

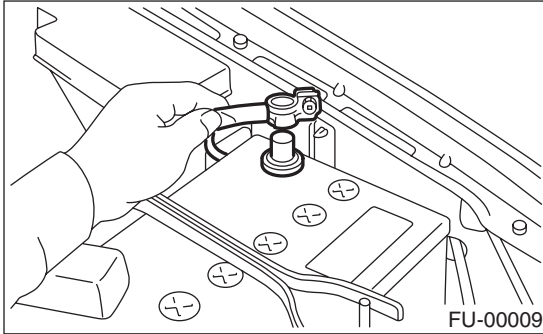
NOTE:

For tightening torque, refer to "COMPONENT".
<Ref. to FU(H4SO)-3, COMPONENT, General Description.>

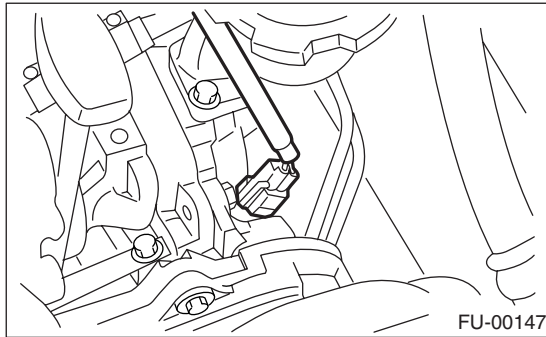
6. Camshaft Position Sensor

A: REMOVAL

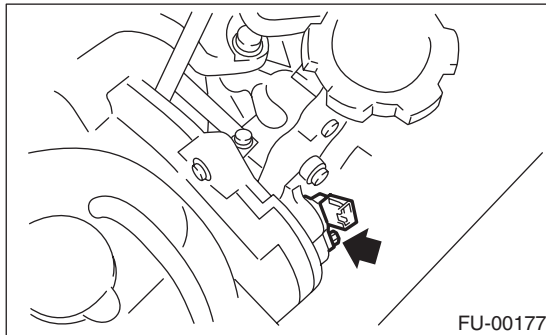
1) Disconnect the ground cable from battery.



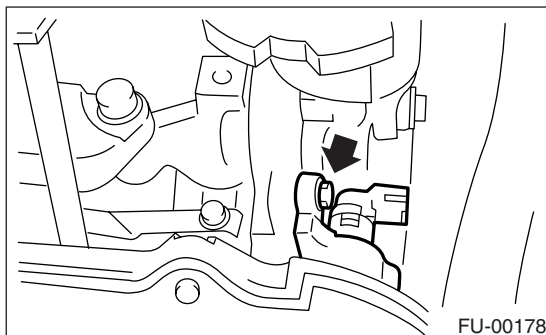
2) Disconnect the connector from the camshaft position sensor.



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

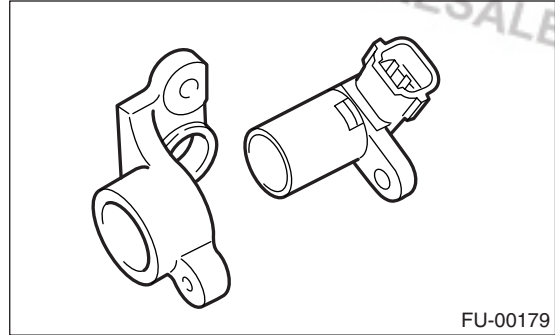


4) Remove the bolt which installs camshaft position sensor support to the camshaft cap LH.



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

6) Remove the camshaft position sensor itself.



B: INSTALLATION

Install in the reverse order of removal.

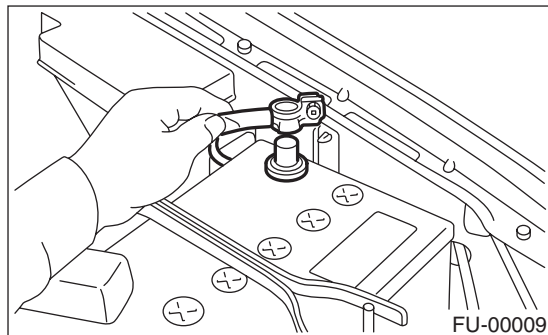
NOTE:

For tightening torque, refer to "COMPONENT".
<Ref. to FU(H4SO)-3, COMPONENT, General Description.>

7. Knock Sensor

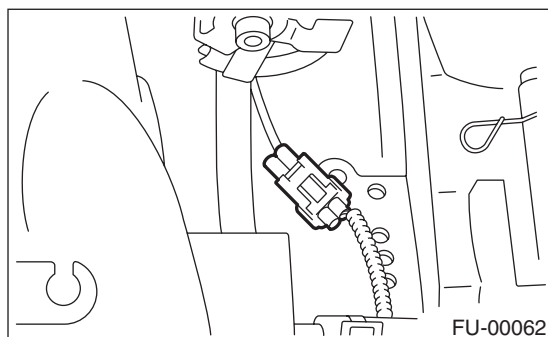
A: REMOVAL

- 1) Disconnect the ground cable from battery.

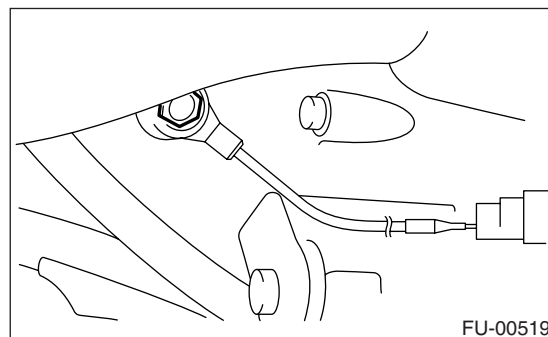


- 2) Remove the air cleaner case. <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>

- 3) Disconnect the knock sensor connector.



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

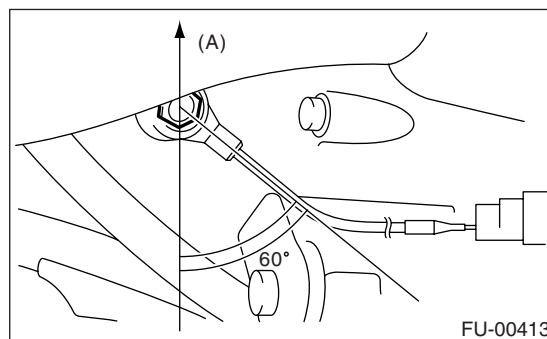


B: INSTALLATION

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

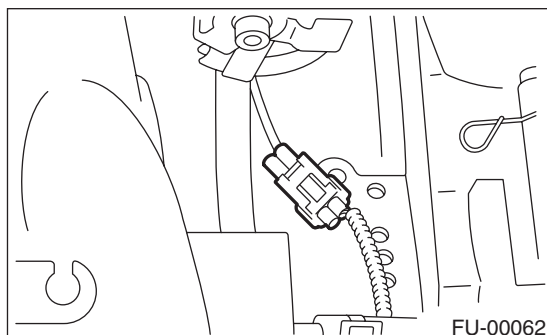
NOTE:

- The extraction area of the knock sensor cord must be positioned at a 60° angle relative to the engine rear.
- For tightening torque, refer to "COMPONENT". <Ref. to FU(H4SO)-3, COMPONENT, General Description.>



(A) Front

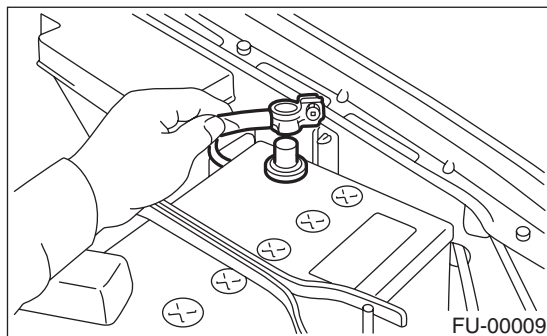
- 2) Connect the knock sensor connector.



- 3) Install the air cleaner case.

<Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>

- 4) Connect the battery ground cable to battery.



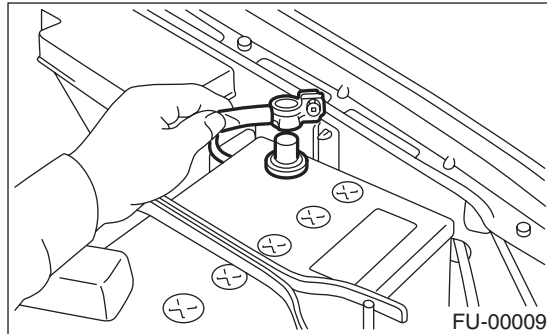
Throttle Position Sensor

FUEL INJECTION (FUEL SYSTEMS)

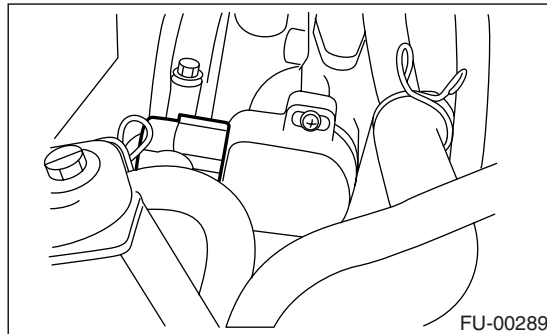
8. Throttle Position Sensor

A: REMOVAL

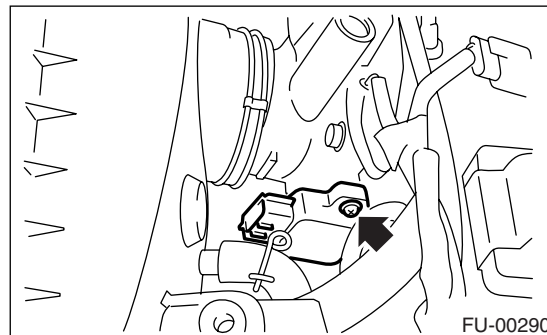
- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connectors from throttle position sensor.



- 3) Remove the throttle position sensor holding screws, and remove it.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

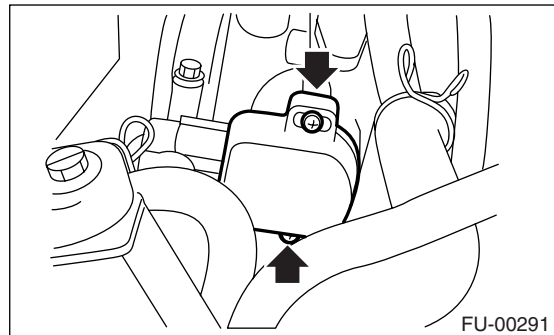
For tightening torque, refer to "COMPONENT".
<Ref. to FU(H4SO)-3, COMPONENT, General Description.>

CAUTION:

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

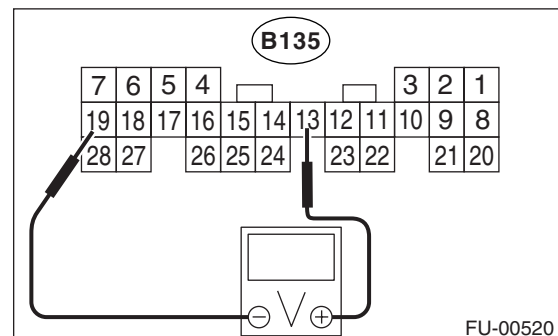
C: ADJUSTMENT

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



- 3) When using a voltmeter;
 - (1) Take out the ECM.
 - (2) Turn the ignition switch to ON.
 - (3) Adjust the throttle position sensor to the proper position to allow the voltage signal to the ECM to be in specification.

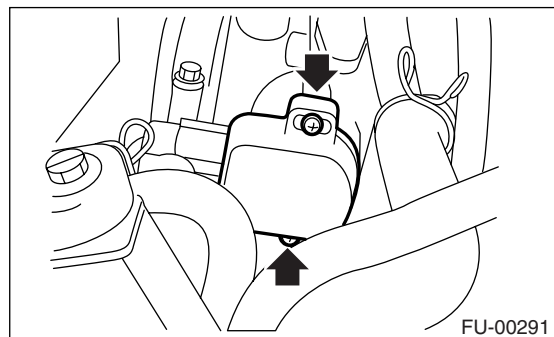
Connector & terminal / Specified voltage
(B135) No. 13 (+) — (B135) No. 19 (–) / 0.45 — 0.55 V
[Fully closed.]



- (4) Tighten the throttle position sensor holding screws.

Tightening torque:

1.6 N·m (0.16 kgf-m, 1.2 ft-lb)

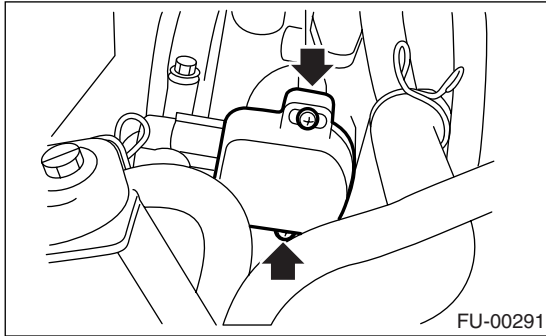


- 4) When using Subaru Select Monitor;
 - (1) Turn the ignition switch to OFF.

Throttle Position Sensor

FUEL INJECTION (FUEL SYSTEMS)

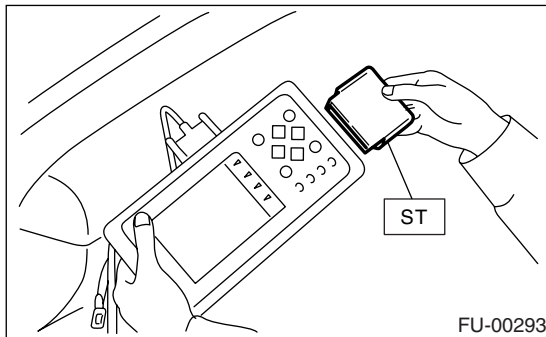
- (2) Loosen the throttle position sensor holding screws.



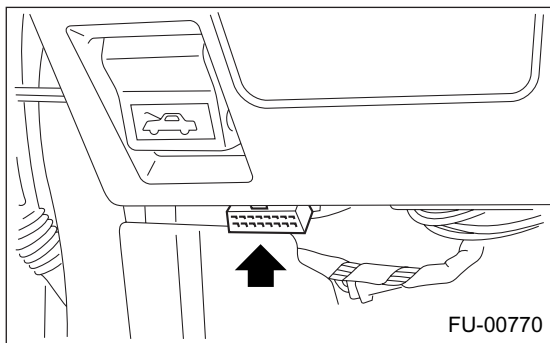
NOTE:

For detailed operation procedures, refer to the Subaru Select Monitor Operation Manual.

- (3) Insert the cartridge to the Subaru Select Monitor.



- (4) Connect the Subaru Select Monitor to the data link connector.



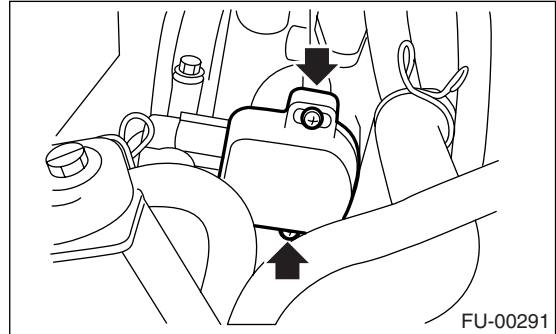
- (5) Turn the ignition switch to ON, and the Subaru Select Monitor switch to ON.
(6) Select {2. Each System Check} in Main Menu.
(7) Select {Engine Control System} in Selection Menu.
(8) Select {1. Current Data Display & Save} in Engine Control System Diagnosis.
(9) Select {1.12 Data Display} in Data Display Menu.
(10) Adjust the throttle position sensor to the proper position to match with the following specifications.

Condition: Throttle fully closed
Throttle opening angle 0.00%
Throttle sensor voltage 0.50 V

- (11) Tighten the throttle position sensor holding screws.

Tightening torque:

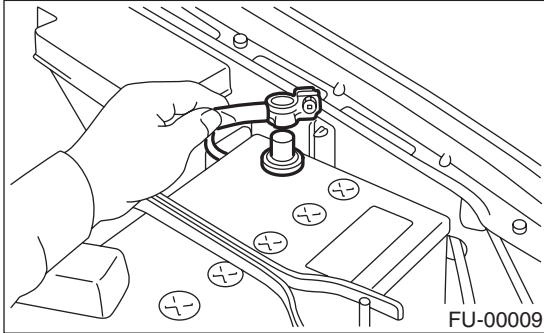
1.6 N·m (0.16 kgf-m, 1.2 ft-lb)



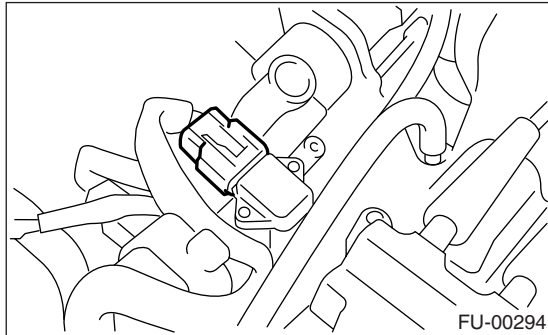
9. Manifold Absolute Pressure Sensor

A: REMOVAL

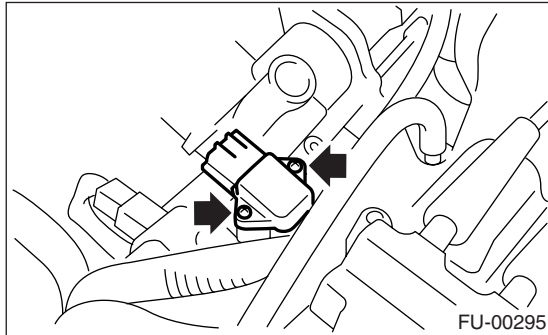
- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from the manifold absolute pressure sensor.



- 3) Remove the manifold absolute pressure sensor.



B: INSTALLATION

Install in the reverse order of removal.

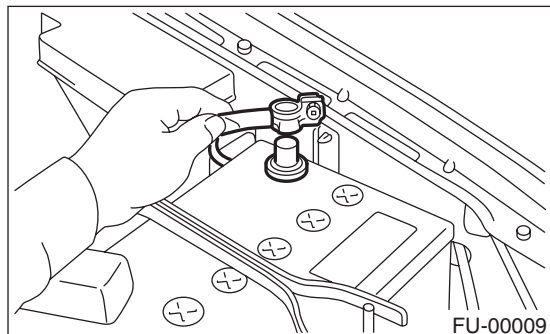
NOTE:

- Replace the O-rings with new ones.
 - For tightening torque, refer to "COMPONENT".
- <Ref. to FU(H4SO)-3, COMPONENT, General Description.>

10. Intake Air Temperature Sensor

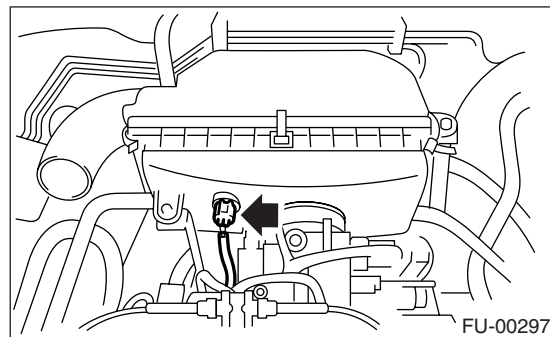
A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from intake air temperature sensor.

- 3) Remove the intake air temperature sensor from air cleaner case.



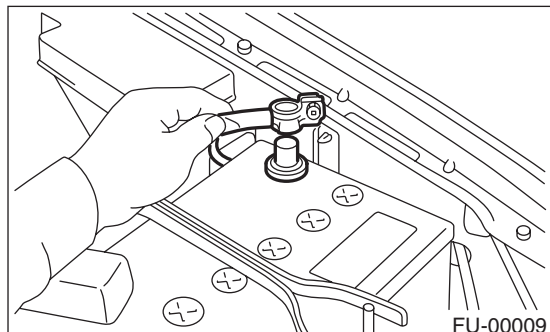
B: INSTALLATION

Install in the reverse order of removal.

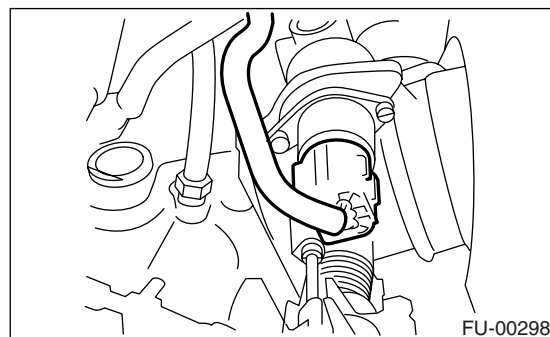
11.Idle Air Control Solenoid Valve

A: REMOVAL

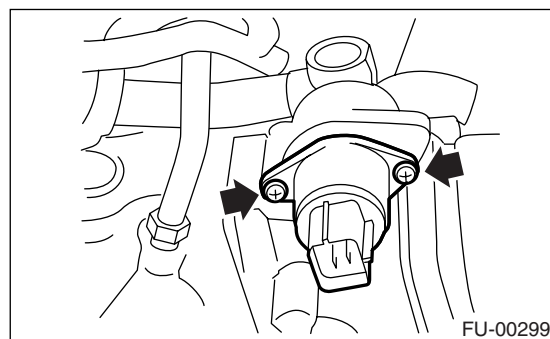
1) Disconnect the ground cable from battery.



2) Disconnect the connector from idle air control solenoid valve.



3) Remove the idle air control solenoid valve from throttle body.



B: INSTALLATION

Install in the reverse order of removal.

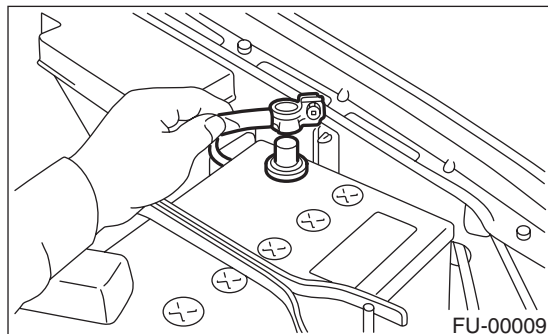
NOTE:

- Replace the gaskets with new ones.
 - For tightening torque, refer to "COMPONENT".
- <Ref. to FU(H4SO)-3, COMPONENT, General Description.>

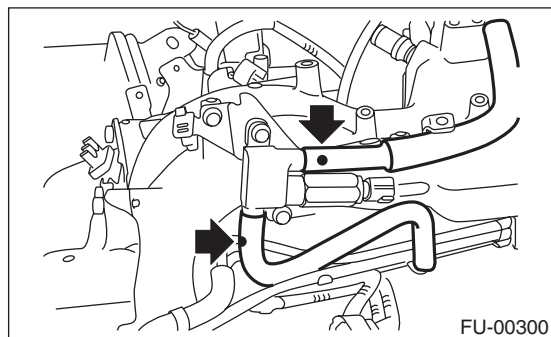
12. Air Assist Injector Solenoid Valve

A: REMOVAL

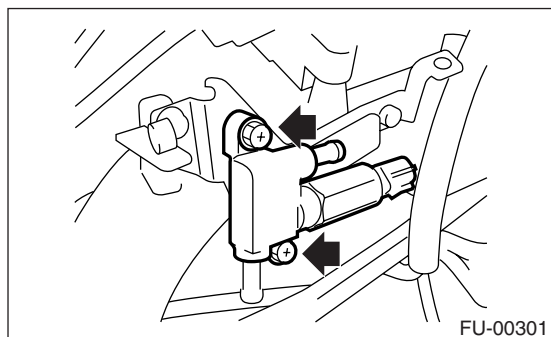
1) Disconnect the ground cable from battery.



2) Disconnect the connector from the air assist injector solenoid valve and disconnect the air bypass hoses.



3) Remove the air assist injector solenoid valve from the intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

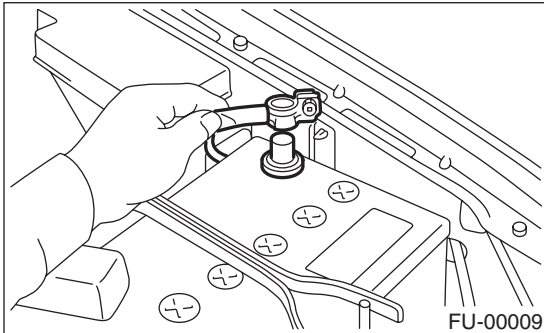
For tightening torque, refer to "COMPONENT".
<Ref. to FU(H4SO)-3, COMPONENT, General Description.>

13. Fuel Injector

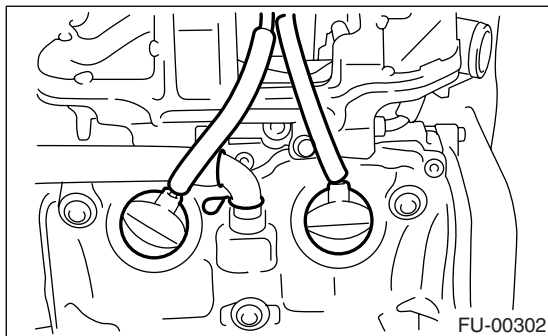
A: REMOVAL

1. RH SIDE

- 1) Release fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Open the fuel flap lid, and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.

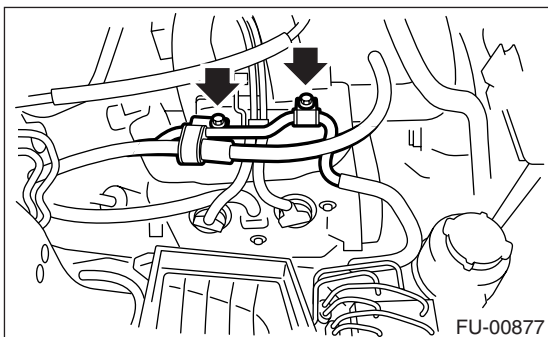


- 4) Remove the resonator chamber. <Ref. to IN(H4SO)-7, REMOVAL, Resonator Chamber.>
- 5) Remove the spark plug cords from the spark plugs (#1 and #3 cylinders).

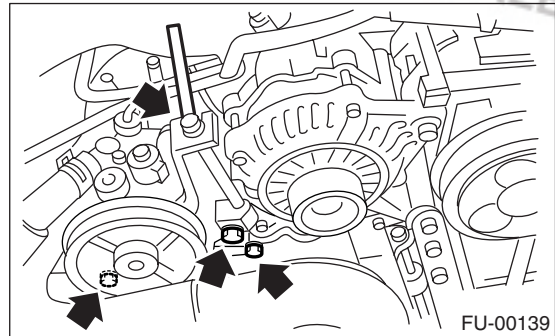


- 6) Remove the power steering pump and tank from the brackets.

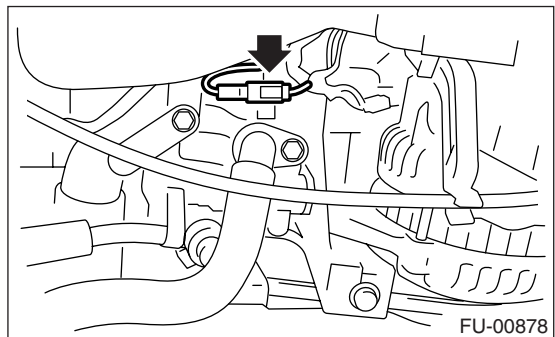
- (1) Remove the front side V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- (2) Remove the bolts which hold the power steering pipes onto the intake manifold protector.



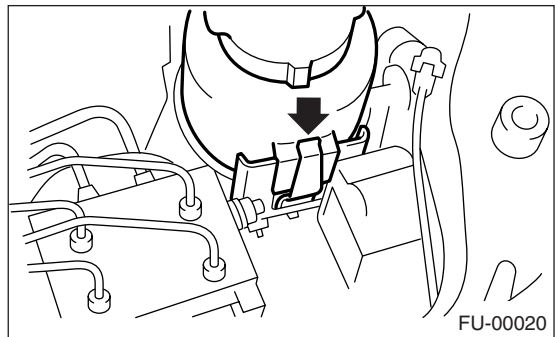
- (3) Remove the bolts which install the power steering pump to the bracket.



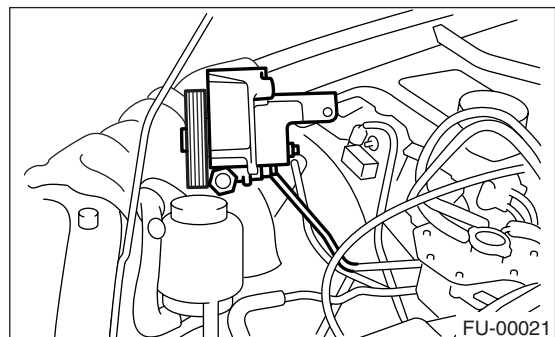
- (4) Disconnect the connector from the power steering pump switch.



- (5) Remove the reservoir tank from the bracket by pulling it upwards.



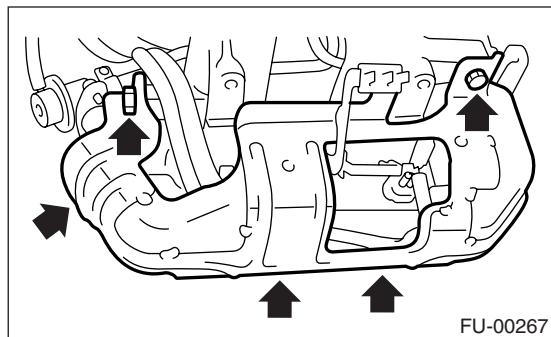
- (6) Place the power steering pump and tank on the right side wheel apron.



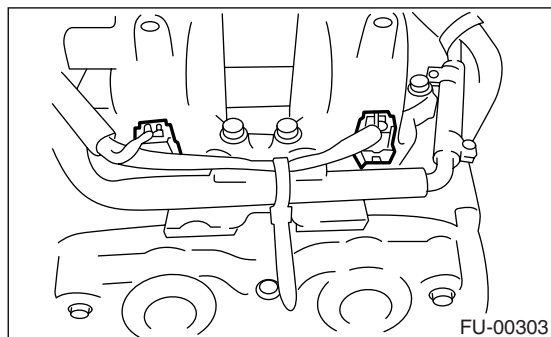
Fuel Injector

FUEL INJECTION (FUEL SYSTEMS)

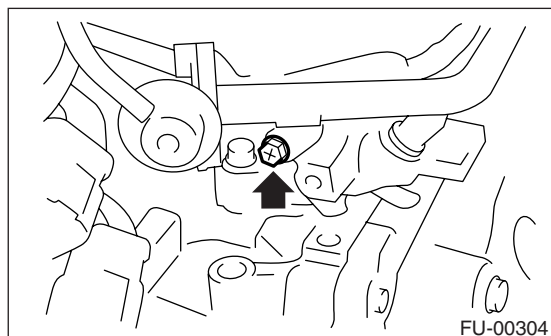
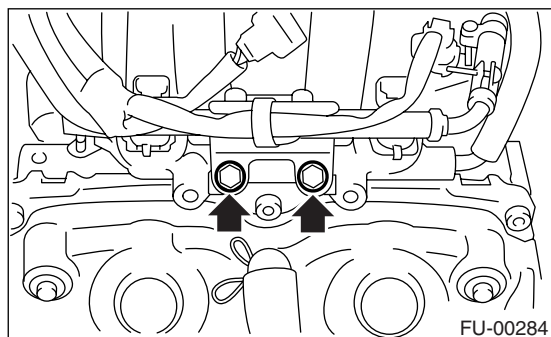
7) Remove the fuel pipe protector RH.



8) Disconnect the connectors from the fuel injectors.

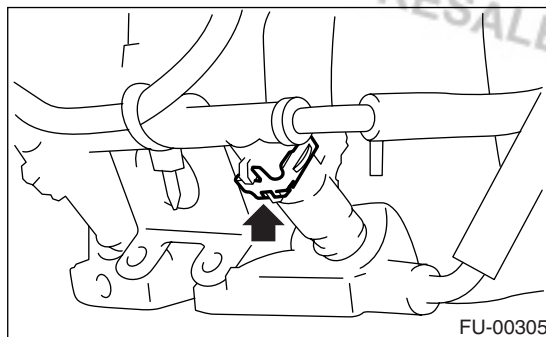


9) Remove the bolt which holds the fuel injector pipe to the intake manifold.

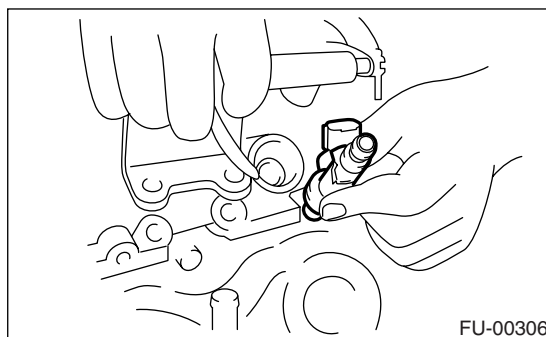


10) Remove the fuel injector from the intake manifold.

(1) Remove the fuel injector securing clip.



(2) Remove the fuel injector while lifting up the fuel injector pipe.

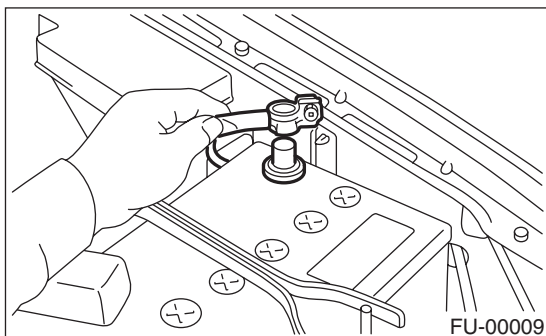


2. LH SIDE

1) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

2) Open the fuel flap lid, and remove the fuel filler cap.

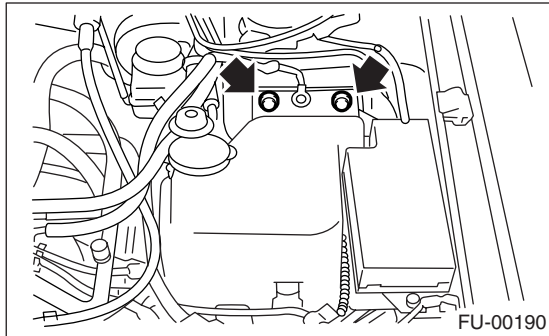
3) Disconnect the ground cable from battery.



Fuel Injector

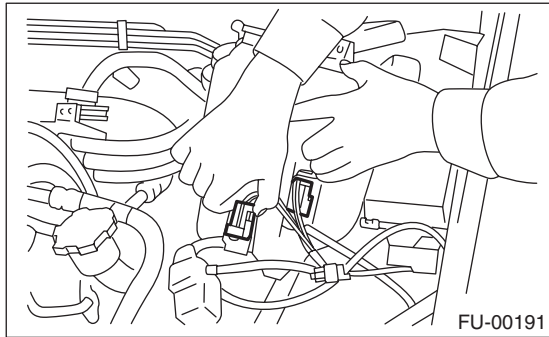
FUEL INJECTION (FUEL SYSTEMS)

4) Remove the two bolts which install the washer tank on the body.



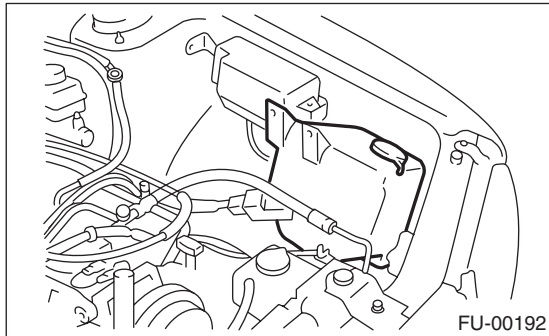
5) Disconnect the connector from the front window washer motor.

6) Disconnect the connector from the rear gate glass washer motor.

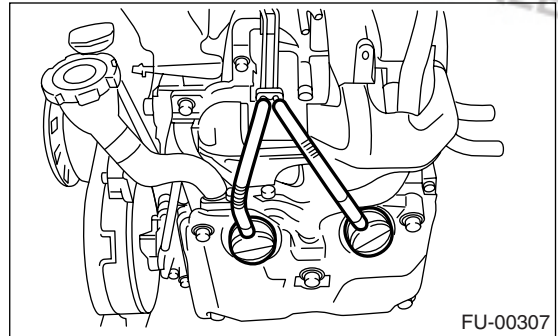


7) Disconnect the rear window glass washer hose from the washer motor, then plug the connection with a suitable cap.

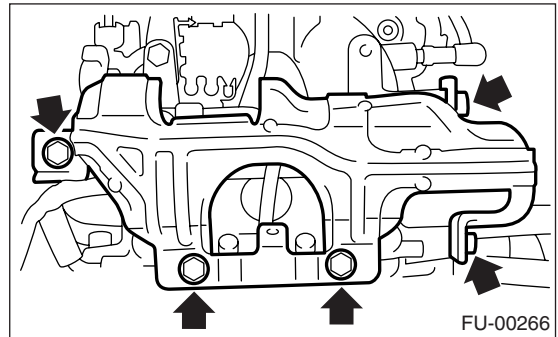
8) Move the washer tank, and secure it away from the working area.



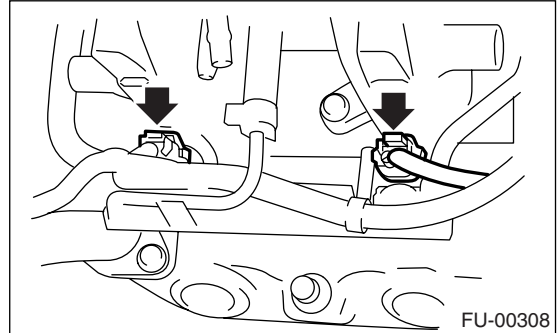
9) Remove the spark plug cords from the spark plugs (#2 and #4 cylinders).



10) Remove the fuel pipe protector LH.



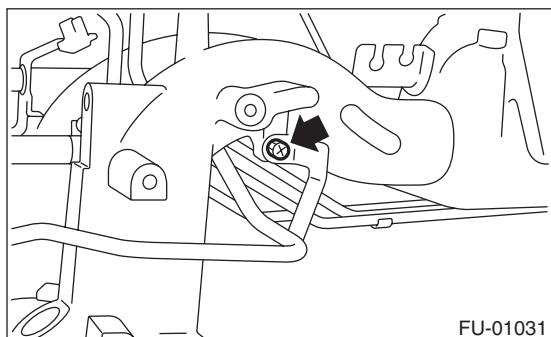
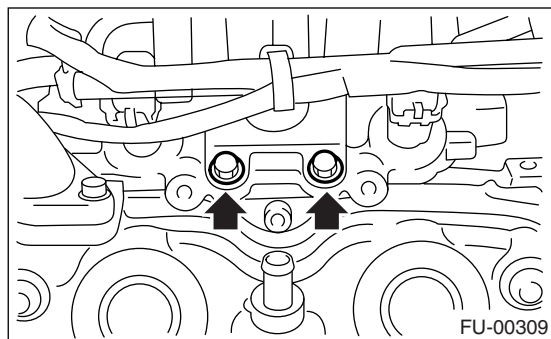
11) Disconnect the connectors from the fuel injectors.



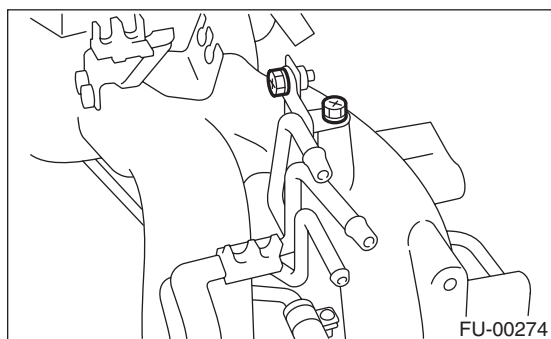
Fuel Injector

FUEL INJECTION (FUEL SYSTEMS)

12) Remove the bolt which holds the fuel injector pipe to the intake manifold.

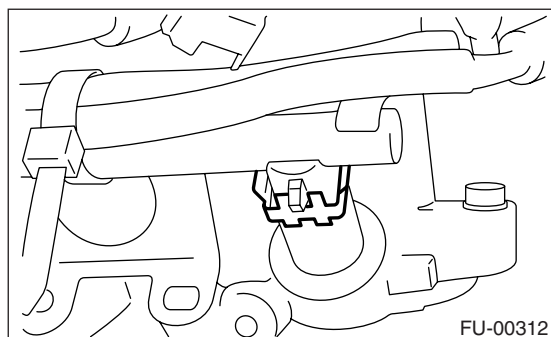


13) Remove the bolt which holds the fuel pipe on the left side intake manifold.

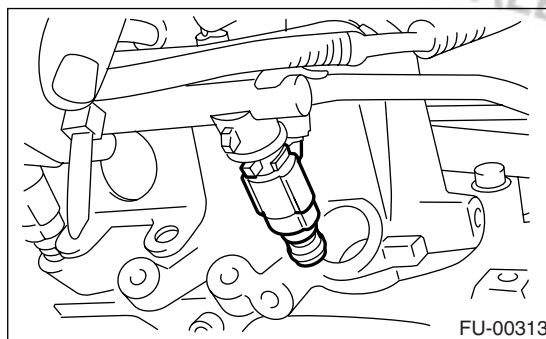


14) Remove the fuel injector from the intake manifold.

(1) Remove the fuel injector securing clip.



(2) Remove the fuel injector while lifting up the fuel injector pipe.



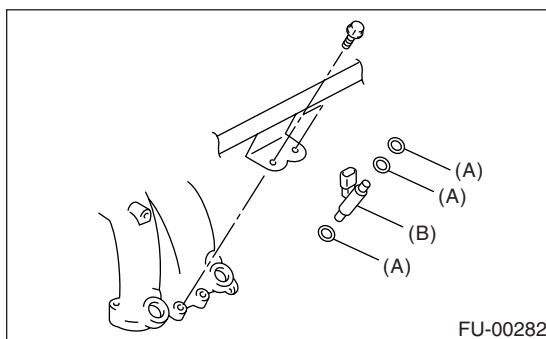
B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

CAUTION:

Replace the O-rings with new ones.

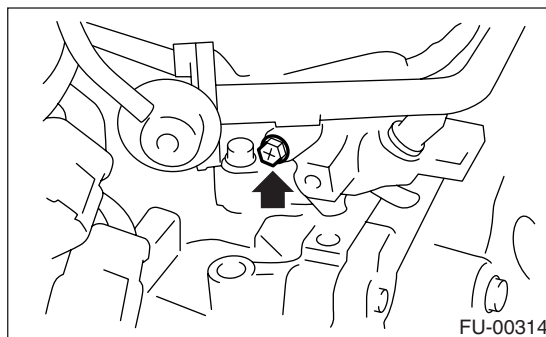


(A) O-ring

(B) Fuel injector

Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

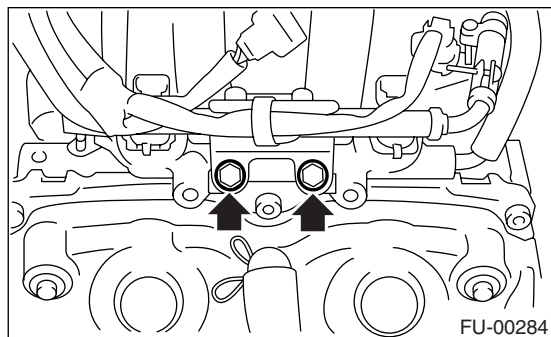


Fuel Injector

FUEL INJECTION (FUEL SYSTEMS)

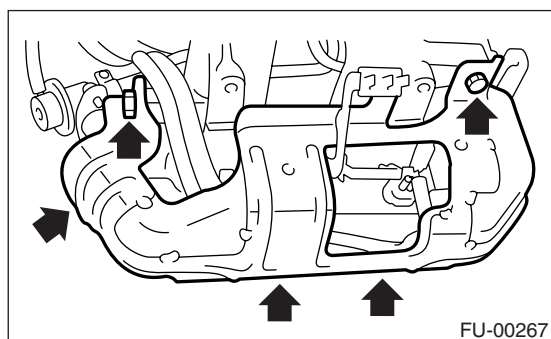
Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



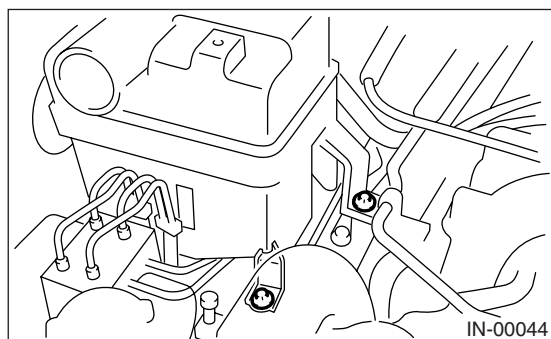
Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)

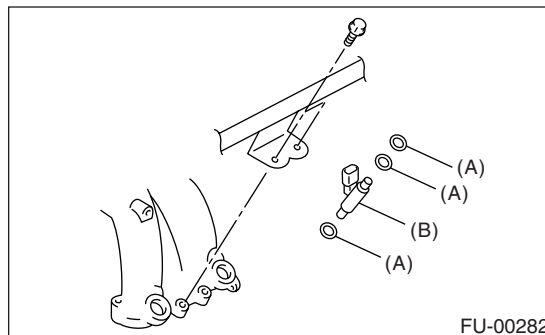


2. LH SIDE

Install in the reverse order of removal.

CAUTION:

Replace the O-rings with new ones.

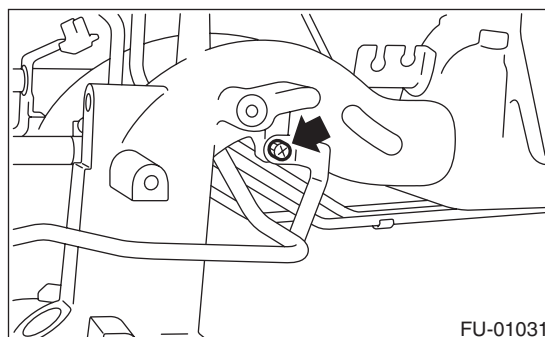


(A) O-ring

(B) Fuel injector

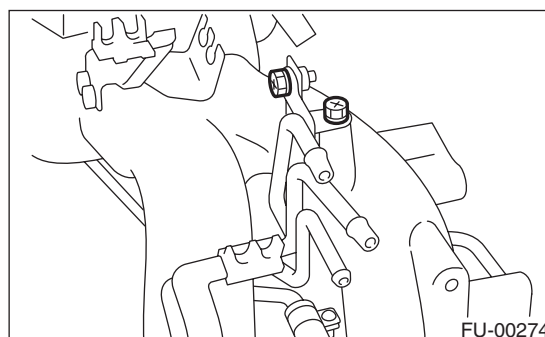
Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)



Tightening torque:

5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

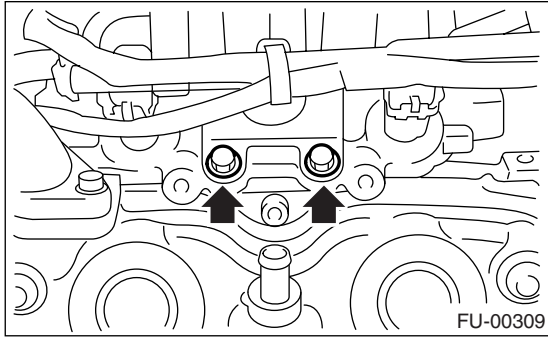


Fuel Injector

FUEL INJECTION (FUEL SYSTEMS)

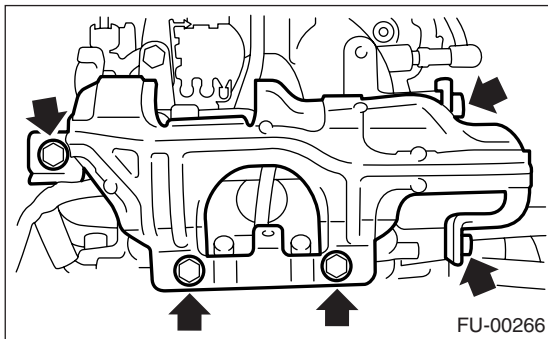
Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



Tightening torque:

19 N·m (1.9 kgf-m, 13.7 ft-lb)



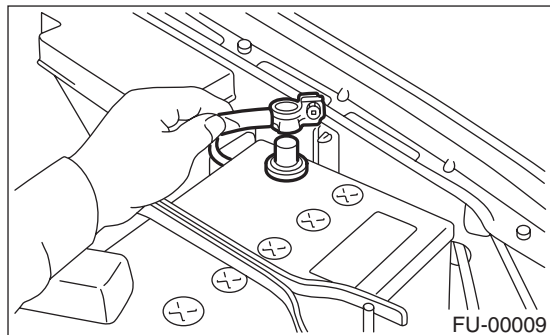
Front Oxygen (A/F) Sensor

FUEL INJECTION (FUEL SYSTEMS)

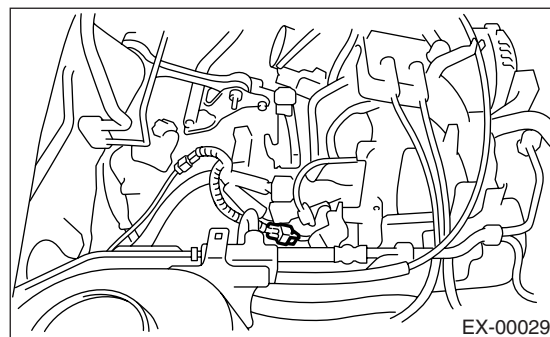
14. Front Oxygen (A/F) Sensor

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from engine hanger, and then disconnect the front oxygen (A/F) sensor connector.



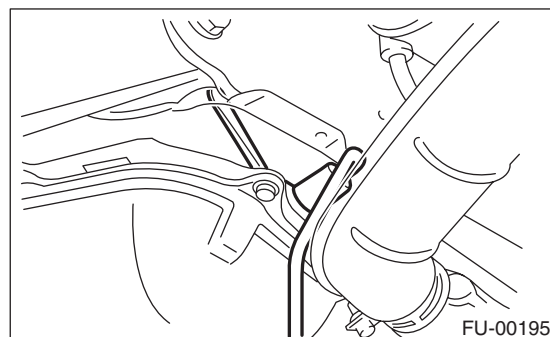
- 3) Lift up the vehicle.
- 4) Apply SUBARU CRC or its equivalent to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

- 5) Remove the front oxygen (A/F) sensor.

CAUTION:

When removing the oxygen (A/F) sensor, wait until exhaust pipe cools, otherwise it will damage exhaust pipe.



B: INSTALLATION

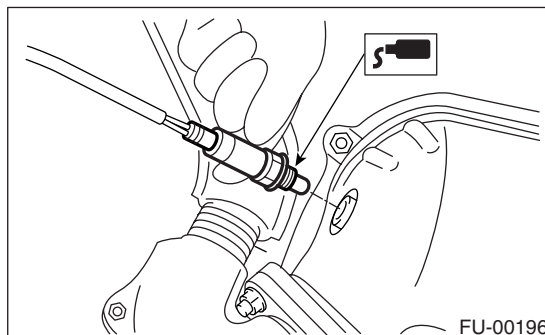
- 1) Before installing front oxygen (A/F) sensor, apply the anti-seize compound only to the threaded portion of front oxygen (A/F) sensor to make the next removal easier.

Anti-seize compound:

SS-30 by JET LUBE

CAUTION:

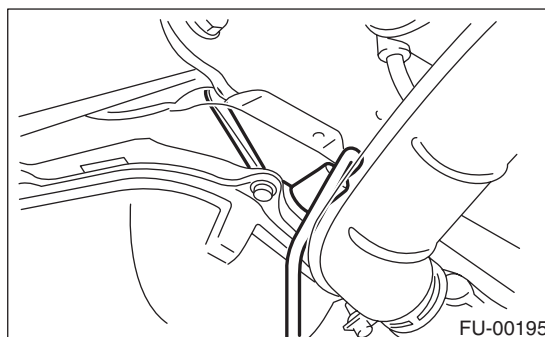
Never apply anti-seize compound to protector of front oxygen (A/F) sensor.



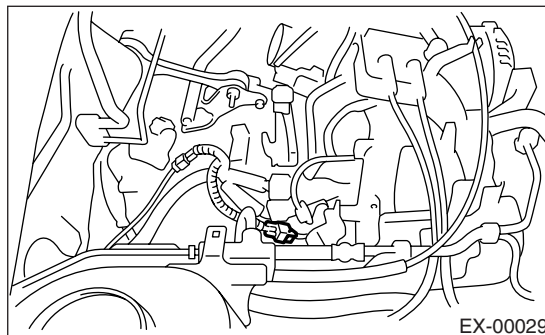
- 2) Install the front oxygen (A/F) sensor.

Tightening torque:

21 N·m (2.1 kgf-m, 15.2 ft-lb)



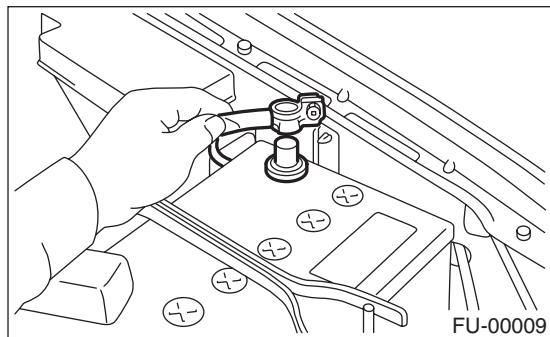
- 3) Lower the vehicle.
- 4) Connect the connector to front oxygen (A/F) sensor, and then connect the connector to engine hanger.



Front Oxygen (A/F) Sensor

FUEL INJECTION (FUEL SYSTEMS)

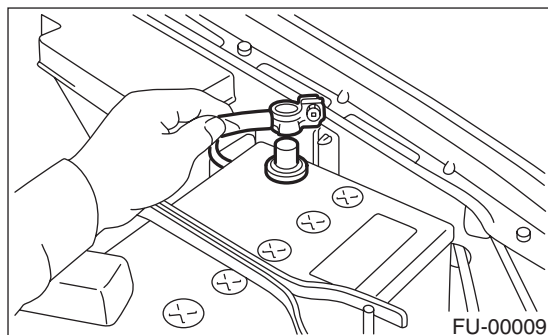
5) Connect the battery ground cable to battery.



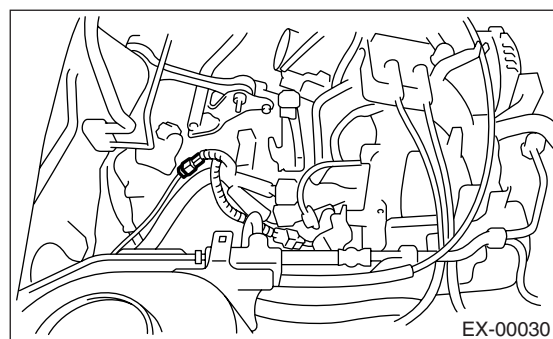
15.Rear Oxygen Sensor

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from securing bracket, and then disconnect the connector of rear oxygen sensor.



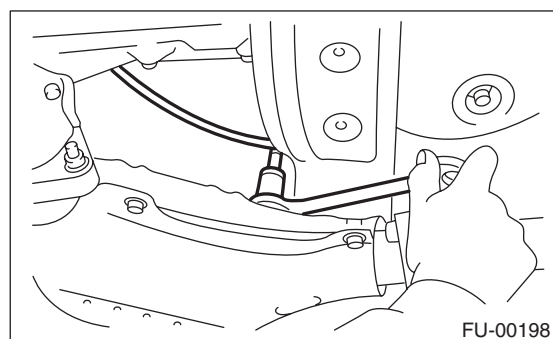
- 3) Lift up the vehicle.
- 4) Apply SUBARU CRC or its equivalent to the threaded portion of rear oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

- 5) Remove the rear oxygen sensor.

CAUTION:

When removing the rear oxygen sensor, wait until the exhaust pipe cools, otherwise it will damage the exhaust pipe.



B: INSTALLATION

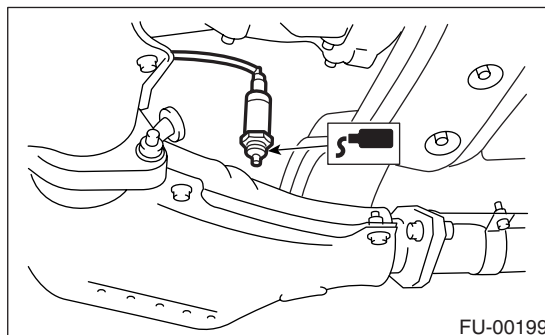
- 1) Before installing the rear oxygen (A/F) sensor, apply the anti-seize compound only to the threaded portion of the rear oxygen (A/F) sensor to make the next removal easier.

CAUTION:

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

Anti-seize compound:

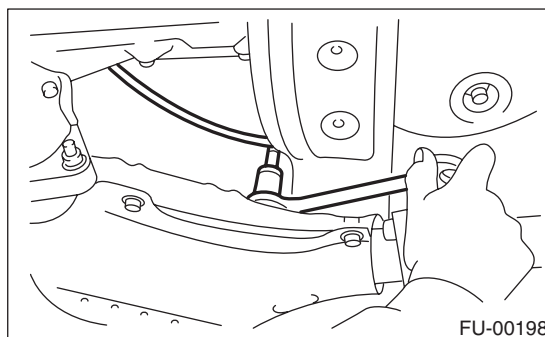
SS-30 by JET LUBE



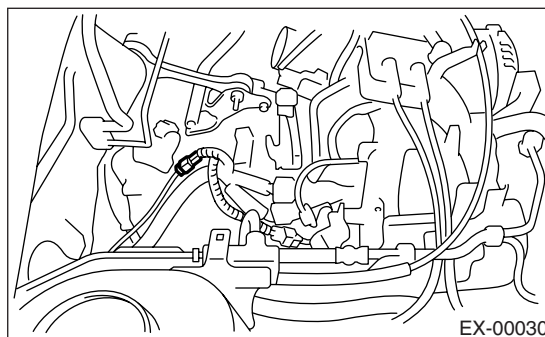
- 2) Install the rear oxygen sensor.

Tightening torque:

21 N·m (2.1 kgf-m, 15.2 ft-lb)



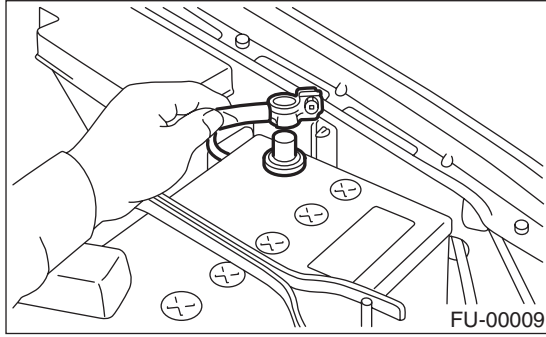
- 3) Lower the vehicle.
- 4) Connect the connector to the rear oxygen sensor, and then install the connector to securing bracket.



Rear Oxygen Sensor

FUEL INJECTION (FUEL SYSTEMS)

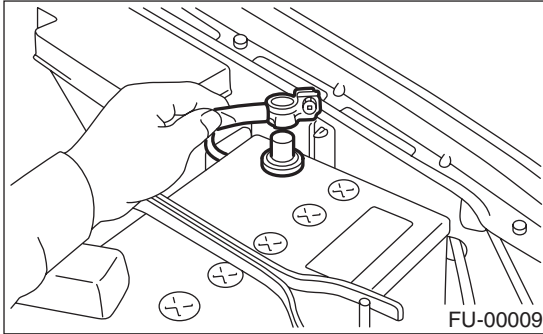
5) Connect the battery ground cable to battery.



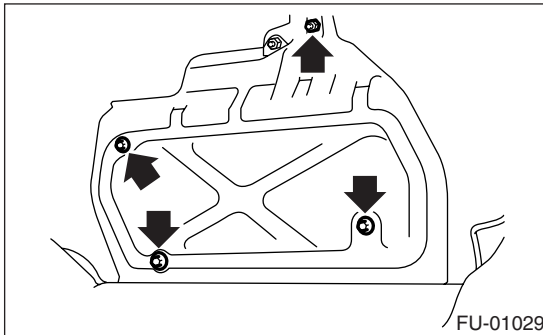
16.Engine Control Module (ECM)

A: REMOVAL

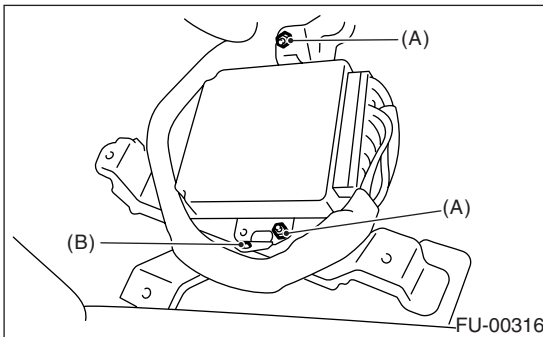
- 1) Disconnect the ground cable from battery.



- 2) Remove the lower inner trim of passenger side.
<Ref. to EI-49, REMOVAL, Lower Inner Trim.>
- 3) Detach the floor mat of front passenger seat.
- 4) Remove the protect cover.



- 5) Remove the nuts (A) which hold ECM to the bracket.
- 6) Remove the clip (B) from the bracket.



- 7) Disconnect the ECM connectors and take out the ECM.

B: INSTALLATION

Install in the reverse order of removal.

CAUTION:

When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on fuel injection system.

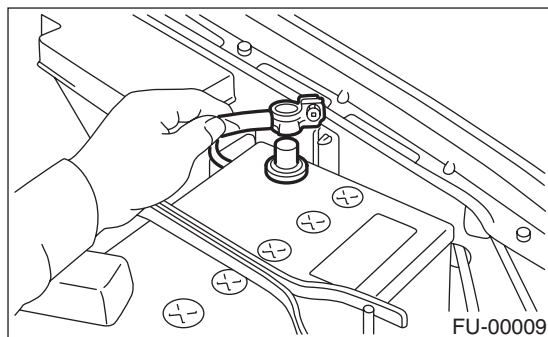
Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

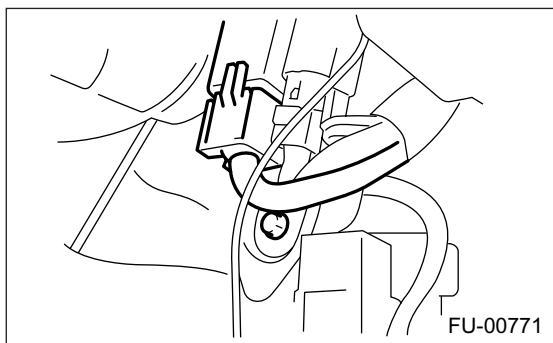
17.Main Relay

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Remove the passenger's side front side sill cover.
- 3) Remove the bolt which holds main bracket on the body.
- 4) Disconnect the connectors from the main relay.



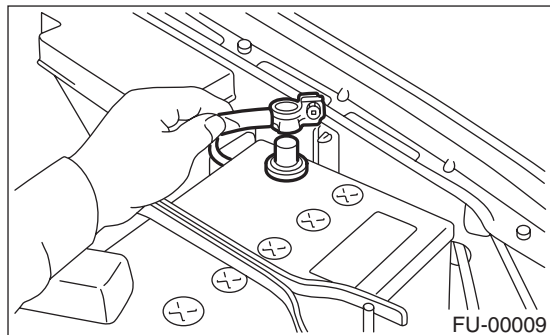
B: INSTALLATION

Install in the reverse order of removal.

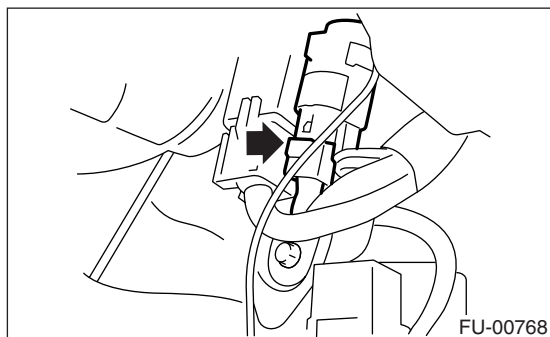
18. Fuel Pump Relay

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Remove the passenger's side front side sill cover.
- 3) Remove the bolt which holds the fuel pump relay bracket on the body.
- 4) Disconnect the connector from fuel pump.



- 5) Remove the fuel pump relay from the mounting bracket.

B: INSTALLATION

Install in the reverse order of removal.

19. Fuel

A: PROCEDURE

1. RELEASING OF FUEL PRESSURE

WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

1) Disconnect the connector from the fuel pump relay.



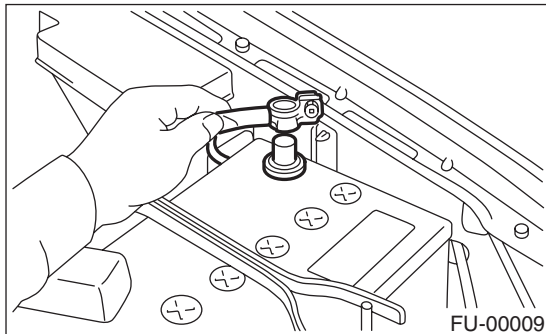
- 2) Start the engine and run it until it stalls.
 3) After the engine stalls, crank it for five more seconds.
 4) Turn the ignition switch to OFF.

2. DRAINING FUEL

WARNING:

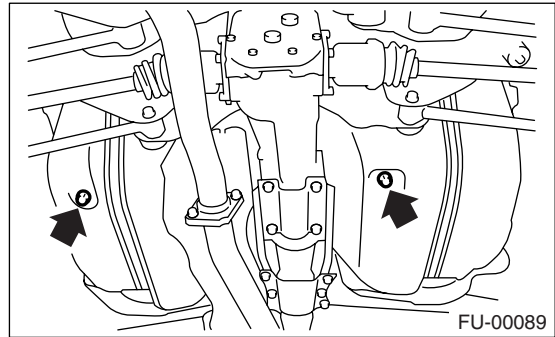
- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

- 1) Set the vehicle on a lift.
 2) Disconnect the ground cable from battery.



- 3) Open the fuel filler flap lid, and then remove the fuel filler cap.
 4) Lift up the vehicle.

- 5) Drain the fuel from the fuel tank.
 Set a container under the vehicle and remove the drain plug from the fuel tank.



- 6) Tighten the fuel drain plug.

Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)

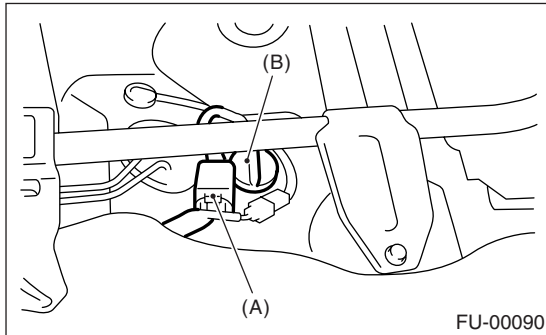
20. Fuel Tank

A: REMOVAL

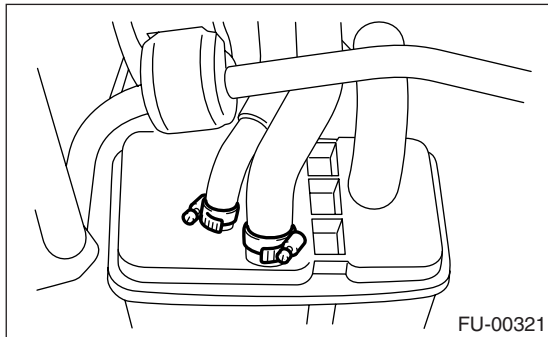
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Drain the fuel from the fuel tank. <Ref. to FU(H4SO)-47, DRAINING FUEL, PROCEDURE, Fuel.>
- 4) Remove the rear seat.
- 5) Disconnect the connector (A) of fuel tank cord to the rear harness.
- 6) Push the grommet (B) which holds the fuel tank cord on floor panel into under the body.

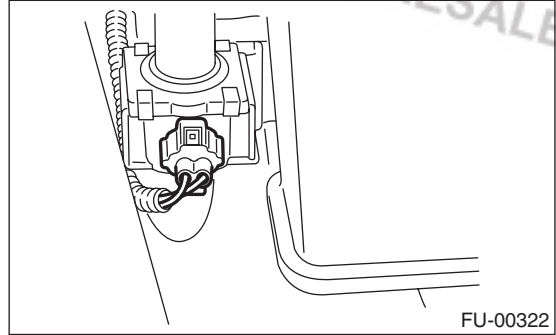


- 7) Remove the rear crossmember. <Ref. to RS-18, REMOVAL, Rear Crossmember.>
- 8) Move the clamp, and disconnect the evaporation hose from canister.

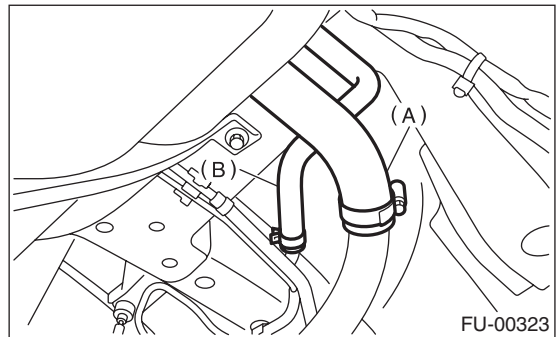


- 9) Disconnect the connector from pressure control solenoid valve.

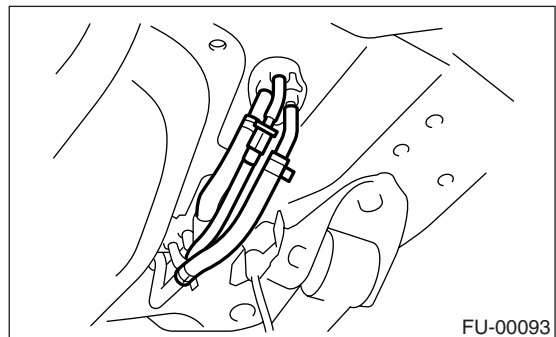
- 10) Disconnect the connector from drain valve.



- 11) Loosen the clamp and disconnect the fuel filler hose (A) and evaporation hose (B) from the fuel filler pipe.



- 12) Move the clips, and disconnect the quick connector. <Ref. to FU(H4SO)-62, REMOVAL, Fuel Delivery, Return and Evaporation lines.>
- 13) Disconnect the fuel hoses.



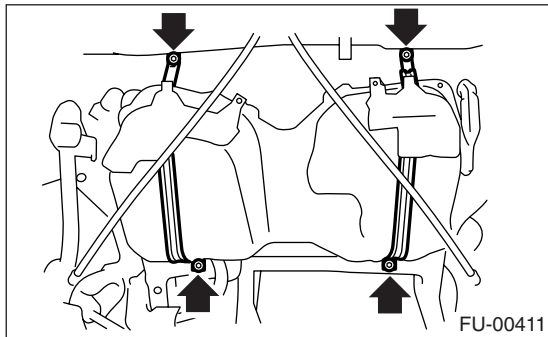
- 14) Support the fuel tank with a transmission jack, remove the bolts from bands and dismount the fuel tank from the vehicle.

Fuel Tank

FUEL INJECTION (FUEL SYSTEMS)

WARNING:

An assistant is required to perform this work.



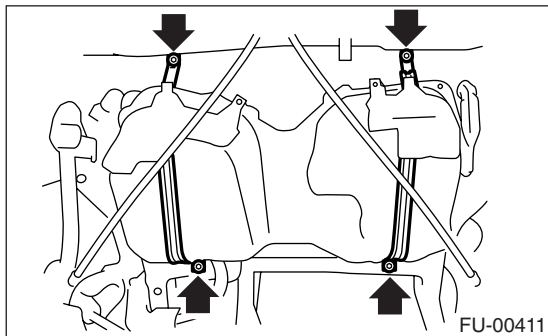
B: INSTALLATION

1) Support the fuel tank with a transmission jack and push the fuel tank harness into the access hole with the grommet.

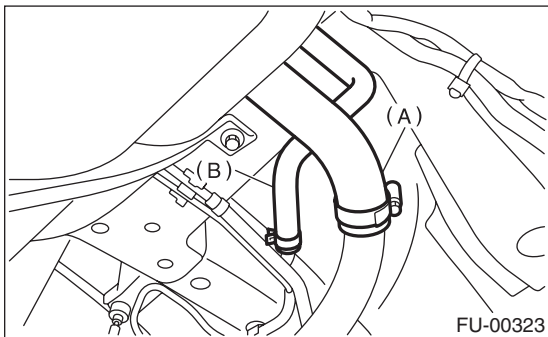
2) Set the fuel tank and temporarily tighten the bolts of fuel tank bands.

WARNING:

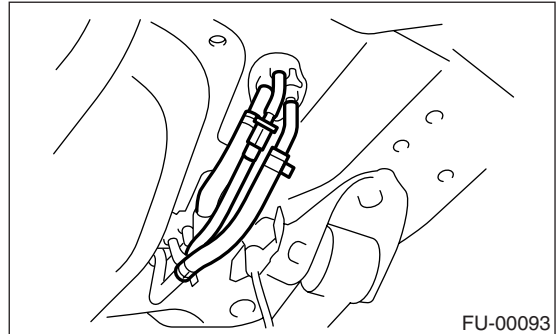
An assistant is required to perform this work.



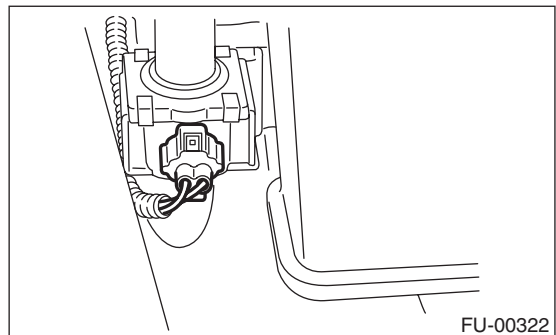
3) Connect the fuel filler hose (A) and air vent hose (B).



4) Connect the fuel hoses, and hold them with clips and quick connector. <Ref. to FU(H4SO)-62, REMOVAL, Fuel Delivery, Return and Evaporation lines.>

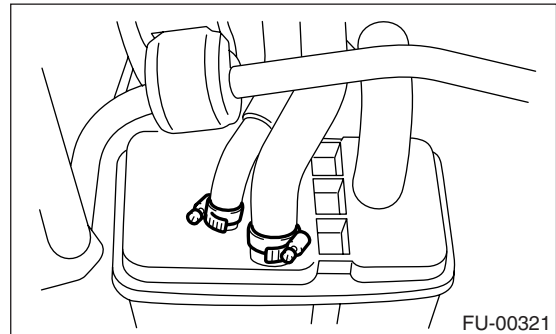


5) Connect the connector to the drain valve.



6) Connect the connector to the pressure control solenoid valve.

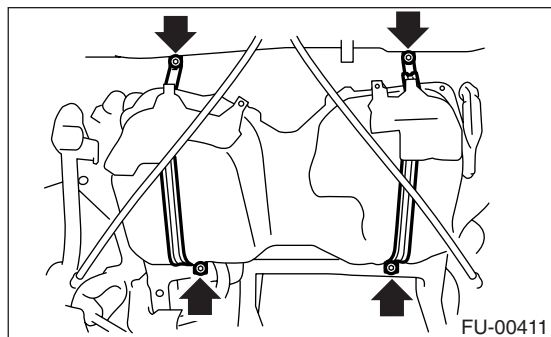
7) Connect the evaporation hose to the canister and secure with the clamp.



8) Tighten the band mounting bolts.

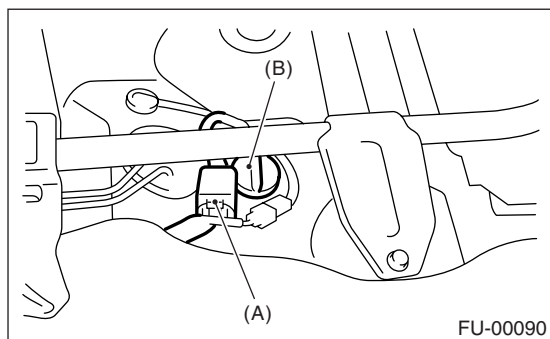
Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)



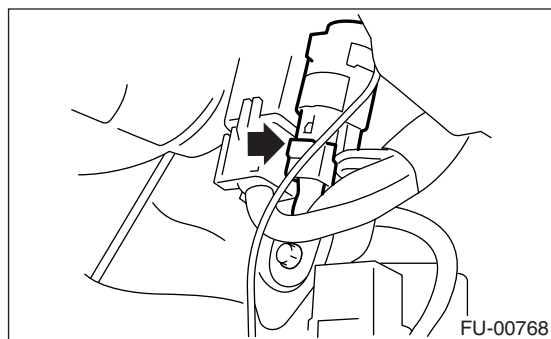
9) Install the rear crossmember. <Ref. to RS-18, INSTALLATION, Rear Crossmember.>

10) Connect the connectors (A) to the fuel tank cord and plug the service hole with grommet (B).



11) Set the rear seat and floor mat.

12) Connect the connector to the fuel pump relay.



C: INSPECTION

1) Make sure there are no cracks, holes, or other damage on the fuel tank.

2) Make sure that the fuel hoses and fuel pipes are not cracked and the connections are tight.

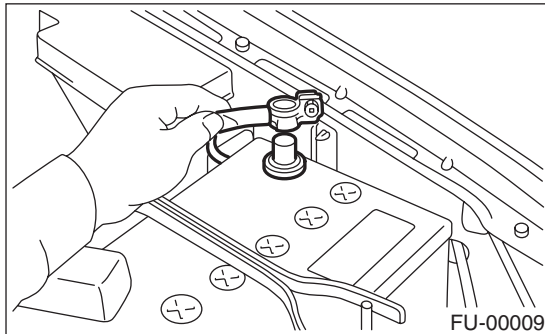
21. Fuel Filler Pipe

A: REMOVAL

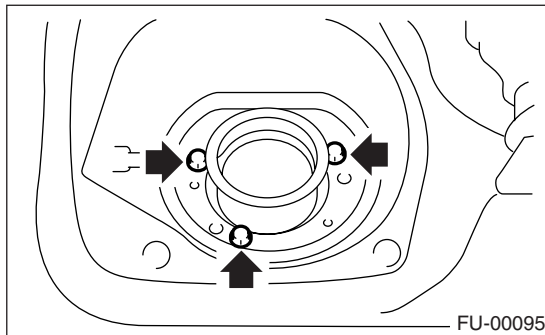
WARNING:

- Place "NO FIRE" signs near the working area.
- Be careful not to spill fuel on the floor.

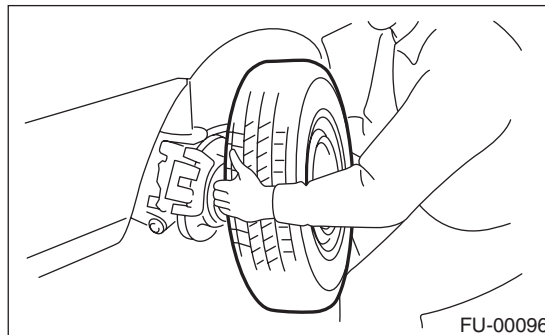
- 1) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Open the fuel filler flap lid and remove the filler cap.
- 3) Disconnect the ground cable from battery.



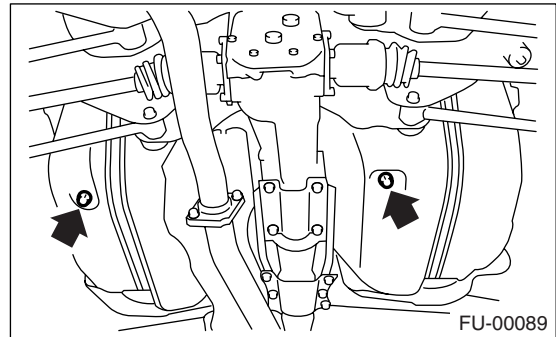
- 4) Remove the screws holding packing in place.



- 5) Lift up the vehicle.
- 6) Remove the rear right side wheel nuts.
- 7) Remove the rear right side wheel.



- 8) Drain the fuel from the fuel tank. Set a container under the vehicle and remove the drain plug from the fuel tank.

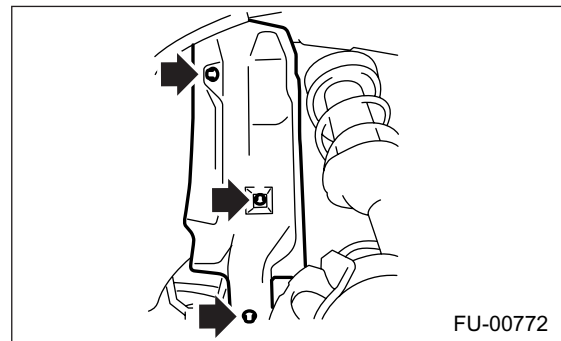


- 9) Tighten the fuel drain plug.

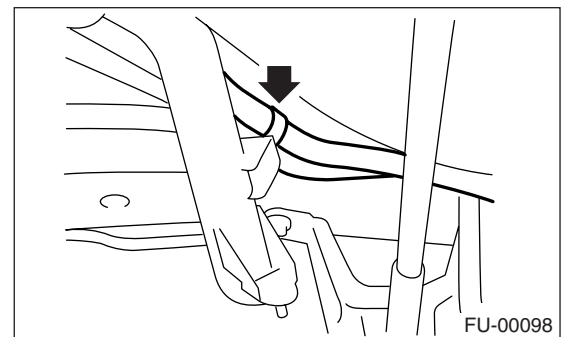
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)

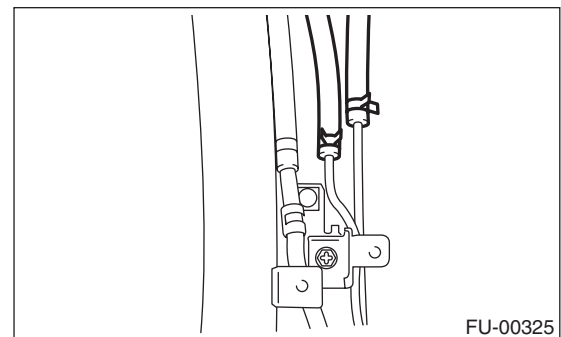
- 10) Remove the fuel filler pipe protector.



- 11) Separate the evaporation hoses from the clip of fuel filler pipe.



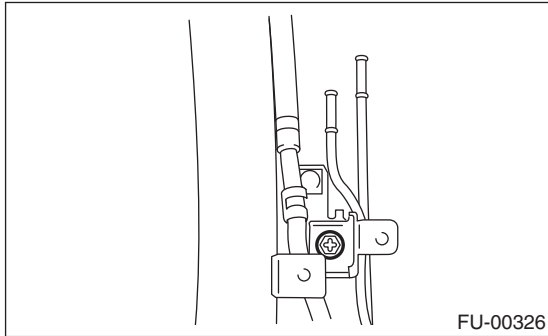
- 12) Disconnect the evaporation hoses from the pipes.



Fuel Filler Pipe

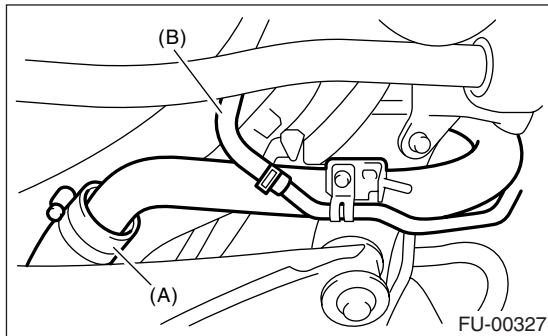
FUEL INJECTION (FUEL SYSTEMS)

- 13) Remove the bolts which hold the fuel filler pipe bracket on the body.



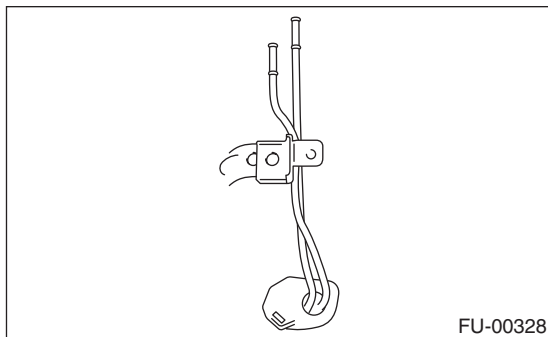
- 14) Loosen the clamp and separate the fuel filler hose (A) from the fuel filler pipe.

- 15) Move the clip and separate the evaporation hose (B).



- 16) Remove the fuel filler pipe to under side of the vehicle.

- 17) Remove the evaporation pipe together with clip from the body.

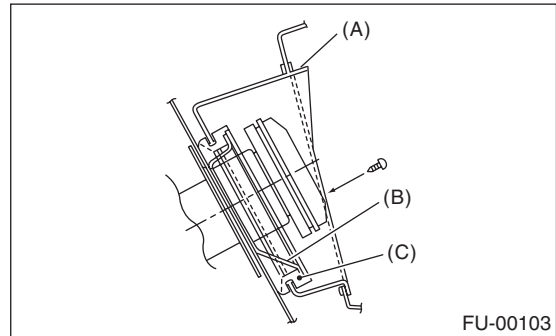


B: INSTALLATION

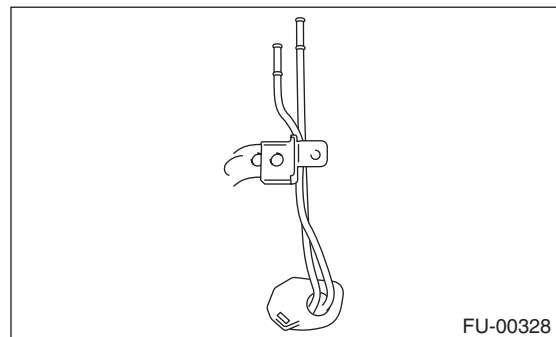
- 1) Open the fuel filler flap lid.
- 2) Set the fuel saucer (A) with rubber packing (C) and insert the fuel filler pipe into hole from the inner side of apron.
- 3) Align the holes in fuel filler pipe neck and set the cup (B), and tighten the screws.

NOTE:

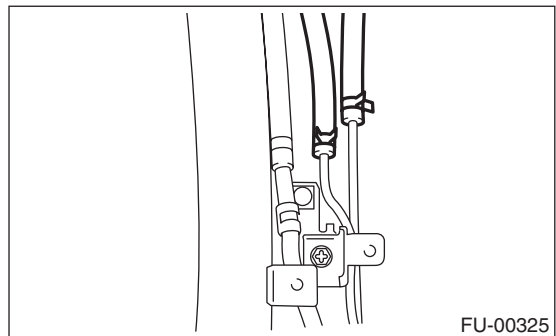
If the edges of rubber packing are folded toward the inside, straighten it with a screwdriver.



- 4) Install the evaporation pipe.



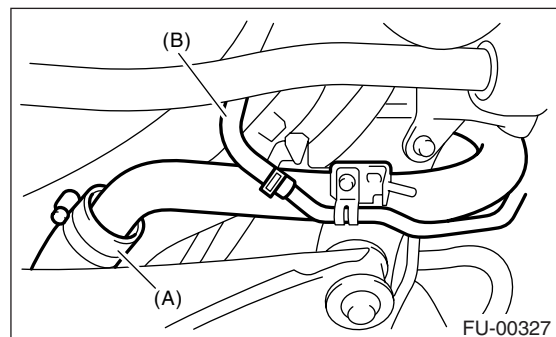
- 5) Connect the evaporation hose to the pipe.



- 6) Insert the fuel filler hose (A) approximately 35 to 40 mm (1.38 to 1.57 in) over the lower end of fuel filler pipe and tighten the clamp.

CAUTION:

Do not allow clips to touch evaporation hose (B) and rear suspension crossmember.

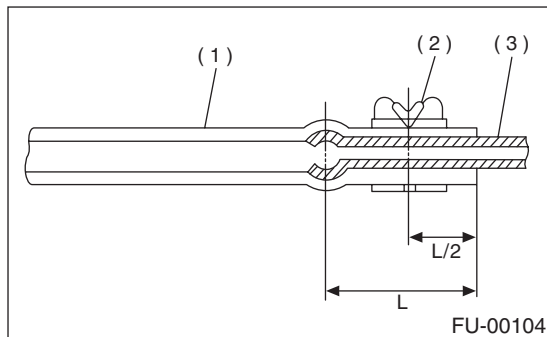


Fuel Filler Pipe

FUEL INJECTION (FUEL SYSTEMS)

7) Insert the evaporation hose approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe and hold the clip.

$L = 27.5 \pm 2.5 \text{ mm (1.083} \pm 0.098 \text{ in)}$

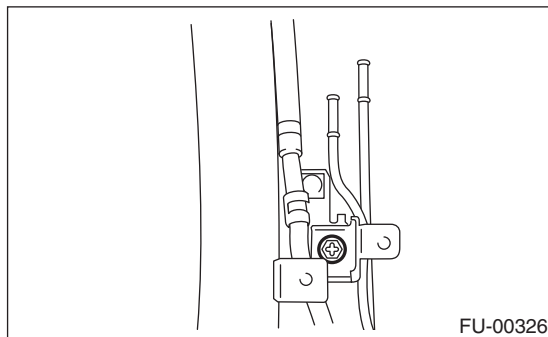


- (1) Hose
- (2) Clip
- (3) Pipe

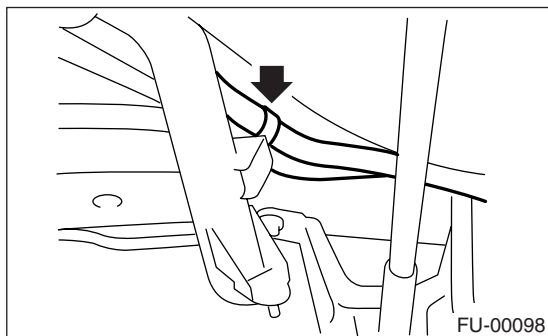
8) Tighten the bolt which holds the fuel filler pipe bracket on the body.

Tightening torque:

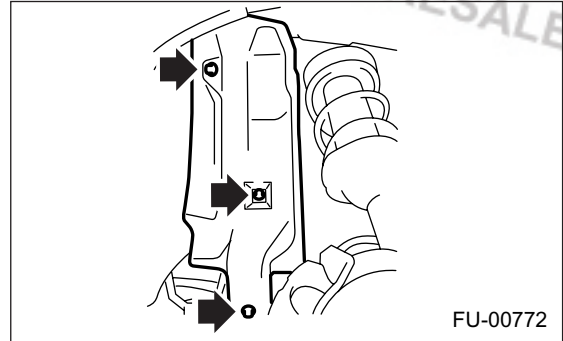
$7.5 \text{ N} \cdot \text{m (0.75 kgf-m, 5.4 ft-lb)}$



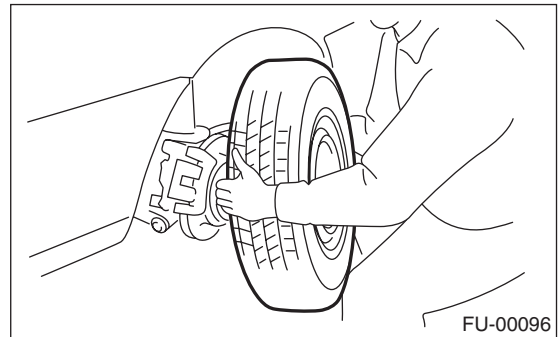
9) Secure the evaporation hose to clip of fuel filler pipe.



10) Install the fuel filler pipe protector.



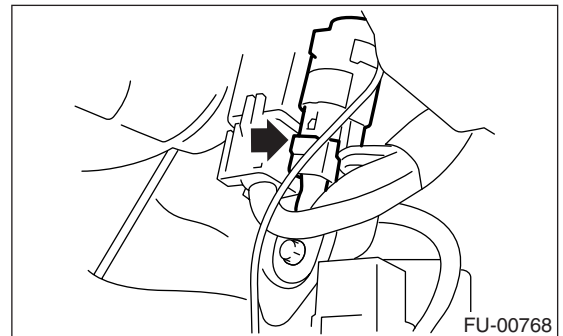
11) Install the rear right wheel.



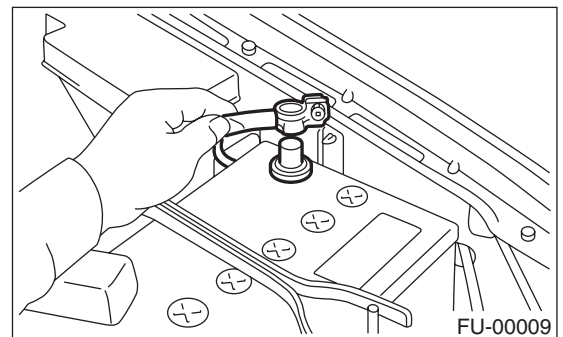
12) Lower the vehicle.

13) Tighten the wheel nuts.

14) Connect the connector to the fuel pump relay.



15) Connect the battery ground cable to battery.

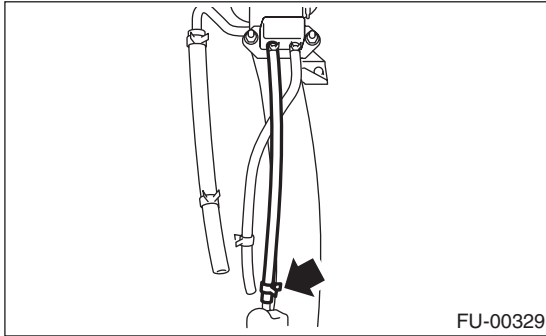


Fuel Filler Pipe

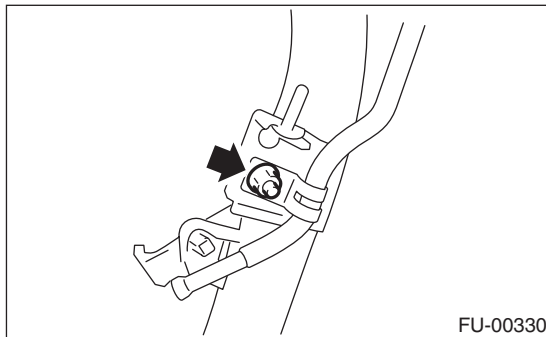
FUEL INJECTION (FUEL SYSTEMS)

C: DISASSEMBLY

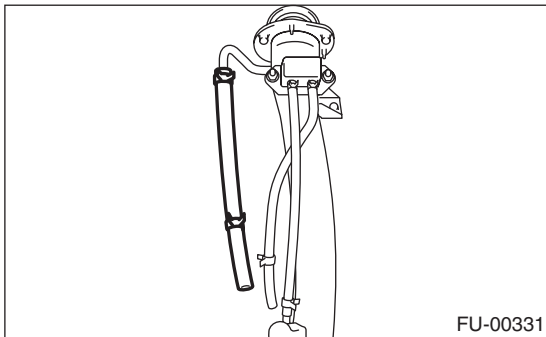
- 1) Move the clamp, and disconnect the evaporation hose from the joint pipe.



- 2) Remove the bolt which installs the joint pipe on the fuel filler pipe.



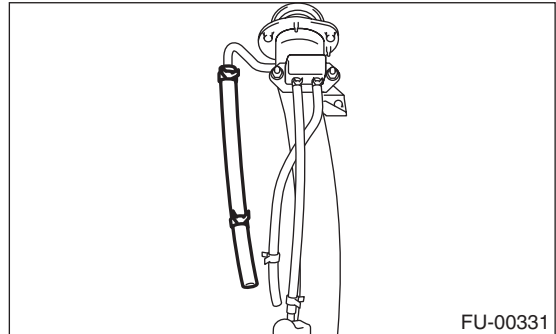
- 3) Disconnect the evaporation hose from the fuel filler pipe.



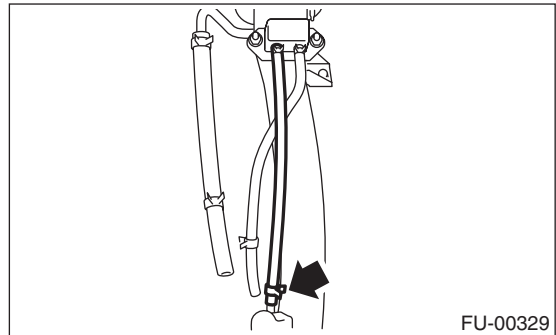
- 4) Remove the shut valve from the fuel filler pipe. <Ref. to EC(H4SO)-17, REMOVAL, Shut Valve.>

D: ASSEMBLY

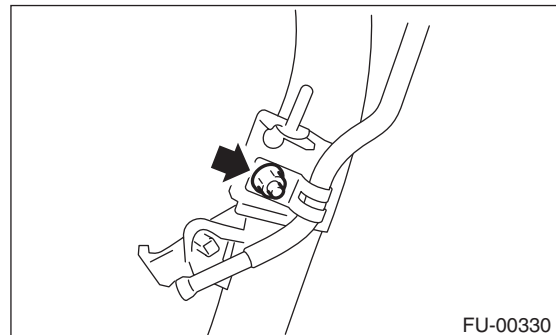
- 1) Install the shut valve on the fuel filler pipe. <Ref. to EC(H4SO)-17, INSTALLATION, Shut Valve.>
- 2) Connect the evaporation hose to the fuel filler pipe.



- 3) Connect the evaporation hose to the evaporation pipe.



- 4) Install the evaporation pipe to the fuel filler pipe.



22.Fuel Pump

A: REMOVAL

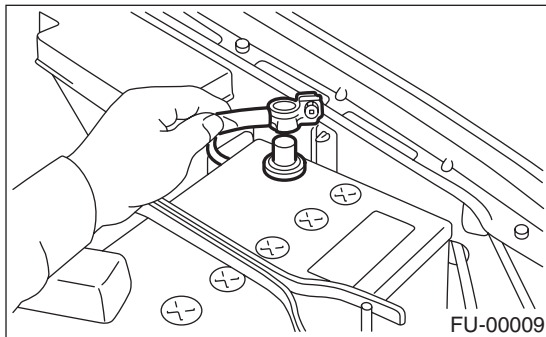
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

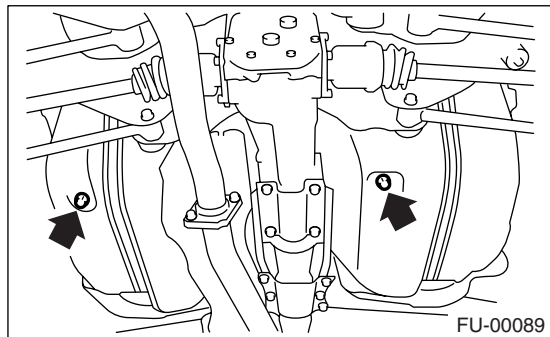
NOTE:

The fuel pump assembly consists of a fuel pump and a fuel level sensor.

- 1) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Open the fuel filler flap lid and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.



- 4) Lift up the vehicle.
- 5) Drain the fuel from the fuel tank. Set a container under the vehicle and remove the drain plug from the fuel tank.



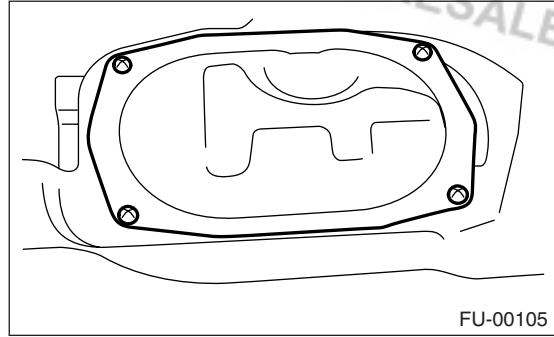
- 6) Tighten the fuel drain plug.

Tightening torque:

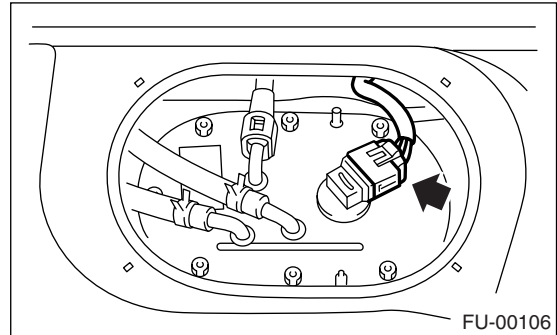
26 N·m (2.65 kgf-m, 19.2 ft-lb)

- 7) Raise the rear seat and turn the floor mat up.

- 8) Remove the access hole lid.

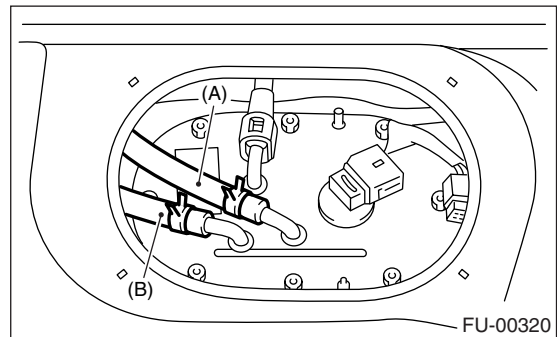


- 9) Disconnect the connector from fuel pump.

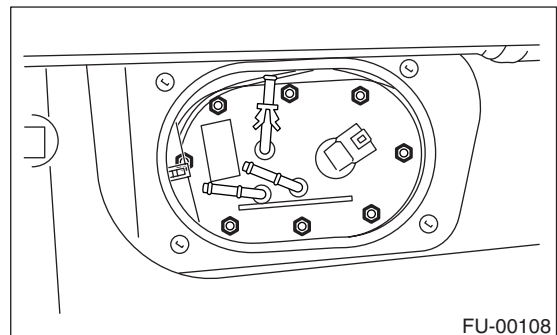


- 10) Disconnect the quick connector and then disconnect the fuel delivery hose. <Ref. to FU(H4SO)-62, REMOVAL, Fuel Delivery, Return and Evaporation lines.>

- 11) Move the clip and then disconnect the fuel return hose (A) and jet pump hose (B).



- 12) Remove the nuts which install the fuel pump assembly onto the fuel tank.



- 13) Take off the fuel pump assembly from the fuel tank.

B: INSTALLATION

Install in the reverse order of removal. Do the following:

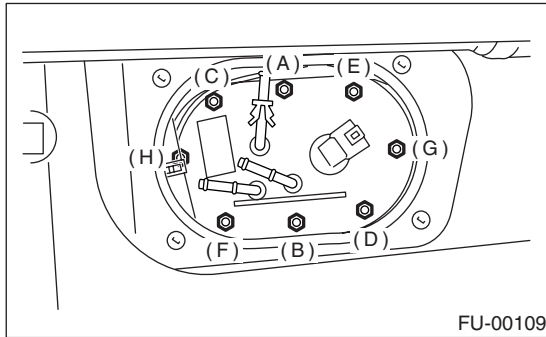
NOTE:

Replace the gaskets with new ones.

- (1) Ensure the sealing portion is free from fuel or foreign particles before installation.
- (2) Tighten the nuts in alphabetical sequence shown in figure to specified torque.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

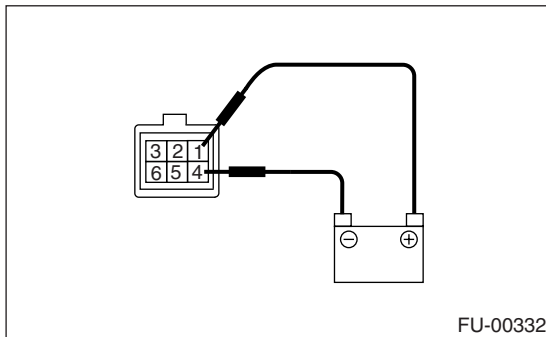


C: INSPECTION

Connect the lead harness to the connector terminal of fuel pump and apply the battery power supply to check whether the pump operates.

WARNING:

- Wipe off the fuel completely.
- Keep battery as far apart from fuel pump as possible.
- Be sure to turn the battery supply ON and OFF on the battery side.
- Do not run fuel pump for a long time under non-load condition.



23. Fuel Level Sensor

A: REMOVAL

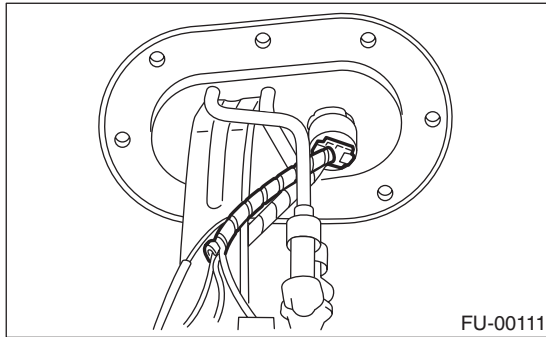
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

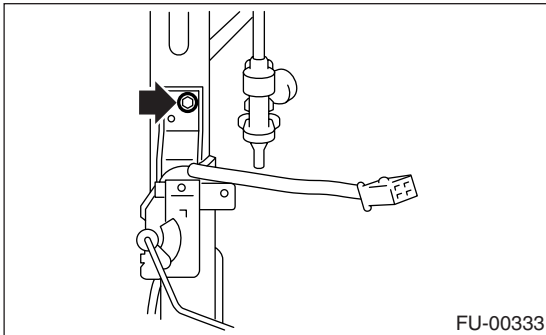
NOTE:

The fuel level sensor is built in the fuel pump assembly.

- 1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-55, REMOVAL, Fuel Pump.>
- 2) Disconnect the connector from the fuel pump bracket.



- 3) Remove the bolt which installs the fuel level sensor on the mounting bracket.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

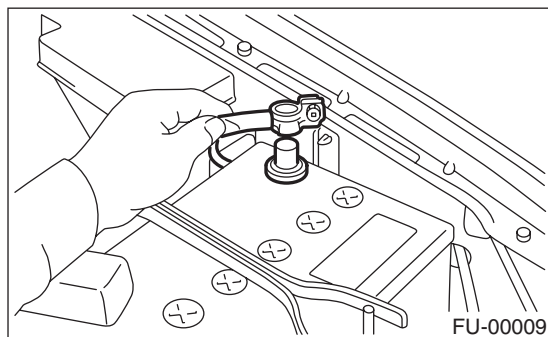
24.Fuel Sub Level Sensor

A: REMOVAL

WARNING:

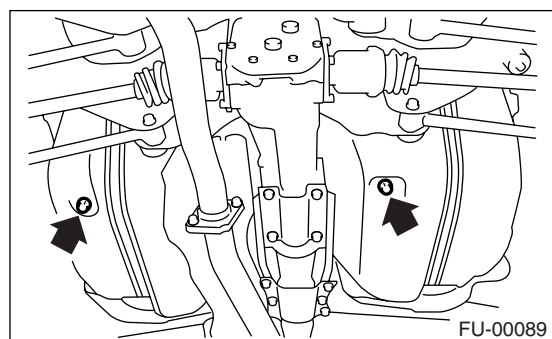
- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

1) Disconnect the ground cable from battery.



2) Lift up the vehicle.

3) Drain the fuel from the fuel tank. Set a container under the vehicle and remove the drain plug from the fuel tank.



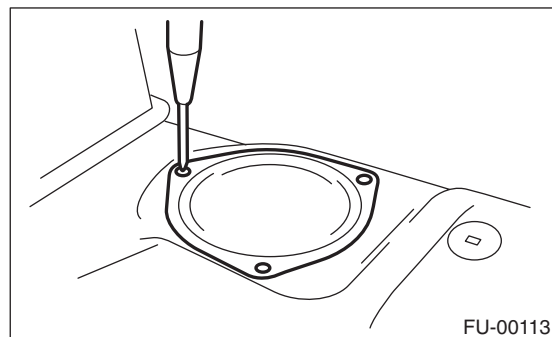
4) Tighten the fuel drain plug.

Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)

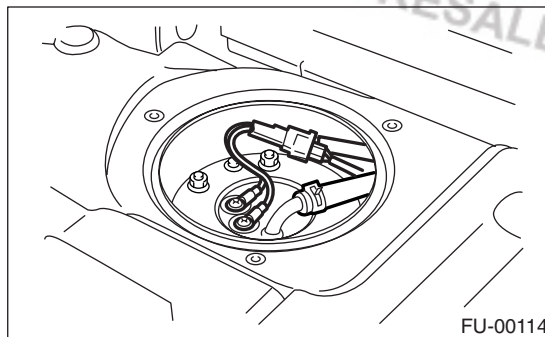
5) Remove the rear seat.

6) Remove the service hole cover.

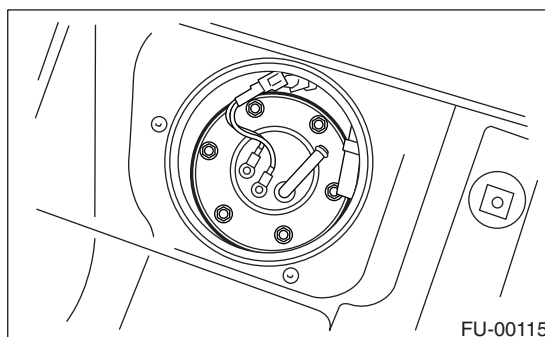


7) Disconnect the connector from the fuel sub level sensor.

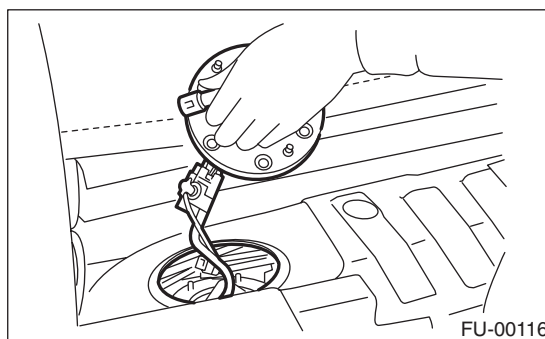
8) Disconnect the fuel jet pump hose.



9) Remove the bolts which install the fuel sub level sensor on the fuel tank.



10) Remove the fuel sub level sensor.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

For tightening torque, refer to “COMPONENT”.
<Ref. to FU(H4SO)-3, COMPONENT, General Description.>

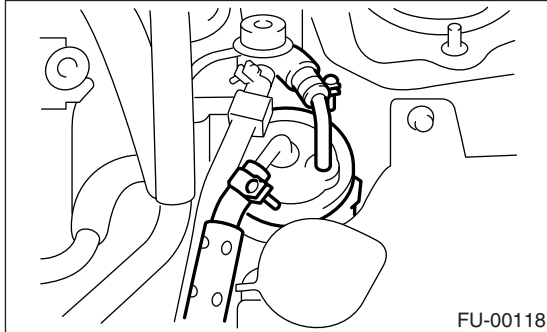
25. Fuel Filter

A: REMOVAL

WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

- 1) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Disconnect the fuel delivery hoses from the fuel filter.



- 3) Remove the filter from the holder.

B: INSTALLATION

- 1) Install in the reverse order of removal.
- 2) Tighten the hose clamp screws.

Tightening torque:

1.25 N·m (0.13 kgf-m, 0.94 ft-lb)

C: INSPECTION

- 1) Check the inside of fuel filter for dirt and water sediment.
- 2) If it is clogged, or if the replacement interval has been reached, replace it.
- 3) If the water is found in it, shake and expel the water from the inlet port.
- 4) If fuel hoses are damaged at the connecting portion, replace them with new ones.
- 5) If clamps are badly damaged, replace them with new ones.

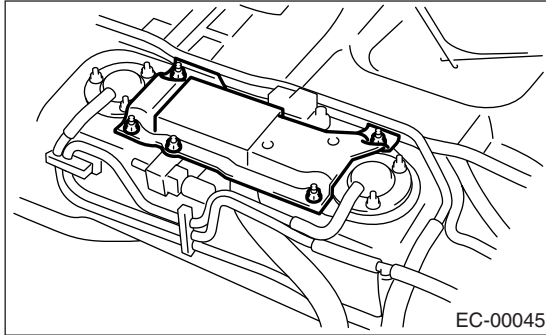
26. Fuel Cut Valve

A: REMOVAL

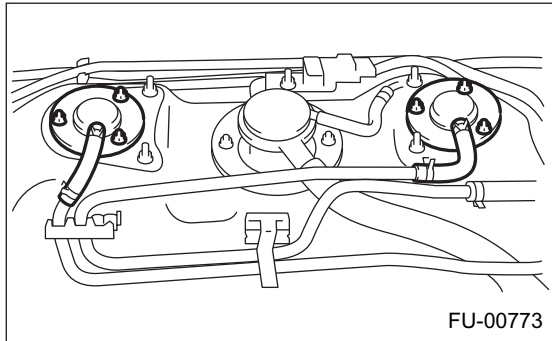
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

- 1) Remove the fuel tank. <Ref. to FU(H4SO)-48, REMOVAL, Fuel Tank.>
- 2) Remove the protect cover.



- 3) Move the clip and disconnect the evaporation hose from the fuel cut valve.



- 4) Remove the bolts which install the fuel cut valve.

B: INSTALLATION

Install in the reverse order of removal.

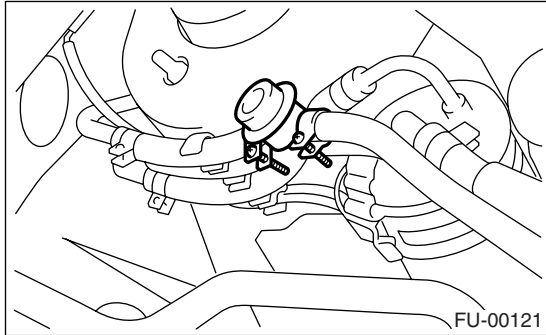
NOTE:

For tightening torque, refer to “COMPONENT”.
<Ref. to FU(H4SO)-3, COMPONENT, General Description.>

27. Fuel Damper Valve

A: REMOVAL

- 1) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Remove the fuel damper valve from the fuel return line.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

1.25 N·m (0.13 kgf-m, 0.94 ft-lb)

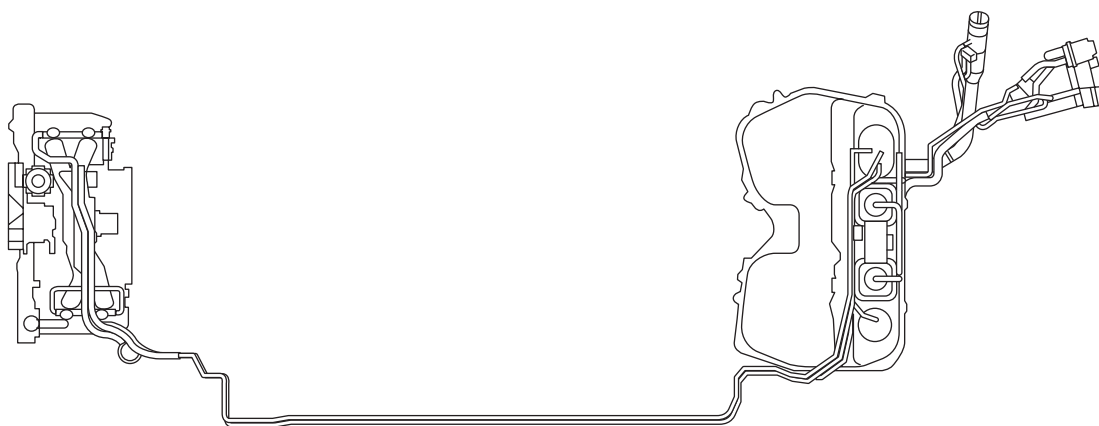
Fuel Delivery, Return and Evaporation lines

FUEL INJECTION (FUEL SYSTEMS)

28.Fuel Delivery, Return and Evaporation lines

A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Open the fuel filler flap lid and remove the fuel filler cap.
- 4) Remove the floor mat. <Ref. to EI-57, REMOVAL, Floor Mat.>
- 5) Remove the fuel delivery pipes and hoses, fuel return pipes and hoses, evaporation pipes and hoses.

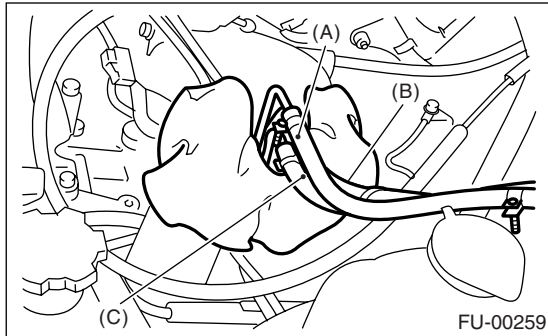


FU-00337

Fuel Delivery, Return and Evaporation lines

FUEL INJECTION (FUEL SYSTEMS)

6) In engine compartment, detach the fuel delivery hoses, return hoses and evaporation hose.



- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

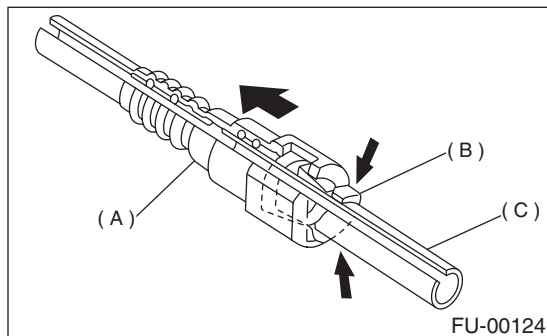
7) Lift up the vehicle.

8) Separate the quick connector on the fuel delivery line.

- (1) Clean the pipe and connector, if they are covered with dust.
- (2) Hold the connector (A) and push retainer (B) down.
- (3) Pull out the connector (A) from retainer (B).

CAUTION:

Always use a new retainer.



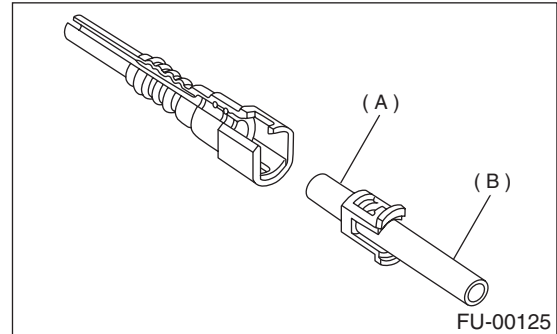
- (A) Connector
- (B) Retainer
- (C) Pipe

B: INSTALLATION

1) Connect the quick connector on fuel delivery line.

CAUTION:

- **Always use a new retainer.**
- **Make sure that the connected portion is not damaged or has dust. If necessary, clean seal surface of pipe.**

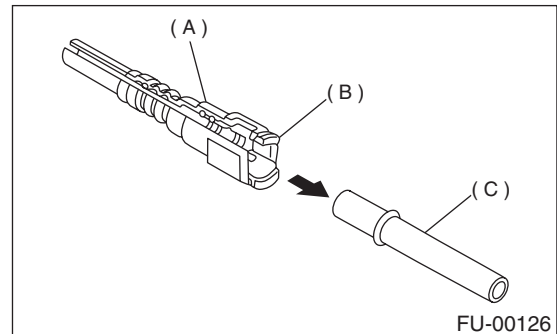


- (A) Seal surface
- (B) Pipe

- (1) Set the new retainer (B) to connector (A).
- (2) Push the pipe into the connector completely.

NOTE:

At this time, two clicking sounds are heard.



- (A) Connector
- (B) Retainer
- (C) Pipe

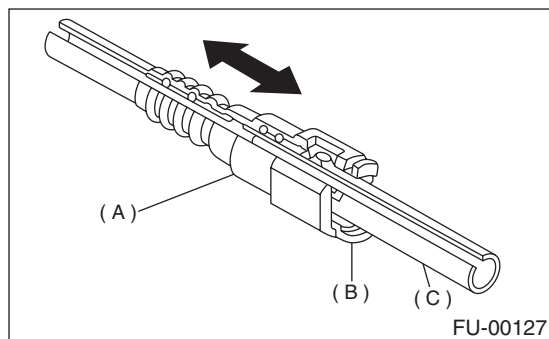
CAUTION:

- **Pull the connector to ensure it is connected securely.**
- **Ensure the two retainer pawls are engaged in their mating positions in the connector.**

Fuel Delivery, Return and Evaporation lines

FUEL INJECTION (FUEL SYSTEMS)

- Be sure to inspect hoses and their connections for any leakage of fuel.



- (A) Connector
(B) Retainer
(C) Pipe

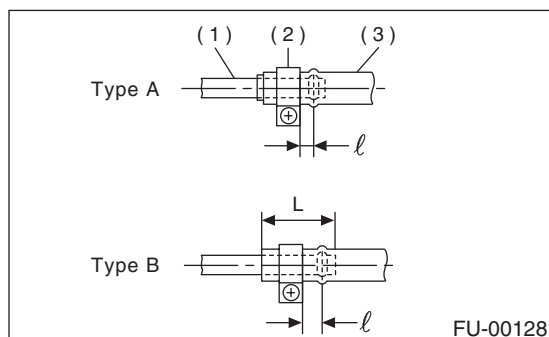
2) Connect the fuel delivery hose to the pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

Type A: When the fitting length is specified.

Type B: When the fitting length is not specified.

$\varnothing : 2.5 \pm 1.5 \text{ mm } (0.098 \pm 0.059 \text{ in})$

$L : 22.5 \pm 2.5 \text{ mm } (0.886 \pm 0.098 \text{ in})$



- (1) Pipe
(2) Clamp
(3) Hose

3) Connect the return hose and evaporation hose to pipe by approx. 15 mm (0.59 in) from the hose end.

Fuel return hose:

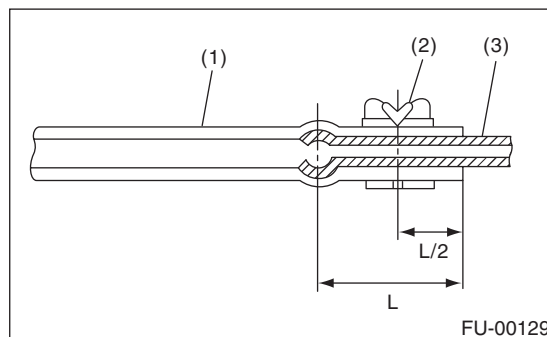
$L = 22.5 \pm 2.5 \text{ mm } (0.885 \pm 0.098 \text{ in})$

Fuel evaporation hose:

$L = 17.5 \pm 2.5 \text{ mm } (0.689 \pm 0.098 \text{ in})$

CAUTION:

Be sure to inspect hoses and their connections for any leakage of fuel.



- (1) Hose
(2) Clip
(3) Pipe

C: INSPECTION

1) Make sure that there are no cracks on the fuel pipes and fuel hoses.

2) Make sure that the fuel pipe and fuel hose connections are tight.

29. Fuel System Trouble in General

A: INSPECTION

Trouble and possible cause		Corrective action
1. Insufficient fuel supply to the injector		
1)	Fuel pump will not operate.	
	○ Defective terminal contact.	Inspect connections, especially ground, and tighten securely.
	○ Trouble in electromagnetic or electronic circuit parts.	Replace the fuel pump.
2)	Lowering of fuel pump function.	Replace the fuel pump.
3)	Clogged dust or water in the fuel filter.	Replace fuel filter, clean or replace fuel tank.
4)	Clogged or bent fuel pipe or hose.	Clean, correct or replace fuel pipe or hose.
5)	Air is mixed in the fuel system.	Inspect or retighten each connection part.
6)	Clogged or bent breather tube or pipe.	Clean, correct or replace air breather tube or pipe.
7)	Damaged diaphragm of pressure regulator.	Replace.
2. Leakage or blow out fuel		
1)	Loosened joints of the fuel pipe.	Retighten.
2)	Cracked fuel pipe, hose and fuel tank.	Replace.
3)	Defective welding part on the fuel tank.	Replace.
4)	Defective drain packing of the fuel tank.	Replace.
5)	Clogged or bent air breather tube or air vent tube.	Clean, correct or replace air breather tube or air vent tube.
3. Gasoline odor inside compartment		
1)	Loose joints at air breather tube, air vent tube and fuel filler pipe.	Retighten.
2)	Defective packing air tightness on the fuel saucer.	Correct or replace packing.
3)	Cracked fuel separator.	Replace separator.
4)	Inoperative fuel pump modulator or circuit.	Replace.
4. Defective fuel meter indicator		
1)	Defective operation of fuel level sensor.	Replace.
2)	Defective operation of fuel meter.	Replace.
5. Noise		
1)	Large operation noise or vibration of fuel pump.	Replace.

NOTE:

- When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank.

To prevent water condensation,

- Top off the fuel tank or drain the fuel completely.
 - Drain the water condensation from the fuel filter.
- Refilling the fuel tank.
- Refill the fuel tank while there is still some fuel left in the tank.
- Protecting the fuel system against freezing and water condensation.

(3) Cold areas

In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop below 0°C (32°F) throughout the winter season, use an anti-freeze solution in the cooling system. Refueling will also complement the effect of anti-freeze solution each time the fuel

level drops to about one-half. After the winter season, drain the water which may have accumulated in the fuel filter and fuel tank in the manner same as that described under Affected areas below.

(4) Affected areas

When the water condensation is notched in the fuel filter, drain the water from both the fuel filter and fuel tank or use a water removing agent (or anti-freeze solution) in the fuel tank.

- Observe the instructions, notes, etc., indicated on the label affixed to the anti-freeze solution (water removing agent) container before use.

Fuel System Trouble in General

FUEL INJECTION (FUEL SYSTEMS)

GENERAL DESCRIPTION

List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

1. List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Index
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-8, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-10, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-12, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-14, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-16, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0065	Air Assisted Injector Control Range/Performance	<Ref. to GD(H4SO)-18, DTC P0065 AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0066	Air Assisted Injector Control Circuit or Circuit Low	<Ref. to GD(H4SO)-21, DTC P0066 AIR ASSISTED INJECTOR CONTROL CIRCUIT OR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0067	Air Assisted Injector Control Circuit High	<Ref. to GD(H4SO)-23, DTC P0067 AIR ASSISTED INJECTOR CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0068	Manifold Pressure Sensor Range/Performance	<Ref. to GD(H4SO)-25, DTC P0068 MANIFOLD PRESSURE SENSOR RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to GD(H4SO)-27, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to GD(H4SO)-29, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0111	Intake Air Temperature Circuit Range/Performance	<Ref. to GD(H4SO)-31, DTC P0111 INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0112	Intake Air Temperature Circuit Low Input	<Ref. to GD(H4SO)-33, DTC P0112 INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0113	Intake Air Temperature Circuit High Input	<Ref. to GD(H4SO)-35, DTC P0113 INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0117	Engine Coolant Temperature Circuit Low Input	<Ref. to GD(H4SO)-37, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0118	Engine Coolant Temperature Circuit High Input	<Ref. to GD(H4SO)-39, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0121	Throttle/Pedal Position Sensor/Switch "A" Circuit Range/Performance	<Ref. to GD(H4SO)-41, DTC P0121 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	<Ref. to GD(H4SO)-43, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	<Ref. to GD(H4SO)-45, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0125	Insufficient Coolant Temperature For Closed Loop Fuel Control	<Ref. to GD(H4SO)-47, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to GD(H4SO)-48, DTC P0128 COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0129	Barometric Pressure Too Low	<Ref. to GD(H4SO)-50, DTC P0129 BAROMETRIC PRESSURE TOO LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0130	O ₂ Sensor Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-51, DTC P0130 O ₂ SENSOR CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0131	O ₂ Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-53, DTC P0131 O ₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0132	O ₂ Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-55, DTC P0132 O ₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0133	O ₂ Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-57, DTC P0133 O ₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0134	O ₂ Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-61, DTC P0134 O ₂ SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0137	O ₂ Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-63, DTC P0137 O ₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0138	O ₂ Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-65, DTC P0138 O ₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0139	O ₂ Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-67, DTC P0139 O ₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0171	System Too Lean (Bank 1)	<Ref. to GD(H4SO)-71, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0172	System Too Rich (Bank 1)	<Ref. to GD(H4SO)-73, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0181	Fuel Temperature Sensor "A" Circuit Range/Performance	<Ref. to GD(H4SO)-75, DTC P0181 FUEL TEMPERATURE SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0182	Fuel Temperature Sensor "A" Circuit Low Input	<Ref. to GD(H4SO)-77, DTC P0182 FUEL TEMPERATURE SENSOR "A" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0183	Fuel Temperature Sensor "A" Circuit High Input	<Ref. to GD(H4SO)-79, DTC P0183 FUEL TEMPERATURE SENSOR "A" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0301	Cylinder 1 Misfire Detected	<Ref. to GD(H4SO)-81, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0302	Cylinder 2 Misfire Detected	<Ref. to GD(H4SO)-86, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0303	Cylinder 3 Misfire Detected	<Ref. to GD(H4SO)-86, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0304	Cylinder 4 Misfire Detected	<Ref. to GD(H4SO)-86, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-87, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-89, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0335	Crankshaft Position Sensor "A" Circuit	<Ref. to GD(H4SO)-91, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0336	Crankshaft Position Sensor "A" Circuit Range/Performance	<Ref. to GD(H4SO)-93, DTC P0336 CRANKSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-96, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0341	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-98, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to GD(H4SO)-100, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to GD(H4SO)-105, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to GD(H4SO)-130, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to GD(H4SO)-132, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0451	Evaporative Emission Control System Pressure Sensor Range/Performance	<Ref. to GD(H4SO)-134, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to GD(H4SO)-137, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to GD(H4SO)-139, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to GD(H4SO)-140, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	<Ref. to GD(H4SO)-140, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0458	Evaporative Emission Control System Purge Control Valve Circuit Low	<Ref. to GD(H4SO)-141, DTC P0458 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0459	Evaporative Emission Control System Purge Control Valve Circuit High	<Ref. to GD(H4SO)-143, DTC P0459 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0461	Fuel Level Sensor Circuit Range/Performance	<Ref. to GD(H4SO)-145, DTC P0461 FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0462	Fuel Level Sensor Circuit Low Input	<Ref. to GD(H4SO)-147, DTC P0462 FUEL LEVEL SENSOR CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0463	Fuel Level Sensor Circuit High Input	<Ref. to GD(H4SO)-149, DTC P0463 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to GD(H4SO)-151, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0483	Cooling Fan Rationality Check	<Ref. to GD(H4SO)-154, DTC P0483 COOLING FAN RATIONALITY CHECK, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0502	Vehicle Speed Sensor Circuit Low Input	<Ref. to GD(H4SO)-156, DTC P0502 VEHICLE SPEED SENSOR CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	<Ref. to GD(H4SO)-157, DTC P0503 VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0506	Idle Control System RPM Lower Than Expected	<Ref. to GD(H4SO)-158, DTC P0506 IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0507	Idle Control System RPM Higher Than Expected	<Ref. to GD(H4SO)-160, DTC P0507 IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0512	Starter Request Circuit	<Ref. to GD(H4SO)-162, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0519	Idle Control System Malfunction (Fail-Safe)	<Ref. to GD(H4SO)-163, DTC P0519 IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0565	Cruise Control On Signal	<Ref. to GD(H4SO)-164, DTC P0565 CRUISE CONTROL ON SIGNAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to GD(H4SO)-165, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0691	Cooling Fan 1 Control Circuit Low	<Ref. to GD(H4SO)-166, DTC P0691 COOLING FAN 1 CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0692	Cooling Fan 1 Control Circuit High	<Ref. to GD(H4SO)-167, DTC P0692 COOLING FAN 1 CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0703	Torque Converter/Brake Switch "B" Circuit	<Ref. to GD(H4SO)-168, DTC P0703 TORQUE CONVERTER/BRAKE SWITCH "B" CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0705	Transmission Range Sensor Circuit (PRNDL Input)	<Ref. to GD(H4SO)-169, DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0710	Transmission Fluid Temperature Sensor Circuit	<Ref. to GD(H4SO)-170, DTC P0710 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0716	Input/Turbine Speed Sensor Circuit Range/Performance	<Ref. to GD(H4SO)-171, DTC P0716 INPUT/TURBINE SPEED SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0720	Output Speed Sensor Circuit	<Ref. to GD(H4SO)-172, DTC P0720 OUTPUT SPEED SENSOR CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0726	Engine Speed Input Circuit Range/Performance	<Ref. to GD(H4SO)-173, DTC P0726 ENGINE SPEED INPUT CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0731	Gear 1 Incorrect Ratio	<Ref. to GD(H4SO)-174, DTC P0731 GEAR 1 INCORRECT RATIO, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0732	Gear 2 Incorrect Ratio	<Ref. to GD(H4SO)-175, DTC P0732 GEAR 2 INCORRECT RATIO, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0733	Gear 3 Incorrect Ratio	<Ref. to GD(H4SO)-176, DTC P0733 GEAR 3 INCORRECT RATIO, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0734	Gear 4 Incorrect Ratio	<Ref. to GD(H4SO)-177, DTC P0734 GEAR 4 INCORRECT RATIO, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0741	Torque Converter Clutch Circuit Performance or Stuck Off	<Ref. to GD(H4SO)-178, DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0743	Torque Converter Clutch Circuit Electrical	<Ref. to GD(H4SO)-179, DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0748	Pressure Control Solenoid "A" Electrical	<Ref. to GD(H4SO)-180, DTC P0748 PRESSURE CONTROL SOLENOID "A" ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0753	Shift Solenoid "A" Electrical	<Ref. to GD(H4SO)-181, DTC P0753 SHIFT SOLENOID "A" ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0758	Shift Solenoid "B" Electrical	<Ref. to GD(H4SO)-182, DTC P0758 SHIFT SOLENOID "B" ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0771	Shift Solenoid "E" Performance or Stuck Off	<Ref. to GD(H4SO)-183, DTC P0771 SHIFT SOLENOID "E" PERFORMANCE OR STUCK OFF, Diagnostic Trouble Code (DTC) Detecting Criteria.>

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List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P0778	Pressure Control Solenoid "B" Electrical	<Ref. to GD(H4SO)-184, DTC P0778 PRESSURE CONTROL SOLENOID "B" ELECTRICAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0785	Shift/Timing Solenoid	<Ref. to GD(H4SO)-185, DTC P0785 SHIFT/TIMING SOLENOID, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Neutral Switch Input Circuit Low	<Ref. to GD(H4SO)-186, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Neutral Switch Input Circuit High	<Ref. to GD(H4SO)-188, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0864	TCM Communication Circuit Range/Performance	<Ref. to GD(H4SO)-190, DTC P0864 TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0865	TCM Communication Circuit Low	<Ref. to GD(H4SO)-191, DTC P0865 TCM COMMUNICATION CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0866	TCM Communication Circuit High	<Ref. to GD(H4SO)-192, DTC P0866 TCM COMMUNICATION CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1110	Atmospheric Pressure Sensor Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-193, DTC P1110 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1111	Atmospheric Pressure Sensor Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-194, DTC P1111 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1134	A/F Sensor Micro-Computer Problem	<Ref. to GD(H4SO)-195, DTC P1134 A/F SENSOR MICRO-COMPUTER PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1137	O ₂ Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-197, DTC P1137 O ₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to GD(H4SO)-199, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to GD(H4SO)-201, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to GD(H4SO)-202, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1446	Fuel Tank Sensor Control Valve Circuit Low	<Ref. to GD(H4SO)-203, DTC P1446 FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1447	Fuel Tank Sensor Control Valve Circuit High	<Ref. to GD(H4SO)-205, DTC P1447 FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1448	Fuel Tank Sensor Control Valve Range/Performance	<Ref. to GD(H4SO)-207, DTC P1448 FUEL TANK SENSOR CONTROL VALVE RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1510	ISC Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-210, DTC P1510 ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1511	ISC Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-212, DTC P1511 ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1512	ISC Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-214, DTC P1512 ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1513	ISC Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-216, DTC P1513 ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1514	ISC Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-218, DTC P1514 ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P1515	ISC Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-220, DTC P1515 ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1516	ISC Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-222, DTC P1516 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1517	ISC Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-224, DTC P1517 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1518	Starter Switch Circuit Low Input	<Ref. to GD(H4SO)-226, DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1560	Back-Up Voltage Circuit Malfunction	<Ref. to GD(H4SO)-227, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1698	Engine Torque Control Cut Signal Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-228, DTC P1698 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1699	Engine Torque Control Cut Signal Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-229, DTC P1699 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1700	Throttle Position Sensor Circuit Malfunction For AT	<Ref. to GD(H4SO)-230, DTC P1700 THROTTLE POSITION SENSOR CIRCUIT MALFUNCTION FOR AT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1711	Engine Torque Control Signal #1 Circuit Malfunction	<Ref. to GD(H4SO)-232, DTC P1711 ENGINE TORQUE CONTROL SIGNAL #1 CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1712	Engine Torque Control Signal #2 Circuit Malfunction	<Ref. to GD(H4SO)-233, DTC P1712 ENGINE TORQUE CONTROL SIGNAL #2 CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to GD(H4SO)-234, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to GD(H4SO)-236, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. Diagnostic Trouble Code (DTC) Detecting Criteria

A: DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1)

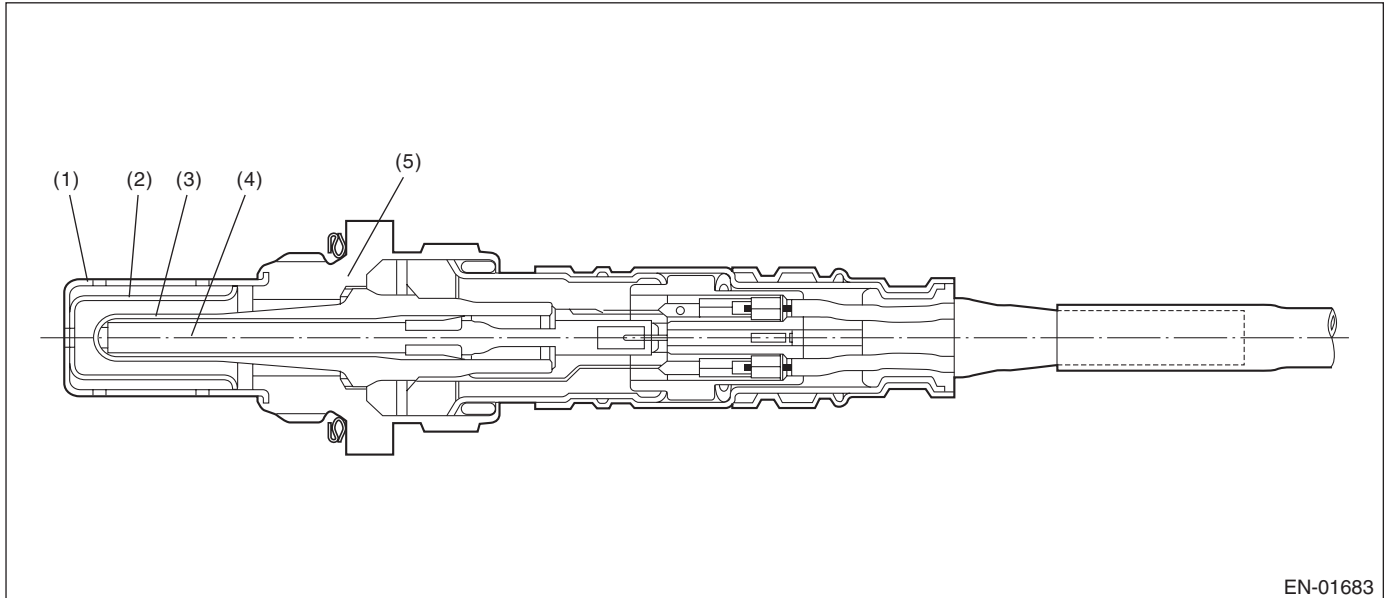
1. OUTLINE OF DIAGNOSIS

Detect the malfunction of front oxygen (A/F) sensor heater.

Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of heater malfunction NG is transmitted.

Judge NG when the front oxygen (A/F) sensor element impedance is out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Element cover (outer)
- (2) Element cover (inner)
- (3) Sensor element
- (4) Ceramic heater
- (5) Sensor housing

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Front oxygen (A/F) sensor heater diagnosis	Incomplete
Battery voltage	> 10.9 V
After heater control starting	More than 30 seconds
After fuel shut-off	More than 20 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 30 seconds after the heater continuity starting, and complete the diagnosis if making a NG judgment.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when one of the malfunction criteria below is completed.

Judgment Value

Malfunction Criteria	Threshold Value
Continuous completion period of malfunction criteria below	120 seconds or more
Impedance of front oxygen (A/F) sensor	$< 10 \Omega$ or $> 40 \Omega$
Element resistance when determined voltage is applied	$\geq 250 \Omega$

Time Needed for Diagnosis: 120 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when all of the malfunction criteria below is completed.

Judgment Value

Malfunction Criteria	Threshold Value
Continuous completion period of malfunction criteria below	30 seconds or more
Impedance of front oxygen (A/F) sensor	$10 \Omega - 40 \Omega$
Continuous completion period of malfunction criteria below	15 seconds or more
Element resistance when determined voltage is applied	$< 250 \Omega$

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

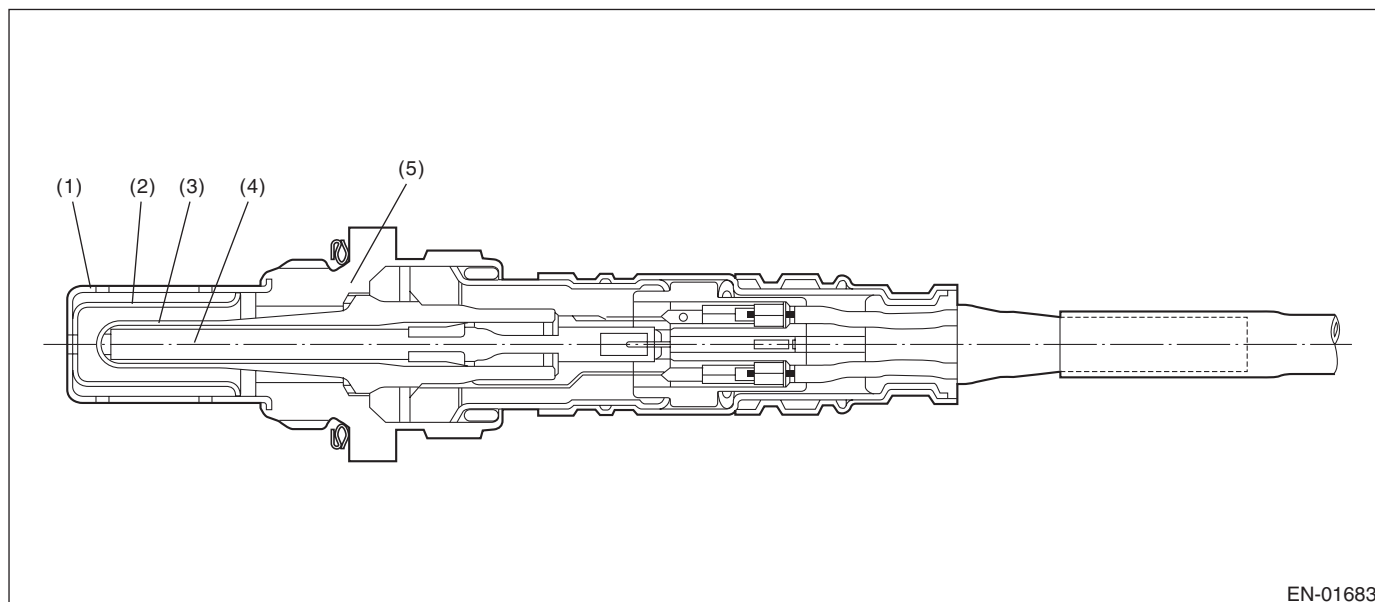
B: DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of front oxygen (A/F) sensor heater.

Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of open circuit and shortage NG is transmitted.

2. COMPONENT DESCRIPTION



- (1) Element cover (outer)
- (2) Element cover (inner)
- (3) Sensor element
- (4) Ceramic heater
- (5) Sensor housing

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Front oxygen (A/F) sensor heater diagnosis	Incomplete
Battery voltage	10.9 V or more

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open or short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing all the malfunction criteria below becomes more than 4.5 seconds.

Judgment Value

Malfunction Criteria	Threshold Value
Heater circuit	ON
Heater both edge voltage	$\leq 5 \text{ V}$
Heater current	$\leq 1.5 \text{ A}$

Time Needed for Diagnosis: 4.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

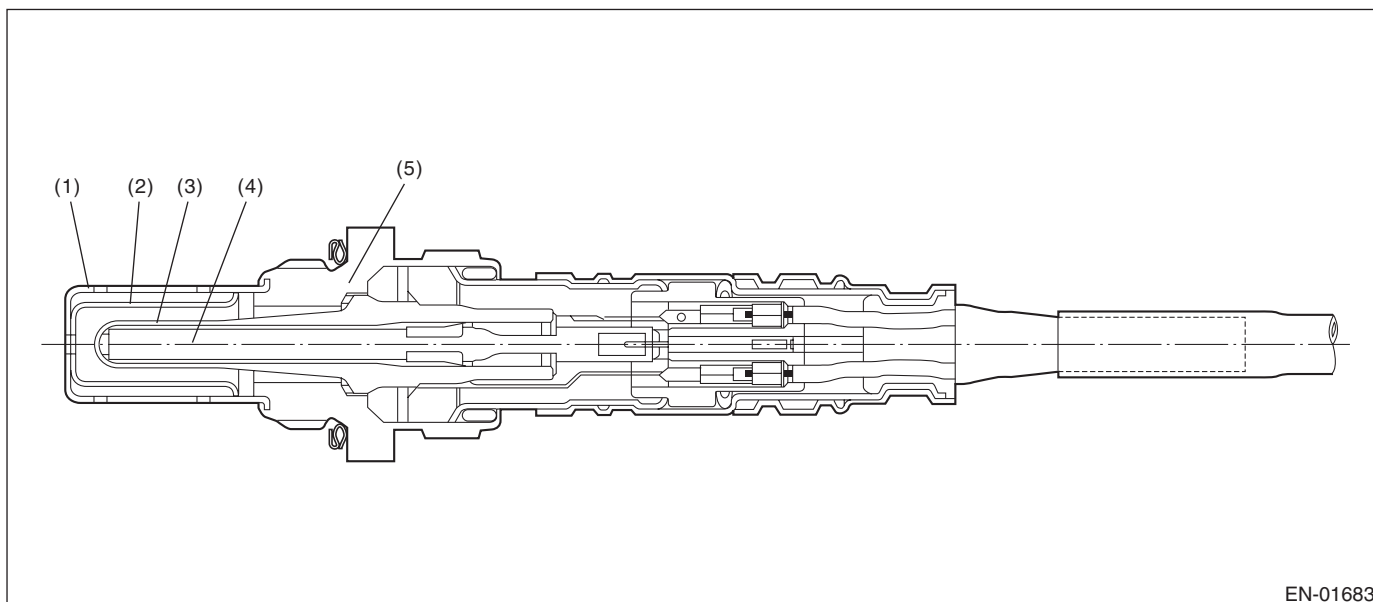
C: DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of front oxygen (A/F) sensor heater.

Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of open circuit and shortage NG is transmitted.

2. COMPONENT DESCRIPTION



- (1) Element cover (outer)
- (2) Element cover (inner)
- (3) Sensor element
- (4) Ceramic heater
- (5) Sensor housing

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Front oxygen (A/F) sensor heater diagnosis	Incomplete
Battery voltage	10.9 V or more

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open or short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when all the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Heater circuit	OFF
Heater both edge voltage	$\geq 5 \text{ V}$
Heater current	$\geq 1.5 \text{ A}$
Heater current $\geq 23 \text{ A}$ event at heater continuity	Continues more than 385 milliseconds

Time Needed for Diagnosis: 4.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

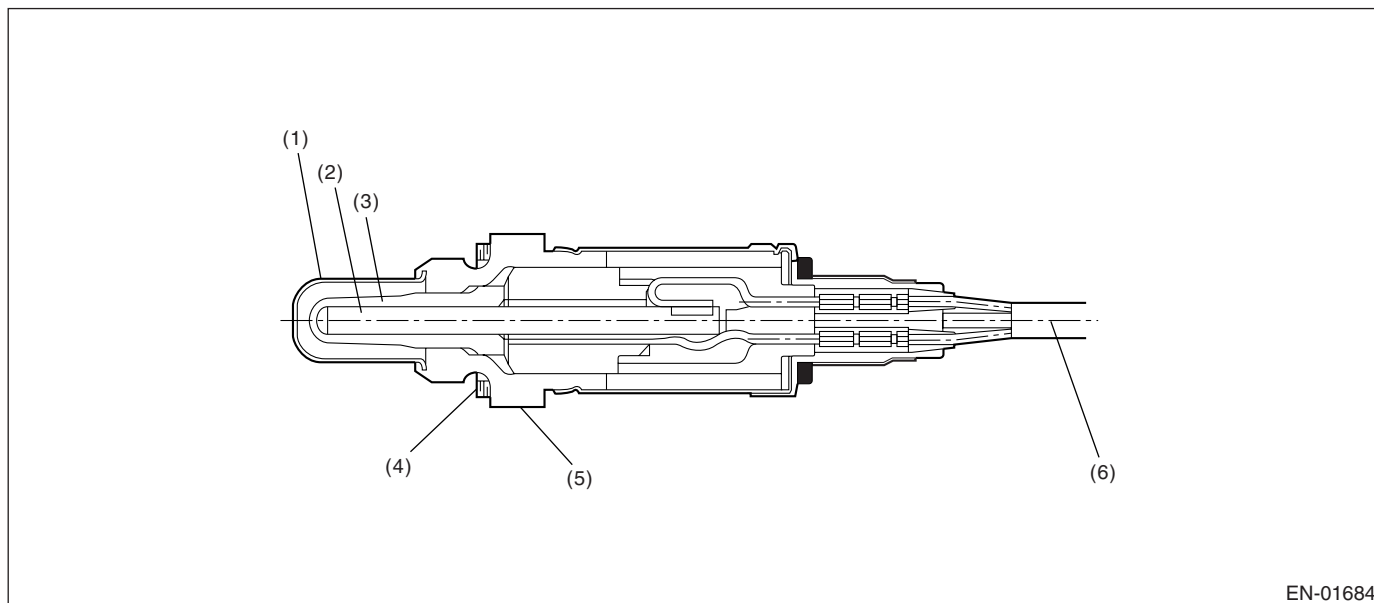
GENERAL DESCRIPTION

D: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of rear oxygen sensor heater.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



EN-01684

- (1) Protection tube
- (2) Ceramic heater
- (3) Zirconium tube

- (4) Gasket
- (5) Sensor housing
- (6) Harness

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Engine speed	≥ 500 rpm
Rear oxygen sensor heater diagnosis	Incomplete
After engine starting	10 seconds or more
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

In 10 seconds after starting the engine, perform the diagnosis just once.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes 10 seconds or more. Judge OK when the continuous time until completing none of the malfunction criteria below becomes 10 seconds or more.

Judgment Value

Malfunction Criteria	Threshold Value
Calculated electric power	< 6 watts

Time needed for diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

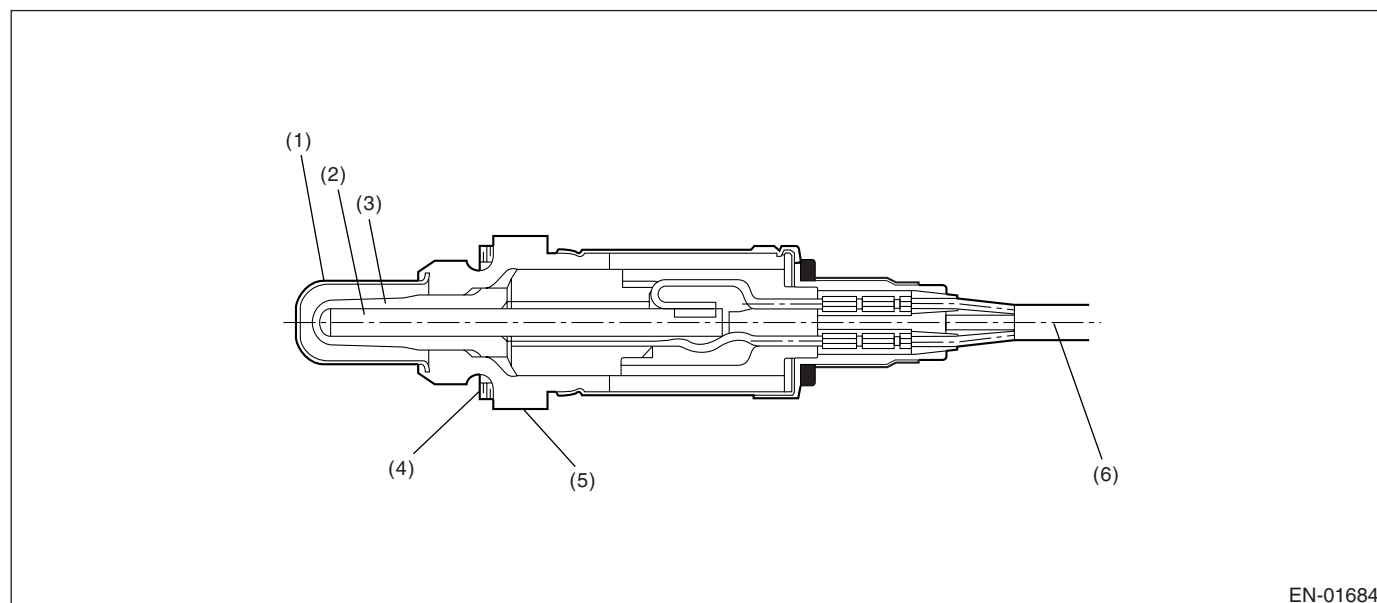
E: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of rear oxygen sensor heater.

Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Protection tube

(2) Ceramic heater

(3) Zirconium tube

(4) Gasket

(5) Sensor housing

(6) Harness

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Engine speed	≥ 500 rpm
Rear oxygen sensor heater diagnosis	Incomplete
After engine starting	10 seconds or more
Battery voltage	≥ 8 V

4. GENERAL DRIVING CYCLE

In 10 seconds after starting the engine, perform the diagnosis just once.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes 10 seconds or more. Judge OK when the continuous time until completing none of the malfunction criteria below becomes 10 seconds or more.

Judgment Value

Malfunction Criteria	Threshold Value
Calculated electric power	≥ 50 watts

Time needed for diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

F: DTC P0065 AIR ASSISTED INJECTOR CONTROL RANGE/PERFORMANCE

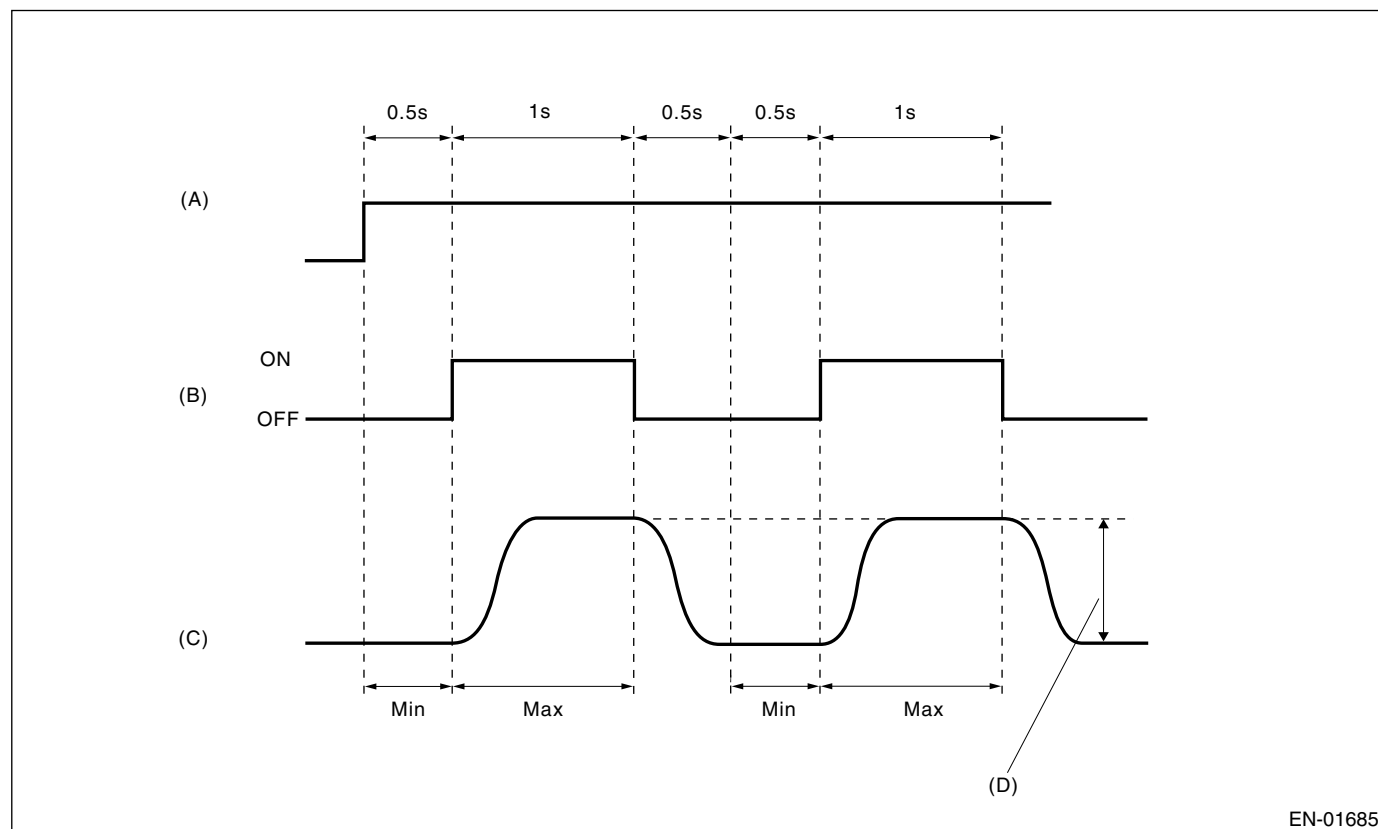
1. OUTLINE OF DIAGNOSIS

Detect the malfunction of AAI solenoid valve.

Intake manifold pressure (negative pressure) is constant because the throttle valve is fully closed during fuel cut at deceleration. At this time, opening AAI solenoid valve makes the intake manifold pressure larger. For AAI solenoid valve function diagnosis, judge OK or NG by the amount of change of intake manifold pressure when opening and closing the AAI solenoid valve.

Max. value with the valve open - Min. value with the valve closed < Threshold value → NG

Max. value with the valve open - Min. value with the valve closed ≥ Threshold value → OK



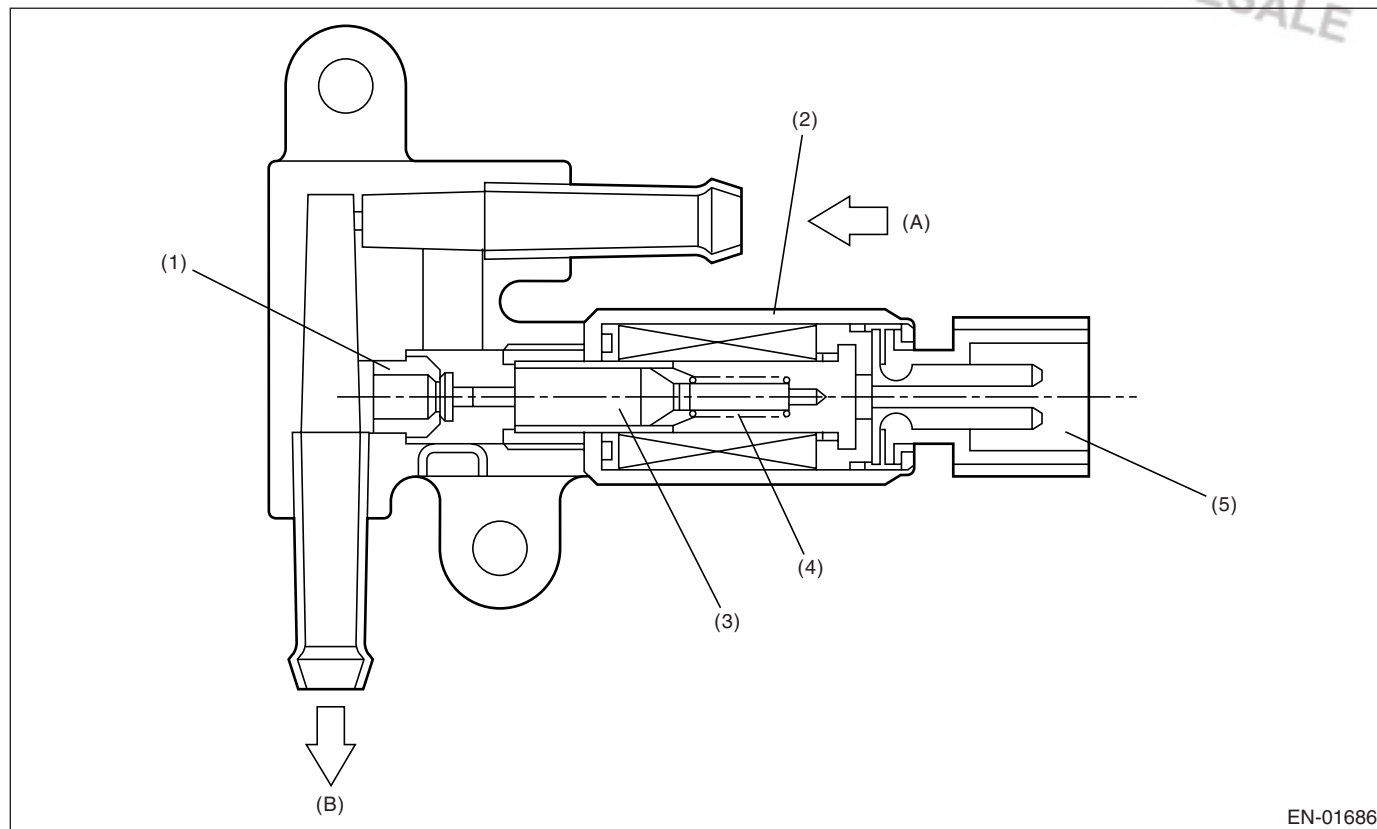
EN-01685

- (A) Conditions executed for diagnosis
- (B) AAI solenoid valve
- (C) Intake manifold pressure (At normal condition)
- (D) Diagnostic value

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION



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3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 75^{\circ}\text{C}$ (167°F)
Engine speed	1,300 $\longleftrightarrow$ 2,300 rpm
Vehicle speed	≥ 60 km/h (37 MPH)
Atmospheric pressure	≥ 86 kPa (642 mmHg, 25 inHg)
Atmospheric-MAP	≥ 53 kPa (400 mmHg, 16 inHg)
Fuel cut event by coasting	In operation
AAI solenoid valve position	OFF (closed)
Estimated ambient air temperature value	$> 5^{\circ}\text{C}$ (41°F)

4. GENERAL DRIVING CYCLE

Conduct a serial diagnosis during fuel cut at deceleration from approx. 100 km/h (62 MPH).
Be careful for vehicle speed and engine speed. (Diagnosis may not finish if the vehicle speed and engine speed conditions become out of specification.)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed 2 times in a row. Judge OK and clear the NG if not completed once

Judgment Value

Malfunction Criteria	Threshold Value
Paai1 – Paai2 Paai1; max. MAP value during AAI solenoid valve ON signal Paai2; min. MAP value during 0.5 seconds just before changing the valve from OFF to ON	< See Map 1

Map 1

Atmospheric pressure kPa (mmHg, inHg)	85.5 (641, 25.2)	86.3 (647, 25.5)	87.5 (656, 25.8)	91.7 (688, 27.1)	92.7 (695, 27.4)	93.9 (704, 27.7)	99.1 (743, 29.3)	100.3 (752, 29.6)	101.3 (760, 29.9)
Judgment value kPa (mmHg, inHg)	0 (0, 0)	0.40 (3, 0.12)	0.40 (3, 0.12)	0.53 (4, 0.16)	0.53 (4, 0.16)	0.80 (6, 0.24)	0.80 (6, 0.24)	0.80 (6, 0.24)	0.80 (6, 0.24)

Time needed for diagnosis: 3.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

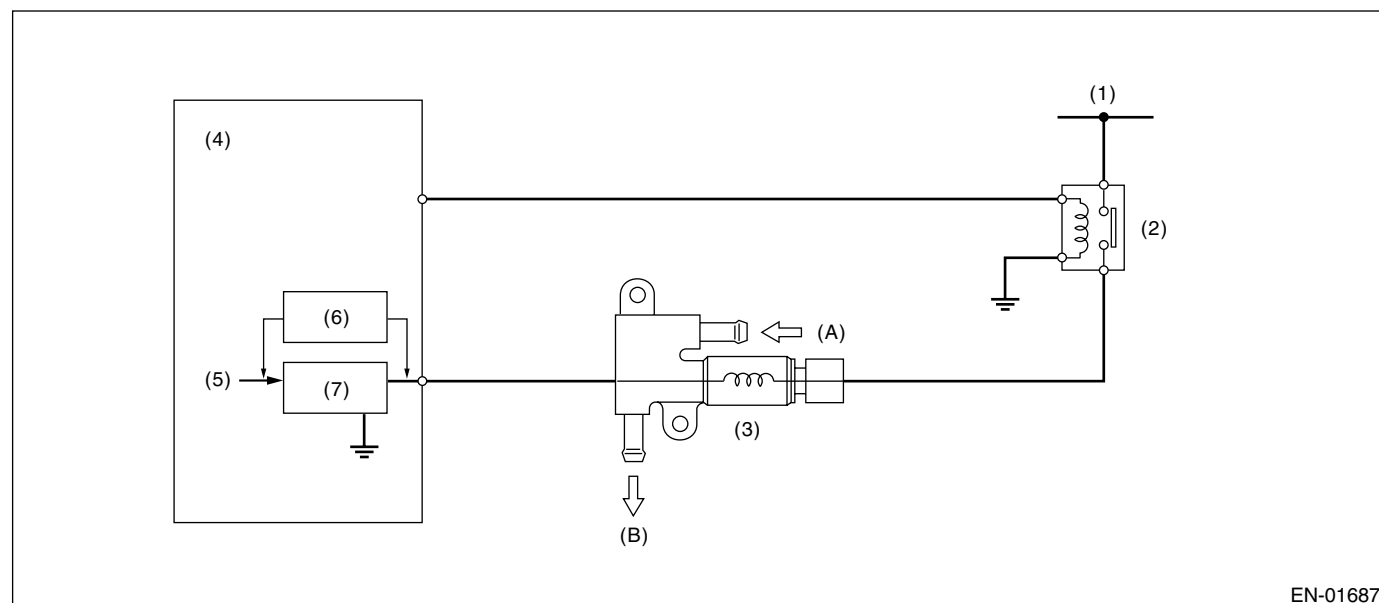
GENERAL DESCRIPTION

G: DTC P0066 AIR ASSISTED INJECTOR CONTROL CIRCUIT OR CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of AAI solenoid valve. Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Battery	(A) From idle air control solenoid valve
(2) Main relay	(B) To injector
(3) AAI solenoid valve	
(4) Engine control module (ECM)	
(5) CPU	
(6) Detecting circuit	
(7) Switching circuit	

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10.9 V
After engine starting	2 seconds or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time needed for diagnosis (2.5 seconds).

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level while ECM sent OFF signal	Low level

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• **Normality Judgment**

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level while ECM sent OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

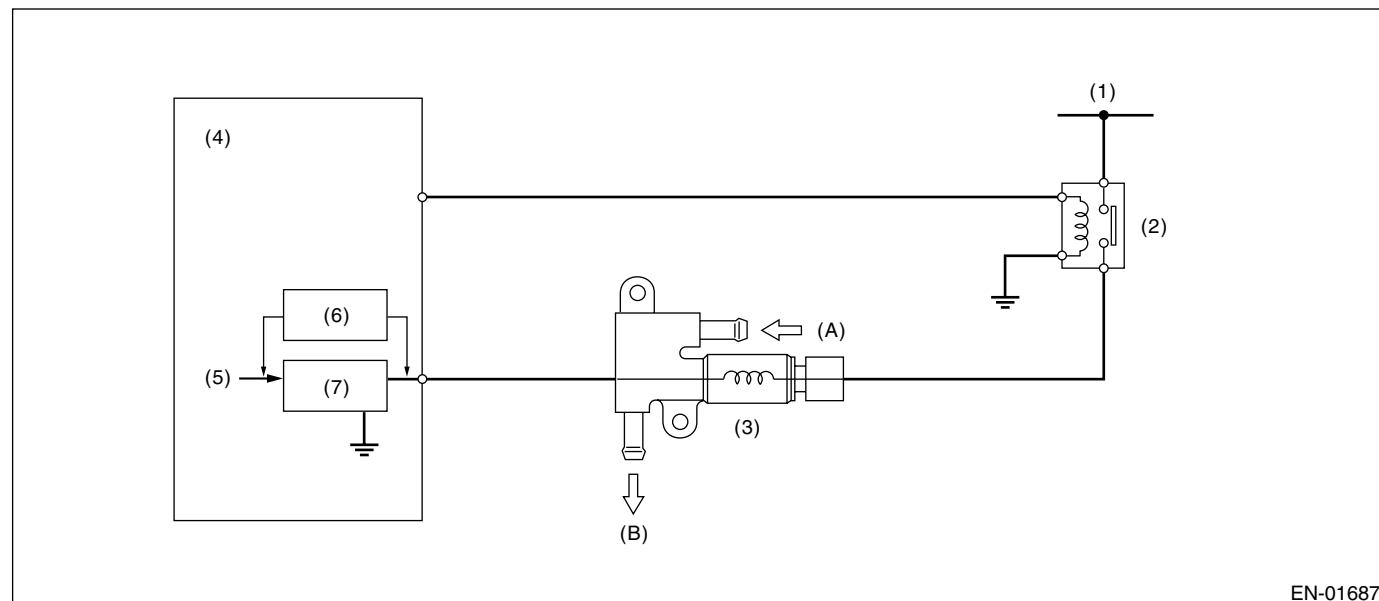
GENERAL DESCRIPTION

H: DTC P0067 AIR ASSISTED INJECTOR CONTROL CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of AAI solenoid valve. Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(1) Battery	(A) From idle air control solenoid valve
(2) Main relay	(B) To injector
(3) AAI solenoid valve	
(4) Engine control module (ECM)	
(5) CPU	
(6) Detecting circuit	
(7) Switching circuit	

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10.9 V
After engine starting	2 seconds or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level while ECM sent OFF signal	High level

Time Needed for Diagnosis: 2.5 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level while ECM sent OFF signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

I: DTC P0068 MANIFOLD PRESSURE SENSOR RANGE/PERFORMANCE

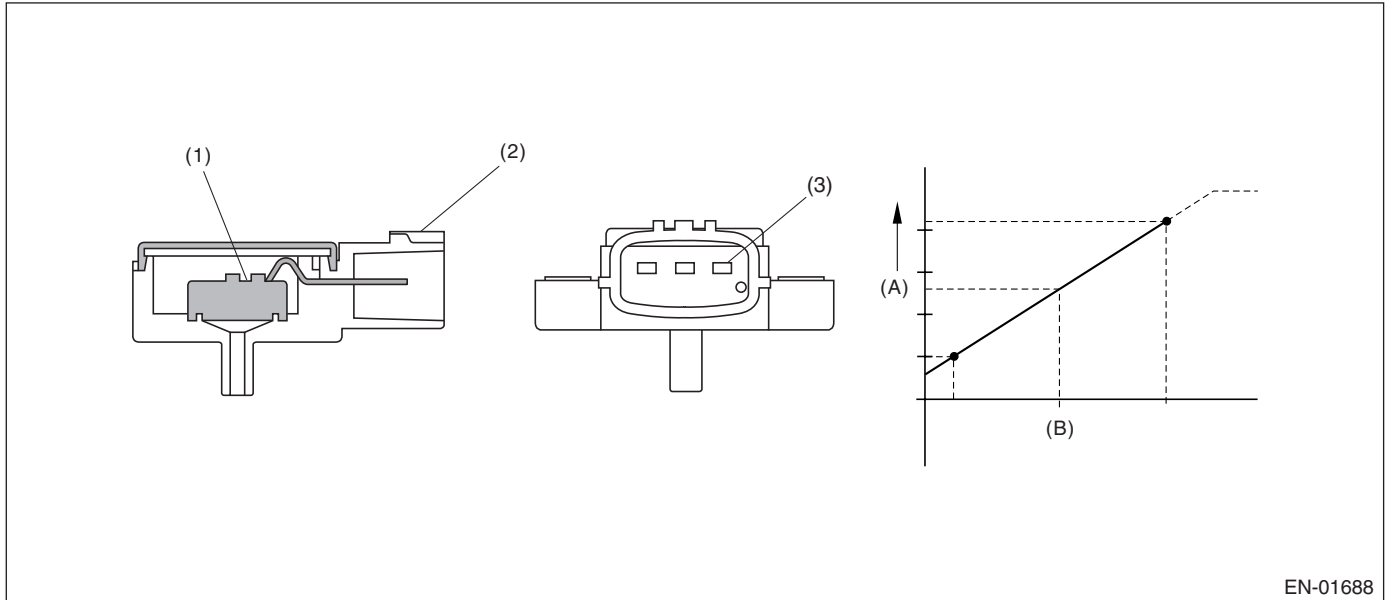
1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake manifold pressure sensor output property.

Judge NG when the intake manifold pressure is small (voltage is low) regardless of the driving situation that the intake manifold pressure may be thought larger than engine speed and throttle opening. (Low side)

On the other hand, judge NG when the intake manifold pressure is large (voltage is high) regardless of the driving situation that the intake manifold pressure may be thought smaller than engine speed and throttle opening. (High side)

2. COMPONENT DESCRIPTION



- (1) Pressure detecting part
- (2) Connector
- (3) Terminal

- (A) Output voltage
- (B) Input voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 75^{\circ}\text{C}$ (167°F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing all the malfunction criteria of Low side or High side below becomes more than the time (3 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
(Low side)	
Engine speed	> 2,500 rpm
Throttle position	> 15°
Output voltage	≤ 0.985 V
(High side)	
Engine speed	600 ↔ 900 rpm
Throttle position	≤ 2°
Output voltage	> 2.81 V

Time Needed for Diagnosis: 3 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria of Low side or High side are completed.

Judgment Value

Malfunction Criteria	Threshold Value
(Low side)	
Engine speed	> 2,500 rpm
Throttle position	> 15°
Output voltage	> 0.985 V
(High side)	
Engine speed	600 ↔ 900 rpm
Throttle position	≤ 2°
Output voltage	≤ 2.81 V

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

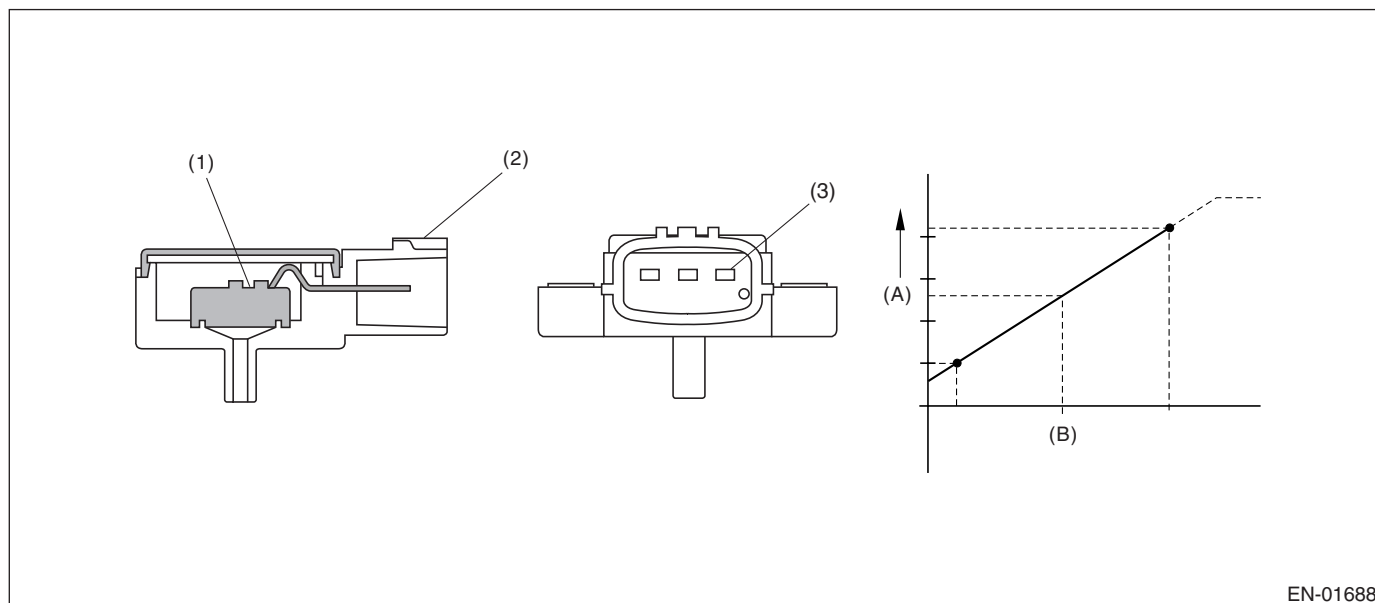
GENERAL DESCRIPTION

J: DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Pressure detecting part
- (2) Connector
- (3) Terminal

- (A) Output voltage
- (B) Input voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10 V
Self-diagnosis timer after starting the engine	≥ 0.5 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.14 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Calculate the manifold absolute pressure using the map figured by engine speed and throttle opening grid.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

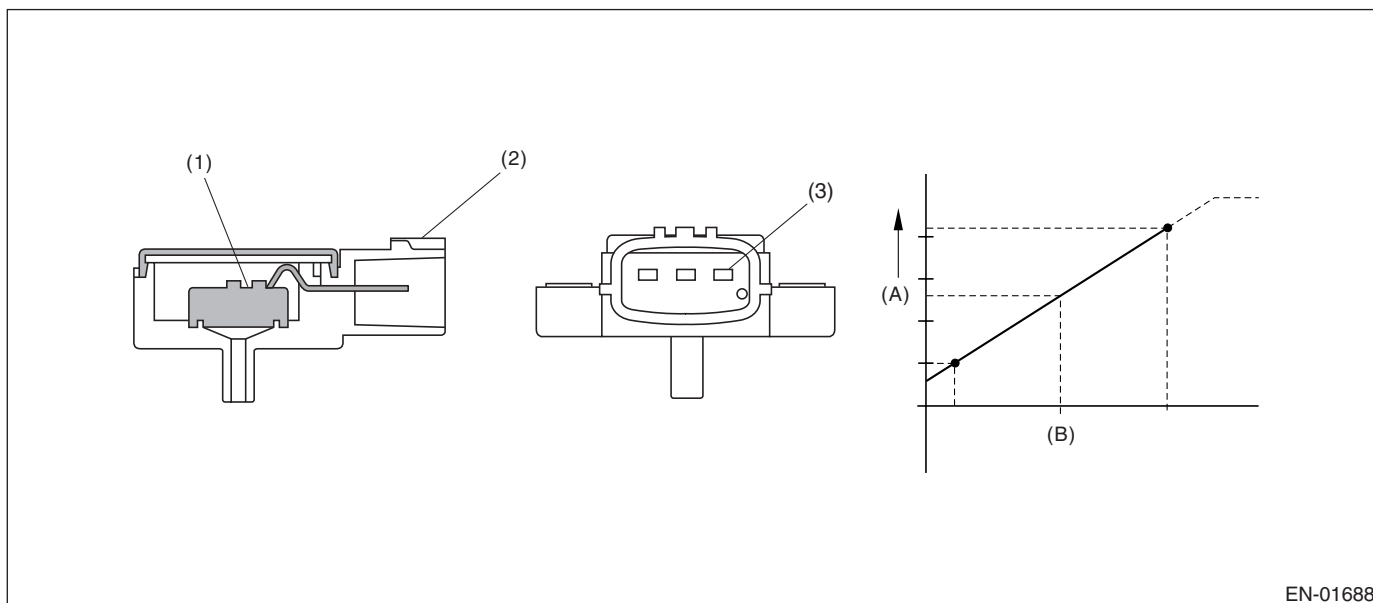
GENERAL DESCRIPTION

K: DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake manifold pressure sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Pressure detecting part
- (2) Connector
- (3) Terminal

- (A) Output voltage
- (B) Input voltage

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3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10 V
Self-diagnosis timer after starting the engine	≥ 0.5 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.88 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Calculate the intake manifold pressure using the map figured by engine speed and throttle opening grid.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

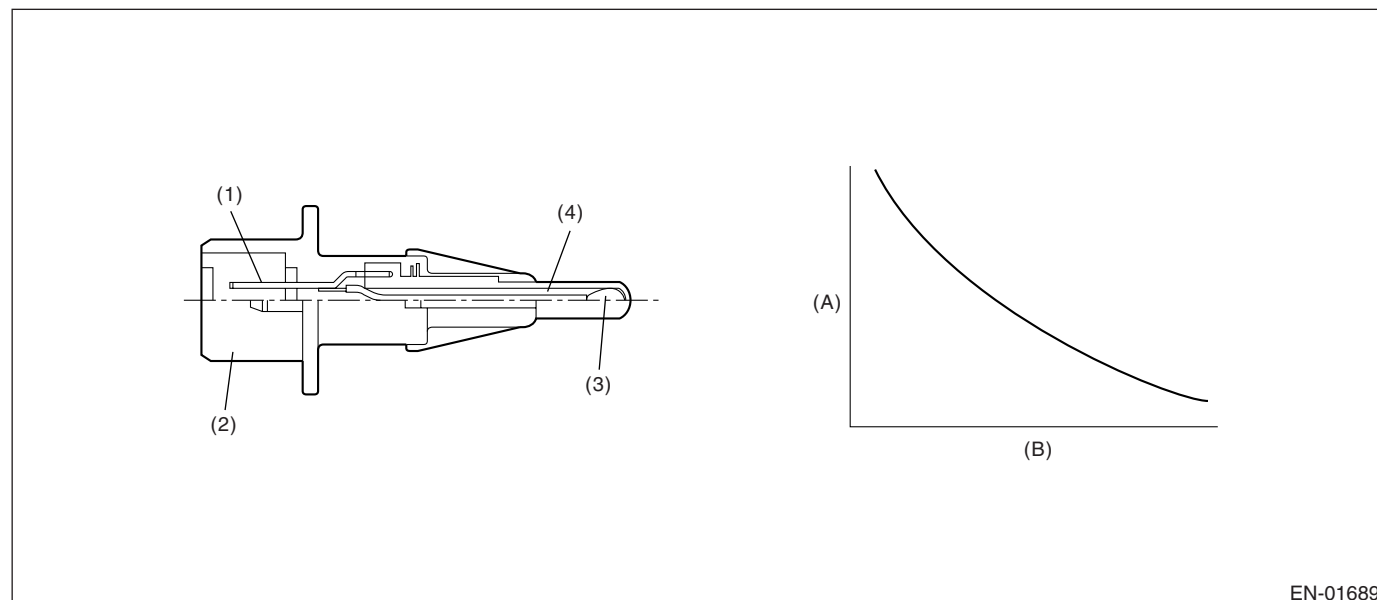
L: DTC P0111 INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake air temperature sensor output property.

Judge NG when the intake air temperature is high regardless of the driving condition that the intake air temperature may be low.

2. COMPONENT DESCRIPTION



- (1) Terminal
- (2) Connector
- (3) Thermistor
- (4) Housing

- (A) Resistance value (Ω)
- (B) Intake air temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing all the malfunction criteria below becomes more than the time (3 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 40°C (104°F)
Fuel temperature	< 40°C (104°F)
Fuel level	≥ 9 ℓ (2.4 US gal, 2.0 Imp gal)
Intake air temperature	≥ 80°C (176°F)

Time Needed for Diagnosis: 3 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Intake air temperature	< 80°C (176°F)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Make the intake air temperature 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

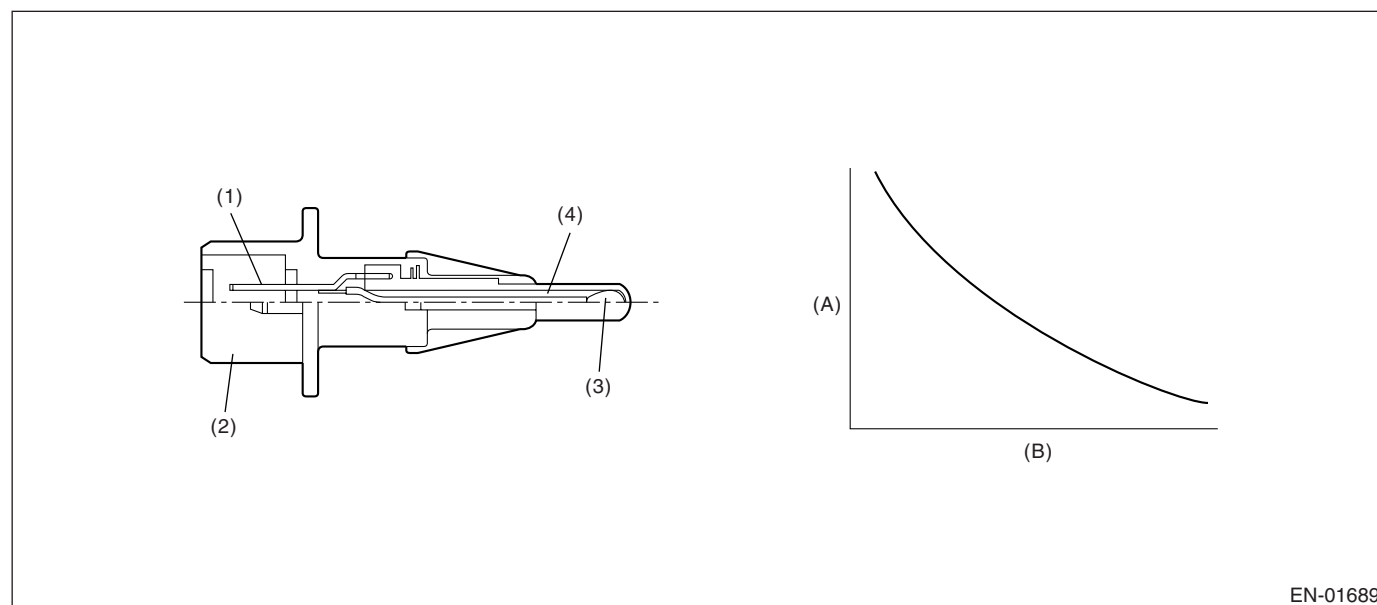
GENERAL DESCRIPTION

M: DTC P0112 INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake air temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Terminal
- (2) Connector
- (3) Thermistor
- (4) Housing

- (A) Resistance value (Ω)
- (B) Intake air temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
Timer after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.1 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Make the intake air temperature 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

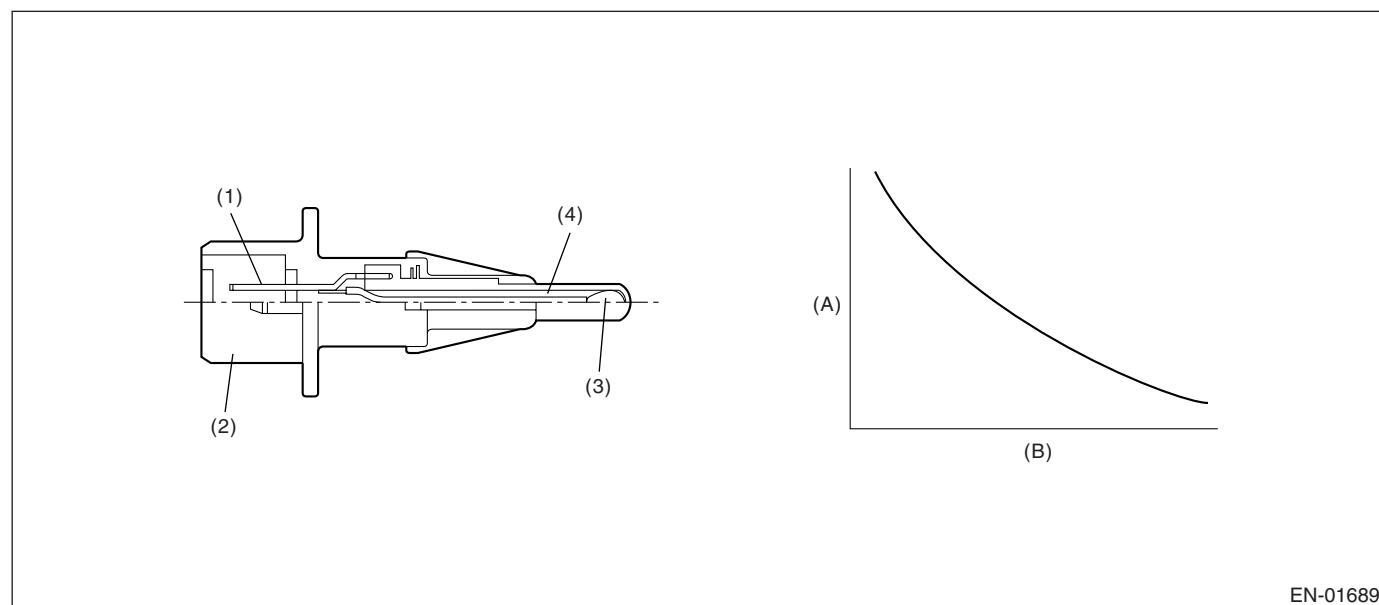
GENERAL DESCRIPTION

N: DTC P0113 INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of intake air temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Terminal
- (2) Connector
- (3) Thermistor
- (4) Housing

- (A) Resistance value (Ω)
- (B) Intake air temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
Timer after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 4.85 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Make the intake air temperature 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

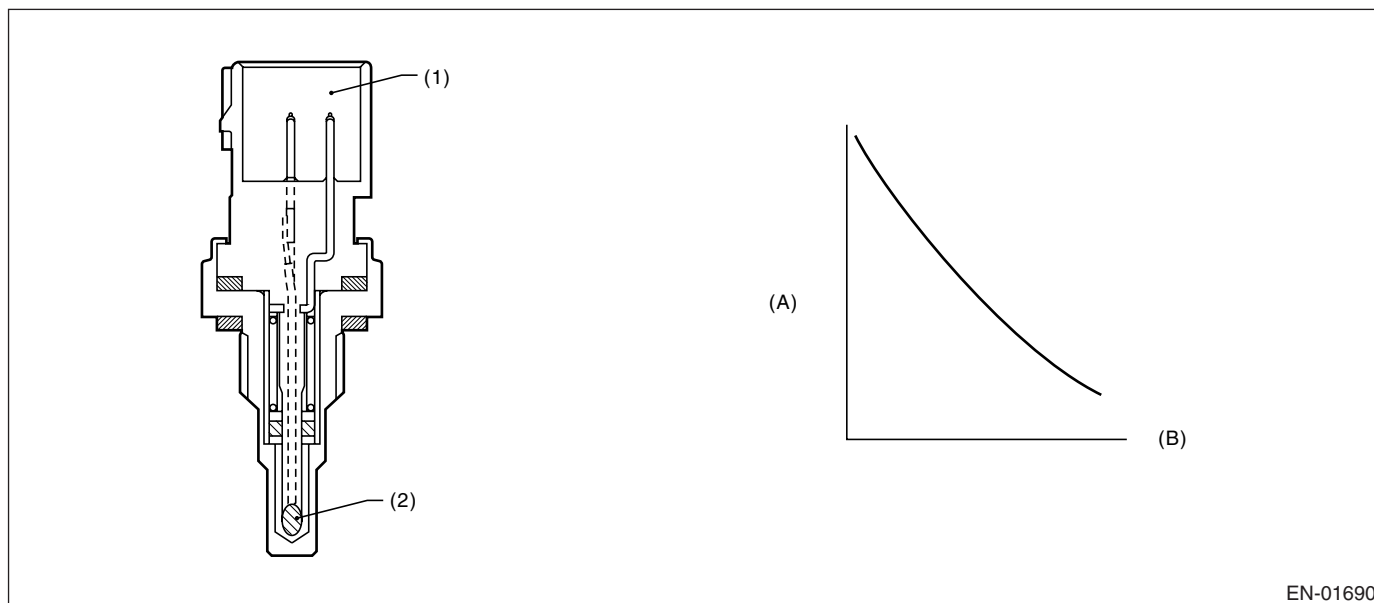
GENERAL DESCRIPTION

O: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of engine coolant temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



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- (1) Connector
(2) Thermistor element

- (A) Resistance value (kΩ)
(B) Temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
Timer after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.

Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.2 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.1 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Keep the engine coolant temperature at 70°C (158°F).

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

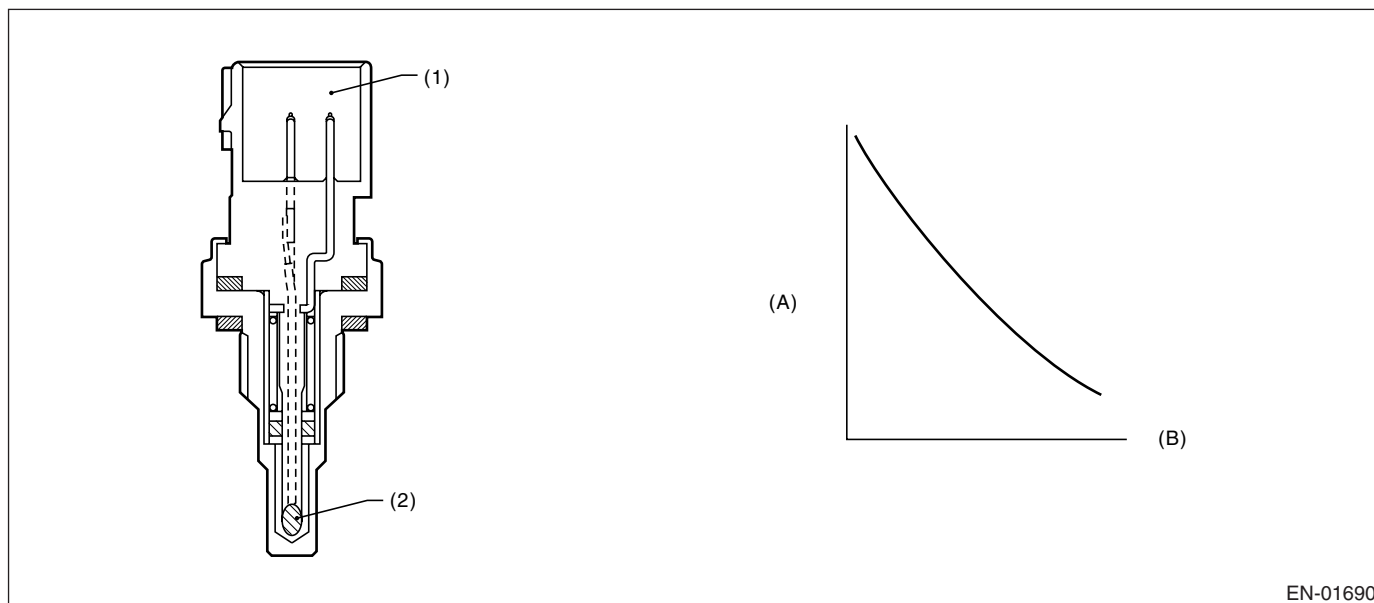
GENERAL DESCRIPTION

P: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of engine coolant temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Connector
(2) Thermistor element

- (A) Resistance value ($k\Omega$)
(B) Temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)

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3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
Timer after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.

Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.2 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.85 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Keep the engine coolant temperature at 70°C (158°F).

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

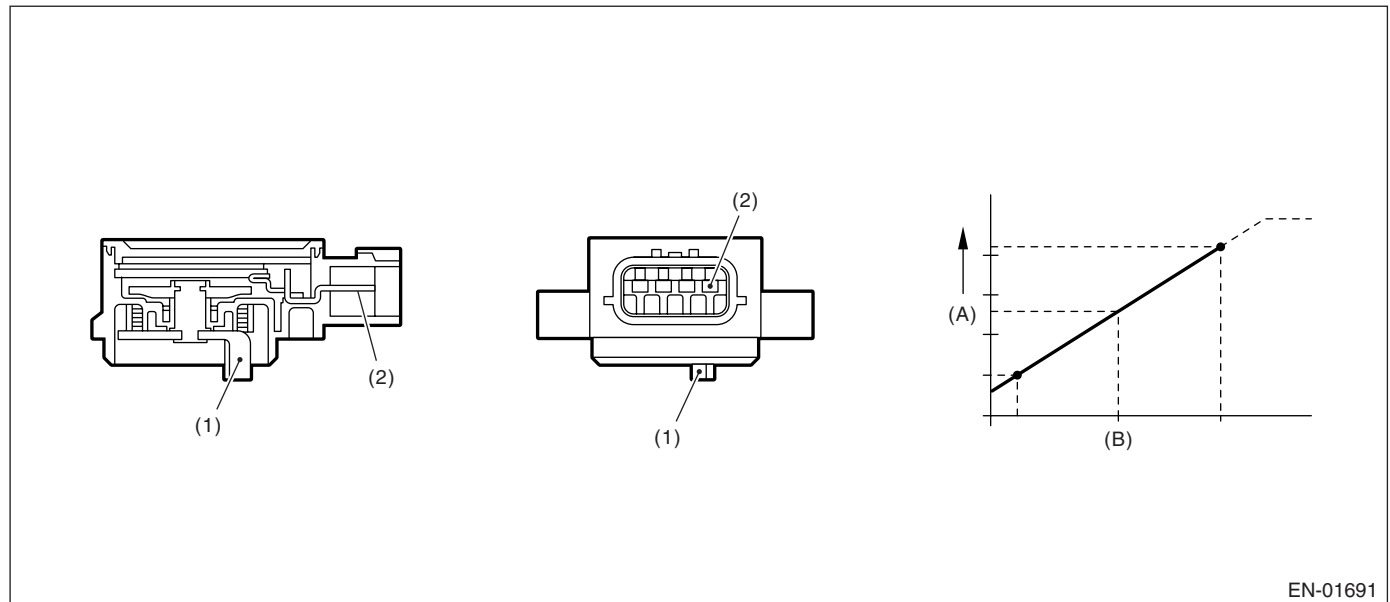
Q: DTC P0121 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of throttle position sensor output property.

Judge NG when the throttle position value is low in spite of the driving condition that accelerator pedal seems to be depressed, or when the throttle position value is high in spite of the driving condition that accelerator pedal seems to be released from engine appearance.

2. COMPONENT DESCRIPTION



- (1) Lever
- (2) Terminal

- (A) Output voltage
- (B) Throttle angle

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Coolant temperature	$\geq 75^{\circ}\text{C}$ (167°F)

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously after starting engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria of Low side or High side below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
(Low side)	
Output voltage	$\leq 0.75 \text{ V}$
Engine speed	$\geq 1,000 \text{ rpm}$
Amount of intake air	$\geq 90 \text{ kg/h}$
Intake manifold pressure	$\geq 80 \text{ kPa}$ (600 mmHg, 24 inHg)
(High side)	
Output voltage	$\geq 1.6 \text{ V}$
Engine speed	600 — 1,900 rpm
Amount of intake air	$\leq 33.8 \text{ kg/h}$
Intake manifold pressure	$\leq 47 \text{ kPa}$ (352 mmHg, 14 inHg)

Time Needed for Diagnosis:

Low side	3 seconds
High side	10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
(Low side)	
Output voltage	$> 0.75 \text{ V}$
Engine speed	$\geq 1,000 \text{ rpm}$
Amount of intake air	$\geq 90 \text{ kg/h}$
Intake manifold pressure	$\geq 80 \text{ kPa}$ (600 mmHg, 24 inHg)
(High side)	
Output voltage	$\leq 1.6 \text{ V}$
Engine speed	600 — 1,900 rpm
Amount of intake air	$\leq 33.8 \text{ kg/h}$
Intake manifold pressure	$\leq 47 \text{ kPa}$ (352 mmHg, 14 inHg)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Fix the throttle position to 6.4° .

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

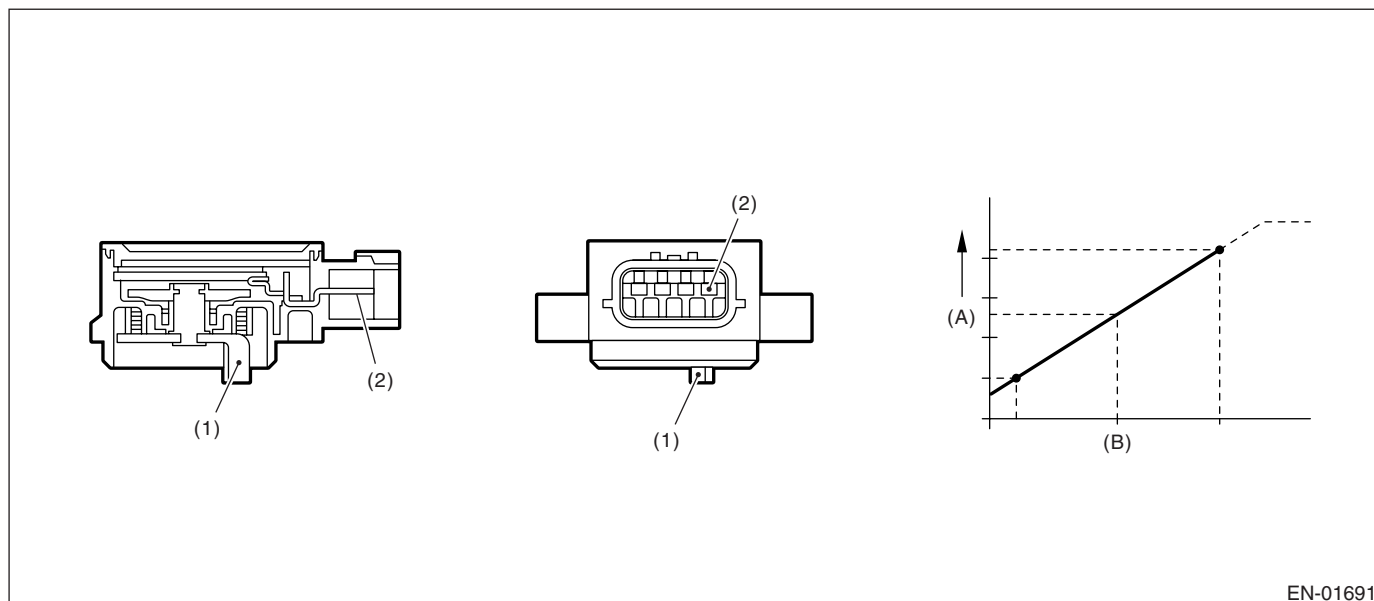
GENERAL DESCRIPTION

R: DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Lever
(2) Terminal

- (A) Output voltage
(B) Throttle angle

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.

Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\leq 0.1 \text{ V}$

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Fix the throttle position to 6.4°.

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

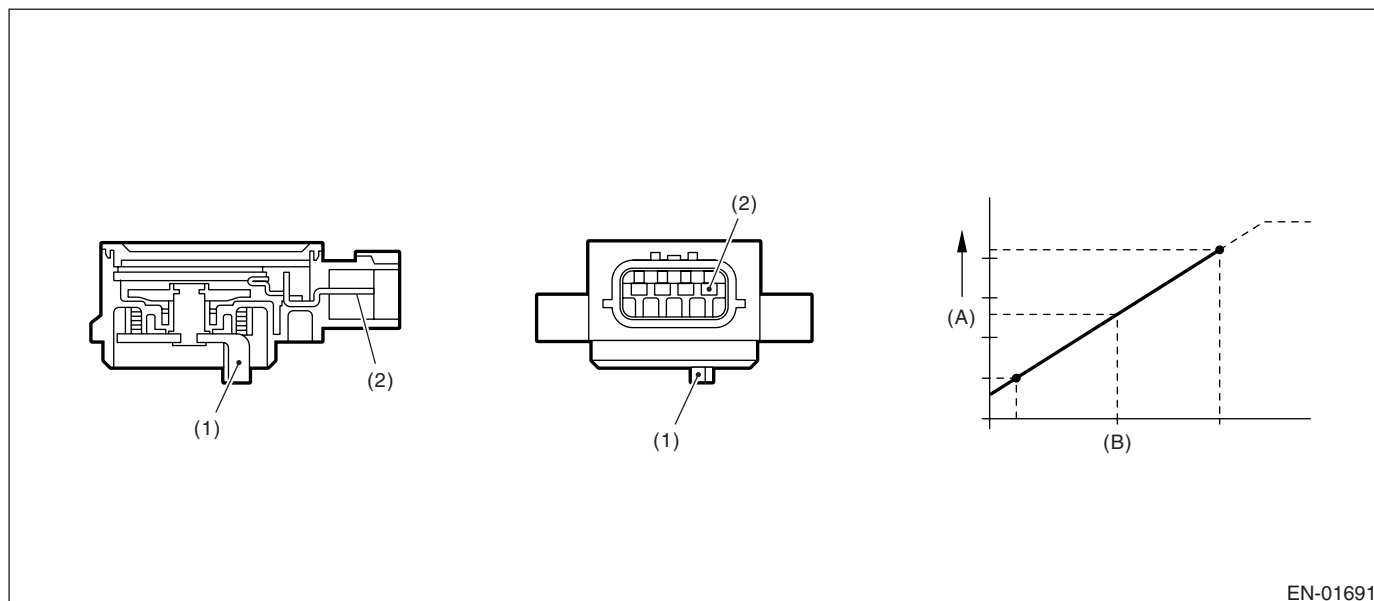
GENERAL DESCRIPTION

S: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Lever
(2) Terminal

- (A) Output voltage
(B) Throttle angle

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis.

Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.9 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Fix the throttle position to 6.4°.

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

T: DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature sensor output property. Judge NG when the engine coolant temperature does not increase after engine starting in spite of the driving condition that it seems to increase.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed loop coolant temperature property diagnosis	Incomplete

3. GENERAL DRIVE CYCLE

Always perform the diagnosis until the engine coolant temperature becomes 20°C (68°F) after starting engine with cooled condition or until NG is judged once.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed. Judge OK and clear NG when the engine coolant temperature is more than 20°C (68°F) or more.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 20°C (68°F)
Timer after starting the engine	≥ Judgment time

Judgment time: Find from minimum engine coolant temperature.

Minimum engine coolant temperature °C (°F)	-30 (-22)	0 (32)	30 (86)	60 (140)	64.25 (147.65)
Judgment time (second)	630.05	429.5	228.95	28.4	0

Time Needed for Diagnosis: Change at minimum engine coolant temperature.

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

Keep engine coolant temperature at 70°C (158°F).

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

U: DTC P0128 COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

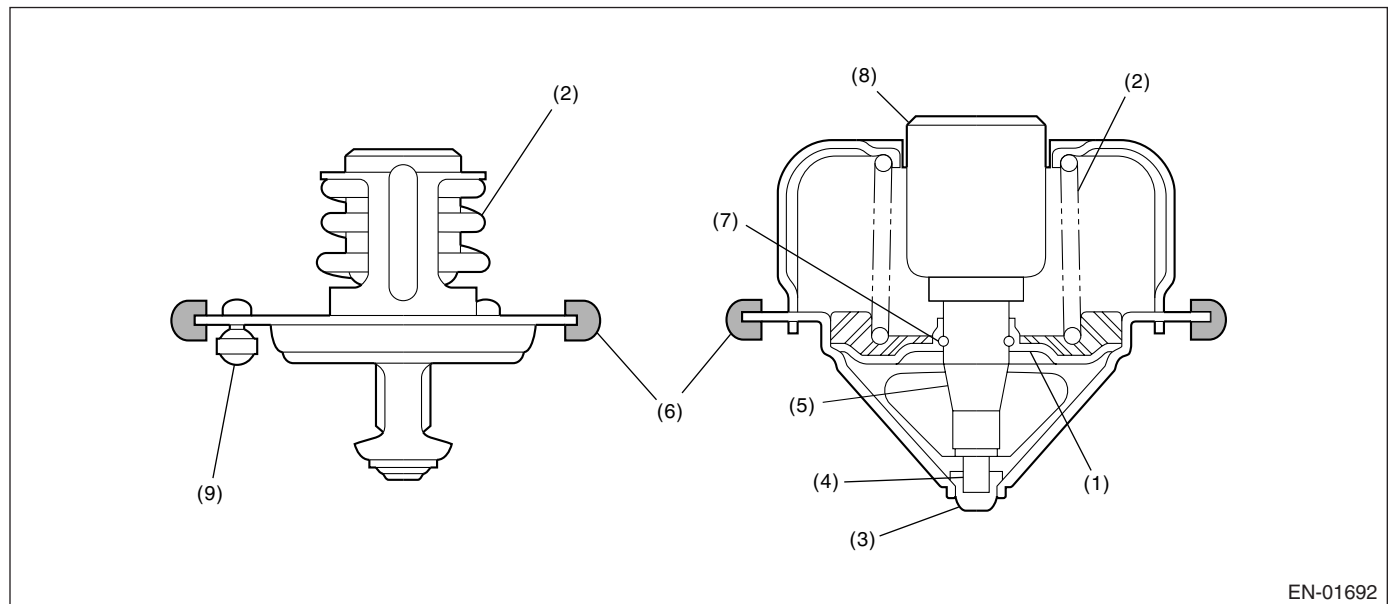
1. OUTLINE OF DIAGNOSIS

Detect the malfunction of thermostat.

Thermostat open fixing may result in overcooling. Therefore, engine coolant temperature becomes low and the control is unable under theoretical air fuel ratio, so the exhaust deteriorate. Furthermore, it is impossible to perform the other diagnosis if the engine coolant temperature does not rise. For these reasons, thermostat open fixing diagnosis should be conducted.

Judge NG when the estimated engine coolant temperature is higher than engine coolant temperature and the difference between them is large. Judge OK when the engine coolant temperature becomes 75°C (167°F) before judging NG.

2. COMPONENT DESCRIPTION



- (1) Valve
- (2) Spring
- (3) Stopper
- (4) Piston
- (5) Guide

- (6) Rubber packing
- (7) Stop ring
- (8) Wax element
- (9) Jiggle valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ambient air temperature	$\geq -7^{\circ}\text{C}$ (19°F)
Engine coolant temperature at engine starting	$< 55^{\circ}\text{C}$ (131°F)

4. GENERAL DRIVING CYCLE

After starting the engine at cool condition, always perform the diagnosis until the engine coolant temperature becomes more than 75°C (167°F).

5. DIAGNOSTIC METHOD

Judge NG when the estimated engine coolant temperature comes to 75°C (167°F) before the engine coolant temperature becomes 75°C (167°F) and the difference between them becomes more than 30°C (86°F). Judge OK when the engine coolant temperature comes to 75°C (167°F) before judging NG.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Abnormality Judgment

Judge NG when the cumulative time becomes more than 30 seconds after completing all the malfunction criteria below.

Judgment Value

Malfunction Criteria	Threshold Value
(Estimated-measured) coolant temperature	> 30°C (86°F)
Engine coolant temperature	< 75°C (167°F)
Estimated coolant temperature	≥ 75°C (167°F)
Vehicle speed	≥ 40 km/h (25 MPH)
Injector pulse	≥ 1.92 milliseconds

Time Needed for Diagnosis: 30 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
(Estimated-measured) coolant temperature	≤ 30°C (86°F)
Engine coolant temperature	≥ 75°C (167°F)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

V: DTC P0129 BAROMETRIC PRESSURE TOO LOW

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of atmospheric pressure sensor output property.

Intake manifold pressure and atmospheric pressure are the same from turning the IG key to ON to turning the start SW to ON. Therefore, compare the pressure from intake manifold pressure and atmospheric pressure sensors, and then judge NG when their difference is large.

2. COMPONENT DESCRIPTION

Atmospheric pressure sensor is built in ECM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Neutral switch	ON
Engine speed	< 500 rpm
Vehicle speed	< 2 km/h (1 MPH)
Start SW	OFF
(Max-min) manifold absolute pressure output	< 1.2 kPa (9 mmHg, 0.4 inHg)
Atmospheric Pressure Sensor Circuit Range/Performance diagnosis	Not yet.

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once from the IG key turned to ON to the start SW turned to ON.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Atmospheric-manifold absolute pressure	≥ 27 kPa (200 mmHg, 8 inHg)

Time Needed for Diagnosis: 0.1 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Make the atmospheric pressure 101 kPa (760 mmHg, 29.8 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

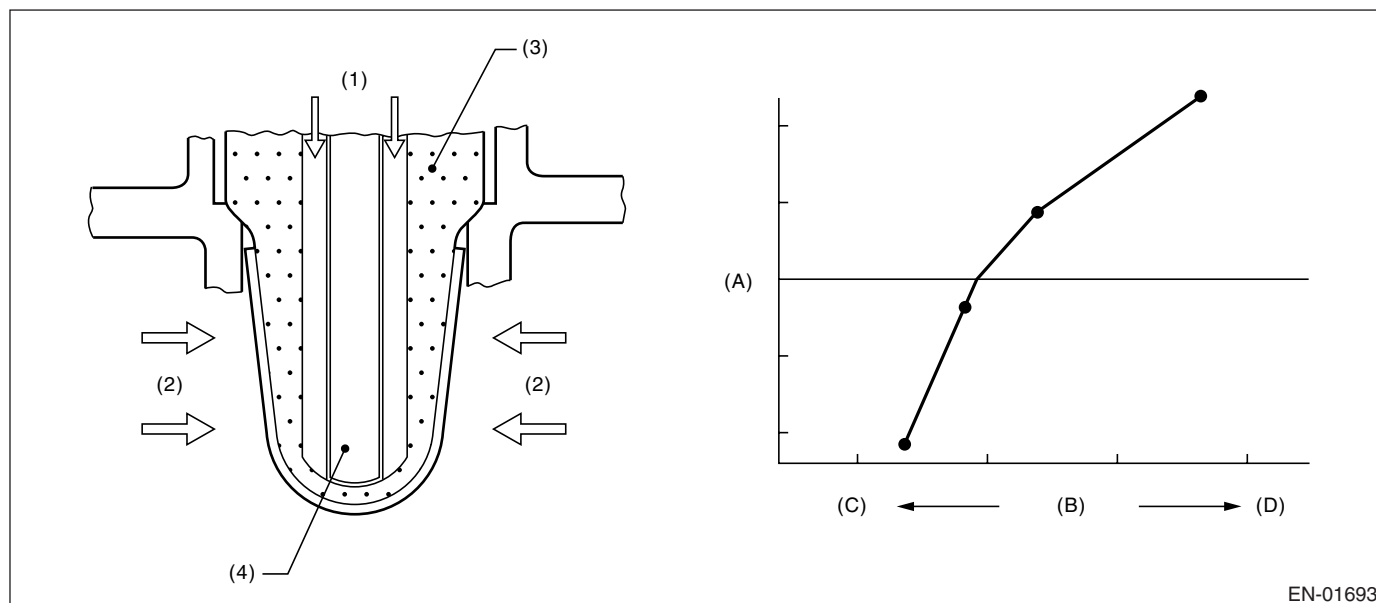
W: DTC P0130 O₂ SENSOR CIRCUIT (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of front oxygen (A/F) sensor output property.

Judge NG when the front oxygen (A/F) sensor output continues to be lean.

2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO₂
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed loop control	In operation
Fuel shut-off event	Not in operation
Misfire rate during 200 engine revs.	≤ 1.0%
After engine starting	230 seconds or more
Engine coolant temperature	≥ 75°C (167°F)
Fuel level	≥ 9 ℓ (2.4 US gal, 2.0 Imp gal)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 200 seconds after engine starting.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing all the malfunction criteria below becomes more than the time (10 seconds) needed for diagnosis

Judgment Value

Malfunction Criteria	Threshold Value
A/F sensor output (VAF)	> 2.3 V (lean)
Lambda fudge factor (LAMBDA)	= Rich clamp at MAX limiter (1.375)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Time Needed for Diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• **Normality Judgment**

Judge OK when the cumulative time until completing all the malfunction criteria below becomes more than the time (10 seconds) needed for diagnosis

Judgment Value

Malfunction Criteria	Threshold Value
A/F sensor output (VAF)	≤ 2.3 V

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

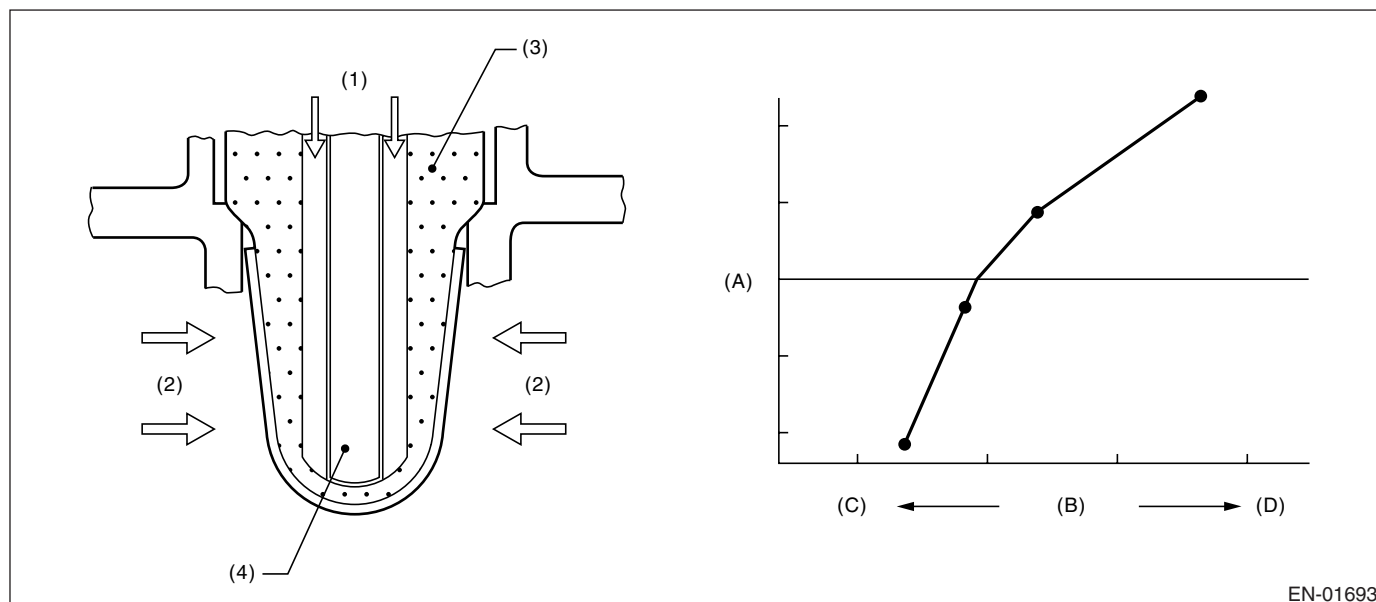
X: DTC P0131 O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the low voltage short circuit of front oxygen (A/F) sensor.

Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of low voltage short circuit NG is transmitted.

2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO₂
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Front oxygen (A/F) sensor diagnosis	Incomplete

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open circuit, low voltage short circuit or high voltage short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below is completed.

Judgment Value

Malfunction Criteria	Threshold Value
AFV voltage ≤ 0.3 V	Continue for 4.02 seconds or more
OR; AFC voltage ≤ 0.4 V	Continue for 4.02 seconds or more.

Time Needed for Diagnosis: 4.02 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

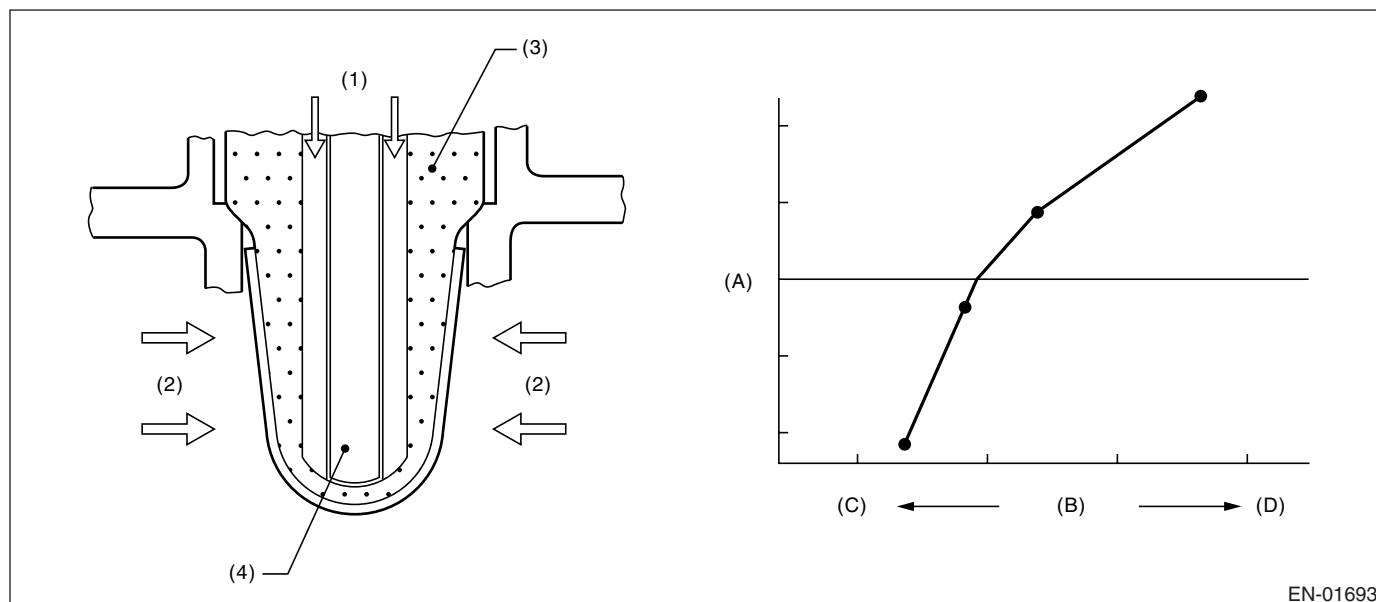
Y: DTC P0132 O₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the high voltage short circuit of front oxygen (A/F) sensor.

Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of high voltage short circuit NG is transmitted.

2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO₂
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Front oxygen (A/F) sensor diagnosis	Incomplete

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open circuit, low voltage short circuit or high voltage short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below is completed.

Judgment Value

Malfunction Criteria	Threshold Value
AFV voltage ≥ 4.4 V or AFC voltage ≥ 4.4 V, OR; heater current ≥ 23 A during heater continuity, AND; AFV / AFC	Continue for 4.02 seconds or more Continue for 385 minutes or more VB short

Time Needed for Diagnosis: 4.02 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

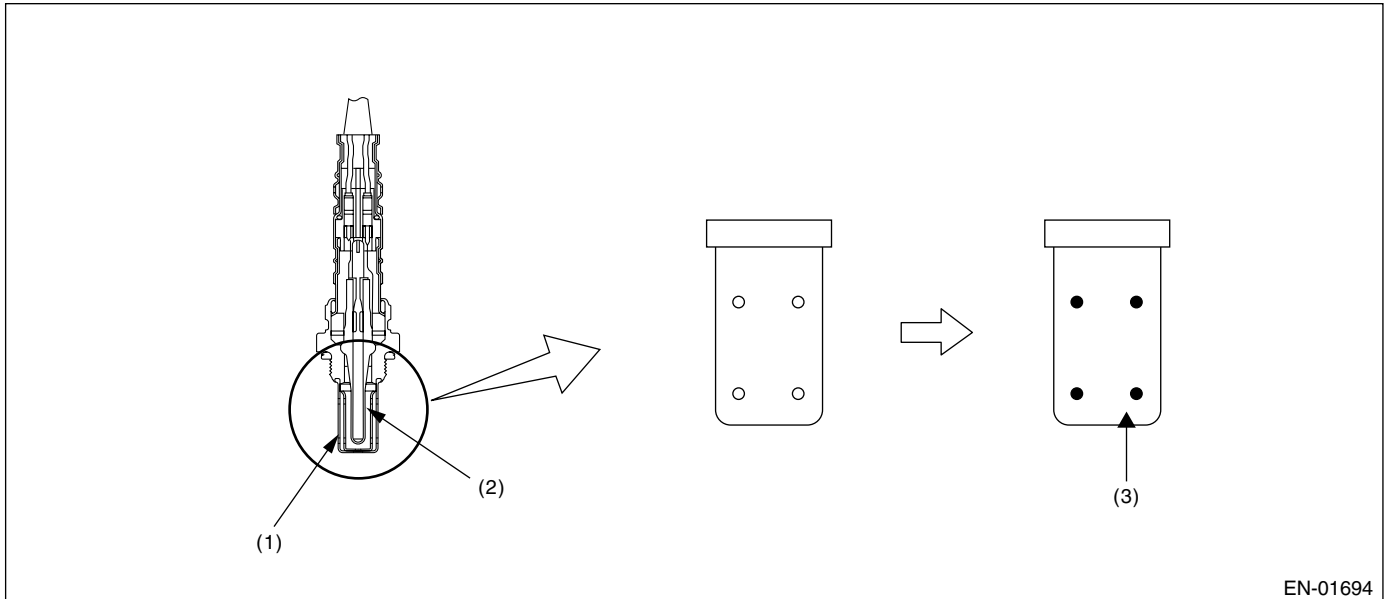
Z: DTC P0133 O₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.

Front oxygen (A/F) sensor cover has some ventilation holes for exhaust gas. Clogged ventilation holes are diagnosed.

When the holes are clogged, the A/F output variation becomes slow comparing with the actual A/F variation because oxygen which reaches the zirconia layer is insufficient. Therefore, if the cover has clogged holes, the rich to lean judgment in ECM is delayed when the change from rich to lean is caused.



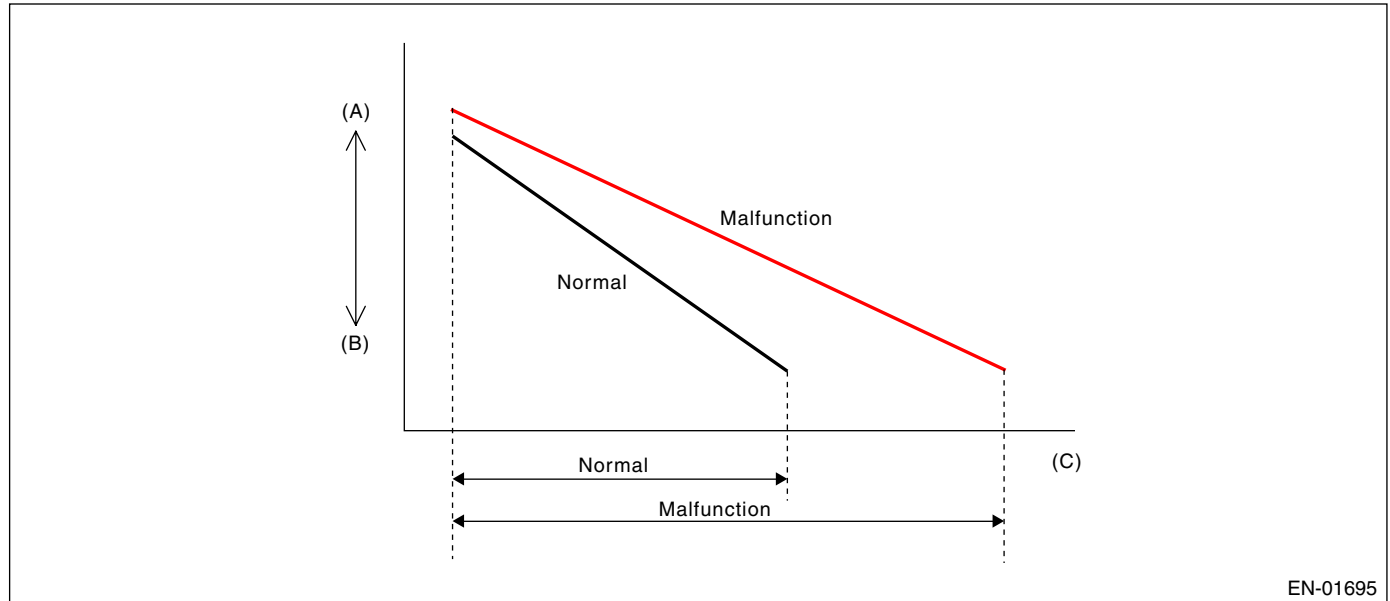
- (1) Cover
- (2) Zirconia
- (3) Clogging

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

When abnormal, the variation period from rich to lean is longer than when normal, as shown in the figure below.

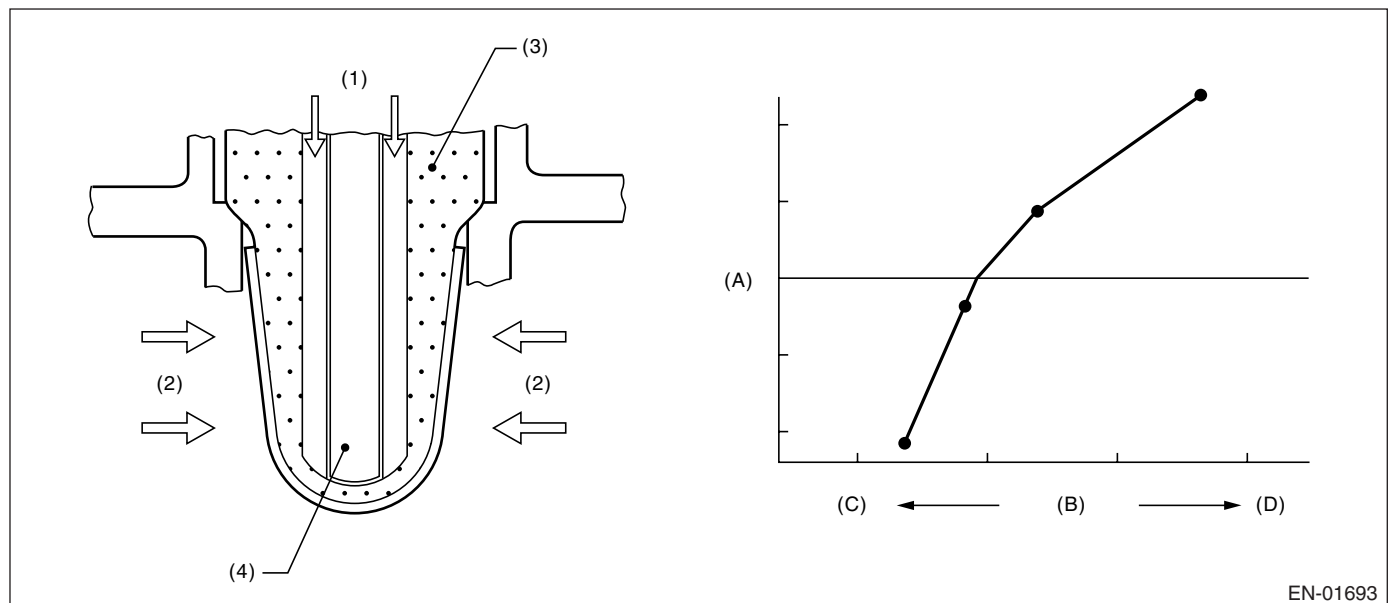
When the condition is completed, the variation time from rich to lean and vice versa is calculated by varying the desired A/F value. Judge NG when the period is long.



EN-01695

- (A) Rich
- (B) Lean
- (C) Time

2. COMPONENT DESCRIPTION



EN-01693

- (1) Atmosphere
- (2) Exhaust
- (3) ZrO₂
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameter	Enable Condition
Closed loop control	In operation
Average lambda	0.703 $\longleftrightarrow$ 1.375
After starting the engine	225 seconds or more
Engine coolant temperature	$\geq 75^{\circ}\text{C}$ (167°F)
Injector pulse	1.792 $\longleftrightarrow$ 4.032 milliseconds
Engine speed	1,800 $\longleftrightarrow$ 3,000 rpm
Vehicle speed	≥ 76 km/h (47 MPH)
Atmospheric air pressure	≥ 76 kPa (568 mmHg, 22 inHg)
Throttle position change for 90 milliseconds	$< 1.60^{\circ}$
Impedance of lambda sensor	10 $\longleftrightarrow$ 40 Ω
Misfire rate at engine 200 rev.	$\leq 1.0\%$
A/F sensor response diagnosis	Incomplete
Idle SW	OFF

4. GENERAL DRIVING CYCLE

Perform diagnosis constantly at 80 km/h (50 MPH) just once in 225 seconds after starting the engine.

5. DIAGNOSTIC METHOD

When enable conditions are completed, measure the A/F sensor output A/F value variation period by changing air fuel ratio desired value to lean and rich. Judge NG when this period is long. Judge OK when this period is short.

Judge NG when the malfunction criteria below is completed. Judge OK when the malfunction criteria below is not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Average time of 5 changes from rich to lean, and from lean to rich	> See Map 5
Response time when noise is detected is not used as data.	

Map 5

Engine Speed (Ne) (rpm)	$1.75 \leq \text{TP} < 2.25$ (milliseconds)	$2.25 \leq \text{TP} < 2.75$ (milliseconds)	$2.75 \leq \text{TP} < 3.19$ (milliseconds)	$3.19 \leq \text{TP}$ (milliseconds)
$1,800 \leq \text{Ne} < 2,100$	1,898	1,731	1,658	1,591
$2,100 \leq \text{Ne} < 2,500$	1,720	1,570	1,540	1,530
$2,500 \leq \text{Ne} < 3,000$	1,674	1,535	1,499	1,478
$3,000 \leq \text{Ne}$	1,674	1,535	1,499	1,478

Time Needed for Diagnosis: 2 to 12 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

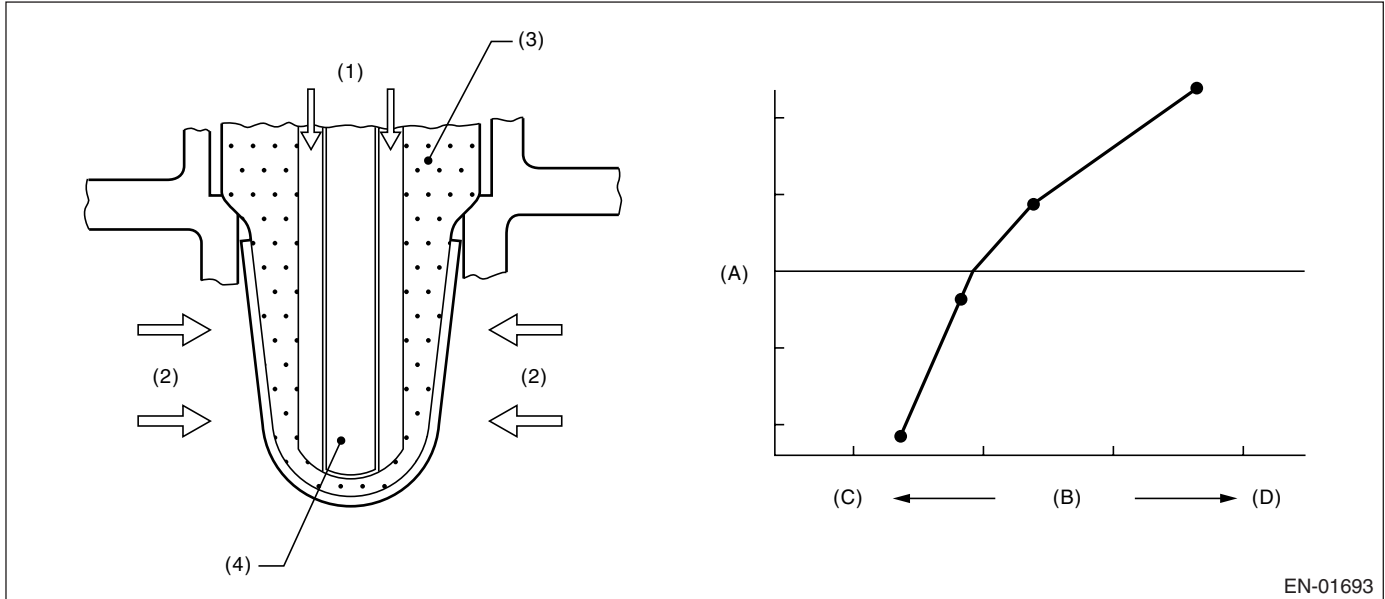
AA:DTC P0134 O₂ SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the open circuit of front oxygen (A/F) sensor.

Diagnosis is performed using A/F microcomputer, and communication is established between A/F microcomputer and main microcomputer. Judge NG when the data of open circuit NG is transmitted.

2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) ZrO₂
- (4) Ceramic heater

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Front oxygen (A/F) sensor diagnosis	Incomplete

4. GENERAL DRIVING CYCLE

Terminate the diagnosis if the open circuit, low voltage short circuit or high voltage short circuit becomes NG once by performing diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when all the malfunction criteria below is completed.

Judgment Value

Malfunction Criteria	Threshold Value
Heater control	In operation
Target heater power = 25 W	Continues more than 5 seconds
Element resistance $\geq 250 \Omega$	Continues more than 5 seconds

Time Needed for diagnosis: 5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

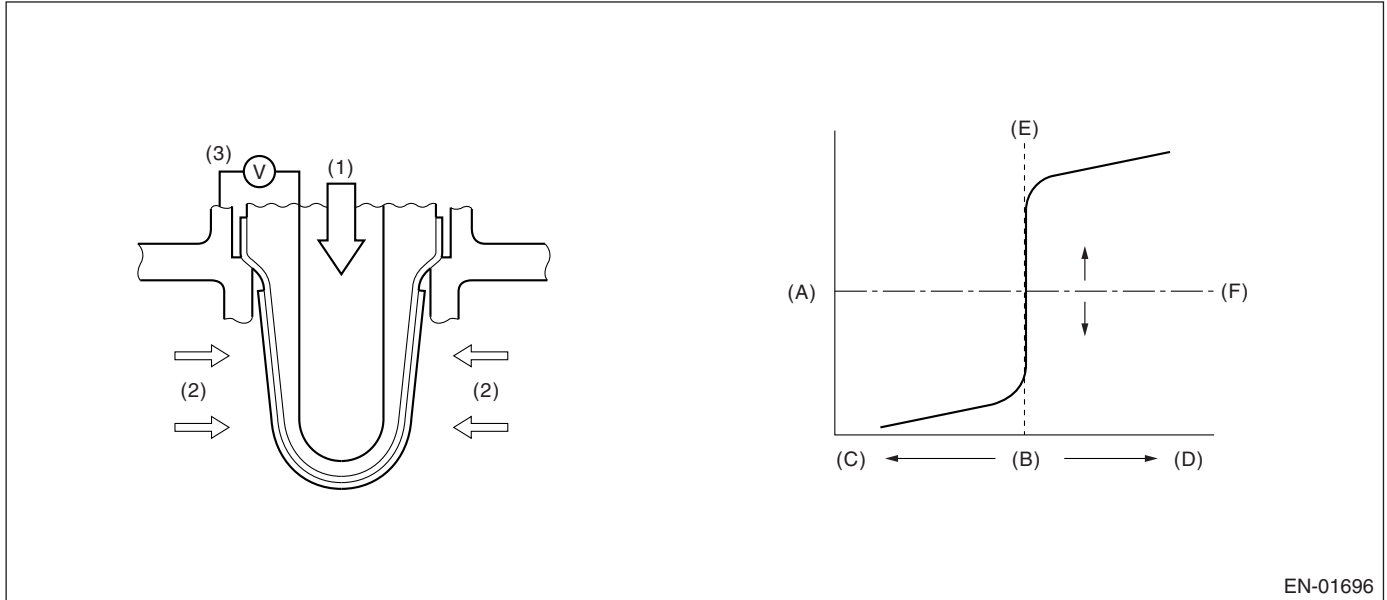
GENERAL DESCRIPTION

AB:DTC P0137 O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of rear oxygen sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed loop control	In operation
Rear oxygen sensor Low diagnosis	Unexperienced

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once during the closed loop.

5. DIAGNOSTIC METHOD

Judge NG when the cumulative time of completing the malfunction criteria below becomes more than time needed for diagnosis.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Judgment Value

Malfunction Criteria	Threshold Value
Maximum output voltage	< 490 mV
Coolant temperature	≥ 75°C (167°F)
Injector pulse	≥ 2.24 milliseconds
Engine speed	≥ 1,500 rpm
2 seconds or more fuel shut-off in decel.	Experienced
Vehicle speed	≥ 32 km/h (20 MPH)
Engine misfire	None
Air fuel ratio feed back	Not in clamp

Time Needed for Diagnosis: 200 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
maximum output voltage	≥ 490 mV

6. DTC CLEAR CONDITION

- When the OK driving cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

Diagnostic Trouble Code (DTC) Detecting Criteria

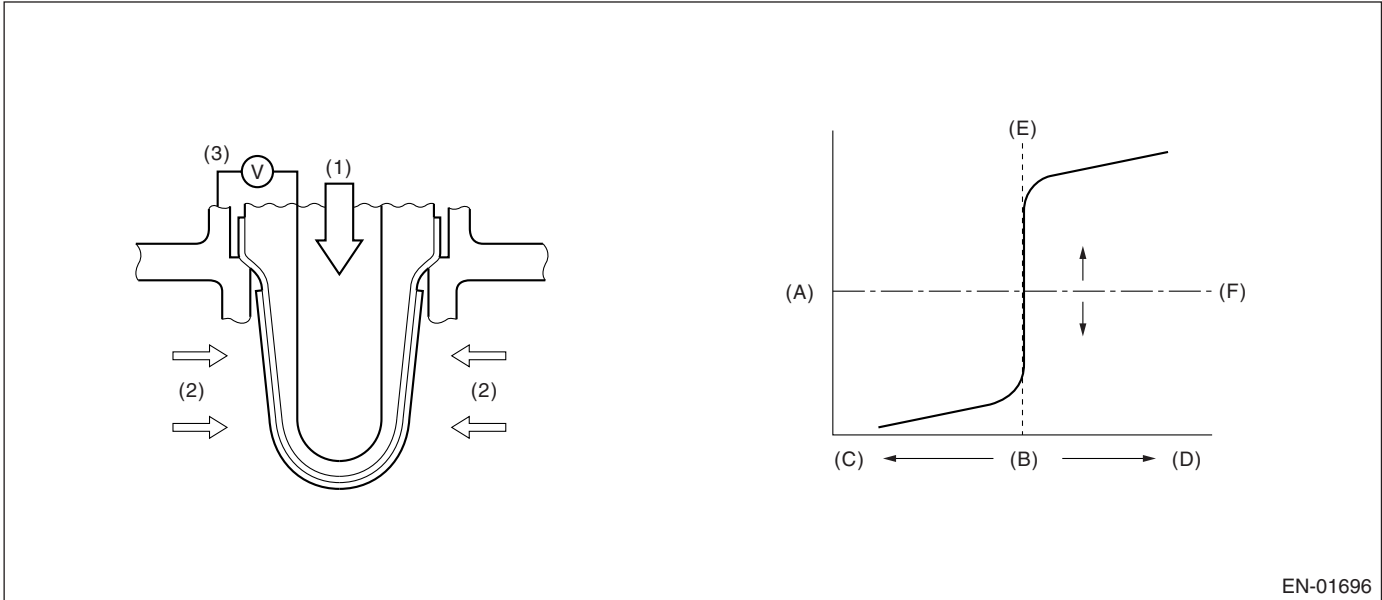
GENERAL DESCRIPTION

AC:DTC P0138 O₂ SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of rear oxygen sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed loop control	In operation
Rear oxygen sensor High diagnosis	Unexperienced

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once during the closed loop.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time of completing all the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Minimum output voltage	> 250 mV
Coolant temperature	≥ 75°C (167°F)
Injector pulse	≥ 2.24 milliseconds
Engine speed	≥ 1,500 rpm
2 seconds or more fuel shut-off in decel.	Experienced
Vehicle speed	≥ 32 km/h (20 MPH)
Engine misfire	No
Air fuel ratio feed back	Not in clamp

Time Needed for Diagnosis: 200 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Minimum output voltage	≤ 250 mV

6. DTC CLEAR CONDITION

- When the OK driving cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

Diagnostic Trouble Code (DTC) Detecting Criteria

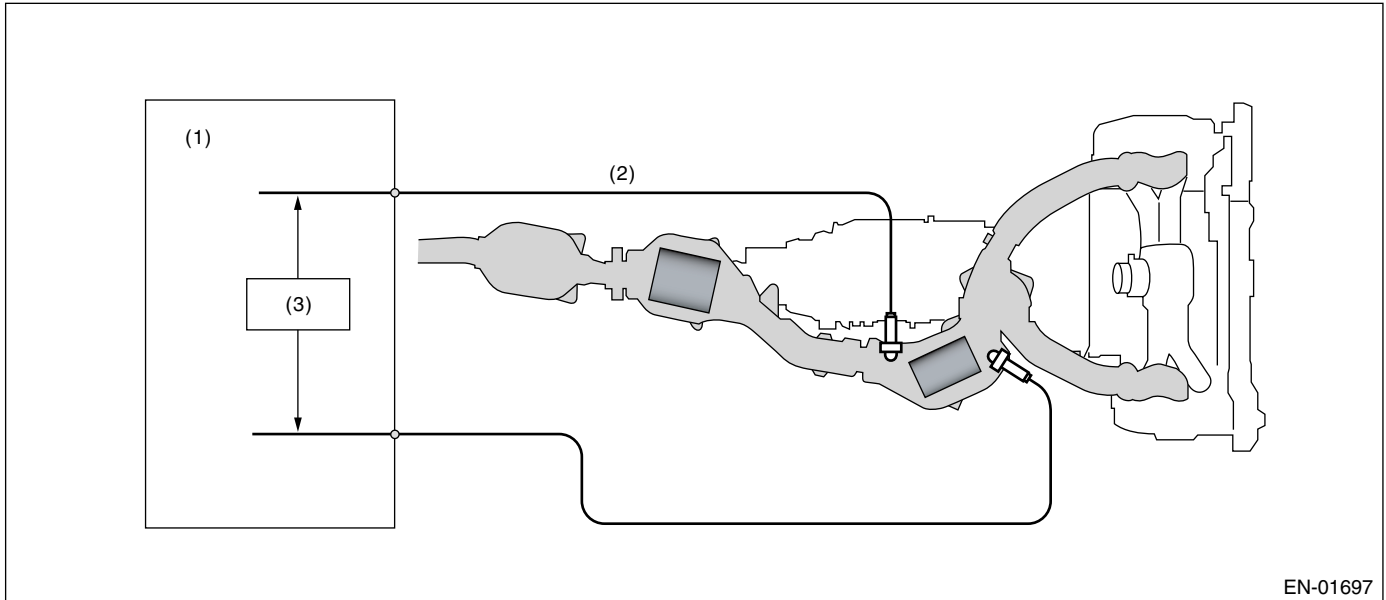
GENERAL DESCRIPTION

AD:DTC P0139 O₂ SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of rear oxygen sensor.

Calculate the response time of the output change of the rear oxygen sensor when the A/F ratio changes from rich to lean. And carry out the diagnosis comparing the calculated response time with the threshold value.

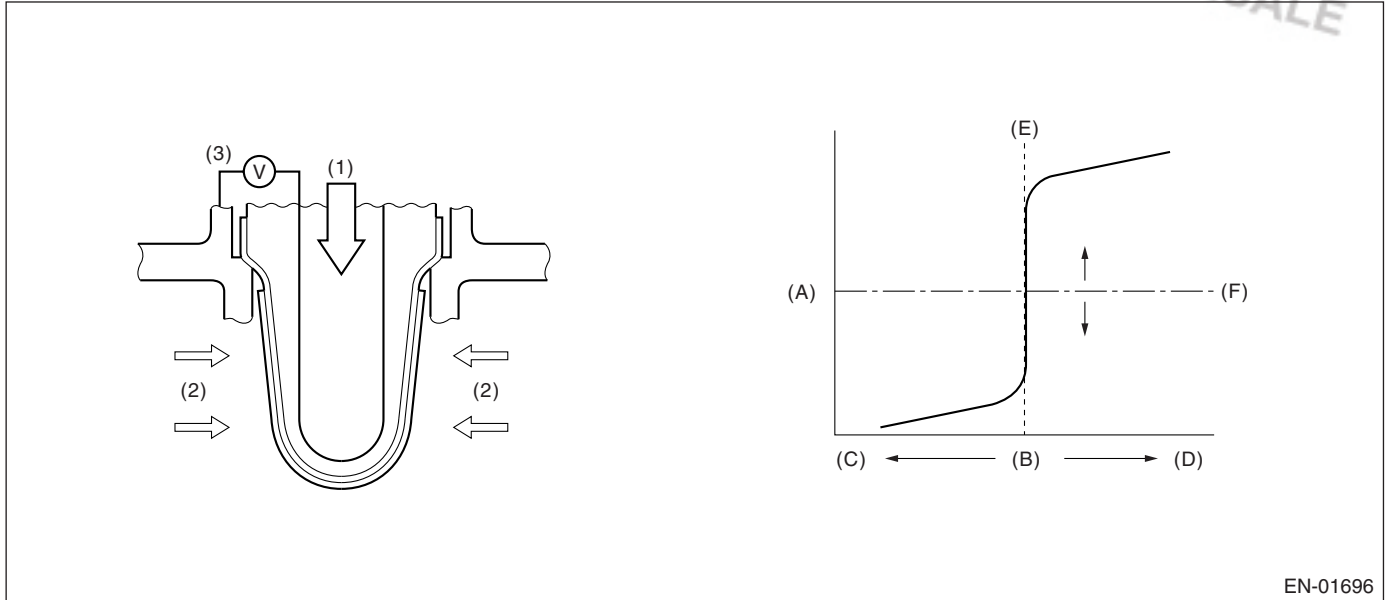


- (1) Engine control module (ECM)
- (2) Rear oxygen sensor
- (3) Diagnosis circuit

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed loop control with rear oxygen sensor	In operation
Closed loop control	In operation
Oxygen sensor response diagnosis	Incomplete

4. GENERAL DRIVING CYCLE

Diagnosis is performed only once during the closed loop. However, from the rapid acceleration, the deceleration fuel is cut to calculate the diagnostic value. (Pay attention to oxygen sensor voltage when deciding the deceleration timing.)

5. DIAGNOSTIC METHOD

When the rear oxygen sensor output voltage changes from 0.5 V (rich) to 0.15 V (lean), carry out calculation regarding the response time of the output change from 0.45 V to 0.2 V as diagnostic value. When the rear oxygen sensor output voltage does not change from 0.5 V to 0.15 V, do not carry out calculation even if the output changes from 0.45 V to 0.2 V.

• Abnormality Judgment

Judge NG when the rear oxygen sensor output change response time (diagnostic value) exceeds the threshold value.

Response time > 2 seconds (threshold value) → Abnormal

Judge NG when all of the malfunction criteria below is completed.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from rich (450 mV oxygen output) to lean (200 mV) if voltage reduces from 500 mV to 150 mV	≥ 0.43 seconds
2 seconds or more fuel shut-off in decel.	Experienced
After fuel shut-off	2 seconds or more

Time Needed for Diagnosis: 4 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the rear oxygen sensor output change response time (diagnostic value) is below the threshold value.

Response time ≤ 2 seconds (threshold value) → Normal

Judge NG when the malfunction criteria below is completed.

Judgment Value

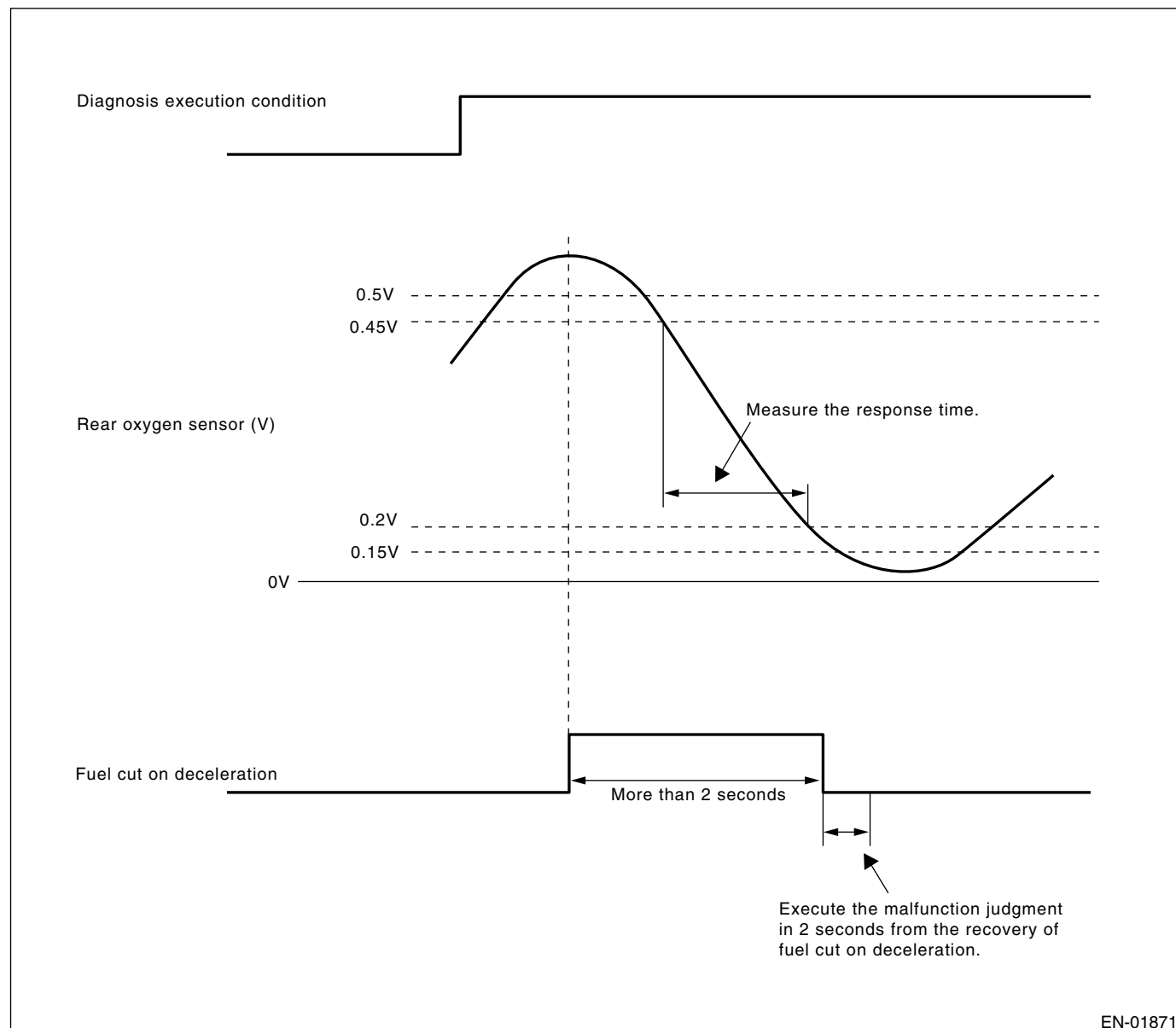
Malfunction Criteria	Threshold Value
Shortest time change	≤ 0.43 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

NOTE:

Response time is calculated during the deceleration fuel cut in case of abnormal judgment. However, in order to make a normal judgment quickly, diagnosis is performed without deceleration fuel cut.



6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

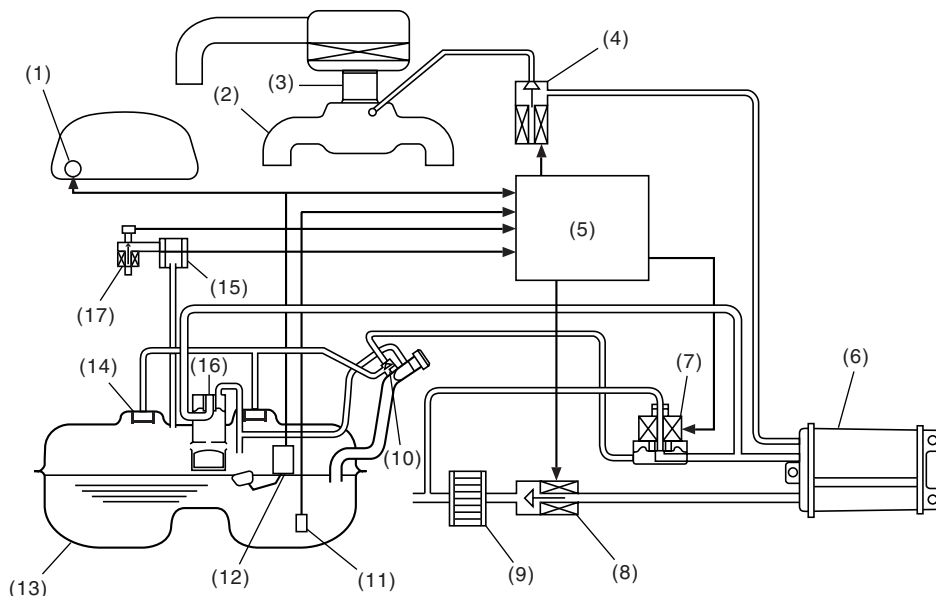
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AE:DTC P0171 SYSTEM TOO LEAN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system by the amount of main feedback control.



(1) Fuel meter	(10) Shut-off valve
(2) Intake manifold	(11) Fuel temperature sensor
(3) Throttle body	(12) Fuel level sensor
(4) Purge control solenoid valve	(13) Fuel tank
(5) Engine control module (ECM)	(14) Fuel cut valve
(6) Canister	(15) Fuel tank pressure sensor
(7) Pressure control solenoid valve	(16) Vent valve
(8) Drain valve	(17) Tank pressure switching solenoid valve
(9) Drain filter	

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel learning system	In operation
Engine coolant temperature	75 $\longleftrightarrow$ 110°C (167 $\longleftrightarrow$ 230°F)
Intake manifold pressure change during 50 msec	$\leq$ 14.6 kPa (110 mmHg, 4.3 inHg)
Learning value of EVAP conc. during purge	$\leq$ 1.0
Cumulative time of canister purge after engine start	20 seconds or more
Continuous period after canister purge starting	10 seconds or more
Intake air temperature	$<$ 70°C (158°F)
Fuel level	$\geq$ 9 $\varnothing$ (2.4 US gal, 2.0 Imp gal)

3. GENERAL DRIVING CYCLE

Perform the serial diagnoses with a constant vehicle speed more than 60 km/h (37 MPH).

4. DIAGNOSTIC METHOD

Judge that the malfunction occurred in fuel system when the malfunction criteria are completed for 30 seconds or more by comparing the diagnostic value (fsobd) with threshold value.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = aflmd + lambda + kblrc	$\geq$ fsobdL1
aflmd = measured lambda	See Map 2
lambda = short term fuel trim	fsobdL1 = lean side
kblrc = long term fuel trim	threshold value of fsobd

Map 2: Threshold value for fuel system malfunction criteria

Amount of air (g/s)	0	3.2	6.4	9.6	12.8	16	19.2
fsobdL1 (%)	40	40	33.2	26.5	26.5	26.5	26.5

Time Needed for Diagnosis: 10 seconds $\times$ 3 times

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Judge OK when the malfunction criteria below are completed for 10 seconds or more.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = aflmd + lambda + kblrc	$<$ 19%

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When diagnosed OK with the similar driving for 3 driving cycles in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

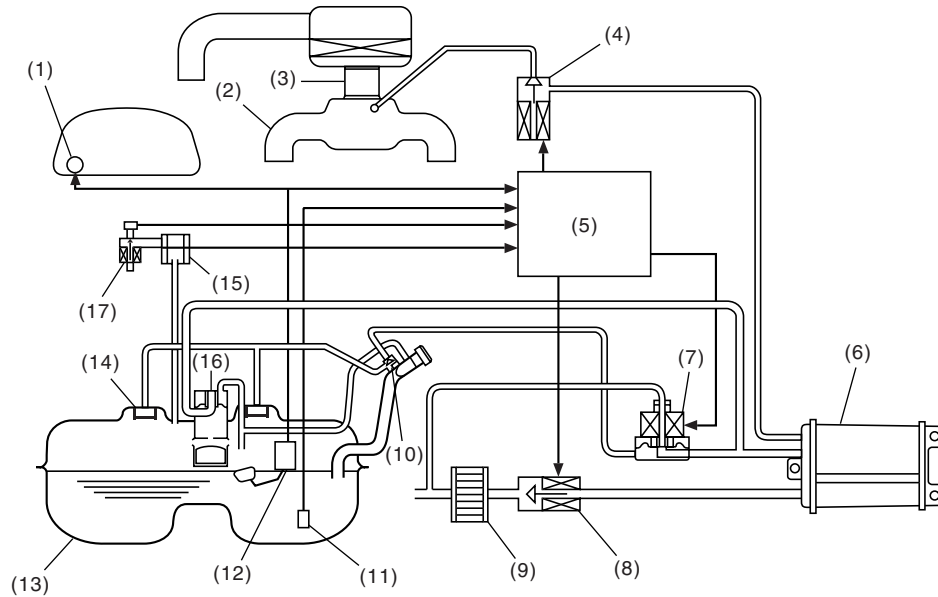
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AF:DTC P0172 SYSTEM TOO RICH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system by the amount of main feedback control.



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(1) Fuel meter	(10) Shut-off valve
(2) Intake manifold	(11) Fuel temperature sensor
(3) Throttle body	(12) Fuel level sensor
(4) Purge control solenoid valve	(13) Fuel tank
(5) Engine control module (ECM)	(14) Fuel cut valve
(6) Canister	(15) Fuel tank pressure sensor
(7) Pressure control solenoid valve	(16) Vent valve
(8) Drain valve	(17) Tank pressure switching solenoid valve
(9) Drain filter	

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel learning system	In operation
Engine coolant temperature	75 $\longleftrightarrow$ 110°C (167 $\longleftrightarrow$ 230°F)
Intake manifold pressure change during 50 msec	$\leq$ 14.6 kPa (110 mmHg, 4.3 inHg)
Learning value of EVAP conc. during purge	$\leq$ 1.0
Cumulative time of canister purge after engine start	20 seconds or more
Continuous period after canister purge starting	10 seconds or more
Intake air temperature	$<$ 70°C (158°F)
Fuel level	$\geq$ 9 $\varnothing$ (2.4 US gal, 2.0 Imp gal)

3. GENERAL DRIVING CYCLE

Perform the serial diagnoses with a constant vehicle speed more than 60km/h (37 MPH).

4. DIAGNOSTIC METHOD

Judge that the malfunction occurred in fuel system when the malfunction criteria are completed for 30 seconds or more by comparing the diagnostic value (fsobd) with threshold value.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = aflmd + lambda + kblrc	$\leq$ fsobdR1
aflmd = measured lambda	See Map 2
lambda = short term fuel trim	fsobdR1 = rich side
kblrc = long term fuel trim	threshold value of fsobd

Map 2: Threshold value for fuel system malfunction criteria

Amount of air (g/s)	0	3.2	6.4	9.6	12.8	16	19.2
fsobdR1 (%)	-40	-40	-33.2	-26.5	-26.5	-26.5	-26.5

Time Needed for Diagnosis: 10 seconds $\times$ 3 times

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Judge OK when the malfunction criteria below are completed for 10 seconds or more.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = aflmd + lambda + kblrc	$\geq$ -20%

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When diagnosed OK with the similar driving for 3 driving cycles in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

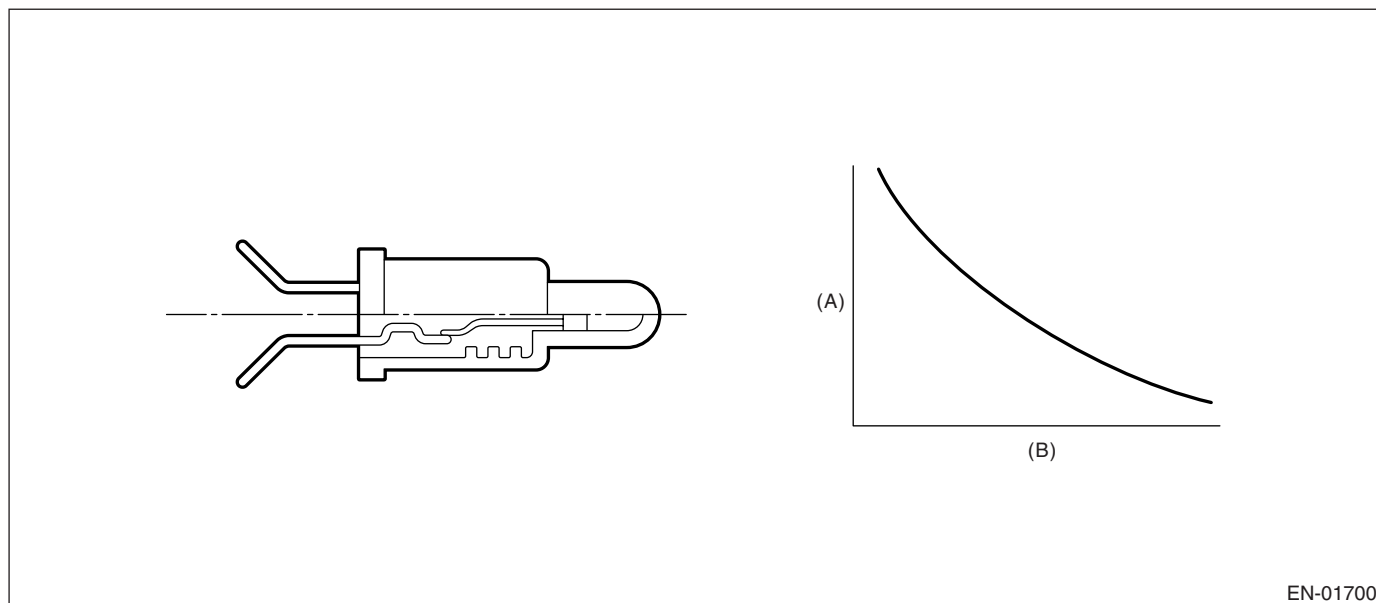
GENERAL DESCRIPTION

AG:DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel temperature sensor output property.
Diagnosis is performed in two methods; namely, drift diagnosis and stuck diagnosis.

2. COMPONENT DESCRIPTION



EN-01700

- (A) Resistance value (Ω)
(B) Fuel temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)

• Drift Diagnosis

Normally fuel temperature is lower than engine coolant temperature. When the fuel temperature becomes higher than the engine coolant temperature, the range is considered to be shifted, and NG judgment is done.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel level	$\geq 9 \ell$ (2.4 US gal, 2.0 Imp gal)
After engine starting	20 seconds or more
Engine coolant temperature difference from engine start	$> 10^{\circ}\text{C}$ (50°F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine coolant temperature increases more than 10 degrees (50°F) from the temperature of engine starting in 20 seconds after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (120 seconds) needed for diagnosis. Also, judge OK when the malfunction criteria below is not completed. And then, clear the NG.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel temperature-engine coolant temperature	$\geq 10^{\circ}\text{C}$ (50°F)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Time Needed for Diagnosis: 120 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Stuck Diagnosis

If the fuel temperature which must increase along with engine idling does not increase, the engine is considered to be stuck and NG judgment is done.

6. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After engine starting	20 seconds or more

7. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 20 seconds and more after starting the engine.

8. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when all of the malfunction criteria below is completed.

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 550 kg (1,213 lb)
Fuel temperature difference between max and min	$< 3^{\circ}\text{C}$ (37°F)

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Malfunction Criteria	Threshold Value
Fuel temperature difference between max. and min.	$\geq 3^{\circ}\text{C}$ (37°F)

Time Needed for Diagnosis: 0 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

9. DTC CLEAR CONDITION

- When the OK idling was completed 40 times in a row
- When "Clear Memory" was performed

10.MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

11.FAIL SAFE

Fix the fuel temperature at 40°C (104°F).

12.ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

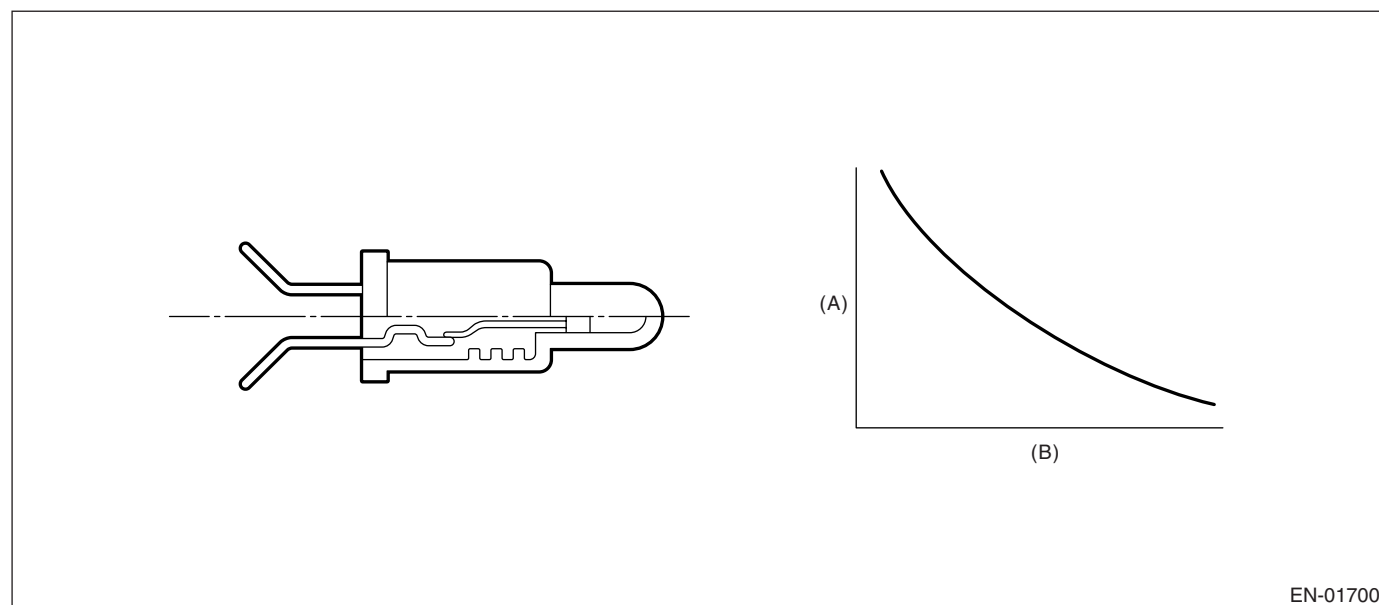
GENERAL DESCRIPTION

AH:DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(A) Resistance value (Ω)

(B) Fuel temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
Timer after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge OK and clear NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.1 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Fix the fuel temperature for control at 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

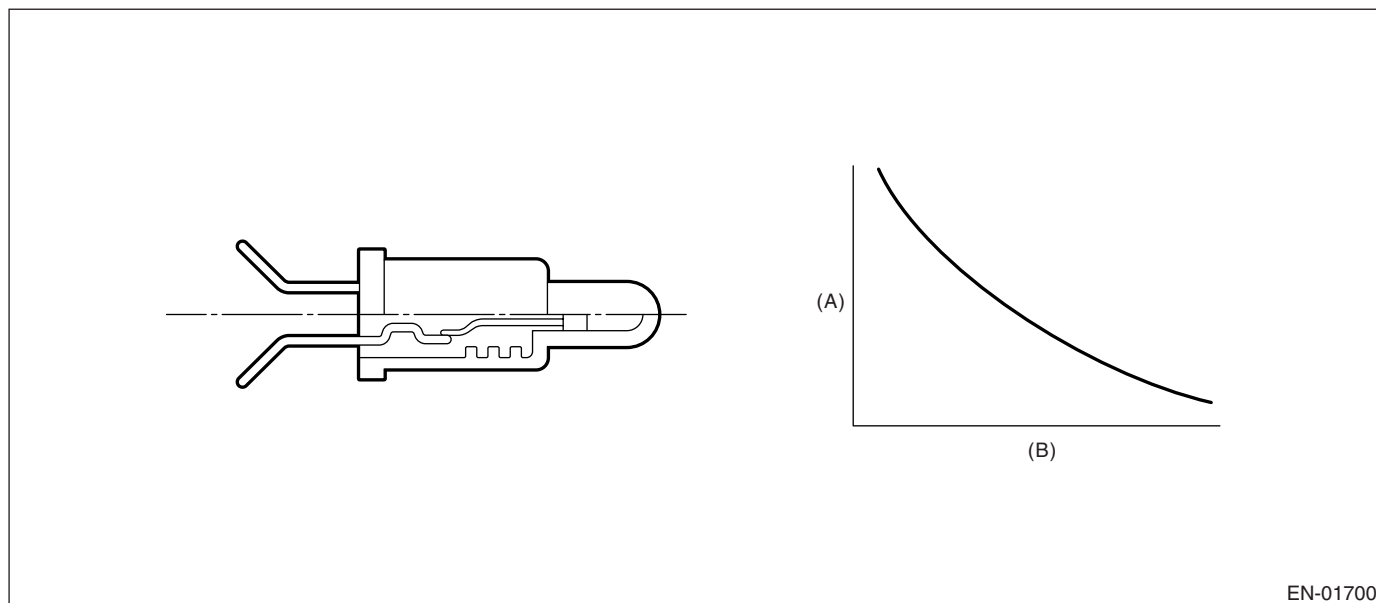
GENERAL DESCRIPTION

AI: DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



EN-01700

(A) Resistance value (Ω)

(B) Fuel temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
Timer after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the cumulative time of completing the malfunction criteria below becomes more than time (2.5 seconds) needed for diagnosis. Judge OK when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.85 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Fix the fuel temperature for control at 40°C (104°F).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AJ:DTC P0301 CYLINDER 1 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

Detect the presence of misfire occurrence.

Monitoring Misfire which influences exhaust deterioration (1.5 times of FTP) and catalyst damage is made obligatory by the law. Misfire affecting these two has three patterns below.

- Intermittent misfire (Different cylinders misfire intermittently.): FTP 1.5 times misfire
- Every time misfire (The same cylinder misfires every time.): Catalyst damage misfire, FTP 1.5 times misfire
- Opposed misfire (Dual ignition equipped model as #1, #2 simultaneously ignite. NA model only.): Catalyst damage misfire, FTP 1.5 times misfire

The following detecting methods are adopted for these detection.

- (1) Intermittent misfire: FTP 1.5 times misfire
 - 180° Interval Difference Method (3,550 rpm or less)
 - 720° Interval Difference Method (2,950 rpm or less)
- (2) Every time misfire: Catalyst damage misfire, FTP 1.5 times misfire
 - 180° Interval Difference Method (3,550 rpm or less)
 - Pattern Recognition Method (2,950 rpm or more)
- (3) Opposed misfire: Catalyst damage misfire, FTP 1.5 times misfire
 - 180° Interval Difference Method (3,550 rpm or less)
 - Pattern Recognition Method (2,950 rpm or more)

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Injector pulse	≥ 1.00 milliseconds
Engine speed	450 — 6,200 rpm
Fuel shut-off function	Not operating
Fuel parameter determination	Not as extremely low volatility
Engine speed change	≥ Misfire level × -4.00
After fuel shut-off finished	15 revs. or more
(Weighted avg. value / given amount) of intake air -1.0	-0.5 ↔ 1.9
Fuel level	≥ 9 ℓ (2.4 US gal, 2.0 Imp gal)
Crankshaft position has been learned	> Value from Map 4
intake manifold pressure	
The change in torque during shifting (Misfire detection by oxygen sensor)	Not in operation
Throttle position change during 30 milliseconds	-20° ↔ 20°
Engine speed	> 4,600 rpm

Map 4

rpm	0	400	800	1,200	1,600	2,000	2,400	2,800
MT (V. Speed < 64 km/h (40 MPH))	164	164	164	144	140	144	140	148
(V. Speed ≥ 64 km/h (40 MPH))	164	164	164	192	188	192	184	236
AT	172	172	172	152	152	160	152	164

rpm	3,200	3,600	4,000	4,400	4,800	5,200	5,600	6,000
MT (V. Speed < 64 km/h (40 MPH))	172	188	212	236	260	288	312	336
(V. Speed ≥ 64 km/h (40 MPH))	244	236	236	236	260	288	312	336
AT	188	216	240	264	284	308	332	356

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. GENERAL DRIVING CYCLE

If the condition matched, detecting misfire is possible in the engine speed of idling to high revolution; however, idling is better from the viewpoint of engine load and damage.

4. DIAGNOSTIC METHOD

When the misfire occurred, the engine speed is decreased and the crankshaft position speed will change. Calculate the interval difference value (diagnostic value) from crankshaft position speed, and judge whether the misfire occurs or not comparing the calculated result with judgment value.

Calculate the diagnostic value (from crankshaft position speed)

→ Misfire detection every single ignition (Compare diagnostic value with judgment value)

- 180° Interval Difference Method
- 720° Interval Difference Method
- Pattern Recognition Method

→ NG judgment (Judge misfire occurrence required by the law) (Compare number of misfire with judgment)

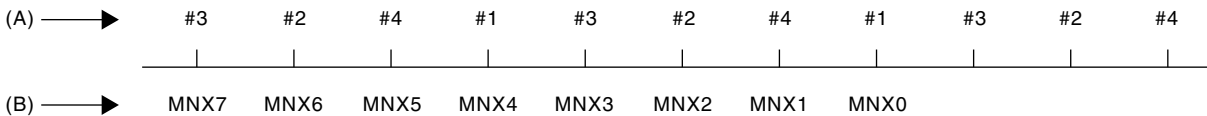
- FTP1.5 times misfire NG judgment
- Catalyst damage misfire NG judgment

For misfire detection, there are three methods such as 180° Interval Difference Method, 720° Interval Difference Method and Pattern Recognition Method.

• 180° Interval Difference Method, 720° Interval Difference Method

Transform the time needed for crankshaft movement from BTDC65° to BTDC10° into revolution. As the following, regard the revolution as MNX0. And then regard the former revolution as MNX1, the second former revolution as MNX2, and the third as MNX3, etc.

Use the detecting method below for misfire patterns, and judge misfire occurrence when the result calculated from the formula is out of threshold value.



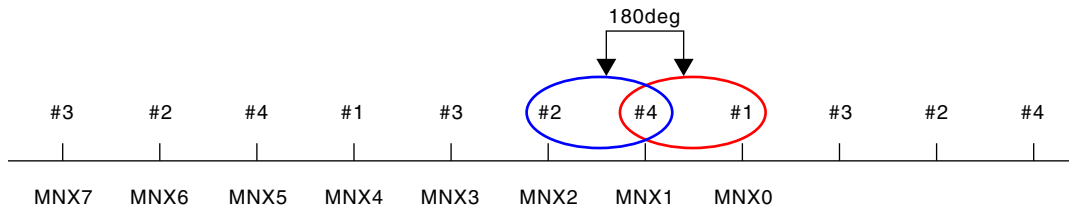
EN-01701

- (A) Ignition order
(B) Engine speed (rpm)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

180° Interval Difference Method (DDNCON0)



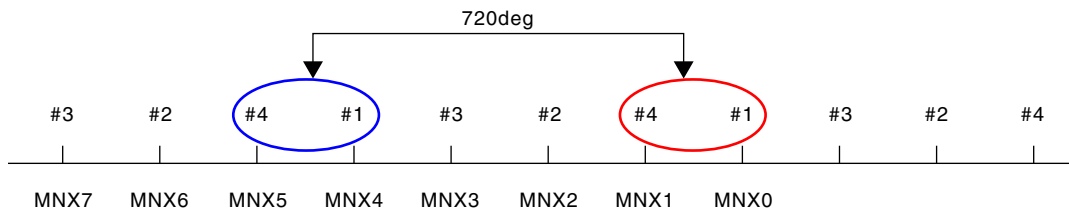
EN-01702

(1) $DDNCON1 = (MNX\ 1 - MNX\ 2) - (MNX\ 2 - MNX\ 3) \leq \text{Threshold value}$

(2) $DDNCON0 = (MNX\ 0 - MNX\ 1) - (MNX\ 1 - MNX\ 2) \geq \text{Threshold value}$

Judge misfire when the (1) and (2) above are completed.

720° Interval Difference Method (DDNCYL0)



EN-01703

(1) $DDNCYL4 = (MNX\ 4 - MNX\ 5) - (MNX\ 8 - MNX\ 9) \leq \text{Threshold value}$

(2) $DDNCYL0 = (MNX\ 0 - MNX\ 1) - (MNX\ 4 - MNX\ 5) \geq \text{Threshold value}$

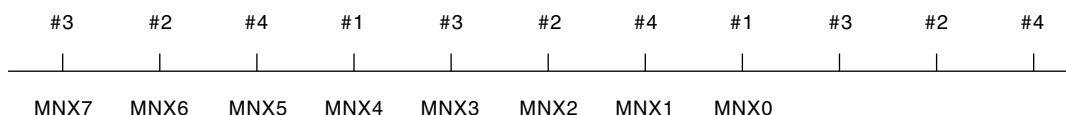
Judge misfire when the (1) and (2) above are completed.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Pattern Recognition Method

Pattern Recognition Method has two patterns such as every time misfire on one cylinder and continuous misfire on two cylinders.



EN-01705

Every time misfire on one cylinder

Calculate the simple average (calculate MNX 0 – MNX 1) per one hundred ignitions for one cylinder (per four hundred ignitions for four cylinder).

Regard the value calculated for #1 cylinder as AVE1, #2 cylinder as AVE2, and as AVE3, AVE4 like the same way. Judge misfire occurrence when the value calculated from the following formula is larger than threshold value.

(Max. value of AVE1 to AVE4) – AVE_n (n=1,2,3,4) ≥ threshold value → Judge that misfire occurs.

Continuous misfire on two cylinders

(1) Two continuous ignitions with “MNX 0 – MNX 1 ≥ threshold value” occurs.

(2) Two continuous ignitions with “MNX 0 – MNX 1 ≤ – (threshold value)” occurs.

Judge misfire occurrence on continuous two cylinders when the judgment criteria (1) and (2) above repeated for four hundred ignition.

• FTP 1.5 times Misfire (Misfire occurrence level which influences exhaust gas)

Judgment Value

Judge malfunction when the misfire rate in 1,000 revs. is large.

Malfunction Criteria	Threshold Value
FTP emission	> 1.0% in 1,000 revs.

Time Needed for Diagnosis: 1,000 engine revs.

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Catalyst Damage Misfire (Misfire occurrence level which results in catalyst damage)

Judgment Value

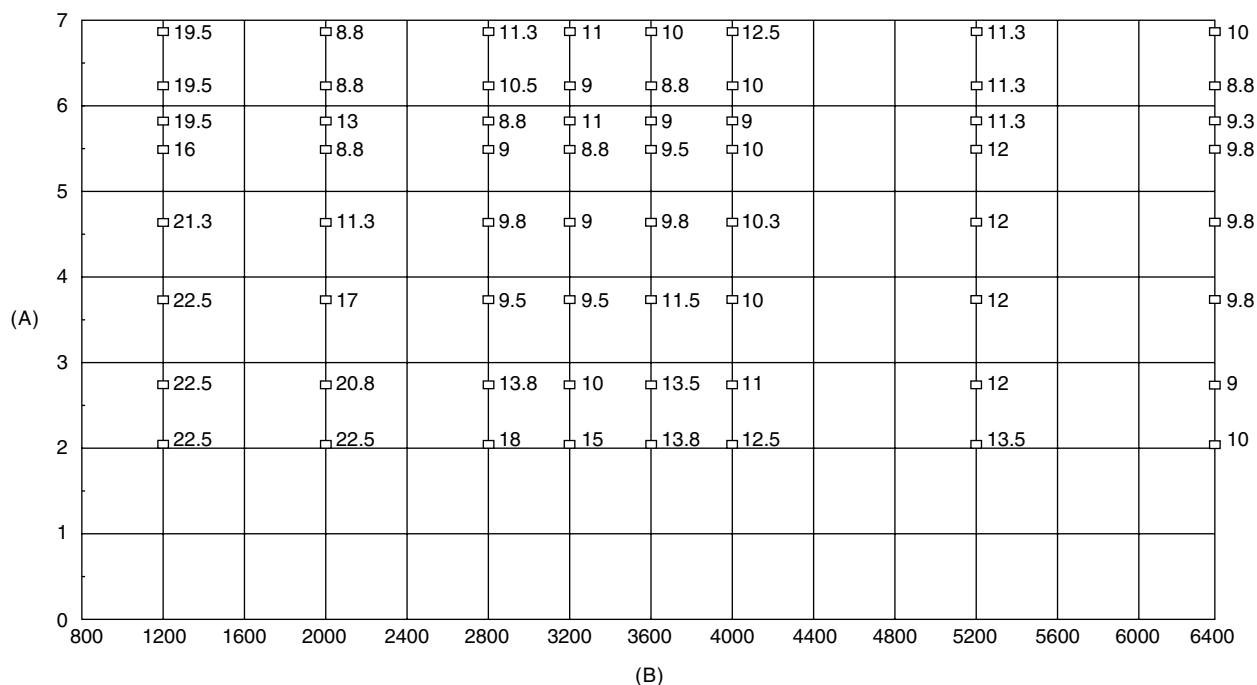
Judge malfunction when the misfire rate in 200 revs (400 ignitions) is large.

Malfunction Criteria	Threshold Value
Catalyst damage	See Map 1

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Map 1 Fault criteria limit for misfire which would result in catalyst damage



EN-01706

(A) Basic injection pulse (millisecond)

(B) Engine speed (rpm)

*These figures represent the misfire rate (%) in 400 ignitions.

22.5 (%) means "400 (ignitions) × 22.5 (%) = 90 (ignitions)" or more, and judge misfire.

Time Needed for Diagnosis: 200 engine revs.

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When diagnosed OK with the similar driving for 3 driving cycles in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

AK:DTC P0302 CYLINDER 2 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

For detecting criteria, refer to DTC P0301 CYLINDER 1 MISFIRE DETECTED. <Ref. to GD(H4SO)-81, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AL:DTC P0303 CYLINDER 3 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

For detecting criteria, refer to DTC P0301 CYLINDER 1 MISFIRE DETECTED. <Ref. to GD(H4SO)-81, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AM:DTC P0304 CYLINDER 4 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

For detecting criteria, refer to DTC P0301 CYLINDER 1 MISFIRE DETECTED. <Ref. to GD(H4SO)-81, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

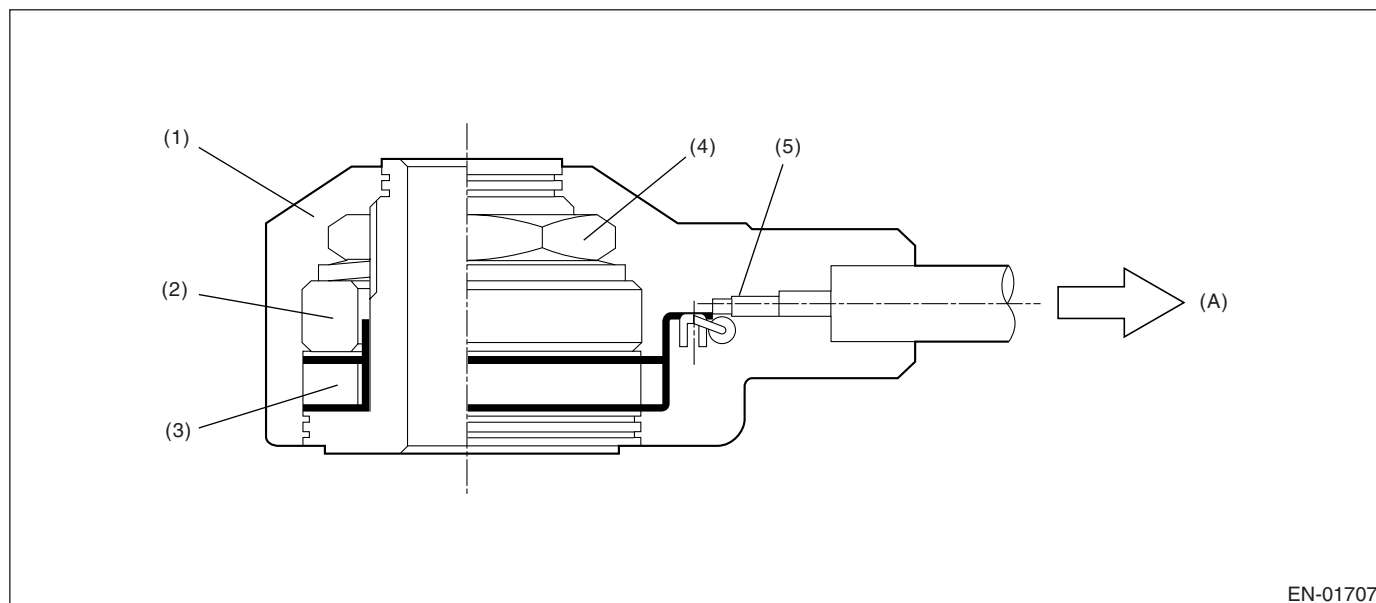
GENERAL DESCRIPTION

AN:DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Case
- (2) Weight
- (3) Piezoelectric element
- (4) Nut
- (5) Resistance

(A) To knock sensor harness

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
Timer after starting the engine	≥ 1 second

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge OK when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.6 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- (1) Stop whole compensation, partial compensation, knock cancel compensation in ignition timing calculation at normal.
- (2) Knock cancel compensation of low engine coolant temperature is fixed value (7°C).
- (3) Stop partial compensation calculation of ignition leaning.

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

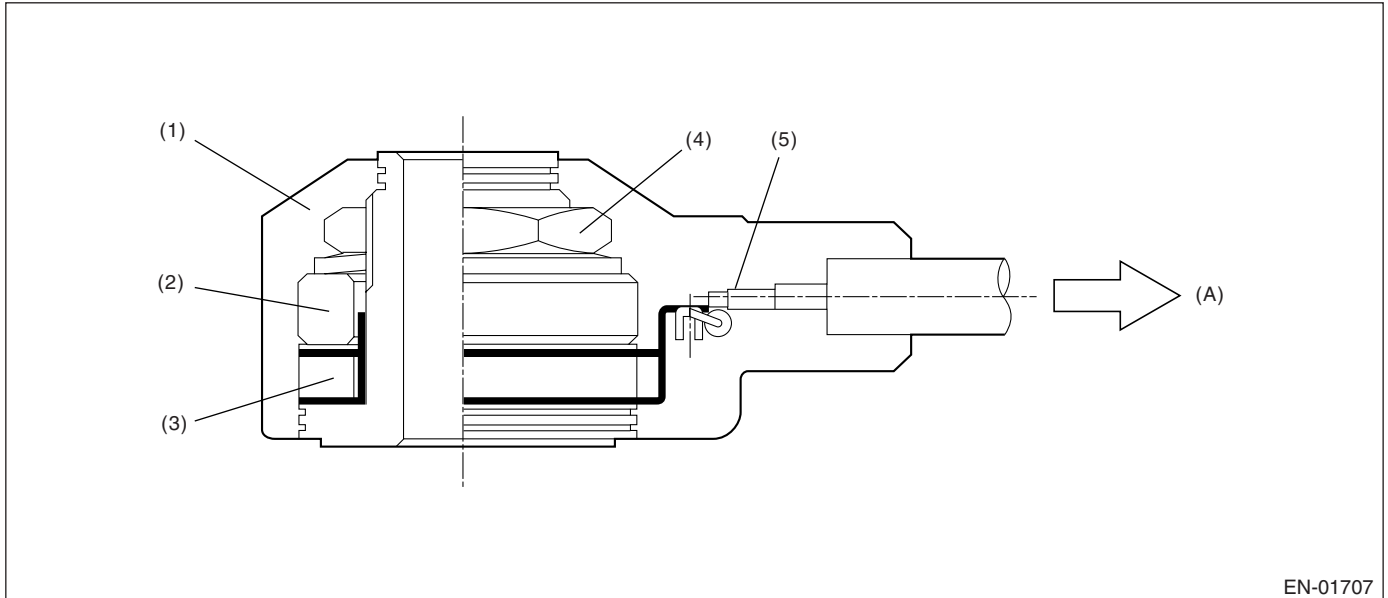
GENERAL DESCRIPTION

AO:DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Case
- (2) Weight
- (3) Piezoelectric element
- (4) Nut
- (5) Resistance

(A) To knock sensor harness

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
Timer after starting the engine	≥ 1 second

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge OK when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 3.5 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- (1) Stop whole compensation, partial compensation, knock cancel compensation in ignition timing calculation at normal.
- (2) Knock cancel compensation of low engine coolant temperature is fixed value (7°C).
- (3) Stop partial compensation calculation of ignition leaning.

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

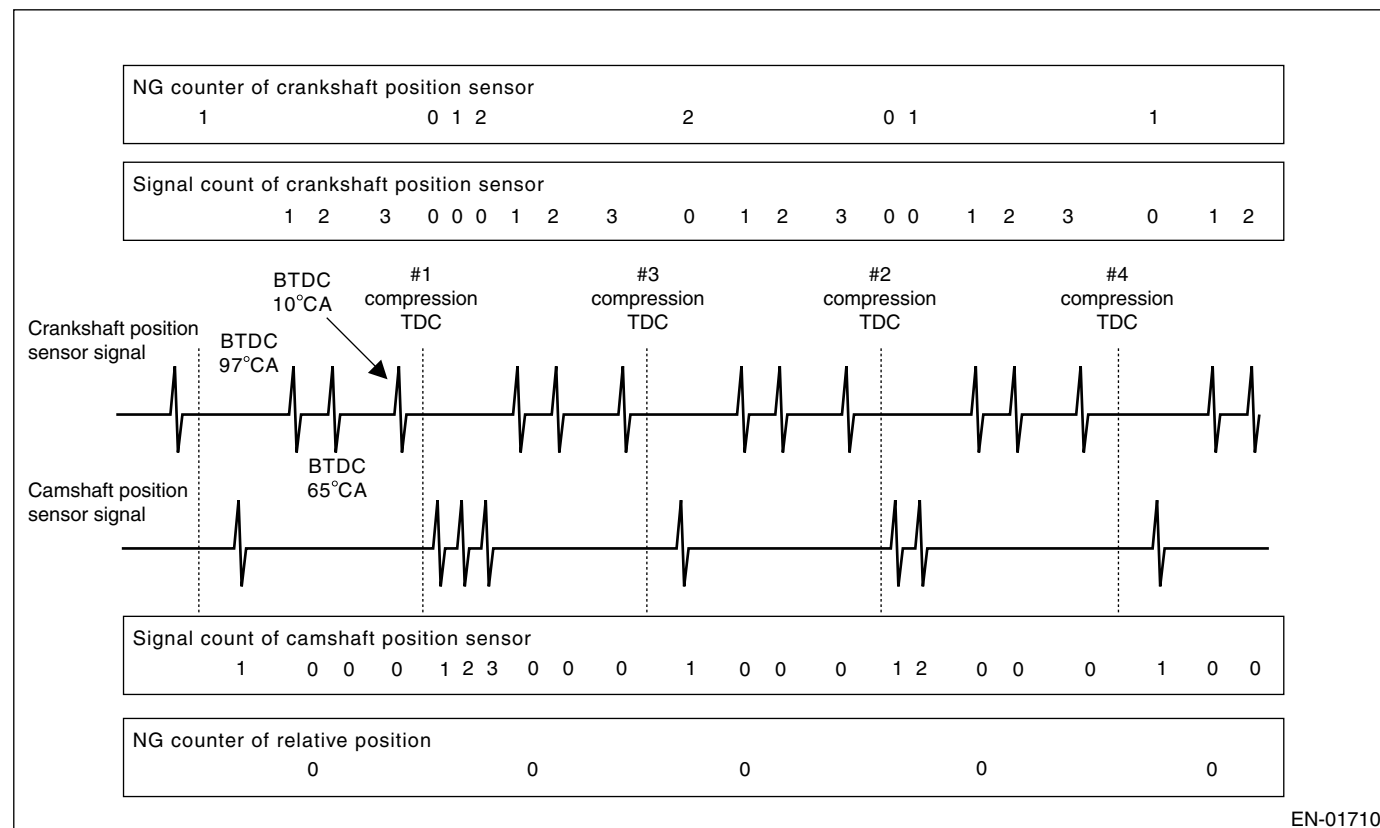
GENERAL DESCRIPTION

AP:DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of crankshaft position sensor.

Normally, the crankshaft position sensor signal and camshaft position sensor signal are input as shown below. But judge NG when continuing not to input the crankshaft position sensor signal.



• Cylinder judgment method

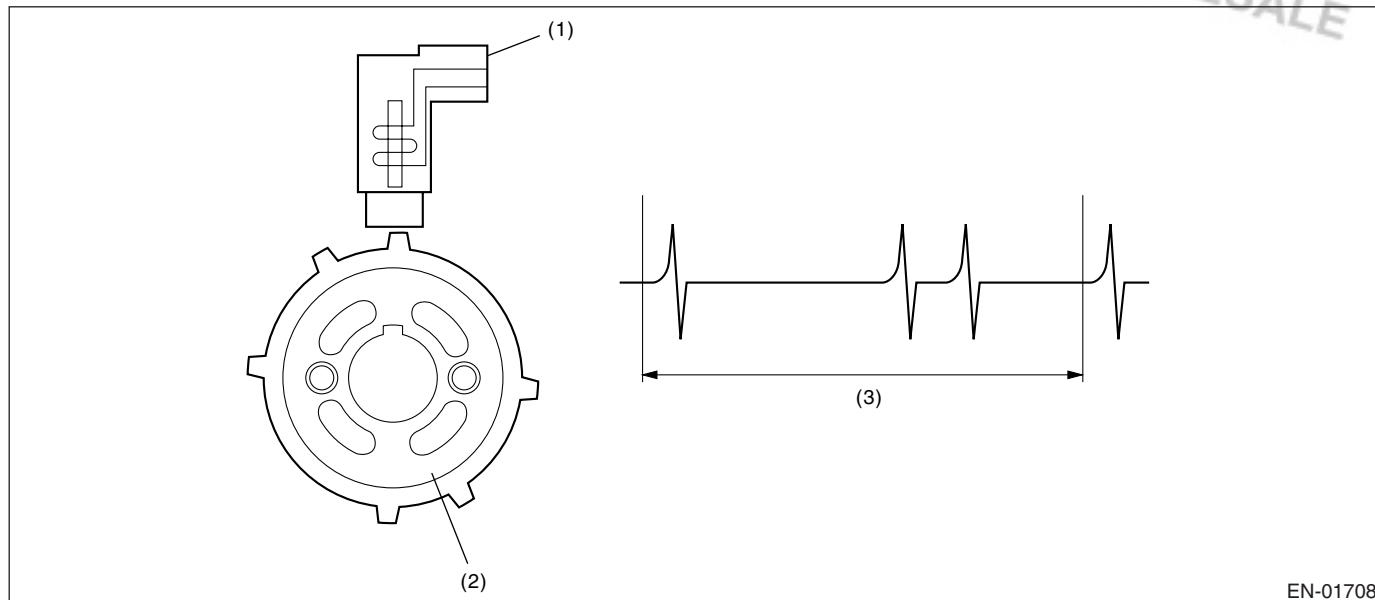
When inputting BTDC97°CA crankshaft position sensor signal, judge what cylinder piston is brought to the top dead center of compression by camshaft position sensor number.

Camshaft position sensor signal number	Next top dead center of compression
3	#3
1	#2
2	#4
1	#1

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION



- (1) Crankshaft position sensor
- (2) Crankshaft sprocket
- (3) Crankshaft half-turn

EN-01708

3. ENABLE CONDITION

Perform the diagnosis without condition.

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	≥ 24

When the crankshaft position sensor signal is input, clear the above camshaft position sensor signal.

Time Needed for Diagnosis: 7 revs.

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

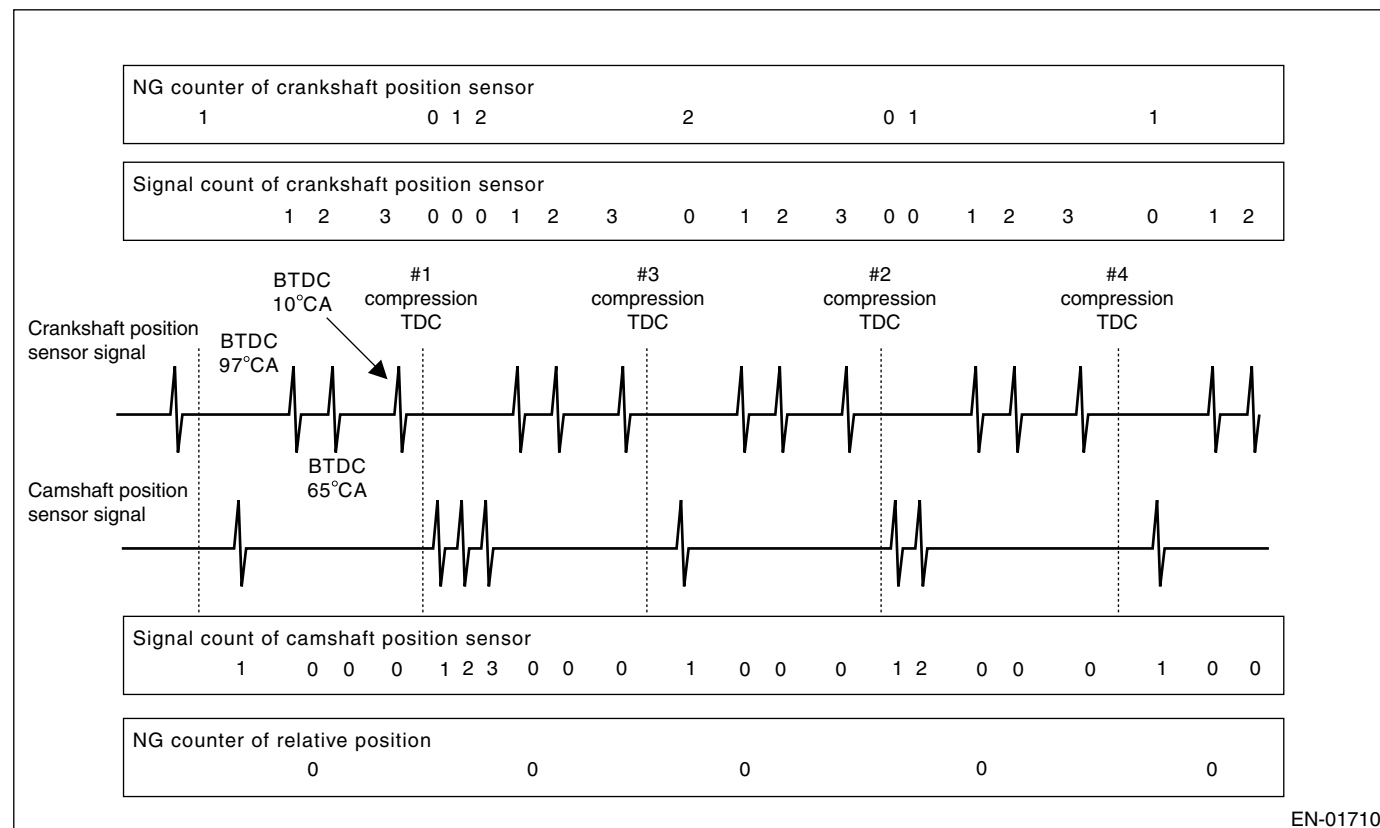
GENERAL DESCRIPTION

AQ:DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of crankshaft position sensor output property.

Compare the normal crankshaft position sensor signal with normal camshaft position sensor signal. When each input number does not correspond, judge NG.



• Cylinder judgment method

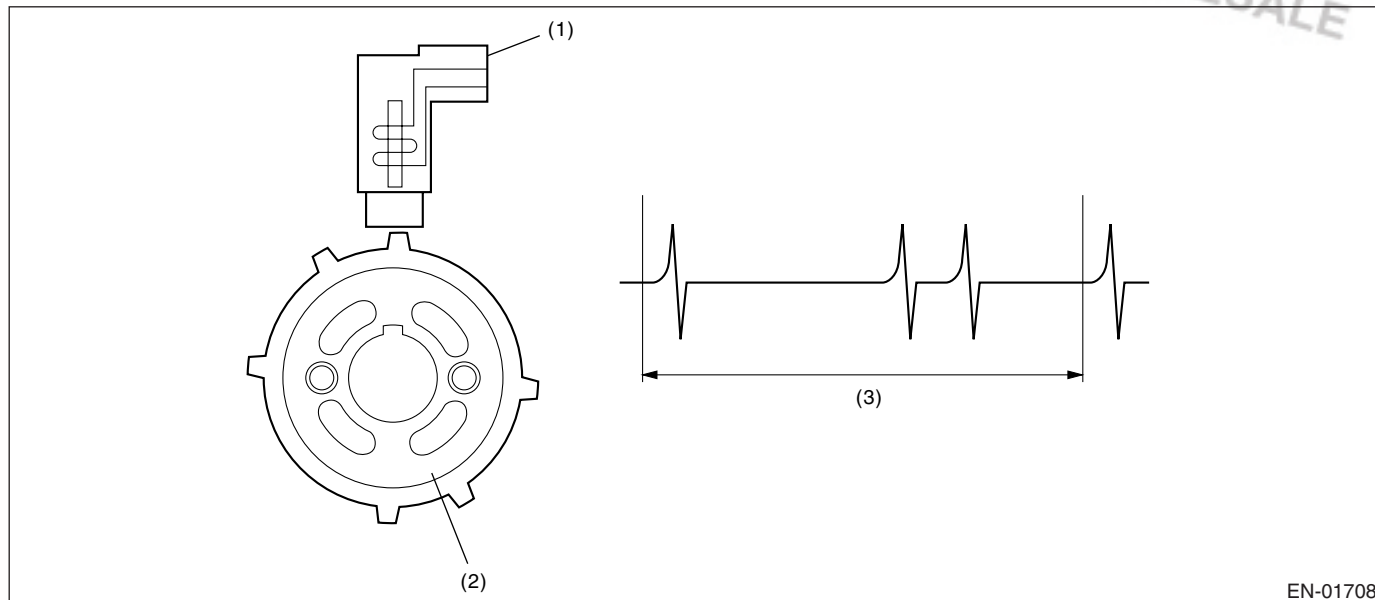
When BTDC97°CA crankshaft position sensor signal is input, judge what cylinder piston is brought to the top dead center of compression by camshaft position sensor signal number.

Camshaft position sensor signal number	Next top dead center of compression
3	#3
1	#2
2	#4
1	#1

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION



- (1) Crankshaft position sensor
- (2) Crankshaft sprocket
- (3) Crankshaft half-turn

EN-01708

3. ENABLE CONDITION

Perform the diagnosis without condition.

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

When the camshaft position sensor signal is input, compare the total crankshaft position sensor signal number from occasion of previous camshaft position sensor signal input to now with crankshaft position sensor signal number at normal. Increase NG judgment counter when each number does not correspond at once. Judge NG when each number does not correspond sequentially (NG counter ≥ 32). Judge OK and clear NG when the crankshaft position sensor signal number corresponds (NG counter = 0).

Judgment Value

Malfunction Criteria	Threshold Value
Fault counter of relative position	≥ 32

Time Needed for Diagnosis: 10 revs.

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

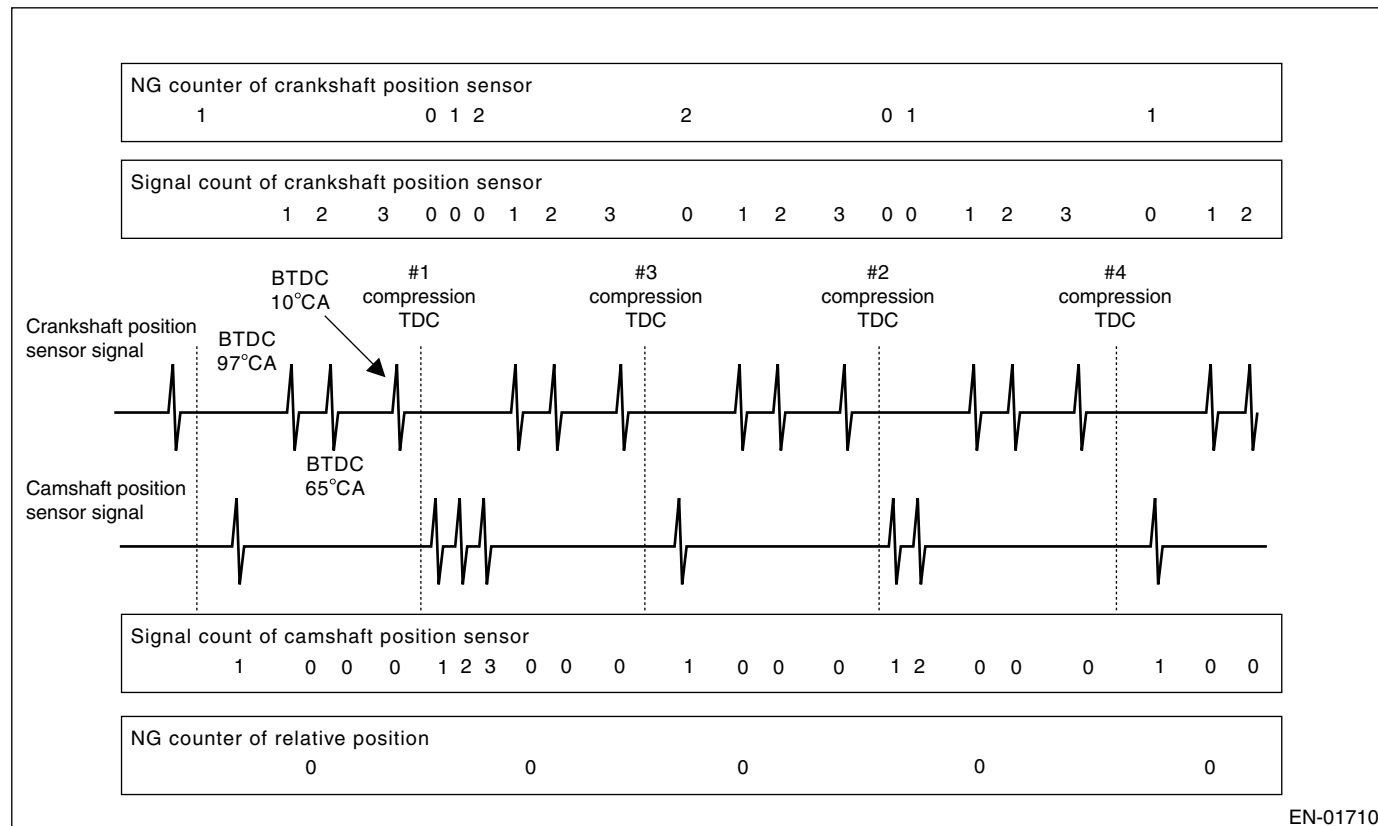
GENERAL DESCRIPTION

AR:DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of crankshaft position sensor output property.

Judge NG when continuing not to input the camshaft position sensor signal.



• Cylinder judgment method

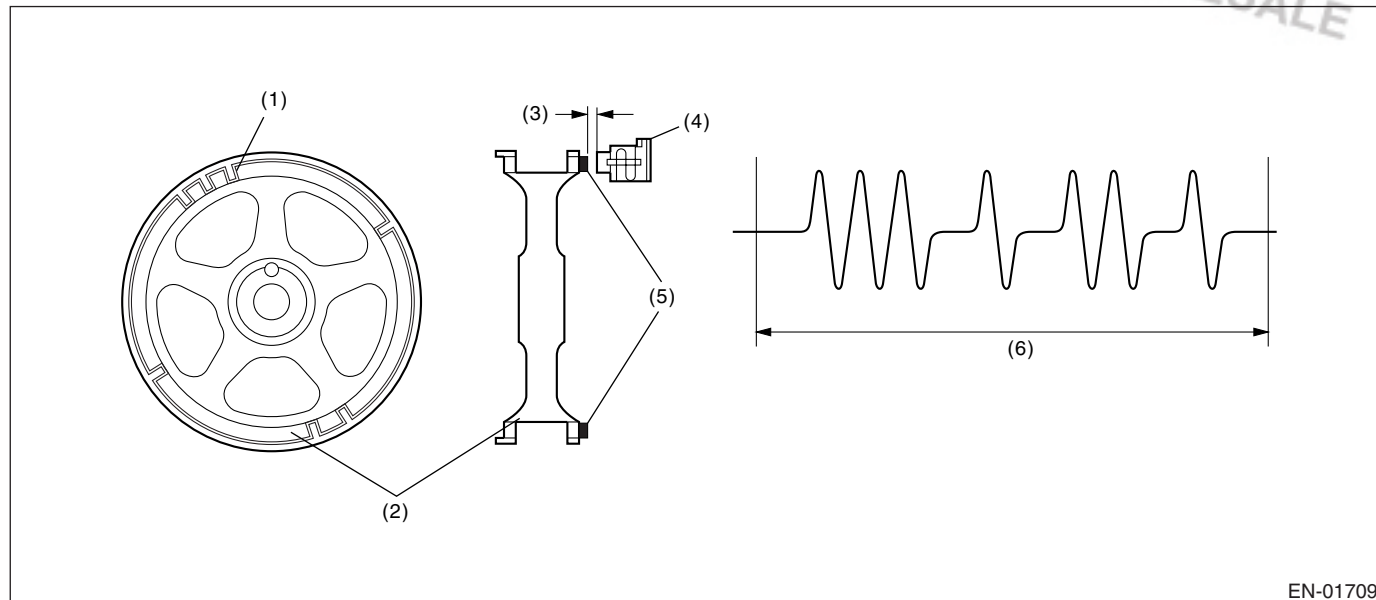
When BTDC97°CA crankshaft position sensor signal is input, judge what cylinder piston is brought to the top dead center of compression by camshaft position sensor signal number.

Camshaft position sensor signal number	Next top dead center of compression
3	#3
1	#2
2	#4
1	#1

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION



EN-01709

- (1) Boss
- (2) Camshaft sprocket
- (3) Air gap

- (4) Camshaft position sensor
- (5) Boss
- (6) Camshaft one turn (Crankshaft two turns)

3. ENABLE CONDITION

Perform the diagnosis without condition.

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

When many crankshaft position sensor signals were input without camshaft position sensor signal input, judge OK and clear NG.

Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	≥ 36

Time Needed for Diagnosis: 6 revs.

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

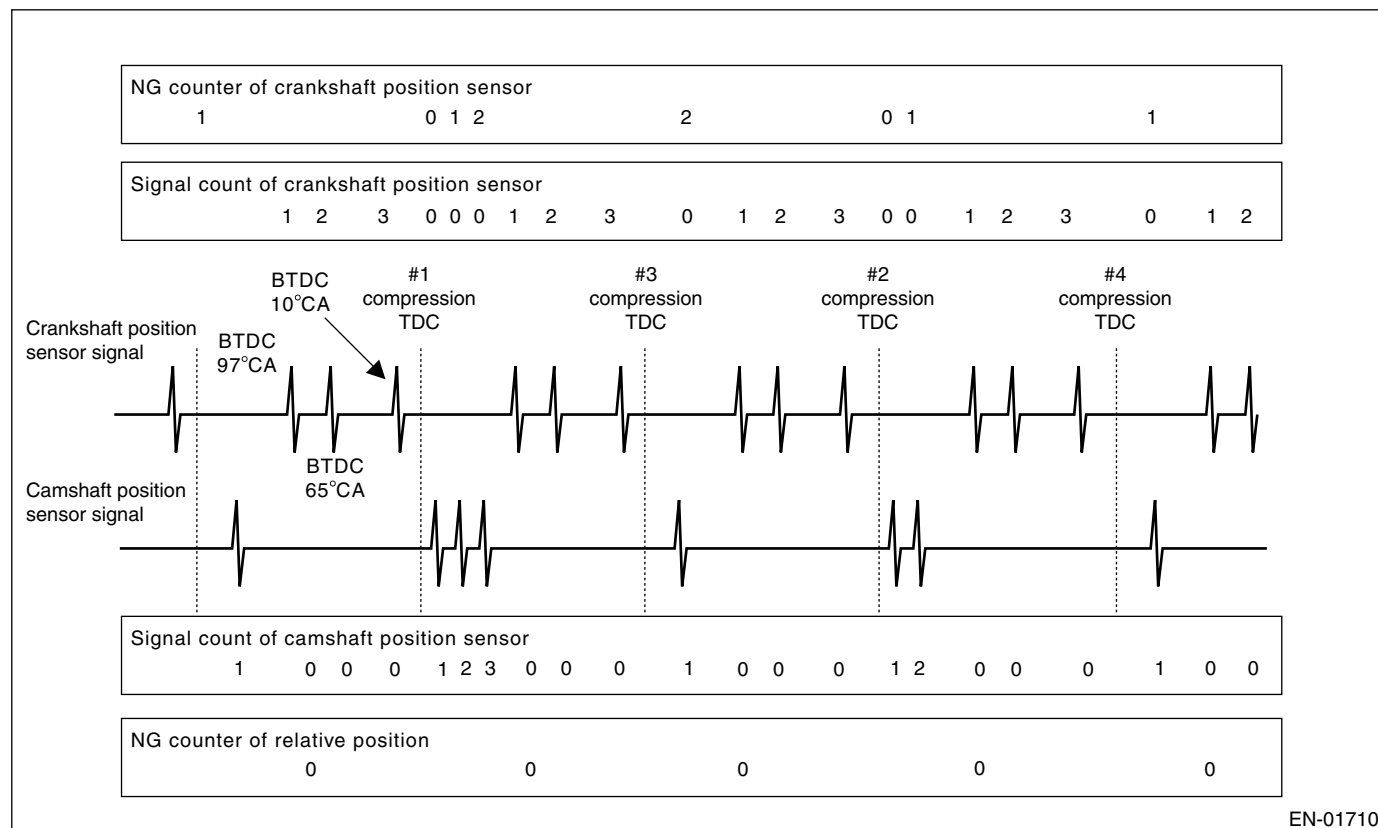
GENERAL DESCRIPTION

AS:DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of crankshaft position sensor output property.

Compare the normal crankshaft position sensor signal with normal camshaft position sensor signal. When each input number does not correspond, judge NG.



• Cylinder judgment method

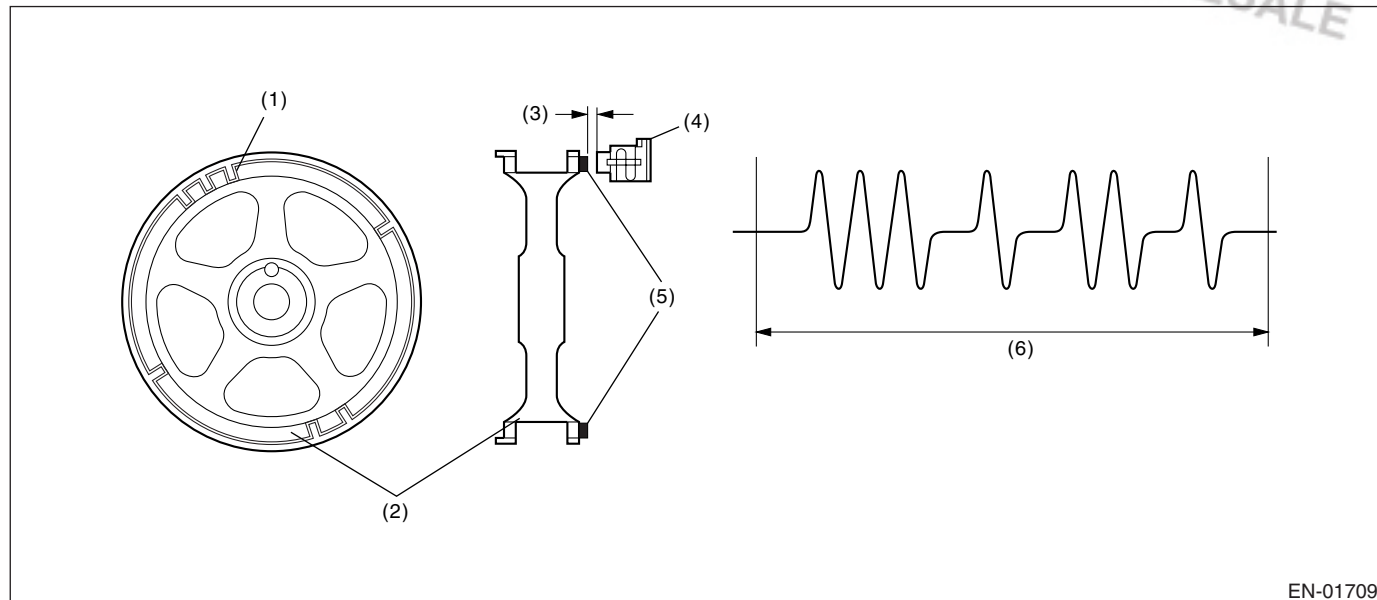
When BTDC97°CA crankshaft position sensor signal is input, judge what cylinder piston is brought to the top dead center of compression by camshaft position sensor signal number.

Camshaft position sensor signal number	Next top dead center of compression
3	#3
1	#2
2	#4
1	#1

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. COMPONENT DESCRIPTION



- (1) Boss
- (2) Camshaft sprocket
- (3) Air gap

- (4) Camshaft position sensor
- (5) Boss
- (6) Camshaft one turn (Crankshaft two turns)

3. ENABLE CONDITION

Perform the diagnosis without condition.

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

When BTDC97°CA crankshaft position sensor signal is input, compare the camshaft position sensor signal number in past 4 times with camshaft position sensor signal number at normal. Increase NG judgment counter when each number does not correspond at once, judge OK and clear NG when the camshaft position sensor signal is normal.

Judgment Value

Malfunction Criteria	Threshold Value
Fault counter of relative position	≥ 32

Time Needed for Diagnosis: 6 revs.

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

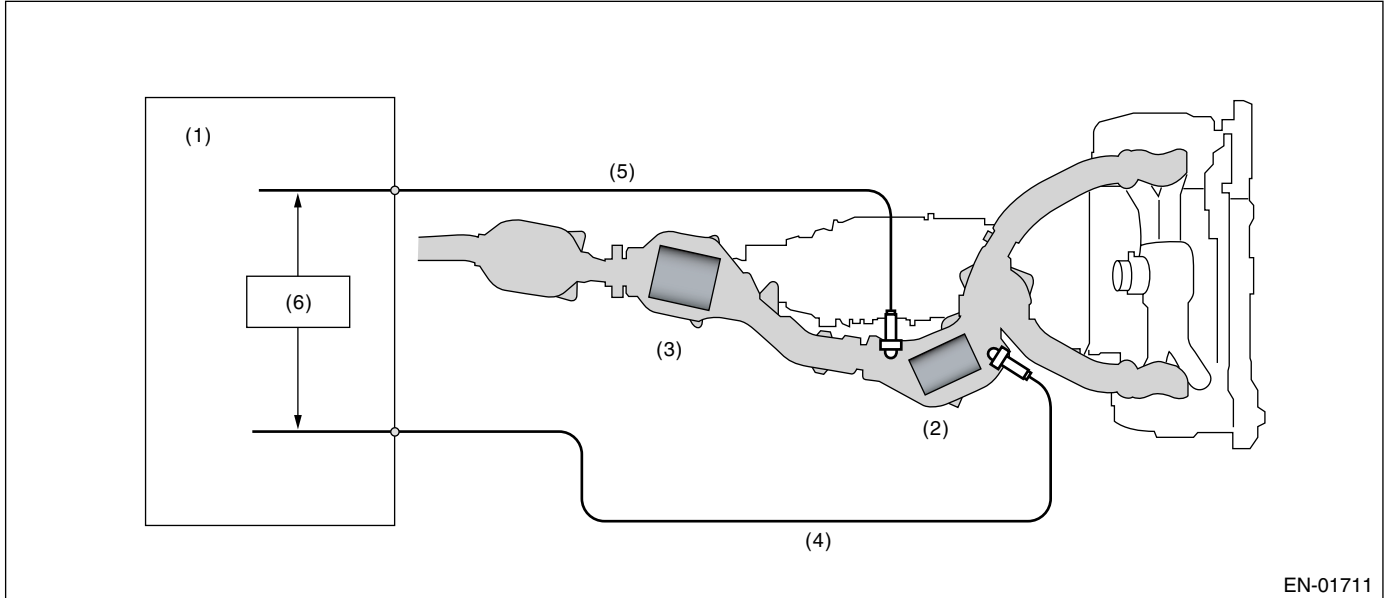
GENERAL DESCRIPTION

AT:DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1)

1. OUTLINE OF DIAGNOSIS

Check the catalyst efficiency deterioration.

Generally, the catalytic converter exhaust gas conversion efficiency and oxygen absorbing/removing function are inter-related. The front A/F sensor and rear oxygen sensor are therefore utilized to monitor the oxygen absorbing/removing function, and the results are used to monitor the conversion efficiency.



- (1) Engine control module (ECM)
- (2) Front catalyst converter
- (3) Rear catalyst converter

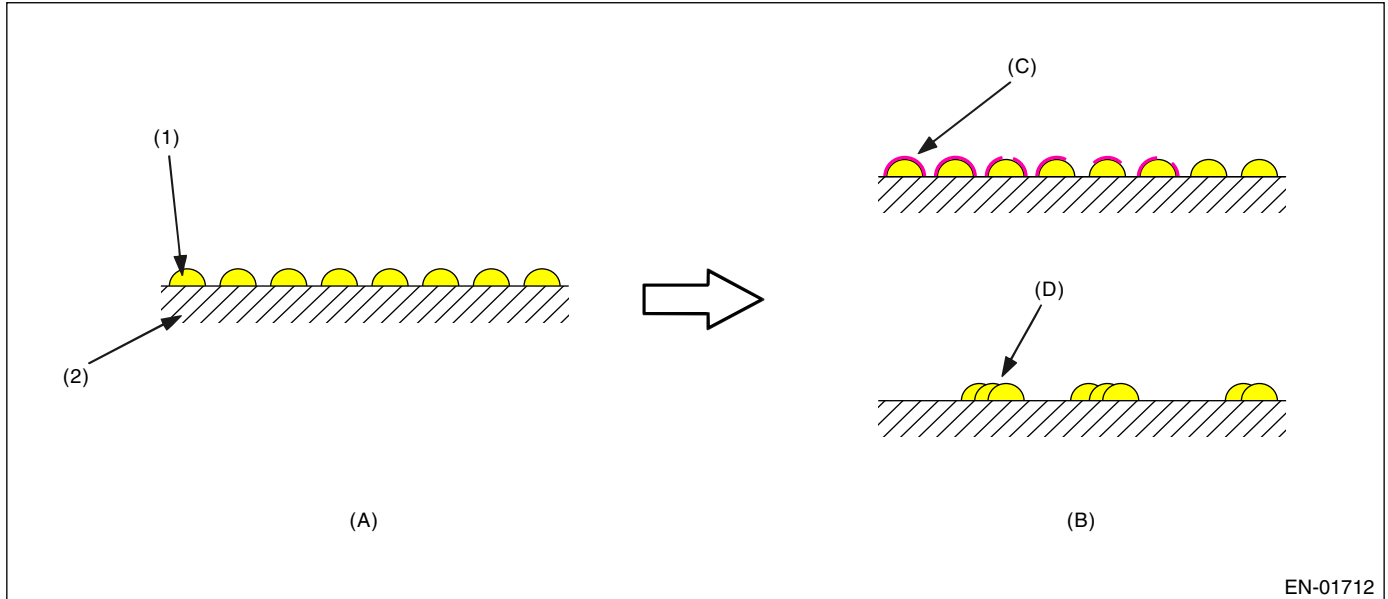
- (4) Front oxygen (A/F) sensor
- (5) Rear oxygen sensor
- (6) Diagnosis circuit

EN-01711

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Oil adherence to the catalytic metal (an alloy of platinum and rhodium, or an alloy of platinum, rhodium and palladium) in catalyst converter or metal melting by extraordinary high temperature result in the decrease of metal surface area contacting exhaust gas. Eventually, catalytic conversion efficiency blunted and oxygen density of catalyst downstream may change.



(1) Metal (catalytic function)

(2) Monolith

(A) Normal

(B) Deterioration

(C) Oil adherence

(D) Metal melting by high temperature

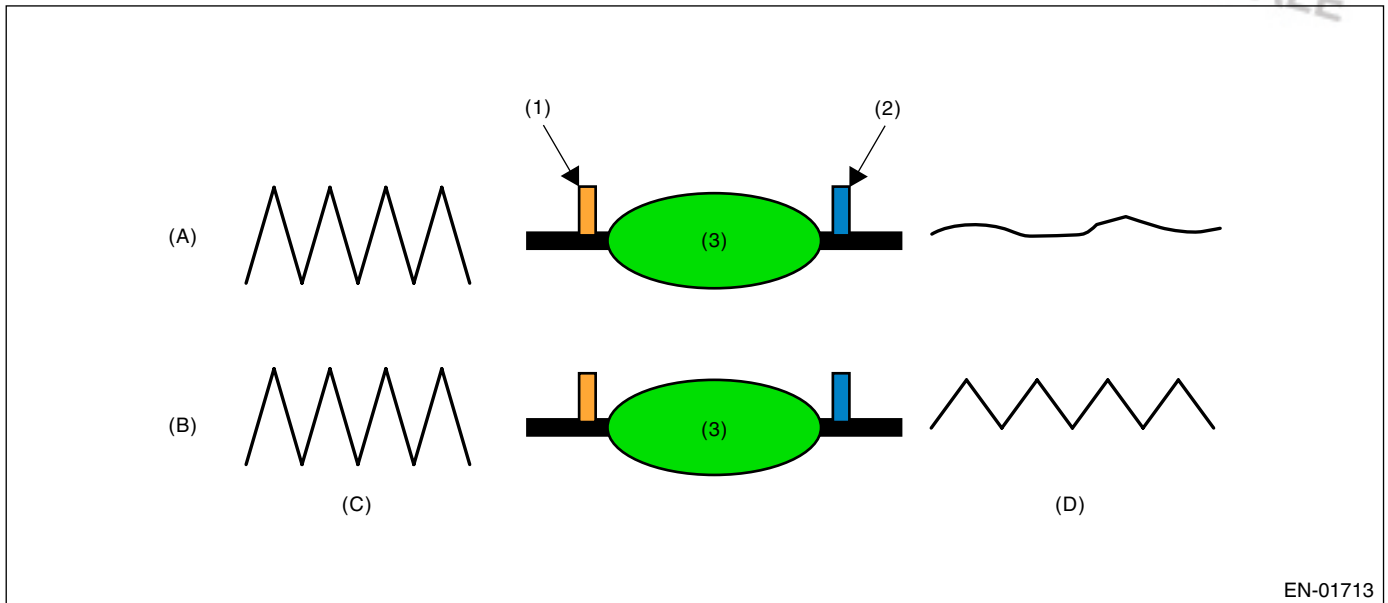
EN-01712

Output of rear oxygen sensor changes gradually with a new catalyst, but the blunted catalyst efficiency mentioned above makes sensor output larger and inverse time shorter.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Therefore, catalyst diagnosis is conducted by monitoring the rear oxygen sensor output and comparing its output with the front A/F sensor output.



- (1) Front oxygen (A/F) sensor
- (2) Rear catalyst converter
- (3) Catalytic converter

- (A) Normal
- (B) Deterioration
- (C) Output waveform from the front oxygen (A/F) sensor
- (D) Output waveform from the rear oxygen sensor

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Idle switch off after coolant temp 71°C (160°F)	180 seconds
Closed loop control continuous 5 seconds	Not in standstill
Vehicle speed	24 — 140 km/h (15 — 87 MPH)
Injector pulse (AT)	0.832 — 4.096 milliseconds
(MT)	0.384 — 3.840 milliseconds
Closed loop control with rear oxygen sensor	Operating
Engine misfire during 400 ignitions	≤ 5 times
Lambda	0.625 — 1.375
Engine speed (AT)	600 — 3,000 rpm
(MT)	1,000 — 3,300 rpm
Neutral position	OFF
Engine coolant temperature	≥ 75°C (167°F)
Throttle position (AT)	< 14.72°
(MT)	< 17.60°
Average AIA during diagnosis	≥ 35.2 kg/h
Integrated fluctuating AIA during diagnosis	> 160 kg/h
After fuel shut-off finished	1 seconds or more
Accumulated amount of intake air (AIA) (entry condition)	0.84 kg (1.85 lb)/60 seconds
Vehicle speed (continuous 80 seconds) (entry condition)	≥ 20 km/h (12 MPH)
Injector pulse (continuous 40 seconds) (entry condition)	1.34 — 4.22 milliseconds
Vehicle speed (continuous 70 seconds) (entry condition)	≥ 74 km/h (46 MPH)
Catalyst deterioration diagnosis	Incomplete

3. GENERAL DRIVING CYCLE

Perform the diagnosis once with a constant vehicle speed 80 — 100 km/h (49.7 — 62.1 MPH).

4. DIAGNOSTIC METHOD

• Output fluctuation accumulate method

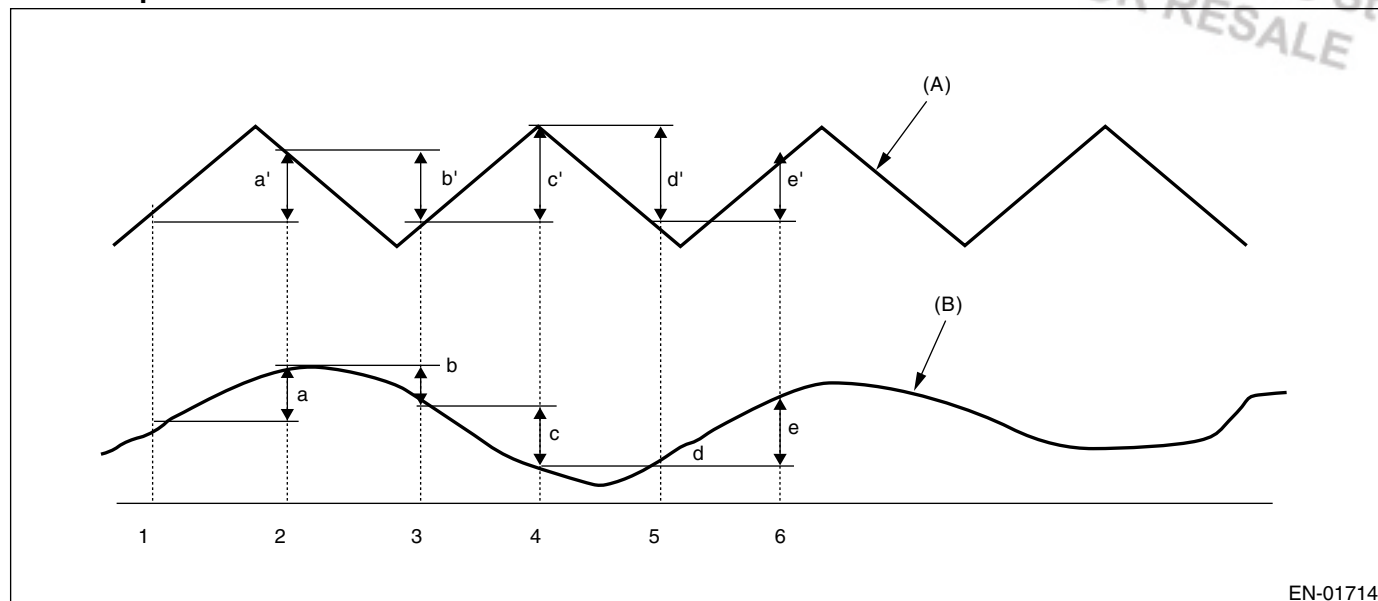
The accumulated value of front A/F sensor output changes and the accumulated value of rear oxygen sensor output changes are determined, and the diagnostic value is calculated using the following formula.

Diagnostic value = Accumulated value of rear oxygen sensor output changes / Accumulated value of front A/F sensor output changes

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

For example



- (A) Front oxygen (A/F) sensor output waveform
(B) Rear oxygen sensor output waveform

Judge NG when the malfunction criteria below are completed, and judge OK when they are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Accumulated variation of output Voltage of rear oxygen sensor per 50 milliseconds divided by accumulated Variation of output voltage of front lambda sensor per 50 milliseconds	≥ 1.5

Time Needed for Diagnosis: 45 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

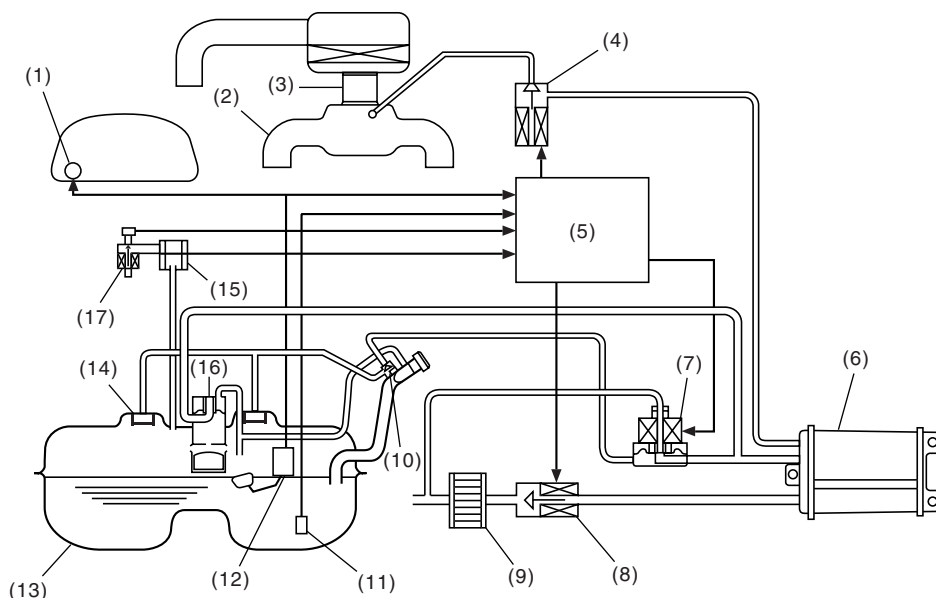
8. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnosis value and trouble standard value. (For test mode \$06)

AU:DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK)

1. OUTLINE OF DIAGNOSIS

Check if there is a leakage in fuel system or not, and perform the function diagnosis of valve.



EN-01699

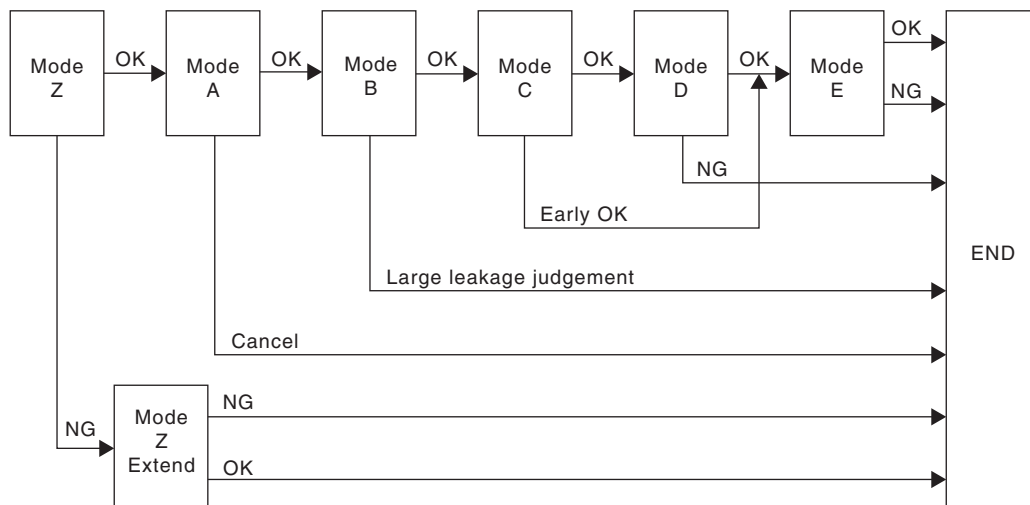
(1) Fuel gauge	(10) Shut-off valve
(2) Intake manifold	(11) Fuel temperature sensor
(3) Throttle body	(12) Fuel level sensor
(4) Purge control solenoid valve	(13) Fuel tank
(5) Engine control module (ECM)	(14) Fuel cut valve
(6) Canister	(15) Fuel tank pressure sensor
(7) Pressure control solenoid valve	(16) Vent valve
(8) CCV	(17) Tank pressure switching solenoid valve
(9) Drain filter	

In this system diagnosis, checking for leakage and valve function is conducted by changing the fuel tank pressure and monitoring the pressure change using the fuel tank pressure sensor. 0.04 inch diagnosis is performed in the order of mode Z, mode A, mode B, mode C, mode D and mode E, and 0.02 inch diagnosis is performed in the order of mode Y, mode A, mode B, mode C, mode D and mode E.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• 0.04-inch Diagnosis



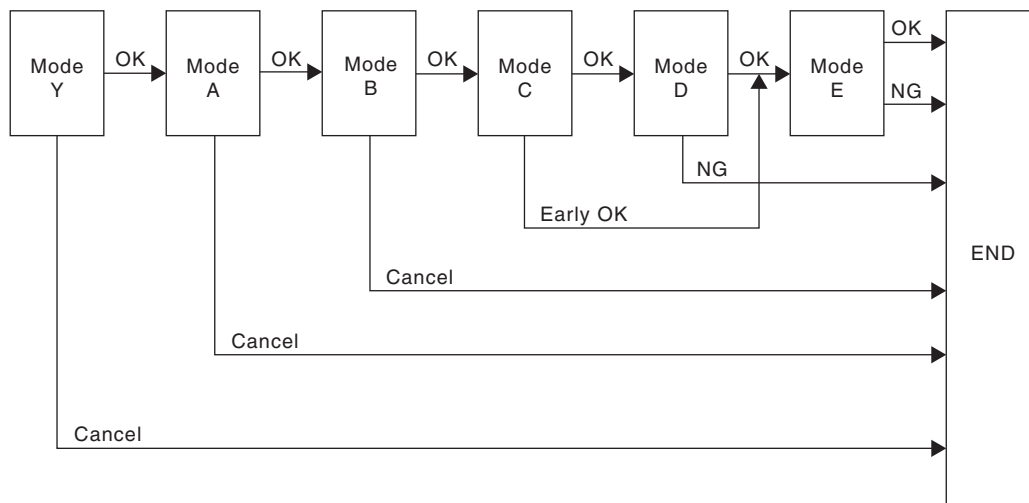
EN-01850

Mode	Mode Description	Diagnosis Period
Mode Z (CPC abnormal open diagnosis, CCV abnormal close diagnosis)	Carry out CPC open trouble and CCV close trouble diagnosis according to tank pressure change amount after diagnosis started.	3 — 16 seconds
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	7 — 15.5 seconds
Mode B (Sealed negative pressure, large leakage judgment)	Introduce the intake manifold pressure to the fuel tank and reduce the tank pressure to the desired value. If the tank pressure cannot be reduced, it is diagnosed as large leak.	5 — 35 seconds
Mode C (Pressure increase check, advanced OK judgment)	Wait until the tank pressure becomes desired pressure. If the tank pressure does not become the value, make advanced OK judgment.	4 — 16 seconds
Mode D (Negative pressure variation mea- surement, evaporation leakage diagnosis)	Calculate the tank pressure variation (P2), and obtain the diag- nostic value using P1 of Mode A. Perform the evaporation leakage diagnosis using the diagnostic value.	7 — 15.5 seconds
Mode E (CCV property abnormal diagnosis)	Perform the CCV property abnormal diagnosis according to the tank pressure change amount after the leakage diagnosis com- pleted.	4 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• 0.02-inch Diagnosis



EN-01872

Mode	Mode Description	Diagnosis Period
Mode Y (Tank pressure stabilization)	Return the tank pressure to atmosphere.	0.1 seconds
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	18 — 29 seconds
Mode B (Negative pressure sealed)	Introduce the intake manifold pressure to the fuel tank and reduce the tank pressure to the desired value.	10 — 62 seconds
Mode C (Pressure increase check, advanced OK judgment)	Wait until the tank pressure becomes desire pressure. If the tank pressure does not become the value, make advanced OK judgment.	5 — 20 seconds
Mode D (Negative pressure variation measurement, evaporation leakage diagnosis)	Calculate the tank pressure variation (P2), and obtain the diagnostic value using P1 of Mode A. Perform the evaporation leakage diagnosis using the diagnostic value.	14 — 25 seconds
Mode E (CCV property abnormal diagnosis)	Perform the CCV property abnormal diagnosis according to the tank pressure change amount after the evaporation leakage diagnosis completed.	4 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Mode Table for Evaporative Emission Control System Diagnosis

0.04-inch Diagnosis

Mode	Behavior of tank internal pressure under normal conditions	Diagnostic item	DTC
Mode Z	Nearly same as atmospheric pressure (equivalent pressure of 0 kPa (0 mmHg, 0 inHg))	CCV is judged to be stuck closed.	P1443
		CPC is judged to be stuck open.	P0457
Mode A	Pressure is in proportion to amount of evaporation gas occurrence.	—	—
Mode B	Negative pressure is formed due to intake manifold negative pressure	Large leakage judgment	P0457
Mode C	Target pressure is reached.	—	—
Mode D	Pressure change is small.	Evaporation system is judged to have large leak [1.0 mm (0.04 in.)].	P0442
Mode E	Return to atmosphere	CCV property judgment	P1443

0.02-inch Diagnosis

Mode	Behavior of tank internal pressure under normal conditions	Diagnostic item	DTC
Mode Y	Return to atmosphere	—	—
Mode A	Pressure is in proportion to amount of evaporation gas occurrence.	—	—
Mode B	Negative pressure is formed due to intake manifold negative pressure	—	—
Mode C	Target pressure is reached.	—	—
Mode D	Pressure change is small.	P2 measurement of small leak in system. Evaporation system is judged to have small leak [0.5 mm (0.02 in.)].	P0456
Mode E	Return to atmosphere	CCV property judgment	P1443

2. COMPONENT DESCRIPTION

• Pressure Control Solenoid Valve

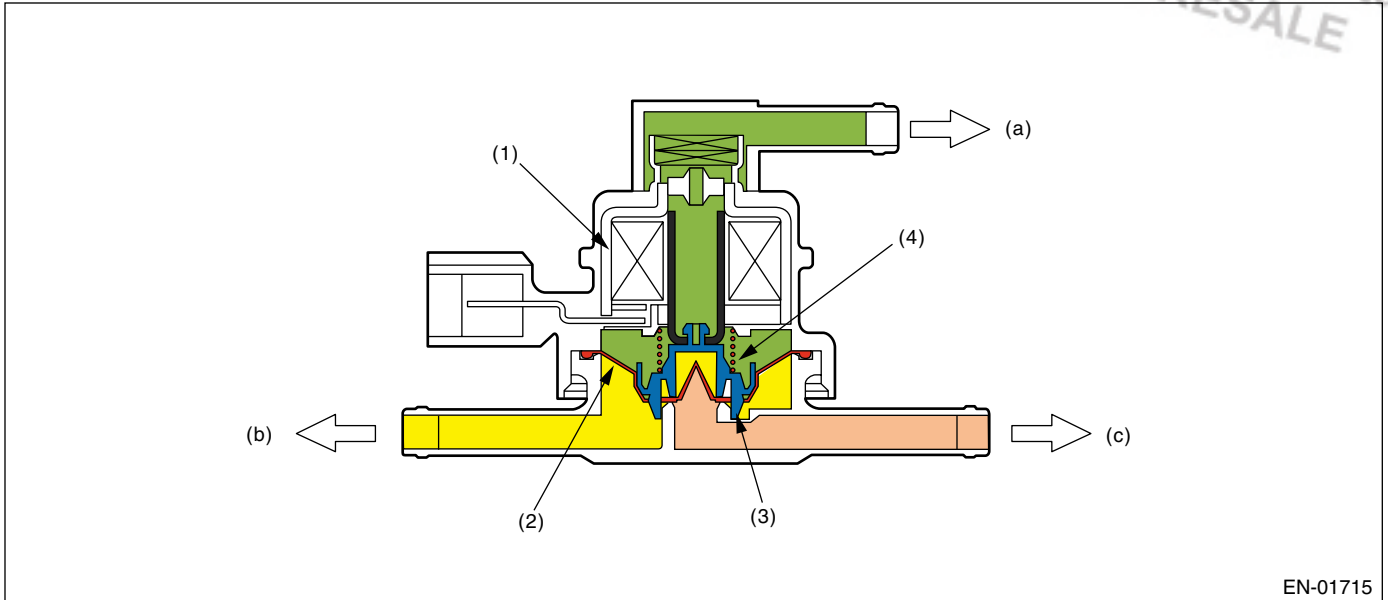
PCV controls the fuel tank pressure to be equal to the atmospheric air pressure.

Normally, the solenoid is set to OFF. And the valve opens and closes mechanically in accordance with the pressure difference between tank and atmospheric air, or tank and canister.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

The solenoid which is set to ON forces to open the valve.



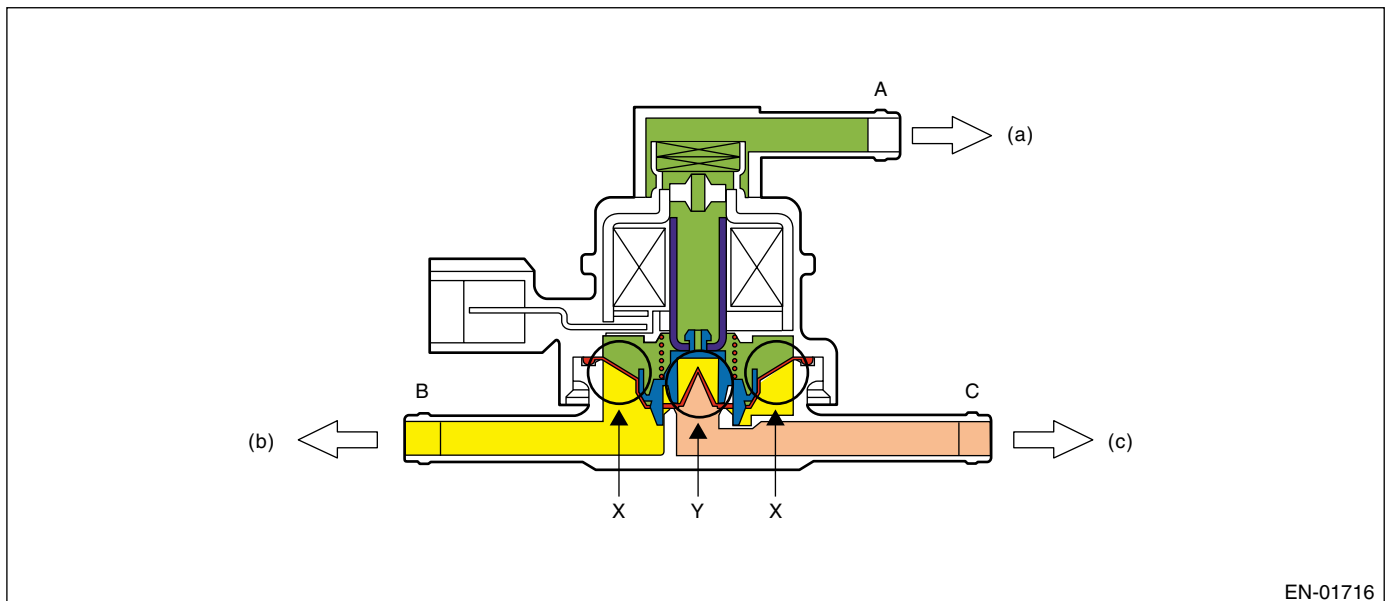
- (1) Solenoid
- (2) Diaphragm
- (3) Valve
- (4) Spring

- (a) Atmospheric pressure
- (b) Fuel tank
- (c) Canister

• Valve Operation and Air Flow

In the figure below, divided by the diaphragm, the part above X is charged with atmospheric air pressure, and the part below X is charged with tank pressure. Also, the part above Y is charged with tank pressure, and the part below Y is charged with canister pressure.

If the atmospheric air pressure port is A, tank pressure port is B, and canister pressure port is C, the air flows according to pressure difference from each port as shown in the table below.



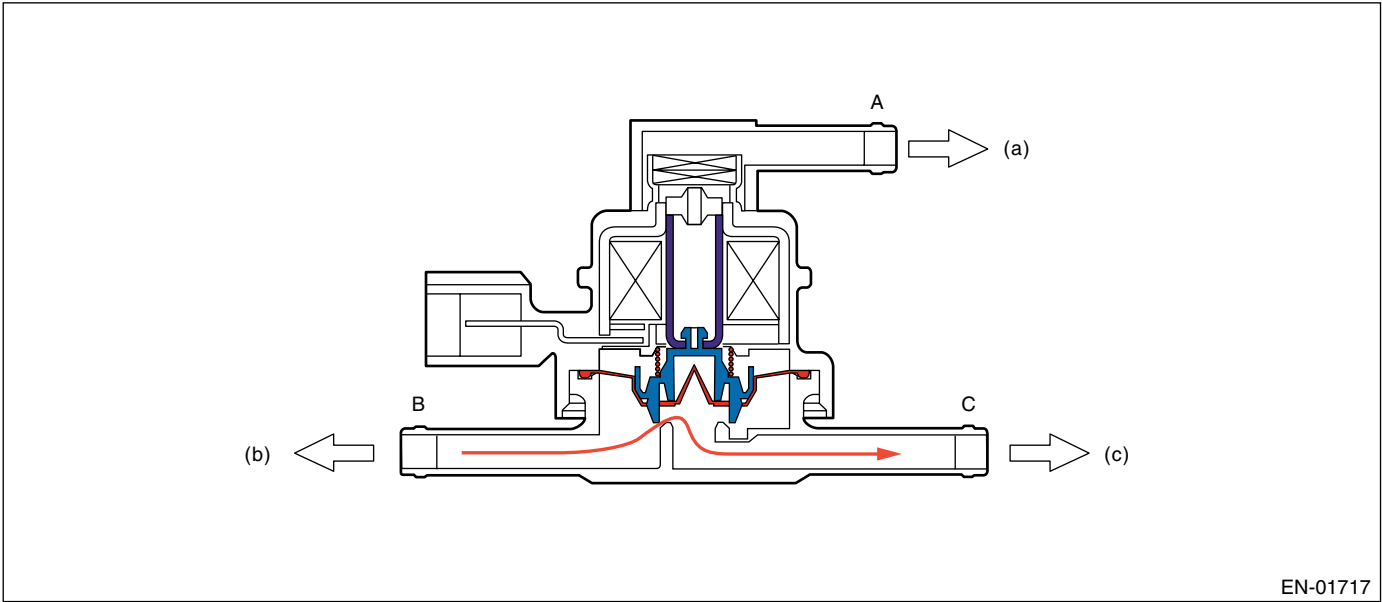
- (a) Atmospheric pressure
- (b) Fuel tank
- (c) Canister

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

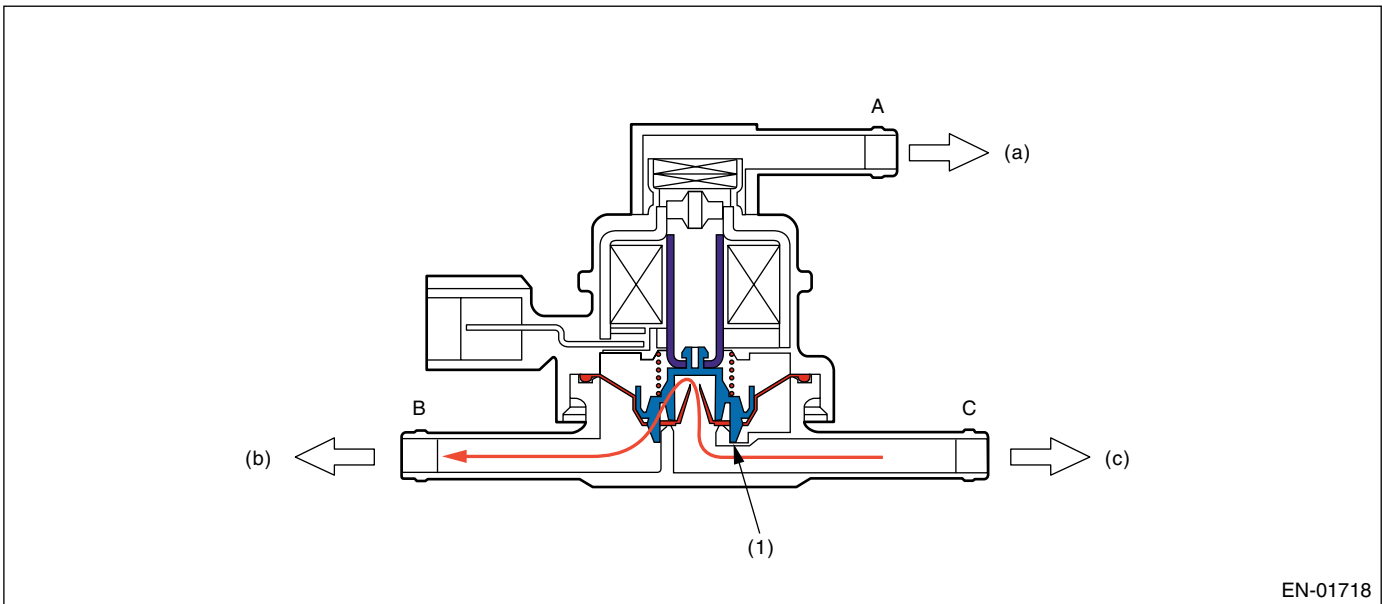
Condition of pressure	Flow
A < B (solenoid OFF)	B → C
B < C (solenoid OFF)	C → B
Solenoid ON	B ↔ C

• When A < B (Solenoid OFF)



- (a) Atmospheric pressure
- (b) Fuel tank
- (c) Canister

• When B < C (Solenoid OFF)

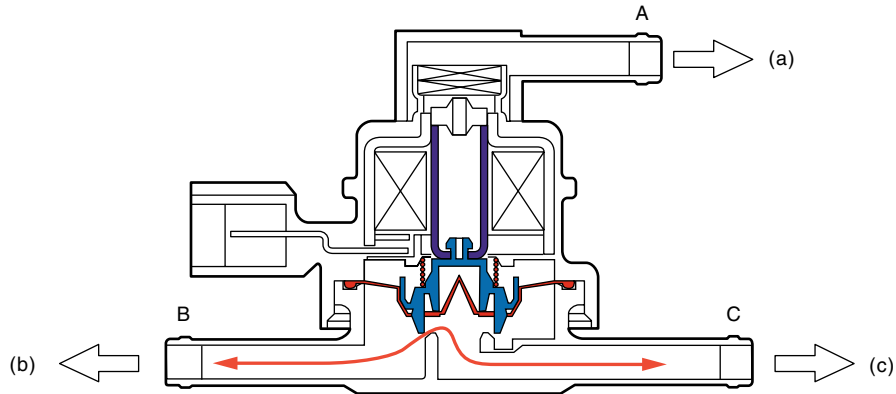


- (1) Valve
- (a) Atmospheric pressure
- (b) Fuel tank
- (c) Canister

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- When Solenoid is ON



EN-01719

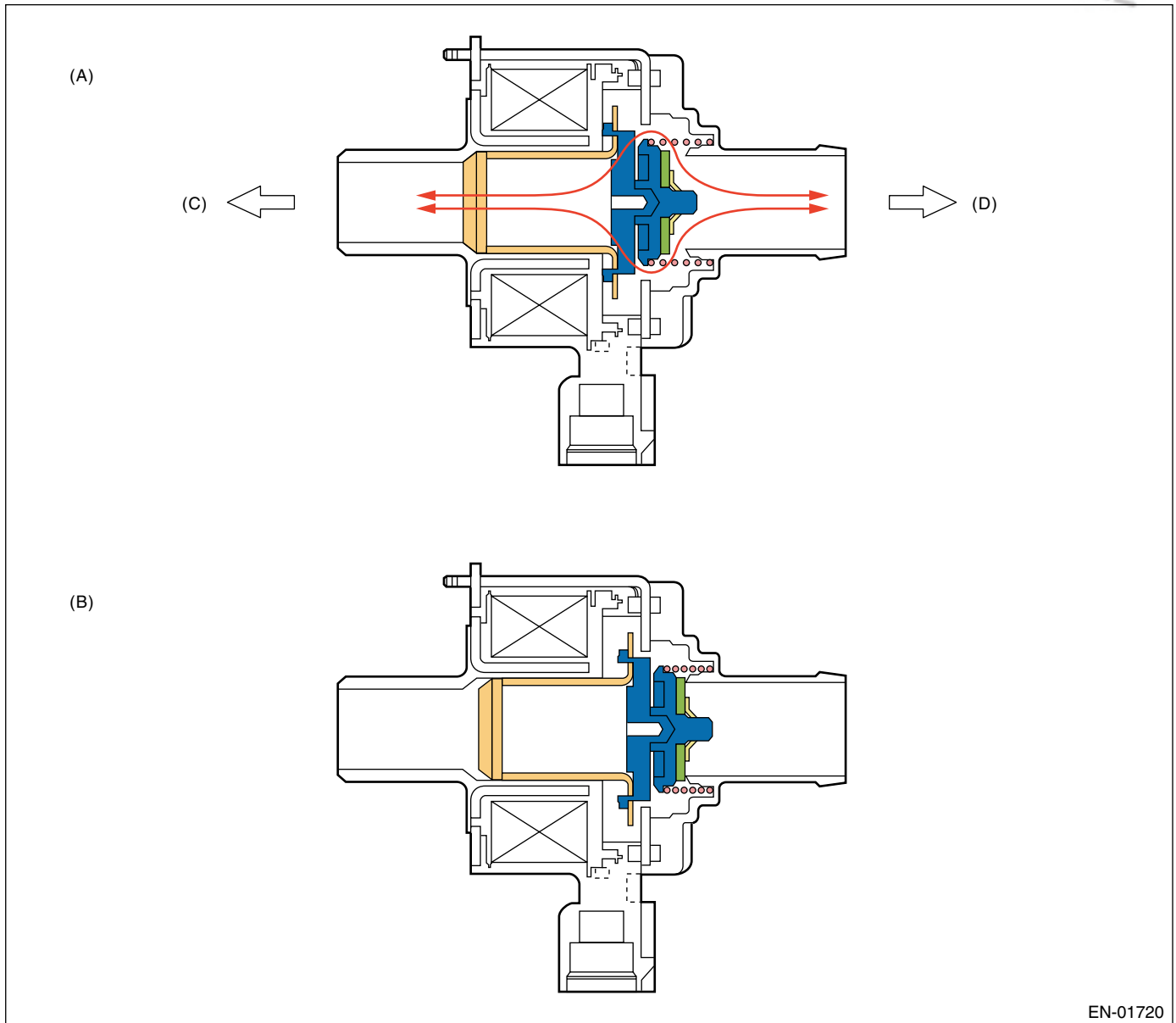
- (a) Atmospheric pressure
- (b) Fuel tank
- (c) Canister

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• CCV

CCV controls the ambient air to be introduced to the canister.



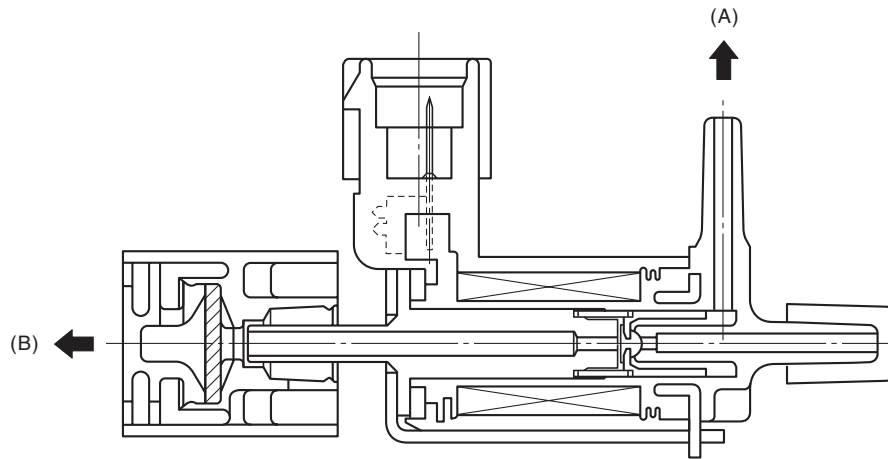
- (A) Open (Solenoid OFF)
- (B) Close (Solenoid ON)
- (C) Filter
- (D) Canister

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Tank Pressure Switching Solenoid

One of the atmospheric pressure switching solenoid valves is connected to fuel tank pressure sensor and the other is released to atmosphere. The passage to fuel tank pressure sensor is usually released to atmosphere because the solenoid is set to OFF, but the solenoid which is set to ON close the passage open to atmosphere.



EN-01721

- (A) Fuel tank pressure sensor
- (B) Atmosphere

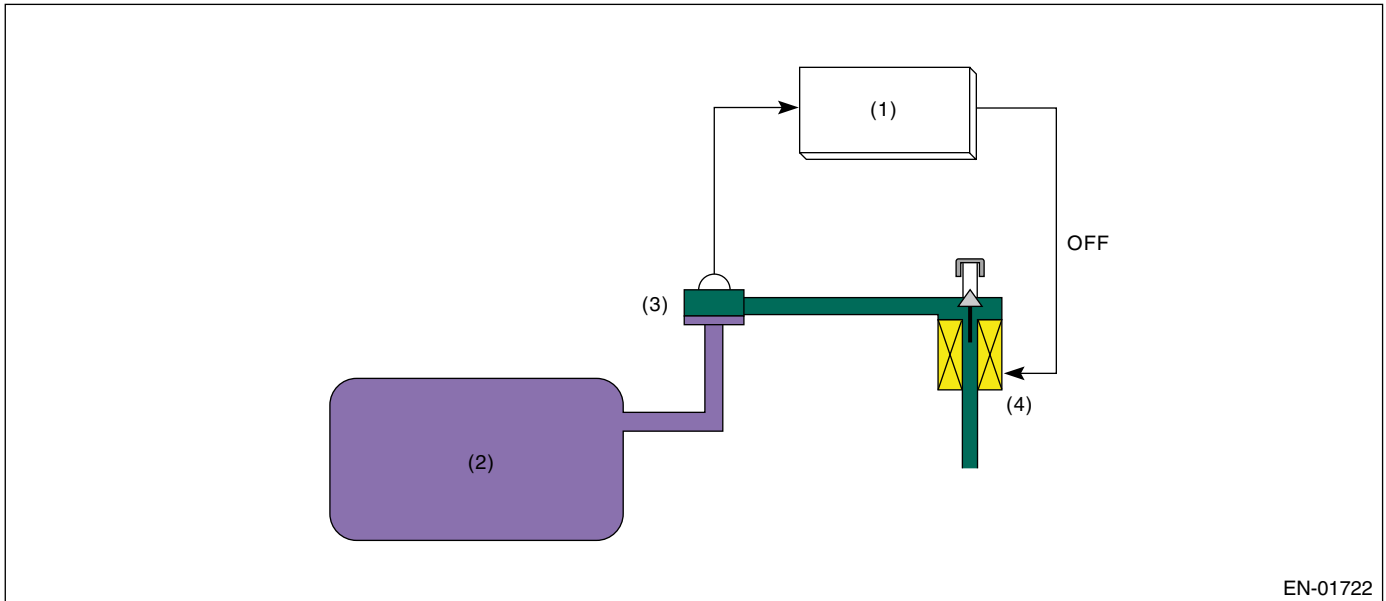
Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Purpose of this solenoid

Fuel tank pressure sensor detects the difference between the atmospheric air pressure and the tank pressure and the ECM monitors the pressure difference.

Even if the tank pressure is constant, the atmospheric air pressure varies depending on the driving height, and the pressure signal transmitted to ECM will change.

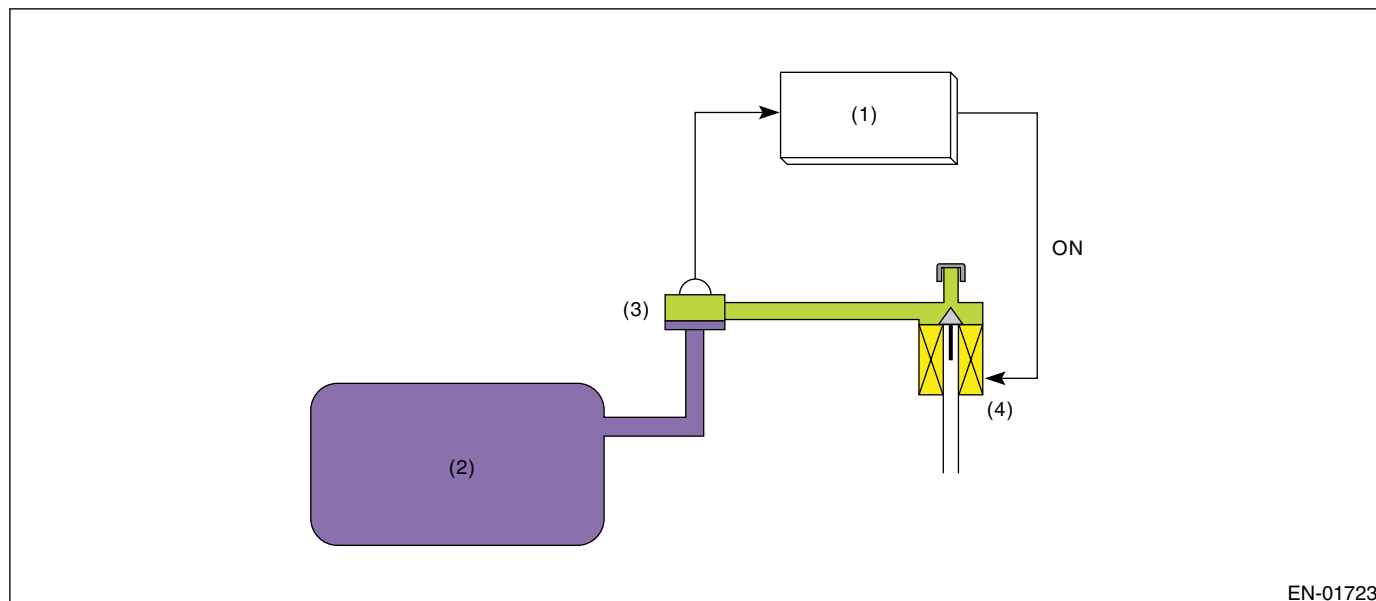


- (1) Engine control module (ECM)
- (2) Fuel tank
- (3) Fuel tank pressure sensor
- (4) Atmospheric pressure switching solenoid

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Especially, in the small leakage [0.5 mm (0.02 in)], minute change in the tank pressure has to be detected. This diagnosis period is long (approx. 29 seconds). And if the driving height changes during the diagnosis, the atmospheric air pressure changes. In this case, it becomes difficult to precisely detect the tank pressure variation, causing erroneous diagnosis. Therefore, using the atmospheric pressure switching solenoid, atmospheric air is sealed between the fuel tank pressure sensor and atmospheric pressure switching solenoid, maintaining the air pressure constant and enabling the detection of minute variation of tank pressure.



- (1) Engine control module (ECM)
- (2) Fuel tank
- (3) Fuel tank pressure sensor
- (4) Atmospheric pressure switching solenoid

NOTE:

ECM also has the atmospheric air pressure sensor, and always monitors atmospheric air. However, as the monitoring range is large, that is, 53 to 107 kPa (400 to 800 mmHg, 16 to 32 inHg) it is not suitable for detection of minute pressure variation.

In the case of small leakage diagnosis, the tank pressure variation is very small, that is, 0.13 to 0.27 kPa (1 to 2 mmHg, 0.04 to 0.08 inHg) and the fuel tank pressure sensor is equipped.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

0.04-inch Diagnosis

Secondary Parameters	Enable Conditions
Evap. diagnosis	Not completed
Since last incomplete diagnosis event of 0.04 inches leak	≥ 180 seconds (vehicle speed ≥ 72 km/h (45 MPH)) ≥ 920 seconds (vehicle speed < 72 km/h (45 MPH))
Throttle angle	$96 \text{ — } 14.1^\circ$
Canister purge cumulative time	≥ 120 seconds
Engine speed	$\geq 1,500$ rpm
Fuel tank pressure at Evap. monitoring starting	$\geq -1,000$ Pa (7.5 mmHg, 0.295 inHg)
Intake manifold relative pressure	≥ 26.65 kPa (200 mmHg, 7.9 inHg)
Vehicle speed	≥ 48 km/h (30 MPH)
Fuel level	$9 \text{ — } 51 \text{ } \ell$ (2.4 — 13.5 US gal, 2.0 — 11.2 Imp gal)
After engine started	More than 454 seconds
Barometric pressure	≥ 75 kPa (563 mmHg, 22.1 inHg)
Fuel temperature	$-10 \text{ — } 45^\circ\text{C}$ (14 — 113°F)
Change of fuel level	$< 5 \text{ } \ell$ (1.3 US gal, 1.1 Imp gal)/ 200 milliseconds
0.02-inch diagnosis cancel timer	≥ 120 seconds (vehicle speed ≥ 72 km/h (45 MPH)) ≥ 920 seconds (vehicle speed < 72 km/h (45 MPH))

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Cancel Conditions

Secondary Parameters	Enable Conditions
Change of fuel level	$\geq 5 \text{ l}$ (1.3 US gal, 1.1 Imp gal)/200 milliseconds
When the continuous time until the conditions below are completed becomes more than 4 seconds during Mode B	
Throttle angle	$\leq 0.640^\circ$
Engine speed	$\leq 1,300 \text{ rpm}$
Intake manifold relative pressure	$\leq -16 \text{ kPa}$ (-120 mmHg, 4.7 inHg)
Vehicle speed	$\leq 48 \text{ km/h}$ (30 MPH)
CPC duty	$\leq 15\%$
Compensation factor of air fuel ratio	$\leq -30\%$
When one of the conditions below is completed during Mode A	
Tank pressure	$\geq 1.8 \text{ kPa}$ (13.5 mmHg, 0.5 inHg)
Tank pressure variation amount	$\geq 0.1 \text{ kPa}$ (0.75 mmHg, 0.03 inHg)
P1	$< -0.1 \text{ kPa}$ (-0.75 mmHg, -0.03 inHg)
When the conditions below are completed during Mode D	
Tank pressure variation amount	$\geq 0.1 \text{ kPa}$ (0.75 mmHg, 0.03 inHg)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

0.02-inch Diagnosis

Secondary Parameters	Enable Conditions
Continuous time until the conditions (1) (2) (3) below are all completed.	≥ 5 seconds
Enable condition (1) (All conditions below are completed.) Fuel tank pressure at vacuum starting	–37.5 — 937 Pa (–0.28 — 7.03 mmHg, –0.0110 — 0.277 inHg)
Evap. 0.02-inch Diagnosis	Not completed
Since last incomplete diagnosis event of 0.02 inches leak	> 180 seconds
Total time of operating canister purge	More than 120 seconds
After engine started	More than 325 seconds
Fuel tank pressure below –3,050 Pa (–22.87 mmHg, –0.9007 inHg) during same driving cycle	< 2 seconds
Fuel temperature	–10 — 35°C (14 — 95°F)
After engine start with coolant temperature of 40°C (104°F) or below	< 2,400 seconds
0.04-inch diagnosis cancel timer	≥ 120 seconds
Number of times changing fuel level at 8 2 or more after starting engine	> 3 seconds
Enable condition (2) (All conditions below are completed.) Fuel level	9 — 51 ℓ (2.4 — 13.5 US gal, 2.0 — 11.2 Imp gal)
Atmospheric pressure	≥ 75.7 kPa (568 mmHg, 22.3 inHg)
Change of fuel level	< 4 — 4.5 ℓ (1.1 — 1.2 US gal, 0.9 — 1.0 Imp gal)
Ambient temperature	≥ –10°C (14°F)
(Ambient-fuel) temperature	≥ 1°C (34°F)
Change of engine speed after starting the diagnosis	< 300 rpm
Change of manifold absolute pressure after starting the diagnosis	< 20 kPa (150 mmHg, 5.9 inHg)
Enable condition (3) (All conditions below are completed.) Engine speed	≥ 1,500 rpm
Intake manifold relative pressure	≥ 8 kPa (60 mmHg, 2.4 inHg)
Vehicle speed	≥ 68 km/h (42 MPH)
Closed air fuel ratio control	In operating
CPC duty	≥ 15%
Lambda factor	≥ 0.75

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Cancel Conditions

Secondary Parameters	Enable Conditions
Enable condition (2) completion during Mode Y	Not completed
Continuous time for enable condition (3) completion during Mode B	≥ 10 seconds
When one of the conditions below is completed during Mode A Fuel tank pressure	≥ 1.1 kPa (8.25 mmHg, 0.32 inHg)
P1	≥ 125 Pa (0.94 mmHg, 0.04 inHg)
P1	< -87.5 Pa (-0.66 mmHg, -0.03 inHg)
Tank pressure variation amount	≥ 0.1 kPa (0.75 mmHg, 0.03 inHg)
When the condition below is completed during Mode D Tank pressure variation amount	≥ 0.1 kPa (0.75 mmHg, 0.03 inHg)

4. GENERAL DRIVING CYCLE

• 0.04-inch Diagnosis

- Perform the diagnosis only once in more than 920 seconds after the engine start at the constant driving speed of 48 km/h (30 MPH) or more.
- Pay attention to the fuel temperature and fuel level.

• 0.02-inch Diagnosis

- Perform diagnosis in more than 325 seconds after engine start at the constant speed of 68 km/h (42 MPH) or more, and then terminate the diagnosis when judged OK or NG.
- If not judged OK or NG, repeat the diagnosis until judged OK or NG.
- Pay attention to the fuel temperature and fuel level.

5. DIAGNOSTIC METHOD

• MODE Y (Tank pressure stabilization)

Return the tank pressure to atmosphere, and perform the diagnosis under the conditions.

Tank pressure > 0.9 kPa (67.5 mmHg, 2.7 inHg) after 0.1 seconds:

Cancel the leak check. (Change to Mode A, Tank pressure ≤ 0.9 kPa (67.5 mmHg, 2.7 inHg).)

• MODE Z (Purge control solenoid valve open malfunction diagnosis, CPC close malfunction diagnosis)

DTC P0457

DTC P1443

• Purpose of Mode Z

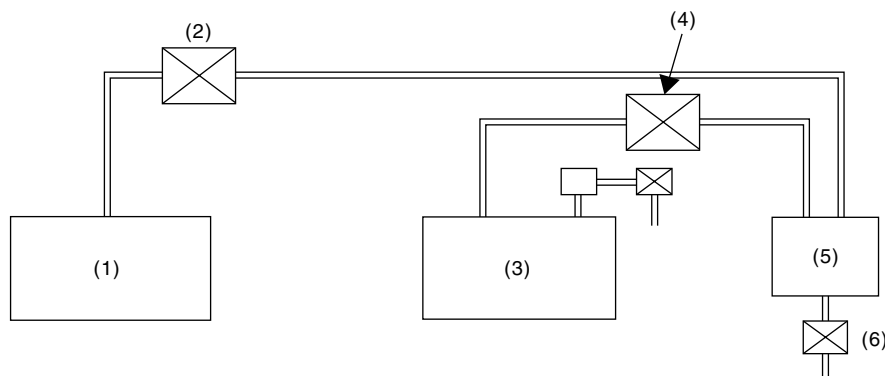
When performing the leakage diagnosis of EVAP system, CCV and CPC have to operate normally. Therefore, mode Z is used to diagnose the CCV close fixation and CPC open fixation.

If the CCV closed fixation trouble or CPC open fixation trouble is detected, the EVAP system leakage diagnosis is cancelled.

Diagnostic Trouble Code (DTC) Detecting Criteria

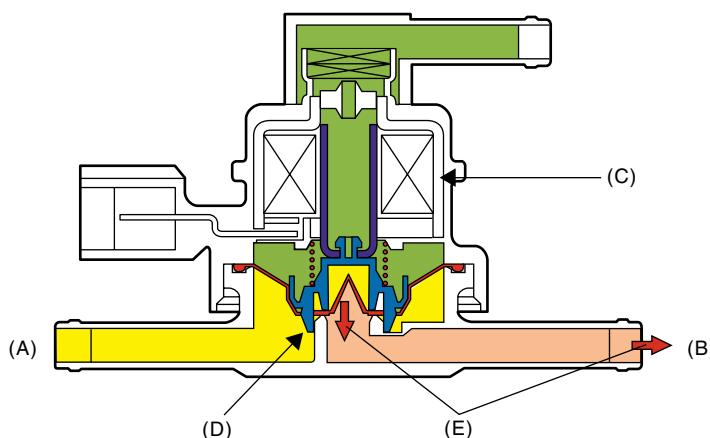
GENERAL DESCRIPTION

If the CCV closed fixation trouble occurred, negative pressure is generated from the engine to pressure control solenoid valve when pressure control solenoid valve is closed and CPC is opened. In this status, the pressure control solenoid valve solenoid, which is set to ON, does not open the valve for its structure when the negative pressure is larger than electromagnetic force.



EN-01724

(1) Engine	(4) Pressure control solenoid valve close
(2) Purge control solenoid valve open	(5) Canister
(3) Fuel tank	(6) CCV stuck close



EN-01725

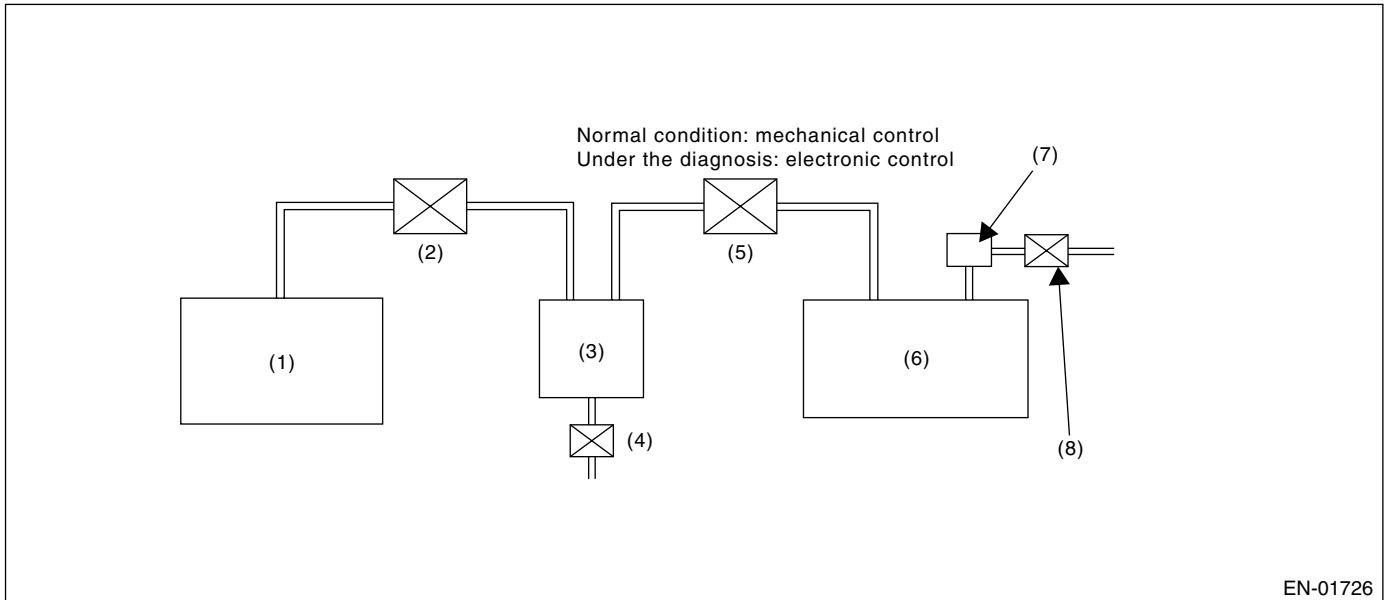
- | |
|-------------------------------------|
| (A) To fuel tank |
| (B) To canister (Negative pressure) |
| (C) Solenoid ON |
| (D) Valve cannot be open. |
| (E) Negative pressure |

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Diagnostic method

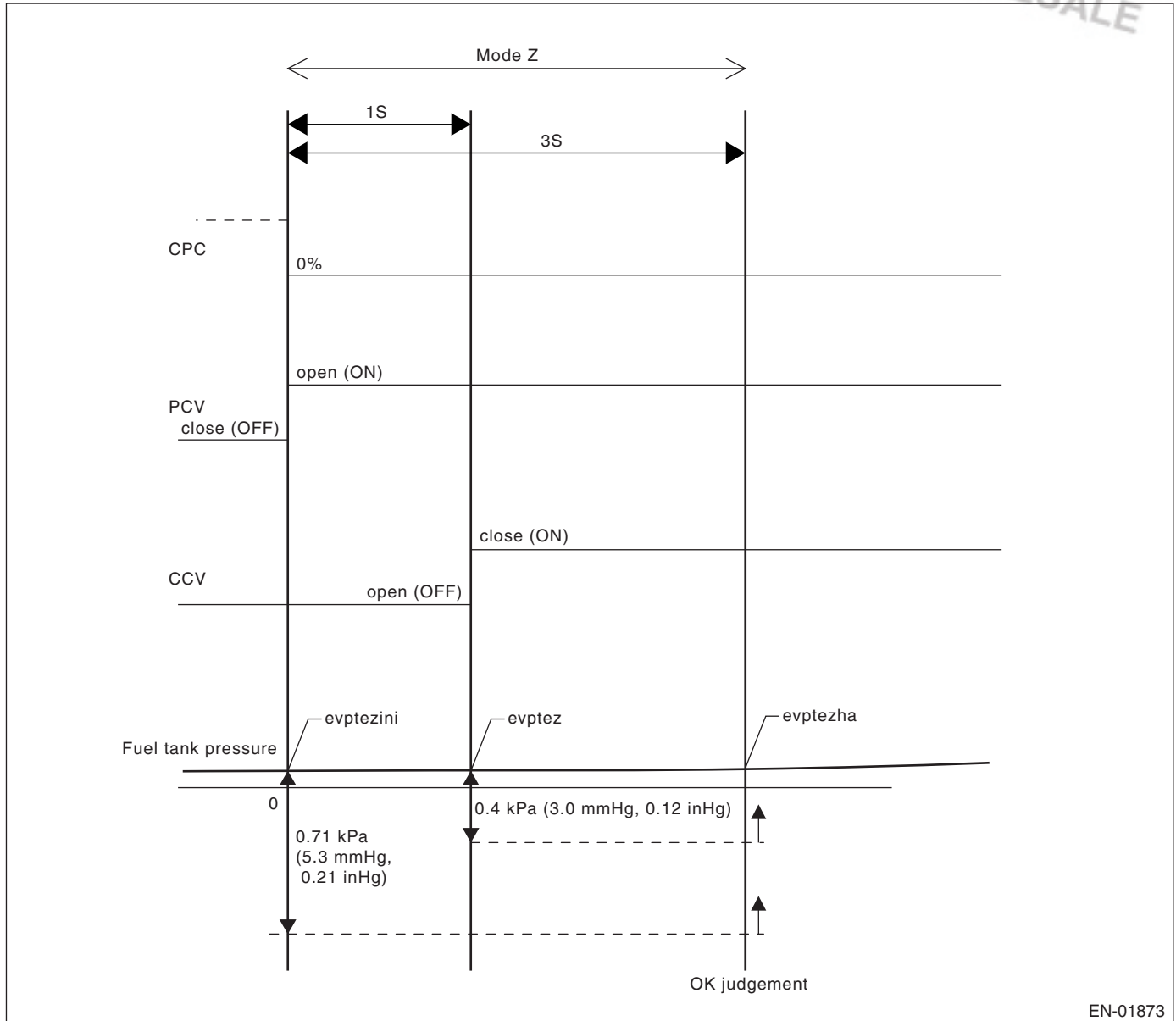
CCV closed fixation diagnosis and CPC open fixation diagnosis are performed in mode Z as shown in the figure below.



Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normal Operation

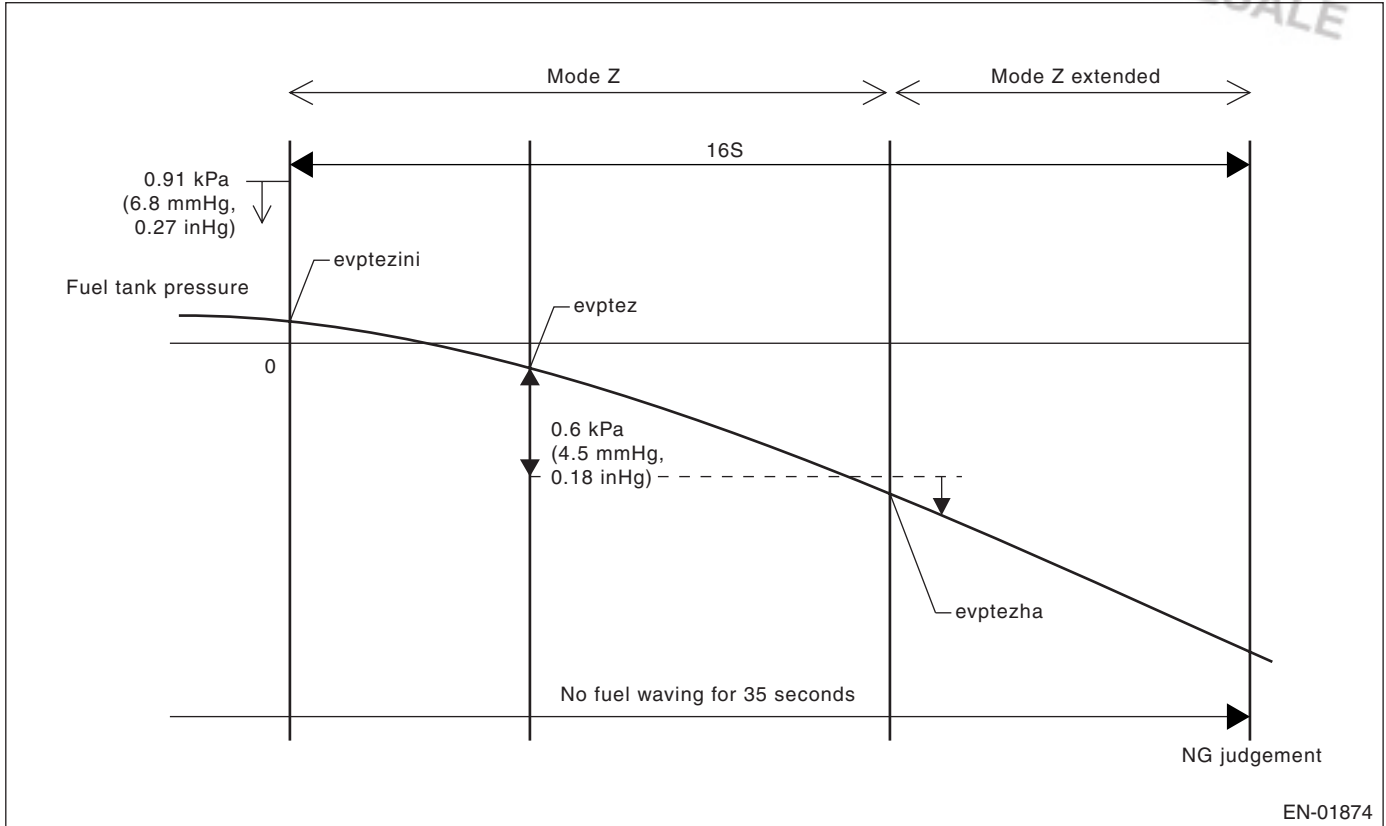


- $evptez - evptezha \leq 0.4 \text{ kPa (3.0 mmHg, 0.12 inHg)}$
 - $evptezini - evptezha \leq 0.71 \text{ kPa (5.3 mmHg, 0.21 inHg)}$
- Judge normal when these calculations are completed.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Purge control solenoid valve Open Fixation

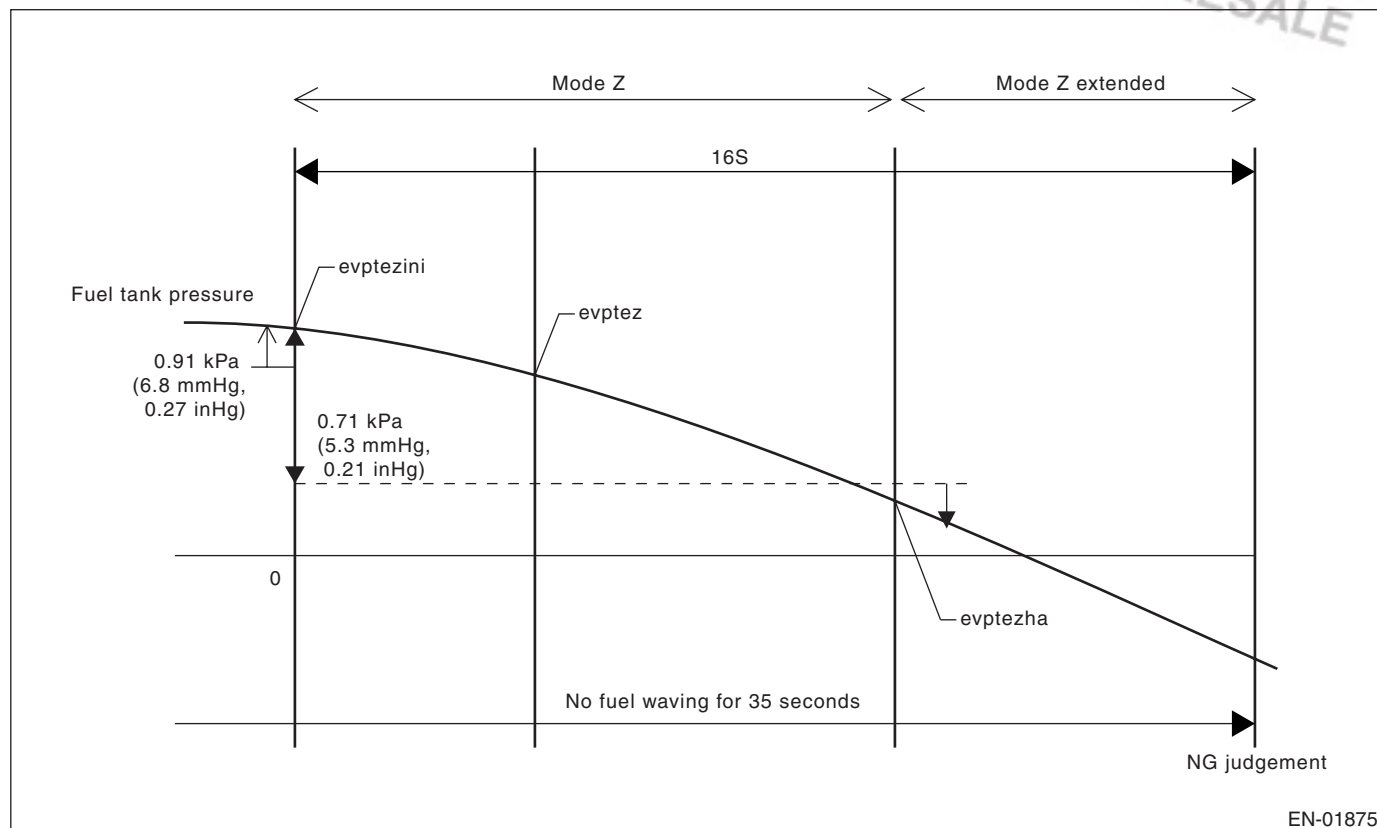


- $evptez - evptezha > 0.6 \text{ kPa}$ (4.5 mmHg, 0.18 inHg)
 - $evptezini \leq 0.91 \text{ kPa}$ (6.8 mmHg, 0.27 inHg)
 - No fuel rolling of above 3 $\varnothing$ (0.79 US gal, 0.67 Imp gal) for more than 35 seconds.
- Judge normal when these calculations are completed.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Drain valve close fixation



- $evptezini - evptezha > 0.71 \text{ kPa (5.3 mmHg, 0.21 inHg)}$
 - $evptezini > 0.91 \text{ kPa (6.8 mmHg, 0.27 inHg)}$
 - No fuel rolling of above 3 $\varnothing$ (0.79 US gal, 0.67 Imp gal) for more than 35 seconds
- Judge normal when these calculations are completed.

• Diagnosing Function of CCV [P1443]

CCV functional diagnosis is performed by monitoring the tank pressure variation in Mode Z.

Normality Judgment

Judge OK and change to Mode A when the criteria below are completed in 3 seconds after Mode Z started.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
(Tank pressure in 1 second after Mode Z started) – (Tank pressure when Mode Z finished)	$\leq 0.4 \text{ kPa (3.0 mmHg, 0.12 inHg)}$	P1443
(Tank pressure when Mode Z started) – (Tank pressure when Mode Z finished)	$\leq 0.6 \text{ kPa (4.5 mmHg, 0.18 inHg)}$	P0457
Tank pressure when Mode Z started	$\leq 1.6 \text{ kPa (12 mmHg, 0.47 inHg)}$	

Abnormality Judgment

If OK judgment cannot be made, extend Mode Z 16 seconds more, and judge NG when all the criteria below are completed in 16 seconds.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Tank pressure when Mode Z started	$> -0.7 \text{ kPa (-5.3 mmHg, -0.21 inHg)}$	P1443
(Tank pressure when Mode Z started) – (Tank pressure when Mode Z finished)	$> 0.6 \text{ kPa (4.5 mmHg, 0.18 inHg)}$	
No fuel locking time	$\geq 40 \text{ seconds}$	

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Time Needed for Diagnosis: 16 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Finish the evaporative emission control system diagnosis when making NG judgment for drain valve close fixation.

Cancel the evaporative emission control system diagnosis when the OK/NG judgment for drain valve close fixation and purge control solenoid valve open fixation cannot be made in Mode Z.

• Diagnosing function of CPC [P0457]

CPC functional diagnosis is performed by monitoring the tank pressure in Mode Z.

Normality Judgment

Make OK judgment in 3 seconds after Mode Z started, and change to Mode A if OK.

Both diagnostic method and judgment value are the same as PCV normality judgment.

Abnormality Judgment

If OK judgment cannot be made, extend Mode Z 16 seconds more, and judge NG when all the criteria below are completed in 16 seconds.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
(Tank pressure in 1 second after Mode Z started) – (Tank pressure when Mode Z finished)	> 0.6 kPa (4.5 mmHg, 0.18 inHg)	P0457
Tank pressure when Mode Z started	≤ –0.7 kPa (–5.3 mmHg, –0.21 inHg)	
No fuel locking time	≥ 40 seconds	
Air fuel ratio rich cumulative time during Mode Z	0.5 seconds	

Time Needed for Diagnosis: 16 seconds

Malfunction Indicator Light Illumination: Immediately

Finish the evaporative emission control system diagnosis when making NG judgment for purge control solenoid valve open fixation.

Cancel the evaporative emission control system diagnosis when the OK/NG judgment for drain valve close fixation and purge control solenoid valve open fixation cannot be made in Mode Z.

• Leak Diagnosis

DTC P0442

DTC P0456

DTC P0457

• Diagnostic method

- The diagnostic method consists of creating a sealed vacuum in the fuel tank and then determining the presence of leakage from the speed at which the tank internal pressure returns to atmospheric pressure.

- The diagnosis is divided into the following five phases.

Mode A;

Calculate tank pressure variation amount (P1). After calculating P1, change to Mode B.

Mode B;

Introduce the negative pressure in the intake manifold to the tank.

Approx. 0 → –1.4 kPa (0 → –10.5 mmHg, 0 → –0.41 inHg) (0.04-in diagnosis)

Approx. 0 → –3.05 kPa (0 → –22.9 mmHg, 0 → –0.9 inHg) (0.02-in diagnosis)

When the pressure above (desired negative pressure) is reached, Mode C is entered.

In this case, if the tank pressure does not become the desired negative pressure, judge that there is a large leakage in the system.

Judge NG when the malfunction criteria below is completed.

Finish the Evap. diagnosis when judging large leak (18 seconds or 35 seconds) in 0.04-inch diagnosis. Cancel the diagnosis (62 seconds) in 0.02-inch diagnosis.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Abnormality Judgment

Judge NG (large leak) when the criteria below are completed in the specified time.

Specified Time

High vehicle speed mode (Vehicle speed ≥ 72 km/h (45 MPH)); 35 seconds

Low vehicle speed mode (Vehicle speed < 72 km/h (45 MPH)); 18 seconds

Judgment Value

Malfunction Criteria	Threshold Value	DTC
(0.04-inch diagnosis) Time for Mode B (Tank pressure when Mode Z started) – (Min. value of tank pressure during Mode B)	≥ 18 seconds or 35 seconds < 900 Pa (6.75 mmHg, 0.25 inHg)	P0457

Cancel the diagnosis when the NG judgment does not completed in the specified time.

Mode C;

Stop the introduction of negative pressure. (Wait until returning to target pressure.)

When returning to target pressure, move to Mode D.

Judge immediate OK and change to Mode E when it does not return in spite of spending the specified time.

	Target pressure	Time for immediate OK judgment
0.04-inch diagnosis	-1.3 kPa (-9.75 mmHg, -0.38 inHg)	16 seconds
0.02-inch diagnosis	-3 kPa (-22.5 mmHg, -0.89 inHg)	20 seconds

Mode D;

Monitor the tank pressure variation in Mode D. In this case, the tank pressure increases, that is, the pressure becomes as high as the atmospheric air pressure, because evaporator is generated. However, if any leakage exists, the pressure increases additionally in proportion to this leakage. The pressure variation of this tank is P2.

After calculating P2, perform small leak diagnosis and change to Mode E if normal. Complete Evap. diagnosis if abnormal.

• After Mode D

Assigning P1 and P2, which are tank variations measured in Mode A and Mode B, to the formula below, judge the small leakage of the system. If the measured judgment value exceeds the threshold value, it is judged to be malfunction.

• 0.04-inch Diagnosis

Abnormality Judgment

Judge NG when the criteria below are completed and judge OK when not completed.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
$P2 - 1.5 \times P1$ P2 = Tank pressure varying at a specified time in mode D. P1 = Tank pressure varying at a specified time in mode A.	> 0.55 kPa (4.13 mmHg, 0.16 inHg)	P0442

*1.5: Compensation value of the amount of evaporator occurrence. (Because evaporator increases more when becoming negative pressure.)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• 0.02-inch Diagnosis

Abnormality Judgment

Judge NG when the criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
$P2 - 1.9375 \times P1$ P2 = Tank pressure varying at a specified time in mode D. P1 = Tank pressure varying at a specified time in mode A.	$\geq 800 \text{ Pa (6.0 mmHg, 0.24 inHg)}$	P0456

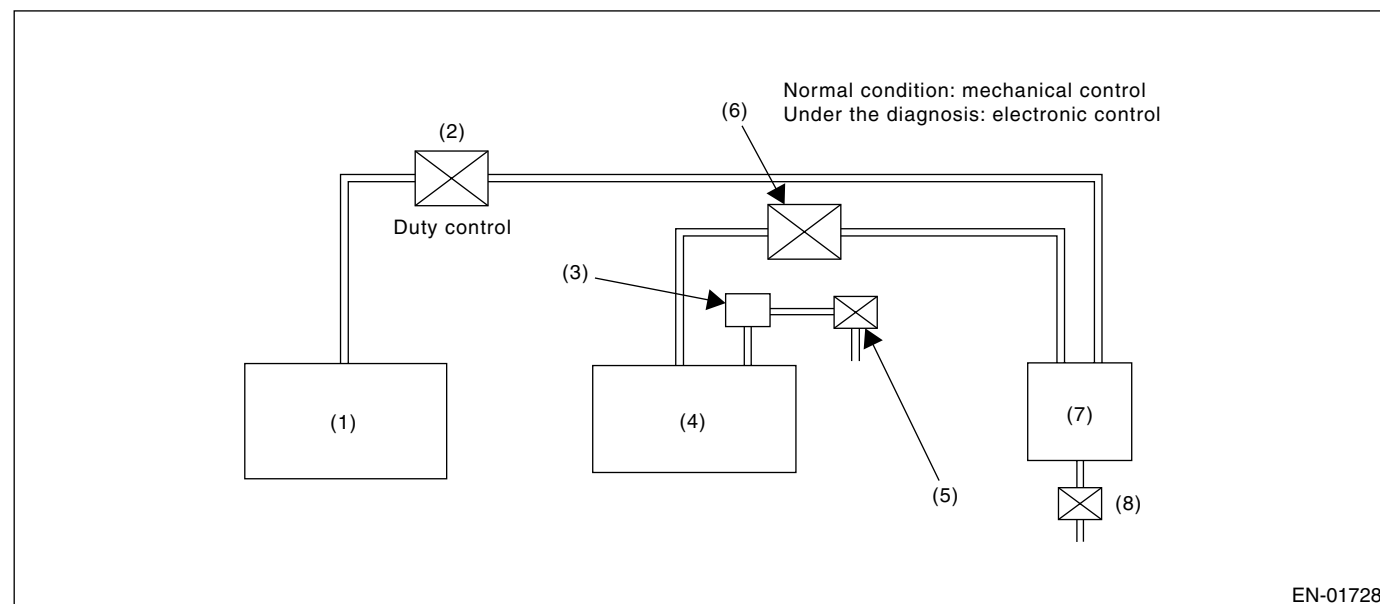
Normality Judgment

Judge OK when the criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
$P2 - 1.9375 \times P1$	$< 600 \text{ Pa (4.5 mmHg, 0.18 inHg)}$	P0456

If not judged OK or NG, repeat the diagnosis.



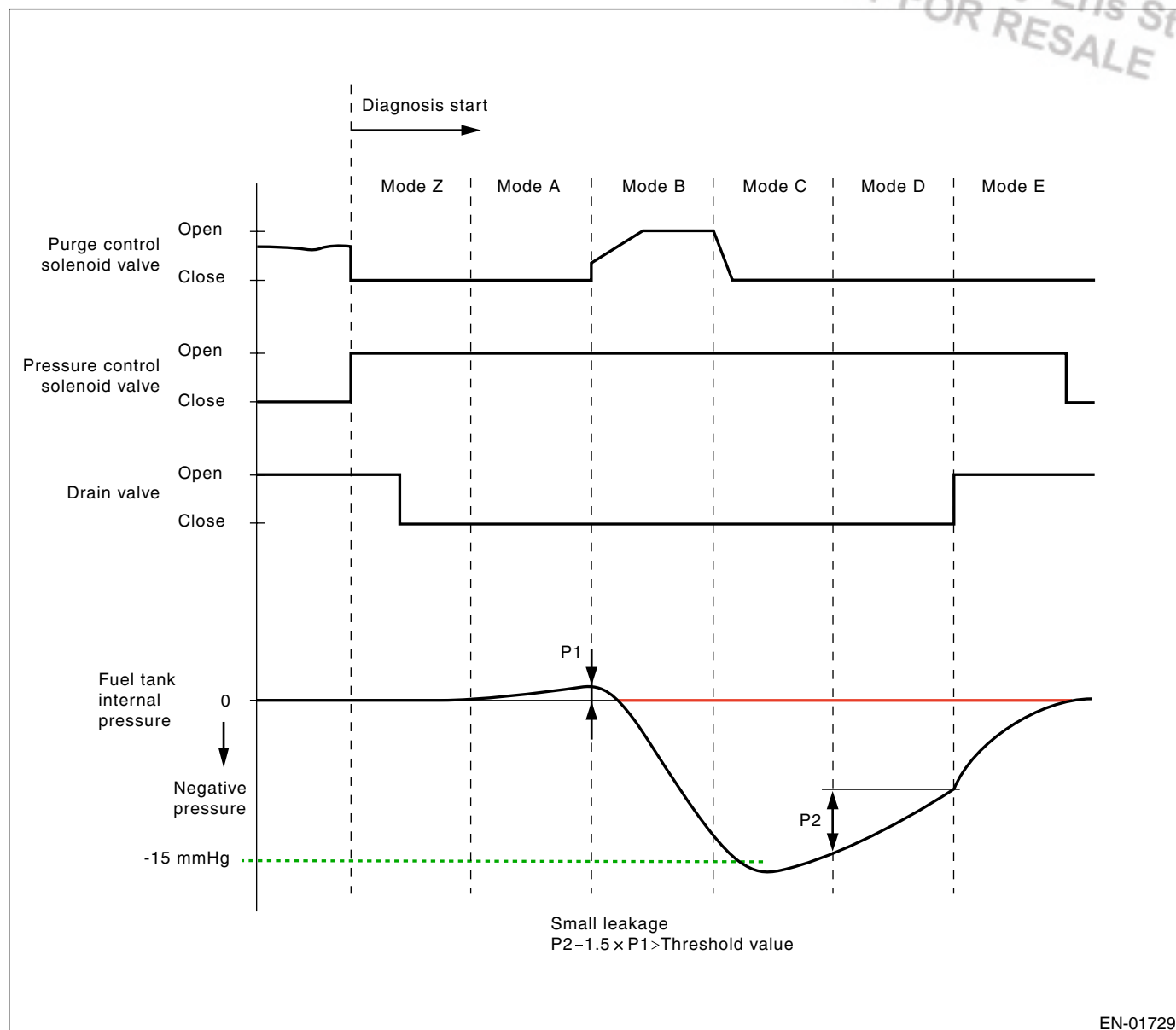
EN-01728

- (1) Engine
- (2) Purge control solenoid valve
- (3) Fuel tank pressure sensor
- (4) Fuel tank

- (5) Atmospheric pressure switching solenoid
- (6) Pressure control solenoid valve
- (7) Canister
- (8) Drain valve

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION



EN-01729

• CCV Property Diagnosis [P1443]

Mode E;

The tank pressure must become again as high as the atmospheric air pressure after the evaporation diagnosis (normal judgment on Mode C or after Mode D). If the tank pressure does not become as high as the atmospheric air pressure, judge that CCV is blocked.

Judge NG when the criteria below are completed.

Malfunction Criteria	Threshold Value	DTC
Fuel tank pressure difference from the end of EVAP sys. diagnosis to 4 seconds later	< 362.5 Pa (2.7 mmHg, 0.11 inHg)	P1443

Time Needed for Diagnosis:

0.04-inch:	30 — 70 seconds
0.02-inch:	45 — 90 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Atmospheric purge solenoid function malfunction; Open the pressure control solenoid valve.

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

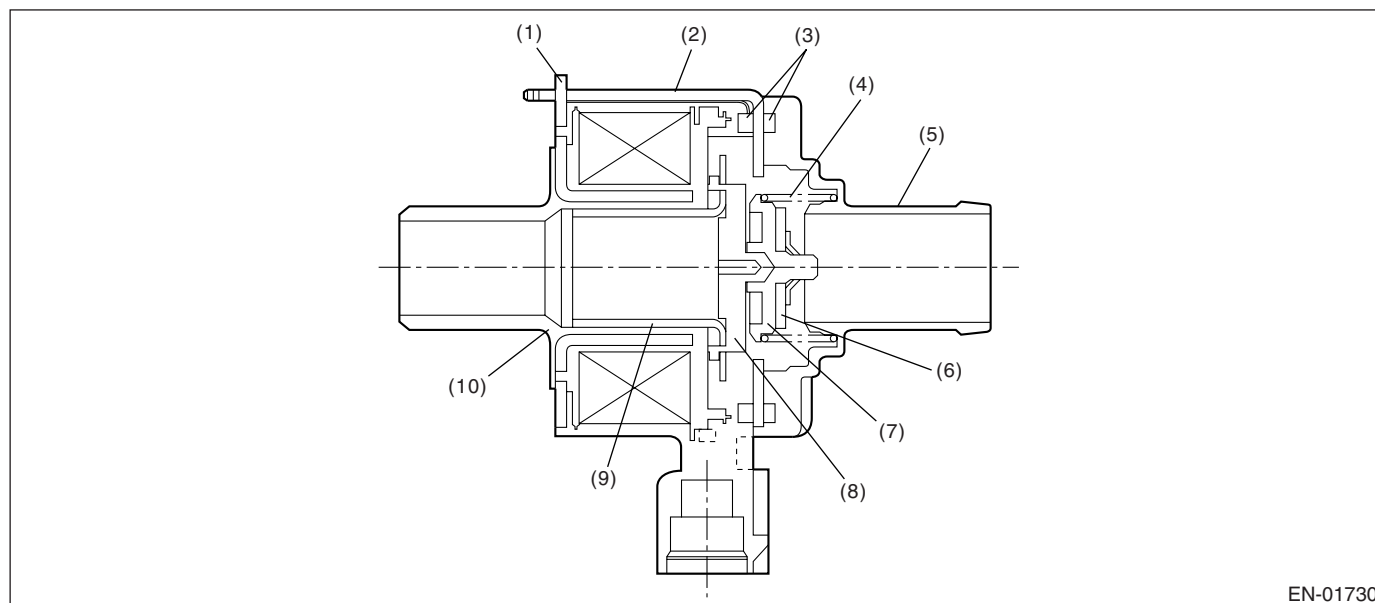
AV:DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of drain valve.

Judge NG when the ECM output level is not equal to the actual terminal level.

2. COMPONENT DESCRIPTION



- (1) Magnetic plate
- (2) Yoke
- (3) Packing
- (4) Spring
- (5) Valve seat

- (6) Valve
- (7) Plate
- (8) Retainer
- (9) Movable core
- (10) Bobbin

3. ENABLE CONDITION

Secondary Parameter	Enable Condition
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After starting the engine	1 second or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after string the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below become more than time (2.5 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal.	Low

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal.	High

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Open PCV solenoid.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

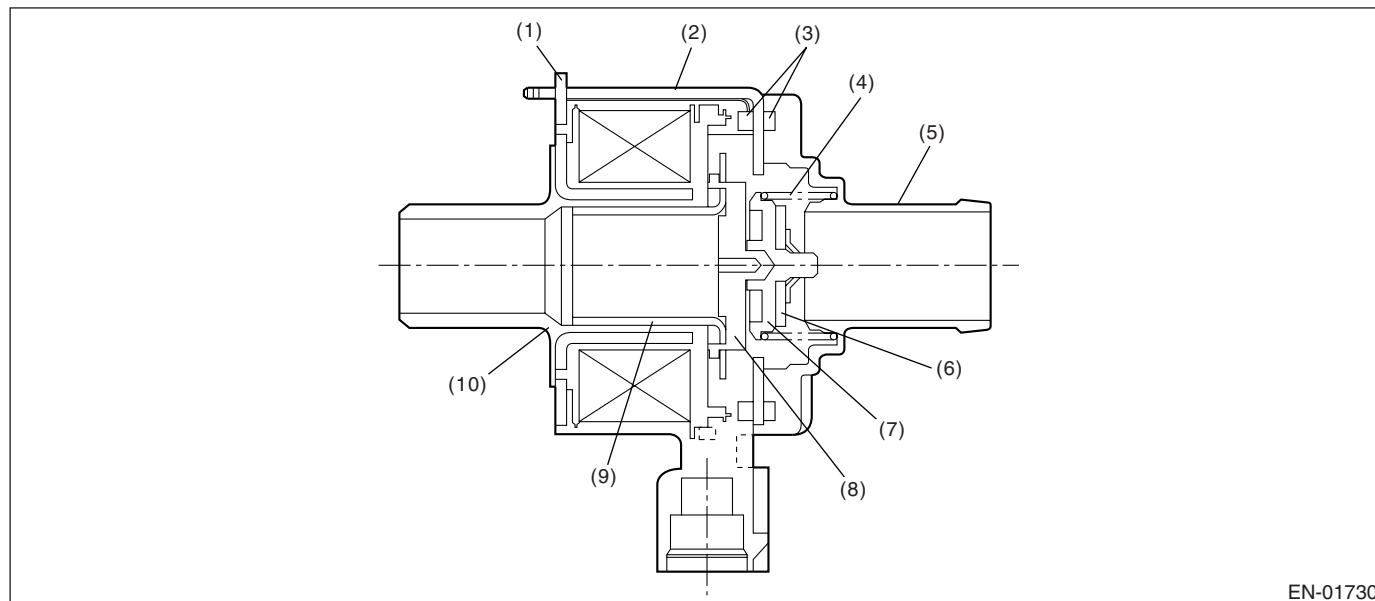
AW:DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED

1. OUTLINE OF DIAGNOSIS

Detect the short circuit of drain valve.

Judge NG when the ECU output level is not equal to the actual terminal level.

2. COMPONENT DESCRIPTION



- (1) Magnetic plate
- (2) Yoke
- (3) Packing
- (4) Spring
- (5) Valve seat

- (6) Valve
- (7) Plate
- (8) Retainer
- (9) Movable core
- (10) Bobbin

3. ENABLE CONDITION

Secondary Parameter	Enable Condition
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After starting the engine	1 second or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below become more than time (2.5 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal.	High

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal.	Low

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Open PCV solenoid.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

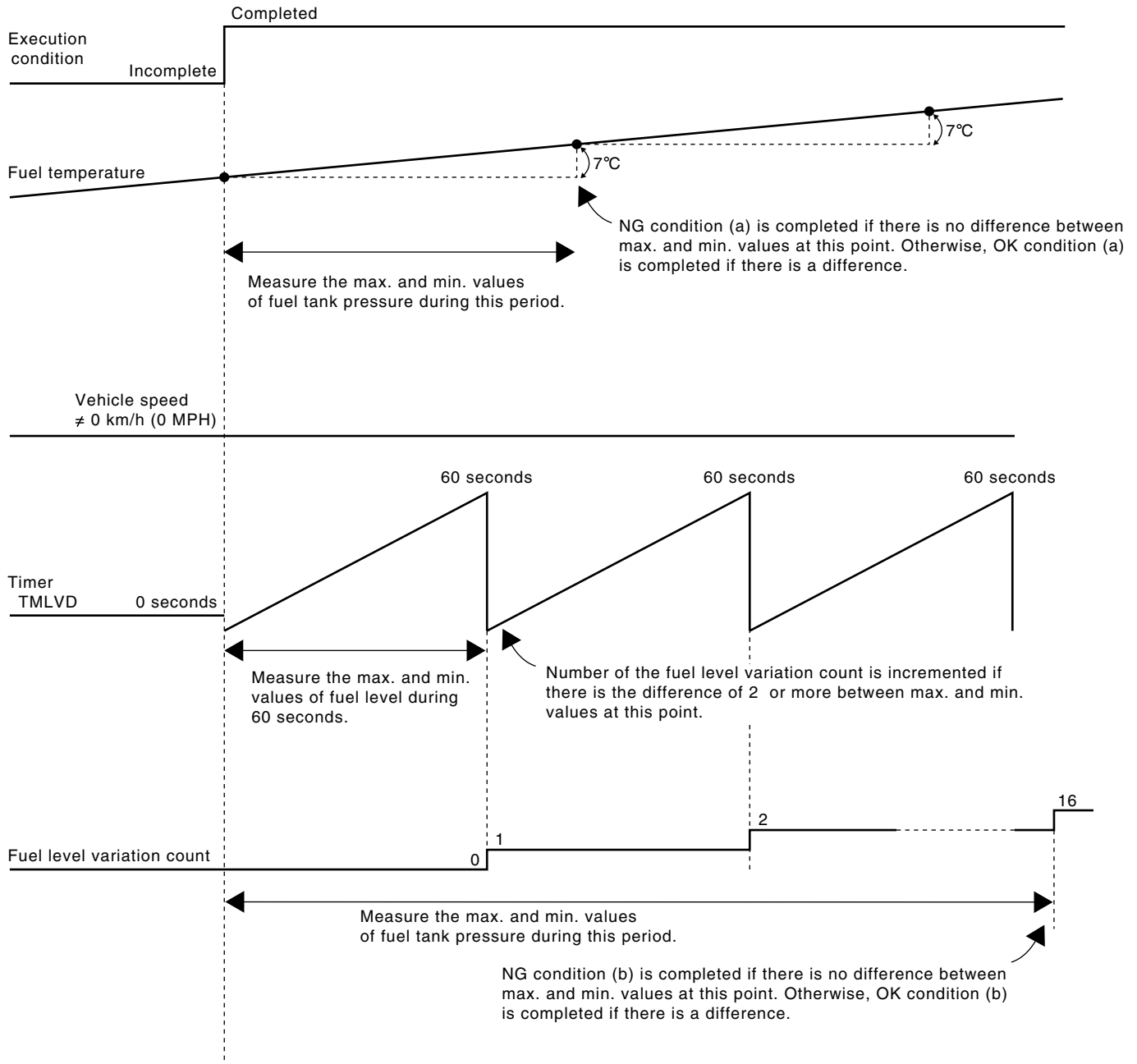
GENERAL DESCRIPTION

AX:DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tank pressure sensor output property.

Judge NG when there is little variation in the fuel tank pressure even if the vehicle is in driving status where there must be variation in the fuel tank pressure considering the fuel temperature and fuel level.



EN-01731

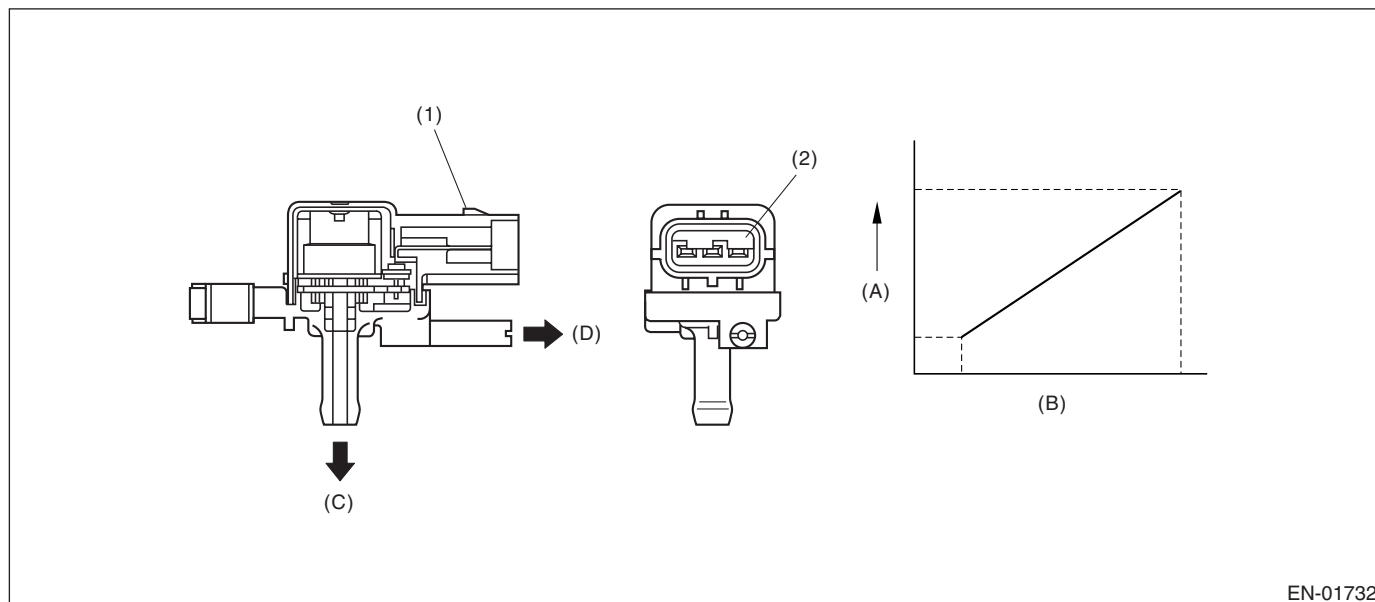
- If NG condition (a) & (b) are experienced, NG results.
(If there is OK, NG experience becomes unexperienced.)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

- If OK conditions (a) & (b) are experienced, OK results.
(If there is NG, OK experience becomes unexperienced.)

2. COMPONENT DESCRIPTION



EN-01732

- (1) Connector
- (2) Terminal

- (A) Output voltage
- (B) Input voltage
- (C) To fuel tank
- (D) To tank pressure switching solenoid valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Timer after starting the engine	≥ 30 seconds
Fuel level	$\geq 9 \text{ l}$ (2.4 US gal, 2.0 Imp gal)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 30 seconds after starting the engine.

5. DIAGNOSTIC METHOD

- (1) There is no tank pressure variation when there is fuel temperature variation of 7°C (45°F).
- (2) There is no tank pressure variation even when there is fuel level variation of 2 l (0.5 US gal, 0.4 Imp gal) or more every 60 seconds.

Judge NG when both of the conditions above are experienced.

• Abnormality Judgment

Judge NG when both of the conditions below are experienced.

Judgment Value

Malfunction Criteria	Threshold Value
Max. – min. tank pressure (During fuel temperature variation of 7°C (45°F))	$\leq 100 \text{ Pa}$ (0.75 mmHg, 0.03 inHg)
Change of fuel temperature	$\geq 7^{\circ}\text{C}$ (45°F)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Malfunction Criteria	Threshold Value
Max. – min. tank pressure (During time lapse below)	≤ 100 Pa (0.75 mmHg, 0.03 inHg)
Total time lapse where there is fuel level variation of 2 ℓ (0.5 US gal, 0.4 Imp gal) or more per minute.	≥ 16 minutes

Time Needed for Diagnosis: 16 minutes

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when both of the conditions below are experienced, and clear NG.

Judgment Value

Malfunction Criteria	Threshold Value
Max. – min. tank pressure (During fuel temperature variation of 7°C (45°F))	> 100 Pa (0.75 mmHg, 0.03 inHg)
Change of fuel temperature	$\geq 7^{\circ}\text{C}$ (45°F)

Malfunction Criteria	Threshold Value
Max. – min. tank pressure (During time lapse below)	> 100 Pa (0.75 mmHg, 0.03 inHg)
Total time lapse where there is fuel level variation of 2 ℓ (0.5 US gal, 0.4 Imp gal) or more per minute.	≥ 16 minutes

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Fix the fuel tank pressure at 0 kPa (0 mmHg, 0 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

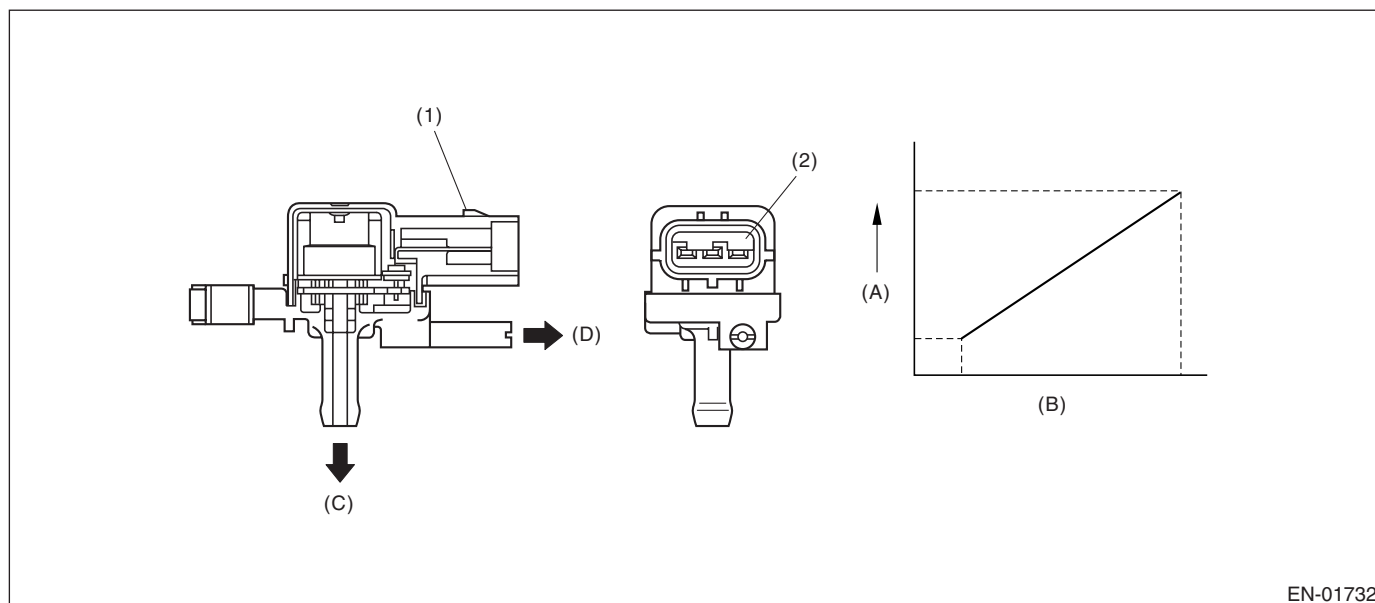
GENERAL DESCRIPTION

AY:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tank pressure sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Connector

(2) Terminal

(A) Output voltage

(B) Input voltage

(C) To fuel tank

(D) To tank pressure switching solenoid valve

EN-01732

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10 V
After engine starting	2 seconds or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing all of the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.2 V

Time Needed for Diagnosis: 20 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.2 V

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Fix the fuel tank pressure at 0 kPa (0 mmHg, 0 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

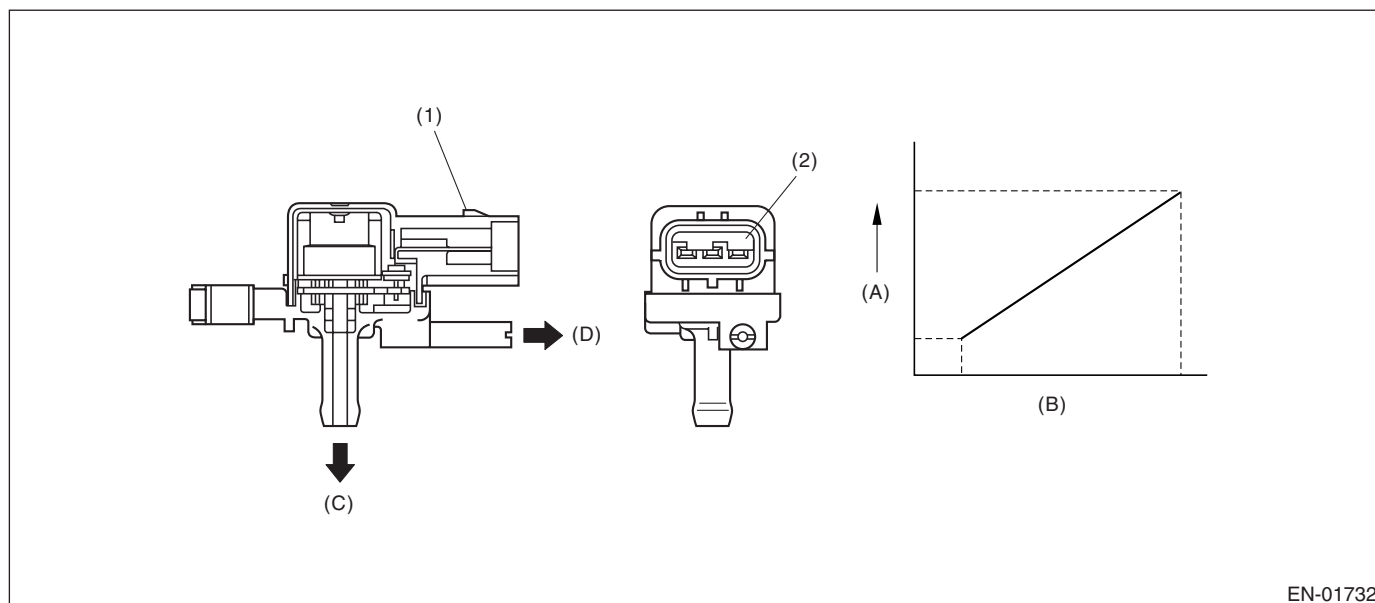
GENERAL DESCRIPTION

AZ:DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tank pressure sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



EN-01732

- (1) Connector
- (2) Terminal

- (A) Output voltage
- (B) Input voltage
- (C) To fuel tank
- (D) To tank pressure switching solenoid valve

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10 V
After engine starting	2 seconds or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing all of the malfunction criteria below becomes more than the time (20 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.8 V
Fuel temperature	$< 35^{\circ}\text{C}$ (95°F)
Barometric pressure	≥ 76 kPa (568 mmHg, 22.4 inHg)

Time Needed for Diagnosis: 20 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.8 V

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Fix the fuel tank pressure at 0 kPa (0 mmHg, 0 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

BA:DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK)

1. OUTLINE OF DIAGNOSIS

For detecting conditions, refer to DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK). <Ref. to GD(H4SO)-105, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BB:DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF)

1. OUTLINE OF DIAGNOSIS

For detecting conditions, refer to DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK). <Ref. to GD(H4SO)-105, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

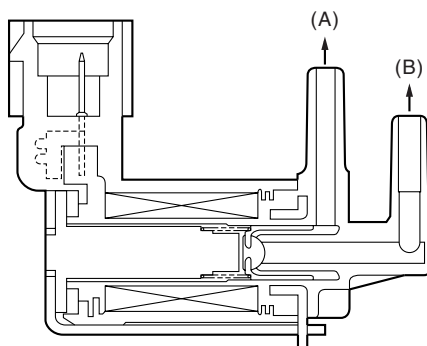
BC:DTC P0458 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of purge control solenoid valve.

Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



EN-01733

(A) To canister

(B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing all the malfunction criteria below becomes more than the time (2 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of "ON"	$< 25\%$
Terminal output voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis: 2.0 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK when the cumulative time until completing all the malfunction criteria below becomes more than 1 second.

Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of "ON"	< 25%
Terminal output voltage when ECM outputs OFF signal	High

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

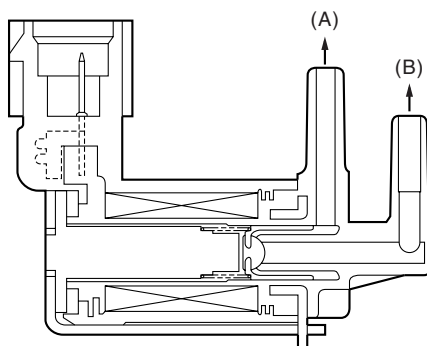
BD:DTC P0459 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of purge control solenoid valve.

Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



EN-01733

(A) To canister

(B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (2 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of "ON"	$> 75\%$
Terminal output voltage when ECM outputs ON signal	High

Time Needed for Diagnosis: 2.0 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK when the cumulative time until completing the malfunction criteria below becomes more than 1 second.

Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of "ON" Terminal output voltage when ECM outputs OFF signal	> 75% Low

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

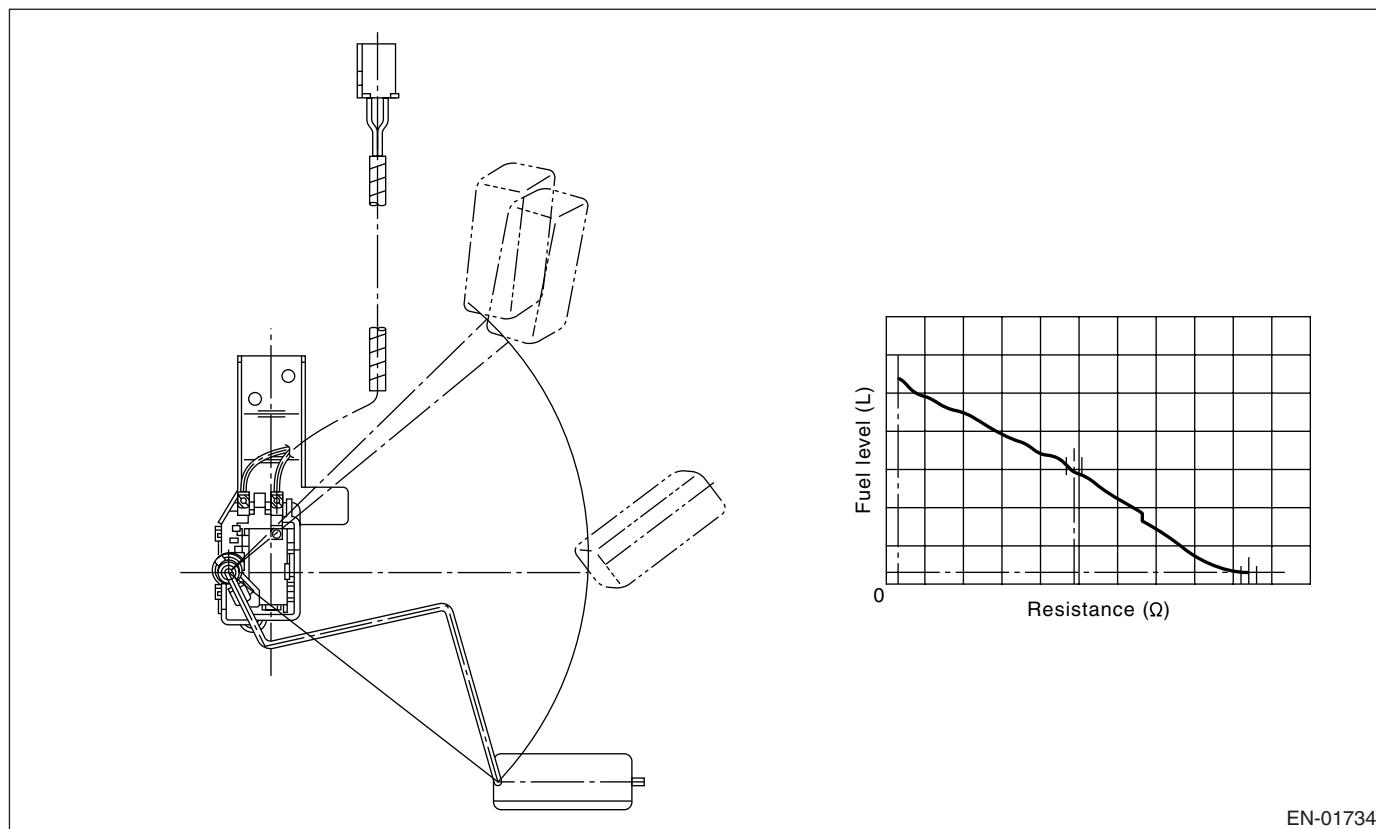
BE:DTC P0461 FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel level sensor output property.

Judge NG by the difference between max. and min. value of fuel level during every 160 km (100 miles) driving distance converted from vehicle speed.

2. COMPONENT DESCRIPTION



EN-01734

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Timer after engine starting	≥ 250 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 250 seconds after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when all the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Max. – min. fuel level	< 10 ℓ (2.6 US gal, 2.2 Imp gal)
Trip distance from last fill up	≥ 160 km (100 miles)

Time Needed for Diagnosis: Not determined.

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Max. – min. fuel level	$\geq 10 \ell$ (2.6 US gal, 2.2 Imp gal)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

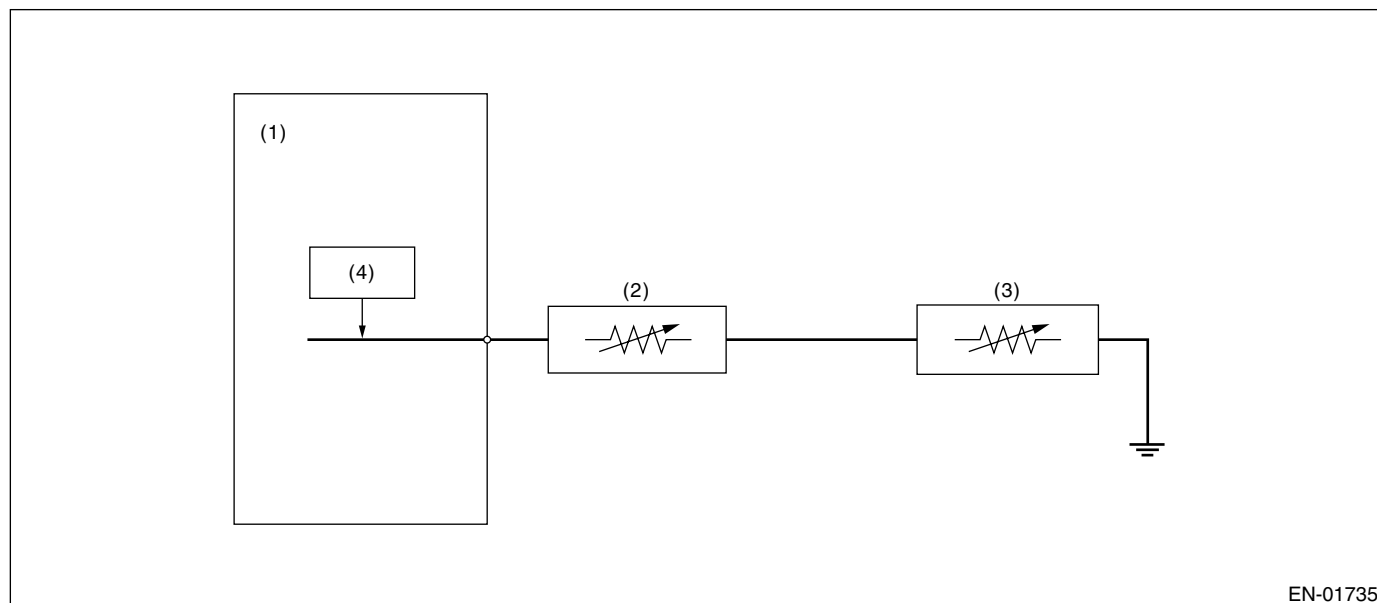
BF:DTC P0462 FUEL LEVEL SENSOR CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor.

Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Engine control module (ECM)
- (2) Fuel level sensor
- (3) Fuel sub level sensor
- (4) Detecting circuit

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	8 — 16 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time (0.5 seconds) needed for diagnosis, and then judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.02 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When “Clear Memory” was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

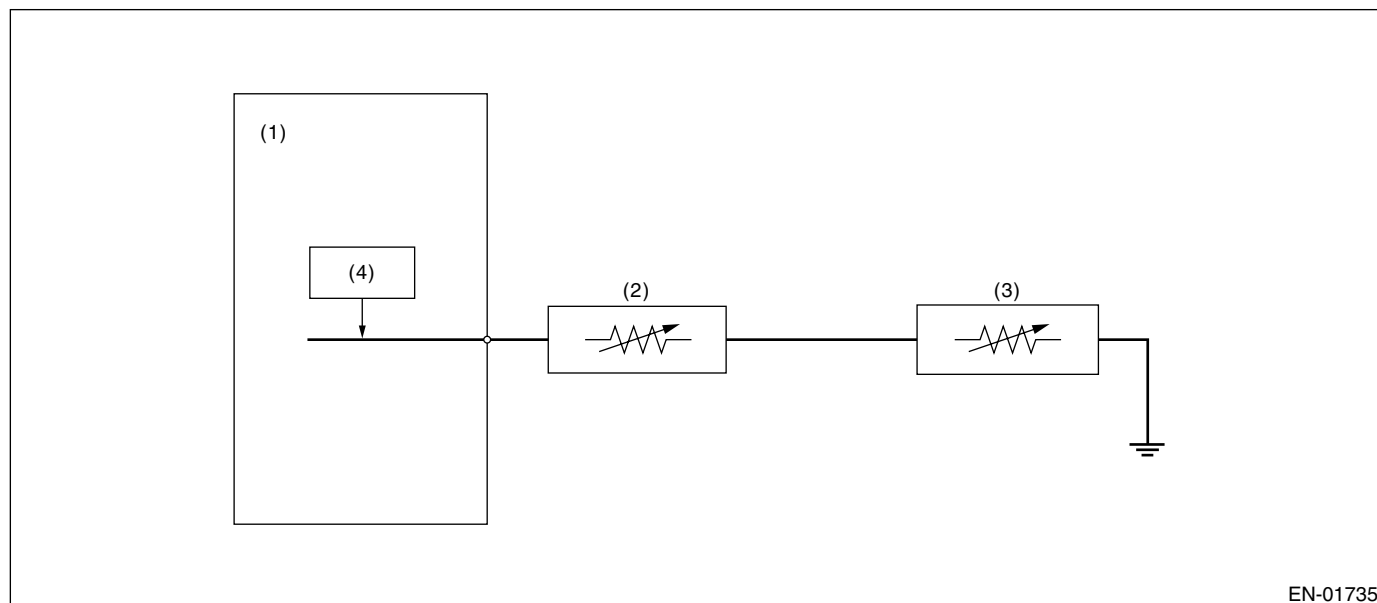
BG:DTC P0463 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor.

Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



- (1) Engine control module (ECM)
- (2) Fuel level sensor
- (3) Fuel sub level sensor
- (4) Detecting circuit

3. ENABLE CONDITION

Secondary Parameter	Enable Conditions
Battery voltage	8 — 16 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (0.5 seconds) needed for diagnosis, and then judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.90 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BH:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of unstable output from fuel level sensor because of noise.

Judge NG by comparing the max value and cumulative value of the amount of output voltage variation from fuel level sensor with threshold value.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	> 10.9 V
After engine starting	1 second or more
Idle switch	ON
Fuel level	9 — 51 ℓ (2.4 — 13.5 US gal, 2.0 — 11.2 Imp gal)
Vehicle speed = 0 km/h (0 MPH)	10 seconds or more

3. GENERAL DRIVING CYCLE

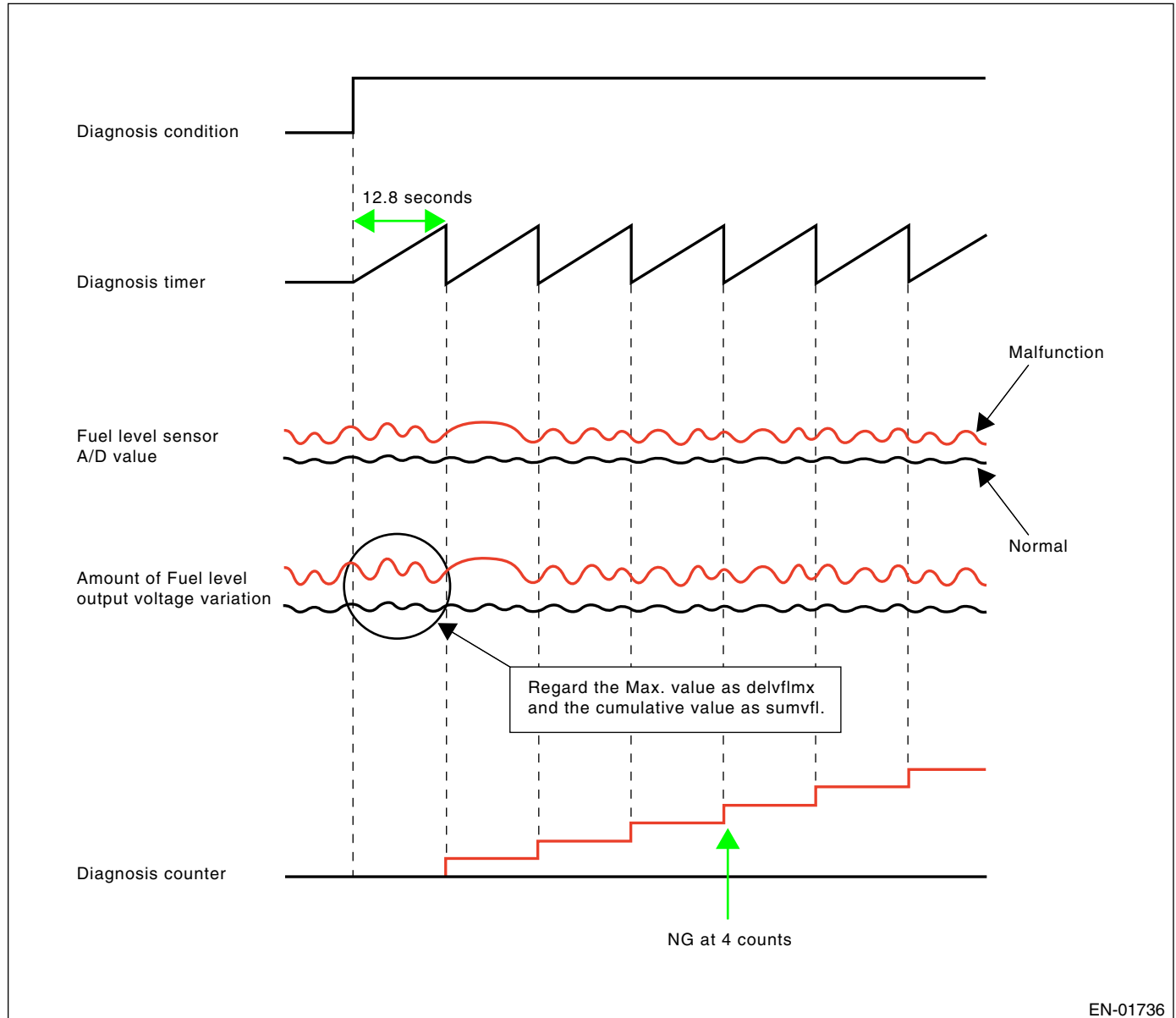
Perform the diagnosis continuously at idling.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

4. DIAGNOSTIC METHOD

Calculate the max. value of the amount of output voltage variation from fuel level sensor and cumulative value during 12.8 seconds. Comparing the max value and cumulative value with the threshold value, and judge OK when the both do not go over the threshold value. Otherwise, when one of them goes over the threshold, count the counter up. Judge the ECM is troubled when the counter increased 4 times in a row.



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• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Integrated times of the condition reaching follows, • DVFLMAX ≥ 0.88 V • SUMVFL ≥ 14.08 V – DVFLMAX is max. value of sensor output during 12.8 seconds. – SUMVFL is cumulative value of sensor output deviation during 12.8 seconds.	≥ 4 times

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Time Needed for Diagnosis: 12.8 seconds × 4 times

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
DVFLMAX	< 0.88 V
SUMVFL	< 14.08 V

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BI: DTC P0483 COOLING FAN RATIONALITY CHECK

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of radiator fan.

Judge NG when the engine coolant temperature decreases slowly even if the radiator fan started rotating.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	$\geq 100^{\circ}\text{C}$ (212°F)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the engine coolant temperature is very high (more than 100°C (212°F)).

4. DIAGNOSTIC METHOD

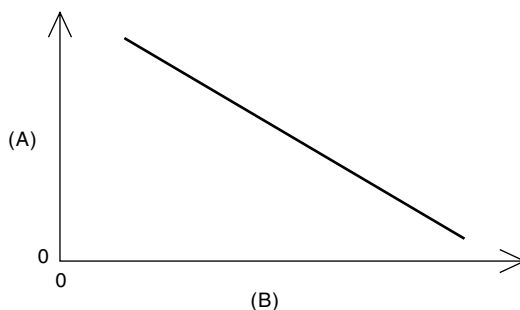
Check the engine coolant temperature (A/D value) when the radiator fan is ON since the radiator fan output turns from OFF to ON with all of the malfunction conditions below completed.

Secondary Parameters	Enable Conditions
Engine speed	600 — 900 rpm
Idle switch	ON
Vehicle speed	0 km/h (0 MPH)
Battery voltage	$\geq 10.9\text{ V}$

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (150 seconds) needed for diagnosis. Also Judge OK when the malfunction criteria below is not completed. And then clear NG.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature sensor A/D value – engine coolant temperature sensor A/D min. value	$< 15\text{ mV}$ (Approx. 1°C (34°F))



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(A) Engine coolant temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)

(B) A/D value (V)

Time Needed for Diagnosis: 150 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR METHOD

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BJ:DTC P0502 VEHICLE SPEED SENSOR CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

- Detect the open or short circuit of vehicle speed.
- Judge NG when the vehicle speed is low while the vehicle speed is assumed to be high.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVE CYCLE

Perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge NG when the time of completing the malfunction criteria below becomes more than time needed for diagnosis. Judge OK when the vehicle speed is more than 4 km/h (2.5 MPH) and less than 224 km/h (140 MPH).

Judgment Value

Malfunction Criteria	Threshold Value
Low side diagnosis (1) Cumulative time when the malfunction criteria below are completed Idle switch Injector pulse Engine speed Neutral switch Vehicle speed	 ≥ 20 seconds OFF ≥ 2.5 milliseconds ≥ 2,800 rpm OFF < 4 km/h (2.5 MPH)
Low side diagnosis (2) Cumulative time when the malfunction criteria below are completed Idle switch Injector pulse Engine speed Neutral switch Vehicle speed	 ≥ 60 seconds OFF ≥ 2.0 milliseconds ≥ 2,100 rpm OFF < 4 km/h (2.5 MPH)

Time Needed for Diagnosis:

Low side (1)	20 seconds
Low side (2)	60 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row.
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BK:DTC P0503 VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH

1. OUTLINE OF DIAGNOSIS

- Detect the open or short circuit of vehicle speed.
- Judge NG when the vehicle speed is high while the vehicle speed is assumed to be low.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVE CYCLE

Perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge NG when the time of completing the malfunction criteria below becomes more than time needed for diagnosis. Judge OK when the vehicle speed is more than 4 km/h (2.5 MPH) and less than 224 km/h (140 MPH).

Judgment Value

Malfunction Criteria	Threshold Value
High side diagnosis	
Cumulative time when the malfunction criteria below are completed	≥ 5 seconds
Idle switch	OFF
Injector pulse	≤ 2.0 milliseconds
Engine speed	≤ 2,100 rpm
Neutral switch	OFF
Vehicle speed	≥ 244 km/h (152 MPH)

Time Needed for Diagnosis:

High	5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

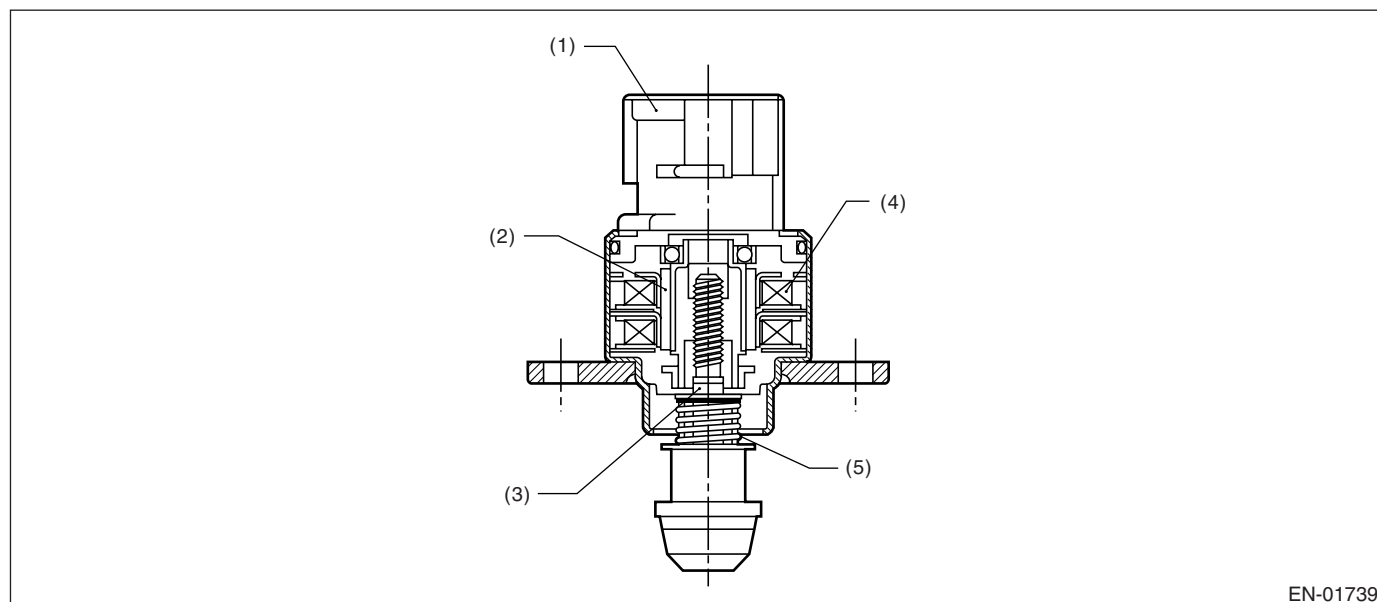
GENERAL DESCRIPTION

BL:DTC P0506 IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that the engine speed does not approach to the target engine speed at idling.
Judge NG when the engine speed is lower than target engine speed and does not increase to target engine speed even though idle air control solenoid valve is opened.

2. COMPONENT DESCRIPTION



- (1) Connector
- (2) Permanent magnet
- (3) Shaft
- (4) Coil
- (5) Spring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed control in ISC	In operation
Dashpot function	0
Vehicle speed	= 0 km/h (0 MPH)
Coolant temperature	$\geq 75^{\circ}\text{C}$ (167°F)
Battery voltage	> 10.9 V
AT or neutral gear for MT model	

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously at idling after warming up engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing all the malfunction criteria below becomes more than the time (10 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	≤ 100 rpm
ISC output ISCON	ISC output MAX value

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Time Needed for Diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the continuous time until completing the malfunction criteria below becomes more than time needed for diagnosis (2 seconds).

Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	> 100 rpm

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

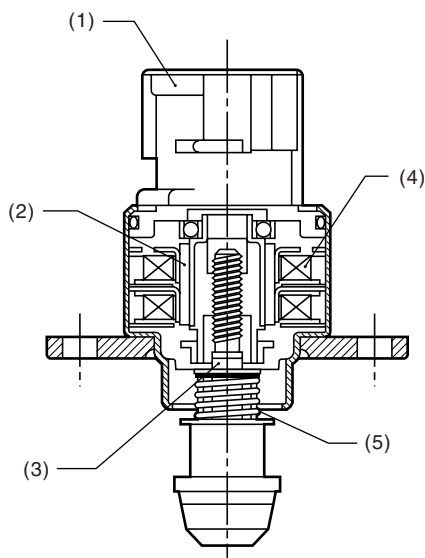
GENERAL DESCRIPTION

BM:DTC P0507 IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that the engine speed does not approach to the target engine speed at idling.
Judge NG when the engine speed is higher than target engine speed and does not decrease to target engine speed even though idle air control solenoid valve is closed.

2. COMPONENT DESCRIPTION



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- (1) Connector
- (2) Permanent magnet
- (3) Shaft
- (4) Coil
- (5) Spring

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Closed control in ISC	In operation
Dashpot function	0
Vehicle speed	= 0 km/h (0 MPH)
Coolant temperature	$\geq 75^{\circ}\text{C}$ (167°F)
Battery voltage	> 10.9 V
AT or neutral gear for MT model	

4. GENERAL DRIVE CYCLE

Perform the diagnosis continuously at idling after warming up engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing all the malfunction criteria below becomes more than the time (10 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	≥ 200 rpm
ISC output ISCON	ISC output MAX value

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Time Needed for Diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the continuous time until completing all the malfunction criteria below becomes more than the time (2 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	< 200 rpm

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BN:DTC P0512 STARTER REQUEST CIRCUIT

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of starter switch.
- Judge ON NG when the starter signal remains ON even though vehicle speed and engine speed increased.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine	Run

3. GENERAL DRIVING CYCLE

Always perform diagnosis continuously after starting engine.

4. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than time needed for diagnosis (10 seconds). Judge OK and clear the NG when the starter switch is turned to OFF.

Judgment Value

Malfunction Criteria	Threshold Value
Engine speed	$\geq 1,500$ rpm
Vehicle speed	≥ 30 km/h (19 MPH)
Starter "OFF" signal	Not detected

Time Needed for Diagnosis:

OFF side	Condition (engine speed 0 $\rightarrow$ 700 rpm) time needed for completion
ON side	10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BO:DTC P0519 IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE)

1. OUTLINE OF DIAGNOSIS

- Detect the malfunction of engine speed increase at idling.
- Judge NG when the engine speed is higher than and too far from the target engine speed.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Dashpot function at closed idle control	0

3. GENERAL DRIVE CYCLE

Always perform the diagnosis continuously at idle speed.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	≥ 800 rpm
ISC closed loop compensation value	= MIN value
Engine speed	≥ Target idle speed

• Normality Judgment

Judge OK when one of the malfunction criteria below is completed.

Judgment Value

Malfunction Criteria	Threshold Value
ISC closed loop compensation value	≠ MIN value
Cumulative time (actual – target engine speed) < 100 rpm	≥ 2 seconds
Cumulative time (engine speed < target idle speed)	≥ 2 seconds

Time Needed for Diagnosis: 2 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BP:DTC P0565 CRUISE CONTROL ON SIGNAL

1. OUTLINE OF DIAGNOSIS

Judge NG when the vehicle speed is less than 20 km/h (12 MPH) and cruise control set signal remains ON for limited time.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Vehicle speed	≤ 20 km/h (12 MPH)

3. GENERAL DRIVING CYCLE

Always perform the diagnosis with less than 20 km/h (12 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Canceling signal	No signal

Time Needed for Diagnosis: 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BQ:DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR

1. OUTLINE OF DIAGNOSIS

- Detect the malfunction of micro-computer (RAM).
- Zero clear the all normal RAM on initial routine, and judge NG when the sum of cleared RAM is not "0".

2. ENABLE CONDITION

Perform the diagnosis without condition by initial routine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis only once immediately after the IG key is turned to ON.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed, and judge OK at the IG key turned to ON.

Judgment Value

Malfunction Criteria	Threshold Value
Sum on RAM data after data cleared operation	Not to zero

Time Needed for Diagnosis: Not determined

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BR:DTC P0691 COOLING FAN 1 CONTROL CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of radiator fan circuit.
- Judge NG when the ECM output level and the actual terminal level are different.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis, and also judge OK when the malfunction criteria below is not completed. And then clear NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM transmits OFF signal	Low level

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BS:DTC P0692 COOLING FAN 1 CONTROL CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of radiator fan circuit.
- Judge NG when the ECM output level and the actual terminal level are different.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis, and also judge OK when the malfunction criteria below is not completed. And then clear NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM transmits ON signal	High level

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BT:DTC P0703 TORQUE CONVERTER/BRAKE SWITCH “B” CIRCUIT

1. OUTLINE OF DIAGNOSIS

Judge NG when the AT break SW circuit is battery short, ground short or open.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Vehicle speed change	30 to 0 km/h (19 to 0 MPH) 0 to 30 km/h (0 to 19 MPH)

3. GENERAL DRIVING CYCLE

Reform the diagnosis continuously after engine start.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
ON signal	No signal
OFF signal	No signal

Time Needed for Diagnosis: 10 times

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BU:DTC P0705 TRANSMISSION RANGE SENSOR CIRCUIT (PRNDL INPUT)

1. OUTLINE OF DIAGNOSIS

Judge NG when the "D" range switch becomes ground short or open circuit.

2. COMPONENT DESCRIPTION

Inhibitor switch ensures the safety at engine start. This switch is installed to the right side of transmission case, and operated by selector lever. When the selector lever is in the "P" or "N" range, the engine will start because the electric circuit in inhibitor switch is closed and the starter circuit is connected. When the selector lever is in the "R", "D", "3", "2" or "1" range, the electric circuit in inhibitor switch is open; therefore, the engine cannot be cranked. In the "R" range, the back-up light will illuminate because the back-up light circuit in the switch is connected. In addition to the functions above, the inhibitor switch has the circuit which detects the selected range position at the present and transmits the range signal to the TCM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Shift	"N" to "3"
Vehicle speed	≥ 60 km/h (37 MPH)
Engine speed	> 500 rpm
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after engine start.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
"D" signal continuously	Not detected
Simultaneous signal	≥ 2

Time Needed for Diagnosis:

- 63.75 seconds
- 10 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BV:DTC P0710 TRANSMISSION FLUID TEMPERATURE SENSOR CIRCUIT

1. OUTLINE OF DIAGNOSIS

- Judge NG when the ATF temperature sensor is open, battery short or ground short.
- Judge NG when the ATF sensor is detective.

2. COMPONENT DESCRIPTION

ATF temperature sensor is installed to the hydraulic control valve body of transmission as a unit with transmission harness. This sensor detects ATF temperature and outputs it as electric resistance signal.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	$\leq 0.1 \text{ V}$
Output at $\geq 80\text{km/h}$ (50 MPH) after 5 minutes from reaching more than 4.8 V	$\geq 4.7 \text{ V}$

Time Needed for Diagnosis: 63.75 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Control ATF temperature at a constant temperature 80°C (176°F).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BW:DTC P0716 INPUT/TURBINE SPEED SENSOR CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge NG when the turbine speed signal is not transmitted for some reasons.

2. COMPONENT DESCRIPTION

Torque converter turbine speed sensor (output shaft speed sensor) is installed to the outside of transmission case. This sensor detects the turbine speed of torque converter by the peripheral speed of high clutch drum connected to input shaft. And then it transmits the sine wave signal (32 pulses per rev.) to TCM. TCM calculates the ratio of the input shaft speed to vehicle speed, and then makes a judgment whether to shift or not.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 1,500 rpm
Vehicle speed	≥ 40 km/h (25 MPH)
Range switch	"D", "3", "2" or "1"

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after engine start.

5. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below were continued for 2 seconds.

- (1) Except "P", "N", "R" ranges and inhibitor switch is normal.
- (2) Engine speed is more than 3,000 rpm.
- (3) Vehicle speed is 30 km/h (19 MPH) and vehicle speed sensor is normal.
- (4) Turbine speed is more than 600 rpm.

Judgment Value

Malfunction Criteria	Threshold Value
Output from turbine shaft speed	< 600 rpm

Time Needed for Diagnosis: 2 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BX:DTC P0720 OUTPUT SPEED SENSOR CIRCUIT

1. OUTLINE OF DIAGNOSIS

Judge NG when an abnormal large signal is input to the front vehicle speed sensor, or no signal is input to the rear vehicle speed sensor.

2. COMPONENT DESCRIPTION

This vehicle speed sensor (output shaft speed sensor) is installed to the outside of transmission case. This sensor detects the front wheel speed, and transmits the sine wave signal (16 pulses per rev.) to TCM. TCM converts the signal to pulse signal, and transmits to both of the ECM and the combination meter.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Vehicle speed	≥ 20 km/h (12 MPH)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously with more than 20 km/h (12 MPH) vehicle speed.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vehicle speed sensor	
Front	≥ 255 km/h (158 MPH)
Rear	= 0 km/h (0 MPH)
Front vehicle speed sensor (When driving at 20 km/h (12 MPH))	= 0 km/h (0 MPH)

Time Needed for Diagnosis: 63.75 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- Use the normal vehicle speed sensor signal when either of them is normal.
- Use the vehicle speed calculated from the current gear position and turbine speed when both front and rear wheels are troubled.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BY:DTC P0726 ENGINE SPEED INPUT CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge NG when the engine speed is not input in the status of running the engine.

2. COMPONENT DESCRIPTION

Engine speed sensor is installed to the outside of engine body and crank part. This sensor detects the crank speed, and transmits the sine wave signal (2 pulses per rev.) to TCM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Output from mass air flow sensor	1.12 — 1.52 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after engine start.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Engine speed	≤ 400 rpm

Time Needed for Diagnosis: 63.75 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

BZ:DTC P0731 GEAR 1 INCORRECT RATIO

1. OUTLINE OF DIAGNOSIS

Judge NG when the expected present gear is different from the actual gear.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Throttle angle	$\geq 15^\circ$
Vehicle speed	≥ 10 km/h (6 MPH)
Range switch	"D", "3", "2" or "1"
Upshift or downshift events	Not in operation

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously with less than 10 km/h (6 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below are not completed for more than 40 milliseconds on normal control.

- (1) Vehicle speed is more than 10 km/h (6 MPH).
- (2) Throttle sensor is more than a certain angle.
- (3) Shifted to "D", "3", "2" or "1" range, and range signal is normal.
- (4) More than 1 second passed after shift change finished.

Judgment Value

Malfunction Criteria	Threshold Value
GR / (1st gear ratio) Where, GR = (vehicle speed sensor 1 output) / (turbine shaft speed sensor output)	> 110% or < 90%

Time Needed for Diagnosis: 3 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CA:DTC P0732 GEAR 2 INCORRECT RATIO

1. OUTLINE OF DIAGNOSIS

Judge NG when the expected present gear is different from the actual gear.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Throttle angle	$\geq 15^\circ$
Vehicle speed	≥ 10 km/h (6 MPH)
Range switch	"D", "3", "2" or "1"
Upshift or downshift events	Not in operation

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously with less than 10 km/h (6 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below are not completed for more than 40 milliseconds on normal control.

- (1) Vehicle speed is more than 10 km/h (6 MPH).
- (2) Throttle sensor is more than a certain angle.
- (3) Shifted to "D", "3", "2" or "1" range, and range signal is normal.
- (4) More than 1 second passed after shift change finished.

Judgment Value

Malfunction Criteria	Threshold Value
GR / (2nd gear ratio) Where, GR = (vehicle speed sensor 1 output) / (turbine shaft speed sensor output)	> 110% or < 90%

Time Needed for Diagnosis: 3 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CB:DTC P0733 GEAR 3 INCORRECT RATIO

1. OUTLINE OF DIAGNOSIS

Judge NG when the expected present gear is different from the actual gear.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Throttle angle	$\geq 15^\circ$
Vehicle speed	≥ 10 km/h (6 MPH)
Range switch	"D", "3", "2" or "1"
Upshift or downshift events	Not in operation

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously with less than 10 km/h (6 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below are not completed for more than 40 milliseconds on normal control.

- (1) Vehicle speed is more than 10 km/h (6 MPH).
- (2) Throttle sensor is more than a certain angle.
- (3) Shifted to "D", "3", "2" or "1" range, and range signal is normal.
- (4) More than 1 second passed after shift change finished.

Judgment Value

Malfunction Criteria	Threshold Value
GR / (3rd gear ratio) Where, GR = (vehicle speed sensor 1 output) / (turbine shaft speed sensor output)	> 110% or < 90%

Time Needed for Diagnosis: 3 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CC:DTC P0734 GEAR 4 INCORRECT RATIO

1. OUTLINE OF DIAGNOSIS

Judge NG when the expected present gear is different from the actual gear.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Throttle angle	$\geq 15^\circ$
Vehicle speed	≥ 10 km/h (6 MPH)
Range switch	"D", "3", "2" or "1"
Upshift or downshift events	Not in operation

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously with less than 10 km/h (6 MPH) vehicle speed.

4. DIAGNOSTIC METHOD

Perform the diagnosis when the conditions below are not completed for more than 40 milliseconds on normal control.

- (1) Vehicle speed is more than 10 km/h (6 MPH).
- (2) Throttle sensor is more than a certain angle.
- (3) Shifted to "D", "3", "2" or "1" range, and range signal is normal.
- (4) More than 1 second passed after shift change finished.

Judgment Value

Malfunction Criteria	Threshold Value
GR / (4th gear ratio) Where, GR = (vehicle speed sensor 1 output) / (turbine shaft speed sensor output)	> 110% or < 90%

Time Needed for Diagnosis: 3 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CD:DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT PERFORMANCE OR STUCK OFF

1. OUTLINE OF DIAGNOSIS

Judge NG when the engine speed is different from the turbine speed for some reasons at AT lock-up.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
In 4th gear position, duty ratio for duty solenoid valve	$\geq 90\%$

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Engine speed $\geq$ (output shaft speed $\times$ 4th gear ratio $\times 9/8$)	

Time Needed for Diagnosis: 10.2 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

Not allowed to lock up.

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CE:DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT ELECTRICAL

1. OUTLINE OF DIAGNOSIS

Judge NG when the lock-up duty solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Lock-up duty solenoid is installed to the transmission hydraulic control valve body. The duty ratio is controlled by the signal from TCM. This allows the lock-up clutch to be connected or released smoothly by controlling the lock-up control valve.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at "ON" signal from ECM	Low level
Vc at "OFF" signal from ECM	High level

Time Needed for Diagnosis: 0.14 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CF:DTC P0748 PRESSURE CONTROL SOLENOID “A” ELECTRICAL

1. OUTLINE OF DIAGNOSIS

Judge NG when the line pressure duty solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Line pressure duty solenoid is installed to the transmission hydraulic control valve body. The duty ratio is controlled by the signal from TCM. This allows controlling the pressure modifier valve and accumulator control valve A, and allows the line pressure to be adjusted to the pressure appropriate for driving condition.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at “ON” signal from ECM	Low
Vc at “OFF” signal from ECM	High

Time Needed for Diagnosis: 0.14 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Control the shift to be fixed in 3rd gear.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CG:DTC P0753 SHIFT SOLENOID “A” ELECTRICAL

1. OUTLINE OF DIAGNOSIS

Judge NG when the shift solenoid 1 becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Shift solenoid 1 Shift solenoid is installed to the transmission hydraulic control valve body. This solenoid is switched on or off by the signal from TCM. Gear positions will change depending on the solenoid condition which is ON or OFF.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Collector voltage of transistor (Vc) for solenoid valve is inconsistent with signal from ECM	

Time Needed for Diagnosis: 30 milliseconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Control the shift to be fixed in 3rd gear.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CH:DTC P0758 SHIFT SOLENOID “B” ELECTRICAL

1. OUTLINE OF DIAGNOSIS

Judge NG when the shift solenoid 2 becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Shift solenoid 2 Shift solenoid is installed to the transmission hydraulic control valve body. This solenoid is switched on or off by the signal from TCM. Gear positions will change depending on the solenoid condition which is ON or OFF.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc for solenoid valve is inconsistent with signal from ECM	

Time Needed for Diagnosis: 30 milliseconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Control the shift to be fixed in 3rd gear.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CI: DTC P0771 SHIFT SOLENOID “E” PERFORMANCE OR STUCK OFF

1. OUTLINE OF DIAGNOSIS

Judge NG when the low clutch timing solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

Low clutch timing solenoid Low clutch timing solenoid is installed to the transmission hydraulic control valve body. This solenoid is switched on or off by the signal from TCM. This allows controlling the low clutch timing valve B and reverse inhibitor valve.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at “ON” signal from ECM	Low level
Vc at “OFF” signal from ECM	High level

Time Needed for Diagnosis: 30 milliseconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CJ:DTC P0778 PRESSURE CONTROL SOLENOID “B” ELECTRICAL

1. OUTLINE OF DIAGNOSIS

Judge NG when the 2-4 brake duty solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

2-4 brake duty solenoid is installed to the transmission hydraulic control valve body. The duty ratio is controlled by the signal from TCM. This solenoid decreases the change gear shock by adjusting the 2-4 brake pressure during 2-4 brake operation.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at “ON” signal from ECM	Low level
Vc at “OFF” signal from ECM	High level

Time Needed for Diagnosis: 0.14 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

8. FAIL SAFE

Control the shift to be fixed in 3rd gear.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CK:DTC P0785 SHIFT/TIMING SOLENOID

1. OUTLINE OF DIAGNOSIS

Judge NG when the 2-4 brake timing solenoid becomes battery short, ground short or open circuit.

2. COMPONENT DESCRIPTION

2-4 brake timing solenoid is installed to the transmission hydraulic control valve body. This solenoid is switched on or off by the signal from TCM. This allows controlling the 2-4 brake timing valve B and decreases the change gear shock.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at "ON" signal from ECM	Low level
Vc at "OFF" signal from ECM	High level

Time Needed for Diagnosis: 30 milliseconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CL:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of neutral switch.
- AT: Judge NG when ECM neutral terminal input is different from reception data from TCM.
- MT: Judge NG when the neutral switch does not respond even though shift lever is changed (neutral switch is turned on or off by vehicle and engine speed).

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After engine starting	1 second or more
Starter switch	OFF
Battery voltage	≥ 8 V

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

AT: Judge NG when the continuous number of times until completing the malfunction criteria below becomes more than number of times needed for diagnosis (10 times).

Judgment Value

Malfunction Criteria	Threshold Value
Switch signal	ON (Low)
“P” range / “N” range on AT	OFF
Any other switches on AT	ON

• Normality Judgment

AT: Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Switch signal	OFF (High)
“P” range / “N” range on AT	OFF
Any other switches on AT	ON

MT: Judge NG when the number of times until completing the malfunction criteria below continue 3 times in a row, judge OK when turning to OFF or ON.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch on MT	
Driving condition change	While changing a) to
a) Vehicle speed = 0 km/h (0 MPH) & engine speed 600 — 900 rpm	b) SW OFF (Low)
b) Vehicle speed 64 — 106 km/h (40 — 66 MPH) & engine speed 1,600 — 2,550 rpm	

Time Needed for Diagnosis:

- Normal reception from AT is 5 times
- 3 monitoring on MT

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When “Clear Memory” was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CM:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of neutral switch.
- AT: Judge NG when ECM neutral terminal input is different from reception data from TCM.
- MT: Judge NG when the neutral switch does not respond even though shift lever is changed (neutral switch is turned on or off by vehicle and engine speed).

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After engine starting	1 second or more
Starter switch	Turn off
Battery voltage	≥ 8 V

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgement

AT: Judge NG when the continuous number of times until completing the malfunction criteria below becomes more than number of times needed for diagnosis (10 times).

Judgment Value

Malfunction Criteria	Threshold Value
Switch signal	OFF (High)
“P” range / “N” range on AT	ON
Any other switches on AT	OFF

• Normality Judgment

AT: Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Switch signal	ON (Low)
“P” range / “N” range on AT	ON
Any other switches on AT	OFF

MT: Judge NG when the number of times until completing the malfunction criteria below continue 3 times in a row, judge OK when turning to OFF or ON.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch on MT Driving condition change a) Vehicle speed = 0 km/h (0 MPH) & engine speed 600 — 900 rpm b) Vehicle speed 64 — 106 km/h (40 — 66 MPH) & engine speed 1,600 — 2,550 rpm	While changing a) to b) SW OFF (High)

Time Needed for Diagnosis:

- Normal reception from AT is 10 times
- 3 monitoring on MT

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CN:DTC P0864 TCM COMMUNICATION CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

- Detect the communication malfunction of AT diagnosis.
- Judge NG when the communication format does not correspond.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8.0 V
Engine speed	≥ 500 rpm

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the continuous time communication format does not correspond continued for time needed for diagnosis. Judge OK and clear the NG when the communication format corresponds.

Judgment Value

Malfunction Criteria	Threshold Value
Incorrect pattern in wiring harness for communication	≥ 60 seconds

Time Needed for Diagnosis: 60 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CO:DTC P0865 TCM COMMUNICATION CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of AT diagnosis line.
- Judge NG when the signal remains Low.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	$\geq 8.0 \text{ V}$
Engine speed	$\geq 500 \text{ rpm}$

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed. Judge OK and clear the NG when the signal is turned over.

Judgment Value

Malfunction Criteria	Threshold Value
Continuous signal line is Low	$\geq 3 \text{ seconds}$

Time Needed for Diagnosis: 3 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CP:DTC P0866 TCM COMMUNICATION CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of AT diagnosis line.
- Judge NG when the signal remains High.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8.0 V
Engine speed	≥ 500 rpm

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed. Judge OK and clear the NG when the signal is turned over.

Judgment Value

Malfunction Criteria	Threshold Value
Continuous signal line is High	≥ 3 seconds

Time Needed for Diagnosis: 3 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CQ:DTC P1110 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of atmospheric pressure sensor.
- Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION

Atmospheric pressure sensor is built in ECM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10 V
Timer after starting the engine	≥ 2 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the continuous time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.755 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Make the atmospheric pressure 101 kPa (760 mmHg, 29.9 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CR:DTC P1111 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of atmospheric pressure sensor.
- Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION

Atmospheric pressure sensor is built in ECM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 10 V
Timer after starting the engine	≥ 2 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge fail safe NG when the cumulative time until completing the malfunction criteria below becomes more than the time (0.1 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 5.06 V

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

Make the atmospheric pressure 101 kPa (760 mmHg, 29.9 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

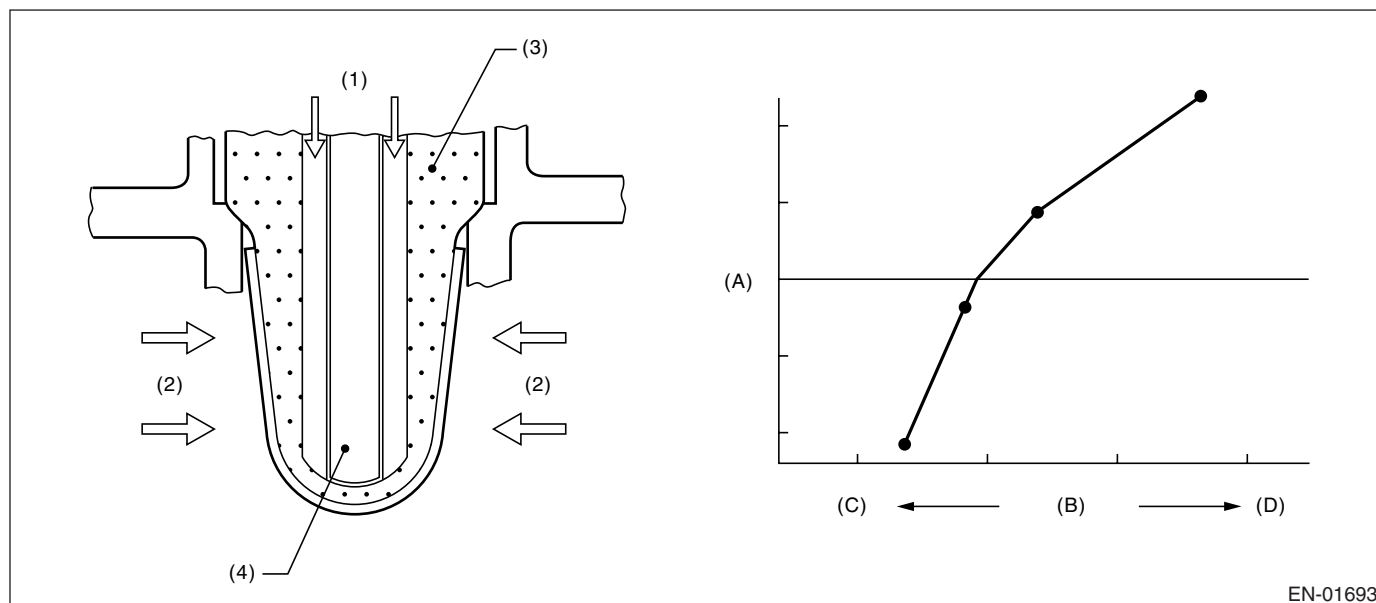
GENERAL DESCRIPTION

CS:DTC P1134 A/F SENSOR MICRO-COMPUTER PROBLEM

1. OUTLINE OF DIAGNOSIS

- Detect the malfunction of IC communication.
- Judge NG when the communication to front oxygen (A/F) sensor control IC is unable.

2. COMPONENT DESCRIPTION



- (1) Atmospheric air
(2) Exhaust gas
(3) ZrO₂
(4) Ceramic heater

- (A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Air fuel ratio feed back control OR; air fuel ratio feed back control	During OPEN LOOP During CLOSED LOOP AND; not during clamp except A/F sensor voltage clamp OR; A/F fudge factor is 0.7 — 1.375.
Misfire rate during 200 engine revs.	≤ 1.0%
Battery voltage	≥ 10.9 V
After engine starting	≥ 140 seconds

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 140 seconds after starting the engine.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Communication error to main CPU	≥ 250 times

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Error	None

Time Needed for Diagnosis: 12.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

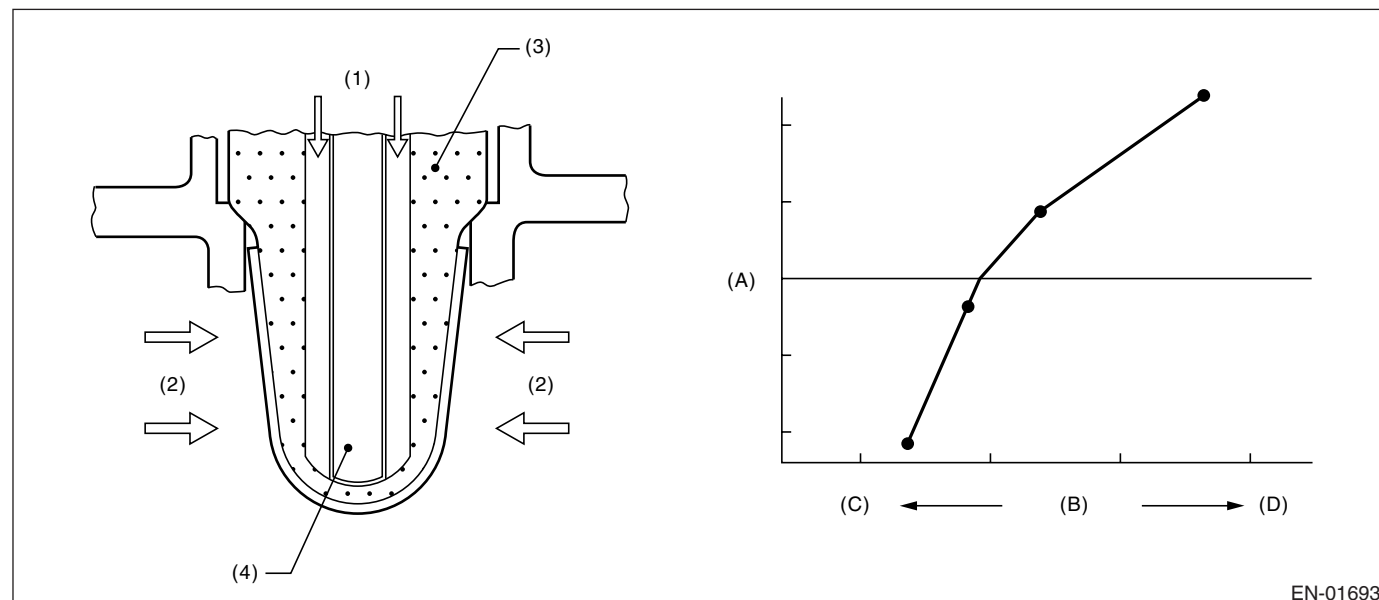
CT:DTC P1137 O₂ SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)

Middle Electric Potential

1. OUTLINE OF DIAGNOSIS

- Detect the output property malfunction of from oxygen (A/F) sensor.
- Judge NG when output voltage does not move to lean side or rich side.

2. COMPONENT DESCRIPTION



- (1) Atmosphere
(2) Exhaust gas
(3) ZrO₂
(4) Ceramic rotor

- (A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameter	Enable Conditions
Middle electric potential malfunction	Incomplete
A/F sensor response diagnosis	Under diagnosis

4. GENERAL DRIVING CYCLE

Perform the diagnosis just once in 225 seconds or more after starting the engine constantly at 80 km/h (50 MPH) of vehicle speed (Same as A/F sensor response diagnosis).

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when one of the malfunction criteria below is completed.

Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of output voltage > 2.065 V ($\lambda = 0.98$)	3.4 seconds or more
Continuous time of output voltage < 2.180 V ($\lambda = 1.0$)	3.4 seconds or more

Time needed for diagnosis: 3.4 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Time Needed for Diagnosis: 0.2 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK when all the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Cumulative time of output voltage $\leq$ 2.065 V	0.2 seconds or more
Cumulative time of output voltage $\geq$ 2.180 V	0.2 seconds or more

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode \$02)
- Memorize the diagnostic value and trouble standard value. (For test mode \$06)

Diagnostic Trouble Code (DTC) Detecting Criteria

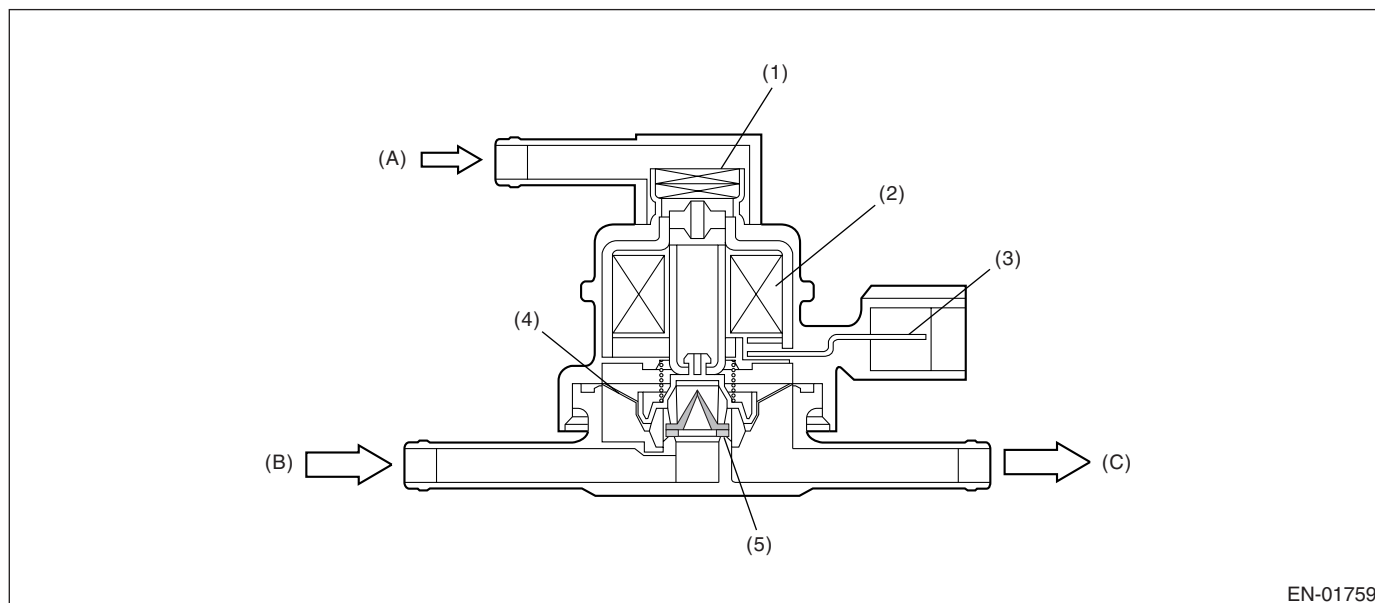
GENERAL DESCRIPTION

CU:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of pressure control solenoid valve.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



- (1) Filter
- (2) Coil
- (3) Connector terminal
- (4) Diaphragm
- (5) Valve

- (A) Atmospheric pressure
- (B) Shut-off valve
- (C) To fuel tank

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below becomes more than time needed for diagnosis (2.5 seconds).

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis: 2.5 seconds

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal	High

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

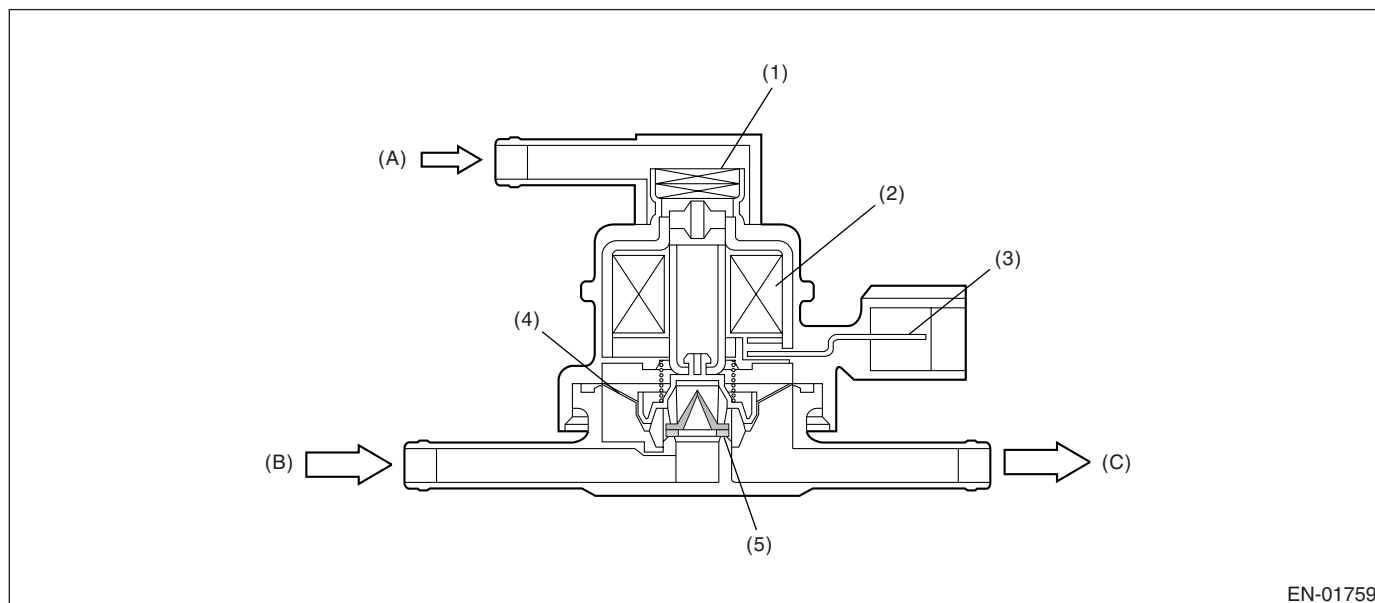
GENERAL DESCRIPTION

CV:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of pressure control solenoid valve.
- Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



- (1) Filter
- (2) Coil
- (3) Connector terminal
- (4) Diaphragm
- (5) Valve

- (A) Atmospheric pressure
- (B) Shut-off valve
- (C) To fuel tank

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below becomes more than time needed for diagnosis (2.5 seconds).

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal	High

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal	Low

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

CW:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

1. OUTLINE OF DIAGNOSIS

For detecting conditions, refer to DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK). <Ref. to GD(H4SO)-105, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

Diagnostic Trouble Code (DTC) Detecting Criteria

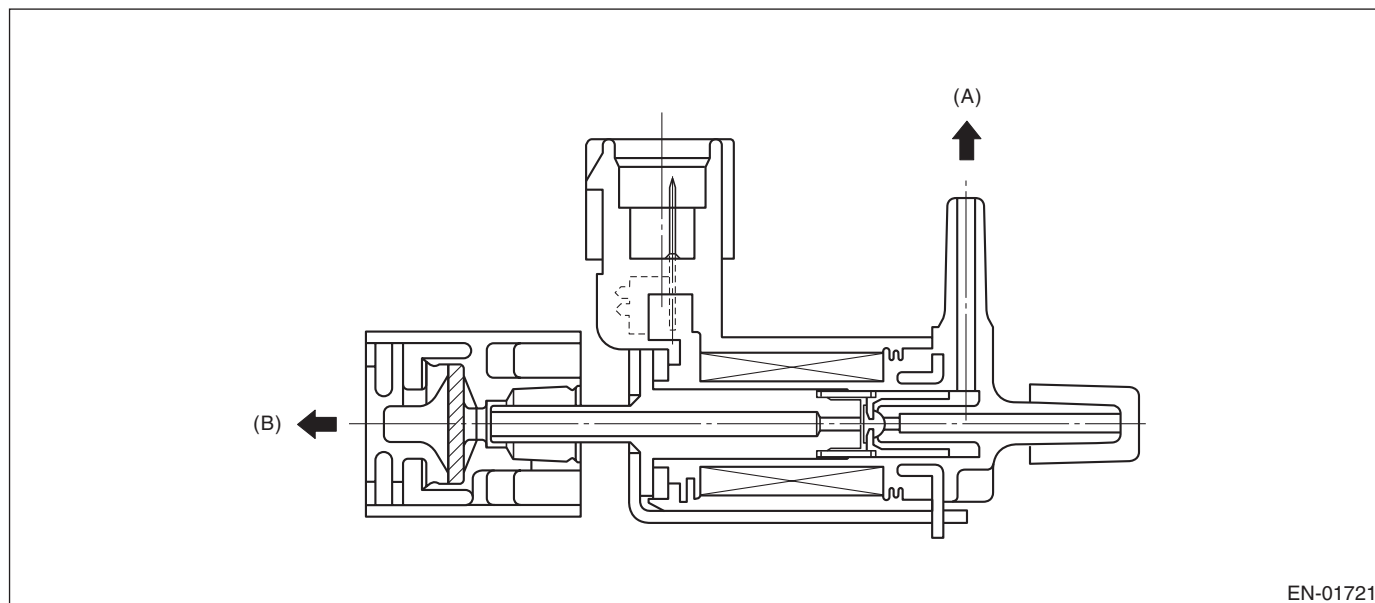
GENERAL DESCRIPTION

CX:DTC P1446 FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of fuel tank sensor control valve.
- Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



- (A) Fuel tank pressure sensor
(B) External air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM sent OFF signals	Low level

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

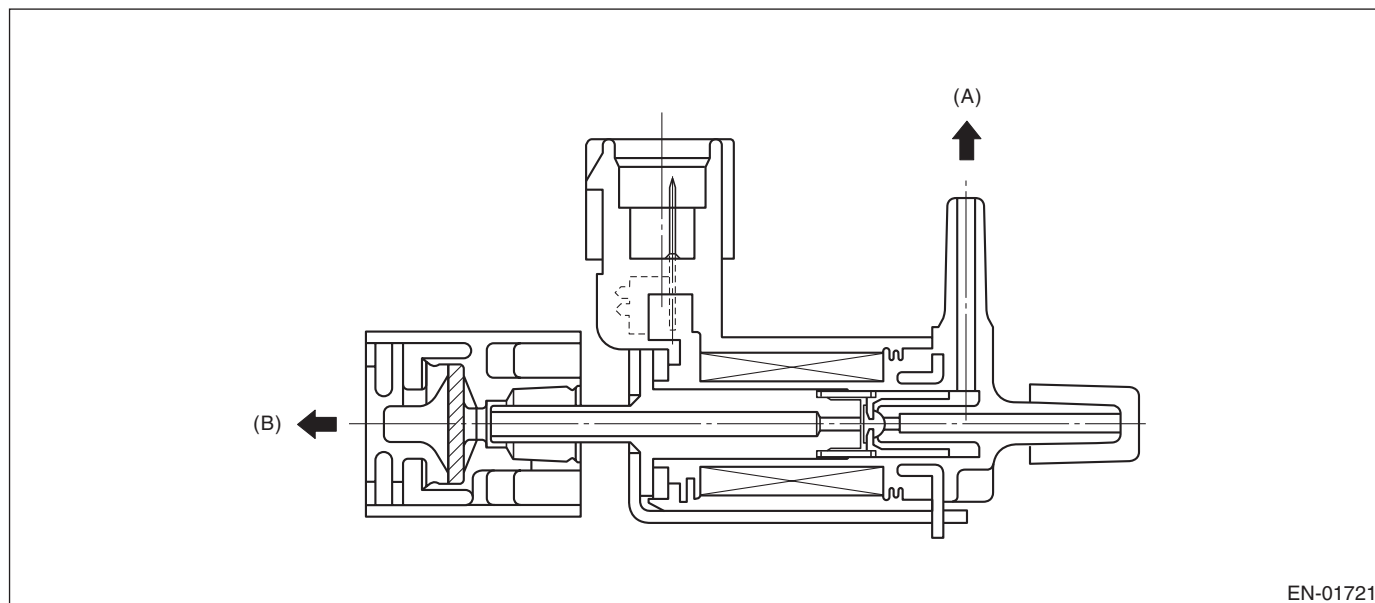
GENERAL DESCRIPTION

CY:DTC P1447 FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of fuel tank sensor control valve.
- Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



- (A) Fuel tank pressure sensor
(B) External air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8 V
After engine starting	1 second or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than the time (2.5 seconds) needed for diagnosis. Judge OK and clear the NG when the malfunction criteria are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM sent ON signals	High level

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

CZ:DTC P1448 FUEL TANK SENSOR CONTROL VALVE RANGE/PERFORMANCE

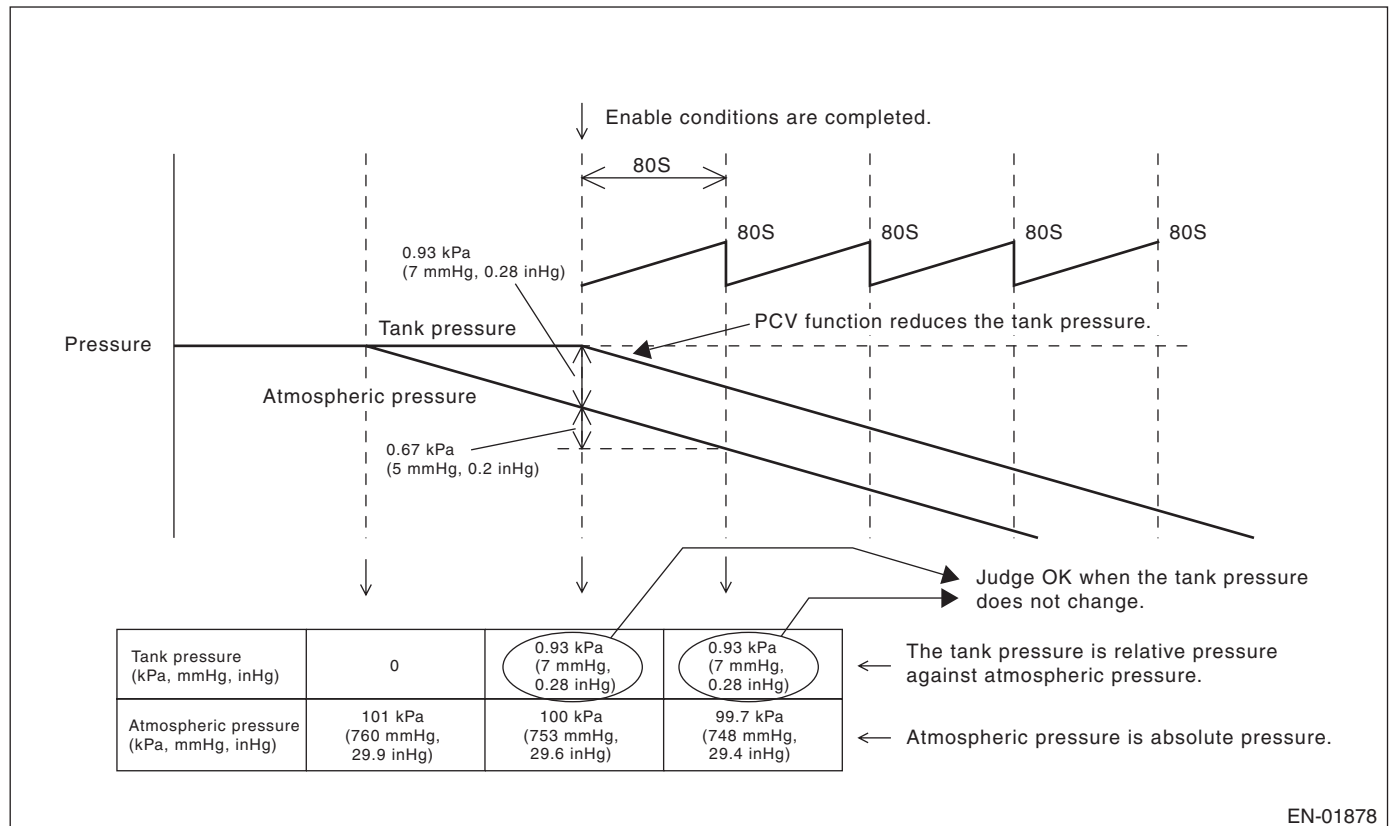
1. OUTLINE OF DIAGNOSIS

Detect the tank pressure switching solenoid function abnormality.

The tank pressure sensor is a relative pressure sensor, which normally compares the pressure with the atmospheric pressure. The tank pressure switching solenoid is a solenoid, which shifts the compare space from opening to closed during the EVAP diagnosis. Detect the malfunction that the compare space remains closed. (Not judge NG after enable condition completed but assume NG before enable condition completed.)

• Normality Judgment

Judge OK when the fuel tank pressure does not change (or changes by less than 0.67 kPa (5 mmHg, 0.2 inHg)) at atmospheric pressure changing by 0.67 kPa (5 mmHg, 0.2 inHg) or more per 80 seconds.

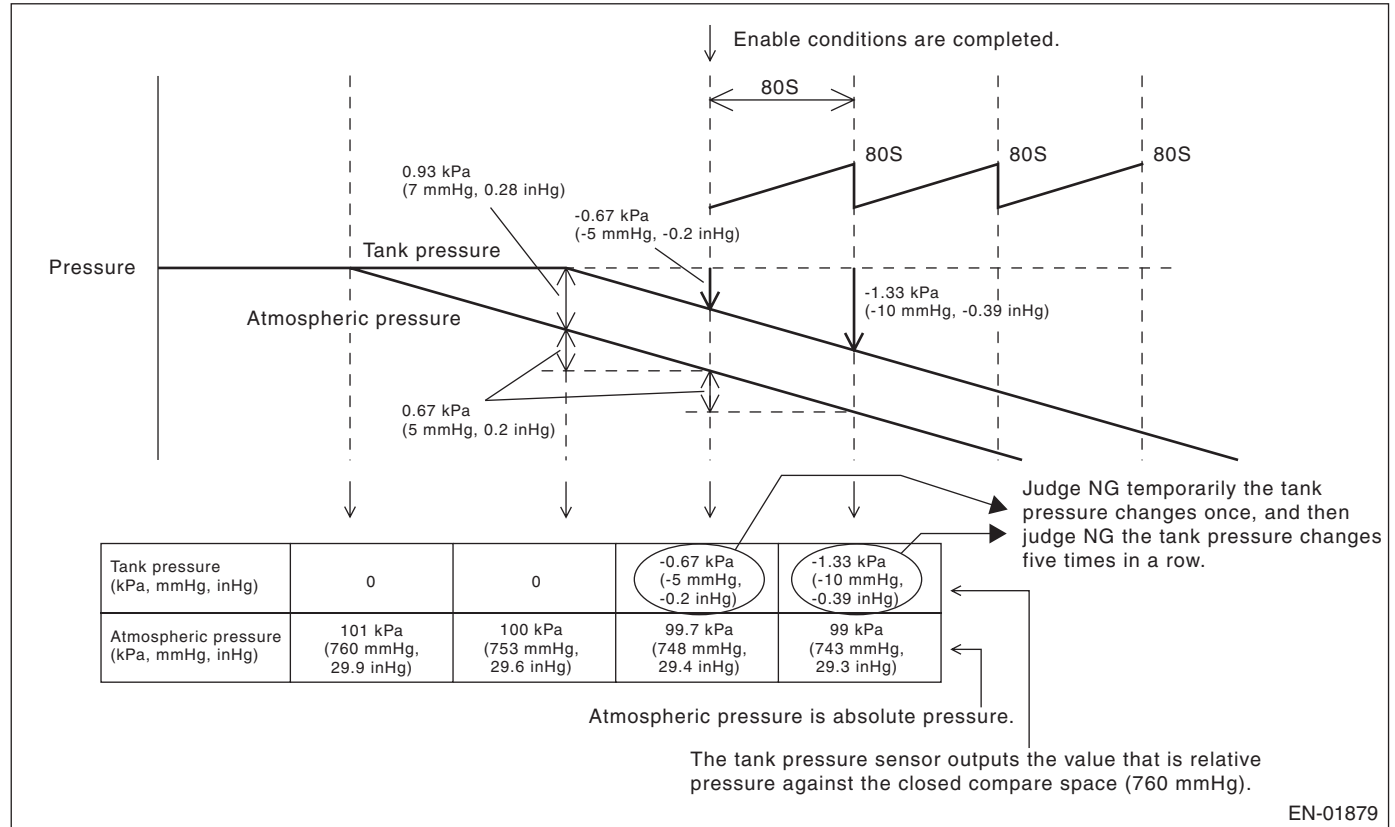


Diagnostic Trouble Code (DTC) Detecting Criteria

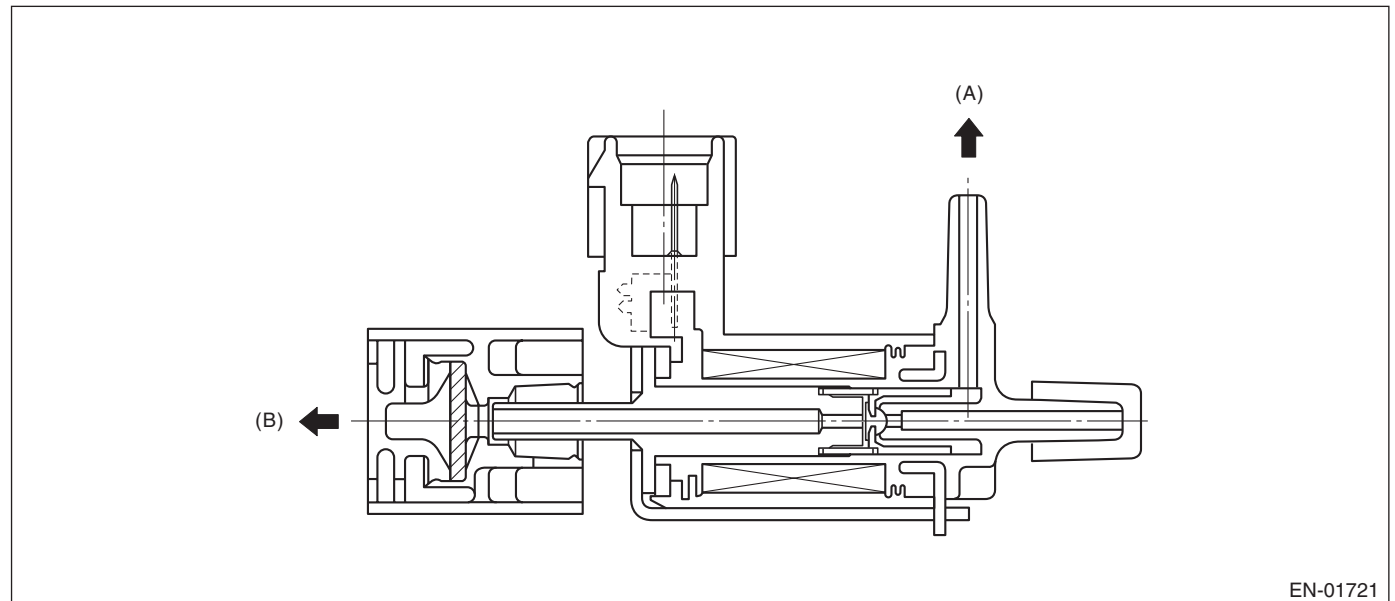
GENERAL DESCRIPTION

• Abnormality Judgment

Judge NG temporarily when the fuel tank pressure changes by 0.67 kPa (5 mmHg, 0.2 inHg) or more at atmospheric pressure changing by 0.67 kPa (5 mmHg, 0.2 inHg) or more per 80 seconds, and then judge NG when the previous condition is completed 5 times in a row.



2. COMPONENT DESCRIPTION



- (A) Fuel tank pressure sensor
- (B) External air

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After engine starting	≥ 80 seconds
Fuel level	9 to 51 ℓ (2.4 — 13.5 US gal, 2.0 — 11.2 Imp gal)
Fuel tank pressure	< 0 or > 1,200 Pa (< 0 or > 9.0 mmHg, < 0 or > 0.4 inHg)
Evaporative emission control system diagnosis	Not in diagnosis

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 80 seconds after starting the engine. (Do not diagnose during evaporative emission control system diagnosis.)

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Count the counter up when the malfunction criteria below are completed by checking the change such as tank pressure, atmospheric pressure and fuel level during every 80 seconds. Judge NG when the count comes to the specified number (3 times).

Judgment Value

Malfunction Criteria	Threshold Value
Change of tank pressure during 80 seconds	≥ 600 Pa (4.5 mmHg, 0.2 inHg)
Change of atmospheric pressure during 80 seconds	≥ 600 Pa (4.5 mmHg, 0.2 inHg)
Change of fuel level during 80 seconds	< 8 ℓ (2.1 US gal, 1.8 Imp gal)

Time Needed for Diagnosis: 80 seconds × 3 times

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Change of tank pressure during 80 seconds	≥ 600 Pa (4.5 mmHg, 0.2 inHg)
Change of atmospheric pressure during 80 seconds	< 600 Pa (4.5 mmHg, 0.2 inHg)

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

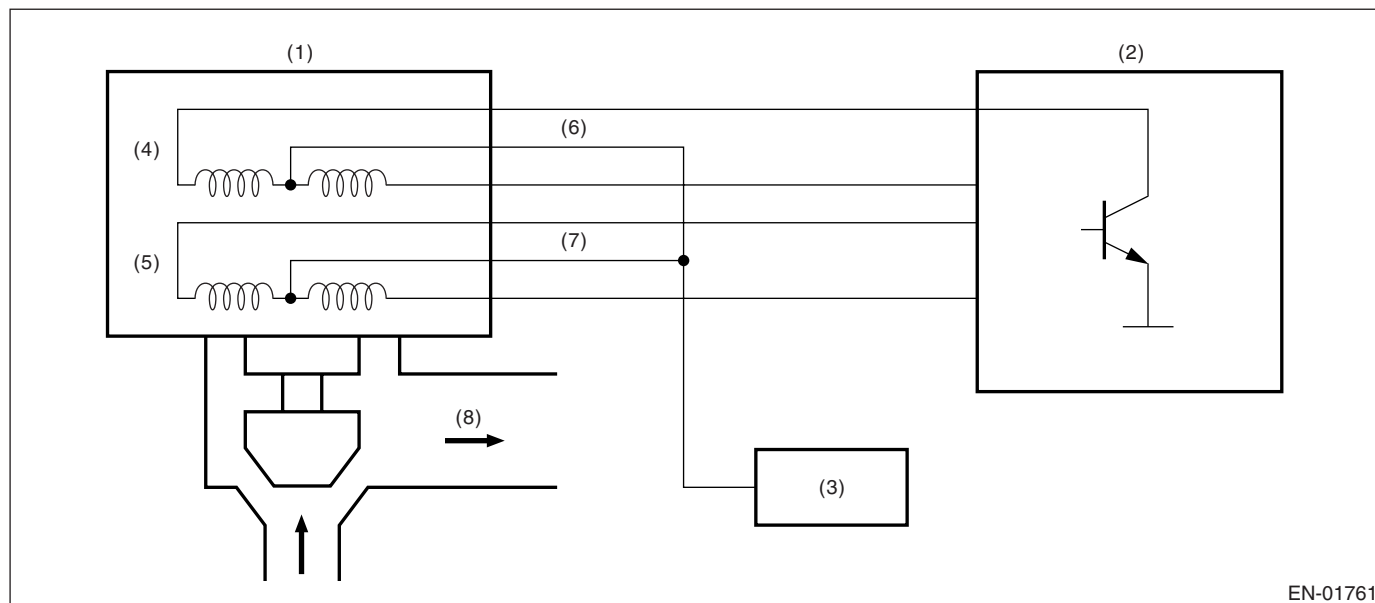
GENERAL DESCRIPTION

DA:DTC P1510 ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is Low level even though ECM outputs OFF signal.

2. COMPONENT DESCRIPTION



- (1) Idle air control solenoid valve
- (2) Engine control module (ECM)
- (3) Ignition relay
- (4) A phase

- (5) B phase
- (6) A phase power
- (7) B phase power
- (8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level

Time Needed for Diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

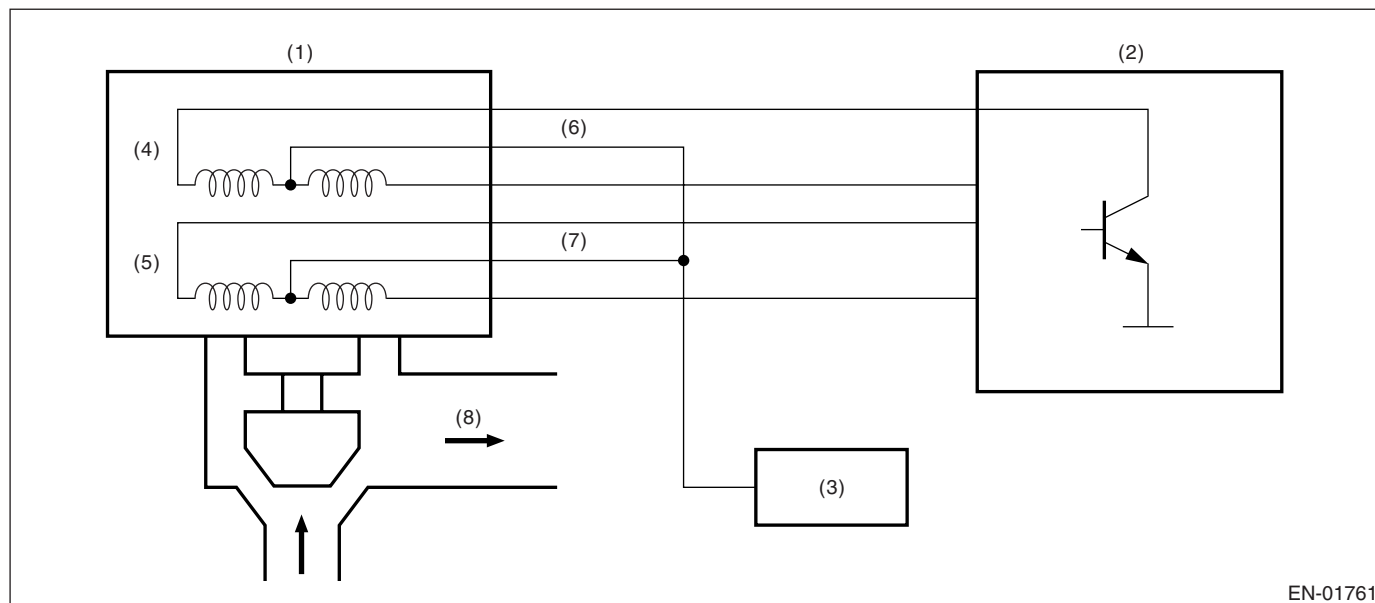
GENERAL DESCRIPTION

DB:DTC P1511 ISC SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is High level even though ECM outputs ON signal.

2. COMPONENT DESCRIPTION



- (1) Idle air control solenoid valve
- (2) Engine control module (ECM)
- (3) Ignition relay
- (4) A phase

- (5) B phase
- (6) A phase power
- (7) B phase power
- (8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	High level

Time needed for diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

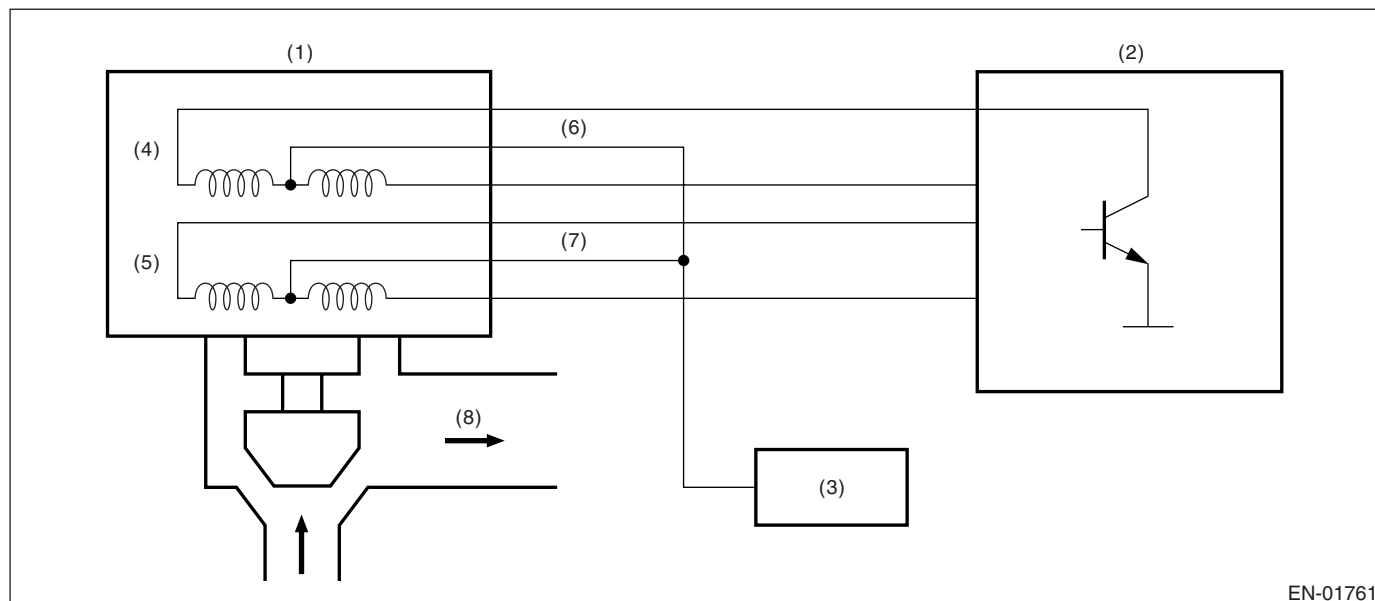
GENERAL DESCRIPTION

DC:DTC P1512 ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is Low level even though ECM outputs OFF signal.

2. COMPONENT DESCRIPTION



- (1) Idle air control solenoid valve
- (2) Engine control module (ECM)
- (3) Ignition relay
- (4) A phase

- (5) B phase
- (6) A phase power
- (7) B phase power
- (8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level

Time Needed for Diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

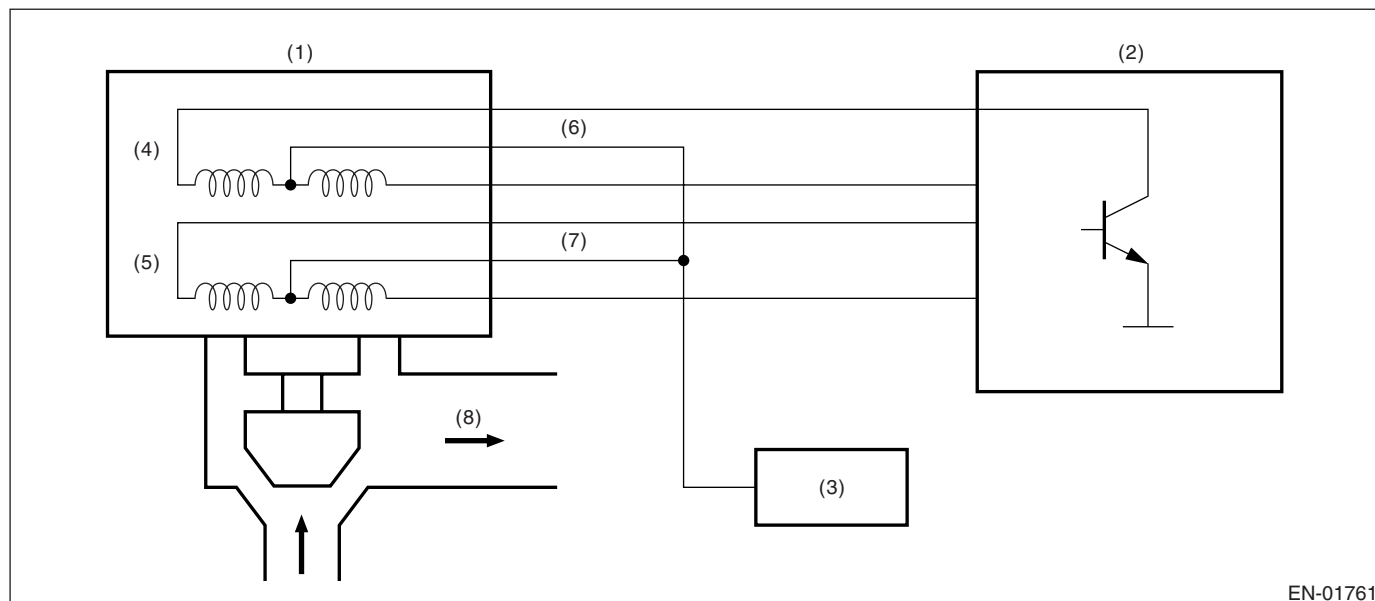
GENERAL DESCRIPTION

DD:DTC P1513 ISC SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is High level even though ECM outputs ON signal.

2. COMPONENT DESCRIPTION



- (1) Idle air control solenoid valve
(2) Engine control module (ECM)
(3) Ignition relay
(4) A phase

- (5) B phase
(6) A phase power
(7) B phase power
(8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	High level

Time Needed for Diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

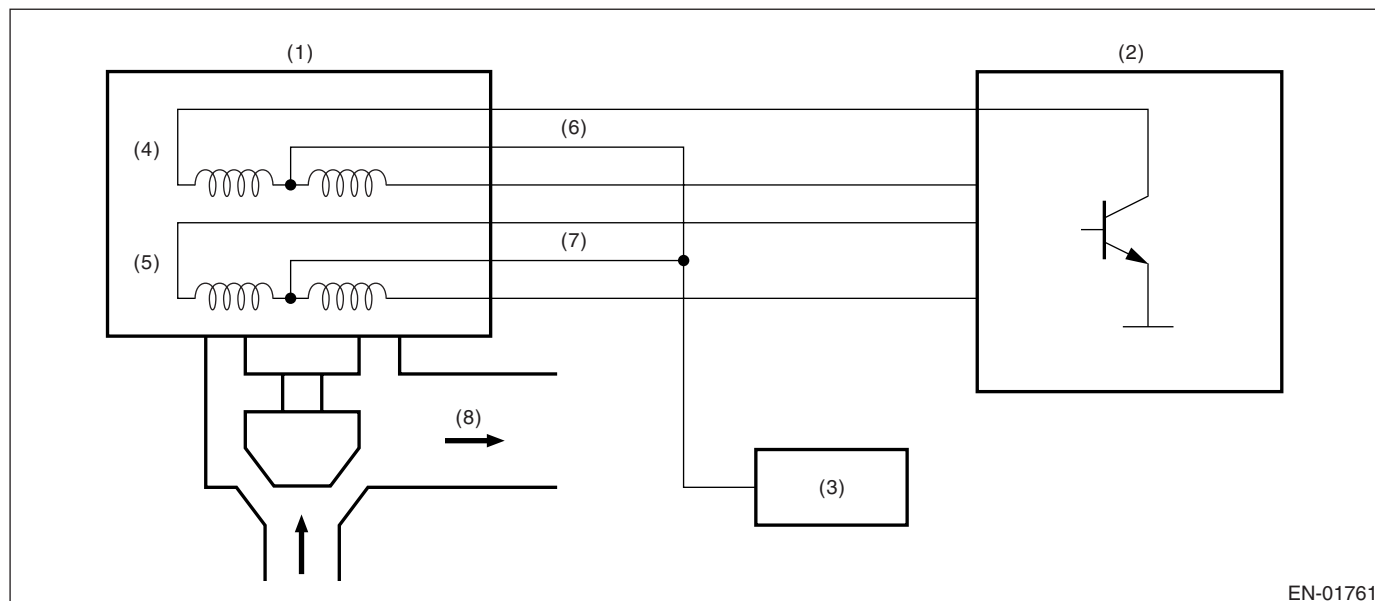
GENERAL DESCRIPTION

DE:DTC P1514 ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is Low level even though ECM outputs OFF signal.

2. COMPONENT DESCRIPTION



- (1) Idle air control solenoid valve
- (2) Engine control module (ECM)
- (3) Ignition relay
- (4) A phase

- (5) B phase
- (6) A phase power
- (7) B phase power
- (8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level

Time Needed for Diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

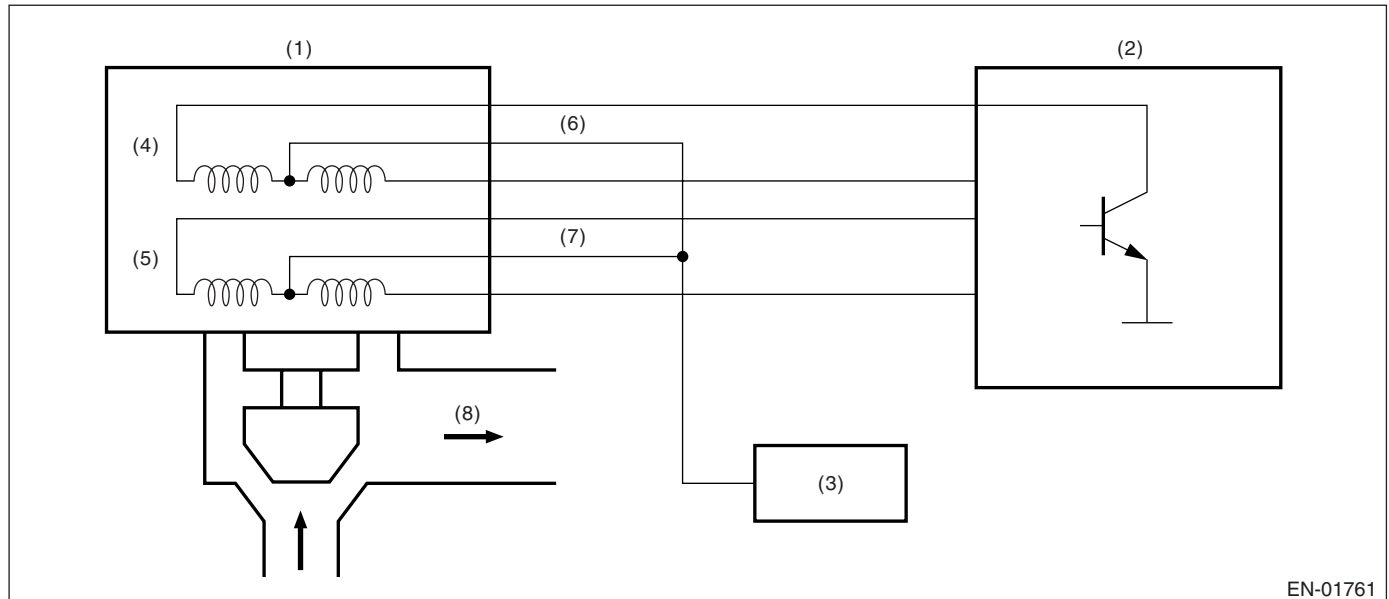
GENERAL DESCRIPTION

DF:DTC P1515 ISC SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is High level even though ECM outputs ON signal.

2. COMPONENT DESCRIPTION



- (1) Idle air control solenoid valve
- (2) Engine control module (ECM)
- (3) Ignition relay
- (4) A phase

- (5) B phase
- (6) A phase power
- (7) B phase power
- (8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	High level

Time Needed for Diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

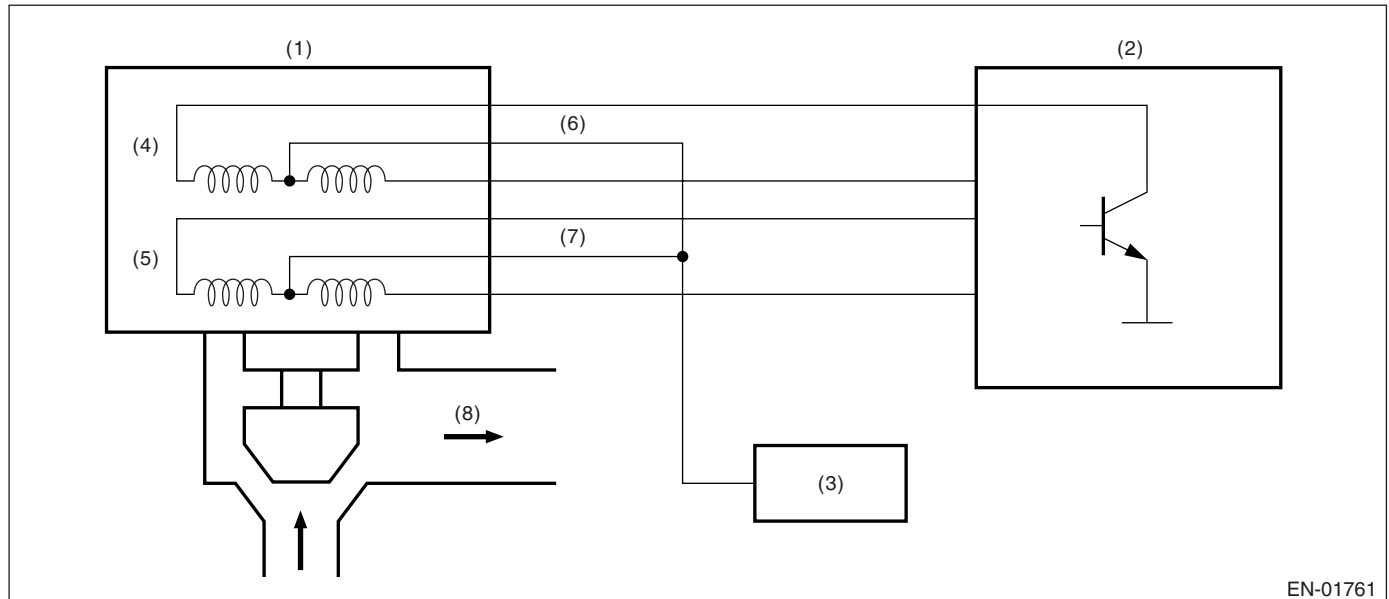
GENERAL DESCRIPTION

DG:DTC P1516 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is Low level even though ECM outputs OFF signal.

2. COMPONENT DESCRIPTION



- (1) Idle air control solenoid valve
- (2) Engine control module (ECM)
- (3) Ignition relay
- (4) A phase

- (5) B phase
- (6) A phase power
- (7) B phase power
- (8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level

Time Needed for Diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

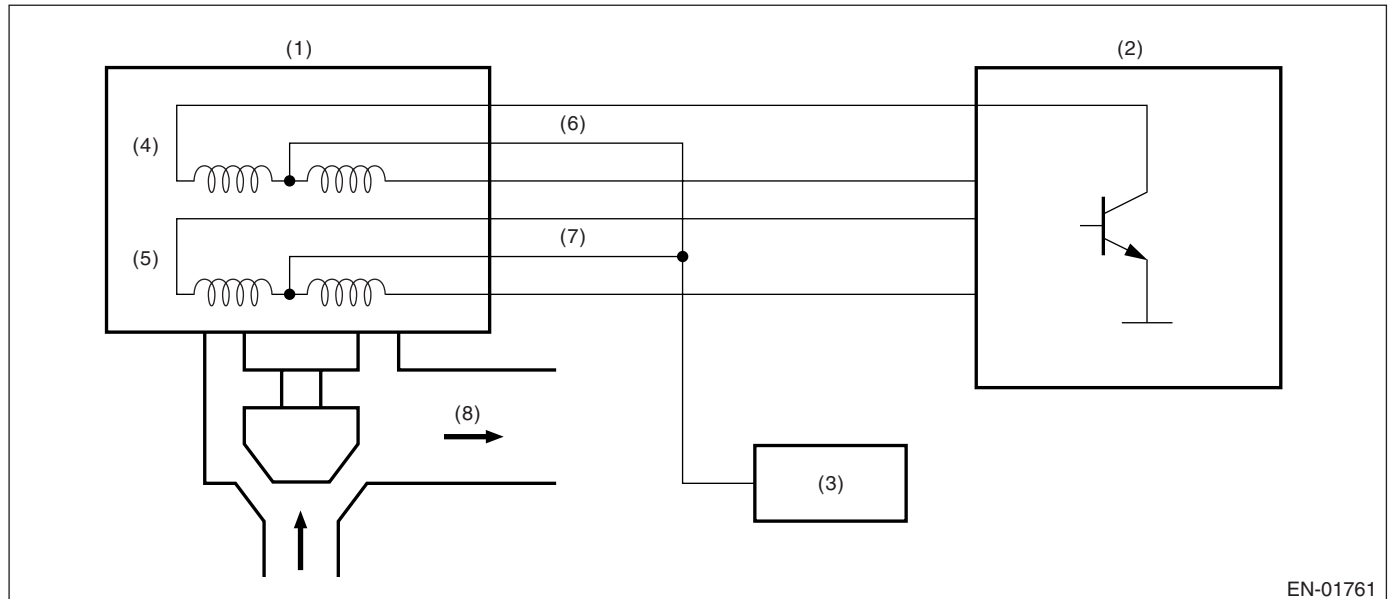
GENERAL DESCRIPTION

DH:DTC P1517 ISC SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of idle air control solenoid valve.
- Judge NG when the output terminal is High level even though ECM outputs ON signal.

2. COMPONENT DESCRIPTION



- (1) Idle air control solenoid valve
- (2) Engine control module (ECM)
- (3) Ignition relay
- (4) A phase

- (5) B phase
- (6) A phase power
- (7) B phase power
- (8) Intake air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Starter switch	OFF
Battery voltage	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when starter switch is OFF.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than time needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	High level

Time Needed for Diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs ON signal	Low level

6. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

- Cut the fuel of all cylinders, #1 cylinder or #1, #2 cylinder according to throttle position, engine speed, vehicle speed.
- ISC closed loop compensation value becomes zero. [ISCCL = 0 (l/min)]

9. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DI: DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of starter switch.
- Judge OFF NG when the starter signal remains OFF even though engine started.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine	Run

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting engine.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed. Judge OK and clear the NG when the starter switch is turned to ON.

Judgment value

Malfunction Criteria	Threshold Value
Engine speed	0 — 700 rpm
Vehicle speed	= 0 km/h (0 MPH)
Starter "ON" signal	Not detected

Time Needed for Diagnosis

OFF side	Condition (engine speed 0 → 700 rpm) time needed for completion

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DJ:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of back-up power supply circuit.
- Judge NG when the back-up power supply does not come to ECM regardless of the battery voltage coming.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Self-diagnosis timer after starting the engine	≥ 5 seconds
Battery voltage MVB	≥ 9.2 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously in 5 seconds after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG and clear the NG when the cumulative time until completing the malfunction criteria below becomes more than the time (5 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Battery back-up power supply	Low

Time Needed for Diagnosis: 5 seconds

Malfunction indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle is completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DK:DTC P1698 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of AT cooperative signal line.
- Judge NG when ECM output level is different from actual terminal level.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8.0 V
After engine starting	1 second or more

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (0.5 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs OFF signal	High

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DL:DTC P1699 ENGINE TORQUE CONTROL CUT SIGNAL CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

- Detect the open/short circuit of AT cooperative signal line.
- Judge NG when ECM output level is different from actual terminal level.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
Battery voltage	≥ 8.0 V
After engine starting	1 second or more

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time until completing the malfunction criteria below becomes more than the time (0.5 seconds) needed for diagnosis.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal	High

Time Needed for Diagnosis: 0.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs ON signal	Low

5. DTC CLEAR CONDITION

- When the OK idling cycle is completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

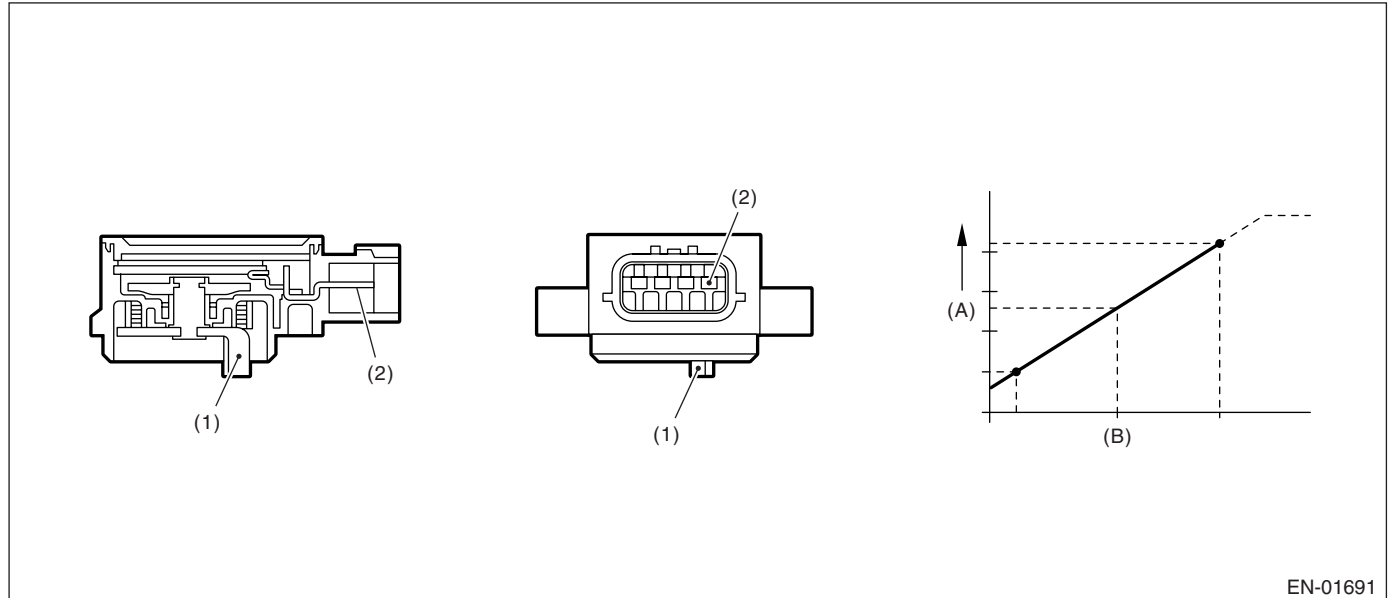
GENERAL DESCRIPTION

DM:DTC P1700 THROTTLE POSITION SENSOR CIRCUIT MALFUNCTION FOR AT

1. OUTLINE OF DIAGNOSIS

Judge NG when the voltage from throttle sensor is out of specified value.

2. COMPONENT DESCRIPTION



- (1) Lever
(2) Terminal

- (A) Output voltage
(B) Throttle valve angle

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.1 or ≥ 4.6 V

Time Needed for Diagnosis: 63.75 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

8. FAIL SAFE

Make the throttle angle to 3/8 open, and the line pressure and 2-4B pressure to maximum.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DN:DTC P1711 ENGINE TORQUE CONTROL SIGNAL #1 CIRCUIT MALFUNCTION

1. OUTLINE OF DIAGNOSIS

Judge NG when detecting the difference 250 times in a row by comparing the CPU output with signal line output every 10 milliseconds.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Collector voltage of transistor (Vc) at "ON" signal from TCM	High level
Collector voltage of transistor (Vc) at "OFF" signal from ECM	Low level

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

DO:DTC P1712 ENGINE TORQUE CONTROL SIGNAL #2 CIRCUIT MALFUNCTION

1. OUTLINE OF DIAGNOSIS

Judge NG when detecting the difference 250 times in a row by comparing the CPU output with signal line output every 10 milliseconds.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judgment Value

Malfunction Criteria	Threshold Value
Vc at "ON" signal from ECM	High
Vc at "OFF" signal from ECM	Low

Time Needed for Diagnosis: 2.5 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

7. FAIL SAFE

None

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

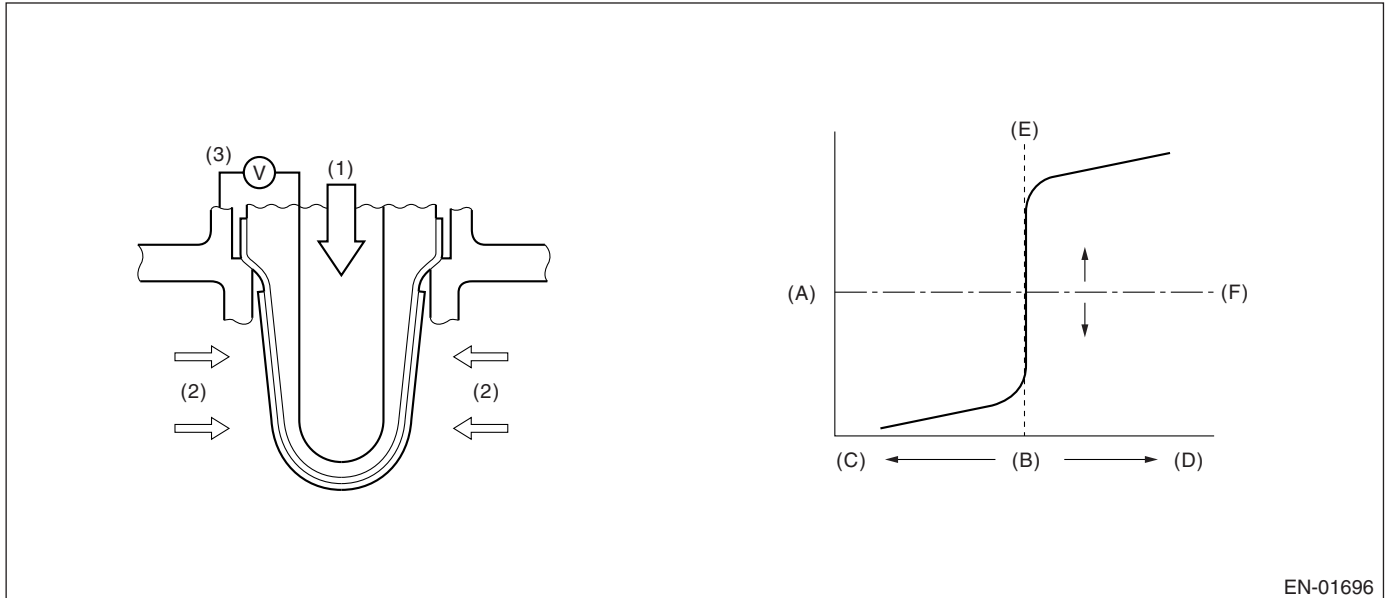
DP:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the amount of sub feedback control.

Judge NG when the rear oxygen sensor output does not approach to the slice level (target voltage) with the control amount sticks to rich or lean side while operating the sub feedback control.

2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel system monitoring with primary oxygen sensor	In operation
Target lambda with primary oxygen sensor	1.0
Closed loop control with secondary oxygen sensor	In operation
Amount of intake air	≥ 20 kg/h
Feed back control with secondary oxygen sensor	Reached to the limit value

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at a constant 80 km/h (50 MPH).

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Calculate the continuous time from the sticking of sub feedback control amount to rich or lean side and cumulative deviation (sumdelo2) of rear oxygen sensor voltage and slice level (target voltage).

Judge NG when the malfunction criteria below are completed after 300 seconds have passed continuously.

Judgment Value

Malfunction Criteria	Threshold Value
$\text{sumdelo2} = \text{sumdelo2} + (\text{rvo2} - \text{rsl})$ where: rvo2 = sensing voltage of secondary oxygen sensor rsl = target voltage of secondary oxygen sensor	$> -16,740 \text{ V}$

Time Needed for Diagnosis: 300 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the rear oxygen output is reversed, and during 4 seconds after that, the sub feedback control amount does not stick to rich or lean sides.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

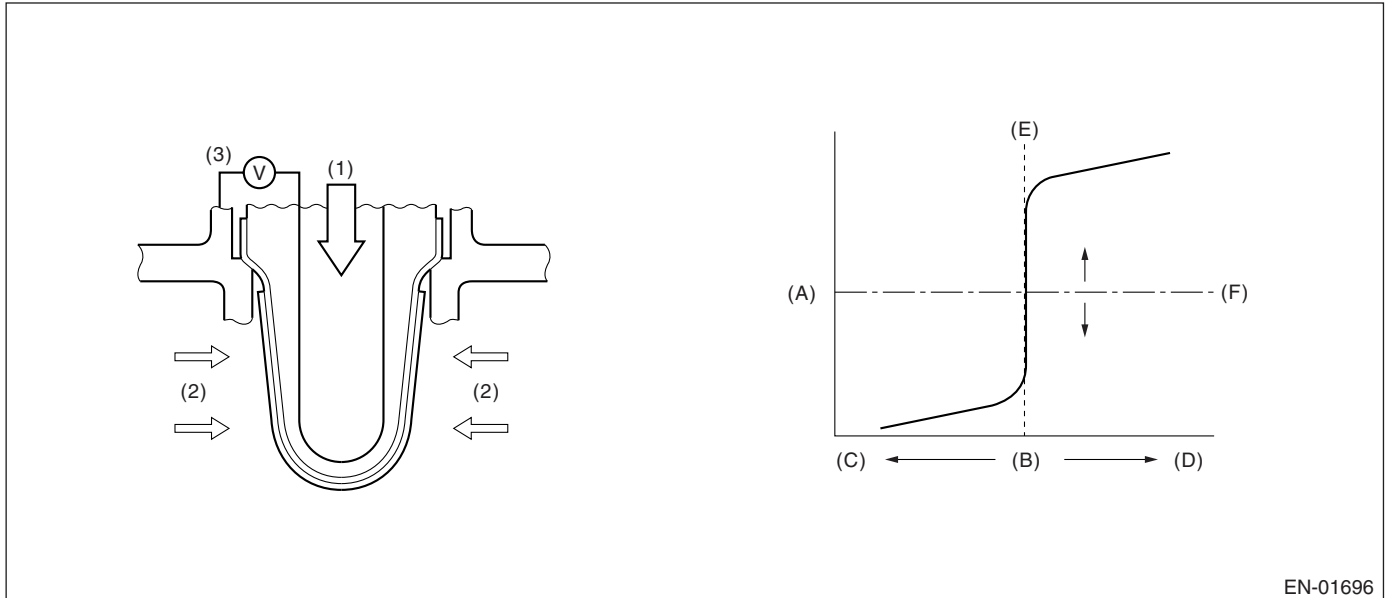
DQ:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the amount of sub feedback control.

Judge NG when the rear oxygen sensor output does not approach to the slice level (target voltage) with the control amount sticks to rich or lean side while operating the sub feedback control.

2. COMPONENT DESCRIPTION



- (1) Atmosphere
- (2) Exhaust gas
- (3) Electromotive force

- (A) Electromotive force
- (B) Air fuel ratio
- (C) Lean
- (D) Rich
- (E) Theoretical air fuel ratio
- (F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Fuel system monitoring with primary oxygen sensor	In operation
Target lambda with primary oxygen sensor	1.0
Closed loop control with secondary oxygen sensor	In operation
Amount of intake air	≥ 20 kg/h
Feed back control with secondary oxygen sensor	Reached to the limit value

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at a constant 80 km/h (50 MPH).

Diagnostic Trouble Code (DTC) Detecting Criteria

GENERAL DESCRIPTION

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Calculate the continuous time from the sticking of sub feedback control amount to rich or lean side and cumulative deviation (sumdelo2) of rear oxygen sensor voltage and slice level (target voltage).

Judge NG when the malfunction criteria below are completed after 300 seconds have passed continuously.

Judgment Value

Malfunction Criteria	Threshold Value
$\text{sumdelo2} = \text{sumdelo2} + (\text{rvo2} - \text{rsl})$ where: rvo2 = sensing voltage of secondary oxygen sensor rsl = target voltage of secondary oxygen sensor	> 6,750 V

Time Needed for Diagnosis: 300 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the rear oxygen output is reversed, and during 4 seconds after that, the sub feedback control amount does not stick to rich or lean sides.

6. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When "Clear Memory" was performed

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode \$02)

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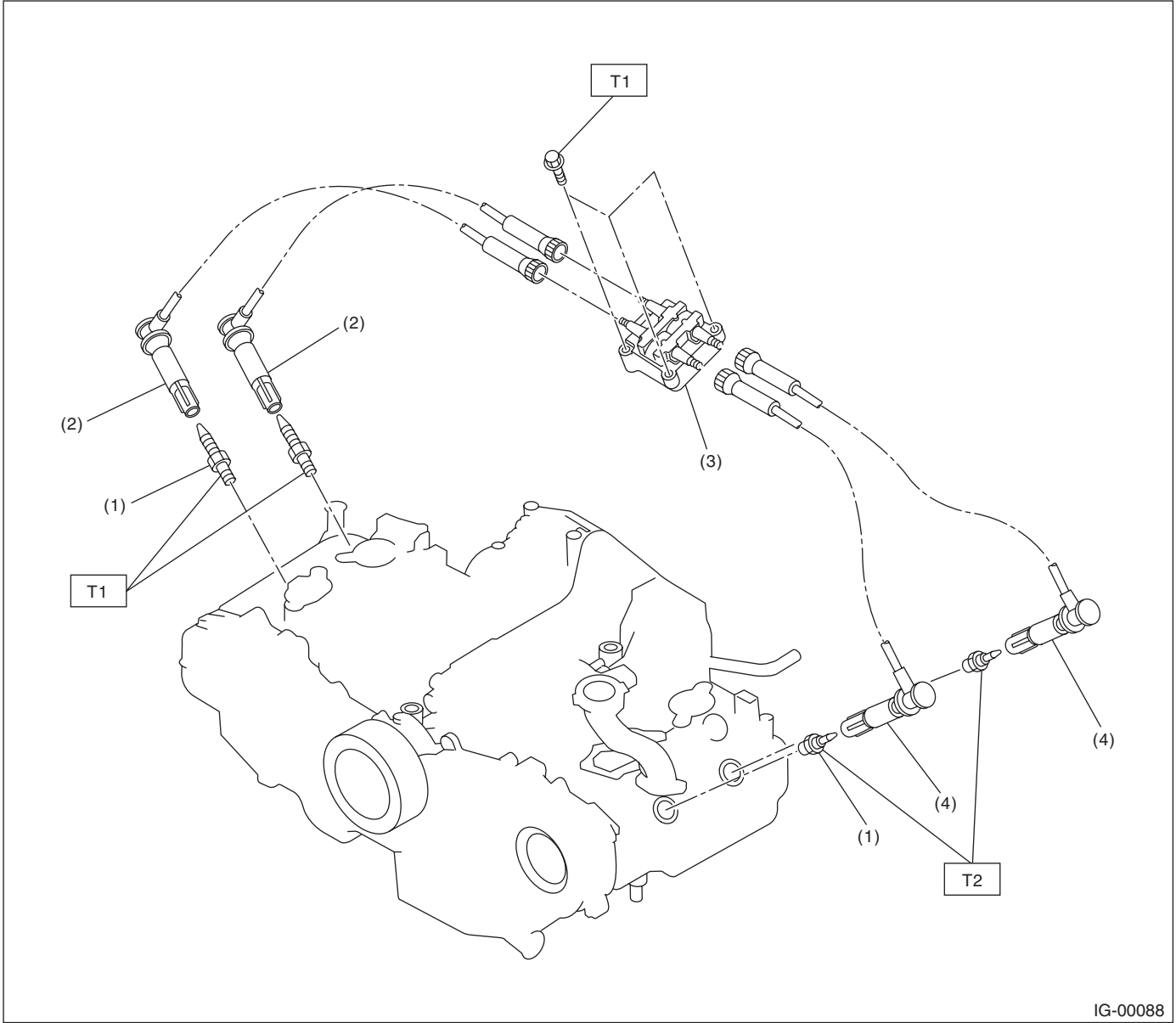
IGNITION

1. General Description

A: SPECIFICATIONS

Item		Designation	
Ignition coil & ignitor ASSY	Model	FH0137	
	Manufacturer	DIAMOND	
	Secondary coil resistance	12.8 kΩ±15%	
Spark plug	Type and manufacturer	CHAMPION: RC10YC4	
		Equivalent	NGK: BKR5E-11
			NGK: BKR6E-11
	Thread size	mm	14, P = 1.25
	Spark gap	mm (in)	1.0 — 1.1 (0.039 — 0.043)

B: COMPONENT



- (1) Spark plug

(2) Spark plug cord (#1, #3)

(3) Ignition coil & ignitor ASSY
- (4) Spark plug cord (#2, #4)

Tightening torque: N·m (kgf·m, ft·lb)

T1: 6.4 (0.65, 4.7)

T2: 21 (2.1, 15.5)

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

Spark Plug

IGNITION

2. Spark Plug

A: REMOVAL

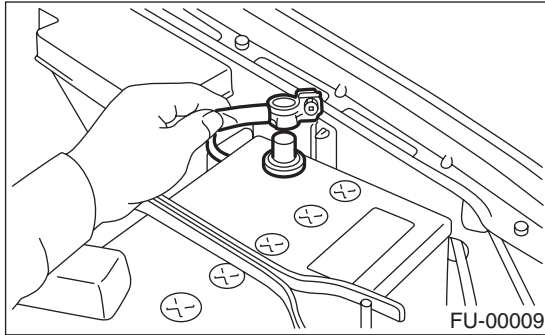
CAUTION:

All spark plugs installed on an engine, must be of the same heat range.

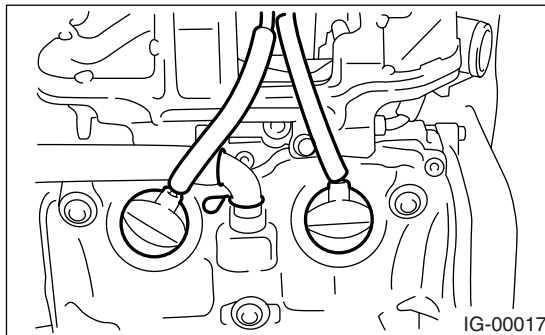
Spark plug	
CHAMPION: RC10YC4	
Equivalent	NGK: BKR5E-11
	NGK: BKR6E-11

1. RH SIDE

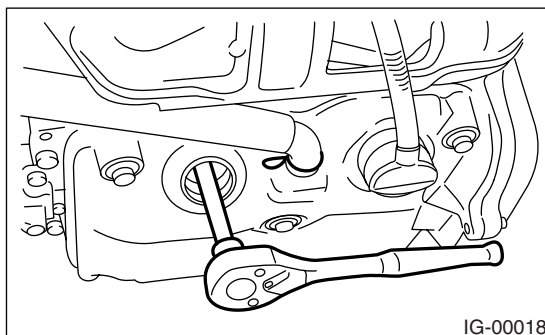
- 1) Disconnect the ground cable from battery.



- 2) Remove the resonator chamber. <Ref. to IN(H4SO)-7, REMOVAL, Resonator Chamber.>
- 3) Remove the spark plug cords by pulling the boot, not the cord itself.

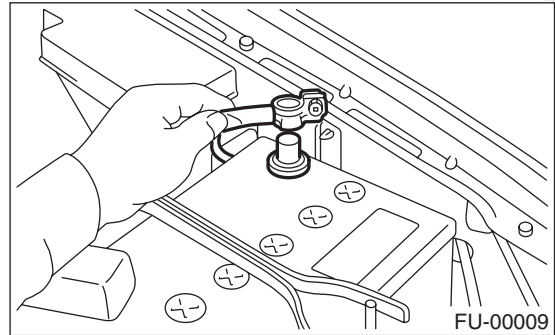


- 4) Remove the spark plugs using spark plug sockets.

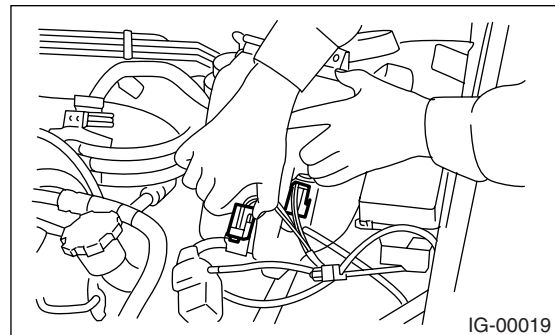


2. LH SIDE

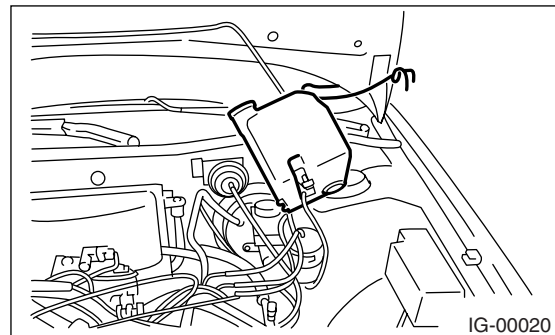
- 1) Disconnect the ground cable from battery.



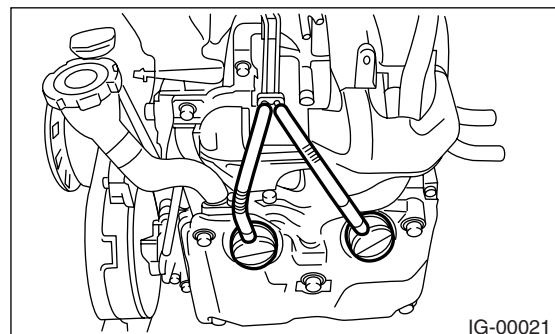
- 2) Disconnect the washer motor connector.



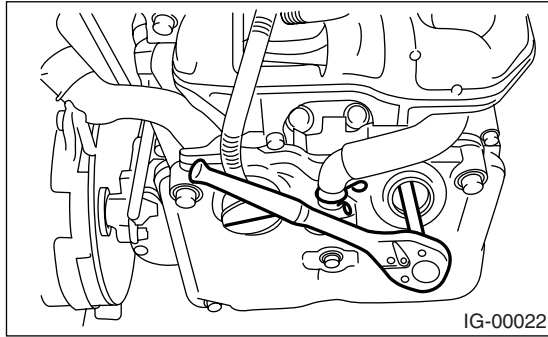
- 3) Disconnect the rear window glass washer hose from washer motor, then plug the connection with a suitable cap.
- 4) Remove the two bolts which hold the washer tank, then take the tank away from working area.



- 5) Remove the spark plug cords by pulling the boot, not the cord itself.



6) Remove the spark plugs with spark plug sockets.



B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

NOTE:

- For tightening torque, refer to "COMPONENT". <Ref. to IG(H4SO)-2, COMPONENT, General Description.>
- The above torque should be only applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approx. 1/3 of the specified torque in order to avoid over-stressing.

2. LH SIDE

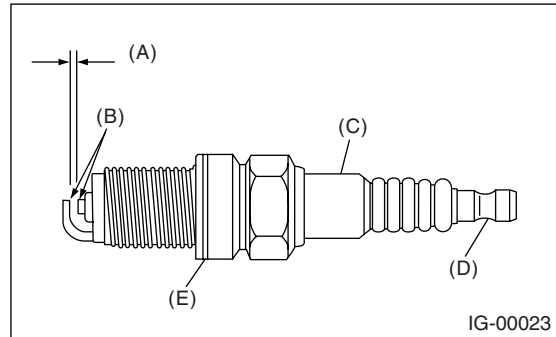
Install in the reverse order of removal.

NOTE:

- For tightening torque, refer to "COMPONENT". <Ref. to IG(H4SO)-2, COMPONENT, General Description.>
- The above torque should be only applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approx. 1/3 of the specified torque in order to avoid over-stressing.

C: INSPECTION

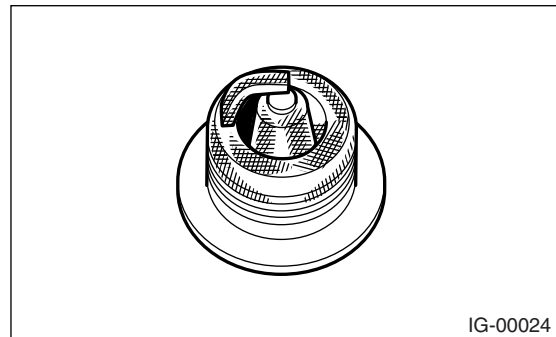
Check the electrodes and inner and outer ceramic insulator of plugs, noting the type of deposits and the degree of electrode erosion.



- (A) Electrode gap
- (B) Carbon accumulation or wear
- (C) Cracks
- (D) Damage
- (E) Damaged gasket

1) Normal:

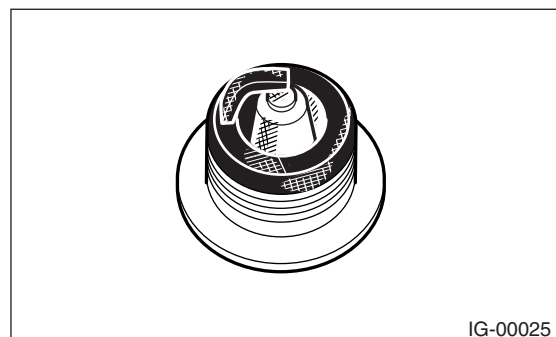
Brown to grayish-tan deposits and slight electrode wear indicates correct spark plug heat range.



2) Carbon fouled:

Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.

It is advisable to replace with plugs having hotter heat range.

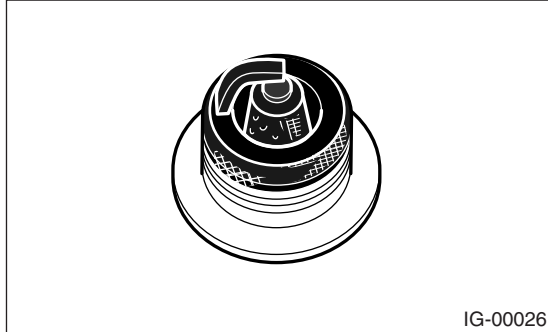


Spark Plug

IGNITION

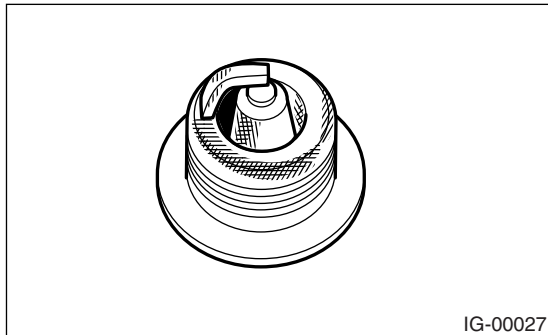
3) Oil fouled:

Wet black deposits show excessive oil entrance into combustion chamber through worn rings and pistons or excessive clearance between valve guides and stems. If the same condition remains after repair, use a hotter plug.



4) Overheating:

White or light gray insulator with black or gray brown spots and bluish burnt electrodes indicates engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, wrong selection of fuel, hotter range plug, etc. It is advisable to replace with plugs having colder heat range.



D: CLEANING

Clean the spark plugs in a sand blast type cleaner. Avoid excessive blasting. Clean and remove the carbon or oxide deposits, but do not wear away ceramic insulator.

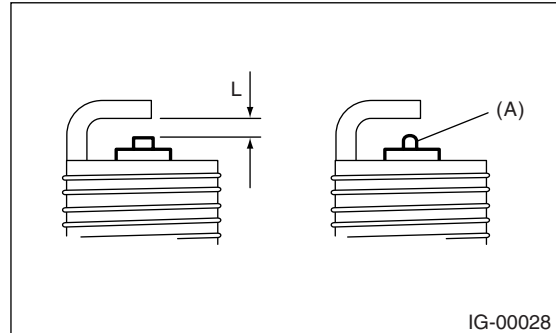
If deposits are too stubborn, replace the plugs.

E: ADJUSTMENT

Correct it if the spark plug gap is measured with a gap gauge, and it is necessary.

Spark plug gap: L

1.0 — 1.1 mm (0.039 — 0.043 in)



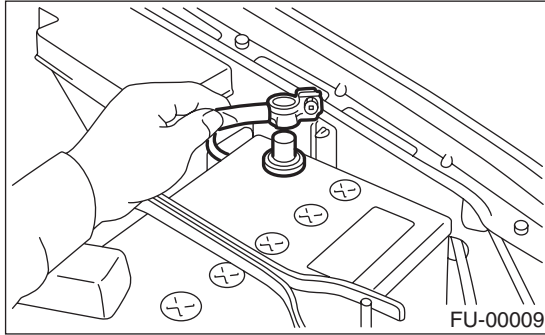
NOTE:

Replace with a new spark plug if this area (A) is worn to “ball” shape.

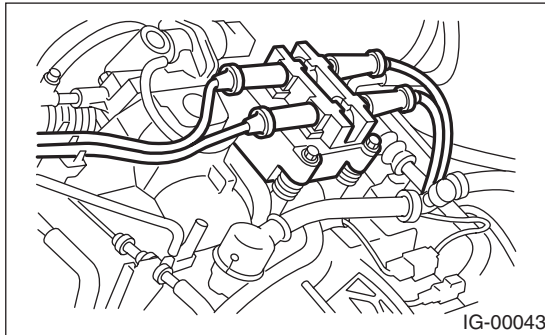
3. Ignition Coil & Ignitor ASSY

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the spark plug cords from ignition coil and ignitor ASSY.

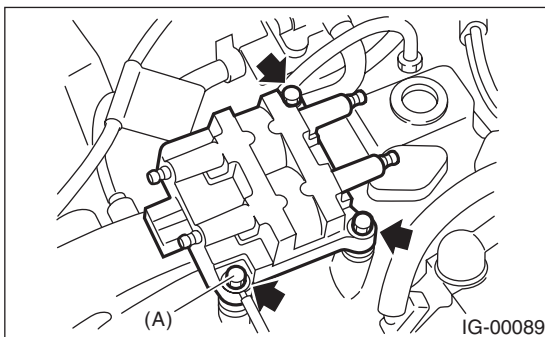


3) Disconnect the connector from ignition coil and ignitor ASSY.

4) Remove the ignition coil and ignitor ASSY.

NOTE:

Both the coil ground and ignition coil and ignitor ASSY are tightened by the bolt (A).



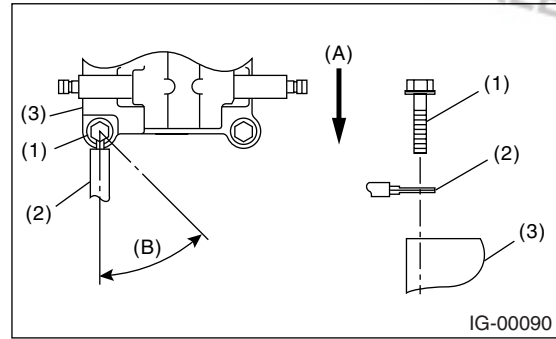
B: INSTALLATION

Install in the reverse order of removal.

NOTE:

• For tightening torque, refer to "COMPONENT".
<Ref. to IG(H4SO)-2, COMPONENT, General Description.>

• Install the coil ground to the place shown in the following figure.



- (1) Bolt
- (2) Coil ground
- (3) Ignition coil & ignitor ASSY
- (A) Front side of engine
- (B) 45°

CAUTION:

Connect the spark plugs to correct position. Misconnection may damage the unit.

C: INSPECTION

Using the accurate tester, inspect the following items, and replace if defective.

- Secondary coil resistance

CAUTION:

- Ignitor is integrated in coil. Therefore, primary coil resistance can not be measured.
- If the resistance is extremely low, this indicates the presence of a short-circuit.

Specified resistance:

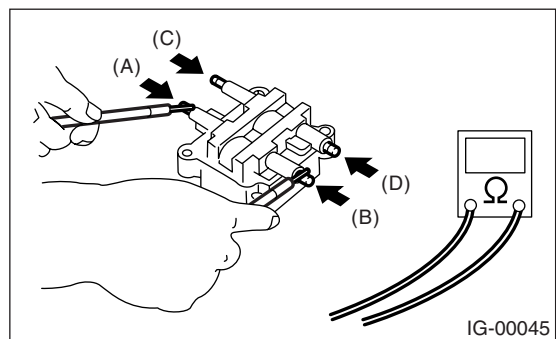
[Secondary side]

Between (A) and (B)

12.8 kΩ±15%

Between (C) and (D)

12.8 kΩ±15%



4. Spark Plug Cord

A: INSPECTION

Check for:

- 1) Damage to cords, deformation, burning or rust formation of terminals
- 2) Resistance values of cords

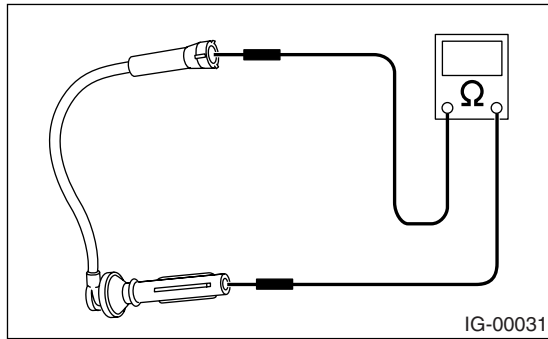
Resistance value:

#1 cord: 5.6 — 10.6 k Ω

#2 cord: 7.3 — 13.7 k Ω

#3 cord: 5.9 — 11.1 k Ω

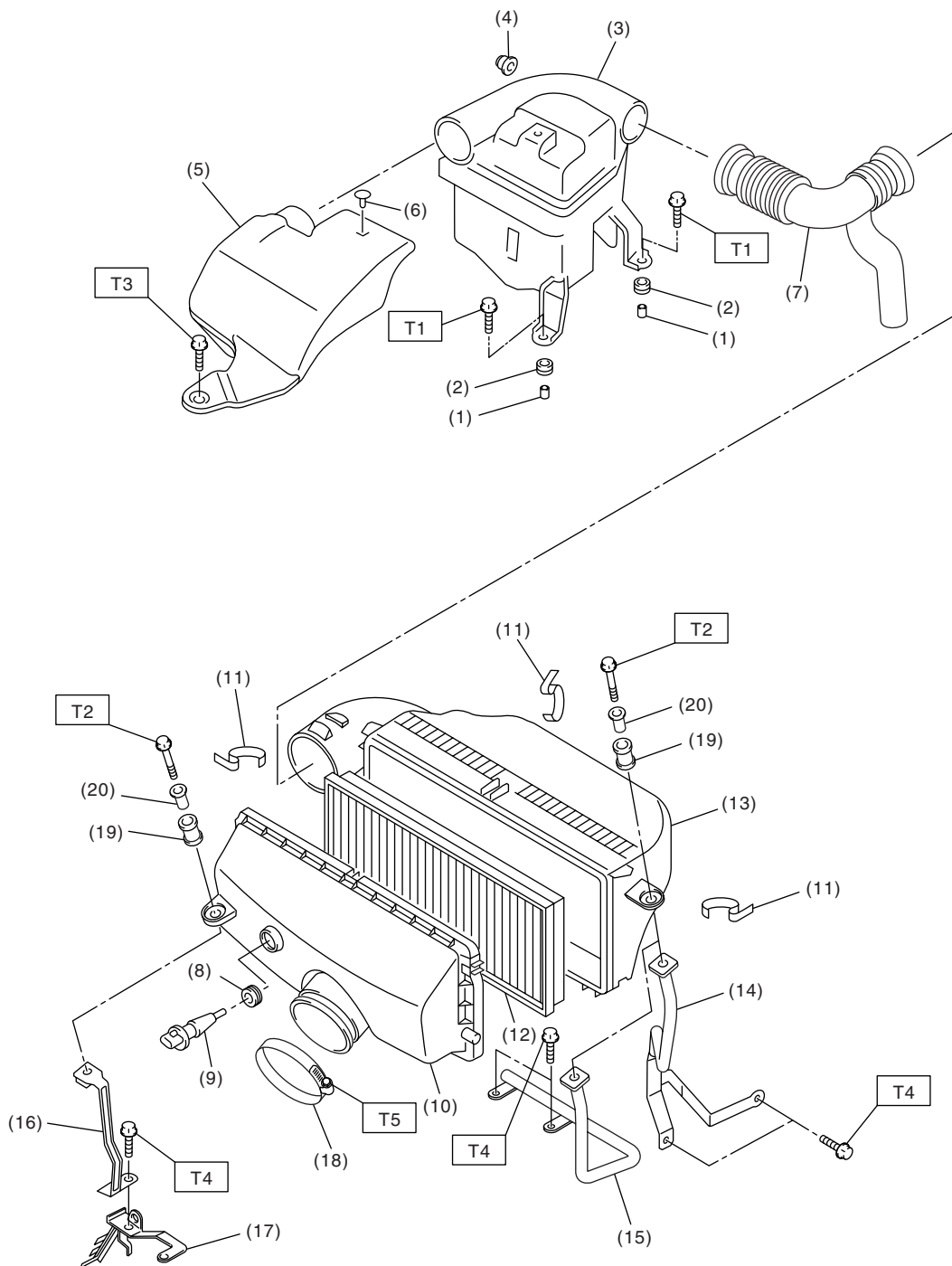
#4 cord: 7.3 — 13.7 k Ω



INTAKE (INDUCTION)

1. General Description

A: COMPONENT



IN-00188

General Description

INTAKE (INDUCTION)

(1) Spacer	(10) Air cleaner case A
(2) Bush	(11) Clip
(3) Resonator chamber	(12) Air cleaner element
(4) Cushion	(13) Air cleaner case B
(5) Air intake duct A	(14) Stay LH (MT model)
(6) Clip	(15) Stay LH (AT model)
(7) Air intake duct B	(16) Stay RH
(8) Bush	(17) Engine harness bracket
(9) Intake air temperature sensor	(18) Clamp

- | |
|-------------|
| (19) Bush |
| (20) Spacer |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 33 (3.4, 24.6)

T2: 6.5 (0.66, 4.8)

T3: 7.5 (0.76, 5.5)

T4: 16 (1.6, 11.6)

T5: 3 (0.3, 2.2)

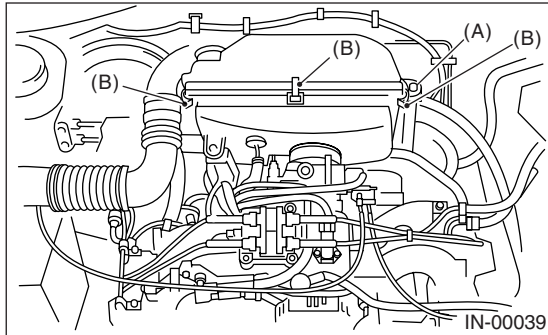
B: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensor or units, be sure to disconnect the ground cable from battery.

2. Air Cleaner Element

A: REMOVAL

- 1) Remove the air intake duct from air cleaner case.
- 2) Remove the bolt (A) which secures the air cleaner case to stay.
- 3) Remove the clip (B) above the air cleaner case.



- 4) Remove the air cleaner element.

B: INSTALLATION

Install in the reverse order of removal.

NOTE:

- Fasten with a clip after inserting the lower tab of case.
- Refer to "COMPONENT" for tightening torque.
<Ref. to IN(H4SO)-2, COMPONENT, General Description.>

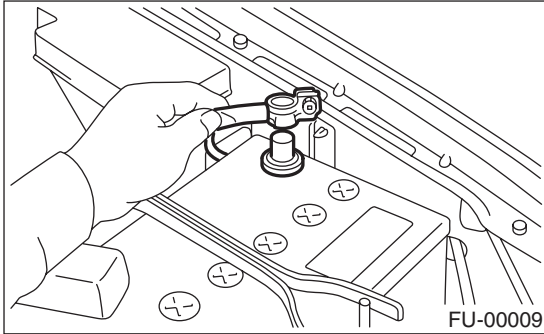
C: INSPECTION

Replace if excessively damaged or dirty.

3. Air Cleaner Case

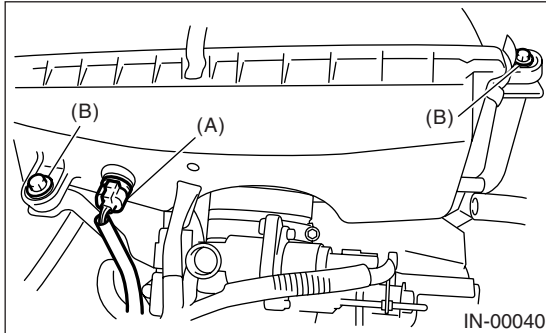
A: REMOVAL

- 1) Disconnect the ground cable from battery.



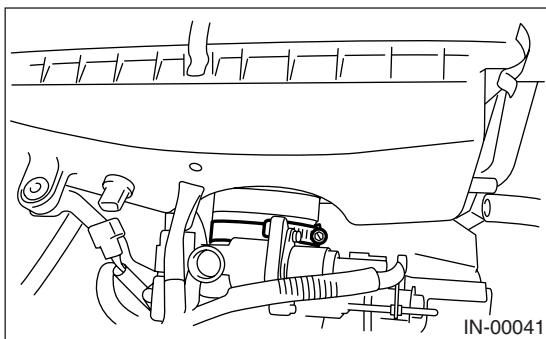
- 2) Disconnect the connector (A) of intake air temperature sensor.

- 3) Remove the bolt (B) which installs the air cleaner case to the stay.



- 4) Disconnect the hoses and intake duct from the air cleaner case.

- 5) Loosen the clamp which connects the air cleaner case to throttle body.



- 6) Remove the air cleaner case.

B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Refer to "COMPONENT" for tightening torque.
<Ref. to IN(H4SO)-2, COMPONENT, General Description.>

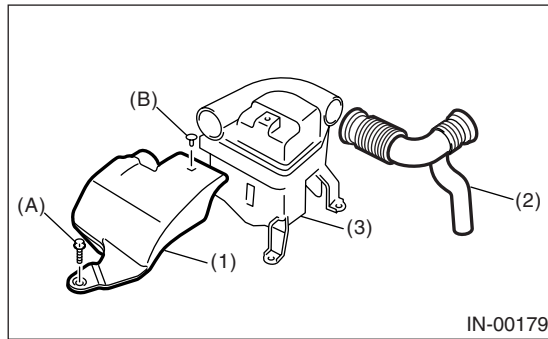
C: INSPECTION

Inspect for cracks and loose connections.

4. Air Intake Duct

A: REMOVAL

- 1) Remove the bolt (A) which installs the air intake duct A on front side of body.
- 2) Remove the clip (B) which connects the air intake duct A to resonator chamber.
- 3) Remove the air intake duct A.
- 4) Remove the air intake duct B from the resonator chamber and air cleaner case.



- (1) Air intake duct A
- (2) Air intake duct B
- (3) Resonator chamber

B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Refer to "COMPONENT" for tightening torque.
<Ref. to IN(H4SO)-2, COMPONENT, General Description.>

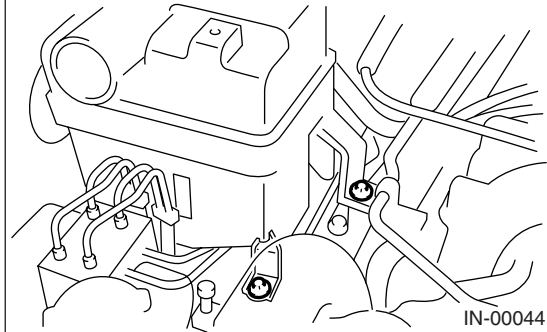
C: INSPECTION

- 1) Inspect for cracks and loose connections.
- 2) Inspect that no foreign objects are mixed in the air intake duct.

5. Resonator Chamber

A: REMOVAL

- 1) Remove the air intake duct. <Ref. to IN(H4SO)-6, REMOVAL, Air Intake Duct.>
- 2) Remove the resonator chamber.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Refer to "COMPONENT" for tightening torque.
<Ref. to IN(H4SO)-2, COMPONENT, General Description.>

C: INSPECTION

Inspect for cracks and loose connections.

Resonator Chamber

INTAKE (INDUCTION)

Brought to you by Eris Studios
NOT FOR RESALE

LUBRICATION

General Description

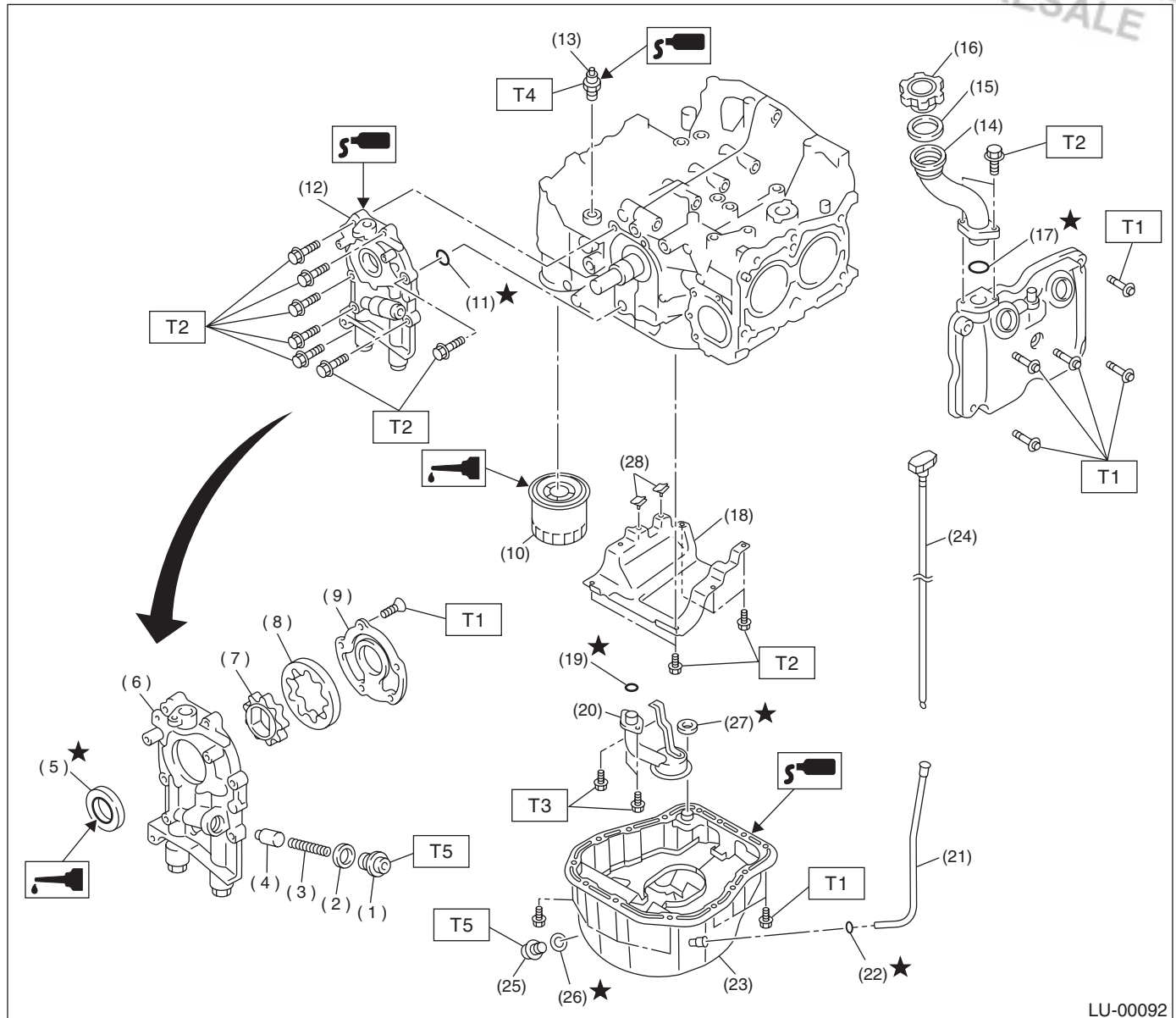
LUBRICATION

1. General Description

A: SPECIFICATIONS

Lubrication method				Forced lubrication	
Oil pump	Pump type			Trochoid type	
	Number of teeth	Inner rotor		9	
		Outer rotor		10	
	Outer rotor diameter × thickness			78 × 7 mm (3.07 × 0.28 in)	
	Tip clearance between inner and outer rotor		STANDARD	0.04 — 0.14 mm (0.0016 — 0.0055 in)	
			LIMIT	0.18 mm (0.0071 in)	
	Side clearance between inner rotor and pump case		STANDARD	0.02 — 0.07 mm (0.0008 — 0.0028 in)	
			LIMIT	0.12 mm (0.0047 in)	
	Case clearance between outer rotor and pump case		STANDARD	0.10 — 0.175 mm (0.0039 — 0.0069 in)	
			LIMIT	0.20 mm (0.0079 in)	
	Capacity at 80°C (176°F)	600 rpm	Discharge pressure	98 kPa (1.0 kg/cm ² , 14 psi)	
			Discharge quantity	3.2 ℓ (3.4 US qt, 2.8 Imp qt)/min.	
		5,000 rpm	Discharge pressure	294 kPa (3.0 kg/cm ² , 43 psi)	
			Discharge quantity	32.6 ℓ (34.4 US qt, 28.7 Imp qt)/min.	
Relief valve operation pressure			490 kPa (5.0 kg/cm ² , 71 psi)		
Oil filter	Type			Full-flow filter type	
	Filtration area	Diameter 80 mm (3.15 in)		760 cm ² (118 sq in)	
		Diameter 68 mm (2.68 in)		800 cm ² (124 sq in)	
		Diameter 65 mm (2.56 in)		470 cm ² (73 sq in)	
	By-pass valve opening pressure			157 kPa (1.60 kg/cm ² , 22.8 psi)	
	Outer diameter × width	Diameter 80 mm (3.15 in)		80 × 70 mm (3.15 × 2.76 in)	
		Diameter 68 mm (2.68 in)		68 × 65 mm (2.68 × 2.56 in)	
		Diameter 65 mm (2.56 in)		65 × 74.4 mm (2.56 × 2.93 in)	
Oil filter to engine thread size			M 20 × 1.5		
Oil pressure switch	Type			Immersed contact point type	
	Working voltage — wattage			12 V — 3.4 W or less	
	Warning light activation pressure			14.7 kPa (0.15 kg/cm ² , 2.1 psi)	
	Proof pressure			More than 981 kPa (10 kg/cm ² , 142 psi)	
Oil capacity (at replacement)				4.0 ℓ (4.2 US qt, 3.5 Imp qt)	

B: COMPONENT



LU-00092

(1) Plug	(13) Oil pressure switch
(2) Gasket	(14) Oil filler duct
(3) Relief valve spring	(15) O-ring
(4) Relief valve	(16) Oil filler cap
(5) Oil seal	(17) O-ring
(6) Oil pump case	(18) Baffle plate
(7) Inner rotor	(19) O-ring
(8) Outer rotor	(20) Oil strainer
(9) Oil pump cover	(21) Oil level gauge guide
(10) Oil filter	(22) O-ring
(11) O-ring	(23) Oil pan
(12) Oil pump ASSY	(24) Oil level gauge

- | |
|-------------------|
| (25) Drain plug |
| (26) Metal gasket |
| (27) Gasket |
| (28) Seal |

Tightening torque: N·m (kgf-m, ft-lb)**T1: 5 (0.5, 3.6)****T2: 6.4 (0.65, 4.7)****T3: 10 (1.0, 7.2)****T4: 25 (2.5, 18.1)****T5: 44 (4.5, 32.5)**

General Description

LUBRICATION

C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.

- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

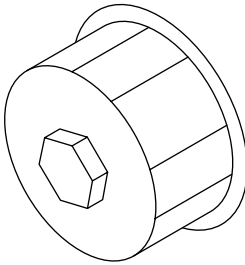
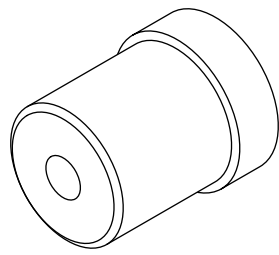
D: PREPARATION TOOL

1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
ST-499977100	499977100	CRANKSHAFT PULLEY WRENCH	• Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt. • For 2.5 L model.
ST-498547000	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 80 mm (3.15 in))
ST18332AA000	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 68 mm (2.68 in))

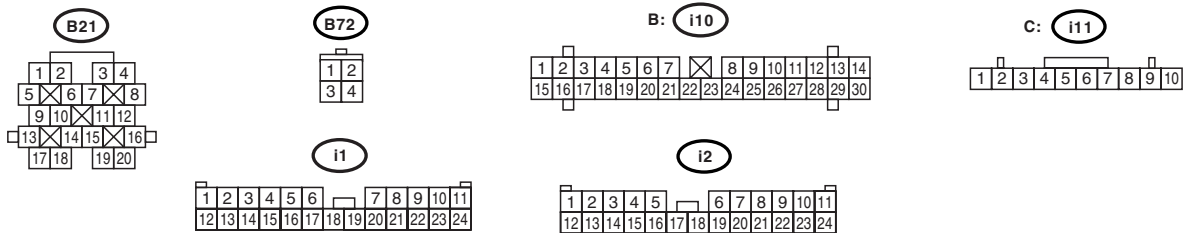
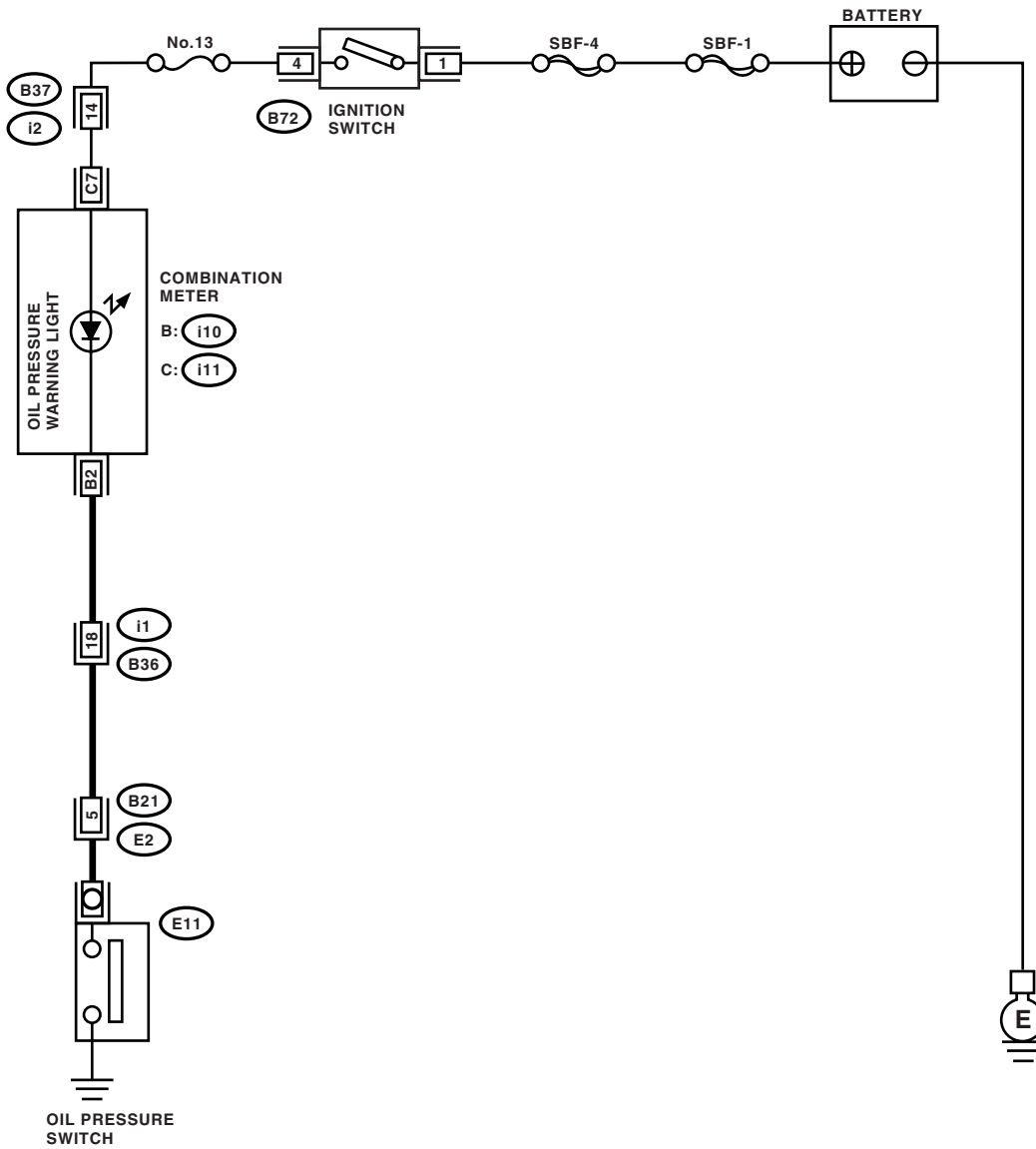
General Description

LUBRICATION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18332AA010	18332AA010	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 65 mm (2.56 in))
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

2. Oil Pressure System

A: WIRING DIAGRAM



LU-00210

B: INSPECTION

Step	Check	Yes	No
1 CHECK COMBINATION METER. 1) Turn the ignition switch to ON (engine OFF). 2) Check other warning lights.	Does the warning lights go on?	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-3, INSPECTION, Combination Meter System.>
2 CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND OIL PRESSURE SWITCH. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from oil pressure switch. 3) Turn the ignition switch to ON. 4) Measure the voltage of harness between the oil pressure switch connector and chassis ground. Connector & terminal (E11) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Replace the oil pressure switch.	Go to step 3.
3 CHECK COMBINATION METER. 1) Turn the ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of combination meter. Terminals (i11) No. 7 — (i10) No. 2:	Is the resistance less than 10 Ω ?	Replace the harness connector between combination meter and oil pressure switch.	Repair or replace the combination meter. <Ref. to IDI-3, INSPECTION, Combination Meter System.>

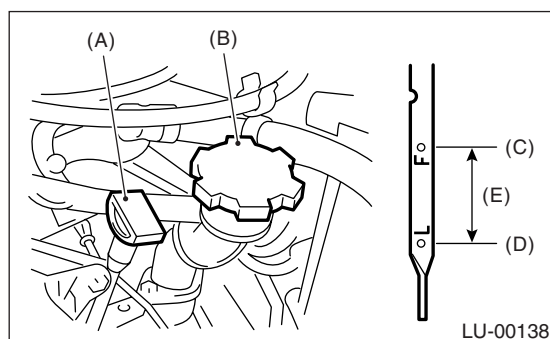
3. Engine Oil

A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Remove the oil level gauge and wipe it clean.
- 3) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted and in the proper orientation.
- 4) Remove it again and note the reading. If the engine oil level is below the "L" line, add oil to bring the level up to "F" line.
- 5) After turning off the engine, wait a few minutes for the oil to drain back into the oil pan before checking the level.
- 6) Just after driving or while the engine is warm, engine oil level may show in the range between the "F" line and notch mark. This is caused by thermal expansion of the engine oil.

NOTE:

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



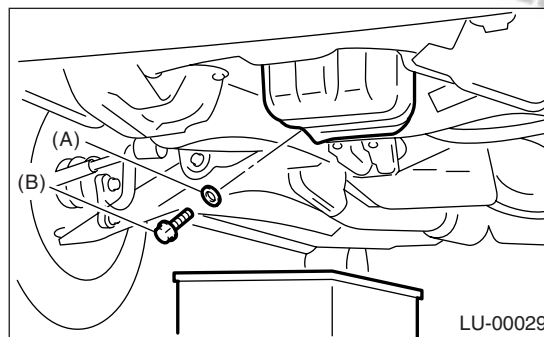
- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

B: REPLACEMENT

- 1) Open the engine oil filler cap for quick draining of the engine oil.
- 2) Lift up the vehicle.
- 3) Drain the engine oil by loosening the engine oil drain plug.

NOTE:

Prepare the container for draining of engine oil.



- (A) Gasket
- (B) Drain plug

- 4) Tighten the engine oil drain plug after draining engine oil.

NOTE:

- Replace the drain plug gasket.
 - Refer to COMPONENT of General Description for tightening torque. <Ref. to LU(H4SO)-3, COMPONENT, General Description.>
- 5) Fill engine oil through the filler duct up to upper level on level gauge. Make sure that the vehicle is placed level when checking oil level. Use the engine oil of proper quality and viscosity, selected in accordance with the table in figure.

Recommended oil

API classification SL with the "Energy Conserving" logo is printed (if you cannot obtain the oil with SL grade, you may use SJ grade "ENERGY CONSERVING" oil.)

ILSAC specification, GF3 or new API certification mark (Star burst mark) label is on the container.

Engine oil capacity:

Upper level

4.0 ℓ (4.2 US qt, 3.5 Imp qt)

Lower level

3.0 ℓ (3.2 US qt, 2.6 Imp qt)

SAE (1)							
(°C)	-30	-20	-15	0	15	30	40
(°F)	-22	-4	5	32	59	86	104
10W-30, 10W-40 5W-30 (2)							

LU-00076

(1) SAE Viscosity No. and Applicable Temperature

(2) PREFERRED

The proper viscosity helps vehicle get good cold and hot starting by reducing viscous friction and thus increasing cranking speed.

CAUTION:

When replenishing oil, it does not matter if the oil to be added is a different brand from that in the engine; however, use oil having the API classification and SAE viscosity No. designated by SUBARU.

NOTE:

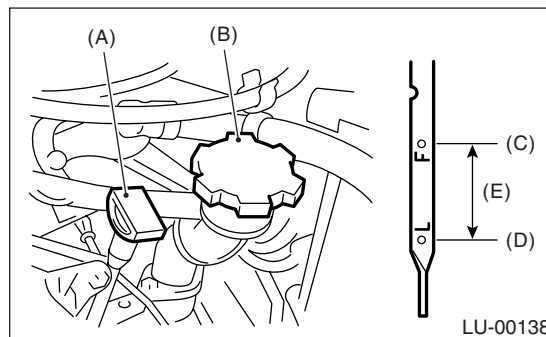
If the vehicle is used in areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used: API classification: SL or SJ

SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50.

6) Close the engine oil filler cap.

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

8) After the engine stops, recheck the oil level. If necessary, add engine oil up to the upper level on level gauge.



(A) Oil level gauge

(B) Engine oil filler cap

(C) Upper level

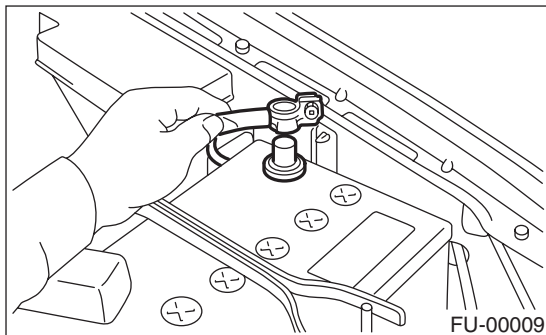
(D) Lower level

(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

4. Oil Pump

A: REMOVAL

1) Disconnect the ground cable from battery.



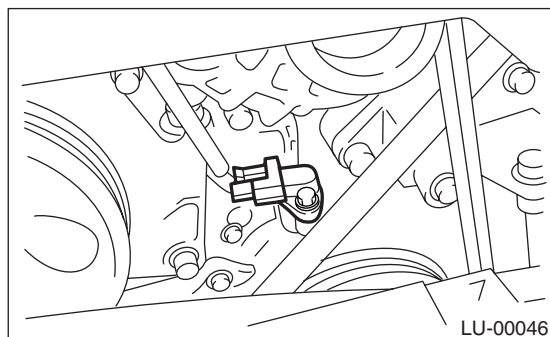
2) Lift-up the vehicle.

3) Remove the under cover.

4) Lower the vehicle.

5) Remove the radiator. <Ref. to CO(H4SO)-18, REMOVAL, Radiator.>

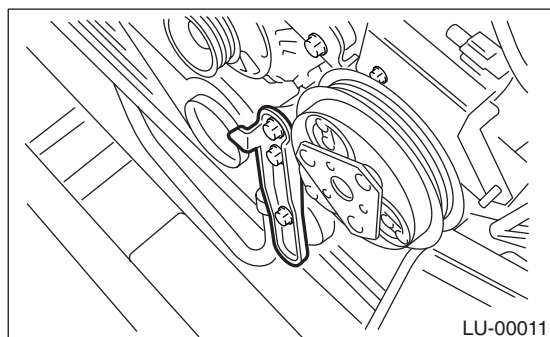
6) Remove the crankshaft position sensor.



7) Remove the V-belts.

<Ref. to ME(H4SO)-39, REMOVAL, V-belt.>

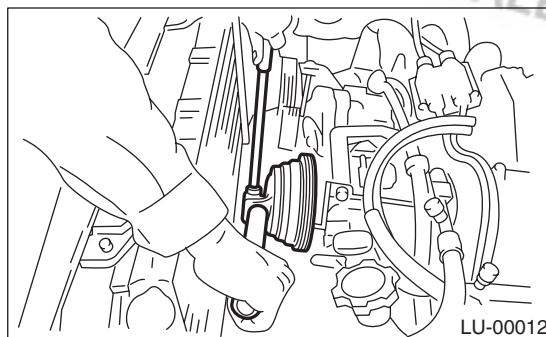
8) Remove the belt tensioner.



9) Remove the crankshaft pulley by using ST.

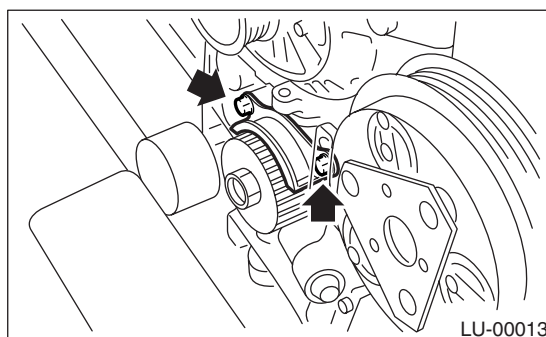
ST 499977100

CRANKSHAFT PULLEY
WRENCH (2.5 L model)

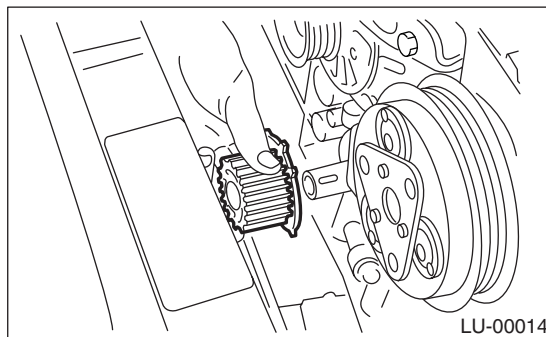


10) Remove the water pump. <Ref. to CO(H4SO)-14, REMOVAL, Water Pump.>

11) Remove the timing belt guide. (MT model)



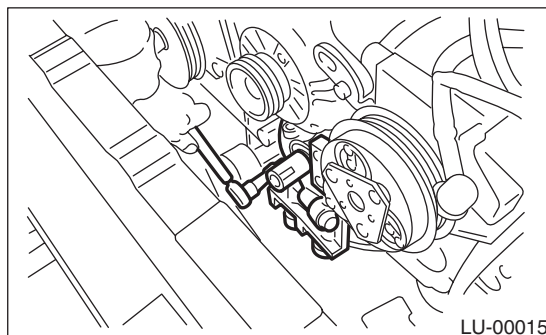
12) Remove the crankshaft sprocket.



13) Remove the bolts which install the oil pump onto cylinder block.

NOTE:

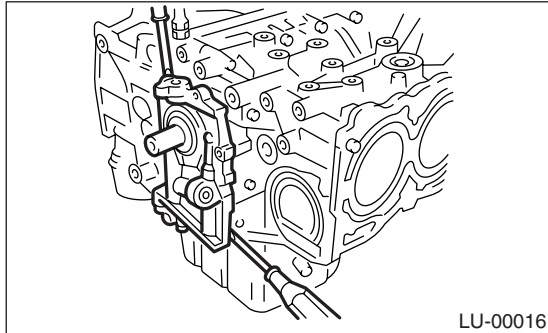
If disassembling or inspecting the oil pump, loosen the plug of relief valve before removing the oil pump.



14) Remove the oil pump by using flat tip screw-driver.

CAUTION:

Be careful not to scratch the mating surfaces of cylinder block and oil pump.



B: INSTALLATION

Install in the reverse order of removal.

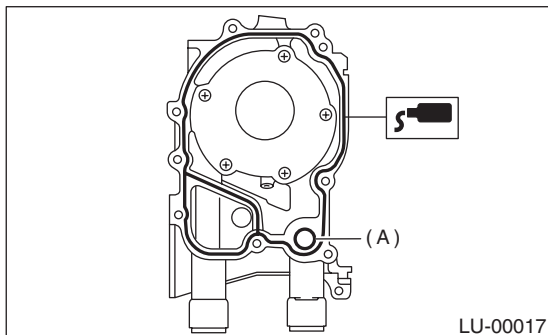
Do the following:

1) Apply fluid packing to the matching surfaces of oil pump.

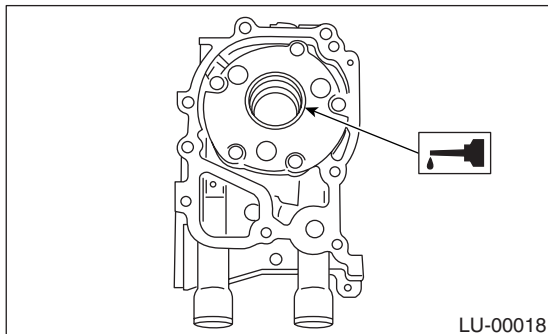
Fluid packing:

THREE BOND 1215 (Part No. 004403007) or equivalent

2) Replace the O-ring (A) with a new one.



3) Apply a coat of engine oil to the inside of oil seal.



4) Be careful not to scratch the oil seal when installing oil pump on cylinder block.

5) Position the oil pump, aligning the notched area with crankshaft, and push the oil pump straight.

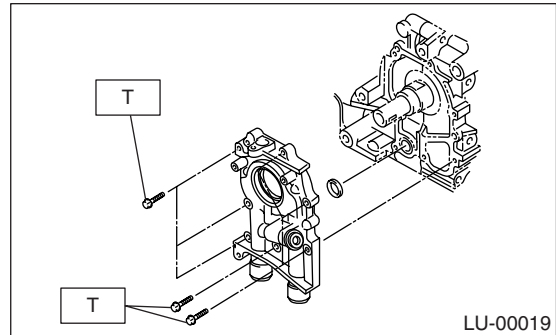
CAUTION:

Make sure the oil seal lip is not folded.

6) Install the oil pump.

Tightening torque:

6.4 N·m (0.65 kgf·m, 4.7 ft·lb)

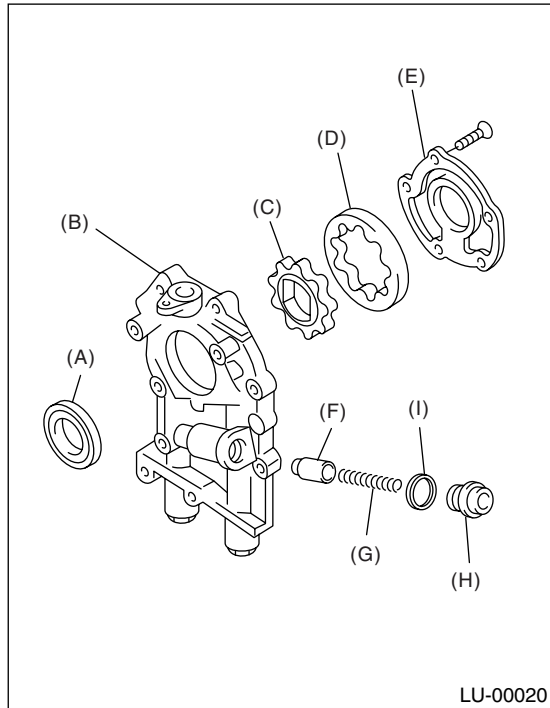


C: DISASSEMBLY

Remove the screws which secure the oil pump cover and disassemble oil pump. Inscribe alignment marks on the inner and outer rotors so that they can be replaced in their original positions during reassembly.

CAUTION:

Before disassembling the oil pump, remove the relief valve.



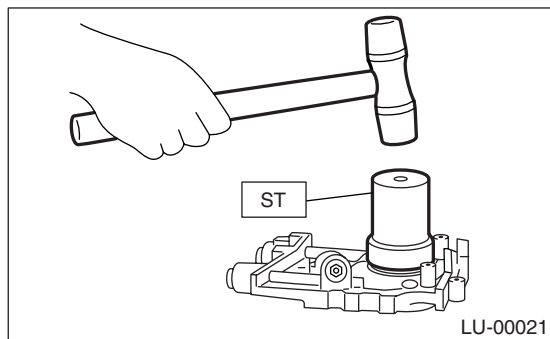
- (A) Oil seal
- (B) Oil pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Oil pump cover
- (F) Relief valve
- (G) Relief valve spring
- (H) Plug
- (I) Gasket

D: ASSEMBLY

1) Install the front oil seal by using ST.
ST 499587100 OIL SEAL INSTALLER

NOTE:

Use a new oil seal.



2) Apply a coat of engine oil to the inner and outer rotors.

3) Install the inner and outer rotors in their original positions.

4) Install the oil relief valve and relief valve spring and plug.

NOTE:

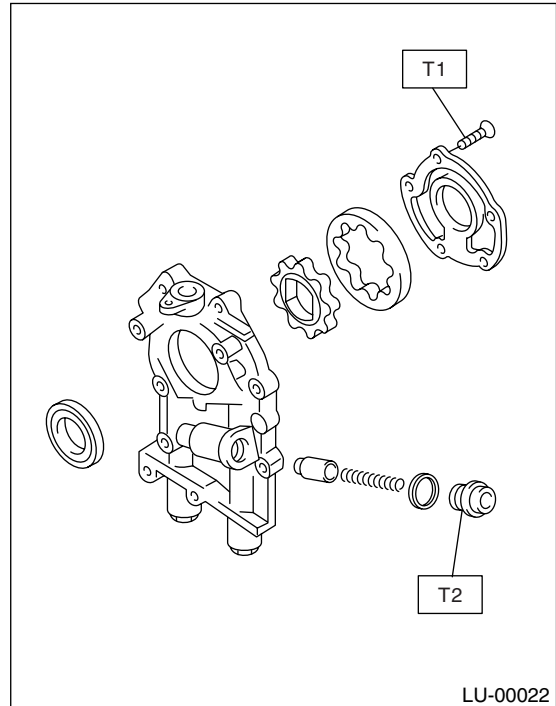
Use a new gasket.

5) Install the oil pump cover.

Tightening torque:

T1: 5 N·m (0.5 kgf-m, 3.6 ft-lb)

T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)

**E: INSPECTION****1. TIP CLEARANCE**

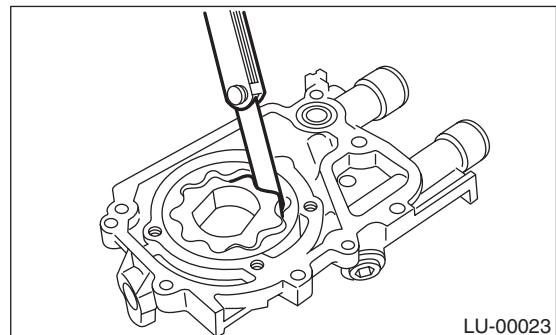
Measure the tip clearance of rotors. If clearance exceeds the limit, replace the rotors as a matched set.

Tip clearance:**Standard**

0.04 — 0.14 mm (0.0016 — 0.0055 in)

Limit

0.18 mm (0.0071 in)



2. CASE CLEARANCE

Measure the clearance between the outer rotor and oil pump rotor housing. If clearance exceeds the limit, replace the rotor.

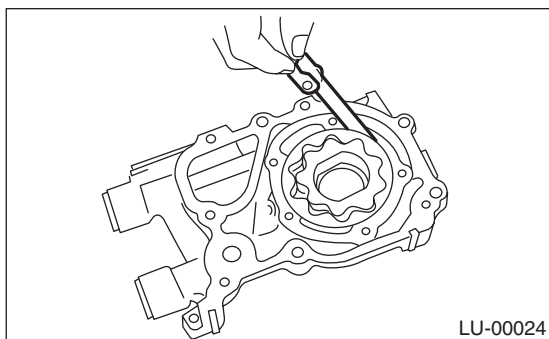
Case clearance:

Standard

0.10 — 0.175 mm (0.0039 — 0.0069 in)

Limit

0.20 mm (0.0079 in)



3. SIDE CLEARANCE

Measure the clearance between the oil pump inner rotor and pump cover. If clearance exceeds the limit, replace the rotor or pump body.

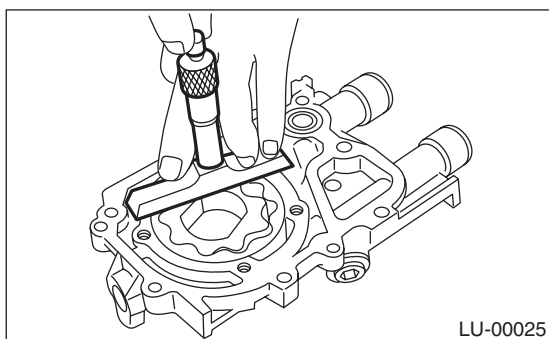
Side clearance:

Standard

0.02 — 0.07 mm (0.0008 — 0.0028 in)

Limit

0.12 mm (0.0047 in)



4. OIL RELIEF VALVE

Check the valve for fitting condition and damage, and the relief valve spring for damage and deterioration. Replace the parts if defective.

Relief valve spring:

Free length

72.8 mm (2.866 in)

Installed length

54.7 mm (2.154 in)

Load when installed

81.3 N (8.29 kgf, 18.24 lb)

5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks, and other faults.

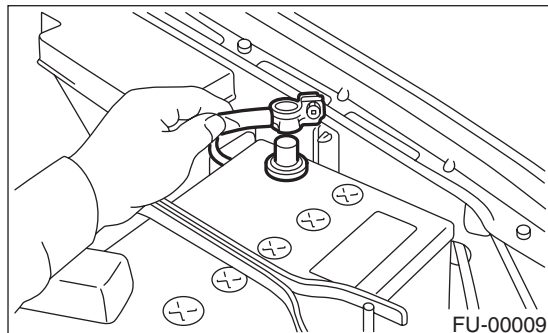
6. OIL SEAL

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

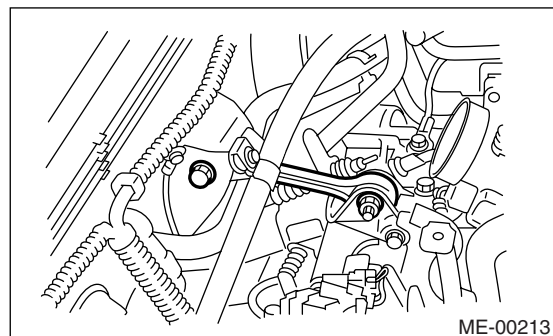
5. Oil Pan and Strainer

A: REMOVAL

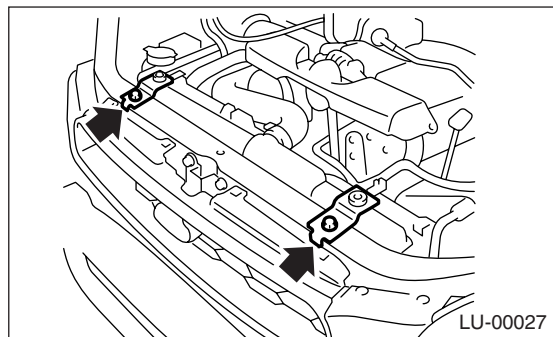
- 1) Set the vehicle on a lift.
- 2) Remove the front wheels.
- 3) Disconnect the ground cable from battery.



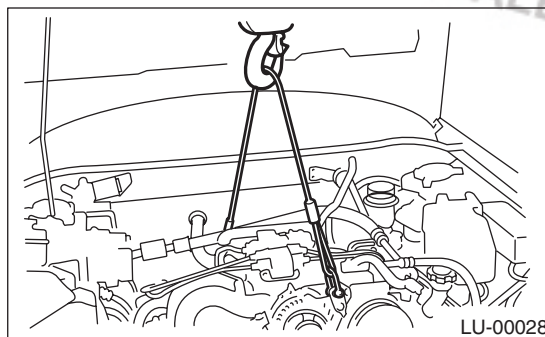
- 4) Remove the air intake duct and air cleaner case.
<Ref. to IN(H4SO)-6, REMOVAL, Air Intake Duct.>
and <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>
- 5) Remove the resonator chamber. <Ref. to IN(H4SO)-7, REMOVAL, Resonator Chamber.>
- 6) Remove the pitching stopper.



- 7) Remove the radiator upper brackets.



- 8) Support the engine with a lifting device and wire ropes.

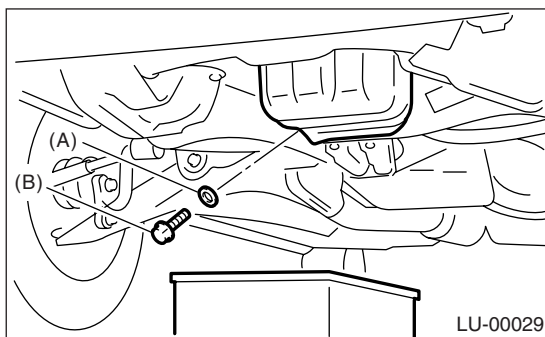


- 9) Lift-up the vehicle.

CAUTION:

When lifting up the vehicle, rise up the wire rope together.

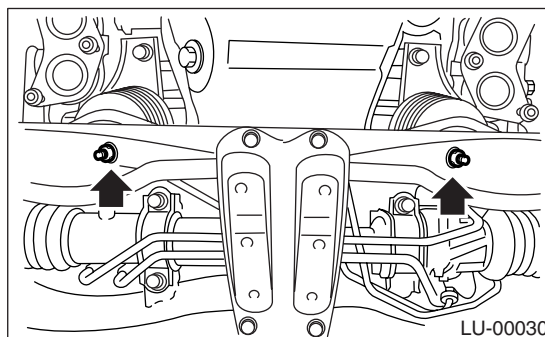
- 10) Remove the under cover.
- 11) Drain the engine oil.
Set a container under the vehicle, and then remove the drain plug from oil pan.



- (A) Gasket
(B) Drain plug

- 12) Remove the front and center exhaust pipes.
<Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>

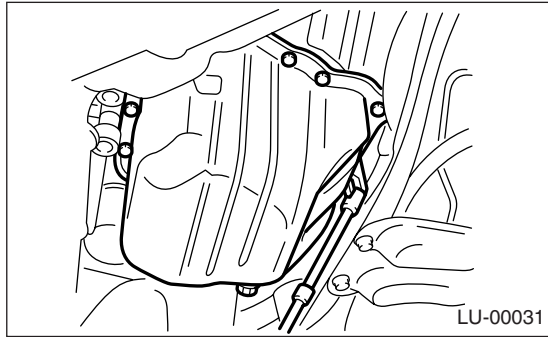
- 13) Remove the nuts which install the front cushion rubber onto front crossmember.



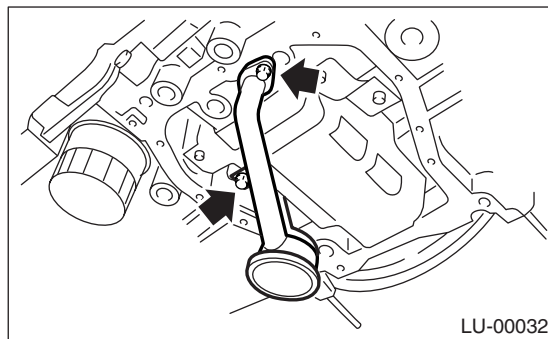
- 14) Remove the bolts which install the oil pan on cylinder block while raising up engine.
- 15) Insert the oil pan cutter blade to the clearance between the cylinder block and oil pan.

CAUTION:

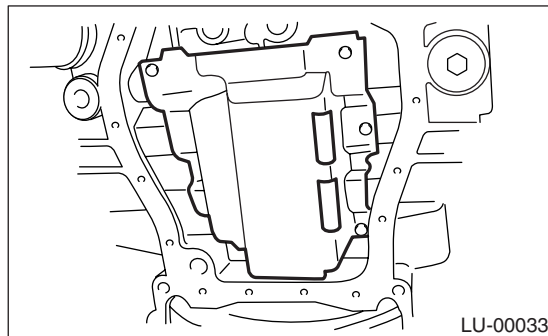
Do not use a screwdriver or similar tool in place of oil pan cutter.



16) Remove the oil strainer.



17) Remove the baffle plate.

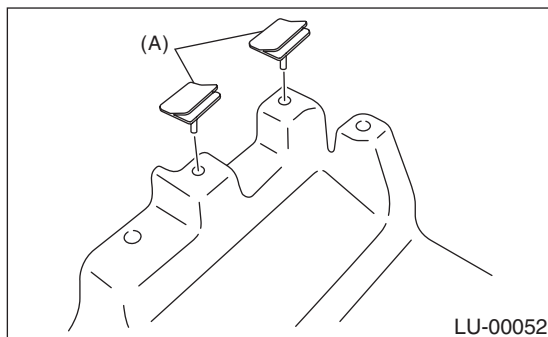


B: INSTALLATION

CAUTION:

Before installing the oil pan, clean the sealant from oil pan and engine block.

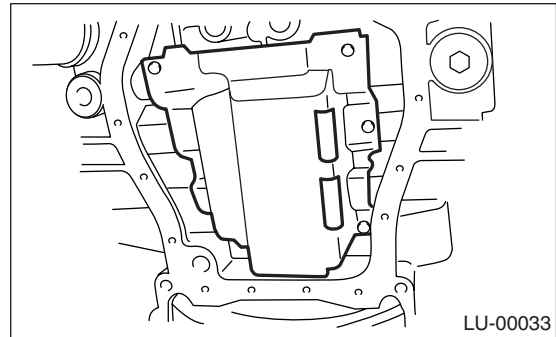
1) Check the seal (A) is securely installed in baffle plate in the direction as shown in the figure.



2) Install the baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



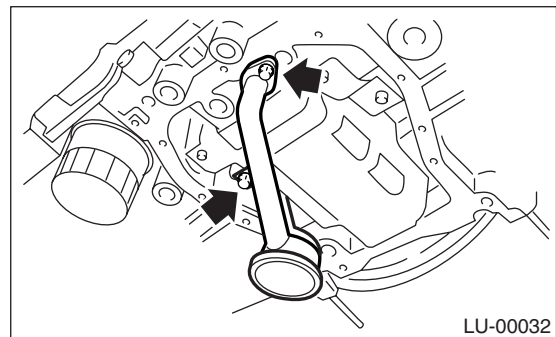
3) Install the oil strainer onto baffle plate.

NOTE:

Replace the O-ring with a new one.

Tightening torque:

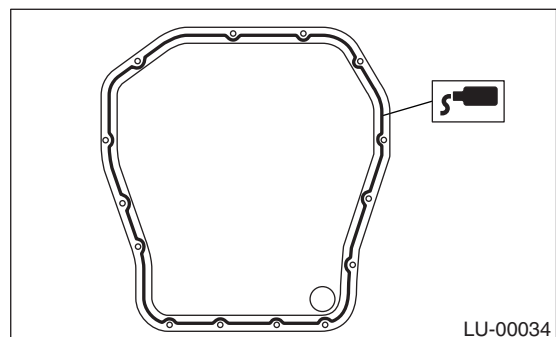
10 N·m (1.0 kgf-m, 7.2 ft-lb)



4) Apply fluid packing to the mating surfaces, and then install the oil pan.

Fluid packing:

THREE BOND 1215 (Part No. 004403007) or equivalent



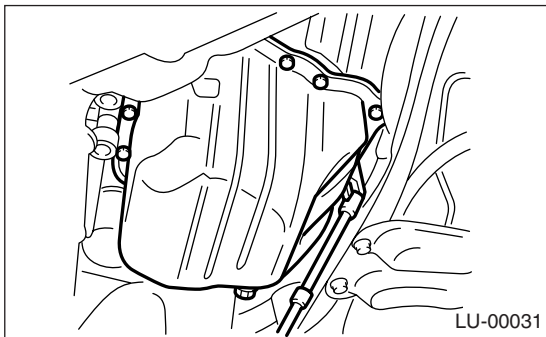
Oil Pan and Strainer

LUBRICATION

5) Tighten the bolts which install the oil pan onto engine block.

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

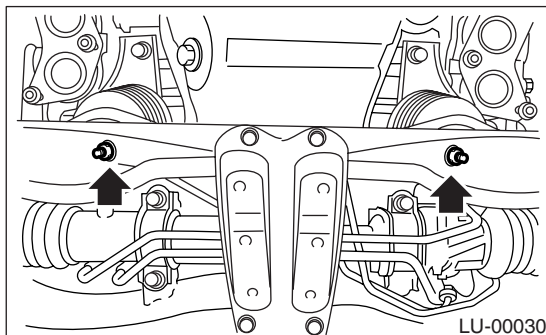


6) Lower the engine onto front crossmember.

7) Tighten the nuts which install the front cushion rubber onto front crossmember.

Tightening torque:

69 N·m (7.0 kgf-m, 50.9 ft-lb)



8) Install the front and center exhaust pipes. <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

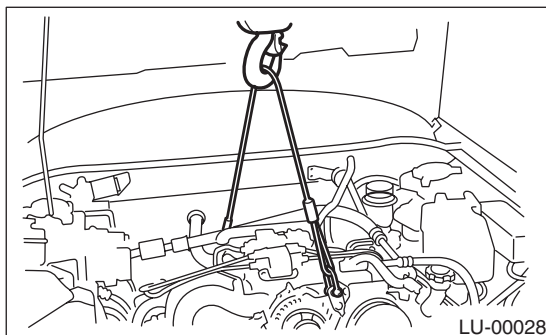
9) Install the under cover.

10) Lower the vehicle.

CAUTION:

When lowering the vehicle, lower the lifting device and wire rope together.

11) Remove the lifting device and steel cables.

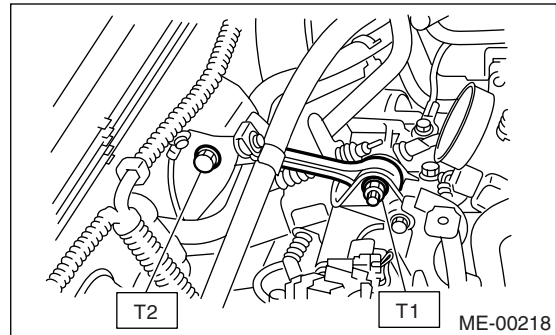


12) Install the pitching stopper.

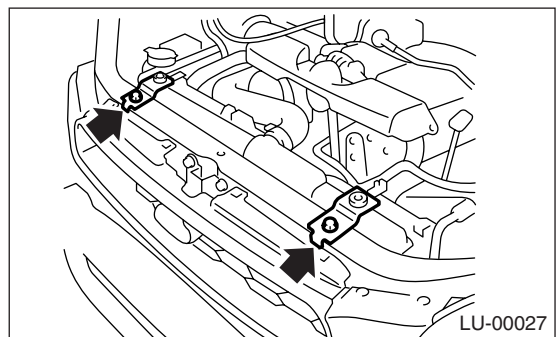
Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



13) Install the radiator upper brackets.

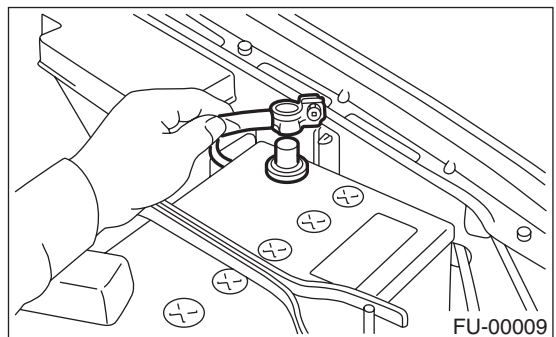


14) Install the resonator chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Resonator Chamber.>

15) Install the air intake duct and air cleaner case. <Ref. to IN(H4SO)-6, INSTALLATION, Air Intake Duct.> and <Ref. to IN(H4SO)-5, INSTALLATION, Air Cleaner Case.>

16) Install the front wheels.

17) Connect the battery ground cable to battery.



18) Fill engine oil. <Ref. to LU(H4SO)-8, INSPECTION, Engine Oil.>

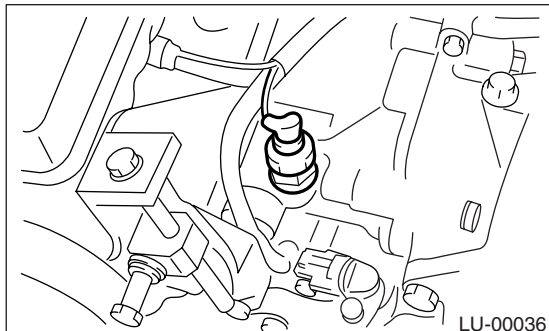
C: INSPECTION

By visual check, make sure the oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

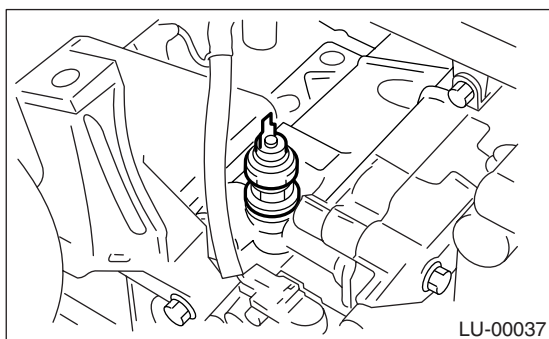
6. Oil Pressure Switch

A: REMOVAL

- 1) Remove the generator from bracket. <Ref. to SC(H4SO)-14, REMOVAL, Generator.>
- 2) Disconnect the terminal from oil pressure switch.



- 3) Remove the oil pressure switch.

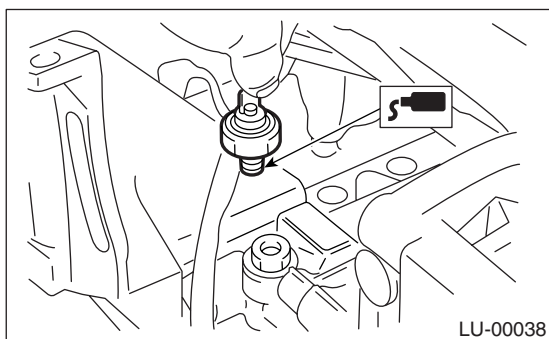


B: INSTALLATION

- 1) Apply fluid packing to the oil pressure switch threads.

Fluid packing:

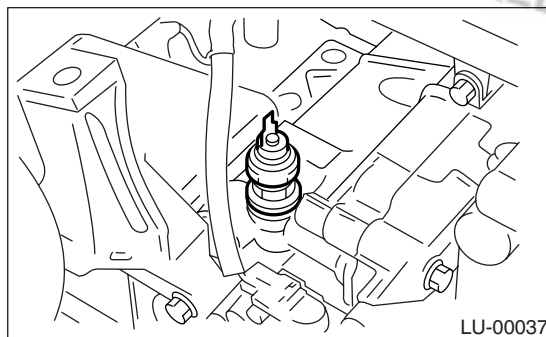
THREE BOND 1324 (Part No. 004403007) or equivalent



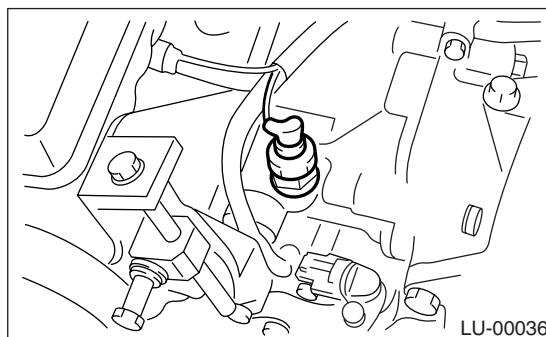
- 2) Install the oil pressure switch onto engine block.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 3) Connect the terminal of oil pressure switch.



- 4) Install the generator on bracket. <Ref. to SC(H4SO)-14, INSTALLATION, Generator.>

C: INSPECTION

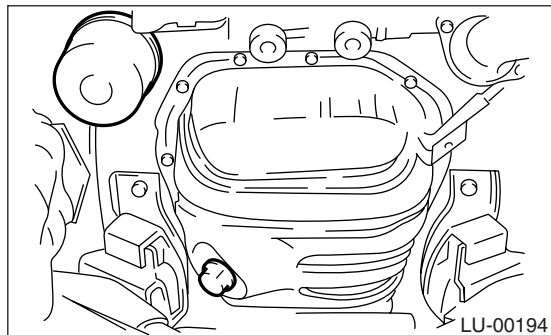
Make sure oil does not leak or seep from the place where the oil pressure switch is installed.

7. Engine Oil Filter

A: REMOVAL

- 1) Lift up the vehicle.
- 2) Remove the under cover.
- 3) Remove the oil filter with ST.

ST 498547000	OIL FILTER WRENCH (Outer diameter: 80 mm (3.15 in))
ST 18332AA000	OIL FILTER WRENCH (Outer diameter: 68 mm (2.68 in))
ST 18332AA010	OIL FILTER WRENCH (Outer diameter: 65 mm (2.56 in))



B: INSTALLATION

- 1) Get a new oil filter and apply a thin coat of engine oil to the seal rubber.
- 2) Install the oil filter by turning it by hand, being careful not to damage seal rubber.
 - Tighten the oil filter 80 mm (3.15 in) or 65 mm (2.56 in) in diameter by approx. 2/3 — 3/4 rotation more after the seal rubber of oil filter comes in contact with cylinder block or oil cooler.
 - Tighten the oil filter 68 mm (2.68 in) in diameter by approx. 1 rotation more after the seal rubber of oil filter comes in contact with cylinder block or oil cooler.

CAUTION:

Do not tighten excessively, or oil may leak.

C: INSPECTION

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

NOTE:

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

- 2) Check the engine oil level. <Ref. to LU(H4SO)-8, INSPECTION, Engine Oil.>

8. Engine Lubrication System Trouble in General

A: INSPECTION

Before performing diagnostics, make sure the engine oil level is correct and no oil leakage exists.

Trouble	Possible cause		Corrective action
1. Warning light remains on.	1) Oil pressure switch failure	Cracked diaphragm or oil leakage within switch	Replace.
		Broken spring or seized contacts	Replace.
	2) Low oil pressure	Clogged oil filter	Replace.
		Malfunction of oil by-pass valve of oil filter	Clean or replace.
		Malfunction of oil relief valve of oil pump	Clean or replace.
		Clogged oil passage	Clean.
		Excessive tip clearance and side clearance of oil pump rotor and gear	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil	Replenish.
		Broken pipe of oil strainer	Replace.
		Stuck oil pump rotor	Replace.
2. Warning light does not go on.	1) Malfunction of combination meter		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact at terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed in 1.— 2).

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MECHANICAL

General Description

MECHANICAL

1. General Description

A: SPECIFICATIONS

Engine	Model			2.5 L
	Type			Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine
	Valve arrangement			Belt driven, single over-head camshaft, 4-valve/cylinder
	Bore × Stroke			mm (in)
	Displacement			cm ³ (cu in)
	Compression ratio			10.0
	Compression pressure (at 350 rpm)			kPa (kg/cm ² , psi)
	Number of piston rings			Pressure ring: 2, Oil ring: 1
	Intake valve timing	Opening		1° BTDC
		Closing		51° ABDC
	Exhaust valve timing	Opening		50° BBDC
		Closing		6° ATDC
	Valve clearance	STD	Intake	mm (in)
			Exhaust	mm (in)
		Limit	Intake	mm (in)
			Exhaust	mm (in)
Idling speed [At neutral position on MT, or “P” or “N” position on AT]		rpm	No load	
			A/C ON	
Firing order				
Ignition timing				

NOTE:

STD: Standard I.D.: Inner Diameter O.D.: Outer Diameter US: Undersize OS: Oversize

Belt tensioner adjuster	Protrusion of adjuster rod		5.2 — 6.2 mm (0.205 — 0.244 in)		
Belt tensioner	Spacer O.D.		17.955 — 17.975 mm (0.7069 — 0.7077 in)		
	Tensioner bush I.D.		18.00 — 18.08 mm (0.7087 — 0.7118 in)		
	Clearance between spacer and bush	STD	0.025 — 0.125 mm (0.0010 — 0.0049 in)		
		Limit	0.175 mm (0.0069 in)		
	Side clearance of spacer	STD	0.20 — 0.55 mm (0.0079 — 0.0217 in)		
		Limit	0.81 mm (0.0319 in)		
Valve rocker arm	Clearance between shaft and arm	STD	0.020 — 0.054 mm (0.0008 — 0.0021 in)		
		Limit	0.10 mm (0.0039 in)		
Camshaft	Bend limit		0.025 mm (0.0010 in)		
	Thrust clearance	STD	0.030 — 0.090 mm (0.0012 — 0.0035 in)		
		Limit	0.10 mm (0.0039 in)		
	Cam lobe height	Intake	STD	39.485 — 39.585 mm (1.5545 — 1.5585 in)	
			Limit	39.385 mm (1.5506 in)	
		Exhaust	STD	39.257 — 39.357 mm (1.5455 — 1.5495 in)	
			Limit	39.157 mm (1.5416 in)	
	Camshaft journal O.D.		31.928 — 31.945 mm (1.2570 — 1.2577 in)		
	Camshaft journal hole I.D.		32.000 — 32.018 mm (1.2598 — 1.2605 in)		
	Oil clearance	STD	0.055 — 0.090 mm (0.0022 — 0.0035 in)		
Limit		0.10 mm (0.0039 in)			

ME(H4SO)-2

General Description

MECHANICAL

Cylinder head	Surface warpage limit			0.05 mm (0.0020 in)
	Surface grinding limit			0.1 mm (0.004 in)
	Standard height			97.5 mm (3.84 in)
Valve seat	Refacing angle			90°
	Contacting width	Intake	STD	1.0 mm (0.039 in)
			Limit	1.7 mm (0.067 in)
		Exhaust	STD	1.5 mm (0.059 in)
			Limit	2.2 mm (0.087 in)
Valve guide	Inner diameter			6.000 — 6.012 mm (0.2362 — 0.2367 in)
	Protrusion above head		Intake	20.0 — 20.5 mm (0.787 — 0.807 in)
			Exhaust	16.5 — 17.0 mm (0.650 — 0.669 in)
Valve	Head edge thickness	Intake	STD	1.0 mm (0.039 in)
			Limit	0.6 mm (0.024 in)
		Exhaust	STD	1.2 mm (0.047 in)
			Limit	0.6 mm (0.024 in)
	Stem diameter		Intake	5.950 — 5.965 mm (0.2343 — 0.2348 in)
			Exhaust	5.945 — 5.960 mm (0.2341 — 0.2346 in)
	Stem oil clearance	STD	Intake	0.035 — 0.062 mm (0.0014 — 0.0024 in)
			Exhaust	0.040 — 0.067 mm (0.0016 — 0.0026 in)
		Limit	—	0.15 mm (0.0059 in)
	Overall length		Intake	120.6 mm (4.75 in)
Exhaust			121.7 mm (4.79 in)	
Valve spring	Free length			54.30 mm (2.1378 in)
	Squareness			2.5°, 2.4 mm (0.094 in)
	Tension/spring height		Set	214 — 246 N (22 — 25 kgf, 48 — 55 lb)/ 45.0 mm (1.772 in)
			Lift	526 — 582 N (54 — 59 kgf, 119 — 130 lb)/ 34.7 mm (1.366 in)
Cylinder block	Surface warpage limit (mating with cylinder head)			0.05 mm (0.0020 in)
	Surface grinding limit			0.1 mm (0.004 in)
	Standard height			201.0 mm (7.91 in)
	Cylinder bore	STD	A	99.505 — 99.515 mm (3.9175 — 3.9179 in)
			B	99.495 — 99.505 mm (3.9171 — 3.9175 in)
	Taper		STD	0.015 mm (0.0006 in)
			Limit	0.050 mm (0.0020 in)
	Out-of-roundness		STD	0.010 mm (0.0004 in)
			Limit	0.050 mm (0.0020 in)
	Piston clearance		STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
Limit			0.050 mm (0.0020 in)	
Enlarging (boring) limit			0.5 mm (0.020 in)	
Piston	Outer diameter	STD	A	99.485 — 99.495 mm (3.9167 — 3.9171 in)
			B	99.475 — 99.485 mm (3.9163 — 3.9167 in)
		0.25 mm (0.0098 in) OS		99.725 — 99.735 mm (3.9262 — 3.9266 in)
		0.50 mm (0.0197 in) OS		99.975 — 99.985 mm (3.9360 — 3.9364 in)
	Standard inner diameter of piston pin hole			23.000 — 23.006 mm (0.9055 — 0.9057 in)
Piston pin	Outer diameter			22.994 — 23.000 mm (0.9053 — 0.9055 in)
	Standard clearance between piston pin and hole in piston			0.004 — 0.008 mm (0.0002 — 0.0003 in)
	Degree of fit			Piston pin must be fitted into position with thumb at 20°C (68°F).

General Description

MECHANICAL

Piston ring	Piston ring gap	Top ring	STD	0.20 — 0.35 mm (0.0079 — 0.0138 in)
			Limit	1.0 mm (0.039 in)
		Second ring	STD	0.35 — 0.50 mm (0.0138 — 0.0197 in)
			Limit	1.0 mm (0.039 in)
		Oil ring	STD	0.20 — 0.50 mm (0.0079 — 0.0197 in)
			Limit	1.5 mm (0.059 in)
	Clearance between piston ring and piston ring groove	Top ring	STD	0.040 — 0.080 mm (0.0016 — 0.0031 in)
			Limit	0.15 mm (0.0059 in)
Second ring		STD	0.030 — 0.070 mm (0.0012 — 0.0028 in)	
		Limit	0.15 mm (0.0059 in)	
Connecting rod	Bend twist per 100 mm (3.94 in) in length	Limit	0.10 mm (0.0039 in)	
	Side clearance	STD	0.070 — 0.330 mm (0.0028 — 0.0130 in)	
		Limit	0.4 mm (0.016 in)	
Connecting rod bearing	Oil clearance	STD	0.012 — 0.038 mm (0.0005 — 0.0014 in)	
		Limit	0.05 mm (0.0020 in)	
	Thickness at center portion	STD	1.490 — 1.502 mm (0.0587 — 0.0591 in)	
		0.03 mm (0.0012 in) US	1.504 — 1.512 mm (0.0592 — 0.0595 in)	
		0.05 mm (0.0020 in) US	1.514 — 1.522 mm (0.0596 — 0.0599 in)	
		0.25 mm (0.0098 in) US	1.614 — 1.622 mm (0.0635 — 0.0639 in)	
Connecting rod bushing	Clearance between piston pin and bushing	STD	0 — 0.022 mm (0 — 0.0009 in)	
		Limit	0.030 mm (0.0012 in)	

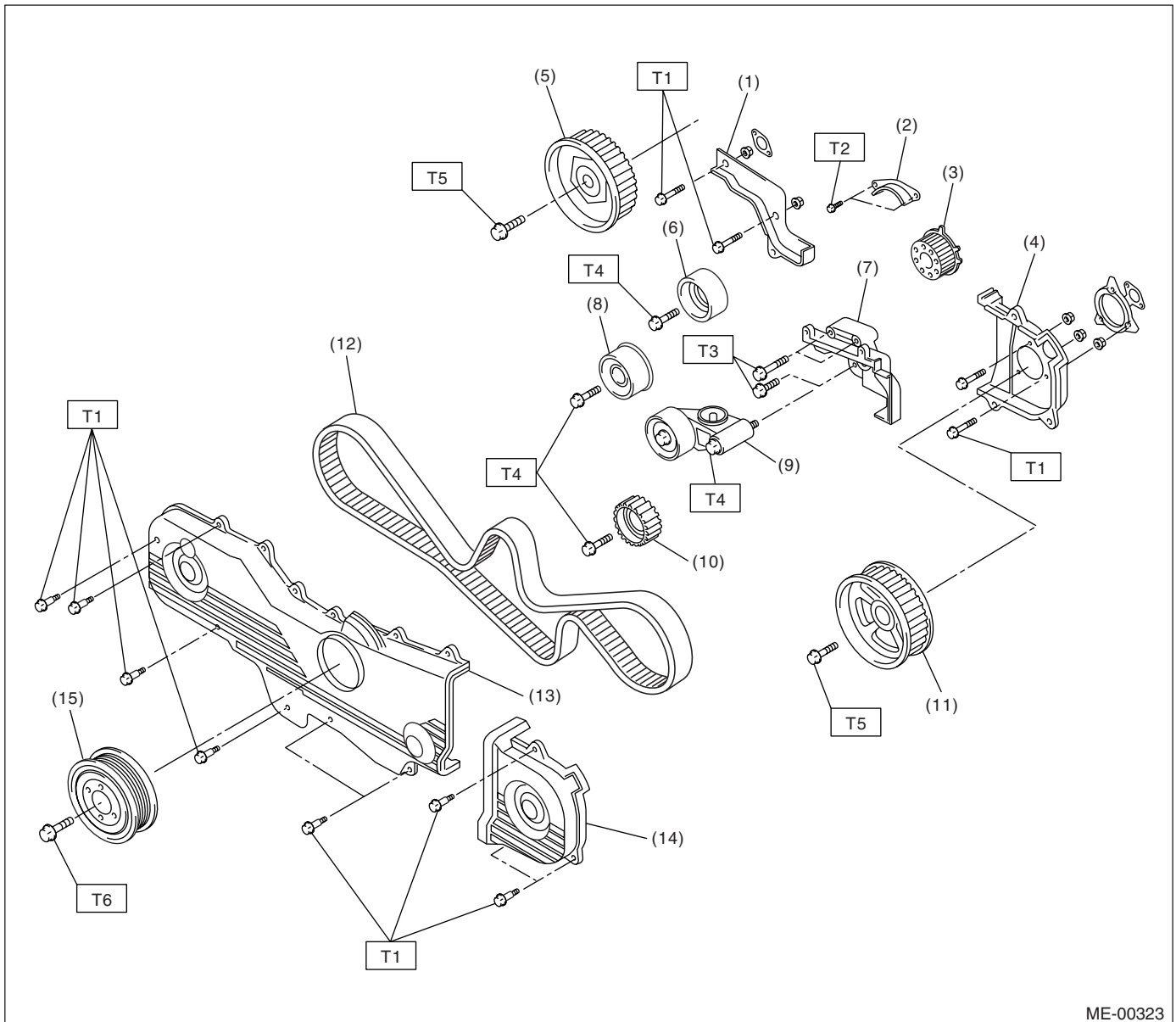
General Description

MECHANICAL

Crankshaft	Bend limit		0.035 mm (0.0014 in)		
	Crank pin and crank journal	Out-of-roundness	0.020 mm (0.0008 in) or less		
		Grinding limit	0.250 mm (0.0098 in)		
	Crank pin outer diameter		STD	51.984 — 52.000 mm (2.0466 — 2.0472 in)	
			0.03 mm (0.0012 in) US	51.954 — 51.970 mm (2.0454 — 2.0461 in)	
			0.05 mm (0.0020 in) US	51.934 — 51.950 mm (2.0446 — 2.0453 in)	
			0.25 mm (0.0098 in) US	51.734 — 51.750 mm (2.0368 — 2.0374 in)	
	Crank journal outer diameter	#1, #3	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)	
			0.03 mm (0.0012 in) US	59.962 — 59.978 mm (2.3607 — 2.3613 in)	
			0.05 mm (0.0020 in) US	59.942 — 59.958 mm (2.3599 — 2.3605 in)	
			0.25 mm (0.0098 in) US	59.742 — 59.758 mm (2.3520 — 2.3527 in)	
		#2, #4, #5	STD	59.992 — 60.008 mm (2.3619 — 2.3625 in)	
			0.03 mm (0.0012 in) US	59.962 — 59.978 mm (2.3607 — 2.3613 in)	
			0.05 mm (0.0020 in) US	59.942 — 59.958 mm (2.3599 — 2.3605 in)	
			0.25 mm (0.0098 in) US	59.742 — 59.758 mm (2.3520 — 2.3527 in)	
	Thrust clearance		STD	0.030 — 0.115 mm (0.0012 — 0.0045 in)	
			Limit	0.25 mm (0.0098 in)	
	Oil clearance		#1	STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
				Limit	0.040 mm (0.0016 in)
			#2	STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
				Limit	0.045 mm (0.0018 in)
			#3	STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
				Limit	0.040 mm (0.0016 in)
			#4	STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
				Limit	0.045 mm (0.0018 in)
			#5	STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
				Limit	0.040 mm (0.0016 in)
Crankshaft bearing	Crankshaft bearing thickness	#1, #3	STD	1.998 — 2.011 mm (0.0787 — 0.0792 in)	
			0.03 mm (0.0012 in) US	2.017 — 2.020 mm (0.0794 — 0.0795 in)	
			0.05 mm (0.0020 in) US	2.027 — 2.030 mm (0.0798 — 0.0799 in)	
			0.25 mm (0.0098 in) US	2.127 — 2.130 mm (0.0837 — 0.0839 in)	
		#2, #4, #5	STD	2.000 — 2.013 mm (0.0787 — 0.0793 in)	
			0.03 mm (0.0012 in) US	2.019 — 2.022 mm (0.0795 — 0.0796 in)	
			0.05 mm (0.0020 in) US	2.029 — 2.032 mm (0.0799 — 0.0800 in)	
			0.25 mm (0.0098 in) US	2.129 — 2.132 mm (0.0838 — 0.0839 in)	

B: COMPONENT

1. TIMING BELT



ME-00323

(1) Timing belt cover No. 2 (RH)	(9) Automatic belt tension adjuster ASSY
(2) Timing belt guide (MT model)	(10) Belt idler No. 2
(3) Crankshaft sprocket	(11) Camshaft sprocket No. 2
(4) Timing belt cover No. 2 (LH)	(12) Timing belt
(5) Camshaft sprocket No. 1	(13) Front timing belt cover
(6) Belt idler (No. 1)	(14) Timing belt cover (LH)
(7) Tensioner bracket	(15) Crankshaft pulley
(8) Belt idler (No. 2)	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

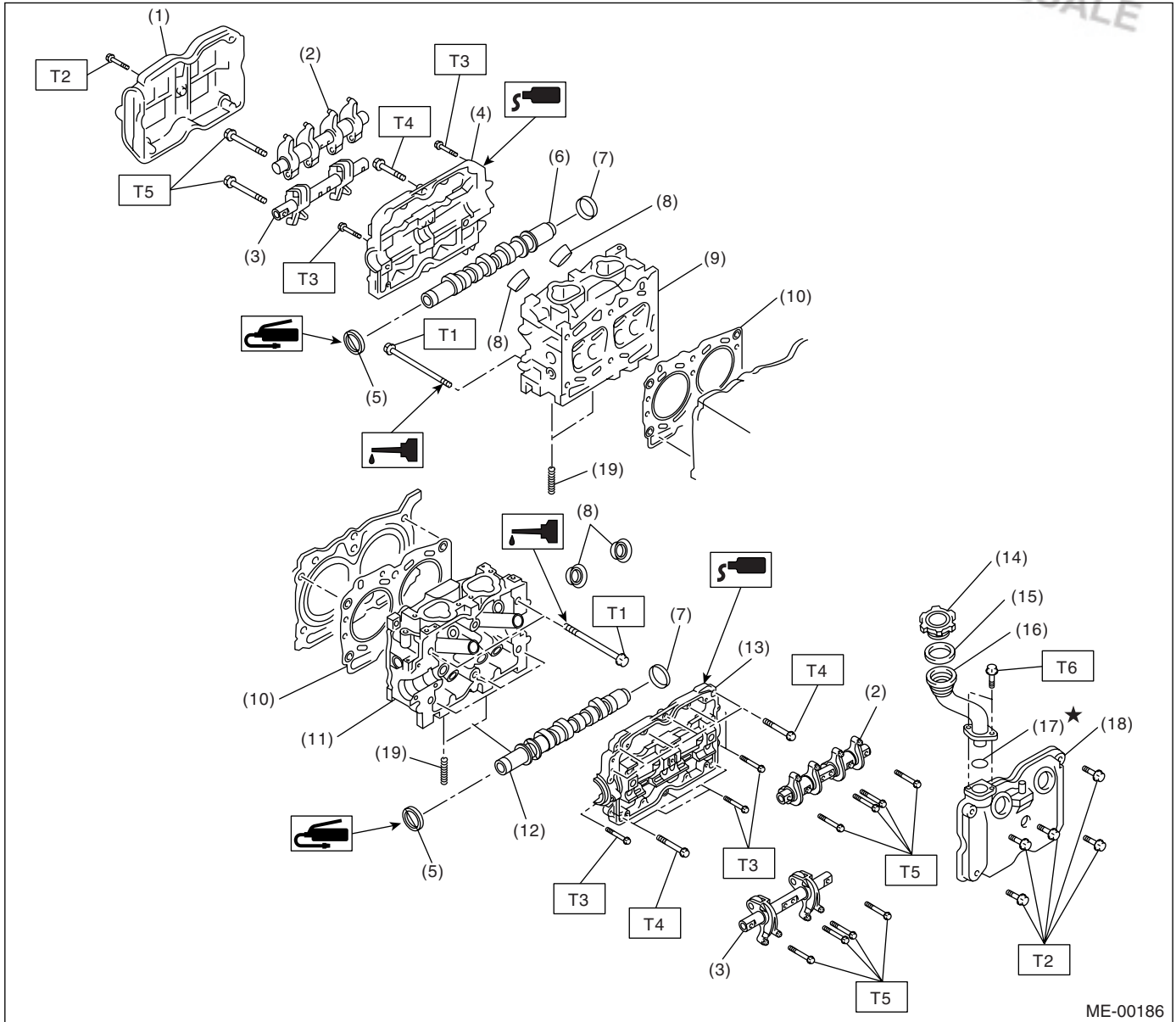
T3: 25 (2.5, 18.1)

T4: 39 (4.0, 28.9)

T5: 78 (8.0, 57.9)

T6: <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>

2. CYLINDER HEAD AND CAMSHAFT



ME-00186

(1) Rocker cover (RH)	(11) Cylinder head (LH)
(2) Intake valve rocker ASSY	(12) Camshaft (LH)
(3) Exhaust valve rocker ASSY	(13) Camshaft cap (LH)
(4) Camshaft cap (RH)	(14) Oil filler cap
(5) Oil seal	(15) Gasket
(6) Camshaft (RH)	(16) Oil filler duct
(7) Plug	(17) O-ring
(8) Spark plug pipe gasket	(18) Rocker cover (LH)
(9) Cylinder head (RH)	(19) Stud bolt
(10) Cylinder head gasket	

Tightening torque: N·m (kgf-m, ft-lb)

T1: <Ref. to ME(H4SO)-58,
INSTALLATION, Cylinder Head
Assembly.>

T2: 5 (0.5, 3.6)

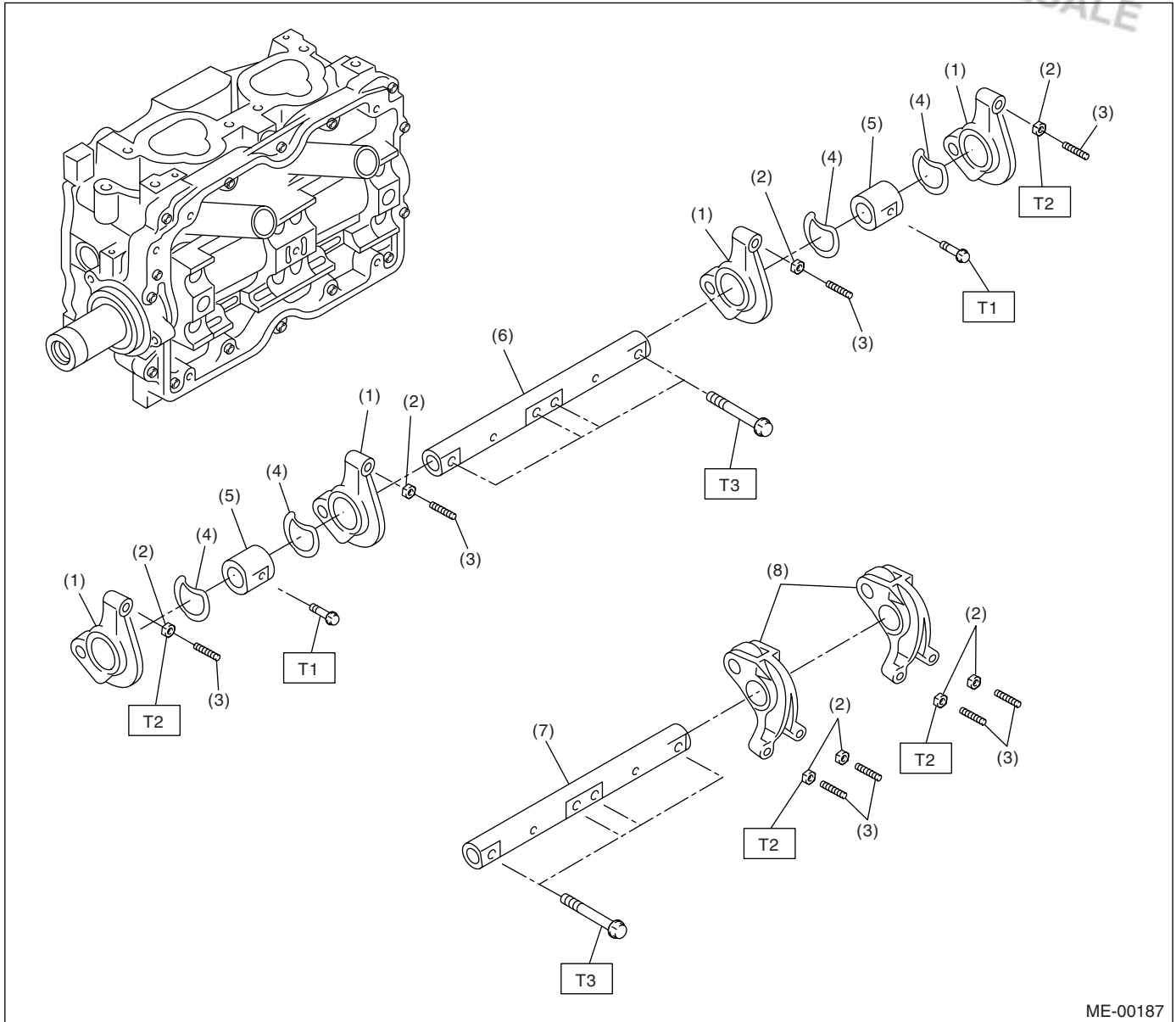
T3: 10 (1.0, 7.2)

T4: 18 (1.8, 13.0)

T5: 25 (2.5, 18.1)

T6: 6.4 (0.65, 4.7)

3. VALVE ROCKER ASSEMBLY

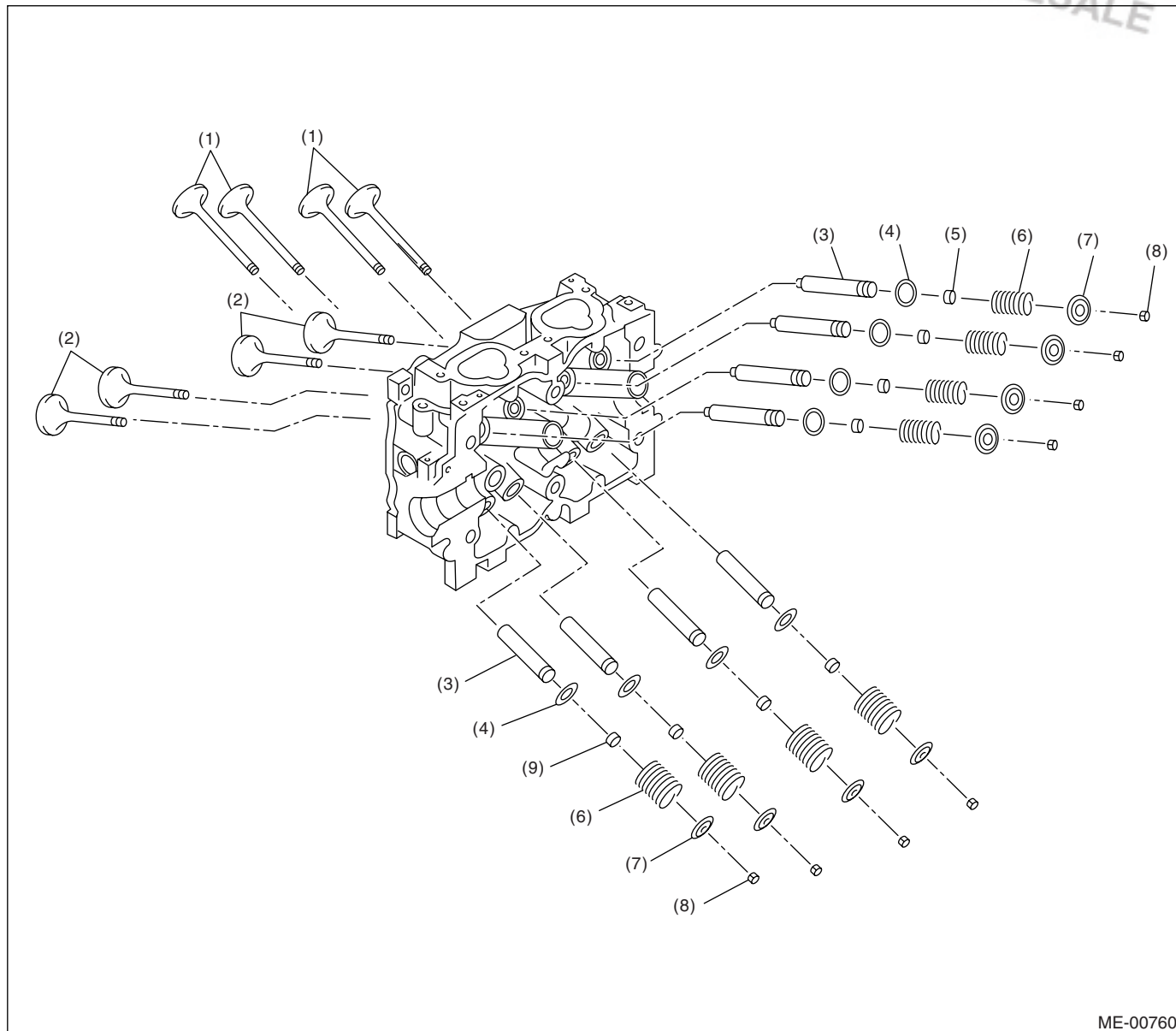


ME-00187

(1) Intake valve rocker arm	(5) Rocker shaft support
(2) Valve rocker nut	(6) Intake rocker shaft
(3) Valve rocker adjust screw	(7) Exhaust rocker shaft
(4) Spring	(8) Exhaust valve rocker arm

Tightening torque: N·m (kgf-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 10 (1.0, 7.2)
T3: 25 (2.5, 18.1)

4. CYLINDER HEAD AND VALVE ASSEMBLY



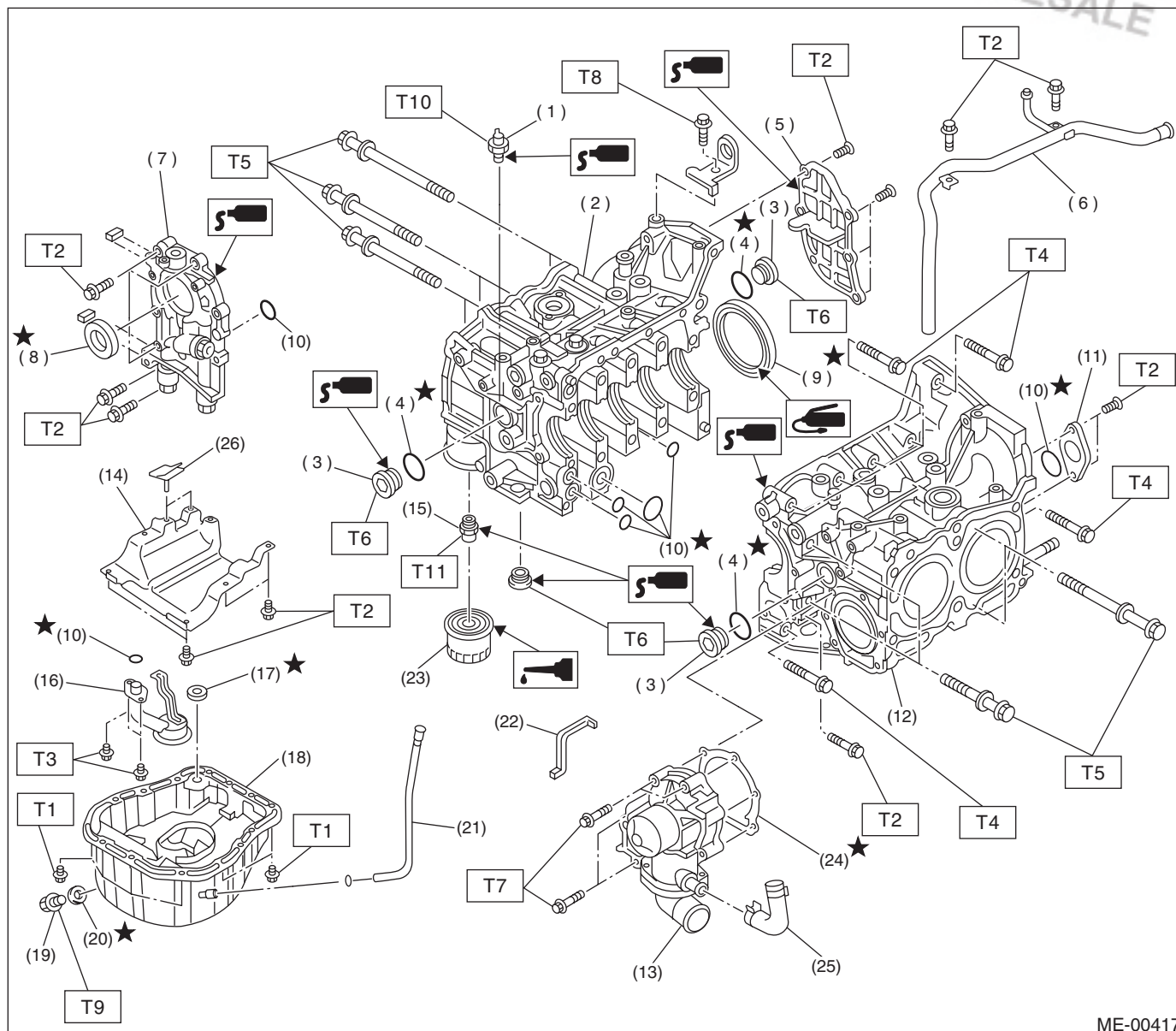
ME-00760

- (1) Exhaust valve
- (2) Intake valve
- (3) Valve guide

- (4) Valve spring seat
- (5) Intake valve oil seal
- (6) Valve spring

- (7) Retainer
- (8) Retainer key
- (9) Exhaust valve oil seal

5. CYLINDER BLOCK



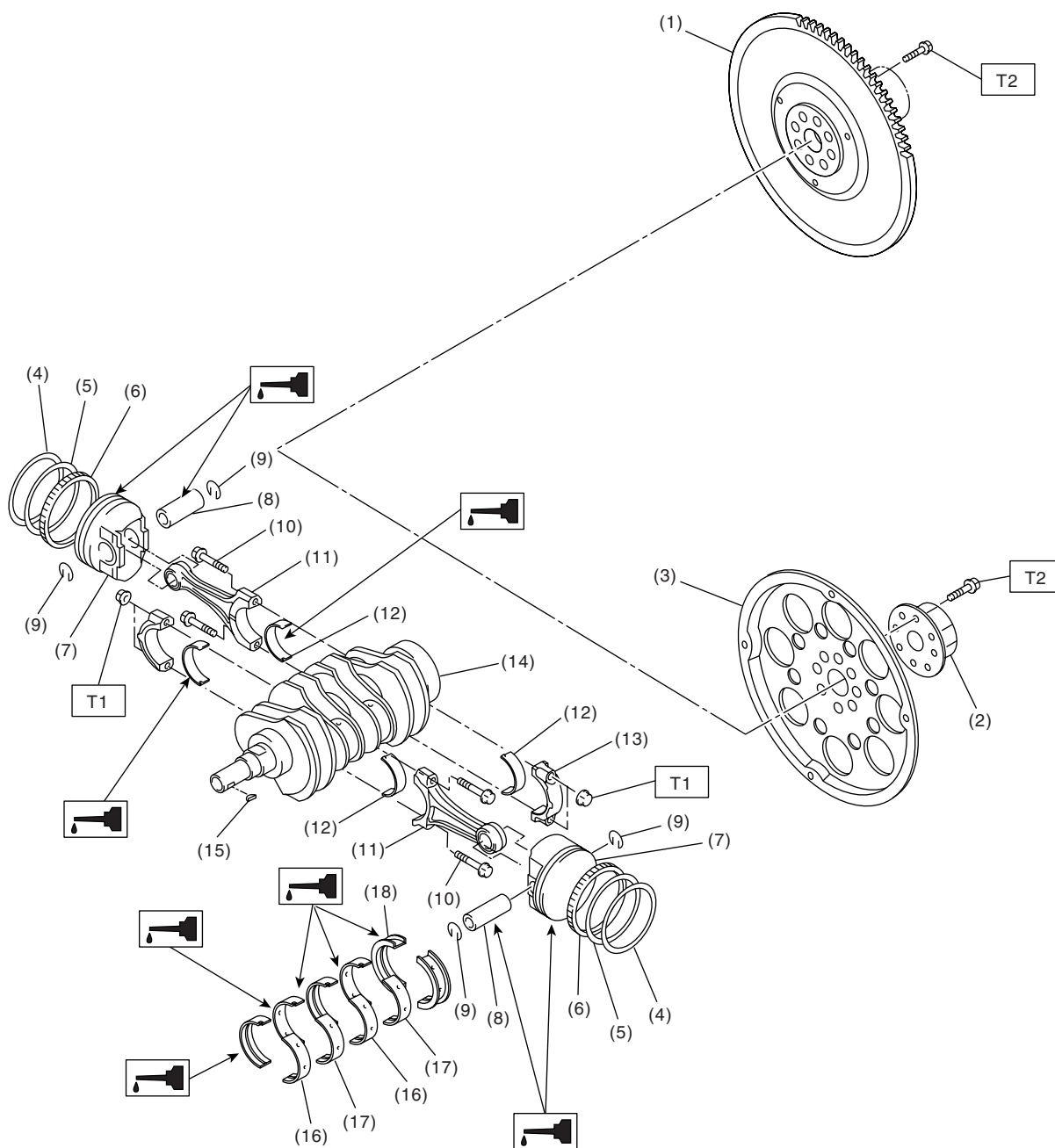
ME-00417

(1) Oil pressure switch	(14) Baffle plate
(2) Cylinder block (RH)	(15) Oil filter connector
(3) Service hole plug	(16) Oil strainer
(4) Gasket	(17) Gasket
(5) Oil separator cover	(18) Oil pan
(6) Water by-pass pipe	(19) Drain plug
(7) Oil pump	(20) Metal gasket
(8) Front oil seal	(21) Oil level gauge guide
(9) Rear oil seal	(22) Water pump sealing
(10) O-ring	(23) Oil filter
(11) Service hole cover	(24) Gasket
(12) Cylinder block (LH)	(25) Water pump hose
(13) Water pump	(26) Seal

Tightening torque: N·m (kgf-m, ft-lb)

- T1: 5 (0.5, 3.6)**
T2: 6.4 (0.65, 4.7)
T3: 10 (1.0, 7.2)
T4: 25 (2.5, 18.1)
T5: <Ref. to ME(H4SO)-68, INSTALLATION, Cylinder Block.>
T6: 70 (7.1, 50.6)
T7: First 12 (1.2, 8.7)
Second 12 (1.2, 8.7)
T8: 16 (1.6, 11.6)
T9: 44 (4.5, 33)
T10: 25 (2.5, 18.1)
T11: 45 (4.6, 33.3)

6. CRANKSHAFT AND PISTON



ME-00190

General Description

MECHANICAL

- (1) Flywheel (MT model)

(2) Reinforcement (AT model)

(3) Drive plate (AT model)

(4) Top ring

(5) Second ring

(6) Oil ring

(7) Piston

(8) Piston pin
- (9) Circlip

(10) Connecting rod bolt

(11) Connecting rod

(12) Connecting rod bearing

(13) Connecting rod cap

(14) Crankshaft

(15) Woodruff key

(16) Crankshaft bearing #1, #3

- (17) Crankshaft bearing #2, #4

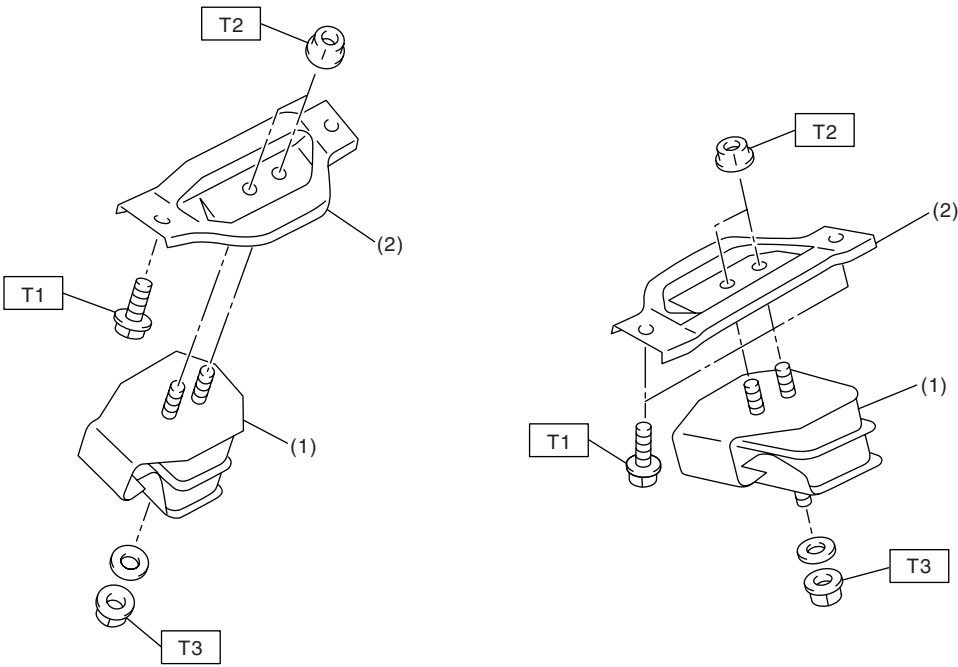
(18) Crankshaft bearing #5

Tightening torque: N·m (kgf-m, ft-lb)

T1: 45 (4.6, 33.3)

T2: 72 (7.3, 52.8)

7. ENGINE MOUNTING



ME-00413

- (1) Front cushion rubber

(2) Front engine mounting bracket

Tightening torque: N·m (kgf-m, ft-lb)

T1: 35 (3.6, 25.8)

T2: 42 (4.3, 31.0)

T3: 85 (8.7, 63)

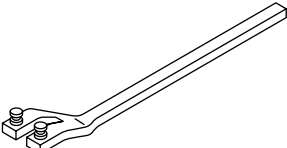
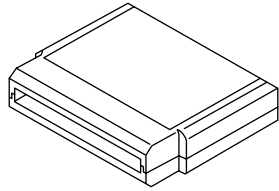
C: CAUTION

- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.
- All parts should be thoroughly cleaned, paying special attention to the engine oil passages, pistons and bearings.

- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
- Be careful not to let oil, grease or coolant contact the timing belt, clutch disc and flywheel.
- All removed parts, if to be reused, should be re-installed in the original positions and directions.
- Bolts, nuts and washers should be replaced with new ones as required.
- Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.
- Remove or install engine in an area where chain hoists, lifting devices, etc. are available for ready use.
- Be sure not to damage coated surfaces of body panels with tools or stain seats and windows with coolant or oil. Place a cover over fenders, as required, for protection.
- Prior to starting work, prepare the following:
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
- Lift-up or lower the vehicle when necessary. Make sure to support the correct positions.

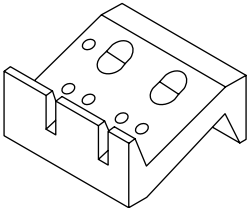
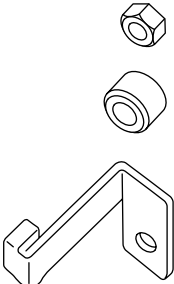
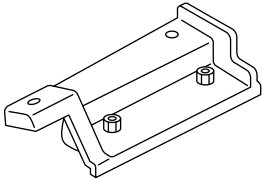
D: PREPARATION TOOL

1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18231AA010	18231AA010	CAMSHAFT SPROCKET WRENCH	• Used for removing and installing camshaft sprocket. (LH side) • Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.
 ST24082AA230	24082AA230	CARTRIDGE	Troubleshooting for electrical systems.

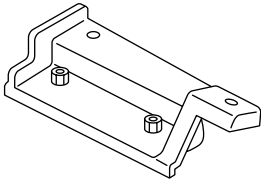
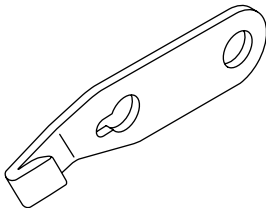
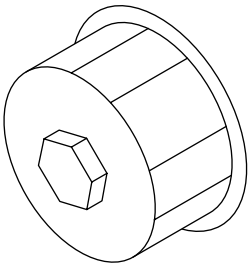
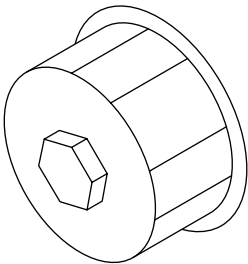
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST22771AA030	22771AA030	SUBARU SELECT MONI- TOR KIT	Troubleshooting for electrical systems.
 ST-498267800	498267800	CYLINDER HEAD TABLE	- Used for replacing valve guides. - Used for removing and installing valve springs.
 ST-498277200	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817100).

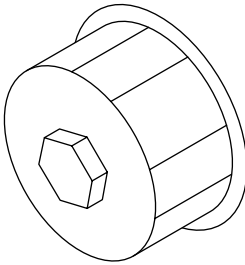
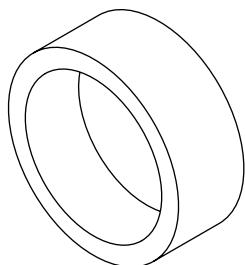
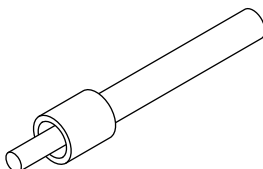
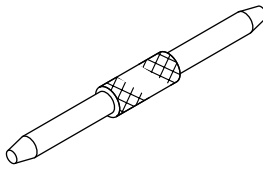
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817100).
 ST-498497100	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.
 ST-498547000	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 80 mm (3.15 in))
 ST18332AA000	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 68 mm (2.68 in))

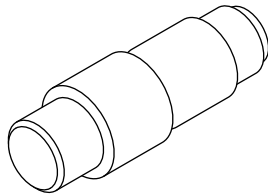
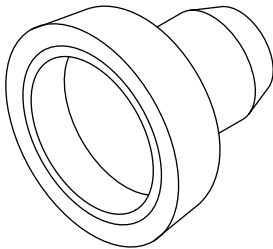
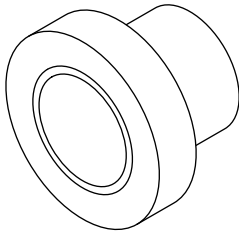
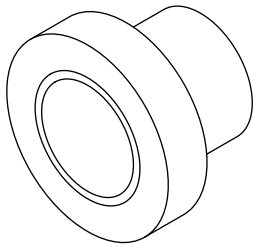
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18332AA010	18332AA010	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 65 mm (2.56 in))
 ST-498747300	498747300	PISTON GUIDE	Used for installing piston in cylinder. (2.5 L model)
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 ST-499017100	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.

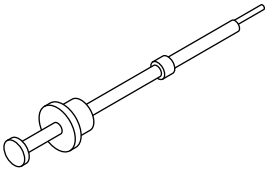
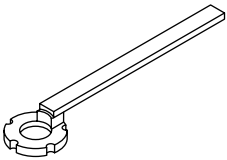
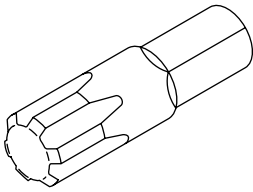
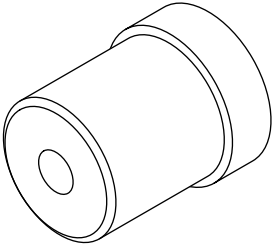
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499037100	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	- Used for installing crankshaft oil seal. - Used with CRANKSHAFT OIL SEAL GUIDE (499597100).
 ST-499587500	499587500	OIL SEAL INSTALLER	- Used for installing camshaft oil seal. - Used with OIL SEAL GUIDE (499597000).
 ST-499587700	499587700	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug.

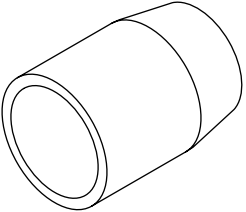
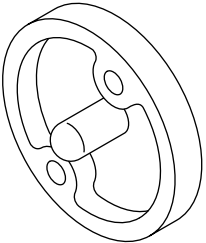
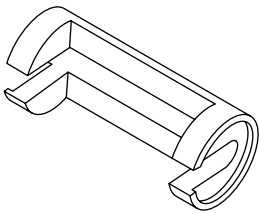
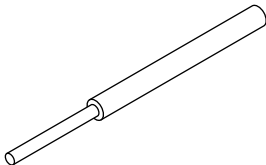
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499097700	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 ST-499207400	499207400	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket. (RH side)
 ST-499497000	499497000	TORX® PLUS	Used for removing and installing camshaft cap.
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

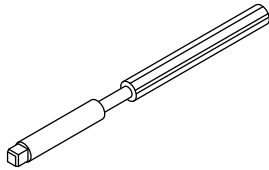
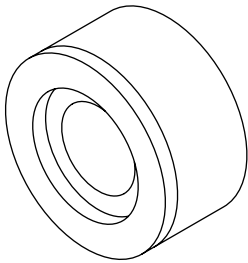
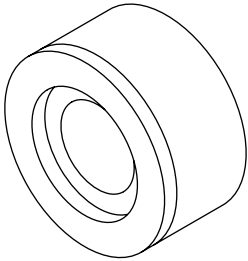
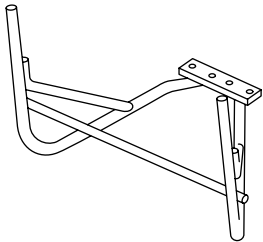
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499597000	499597000	OIL SEAL GUIDE	- Used for installing camshaft oil seal. - Used with CAMSHAFT OIL SEAL INSTALLER (499587500).
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	- Used for installing crankshaft oil seal. - Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.

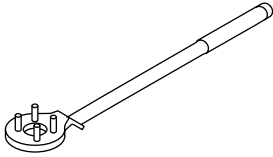
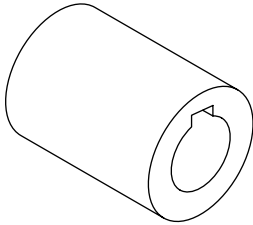
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499767700	499767700	VALVE GUIDE ADJUSTER	Used for installing valve guide. (Intake side)
 ST-499767800	499767800	VALVE GUIDE ADJUSTER	Used for installing valve guide. (Exhaust side)
 ST-499817100	499817100	ENGINE STAND	- Stand used for engine disassembly and assembly. - Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).

General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts. (2.5 L model)
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Compression Gauge	Used for measuring compression.
Tachometer (Secondary pick-up type)	Used for measuring idle speed.
Timing Light	Used for measuring ignition timing.

E: PROCEDURE

It is possible to conduct the following service procedures with engine on the vehicle; however, the procedures described in this section are based on the condition that the engine is removed from the vehicle.

- V-belt
- Timing Belt
- Valve Rocker Assembly
- Camshaft
- Cylinder Head

2. Compression

A: INSPECTION

CAUTION:

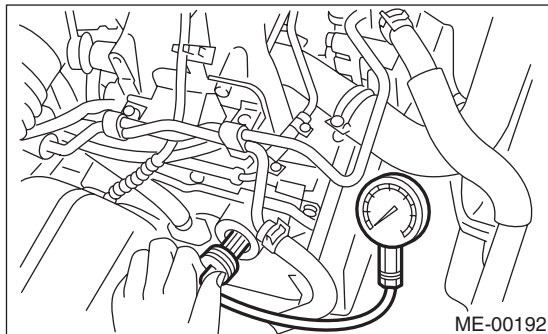
After warming up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) After warming up the engine, turn the ignition switch to OFF.
- 2) Make sure that the battery is fully charged.
- 3) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 4) Remove all the spark plugs. <Ref. to IG(H4SO)-4, REMOVAL, Spark Plug.>
- 5) Fully open the throttle valve.
- 6) Check the starter motor for satisfactory performance and operation.
- 7) Hold the compression gauge tight against spark plug hole.

NOTE:

When using a screw-in type compression gauge, the screw (put into cylinder head spark plug hole) should be less than 18 mm (0.71 in) long.

- 8) Crank the engine by means of starter motor, and then read the maximum value on the gauge when the pointer is steady.



- 9) Perform at least two measurements per cylinder, and make sure that the values are correct.

Compression (350 rpm and fully open throttle):

Standard;

1,275 kPa (13.0 kgf/cm², 185 psi)

Limit;

1,020 kPa (10.4 kgf/cm², 148 psi)

Difference between cylinders;

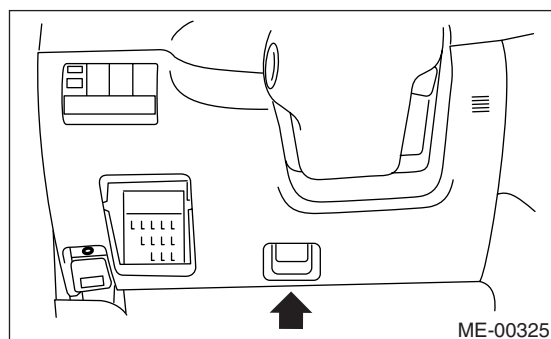
49 kPa (0.5 kgf/cm², 7 psi), or less

3. Idle Speed

A: INSPECTION

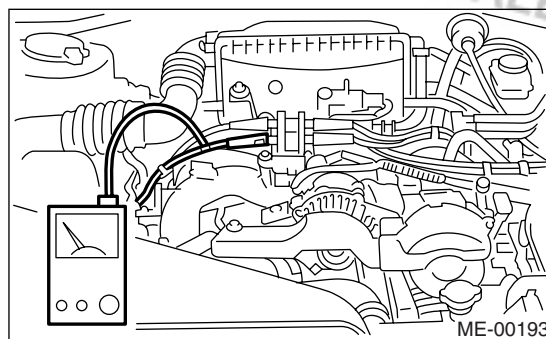
- 1) Before checking idle speed, check the following:
 - (1) Ensure the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and the hoses are connected properly.
 - (2) Ensure the malfunction indicator light does not illuminate.
- 2) Warm up the engine.
- 3) Stop the engine, and then turn the ignition switch to OFF.
- 4) When using the SUBARU SELECT MONITOR, refer to the following. <Ref. to ME(H4SO)-13, SPECIAL TOOLS, PREPARATION TOOL, General Description.>

- (1) Insert the cartridge to SUBARU SELECT MONITOR.
- (2) Connect the SUBARU SELECT MONITOR to data link connector.



- (3) Turn the ignition switch to ON, and turn the SUBARU SELECT MONITOR switch to ON.
 - (4) Select the {2. Each System Check} in Main Menu.
 - (5) Select the {Engine Control System} in Selection Menu.
 - (6) Select the {1. Current Data Display & Save} in Engine Control System Diagnosis.
 - (7) Select the {1.12 Data Display} in Data Display Menu.
 - (8) Start the engine, and then read the engine idle speed.
- 5) When using the tachometer (Secondary pick-up type).
 - (1) Attach the pick-up clip to No. 1 cylinder spark plug cord.

- (2) Start the engine, and then read the engine idle speed.



NOTE:

- When using the OBD-II general scan tool, carefully read its operation manual.
- This ignition system provides simultaneous ignition for #1 and #2 plugs. It must be noted that some tachometers may register twice that of actual engine speed.

- 6) Check the idle speed when unloaded. (With headlights, heater fan, rear defroster, radiator fan, air conditioning, etc. OFF)

Idle speed [No load and gears in neutral (MT model), or N or P (AT model) range]:

650±100 rpm (MT model)

700±100 rpm (AT model)

- 7) Check the idle speed when loaded. (Turn the air conditioning switch to "ON" and operate the compressor for at least 1 minute before measurement.)

Idle speed [A/C "ON" and gears in neutral (MT model) or N or P (AT model) range]:

850±100 rpm

NOTE:

Idle speed can not be adjusted manually, because the idle speed is automatically adjusted.

If the specified idle speed can not be maintained, refer to General On-board Diagnosis Table under "Engine Control System". <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>

4. Ignition Timing

A: INSPECTION

CAUTION:

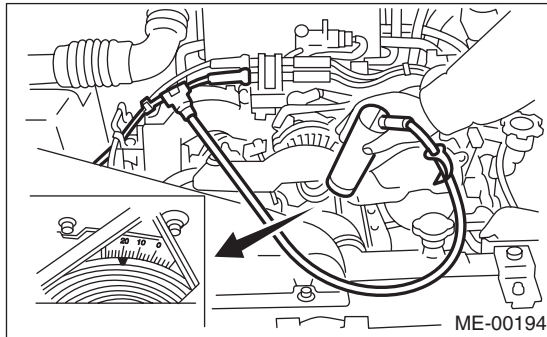
After warming up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) Warm up the engine.
- 2) To check the ignition timing, connect a timing light to #1 cylinder spark plug cord, and illuminate the timing mark with timing light.
- 3) Start the engine at idle speed and check the ignition timing.

Ignition timing [BTDC/rpm]:

$10^{\circ} \pm 8^{\circ} / 650$ (MT model)

$15^{\circ} \pm 8^{\circ} / 700$ (AT model)



If the timing is not correct, check the ignition control system.

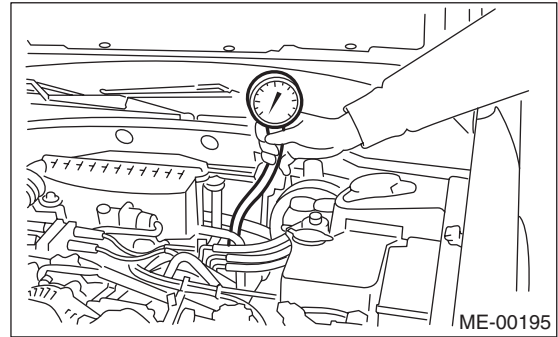
Refer to Engine Control System. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>

5. Intake Manifold Vacuum

A: INSPECTION

- 1) Warm up the engine.
- 2) Disconnect the brake vacuum hose from manifold, and then install the vacuum gauge to the hose fitting on manifold.
- 3) Keep the engine at idle speed, and then read the vacuum gauge indication.

By observing the gauge needle movement, the internal condition of engine can be diagnosed as described below.



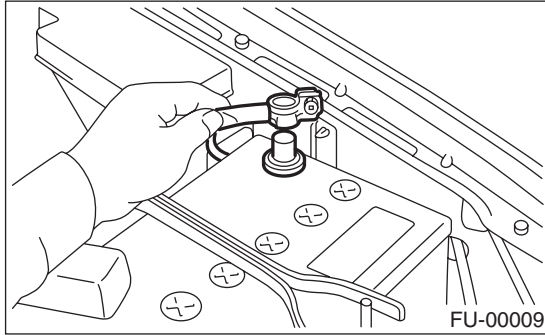
Vacuum pressure (at idling, A/C "OFF"):
Less than -60.0 kPa (-450 mmHg, -17.72 in-Hg)

Diagnosis of engine condition by measurement of manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket or disconnection or damaged vacuum hose
2. When engine speed is reduced slowly from higher speed, needle stops temporarily when it is lowering or becomes steady above normal position.	Back pressure too high, or exhaust system clogged
3. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
4. Needle drops suddenly and intermittently from normal position.	Sticky valves
5. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
6. Needle vibrates above and below normal position in narrow range.	Defective ignition system

6. Engine Oil Pressure

A: INSPECTION

1) Disconnect the ground cable from battery.



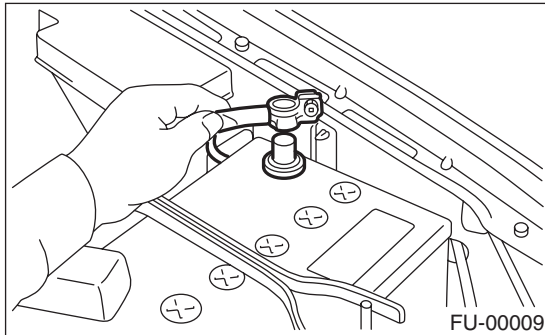
2) Remove the generator from bracket. <Ref. to SC(H4SO)-14, REMOVAL, Generator.>

3) Disconnect the connector from oil pressure switch.

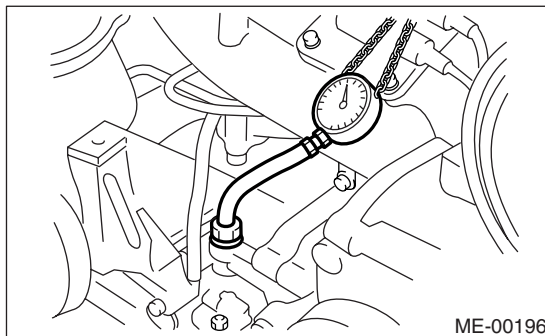
4) Remove the oil pressure switch from engine cylinder block. <Ref. to LU(H4SO)-17, REMOVAL, Oil Pressure Switch.>

5) Connect the oil pressure gauge hose to cylinder block.

6) Connect the battery ground cable to battery.



7) Start the engine, and then measure the oil pressure.



Oil pressure:

88 kPa (0.9 kg/cm², 13 psi) or more at 800 rpm
294 kPa (3.0 kg/cm², 43 psi) or more at 5,000 rpm

CAUTION:

- If the oil pressure is out of specification, check the oil pump, oil filter and lubrication line. <Ref. to LU(H4SO)-19, INSPECTION, Engine Lubrication System Trouble in General.>
- If the oil pressure warning light is turned ON and oil pressure is in specification, replace the oil pressure switch. <Ref. to LU(H4SO)-19, INSPECTION, Engine Lubrication System Trouble in General.>

NOTE:

The specified data is based on an engine oil temperature of 80°C (176°F).

8) After measuring the oil pressure, install the oil pressure switch. <Ref. to LU(H4SO)-17, INSTALLATION, Oil Pressure Switch.>

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

9) Install the generator and V-belt in the reverse order of removal, and then adjust the V-belt deflection. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

7. Fuel Pressure

A: INSPECTION

WARNING:

Before removing the fuel pressure gauge, lower the fuel pressure.

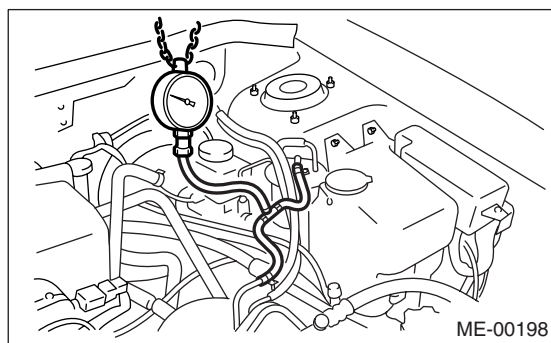
NOTE:

If out of specification, check or replace the pressure regulator and pressure regulator vacuum hose.

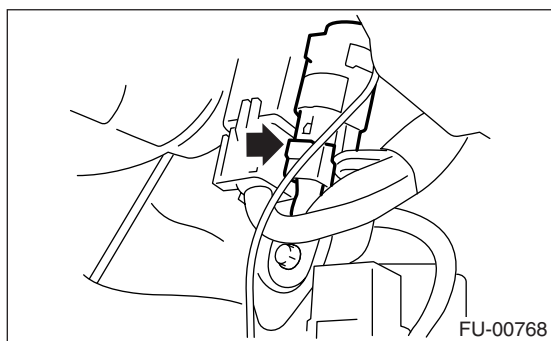
1) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

2) Open the fuel flap lid, and then remove the fuel filler cap.

3) Disconnect the fuel delivery hoses from fuel damper, and then connect the fuel pressure gauge.



4) Connect the connector of fuel pump relay.



5) Start the engine.

6) Measure the fuel pressure while disconnecting the pressure regulator vacuum hose from intake manifold.

Fuel pressure:

Standard; 284 — 314 kPa (2.9 — 3.2 kg/cm², 41 — 46 psi)

7) After connecting the pressure regulator vacuum hose, measure the fuel pressure.

Fuel pressure:

Standard; 206 — 235 kPa (2.1 — 2.4 kg/cm², 30 — 34 psi)

NOTE:

The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm², 1 to 3 psi) higher than standard values during high-altitude operations.

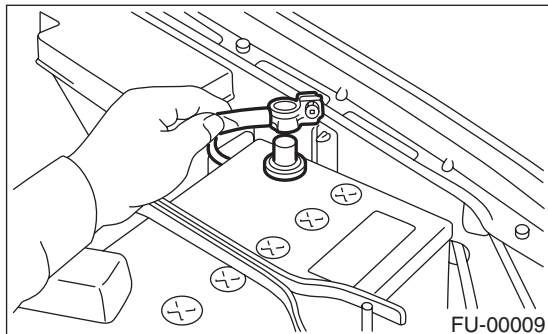
8. Valve Clearance

A: INSPECTION

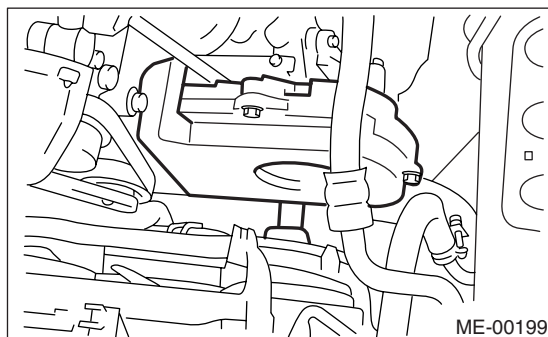
NOTE:

Inspection and adjustment of the valve clearance should be performed while engine is cold.

- 1) Set the vehicle on a lift.
- 2) Lift-up the vehicle.
- 3) Remove the under cover.
- 4) Lower the vehicle.
- 5) Disconnect the ground cable from battery.



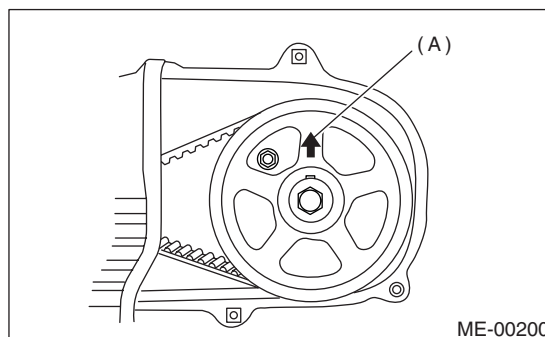
- 6) Remove the timing belt cover (LH).



- 7) When inspecting the #1 and #3 cylinders;
 - (1) Disconnect the spark plug cords from spark plugs RH side. <Ref. to IG(H4SO)-4, RH SIDE, REMOVAL, Spark Plug.>
 - (2) Disconnect the PCV hose from rocker cover (RH).
 - (3) Remove the bolts, and then remove the rocker cover (RH).
- 8) When inspecting the #2 and #4 cylinders;
 - (1) Disconnect the spark plug cords from spark plugs (LH Side). <Ref. to IG(H4SO)-4, LH SIDE, REMOVAL, Spark Plug.>
 - (2) Disconnect the PCV hose from rocker cover (LH).
 - (3) Remove the bolts, and then remove the rocker cover (LH).
- 9) Set the #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise using a socket wrench.

NOTE:

When arrow mark (A) on the camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



- 10) Measure the #1 cylinder valve clearance by using thickness gauge.

CAUTION:

- Insert the thickness gauge (A) in as horizontal a direction as possible with respect to the valve stem end face.
- Measure the exhaust valve clearances while lifting up the vehicle.

Valve clearance (Standard):

Intake:

0.20 ± 0.02 mm (0.0079 ± 0.0008 in)

Exhaust:

0.25 ± 0.02 mm (0.0098 ± 0.0008 in)

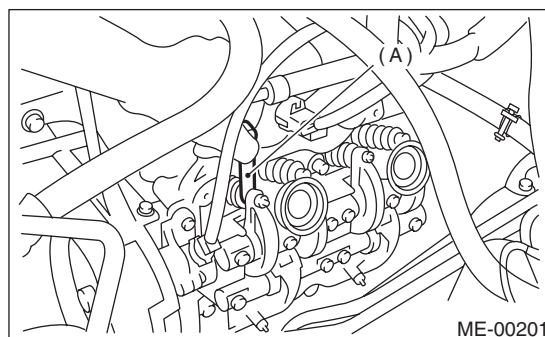
Valve clearance (Limit):

Intake:

0.20 ± 0.04 mm (0.0079 ± 0.0016 in)

Exhaust:

0.25 ± 0.04 mm (0.0098 ± 0.0016 in)



- 11) If necessary, adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>

- 12) Similar to measurement procedures used for #1 cylinder, measure the cylinder valve clearances in the following sequence: #3, #2 and #4 cylinder.

NOTE:

- Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before measuring valve clearances.
- To set each cylinder piston to its top dead center on compression stroke in the following sequence: #3, #2 and #4 cylinder, turn the crankshaft pulley clockwise by every 180° at starting with #1 cylinder piston being on top dead center on compression stroke.

13) After inspection, install the related parts in the reverse order of removal.

B: ADJUSTMENT

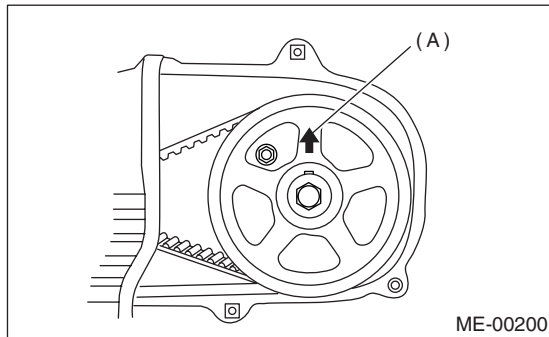
NOTE:

Adjustment of the valve clearance should be performed while engine is cold.

1) Set the #1 cylinder piston to top dead center of compression stroke by rotating crankshaft pulley clockwise using socket wrench.

NOTE:

When arrow mark (A) on the camshaft sprocket (LH) comes exactly to the top, #1 cylinder piston is brought to the top dead center of compression stroke.



2) Adjust the #1 cylinder valve clearance.

- (1) Loosen the valve rocker nut and screw.
- (2) Place suitable thickness gauge.
- (3) While noting the valve clearance, tighten the valve rocker adjust screw.
- (4) When specified valve clearance is obtained, tighten the valve rocker nut.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

CAUTION:

- Insert the thickness gauge in as horizontal a direction as possible with respect to the valve stem end face.
- Adjust the exhaust valve clearances while lifting up the vehicle.

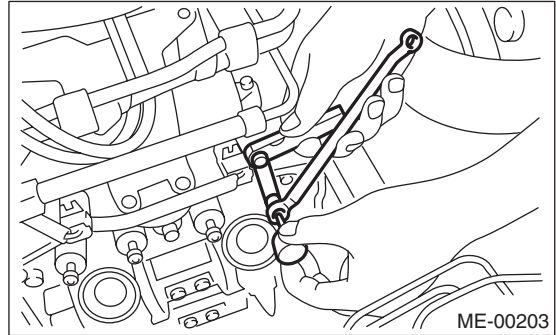
Valve clearance:

Intake;

0.20±0.02 mm (0.0079±0.0008 in)

Exhaust;

0.25±0.02 mm (0.0098±0.0008 in)



3) Ensure the valve clearances are within specifications.

4) Turn the crankshaft two complete rotations until #1 cylinder piston is again set to the top dead center on compression stroke.

5) Ensure the valve clearances are within specifications. If necessary, readjust the valve clearances.

6) Similar to adjustment procedures used for #1 cylinder, adjust the #2, #3 and #4 cylinder valve clearances.

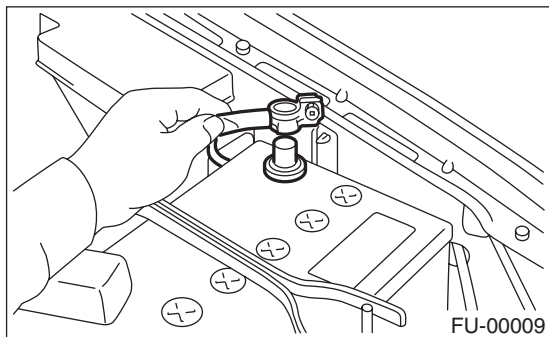
NOTE:

- Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
- To set each cylinder piston to its top dead center on compression stroke in the following sequence: #3, #2 and #4 cylinder, turn the crankshaft pulley clockwise by every 180° at starting with #1 cylinder piston being on top dead center on compression stroke.

9. Engine Assembly

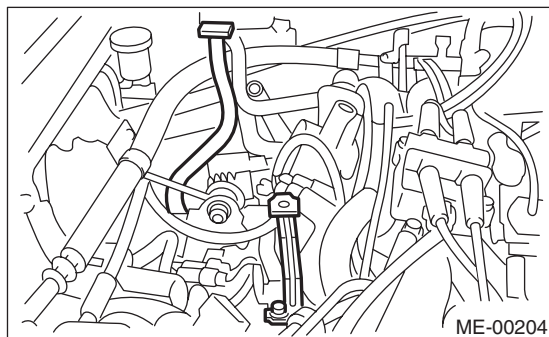
A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood fully, and then support with the hood stay.
- 3) Using the refrigerant recovery system, discharge refrigerant. <Ref. to AC-20, PROCEDURE, Refrigerant Recovery Procedure.>
- 4) Release the fuel pressure. <Ref. to FU(H4SO)-47, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 5) Remove the fuel filler cap.
- 6) Disconnect the ground cable from battery.

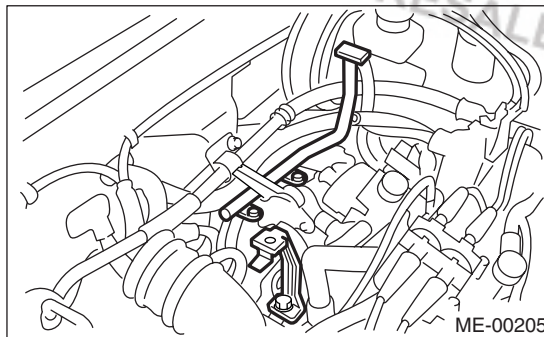


- 7) Remove the air intake duct and air cleaner case. <Ref. to IN(H4SO)-6, REMOVAL, Air Intake Duct.> and <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>
- 8) Remove the under cover.
- 9) Remove the radiator from vehicle. <Ref. to CO(H4SO)-18, REMOVAL, Radiator.>
- 10) Disconnect the A/C pressure hoses from A/C compressor.
- 11) Remove the air intake chamber stay.

• MT MODEL

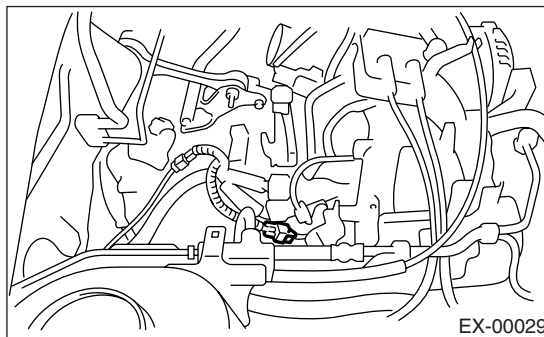


• AT MODEL

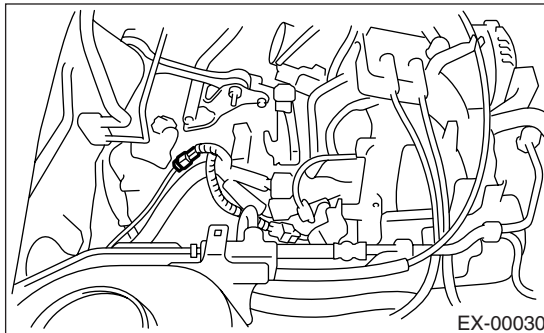


- 12) Disconnect the following connectors and cables.

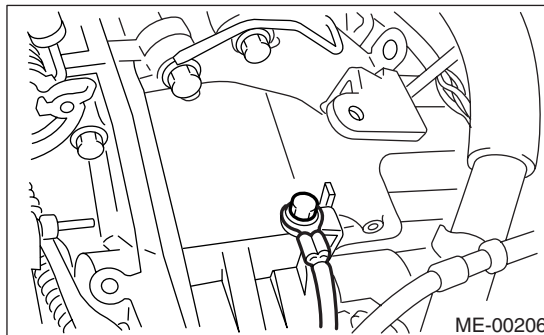
(1) Front oxygen (A/F) sensor connector



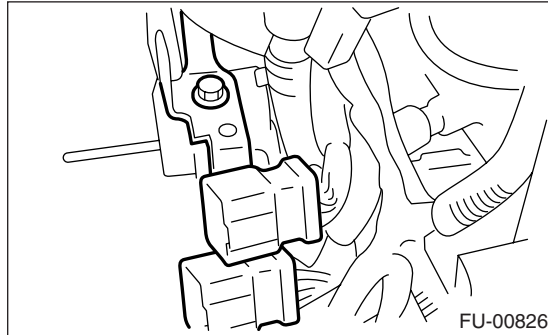
(2) Rear oxygen sensor connector



(3) Engine ground cable

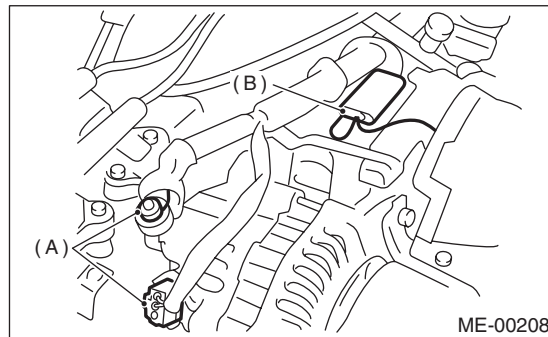


(4) Engine harness connectors



FU-00826

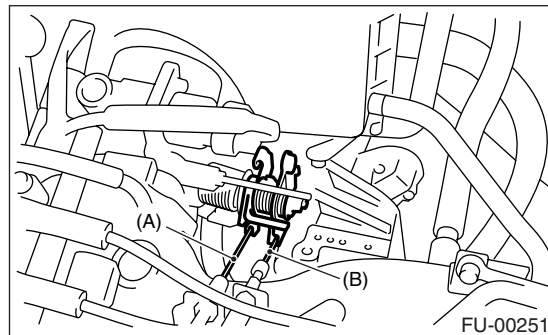
(5) Generator connector, terminal and A/C compressor connector



ME-00208

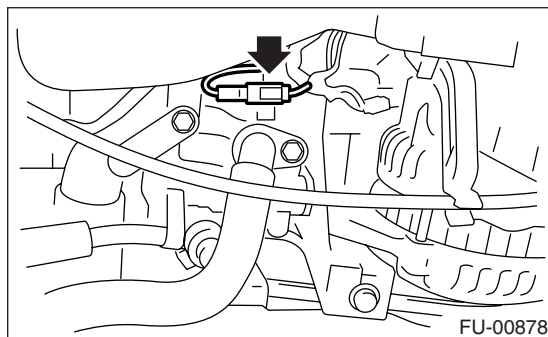
- (A) Generator connector and terminal
- (B) A/C compressor connector

(6) Accelerator cable (A) and cruise control cable (B) (Model with cruise control)



FU-00251

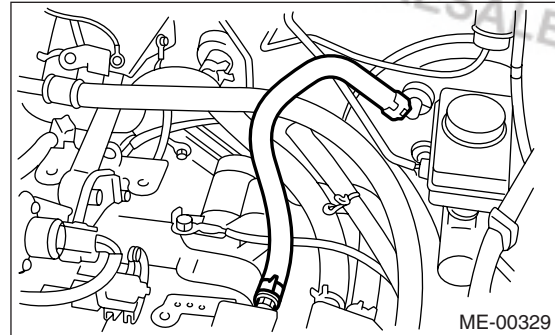
(7) Power steering switch connector



FU-00878

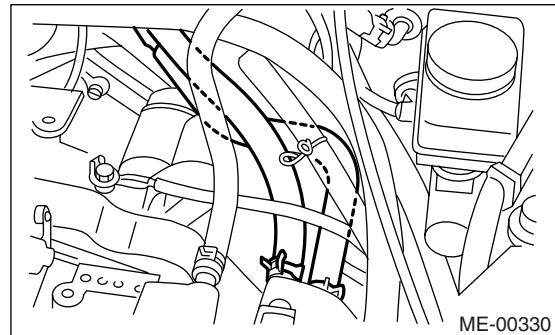
13) Disconnect the following hoses.

(1) Brake booster vacuum hose



ME-00329

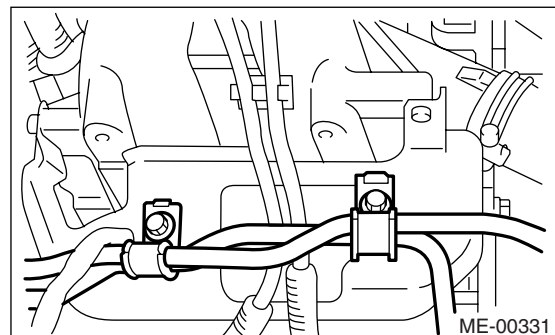
(2) Heater inlet outlet hose



ME-00330

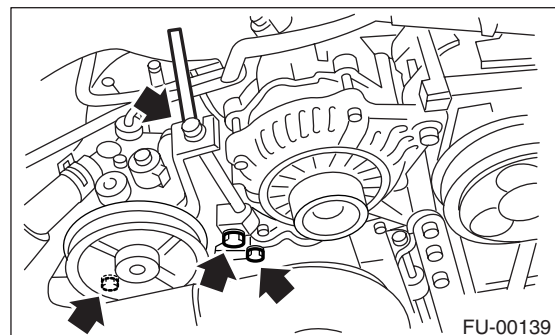
14) Remove the power steering pump from bracket.

- (1) Remove the resonator chamber.
- (2) Loosen the lock bolt and slider bolt, and then remove the front side V-belt. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, REMOVAL, V-belt.>
- (3) Remove the pipe with bracket.



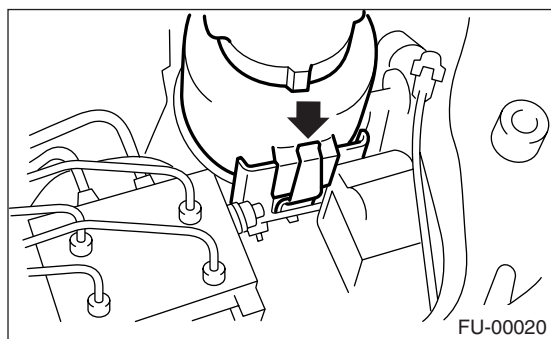
ME-00331

(4) Remove the bolts which install the power steering pump bracket.

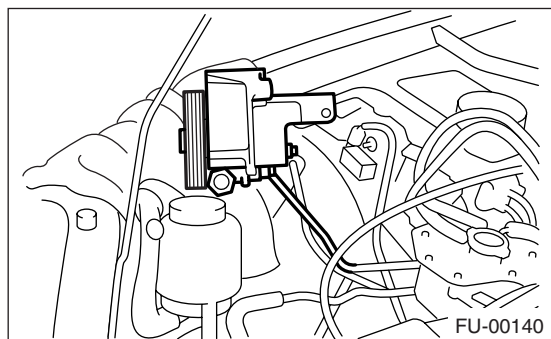


FU-00139

- (5) Remove the power steering tank from bracket by pulling it upward.

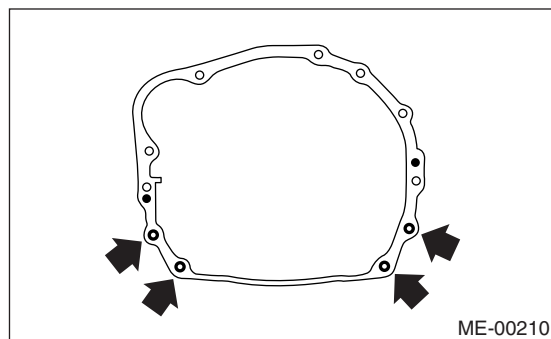


- (6) Place the power steering pump on right side wheel apron.

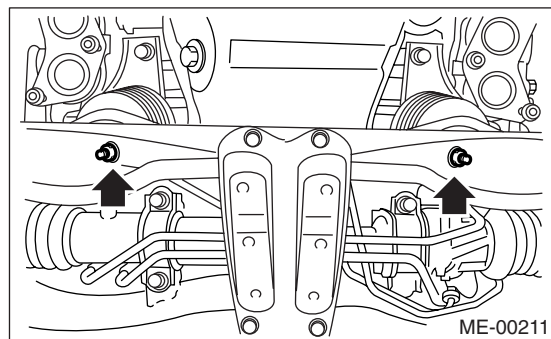


- 15) Remove the front and center exhaust pipe.
<Ref. to EX(H4SO)-4, REMOVAL, Front Exhaust Pipe.>

- 16) Remove the nuts which hold the lower side of transmission to engine.

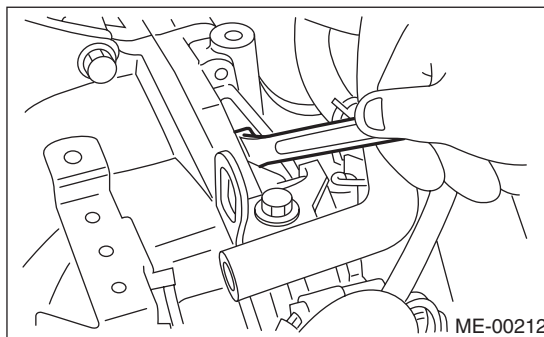


- 17) Remove the nuts which install the front cushion rubber onto front crossmember.

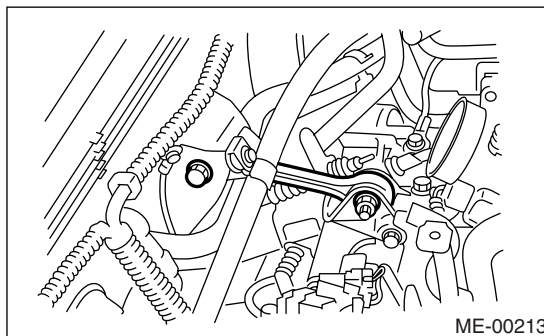


- 18) Separate the torque converter clutch from drive plate. (AT model)

- (1) Lower the vehicle.
- (2) Remove the service hole plug.
- (3) Remove the bolts which hold the torque converter clutch to drive plate.
- (4) Remove other bolts while rotating the engine using socket wrench.



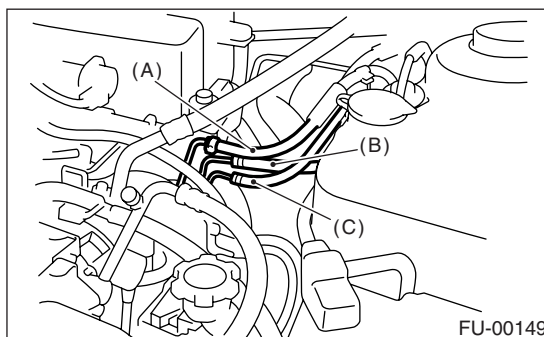
- 19) Remove the pitching stopper.



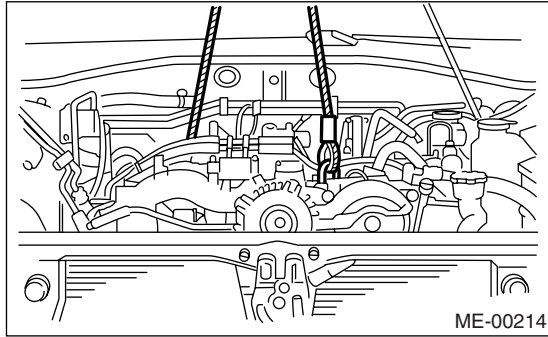
- 20) Disconnect the fuel delivery hose (A), return hose (B) and evaporation hose (C).

CAUTION:

- Disconnect the hose with its end wrapped with cloth to prevent fuel from splashing.
- Catch fuel from the hose into container.



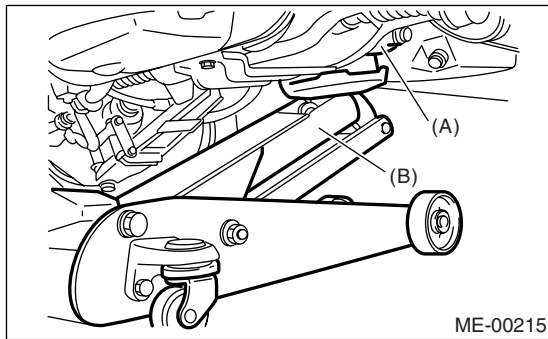
- 21) Support the engine with a lifting device and wire ropes.



- 22) Support the transmission with a garage jack.

CAUTION:

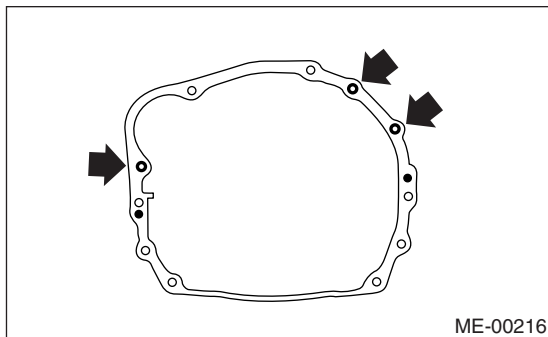
Before moving the engine away from transmission, check to be sure no work has been overlooked. Doing this is very important in order to facilitate re-installation and because the transmission lowers under its own weight.



(A) Transmission

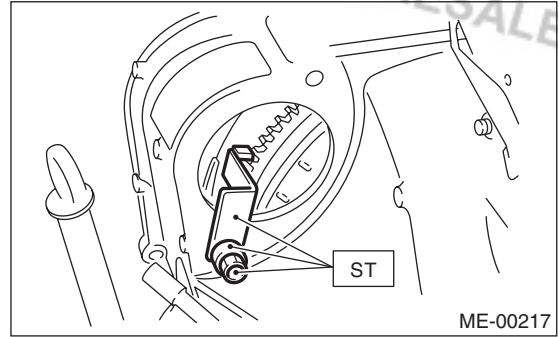
(B) Garage jack

- 23) Separation of the engine and transmission.
- (1) Remove the starter. <Ref. to SC(H4SO)-7, REMOVAL, Starter.>
 - (2) Remove the bolts which hold the upper side of transmission to engine.



- 24) Install the ST to torque converter clutch case. (AT model)

ST 498277200 STOPPER SET

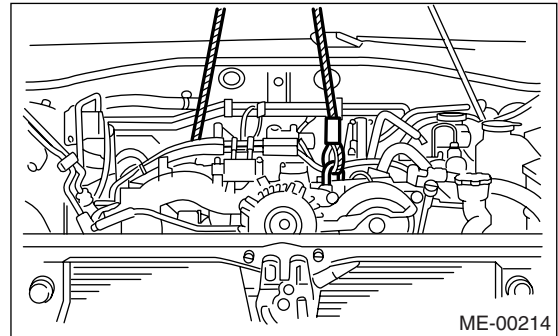


- 25) Remove the engine from vehicle.

- (1) Slightly raise the engine.
- (2) Raise the transmission with garage jack.
- (3) Move the engine horizontally until main shaft is withdrawn from clutch cover.
- (4) Slowly move the engine away from engine compartment.

NOTE:

Be careful not to damage the adjacent parts or body panels with crank pulley, oil level gauge, etc.



- 26) Remove the front cushion rubbers.

B: INSTALLATION

- 1) Install the front cushion rubbers.

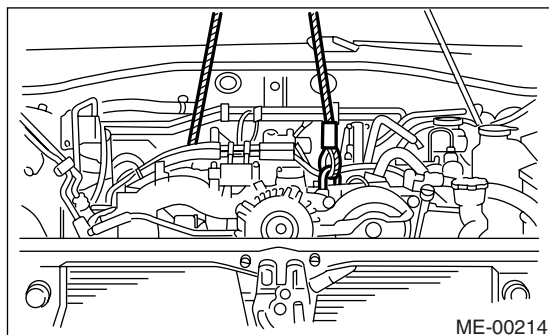
Tightening torque:

34 N·m (3.5 kgf-m, 25.3 ft-lb)

- 2) Install the engine onto transmission.
- (1) Position the engine in engine compartment and align it with transmission.

NOTE:

Be careful not to damage the adjacent parts or body panels with crank pulley, oil level gauge, etc.

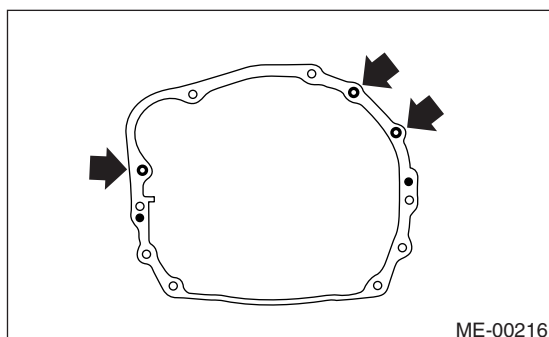


(2) Apply a small amount of grease to the spline of main shaft. (MT model)

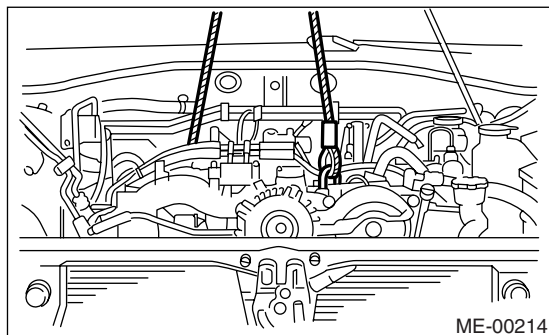
3) Tighten the bolts which hold the upper side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



4) Remove the lifting device and wire ropes.



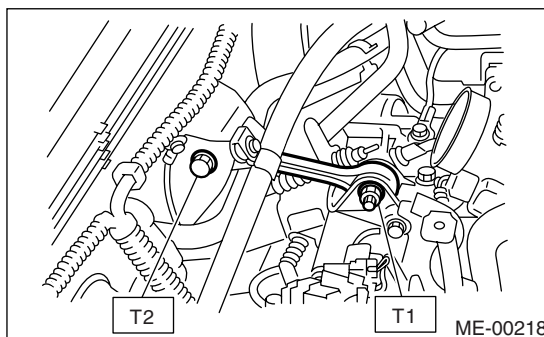
5) Remove the garage jack.

6) Install the pitching stopper.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 37 ft-lb)

T2: 58 N·m (5.9 kgf-m, 43 ft-lb)



7) Remove the ST from torque converter clutch case. (AT model)

NOTE:

Be careful not to drop the ST into torque converter clutch case when removing ST.

ST 498277200 STOPPER SET

8) Install the starter. <Ref. to SC(H4SO)-7, INSTALLATION, Starter.>

9) Install the torque converter clutch onto drive plate. (AT model)

(1) Tighten the bolts which hold the torque converter clutch to drive plate.

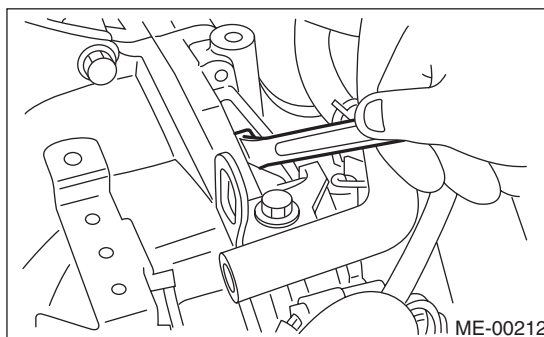
(2) Tighten other bolts while rotating the engine by using a socket wrench.

NOTE:

Be careful not to drop the bolts into torque converter clutch housing.

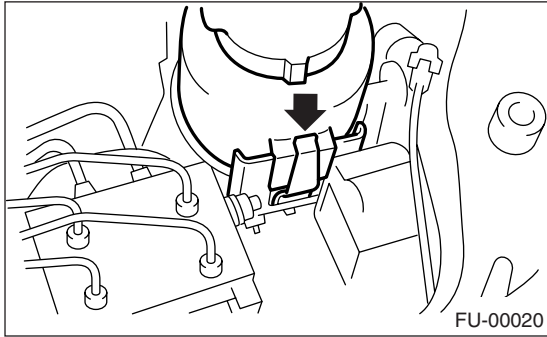
Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



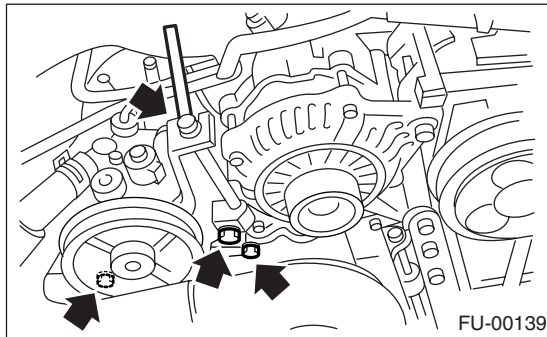
(3) Clog the plug onto service hole.

- 10) Install the power steering pump on bracket.
(1) Install the power steering tank on bracket.

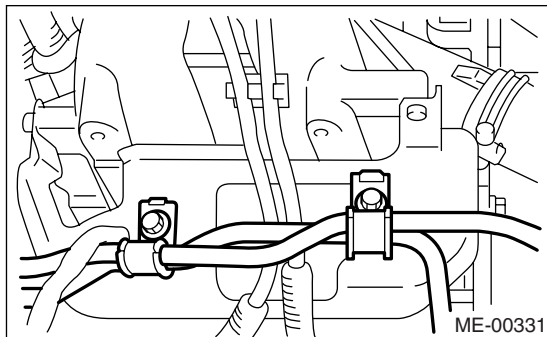


- (2) Install the power steering pump on bracket, and then tighten the bolts.

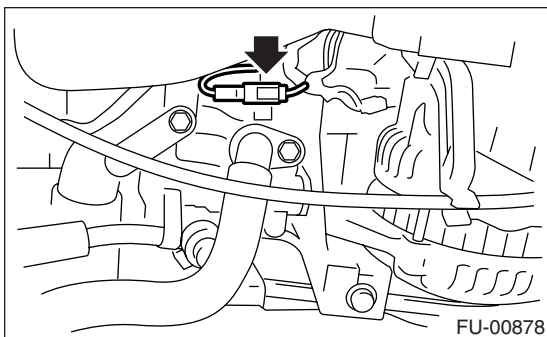
Tightening torque:
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



- (3) Tighten the bolts which install the power steering pipe bracket, and then install the spark plug cords.

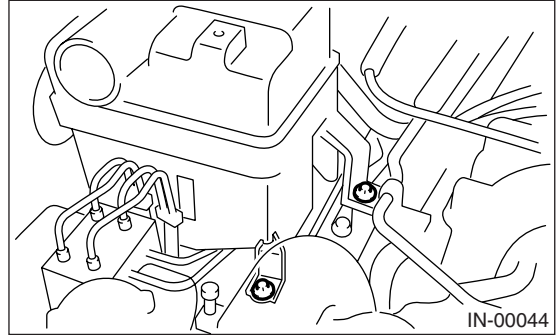


- (4) Connect the power steering switch connector.



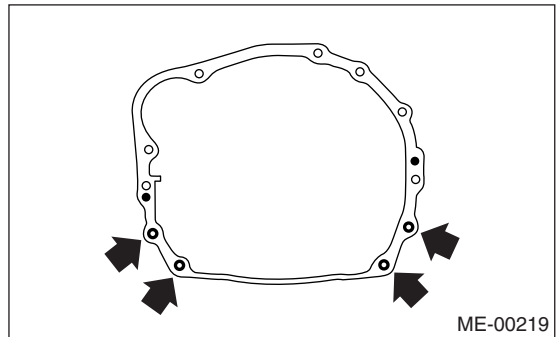
- (5) Install the front side V-belt, and adjust it. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, INSTALLATION, V-belt.>
(6) Install the resonator chamber.

Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)



- 11) Tighten the nuts which hold the lower side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)

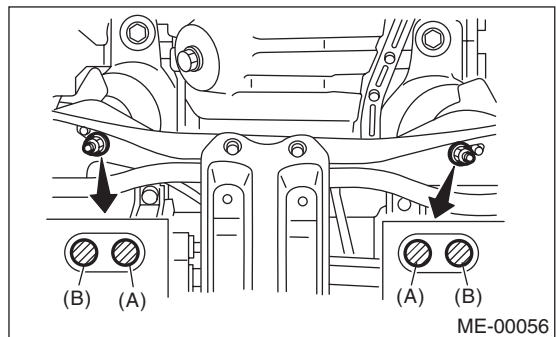


- 12) Tighten the nuts which install the front cushion rubber onto crossmember.

Tightening torque:
85 N·m (8.7 kgf-m, 63 ft-lb)

NOTE:

Make sure the front cushion rubber mounting bolts (A) and locator (B) are securely installed.



- 13) Install the front and center exhaust pipe. <Ref. to EX(H4SO)-5, INSTALLATION, Front Exhaust Pipe.>

- 14) Connect the following hoses.
- (1) Fuel delivery hose, return hose and evaporation hose
 - (2) Heater inlet and outlet hoses
 - (3) Brake booster vacuum hose
- 15) Connect the following connectors.
- (1) Engine ground cables

Tightening torque:

14 N·m (1.4 kgf-m, 10.1 ft-lb)

- (2) Engine harness connectors
 - (3) Generator connector and terminal
 - (4) A/C compressor connectors
- 16) Connect the following cables.
- (1) Accelerator cable
 - (2) Cruise control cable (Model with cruise control)
- 17) Adjust each connected cable.
- 18) Install the air cleaner case stay.

Tightening torque:

16 N·m (1.6 kgf-m, 11.6 ft-lb)

- 19) Install the A/C pressure hoses. <Ref. to AC-36, INSTALLATION, Hose and Tube.>
- 20) Install the radiator to vehicle. <Ref. to CO(H4SO)-19, INSTALLATION, Radiator.>
- 21) Install the air intake duct and air cleaner case. <Ref. to IN(H4SO)-6, INSTALLATION, Air Intake Duct.> and <Ref. to IN(H4SO)-5, INSTALLATION, Air Cleaner Case.>
- 22) Install the under cover.
- 23) Install battery in the vehicle, and then connect the cables.
- 24) Fill engine coolant.
<Ref. to CO(H4SO)-12, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 25) Check the ATF level and correct if necessary. (AT model)
<Ref. to 4AT-30, INSPECTION, Automatic Transmission Fluid.>
- 26) Charge the A/C system with refrigerant.
<Ref. to AC-21, PROCEDURE, Refrigerant Charging Procedure.>
- 27) Remove the front hood stay, and then close the front hood.
- 28) Take off the vehicle from lift arms.

C: INSPECTION

- 1) Make sure the pipes and hoses are installed correctly.
- 2) Make sure the engine coolant and ATF are at specified levels.

10.Engine Mounting

A: REMOVAL

- 1) Remove the engine assembly. <Ref. to ME(H4SO)-30, REMOVAL, Engine Assembly.>
- 2) Remove the engine mounting from engine assembly.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

Engine mounting;

35 N·m (3.6 kgf-m, 25.8 ft-lb)

C: INSPECTION

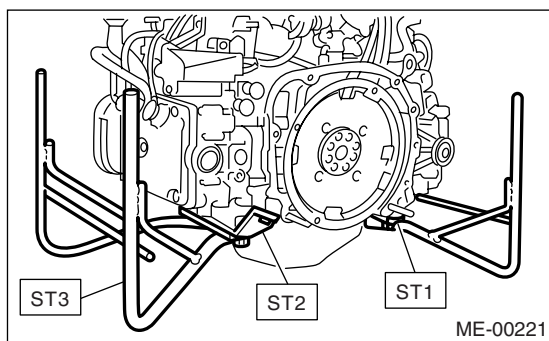
Make sure there are no cracks or other damage.

11.Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from body, secure it in the ST shown below.

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	4998171 00	ENGINE STAND



2) In this section the procedures described under each index are all connected and stated in order. It will be the complete procedure for overhauling of the engine itself when you go through all steps in the process.

Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

12.V-belt

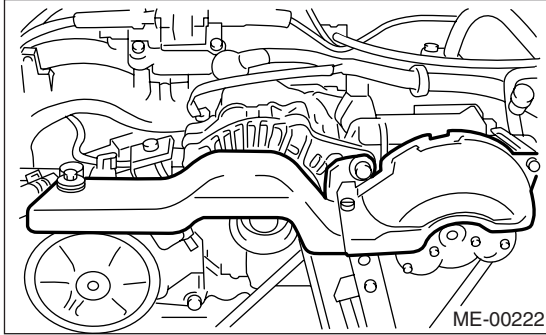
A: REMOVAL

1. FRONT SIDE BELT

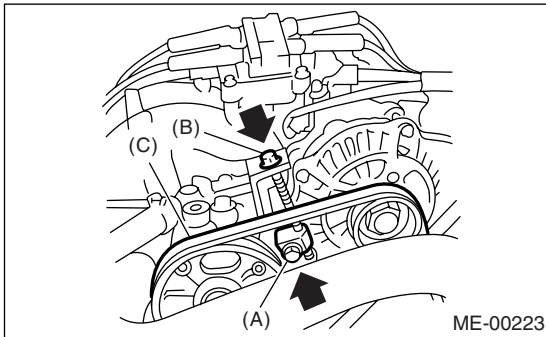
NOTE:

Perform the following procedures 1) to 4) with the engine installed to body.

- 1) Remove the V-belt cover.

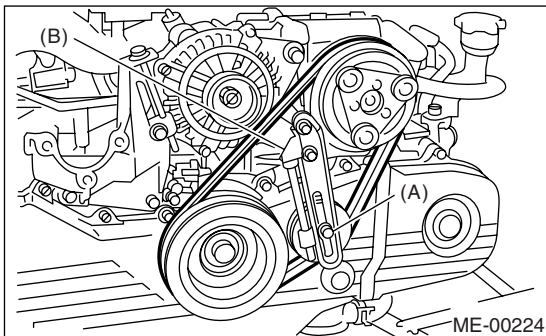


- 2) Loosen the lock bolt (A).
- 3) Loosen the slider bolt (B).
- 4) Remove the front side belt (C).



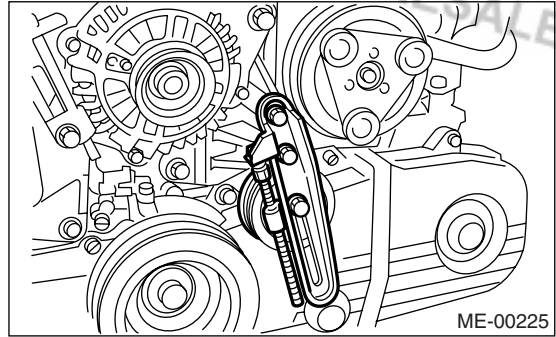
2. REAR SIDE BELT

- 1) Loosen the lock nut (A).
- 2) Loosen the slider bolt (B).



- 3) Remove the rear side belt.

- 4) Remove the belt tensioner.



B: INSTALLATION

NOTE:

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

1. FRONT SIDE BELT

- 1) Install the belt (C), and tighten the slider bolt so as to obtain the specified belt tension. <Ref. to ME(H4SO)-40, INSPECTION, V-belt.>
- 2) Tighten the lock bolt (A).
- 3) Tighten the slider bolt (B).

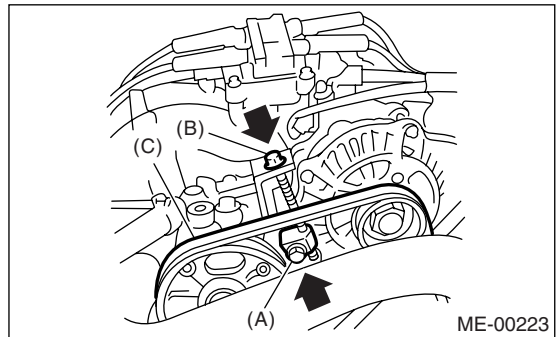
Tightening torque:

Lock bolt (A):

25 N·m (2.5 kgf-m, 18.1 ft-lb)

Slider bolt (B):

8 N·m (0.8 kgf-m, 5.5 ft-lb)



- 4) Idle the engine for approx. 5 min. to normalize the V-belt. (With using tension gauge)
- 5) Stop the engine, and then check the belt tension and adjust it. (With using tension gauge)
- 6) Idle the engine for approx. 1 min. to normalize the V-belt. (With using tension gauge)
- 7) Stop the engine, and then check the belt tension is within specified value. (With using tension gauge)
- 8) Adjust the belt tension until the value within specification. (With using tension gauge)

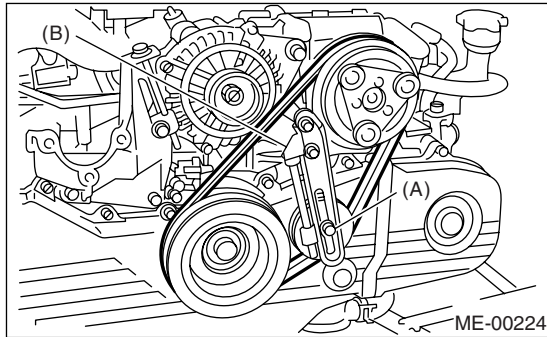
2. REAR SIDE BELT

- 1) Install the belt tensioner.
- 2) Install the belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4SO)-40, INSPECTION, V-belt.>
- 3) Tighten the lock nut (A).

Tightening torque:

Lock nut (A);

23 N·m (2.3 kgf-m, 17.0 ft-lb)



- 4) Idle the engine for approx. 5 min. to normalize the V-belt. (With using tension gauge)
- 5) Stop the engine, and then check the belt tension and adjust it. (With using tension gauge)
- 6) Idle the engine for approx. 1 min. to normalize the V-belt. (With using tension gauge)
- 7) Stop the engine, and then check the belt tension is within specified value. (With using tension gauge)
- 8) Adjust the belt tension until the value within specification. (With using tension gauge)

C: INSPECTION

1. PROCEDURES WITHOUT BELT TENSION GAUGE

- 1) Replace the belts; if cracks, fraying or wear is found.
- 2) Check the drive belt tension and adjust it if necessary by changing the generator installing position and/or idler pulley installing position.

Belt tension

(A)

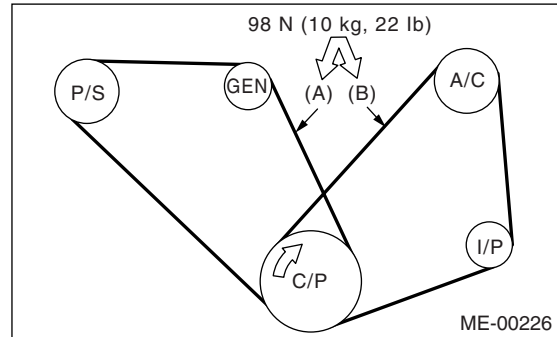
replaced: 7 — 9 mm (0.276 — 0.354 in)

reused: 9 — 11 mm (0.354 — 0.433 in)

(B)

replaced: 7.5 — 8.5 mm (0.295 — 0.335 in)

reused: 9.0 — 10.0 mm (0.354 — 0.394 in)



C/P Crankshaft pulley

GEN Generator

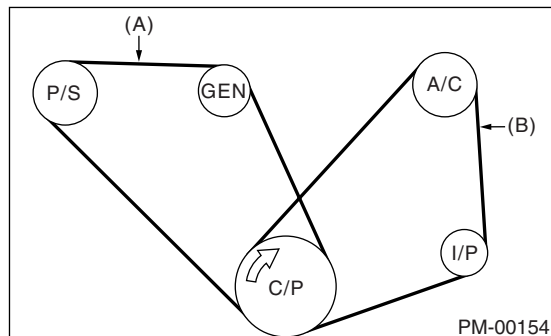
P/S Power steering oil pump pulley

A/C Air conditioning compressor pulley

I/P Idler pulley

2. PROCEDURES WITH BELT TENSION GAUGE

- 1) Replace the belts; if cracks, fraying or wear is found.
- 2) Remove the V-belt cover and reservoir tank.
- 3) Check the V-belt tension using belt tension gauge and adjust it if necessary by changing the generator installing position and/or idler pulley installing position.

Belt tension**(A)****490 — 640 N (50.0 — 65.3 kgf, 110.2 — 143.9****lb)****(B)****350 — 450 N (35.7 — 45.9 kgf, 78.7 — 101.2 lb)**

- C/P Crankshaft pulley
- GEN Generator
- P/S Power steering oil pump pulley
- A/C Air conditioning compressor pulley
- I/P Idler pulley

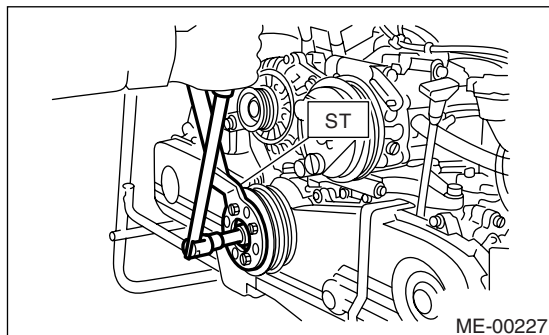
13. Crankshaft Pulley

A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>

2) Remove the crankshaft pulley bolt. To lock the crankshaft, use ST.

ST 499977100 CRANKSHAFT PULLEY
WRENCH



3) Remove the crankshaft pulley.

B: INSTALLATION

1) Install the crankshaft pulley.

2) Install the pulley bolt.

To lock the crankshaft, use ST.

ST 499977100 CRANKSHAFT PULLEY
WRENCH

(1) Clean the crankshaft pulley thread using an air gun.

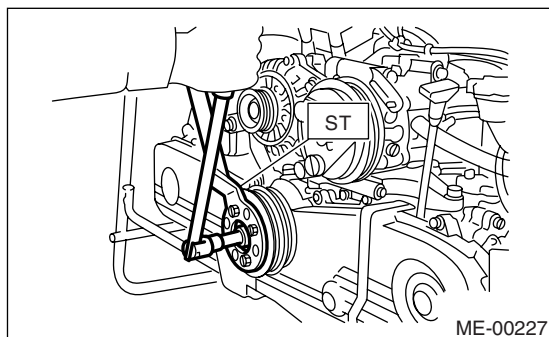
(2) Apply engine oil to the crankshaft pulley bolt seat and thread.

(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).

(4) Tighten the crankshaft pulley bolts.

Tightening torque:

177 N·m (18.0 kgf-m, 130.2 ft-lb)



3) Confirm that the tightening angle of crankshaft pulley bolt is 65 degrees or more. If the tightening angle of crankshaft pulley bolt is less than 65 degrees, conduct the following procedures.

(1) Replace the crankshaft pulley bolts and clean them.

Crankshaft pulley bolt:

12369AA011

(2) Clean the crankshaft thread using an air gun.

(3) Apply engine oil to the crankshaft pulley bolt seal and thread.

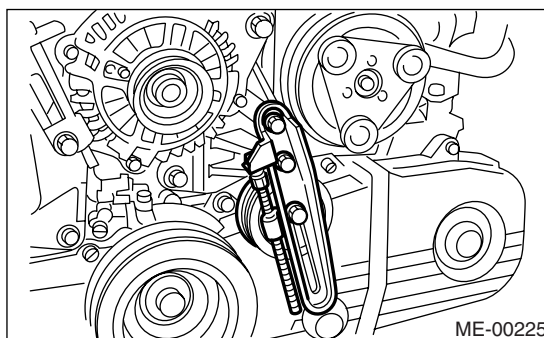
(4) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).

(5) Tighten the crankshaft pulley bolts keeping them in an angle between 65 degrees and 75 degrees.

NOTE:

Conduct the tightening procedures by confirming the turning angle of crankshaft pulley bolt referring to the gauge indicated on timing belt cover.

4) Install the A/C belt tensioner.



5) Install the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: INSPECTION

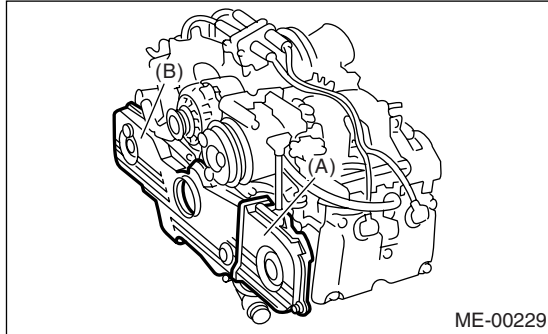
1) Make sure the V-belt is not worn or otherwise damaged.

2) Check the tension of the belt. <Ref. to ME(H4SO)-40, INSPECTION, V-belt.>

14. Timing Belt Cover

A: REMOVAL

- 1) Remove the V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover (LH).
- 4) Remove the front timing belt cover.



- (A) Timing belt cover (LH)
(B) Front timing belt cover

B: INSTALLATION

- 1) Install the front timing belt cover.

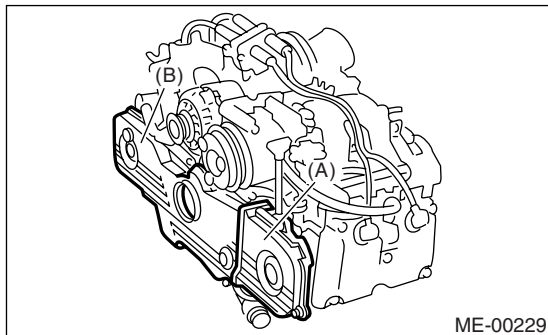
Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

- 2) Install the timing belt cover (LH).

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



- (A) Timing belt cover (LH)
(B) Front timing belt cover

- 3) Install the crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
- 4) Install the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: INSPECTION

Make sure the cover is not damaged.

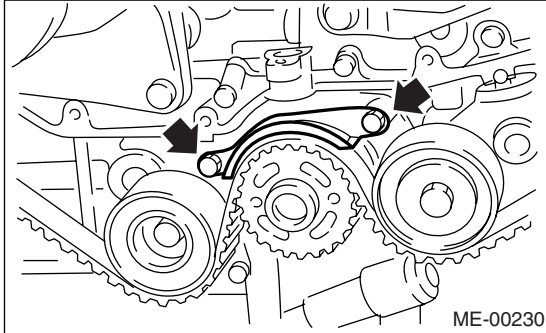
15. Timing Belt Assembly

ST 499987500 CRANKSHAFT SOCKET

A: REMOVAL

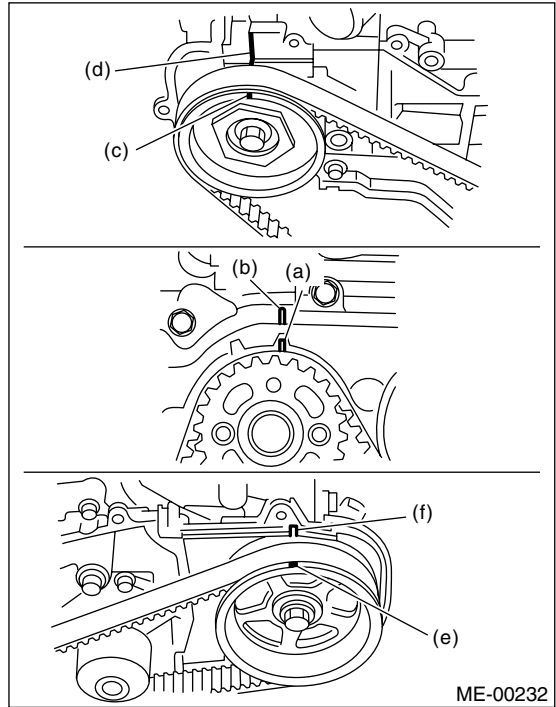
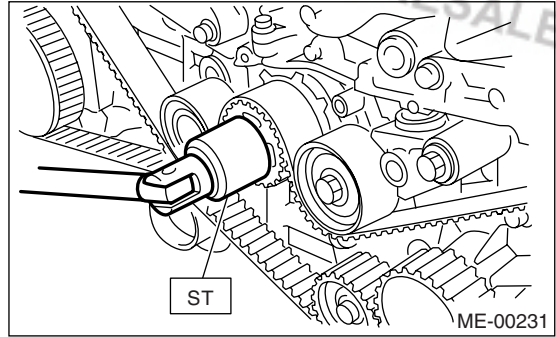
1. TIMING BELT

- 1) Remove the V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt guide. (MT model)

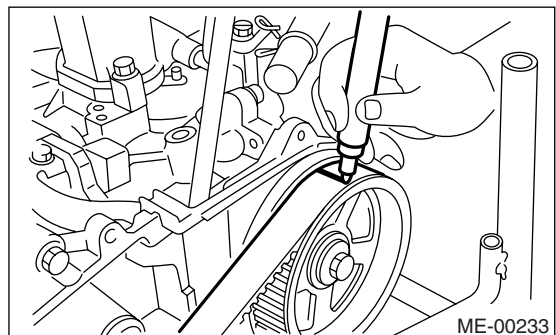


- 5) If the alignment mark (a) and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.

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



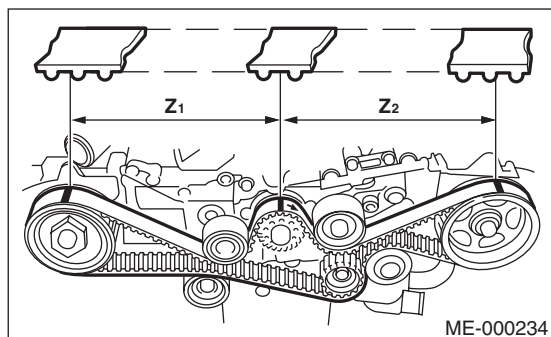
- (2) Using white paint, put alignment and/or arrow marks on the timing belts in relation to crank sprocket and cam sprockets.



Specified data:

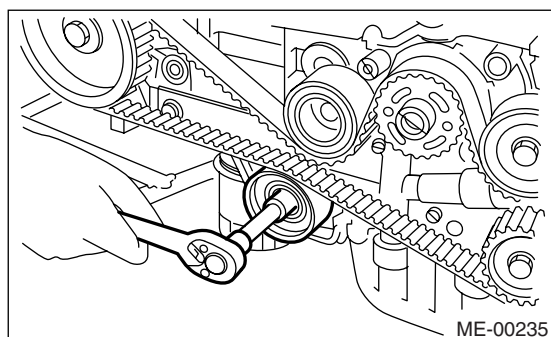
Z_1 : 46.8 tooth length

Z_2 : 43.7 tooth length

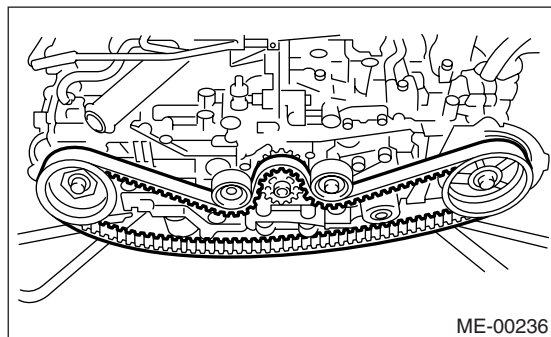


6) Remove the belt idler (No. 2).

7) Remove the belt idler No. 2.

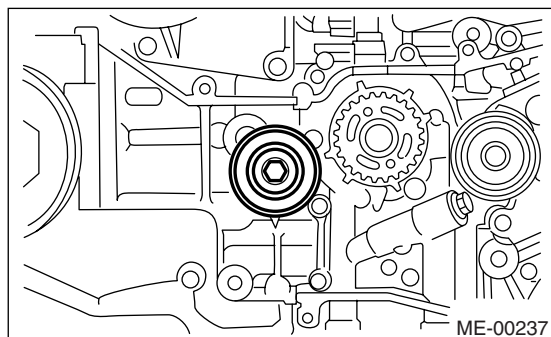


8) Remove the timing belt.

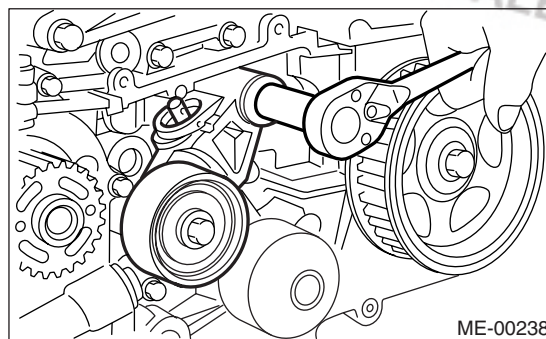


2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

1) Remove the belt idler (No. 1).



2) Remove the automatic belt tension adjuster assembly.



B: INSTALLATION

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

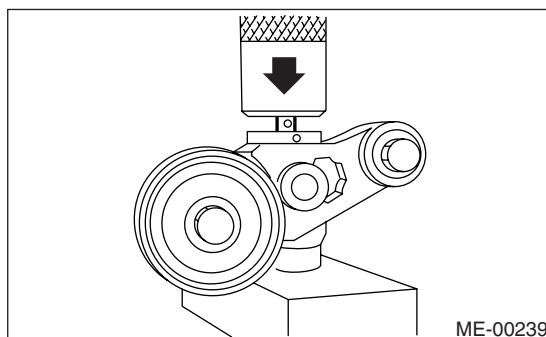
1) Preparation for installation of automatic belt tension adjuster assembly;

CAUTION:

- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Press-in the push adjuster rod gradually taking more than 3 minutes.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
- Press the adjuster rod as far as the end surface of cylinder. Do not press the adjuster rod into the cylinder. Doing so may damage the cylinder.
- Do not release the press pressure until stopper pin is completely inserted.

(1) Attach the automatic belt tension adjuster assembly to the vertical pressing tool.

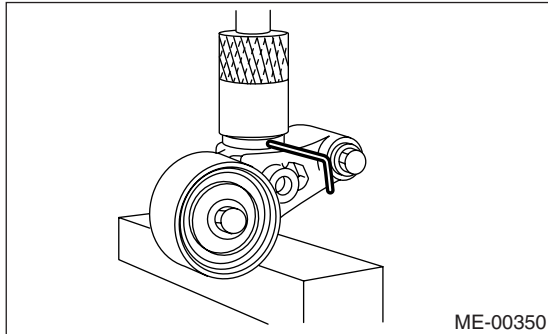
(2) Slowly move the adjuster rod down with a pressure of 294 N (30 kgf, 66 lb) until the adjuster rod is aligned with the stopper pin hole in the cylinder.



Timing Belt Assembly

MECHANICAL

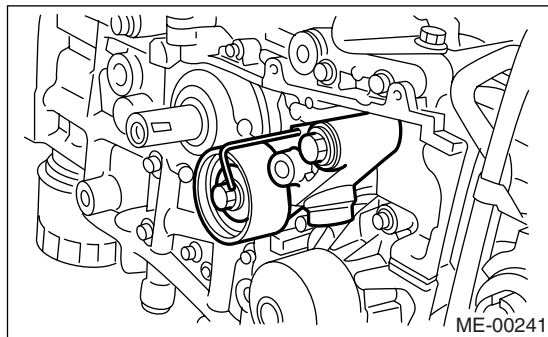
- (3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex bar wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



- 2) Install the automatic belt tension adjuster assembly.

Tightening torque:

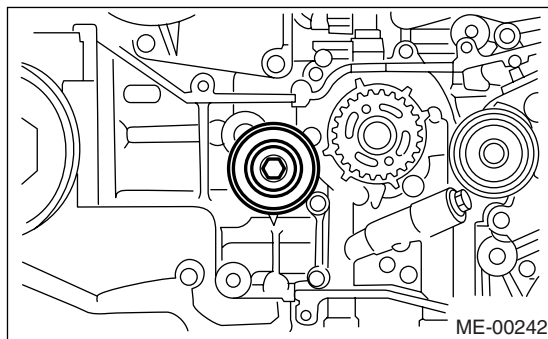
39 N·m (4.0 kgf-m, 28.9 ft-lb)



- 3) Install the belt idler (No. 1).

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)



2. TIMING BELT

- 1) Preparation for the installation of automatic belt tension adjuster assembly. <Ref. to ME(H4SO)-45, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt Assembly.>

- 2) Installation of timing belt

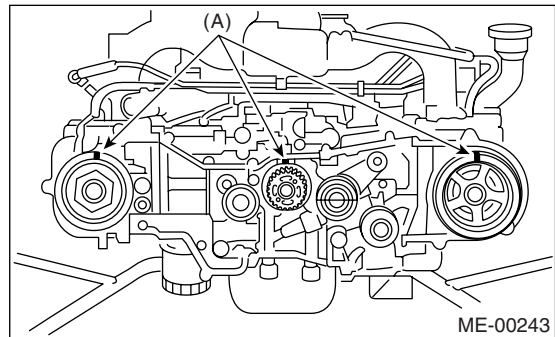
- (1) Turn the camshaft sprocket No. 2 using ST1, and then turn the camshaft sprocket No. 1 using ST2 so that their alignment marks (A) come to top positions.

ST1 18231AA010 CAMSHAFT SPROCKET WRENCH

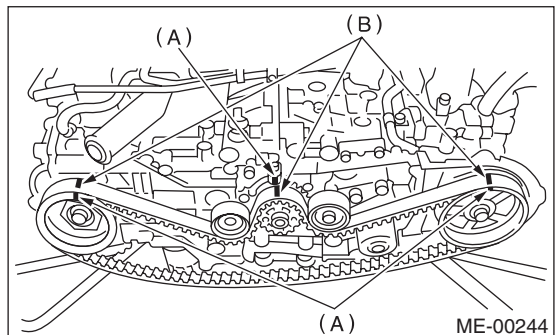
NOTE:

Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.

ST2 499207400 CAMSHAFT SPROCKET WRENCH



- (2) While aligning alignment marks (B) on the timing belt with marks (A) on sprockets, position the timing belt properly.



- 3) Install the belt idler No. 2.

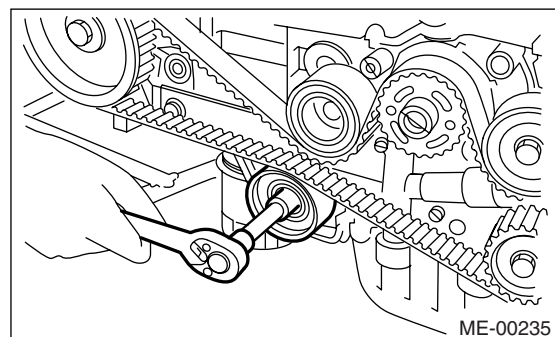
Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

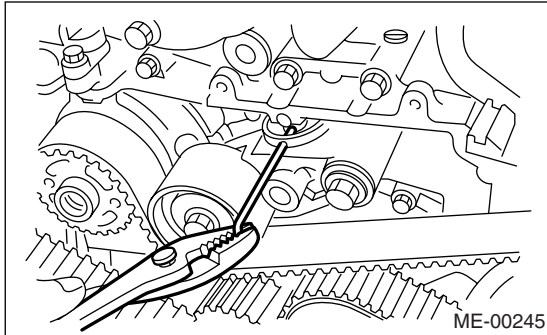
- 4) Install the belt idler (No. 2).

Tightening torque:

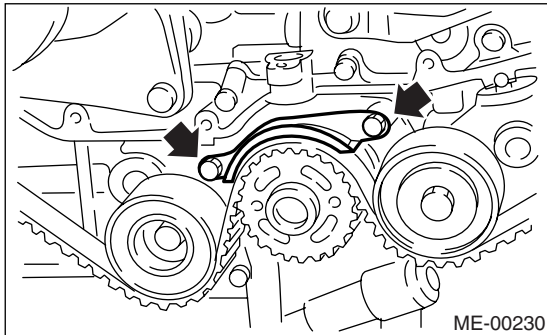
39 N·m (4.0 kgf-m, 28.9 ft-lb)



- 5) After ensuring that the marks on timing belt and camshaft sprockets are aligned, remove the stopper pin from belt tension adjuster.



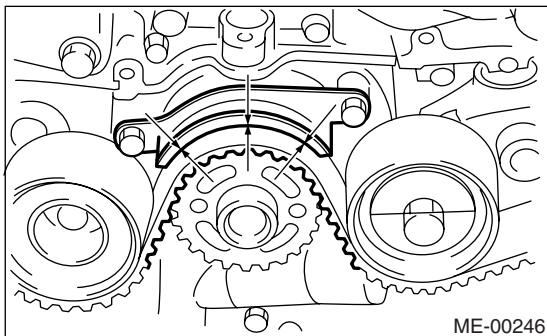
- 6) Install the timing belt guide. (MT model)
(1) Temporarily tighten the timing belt guide mounting bolts.



- (2) Check and adjust the clearance between timing belt and timing belt guide by using thickness gauge.

Clearance:

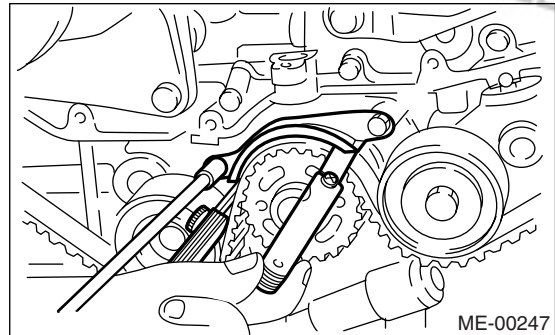
$1.0 \pm 0.5 \text{ mm}$ ($0.039 \pm 0.020 \text{ in}$)



- (3) Tighten the timing belt guide mounting bolts.

Tightening torque:

$10 \text{ N}\cdot\text{m}$ ($1.0 \text{ kgf}\cdot\text{m}$, $7.2 \text{ ft}\cdot\text{lb}$)



- 7) Install the timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
8) Install the crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
9) Install the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: INSPECTION

1. TIMING BELT

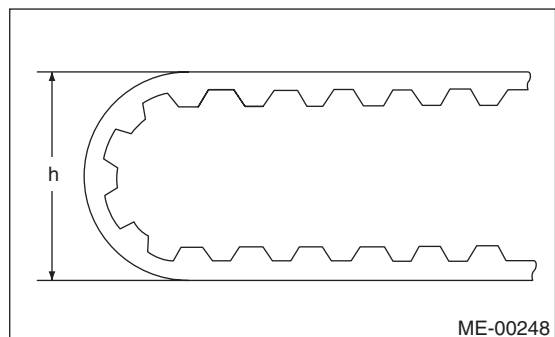
- 1) Check the timing belt teeth for breaks, cracks, and wear. If any fault is found, replace the belt.
- 2) Check the condition of back side of belt; if any crack is found, replace the belt.

CAUTION:

- Be careful not to let oil, grease or coolant contact the belt. Remove quickly and thoroughly if this happens.
- Do not bend the belt sharply.

Bending radius: h

60 mm (2.36 in) or more



2. AUTOMATIC BELT TENSION ADJUST-ER

- 1) Visually check oil seals for leaks, and rod ends for abnormal wear or scratches. If necessary, replace faulty parts.
- 2) Check that the adjuster rod does not move when a pressure of 294 N (30 kgf, 66 lb) is applied to it. This is to check adjuster rod stiffness.

3) If the adjuster rod is not stiff and moves freely when applying 294 N (30 kgf, 66 lb), check it using the following procedures:

- (1) Slowly press the adjuster rod down to the end surface of the cylinder. Repeat this motion 2 or 3 times.
- (2) With the adjuster rod moved all the way up, apply a pressure of 294 N (30 kgf, 66 lb) to it. Check adjuster rod stiffness.
- (3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new one.

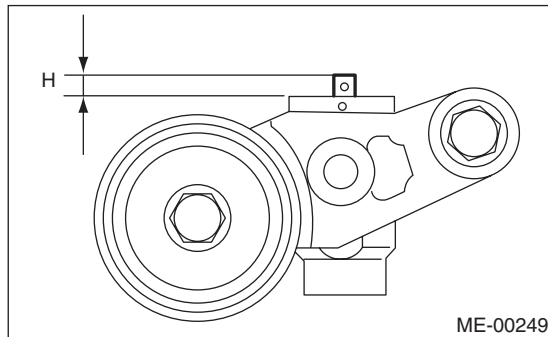
CAUTION:

- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Press-in the adjuster rod gradually taking more than 3 minutes.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
- Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into the cylinder. Doing so may damage the cylinder.

4) Measure the extension of rod beyond the body. If it is not within specifications, replace with a new one.

Rod extension: H

$5.7 \pm 0.5 \text{ mm (0.224} \pm 0.020 \text{ in)}$



3. BELT TENSION PULLEY

- 1) Check the mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace the automatic belt tension adjuster assembly if faulty.
- 2) Check the tension pulley for smooth rotation. Replace if noise or excessive play is noted.
- 3) Check the tension pulley for grease leakage.

4. BELT IDLER

- 1) Check the belt idler for smooth rotation. Replace if noise or excessive play is noted.
- 2) Check the belt outer contacting surfaces of idler pulley for abnormal wear and scratches.
- 3) Check the belt idler for grease leakage.

16. Camshaft Sprocket

A: REMOVAL

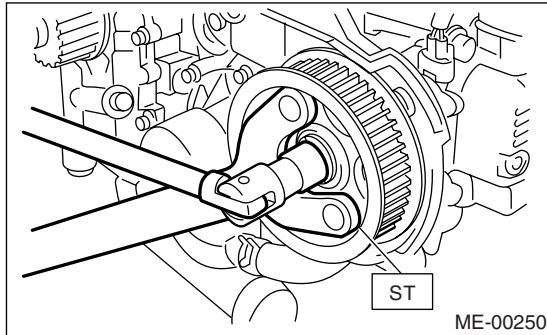
1. REMOVAL

- 1) Remove the V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt assembly. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt Assembly.>
- 5) Remove the camshaft position sensor. <Ref. to FU(H4SO)-26, REMOVAL, Camshaft Position Sensor.>
- 6) Remove the camshaft sprocket No. 2. To lock the camshaft, use ST.

ST 18231AA010 CAMSHAFT SPROCKET WRENCH

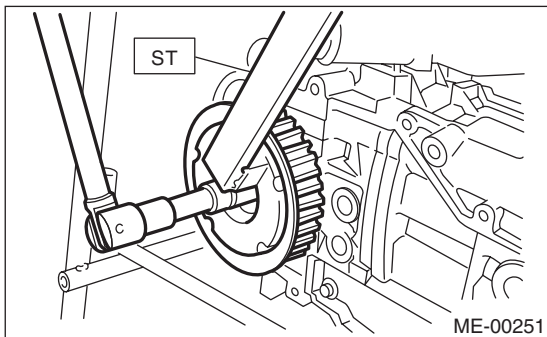
NOTE:

Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.



- 7) Remove the camshaft sprocket No. 1. To lock the camshaft, use ST.

ST 499207400 CAMSHAFT SPROCKET WRENCH



B: INSTALLATION

- 1) Install the camshaft sprocket No. 1. To lock the camshaft, use ST.

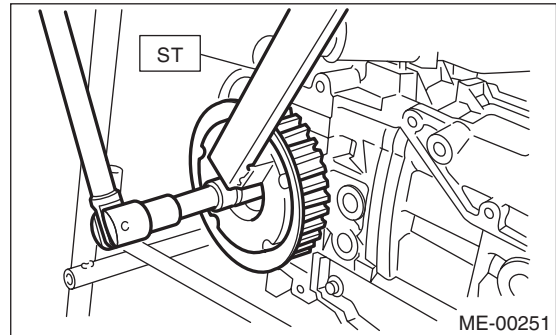
ST 499207400 CAMSHAFT SPROCKET WRENCH

Tightening torque:

78 N·m (8.0 kgf-m, 57.9 ft-lb)

NOTE:

Do not confuse the right and left side camshaft sprockets during installation. The camshaft sprocket No. 2 is identified by a projection used to monitor camshaft position sensor.



- 2) Install the camshaft sprocket No. 2. To lock camshaft, use ST.

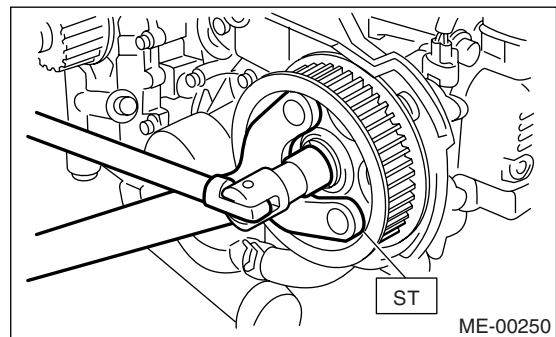
ST 18231AA010 CAMSHAFT SPROCKET WRENCH

NOTE:

Also the CAMSHAFT SPROCKET WRENCH (499207100) can be used.

Tightening torque:

78 N·m (8.0 kgf-m, 57.9 ft-lb)



- 3) Install the camshaft position sensor. <Ref. to FU(H4SO)-26, INSTALLATION, Camshaft Position Sensor.>

- 4) Install the timing belt assembly. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Assembly.>

- 5) Install the timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>

- 6) Install the crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>

7) Install the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

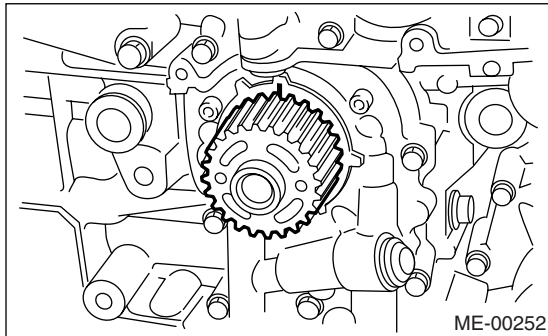
C: INSPECTION

- 1) Check the sprocket teeth for abnormal wear and scratches.
- 2) Make sure there is no free play between sprocket and key.
- 3) Check the camshaft sprocket notch for sensor for damage and contamination of foreign matter.

17.Crankshaft Sprocket

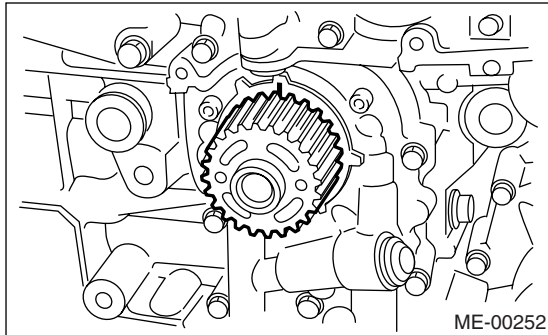
A: REMOVAL

- 1) Remove the V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt assembly. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt Assembly.>
- 5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
- 6) Remove the crankshaft sprocket.



B: INSTALLATION

- 1) Install the crankshaft sprocket.



- 2) Install the camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>
- 3) Install the timing belt assembly. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Assembly.>
- 4) Install the timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
- 5) Install the crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
- 6) Install the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: INSPECTION

- 1) Check the sprocket teeth for abnormal wear and scratches.
- 2) Make sure there is no free play between sprocket and key.
- 3) Check the crankshaft sprocket notch for sensor for damage and contamination of foreign matter.

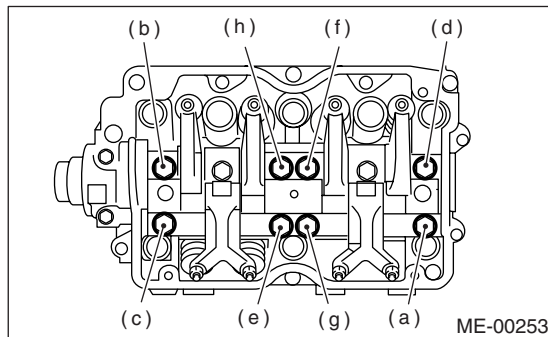
18. Valve Rocker Assembly

A: REMOVAL

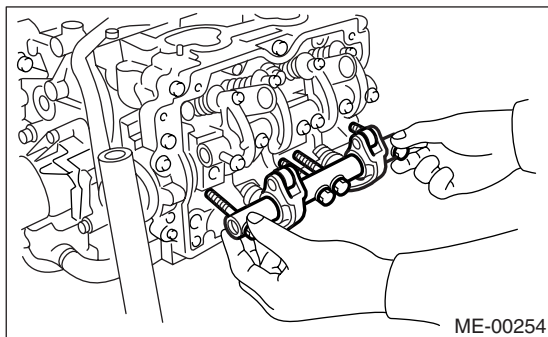
- 1) Remove the V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt assembly. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt Assembly.>
- 5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
- 6) Disconnect the PCV hose and remove rocker cover.
- 7) Removal of valve rocker assembly
 - (1) Remove the bolts (a) through (h) in alphabetical sequence.

NOTE:

Leave two or three threads of bolts (g and h) engaged to retain the valve rocker assembly.



- (2) Remove the valve rocker assembly.



B: INSTALLATION

- 1) Installation of valve rocker assembly
 - (1) Temporarily tighten the bolts (a) through (d) equally as shown in the figure.

NOTE:

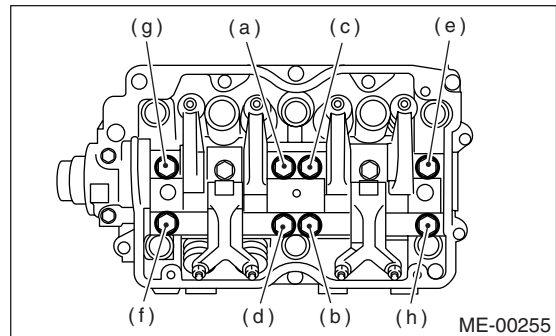
Do not allow the valve rocker assembly to gouge knock pins.

- (2) Tighten the bolts (e) through (h) to specified torque.

- (3) Tighten the bolts (a) through (d) to specified torque.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 2) Adjust the valve clearances. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
- 3) Install the rocker cover and connect PCV hose.
- 4) Install the camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>
- 5) Install the timing belt assembly. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Assembly.>
- 6) Install the timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
- 7) Install the crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
- 8) Install the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: DISASSEMBLY

- 1) Remove the bolts which secure the rocker shaft.
- 2) Extract the rocker shaft. Remove the valve rocker arms, springs and shaft supports from rocker shaft.

NOTE:

Arrange all removed parts in order so that they can be installed in their original positions.

- 3) Remove the nut and adjuster screw from valve rocker.

D: ASSEMBLY

- 1) Install the adjuster screw and nut to valve rocker.
- 2) Arrange the valve rocker arms, springs and shaft supports in assembly order and insert valve rocker shaft.

Tightening torque (Shaft supports installing bolts):

5 N·m (0.5 kgf-m, 3.6 ft-lb)

NOTE:

Valve rocker arms, rocker shaft and shaft supports have identification marks. Ensure the parts with same markings are properly assembled.

3) Install the valve rocker shaft securing bolts.

E: INSPECTION

1. VALVE ROCKER ARM AND ROCKER SHAFT

1) Measure the inside diameter of valve rocker arm and outside diameter of valve rocker shaft, and determine the difference between the two (= oil clearance).

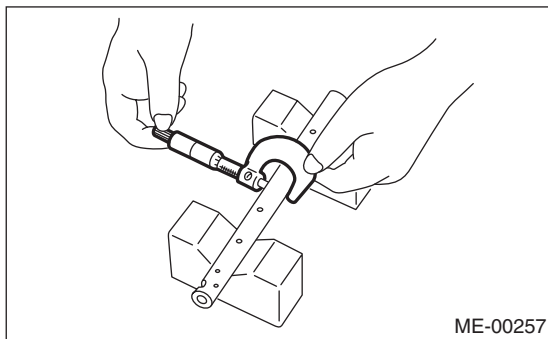
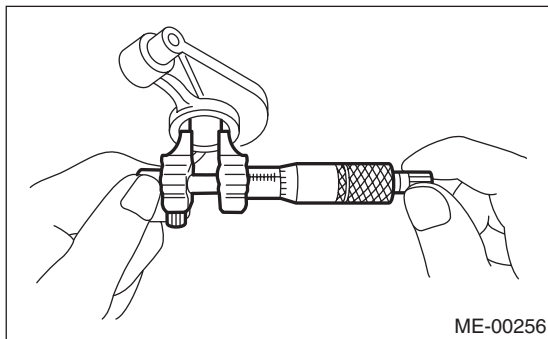
Clearance between arm and shaft:

Standard

0.020 — 0.054 mm (0.0008 — 0.0021 in)

Limit

0.10 mm (0.0039 in)



2) If oil clearance exceeds the limit, replace the valve rocker arm or shaft, whichever shows greater amount of wear.

Rocker arm inside diameter:

22.020 — 22.041 mm (0.8669 — 0.8678 in)

Rocker shaft diameter:

21.987 — 22.000 mm (0.8656 — 0.8661 in)

3) If cam or valve contact surface of valve rocker arm is worn or dented excessively, replace the valve rocker arm.

4) Check that the valve rocker arm roller rotates smoothly. If not, replace the valve rocker arm.

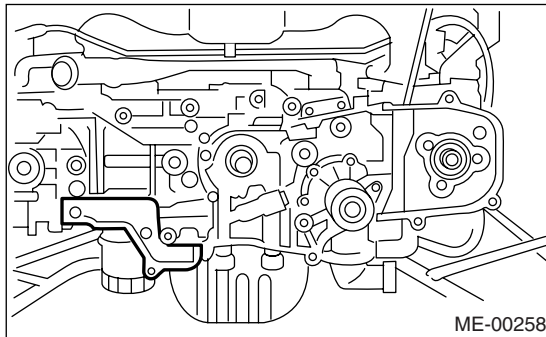
19. Camshaft

A: REMOVAL

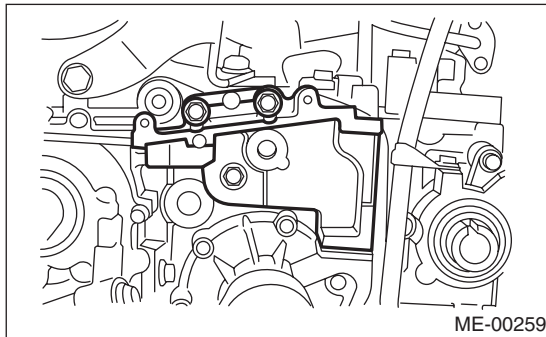
- 1) Remove the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt assembly. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt Assembly.>
- 5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
- 6) Remove the crankshaft sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Crankshaft Sprocket.>
- 7) Remove the timing belt cover No. 2 (LH).
- 8) Remove the timing belt cover No. 2 (RH).

NOTE:

Do not damage or lose the seal rubber when removing the timing belt covers.

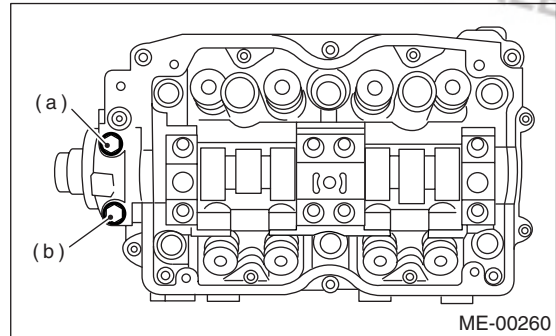


- 9) Remove the tensioner bracket.

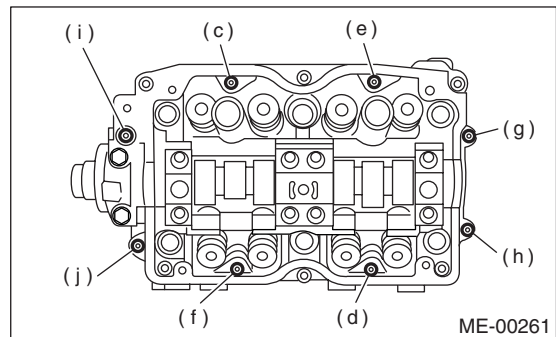


- 10) Remove the camshaft position sensor support. (LH side only)
- 11) Remove the oil level gauge guide. (LH side only)
- 12) Remove the valve rocker assembly. <Ref. to ME(H4SO)-52, REMOVAL, Valve Rocker Assembly.>
- 13) Remove the camshaft cap.

- (1) Remove the bolts (a) through (b) in alphabetical sequence.

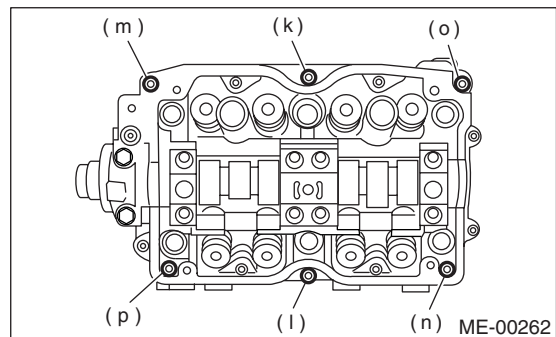


- (2) Equally loosen the bolts (c) through (j) all the way in alphabetical sequence.

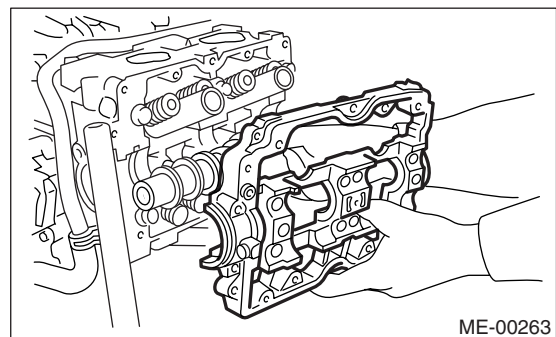


- (3) Remove the bolts (k) through (p) in alphabetical sequence using ST.

ST 499497000 TORX® PLUS



- (4) Remove the camshaft cap.



- 14) Remove the camshaft.
- 15) Remove the oil seal.
- 16) Remove the plug from rear side of camshaft.

CAUTION:

- Do not remove the oil seal unless necessary.
- Do not scratch the journal surface when removing oil seal.

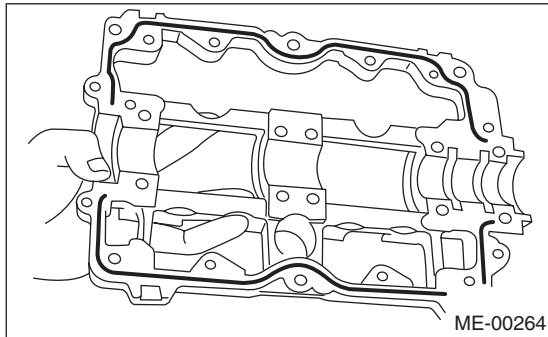
B: INSTALLATION

- 1) Apply a coat of engine oil to the camshaft journals, and then install the camshaft.
- 2) Install the camshaft cap.
 - (1) Apply liquid gasket on the around of camshaft cap.

Liquid gasket:

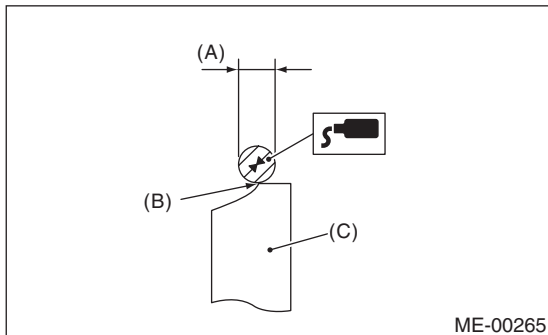
THREE BOND 1280B

Part No. K0877YA018

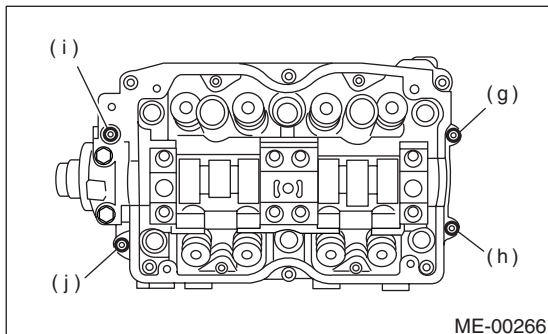


NOTE:

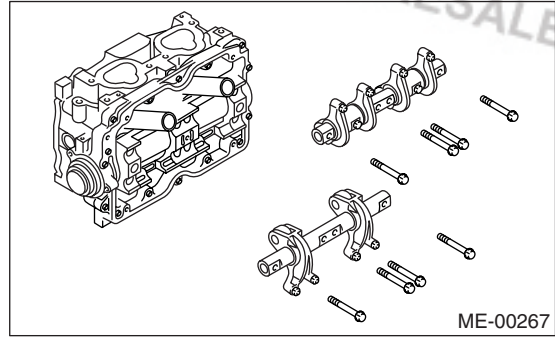
Apply a coat of 3 mm (0.12 in) dia. (A) liquid gasket along edge (B) of the camshaft cap (C) mating surface.



- (2) Temporarily tighten the bolts (g) through (j) in alphabetical sequence.



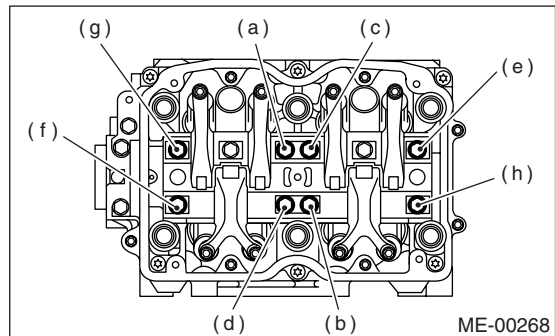
- (3) Install the valve rocker assembly.



- (4) Tighten the bolts (a) through (h) in alphabetical sequence.

Tightening torque:

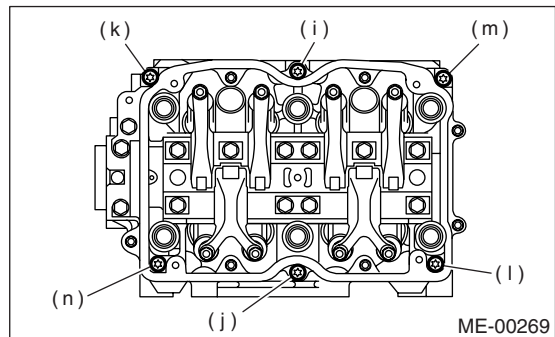
25 N·m (2.5 kgf-m, 18.1 ft-lb)



- (5) Tighten the TORX® bolts (i) through (n) in alphabetical sequence using ST. ST 499497000 TORX® PLUS

Tightening torque:

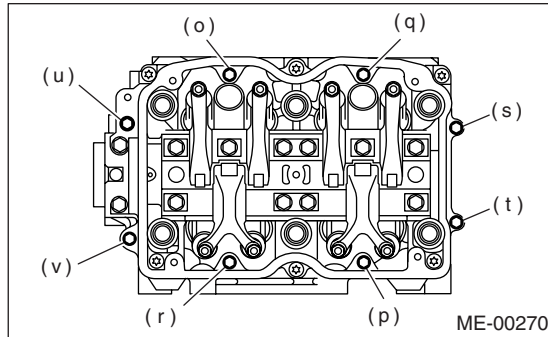
18 N·m (1.8 kgf-m, 13.0 ft-lb)



- (6) Tighten the bolts (o) through (v) in alphabetical sequence.

Tightening torque:

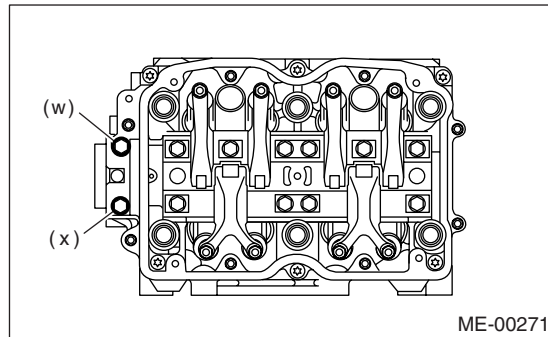
10 N·m (1.0 kgf-m, 7.2 ft-lb)



- (7) Tighten the bolts (w) through (x) in alphabetical sequence.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

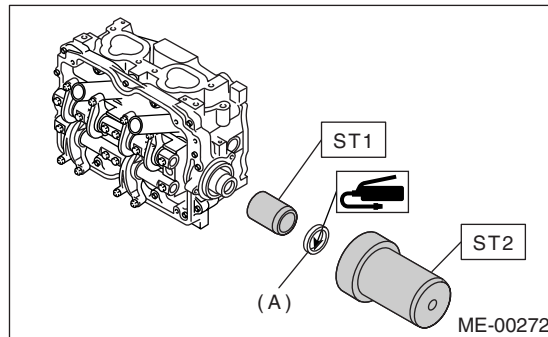


- 3) Apply a coat of grease to oil seal lips, and then install the oil seal (A) on camshaft using ST1 and ST2.

NOTE:

Use a new oil seal.

ST1	499597000	OIL SEAL GUIDE
ST2	499587500	OIL SEAL INSTALLER

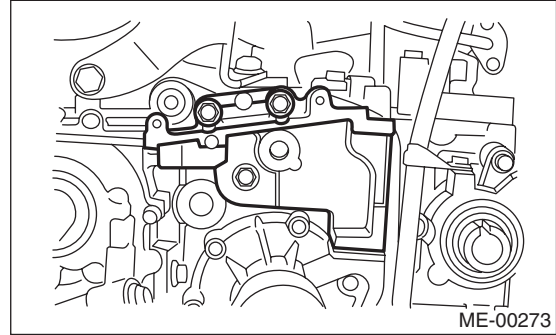


- 4) Install the plug using ST.
ST 499587700 CAMSHAFT OIL SEAL INSTALLER
- 5) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
- 6) Install the rocker cover and connect PCV hose.

- 7) Install the oil level gauge guide. (LH side only)
- 8) Install the camshaft position sensor support. (LH side only)
- 9) Install the tensioner bracket.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 10) Install the timing belt cover No. 2 (RH).

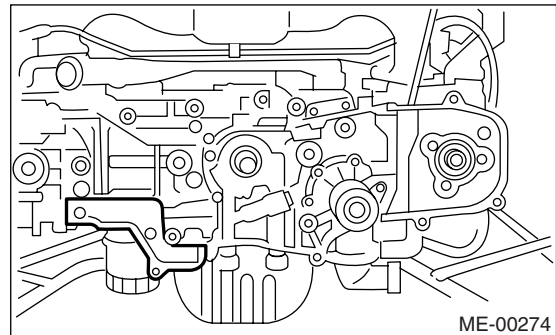
Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

- 11) Install the timing belt cover No. 2 (LH).

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



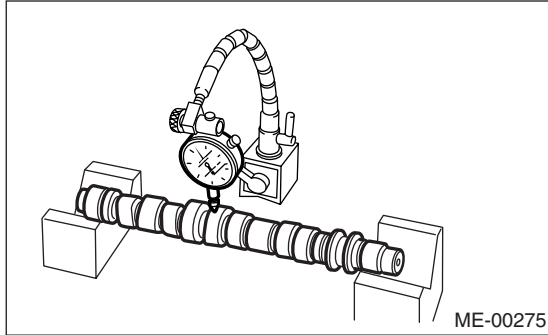
- 12) Install the crankshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Crankshaft Sprocket.>
- 13) Install the camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>
- 14) Install the timing belt assembly. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Assembly.>
- 15) Install the timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
- 16) Install the crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
- 17) Install the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: INSPECTION**1. CAMSHAFT**

1) Measure the bend, and repair or replace if necessary.

Limit:

0.025 mm (0.0010 in)



2) Check the journal for damage and wear. Replace if faulty.

3) Measure the outside diameter of camshaft journal and inside diameter of cylinder head journal, and determine the difference between two (= oil clearance). If the oil clearance exceeds specifications, replace the camshaft or cylinder head as necessary.

Unit: mm (in)		
Clearance at journal	Standard	0.055 — 0.090 (0.0022 — 0.0035)
	Limit	0.10 (0.0039)
Camshaft journal O.D.		31.928 — 31.945 (1.2570 — 1.2577)
Journal hole I.D.		32.000 — 32.018 (1.2598 — 1.2605)

4) Check the cam face condition; remove the minor faults by grinding with oil stone. Measure the cam height H; replace if the limit has been exceeded.

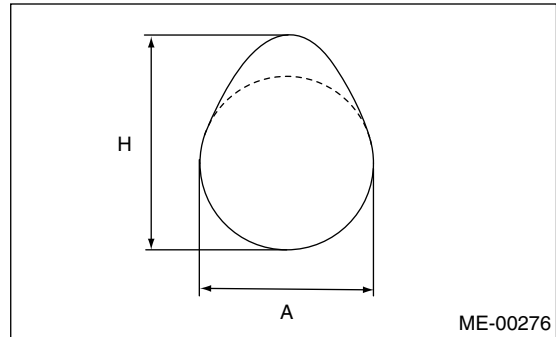
Cam height: H

Unit: mm (in)		
Intake	STD	39.485 — 39.585 (1.5545 — 1.5585)
	Limit	39.385 (1.5506)
Exhaust	STD	39.257 — 39.357 (1.5455 — 1.5495)
	Limit	39.157 (1.5416)

Cam base circle diameter A:

IN: 34.00 mm (1.3386 in)

EX: 34.00 mm (1.3386 in)

**2. CAMSHAFT SUPPORT**

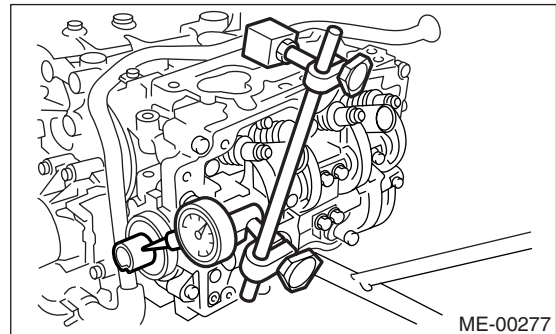
Measure the thrust clearance of camshaft with dial gauge. If the clearance exceeds the limit, replace the camshaft support.

Standard:

0.030 — 0.090 mm (0.0012 — 0.0035 in)

Limit:

0.10 mm (0.0039 in)



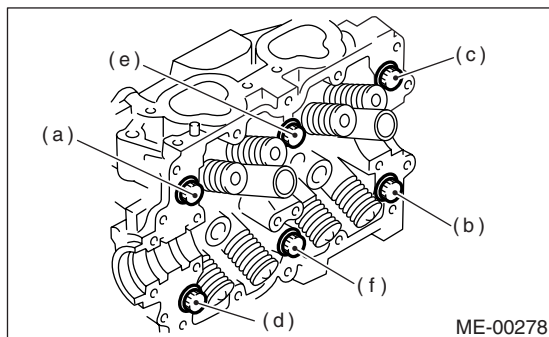
20. Cylinder Head Assembly

A: REMOVAL

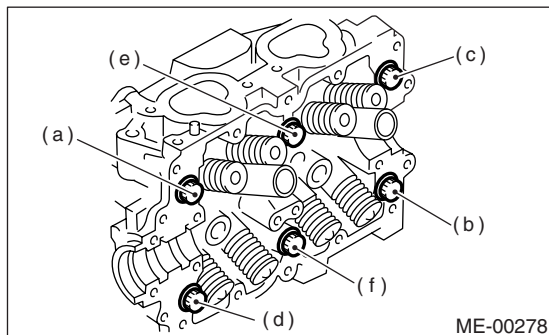
- 1) Remove the V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- 2) Remove the crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt assembly. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt Assembly.>
- 5) Remove the camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
- 6) Remove the intake manifold. <Ref. to FU(H4SO)-13, REMOVAL, Intake Manifold.>
- 7) Remove the bolt which installs the A/C compressor bracket on cylinder head.
- 8) Remove the valve rocker assembly. <Ref. to ME(H4SO)-52, REMOVAL, Valve Rocker Assembly.>
- 9) Remove the camshaft. <Ref. to ME(H4SO)-54, REMOVAL, Camshaft.>
- 10) Remove the cylinder head bolts in alphabetical sequence shown in the figure.

NOTE:

Leave the bolts (a) and (c) engaged by three or four threads to prevent cylinder head from falling.



- 11) While tapping the cylinder head with a plastic hammer, separate it from cylinder block.
- 12) Remove the bolts (a) and (c) to remove cylinder head.



- 13) Remove the cylinder head gasket.

CAUTION:

Do not scratch the mating surface of cylinder head and cylinder block.

- 14) Similarly, remove the right side cylinder head.

B: INSTALLATION

- 1) Install the cylinder head and gaskets on cylinder block.

CAUTION:

- Use new cylinder head gaskets.
- Be careful not to scratch the mating surface of cylinder block and cylinder head.

- 2) Tighten the cylinder head bolts.
 - (1) Apply a coat of engine oil to the washers and bolt threads.
 - (2) Tighten all bolts to 29 N·m (3.0 kgf-m, 22 ft-lb) in alphabetical sequence. Then tighten all bolts to 69 N·m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence.
 - (3) Back off all bolts by 180° first; back them off by 180° again in reverse order of installation.
 - (4) Tighten the bolts (a) and (b) to 34 N·m (3.5 kgf-m, 25 ft-lb) in reverse order of installation.
 - (5) Tighten the bolts (c), (d), (e) and (f) to 15 N·m (1.5 kgf-m, 11 ft-lb).
 - (6) Tighten all bolts by 80° to 90° in alphabetical sequence.

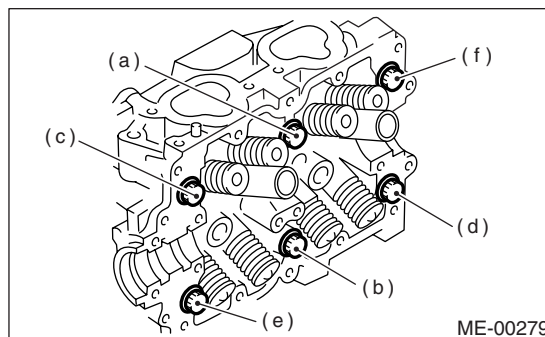
CAUTION:

Do not tighten bolts more than 90°.

- (7) Further tighten all bolts by 80° to 90° in alphabetical sequence shown in figure below.

CAUTION:

Ensure that the total “re-tightening angle” [in the former two steps], do not exceed 180°.



- 3) Install the camshaft. <Ref. to ME(H4SO)-55, INSTALLATION, Camshaft.>
- 4) Install the valve rocker assembly. <Ref. to ME(H4SO)-52, INSTALLATION, Valve Rocker Assembly.>
- 5) Install the A/C compressor bracket on cylinder head.
- 6) Install the intake manifold. <Ref. to FU(H4SO)-15, INSTALLATION, Intake Manifold.>

- 7) Install the camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>
- 8) Install the timing belt assembly. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Assembly.>
- 9) Install the timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>
- 10) Install the crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>
- 11) Install the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

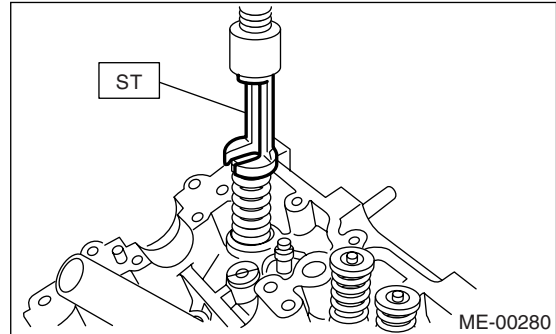
C: DISASSEMBLY

- 1) Place the cylinder head on ST.
- ST 498267800 CYLINDER HEAD TABLE

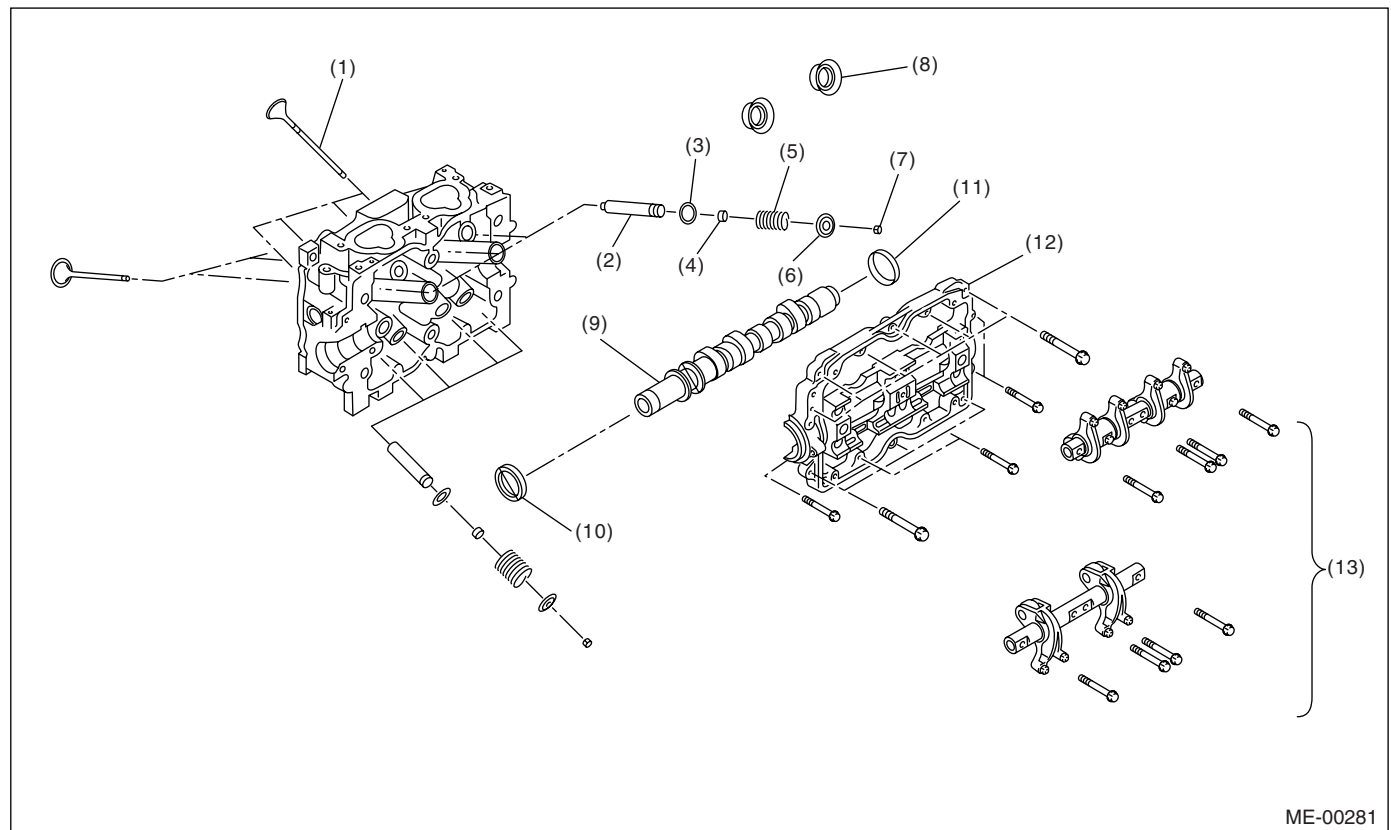
- 2) Set the ST on valve spring. Compress the valve spring, and then remove the valve spring retainer key. Remove each valve and valve spring.
- ST 499718000 VALVE SPRING REMOVER

CAUTION:

- Mark each valve to prevent confusion.
- Use extreme care not to damage the lips of intake valve oil seals and exhaust valve oil seals.



D: ASSEMBLY



(1) Valve	(6) Retainer	(11) Plug
(2) Valve guide	(7) Retainer key	(12) Camshaft cap
(3) Valve spring seat	(8) Spark plug gasket	(13) Valve rocker ASSY
(4) Oil seal	(9) Camshaft	
(5) Valve spring	(10) Oil seal	

Cylinder Head Assembly

MECHANICAL

1) Installation of valve spring and valve

(1) Place the cylinder head on ST.

ST 4982678 00 CYLINDER HEAD TABLE

(2) Coat the stem of each valve with engine oil and insert valve into valve guide.

NOTE:

When inserting the valve into valve guide, use special care not to damage the oil seal lip.

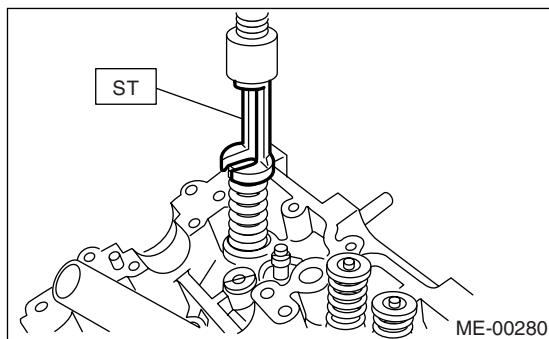
(3) Install the valve spring and retainer.

NOTE:

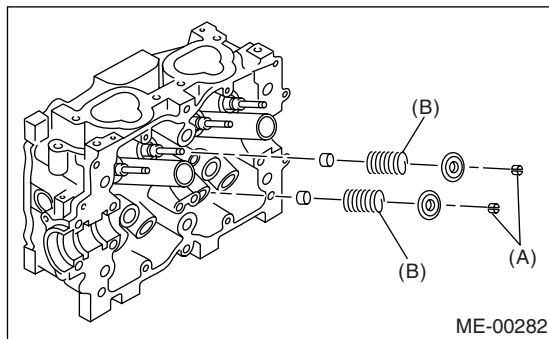
Be sure to install the valve springs with their close-coiled end facing the seat on the cylinder head.

(4) Set the ST on valve spring.

ST 499718000 VALVE SPRING REMOVER



(5) Compress the valve spring, and then fit the valve spring retainer key.



(A) Retainer key

(B) Valve spring

(6) After installing, tap the valve spring retainers lightly with plastic hammer for better seating.

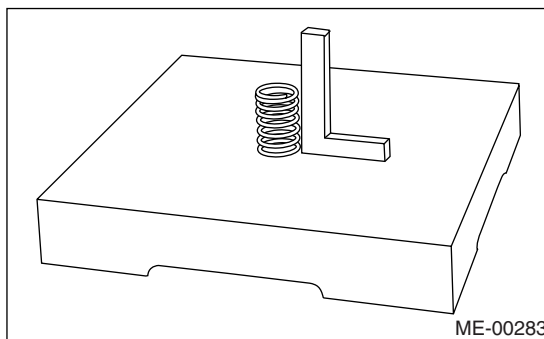
E: INSPECTION

1. VALVE SPRING

1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not to the specifications presented below.

2) To measure the squareness of valve spring, stand the spring on a surface plate and measure its deflection at the top using a try square.

Free length	54.30 mm (2.1378 in)
Squareness	2.5°, 2.4 mm (0.094 in)
Tension/spring height	Set 214 — 246 N (22 — 25 kgf, 48 — 55 lb)/ 45.0 mm (1.772 in)
	Lift 526 — 582 N (54 — 59 kgf, 119 — 130 lb)/ 34.7 mm (1.366 in)



2. INTAKE AND EXHAUST VALVE OIL SEAL

Replace the oil seal with new one, if lip is damaged or spring out of place, or when the surfaces of intake valve and valve seat are reconditioned or intake valve guide is replaced. Use pliers to pinch and remove oil seal from valve.

1) Place the cylinder head on ST1.

2) Press-fit oil seal using ST2.

CAUTION:

- Apply engine oil to oil seal before press-fitting.

- When press-fitting oil seal, do not use hammer or strike in.

- Differentiate between intake valve oil seal and exhaust valve oil seal by noting their difference in color.

ST1 498267800 CYLINDER HEAD TABLE

ST2 498857100 VALVE OIL SEAL GUIDE

Color of rubber part:

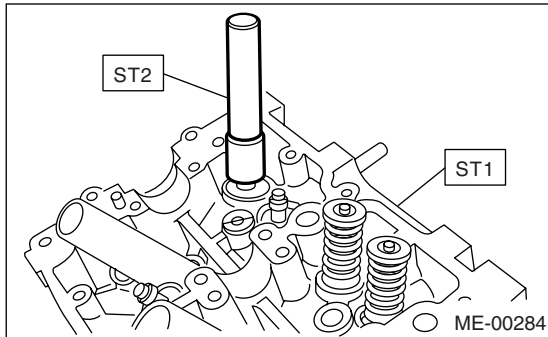
Intake [Black]

Exhaust [Brown]

Color of spring part:

Intake [Silver]

Exhaust [Silver]



F: ADJUSTMENT

1. CYLINDER HEAD

1) Make sure that no crack or other damage exists. In addition to visual inspection, inspect important areas by means of red lead check.

Also make sure that gasket installing surface shows no trace of gas and water leaks.

2) Place the cylinder head on ST.

ST 498267800 CYLINDER HEAD TABLE

3) Measure the warping of the cylinder head surface that mates with crankcase using a straight edge and thickness gauge.

If the warping exceeds 0.05 mm (0.0020 in), re-grind the surface with a surface grinder.

Warping limit:

0.05 mm (0.0020 in)

Grinding limit:

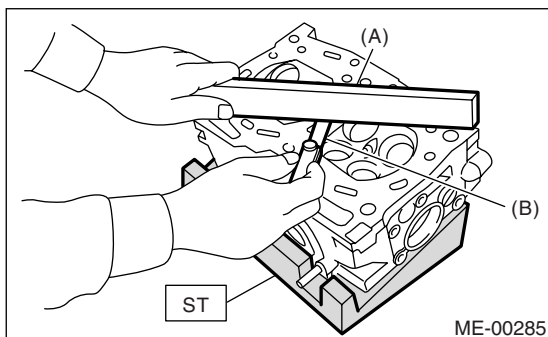
0.1 mm (0.004 in)

Standard height of cylinder head:

97.5 mm (3.839 in)

NOTE:

Uneven torque for the cylinder head bolts can cause warping. When reassembling, pay special attention to the torque so as to tighten evenly.



(A) Straight edge

(B) Thickness gauge

2. VALVE SEAT

Inspect the intake and exhaust valve seats, and then correct the contact surfaces with valve seat cutter if they are defective or when valve guides are replaced.

Valve seat width: *W*

Intake (A)

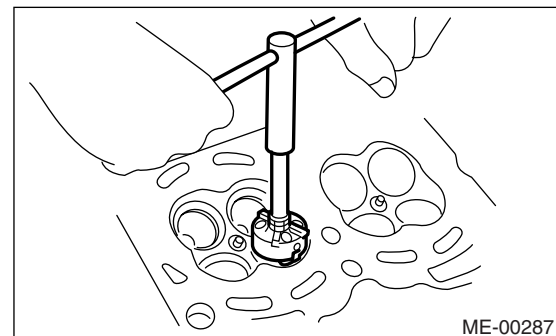
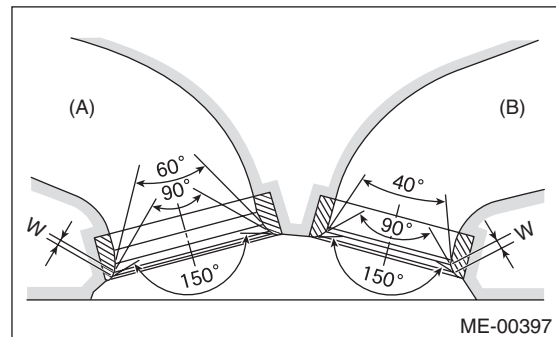
Standard 1.0 mm (0.039 in)

Limit 1.7 mm (0.067 in)

Exhaust (B)

Standard 1.5 mm (0.059 in)

Limit 2.2 mm (0.087 in)



3. VALVE GUIDE

1) Check the clearance between valve guide and stem. The clearance can be checked by measuring the outside diameter of valve stem and the inside diameter of valve guide with outside and inside micrometers respectively.

Cylinder Head Assembly

MECHANICAL

Clearance between the valve guide and valve stem:

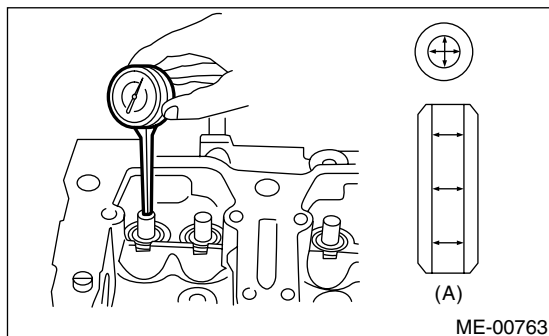
Standard

Intake 0.035 — 0.062 mm (0.0014 — 0.0024 in)

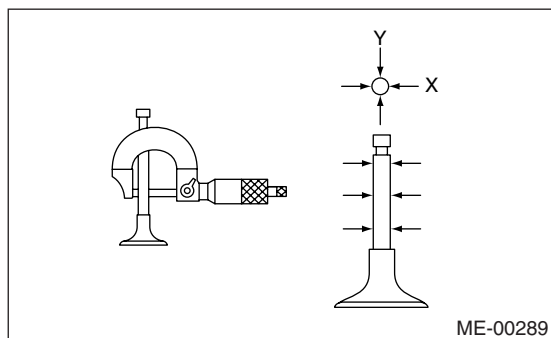
Exhaust 0.040 — 0.067 mm (0.0016 — 0.0026 in)

Limit

0.15 mm (0.0059 in)



(A) Valve guide



2) If the clearance between valve guide and stem exceeds the limit, replace the valve guide or valve itself whichever shows greater amount of wear. See the following procedure for valve guide replacement.

Valve guide inner diameter:

6.000 — 6.012 mm (0.2362 — 0.2367 in)

Valve stem outer diameters:

Intake

5.950 — 5.965 mm (0.2343 — 0.2348 in)

Exhaust

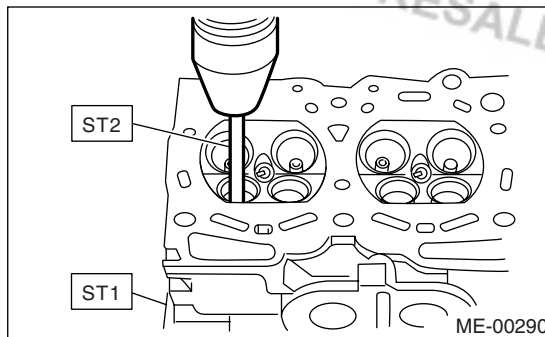
5.945 — 5.960 mm (0.2341 — 0.2346 in)

(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides enter the holes in ST1.

(2) Insert the ST2 into valve guide and press it down to remove valve guide.

ST1 498267800 CYLINDER HEAD TABLE

ST2 499767200 VALVE GUIDE REMOVER



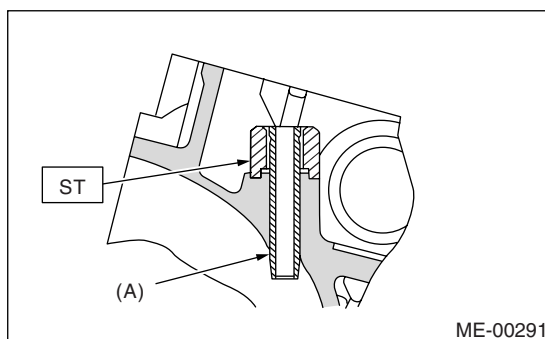
(3) Turn the cylinder head upside down and place ST as shown in the figure.

Intake side:

ST 499767700 VALVE GUIDE ADJUSTER

Exhaust side:

ST 499767800 VALVE GUIDE ADJUSTER



(A) Valve guide

(4) Before installing new oversize valve guide, make sure that neither scratches nor damages exist on the inside surface of valve guide holes in cylinder head.

(5) Put new valve guide, coated with sufficient oil, in the cylinder, and then insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

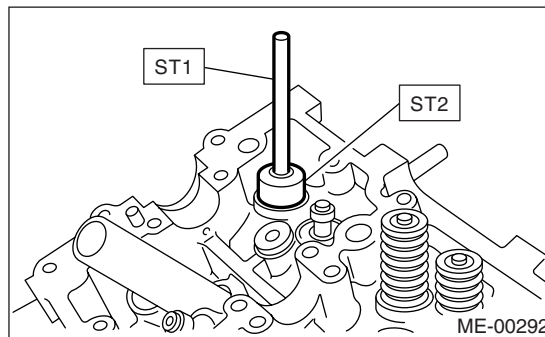
ST1 499767200 VALVE GUIDE REMOVER

Intake side:

ST2 499767700 VALVE GUIDE ADJUSTER

Exhaust side:

ST2 499767800 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

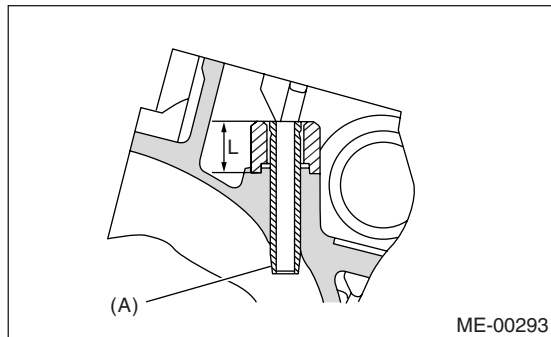
Valve guide protrusion: L

Intake

20.0 — 20.5 mm (0.787 — 0.807 in)

Exhaust

16.5 — 17.0 mm (0.650 — 0.669 in)



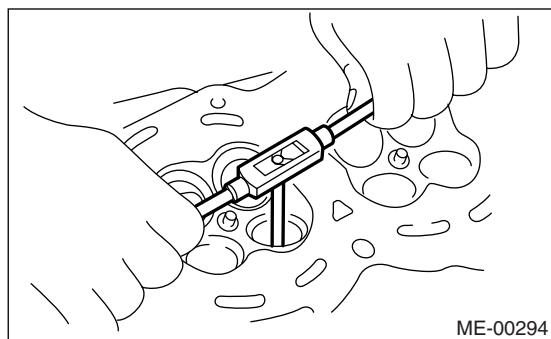
(A) Valve guide

(7) Ream the inside of valve guide with ST. Gently rotate the reamer clockwise while pressing it lightly into valve guide, and return it also rotating clockwise. After reaming, clean the valve guide to remove chips.

CAUTION:

- Apply engine oil to the reamer when reaming.
- If the inner surface of the valve guide is torn, the edge of the reamer should be slightly ground with an oil stone.
- If the inner surface of the valve guide becomes lustrous and the reamer does not chip, use a new reamer or remedy the reamer.

ST 499767400 VALVE GUIDE REAMER



(8) Recheck the contact condition between valve and valve seat after replacing valve guide.

4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace if damaged, worn, or deformed, or if "H" is less than the specified limit.

H:

Intake

Standard 1.0 mm (0.039 in)

Limit 0.6 mm (0.024 in)

Exhaust

Standard 1.2 mm (0.047 in)

Limit 0.6 mm (0.024 in)

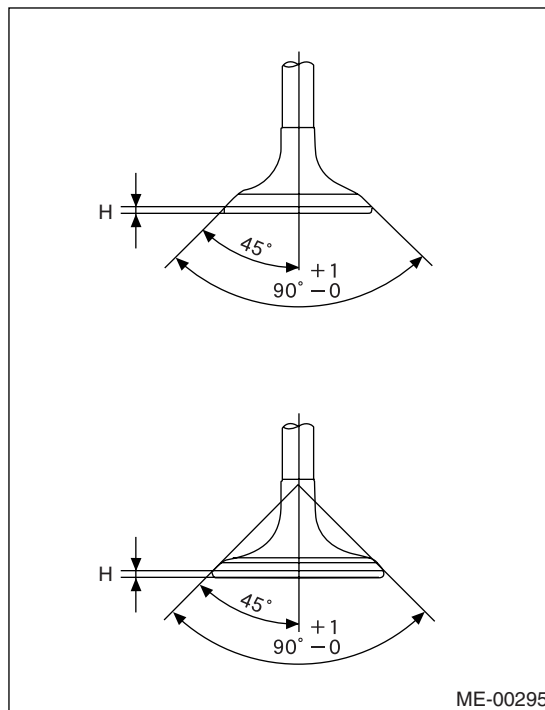
Valve overall length:

Intake

120.6 mm (4.75 in)

Exhaust

121.7 mm (4.79 in)



2) Put a small amount of grinding compound on the seat surface and lap the valve and seat surface. <Ref. to ME(H4SO)-61, VALVE SEAT, ADJUSTMENT, Cylinder Head Assembly.> Install a new intake valve oil seal after lapping.

21. Cylinder Block

A: REMOVAL

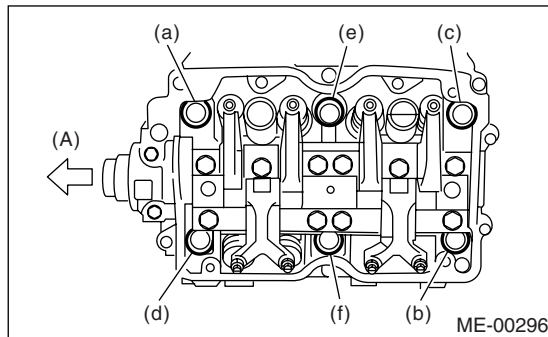
NOTE:

Before conducting this procedure, drain the engine oil completely if applicable.

- 1) Remove the intake manifold. <Ref. to FU(H4SO)-13, REMOVAL, Intake Manifold.>
- 2) Remove the V-belt. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
- 3) Remove the crankshaft pulley. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
- 4) Remove the timing belt cover. <Ref. to ME(H4SO)-43, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt assembly. <Ref. to ME(H4SO)-44, REMOVAL, Timing Belt Assembly.>
- 6) Remove the camshaft sprocket. <Ref. to ME(H4SO)-49, REMOVAL, Camshaft Sprocket.>
- 7) Remove the crankshaft sprocket. <Ref. to ME(H4SO)-42, REMOVAL, Crankshaft Pulley.>
- 8) Remove the generator and A/C compressor with their brackets.
- 9) Remove the rocker cover.
- 10) Remove the cylinder head bolts in alphabetical sequence shown in the figure.

NOTE:

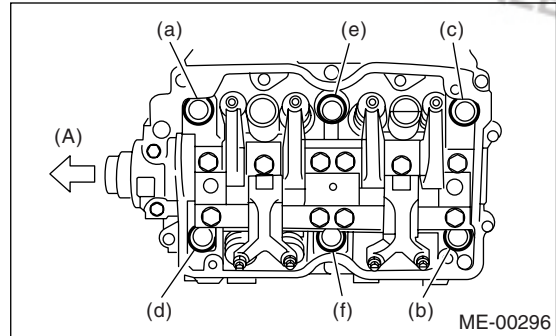
Leave bolts (a) and (c) engaged by three or four threads to prevent cylinder head from falling.



(A) Front

- 11) While tapping the cylinder head with a plastic hammer, separate it from cylinder block.

- 12) Remove the bolts (a) and (c) to remove cylinder head.



(A) Front

- 13) Remove the cylinder head gasket.

NOTE:

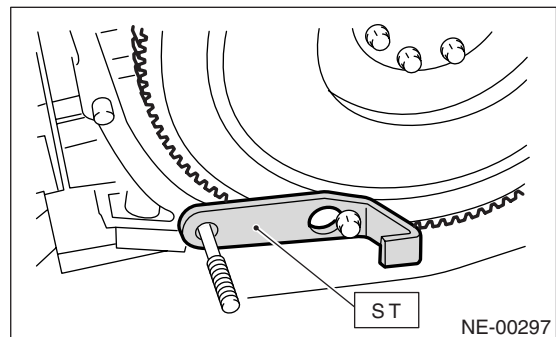
Do not scratch the mating surface of cylinder head and cylinder block.

- 14) Similarly, remove the right side cylinder head.
- 15) Remove the clutch housing cover. (MT model)
- 16) Remove the flywheel (MT model) or drive plate (AT model).

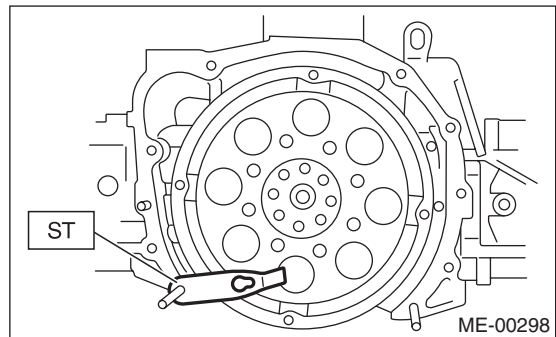
Using the ST, lock the crankshaft.

ST 498497100 CRANKSHAFT STOPPER

- MT MODEL

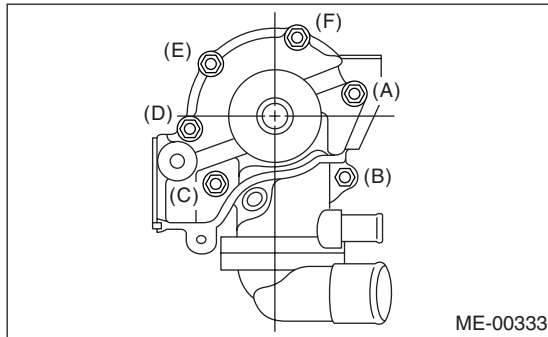


- AT MODEL



- 17) Remove the oil separator cover.
- 18) Remove the water by-pass pipe for heater.

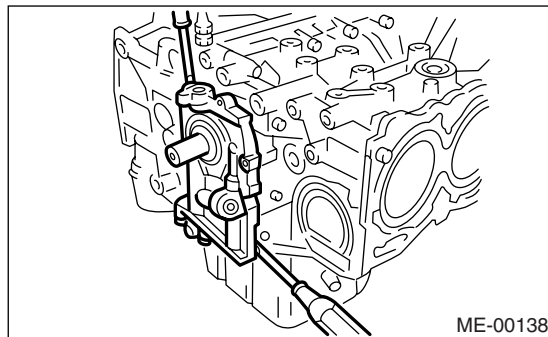
19) Loosen the bolts in alphabetical sequence as shown in the figure, and then remove the water pump.



20) Remove the oil pump from cylinder block. Use a flat-bladed screwdriver as shown in the figure when removing oil pump.

CAUTION:

Be careful not to scratch the mating surface of cylinder block and oil pump.

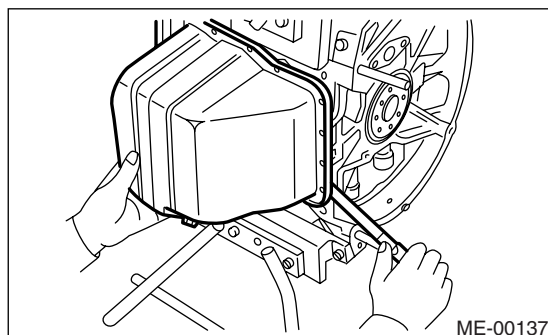


21) Removal of oil pan

- (1) Turn the cylinder block to face the #2 and #4 piston sides upward.
- (2) Remove the bolts which secure the oil pan to cylinder block.
- (3) Insert a oil pan cutter blade between cylinder block-to-oil pan clearance, and then remove the oil pan.

NOTE:

Do not use a screwdriver or similar tool in place of oil pan cutter.



22) Remove the oil strainer stay.

23) Remove the oil strainer.

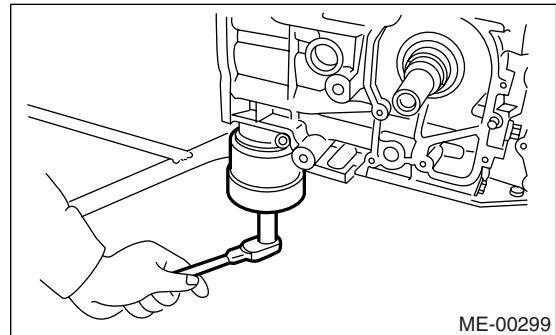
24) Remove the baffle plate.

25) Remove the oil filter using ST.

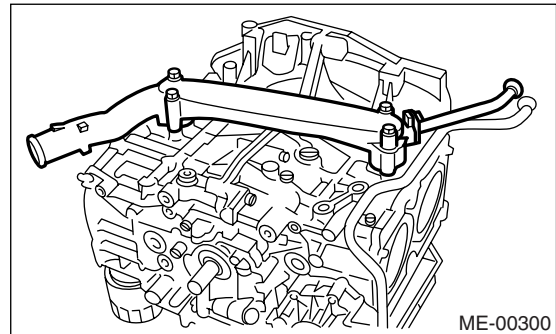
ST 498547000 OIL FILTER WRENCH (Outer diameter: 80 mm (3.15 in))

ST 18332AA000 OIL FILTER WRENCH (Outer diameter: 68 mm (2.68 in))

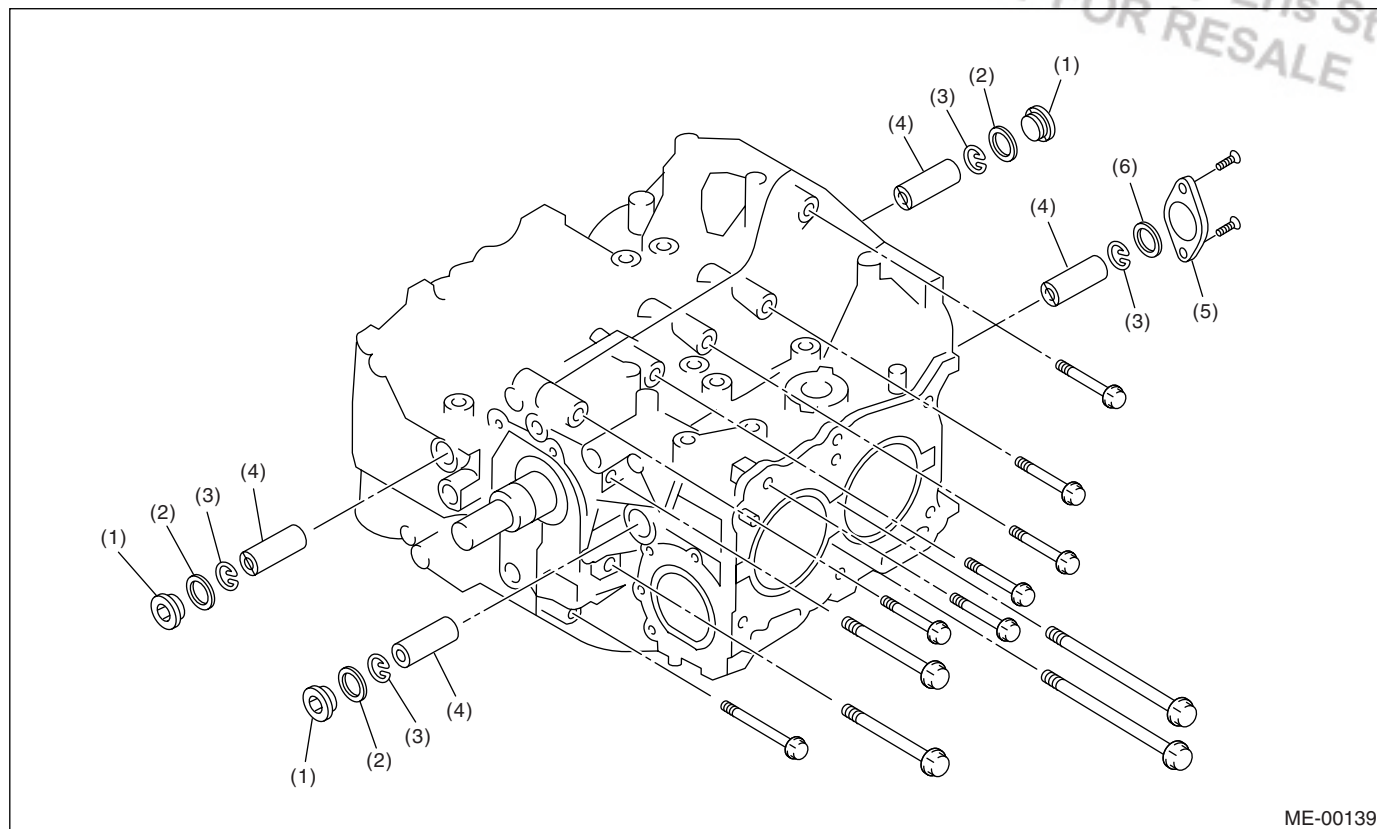
ST 18332AA010 OIL FILTER WRENCH (Outer diameter: 65 mm (2.56 in))



26) Remove the water pipe.



Cylinder Block



ME-00139

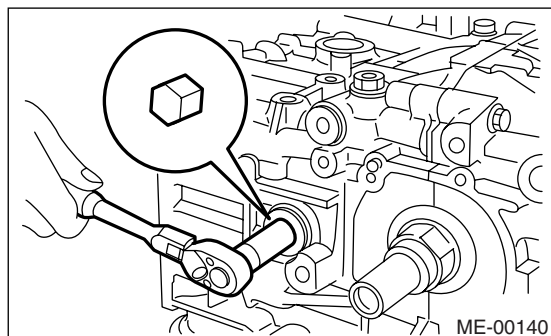
- (1) Service hole plug
(2) Gasket

- (3) Circlip
(4) Piston pin

- (5) Service hole cover
(6) O-ring

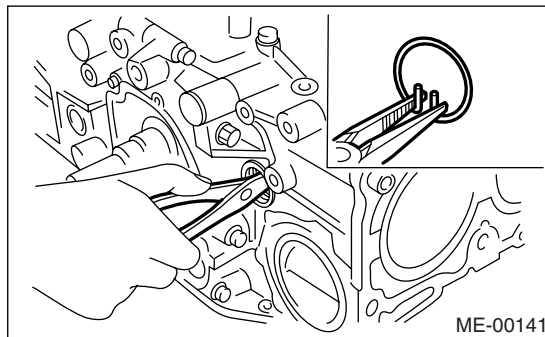
27) Remove the service hole cover and service hole plugs using hexagon wrench [14 mm (0.55 in)].

move the piston circlip through service hole of #1 and #2 cylinders.



ME-00140

28) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, and then re-



ME-00141

29) Draw out the piston pin from #1 and #2 pistons using ST.

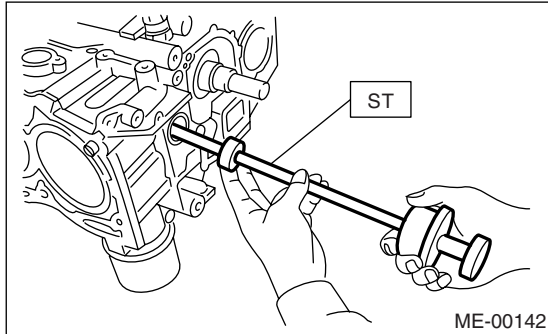
ST 499097700 PISTON PIN REMOVER

Cylinder Block

MECHANICAL

NOTE:

Be careful not to confuse the original combination of piston, piston pin and cylinder.



30) Similarly remove the piston pins from #3 and #4 pistons.

31) Remove the bolts which connect the cylinder block on the side of #2 and #4 cylinders.

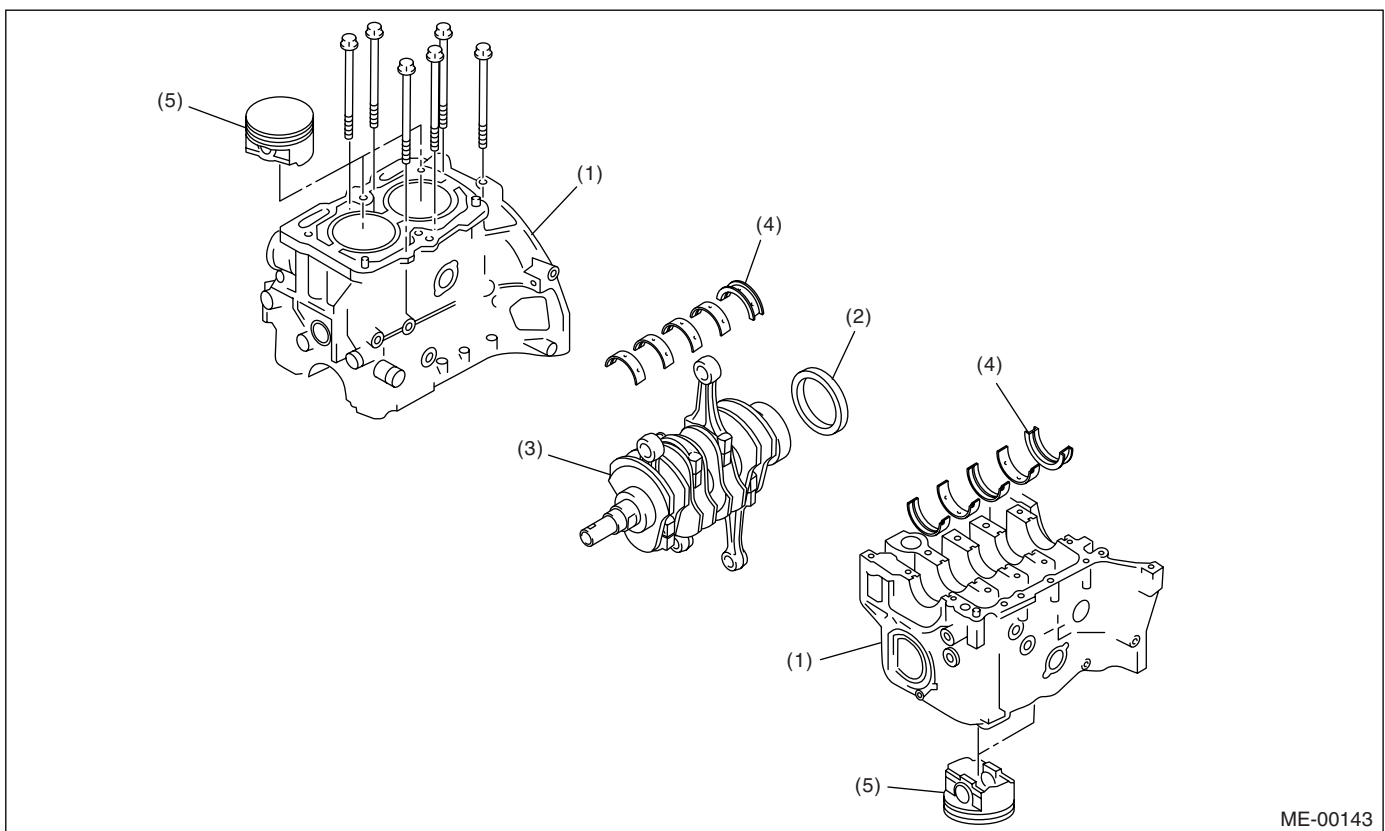
32) Back off the bolts which connect the cylinder block on the side of #1 and #3 cylinders two or three turns.

33) Set up the cylinder block so that #1 and #3 cylinders are on the upper side, and then remove the cylinder block connecting bolts.

34) Separate the cylinder blocks (RH) and (LH).

NOTE:

When separating the cylinder block, do not allow the connecting rod to fall and damage the cylinder block.



(1) Cylinder block

(2) Rear oil seal

(3) Crankshaft

(4) Crankshaft bearing

(5) Piston

35) Remove the rear oil seal.

36) Remove the crankshaft together with connecting rod.

37) Remove the crankshaft bearings from cylinder block using hammer handle.

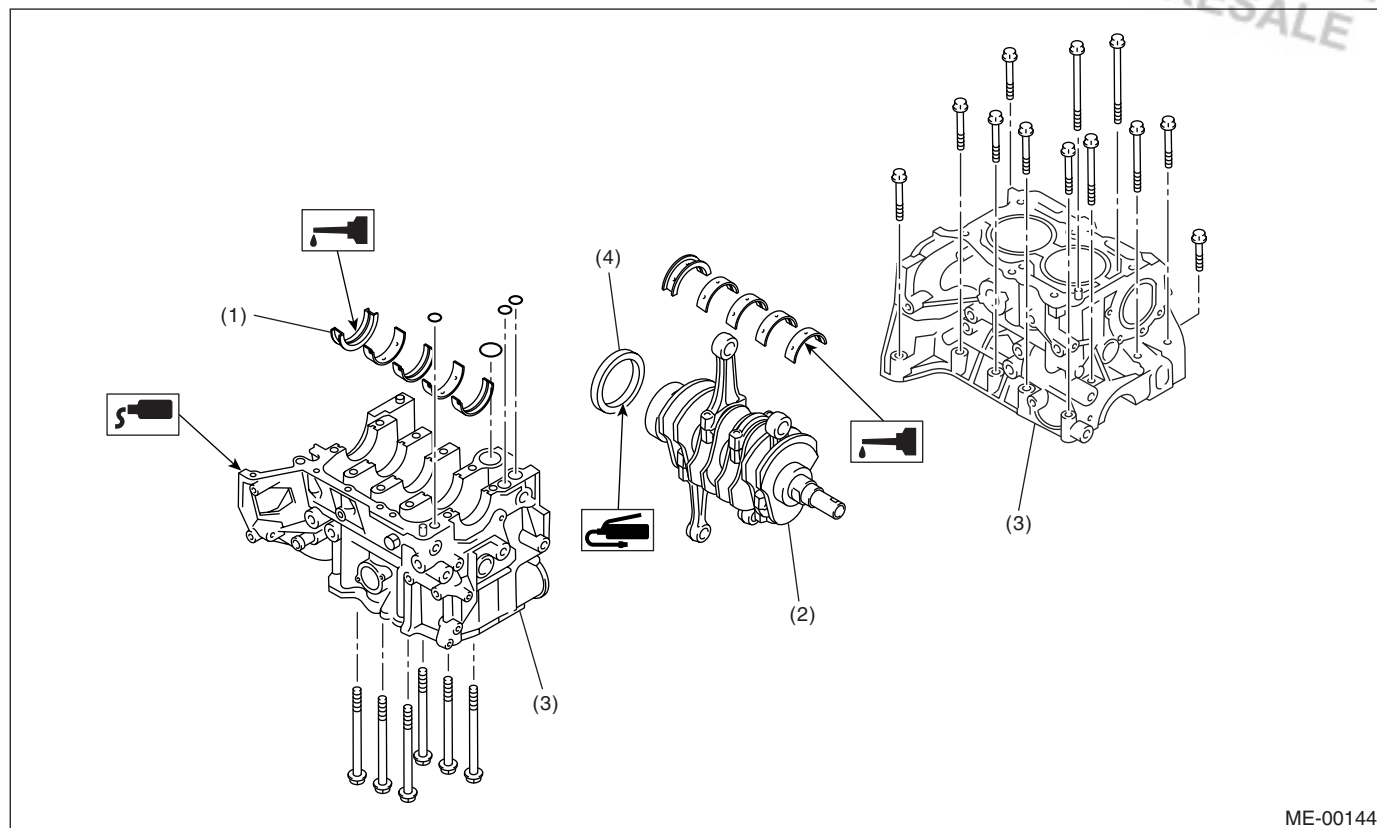
NOTE:

Do not confuse the combination of crankshaft bearings. Press bearing at the end opposite to locking lip.

38) Draw out each piston from cylinder block using wooden bar or hammer handle.

NOTE:

Do not confuse the combination of piston and cylinder.

B: INSTALLATION

(1) Crankshaft bearing

(3) Cylinder block

(4) Rear oil seal

(2) Crankshaft

NOTE:

Remove oil in the mating surface of bearing and cylinder block before installation. Also apply a coat of engine oil to crankshaft pins.

1) Position the crankshaft on #2 and #4 cylinder block.

2) Apply fluid packing to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

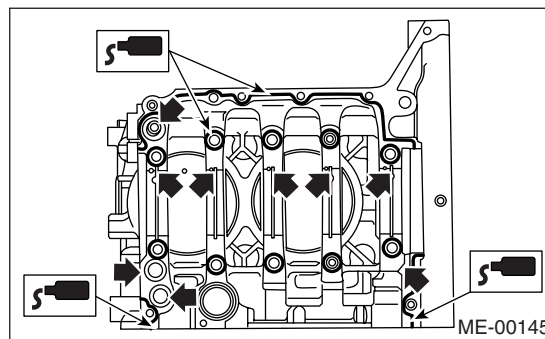
Fluid packing:

Part No. 004403007

THREE BOND 1215 or equivalent

NOTE:

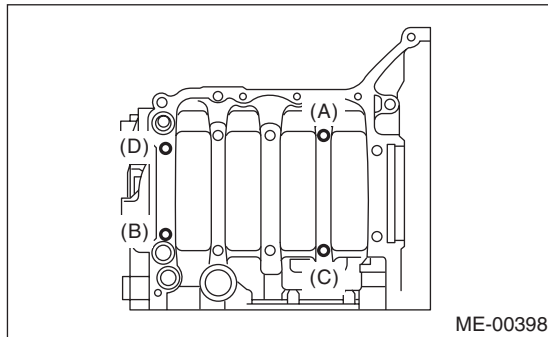
Do not allow fluid packing to jut into O-ring grooves, oil passages, bearing grooves, etc.



3) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (LH side)

Tightening torque:

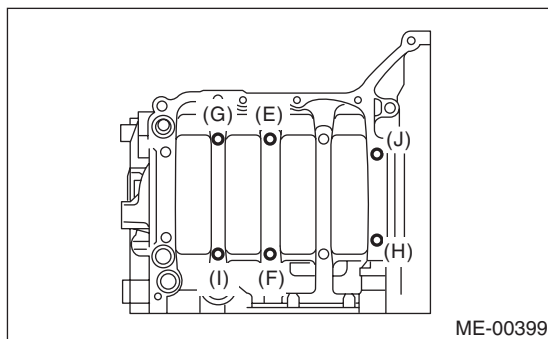
15 N·m (1.5 kgf-m, 10.8 ft-lb)



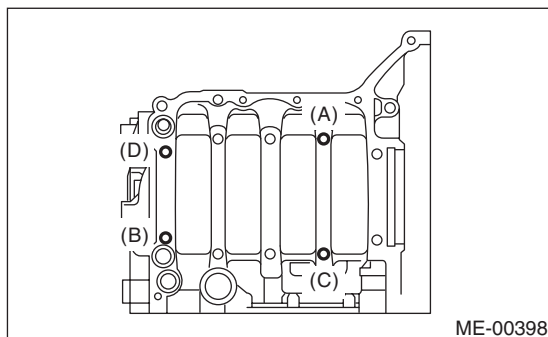
4) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (RH side)

Tightening torque:

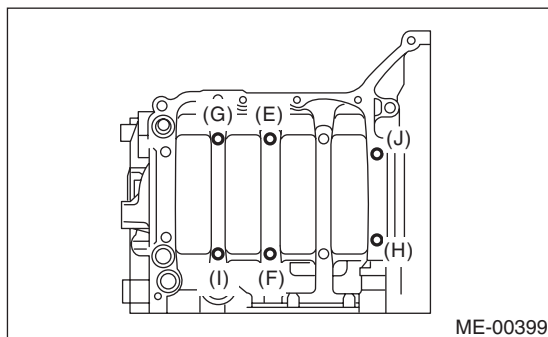
15 N·m (1.5 kgf-m, 10.8 ft-lb)



5) Further tighten the LH side bolts (A — D) to 90° in alphabetical sequence.



6) Further tighten the RH side bolts (E — J) to 90° in alphabetical sequence.

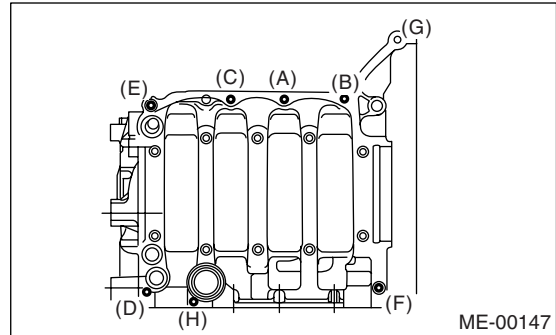


7) Tighten the 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in the figure.

Tightening torque:

(A) — (G): 25 N·m (2.5 kgf-m, 18.1 ft-lb)

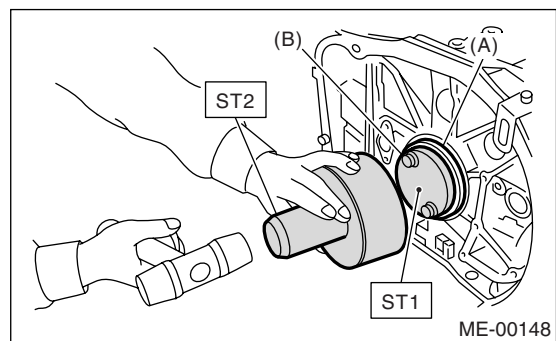
(H): 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



8) Install the rear oil seal using ST1 and ST2.

ST1 499597100 OIL SEAL GUIDE

ST2 499587200 OIL SEAL INSTALLER

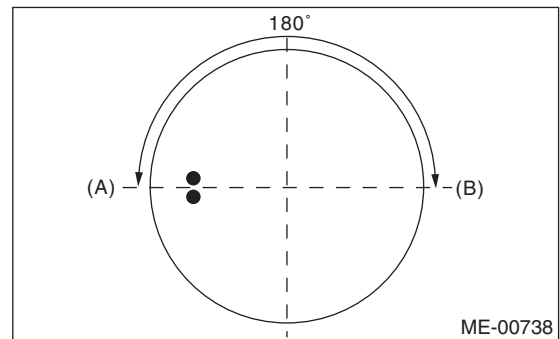


(A) Rear oil seal

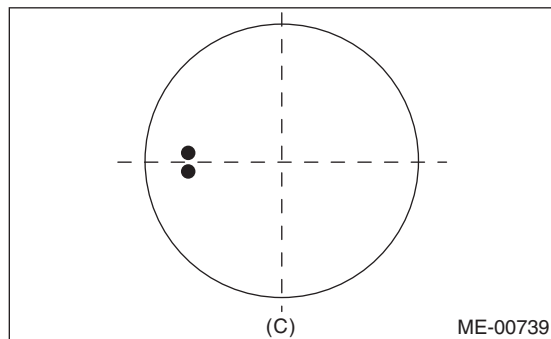
(B) Flywheel attaching bolt

9) Position the top ring gap at (A) or (B) in the figure.

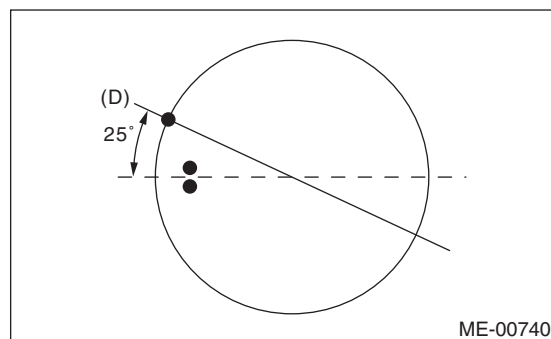
10) Position the second ring gap at 180° on the reverse side for top ring gap.



11) Position the expander gap at (C) in the figure.

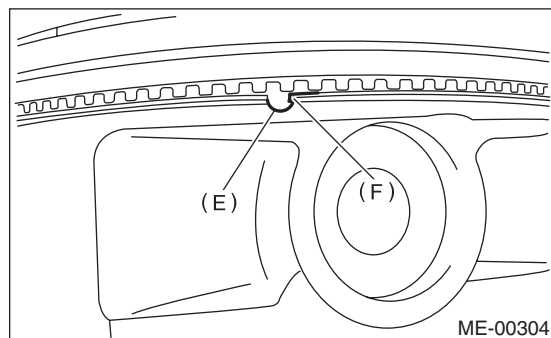


12) Position the lower rail gap at (D) in the figure.

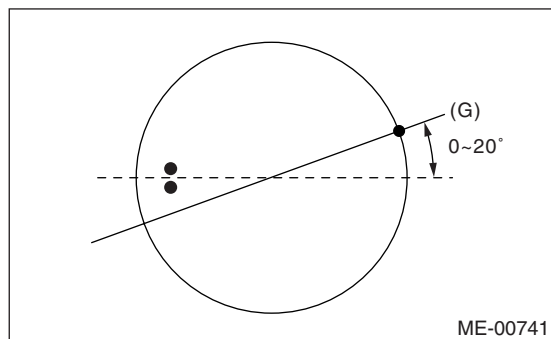


NOTE:

Align the lower rail stopper (F) to the lateral hole (E) on the piston.



13) Position the upper rail gap at (G) in the figure.



CAUTION:

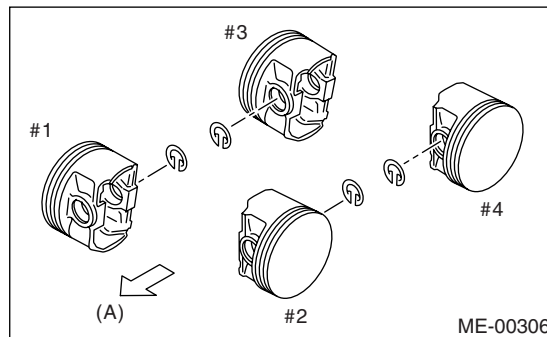
- Ensure ring gaps do not face the same direction.
- Ensure ring gaps are not within the piston skirt area.

14) Install the circlip.

Install circlips in the piston holes located opposite service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

NOTE:

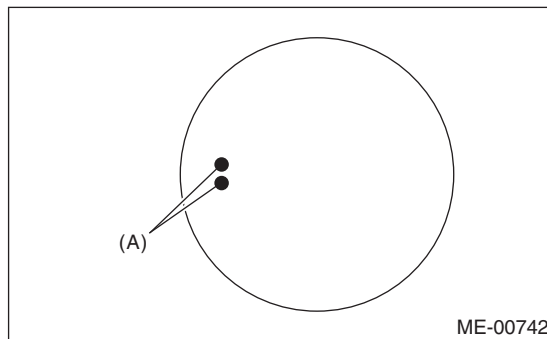
Use new circlips.



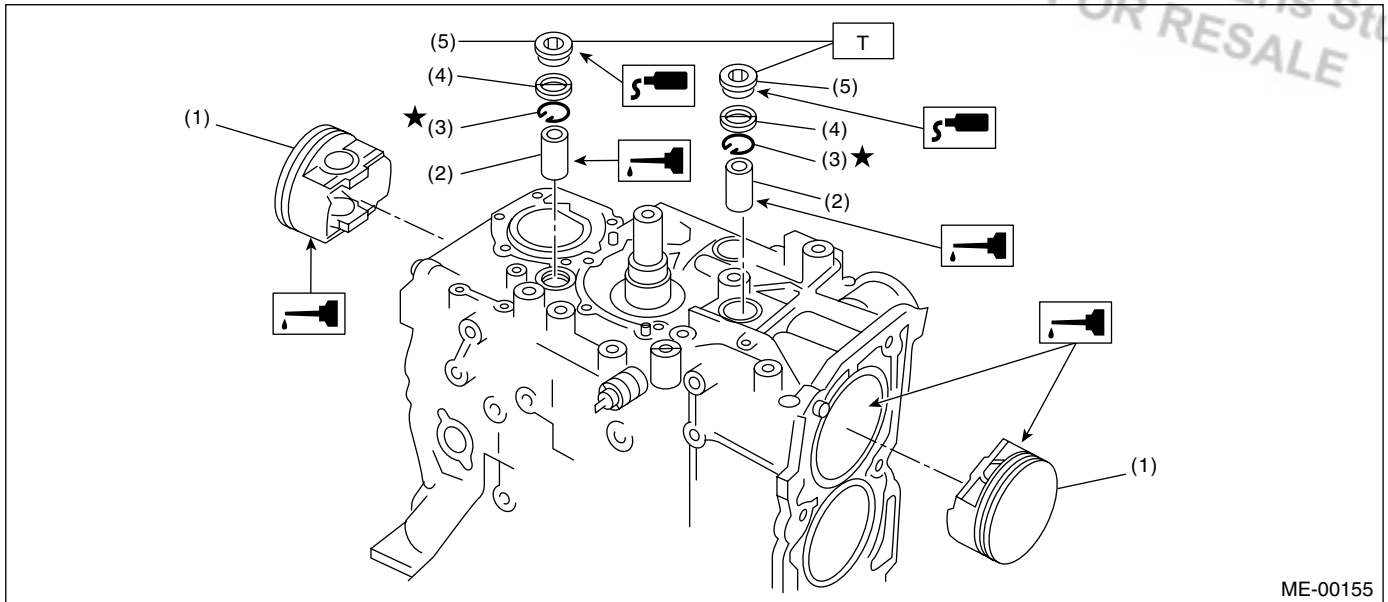
(A) Front side

CAUTION:

Piston front mark faces towards the front of the engine.



(A) Front mark



ME-00155

(1) Piston	(4) Gasket
(2) Piston pin	(5) Service hole plug
(3) Circlip	

Tightening torque: N·m (kgf-m, ft-lb)

T: 70 (7.0, 50.6)

15) Installing piston

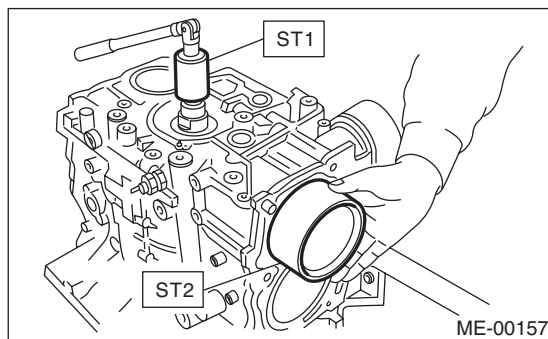
(1) Turn the cylinder block to face the #1 and #2 piston side upward.

(2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

(3) Apply a coat of engine oil to pistons and cylinders, and then insert the pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE

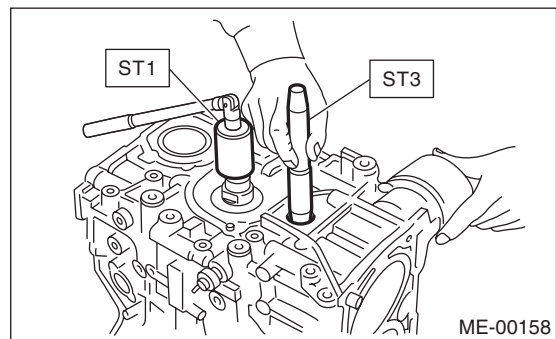


ME-00157

16) Installing piston pin

(1) Apply a coat of engine oil to the ST3 before insertion.

(2) Insert the ST3 into service hole to align piston pin hole with connecting rod small end.
ST3 499017100 PISTON PIN GUIDE



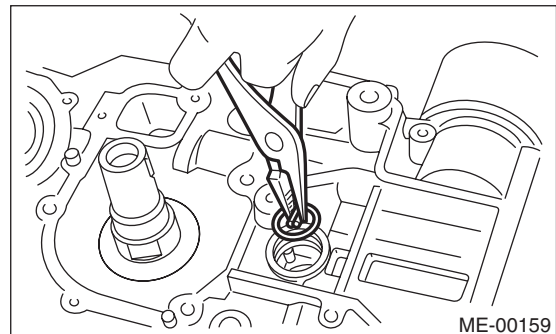
ME-00158

(3) Apply a coat of engine oil to the piston pin, and then insert the piston pin into piston and connecting rod through service hole.

(4) Install the circlip.

NOTE:

Use new circlips.



ME-00159

Cylinder Block

MECHANICAL

(5) Apply fluid packing around the service hole plug.

(6) Install the service hole plug and gasket.

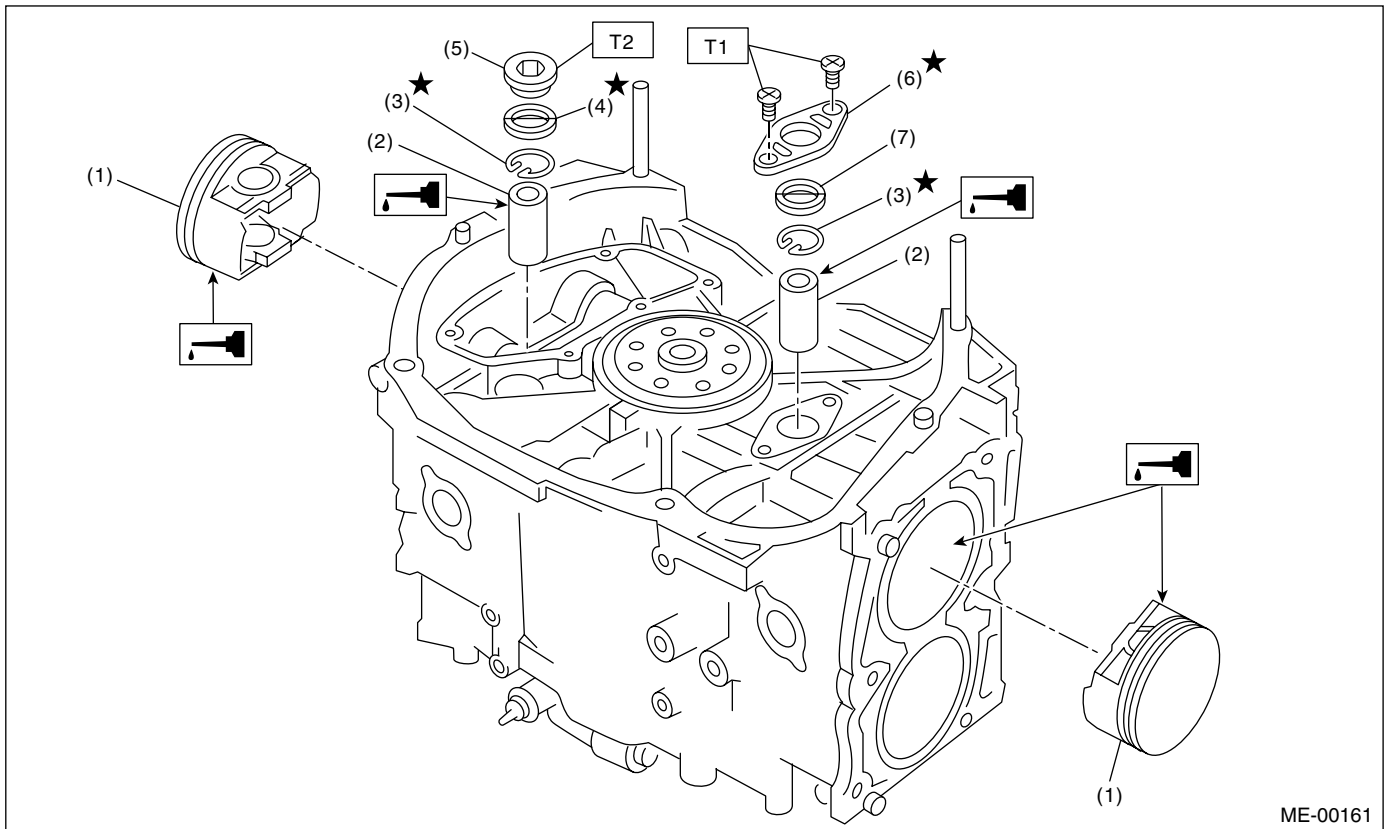
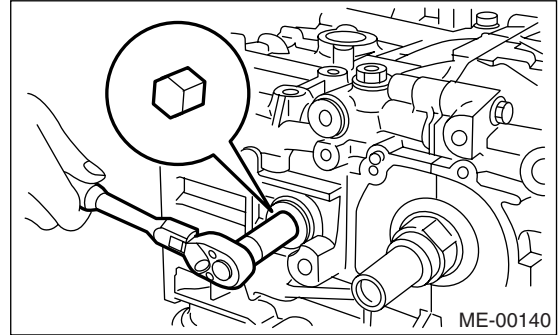
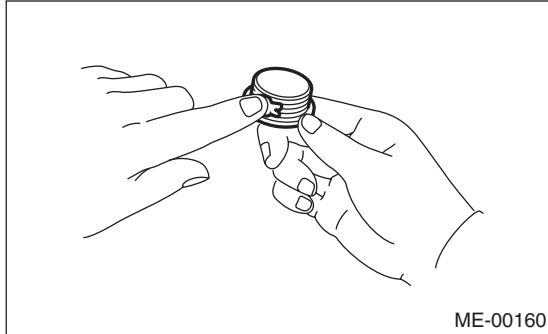
Fluid packing:

Part No. 004403007

THREE BOND 1215 or equivalent

NOTE:

Use a new gasket.



(1) Piston	(5) Service hole plug
(2) Piston pin	(6) Service hole cover
(3) Circlip	(7) O-ring
(4) Gasket	

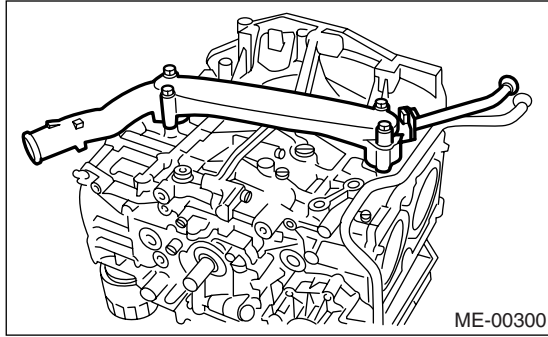
Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.65, 4.7)

T2: 70 (7.1, 51.4)

(7) Turn the cylinder block to face the #3 and #4 piston side upward. Using the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.

17) Install the water pipe.



18) Install the baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

19) Install the oil strainer and O-ring.

Tightening torque:

10 N·m (1.0 kgf-m, 7 ft-lb)

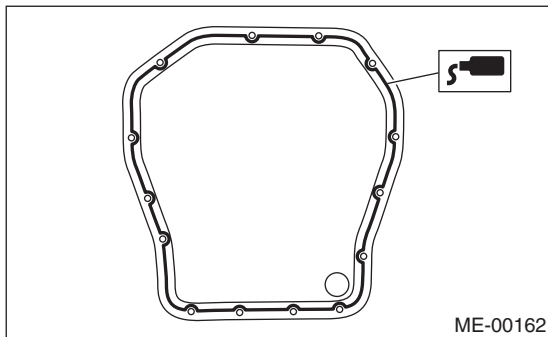
20) Install the oil strainer stay.

21) Apply fluid packing to the matching surfaces, and then install the oil pan.

Fluid packing:

Part No. 004403007

THREE BOND 1215 or equivalent

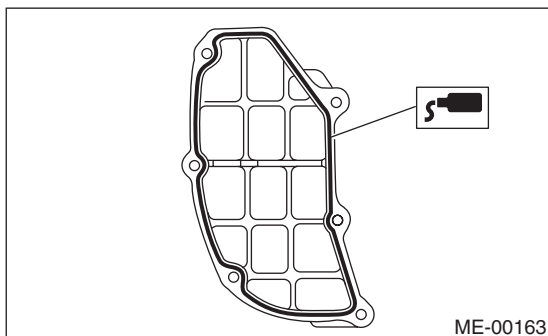


22) Apply fluid packing to the matching surfaces, and then install the oil separator cover.

Fluid packing:

Part No. 004403007

THREE BOND 1215 or equivalent



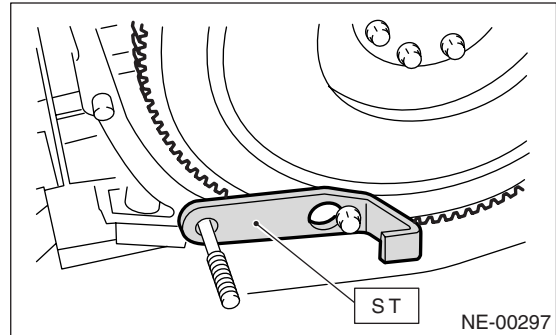
23) Install the flywheel or drive plate.
To lock the crankshaft, use ST.

ST 498497100 CRANKSHAFT STOPPER

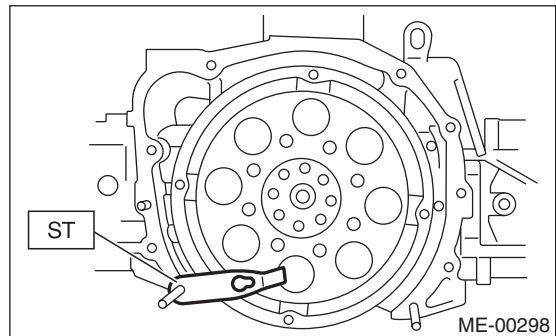
Tightening torque:

72 N·m (7.3 kgf-m, 52.8 ft-lb)

• MT MODEL



• AT MODEL

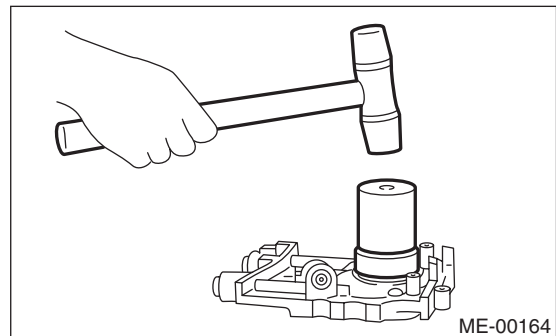


24) Install the housing cover.

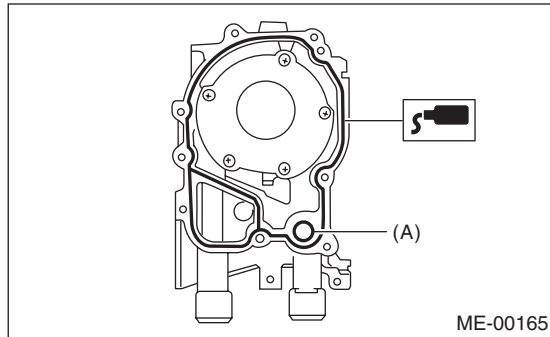
25) Installation of oil pump

(1) Discard the front oil seal after removal. Replace with a new one using the ST.

ST 499587100 OIL SEAL INSTALLER

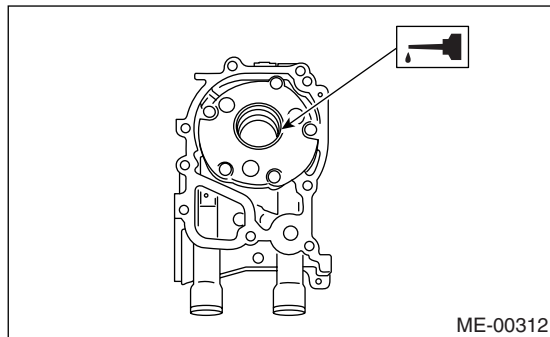


(2) Apply fluid packing to the matching surface of oil pump.

Fluid packing:**Part No. 004403007****THREE BOND 1215 or equivalent**

(A) O-ring

- (3) Apply a coat of engine oil to the inside of oil seal.



- (4) Install the oil pump on cylinder block. Be careful not to damage the oil seal during installation.

Tightening torque:**6.4 N·m (0.65 kgf-m, 4.7 ft-lb)****CAUTION:**

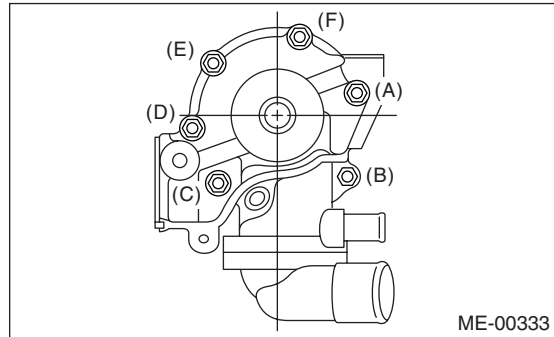
- Do not forget to install the O-ring and seal when installing oil pump.
- Align flat surface of oil pump's inner rotor with crankshaft before installation.

- 26) Install the water pump and gasket.

Tightening torque:**First; 12 N·m (1.2 kgf-m, 8.7 ft-lb)****Second; 12 N·m (1.2 kgf-m, 8.7 ft-lb)****CAUTION:**

- Be sure to use a new gasket.

- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in the figure.



- 27) Install the water by-pass pipe for heater.

- 28) Install the oil filter using ST.

ST 498547000 OIL FILTER WRENCH (Outer diameter: 80 mm (3.15 in))

ST 18332AA000 OIL FILTER WRENCH (Outer diameter: 68 mm (2.68 in))

ST 18332AA010 OIL FILTER WRENCH (Outer diameter: 65 mm (2.56 in))

Install the oil filter by turning it by hand, being careful not to damage the seal rubber.

- Tighten the oil filter 80 mm (3.15 in) or 65 mm (2.56 in) in diameter by approx. 2/3 - 3/4 rotation more after the seal rubber of oil filter comes in contact with cylinder block or oil cooler.

- Tighten the oil filter 68 mm (2.68 in) in diameter by approx. 1 rotation more after the seal rubber of oil filter comes in contact with cylinder block or oil cooler.

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

- 29) Tighten the cylinder head bolts.

- (1) Apply a coat of engine oil to the washers and bolt threads.

- (2) Tighten all bolts to 29 N·m (3.0 kgf-m, 22 ft-lb) in alphabetical sequence.

Then tighten all bolts to 69 N·m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence.

- (3) Back off all bolts by 180° first; back them off by 180° again.

- (4) Tighten the bolts (a) and (b) to 34 N·m (3.5 kgf-m, 25 ft-lb).

- (5) Tighten the bolts (c), (d), (e) and (f) to 15 N·m (1.5 kgf-m, 11 ft-lb).

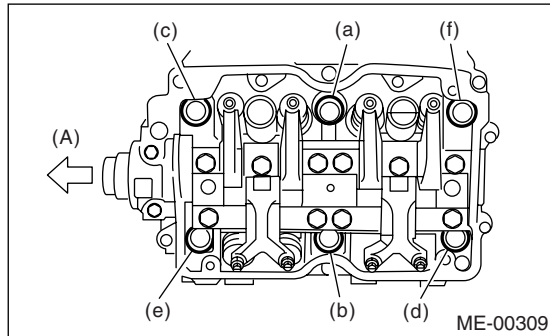
- (6) Tighten all bolts by 80° to 90° in alphabetical sequence.

CAUTION:**Do not tighten bolts more than 90°.**

- (7) Further tighten all bolts by 80° to 90° in alphabetical sequence.

CAUTION:

Ensure that the total “re-tightening angle” [in the former two steps], do not exceed 180°.



(A) Front

30) Install the oil level gauge guide, and then tighten the attaching bolt (left side only).

31) Install the rocker cover.

32) Install the crankshaft sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Crankshaft Sprocket.>

33) Install the camshaft sprocket. <Ref. to ME(H4SO)-49, INSTALLATION, Camshaft Sprocket.>

34) Install the timing belt assembly. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Assembly.>

35) Install the timing belt cover. <Ref. to ME(H4SO)-43, INSTALLATION, Timing Belt Cover.>

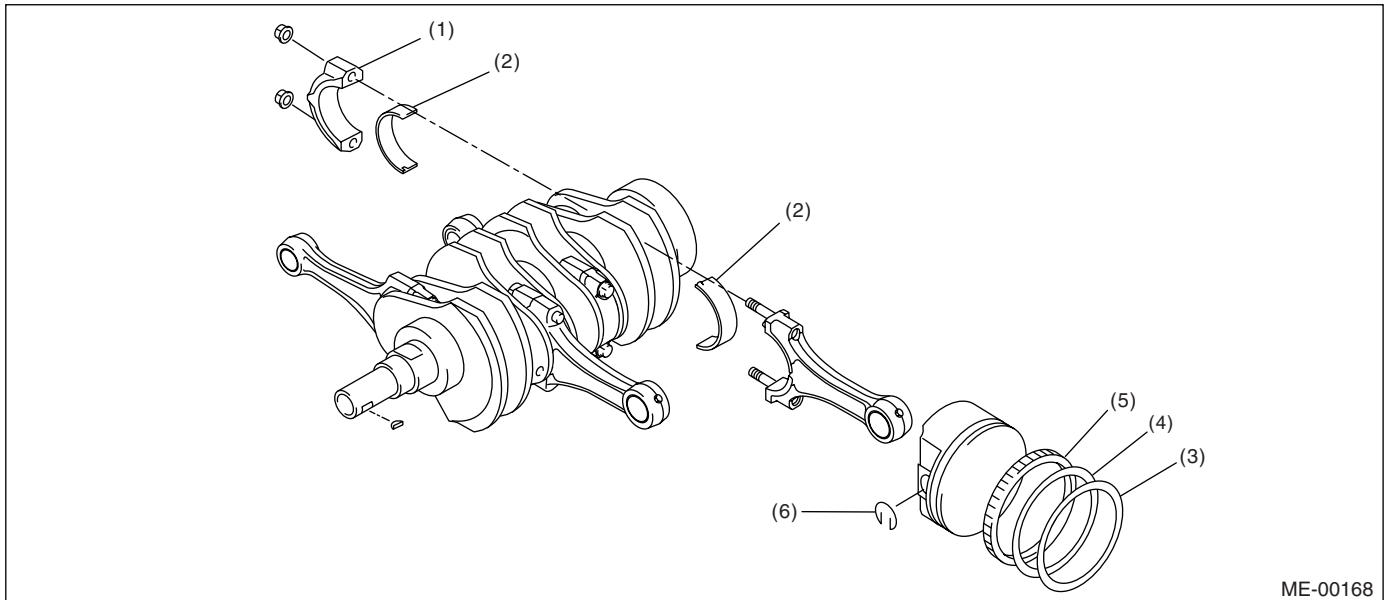
36) Install the crankshaft pulley. <Ref. to ME(H4SO)-42, INSTALLATION, Crankshaft Pulley.>

37) Install the generator and A/C compressor brackets on cylinder head.

38) Install the V-belt. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

39) Install the intake manifold. <Ref. to FU(H4SO)-15, INSTALLATION, Intake Manifold.>

C: DISASSEMBLY



(1) Connecting rod cap

(2) Connecting rod bearing

(3) Top ring

(4) Second ring

(5) Oil ring

(6) Circlip

1) Remove the connecting rod cap.

2) Remove the connecting rod bearing.

NOTE:

Arrange the removed connecting rod, connecting rod cap and bearing in order to prevent confusion.

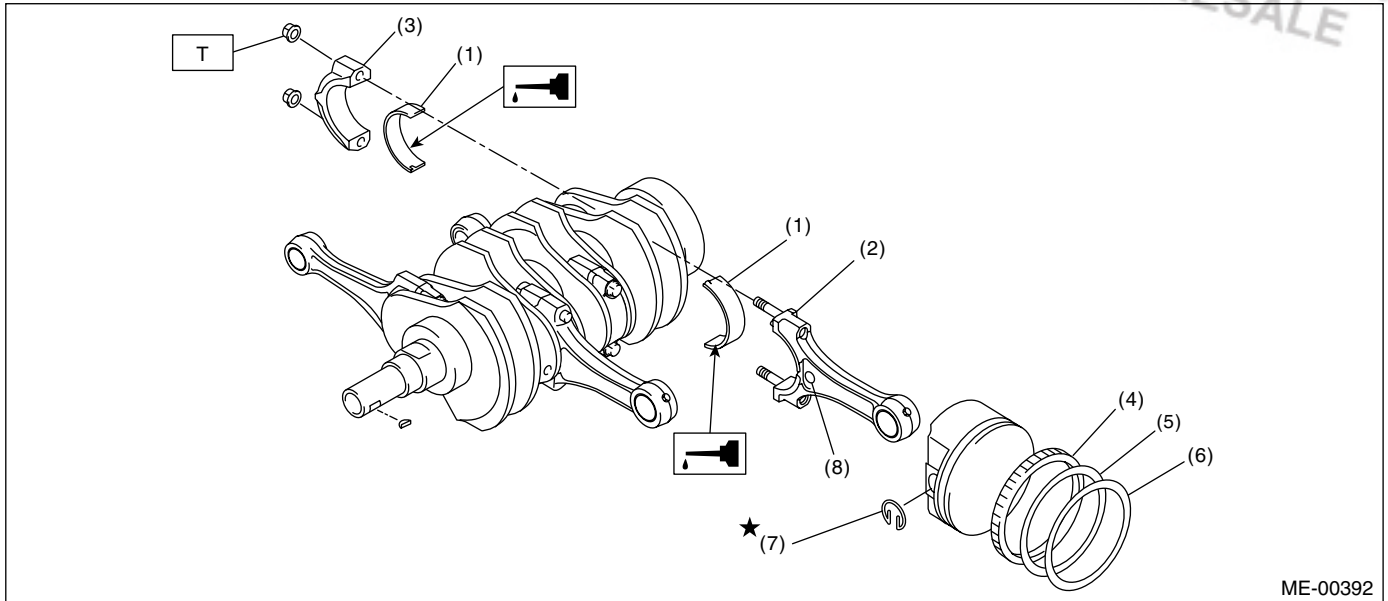
3) Remove the piston rings using the piston ring expander.

4) Remove the oil ring by hand.

NOTE:

Arrange the removed piston rings in good order to prevent confusion.

5) Remove the circlip.

D: ASSEMBLY

ME-00392

(1) Connecting rod bearing	(5) Second ring
(2) Connecting rod	(6) Top ring
(3) Connecting rod cap	(7) Circlip
(4) Oil ring	(8) Side mark

Tightening torque: N·m (kgf-m, ft-lb)**T: 45 (4.6, 33)**

1) Apply oil to the surfaces of the connecting rod bearings.

2) Install the connecting rod bearings on connecting rods and connecting rod caps.

3) Position each connecting rod with the marked side facing forward, and then install them.

4) Install the connecting rod cap with connecting rod nut.

Ensure the arrow on connecting rod cap faces the front during installation.

CAUTION:

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.

- When tightening the connecting rod nuts, apply oil on the threads.

5) Install the expander, lower rail and upper rail in this order by hand. Then install the second ring and top ring using piston ring expander.

E: INSPECTION**1. CYLINDER BLOCK**

1) Visually check for cracks and damage. Especially, inspect the important parts by means of red lead check.

2) Check the oil passages for clogging.

3) Inspect the crankcase surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:**0.05 mm (0.0020 in)****Grinding limit:****0.1 mm (0.004 in)****Standard height of cylinder block:****201.0 mm (7.91 in)****2. CYLINDER AND PISTON**

1) The cylinder bore size is stamped on cylinder block's front upper surface.

NOTE:

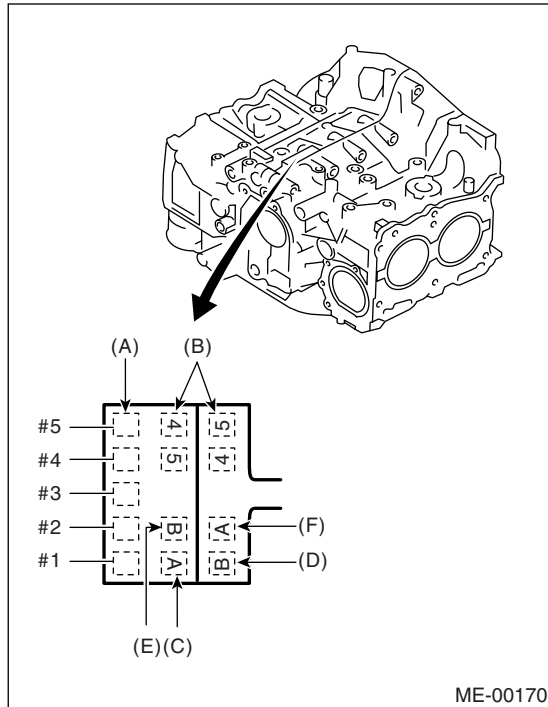
- Measurement should be performed at a temperature 20°C (68°F).

- Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as a guide line in selecting a standard piston.

Standard diameter:

A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)

B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)



- (A) Main journal size mark
- (B) Cylinder block RH-LH combination mark
- (C) #1 cylinder bore size mark
- (D) #2 cylinder bore size mark
- (E) #3 cylinder bore size mark
- (F) #4 cylinder bore size mark

2) How to measure the inner diameter of each cylinder

Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights shown in the figure, using a cylinder bore gauge.

NOTE:

Measurement should be performed at a temperature 20°C (68°F).

Taper:

Standard

0.015 mm (0.0006 in)

Limit

0.050 mm (0.0020 in)

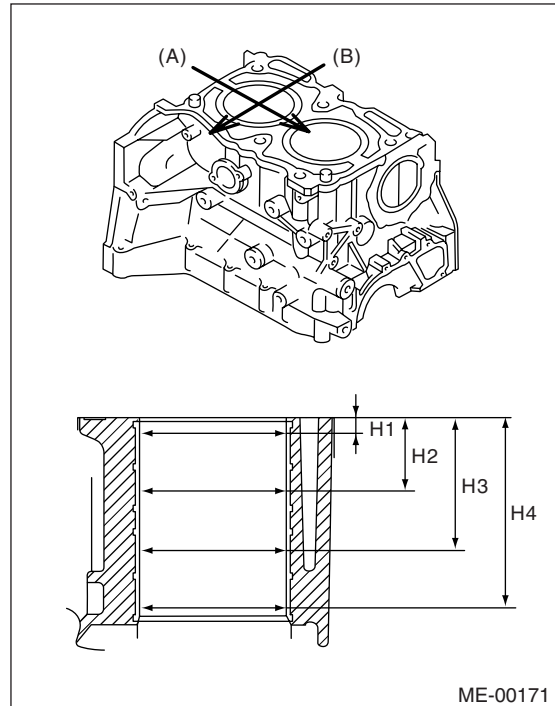
Out-of-roundness:

Standard

0.010 mm (0.0004 in)

Limit

0.050 mm (0.0020 in)



- (A) Piston pin direction
- (B) Thrust direction
- H1 10 mm (0.39 in)
- H2 45 mm (1.77 in)
- H3 80 mm (3.15 in)
- H4 115 mm (4.35 in)

3) When the piston is to be replaced due to general or cylinder wear, determine a suitable sized piston by measuring the piston clearance.

4) How to measure the outer diameter of each piston

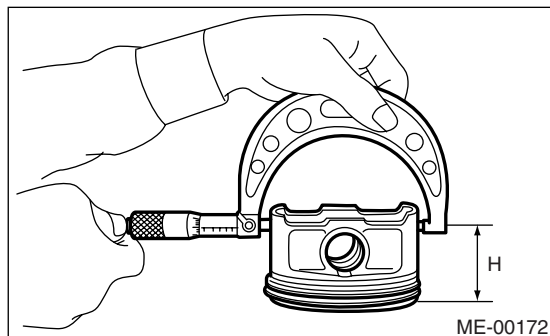
Measure the outer diameter of each piston at the height shown in the figure. (Thrust direction)

NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

Piston grade point H:

37.0 mm (1.457 in)

Standard**A: 99.485 — 99.495 mm (3.9167 — 3.9171 in)****B: 99.475 — 99.485 mm (3.9163 — 3.9167 in)****0.25 mm (0.0098 in) oversize****99.725 — 99.735 mm (3.9262 — 3.9266 in)****0.50 mm (0.0197 in) oversize****99.975 — 99.985 mm (3.9360 — 3.9364 in)**

5) Calculate the clearance between cylinder and piston.

NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

Cylinder to piston clearance at 20°C (68°F):**Standard****0.010 — 0.030 mm (0.0004 — 0.0012 in)****Limit****0.050 mm (0.0020 in)**

6) Boring and honing

(1) If the value of taper, out-of-roundness, or cylinder-to-piston clearance measured exceeds the specified limit or if there is any damage on the cylinder wall, reboring it to use an oversize piston.

CAUTION:

When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and use oversize pistons. Do not perform boring on one cylinder only, nor use an oversize piston for one cylinder only.

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the crankcase.

NOTE:

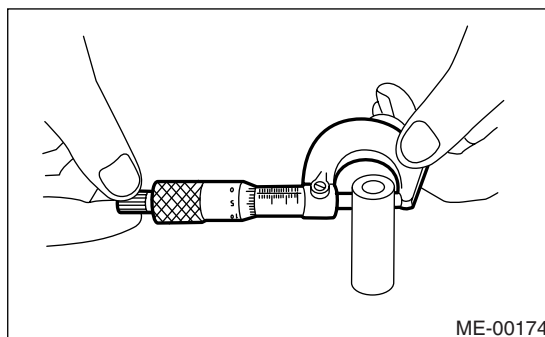
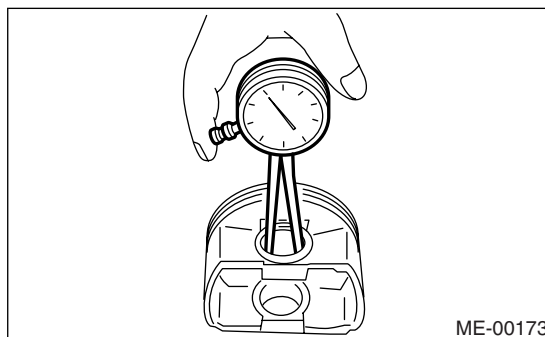
Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, pay attention to this when measuring the cylinder diameter.

Limit of cylinder enlarging (boring):**0.5 mm (0.020 in)****3. PISTON AND PISTON PIN**

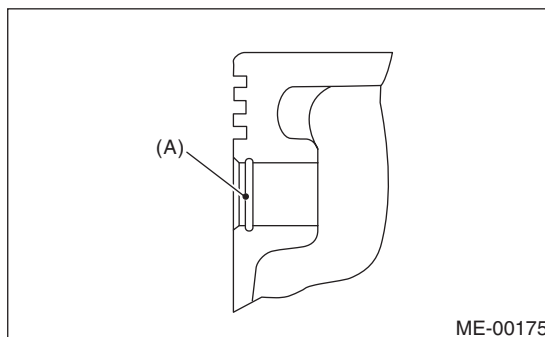
1) Check the pistons and piston pins for damage, cracks, and wear and the piston ring grooves for wear and damage. Replace if defective.

2) Measure the piston-to-cylinder clearance at each cylinder. <Ref. to ME(H4SO)-76, CYLINDER AND PISTON, INSPECTION, Cylinder Block.> If any of the clearances is not to specification, replace the piston or bore the cylinder to use an oversize piston.

3) Make the sure that piston pin can be inserted into piston pin hole with a thumb at 20°C (68°F). Replace if defective.

Standard clearance between piston pin and hole in piston:**Standard****0.004 — 0.008 mm (0.0002 — 0.0003 in)****Limit****0.020 mm (0.0008 in)**

4) Check the circlip installation groove on piston for burr (A). If necessary, remove the burr from groove so that piston pin can lightly move.



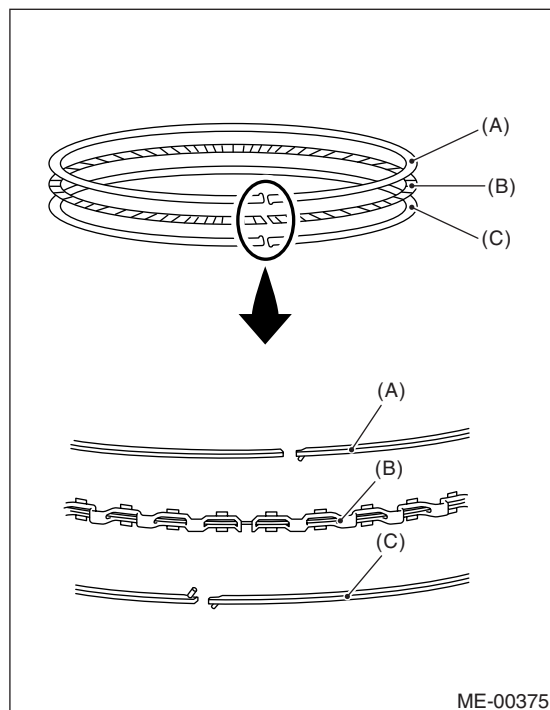
5) Check the piston pin circlip for distortion, cracks and wear.

4. PISTON RING

1) If the piston ring is broken, damaged, or worn, or if its tension is insufficient, or when the piston is replaced, replace the piston ring with a new one of the same size as the piston.

CAUTION:

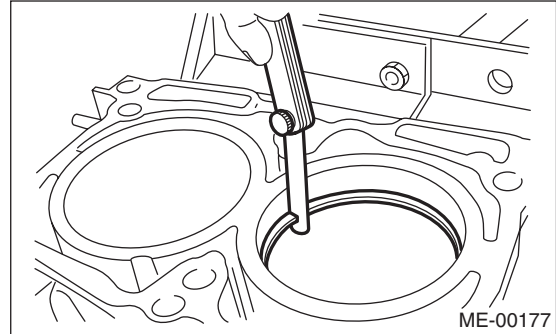
- Marks are shown on the end of top and second rings. When installing the rings to piston, face these marks upward.
- Oil ring is composed of upper rail, expander and lower rail. Be careful of the rail direction when installing oil ring to the piston.



- (A) Upper rail
(B) Expander
(C) Lower rail

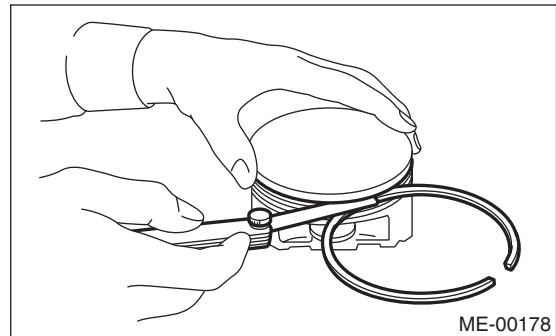
2) Clean the piston ring groove and piston ring.
3) Squarely place the piston ring and oil ring in cylinder, and then measure the piston ring gap with a thickness gauge.

		Unit: mm (in)	
		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)	1.0 (0.039)
	Second ring	0.35 — 0.50 (0.0138 — 0.0197)	1.0 (0.039)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)	1.5 (0.059)



4) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

		Unit: mm (in)	
		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)	0.15 (0.0059)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)	0.15 (0.0059)

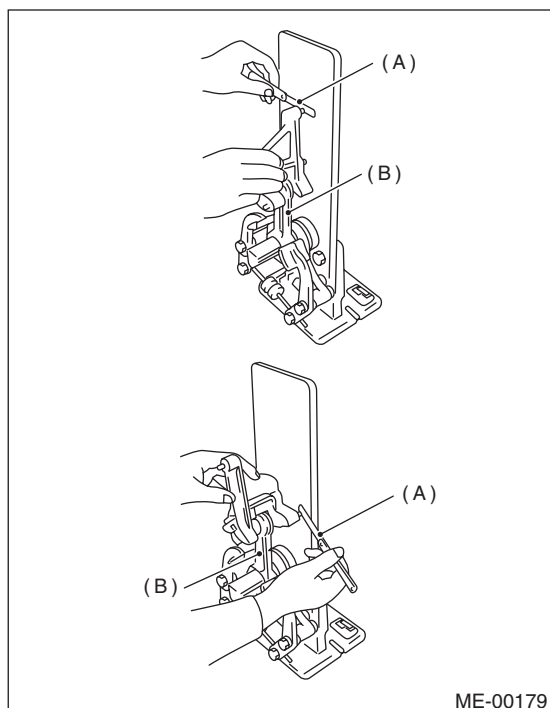


5. CONNECTING ROD

- 1) Replace the connecting rod, if the large or small end thrust surface is damaged.
- 2) Check for bend or twist using a connecting rod aligner. Replace the connecting rod if the bend or twist exceeds the limit.

Limit of bend or twist per 100 mm (3.94 in) in length:

0.10 mm (0.0039 in)



(A) Thickness gauge

(B) Connecting rod

- 3) Install the connecting rod fitted with bearing to crankshaft, and then measure the side clearance (thrust clearance). Replace the connecting rod if the side clearance exceeds the specified limit.

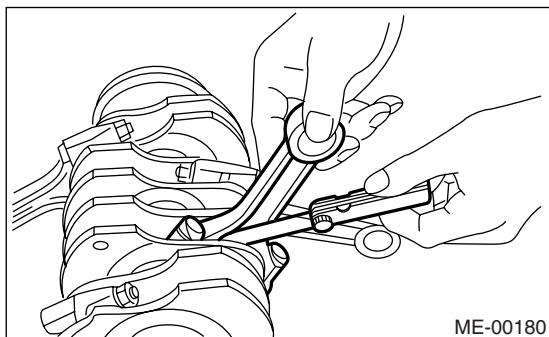
Connecting rod side clearance:

Standard

0.070 — 0.330 mm (0.0028 — 0.0130 in)

Limit

0.4 mm (0.016 in)



- 4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.

- 5) Measure the oil clearance on individual connecting rod bearings by means of plastigauge. If any oil clearance is not within specification, replace the defective bearing with a new one of standard size or undersize as necessary. (See the table below.)

Connecting rod oil clearance:

Standard

0.012 — 0.038 mm (0.0005 — 0.0014 in)

Limit

0.05 mm (0.0020 in)

Unit: mm (in)		
Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.502 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

- 6) Inspect the bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at connecting rod small end.

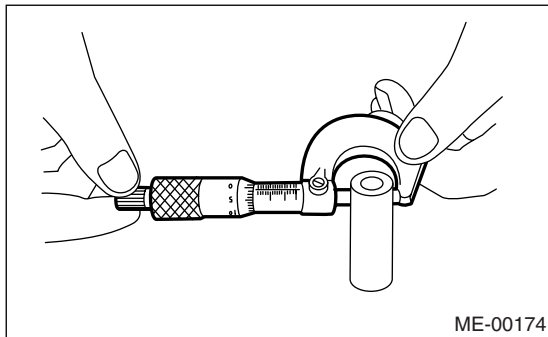
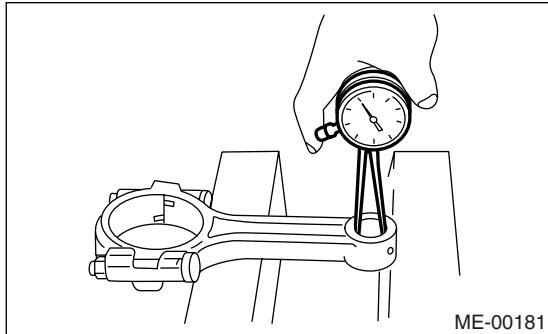
Clearance between piston pin and bushing:

Standard

0 — 0.022 mm (0 — 0.0009 in)

Limit

0.030 mm (0.0012 in)

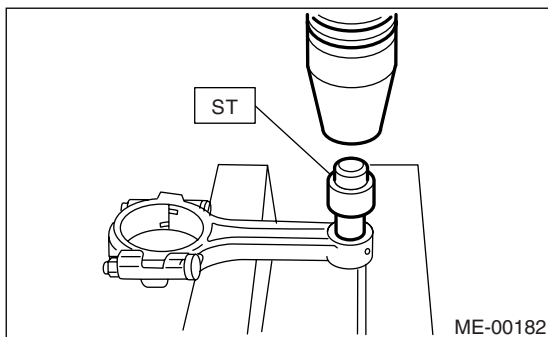


7) Replacement procedure is as follows.

(1) Remove the bushing from connecting rod with ST and press.

(2) Press the bushing with ST after applying oil on the periphery of bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



(3) Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.

(4) After the completion of reaming, clean the bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean the crankshaft completely and check for cracks by means of red lead check etc., and replace if defective.

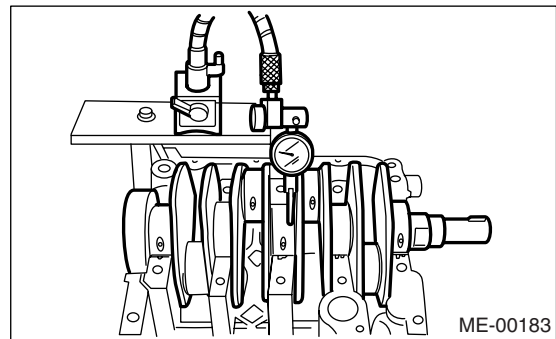
2) Measure the crankshaft bend, and correct or replace if it exceeds the limit.

NOTE:

If a suitable V-block is not available, install the #1 and #5 crankshaft bearing on cylinder block, position the crankshaft on these bearings and measure the crankshaft bend using a dial gauge.

Crankshaft bend limit:

0.035 mm (0.0014 in)



3) Inspect the crank journal and crank pin for wear. If they are not within the specifications, replace the bearing with a suitable (undersize) one, and then replace or recondition the crankshaft as necessary. When grinding the crank journal or crank pin, finish them to specified dimensions according to the undersize bearing to be used.

Crank pin and crank journal:

Out-of-roundness

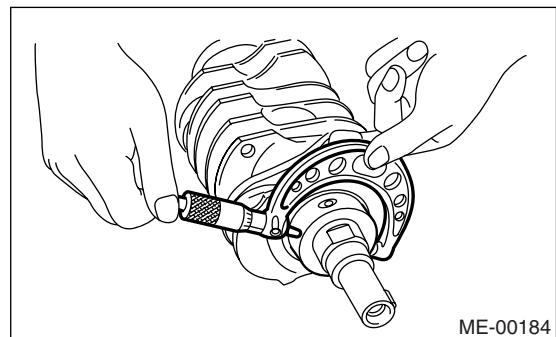
0.020 mm (0.0008 in) or less

Taper limit

0.07 mm (0.0028 in)

Grinding limit

0.250 mm (0.0098 in)



Cylinder Block

MECHANICAL

		Crank journal diameter		Crank pin diameter
		#1, #3	#2, #4, #5	2.5 L
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.490 — 1.502 (0.0587 — 0.0591)
0.03 (0.0012) undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0446 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

O.D.: Outer Diameter

4) Measure the thrust clearance of crankshaft at center bearing. If the clearance exceeds the limit, replace bearing.

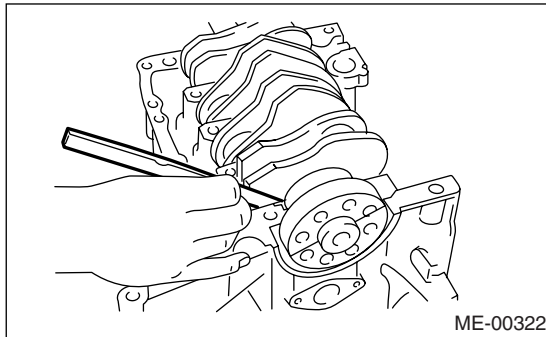
Crankshaft thrust clearance:

Standard

0.030 — 0.115 mm (0.0012 — 0.0045 in)

Limit

0.25 mm (0.0098 in)



5) Inspect the individual crankshaft bearings for signs of flaking, seizure, melting, and wear.

6) Measure the oil clearance on each crankshaft bearing by means of plastigauge. If the measurement is not within the specification, replace the defective bearing with an undersize one, and then replace or recondition the crankshaft as necessary.

Unit: mm (in)		
Crankshaft oil clearance		
#1	Standard	0.010 — 0.030 (0.0004 — 0.0012)
	Limit	0.040 (0.0016)
#2	Standard	0.010 — 0.030 (0.0004 — 0.0012)
	Limit	0.045 (0.0018)
#3	Standard	0.010 — 0.030 (0.0004 — 0.0012)
	Limit	0.040 (0.0016)
#4	Standard	0.010 — 0.030 (0.0004 — 0.0012)
	Limit	0.045 (0.0018)
#5	Standard	0.010 — 0.030 (0.0004 — 0.0012)
	Limit	0.040 (0.0016)

22.Engine Trouble in General

A: INSPECTION

NOTE:

“RANK” shown in the chart refer to the possibility of reason for the trouble in order (“Very often” to “Rarely”)

A — Very often

B — Sometimes

C — Rarely

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
1. Engine will not start.			
1) Starter does not turn.	• Starter	• Defective battery-to-starter harness	B
		• Defective starter switch	C
		• Defective inhibitor switch or neutral switch	C
		• Defective starter	B
	• Battery	• Poor terminal connection	A
		• Run-down battery	A
		• Defective charging system	B
	• Friction	• Seizure of crankshaft and connecting rod bearing	C
		• Seized camshaft	C
		• Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	• Starter	• Defective starter	C
	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Fuel line	• Defective fuel pump and relay	A
		• Lack of or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
3) Initial combustion occurs.	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
	• Fuel line	• Defective fuel pump and relay	C
		• Clogged fuel line	C
		• Lack of or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B

Engine Trouble in General

MECHANICAL

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
4) Engine stalls after initial combustion.	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	B
		• Loosened or cracked PCV hose	C
		• Loosened or cracked vacuum hose	C
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Dirty air cleaner element	C
	• Fuel line	• Clogged fuel line	C
		• Lack of or insufficient fuel	B
	• Belt	• Defective	B
		• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	B
		• Improper engine oil (low viscosity)	B
2. Rough idle and engine stall	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	A
		• Loosened or cracked PCV hose	A
		• Loosened or cracked vacuum hose	A
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Defective PCV valve	C
		• Loosened oil filler cap	B
		• Dirty air cleaner element	C
	• Fuel line	• Defective fuel pump and relay	C
		• Clogged fuel line	C
		• Lack of or insufficient fuel	B
	• Belt	• Defective timing	C
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	B
		• Loosened cylinder head bolts or defective gasket	B
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	B
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Lubrication system	• Incorrect oil pressure	B
		• Defective rocker cover gasket	C
	• Cooling system	• Overheating	C
	• Others	• Malfunction of evaporative emission control system	A
		• Stuck or damaged throttle valve	B
		• Accelerator cable out of adjustment	C

Engine Trouble in General

MECHANICAL

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
3. Low output, hesitation and poor acceleration	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	A
		• Loosened or cracked PCV hose	A
		• Loosened or cracked vacuum hose	B
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Defective PCV valve	B
		• Loosened oil filler cap	B
		• Dirty air cleaner element	A
	• Fuel line	• Defective fuel pump and relay	B
		• Clogged fuel line	B
		• Lack of or insufficient fuel	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	B
		• Loosened cylinder head bolts or defective gasket	B
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	B
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Lubrication system	• Incorrect oil pressure	B
	• Cooling system	• Overheating	C
		• Over cooling	C
	• Others	• Malfunction of evaporative emission control system	A
4. Surging	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	A
		• Loosened or cracked PCV hose	A
		• Loosened or cracked vacuum hose	A
		• Defective intake manifold gasket	B
		• Defective throttle body gasket	B
		• Defective PCV valve	B
		• Loosened oil filler cap	B
		• Dirty air cleaner element	B
	• Fuel line	• Defective fuel pump and relay	B
		• Clogged fuel line	B
		• Lack of or insufficient fuel	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	C
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
		• Improper engine oil (low viscosity)	B
	• Cooling system	• Overheating	B
	• Others	• Malfunction of evaporative emission control system	C

Engine Trouble in General

MECHANICAL

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
5. Engine does not return to idle.	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked vacuum hose	A
	• Others	• Stuck or damaged throttle valve	A
		• Accelerator cable out of adjustment	B
6. Dieseling (Run-on)	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Cooling system	• Overheating	B
	• Others	• Malfunction of evaporative emission control system	B
7. After burning in exhaust system	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened or cracked intake duct	C
		• Loosened or cracked PCV hose	C
		• Loosened or cracked vacuum hose	B
		• Defective PCV valve	B
		• Loosened oil filler cap	C
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	C
		• Incorrect valve timing	A
	• Lubrication system	• Incorrect oil pressure	C
	• Cooling system	• Over cooling	C
	• Others	• Malfunction of evaporative emission control system	C
8. Knocking	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Loosened oil filler cap	B
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	C
		• Incorrect valve timing	B
	• Cooling system	• Overheating	A
9. Excessive engine oil consumption	• Intake system	• Loosened or cracked PCV hose	A
		• Defective PCV valve	B
		• Loosened oil filler cap	C
	• Compression	• Defective valve stem	A
		• Worn or stuck piston rings, cylinder and piston	A
	• Lubrication system	• Loosened oil pump attaching bolts and defective gasket	B
		• Defective oil filter seal	B
		• Defective crankshaft oil seal	B
		• Defective rocker cover gasket	B
		• Loosened oil drain plug or defective gasket	B
		• Loosened oil pan fitting bolts or defective oil pan	B

Engine Trouble in General

MECHANICAL

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
10. Excessive fuel consumption	• Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	• Intake system	• Dirty air cleaner element	A
	• Belt	• Defective timing	B
	• Compression	• Incorrect valve clearance	B
		• Loosened spark plugs or defective gasket	C
		• Loosened cylinder head bolts or defective gasket	C
		• Improper valve seating	B
		• Defective valve stem	C
		• Worn or broken valve spring	C
		• Worn or stuck piston rings, cylinder and piston	B
		• Incorrect valve timing	B
	• Lubrication system	• Incorrect oil pressure	C
	• Cooling system	• Over cooling	C
	• Others	• Accelerator cable out of adjustment	B

23.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	- Valve mechanism is defective. - Incorrect valve clearance - Worn valve rocker - Worn camshaft - Broken valve spring
Heavy and dull clank	Oil pressure is low.	- Worn crankshaft main bearing - Worn connecting rod bearing (big end)
	Oil pressure is normal.	- Loose flywheel mounting bolts - Damaged engine mounting
High-pitched clank (Spark knock)	Sound is noticeable when accelerating with an overload.	- Ignition timing advanced - Accumulation of carbon inside combustion chamber - Wrong spark plug - Improper gasoline
Clank when engine speed is medium (1,000 to 2,000 rpm).	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	- Worn crankshaft main bearing - Worn bearing at crankshaft end of connecting rod
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	- Worn cylinder liner and piston ring - Broken or stuck piston ring - Worn piston pin and hole at piston end of connecting rod
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	- Unusually worn valve lifter - Worn cam gear - Worn camshaft journal bore in crankcase
Squeaky sound	—	Insufficient generator lubrication
Rubbing sound	—	Defective generator brush and rotor contact
Gear scream when starting engine	—	- Defective ignition starter switch - Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	- Loose drive belt - Defective water pump shaft
Hissing sound	—	- Loss of compression - Air leakage in air intake system, hoses, connections or manifolds
Timing belt noise	—	- Loose timing belt - Belt contacting case/adjacent part
Valve tappet noise	—	Incorrect valve clearance

NOTE*:

When disconnecting the fuel injector connector, Malfunction Indicator Light illuminates and DTC is stored in ECM memory. Therefore, carry out the CLEAR MEMORY MODE <Ref. to EN(H4SO)(diag)-44, OPERATION, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4SO)(diag)-37, OPERATION, Inspection Mode.> after connecting fuel injector connector.

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STARTING/CHARGING SYSTEMS

General Description

STARTING/CHARGING SYSTEMS

1. General Description

A: SPECIFICATIONS

1. NON-TURBO MODEL

Item		Designation	
Starter	Type	Reduction type	
	Vehicle type	MT	AT
	Model	M000T30471	M000T20171
	Manufacturer	Mitsubishi Electric	
	Voltage and output	12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation	Counterclockwise (when observed from pinion)	
	Number of pinion teeth	8	9
	No-load characteristics	Voltage	11 V
		Current	95 A or less
		Rotating speed	2,500 rpm or more
	Load characteristics	Voltage	7.5 V
		Current	300 A
		Torque	8.84 N·m (0.90 kgf-m, 6.5 ft-lb) or more
		Rotating speed	870 rpm or more
	Lock characteristics	Voltage	4 V
		Current	680 A or less
		Torque	17 N·m (1.73 kgf-m, 12.5 ft-lb) or more
Generator	Type	Rotating-field three-phase, voltage regulator built-in type, with load response control system	
	Model	A2TB6291	
	Manufacturer	Mitsubishi Electric	
	Voltage and output	12 V — 75 A	
	Polarity on ground side	Negative	
	Direction of rotation	Clockwise (when observed from pulley side)	
	Armature connection	Three-phase Y-type	
	Output current	1,500 rpm — 30 A or more 2,500 rpm — 64 A or more 5,000 rpm — 76 A or more	
	Regulated voltage	14.1 — 14.8 V [20°C (68°F)]	
Battery	Type and capacity	12 V — 48 AH (55D 23L)	12 V — 52 AH (75D 23L)

General Description

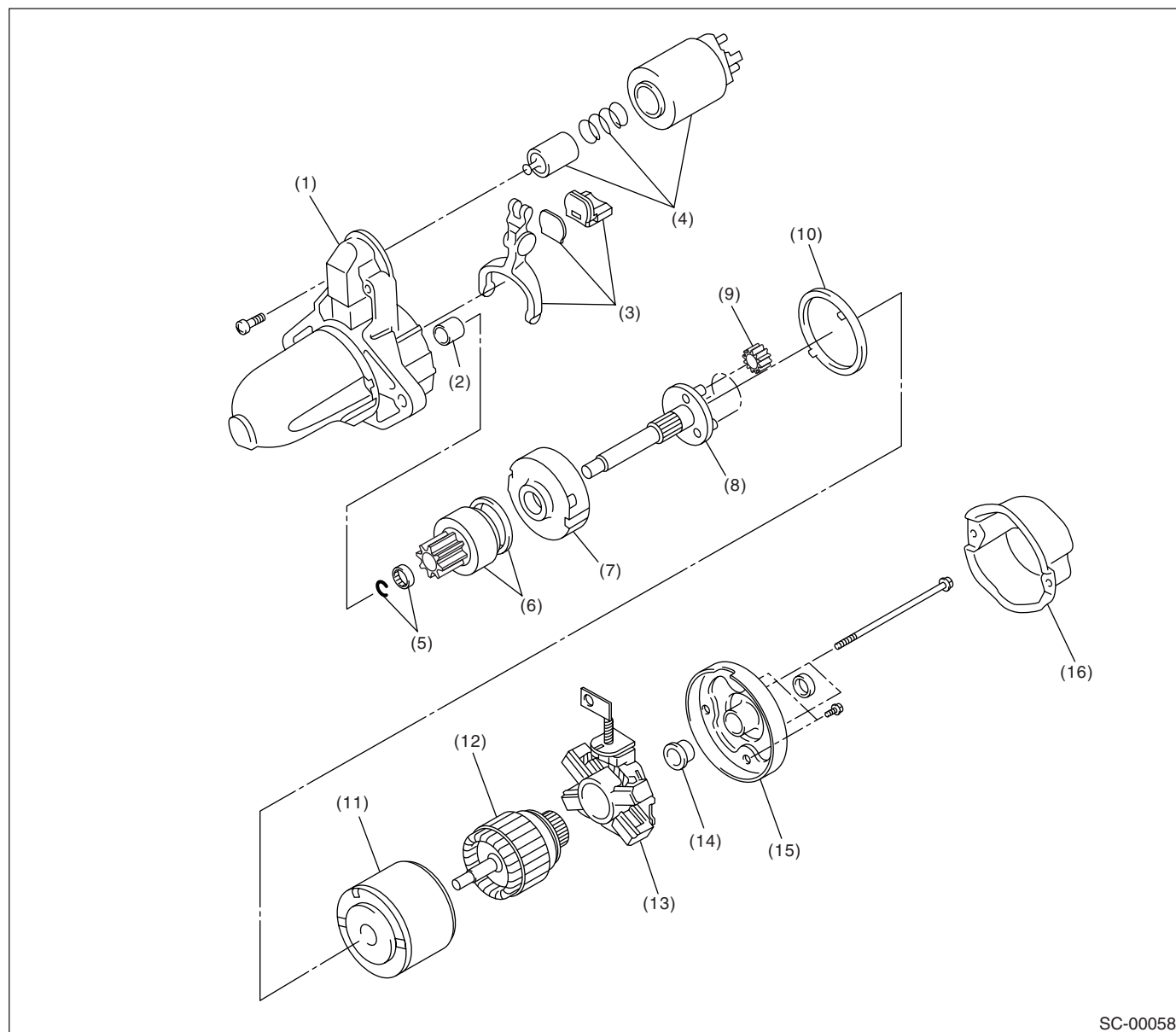
STARTING/CHARGING SYSTEMS

2. TURBO MODEL

Item		Designation	
Starter	Type	Reduction type	
	Vehicle type	MT	AT
	Model	228000 — 9270	M001T20171
	Manufacturer	DENSO	Mitsubishi Electric
	Voltage and output	12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation	Counterclockwise (when observed from pinion)	
	Number of pinion teeth	9	
	No-load characteristics	Voltage	11 V
		Current	90 A or less
		Rotating speed	2,860 rpm or more 2,000 rpm or more
	Load characteristics	Voltage	8 V 7.7 V
		Current	280 A 400 A
		Torque	9.3 N·m (0.95 kgf-m, 6.9 ft-lb) or more 16.7 N·m (1.70 kgf-m, 12.3 ft-lb) or more
		Rotating speed	860 rpm or more 710 rpm or more
	Lock characteristics	Voltage	5 V 3.5 V
		Current	515 A or less 960 A or less
		Torque	16 N·m (1.63 kgf-m, 11.8 ft-lb) or more 31 N·m (3.16 kgf-m, 22.9 ft-lb) or more
Generator	Type	Rotating-field three-phase, voltage regulator built-in type, with load response control system	
	Model	A2TB6291	
	Manufacturer	Mitsubishi Electric	
	Voltage and output	12 V — 75 A	
	Polarity on ground side	Negative	
	Direction of rotation	Clockwise (when observed from pulley side)	
	Armature connection	Three-phase Y-type	
	Output current	1,500 rpm — 30 A or more 2,500 rpm — 64 A or more 5,000 rpm — 76 A or more	
	Regulated voltage	14.1 — 14.8 V [20°C (68°F)]	
Battery	Type and capacity	12 V — 48 AH (55D 23L)	12 V — 52 AH (65D 23L)

B: COMPONENT**1. STARTER**

• EXCEPT DOHC TURBO MT MODEL



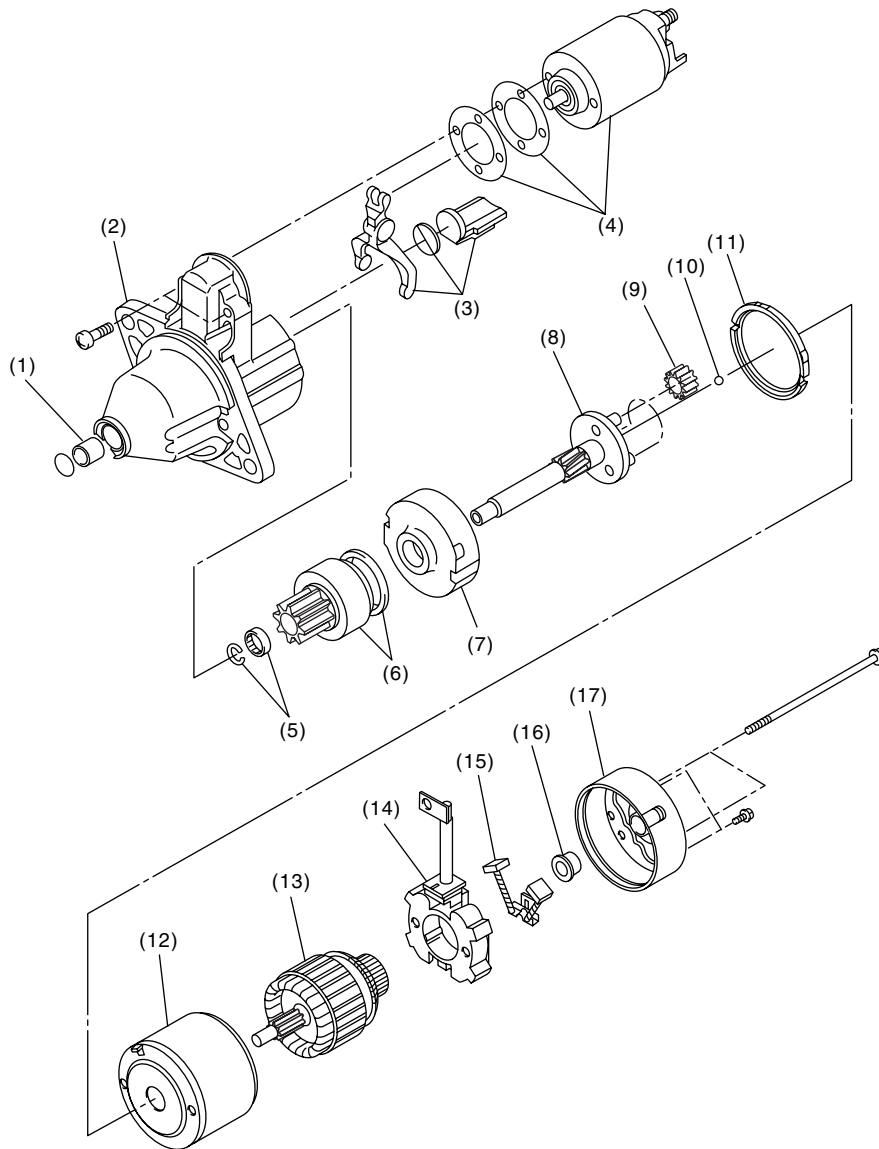
SC-00058

(1) Front bracket	(7) Internal gear ASSY	(13) Brush holder ASSY
(2) Sleeve bearing	(8) Shaft ASSY	(14) Sleeve bearing
(3) Lever set	(9) Gear ASSY	(15) Rear cover
(4) Magnet switch ASSY	(10) Packing	(16) Rear cover set
(5) Stopper set	(11) Yoke ASSY	
(6) Overrunning clutch	(12) Armature	

General Description

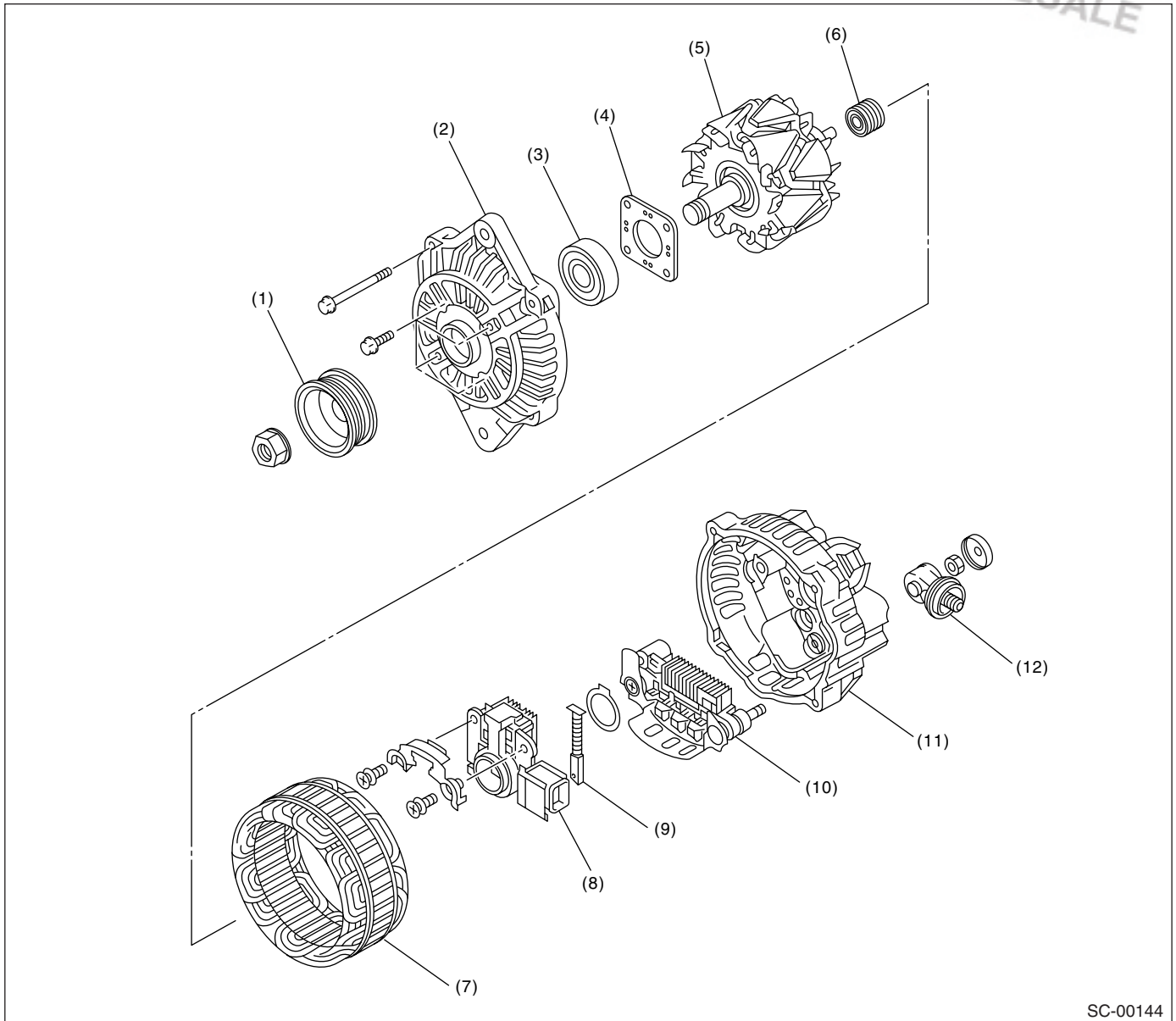
STARTING/CHARGING SYSTEMS

• DOHC TURBO MT MODEL



SC-00168

(1) Sleeve bearing	(7) Internal gear assembly	(13) Armature
(2) Front bracket	(8) Shaft assembly	(14) Brush holder assembly
(3) Lever set	(9) Gear assembly	(15) Brush
(4) Magnet switch assembly	(10) Ball	(16) Sleeve bearing
(5) Stopper set	(11) Packing	(17) Rear bracket
(6) Overrunning clutch	(12) Yoke assembly	

2. GENERATOR

SC-00144

(1) Pulley	(5) Rotor	(9) Brush
(2) Front cover	(6) Bearing	(10) Rectifier
(3) Ball bearing	(7) Stator coil	(11) Rear cover
(4) Bearing retainer	(8) IC regulator with brush	(12) Terminal

C: CAUTION

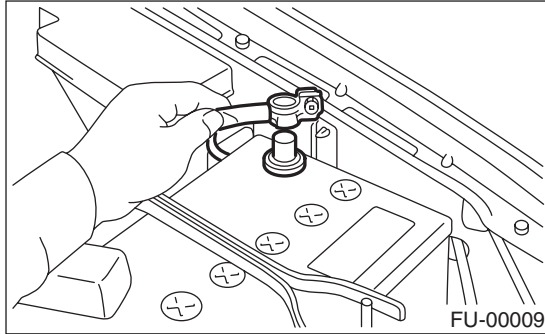
- Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust or dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.

- Be careful not to burn your hands, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

2. Starter

A: REMOVAL

- 1) Disconnect the ground cable from battery.

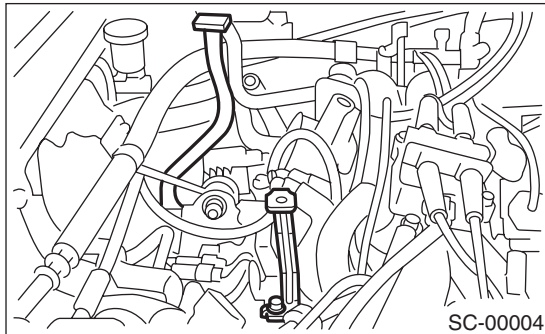


- 2) Remove the air cleaner case. (Non-turbo model)
<Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>

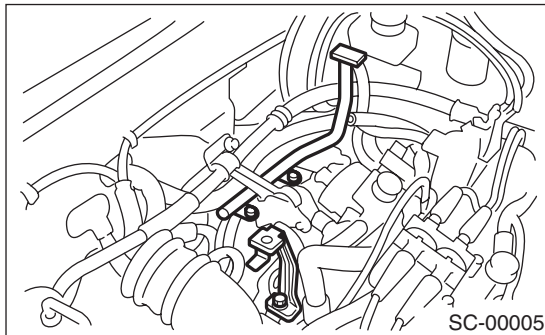
- 3) Remove the intercooler. (Turbo model)
<Ref. to IN(H4DOTC)-10, REMOVAL, Intercooler.>

- 4) Remove the air cleaner case stay. (Non-turbo model)

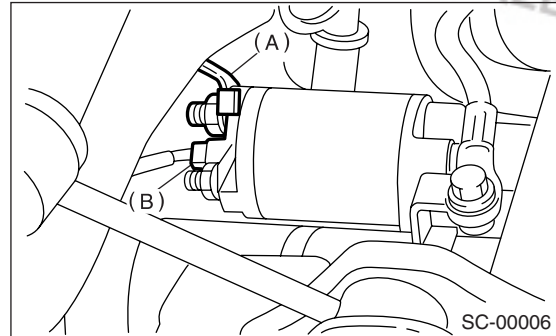
• MT MODEL



• AT MODEL

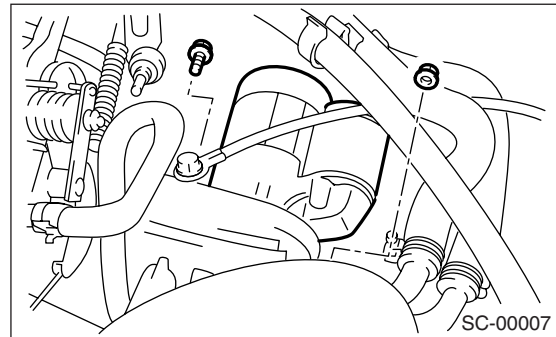


- 5) Disconnect the connector and terminal from starter.



- (A) Terminal
(B) Connector

- 6) Remove the starter from transmission.

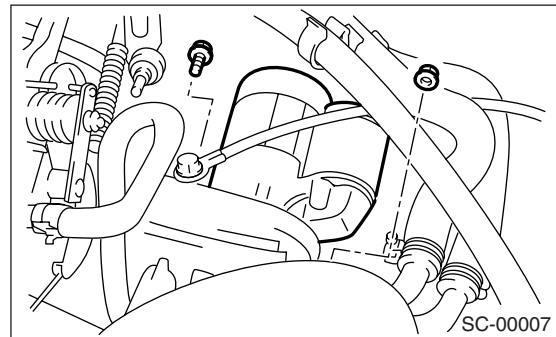


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

50 N·m (5.1 kgf-m, 37 ft-lb)



C: DISASSEMBLY

1. STARTER ASSEMBLY

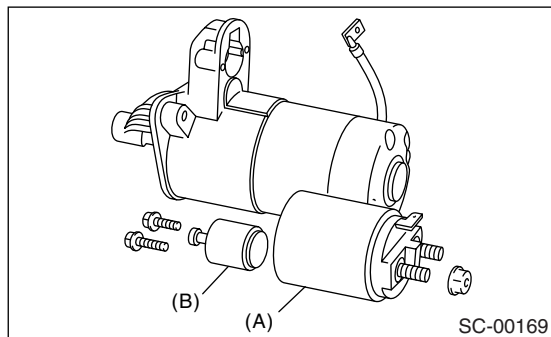
- 1) Loosen the nut which holds the terminal M of switch assembly, and then disconnect the connector.
- 2) Remove the bolts which hold the switch assembly, and then remove switch assembly, plunger and plunger spring from starter as a unit.

Starter

STARTING/CHARGING SYSTEMS

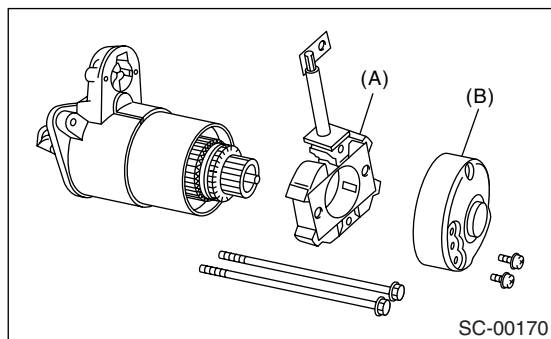
NOTE:

Be careful because the pinion gap adjustment washer may sometimes be used on the mounting surface of switch assembly.



- (A) Switch assembly
- (B) Plunger

3) Remove both through-bolts and brush holder screws, and then detach the rear cover and brush holder.

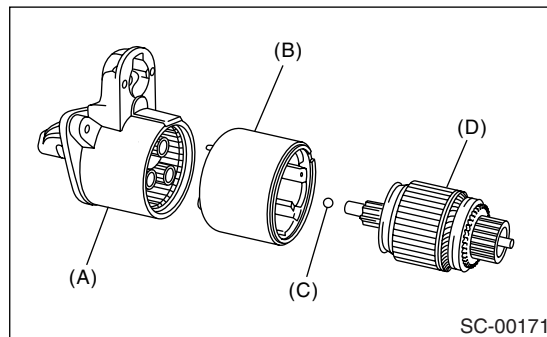


- (A) Brush holder
- (B) Rear cover

4) Remove the armature and yoke from front bracket. The ball used as a bearing will come off from the armature end.

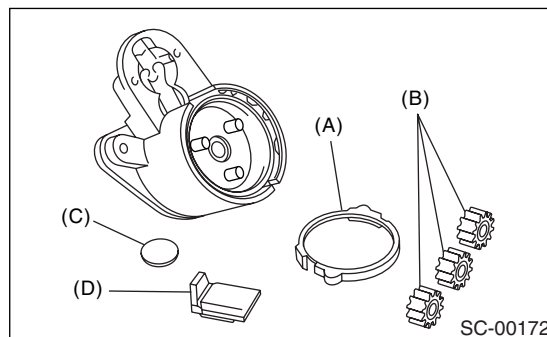
NOTE:

Before removal of the yoke, put alignment marks on the yoke and front bracket.



- (A) Front bracket
- (B) Yoke
- (C) Ball
- (D) Armature

5) Remove packing A, planetary gears, packing B and plate.

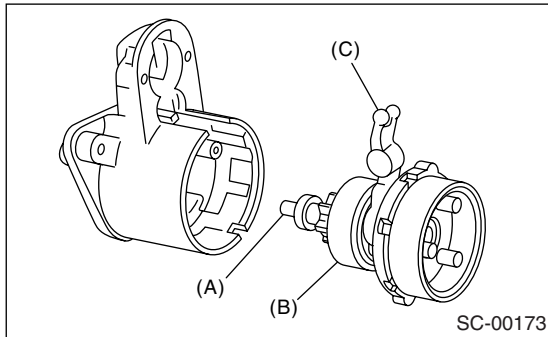


- (A) Packing A
- (B) Planetary gear
- (C) Plate
- (D) Packing B

6) Remove the shaft assembly and overrunning clutch as a unit.

NOTE:

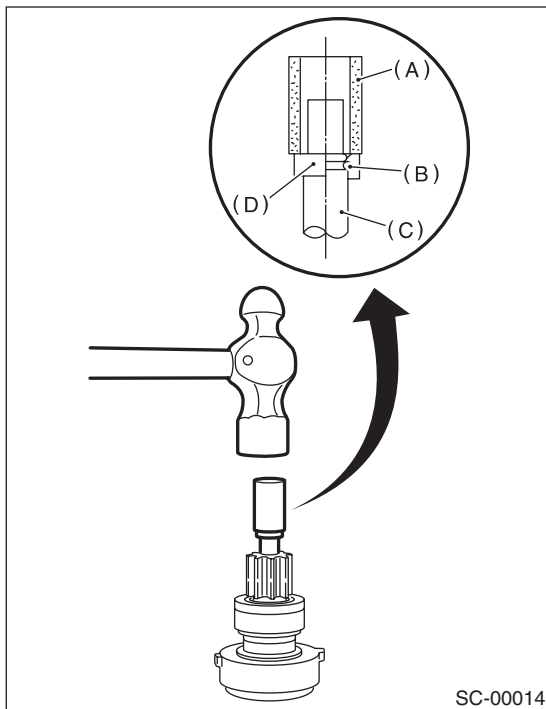
Note the direction of the lever before removing.



- (A) Shaft assembly
- (B) Overrunning clutch
- (C) Lever

7) Remove the overrunning clutch from shaft assembly as follows:

- (1) Remove the stopper from ring by lightly tapping the stopper with an appropriate tool (such as a fit socket wrench).
- (2) Remove the ring, stopper and clutch from shaft.



- (A) Socket wrench
- (B) Ring
- (C) Shaft
- (D) Stopper

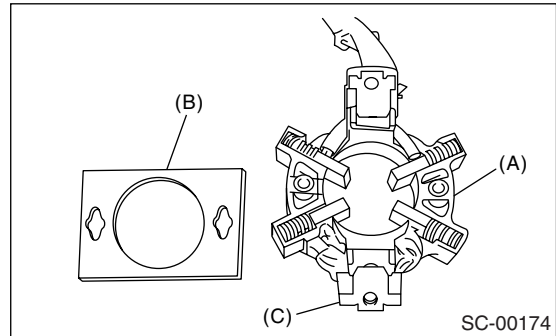
2. BRUSH HOLDER

NOTE:

Only the brush holder of turbo MT model starter can be disassembled.

Slightly open the metal fitting while holding the insulating plate against the brush holder. Remove the insulating plate.

The brush and spring can be easily removed from the brush holder at this time.



- (A) Brush holder
- (B) Insulating plate
- (C) Metal fitting

D: ASSEMBLY

- 1) Assemble in the reverse order of disassembly.
- 2) Apply grease to the following parts before assembly.

- Front and rear bracket sleeve bearings
- Armature shaft gear
- Outer periphery of plunger
- Mating surfaces of plunger and lever
- Gear shaft splines
- Mating surfaces of lever and clutch
- Ball at armature shaft end
- Planetary gear

E: INSPECTION

1. ARMATURE

- 1) Check the commutator for any sign of burns or rough surfaces or stepped wear. If wear is of a minor nature, correct it by using sand paper.

2) Run-out test

Check the commutator run-out, and then replace if it exceeds the limit.

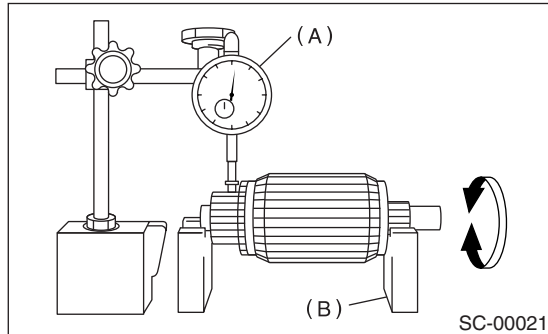
Commutator run-out:

Standard

0.05 mm (0.0020 in)

Service limit

Less than 0.10 mm (0.0039 in)



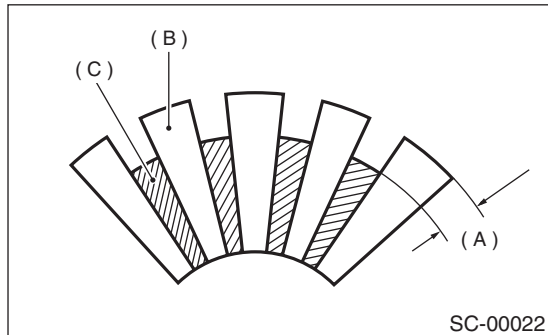
- (A) Dial gauge
- (B) V-block

3) Depth of segment mold

Check the depth of segment mold.

Depth of segment mold:

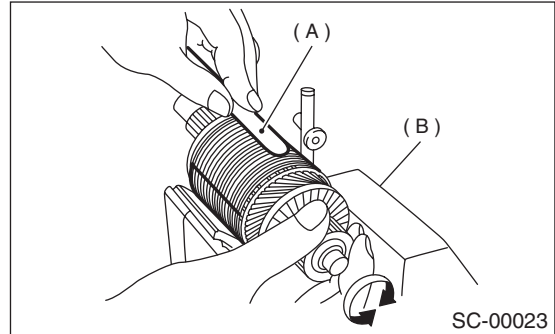
0.5 mm (0.020 in)



- (A) Depth of mold
- (B) Segment
- (C) Mold

4) Armature short-circuit test

Check the armature for short-circuit by placing it on a growler tester. Hold an iron sheet against the armature core while slowly rotating armature. A short-circuited armature will cause the iron sheet to vibrate and to be attracted to core. If the iron sheet is attracted or vibrates, the armature, which is short-circuited, must be replaced or repaired.

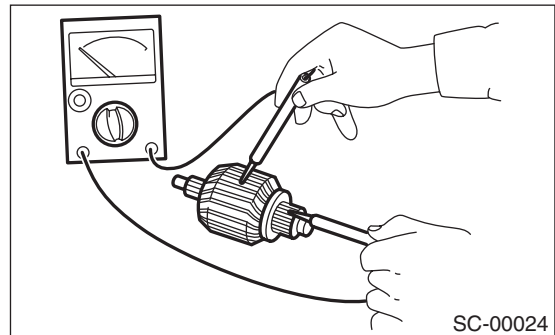


- (A) Iron sheet
- (B) Growler tester

5) Armature ground test

Using a circuit tester, touch one probe to the commutator segment and the other to shaft. There should be no continuity. If there is continuity, the armature is grounded.

Replace the armature if it is grounded.



2. YOKE

Make sure the pole is set in position.

3. OVERRUNNING CLUTCH

Inspect the teeth of pinion for wear and damage. Replace if it is damaged. It is normal if the pinion rotates smoothly in direction of rotation (counter-clockwise) and does not rotate in the opposite direction.

CAUTION:

Do not clean the overrunning clutch with oil to prevent grease from flowing out.

4. BRUSH AND BRUSH HOLDER

1) Brush length

Measure the brush length, and then replace if it is worn down to under the service limit.

Replace if abnormal wear or cracks are noticed.

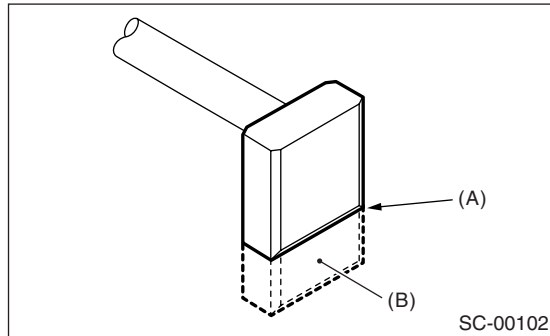
Brush length:

Standard

12.3 mm (0.484 in)

Service limit

7.0 mm (0.276 in)



(A) Service limit line

(B) Brush

2) Brush movement

Be sure the brush moves smoothly inside brush holder.

3) Brush spring force

Measure the brush spring force with a spring scale. If it is less than the service limit, replace the brush holder.

Brush spring force:

Standard

Except DOHC turbo MT model

15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lb) (when new)

DOHC turbo MT model

21.6 N (2.2 kgf, 4.9 lb) (when new)

Service limit

Except DOHC turbo MT model

2.5 N (0.25 kgf, 0.56 lb)

DOHC turbo MT model

5.9 N (0.6 kgf, 1.3 lb)

5. SWITCH ASSEMBLY

Using a circuit tester (set in "ohm"), check that there is continuity between terminals S and M, and between terminal S and ground.

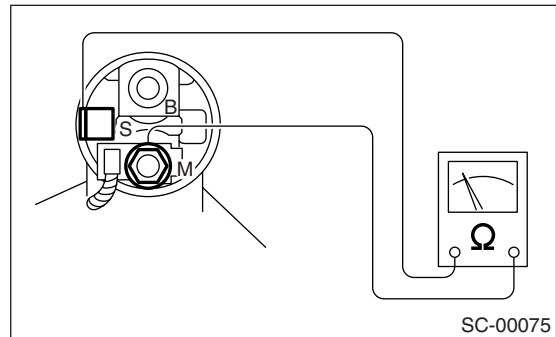
Also check to be sure there is no continuity between terminals M and B.

Terminal/Specified resistance:

S — M/Less than 1 Ω

S — Ground/Less than 1 Ω

M — B/More than 1 M Ω



6. SWITCH ASSEMBLY OPERATION

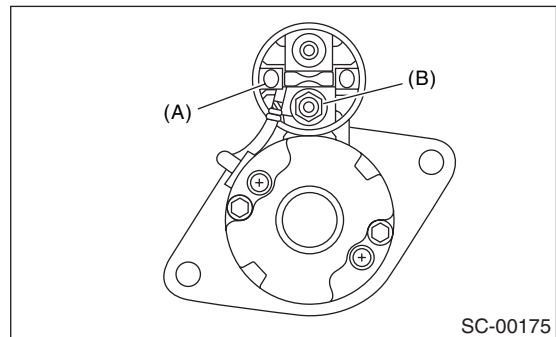
1) Connect the terminal S of switch assembly to positive terminal of battery with a lead wire, and starter body to ground terminal of battery. The pinion should be forced endwise on shaft.

CAUTION:

With the pinion forced endwise on shaft, the starter motor may rotate because current flows through the pull-in coil to motor, however, this is not a problem.

2) Disconnect the connector from terminal M, and then connect the positive terminal of battery and terminal M using a lead wire and ground terminal to starter body.

In this test set up, the pinion should return to its original position even when it is pulled out with a screwdriver.



(A) Terminal S

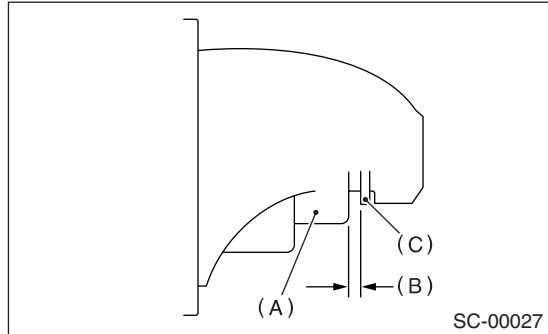
(B) Terminal M

7. PINION GAP

1) Measure the pinion gap while the pinion is pulled out as shown in the figure.

Pinion gap:

0.5 — 2.0 mm (0.020 — 0.079 in)



- (A) Pinion
- (B) Gap
- (C) Stopper

If the motor is running with the pinion forced end-wise on shaft, disconnect the connector from terminal M of switch assembly, and then connect terminal M to ground terminal (–) of battery with a lead wire. Next, gently push the pinion back with your fingertips, and then measure the pinion gap.

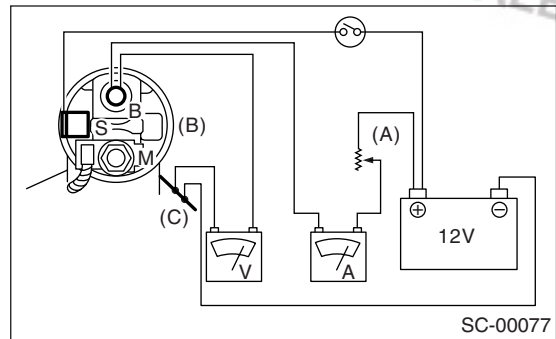
2) If the pinion gap is outside specified range, remove or add number of adjustment washers used on the mounting surface of switch assembly until correct pinion gap is obtained.

8. PERFORMANCE TEST

The starter should be submitted to performance tests whenever it has been overhauled, to assure its satisfactory performance when installed on the engine.

Three performance tests, no-load test, load test, and lock test, are presented here; however, if the load test and lock test cannot be performed, carry out at least the no-load test.

For these performance tests, use the circuit shown in figure.



- (A) Variable resistor
- (B) Magnetic switch
- (C) Starter body

1) No-load test

With switch on, adjust the variable resistor to obtain 11 V, take the ammeter reading, and then measure the starter speed. Compare these values with the specifications.

No-load test (standards):

Voltage/Current

Non-turbo MT

MAX. 11 V/95 A

Turbo MT

MAX. 11 V/90 A

AT

MAX. 11 V/90 A

Rotating speed

Non-turbo MT

More than 2,500 rpm

Turbo MT

More than 2,860 rpm

AT

More than 2,000 rpm

2) Load test

Apply the specified braking torque to starter. The condition is satisfactory if the current draw and starter speed are within the specifications.

Load test (standards):

Voltage/Load

Non-turbo MT

7.5 V/8.84 N·m (0.90 kgf-m, 6.5 ft-lb)

Turbo MT

8 V/9.3 N·m (0.95 kgf-m, 6.9 ft-lb)

AT

7.7 V/16.7 N·m (1.70 kgf-m, 12.3 ft-lb)

Current/Speed

Non-turbo MT

More than 300 A/870 rpm

Turbo MT

More than 280 A/860 rpm

AT

More than 400 A/710 rpm

3) Lock test

With the starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to the specified voltage.

Lock test (standards):

Voltage/Current

Non-turbo MT

Less than 4 V/680 A

Turbo MT

Less than 5 V/515 A

AT

Less than 3.5 V/960 A

Torque

Non-turbo MT

17 N·m (1.73 kgf-m, 12.5 ft-lb)

Turbo MT

16 N·m (1.63 kgf-m, 11.8 ft-lb)

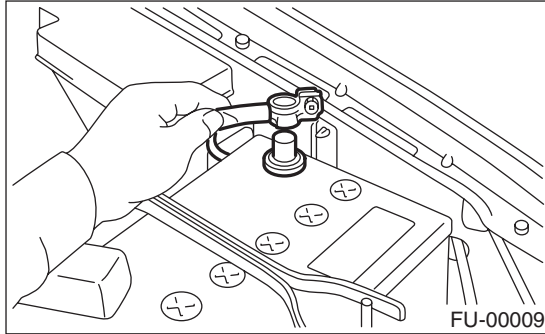
AT

31 N·m (3.16 kgf-m, 22.9 ft-lb)

3. Generator

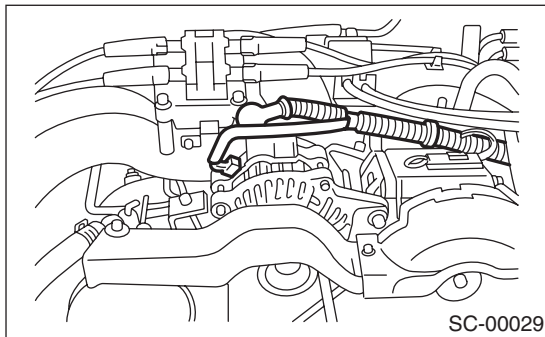
A: REMOVAL

- 1) Disconnect the ground cable from battery.

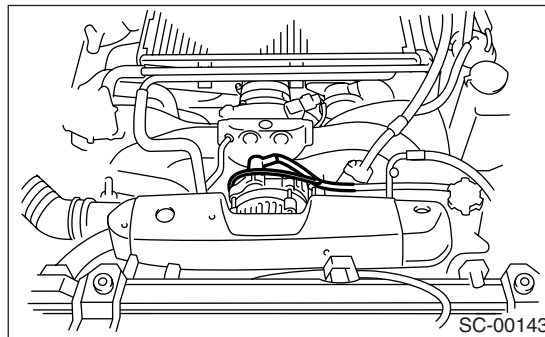


- 2) Disconnect the connector and terminal from generator.

- NON-TURBO MODEL

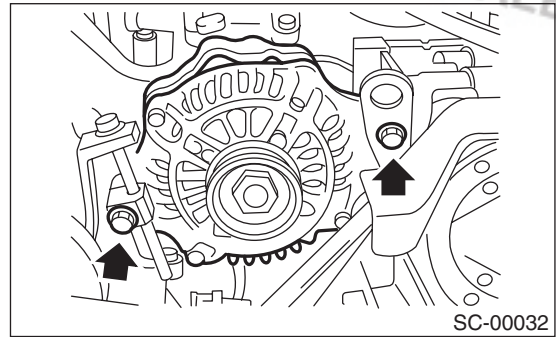


- TURBO MODEL



- 3) Remove the V-belt cover.
- 4) Remove the front side V-belt.
<Ref. to ME(H4SO)-39, FRONT SIDE BELT, REMOVAL, V-belt.> or <Ref. to ME(H4DOTC)-42, FRONT SIDE BELT, REMOVAL, V-belt.>

- 5) Remove the bolts which install generator onto bracket.



B: INSTALLATION

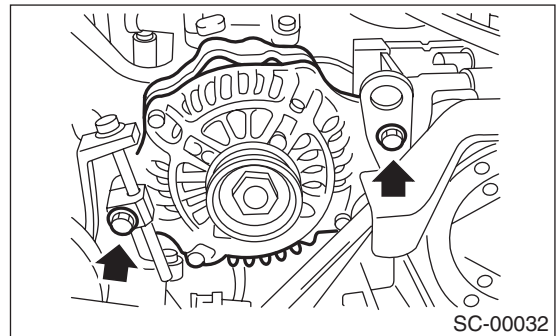
Install in the reverse order of removal.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

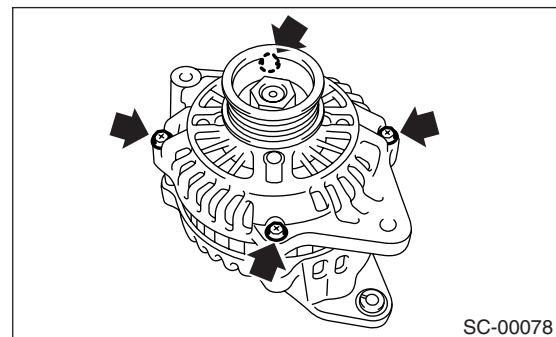
CAUTION:

Check and adjust the V-belt tension. <Ref. to ME(H4SO)-40, INSPECTION, V-belt.> or <Ref. to ME(H4DOTC)-43, INSPECTION, V-belt.>

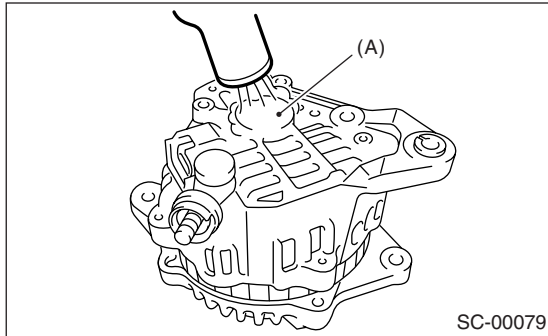


C: DISASSEMBLY

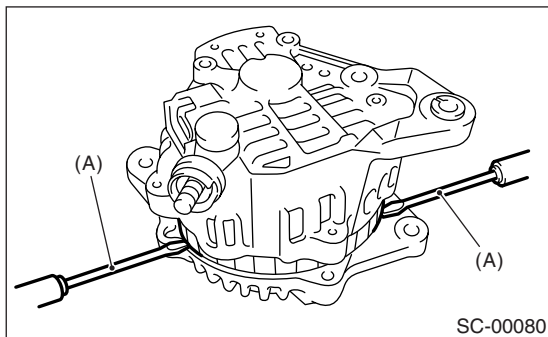
- 1) Remove the four through-bolts.



- 2) Heat portion (A) of rear cover to 50°C (122°F) with a heater drier.

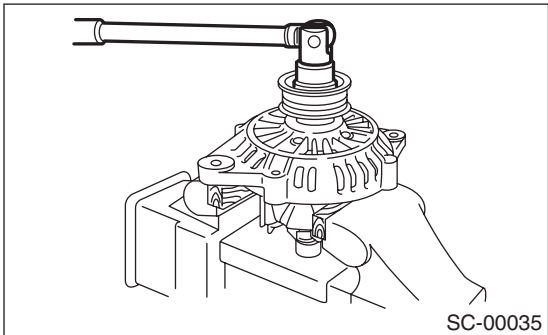


- 3) Then insert the tip of a flat tip screwdriver into the gap between stator core and front cover. Pry them apart to disassemble.

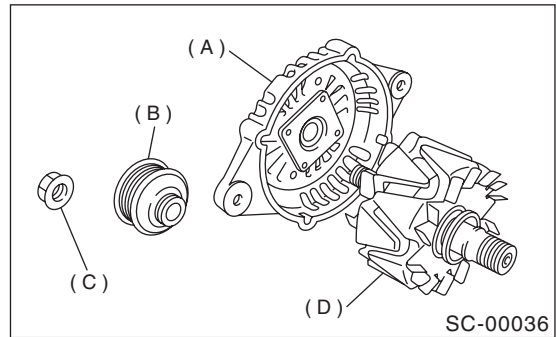


(A) Screwdriver

- 4) Hold the rotor with a vise and remove pulley nut.

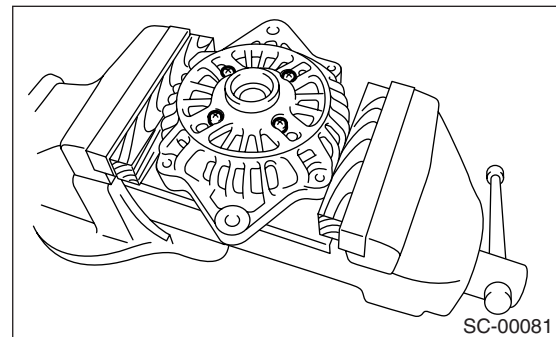


CAUTION:
When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.

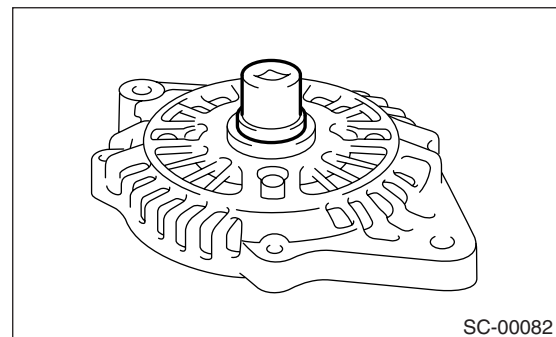


- (A) Front cover
(B) Pulley
(C) Nut
(D) Rotor

- 5) Remove the ball bearing as follows.
(1) Remove the bolt, and then remove the bearing retainer.



- (2) Firmly install an appropriate tool (such as a fit socket wrench) to bearing inner race.

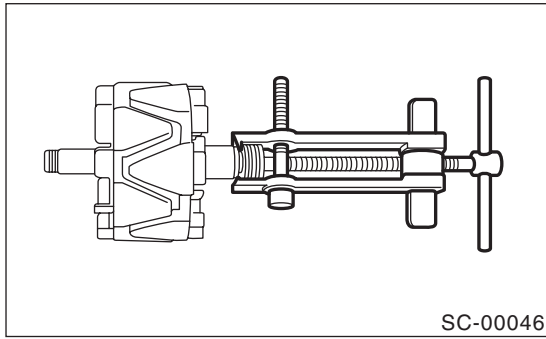


- (3) Push the ball bearing off the front cover using a press.

Generator

STARTING/CHARGING SYSTEMS

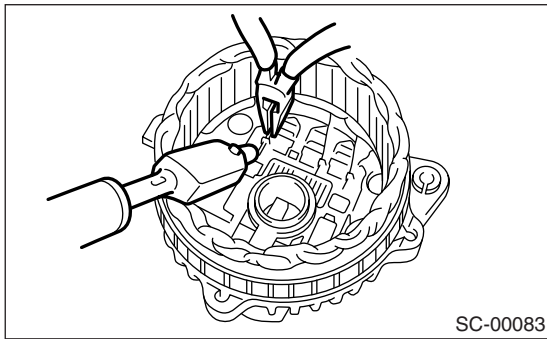
6) Remove the bearing from rotor using a bearing puller.



7) Unsolder connection between rectifier and stator coil to remove the stator coil.

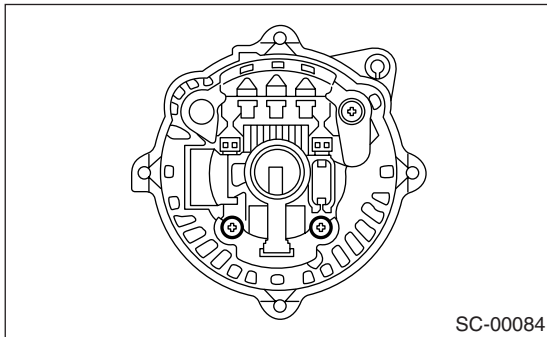
CAUTION:

Do not allow a 180 — 270 W soldering iron to contact the terminals for more than 5 seconds at once because the rectifier cannot withstand so much heat.

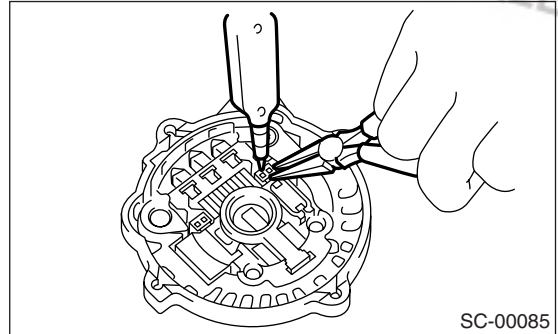


8) Remove the IC regulator as follows.

(1) Remove the screws which secure IC regulator to rear cover.

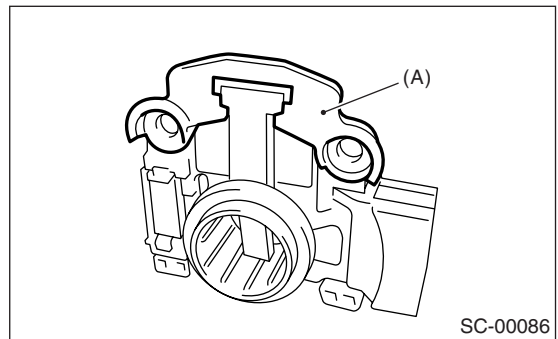


(2) Unsolder the connection between IC regulator and rectifier to remove the IC regulator.



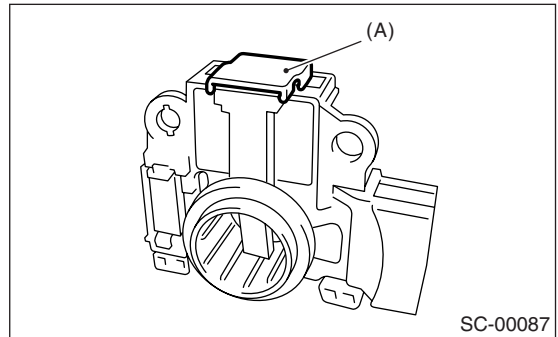
9) Remove the brush as follows.

(1) Remove cover A.



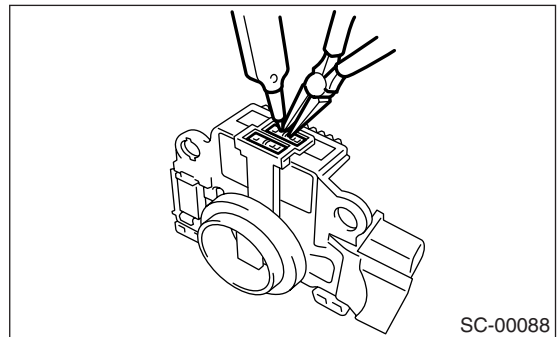
(A) Cover A

(2) Remove cover B.



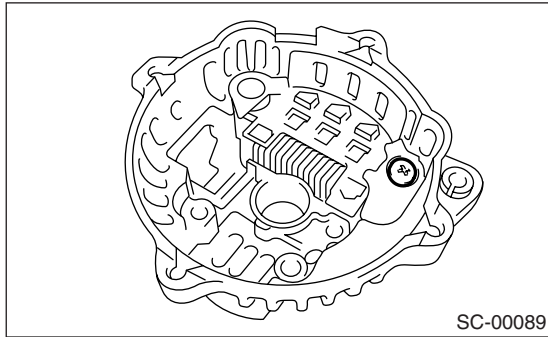
(A) Cover B

(3) Separate the brush from connection to remove.

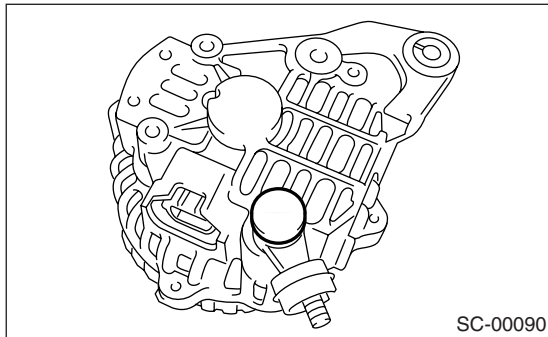


10) Remove the rectifier as follows.

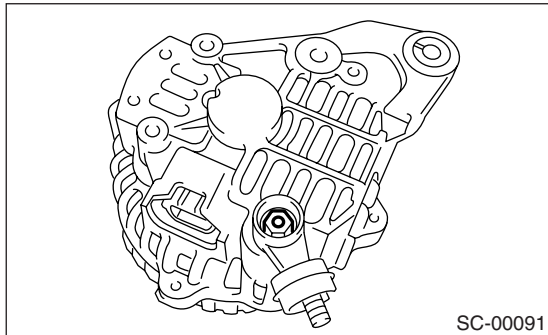
(1) Remove the bolts which secure the rectifier.



(2) Remove the cover of terminal B.



(3) Remove the nut of terminal B, and then remove the rectifier.



D: ASSEMBLY

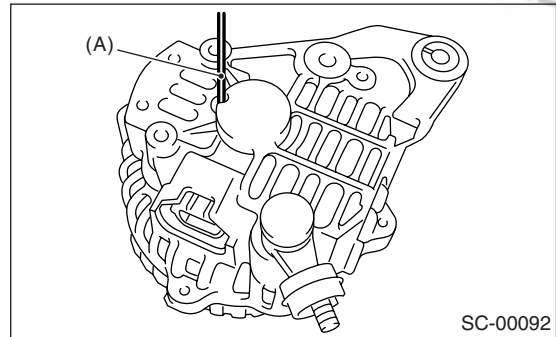
Assemble in the reverse order of disassembly.

1) Pulling up brush

Before assembling, press the brush down into brush holder, and then fix them in that position by passing a [1 mm (0.08 in) dia. 40 to 50 mm (1.6 to 2.0 in) long] wire through the hole as shown in the figure.

CAUTION:

Be sure to remove the wire after reassembly.



(A) Wire

2) Install the ball bearing.

(1) Set the ball bearing on the front cover, and then securely install an appropriate tool (such as a fit socket wrench) to the bearing outer race.

(2) Press the ball bearing into the specified position using a press.

(3) Install the bearing retainer.

3) Press the bearing (rear side) into the rotor shaft using a press to install.

4) Heat the bearing box in rear cover [50 to 60°C (122 to 140°F)], and then press the rear bearing into rear cover.

CAUTION:

Grease should not be applied to rear bearing. Remove the oil completely if it is found on bearing box.

5) After reassembly, turn the pulley by hand to check that rotor turns smoothly.

E: INSPECTION

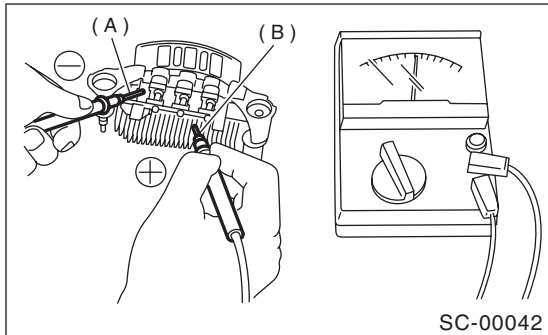
1. DIODE

CAUTION:

Never use a mega tester (designed for reading high voltage) or any other similar instrument for this test; otherwise, the diodes may be damaged.

1) Checking positive diode

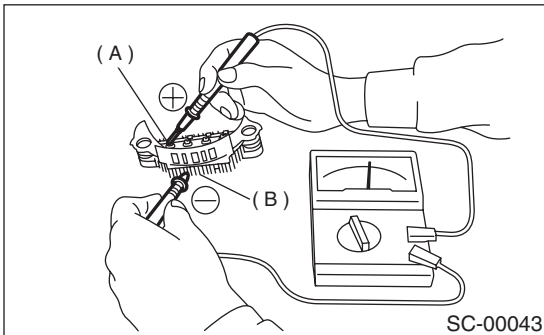
Check for continuity between the diode lead and positive side heat sink. The positive diode is in good condition if resistance is $1\ \Omega$ or less only in the direction from the diode lead to heat sink.



- (A) Diode lead
- (B) Heat sink (positive side)

2) Checking negative diode

Check for continuity between the negative side heat sink and diode lead. The negative diode is in good condition if resistance is $1\ \Omega$ or less only in the direction from the heat sink to diode lead.



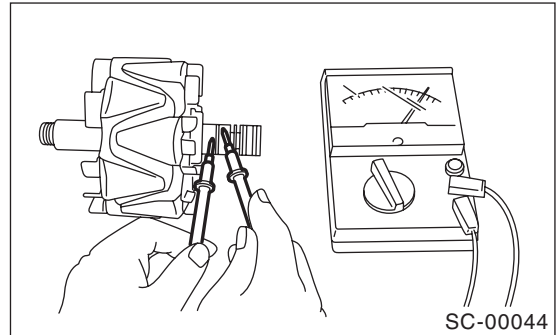
- (A) Diode lead
- (B) Heat sink (negative side)

3) Continuity test

Check the resistance between slip rings using circuit tester. If the resistance is not within the specified range, replace the rotor assembly.

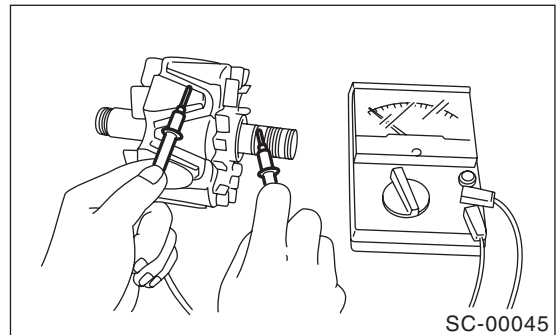
Specified resistance:

Approx. $1.8 - 2.2\ \Omega$



4) Insulation test

Check the continuity between slip ring and rotor core or shaft. If resistance is $1\ \Omega$ or less, the rotor coil is grounded, and so replace the rotor assembly.



5) Ball bearing (rear side)

Check the rear ball bearing. Replace if it is noisy or if the rotor does not turn smoothly.

2. ROTOR

1) Slip ring surface

Inspect the slip rings for contamination or any roughness on the sliding surface. Repair the slip ring surface using a lathe or sand paper.

2) Slip ring outer diameter

Measure the slip ring outer diameter. If the slip ring is worn, replace the rotor assembly.

Slip ring outer diameter:

Standard

22.7 mm (0.894 in)

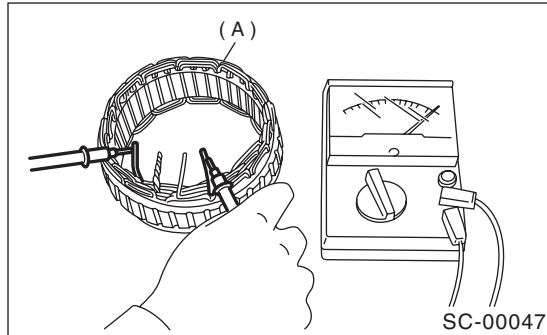
Limit

22.1 mm (0.870 in)

3. STATOR

1) Continuity test

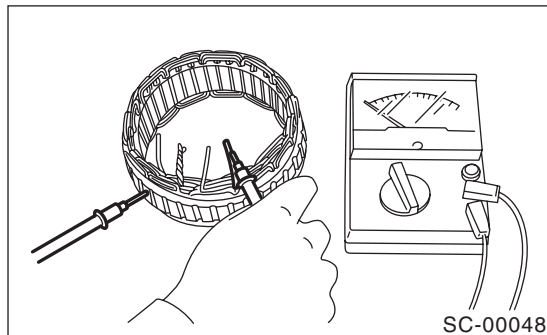
Inspect the stator coil for continuity between each end of the lead wires. If resistance is $1\text{ M}\Omega$ or more, the lead wire is broken, and so replace the stator assembly.



(A) Stator

2) Insulation test

Inspect the stator coil for continuity between stator core and each end of lead wire. If resistance is $1\ \Omega$ or less, the stator coil is grounded, and so replace the stator assembly.



4. BRUSH

1) Measure the length of each brush. If wear exceeds the service limit, replace the brush. Each brush has the service limit mark (A) on it.

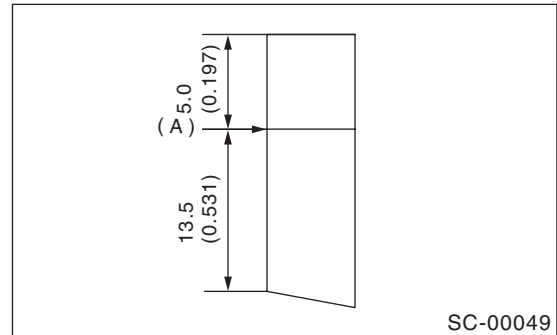
Brush length:

Standard

18.5 mm (0.728 in)

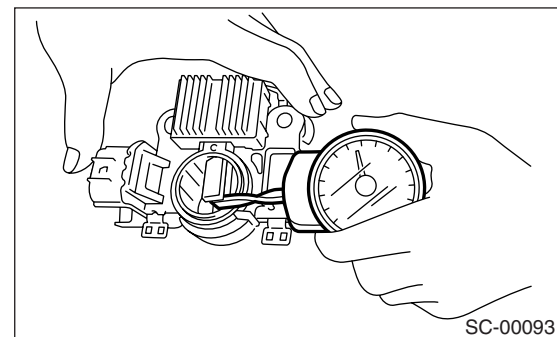
Service limit

5.0 mm (0.197 in)



2) Checking brush spring for proper pressure

Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.08 in). Then measure the pressure of brush spring. If the pressure is less than 2.648 N (270 g, 9.52 oz), replace the brush spring with a new one. The new spring must have a pressure of 4.609 to 5.786 N (470 to 590 g, 16.58 to 20.810 oz).



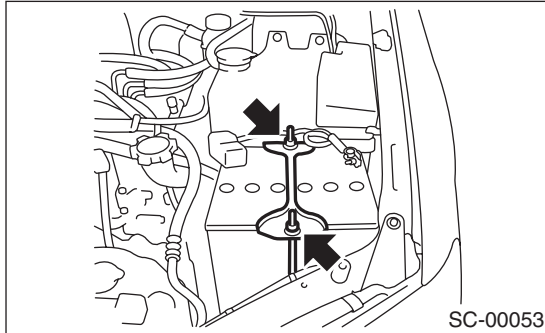
5. BEARING (FRONT SIDE)

Check the front ball bearing. If the resistance is felt while rotating, or if abnormal noise is heard, replace the ball bearing.

4. Battery

A: REMOVAL

- 1) Disconnect the positive (+) cable after disconnecting the ground (–) cable of battery.
- 2) Remove the flange nuts from battery rods, and then take off the battery holder.



- 3) Remove the battery.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

3.4 N·m (0.35 kgf-m, 2.5 ft-lb)

NOTE:

- Clean the battery cable terminals, and then apply grease to retard formation of corrosion.
- Connect the positive (+) cable of battery and then the ground (–) cable of battery.

C: INSPECTION

WARNING:

- Electrolyte has toxicity; be careful handling the fluid.
- Avoid contact with skin, eyes or clothing. Especially at contact with eyes, flush with running water for 15 minutes and get prompt medical attention.
- Batteries produce explosive gasses. Keep sparks, flame, cigarettes away.
- Ventilate when charging or using in enclosed space.
- For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. Never lean over a battery.
- Do not let the battery fluid contact eyes, skin, fabrics, or paint-work because battery fluid is corrosive acid.
- To lessen the risk of sparks, remove rings, metal watch-bands, and other metal jewelry. Never allow metal tools to contact the positive battery terminal and anything connected to it while you are at the same time in contact with any other metallic portion of the vehicle. This may cause a short circuit.

1. EXTERNAL PARTS:

Check for the existence of dirt or cracks on battery case, top cover, vent plugs, and terminal posts. If necessary, clean with water and wipe with a dry cloth.

Apply a thin coat of grease on the terminal posts to prevent corrosion.

2. ELECTROLYTE LEVEL:

Check the electrolyte level in each cell. If the level is below MIN LEVEL, bring the level to MAX LEVEL by pouring distilled water into the battery cell. Do not fill beyond MAX LEVEL.

3. SPECIFIC GRAVITY OF ELECTROLYTE:

- 1) Measure the specific gravity of electrolyte using a hydrometer and a thermometer.

Specific gravity varies with temperature of electrolyte so that it must be corrected at 20°C (68°F) using the following equation:

$$S_{20} = S_t + 0.0007 \times (t - 20)$$

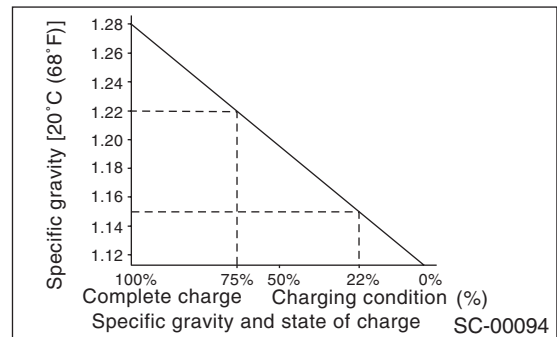
S₂₀: Specific gravity corrected at electrolyte temperature of 20°C

S_t: Measured specific gravity

t: Measured temperature (°C)

Determine whether or not battery must be charged, according to corrected specific gravity.

Standard specific gravity: 1.220 — 1.290 [at 20°C (68°F)]



- 2) Measuring the specific gravity of the electrolyte in battery will disclose the state of charge of battery. The relation between specific gravity and state of charge is as shown in the figure.

D: MEASUREMENT

WARNING:

Do not bring an open flame close to the battery at this time.

CAUTION:

- Prior to charging, corroded terminals should be cleaned with a brush and common caustic soda solution.

- Be careful since the battery electrolyte overflows while charging the battery.
- Observe the instructions when handling battery charger.
- Before charging the battery on vehicle, disconnect battery ground terminal to prevent damage of generator diodes or other electrical units.

1. JUDGMENT OF BATTERY IN CHARGED CONDITION

- 1) Specific gravity of electrolyte is held within the specified range from 1.250 to 1.290 for more than one hour.
- 2) Voltage per battery cell is held at the specified range from 2.5 to 2.8 volts for more than one hour.

2. STATE OF CHARGE CHECK USING A HYDROMETER

Hydrometer indicator	State of charge	Corrective action
Green dot	Above 65%	Load test
Dark dot	Below 65%	Charge battery
Clear dot	Low electrolyte	Replace battery* (If cranking is difficult)
*: Check electrical system before replacement.		

3. NORMAL CHARGING

Charge the battery at current value specified by manufacturer or at approx. 1/10 of the battery's ampere-hour rating.

4. QUICK CHARGING

Quick charging is a method in which the battery is charged in a short period of time with a relatively large current by using a quick charger.

Since a large current flow raises electrolyte temperature, the battery is subject to damage if large current is used for prolonged time. For this reason, the quick charging must be carried out within a current range that will not increase the electrolyte temperature above 40°C (104°F).

It should be also remembered that the quick charging is a temporary means to bring battery voltage up to a fair value and, as a rule, a battery should be charged slowly with a low current.

CAUTION:

- Observe the items in 3. NORMAL CHARGING.
- Never use more than 10 amperes when charging the battery because that will shorten battery life.

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SECTION 3

H4SO ENGINE

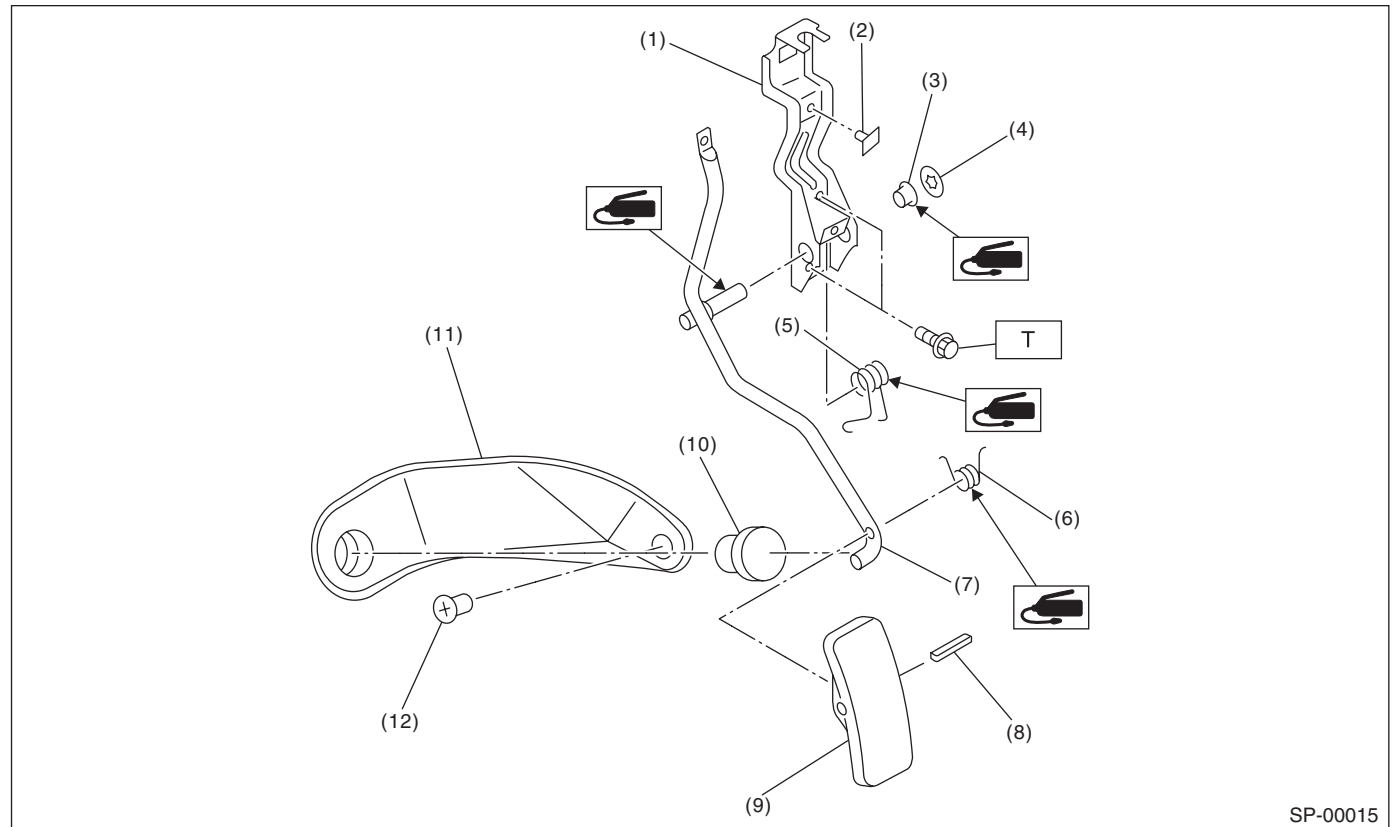
SPEED CONTROL SYSTEMS

1. General Description

A: SPECIFICATION

Accelerator pedal	Free play	At pedal pad	0 — 4 mm (0 — 0.16 in)
	Stroke	At pedal pad	52 — 57 mm (2.05 — 2.24 in)

B: COMPONENT



SP-00015

(1) Accelerator bracket	(6) Accelerator pedal spring	(11) Accelerator plate
(2) Stopper	(7) Accelerator pedal lever	(12) Clip
(3) Bushing	(8) Spring pin	
(4) Clip	(9) Accelerator pedal	
(5) Accelerator spring	(10) Accelerator stopper	

Tightening torque: N·m (kgf-m, ft-lb)

T: 18 (1.8, 13.0)

C: CAUTION

- Wear work clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination, including dirt and corrosion, before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
- Be careful not to burn your hands, because each part in the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or safety stands at the specified points.

- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.

2. Accelerator Pedal

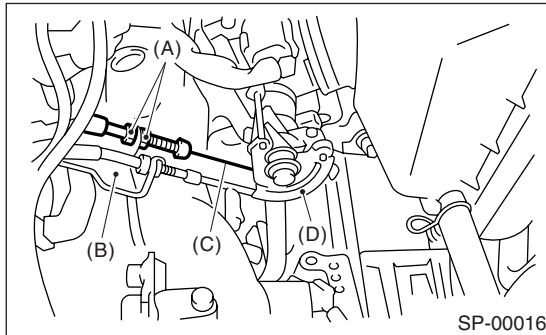
A: REMOVAL

- 1) Disconnect the ground cable from battery.
- 2) Remove the lock nut from accelerator cable bracket.
- 3) Separate the accelerator cable from bracket.
- 4) Remove the accelerator cable end from throttle cam.

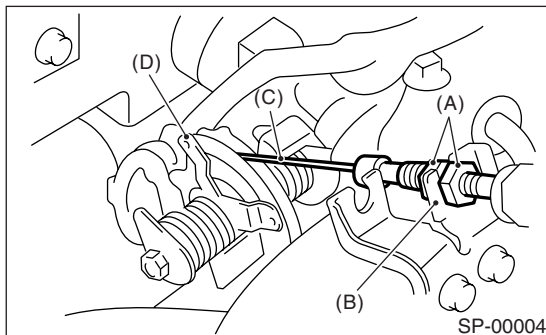
NOTE:

Be careful not to kink the accelerator cable.

• NON-TURBO MODEL



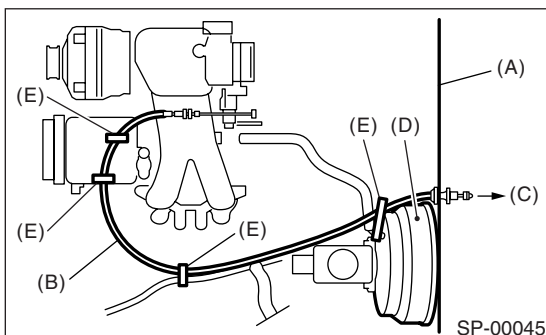
• TURBO MODEL



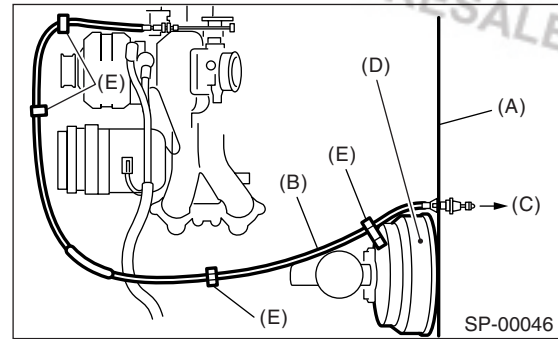
- (A) Lock nut
- (B) Accelerator cable bracket
- (C) Accelerator cable
- (D) Throttle cam

- 5) Remove the clip inside engine compartment.

• NON-TURBO MODEL



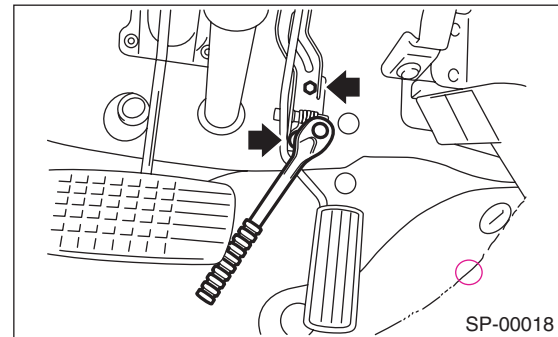
• TURBO MODEL



- (A) Toe board
- (B) Accelerator cable
- (C) To accelerator pedal
- (D) Brake booster
- (E) Clip

- 6) Remove the instrument panel lower cover from instrument panel.

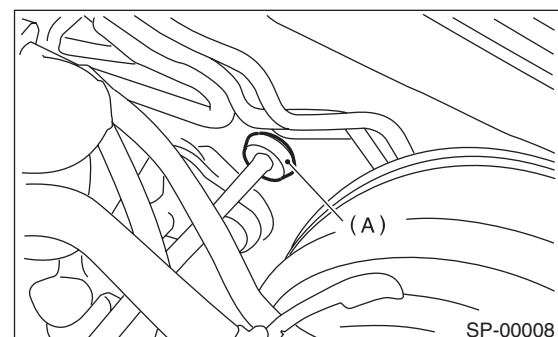
- 7) Remove the accelerator pedal connecting bolt from accelerator pedal bracket.



- 8) Disconnect the grommet from toe board.

NOTE:

From inside compartment, push the grommet (A) into hole.

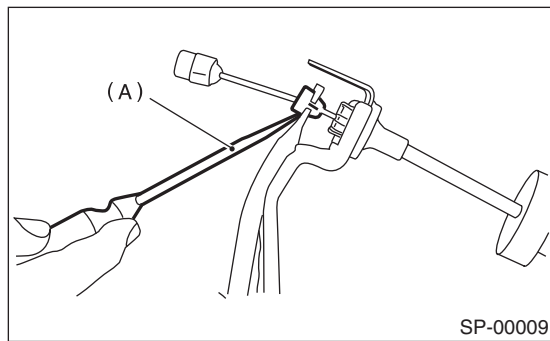


- 9) Pull out the cable from toe board hole.

Accelerator Pedal

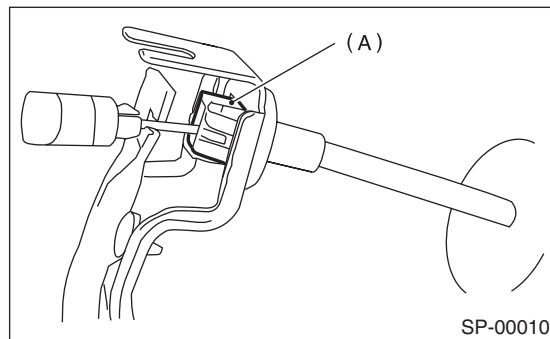
SPEED CONTROL SYSTEMS

10) Disconnect the accelerator cable bushing from accelerator pedal lever.



(A) Flat tip screwdriver

11) Disconnect the accelerator cable stopper (A) from bracket.



12) Separate the accelerator cable and bracket.

B: INSTALLATION

1) Install in the reverse order of removal.

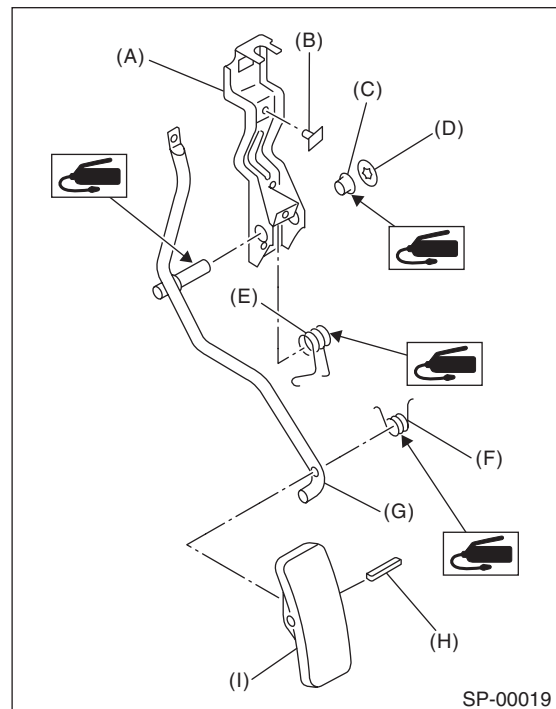
NOTE:

- If the cable clamp is damaged, replace it with a new one.
- Never fail to cover the outer cable end with boot.
- Be careful not to kink the accelerator cable.
- For tightening torque, refer to "COMPONENT". <Ref. to SP(H4SO)-2, COMPONENT, General Description.>

2) After the installation, adjust the pedal. <Ref. to SP(H4SO)-5, ADJUSTMENT, Accelerator Pedal.>

C: DISASSEMBLY

- 1) Remove the clip, and then remove the accelerator pedal lever from bracket.
- 2) Pull out the spring pin, and then remove the accelerator pedal from accelerator pedal lever.



- (A) Accelerator bracket
- (B) Stopper
- (C) Bushing
- (D) Clip
- (E) Accelerator spring
- (F) Accelerator pedal spring
- (G) Accelerator pedal lever
- (H) Spring pin
- (I) Accelerator pedal

D: ASSEMBLY

Assemble in the reverse order of disassembly.

NOTE:

Clean and apply grease to the portions indicated in the figure.

Grease:

SUNLIGHT No. 2 (Part No. 003602010)

E: INSPECTION

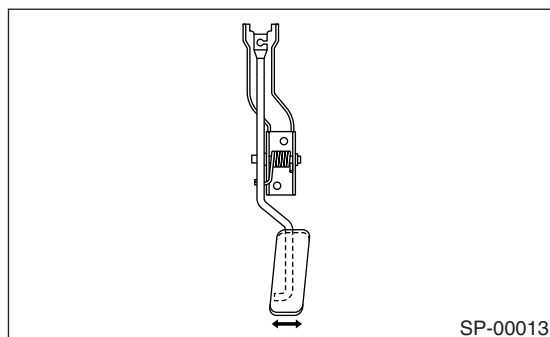
1. ACCELERATOR PEDAL

- 1) Lightly move the pedal pad in lateral direction to ensure that pedal deflection is in specified range.
- 2) If excessive deflection is noted, replace the bushing and clip with new ones.

Deflection of accelerator pedal:

Service limit

2.0 mm (0.079 in) or less



F: ADJUSTMENT

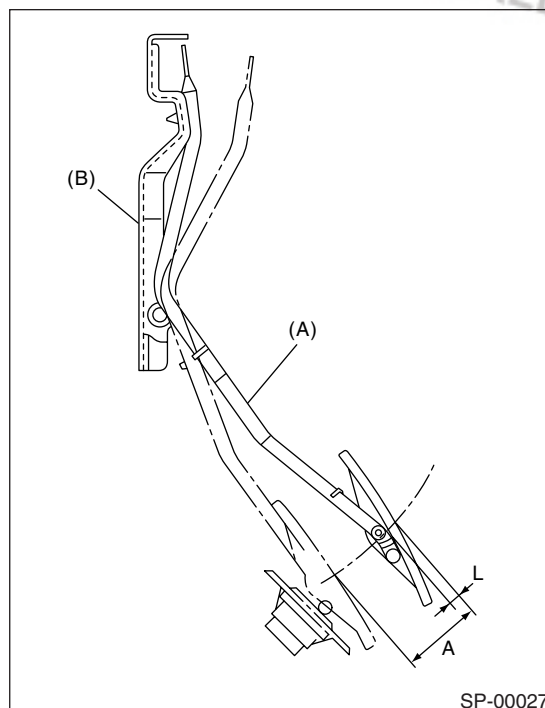
- 1) Check the pedal stroke and free play by operating the accelerator pedal by hand.
- 2) If it is not within specified value, adjust it by turning the nut connecting the accelerator cable to throttle body.

Free play at pedal pad: L

0 — 4 mm (0 — 0.16 in)

Stroke at pedal pad: A

52 — 57 mm (2.05 — 2.24 in)



(A) Accelerator pedal

(B) Accelerator pedal bracket

Accelerator cable lock nut tightening torque:

12 N·m (1.2 kgf-m, 9 ft-lb)

3. Accelerator Control Cable

A: REMOVAL

- 1) Remove the accelerator pedal.
<Ref. to SP(H4SO)-3, REMOVAL, Accelerator Pedal.>
- 2) Separate the accelerator cable and accelerator pedal.

B: INSTALLATION

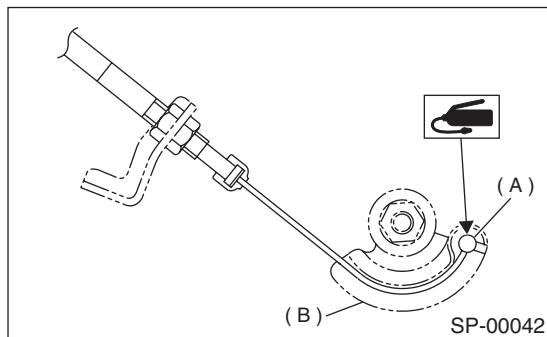
- 1) Install in the reverse order of removal.

NOTE:

- If the cable clamp is damaged, replace it with a new one.
 - Never fail to cover the outer cable end with boot.
 - Be careful not to kink the accelerator cable.
 - Do not apply grease to except specified part.
- 2) Apply grease to engine side accelerator cable end.

Grease:

Silicolube G-30M (Part No. 004404002)



- (A) Accelerator cable end
(B) Throttle cam

- 3) Adjustment after pedal installation. <Ref. to SP(H4SO)-5, ADJUSTMENT, Accelerator Pedal.>

C: INSPECTION

- 1) Make sure the inner cable is not twisted or worn.
- 2) Make sure the outer cable is not cracked.