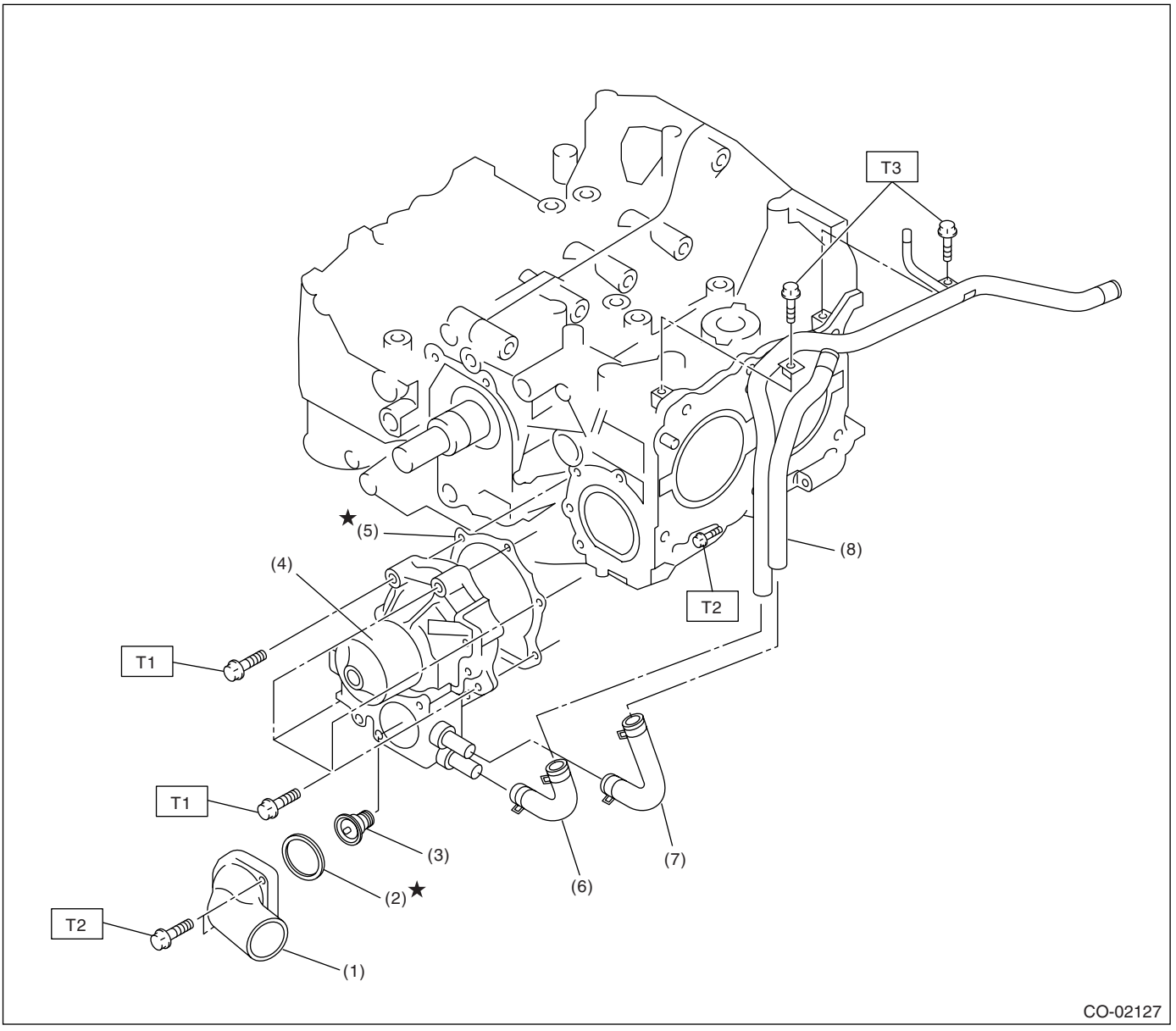
1. General Description

A: SPECIFICATIONS

Model			DOHC TURBO
Cooling system			Electric fan + Forced engine coolant circulation system
Total engine coolant capacity ℓ (US qt, Imp qt)			AT: Approx. 7.6 (8.03, 6.69) MT: Approx. 7.7 (8.14, 6.78)
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	80°C (176°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 — 1.5 mm (0.020 — 0.059 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/91°C (196°F)
	Valve bore		35 mm (1.38 in)
Radiator fan	Motor	Main fan	120 W
		Sub fan	120 W
	Fan diameter × Blade		320 mm (12.60 in) × 5 (main fan) 320 mm (12.60 in) × 7 (sub fan)
Radiator	Type		Down flow
	Core dimensions	Width × Height × Thickness	691.5 × 340 × 27 mm (27.22 × 13.39 × 1.06 in)
	Pressure range in which cap valve is open	Coolant filler tank side	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)
		Radiator side	Above only: 137±14.7 kPa (1.40±0.15 kg/cm^2, 20±2.1 psi)
	Fins		Corrugated fin type
Reservoir tank	Capacity		0.5 ℓ (0.5 US qt, 0.4 Imp qt)

B: COMPONENT

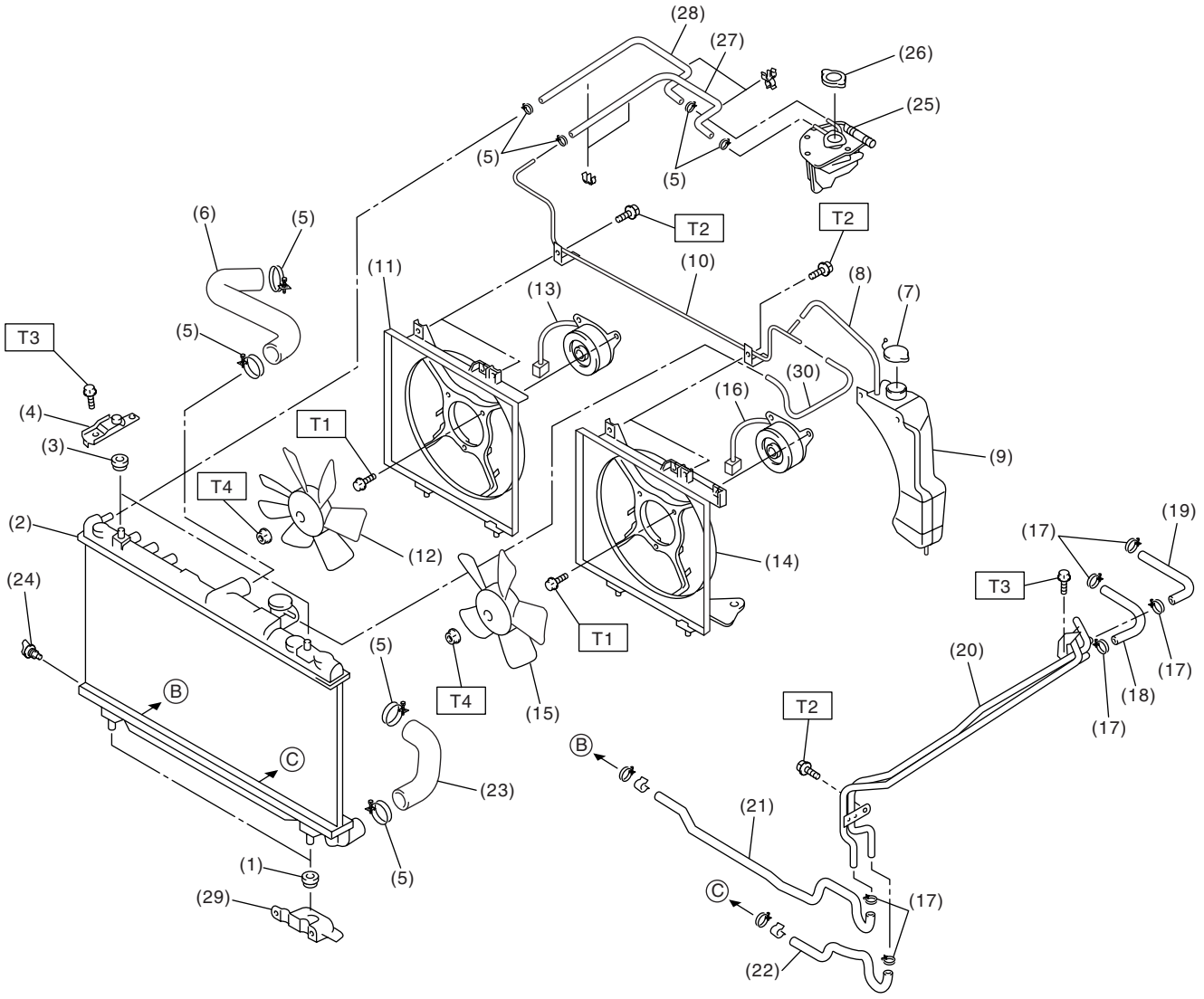
1. WATER PUMP



(1) Thermostat cover
(2) Gasket
(3) Thermostat
(4) Water pump ASSY
(5) Gasket
(6) Heater by-pass hose
(7) Coolant filler tank by-pass hose
(8) Water by-pass pipe

Tightening torque: N·m (kgf-m, ft-lb)
T1: First 12 (1.2, 8.7)
Second 12 (1.2, 8.7)
T2: 12 (1.2, 8.7)
T3: 6.5 (0.66, 4.8)

2. RADIATOR AND RADIATOR FAN



CO-02122

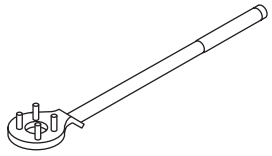
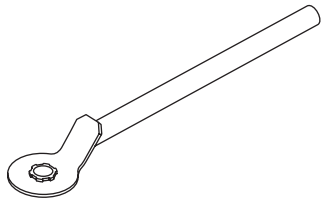
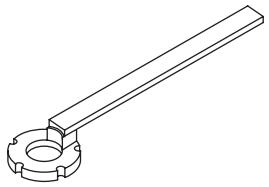
(1) Radiator lower cushion
(2) Radiator
(3) Radiator upper cushion
(4) Radiator upper bracket
(5) Clamp
(6) Radiator inlet hose
(7) Engine coolant reservoir tank cap
(8) Overflow hose A
(9) Engine coolant reservoir tank
(10) Overflow pipe
(11) Radiator sub fan shroud
(12) Radiator sub fan
(13) Radiator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

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.4 (0.45, 3.3)
T2: 7.5 (0.76, 5.5)
T3: 18 (1.8, 13.0)
T4: 3.4 (0.35, 2.5)

C: CAUTION

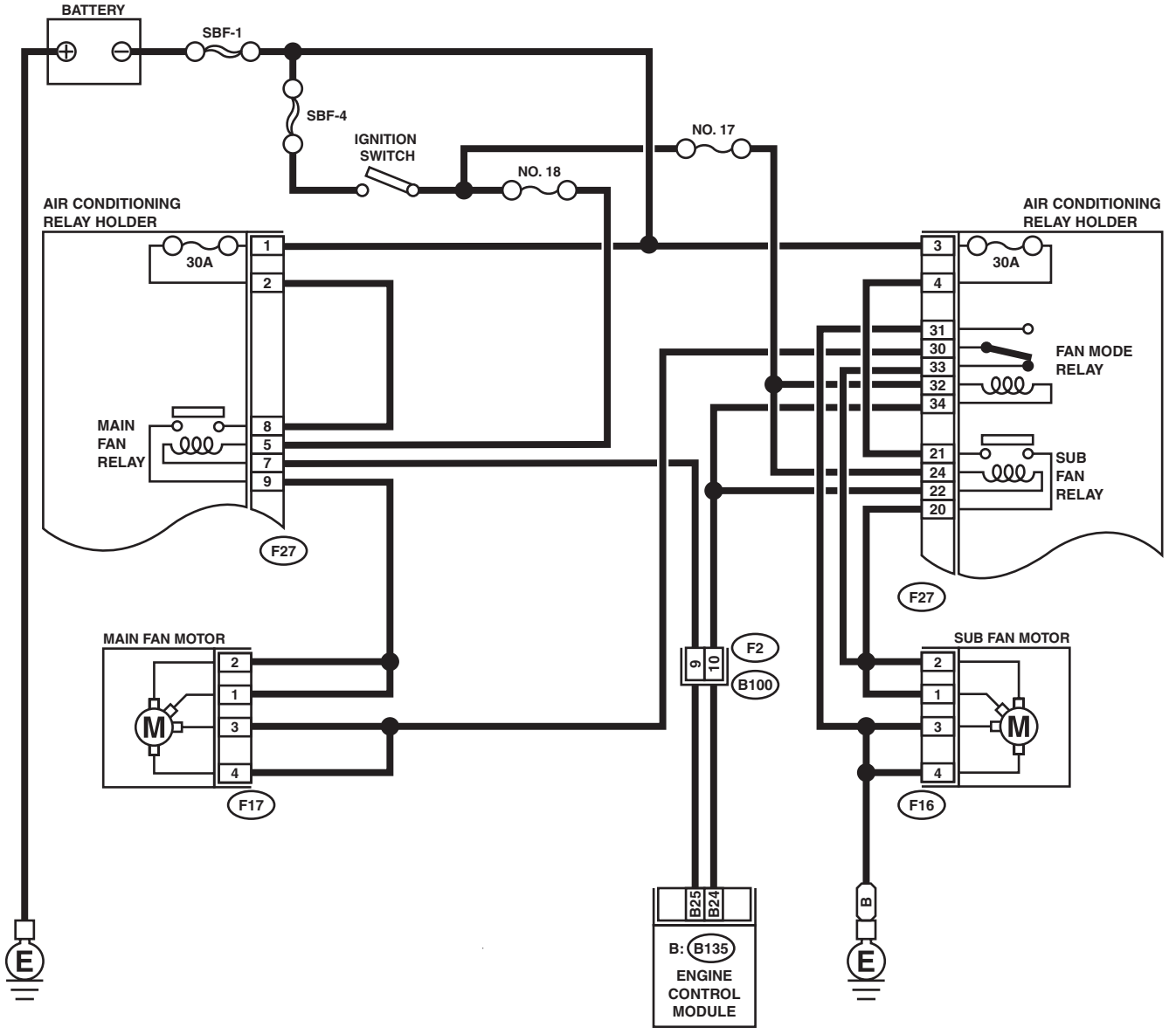
• Wear working clothing, including a cap, protective goggles, and protective shoes during operation.
• Remove contamination including dirt and corrosion before removal, installation or disassembly.
• Keep the disassembled parts in order and protect them from dust or dirt.
• Before removal, installation 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 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.

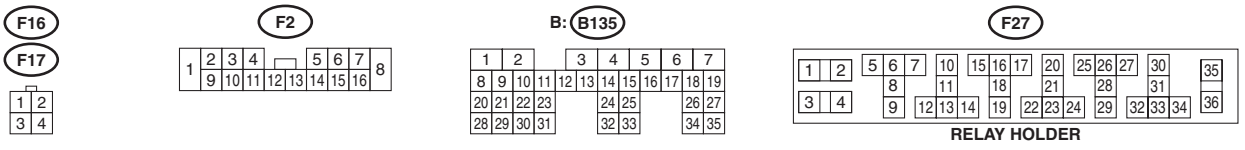
D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANKSHAFT PULLEY WRENCH	Used for stopping crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 ST-499977500	499977500	CAMSHAFT SPROCKET WRENCH	Used for removing and installing intake camshaft sprockets.
 ST-499207400	499207400	CAMSHAFT SPROCKET WRENCH	Used for removing and installing exhaust camshaft sprockets.

2. Radiator Fan System

A: SCHEMATIC





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B: INSPECTION

DETECTING CONDITION:

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

TROUBLE SYMPTOM:

- Radiator main and sub fan do not rotate under the above conditions.

	Step	Check	Yes	No
1	**CHECK OPERATION OF RADIATOR FAN.** 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Using Subaru Select Monitor, check the compulsory operation of radiator fan. NOTE: •With Subaru Select Monitor When checking the compulsory operation of radiator fan, the radiator main and sub fan repeat the rotation in order of following: low speed rotation → high speed rotation → off. •Subaru Select Monitor Refer to Compulsory Valve Operation Check Mode for detail procedures. <Ref. to EN(H4DOTC)-53, Compulsory Valve Operation Check Mode.>	Do the radiator main and sub fan rotate at low speed?	Go to step **2.**	Go to step **3.**
2	**CHECK OPERATION OF RADIATOR FAN.** 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Using Subaru Select Monitor, check the compulsory operation of radiator fan. NOTE: •With Subaru Select Monitor When checking the compulsory operation of radiator fan, the radiator main and sub fan repeat the rotation in order of following: low speed rotation → high speed rotation → off. •Subaru Select Monitor Refer to Compulsory Valve Operation Check Mode for detail procedures. <Ref. to EN(H4DOTC)-53, Compulsory Valve Operation Check Mode.>	Do the radiator main and sub fan rotate at high speed?	Radiator main fan system is okay.	Go to step **32.**
3	**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. 8 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **4.**	Go to step **5.**
4	**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. 5 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **8.**	Go to step **7.**
5	**CHECK FUSE.** 1) Remove the 30 A fuse from A/C relay holder. 2) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step **6.**

Step		Check	Yes	No
6	**CHECK HARNESS OF 30 A FUSE TERMINAL AND MAIN FAN RELAY TERMINAL.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between 20 A fuse terminal and main fan relay terminal. ***Terminal*** ***No. 2 — No. 8:***	Is the measured value less than 1 Ω?	Repair the power supply line.	Repair the open harness.
7	**CHECK FUSE.** 1) Turn the ignition switch to OFF 2) Remove the fuse No. 18. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
8	**CHECK N\AIN FAN RELAY.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between main fan relay terminals. ***Terminal*** ***No. 8 — No. 9:***	Is the measured value more than 1 MΩ?	Go to step **9.**	Replace the main fan relay.
9	**CHECK MAIN FAN RELAY.** 1) Connect the battery to main fan relay terminals No. 5 and No. 7. 2) Measure the resistance between main fan relay terminals. ***Terminal*** ***No. 8 — No. 9:***	Is the measured value less than 1 Ω?	Go to step **10.**	Replace the main fan relay.
10	**CHECK HARNESS BETWEEN MAIN FAN RELAY TERMINAL AND MAIN FAN MOTOR CONNECTOR.** 1) Disconnect the connector from main fan motor. 2) Measure the resistance between main fan relay terminal and main fan motor connector. ***Connector & terminal*** ***(F17) No. 1 — (F27) No. 9:*** ***(F17) No. 2 — (F27) No. 9:***	Is the measured value less than 1 Ω?	Go to step **11.**	Repair the open harness between main fan relay terminal and main fan motor connector.
11	**CHECK HARNESS BETWEEN MAIN FAN MOTOR CONNECTOR AND FAN MODE RELAY CONNECTOR.** 1) Remove the fan mode relay from A/C relay holder. 2) Measure the resistance between main fan motor connector and fan mode relay connector. ***Connector & terminal*** ***(F17) No. 3 — (F27) No. 30:*** ***(F17) No. 4 — (F27) No. 30:***	Is the measured value less than 1 Ω?	Go to step **12.**	Repair the open harness between main fan motor connector and fan mode relay connector.
12	**CHECK POOR CONTACT.** Check poor contact in main fan motor connector.	Is there poor contact in main fan motor connector?	Repair poor contact in main fan motor connector.	Go to step **13.**
13	**CHECK MAIN FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 and No. 2, and ground (-) terminal to terminal No. 3 and No. 4 of main fan motor.	Does the main fan rotate?	Go to step **14.**	Replace the main fan motor.
14	**CHECK FAN MODE RELAY.** Measure the resistance of fan mode relay. ***Terminal*** ***No. 30 — No. 33***	Is the measured value less than 1 Ω?	Go to step **15.**	Replace the fan mode relay.

	Step	Check	Yes	No
15	**CHECK RESISTANCE BETWEEN FAN MODE RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.** 1) Disconnect the connector from sub fan motor. 2) Measure the resistance between fan mode relay terminal and sub fan motor connector. ***Connector & terminal*** ***(F16) No. 1 — (F27) No. 33:*** ***(F16) No. 2 — (F27) No. 33:***	Is the measured value less than 1 Ω?	Go to step **16.**	Repair the open harness between fan mode relay terminal and sub fan motor connector.
16	**CHECK SUB FAN MOTOR AND GROUND CIRCUIT.** Measure the resistance between sub fan motor connector and chassis ground. ***Connector & terminal*** ***(F16) No. 3 — Chassis ground:*** ***(F16) No. 4 — Chassis ground:***	Is the measured value less than 5 Ω?	Go to step **17.**	Repair the open harness between sub fan motor connector and chassis ground.
17	**CHECK POOR CONTACT.** Check poor contact in sub fan motor connector.	Is there poor contact in sub fan motor connector?	Repair poor contact in sub fan motor connector.	Go to step **18.**
18	**CHECK SUB FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 and No. 2, and ground (-) terminal to terminal No. 3 and No. 4 of sub fan motor.	Does the sub fan rotate?	Go to step **19.**	Replace the sub fan motor.
19	**CHECK HARNESS BETWEEN MAIN FAN RELAY AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between main fan relay terminal and ECM connector. ***Connector & terminal*** ***(B135) No. 25 — (F25) No. 7:***	Is the measured value less than 1 Ω?	Go to step **20.**	Repair the open harness between main fan relay terminal and ECM.
20	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair poor contact in ECM connector.	Contact with SOA (distributor) service.
21	**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 fan relay 2 terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 21 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **22.**	Go to step **23.**
22	**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 measured value more than 10 V?	Go to step **26.**	Go to step **25.**
23	**CHECK FUSE.** 1) Remove the 30 A fuse from A/C relay holder. 2) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step **24.**

Step		Check	Yes	No
24	**CHECK HARNESS BETWEEN 30 A FUSE TERMINAL AND SUB FAN RELAY TERMINAL.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between 30 A fuse terminal and sub fan relay terminal. ***Terminal*** ***No. 4 — No. 21:***	Is the measured value less than 1 Ω?	Repair the power supply line.	Repair the open harness.
25	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 17. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
26	**CHECK SUB FAN RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the sub fan relay from A/C relay holder. 3) Measure the resistance of sub fan relay. ***Terminal*** ***No. 20 — No. 21:***	Is the measured value more than 1 MΩ?	Go to step **27.**	Replace the sub fan relay.
27	**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. ***Terminal*** ***No. 20 — No. 21:***	Is the measured value less than 1 Ω?	Go to step **28.**	Replace the sub fan relay.
28	**CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.** 1) Disconnect the connector from sub fan motor. 2) Measure the resistance between sub fan relay terminal and sub fan motor connector. ***Connector & terminal*** ***(F16) No. 1 — (F27) No. 20:*** ***(F16) No. 2 — (F27) No. 20:***	Is the measured value less than 1 Ω?	Go to step **30.**	Repair the open harness between sub fan relay terminal and sub fan motor connector.
29	**CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between sub fan relay terminal and ECM connector. ***Connector & terminal*** ***(B135) No. 24 — (F27) No. 22:***	Is the measured value less than 1 Ω?	Go to step **30.**	Repair the open harness between sub fan relay terminal and ECM.
30	**CHECK HARNESS BETWEEN FAN MODE RELAY AND ECM.** Measure the resistance between fan mode relay terminal and ECM connector. ***Connector & terminal*** ***(B135) No. 24 — (F27) No. 34:***	Is the measured value less than 1 Ω?	Go to step **31.**	Repair the open harness between fan mode relay terminal and ECM.
31	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Contact with your SOA (distributor) service.
32	**CHECK OPERATION OF RADIATOR FAN.**	Does the radiator main fan rotate when the radiator main and sub fan do not rotate at high speed at step 2?	Go to step **21.**	Go to step **33.**

Step		Check	Yes	No
33	**CHECK GROUND CIRCUIT OF FAN MODE RELAY.** 1) Remove the fan mode relay from A/C relay holder. 2) Measure the resistance between fan mode relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 31 — Chassis ground:***	Is the measured value less than 1 Ω?	Go to step **34.**	Repair the open harness between fan mode relay and chassis ground.
34	**CHECK POWER SUPPLY TO FAN MODE RELAY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fan mode relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 32 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **35.**	Repair the power supply line.
35	**CHECK FAN MODE RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the fan mode relay. 3) Measure the resistance of fan mode relay. ***Terminal*** ***(F27) No. 30 — (F27) No. 31:***	Is the measured value more than 1 MΩ?	Go to step **36.**	Replace the fan mode relay.
36	**CHECK FAN MODE RELAY.** 1) Connect the battery to terminals No. 32 and No. 34 of fan mode relay. 2) Measure the resistance of fan mode relay. ***Terminal*** ***(F27) No. 30 — (F27) No. 31:***	Is the measured value less than 1 Ω?	Go to step **29.**	Replace the fan mode relay.

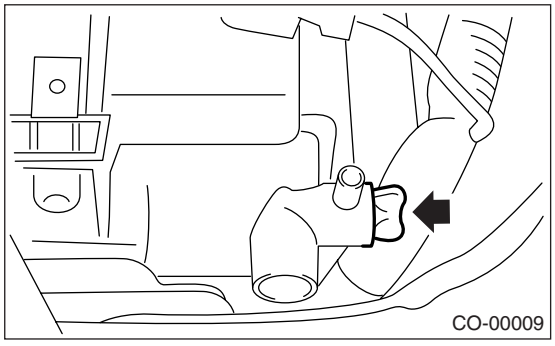
3. Engine Coolant

A: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

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

NOTE:
Remove the coolant filler tank cap so that engine coolant will drain faster.



4) Install the drain cock.

2. FILLING OF ENGINE COOLANT

1) Fill cooling system conditioner from filling port.

Cooling system protecting agent:
COOLING SYSTEM CONDITIONER (Part No. SOA635071)

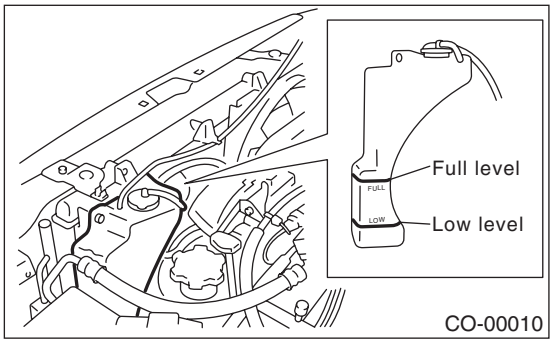
2) Fill engine coolant into the coolant filler tank up to filler neck position.

Coolant capacity (fill up to "FULL" level):
AT model
Approx. 7.6 ℓ (8.03 US qt, 6.69 Imp qt)
MT model
Approx. 7.7 ℓ (8.14 US qt, 6.78 Imp qt)

CAUTION:
Do not mix up the coolant filler tank side cap with radiator side cap.

NOTE:
• Do not remove the radiator side cap when filling engine coolant.
• 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.

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

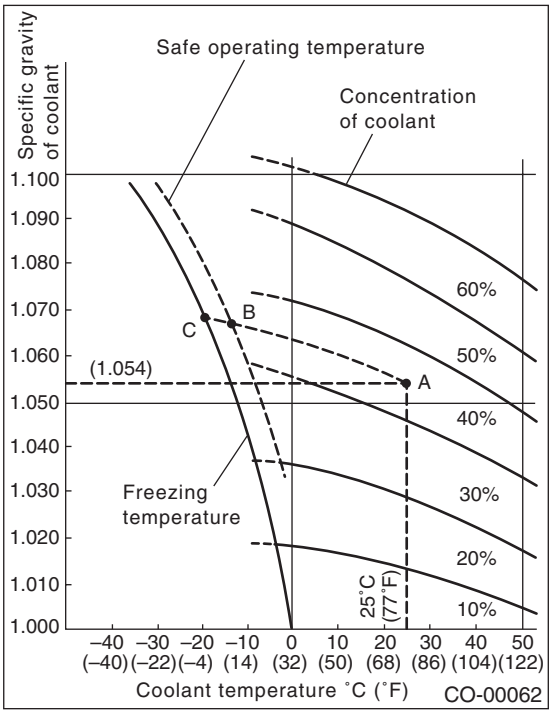


4) Warm-up the engine completely for more than 5 minutes at 2,000 to 3,000 rpm.
5) If the engine coolant level drops in coolant filler tank, add engine coolant to filler neck position.
6) If the engine coolant level drops from Full level of reservoir tank, add engine coolant to Full level.
7) Attach the coolant filler tank cap and reservoir tank cap properly.

B: INSPECTION

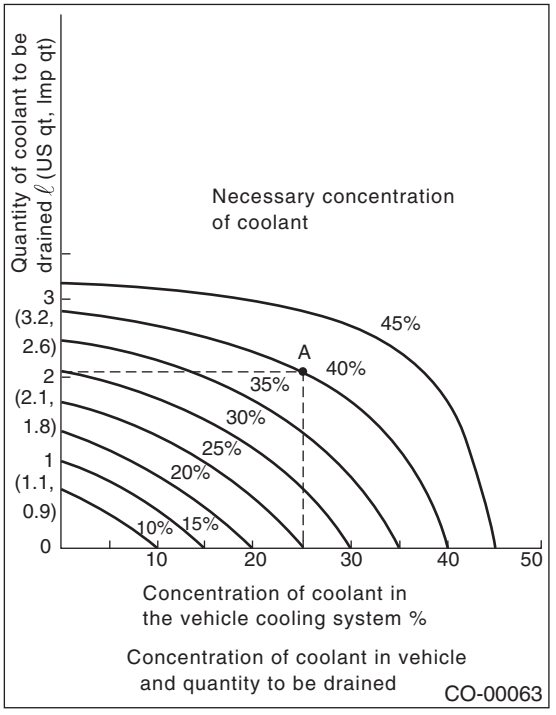
1. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

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 45% (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

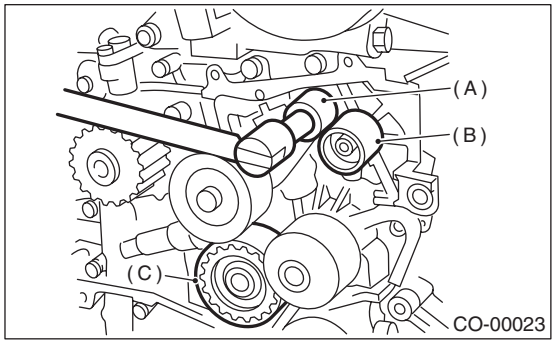
To adjust the concentration of the coolant according to temperature, find the proper fluid concentration in the above diagram and replace the necessary amount of coolant with an undiluted solution of SUBARU genuine coolant (concentration 50%).
The amount of coolant that should be replaced can be determined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



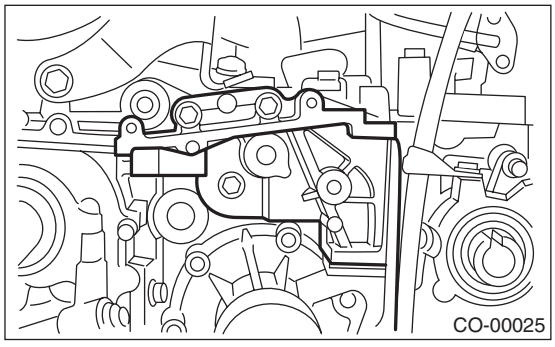
4. Water Pump

A: REMOVAL

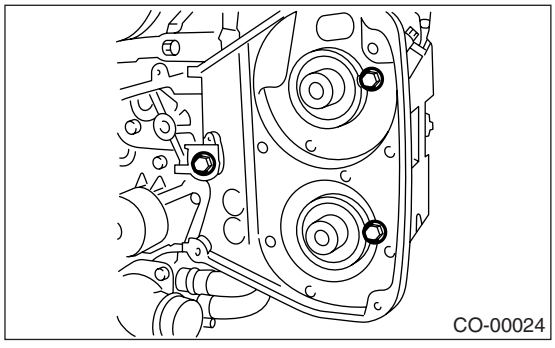
1) Remove the radiator. <Ref. to CO(H4DOTC)-19, REMOVAL.>
2) Remove the V-belts. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
3) Remove the timing belt. <Ref. to ME(H4DOTC)-49, REMOVAL, Timing Belt Assembly.>
4) Remove the automatic belt tension adjuster (A).
5) Remove the belt idler (B).
6) Remove the belt idler No. 2 (C).



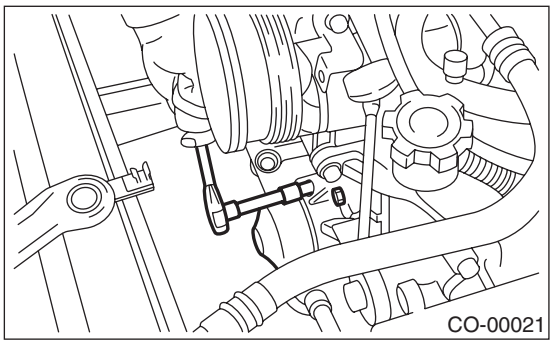
7) Remove the camshaft position sensor. <Ref. to FU(H4DOTC)-29, REMOVAL, Camshaft Position Sensor.>
8) Remove the camshaft sprockets (LH) by using ST. <Ref. to ME(H4DOTC)-57, REMOVAL, Camshaft Sprocket.>
9) Remove the tensioner bracket.



10) Remove the belt cover No. 2 (LH).



11) Disconnect the hose from water pump.
12) Remove the water pump.

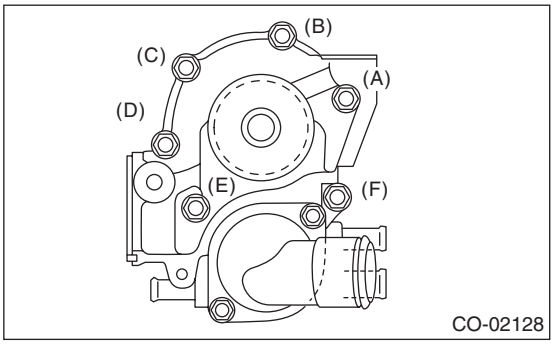


B: INSTALLATION

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

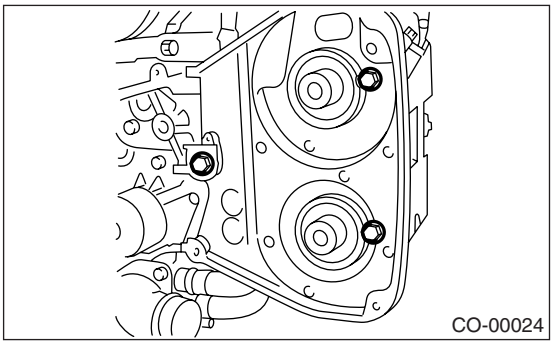
NOTE:
- Replace the gasket with a new one.
- When installing the water pump, tighten bolts in two stages in alphabetical sequence as shown in the figure.

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)



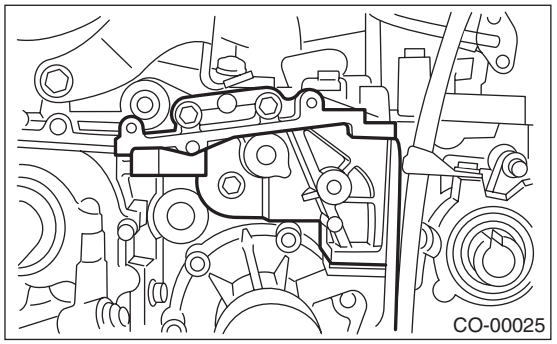
2) Connect the hose to water pump.
3) Install the belt cover No. 2 (LH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



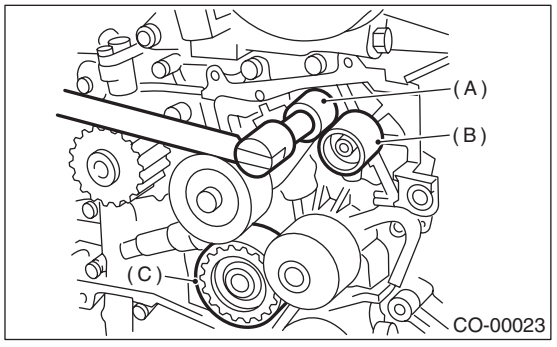
4) Install the tensioner bracket.

Tightening torque:
24.5 N·m (2.5 kgf-m, 18.1 ft-lb)



5) Install the camshaft sprockets (LH) by using ST. <Ref. to ME(H4DOTC)-57, INSTALLATION, Camshaft Sprocket.>
6) Install the camshaft position sensor. <Ref. to FU(H4DOTC)-29, INSTALLATION, Camshaft Position Sensor.>
7) Install the belt idler No. 2 (C).
8) Install the belt idler (B).
9) Install the automatic belt tension adjuster (A) which has tension rod held by pin. <Ref. to ME(H4DOTC)-51, INSTALLATION, Timing Belt Assembly.>

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)

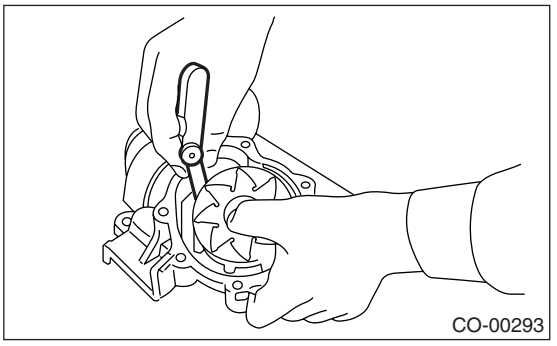


10) Install the timing belt. <Ref. to ME(H4DOTC)-52, TIMING BELT, INSTALLATION, Timing Belt Assembly.>
11) Install the V-belts. <Ref. to ME(H4DOTC)-45, INSTALLATION, V-belt.>
12) Install the radiator. <Ref. to CO(H4DOTC)-20, INSTALLATION, Radiator.>

C: INSPECTION

1) Check the water pump bearing for smooth rotation.
2) Check the water pump pulley for abnormalities.
3) Check the clearance between impeller and pump case.

Clearance between impeller and pump case:
Standard
0.5 — 1.5 mm (0.020 — 0.059 in)

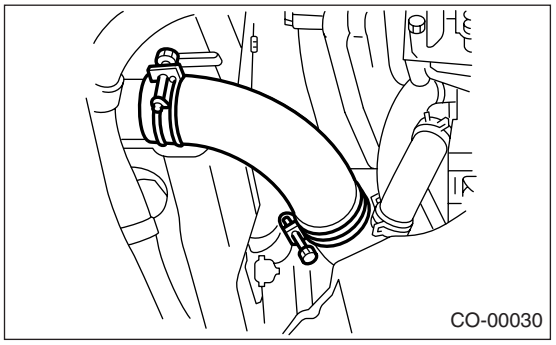


4) After water pump installation, check the pulley shaft for engine coolant leaks. If leaks are noted, replace the water pump assembly.

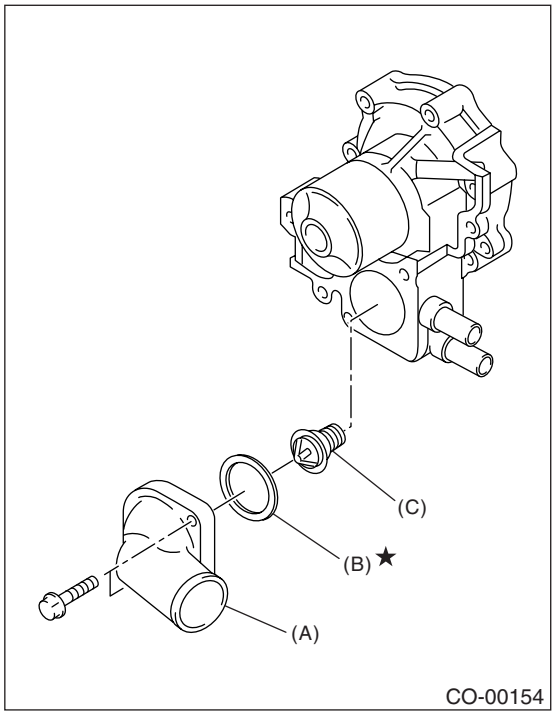
5. Thermostat

A: REMOVAL

1) Lift-up the vehicle.
2) Remove the under cover.
3) Drain the engine coolant completely. <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the radiator outlet hose.



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



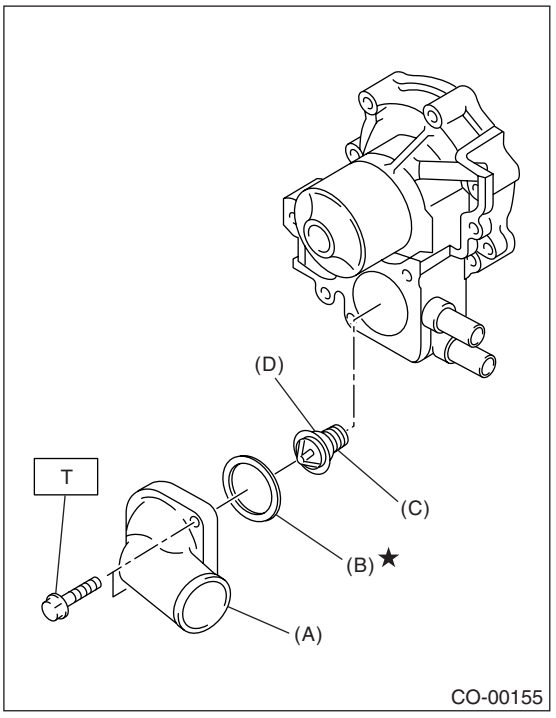
(A) Thermostat cover
(B) Gasket
(C) Thermostat

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 (D) facing to upper side.

Tightening torque:
12 N·m (1.2 kgf-m, 8.7 ft-lb)



(A) Thermostat cover
(B) Gasket
(C) Thermostat
(D) Jiggle pin

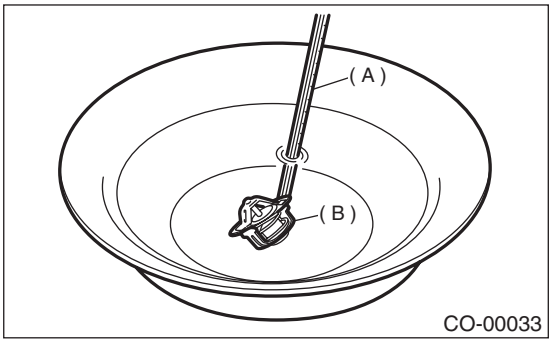
2) Fill engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

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)



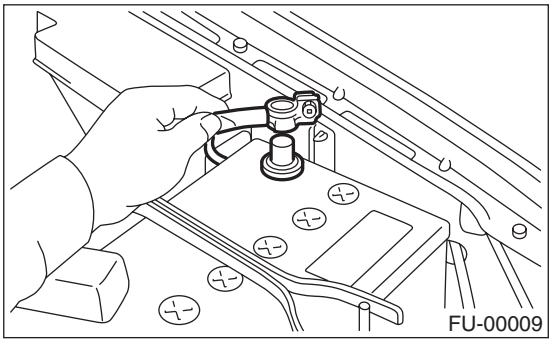
(A) Thermometer
(B) Thermostat

6. Radiator

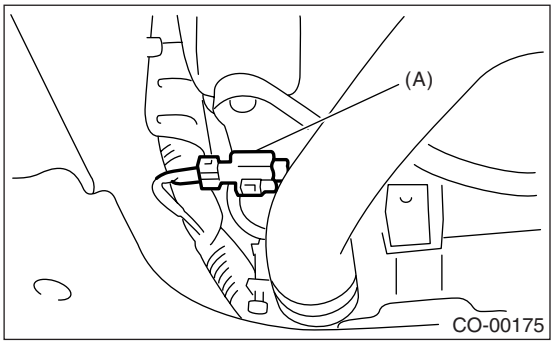
A: REMOVAL

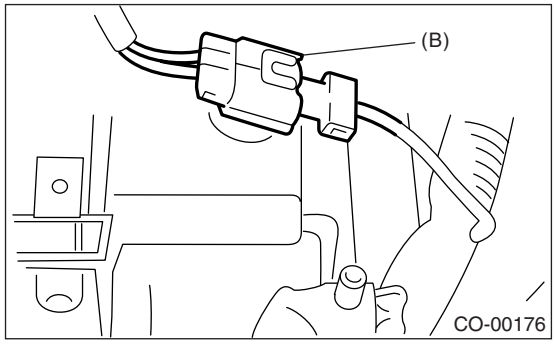
WARNING:
The radiator is pressurized. Wait until the engine cools down before working on the radiator.

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

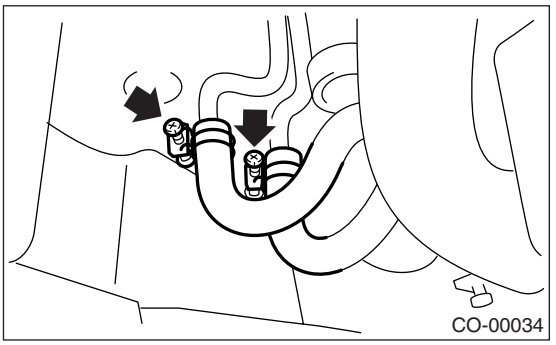


3) Lift-up the vehicle.
4) Remove the under cover.
5) Drain the engine coolant completely. <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
6) Disconnect the connectors of radiator main fan motor (A) and sub fan motor (B).

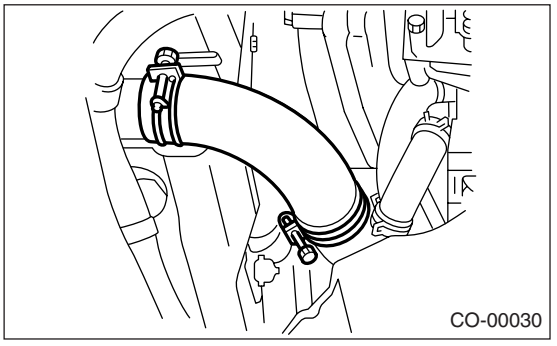




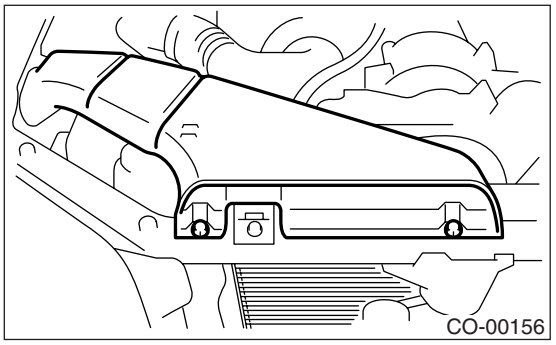
7) Disconnect the ATF cooler hose from ATF pipe. (AT model) Plug the openings in the hose and radiator with caps in order to prevent ATF from leaking.



8) Disconnect the radiator outlet hose from thermostat cover.

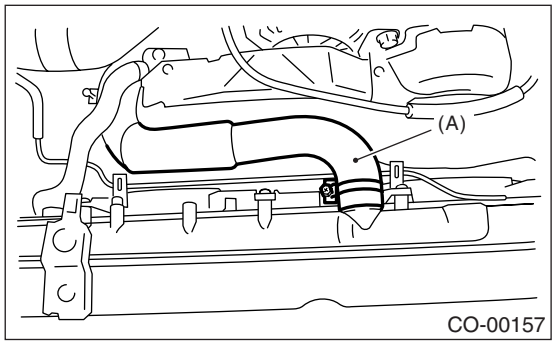


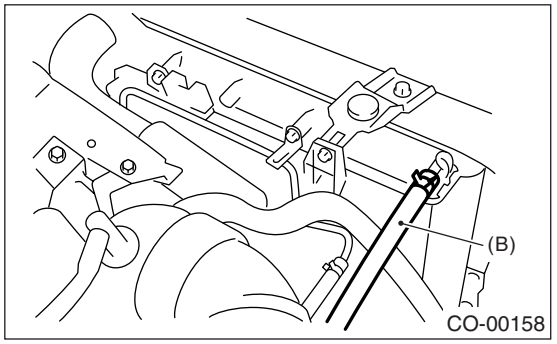
9) Lower the vehicle.
10) Remove the air intake duct.



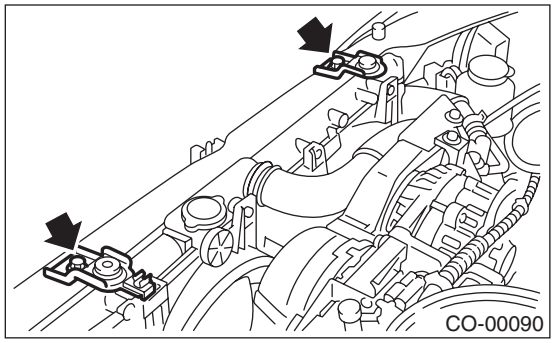
11) Remove the V-belt covers.
12) Disconnect the overflow hose.
13) Remove the reservoir tank. <Ref. to CO(H4DOTC)-28, REMOVAL, Reservoir Tank.>

14) Disconnect the radiator inlet hose (A) and water tank hose (B) from radiator.





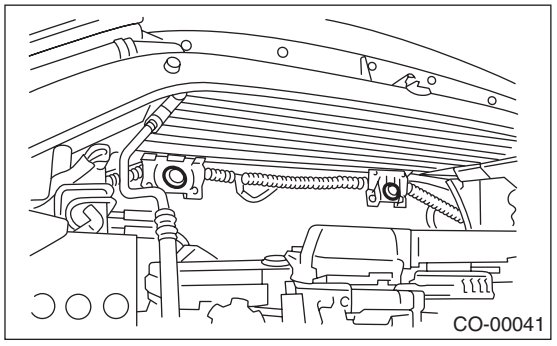
15) Remove the radiator upper brackets.



16) Lift-up the radiator, and then remove it from vehicle.

B: INSTALLATION

1) Attach the radiator mounting cushions to the holes on vehicle.

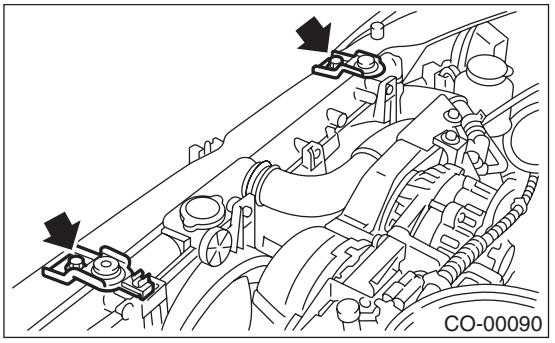


2) Install the radiator to vehicle.

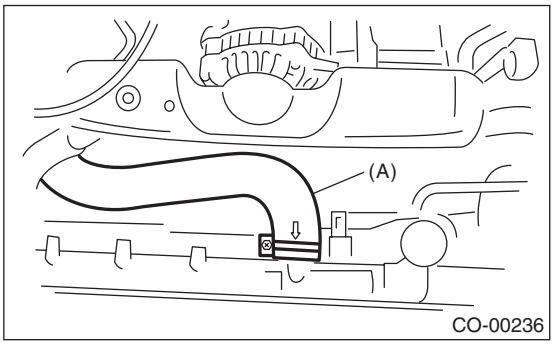
NOTE:
Fit the pins on lower side of radiator into the cushions on body side.

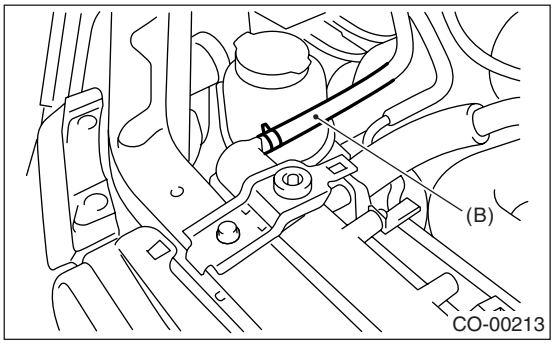
3) Install the radiator brackets, and then tighten the bolts.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



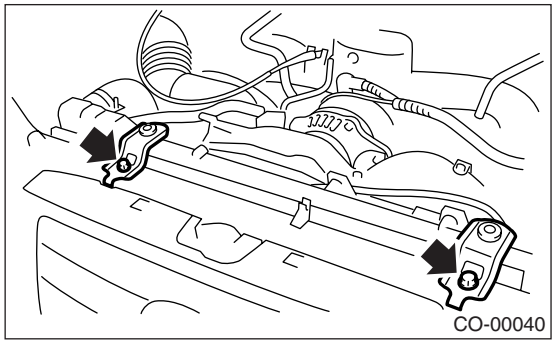
4) Connect the radiator inlet hose (A) and water tank hose (B).



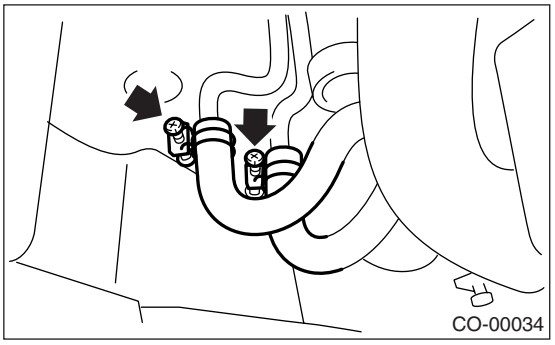


5) Install the reservoir tank. <Ref. to CO(H4DOTC)-28, INSTALLATION, Reservoir Tank.>
6) Connect the overflow hose.

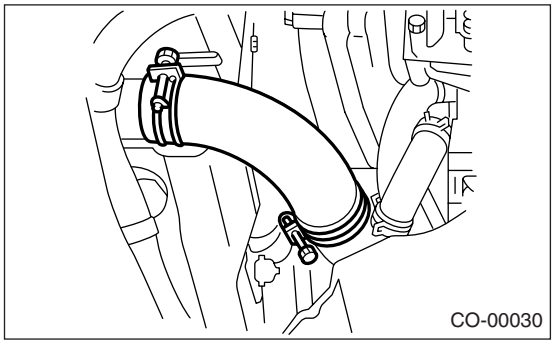
7) Install the V-belt cover.



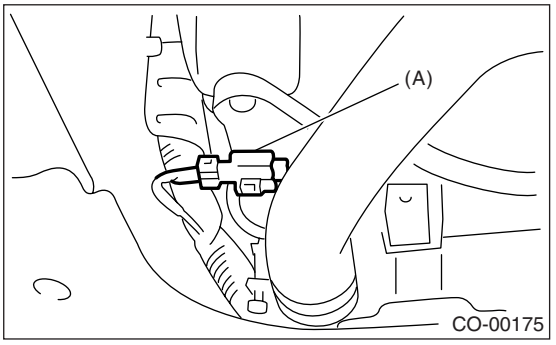
8) Install the air intake duct.
<Ref. to IN(H4DOTC)-8, INSTALLATION, Air Intake Duct.>
9) Lift-up the vehicle.
10) Connect the ATF cooler hoses. (AT model).

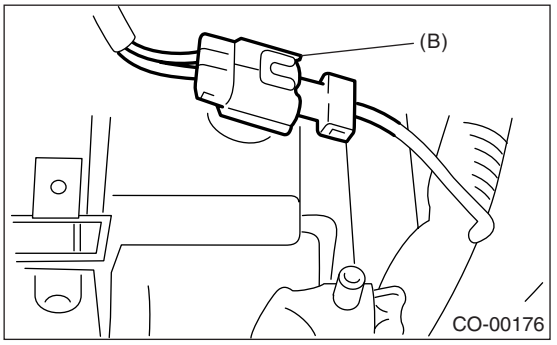


11) Connect the radiator outlet hose.

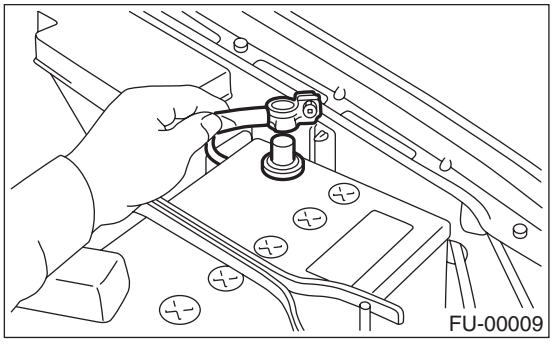


12) Connect the connectors to radiator main fan motor (A) and sub fan motor (B).





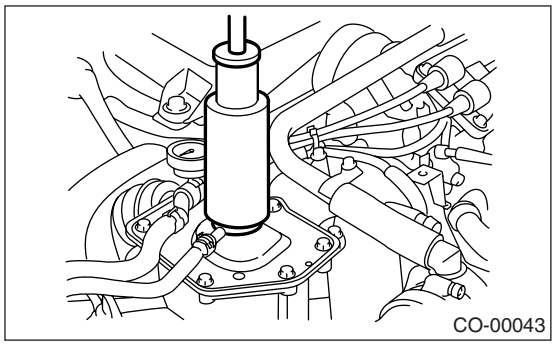
13) Install the under cover.
14) Lower the vehicle.
15) Connect the battery ground cable to battery.



16) Fill engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
17) Check the ATF level. <Ref. to 4AT-31, INSPECTION, Automatic Transmission Fluid.>

C: INSPECTION

1) Remove the coolant filler tank cap, top off coolant filler tank, and then attach the tester to coolant filler tank in place of cap.



2) Apply a pressure of 122 kPa (1.2 kg/cm^2, 18 psi) to the radiator to check if:

(1) Engine coolant leaks at/around radiator.

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

CAUTION:

• Inspection must be carried out at the side of coolant filler tank, not at the side of radiator.

• Engine should be turned off.

• Wipe engine coolant from check points in advance.

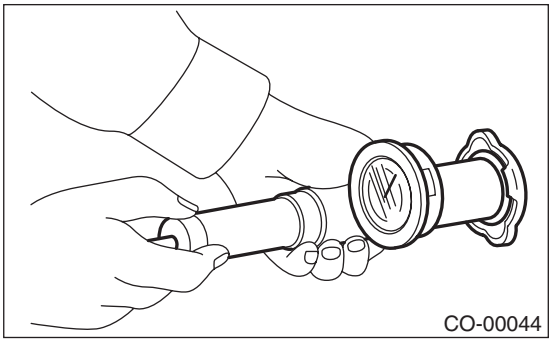
• Be careful to prevent engine coolant from spurting out when removing the tester.

• Be careful also not to deform the filler neck of coolant filler tank when installing or removing tester.

7. 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.

Coolant filler tank side

Standard pressure:

93 — 123 kPa (0.95 — 1.25 kg/cm^2, 14 — 18 psi)

Service limit pressure:

83 kPa (0.85 kg/cm^2, 12 psi)

Radiator side

Standard pressure:

122 — 152 kPa (1.24 — 1.55 kg/cm^2, 18 — 22 psi)

Service limit pressure:

112 kPa (1.14 kg/cm^2, 16 psi)

CAUTION:

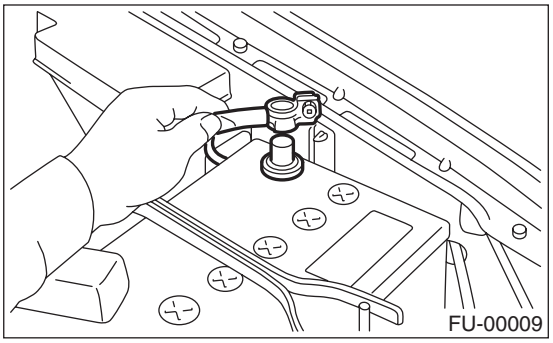
• Be sure to remove foreign matter and rust from the cap in advance otherwise, results of pressure test will be incorrect.

• Do not mix up the coolant filler tank side cap with radiator side cap.

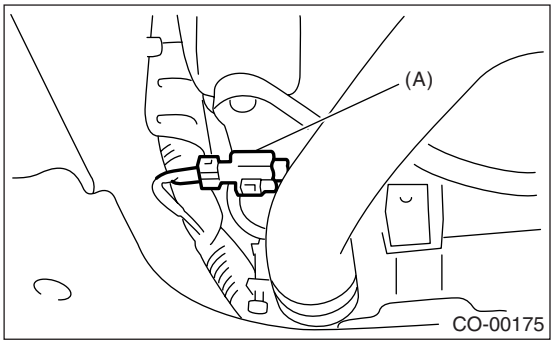
8. Radiator Main Fan and Fan Motor

A: REMOVAL

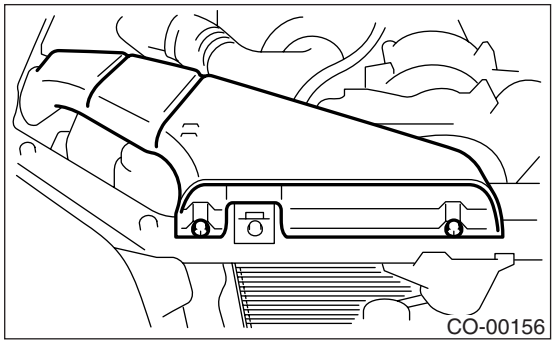
1) Disconnect the ground cable from battery.



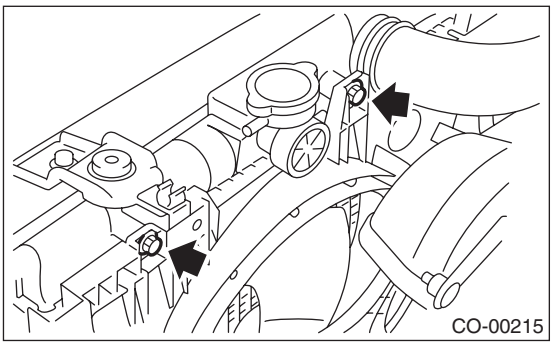
2) Lift-up the vehicle.
3) Remove the under cover.
4) Disconnect the connector of main fan motor.



5) Lower the vehicle.
6) Remove the air intake duct.



7) Disconnect the overflow hose.
8) Remove the overflow pipe.
9) Remove the reservoir tank. <Ref. to CO(H4DOTC)-28, REMOVAL, Reservoir Tank.>
10) Remove the radiator main fan motor assembly.

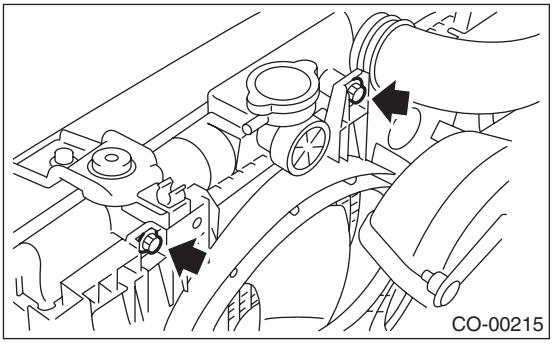


B: INSTALLATION

Install in the reverse order of removal.

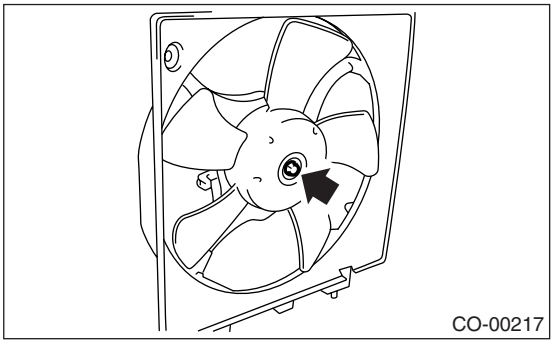
NOTE:
When the main fan motor assembly cannot be installed as is, loosen the sub fan motor assembly securing bolts to install it.

Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

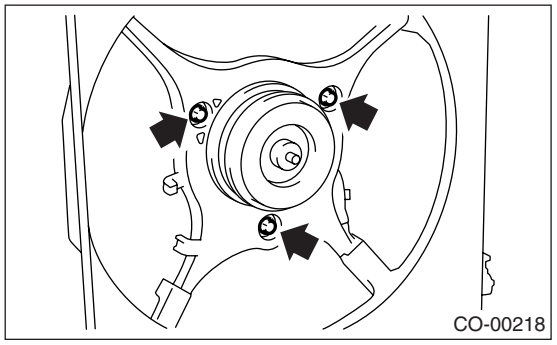


C: DISASSEMBLY

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



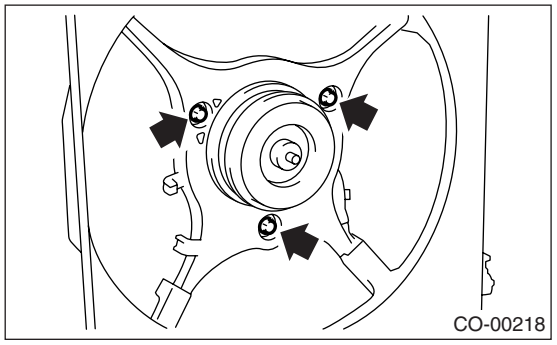
2) Remove the bolts which install the fan motor onto shroud.



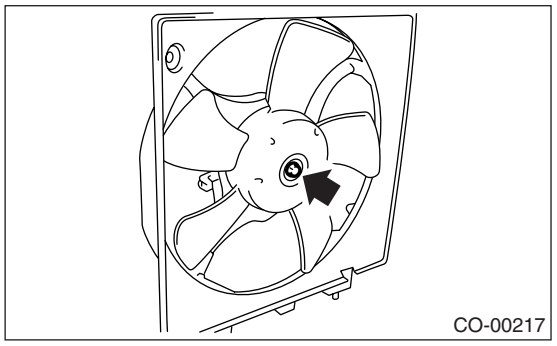
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



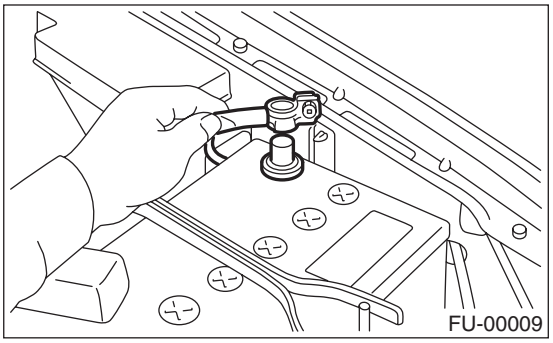
Tightening torque:
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



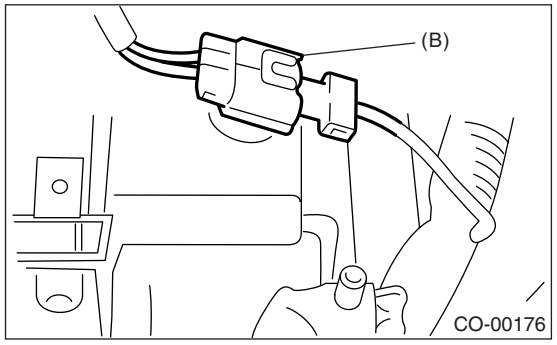
9. Radiator Sub Fan and Fan Motor

A: REMOVAL

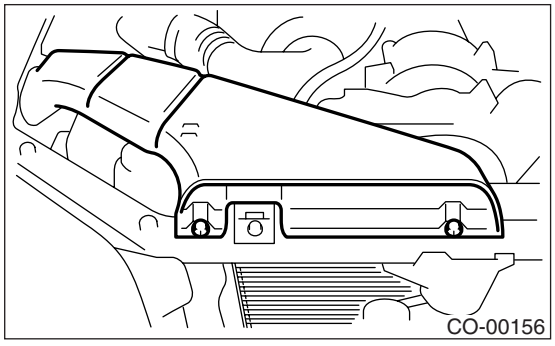
1) Disconnect the ground cable from battery.



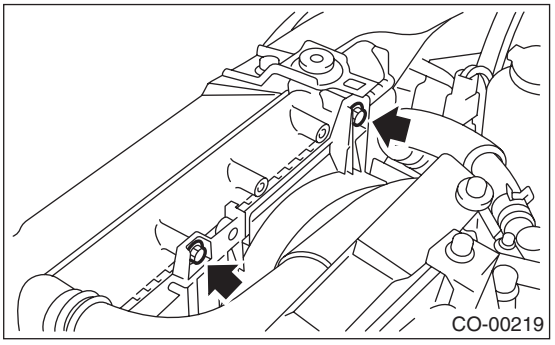
2) Lift-up the vehicle.
3) Remove the under cover.
4) Disconnect the connector of sub fan motor (B).



5) Lower the vehicle.
6) Remove the air intake duct.



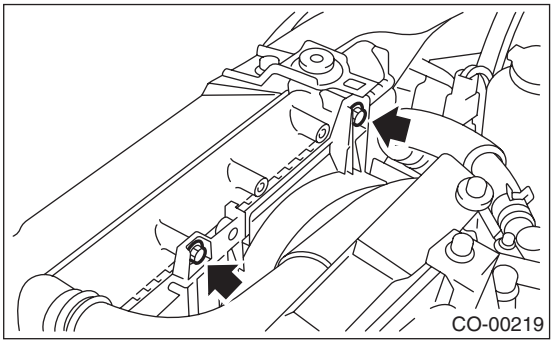
7) Remove the bolts which hold the sub fan shroud to radiator.
8) Remove the overflow pipe.
9) Remove the radiator sub fan shroud through the under side of vehicle.



B: INSTALLATION

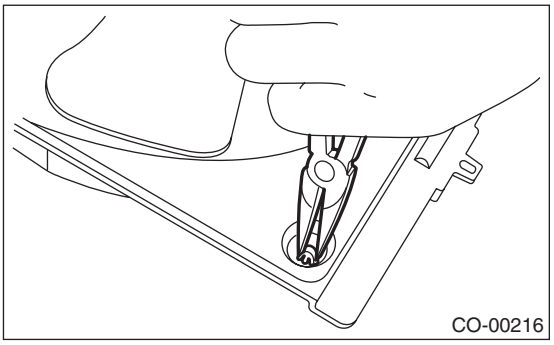
Install in the reverse order of removal.

Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

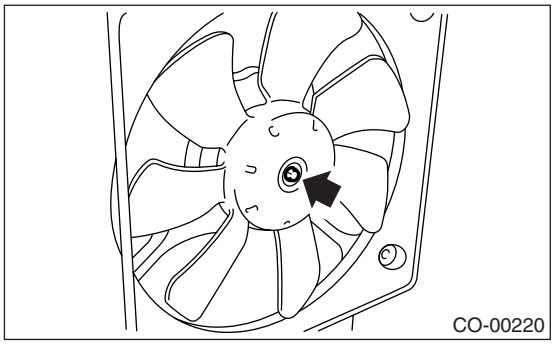


C: DISASSEMBLY

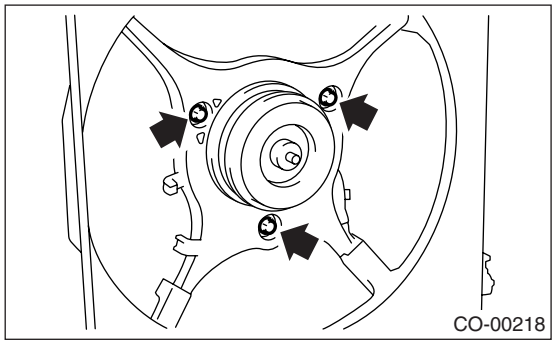
1) Remove the clip which holds the motor harness onto shroud.



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



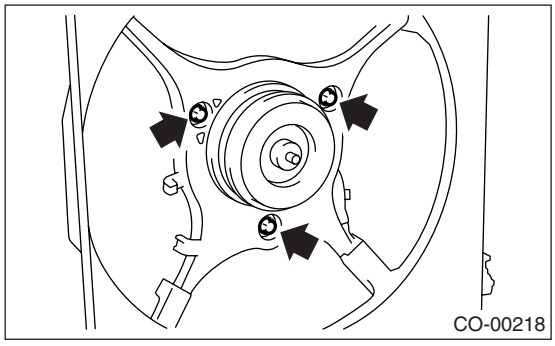
3) Remove the bolts which install the fan motor onto shroud.



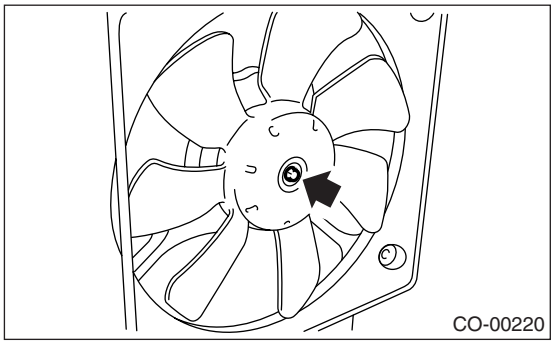
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



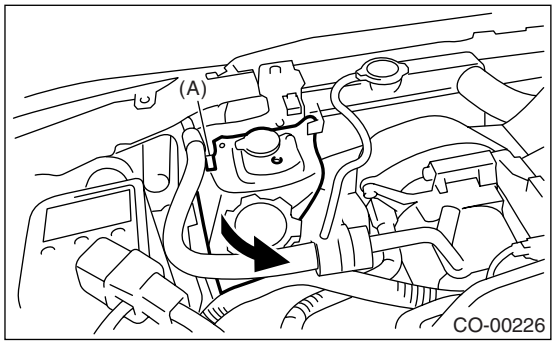
Tightening torque:
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



10.Reservoir Tank

A: REMOVAL

1) Disconnect the overflow hose from the radiator filler neck position.
2) Pull out the reservoir tank to direction of arrow while pushing the pawl (A).



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Refer to COMPONENT for tightening torque. <Ref. to CO(H4DOTC)-3, COMPONENT, General Description.>

C: INSPECTION

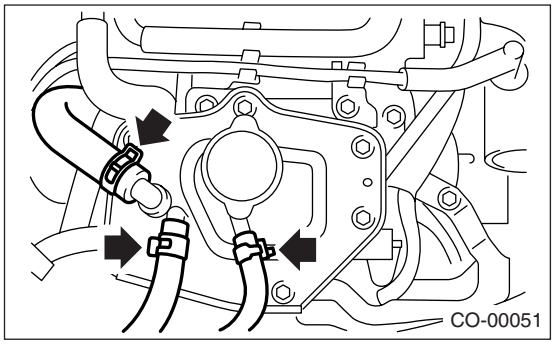
Make sure the engine coolant level is between full and low.

11.Coolant Filler Tank

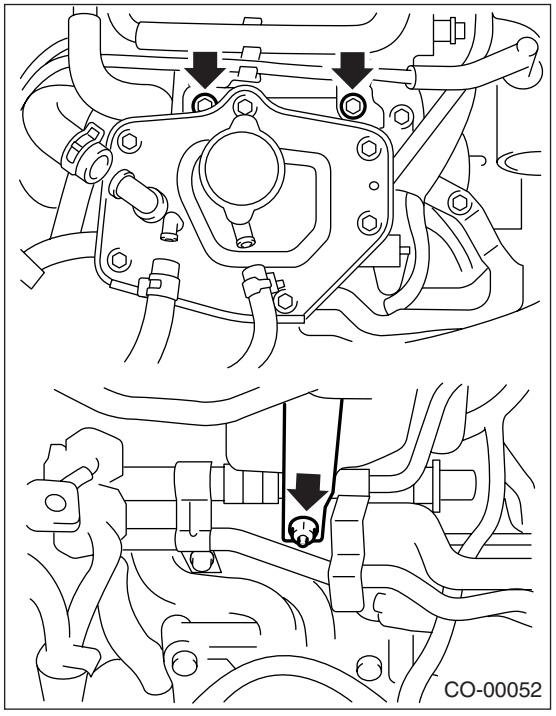
A: REMOVAL

WARNING:
The radiator is pressurized. Wait until the engine cools down before working on the radiator.

1) Drain the coolant about 3.0 ℓ (3.2 US qt, 2.6 Imp qt). <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
2) Remove the air cleaner upper cover and air intake boot. <Ref. to IN(H4DOTC)-7, REMOVAL, Air Cleaner.>
3) Remove the air cleaner element.
4) Disconnect the engine coolant hoses from coolant filler tank.



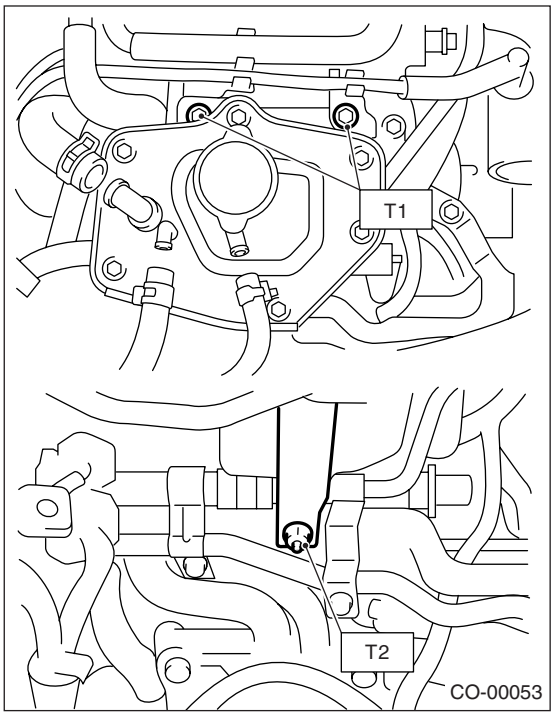
5) Remove the bolts and nut which install the coolant filler tank.
6) Disconnect the engine coolant hose which connects the under side of coolant filler tank.
7) Remove the coolant filler tank.



B: INSTALLATION

1) Install in the reverse order of removal.

Tightening torque:
T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)
T2: 13 N·m (1.3 kgf-m, 9.6 ft-lb)



2) Fill engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

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 drive 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(H4DOTC)-2, PROCEDURE, 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(H4DOTC)-2, PROCEDURE, 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. 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 drive 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.

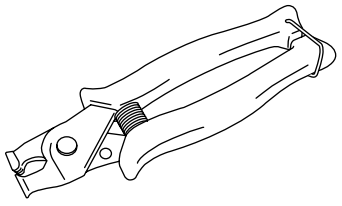
1. General Description

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 negative terminal from battery.

B: PREPARATION TOOL

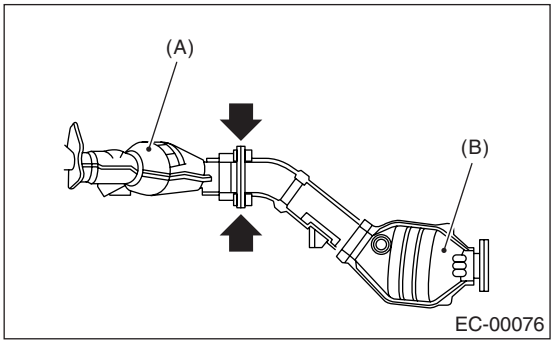
1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18353AA000	18353AA000	CLAMP PLIERS	• Used for removing and installing PCV hose. • This tool is a general tool that is made by CAILLAU in France. (Code: 54.0.000.205) Tool number is fixed as special tool in order to obtain it as easily as SUBARU genuine parts.

2. Front Catalytic Converter

A: REMOVAL

1) Remove the center exhaust pipe. <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
2) Separate the front catalytic converter (A) from rear catalytic converter (B).



B: INSTALLATION

NOTE:
- Replace the gaskets with new ones.
- Install in the reverse order of removal.

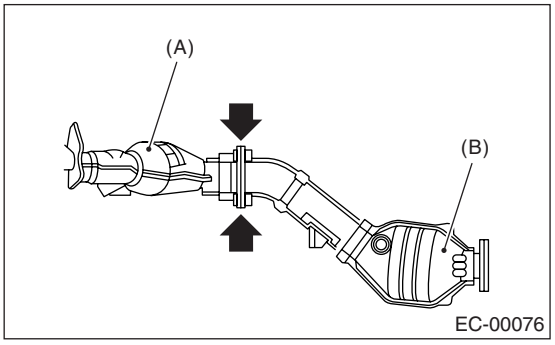
C: INSPECTION

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

3. Rear Catalytic Converter

A: REMOVAL

1) Remove the center exhaust pipe. <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
2) Separate the rear catalytic converter (B) from front catalytic converter (A).



B: INSTALLATION

NOTE:
- Replace the gaskets with new ones.
- Install in the reverse order of removal.

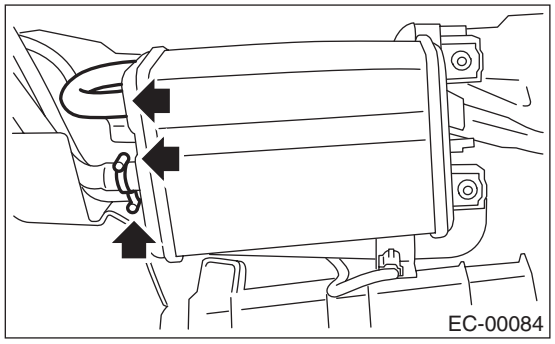
C: INSPECTION

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

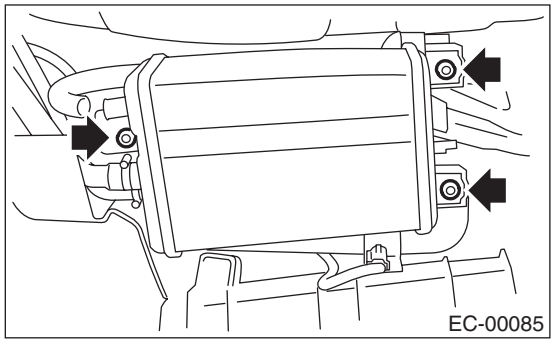
4. Canister

A: REMOVAL

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



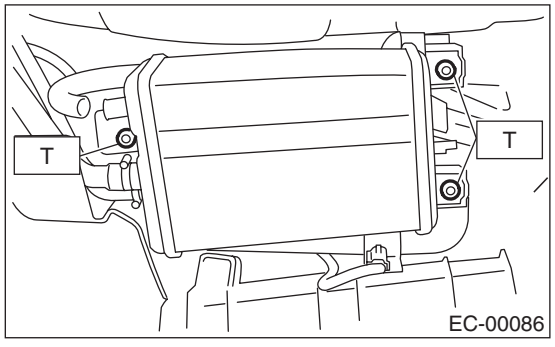
3) Remove canister from body.



B: INSTALLATION

1) Install in the reverse order of removal.

Tightening torque:
23 N·m (2.3 kgf-m, 17 ft-lb)



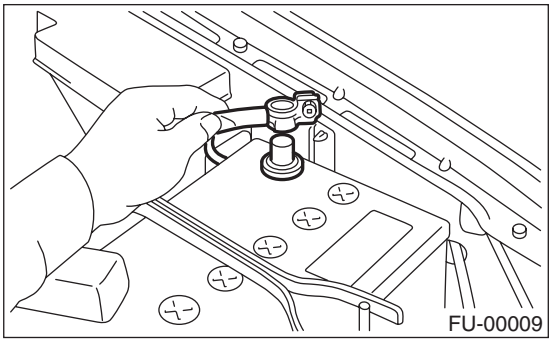
C: INSPECTION

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

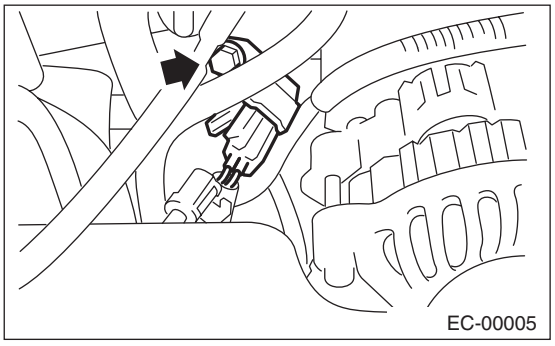
5. Purge Control Solenoid Valve

A: REMOVAL

1) Disconnect ground cable from battery.



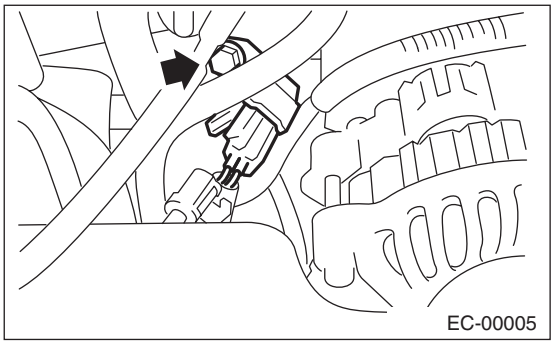
2) Disconnect the connector and hoses from purge control solenoid valve.
3) Remove the bolt which installs the purge control solenoid valve onto intake manifold.



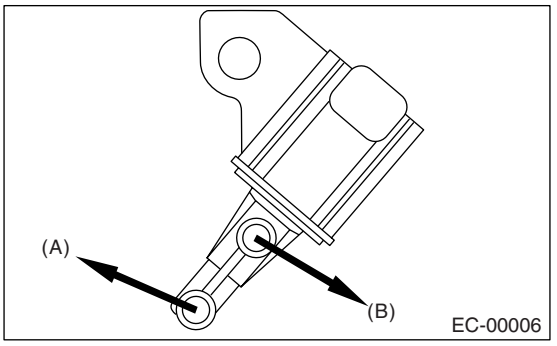
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.6 ft-lb)



NOTE:
Connect the evaporation hoses as shown in the figure.



(A) To purge value
(B) To intake manifold

C: INSPECTION

Make sure the hoses are not cracked or loose.

6. Main Fuel Level Sensor

A: REMOVAL

For work procedures, refer to FU(H4DOTC) section. <Ref. to FU(H4DOTC)-70, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION

For work procedures, refer to FU(H4DOTC) section. <Ref. to FU(H4DOTC)-70, INSTALLATION, Fuel Level Sensor.>

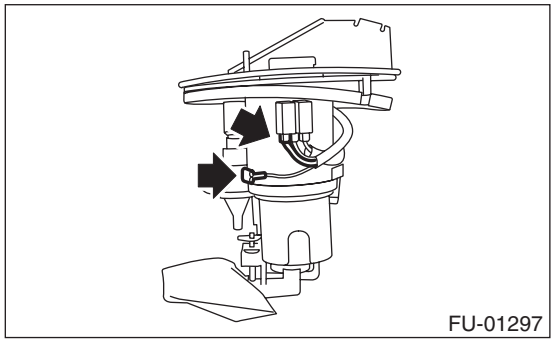
7. Fuel Temperature Sensor

A: REMOVAL

WARNING:
During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.

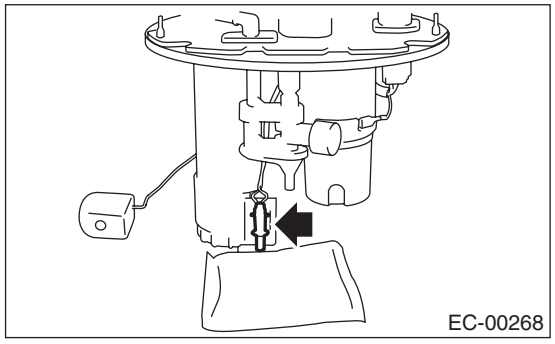
NOTE:
Fuel temperature sensor is built in fuel pump assembly.

1) Remove fuel pump assembly. <Ref. to FU(H4DOTC)-67, REMOVAL, Fuel Pump.>
2) Disconnect connector from fuel pump bracket.



3) Remove fuel temperature sensor.

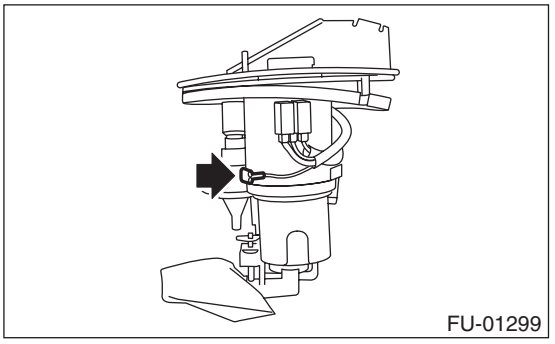
NOTE:
When replacing fuel temperature sensor, also replace fuel level sensor. <Ref. to FU(H4DOTC)-70, REMOVAL, Fuel Level Sensor.>



B: Installation

1) Install in the reverse order of removal.

WARNING:
- **Ground cable must be connected.**
- **Spark may occur and ignite if fuel is nearby.**



8. Sub Fuel Level Sensor

A: REMOVAL

For work procedures, refer to “FU(H4DOTC)” section. <Ref. to FU(H4DOTC)-71, REMOVAL, Fuel Sub Level Sensor.>

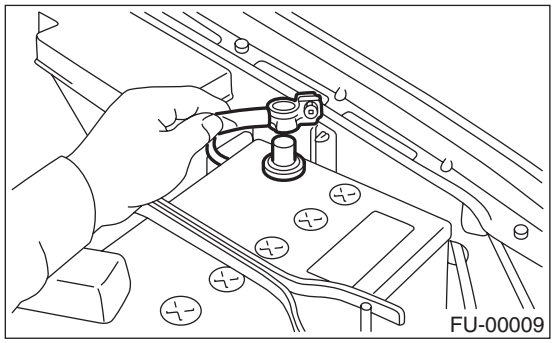
B: INSTALLATION

For work procedures, refer to “FU(H4DOTC)” section. <Ref. to FU(H4DOTC)-71, INSTALLATION, Fuel Sub Level Sensor.>

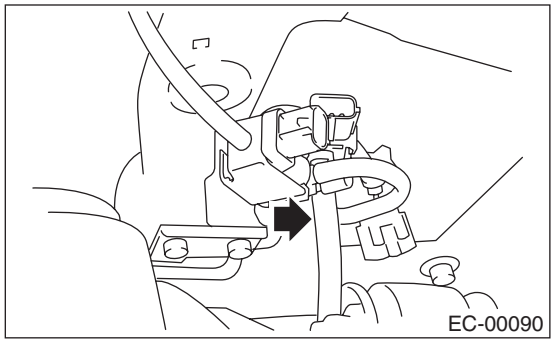
9. Fuel Tank Pressure Sensor

A: REMOVAL

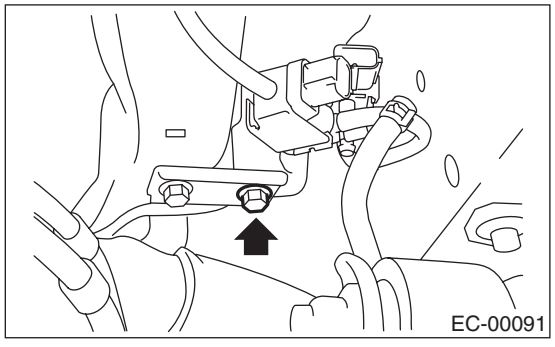
1) Set the vehicle on the lift.
2) Open fuel flap lid, and remove fuel filler cap.
3) Disconnect ground cable from battery.



4) Lift-up the vehicle.
5) Disconnect connector from fuel tank pressure sensor and fuel tank sensor control valve.
6) Disconnect pressure hose from fuel tank pressure sensor.

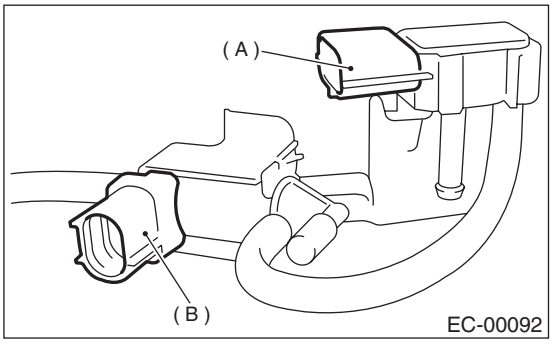


7) Remove fuel tank pressure sensor and fuel tank sensor control valve with bracket.



8) Remove fuel tank sensor control valve from bracket.

NOTE:
Fuel tank pressure sensor cannot be removed because it is integral with bracket.

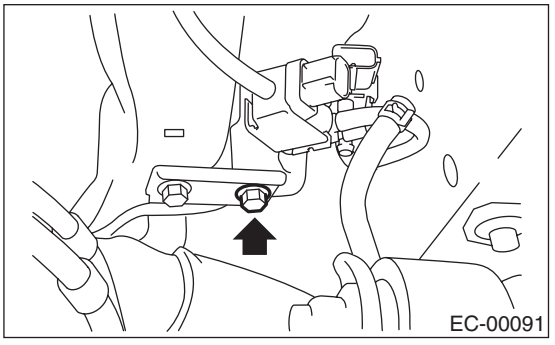


(A) Fuel tank pressure sensor
(B) Fuel tank sensor control valve

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
7.4 N·m (0.75 kgf-m, 5.4 ft-lb)



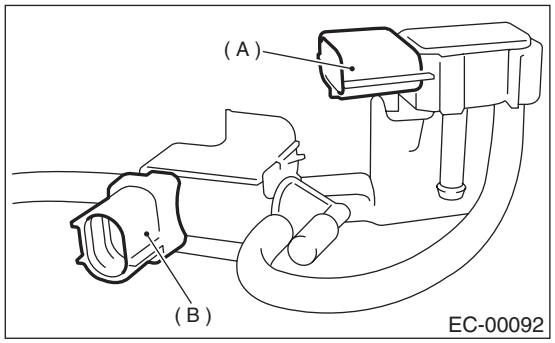
C: INSPECTION

Make sure that hoses are not cracked or loose.

10.Fuel Tank Sensor Control Valve

A: REMOVAL

1) Remove fuel tank pressure sensor. <Ref. to EC(H4DOTC)-10, REMOVAL, Fuel Tank Pressure Sensor.>
2) Remove fuel tank sensor control valve from bracket.



(1) Fuel tank pressure sensor
(2) Fuel tank sensor control valve

B: INSTALLATION

Install in the reverse order of removal.

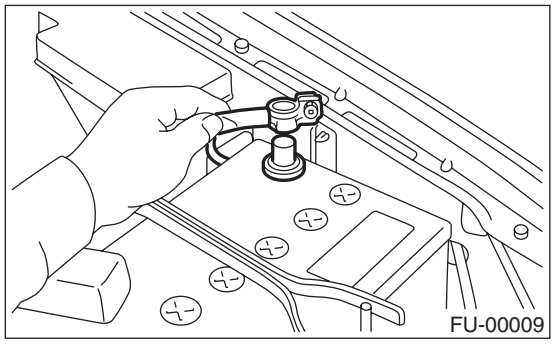
C: INSPECTION

Make sure that hoses are not cracked or loose.

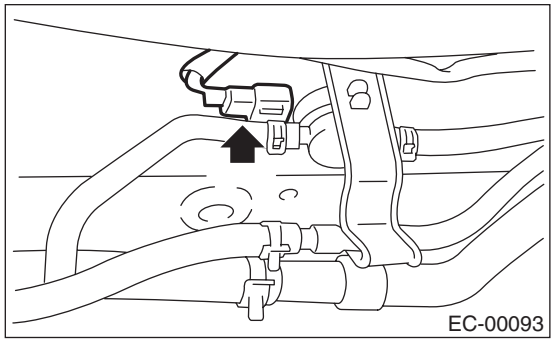
11.Pressure Control Solenoid Valve

A: REMOVAI

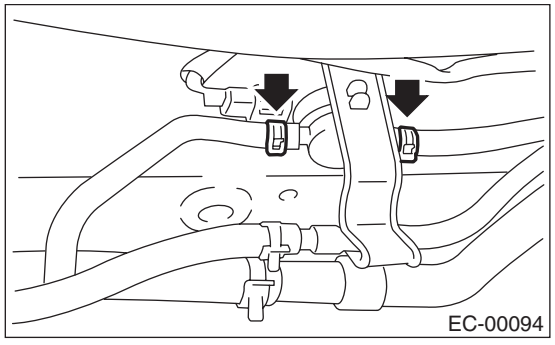
1) Set the vehicle on the lift.
2) Disconnect ground cable from batetry.



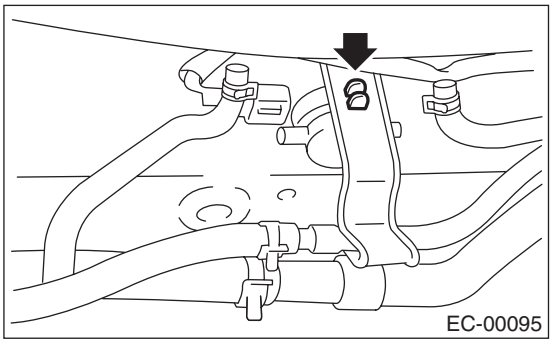
3) Lift-up the vehicle.
4) Disconnect connector from pressure control solenoid valve.



5) Disconnect two evaporation hoses from pressure control solenoid valve.



6) Remove pressure control solenoid valve from bracket.



B: INSTALLTION

Install in the reverse order of removal.

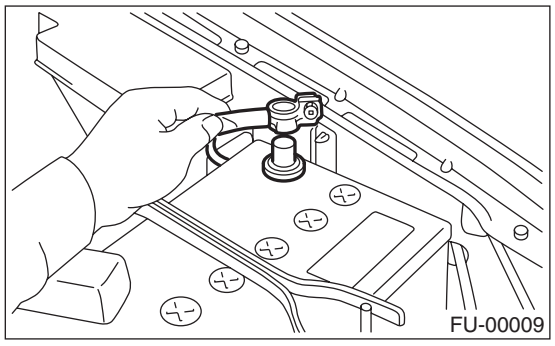
C: INSPECTION

Make sure that hoses are not cracked or loose.

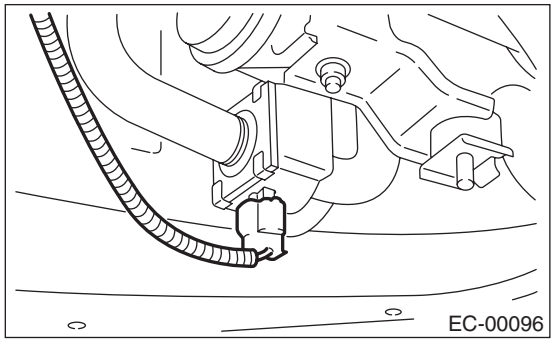
12.Drain Filter

A: REMOVAL

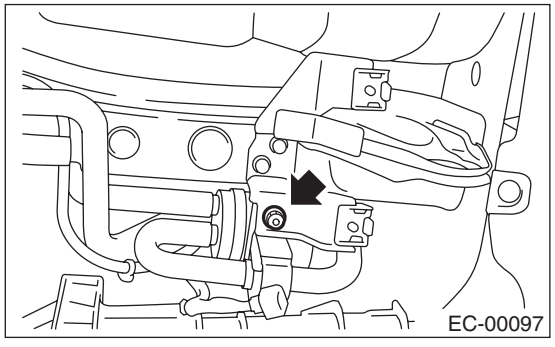
1) Set the vehicle on the lift.
2) Disconnect battery ground cable.



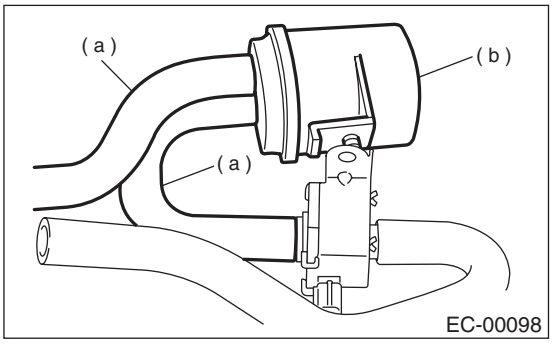
3) Lift-up the vehicle.
4) Remove canister. <Ref. to EC(H4DOTC)-5, REMOVAL, Canister.>
5) Disconnect connector from drain valve.



6) Remove nut which installs drain filter and drain valve brackets on body, and remove them as a unit.



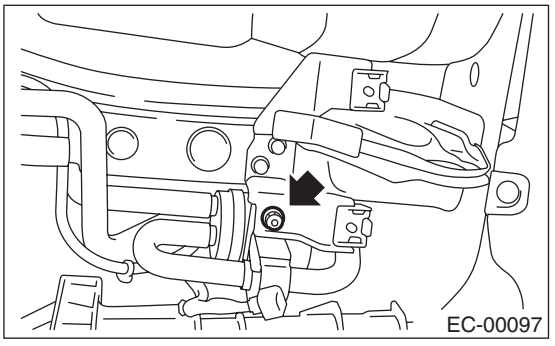
7) Disconnect evaporation hoses, (a) and remove drain filter (b).



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



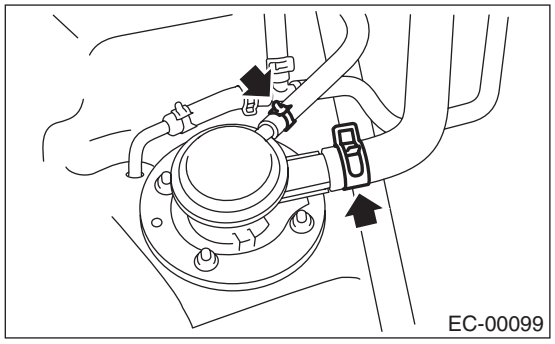
C: INSPECTION

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

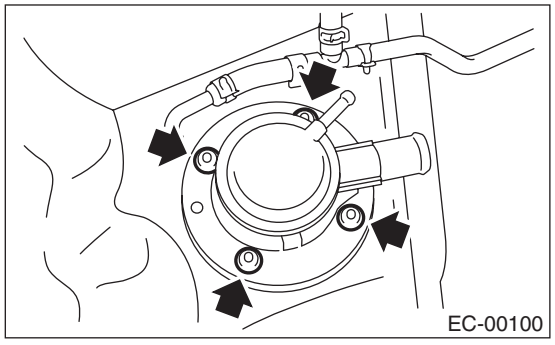
13.Vent Valve

A: REMOVAL

1) Remove fuel tank. <Ref. to FU(H4DOTC)-51, REMOVAL, Fuel Tank.>
2) Move clips, and disconnect hoses from vent valve.



3) Remove nuts which install vent valve on fuel tank.

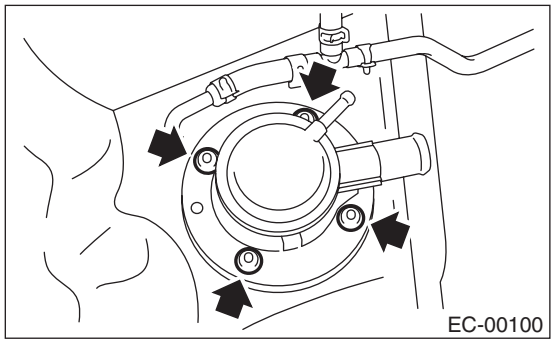


B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Replace rubber seat with a new one.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



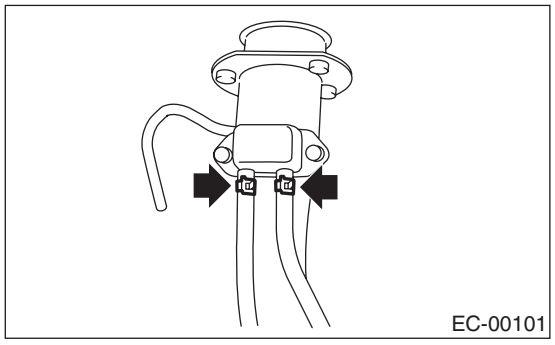
C: INSPECTION

Make sure that hoses are not cracked or loose.

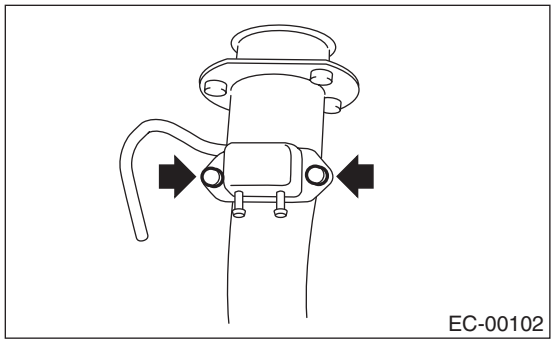
14.Shut Valve

A: REMOVAL

1) Drain fuel from fuel tank. <Ref. to FU(H4DOTC)-48, DRAINING FUEL, OPERATION, Fuel.>
2) Remove fuel filler pipe. <Ref. to FU(H4DOTC)-59, REMOVAL, Fuel Filler Pipe.>
3) Disconnect evaporation hoses from shut valve.



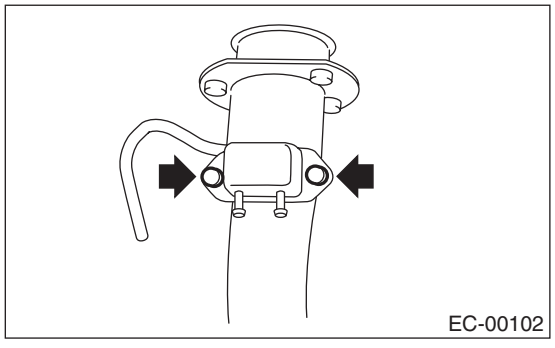
4) Remove shut valve from fuel filler pipe.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



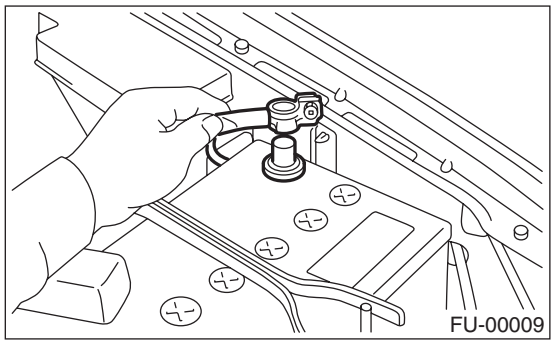
C: INSPECTION

Make sure that hoses are not cracked or loose.

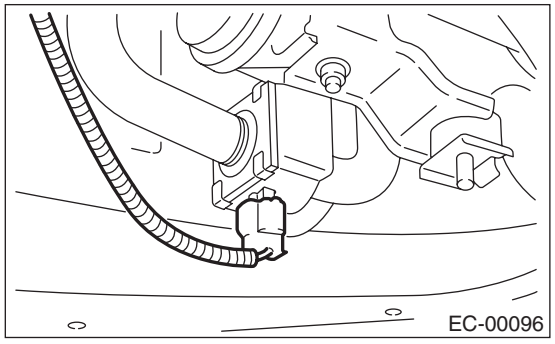
15.Drain Valve

A: REMOVAL

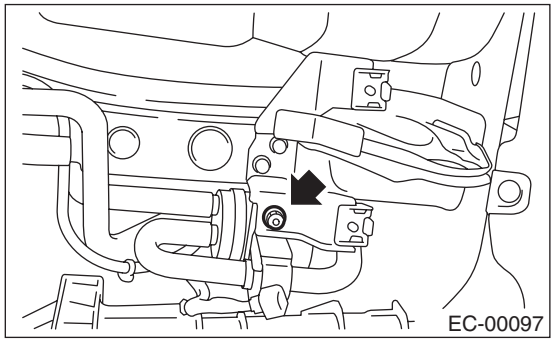
1) Set the vehicle on the lift.
2) Disconnect battery ground cable.



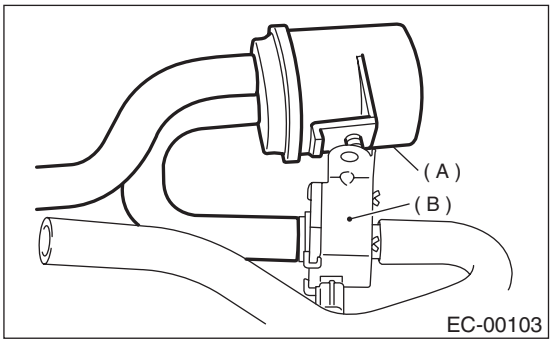
3) Lift-up the vehicle.
4) Remove canister. <Ref. to EC(H4DOTC)-5, REMOVAL, Canister.>
5) Disconnect connector from drain valve.



6) Remove bolt which installs drain filter and drain valve brackets on body.



7) Disconnect evaporation hose and remove drain valve.

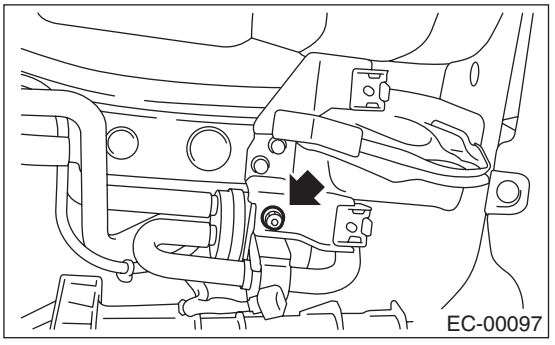


(1) Drain filter
(2) Drain valve

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



C: INSPECTION

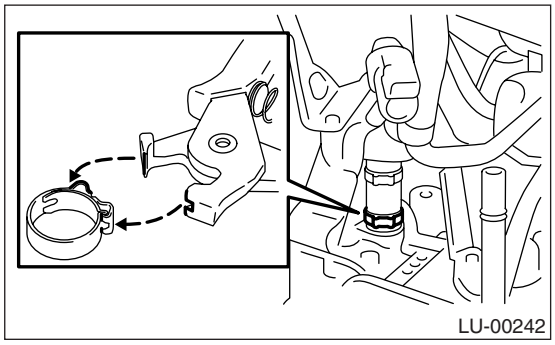
1) Make sure that all hoses are installed correctly.
2) Make sure that hoses are not cracked or loose.

16.PCV Hose Assembly

A: REMOVAL

CAUTION:
Removal is not allowed except for the damage of PCV hose, diagnosis connector and PCV valve.

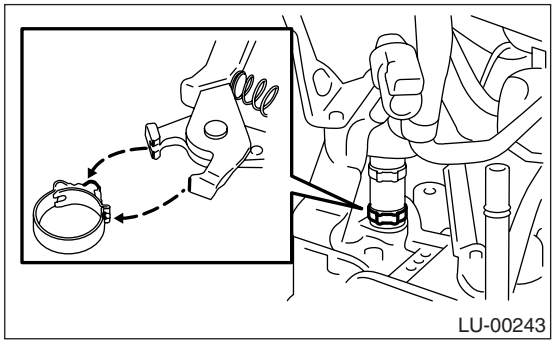
1) Remove the intake manifold.
<Ref. to FU(H4DOTC)-15, REMOVAL, Intake Manifold.>
2) Unlock with a dent of special tool clipped by a protrusion of clamp.
3) Remove the PCV hose assembly.
ST 18353AA000 CLUMP PLIER



B: INSTALLATION

NOTE:
Replace the clamp with a new one.

1) Install the PCV hose assembly and lock it with a protrusion of clamp clipped by special tool.
ST 18353AA000 CLUMP PLIER



2) Install the intake manifold.
<Ref. to FU(H4DOTC)-17, INSTALLATION, Intake Manifold.>

MEMO:

1. Basic Diagnostic Procedure

A: PROCEDURE

1. ENGINE

Step		Check	Yes	No
1	**CHECK ENGINE START FAILURE.** 1) Ask the customer when and how trouble occurred using the interview check list. <Ref. to EN(H4DOTC)-3, 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(H4DOTC)-66, Diagnostics for Engine Starting Failure.>
2	**CHECK ILLUMINATION OF MALFUNCTION INDICATOR LIGHT.**	Does the malfunction indicator light illuminate?	Go to step **3.**	Inspection using "General Diagnostics Table". <Ref. to EN(H4DOTC)-449, General Diagnostic Table.>
3	**CHECK INDICATION OF DTC ON DISPLAY.** 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor or general scan tool to data link connector. 3) Turn the ignition switch to ON and the Subaru Select Monitor or general scan tool switch to ON. 4) Read the DTC on Subaru Select Monitor or general scan tool.	Does the Subaru Select Monitor or general scan tool indicate DTC?	Record the DTC code. Repair the trouble cause. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Repair the related parts. NOTE: If a DTC is not shown on display although malfunction indicator light illuminates, perform diagnostics of malfunction indicator light circuit or combination meter. <Ref. to EN(H4DOTC)-55, Malfunction Indicator Light.>
4	**PERFORM THE DIAGNOSIS.** 1) Perform the clear memory mode. <Ref. to EN(H4DOTC)-52, Clear Memory Mode.> 2) Perform the inspection mode. <Ref. to EN(H4DOTC)-39, Inspection Mode.>	Does the Subaru Select Monitor or general scan tool indicate DTC?	Inspect using "Diagnostics Procedure with Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-89, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Complete the diagnosis.

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			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
Cooling fan	❑ ON/❑ OFF	Car phone	❑ ON/❑ OFF
Front wiper	❑ ON/❑ OFF	CB	❑ ON/❑ OFF
Rear wiper	❑ ON/❑ OFF		

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: • Had run out of gas before: ❑ Yes/❑ No
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 the 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 cables while the engine is running.
• A large counter electromotive force will be generated in the alternator, 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 the ignition switch to OFF.

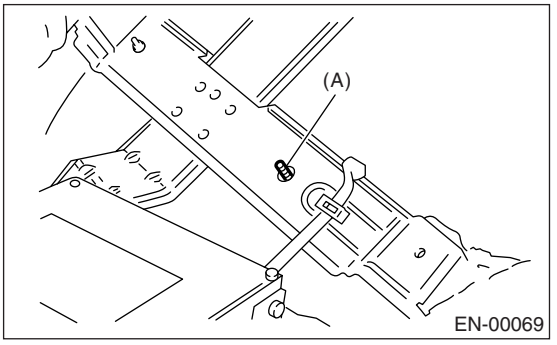
5) Poor contact has been identified as a primary cause of this problem. To measure the voltage and/or resistance of individual sensors or all electrical control modules at the harness side connector, use a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5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

6) Before removing the ECM from 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 the fuel injection system.

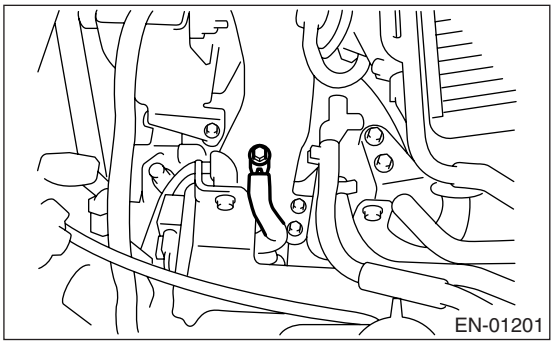
7) The connectors to each sensor in the engine compartment and the harness connectors on the engine side and body side are all designed to be waterproof. However, it is still necessary to take care not to allow water to get into the connectors when washing the vehicle, or when servicing the vehicle on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

8) Use the ECM mounting stud bolt at the body head grounding points when measuring voltage and resistance inside the passenger compartment.



(A) Stud bolt

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



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

11) 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 as possible from 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 ECM.

12) Before disconnecting the fuel hose, disconnect the fuel pump connector and crank the engine for more than 5 seconds to release pressure in the fuel system. If the engine starts during this operation, run it until it stops.

13) 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.
14) On model 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 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 the battery voltage and specific gravity of electrolyte.

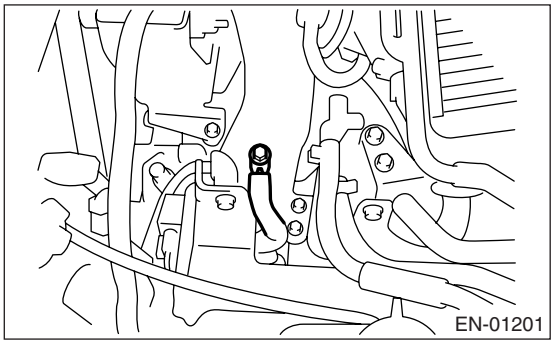
Standard voltage: 12 V

Specific gravity: Above 1.260

2) Check the condition of 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 engine.



C: NOTE

1. DESCRIPTION

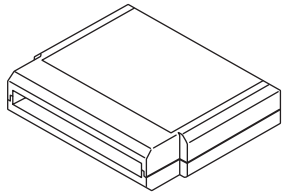
• The on-board diagnostics (OBD) system detects and indicates a fault in various inputs and outputs of the complex electronic control. Malfunction indicator light in the combination meter indicates occurrence of a fault or trouble.
• Further, against such a failure or sensors as may disable the drive, the fail-safe function is provided to ensure the minimal driveability.
• The OBD system incorporated with the vehicles within this engine family complies with OBD-II Regulations. 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.
• When troubleshooting the vehicle which complies with OBD-II Regulations, connect the Subaru Select Monitor or 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.
• Reduced 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.

D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA260	24082AA260	CARTRIDGE	Troubleshooting for electrical systems.
ST22771AA030	22771AA030	SUBARU SELECT MONITOR KIT	Troubleshooting for electrical systems.

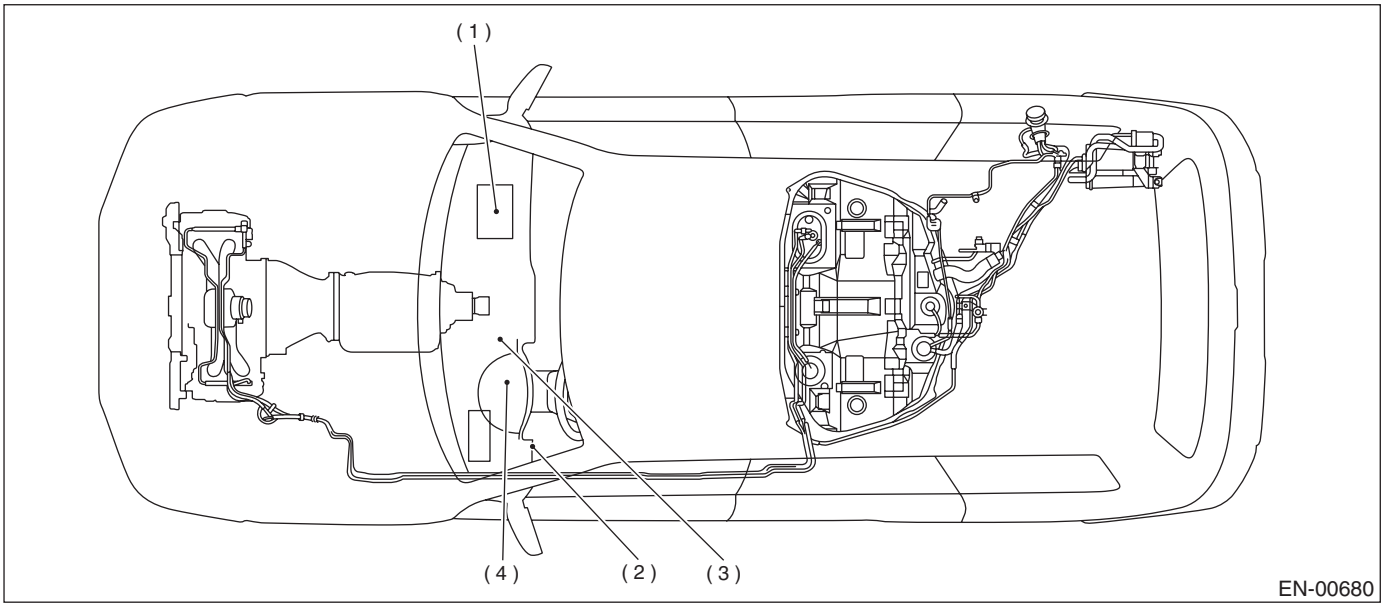
MEMO:

4. Electrical Components Location

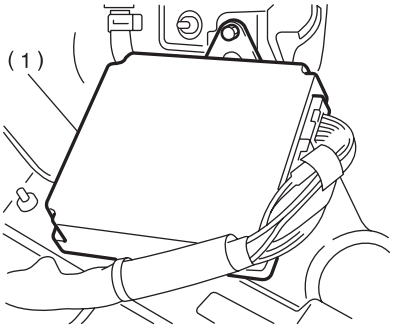
A: LOCATION

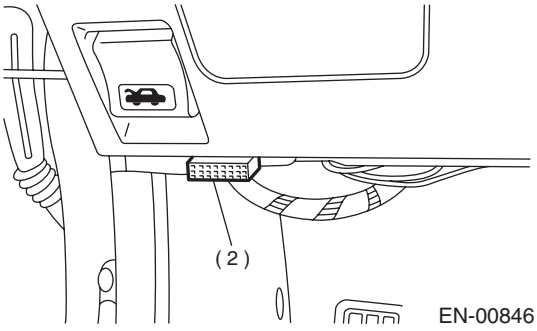
1. ENGINE

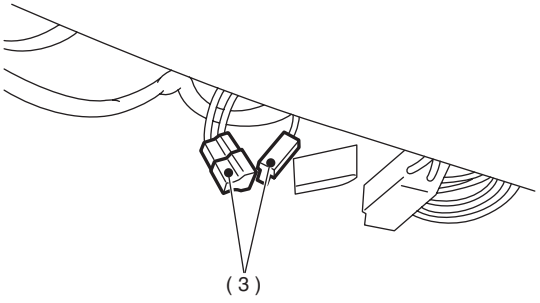
• Module

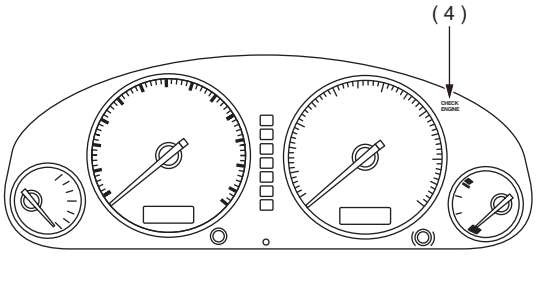


(1) Engine control module (ECM)
(2) Data link connector
(3) Test mode connector
(4) Malfunction indicator light

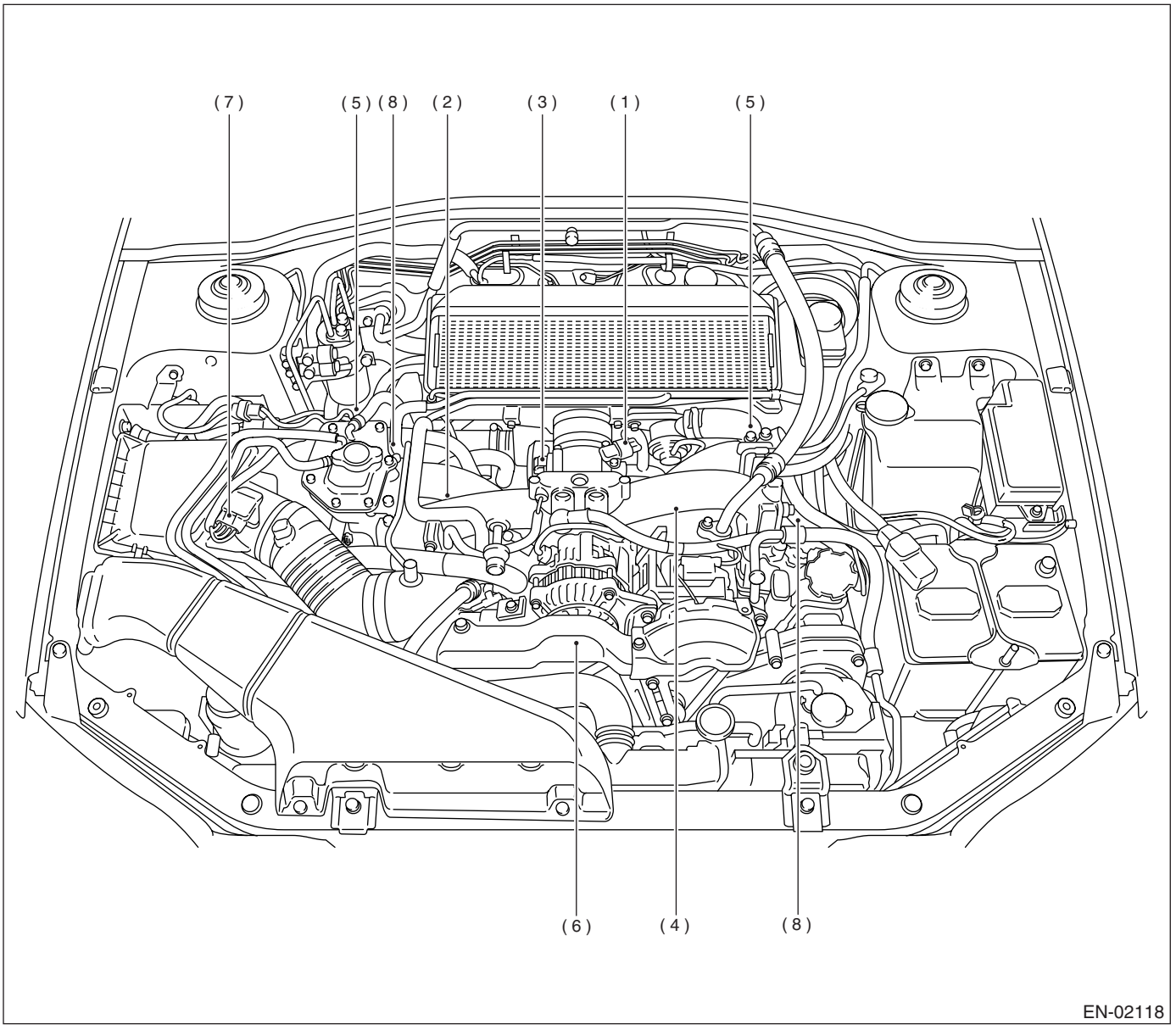




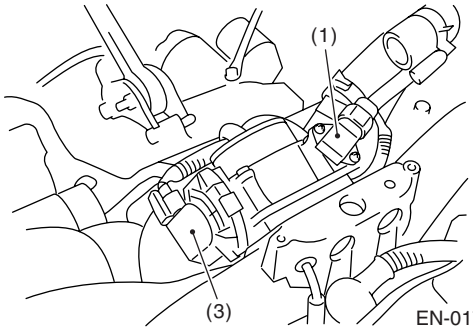


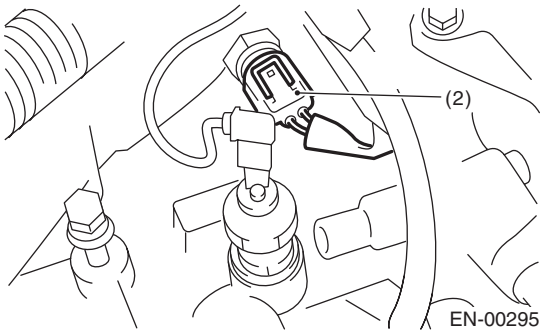


• Sensor



(1) Manifold absolute pressure sensor
(2) Engine coolant temperature sensor
(3) Electric throttle
(4) Knock sensor
(5) Camshaft position sensor
(6) Crankshaft position sensor
(7) Mass air flow and intake air temperature sensor
(8) Tumble generator valve position sensor


(1)
(3)
EN-01797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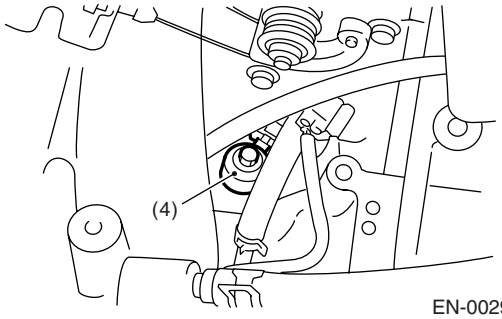
EN-00295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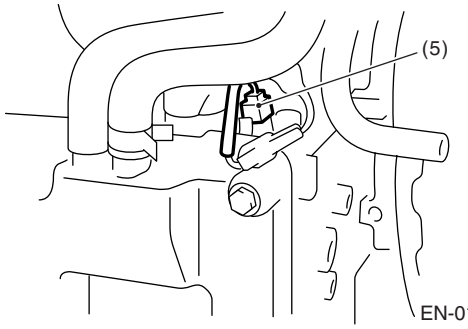
EN-00297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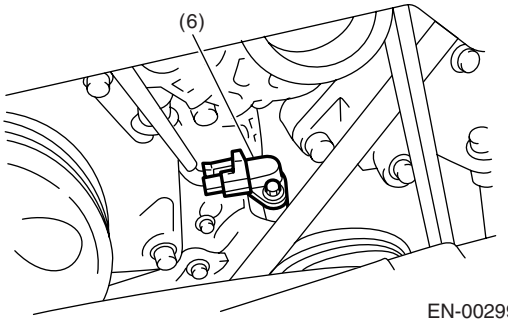
EN-01798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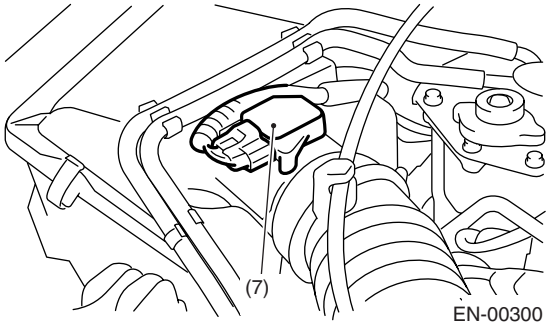
EN-00299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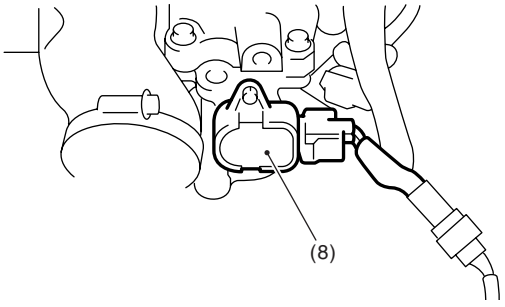
EN-00300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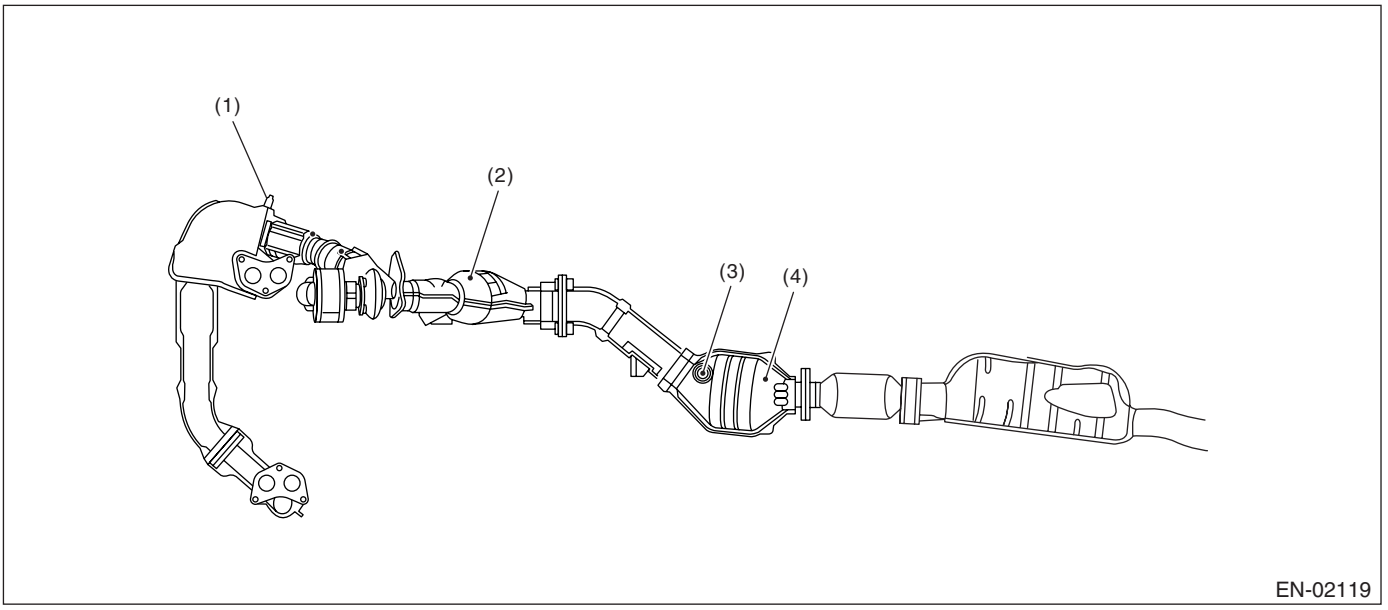
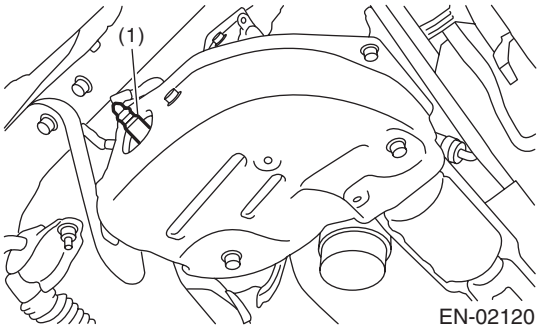
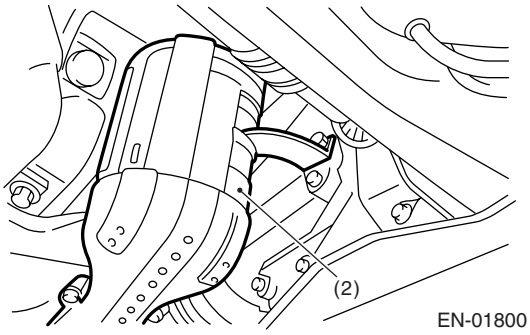
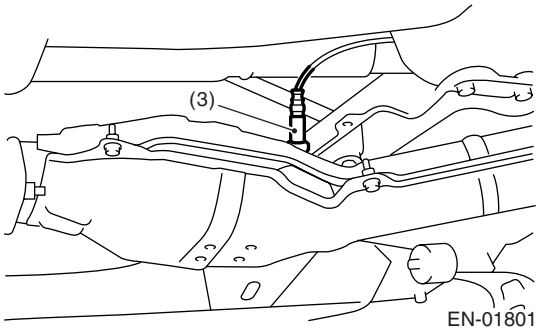
EN-00301

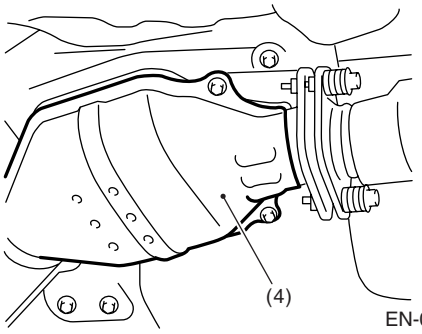


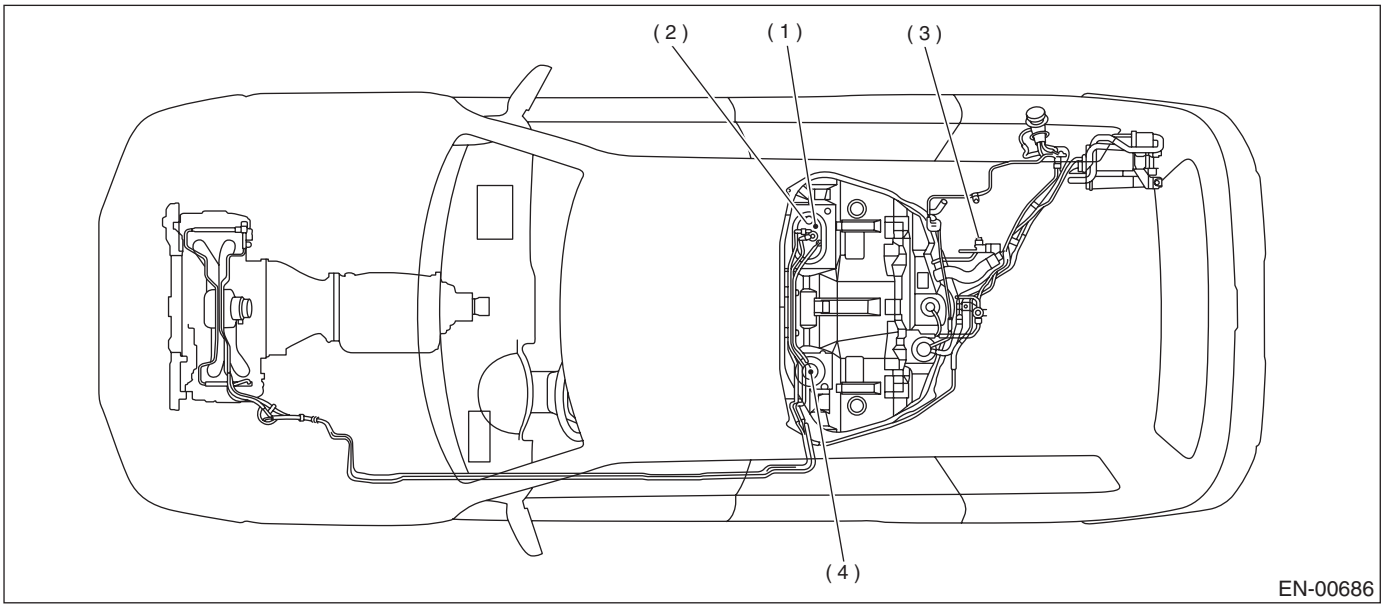
(1) Front oxygen (A/F) sensor
(2) Front catalytic converter
(3) Rear oxygen sensor
(4) Rear catalytic converter



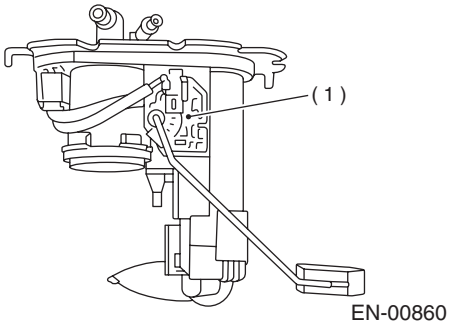


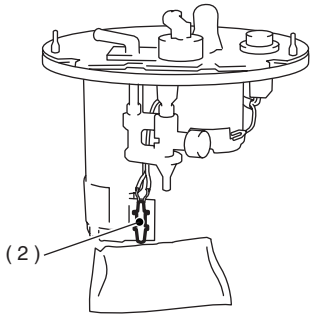


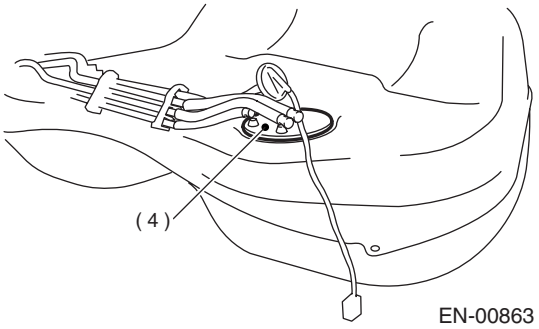




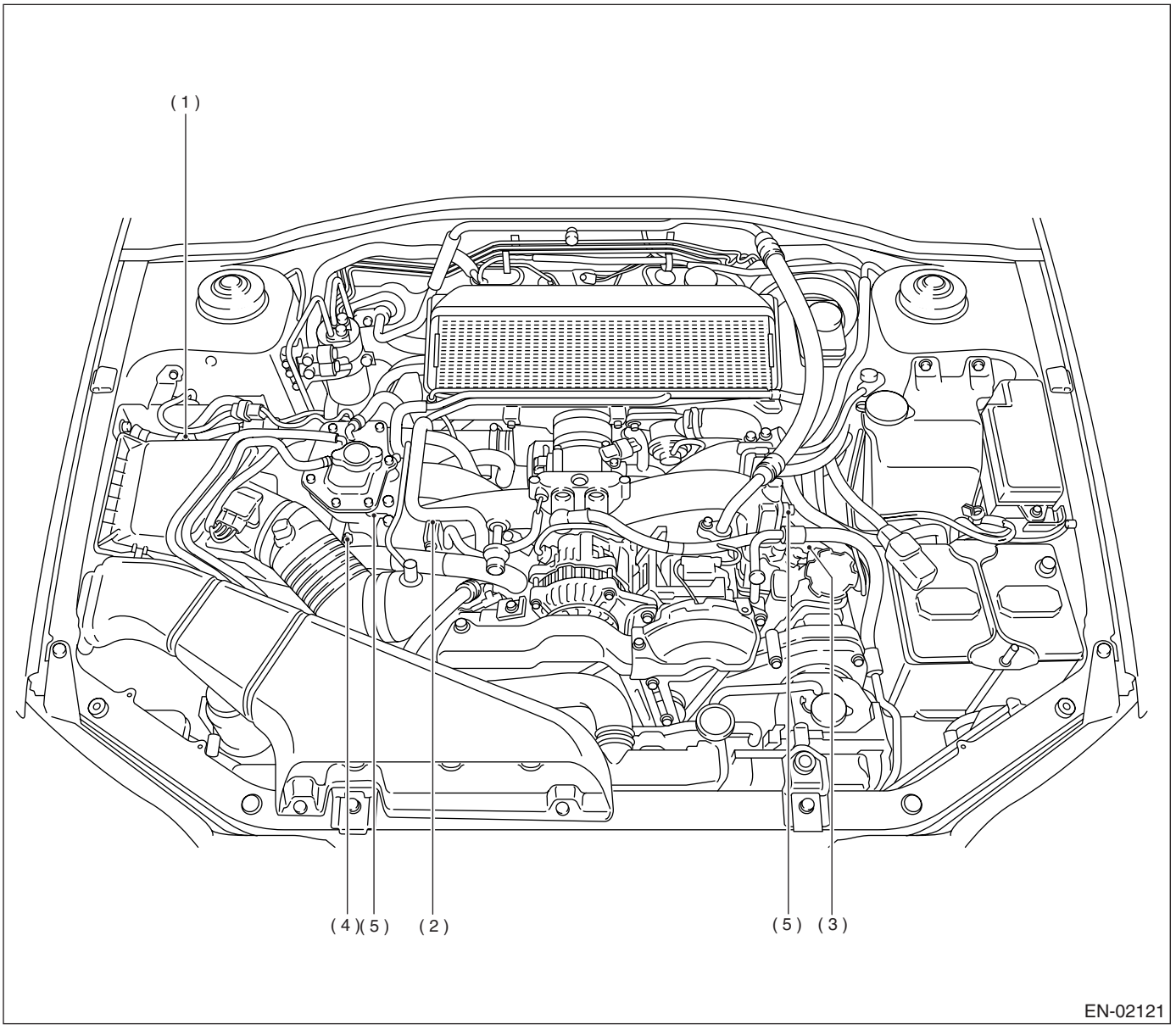
(1) Fuel level sensor
(2) Fuel temperature sensor
(3) Fuel tank pressure sensor
(4) Fuel sub level sensor



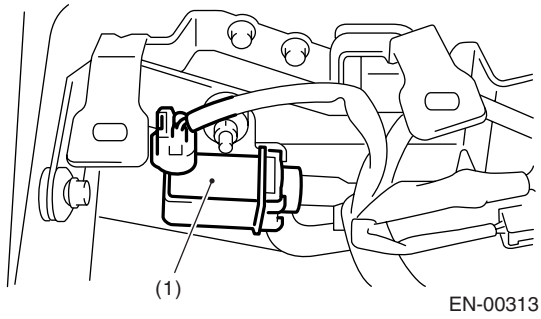




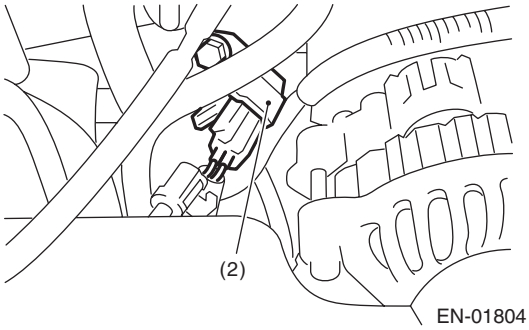
• Solenoid Valve, Actuator, Emission Control System Parts and Ignition System Parts



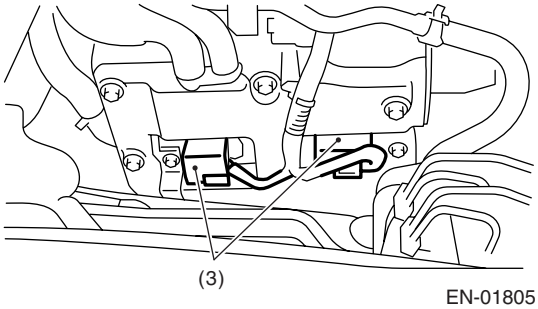
(1) Wastegate control solenoid valve
(2) Purge control solenoid valve
(3) Ignition coil
(4) Tumble generator valve actuator
(5) Oil flow control solenoid valve



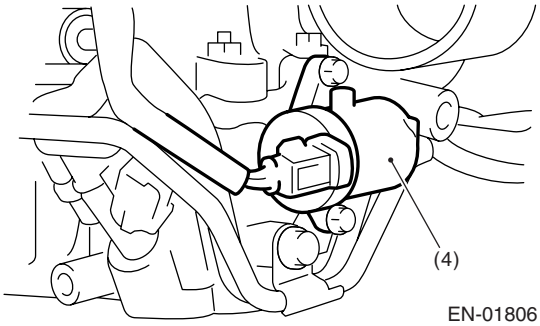
EN-00313



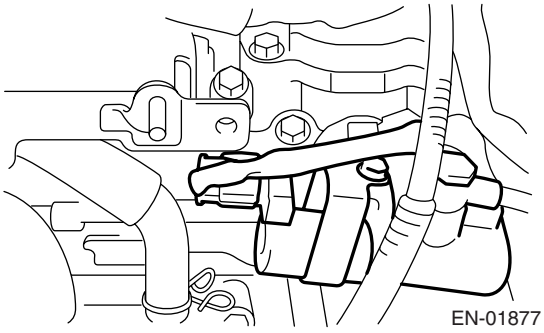
EN-01804



EN-01805



EN-01806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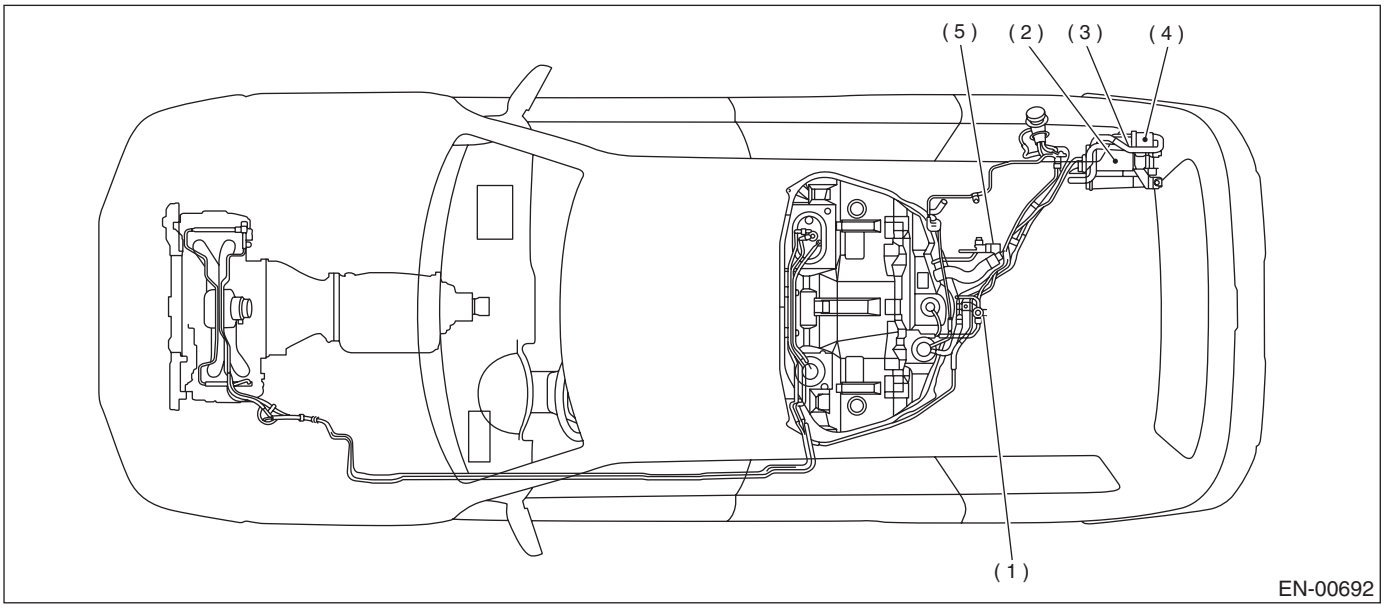
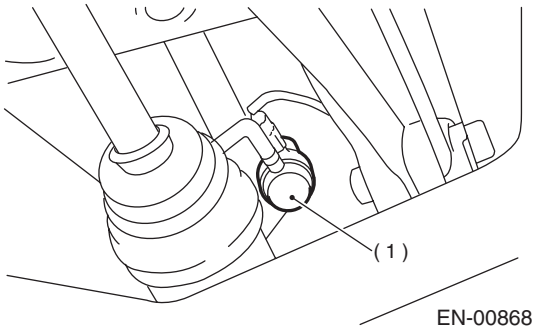
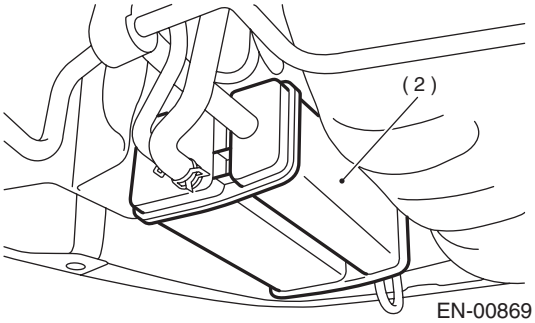
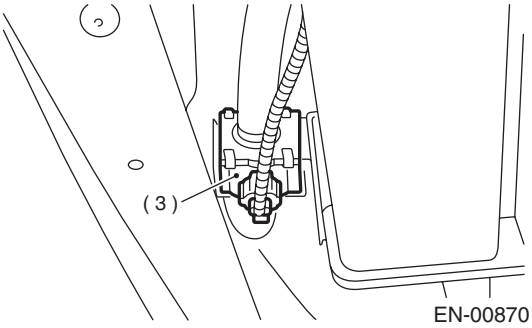
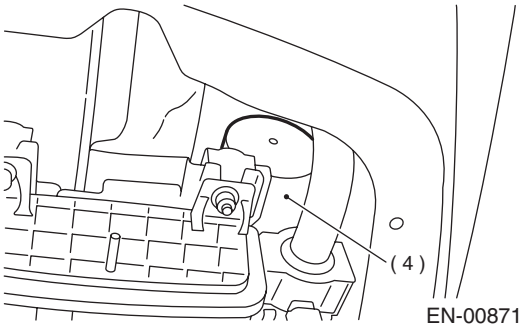


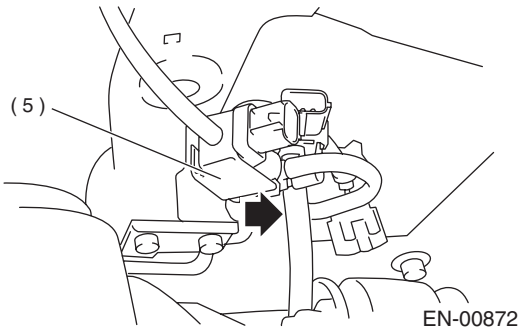
(1) Pressure control solenoid valve
(2) Canister
(3) Drain valve
(4) Drain filter
(5) Fuel tank sensor control valve







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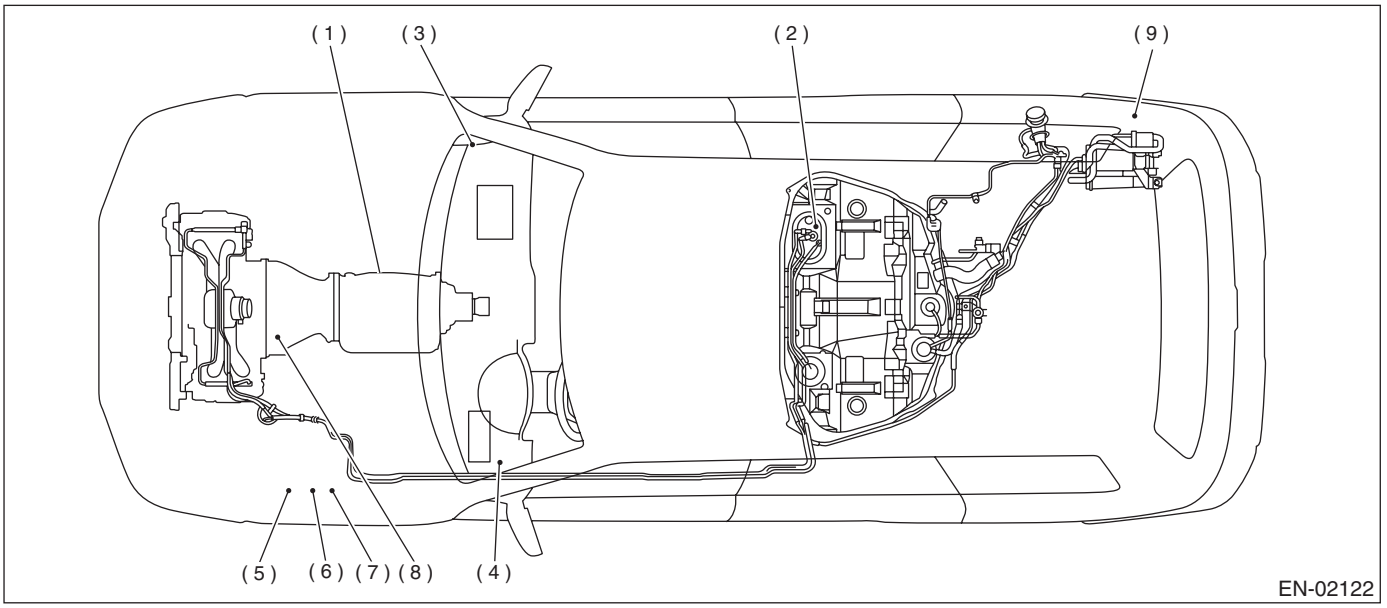
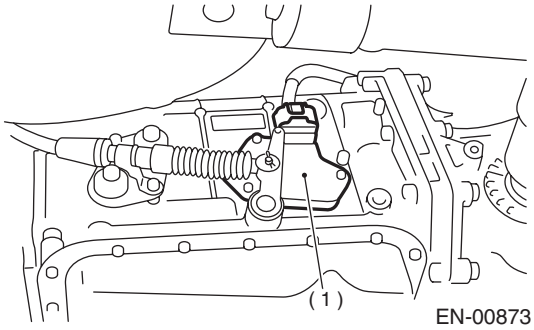
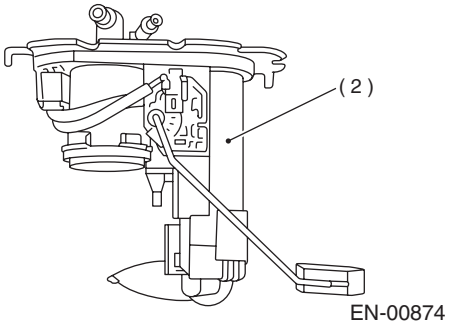
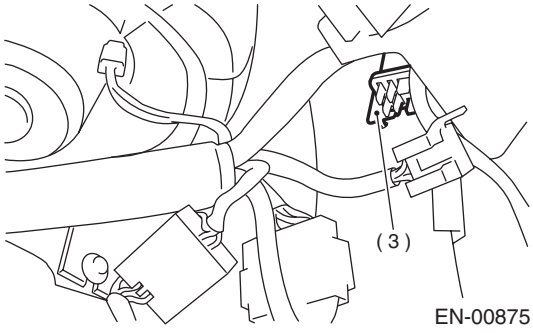
EN-00872

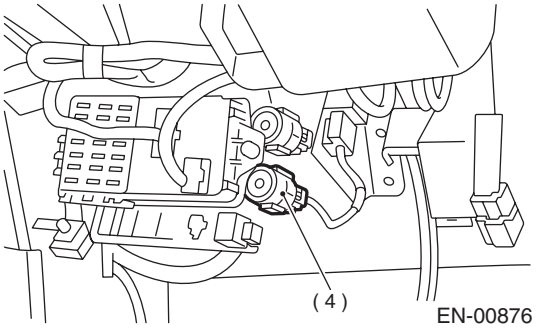


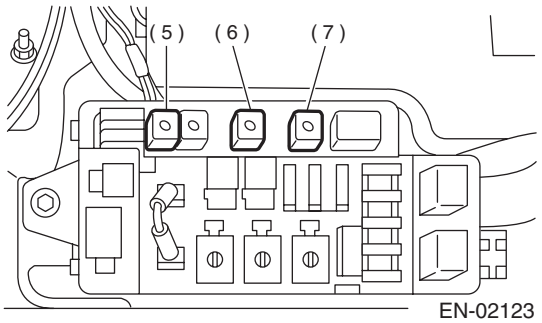
(1) Inhibitor switch
(2) Fuel pump
(3) Main relay
(4) Fuel pump relay
(5) Radiator main fan relay
(6) Radiator sub fan relay
(7) Radiator fan mode relay
(8) Starter
(9) Fuel pump control unit



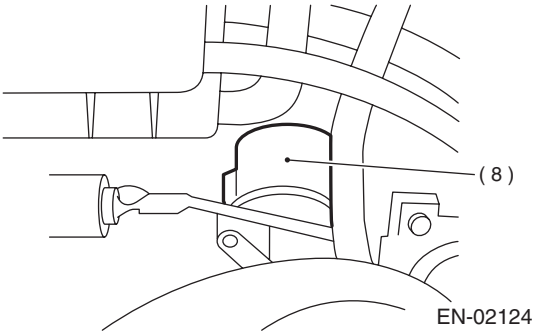




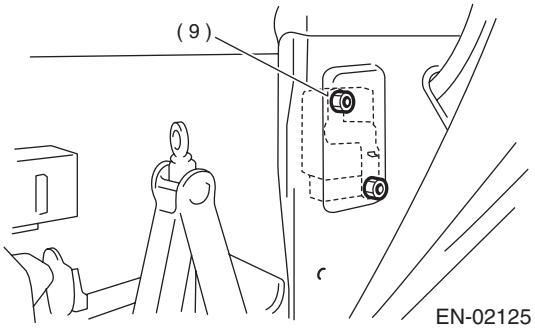




EN-02123



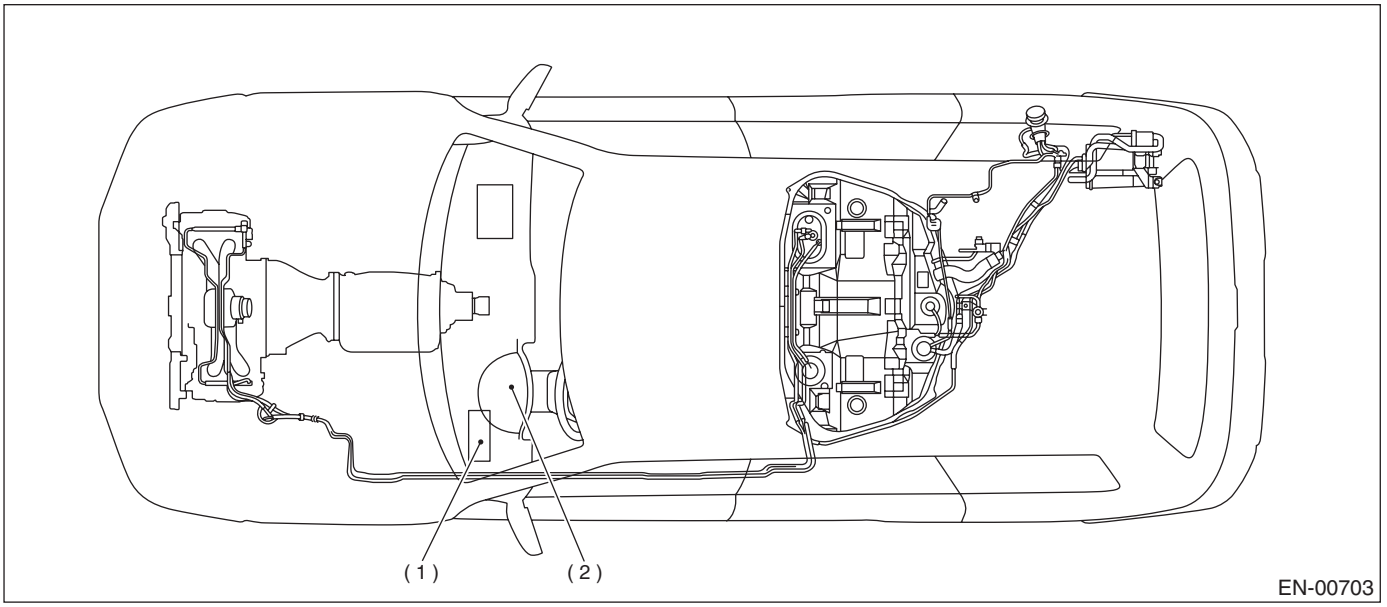
EN-02124



EN-02125

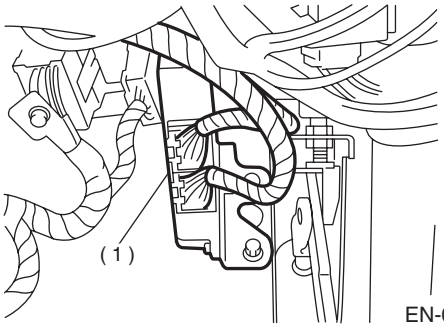
2. TRANSMISSION

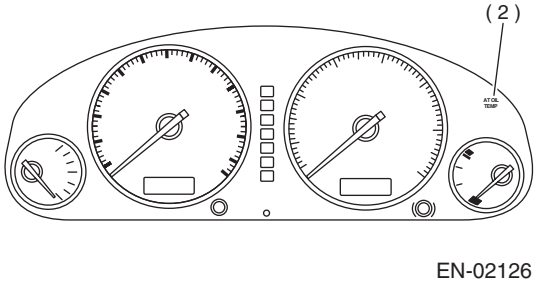
• MODULE



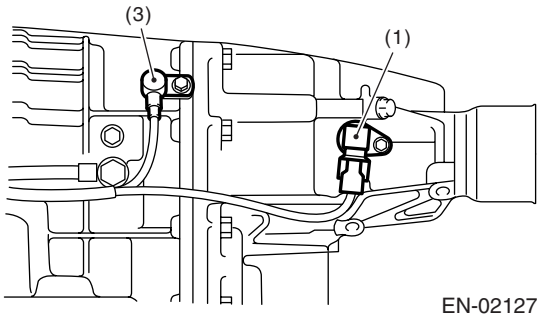
(1) Transmission Control Module (TCM) (for AT vehicles)

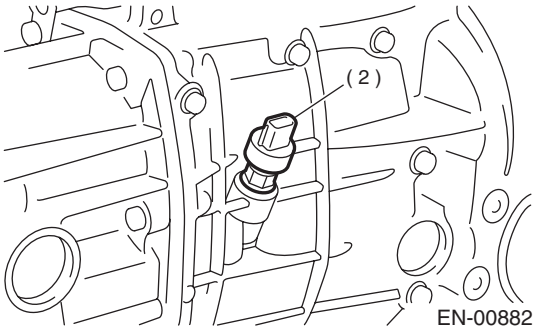
(2) AT diagnostic indicator light (for AT vehicles)

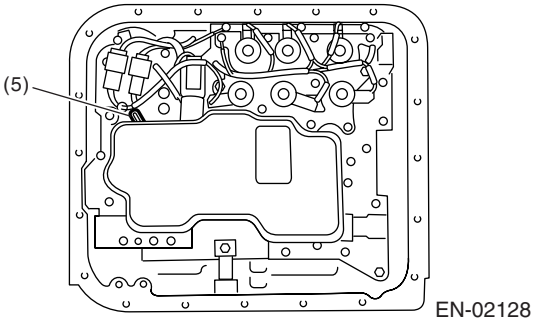


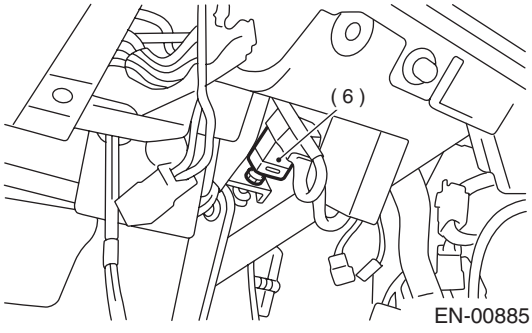


• SENSOR



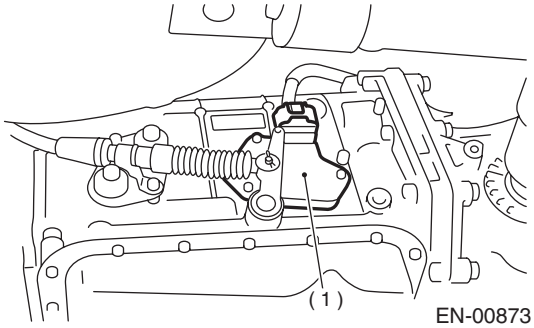




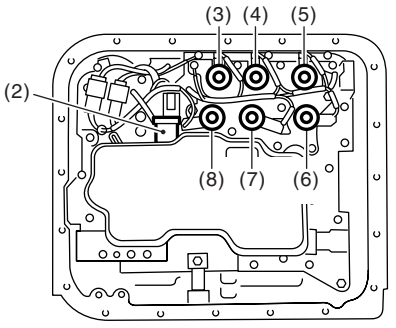


(1) Rear vehicle speed sensor (for AT vehicles)
(2) Front vehicle speed sensor (for MT vehicles)
(3) Front vehicle speed sensor (for AT vehicles)
(4) Torque converter turbine speed sensor
(5) ATF temperature sensor (for AT vehicles)
(6) Brake light switch

• SOLENOID VALVE AND SWITCH (AT MODEL)



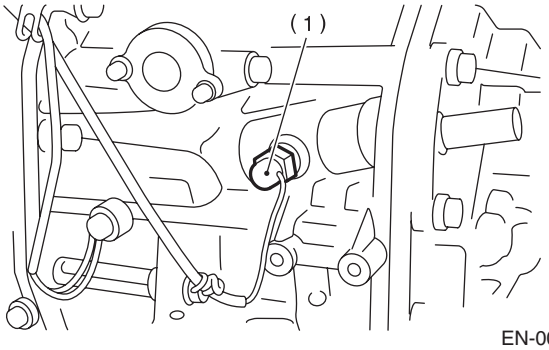
EN-00873



EN-02129

(1) Inhibitor switch
(2) Line pressure linear solenoid
(3) High clutch duty solenoid
(4) 2-4 brake duty solenoid
(5) Low clutch duty solenoid valve
(6) Transfer duty solenoid
(7) Low & reverse duty solenoid
(8) Lock-up duty solenoid

• SOLENOID VALVE AND SWITCH (MT MODEL)

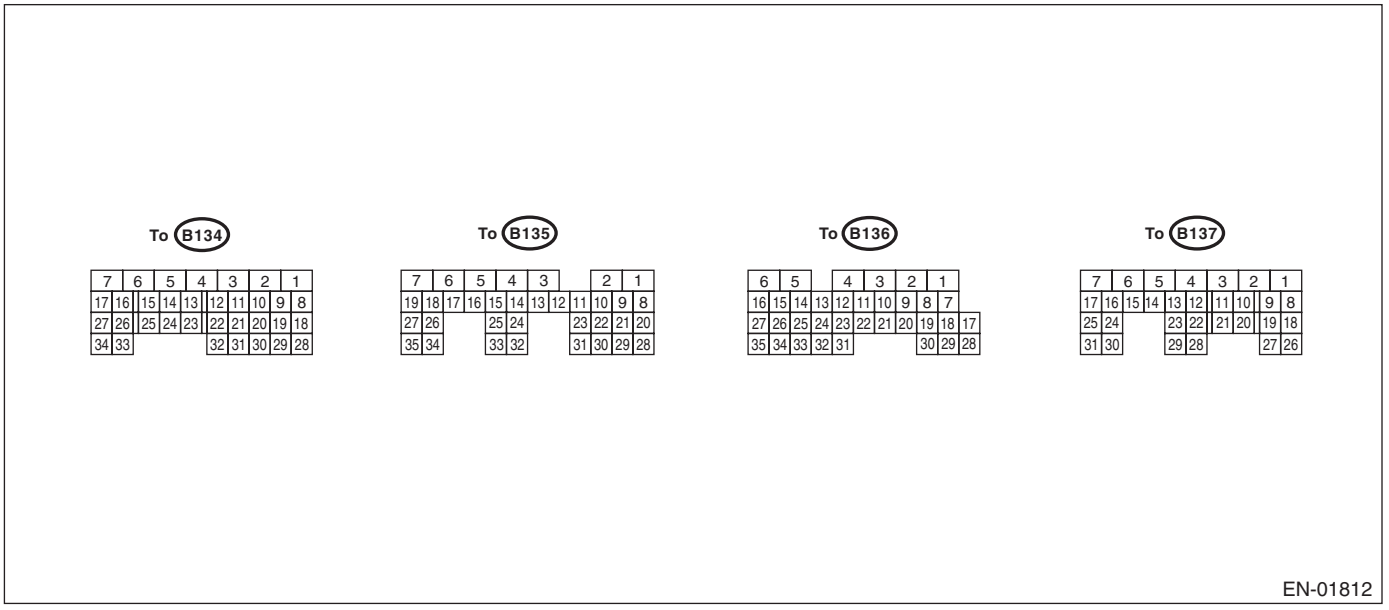


EN-00192

(1) Neutral position switch

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

A: ELECTRICAL SPECIFICATION



Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Crankshaft position sensor	Signal (+)	B135	10	0	–7 — +7	Sensor output waveform
	Signal (–)	B135	22	0	0	—
	Shield	B135	31	0	0	—
Rear oxygen sensor	Signal	B137	25	0	0 — 0.9	—
	Shield	B137	31	0	0	—
	GND (sensor)	B136	35	0	0	—
Front oxygen (A/F) sensor heater	Signal 1	B134	3	0 — 1.0	—	Sensor output waveform
	Signal 2	B134	2	0 — 1.0	—	Sensor output waveform
Rear oxygen sensor heater signal		B135	2	0 — 1.0	—	Sensor output waveform
Engine coolant temperature sensor	Signal	B136	14	1.0 — 1.4	1.0 — 1.4	After warm-up the engine.
	GND (sensor)	B136	35	0	0	After warm-up the engine.
Vehicle speed signal		B135	27	0 or 5	0 or 5	“5” and “0” are repeatedly displayed when vehicle is driven.
Mass air flow sensor	Signal	B136	23	—	0.3 — 4.5	—
	Shield	B136	32	0	0	—
	GND	B136	31	0	0	—
Intake air temperature sensor signal		B136	13	0.3 — 4.6	0.3 — 4.6	—
Tumble generator valve position sensor RH	Signal	B136	27	Fully closed: 3.8 — 4.9 Fully opened: 0.2 — 0.9		—
	Power supply	B136	16	5	5	—
	GND (sensor)	B136	35	0	0	—
Tumble generator valve position sensor LH	Signal	B136	26	Fully closed: 3.8 — 4.9 Fully opened: 0.2 — 0.9		—
	Power supply	B136	16	5	5	—
	GND (sensor)	B136	35	0	0	—

Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Tumble generator valve RH (open)		B134	9	0 or 10 — 13	0 or 13 — 14	Sensor output waveform
Tumble generator valve RH (close)		B134	8	0 or 10 — 13	0 or 13 — 14	Sensor output waveform
Tumble generator valve LH (open)		B134	11	0 or 10 — 13	0 or 13 — 14	Sensor output waveform
Tumble generator valve LH (close)		B134	10	0 or 10 — 13	0 or 13 — 14	Sensor output waveform
Wastegate control solenoid valve		B134	32	0 or 10 — 13	0 or 13 — 14	Sensor output waveform
Starter switch		B137	8	0	0	Cranking: 8 — 14
A/C switch		B137	16	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
Ignition switch		B137	15	10 — 13	13 — 14	—
Neutral position switch		B137	9	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
Test mode connector		B137	14	10 — 13	13 — 14	When connected: 0
Knock sensor	Signal	B136	25	2.8	2.8	—
	Shield	B136	33	0	0	—
Back-up power supply		B135	19	10 — 13	13 — 14	Ignition switch “OFF”: 10 — 13
Control unit power supply		B135	5	10 — 13	13 — 14	—
		B135	6	10 — 13	13 — 14	—
Sensor power supply		B136	16	5	5	—
Ignition control	#1	B135	18	0	13 — 14	Waveform
	#2	B135	17	0	13 — 14	Waveform
	#3	B135	16	0	13 — 14	Waveform
	#4	B135	15	0	13 — 14	Waveform
Fuel injector	#1	B136	6	10 — 13	1 — 14	Waveform
	#2	B136	5	10 — 13	1 — 14	Waveform
	#3	B136	4	10 — 13	1 — 14	Waveform
	#4	B136	3	10 — 13	1 — 14	Waveform
Fuel pump control unit	Signal 1	B135	26	0 or 5	0 or 5	Sensor output waveform
	Signal 2	B137	28	10 — 13	13 — 14	—
A/C relay control		B133	33	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	—
Radiator fan relay 1 control		B135	25	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	—
Radiator fan relay 2 control		B135	24	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	Model with A/C only
Malfunction indicator lamp		B134	17	—	—	Light “ON”: 1 or less Light “OFF”: 10 — 14
Engine speed output		B134	23	—	0 — 13, or more	Waveform
Purge control solenoid valve		B134	14	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	Sensor output waveform
Manifold absolute pressure sensor	Signal	B136	22	1.7 — 2.4	1.1 — 1.6	—
	Power supply	B136	16	5	5	
	GND (sensor)	B136	35	0	0	
Fuel tank pressure sensor	Signal	B136	21	2.3 — 2.7	2.3 — 2.7	The valve operates when fuel filler cap is removed and reinstalled.
	GND (sensor)	B136	35	0	0	—

Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Pressure control solenoid valve		B134	12	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Drain valve		B134	13	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Fuel tank sensor control valve		B134	24	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	—
Fuel level sensor		B136	20	0.12 — 4.75	0.12 — 4.75	—
Fuel temperature sensor signal		B136	12	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (75°F)
Blow-by leak diagnosis signal		B137	24	0	0	When disconnection (malfunction): 5
Small light switch		B137	12	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	11	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Power steering oil pressure switch		B137	10	10 — 13	ON: 0 OFF: 13 — 14	—
Front oxygen (A/F) sensor signal (+)		B134	33	2.8 — 3.2	2.8 — 3.2	—
Front oxygen (A/F) sensor signal (–)		B134	26	2.4 — 2.7	2.4 — 2.7	—
Front oxygen (A/F) sensor shield		B134	25	0	0	—
SSM/GST communication line		B137	20	Less than 1 ←→ More than 4	Less than 1 ←→ More than 4	—
GND (injectors)		B137	7	0	0	—
GND (ignition system)		B135	12	0	0	—
GND (power supply)		B135	4	0	0	—
		B135	1	0	0	—
GND (control systems)		B137	1	0	0	—
		B137	2	0	0	—
GND (front oxygen (A/F) sensor heater 1)		B134	7	0	0	—
GND (front oxygen (A/F) sensor heater 2)		B134	6	0	0	—
Camshaft position sensor (LH)		B135	8	0 — 0.9	ON: 0 OFF: 4.7 — 5.3	Sensor output waveform
Camshaft position sensor (RH)		B135	9	0 — 0.9	ON: 0 OFF: 4.7 — 5.3	Sensor output waveform
Electric throttle	Main	B136	18	0.64 — 0.72 Fully opened: 3.96	0.64 — 0.72 (After engine warm-up)	Fully closed: 0.6 Fully opened: 3.96
	Sub	B136	29	1.51 — 1.58 Fully opened: 4.17	1.51 — 1.58 (After engine warm-up)	Fully closed: 1.48 Fully opened: 4.17
	Power supply	B136	16	5	5	—
	GND (sensor)	B137	3	0	0	—
Electric throttle motor (+)		B137	5	Duty waveform	Duty waveform	Driving frequeney: 500Hz
Electric throttle motor (–)		B137	4	Duty waveform	Duty waveform	Driving frequeney: 500Hz
Electric throttle motor power supply		B137	6	10 — 13	13 — 14	—

ENGINE CONTROL MODULE (ECM) I/O SIGNAL

Content		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (Engine OFF)	Engine ON (Idling)	
Electric throttle motor relay		B135	35	ON: 010 OFF: — 13	ON: 0 OFF: 13 — 14	When ignition switch is ON: ON
Oil flow control solenoid valve (LH)	Signal (+)	B134	19	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
	Signal (–)	B134	29	0	0	—
Oil flow control solenoid valve (RH)	Signal (+)	B134	18	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
	Signal (–)	B134	28	0	0	—
Accelerator position sensor	Main	B136	17	Fully closed: 1 Fully opened: 3.5	Fully closed: 1 Fully opened: 3.5	—
	Power supply	B136	15	5	5	—
	GND (sensor)	B136	34	0	0	—
	Sub	B136	28	Fully closed: 1 Fully opened: 3.5	Fully closed: 1 Fully opened: 3.5	—
Cruise control set light		B134	16	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Main light		B134	15	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Clutch switch		B134	1	When clutch pedal is depressed: 0 When clutch pedal is released: 10 — 13	When clutch pedal is depressed: 0 When clutch pedal is released: 13 — 14	—
SET/COAST switch		B136	11	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
Brake switch 1		B136	9	When brake pedal is depressed: 0 When brake pedal is released: 10 — 13	When brake pedal is depressed: 0 When brake pedal is released: 13 — 14	—
Brake switch 2		B136	8	When brake pedal is depressed: 10 — 13 When brake pedal is released: 0	When brake pedal is depressed: 13 — 14 When brake pedal is released: 0	—
RESUME/ACCEL switch		B136	10	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
Main switch		B136	7	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
CAN communication	Signal (+)	B137	18	Pulse signal		—
	Signal (–)	B137	26	Pulse signal		—

6. Engine Condition Data

A: ELECTRICAL SPECIFICATION

Content	Specified data
Engine load	1.92 — 3.9 (%): Idling
	5.4 — 10.9 (%): 2,500 rpm racing

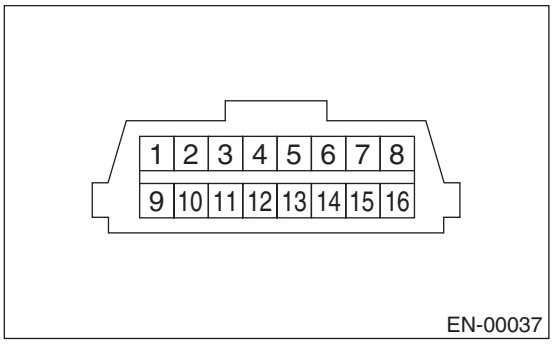
Measuring condition:
- After warm-up the engine.
- Gear position is in neutral position.
- A/C is turned to OFF.
- All accessory switches are turned to OFF.

7. Data Link Connector

A: NOTE

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

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



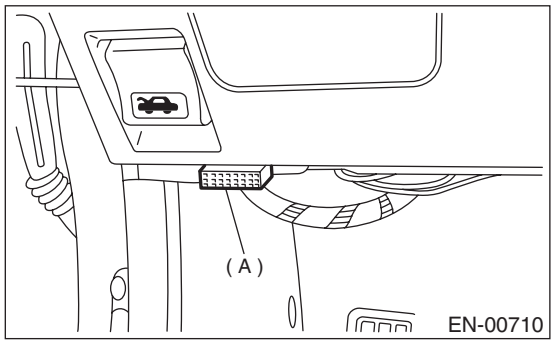
Terminal No.	Contents	Terminal No.	Contents
1	Power supply	9	Blank
2	Blank	10	Subaru Select Monitor/General scan tool signal
3	Blank	11	Blank
4	Blank	12	Ground
5	Blank	13	Ground
6	Line end check signal 1	14	Blank
7	Blank	15	Blank
8	Line end check signal 2	16	Blank

8. General Scan Tool

A: OPERATION

1. HOW TO USE GENERAL SCAN TOOL

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



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

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 General Scan Tool Operation Manual.)

NOTE:
For details concerning DTC, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4DOTC)-81, 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	kPaA
0C	Engine revolution	rpm
0D	Vehicle speed	MPH
0E	Ignition timing advance	°
0F	Intake air temperature	°C
10	Air flow rate from mass air flow sensor	gm/s
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
34	A/F value and A/F sensor current	— and mA

NOTE:
Refer to 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	kPaA
0C	Engine revolution	rpm
0D	Vehicle speed	MPH
0E	Ignition timing advance	°
0F	Intake air temperature	°C
10	Air flow rate from mass air flow sensor	gm/s
11	Throttle valve opening angle	%
15	O_2 sensor output voltage and O_2 sensor short term fuel trim	V and %

NOTE:
Refer to 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(H4DOTC)-38, 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 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
$81	$01	Catalyst system efficiency below threshold
$83	$01	Evaporative emission control system large leak
	$02	Evaporative emission control system small leak
	$03	Evaporative emission control system very small leak
$05	$01	O_2 sensor circuit slow response (Bank 1 Sensor 1)
$06	$01	O_2 sensor circuit (Bank 1 Sensor 2)
	$02	
$07	$01	O_2 sensor circuit slow response (Bank 1 Sensor 2)
$0C	$01	Coolant thermostat (Coolant temperature below thermostat regulating temperature)
$0F	$01	Drain valve range/performance
	$02	

7. MODE $07

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

8. MODE $09

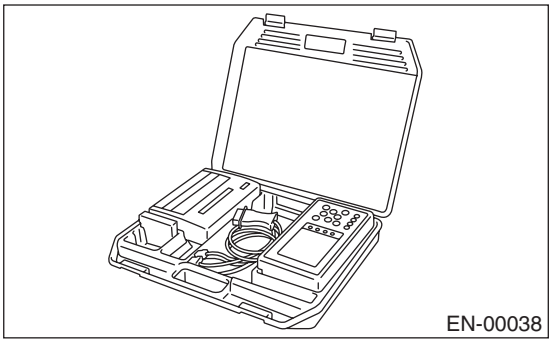
Refer to data of vehicle specification (VIN, calibration ID, etc.).

9. Subaru Select Monitor

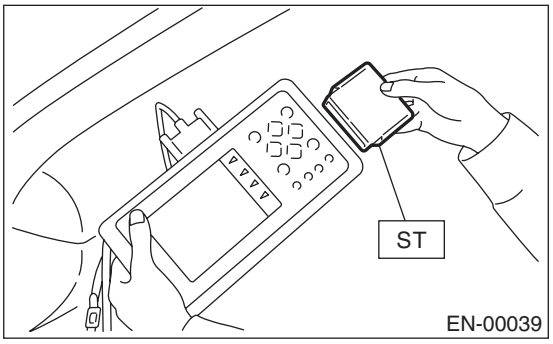
A: OPERATION

1. HOW TO USE SUBARU SELECT MONITOR

1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)-7, PREPARATION TOOL, General Description.>

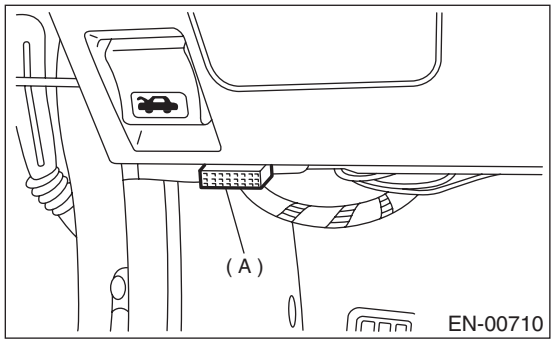


2) Connect the diagnosis cable to Subaru Select Monitor.
3) Insert the cartridge into Subaru Select Monitor. <Ref. to EN(H4DOTC)-7, PREPARATION TOOL, General Description.>



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

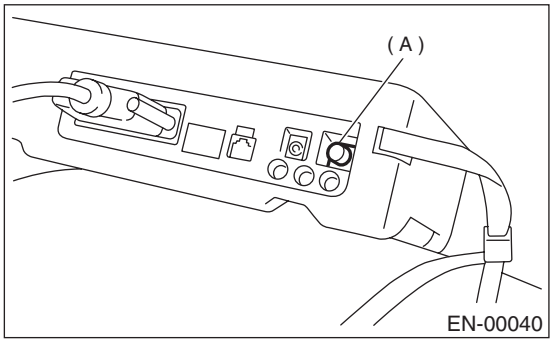
(1) Data link connector is located in the lower portion of instrument panel (on the driver's side).



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

CAUTION:
Do not connect the scan tools except for Subaru Select Monitor and 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 the DTC and various data, and 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(H4DOTC)-38, 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(H4DOTC)-38, Read Diagnostic Trouble Code (DTC).>

4. READ CURRENT DATA FOR ENGINE. (NORMAL MODE)

1) On the «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
2) On the «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 the «Engine Diagnosis» display screen, select the {Current Data Display & Save} and press the [YES] key.
5) On the «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 desired data is shown.
• A list of the 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	%
Injection pulse width	Fuel Injection #1 Pulse	ms
Fuel pump duty control signal	Fuel Pump Duty	%
A/F sensor current	A/F Sensor #1 Current	mA
A/F sensor resistance	A/F Sensor #1 Resistance	ohm
Front oxygen (A/F) sensor lambda value	A/F Sensor #1	—
Rear oxygen sensor output signal	Rear O_2 Sensor	V
Short term fuel trim	A/F Correction #1	%
Knock sensor correction	Knocking Correction	deg
Atmospheric absolute pressure signal	Atmosphere Pressure	mmHg or kPa or inHg or psi
Intake manifold relative pressure signal	Mani. Relative Pressure	mmHg or kPa or inHg or psi
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg or kPa or 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	%
Canister purge control solenoid valve duty ratio	CPC Valve Duty Ratio	%
Primary supercharged pressure control signal	Primary Control	%
Tumble generator valve position sensor signal (right side)	TGV Position Sensor R	V
Tumble generator valve position sensor signal (left side)	TGV Position Sensor L	V
Accelerator position	Accel.Opening Angle	%
VVT advanced timing (R)	VVTAdv.Amount R	deg
VVT advanced timing (L)	VVTAdv.Amount L	deg
OCV duty ratio (R)	OCV Duty R	%
OCV duty ratio (L)	OCV Duty L	%
OCV duty current (R)	OCV Current R	mA
OCV duty current (L)	OCV Current L	mA
Throttle motor duty	Throttle Motor Duty	%
Throttle power supply voltage	Throttle Motor Voltage	V
Sub-throttle sensor voltage	Sub-Throttle Sensor	V
Main-throttle sensor voltage	Main-Throttle Sensor	V
Sub-accelerator sensor voltage	Sub-Accelerator Sensor	V
Main-accelerator sensor voltage	Main-Accelerator Sensor	V
Memorized cruise speed	Memorized Cruise Speed	km/h
Roughness Monitor for #1 cylinder	Roughness Monitor #1	—

Contents	Display	Unit of measure
Roughness Monitor for #2 cylinder	Roughness Monitor #2	—
Roughness Monitor for #3 cylinder	Roughness Monitor #3	—
Roughness Monitor for #4 cylinder	Roughness Monitor #4	—
Fuel level signal	Fuel Level	V
Intake air temperature signal	Intake Air Temp.	°C or °F
Mass air flow sensor signal	Mass Air Flow	g/s
Mass air flow sensor signal	Air Flow Sensor Voltage	V
Fuel tank pressure signal	Fuel Tank Pressure	mmHg or kPa or inHg or psi
Fuel temperature signal	Fuel Temp.	°C or °F
AT/MT identification signal	AT Vehicle ID Signal	ON or OFF
Fuel pressure control signal	PCV Solenoid Valve	ON or OFF
Drain valve signal	Vent. Solenoid Valve	ON or OFF
Tank sensor control solenoid valve signal	Tank Sensor Cntl Valve	ON or OFF
ETC Motor Relay	ETC Motor Relay	ON or OFF
Clutch SW	Clutch Switch	ON or OFF
Stop light SW	Stop Light Switch	ON or OFF
SET/COAST SW	SET/COAST Switch	ON or OFF
RESUME/ACCEL SW	RESUME/ACCEL Switch	ON or OFF
Brake SW	Brake Switch	ON or OFF
Main SW	Main Switch	ON or OFF
Ignition switch signal	Ignition Switch	ON or OFF
Test mode 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
Blow-by leak diagnosis SW	Blow-by Leak Connector	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
Rear oxygen sensor rich signal	Rear O_2 Rich Signal	ON or OFF
Starter switch signal	Starter Switch	ON or OFF
Idle switch signal	Idle Switch	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 SW	ON or OFF
Blower fan switch signal	Blower Fan SW	ON or OFF
Small light switch signal	Light Switch	ON or OFF
Tumble generator valve output signal	TGV Output	ON or OFF
Tumble generator valve drive signal	TGV Drive	OPEN or CLOSE

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

5. READ CURRENT DATA FOR ENGINE. (OBD MODE)

1) On the «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
2) On the «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 the «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
5) On the «OBD Menu» display screen, select the {Current Data Display & Save} and press the [YES] key.
6) On the «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 desired data is shown.
• A list of the 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 catalyst	Catalyst Diagnosis	Complete or incomplete
Test of heated catalyst	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 or kPa or 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
Throttle position signal	Throttle Opening Angle	%
Oxygen sensor #11	Oxygen Sensor #11	—
Oxygen sensor #12	Oxygen Sensor #12	—
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	CARB-OBD2
A/F sensor output signal	A/F sensor #11	V
A/F lambda signal	A/F sensor #11	—
A/F lambda signal #11	A/F sensor #11	—
A/F sensor current #11	A/F sensor #11	mA

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

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

1) On the «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
2) On the «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 the «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
5) On the «OBD Menu» display screen, select the {Freeze Frame Data} and press the [YES] key.
• A list of the 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	Closed loop or Open loop
O_2 sensor output voltage	Oxygen Sensor #12	V
Short term fuel trim by O_2 sensor	Short term fuel trim #12	%
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
Throttle position signal	Throttle Opening Angle	%
O_2 sensor #11	Oxygen Sensor #11	—
O_2 sensor #12	Oxygen Sensor #12	—

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

7. LED OPERATION MODE FOR ENGINE

1) On the «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
2) On the «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 the «Engine Diagnosis» display screen, select the {Current Data Display & Save} and press the [YES] key.
5) On the «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 the 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 to ON.
Test mode 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 Compressor Signal	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.
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.
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 Signal	ON or OFF	When crankshaft position sensor signal is entered.
Camshaft position sensor signal	Camshaft Position Signal	ON or OFF	When camshaft position sensor signal is entered.
Power steering switch signal	P/S Switch	ON or OFF	When power steering switch 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.
Tumble generator valve actuator signal	TGV Output	ON or OFF	When TGV actuator signal is entered.
Tumble generator valve drive signal	TGV Drive	Close or Open	When TGV moves and valve opens.
Fuel pressure control solenoid	PCV Solenoid Valve	ON or OFF	When fuel pressure control solenoid valve is in function.
Drain valve signal	Vent. Solenoid Valve	ON or OFF	When drain valve is in function.
Fuel tank sensor control solenoid valve signal	Fuel Tank Sensor Ctrl Valve	ON or OFF	When tank sensor control solenoid valve is in function.
Blow-by leak diagnosis SW	Blow-by Leak Connector	ON or OFF	When connected.
Handle SW	Handle SW	RHD/LHD	When the vehicle is LHD model.
ETC motor relay	ETC Motor Relay	ON or OFF	When electric throttle is in function.
Clutch SW	Clutch SW	ON or OFF	When clutch switch is turned ON.
Stop SW	Stop Light Switch	ON or OFF	When stop light switch is turned ON.
SET/CST SW	SET/COAST Switch	ON or OFF	When SET/COAST switch is turned ON.
RES/ACC SW	RESUME/ACCEL Switch	ON or OFF	When RESUME/ACCEL switch is turned ON.
Brake SW	Brake Switch	ON or OFF	When brake switch is turned ON.
Main SW	Main Switch	ON or OFF	When main switch is turned ON.

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

10.Read Diagnostic Trouble Code (DTC)

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

1) On the «Main Menu» display screen, select the {Each System Check} and press the [YES] key.
2) On the «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 the «Engine Diagnosis» display screen, select the {DTC Display} and press the [YES] key.
5) On the «DTC Display» display screen, select the {Current DTC} or {History DTC} and press the [YES] key.

NOTE:
• For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
• For detailed concerning DTC, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>

2. SUBARU SELECT MONITOR (OBD MODE)

1) On the «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
2) On the «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 the «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
5) On the «OBD Menu» display screen, select the {DTC Display} and press the [YES] key.
6) Make sure that a DTC is shown on the display screen.

NOTE:
• For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
• For detailed concerning DTC, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>

3. 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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>

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

11.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(H4DOTC)-44, Drive Cycle.>

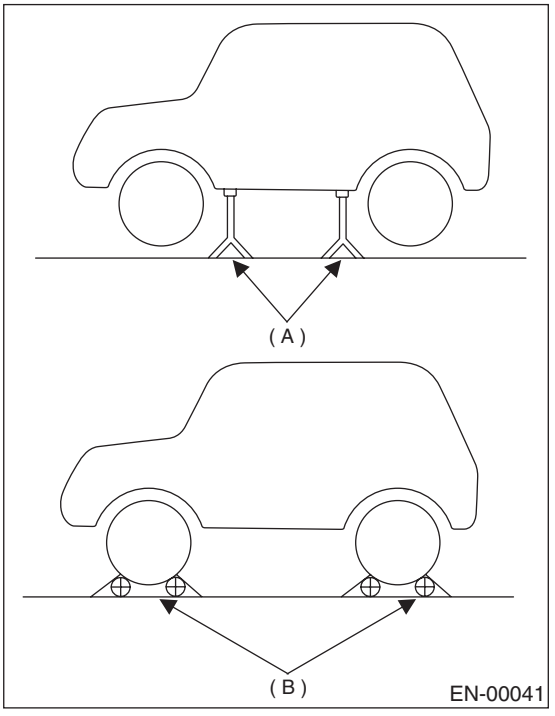
DTC	Item	Condition
P0011	"A" Camshaft Position-Timing Over-Advanced or System Performance (Bank 1)	—
P0021	"A" Camshaft Position-Timing Over-Advanced or System Performance (Bank 2)	—
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	—
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	—
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	—
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	—
P0102	Mass or Volume Air Flow Circuit Low Input	—
P0103	Mass or Volume Air Flow Circuit High Input	—
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	—
P0131	O_2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	—
P0132	O_2 Sensor Circuit High Voltage (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	—
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low Input	—
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High Input	—
P0230	Fuel Pump Primary Circuit	—
P0245	Turbo/Super Charger Wastegate Solenoid "A" Low	—
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)	—
P0345	Camshaft Position Sensor "A" Circuit (Bank 2)	—
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	—

DTC	Item	Condition
P0519	Idle Control System Malfunction (Fail-Safe)	—
P0545	Exhaust Gas Temperature Sensor Circuit Low-BANK 1	—
P0600	Improper CAN Communication	—
P0604	Internal Control Module Random Access Memory (RAM) Error	—
P0605	Internal Control Module Read Only Memory (ROM) Error	—
P0607	Control Module Performance	—
P0638	Throttle Actuator Control Range/Performance (Bank 1)	—
P0691	Cooling Fan 1 Control Circuit Low	—
P0700	Request AT MIL ON	—
P0851	Neutral Switch Input Circuit Low	—
P0852	Neutral Switch Input Circuit High	—
P1152	O_2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1)	—
P1153	O_2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1)	—
P1160	Return Spring Failure	—
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	—
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	—
P1446	Fuel Tank Sensor Control Valve Circuit Low	—
P1447	Fuel Tank Sensor Control Valve Circuit High	—
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	—
P1518	Starter Switch Circuit Low Input	—
P1544	Exhaust Gas Temperature Too High	—
P1560	Back-up Voltage Circuit Malfunction	—
P2006	Tumble Generated Valve System 1 (Valve Close)	—
P2007	Tumble Generated Valve System 2 (Valve Close)	—
P2008	Tumble Generated Valve Signal 1 Circuit Malfunction (Open)	—
P2009	Tumble Generated Valve Signal 1 Circuit Malfunction (Short)	—
P2011	Tumble Generated Valve Signal 2 Circuit Malfunction (Open)	—
P2012	Tumble Generated Valve Signal 2 Circuit Malfunction (Short)	—
P2016	Tumble Generated Valve Position Sensor 1 Circuit Low	—
P2017	Tumble Generated Valve Position Sensor 1 Circuit High	—
P2021	Tumble Generated Valve Position Sensor 2 Circuit Low	—
P2022	Tumble Generated Valve Position Sensor 2 Circuit High	—
P2088	OCV Solenoid Valve Signal A Circuit Open (Bank 1)	—
P2089	OCV Solenoid Valve Signal A Circuit Short (Bank 1)	—
P2092	OCV Solenoid Valve Signal A Circuit Open (Bank 2)	—
P2093	OCV Solenoid Valve Signal A Circuit Short (Bank 2)	—
P2101	Throttle Actuator Control Motor Circuit Range/Performance	—
P2102	Throttle Actuator Control Motor Circuit Low	—
P2109	Throttle/Pedal Position Sensor A Minimum Stop Performance	—
P2122	Throttle/Pedal Position Sensor/Switch “D” Circuit Low Input	—
P2123	Throttle/Pedal Position Sensor/Switch “D” Circuit High Input	—
P2127	Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input	—
P2128	Throttle/Pedal Position Sensor/Switch “E” Circuit High Input	—
P2135	Throttle/Pedal Position Sensor/Switch “A” / “B” Voltage Rationality	—
P2138	Throttle/Pedal Position Sensor/Switch “D” / “E” Voltage Rationality	—
P2227	Atmospheric Pressure Sensor Circuit Range/Performance	—
P2228	Atmospheric Pressure sensor circuit malfunction (Low input)	—
P2229	Atmospheric Pressure sensor circuit malfunction (High input)	—

1. PREPARATION FOR THE INSPECTION MODE

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 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.

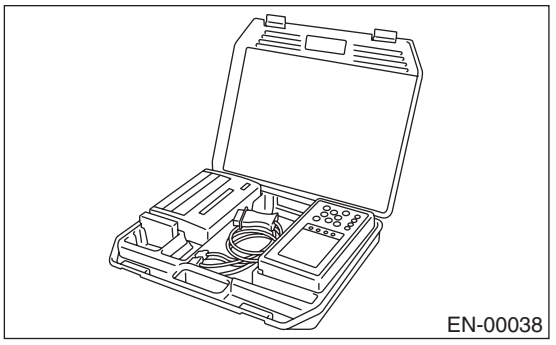
WARNING:
• Before raising the vehicle, ensure the parking brake is applied.
• Do not use a pantograph jack in place of a safety stand.
• Secure a rope or wire to the front and rear towing or tie-down hooks to prevent the lateral runout of front wheels.
• Do not abruptly depress/release the clutch pedal 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 that nobody goes in front of the vehicle.



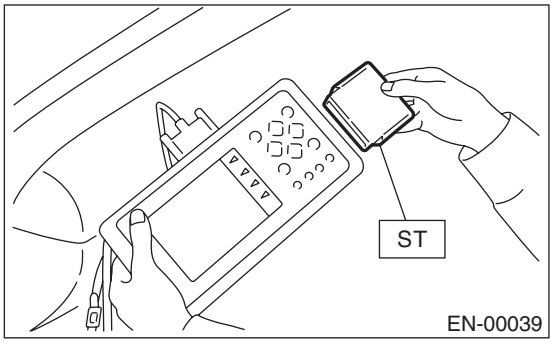
(A) Safety stand
(B) Free rollers

2. SUBARU SELECT MONITOR

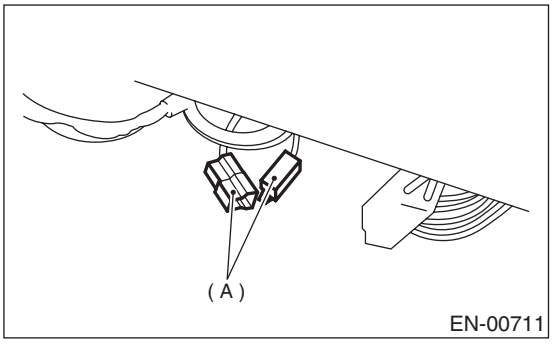
1) Warm up the engine.
2) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)-7, PREPARATION TOOL, General Description.>



3) Connect the diagnosis cable to Subaru Select Monitor.
4) Insert the cartridge into Subaru Select Monitor. <Ref. to EN(H4DOTC)-7, PREPARATION TOOL, General Description.>

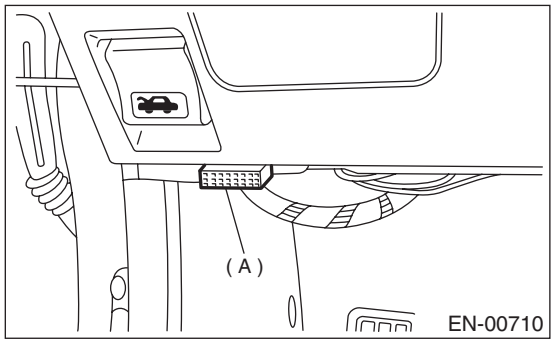


5) Connect the test mode connector (A) at the lower portion of instrument panel (on the driver's side).



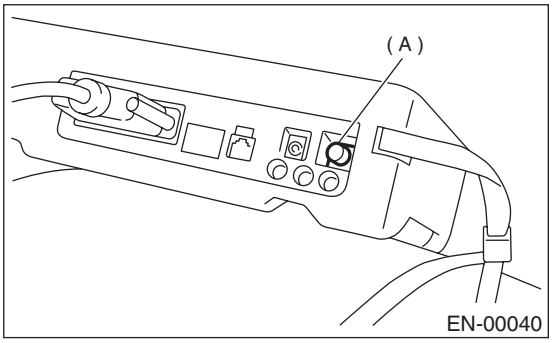
(A) Test mode connector

6) Connect the Subaru Select Monitor to data link connector located in the lower portion of the instrument panel (on the driver's side).



CAUTION:
Do not connect the scan tools except for Subaru Select Monitor and general scan tool.

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



(A) Power switch

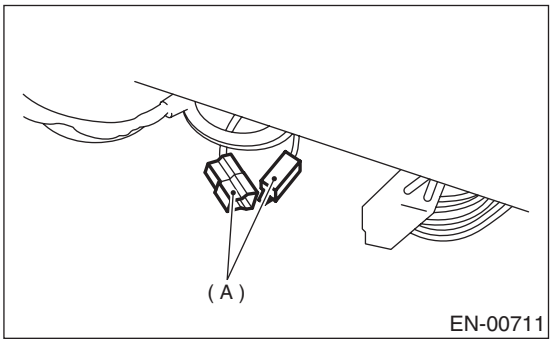
8) On the «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
9) On the «System Selection Menu» display screen, select the {Engine Control System} and press the [YES] key.
10) Press the [YES] key after the information of engine type is displayed.
11) On the «Engine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

• If trouble still remains in the memory, the corresponding DTC appears on the display screen.

NOTE:
• For detailed operation procedure, refer to the SUBARU SELECT MONITOR OPERATION MANUAL.
• For detailed concerning the DTC, refer to the List of Diagnostic Trouble Code (DTC).
<Ref. to EN(H4DOTC)-81, 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.

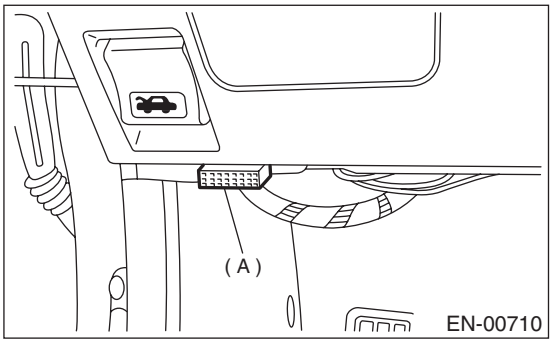
3. GENERAL SCAN TOOL

1) Warm up the engine.
2) Connect the test mode connector (A) at the lower side of instrument panel (on the driver's side).



3) Connect the general scan tool to its data link connector in the lower portion of instrument panel (on the driver's side).

CAUTION:
Do not connect the scan tools except for Subaru Select Monitor and general scan tool.



4) Start the engine.

NOTE:
• Ensure the selector lever is placed in the "P" position before starting. (AT vehicles)
• Depress clutch pedal when starting the engine. (MT vehicles)

5) Using the selector lever or shift lever, turn the "P" position switch and the "N" position switch to ON.
6) Depress the brake pedal to turn the brake switch ON. (AT vehicles)
7) Keep engine speed in the 2,500 to 3,000 rpm range for 40 seconds.

8) Place the selector lever or shift lever in the “D” position (AT vehicles) or “1st” gear (MT vehicles) and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

NOTE:
• On AWD model, 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.

9) Using the general scan tool, check for DTC and record the result(s).

NOTE:
• For detailed operation procedures, refer to the General Scan Tool Instruction Manual.
• For detailed concerning DTC, refer to the List of Diagnostic Trouble Code (DTC).
<Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>

12.Drive Cycle

A: OPERATION

There are six drive patterns of drive cycles A — F for the trouble diagnosis. Performing the specified drive pattern allows diagnose malfunctioning items listed below. After the malfunctioning items listed below are repaired, always check if they correctly resume their functions by performing the required drive pattern.

1. PREPARATION FOR THE 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) Disconnect the test mode connector.

NOTE:
• Except for the engine coolant 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. DRIVE CYCLE A (AFTER RUNNING 20 MINUTES AT 80 KM/H (50 MPH), IDLE ENGINE FOR 1 MINUTE.)

DTC	Item	Condition
*P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	Engine coolant temperature is less than 20°C (68°F) at engine start.
*P0126	Insufficient Coolant Temperature for Stable Operation	—
*P0128	Coolant Thermostat	Engine coolant temperature is less than 55°C (131°F) at engine start.
*P0133	O_2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	—
*P0171	System too Lean (Bank 1)	Diagnosis is also completed at drive cycles B and C.
*P0172	System too Rich (Bank 1)	Diagnosis is also completed at drive cycles B and C.
P0301	Cylinder 1 misfire detected	Diagnosis is also completed at drive cycles B and C.
P0302	Cylinder 2 misfire detected	Diagnosis is also completed at drive cycles B and C.
P0303	Cylinder 3 misfire detected	Diagnosis is also completed at drive cycles B and C.
P0304	Cylinder 4 misfire detected	Diagnosis is also completed at drive cycles B and C.
*P0420	Catalyst System Efficiency Below Threshold (Bank 1)	—
*P0442	Evaporative Emission Control System Leak Detected (small leak)	Engine coolant temperature is less than 25°C (77°F) at engine start.
*P0451	Evaporative Emission Control System Pressure Sensor Range/Performance	—
*P0456	Evaporative Emission Control System Leak Detected (very small leak)	Engine coolant temperature is less than 25°C (77°F) at engine start.
*P0457	Evaporative Emission Control System Leak Detected (fuel cap loose/off)	Engine coolant temperature is less than 25°C (77°F) at engine start.
P0459	Evaporative Emission Control System Purge Control Valve Circuit High	—
P0546	Exhaust Gas Temperature Sensor Circuit High-BANK1	—
P0692	Cooling Fan 1 Control Circuit High	—
P1301	Misfire Detected (High Temperature Exhaust Gas)	Diagnosis is also completed at drive cycles B and C.
P1312	Exhaust Gas Temperature Sensor Malfunction	Engine coolant temperature is less than 30°C (86°F) when engine start.
P1443	Vent Control Solenoid Valve Function Problem	—

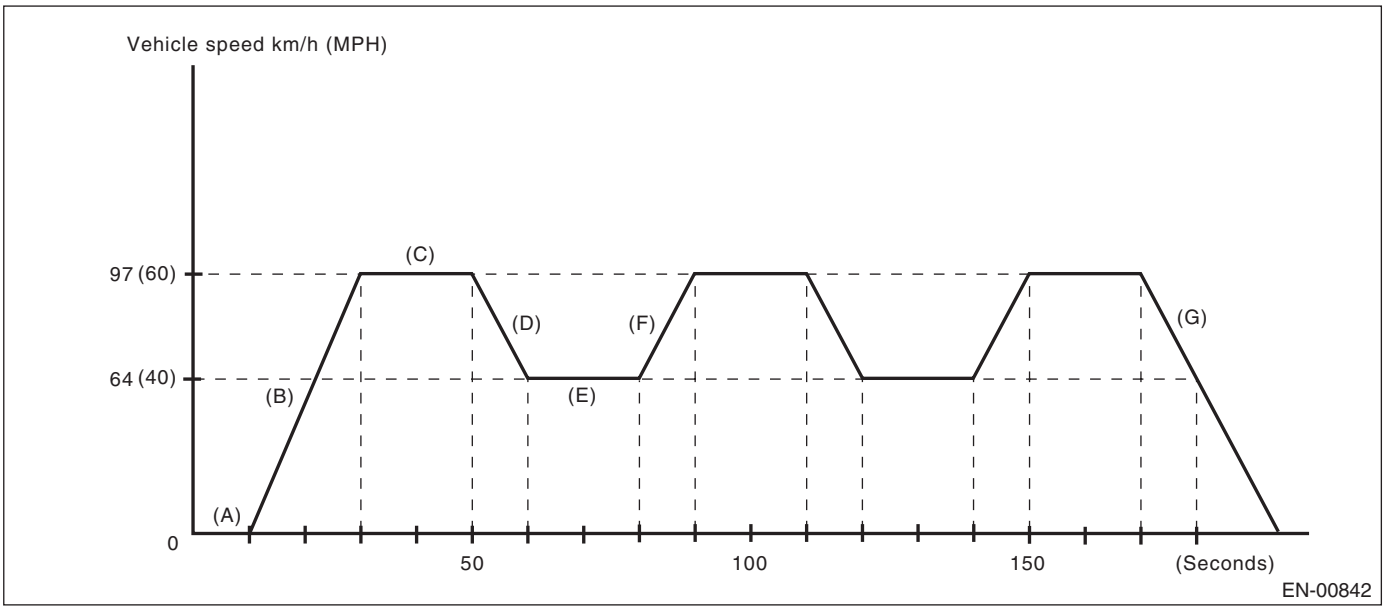
DTC	Item	Condition
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis is also completed at drive cycles B and C.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis is also completed at drive cycles B and C.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis is also completed at drive cycles B and C.

3. DRIVE CYCLE B (IDLE FOR 10 MINUTES)

NOTE:
Before the diagnosis, drive the vehicle at 10 km/h (6 MPH) or more.

DTC	Item	Condition
*P0111	Intake Air Temperature Sensor Range/Performance Problem	Engine coolant temperature is less than 30°C (86°F) at engine start.
*P0171	System too Lean (Bank 1)	Diagnosis is also completed at drive cycles A and C.
*P0172	System too Rich (Bank 1)	Diagnosis is also completed at drive cycles A and C.
P0301	Cylinder 1 misfire detected	Diagnosis is also completed at drive cycles A and C.
P0302	Cylinder 2 misfire detected	Diagnosis is also completed at drive cycles A and C.
P0303	Cylinder 3 misfire detected	Diagnosis is also completed at drive cycles A and C.
P0304	Cylinder 4 misfire detected	Diagnosis is also completed at drive cycles A and C.
*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	—
P1301	Misfire Detected (High Temperature Exhaust Gas)	Diagnosis is also completed at drive cycles A and C.
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis is also completed at drive cycles A and C.
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis is also completed at drive cycles A and C.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis is also completed at drive cycles A and C.

4. DRIVE CYCLE C (DRIVE ACCORDING TO THE FOLLOWING DRIVE PATTERN)



(A) Idle engine for 10 seconds or more.

(B) Accelerate to 97 km/h (60 MPH) within 20 seconds.

(C) Drive vehicle at 97 km/h (60 MPH) for 20 seconds.

(D) Decelerate with fully closed throttle to 64 km/h (40 MPH).

(E) Drive vehicle at 64 km/h (40 MPH) for 20 seconds.

(F) Accelerate to 97 km/h (60 MPH) within 10 seconds.

(G) Stop vehicle with throttle fully closed.

DTC	Item	Condition
*P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	—
P0068	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	—
*P0101	Mass or Volume Air Flow Circuit Range/performance	—
P0134	O_2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	—
*P0139	O_2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	—
*P0171	System too Lean (Bank 1)	Diagnosis is also completed at drive cycles A and B.
*P0172	System too Rich (Bank 1)	Diagnosis is also completed at drive cycles A and B.
*P0244	Turbo/Supercharger Wastegate Solenoid “A” Range/Performance	—
P0246	Turbo/Supercharger Wastegate Solenoid “A” High	—
*P0301	Cylinder 1 Misfire Detected	Diagnosis is also completed at drive cycles A and B.
*P0302	Cylinder 2 Misfire Detected	Diagnosis is also completed at drive cycles A and B.
*P0303	Cylinder 3 Misfire Detected	Diagnosis is also completed at drive cycles A and B.
*P0304	Cylinder 4 Misfire Detected	Diagnosis is also completed at drive cycles A and B.
P1301	Misfire Detected (High Temperature Exhaust Gas)	Diagnosis is also completed at drive cycles A and B.
P2004	Tumble Generated Valve System 1 (Valve Open)	—
P2005	Tumble Generated Valve System 2 (Valve Open)	—
*P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	Diagnosis is also completed at drive cycles A and B.

DTC	Item	Condition
*P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	Diagnosis is also completed at drive cycles A and B.
P2103	Throttle Actuator Control Motor Circuit High	Diagnosis is also completed at drive cycles A and B.

5. DRIVE CYCLE D

• DRIFT DIAGNOSIS

1) Make sure that the engine coolant temperature at engine starting is less than 30°C (86°F).
2) Make sure that fuel of more than 10 ℓ (2.6 US gal, 2.2 Imp gal), remains and the battery voltage is more than 10.9V.
3) Make sure that the engine coolant temperature rises for more than 10°C (50°F) from the level of engine starting and is also more than 70°C (158°F).
4) Idle the engine for more than 120 seconds in the condition of step 3.

• STUCK DIAGNOSIS

1) Make sure that the battery voltage is more than 10.9V.
2) Perform the clear memory mode. <Ref. to EN(H4DOTC)-52, Clear Memory Mode.>
3) Drive the vehicle for the distance equal to fuel of 50 ℓ (13.2 US gal, 11.0 Imp gal).

NOTE:
• It is possible to drive intermittently.
• Do not disconnect the terminal of battery during diagnosis. (If disconnecting the terminal of battery, the data will be cleared.)

DTC	Item	Condition
P0181	Fuel Temperature Sensor “A” Circuit Range/Performance	—

6. DRIVE CYCLE E

1) Make sure that the battery voltage is more than 10.9V.
2) Perform the clear memory mode. <Ref. to EN(H4DOTC)-52, Clear Memory Mode.>
3) Drive the vehicle for the distance equal to fuel of 30 ℓ (7.9 US gal, 6.6 Imp gal).

NOTE:
- It is possible to drive intermittently.
- Do not disconnect the terminal of battery during diagnosis. (If disconnecting the terminal of battery, the data will be cleared.)

DTC	Item	Condition
P0461	Fuel Level Sensor Circuit Range/Performance	—

7. DRIVE CYCLE F

1) Make sure that the battery voltage is more than 10.9V.
2) Drive the vehicle at 80 km/h (50 MPH) for 20 minutes, and then idle the engine for a minute.
3) Read the current data of engine using Subaru Select Monitor. Make sure that the item of evaporative emission purge control system is displayed as “Completed”. <Ref. to EN(H4DOTC)-35, READ CURRENT DATA FOR ENGINE. (OBD MODE), OPERATION, Subaru Select Monitor.>
4) Drive down for difference of elevation of 50 m (164 ft) within 80 seconds. (Ex: Drive down a incline with grade of 6% at 40 km/h (25 MPH).]
5) Repeat the steps 4 for five times.

NOTE:
- Do not drive at more than 68 km/h (42 MPH) in steps 4 and 5.
- Do not disconnect the terminal of battery during diagnosis. (If disconnecting the terminal of battery, the data will be cleared.)
- Do not perform the Clear Memory in diagnosis. (If the Clear Memory is performed, the data will be cleared.)

DTC	Item	Condition
P1448	Fuel Tank Sensor Control Valve Range/Performance	—

13.Clear Memory Mode

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

1) On the «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
2) On the «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 the «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 the display screen, turn the ignition switch to OFF, and then turn the Subaru Select Monitor to OFF.

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

2. SUBARU SELECT MONITOR (OBD MODE)

1) On the «Main Menu» display screen, select the {2. Each System Check} and press the [YES] key.
2) On the «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 the «Engine Diagnosis» display screen, select the {OBD System} and press the [YES] key.
5) On the «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 ignition switch to OFF, and then turn the Subaru Select Monitor to OFF.

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

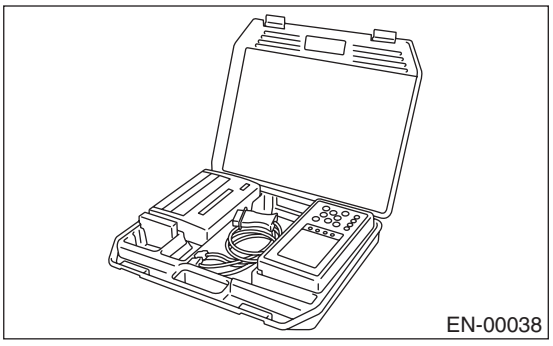
3. GENERAL SCAN TOOL

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

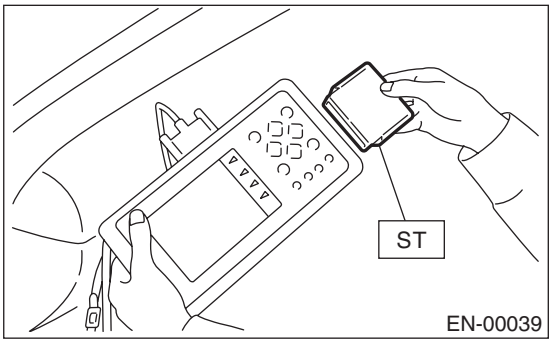
14.Compulsory Valve Operation Check Mode

A: OPERATION

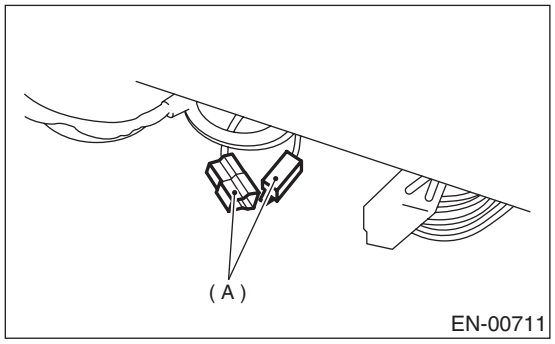
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)-7, PREPARATION TOOL, General Description.>



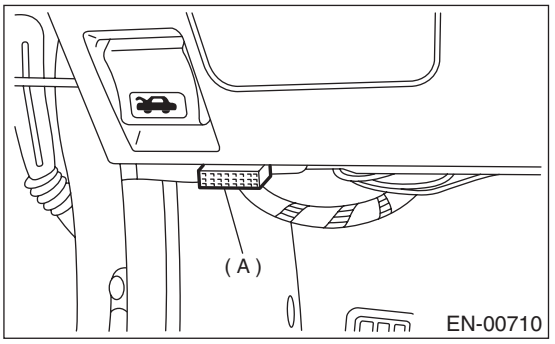
2) Connect the diagnosis cable to Subaru Select Monitor.
3) Insert the cartridge into Subaru Select Monitor. <Ref. to EN(H4DOTC)-7, PREPARATION TOOL, General Description.>



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

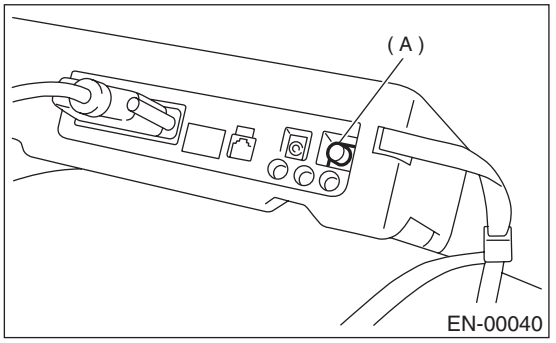


5) Connect the Subaru Select Monitor to data link connector located in the lower portion of instrument panel (on the driver's side).



CAUTION:
Do not connect scan tools except for the Subaru Select Monitor and general scan tool.

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



(A) Power switch

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

• 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 pressure control solenoid valve operation check	PCV Solenoid Valve
Compulsory drain valve operation check	Vent. Control Solenoid Valve
Compulsory fuel tank sensor control valve operation check	Fuel Tank Sensor Control Valve

NOTE:
• The following parts will be displayed but not functional because they are not installed on the vehicle.

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

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

15.Malfunction Indicator Light

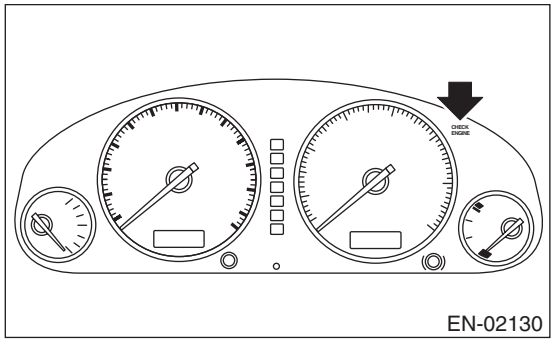
A: PROCEDURE

1. Activation of check malfunction indicator light. <Ref. to EN(H4DOTC)-56, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.>
↓
2. Check that the malfunction indicator light does not come on. <Ref. to EN(H4DOTC)-57, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON., Malfunction Indicator Light.>
↓
3. Check that the malfunction indicator light does not go off. <Ref. to EN(H4DOTC)-59, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF., Malfunction Indicator Light.>
↓
4. Check that the malfunction indicator light does not blink at a cycle of 3 Hz. <Ref. to EN(H4DOTC)-61, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK AT A CYCLE OF 3 HZ., Malfunction Indicator Light.>
↓
5. Check that the malfunction indicator light remains blinking at a cycle of 3 Hz. <Ref. to EN(H4DOTC)-63, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING AT A CYCLE OF 3 HZ., Malfunction Indicator Light.>

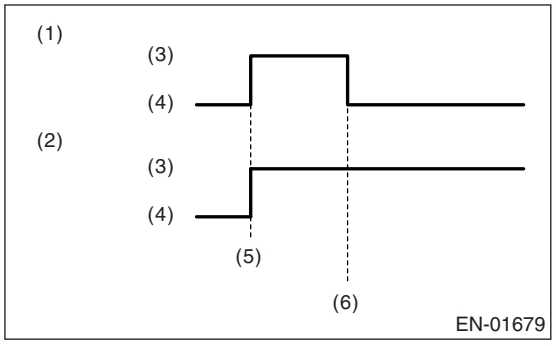
B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

1) When the ignition switch is turned to ON (engine off), the malfunction indicator light 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(H4DOTC)-57, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON., Malfunction Indicator Light.>

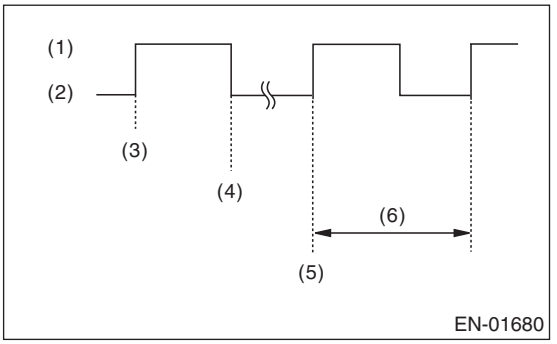


2) After starting the engine, the malfunction indicator light goes out. If it does not, either the engine or the emission control system is malfunctioning.



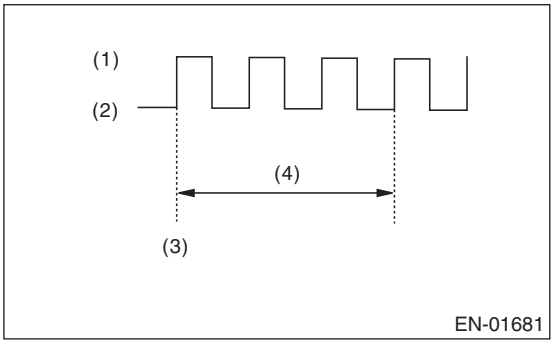
(1) No trouble
(2) Trouble occurs
(3) ON
(4) OFF
(5) Ignition switch ON
(6) Engine start

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

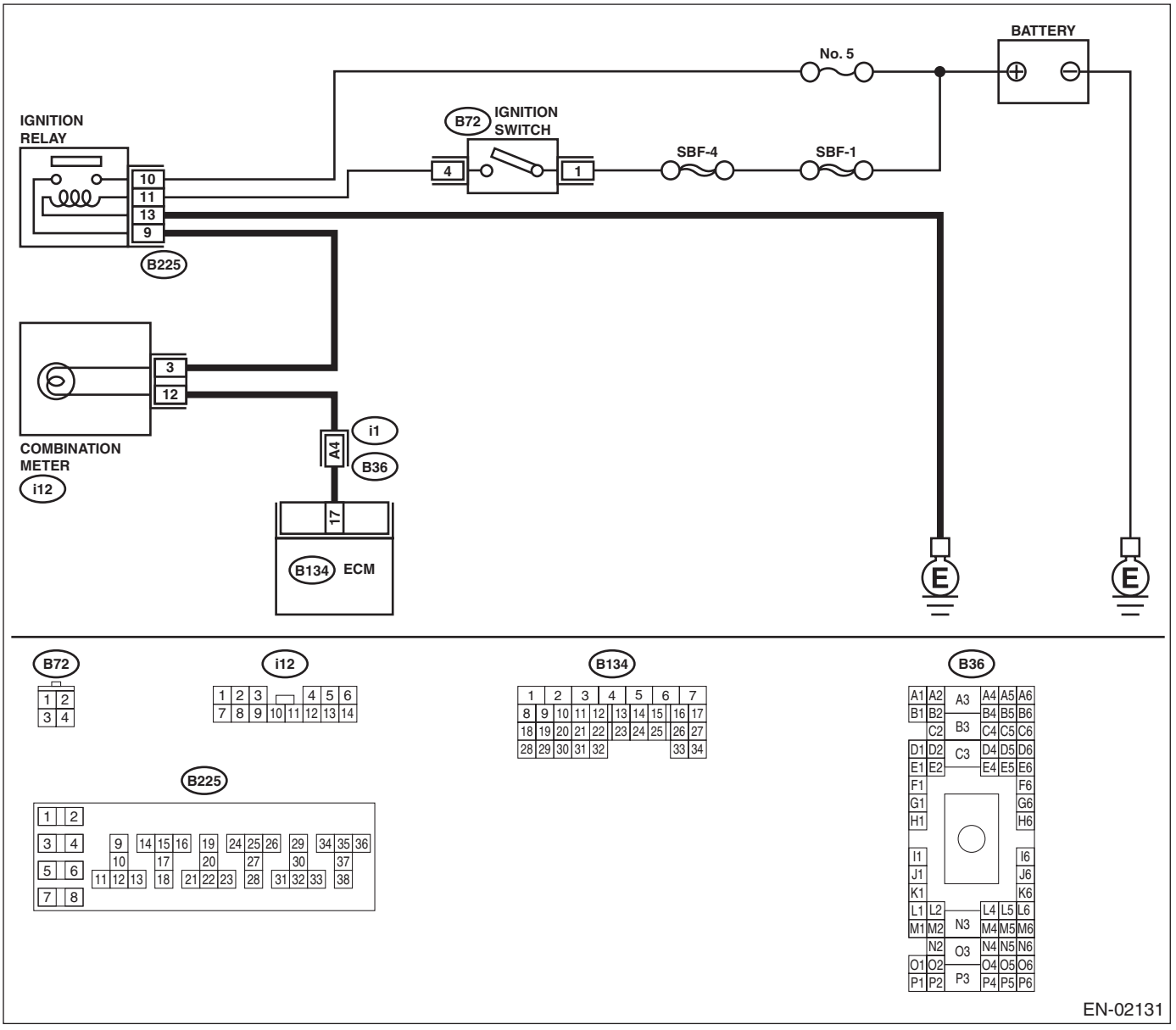
4) When the ignition switch is turned to ON (engine off) or to START with the test mode connector connected, the malfunction indicator light blinks at a cycle of 3 Hz.



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

C: MALFUNCTION INDICATOR LIGHT DOES NOT COME ON.

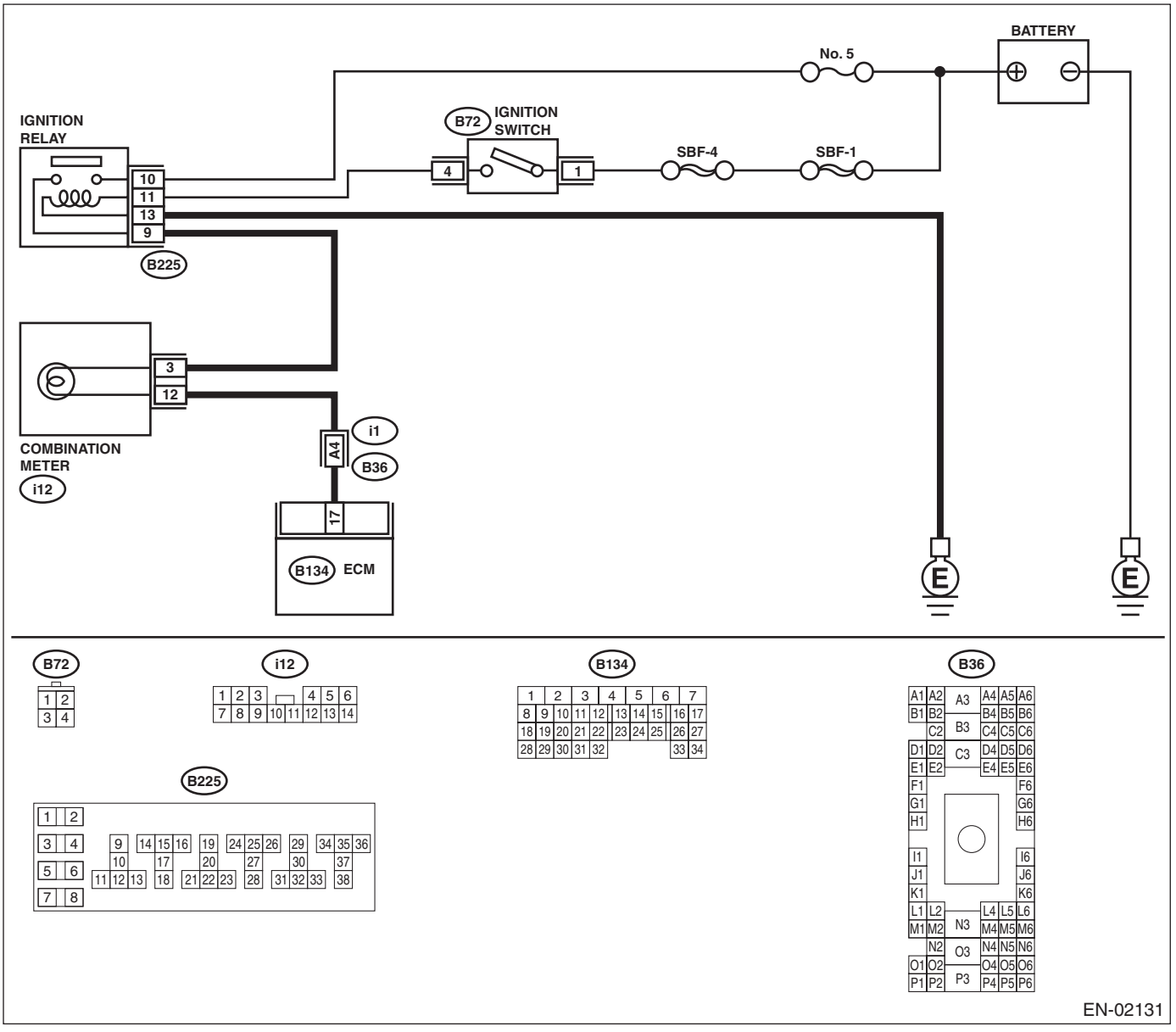
- **DIAGNOSIS:**
  - The malfunction indicator light circuit is shorted.
- **TROUBLE SYMPTOM:**
  - When the ignition switch is turned to ON (engine OFF), malfunction indicator light does not come on.
- **WIRING DIAGRAM:**



	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. 17 (+) — Chassis ground (−):***	Is the measured value less than 1 V?	Go to step **4.**	Go to step **2.**
2	**CHECK POOR CONTACT.**	Does the malfunction indicator light come on when shaking or pulling ECM connector and harness?	Repair the poor contact in ECM connector.	Go to step **3.**
3	**CHECK ECM CONNECTOR.**	Is the ECM connector correctly connected?	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Repair the 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-13, 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. 17 — (i12) No. 12:***	Is the measured value less than 1 Ω?	Go to step **5.**	Repair the 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 the 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*** ***(i12) No. 3 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Replace the combination meter circuit board. <Ref. to IDI-13, Combination Meter Assembly.>	Check the following and repair if necessary. NOTE: • Blown out fuse (No. 5) • Open or short circuit in harness between fuse (No. 5) and battery terminal • Poor contact in ignition switch connector

D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF.

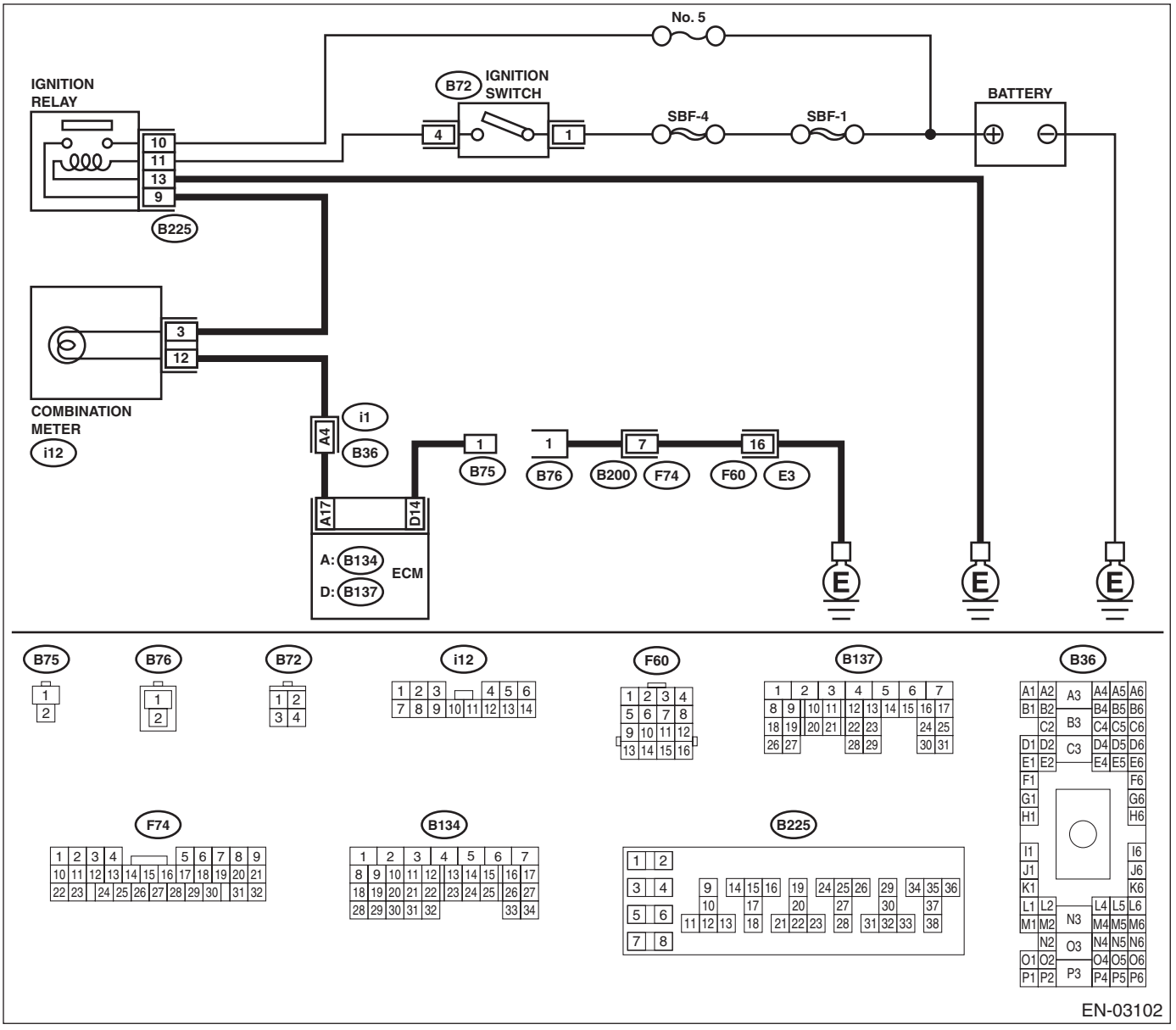
- **DIAGNOSIS:**
  - The malfunction indicator light circuit is shorted.
- **TROUBLE SYMPTOM:**
  - Although malfunction indicator light comes on when engine runs, but DTC is not shown on Subaru Select Monitor or general scan tool display.
- **WIRING DIAGRAM:**



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.	Does the malfunction indicator light come on?	Repair the short circuit in harness between combination meter and ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

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

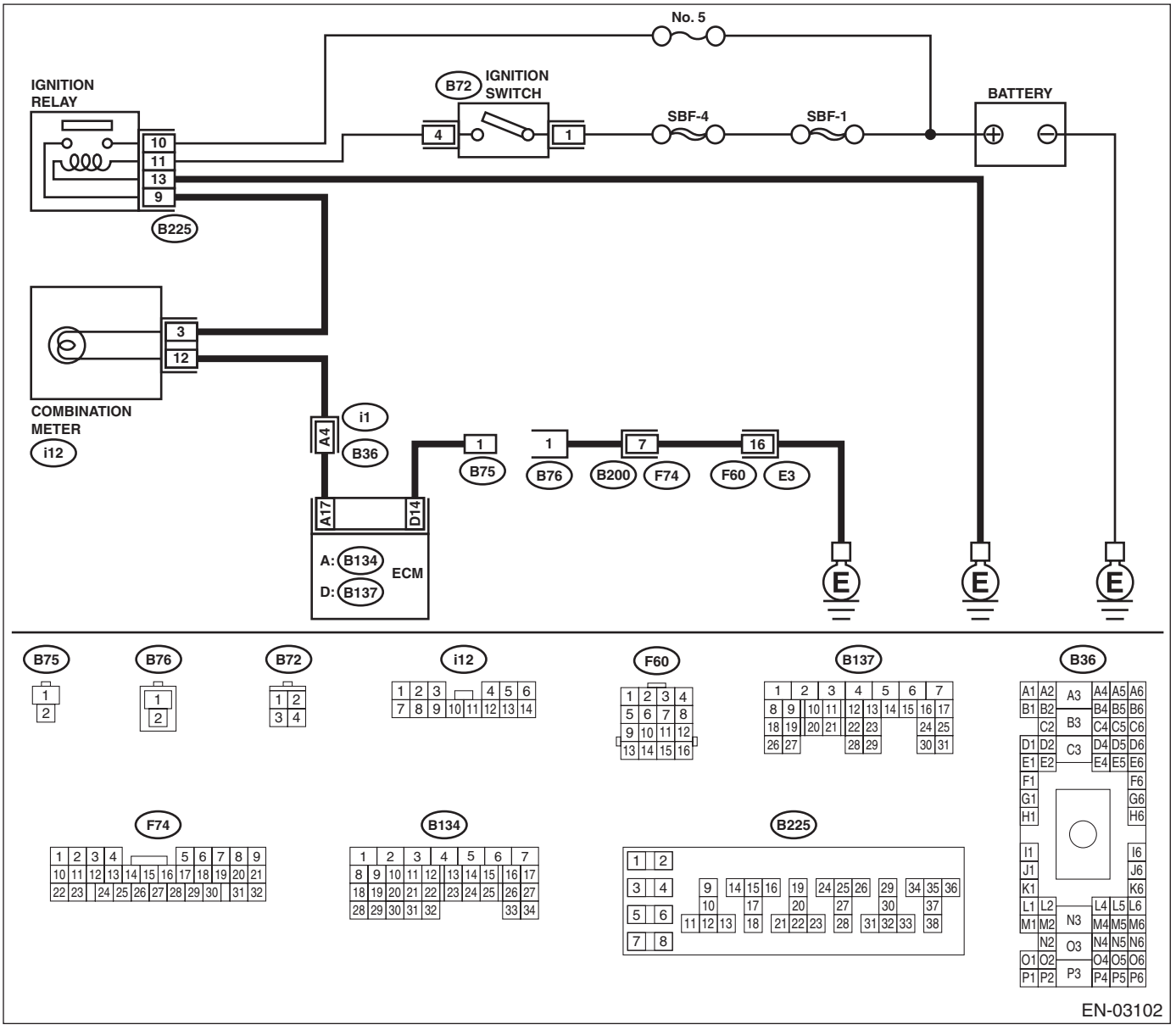
- **DIAGNOSIS:**
  - The malfunction indicator light circuit is open or shorted.
  - Test mode connector circuit is open.
- **TROUBLE SYMPTOM:**
  - During inspection mode, malfunction indicator light does not blink at a cycle of 3 Hz.
- **WIRING DIAGRAM:**



	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)	Does the malfunction indicator light come on?	Go to step **2.**	Repair the malfunction indicator light circuit. <Ref. to EN(H4DOTC)-57, 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.	Does the malfunction indicator light come on?	Repair the 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. ***Connector & terminal*** ***(B76) No. 1 — Chassis ground:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the 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 the 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. ***Connector & terminal*** ***(B137) No. 14 — Chassis ground:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair the 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 the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

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 ignition switch is turned to ON.
- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK TEST MODE CONNECTOR.** 1) Disconnect the test mode connector. 2) Turn the ignition switch to ON.	Does 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*** ***(B137) No. 14 — Chassis ground:***	Is the measured value less than 5 Ω?	Repair the short circuit in harness between ECM and test mode connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

MEMO:

16.Diagnostics for Engine Starting Failure

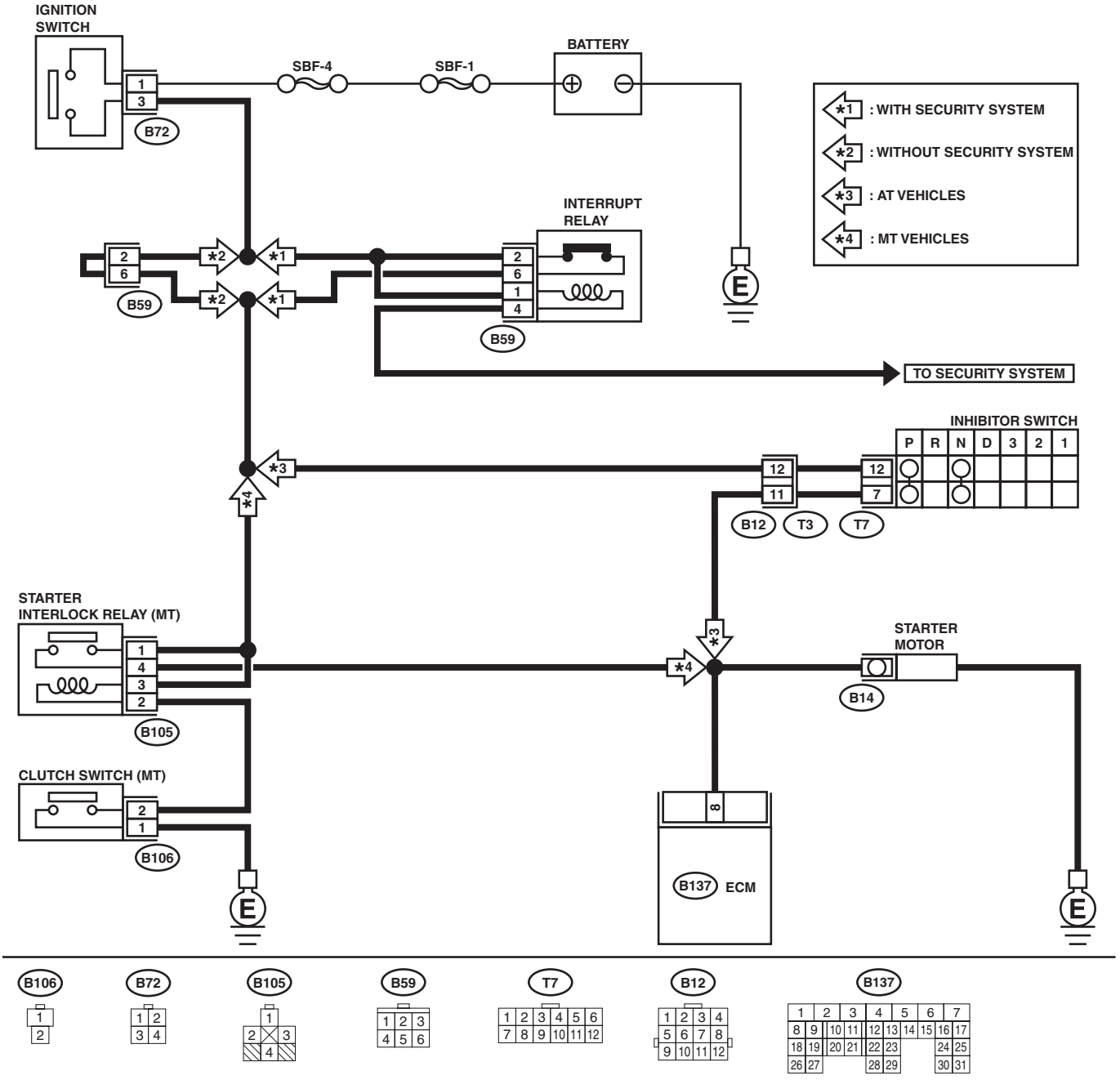
A: PROCEDURE

1. Check the fuel level.
↓
2. Inspection of starter motor circuit. <Ref. to EN(H4DOTC)-67, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ECM power supply and ground line. <Ref. to EN(H4DOTC)-71, CONTROL MODULE POWER SUPPLY AND GROUND LINE, Diagnostics for Engine Starting Failure.>
↓
4. Inspection of ignition control system. <Ref. to EN(H4DOTC)-73, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel pump circuit. <Ref. to EN(H4DOTC)-77, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
6. Inspection of fuel injector circuit. <Ref. to EN(H4DOTC)-79, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



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DIAGNOSTICS FOR ENGINE STARTING FAILURE

	Step	Check	Yes	No
1	**CHECK OPERATION OF STARTER MOTOR.**	Does the starter motor operate?	Go to step **2.**	Go to step **3.**
2	**CHECK DTC.**	Is the DTC displayed? <Ref. to EN(H4DOTC)-38, OPERATION, Read Diagnostic Trouble Code (DTC).>	Using the List of Diagnostic Trouble Code (DTC), check the appropriate DTC. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Repair the poor contact in ECM connector.
3	**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 START. 4) Measure the power supply voltage between starter motor connector terminal and engine ground. ***Connector & terminal*** ***(B14) No. 1 (+) — Engine ground (−):*** NOTE: Depress the clutch pedal.	Is the measured value more than 10 V?	Go to step **4.**	Go to step **5.**
4	**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 measured value less than 5 Ω?	Check the starter motor. <Ref. to SC(H4SO)-7, Starter.>	Repair the open circuit of ground cable.
5	**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 measured value more than 10 V?	Go to step **6.**	Check the following, repair if necessary. • Fuse is blown out. • Open circuit in harness between ignition switch and battery.
6	**CHECK IGNITION SWITCH.** 1) Disconnect the connector from ignition switch. 2) Measure the resistance between ignition switch terminals while turning ignition switch to START. ***Terminals*** ***No. 1 — No. 3:***	Is the measured value less than 5 Ω?	Go to step **7.**	Replace the ignition switch.
7	**CHECK TRANSMISSION TYPE.**	Is the transmission type AT?	Go to step **8.**	Go to step **10.**

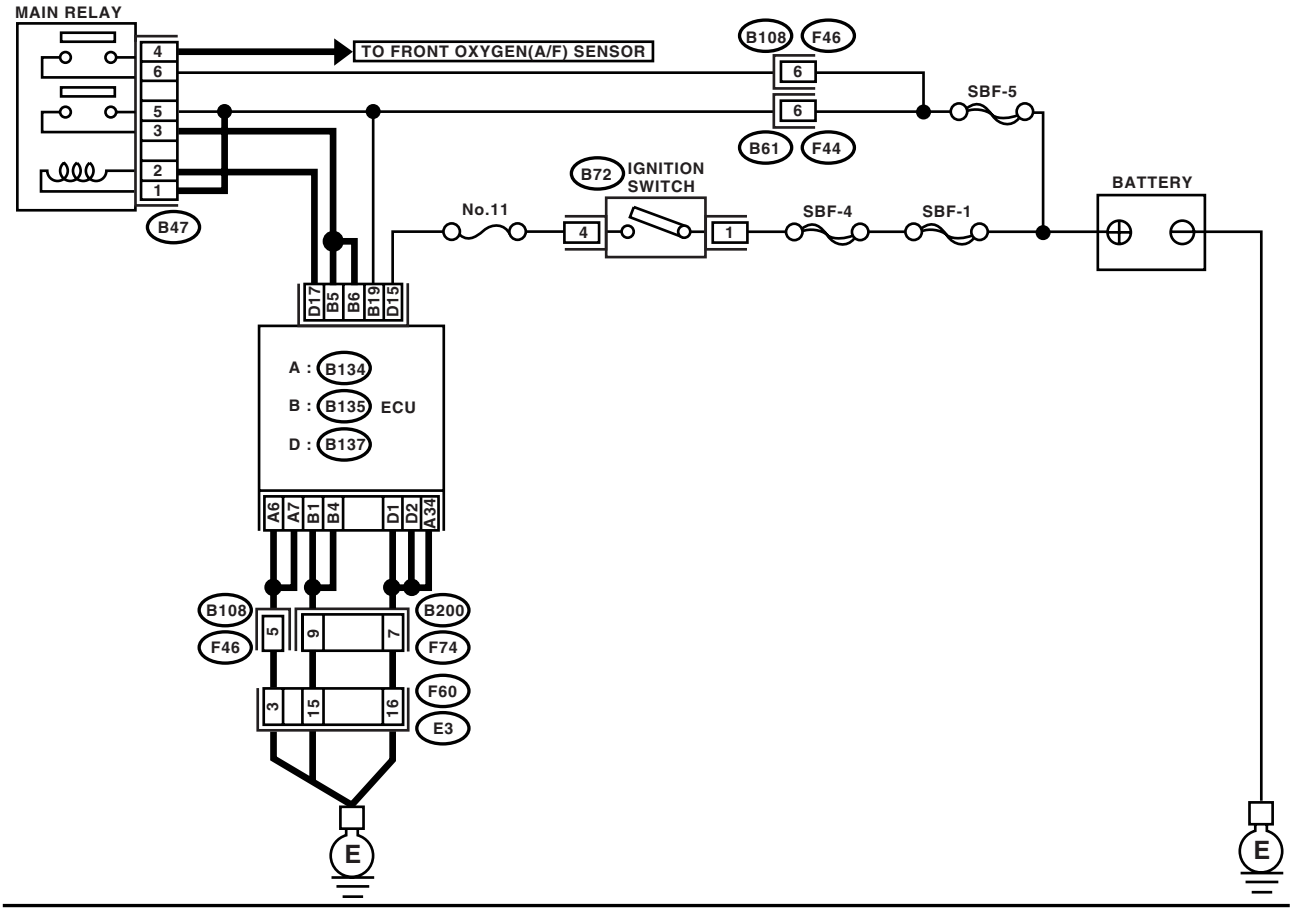
	Step	Check	Yes	No
8	**CHECK INPUT VOLTAGE OF INHIBITOR SWITCH.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from inhibitor switch. 3) Connect the connector to ignition switch. 4) Measure the input voltage between inhibitor switch connector terminal and engine ground while turning ignition switch to ST. ***Connector & terminal*** ***(B12) No. 12 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Go to step **9.**	Repair open or ground short circuit in harness between inhibitor switch and ignition switch. NOTE: Check security system (if equipped). <Ref. to SL-23, Security System.>
9	**CHECK INHIBITOR SWITCH.** 1) Place the selector lever in the "P" or "N" position. 2) Measure the resistance between inhibitor switch terminals. ***Connector & terminal*** ***(T3) No. 11 — No. 12:***	Is the measured value 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-51, REMOVAL, Inhibitor Switch.>
10	**CHECK INPUT VOLTAGE OF STARTER INTERLOCK RELAY.** 1) Turn the 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 START. ***Connector & terminal*** ***(B105) No. 1 (+) — Chassis ground (–):*** ***(B105) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **11.**	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-23, Security System.>
11	**CHECK STARTER INTERLOCK RELAY.** 1) Connect the battery to starter interlock relay terminals No. 2 and No. 3. 2) Measure the resistance between starter interlock relay terminals. ***Terminals*** ***No. 1 — No. 4:***	Is the measured value less than 1 Ω?	Go to step **12.**	Replace the starter interlock relay.
12	**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 measured value less than 5 Ω?	Go to step **13.**	Repair open circuit of ground cable.
13	**CHECK CLUTCH SWITCH.** Measure the resistance between clutch switch terminals while depressing the clutch pedal. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 1 Ω?	Go to step **14.**	Replace the clutch switch. <Ref. to CL-31, Clutch Switch.>
14	**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*** ***(B105) No. 2 — Chassis ground:***	Is the measured value 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.

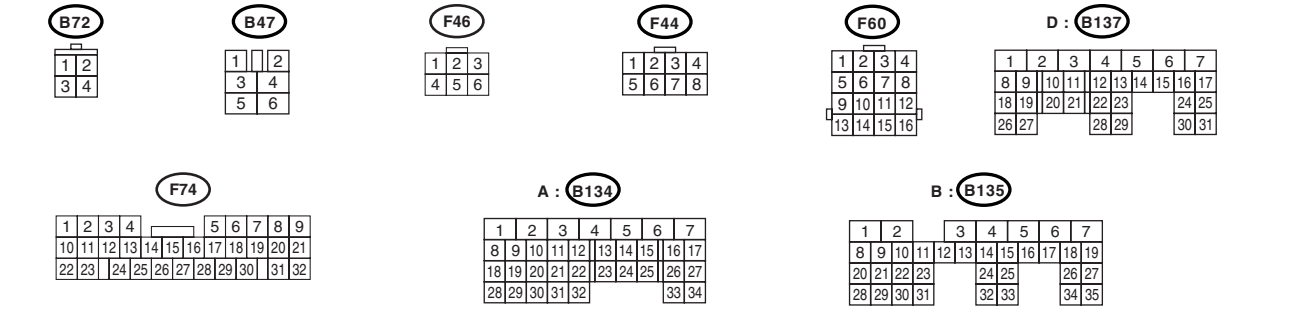
MEMO:

C: CONTROL MODULE POWER SUPPLY AND GROUND LINE

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





EN-02134

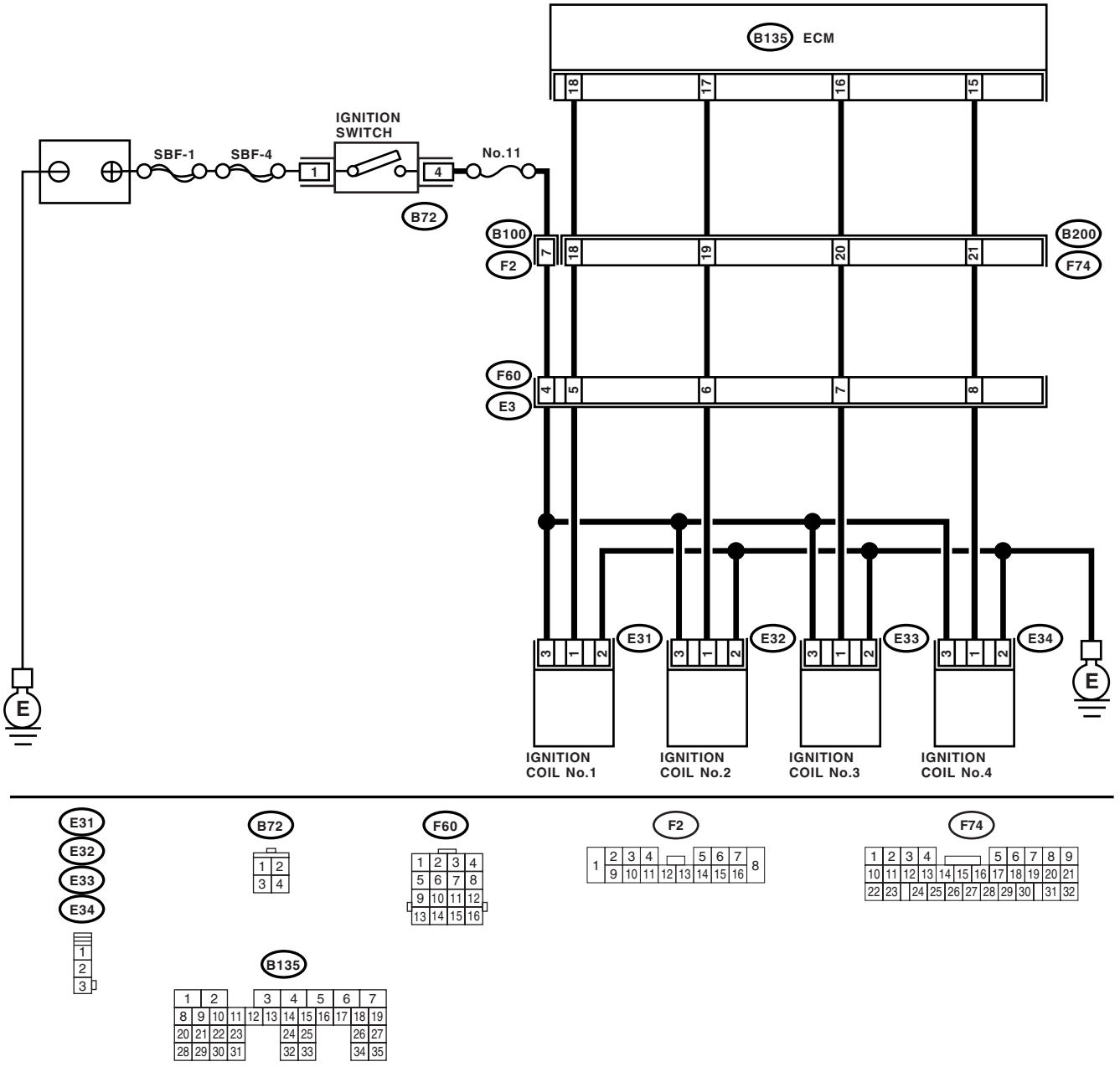
DIAGNOSTICS FOR ENGINE STARTING FAILURE

	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 measured value 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. 6 — Chassis ground:*** ***(B134) No. 7 — Chassis ground:*** ***(B134) No. 34 — Chassis ground:*** ***(B135) No. 1 — Chassis ground:*** ***(B135) No. 4 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 2 — Chassis ground:***	Is the measured value less than 5 Ω?	Go to step **3.**	Repair the 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. 19 (+) — Chassis ground (–):*** ***(B137) No. 15 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **4.**	Repair the open or ground short circuit of power supply circuit.
4	**CHECK INPUT VOLTAGE OF MAIN RELAY.** Measure the voltage between main relay connector and chassis ground. ***Connector & terminal*** ***(B47) No. 1 (+) — Chassis ground (–):*** ***(B47) No. 5 (+) — Chassis ground (–):*** ***(B47) No. 6 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Go to step **5.**	Repair the open or ground short circuit in harness of power supply circuit.
5	**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. 5 (+) — Chassis ground (–):*** ***(B135) No. 6 (+) — Chassis ground (–):*** ***(B137) No. 17 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Check the ignition control system. <Ref. to EN(H4DOTC)-73, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair the 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-03194

DIAGNOSTICS FOR ENGINE STARTING FAILURE

	Step	Check	Yes	No
1	**CHECK SPARK PLUG CONDITION.** 1) Remove the spark plug. <Ref. to IG(H4DOTC)-6, INSTALLATION, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG(H4DOTC)-6, INSPECTION, Spark Plug.>	Is the spark plug's status OK?	Go to step **2.**	Replace the spark plug.
2	**CHECK IGNITION SYSTEM FOR SPARKS.** 1) Connect the spark plug to ignition coil. 2) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.> 3) Contact the spark plug's thread portion on engine. 4) While opening the throttle valve fully, crank engine to check that spark occurs at each cylinder.	Does spark occur at each cylinder?	Check the fuel pump system. <Ref. to EN(H4DOTC)-77, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step **3.**
3	**CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL & IGNITOR ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition coil & ignitor assembly. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between ignition coil & ignitor assembly connector and engine ground. ***Connector & terminal*** ***(E31) No. 3 (+) — Engine ground (–):*** ***(E32) No. 3 (+) — Engine ground (–):*** ***(E33) No. 3 (+) — Engine ground (–):*** ***(E34) No. 3 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Go to step **4.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor assembly, and ignition switch connector • Poor contact in coupling connectors
4	**CHECK HARNESS OF IGNITION COIL & IGNITOR ASSEMBLY GROUND CIRCUIT.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between ignition coil & ignitor assembly connector and engine ground. ***Connector & terminal*** ***(E31) No. 2 — Engine ground:*** ***(E32) No. 2 — Engine ground:*** ***(E33) No. 2 — Engine ground:*** ***(E34) No. 2 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor assembly connector and engine grounding terminal
5	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from ignition coil & ignitor assembly. 4) Measure the resistance of harness between ECM and ignition coil & ignitor assembly connector. ***Connector & terminal*** ***(B135) No. 15 — (E34) No. 1:*** ***(B135) No. 16 — (E33) No. 1:*** ***(B135) No. 17 — (E32) No. 1:*** ***(B135) No. 18 — (E31) No. 1:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and ignition coil & ignitor assembly connector • Poor contact in coupling connector

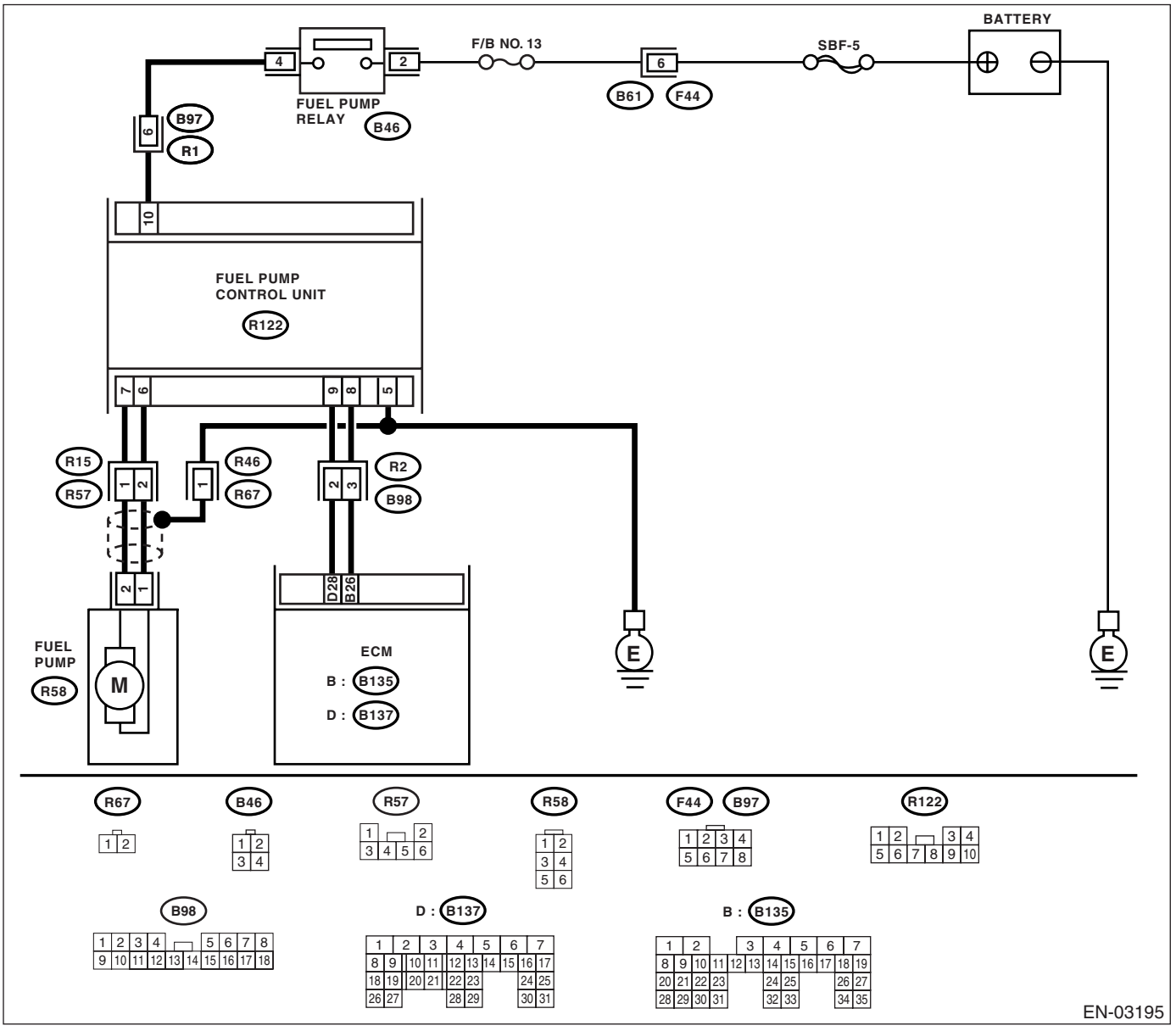
	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSEMBLY CONNECTOR.** Measure the resistance of harness between ECM and engine ground. ***Connector & terminal:*** ***(B135) No. 15 — Engine ground:*** ***(B135) No. 16 — Engine ground:*** ***(B135) No. 17 — Engine ground:*** ***(B135) No. 18 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **7.**	Repair the ground short circuit in harness between ECM and ignition coil & ignitor assembly connector.
7	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ignition coil and ignitor assembly.

MEMO:

E: FUEL PUMP CIRCUIT

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**

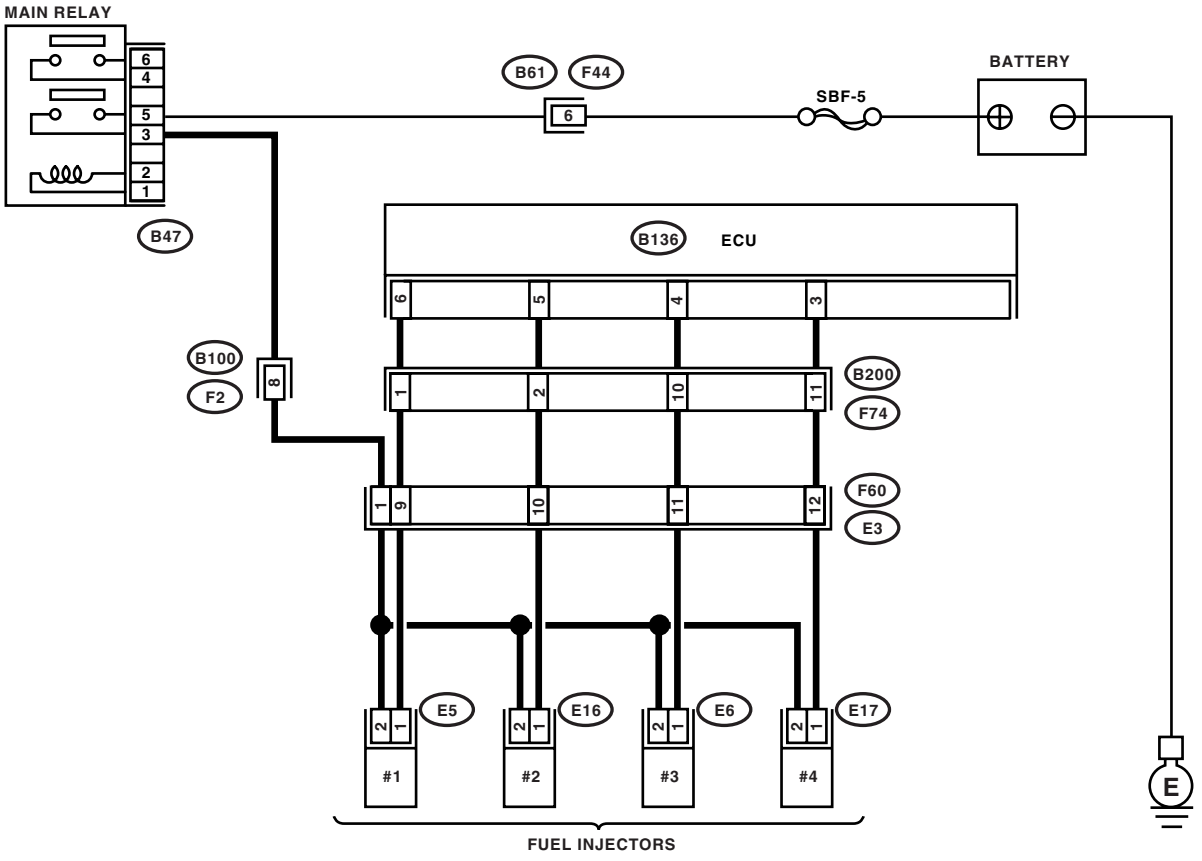


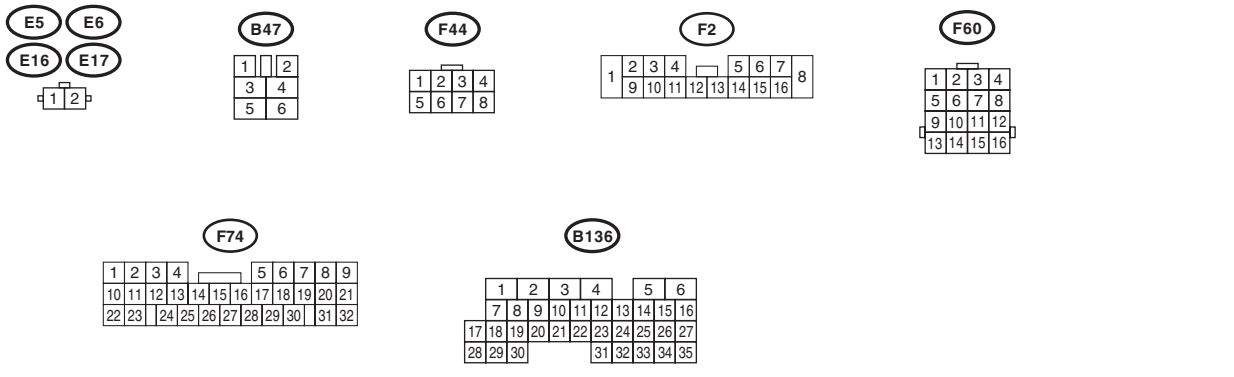
	Step	Check	Yes	No
1	**CHECK OPERATING SOUND OF FUEL PUMP.** Make sure that the fuel pump is in operation for 2 seconds when turning ignition switch to ON. NOTE: Fuel pump operation check can also be executed using the Subaru Select Monitor. For the procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4DOTC)-53, Compulsory Valve Operation Check Mode.>	Does the fuel pump produce “operating” sound?	Check the fuel injector circuit. <Ref. to EN(H4DOTC)-79, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>	Display the DTC. <Ref. to EN(H4DOTC)-38, OPERATION, Read Diagnostic Trouble Code (DTC).>

F: FUEL INJECTOR CIRCUIT

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





EN-02137

DIAGNOSTICS FOR ENGINE STARTING FAILURE

	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 injector for this check.	Does the fuel injector emit “operating” sound?	Check the fuel pressure. <Ref. to ME(H4DOTC)-29, 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 measured value more than 10 V?	Go to step **3.**	Repair the 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 • 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*** ***(B136) No. 6 — (E5) No. 1:*** ***(B136) No. 5 — (E16) No. 1:*** ***(B136) No. 4 — (E6) No. 1:*** ***(B136) No. 3 — (E17) No. 1:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the 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*** ***(B136) No. 6 — Chassis ground:*** ***(B136) No. 5 — Chassis ground:*** ***(B136) No. 4 — Chassis ground:*** ***(B136) No. 3 — Chassis ground:***	Is the measured value less than 1 Ω?	Repair the ground short circuit in harness between ECM and fuel injector connector.	Go to step **5.**
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 measured value within 5 to 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 the poor contact in ECM connector.	Inspection using “General Diagnostic Table”. <Ref. to EN(H4DOTC)-449, INSPECTION, General Diagnostic Table.>

17.List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Index
P0011	A Camshaft Position-Timing Over-Advanced or System Performance (Bank 1)	<Ref. to EN(H4DOTC)-89, DTC P0011 — "A" CAMSHAFT POSITION-TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0021	A Camshaft Position-Timing Over-Advanced or System Performance (Bank 2)	<Ref. to EN(H4DOTC)-90, DTC P0021 — "A" CAMSHAFT POSITION-TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)-91, 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(H4DOTC)-93, 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(H4DOTC)-97, 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(H4DOTC)-99, 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(H4DOTC)-103, DTC P0038 — HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0068	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	<Ref. to EN(H4DOTC)-105, DTC P0068 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to EN(H4DOTC)-107, DTC P0101 — MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to EN(H4DOTC)-109, DTC P0102 — MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to EN(H4DOTC)-113, DTC P0103 — MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to EN(H4DOTC)-115, 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(H4DOTC)-117, 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(H4DOTC)-119, 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(H4DOTC)-121, 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(H4DOTC)-123, 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(H4DOTC)-127, 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(H4DOTC)-129, DTC P0118 — ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Index
P0122	Throttle/Pedal Position Sensor/ Switch “A” Circuit Low Input	<Ref. to EN(H4DOTC)-133, DTC P0122 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0123	Throttle/Pedal Position Sensor/ Switch “A” Circuit High Input	<Ref. to EN(H4DOTC)-137, 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(H4DOTC)-141, DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0126	Insufficient Coolant Temperature for Stable Operation	<Ref. to EN(H4DOTC)-143, DTC P0126 — INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to EN(H4DOTC)-146, DTC P0128 — COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O_2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)-147, DTC P0131 — O2 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(H4DOTC)-149, DTC P0132 — O2 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(H4DOTC)-151, DTC P0133 — O2 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(H4DOTC)-153, DTC P0134 — O2 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(H4DOTC)-155, DTC P0137 — O2 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(H4DOTC)-159, DTC P0138 — O2 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(H4DOTC)-163, DTC P0139 — O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System too Lean (Bank 1)	<Ref. to EN(H4DOTC)-165, DTC P0171 — SYSTEM TOO LEAN (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0172	System too Rich (Bank 1)	<Ref. to EN(H4DOTC)-166, 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(H4DOTC)-169, 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(H4DOTC)-171, 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(H4DOTC)-173, DTC P0183 — FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0222	Throttle/Pedal Position Sensor/ Switch “B” Circuit Low Input	<Ref. to EN(H4DOTC)-177, DTC P0222 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0223	Throttle/Pedal Position Sensor/ Switch “B” Circuit High Input	<Ref. to EN(H4DOTC)-181, DTC P0223 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Index
P0230	Fuel Pump Primary Circuit	<Ref. to EN(H4DOTC)-185, DTC P0230 — FUEL PUMP PRIMARY CIRCUIT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0244	Turbo/Super Charger Wastegate Solenoid “A” Range/Performance	<Ref. to EN(H4DOTC)-189, DTC P0244 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0245	Turbo/Super Charger Wastegate Solenoid “A” Low	<Ref. to EN(H4DOTC)-191, DTC P0245 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0246	Turbo/Super Charger Wastegate Solenoid “A” High	<Ref. to EN(H4DOTC)-193, DTC P0246 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder 1 misfire detected	<Ref. to EN(H4DOTC)-196, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 misfire detected	<Ref. to EN(H4DOTC)-196, DTC P0302 — CYLINDER 2 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0303	Cylinder 3 misfire detected	<Ref. to EN(H4DOTC)-196, DTC P0303 — CYLINDER 3 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 misfire detected	<Ref. to EN(H4DOTC)-197, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	<Ref. to EN(H4DOTC)-203, 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(H4DOTC)-205, 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(H4DOTC)-207, 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(H4DOTC)-209, 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(H4DOTC)-211, DTC P0340 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	<Ref. to EN(H4DOTC)-213, DTC P0345 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to EN(H4DOTC)-215, 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(H4DOTC)-219, 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(H4DOTC)-223, 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(H4DOTC)-227, 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(H4DOTC)-229, 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(H4DOTC)-231, DTC P0452 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Index
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to EN(H4DOTC)-235, 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(H4DOTC)-239, 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(H4DOTC)-243, 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(H4DOTC)-247, 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(H4DOTC)-249, 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(H4DOTC)-251, 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(H4DOTC)-253, DTC P0462 — FUEL LEVEL SENSOR CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0463	Fuel Level Sensor Circuit High Input	<Ref. to EN(H4DOTC)-257, DTC P0463 — FUEL LEVEL SENSOR CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to EN(H4DOTC)-261, DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0483	Cooling Fan Rationality Check	<Ref. to EN(H4DOTC)-263, DTC P0483 — COOLING FAN RATIONALITY CHECK —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0502	Vehicle Speed Sensor Circuit Low Input	<Ref. to EN(H4DOTC)-267, 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(H4DOTC)-269, 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(H4DOTC)-271, 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(H4DOTC)-275, DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter Request Circuit	<Ref. to EN(H4DOTC)-279, DTC P0512 — STARTER REQUEST CIRCUIT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0519	Idle Control System Malfunction (Fail-Safe)	<Ref. to EN(H4DOTC)-283, DTC P0519 — IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0545	Exhaust Gas Temperature Sensor Circuit Low-BANK 1	<Ref. to EN(H4DOTC)-287, DTC P0545 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW-BANK 1 —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0546	Exhaust Gas Temperature Sensor Circuit High-BANK 1	<Ref. to EN(H4DOTC)-289, DTC P0546 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH-BANK 1 —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0600	Improper CAN Communication	<Ref. to EN(H4DOTC)-293, DTC P0600 — CAN COMMUNICATION CIRCUIT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to EN(H4DOTC)-295, DTC P0604 — INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Index
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to EN(H4DOTC)-298, DTC P0605 — INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0607	Control Module Performance	<Ref. to EN(H4DOTC)-299, DTC P0607 — CONTROL MODULE PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0638	Throttle Actuator Control Range/Performance (Bank 1)	<Ref. to EN(H4DOTC)-302, DTC P0638 — THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0691	Cooling Fan 1 Control Circuit Low	<Ref. to EN(H4DOTC)-303, 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(H4DOTC)-307, DTC P0692 — COOLING FAN 1 CONTROL CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0700	Request AT MIL ON	<Ref. to EN(H4DOTC)-310, DTC P0700 — AT MIL LIGHT UP REQUEST —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Neutral Switch Input Circuit Low	<Ref. to EN(H4DOTC)-311, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> or <Ref. to EN(H4DOTC)-313, 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(H4DOTC)-315, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> or <Ref. to EN(H4DOTC)-319, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1152	O_2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1)	<Ref. to EN(H4DOTC)-321, DTC P1152 — O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1153	O_2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1)	<Ref. to EN(H4DOTC)-323, DTC P1153 — O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1160	Return Spring Failure	<Ref. to EN(H4DOTC)-326, DTC P1160 — RETURN SPRING FAILURE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1301	Misfire Detected (High Temperature Exhaust Gas)	<Ref. to EN(H4DOTC)-327, DTC P1301 — MISFIRE DETECTED (HIGH TEMPERATURE EXHAUST GAS) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1312	Exhaust Gas Temperature Sensor Function	<Ref. to EN(H4DOTC)-329, DTC P1312 — EXHAUST GAS TEMPERATURE SENSOR MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to EN(H4DOTC)-331, DTC P1400 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to EN(H4DOTC)-335, 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(H4DOTC)-337, 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(H4DOTC)-339, 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(H4DOTC)-343, DTC P1447 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1448	Fuel Tank Sensor Control Valve Range/Performance	<Ref. to EN(H4DOTC)-345, DTC P1448 — FUEL TANK SENSOR CONTROL VALVE RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Index
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	<Ref. to EN(H4DOTC)-347, DTC P1491 — POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1518	Starter Switch Circuit Low Input	<Ref. to EN(H4DOTC)-349, DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1544	Exhaust Gas Temperature Too High	<Ref. to EN(H4DOTC)-353, DTC P1544 — EXHAUST GAS TEMPERATURE TOO HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-Up Voltage Circuit Malfunction	<Ref. to EN(H4DOTC)-355, DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2004	Tumble Generated Valve System 1 (Valve Open)	<Ref. to EN(H4DOTC)-359, DTC P2004 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE OPEN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2005	Tumble Generated Valve System 2 (Valve Open)	<Ref. to EN(H4DOTC)-360, DTC P2005 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE OPEN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2006	Tumble Generated Valve System 1 (Valve Close)	<Ref. to EN(H4DOTC)-361, DTC P2006 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE CLOSE) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2007	Tumble Generated Valve System 2 (Valve Close)	<Ref. to EN(H4DOTC)-362, DTC P2007 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE CLOSE) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2008	Tumble Generated Valve Signal 1 Circuit Malfunction (Open)	<Ref. to EN(H4DOTC)-363, DTC P2008 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (OPEN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2009	Tumble Generated Valve Signal 1 Circuit Malfunction (Short)	<Ref. to EN(H4DOTC)-365, DTC P2009 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (SHORT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2011	Tumble Generated Valve Signal 2 Circuit Malfunction (Open)	<Ref. to EN(H4DOTC)-367, DTC P2011 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (OPEN) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2012	Tumble Generated Valve Signal 2 Circuit Malfunction (Short)	<Ref. to EN(H4DOTC)-369, DTC P2012 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (SHORT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2016	Tumble Generated Valve Position Sensor 1 Circuit Low	<Ref. to EN(H4DOTC)-371, DTC P2016 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2017	Tumble Generated Valve Position Sensor 1 Circuit High	<Ref. to EN(H4DOTC)-375, DTC P2017 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2021	Tumble Generated Valve Position Sensor 2 Circuit Low	<Ref. to EN(H4DOTC)-377, DTC P2021 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2022	Tumble Generated Valve Position Sensor 2 Circuit High	<Ref. to EN(H4DOTC)-381, DTC P2022 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2088	OCV Solenoid Valve Signal A Circuit Open (Bank 1)	<Ref. to EN(H4DOTC)-383, DTC P2088 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2089	OCV Solenoid Valve Signal A Circuit Short (Bank 1)	<Ref. to EN(H4DOTC)-385, DTC P2089 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2092	OCV Solenoid Valve Signal A Circuit Open (Bank 2)	<Ref. to EN(H4DOTC)-387, DTC P2092 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Index
P2093	OCV Solenoid Valve Signal A Circuit Short (Bank 2)	<Ref. to EN(H4DOTC)-389, DTC P2093 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 2) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to EN(H4DOTC)-391, 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(H4DOTC)-397, DTC P2097 — POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1 —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to EN(H4DOTC)-403, DTC P2101 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to EN(H4DOTC)-411, DTC P2102 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to EN(H4DOTC)-415, DTC P2103 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2109	Throttle/Pedal Position Sensor A Minimum Stop Performance	<Ref. to EN(H4DOTC)-418, DTC P2109 — THROTTLE/PEDAL POSITION SENSOR A MINIMUM STOP PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2122	Throttle/Pedal Position Sensor/ Switch “D” Circuit Low Input	<Ref. to EN(H4DOTC)-419, DTC P2122 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2123	Throttle/Pedal Position Sensor/ Switch “D” Circuit High Input	<Ref. to EN(H4DOTC)-423, DTC P2123 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2127	Throttle/Pedal Position Sensor/ Switch “E” Circuit Low Input	<Ref. to EN(H4DOTC)-427, DTC P2127 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2128	Throttle/Pedal Position Sensor/ Switch “E” Circuit High Input	<Ref. to EN(H4DOTC)-431, DTC P2128 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGHT INPUT —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2135	Throttle/Pedal Position Sensor/ Switch “A”/“B” Voltage Rationality	<Ref. to EN(H4DOTC)-435, DTC P2135 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE RATIONALITY —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2138	Throttle/Pedal Position Sensor/ Switch “D”/“E” Voltage Rationality	<Ref. to EN(H4DOTC)-441, DTC P2138 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE RATIONALITY —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2227	Atmospheric Pressure Sensor Circuit Range/Performance	<Ref. to EN(H4DOTC)-446, DTC P2227 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2228	Atmospheric Pressure Sensor Circuit Malfunction (Low Input)	<Ref. to EN(H4DOTC)-447, DTC P2228 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2229	Atmospheric Pressure Sensor Circuit Malfunction (High Input)	<Ref. to EN(H4DOTC)-448, DTC P2229 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

MEMO:

18.Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: DTC P0011 — "A" CAMSHAFT POSITION-TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Erroneous idling

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, 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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Inspect the advance angle and OCV duty output using Subaru Select Monitor and general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the advance angle more than approx. 0°C and the OCV duty output more than approx. 10%?	Inspect the following items and repair or replace if necessary. • Engine oil (amount, contamination) • Oil pipe (clog) • OCV (clog or contamination in oil passage, settling at spring, stuck at valve) • Intake camshaft (sludge, damage at camshaft) • Timing belt (timing mark aligning)	A temporary malfunction. Conduct the following to clean the oil passage. Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil.

B: DTC P0021 — "A" CAMSHAFT POSITION-TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Erroneous idling

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

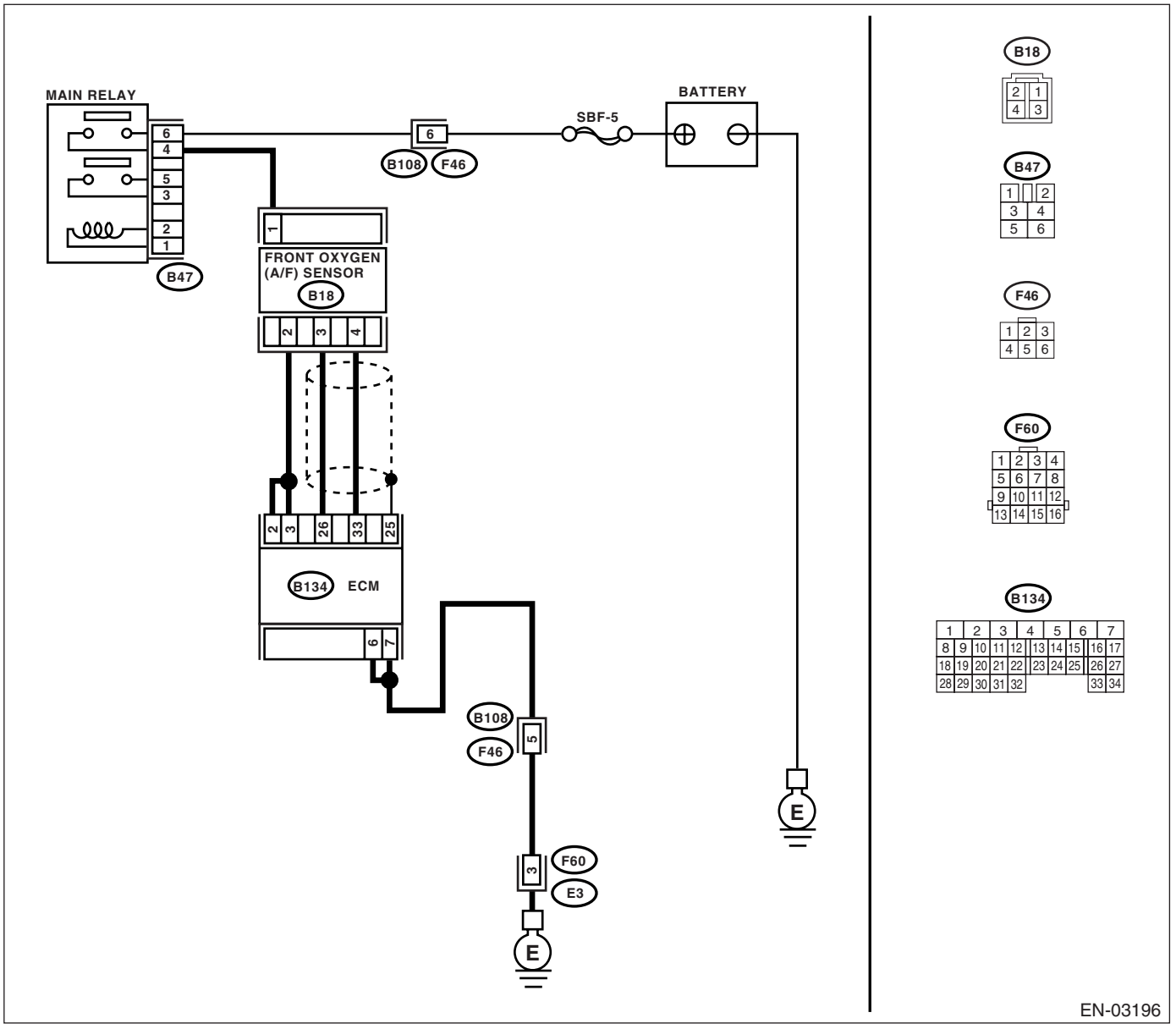
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Inspect the advance angle and OCV duty output using Subaru Select Monitor and general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the advance angle more than approx. 0°C and the OCV duty output more than approx. 10%?	Inspect the following items and repair or replace if necessary. • Engine oil (amount, contamination) • Oil pipe (clog) • OCV (clog or contamination in oil passage, settling at spring, stuck at valve) • Intake camshaft (sludge, damage at camshaft) • Timing belt (timing mark aligning)	A temporary malfunction. Conduct the following to clean the oil passage. Replace the engine oil and idle the engine for 5 minutes, then replace the oil filter and engine oil.

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-13, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



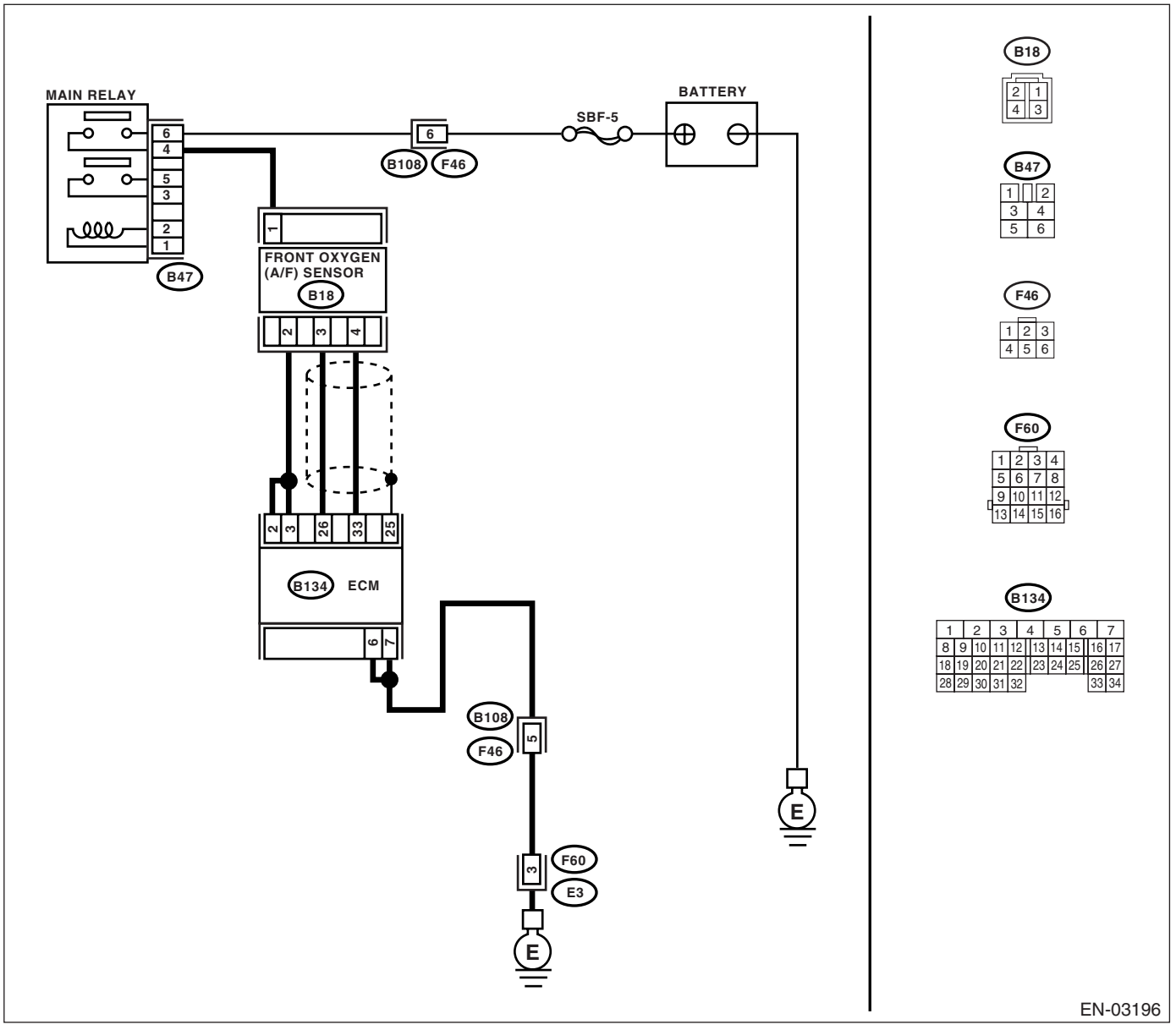
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Start the engine and warm-up engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 4) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B134) No. 2 — (B18) No. 2:*** ***(B134) No. 3 — (B18) No. 2:***	Is the measured value 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*** ***(B134) No. 26 — (B18) No. 3:*** ***(B134) No. 33 — (B18) No. 4:***	Is the measured value less than 1 Ω?	Go to step **3.**	Repair the open circuit in harness between ECM 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. 1:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open circuit in harness between ECM 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. 1 — No. 2:***	Is the measured value less than 5 Ω?	Go to step **5.**	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, 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(H4DOTC)-38, Front Oxygen (A/F) Sensor.>

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

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-15, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**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. 1 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Go to step **2.**	Repair the 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
2	**CHECK GROUND CIRCUIT OF ECM.** Measure the resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 6 — Chassis ground:*** ***(B134) No. 7 — Chassis ground:***	Is the measured value less than 5 Ω?	Go to step **3.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine ground cable • Poor contact in ECM connector • Poor contact in coupling connector
3	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of front oxygen (A/F) sensor heater current using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •OBD-II scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 0.2 A?	Repair the 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 **4.**
4	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Start and idle the engine. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 2 (+) — Chassis ground (−):*** ***(B134) No. 3 (+) — Chassis ground (−):***	Is the measured value less than 1 V?	Go to step **6.**	Go to step **5.**
5	**CHECK OUTPUT SIGNAL FROM ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 2 (+) — Chassis ground (−):*** ***(B134) No. 3 (+) — Chassis ground (−):***	Shake the ECM harness and connector, while monitoring value of voltage meter. Does the voltage change?	Repair the poor contact in ECM connector.	Go to step **6.**

	Step	Check	Yes	No
6	**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. 1 — No. 2:***	Is the measured value less than 10 Ω?	Repair the 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(H4DOTC)-38, Front Oxygen (A/F) Sensor.>

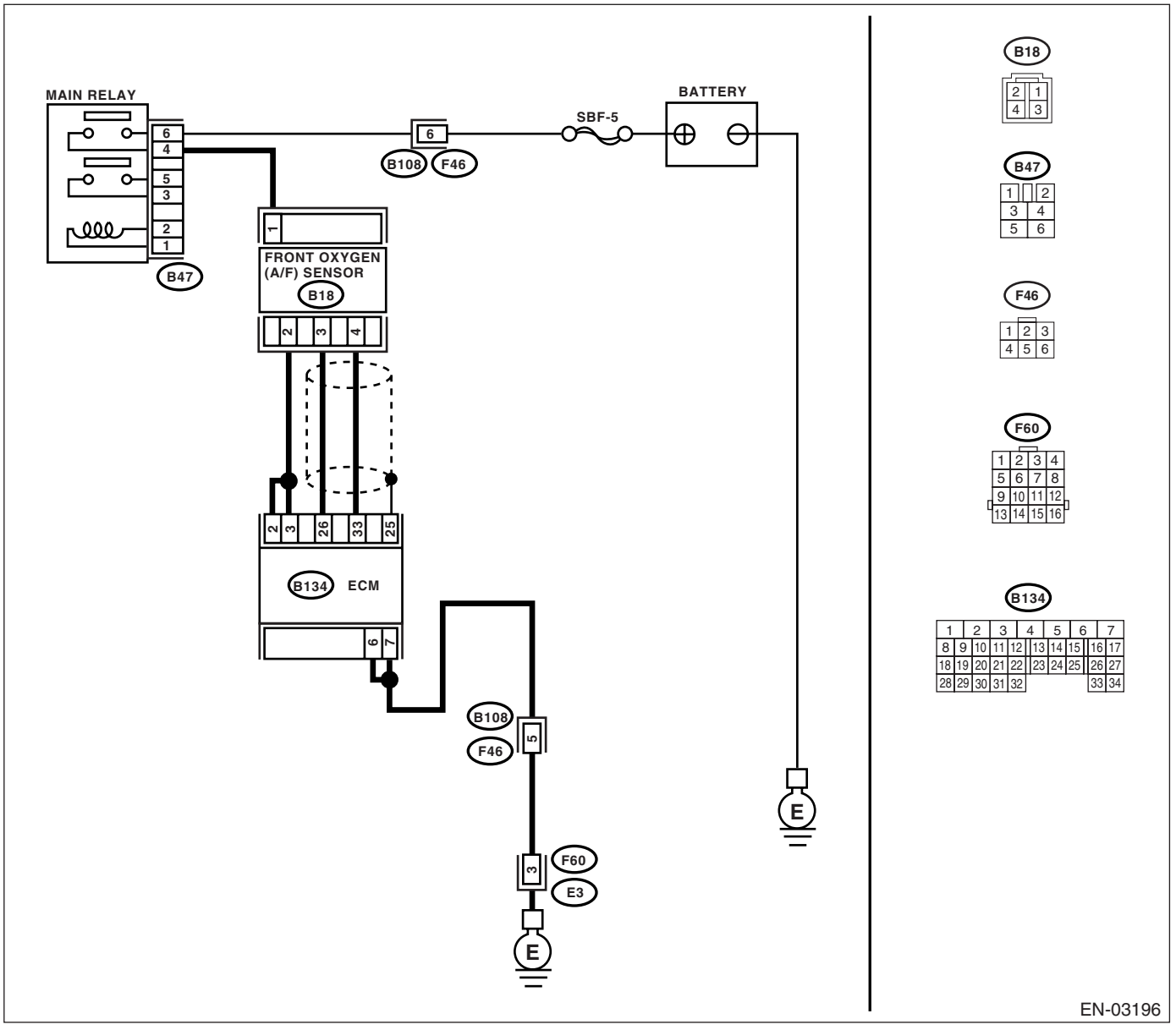
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-17, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



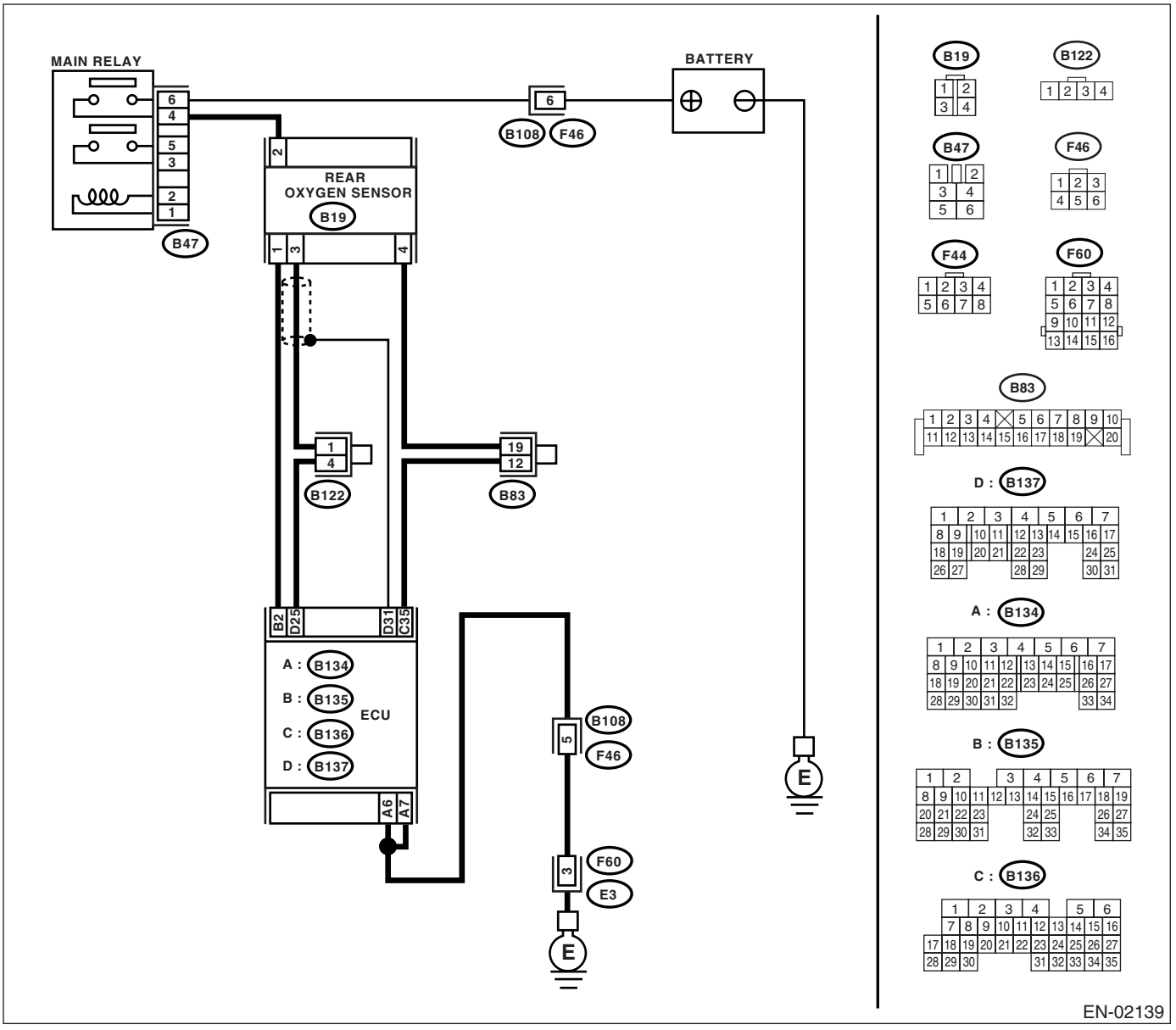
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 2 (+) — Chassis ground (–):*** ***(B134) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 8 V?	Go to step **3.**	Go to step **2.**
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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 2.3 A?	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	END
3	**CHECK OUTPUT SIGNAL FROM ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 2 (+) — Chassis ground (–):*** ***(B134) No. 3 (+) — Chassis ground (–):***	Shake the ECM harness and connector, while monitoring value of voltage meter. Does the voltage change?	Repair the battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.	END

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

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-19, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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*** ***(B134) No. 6 — Chassis ground:*** ***(B134) No. 7 — Chassis ground:***	Is the measured value less than 5 Ω?	Go to step **2.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and engine ground cable • 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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •OBD-II scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value 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*** ***(B135) No. 2 (+) — Chassis ground (–):***	Is the measured value 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*** ***(B135) No. 2 (+) — Chassis ground (–):***	Shake the ECM harness and connector, while monitoring value of voltage meter. Does the voltage change?	Repair the poor contact in ECM connector.	Go to step **5.**
5	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 2 (+) — Chassis ground (–):***	Is the measured value less than 1 V?	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Repair the battery short circuit in harness between ECM and rear oxygen sensor connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

	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. 2 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **7.**	Repair the 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 measured value less than 30 Ω?	Repair the 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(H4DOTC)-40, Rear Oxygen Sensor.>

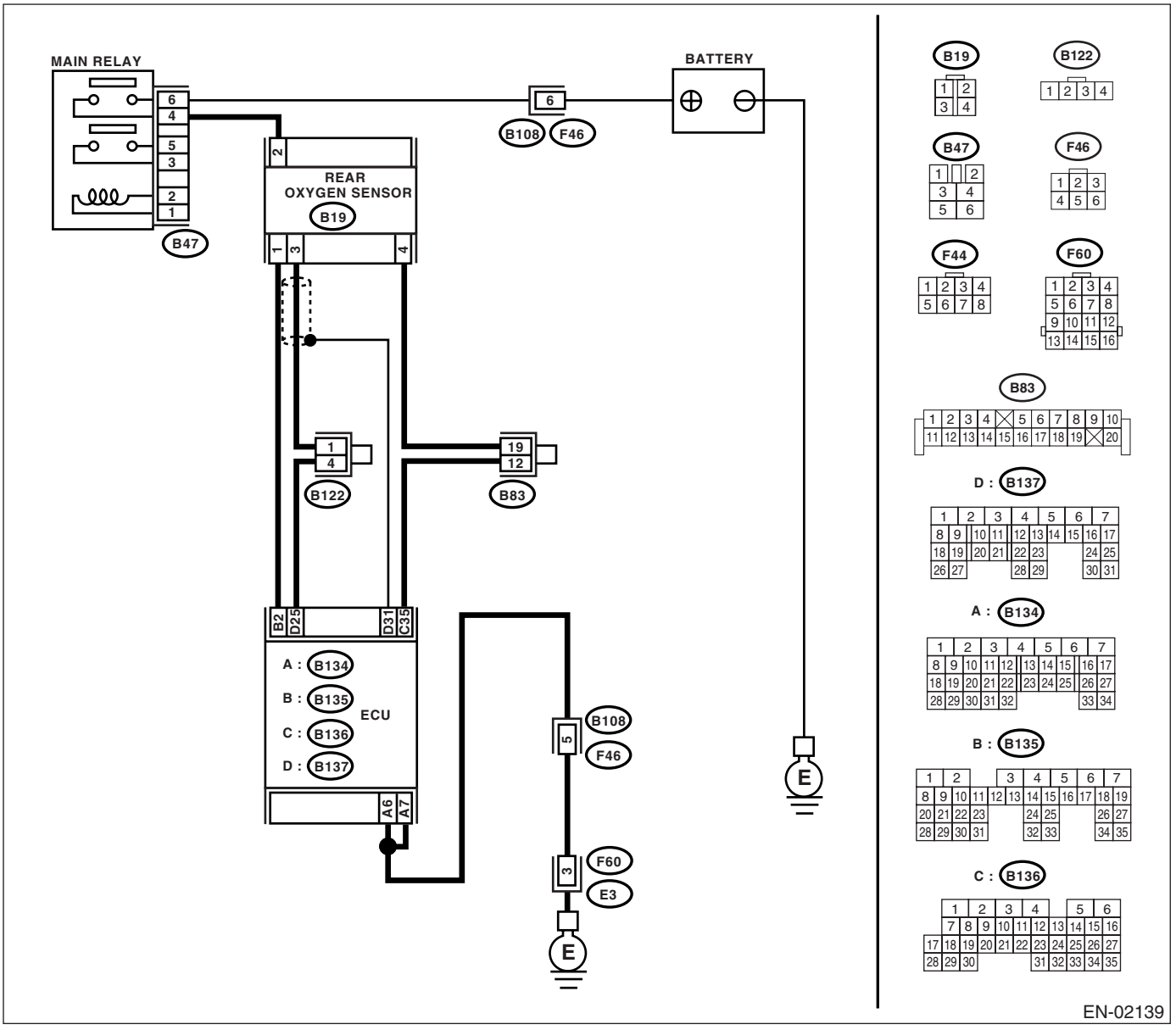
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-21, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



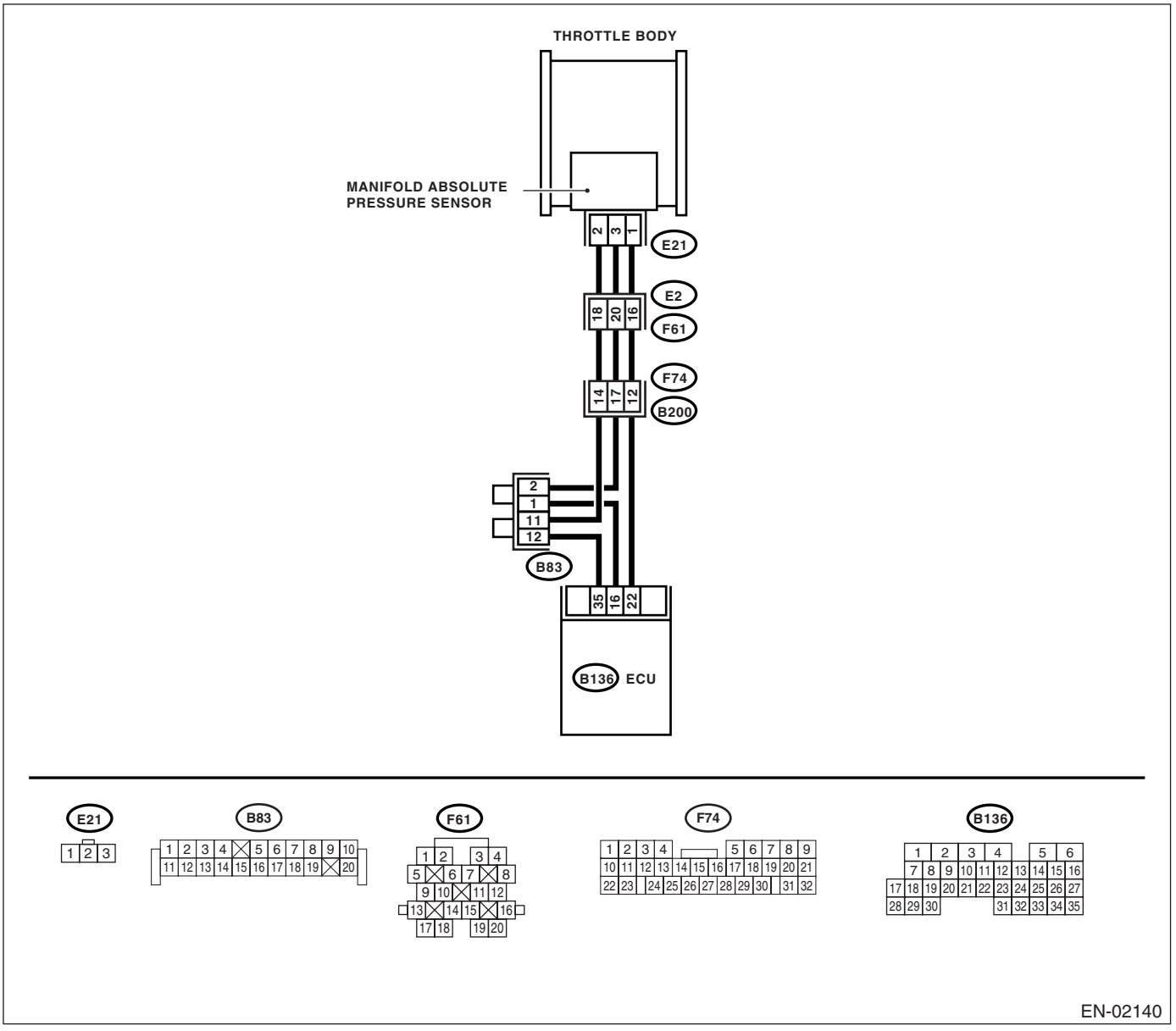
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 2 (+) — Chassis ground (−):***	Is the measured value more than 8 V?	Go to step **2.**	Go to step **3.**
2	**CHECK CURRENT DATA.** 1) Repair the battery short circuit in harness between ECM and rear oxygen sensor connector. 2) Turn the ignition switch to ON. 3) Read the data of rear oxygen sensor heater current using Subaru Select Monitor or the general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 7 A?	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	END
3	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	END

H: DTC P0068 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-23, DTC P0068 — MANIFOLD PRESSURE SENSOR RANGE/PERFORMANCE —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



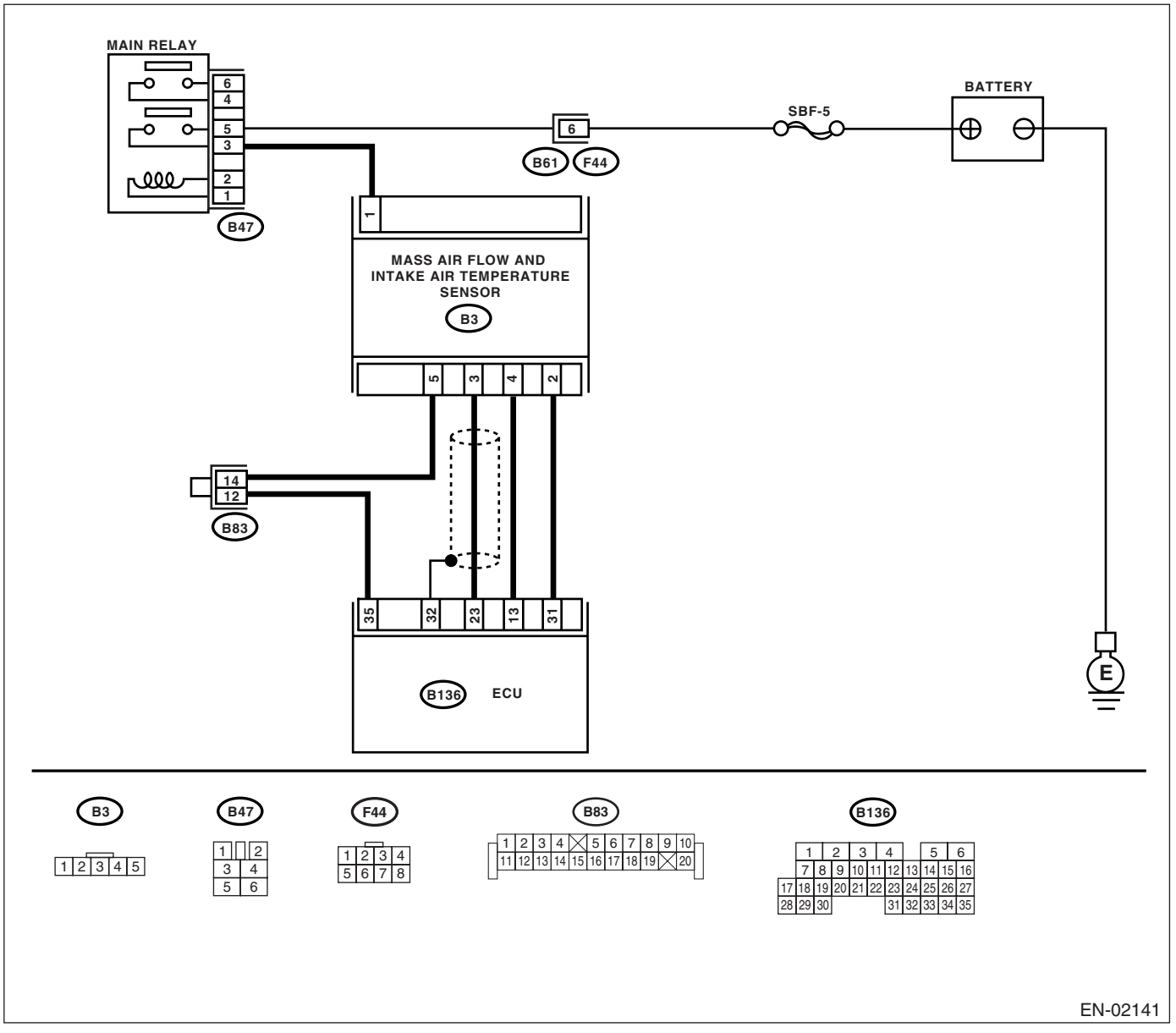
	Step	Check	Yes	No
1	**CHECK IDLE SWITCH SIGNAL.** 1) Turn the ignition switch to ON. 2) Operate the LED operation mode for engine using Subaru Select Monitor. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "LED OPERATION MODE FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.>	Does the LED of {Idle Switch Signal} come on?	Go to step **2.**	Check the throttle position sensor circuit. <Ref. to EN(H4DOTC)-435, DTC P2135 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "A"/"B" VOLTAGE RATIONALITY —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0106.
2	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC. "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0106.	Go to step **3.**
3	**CHECK CONDITION OF MANIFOLD ABSOLUTE PRESSURE SENSOR.**	Is the manifold absolute pressure sensor installation bolt tightened securely?	Go to step **4.**	Tighten the manifold absolute pressure sensor installation bolt securely.
4	**CHECK CONDITION OF THROTTLE BODY.**	Is the throttle body installation bolt tightened securely?	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DOTC)-32, Manifold Absolute Pressure Sensor.>	Tighten the throttle body installation bolt securely.

I: DTC P0101 — MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-25, DTC P0101 — MASS OR VOLUME AIR FLOW 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



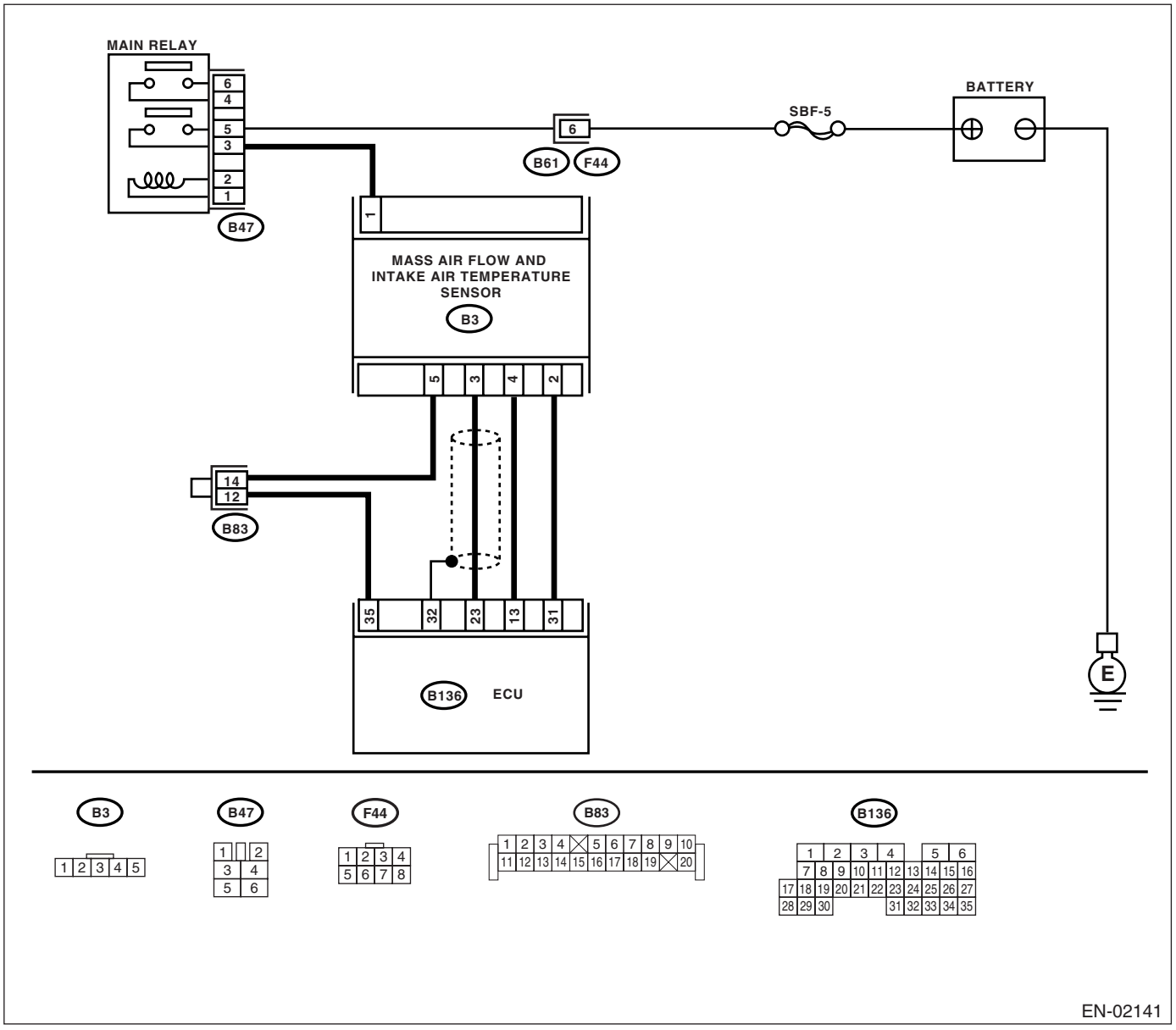
Step		Check	Yes	No
1	CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0101.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>

J: DTC P0102 — MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-28, DTC P0102 — MASS OR VOLUME AIR FLOW 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CONNECT SUBARU SELECT MONITOR OR THE GENERAL SCAN TOOL, AND READ DATA.** 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor or general scan tool to data link connector. 3) Turn the ignition switch to ON and Subaru Select Monitor or the general scan tool switch to ON. 4) Start the engine. 5) Read the mass air flow sensor voltage using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 0.2 to 4.7 V?	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 or harness may be the cause. Repair the harness or connector in the mass air flow sensor. NOTE: In this case, repair the following: • Open or ground short circuit in harness between mass air flow sensor and ECM connector • Poor contact in mass air flow sensor or ECM connector	Go to step **2.**
2	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground while engine is idling. ***Connector & terminal*** ***(B136) No. 23 (+) — Chassis ground (−):***	Is the measured value less than 0.2 V?	Go to step **4.**	Go to step **3.**
3	**CHECK INPUT SIGNAL FOR ECM (USING SUBARU SELECT MONITOR).** Measure the voltage between ECM connector and chassis ground while engine is idling.	Shake the ECM harness and connector, while monitoring value of Subaru Select Monitor. Does the voltage change?	Repair the poor contact in ECM connector.	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	**CHECK POWER SUPPLY TO MASS AIR FLOW SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from mass air flow sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between mass air flow sensor connector and chassis ground. ***Connector & terminal*** ***(B3) No. 1 (+) — Chassis ground (−):***	Is the measured value more than 5 V?	Go to step **5.**	Repair the open circuit between mass air flow sensor and main relay.

	Step	Check	Yes	No
5	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and mass air flow sensor connector. ***Connector & terminal*** ***(B136) No. 23 — (B3) No. 3:*** ***(B136) No. 31 — (B3) No. 2:*** ***(B136) No. 35 — (B3) No. 5:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair the open circuit between ECM and mass air flow sensor connector.
6	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW SENSOR CONNECTOR** Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 23 — Chassis ground:*** ***(B136) No. 31 — Chassis ground:*** ***(B136) No. 35 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **7.**	Repair the ground short circuit between ECM and mass air flow sensor connector.
7	**CHECK POOR CONTACT** Check poor contact in mass air flow sensor connector.	Is there poor contact in mass air flow sensor connector?	Repair the poor contact in mass air flow sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>

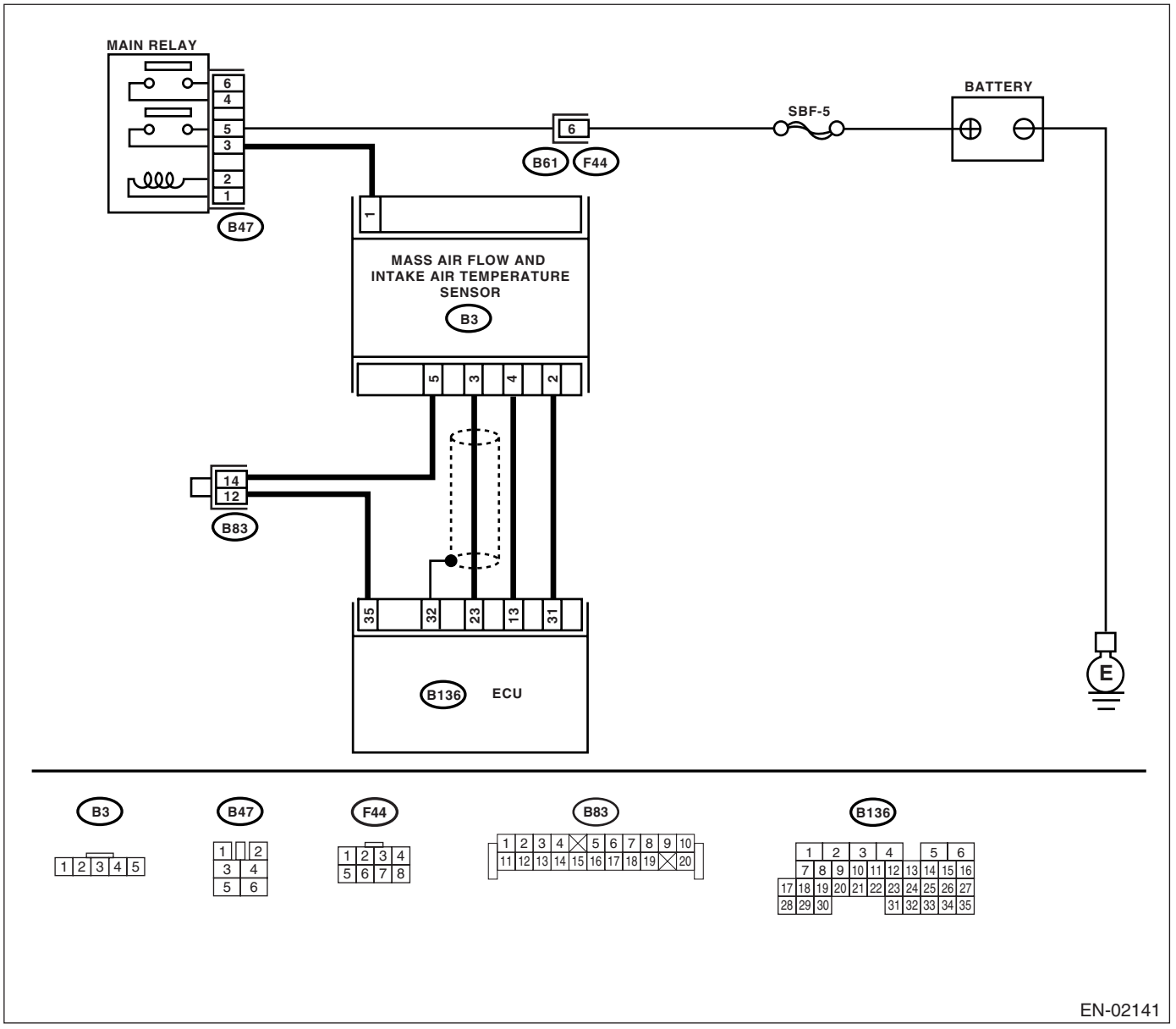
MEMO:

K: DTC P0103 — MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-30, DTC P0103 — MASS OR VOLUME AIR FLOW 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



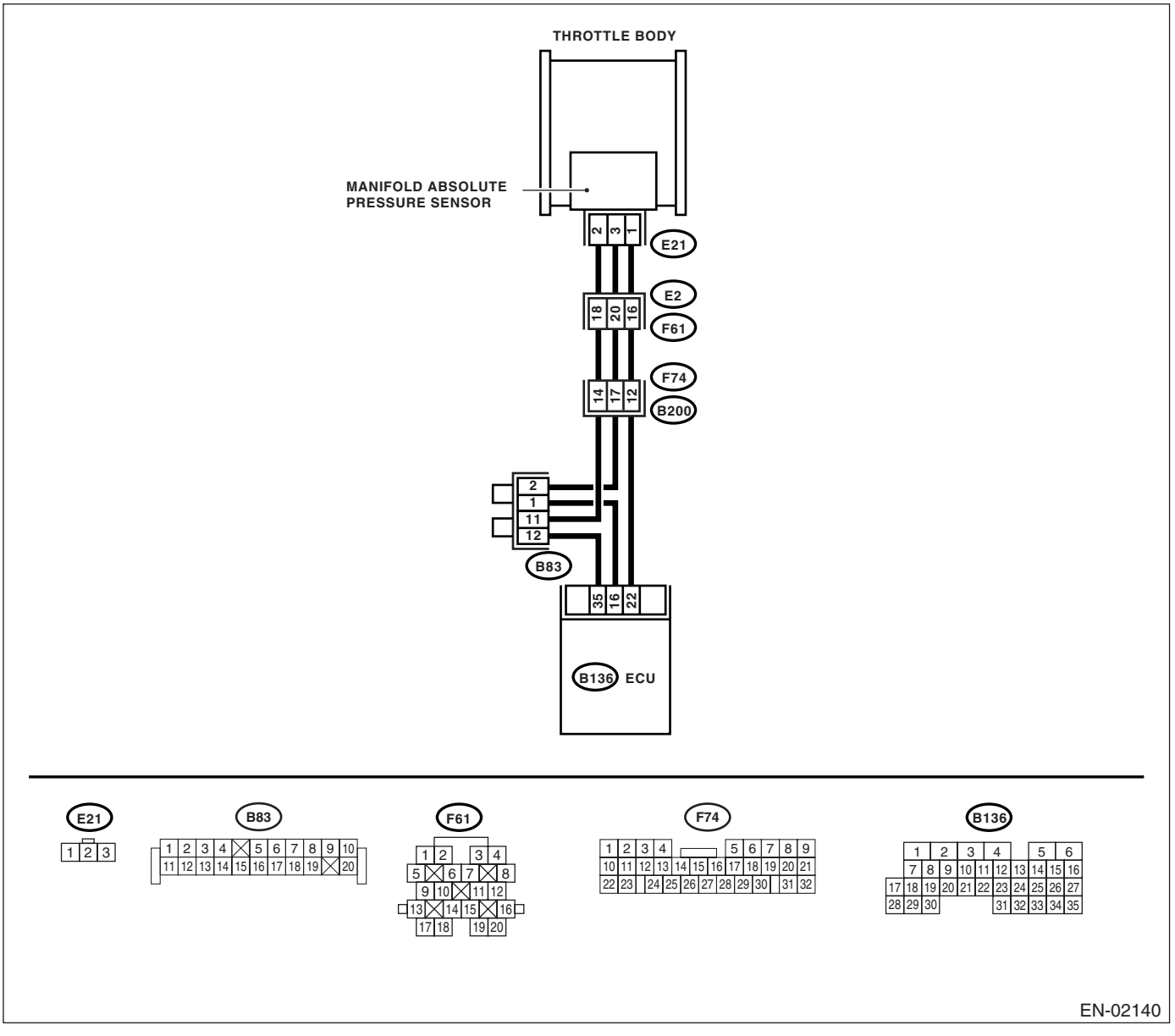
	Step	Check	Yes	No
1	**CONNECT SUBARU SELECT MONITOR OR THE GENERAL SCAN TOOL, AND READ DATA.** 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor or general scan tool to data link connector. 3) Turn the ignition switch to ON and Subaru Select Monitor or general scan tool switch to ON. 4) Start the engine. 5) Read the mass air flow sensor voltage using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 0.2 to 4.7 V?	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time.	Go to step **2.**
2	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from mass air flow sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between mass air flow sensor connector and chassis ground. ***Connector & terminal*** ***(B3) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 5 V?	Repair the battery short of harness between mass air flow sensor connector and ECM connector.	Go to step **3.**
3	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and mass air flow sensor connector. ***Connector & terminal*** ***(B3) No. 2 — (B136) No. 31:***	Is the measured value less than 1 Ω?	Replace the mass air flow sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>	Repair the open harness between mass air flow sensor connector and ECM connector.

L: DTC P0107 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-32, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



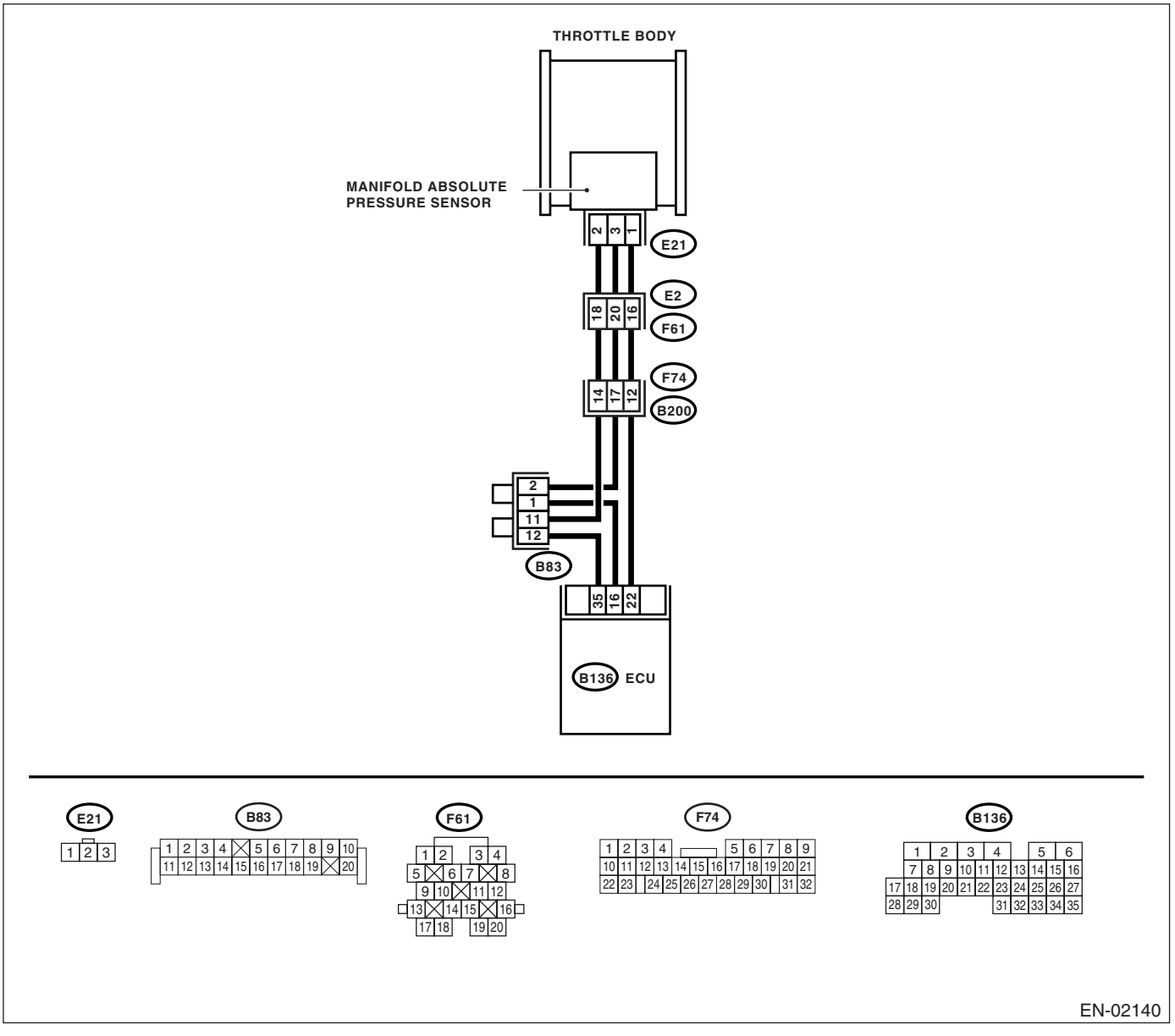
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V?	Go to step **3.**	Go to step **2.**
2	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (−):***	Shake the ECM harness and connector, while monitoring value of voltage meter. Does the voltage change?	Repair the poor contact in ECM connector.	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
3	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 22 (+) — Chassis ground (−):***	Is the measured value less than 0.7 V?	Go to step **4.**	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR 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 measured value more than 4.5 V?	Go to step **5.**	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
5	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR 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*** ***(B136) No. 35 — (E21) No. 2:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
6	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.** Measure the resistance of harness between manifold absolute pressure sensor connector and engine ground. ***Connector & terminal*** ***(E21) No. 1 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **7.**	Repair the ground short circuit in harness between ECM and manifold absolute pressure sensor connector.
7	**CHECK POOR CONTACT.** Check poor contact in manifold absolute pressure sensor connector.	Is there poor contact in manifold absolute pressure sensor connector?	Repair the poor contact in manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DOTC)-32, Manifold Absolute Pressure Sensor.>

M: DTC P0108 — MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-34, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



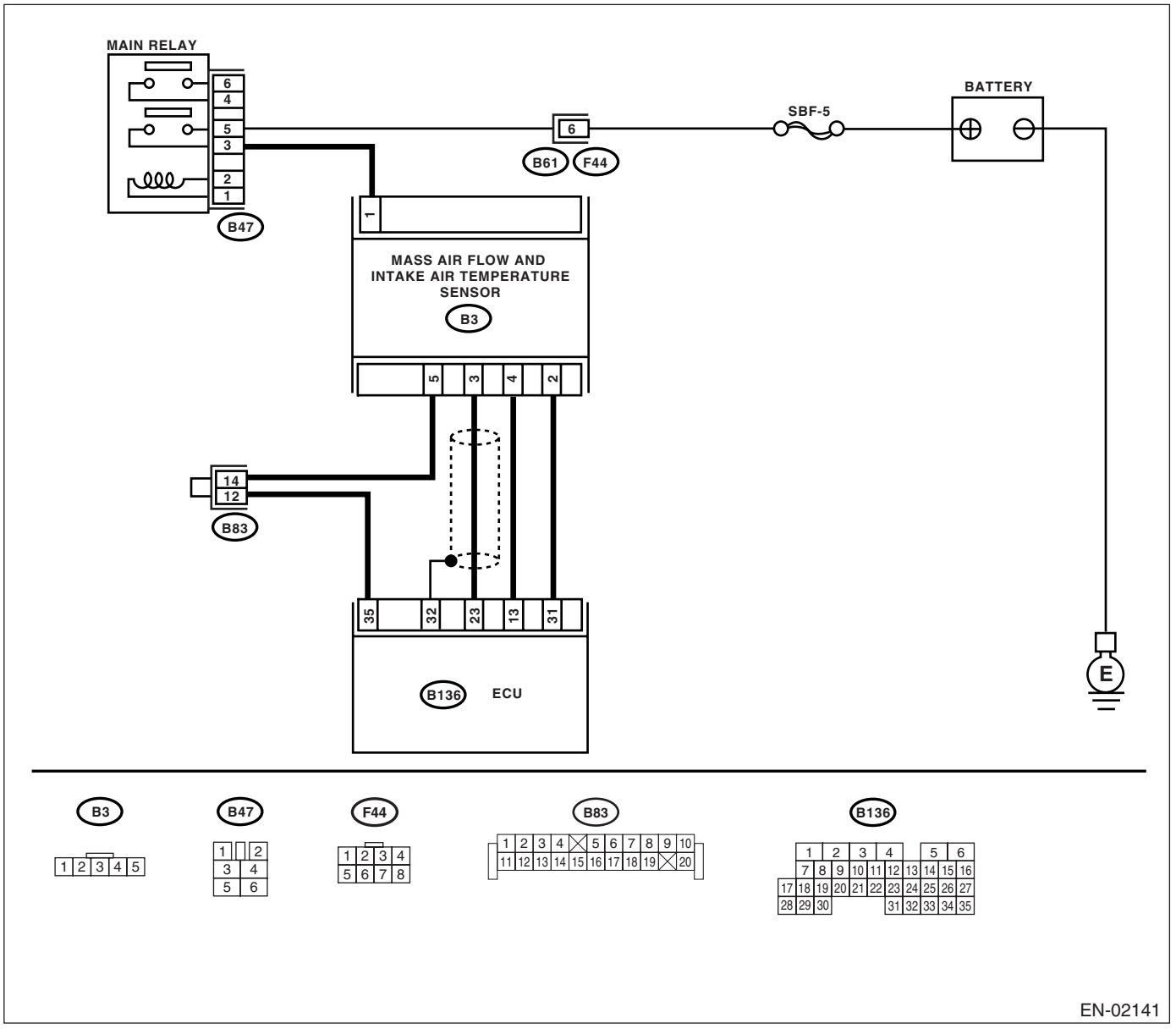
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V?	Go to step **3.**	Go to step **2.**
2	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (−):***	Shake the ECM harness and connector, while monitoring value of voltage meter. Does the voltage change?	Repair the poor contact in ECM connector.	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
3	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 22 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V?	Go to step **4.**	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.
4	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR 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 measured value more than 4.5 V?	Go to step **5.**	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
5	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR 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*** ***(B136) No. 22 — (E21) No. 1:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
6	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.** Measure the resistance of harness between ECM and manifold absolute pressure sensor connector. ***Connector & terminal*** ***(B136) No. 35 — (E21) No. 2:***	Is the measured value less than 1 Ω?	Go to step **7.**	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
7	**CHECK POOR CONTACT.** Check poor contact in manifold absolute pressure sensor connector.	Is there poor contact in manifold absolute pressure sensor connector?	Repair the poor contact in manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DOTC)-32, Manifold Absolute Pressure Sensor.>

N: DTC P0111 — INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-36, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



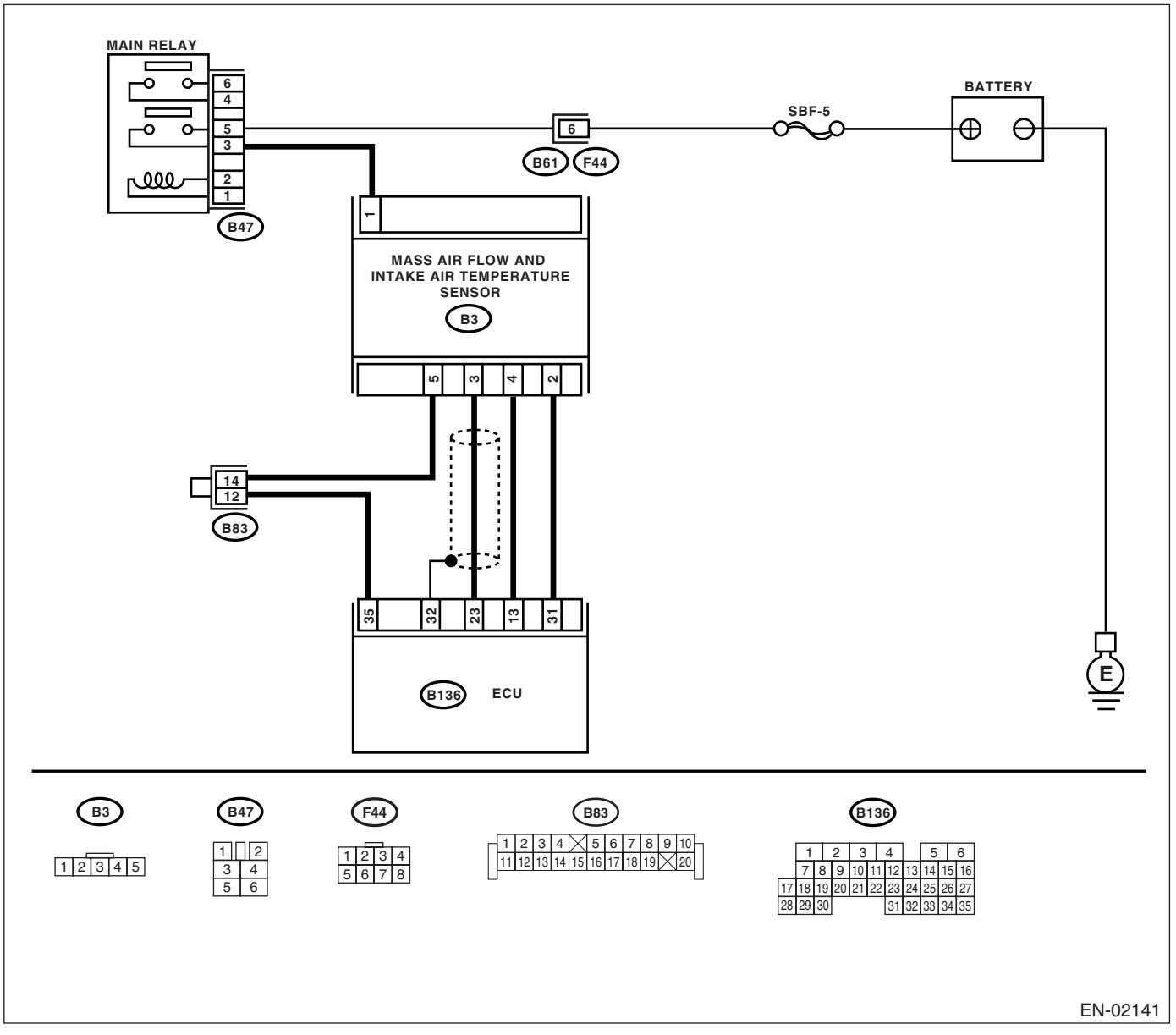
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0111.	Go to step **2.**
2	**CHECK ENGINE COOLANT TEMPERATURE.** 1) Start the engine and warm it up completely. 2) Measure the engine coolant temperature using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 75°C (167°F) to 95°C (203°F)?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>	Inspect the DTC P0125 using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>

O: DTC P0112 — INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-38, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



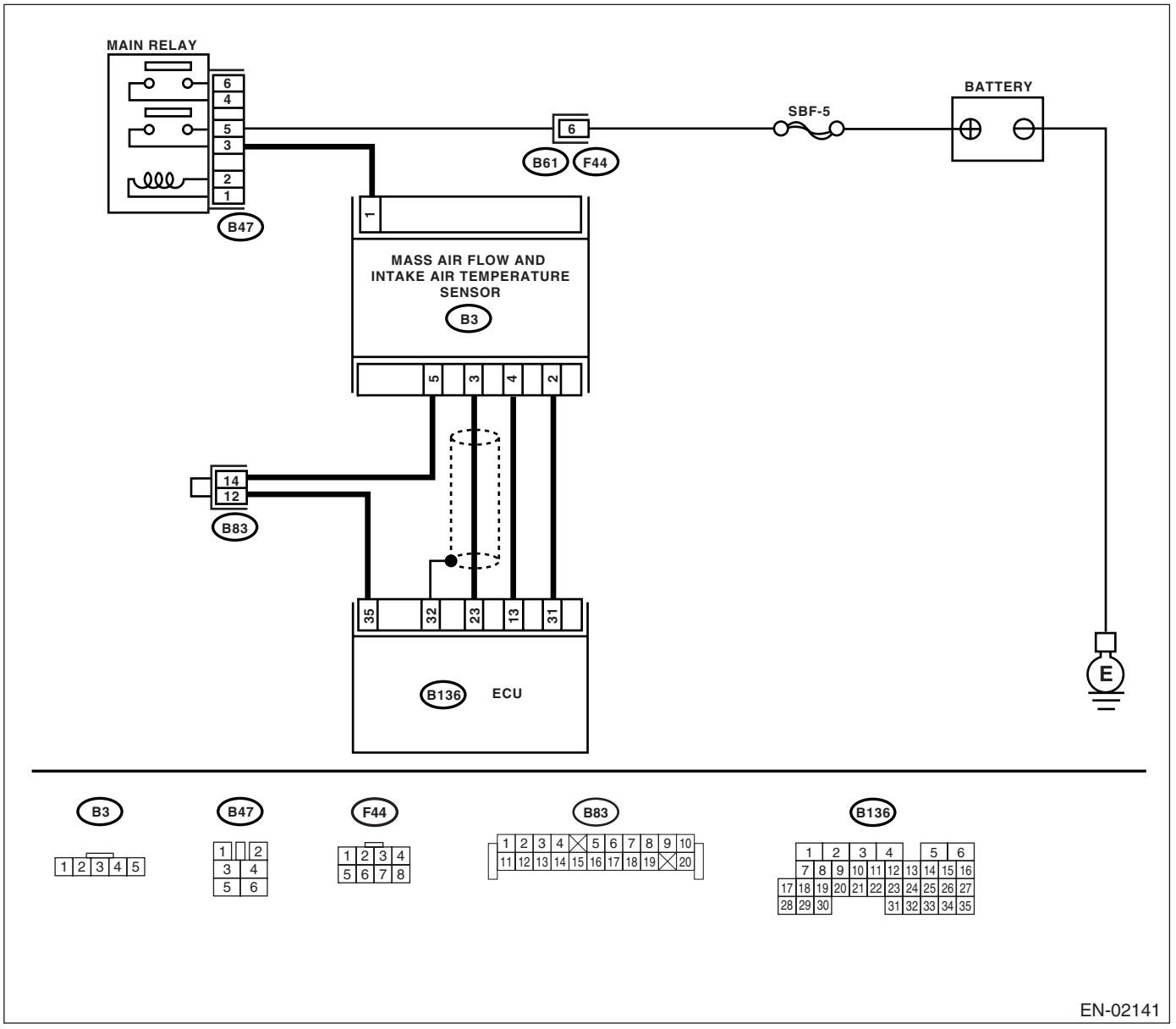
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of intake air temperature sensor signal using Subaru Select Monitor or the general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 55°C (131°F)?	Go to step **2.**	Repair the poor contact. NOTE: In this case, repair the following: • Poor contact mass air flow and intake air temperature sensor • Poor contact in ECM • Poor contact in joint connector
2	**CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from mass air flow and 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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –36°C (–33°F)?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>	Repair the ground short circuit in harness between mass air flow and intake air temperature sensor and ECM connector.

P: DTC P0113 — INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-40, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –36°C (–33°F)?	Go to step **2.**	Repair the poor contact. NOTE: In this case, repair the following: • Poor contact in mass air flow and intake air temperature sensor • Poor contact in ECM • Poor contact in joint connector
2	**CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from mass air flow and intake air temperature sensor. 3) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground. ***Connector & terminal*** ***(B3) No. 4 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between mass air flow and intake air temperature sensor and ECM connector.	Go to step **3.**
3	**CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground. ***Connector & terminal*** ***(B3) No. 4 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between mass air flow and intake air temperature sensor and ECM connector.	Go to step **4.**
4	**CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR.** Measure the voltage between mass air flow and intake air temperature sensor and manifold absolute pressure sensor connector and engine ground. ***Connector & terminal*** ***(B3) No. 4 (+) — Engine ground (–):***	Is the measured value more than 4 V?	Go to step **5.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between mass air flow and intake air temperature sensor and ECM connector • Poor contact in mass air flow and intake air temperature sensor • Poor contact in ECM • Poor contact in joint connector

	Step	Check	Yes	No
5	**CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between mass air flow and intake air temperature sensor and engine ground. ***Connector & terminal*** ***(B3) No. 5 — Engine ground:***	Is the measured value less than 5 Ω?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between mass air flow and intake air temperature sensor and ECM connector • Poor contact in mass air flow and intake air temperature sensor • Poor contact in ECM • Poor contact in joint connector

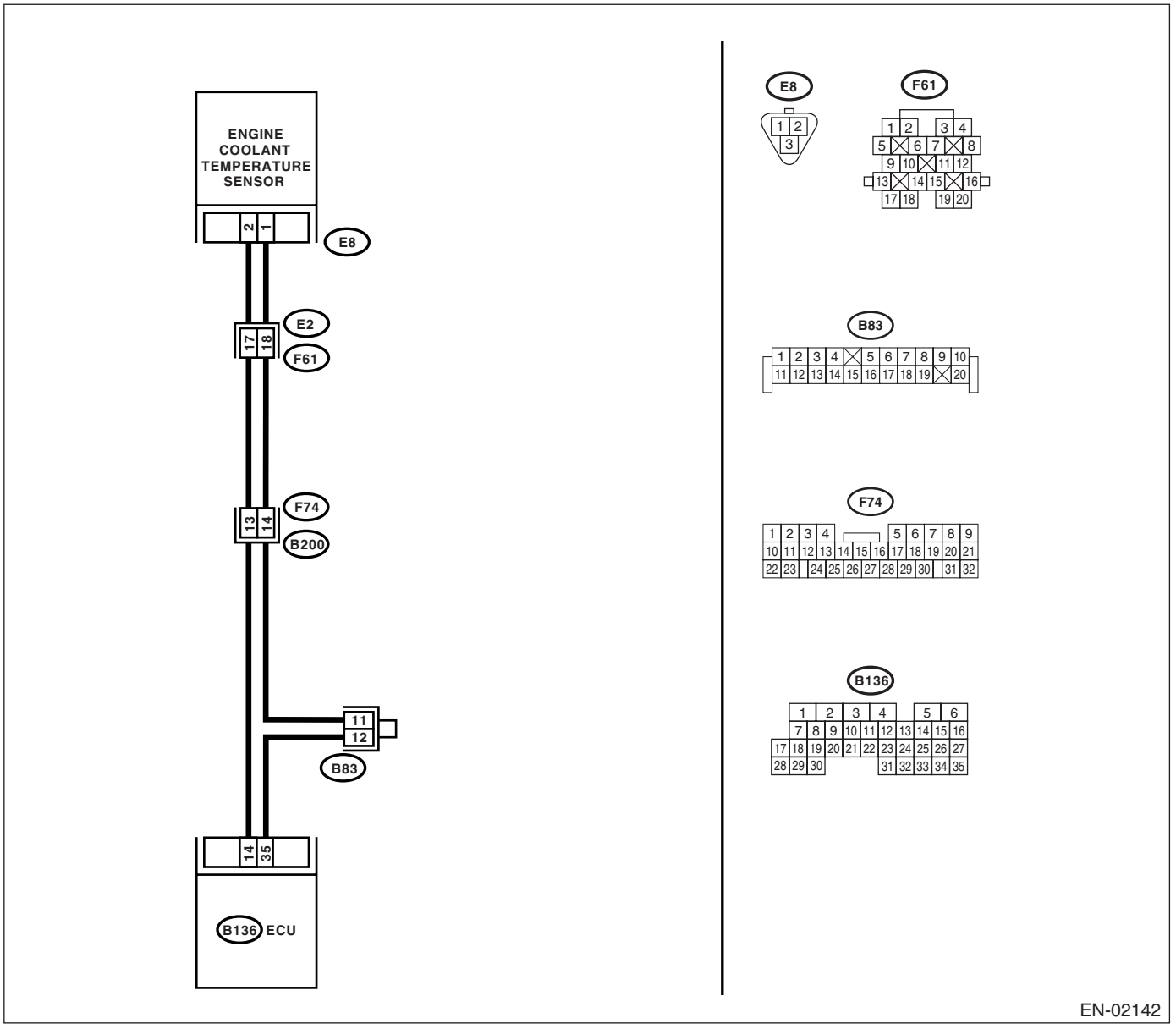
MEMO:

Q: DTC P0117 — ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-42, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



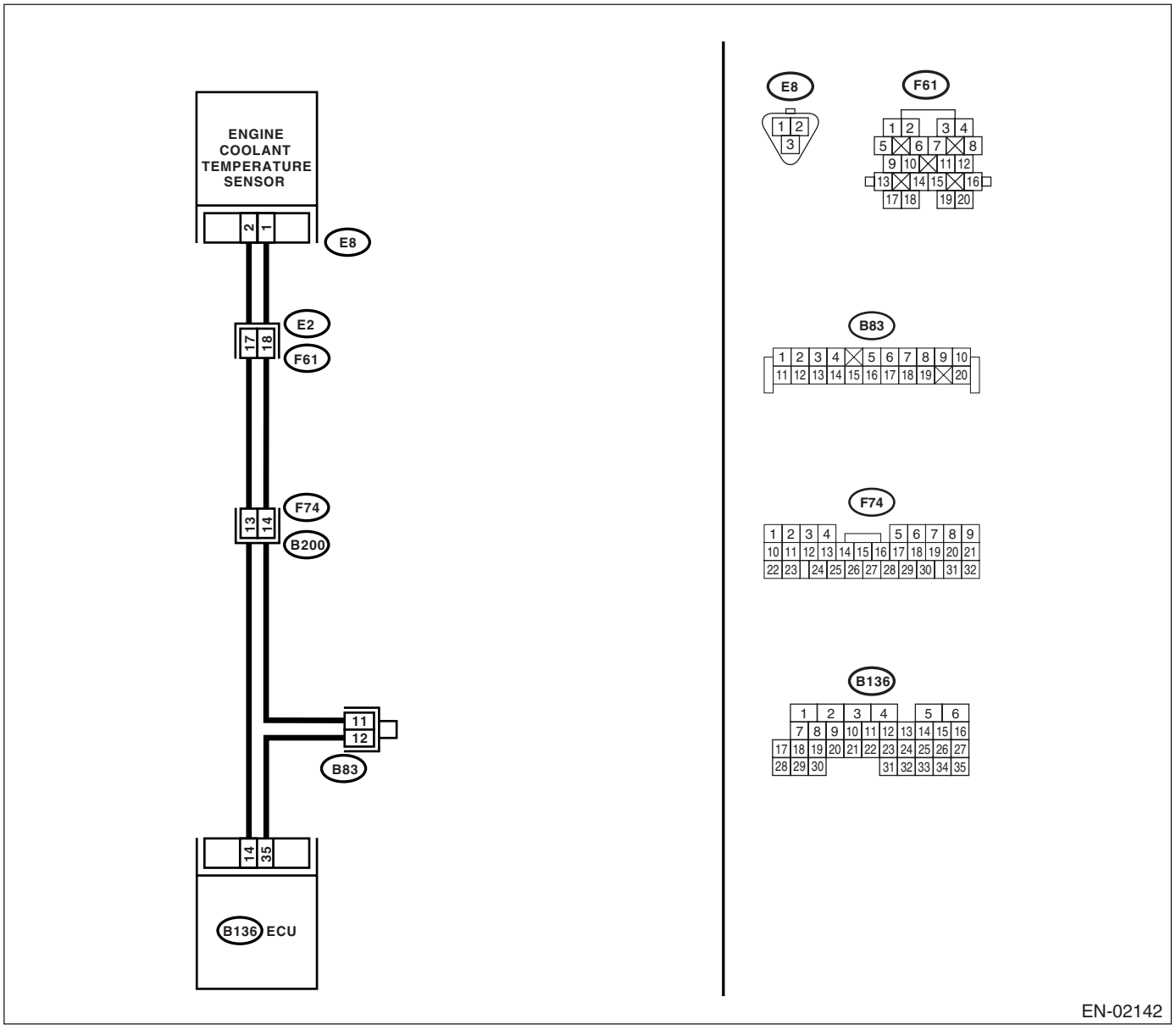
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 120°C (248°F)?	Go to step **2.**	Repair the 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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –40°C (–40°F)?	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-27, Engine Coolant Temperature Sensor.>	Repair the ground short circuit in harness between engine coolant temperature sensor and ECM connector.

R: DTC P0118 — ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-44, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –40°C (–40°F)?	Go to step **2.**	Repair the 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. 2 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair the 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. 2 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair the 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. 2 (+) — Engine ground (–):***	Is the measured value more than 4 V?	Go to step **5.**	Repair the 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

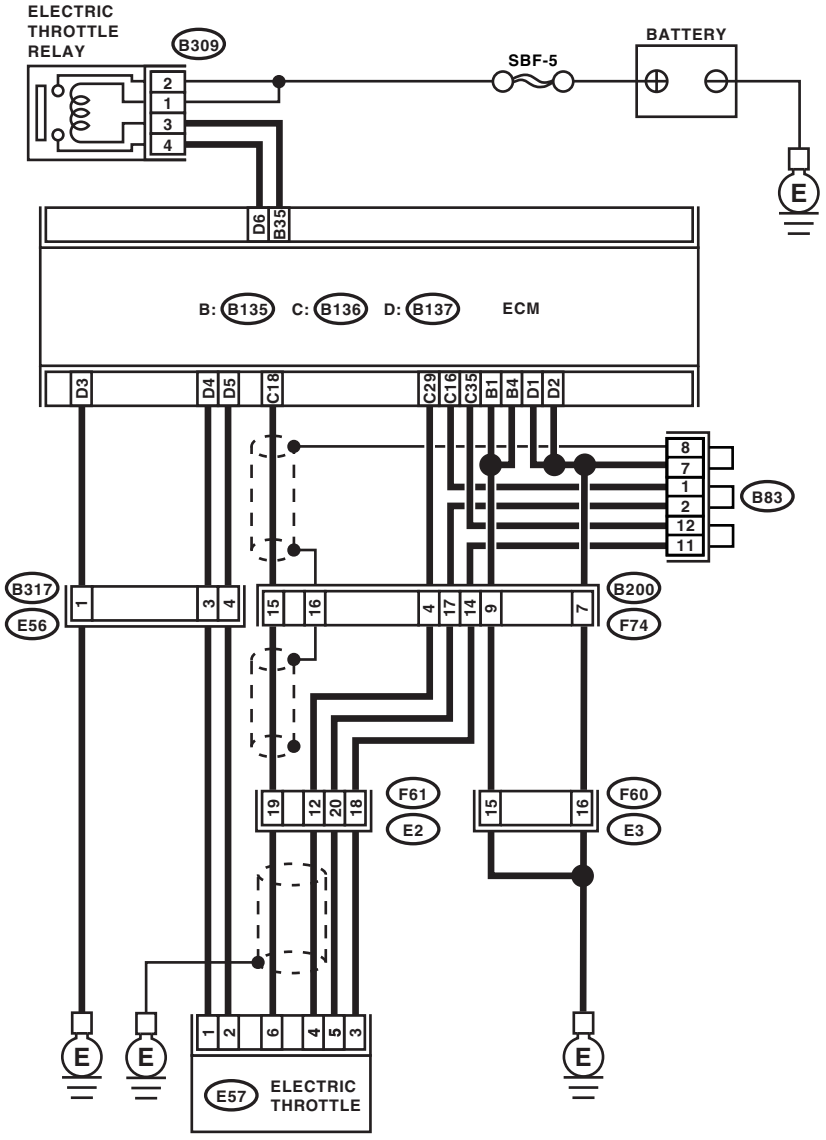
	Step	Check	Yes	No
5	**CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between engine coolant temperature sensor connector and engine ground. ***Connector & terminal*** ***(E8) No. 1 — Engine ground:***	Is the measured value less than 5 Ω?	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-27, Engine Coolant Temperature Sensor.>	Repair the 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

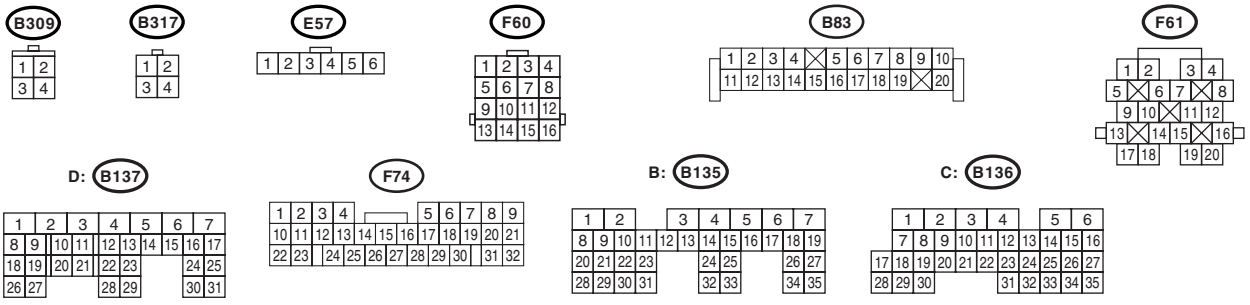
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-46, 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

- **WIRING DIAGRAM:**





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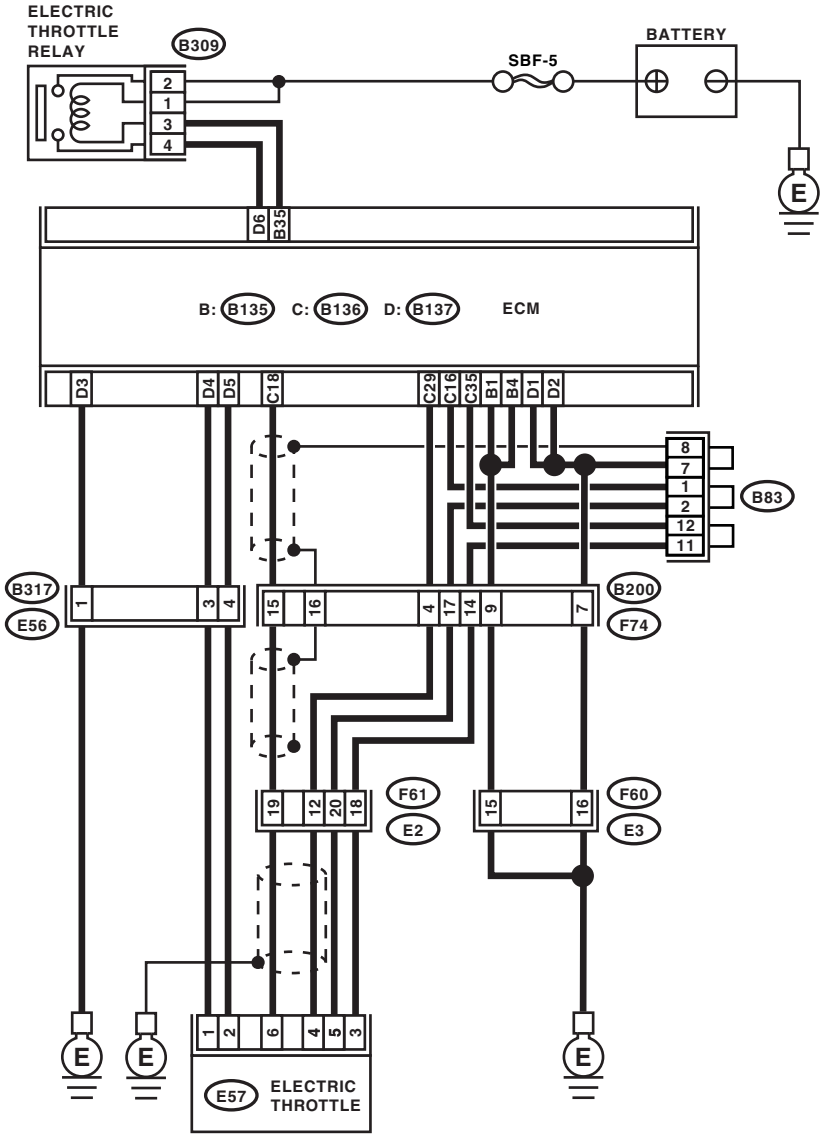
Step		Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF SENSOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector terminals. ***Connector & terminal*** ***(B136) No. 29 (+) — (B136) No. 35 (-):*** 3) Shake the ECM harness and connector, engine harness connectors and electric throttle.	Is the measured value more than 0.4 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and electric throttle.	Is there poor contact in the connectors between ECM and electric throttle?	Repair the poor contact in connectors.	Connector has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from electric throttle. 4) Measure the resistance between ECM connector and electric throttle connector. ***Connector & terminal*** ***(B136) No. 16 — (E57) No. 5:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair open of harness connector.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 18 — Chassis ground:*** ***(B136) No. 16 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the chassis short of harness.
5	**CHECK POWER SURPLY TO SENSOR.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 5 (+) — Engine ground (−):*** 4) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value within 4.5 to 5.5 V?	Go to step **6.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
6	**CHECK SHORT OF ECM.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:***	Is the measured value more than 10 Ω?	Repair the poor contact in electric throttle connector. If problem persists, replace the accelerator position sensor.	Repair the poor the contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

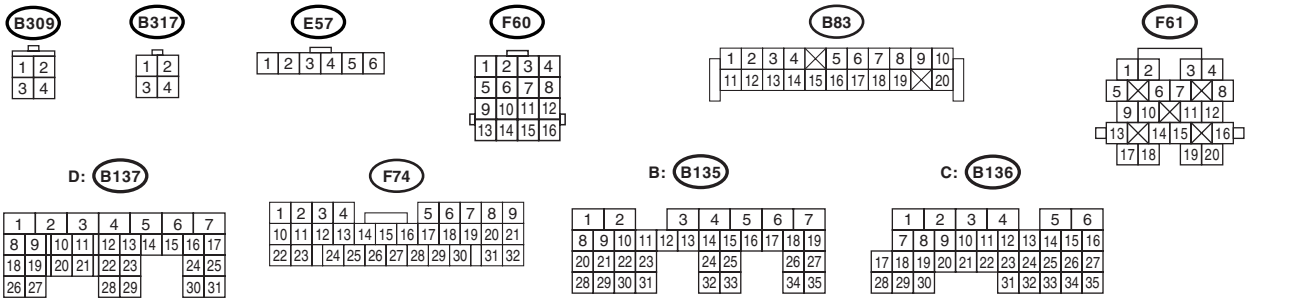
MEMO:

T: DTC P0123 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-48, 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

- **WIRING DIAGRAM:**





EN-03197

	Step	Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF SENSOR.** 1) Turn the ignition switch to ON. 2) Read the data of main throttle sensor signals, using the Subaru Select Monitor. 3) Shake the ECM harness and connector, engine harness connectors, electric throttle connector harness while monitoring value of voltage meter.	Is the measured value less than 4.63 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and electric throttle.	Is there poor contact in the connectors between ECM and electric throttle?	Repair the poor contact in connectors.	Connector has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Disconnect the connectors from electric throttle. 4) Measure the resistance between ECM connector and electric throttle connector. ***Connector & terminal*** ***(B136) No. 18 — (E57) No. 6:*** ***(B136) No. 35 — (E57) No. 3:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open of harness connector.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Connect the ECM connector. 2) Measure the resistance between the electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the measured value less than 1 Ω?	Go to step **5.**	Repair the poor contact in ECM connector. If the problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
5	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 5 (+) — Engine ground (−):*** 3) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value more than 10 V?	Go to step **6.**	Repair the battery short of harness between ECM connector and electric throttle connector.
6	**CHECK POWER SUPPLY TO SENSOR.** 1) Measure the voltage between the electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (−):*** 2) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value less than 10 V?	Go to step **7.**	Repair the short of harness between ECM connector and electric throttle connector.

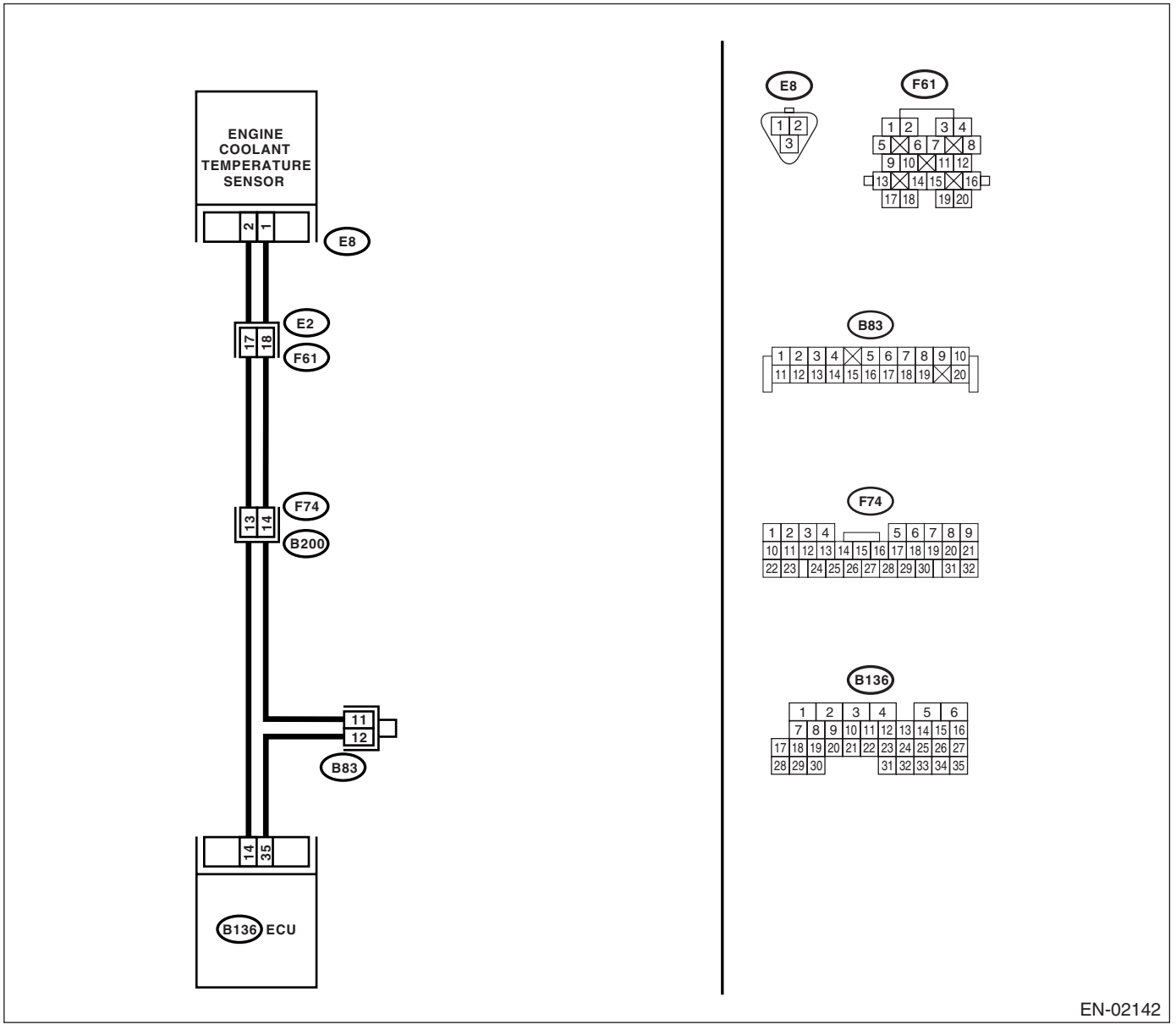
	Step	Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B136) No. 18 — (B136) No. 16:***	Is the measured value more than 1 MΩ?	Repair the poor contact in harness. Replace the electric throttle.	Repair the short of harness of power supply to sensor.

U: DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-50, DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
- **TROUBLE SYMPTOM:**
  - Engine will not return to idling.

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



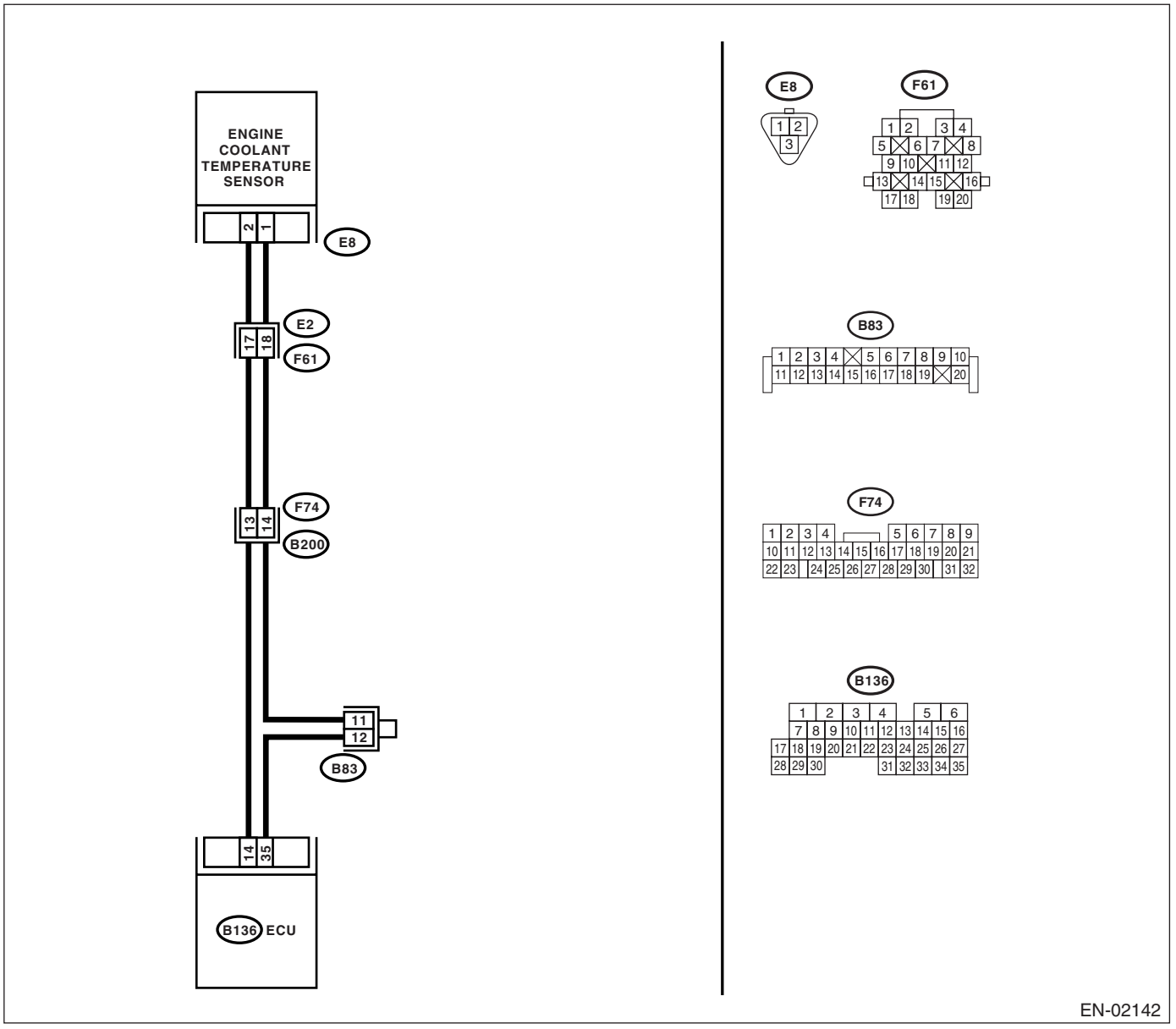
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0125.	Go to step **2.**
2	**CHECK ENGINE COOLING SYSTEM.** NOTE: Check the following items. •Thermostat open stuck •Coolant level •Coolant freeze •Tire diameter	Is there a fault in engine cooling system?	Replace the thermostat. <Ref. to CO(H4DOTC)-17, Thermostat.>	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-27, Engine Coolant Temperature Sensor.>

V: DTC P0126 — INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-53, DTC P0126 — INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** Measure the resistance between terminals of engine coolant temperature sensor when the engine is cold and when the engine is warmed up. ***Terminal*** ***No. 1 — No. 2:***	Does the resistance value change between the condition when the engine is cooled and when it is warmed up?	Go to step **3.**	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-27, Engine Coolant Temperature Sensor.>
3	**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. 2 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Repair the 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.** 1) Turn the ignition switch to ON. 2) Measure the voltage between engine coolant temperature sensor connector and engine ground. ***Connector & terminal*** ***(E8) No. 2 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between ECM and engine coolant temperature sensor connector.	Go to step **5.**
5	**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. 2 (+) — Engine ground (−):***	Is the measured value more than 4 V?	Go to step **6.**	Repair the 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

	Step	Check	Yes	No
6	**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. 1 — Engine ground:***	Is the measured value less than 5 Ω?	Contact your SOA Service Center.	Repair the 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

W: DTC P0128 — COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-55, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

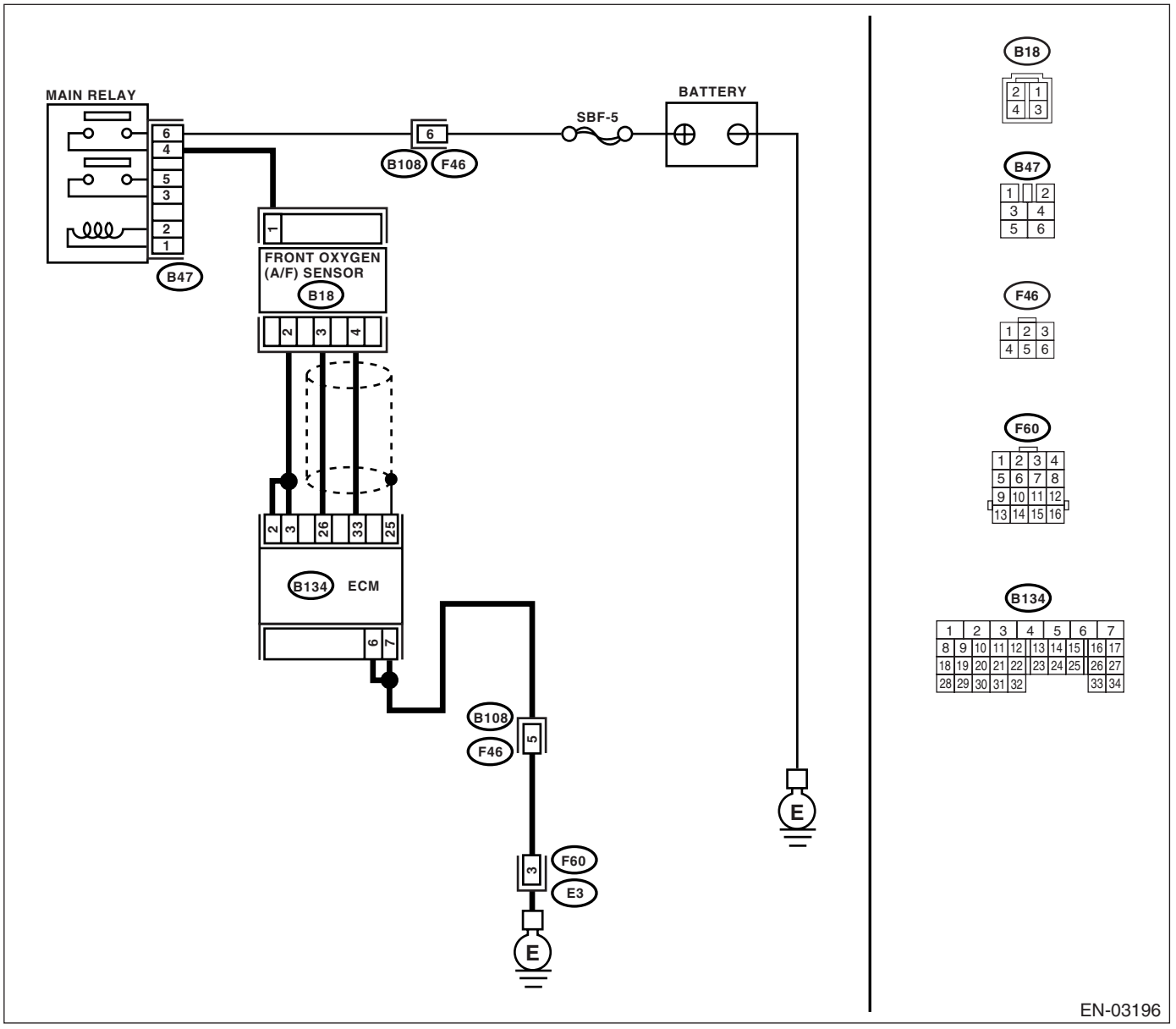
	Step	Check	Yes	No
1	**CHECK VEHICLE CONDITION.**	Was the vehicle driven or idled with the engine partially submerged under water?	In this case, it is not necessary to inspect DTC P0128.	Go to step **2.**
2	**CHECK FOR OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using “List of Diagnostic Trouble Codes (DTC)”. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **3.**
3	**CHECK ENGINE COOLANT.**	Are coolant level and mixture ratio of cooling water to antifreeze solution correct?	Go to step **4.**	Replace the engine coolant. <Ref. to CO(H4DOTC)-13, REPLACEMENT, Engine Coolant.>
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(H4DOTC)-24, Radiator Main Fan and Fan Motor.> and<Ref. to CO(H4DOTC)-26, Radiator Sub Fan and Fan Motor.>.	Replace the thermostat. <Ref. to CO(H4DOTC)-17, Thermostat.>

X: DTC P0131 — O_2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-57, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



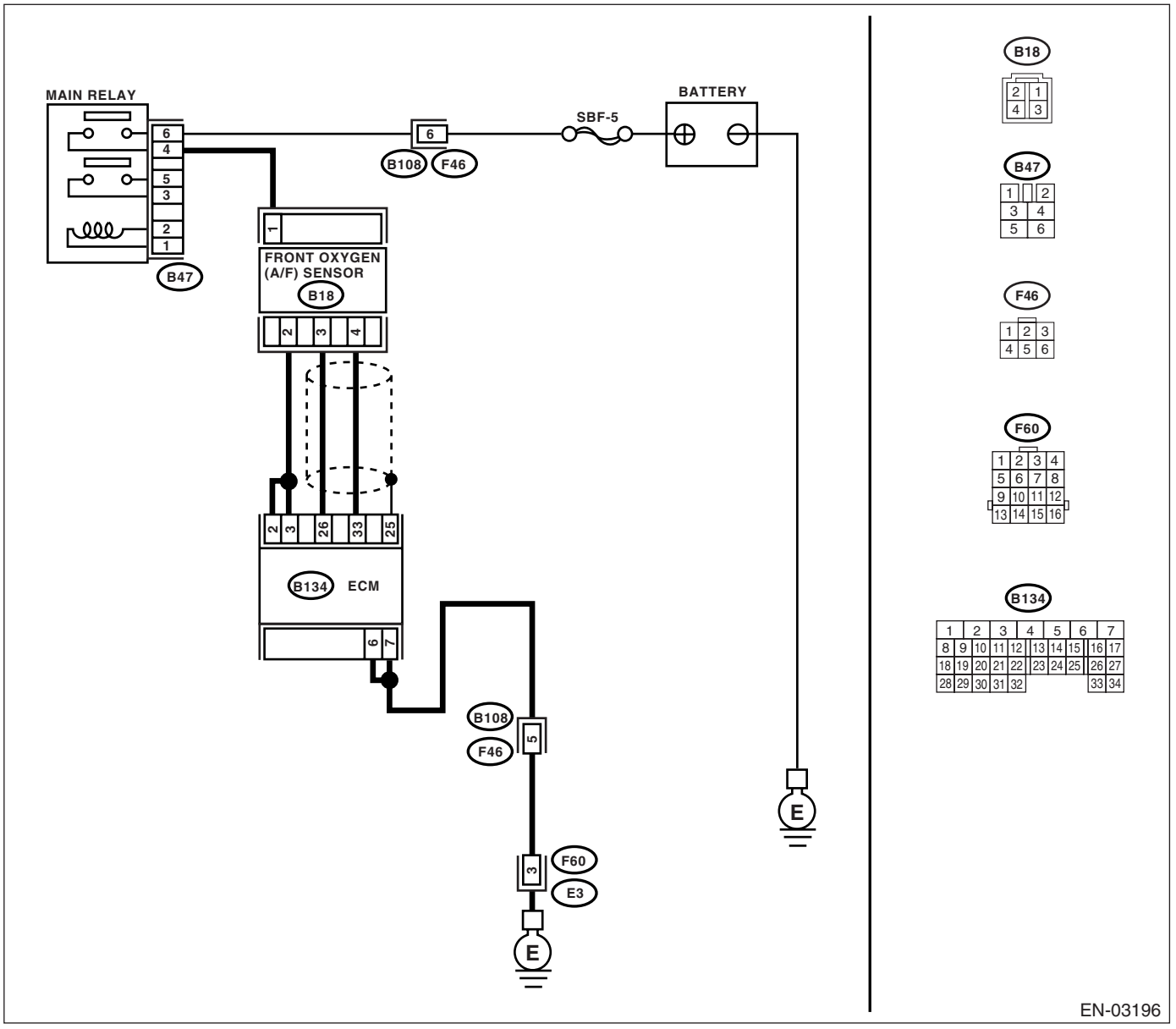
Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor connector. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B134) No. 26 — Chassis ground:*** ***(B134) No. 33 — Chassis ground:***	Is the measured value more than 1 MΩ?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, Front Oxygen (A/F) Sensor.>	Repair ground short circuit in harness between ECM and front oxygen (A/F) sensor connector.

Y: DTC P0132 — O_2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-59, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



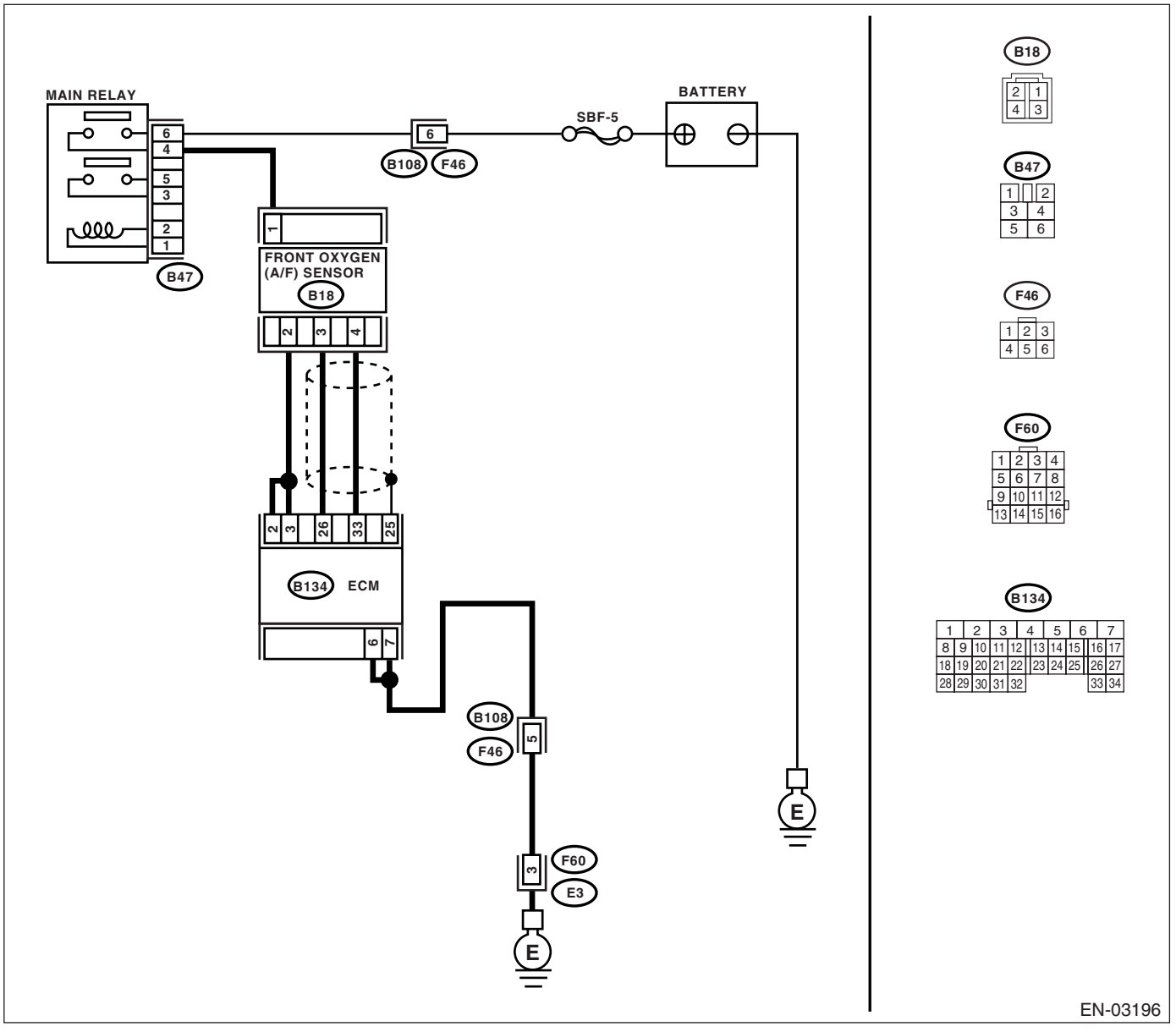
Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from front oxygen (A/F) sensor. 3) Measure the voltage of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 26 (+) — Chassis ground (−):*** ***(B134) No. 33 (+) — Chassis ground (−):***	Is the measured value more than 8 V?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, Front Oxygen (A/F) Sensor.>	Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.

Z: DTC P0133 — O_2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-61, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



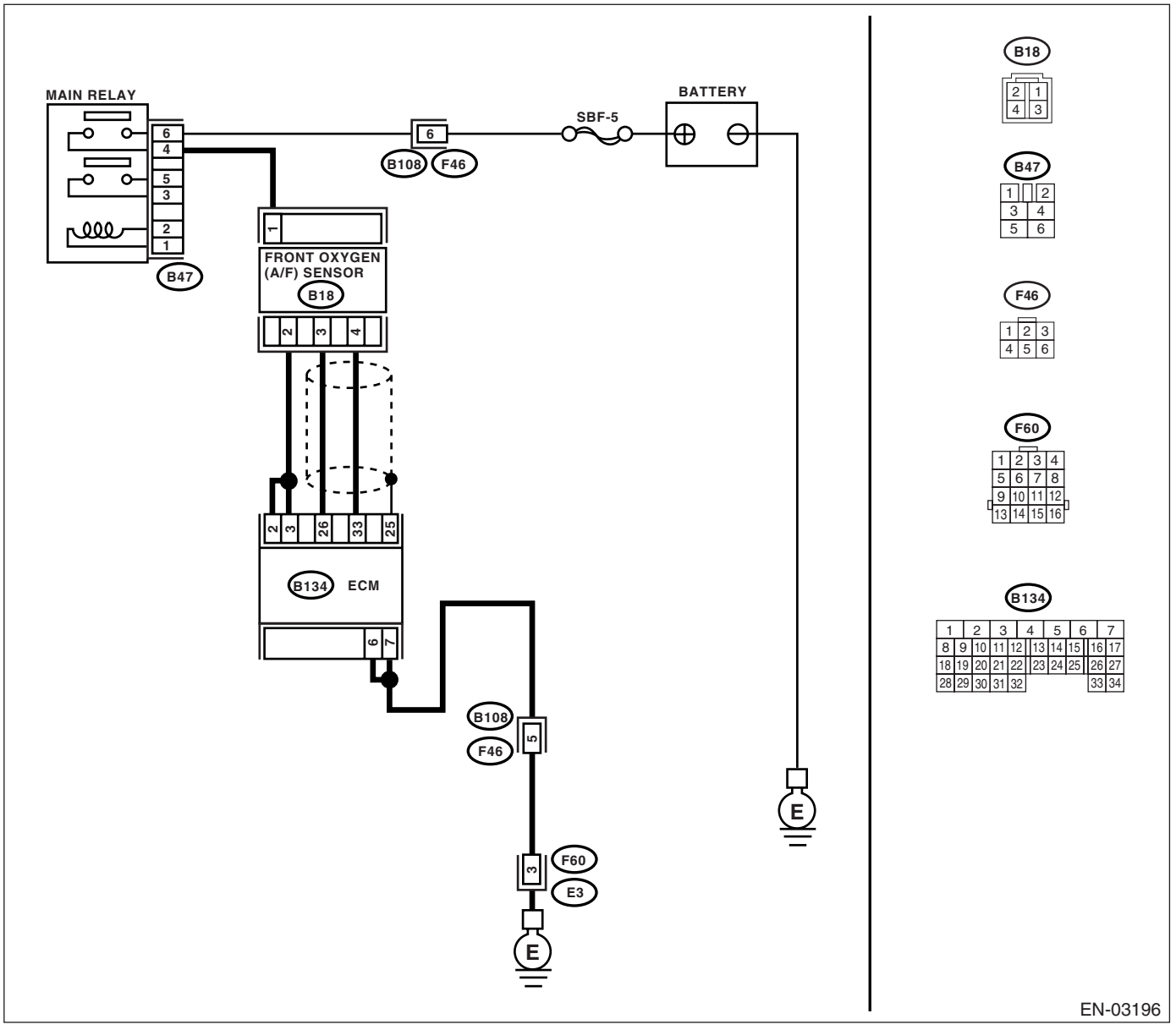
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0133.	Go to step **2.**
2	**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 the exhaust system.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, Front Oxygen (A/F) Sensor.>

AA: DTC P0134 — O_2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-64, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



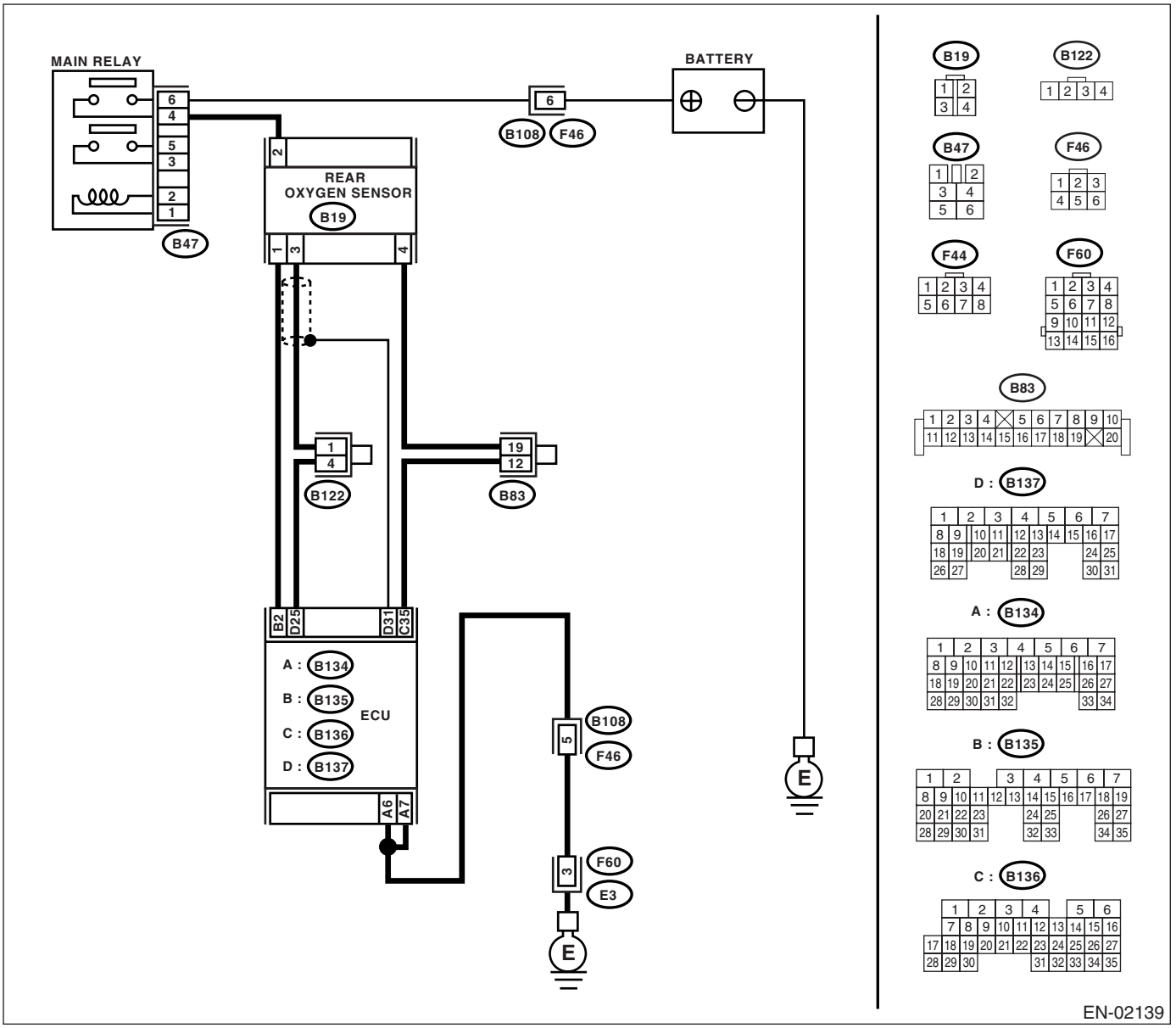
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor connector. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B134) No. 26 — (B18) No. 3:*** ***(B134) No. 33 — (B18) No. 4:***	Is the measured value less than 1 Ω?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, Front Oxygen (A/F) Sensor.>	Repair open circuit in harness between ECM and front oxygen (A/F) sensor connector.

AB:DTC P0137 — O_2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-66, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Using the List of Diagnostic Trouble Code (DTC), check the appropriate DTC. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	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 2,000 rpm to 3,000 rpm for 2 minutes. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or 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(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Does the value fluctuate?	Go to step **6.**	Go to step **3.**
3	**CHECK REAR OXYGEN SENSOR DATA.** Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.	Is the measured value within 0.2 to 0.4 V?	Go to step **4.**	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-40, Rear Oxygen Sensor.>
4	**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*** ***(B137) No. 25 — (B19) No. 3:***	Is the measured value more than 3 Ω?	Repair the open circuit in harness between ECM and rear oxygen sensor connector.	Go to step **5.**
5	**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 measured value more than 0.2 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-40, Rear Oxygen Sensor.>	Repair the 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

	Step	Check	Yes	No
6	**CHECK EXHAUST SYSTEM.** Check the 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 the faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-40, Rear Oxygen Sensor.>

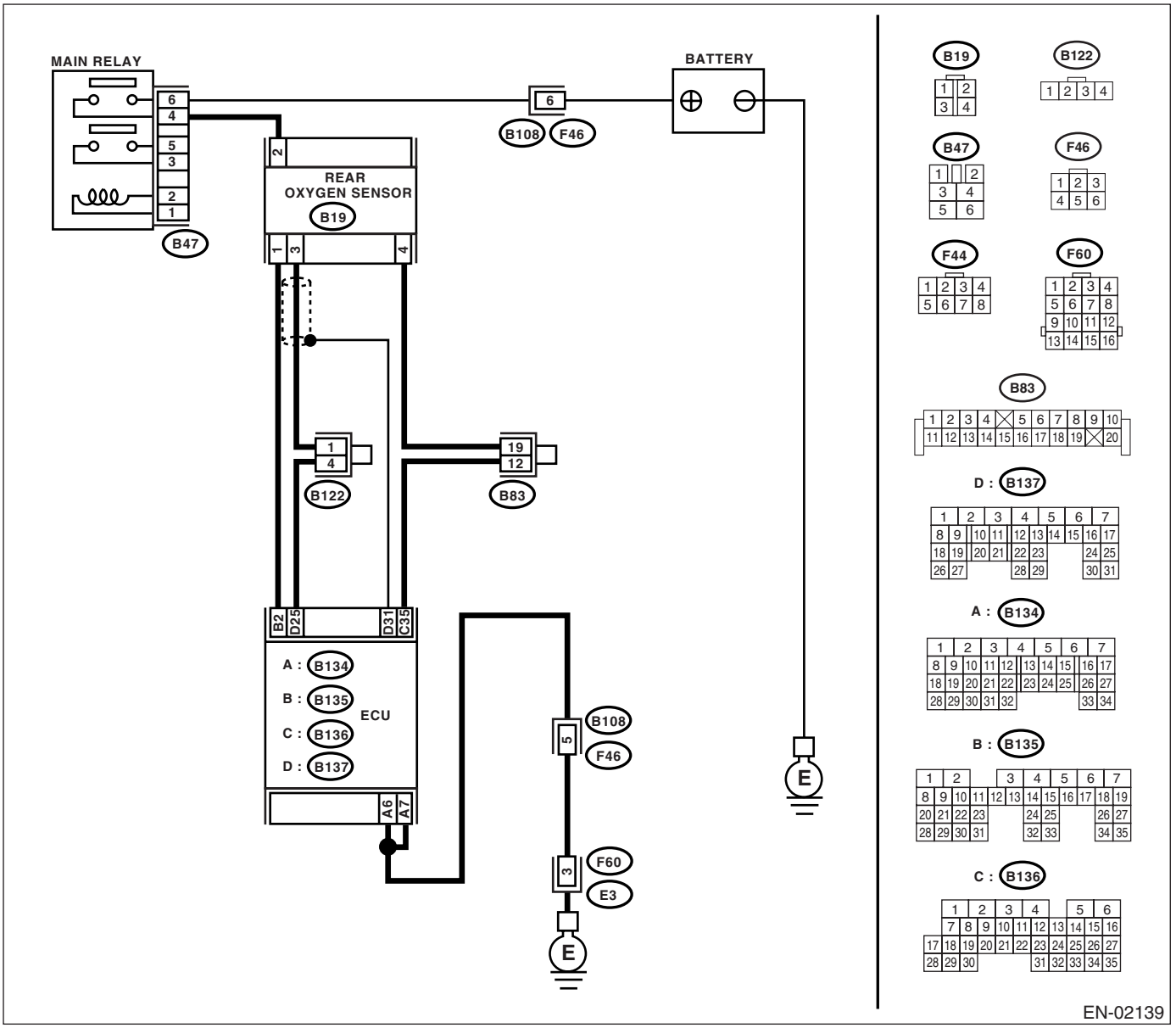
MEMO:

AC:DTC P0138 — O_2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-68, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Using the List of Diagnostic Trouble Code (DTC), check the appropriate DTC. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	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 2,000 rpm to 3,000 rpm for 2 minutes. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or 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(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Does the value fluctuate?	Go to step **6.**	Go to step **3.**
3	**CHECK REAR OXYGEN SENSOR DATA.** Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool.	Is the measured value within 0.2 to 0.4 V?	Go to step **4.**	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-40, Rear Oxygen Sensor.>
4	**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*** ***(B137) No. 25 — (B19) No. 3:***	Is the measured value more than 3 Ω?	Repair the open circuit in harness between ECM and rear oxygen sensor connector.	Go to step **5.**
5	**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 measured value more than 0.2 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-40, Rear Oxygen Sensor.>	Repair the 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

	Step	Check	Yes	No
6	**CHECK EXHAUST SYSTEM.** Check the 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 the faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-40, Rear Oxygen Sensor.>

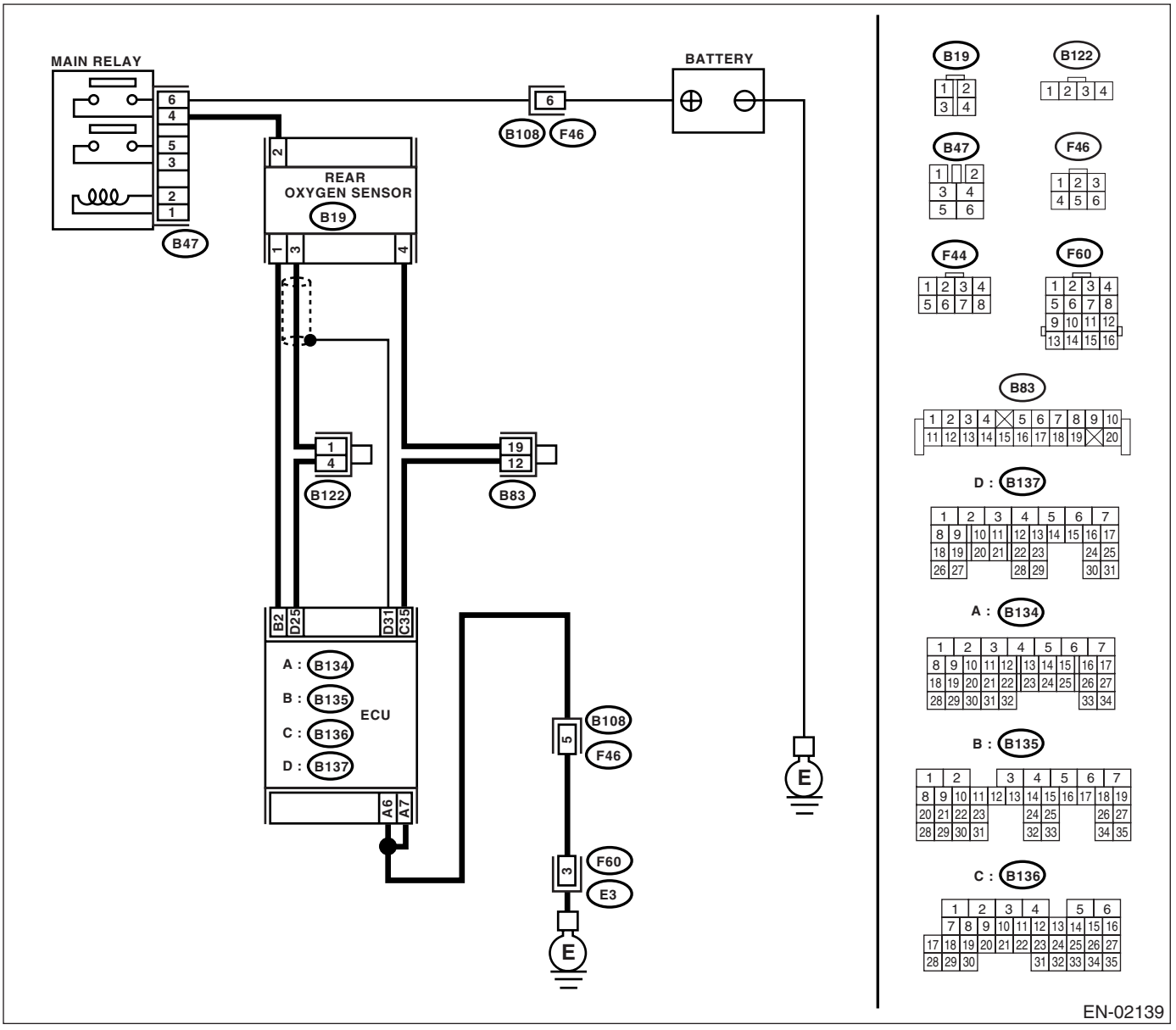
MEMO:

AD:DTC P0139 — O_2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-70, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



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(H4DOTC)-81, 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(H4DOTC)-40, Rear Oxygen Sensor.>

AE:DTC P0171 — SYSTEM TOO LEAN (BANK 1) —

NOTE:
For the diagnostic procedure, refer to DTC P0172. <Ref. to EN(H4DOTC)-166, DTC P0172 — SYSTEM TOO RICH (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AF:DTC P0172 — SYSTEM TOO RICH (BANK 1) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-75, DTC P0171 — SYSTEM TOO LEAN (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.> and <Ref. to GD(H4DOTC)-78, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the 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 the air intake system.	Go to step **3.**
3	**CHECK FUEL PRESSURE.** **Warning:** **•Place "NO FIRE" signs near the working area.** **•Be careful not to spill fuel on the floor.** 1) Release the 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 5 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 the fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value within 284 to 314 kPa (within 2.9 to 3.2 kg/cm^2, within 41 to 46 psi)?	Go to step **4.**	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

	Step	Check	Yes	No
4	**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 the 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 the pressure regulator and pressure regulator vacuum hose.	Is the measured value within 206 to 235 kPa (within 2.1 to 2.4 kg/cm^2, within 30 to 34 psi)?	Go to step **5.**	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
5	**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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 60°C (140°F)?	Go to step **6.**	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-27, Engine Coolant Temperature Sensor.>
6	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE.** 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value within the followings? Ignition ON: 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) Idling: 24.0 — 41.3 kPa (180 — 310 mmHg, 7.09 — 12.20 inHg)	Go to step **7.**	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>

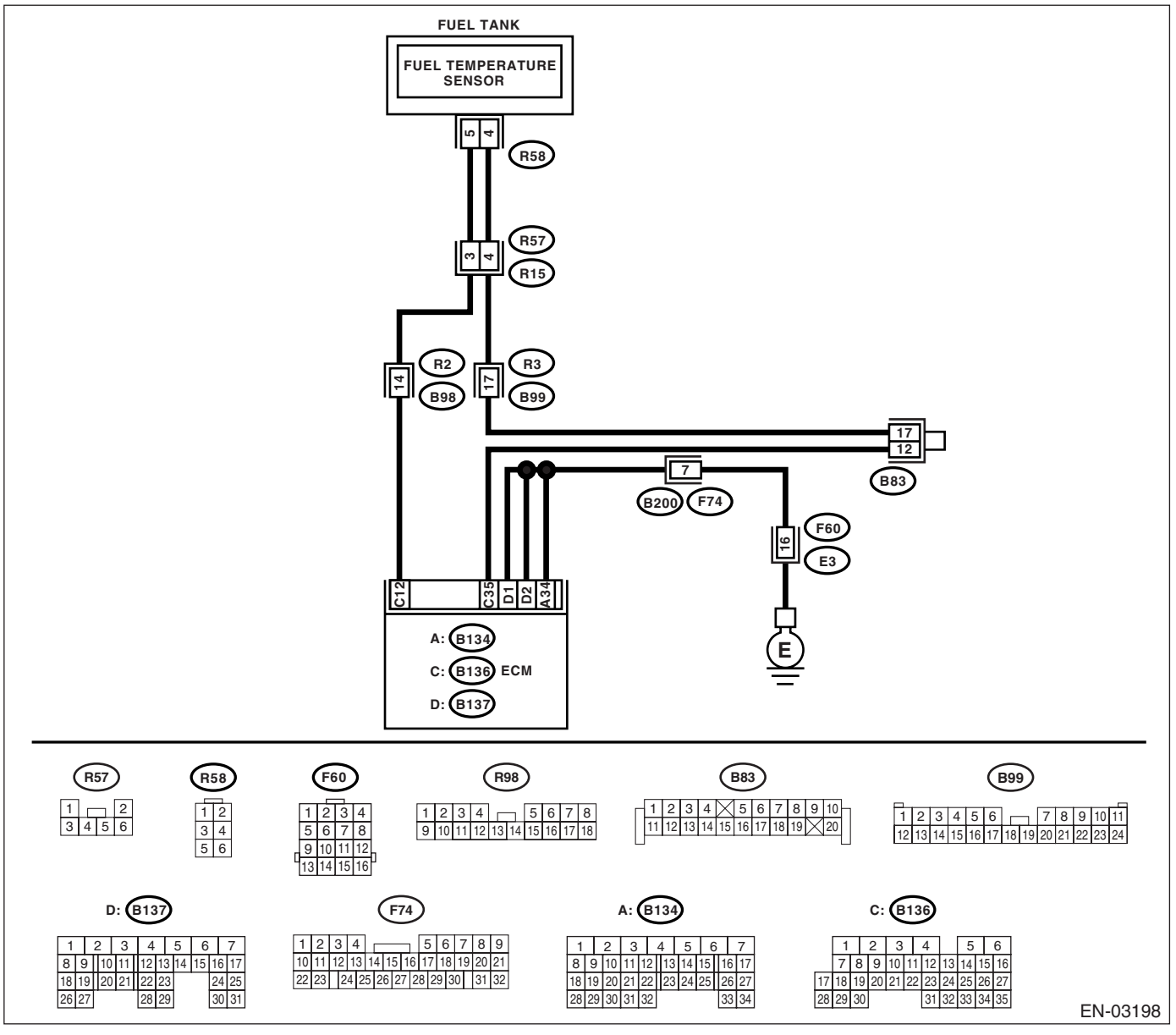
	Step	Check	Yes	No
7	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Subtract ambient temperature from intake air temperature. Is the obtained value within −10°C to 50°C (within 14°F to 122°F)?	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>

AG:DTC P0181 — FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-81, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



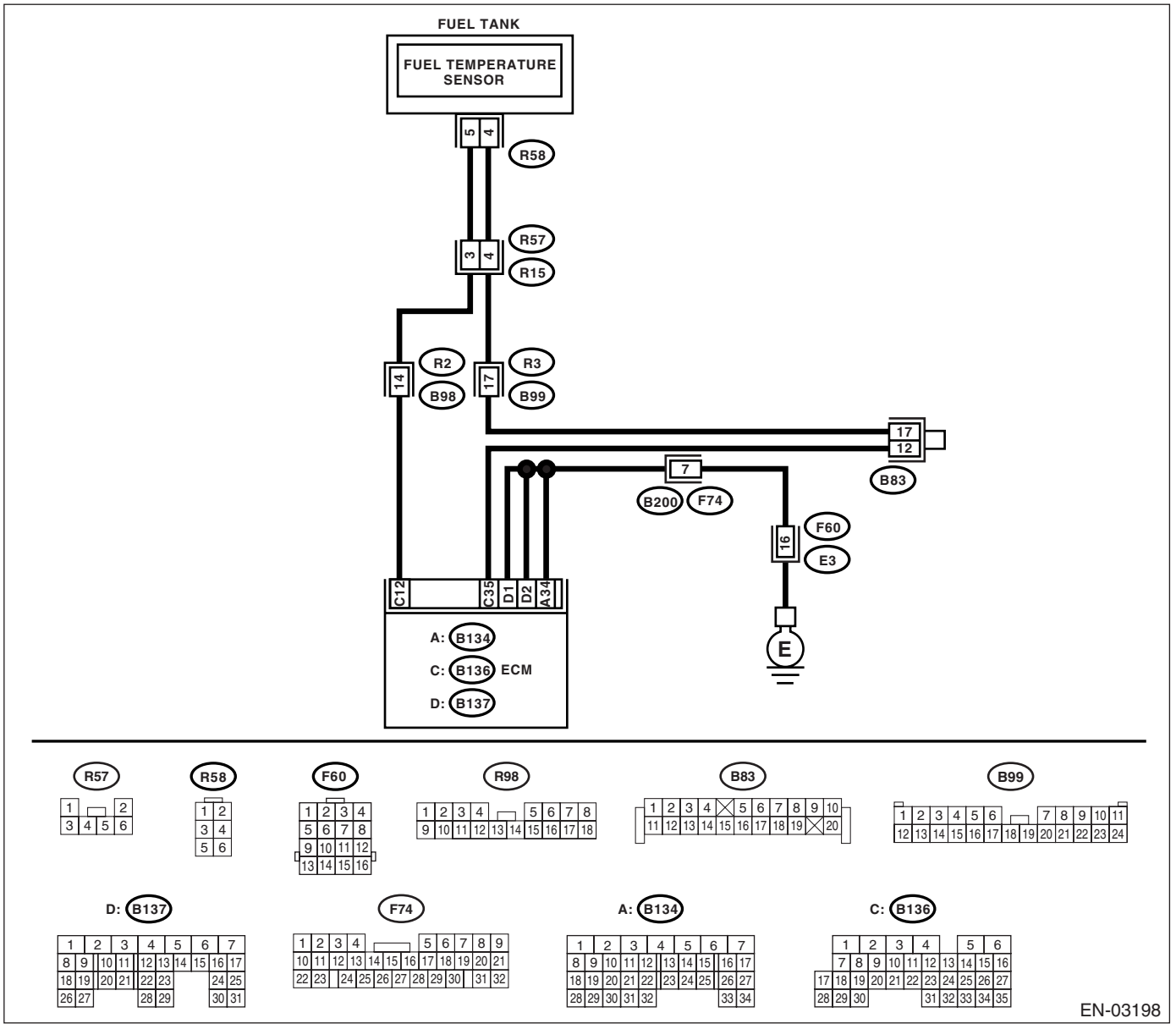
Step		Check	Yes	No
1	CHECK FOR OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Codes (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0181.	Replace the fuel temperature sensor. <Ref. to EC(H4DOTC)-8, Fuel Temperature Sensor.>

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

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-84, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



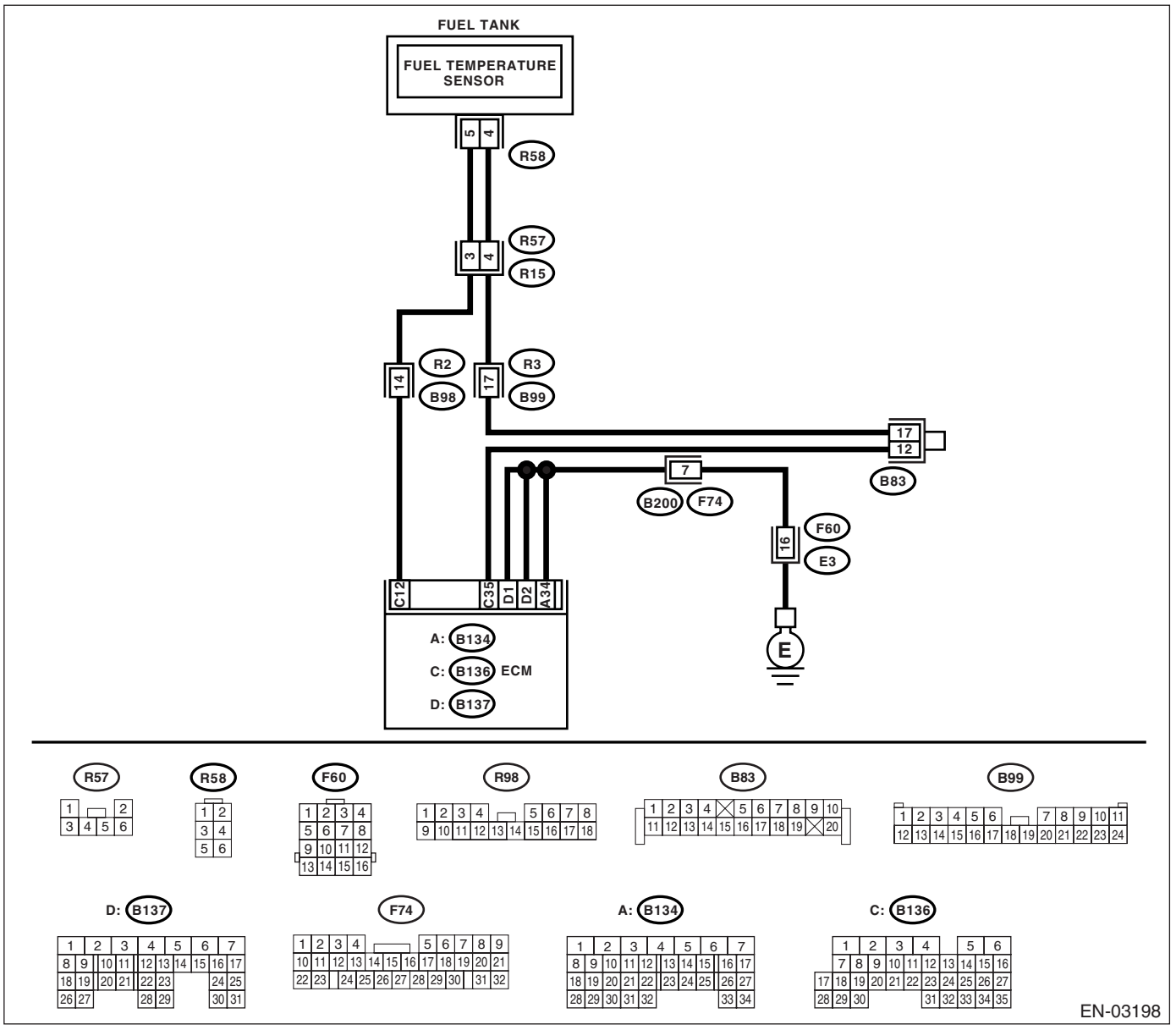
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of fuel temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 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.
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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –40°C (–40°F)?	Replace the fuel temperature sensor. <Ref. to EC(H4DOTC)-8, Fuel Temperature Sensor.>	Repair short circuit to ground in harness between fuel pump and ECM connector.

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

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-86, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than –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. 5 (+) — Chassis ground (–):***	Is the measured value 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. 5 (+) — Chassis ground (–):***	Is the measured value 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. 5 (+) — Chassis ground (–):***	Is the measured value 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

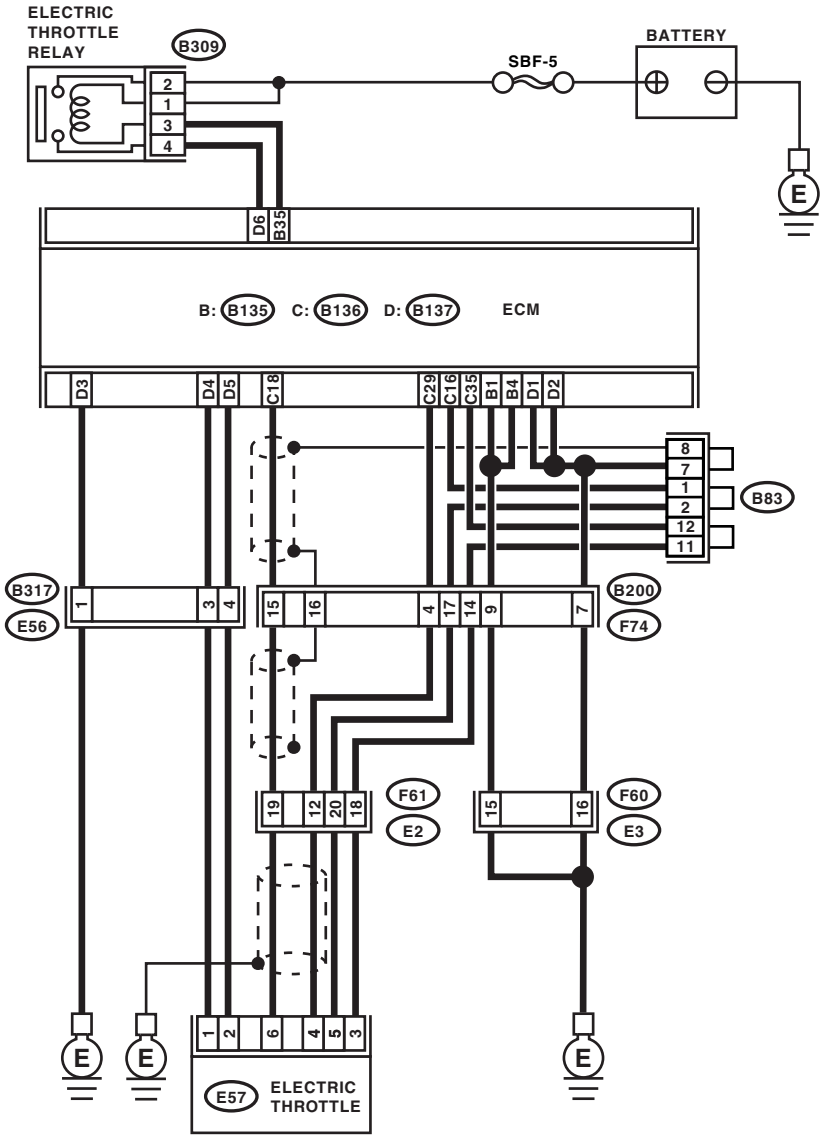
	Step	Check	Yes	No
5	**CHECK HARNESS BETWEEN FUEL TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between fuel pump connector and ECM. ***Connector & terminal*** ***(R58) No. 4 — (B136) No. 35:***	Is the measured value less than 1 Ω?	Replace the fuel temperature sensor. <Ref. to EC(H4DOTC)-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

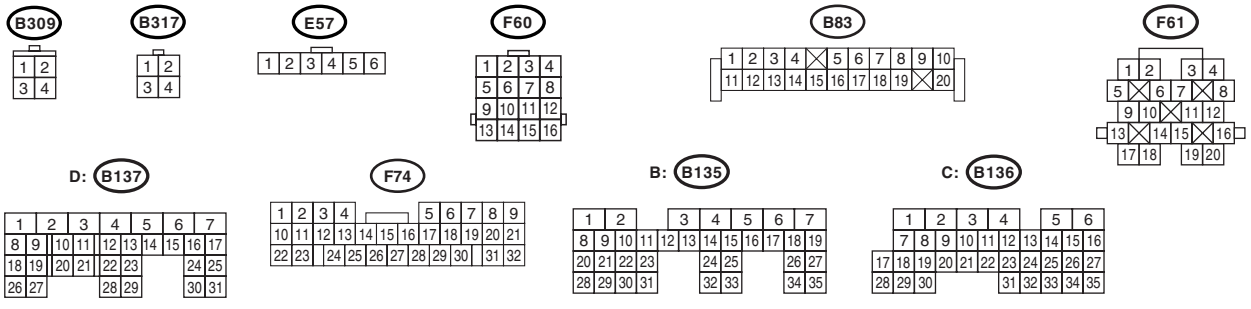
MEMO:

AJ:DTC P0222 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-88, DTC P0222 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance
  - Engine stalls.

- **WIRING DIAGRAM:**





EN-03197

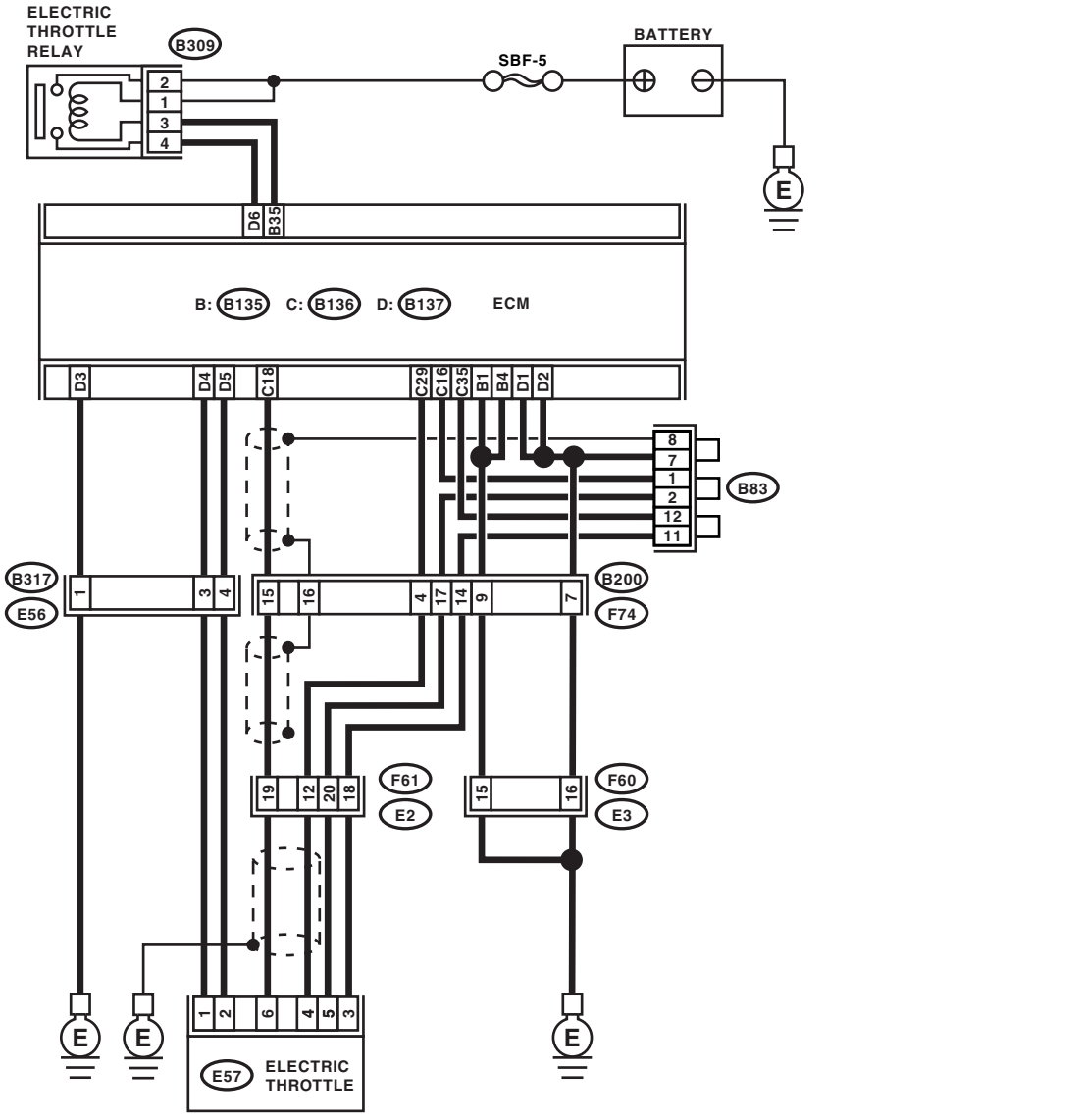
	Step	Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF SENSOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector terminals. ***Connector & terminal*** ***(B136) No. 29 (+) — (B136) No. 35 (–):*** 3) Shake the ECM harness and connector, engine harness connectors (E84, E22), electric throttle connector harness while monitoring value of voltage meter.	Is the measured value more than 0.8 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in the connectors between the ECM and electric throttle.	Is there poor contact in the connectors between ECM and electric throttle?	Repair the poor contact in connectors.	Connector has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from electric throttle. 4) Measure the resistance between the ECM connector and electric throttle connector. ***Connector & terminal*** ***(B136) No. 16 — (E57) No. 5:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open harness connector.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** Check the resistance between the ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 29 — Chassis ground:*** ***(B136) No. 16 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the chassis short of harness.
5	**CHECK POWER SURPLY TO SENSOR.** 1) Connect the ECM connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 5 (+) — Engine ground (-):*** 4) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value within 4.5 to 5.5 V?	Go to step **6.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
6	**CHECK SHORT OF ECM.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 4 — Engine ground:***	Is the measured value more than 10 Ω?	Repair the poor contact in electric throttle connector. If problem persists, replace the electric throttle.	Repair the poor contact in ECM connectors. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

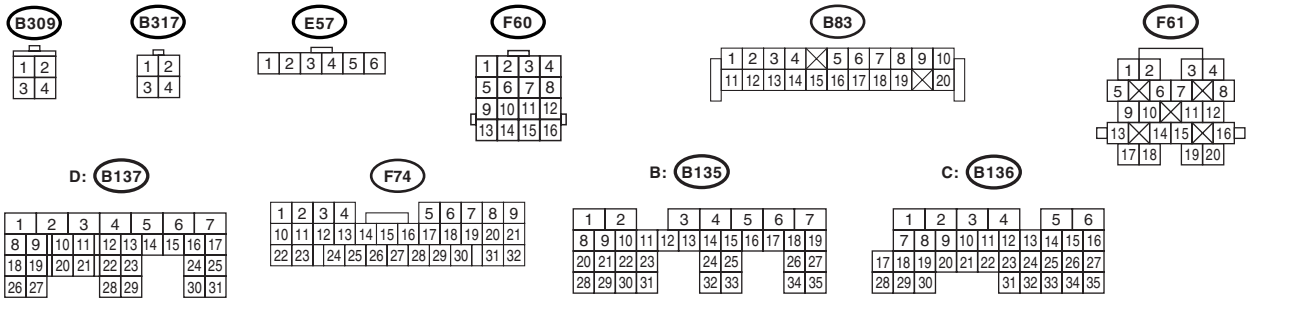
MEMO:

AK:DTC P0223 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-90, DTC P0223 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance
  - Engine stalls.

- **WIRING DIAGRAM:**





EN-03197

	Step	Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF SENSOR.** 1) Turn the ignition switch to ON. 2) Read the data of sub throttle sensor signals, using the Subaru Select Monitor. 3) Shake the ECM harness and connector, engine harness connectors (E84, E22), electric throttle connector harness while monitoring value of voltage meter.	Is the measured value less than 4.73 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and electric throttle.	Is there poor contact in the connectors between ECM and electric throttle?	Repair the poor contact in connectors.	Connector has returned to a normal condition at this time. A temporary poor contact of the connector may be the cause.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Disconnect the connectors from electric throttle. 4) Measure the resistance between ECM connector and electric throttle connector. ***Connector & terminal*** ***(B136) No. 35 — (E57) No. 3:*** ***(B136) No. 29 — (E57) No. 4:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open circuit of harness connector.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Connect the ECM connector. 2) Measure the resistance between the electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair the poor contact in ECM connector. If the problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
5	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 5 — Engine ground:*** 4) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value more than 10 V?	Go to step **6.**	Repair the battery short of harness between ECM connector and electric throttle connector.
6	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Measure the voltage between the electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 4 (+) — Engine ground (−):*** 2) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value less than 10 V?	Go to step **7.**	Repair the short of harness between ECM connector and electric throttle connector.

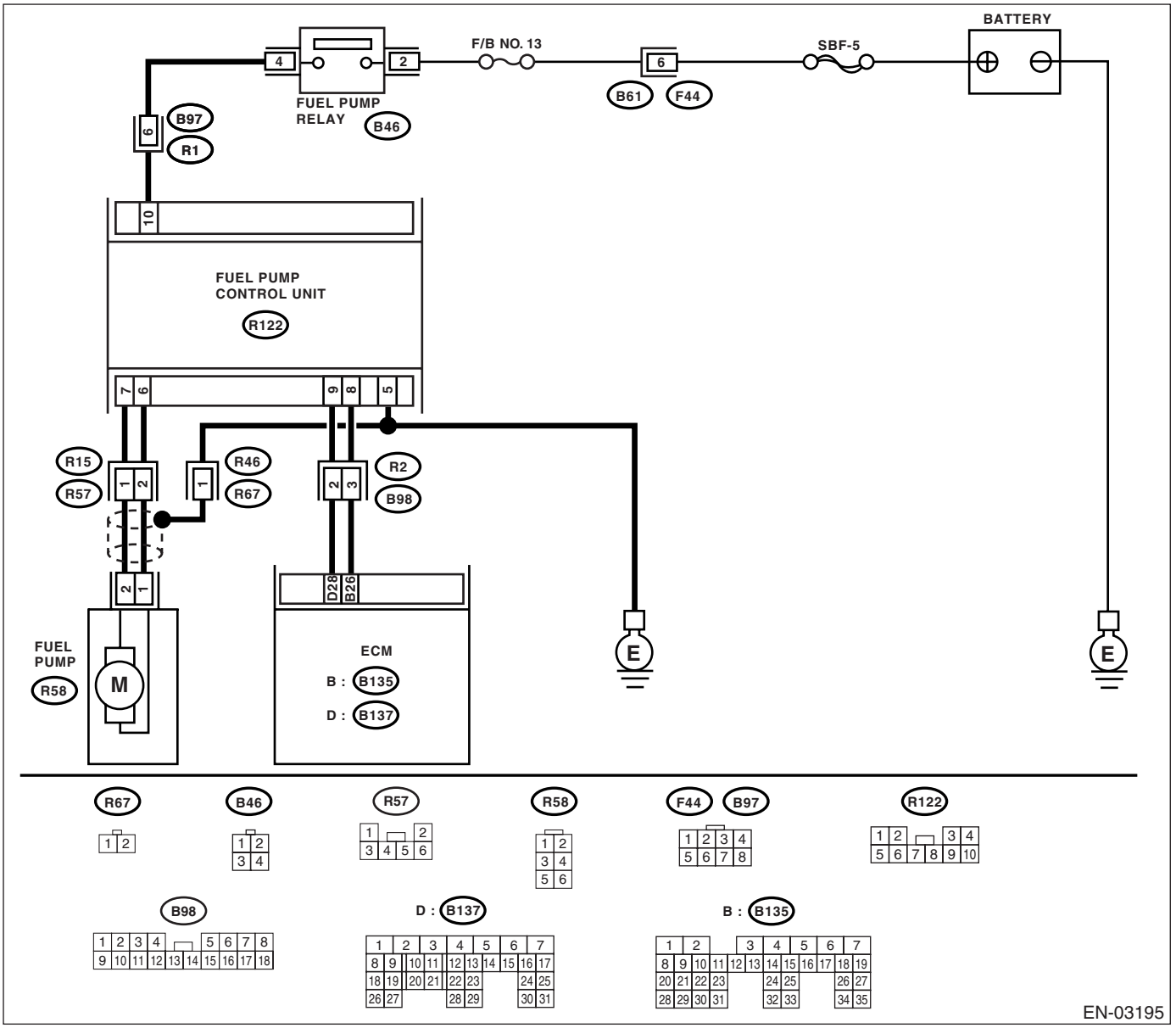
	Step	Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the voltage between connectors. ***Connector & terminal*** ***(B136) No. 29 — (B136) No. 16:***	Is the measured value more than 1 MΩ?	Repair the poor contact in electric throttle connector. If problem persists, replace the electric throttle.	Short circuit of sensor power supply may be the cause.

AL:DTC P0230 — FUEL PUMP PRIMARY CIRCUIT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-92, DTC P0230 — FUEL PUMP PRIMARY CIRCUIT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY CIRCUIT TO FUEL PUMP CONTROL UNIT.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel pump control unit. 3) Turn the ignition switch to ON. 4) Measure the voltage between fuel pump control unit and chassis ground. ***Connector & terminal*** ***(R122) No. 10 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **2.**	Repair the power supply circuit. NOTE: In this case repair the following: • Open or ground short circuit in harness between fuel pump relay and fuel pump control unit • Poor contact in fuel pump control unit connector • Poor contact in fuel pump relay connector
2	**CHECK GROUND CIRCUIT OF FUEL PUMP CONTROL UNIT.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between fuel pump control unit and chassis ground. ***Connector & terminal*** ***(R122) No. 5 — Chassis ground:***	Is the measured value less than 5 Ω?	Go to step **3.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit between fuel pump control unit and chassis ground • Poor contact in fuel pump control unit connector
3	**CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR.** 1) Disconnect the connector from fuel pump. 2) Measure the resistance of harness between fuel pump control unit and fuel pump connector. ***Connector & terminal*** ***(R122) No. 7 — (R58) No. 2:*** ***(R122) No. 6 — (R58) No. 1:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open circuit between fuel pump control unit and fuel pump.
4	**CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR.** Measure the resistance of harness between fuel pump control unit and chassis ground. ***Connector & terminal*** ***(R122) No. 7 — Chassis ground:*** ***(R122) No. 6 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the ground short circuit between fuel pump control unit and fuel pump.

	Step	Check	Yes	No
5	**CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between fuel pump control unit and ECM connector. ***Connector & terminal*** ***(R122) No. 9 — (B137) No. 28:*** ***(R122) No. 8 — (B135) No. 26:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit between fuel pump control unit and ECM • Poor contact in fuel pump control unit and ECM connector
6	**CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND ECM CONNECTOR.** Measure the resistance of harness between fuel pump control unit and chassis ground. ***Connector & terminal*** ***(R122) No. 9 — Chassis ground:*** ***(R122) No. 8 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **7.**	Repair the ground short circuit between fuel pump control unit and ECM.
7	**CHECK POOR CONTACT.** Check poor contact in ECM and fuel pump control unit connector.	Is there poor contact in ECM and fuel pump control unit connector?	Repair the poor contact in ECM and fuel pump control unit.	Go to step **8.**
8	**CHECK EXPERIENCE OF OUT OF GAS.**	Have the vehicle been out of gas before?	Complete the diagnosis. NOTE: DTC may be recorded due to the idle running of fuel pump at out of gas.	Replace the fuel pump control unit. <Ref. to FU(H4DOTC)-47, FUEL PUMP CONTROL UNIT, .>

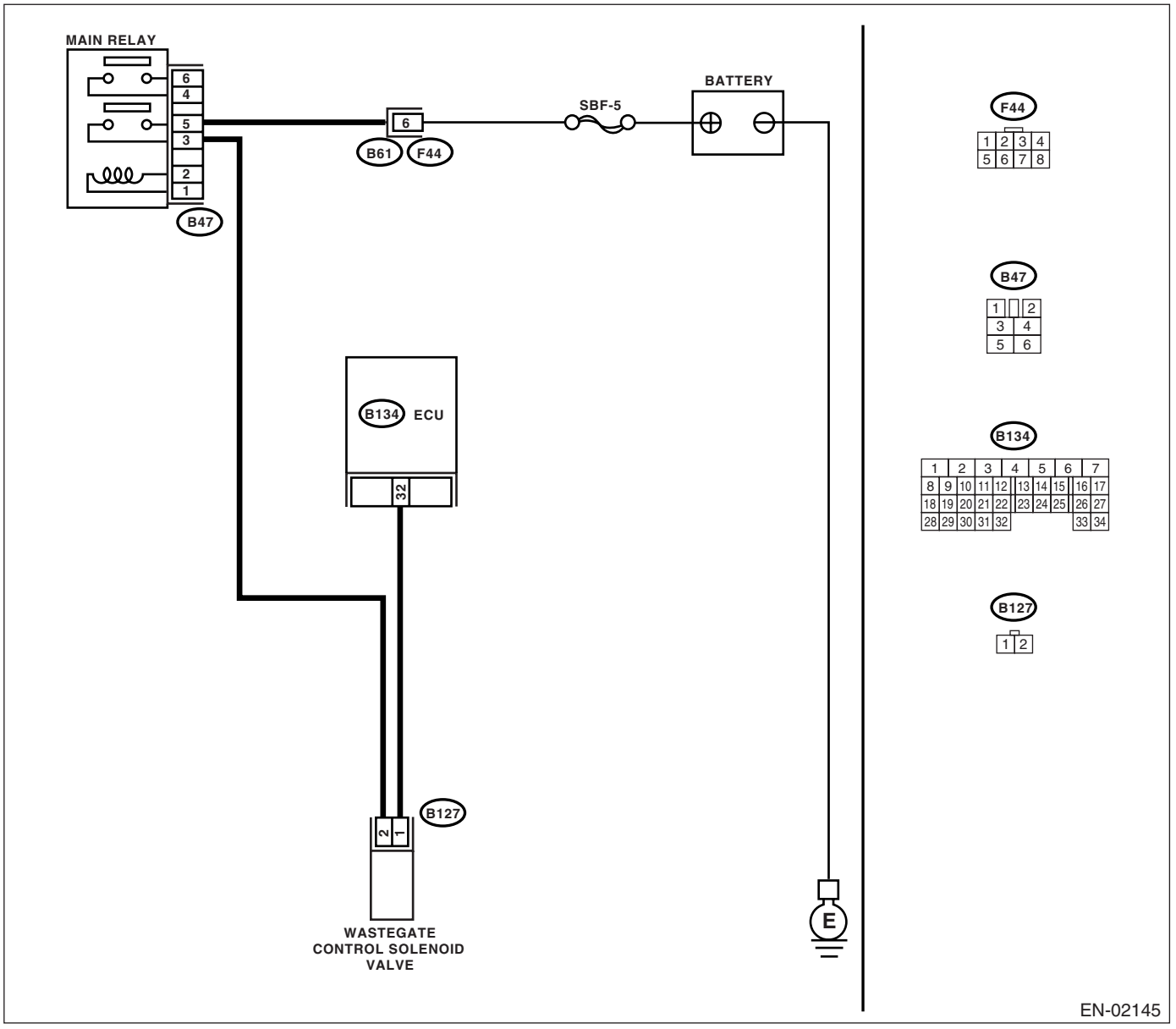
MEMO:

AM:DTC P0244 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-94, DTC P0244 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



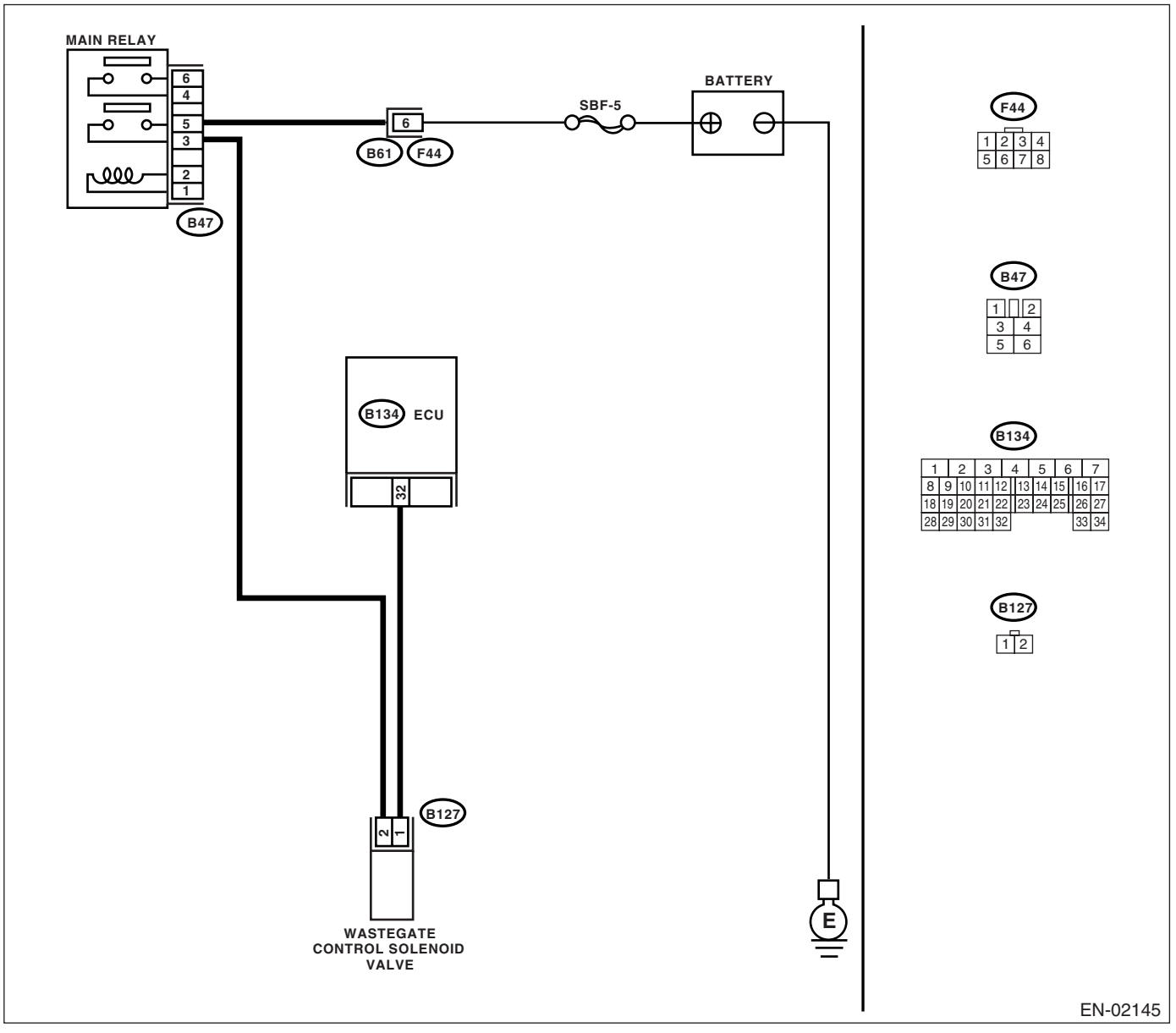
Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0244.	Replace the wastegate control solenoid valve. <Ref. to FU(H4DOTC)-37, Wastegate Control Solenoid Valve.>

AN:DTC P0245 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” LOW —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-96, DTC P0245 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



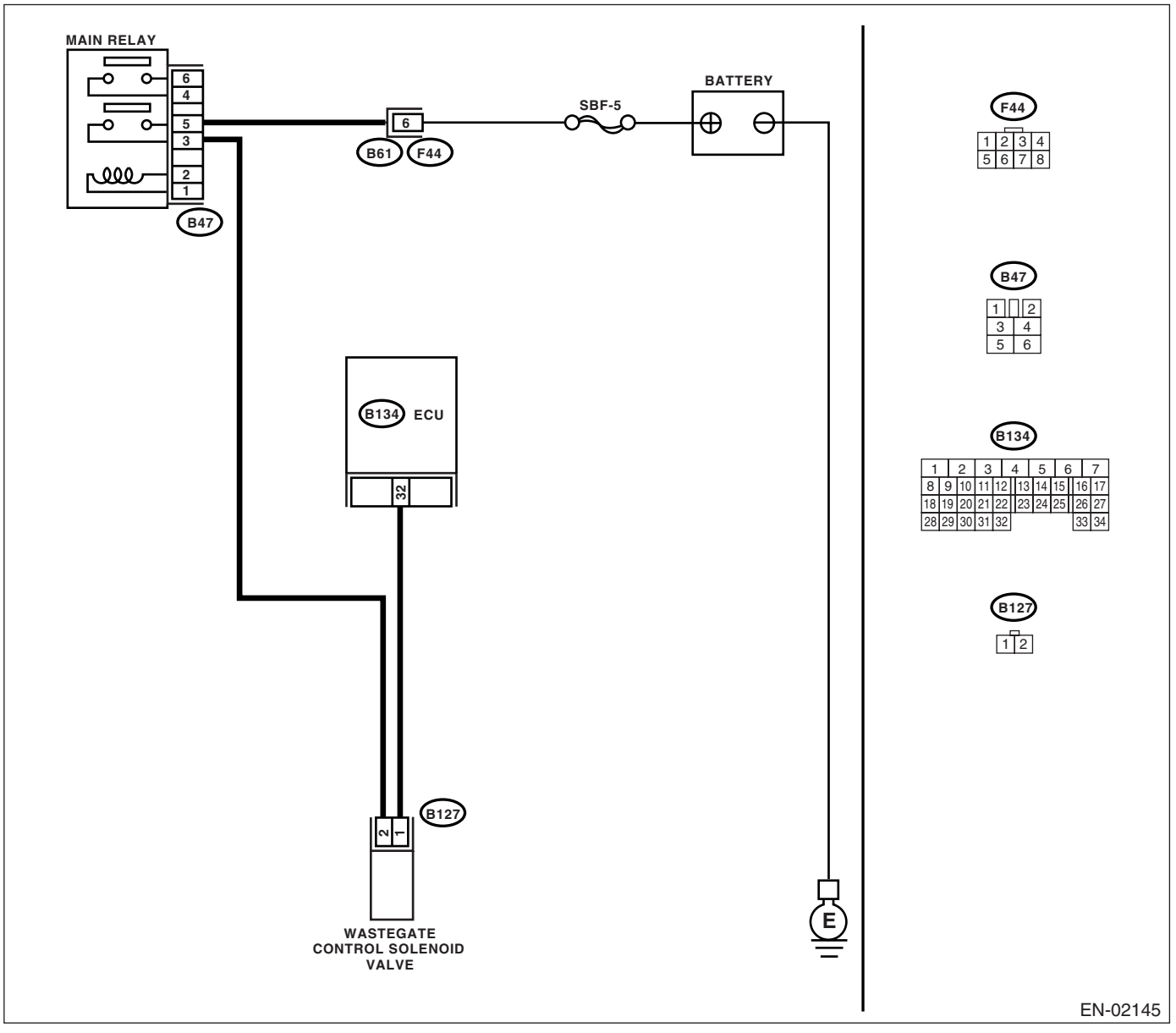
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 32 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time.	Go to step **2.**
2	**CHECK HARNESS BETWEEN WASTEGATE CONTROL SOLENOID VALVE AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from wastegate control solenoid valve and ECM. 3) Measure the resistance of harness between wastegate control solenoid valve connector and engine ground. ***Connector & terminal*** ***(B127) No. 1 — Engine ground:***	Is the measured value less than 10 Ω?	Repair the ground short circuit in harness between ECM and wastegate control solenoid valve connector.	Go to step **3.**
3	**CHECK HARNESS BETWEEN WASTEGATE CONTROL SOLENOID VALVE AND ECM CONNECTOR.** Measure the resistance of harness between ECM and wastegate control solenoid valve of harness connector. ***Connector & terminal*** ***(B134) No. 32 — (B127) No. 1:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open circuit in harness between ECM and wastegate control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and wastegate control solenoid valve connector
4	**CHECK WASTEGATE CONTROL SOLENOID VALVE.** 1) Remove the wastegate control solenoid valve. 2) Measure the resistance between wastegate control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 30 to 40 Ω?	Go to step **5.**	Replace the wastegate control solenoid valve. <Ref. to FU(H4DOTC)-37, Wastegate Control Solenoid Valve.>
5	**CHECK POWER SUPPLY TO WASTEGATE CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between wastegate control solenoid valve and engine ground. ***Connector & terminal*** ***(B127) No. 2 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Go to step **6.**	Repair the open circuit in harness between main relay and wastegate control solenoid valve connector.
6	**CHECK POOR CONTACT.** Check poor contact in wastegate control solenoid valve connector.	Is there poor contact in wastegate control solenoid valve connector?	Repair the poor contact in wastegate control solenoid valve connector.	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

AO:DTC P0246 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” HIGH —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-98, DTC P0246 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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. 32 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **3.**	Go to step **2.**
2	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
3	**CHECK HARNESS BETWEEN WASTEGATE CONTROL SOLENOID VALVE AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from wastegate control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 32 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between ECM and wastegate control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Go to step **4.**
4	**CHECK WASTEGATE CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between wastegate control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 1 Ω?	Replace the wastegate control solenoid valve <Ref. to FU(H4DOTC)-37, Wastegate Control Solenoid Valve.> and ECM <Ref. to FU(H4DOTC)-43, 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 the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

MEMO:

AP:DTC P0301 — CYLINDER 1 MISFIRE DETECTED —

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DOTC)-197, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AQ:DTC P0302 — CYLINDER 2 MISFIRE DETECTED —

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DOTC)-197, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AR:DTC P0303 — CYLINDER 3 MISFIRE DETECTED —

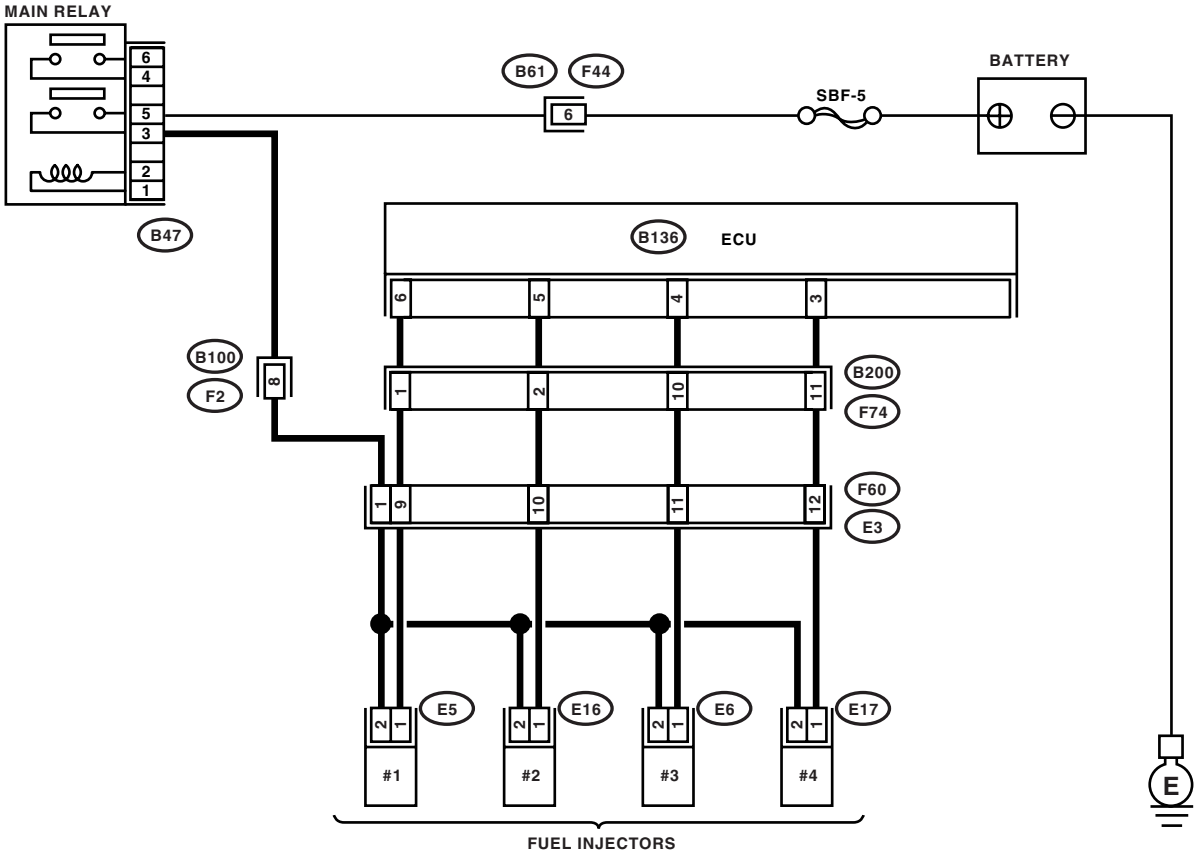
NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DOTC)-197, DTC P0304 — CYLINDER 4 MISFIRE DETECTED —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AS:DTC P0304 — CYLINDER 4 MISFIRE DETECTED —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - Immediately at fault recognition (A misfire which could damage catalyst occurs.)
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-100, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Erroneous idling
  - Rough driving

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-02137

	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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	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 (B136) No. 6 (+) — Chassis ground (–):*** ***#2 (B136) No. 5 (+) — Chassis ground (–):*** ***#3 (B136) No. 4 (+) — Chassis ground (–):*** ***#4 (B136) No. 3 (+) — Chassis ground (–):***	Is the measured value 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) Disconnect the connector from ECM. 4) 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 measured value more than 1 MΩ?	Go to step **4.**	Repair the 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 (B136) No. 6 — (E5) No. 1:*** ***#2 (B136) No. 5 — (E16) No. 1:*** ***#3 (B136) No. 4 — (E6) No. 1:*** ***#4 (B136) No. 3 — (E17) No. 1:***	Is the measured value less than 1 Ω?	Go to step **5.**	Repair the 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 measured value within 5 to 20 Ω?	Go to step **6.**	Replace the faulty fuel injector. <Ref. to FU(H4DOTC)-33, Fuel Injector.>

	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 measured value more than 10 V?	Repair the poor contact in all connectors in fuel injector circuit.	Repair the 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 (B136) No. 6 (+) — Chassis ground (–):*** ***#2 (B136) No. 5 (+) — Chassis ground (–):*** ***#3 (B136) No. 4 (+) — Chassis ground (–):*** ***#4 (B136) No. 3 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between ECM and fuel injector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, 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 measured value less than 1 Ω?	Replace the faulty fuel injector <Ref. to FU(H4DOTC)-33, Fuel Injector.> and ECM <Ref. to FU(H4DOTC)-43, 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 the 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(H4DOTC)-58, Crankshaft Sprocket.>	Go to step **11.**

	Step	Check	Yes	No
11	**CHECK INSTALLATION CONDITION OF TIMING BELT.** Turn the crankshaft, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block.	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4DOTC)-49, Timing Belt Assembly.>	Go to step **12.**
12	**CHECK FUEL LEVEL.**	Is the fuel meter indication higher than the “Lower” level?	Go to step **13.**	Replenish the 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(H4DOTC)-32, Subaru Select Monitor.> 2) Start the engine, and drive the vehicle more than 10 minutes.	Is the malfunction indicator light coming on or blinking?	Go to step **15.**	Go to step **14.**
14	**CHECK CAUSE OF MISFIRE DIAGNOSED.**	Was the cause of misfire diagnosed when the engine is running?	Finish the diagnostics operation, if the engine has no abnormality.	Repair the poor contact. NOTE: In this case, repair the following: • Poor contact in ignition coil connector • Poor contact in fuel injector connector on faulty cylinders • Poor contact in ECM connector • Poor contact in coupling connector
15	**CHECK AIR INTAKE SYSTEM.**	Is there a fault in air intake system?	Repair the 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 **16.**
16	**CHECK CYLINDER.**	Is there a fault in that cylinder?	Repair or replace the faulty parts. NOTE: Check the following items. • Spark plug • Fuel injector • Compression pressure	Go to DTC P0171 and P0172. <Ref. to EN(H4DOTC)-165, DTC P0171 — SYSTEM TOO LEAN (BANK 1) —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

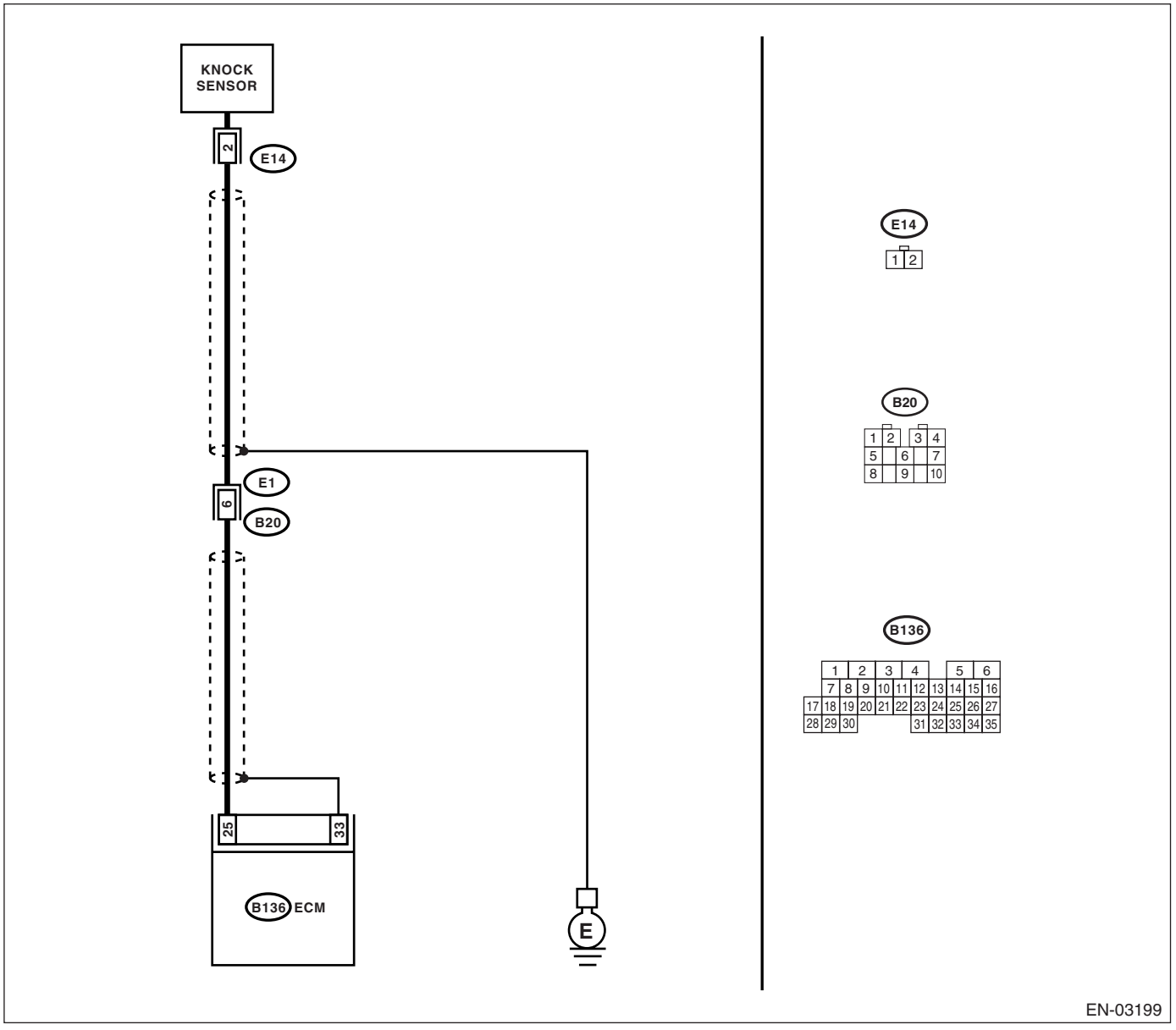
MEMO:

AT: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(H4DOTC)-109, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



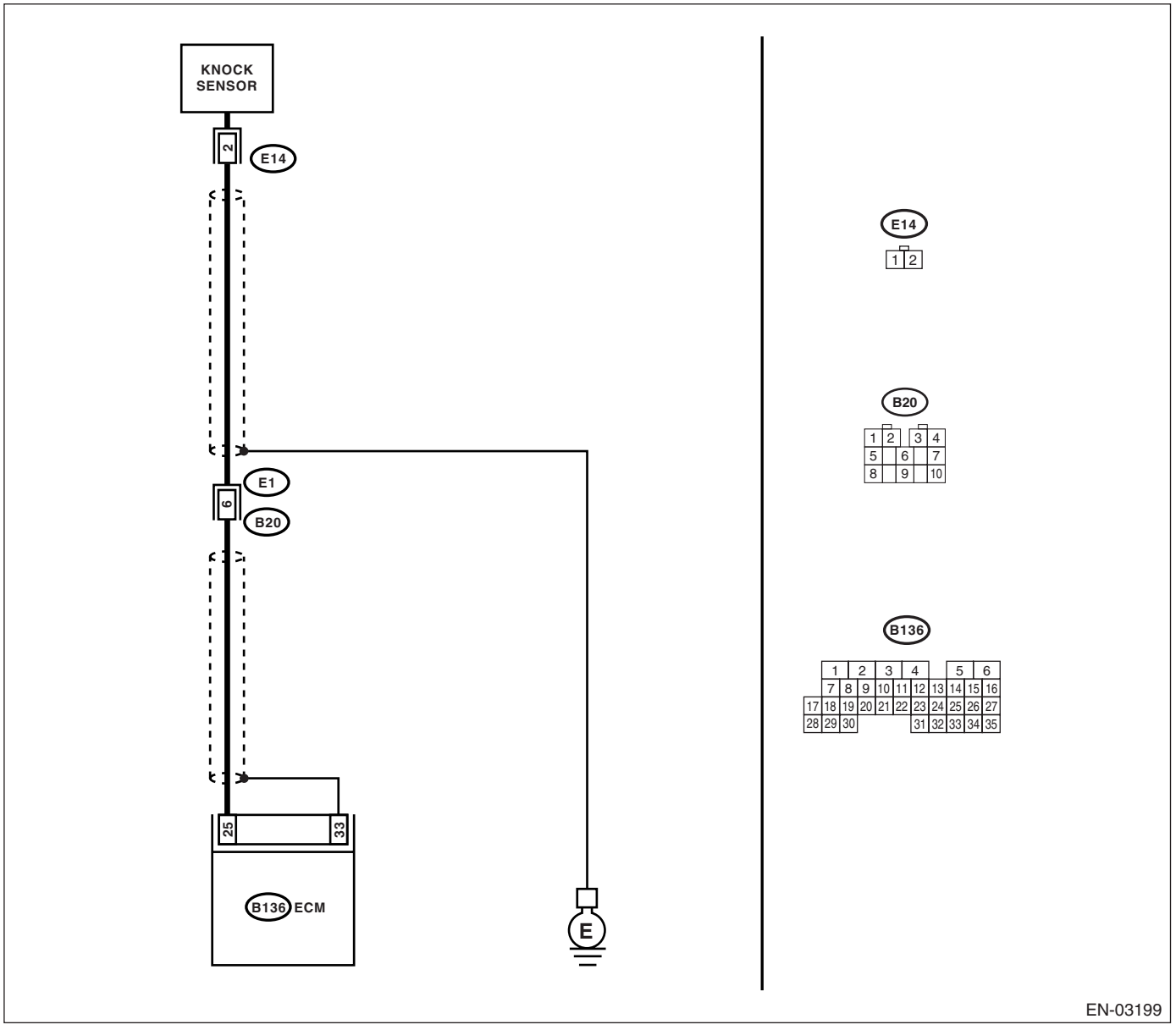
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM harness connector and chassis ground. ***Connector & terminal*** ***(B136) No. 25 — Chassis ground:***	Is the measured value more than 700 kΩ?	Go to step **2.**	Repair the 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 measured value more than 700 kΩ?	Go to step **3.**	Repair the harness and connector. NOTE: In this case, repair the following: • Poor contact in knock sensor connector • Poor contact in coupling connector
3	**CHECK CONDITION OF KNOCK SENSOR INSTALLATION.**	Is the knock sensor installation bolt tightened securely?	Replace the knock sensor. <Ref. to FU(H4DOTC)-30, Knock Sensor.>	Tighten the knock sensor installation bolt securely.

AU: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(H4DOTC)-111, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



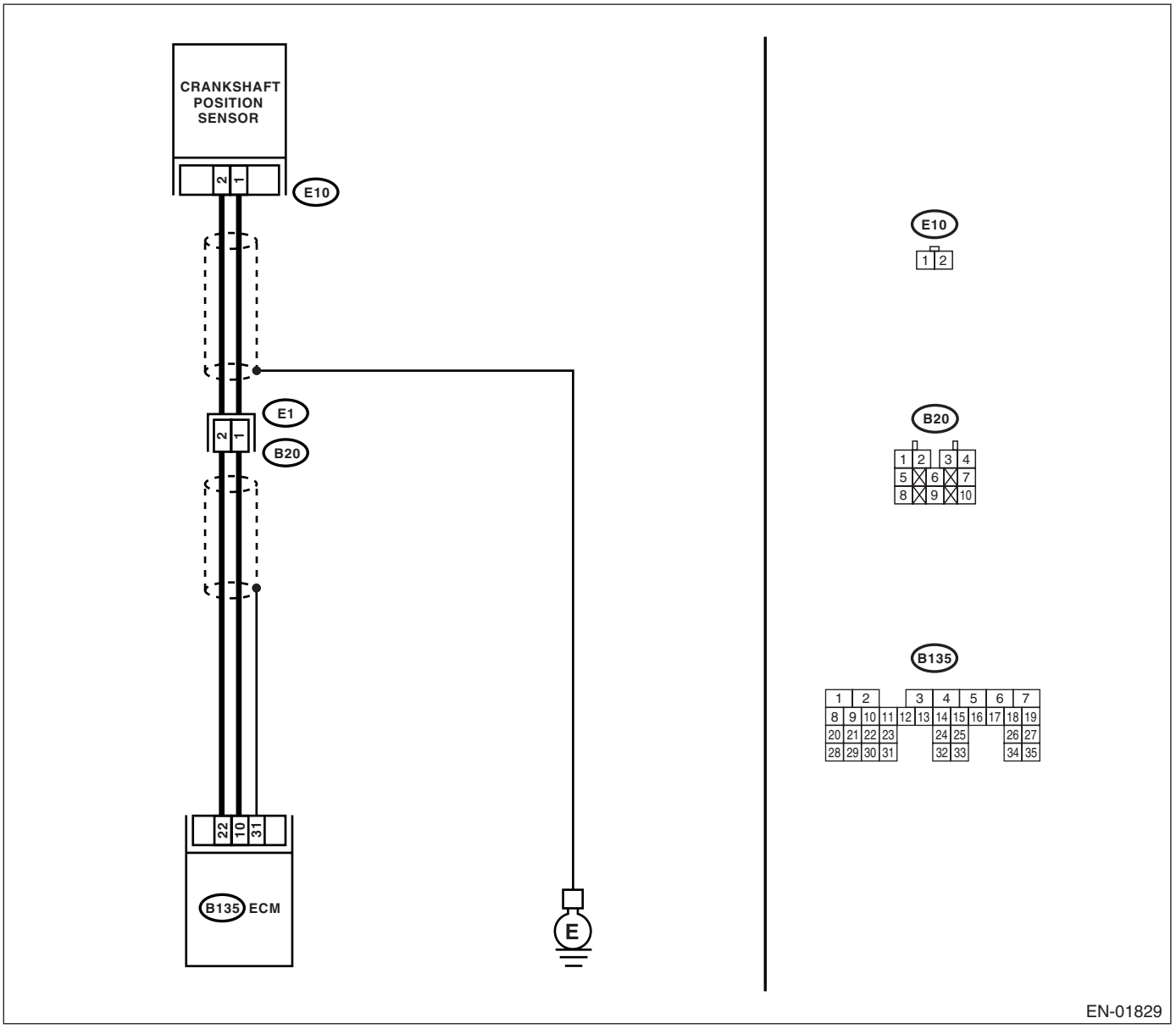
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR.** Measure the resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 25 — Chassis ground:***	Is the measured value less than 400 kΩ?	Go to step **2.**	Go to step **3.**
2	**CHECK 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 measured value less than 400 kΩ?	Replace the knock sensor. <Ref. to FU(H4DOTC)-30, Knock Sensor.>	Repair the ground short circuit in harness between knock sensor connector and ECM connector. NOTE: The harness between both connectors is shielded. Repair the 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*** ***(B136) No. 25 (+) — Chassis ground (−):***	Is the measured value 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 the poor contact in ECM connector.

AV:DTC P0335 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-113, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



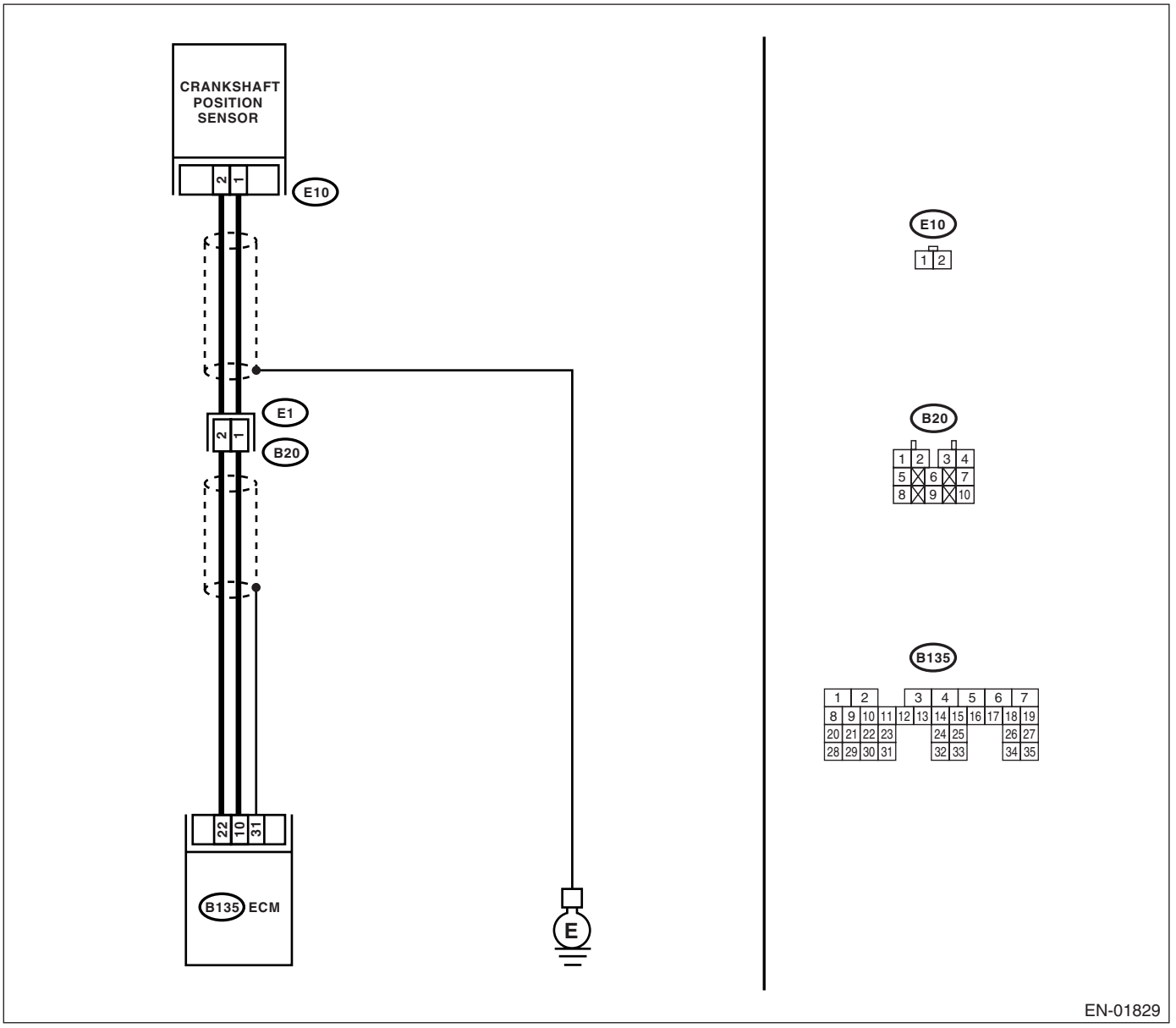
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from crankshaft position sensor. 3) Measure the resistance of harness between crankshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E10) No. 1 — Engine ground:***	Is the measured value more than 100 kΩ?	Repair the 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 measured value more than 1 MΩ?	Go to step **3.**	Repair the 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.
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 measured value less than 5 Ω?	Go to step **4.**	Repair the 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 the 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 measured value within 1 to 4 kΩ?	Repair the poor contact in crankshaft position sensor connector.	Replace the crankshaft position sensor. <Ref. to FU(H4DOTC)-28, Crankshaft Position Sensor.>

AW:DTC P0336 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/ PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-115, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



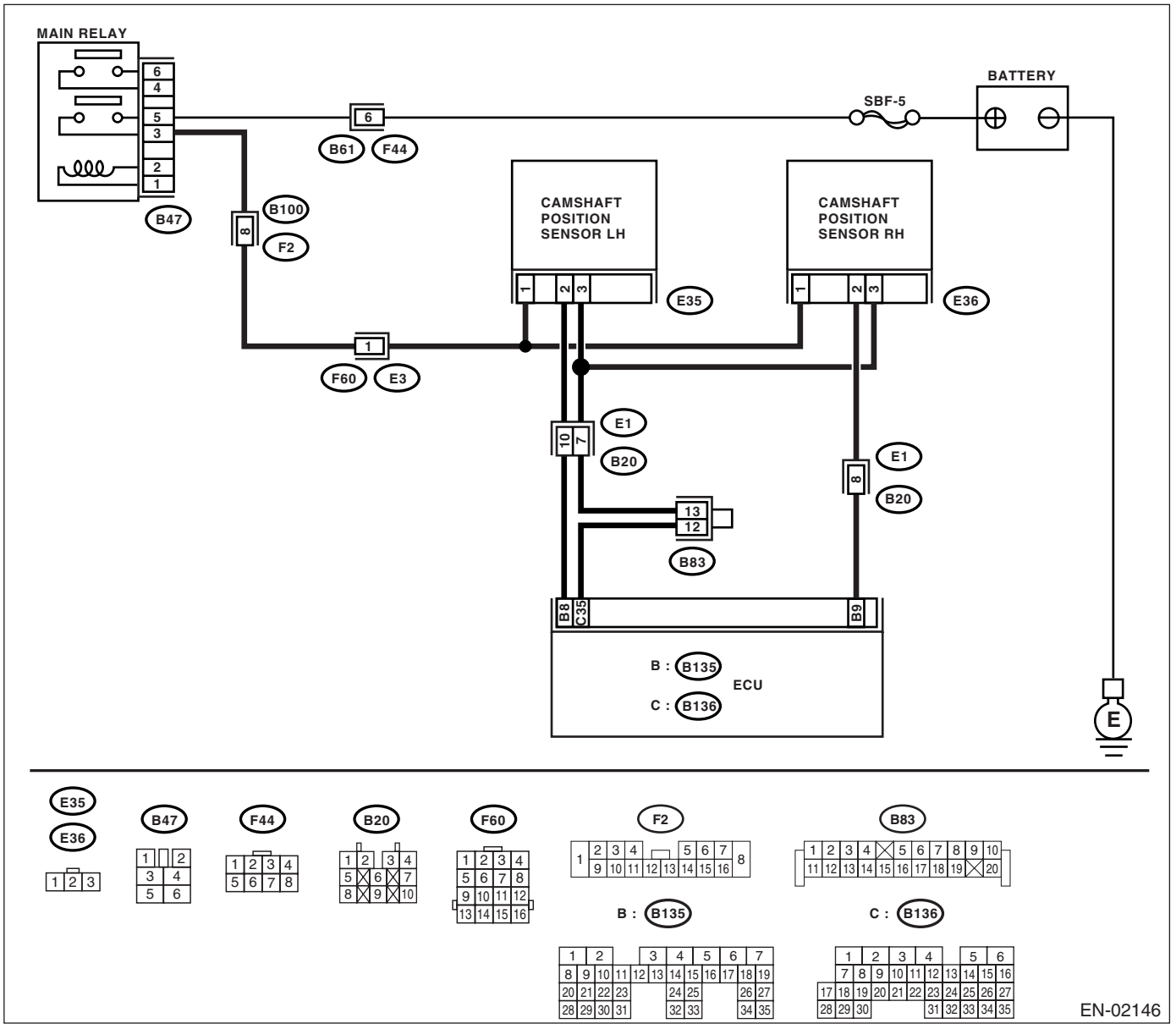
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.** Turn the ignition switch to OFF.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step **3.**	Tighten the crankshaft position sensor installation bolt securely.
3	**CHECK CRANKSHAFT SPROCKET.** Remove the front belt cover.	Are the crankshaft sprocket teeth cracked or damaged?	Replace the crankshaft sprocket. <Ref. to FU(H4DOTC)-28, Crankshaft Position Sensor.>	Go to step **4.**
4	**CHECK INSTALLATION CONDITION OF TIMING BELT.** Turn the crankshaft, and align alignment mark on crankshaft sprocket with alignment mark on cylinder block.	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4DOTC)-49, Timing Belt Assembly.>	Replace the crankshaft position sensor. <Ref. to FU(H4DOTC)-28, Crankshaft Position Sensor.>

AX:DTC P0340 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-117, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



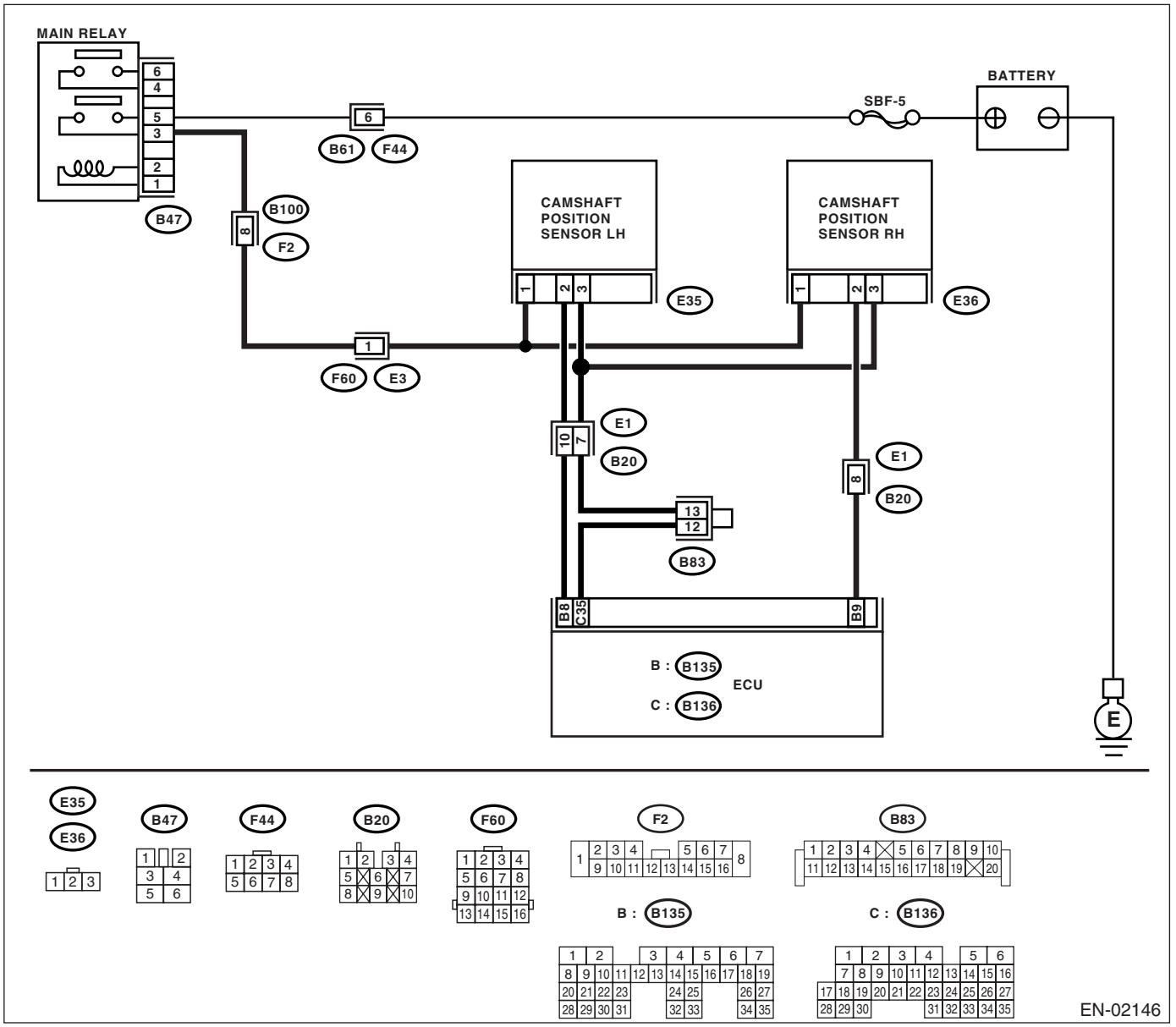
	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the voltage between camshaft position sensor and engine ground. ***Connector & terminal*** ***(E36) No. 1 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Repair the ground short circuit between main relay connector and camshaft position sensor connector.	Go to step **2.**
2	**CHECK POWER SUPPLY TO CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between camshaft position sensor and engine ground. ***Connector & terminal*** ***(E36) No. 1 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Go to step **3.**	Repair the open or ground short circuit between main relay connector and camshaft position sensor connector.
3	**CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between camshaft position sensor and ECM. ***Connector & terminal*** ***(E36) No. 2 — (E135) No. 9:*** ***(E36) No. 3 — (E136) No. 35:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open circuit between camshaft position sensor and ECM.
4	**CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM.** Measure the resistance between camshaft position sensor and engine ground. ***Connector & terminal*** ***(E36) No. 2 — Engine ground:*** ***(E36) No. 3 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the ground short circuit between camshaft position sensor and ECM.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6.**	Tighten the camshaft position sensor installation bolt securely.
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the camshaft position sensor wave form. <Ref. to EN(H4DOTC)-23, Engine Control Module (ECM) I/O Signal.>	Is any abnormality found in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DOTC)-29, Camshaft Position Sensor.>	Go to step **7.**
7	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

AY:DTC P0345 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-119, DTC P0345 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



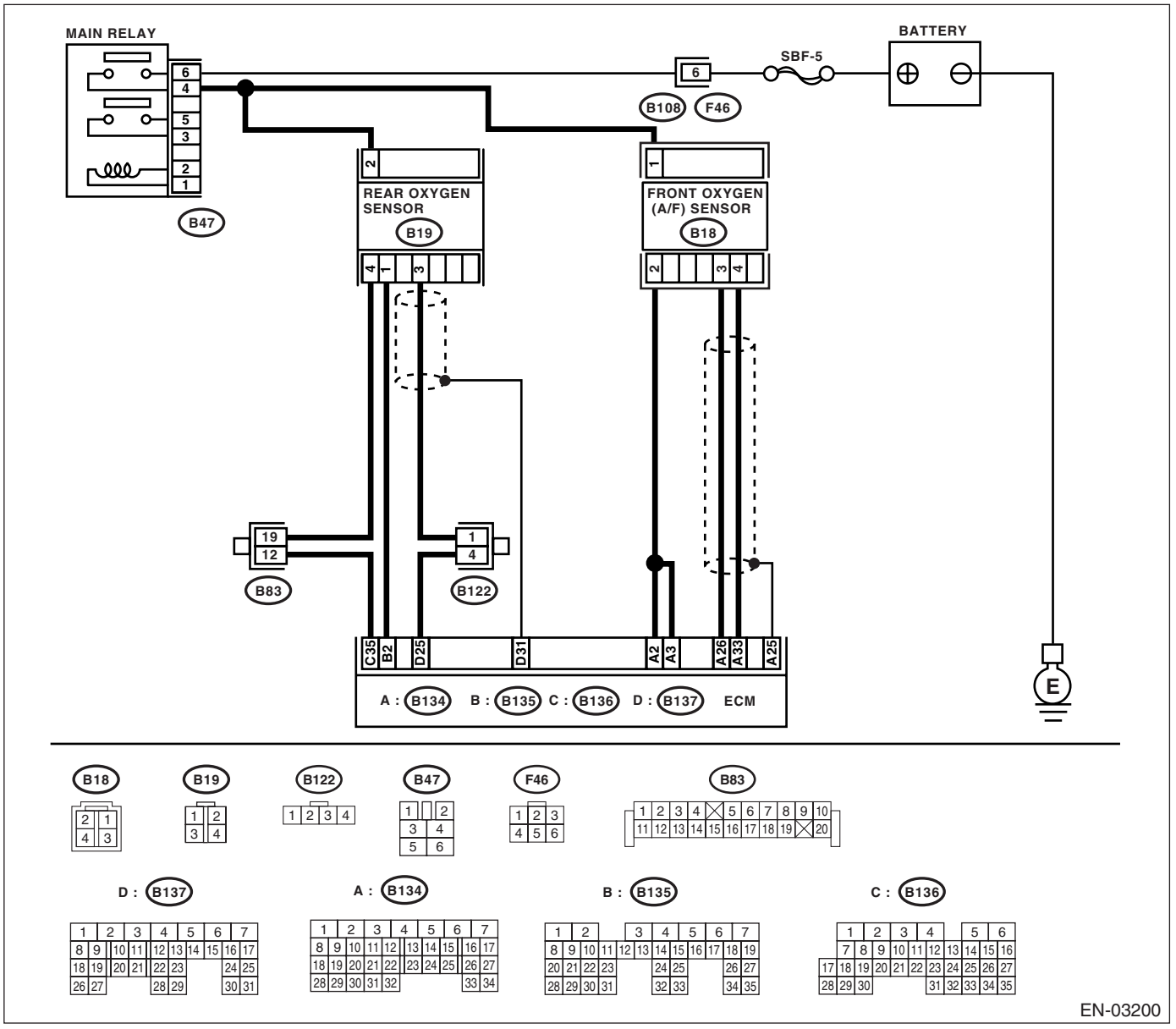
	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the voltage between camshaft position sensor and engine ground. ***Connector & terminal*** ***(E35) No. 1 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Repair the battery short circuit between main relay connector and camshaft position sensor connector.	Go to step **2.**
2	**CHECK POWER SUPPLY TO CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between camshaft position sensor and engine ground. ***Connector & terminal*** ***(E35) No. 1 (+) — Engine ground (−):***	Is the measured value more than 10 V?	Go to step **3.**	Repair the open or ground short circuit between main relay connector and camshaft position sensor connector.
3	**CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between camshaft position sensor and ECM. ***Connector & terminal*** ***(E35) No. 2 — (B135) No. 8:*** ***(E35) No. 3 — (B136) No. 35:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open circuit between camshaft position sensor and ECM.
4	**CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM.** Measure the resistance between camshaft position sensor and engine ground. ***Connector & terminal*** ***(E35) No. 2 — Engine ground:*** ***(E35) No. 3 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the ground short circuit between camshaft position sensor and ECM.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6.**	Tighten the camshaft position sensor installation bolt securely.
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the camshaft position sensor wave form. <Ref. to EN(H4DOTC)-23, Engine Control Module (ECM) I/O Signal.>	Is any abnormality found in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DOTC)-29, Camshaft Position Sensor.>	Go to step **7.**
7	**CHECK POOR CONTACT.** Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

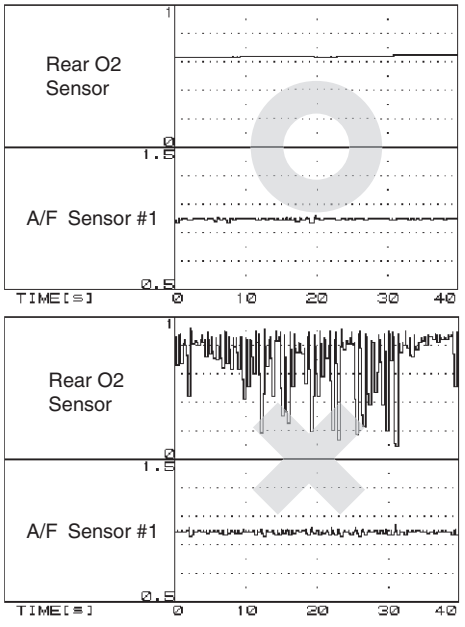
AZ:DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) —

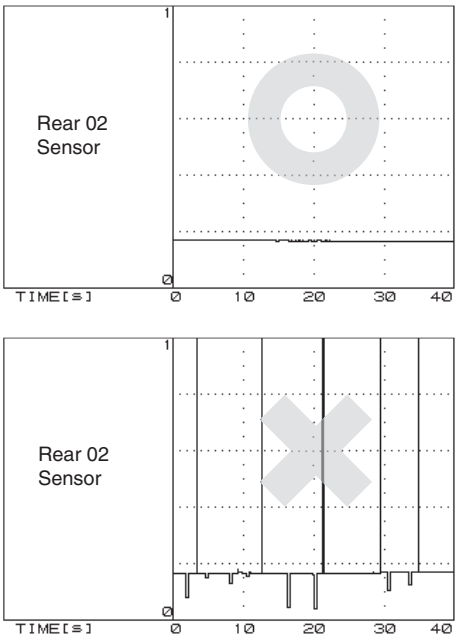
- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-120, DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
- **TROUBLE SYMPTOM:**
  - Engine stalls.
  - Idle mixture is out of specifications.

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, 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 •Loose part and improper installation of front oxygen (A/F) sensor or rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace the exhaust system. <Ref. to EX(H4DOTC)-2, General Description.>	Go to step **3.**
3	**CHECK WAVEFORM DATA ON SUBARU SELECT MONITOR (WHILE DRIVING).** 1) Drive the vehicle at a constant speed of 80 — 112 km/h (50 — 70 MPH). 2) Keep the condition of step 1) for 5 minutes, then read the waveform data in a driving condition using Subaru Select Monitor.  EN-04680	Is normal waveform pattern displayed?	Contact your SOA Service Center. NOTE: The probable cause is considered as the deterioration of multiple parts.	Go to step **4.**

	Step	Check	Yes	No
4	**CHECK WAVEFORM DATA ON SUBARU SELECT MONITOR (WHILE IDLING).** 1) Idle the engine. 2) Under the condition of step 1), read the waveform data using Subaru Select Monitor.  EN-04681	Is normal waveform pattern displayed?	Go to step **10.**	Go to step **5.**
5	**CHECK REAR OXYGEN SENSOR VOLTAGE.** 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and keep the engine speed at 3,000 rpm. (Max. 2 minutes) 2) Read the voltage of rear oxygen (A/F) sensor using Subaru Select Monitor. NOTE: •For MT model, depress the clutch pedal. •Subaru Select Monitor For detailed operation procedure, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.>	Is the voltage more than 490 mV?	Go to step **9.**	Go to step **6.**
6	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Does water enter the connector?	Dry the water thoroughly.	Go to step **7.**
7	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and rear oxygen sensor. 3) Measure the resistance of harness between ECM and rear oxygen sensor connector. ***Connector & terminal*** ***(B137) No. 25 — (B19) No. 3:*** ***(B136) No. 35 — (B19) No. 4:***	Is the resistance more than 3 Ω?	Repair the open circuit of harness between ECM and rear oxygen sensor connector.	Go to step **8.**

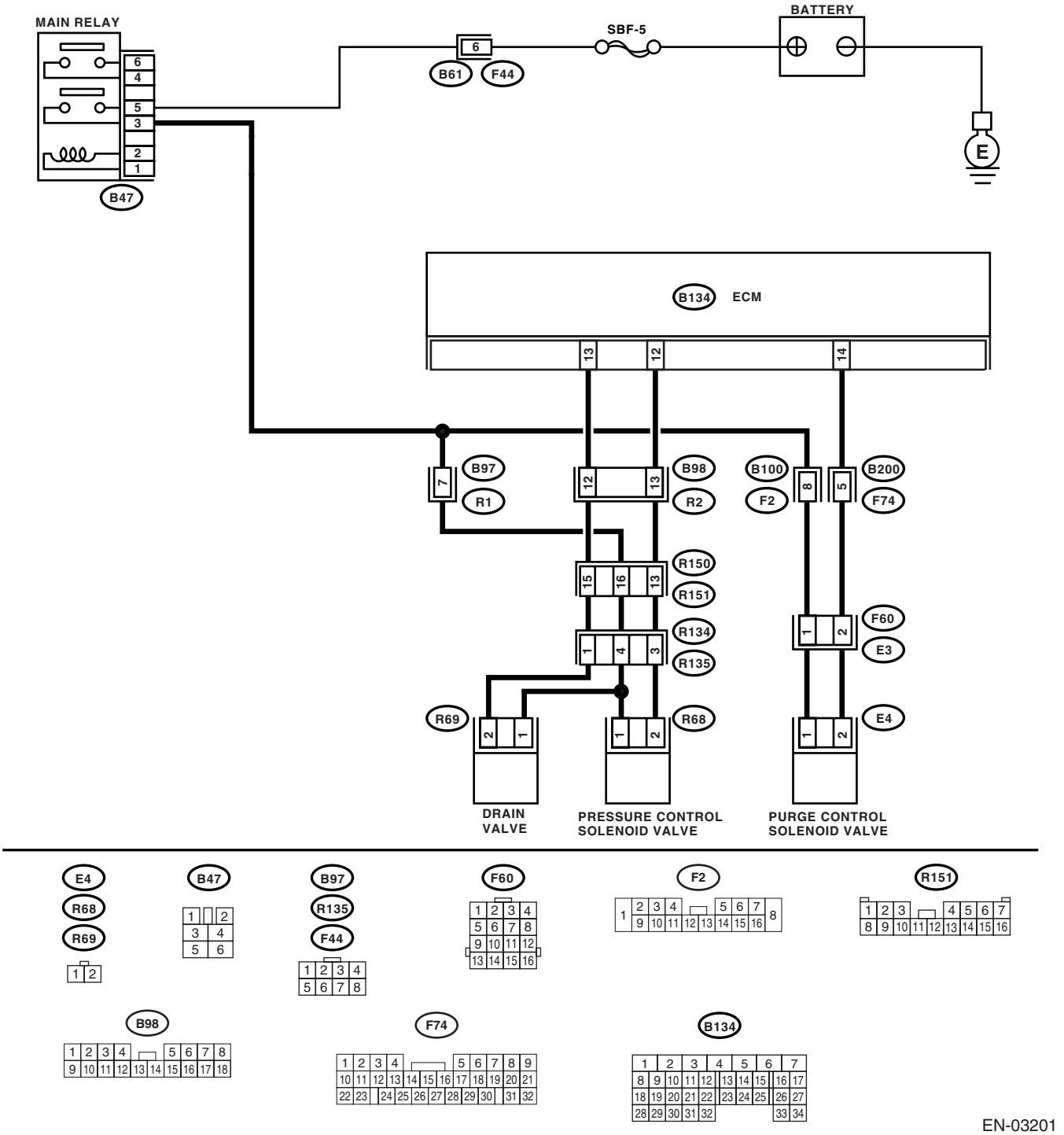
	Step	Check	Yes	No
8	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(B19) No. 3 (+) — Chassis ground (−):***	Is the voltage 0.2 — 0.5 V?	Go to step **11.**	Repair the harness and connector. NOTE: Repair the following. • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor and ECM connector • Poor contact in ECM connector
9	**CHECK REAR OXYGEN SENSOR VOLTAGE.** 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the voltage of rear oxygen (A/F) sensor using Subaru Select Monitor. NOTE: •For MT model, depress the clutch pedal. •Subaru Select Monitor For detailed operation procedure, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.>	Is the voltage 250 mV or less?	Contact your SOA Service Center. NOTE: The probable cause is considered as the deterioration of multiple parts.	Go to step **6.**
10	**CHECK CATALYTIC CONVERTER.**	Is the catalytic converter damaged?	Replace the catalytic converter. <Ref. to EC(H4DOTC)-3, Front Catalytic Converter.>	Contact your SOA Service Center. NOTE: The probable cause is considered as the deterioration of multiple parts.
11	**CHECK REAR OXYGEN SENSOR SHIELD.** 1) Turn the ignition switch to OFF. 2) Bare the harness sensor shield on the body side of rear oxygen sensor connector. 3) Measure the resistance between sensor shield and chassis ground.	Is resistance less than 1 Ω?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-40, Rear Oxygen Sensor.>	Repair the open circuit of rear oxygen sensor harness.

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-123, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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(H4DOTC)-81, 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(H4DOTC)-59, 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(H4DOTC)-53, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step **6.**	Replace the drain valve. <Ref. to EC(H4DOTC)-16, 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(H4DOTC)-53, 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(H4DOTC)-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(H4DOTC)-53, 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(H4DOTC)-12, Pressure Control Solenoid Valve.>

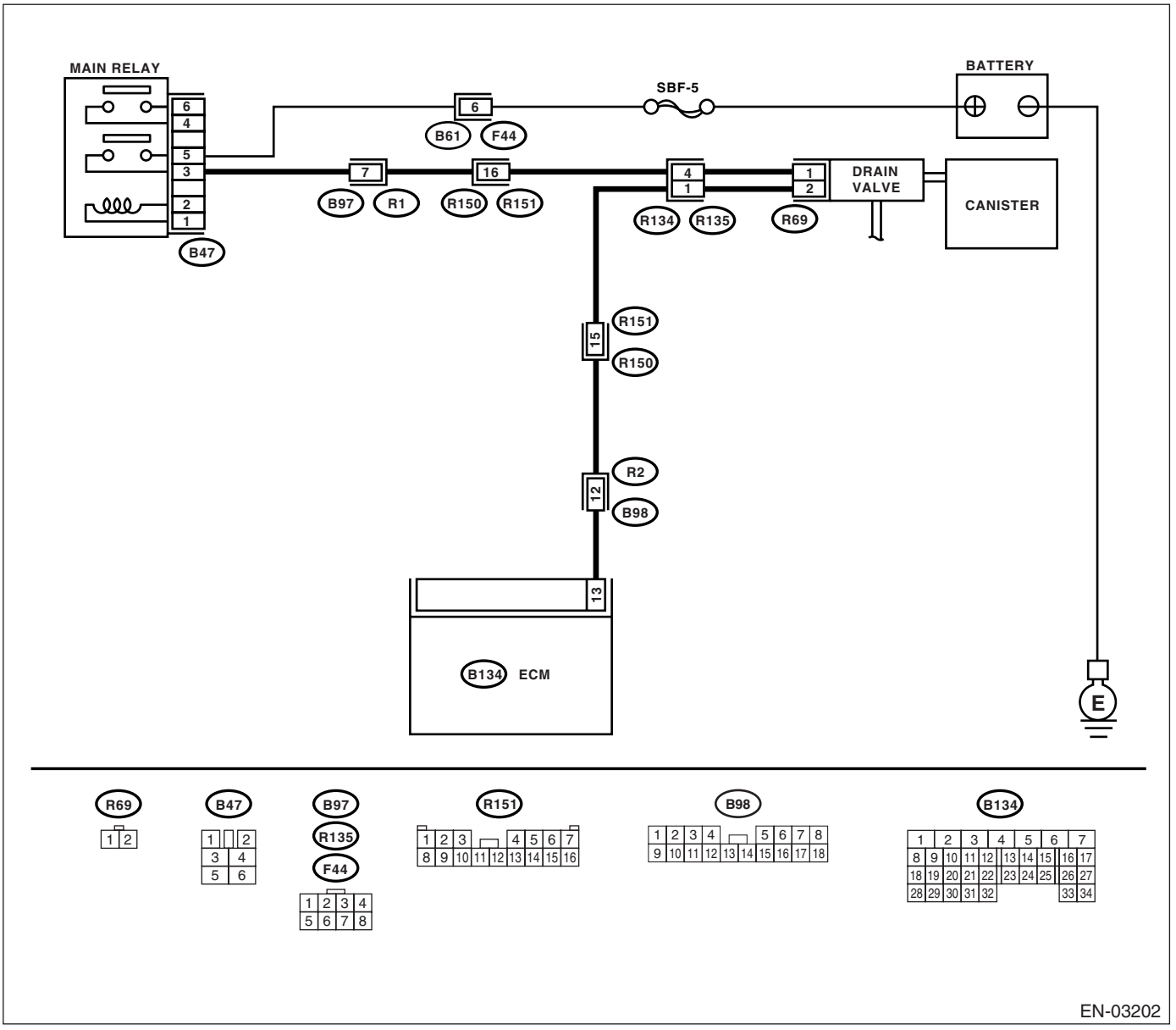
	Step	Check	Yes	No
8	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.** Turn ignition switch to OFF.	Is there a hole of more than 1.0 mm (0.04 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4DOTC)-75, Fuel Delivery, Return and Evaporation Lines.>	Go to step **9.**
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(H4DOTC)-5, Canister.>	Go to step **10.**
10	**CHECK FUEL TANK.** Remove the fuel tank. <Ref. to FU(H4DOTC)-51, 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(H4DOTC)-51, 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, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Contact with SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

BB:DTC P0447 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-146, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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. 13 (+) — Chassis ground (−):***	Is the measured value 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 measured value 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. 13 — (R69) No. 2:***	Is the measured value 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 measured value within 10 to 100 Ω?	Go to step **6.**	Replace the drain valve. <Ref. to EC(H4DOTC)-16, Drain Valve.>

	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 measured value 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 with SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

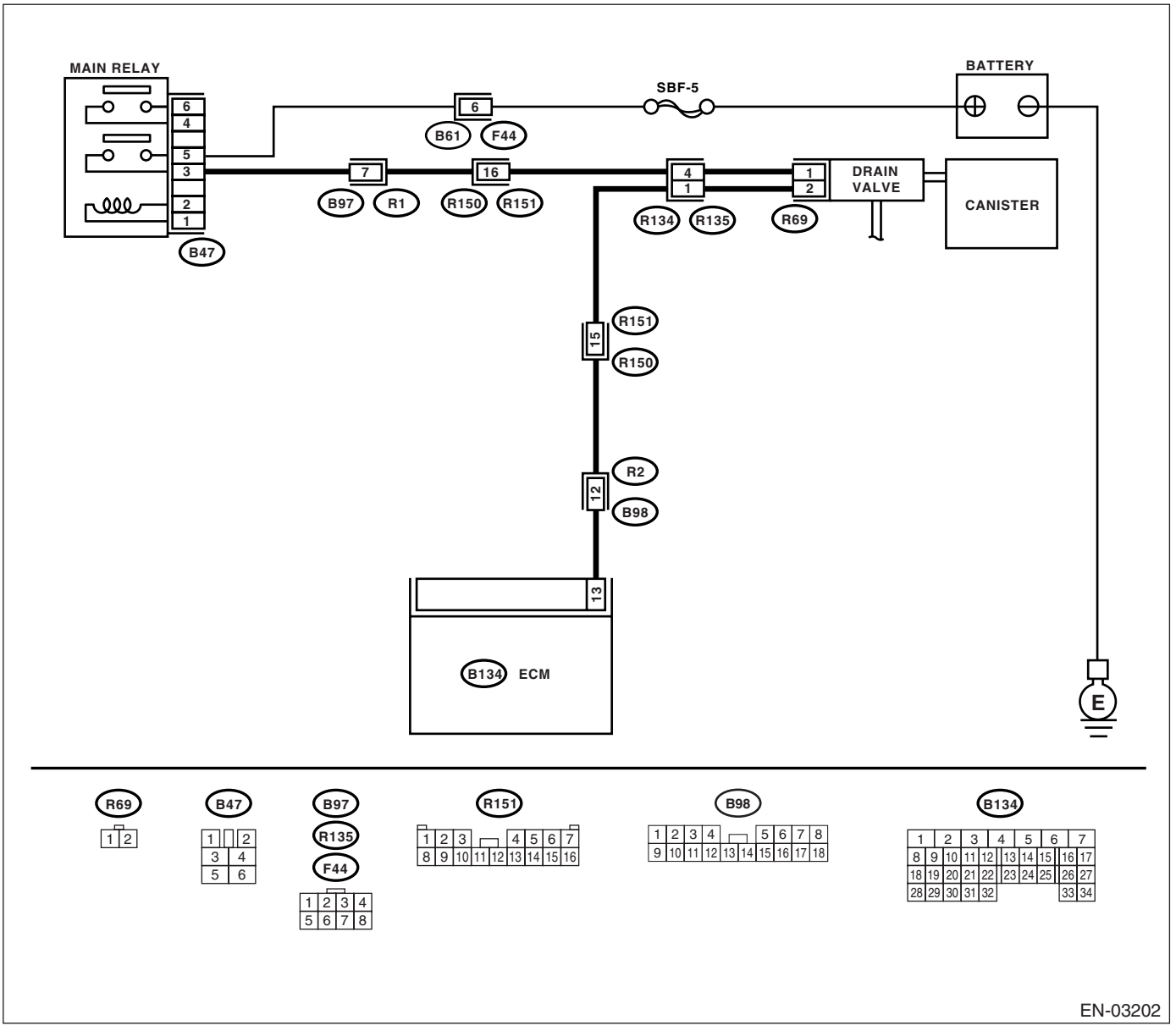
MEMO:

BC:DTC P0448 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-148, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



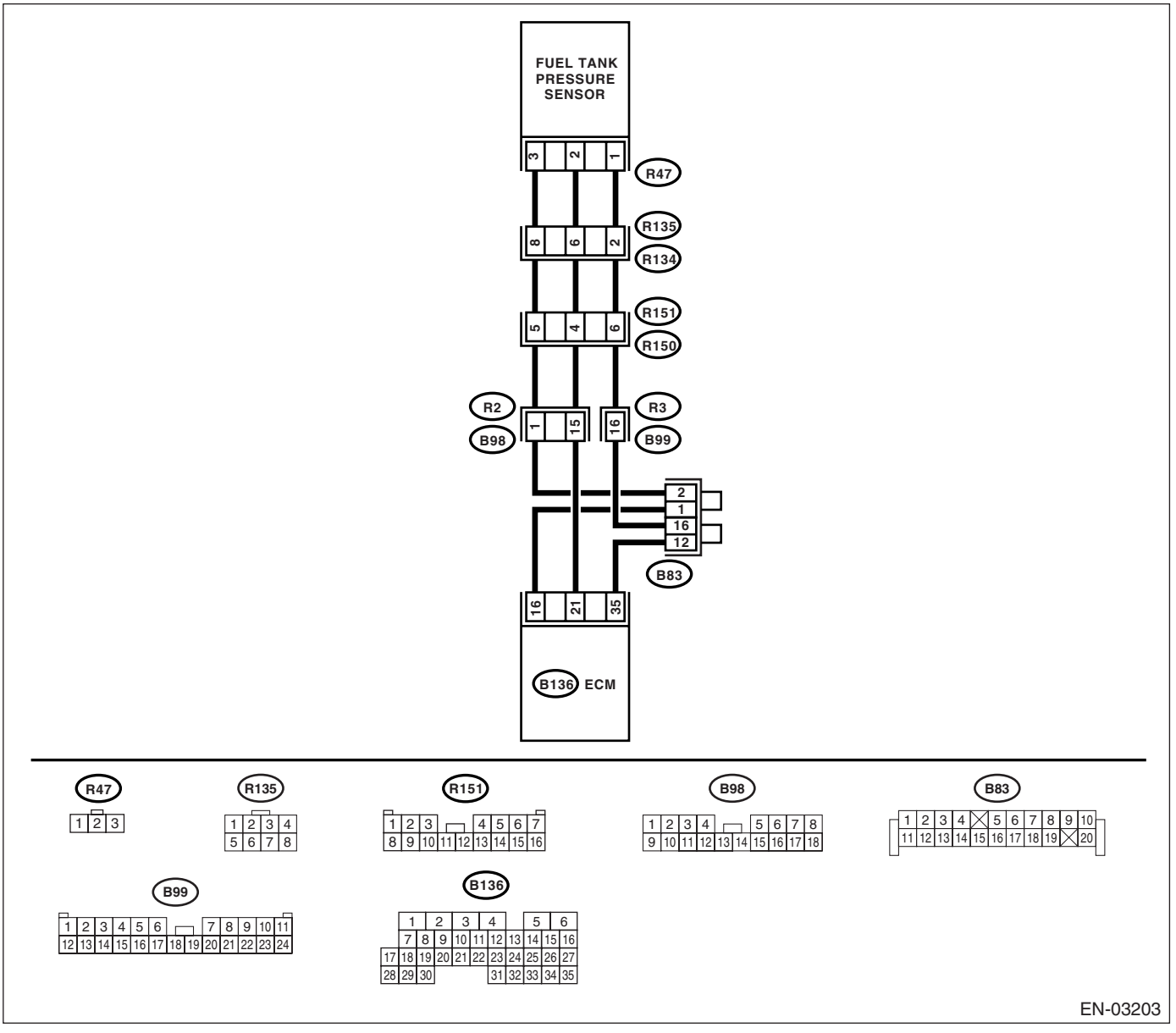
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating the drain valve, measure voltage between ECM and chassis ground. NOTE: Drain valve operation can be executed using Subaru Select Monitor. For the procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)-53, Compulsory Valve Operation Check Mode.> ***Connector & terminal*** ***(B134) No. 13 (+) — Chassis ground (−):***	Does the resistance change within 0 to 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. 13 (+) — Chassis ground (−):***	Is the measured value 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(H4DOTC)-43, 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. 13 (+) — Chassis ground (−):***	Is the measured value 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(H4DOTC)-43, 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 measured value less than 1 Ω?	Replace the drain valve <Ref. to EC(H4DOTC)-16, Drain Valve.> and ECM <Ref. to FU(H4DOTC)-43, 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(H4DOTC)-43, Engine Control Module (ECM).>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-150, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



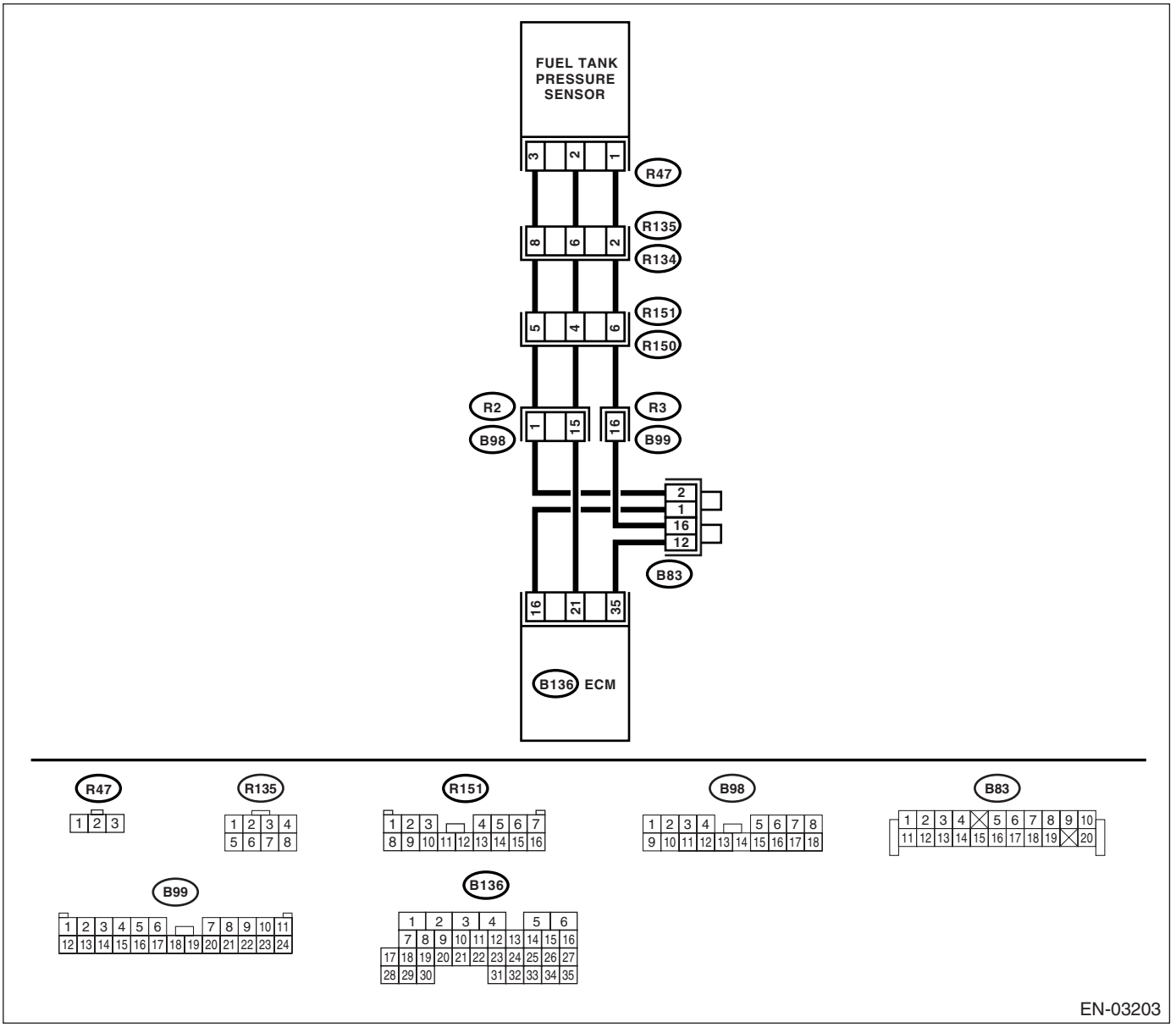
	Step	Check	Yes	No
1	**CHECK FOR OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FUEL FILLER CAP.** 1) Turn ignition switch to OFF. 2) 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(H4DOTC)-10, Fuel Tank Pressure Sensor.>

BE:DTC P0452 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-152, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured valve 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*** ***(B136) No. 16 (+) — Chassis ground (–):***	Is the measured value 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*** ***(B136) No. 16 (+) — Chassis ground (–):***	Is the measured value more than 4.5 V?	Repair poor contact in ECM connector.	Contact with 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*** ***(B136) No. 21 (+) — Chassis ground (–):***	Is the measured value 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(H4DOTC)-32, Subaru Select Monitor.>	Does the measured value exceed the specified value 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*** ***(R150) No. 5 (+) — Chassis ground (–):***	Is the measured value 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

	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*** ***(B136) No. 35 — (R150) No. 6:***	Is the measured value 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. 6 — Chassis ground:***	Is the measured value more than 1 MΩ?	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*** ***(R151) No. 5 — (R47) No. 3:***	Is the measured value 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*** ***(R151) No. 6 — (R47) No. 1:***	Is the measured value 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 measured value more than 1 MΩ?	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(H4DOTC)-10, Fuel Tank Pressure Sensor.>

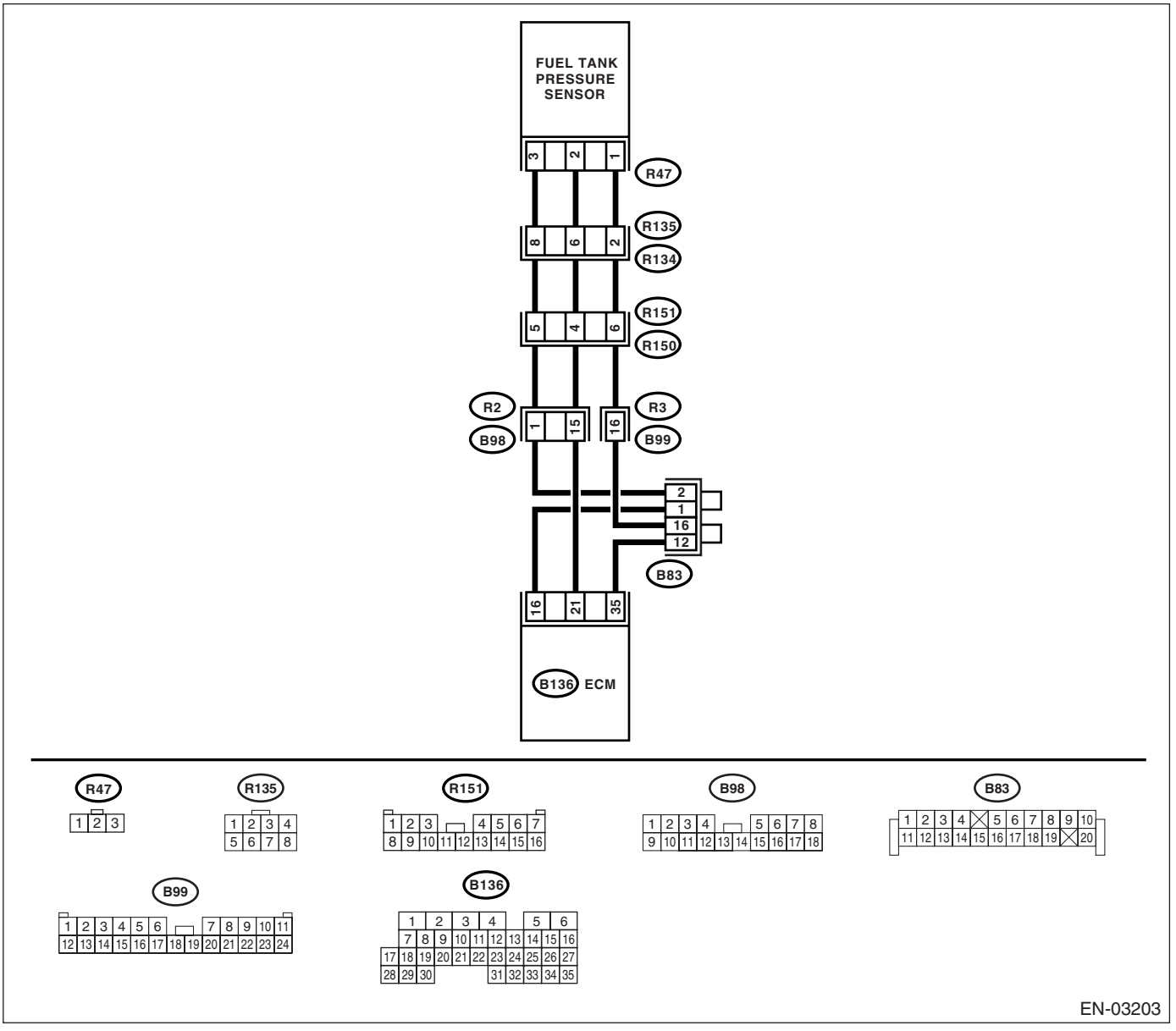
MEMO:

BF:DTC P0453 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-154, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the 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*** ***(B136) No. 16 (+) — Chassis ground (−):***	Is the measured value 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*** ***(B136) No. 16 (+) — Chassis ground (−):***	Does the measured value exceed the specified value by shaking the ECM harness and connector?	Repair poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
4	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 21 (+) — Chassis ground (−):***	Is the measured value 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(H4DOTC)-32, Subaru Select Monitor.>	Does the measured value exceed −2.8 kPa (−21.0 mmHg, −0.827 inHg) 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*** ***(R150) No. 5 (+) — Chassis ground (−):***	Is the measured value 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

	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*** ***(B136) No. 21 — (R150) No. 4:*** ***(B136) No. 35 — (R150) No. 6:***	Is the measured value 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*** ***(R151) No. 4 — (R47) No. 2:***	Is the measured value 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*** ***(R151) No. 6 — (R47) No. 1:***	Is the measured value 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(H4DOTC)-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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the 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(H4DOTC)-10, Fuel Tank Pressure Sensor.>

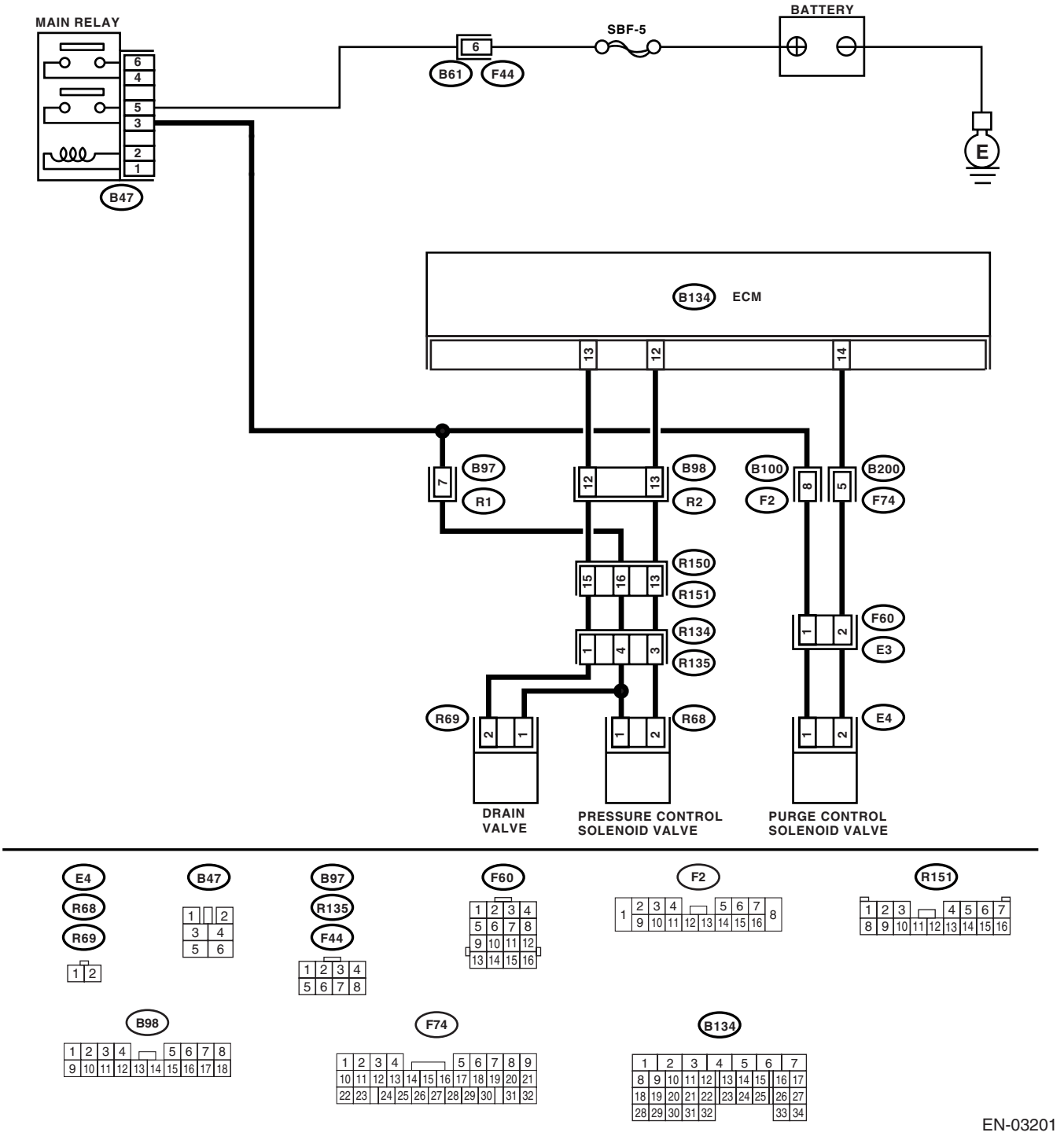
MEMO:

BG: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(H4DOTC)-156, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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(H4DOTC)-81, 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(H4DOTC)-59, 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(H4DOTC)-53, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step **6.**	Replace the drain valve. <Ref. to EC(H4DOTC)-16, 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(H4DOTC)-53, 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(H4DOTC)-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(H4DOTC)-53, 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(H4DOTC)-6, Purge Control Solenoid Valve.>

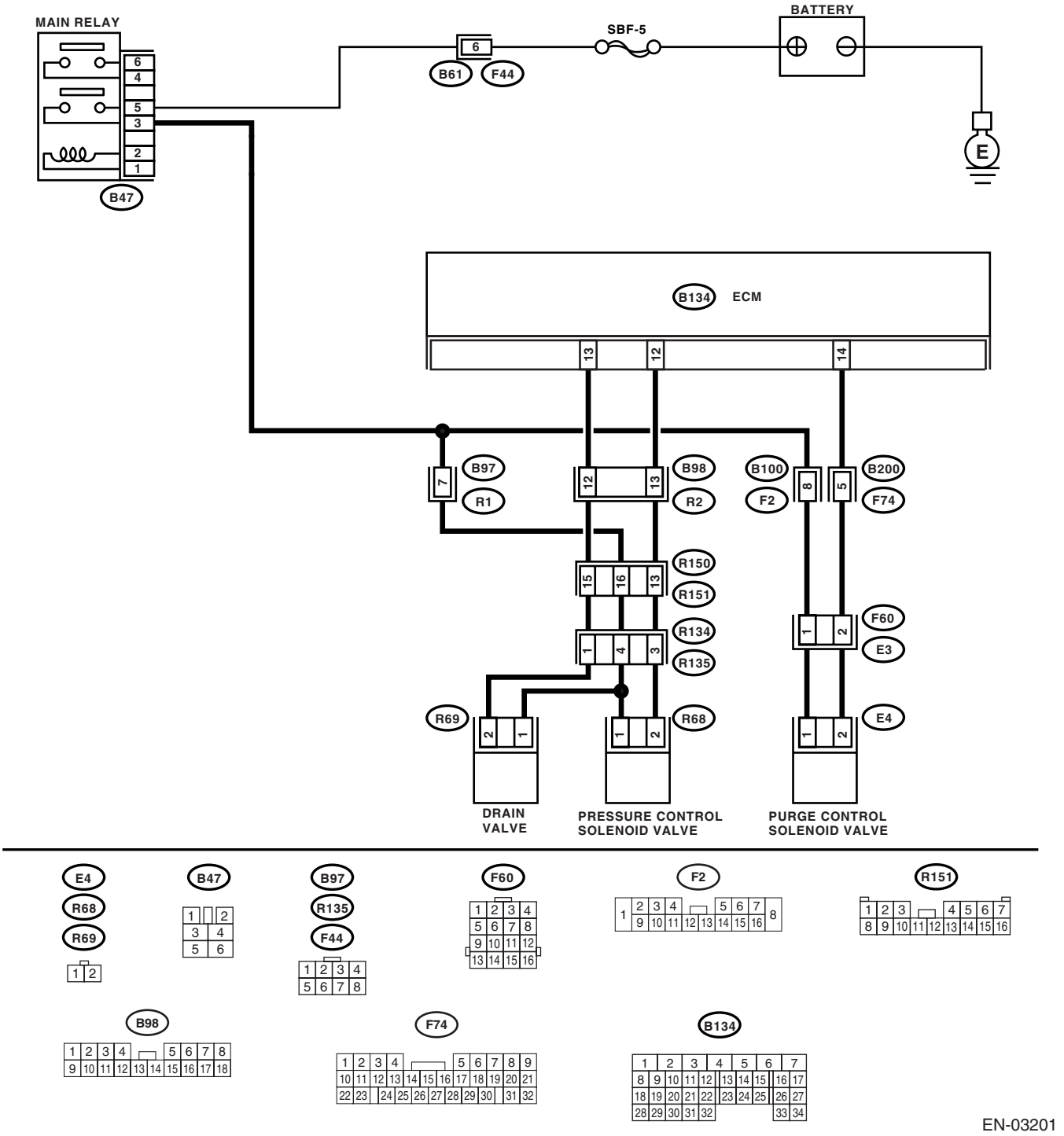
	Step	Check	Yes	No
8	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.** Turn ignition switch to OFF.	Is there a hole of more than 0.5 mm (0.020 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4DOTC)-75, Fuel Delivery, Return and Evaporation Lines.>	Go to step **9.**
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(H4DOTC)-5, Canister.>	Go to step **10.**
10	**CHECK FUEL TANK.** Remove the fuel tank. <Ref. to FU(H4DOTC)-51, 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(H4DOTC)-51, 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, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Contact with SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

BH: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(H4DOTC)-157, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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(H4DOTC)-81, 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(H4DOTC)-59, 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(H4DOTC)-53, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step **6.**	Replace the drain valve. <Ref. to EC(H4DOTC)-16, 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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Does the purge control solenoid valve operate?	Go to step **7.**	Replace the purge control solenoid valve. <Ref. to EC(H4DOTC)-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(H4DOTC)-53, 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(H4DOTC)-6, Purge Control Solenoid Valve.>
8	**CHECK CANISTER.**	Is the canister damaged?	Repair or replace the canister. <Ref. to EC(H4DOTC)-5, Canister.>	Go to step **9.**

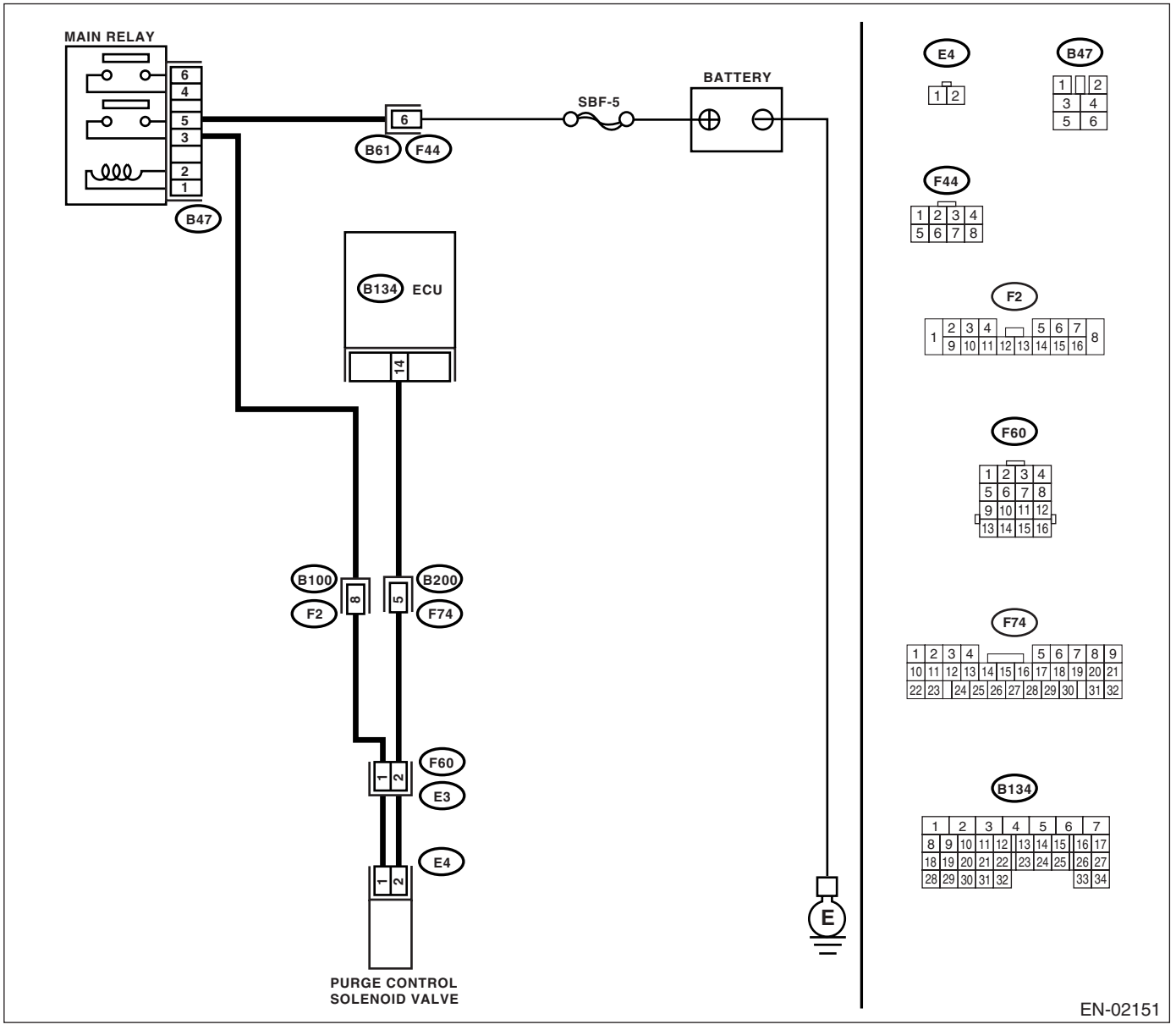
	Step	Check	Yes	No
9	**CHECK FUEL TANK.** Remove the fuel tank. <Ref. to FU(H4DOTC)-51, Fuel Tank.>	Is the fuel tank damaged?	Repair or replace the fuel tank. <Ref. to FU(H4DOTC)-51, Fuel Tank.>	Go to step **10.**
10	**CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.**	Are there holes of more than 0.5 mm (0.020 in) dia., cracks, clogging, or disconnections, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Contact with SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

BI: 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(H4DOTC)-158, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



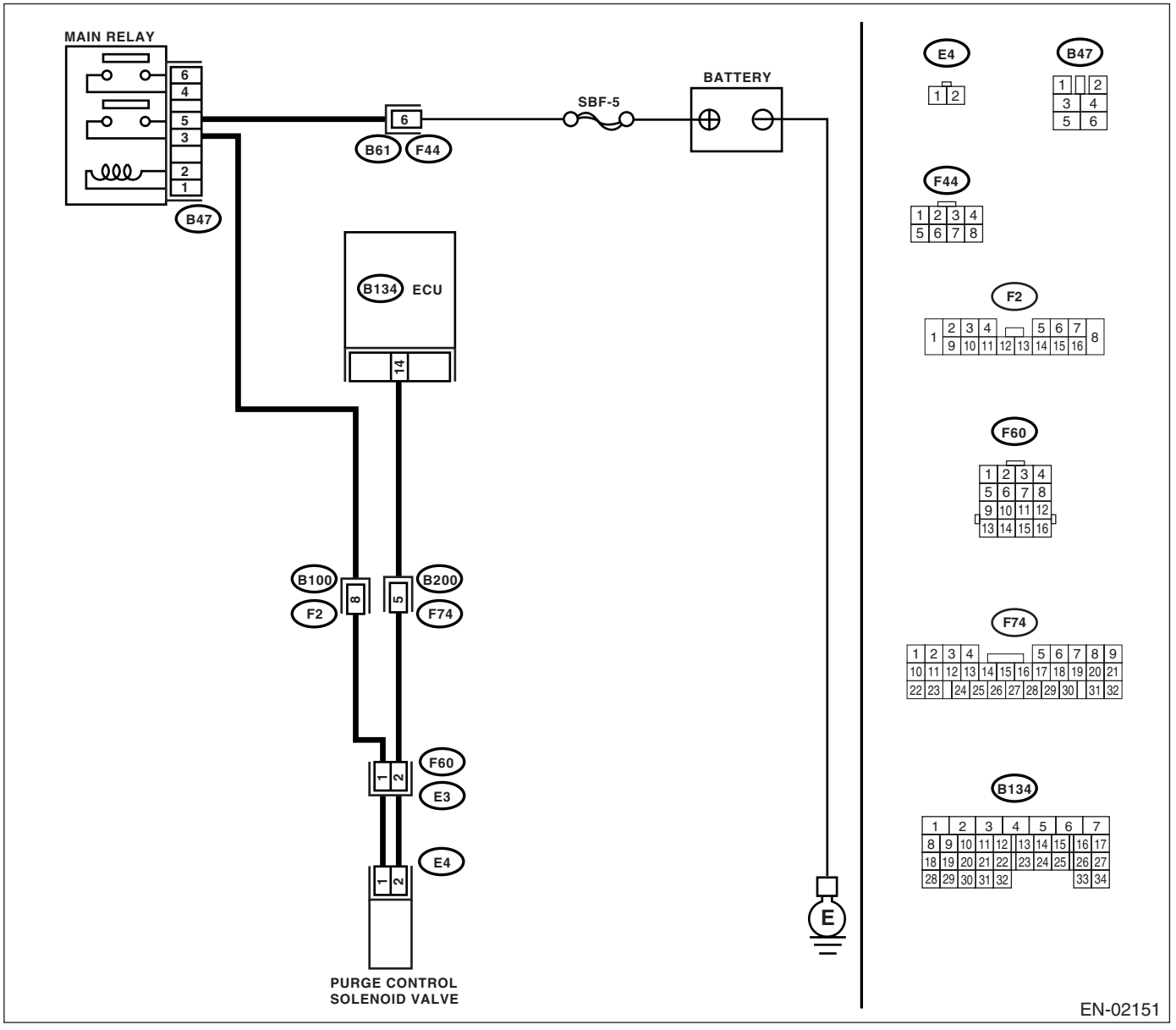
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 14 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time.	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 measured value more than 1 MΩ?	Go to step **3.**	Repair the 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. 14 — (E4) No. 2:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the 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 measured value within 10 to 100 Ω?	Go to step **5.**	Replace the purge control solenoid valve. <Ref. to EC(H4DOTC)-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 measured value more than 10 V?	Go to step **6.**	Repair the open circuit in harness between main relay and purge control solenoid valve connector.
6	**CHECK POOR CONTACT.** Check poor contact in purge control solenoid valve connector.	Is there poor contact in purge control solenoid valve connector?	Repair the poor contact in purge control solenoid valve connector.	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

BJ: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(H4DOTC)-160, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



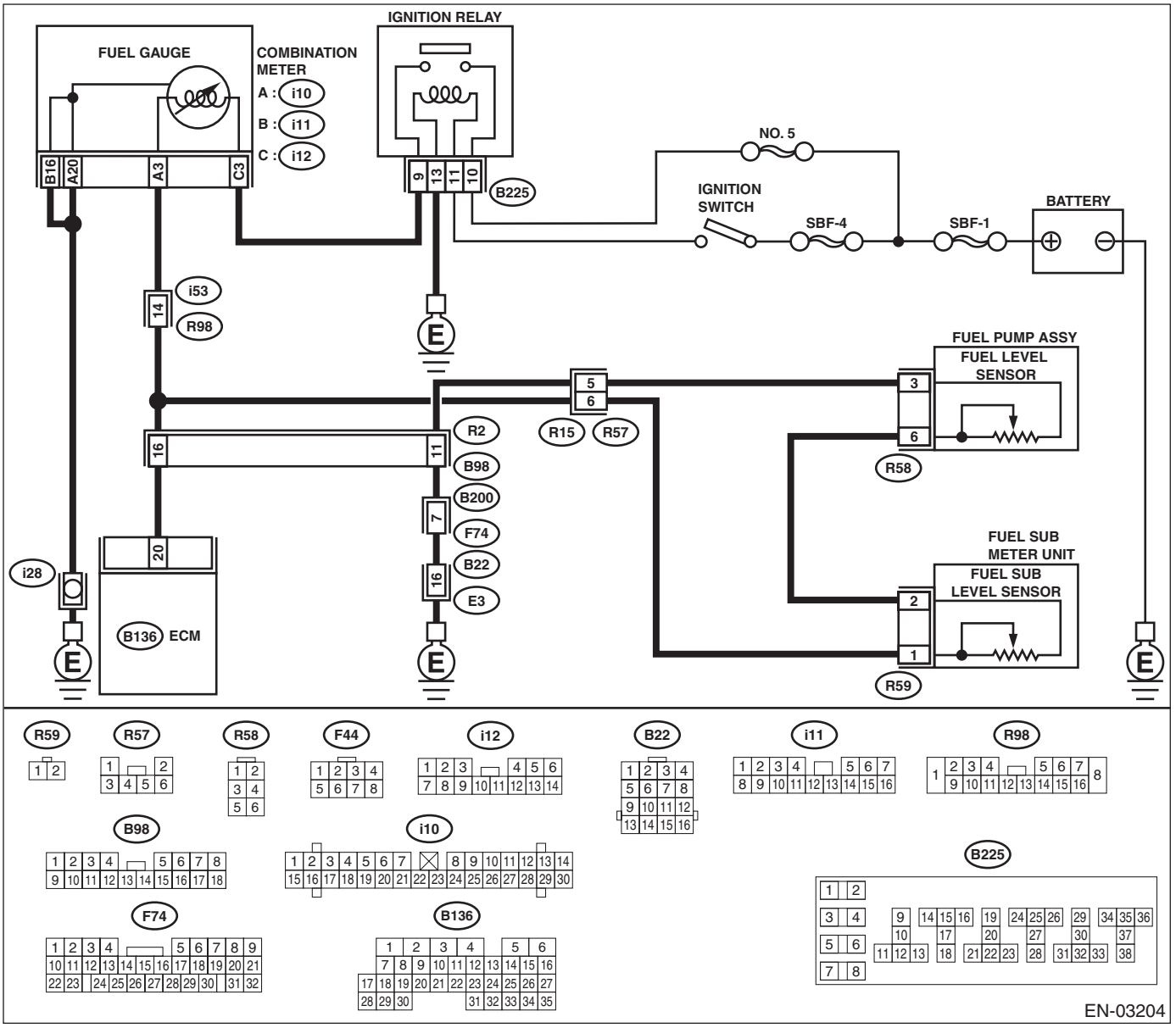
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn the ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn the ignition switch to ON. 4) While operating the purge control solenoid valve, measure the voltage between ECM and chassis ground. NOTE: Purge control solenoid valve operation can be executed using the Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)-53, Compulsory Valve Operation Check Mode.> ***Connector & terminal*** ***(B134) No. 14 (+) — Chassis ground (−):***	Is the measured value within 0 to 13 V?	Go to step **2.**	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. In this case, repair the 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. 14 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **4.**	Go to step **3.**
3	**CHECK POOR CONTACT.** Check the poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, 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. 14 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between ECM and purge control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, 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 measured value less than 1 Ω?	Replace the purge control solenoid valve <Ref. to EC(H4DOTC)-6, Purge Control Solenoid Valve.> and ECM <Ref. to FU(H4DOTC)-43, 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 the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

BK:DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-162, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



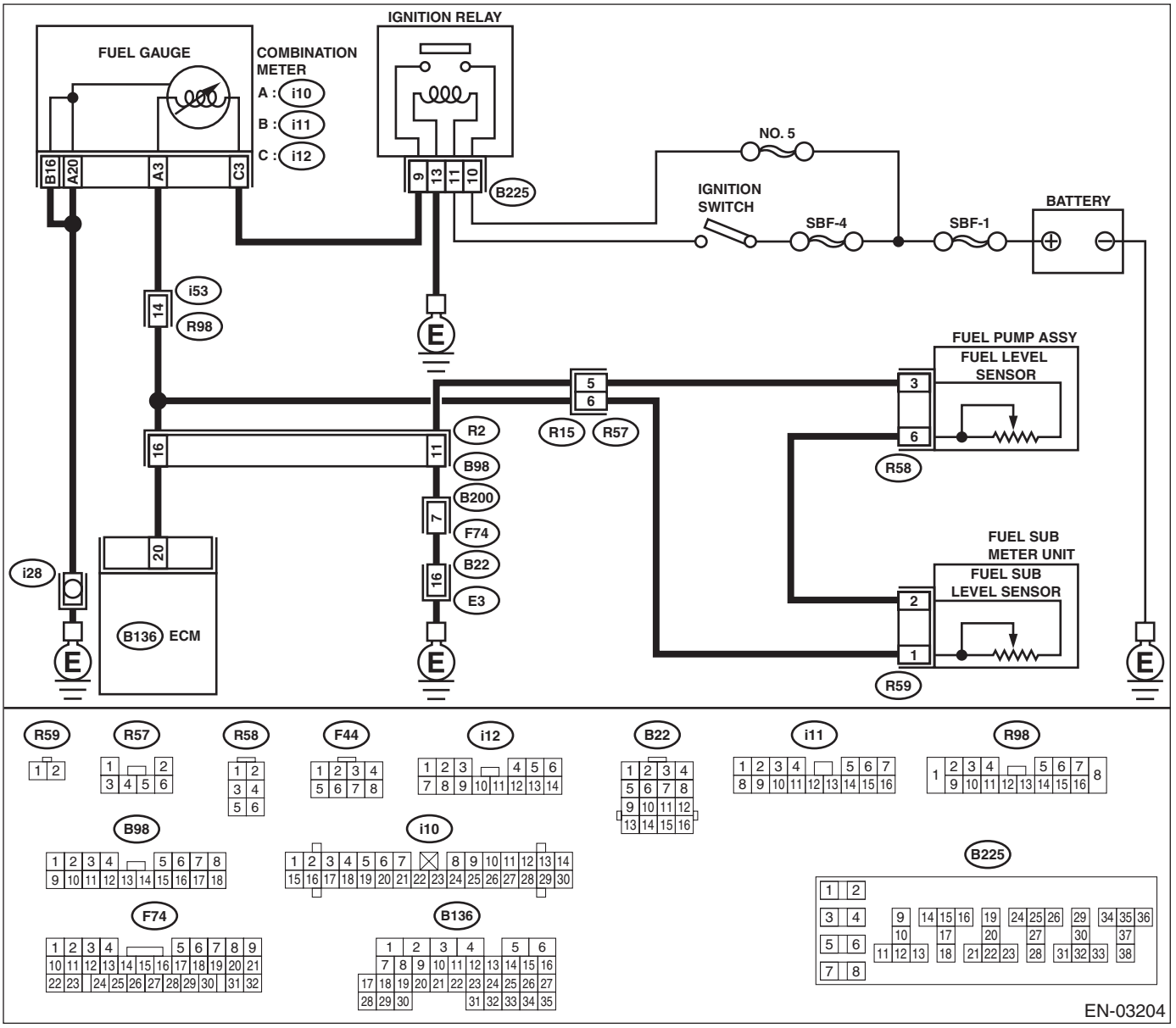
Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0461.	Replace the fuel level sensor. <Ref. to FU(H4DOTC)-70, Fuel Level Sensor.> and fuel sub level sensor <Ref. to FU(H4DOTC)-71, Fuel Sub Level Sensor.>

BL:DTC P0462 — FUEL LEVEL SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-164, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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-4, 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*** ***(B136) No. 20 (+) — Chassis ground (−):***	Is the measured value 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(H4DOTC)-32, Subaru Select Monitor.>	Does the voltage change, while shaking the ECM harness and connector?	Repair the 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 the 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*** ***(B136) No. 20 (+) — Chassis ground (−):***	Is the measured value 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 (i10), (i12) and ECM connector. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 20 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **7.**	Repair the ground short circuit in harness between ECM and combination meter connector.

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND COMBINATION METER.** Measure the resistance between ECM and combination meter connector. ***Connector & terminal*** ***(B136) No. 20 — (i10) No. 3:***	Is the measured value less than 10 Ω?	Repair or replace the combination meter. <Ref. to IDI-4, Combination Meter System.>	Repair the open circuit between ECM and combination meter connector. NOTE: In this case, repair the following: Poor contact in coupling connector
7	**CHECK FUEL TANK CORD.** 1) Turn the 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 measured value more than 1 MΩ?	Go to step **8.**	Repair the ground short circuit 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 measured value more than 1 MΩ?	Go to step **9.**	Repair the ground short circuit in fuel tank cord.
9	**CHECK FUEL LEVEL SENSOR.** 1) Remove the fuel pump assembly. <Ref. to FU(H4DOTC)-67, Fuel Pump.> 2) Measure the resistance between fuel level sensor and terminals with its float set to the full position. ***Terminals*** ***No. 3 — No. 6:***	Is the measured value within 0.5 to 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(H4DOTC)-71, 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 measured value within 0.5 to 2.5 Ω?	Repair the poor contact in harness between ECM and combination meter connector.	Replace the fuel sub level sensor.

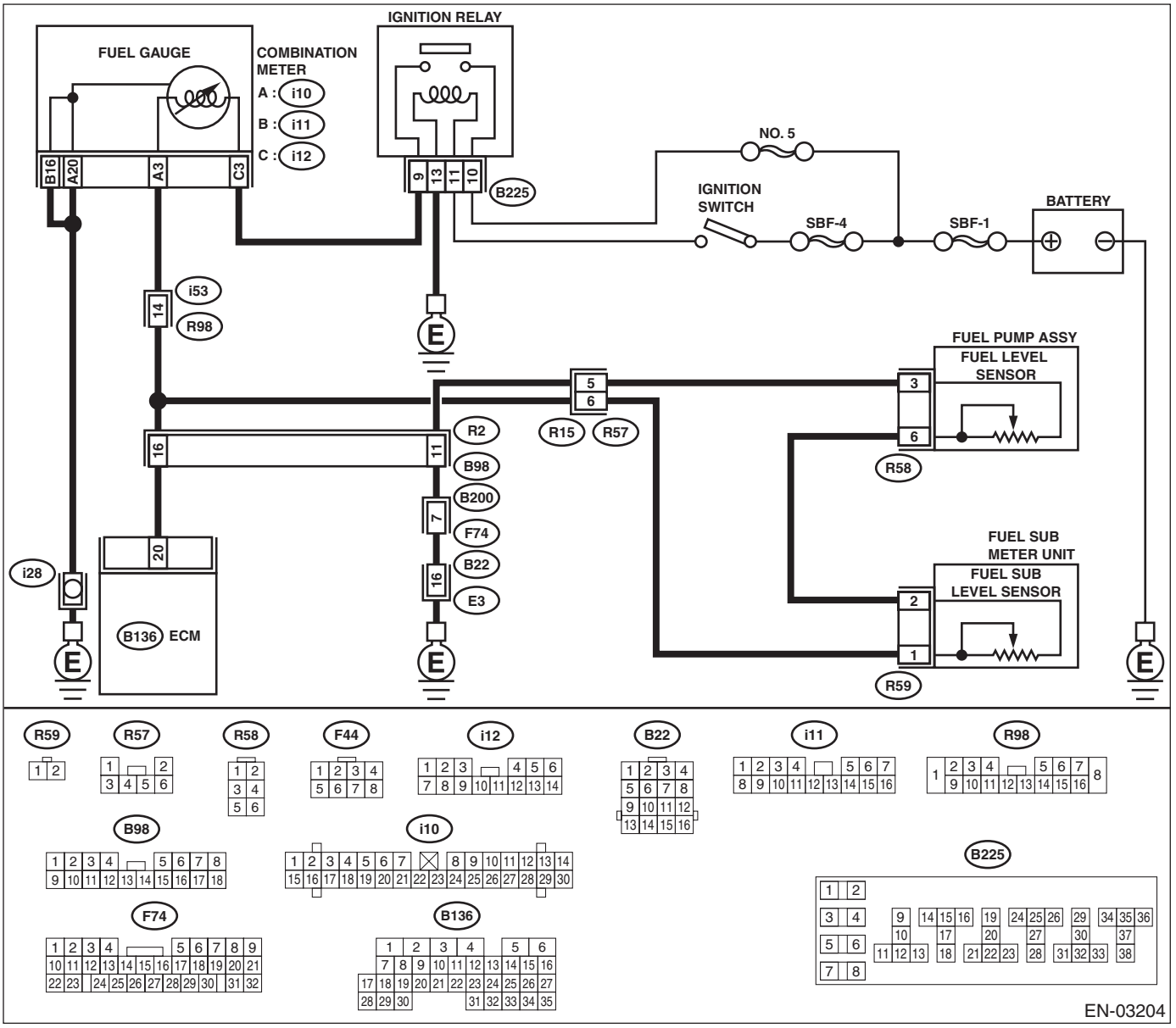
MEMO:

BM:DTC P0463 — FUEL LEVEL SENSOR CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-166, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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-4, 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*** ***(B136) No. 20 (+) — Chassis ground (−):***	Is the measured value 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 (i11) and ECM connector. 3) Turn the ignition switch to ON. 4) Measure the voltage of harness between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 20 (+) — Chassis ground (−):***	Is the measured value more than 4.75 V?	Go to step **4.**	Repair the 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 the fuel tank cord connector (R57) and rear wiring harness connector (R15). 3) Measure the resistance between ECM and fuel tank cord. ***Connector & terminal*** ***(B136) No. 20 — (R15) No. 6:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair the 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. 5 — Chassis ground:***	Is the measured value less than 5 Ω?	Go to step **6.**	Repair the 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. 5 — (R58) No. 3:***	Is the measured value less than 10 Ω?	Go to step **7.**	Repair the open circuit between coupling connector and fuel level sensor.

	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. 6 — (R59) No. 2:***	Is the measured value less than 10 Ω?	Go to step **8.**	Repair the open circuit between fuel level sensor and fuel sub level sensor.
8	**CHECK FUEL TANK CORD.** Measure the resistance between fuel sub level sensor and coupling connector. ***Connector & terminal*** ***(R57) No. 6 — (R59) No. 1:***	Is the measured value less than 10 Ω?	Go to step **9.**	Repair the open circuit between coupling connector and fuel sub level sensor.
9	**CHECK FUEL LEVEL SENSOR.** 1) Remove the fuel pump assembly. <Ref. to FU(H4DOTC)-67, Fuel Pump.> 2) While moving the fuel level sensor float up and down, measure the resistance between fuel level sensor terminals. ***Terminals*** ***No. 3 — No. 6:***	Is the measured value more than 53 Ω?	Replace the fuel level sensor. <Ref. to FU(H4DOTC)-70, Fuel Level Sensor.>	Go to step **10.**
10	**CHECK FUEL SUB LEVEL SENSOR.** 1) Remove the fuel sub level sensor. <Ref. to FU(H4DOTC)-71, Fuel Sub Level Sensor.> 2) While moving the fuel sub level sensor float up and down, measure the resistance between fuel sub level sensor terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value more than 45 Ω?	Replace the fuel sub level sensor. <Ref. to FU(H4DOTC)-71, Fuel Sub Level Sensor.>	Replace the combination meter. <Ref. to IDI-13, Combination Meter Assembly.>

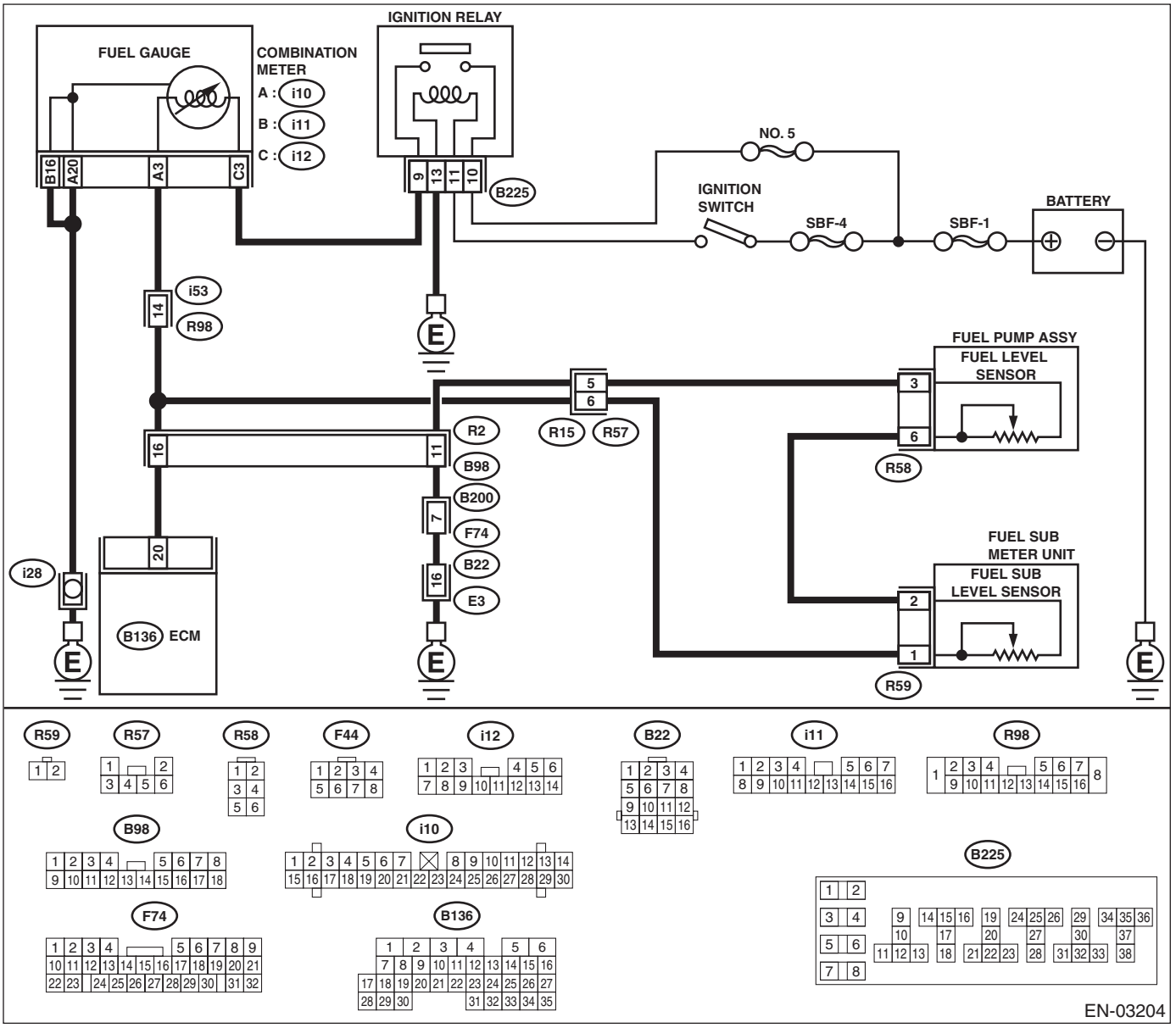
MEMO:

BN:DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-168, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FUEL LEVEL SENSOR.** 1) Remove the fuel pump assembly. <Ref. to FU(H4DOTC)-67, 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. 6:***	Does the resistance change smoothly?	Go to step **3.**	Replace the fuel level sensor. <Ref. to FU(H4DOTC)-70, Fuel Level Sensor.>
3	**CHECK FUEL SUB LEVEL SENSOR.** 1) Remove the fuel sub level sensor. <Ref. to FU(H4DOTC)-71, Fuel Sub 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 the poor contact in ECM, combination meter and coupling connectors.	Replace the fuel sub level sensor. <Ref. to FU(H4DOTC)-71, Fuel Sub Level Sensor.>

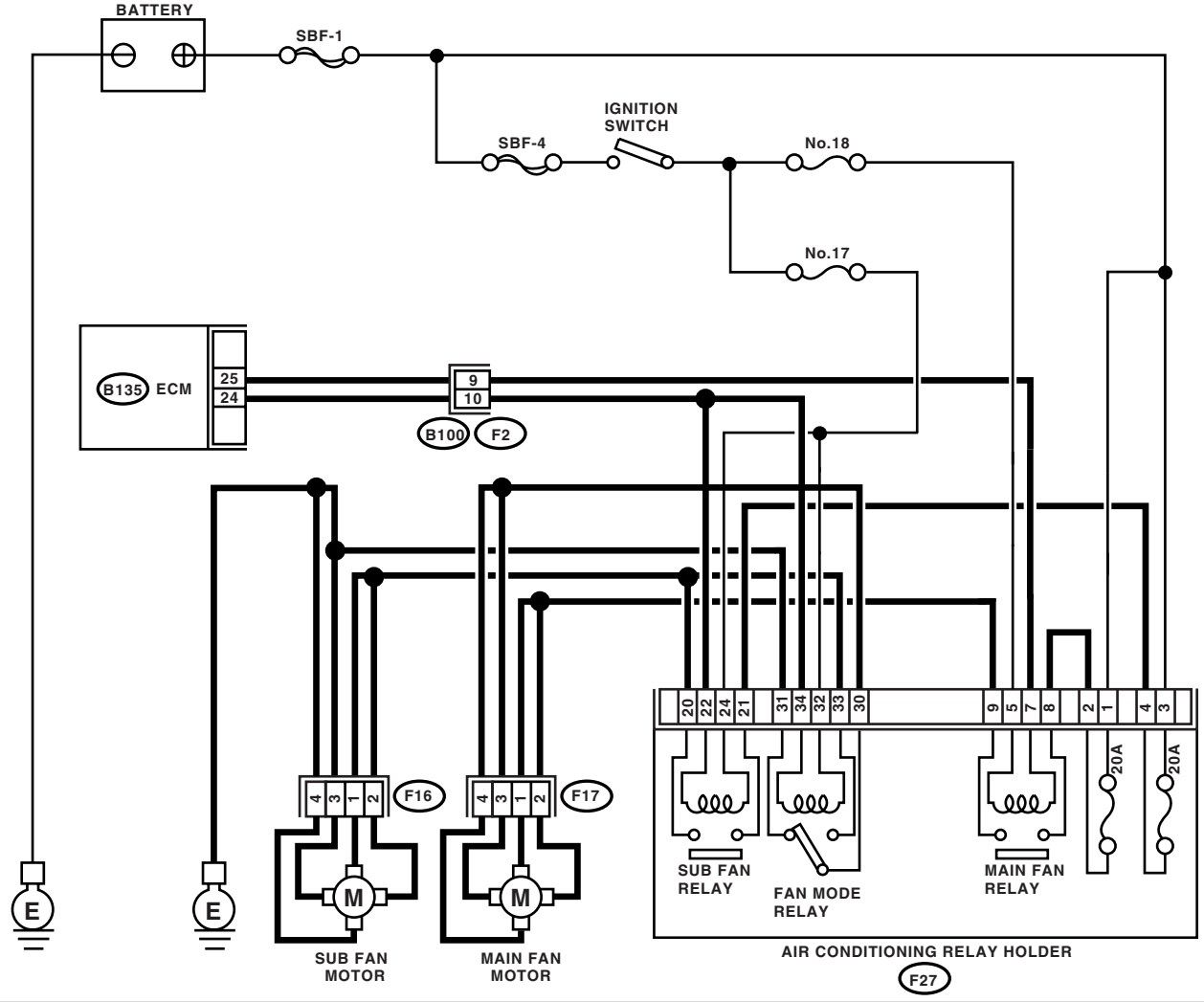
BO:DTC P0483 — COOLING FAN RATIONALITY CHECK —

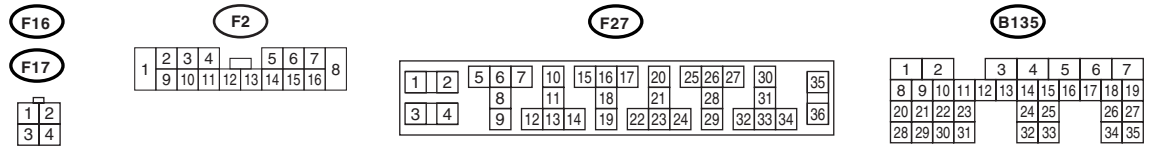
- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-171, DTC P0483 — COOLING FAN RATIONALITY CHECK —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
- **TROUBLE SYMPTOM:**
  - Occurrence of noise
  - Overheating

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, 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.

- **WIRING DIAGRAM:**





EN-03205

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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Check the radiator fan, fan motor and thermostat. <Ref. to CO(H4DOTC)-24, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4DOTC)-26, Radiator Sub Fan and Fan Motor.> If thermostat is stuck, replace thermostat.

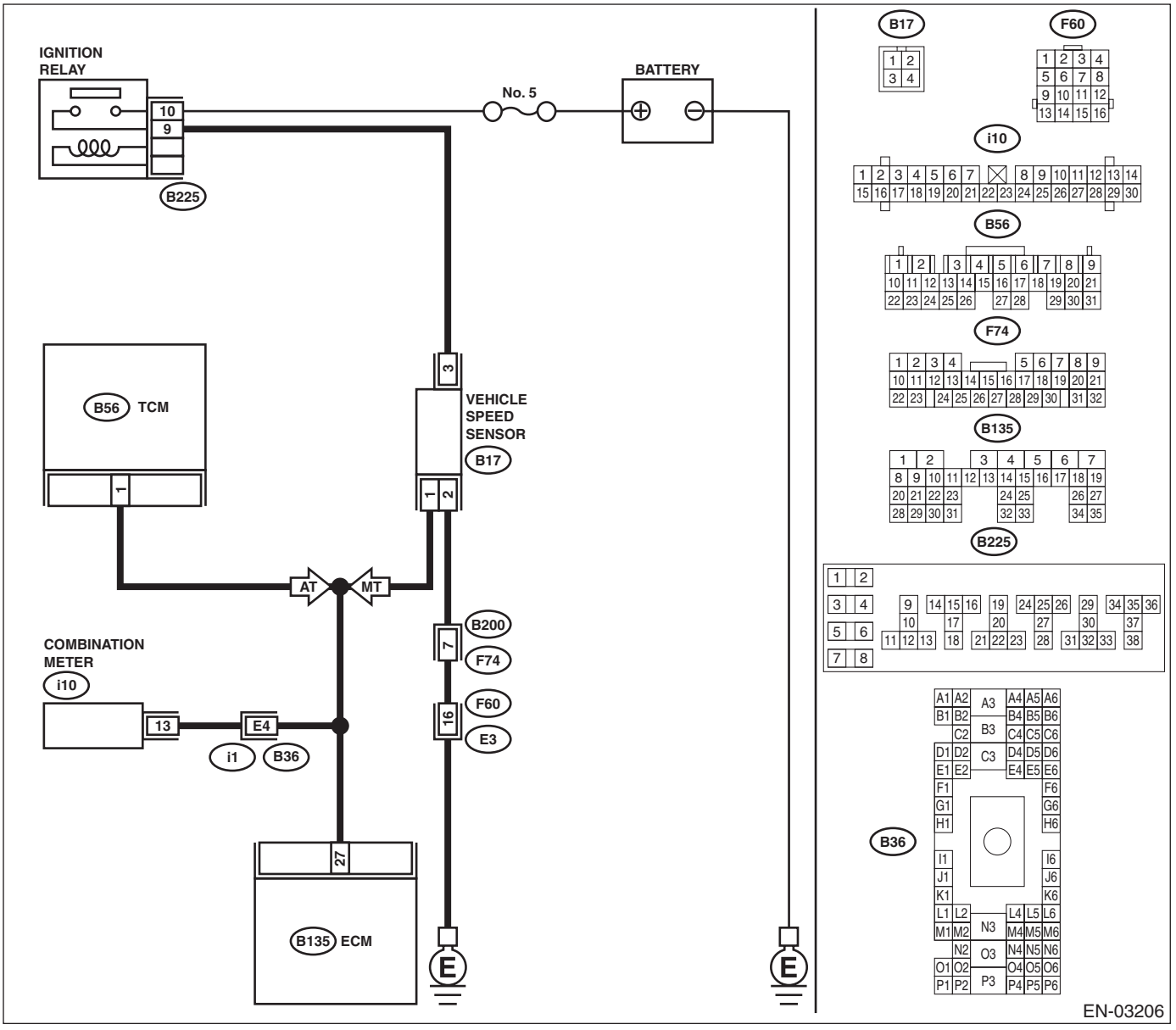
MEMO:

BP:DTC P0502 — VEHICLE SPEED SENSOR CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-172, DTC P0502 — VEHICLE SPEED 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



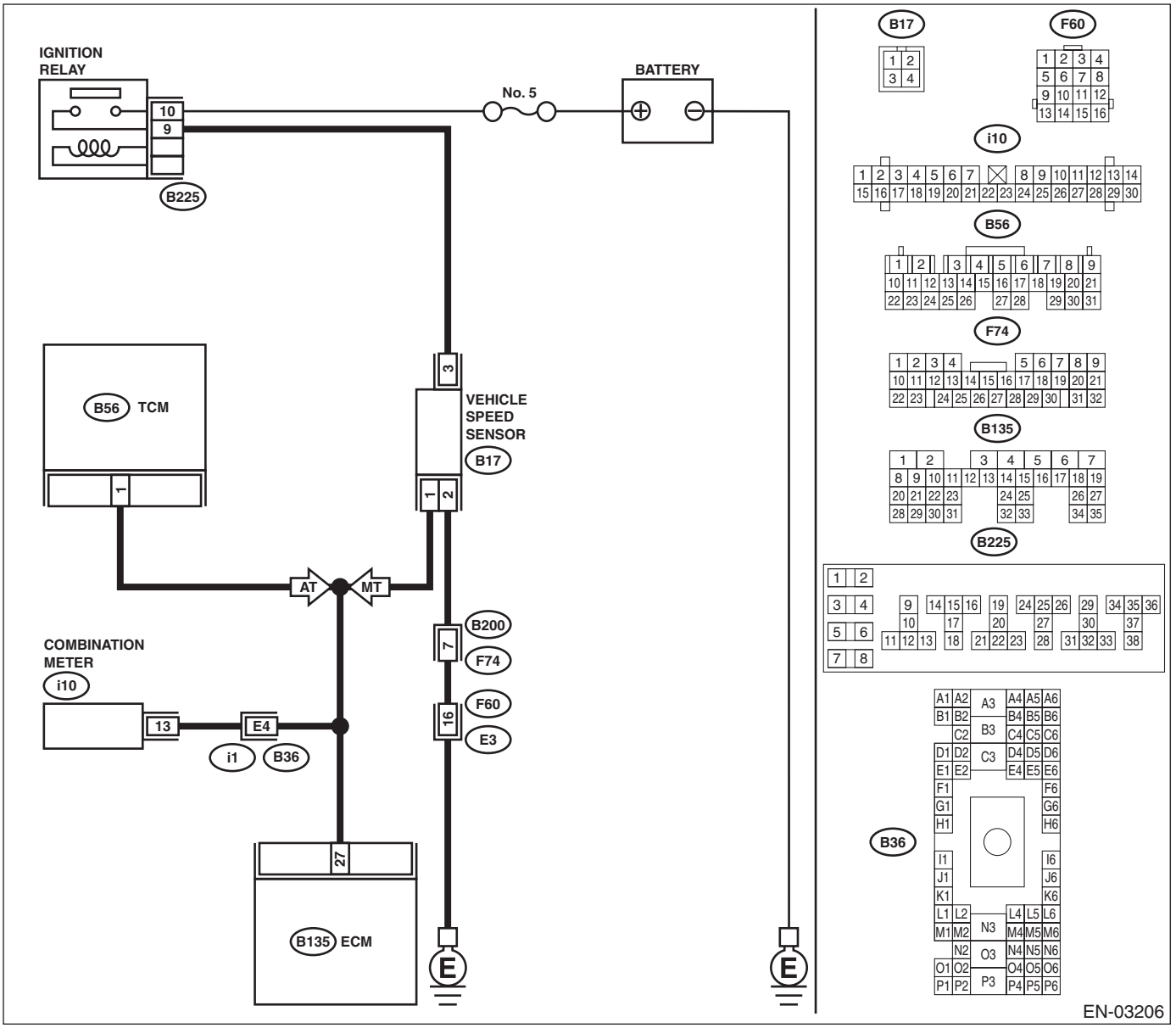
	Step	Check	Yes	No
1	**CHECK TRANSMISSION TYPE.**	Is the transmission AT?	Go to step **2.**	Go to step **4.**
2	**Check the harness between ECM and TCM connector.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and TCM. 3) Measure the resistance between TCM connector and chassis ground. ***Connector & terminal*** ***(B56) No. 1 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair ground short circuit in harness between vehicle speed sensor and ECM connector.
3	**CHECK FOR POOR CONTACT.** Check poor contact in TCM connector.	Is there poor contact in TCM connector?	Repair poor contact in TCM connector.	Contact your SOA service center.
4	**CHECK HARENESS BETWEEN VEHICLE SPEED SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from vehicle speed sensor and ECM. 3) Measure the resistance of harness between vehicle speed sensor connector and chassis ground. ***Connector & terminal*** ***(B17) No. 1 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the ground short circuit in harness between vehicle speed sensor and ECM connector.
5	**CHECK POOR CONTACT.** Check poor contact in the vehicle speed sensor connector.	Is there poor contact in the vehicle speed sensor connector?	Repair poor contact in the vehicle speed sensor connector.	Replace the vehicle speed sensor. <Ref. to 5MT-39, Vehicle Speed Sensor.>

BQ:DTC P0503 — VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-174, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



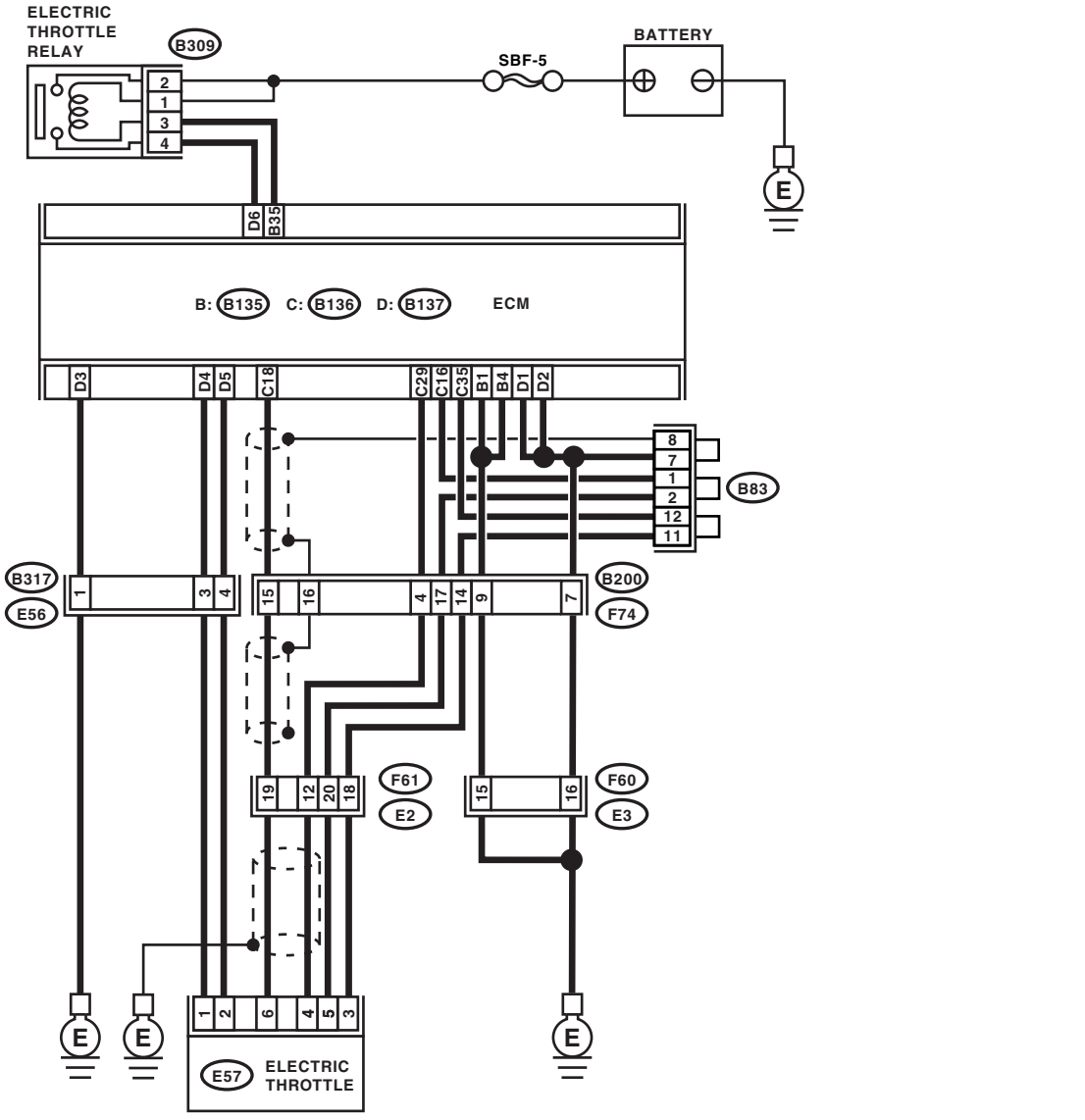
	Step	Check	Yes	No
1	**CHECK SPEEDOMETER OPERATION IN COMBINATION METER.**	Does the speedometer operate normally?	Go to step **2.**	Check the speedometer. <Ref. to IDI-15, Speedometer.>
2	**CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from combination meter. 3) Measure the resistance between ECM and combination meter. ***Connector & terminal*** ***(B135) No. 27 — (i10) No. 13:***	Is the measured value less than 10 Ω?	Repair the poor contact in ECM connector.	Repair the 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

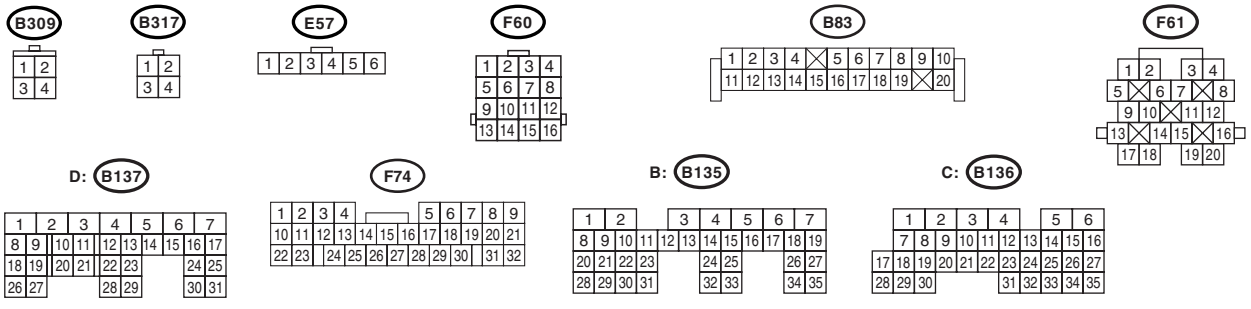
BR:DTC P0506 — IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-176, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





EN-03197

	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(H4DOTC)-81, 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 CLEANER ELEMENT.** 1) Turn the ignition switch to OFF. 2) Check air cleaner element.	Is there excessive clogging on air cleaner element.	Replace the air cleaner element. <Ref. to IN(H4DOTC)-7, Air Cleaner.>	Go to step **3.**
3	**CHECK ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Remove the electric throttle. 3) Check the electric throttle.	Are there foreign particles in electric throttle?	Remove the foreign particles from electric throttle.	Perform the diagnosis of DTC P2101.

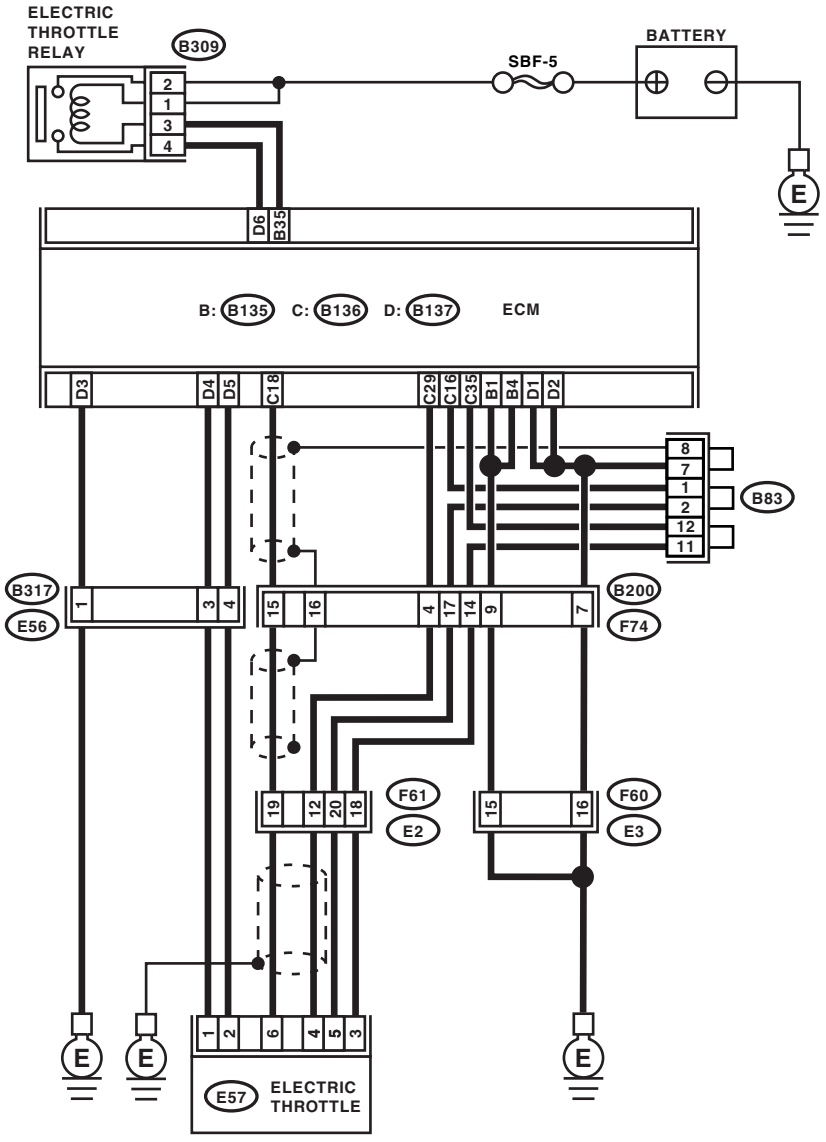
MEMO:

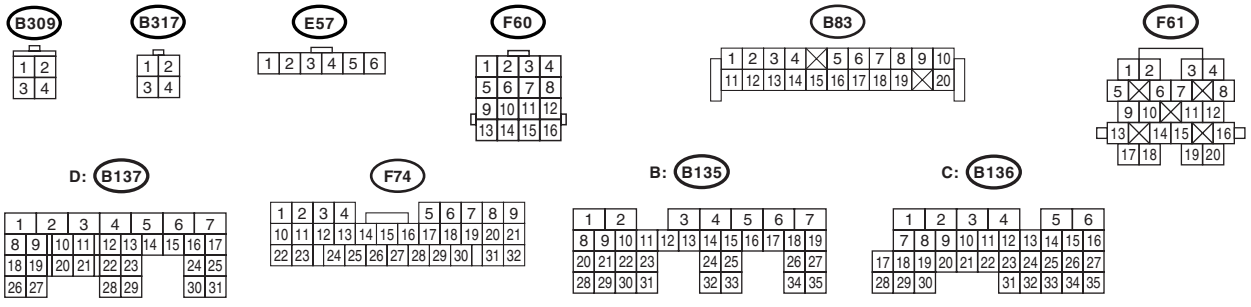
BS:DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-178, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





EN-03197

	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(H4DOTC)-81, 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 and throttle body •Cracks of intake manifold gasket and throttle body gasket •Disconnections of vacuum hoses	Is there a fault in air intake system?	Repair the air suction and leaks.	Go to step **3.**
3	**CHECK ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Remove the electric throttle. 3) Check the electric throttle.	Are there foreign particles in electric throttle?	Remove the foreign particles from electric throttle.	Perform the diagnosis of DTC P2102.

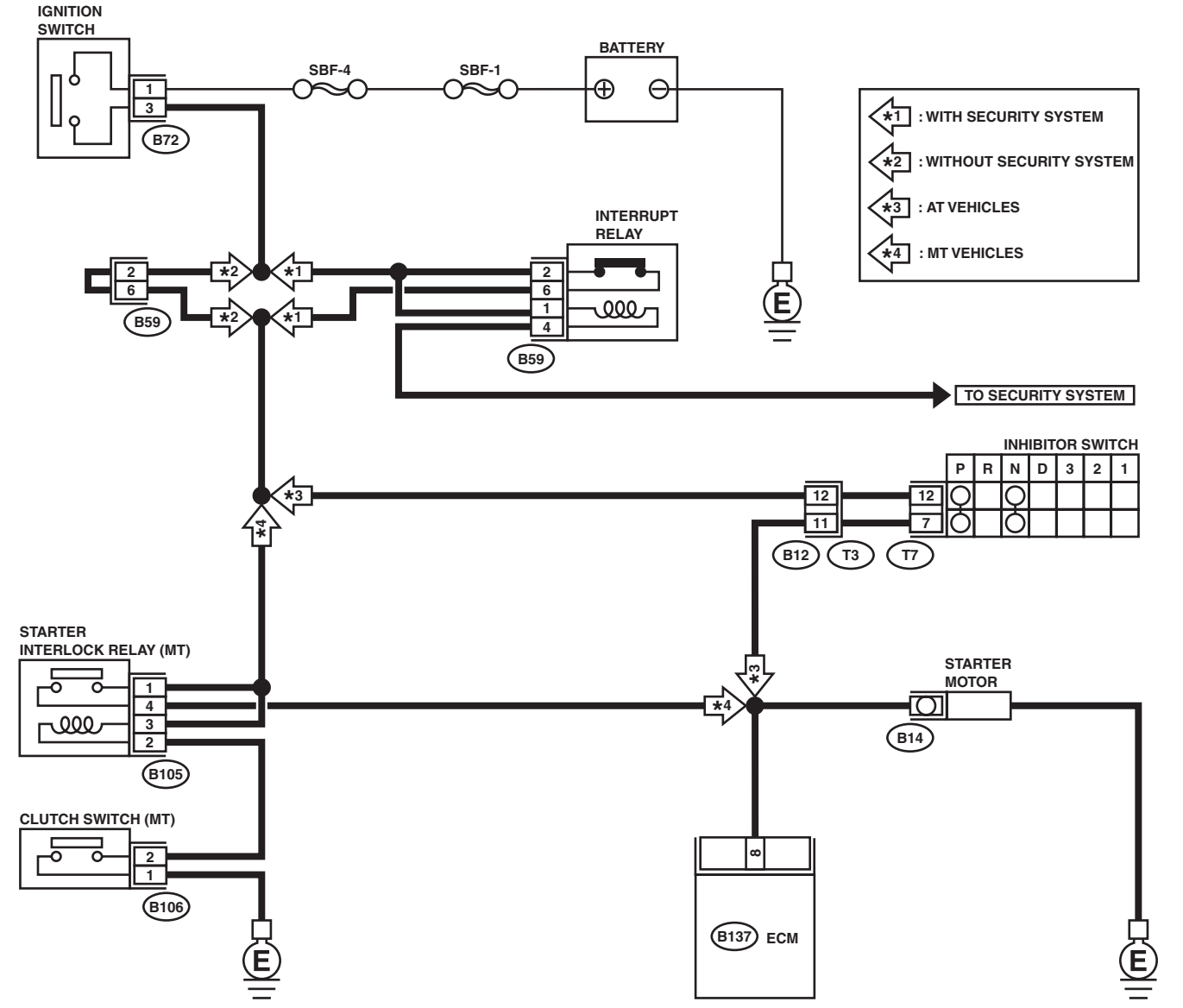
MEMO:

BT:DTC P0512 — STARTER REQUEST CIRCUIT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-180, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-02133

Step		Check	Yes	No
1	CHECK OPERATION OF STARTER MOTOR.	Does the starter motor operate when ignition switch is turned to ON?	Repair the battery short circuit in starter motor circuit. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Check the starter motor circuit. <Ref. to EN(H4DOTC)-67, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

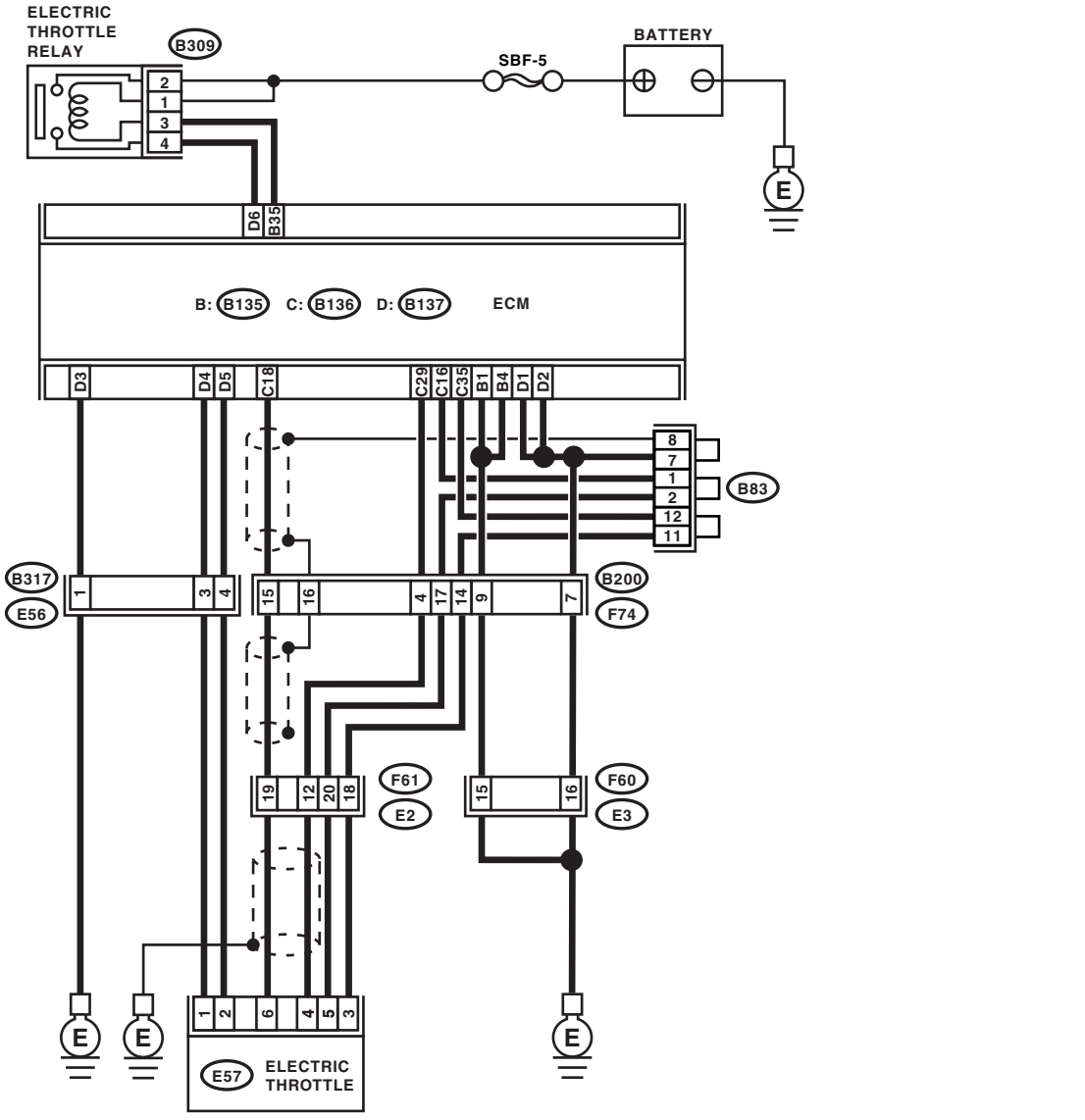
MEMO:

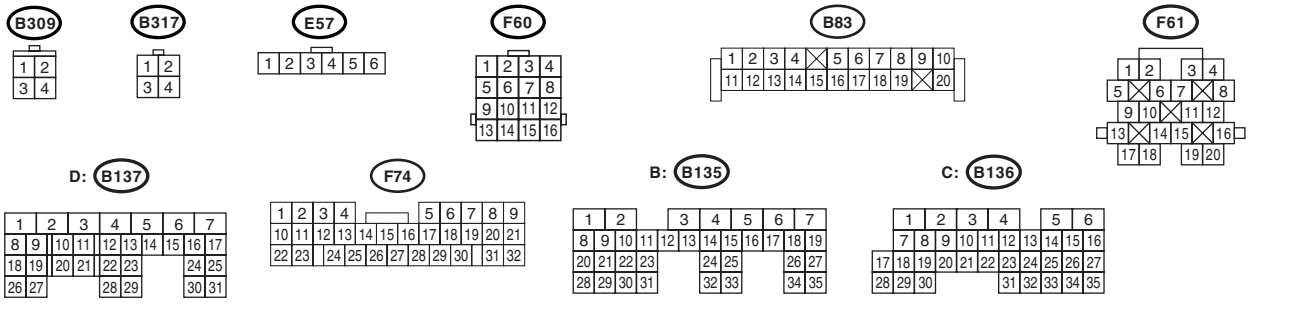
BU:DTC P0519 — IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-181, 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.
  - Fuel is cut according to fail-safe function.

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





EN-03197

	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(H4DOTC)-81, 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 and throttle body •Cracks of intake manifold gasket and throttle body gasket •Disconnections of vacuum hoses	Is there a fault in air intake system?	Repair the air suction and leaks.	Go to step **3.**
3	**CHECK ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Remove the electric throttle. 3) Check the electric throttle.	Are there foreign particles in electric throttle?	Remove the foreign particles from electric throttle.	Perform the diagnosis of DTC P2102.

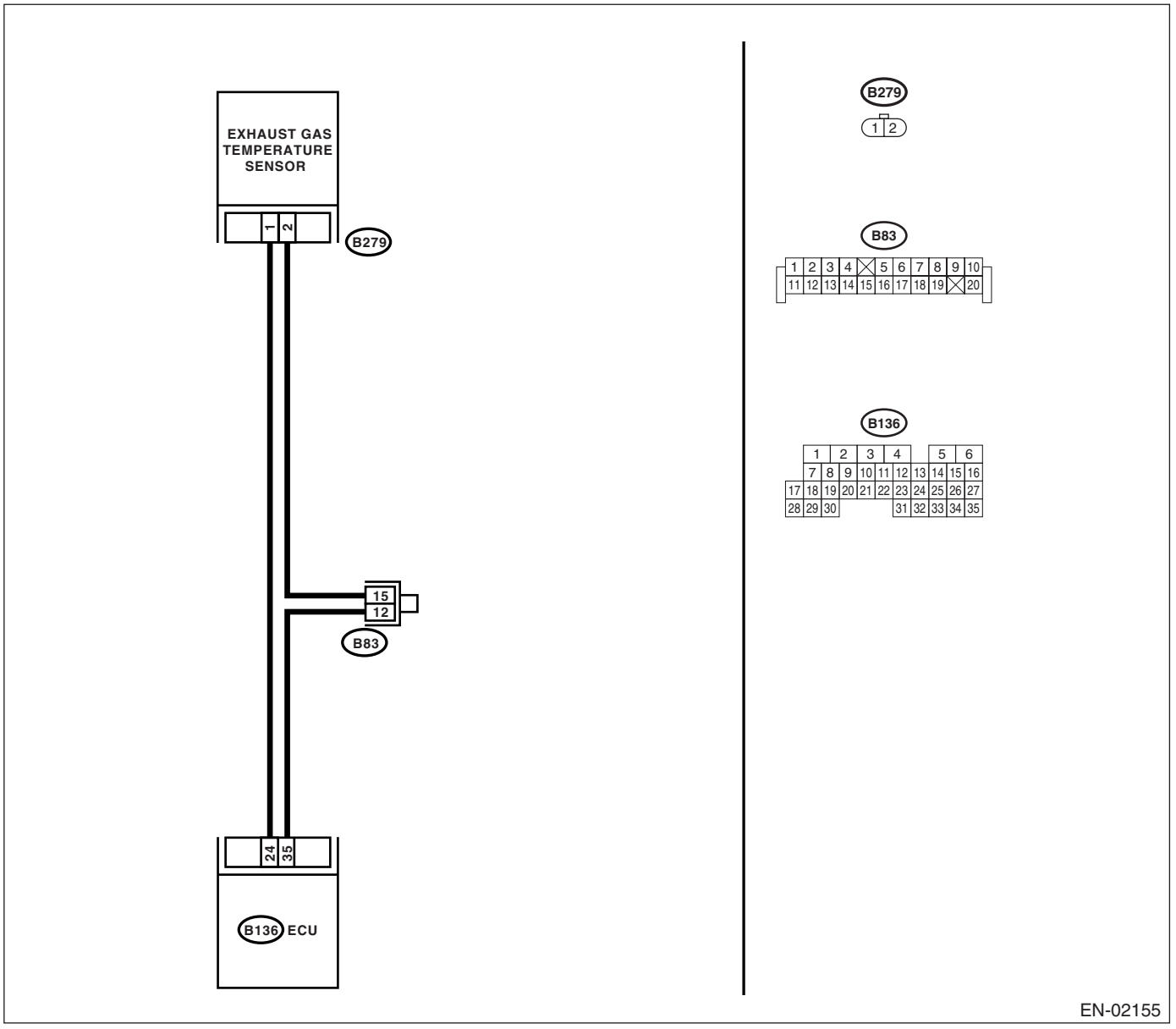
MEMO:

BV:DTC P0545 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW-BANK 1 —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-182, DTC P0545 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW-BANK 1 —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



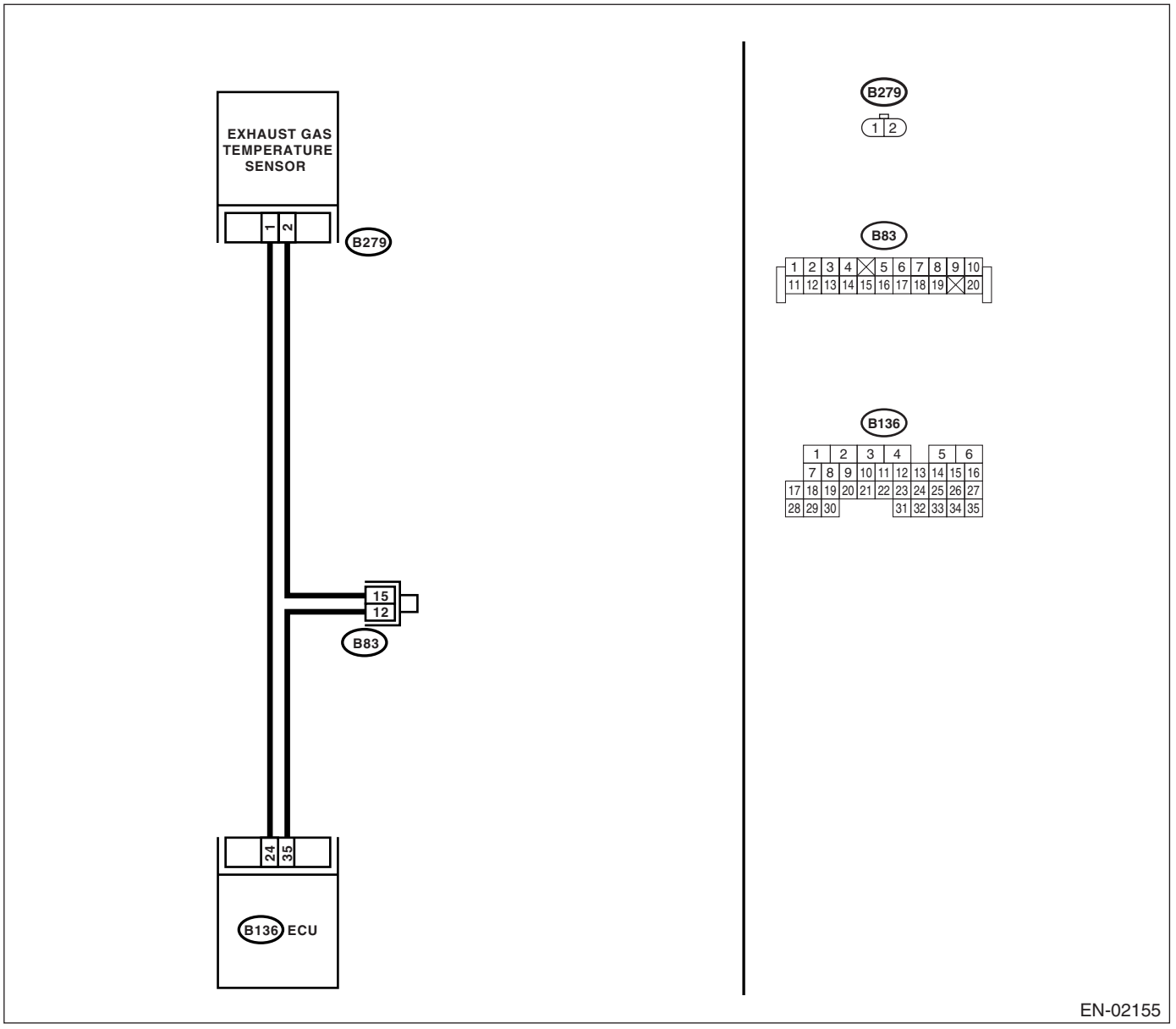
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of exhaust gas temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 1200°C (2192°F)?	Go to step **2.**	Repair the poor contact. NOTE: In this case, repair the following: • Poor contact in exhaust gas temperature sensor • Poor contact in ECM • Poor contact in joint connector
2	**CHECK HARNESS BETWEEN EXHAUST GAS TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from exhaust gas temperature sensor. 3) Turn the ignition switch to ON. 4) Read the data of exhaust gas temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than 372°C (702°F)?	Replace the exhaust gas temperature sensor. <Ref. to FU(H4DOTC)-42, Exhaust Temperature Sensor.>	Repair the ground short circuit in harness between exhaust gas temperature sensor and ECM connector.

BW:DTC P0546 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH-BANK 1 —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-184, DTC P0546 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH-BANK 1 —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of exhaust gas temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value less than 372°C (702°F)?	Go to step **2.**	Repair the poor contact. NOTE: In this case, repair the following: • Poor contact in exhaust gas temperature sensor • Poor contact in ECM • Poor contact in joint connector
2	**CHECK HARNESS BETWEEN EXHAUST GAS TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from exhaust gas temperature sensor. 3) Measure the voltage between exhaust gas temperature sensor connector and engine ground. ***Connector & terminal*** ***(B279) No. 1 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between ECM and exhaust gas temperature sensor connector.	Go to step **3.**
3	**CHECK HARNESS BETWEEN EXHAUST GAS TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between exhaust gas temperature sensor connector and engine ground. ***Connector & terminal*** ***(B279) No. 1 (+) — Engine ground (–):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between ECM and exhaust gas temperature sensor connector.	Go to step **4.**
4	**CHECK HARNESS BETWEEN EXHAUST GAS TEMPERATURE SENSOR AND ECM CONNECTOR.** Measure the voltage between exhaust gas temperature sensor connector and engine ground. ***Connector & terminal*** ***(B279) No. 1 (+) — Engine ground (–):***	Is the measured value more than 4 V?	Go to step **5.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and exhaust gas temperature sensor connector • Poor contact in exhaust gas temperature sensor connector • Poor contact in ECM connector • Poor contact in joint connector

Step		Check	Yes	No
5	**CHECK HARNESS BETWEEN EXHAUST GAS TEMPERATURE SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between exhaust gas temperature sensor connector and engine ground. ***Connector & terminal*** ***(B279) No. 2 — Engine ground:***	Is the measured value less than 5 Ω?	Replace the exhaust gas temperature sensor. <Ref. to FU(H4DOTC)-42, Exhaust Temperature Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and exhaust gas temperature sensor connector • Poor contact in exhaust gas temperature sensor connector • Poor contact in ECM connector • Poor contact in joint connector

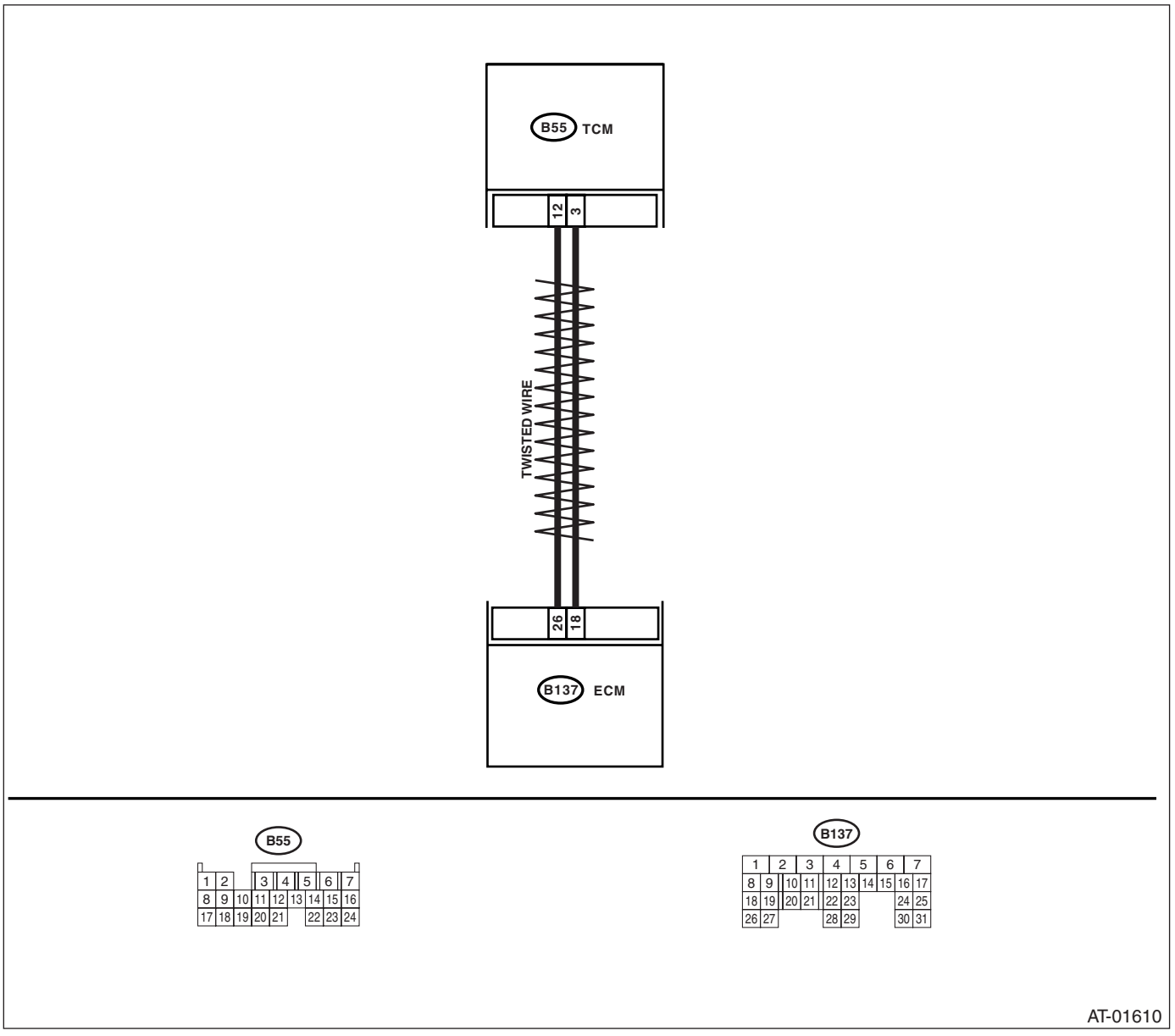
MEMO:

BX:DTC P0600 — CAN COMMUNICATION CIRCUIT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



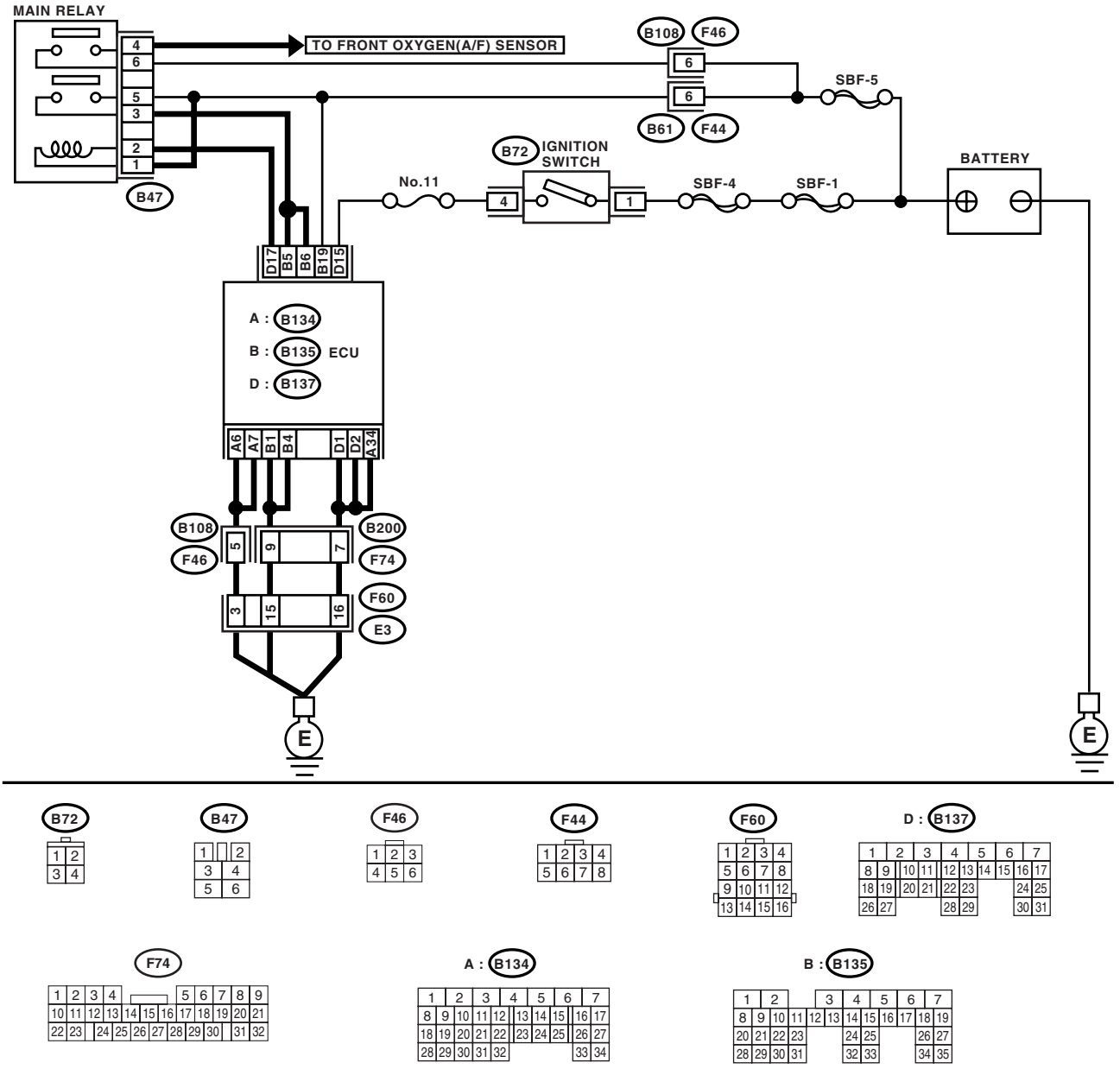
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TCM.** 1) Turn ignition switch to OFF. 2) Disconnect connector from ECM. 3) Disconnect connector from TCM. 4) Measure the resistance between ECM and TCM. ***Connector & terminal*** ***(B137) No. 18 — (B55) No. 3:*** ***(B137) No. 26 — (B55) No. 12:***	Is measured value less than 1 Ω?	Go to step **2.**	Repair harness and connector.
2	**CHECK HARNESS BETWEEN ECM AND TCM.** Measure resistance between ECM connector and chassis. ***Connector & terminal*** ***(B137) No. 18 — Chassis ground:*** ***(B137) No. 26 — Chassis ground:***	Is measured value more than 1 MΩ?	Go to step **3.**	Repair harness and connector.
3	**CHECK HARNESS BETWEEN ECM AND TCM.** Check resistance in ECM. ***Connector & terminal*** ***(B137) No. 18 — (B137) No. 26:***	Is measured value more than 1 MΩ?	Go to step **4.**	Repair harness and connector.
4	**CHECK AT SYSTEM STATE.** Perform diagnosis of AT using Subaru Select Monitor. Check DTC P1718 display.	Is there displayed DTC P1718?	Check AT system.	Replace ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

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

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-187, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-02134

Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P0604?	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	A temporary poor contact.

MEMO:

BZ:DTC P0605 — INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR —

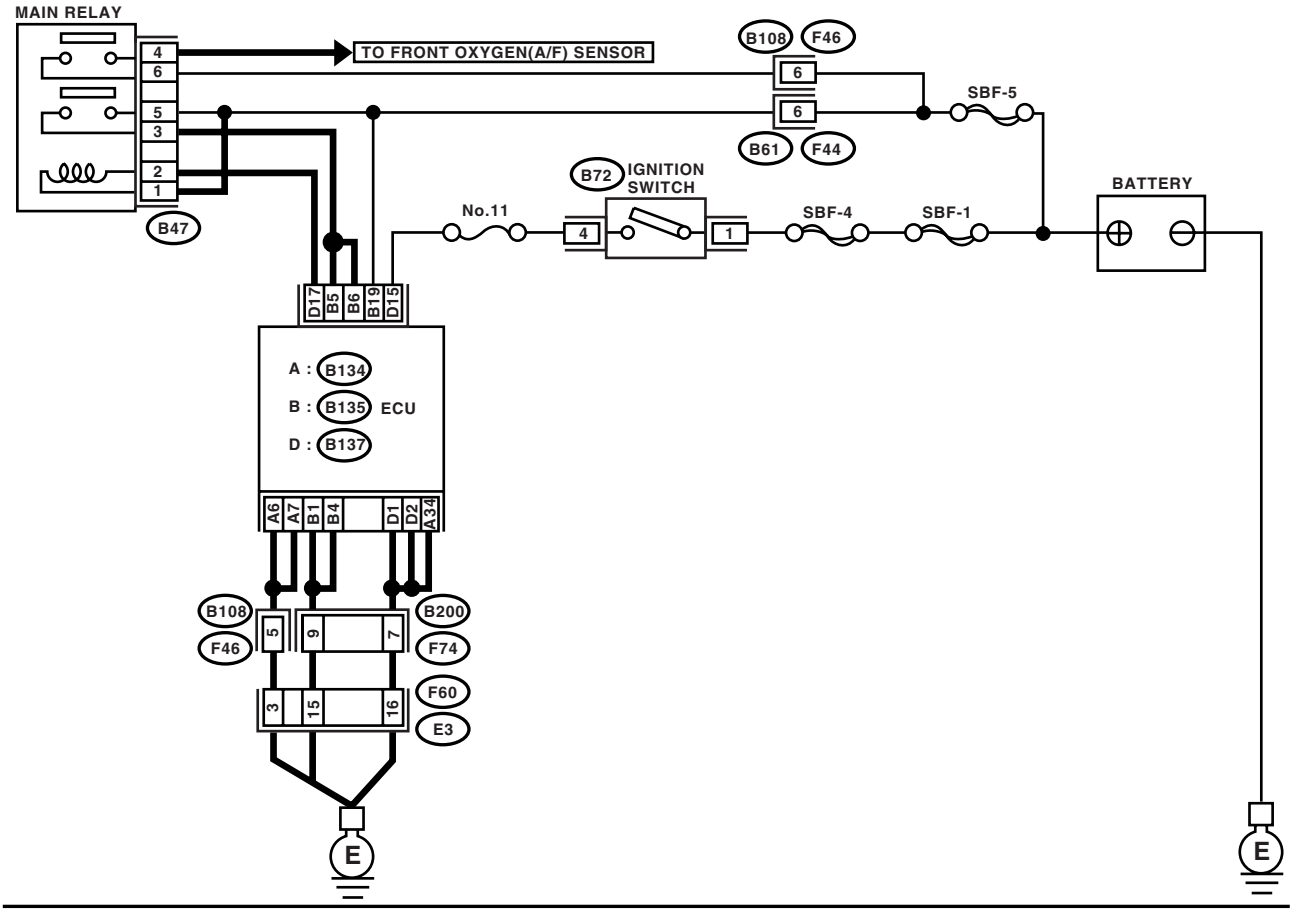
NOTE:
For the diagnostic procedure, refer to DTC P0607. <Ref. to EN(H4DOTC)-299, DTC P0607 — CONTROL MODULE PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

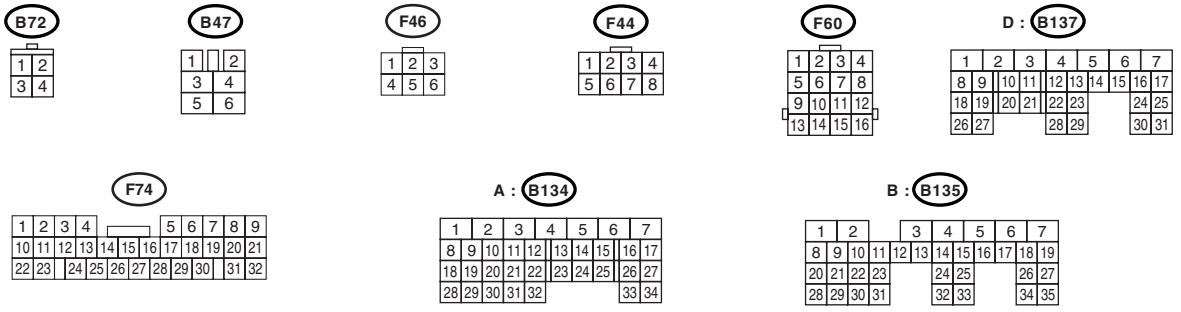
CA:DTC P0607 — CONTROL MODULE PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-188, DTC P0605 — INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR —, Diagnostic Trouble Code (DTC) Detecting Criteria.> and <Ref. to GD(H4DOTC)-189, DTC P0607 — CONTROL MODULE 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





EN-02134

Step		Check	Yes	No
1	**CHECK INPUT VOLTAGE OF ECM** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and ground. ***Connector & terminal*** ***(B135) No. 5 (+) — Chassis ground (–):*** ***(B135) No. 6 (+) — Chassis ground (–):***	Is the measured value within 10 to 13 V?	Go to step **2.**	Repair the open circuit or ground short of power supply circuit.
2	**CHECK INPUT VOLTAGE OF ECM** 1) Start the engine. 2) Measure the voltage between ECM connector and ground. ***Connector & terminal*** ***(B135) No. 5 (+) — Chassis ground (–):*** ***(B135) No. 6 (+) — Chassis ground (–):***	Is the measured value within 13 to 15 V?	Go to step **3.**	Repair the open circuit or ground short of power supply circuit.
3	**CHECK GROUND HARNESS OF ECM** Measure the voltage between ECM connector and ground. ***Connector & terminal*** ***(B137) No. 1 (+) — Chassis ground (–):*** ***(B137) No. 2 (+) — Chassis ground (–):***	Is the measured value less than 1 V?	Repair poor contact of ECM connector. If poor contact occur, replace the ECM.	Retighten the engine ground terminal.

CB:DTC P0638 — THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1) —

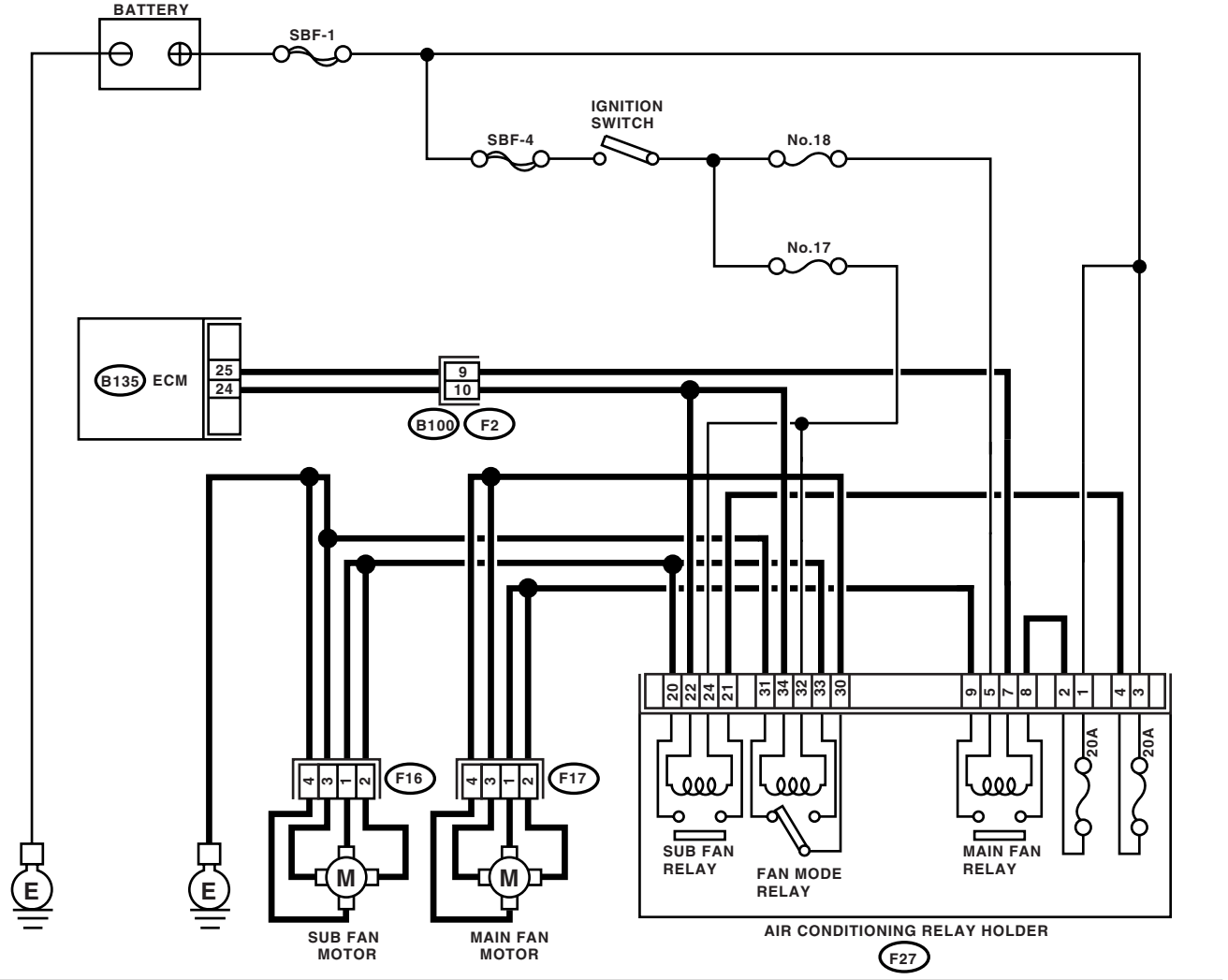
NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)-403, DTC P2101 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

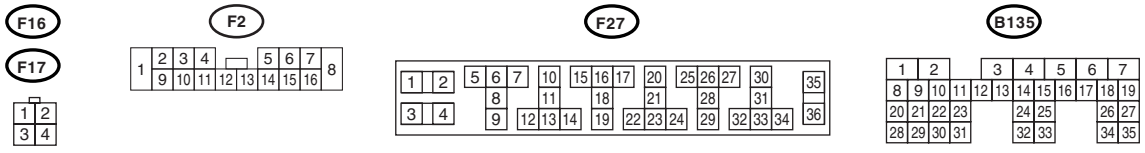
CC:DTC P0691 — COOLING FAN 1 CONTROL CIRCUIT LOW —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-195, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





EN-03205

	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn the ignition switch to OFF. 2) Connect the test mode connector. 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(H4DOTC)-32, Subaru Select Monitor.> ***Connector & terminal*** ***(B135) No. 25 (+) — Chassis ground (−):***	Does the voltage change within 0 to 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*** ***(B135) No. 25 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair ground short circuit in radiator fan relay control circuit.
3	**CHECK POWER SUPPLY FOR RELAY.** 1) Remove the main fan relay 1 and main fan relay 2 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. 5 (+) — Chassis ground (−):***	Is the measured value 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 MAIN FAN RELAY.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between main fan relay terminals. ***Terminals*** ***No. 5 — No. 7:***	Is the measured value within 87 to 107 Ω?	Go to step **5.**	Replace the main fan relay.
5	**CHECK OPEN CIRCUIT IN MAIN FAN RELAY CONTROL CIRCUIT.** Measure the resistance of harness between ECM and fan relay connector. ***Connector & terminal*** ***(B135) No. 25 — (F27) No. 7:***	Is the measured value 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 fan relay connector • Poor contact in coupling connector
6	**CHECK POOR CONTACT.** Check poor contact in ECM or fan relay connector.	Is there poor contact in ECM or fan relay connector?	Repair poor contact in ECM or fan relay connector.	Contact your SOA Service Center.

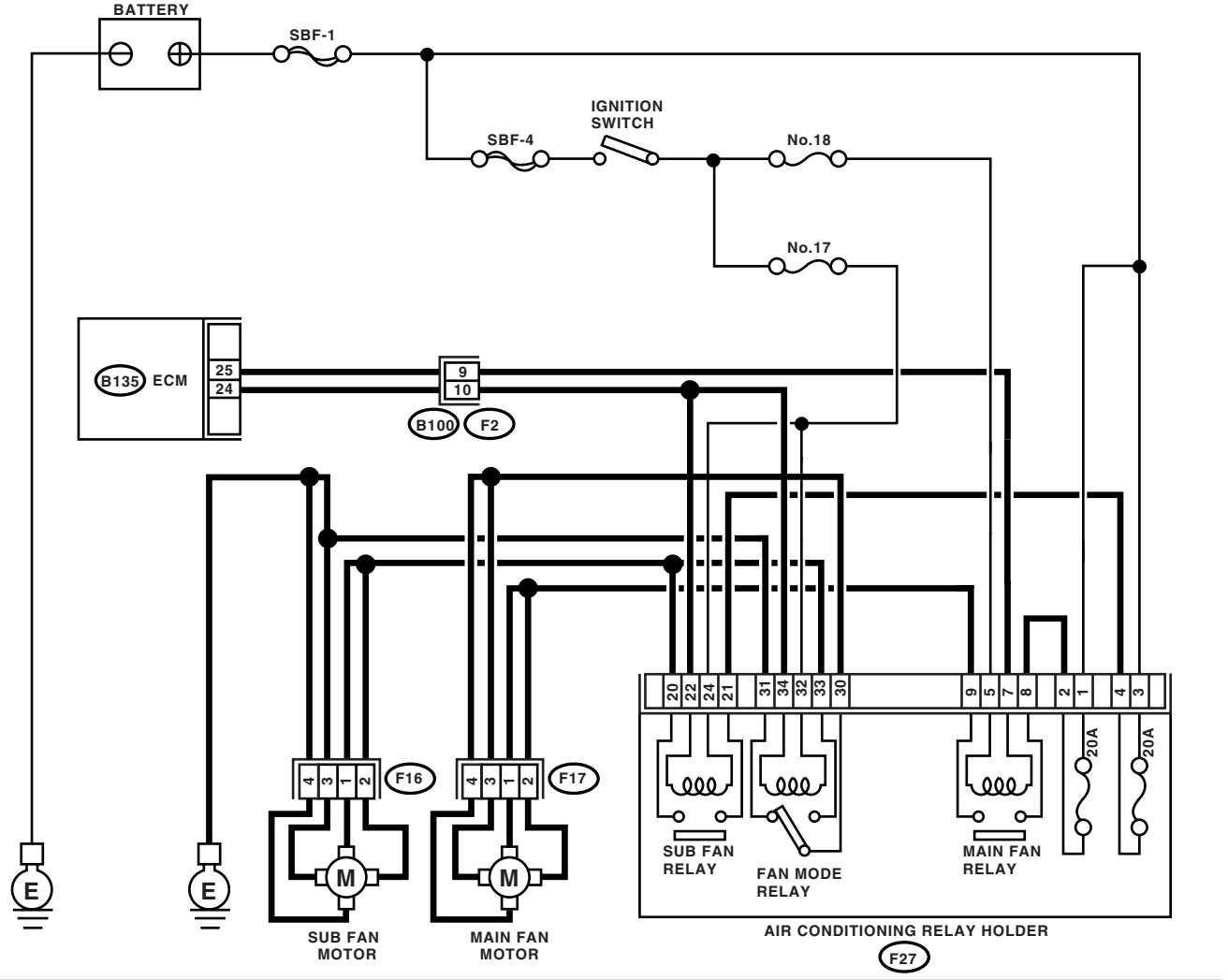
MEMO:

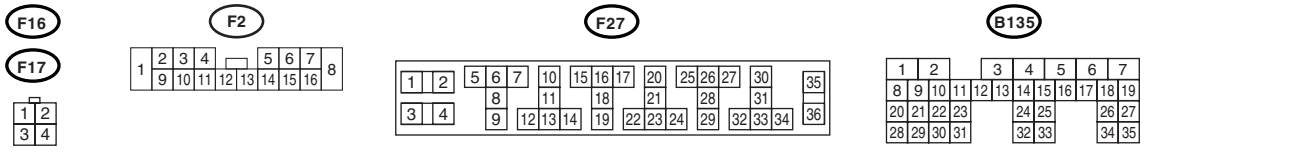
CD:DTC P0692 — COOLING FAN 1 CONTROL CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-196, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





EN-03205

	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn the ignition switch to OFF. 2) Connect the test mode connector. 3) Turn the ignition switch to ON. 4) While operating the radiator fan relay, measure the voltage between ECM and chassis ground. NOTE: Radiator fan relay operation can be executed using the Subaru Select Monitor. For procedure, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4DOTC)-53, Compulsory Valve Operation Check Mode.> ***Connector & terminal*** ***(B135) No. 25 (+) — Chassis ground (−):***	Does the voltage change within 0 to 10 V?	Even if malfunction indicator light lights up, the circuit has returned to a normal condition at this time. In this case, repair the 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, sub fan relay and fan mode relay. 3) Disconnect the test mode connector. 4) Turn the ignition switch to ON. 5) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 25 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair the battery short circuit in radiator fan relay control circuit. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, 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. 8 — No. 9:***	Is the measured value less than 1 Ω?	Replace the main fan relay and ECM. <Ref. to FU(H4DOTC)-43, 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 measured value less than 1 Ω?	Replace the sub fan relay and ECM. <Ref. to FU(H4DOTC)-43, 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 the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>

CE:DTC P0700 — AT MIL LIGHT UP REQUEST —

- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-197, DTC P0700 — AT MIL LIGHT UP REQUEST — , Diagnostic Trouble Code (DTC) Detecting Criteria.>

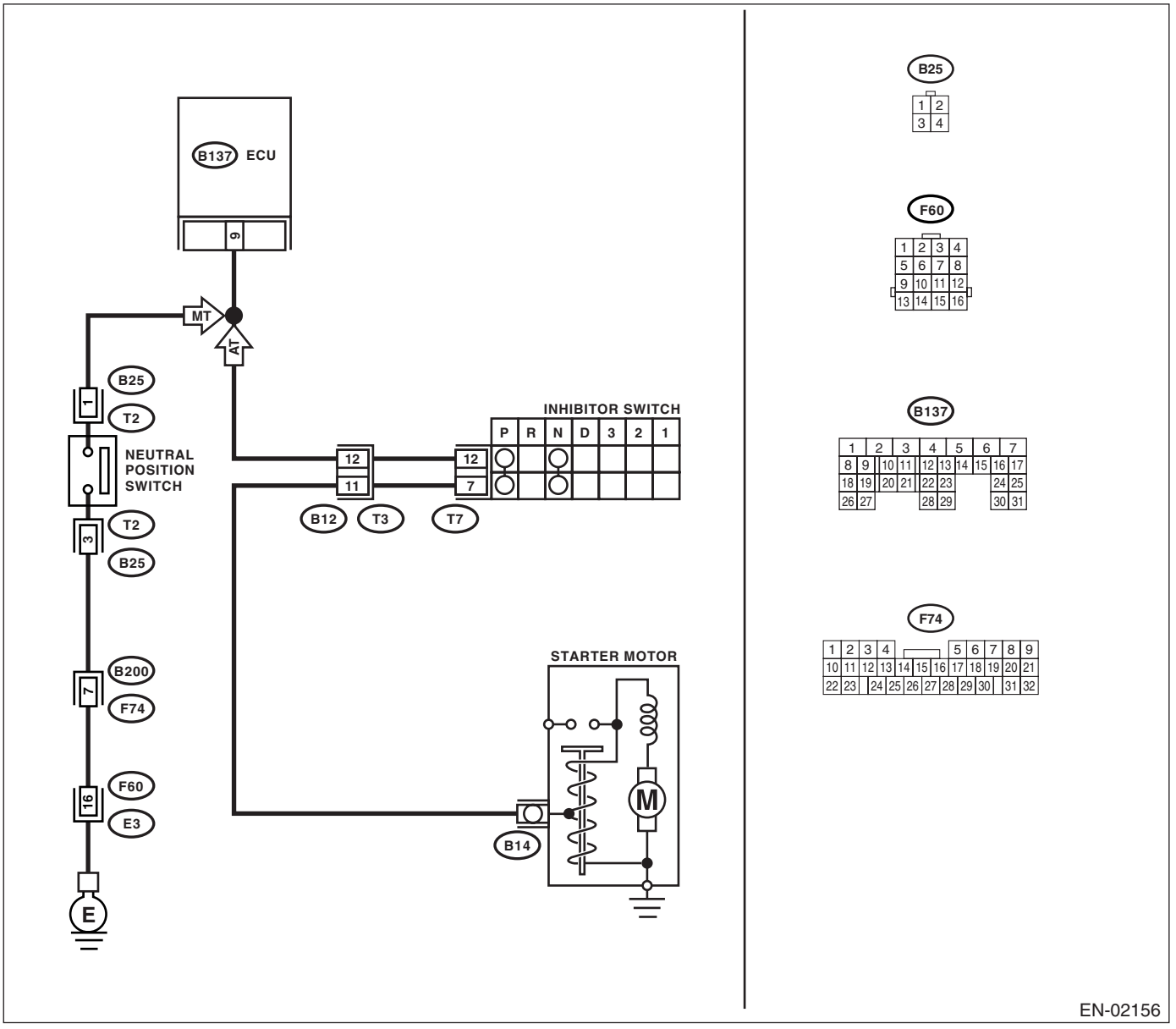
NOTE:
For the diagnostic procedure, refer to AT section. <Ref. to 4AT(D)-2, PROCEDURE, Basic Diagnostic Procedure.>

CF:DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-198, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



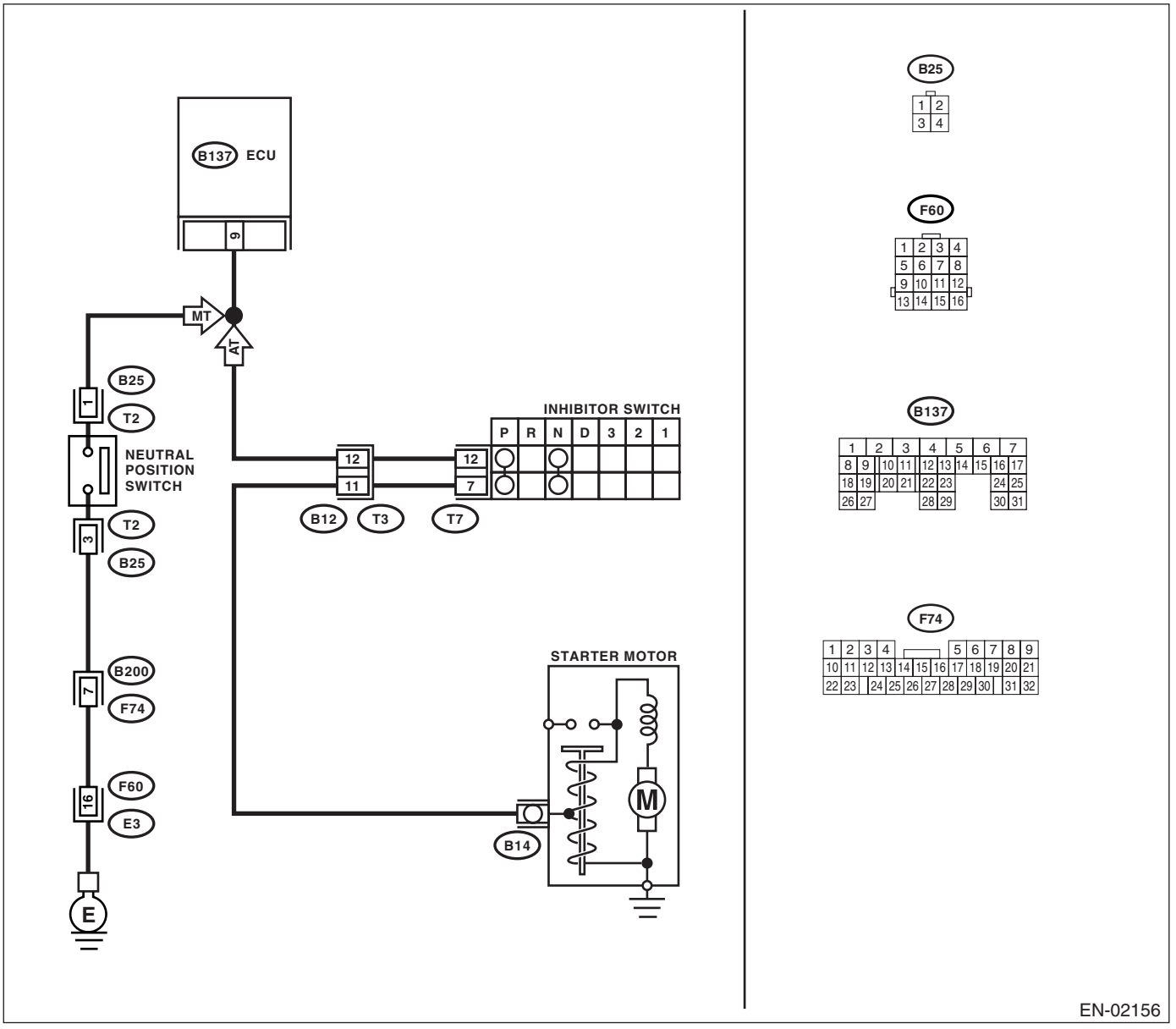
	Step	Check	Yes	No
1	**CHECK SELECTOR CABLE.**	Is there any fault in selector cable?	Repair or adjust selector cable. <Ref. to CS-32, INSPECTION, Select Cable.>	Go to step **2.**
2	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn the ignition switch to ON. 2) Place the select lever except for "N" and "P" positions. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 9 (+) — Chassis ground (−):***	Is the measured value more than 10 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*** ***(B137) No. 9 — Chassis ground:***	Is the measured value 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 measured value 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 selector lever except for "N" position. ***Terminals*** ***No. 7 — No. 12:***	Is the measured value more than 1 MΩ?	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace the inhibitor switch. <Ref. to 4AT-50, Inhibitor Switch.>

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-199, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



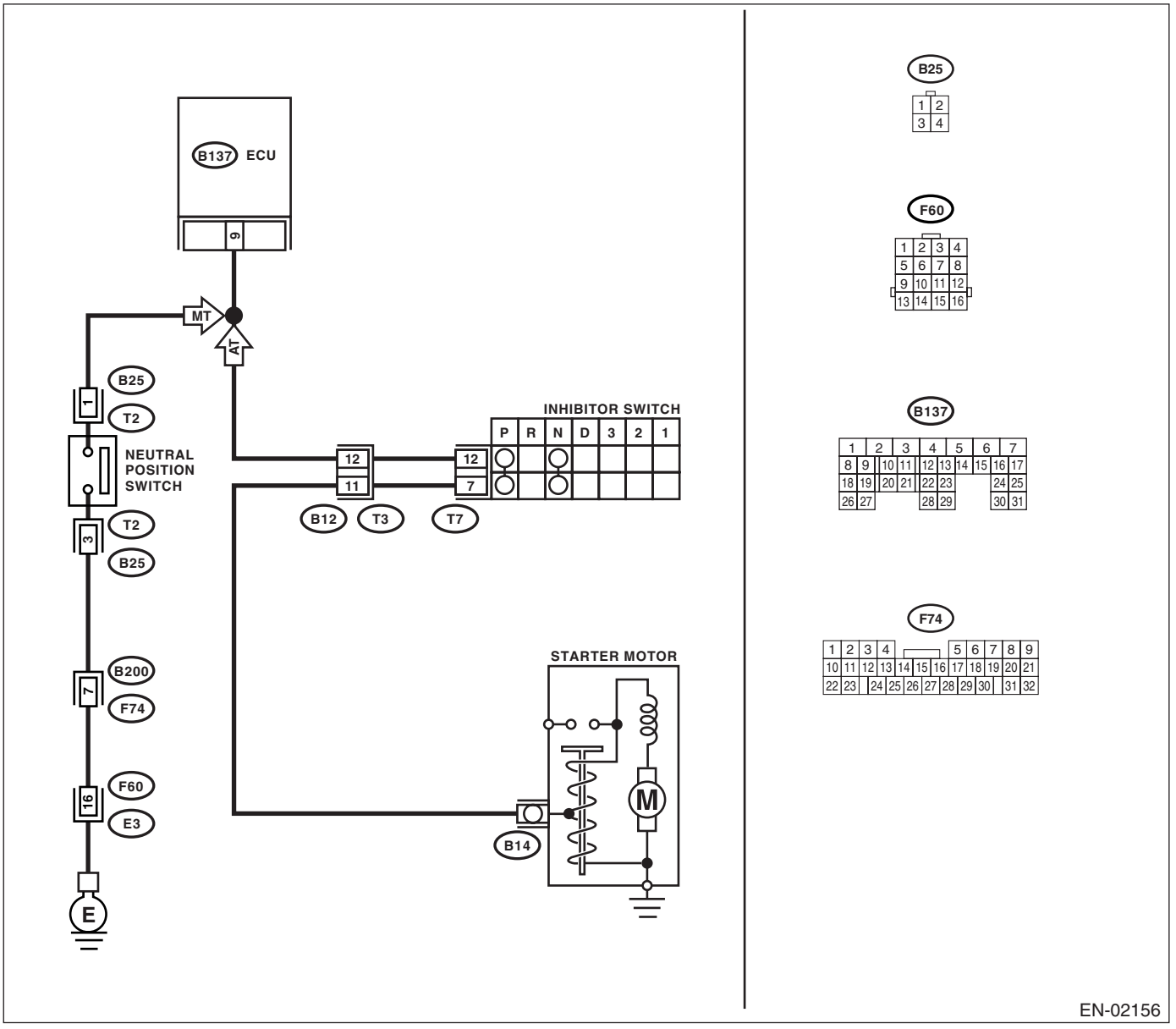
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn the ignition switch to ON. 2) Place the shift lever in a position except for neutral. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 9 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **2.**	Go to step **4.**
2	**CHECK INPUT SIGNAL FOR ECM.** 1) Place the shift lever in neutral. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 9 (+) — Chassis ground (−):***	Is the measured value 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 your 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 a position except for neutral. 4) Measure the resistance between transmission harness and connector terminals. ***Connector & terminal*** ***(T2) No. 1 — No. 3:***	Is the measured value 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 neutral. 2) Measure the resistance between transmission harness connector terminals.	Is the measured value 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*** ***(B137) No. 9 — Chassis ground:***	Is the measured value 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*** ***(B137) No. 9 — (B25) No. 1:***	Is the measured value less than 1 Ω?	Go to step **8.**	Repair open circuit in harness between ECM and transmission harness connector.
8	**CHECK NEUTRAL POSITION SWITCH GROUND LINE.** Measure the resistance of harness between transmission harness connector and engine ground. ***Connector & terminal*** ***(B25) No. 3 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **9.**	Repair open circuit between transmission harness connector and engine ground terminal.
9	**CHECK POOR CONTACT.** Check poor contact in transmission harness connector.	Is there poor contact in transmission harness connector?	Repair poor contact in transmission harness connector.	Contact your SOA Service Center.

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-200, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK SELECTOR CABLE.**	Is there any fault in selector cable?	Repair or adjust selector cable. <Ref. to CS-32, INSPECTION, Select Cable.>	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 selector lever "N" and "P" positions. ***Connector & terminal*** ***(B137) No. 9 (+) — Chassis ground (−):***	Is the measured value 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 selector lever except for "N" and "P" positions. ***Connector & terminal*** ***(B137) No. 9 (+) — Chassis ground (−):***	Is the measured value more than 10 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 your 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*** ***(B137) No. 9 (+) — Chassis ground (−):***	Is the measured value 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*** ***(B137) No. 9 — (T7) No. 12:***	Is the measured value 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

	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. 7 — Engine ground:***	Is the measured value 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 selector lever "N" and "P" positions. ***Terminals*** ***No. 7 — No. 12:***	Is the measured value less than 1 Ω?	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace the inhibitor switch. <Ref. to 4AT-50, Inhibitor Switch.>

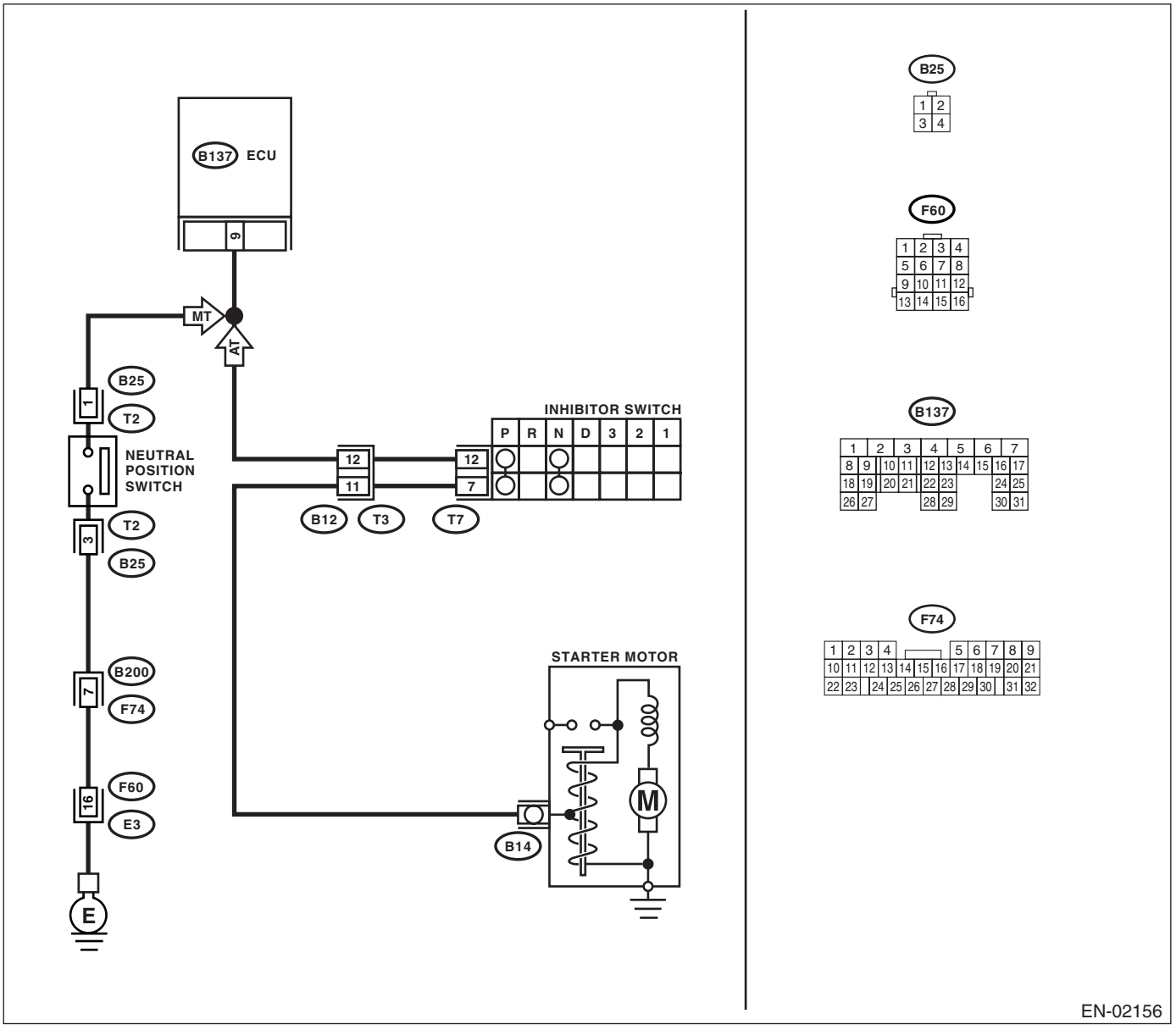
MEMO:

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

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-201, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



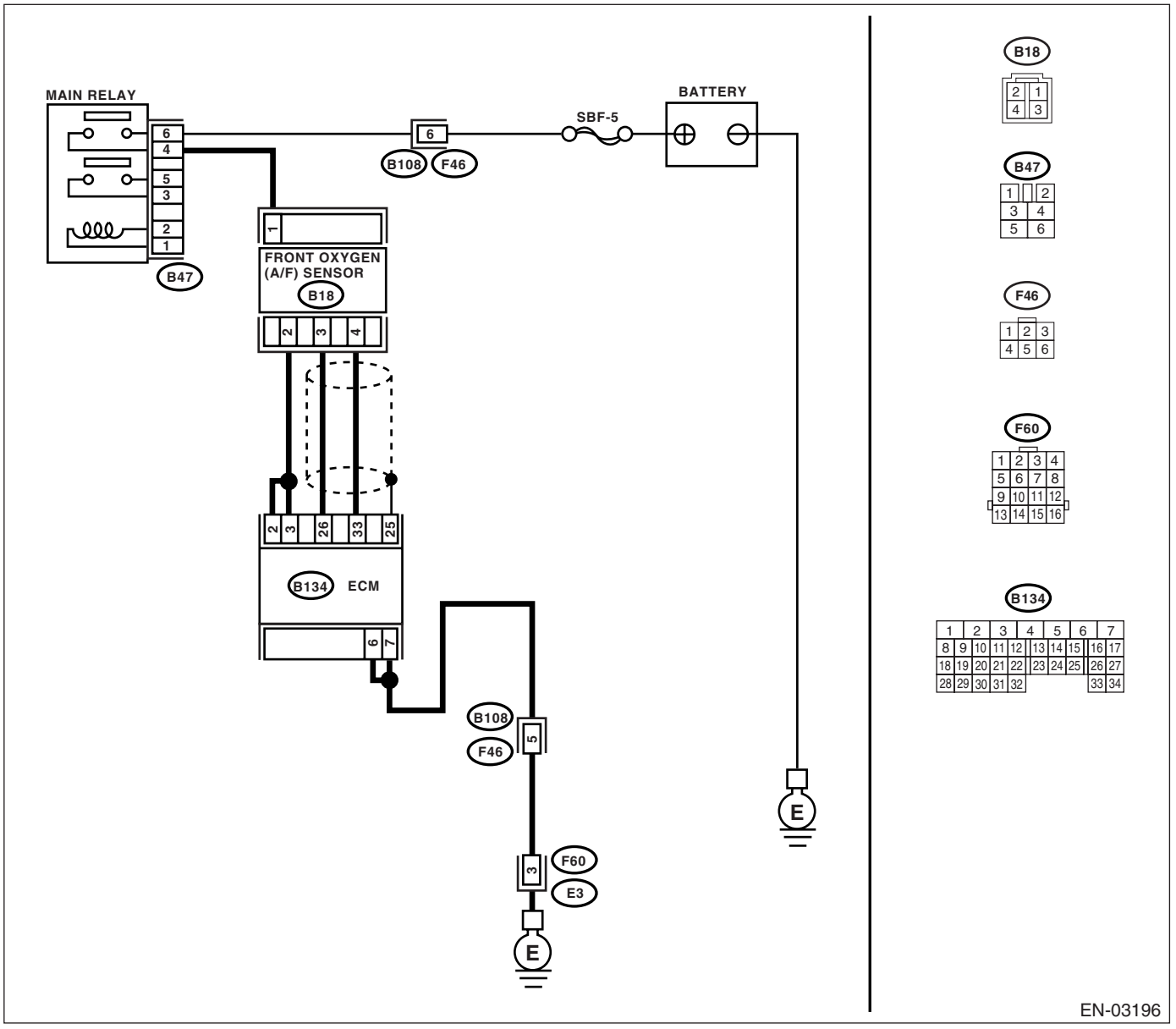
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn the ignition switch to ON. 2) Set the shift lever to neutral position. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 9 (+) — Chassis ground (–):***	Is the measured value less than 1 V?	Go to step **2.**	Go to step **4.**
2	**CHECK INPUT SIGNAL FOR ECM.** 1) Set the shift lever to except neutral position. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 9 (+) — Chassis ground (–):***	Is the measured value more than 10 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 the poor contact in ECM connector.	Contact your SOA Service Center.
4	**CHECK INPUT SIGNAL FOR ECM.** 1) Disconnect ECM connector from ECM. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 9 (+) — Chassis ground (–):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between ECM and transmission connector.	Go to step **5.**
5	**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 (T9). 3) Measure the resistance of harness between ECM and neutral switch connector. ***Connector & terminal*** ***(B137) No. 9 — (B25) No. 1:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and transmission harness • Poor contact in transmission harness connector • Poor contact in ECM connector
6	**CHECK NEUTRAL POSITION SWITCH GROUND LINE.** Measure the resistance of harness between transmission harness connector and engine ground. ***Connector & terminal*** ***(B25) No. 3 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **7.**	Repair the open circuit in harness of neutral position switch ground line.
7	**CHECK NEUTRAL POSITION SWITCH.** 1) Set the shift lever to neutral position. 2) Measure the resistance between transmission harness connector receptacle's terminals. ***Terminals*** ***No. 1 — No. 3:***	Is the measured value less than 1 Ω?	Go to step **8.**	Replace the neutral position switch.
8	**CHECK POOR CONTACT.** Check poor contact in the transmission harness connector.	Is there poor contact in the transmission harness connector?	Repair poor contact in transmission harness connector.	Contact your SOA Service Center.

CJ: DTC P1152 — O_2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-202, DTC P1152 — O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



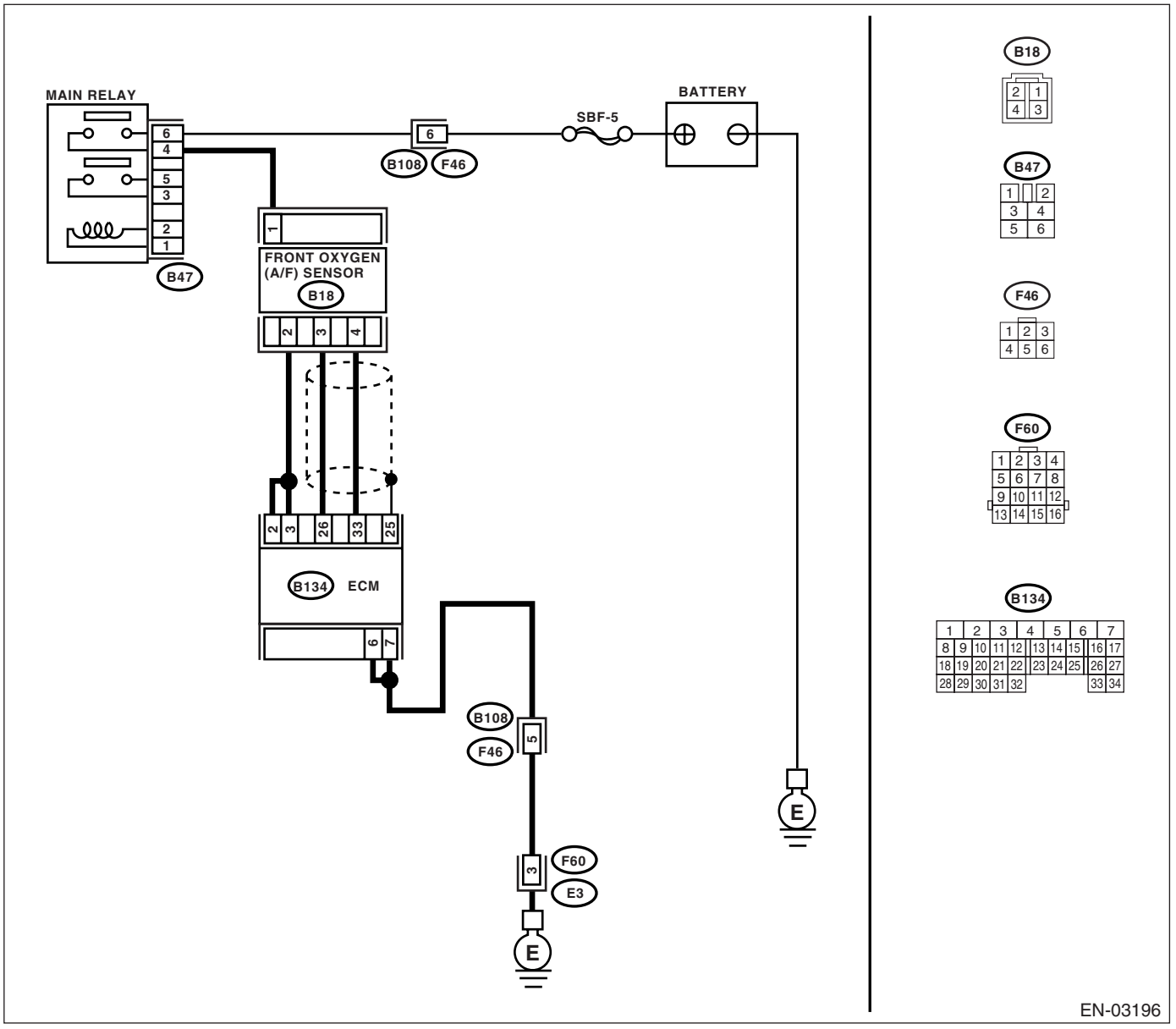
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and front oxygen (A/F) sensor connector. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B134) No. 33 — (B18) No. 4:*** ***(B134) No. 26 — (B18) No. 3:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair the 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 the poor contact in front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, Front Oxygen (A/F) Sensor.>

CK: DTC P1153 — O_2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-205, DTC P1153 — O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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 connector from ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 26 — Chassis ground:***	Is the measured value more than 1 MΩ?	Repair the ground short circuit in harness between ECM and front oxygen (A/F) sensor connector.	Go to step **2.**
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure the resistance of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 33 — Chassis ground:***	Is the measured value more than 1 MΩ?	Repair the ground short circuit in harness between ECM and front oxygen (A/F) sensor connector.	Go to step **3.**
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 connector and chassis ground. ***Connector & terminal*** ***(B134) No. 26 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V?	Go to step **4.**	Go to step **5.**
4	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 26 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Repair the poor contact in ECM connector.
5	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 33 (+) — Chassis ground (−):***	Is the measured value more than 4.95 V?	Go to step **6.**	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, Front Oxygen (A/F) Sensor.>
6	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 33 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair the battery short circuit in harness between ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Repair the poor contact in ECM connector.

MEMO:

CL:DTC P1160 — RETURN SPRING FAILURE —

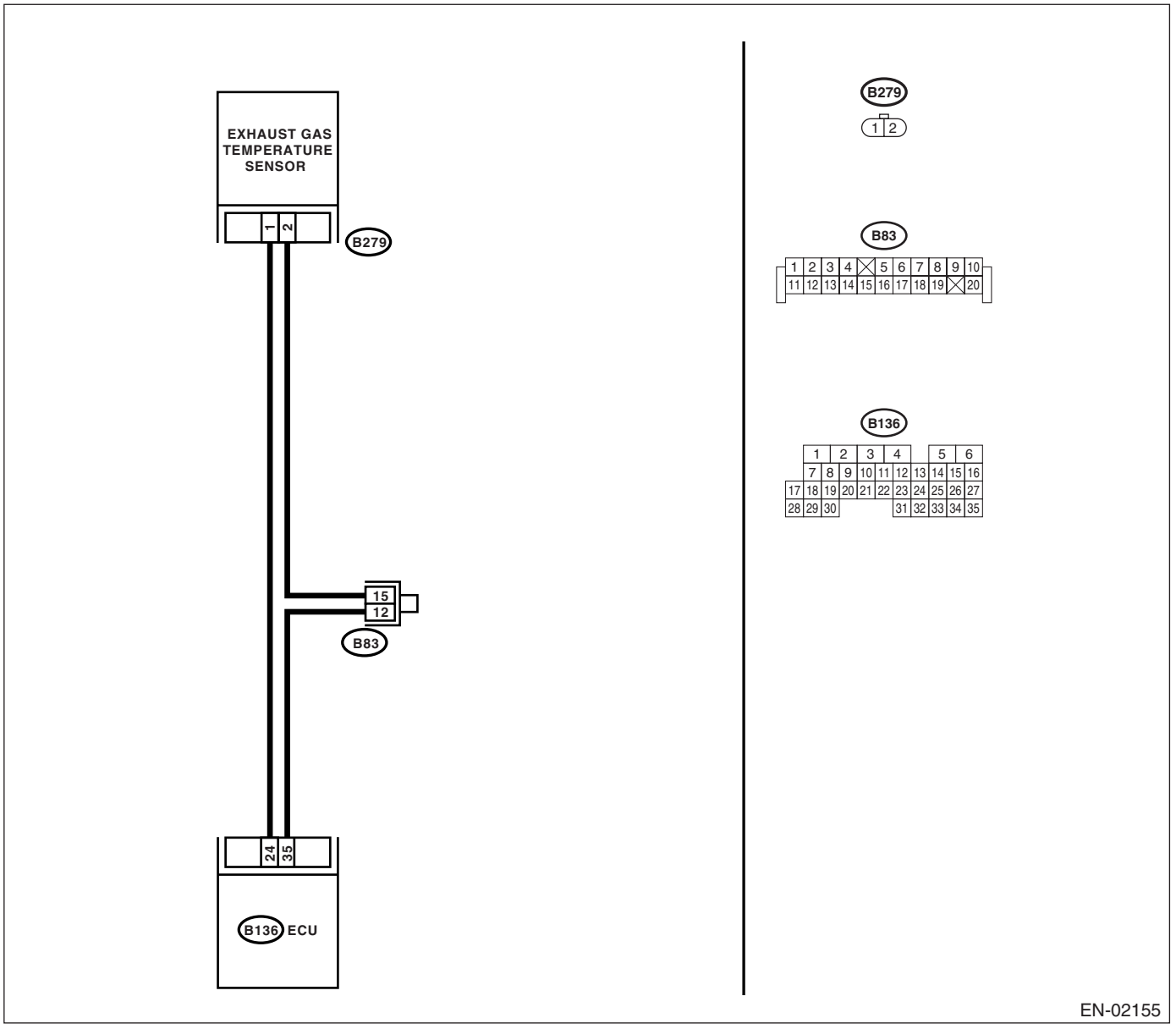
NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)-403, DTC P2101 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CM:DTC P1301 — MISFIRE DETECTED (HIGH TEMPERATURE EXHAUST GAS) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-210, DTC P1301 — MISFIRE DETECTED (HIGH TEMPERATURE EXHAUST GAS) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



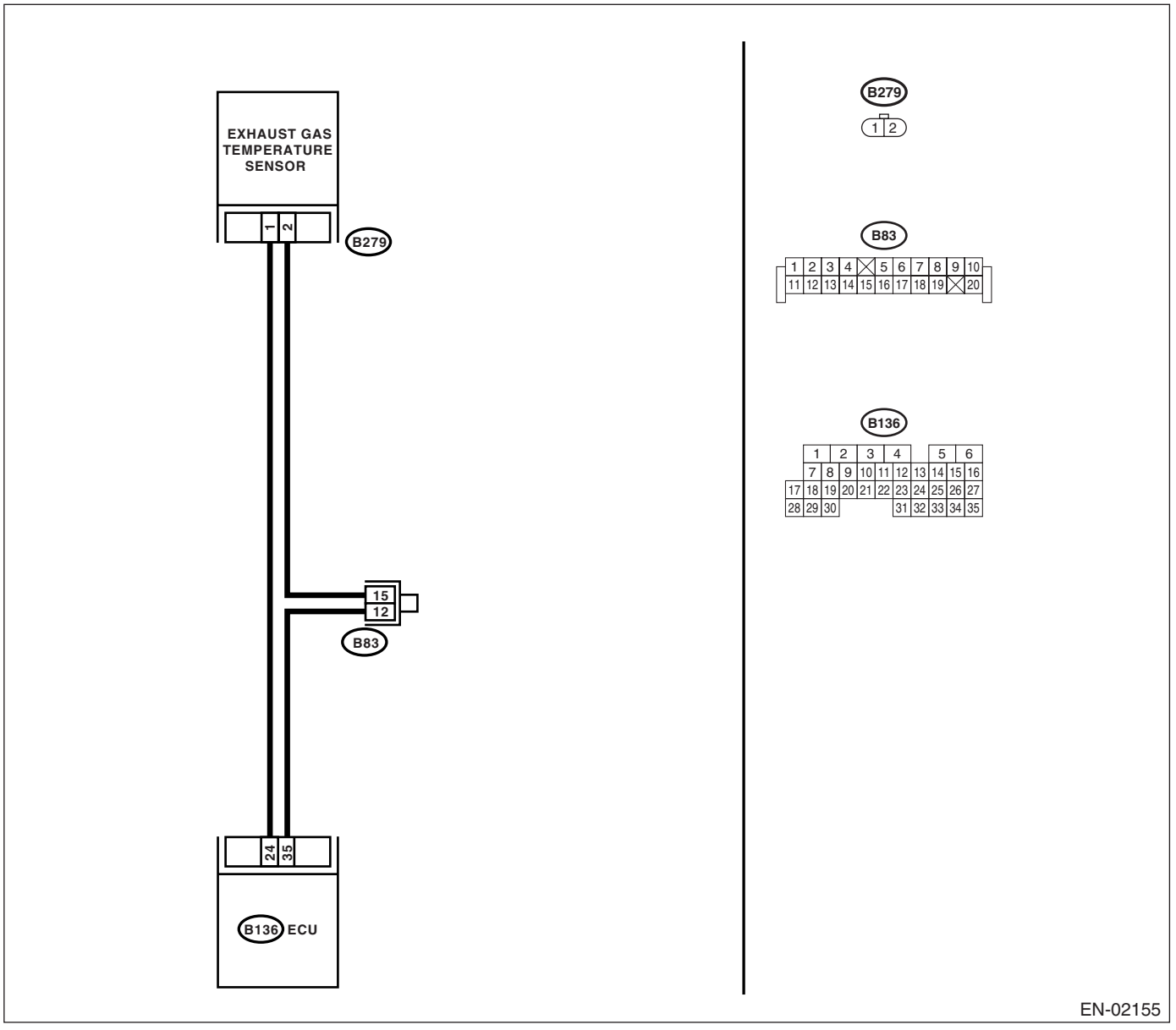
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC.** Conduct the troubleshooting for all DTC P0301, P0302, P0303 and P0304. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Does failure for repair or replacement exist?	Repair or replace the failure, then replace precatalytic converter.	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

CN:DTC P1312 — EXHAUST GAS TEMPERATURE SENSOR MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-212, DTC P1312 — EXHAUST GAS TEMPERATURE SENSOR MALFUNCTION —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



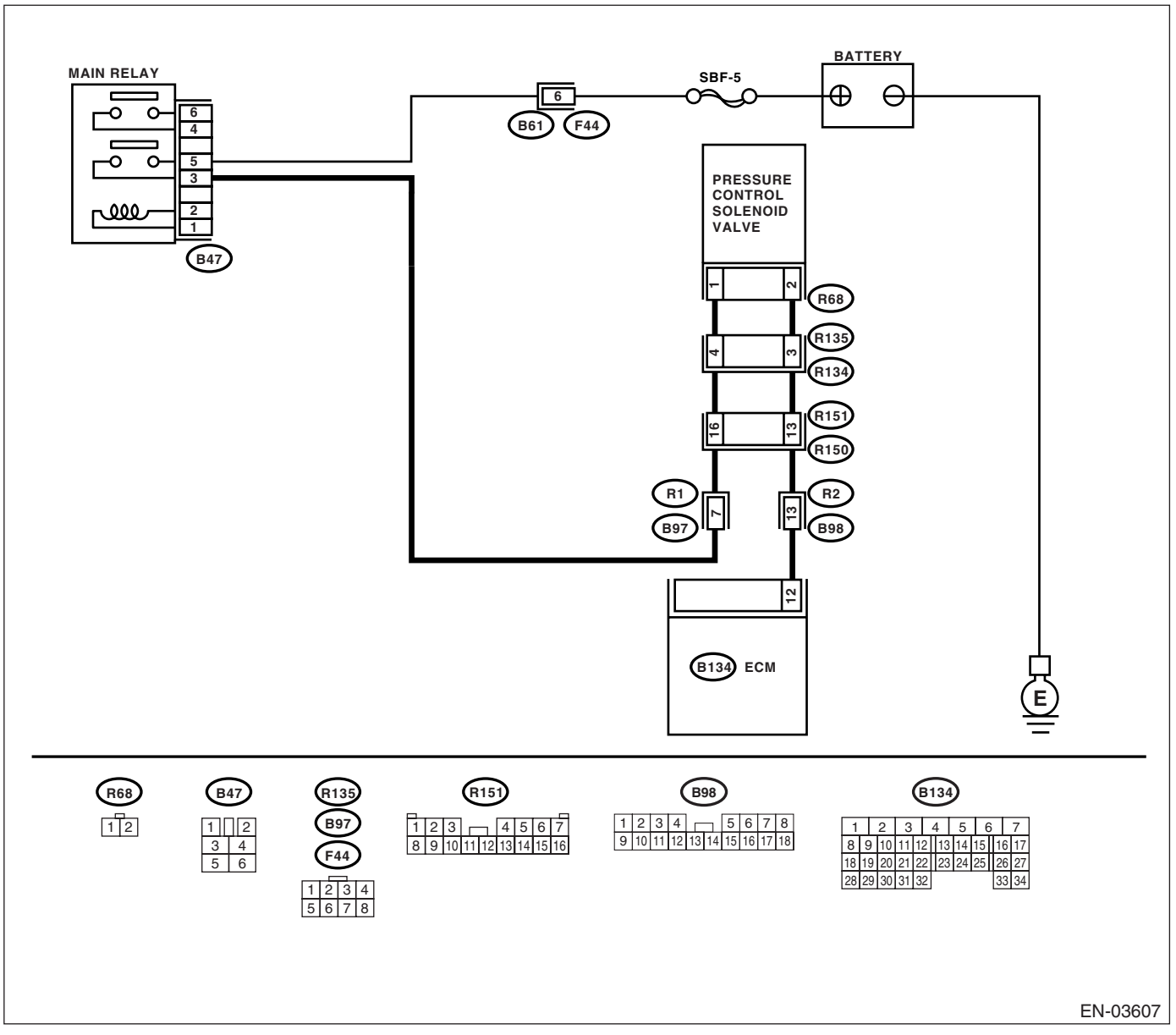
Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P1312.	Replace the exhaust gas temperature sensor. <Ref. to FU(H4DOTC)-42, Exhaust Temperature Sensor.>

CO:DTC P1400 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-213, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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. 12 (+) — Chassis ground (−):***	Is the measured value 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 with 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 measured value more than 1 MΩ?	Go to step **4.**	Repair short circuit to ground in harness between ECM and pressure control solenoid valve connector.
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. 12 — (R68) No. 2:***	Is the measured value 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 measured value within 10 to 100 Ω?	Go to step **6.**	Replace the pressure control solenoid valve. <Ref. to EC(H4DOTC)-12, Pressure Control Solenoid Valve.>

	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 measured value 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 with SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

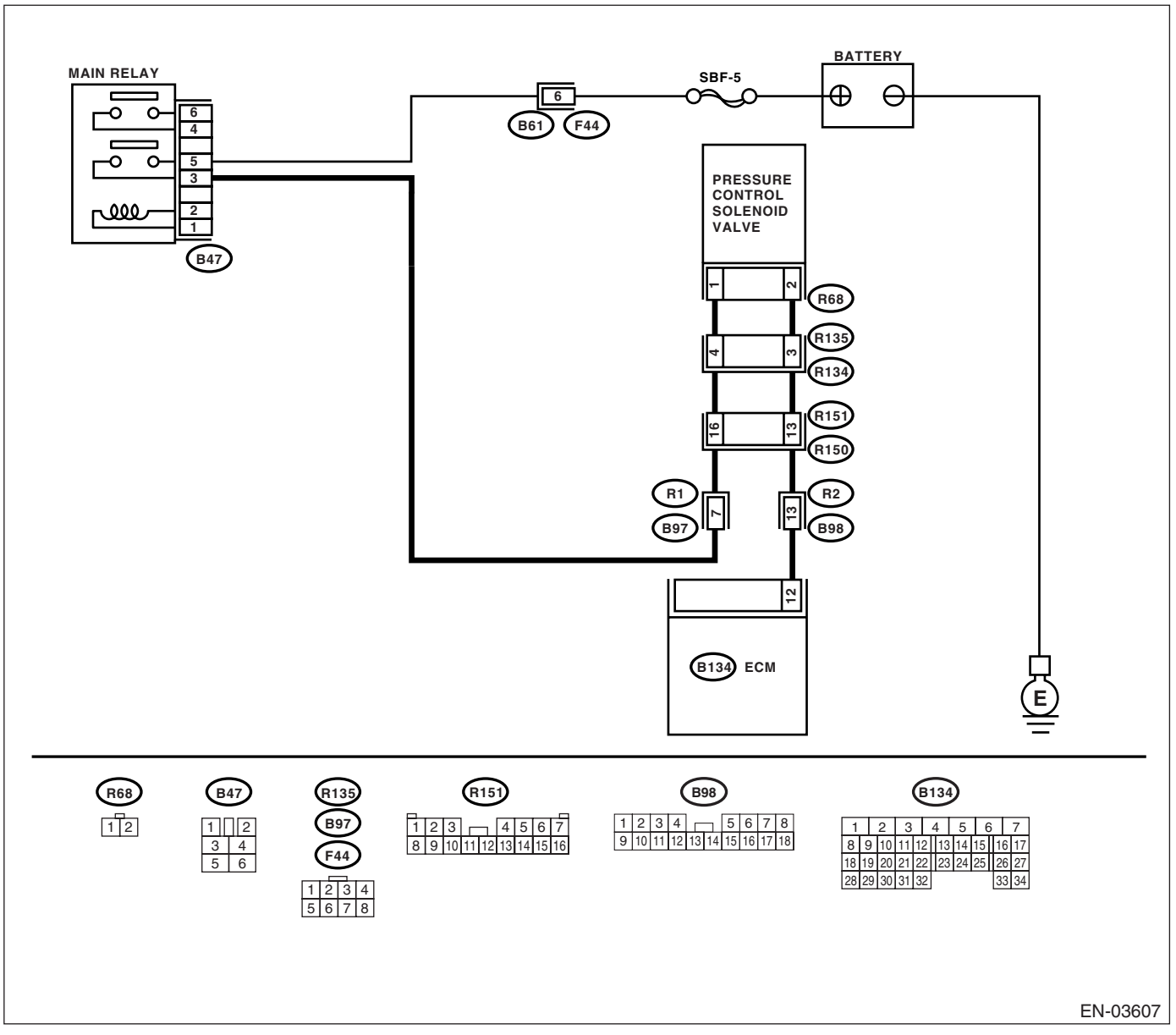
MEMO:

CP:DTC P1420 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-215, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



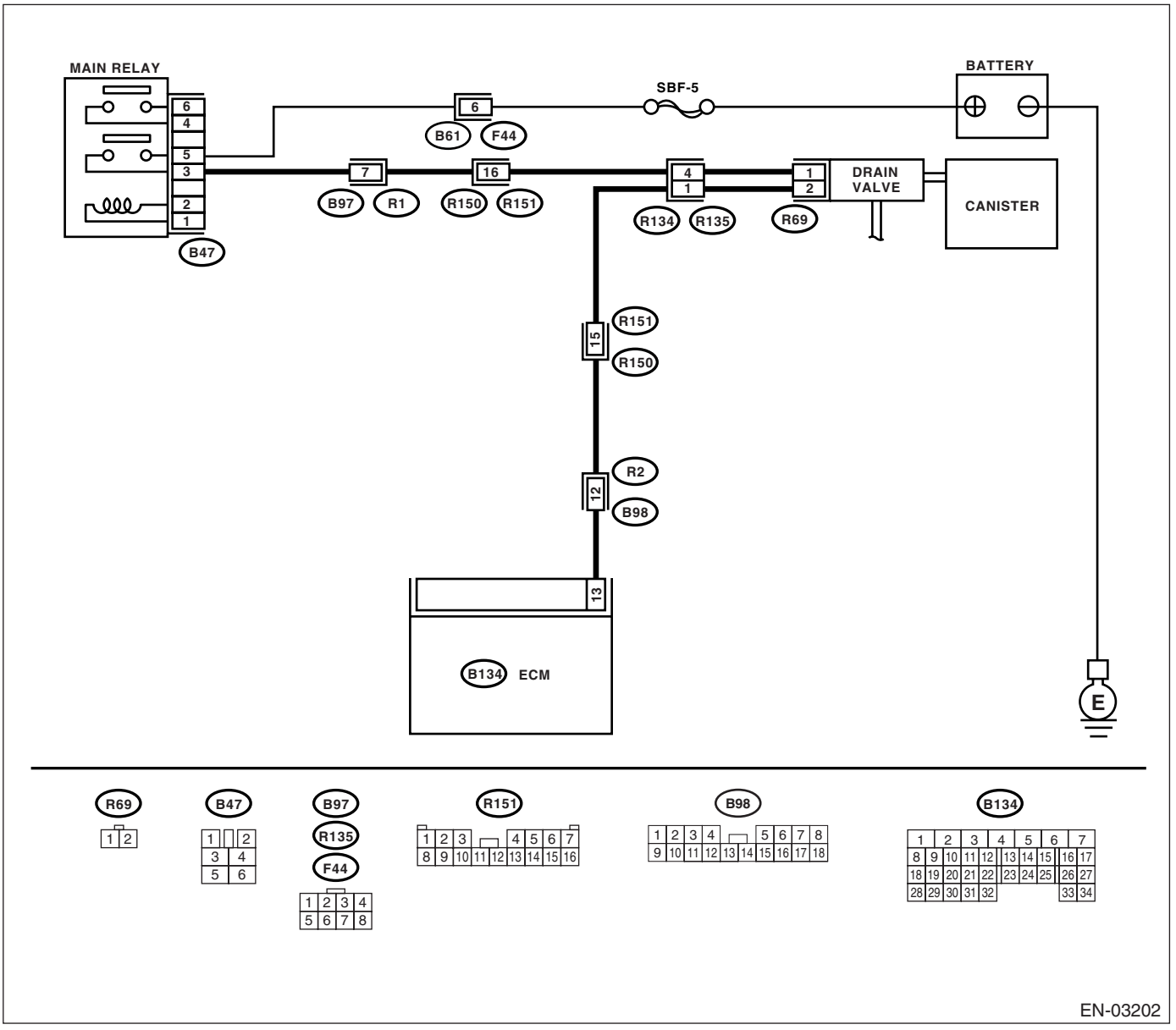
	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL FOR ECM.** 1) Turn ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn ignition switch to ON. 4) While operating the pressure control solenoid valve, measure voltage between ECM and 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(H4DOTC)-53, Compulsory Valve Operation Check Mode.> ***Connector & terminal*** ***(B134) No. 12 (+) — Chassis ground (−):***	Does the voltage value change within 0 to 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. 12 (+) — Chassis ground (−):***	Is the measured value 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(H4DOTC)-43, 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. 12 (+) — Chassis ground (−):***	Is the measured value 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(H4DOTC)-43, 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 measured value less than 1 Ω?	Replace the pressure control solenoid valve <Ref. to EC(H4DOTC)-12, Pressure Control Solenoid Valve.> and the ECM <Ref. to FU(H4DOTC)-43, 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(H4DOTC)-43, Engine Control Module (ECM).>

CQ:DTC P1443 — VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-217, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



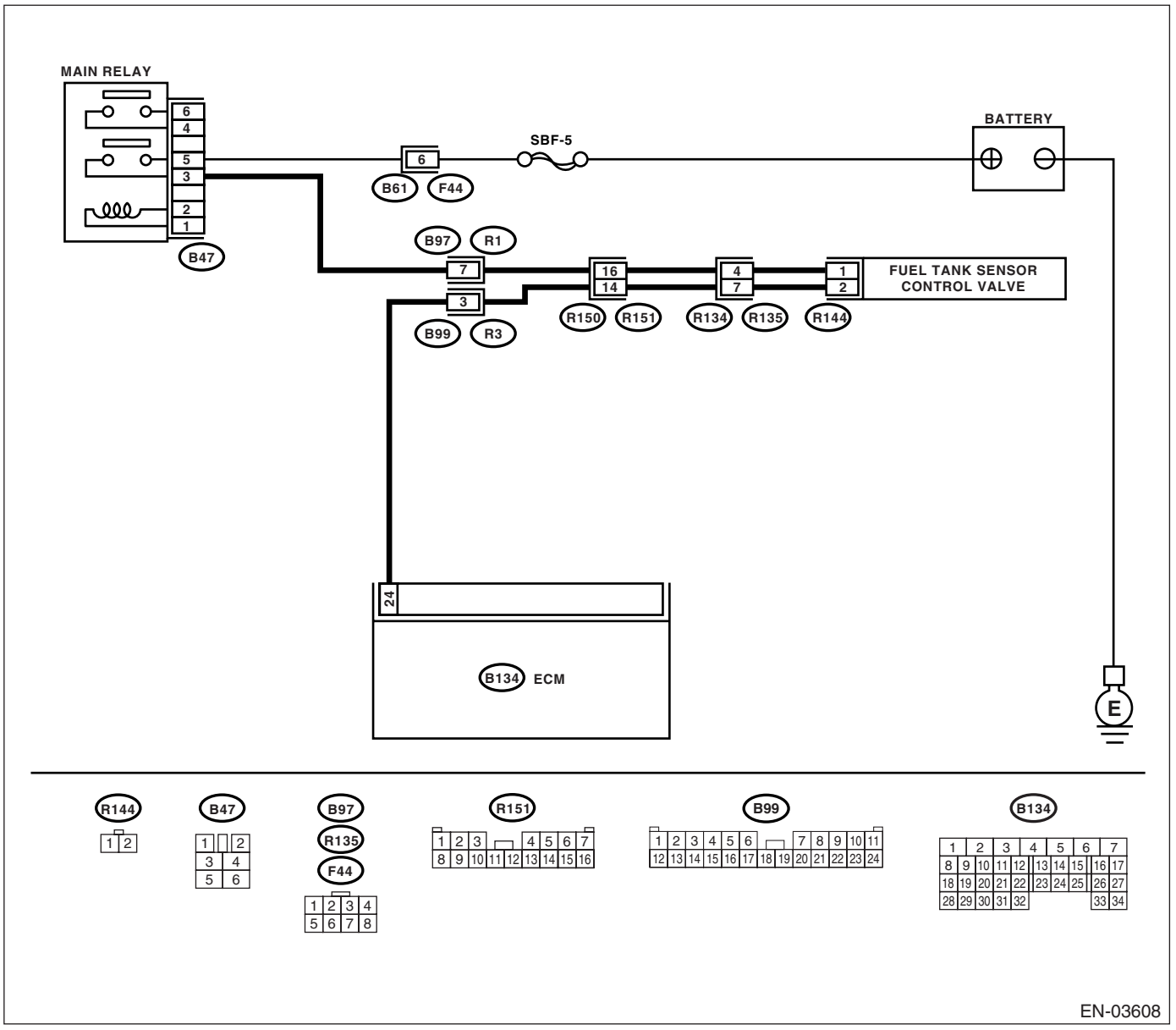
	Step	Check	Yes	No
1	**CHECK FOR OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK VENT LINE HOSES.** Check the following items. •Clogging 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(H4DOTC)-53, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Contact with SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.	Replace the drain valve. <Ref. to EC(H4DOTC)-16, Drain Valve.>

CR:DTC P1446 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-218, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	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. 24 (+) — Chassis ground (−):***	Is the measured value 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.)j 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 measured value more than 1 MΩ?	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. 24 — (R144) No. 2:***	Is the measured value 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 measured value within 10 to 100 Ω?	Go to step **6.**	Replace the fuel tank sensor control valve. <Ref. to EC(H4DOTC)-16, Drain Valve.>

	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 measured value 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 with SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

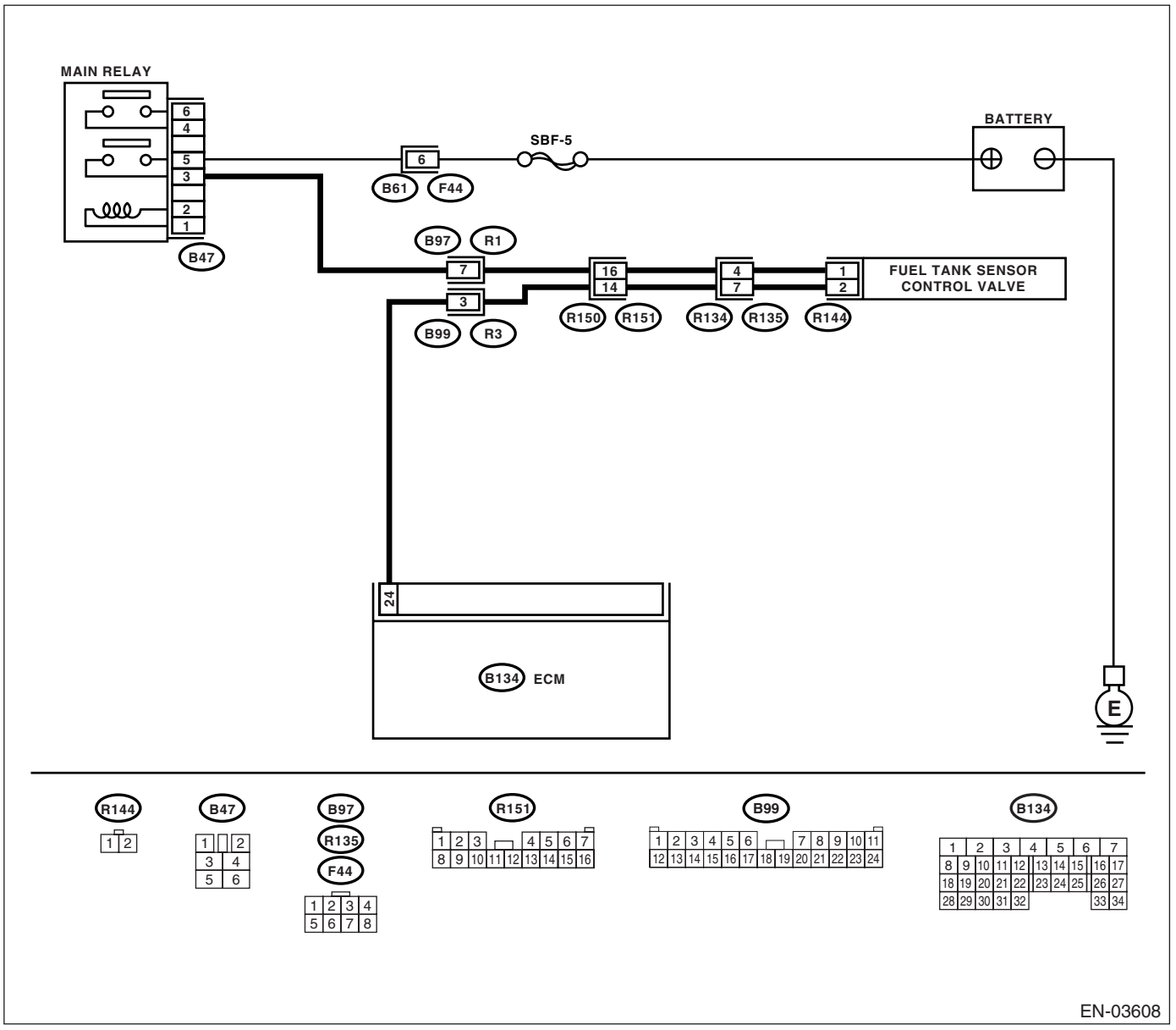
MEMO:

CS:DTC P1447 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-220, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-03608

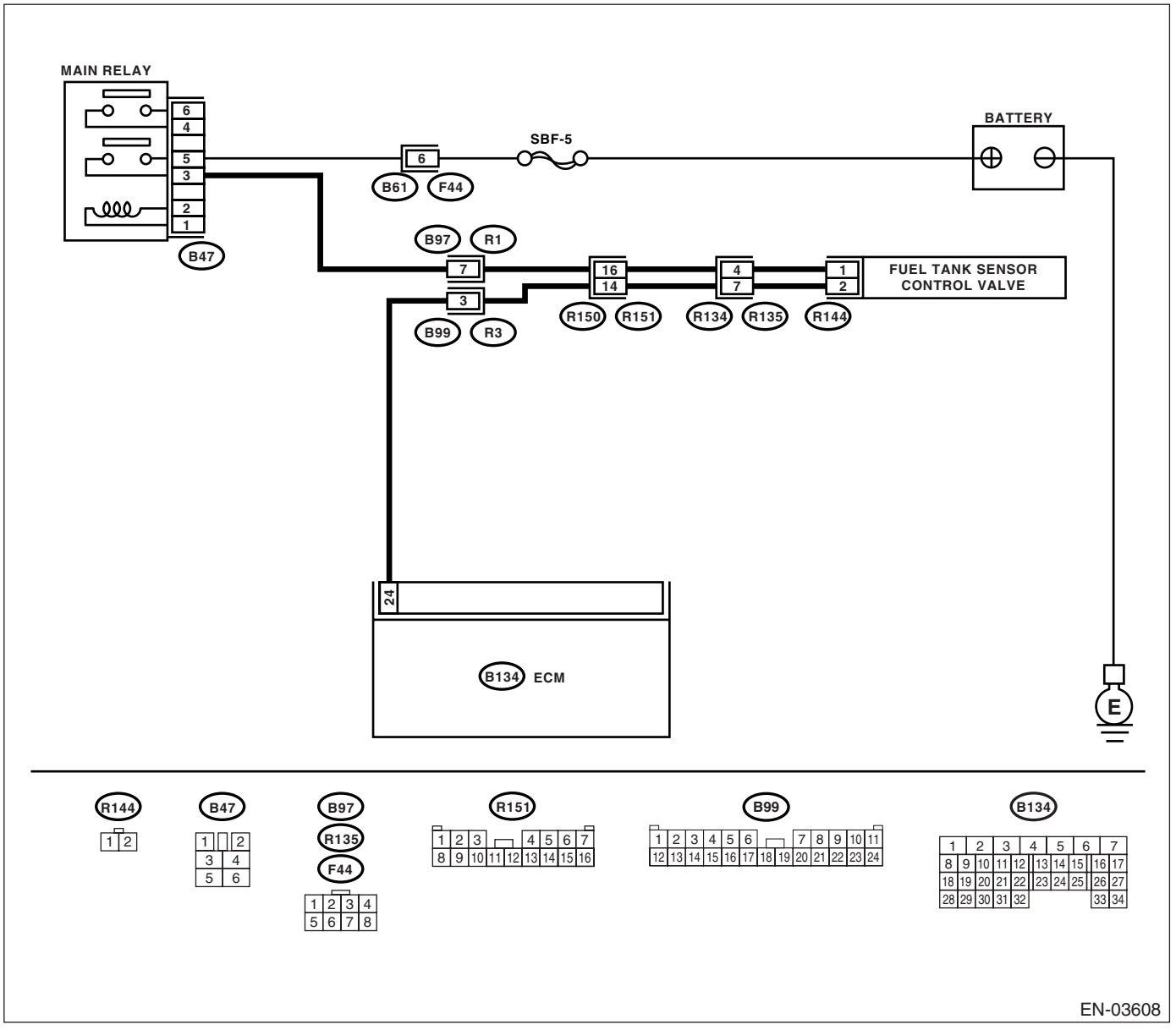
	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL FROM ECM.** 1) Turn ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 24 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Go to step **3.**	Go to step **2.**
2	**CHECK FOR 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(H4DOTC)-43, 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. 24 (+) — Chassis ground (−):***	Is the measured value 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(H4DOTC)-43, 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 measured value less than 1 Ω?	Replace the fuel tank sensor control valve <Ref. to EC(H4DOTC)-11, Fuel Tank Sensor Control Valve.> and the ECM <Ref. to FU(H4DOTC)-43, 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(H4DOTC)-43, Engine Control Module (ECM).>

CT:DTC P1448 — FUEL TANK SENSOR CONTROL VALVE RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-222, DTC P1448 — FUEL TANK SENSOR CONTROL VALVE RANGE PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-03608

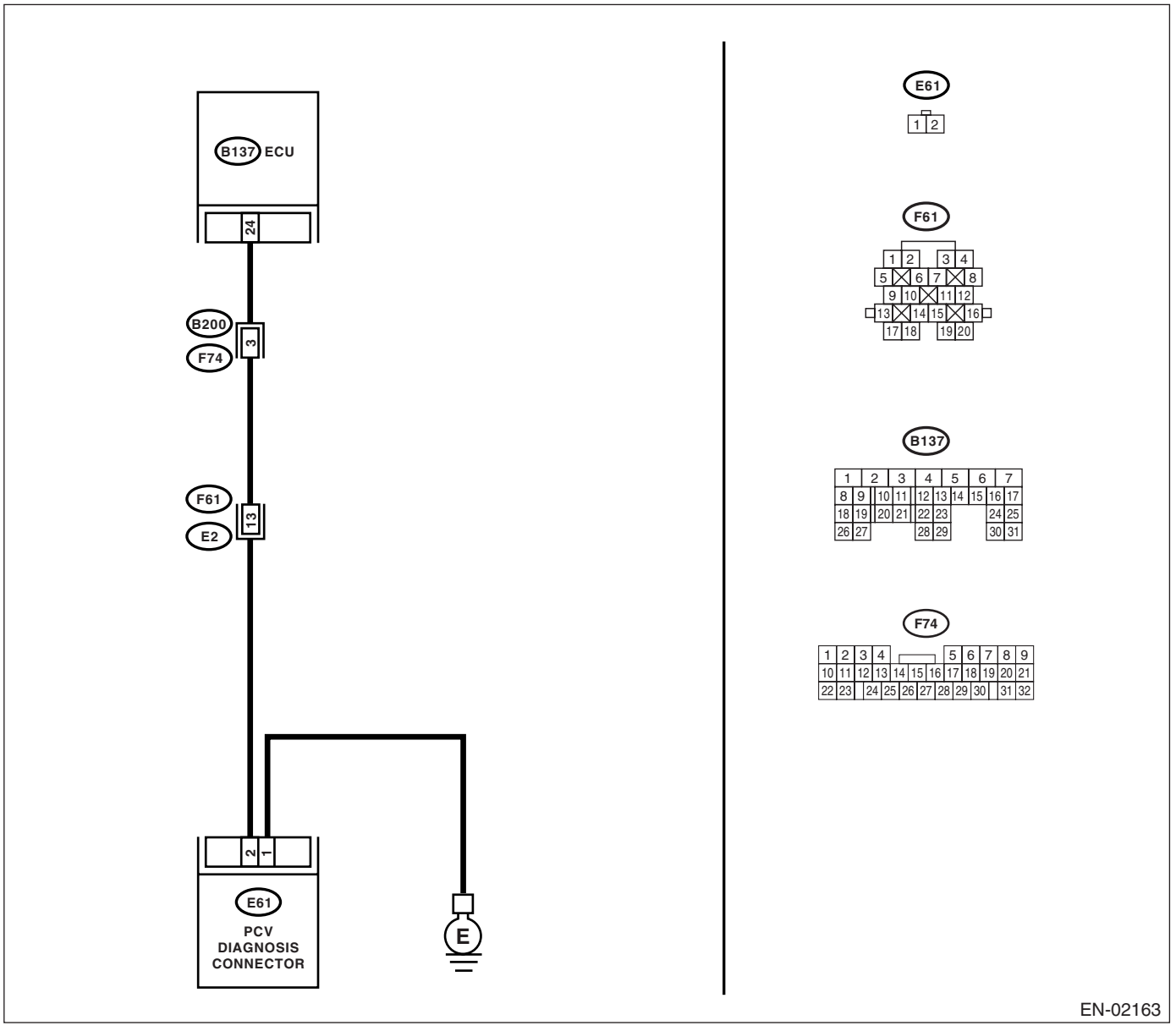
	Step	Check	Yes	No
1	**CHECK FOR OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using the “List of Diagnostic Trouble Codes (DTC)”. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FUEL FILLER CAP.** 1) Turn ignition switch to OFF. 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 evaporative emission line?	Repair the hoses and pipes.	Replace the fuel tank pressure sensor.

CU:DTC P1491 — POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-226, DTC P1491 — POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



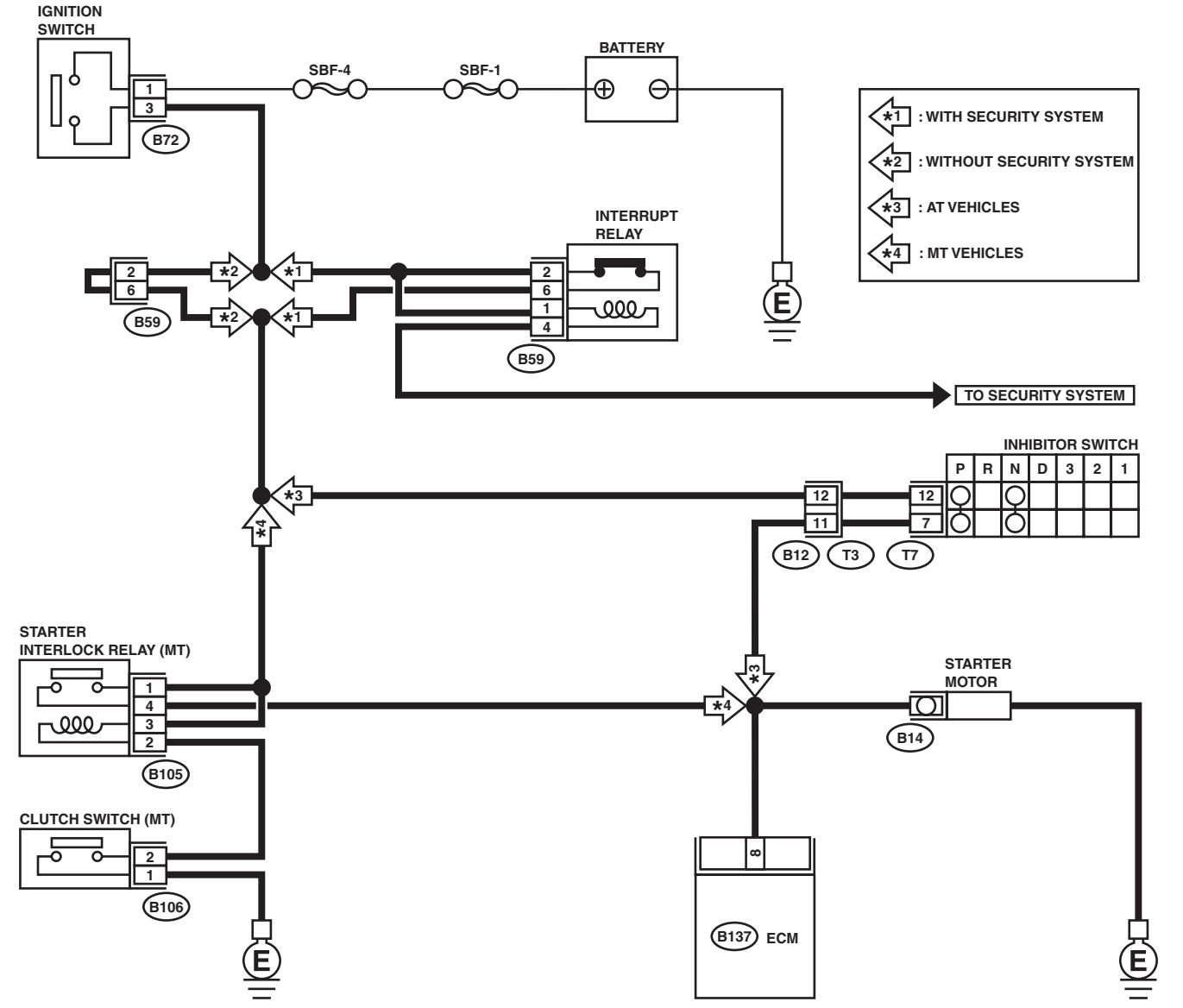
	Step	Check	Yes	No
1	**CHECK BLOW-BY HOSE.** Check the blow-by hose.	Is there disconnection or crack in blow-by hose?	Replace or repair blow-by hose.	Go to step **2.**
2	**INSPECT HARNESS BETWEEN PCV DIAGNOSIS CONNECTOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from PCV diagnosis connector and ECM. 3) Measure the resistance of harness between PCV diagnosis connector and ECM connector. ***Connector & terminal*** ***(B137) No. 24 — (E61) No. 2:***	Is the measured value less than 1 Ω?	Go to step **3.**	Repair open circuit in harness between PCV diagnosis connector and ECM.
3	**INSPECT HARNESS BETWEEN PCV DIAGNOSIS CONNECTOR AND ECM CONNECTOR.** Measure the resistance of harness between PCV diagnosis connector and chassis ground. ***Connector & terminal*** ***(B137) No. 24 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **4.**	Repair short circuit to chassis ground in harness between PCV diagnosis connector and ECM.
4	**INSPECT PCV DIAGNOSIS CONNECTOR GROUND CIRCUIT.** Measure the resistance between PCV diagnosis connector and engine ground. ***Connector & terminal*** ***(B61) No. 1 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair PCV diagnosis connector ground circuit.
5	**INSPECT PCV DIAGNOSIS CONNECTOR.** Measure the resistance between PCV diagnosis connector and terminal. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 1 Ω?	Repair poor contact in ECM and PCV diagnosis connector.	Replace PCV diagnosis connector.

CV:DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-228, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-02133

Step		Check	Yes	No
1	CHECK OPERATION OF STARTER MOTOR.	Does the starter motor operate when ignition switch is turned to START?	Repair the 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 the starter motor circuit. <Ref. to EN(H4DOTC)-67, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

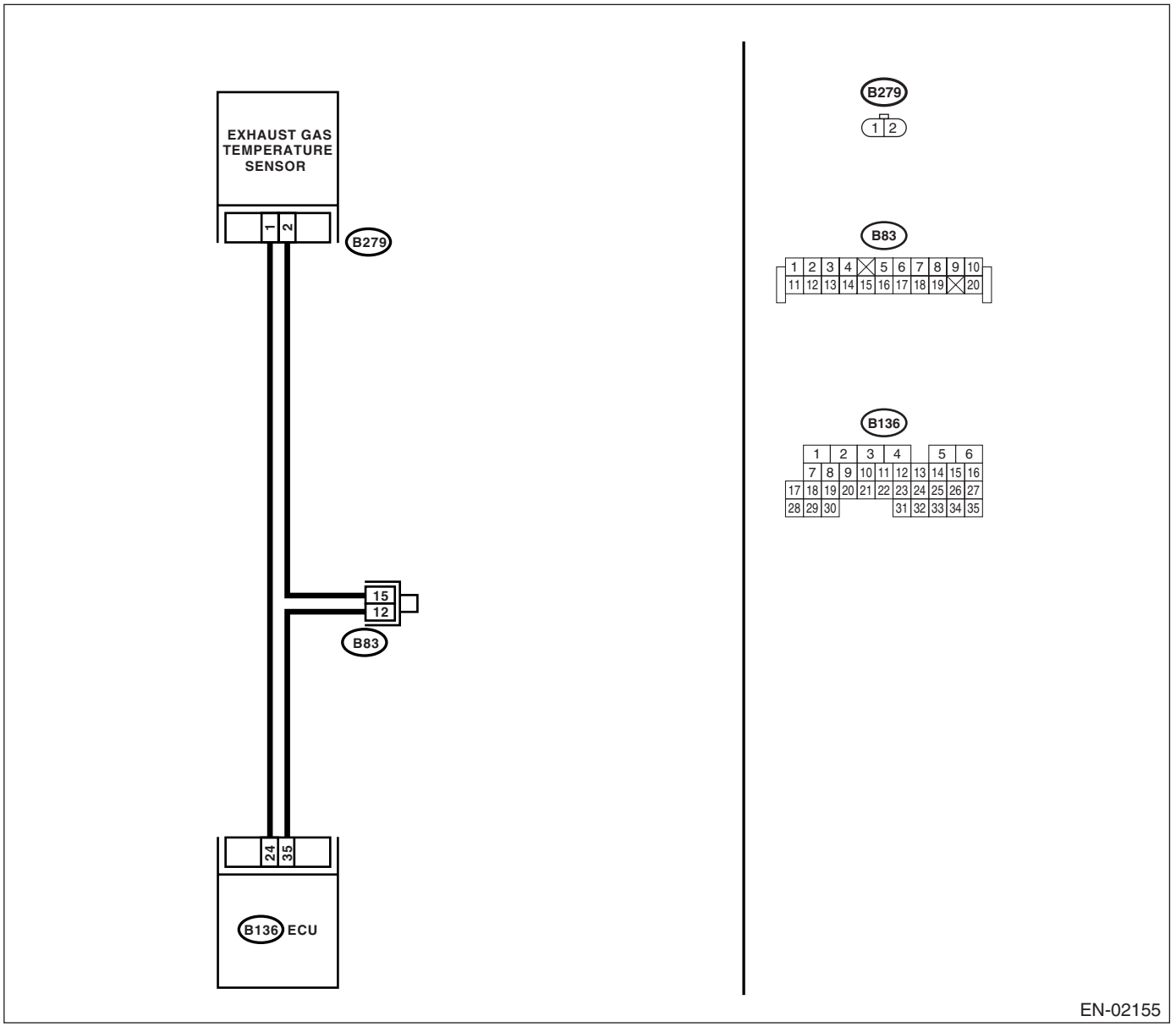
MEMO:

CW:DTC P1544 — EXHAUST GAS TEMPERATURE TOO HIGH —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-229, DTC P1544 — EXHAUST GAS TEMPERATURE TOO HIGH —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



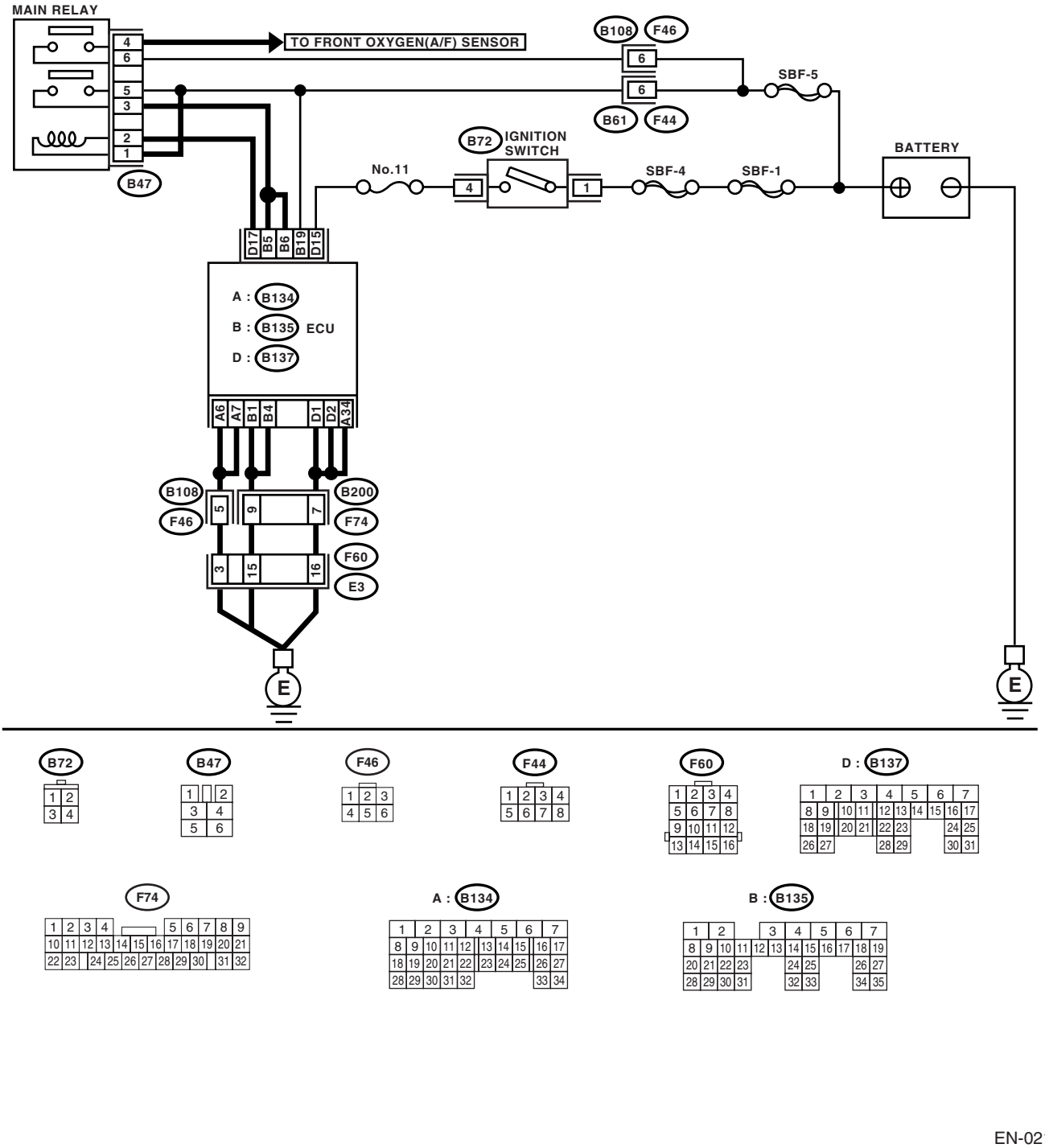
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P1544.	Go to step **2.**
2	**CHECK EXHAUST SYSTEM.** Check the exhaust system parts. NOTE: Check the following items. •Loose installation of exhaust manifold •Cracks or hole of exhaust manifold •Loose installation of front oxygen (A/F) sensor	Is there a fault in exhaust system?	Repair or replace the failure, then replace precatalytic converter.	Contact your SOA Service Center. NOTE: Inspection by DTM is required, because probable cause is deterioration of multiple parts.

CX:DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-230, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



EN-02134

	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. 19 (+) — Chassis ground (−):***	Is the measured value more than 10 V?	Repair the 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. 19 — Chassis ground:***	Is the measured value less than 10 Ω?	Repair the ground short circuit in harness between ECM connector and battery terminal.	Go to step **3.**
3	**CHECK FUSE SBF-5.**	Is the fuse blown?	Replace the fuse.	Repair the 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

MEMO:

CY:DTC P2004 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE OPEN) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-231, DTC P2004 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE OPEN) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, 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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK TUMBLE GENERATOR VALVE RH.** 1) Remove the tumble generator valve assembly. 2) Check the tumble generator valve body.	Does the tumble generator valve move smoothly? (No dirt or foreign materials clogged)	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-34, Tumble Generator Valve Assembly.>	Clean the tumble generator valve.

CZ:DTC P2005 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE OPEN) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-232, DTC P2005 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE OPEN) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, 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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK TUMBLE GENERATOR VALVE LH.** 1) Remove the tumble generator valve assembly. 2) Check the tumble generator valve body.	Does the tumble generator valve move smoothly? (No dirt or foreign materials clogged)	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-34, Tumble Generator Valve Assembly.>	Clean the tumble generator valve.

DA:DTC P2006 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE CLOSE) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-233, DTC P2006 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE CLOSE) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, 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(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK TUMBLE GENERATOR VALVE RH.** 1) Remove the tumble generator valve assembly. 2) Check the tumble generator valve body.	Does the tumble generator valve move smoothly? (No dirt or foreign materials clogged)	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-34, Tumble Generator Valve Assembly.>	Clean the tumble generator valve.

DB:DTC P2007 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE CLOSE) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-234, DTC P2007 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE CLOSE) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

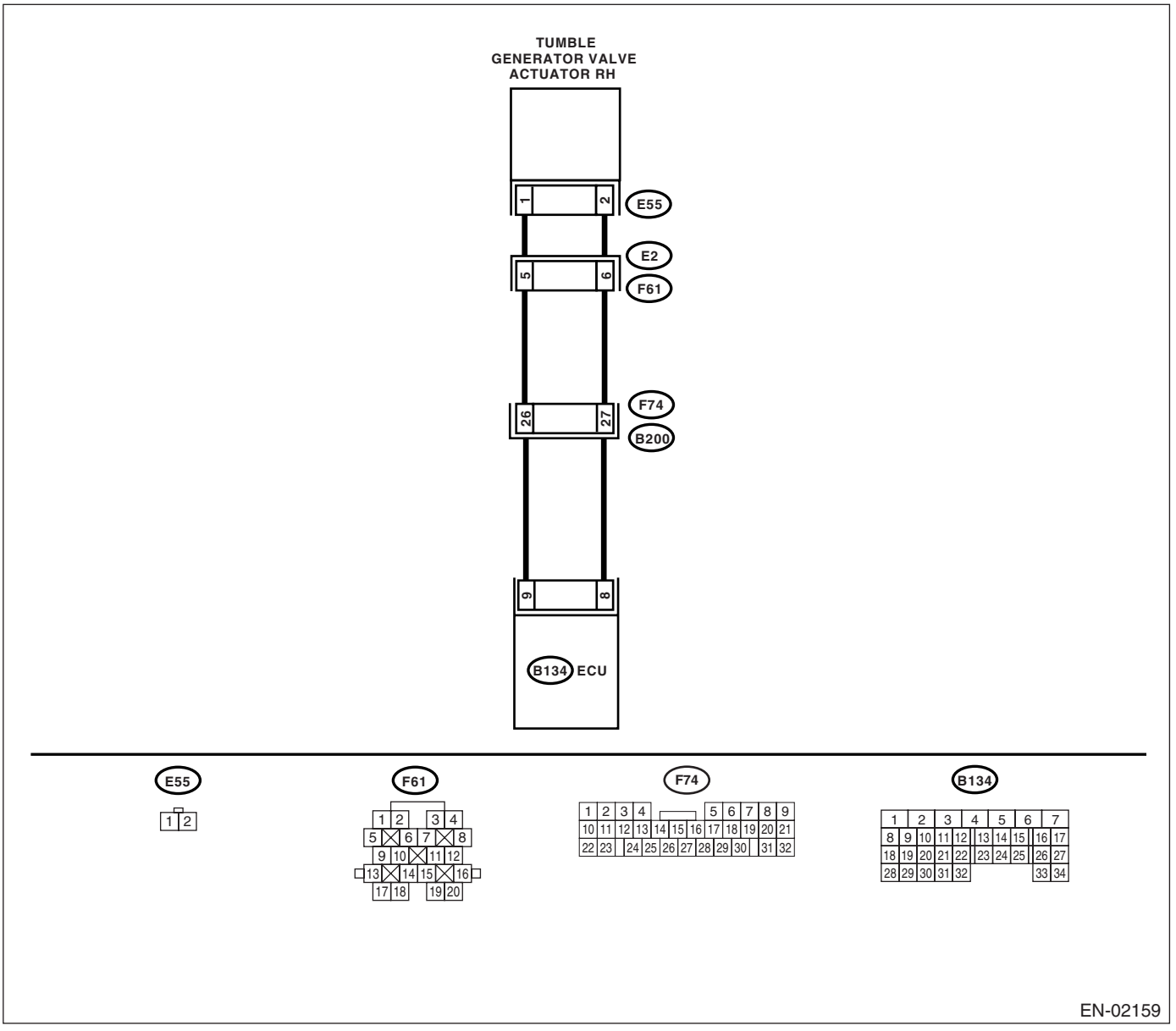
	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK TUMBLE GENERATOR VALVE LH.** 1) Remove the tumble generator valve assembly. 2) Check the tumble generator valve body.	Does the tumble generator valve move smoothly? (No dirt or foreign materials clogged)	Replace the tumble generator valve assembly. <Ref. to FU(H4DOTC)-34, Tumble Generator Valve Assembly.>	Clean the tumble generator valve.

DC:DTC P2008 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (OPEN) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-235, DTC P2008 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (OPEN) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



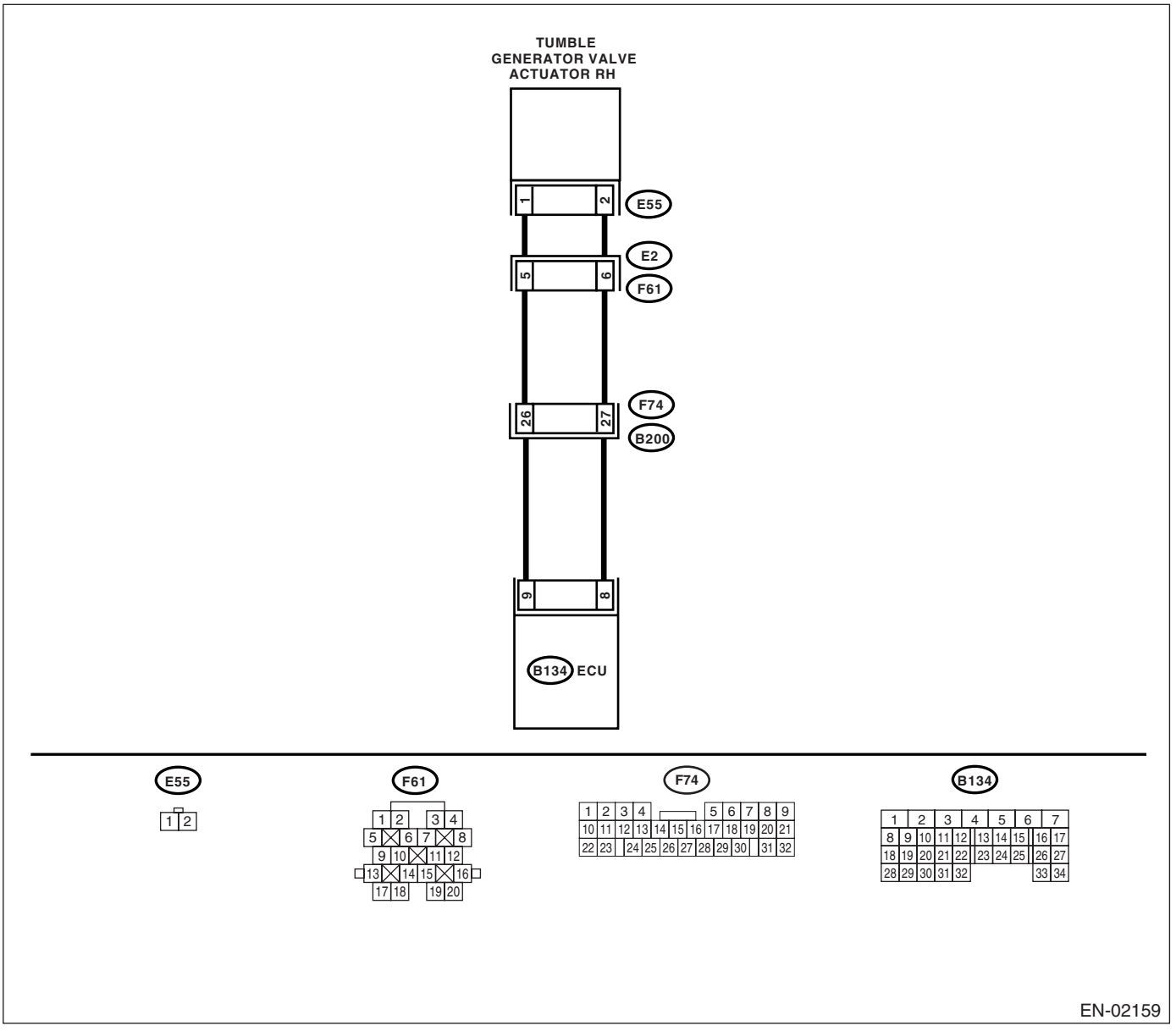
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ACTUATOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve and ECM connector. 3) Measure the resistance between tumble generator valve actuator and ECM connector. ***Connector & terminal*** ***(E55) No. 1 — (B134) No. 9:*** ***(E55) No. 2 — (B134) No. 8:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair the open circuit between ECM and tumble generator valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and tumble generator valve actuator connector. • Poor contact in coupling connector.
2	**CHECK POOR CONTACT.** Check poor contact in tumble generator valve actuator connector.	Is there poor contact in tumble generator valve actuator connector?	Repair the poor contact in tumble generator valve actuator connector.	Replace the tumble generator valve actuator. <Ref. to FU(H4DOTC)-35, Tumble Generator Valve Actuator.>

DD:DTC P2009 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (SHORT) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-237, DTC P2009 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (SHORT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



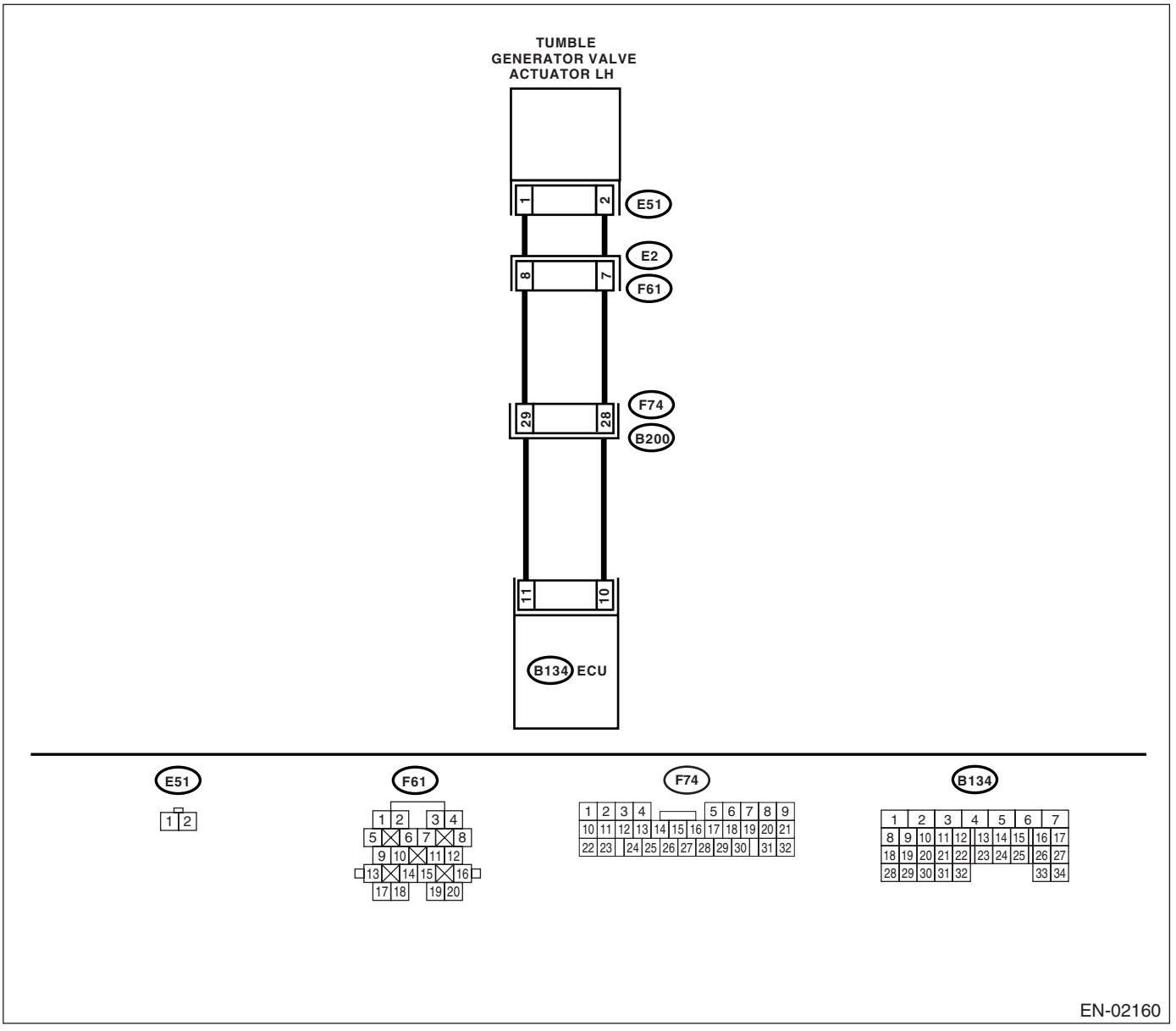
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ACTUATOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve connector. 3) Measure the voltage between tumble generator valve actuator and chassis ground. ***Connector & terminal*** ***(E55) No. 1 (+) — Chassis ground (–):*** ***(E55) No. 2 (+) — Chassis ground (–):***	Is the measured value less than 5 V?	Replace the tumble generator valve actuator. <Ref. to FU(H4DOTC)-35, Tumble Generator Valve Actuator.>	Repair the battery short circuit between ECM and tumble generator valve actuator.

DE:DTC P2011 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (OPEN) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-239, DTC P2011 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (OPEN) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



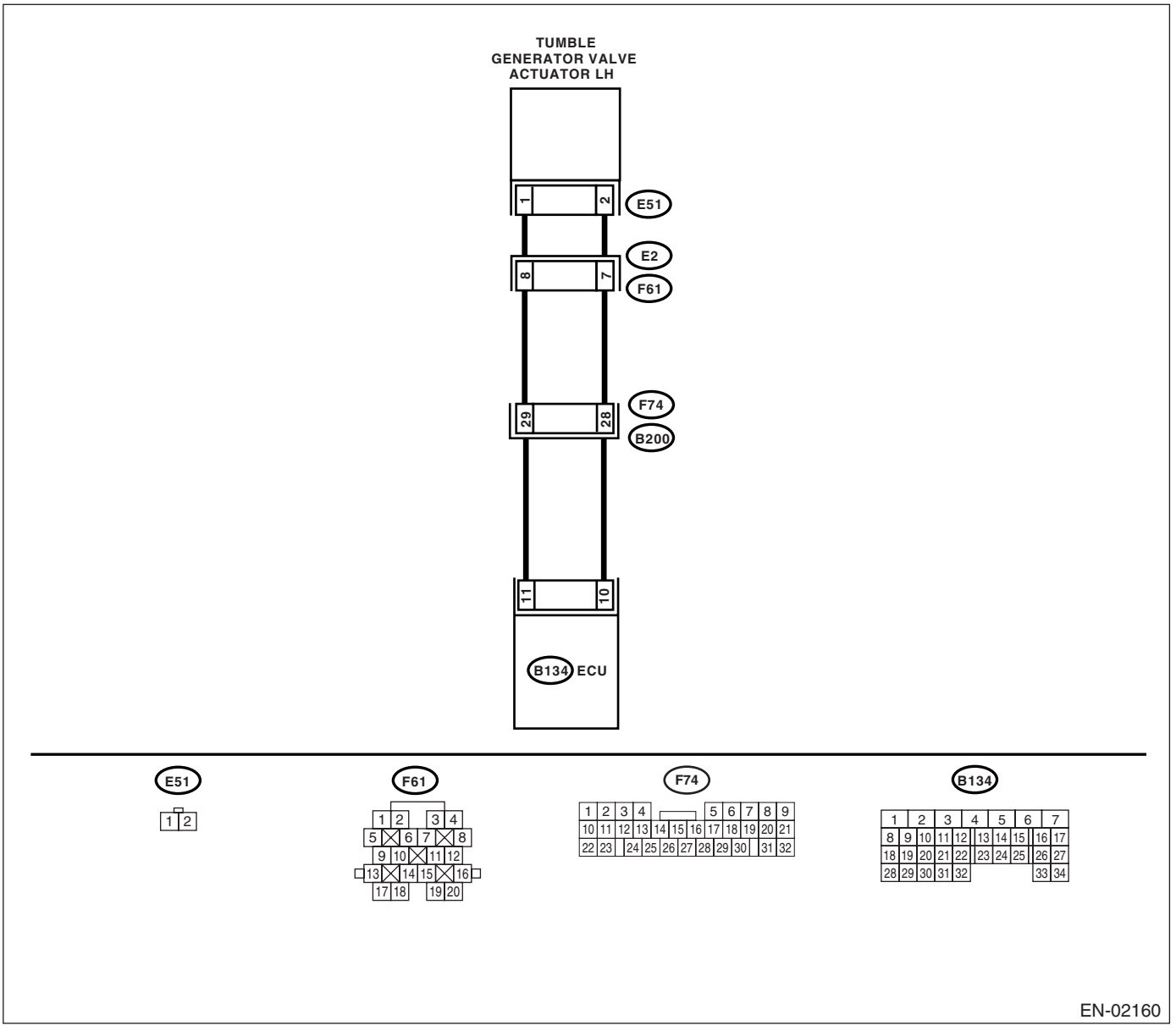
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ACTUATOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve and ECM connector. 3) Measure the resistance between tumble generator valve actuator and ECM connector. ***Connector & terminal*** ***(E51) No. 1 — (B134) No. 11:*** ***(E51) No. 2 — (B134) No. 10:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair the open circuit between ECM and tumble generator valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and tumble generator valve actuator connector. • Poor contact in coupling connector.
2	**CHECK POOR CONTACT.** Check poor contact in tumble generator valve actuator connector.	Is there poor contact in tumble generator valve actuator connector?	Repair the poor contact in tumble generator valve actuator connector.	Replace the tumble generator valve actuator. <Ref. to FU(H4DOTC)-35, Tumble Generator Valve Actuator.>

DF:DTC P2012 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (SHORT) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-241, DTC P2012 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (SHORT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



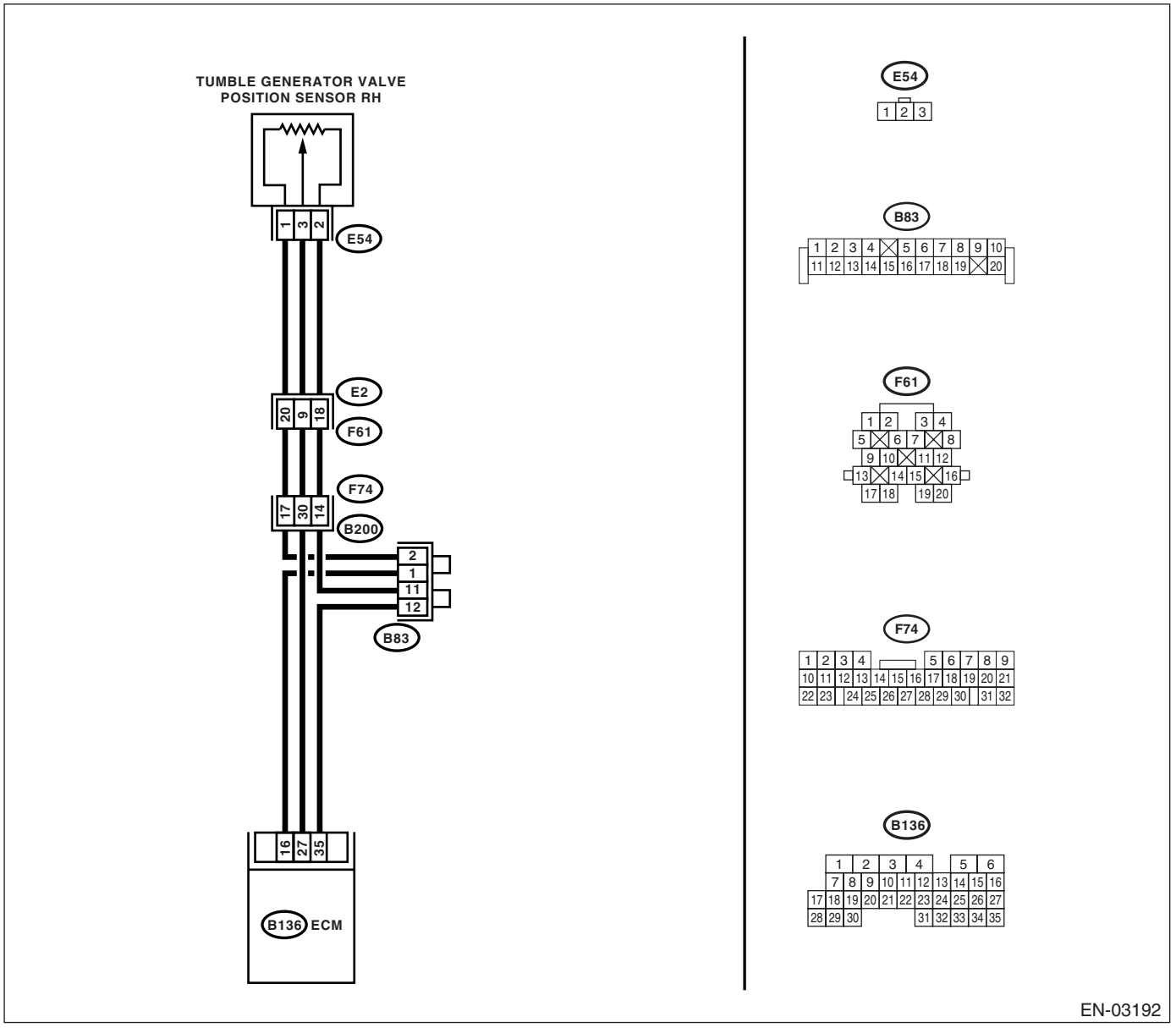
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ACTUATOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve connector. 3) Measure the voltage between tumble generator valve actuator and chassis ground. ***Connector & terminal*** ***(E51) No. 1 (+) — Chassis ground (–):*** ***(E51) No. 2 (+) — Chassis ground (–):***	Is the measured value less than 5 V?	Replace the tumble generator valve actuator. <Ref. to FU(H4DOTC)-35, Tumble Generator Valve Actuator.>	Repair the battery short circuit between ECM and tumble generator valve actuator.

DG: DTC P2016 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-243, DTC P2016 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value 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 tumble generator valve position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector
2	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V?	Go to step **4.**	Go to step **3.**
3	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (−):***	Shake the ECM harness and connector, while monitoring value of voltage meter. Does the voltage change?	Repair the poor contact in ECM connector.	Contact your 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*** ***(B136) No. 27 (+) — Chassis ground (−):***	Is the measured value less 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.	Shake the ECM harness and connector, while monitoring value of Subaru Select Monitor. Does the voltage change?	Repair the poor contact in ECM connector.	Go to step **6.**

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from tumble generator valve position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between tumble generator valve position sensor connector and engine ground. ***Connector & terminal*** ***(E54) No. 1 (+) — Engine ground (−):***	Is the measured value more than 4.5 V?	Go to step **7.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between tumble generator valve position sensor and ECM connector • Poor contact in tumble generator valve position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector
7	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between ECM connector and tumble generator valve position sensor connector. ***Connector & terminal*** ***(B136) No. 27 — (E54) No. 3:***	Is the measured value less than 1 Ω?	Go to step **8.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between tumble generator valve position sensor and ECM connector • Poor contact in ECM connector • Poor contact in tumble generator valve position sensor connector • Poor contact in coupling connector
8	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.** Measure the resistance of harness between tumble generator valve position sensor connector and engine ground. ***Connector & terminal*** ***(E54) No. 3 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **9.**	Repair the ground short circuit in harness between tumble generator valve position sensor and ECM connector.
9	**CHECK POOR CONTACT.** Check poor contact in tumble generator valve position sensor connector.	Is there poor contact in tumble generator valve position sensor connector?	Repair the poor contact in tumble generator valve position sensor connector.	Replace the tumble generator valve position sensor. <Ref. to FU(H4DOTC)-36, Tumble Generator Valve Position Sensor.>

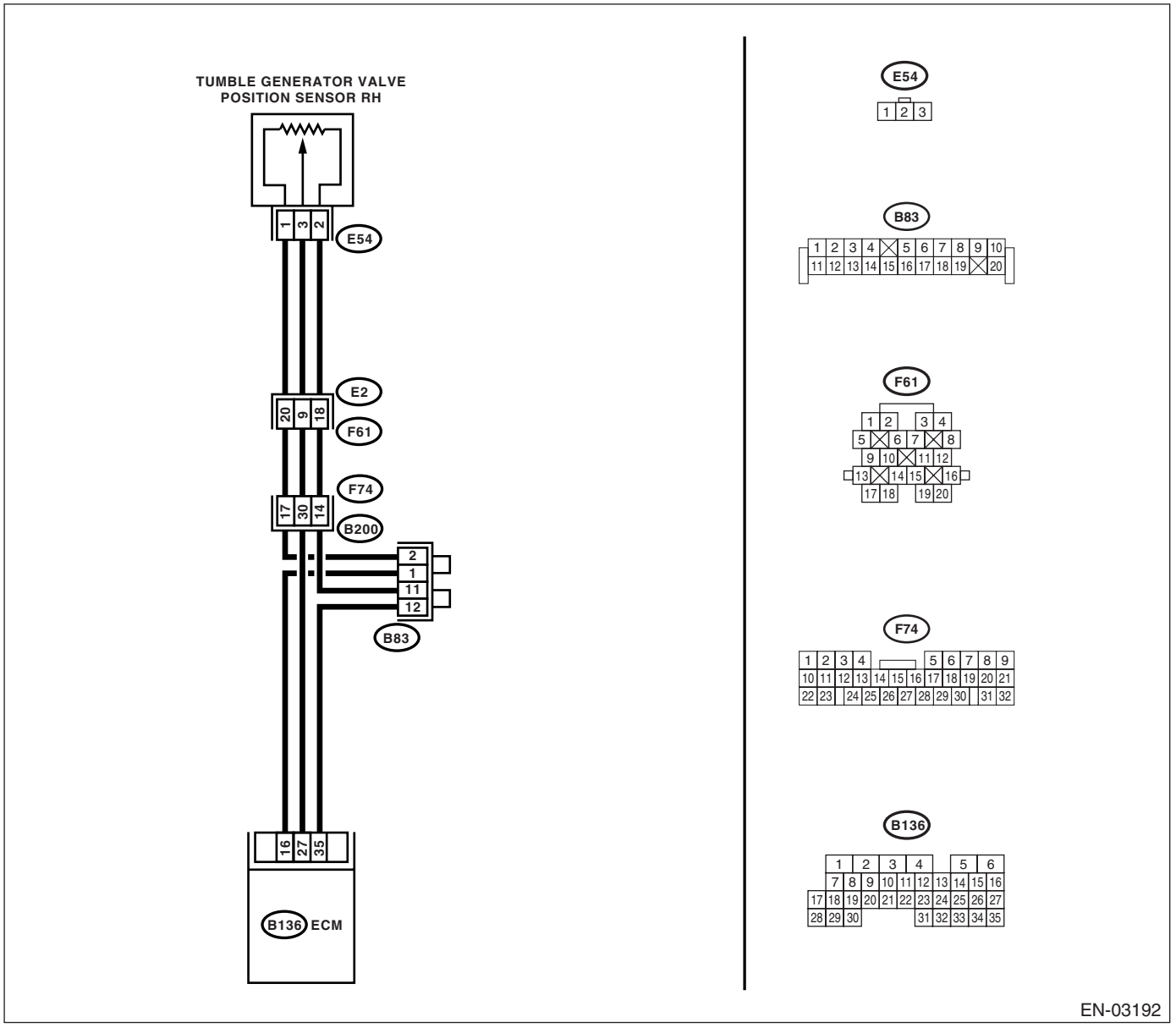
MEMO:

DH:DTC P2017 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-245, DTC P2017 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



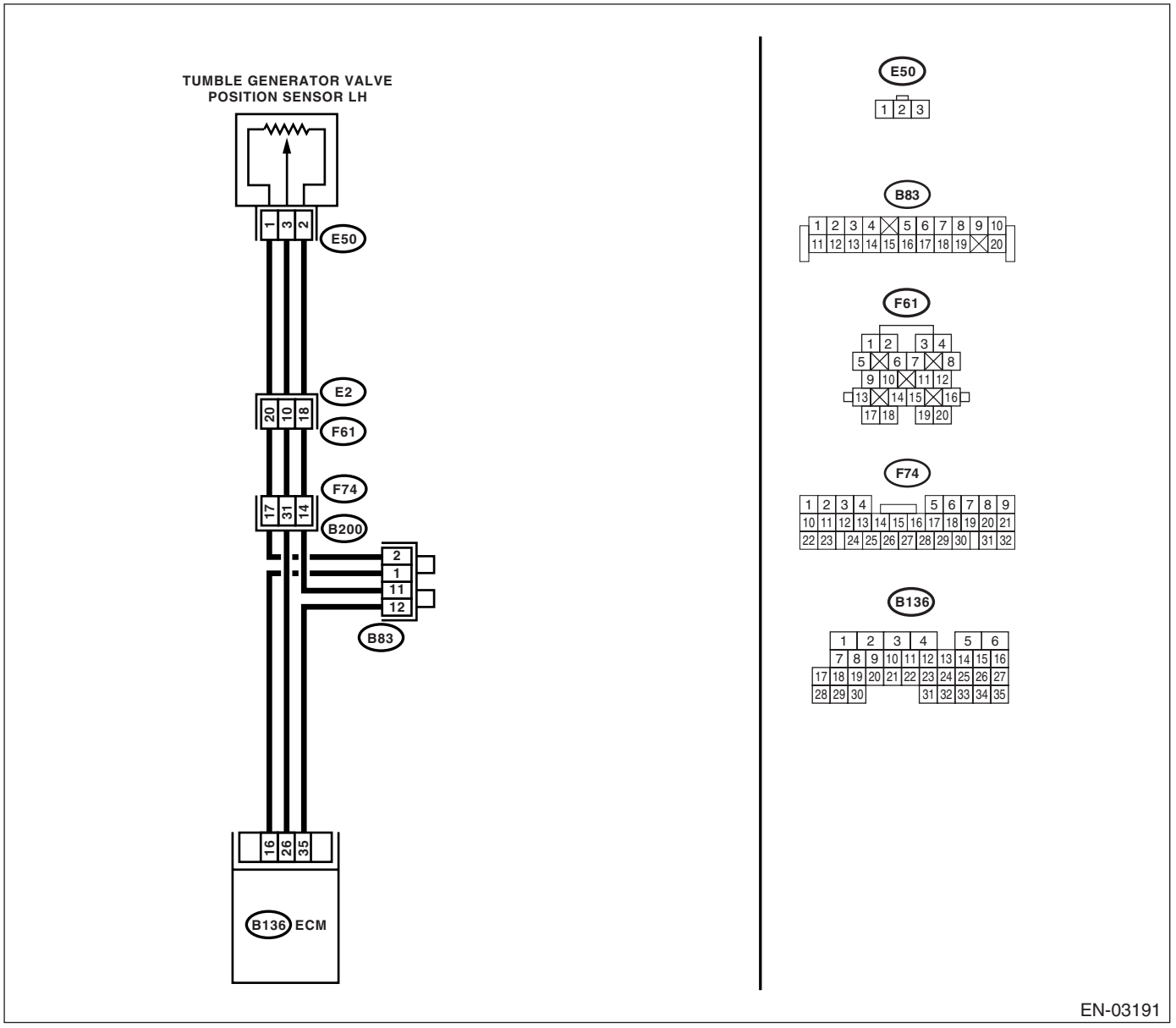
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value 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 tumble generator valve position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector
2	**CHECK HARNESS BETWEEN TUMBLE GENERATOR VALVE POSITION SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve position sensor. 3) Measure the resistance of harness between tumble generator valve position sensor connector and engine ground. ***Connector & terminal*** ***(E54) No. 2 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **3.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between tumble generator valve position sensor and ECM connector • Poor contact in coupling connector • Poor contact in joint connector
3	**CHECK HARNESS BETWEEN TUMBLE GENERATOR VALVE POSITION SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between tumble generator valve position sensor connector and engine ground. ***Connector & terminal*** ***(E54) No. 3 (+) — Engine ground (–):***	Is the measured value more than 4.9 V?	Repair the battery short circuit in harness between tumble generator valve position sensor and ECM connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Replace the tumble generator valve position sensor. <Ref. to FU(H4DOTC)-36, Tumble Generator Valve Position Sensor.>

DI: DTC P2021 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-247, DTC P2021 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value 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 tumble generator valve position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector
2	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (−):***	Is the measured value more than 4.5 V?	Go to step **4.**	Go to step **3.**
3	**CHECK INPUT SIGNAL FOR ECM.** Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (−):***	Shake the ECM harness and connector, while monitoring value of voltage meter. Does the voltage change?	Repair the poor contact in ECM connector.	Contact your 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*** ***(B136) No. 26 (+) — Chassis ground (−):***	Is the measured value less 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.	Shake the ECM harness and connector, while monitoring value of Subaru Select Monitor. Does the voltage change?	Repair the poor contact in ECM connector.	Go to step **6.**

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from tumble generator valve position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between tumble generator valve position sensor connector and engine ground. ***Connector & terminal*** ***(E50) No. 1 (+) — Engine ground (−):***	Is the measured value more than 4.5 V?	Go to step **7.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between tumble generator valve position sensor and ECM connector • Poor contact in tumble generator valve position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector
7	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between ECM connector and tumble generator valve position sensor connector. ***Connector & terminal*** ***(B136) No. 26 — (E50) No. 3:***	Is the measured value less than 1 Ω?	Go to step **8.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between tumble generator valve position sensor and ECM connector • Poor contact in ECM connector • Poor contact in tumble generator valve position sensor connector • Poor contact in coupling connector
8	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE POSITION SENSOR CONNECTOR.** Measure the resistance of harness between tumble generator valve position sensor connector and engine ground. ***Connector & terminal*** ***(E50) No. 3 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **9.**	Repair the ground short circuit in harness between tumble generator valve position sensor and ECM connector.
9	**CHECK POOR CONTACT.** Check poor contact in tumble generator valve position sensor connector.	Is there poor contact in tumble generator valve position sensor connector?	Repair the poor contact in tumble generator valve position sensor connector.	Replace the tumble generator valve position sensor. <Ref. to FU(H4DOTC)-36, Tumble Generator Valve Position Sensor.>

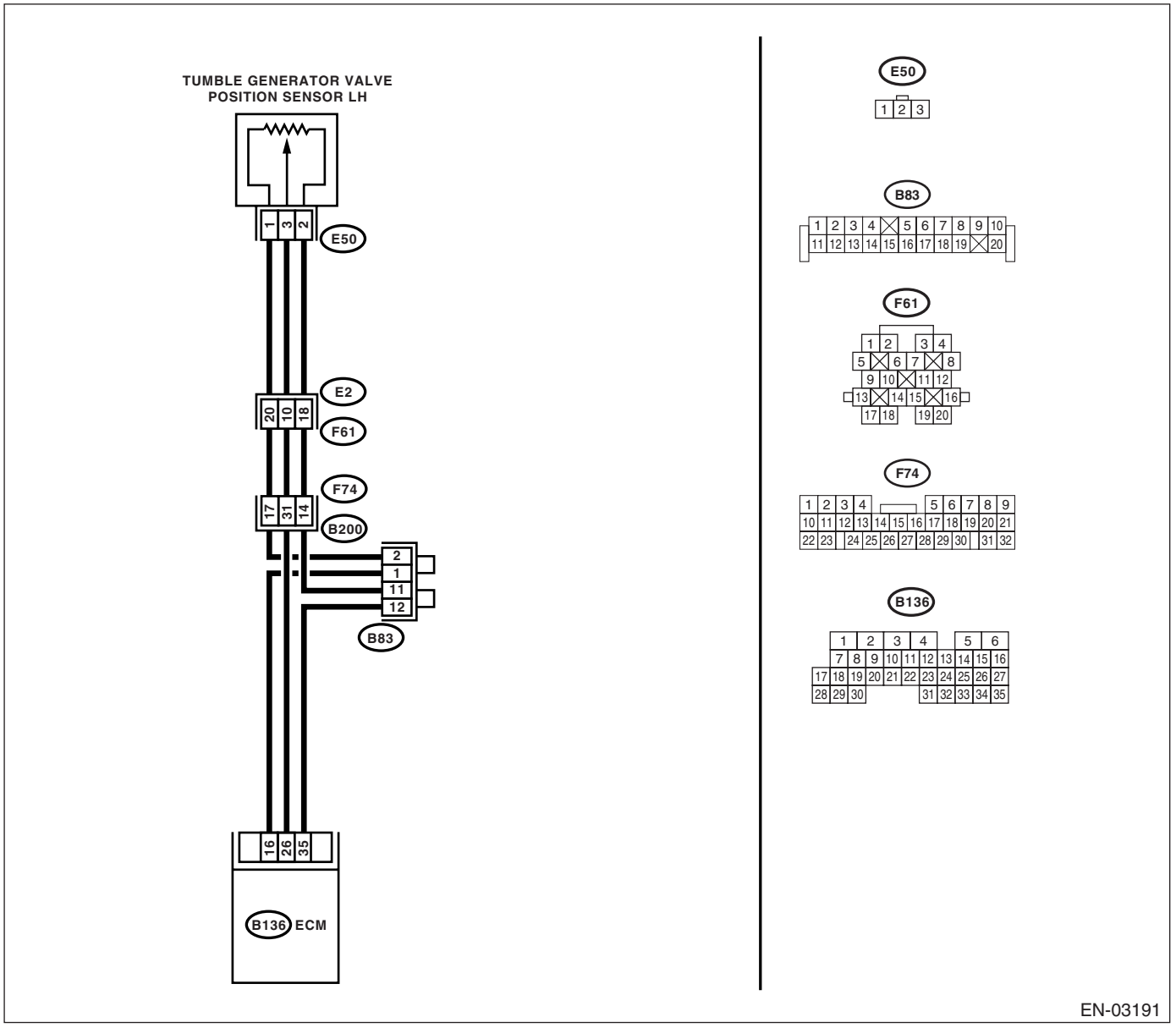
MEMO:

DJ:DTC P2022 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-249, DTC P2022 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



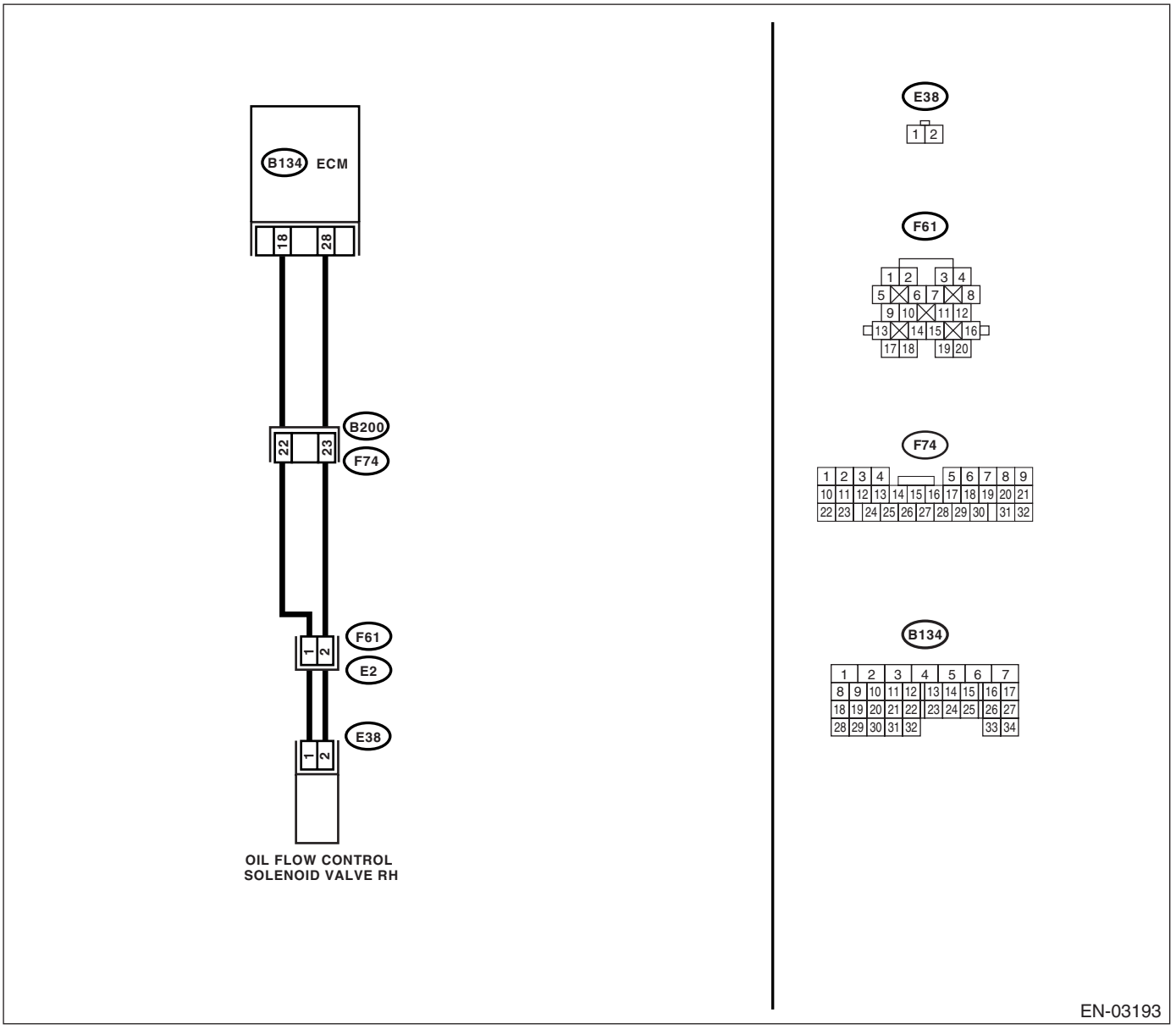
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of tumble generator valve position sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value 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 tumble generator valve position sensor connector • Poor contact in ECM connector • Poor contact in coupling connector
2	**CHECK HARNESS BETWEEN TUMBLE GENERATOR VALVE POSITION SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve position sensor. 3) Measure the resistance of harness between tumble generator valve position sensor connector and engine ground. ***Connector & terminal*** ***(E50) No. 2 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **3.**	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between tumble generator valve position sensor and ECM connector • Poor contact in coupling connector • Poor contact in joint connector
3	**CHECK HARNESS BETWEEN TUMBLE GENERATOR VALVE POSITION SENSOR AND ECM CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between tumble generator valve position sensor connector and engine ground. ***Connector & terminal*** ***(E50) No. 3 (+) — Engine ground (–):***	Is the measured value more than 4.9 V?	Repair the battery short circuit in harness between tumble generator valve position sensor and ECM connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Replace the tumble generator valve position sensor. <Ref. to FU(H4DOTC)-36, Tumble Generator Valve Position Sensor.>

DK:DTC P2088 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 1) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-251, DTC P2088 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 1) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



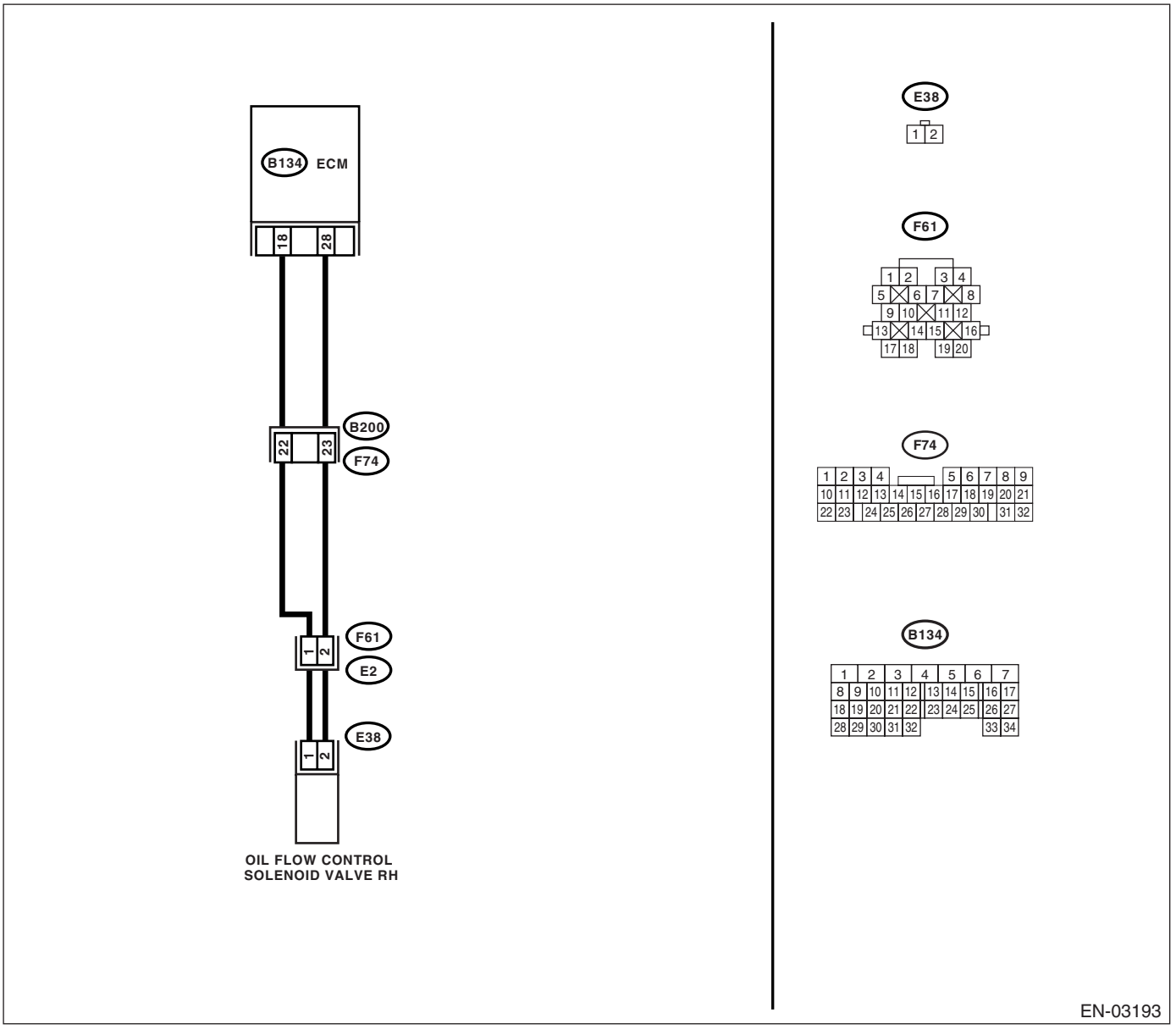
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. ***Connector & terminal*** ***(B134) No. 18 — (E38) No. 1:*** ***(B134) No. 28 — (E38) No. 2:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair the open circuit in harness between ECM and oil flow control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and oil flow control solenoid valve connector • Poor contact in coupling connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between ECM and oil flow control solenoid valve. ***Connector & terminal*** ***(E38) No. 1 — Engine ground:*** ***(E38) No. 2 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair the short circuit between ECM and oil flow control solenoid valve connector.
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** 1) Remove the oil flow control solenoid valve. 2) Measure the resistance between oil flow control solenoid valve terminal. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 6 to 12 Ω?	Repair the poor contact in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-59, Camshaft.>

DL:DTC P2089 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 1) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-253, DTC P2089 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 1) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



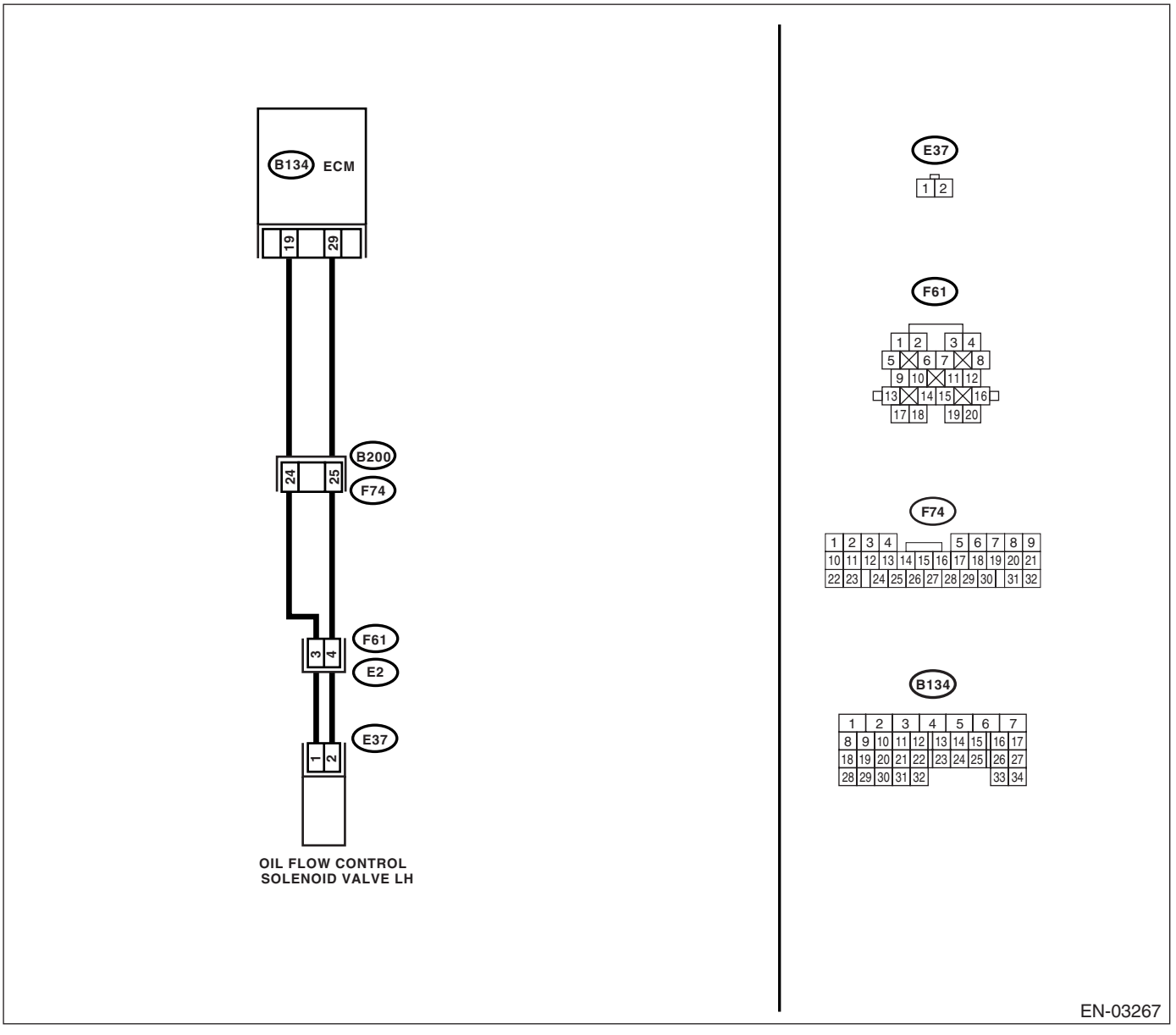
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. ***Connector & terminal*** ***(B134) No. 18 — (E38) No. 1:*** ***(B134) No. 28 — (E38) No. 2:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair the open circuit in harness between ECM and oil flow control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and oil flow control solenoid valve connector • Poor contact in coupling connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. ***Connector & terminal*** ***(E38) No. 1 — Engine ground:*** ***(E38) No. 2 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair the short circuit between ECM and oil flow control solenoid valve connector.
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** 1) Remove the oil flow control solenoid valve. 2) Measure the resistance between oil flow control solenoid valve terminal. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 6 to 12 Ω?	Repair the poor contact in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-59, Camshaft.>

DM:DTC P2092 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 2) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-255, DTC P2092 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 2) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



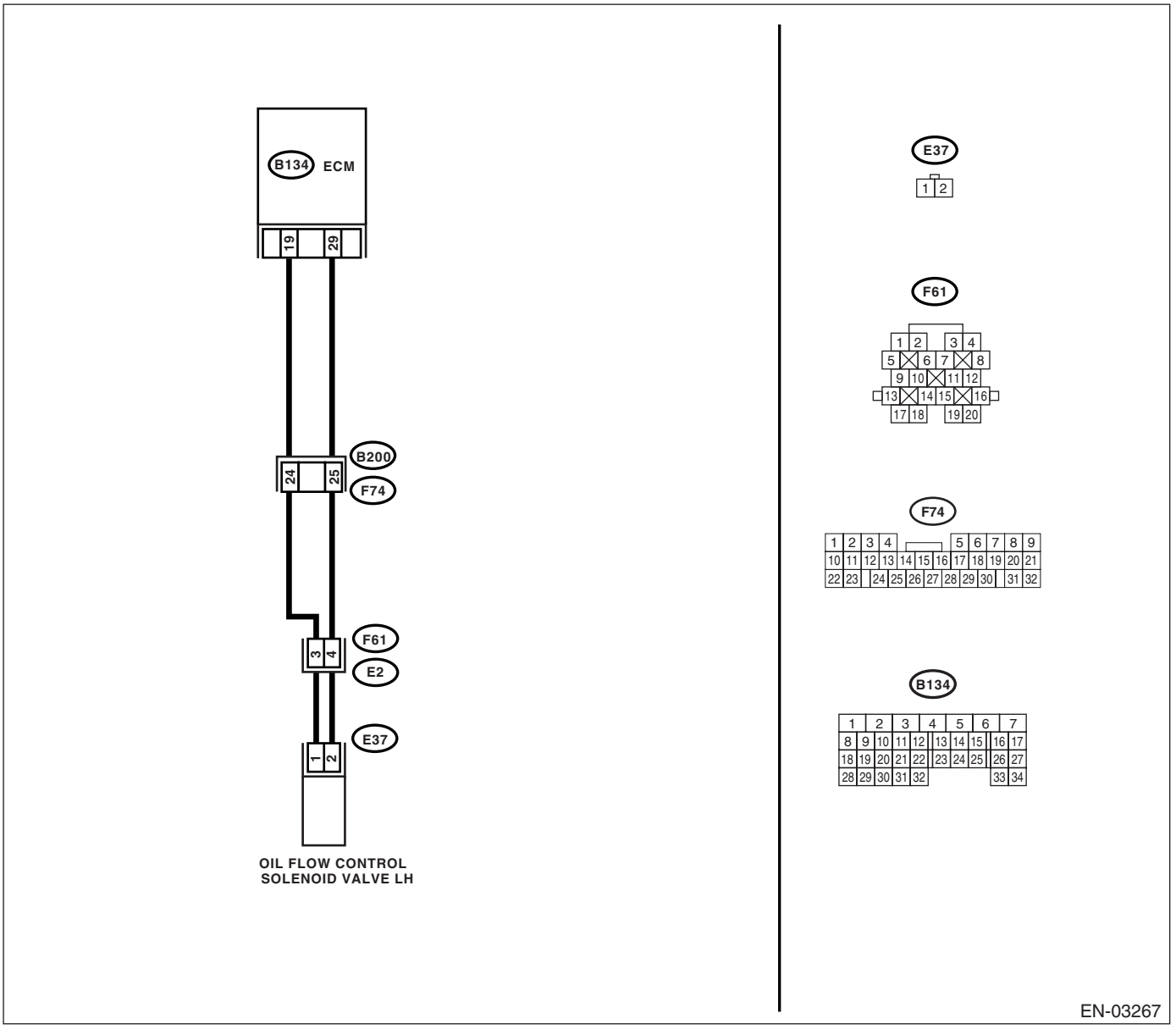
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. ***Connector & terminal*** ***(B134) No. 19 — (E37) No. 1:*** ***(B134) No. 29 — (E37) No. 2:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair the open circuit in harness between ECM and oil flow control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and oil flow control solenoid valve connector • Poor contact in coupling connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between ECM and oil flow control solenoid valve. ***Connector & terminal*** ***(E37) No. 1 — Engine ground:*** ***(E37) No. 2 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair the short circuit between ECM and oil flow control solenoid valve connector.
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** 1) Remove the oil flow control solenoid valve. 2) Measure the resistance between oil flow control solenoid valve terminal. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 6 to 12 Ω?	Repair the poor contact in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-59, Camshaft.>

DN:DTC P2093 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 2) —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-257, DTC P2093 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 2) —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



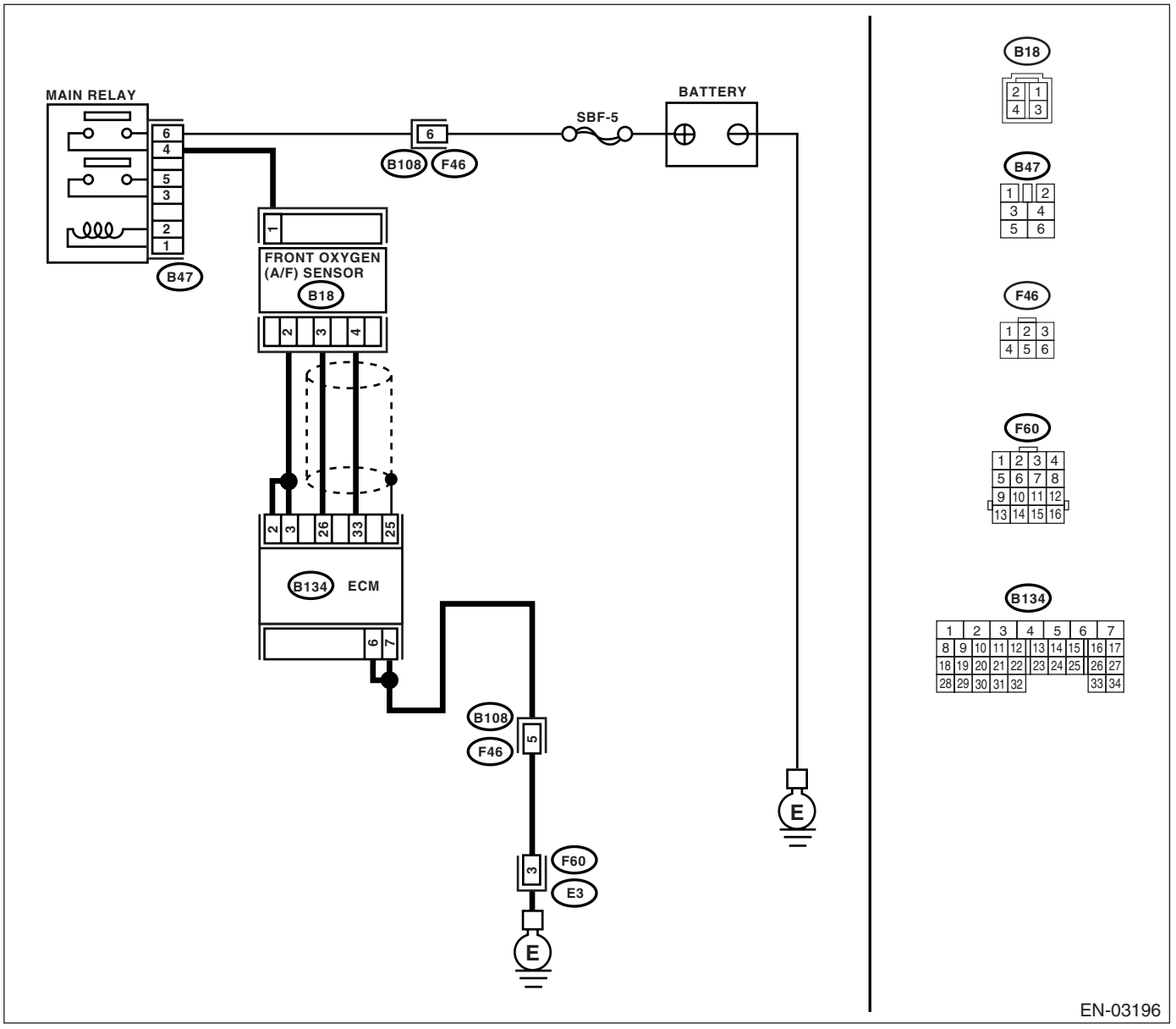
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. ***Connector & terminal*** ***(B134) No. 19 — (E37) No. 1:*** ***(B134) No. 29 — (E37) No. 2:***	Is the measured value less than 1 Ω?	Go to step **2.**	Repair the open circuit in harness between ECM and oil flow control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and oil flow control solenoid valve connector • Poor contact in coupling connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. ***Connector & terminal*** ***(E37) No. 1 — Engine ground:*** ***(E37) No. 2 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **3.**	Repair the short circuit between ECM and oil flow control solenoid valve connector.
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** 1) Remove the oil flow control solenoid valve. 2) Measure the resistance between oil flow control solenoid valve terminal. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value within 6 to 12 Ω?	Repair the poor contact in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-59, Camshaft.>

DO: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(H4DOTC)-259, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Using the List of Diagnostic Trouble Code (DTC), check the appropriate DTC. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FRONT (A/F) OXYGEN SENSOR DATA.** 1) Start the engine. 2) While observing the Subaru Select Monitor or general scan tool screen, warm-up the engine until coolant temperature is above 70°C (158°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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 0.85 to 1.15 (in idling)?	Go to step **3.**	Go to step **4.**
3	**CHECK REAR OXYGEN SENSOR SIGNAL.** 1) Race the engine at speeds from idling to 5,000 rpm for a total of 5 cycles. NOTE: To increase the engine speed to 5,000 rpm, slowly depress accelerator pedal, taking approx. 5 seconds, and quickly release accelerator pedal to decrease engine speed. 2) Operate the LED operation mode for engine. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "LED OPERATION MODE FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.>	Does the LED of (Rear O2 Rich Signal) blink?	Repair the poor contact in front oxygen (A/F) sensor and rear oxygen sensor connector.	Check the rear oxygen sensor circuit. <Ref. to FU(H4DOTC)-40, Rear Oxygen Sensor.>
4	**CHECK EXHAUST SYSTEM.** Check the 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 the faulty parts.	Go to step **5.**
5	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step **6.**

	Step	Check	Yes	No
6	**CHECK FUEL PRESSURE.** **Warning:** **•Place "NO FIRE" signs near the working area.** **•Be careful not to spill fuel on the floor.** 1) Release the 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 5 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 the fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value within 284 to 314 kPa (within 2.9 to 3.2 kg/cm^2, within 41 to 46 psi)?	Go to step **7.**	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
7	**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 the 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 the pressure regulator and pressure regulator vacuum hose.	Is the measured value within 206 to 235 kPa (within 2.1 to 2.4 kg/cm^2, within 30 to 34 psi)?	Go to step **8.**	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
8	**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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 60°C (140°F)?	Go to step **9.**	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-27, Engine Coolant Temperature Sensor.>

	Step	Check	Yes	No
9	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE.** 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value within the followings? Ignition ON: 73.3 to 106.6 kPa (550 to 800 mmHg, 21.65 to 31.50 inHg) Idling: 24.0 to 41.3 kPa (180 to 310 mmHg, 7.09 to 12.20 inHg)	Go to step **10.**	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>
10	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Subtract ambient temperature from intake air temperature. Is the obtained value within −10°C to 50°C (within 14°F to 122°F)?	Go to step **11.**	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>
11	**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*** ***(B134) No. 26 — Chassis ground:*** ***(B134) No. 33 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **12.**	Repair ground short circuit in harness between ECM and front oxygen (A/F) sensor connector.

	Step	Check	Yes	No
12	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from front oxygen (A/F) sensor. 3) Measure the voltage of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 26 (+) — Chassis ground (−):*** ***(B134) No. 33 (+) — Chassis ground (−):***	Is the measured value more than 8 V?	Go to step **13.**	Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.
13	**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*** ***(B134) No. 26 — (B18) No. 3:*** ***(B134) No. 33 — (B18) No. 4:***	Is the measured value less than 1 Ω?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, Front Oxygen (A/F) Sensor.>	Repair open circuit in harness between ECM and front oxygen (A/F) sensor connector.

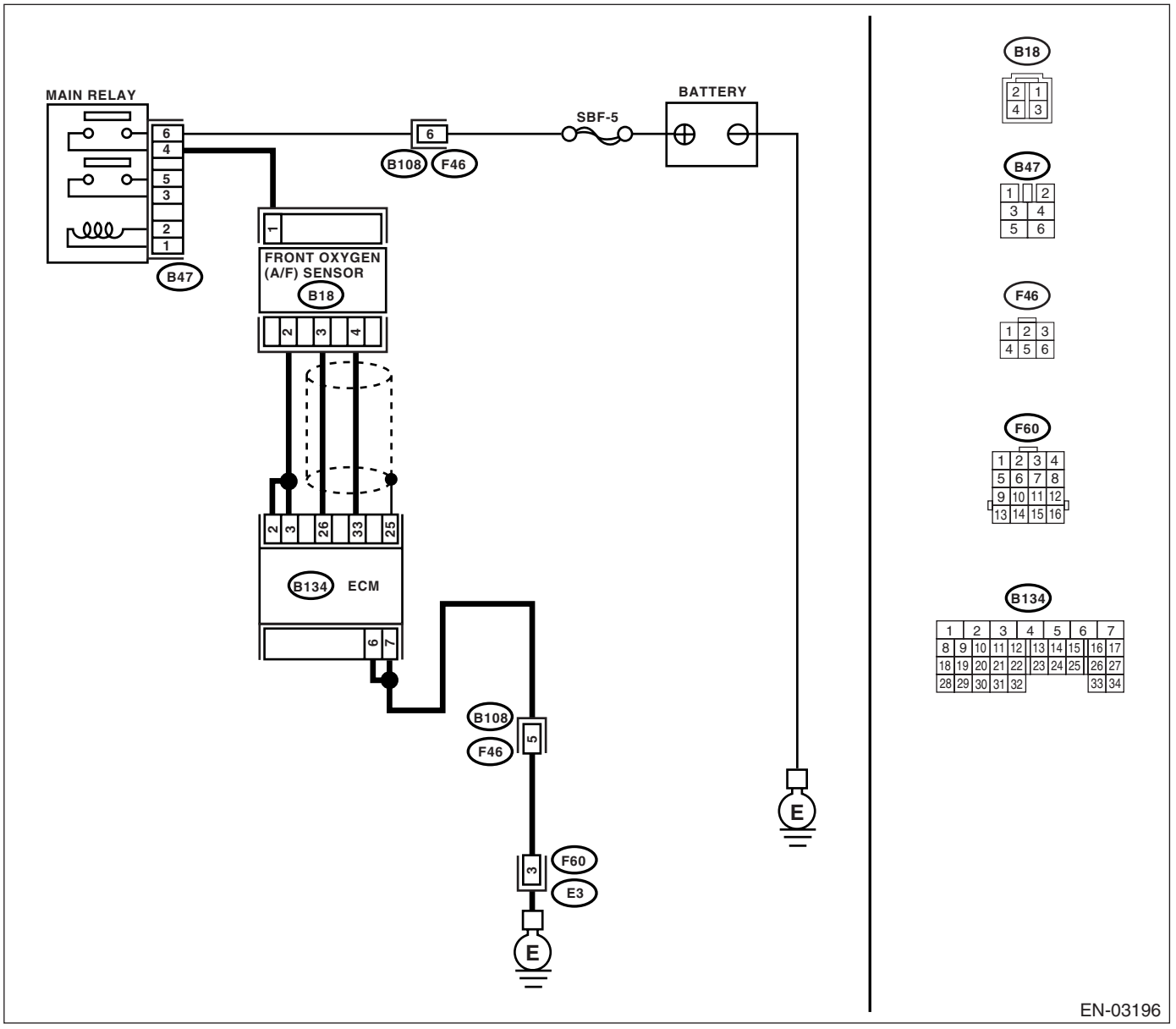
MEMO:

DP: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(H4DOTC)-261, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Using the List of Diagnostic Trouble Code (DTC), check the appropriate DTC. <Ref. to EN(H4DOTC)-81, List of Diagnostic Trouble Code (DTC).>	Go to step **2.**
2	**CHECK FRONT (A/F) OXYGEN SENSOR DATA.** 1) Start the engine. 2) While observing the Subaru Select Monitor or general scan tool screen, warm-up the engine until coolant temperature is above 70°C (158°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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value within 0.85 to 1.15 (in idling)?	Go to step **3.**	Go to step **4.**
3	**CHECK REAR OXYGEN SENSOR SIGNAL.** 1) Race the engine at speeds from idling to 5,000 rpm for a total of 5 cycles. NOTE: To increase the engine speed to 5,000 rpm, slowly depress accelerator pedal, taking approx. 5 seconds, and quickly release accelerator pedal to decrease engine speed. 2) Operate the LED operation mode for engine. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "LED OPERATION MODE FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.>	Does the LED of (Rear O2 Rich Signal) blink?	Repair the poor contact in front oxygen (A/F) sensor and rear oxygen sensor connector.	Check the rear oxygen sensor circuit. <Ref. to FU(H4DOTC)-40, Rear Oxygen Sensor.>
4	**CHECK EXHAUST SYSTEM.** Check the 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 the faulty parts.	Go to step **5.**
5	**CHECK AIR INTAKE SYSTEM.**	Are there holes, loose bolts or disconnection of hose on air intake system?	Repair the air intake system.	Go to step **6.**

	Step	Check	Yes	No
6	**CHECK FUEL PRESSURE.** **Warning:** **•Place "NO FIRE" signs near the working area.** **•Be careful not to spill fuel on the floor.** 1) Release the 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 5 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 the fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value within 284 to 314 kPa (within 2.9 to 3.2 kg/cm^2, within 41 to 46 psi)?	Go to step **7.**	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
7	**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 the 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 the pressure regulator and pressure regulator vacuum hose.	Is the measured value within 206 to 235 kPa (within 2.1 to 2.4 kg/cm^2, within 30 to 34 psi)?	Go to step **8.**	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
8	**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 general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedures, refer to the General Scan Tool Instruction Manual.	Is the measured value more than 60°C (140°F)?	Go to step **9.**	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-27, Engine Coolant Temperature Sensor.>

	Step	Check	Yes	No
9	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE.** 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Is the measured value within the followings? Ignition ON: 73.3 to 106.6 kPa (550 to 800 mmHg, 21.65 to 31.50 inHg) Idling: 24.0 to 41.3 kPa (180 to 310 mmHg, 7.09 to 12.20 inHg)	Go to step **10.**	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>
10	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm-up engine until coolant temperature is greater than 60°C (140°F). 2) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: •Subaru Select Monitor For detailed operation procedure, refer to the "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)-32, Subaru Select Monitor.> •General scan tool For detailed operation procedure, refer to the General Scan Tool Instruction Manual.	Subtract ambient temperature from intake air temperature. Is the obtained value within −10°C to 50°C (within 14°F to 122°F)?	Go to step **11.**	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-31, Mass Air Flow and Intake Air Temperature Sensor.>
11	**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*** ***(B134) No. 26 — Chassis ground:*** ***(B134) No. 33 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **12.**	Repair ground short circuit in harness between ECM and front oxygen (A/F) sensor connector.

	Step	Check	Yes	No
12	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from front oxygen (A/F) sensor. 3) Measure the voltage of harness between ECM connector and chassis ground. ***Connector & terminal*** ***(B134) No. 26 (+) — Chassis ground (−):*** ***(B134) No. 33 (+) — Chassis ground (−):***	Is the measured value more than 8 V?	Go to step **13.**	Repair battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.
13	**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*** ***(B134) No. 26 — (B18) No. 3:*** ***(B134) No. 33 — (B18) No. 4:***	Is the measured value less than 1 Ω?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, Front Oxygen (A/F) Sensor.>	Repair open circuit in harness between ECM and front oxygen (A/F) sensor connector.

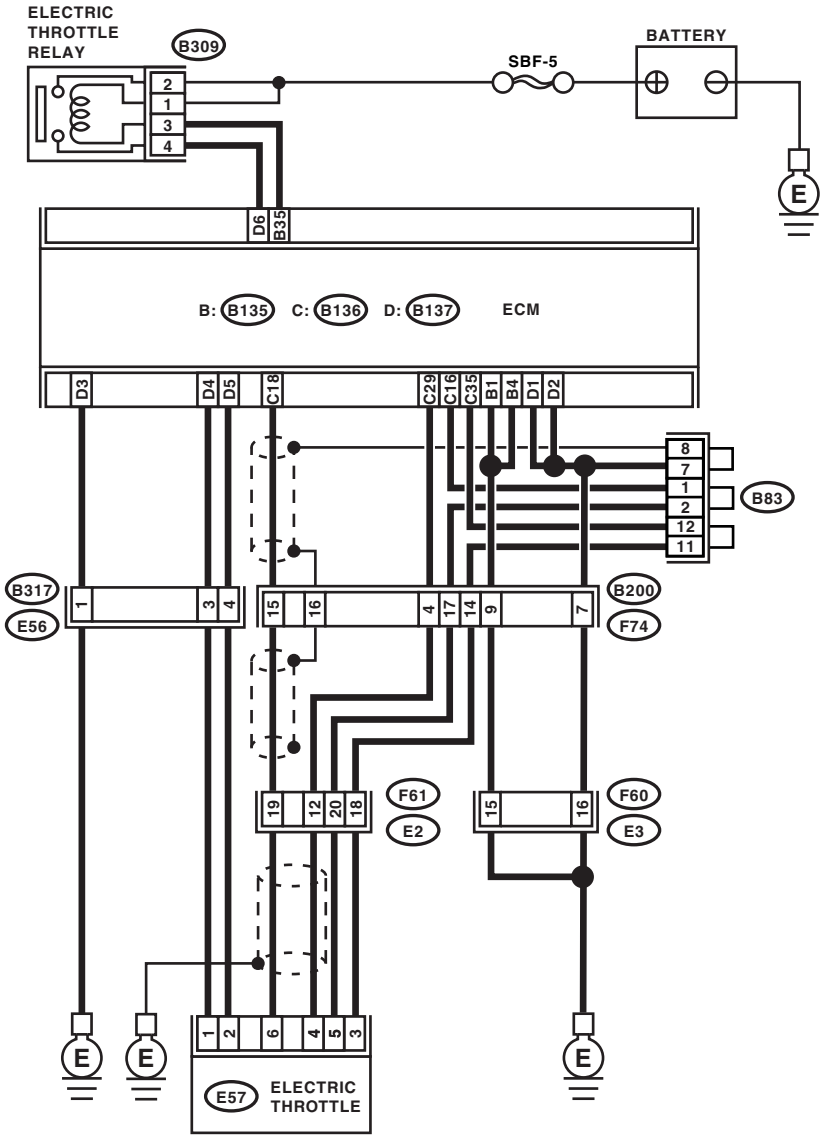
MEMO:

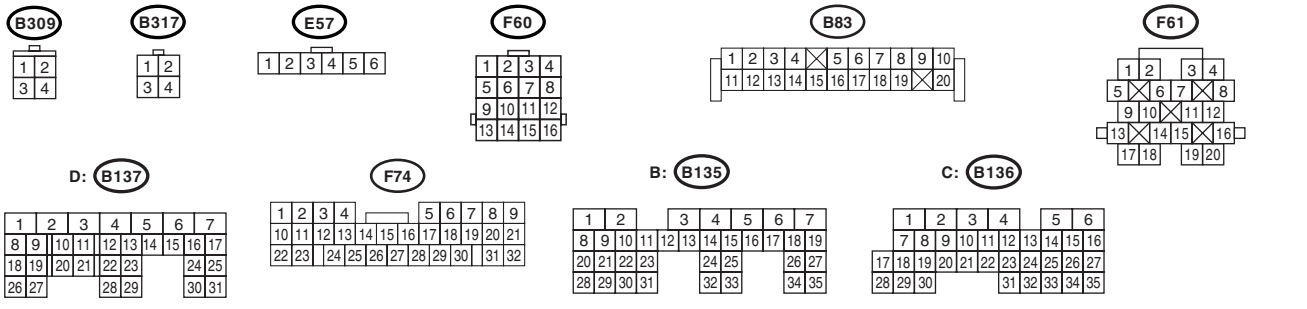
DQ:DTC P2101 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-192, DTC P0638 — THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>, <Ref. to GD(H4DOTC)-208, DTC P1160 — RETURN SPRING FAILURE —, Diagnostic Trouble Code (DTC) Detecting Criteria.> and <Ref. to GD(H4DOTC)-263, DTC P2101 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance
  - Engine stalls.

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





EN-03197

Step		Check	Yes	No
1	**CHECK ELECTRIC THROTTLE RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electric throttle relay. 3) Connect the battery to electric throttle relay terminal No. 1 and No. 3. 4) Measure the resistance between electric throttle relay terminals. ***Terminals*** ***No. 2 — No. 4:***	Is the measured value less than 1 Ω?	Go to step **2.**	Replace the electric throttle relay.
2	**CHECK POWER SUPPLY TO ELECTRIC THROTTLE RELAY.** Measure the voltage between electric throttle relay connector and engine ground. ***Connector & terminal*** ***(B309) No. 1 (+) — Engine ground (−):*** ***(B309) No. 2 (+) — Engine ground (−):***	Is the measured value more than 5 V?	Go to step **3.**	Repair the open power supply circuit or ground short.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Disconnect the connector from ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electric throttle relay connector and engine ground. ***Connector & terminal*** ***(B309) No. 3 (+) — Engine ground (−):***	Is the measured value less than 5 V?	Go to step **4.**	Repair short of the power supply circuit between ECM and electric throttle.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electric throttle relay connector and chassis ground. ***Connector & terminal*** ***(B309) No. 3 — Engine ground:*** ***(B309) No. 4 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the ground short of harness between ECM and electric throttle relay.
5	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE RELAY.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electric throttle connector and electric throttle relay connector. ***Connector & terminal*** ***(B135) No. 35 — (B309) No. 3:*** ***(B137) No. 6 — (B309) No. 4:***	Is the measured value less than 1 Ω?	Go to step **6.**	Repair the open circuit of harness between ECM and electric throttle relay.
6	**CHECK OUTPUT VOLTAGE OF SENSOR.** 1) Connect all the connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector terminals. ***Connector & terminal*** ***(B136) No. 18 (+) — (B136) No. 35 (−):*** 4) Shake the ECM harness and connector, engine harness connectors (B136, F61), electric throttle connector harness while monitoring value of voltage meter.	Is the measured value more than 0.4 V?	Go to step **7.**	Go to step **9.**

Step		Check	Yes	No
7	**CHECK OUTPUT VOLTAGE OF SENSOR.** 1) Connect all the connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector terminals. ***Connector & terminal*** ***(B136) No. 29 (+) — (B136) No. 35 (–):*** 4) Shake the ECM harness and connector, engine harness connectors, electric throttle connector harness while monitoring value of voltage meter.	Is the measured value more than 0.8 V?	Go to step **8.**	Go to step **9.**
8	**CHECK POOR CONTACT.** Check poor contact between ECM connector and electric throttle connector.	Is there poor contact between ECM connector and electric throttle connector?	Repair the poor contact.	Go to step **13.**
9	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from electric throttle. 4) Measure the resistance between ECM connector and electric throttle connector. ***Connector & terminal*** ***(B136) No. 16 — (E57) No. 5:***	Is the measured value less than 1 Ω?	Go to step **10.**	Repair the open harness connector.
10	**CHECK THE HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 — Chassis ground:*** ***(B136) No. 18 — Chassis ground:*** ***(B136) No. 29 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **11.**	Repair the ground short of harness.
11	**CHECK POWER SUPPLY TO SENSOR.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the resistance between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 5 (+) — Engine ground (–):*** 4) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value within 4.5 to 5.5 V?	Go to step **12.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
12	**CHECK SHORT OF ECM.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:*** ***(E57) No. 4 — Engine ground:***	Is the measured value more than 10 Ω?	Go to step **13.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM.
13	**CHECK OUTPUT VOLTAGE OF SENSOR.** 1) Connect all the connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal, using the Subaru Select Monitor. 4) Shake the ECM harness and connector, engine harness connectors, electric throttle connector harness while monitoring value of voltage meter.	Is the measured value 4.63 V?	Go to step **14.**	Go to step **16.**

	Step	Check	Yes	No
14	**CHECK OUTPUT VOLTAGE OF SENSOR.** 1) Read the data of sub throttle sensor signal, using the Subaru Select Monitor. 2) Shake the ECM harness and connector, engine harness connectors, electric throttle connector harness while monitoring value of voltage meter.	Is the measured value 4.73 V?	Go to step **15.**	Go to step **16.**
15	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and electric throttle?	Is there poor contact in connectors between ECM and electric throttle?	Repair the poor contact in connectors.	Go to step **21.**
16	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from electric throttle. 4) Measure the resistance between ECM connector and electric throttle connector. ***Connector & terminal*** ***(B136) No. 35 — (E57) No. 3:*** ***(B136) No. 18 — (E57) No. 6:*** ***(B136) No. 29 — (E57) No. 4:***	Is the measured value less than 1 Ω?	Go to step **17.**	Repair the open harness connector.
17	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Connect the ECM connector. 2) Measure the resistance between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **18.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM.
18	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 5 (+) — Engine ground (−):*** 3) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value more than 10 V?	Go to step **19.**	Repair the battery short of harness between ECM connector and electric throttle connector.
19	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (−):*** ***(E57) No. 4 (+) — Engine ground (−):*** 2) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value less than 10 V?	Go to step **20.**	Repair the short of harness between ECM connector and electric throttle connector.
20	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Remove the ECM. 3) Measure the voltage between ECM connectors. ***Connector & terminal*** ***(B136) No. 18 — (B136) No. 35:*** ***(B136) No. 29 — (B136) No. 35:***	Is the measured value more than 1 MΩ?	Go to step **21.**	Repair the short of sensor power supply.

Step		Check	Yes	No
21	**CHECK OUTPUT VOLTAGE OF SENSOR.** 1) Turn the ignition switch to OFF. 2) Connect all the connectors except electric throttle replay. 3) Turn the ignition switch to ON. 4) Read the data of main throttle sensor signals, using Subaru Select Monitor.	Is the measured value within 0.81 to 0.87 V?	Go to step **22.**	Repair the poor contact in electric throttle connector. If problem persists, replace the electric throttle.
22	**CHECK OUTPUT VOLTAGE OF SENSOR.** Read the data of sub throttle sensor signals, using Subaru Select Monitor.	Is the measured value within 1.64 to 1.70 V?	Go to step **23.**	Repair the poor contact in electric throttle connector. If problem persists, replace the electric throttle.
23	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE MOTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from electric throttle. 4) Measure the resistance between ECM connector and electric throttle connector. ***Connector & terminal*** ***(B137) No. 5 — (E57) No. 2:*** ***(B137) No. 4 — (E57) No. 1:***	Is the measured value less than 1 Ω?	Go to step **24.**	Repair the open harness connector.
24	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE MOTOR.** 1) Connect the connectors to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 (+) — Engine ground (−):*** ***(E57) No. 1 (+) — Engine ground (−):***	Is the measured value less than 5 V?	Go to step **25.**	Repair the short of harness to power supply circuit between ECM and electric throttle.
25	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE MOTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 — Engine ground:*** ***(E57) No. 1 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **26.**	Repair the short of harness.
26	**CHECK ELECTRIC THROTTLE MOTOR HARNESS.** Measure the resistance between electric throttle connector terminals. ***Connector & terminal*** ***(E57) No. 2 — (E57) No. 1:***	Is the measured value more than 1 MΩ?	Go to step **27.**	Repair the short of harness.
27	**CHECK ELECTRIC THROTTLE GROUND CIRCUIT.** Measure the resistance between ECM connector and engine ground. ***Connector & terminal*** ***(B137) No. 3 — Engine ground:***	Is the measured value less than 10 Ω?	Go to step **28.**	Repair the open circuit harness.
28	**CHECK ELECTRIC THROTTLE.** Measure the resistance between electric throttle terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the measured value less than 5 Ω?	Go to step **29.**	Replace the electric throttle.

Step		Check	Yes	No
29	**CHECK ELECTRIC THROTTLE.** Open and close the throttle valve to its full width with finger.	Does it return to specified position (3 mm (0.12 in) open from fully closed position.) when finger is released?	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Replace the electric throttle.

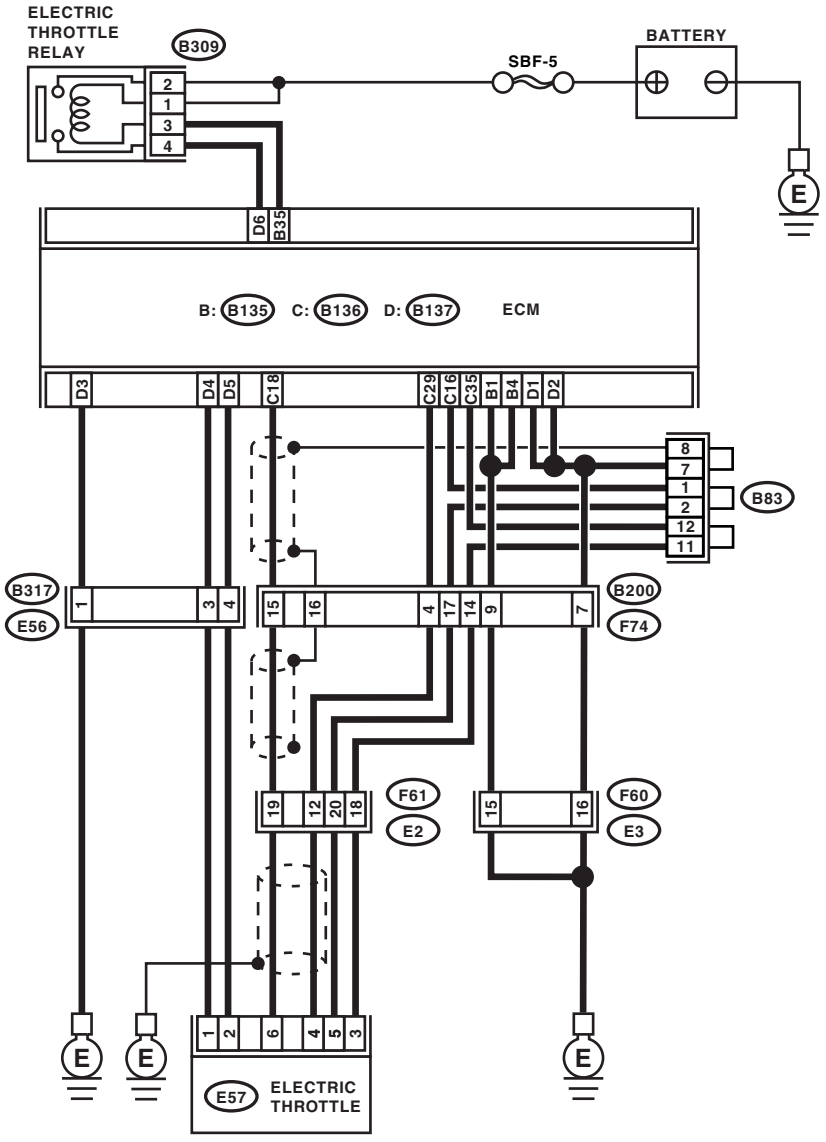
MEMO:

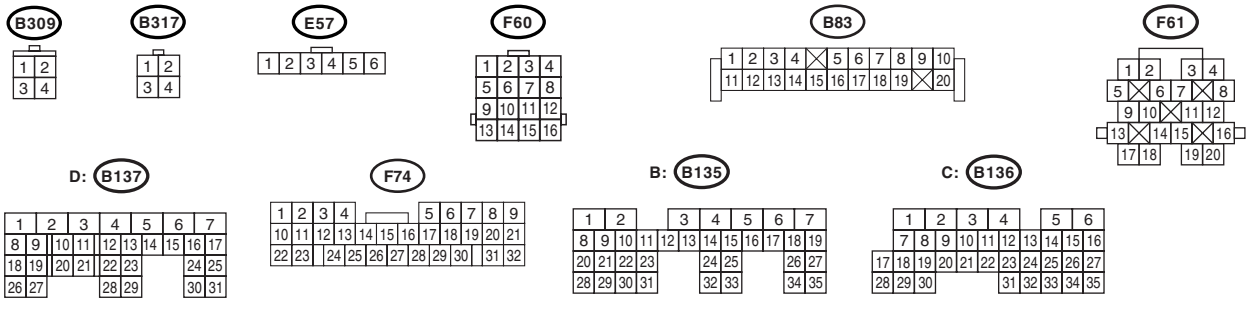
DR:DTC P2102 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-265, DTC P2102 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
- **TROUBLE SYMPTOM:**
  - Erroneous idling
  - Poor driving performance
  - Engine stalls.

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





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	Step	Check	Yes	No
1	**CHECK ELECTRIC THROTTLE RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electric throttle relay. 3) Connect the battery to electric throttle relay terminal No. 1 and No. 3. 4) Measure the resistance between electric throttle terminals. ***Connector & terminal*** ***No. 2 — No. 4:***	Is the measured value less than 1 Ω?	Go to step **2.**	Replace the electric throttle relay.
2	**CHECK POWER TO ELECTRIC THROTTLE RELAY** Measure the voltage between electric throttle relay connector and engine ground. ***Connector & terminal*** ***(B309) No. 1 (+) — Engine ground (−):*** ***(B309) No. 2 (+) — Engine ground (−):***	Is the measured value more than 5 V?	Go to step **3.**	Repair the open power supply circuit or ground short.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Disconnect the connector from ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electric throttle relay connector and engine ground. ***Connector & terminal*** ***(B309) No. 3 (+) — Engine ground (−):***	Is the measured value less than 5 V?	Go to step **4.**	Repair the short of power supply circuit between ECM and electric throttle.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE RELAY.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electric throttle relay connector and chassis ground. ***Connector & terminal*** ***(B309) No. 3 — Engine ground:*** ***(B309) No. 4 — Engine ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the ground short of harness between ECM and electric throttle relay.
5	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE RELAY.** Measure the resistance between ECM connector and electric throttle relay connector. ***Connector & terminal*** ***(B135) No. 35 — (B309) No. 3:*** ***(B137) No. 6 — (B309) No. 4:***	Is the measured value less than 1 Ω?	Repair the poor contact in ECM connector. If problem persists, replace the ECM.	Repair the open harness between ECM and electric throttle relay.

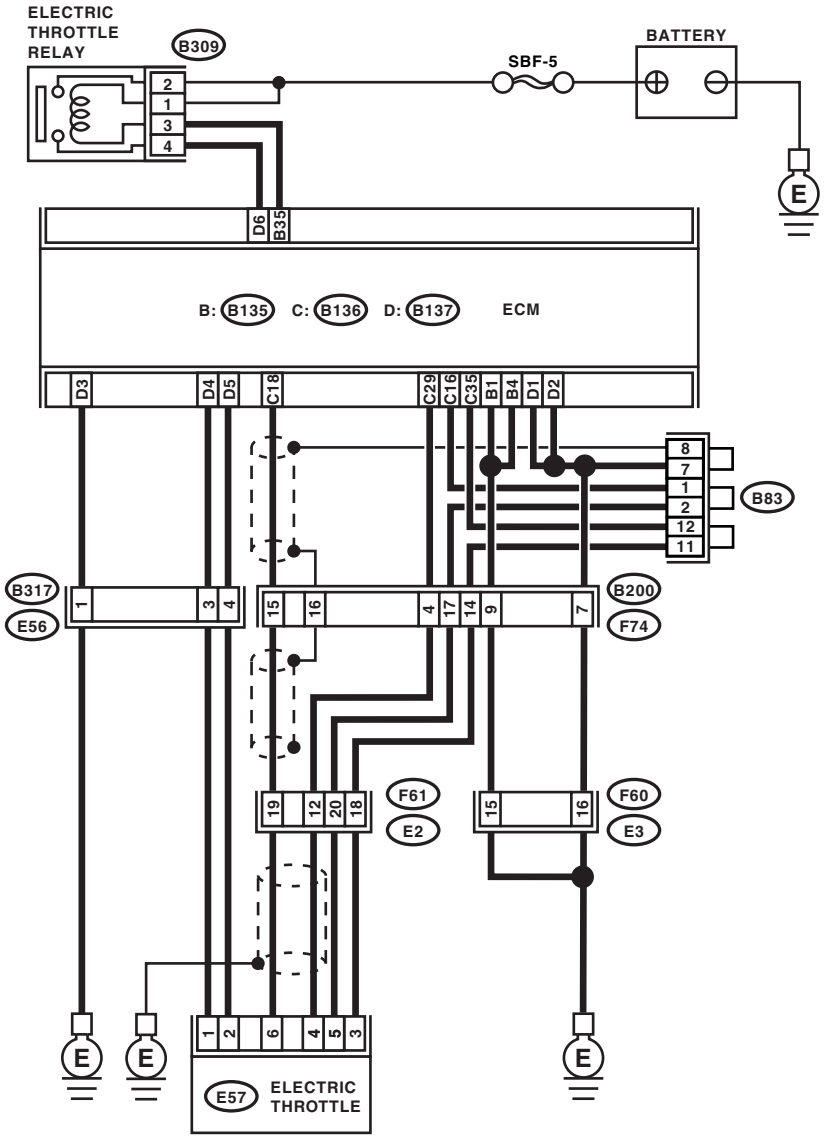
MEMO:

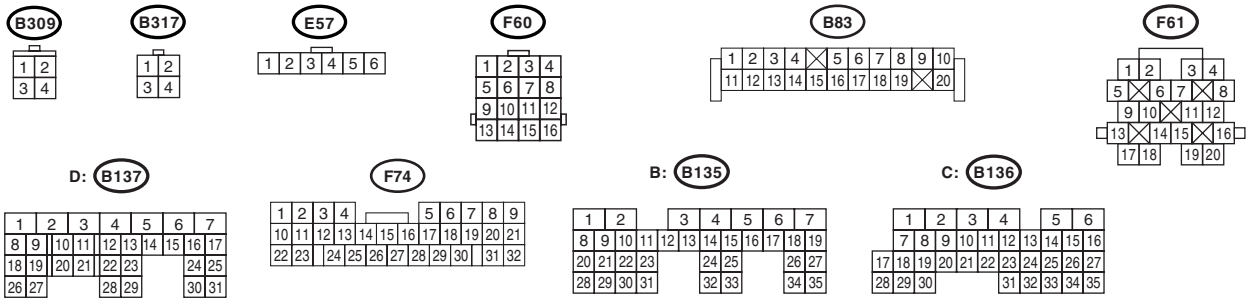
DS:DTC P2103 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-267, DTC P2103 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





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	Step	Check	Yes	No
1	**CHECK ELECTRIC THROTTLE RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electric throttle relay. 3) Measure the resistance between electric throttle relay terminals. ***Terminals*** ***No. 2 — No. 4:***	Is the measured value more than 1 MΩ?	Go to step **2.**	Replace the electric throttle relay.
2	**CHECK SHORT OF ELECTRIC THROTTLE RELAY POWER SUPPLY CIRCUIT.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electric throttle relay connector and engine ground. ***Connector & terminal*** ***(B309) No. 4 (+) — Engine ground (−):***	Is the measured value more than 5 V?	Repair the short of power supply to harness between ECM and electric throttle relay.	Go to step **3.**
3	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE RELAY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connector and engine ground. ***Connector & terminal*** ***(B135) No. 35 — Engine ground:***	Is the measured value more than 1 MΩ?	Repair the poor contact in ECM connector. If problem persists, replace the ECM.	Repair the ground short of harness between ECM and electric throttle relay.

DT:DTC P2109 — THROTTLE/PEDAL POSITION SENSOR A MINIMUM STOP PERFORMANCE —

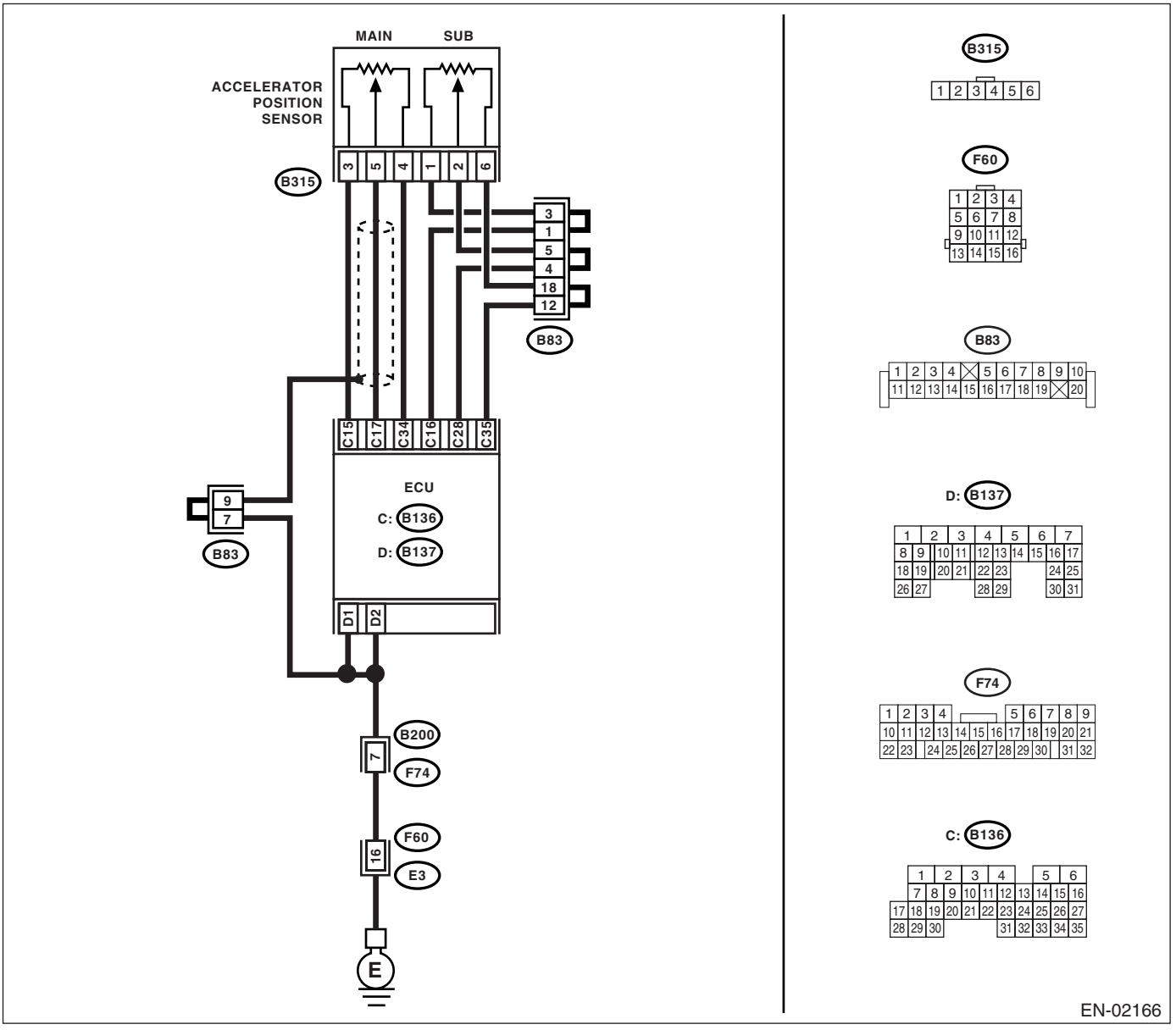
NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)-403, DTC P2101 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DU:DTC P2122 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-271, DTC P2122 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector terminals. ***Connector & terminal*** ***(B136) No. 17 (+) — (B136) No. 34 (–):*** 3) Shake the ECM harness and connector, accelerator position sensor.	Is the measured value more than 0.4 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and accelerator position sensor.	Is there poor contact in connectors between ECM and accelerator position sensor?	Repair the poor contact in connectors.	Connector has returned to its normal condition at this time. A temporary poor contact of the connector may be the cause.
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor. ***Connector & terminal*** ***(B136) No. 17 — (B315) No. 5:*** ***(B136) No. 15 — (B315) No. 3:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open harness connector.
4	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 17 — Chassis ground:*** ***(B136) No. 15 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the open harness connector.
5	**CHECK ACCELERATOR POSITION SENSOR POWER SUPPLY** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and engine ground. ***Connector & terminal*** ***(B315) No. 3 (+) — Engine ground (–):*** 4) Shake the ECM harness and connector, while monitoring value of voltage meter.	Is the measured value within 4.5 to 5.5 V?	Go to step **6.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
6	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor. ***Terminals*** ***No. 3 — No. 4:***	Is the measured value within 1.2 to 4.8 kΩ?	Go to step **7.**	Replace the accelerator position sensor.
7	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor when accelerator pedal is released. ***Terminals*** ***No. 5 — No. 4:***	Is the measured value within 0.2 to 1.0 kΩ?	Go to step **8.**	Replace the accelerator position sensor.

	Step	Check	Yes	No
8	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor when acceleration pedal is being depressed. ***Terminals*** ***No. 5 — No. 4:***	Is the measured value within 0.5 to 2.5 kΩ?	Repair the poor contact in ECM connector. If problem persists, replace the ECM.	Replace the accelerator position sensor.

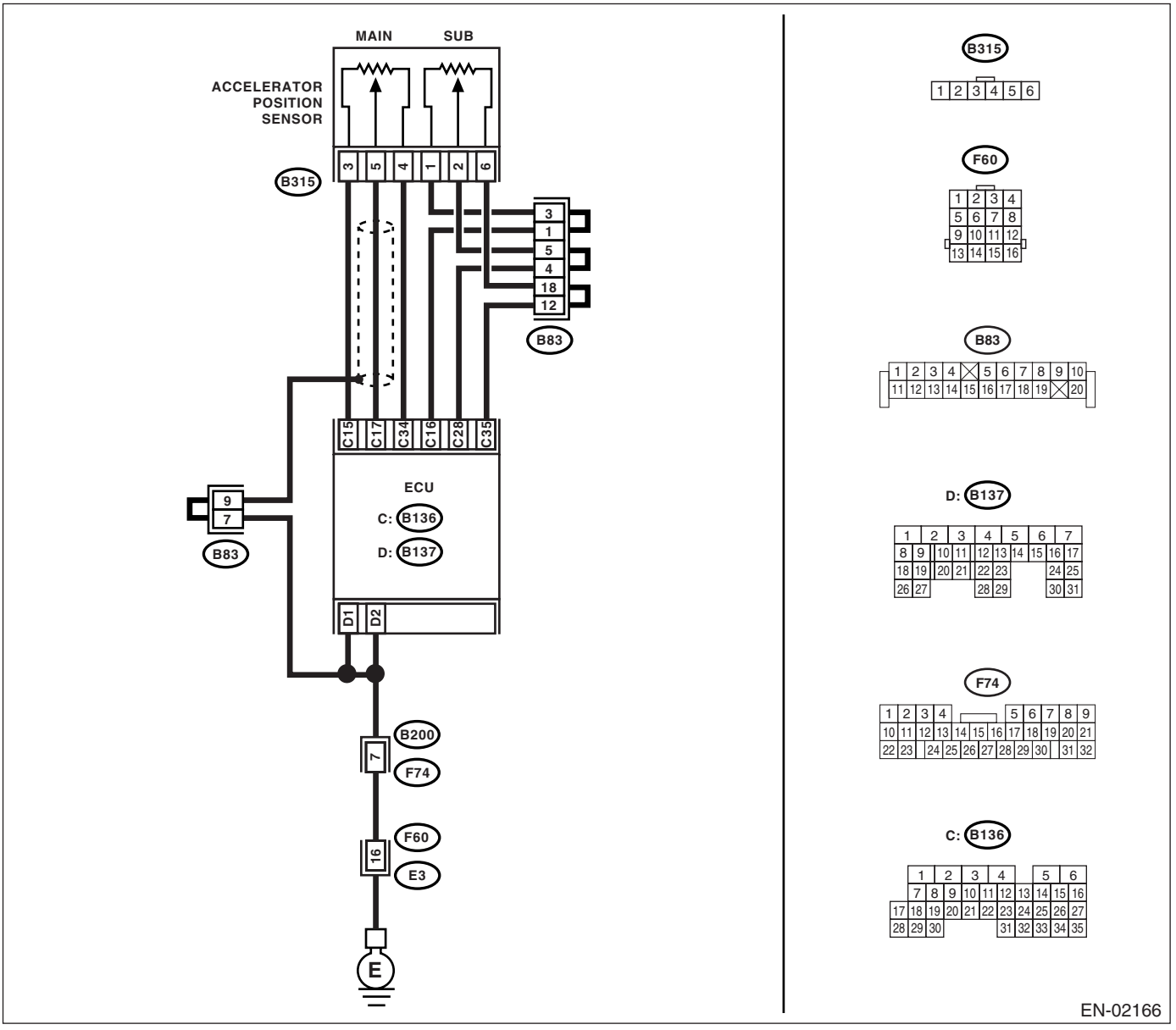
MEMO:

DV:DTC P2123 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-273, DTC P2123 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to ON. 2) Read the data of main accelerator position sensor signals, using Subaru Select Monitor. 3) Shake the ECM harness and connector, engine harness connector, accelerator position sensor connector harness while monitoring value of voltage meter.	Is the measured value less than 4.8 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and accelerator position sensor.	Is there any poor contact in connectors between ECM and accelerator position sensor?	Repair the poor contact in connectors.	Connector has returned to its normal condition at this time. A temporary poor contact in the connector might have been the cause.
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor. ***Connector & terminal*** ***(B136) No. 34 — (B315) No. 4:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open harness connector.
4	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Connect the ECM connector. 2) Measure the resistance between accelerator position sensor and engine ground. ***Connector & terminal*** ***(B315) No. 4 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
5	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and engine ground. ***Connector & terminal*** ***(B315) No. 3 (+) — Engine ground (−):*** 4) Shake the ECM harness and connector, while monitoring value of voltage meter.	Is the measured value more than 6 V?	Go to step **6.**	Repair the battery short of harness between ECM connector and accelerator position sensor.
6	**CHECK POWER SUPPLY TO ACCELERATOR POSITION SENSOR.** 1) Measure the voltage between accelerator position sensor connector and engine ground. ***Connector & terminal*** ***(B315) No. 5 (+) — Engine ground (−):*** 2) Shake the ECM harness and connector, while monitoring value of voltage meter.	Is the measured value less than 4.8 V?	Go to step **7.**	Repair the short of harness between ECM connector and accelerator position sensor connector.

	Step	Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Connect the accelerator position sensor connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 17 (+) — Chassis ground (−):***	Is the measured value 4.8 V?	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Repair the poor contact in electric throttle connector. If problem persists, replace the electric throttle.

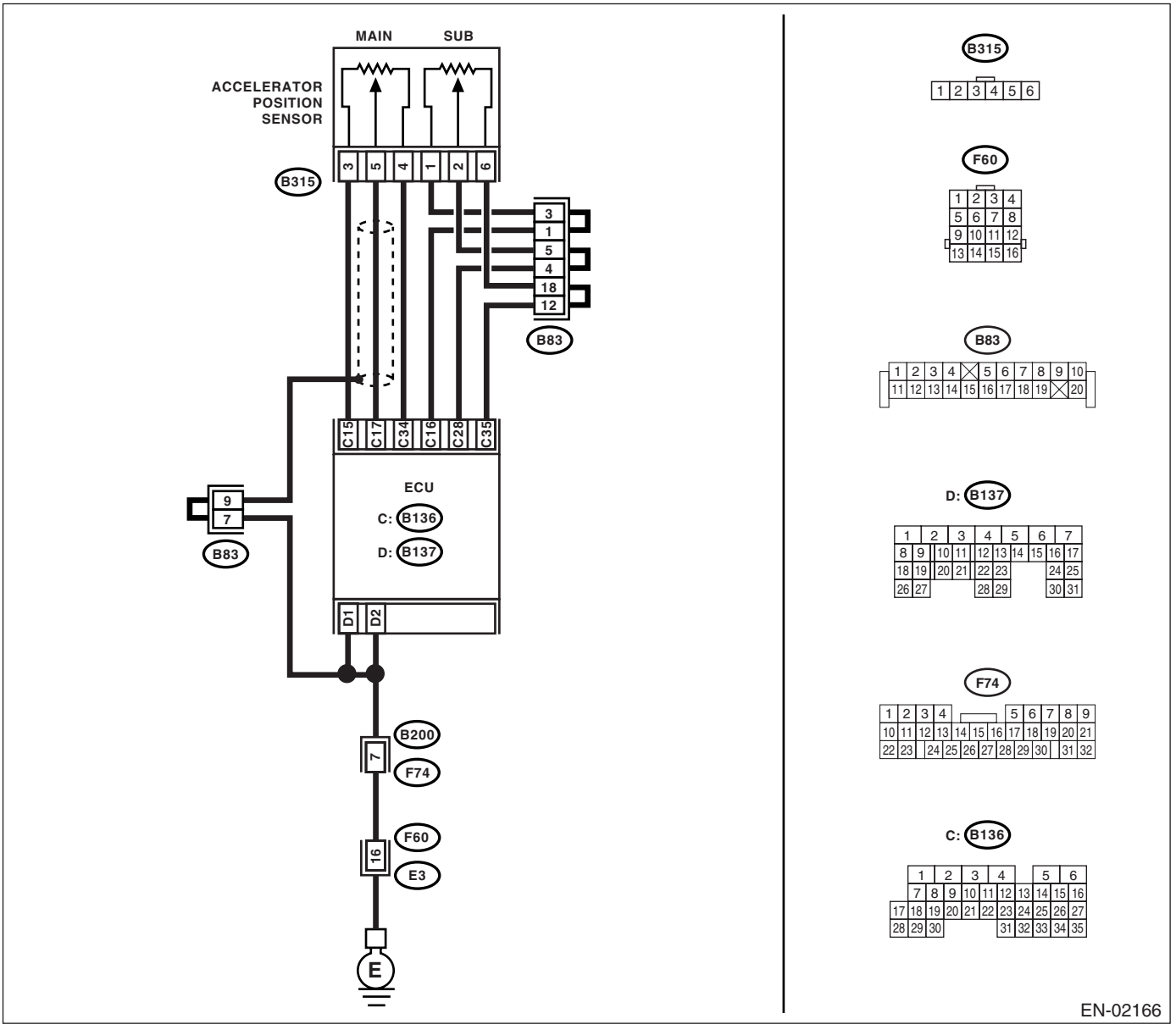
MEMO:

DW:DTC P2127 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-275, DTC P2127 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector terminals. ***Connector & terminal*** ***(B136) No. 28 (+) — (B136) No. 35 (–):*** 3) Shake the ECM harness and connector, accelerator position sensor.	Is the measured value more than 0.4 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and accelerator position sensor.	Is there any poor contact in connectors between ECM and accelerator position sensor?	Repair the poor contact in connectors.	Connector has returned to its normal condition at this time. A temporary poor contact in the connector might have been the cause.
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor. ***Connector & terminal*** ***(B136) No. 28 — (B315) No. 2:*** ***(B136) No. 16 — (B315) No. 1:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open harness connector.
4	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 28 — Chassis ground:*** ***(B136) No. 16 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the ground short of harness.
5	**CHECK POWER SUPPLY TO ACCELERATOR POSITION SENSOR.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and engine ground. ***Connector & terminal*** ***(B315) No. 1 (+) — Engine ground (–):*** 4) Shake the ECM harness and connector, while monitoring value of voltage meter.	Is the measured value within 4.5 to 5.5 V?	Go to step **6.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
6	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor. ***Terminals*** ***No. 1 — No. 6:***	Is the measured value within 0.75 to 3.15 kΩ?	Go to step **7.**	Replace the accelerator position sensor.
7	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor when accelerator pedal is released. ***Terminals*** ***No. 2 — No. 6:***	Is the measured value within 0.15 to 0.63 kΩ?	Go to step **8.**	Replace the accelerator position sensor.

Step		Check	Yes	No
8	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor when acceleration pedal is being depressed. ***Terminals*** ***No. 2 — No. 6:***	Is the measured value within 0.28 to 1.68 kΩ?	Repair the poor contact in ECM connector. If problem persists, replace the ECM.	Replace the accelerator position sensor.

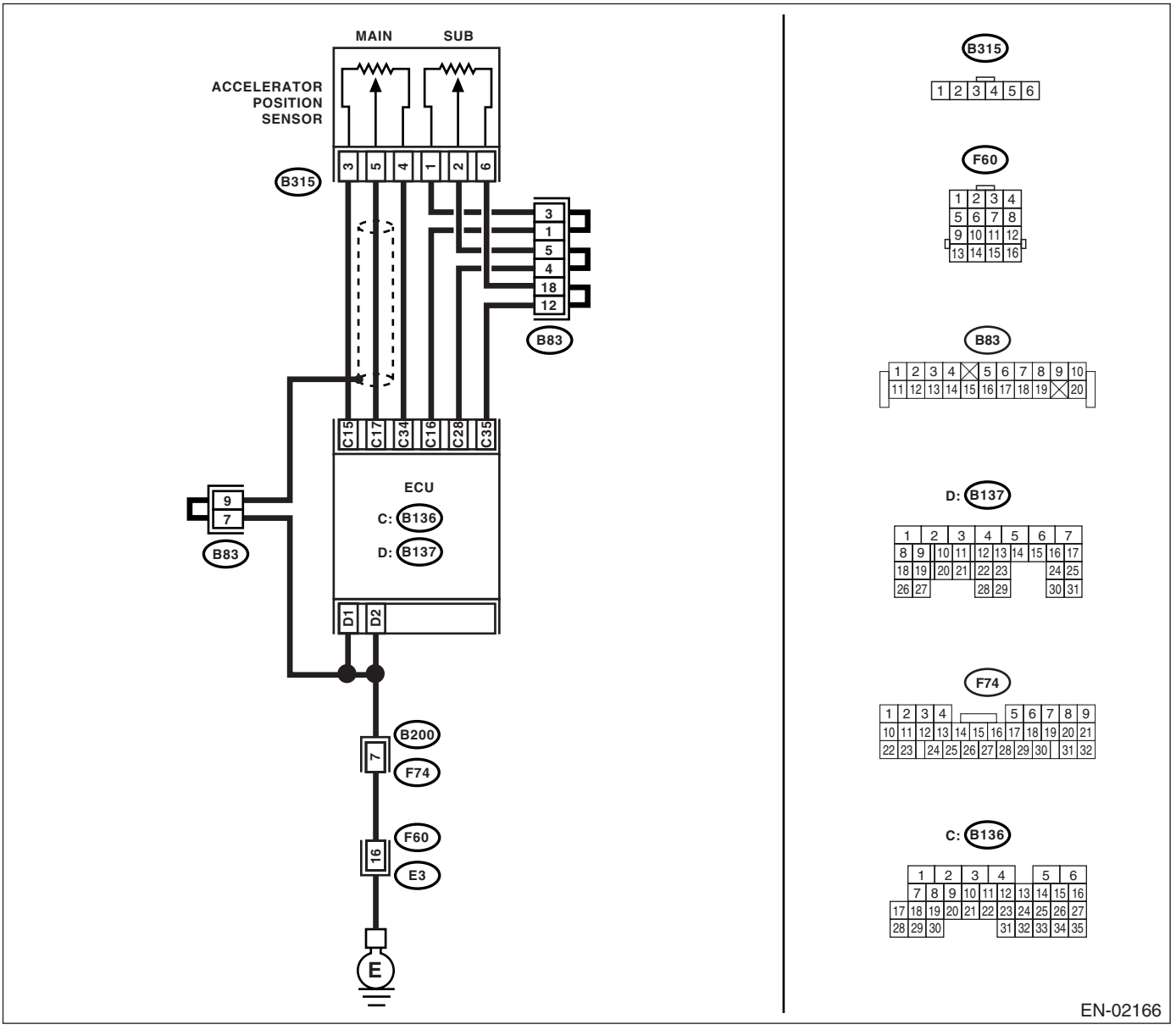
MEMO:

DX:DTC P2128 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGHT INPUT —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-277, DTC P2128 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to ON. 2) Read the data of sub accelerator position sensor signals, using Subaru Select Monitor. 3) Shake the ECM harness and connector, engine harness connector, accelerator position sensor connector harness while monitoring value of voltage meter.	Is the measured value less than 4.8 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and accelerator position sensor.	Is there any poor contact in connectors between ECM and accelerator position sensor?	Repair the poor contact in connectors.	Connector has returned to its normal condition at this time. A temporary poor contact in the connector might have been the cause.
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor. ***Connector & terminal*** ***(B136) No. 35 — (B315) No. 6:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open harness connector.
4	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Connect the ECM connector. 2) Measure the resistance between accelerator position sensor connector and engine ground. ***Connector & terminal*** ***(B315) No. 6 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **5.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM.
5	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and engine ground. ***Connector & terminal*** ***(B315) No. 1 (+) — Engine ground (−):*** 4) Shake the ECM harness and connector, while monitoring value of voltage meter.	Is the measured value less than 6 V?	Go to step **6.**	Repair the battery short of harness between ECM connector and accelerator position sensor connector.
6	**CHECK POWER SUPPLY TO ACCELERATOR POSITION SENSOR.** 1) Measure the voltage between accelerator position sensor connector and engine ground. ***Connector & terminal*** ***(B315) No. 2 (+) — Engine ground (−):*** 2) Shake the ECM harness and connector, while monitoring value of voltage meter.	Is the measured value less than 4.8 V?	Go to step **7.**	Repair the short of harness between ECM connector and accelerator position sensor connector.

	Step	Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Connect the accelerator position sensor connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (−):***	Is the measured value 4.8 V?	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>	Repair the poor contact in electric throttle connector. If problem persists, replace the electric throttle.

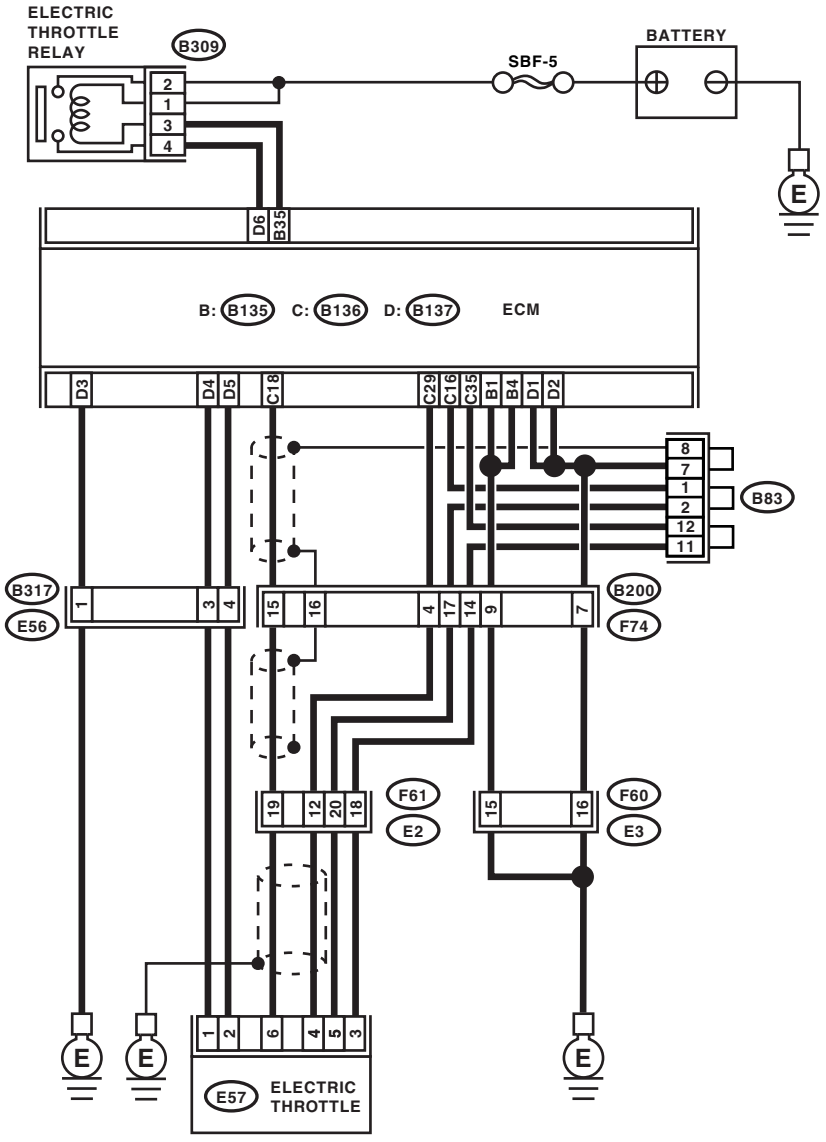
MEMO:

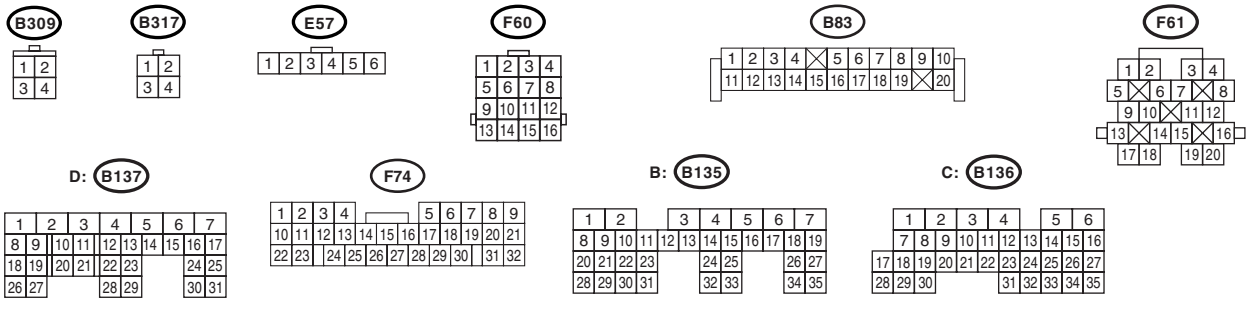
DY:DTC P2135 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE RATIONALITY —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-279, DTC P2135 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” / “B” VOLTAGE RATIONALITY —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**





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	Step	Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector terminals. ***Connector & terminal*** ***(B136) No. 18 (+) — (B136) No. 35 (–):*** 3) Shake the ECM harness and connector, engine harness connectors, electric throttle connector harness while monitoring value of voltage meter.	Is the measured value more than 0.4 V?	Go to step **2.**	Go to step **4.**
2	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Measure the voltage between ECM connector terminals. ***Connector & terminal*** ***(B136) No. 29 (+) — (B136) No. 35 (–):*** 2) Shake the ECM harness and connector, engine harness connectors, electric throttle connector harness while monitoring value of voltage meter.	Is the measured value more than 0.8 V?	Go to step **3.**	Go to step **4.**
3	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and electric throttle.	Is there any poor contact in connectors between ECM and electric throttle?	Repair the poor contact in connectors.	Go to step **14.**
4	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from electric throttle. 4) Measure the resistance between ECM connector and electric throttle connector. ***Connector & terminal*** ***(B136) No. 16 — (E57) No. 5:***	Is the measured value less than 1 Ω?	Go to step **5.**	Repair the open harness connector.
5	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 18 — Chassis ground:*** ***(B136) No. 29 — Chassis ground:*** ***(B136) No. 16 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **6.**	Repair the ground short of harness.
6	**CHECK POWER SUPPLY TO SENSOR.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 5 (+) — Engine ground (–):*** 4) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value within 4.5 to 5.5 V?	Go to step **7.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM.

Step		Check	Yes	No
7	**CHECK SHORT OF ECM.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:*** ***(E57) No. 4 — Engine ground:***	Is the measured value more than 10 Ω?	Go to step **8.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).>
8	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Connect all the connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signals, using Subaru Select Monitors. 4) Shake the ECM harness and connector, engine harness connector, electric throttle connector harness while monitoring value of voltage meter.	Is the measured value less than 4.63 V?	Go to step **9.**	Go to step **11.**
9	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Read the data of sub throttle sensor signals, using Subaru Select Monitors. 2) Shake the ECM harness and connector, engine harness connector, electric throttle connector harness while monitoring value of voltage meter.	Is the measured value less than 4.73 V?	Go to step **10.**	Go to step **11.**
10	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and electric throttle.	Is there any poor contact in connectors between ECM and electric throttle?	Repair the poor contact in connectors.	Connector has returned to a normal condition at this time. A temporary poor contact in the connector might have been the cause.
11	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from electric throttle. 4) Measure the resistance between ECM connector and electric throttle connector. ***Connector & terminal*** ***(B136) No. 35 — (E57) No. 3:*** ***(B136) No. 18 — (E57) No. 6:*** ***(B136) No. 29 — (E57) No. 4:***	Is the measured value less than 1 Ω?	Go to step **12.**	Repair the open harness connector.
12	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Connect the ECM connector. 2) Measure the resistance between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **13.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM.

	Step	Check	Yes	No
13	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 5 (+) — Engine ground (–):*** 4) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value more than 10 V?	Go to step **14.**	Repair the battery short of harness between ECM connector and electric throttle connector.
14	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Measure the voltage between electric throttle connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (–):*** ***(E57) No. 4 (+) — Engine ground (–):*** 2) Shake the ECM harness and connector, engine harness connectors, while monitoring value of voltage meter.	Is the measured value less than 10 V?	Go to step **15.**	Repair the short of harness between ECM connector and electric throttle connector.
15	**CHECK HARNESS BETWEEN ECM AND ELECTRIC THROTTLE.** 1) Turn the ignition switch to OFF. 2) Disconnect the electric throttle connector. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B136) No. 18 (+) — (B136) No. 35 (–):*** ***(B136) No. 29 (+) — (B136) No. 35 (–):***	Is the measured value more than 1 MΩ?	Go to step **16.**	Repair the short of power supply sensor.
16	**CHECK ELECTRIC THROTTLE HARNESS.** 1) Disconnect the connector from ECM. 2) Disconnect the connector from electric throttle. 3) Measure the resistance between electric throttle connector terminals. ***Connector & terminal*** ***(E57) No. 6 — (E57) No. 4:***	Is the measured value more than 1 MΩ?	Repair the poor contact in ECM connector. If problem persists, replace the ECM.	Repair the short of harness.

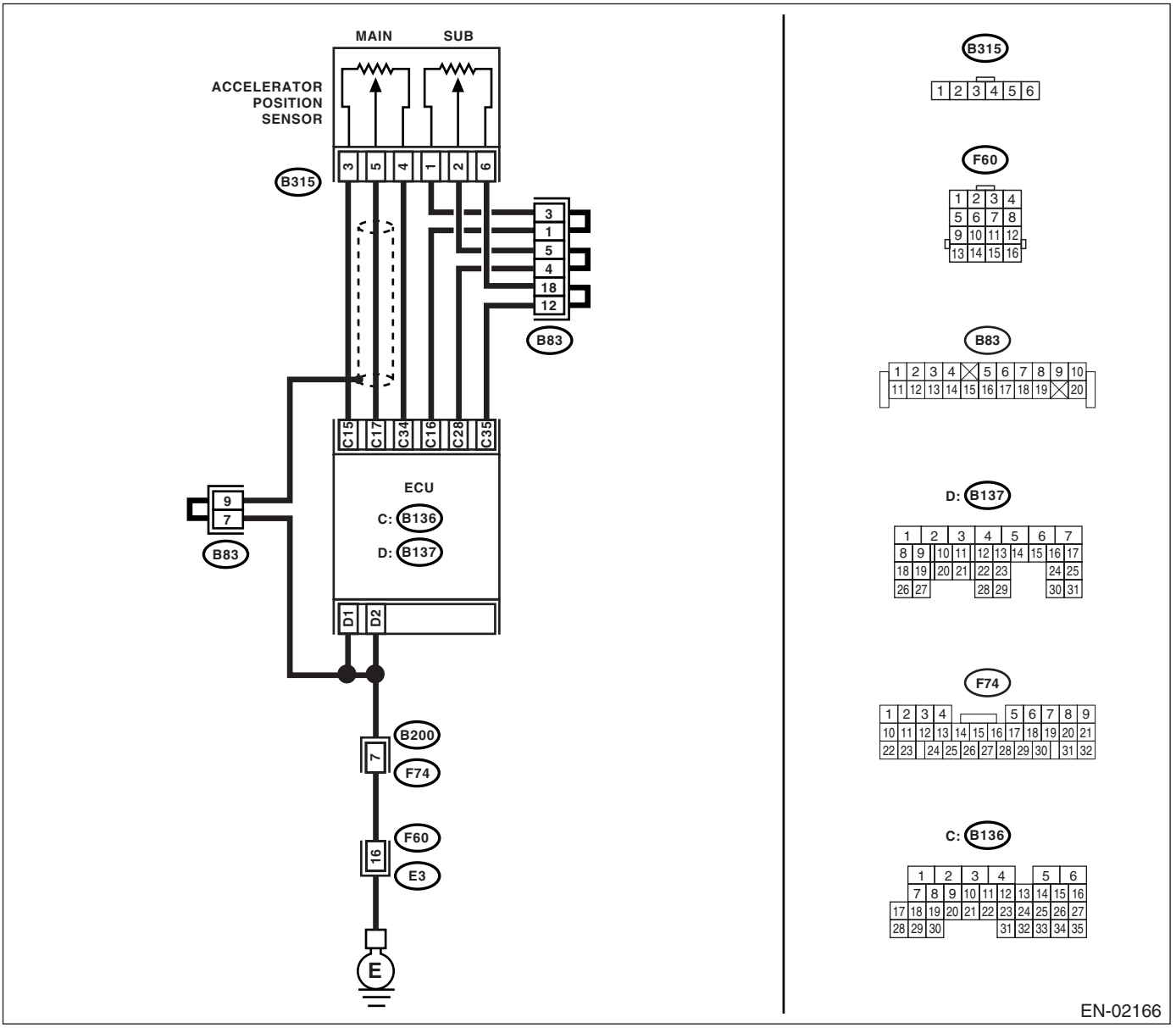
MEMO:

DZ:DTC P2138 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE RATIONALITY —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-281, DTC P2138 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” / “E” VOLTAGE RATIONALITY —, 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

- **WIRING DIAGRAM:**



	Step	Check	Yes	No
1	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector terminals. ***Connector & terminal*** ***(B136) No. 17 (+) — (B136) No. 34 (–):*** ***(B136) No. 28 (+) — (B136) No. 35 (–):*** 3) Shake the ECM harness and connector, accelerator position sensor connector and harness.	Is the measured value more than 0.4 V?	Go to step **2.**	Go to step **3.**
2	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and electric throttle.	Is there any poor contact in connectors between ECM and electric throttle?	Repair the poor contact in connectors.	Go to step **9.**
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor connector. ***Connector & terminal*** ***(B136) No. 17 — (B315) No. 5:*** ***(B136) No. 15 — (B315) No. 3:*** ***(B136) No. 28 — (B315) No. 2:*** ***(B136) No. 16 — (B315) No. 1:***	Is the measured value less than 1 Ω?	Go to step **4.**	Repair the open harness connector.
4	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** Measure the resistance between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 17 — Chassis ground:*** ***(B136) No. 15 — Chassis ground:*** ***(B136) No. 28 — Chassis ground:*** ***(B136) No. 16 — Chassis ground:***	Is the measured value more than 1 MΩ?	Go to step **5.**	Repair the ground short of harness.
5	**CHECK POWER SUPPLY TO ACCELERATOR POSITION SENSOR.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and engine ground. ***Connector & terminal*** ***(B315) No. 3 (+) — Engine ground (–):*** ***(B315) No. 1 (+) — Engine ground (–):*** 4) Shake the ECM harness and connector, while monitoring value of voltage meter.	Is the measured value 4.5 — 5.5 V?	Go to step **6.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM.
6	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor. ***Terminals*** ***No. 3 — No. 4:***	Is the measured value within 1.2 to 4.8 kΩ?	Go to step **7.**	Replace the accelerator position sensor.

	Step	Check	Yes	No
7	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor. ***Terminals*** ***No. 1 — No. 6:***	Is the measured value within 0.75 to 3.15 kΩ?	Go to step **8.**	Replace the accelerator position sensor.
8	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor when the acceleration pedal is released. ***Terminals*** ***No. 5 — No. 4:***	Is the measured value within 0.2 to 0.8 kΩ?	Go to step **9.**	Replace the accelerator position sensor.
9	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor when the acceleration pedal is released. ***Connector & terminal*** ***No. 2 — No. 6:***	Is the measured value within 0.15 to 0.63 kΩ?	Go to step **10.**	Replace the accelerator position sensor.
10	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor when the acceleration pedal is being depressed. ***Terminals*** ***No. 5 — No. 4:***	Is the measured value within 0.5 to 2.5 kΩ?	Go to step **11.**	Replace the accelerator position sensor.
11	**CHECK ACCELERATOR POSITION SENSOR.** Measure the resistance of accelerator position sensor when the acceleration pedal is being depressed. ***Terminals*** ***No. 2 — No. 6: (Sub)***	Is the measured value within 0.28 to 1.68 kΩ?	Go to step **12.**	Replace the accelerator position sensor.
12	**CHECK OUTPUT VOLTAGE OF ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Connect all the connectors. 3) Turn the ignition switch to ON. 4) Read the data of main accelerator position sensor signals and sub accelerator position sensor signals, using Subaru Select Monitor. 5) Shake the ECM harness and connector, engine harness connector, accelerator position sensor connector harness while monitoring value of voltage meter.	Is the measured value less than 4.8 V?	Go to step **13.**	Go to step **14.**
13	**CHECK POOR CONTACT IN CONNECTORS.** Check poor contact in connectors between ECM and electric throttle.	Is there any poor contact in connectors between ECM and electric throttle?	Repair the poor contact in connectors.	Go to step **19.**

	Step	Check	Yes	No
14	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor connector. ***Connector & terminal*** ***(B136) No. 34 — (B315) No. 4:*** ***(B136) No. 35 — (B315) No. 6:***	Is the measured value less than 1 Ω?	Go to step **15.**	Repair the open harness connector.
15	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Connect the ECM connector. 2) Measure the resistance between accelerator position sensor and engine ground. ***Connector & terminal*** ***(B315) No. 4 — Engine ground:*** ***(B315) No. 6 — Engine ground:***	Is the measured value less than 5 Ω?	Go to step **16.**	Repair the poor contact in ECM connector. If problem persists, replace the ECM.
16	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor and engine ground. ***Connector & terminal*** ***(B315) No. 3 (+) — Engine ground (–):*** ***(B315) No. 1 (+) — Engine ground (–):*** 4) Shake the ECM harness and connector, while monitoring value of voltage meter.	Is the measured value less than 6 V?	Go to step **17.**	Repair the battery short of harness between ECM connector and accelerator position sensor.
17	**CHECK POWER SUPPLY TO ACCELERATOR POSITION SENSOR.** 1) Measure the voltage between accelerator position sensor connector and engine ground. ***Connector & terminal*** ***(B315) No. 5 (+) — Engine ground (–):*** ***(B315) No. 2 (+) — Engine ground (–):*** 2) Shake the ECM harness and connector, while monitoring value of voltage meter.	Is the measured value less than 4.8 V?	Go to step **18.**	Repair the short of harness between ECM connector and accelerator position sensor connector.
18	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Connect the accelerator position sensor connector. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 17 (+) — Chassis ground (–):*** ***(B136) No. 28 (+) — Chassis ground (–):***	Is the measured value less than 4.8 V?	Go to step **19.**	Repair the poor contact in accelerator position sensor connector. If problem persists, replace the accelerator position sensor.

	Step	Check	Yes	No
19	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from accelerator position sensor. 4) Measure the resistance between terminals of accelerator position sensor connector. ***Connector & terminal*** ***(B315) No. 5 — (B315) No. 2:***	Is the measured value less than 1 MΩ?	Repair the poor contact in ECM connector. If problem persists, replace the ECM.	Repair the short of harness between accelerator position sensor connector and accelerator position sensor connector.

EA:DTC P2227 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE —

- **DTC DETECTING CONDITION:**
  - Two consecutive driving cycles with fault
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-283, DTC P2227 — ATMOSPHERIC PRESSURE 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).> NOTE: Atmospheric pressure sensor is built into ECM.	NOTE: It is not necessary to inspect DTC P2227.

EB:DTC P2228 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-284, DTC P2228 — 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P1110?	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).> NOTE: Atmospheric pressure sensor is built into ECM.	A temporary poor contact.

EC:DTC P2229 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT) —

- **DTC DETECTING CONDITION:**
  - Immediately at fault recognition
  - GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-285, DTC P2229 — 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(H4DOTC)-52, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)-39, OPERATION, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK ANY OTHER DTC ON DISPLAY.**	Does the Subaru Select Monitor or general scan tool indicate DTC P1111?	Replace the ECM. <Ref. to FU(H4DOTC)-43, Engine Control Module (ECM).> NOTE: Atmospheric pressure sensor is built into ECM.	A temporary poor contact.

19.General Diagnostic Table

A: INSPECTION

1. ENGINE

NOTE:
Malfunction of parts other than those listed is also possible. <Ref. to ME(H4DOTC)-97, Engine Trouble in General.>

Symptom	Problem parts
1. Engine stalls during idling.	1) Electric throttle 2) Manifold absolute pressure sensor 3) Mass air flow and intake temperature sensor 4) Ignition parts (*1) 5) Engine coolant temperature sensor (*2) 6) Crankshaft position sensor (*3) 7) Camshaft position sensor (*3) 8) Fuel injection parts (*4)
2. Rough idling	1) Electric throttle 2) Manifold absolute pressure sensor 3) Mass air flow and intake temperature sensor 4) Engine coolant temperature sensor (*2) 5) Ignition parts (*1) 6) Air intake system (*5) 7) Fuel injection parts (*4) 8) Crankshaft position sensor (*3) 9) Camshaft position sensor (*3) 10) Oxygen sensor 11) Fuel pump and fuel pump relay
3. Engine does not return to idle.	1) Electric throttle 2) Engine coolant temperature sensor 3) Manifold absolute pressure sensor 4) Mass air flow sensor
4. Poor acceleration	1) Manifold absolute pressure sensor 2) Mass air flow and intake temperature sensor 3) Electric throttle 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay 6) Engine coolant temperature sensor (*2) 7) Crankshaft position sensor (*3) 8) Camshaft position sensor (*3) 9) A/C switch and A/C cut relay 10) Engine torque control signal circuit 11) Ignition parts (*1)
5. Engine stalls or engine sags or hesitates at acceleration.	1) Manifold absolute pressure sensor 2) Mass air flow and intake temperature sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Purge control solenoid valve 7) Fuel injection parts (*4) 8) Fuel pump and fuel pump relay
6. Surge	1) Manifold absolute pressure sensor 2) Mass air flow and intake temperature sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Fuel injection parts (*4) 7) Throttle position sensor 8) Fuel pump and fuel pump relay

GENERAL DIAGNOSTIC TABLE

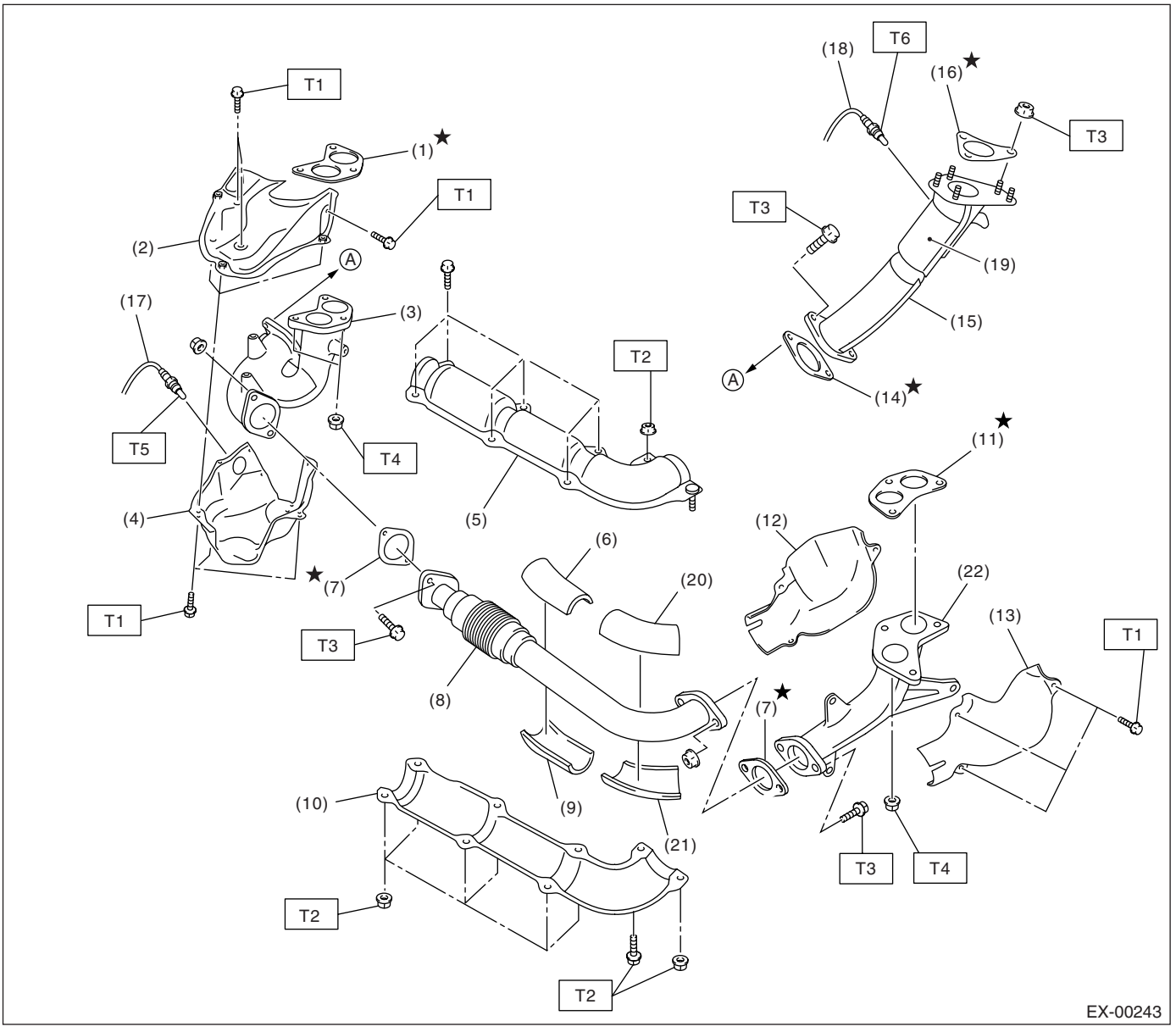
Symptom	Problem parts
7. Spark knock	1) Manifold absolute pressure sensor 2) Mass air flow and intake temperature sensor 3) Engine coolant temperature sensor 4) Knock sensor 5) Fuel injection parts (*4) 6) Fuel pump and fuel pump relay
8. After-burning in exhaust system	1) Manifold absolute pressure sensor 2) Mass air flow and intake temperature sensor 3) Engine coolant temperature sensor (*2) 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay

*1: Check ignition coil & ignitor ASSY and spark plug.
*2: Indicate the symptom occurring only in cold temperatures.
*3: Ensure the secure installation.
*4: Check fuel injector, fuel pressure regulator and fuel filter.
*5: Inspect air leak in air intake system.

1. General Description

A: COMPONENT

1. FRONT EXHAUST PIPE



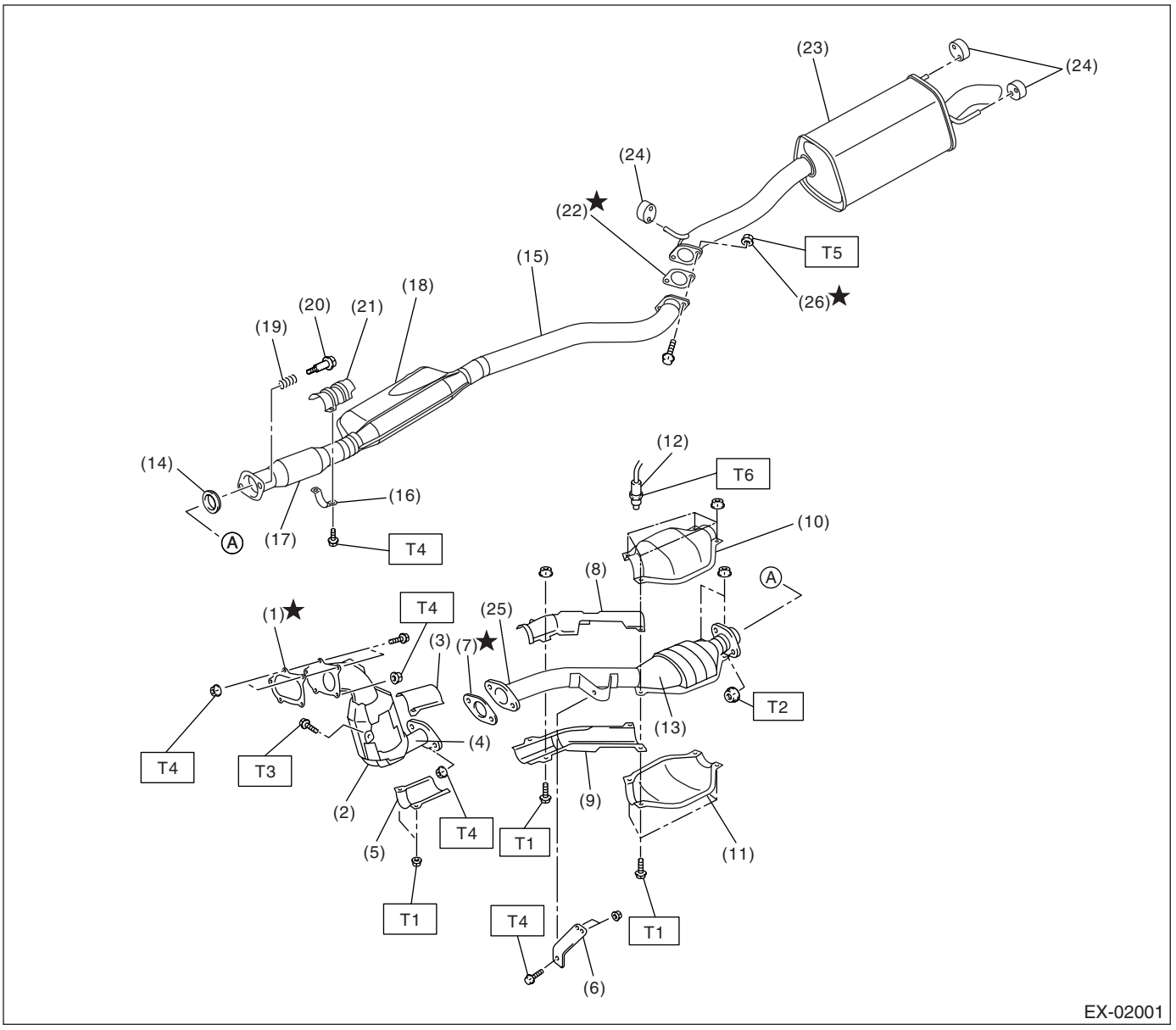
EX-00243

(1) Gasket
(2) Exhaust manifold upper cover (RH)
(3) Exhaust manifold (RH)
(4) Exhaust manifold lower cover (RH)
(5) Front exhaust pipe upper cover
(6) Front exhaust pipe upper insulator (RH)
(7) Gasket
(8) Front exhaust pipe
(9) Front exhaust pipe lower insulator (RH)
(10) Front exhaust pipe lower cover
(11) Gasket
(12) Exhaust manifold upper cover (LH)
(13) Exhaust manifold lower cover (LH)
(14) Gasket
(15) Turbocharger joint pipe
(16) Gasket
(17) Front oxygen (A/F) sensor
(18) Exhaust temperature sensor
(19) Precatalytic converter
(20) Front exhaust pipe upper insulator (LH)
(21) Front exhaust pipe lower insulator (LH)
(22) Exhaust manifold (LH)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 19 (1.9, 13.7)
T2: 7.5 (0.8, 5.5)
T3: 35 (3.6, 26.0)
T4: 40 (4, 28.9)
T5: <Ref. to FU(H4DOTC)-38, INSTALLATION, Front Oxygen (A/F) Sensor.>
T6: <Ref. to FU(H4DOTC)-42, INSTALLATION, Exhaust Temperature Sensor.>

2. CENTER AND REAR EXHAUST PIPE, AND MUFFLER



(1) Gasket
(2) Front catalytic converter
(3) Center pipe upper cover (Front)
(4) Center exhaust pipe (Front)
(5) Center pipe lower cover (Front)
(6) Bracket
(7) Gasket
(8) Center pipe upper cover (Rear)
(9) Center pipe lower cover (Rear)
(10) Rear catalytic converter upper cover
(11) Rear catalytic converter lower cover
(12) Rear oxygen sensor
(13) Rear catalytic converter
(14) Gasket
(15) Rear exhaust pipe
(16) Clamp
(17) Chamber (Front)
(18) Chamber (Rear)
(19) Spring
(20) Bolt
(21) Rear exhaust pipe upper cover (Front)
(22) Gasket
(23) Muffler
(24) Cushion rubber
(25) Center exhaust pipe (Rear)
(26) Self-locking nut

Tightening torque: N·m (kgf-m, ft-lb)

T1: 13 (1.3, 9.6)
T2: 18 (1.8, 13.0)
T3: 30 (3.1, 22.4)
T4: 35 (3.6, 26.0)
T5: 48 (4.9, 35.4)
T6: <Ref. to FU(H4DOTC)-40, INSTALLATION, Rear Oxygen Sensor.>

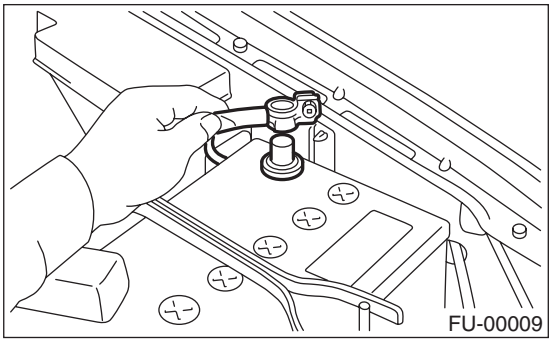
B: CAUTION

• 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.

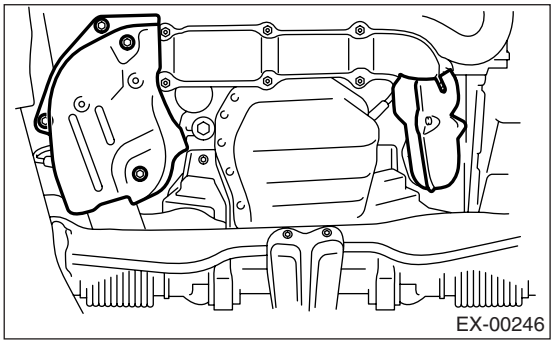
2. Front Exhaust Pipe

A: REMOVAL

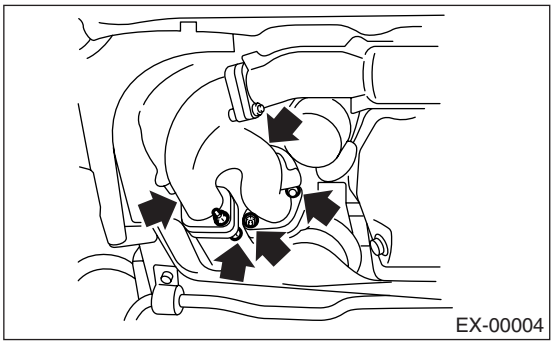
1) Disconnect the ground cable from battery.

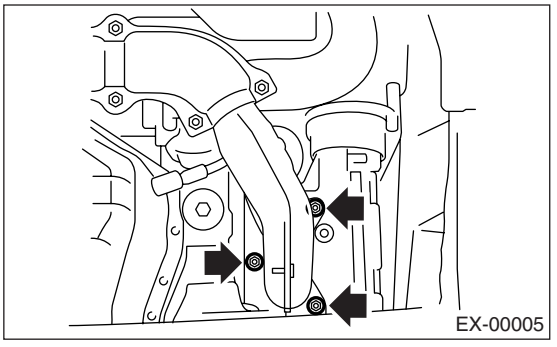


2) Remove the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, REMOVAL, Front Oxygen (A/F) Sensor.>
3) Remove the under cover.
4) Remove the lower exhaust manifold cover (RH).
5) Remove the lower and upper exhaust manifold covers (LH).

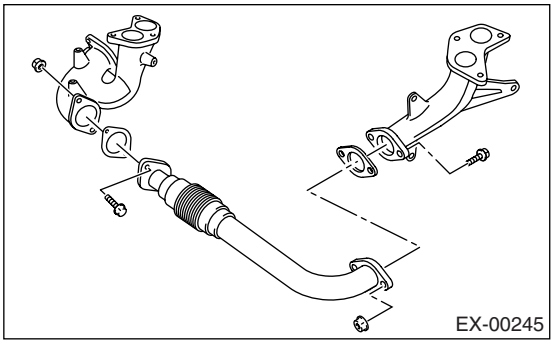


6) Remove the nuts and bolts which hold the front exhaust pipe assembly to turbocharger joint pipe.
7) While holding the front exhaust pipe assembly with one hand, remove the nuts which hold the front exhaust pipe assembly to cylinder head exhaust port.





8) Remove the front exhaust pipe assembly.
9) Remove the covers from exhaust manifold and front exhaust pipe.
10) Separate the front exhaust pipe from exhaust manifolds.

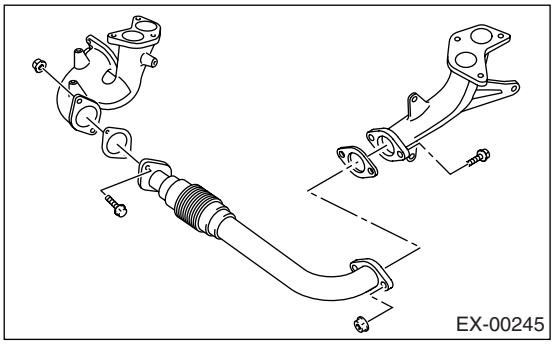


B: INSTALLATION

NOTE:
Replace the gaskets with new ones.

1) Assemble the front exhaust pipe and exhaust manifolds.

Tightening torque:
35 N·m (3.6 kgf-m, 26.0 ft-lb)



2) Install the front exhaust pipe covers.

Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

3) Install the upper exhaust manifold cover (RH).

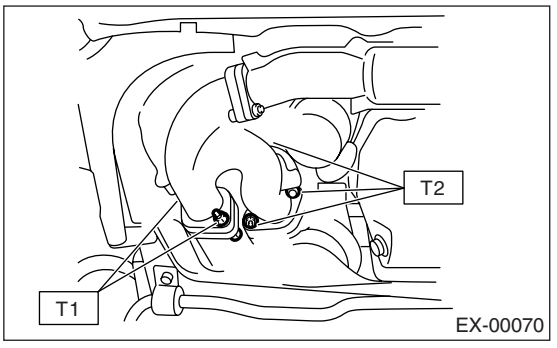
Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)

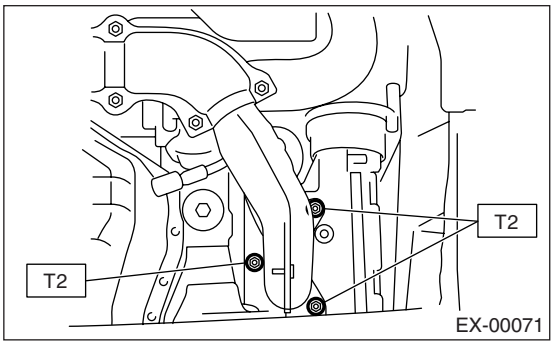
4) Install the front exhaust pipe assembly.

Tightening torque:
35 N·m (3.6 kgf-m, 26.0 ft-lb)

5) Connect the exhaust manifold (RH) to turbocharger joint pipe.

Tightening torque:
T1: 35 N·m (3.6 kgf-m, 26.0 ft-lb)
T2: 40 N·m (4.0 kgf-m, 28.9 ft-lb)



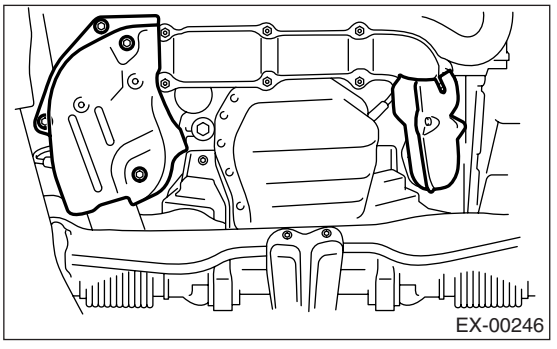


6) Install the upper and lower exhaust manifold covers (LH).

Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)

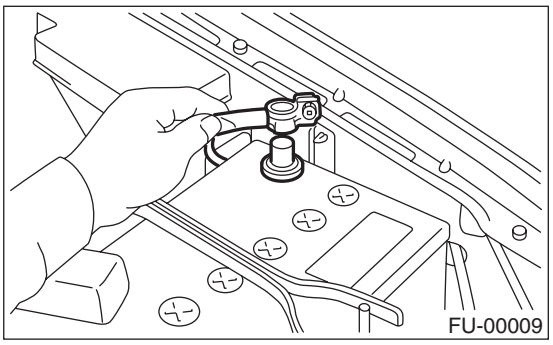
7) Install the lower exhaust manifold cover (RH).

Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)



8) Install the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, INSTALLATION, Front Oxygen (A/F) Sensor.>
9) Install the under cover.

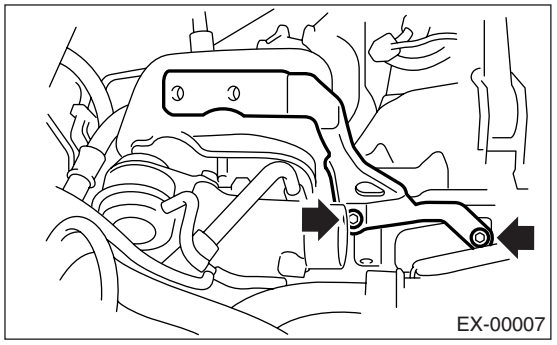
10) Connect the battery ground cable to battery.



3. Center Exhaust Pipe

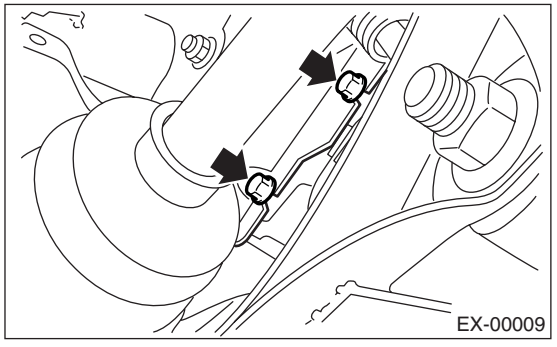
A: REMOVAL

1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.
3) Remove the intercooler. <Ref. to IN(H4DOTC)-10, REMOVAL, Intercooler.>
4) Remove the intercooler bracket.

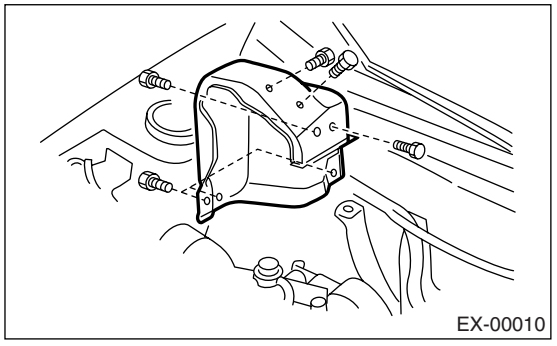

EX-00007

5) Lift-up the vehicle.
6) Remove the under cover.
7) Remove the bolts which install the lower side of turbocharger upper cover.

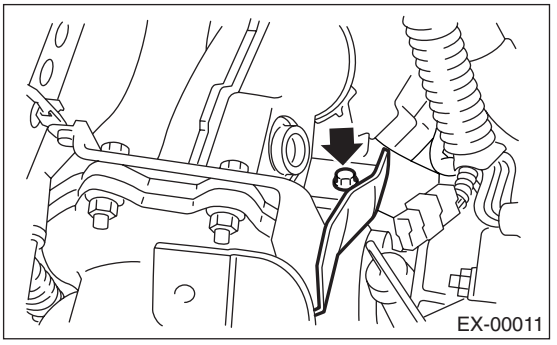
CAUTION:
Be careful, the turbocharger and exhaust pipe are hot.


EX-00009

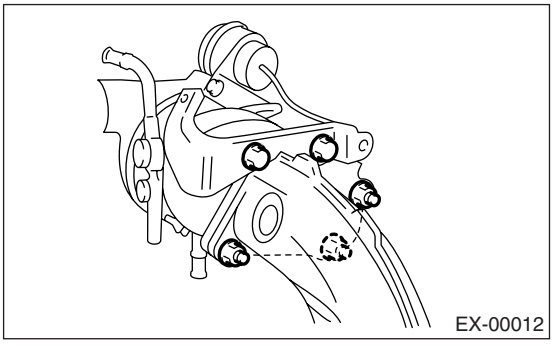
8) Lower the vehicle.
9) Remove the turbocharger upper cover.


EX-00010

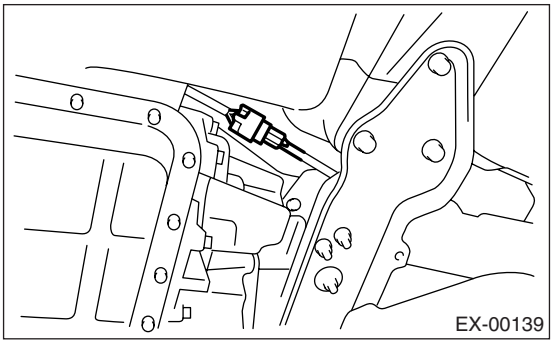
10) Remove the bolts which install the lower upper side of turbocharger upper cover, and remove it.


EX-00011

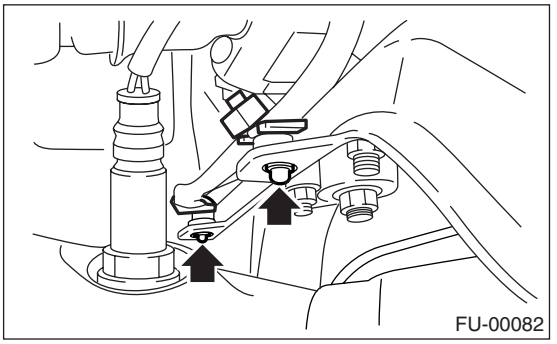
11) Separate the center exhaust pipe from turbocharger.


EX-00012

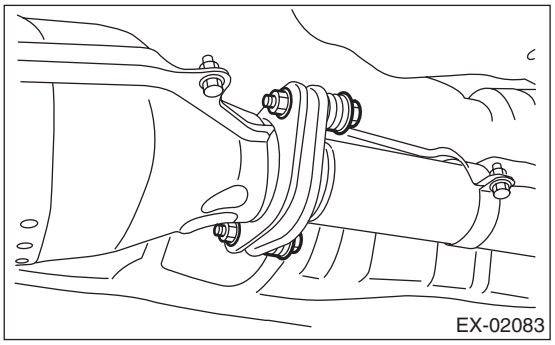
12) Lift-up the vehicle.
13) Disconnect the connector from rear oxygen sensor.


EX-00139

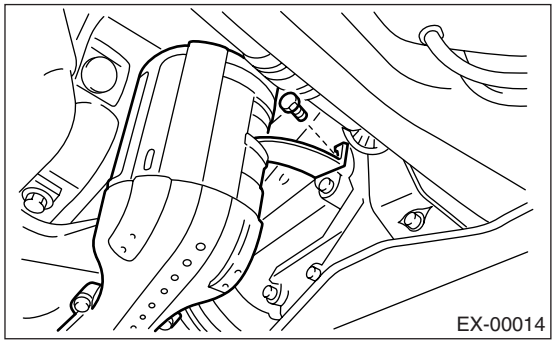
14) Vertically draw out the clip from crossmember.


FU-00082

15) Separate the center exhaust pipe from rear exhaust pipe.

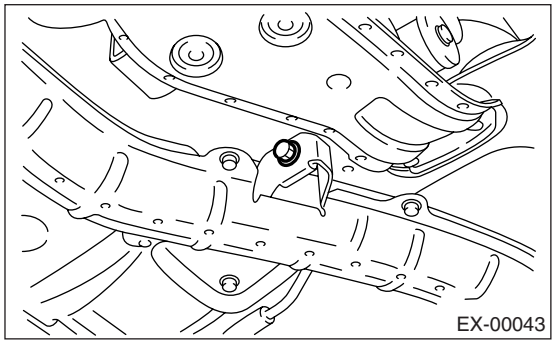


16) Remove the bolt which holds the center exhaust pipe bracket to transmission.

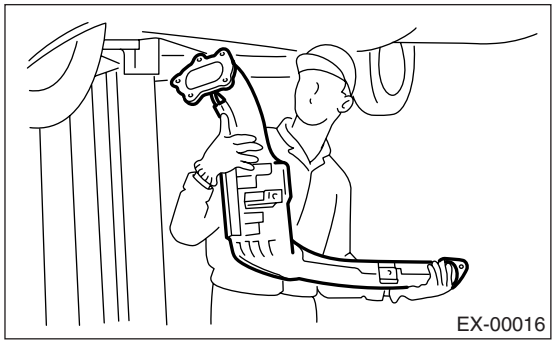


17) Remove the intercooler bracket.
18) Remove the bolt which holds the center exhaust pipe to hanger bracket.

CAUTION:
Be careful not to pull down the center exhaust pipe.



19) Remove the center exhaust pipe.

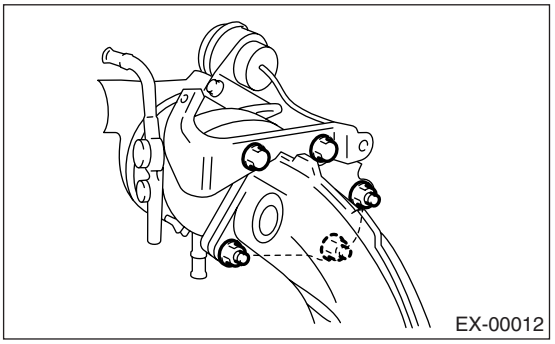


B: INSTALLATION

NOTE:
Replace the gaskets with new ones.

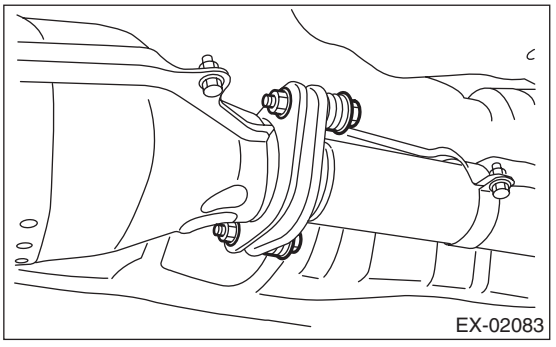
1) Install the center exhaust pipe and temporarily tighten the bolt which holds the center exhaust pipe to hanger bracket.
2) Temporarily tighten the bolt which holds the center pipe to transmission.
3) Connect the center exhaust pipe to turbocharger.

Tightening torque:
35 N·m (3.6 kgf-m, 26.0 ft-lb)

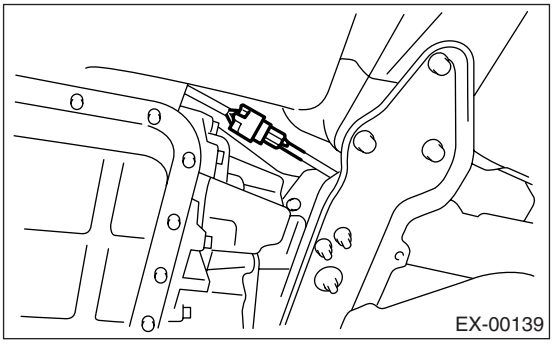


4) Install the center exhaust pipe to rear exhaust pipe.

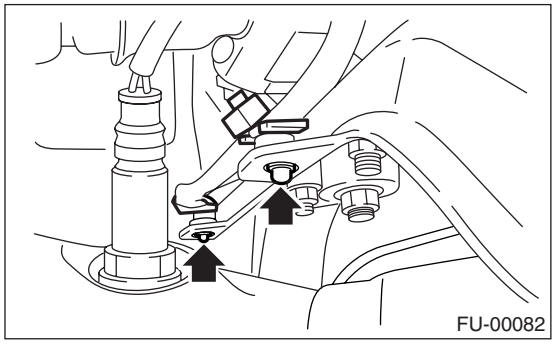
Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



5) Connect the connector to rear oxygen sensor.

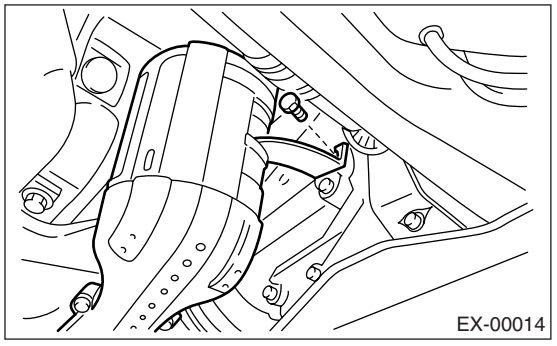


6) Secure the clip on crossmember.



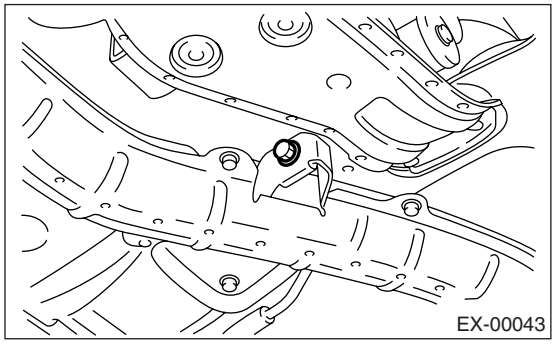
7) Tighten the bolt which holds the center exhaust pipe bracket to transmission.

Tightening torque:
30 N·m (3.1 kgf-m, 22.4 ft-lb)



8) Tighten the bolt which holds the center exhaust pipe to hanger bracket.

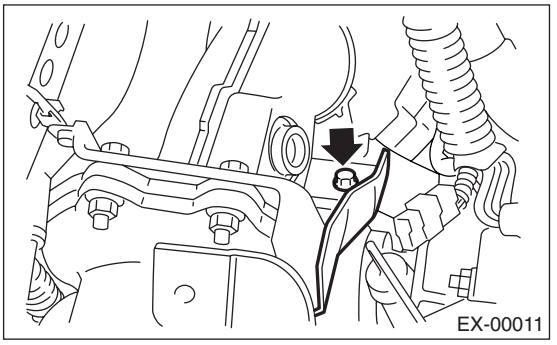
Tightening torque:
35 N·m (3.6 kgf-m, 26.0 ft-lb)



9) Lower the vehicle.

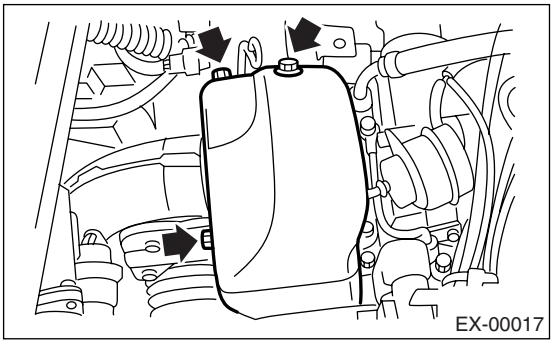
10) Place the turbocharger lower cover, and tighten the bolts which install the upper side of lower cover.

Tightening torque:
7.4 N·m (0.75 kgf-m, 5.4 ft-lb)



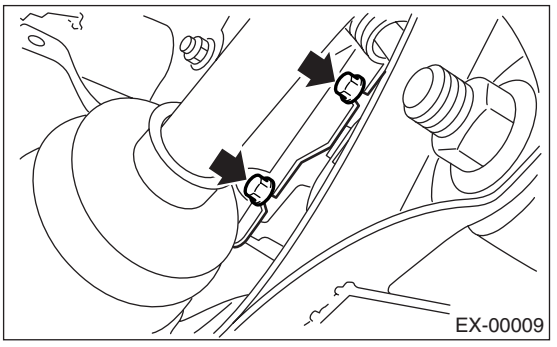
11) Place the turbocharger upper cover, and tighten the bolts which install the upper side of upper cover.

Tightening torque:
7.4 N·m (0.75 kgf-m, 5.4 ft-lb)



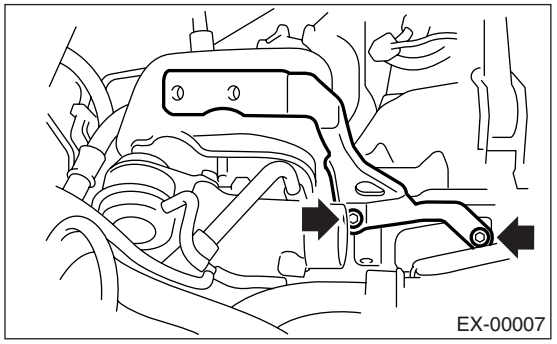
12) Lift-up the vehicle.
13) Tighten the bolts which install the under side of turbocharger upper cover.

Tightening torque:
7.4 N·m (0.75 kgf-m, 5.4 ft-lb)



14) Install the under cover.
15) Lower the vehicle.

16) Install the intercooler bracket.

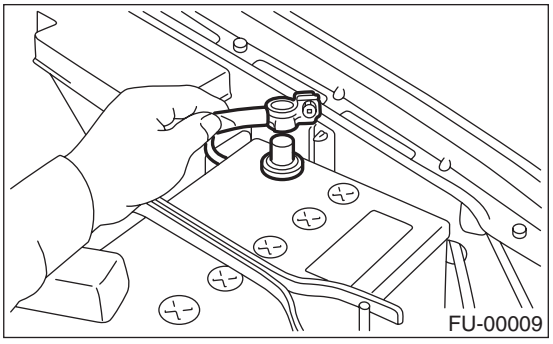


17) Install the intercooler. <Ref. to IN(H4DOTC)-11, INSTALLATION, Intercooler.>

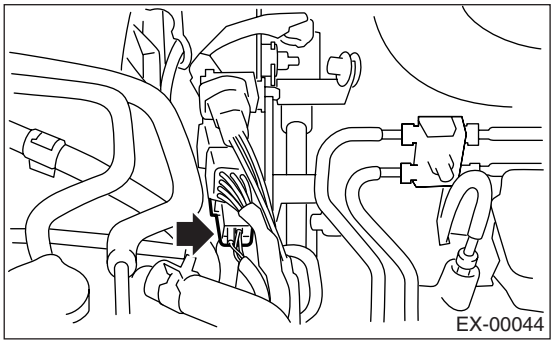
4. Joint Pipe

A: REMOVAL

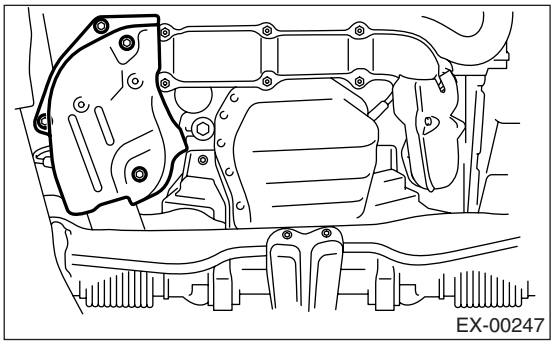
1) Disconnect the ground cable from battery.



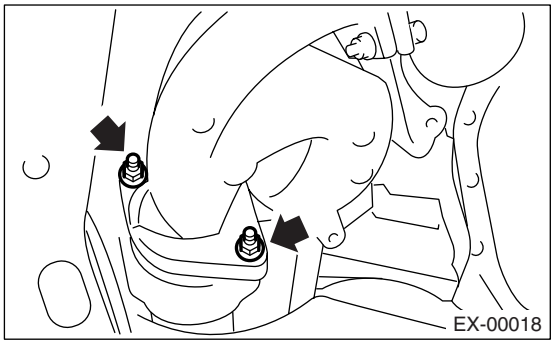
2) Disconnect the exhaust temperature sensor connector.



3) Remove the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-38, REMOVAL, Front Oxygen (A/F) Sensor.>
4) Remove the under cover.
5) Remove the lower exhaust manifold cover (RH).



6) Remove the nuts which hold the front exhaust manifold to joint pipe.

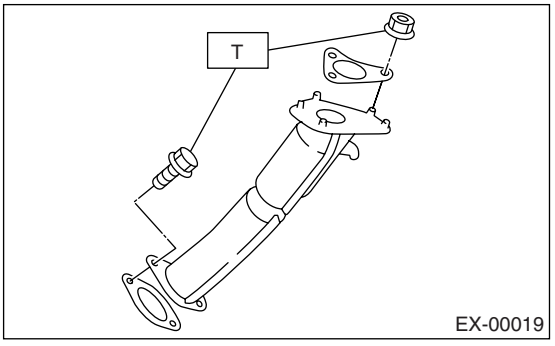


7) Remove the center exhaust pipe. <Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
8) Remove the turbocharger. <Ref. to IN(H4DOTC)-12, REMOVAL, Turbocharger.>
9) Take off the joint pipe in the upward direction.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
T: 35 N·m (3.6 kgf-m, 26.0 ft-lb)

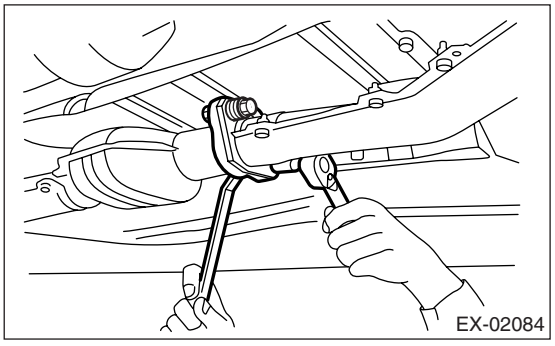


5. Rear Exhaust Pipe

A: REMOVAL

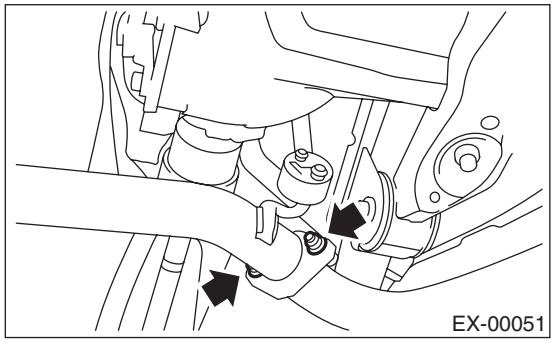
1) Lift-up the vehicle.
2) Separate the rear exhaust pipe from center exhaust pipe.

CAUTION:
Be careful, the exhaust pipe is hot.



3) Separate the rear exhaust pipe from muffler.

CAUTION:
Be careful not to pull down the rear exhaust pipe.



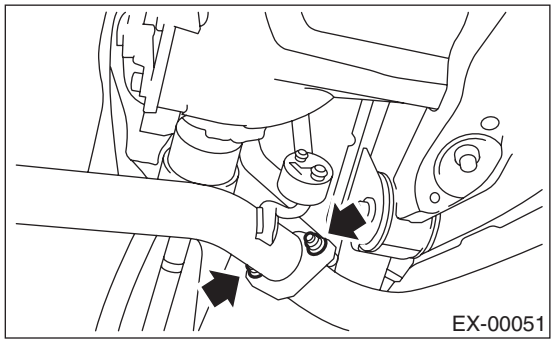
4) Remove the rear exhaust pipe.

B: INSTALLATION

NOTE:
Replace the gaskets with new ones.

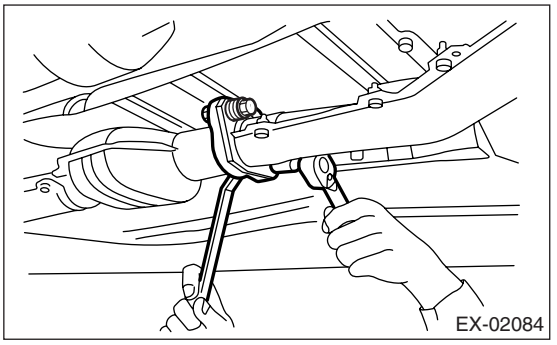
1) Install the rear exhaust pipe to muffler.

Tightening torque:
48 N·m (4.9 kgf-m, 35.4 ft-lb)



2) Install the rear exhaust pipe to center exhaust pipe.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



3) Lower the vehicle.

C: INSPECTION

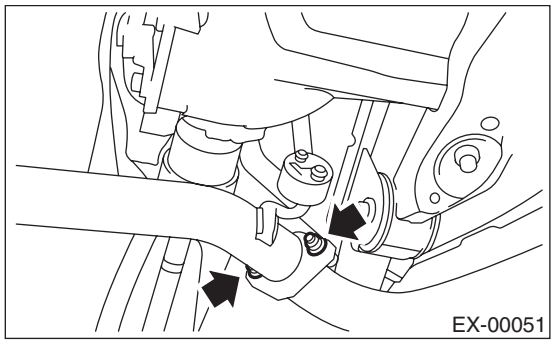
1) Make sure there are no exhaust leaks from connections and welds.
2) Make sure there are no holes or rusting.
3) Make sure the cushion rubber is not worn or cracked.

6. Muffler

A: REMOVAL

1) Separate the muffler from rear exhaust pipe.

CAUTION:
Be careful, the exhaust pipe is hot.

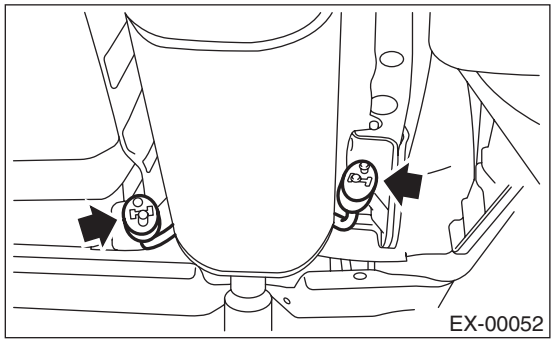


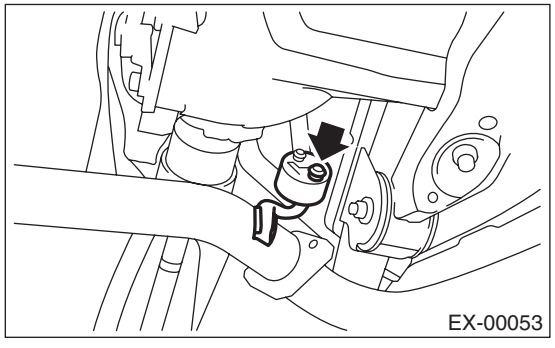
2) Remove the rubber cushions, and detach the muffler.

CAUTION:
Be careful not to drop the muffler during removal.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to the mating area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)



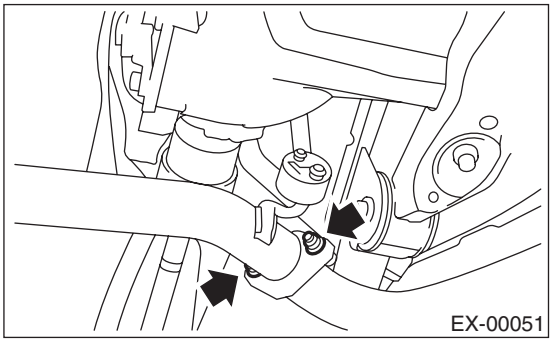


B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Replace the gasket and self-locking nut with a new one.

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.

MUFFLER

MEMO:

1. General Description

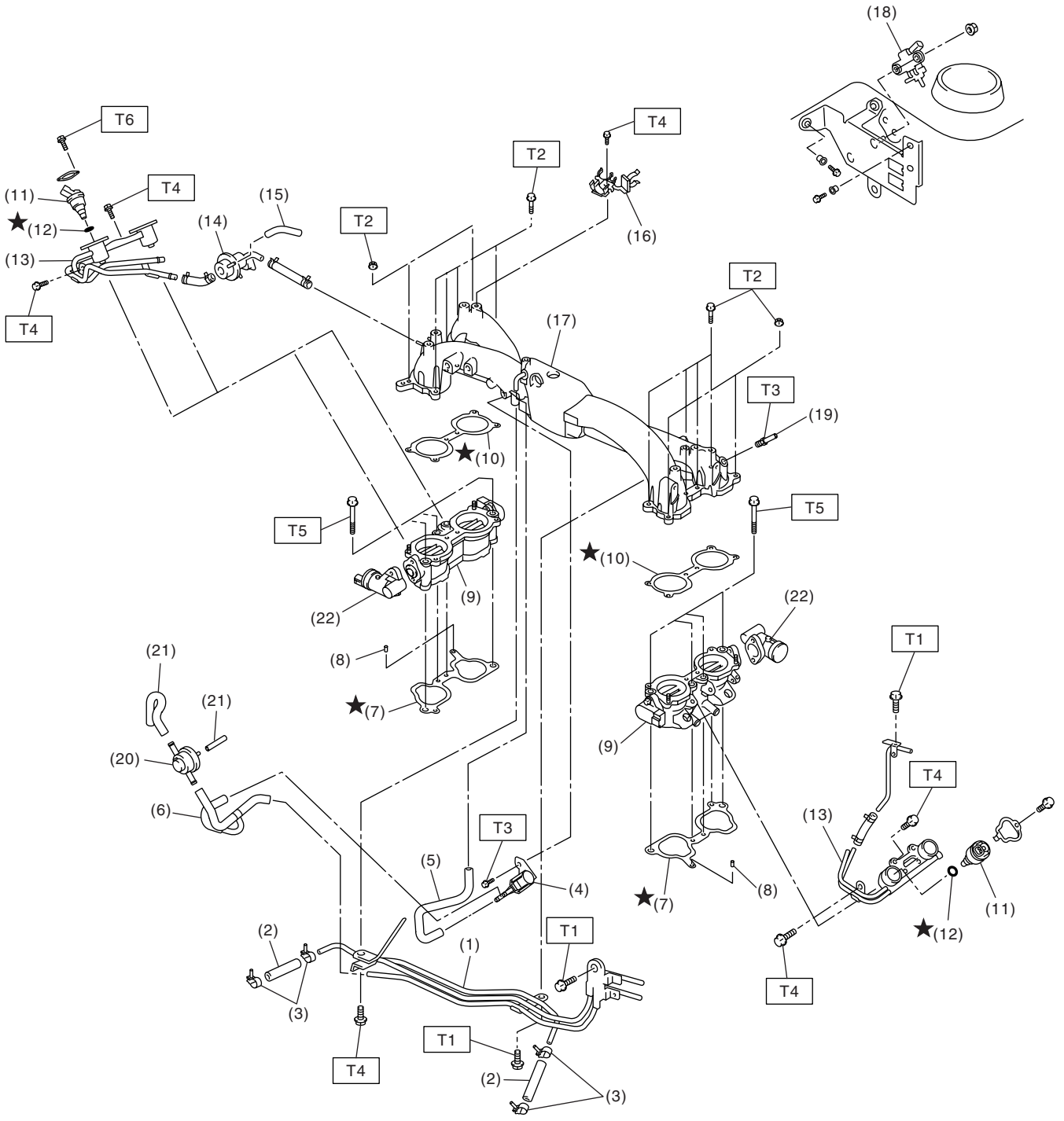
A: SPECIFICATIONS

Fuel tank	Capacity	64 ℓ (16.9 US gal, 14.1 Imp gal)
	Location	Under rear seat
Fuel pump	Type	Impeller
	Shutoff discharge pressure	450 — 677 kPa (4.59 — 6.9 kg/cm^2, 65.27 — 98.2 psi)
	Discharge flow	More than 130 ℓ (34.3 US gal, 28.6 Imp gal)/h [12 V at 300 kPa (3.06 kg/cm^2, 43.5 psi)]
Fuel filter		Cartridge type

MEMO:

B: COMPONENT

1. INTAKE MANIFOLD

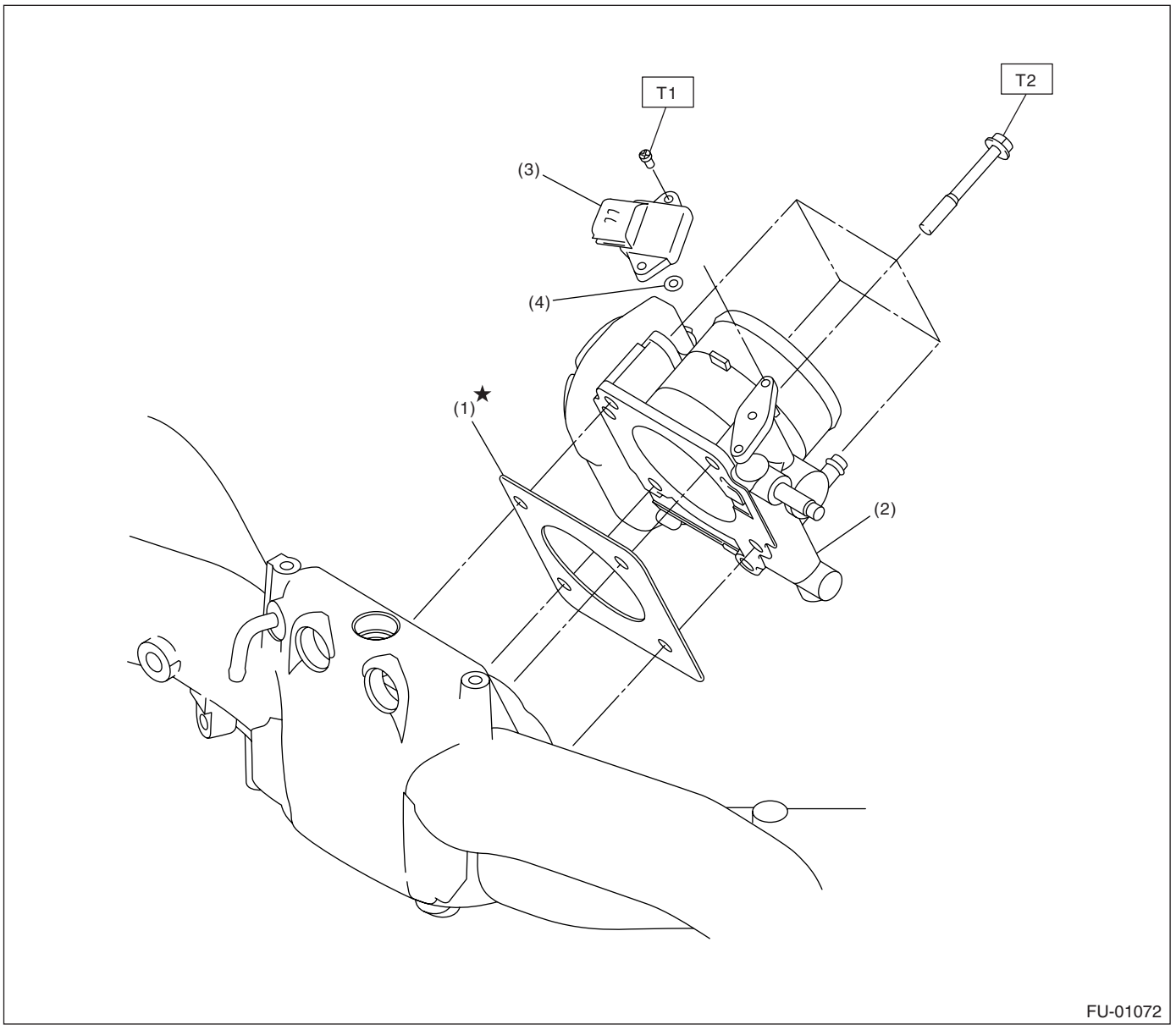


FU-02548

(1) Fuel pipe ASSY
(2) Fuel hose
(3) Clip
(4) Purge control solenoid valve
(5) Vacuum hose
(6) Vacuum control hose
(7) Intake manifold gasket
(8) Guide pin
(9) Tumble generator valve ASSY
(10) Tumble generator valve gasket
(11) Fuel injector
(12) O-ring
(13) Fuel injector pipe
(14) Pressure regulator
(15) Pressure regulator hose
(16) Blow-by hose stay
(17) Intake manifold
(18) Wastegate control solenoid valve ASSY
(19) Nipple
(20) Purge valve
(21) Purge hose
(22) Tumble generator valve actuator

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.65, 4.8)
T2: 8.25 (0.84, 6.1)
T3: 17 (1.73, 12.5)
T4: 19 (1.94, 13.7)
T5: 25 (2.5, 18.1)
T6: 3.5 (0.36, 2.6)

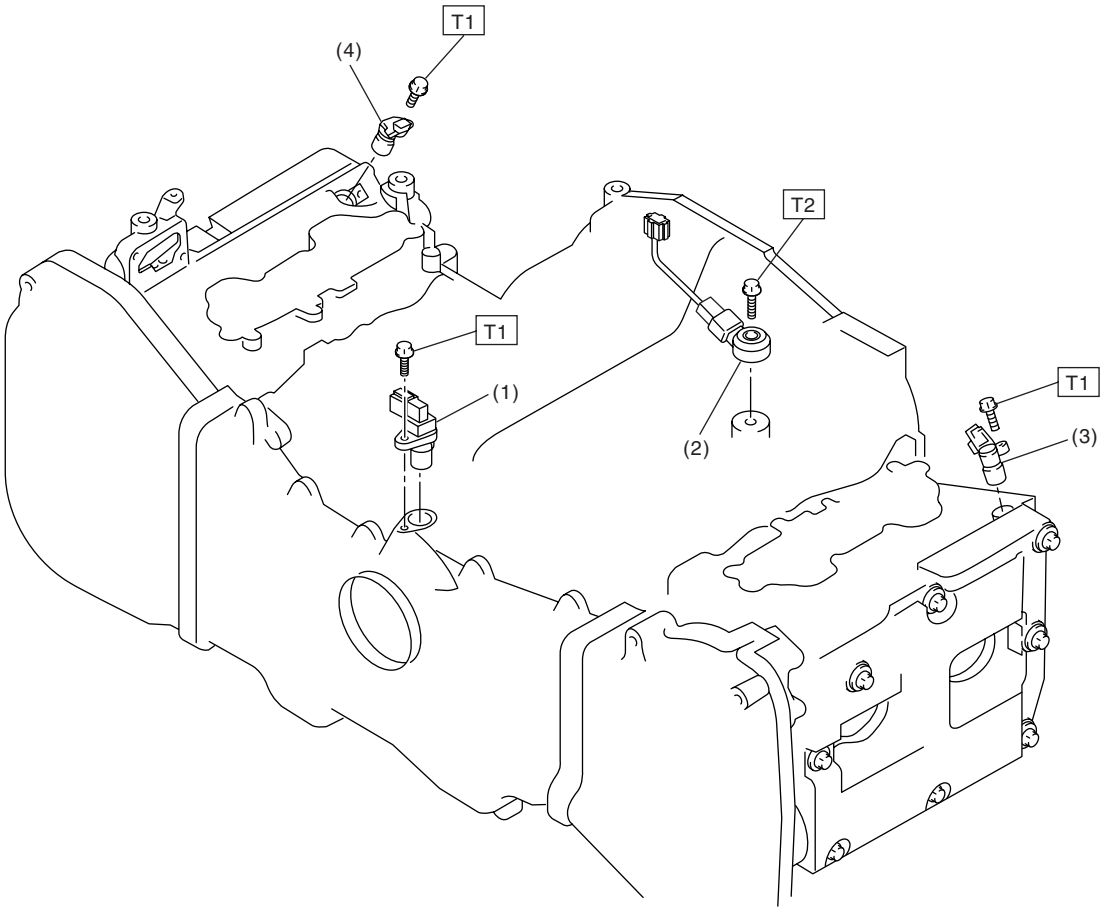
2. AIR INTAKE SYSTEM



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

Tightening torque: N·m (kgf-m, ft-lb)
T1: 2 (0.20, 1.5)
T2: 8 (0.8, 5.8)

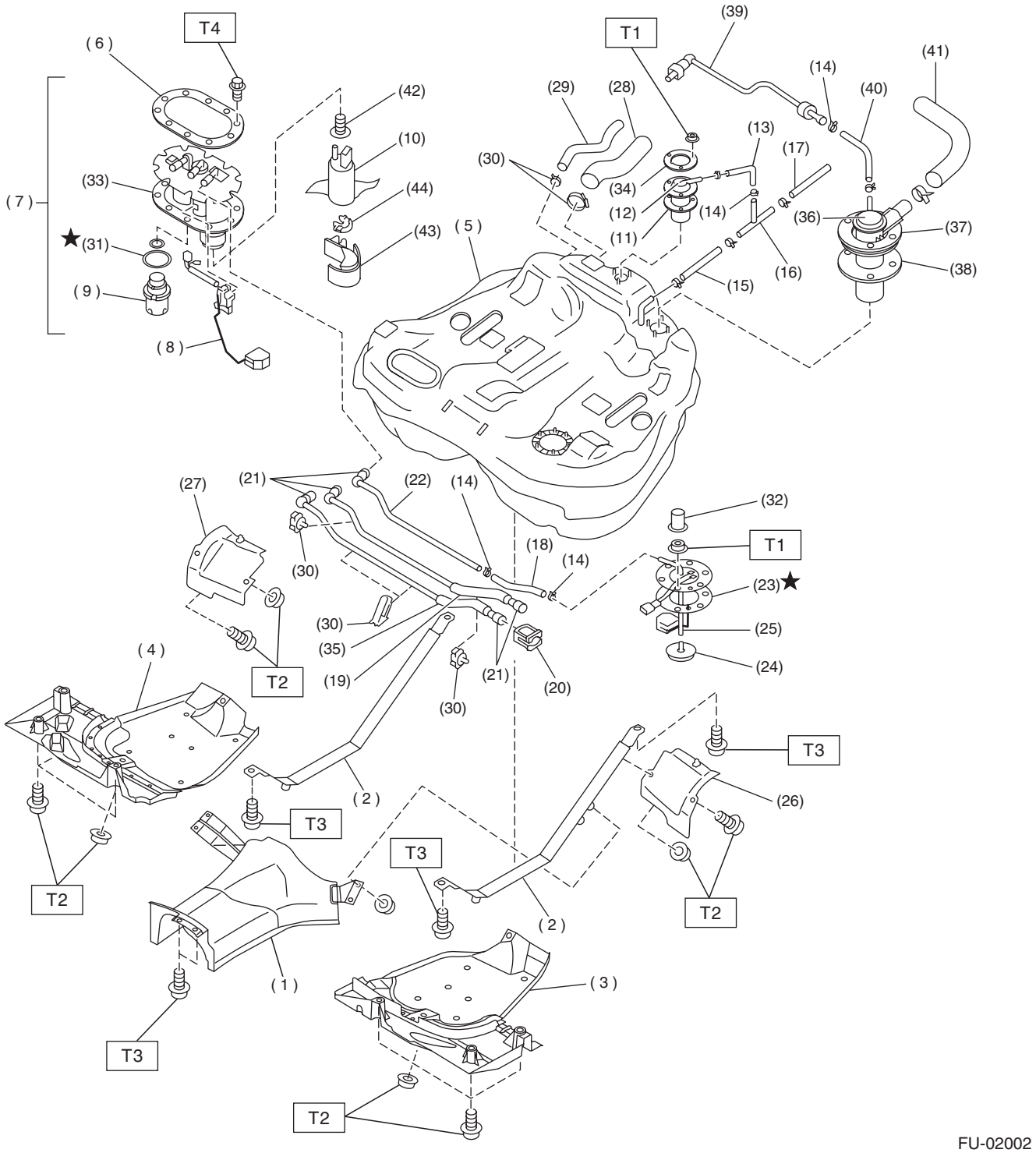
3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



(1) Crankshaft position sensor
(2) Knock sensor
(3) Camshaft position sensor LH
(4) Camshaft position sensor RH

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.65, 4.7)
T2: 24 (2.4, 17.4)

4. FUEL TANK

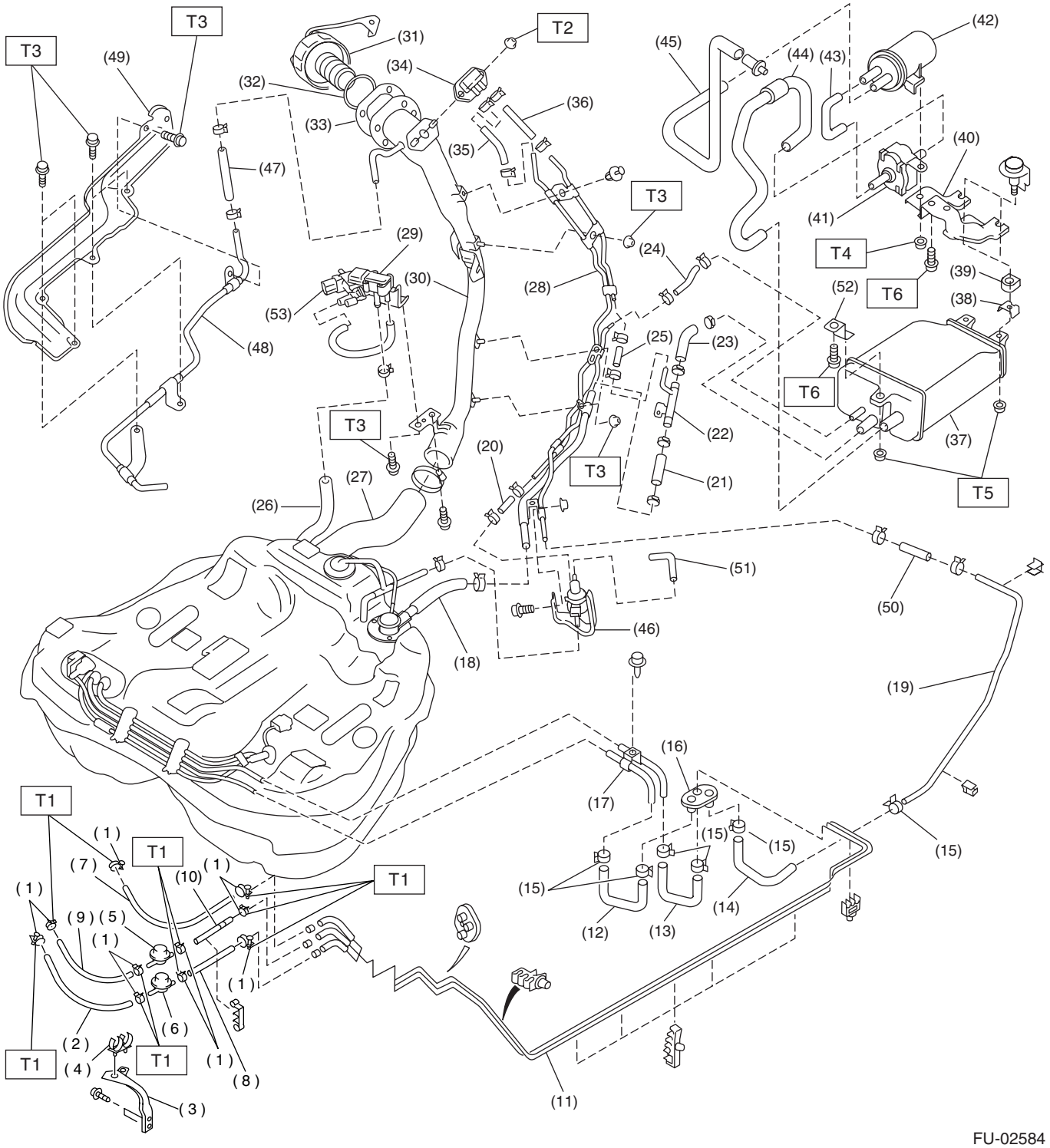


FU-02002

(1) Heat sealed cover
(2) Fuel tank band
(3) Protector LH (Front)
(4) Protector RH (Front)
(5) Fuel tank
(6) Fuel pump plate
(7) Fuel pump ASSY
(8) Fuel level sensor
(9) Fuel filter
(10) Fuel pump
(11) Fuel cut valve gasket
(12) Fuel cut valve
(13) Evaporation hose A
(14) Clip
(15) Evaporation hose C
(16) Joint pipe
(17) Evaporation hose B
(18) Jet pump hose
(19) Fuel return tube
(20) Retainer
(21) Quick connector
(22) Jet pump tube
(23) Fuel sub level sensor gasket
(24) Jet pump filter
(25) Fuel sub level sensor
(26) Protector LH (Rear)
(27) Protector RH (Rear)
(28) Fuel filler hose
(29) Fuel tank pressure sensor hose
(30) Clamp
(31) Gasket
(32) Cap
(33) Gasket
(34) Fuel cut valve plate
(35) Fuel delivery tube
(36) Vent valve
(37) Vent valve plate
(38) Vent valve gasket
(39) Evaporation tube
(40) Evaporation hose D
(41) Air vent hose
(42) Seal
(43) Fuel pump holder
(44) Grommet

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.4 (0.45, 3.3)
T2: 18 (1.8, 13.0)
T3: 33 (3.4, 25)
T4: 5.9 (0.6, 4.3)

5. Fuel Line


T1
T2
T3
T4
T5
T6
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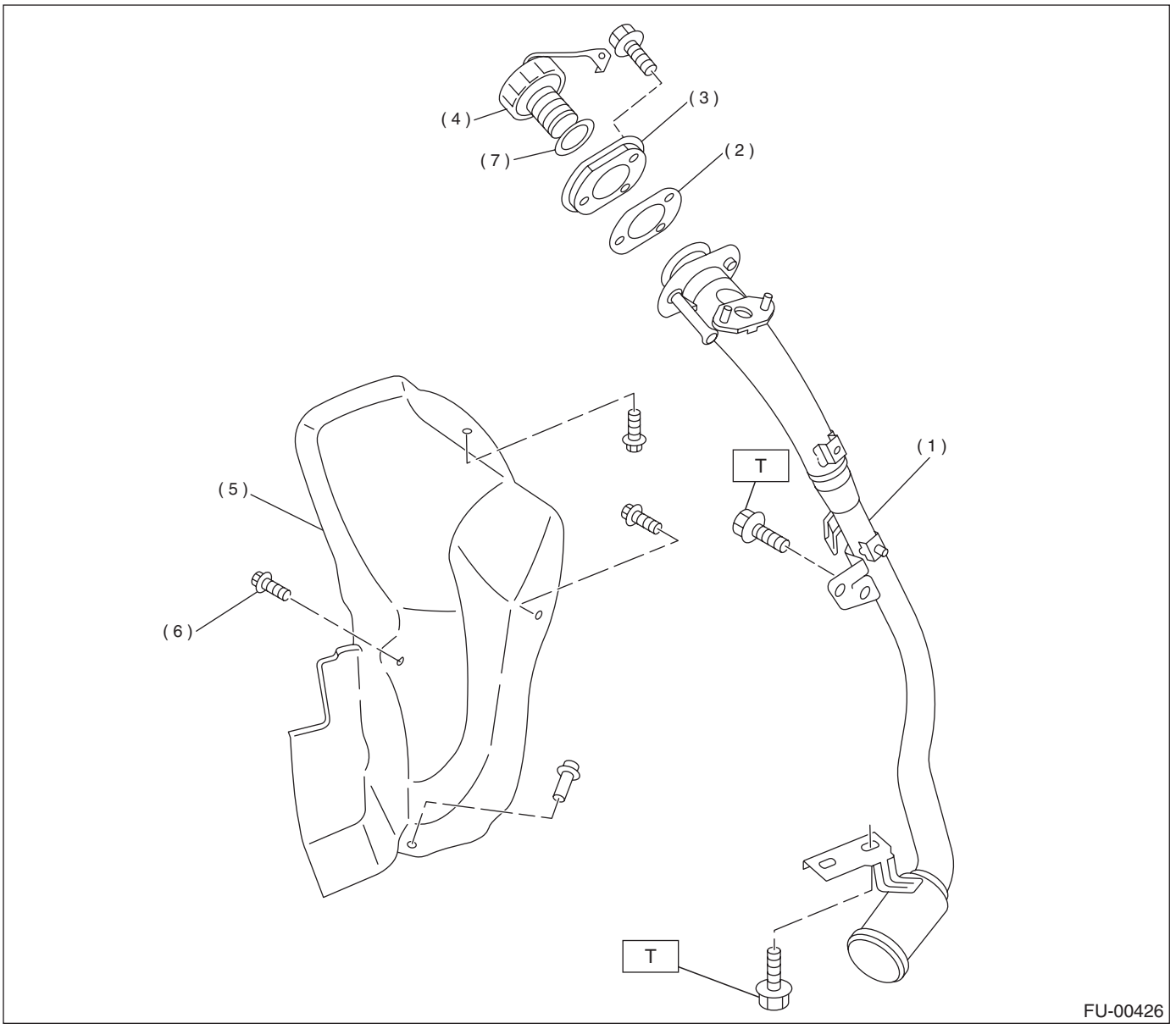
FU-02584

(1) Clamp
(2) Fuel delivery hose A
(3) Bracket
(4) Clamp
(5) Fuel damper (return)
(6) Fuel damper (delivery)
(7) Evaporation hose F
(8) Fuel delivery hose B
(9) Fuel return hose A
(10) Fuel return hose B
(11) Fuel pipe ASSY
(12) Fuel delivery hose C
(13) Fuel return hose C
(14) Evaporation hose G
(15) Clamp
(16) Grommet
(17) Fuel pipe ASSY
(18) Air vent hose A
(19) Evaporation pipe A
(20) Evaporation hose H
(21) Air vent hose B
(22) Air vent pipe
(23) Evaporation hose I
(24) Evaporation hose J
(25) Evaporation hose K
(26) Fuel tank pressure sensor hose
(27) Fuel filler hose
(28) Evaporation pipe B
(29) Fuel tank pressure sensor
(30) Fuel filler pipe
(31) Fuel filler cap
(32) Ring B
(33) Packing
(34) Shut valve
(35) Evaporation hose L
(36) Evaporation hose M
(37) Canister
(38) Canister lower bracket
(39) Cushion rubber
(40) Canister upper bracket
(41) Drain valve
(42) Drain filter
(43) Drain filter hose A
(44) Drain valve hose
(45) Drain filter hose B
(46) Pressure control solenoid valve
(47) Evaporation hose N
(48) Evaporation pipe C
(49) Pipe protector
(50) Evaporation hose O
(51) Pressure control solenoid valve hose
(52) Canister bracket (front)
(53) Fuel tank sensor control valve

Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.5 (0.15, 1.1)
T2: 4.5 (0.46, 3.3)
T3: 7.5 (0.76, 5.5)
T4: 18 (1.8, 13.0)
T5: 23 (2.3, 16.6)
T6: 33 (3.4, 25)

6. Fuel Filler Pipe



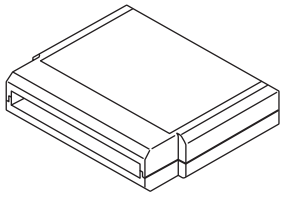
(1) Fuel filler pipe ASSY
(2) Filler pipe packing
(3) Filler ring
(4) Filler cap
(5) Filler pipe protector
(6) Clip
(7) Ring B

Tightening torque: N·m (kgf-m, ft-lb)
T: 7.5 (0.75, 5.4)

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 negative terminal from battery.
- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

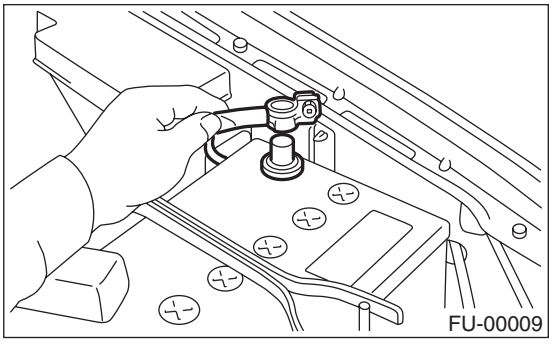
D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA260	24082AA260 (New adopted tool)	CARTRIDGE	Troubleshooting for electrical system.
ST22771AA030	22771AA030	SELECT MONITOR KIT	Troubleshooting for electrical systems.

2. Throttle Body

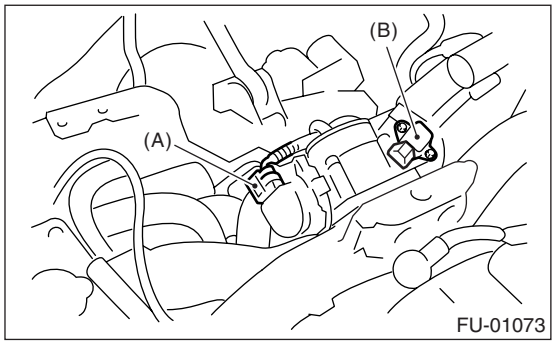
A: REMOVAL

1) Disconnect the ground cable from battery.

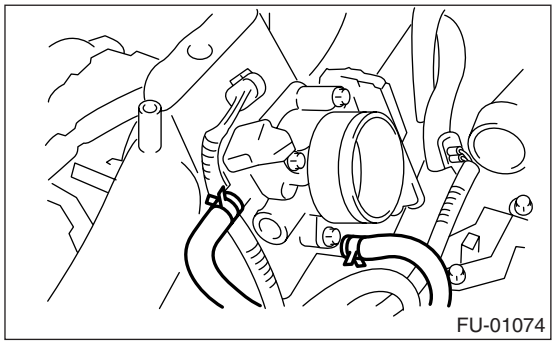


2) Remove the intercooler. <Ref. to IN(H4DOTC)-10, REMOVAL, Intercooler.>

3) Disconnect the connector from the throttle position sensor (A) and manifold absolute pressure sensor (B).



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



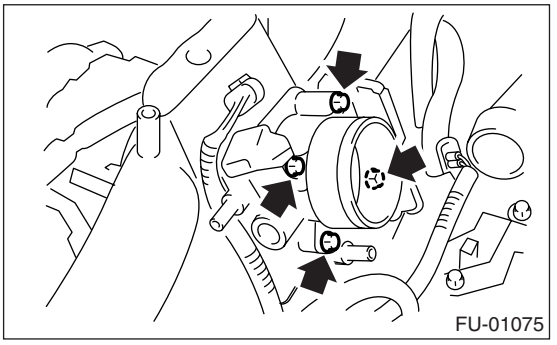
5) Remove the bolts which secure the throttle body to intake manifold.

B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Always use a new gasket.

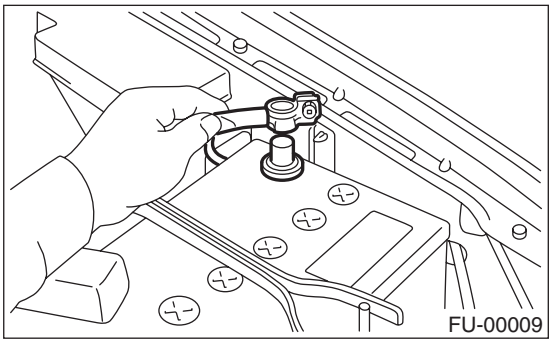
Tightening torque:
8 N·m (0.8 kgf-m, 5.8 ft-lb)



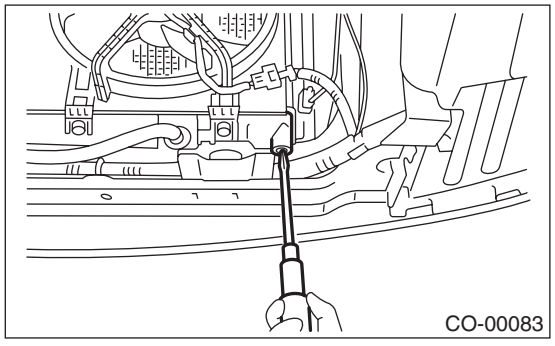
3. Intake Manifold

A: REMOVAL

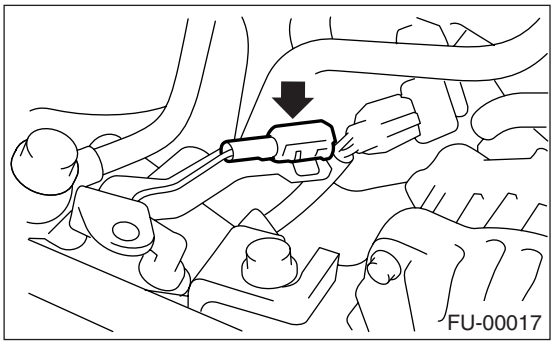
1) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Disconnect the ground cable from battery.



4) Lift up the vehicle.
5) Remove the under cover.
6) Drain the engine coolant about 3.0 ℓ (3.2 US qt, 2.6 Imp qt).

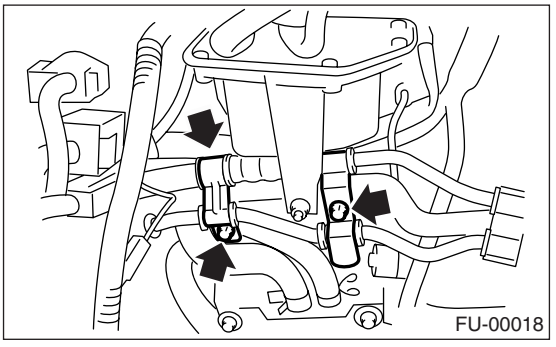


7) Remove the air cleaner upper cover and air intake boot. <Ref. to IN(H4DOTC)-7, REMOVAL, Air Cleaner.>
8) Remove the air cleaner element.
9) Remove the intercooler. <Ref. to IN(H4DOTC)-10, REMOVAL, Intercooler.>
10) Remove the coolant filler tank. <Ref. to CO(H4DOTC)-29, REMOVAL, Coolant Filler Tank.>
11) Remove the power steering pump.
(1) Remove the front side V-belt. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
(2) Disconnect the power steering switch connector.

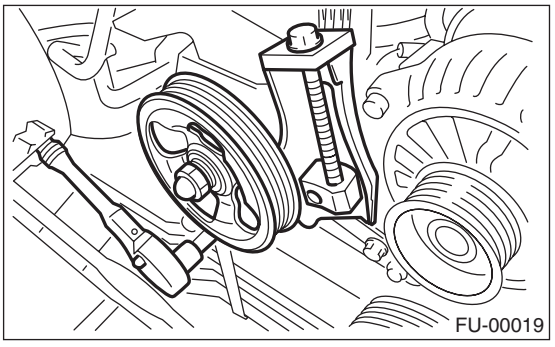


(3) Remove the bolts which secure the power steering pipe brackets to the intake manifold.

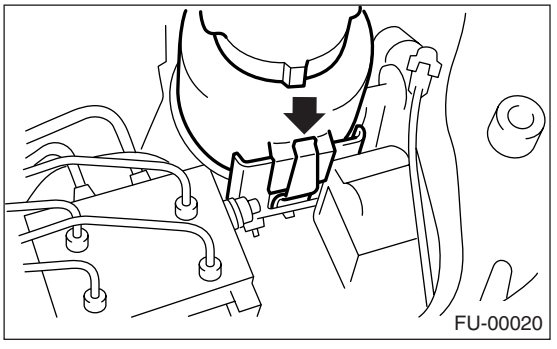
NOTE:
Do not disconnect the power steering hose.



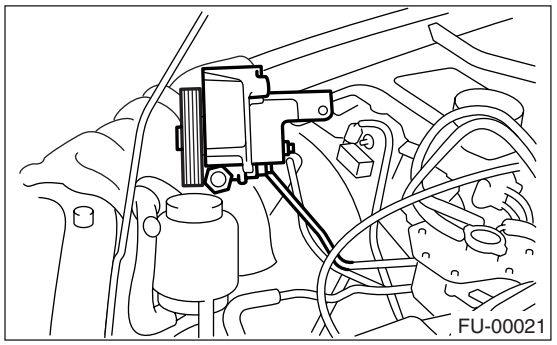
(4) Remove the bolts which secure the power steering pump bracket.



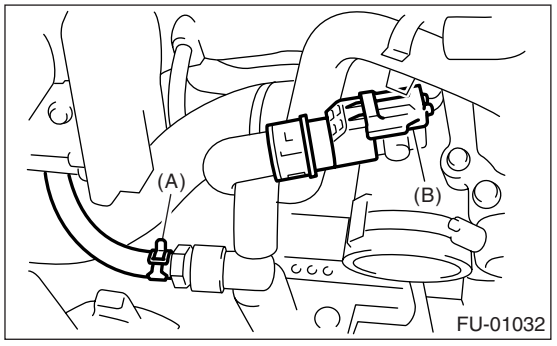
(5) Remove the power steering tank from the bracket by pulling it upward.



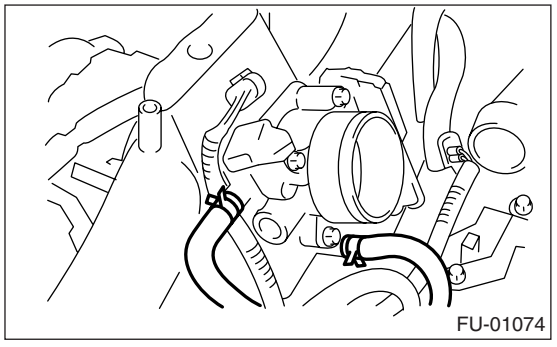
(6) Place the power steering pump on the right side wheel apron.



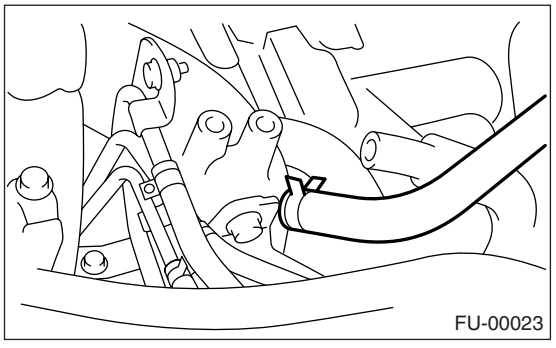
12) Disconnect the emission hose (A) and connector (B) from the PCV hose assembly.



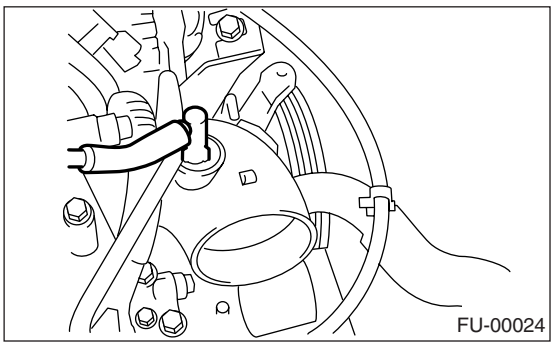
13) Disconnect the engine coolant hoses from the throttle body.



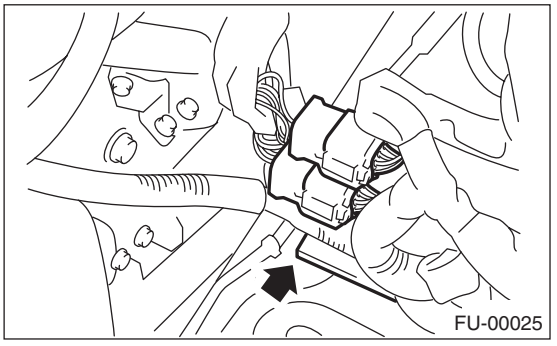
14) Disconnect the brake booster hose.

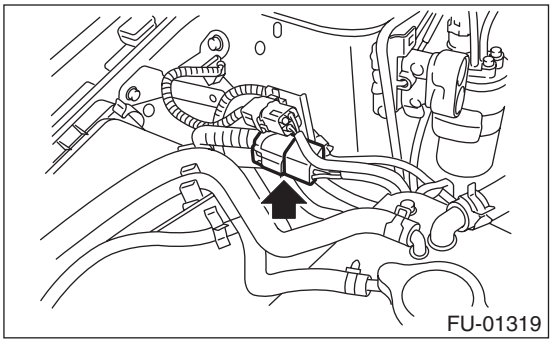


15) Disconnect the pressure hose from the intake duct.

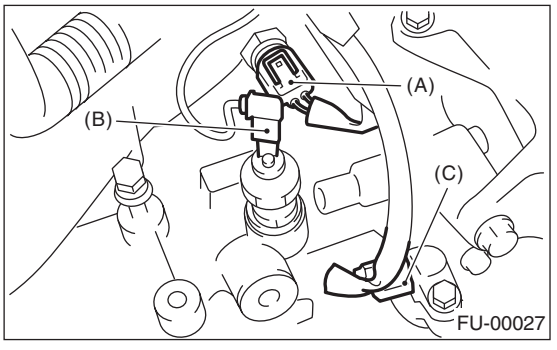


16) Disconnect the engine harness connectors from the bulkhead harness connectors.

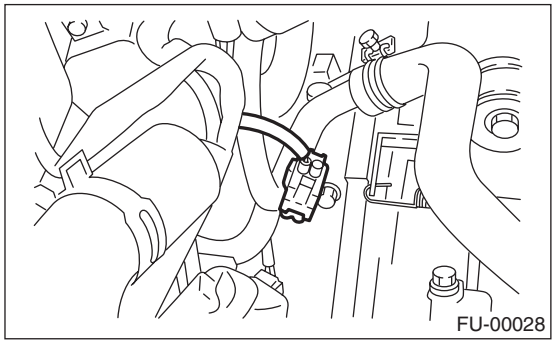




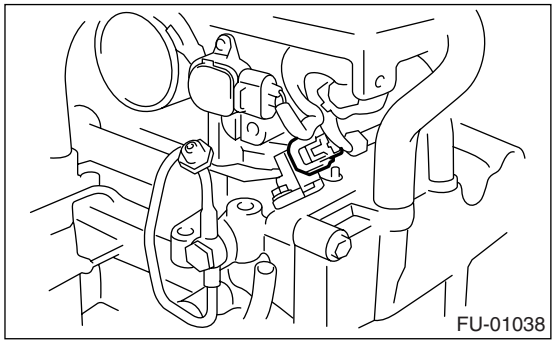
17) Disconnect the connectors from the engine coolant temperature sensor (A), oil pressure switch (B) and crankshaft position sensor (C).



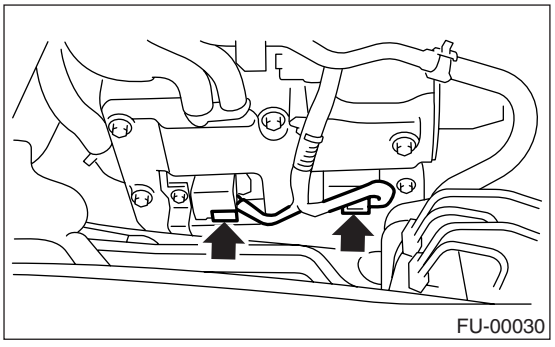
18) Disconnect the knock sensor connector.



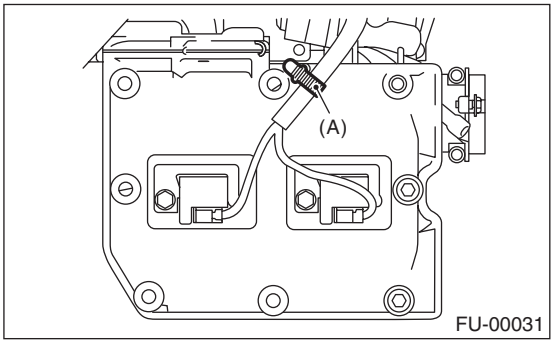
19) Disconnect the connector from the camshaft position sensor.



20) Disconnect the connector from the ignition coil.

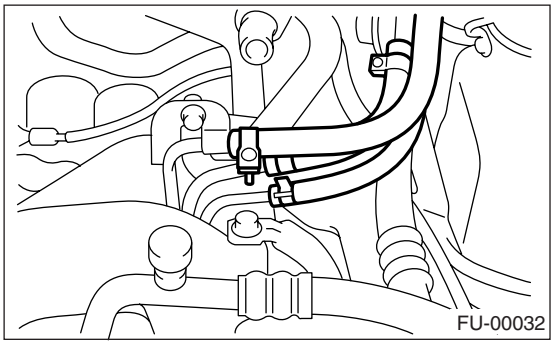


21) Disconnect the engine harness fixed by clip (A) from the bracket.

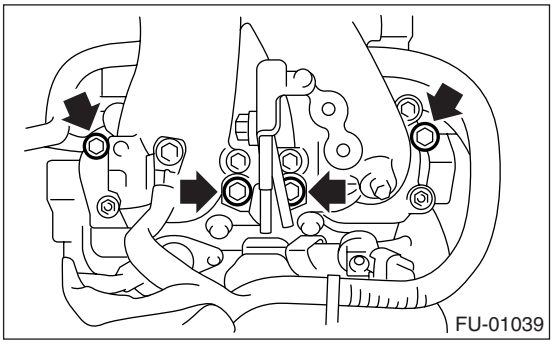


22) Disconnect the fuel delivery hose, return hose and evaporation hose.

CAUTION:
- **Do not spill fuel.**
- **Catch fuel from hoses in a container or cloth.**



23) Remove the bolts which secure the intake manifold to the cylinder heads.



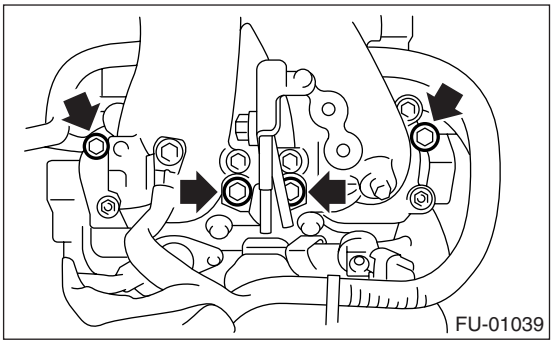
24) Remove the intake manifold.

B: INSTALLATION

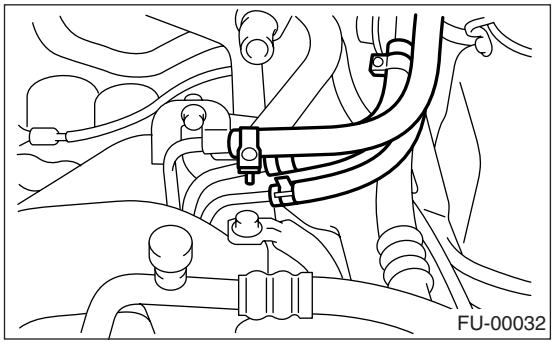
1) Install the intake manifold onto cylinder heads.

NOTE:
Always use new gaskets.

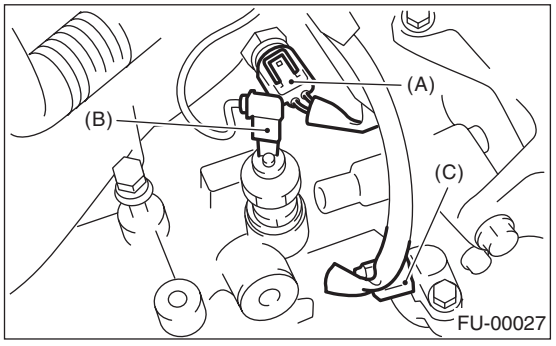
Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)



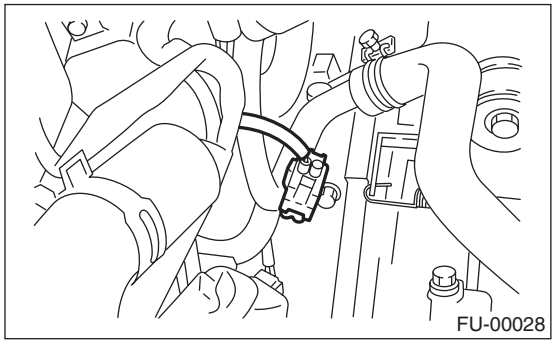
2) Connect the fuel delivery hose, return hose and evaporation hose.



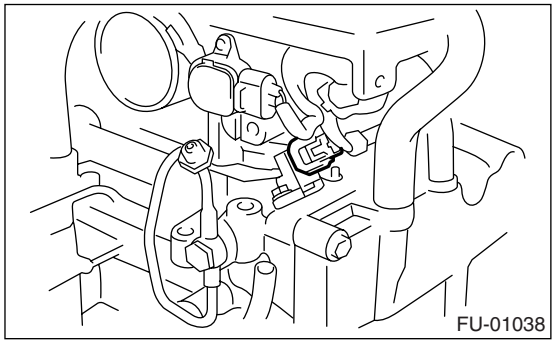
3) Connect the connector to the oil pressure switch (B), crankshaft position sensor (C) and engine coolant temperature sensor (A).



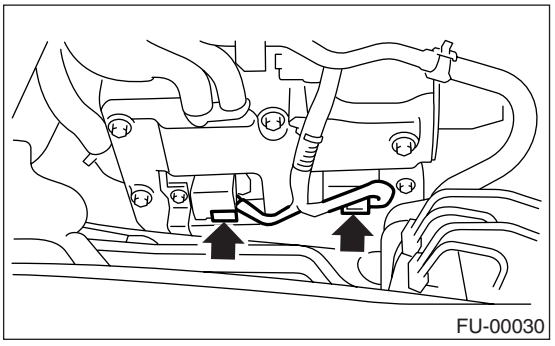
4) Connect the connector to the knock sensor.



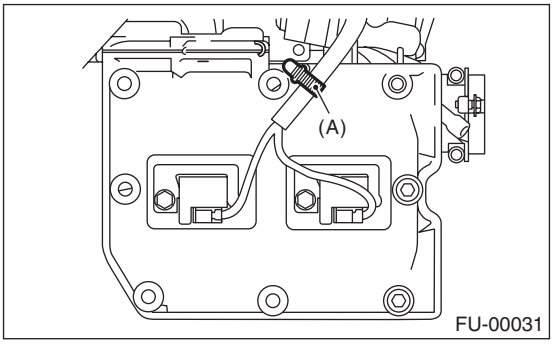
5) Connect the connector to the camshaft position sensor.



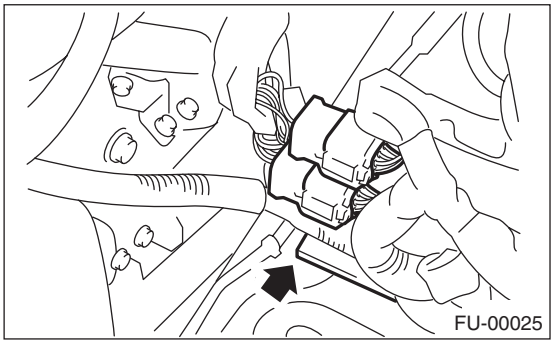
6) Connect the connector to the ignition coil.

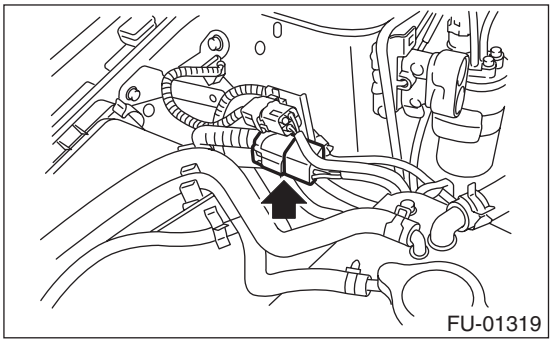


7) Connect the engine harness with clip (A) to the bracket.

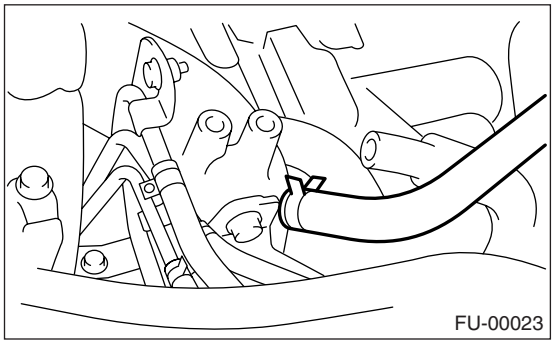


8) Connect the engine harness connector to the bulkhead harness connectors.

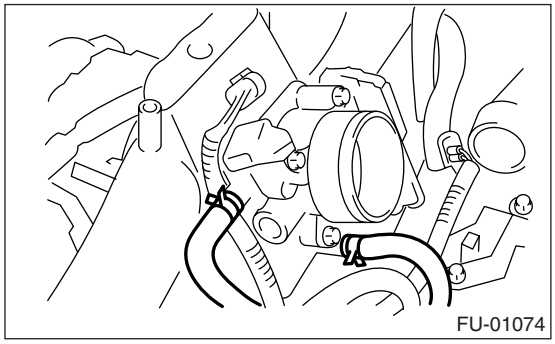




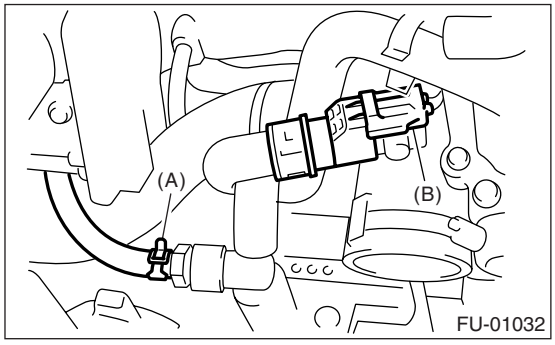
9) Connect the brake booster vacuum hose.



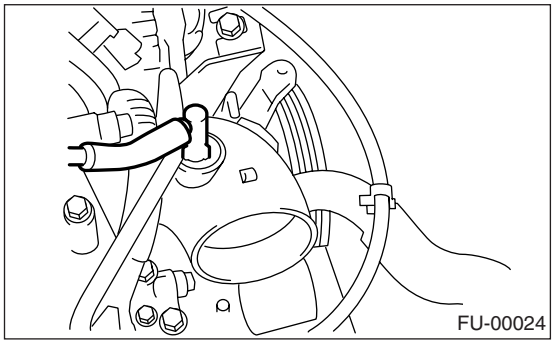
10) Connect the engine coolant hoses to the throttle body.



11) Connect the emission hose (A) and connector (B) to the PCV hose assembly.

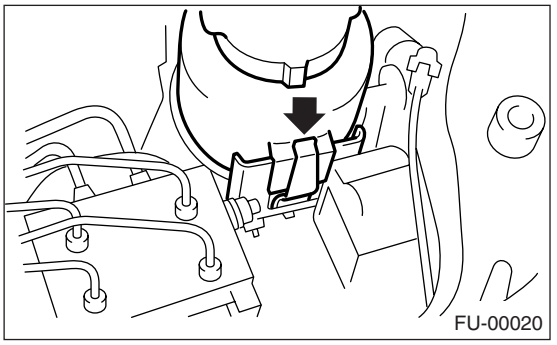


12) Connect the pressure hose to the intake duct.

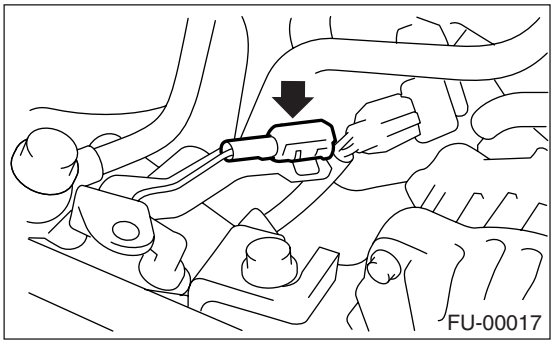


13) Install the power steering pump.

(1) Install the power steering tank on the bracket.

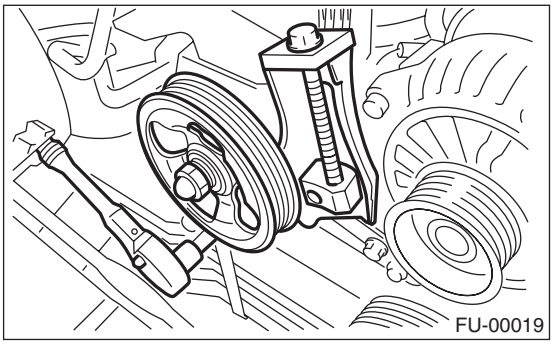


(2) Connect the connector to the power steering pump switch.

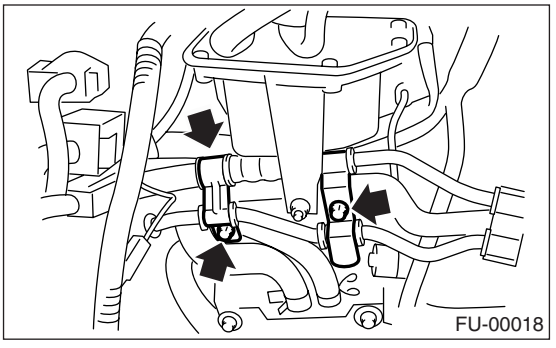


(3) Install the power steering pump, and tighten the bolts.

Tightening torque:
22 N·m (2.2 kgf-m, 15.9 ft-lb)

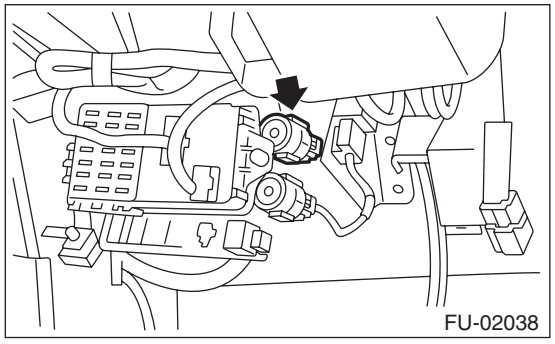


(4) Install the power steering pipe brackets on the intake manifold RH.



(5) Install the front side V-belt. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>

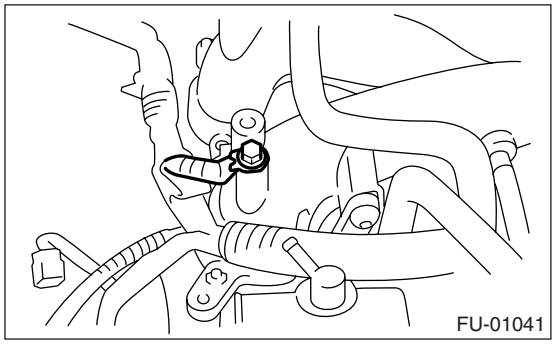
14) Install the coolant filler tank. <Ref. to CO(H4DOTC)-29, INSTALLATION, Coolant Filler Tank.>
15) Install the intercooler. <Ref. to IN(H4DOTC)-11, INSTALLATION, Intercooler.>
16) Install the air cleaner element.
17) Install the air cleaner upper cover and air intake duct as a unit. <Ref. to IN(H4DOTC)-7, INSTALLATION, Air Cleaner.>
18) Connect the connector to the fuel pump relay.

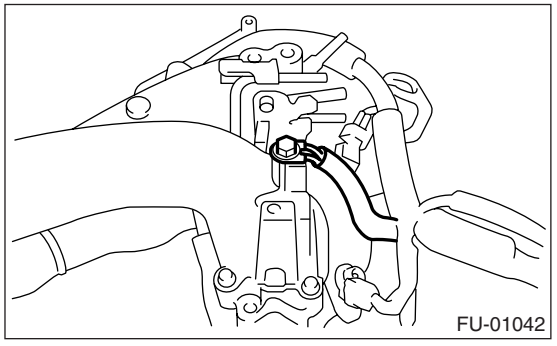

FU-02038

19) Connect the battery ground cable to battery.
20) Lift up the vehicle.
21) Install the under cover.
22) Fill the engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

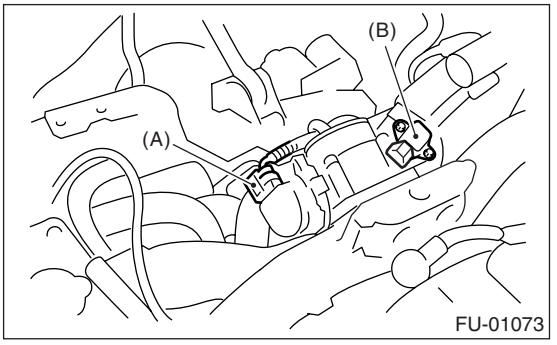
C: DISASSEMBLY

1) Remove the engine ground terminal from the intake manifold.


FU-01041

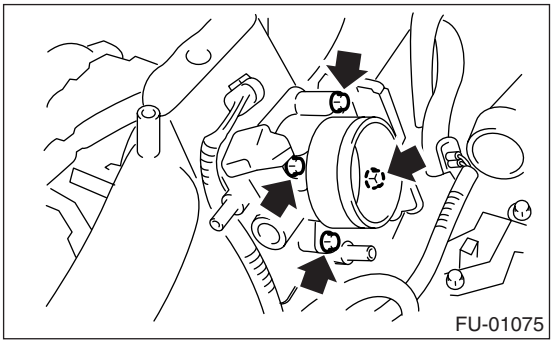

FU-01042

2) Disconnect the connector from the throttle position sensor (A) and manifold absolute pressure sensor (B).

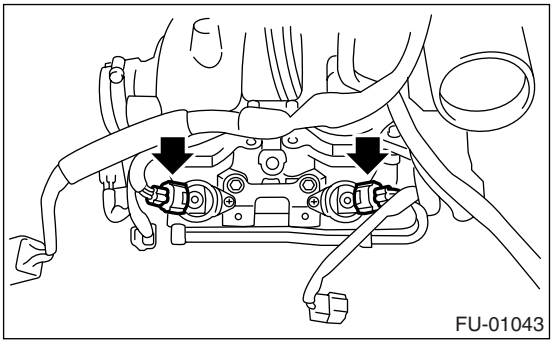


FU-01073

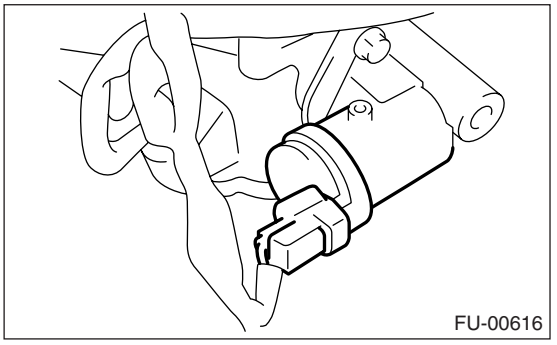
3) Remove the throttle body from the intake manifold.


FU-01075

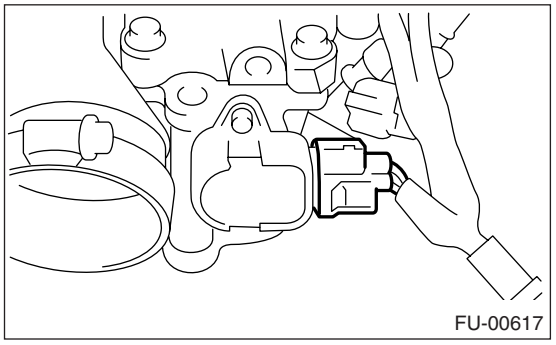
4) Disconnect the connector from the fuel injector.


FU-01043

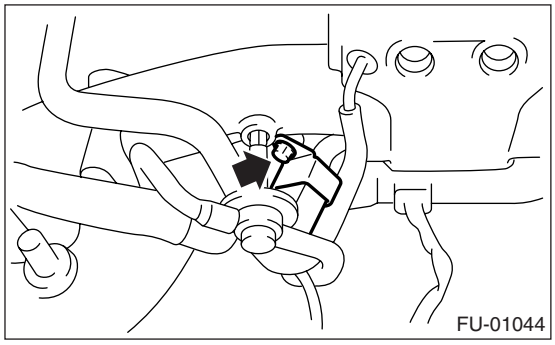
5) Disconnect the connector from the tumble generator valve actuator.


FU-00616

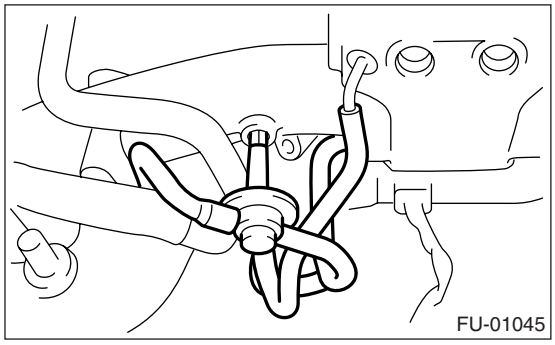
6) Disconnect the connector from the tumble generator valve sensor.


FU-00617

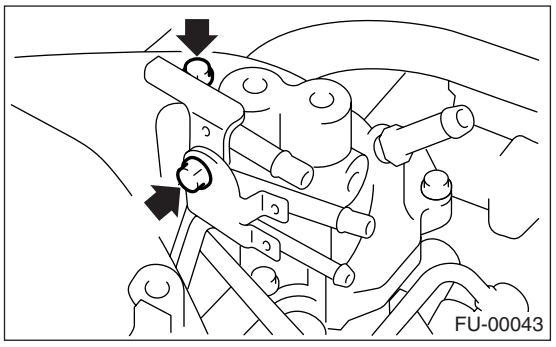
7) Disconnect the connector from the purge control solenoid valve.
8) Remove the purge control solenoid valve.


FU-01044

9) Disconnect the evaporation hose and purge valve from the intake manifold.

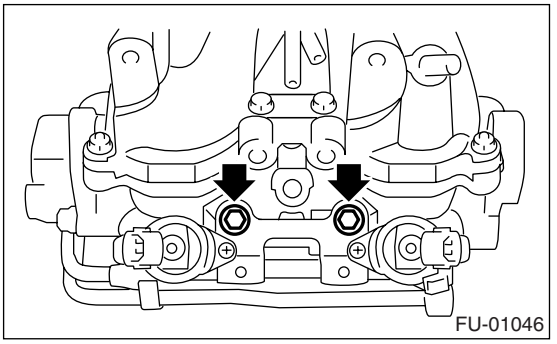

FU-01045

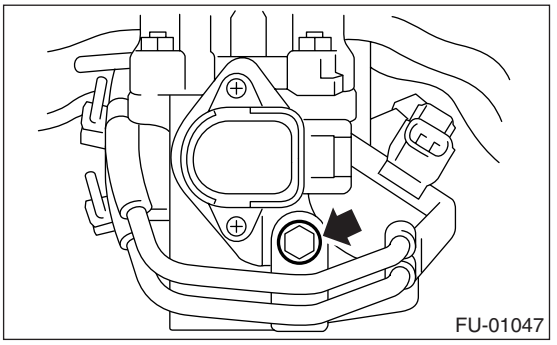
10) Remove the two bolts which hold the fuel pipes on the left side of intake manifold.


FU-00043

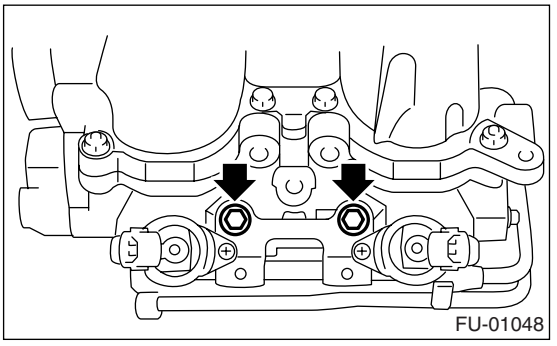
11) Remove the bolt which hold the fuel injector pipe onto intake manifold.

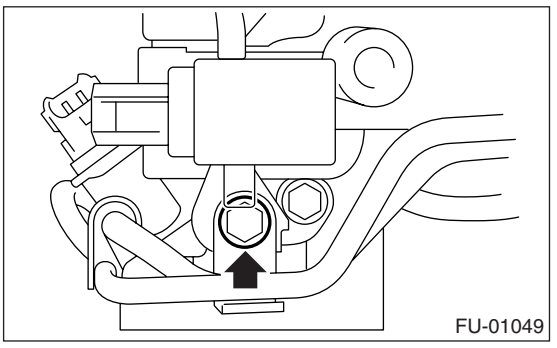
- LH SIDE


FU-01046

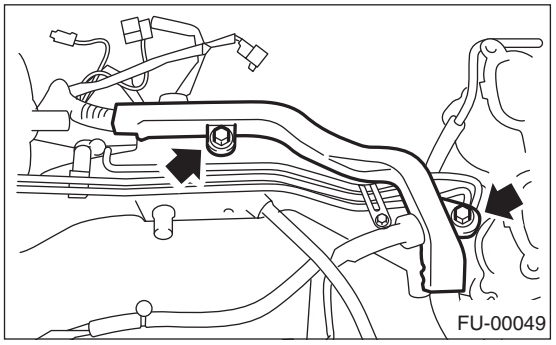

FU-01047

- RH SIDE

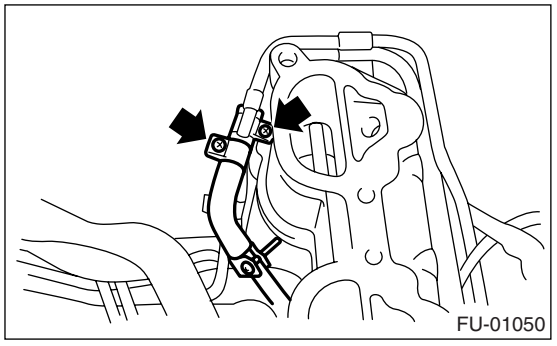

FU-01048


FU-01049

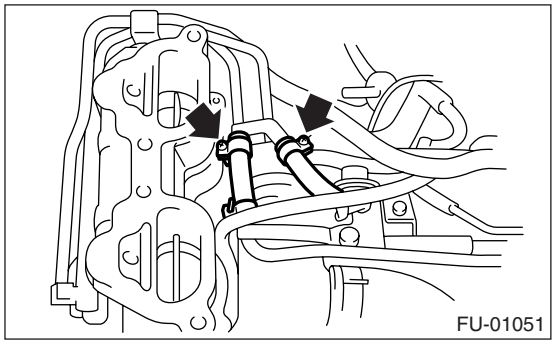
12) Remove the harness bracket which holds the engine harness onto intake manifold.



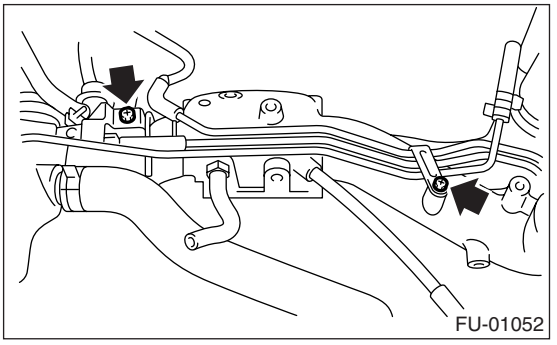
13) Remove the engine harness from the intake manifold.
14) Loosen the clamp which holds the front left side fuel hose to injector pipe, and then remove the pipe from clamp.



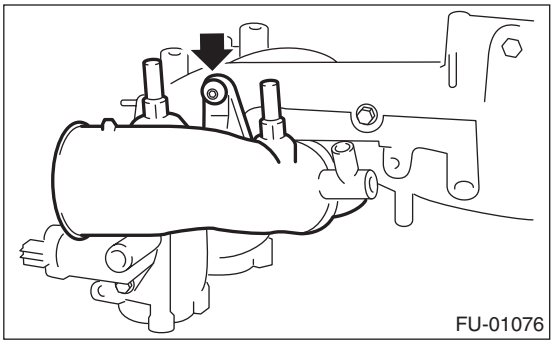
15) Loosen the clamp which holds the right side fuel hose to injector pipe, and then remove the pipe from clamp.



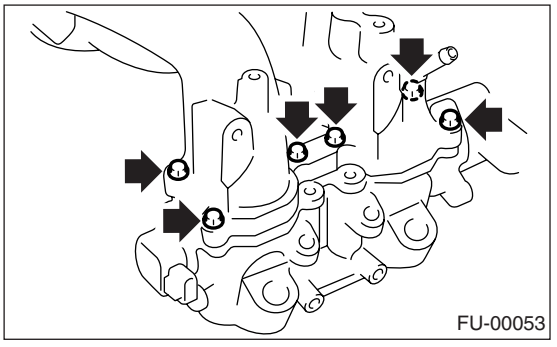
16) Remove the bolts which install the fuel pipe on intake manifold.



17) Remove the fuel pipe assembly and pressure regulator from the intake manifold.
18) Remove the intake duct from the intake manifold.



19) Remove the tumble generator valve assembly from the intake manifold.

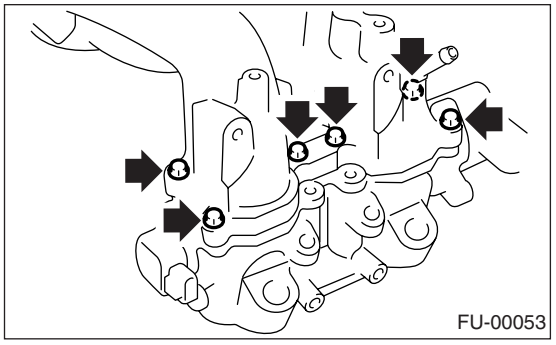


D: ASSEMBLY

NOTE:
Replace the gasket with a new one.

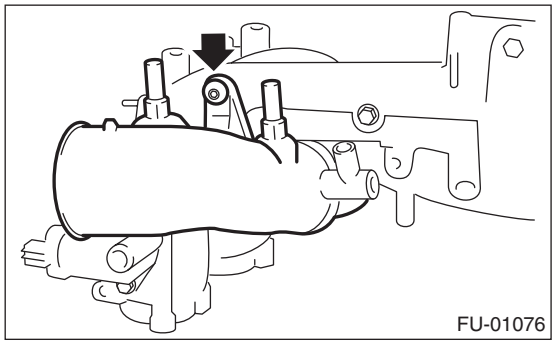
1) Install the tumble generator valve assembly to the intake manifold.

Tightening torque:
8.25 N·m (0.84 kgf-m, 6.1 ft-lb)



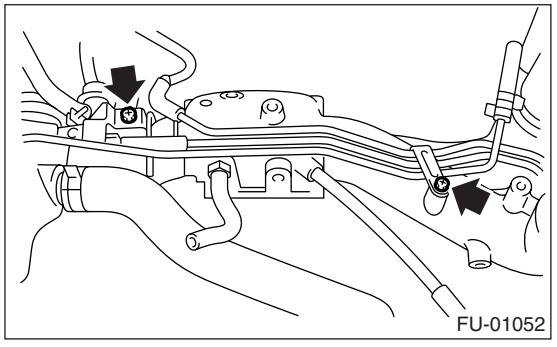
2) Install the air intake duct to the intake manifold.

Tightening torque:
19 N·m (1.94 kgf-m, 13.7 ft-lb)



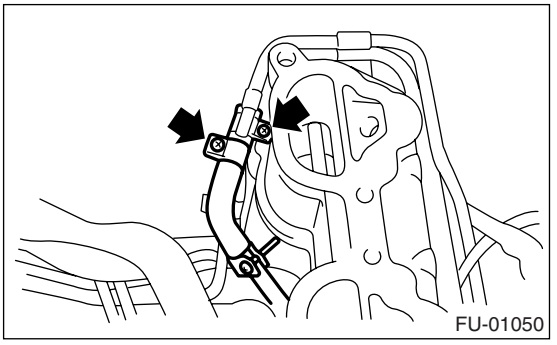
3) Install the fuel pipe assembly and pressure regulator to the intake manifold.

Tightening torque:
4.9 N·m (0.5 kgf-m, 3.6 ft-lb)

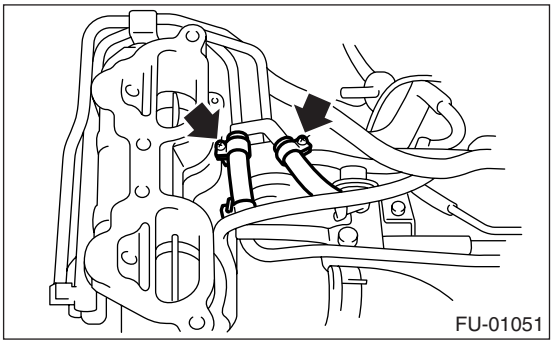


4) Install the fuel injector pipe LH.

5) Connect the left side fuel hose to injector pipe, and tighten the clamp screw.

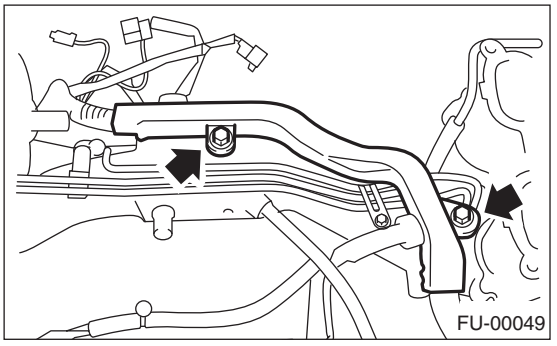


6) Install the fuel injector pipe RH.
7) Connect the right side fuel hose to injector pipe, and tighten the clamp screw.



8) Install the engine harness to the intake manifold.
9) Install the harness bracket which holds the engine harness onto intake manifold.

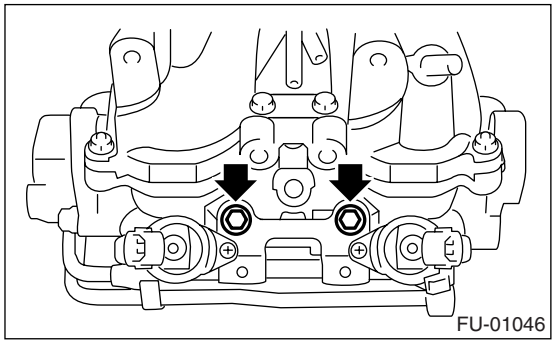
Tightening torque:
19 N·m (1.94 kgf-m, 13.7 ft-lb)

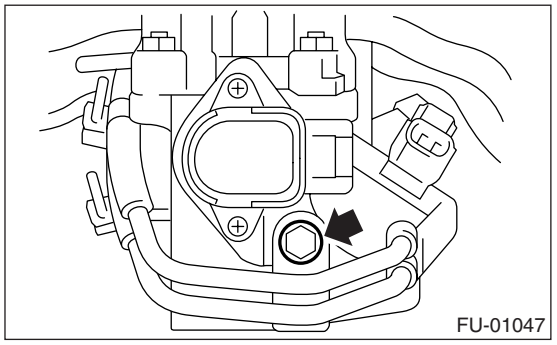


10) Tighten the bolts which install the fuel injector pipe onto intake manifold.

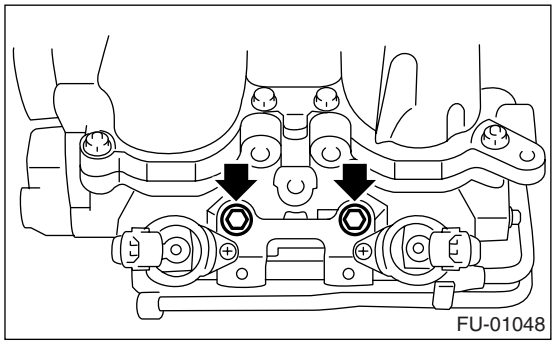
Tightening torque:
19 N·m (1.94 kgf-m, 13.7 ft-lb)

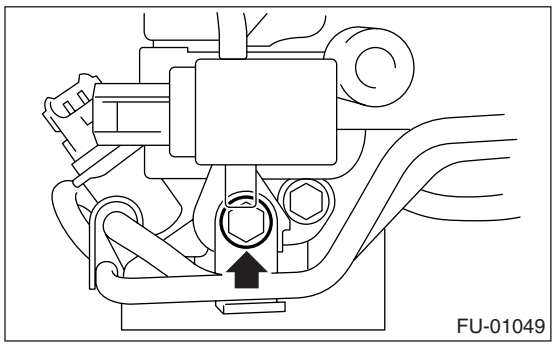
- LH SIDE





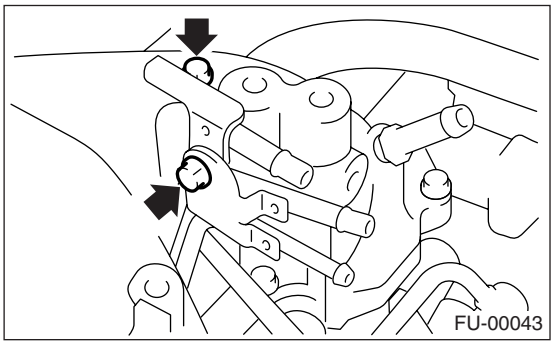
- RH SIDE





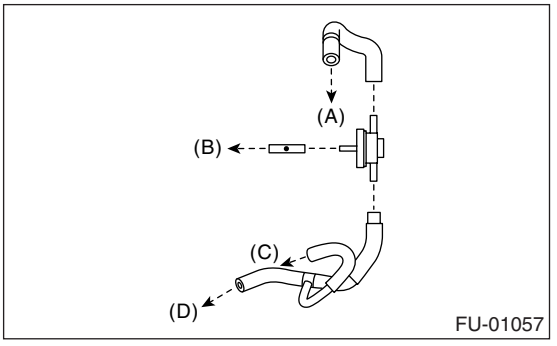
11) Tighten the two bolts which install the fuel pipes on the left side of intake manifold.

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.8 ft-lb)



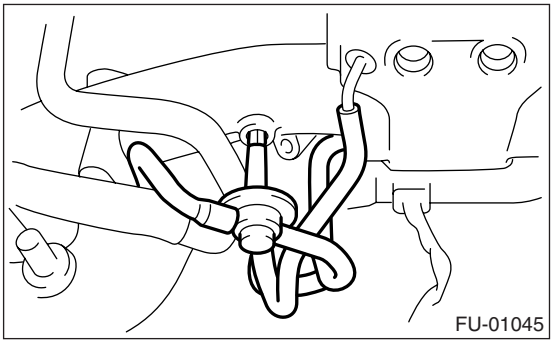
12) Connect the evaporation hoses to the purge valve.

NOTE:
Connect the evaporation hoses as shown in the figure.



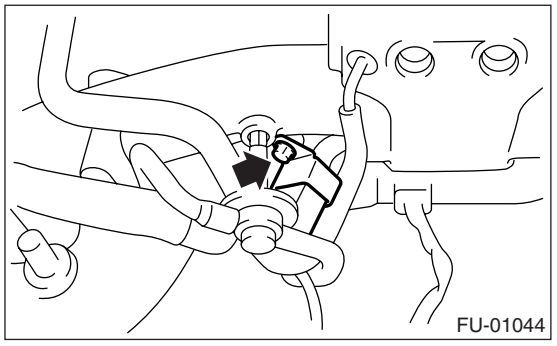
(A) To intake duct
(B) To intake manifold
(C) To purge control solenoid valve
(D) To fuel pipe ASSY

13) Connect the evaporation hose and purge valve to the intake manifold.



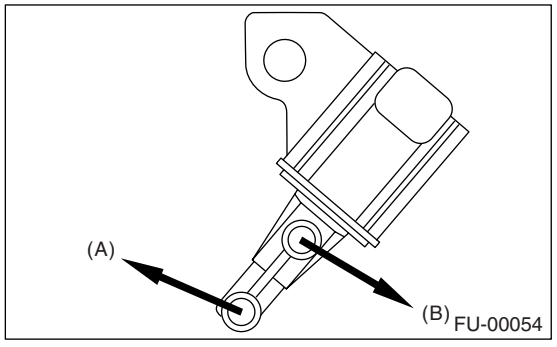
14) Install the purge control solenoid valve.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)



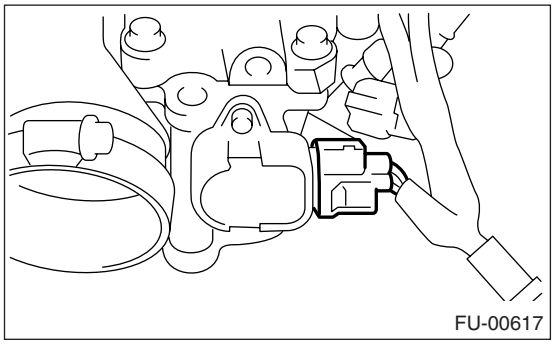
15) Connect the hoses to the purge control solenoid valve.

NOTE:
Connect the evaporation hoses as shown in the figure.

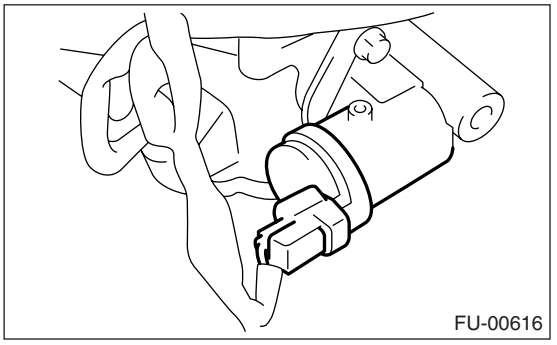


(A) To purge valve
(B) To intake manifold

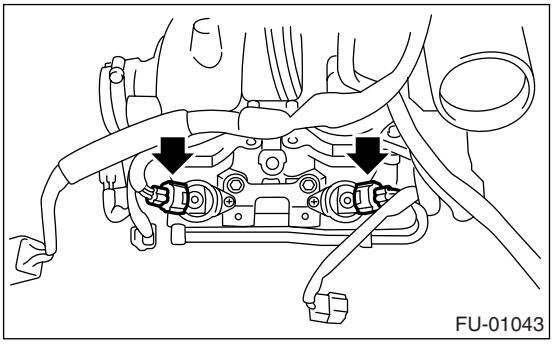
16) Connect the connector to the purge control solenoid valve.
17) Connect the connector to the tumble generator valve sensor.



18) Connect the connector to the tumble generator valve actuator.



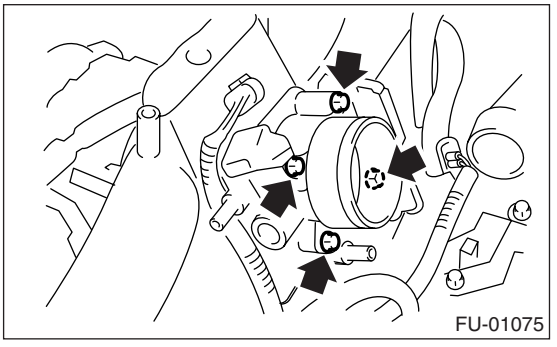
19) Connect the connector to the fuel injector.



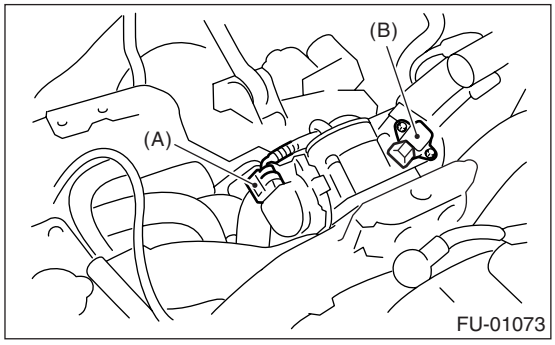
20) Install the throttle body to the intake manifold.

NOTE:
Replace the gasket with a new one.

Tightening torque:
8 N·m (0.8 kgf-m, 5.8 ft-lb)

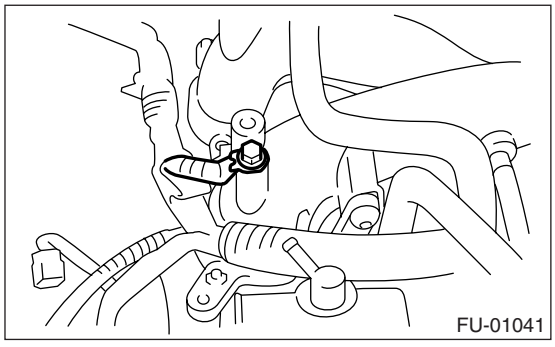


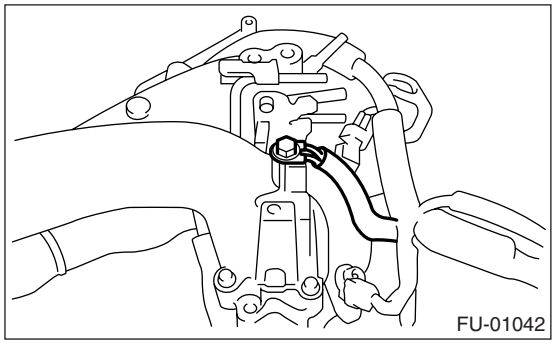
21) Connect the connector to the throttle position sensor (A) and manifold absolute pressure sensor (B).



22) Install the engine ground terminal to the intake manifold.

Tightening torque:
19 N·m (1.94 kgf-m, 13.7 ft-lb)





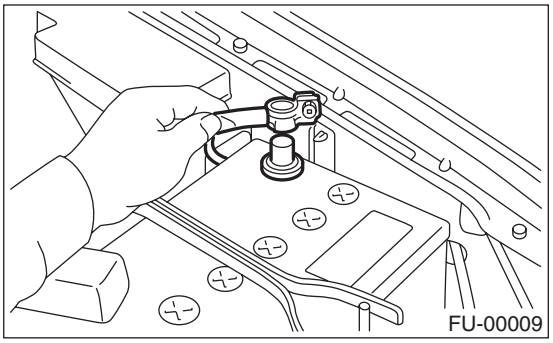
E: INSPECTION

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

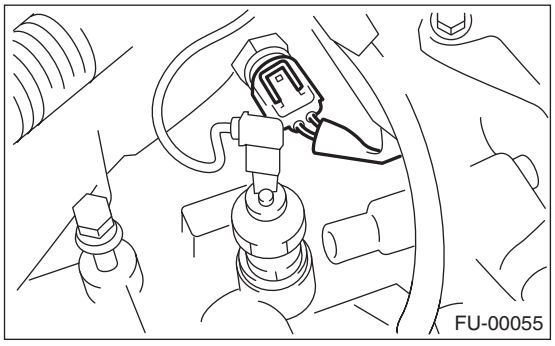
4. Engine Coolant Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the generator. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
3) Drain the engine coolant. <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the connector from the engine coolant temperature sensor.



5) Remove the engine coolant temperature sensor.

B: INSTALLATION

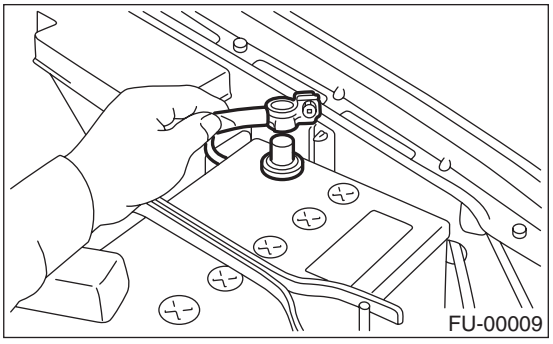
Install in the reverse order of removal.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

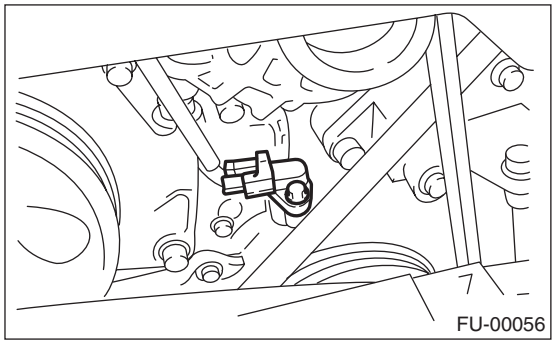
5. Crankshaft Position Sensor

A: REMOVAL

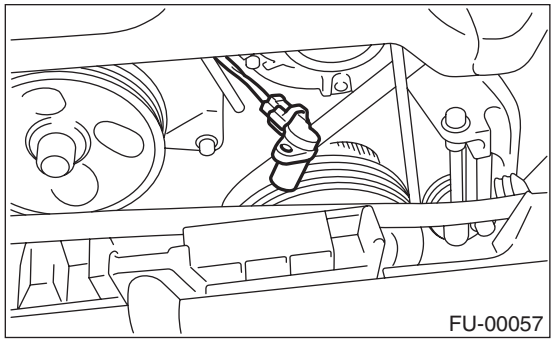
1) Disconnect the ground cable from battery.



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



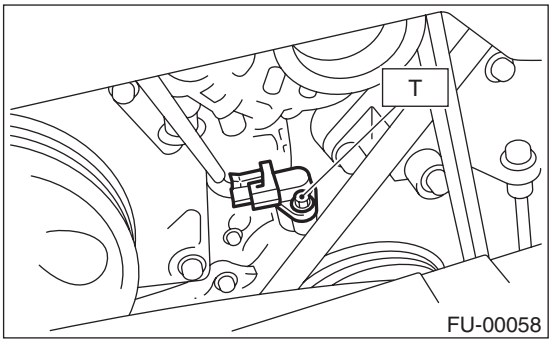
3) Remove the crankshaft position sensor, and disconnect the connector from it.



B: INSTALLATION

Install in the reverse order of removal.

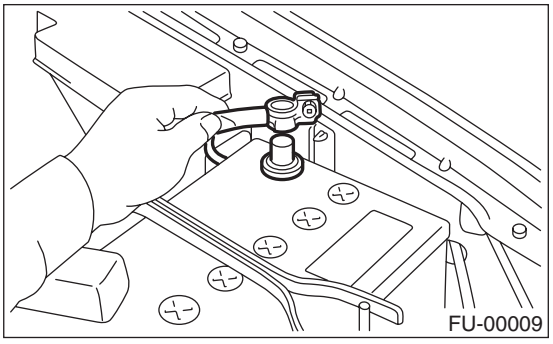
Tightening torque:
T: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



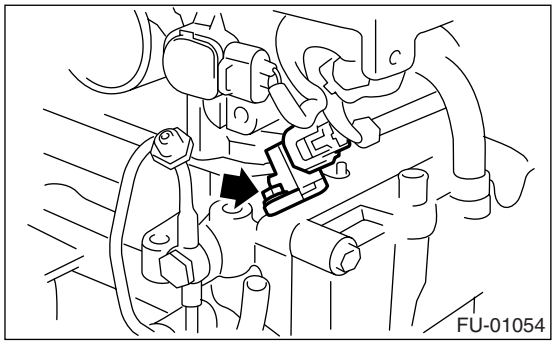
6. Camshaft Position Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector from the camshaft position sensor RH.
3) Remove the camshaft position sensor RH from the backside of cylinder head.

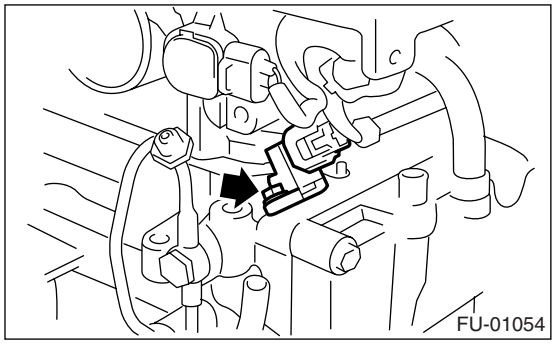


4) Remove the camshaft position sensor LH same as RH side.

B: INSTALLATION

Install in the reverse order of removal.

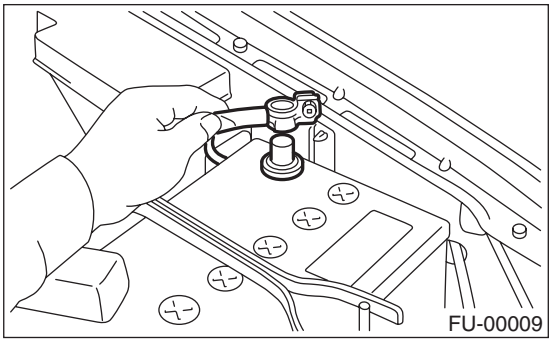
Tightening torque:
T: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



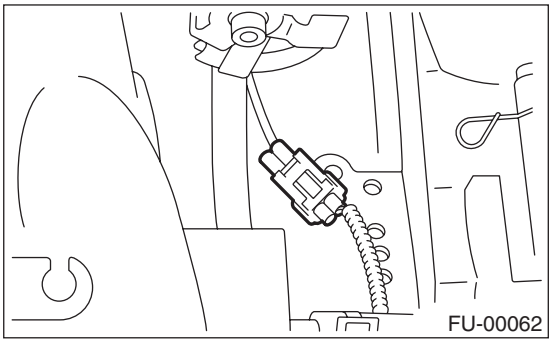
7. Knock Sensor

A: REMOVAL

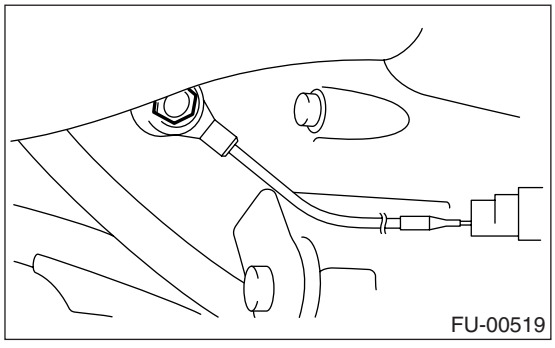
1) Disconnect the ground cable from battery.



2) Remove the intercooler. <Ref. to IN(H4DOTC)-10, REMOVAL, Intercooler.>
3) Disconnect the knock sensor connector.



4) Remove the knock sensor from the cylinder block.

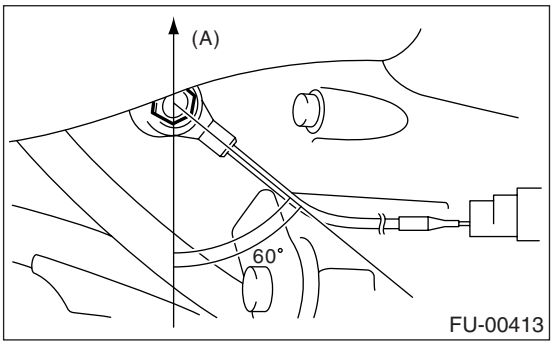


B: INSTALLATION

1) Install the knock sensor to the cylinder block.

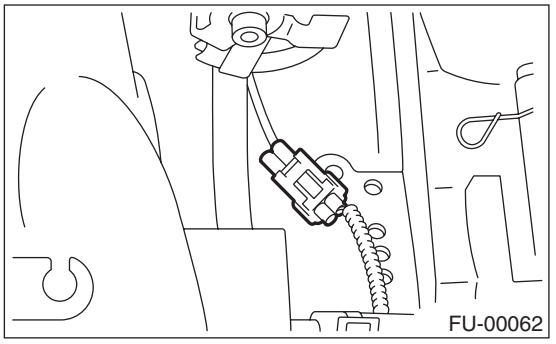
Tightening torque:
24 N·m (2.4 kgf-m, 17.4 ft-lb)

NOTE:
Extraction area of the knock sensor cord must be positioned at a 60° angle relative to the engine rear.

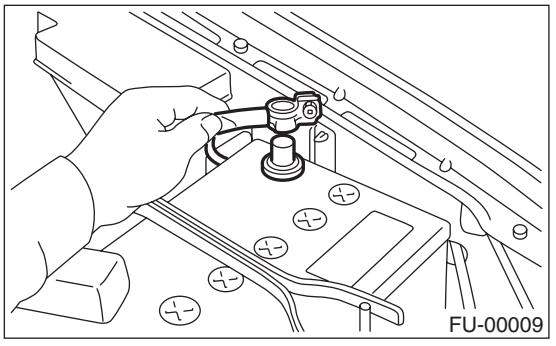


(A) Front side

2) Connect the knock sensor connector.



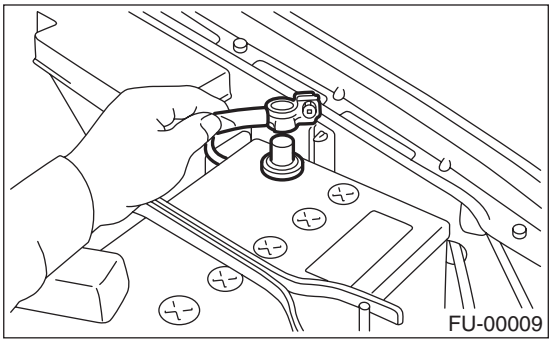
3) Install the intercooler. <Ref. to IN(H4DOTC)-11, INSTALLATION, Intercooler.>
4) Connect the battery ground cable to battery.



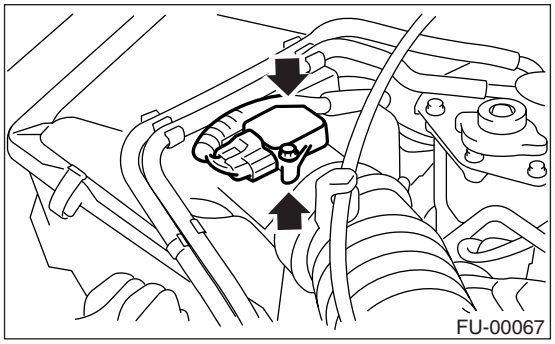
8. Mass Air Flow and Intake Air Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector from mass air flow and intake air temperature sensor.
3) Remove the mass air flow and intake air temperature sensor.



B: INSTALLATION

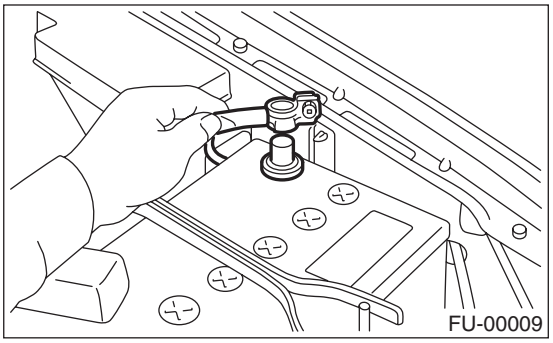
Install in the reverse order of removal.

Tightening torque:
1 N·m (0.10 kgf-m, 0.8 ft-lb)

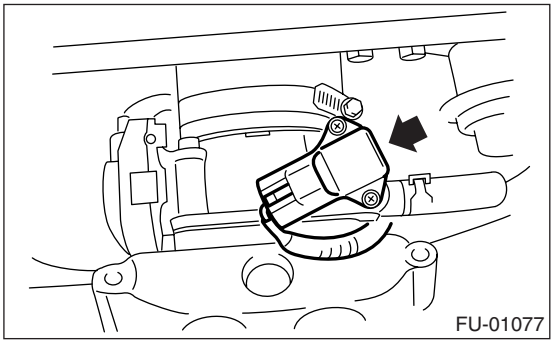
9. Manifold Absolute Pressure Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connectors from manifold absolute pressure sensor.



3) Remove the manifold absolute pressure sensor from the throttle body.

B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Replace the O-rings for the manifold absolute pressure sensor with new ones.

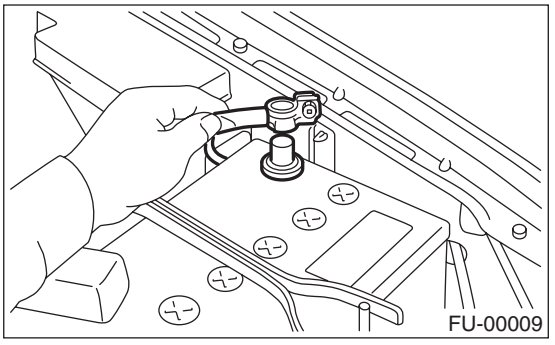
Tightening torque:
1.6 N·m (0.16 kgf-m, 1.2 ft-lb)

10.Fuel Injector

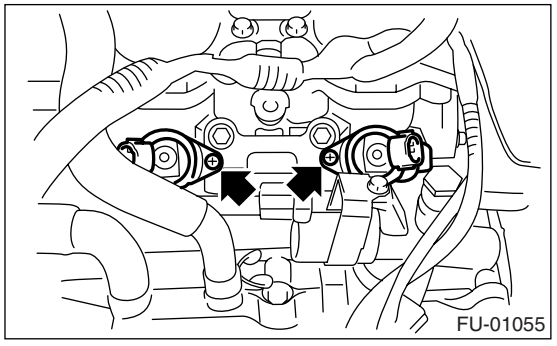
A: REMOVAL

1. RH SIDE

1) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open the fuel filler flap lid and remove the fuel filler cap.
3) Disconnect the ground cable from battery.

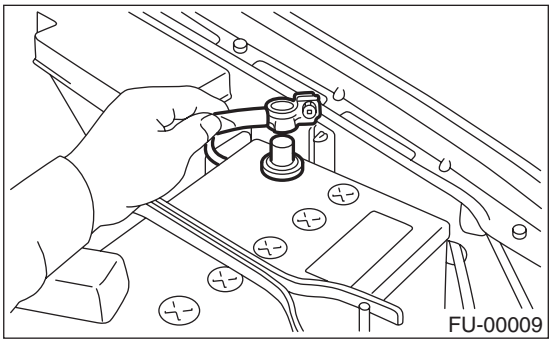


4) Disconnect the connector from the fuel injector.
5) Remove the screw and remove the fuel injector.

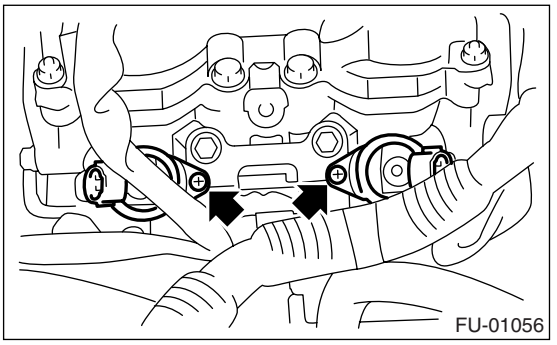


2. LH SIDE

1) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open the fuel filler flap lid and remove the fuel filler cap.
3) Disconnect the ground cable from battery.



4) Remove the intake manifold. <Ref. to FU(H4DOTC)-15, REMOVAL, Intake Manifold.>
5) Disconnect the connector from the fuel injector.
6) Remove the screw and remove the fuel injector.



B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

NOTE:
Replace the O-rings with new ones.

2. LH SIDE

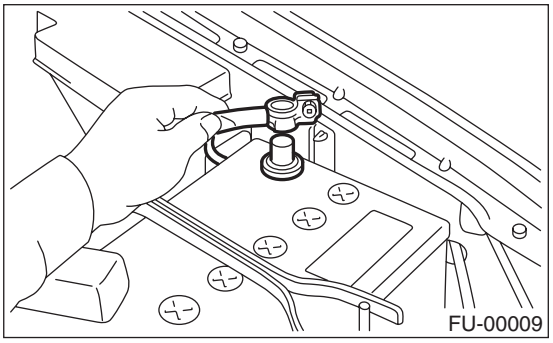
Install in the reverse order of removal.

NOTE:
Replace the O-rings with new ones.

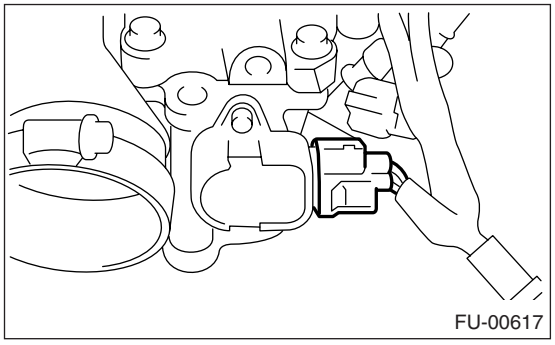
11.Tumble Generator Valve Assembly

A: REMOVAL

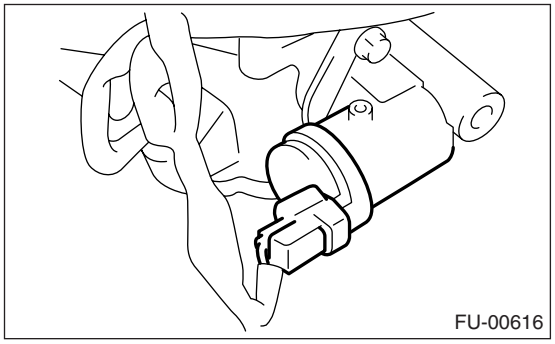
1) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Disconnect the ground cable from battery.


FU-00009

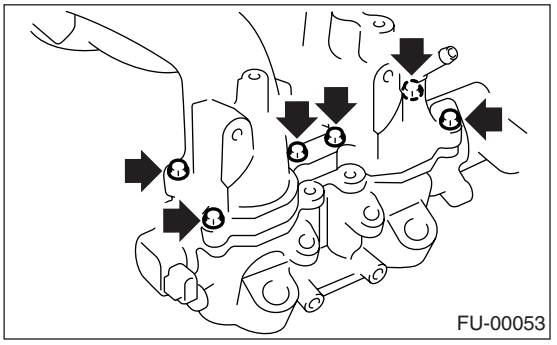
4) Remove the intake manifold. <Ref. to FU(H4DOTC)-15, REMOVAL, Intake Manifold.>
5) Disconnect the connector from the tumble generator valve sensor.


FU-00617

6) Disconnect the connector from the tumble generator valve actuator.


FU-00616

7) Remove the fuel injector. <Ref. to FU(H4DOTC)-33, REMOVAL, Fuel Injector.>
8) Remove the tumble generator valve body from the intake manifold.

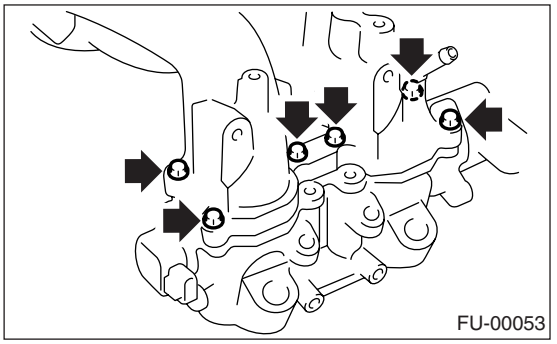

FU-00053

B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Always use new gaskets.

Tightening torque:
8.25 N·m (0.84 kgf-m, 6.1 ft-lb)

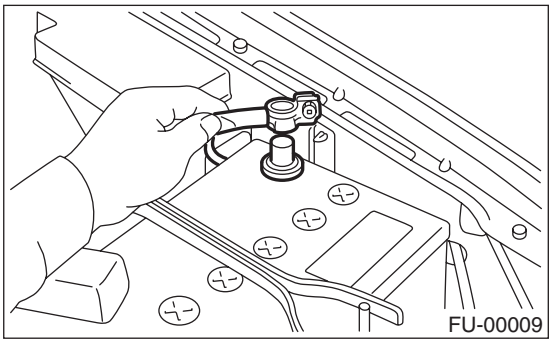

FU-00053

12.Tumble Generator Valve Actuator

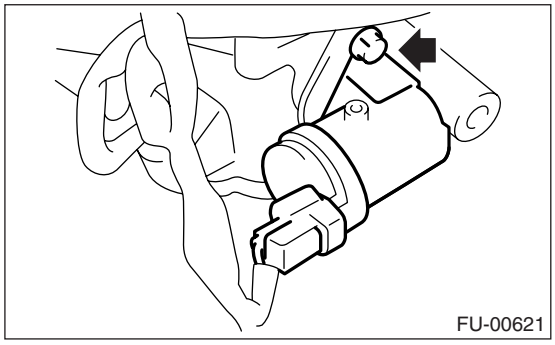
A: REMOVAL

1. RH SIDE

1) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Disconnect the ground cable from battery.

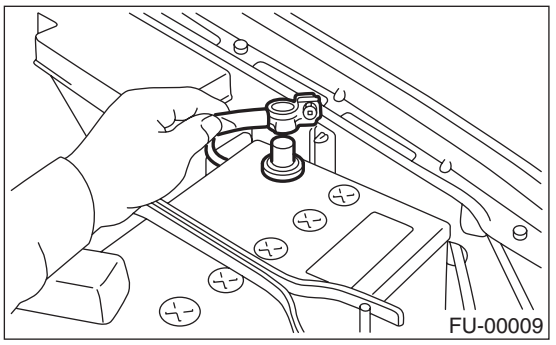


4) Remove the intake manifold. <Ref. to FU(H4DOTC)-15, REMOVAL, Intake Manifold.>
5) Disconnect the connector from tumble generator valve actuator RH.
6) Remove the tumble generator valve actuator RH.

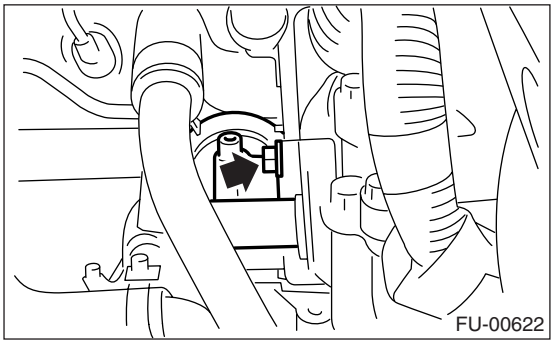


2. LH SIDE

1) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Disconnect the ground cable from battery.



4) Disconnect the connector from tumble generator valve actuator LH.
5) Remove the tumble generator valve actuator LH.



B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

2. LH SIDE

Install in the reverse order of removal.

13.Tumble Generator Valve Position Sensor

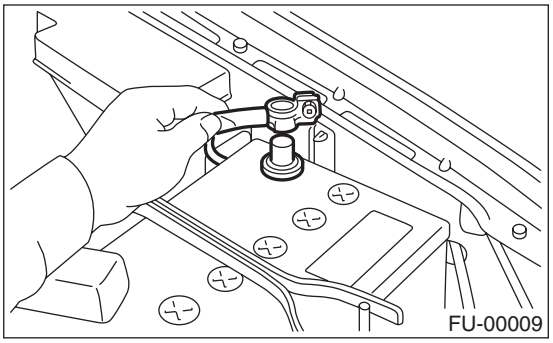
A: Specification

Do not remove tumble generator valve position sensor from tumble generator valve assembly because it cannot be adjusted when installed.
<Ref. to FU(H4DOTC)-34, REMOVAL, Tumble Generator Valve Assembly.>
<Ref. to FU(H4DOTC)-34, INSTALLATION, Tumble Generator Valve Assembly.>

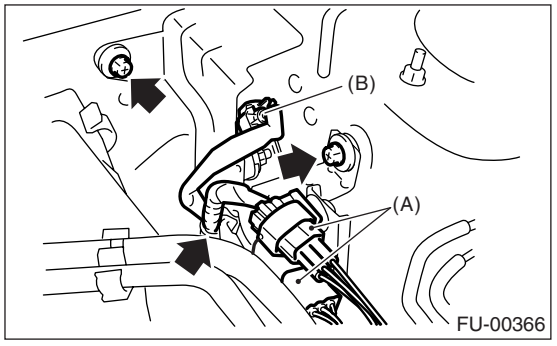
14.Wastegate Control Solenoid Valve

A: REMOVAL

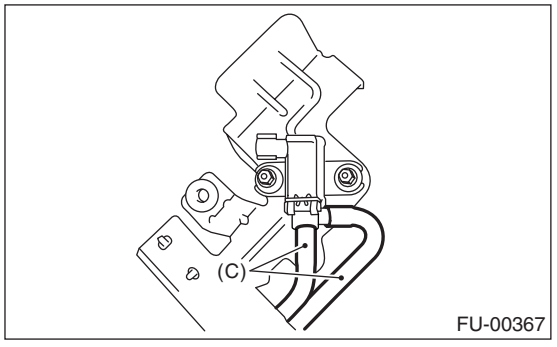
1) Disconnect the ground cable from battery.



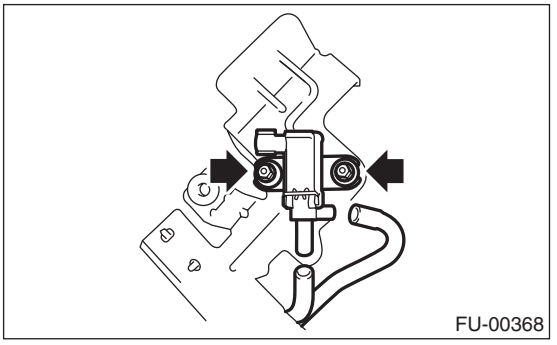
2) Disconnect the engine harness connector (A) from bracket.
3) Disconnect the connector (B) from wastegate control solenoid valve.
4) Remove the bracket from body.



5) Disconnect the pressure hoses (C) from wastegate control solenoid valve.



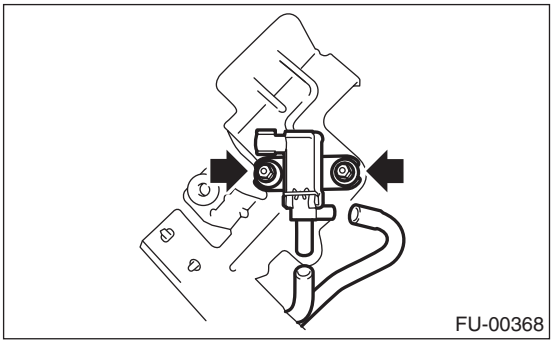
6) Remove the wastegate control solenoid valve from bracket.



B: INSTALLATION

Install in the reverse order of removal.

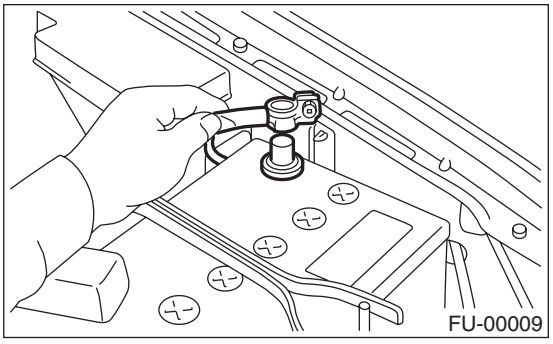
Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



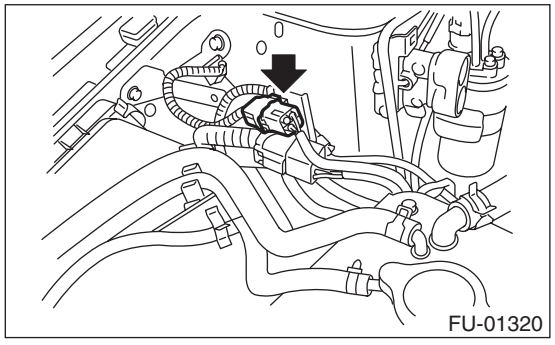
15.Front Oxygen (A/F) Sensor

A: REMOVAL

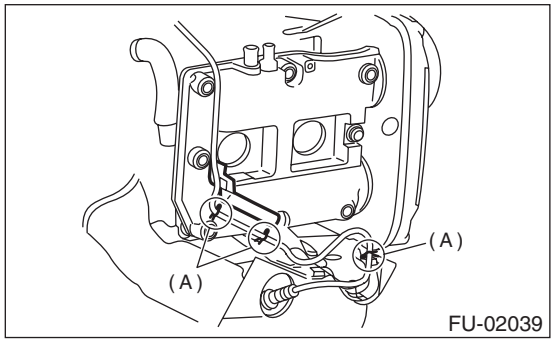
1) Disconnect the ground cable from battery.



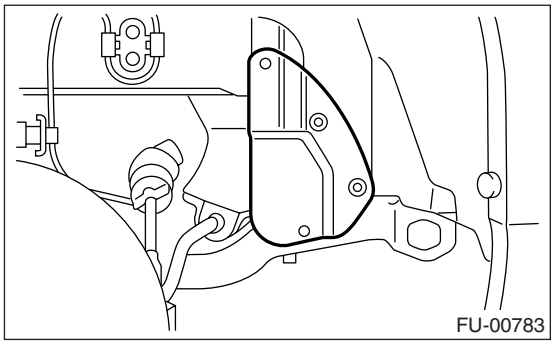
2) Disconnect the connector from the front oxygen (A/F) sensor.



3) Disconnect the engine harness fixed by clip (A).



4) Remove the front right side wheel.
5) Lift-up the vehicle.
6) Remove the service hole cover.

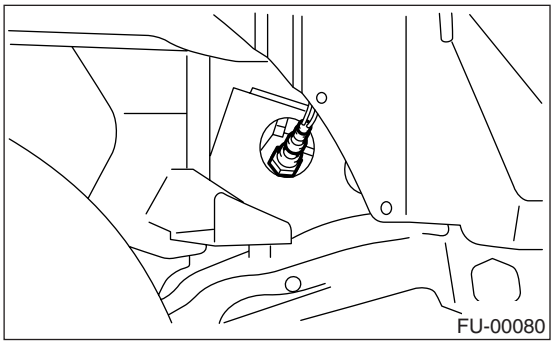


7) Apply SUBARU CRC or its equivalent to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

8) 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

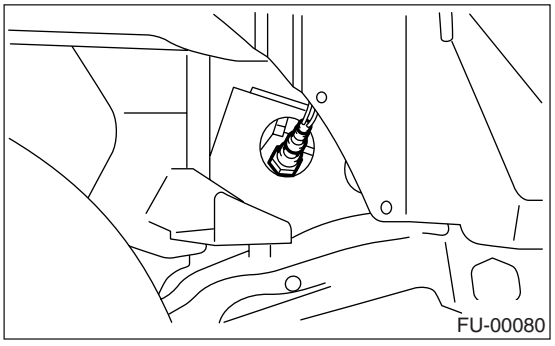
1) Before installing front oxygen (A/F) sensor, apply anti-seize compound only to the threaded portion of front oxygen (A/F) sensor to make the next removal easier.

Anti-seize compound:
SS-30 by JET LUBE

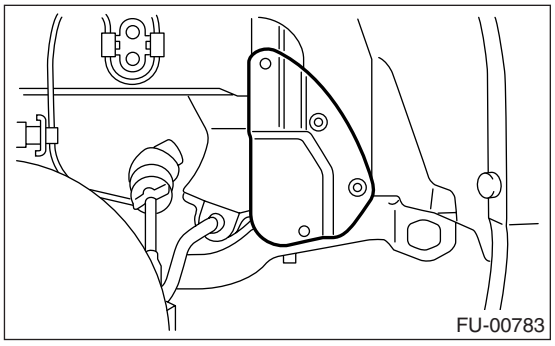
CAUTION:
Never apply anti-seize compound to protector of front oxygen (A/F) sensor.

2) Install the front oxygen (A/F) sensor.

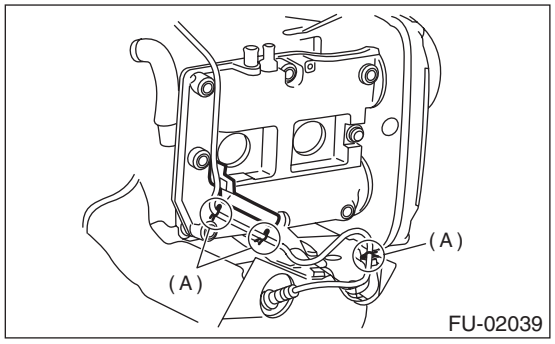
Tightening torque:
30 N·m (3.1 kgf-m, 22.1 ft-lb)



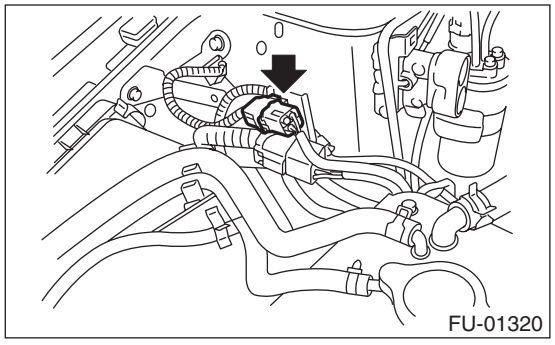
3) Install the service hole cover.



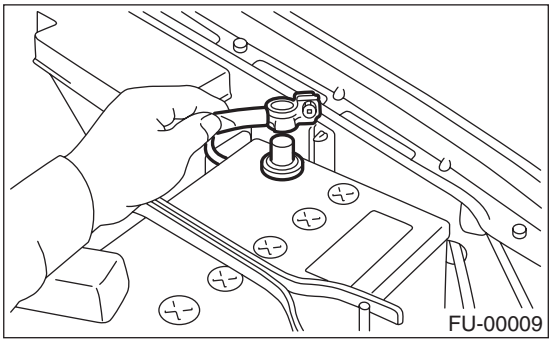
4) Lower the vehicle.
5) Install the front right side wheel.
6) Connect the engine harness using clips (A).



7) Connect the connector of front oxygen (A/F) sensor.



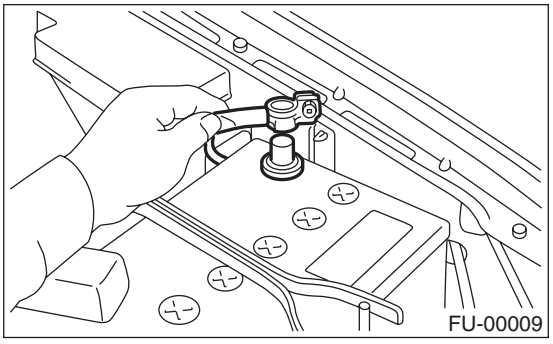
8) Connect the battery ground cable to battery.



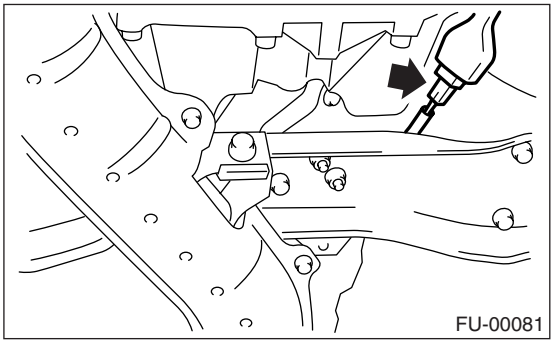
16.Rear Oxygen Sensor

A: REMOVAL

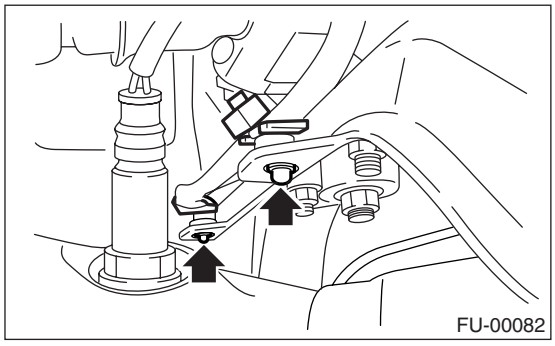
1) Disconnect the ground cable from battery.



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



4) Remove the clip by pulling out from the upper side of crossmember.

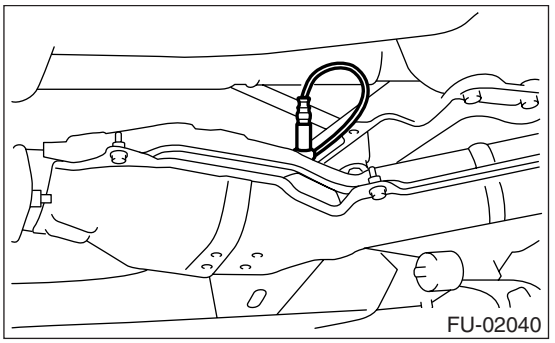


5) Apply SUBARU CRC or its equivalent to the threaded portion of rear oxygen sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

6) Remove the rear oxygen sensor.

CAUTION:
When removing the oxygen sensor, wait until exhaust pipe cools; otherwise, it will damage exhaust pipe.



B: INSTALLATION

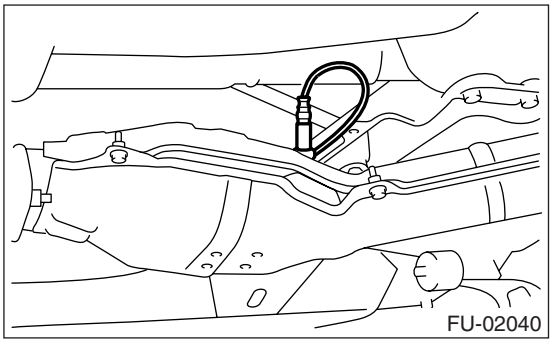
1) Before installing rear oxygen sensor, apply anti-seize compound only to the threaded portion of rear oxygen sensor to make the next removal easier.

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

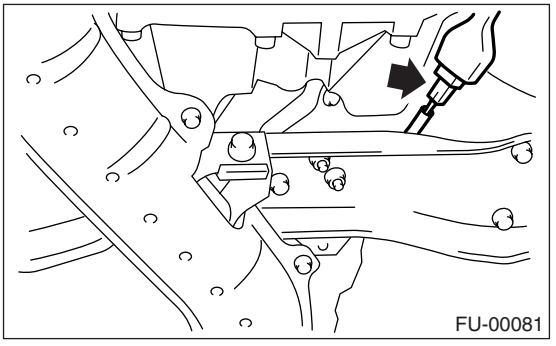
Anti-seize compound:
SS-30 by JET LUBE

2) Install the rear oxygen sensor.

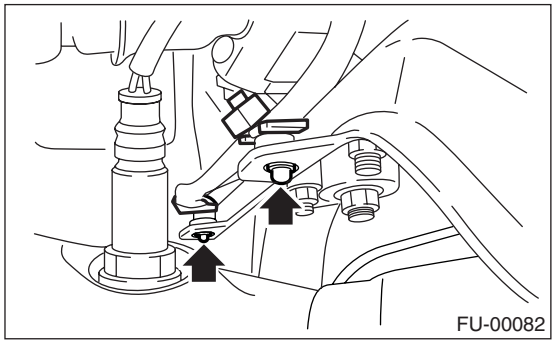
Tightening torque:
21 N·m (2.1 kgf-m, 15.2 ft-lb)



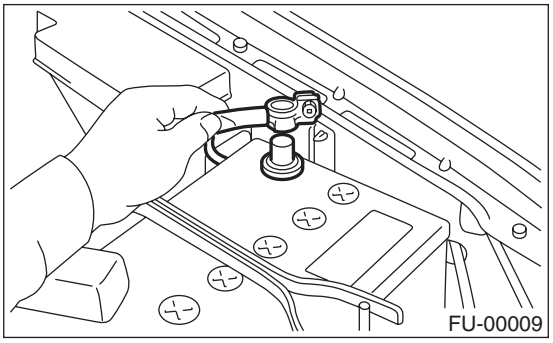
3) Connect the connector to the rear oxygen sensor.



4) Connect the clip to the crossmember.



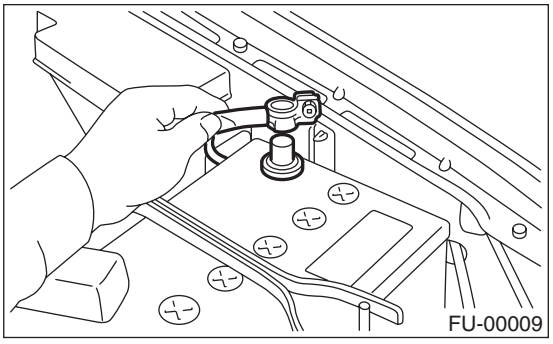
5) Lower the vehicle.
6) Connect the battery ground cable to battery.



17.Exhaust Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.

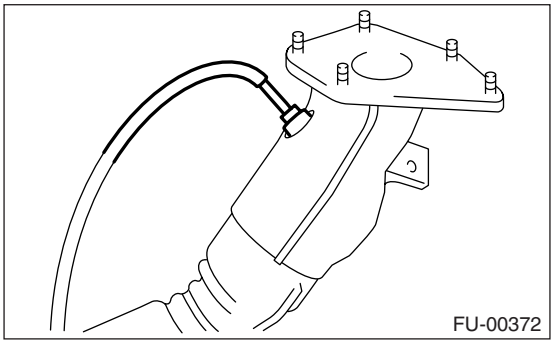


2) Remove the joint pipe. <Ref. to EX(H4DOTC)-13, REMOVAL, Joint Pipe.>
3) Apply SUBARU CRC or its equivalent to the threaded portion of exhaust temperature sensor, and leave it for one minute or more.

SUBARU CRC (Part No. 004301003)

4) Remove the exhaust temperature sensor.

CAUTION:
When removing the exhaust temperature sensor, wait until joint pipe cools, otherwise it will damage exhaust pipe.



B: INSTALLATION

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

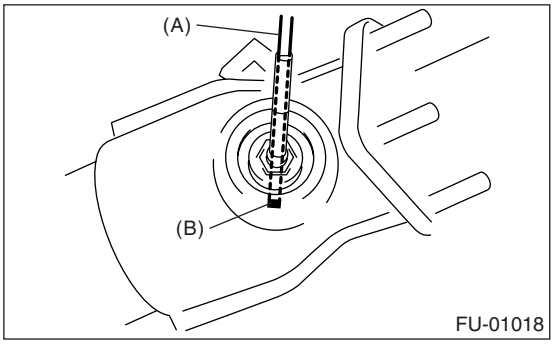
CAUTION:
Never apply anti-seize compound to protector of exhaust temperature sensor.

Anti-seize compound:
SS-30 by JET LUBE

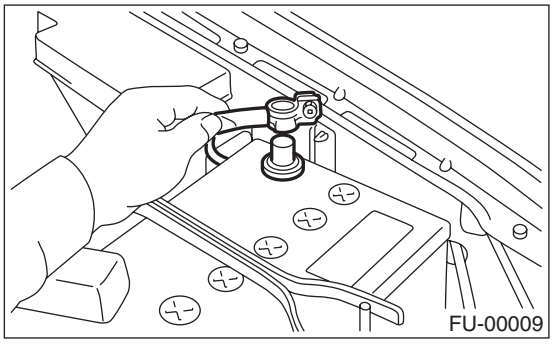
2) Install the exhaust temperature sensor.

NOTE:
Align the harness (A) of exhaust temperature sensor to the marking (B) of joint pipe, and tighten the screws.

Tightening torque:
21 N·m (2.1 kgf-m, 15.2 ft-lb)



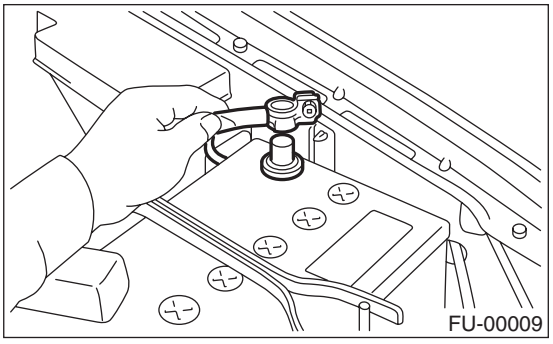
3) Install the joint pipe. <Ref. to EX(H4DOTC)-13, INSTALLATION, Joint Pipe.>
4) Connect the battery ground cable to battery.



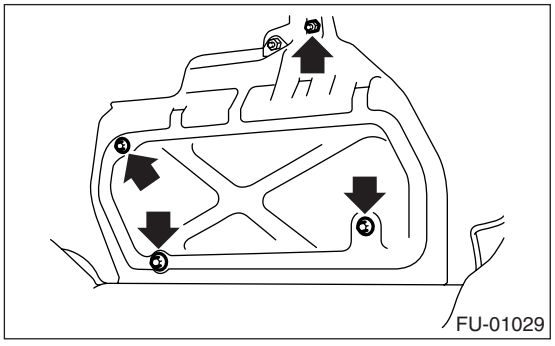
18.Engine Control Module (ECM)

A: REMOVAL

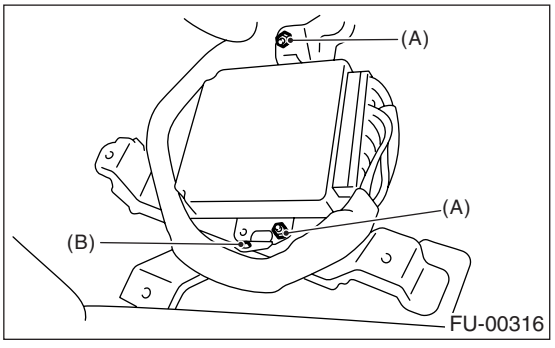
1) Disconnect the ground cable from battery.



2) Remove the lower inner trim of the passenger side.
<Ref. to EI-42, REMOVAL, Lower Inner Trim.>
3) Detach the floor mat of the 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

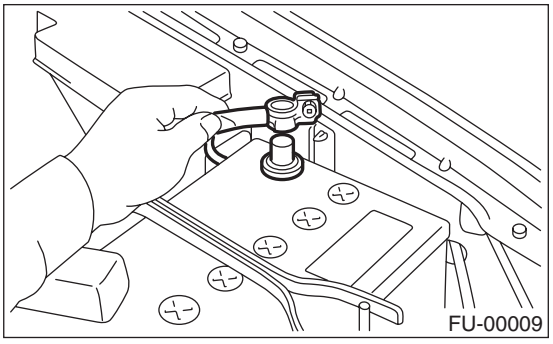
Install in the reverse order of removal.

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

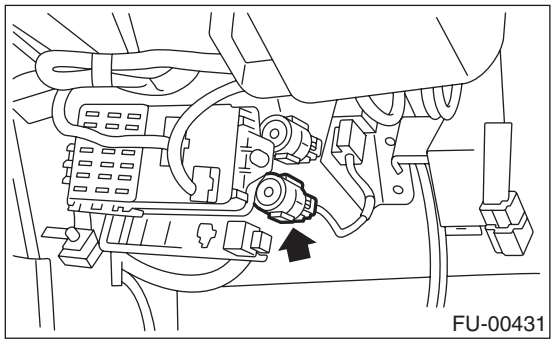
19.Main Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the driver's side lower cover.
3) Disconnect the connectors from the main relay.
4) Remove the main relay from the bracket.



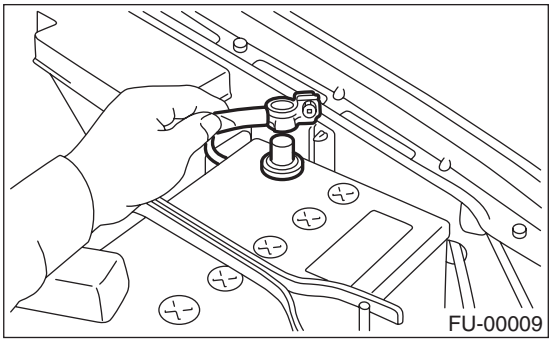
B: INSTALLATION

Install in the reverse order of removal.

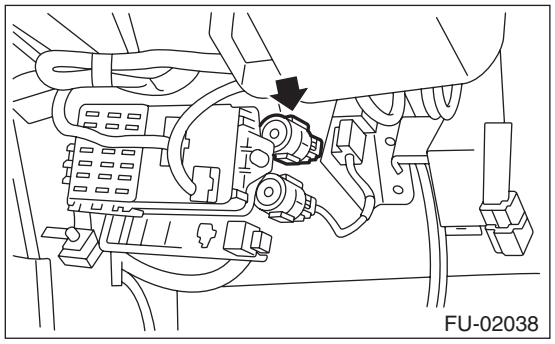
20.Fuel Pump Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the driver's side lower cover.
3) Disconnect the connector from the fuel pump relay.
4) Remove the fuel pump relay from the bracket.



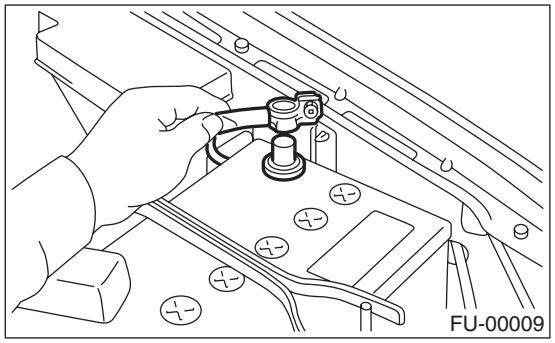
B: INSTALLATION

Install in the reverse order of removal.

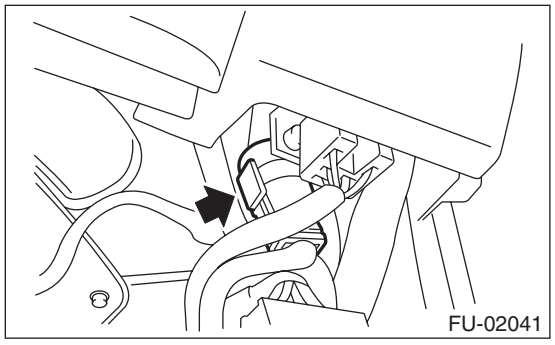
21.Electronic Contorl Throttle Relay

A: REMOVAL

1) Disconnect ground cable from battery.



2) Disconnect connector form the passenger's side electronic control throttle relay.
3) Remove the electronic control throttle relay from the bracket.



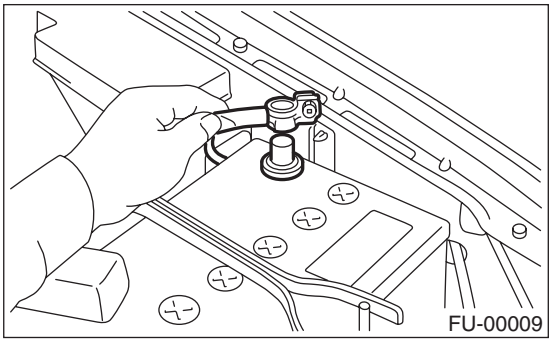
B: INSTALLATION

Install in the reverse order of removal.

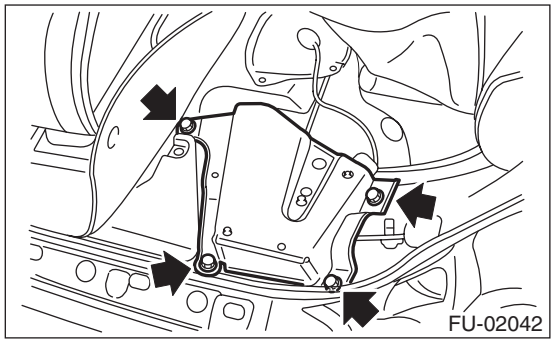
22.Fuel Pump Control Unit

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the rear pillar trim. <Ref. to EI-52, REMOVAL, Rear Pillar Trim.>
3) Remove the fuel pump control unit bracket from the vehicle body.



4) Disconnect the connector from the fuel pump control unit.
5) Remove the fuel pump control unit.

B: INSTALLATION

Install in the reverse order of removal.

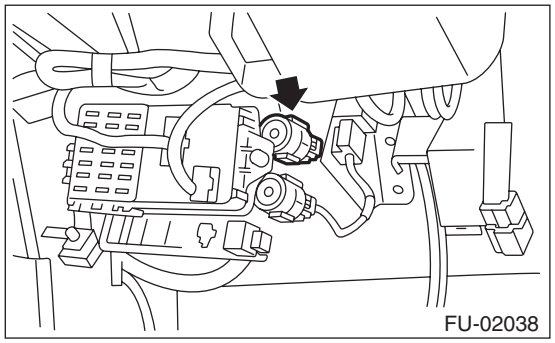
23.Fuel

A: OPERATION

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 connector from fuel pump relay.

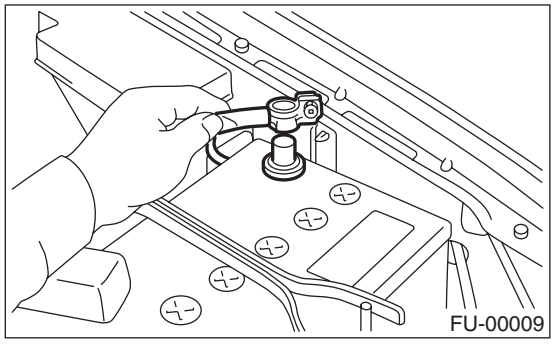


2) Start the engine and run it until it stalls.
3) After the engine stalls, crank it for five more seconds.
4) Turn ignition switch to OFF.

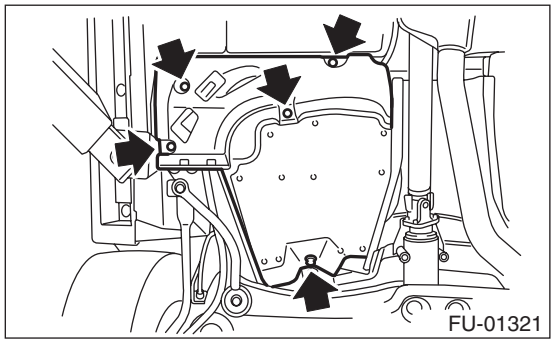
2. DRAINING FUEL

WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**

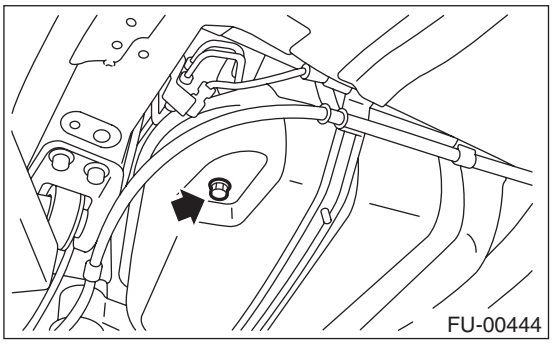
1) Set vehicle on the lift.
2) Disconnect battery ground cable.



3) Lift-up the vehicle.
4) Remove front right side fuel tank cover.



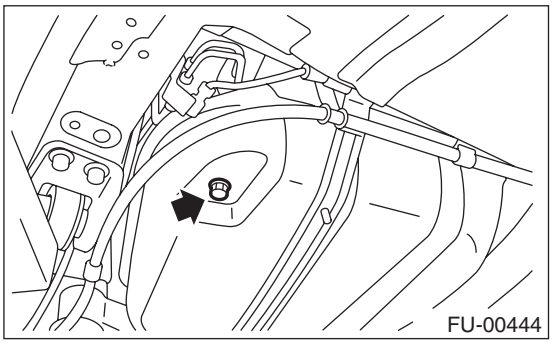
5) Drain fuel from fuel tank.
Set a container under the vehicle and remove drain plug from fuel tank.



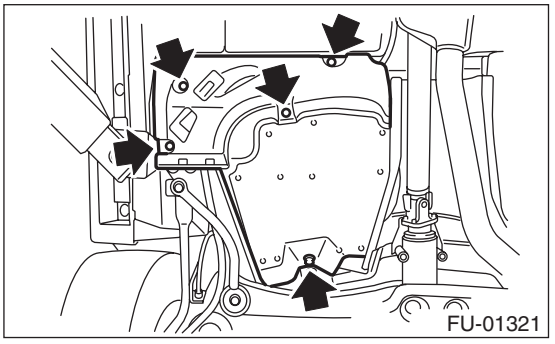
6) Tighten fuel drain plug and install front right side tank cover.

NOTE:
Replace gasket with new one.

Tightening torque:
26 N·m (2.65 kgf-m, 19.2 ft-lb)

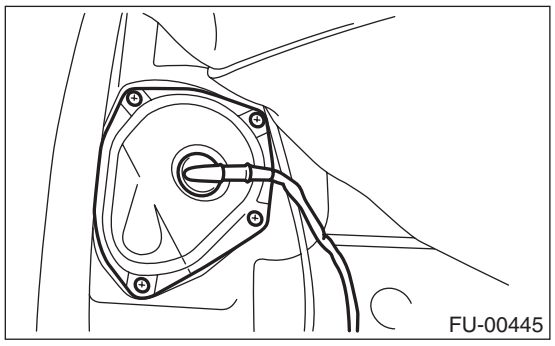


Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)

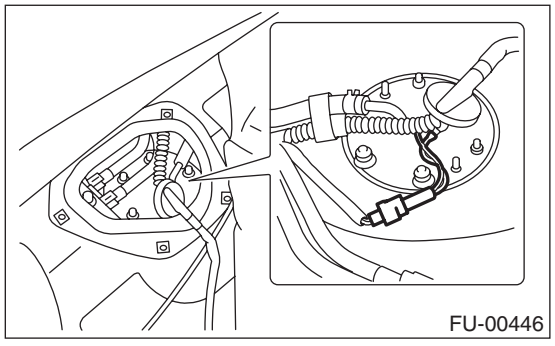


7) Lower the vehicle.

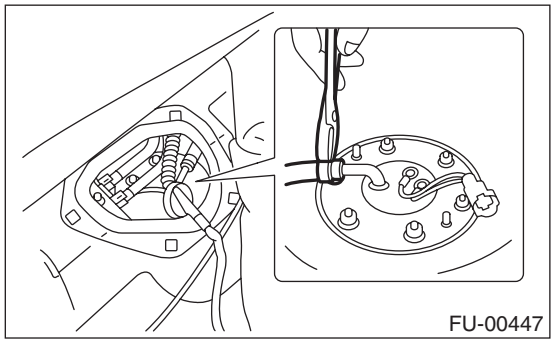
8) Remove sub service hole cover.



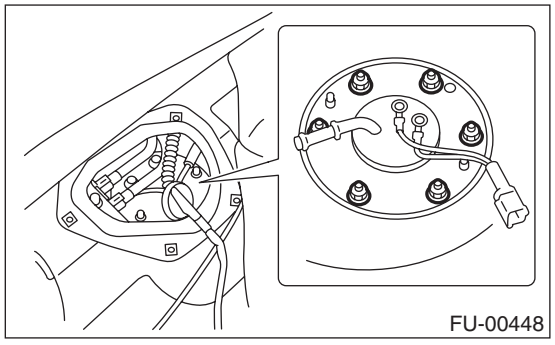
9) Disconnect connector from fuel sub level sensor.



10) Disconnect fuel jet pump hose.



11) Remove fuel sub level sensor.

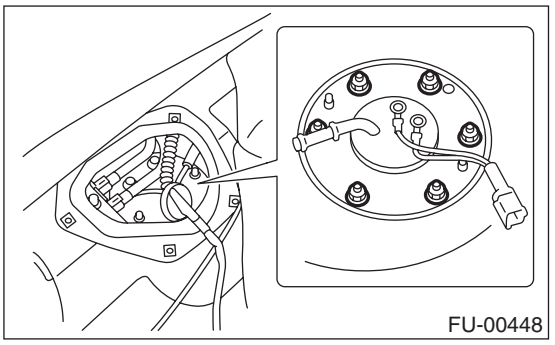


12) Drain fuel from fuel tank by using hand pump.

WARNING:
Do not use a motor pump when draining fuel.

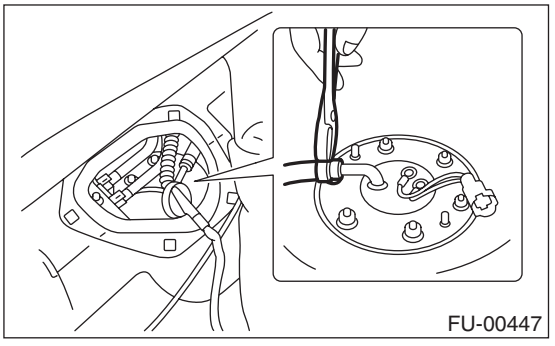
13) After draining fuel, reinstall fuel sub level sensor.

Tightening torque:
T: 4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

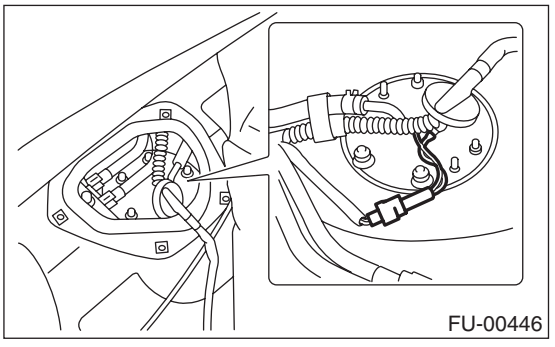


NOTE:
If you have not removed fuel tank yet, proceed with the procedure below for installation.

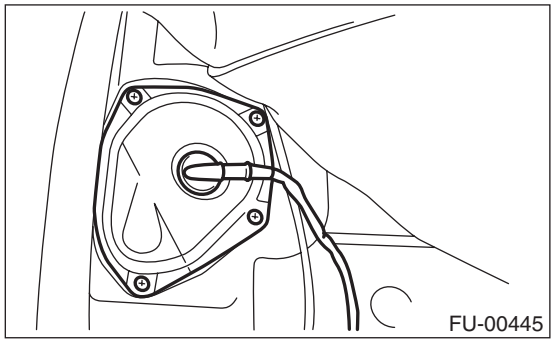
(1) Connect fuel jet pump hose.



(2) Connect connector from fuel sub level sensor.



(3) Install sub service hole cover.

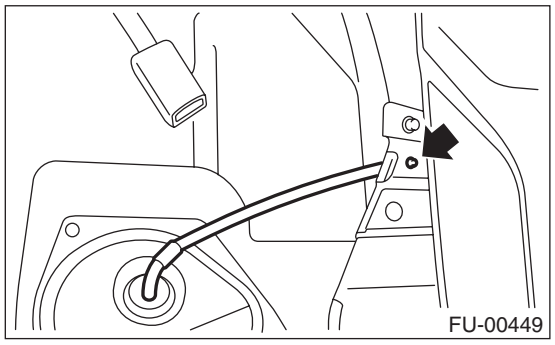


(4) Set rear seat and floor mat.

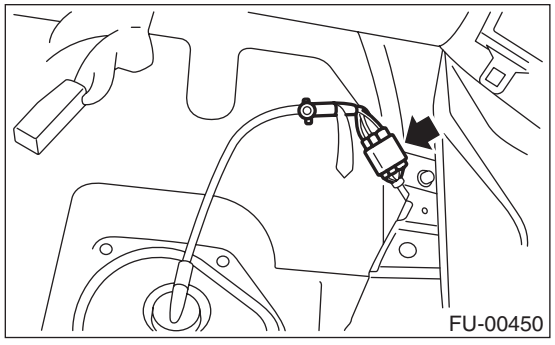
24.Fuel Tank

A: REMOVAL

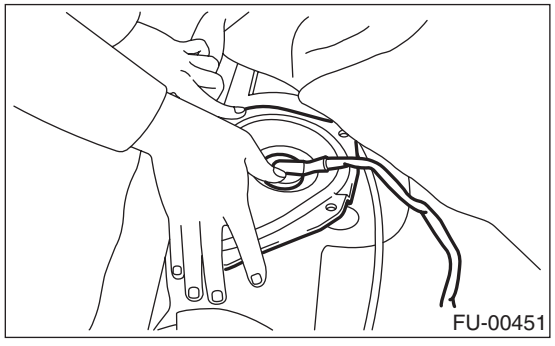
1) Set vehicle on the lift.
2) Release fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
3) Drain fuel from fuel tank. <Ref. to FU(H4DOTC)-48, DRAINING FUEL, OPERATION, Fuel.>
4) Remove holder clip which secures fuel tank cord on bracket.



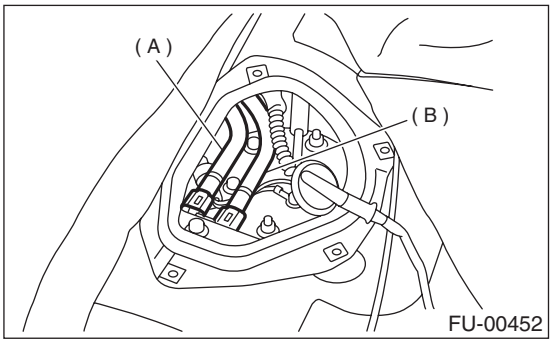
5) Disconnect connector of fuel tank cord to rear harness.



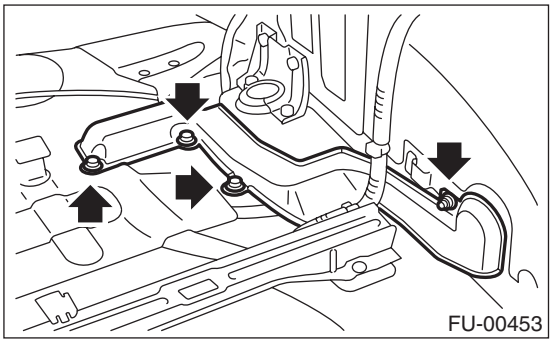
6) Push grommet which holds fuel tank cord on service hole cover into body side.



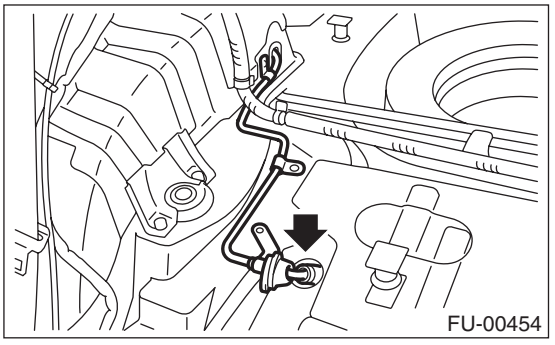
7) Separate quick connector of fuel delivery (A) and return hose (B).<Ref. to FU(H4DOTC)-75, REMOVAL, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



8) Remove parking brake cable.
   (1) Remove console box. <Ref. to EI-36, REMOVAL, Console Box.>
   (2) Remove parking brake bracket and disconnect parking brake cable from equalizer. <Ref. to PB-6, REMOVAL, Parking Brake Cable.>
9) Remove rear pillar trim.
<Ref. to EI-52, REMOVAL, Rear Pillar Trim.>
10) Remove pipe protector.

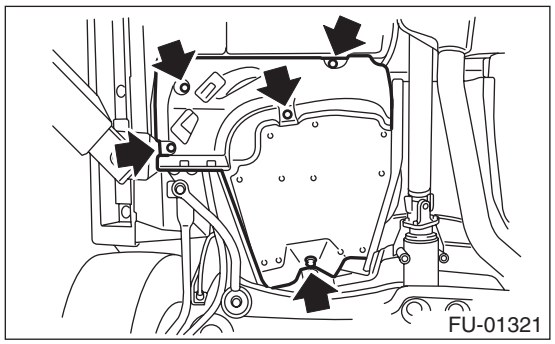


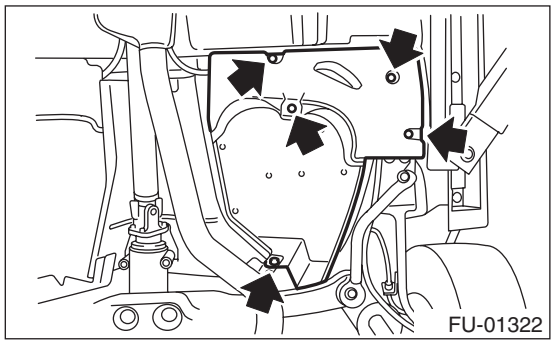
11) Separate quick connector of evaporation pipe. <Ref. to FU(H4DOTC)-75, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



12) Remove wheel nuts from rear wheels.
13) Lift-up the vehicle.
14) Remove rear wheel.

15) Remove front side fuel tank cover.


FU-01321

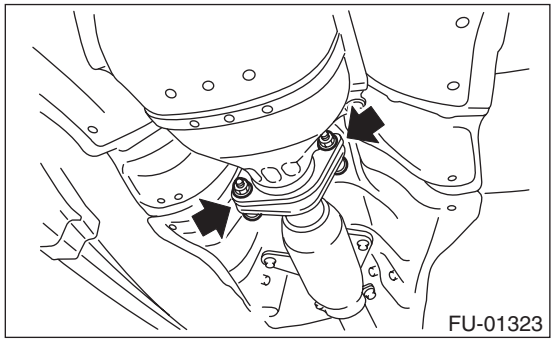

FU-01322

16) Remove rear exhaust pipe and muffler.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

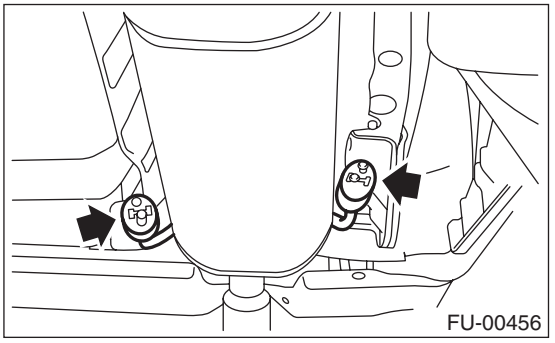
SUBARU CRC (Part No. 004301003)

(1) Separate rear exhaust pipe from center exhaust pipe.

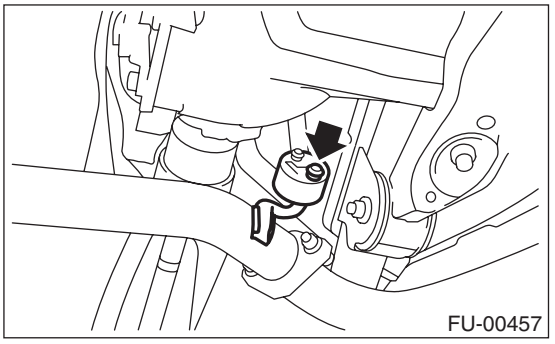

FU-01323

(2) Remove left and right rubber cushions.

CAUTION:
Be careful not to pull down muffler.

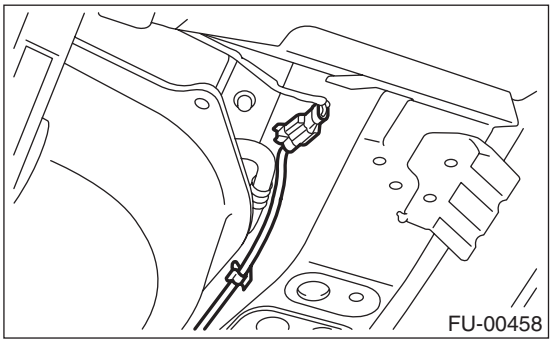

FU-00456

(3) Remove front rubber cushion and detach muffler assembly.


FU-00457

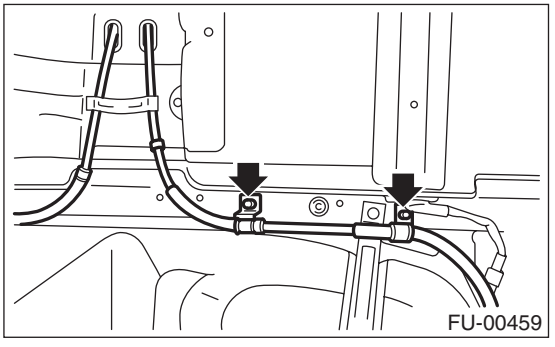
17) Remove propeller shaft. <Ref. to DS-15, REMOVAL, Propeller Shaft.>

18) Disconnect connector from ABS sensor.

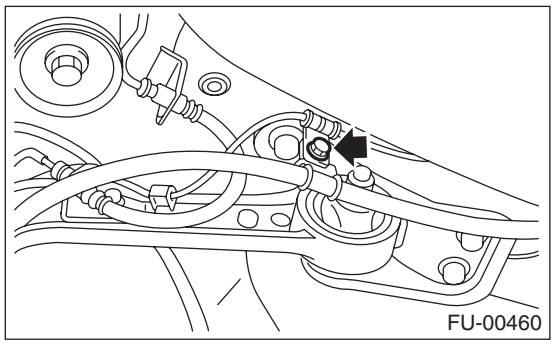

FU-00458

19) Remove bolts which hold parking brake cable holding bracket.

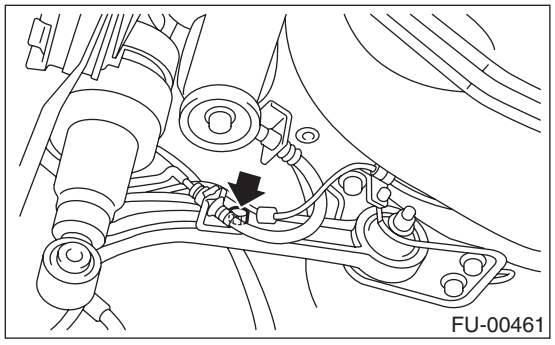
20) Remove parking brake cable from cabin by forcibly pulling it backward.


FU-00459

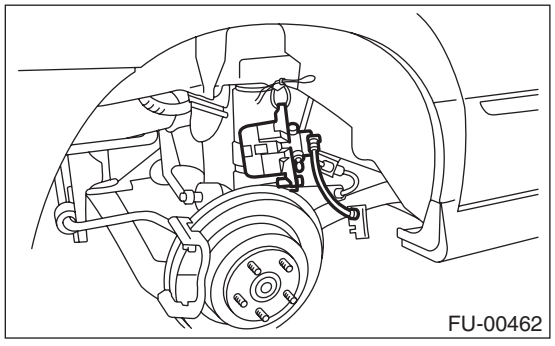
21) Remove bolts which hold parking brake cable holding bracket.



22) Remove bolts which hold rear brake hoses holding bracket.



23) Remove rear brake caliper, then tie it up to the body side of the vehicle as shown in figure.

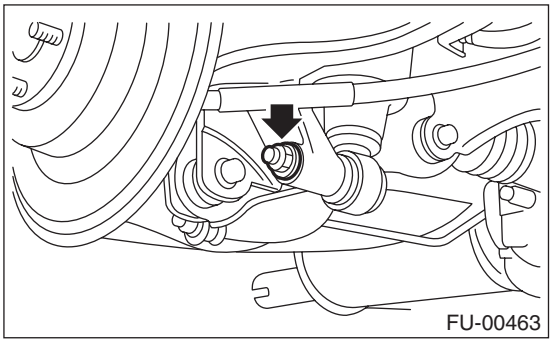


24) Remove rear suspension assembly.

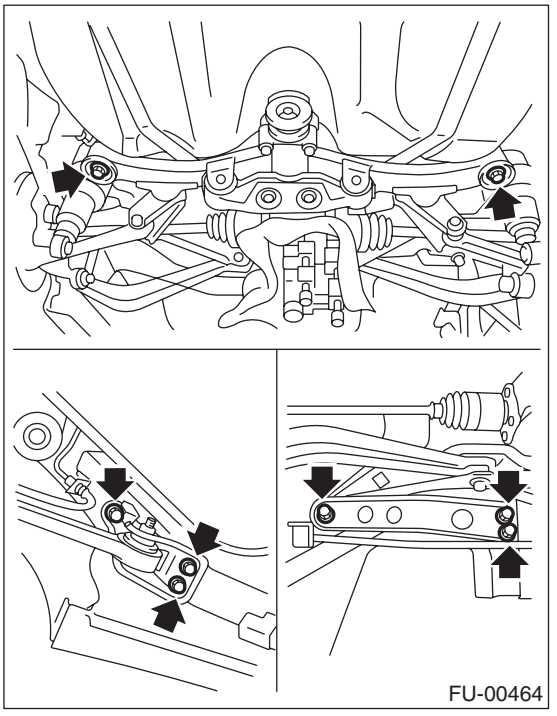
WARNING:
A helper is required to perform this work.

(1) Support rear differential with transmission jack.

(2) Remove bolt which holds rear shock absorber to rear suspension arm.

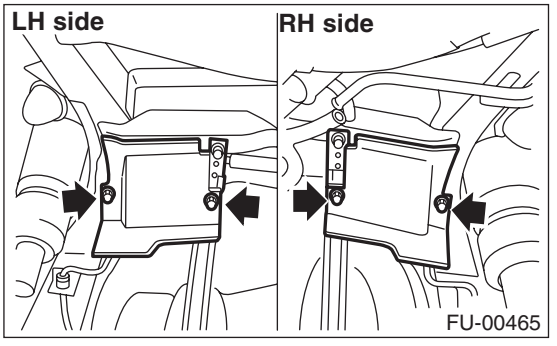


(3) Remove bolts which secure rear suspension assembly to body.

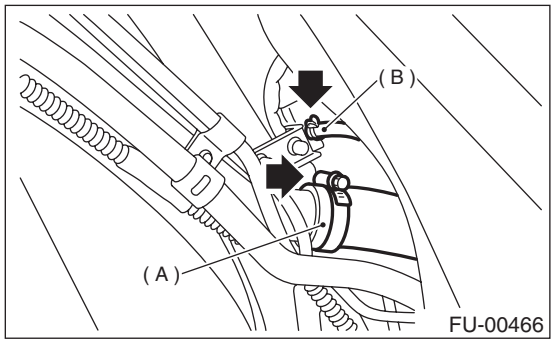


(4) Remove rear suspension assembly.

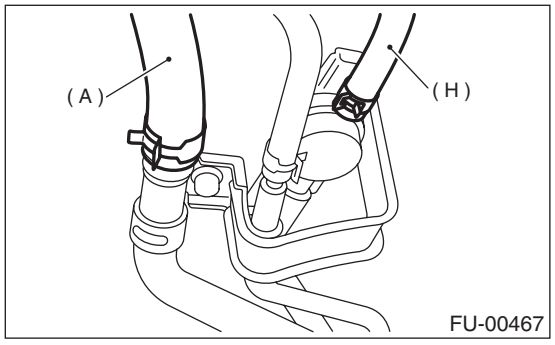
25) Remove rear side fuel tank cover.



26) Disconnect fuel filler hose (A) and fuel tank pressure sensor hose (B).

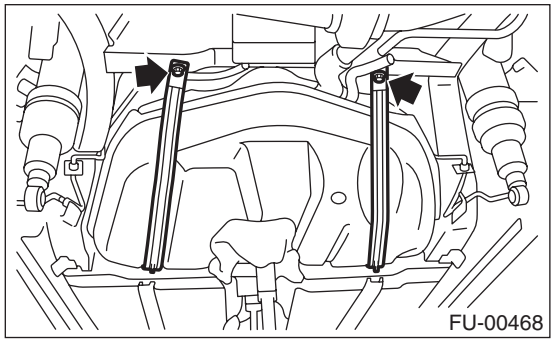


27) Disconnect air vent hose (A) from evaporation pipe assembly and disconnect evaporation hose (H) from pressure control solenoid valve.



28) Support fuel tank with transmission jack, remove bolts from bands and dismount fuel tank from the vehicle.

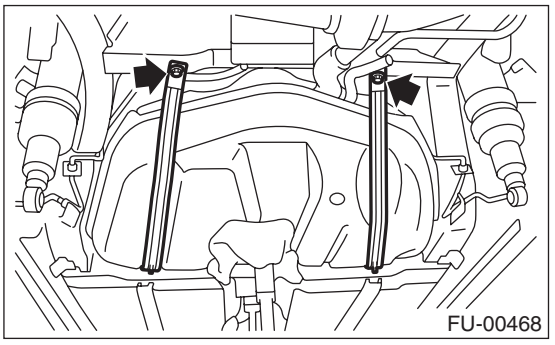
WARNING:
A helper is required to perform this work.



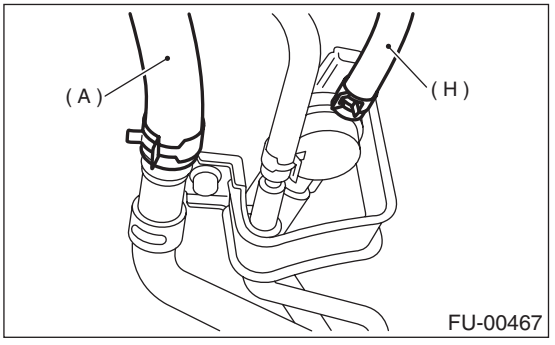
B: Installation

1) Support fuel tank with transmission jack and push fuel tank harness into access hole with grommet.
2) Set fuel tank and temporarily tighten bolts of fuel tank bands.

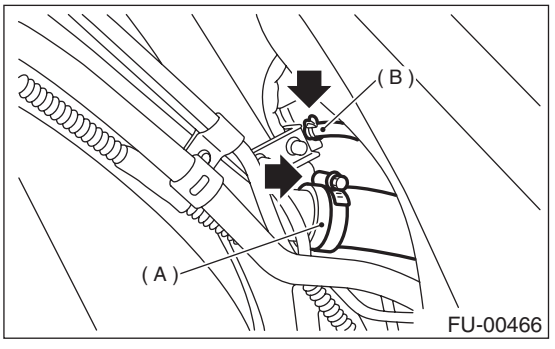
WARNING:
A helper is required to perform this work.



3) Connect air vent hose (A) to evaporation pipe assembly and connect evaporation hose (H) to pressure control solenoid valve.

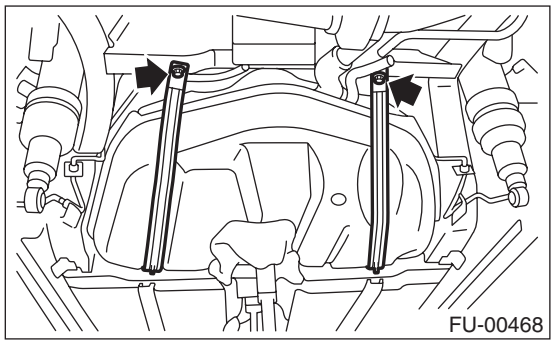


4) Connect fuel filler hose (A) and fuel tank pressure sensor hose (B).



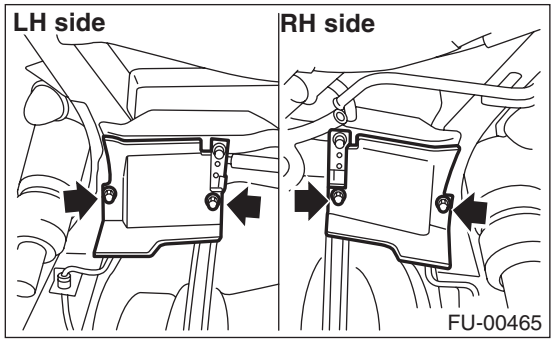
5) Tighten band mounting bolts.

Tightening torque:
33 N·m (3.4 kgf-m, 25 ft-lb)



6) Install rear side fuel tank cover.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)

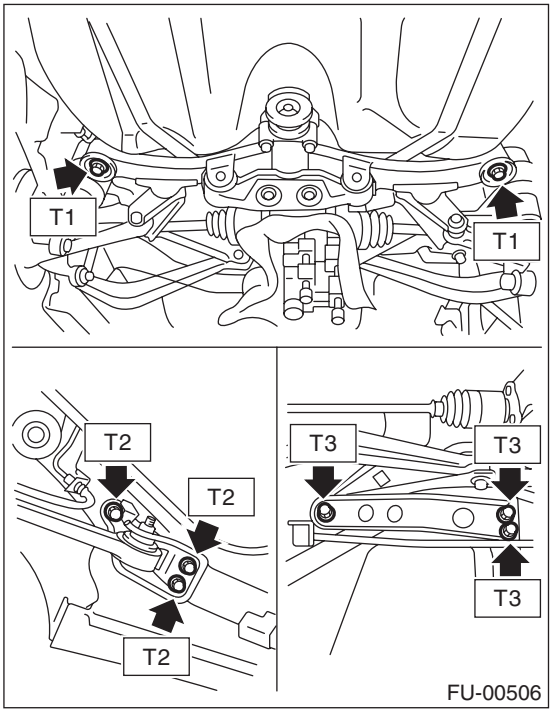


7) Install rear suspension assembly.

WARNING:
A helper is required to perform this work.

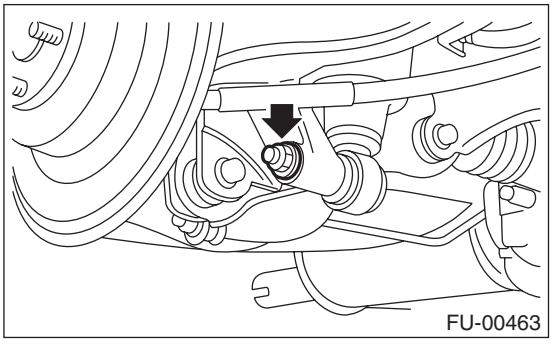
(1) Support rear suspension assembly and then tighten bolts which secure rear suspension assembly.

Tightening torque:
T1: 172 N·m (17.5 kgf-m, 127 ft-lb)
T2: 108 N·m (11.0 kgf-m, 80 ft-lb)
T3: 66 N·m (6.7 kgf-m, 48 ft-lb)

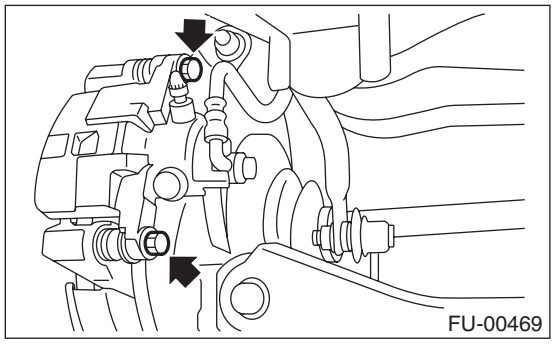


(2) Tighten bolt which holds rear shock absorber to rear suspension arm. <Ref. to RS-14, INSTALLATION, Link Upper.>

Tightening torque:
157 N·m (16 kgf-m, 116 ft-lb)

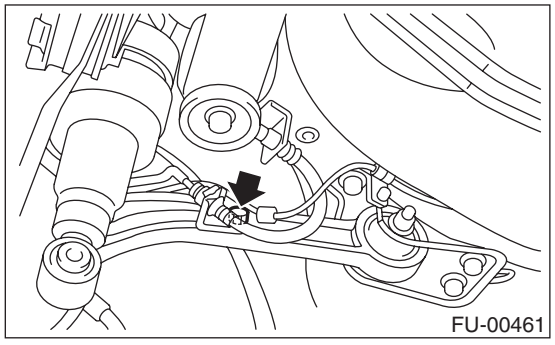


8) Install rear brake caliper. <Ref. to BR-21, INSTALLATION, Rear Disc Brake Assembly.>



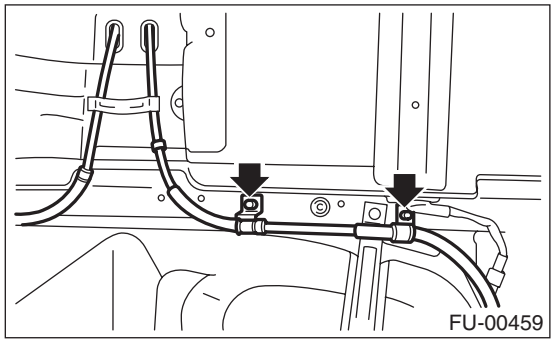
9) Tighten bolts which hold rear brake hoses holding bracket.

Tightening torque:
33 N·m (3.4 kgf-m, 25 ft-lb)

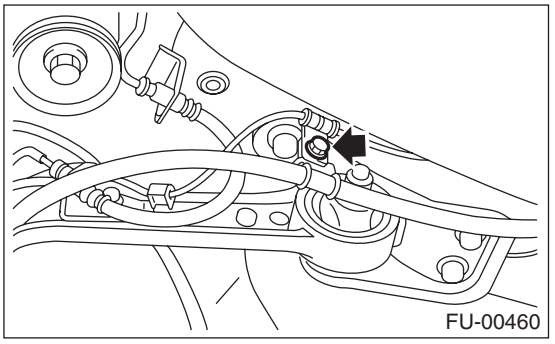


10) Install parking brake cable to cabin by forcibly pushing it forward.
11) Tighten bolts which hold parking brake cable holding bracket.

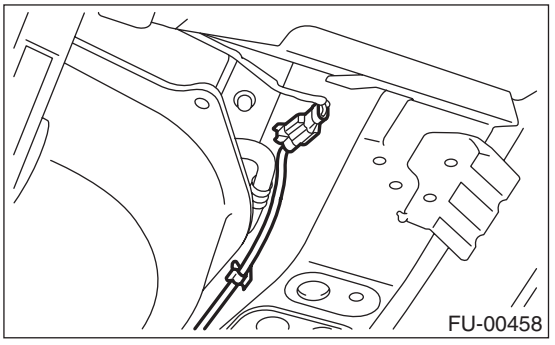
Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



Tightening torque:
32 N·m (3.3 kgf-m, 23.9 ft-lb)



12) Connect connector to ABS sensor.

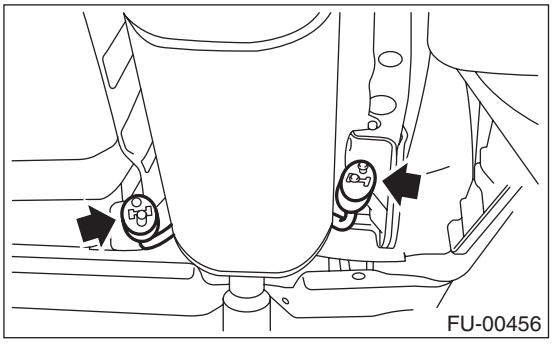


13) Install propeller shaft. <Ref. to DS-16, INSTALLATION, Propeller Shaft.>
14) Install rear exhaust pipe and muffler.

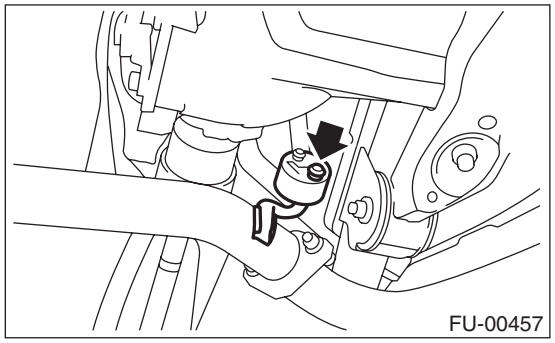
NOTE:
To facilitate the procedure, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

(1) Install left and right rubber cushions.

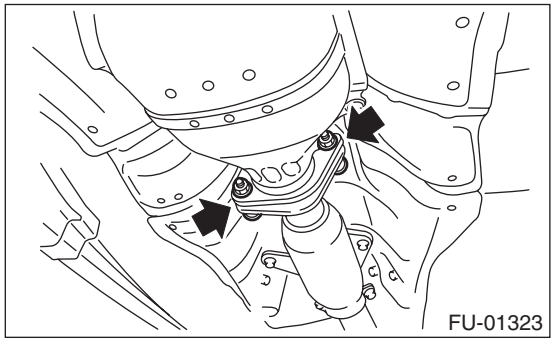


(2) Install front rubber cushion and attach muffler assembly.


FU-00457

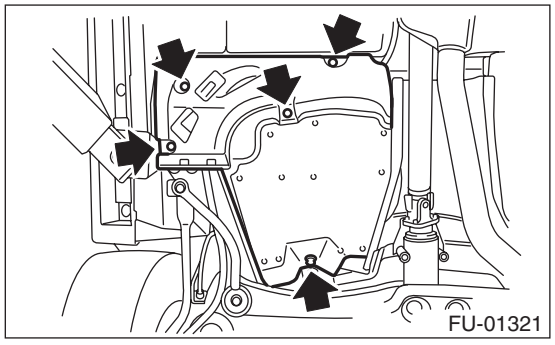
(3) Install rear exhaust pipe to center exhaust pipe.

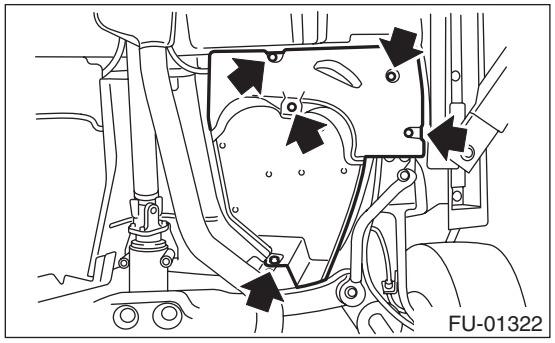
Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)


FU-01323

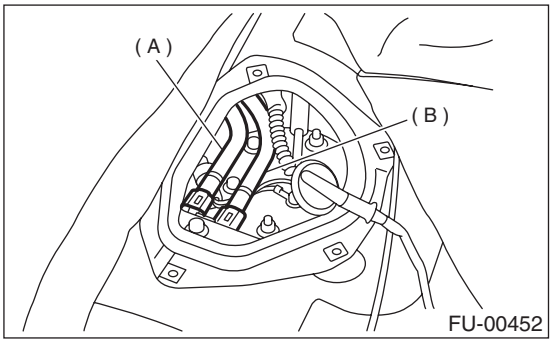
15) Install front side fuel tank cover.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)


FU-01321


FU-01322

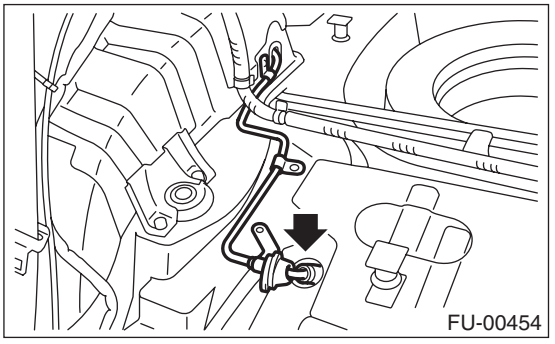
16) Install rear wheel.
17) Lower the vehicle.
18) Tighten wheel nuts to rear wheel.
19) Install parking brake cable. <Ref. to PB-5, INSTALLATION, Parking Brake Lever.>
20) Install console box. <Ref. to EI-36, INSTALLATION, Console Box.>
21) Connect fuel hoses and hold them with quick connector. <Ref. to FU(H4DOTC)-76, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>



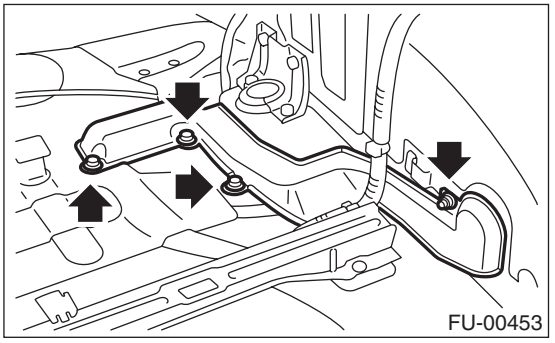
FU-00452

(A) Delivery hose
(B) Return hose

22) Connect evaporation pipe and hold it with quick connector. <Ref. to FU(H4DOTC)-76, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

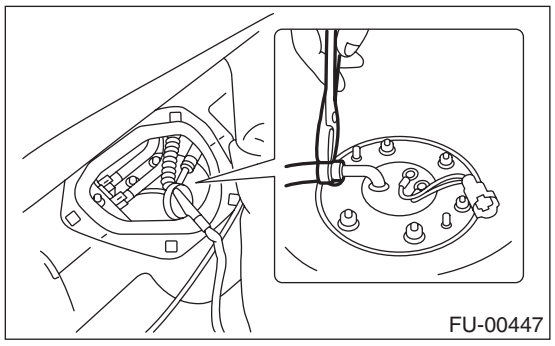

FU-00454

23) Install pipe protector.

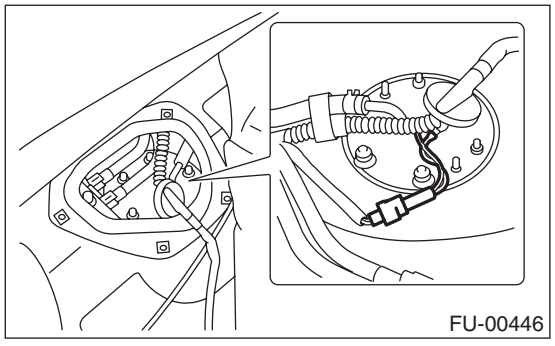

FU-00453

24) Install rear pillar trim. <Ref. to EI-52, REMOVAL, Rear Pillar Trim.>

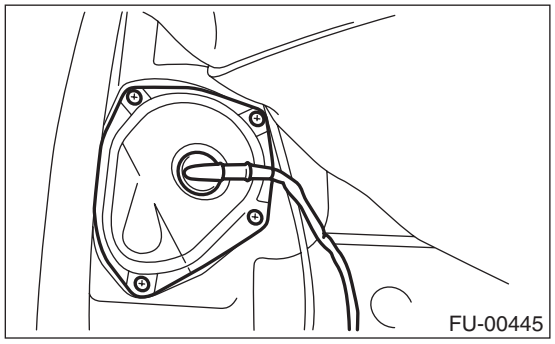
25) Connect fuel jet pump hose.



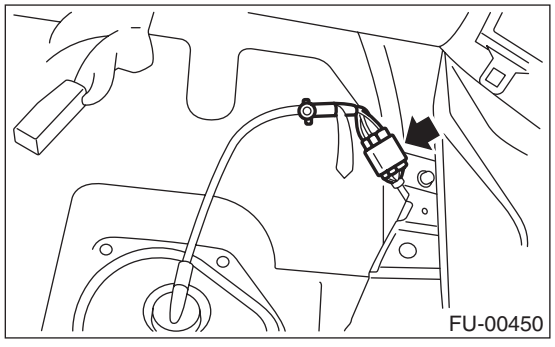
26) Connect connector to fuel sub level sensor.



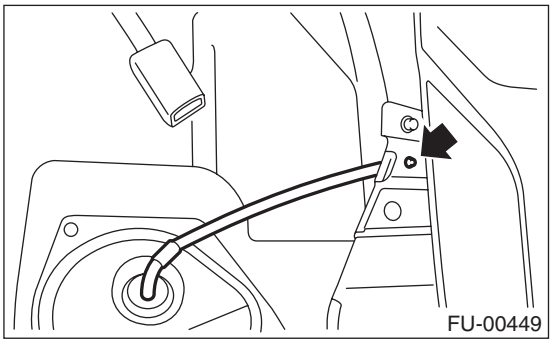
27) Install sub service hole cover.



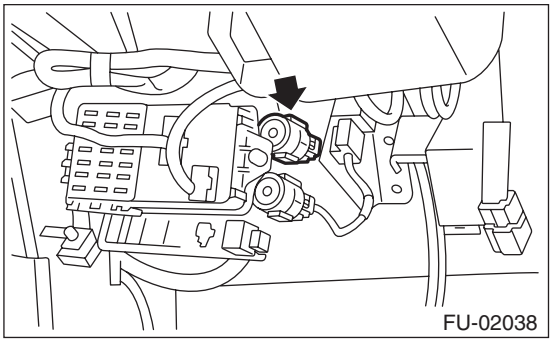
28) Connect connectors to fuel tank cord and plug service hole with grommet.



29) Install holder clip which secures fuel tank cord on bracket.



30) Set rear seat and floor mat.
31) Connect connector to fuel pump relay.



32) Adjust parking brake lever stroke. <Ref. to PB-5, ADJUSTMENT, Parking Brake Lever.>
33) Check wheel alignment and adjust if necessary. <Ref. to FS-8, INSPECTION, Wheel Alignment.>

C: INSPECTION

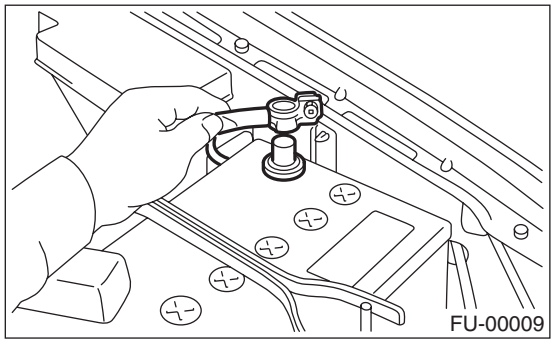
1) Make sure there are no cracks, holes, or other damage on the fuel tank.
2) Make sure that the fuel hoses and fuel pipes are not cracked and that connections are tight.

25.Fuel Filler Pipe

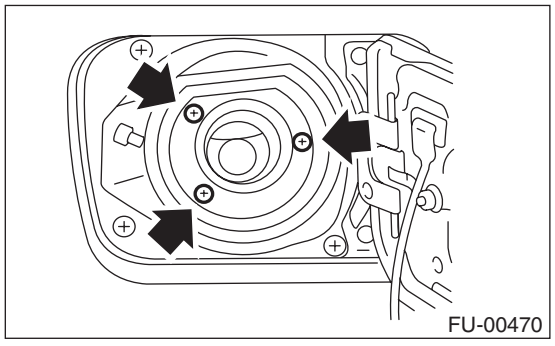
A: REMOVAL

WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**

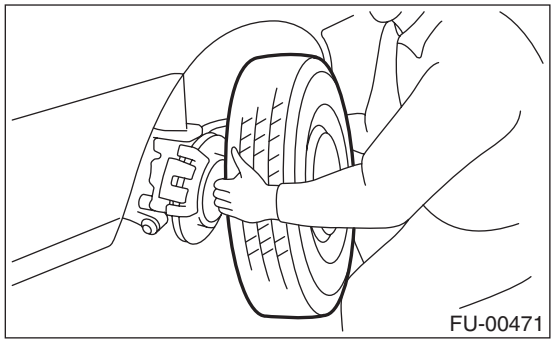
1) Set the vehicle on the lift.
2) Disconnect battery ground cable.



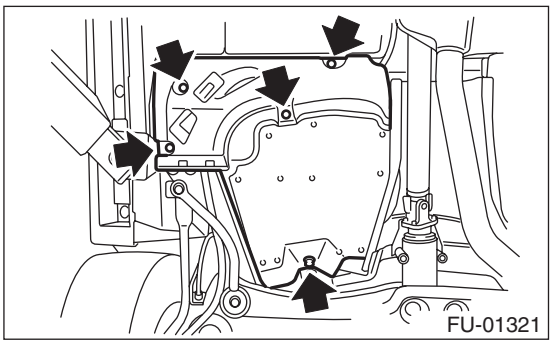
3) Open fuel filler flap lid and remove filler cap.
4) Remove screws holding packing in place.



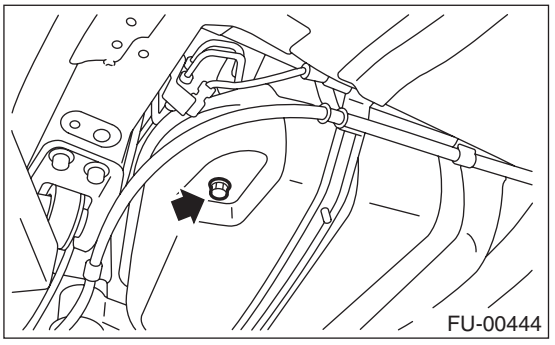
5) Lift-up the vehicle.
6) Remove rear wheel nuts.
7) Remove rear wheel.



8) Remove front right side fuel tank cover.



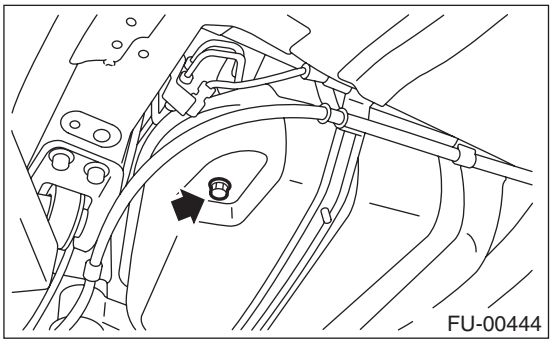
9) Drain fuel from fuel tank. Set a container under the vehicle and remove drain plug from fuel tank.



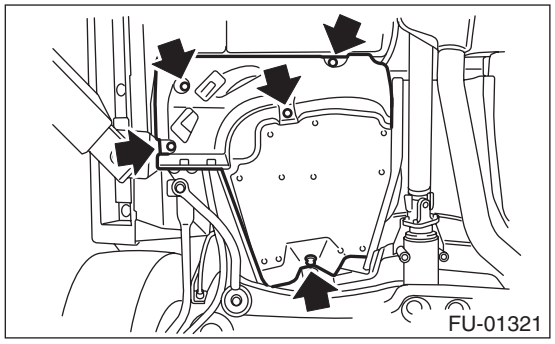
10) Tighten fuel drain plug and then install front right side tank cover.

NOTE:
Replace gasket with new one.

Tightening torque:
26 N·m (2.65 kgf-m, 19.2 ft-lb)



Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)

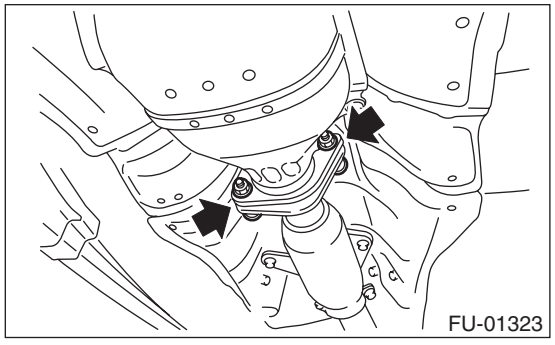

FU-01321

11) Remove rear exhaust pipe and muffler.

NOTE:
To facilitate removal, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

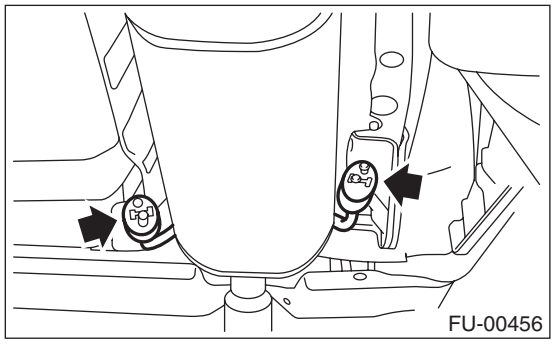
SUBARU CRC (Part No. 004301003)

(1) Separate rear exhaust pipe from center exhaust pipe.

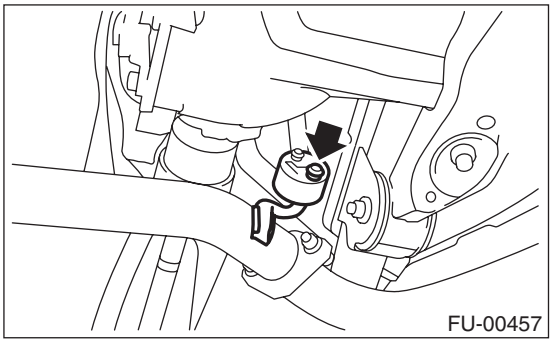

FU-01323

(2) Remove left and right rubber cushions.

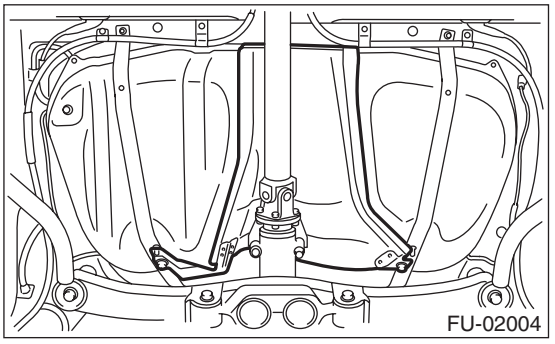
CAUTION:
Be careful not to pull down muffler.


FU-00456

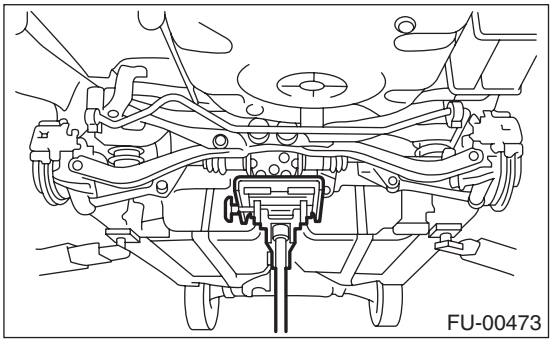
(3) Remove front rubber cushion and detach muffler assembly.


FU-00457

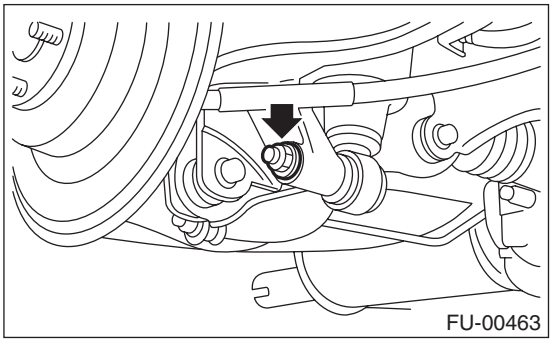
12) Remove heat sealed cover.


FU-02004

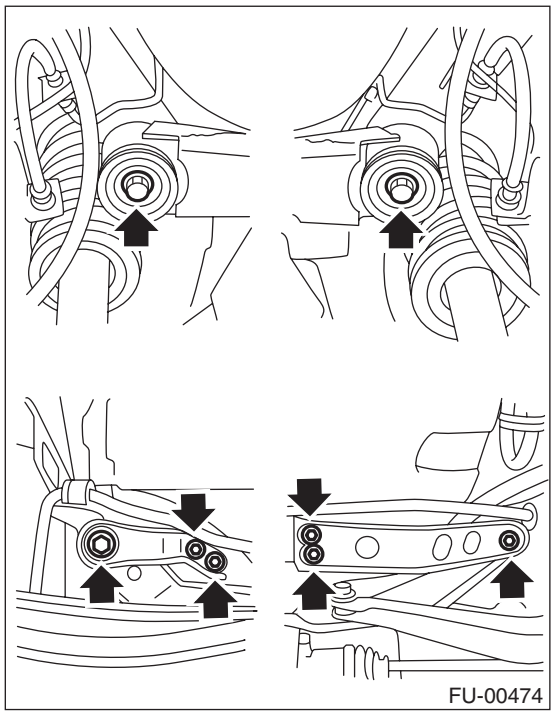
13) Place transmission jack under sub frame.


FU-00473

14) Remove bolt which holds rear shock absorber to rear suspension arm.


FU-00463

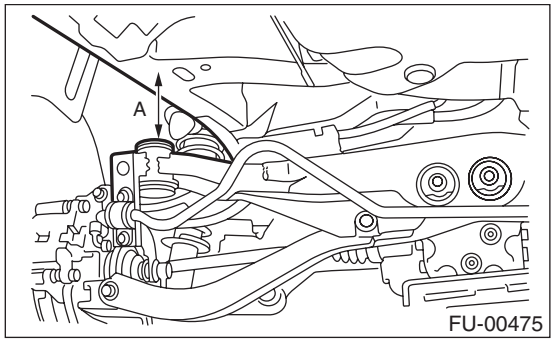
15) Remove bolts which hold rear sub frame on body.



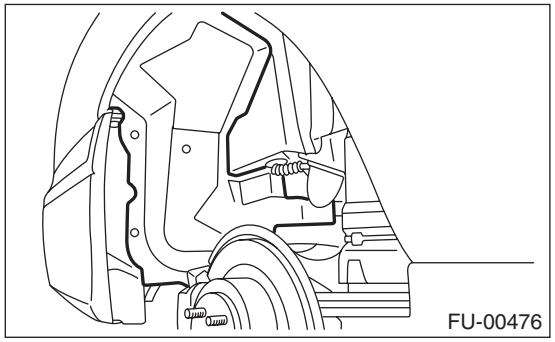
16) Lower the rear sub frame.

CAUTION:
Be sure to lower sub frame slowly.

A = 150 mm (5.91 in)

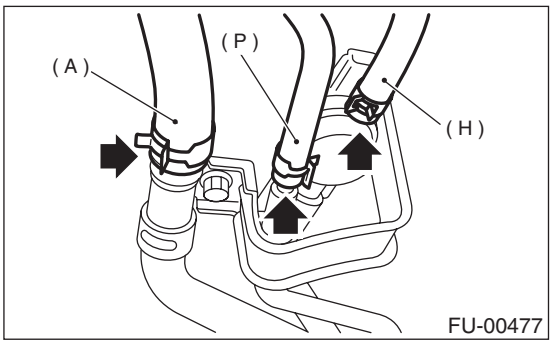


17) Remove fuel filler pipe protector.

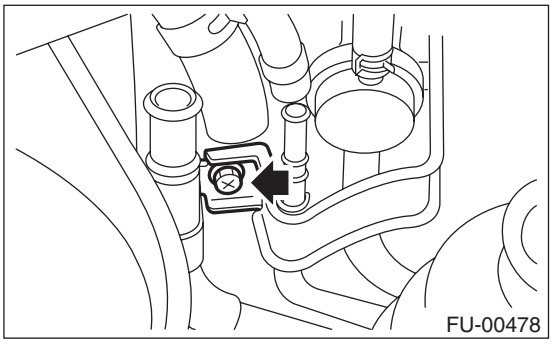


18) Disconnect air vent hose (A) and evaporation hose (P) from evaporation pipe assembly.

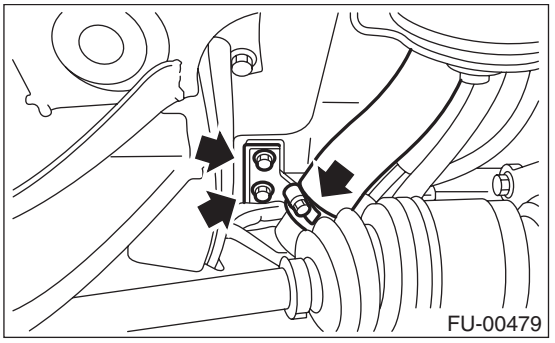
19) Disconnect evaporation hose (H) from pressure control solenoid valve.



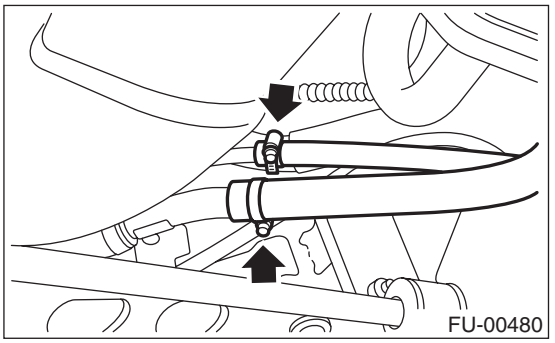
20) Remove bolt which holds evaporation pipe assembly on body.



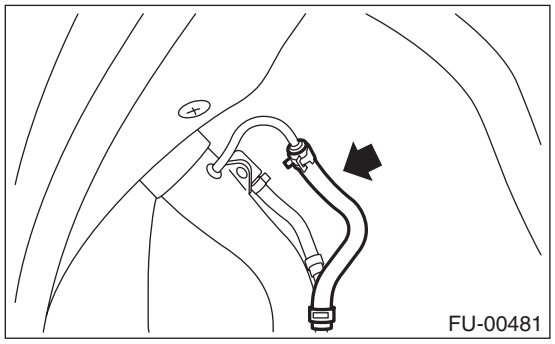
21) Disconnect fuel filler hose.
22) Remove bolt which holds fuel pressure sensor on fuel filler pipe and remove bolt which holds fuel filler pipe on body.



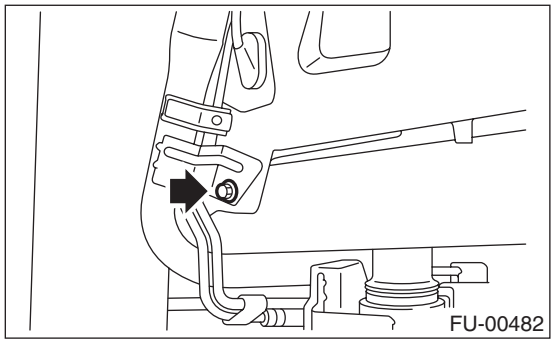
23) Disconnect canister hose from evaporation pipe assembly.



24) Disconnect evaporation hose (O) from fuel filler pipe.



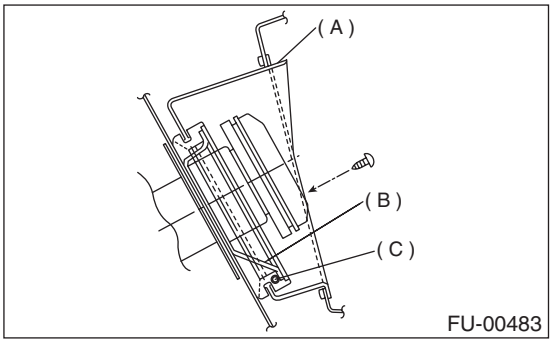
25) Remove bolt which holds fuel filler pipe to body.



26) Remove fuel filler pipe from under side of the vehicle.

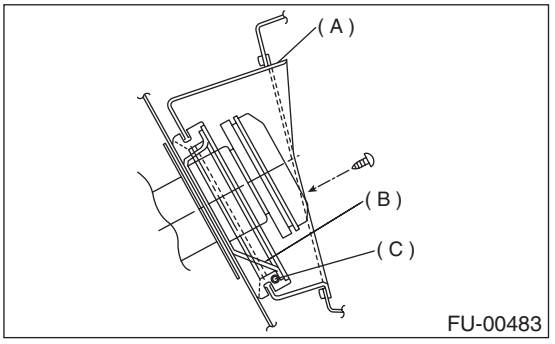
B: Installation

1) Hold fuel filler flap open.
2) Set fuel saucer (A) with rubber packing (C) and insert fuel filler pipe into hole from the inner side of apron.



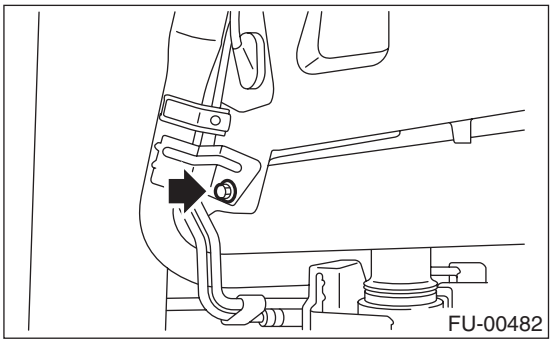
3) Align holes in fuel filler pipe neck and set cup (B), and tighten screws.

NOTE:
If edges of rubber packing are folded toward the inside, straighten it with a screwdriver.

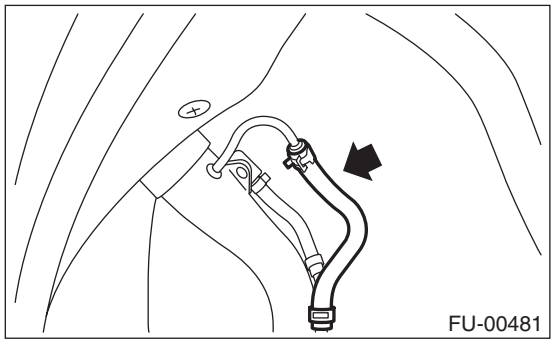


4) Tighten bolt which holds fuel filler pipe on body.

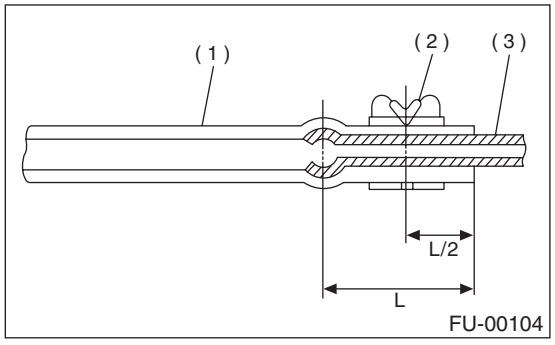
Tightening torque:
7.5 N·m (0.75 kgf-m, 5.4 ft-lb)



5) Insert evaporation hose approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe and hold clip.

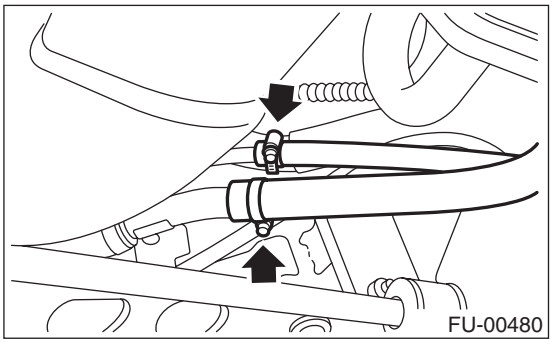


L = 27.5±2.5 mm (1.083±0.098 in)

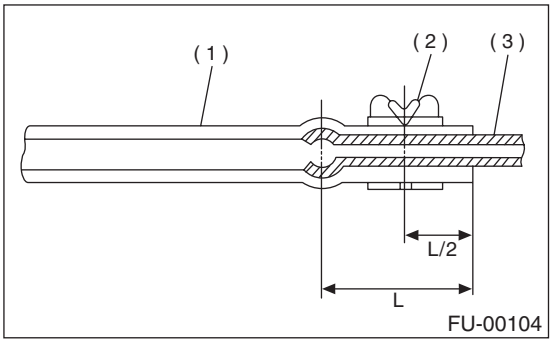


(1) Hose
(2) Clip
(3) Pipe

6) Insert canister hoses approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe assembly and tighten clamp.



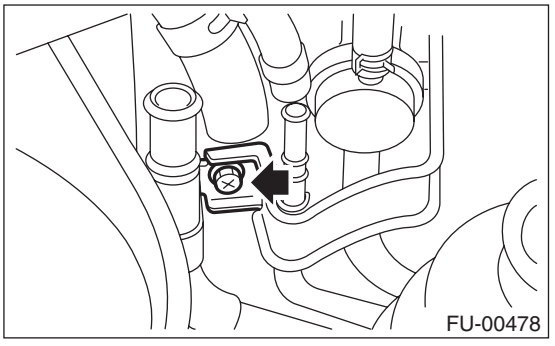
L = 27.5±2.5 mm (1.083±0.098 in)



(1) Hose
(2) Clip
(3) Pipe

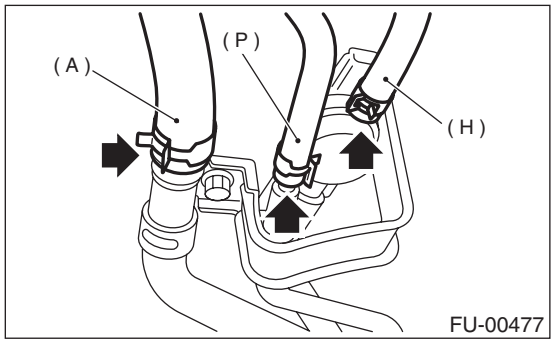
7) Tighten bolt which holds evaporation pipe assembly on body.

Tightening torque:
7.5 N·m (0.75 kgf-m, 5.4 ft-lb)

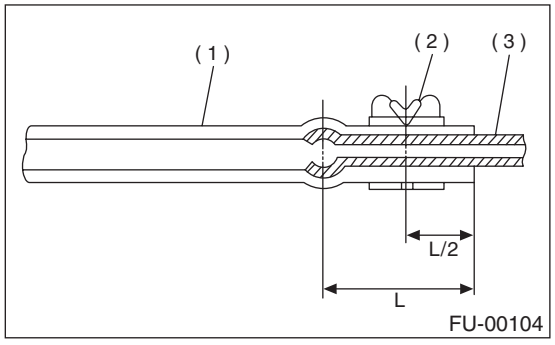


8) Insert air vent hose (A), evaporation hose (P) approximately 25 to 30 mm (0.98 to 1.18 in) into the lower end of evaporation pipe assembly and hold clip.

9) Insert evaporation hose (H) to pressure control solenoid valve and hold clip.



L = 27.5±2.5 mm (1.083±0.098 in)

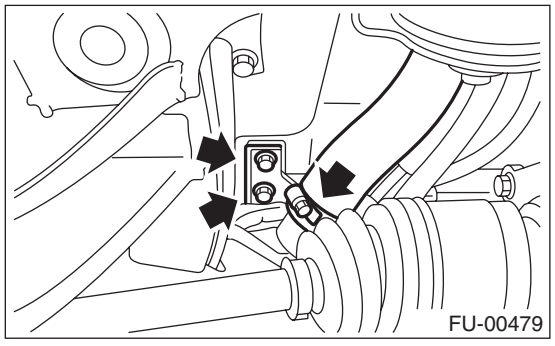


(1) Hose
(2) Clip
(3) Pipe

10) Tighten bolt which holds fuel filler pipe on body and tighten bolt which holds fuel pressure sensor on fuel filler pipe.

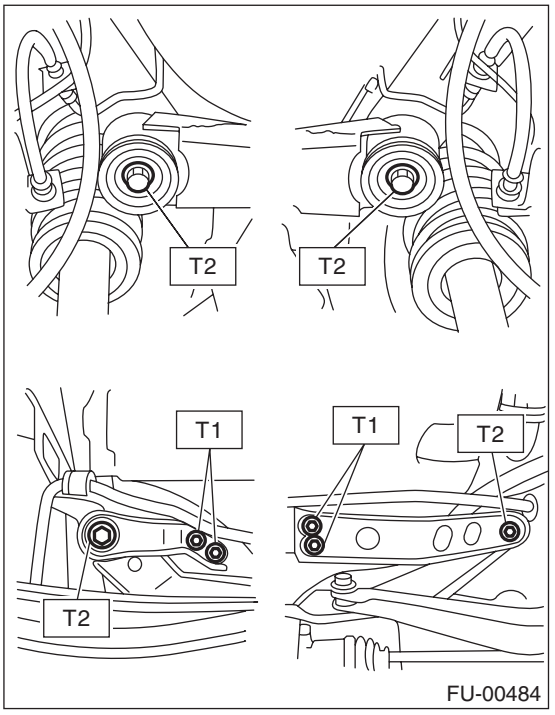
Tightening torque:
7.5 N·m (0.75 kgf-m, 5.4 ft-lb)

11) Insert fuel filler hose approximately 35 to 40 mm (1.38 to 1.57 in) over the lower end of fuel filler pipe and tighten clamp.



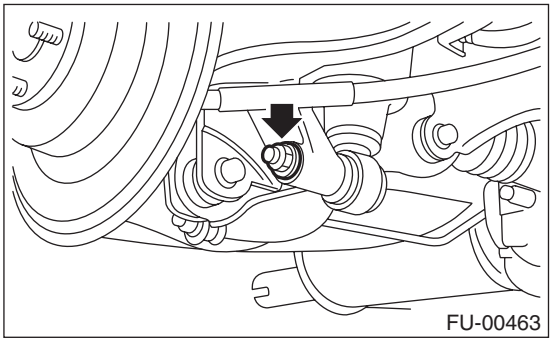
12) Jack-up the rear sub frame and tighten bolts which hold rear sub frame on body.

Tightening torque:
T1: 66 N·m (6.7 kgf-m, 48.5 ft-lb)
T2: 172 N·m (17.5 kgf-m, 127 ft-lb)

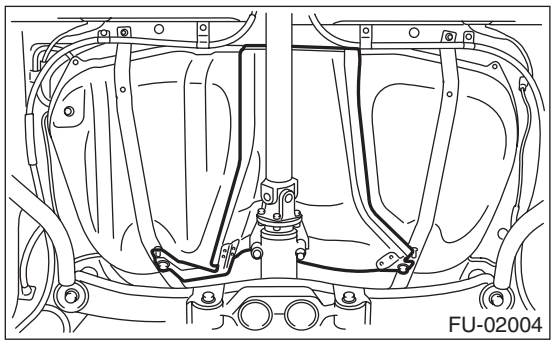


13) Tighten bolt which holds rear shock absorber to rear suspension arm. <Ref. to RS-16, INSTALLATION, Rear Shock Absorber.>

Tightening torque:
157 N·m (16 kgf-m, 116 ft-lb)



14) Install heat shield cover.

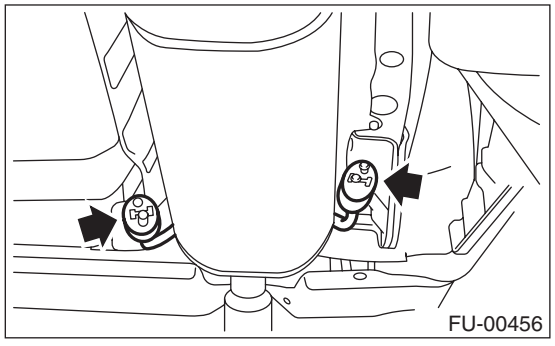


15) Install rear exhaust pipe and muffler.

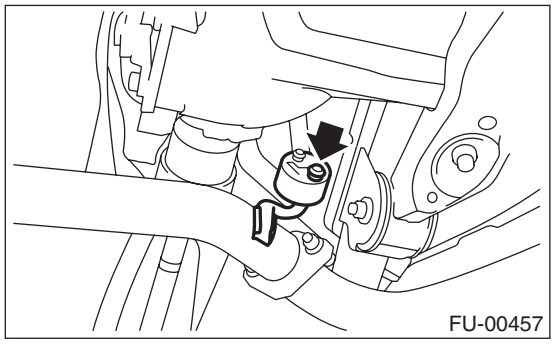
NOTE:
To facilitate the procedure, apply a coat of SUBARU CRC to matching area of rubber cushions in advance.

SUBARU CRC (Part No. 004301003)

(1) Install left and right rubber cushions.

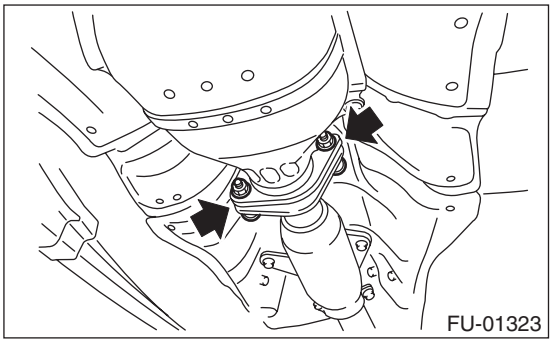


(2) Install front rubber cushion and attach muffler assembly.

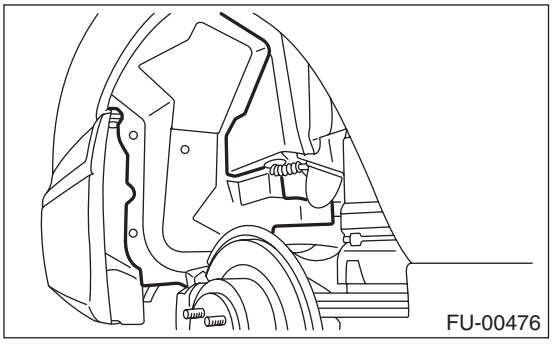


(3) Install rear exhaust pipe to center exhaust pipe.

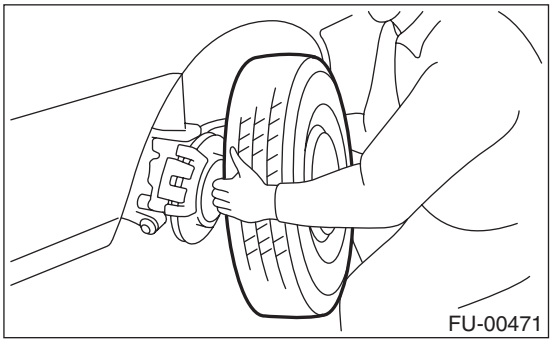
Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



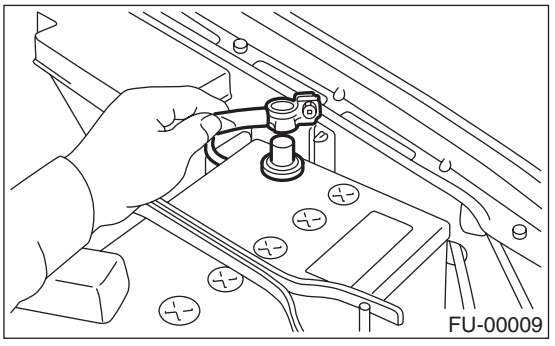
16) Install fuel filler pipe protector.



17) Install rear right wheel.



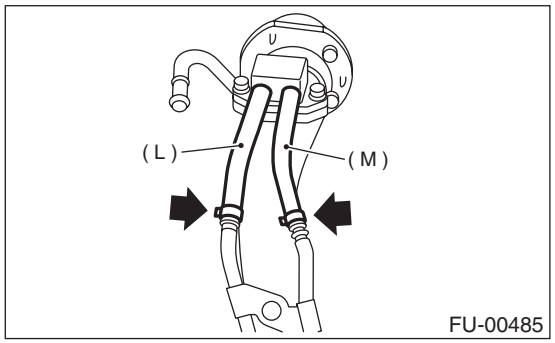
18) Lower the vehicle.
19) Tighten wheel nuts.
20) Connect battery ground cable.



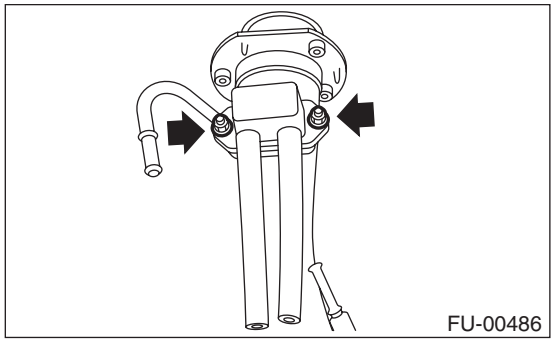
21) Remove fuel filler pipe to under side of the vehicle.

C: DISASSEMBLY

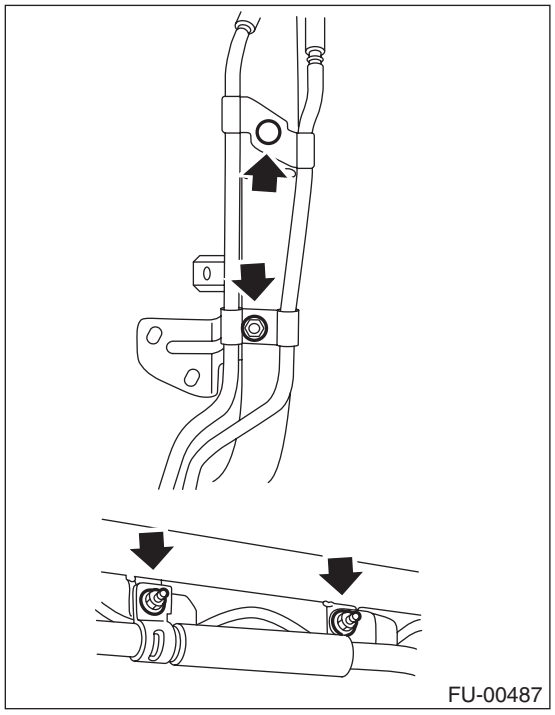
1) Disconnect evaporation hose (L) and (M) from evaporation pipe assembly.



2) Remove shut valve from fuel filler pipe.



3) Remove nut which holds evaporation pipe assembly on fuel filler pipe.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

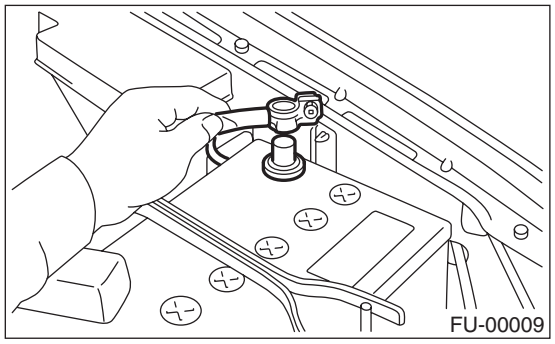
26.Fuel Pump

A: REMOVAL

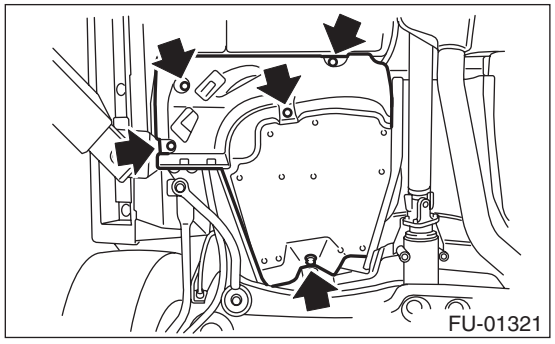
WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**
- **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.**

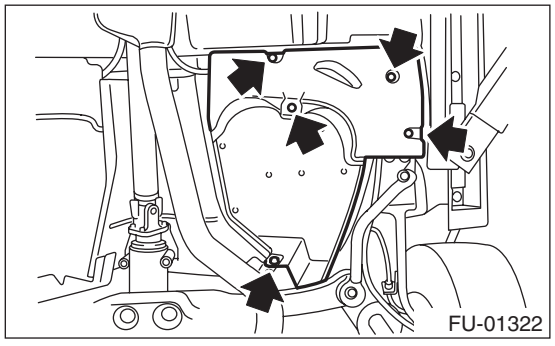
NOTE:
Fuel pump assembly consists of fuel pump and fuel level sensor.

1) Release fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open fuel filler flap lid and remove fuel filler cap.
3) Disconnect battery ground cable.

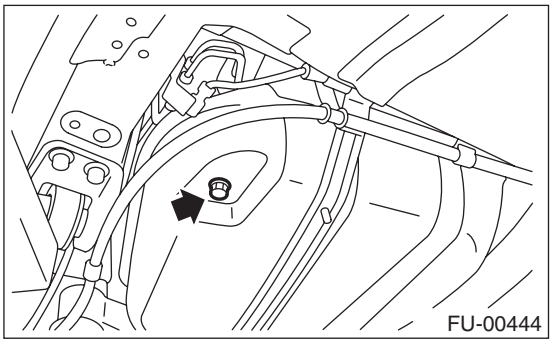

FU-00009

4) Lift-up the vehicle.
5) Remove front side fuel tank cover.


FU-01321


FU-01322

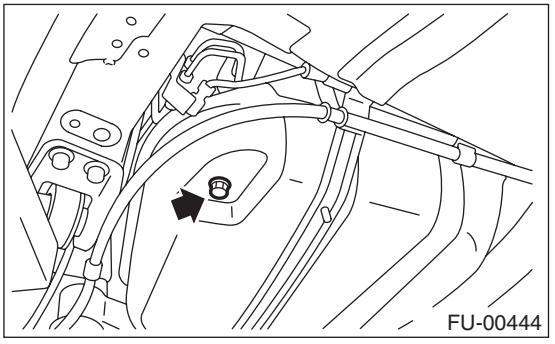
6) Drain fuel from fuel tank. Set a container under the vehicle and remove drain plug from fuel tank.


FU-00444

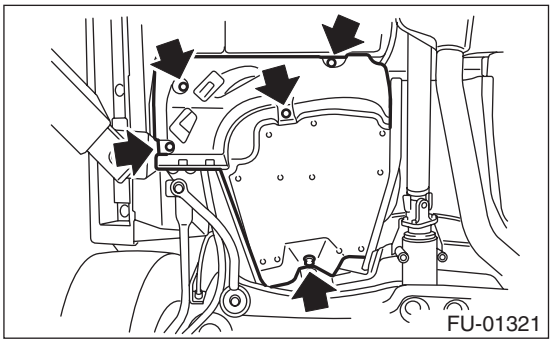
7) Tighten fuel drain plug and install front right side fuel tank cover.

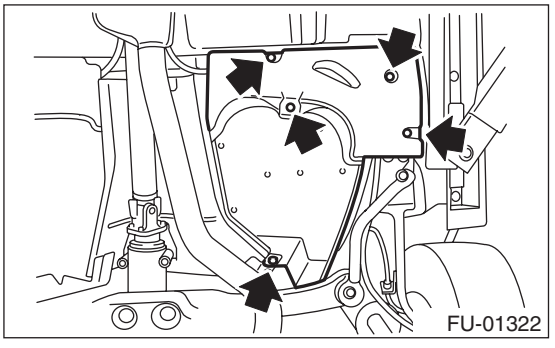
NOTE:
Replace gasket with new one.

Tightening torque:
26 N·m (2.65 kgf-m, 19.2 ft-lb)

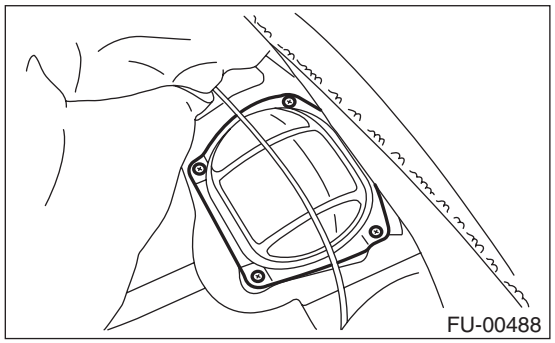

FU-00444

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)

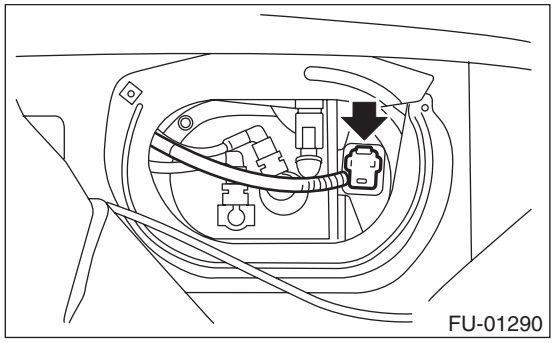

FU-01321


FU-01322

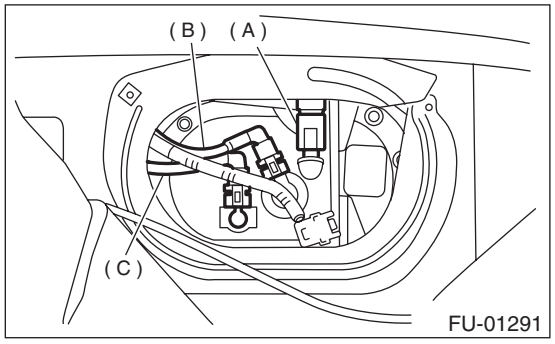
8) Raise rear seat and turn floor mat up.
9) Remove access hole lid.



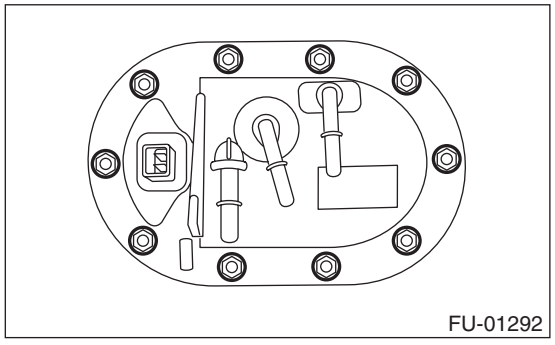
10) Disconnect connector from fuel pump.



11) Move clips and then disconnect jet pump hose (C).
12) Disconnect quick connector and then disconnect fuel delivery hose (A) and return hose (B). <Ref. to FU(H4DOTC)-75, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



13) Remove nuts which install fuel pump assembly onto fuel tank.

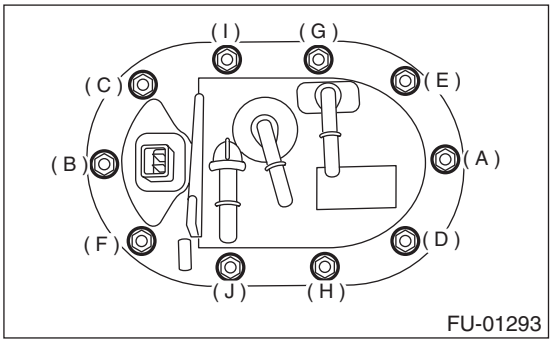


14) Take off fuel pump assembly from fuel tank.

B: INSTALLATION

Install in the reverse order of removal. Do the following:
(1) Always use new gaskets.
(2) Ensure sealing portion is free from fuel or foreign particles before installation.
(3) Tighten nuts in alphabetical sequence shown in figure to specified torque.

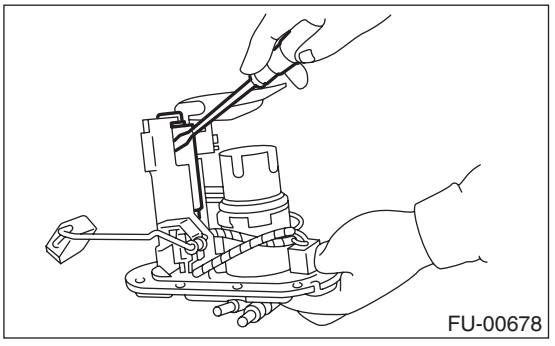
Tightening torque:
5.9 N·m (0.6 kgf-m, 4.3 ft-lb)



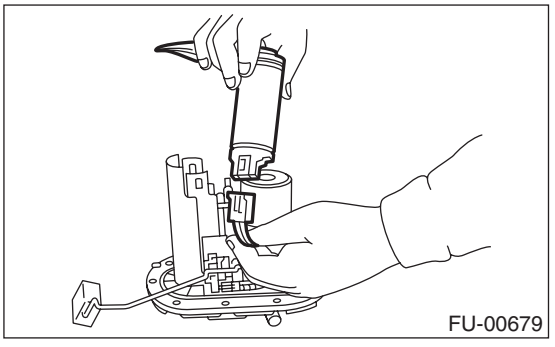
C: Disassembly

1) Remove fuel pump and pump holder.

NOTE:
When disassembling pump holder, be careful as it is installed with two pawls.



2) Disconnect connector from fuel pump.



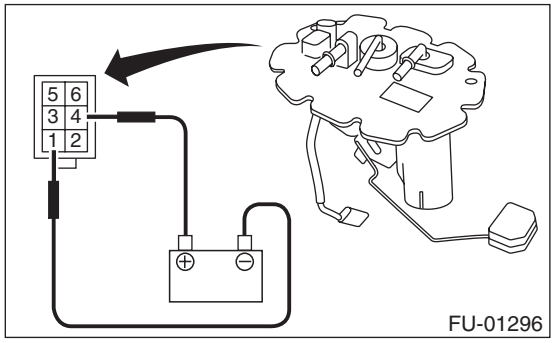
D: ASSEMBLY

Assemble in the reverse order of disassembly.

E: INSPECTION

Connect lead harness to connector terminal of fuel pump and apply battery power supply to check whether the pump operate.

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.



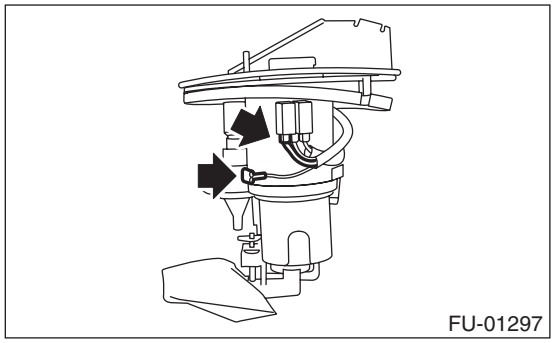
27.Fuel Level Sensor

A: REMOVAL

WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**
- **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.**

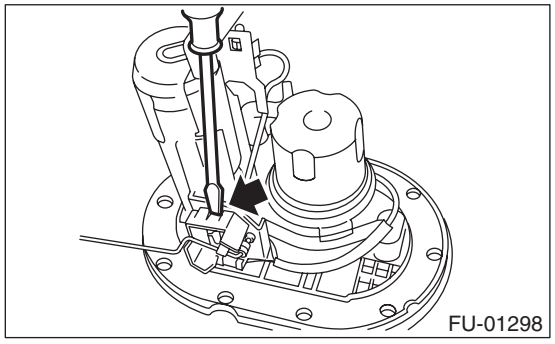
NOTE:
Fuel level sensor is built in fuel pump assembly.

1) Remove fuel pump assembly. <Ref. to FU(H4DOTC)-67, REMOVAL, Fuel Pump.>
2) Disconnect connector from fuel pump bracket.


FU-01297

3) Pushing the pawls with a screwdriver, remove fuel level sensor by pulling it downwards.

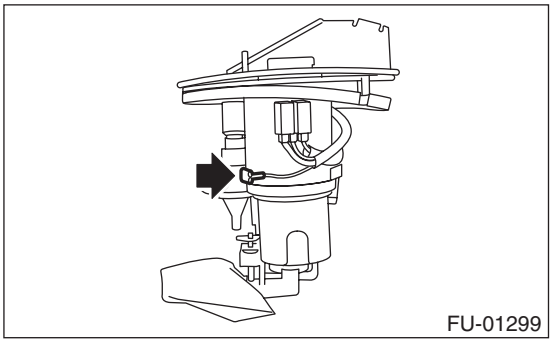
NOTE:
If the retainer pawls are broken during removal, the fuel level sensor must be replaced with a new one.


FU-01298

B: Installation

Install in the reverse order of removal.

WARNING:
- **Ground cable must be connected.**
- **Spark may occur and ignite if fuel is nearby.**

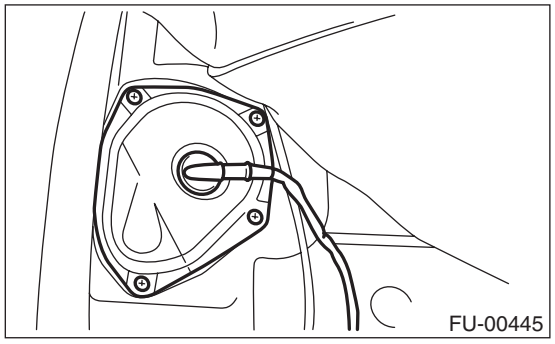

FU-01299

28.Fuel Sub Level Sensor

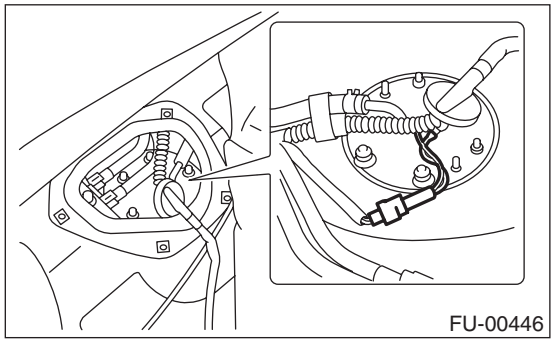
A: REMOVAL

WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**
- **During work procedures, if fuel tank is more than 3/4 full, be careful because fuel may spill.**

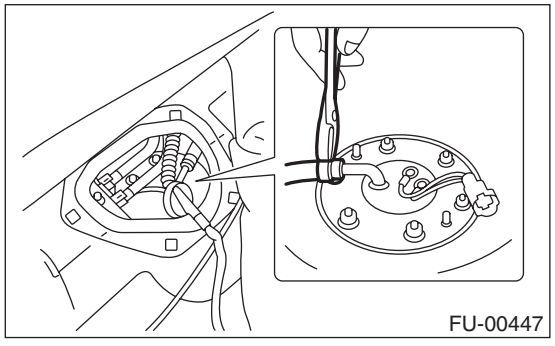
1) Drain fuel from fuel tank. <Ref. to FU(H4DOTC)-48, DRAINING FUEL, OPERATION, Fuel.>
2) Raise rear seat and turn floor mat up.
3) Remove service hole cover.



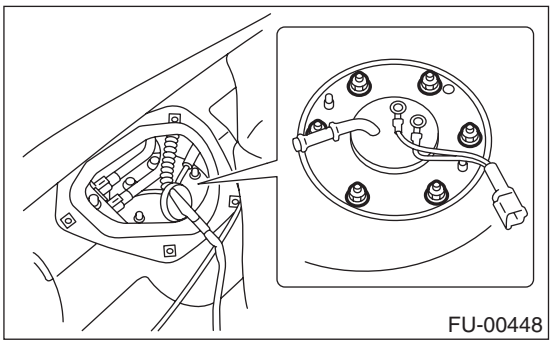
4) Disconnect connector from fuel sub level sensor.



5) Disconnect fuel jet pump hose.



6) Remove bolts which install fuel sub level sensor on fuel tank.

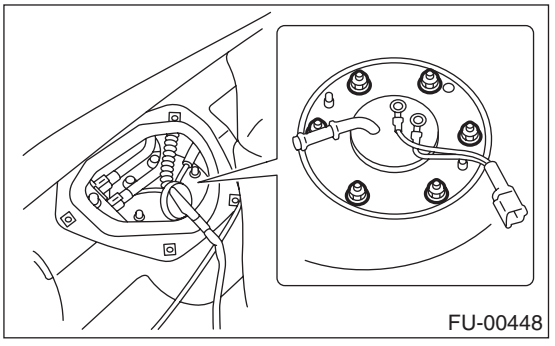


7) Remove fuel sub level sensor.

B: Installation

Install in the reverse order of removal.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



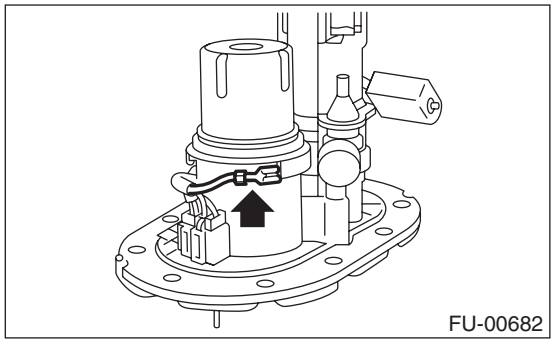
29.Fuel Filter

A: REMOVAL

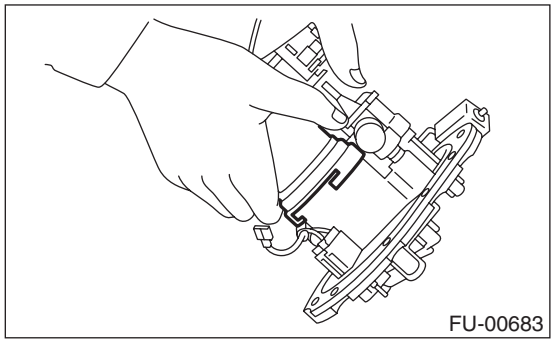
WARNING:
- **Place "NO FIRE" signs near the working area.**
- **Be careful not to spill fuel on the floor.**

NOTE:
The fuel filter is built in fuel pump assembly.

1) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Remove the fuel pump assembly. <Ref. to FU(H4DOTC)-67, REMOVAL, Fuel Pump.>
3) Disconnect the ground cable from filter holder.


FU-00682

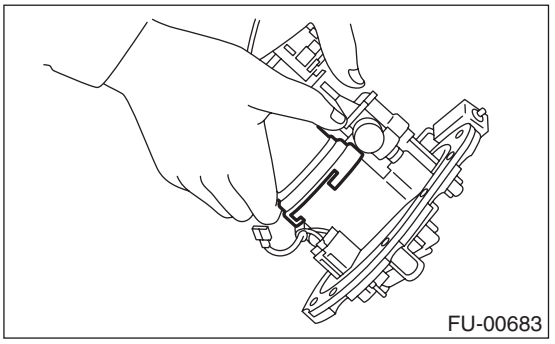
4) Remove the filter holder by turning it to the left from the body pawls, and then take out the filter.


FU-00683

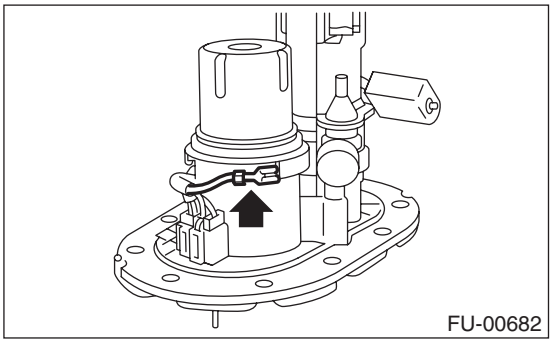
B: Installation

NOTE:
- If the fuel hoses are damaged at the connecting portion, replace it with a new one.
- If the clamps are badly damaged, replace with new ones.
- Replace the o-ring with new ones.

1) Set the O-ring on the filter holder, and then install by turning to the right.


FU-00683

2) Connect the ground cable to filter holder.


FU-00682

3) Install the fuel pump assembly. <Ref. to FU(H4DOTC)-68, INSTALLATION, Fuel Pump.>

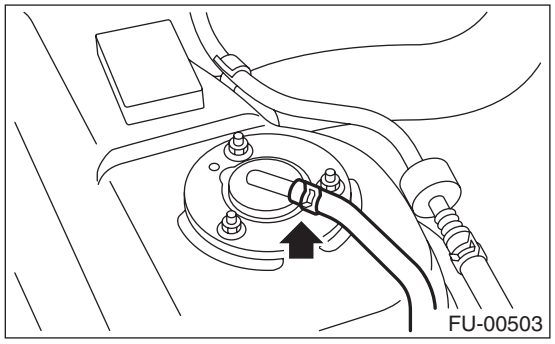
C: INSPECTION

1) Check the inside of fuel filter for dirt and water sediment.
2) If it is clogged, or if replacement interval has been reached, replace it.

30.Fuel Cut Valve

A: REMOVAL

1) Remove fuel tank. <Ref. to FU(H4DOTC)-51, REMOVAL, Fuel Tank.>
2) Move clip and disconnect evaporation hose from fuel cut valve.

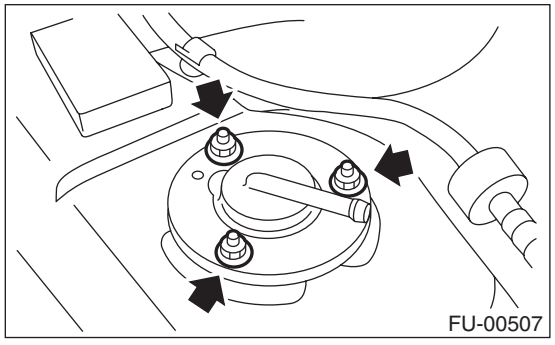


3) Remove bolts which install fuel cut valve.

B: INSTALLATION

Install in the reverse order of removal.

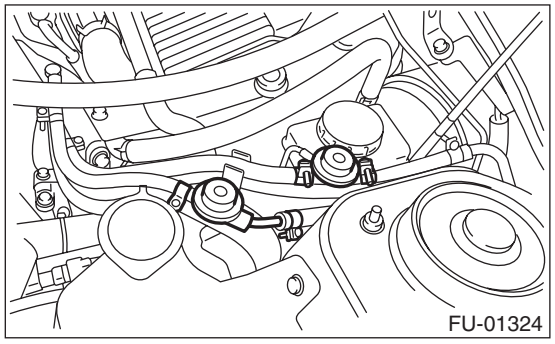
Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



31.Fuel Damper Valve

A: REMOVAL

1) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Remove the fuel damper valve from the fuel delivery line and return line.



B: INSTALLATION

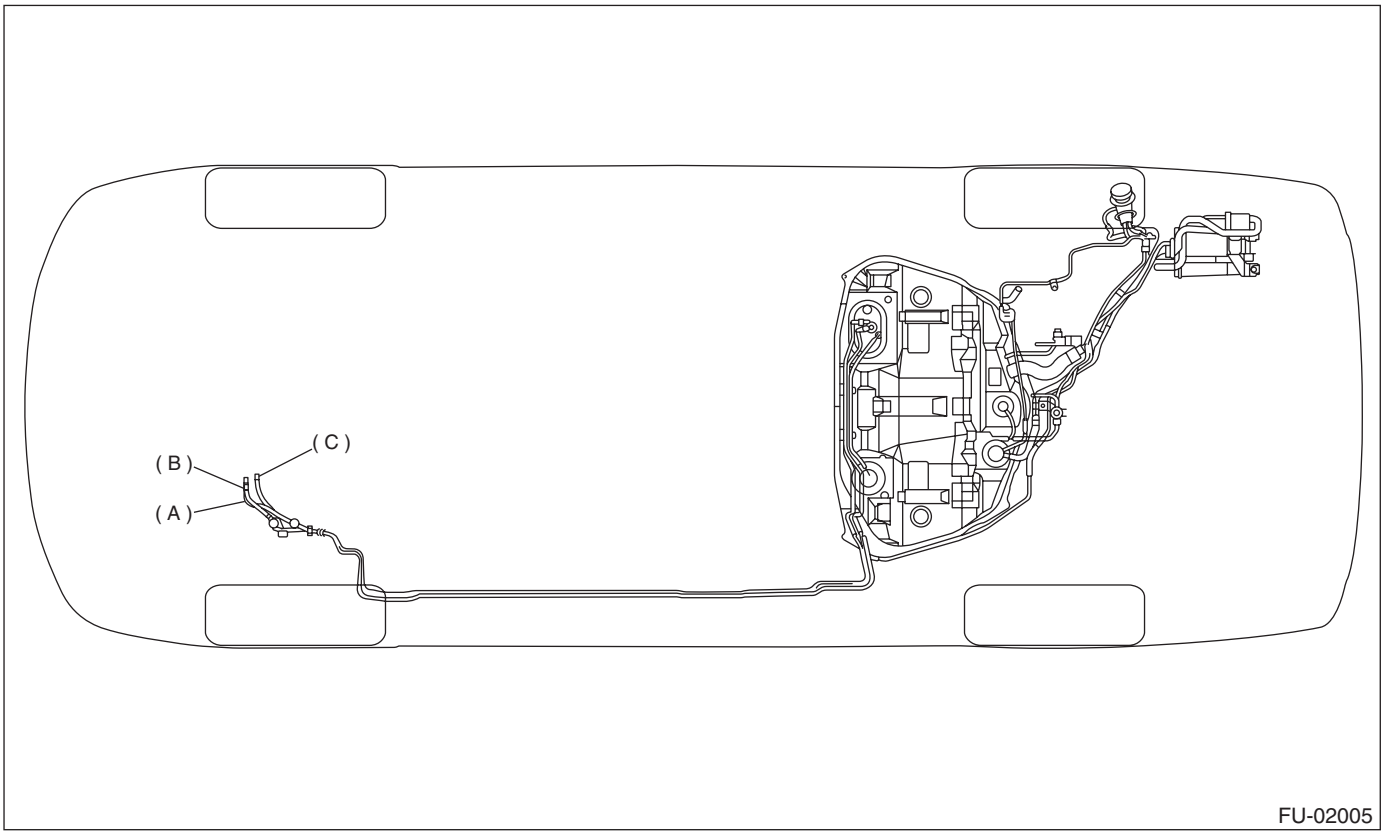
Install in the reverse order of removal.

Tightening torque:
1.25 N·m (0.13 kgf-m, 0.94 ft-lb)

32. Fuel Delivery, Return and Evaporation Lines

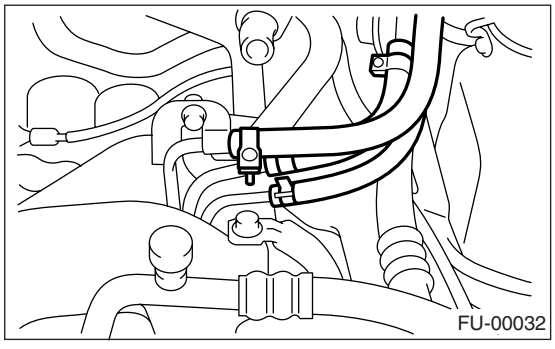
A: REMOVAL

1) Set vehicle on the lift.
2) Release fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
3) Open fuel filler flap lid and remove fuel filler cap.
4) Remove fuel tank. <Ref. to FU(H4DOTC)-51, REMOVAL, Fuel Tank.>
5) Remove fuel filler pipe. <Ref. to FU(H4DOTC)-59, REMOVAL, Fuel Filler Pipe.>
6) Remove floor mat. <Ref. to EI-45, REMOVAL, Floor Mat.>
7) Remove fuel delivery pipes and hoses, fuel return pipes and hoses, evaporation pipes and hoses.



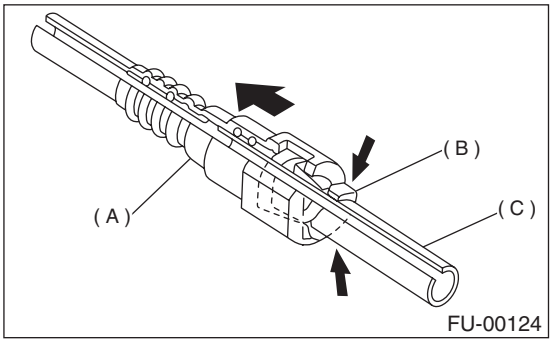
(A) Fuel delivery line (B) Fuel return line (C) Evaporation line

8) In engine room, detach fuel delivery hoses, return hoses and evaporation hose.



9) Separate quick connector on fuel delivery and return line.
(1) Clean pipe and connector, if they are covered with dust.
(2) Hold connector (A) and push retainer (B) down.
(3) Pull out connector (A) from retainer (B).

CAUTION:
Replace retainer with new ones.

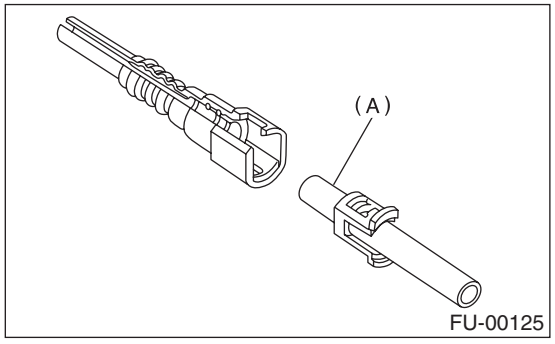


(A) Connector
(B) Retainer
(C) Pipe

B: Installation

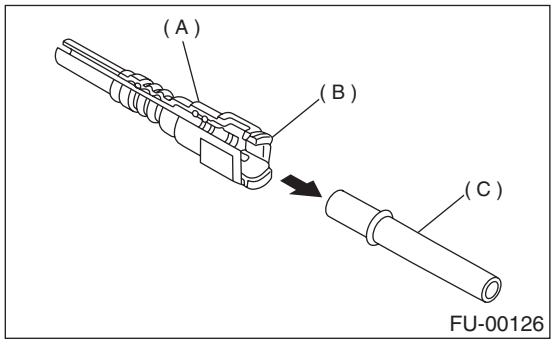
1) Connect quick connector on fuel delivery and return line.

CAUTION:
• Always use a new retainer.
• Make sure that the connected portion is not damaged or has dust. If necessary, clean seal surface (A) of pipe.



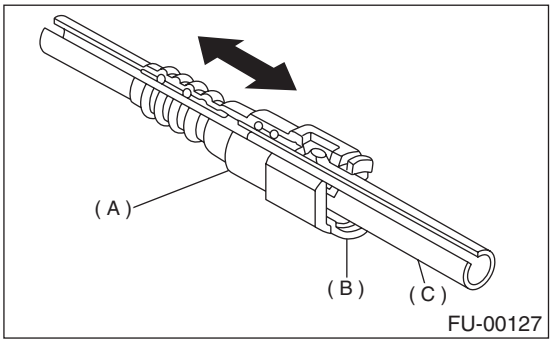
(1) Set new retainer (B) to connector (A).
(2) Push pipe into connector completely.

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.
• Be sure to inspect hoses and their connections for any leakage of fuel.

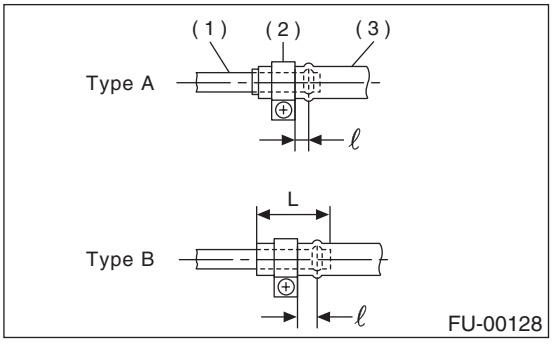


(A) Connector
(B) Retainer
(C) Pipe

2) Connect fuel delivery hose to pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).
Type A: When insertion length is specified.
Type B: When insertion length is not specified.

ℓ : 2.5±1.5 mm (0.098±0.059 in)

L: 22.5±2.5 mm (0.886±0.098 in)

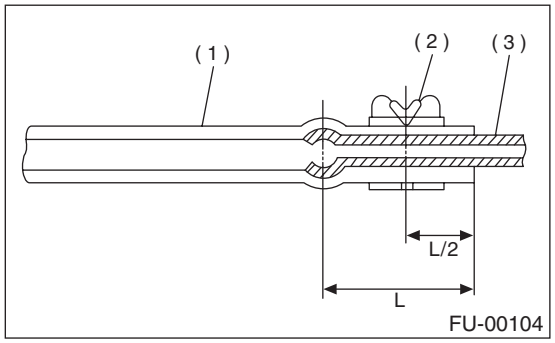


(1) Pipe
(2) Clamp
(3) Hose

3) Connect evaporation hose to pipe by approx. 15 mm (0.59 in) from hose end.

L = 17.5±2.5 mm (0.689±0.098 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.

33.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 fuel pump.
2)	Lowering of fuel pump function.	Replace 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.	Retightening.
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 smell inside of compartment		
1)	Loose joints at air breather tube, air vent tube and fuel filler pipe.	Retightening.
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 level indicator		
1)	Defective operation of fuel level sensor.	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.
(1) Top off the fuel tank or drain the fuel completely.
(2) Drain 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.
(1) 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 fuel tank. 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 water which may have accumulated in the fuel filter and fuel tank in the manner same as that described under damaged areas below.
(2) Damaged areas
If water accumulated in the fuel filter, drain water from both the fuel filter and fuel tank or use an anti-freeze solution (water removing agent) 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.

1. List of DiagnosticTrouble Code (DTC)

A: LIST

DTC	Item	Index
P0011	A Camshaft Position-Timing Over-Advanced or System Performance (Bank 1)	<Ref. to GD(H4DOTC)-9, DTC P0011 — “A” CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0021	A Camshaft Position-Timing Over-Advanced or System Performance (Bank 2)	<Ref. to GD(H4DOTC)-12, DTC P0021 — “A” CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-13, 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(H4DOTC)-15, 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(H4DOTC)-17, 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(H4DOTC)-19, 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(H4DOTC)-21, DTC P0038 — HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0068	Manifold Absolute Pressure/Barometric Pressure Circuit Range/Performance	<Ref. to GD(H4DOTC)-23, DTC P0068 — MANIFOLD PRESSURE SENSOR RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to GD(H4DOTC)-25, DTC P0101 — MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to GD(H4DOTC)-28, DTC P0102 — MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to GD(H4DOTC)-30, DTC P0103 — MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to GD(H4DOTC)-32, 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(H4DOTC)-34, 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(H4DOTC)-36, DTC P0111 — INTAKE AIR TEMPERATURE CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0112	Intake Air Temperature Circuit Low Input	<Ref. to GD(H4DOTC)-38, DTC P0112 — INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0113	Intake Air Temperature Circuit High Input	<Ref. to GD(H4DOTC)-40, DTC P0113 — INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0117	Engine Coolant Temperature Circuit Low Input	<Ref. to GD(H4DOTC)-42, DTC P0117 — ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0118	Engine Coolant Temperature Circuit High Input	<Ref. to GD(H4DOTC)-44, DTC P0118 — ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0122	Throttle/Pedal Position Sensor/ Switch “A” Circuit Low Input	<Ref. to GD(H4DOTC)-46, 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(H4DOTC)-48, 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(H4DOTC)-50, DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0126	Insufficient Coolant Temperature for Stable Operation	<Ref. to GD(H4DOTC)-53, DTC P0126 — INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to GD(H4DOTC)-55, DTC P0128 — COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0131	O_2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-57, DTC P0131 — O2 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(H4DOTC)-59, DTC P0132 — O2 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(H4DOTC)-61, DTC P0133 — O2 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(H4DOTC)-64, DTC P0134 — O2 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(H4DOTC)-66, DTC P0137 — O2 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(H4DOTC)-68, DTC P0138 — O2 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(H4DOTC)-70, DTC P0139 — O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0171	System too Lean (Bank 1)	<Ref. to GD(H4DOTC)-75, DTC P0171 — SYSTEM TOO LEAN (BANK 1) — , Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0172	System too Rich (Bank 1)	<Ref. to GD(H4DOTC)-78, DTC P0172 — SYSTEM TOO RICH (BANK 1) — , Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0181	Fuel Temperature Sensor “A” Circuit Range/Performance	<Ref. to GD(H4DOTC)-81, 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(H4DOTC)-84, 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(H4DOTC)-86, DTC P0183 — FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0222	Throttle/Pedal Position Sensor/ Switch “B” Circuit Low Input	<Ref. to GD(H4DOTC)-88, DTC P0222 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0223	Throttle/Pedal Position Sensor/ Switch “B” Circuit High Input	<Ref. to GD(H4DOTC)-90, DTC P0223 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0230	Fuel Pump Primary Circuit	<Ref. to GD(H4DOTC)-92, DTC P0230 — FUEL PUMP PRIMARY CIRCUIT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0244	Turbo/Super Charger Wastegate Solenoid “A” Range/Performance	<Ref. to GD(H4DOTC)-94, DTC P0244 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0245	Turbo/Super Charger Wastegate Solenoid “A” Low	<Ref. to GD(H4DOTC)-96, DTC P0245 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0246	Turbo/Super Charger Wastegate Solenoid “A” High	<Ref. to GD(H4DOTC)-98, DTC P0246 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0301	Cylinder 1 misfire detected	<Ref. to GD(H4DOTC)-100, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0302	Cylinder 2 misfire detected	<Ref. to GD(H4DOTC)-106, DTC P0302 — CYLINDER 2 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0303	Cylinder 3 misfire detected	<Ref. to GD(H4DOTC)-107, DTC P0303 — CYLINDER 3 MISFIRE DETECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0304	Cylinder 4 misfire detected	<Ref. to GD(H4DOTC)-108, 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(H4DOTC)-109, 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(H4DOTC)-111, 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(H4DOTC)-113, DTC P0335 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	<Ref. to GD(H4DOTC)-115, DTC P0336 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	<Ref. to GD(H4DOTC)-117, DTC P0340 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	<Ref. to GD(H4DOTC)-119, DTC P0345 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to GD(H4DOTC)-120, 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(H4DOTC)-123, 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(H4DOTC)-146, 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(H4DOTC)-148, 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(H4DOTC)-150, 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(H4DOTC)-152, 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(H4DOTC)-154, DTC P0453 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0456	Evaporative Emission Control System Leak Detected (very small leak)	<Ref. to GD(H4DOTC)-156, 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(H4DOTC)-157, 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(H4DOTC)-158, 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(H4DOTC)-160, 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(H4DOTC)-162, DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0462	Fuel Level Sensor Circuit Low Input	<Ref. to GD(H4DOTC)-164, DTC P0462 — FUEL LEVEL SENSOR CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0463	Fuel Level Sensor Circuit High Input	<Ref. to GD(H4DOTC)-166, DTC P0463 — FUEL LEVEL SENSOR CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to GD(H4DOTC)-168, DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0483	Cooling Fan Rationality Check	<Ref. to GD(H4DOTC)-171, DTC P0483 — COOLING FAN RATIONALITY CHECK —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0502	Vehicle Speed Sensor Circuit Low Input	<Ref. to GD(H4DOTC)-172, DTC P0502 — VEHICLE SPEED SENSOR CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0503	Vehicle Speed Sensor Intermittent/Erratic/High	<Ref. to GD(H4DOTC)-174, DTC P0503 — VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0506	Idle Control System RPM Lower Than Expected	<Ref. to GD(H4DOTC)-176, 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(H4DOTC)-178, DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0512	Starter Request Circuit	<Ref. to GD(H4DOTC)-180, DTC P0512 — STARTER REQUEST CIRCUIT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0519	Idle Control System Malfunction (Fail-Safe)	<Ref. to GD(H4DOTC)-181, DTC P0519 — IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0545	Exhaust Gas Temperature Sensor Circuit Low — Bank 1 —	<Ref. to GD(H4DOTC)-182, DTC P0545 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW-BANK 1 —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0546	Exhaust Gas Temperature Sensor Circuit High — Bank 1 —	<Ref. to GD(H4DOTC)-184, DTC P0546 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH-BANK 1 —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0600	CAN Communication Circuit	<Ref. to GD(H4DOTC)-186, DTC P0600 — CAN COMMUNICATION CIRCUIT—, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to GD(H4DOTC)-187, DTC P0604 — INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to GD(H4DOTC)-188, DTC P0605 — INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0607	Control Module Performance	<Ref. to GD(H4DOTC)-189, DTC P0607 — CONTROL MODULE PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0638	Throttle Actuator Control Range/Performance (Bank 1)	<Ref. to GD(H4DOTC)-192, DTC P0638 — THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0691	Cooling Fan 1 Control Circuit Low	<Ref. to GD(H4DOTC)-195, DTC P0691 — COOLING FAN 1 CONTROL CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0692	Cooling Fan 1 Control Circuit High	<Ref. to GD(H4DOTC)-196, DTC P0692 — COOLING FAN 1 CONTROL CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0700	AT MIL Light up Request	<Ref. to GD(H4DOTC)-197, DTC P0700 — AT MIL LIGHT UP REQUEST —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Neutral Switch Input Circuit Low (AT model)	<Ref. to GD(H4DOTC)-198, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Neutral Switch Input Circuit Low (MT model)	<Ref. to GD(H4DOTC)-199, DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Neutral Switch Input Circuit High (AT model)	<Ref. to GD(H4DOTC)-200, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Neutral Switch Input Circuit High (MT model)	<Ref. to GD(H4DOTC)-201, DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1152	O_2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1)	<Ref. to GD(H4DOTC)-202, DTC P1152 — O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1153	O_2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1)	<Ref. to GD(H4DOTC)-205, DTC P1153 — O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1160	Return Spring Failure	<Ref. to GD(H4DOTC)-208, DTC P1160 — RETURN SPRING FAILURE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1301	Misfire Defected (High Temperature Exhaust Gas)	<Ref. to GD(H4DOTC)-210, DTC P1301 — MISFIRE DETECTED (HIGH TEMPERATURE EXHAUST GAS) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1312	Exhaust Gas Temperature Sensor Malfunction	<Ref. to GD(H4DOTC)-212, DTC P1312 — EXHAUST GAS TEMPERATURE SENSOR MALFUNCTION —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to GD(H4DOTC)-213, 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(H4DOTC)-215, 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(H4DOTC)-217, 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(H4DOTC)-218, 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(H4DOTC)-220, 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(H4DOTC)-222, DTC P1448 — FUEL TANK SENSOR CONTROL VALVE RANGE PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	<Ref. to GD(H4DOTC)-226, DTC P1491 — POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P1518	Starter Switch Circuit Low Input	<Ref. to GD(H4DOTC)-228, DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1544	Exhaust Gas Temperature Tool High	<Ref. to GD(H4DOTC)-229, DTC P1544 — EXHAUST GAS TEMPERATURE TOO HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1560	Back-Up Voltage Circuit Malfunction	<Ref. to GD(H4DOTC)-230, DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2004	Tumble Generated Valve System 1 (Valve Open)	<Ref. to GD(H4DOTC)-231, DTC P2004 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE OPEN) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2005	Tumble Generated Valve System 2 (Valve Open)	<Ref. to GD(H4DOTC)-232, DTC P2005 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE OPEN) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2006	Tumble Generated Valve System 1 (Valve Close)	<Ref. to GD(H4DOTC)-233, DTC P2006 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE CLOSE) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2007	Tumble Generated Valve System 2 (Valve Close)	<Ref. to GD(H4DOTC)-234, DTC P2007 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE CLOSE) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2008	Tumble Generated Valve Signal 1 Circuit Malfunction (Open)	<Ref. to GD(H4DOTC)-235, DTC P2008 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (OPEN) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2009	Tumble Generated Valve Signal 1 Circuit Malfunction (Short)	<Ref. to GD(H4DOTC)-237, DTC P2009 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (SHORT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2011	Tumble Generated Valve Signal 2 Circuit Malfunction (Open)	<Ref. to GD(H4DOTC)-239, DTC P2011 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (OPEN) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2012	Tumble Generated Valve Signal 2 Circuit Malfunction (Short)	<Ref. to GD(H4DOTC)-241, DTC P2012 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (SHORT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2016	Tumble Generated Valve Position Sensor 1 Circuit Low	<Ref. to GD(H4DOTC)-243, DTC P2016 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2017	Tumble Generated Valve Position Sensor 1 Circuit High	<Ref. to GD(H4DOTC)-245, DTC P2017 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2021	Tumble Generated Valve Position Sensor 2 Circuit Low	<Ref. to GD(H4DOTC)-247, DTC P2021 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2022	Tumble Generated Valve Position Sensor 2 Circuit High	<Ref. to GD(H4DOTC)-249, DTC P2022 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2088	OCV Solenoid Valve Signal A Circuit Open (Bank 1)	<Ref. to GD(H4DOTC)-251, DTC P2088 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2089	OCV Solenoid Valve Signal A Circuit Short (Bank 1)	<Ref. to GD(H4DOTC)-253, DTC P2089 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2092	OCV Solenoid Valve Signal A Circuit Open (Bank 2)	<Ref. to GD(H4DOTC)-255, DTC P2092 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2093	OCV Solenoid Valve Signal A Circuit Short (Bank 2)	<Ref. to GD(H4DOTC)-257, DTC P2093 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 2) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2096	Post Catalyst Fuel Trim System Too Lean Bank 1	<Ref. to GD(H4DOTC)-259, DTC P2096 — POST CATALYST FUEL TRIM SYSTEM TOO LEAN BANK 1 —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P2097	Post Catalyst Fuel Trim System Too Rich Bank 1	<Ref. to GD(H4DOTC)-261, DTC P2097 — POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1 —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to GD(H4DOTC)-263, DTC P2101 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to GD(H4DOTC)-265, DTC P2102 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to GD(H4DOTC)-267, DTC P2103 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2109	Throttle/Pedal Position Sensor A Minimum Stop Performance	<Ref. to GD(H4DOTC)-269, DTC P2109 — THROTTLE/PEDAL POSITION SENSOR A MINIMUM STOP PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2122	Throttle/Pedal Position Sensor/ Switch “D” Circuit Low Input	<Ref. to GD(H4DOTC)-271, DTC P2122 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2123	Throttle/Pedal Position Sensor/ Switch “D” Circuit High Input	<Ref. to GD(H4DOTC)-273, DTC P2123 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2127	Throttle/Pedal Position Sensor/ Switch “E” Circuit Low Input	<Ref. to GD(H4DOTC)-275, DTC P2127 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2128	Throttle/Pedal Position Sensor/ Switch “E” Circuit High Input	<Ref. to GD(H4DOTC)-277, DTC P2128 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2135	Throttle/Pedal Position Sensor/ Switch “A”/“B” Voltage Rationality	<Ref. to GD(H4DOTC)-279, DTC P2135 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” / “B” VOLTAGE RATIONALITY —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2138	Throttle/Pedal Position Sensor/ Switch “D”/“E” Voltage Rationality	<Ref. to GD(H4DOTC)-281, DTC P2138 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” / “E” VOLTAGE RATIONALITY —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2227	Atmospheric Pressure Sensor Circuit Range/Performance	<Ref. to GD(H4DOTC)-283, DTC P2227 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2228	Atmospheric Pressure Sensor Circuit Malfunction (Low Input)	<Ref. to GD(H4DOTC)-284, DTC P2228 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2229	Atmospheric Pressure Sensor Circuit Malfunction (High Input)	<Ref. to GD(H4DOTC)-285, DTC P2229 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>

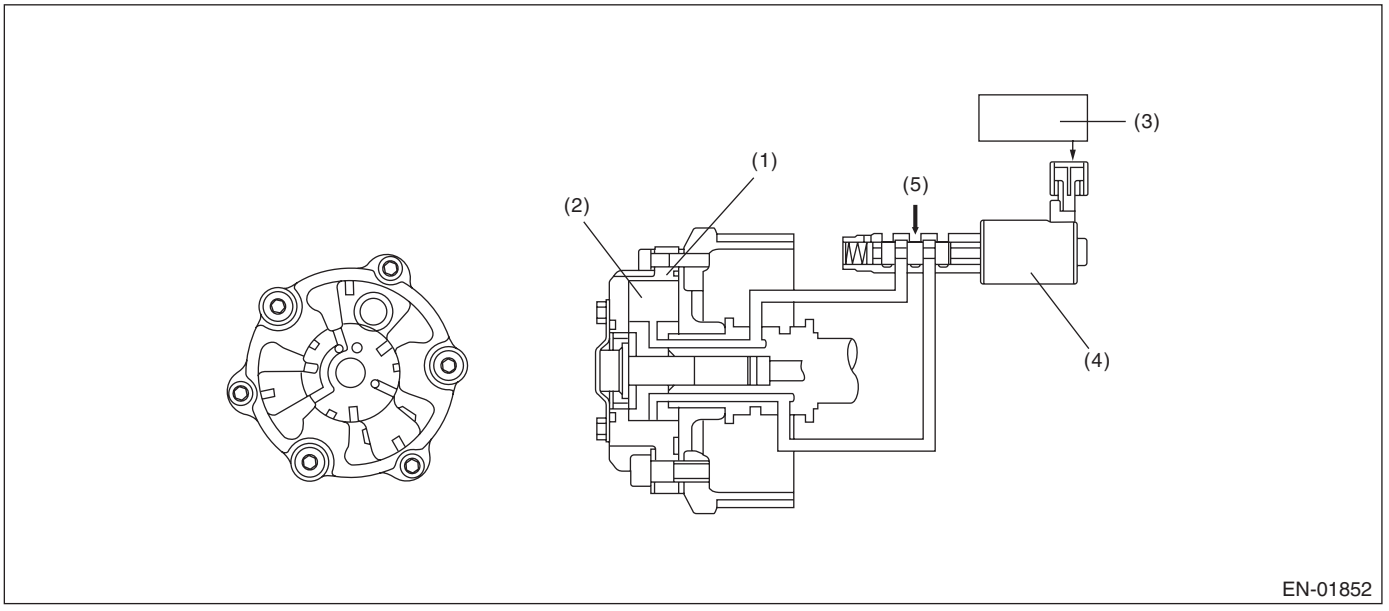
2. Diagnostic Trouble Code (DTC) Detecting Criteria

A: DTC P0011 — "A" CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of AVCS system.
1) Judge NG when the amount of AVCS actual timing advance does not approach to the amount of AVCS target timing advance.
2) Judge NG when the most retarded learning value is outside of the normal range.

2. COMPONENT DESCRIPTION



(1) AVCS timing controller
(2) Vane
(3) Engine control module (ECM)
(4) Oil flow control valve
(5) Oil pressure

3. ENABLE CONDITION (For abnormality judgment only)

Secondary Parameters	Enable Conditions
Abnormality judgement (1)	
Battery voltage	≥ 10.9 V
Engine speed	≥ 1500 rpm
Coolant temperature	≥ 60°C (140 °F)
Abnormality judgement (2)	
Battery voltage	≥ 10.9 V
Engine speed	≥ 500 rpm
Coolant temperature	≥ 60°C (140 °F)

4. GENERAL DRIVING CYCLE

1) Always perform the diagnosis after idling when the engine speed is more than 1500 rpm.
2) Always perform the diagnosis after warming up the engine when the engine speed is more than 500 rpm.

5. DIAGNOSTIC METHOD

1) Judge NG when the difference of the amount of AVCS target timing advance and the amount of AVCS actual timing advance becomes large.
2) Judge NG when the most retarded learning value is outside of the normal range.

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 20 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
(1) Judgemet value |AVCS target position – AVCS actual position|	≥ 7.5°
(2) Judgemet value AVCS control	During most timing retard learning
Most timing retard learning value	< –29.5°CA or > 29.5°CA

Time Needed for Diagnosis: 20 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the continuous time of completing the malfunction criteria below becomes more than 1 second.

• Judgment Value

Malfunction Criteria	Threshold Value
AVCS control	During feedback
Amount of AVCS target timing advance	5 — 30°CA
AVCS target position – AVCS actual position	< 10°
Most timing retard learning value	–29.5 — 29.5°CA

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

- Ignition timing whole learning compensation:
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when IG OFF.
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment from abnormality judgment.
- AVCS control: Most timing retard learning is not complete or most timing retard learning completion is not experienced.
- ISC feedback compensation: Do not perform the AVCS actual timing advance compensation. Make the OCV driving Duty to be the given value (9.36%).

9. ECM OPERATING AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

B: DTC P0021 — “A” CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2) —

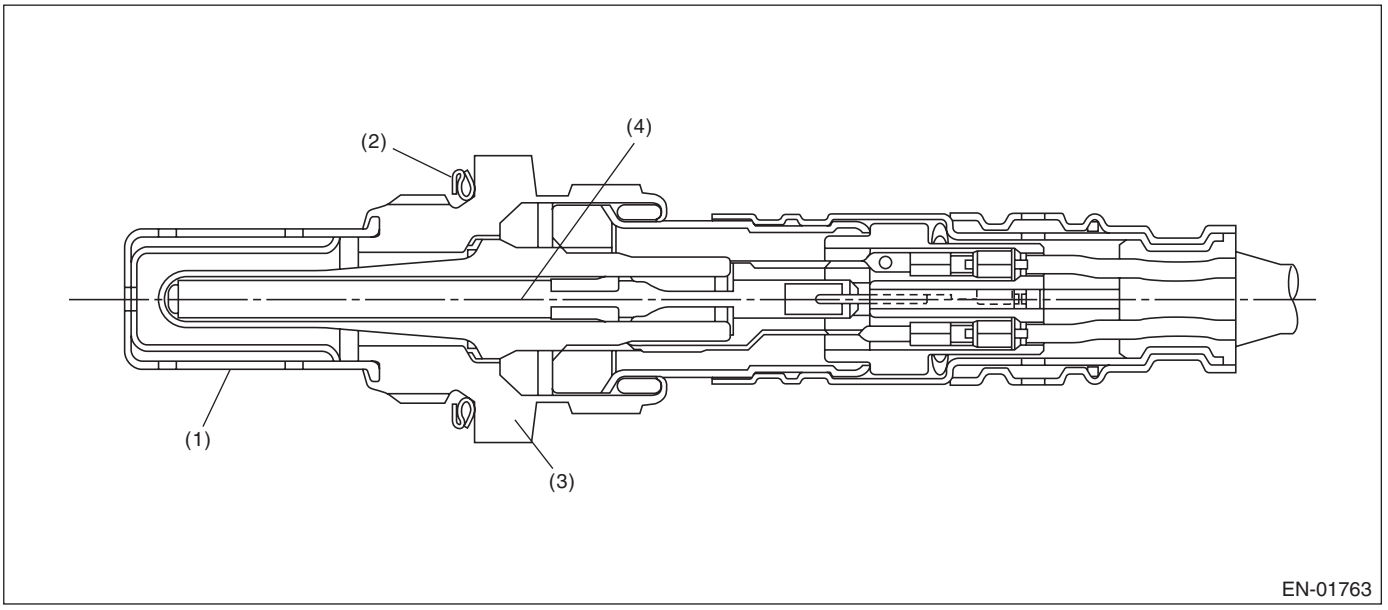
NOTE:
For the diagnostic procedure, refer to DTC P0011. <Ref. to GD(H4DOTC)-9, DTC P0011 — “A” CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1) —.>

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of front oxygen (A/F) sensor heater.
Judge NG when impedance of front oxygen (A/F) sensor is larger than the standard value by referring to the engine condition such as fuel shut-off in deceleration, etc.

2. COMPONENT DESCRIPTION



(1) Protection tube
(2) Gasket
(3) Sensor housing
(4) Ceramic heater

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	60 seconds or more
Battery voltage	> 10.9 V
After fuel shut-off	20 seconds or more
Front oxygen (A/F) sensor heater control duty ≥ 70%	Experienced

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously in 60 seconds after starting engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (10 seconds). Judge OK and clear NG when the continuous time of not completing the malfunction criteria below becomes more than the time needed for diagnosis (10 seconds).

Judgment Value

Malfunction Criteria	Threshold Value
Impedance of front oxygen (A/F) sensor	> 50 Ω

Time Needed for Diagnosis: 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

- Front oxygen (A/F) sensor main learning correction: Not allowed to calculate
- Correction when re-starting at high temperature: Normally minimum value 0.3 → 0
- Purge control: Not allowed to purge

9. ECM OPERATING AT DTC SETTING

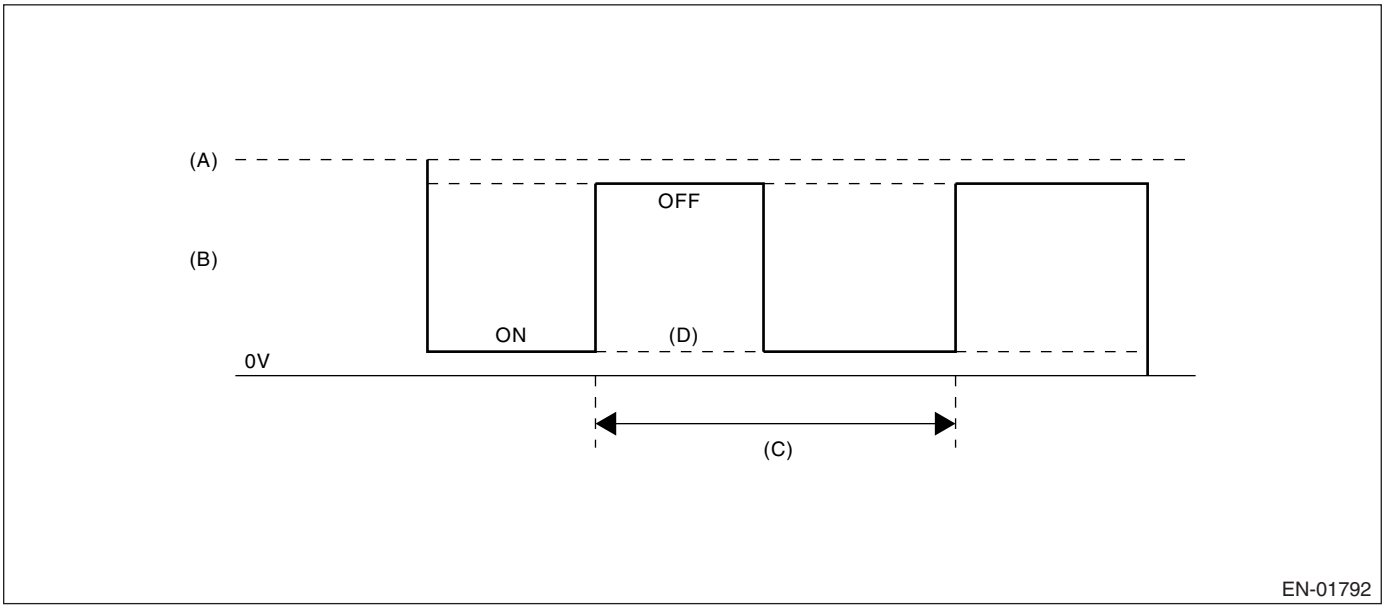
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of heater.
The heater conducts the duty control. The output terminal voltage at ON becomes 0 V, and the output terminal voltage at OFF becomes battery voltage.
Judge NG when the terminal voltage remains to be Low.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Front oxygen (A/F) sensor heater output voltage
(C) 128 milliseconds
(D) Low abnormality

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 1 second (8 cycles).

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level Front oxygen (A/F) sensor heater control duty	Low < 87.5%

Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	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

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0 from 0.3 normally.
- Purge control: Not allowed to purge.

9. ECM OPERATING AT DTC SETTING

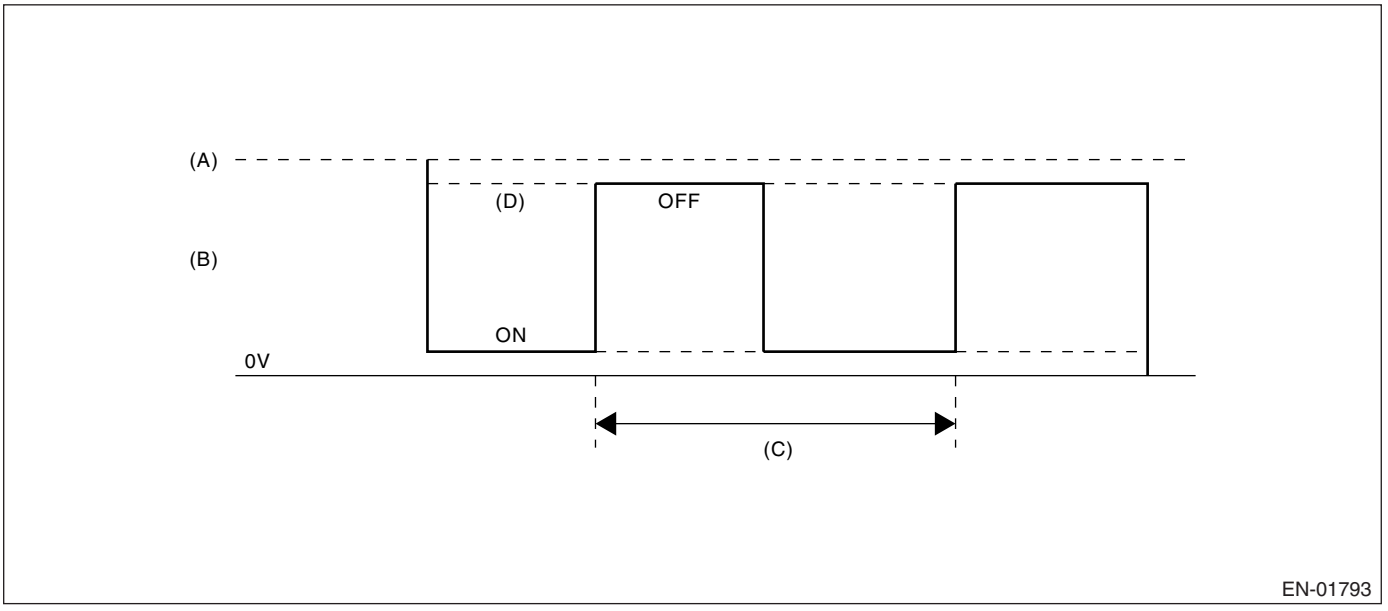
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of heater.
The heater conducts the duty control. The output terminal voltage at ON becomes 0 V, and the output terminal voltage at OFF becomes battery voltage.
Judge NG when the terminal voltage remains to be High.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Front oxygen (A/F) sensor heater output voltage
(C) 128 milliseconds
(D) High abnormality

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes 1 second (8 cycles).

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level Front oxygen (A/F) sensor heater control duty	High ≥ 12.5%

Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when all the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	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

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0 from 0.3 normally.
- Purge control: Not allowed to purge.

9. ECM OPERATING AT DTC SETTING

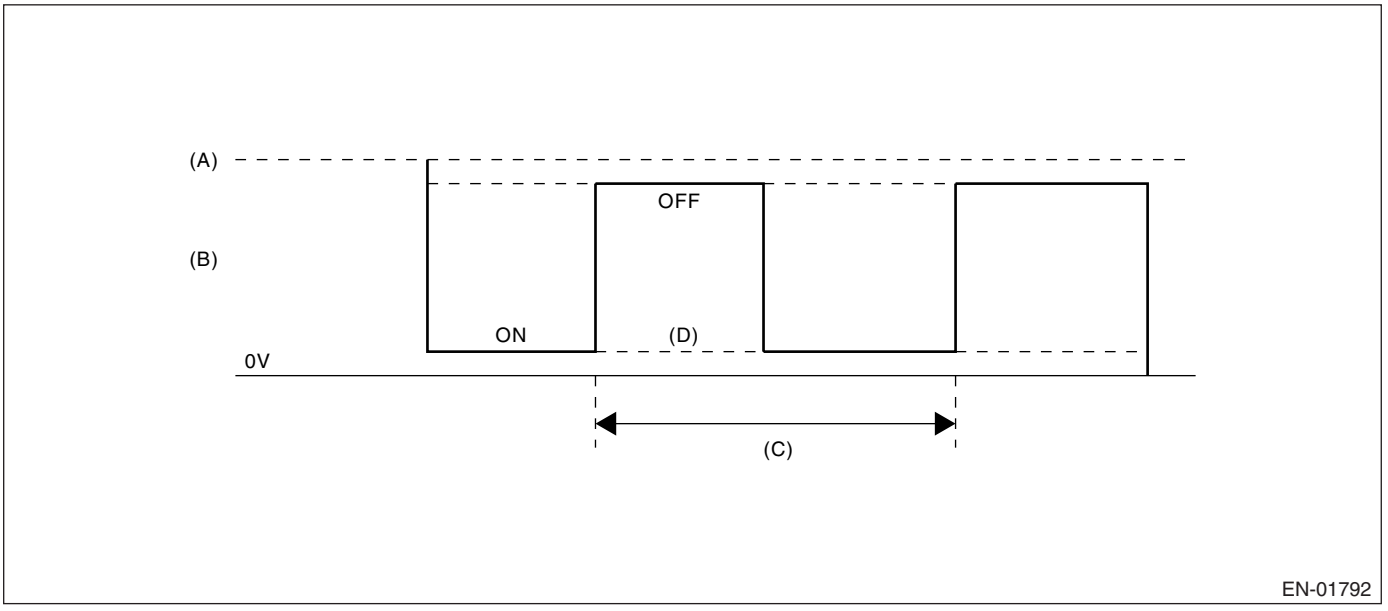
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of rear oxygen sensor heater.
Rear oxygen sensor heater conducted the duty control, and the output terminal voltage at ON is 0 V and the output terminal voltage at OFF is the battery voltage.
Judge NG when the terminal voltage remains to be Low.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Rear oxygen sensor heater output voltage
(C) 256 milliseconds (cycles)
(D) Low malfunction

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Elapsed time after engine starting	≥ 1 second

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after engine starting.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing all the malfunction criteria below becomes more than 2560 millisecond (10 cycles).

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low
Rear oxygen sensor heater control duty	< 75%

Time Needed for Diagnosis: 2.56 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
Output voltage level	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

Sub feedback control: Not allowed

9. ECM OPERATING AT DTC SETTING

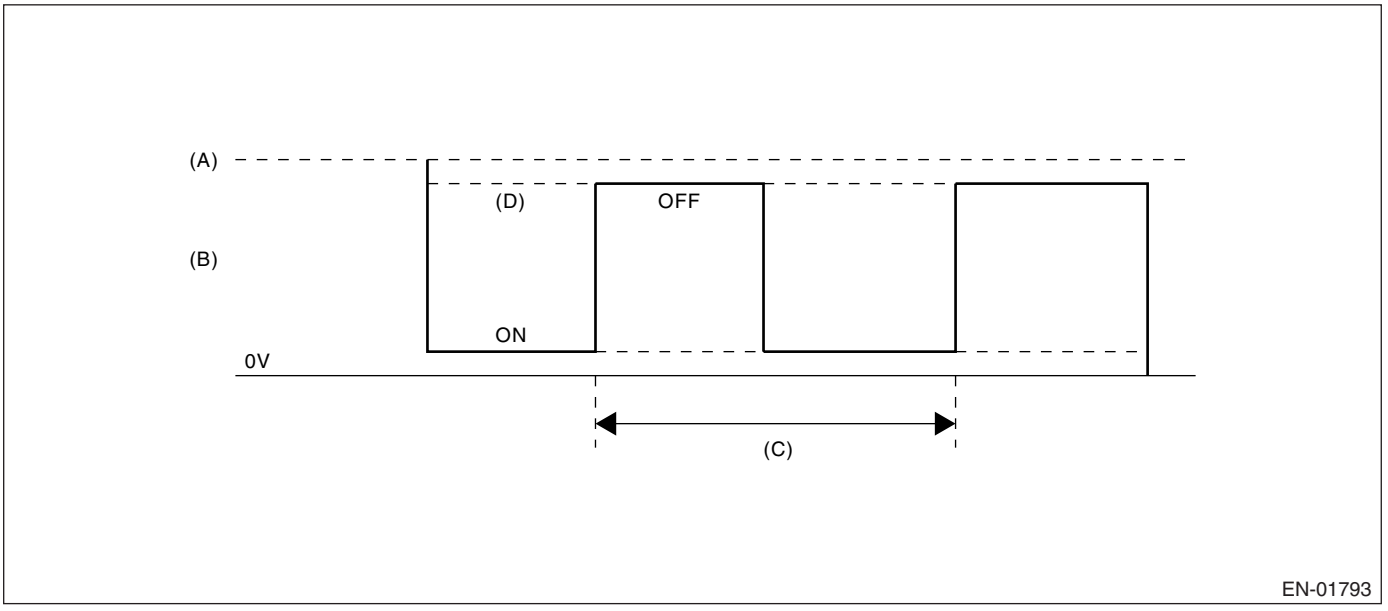
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of rear oxygen heater.
Rear oxygen heater conducted the duty control, and the output terminal voltage at ON is 0 V and the output terminal voltage at OFF is the battery voltage.
Judge NG when the terminal voltage remains to be High.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Rear oxygen sensor heater output voltage
(C) 256 milliseconds (cycle)
(D) High malfunction

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Elapsed time after engine starting	≥ 1 second

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after engine starting.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing all the malfunction criteria below becomes more than 2560 milliseconds (10 cycles).

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High
Rear oxygen sensor heater control duty	≥ 25%

Time Needed for Diagnosis: 2.56 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
Output voltage level	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

Sub feedback control: Not allowed

9. ECM OPERATING AT DTC SETTING

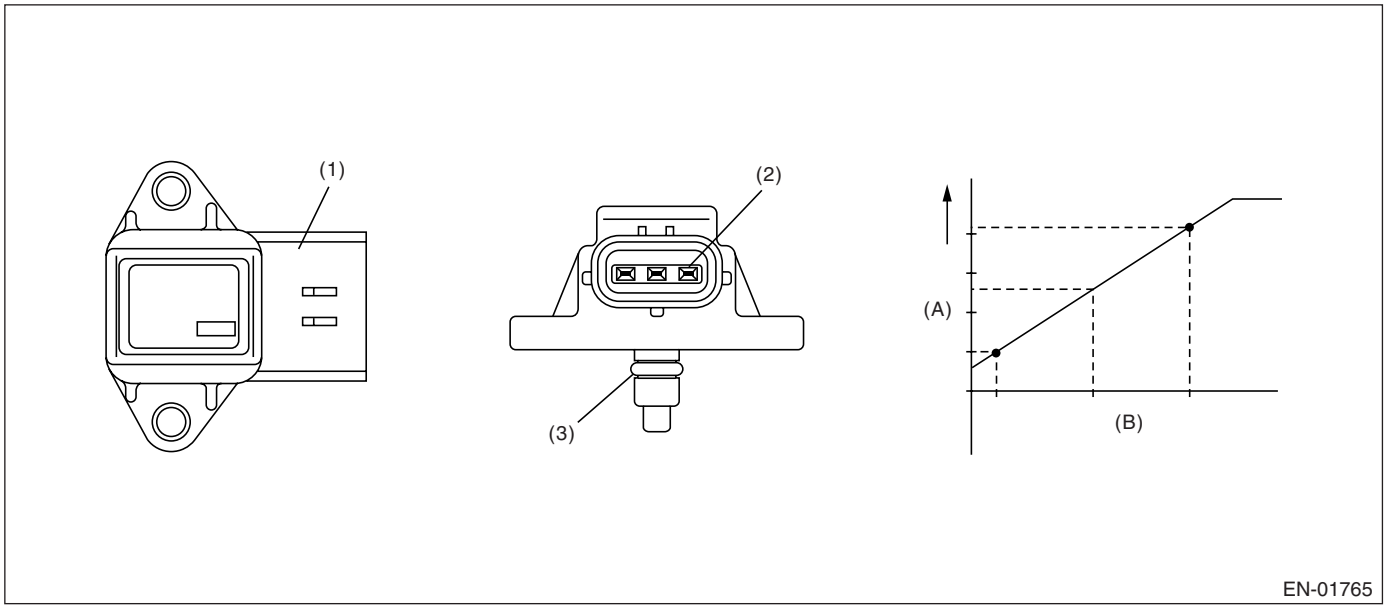
Memorize the freeze frame data. (For test mode $02)

H: 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 air pressure AD value is Low whereas it seemed to be High from the viewpoint of engine condition, or when it is High whereas it seemed to be Low from the engine condition.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Terminal
(3) O-ring
(A) Output voltage
(B) Absolute pressure

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75°C (167°F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when either Low side or High side becomes NG. Judge NG when the continuous time of completing the malfunction criteria below becomes more than 3 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Low side	
Engine speed	< 2500 rpm
Throttle position	≥ 10°
Intake air flow of every 0.5 engine rev.	> 1.356
Output voltage	< 1.0 V
High side	
Engine speed	600 ←→ 900 rpm
Throttle position	< 1.3°
Intake air flow of every 0.5 engine rev.	≤ 0.4
Output voltage	≥ 2.36 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 both Low side and High side become OK. Judge OK when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Low side	
Engine speed	< 2500 rpm
Throttle position	≥ 10°
Output voltage	≥ 1.0 V
High side	
Engine speed	600 ←→ 900 rpm
Throttle position	< 1.3°
Output voltage	< 2.36 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

- Intake manifold pressure sensor process: Estimate the pressure from engine load.
- ISC feedback: Not allowed to calculate the amount of feedback.
- Heavy fuel judgment: Not allowed to carry out the heavy judgment.
- Fuel cut control: Not allowed to cut the over pressure charged fuel.

9. ECM OPERATING AT DTC SETTING

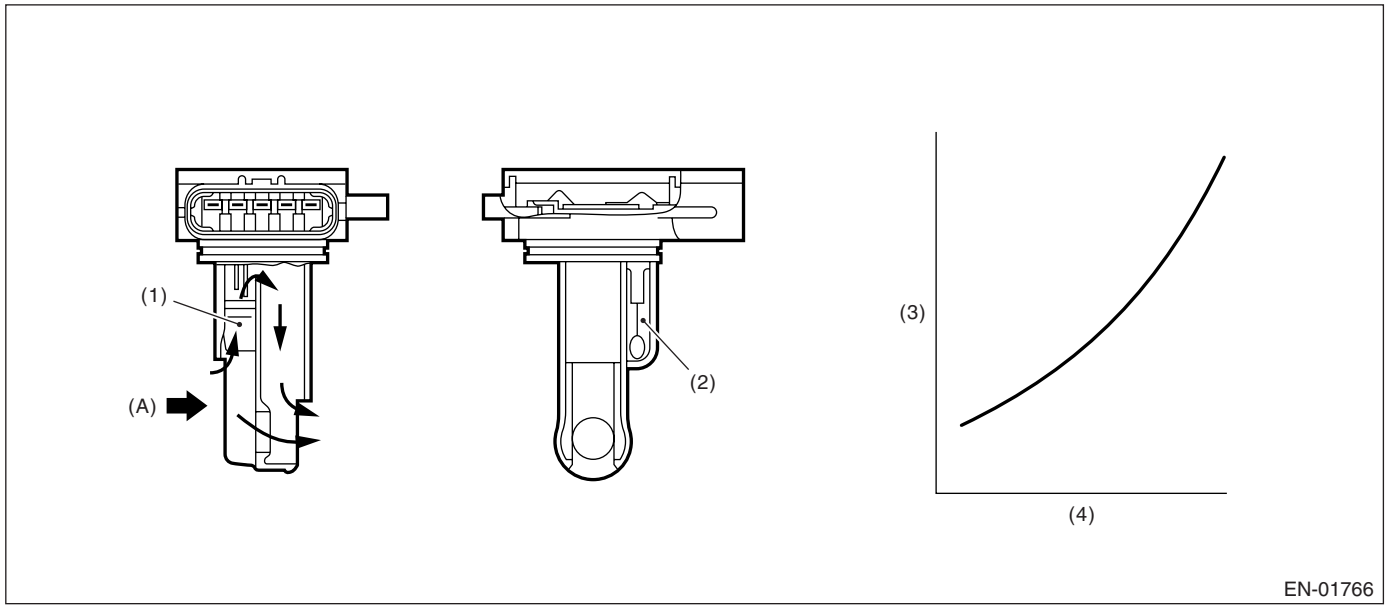
Memorize the freeze frame data. (For test mode $02)

I: DTC P0101 — MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output property. Judge Low side NG when the air flow voltage indicates low value in spite of the driving condition that the air flow voltage might be high; otherwise, judge High side NG when the air flow voltage indicates high value in spite of the driving condition that the air flow voltage might be low. Judge air flow sensor property NG when the Low side or High side becomes NG.

2. COMPONENT DESCRIPTION



(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Intake air volume (kg (lb)/s)
(A) Air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 70°C (158°F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after idling.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more then the time needed for diagnosis.

• Judgment Value

Malfunction Criteria	Threshold Value
Low side NG	
Output voltage	< 1.5 V
Engine speed	≥ 2500 rpm
Throttle angle	≥ 15°
Intake manifold pressure	≥ 53.3 kPa (400 mmHg, 15.7 inHg)
High side NG	
Output voltage	≥ 1.95 V
(Voltage when rich condition of fuel system is NG)	(≥ 1.7 V)
Engine speed	600 ←→ 900 rpm
Throttle angle	< 4.1°
Intake manifold pressure	< 52.7 kPa (395 mmHg, 15.6 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 the when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Low side NG	
Output voltage	≥ 1.5 V
Engine speed	≥ 2500 rpm
Throttle angle	≥ 15°
Intake manifold pressure	≥ 53.3 kPa (400 mmHg, 15.7 inHg)
High side NG	
Output voltage	< 1.95 V
Engine speed	600 ←→ 900 rpm
Throttle angle	< 4.1°
Intake manifold pressure	< 46.7 kPa (350 mmHg, 13.8 inHg)

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

• Air flow meter: Engine load is normally calculated by manifold pressure and engine speed; however, calculated only by manifold pressure.
• EVAP conc. learning (fuel): Not allowed to learn.
• Knock compensation:
  – Knock compensation final timing advance and retard value = knock compensation + whole learning compensation value + partial learning compensation value.
  – At normal: knock compensation = 0°CA is fixed.
  – At trouble: knock compensation ≠ 0°CA is fixed. (Retard max. 12°CA at knock.)
  – Not allowed to update the whole learning compensation factor.
  – Not allowed to calculate the partial learning zone compensation value.
• ISC control: Make the open loop compensation to be the given value (1 g (0.04 oz)/s). Stop calculating the throttle sensor temperature compensation. (Hold the previous value.)
• Purge control: Not allowed to purge.

9. ECM OPERATING AT DTC SETTING

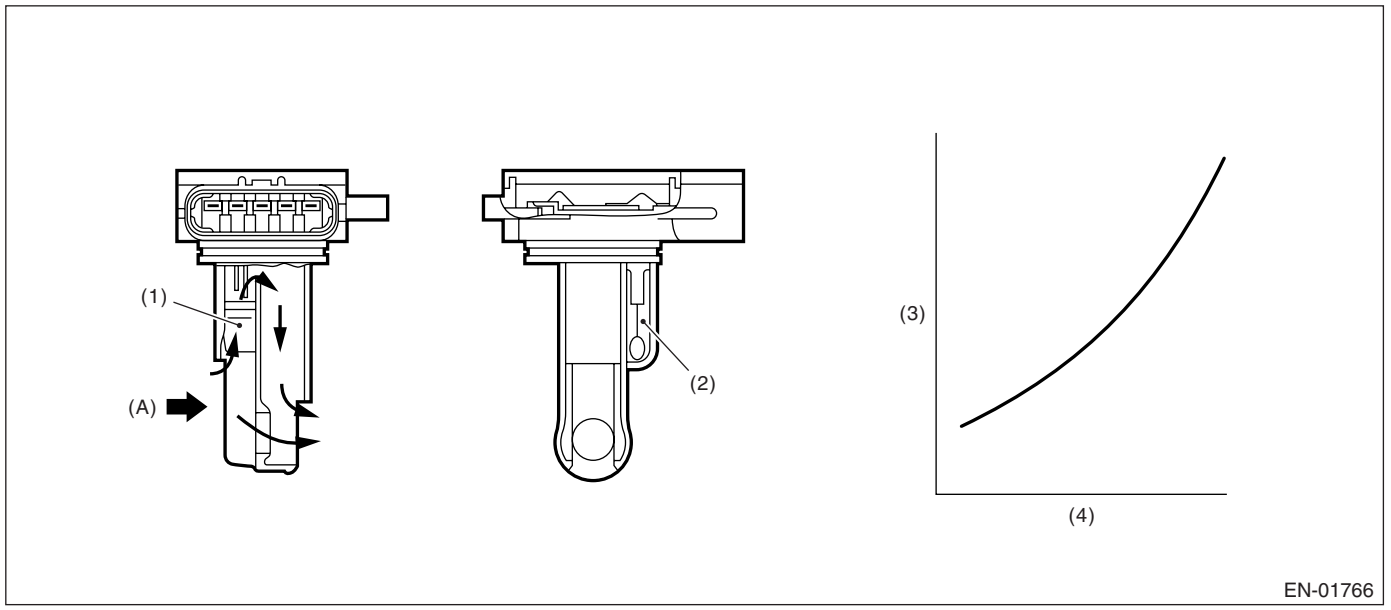
Memorize the freeze frame data. (For test mode $02)

J: DTC P0102 — MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of air flow sensor. Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Intake air volume (kg (lb)/s)
(A) Air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.2 V

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the 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

- Air flow meter: Engine load is normally calculated by manifold pressure and engine speed; however, calculated only by manifold pressure.
- EVAP conc. learning (fuel): Not allowed to learn.
- Knock compensation:
  - Knock compensation final timing advance and retard value = knock compensation + whole learning compensation value + partial learning compensation value.
  - At normal: knock compensation = 0°CA is fixed.
  - At trouble: knock compensation ≠ 0°CA is fixed. (Retard max. 12°CA at knock.)
  - Not allowed to update the whole learning compensation factor.
  - Not allowed to calculate the partial learning zone compensation value.
- ISC control: Make the open loop compensation to be the given value (1 g (0.04 oz)/s). Stop calculating the throttle sensor temperature compensation. (Hold the previous value.)
- Purge control: Not allowed to purge.

9. ECM OPERATING AT DTC SETTING

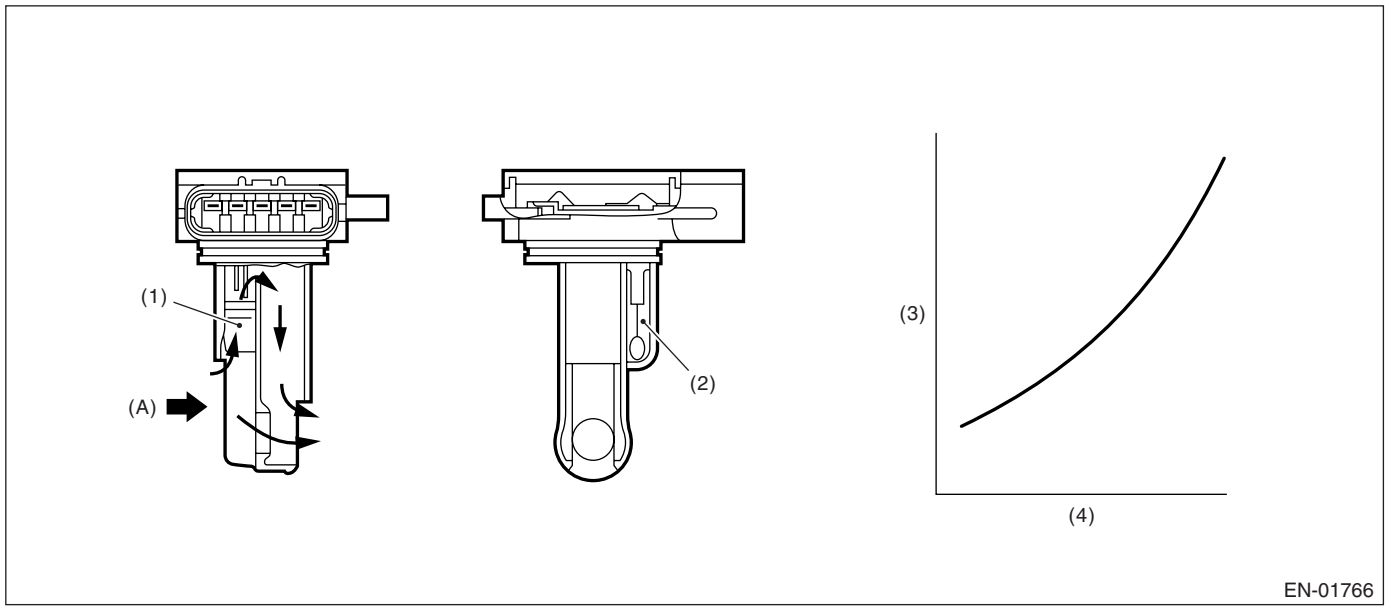
Memorize the freeze frame data. (For test mode $02)

K: DTC P0103 — MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of air flow sensor. Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Intake air volume (kg (lb)/s)
(A) Air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.985 V

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the 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

• Air flow meter: Engine load is normally calculated by manifold pressure and engine speed; however, calculated only by manifold pressure.
• EVAP conc. learning (fuel): Not allowed to learn.
• Knock compensation:
  – Knock compensation final timing advance and retard value = knock compensation + whole learning compensation value + partial learning compensation value.
  – At normal: knock compensation = 0°CA is fixed.
  – At trouble: knock compensation ≠ 0°CA is fixed. (Retard max. 12°CA at knock.)
  – Not allowed to update the whole learning compensation factor.
  – Not allowed to calculate the partial learning zone compensation value.
• ISC control: Make the open loop compensation to be the given value (1 g (0.04 oz)/s). Stop calculating the throttle sensor temperature compensation. (Hold the previous value.)
• Purge control: Not allowed to purge.

9. ECM OPERATING AT DTC SETTING

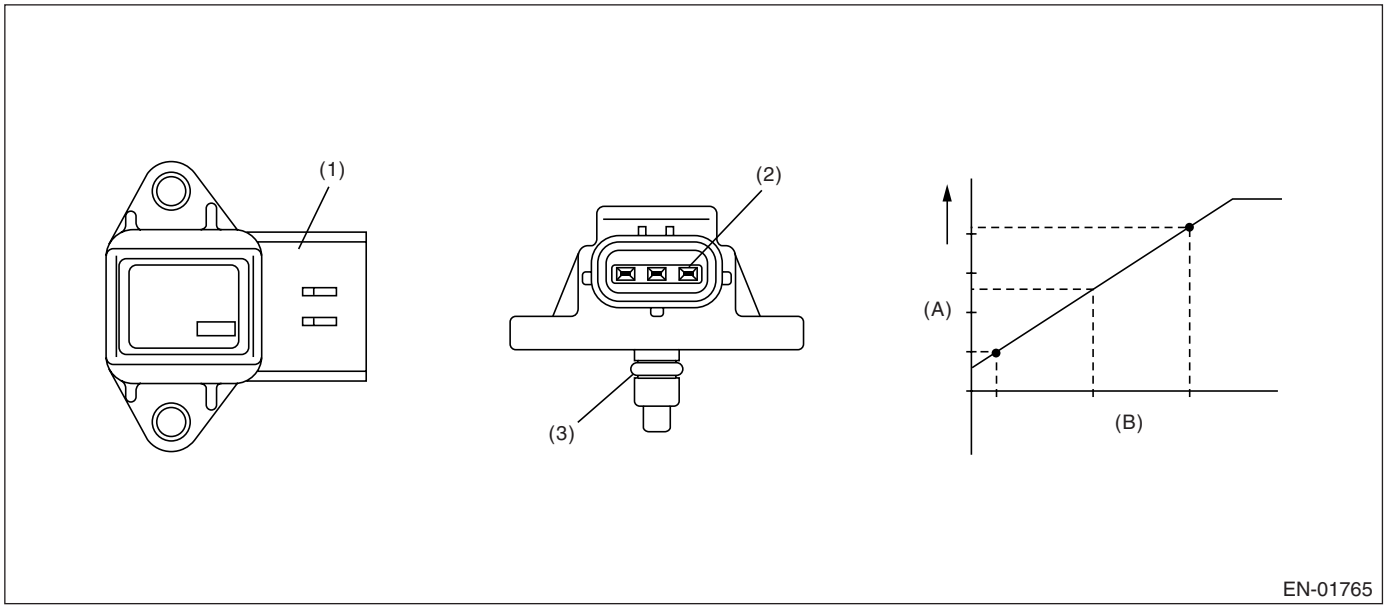
Memorize the freeze frame data. (For test mode $02)

L: 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) Connector
(2) Terminal
(3) O-ring
(A) Output voltage
(B) Absolute pressure

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.568 V

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the 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

- Intake manifold pressure sensor process: Estimate the pressure from engine load.
- ISC feedback: Not allowed to calculate the amount of feedback.
- Heavy fuel judgment: Not allowed to carry out the heavy judgment.
- Fuel cut control: Not allowed to cut the over pressure charged fuel.

9. ECM OPERATING AT DTC SETTING

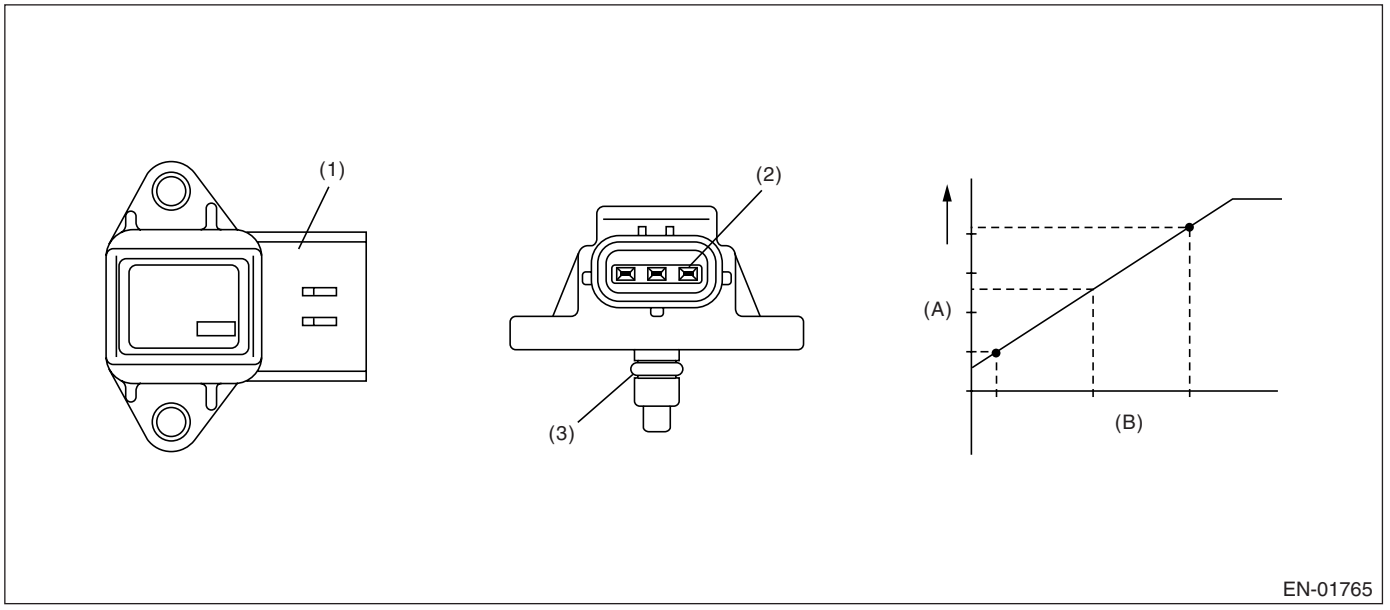
Memorize the freeze frame data. (For test mode $02)

M: 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) Connector
(2) Terminal
(3) O-ring
(A) Output voltage
(B) Absolute pressure

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.93 V

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the 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

- Intake manifold pressure sensor process: Estimate the pressure from engine load.
- ISC feedback: Not allowed to calculate the amount of feedback.
- Heavy fuel judgment: Not allowed to carry out the heavy judgment.
- Fuel cut control: Not allowed to cut the over pressure charged fuel.

9. ECM OPERATING AT DTC SETTING

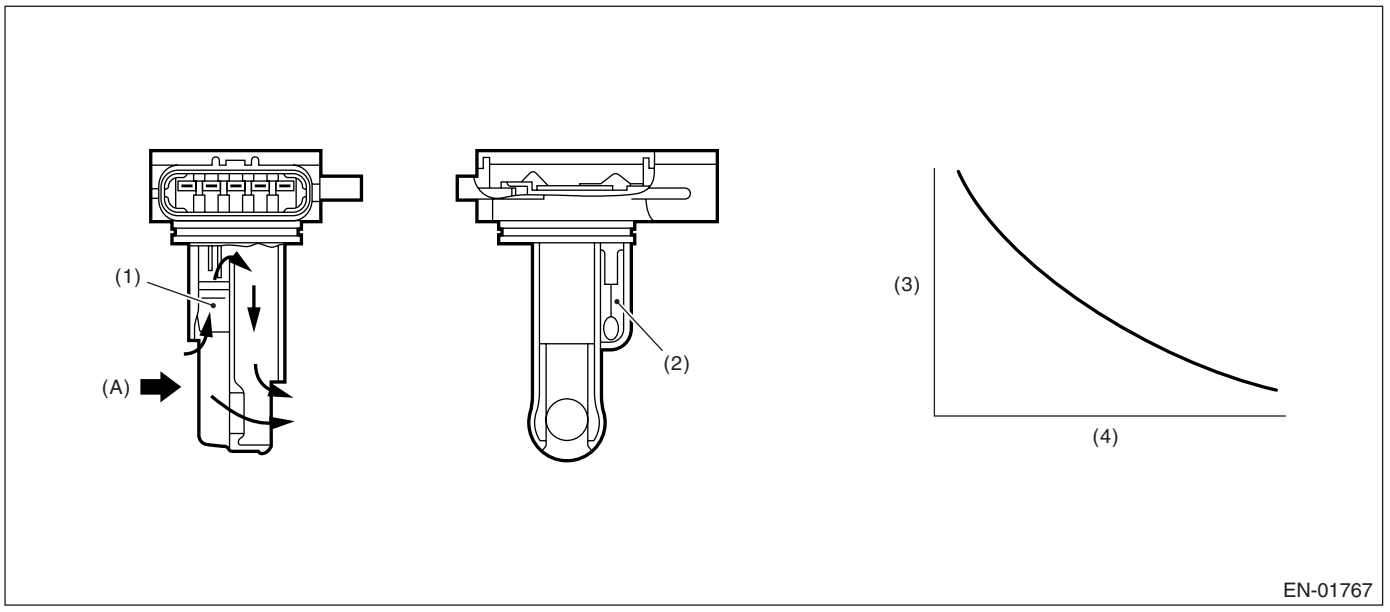
Memorize the freeze frame data. (For test mode $02)

N: 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 not varied whereas it seemed to be varied from the viewpoint of engine condition.

2. COMPONENT DESCRIPTION



(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance (Ω)
(4) Intake air temperature °C (°F)
(A) Air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Coolant temp. before engine start	< 30°C (86°F)
Coolant temperature	> 75°C (167°F)
Battery voltage	≥ 10.9 V
Continuous time when the vehicle speed is less than 50 km/h (31 MPH)	600 seconds or more

4. GENERAL DRIVING CYCLE

Perform the diagnosis when the vehicle speed condition is completed after idling from starting the cooled engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 1 second.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	< 20 mV (It is equal to approx. 0.5°C (33°F) around 25°.)
Exhaust temperature above 500°C (932°F)	60 seconds or more

Time Needed for Diagnosis: 1 second
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
Output voltage difference between Max. and Min.	≥ 20 mV

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

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

9. ECM OPERATING AT DTC SETTING

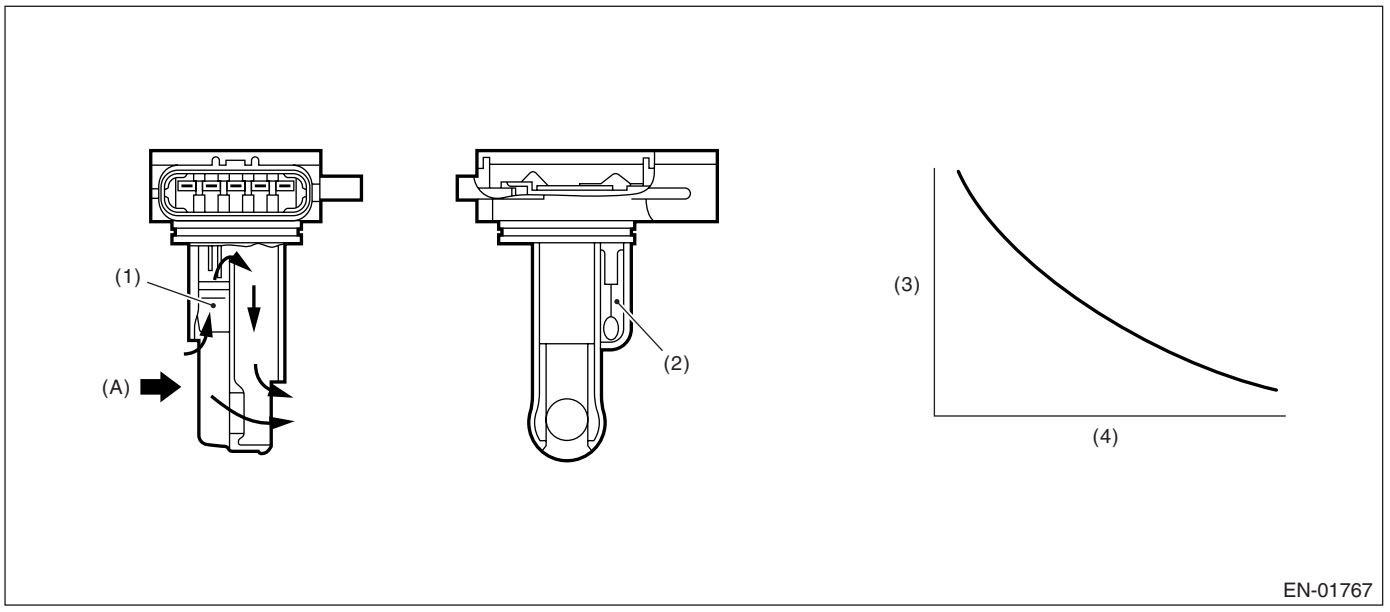
Memorize the freeze frame data. (For test mode $02)

O: 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) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance (Ω)
(4) Intake air temperature °C (°F)
(A) Air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.165 V
Ignition switch	ON

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the 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	≥ 0.165 V
Ignition switch	ON

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

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

9. ECM OPERATING AT DTC SETTING

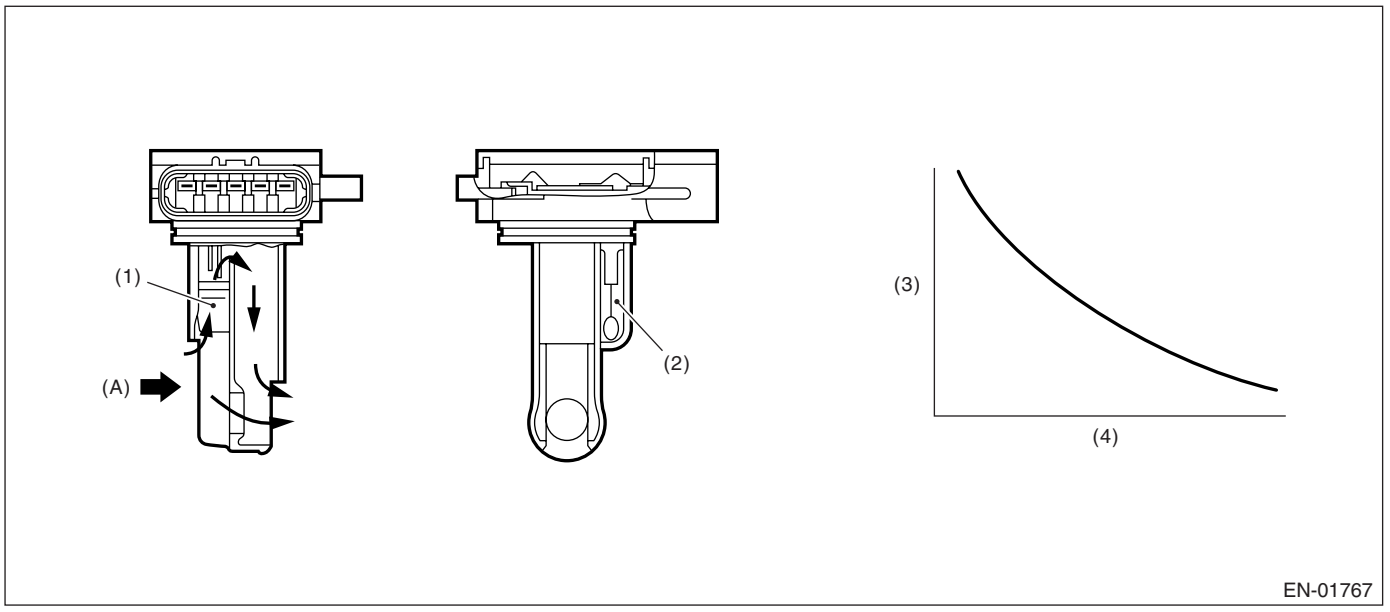
Memorize the freeze frame data. (For test mode $02)

P: 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) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance (Ω)
(4) Intake air temperature °C (°F)
(A) Air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.72 V
Ignition switch	ON

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the 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	≥ 0.23 V
Ignition switch	ON

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

Intake air temperature sensor process: Intake air temperature is fixed at 20°C (68°F).

9. ECM OPERATING AT DTC SETTING

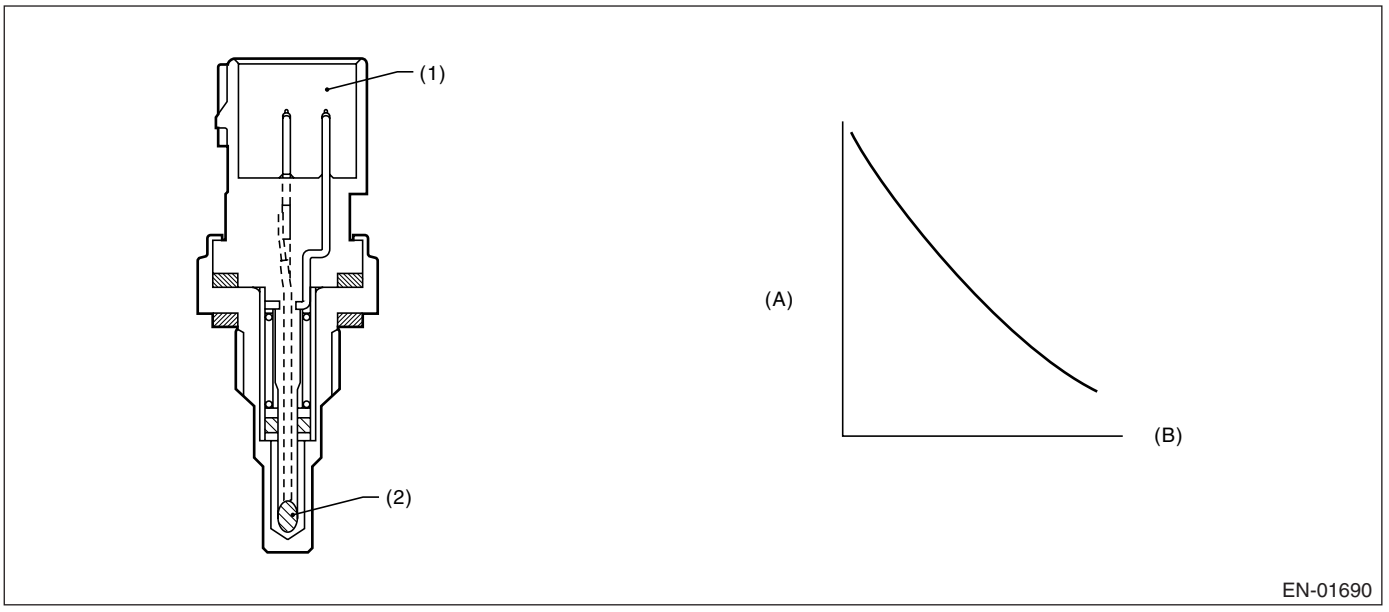
Memorize the freeze frame data. (For test mode $02)

Q: 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



(1) Connector
(2) Thermistor element
(A) Resistance value (kΩ)
(B) Temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.165 V

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the 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

- Engine coolant temperature process: Fix the engine coolant temperature at 70°C (158°F).
- ISC feedback: Calculate the target engine speed setting the engine coolant temperature to 70°C (158°F).
- ISC learning: Not allowed to learn.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan are in High driving.
- Increase compensation factor at high coolant temperature: Increase normally occurs with high temperature and other conditions; however, occurs with other conditions except coolant temperature condition.
- AVCS control: Make the oil flow control valve driving output to be Duty=0%.
- Tumble generator valve control: Open the tumble generator valve.

9. ECM OPERATING AT DTC SETTING

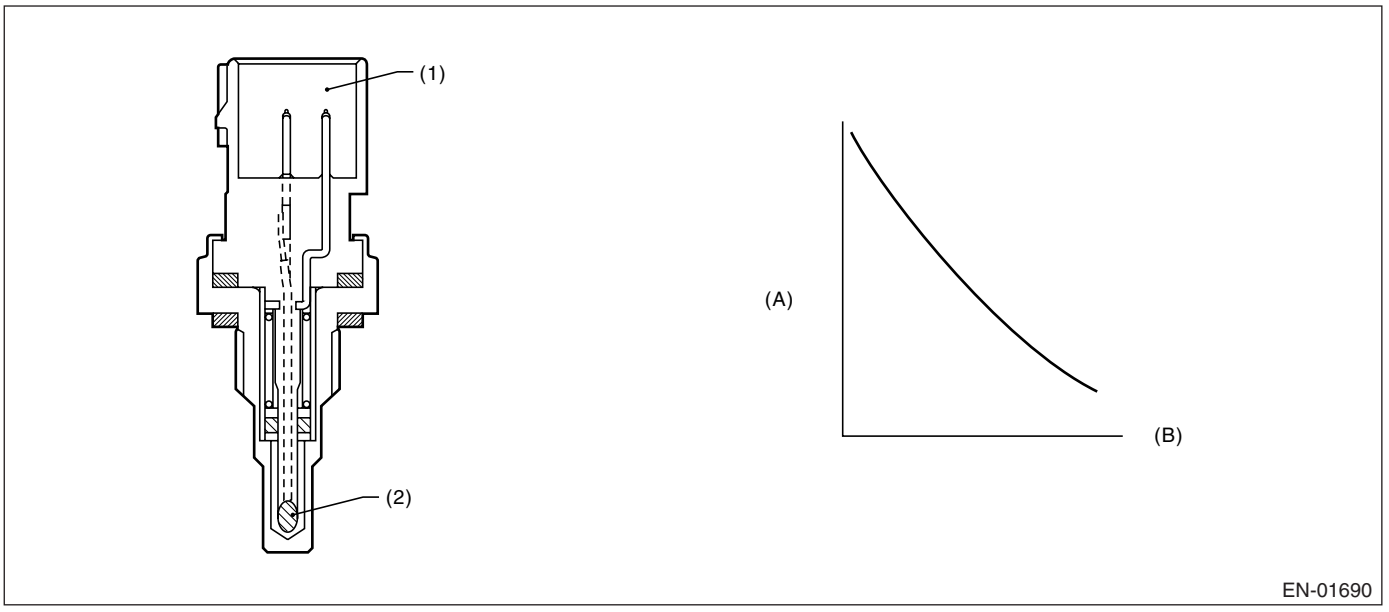
Memorize the freeze frame data. (For test mode $02)

R: 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 (kΩ)
(B) Temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds. Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.72 V

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the 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

- Engine coolant temperature process: Fix the engine coolant temperature at 70°C (158°F).
- ISC feedback: Calculate the target engine speed setting the engine coolant temperature to 70°C (158°F).
- ISC learning: Not allowed to learn.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan are in High driving.
- Increase compensation factor at high coolant temperature: Increase normally occurs with high temperature and other conditions; however, occurs with other conditions except coolant temperature condition.
- AVCS control: Make the oil flow control valve driving output to be Duty=0%.
- Tumble generator valve control: Open the tumble generator valve.

9. ECM OPERATING AT DTC SETTING

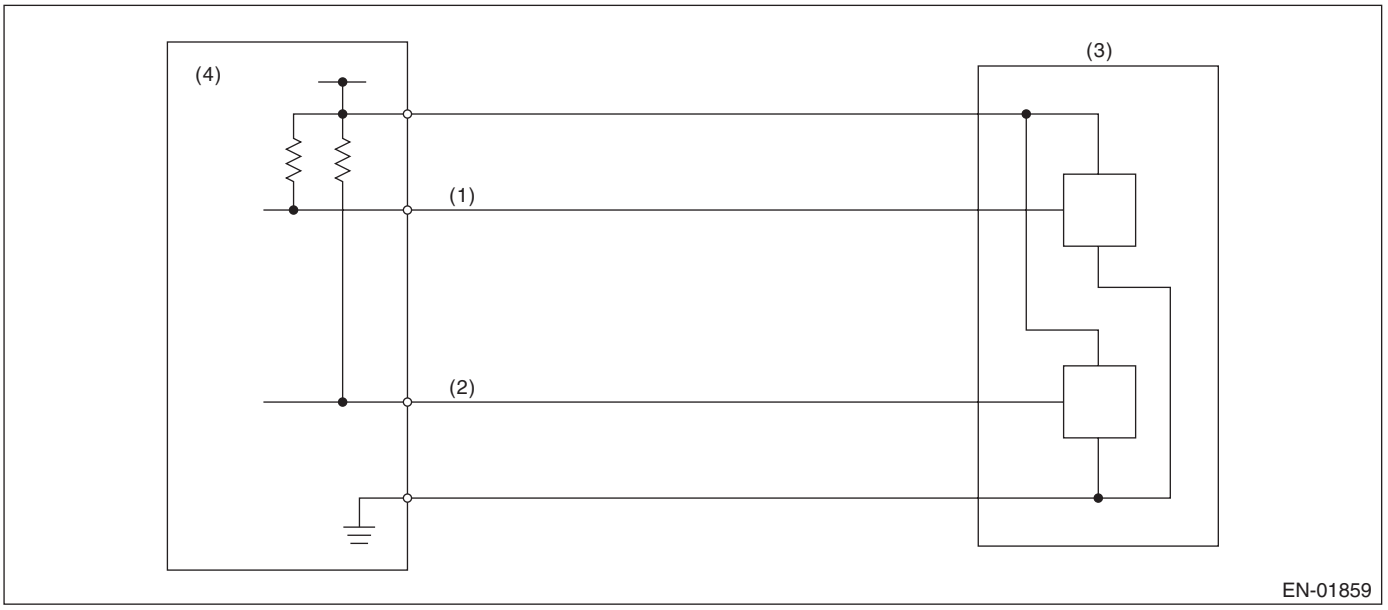
Memorize the freeze frame data. (For test mode $02)

S: 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 1.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always 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
Sensor 1 input voltage	≤ 0.309 V

Time Needed for Diagnosis: 24 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed (Only engine stop)

8. FAIL SAFE

Stop power distribution to electric control throttle motor. (Throttle opening is fixed to 6°.)

9. ECM OPERATION AT DTC SETTING

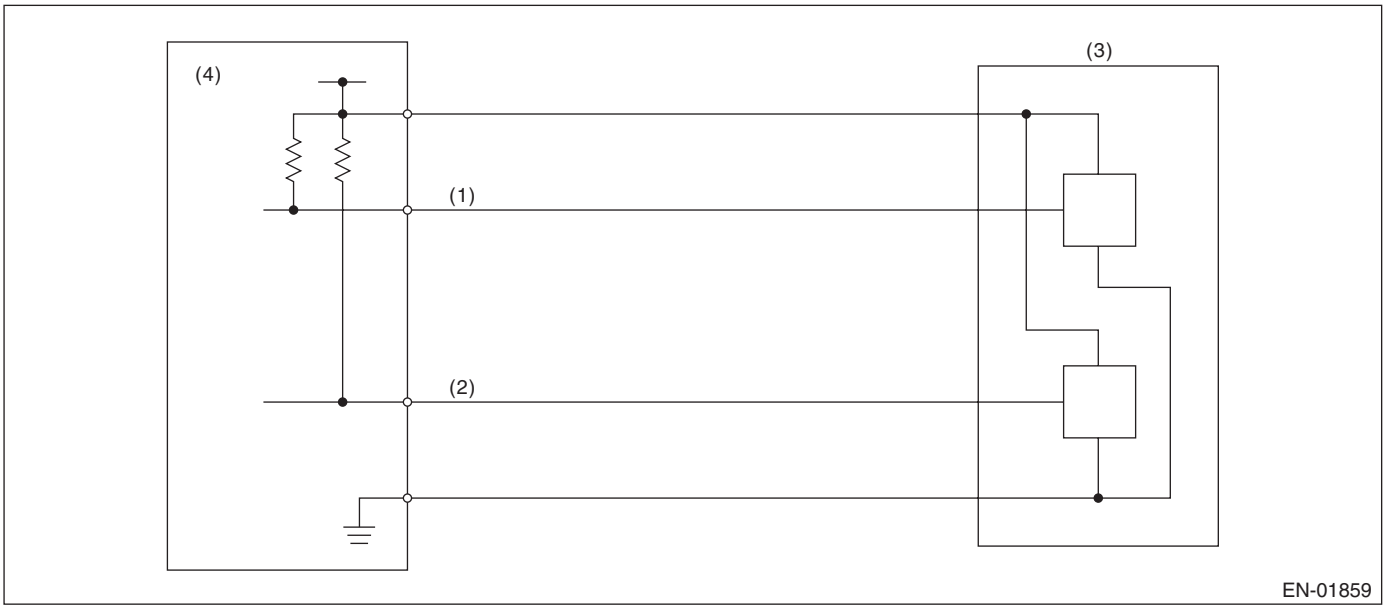
Memorize the freeze frame data. (For test mode $02)

T: 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 1.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always 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
Sensor 1 input voltage	< 4.646 V

Time Needed for Diagnosis: 24 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed (Only engine stop)

8. FAIL SAFE

Stop power distribution to electric control throttle motor. (Throttle opening is fixed to 6°.)

9. ECM OPERATION AT DTC SETTING

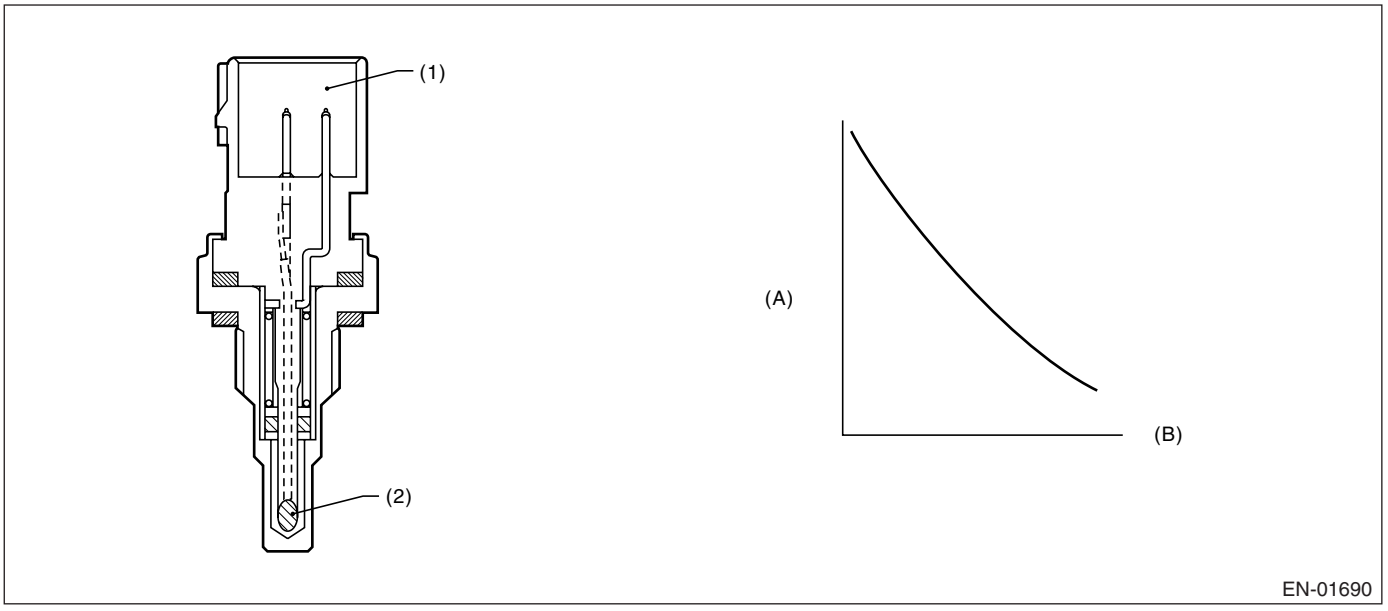
Memorize the freeze frame data. (For test mode $02)

U: DTC P0125 — INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature output property. Judge NG when the engine coolant temperature does not rise whereas it seemed to rise from the viewpoint of the engine condition.

2. COMPONENT DESCRIPTION



(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	> 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine starting.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 20°C (68°F)
Timer for diagnosis after engine starting	≥ Timer judgment value after engine starting

Timer for diagnosis after engine starting
a) Timer stop at fuel cut mode.
b) During the driving conditions except a) above, timer count up by 64 milliseconds + TWCNT milliseconds at every 64 milliseconds.
Where,TWCNT is determined as follows,
TWCNT = 0 at idle switch ON,
TWCNT show on the following table at idle switch OFF.

Temperature °C (°F)	Vehicle speed km/h (MPH)							
	0 (0)	8 (4.97)	16 (9.94)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
–20 (–4)	0 ms	37.14 ms	74.27 ms	111.41 ms	126.66 ms	141.91 ms	163.59 ms	185.26 ms
–10 (14)	0 ms	27.39 ms	54.78 ms	82.17 ms	99.65 ms	117.13 ms	135.96 ms	154.80 ms
0 (32)	0 ms	17.65 ms	35.29 ms	52.94 ms	72.64 ms	92.34 ms	108.34 ms	124.33 ms
10 (50)	0 ms	7.90 ms	15.80 ms	23.70 ms	45.63 ms	67.56 ms	80.71 ms	93.87 ms
20 (68)	0 ms	7.90 ms	15.80 ms	23.70 ms	45.63 ms	67.56 ms	80.71 ms	93.87 ms

Judgment value of timer after engine starting
$t = 451.1 - 28.6 \times Ti$
Ti is the lowest coolant temperature after starting the engine.
Time Needed for Diagnosis: To be determined. (It is varied by the Min. engine coolant temperature and engine conditions such as vehicle speed and engine coolant temperature.)
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
Engine coolant temperature	≥ 20°C (68°F)

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

- Engine coolant temperature process: Fix the engine coolant temperature at 70°C (158°F).
- ISC feedback: Calculate the target engine speed setting the engine coolant temperature to 70°C (158°F).
- ISC learning: Not allowed to learn.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.
- Air conditioner control: Not allowed to turn the air conditioner to ON.
- Radiator fan control: Both main and sub fan are in High driving.
- Increase compensation factor at high coolant temperature: Increase normally occurs with high temperature and other conditions; however, occurs with other conditions except coolant temperature condition.
- AVCS control: Make the oil flow control valve driving output to be Duty=0%.
- Tumble generator valve control: Open the tumble generator valve.

9. ECM OPERATING AT DTC SETTING

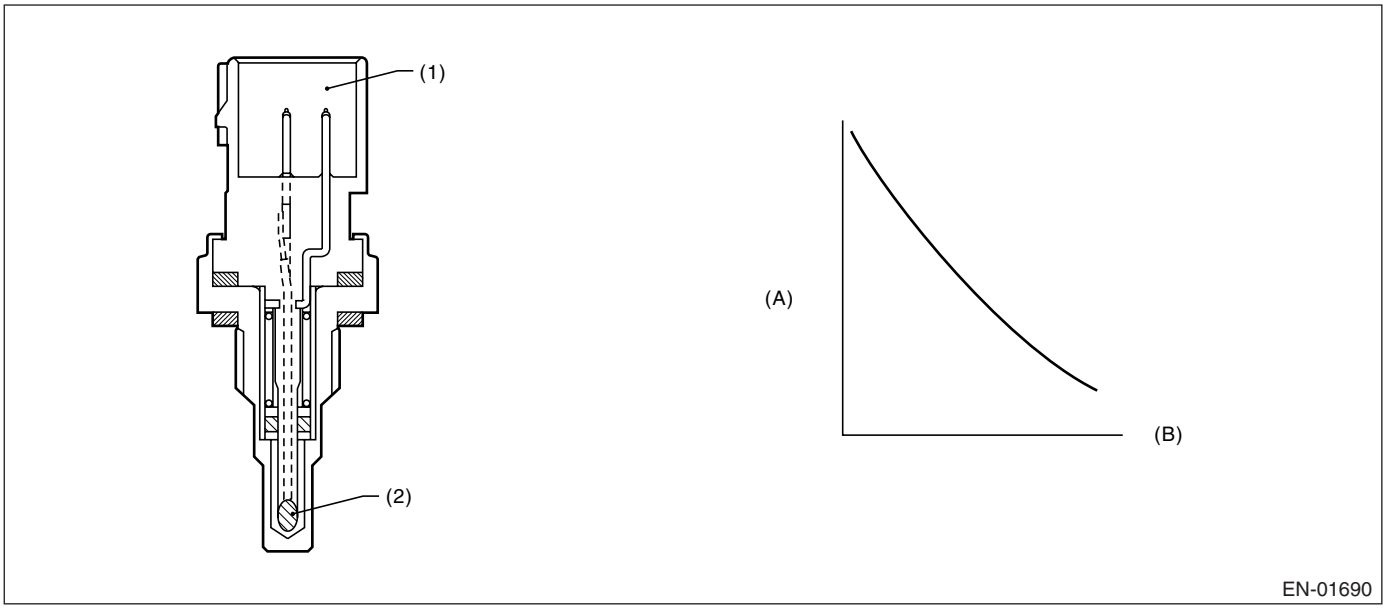
Memorize the freeze frame data. (For test mode $02)

V: DTC P0126 — INSUFFICIENT COOLANT TEMPERATURE FOR STABLE OPERATION —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature output properly. Judge NG when the engine coolant temperature sensor output does not change whereas it seemed to change from the viewpoint of the engine condition.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Thermistor element
(A) Resistance value (kΩ)
(B) Temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
More than 20 seconds with idling after engine starting	Experienced
More than 20 seconds with vehicle running at 30 km/h (18.6 MPH) or more	Experienced

4. GENERAL DRIVING CYCLE

After idling and running for the specified time, perform the diagnosis only once for OK/NG judgment.

5. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed and judge OK when not completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature sensor Max. voltage – Min. voltage	< 0.005 V

Time Needed for Diagnosis: To be determined. (It is varied by Min. engine coolant temperature and engine conditions such as vehicle speed and engine coolant temperature.)
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 OPERATING AT DTC SETTING

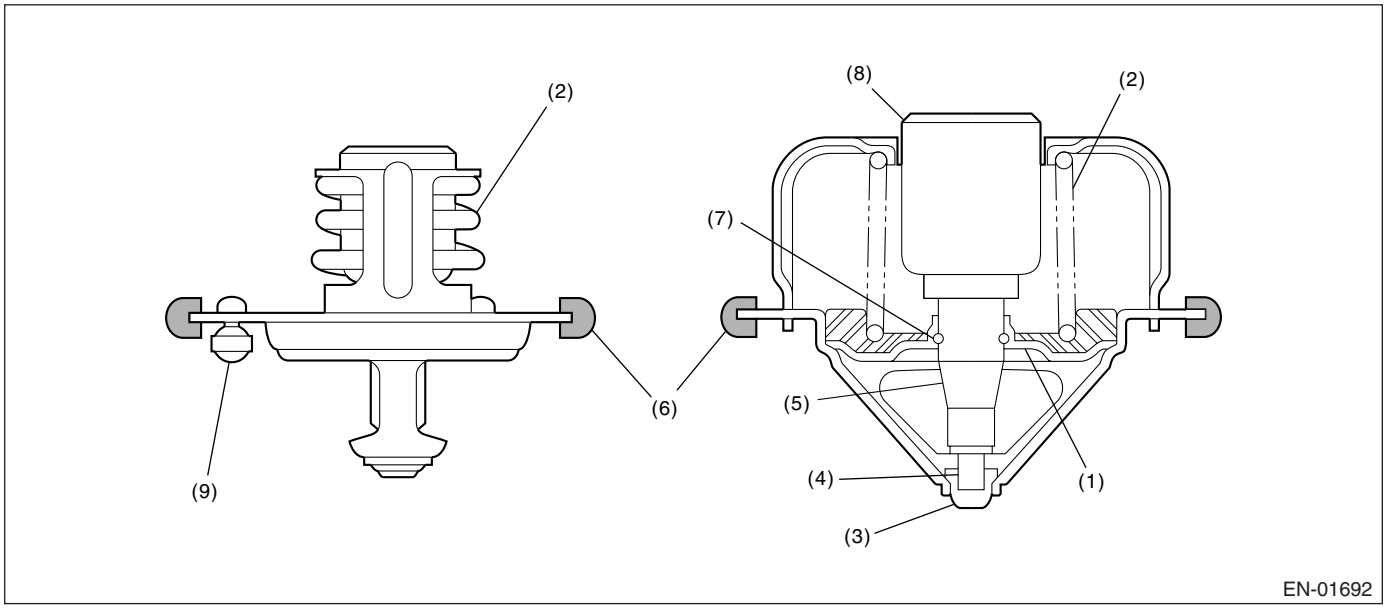
Memorize the freeze frame data. (For test mode $02)

W: DTC P0128 — COOLANT THERMOSTAT (COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of thermostat function. Judge NG when the engine coolant temperature is lower than the estimated engine coolant temperature and the difference between them is large. Judge OK when the engine coolant temperature becomes 75°C (167°F) and the difference is small 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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 30 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Vehicle speed	≥ 30 km/h (19 MPH)
Battery voltage	≥ 10.9 V
Estimated ambient air temperature	≥ –7°C (19.4°F)
Engine coolant temperature at engine starting	< 55°C (131°F)
Estimated coolant temperature	≥ 75°C (167°F)
Engine coolant temperature	< 75°C (167°F)
(Estimated – measured) coolant temperature	> 30°C (86°F)

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 the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Estimated ambient air temperature	≥ –7°C (19.4°F)
Thermostat malfunction diagnosis	Not finished
Engine coolant temperature at engine starting	< 55°C (131°F)
Engine coolant temperature	≥ 75°C (167°F)
(Estimated – measured) coolant temperature	≤ 30°C (86°F)

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 OPERATING AT DTC SETTING

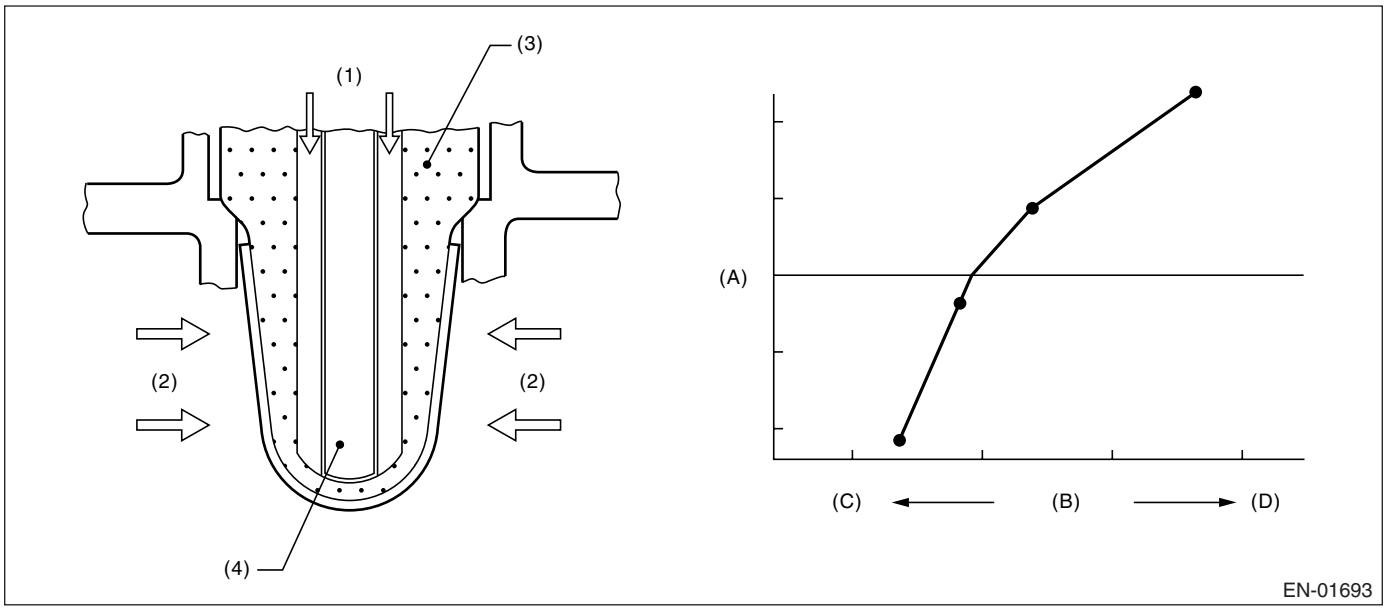
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

X: DTC P0131 — O_2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.
Judge NG when the element impressed voltage is out of range, or the element current is out of range.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing any malfunction criteria below becomes more than 1 second.

Judgment Value

Malfunction Criteria	Threshold Value
Input voltage	< 1.8 V
Input current	< –0.01 A

Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as the 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

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0 from 0.3 normally.
- Purge control: Not allowed to purge.

9. ECM OPERATING AT DTC SETTING

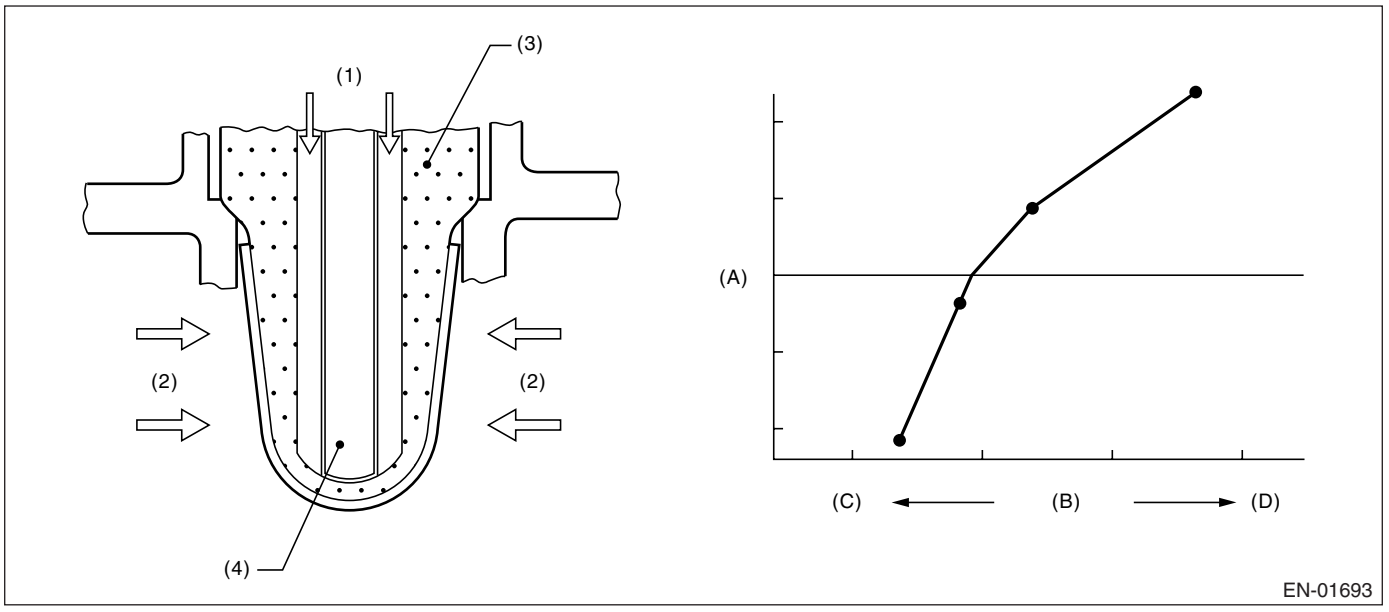
Memorize the freeze frame data. (For test mode $02)

Y: DTC P0132 — O_2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.
Judge NG when the element impressed voltage is out of range, or the element current is out of range.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing any malfunction criteria below becomes more than 1 second.

Judgment Value

Malfunction Criteria	Threshold Value
Input voltage	≥ 3.8 V
Input current	≥ 0.01 A

Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as the 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

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0 from 0.3 normally.
- Purge control: Not allowed to purge.

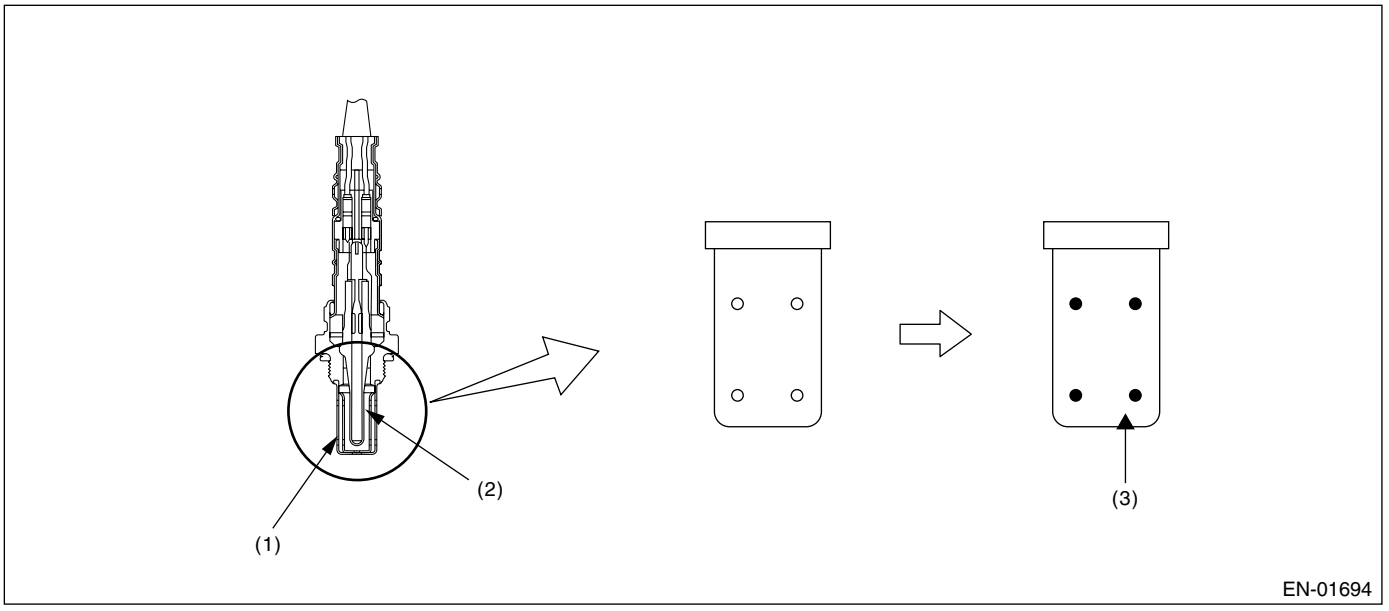
9. ECM OPERATING AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

Z: DTC P0133 — O_2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1) —

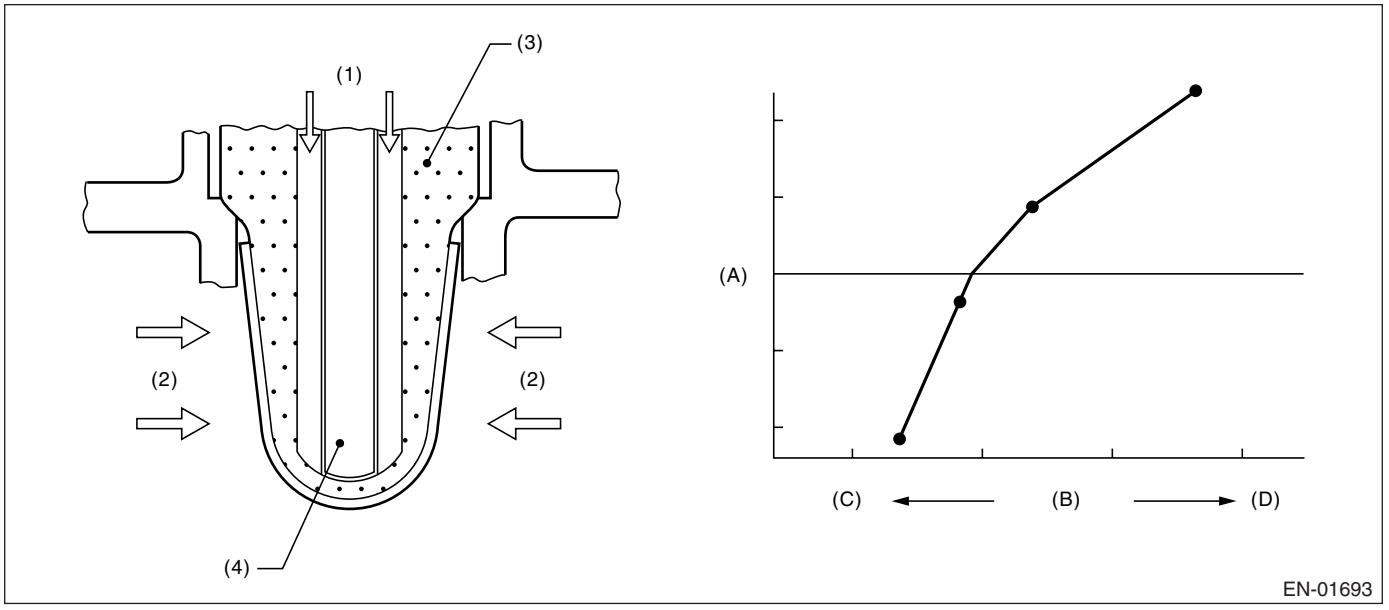
1. OUTLINE OF DIAGNOSIS

Detect time-lag of front oxygen (A/F) sensor response. 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

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameter enable conditions	more than 1 second
Battery voltage	> 10.9 V
Atmospheric pressure	> 75.1 kPa (563 mmHg, 22.2 inHg)
Closed loop control with main feedback	operating
Impedance of front oxygen (A/F) sensor	0 ←→ 50 Ω
After starting engine	120 seconds or more
Engine coolant temperature	≥ 75°C (167°F)
Engine speed	1000 ←→ 3200 rpm
Vehicle speed	10 ←→ 120 km/h (6.21 ←→ 74.6 MPH)
Amount of intake air	10 ←→ 31 g (0.35 ←→ 1.09 oz)/s
Engine load change during 0.5 engine rev.	≤ 0.02 g (0.001 oz)/rev
Learning value of EVAP conc. during purge	≤ 0.2
Total time of operating canister purge	20 seconds or more

4. GENERAL DRIVING CYCLE

Perform diagnosis only once at a constant speed of 10 to 120 km/h (6.21 to 74.6 MPH) in 120 seconds after starting the engine.

5. DIAGNOSTIC METHOD

Integrate the difference of faf in every 128 milliseconds and difference of λ value.
After integrate 1640 times (210 seconds), calculate the diagnosis value.
Judge NG when the malfunction criteria below are completed. Judge OK and clear NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
parafca = td2faf/td2lmd where, td2faf (N) = td2faf (n−1) + |d2faf (n)| td2lmd (N) = td2lmd (n−1) + |d2lmd (n)| add up for a total of 210 seconds d2faf (n) = (faf (n) − faf (n−1)) − (faf (n−1) − faf (n−2)) d2lmd (n) = (lmd (n) − lmd (n−1)) − (lmd (n−1) − lmd (n−2)) faf = main feedback compensation coefficient every 128 milliseconds lmd = output lambda every 128 milliseconds	≥ 0.367

Time Needed for Diagnosis: 210 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

- Front oxygen (A/F) sensor main learning correction: Not allowed to calculate.
- Correction when re-starting at high temperature: Normally minimum value 0.3 → 0.
- Purge control: Not allowed to purge.

9. ECM OPERATING AT DTC SETTING

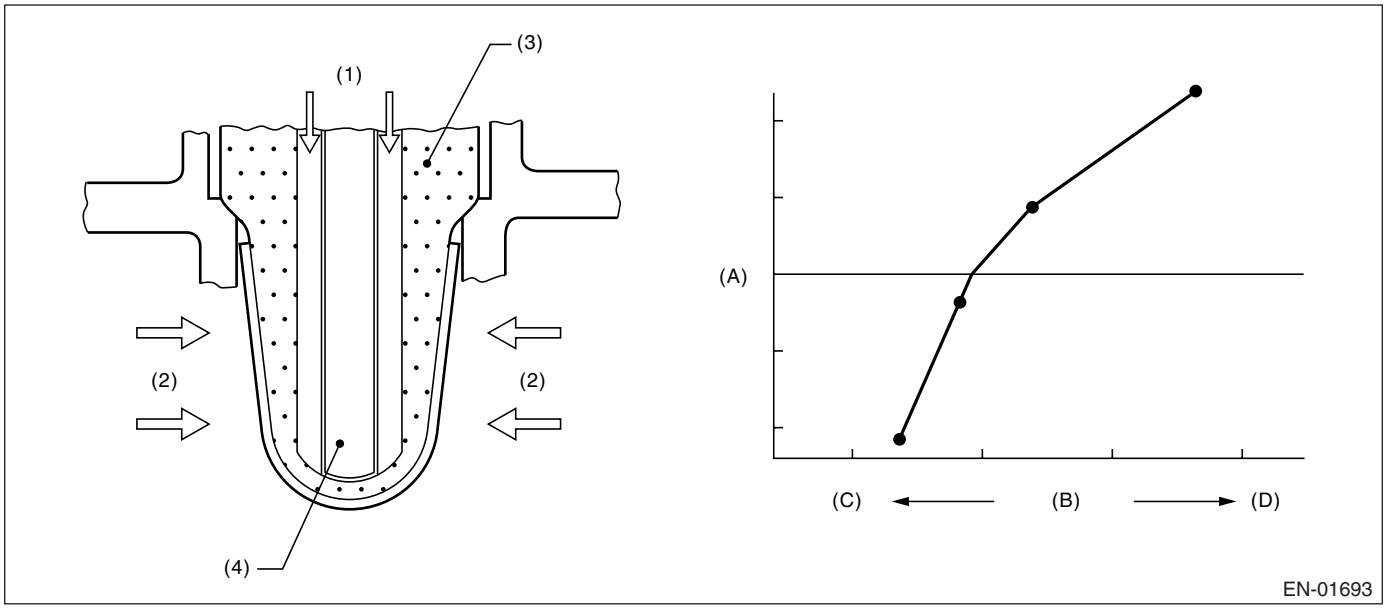
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

AA:DTC P0134 — O_2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1) —

1. OUTLINE OF DIAGNOSIS

Detect the open circuit of sensor.
Judge NG when the element impedance is large.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 5 seconds.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Time after engine starting	≥ 50 seconds
Cumulative amount of Front O_2 (A/F) sensor heater control duty every 128 milliseconds	≥ 28000%
Front lambda sensor impedance	≥ 500 Ω

Time Needed for Diagnosis: 5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the 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

- Front oxygen (A/F) sensor activation judgment: Front oxygen (A/F) sensor full activation is not complete, or front oxygen (A/F) sensor half activation is not complete.
- A/F main learning: Not allowed to calculate the A/F main learning compensation factor.
- Compensation when starting the engine at high temperature: Make the MIN value to be 0 from 0.3 normally.
- Purge control: Not allowed to purge.

9. ECM OPERATING AT DTC SETTING

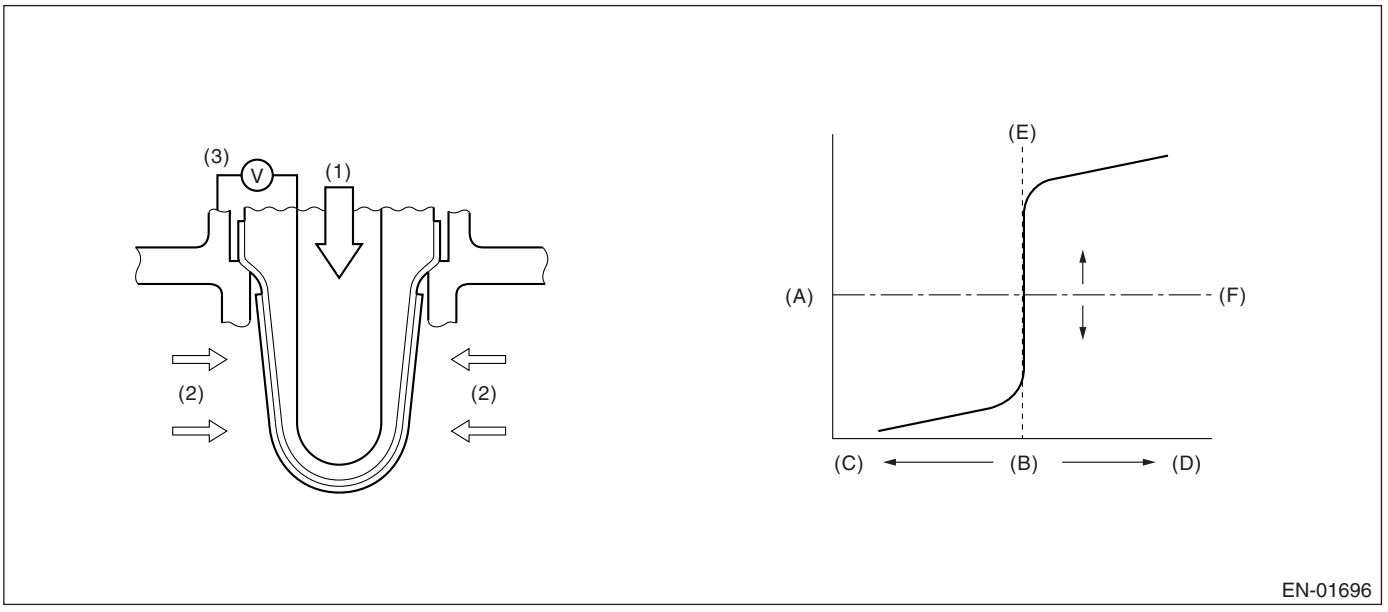
Memorize the freeze frame data. (For test mode $02)

AB:DTC P0137 — O_2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of rear oxygen sensor open or short circuit. Judge NG when the rear oxygen sensor voltage may be abnormal from rear oxygen sensor voltage value with considering the conditions such as intake air amount, engine coolant temperature, main feedback control.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Rich
(D) Lean
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION JUDGMENT)

Secondary Parameters	Enable Conditions
Closed loop control with main feedback control	In operation
Target output voltage of rear oxygen sensor	≥ 0.54 V
Amount of intake air	≥ 10 g (0.35 oz)/s
Engine coolant temperature	≥ 75°C (167°F)
Misfire detection during 200 engine revs.	< 5 times
Compensation factor for front oxygen (A/F) sensor with main feedback control	Not in limit value
Battery voltage	> 10.9 V
5 seconds or more fuel shut-off in decel.	Experienced

4. GENERAL DRIVING CYCLE

Perform the diagnosis once after warming up the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Max. output voltage	< 490 mV

Time Needed for Diagnosis: 200 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Low side diagnosis of rear oxygen sensor voltage	Incomplete
Max. output voltage	≥ 490 mV

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

Sub feedback control: Not allowed

9. ECM OPERATING AT DTC SETTING

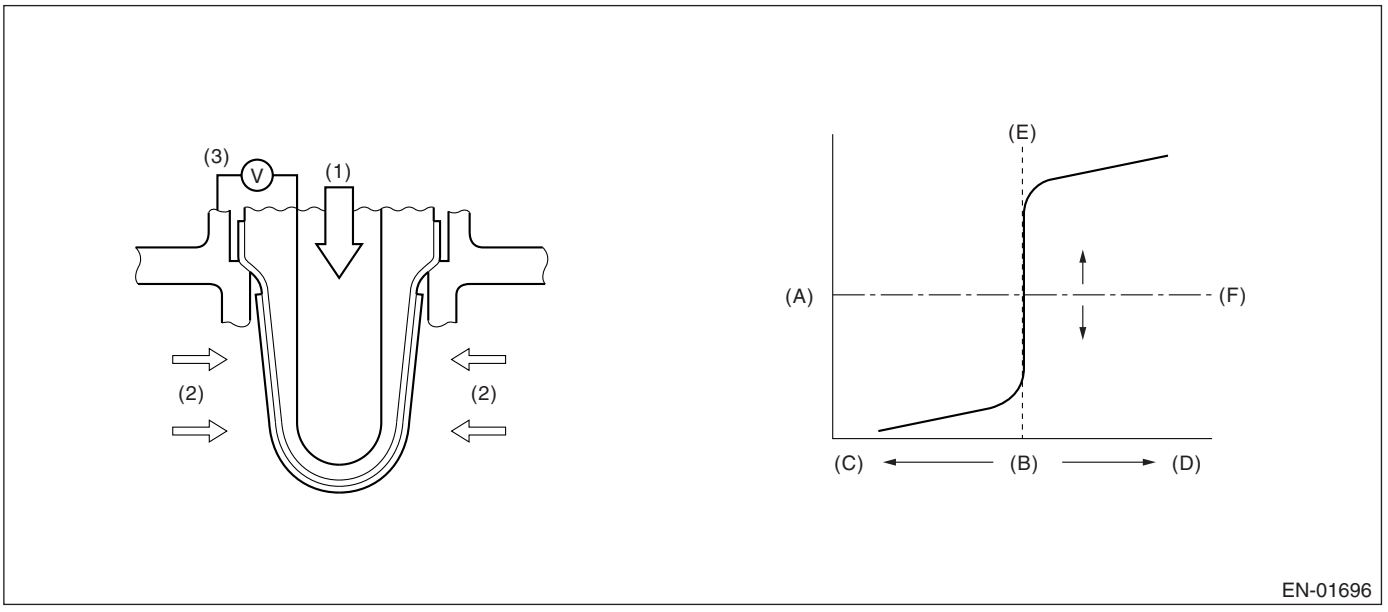
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

AC:DTC P0138 — O_2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of rear oxygen sensor open or short circuit. Judge NG when the rear oxygen sensor voltage may be abnormal with considering the conditions such as intake air amount, engine coolant temperature, main feedback control.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Rich
(D) Lean
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION JUDGMENT)

Secondary Parameters	Enable Conditions
Closed loop control with main feedback control	In operation
Target output voltage of rear oxygen sensor	≥ 0.54 V
Amount of intake air	≥ 10 g (0.35 oz)/s
Engine coolant temperature	≥ 75°C (167°F)
Misfire detection during 200 engine revs.	< 5 times
Compensation factor for front oxygen (A/F) sensor with main feedback control	Not in limit value
Battery voltage with main feedback control	> 10.9 V
Cumulative time for completing the conditions with main feedback control	≥ 200 seconds
5 seconds or more fuel shut-off in decel.	Experienced

4. GENERAL DRIVING CYCLE

Perform the diagnosis once after warming up the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Min. output voltage	> 250 mV

Time Needed for Diagnosis: 200 seconds

Malfunction Indicator Light Illumination: Detect when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
High side diagnosis of rear oxygen sensor voltage	Incomplete
Min. output voltage	≤ 250 mV

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

Sub feedback control: Not allowed

9. ECM OPERATING AT DTC SETTING

- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

AD:DTC P0139 — O_2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2) —

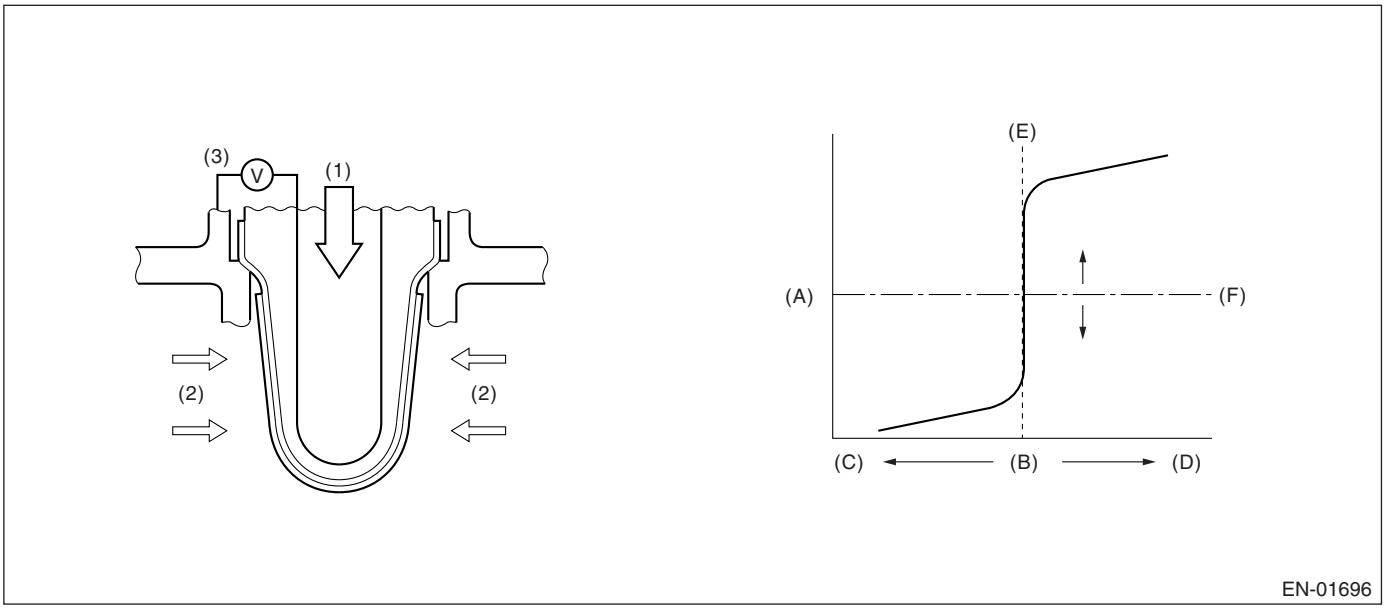
1. OUTLINE OF DIAGNOSIS

Detect the slow response of rear oxygen sensor.

• Diagnostic Method

Measure the response time of the output change of the rear oxygen sensor when the A/F ratio changes from rich to lean. And Judge NG when the measured response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Rich
(D) Lean
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION

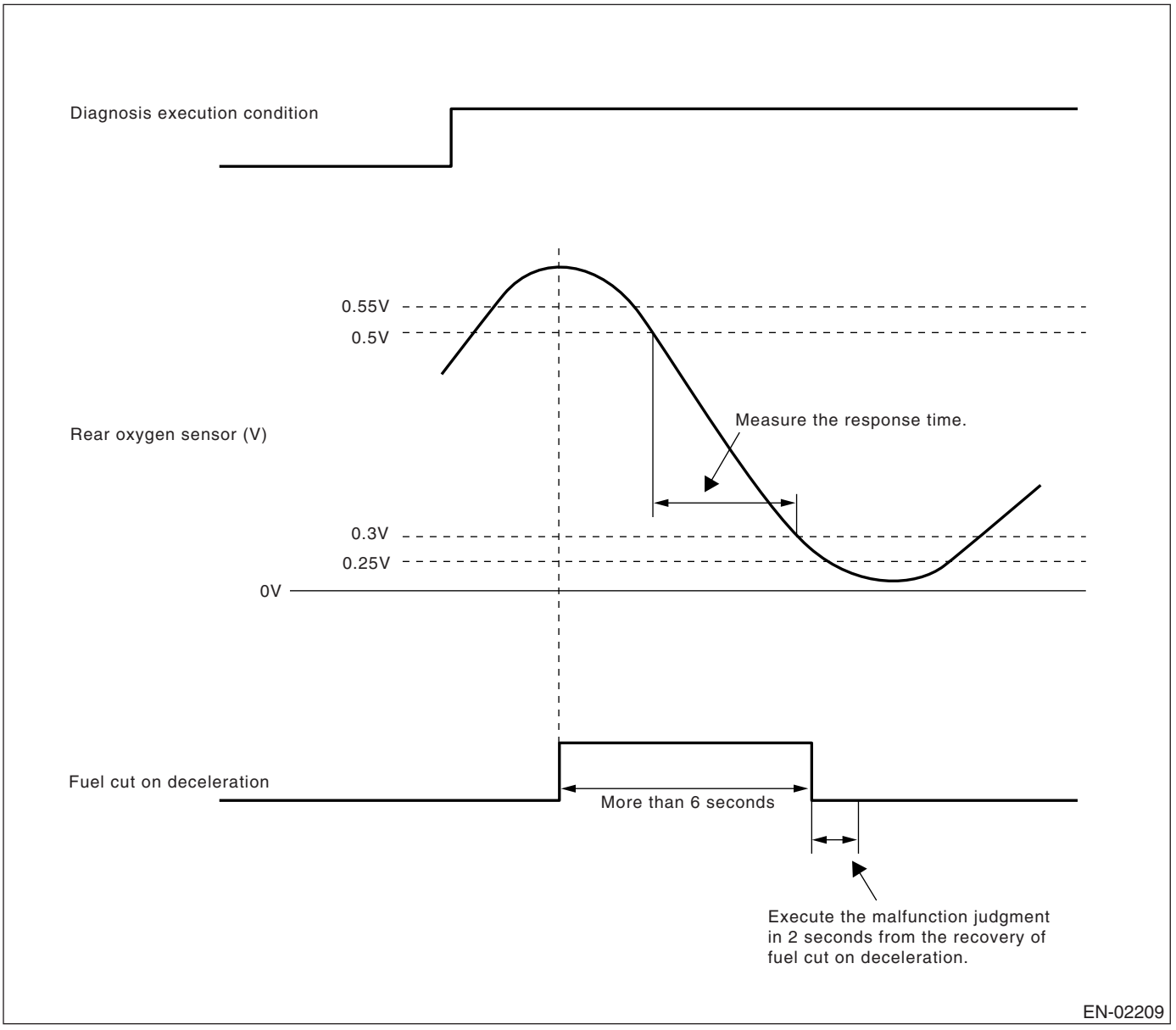
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
A/F main feedback control condition	Completed
5 seconds or more fuel shut-off in deceleration	Experienced
Number of times for fuel cut at deceleration	1 time
After fuel shutting-off	≥ 2 seconds
Time elapsed for rear oxygen sensor heater ON	≥ 50 seconds
Continuous time for rear oxygen sensor heater ON	≥ 30 seconds
Catalytic warm-up counter <Ref. to GD(H4DOTC)-120, DTC P0420 — CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1) —, Diagnostic Trouble Code (DTC) Detecting Criteria.>	≥ 7,500 times

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when fuel shut-off in deceleration after rapid acceleration. (Pay attention to oxygen sensor voltage for the timing of deceleration in order to calculated the diagnostic value.)

5. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes 0.55 V (rich) to 0.25 V (lean), caluculate the Min. value of response time regarded as judgment value while the output varies from 0.5 V to 0.3 V.



• Abnormality Judgment

1) Judge NG when the judgment value is larger than the threshold value after fuel cut at deceleration.
Response time (Diagnosi value) > Threshold value → Abnormal

NOTE:
Variation time of rear oxygen sensor output voltages is short during fuel cut at deceleration. Carry out the NG judgment only after the fuel cut at deceleration. As for OK judgment, without the condition of fuel cut at deceleration, judge OK if the value is below the threshold value.
Judge NG when the malfunction criteria below are completed in 2 seconds after the recovery of fuel cut at deceleration which requires 6 seconds or more.

2) Judge NG when the O_2 sensor voltage after recovery of fuel cut at deceleration is large. Judge NG when fuel cut at deceleration is also long (6s or more), and although carried out the recovery of fuel cut at deceleration, when O_2 sensor voltage is large (more than 0.55V).

• Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from rich (500 mV O_2 output) to lean (300 mV) if voltage reduces from 550 mV to 250 mV.	> 0.698 seconds
Or, longest time when more than 550 mV	> 2 seconds

Time Needed for Diagnosis: Once

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

1) Judge Normal When the response time (diagnostic value) is smaller than threshold (judgment value) when oxygen sensor voltage changes from rich to lean, even with or without fuel cut at deceleration.
2) A normal judging is not carried out.

• Judgment Value

Judge OK when the following standards value are completed.

Malfunction Criteria	Threshold Value
Shortest time change from rich (500 mV O_2 output) to lean (300 mV) if voltage reduces from 550 mV to 250 mV.	≤ 0.698 seconds

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

Sub feedback control: Not allowed

9. ECM OPERATING AT DTC SETTING

- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

10.ENABLE CONDITON

- Lean → Rich response diagnosis

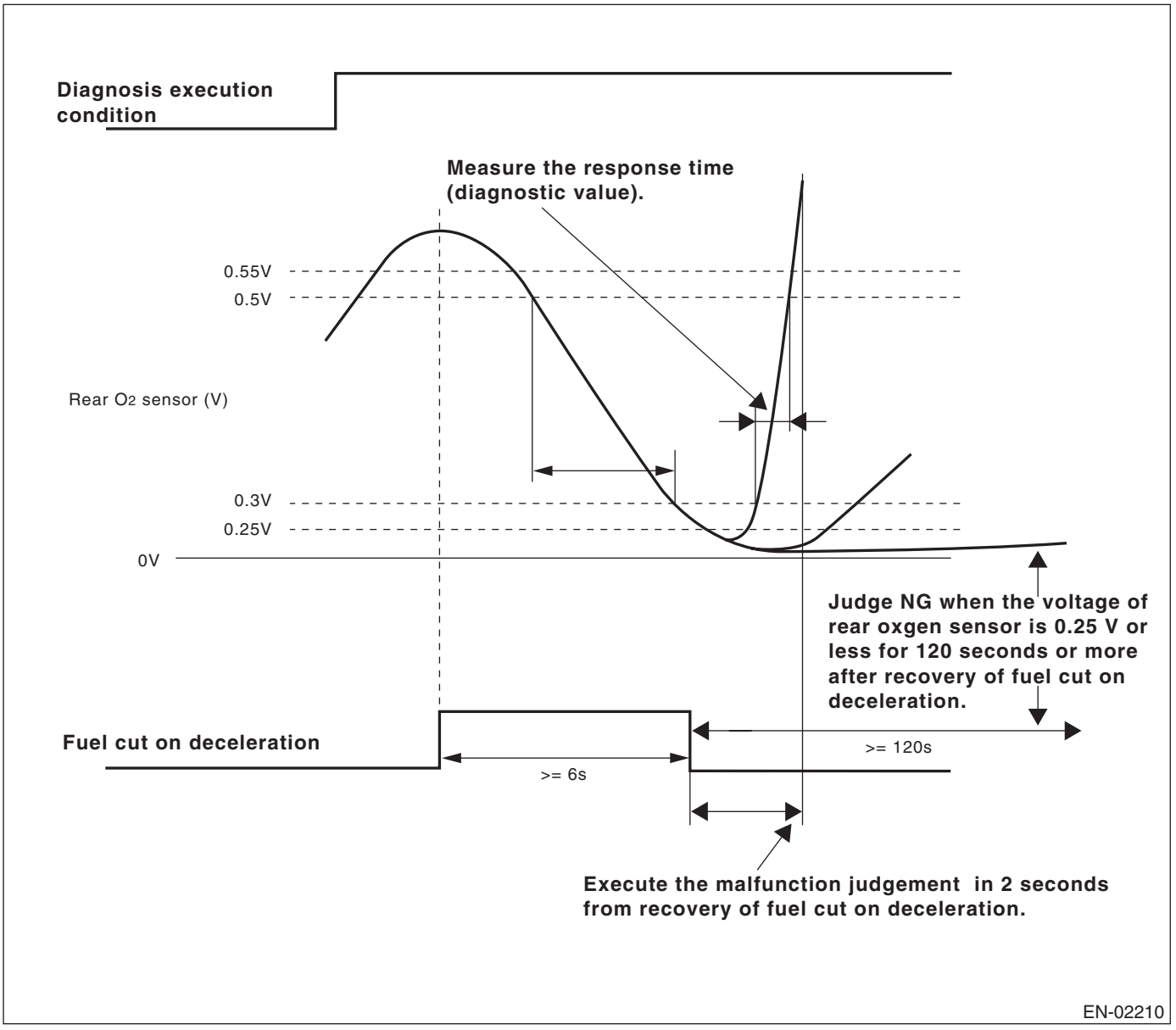
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
A/F main feedback control condition	Completed
Fuel cut at deceleration ≥ 5 seconds	Experienced
Number of times for fuel cut at deceleration	1 time
After fuel cut	≥ 2 seconds
Time elapsed for rear oxygen sensor heater ON	≥ 60 seconds
Continuous time for rear oxygen sensor heater ON	≥ 30 seconds

11.GENERAL DRIVING CYCLE

Perform the diagnosis only when fuel cut at deceleration after rapid acceleration. (Pay attention to oxygen sensor voltage for the timing of deceleration.)

12.DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes 0.25 V (lean) to 0.55 V (rich), caluculate the Min. value of response time regarded as judgment value while the output varies from 0.3 V to 0.5 V.



• Abnormality Judgment

1) Judge NG when the judgment value is larger than the threshold value after recovery of fuel cut at deceleration.
Response time (Diagnosis time) > Threshold value → Abnormal

2) Judge NG when the O_2 sensor voltage after recovery of fuel cut at deceleration is small.

• Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (300 mV O_2 output) to rich (500 mV) if voltage reduces from 500 mV to 250 mV.	> 2 seconds
Or longest time to change to 250 mV	> 120 seconds

Time Needed for Diagnosis: Once

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

1) Judge Normal When the response time (diagnostic value) is smaller than threshold (judgment value) when oxygen sensor voltage changes from rich to lean, even with or without fuel cut at deceleration.
Response Time (diagnosis value) ≤ Threshold value → Normal
2) A normal judging is not carried out.

• Judgment Value

Judge OK when the following standards value are completed.

Malfunction Criteria	Threshold Value
Shortest time change from lean (300 mV O_2 output) to rich (500 mV) if voltage reduces from 550 mV to 250 mV.	≤ 2 seconds

13.DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed

14.MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed

15.FAIL SAFE

Sub feedback control: Not allowed

16.ECM OPERATION AT DTC SETTING

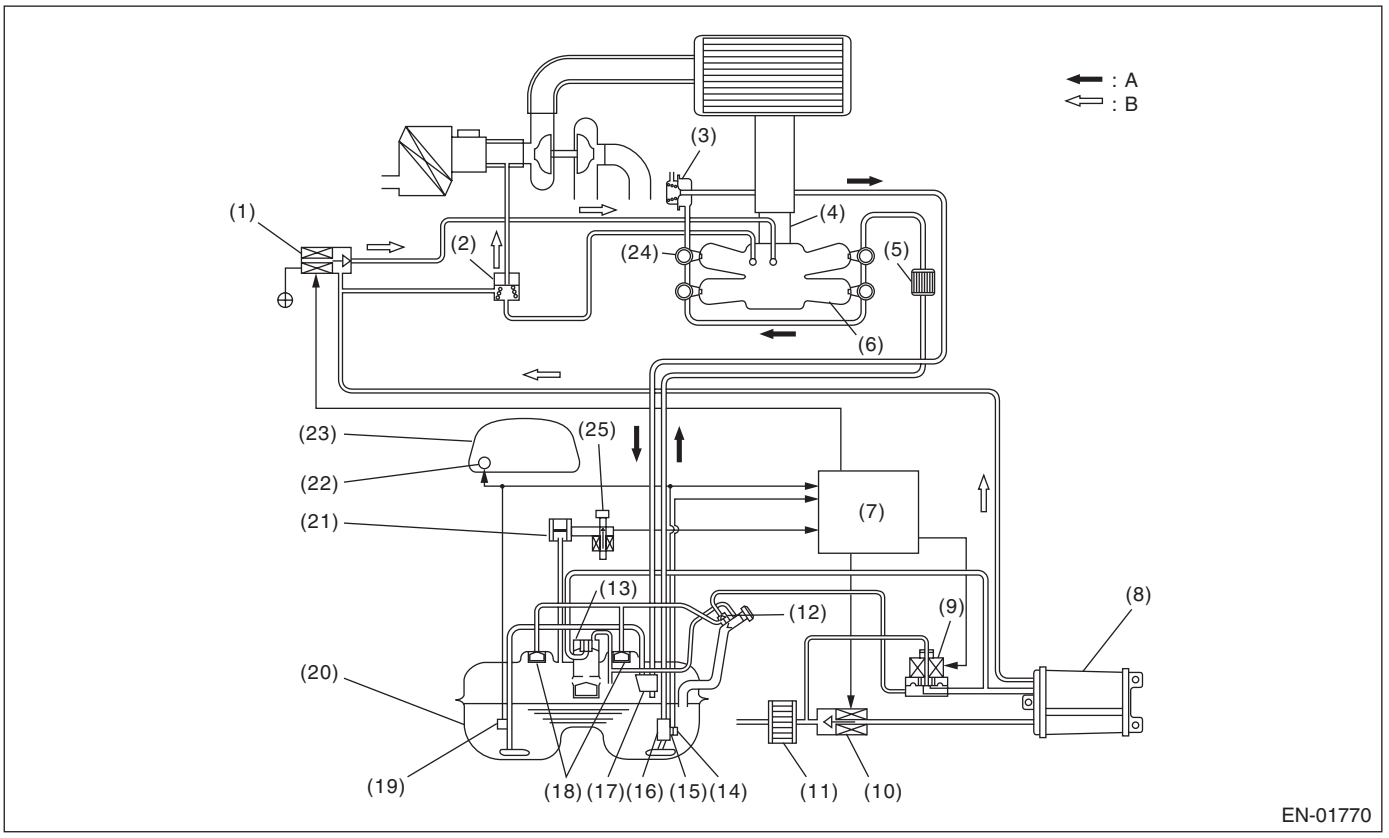
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

AE:DTC P0171 — SYSTEM TOO LEAN (BANK 1) —

1. OUTLINE OF DIAGNOSIS

Detect the fuel system malfunction by the amount of main feedback control.

• Fuel System Diagnosis



(1) Purge control solenoid valve
(2) Purge valve
(3) Pressure regulator
(4) Throttle body
(5) Fuel filter
(6) Intake manifold
(7) Engine control module (ECM)
(8) Canister
(9) Pressure control solenoid valve
(10) Drain valve
(11) Drain filter
(12) Shut-off valve
(13) Vent valve
(14) Fuel temperature sensor
(15) Fuel level sensor
(16) Fuel pump
(17) Jet pump
(18) Fuel cut valve
(19) Fuel sub level sensor
(20) Fuel tank
(21) Fuel tank pressure sensor
(22) Fuel meter
(23) Combination meter
(24) Fuel injector
(25) Tank pressure switching solenoid valve

• Diagnostic Method

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	≥ 70 °C (158°F)
Engine load	≥ Map 5
Intake air change during 0.5 engine rev.	≤ 0.02 g (0.001 oz)/rev

Map 5

Engine speed (rpm)	idle	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g (oz)/rev)	NA	0.236 (0.008)	0.232 (0.008)	0.226 (0.008)	0.231 (0.008)	0.252 (0.009)	0.262 (0.009)	0.243 (0.009)	0.243 (0.009)	0.267 (0.009)	0.270 (0.010)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or a constant speed after warming up the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge that the fuel system malfunction occurs when the time during completing the malfunction criteria below continues 30 seconds or more by comparing the diagnosed value (fsobd) with threshold value.

• Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf	≥ fsobdL1
where,	See Map 4
sglmd = measured lambda	
tglmda = target lambda	fsobdL1 = lean side threshold value of fsobd
faf = main feedback compensation coefficient every 64 milliseconds	
flaf = main feedback learning compensation coefficient	

Map 4 Threshold value for fuel system malfunction criteria

Amount of air (g (oz)/s)	0 (0)	2.4 (0.085)	4.7 (0.166)	7 (0.247)	9.4 (0.332)	11.7 (0.413)	14.1 (0.497)
fsobdL1 (%)	40	40	36.9	32.0	27.0	26.5	26.5

Time Needed for Diagnosis: 10 seconds × 5 times
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the malfunction criteria below are continued for 10 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf	< 19%

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 OK with similar drive in 3 driving cycles.
- When “Clear Memory” was performed

7. FAIL SAFE

Rich side malfunction
- Purge control solenoid valve control: Not allowed to purge.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.

8. ECM OPERATING AT DTC SETTING

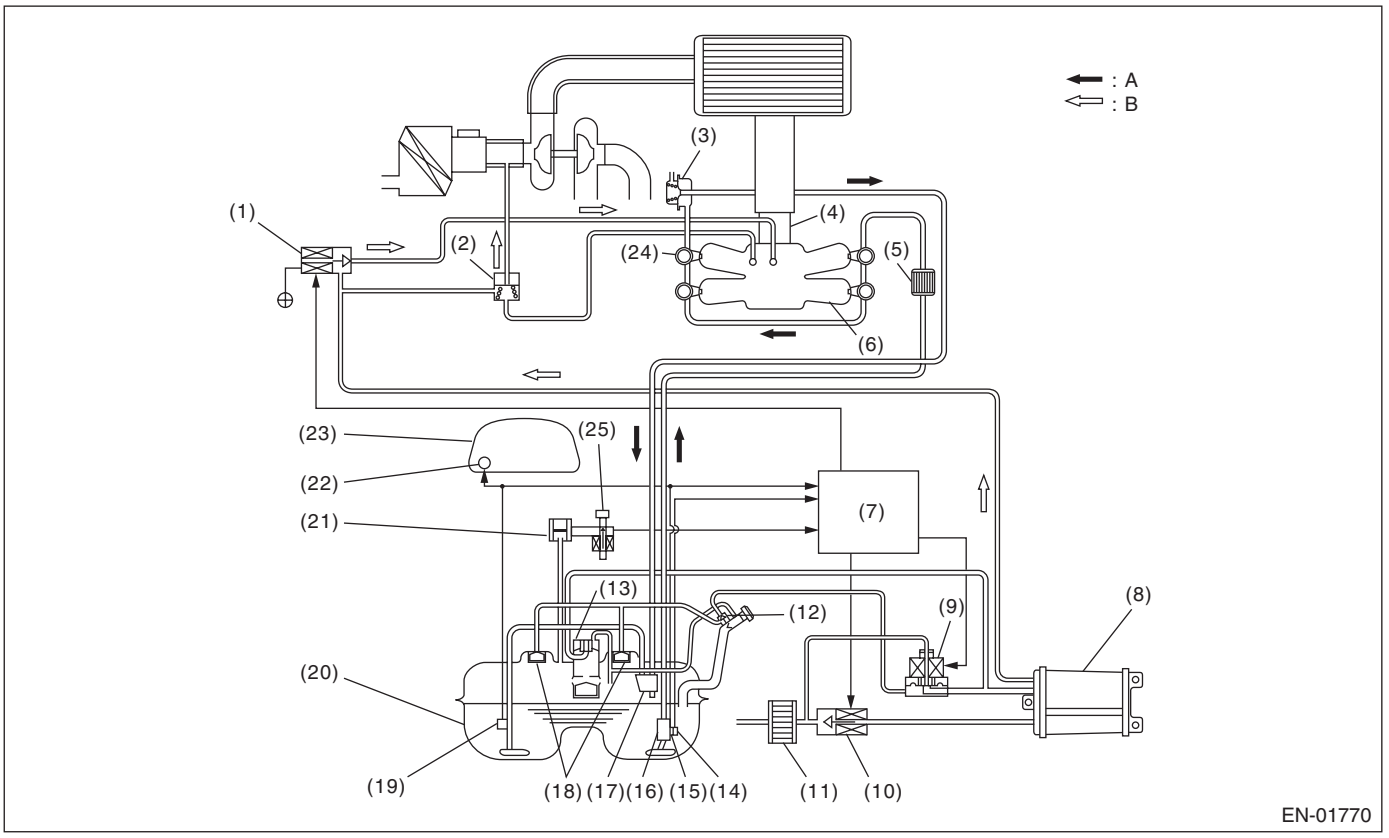
Memorize the freeze frame data. (For test mode $02)

AF:DTC P0172 — SYSTEM TOO RICH (BANK 1) —

1. OUTLINE OF DIAGNOSIS

Detect the fuel system malfunction by the amount of main feedback control.

• Fuel System Diagnosis



(1) Purge control solenoid valve
(2) Purge valve
(3) Pressure regulator
(4) Throttle body
(5) Fuel filter
(6) Intake manifold
(7) Engine control module (ECM)
(8) Canister
(9) Pressure control solenoid valve
(10) Drain valve
(11) Drain filter
(12) Shut-off valve
(13) Vent valve
(14) Fuel temperature sensor
(15) Fuel level sensor
(16) Fuel pump
(17) Jet pump
(18) Fuel cut valve
(19) Fuel sub level sensor
(20) Fuel tank
(21) Fuel tank pressure sensor
(22) Fuel meter
(23) Combination meter
(24) Fuel injector
(25) Tank pressure switching solenoid valve

• Diagnostic Method

Fuel system is diagnosed by comparing the target air fuel ratio calculated by ECM with the actual air fuel ratio measured by sensor.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	≥70°C (158°F)
Engine load	≥ Map 5
Intake air change during 0.5 engine rev.	≤ 0.02 g (0.001 oz)/rev
Learning value of EVAP conc. during purge	≤ 0.1
Cumulative time of canister purge after engine start	20 seconds or more
Continuous period after canister purge starting	30 seconds or more

Map 5

Engine speed (rpm)	idle	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g (oz)/ rev)	NA	0.236 (0.008)	0.232 (0.008)	0.226 (0.008)	0.231 (0.008)	0.252 (0.009)	0.262 (0.009)	0.243 (0.009)	0.243 (0.009)	0.267 (0.009)	0.270 (0.010)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or a constant speed after warming up the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge that the fuel system malfunction occurs when the time during completing the malfunction criteria below continues 30 seconds or more by comparing the diagnosed value (fsobd) with threshold value.

• Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf	≤ fsobdR1
where,	See Map 4
sglmd = measured lambda	fsobdR1 = rich side threshold value of fsobd
tglmda = target lambda	
faf = main feedback compensation coefficient every 64 milliseconds	
flaf = main feedback learning compensation coefficient	

Map 4 Threshold value for fuel system malfunction criteria

Amount of air (g/s)	0 (0)	2.4 (0.085)	4.7 (0.166)	7 (0.247)	9.4 (0.332)	11.7 (0.413)
fsobdR1 (%)	–40	–40	–36.9	–32.0	–27.0	–27.0

Time Needed for Diagnosis: 10 seconds × 5 times
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the malfunction criteria below are continued for 10 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf	≥ –20%

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 OK with similar drive in 3 drive cycles.
- When “Clear Memory” was performed

7. FAIL SAFE

Rich side malfunction
- Purge control solenoid valve control: Not allowed to purge.
- Heavy fuel judgment control: Not allowed to carry out the heavy judgment.

8. ECM OPERATING AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

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

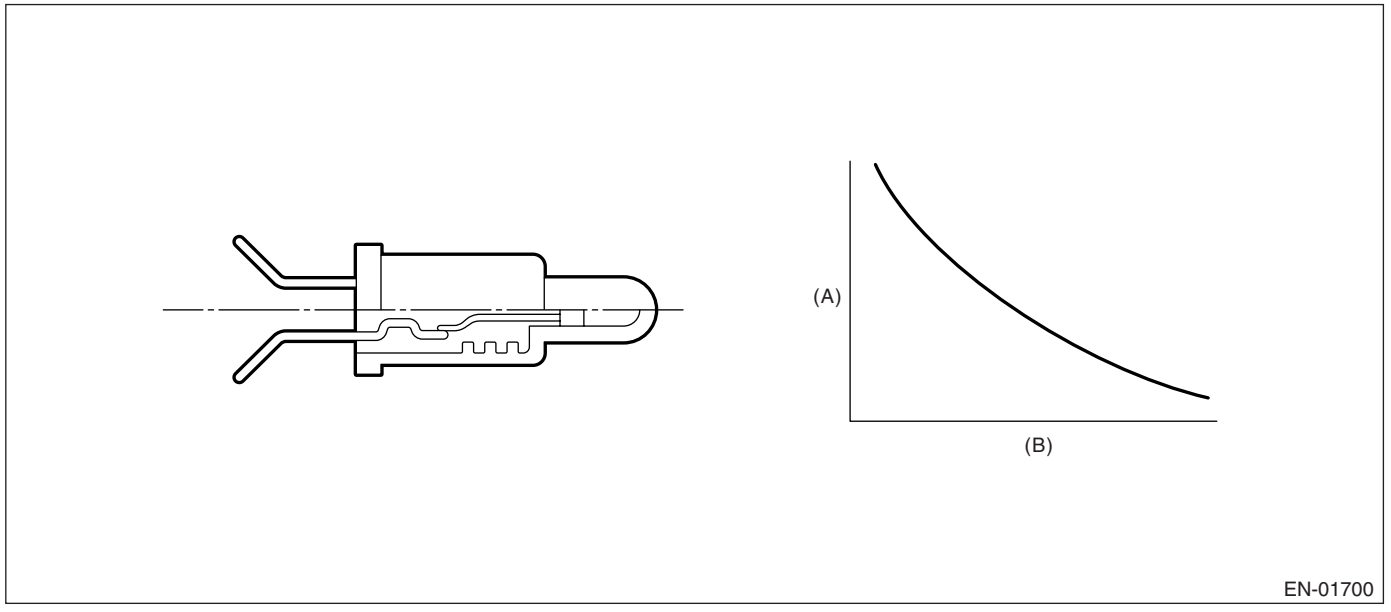
1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel temperature sensor output property. Perform the diagnosis in two methods; namely, drift diagnosis and stuck diagnosis. Judge NG when either of them results in NG, and judge OK when both of them result in OK.

• 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 make an NG judgment.

2. COMPONENT DESCRIPTION



(A) Resistance (Ω)
(B) Fuel temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 120 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 10 ℓ (2.64 US gal, 2.20 Imp gal)
After starting engine	20 seconds or more
Engine coolant temperature – engine coolant temperature at engine starting	> 10°C (50°F)
Fuel temperature – engine coolant temperature	≥ 10°C (50°F)
Battery voltage	> 10.9 V

Time Needed for Diagnosis: 120 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 10 ℓ (2.64 US gal, 2.20 Imp gal)
After starting engine	20 seconds or more
Engine coolant temperature – engine coolant temperature at engine starting	> 10°C (50°F)
Fuel temperature – engine coolant temperature	< 10°C (50°F)
Engine coolant temperature	< 70°C (158°F)
Battery voltage	> 10.9 V

• Stuck Diagnosis

If the fuel temperature which might rise along with the engine idling (the cumulative amount of intake air after engine starting is large) does not increase, the engine is considered to be stuck and make an NG judgment.

6. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After starting engine	20 seconds or more
Battery voltage	> 10.9 V

7. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 20 seconds or more after starting the engine.

8. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 550 kg (1212.5 lb)
Fuel temperature difference between Max. and Min.	< 3°C (37.4°F)

Time Needed for Diagnosis: To be determined.

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 550 kg (1212.5 lb)
Fuel temperature difference between Max. and Min.	≥ 3°C (37.4°F)

9. DTC CLEAR CONDITION

- When the OK idling cycle 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

None

12.ECM OPERATING AT DTC SETTING

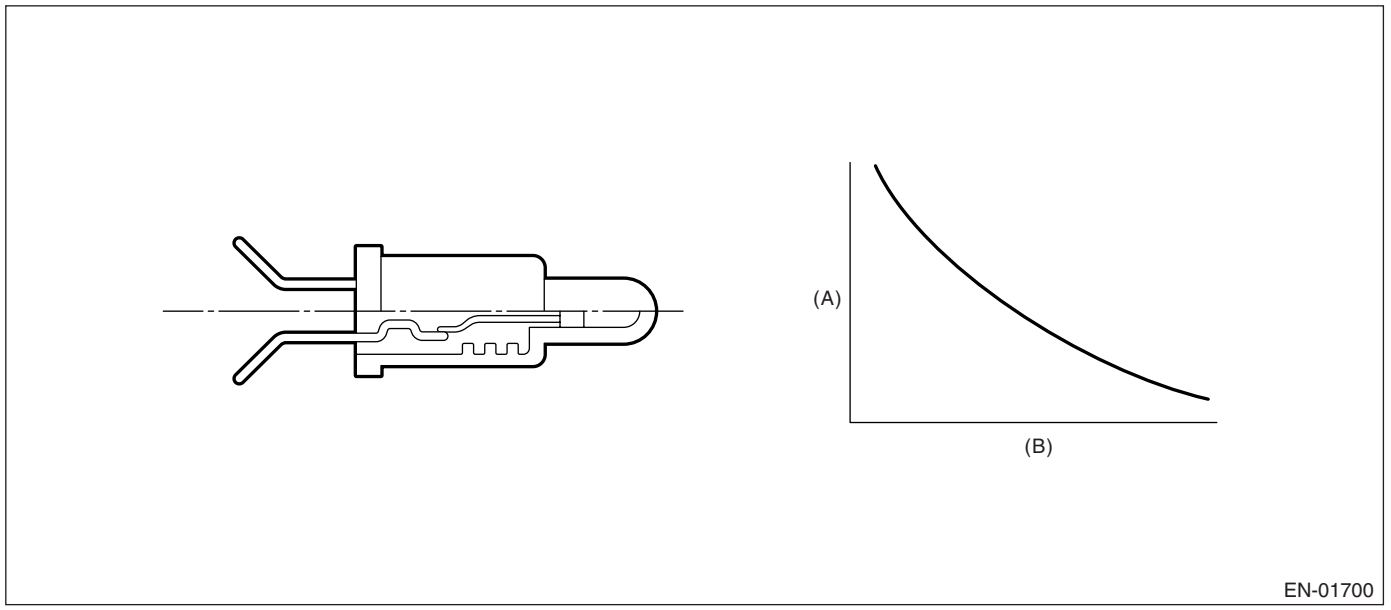
Memorize the freeze frame data. (For test mode $02)

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 (Ω) (B) Fuel temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.1646 V
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK when the cumulative time until completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.1646 V
Battery voltage	≥ 10.9 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 OPERATING AT DTC SETTING

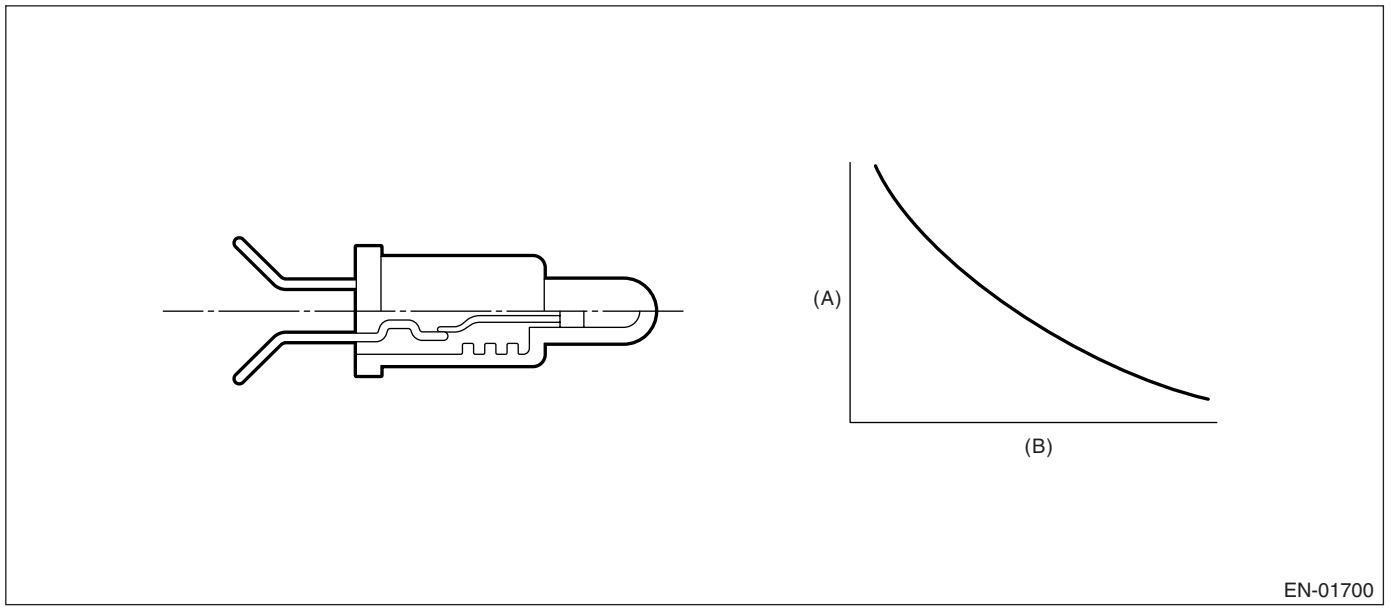
Memorize the freeze frame data. (For test mode $02)

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



(A) Resistance (Ω)
(B) Fuel temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.72 V
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK when the cumulative time until completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.72 V
Battery voltage	≥ 10.9 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 OPERATING AT DTC SETTING

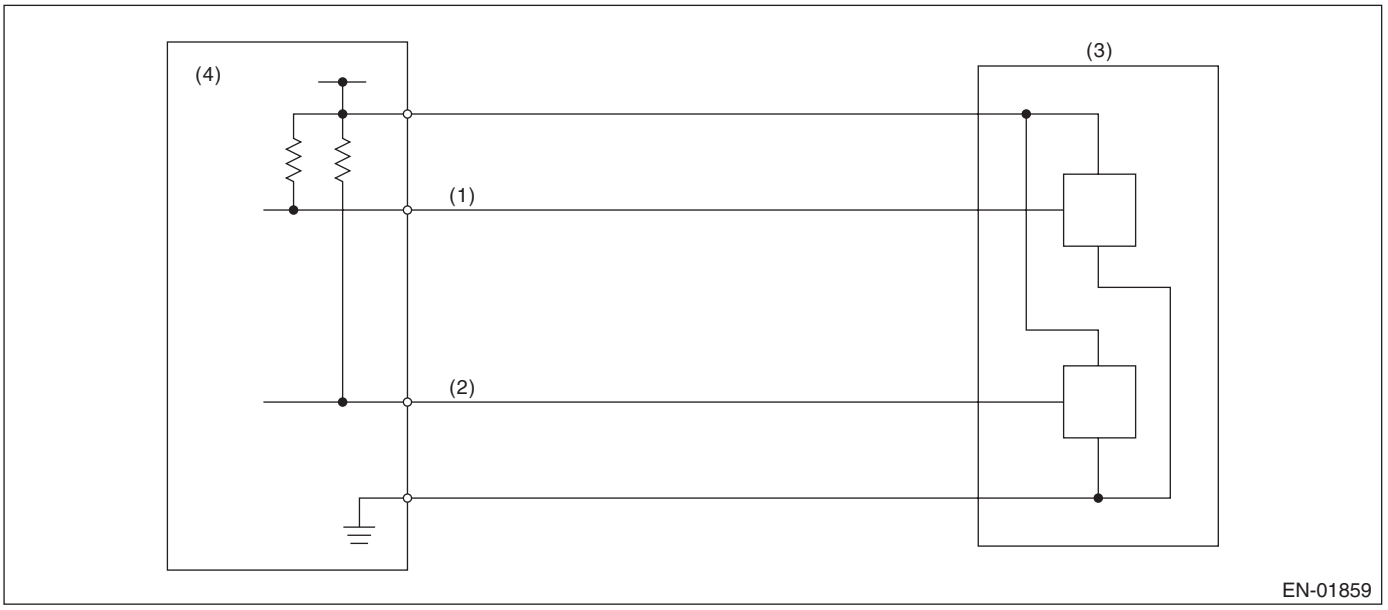
Memorize the freeze frame data. (For test mode $02)

AJ:DTC P0222 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always 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
Sensor 1 input voltage	> 0.749 V

Time Needed for Diagnosis: 24 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed (Only engine stop)

8. FAIL SAFE

Stop power distribution to electric control throttle motor. (Throttle opening is fixed to 6°.)

9. ECM OPERATION AT DTC SETTING

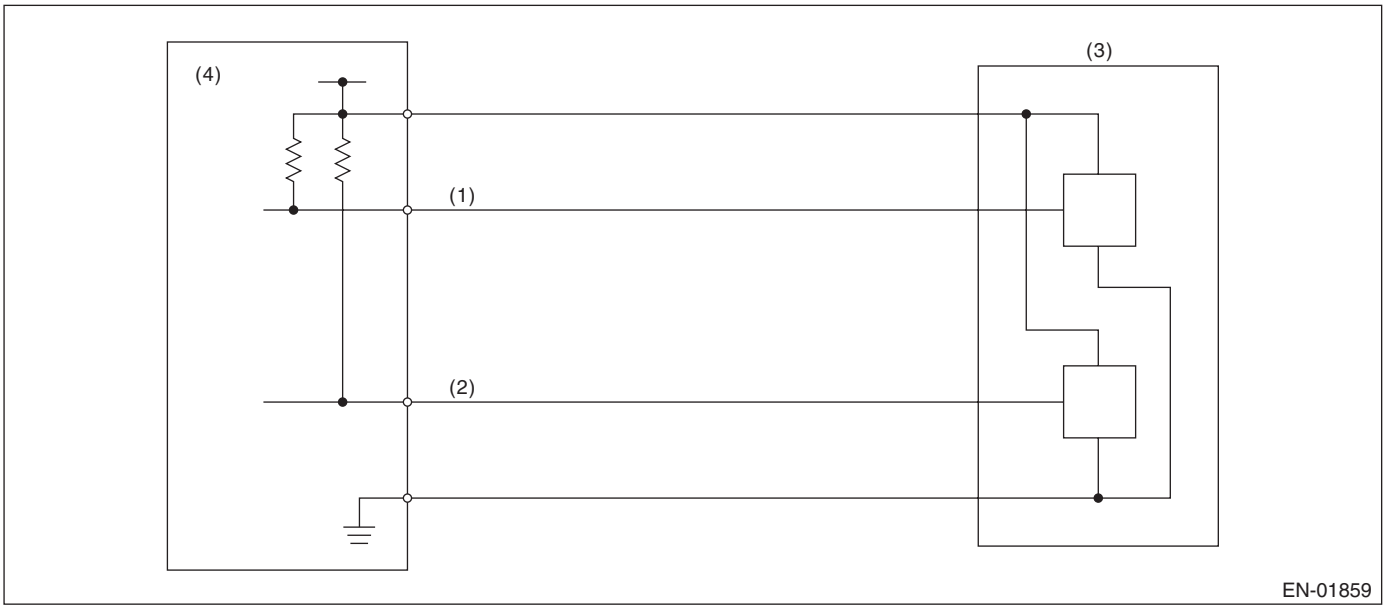
Memorize the freeze frame data. (For test mode $02)

AK:DTC P0223 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal
(2) Throttle position sensor 2 signal
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always 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
Sensor 1 input voltage	< 4.747 V

Time Needed for Diagnosis: 24 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed (Only engine stop)

8. FAIL SAFE

Stop power distribution to electric control throttle motor. (Throttle opening is fixed to 6°.)

9. ECM OPERATION AT DTC SETTING

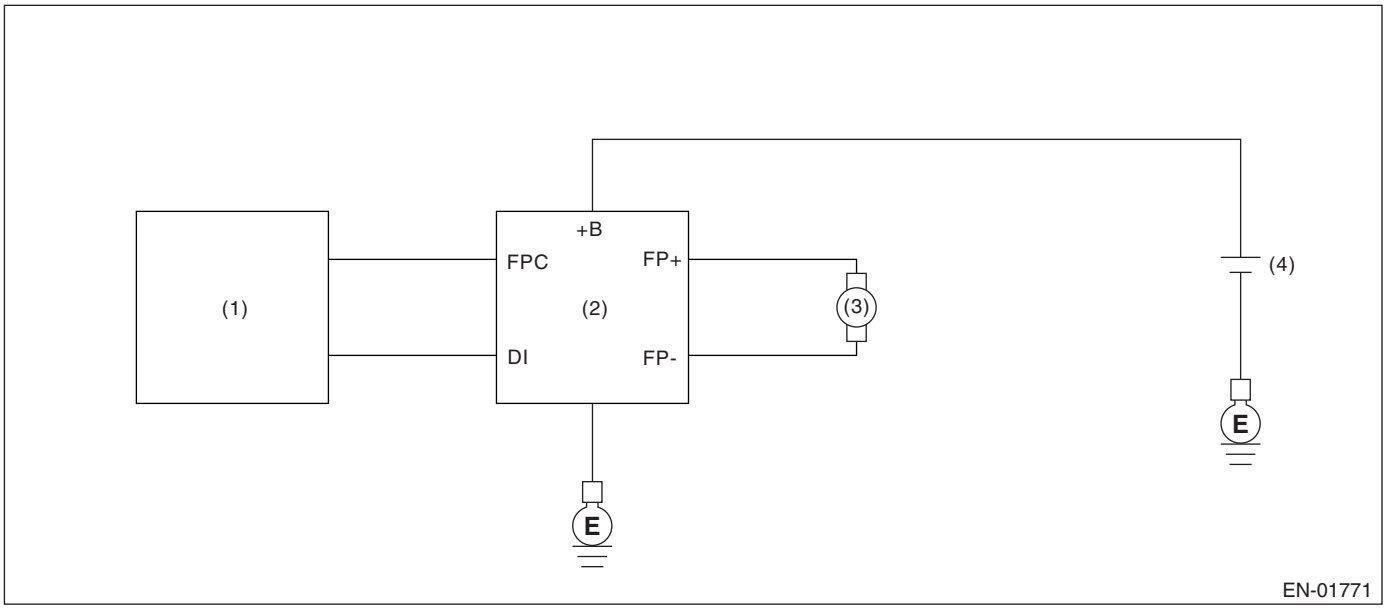
Memorize the freeze frame data. (For test mode $02)

AL:DTC P0230 — FUEL PUMP PRIMARY CIRCUIT —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel pump control unit. Judge NG when the NG signal is sent through a diagnostic line coming from the fuel pump control unit. Fuel pump control unit detects the open or short circuit malfunction for each line, and then sends NG signals if one of them is found NG.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Fuel pump control unit
(3) Fuel pump
(4) Battery

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 8 V
After starting engine	≥ 180 seconds
Fuel pump control	ON
Fuel pump control unit output diagnosis signal	Low
Fuel level	≥ 10 ℓ

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
Battery voltage	≥ 8 V
After starting engine	≥ 180 seconds
Fuel pump control	ON
Fuel pump control unit output diagnosis 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

OFF setting may be needed depending on the NG portion.

9. ECM OPERATING AT DTC SETTING

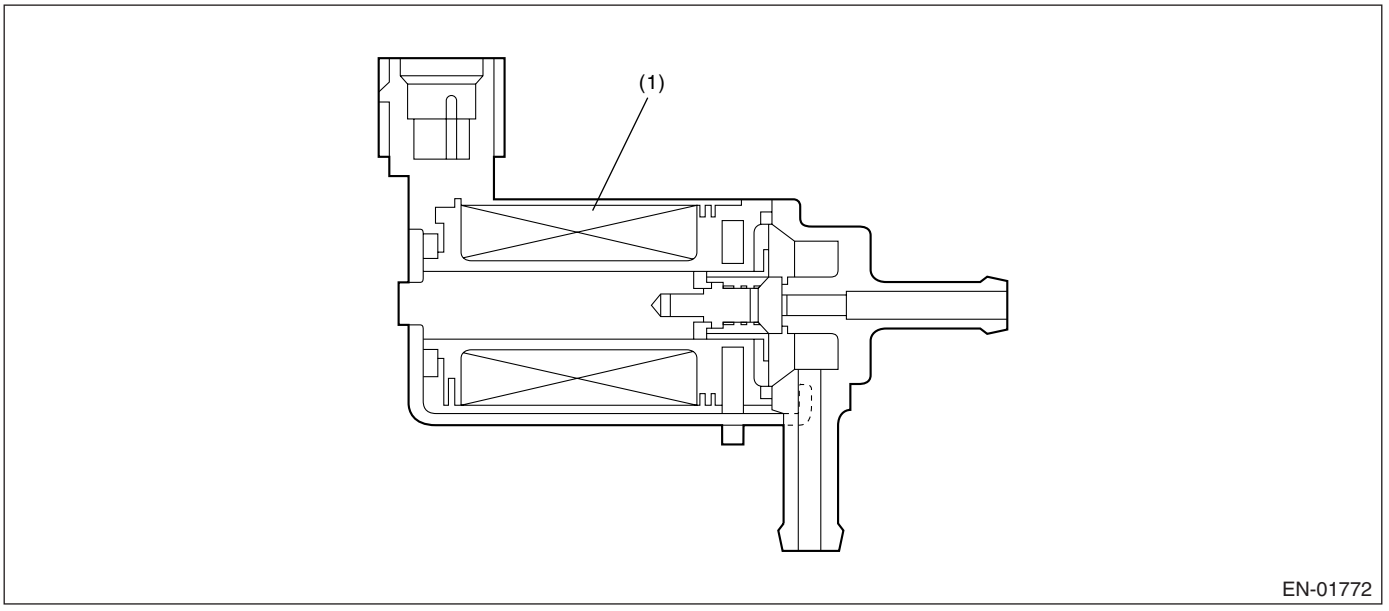
Memorize the freeze frame data. (For test mode $02)

AM:DTC P0244 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of wastegate control solenoid valve function. Judge NG when becoming high wastegate pressure.

2. COMPONENT DESCRIPTION



(1) Coil

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 1 second.

• Judgment Value

Malfunction Criteria	Threshold Value
Intake manifold pressure	≥ Map 10

• Map 10

Pa (kPa (mmHg, inHg))	56.7 (440,17.3)	67.2 (504, 19.8)	75.7 (568, 22.4)	84.3 (632, 24.9)	92.8 (696, 27.4)	101.3 (760, 29.9)
Abnormal threshold (kPa (mmHg, inHg))	152.6 (1145, 45.08)	165.4 (1241, 48.8)	177.2 (1329, 52.3)	189.0 (1418, 55.8)	200.7 (1506, 59.3)	212.5 (1594, 62.8)
Normal threshold (kPa (mmHg, inHg))	130.2 (977, 38.5)	143.0 (1073, 42.2)	154.8 (1161, 45.7)	166.6 (1250, 49.2)	178.4 (1338, 52.7)	190.1 (1426, 56.1)

Time Needed for Diagnosis: 1 second
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
Intake manifold pressure	< Map 10

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 OPERATING AT DTC SETTING

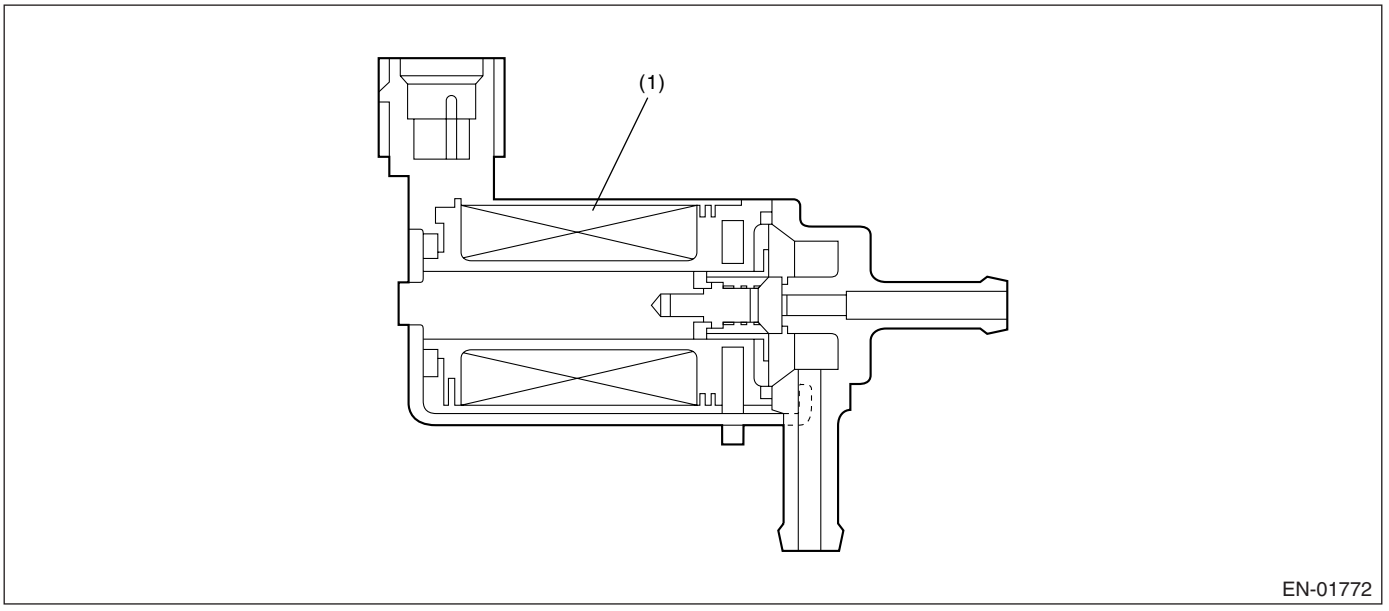
Memorize the freeze frame data. (For test mode $02)

AN:DTC P0245 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” LOW —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of wastegate control solenoid valve. Judge NG when the terminal output voltage remains Low during outputting the duty signal.

2. COMPONENT DESCRIPTION



(1) Coil

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
After starting 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 becomes more than 655 milliseconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage Duty ratio for turbocharged pressure control	Low < 75%

Time Needed for Diagnosis: 655 milliseconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	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

None

9. ECM OPERATING AT DTC SETTING

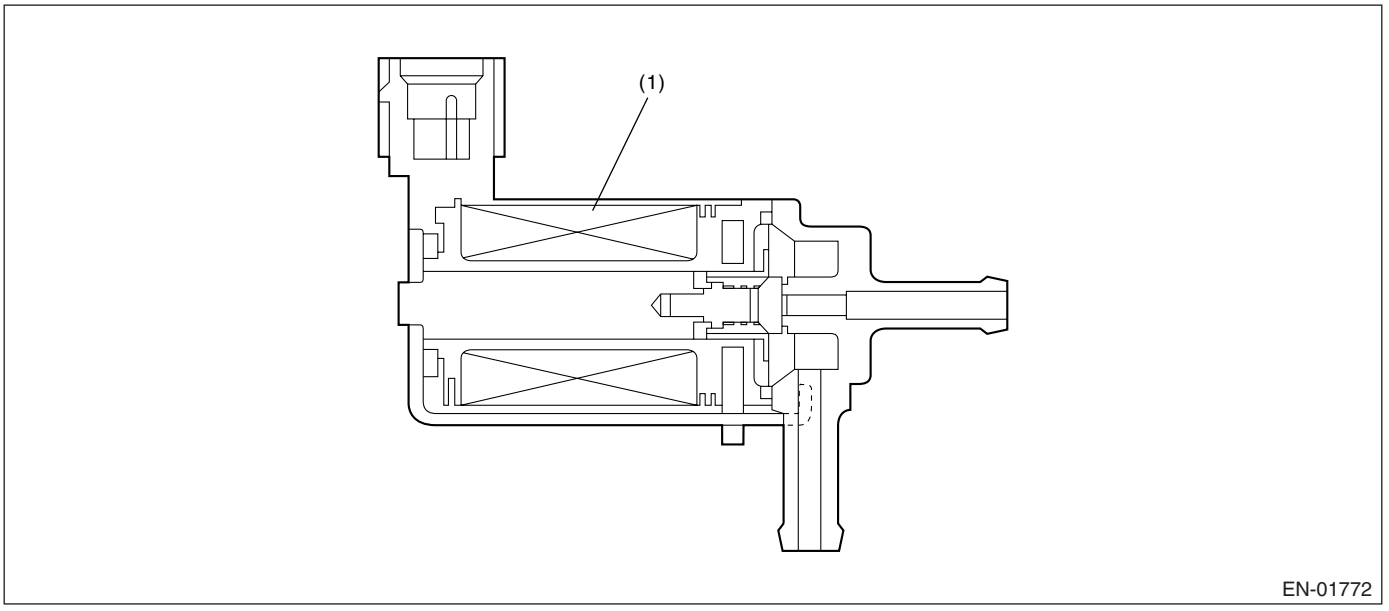
Memorize the freeze frame data. (For test mode $02)

AO:DTC P0246 — TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” HIGH —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of wastegate control solenoid valve. Judge NG when the terminal output voltage remains Low or High during outputting the duty signal.

2. COMPONENT DESCRIPTION



(1) Coil

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
After starting 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 becomes more than 655 milliseconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage Duty ratio for turbocharged pressure control	High > 25%

Time Needed for Diagnosis: 655 milliseconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	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

None

9. ECM OPERATING AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

AP:DTC P0301 — CYLINDER 1 MISFIRE DETECTED —

1. OUTLINE OF DIAGNOSIS

Detect whether the misfire occurred or not. (Revolution fluctuation method) Monitoring the 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 (The same cylinder misfires in random, or different cylinders misfire in random.): FTP 1.5 times misfire
- Every time misfire (The same cylinder misfires every time.): FTP 1.5 times misfire, Catalyst damage misfire

The following detecting methods are adopted for these detection.

1) Intermittent misfire: FTP 1.5 times misfire
- 180° Interval Difference Method (MT: 1,800 rpm or less; AT: None)
- 360° Interval Difference Method (whole range)
- 720° Interval Difference Method (3,000 rpm or less)

2) Every time misfire: FTP 1.5 times misfire, Catalyst damage misfire
- 360° Interval Difference Method

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters approval continuation time	1 second or more
Intake manifold pressure change during 0.5 engine rev.	< 16.0 kPa (120 mmHg, 4.72 inHg) (MT) < 14.7 kPa (110 mmHg, 4.33 inHg) (AT)
Engine speed change	< 1000 rpm/32 milliseconds
Throttle position change during 16 milliseconds	< 14°
Fuel shut-off function	Not in operation
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Evaporative system leak check	Not in operation
Engine speed	550 — 6700 rpm
Intake manifold pressure	> Map 3 or more
Battery voltage	≥ 8 V

Map3

- MT

Vehicle Speed < 64.4 km/h (40 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa (mmHg, inHg)	25.1 (188, 7.40)	24.8 (186, 7.32)	25.6 (192, 7.56)	23.3 (175, 6.89)	26.3 (197, 7.76)	25.9 (194, 7.64)	28.9 (216.5, 8.52)	30.0 (225, 8.86)	31.7 (237.5, 9.35)	33.0 (248, 9.76)	37.1 (278.5, 11.0)	41.9 (314, 12.4)	47.0 (352.5, 13.9)	51.1 (383, 15.1)

Vehicle Speed ≥ 64.4 km/h (40 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa (mmHg, inHg)	25.5 (191, 7.52)	25.1 (188, 7.40)	30.4 (227.7, 8.96)	35.6 (267.4, 10.5)	38.5 (288.9, 11.4)	40.4 (302.9, 11.9)	41.1 (308.6, 12.1)	40.8 (306, 12.0)	44.8 (335.8, 13.2)	47.3 (354.5, 14.0)	49.1 (368.2, 14.5)	50.9 (381.9, 15.0)	52.8 (396, 15.6)	52.8 (396, 15.6)

- AT

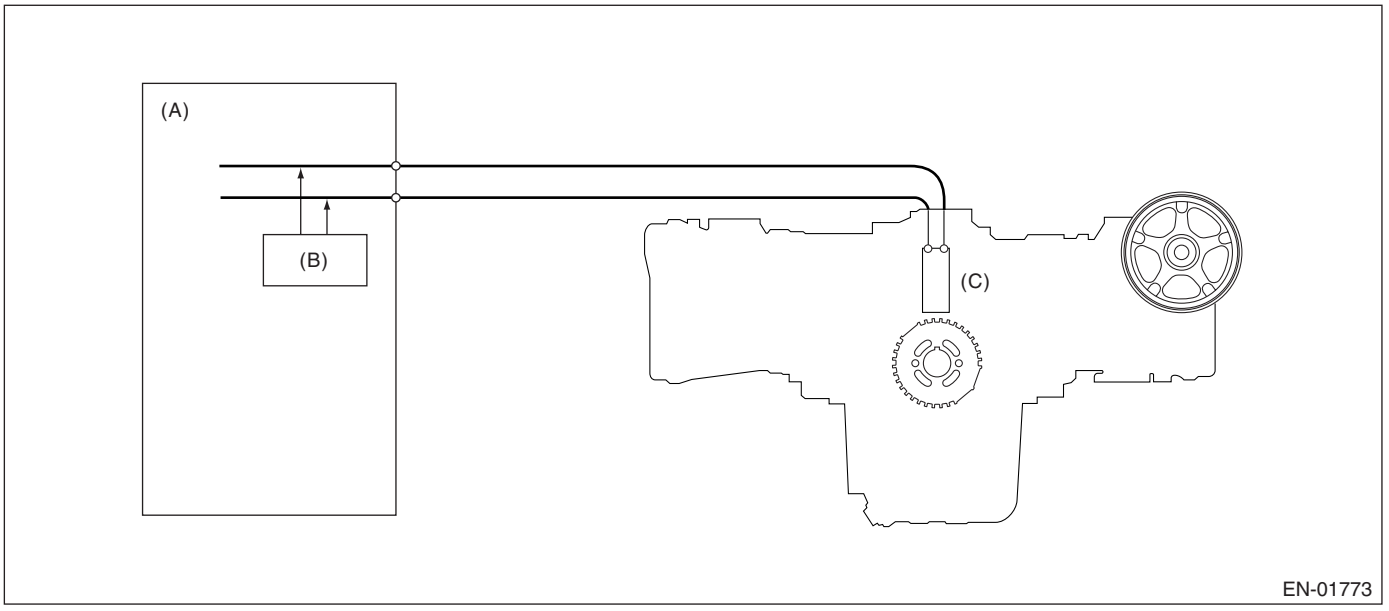
Vehicle Speed ≥ 64.4 km/h (40 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa (mmHg, inHg)	26.3 (197, 7.76)	24.7 (185, 7.28)	23.6 (177, 6.97)	25.5 (191, 7.52)	27.3 (205, 8.07)	26.1 (196, 7.72)	29.5 (221.5, 8.72)	31.3 (235, 9.25)	32.7 (245.5, 9.67)	34.1 (256, 10.08)	38.2 (286.5, 11.3)	33.6 (252.3, 9.93)	49.5 (371.5, 14.62)	51.5 (386, 15.20)

3. GENERAL DRIVING CYCLE

- Detecting misfire is able to be carried out in the condition between idling and high revolution.
- Perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

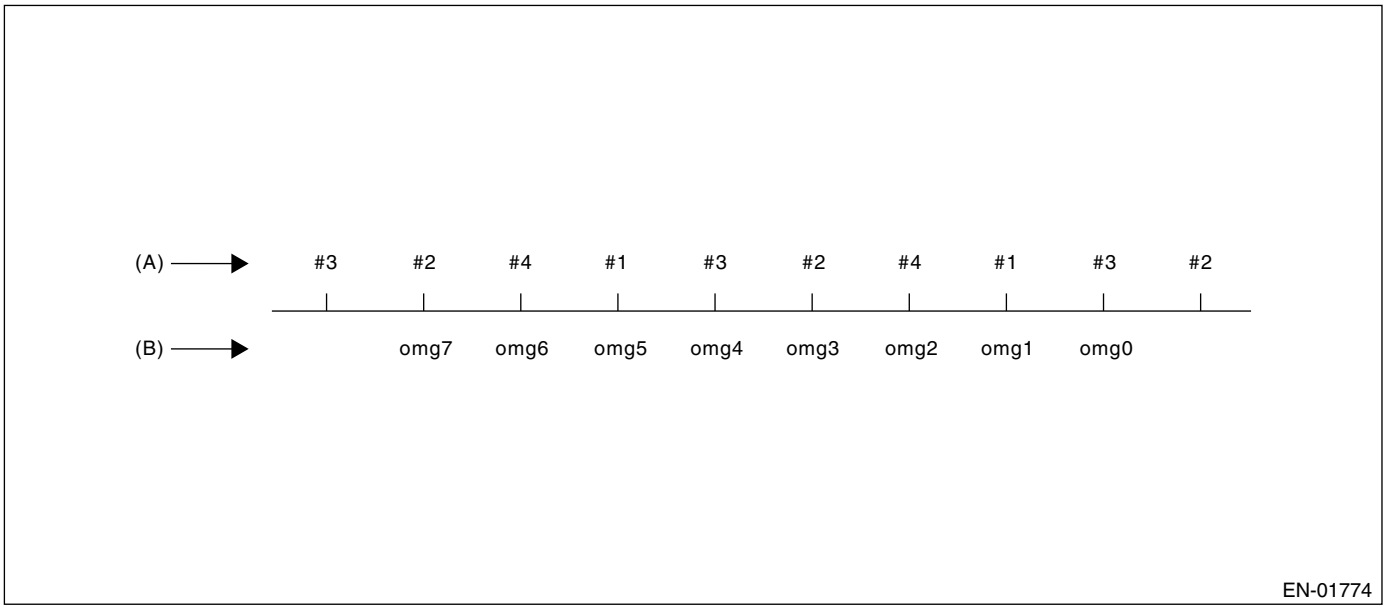


(A) Engine control module (ECM) (B) Diagnosis circuit (C) Crankshaft position sensor

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 by the following formula, and judge whether the misfire occurs or not comparing the calculated result with judgment value. Counting the number of misfire up, and if the misfire ratio is higher during 1000 rev. or 200 rev., judge NG for the corresponding cylinder.

Calculate the diagnostic value (from crankshaft position speed)	→	Misfire detection every single ignition (Compare diagnostic value with judgment value) • 180° Interval Difference Method • 360° Interval Difference Method • 720° Interval Difference 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

As the following figure, pick out a random cylinder as the standard and name it omg 0. And the former crankshaft position speed is named omg 1, the second former crankshaft position speed is named omg 2, the third is named omg 3, and the following is the same.



(A) Ignition order

(B) Crankshaft position speed

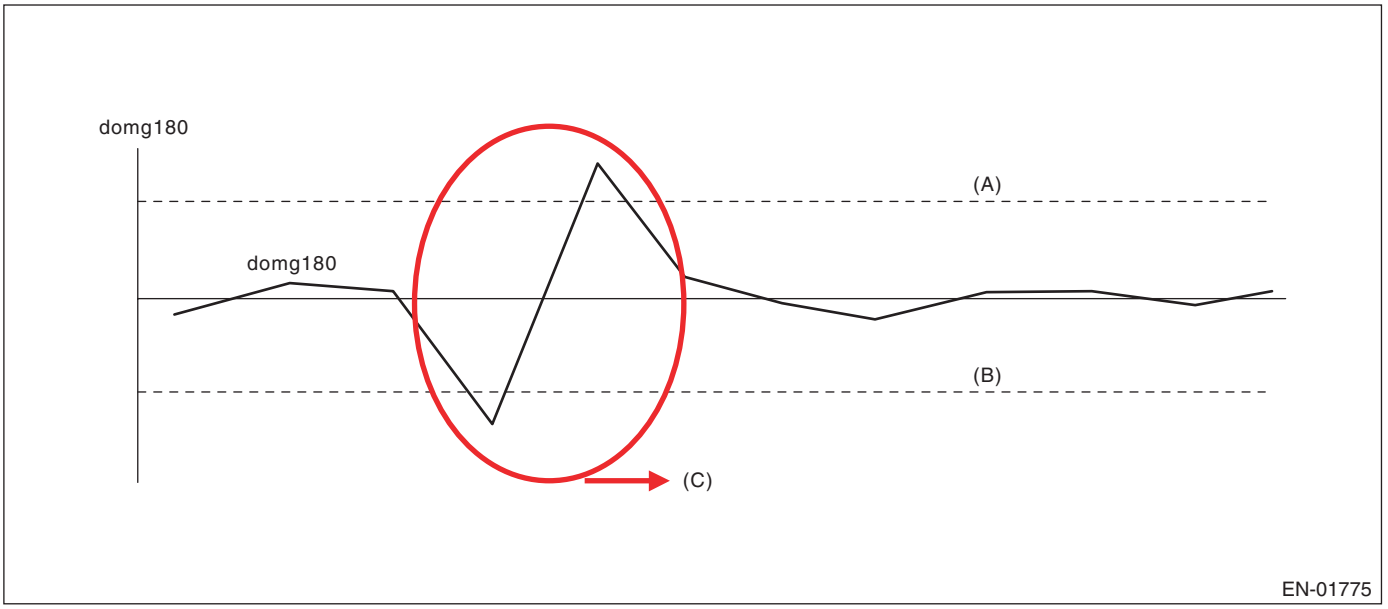
• 180° Interval Difference Method

Diagnosis value domg 180 = (omg –1 omg 0) – (omg 7 – omg 1)/6

Judge misfire occurs in the following cases.

- domg 180 > judgment value of positive side
- domg 180 ≤ judgment value of negative side

(judgment value before 180°CA)



(A) Threshold value (positive judged value)

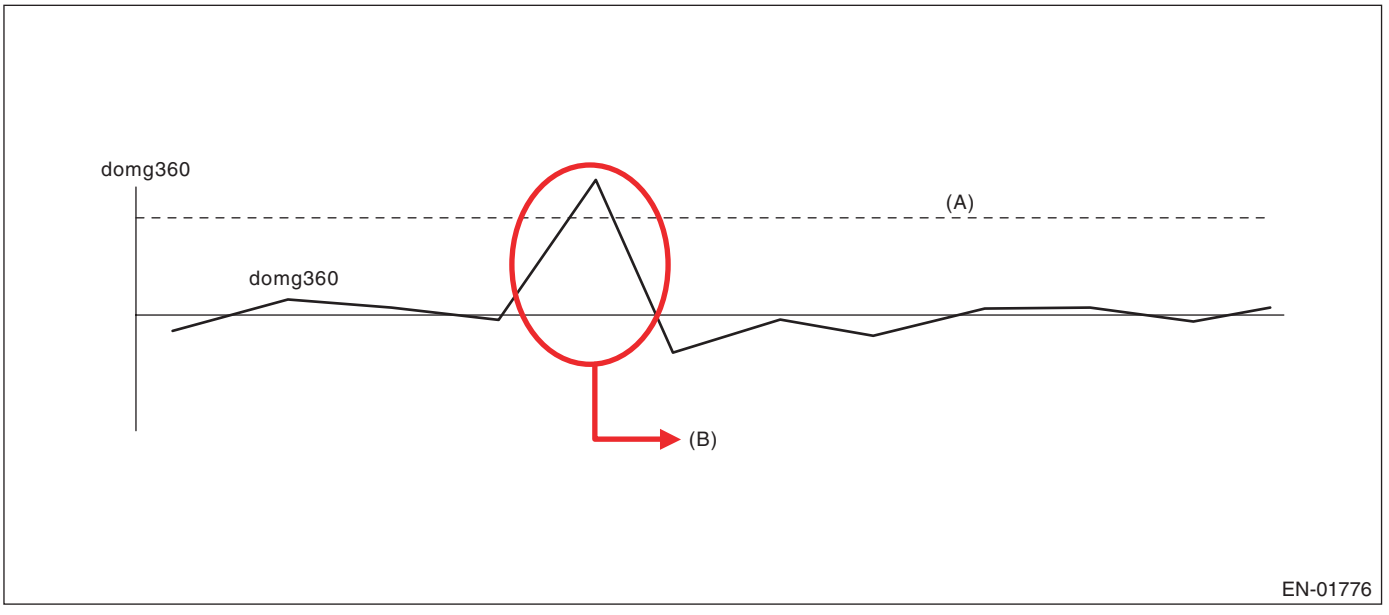
(B) Threshold value (negative judged value)

(C) Judged as misfire

• 360° Interval Difference Method

Diagnosis value domg 360 = (omg 1 – omg 0) – (omg 4 – omg 3)

Misfire judgment domg 360 > judgment value → Misfire occurs

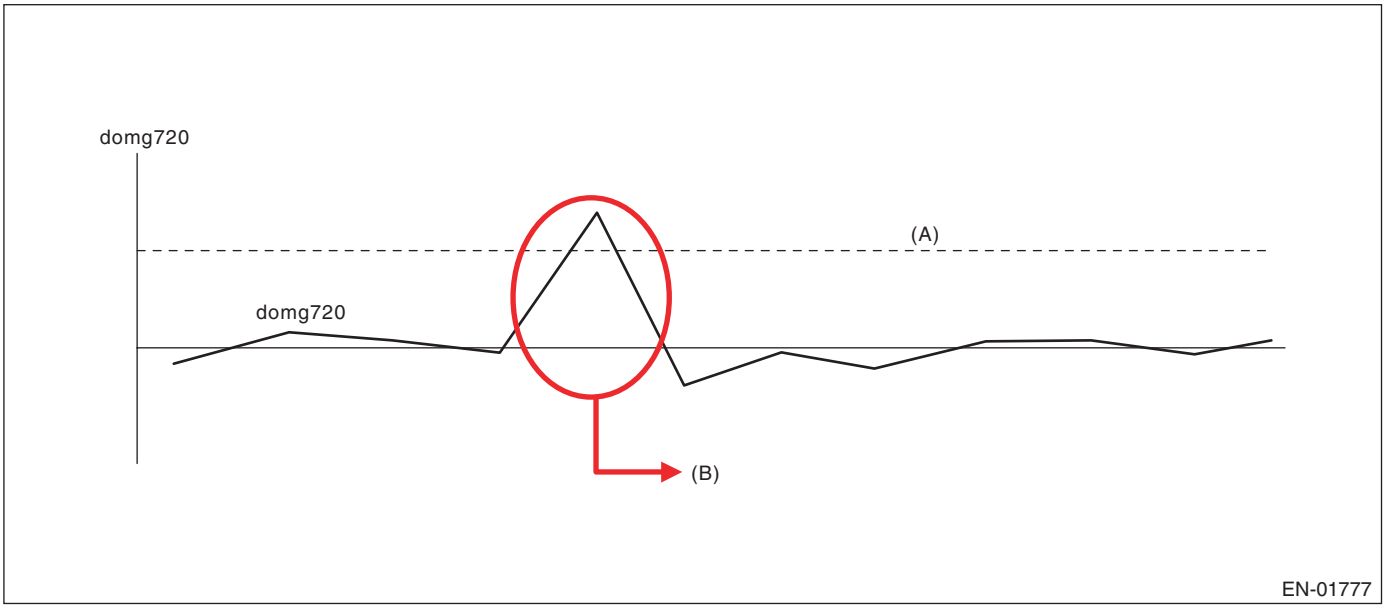


(A) Threshold value

(B) Judged as misfire

• 720° Interval Difference Method

Diagnosis value	domg 720 = (omg 1 – omg 0) – (omg 7 – omg 6)		
Misfire judgment	domg 720 > judgment value	→	Misfire occurs



(A) Threshold value (B) Judged as misfire

• FTP 1.5 times misfire (Misfire occurrence level affecting exhaust gas)

• Judgment Value (Judge that malfunction occurs when the misfire ratio is high in 1000 engine revs.)

Malfunction Criteria	Threshold Value
FTP emission judgment value	> 1.0% in 1000 revs.

Time Needed for Diagnosis: 1000 engine revs.
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Catalyst damage misfire (Misfire occurrence level damaging catalyst)

• Judgment Value (Judge that malfunction occurs when the misfire ratio is high in 200 engine revs. (400 ignitions))

Malfunction Criteria	Threshold Value
Catalyst damage misfire judgment value	See Map 1

Map 1 Fault criteria threshold for misfire which would result in catalyst damage

percentage		Intake air (g (oz)/gev.)									
		0.2 (0.007)	0.4 (0.014)	0.6 (0.021)	0.8 (0.028)	1.0 (0.035)	1.2 (0.042)	1.4 (0.049)	1.6 (0.056)	1.8 (0.063)	2.0 (0.071)
Engine speed (rpm)	1000	37.0	32.0	28.5	26.0	23.0	21.3	21.3	—	—	—
	1500	35.0	29.5	25.5	22.5	21.3	21.3	21.3	18.0	—	—
	2000	32.0	22.5	22.5	18.3	14.5	10.8	10.0	9.0	8.0	5.0
	2500	29.0	21.8	14.3	11.3	9.8	9.0	8.5	8.0	7.5	5.0
	3000	27.0	21.8	14.5	9.8	9.0	9.0	8.0	7.5	7.0	5.0
	3500	24.5	18.5	10.8	6.8	5.8	5.5	5.0	5.0	5.0	5.0
	4000	—	15.3	10.0	6.8	5.5	5.0	5.0	5.0	5.0	5.0
	4500	—	13.8	8.5	6.3	5.0	5.0	5.0	5.0	5.0	—
	5000	—	13.8	8.5	5.8	5.0	5.0	5.0	5.0	5.0	—
	5500	—	13.5	8.3	5.5	5.0	5.0	5.0	5.0	5.0	—
	6000	—	13.0	8.0	5.3	5.0	5.0	5.0	5.0	5.0	—
	6500	—	12.5	7.5	5.0	5.0	5.0	5.0	5.0	—	—
	6700	—	12.3	7.3	5.0	5.0	5.0	5.0	5.0	—	—

These figures mean the misfire ratio (%) in 400 ignitions; for example, 22.5 (%) means 400 (ignition) × 22.5 (%) = 90 (ignition) or more, so this case is judged misfire.
Time Needed for Diagnosis: 200 engine revs.
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

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 consecutive times.
- When “Clear Memory” was performed

7. FAIL SAFE

None

8. ECM OPERATING AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

AQ:DTC P0302 — CYLINDER 2 MISFIRE DETECTED —

NOTE:
For the diagnostic procedure, refer to DTC P0301. <Ref. to GD(H4DOTC)-100, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —.>

AR:DTC P0303 — CYLINDER 3 MISFIRE DETECTED —

NOTE:
For the diagnostic procedure, refer to DTC P0301. <Ref. to GD(H4DOTC)-100, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —.>

AS:DTC P0304 — CYLINDER 4 MISFIRE DETECTED —

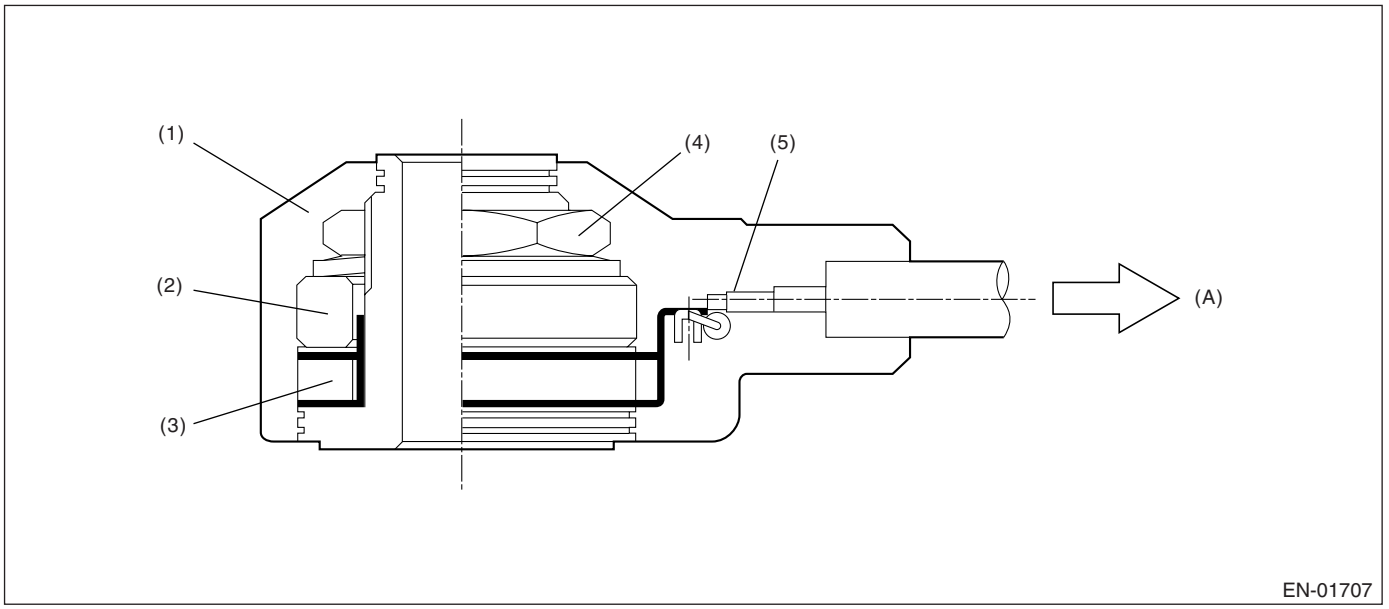
NOTE:
For the diagnostic procedure, refer to DTC P0301. <Ref. to GD(H4DOTC)-100, DTC P0301 — CYLINDER 1 MISFIRE DETECTED —.>

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the 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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 1 second.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.238 V
Ignition switch	ON

Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.238 V
Ignition switch	ON

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

Knock compensation:

- Knock compensation final timing advance and retard value = knock compensation + whole learning compensation value + partial learning compensation value.
- At normal: knock compensation = 0°CA is fixed.
- At trouble: knock compensation = –5°CA. (Retard 5°CA.)
- Not allowed to update the whole learning compensation factor.
- Not allowed to calculate the partial learning zone compensation value.

9. ECM OPERATING AT DTC SETTING

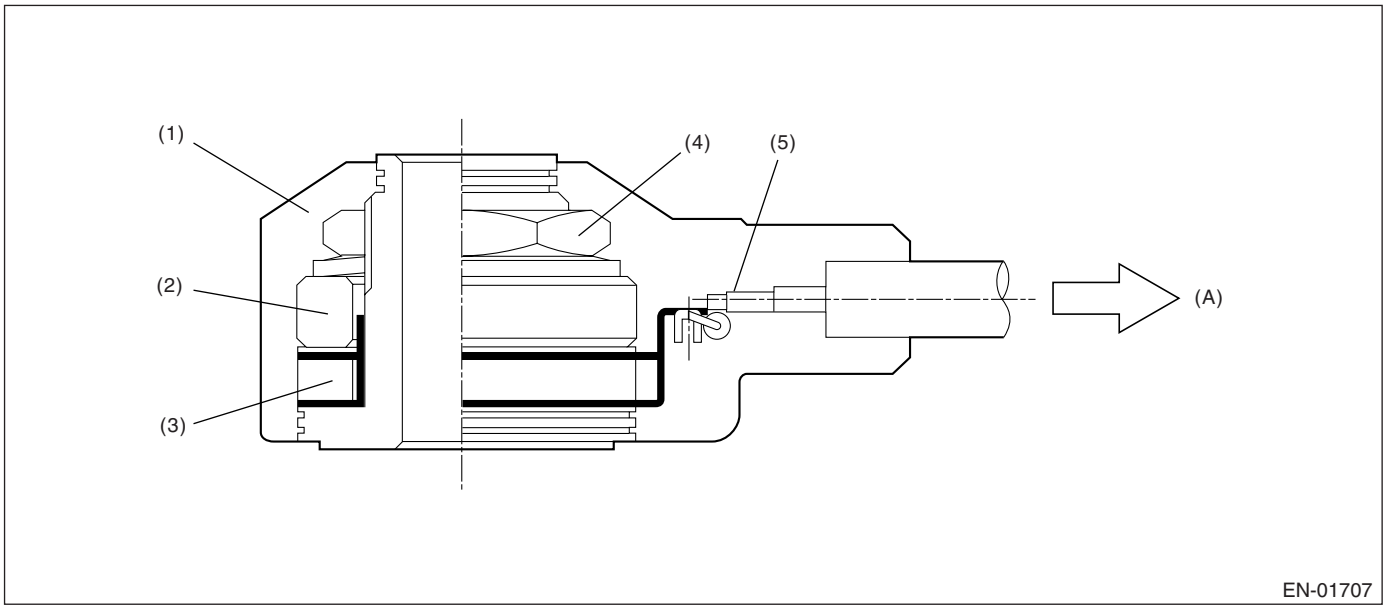
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the 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
None	

4. GENERAL DRIVING CYCLE

Always perform diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 1 second.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.714 V
Ignition switch	ON

Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.714 V
Ignition switch	ON

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

Knock compensation:

- Knock compensation final timing advance and retard value = knock compensation + whole learning compensation value + partial learning compensation value.
- At normal: knock compensation = 0°CA is fixed.
- At trouble: knock compensation = –5°CA. (Retard 5°CA.)
- Not allowed to update the whole learning compensation factor.
- Not allowed to calculate the partial learning zone compensation value.

9. ECM OPERATING AT DTC SETTING

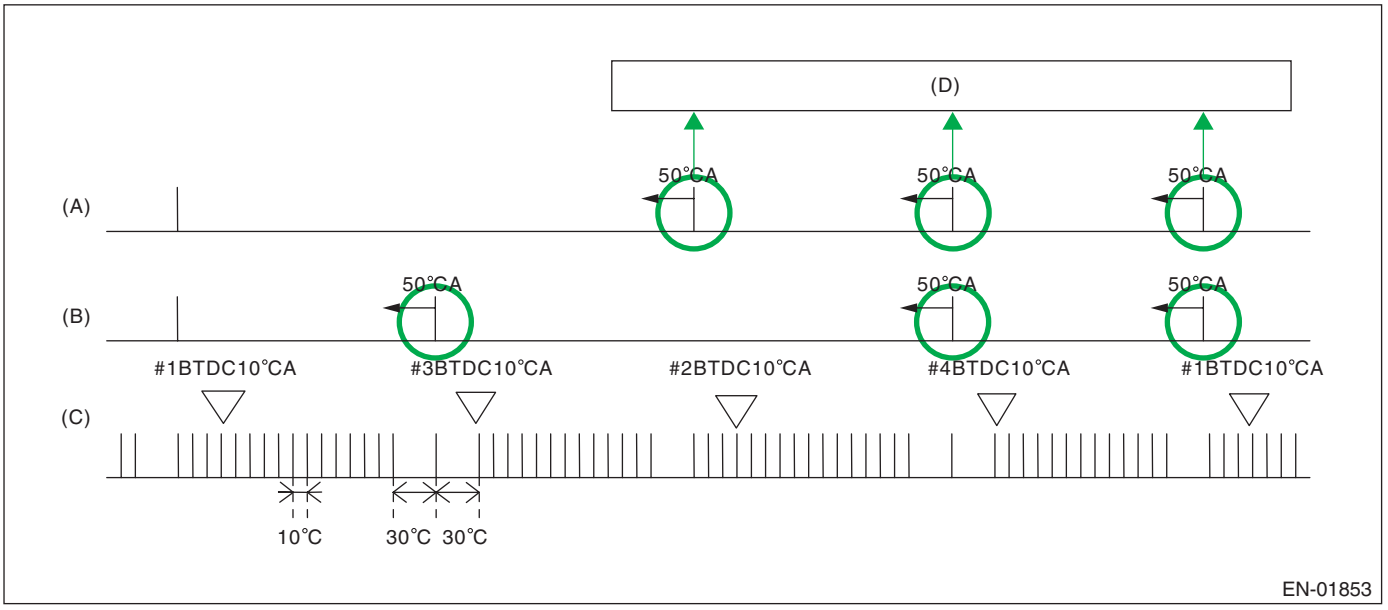
Memorize the freeze frame data. (For test mode $02)

AV:DTC P0335 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT —

1. OUTLINE OF DIAGNOSIS

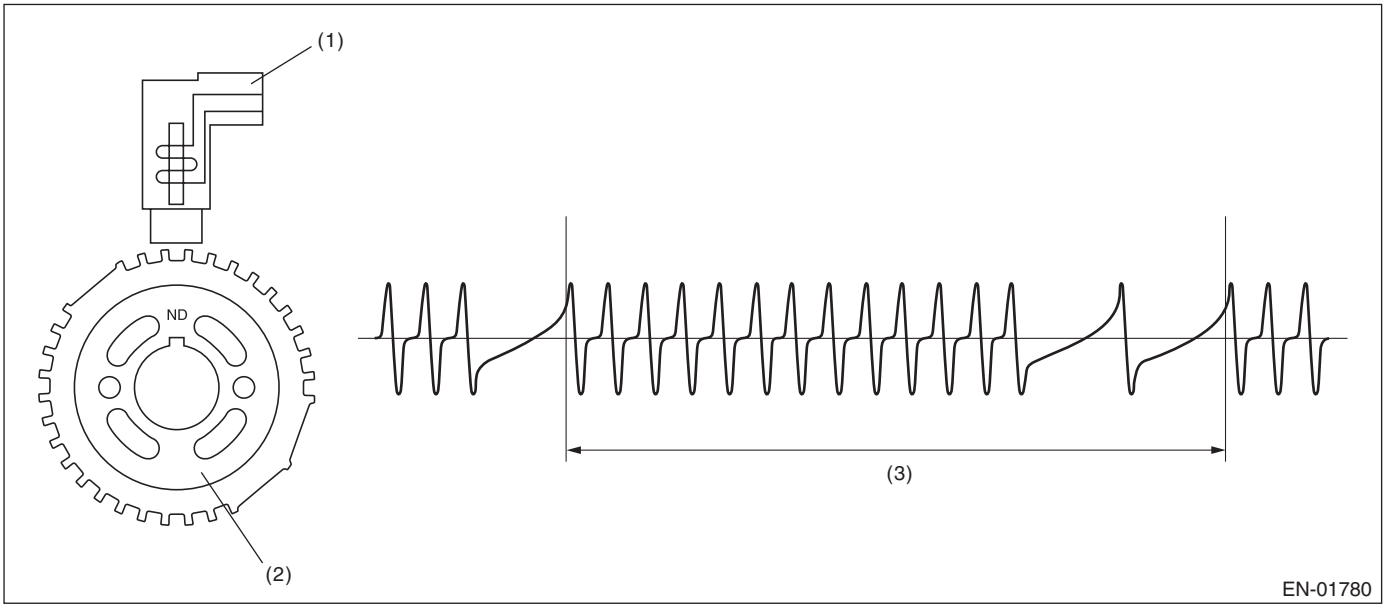
Detect the open or short circuit of crankshaft position sensor. Judge NG when the crankshaft signal does not input regardless of turning the starter.

2. COMPONENT DESCRIPTION



(A) Camshaft signal

(B) Crankshaft signal



(1) Crankshaft position sensor

(2) Crankshaft sprocket

(3) Crankshaft half-turn

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 3 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Starter switch	ON
Crankshaft position sensor signal	Not detected
Battery voltage	≥ 8 V

Time Needed for Diagnosis: 3 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK when the continuous time of completing the malfunction criteria below becomes more than 3 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	Input exists
Battery voltage	≥ 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

None

9. ECM OPERATING AT DTC SETTING

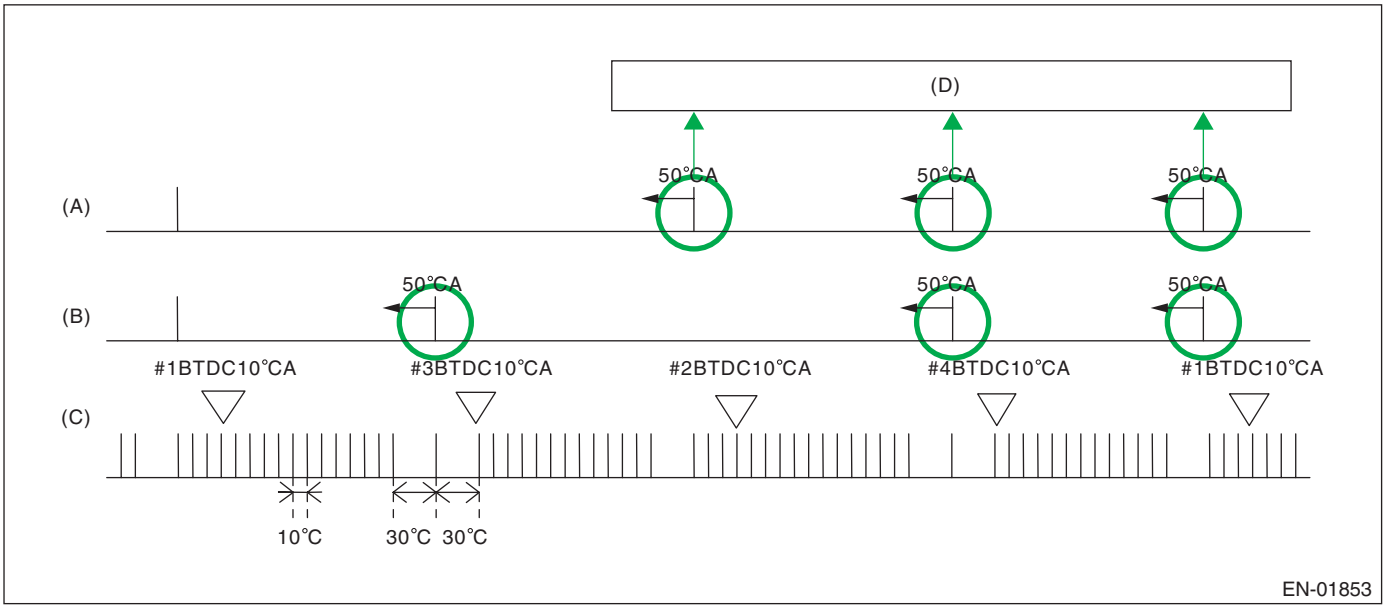
Memorize the freeze frame data. (For test mode $02)

AW:DTC P0336 — CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/ PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of crankshaft position sensor output property. Judge NG when the number of crankshaft signal every 1 revolution becomes abnormal.

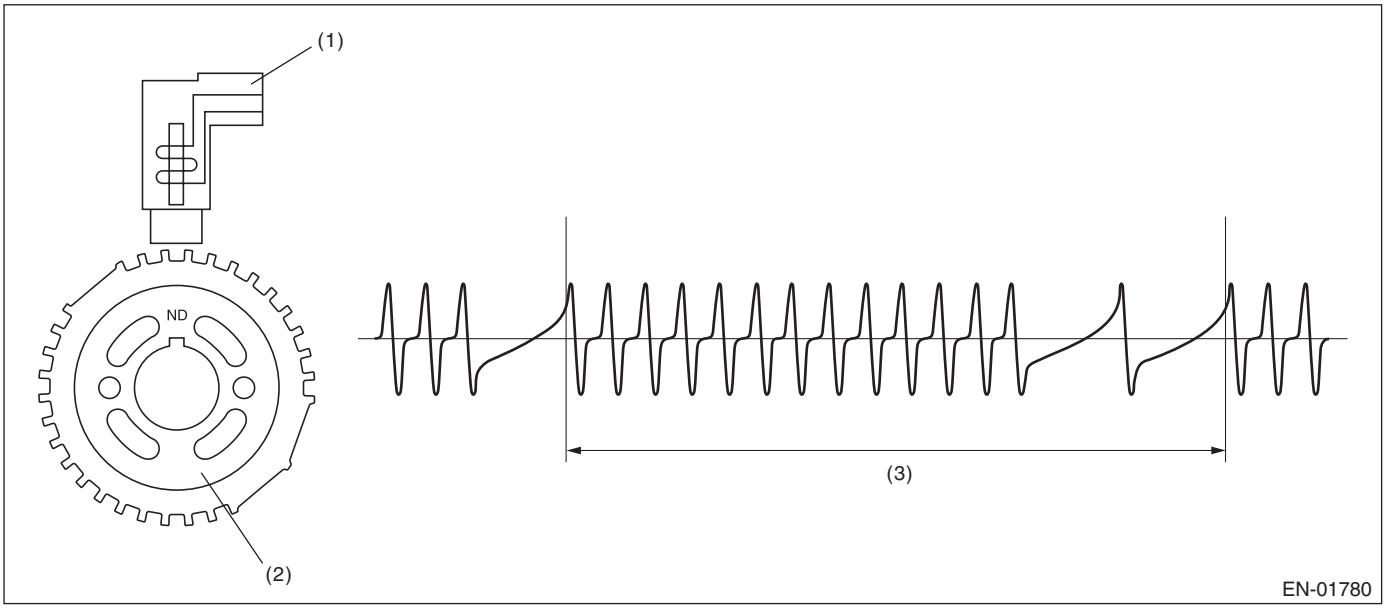
2. COMPONENT DESCRIPTION



(A) Camshaft signal

(B) Crankshaft signal

(C) Number of crankshaft signal = 30 is normal.



(1) Crankshaft position sensor

(2) Crankshaft sprocket

(3) Crankshaft half-turn

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed	< 3000 rpm

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine speed.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when all the malfunction criteria below are completed more than 10 times in a row.

• Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number distinction	Completed
Amount of crank sensor signal during 1 rev.	Not = 30

Time Needed for Diagnosis: 10 engine revs.

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
Cylinder number distinction	Completed
Amount of crank sensor signal during 1 rev.	= 30

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 OPERATING AT DTC SETTING

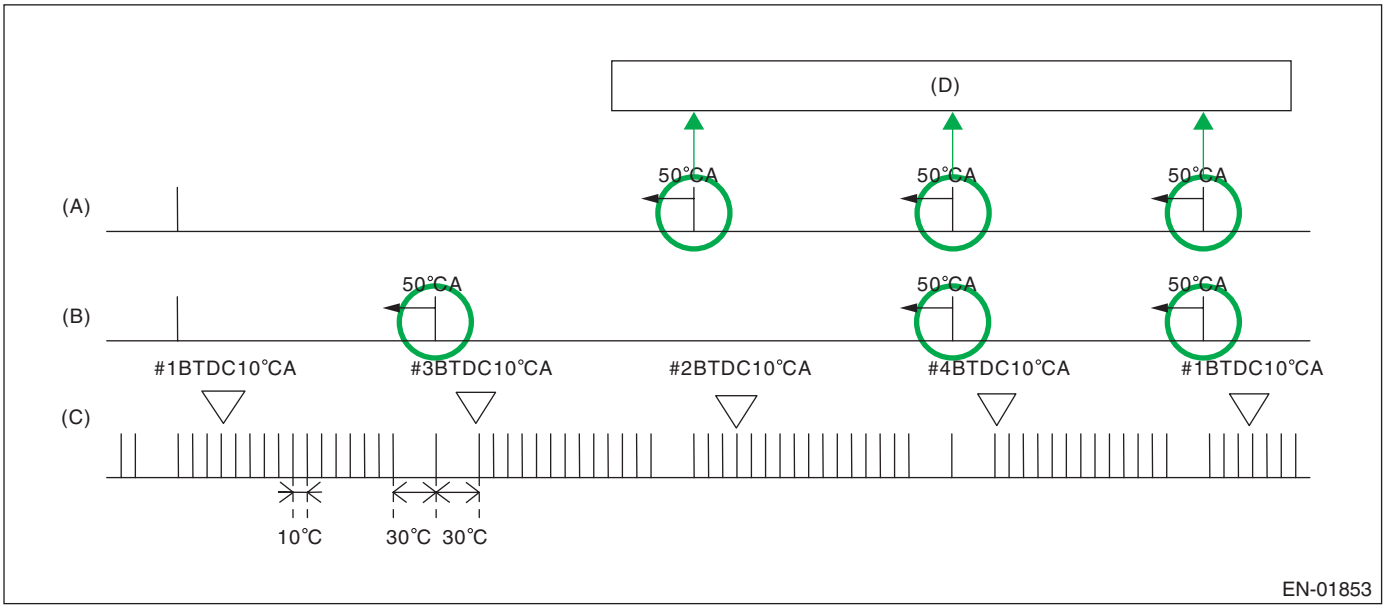
Memorize the freeze frame data. (For test mode $02)

AX:DTC P0340 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of camshaft position sensor. Judge NG when the number of camshaft signal remains to be abnormal.

2. COMPONENT DESCRIPTION



(A) Camshaft signal RH
(B) Camshaft signal LH
(C) Crankshaft signal
(D) Number of camshaft position signals = Recieve camshaft position signal 3 times per tow engine revolutions.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Voltage	≥ 8 V
Engine speed	≥ 600 rpm

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

The camshaft signal normally enters three times by two rev. of engine speed; however, judge NG when the camshaft signal does not enter three times continuously.
Judge NG when the malfunction criteria below are completed more than 100 rev. of engine speed. Judge OK and clear NG when the malfunction criteria below are not completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Number of camshaft sensor signal during 2 rev.	Except 3
Engine speed	≥ 600 rpm

Time Needed for Diagnosis: 100 rev.
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Camshaft angle signal	Exists

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

- Ignition timing whole learning compensation:
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when IG OFF.
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment from abnormality judgment.
- AVCS control: Most timing retard learning is not complete or most timing retard learning completion is not experienced.
- ISC feedback compensation: Do not perform the AVCS actual timing advance compensation. Make the OCV driving Duty to be the given value (9.36%).

9. ECM OPERATING AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

AY:DTC P0345 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2) —

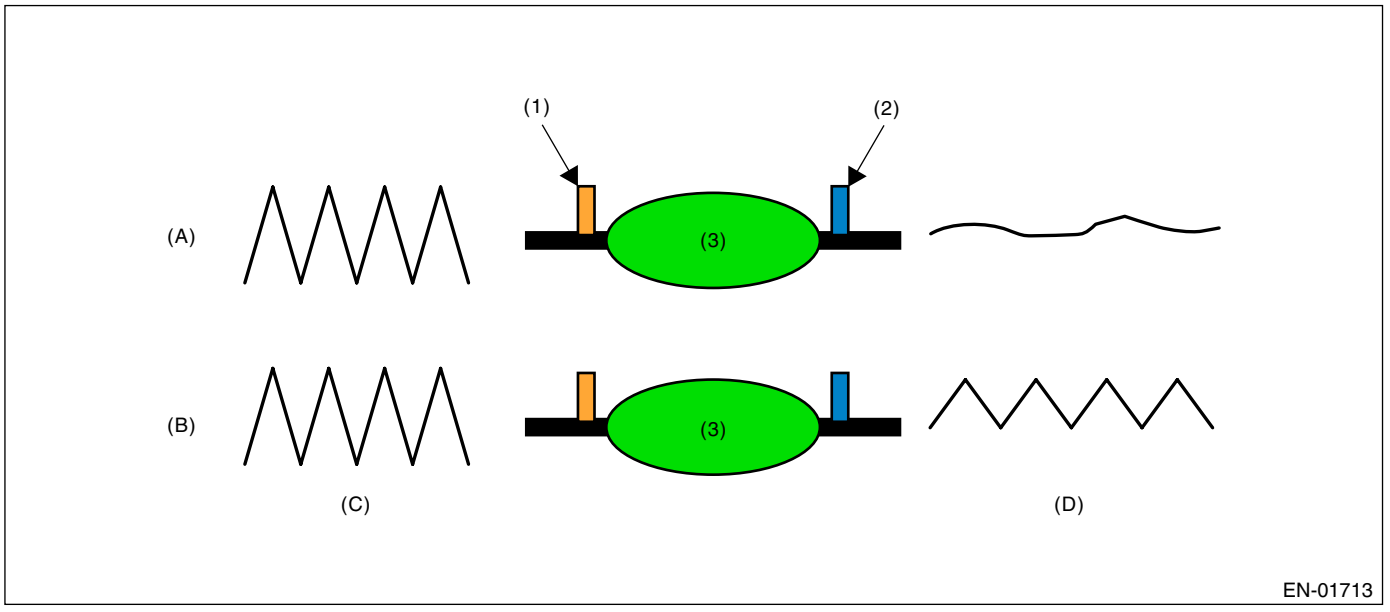
NOTE:
For diagnostic procedure, refer to DTC P0340. <Ref. to GD(H4DOTC)-117, DTC P0340 — CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR) —.>

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

1. OUTLINE OF DIAGNOSIS

Detect the deterioration of catalyst function.
Though the rear oxygen sensor output would change slowly with a new catalyst, the sensor output with a deteriorated catalyst becomes high and the inversion time is shortened. For this reason, the catalyst diagnosis is carried out by monitoring the rear oxygen sensor output and comparing it with the front A/F sensor output.

2. COMPONENT DESCRIPTION



(1) Front oxygen (A/F) sensor
(2) Rear oxygen sensor
(3) Catalyst
(A) Normal
(B) Deterioration
(C) Front oxygen (A/F) sensor waveform
(D) Rear oxygen (A/F) sensor waveform

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Atmospheric pressure	> 75.1 kPa (563 mmHg, 22.2 inHg)
Engine coolant temperature	≥ 65°C (149°F)
Catalyst warm-up counter on Map 2	≥ 8000
Misfire detection during 200 engine revs.	< 5 times
Learning value of evaporation gas density	< 0.20
Sub feedback	In operation
Evaporative system diagnostic	Not in operation
Difference between actual and target time lambda < 0.10	1000 milliseconds or more
Vehicle speed	≥ 85 km/h (53 MPH)
Amount of intake air	12 — 40 g (0.35 ←→ 1.41 oz)/s
Engine load change every 0.5 engine revs.	< 0.03 g (0.001 oz)/rev
Rear O_2 output change from below 600 mV to over	Experienced after fuel cut
After starting engine	≥ 200 seconds
Cumulative time for canister purge after starting engine	≥ 19.9 seconds

• Map 2

Add the following value every 512 milliseconds.

• Catalyst warm-up counter ≤ 9000

Amount of intake air (g (oz)/s)	0 (0)	5 (0.18)	7.5 (0.265)	10 (0.35)	15 (0.53)	20 (0.71)	25 (0.88)	30 (1.06)	35 (1.23)	40 (1.41)	45 (1.59)	50 (1.76)
Integrated value for warm-up counter	–18	–5	3	11	25	40	57	72	87	100	100	100

• Catalyst warm-up counter > 8000

Amount of intake air (g (oz)/s)	0 (0)	5 (0.18)	7.5 (0.265)	10 (0.35)	15 (0.53)	20 (0.71)	25 (0.88)	30 (1.06)	35 (1.23)	40 (1.41)	45 (1.59)	50 (1.76)
Integrated value for warm-up counter	–8	–4	–1	3	6	8	9	11	13	14	14	14

4. GENERAL DRIVING CYCLE

Perform the diagnosis once at the constant vehicle speed of 75 km/h (46.6 MPH) or more after warming up the engine.

5. DIAGNOSTIC METHOD

After the malfunction criteria are completed, calculate the output fluctuation value of front oxygen (A/F) sensor and output fluctuation value of rear oxygen sensor.
Calculate the diagnosis value when the front oxygen (A/F) sensor output fluctuation value more than specified value.
Regard the A/F response properties and diagnosis value as parameters for judgment value.
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 32 milliseconds divided by accumulated variation of lambda of front oxygen (A/F) sensor per 32 milliseconds	≥ 7.0

Time Needed for Diagnosis: 30 to 55 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

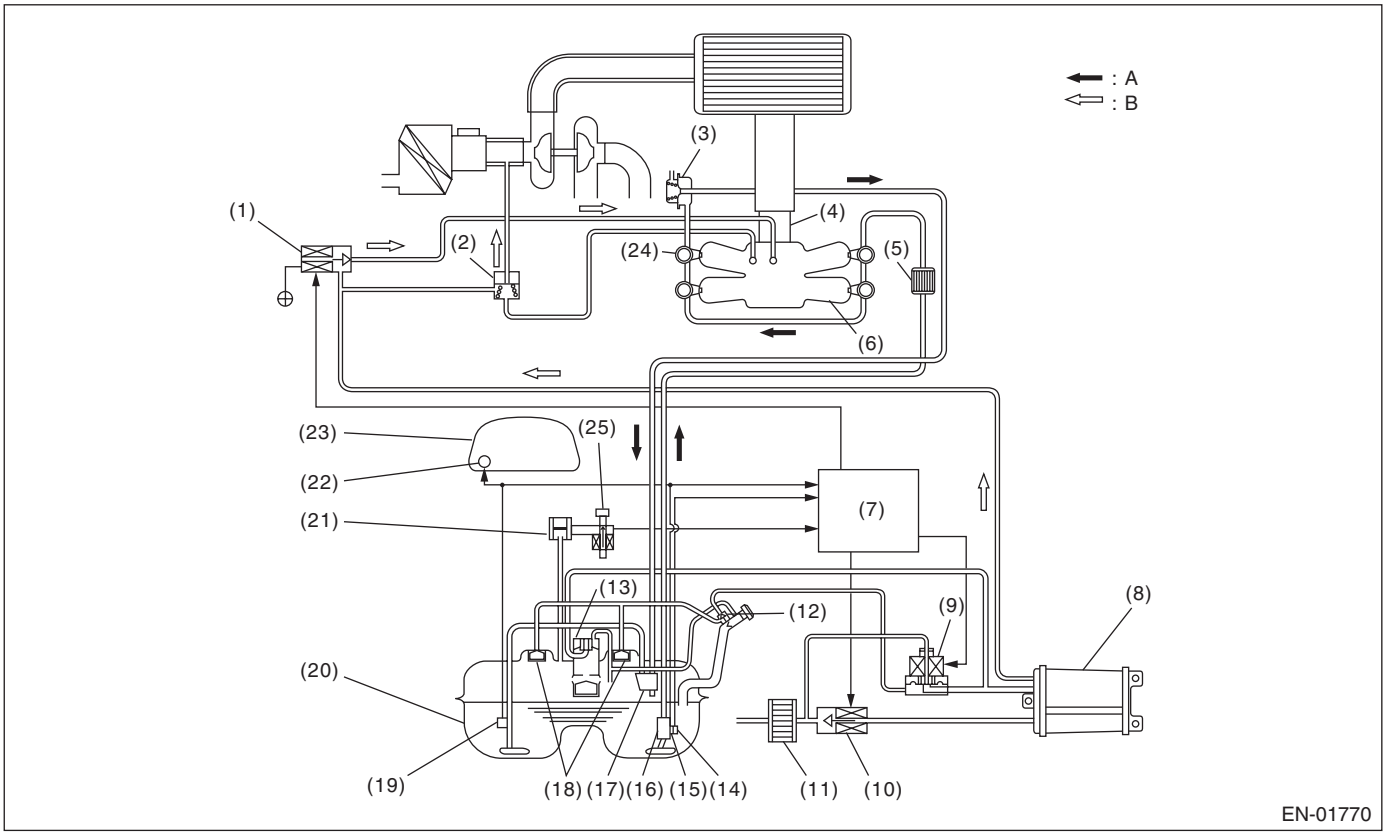
9. ECM OPERATION AT DTC SETTING

- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

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

1. OUTLINE OF DIAGNOSIS

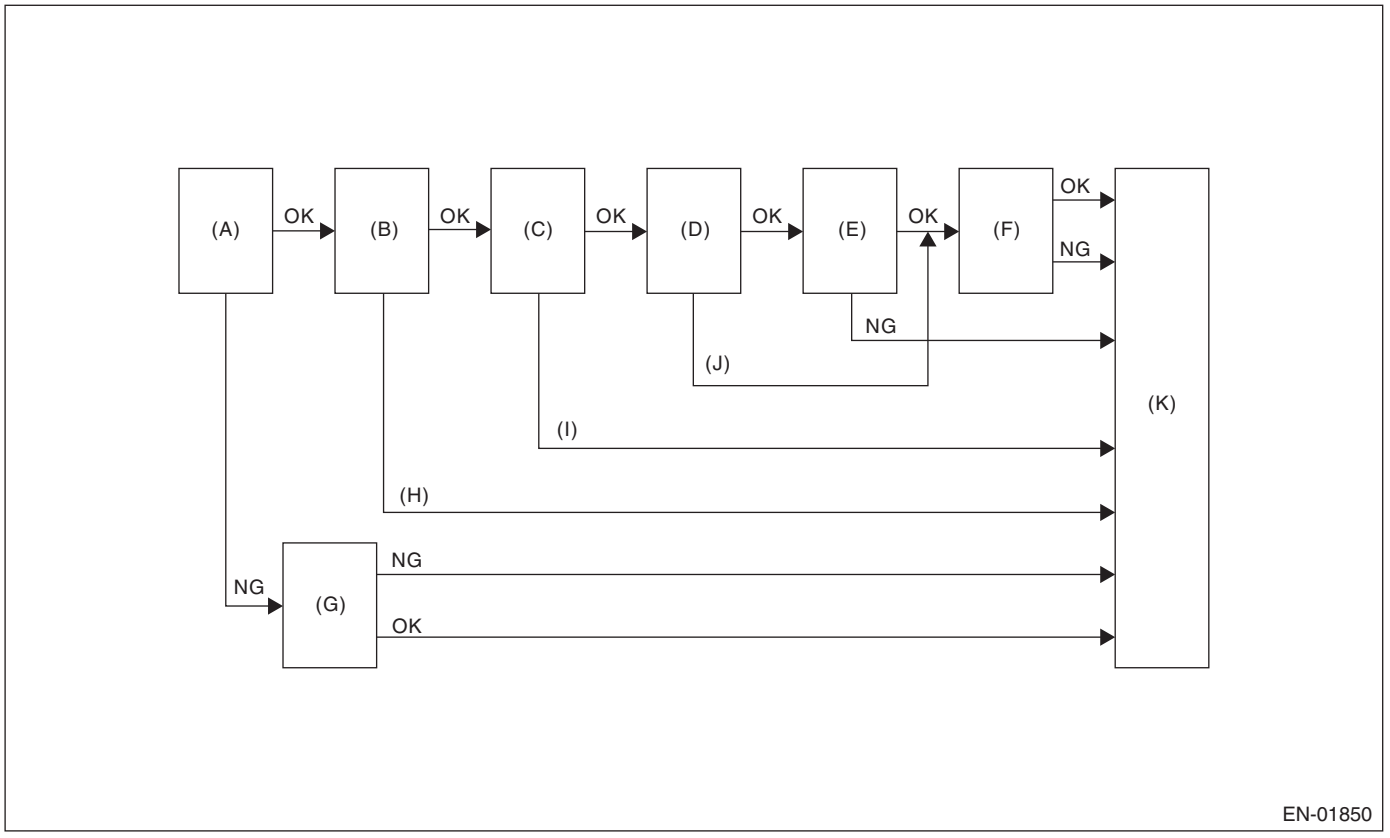
Perform the diagnosis of leakage of fuels system and valve functions.



(1) Purge control solenoid valve
(2) Purge valve
(3) Pressure regulator
(4) Throttle body
(5) Fuel filter
(6) Intake manifold
(7) Engine control module (ECM)
(8) Canister
(9) Pressure control solenoid valve
(10) Drain valve
(11) Drain filter
(12) Shut-off valve
(13) Vent valve
(14) Fuel temperature sensor
(15) Fuel level sensor
(16) Fuel pump
(17) Jet pump
(18) Fuel cut valve
(19) Fuel sub level sensor
(20) Fuel tank
(21) Fuel tank pressure sensor
(22) Fuel meter
(23) Combination meter
(24) Fuel injector
(25) Tank pressure switching solenoid valve

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.

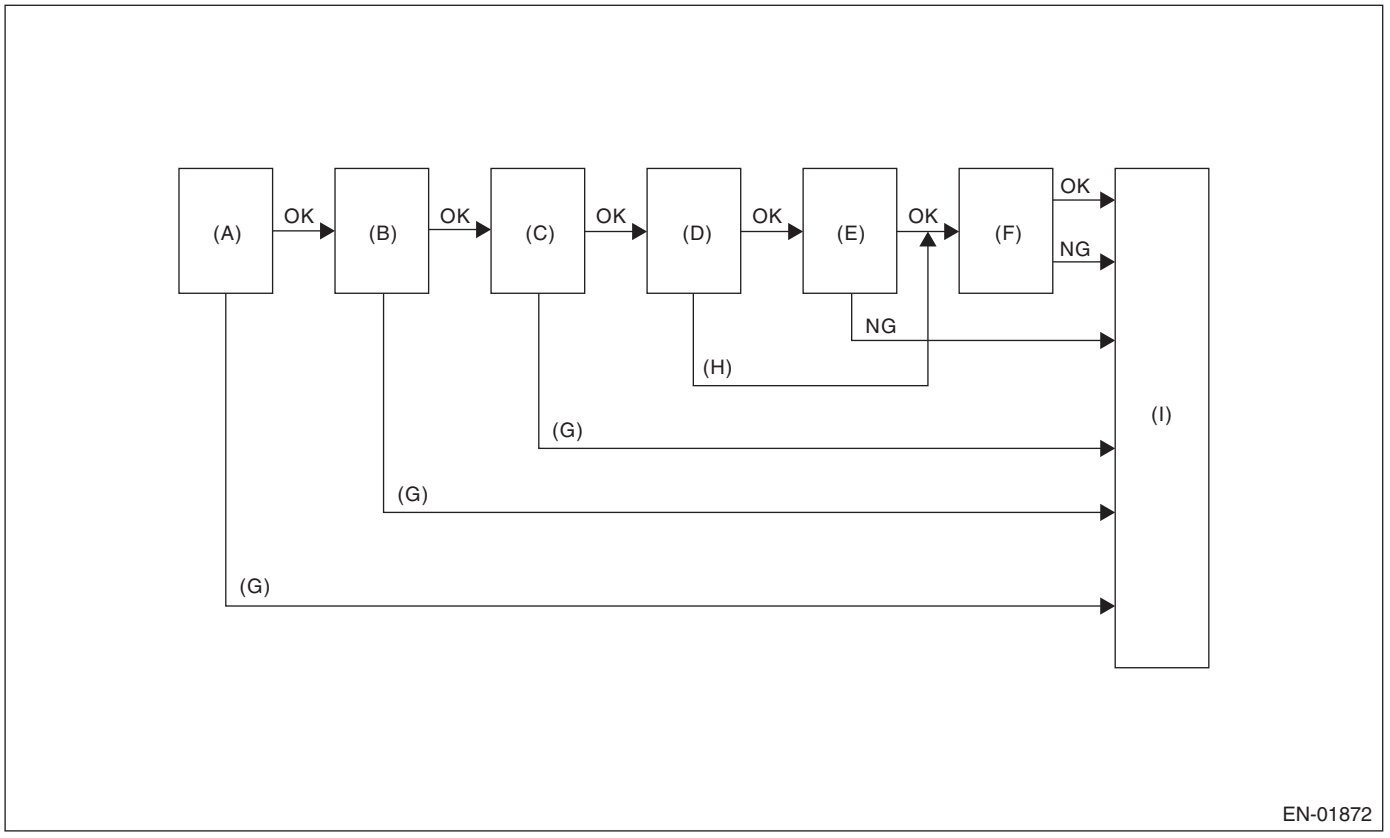
• 0.04-inch Diagnosis



(A) Mode Z
(B) Mode A
(C) Mode B
(D) Mode C
(E) Mode D
(F) Mode E
(G) Mode Z Extend
(H) Cancel
(I) Large leakage diagnosis
(J) Quick OK judgement
(K) END

Mode	Mode Description	Diagnosis Period
Mode Z (CCV close trouble diagnosis)	Perform CCV close stick fast diagnosis according to tank pressure change amount after the diagnosis has started.	3 — 16 seconds
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	16 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.	4 — 35 seconds
Mode C (Pressure increase check advanced OK judgment)	Wait until the tank pressure becomes the desired value (detection starting pressure of P2). If the tank pressure does not become the value, make advanced OK judgment.	4 — 15 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 1. Perform the evaporation leakage diagnosis using the diagnostic value.	12 — 16 seconds
Mode E (CCV property abnormal diagnosis)	Perform the CCV property abnormal diagnosis according to the tank pressure change amount after the leak diagnosis has finished.	4 seconds

• 0.02-inch Diagnosis



(A) Mode Y
(B) Mode A
(C) Mode B
(D) Mode C
(E) Mode D
(F) Mode E
(G) Cancel
(H) Quick OK judgement
(I) END

Mode	Mode Description	Diagnosis Period
Mode Y (Tank pressure stabilization)	Return the tank pressure to atmosphere.	15 seconds
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	29 seconds
Mode B (Negative pressure sealed)	Intake manifold pressure to the fuel tank and reduce the tank pressure to the desired value.	10 — 20 seconds
Mode C (Pressure increase check advanced OK judgment)	Wait until the tank pressure becomes the desired value (detection starting pressure of P2). 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 1. Perform the evaporation leakage diagnosis using the diagnostic value.	20 — 25 seconds
Mode E (CCV property abnormal diagnosis)	Perform the CCV property abnormal diagnosis according to the tank pressure change amount after the leak diagnosis has finished.	4 seconds

• 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
Mode A	Pressure is in proportion to amount of evaporative emission.		
Mode B	Negative pressure is formed due to intake manifold negative pressure	Large leakage	P0457
Mode C	Target pressure is reached		None
Mode D	Pressure change is small.	EVAP system is judged to have large leak [1.0 mm (0.04 in)].	P0442
Mode E	Return to atmosphere	CCV property	P1443

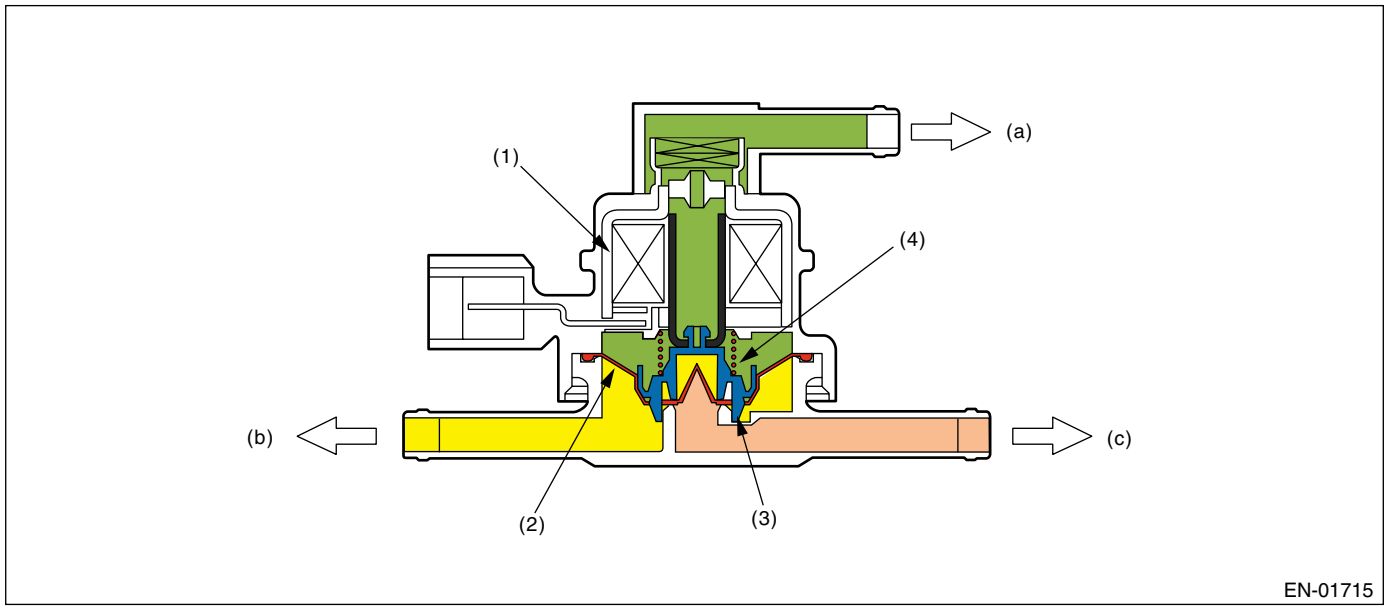
• 0.02-inch Diagnosis

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

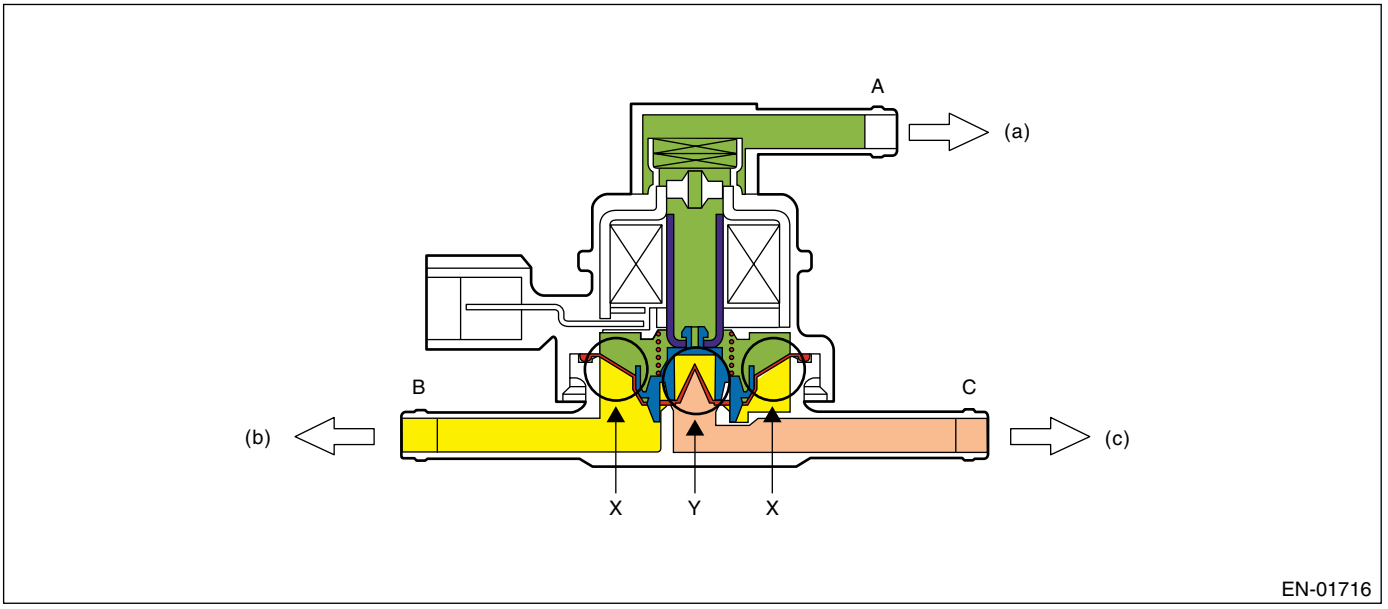
PCV controls the fuel tank pressure to be equal to the atmospheric air pressure.
Normally, the solenoid is set to OFF. And the valve opens and closes mechanically in accordance with the pressure difference between tank and atmospheric air, or tank and canister.
Also the valve can be forcibly opened by setting the solenoid to ON.



(1) Solenoid
(2) Diaphragm
(3) Valve
(4) Spring
(a) Atmospheric pressure
(b) Fuel tank
(c) Canister

• Valve Operation and Air Flow

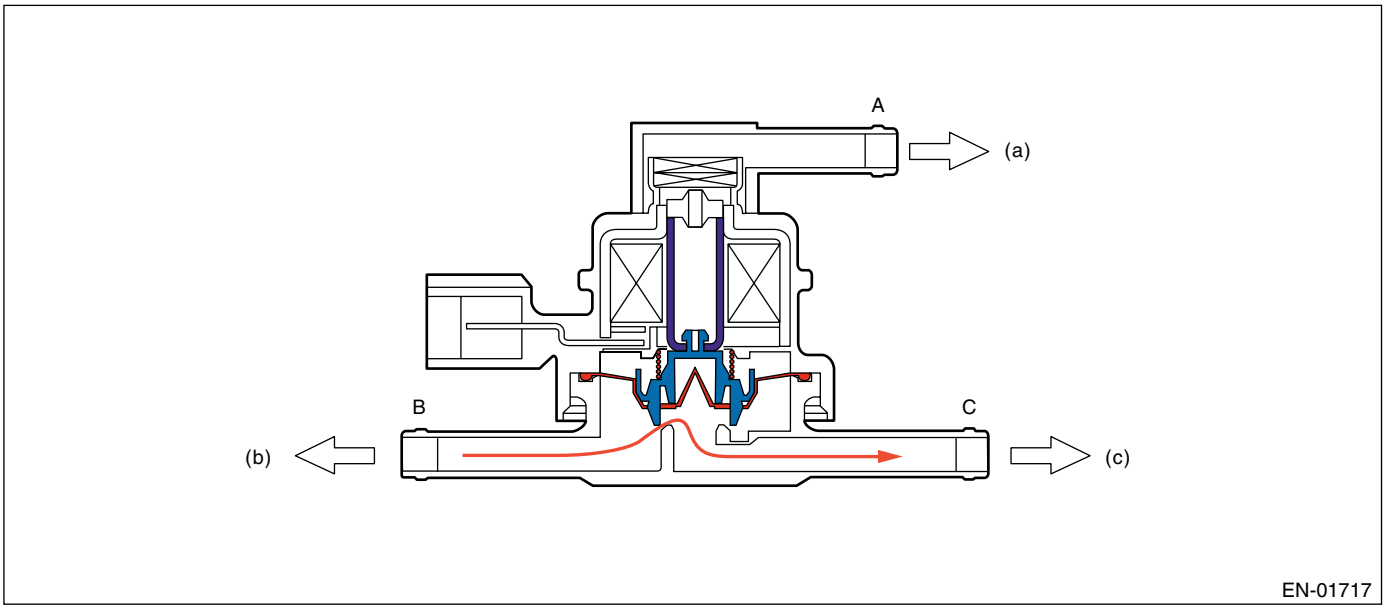
In the figure below, divided by the diaphragm, the part above X is charged with atmospheric air pressure, and the part below X is charged with tank pressure. Also, the part above Y is charged with tank pressure, and the part below Y is charged with canister pressure.
If the atmospheric air pressure port 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

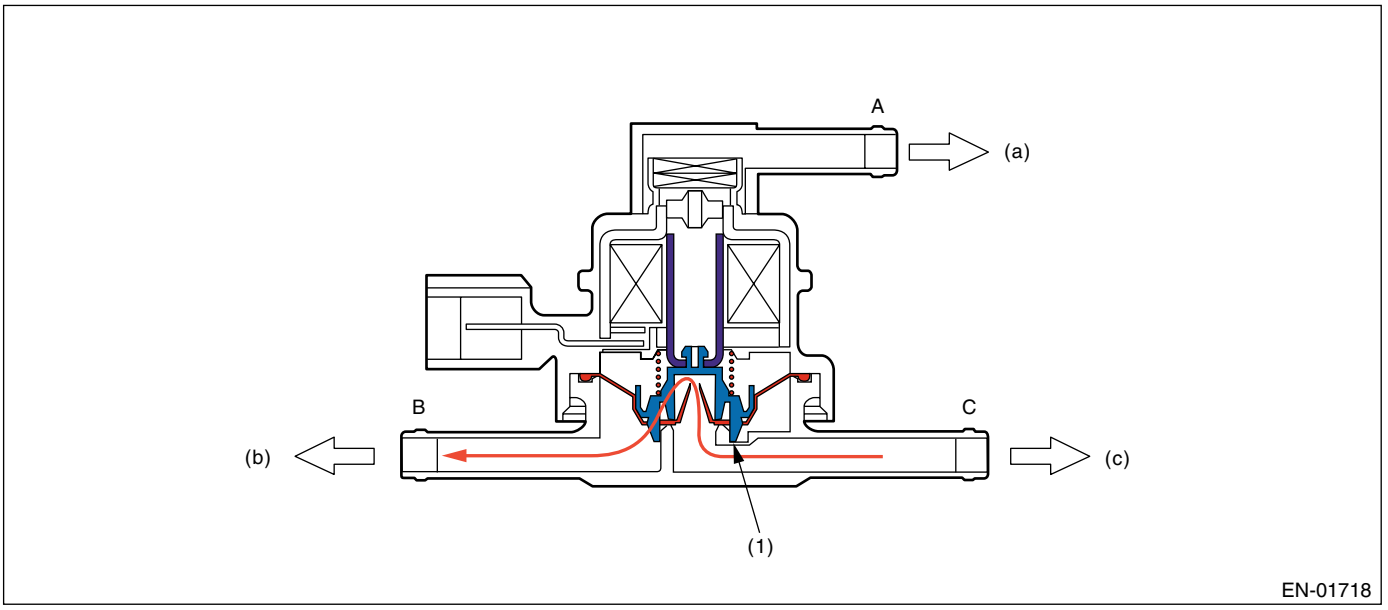
Condition of pressure	Flow
A < B (solenoid OFF)	B → C
B < C (solenoid OFF)	C → B
Solenoid ON	B ←→ C

• When A < B (Solenoid OFF)



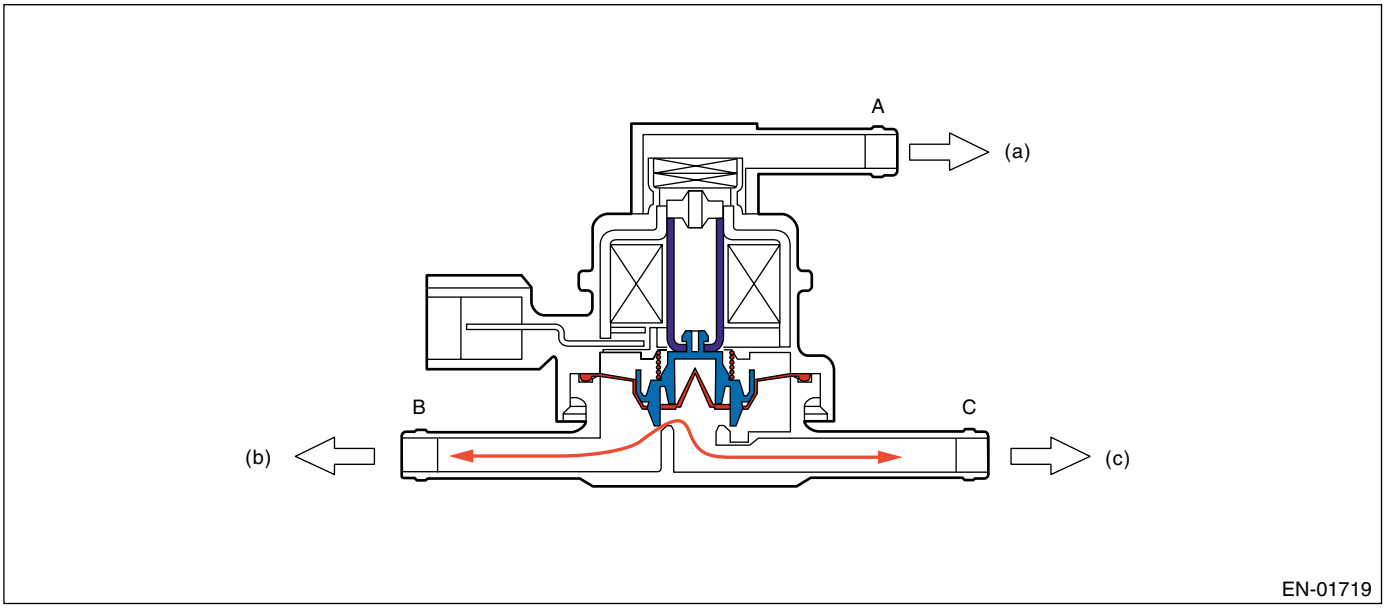
(a) Atmospheric pressure (b) Fuel tank (c) Canister

• When B < C (Solenoid OFF)



(1) Valve
(a) Atmospheric pressure
(b) Fuel tank
(c) Canister

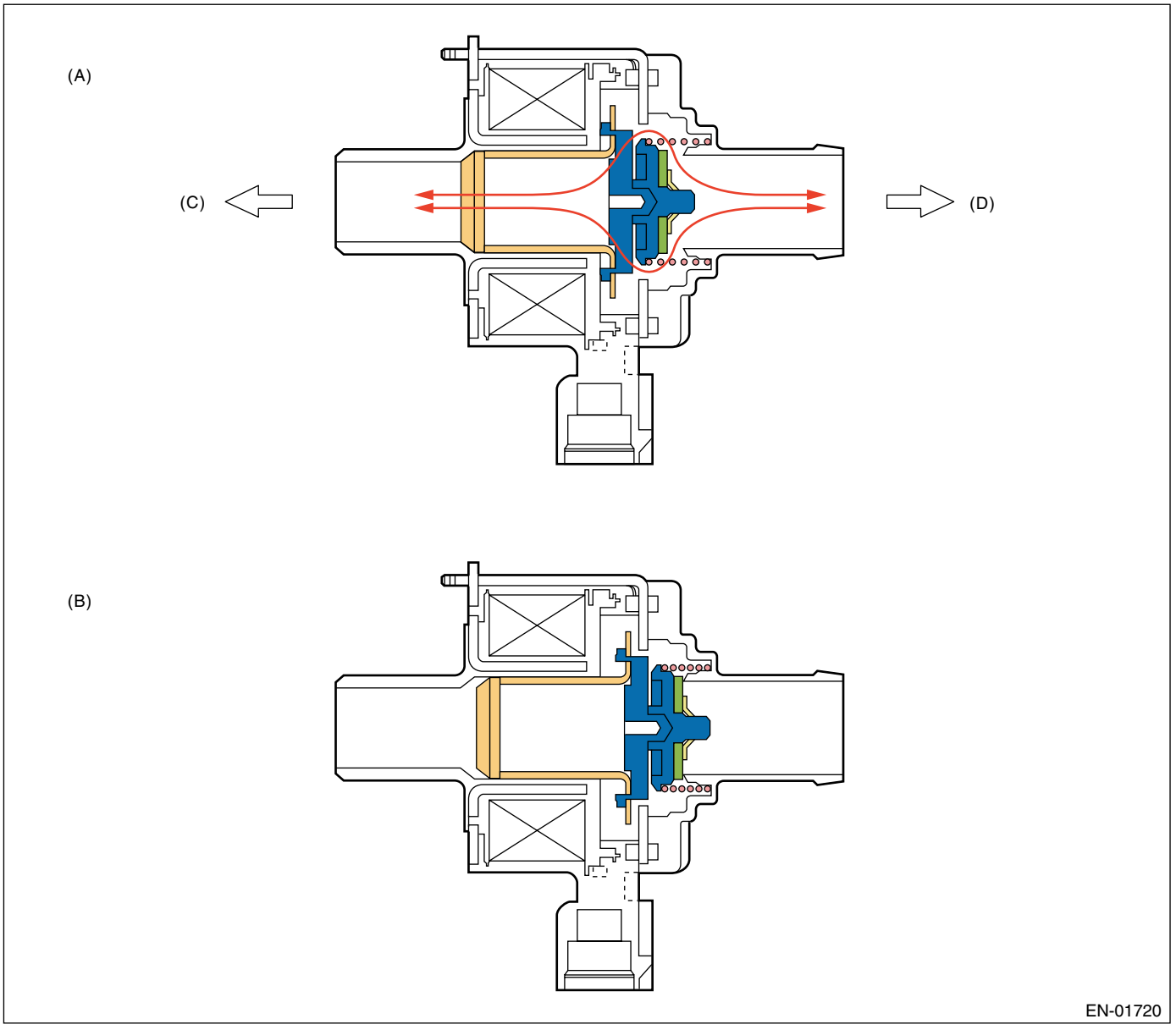
• When Solenoid is ON



(a) Atmospheric pressure
(b) Fuel tank
(c) Canister

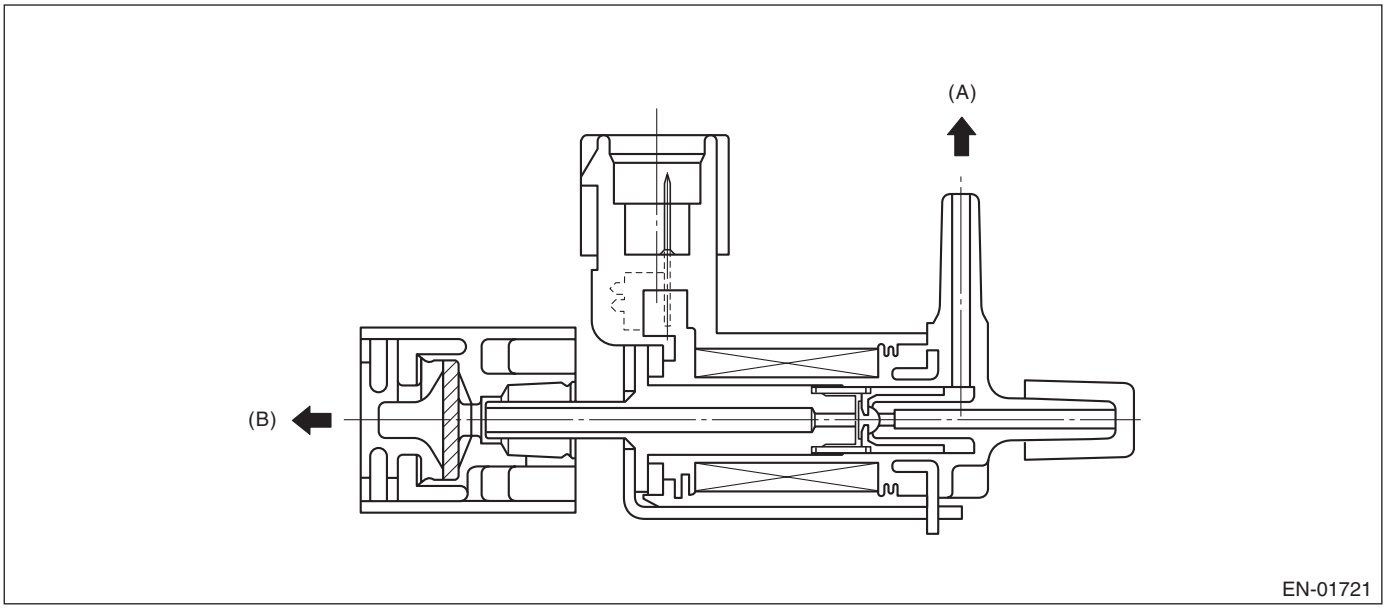
• CCV

CCV controls the ambient air to be introduced to the canister.



(A) Open (Solenoid OFF)
(B) Close (Solenoid ON)
(C) Filter
(D) Canister

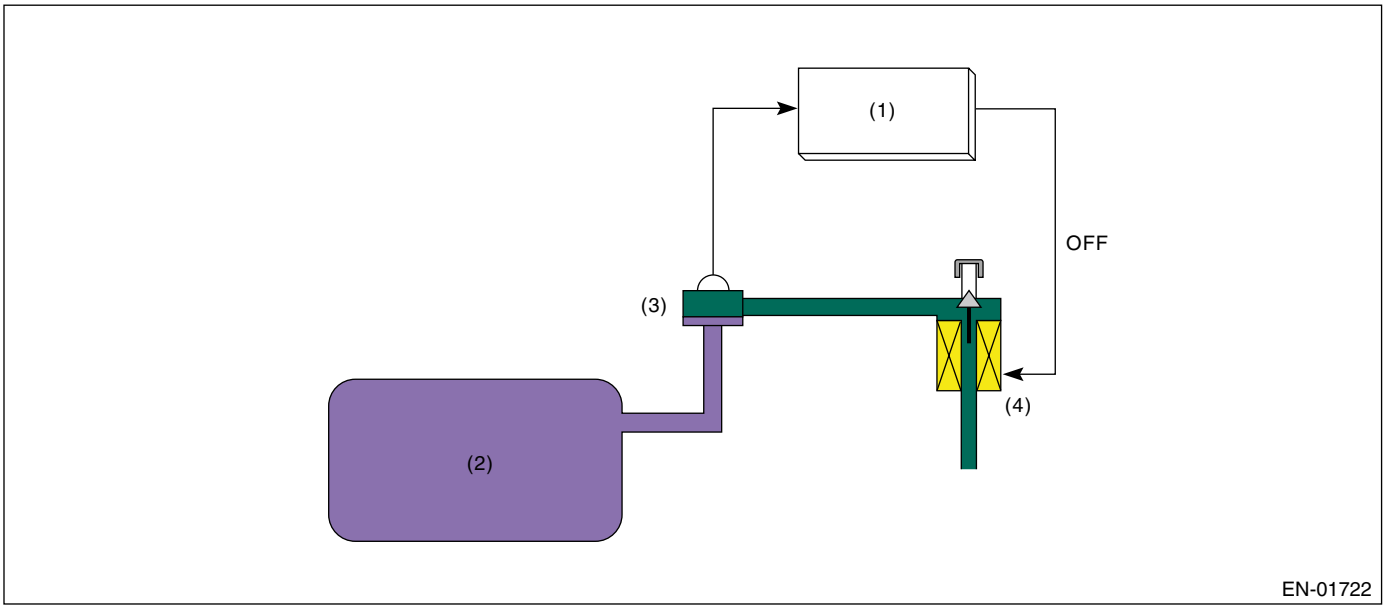
• Tank Pressure Switching Solenoid



(A) Fuel tank pressure sensor (B) Atmosphere

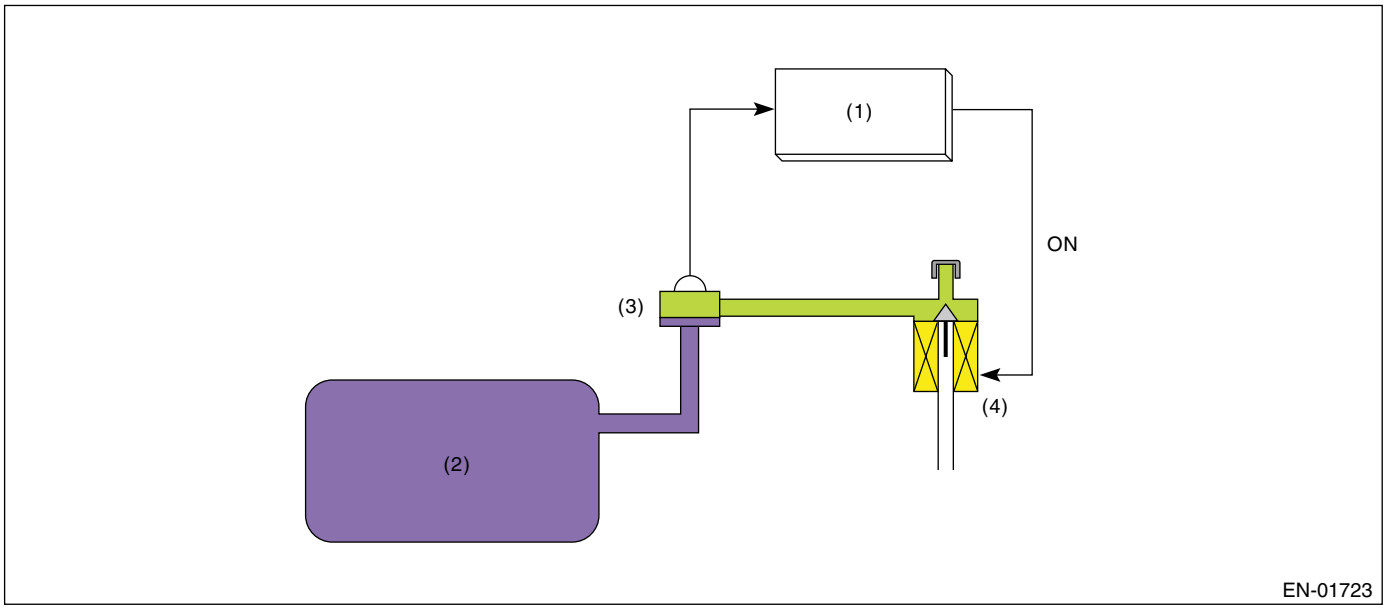
• Purpose of this solenoid

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

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.

3. ENABLE CONDITION

0.04-inch Diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Barometric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Total time of canister purge operation	120 seconds or more
After starting engine	856 seconds or more
Learning value of evaporation gas density	≤ 0.04
Engine speed	1050 ←→ 6500 rpm
Fuel tank pressure	< 1.03 kPa (7.72 mmHg, 0.30 inHg)
Intake manifold vacuum (relative pressure)	< −13.3 kPa (−100 mmHg, −3.92 inHg)
Vehicle speed	≥ 32 km/h (20 MPH)
Fuel level	9.6 ←→ 48 ℓ (2.54 ←→ 12.7 US gal, 2.11 ←→ 10.6 Imp gal)
Closed air/fuel ratio control	In operation
Fuel temperature	−10 ←→ 45°C (14 ←→ 113°F)
Intake air temperature	≥ −10°C (14°F)
Pressure change per second	< 0.13 kPa (0.95 mmHg, 0.037 inHg)
Min. pressure change per second − Max. pressure change per second	< 0.23 kPa (1.75 mmHg, 0.07 inHg)
Fuel level change	< 3.0 ℓ (3.2 US gal, 2.6 Imp gal)/128 milliseconds
Air fuel ratio	0.76 — 1.25

0.02-inch Diagnosis

Secondary Parameters	Enable Conditions
(At starting a diagnosis)	
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75.7 kPa (568 mmHg, 22.4 inHg)
Since last incomplete diagnosis event of 0.02-inch leakage	> 120 seconds
Total time of canister purge operation	120 second or more
After starting engine	335 second or more
Fuel temperature	−10 ←→ 35°C (14 ←→ 95°F)
Or engine coolant temperature at engine start	< 45°C (113°F)
And time after engine start	< 2400 seconds
Fuel level	9.6 ←→ 48 ℓ (2.54 ←→ 12.7 US gal, 2.11 ←→ 10.6 Imp gal)
Ambient temperature	≥ −10°C (14°F)
(Ambient − fuel) temperature	< 1°C (1.8°F)
Fuel tank pressure below −3.01 kPa (−22.8 mmHg, −0.88 inHg) (during same driving cycle)	Up to 2 times
Intake manifold vacuum (relative pressure)	< −13.3 kPa (−100 mmHg, −3.92 inHg)
Fuel tank pressure	−0.67 — 1.03 kPa (−5 — 7.72 mmHg, −0.197 — 0.304 inHg)
Vehicle speed	≥ 68 km/h (42 MPH)
Closed air/fuel ratio control	In operation
Engine speed	1500 ←→ 6500 rpm
(During diagnosis)	
P1	−0.13 ←→ 0.13 kPa (−1 ←→ 1 mmHg, −0.04 ←→ 0.04 inHg)
Pressure change per second	< 0.13 kPa (0.95 mmHg, 0.037 inHg)
Fuel level change	2 ←→ 3 ℓ (2.1 ←→ 3.2 US gal, 1.8 ←→ 2.6 Imp gal)
Min. tank pressure change per second − Max. tank pressure change per second	< Mode A: 0.23 kPa (1.75 mmHg, 0.07 inHg) Mode D: 0.13 kPa (1.00 mmHg, 0.04 inHg)
Change of atmospheric pressure during P1 calculation	−0.04 ←→ 0.17 kPa (−0.3 ←→ 1.3 mmHg, −0.01 ←→ 0.05 inHg)
Change of atmospheric pressure during P2 calculation	−0.08 ←→ 0.12 kPa (−0.6 ←→ 0.9 mmHg, −0.024 ←→ 0.035 inHg)

4. GENERAL DRIVING CYCLE

• 0.04-inch Diagnosis

• Perform the diagnosis only once in more than 856 seconds after the engine start at the constant driving speed of 32 km/h (20 MPH) or more.
• Pay attention to the fuel temperature and fuel level.

• 0.02-inch Diagnosis

• Perform diagnosis in more than 335 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.

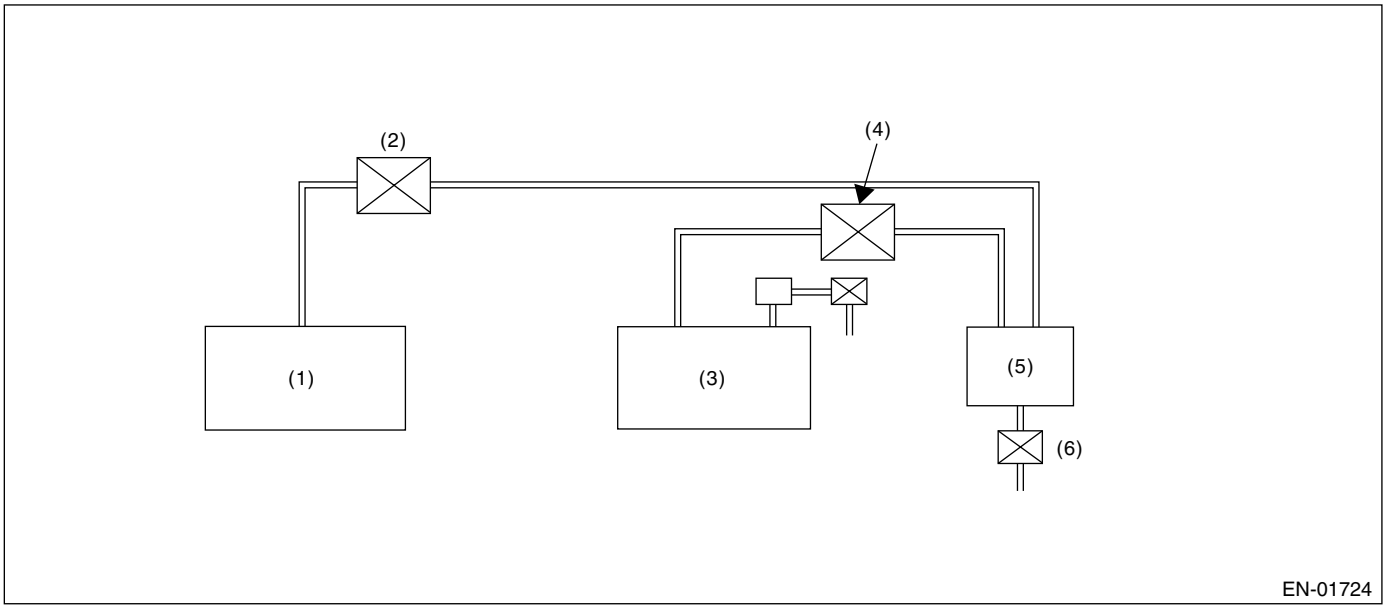
5. DIAGNOSTIC METHOD

• MODE Z (CPC close trouble diagnosis)

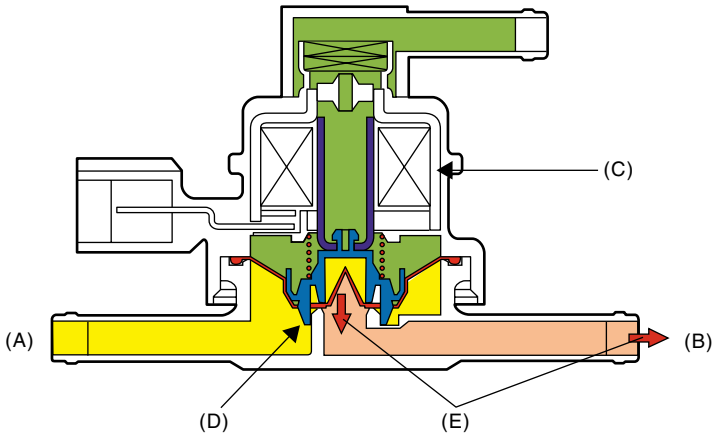
DTC P0457
DTC P1443

• Purpose of Mode Z

When performing the leakage diagnosis of EVAP system, CCV have to operate normally. Therefore, mode Z is used to diagnose the CCV close fixation.
If the CCV closed fixation trouble is detected, the EVAP system leakage diagnosis is cancelled.
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. When this status occurs the valve cannot be opened for the pressure control solenoid valve structure if the negative pressure is larger than electromagnetic force when pressure control solenoid valve solenoid is set to ON in order to open the valve.



(1) Engine
(2) Purge control solenoid valve open
(3) Fuel tank
(4) Pressure control solenoid valve close
(5) Canister
(6) CCV stuck close

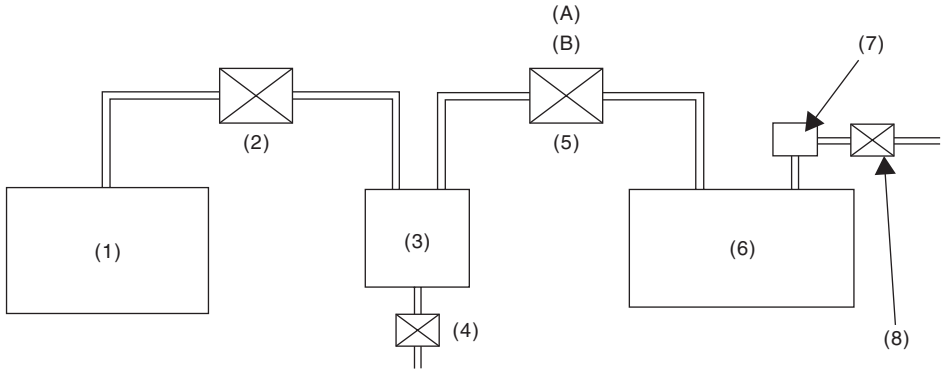


EN-01725

(A) To fuel tank
(B) To canister (Negative pressure)
(C) Solenoid ON
(D) Valve cannot be open.
(E) Negative pressure

• Diagnostic method

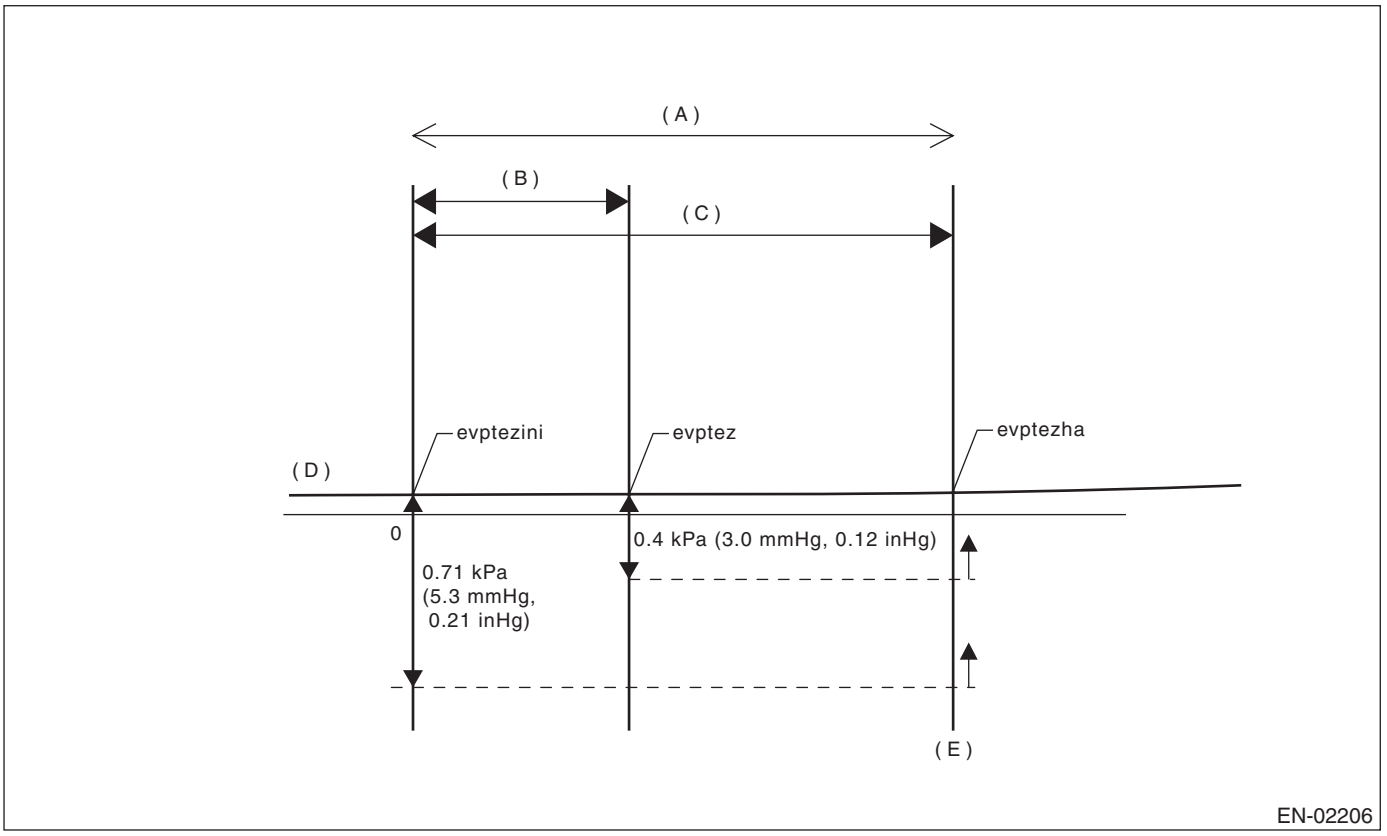
CCV closed fixation diagnosis is performed in mode Z as shown in the figure below.



EN-01726

(1) Engine
(2) Purge control solenoid valve
(3) Canister
(4) Drain valve
(5) Pressure control solenoid valve
(6) Fuel tank
(7) Fuel tank pressure sensor
(8) Tank pressure switching solenoid valve
(A) Normal condition: mechanical control
(B) Under the diagnosis: electronic control

• Normal Operation

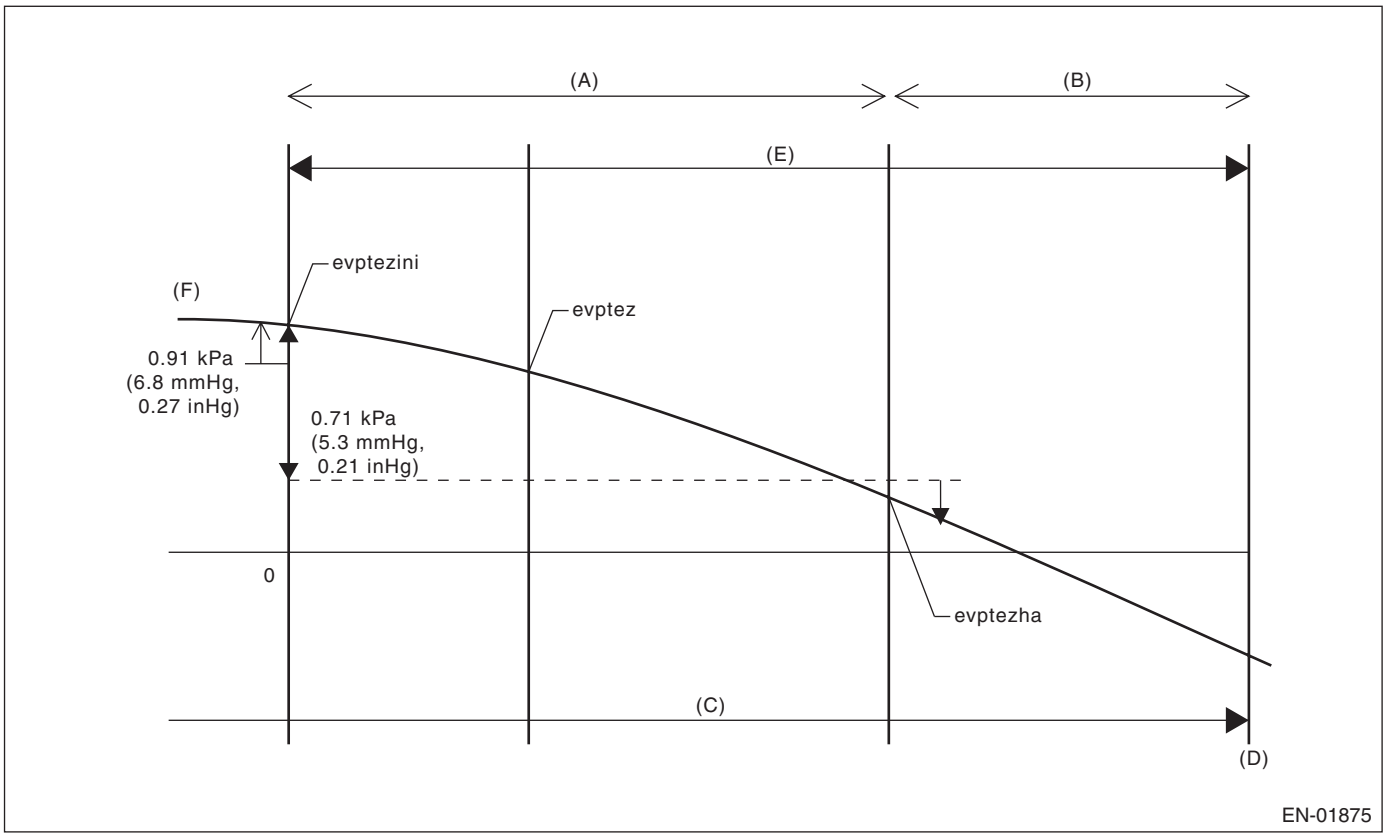


(A) Mode Z
(B) 1 second
(C) 3 seconds
(D) Fuel tank pressure
(E) OK judgement

- evptez – evptezha ≤ 0.4 kPa (3.0 mmHg, 0.12 inHg)
- evptezini – evptezha ≤ 0.71 kPa (5.3 mmHg, 0.21 inHg)

Judge normal when these calculations are completed.

• Drain Valve close fixation



(A) Mode Z
(B) Mode Z extened
(C) Fuel does not waver more than 3 seconds.
(D) Judgement
(E) 16S
(F) Fuel tank pressure

- evptezini – evptezha > 0.71 kPa (5.3 mmHg, 0.21 inHg)
- evptezini > 0.91 kPa (6.8 mmHg, 0.27 inHg)

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

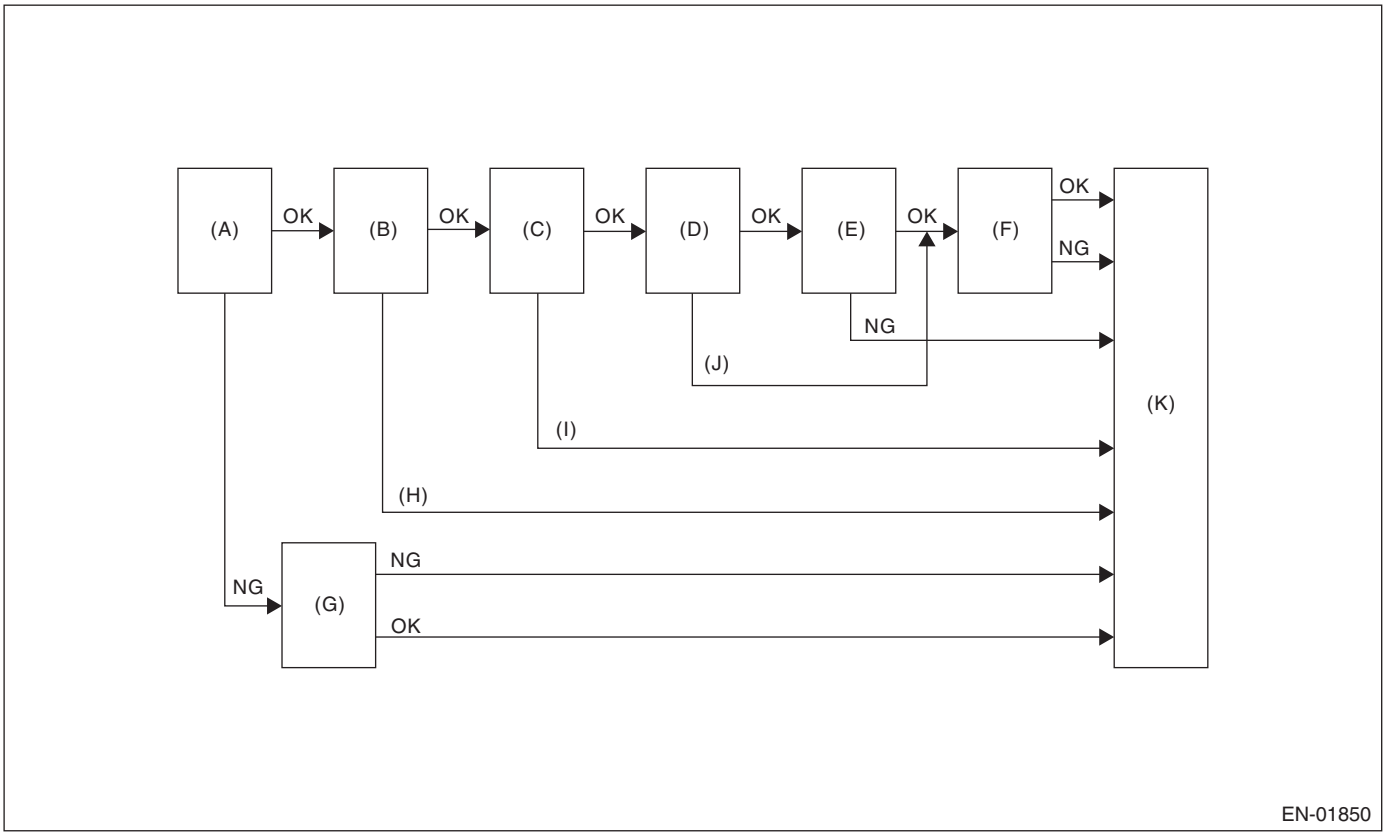
Malfunction Criteria	Threshold Value	DTC
(Tank pressure in 3 seconds after Mode Z started) – (Tank pressure when Mode Z finished)	≤ 0.4 kPa (3.0 mmHg, 0.12 inHg)	P1443

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	> 0.91 kPa (6.8 mmHg, 0.27 inHg)	P1443
(Tank pressure when Mode Z started) – (Tank pressure when Mode Z finished)	> 0.7 kPa (5.3 mmHg, 0.21 inHg)	

Time Needed for Diagnosis: 4 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.
Finish the Evap. diagnosis when making NG judgment for drain valve close fixation.
Cancel the Evap. diagnosis when the OK/NG judgment for drain valve close fixation cannot be made in Mode Z.



(A) Mode Z
(B) Mode A
(C) Mode B
(D) Mode C
(E) Mode D
(F) Mode E
(G) Mode Z Extend
(H) Cancel
(I) Large leakage diagnosis
(J) Quick OK judgement
(K) END

• 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: (Estimation of evaporation gas yield)

The tank pressure variation amount in Mode A is calculated as P1. The tank pressure variation amount in Mode A is calculated as P1. After calculating P1, change to Mode B.

Mode B: (Seal negative pressure)

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 (10 seconds) in 0.04-inch diagnosis. Cancel the diagnosis (10 to 20 seconds) in 0.02-inch diagnosis.

Abnormality Judgment

Judge NG (large leak) when the criteria below are completed in the specified time.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
(0.04-inch diagnosis)		P0457
Time for Mode B	10 seconds	
(Tank pressure during Mode B) – (Tank pressure when Mode B started)	< –0.3 kPa (–2 mmHg, –0.08 inHg)	

Mode C: (Check increasing pressure)

Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)
Change to Mode D when the tank pressure returns to the start level of P2 calculation.
Judge immediate OK and change to Mode E when it does not return in spite of spending the specified time.

	Tank pressure when P2 calculation started	Time for immediate OK judgment
0.04-inch diagnosis	–1.3 kPa (–9.75 mmHg, –0.38 inHg)	15 seconds
0.02-inch diagnosis	–3 kPa (–22.5 mmHg, –0.89 inHg)	20 seconds

Mode D: (Measurement of negative pressure changes)

Monitor the pressure variation in the tank 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 × P1 P2: Change of tank pressure within 16 seconds on Mode D P1: Change of tank pressure within 16 seconds on Mode A	> Value on map 7. *Threshold value: Figure (Fuel level vs Tank temperature)	P0442

***1.5:** Compensation value of the amount of evaporator occurrence. (Because evaporator increases more when becoming negative pressure.)

• Map 7 Limit of malfunction criteria for 0.04-inch leak as Evap. diagnosis.

Fuel temperature & Fuel level	5°C (41°F)	15°C (59°F)	25°C (77°F)	35°C (95°F)	45°C (113°F)
10 L (2.6 US gal, 2.2 Imp gal)	0.31 kPa (2.34 mmHg, 0.092 inHg)	0.31 kPa (2.34 mmHg, 0.092 inHg)	0.33 kPa (2.49 mmHg, 0.098 inHg)	0.35 kPa (2.64 mmHg, 0.104 inHg)	0.37 kPa (2.80 mmHg, 0.110 inHg)
20 L (5.3 US gal, 4.4 Imp gal)	0.35 kPa (2.64 mmHg, 0.104 inHg)	0.35 kPa (2.64 mmHg, 0.104 inHg)	0.38 kPa (2.84 mmHg, 0.112 inHg)	0.41 kPa (3.08 mmHg, 0.121 inHg)	0.44 kPa (3.28 mmHg, 0.129 inHg)
30 L (7.9 US gal, 6.6 Imp gal)	0.39 kPa (2.94 mmHg, 0.116 inHg)	0.39 kPa (2.94 mmHg, 0.116 inHg)	0.42 kPa (3.18 mmHg, 0.125 inHg)	0.47 kPa (3.52 mmHg, 0.139 inHg)	0.50 kPa (3.76 mmHg, 0.148 inHg)
40 L (10.6 US gal, 8.8 Imp gal)	0.45 kPa (3.35 mmHg, 0.132 inHg)	0.45 kPa (3.35 mmHg, 0.132 inHg)	0.47 kPa (3.49 mmHg, 0.137 inHg)	0.50 kPa (3.74 mmHg, 0.147 inHg)	0.52 kPa (3.88 mmHg, 0.153 inHg)
50 L (13.2 US gal, 11.0 Imp gal)	0.50 kPa (3.76 mmHg, 0.148 inHg)	0.50 kPa (3.76 mmHg, 0.148 inHg)	0.51 kPa (3.80 mmHg, 0.150 inHg)	0.53 kPa (3.95 mmHg, 0.156 inHg)	0.53 kPa (3.99 mmHg, 0.157 inHg)

• 0.02-inch Diagnosis

Abnormality Judgment

Judge NG when the criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value	DTC
P2 – 1.5 × P1 P2: Change of tank pressure within 22 seconds on Mode D P1: Change of tank pressure within 22 seconds on Mode A	> Value on map 8. *Threshold value: Figure (Fuel level vs Tank temperature)	P0456

• Map 8 Limit of malfunction criteria for 0.04-inch leak as Evap. diagnosis.

Fuel temperature & Fuel level	15°C (59°F)	25°C (77°F)	35°C (95°F)	40°C (104°F)
10 L (2.6 US gal, 2.2 Imp gal)	0.34 kPa (2.57 mmHg, 0.101 inHg)	0.37 kPa (2.80 mmHg, 0.110 inHg)	0.44 kPa (3.30 mmHg, 0.130 inHg)	0.73 kPa (5.49 mmHg, 0.216 inHg)
20 L (5.3 US gal, 4.4 Imp gal)	0.38 kPa (2.83 mmHg, 0.111 inHg)	0.42 kPa (3.12 mmHg, 0.123 inHg)	0.49 kPa (3.70 mmHg, 0.146 inHg)	0.79 kPa (5.92 mmHg, 0.233 inHg)
30 L (7.9 US gal, 6.6 Imp gal)	0.41 kPa (3.09 mmHg, 0.122 inHg)	0.46 kPa (3.43 mmHg, 0.135 inHg)	0.55 kPa (4.10 mmHg, 0.161 inHg)	0.85 kPa (6.34 mmHg, 0.250 inHg)
40 L (10.6 US gal, 8.8 Imp gal)	0.46 kPa (3.46 mmHg, 0.136 inHg)	0.49 kPa (3.66 mmHg, 0.144 inHg)	0.56 kPa (4.18 mmHg, 0.165 inHg)	0.89 kPa (6.70 mmHg, 0.264 inHg)
50 L (13.2 US gal, 11.0 Imp gal)	0.51 kPa (3.83 mmHg, 0.151 inHg)	0.52 kPa (3.89 mmHg, 0.153 inHg)	0.57 kPa (4.25 mmHg, 0.167 inHg)	0.93 kPa (7.00 mmHg, 0.276 inHg)

Normality Judgment

Judge OK when the criteria below are completed.

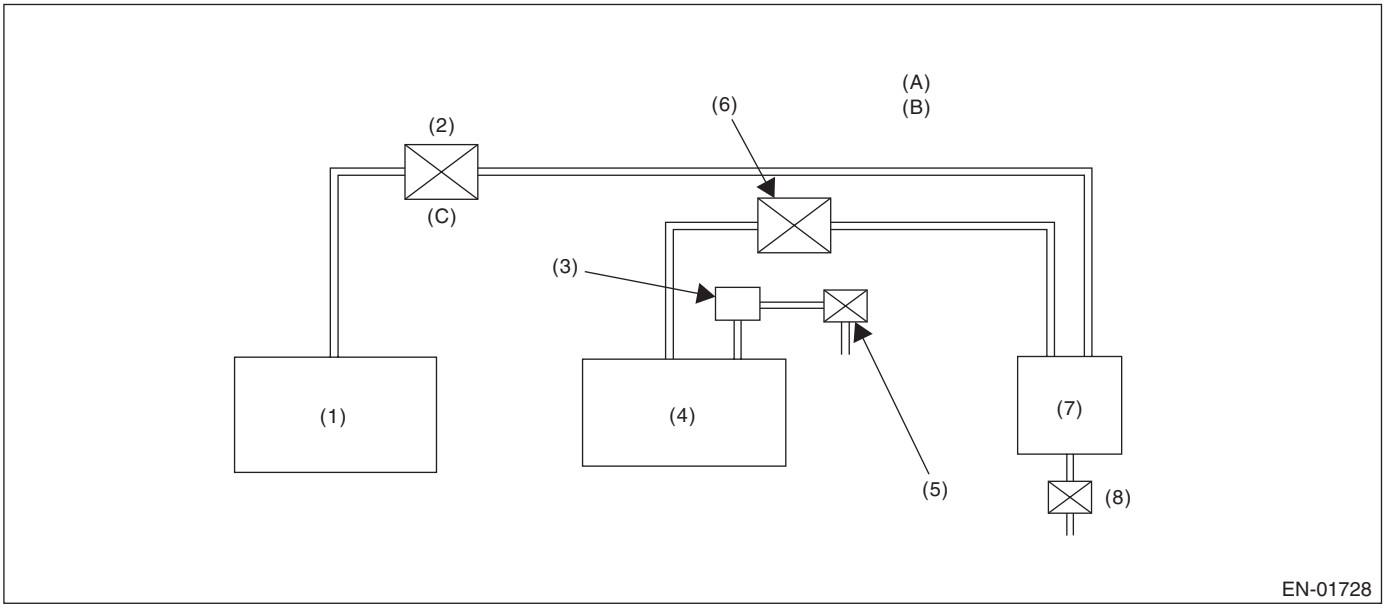
• Judgment Value

Malfunction Criteria	Threshold Value	DTC
P2 – 1.5 × P1	> Valve on map 9.	P0456

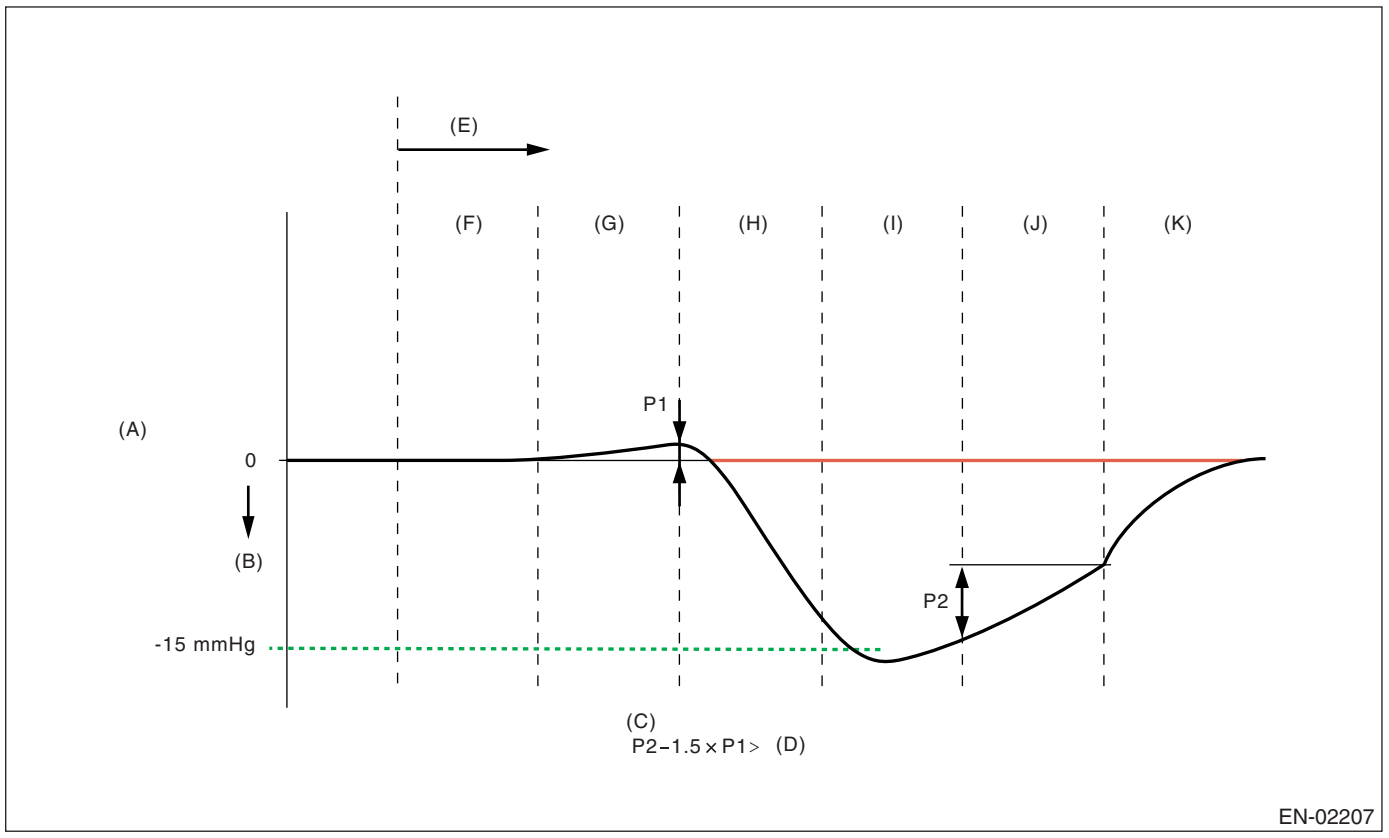
• Map 9.

Fuel temperature & Fuel level	15°C (59°F)	25°C (77°F)	35°C (95°F)	40°C (104°F)
10 L (2.6 US gal, 2.2 Imp gal)	0.21 kPa (1.59 mmHg, 0.063 inHg)	0.21 kPa (1.59 mmHg, 0.063 inHg	0.26 kPa (1.97 mmHg, 0.078 inHg)	0.31 kPa (2.36 mmHg, 0.093 inHg)
20 L (5.3 US gal, 4.4 Imp gal)	0.28 kPa (2.09 mmHg, 0.082 inHg)	0.28 kPa (2.09 mmHg, 0.082 inHg	0.33 kPa (2.45 mmHg, 0.096 inHg)	0.37 kPa (2.81 mmHg, 0.111 inHg)
30 L (7.9 US gal, 6.6 Imp gal)	0.35 kPa (2.59 mmHg, 0.102 inHg)	0.35 kPa (2.59 mmHg, 0.102 inHg)	0.39 kPa (2.92 mmHg, 0.115 inHg)	0.43 kPa (3.26 mmHg, 0.128 inHg)
40 L (10.6 US gal, 8.8 Imp gal)	0.30 kPa (2.26 mmHg, 0.089 inHg)	0.30 kPa (2.26 mmHg, 0.089 inHg)	0.35 kPa (2.64 mmHg, 0.104 inHg)	0.40 kPa (3.02 mmHg, 0.119 inHg)
50 L (13.2 US gal, 11.0 Imp gal)	0.26 kPa (1.93 mmHg, 0.076 inHg)	0.26 kPa (1.93 mmHg, 0.076 inHg)	0.31 kPa (2.36 mmHg, 0.093 inHg)	0.37 kPa (2.78 mmHg, 0.109 inHg)

If not judged OK or NG, repeat the diagnosis until judged OK or NG.



(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
(A) Normal condition: mehcanical control
(B) Under the diagnosis electronic control
(C) Duty control



(A) Fuel tank pressure
(B) Negative pressure
(C) Small leakage
(D) Threshold value
(E) Diagnosis start
(F) Mode Z
(G) Mode A
(H) Mode B
(I) Mode C
(J) Mode D
(K) Mode E

• 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	< 0.36 kPa (2.72 mmHg, 0.11 inHg)	P1443

• Time Needed for Diagnosis:

0.04-inch:	30 — 100 seconds
0.02-inch:	30 — 100 seconds

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous drive 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

Atmospheric purge solenoid function malfunction; Open the pressure control solenoid valve.

9. ECM OPERATION AT DTC SETTING

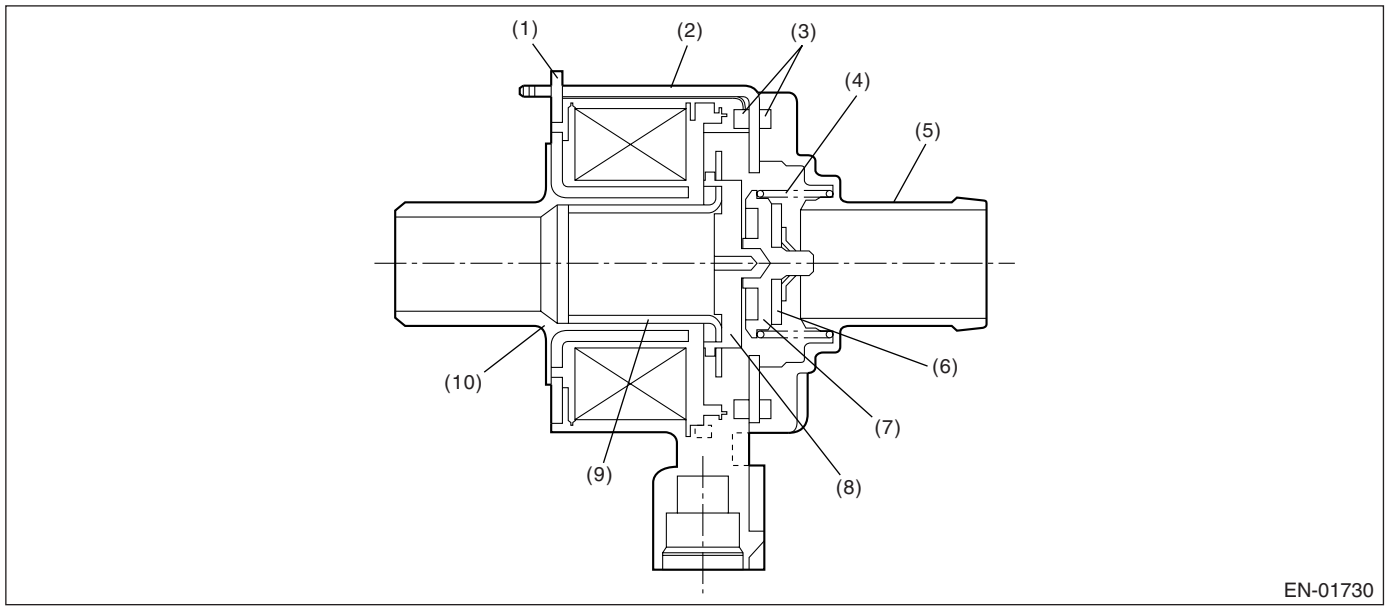
- Memorize the freeze frame data. (For test mode $02)
- Memorize the diagnostic value and trouble standard value. (For test mode $06)

BB: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 different from 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 Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	1 second or more
Terminal output voltage when ECM sends OFF signal	Low

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	1 second or more
Terminal output voltage when ECM sends 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

PCV control: Open the PCV solenoid.

9. ECM OPERATION AT DTC SETTING

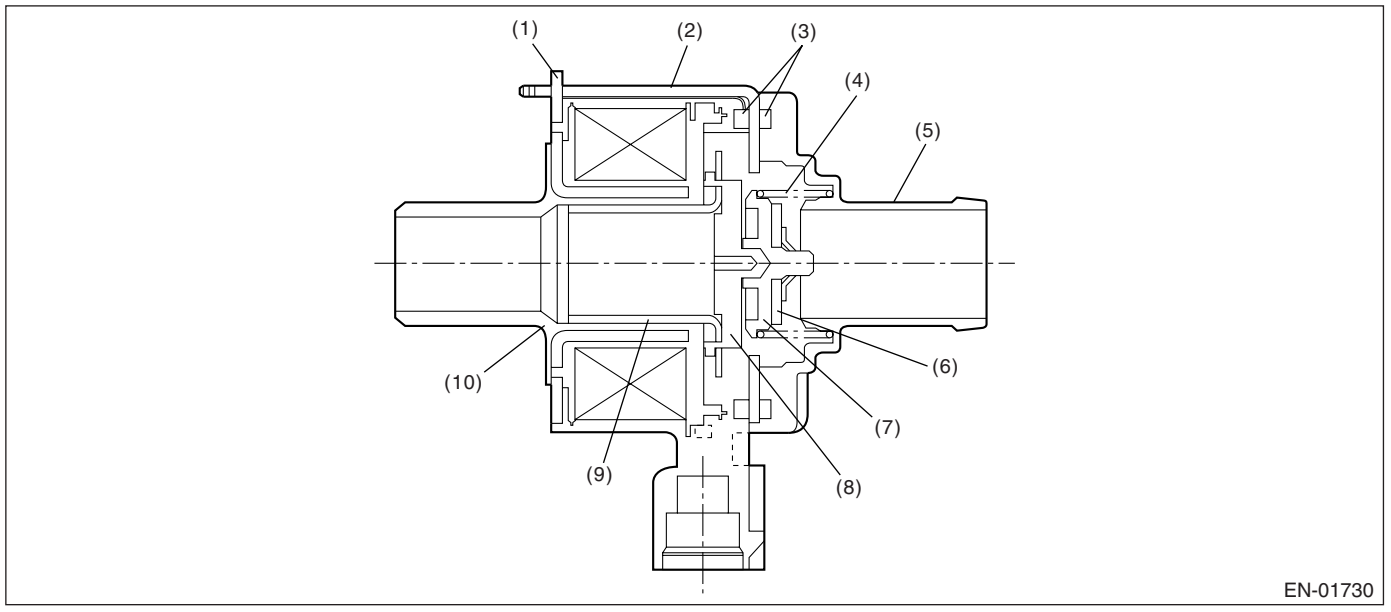
Memorize the freeze frame data. (For test mode $02)

BC:DTC P0448 — EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of drain valve.
Judge NG when the ECM output level is different from 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 Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	1 second or more
Terminal output voltage when ECM sends ON signal	High

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	1 second or more
Terminal output voltage when ECM sends 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

PCV control: Open the PCV solenoid.

9. ECM OPERATION AT DTC SETTING

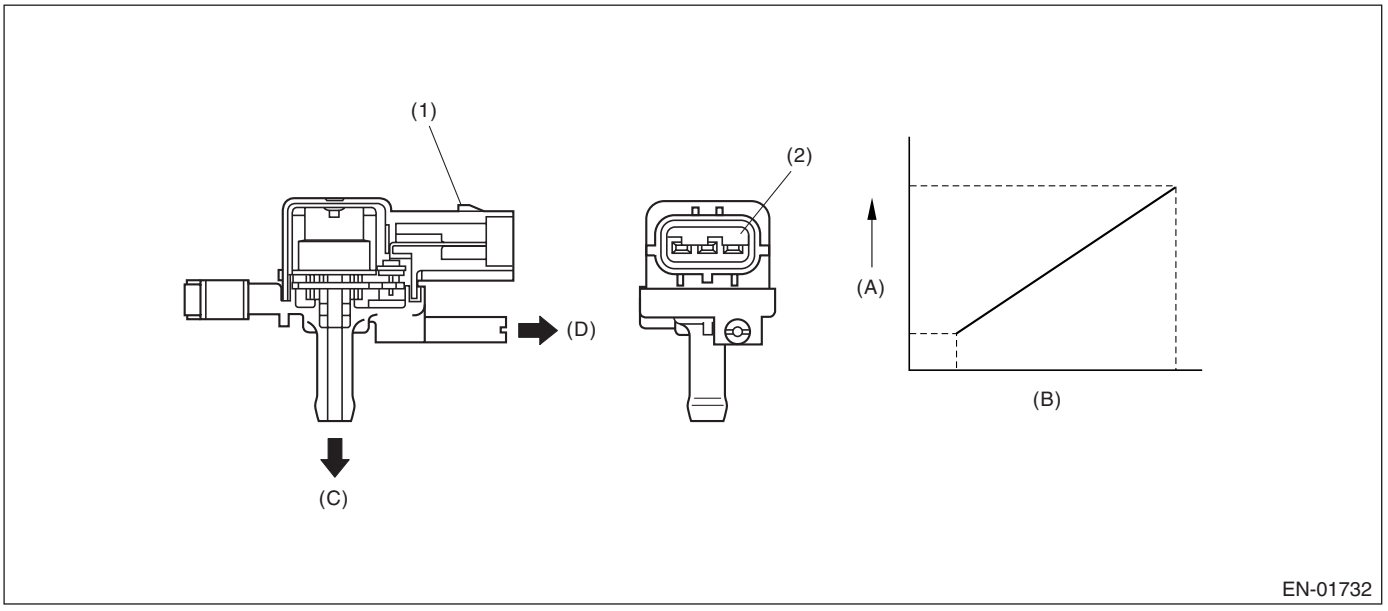
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the tank pressure sensor output property abnormality.
Judge NG when there is no pressure variation, which should exist in the tank, considering the engine status.

2. COMPONENT DESCRIPTION



(1) Connector
(2) Terminal
(A) Output voltage
(B) Input voltage
(C) To fuel tank
(D) To atmospheric pressure switching solenoid

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After starting engine	60 second or more
Fuel level	≥ 9.6 ℓ (10.1 US gal, 8.4 Imp gal)
Fuel temperature	< 35°C (95°F)
Battery voltage	≥ 10.9 V
Atmospheric pressure	> 75.1 kPa (563 mmHg, 22.2 inHg)
Engine speed	< 6500 rpm
Purge control solenoid valve ON/OFF	Experienced

4. GENERAL DRIVING CYCLE

- Perform the diagnosis continuously in 60 seconds or more after starting the engine.
- Be sure to check the fuel level and fuel temperature.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Number of times when the difference between the Max. fuel level and the Min., fuel level every 60 seconds is 5 ℓ (0.53 US gal, 0.44 Imp gal) or more (with enable condition completed)	≥ 16 times
Max. – Min. tank pressure (with enable condition completed)	< 0.05 kPa (0.375 mmHg, 0.02 inHg)
Max. – Min. fuel temperature (with enable condition completed)	≥ 7°C (44.6 °F)

If the fuel level (Max. – Min.) in every 60 seconds is less than 5 ℓ , extend 60 seconds more and make judgment with the Max. and Min. fuel level in 120 seconds.
If the difference did not appear though the time extended, extend the time (180, 240, 300 seconds) and continue the judgment.
Diagnosis counter will count up when the difference of fuel level (Max. – Min.) is more than 5 ℓ .
Time Needed for Diagnosis: 1 minute × 16 times or more
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in two continuous drive cycles.

• Normality Judgment

Judge OK when the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Max. – Min. tank pressure	≥ 0.05 kPa (0.375 mmHg, 0.02 inHg)

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

Purge control solenoid valve control: Purge fixation mode is prohibited.

9. ECM OPERATION AT DTC SETTING

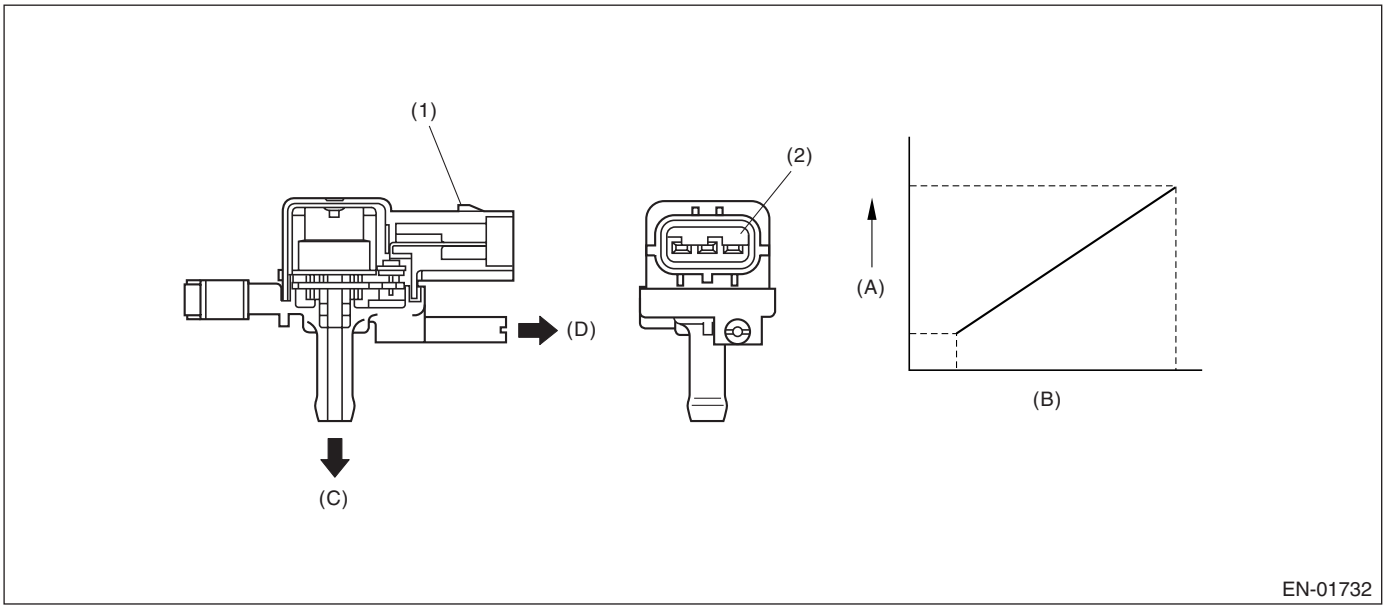
Memorize the freeze frame data. (For test mode $02)

BE:DTC P0452 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel 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 atmospheric pressure switching solenoid

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 15 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< –7.44 kPa (–55.85 mmHg, –2.12 inHg)

Time Needed for Diagnosis: 15 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK when the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≥ –7.33 kPa (–55 mmHg, –2.17 inHg)
Feedback lambda coefficient	≥ 0.9

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

Purge control solenoid valve control: Purge fixation mode is prohibited.

9. ECM OPERATION AT DTC SETTING

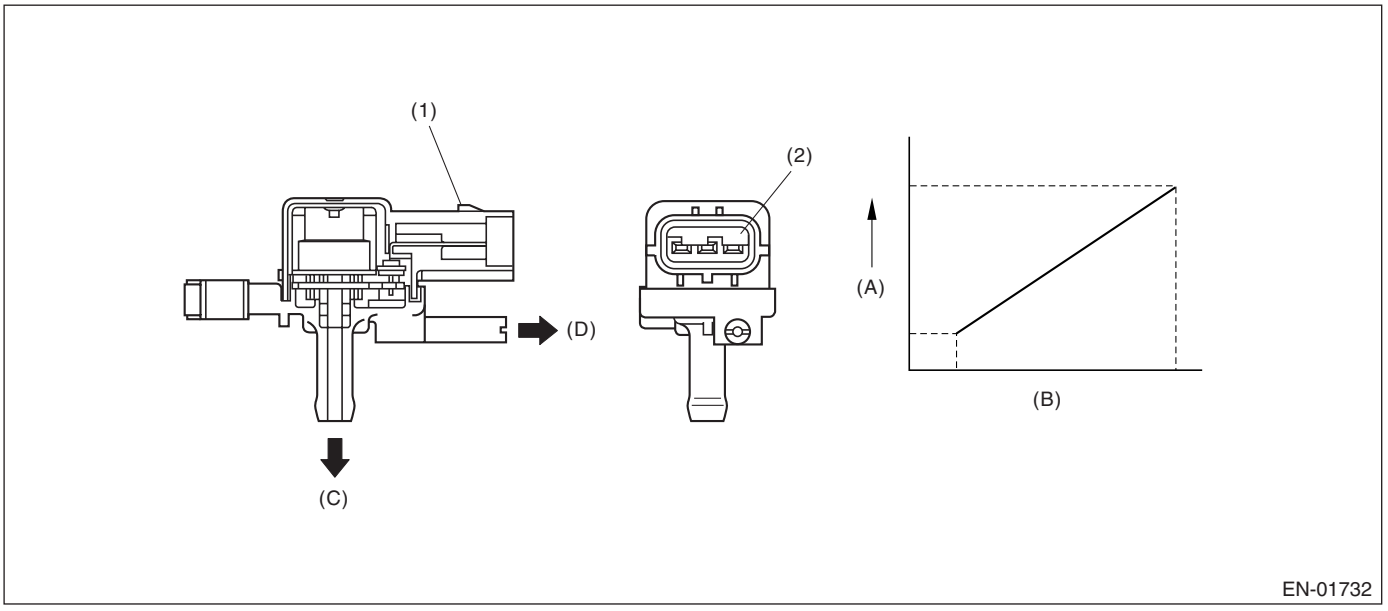
Memorize the freeze frame data. (For test mode $02)

BF:DTC P0453 — EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the breaking/shortage of the fuel 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 atmospheric pressure switching solenoid

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Continuous time when all conditions are completed.	≥ 5 seconds
Vehicle speed	≥ 2 km/h (1.24 MPH)
All conditions of EVAP canister purge	Complete
Evaporation gas density learning value	≤ 0.08
Main feedback compensation coefficient	≥ 0.9
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when purging.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below becomes more than 15 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≥ 7.98 kPa (59.85 mmHg, 2.36 inHg)
Fuel temperature	< 35°C (95°F)
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)

Time Needed for Diagnosis: 15 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK when the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< 7.33 kPa (55 mmHg, 2.17 inHg)

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

Purge control solenoid valve control: Purge fixation mode is prohibited.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BG: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(H4DOTC)-123, DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK) —.>

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

1. OUTLINE OF DIAGNOSIS

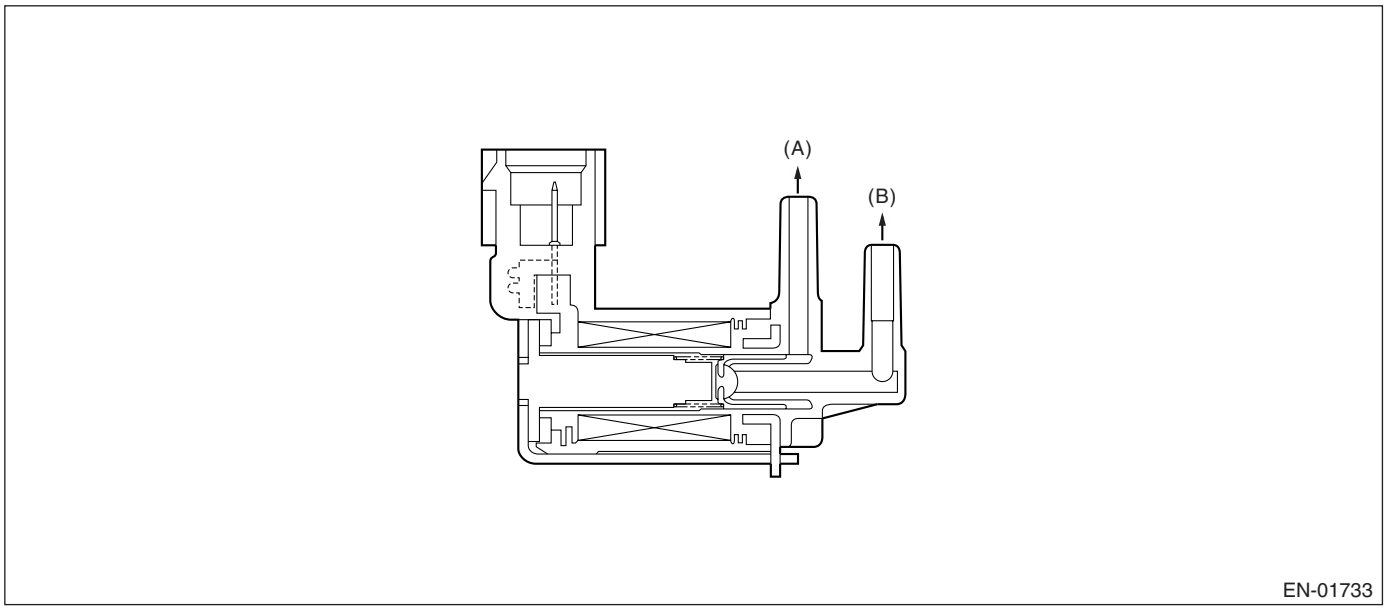
For detecting conditions, refer to DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK). <Ref. to GD(H4DOTC)-123, DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK) —.>

BI: DTC P0458 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of purge control solenoid valve.
Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A) To canister
(B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	1 second or more

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of completing criteria below.	≥ 2.5 seconds
Duty ratio of 'ON'	< 75%
Terminal output voltage	Low

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear NG when the malfunction criterion below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	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

None

9. ECM OPERATION AT DTC SETTING

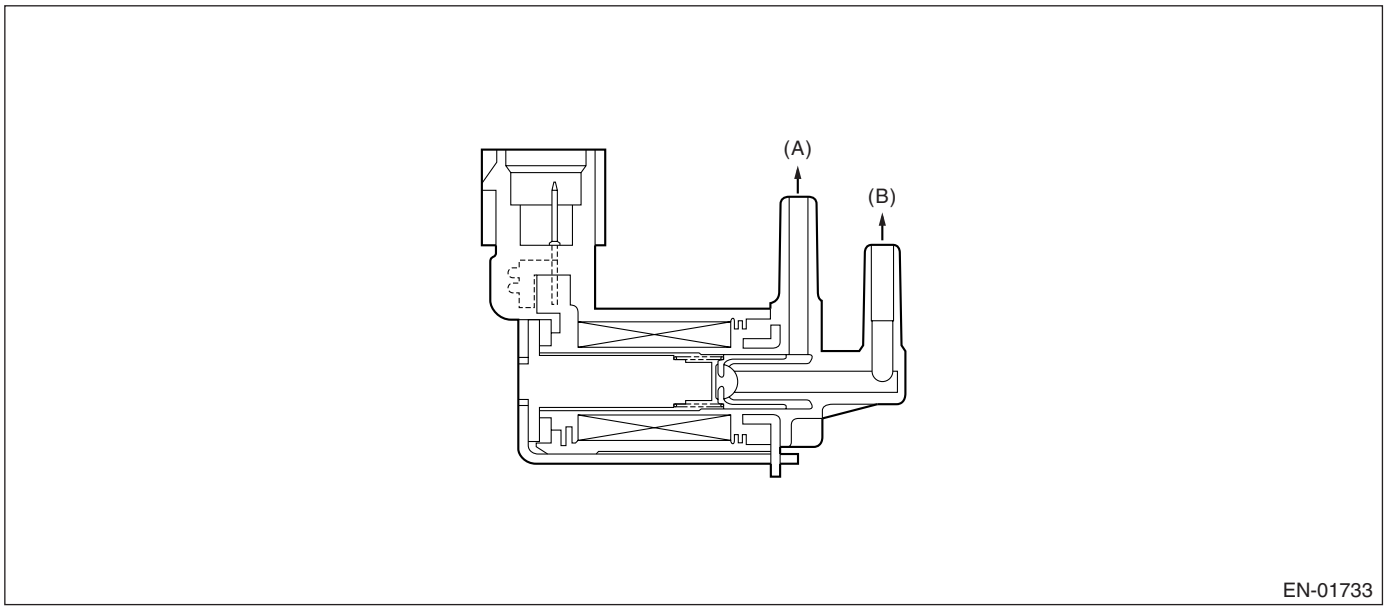
Memorize the freeze frame data. (For test mode $02)

BJ:DTC P0459 — EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of purge control solenoid valve.
Judge NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A) To canister (B) To intake manifold

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	1 second or more

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of completing criteria below.	≥ 2.5 seconds
Duty ratio of 'ON'	≥ 25%
Terminal output voltage	High

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 NG when the malfunction criterion below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	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

None

9. ECM OPERATION AT DTC SETTING

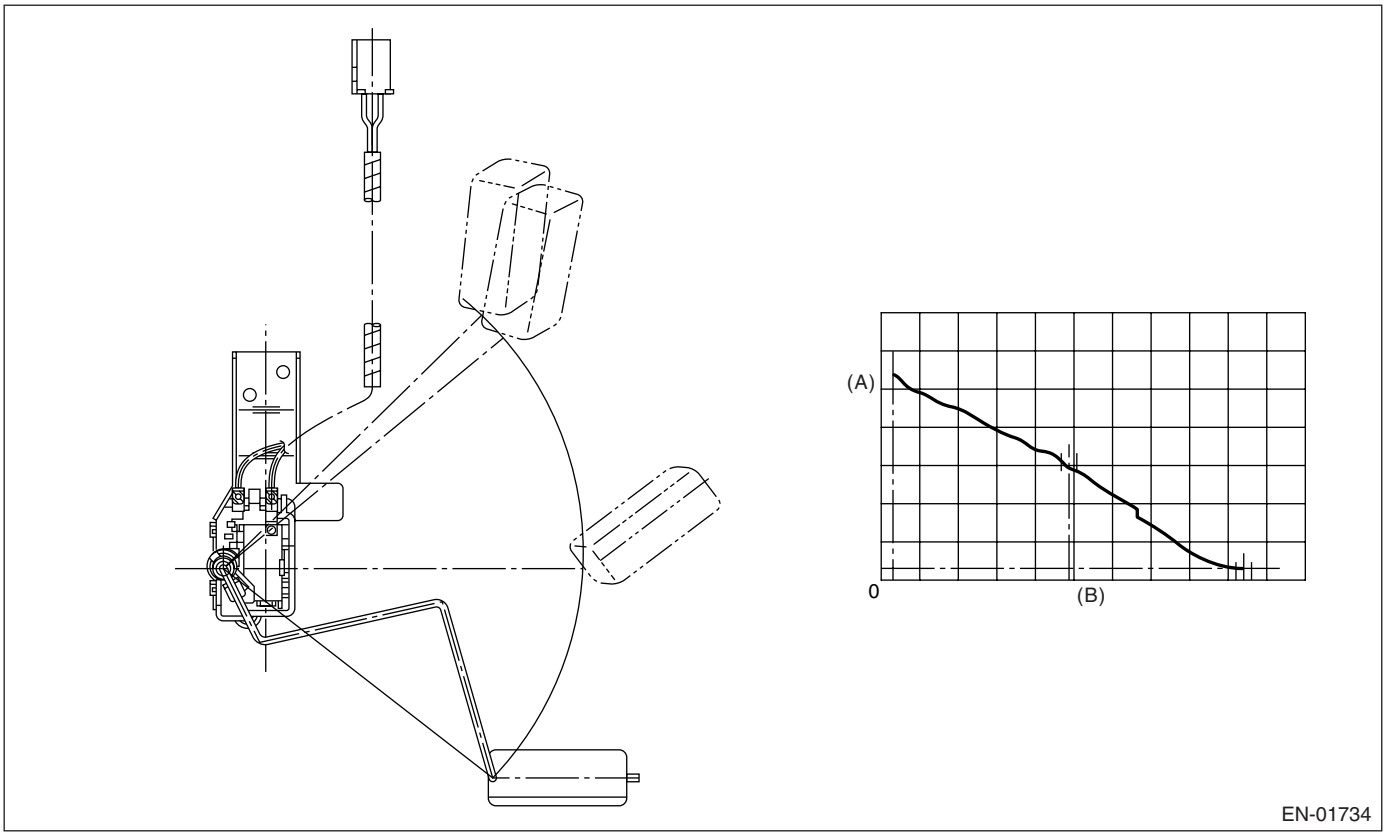
Memorize the freeze frame data. (For test mode $02)

BK:DTC P0461 — FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel level sensor output property.
Judge NG when the fuel level does not vary whereas it seemed to vary be in a usual driving speed.

2. COMPONENT DESCRIPTION



(A) Fuel level (L)
(B) Resistance (Ω)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	> 331 kg (729.7 lb)
Max.– Min. fuel level output	< 2.6 ℓ (0.69 US gal, 0.57 Imp gal)
Battery voltage	≥ 10.9 V
After starting engine	More than 10 seconds

Time Needed for Diagnosis: To be determined.
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
Accumulated amount of intake air	> 331 kg (729.7 lb)
Max.– Min. fuel level output	≥ 2.6 ℓ (0.69 US gal, 0.57 Imp gal)
Battery voltage	≥ 10.9 V
After starting engine	More than 10 seconds

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

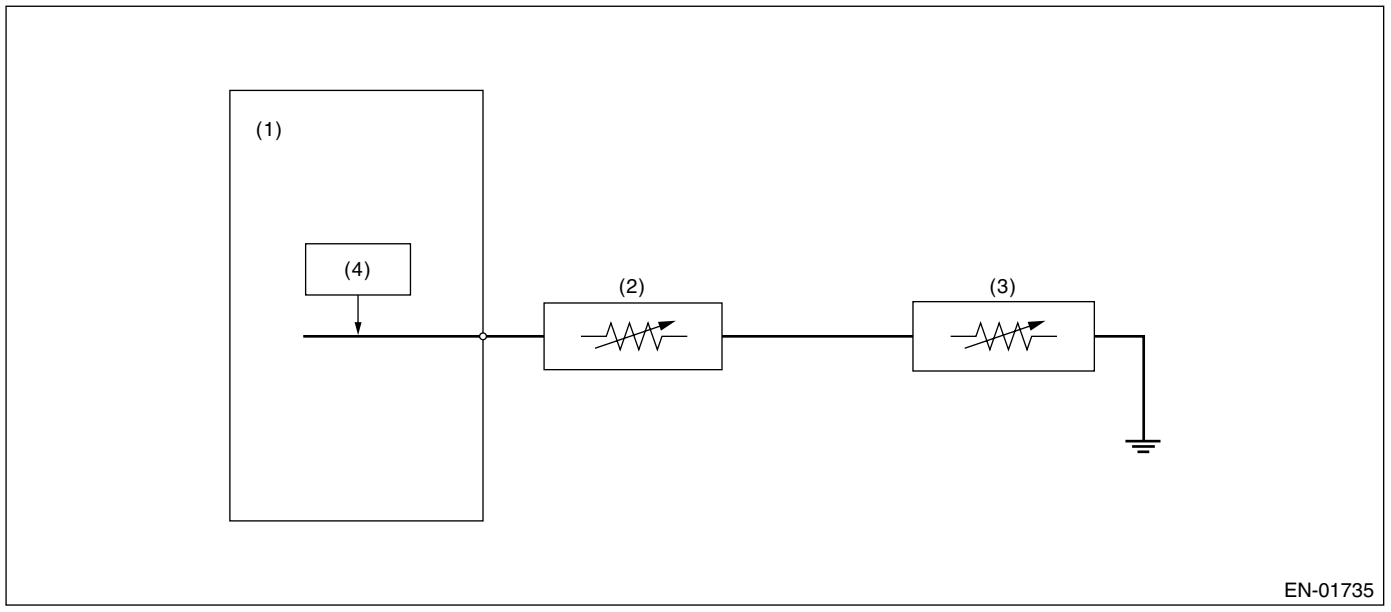
Memorize the freeze frame data. (For test mode $02)

BL: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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (2.5 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	3 seconds or more
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.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	3 seconds or more
Output voltage	≥ 0.02 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

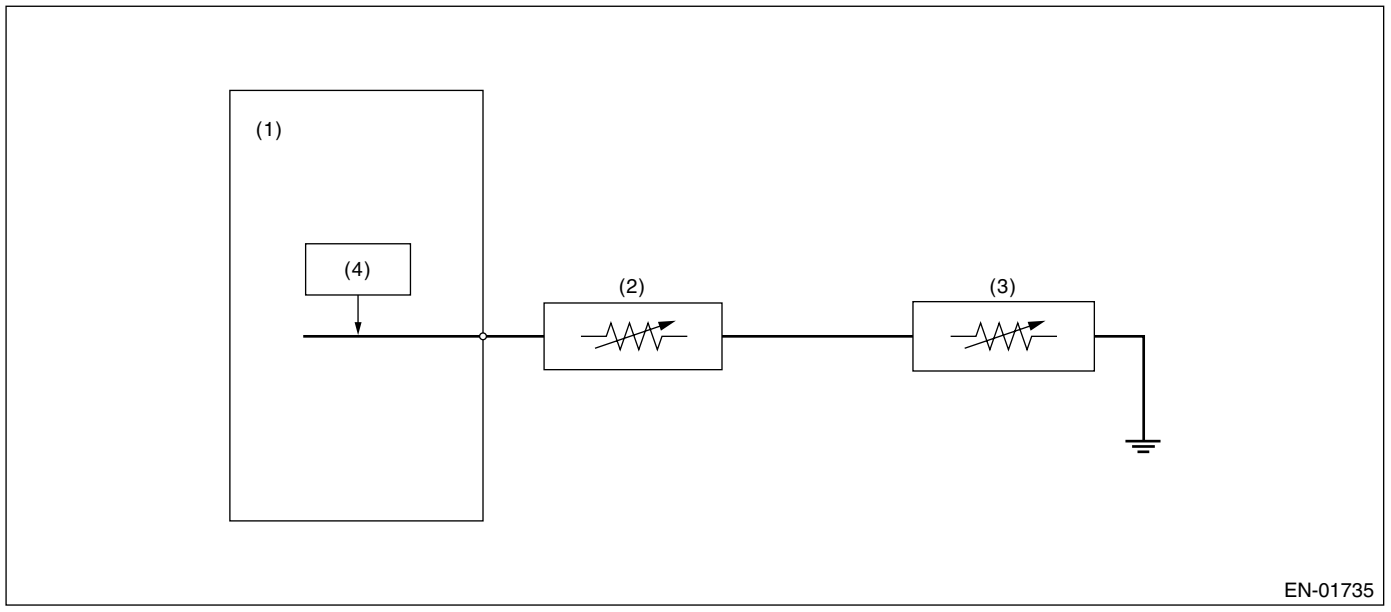
Memorize the freeze frame data. (For test mode $02)

BM: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 Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (1 second).

• Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	3 seconds or more
Output voltage	≥ 4.95 V

Time Needed for Diagnosis: 1 second
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
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	3 seconds or more
Output voltage	< 4.95 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)

BN:DTC P0464 — FUEL LEVEL SENSOR CIRCUIT INTERMITTENT —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of unstable output from fuel level sensor caused by noise.
Judge NG when the max. value and cumulative value of output voltage variation of fuel level sensor is larger than the threshold value.

2. ENABLE CONDITION

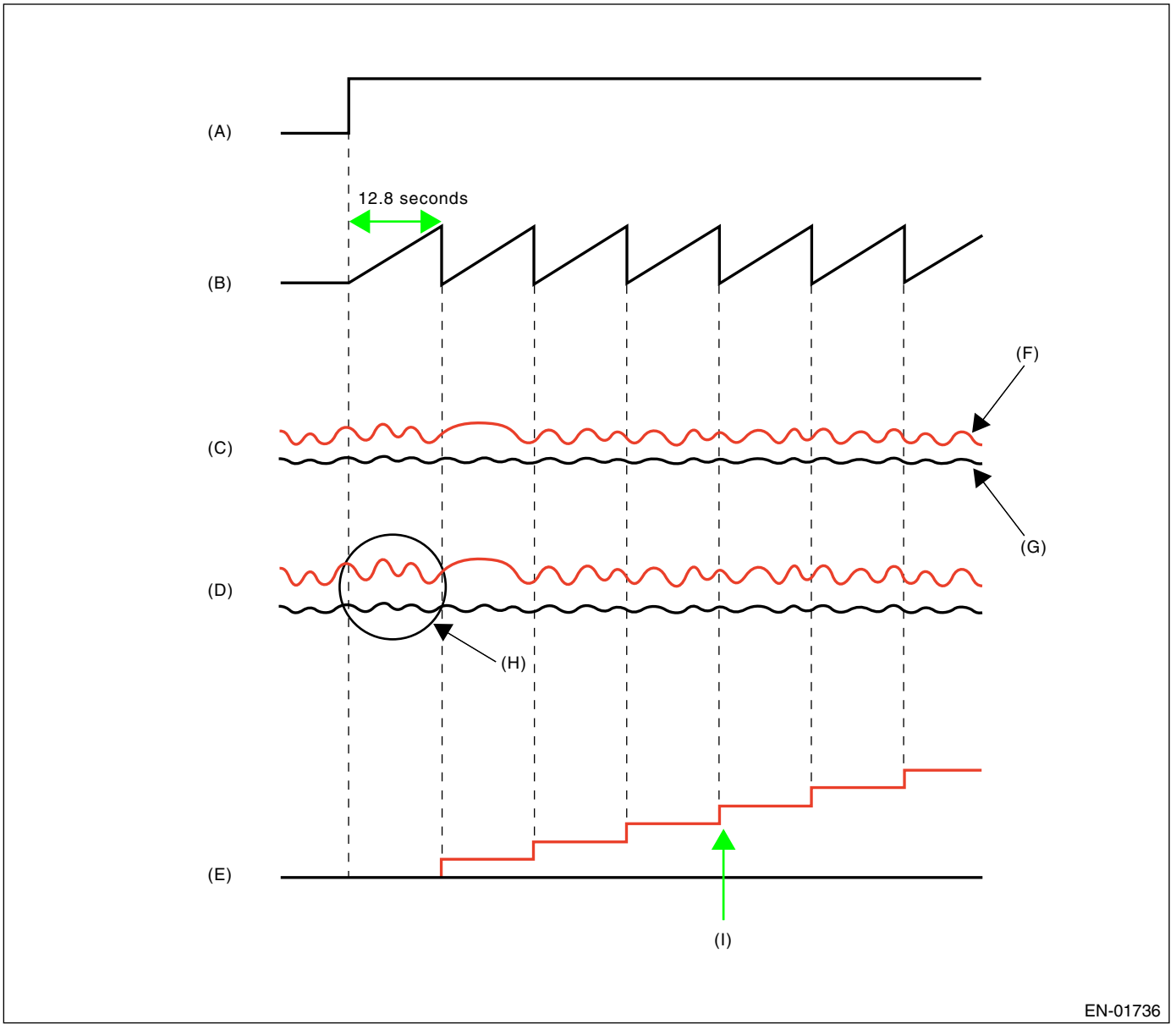
Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm
After starting engine	1 second or more
Ignition switch	ON
Battery voltage	> 10.9 V
Idle switch	ON
Fuel level	9 ←→ 51 ℓ (2.4 ←→ 13.4 US gal, 1.98 ←→ 11.2 Imp gal)
Vehicle speed = 0 km/h (0 MPH)	10 seconds or more

3. GENERAL DRIVING CYCLE

- Perform the diagnosis continuously in idling condition.
- Pay attention to the fuel level.

4. DIAGNOSTIC METHOD

Calculate the Max. value (delflmax) and cumulative value (sumfl) of output voltage variation of fuel level sensor during 12.8 seconds. Judge it normal when both max. and cumulative values are not over the threshold value. Otherwise, when either of them is over the threshold value, count the diagnosis counter up. And judge NG if the counter indicated 6 counts.



(A) Diagnosis condition
(B) Diagnosis time
(C) Fuel level sensor at idle
(D) Amount of fuel level output voltage variation
(E) Diagnosis counter
(F) Malfunction
(G) Normal
(H) Calculate the Max. value (delvfmx) and the cumulative value (sumvfl)
(I) NG at 4 counts

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Integrated times of the condition reaching follows, DELFLMAX ≥ 0.2 V or SUMFL ≥ 19.2 V where, DELFLMAX is Max. deviation of sensor output during 12.8 seconds. SUMFL is integrated value of sensor output deviation during 12.8 seconds.	≥ 4 times

Do not count the diagnosis counter up when the following conditions are completed during 12.8 seconds.

Max – Min of tank pressure during 12.8 seconds	≥ 0.05 kPa (0.375 mmHg, 0.02 inHg)
Max – Min of battery voltage during 12.8 seconds	≥ 0.465 V

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 the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
DELFLMAX	< 0.2 V
SUMFL Where, DELFLMAX is Max. deviation of sensor output during 12.8 seconds. SUMFL is integrated value of sensor output deviation during 12.8 seconds.	< 19.2 V

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)

BO:DTC P0483 — COOLING FAN RATIONALITY CHECK —

1. OUTLINE OF DIAGNOSIS

Detect the function abnormality of the radiator fan.
Judge NG when the engine coolant temperature slowly decreases even when the radiator fan is rotating.

2. ENABLE CONDITION

Diagnostic enable condition is completed if the radiator fan changes from OFF to ON when all of the conditions below are completed. When one of the conditions below is not completed, the diagnostic enable condition is not completed.

Secondary Parameters	Enable Conditions
Engine Speed	500 — 900 rpm
Idle switch	ON
Vehicle speed	0 km/h (0 MPH)
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when idling.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 5 minutes.

• Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	≥ 98°C (208°F)
Radiator fan	OFF → ON
Engine coolant temperature	not reduce

Time Needed for Diagnosis: 5 minutes
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Radiator fan	OFF → ON
Engine coolant temperature	reduce

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)

BP:DTC P0502 — VEHICLE SPEED SENSOR CIRCUIT LOW INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of vehicle speed sensor.
Judge NG when low vehicle speed (0 km/h (0 MPH)) remains whereas it seemed to be in a usual driving speed.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	< 4000 rpm
Fuel cut in decel.	In operation
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously during fuel cut in deceleration at engine speed of 4000 rpm or less.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 4 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Vehicle speed	< 1

Time Needed for Diagnosis: 4 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when all malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Vehicle speed	≥ 1
Starter switch	OFF
Time after starter switch ON → OFF	≥ 3 seconds

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

- Accelerator sensor signal process: Not allowed all closed points learning.
- Vehicle speed sensor signal process: Vehicle speed = 10 km/h (6 MPH)
- Fuel cut control: Not allowed vehicle speed 0 km/h (0 MPH) fuel cut. Normally the high vehicle speed fuel cut performs on “and” of vehicle speed condition and engine speed, but perform the fuel cut only on engine speed condition (4,800 rpm or more).
- ISC control: Set the open loop compensation to specified value (1 g (0.04 oz)/s). Not allowed ISC feedback volume calculation.
- Air conditioner control: Not allowed air conditioner cut at accelerating.
- Radiator fan control: Hi drive both main/sub.
- Judge gear ratio: Control as gear fixed on 6th.
- Tumble generator valve control: Open the tumble generator valve.

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BQ:DTC P0503 — VEHICLE SPEED SENSOR INTERMITTENT/ERRATIC/HIGH —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of vehicle speed sensor.
Judge NG when high vehicle speed (300 km/h (186 MPH) or more) remains whereas it seemed to be in a usual driving speed.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	< 4000 rpm
Fuel cut in decel.	In operation
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously during fuel cut in deceleration at engine speed of 4000 rpm or less.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time of completing the malfunction criteria below becomes more than 4 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Vehicle speed	≥ 300

Time Needed for Diagnosis: 4 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when all malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Vehicle speed	< 300
Starter switch	OFF
Time after starter switch ON → OFF	≥ 3 seconds

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

- Accelerator sensor signal process: Not allowed all closed points learning.
- Vehicle speed sensor signal process: Vehicle speed = 10 km/h (6 MPH)
- Fuel cut control: Not allowed vehicle speed 0 km/h (0 MPH) fuel cut. Normally the high vehicle speed fuel cut performs on “and” of vehicle speed condition and engine speed, but perform the fuel cut only on engine speed condition (4,800 rpm or more).
- ISC control: Set the open loop compensation to specified value (1 g (0.04 oz)/s). Not allowed ISC feedback volume calculation.
- Air conditioner control: Not allowed air conditioner cut at accelerating.
- Radiator fan control: Hi drive both main/sub.
- Judge gear ratio: Control as gear fixed on 6th.
- Tumble generator valve control: Open the tumble generator valve.

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BR:DTC P0506 — IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling.
Judge NG when actual engine speed is not close to target engine speed during idling.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75°C (167°F)
Battery voltage	≥ 10.9 V
Atmospheric pressure	> 75.1 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 9 ℓ (2.38 US gal, 1.98 Imp gal)
After starting engine	10 seconds or more
Feedback in ISC	In operation
Measured lambda	0.90 ←→ 1.1
After air condition switching ON-OFF, OFF-ON	5 seconds or more
After in-manifold pressure change more than 4 kPa (30 mmHg, 1.2 inHg)	> 5 seconds
After neutral switch ON-OFF event	> 5 seconds
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously during idling, 10 seconds after starting and warming up.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time of completing the malfunction criterion below becomes more than the time needed for diagnosis (10 seconds × 3 times).

• Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	< –100 rpm
Feedback correction for idle air control solenoid valve	Max.

Time Needed for Diagnosis: 10 seconds × 3 times
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear NG when the continuous time of completing the malfunction criterion below becomes more than the time needed for diagnosis (10 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Actual – target engine speed	≥ –100 rpm

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

Judgment of heavy fuel: Not allowed to make the judgment of heavy fuel.
Knock compensation:

- Knock compensation final retard/advance value: Knock compensation value + Total learning compensation value + Partial learning compensation value
- AT normal: Knock compensation value = Fixed on 0°CA
- AT abnormal: Knock compensation value ≠ Fixed on 0°CA (Maximum 12°CA retard on knocking)
- Not allowed to refresh learning compensation coefficient
- Not allowed to calculate partial learning zone compensation value

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BS:DTC P0507 — IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that actual engine speed is not close to target engine speed during idling.
Judge NG when actual engine speed is not close to target engine speed during idling.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75°C (167°F)
Battery voltage	≥ 10.9 V
Atmospheric pressure	> 75.1 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 9 ℓ (2.38 US gal, 1.98 Imp gal)
After starting engine	10 seconds or more
Feedback in ISC	In operation
Lambda	0.90 ←→ 1.1
After air condition switching ON-OFF, OFF-ON	5 seconds or more
After in-manifold pressure change more than 4 kPa (30 mmHg, 1.2 inHg)	> 5 seconds
After neutral switch ON-OFF event	> 5 seconds
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously during idling, 10 seconds after starting and warming up.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criterion below becomes more than the time needed for diagnosis (10 seconds × 3 times).

• Judgment Value

Malfunction Criteria	Threshold Value
Actual – target eng. speed	≥ 200 rpm
Feedback correction for idle air control solenoid valve	Min.

Time Needed for Diagnosis: 10 seconds × 3 times
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear NG when the continuous time of completing the malfunction criterion below becomes more than the time needed for diagnosis (10 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Actual – target eng. speed	< 200 rpm

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

Judgment of heavy fuel: Not allowed to make the judgment of heavy fuel.
Knock compensation:

- Knock compensation final retard/advance value: Knock compensation value + Total learning compensation value + Partial learning compensation value
- AT normal: Knock compensation value = Fixed on 0°CA
- AT abnormal: Knock compensation value ≠ Fixed on 0°CA (Maximum 12°CA retard on knocking)
- Not allowed to refresh learning compensation coefficient
- Not allowed to calculate partial learning zone compensation value

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

BT:DTC P0512 — STARTER REQUEST CIRCUIT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.
Judge ON NG when the starter SW signal remains to be on.
Judge OFF NG when the engine starts without starter experience.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 3 minutes.

• Judgment Value

Malfunction Criteria	Threshold Value
Engine speed	> 500 rpm
Starter OFF signal	Not detected
Battery voltage	> 8 V

Time Needed for Diagnosis: 180 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge ON OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Starter SW	OFF
Battery voltage	> 8 V

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)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction that engine speed increases more than that in normal condition during idling.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Feedback in ISC	In operation
Vehicle speed	< 4 km/h (2.49 MPH)
After engine starting	1 seconds or more

3. GENERAL DRIVING CYCLE

Always perform diagnosis at less than 4 km/h (2.49 MPH) of vehicle speed.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the all malfunction criteria below becomes more than the time needed for diagnosis (2 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Engine speed – target eng. speed	≥ 1000 rpm
Feedback value for ISC	≤ 0%
Engine speed change every 180 degree engine rev.	≥ –5 rpm

Time Needed for Diagnosis: 2 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.
Judge OK and clear NG when the continuous time until completing the malfunction criteria below becomes more than the time needed for diagnosis (5 seconds).

• Normality Judgment

Judge OK and clear NG when the continuous time until completing the malfunction criteria below becomes more than the time needed for diagnosis (5 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Engine speed – target eng. speed	< 200 rpm

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

Fuel shut-off: Shut-off fuel for only #1 and #2 cylinder, or for all cylinder in accordance with vehicle speed, engine speed, throttle position

8. ECM OPERATION AT DTC SETTING

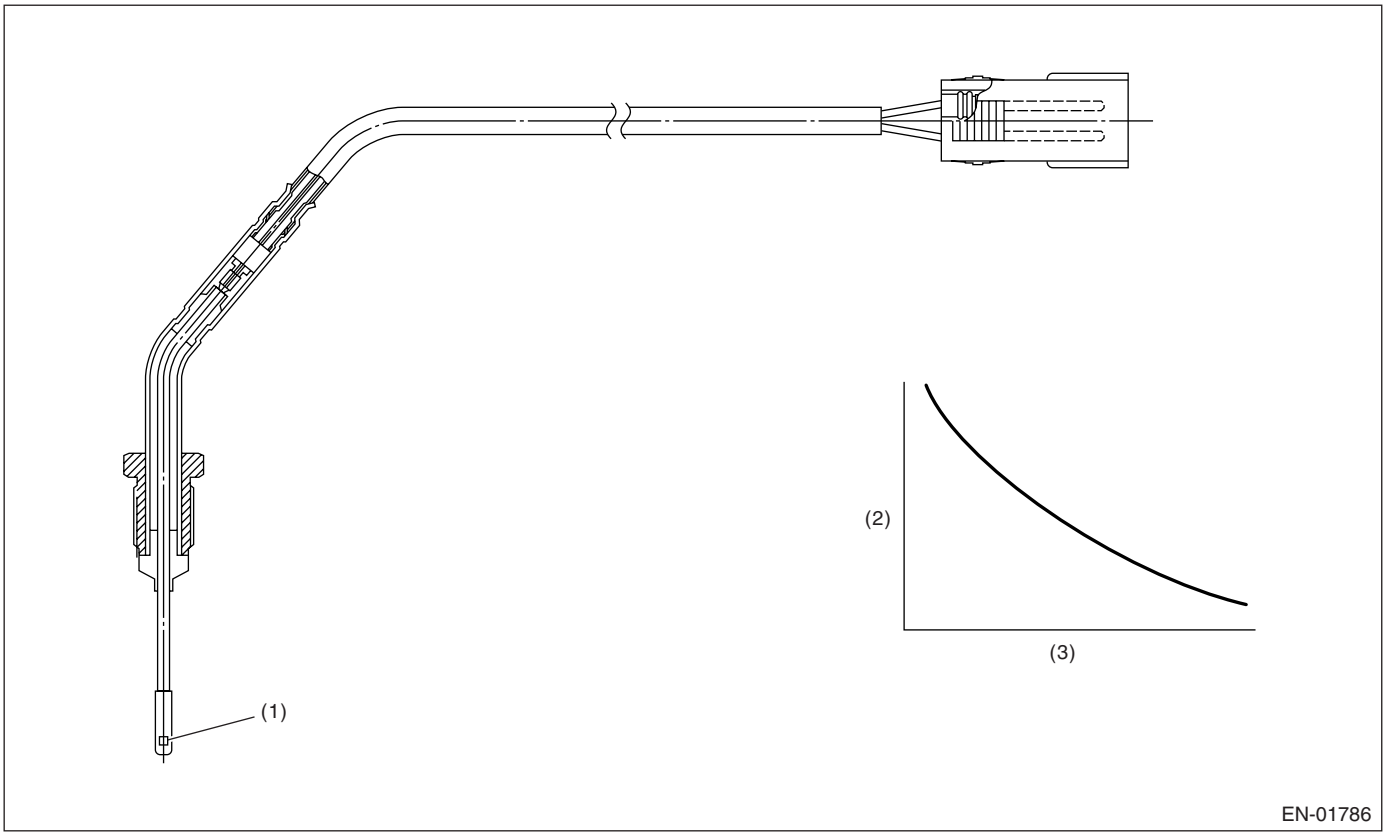
Memorize the freeze frame data. (For test mode $02)

BV:DTC P0545 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT LOW-BANK 1 —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of exhaust temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Thermistor (2) Resistance value (kΩ) (3) Exhaust temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (5 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
Sensor output voltage	< 0.15 V
Amount of intake air	< 100 g (3.53 oz)/s

Time Needed for Diagnosis: 5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Sensor output voltage	≥ 0.15 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

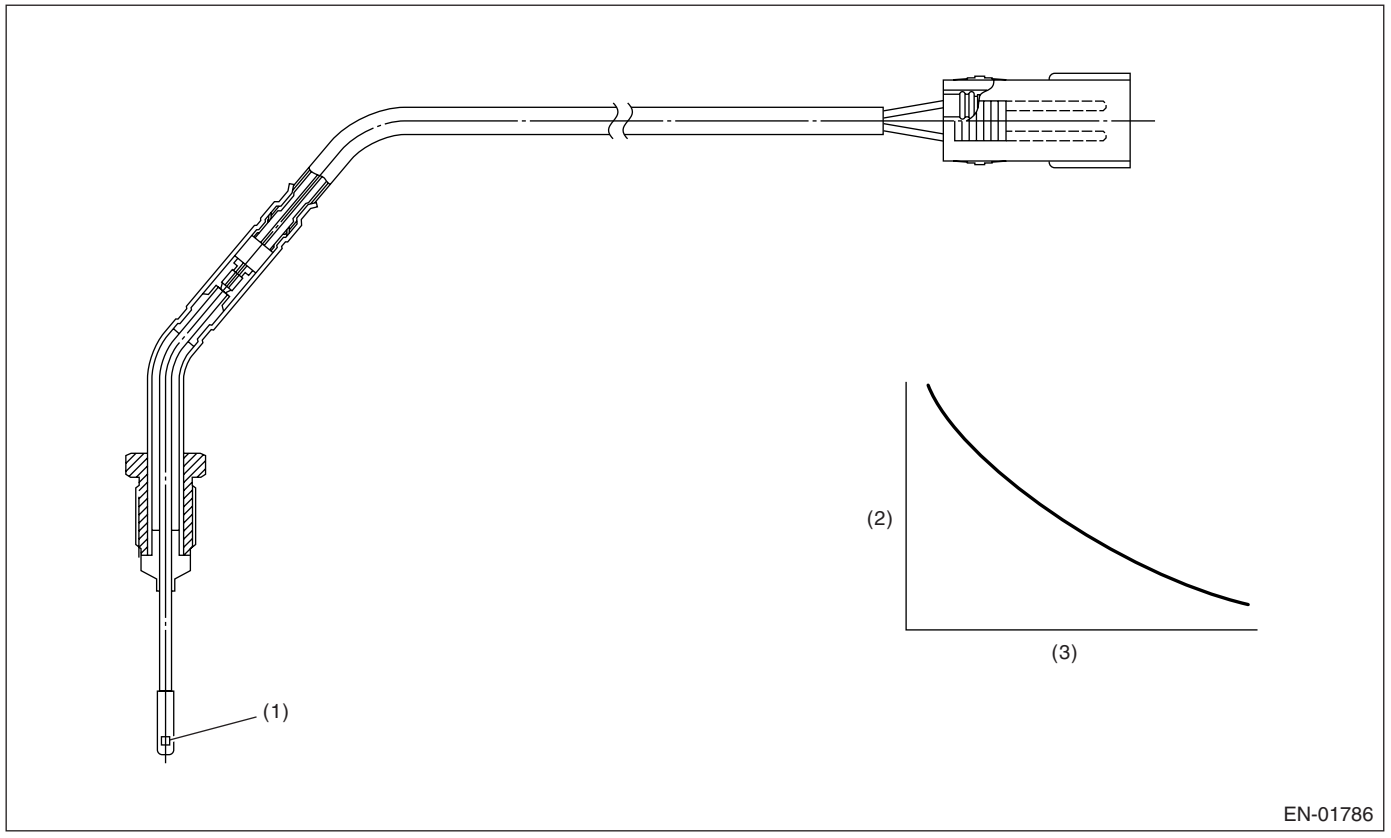
Memorize the freeze frame data. (For test mode $02)

BW:DTC P0546 — EXHAUST GAS TEMPERATURE SENSOR CIRCUIT HIGH-BANK 1 —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of exhaust temperature sensor.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Thermistor (2) Resistance value (kΩ) (3) Exhaust temperature °C (°F)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time of completing the malfunction criteria below becomes more than the time needed for diagnosis (30 seconds).

• Judgment Value

Malfunction Criteria	Threshold Value
After starting engine	240 seconds or more
Engine coolant temperature	≥ 75°C (167°F)
Vehicle speed	≥ 65 km/h (40.4 MPH)
Engine speed	≥ 1800 rpm
Engine load (gn)	≥ 0.6 g (0.021 oz)/rev
Fuel cut event	Not in operation
After the recovery from fuel cut event	30 seconds or more
Sensor output voltage	≥ 4.72 V

Time Needed for Diagnosis: 30 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Sensor output voltage	< 4.72 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)

BX:DTC P0600 — CAN COMMUNICATION CIRCUIT—

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of CAN communication.
It judges as NG when CAN communication becomes impossible, the CAN communication with AT becomes impossible, and the data from AT is not normal.

2. COMPONENT DISCRIPTION

CAN connects between ECU and TCU with high speed.

(Common Specification)
CAN PROTCOL 2.0B (active)
Frame format: 11 bit ID Frame (Standard frame)
(High Speed CAN)
ISO 11898 compliance
Communication Speed: 500 kbps

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery Voltages	≥ 10.9 V
Starter switch	OFF
Engine	run

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

• JUDGMENT OF MALFUNCTION

It judges as NG if any of the following conditions are judged as NG. It judges as OK if all of the following conditions are judged as OK within 1s, and the NG memory is cleared.

• Judgement Value

Malfunction Criteria	Threshold Value
Buss off flag or warning flag	Set
ID cannot be received from TCU	= 500 m/s

Time needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates simultaneously when malfunction is detected.

6. DTC CLEAR CONDITION

When the OK driving cycle was completed 40 consecutive times.
When “Clear Memory” was performed.

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 consecutive times.
- When “Clear Memory” was performed.

8. FAIL-SAFE

The angle operation of accelerator position sensor demand target throttle opening calculation

9. ECM OPERATING AT DTC SETTING

Store the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the function abnormality of the micro-computer (RAM).
Write zero to all area of RAM. After the zero initialization, judge NG when the result of addition of all values in area of RAM is not zero.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	OFF → ON

Perform the diagnosis in the initial routine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis immediately after IG key SW is turned ON.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below is completed, and judge OK when it is not completed.
Judgment Value

Malfunction Criteria	Threshold Value
Result of RAM data addition, after zero initialization	Except zero

Time Needed for Diagnosis: To be determined.
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

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)

BZ:DTC P0605 — INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR —

1. OUTLINE OF DIAGNOSIS

Judge NG when SUM value of ROM is out of the standard value.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge OK and clear NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
SUM value of ROM	Standard value

Time Needed for Diagnosis: 0.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

5. DTC CLEAR CONDITION

- When the OK idling cycle was completed 40 times in a row
- When “Clear Memory” was performed (Only at engine stop)

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

Stop the current to electric control throttle motor. (Fix the throttle opening angle to 6°.)

8. ECM OPERATION AT DTC SETTING

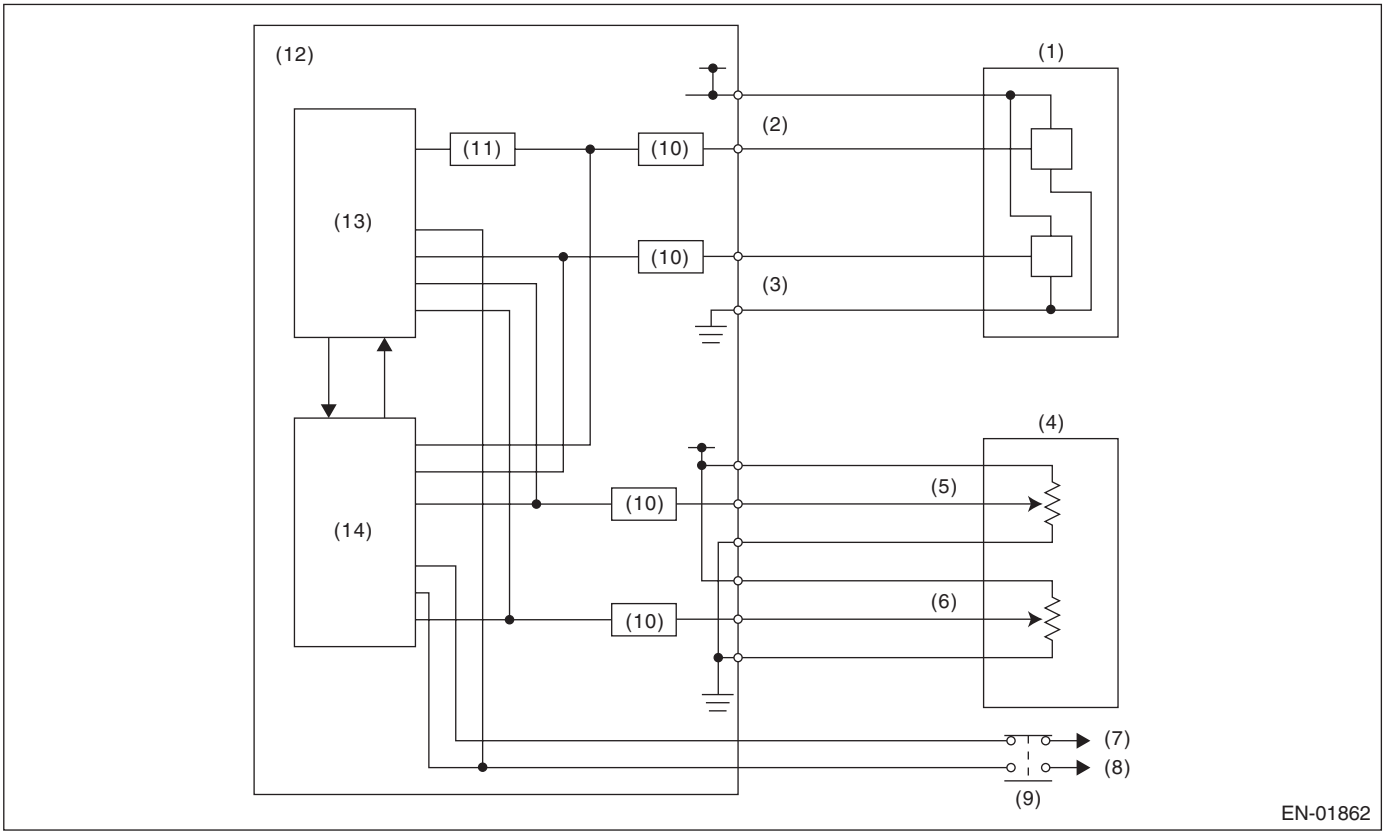
Memorize the freeze frame data. (For test mode $02)

CA:DTC P0607 — CONTROL MODULE PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Judge NG when either the following is completed.
- When the read value of throttle position sensor 1 signal is mismatched between main CPU and sub CPU.
- When the read value of accelerator position sensor 1 signal is mismatched between main CPU and sub CPU.
- When the sub CPU operates abnormally.
- When the communication between main CPU and sub CPU is abnormal.
- When the input amplifier circuit of throttle position sensor 1 is abnormal.
- When the cruise control cannot be canceled correctly.
- When the signal of brake SW1 and 2 is mismatched.
- When the directed angle from main CPU is abnormal.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor
(2) Throttle position sensor 1
(3) Throttle position sensor 2
(4) Accelerator pedal position sensor
(5) Accelerator pedal position sensor 1
(6) Accelerator pedal position sensor 2
(7) Battery
(8) Stop light
(9) Brake switch
(10) I/F circuit
(11) Amplifier circuit
(12) Engine control module (ECM)
(13) Sub CPU
(14) Main CPU

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
(1) Ignition switch	ON
(2) Ignition switch	ON
(3) None	—
(4) None	—
(5) Throttle opening angle	
(6) Brake SW (with cruise control)	ON
(7) None	—
(8) Cruise control	OFF

4. GENERAL DRIVING CYCLE

(1) — (4): Always perform the diagnosis continuously.
(5): Always perform the diagnosis continuously on idling.
(6): Perform the diagnosis when the brake pedal is depressed.
(7): Always perform the diagnosis continuously.
(8): Always perform the diagnosis continuously when the cruise control pedal is not operating.

5. DIAGNOSTIC METHOD

Judge OK and clear NG when the malfunction criteria below are completed.
Judgment Value

Malfunction Criteria	Threshold Value
(1) Difference of CPU on reading value of throttle position sensor signal	Within 0.12 V
(2) Difference of CPU on reading value of accelerator position sensor signal	Within 0.07 V
(3) WD pulse from sub CPU	WD pulse occur
(4) Communication between CPU	Possible to communicate
(5) Difference of signal on connection of amplifier	Within × 4±0.6 V
(6) Cruise control cancel signal at brake ON	Cruise control cancel signal ON
(7) Brake switch 1, 2 signal	SW 1 and 2 are matched
(8) Throttle opening angle directing value	Within the opening angle +3.4° which calculated from accelerator opening angle coefficient.

Time Needed for Diagnosis:
(1) 250 milliseconds
(2) 250 milliseconds
(3) 200 milliseconds
(4) 200 milliseconds
(5) 24 milliseconds
(6) 250 milliseconds
(7) 200 milliseconds
(8) 250 milliseconds
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

Stop the current to electric control throttle motor. (Fix the throttle opening angle to 6°.)

9. ECM OPERATION AT DTC SETTING

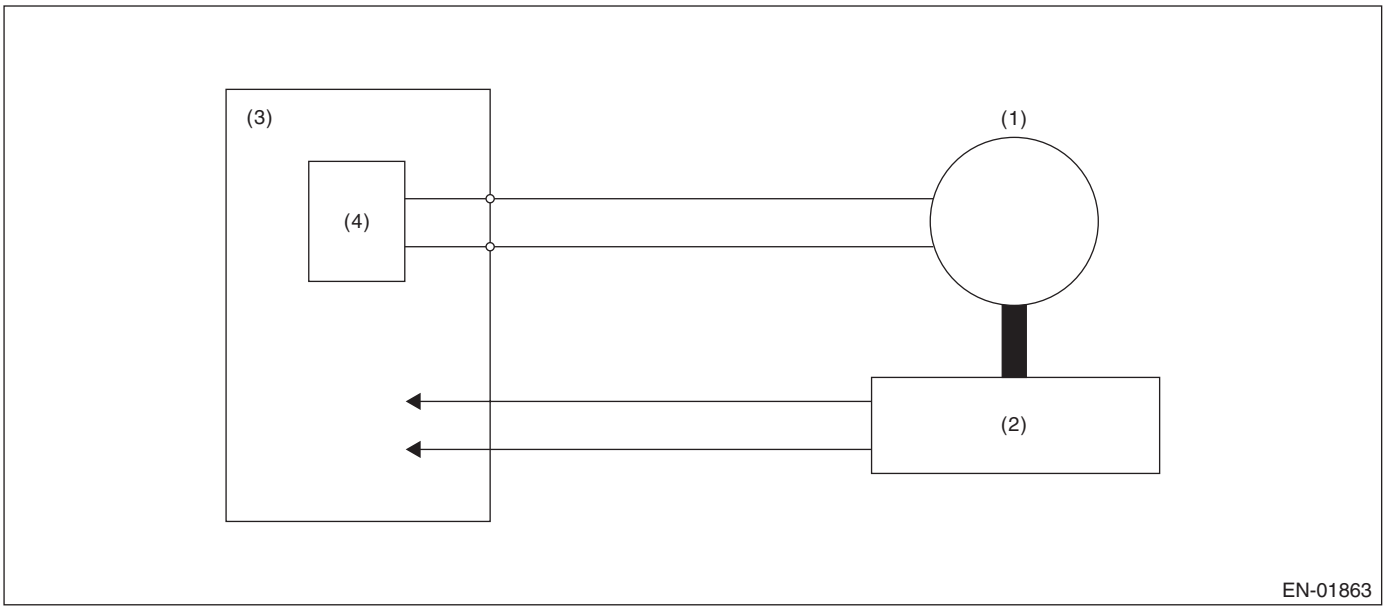
Memorize the freeze frame data. (For test mode $02)

CB:DTC P0638 — THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1) —

1. OUTLINE OF DIAGNOSIS

Judge NG when the target opening angle and actual opening angle is mismatched or the current to motor is more than specified duty for specified time continuously.

2. COMPONENT DESCRIPTION



(1) Motor
(2) Throttle position sensor
(3) Engine control module (ECM)
(4) Drive circuit

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Normal operation of electric control throttle	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously when the electric control throttle is operating.

5. DIAGNOSTIC METHOD

Judge OK and clear NG when the malfunction criteria below are completed.

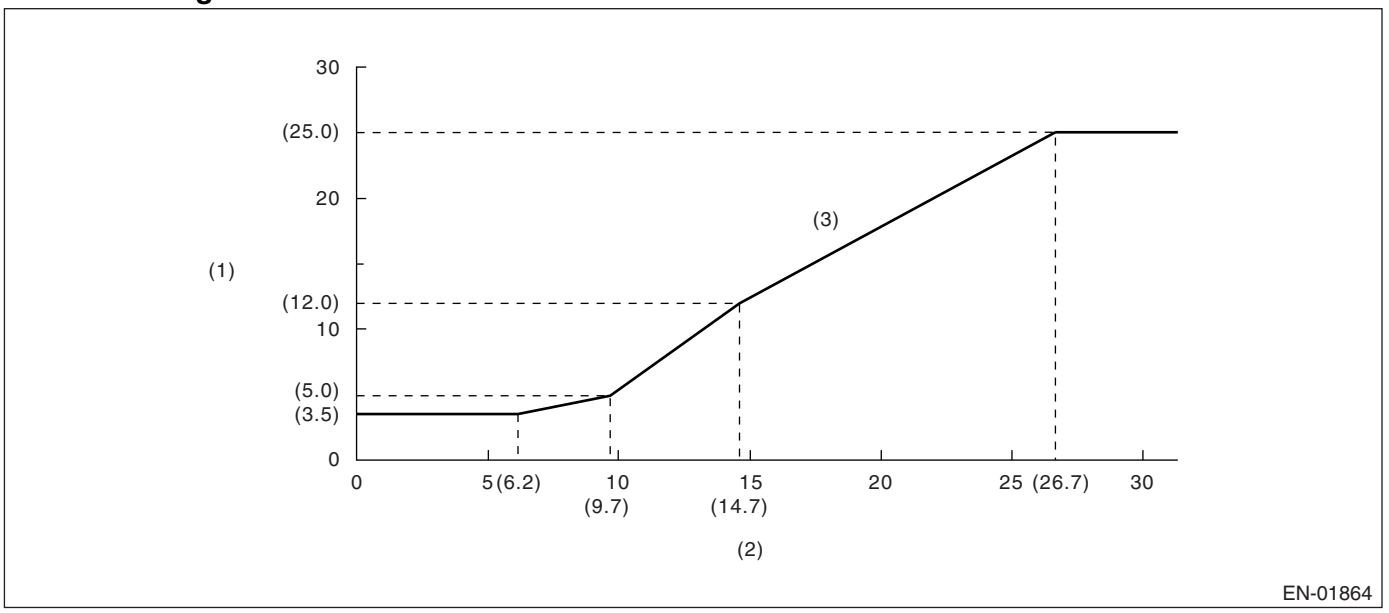
Judgment Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	Less than 3.5°
Output duty to drive circuit	Less than 95%

Time Needed for Diagnosis:

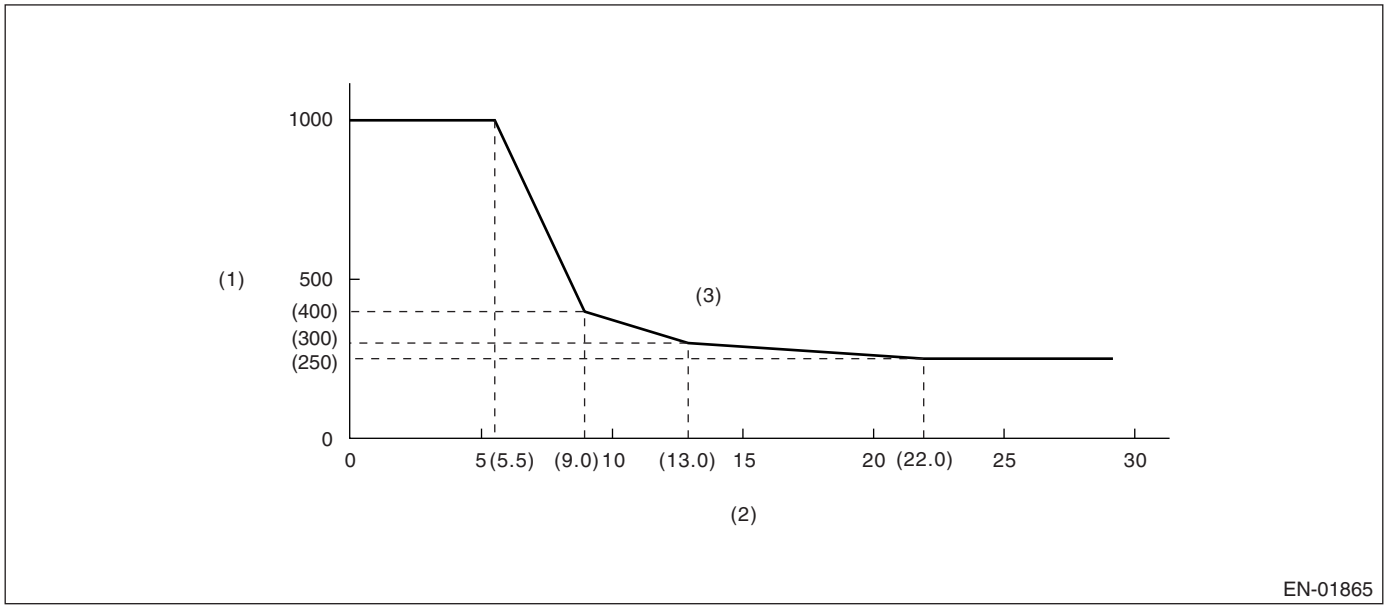
Target opening angle and actual opening angle: 250 milliseconds (For NG) 2000 milliseconds (For OK)
Output duty to drive circuit: 2000 milliseconds

Details of Judgment



(1) Difference between target opening angle and actual opening angle (°)
(2) Target throttle opening angle (°)
(3) NG area

Details of Judgment (Always 1000 milliseconds when the actual opening angle ≤ target opening angle)



(1) Judgment time (milliseconds)
(2) Throttle position sensor 1 opening angle
(3) NG area

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 (Only engine stopped)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed (Only engine stopped)

8. FAIL SAFE

Stop the current to electric control throttle motor. (Fix the throttle opening angle to 6°.)

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CC:DTC P0691 — COOLING FAN 1 CONTROL CIRCUIT LOW —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the radiator fan circuit.
Judge NG when the ECM output level differs from the actual terminal level.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
After starting engine	1 seconds or more
Engine speed	≥ 500 rpm
Ignition switch	ON
Battery voltage	≥ 10.9 V
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.

• Normality Judgment

Judge OK and clear NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
After starting engine	1 seconds or more
Engine speed	≥ 500 rpm
Ignition switch	ON
Battery voltage	≥ 10.9 V
Terminal voltage level when ECM transmits OFF signal	High level

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)

CD:DTC P0692 — COOLING FAN 1 CONTROL CIRCUIT HIGH —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the radiator fan circuit.
Judge NG when the ECM output level differs from the actual terminal level.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Valueg

Malfunction Criteria	Threshold Value
After starting engine	1 seconds or more
Engine speed	≥ 500 rpm
Ignition switch	ON
Battery voltage	≥ 10.9 V
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.

• Normality Judgment

Judge OK and clear NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
After starting engine	1 seconds or more
Engine speed	≥ 500 rpm
Ignition switch	ON
Battery voltage	≥ 10.9 V
Terminal voltage level when ECM transmits ON signal	Low level

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)

CE:DTC P0700 — AT MIL LIGHT UP REQUEST —

1. OUTLINE OF DIAGNOSIS

AT C/U performs CAN communication. It judges as NG if malfunction is detected.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Batery Voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Always perform diagnosis continously.

4. DIAGNOSTIC METHOD

It judges as NG if the following condition malfunctions more than the predetermined time (0.5s). It judges as OK if the following condition does not malfunction, and the NG memory is cleared.

Judgement Value

Malfunction Criteria	Threshold Value
MIL light up request from TCU	set

Time needed for diagnosis: 500 m/seconds

Malfunction Indicator Light Illumination: Illuminates simultaneously when malfunction is detected.

5. DTC CLEAR CONDITION

- When the OK driving cycle was completed 40 consecutive times.
- When “Clear Memory” was performed.

6. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 consecutive times.
- When “Clear Memory” was performed.

7. FAIL-SAFE

None

8. ECU OPERATING AT DTC SETTING

Store the freeze frame data. (For test mode $02)

CF:DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (AT model) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the neutral SW.
Judge NG when the ECM neutral terminal input differs from the reception data from TCM.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	2 seconds or more
Starter switch	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds or more after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 6.5 seconds. Judge OK and clear NG when the malfunction criteria below are not completed.
Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal when park/neutral = “OFF” & any other switches = “ON” on AT	ON (Low)

Time Needed for Diagnosis: 6.5 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)

CG:DTC P0851 — NEUTRAL SWITCH INPUT CIRCUIT LOW (MT model) —

1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.
Judge NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	2 seconds or more
Starter switch	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds or more after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed 3 time or more after the neutral SW change. And clear NG if there is change in the neutral SW.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	ON (Low) continues
Driving condition change	a) to b)
a) Vehicle speed = 0 km/h (0 MPH) & engine speed 600 — 900 rpm	
b) Vehicle speed ≥ 64 km/h (40 MPH) & engine speed 1600 — 2550 rpm	

Time Needed for Diagnosis: 3 monitoring
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

Cruise control command: Not allowed to command cruise control

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CH:DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT model) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the neutral SW.
Judge NG when the ECM neutral terminal input differs from the reception data from TCM.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	2 seconds or more
Starter switch	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds or more after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the continuous time until completing the malfunction criteria below becomes more than 6.5 seconds. Judge OK and clear NG when the malfunction criteria below are not completed.
Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal when park/neutral = “ON” & any other switches = “OFF” on AT	OFF (High)

Time Needed for Diagnosis: 6.5 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)

CI: DTC P0852 — NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT model) —

1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.
Judge NG when there is no change in the neutral SW even if the driving shift was applied. (There is neutral SW ON/OFF inversion from the vehicle speed and engine speed.)

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	2 seconds or more
Starter switch	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds or more after starting the engine.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed 3 time or more after the neutral SW change. And clear NG if there is change in the neutral SW.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	OFF (High) continues
Driving condition change	a) to b)
a) Vehicle speed = 0 km/h (0 MPH) & engine speed 600 — 900 rpm	
b) Vehicle speed ≥ 64 km/h (40 MPH) & engine speed 1600 — 2550 rpm	

Time Needed for Diagnosis: 3 monitoring
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

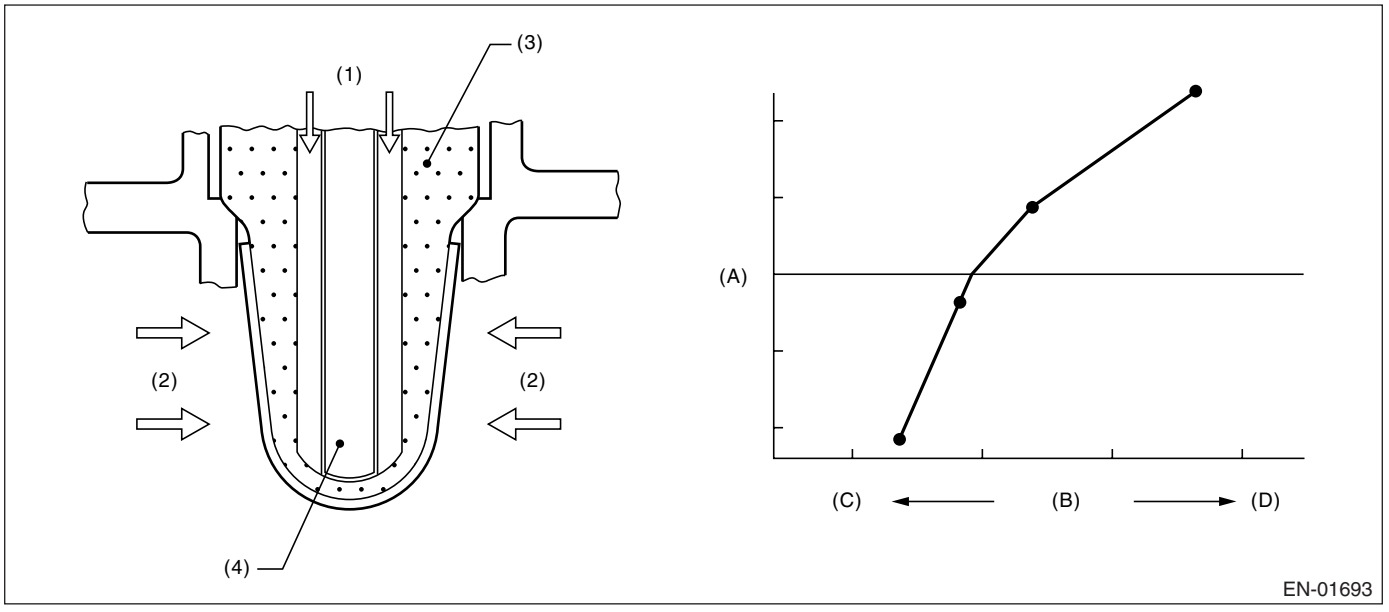
Memorize the freeze frame data. (For test mode $02)

CJ:DTC P1152 — O_2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1) —

1. OUTLINE OF DIAGNOSIS

Detect that lambda value remains Low.
Judge NG when lambda value is abnormal in accordance with lambda value of front oxygen (A/F) sensor and running condition that is vehicle speed, amount of intake air engine coolant temperature, sub feedback control, etc.
Lambda value = Actual air fuel ratio/Theoretical air fuel ratio
Lambda > 1: Lean
Lambda < 1: Rich

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters to be in enable conditions	4 seconds or more
Battery voltage	> 10.9 V
Atmospheric pressure	> 75.1 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	In operation
Rear oxygen sensor output voltage – feedback target voltage	–0.2 V ←→ 0.1 V
or	
rear oxygen sensor sub feedback compensation coefficient	On Min.
or	
rear oxygen sensor sub feedback compensation coefficient	On Max.
After starting engine	60 seconds or more
Engine coolant temperature	≥ 75°C (167°F)
Vehicle speed	≥ 20 km/h (12 MPH)
Amount of intake air	≥ 6 g (0.21 oz)/s
Load change during 0.5 engine rev.	≤ 0.01 g (0.0003 oz)/rev
Impedance of front oxygen (A/F) sensor	0 ←→ 50 Ω
Learning value of evaporation gas density	≤ 0.2
Total time of operating canister purge	20 seconds or more

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12 MPH) or more since 60 seconds after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (10 seconds). Judge OK and clear NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output lambda when rear oxygen sensor sub feedback compensation coefficient being at not high limit	≤ 0.85

Time Needed for Diagnosis: 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

- Front oxygen (A/F) sensor main learning correction: Not allowed to calculate
- Correction when re-starting at high temperature: Normally minimum value 0.3 → 0
- Purge control: Not allowed to purge

9. ECM OPERATION AT DTC SETTING

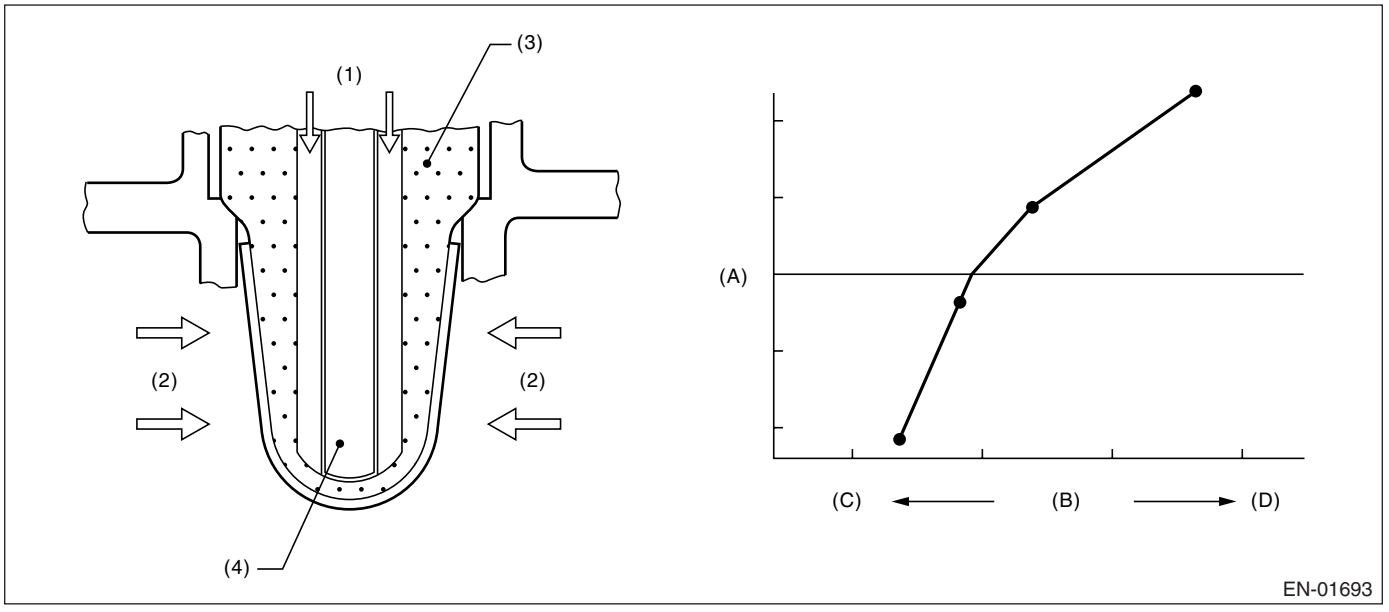
Memorize the freeze frame data. (For test mode $02)

CK:DTC P1153 — O_2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1) —

1. OUTLINE OF DIAGNOSIS

Detect that lambda value remains High.
Judge NG when lambda value is abnormal in accordance with lambda value of front oxygen (A/F) sensor and running condition that is vehicle speed, amount of intake air engine coolant temperature, sub feedback control, etc.
Lambda value = Actual air fuel ratio/Theoretical air fuel ratio
Lambda > 1: Lean
Lambda < 1: Rich

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust
(3) ZrO_2
(4) Ceramic heater
(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters to be in enable conditions	4 seconds or more
Battery voltage	> 10.9 V
Atmospheric pressure	> 75.1 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	In operation
Rear oxygen sensor output voltage – feedback target voltage	–0.2 V ←→ 0.1 V
or	
rear oxygen sensor sub feedback compensation coefficient	On Min.
or	
rear oxygen sensor sub feedback compensation coefficient	On Max.
After engine starting	60 seconds or more
Engine coolant temperature	≥ 75°C (167°F)
Vehicle speed	≥ 20 km/h (12 MPH)
Amount of intake air	≥ 6 g (0.21 oz)/s
Load change during 0.5 engine rev.	≤ 0.01 g (0.0003 oz)/rev
Impedance of front oxygen (A/F) sensor	0 ←→ 50 Ω
Learning value of evaporation gas density	≤ 0.2
Total time of operating canister purge	20 seconds or more

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12 MPH) or more since 60 seconds after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (10 seconds). Judge OK and clear NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output lambda when rear O_2 sensor sub feedback compensation coefficient value being at not low limit	≥ 1.15

Time Needed for Diagnosis: 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

- Front oxygen (A/F) sensor main learning correction: Not allowed to calculate
- Correction when re-starting at high temperature: Normally minimum value 0.3 → 0
- Purge control: Not allowed to purge

9. ECM OPERATION AT DTC SETTING

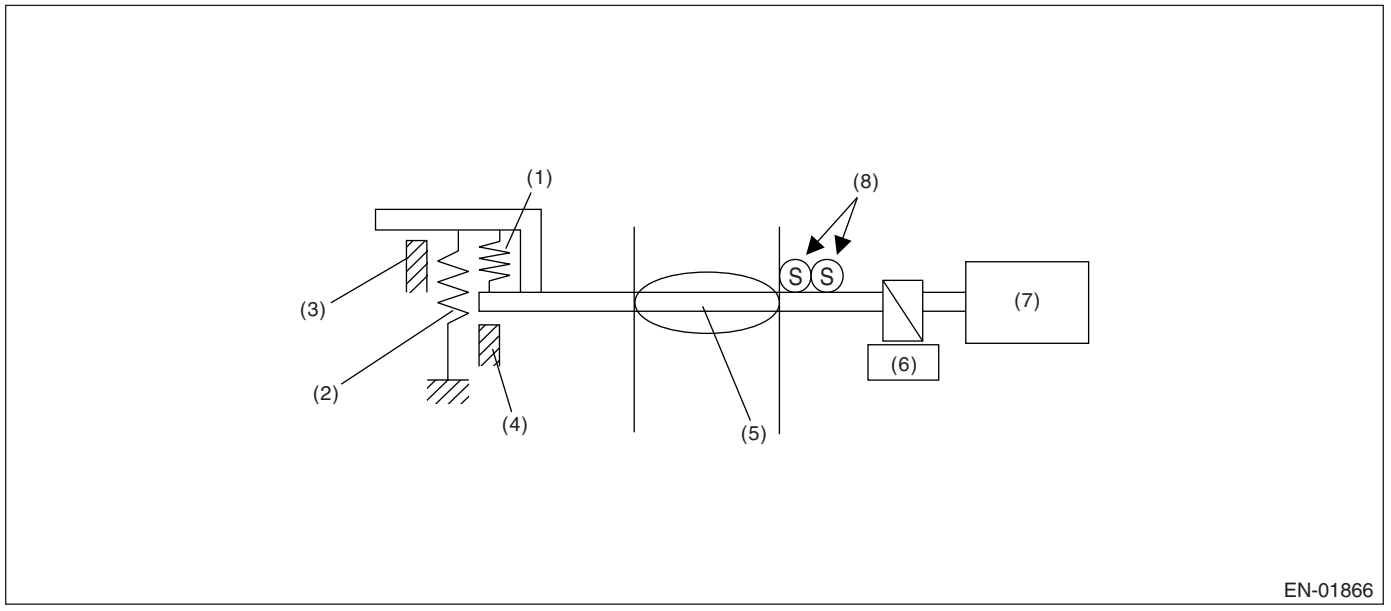
Memorize the freeze frame data. (For test mode $02)

CL:DTC P1160 — RETURN SPRING FAILURE —

1. OUTLINE OF DIAGNOSIS

Judge NG when the valve does not move to the close direction with the motor power stopped and the valve open more than the default opening.

2. COMPONENT DESCRIPTION



(1) Opener spring
(2) Return spring
(3) Intermediate stopper
(4) Full closed stopper
(5) Throttle valve
(6) Gear
(7) DC motor
(8) Main and sub throttle sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Motor continuity	OFF

4. GENERAL DRIVING CYCLE

- Ignition switch ON → OFF
- Ignition switch OFF → ON (After clear memory only)

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge OK and clear NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Opening variation after continuity is set to OFF	≥ 2°

Time Needed for Diagnosis: 600 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed (Only engine stop)

8. FAIL SAFE

Fix the throttle opening to 6°.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CM:DTC P1301 — MISFIRE DETECTED (HIGH TEMPERATURE EXHAUST GAS) —

1. OUTLINE OF DIAGNOSIS

Detect whether the misfire occurred or not. (Exhaust temperature method)
Judge NG when the exhaust temperature is high.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
All secondary parameters approval continuation time	1 second or more
Intake manifold pressure change during 0.5 engine rev.	< 16.0 kPa (120 mmHg, 4.72 inHg) (MT) < 14.7 kPa (110 mmHg, 4.33 inHg) (AT)
Engine speed change	< 1000 rpm/32 milliseconds
Throttle position change during 16 milliseconds	< 14°
Fuel shut-off function	Not in operation
Atmospheric pressure	≥ 75.1 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Evaporative system leak check	Not in operation
Engine speed	550 — 6700 rpm
Intake manifold pressure	> Map3 or more
Battery voltage	≥ 8 V

Map3

- MT

Vehicle Speed < 64.4 km/h (40 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa (mmHg, inHg)	25.1 (188, 7.40)	24.8 (186, 7.32)	25.6 (192, 7.56)	23.3 (175, 6.89)	26.3 (197, 7.76)	25.9 (194, 7.64)	28.9 (216.5, 8.52)	30.0 (225, 8.86)	31.7 (237.5, 9.35)	33.0 (248, 9.76)	37.1 (278.5, 11.0)	41.9 (314, 12.4)	47.0 (352.5, 13.9)	51.1 (383, 15.1)

Vehicle Speed ≥ 64.4 km/h (40 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa (mmHg, inHg)	25.5 (191, 7.52)	25.1 (188, 7.40)	30.4 (227.7, 8.96)	35.6 (267.4, 10.5)	38.5 (288.9, 11.4)	40.4 (302.9, 11.9)	41.1 (308.6, 12.1)	40.8 (306, 12.0)	44.8 (335.8, 13.2)	47.3 (354.5, 14.0)	49.1 (368.2, 14.5)	50.9 (381.9, 15.0)	52.8 (396, 15.6)	52.8 (396, 15.6)

- AT

Vehicle Speed ≥ 64.4 km/h (40 MPH)

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	6700
kPa (mmHg, inHg)	26.3 (197, 7.76)	24.7 (185, 7.28)	23.6 (177, 6.97)	25.5 (191, 7.52)	27.3 (205, 8.07)	26.1 (196, 7.72)	29.5 (221.5, 8.72)	31.3 (235, 9.25)	32.7 (245.5, 9.67)	34.1 (256, 10.08)	38.2 (286.5, 11.3)	33.6 (252.3, 9.93)	49.5 (371.5, 14.62)	51.5 (386, 15.20)

3. GENERAL DRIVING CYCLE

- Detecting misfire is able to be carried out in the condition between idling and high revolution.
- Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below continue 200 engine revs. (400 ignitions) in a row.
Judgment Value

Malfunction Criteria	Threshold Value
Exhaust temperature	> 1050°C (1922°F)

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 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)

CN:DTC P1312 — EXHAUST GAS TEMPERATURE SENSOR MALFUNCTION —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of exhaust temperature sensor output property.
Judge NG when the exhaust temperature remains high or low whereas it seemed to vary from the viewpoint of driving condition.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
After starting engine	240 seconds or more
Engine coolant temperature at engine start	≤ 40°C (104°F)
Engine coolant temperature	≥ 75°C (167°F)
Intake air temperature at engine start	≥ 0°C (32°F)
Estimate ambient temperature	≥ 0°C (32°F)
Engine speed	≥ 2400 rpm
Engine load	≥ 0.85 g (0.030 oz)/rev
Lambda value	0.75 ←→ 1.25

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at more than 2400 rpm of engine speed in 240 seconds and more after starting the engine in cool condition.
Pay attention to the coolant temperature at engine starting.

4. DIAGNOSTIC METHOD

Judge NG when one of the malfunction criteria below is completed, and judge OK and clear the NG when all of the malfunction criteria below are not completed.
Judgment Value

Malfunction Criteria	Threshold Value
Min. exhaust temperature from engine starting	≥ 700°C (1292°F)
Max. exhaust temperature from engine starting	< 500°C (932°F)

Time Needed for Diagnosis: 30 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

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

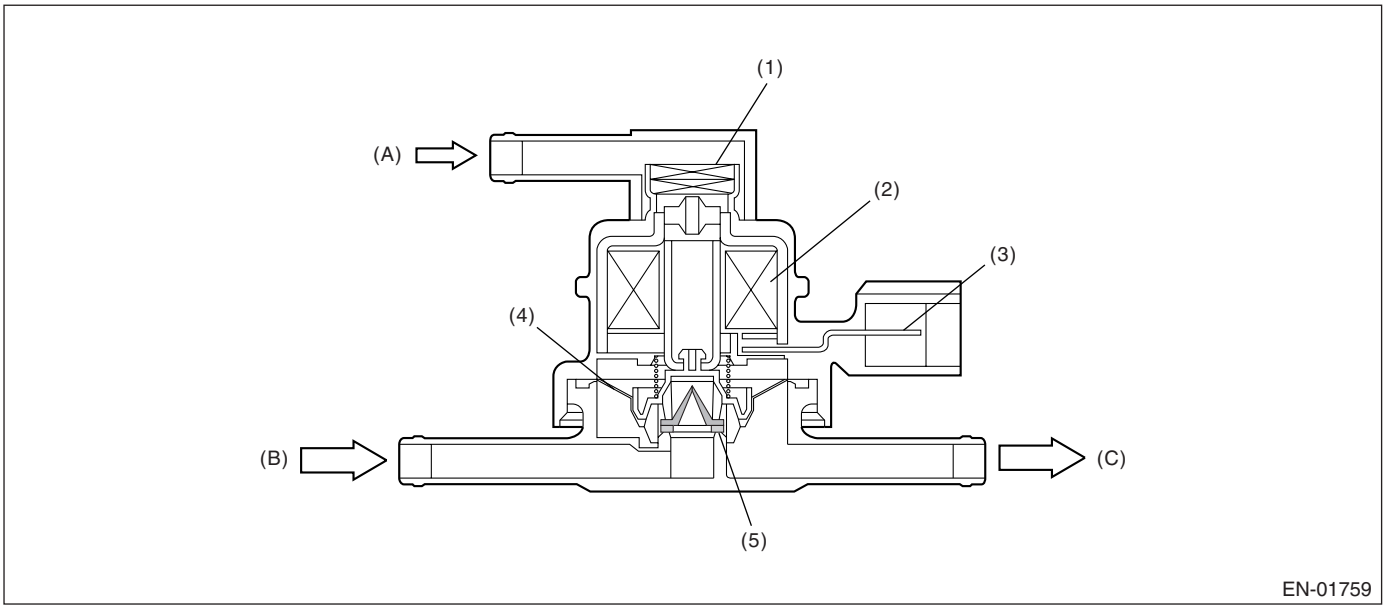
Memorize the freeze frame data. (For test mode $02)

CO:DTC P1400 — FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW —

1. OUTLINE OF DIAGNOSIS

Detect open or 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
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	1 second or more

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than time needed for diagnosis (2.5 seconds). Judge OK and clear the NG when the malfunction criteria below are not completed.

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 two continuous drive 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 OPERATING AT DTC SETTING

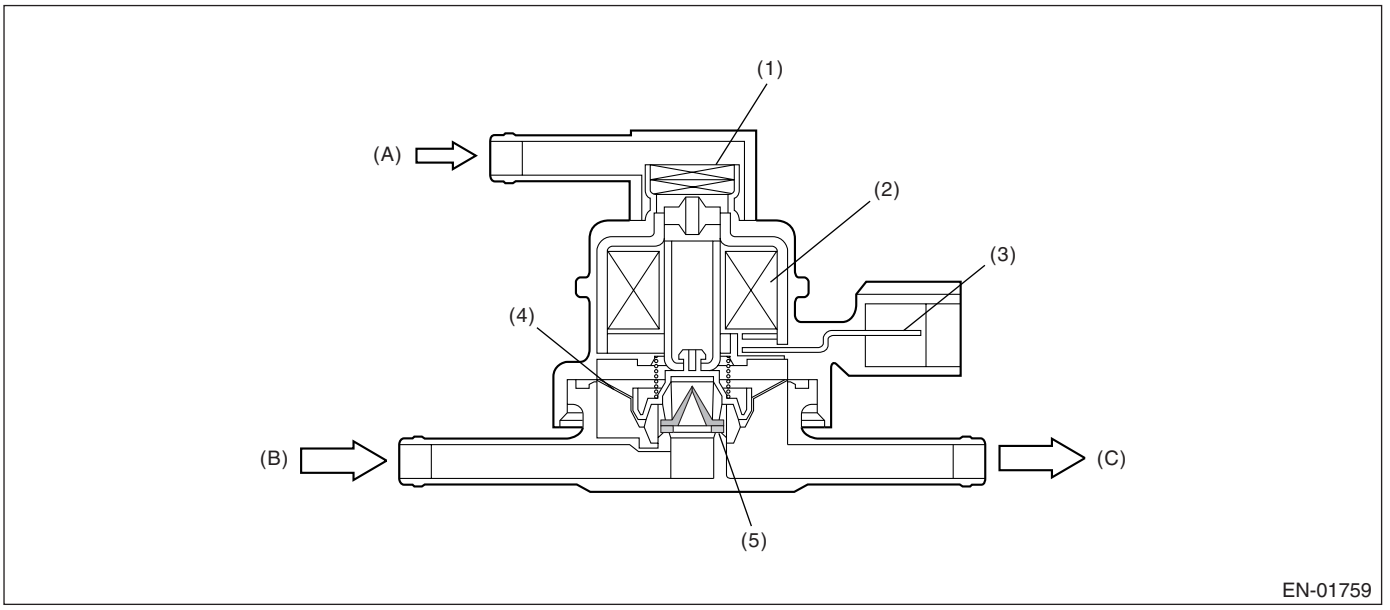
Memorize the freeze frame data. (For test mode $02)

CP:DTC P1420 — FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH —

1. OUTLINE OF DIAGNOSIS

Detect open or 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
Ignition switch	ON
Battery voltage	≥ 10.9 V
After starting engine	1 second or more

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than time needed for diagnosis (2.5 seconds). Judge OK and clear the NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage when ECM outputs off signal	High

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in two continuous drive 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 OPERATING AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CQ:DTC P1443 — VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM —

1. OUTLINE OF DIAGNOSIS

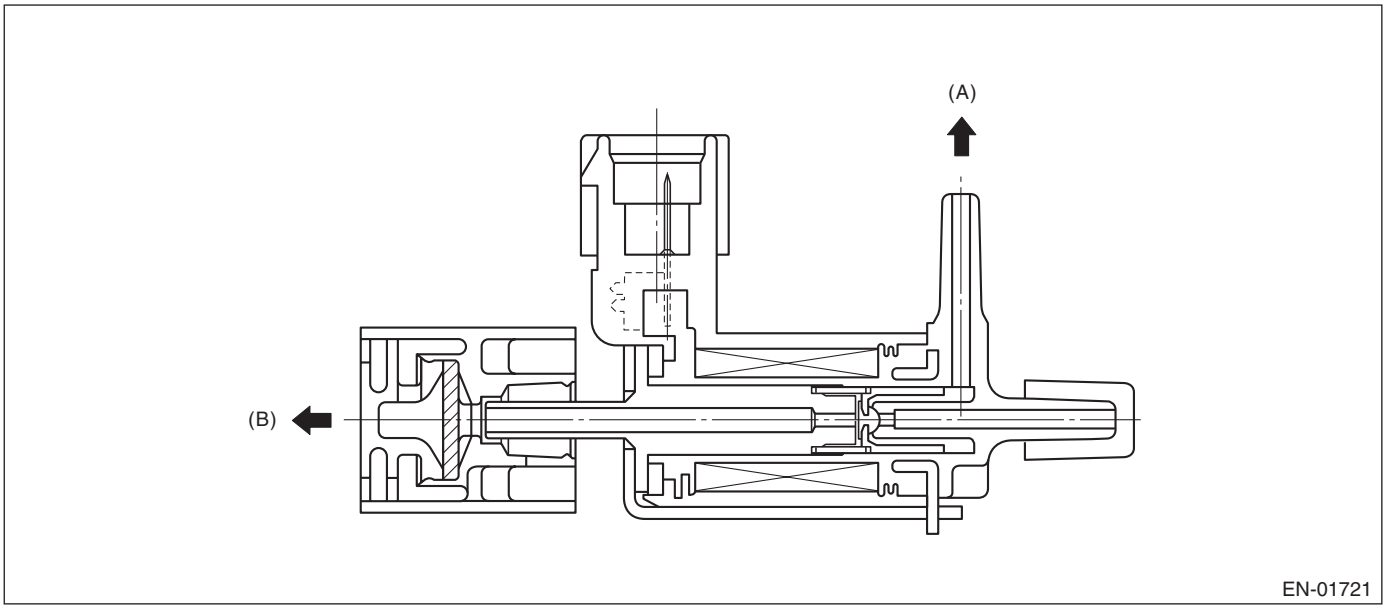
For detecting conditions, refer to DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK). <Ref. to GD(H4DOTC)-123, DTC P0442 — EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK) —.>

CR:DTC P1446 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT LOW —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tank pressure switching solenoid.
Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A) Fuel tank pressure sensor (B) Ambient air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
After starting engine	1 second or more
Terminal output voltage when ECM sent OFF signals	Low
Ignition switch	ON

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
After starting engine	1 second or more
Terminal output voltage when ECM sent OFF signals	High
Ignition switch	ON

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

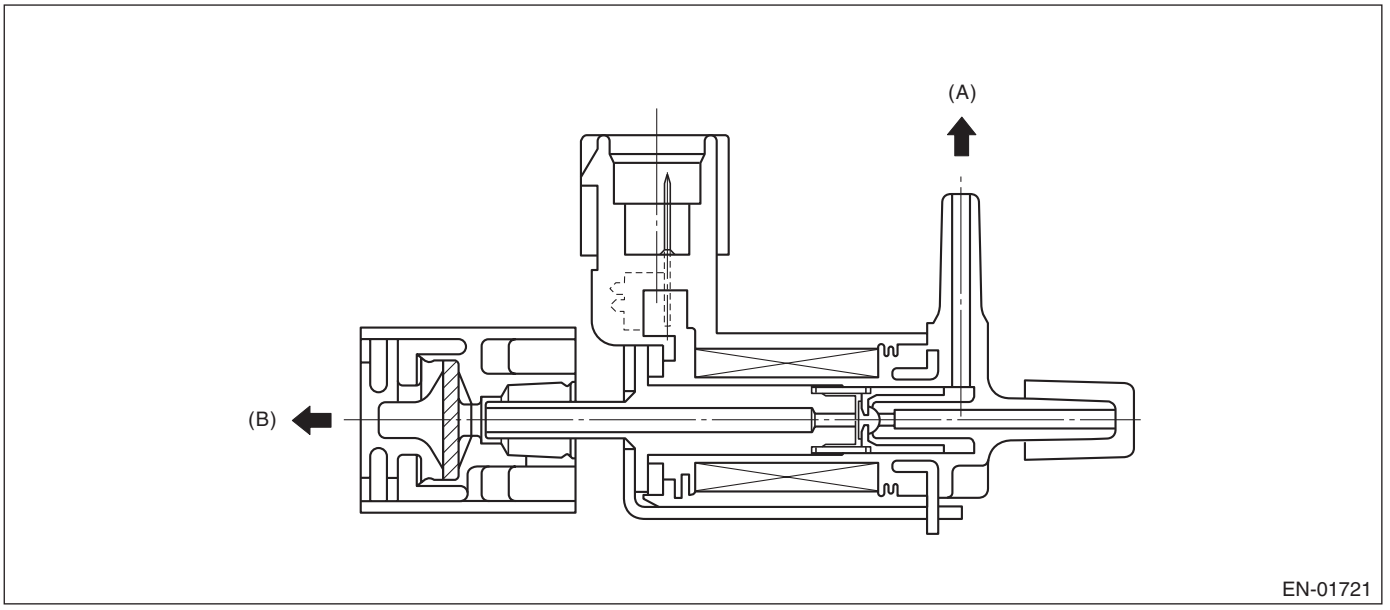
Memorize the freeze frame data. (For test mode $02)

CS:DTC P1447 — FUEL TANK SENSOR CONTROL VALVE CIRCUIT HIGH —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tank pressure switching solenoid.
Judge NG when the ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A) Fuel tank pressure sensor (B) Ambient air

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the cumulative time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
After starting engine	1 second or more
Terminal output voltage when ECM sent ON signals	High
Ignition switch	ON

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in two continuous drive cycles.

• Normality Judgment

Judge OK when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
After starting engine	1 second or more
Terminal output voltage when ECM sent OFF signals	Low
Ignition switch	ON

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)

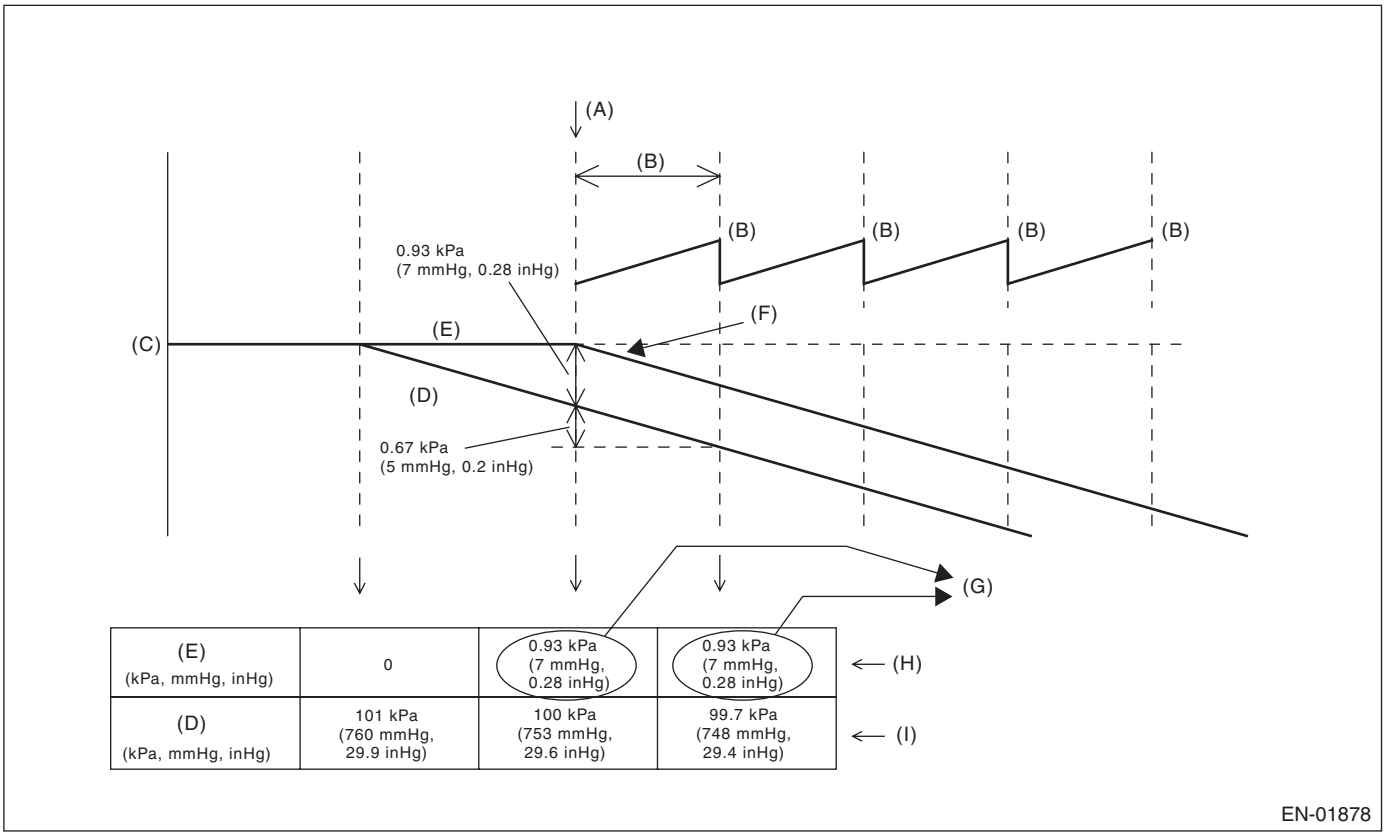
CT:DTC P1448 — FUEL TANK SENSOR CONTROL VALVE RANGE PERFORMANCE —

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

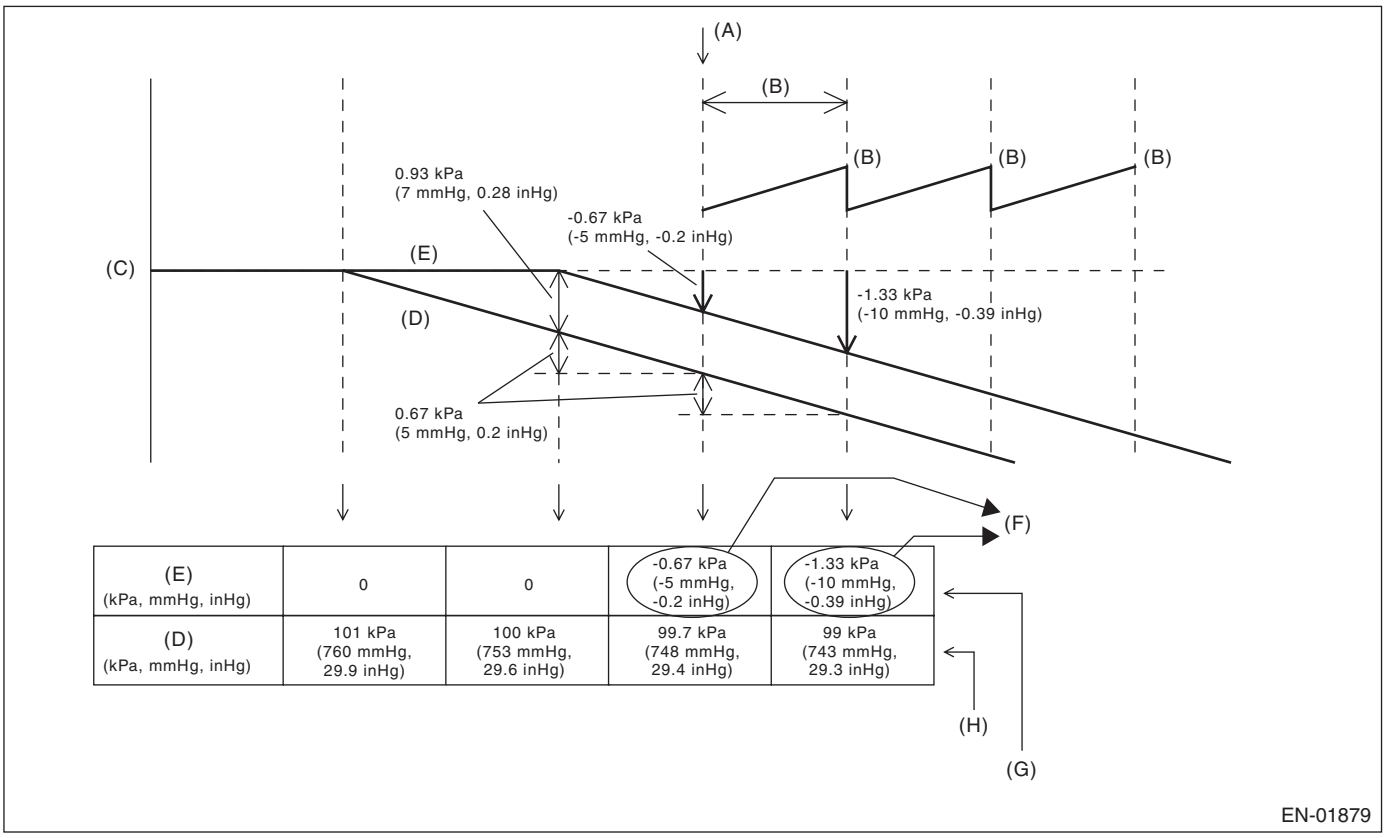
Judge OK when the fuel tank pressure does not change (or changes by less than 0.60 kPa (4.5 mmHg, 0.18 inHg)) at atmospheric pressure changing by 0.60 kPa (4.5 mmHg, 0.18 inHg) or more per 80 seconds.



(A) Enable conditions are completed.
(B) 80S
(C) Pressure
(D) Atmospheric pressure
(E) Tank pressure
(F) PCV function reduces the tank pressure
(G) Judge OK when the tank pressure does not change.
(H) The tank pressure is relative pressure against atmospheric pressure
(I) Change of atmospheric pressure

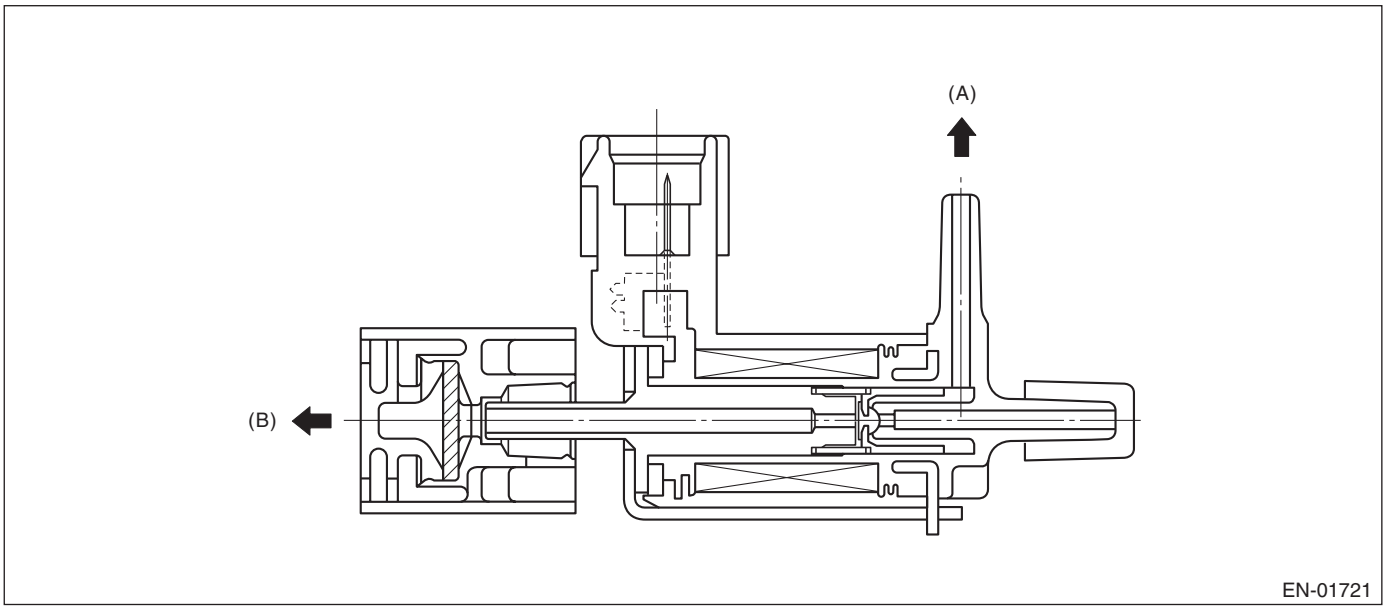
• Abnormality Judgment

Judge NG temporarily when the fuel tank pressure changes by 0.60 kPa (4.5 mmHg, 0.18 inHg) or more at atmospheric pressure changing by 0.60 kPa (4.5 mmHg, 0.18 inHg) or more per 80 seconds, and then judge NG when the previous condition is completed 5 times in a row.



(A) Enable conditions are completed.
(B) 80S
(C) Pressure
(D) Atmospheric pressure
(E) Tank pressure
(F) Judge NG temporarily the tank pressure changes once, and then judge NG the tank pressure changes five consecutive times
(G) The tank pressure is relative pressure against atmospheric pressure. Ordinary, part of pressure comparison is atmospheric pressure.
101 kPa (760 mmHg, 29.9 inHg)
(H) Atmospheric pressure is absolute pressure.

2. COMPONENT DESCRIPTION



(A) Fuel tank pressure sensor (B) Ambient air

3. ENABLE CONDITION

Secondary Parameter	Enable Condition
Battery voltage	≥ 10.9 V
Fuel level	9.6 ←→ 48 ℓ (2.54 ←→ 12.68 US gal, 2.11 ←→ 10.56 Imp gal)
Evaporation system diagnosis	Not in operation
After starting engine	80 seconds or more
Fuel tank pressure	< –0.67 kPa (–5 mmHg, –0.2 inHg) or > –0.93 kPa (7 mmHg, 0.28 inHg)

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the fuel tank pressure is large or small in 80 seconds or more after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below is completed 5 times.

• Judgment Value

Malfunction Criteria	Threshold Value
Atmospheric air change in 80 seconds	≥ 0.67 kPa (4.5 mmHg, 0.2 inHg)
Fuel tank pressure change in 80 seconds	≥ 0.67 kPa (4.5 mmHg, 0.2 inHg)
Fuel level change	< 3 ℓ (3.2 US gal, 2.6 Imp gal)

Time Needed for Diagnosis: 80 seconds × 5 times

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear NG when the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Atmospheric air change in 80 seconds	≥ 0.67 kPa (4.5 mmHg, 0.2 inHg)
Fuel tank pressure change in 80 seconds	< 0.67 kPa (4.5 mmHg, 0.2 inHg)

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

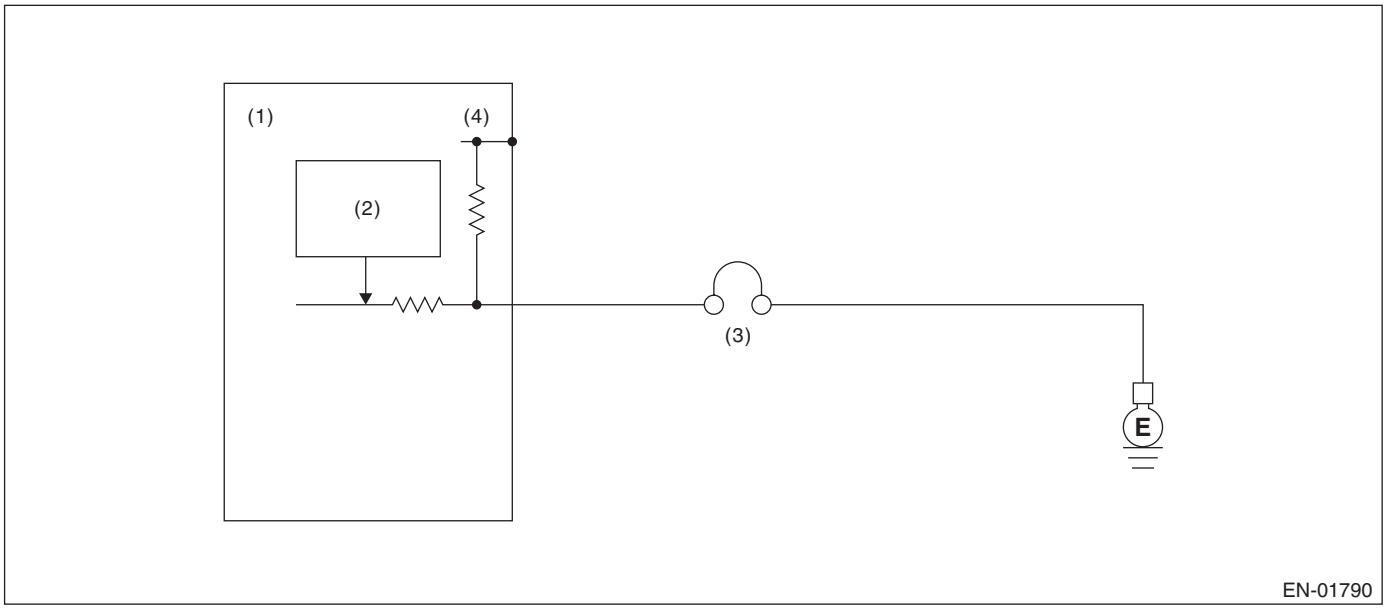
Memorize the freeze frame data. (For test mode $02)

CU:DTC P1491 — POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM —

1. OUTLINE OF DIAGNOSIS

Detect the blow-by hose release abnormality.
Judge NG when the diagnosis terminal voltage is high.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Detecting circuit
(3) PCV diagnosis connector
(4) 5 V

3. ENABLE CONDITION

Secondary Parameter	Enable Condition
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSIS METHOD

• Abnormality Judgment

Judge NG when the continuous time until completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Engine speed	≥ 500 rpm
Positive crankcase ventilation diagnosis voltage	High

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear NG when the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Engine speed	≥ 500 rpm
Positive crankcase ventilation diagnosis voltage	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 performed 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)

CV:DTC P1518 — STARTER SWITCH CIRCUIT LOW INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.
Judge OFF NG when it turns to “after engine starting” while the starter has never been set to ON.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge OFF NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Vehicle speed	< 1 km/h (0.62 MPH)
Starter ON signal	Not detected
Engine speed after the engine speed of 500 rpm or less has continued for 0.8 seconds or more	≥ 500 rpm

Time Needed for Diagnosis: 1 second
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OFF OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Starter ON	Experienced
Starter ON diagnosis	Not diagnosis
Battery voltage	> 8 V

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)

CW:DTC P1544 — EXHAUST GAS TEMPERATURE TOO HIGH —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of high exhaust gas temperature.
Judge NG when the exhaust gas becomes too high.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 8.2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Fuel cut event	Not in operation
After fuel cut	≥ 1 milliseconds
Exhaust temperature	≥ 1050°C (1922°F)

Time Needed for Diagnosis: 8.2 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as the malfunction occurs.

• Normality Judgment

Judge OK and clear the NG when the continuous time of completing the malfunction criteria below becomes more than 8.2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Exhaust temperature	< 550°C (1022°F)

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)

CX:DTC P1560 — BACK-UP VOLTAGE CIRCUIT MALFUNCTION —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the back-up voltage circuit.
Judge NG when the back-up voltage becomes smaller than the battery voltage.

2. ENABLE CONDITION

Secondary Parameter	Enable Condition
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power	< Battery voltage × 0.7
Battery voltage	≥ 10.9 V
Before/After starting engine	After starting engine

Time Needed for Diagnosis: 2.5 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear NG when the malfunction criteria below is completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	≥ Battery voltage × 0.7
Battery voltage	≥ 10.9 V
Before/After starting engine	After starting engine

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)

CY:DTC P2004 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE OPEN) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generated valve motor function.
Judge open fixing malfunction when the opening degree is large even after finishing the tumble generated valve close driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 0°C (32°F)
Ambient temperature	≥ 0°C (32°F)

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 3 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Tumble generated valve angle	≥ 67.4°
Tumble generated valve “close” signal output	2.2 seconds or more

Time Needed for Diagnosis: 3 seconds
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
Tumble generated valve angle	< 67.4°
Tumble generated valve “close” signal output	2.2 seconds or more

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

Tumble generated valve opening
- For tumble generated valve all closing points learning, not allowed to update to the closing side.
- For tumble generated valve all opening points learning, not allowed to update to the opening side.

Tumble generated valve control
- Output the open signal.

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

CZ:DTC P2005 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE OPEN) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generated valve motor function.
Judge open fixing malfunction when the opening degree is large even after finishing the tumble generated valve closing driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 0°C (32°F)
Ambient temperature	≥ 0°C (32°F)

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 3 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Tumble generated valve angle	≥ 67.4°
Tumble generated valve “close” signal output	2.2 seconds or more

Time Needed for Diagnosis: 3 seconds
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
Tumble generated valve angle	< 67.4°
Tumble generated valve “close” signal output	2.2 seconds or more

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

Tumble generated valve opening
- For tumble generated valve all closing points learning, not allowed to update to the closing side.
- For tumble generated valve all opening points learning, not allowed to update to the opening side.

Tumble generated valve control
- Output the open signal.

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DA:DTC P2006 — TUMBLE GENERATED VALVE SYSTEM 1 (VALVE CLOSE) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generated valve motor function.
Judge close fixing malfunction when the opening degree is small even after finishing the tumble generated valve open driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 0°C (32°F)
Ambient temperature	≥ 0°C (32°F)

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 3 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Tumble generated valve angle	< 67.4°
Tumble generated valve “open” signal output	2.2 seconds or more

Time Needed for Diagnosis: 3 seconds
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
Tumble generated valve angle	≥ 67.4°
Tumble generated valve “open” signal output	2.2 seconds or more

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

Tumble generated valve opening
- For tumble generated valve all closing points learning, not allowed to update to the closing side.
- For tumble generated valve all opening points learning, not allowed to update to the opening side.

Tumble generated valve control
- Output the close signal.

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DB:DTC P2007 — TUMBLE GENERATED VALVE SYSTEM 2 (VALVE CLOSE) —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generated valve motor function.
Judge close fixing malfunction when the opening degree is small even after finishing the tumble generated valve open driving.

2. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 0°C (32°F)
Ambient temperature	≥ 0°C (32°F)

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 3 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Tumble generated valve angle	< 67.4°
Tumble generated valve “open” signal output	2.2 seconds or more

Time Needed for Diagnosis: 3 seconds
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
Tumble generated valve angle	≥ 67.4°
Tumble generated valve “open” signal output	2.2 seconds or more

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

Tumble generated valve opening
- For tumble generated valve all closing points learning, not allowed to update to the closing side.
- For tumble generated valve all opening points learning, not allowed to update to the opening side.

Tumble generated valve control
- Output the close signal.

8. ECM OPERATION AT DTC SETTING

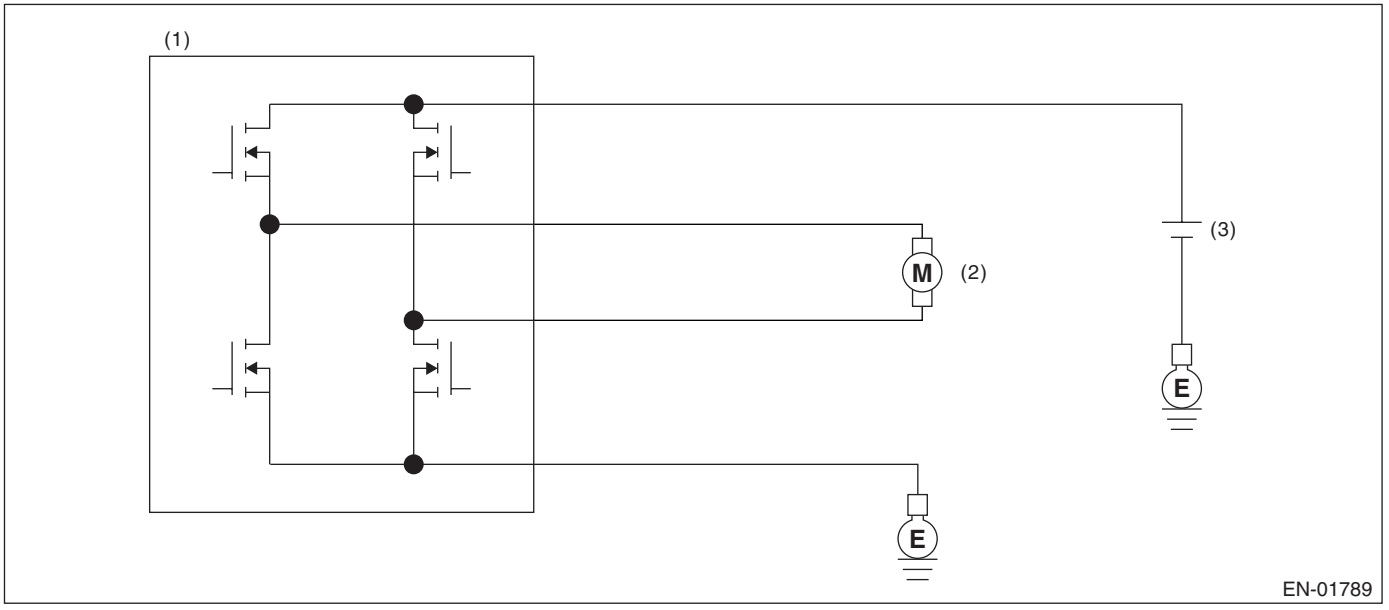
Memorize the freeze frame data. (For test mode $02)

DC:DTC P2008 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (OPEN) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generated valve motor.
Judge NG when the open signal is sent from IC after tumble generated valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generated valve (3) Battery

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
ECM output signal	before set ON → OFF
Tumble generated valve ON signal output	20 milliseconds or more

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

At the main IC, check the sent signal at each timing which occurs just before the tumble generated valve output is set to ON and OFF, and judge open NG when the open NG signal is sent during 2 seconds in a row. Judge OK and clear the NG when the OK signal is sent.

Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	Low
Overcurrent NG signal input	High

Time Needed for Diagnosis: 2 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

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

Tumble generated valve control: Not allowed to move tumble generated valve.

9. ECM OPERATION AT DTC SETTING

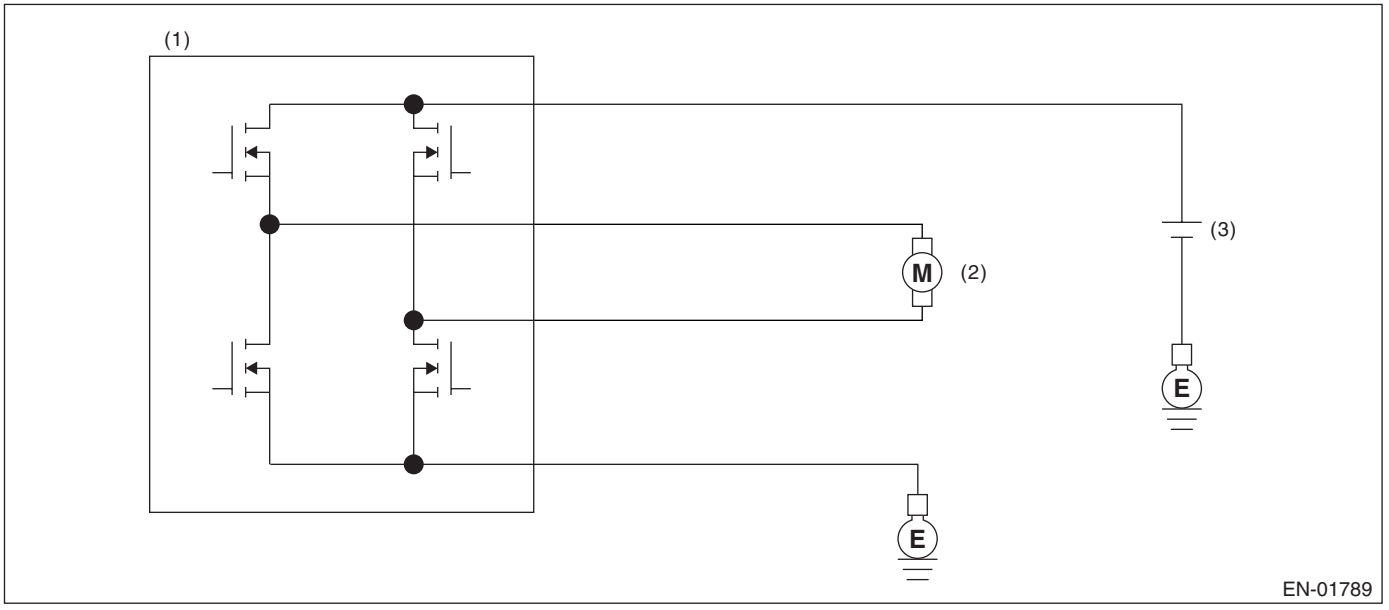
Memorize the freeze frame data. (For test mode $02)

DD:DTC P2009 — TUMBLE GENERATED VALVE SIGNAL 1 CIRCUIT MALFUNCTION (SHORT) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generated valve motor.
Judge NG when the overcurrent signal is sent from IC after tumble generated valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generated valve (3) Battery

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
ECM output signal	before set ON → OFF
Tumble generated valve ON signal output	20 milliseconds or more

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

NG signal is sent to main IC. At the main IC, check the sent signal at each timing which occurs just before the tumble generated valve output is set to ON and OFF, and judge overcurrent NG when the overcurrent NG signal is sent during 1 second in a row. Judge OK and clear the NG when the OK signal is sent.
Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High
Overcurrent NG signal input	Low

Time Needed for Diagnosis: 1 second
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

Tumble generated valve control: Not allowed to move tumble generated valve.

9. ECM OPERATION AT DTC SETTING

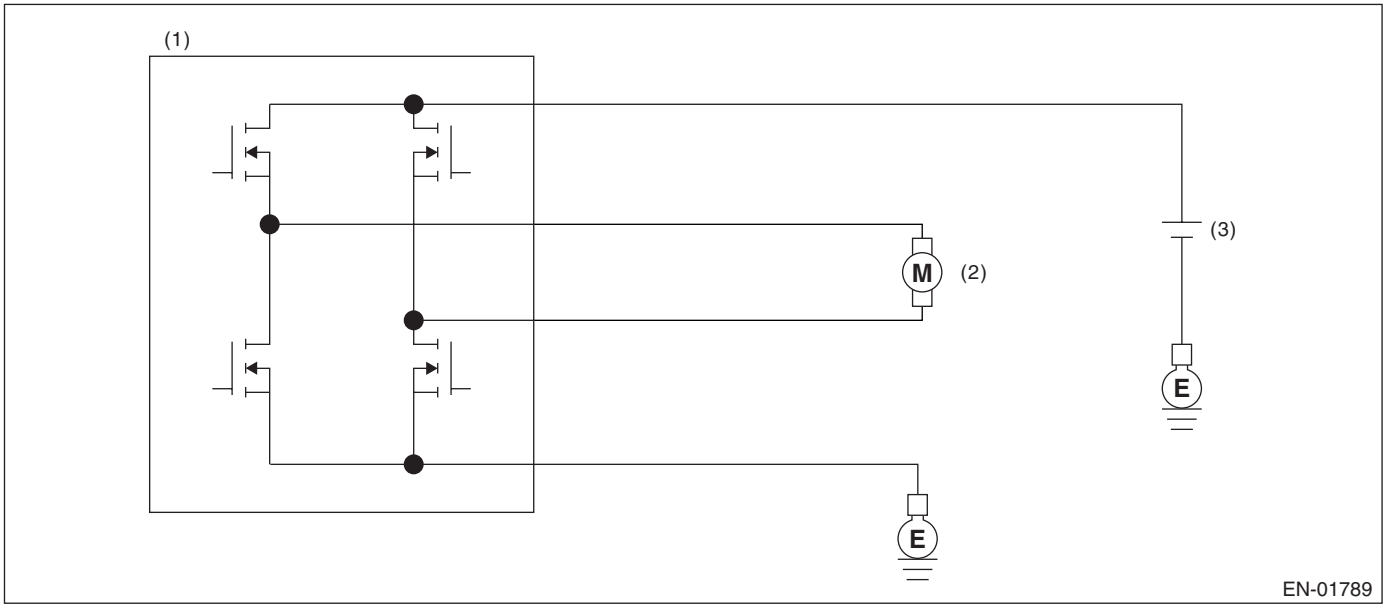
Memorize the freeze frame data. (For test mode $02)

DE:DTC P2011 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (OPEN) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generated valve motor.
Judge NG when the open signal is sent from IC after tumble generated valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generated valve (3) Battery

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
ECM output signal	before set ON → OFF
Tumble generated valve ON signal output	20 milliseconds or more

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed by tumble generated valve driving IC, and then NG signal is sent to main IC. At the main IC, check the sent signal at each timing which occurs just before the tumble generated valve output is set to ON and OFF, and judge open NG when the open NG signal is sent during 2 seconds in a row. Judge OK and clear the NG when the OK signal is sent.

Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High
Overcurrent NG signal input	Low

Time Needed for Diagnosis: 2 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

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

Tumble generated valve control: Not allowed to move tumble generated valve.

9. ECM OPERATION AT DTC SETTING

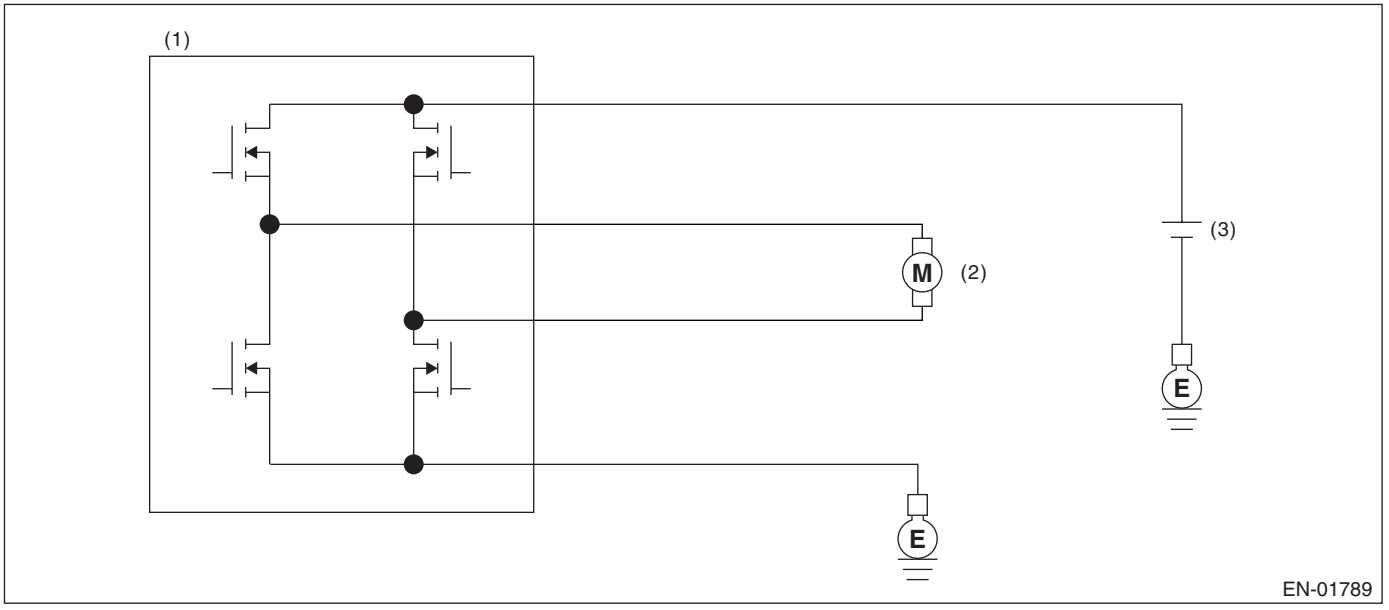
Memorize the freeze frame data. (For test mode $02)

DF:DTC P2012 — TUMBLE GENERATED VALVE SIGNAL 2 CIRCUIT MALFUNCTION (SHORT) —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generated valve motor.
Judge NG when the overcurrent signal is sent from IC after tumble generated valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generated valve (3) Battery

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
ECM output signal	before set ON → OFF
Tumble generated valve ON signal output	20 milliseconds or more

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge NG when the malfunction criteria below are completed by tumble generated valve driving IC, and then NG signal is sent to main IC. At the main IC, check the sent signal at each timing which occurs just before the tumble generated valve output is set to ON and OFF, and judge overcurrent NG when the overcurrent NG signal is sent during 1 second in a row.
Judge OK and clear the NG when the OK signal is sent.

Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High
Overcurrent NG signal input	Low

Time Needed for Diagnosis: 1 second
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

Tumble generated valve control: Not allowed to move tumble generated valve.

9. ECM OPERATION AT DTC SETTING

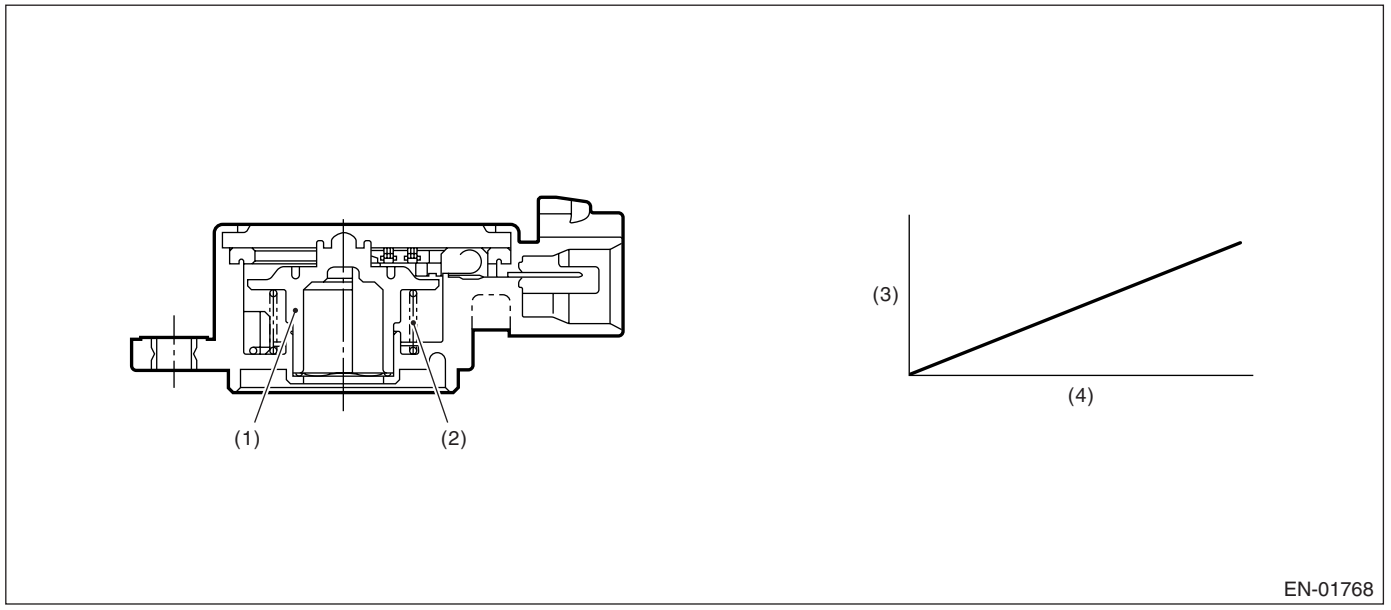
Memorize the freeze frame data. (For test mode $02)

DG:DTC P2016 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generated valve position sensor.
Judge NG when the value is out of standard range.

2. COMPONENT DESCRIPTION



(1) Rotor
(2) Return spring
(3) Voltage (V)
(4) Tumble generated valve angle (°)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform diagnosis.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (0.5 seconds). Judge OK and clear NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.167 V

Time Needed for Diagnosis: 0.5 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

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

Tumble generated valve position
- Learning of tumble generated valve position fully closed and date renewed to close side.
- Learning of tumble generated valve position fully opened and date renewed to open side.

9. ECM OPERATION AT DTC SETTING

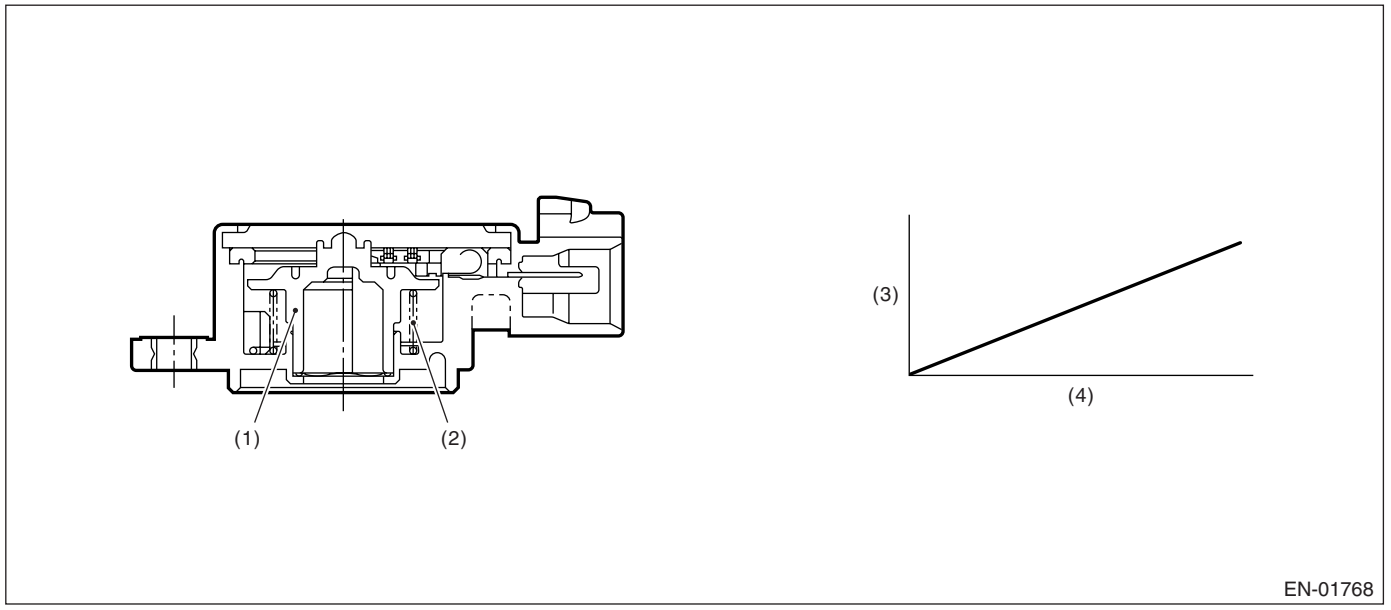
Memorize the freeze frame data. (For test mode $02)

DH:DTC P2017 — TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generated valve position sensor.
Judge NG when the value is out of standard range.

2. COMPONENT DESCRIPTION



(1) Rotor
(2) Return spring
(3) Voltage (V)
(4) Tumble generated valve angle (°)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform diagnosis.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (0.5 seconds). Judge OK and clear NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.843 V

Time Needed for Diagnosis: 0.5 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

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

Tumble generated valve position
- Learning of tumble generated valve position fully closed and date renewed to close side.
- Learning of tumble generated valve position fully opened and date renewed to open side.

9. ECM OPERATION AT DTC SETTING

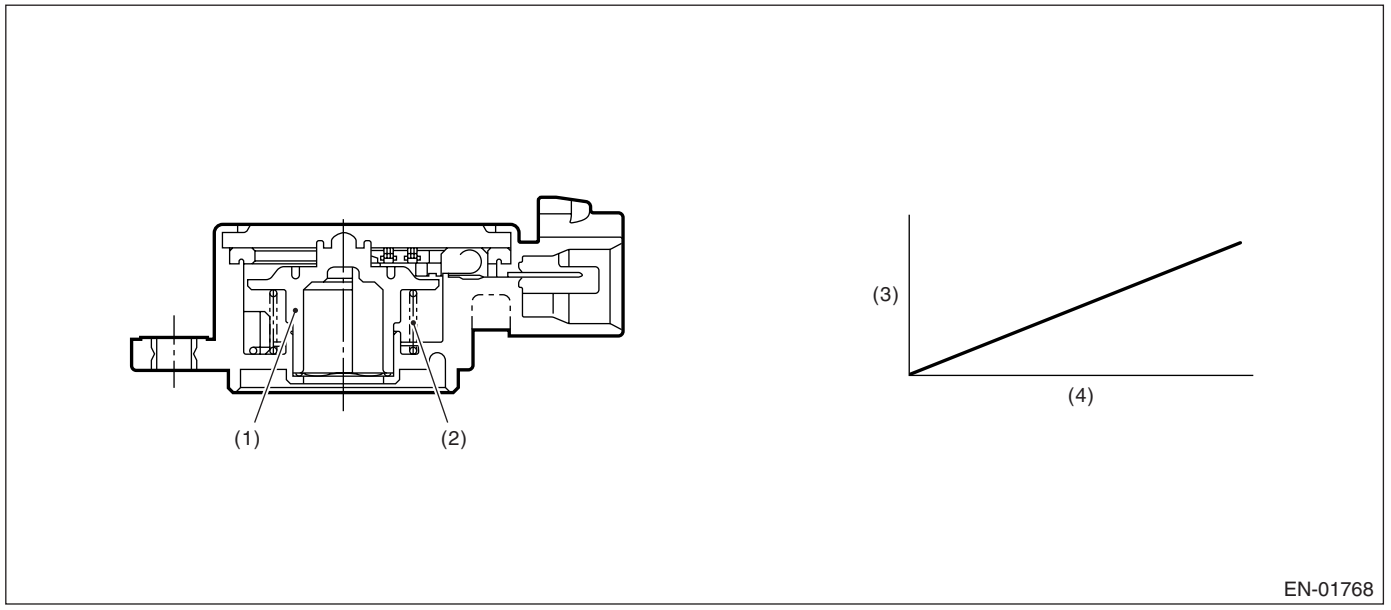
Memorize the freeze frame data. (For test mode $02)

DI: DTC P2021 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generated valve position sensor.
Judge NG when the value is out of standard range.

2. COMPONENT DESCRIPTION



(1) Rotor
(2) Return spring
(3) Voltage (V)
(4) Tumble generated valve angle (°)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform diagnosis.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (0.5 seconds). Judge OK and clear NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.167 V

Time Needed for Diagnosis: 0.5 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

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

Tumble generated valve position
- Learning of tumble generated valve position fully closed and date renewed to close side.
- Learning of tumble generated valve position fully opened and date renewed to open side.

9. ECM OPERATION AT DTC SETTING

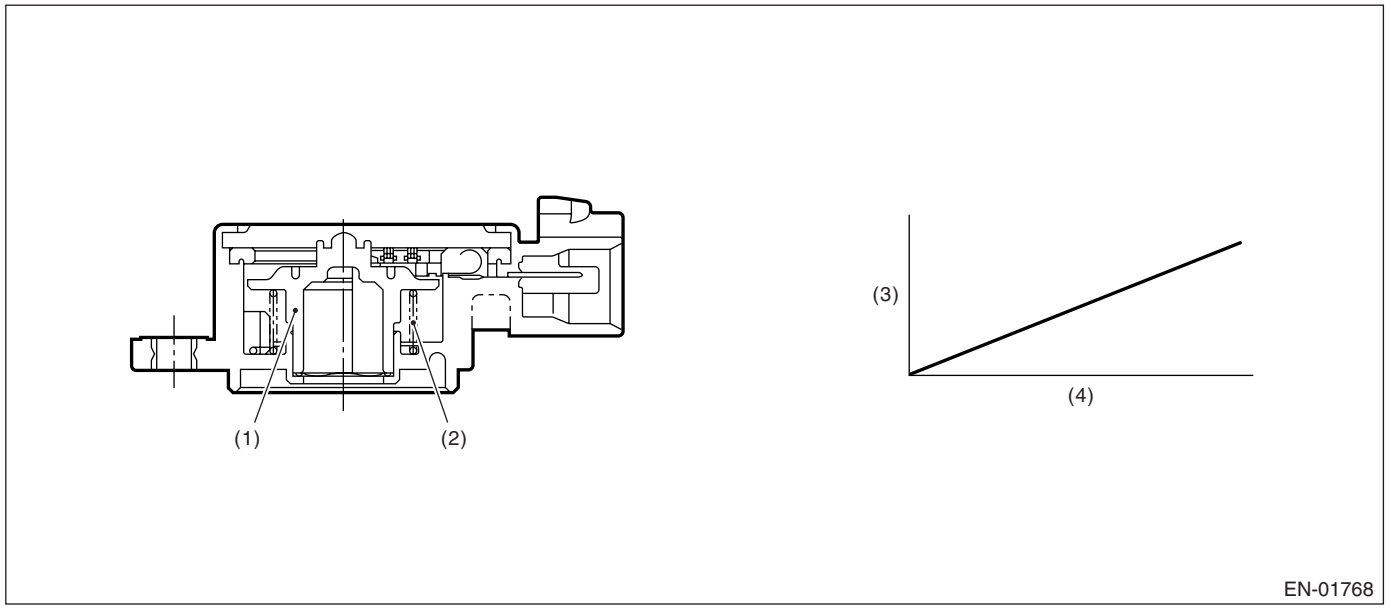
Memorize the freeze frame data. (For test mode $02)

DJ:DTC P2022 — TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generated valve position sensor.
Judge NG when the value is out of standard range.

2. COMPONENT DESCRIPTION



(1) Rotor
(2) Return spring
(3) Voltage (V)
(4) Tumble generated valve angle (°)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform diagnosis.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than the time needed for diagnosis (0.5 seconds). Judge OK and clear NG when the malfunction criteria below are not completed.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.843 V

Time Needed for Diagnosis: 0.5 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

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

Tumble generated valve position
- Learning of tumble generated valve position fully closed and date renewed to close side.
- Learning of tumble generated valve position fully opened and date renewed to open side.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DK:DTC P2088 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 1) —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil flow control valve solenoid.
Judge open NG when the current flow is small whereas duty signal is large, and judge short NG when the current flow is large whereas duty signal is small.

2. ENABLE CONDITION

Secondary Parameter	Enable Condition
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
OCV control duty	≥ 99.61%
OCV control present current	< 0.306 A

Time Needed for Diagnosis: 2000 milliseconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear NG when the continuous time of completing the malfunction criteria below becomes more than 2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Target current value of OCV	≥ 0.14%
| Target current value of OCV – Control current value of OCV |	≥ 0.08 A

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

- Ignition timing whole learning compensation:
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when IG OFF.
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment from abnormality judgment.
- AVCS control:
  – Most timing retard learning is not complete or most timing retard learning completion is not experienced.
  – ISC feedback compensation: Do not perform the AVCS actual timing advance compensation.
  – Make the OCV driving Duty to be the given value (9.36%).

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DL:DTC P2089 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 1) —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil flow control valve solenoid.
Judge open NG when the current flow is small whereas duty signal is large, and judge short NG when the current flow is large whereas duty signal is small.

2. ENABLE CONDITION

Secondary Parameter	Enable Condition
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
OCV control duty	< 0.39%
OCV control present current	≥ 0.306 A

Time Needed for Diagnosis: 2000 milliseconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear NG when the continuous time of completing the malfunction criteria below becomes more than 2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
| Target current value of OCV – Control current value of OCV |	< 0.08 A

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

- Ignition timing whole learning compensation:
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when IG OFF.
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment from abnormality judgment.
- AVCS control:
  – Most timing retard learning is not complete or most timing retard learning completion is not experienced.
  – ISC feedback compensation: Do not perform the AVCS actual timing advance compensation.
  – Make the OCV driving Duty to be the given value (9.36%).

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DM:DTC P2092 — OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 2)

—

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil flow control valve solenoid.
Judge open NG when the current flow is small whereas duty signal is large, and judge short NG when the current flow is large whereas duty signal is small.

2. ENABLE CONDITION

Secondary Parameter	Enable Condition
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
OCV control duty	≥ 99.61%
OCV control present current	< 0.306 A

Time Needed for Diagnosis: 2000 milliseconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear NG when the continuous time of completing the malfunction criteria below becomes more than 2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Target current value of OCV	≥ 0.14%
| Target current value of OCV – Control current value of OCV |	≥ 0.08 A

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

- Ignition timing whole learning compensation:
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when IG OFF.
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment from abnormality judgment.
- AVCS control:
  – Most timing retard learning is not complete or most timing retard learning completion is not experienced.
  – ISC feedback compensation: Do not perform the AVCS actual timing advance compensation.
  – Make the OCV driving Duty to be the given value (9.36%).

8. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

DN:DTC P2093 — OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 2) —

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil flow control valve solenoid.
Judge open NG when the current flow is small whereas duty signal is large, and judge short NG when the current flow is large whereas duty signal is small.

2. ENABLE CONDITION

Secondary Parameter	Enable Condition
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
OCV control duty	< 0.39%
OCV control present current	≥ 0.306 A

Time Needed for Diagnosis: 2000 milliseconds
Malfunction Indicator Light Illumination: Illuminates as soon as malfunction occurs.

• Normality Judgment

Judge OK and clear NG when the continuous time of completing the malfunction criteria below becomes more than 2 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
| Target current value of OCV – Control current value of OCV |	< 0.08 A

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

- Ignition timing whole learning compensation:
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when IG OFF, and then make the whole learning incomplete.
  – Enter the initial value (whole learning compensation factor = 0.5, Variable amount of whole learning compensation factor = 0.25) to the whole learning compensation factor and variable amount of whole learning compensation factor when making a normality judgment from abnormality judgment, and then make the whole learning incomplete.
- Ignition timing partial learning compensation:
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when IG OFF.
  – Enter the initial value (0°CA) to the compensation value of partial learning zone when making a normality judgment from abnormality judgment.
- AVCS control:
  – Most timing retard learning is not complete or most timing retard learning completion is not experienced.
  – ISC feedback compensation: Do not perform the AVCS actual timing advance compensation.
  – Make the OCV driving Duty to be the given value (9.36%).

8. ECM OPERATION AT DTC SETTING

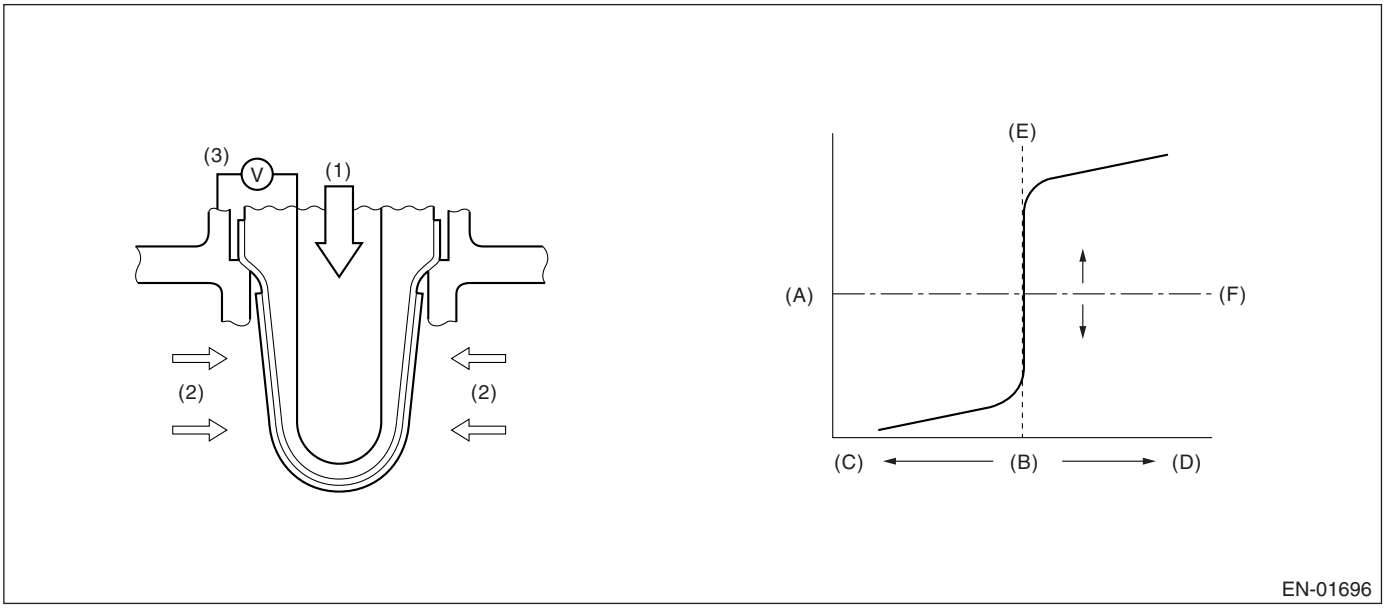
Memorize the freeze frame data. (For test mode $02)

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system whether the amount of sub feedback correction shifts to lean or not. Judge poor correction amount when the amount of sub feedback correction from the start to switching ignition OFF shifts to lean. Change the sub feedback correction amount guard value and shift judgment line and count up the guard operation counter (temporary NG counter) if it is a poor correction amount. Judge NG when the value of guard operation counter exceeds the specified value and when the amount of sub feedback correction shifts to lean.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Rich
(D) Lean
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	40°C (104°F) - 105°C (221°F)
Accumulation time of closed loop control by rear oxygen sensor	200 seconds
Closed loop control by rear oxygen sensor	In operation
Idle switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis at a speed of 75 km/h (47 MPH) or more.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time that the malfunction criteria below are completed is 5 seconds or more. Judge OK when the continuous time that the malfunction criteria below are not completed is 5 seconds or more, and then clear NG.

• Judgment Value

Malfunction Criteria	Threshold Value
Mean value of fuel trim parameter based on rear oxygen sensor	< –0.03 V
Limit of frequency that shifts to rich	≥ 4 times
Ratio of up/down time or rich/lean time of oxygen sensor	≥ 0.4

Time Needed for Diagnosis: 600 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 OK with similar drive in 3 drive cycles
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

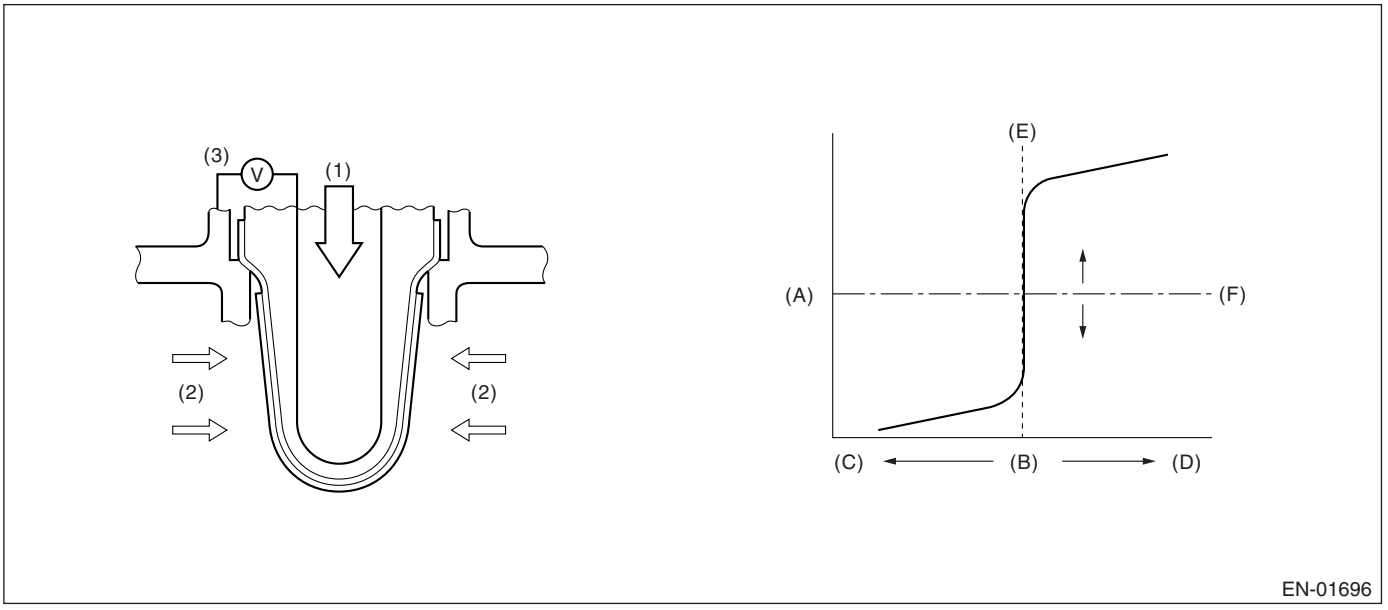
Memorize the freeze frame data. (For test mode $02)

DP:DTC P2097 — POST CATALYST FUEL TRIM SYSTEM TOO RICH BANK 1 —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system whether the amount of sub feedback correction shifts to rich or not. Judge poor correction amount when the amount of sub feedback correction from the start to switching ignition OFF shifts to rich. Change the sub feedback correction amount guard value and shift judgment line and count up the guard operation counter (temporary NG counter) if it is a poor correction amount. Judge NG when the value of guard operation counter exceeds the specified value and when the amount of sub feedback correction shifts to rich.

2. COMPONENT DESCRIPTION



(1) Atmosphere
(2) Exhaust gas
(3) Electromotive force
(A) Electromotive force
(B) Air fuel ratio
(C) Rich
(D) Lean
(E) Theoretical air fuel ratio
(F) Comparative voltage

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine coolant temperature	40°C (104°F) - 105°C (221°F)
Accumulation time of closed loop control by rear oxygen sensor	200 seconds
Closed loop control by rear oxygen sensor	In operation
Idle switch	ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis at a speed of 75 km/h (47 MPH) or more.

5. DIAGNOSTIC METHOD

Judge NG when the continuous time that the malfunction criteria below are completed is 5 seconds or more. Judge OK when the continuous time that the malfunction criteria below are not completed is 5 seconds or more, and then clear NG.

• Judgment Value

Malfunction Criteria	Threshold Value
Mean value of fuel trim parameter based on rear oxygen sensor	≥ 0.025
Limit of frequency that shifts to lean	≥ 4 times
Ratio of up/down time or rich/lean time of oxygen sensor	≤ 2.3

Time Needed for Diagnosis: 600 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous drive 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 OK with similar drive in 3 drive cycles.
- When “Clear Memory” was performed

8. FAIL SAFE

None

9. ECM OPERATION AT DTC SETTING

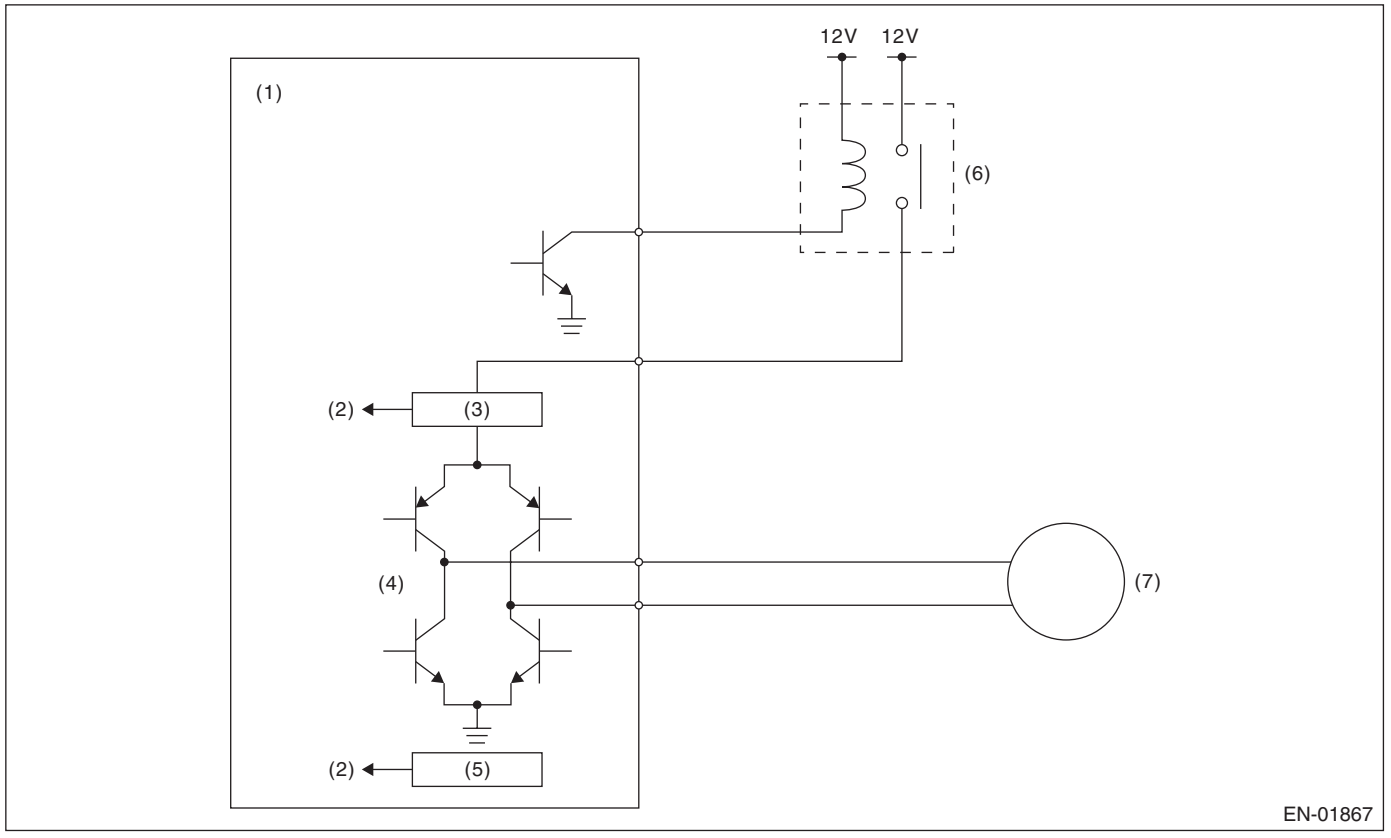
Memorize the freeze frame data. (For test mode $02)

DQ:DTC P2101 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Judge NG when the motor current becomes large or drive circuit is heated.

2. COMPONENT DESCRIPTION



(1) Engine control unit (ECM)
(2) Detection circuit
(3) Overcurrent detection circuit
(4) Drive circuit
(5) Temperature detection circuit
(6) Electronic control throttle relay
(7) Motor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Under control of electronic control throttle	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Motor current	≤ 8 A
Drive circuit inner temperature	≤ 175°C (347°F)

Time Needed for Diagnosis:

- 500 milliseconds (NG judgment)
- 2000 milliseconds (OK judgment)

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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed (Only engine stop)

8. FAIL SAFE

Stop the continuity to the electronic control throttle motor. (Fix the throttle opening angle to 6°.)

9. ECM OPERATION AT DTC SETTING

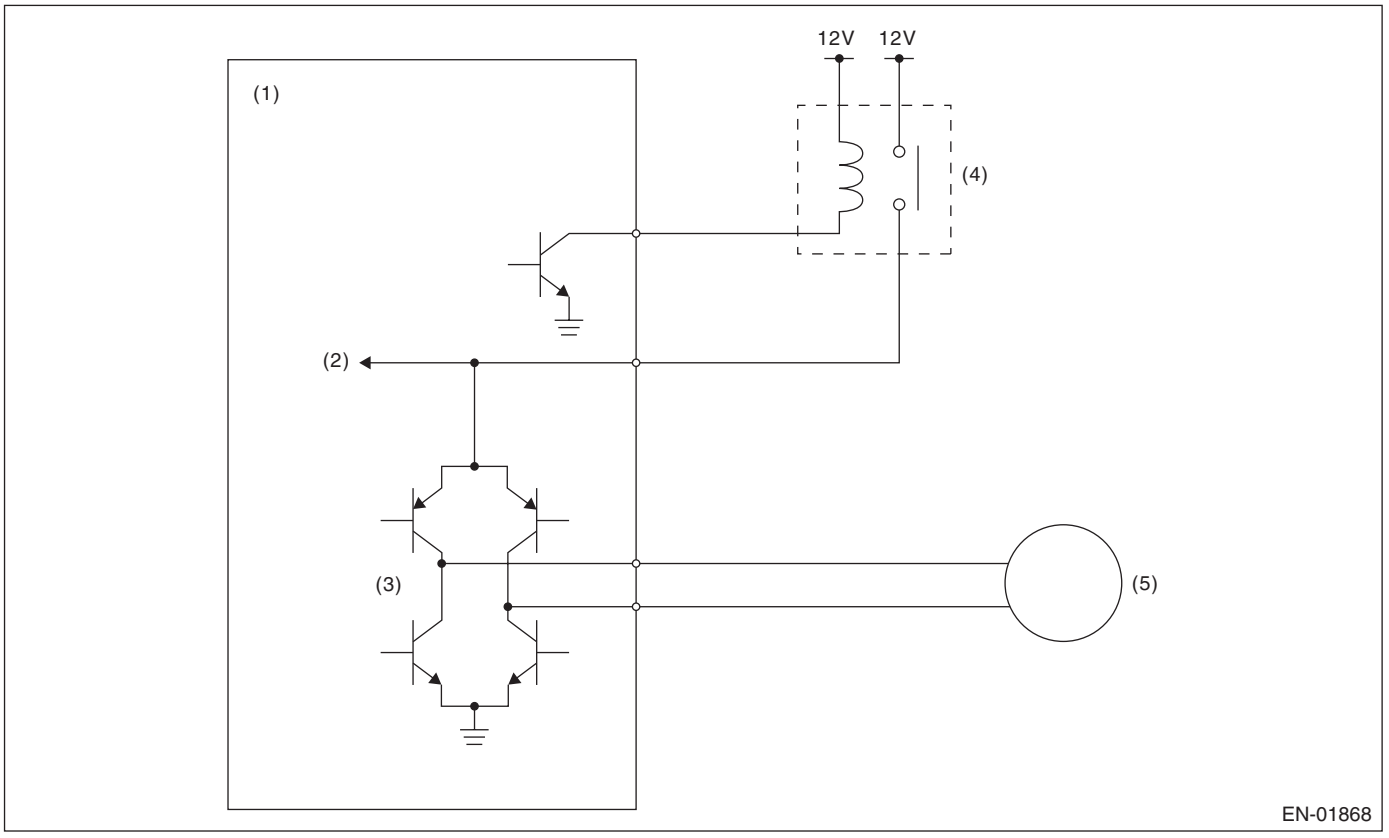
Memorize the freeze frame data. (For test mode $02)

DR:DTC P2102 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW —

1. OUTLINE OF DIAGNOSIS

Judge NG when the electronic control throttle power is not supplied even when ECM sets the electric control throttle relay to ON.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Voltage detection circuit
(3) Drive circuit
(4) Electronic control throttle relay
(5) Motor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Electronic control throttle relay output	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge OK and clear NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	≥ 5 V

Time Needed for Diagnosis:

- 400 milliseconds (For NG)
- 2000 milliseconds (For OK)

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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed (Only engine stop)

8. FAIL SAFE

Stop the continuity to the electronic control throttle motor. (Fix the throttle opening angle to 6°.)

9. ECM OPERATION AT DTC SETTING

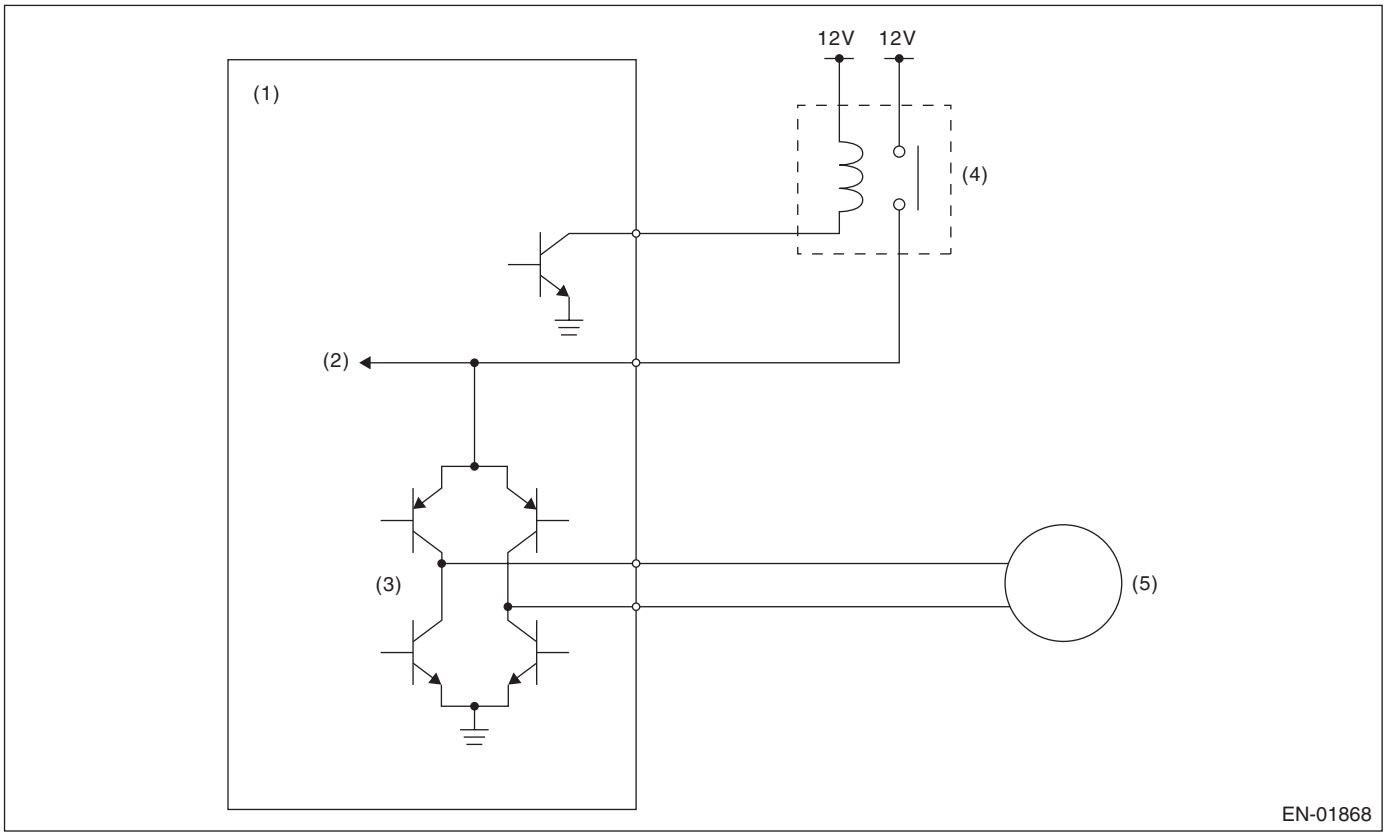
Memorize the freeze frame data. (For test mode $02)

DS:DTC P2103 — THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH —

1. OUTLINE OF DIAGNOSIS

Judge NG when the power for electronic throttle control system is not supplied even when ECM sets the electric throttle control relay to OFF.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Voltage detection circuit
(3) Drive circuit
(4) Electronic throttle control relay
(5) Motor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Electronic throttle control relay output	OFF

4. GENERAL DRIVING CYCLE

- Ignition switch ON → OFF
- Ignition switch OFF → ON (After clear memory only)

5. DIAGNOSTIC METHOD

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	≤ 5 V

Time Needed for Diagnosis:

- 600 milliseconds (For NG)
- 400 milliseconds (For OK)

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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed (Only engine stop)

8. FAIL SAFE

Stop the continuity to the electronic control throttle motor. (Fix the throttle opening angle to 6°.)

9. ECM OPERATION AT DTC SETTING

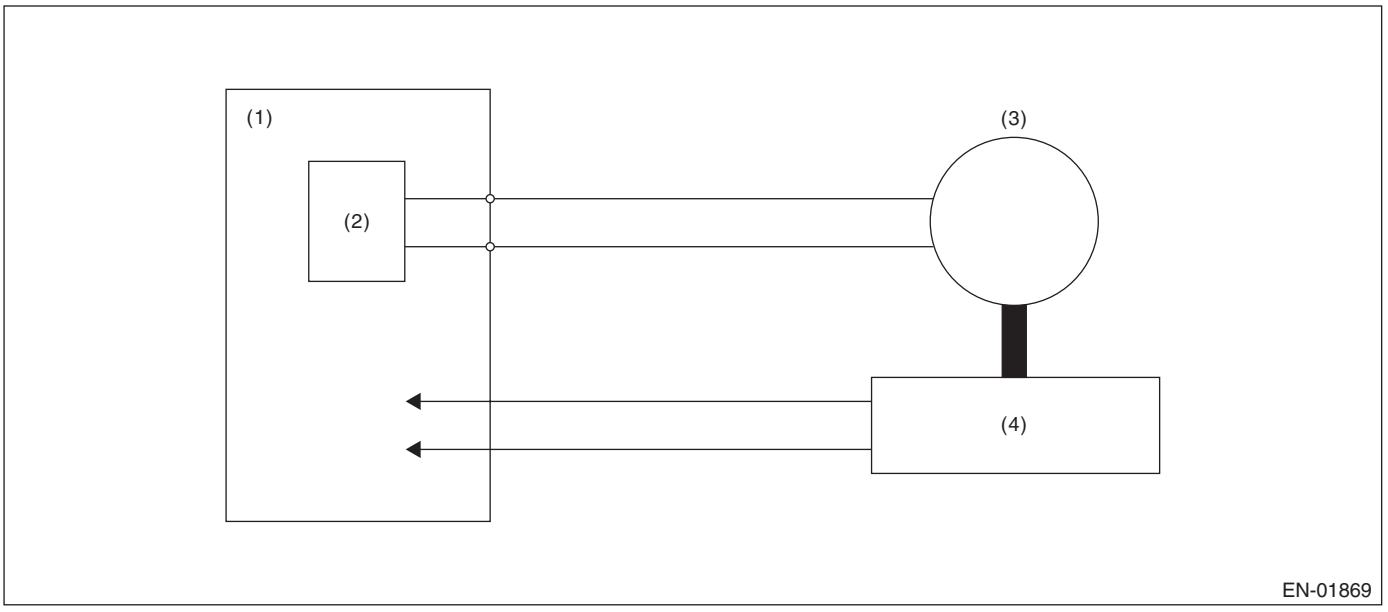
Memorize the freeze frame data. (For test mode $02)

DT:DTC P2109 — THROTTLE/PEDAL POSITION SENSOR A MINIMUM STOP PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Judge NG when all close point learning cannot conducted or abnormal value is detected.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Drive circuit
(3) Motor
(4) Throttle position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON → OFF
Ignition switch (after clear memory only)	OFF → ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis at all close point learning.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge OK and clear the NG when the malfunction criteria below are completed.

• Judgment Value

Malfunction Criteria	Threshold Value
Throttle sensor voltage at all close point learning	0.41 — 0.79 V
Time for all close point learning completion	Within 80 milliseconds

Time Needed for Diagnosis: None
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed (Only engine stop)

8. FAIL SAFE

Stop the continuity to the electronic control throttle motor. (Fix the throttle opening angle to 6°.)

9. ECM OPERATION AT DTC SETTING

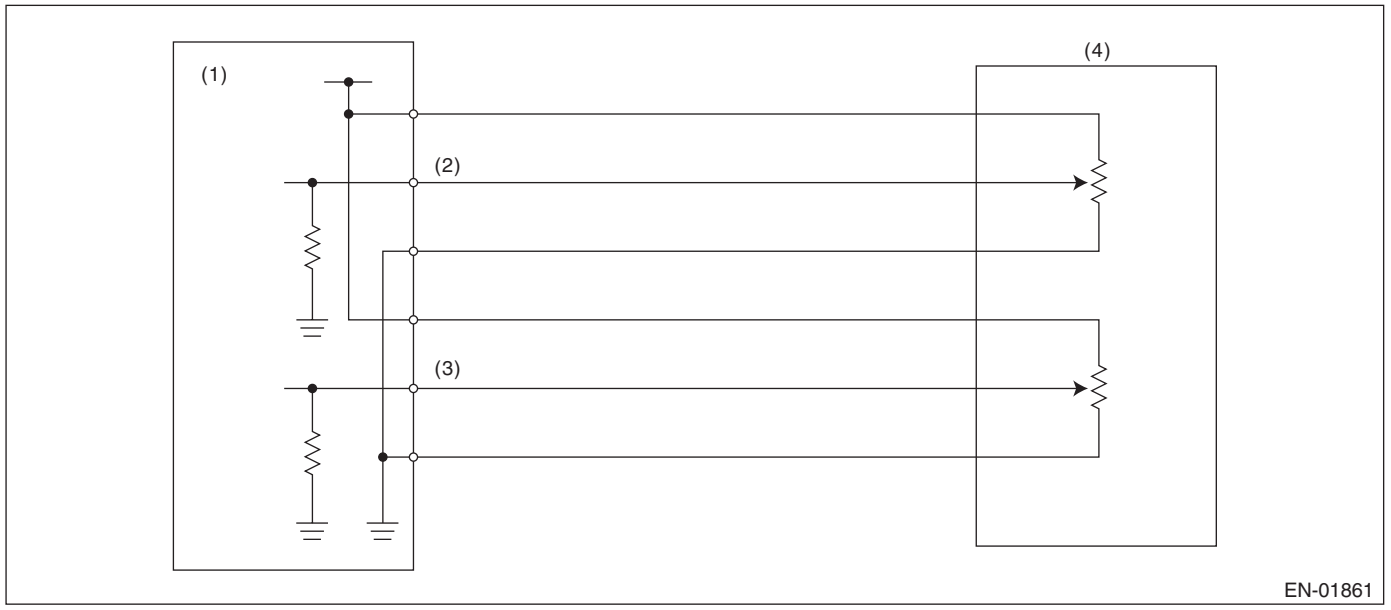
Memorize the freeze frame data. (For test mode $02)

DU:DTC P2122 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal.
(3) Accelerator pedal position sensor 2 signal.
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always 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
Sensor 1 input voltage	≥ 0.308 V

Time Needed for Diagnosis: 100 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed (Only engine stop)

8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Multi malfunction: Fix the throttle opening angle to 6°.

9. ECM OPERATION AT DTC SETTING

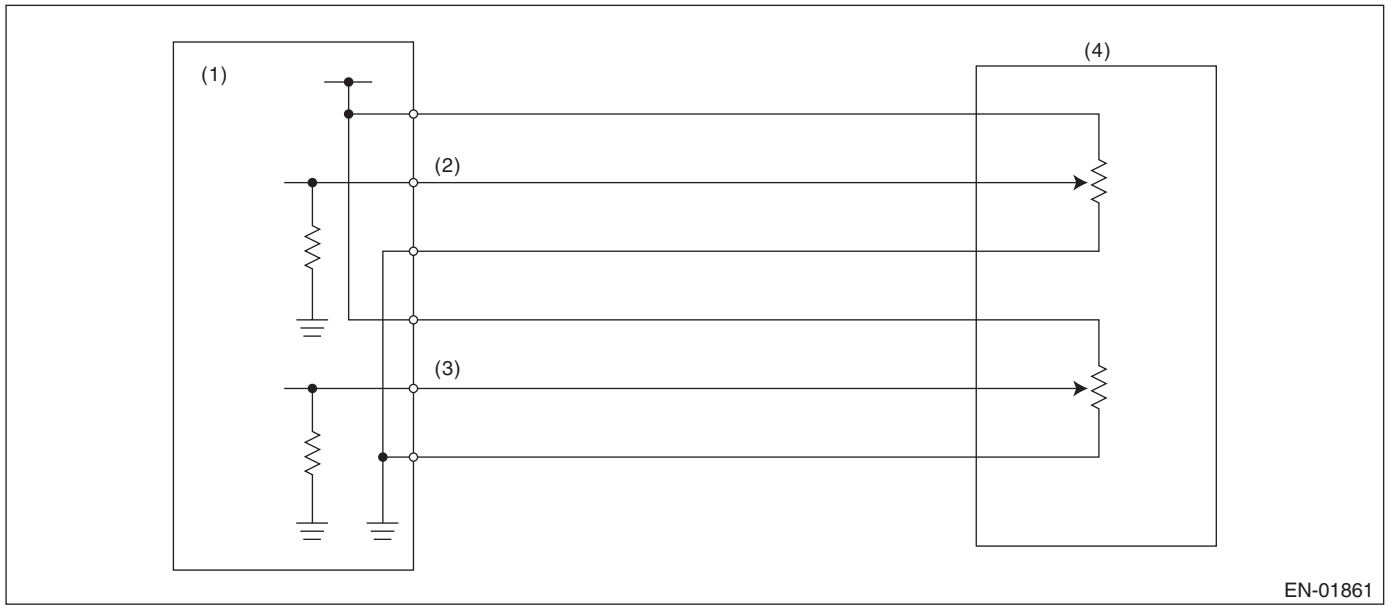
Memorize the freeze frame data. (For test mode $02)

DV:DTC P2123 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 1.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal.
(3) Accelerator pedal position sensor 2 signal.
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always 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
Sensor 1 input voltage	≤ 4.856 V

Time Needed for Diagnosis: 100 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed (Only engine stop)

8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Multi malfunction: Fix the throttle opening angle to 6°.

9. ECM OPERATION AT DTC SETTING

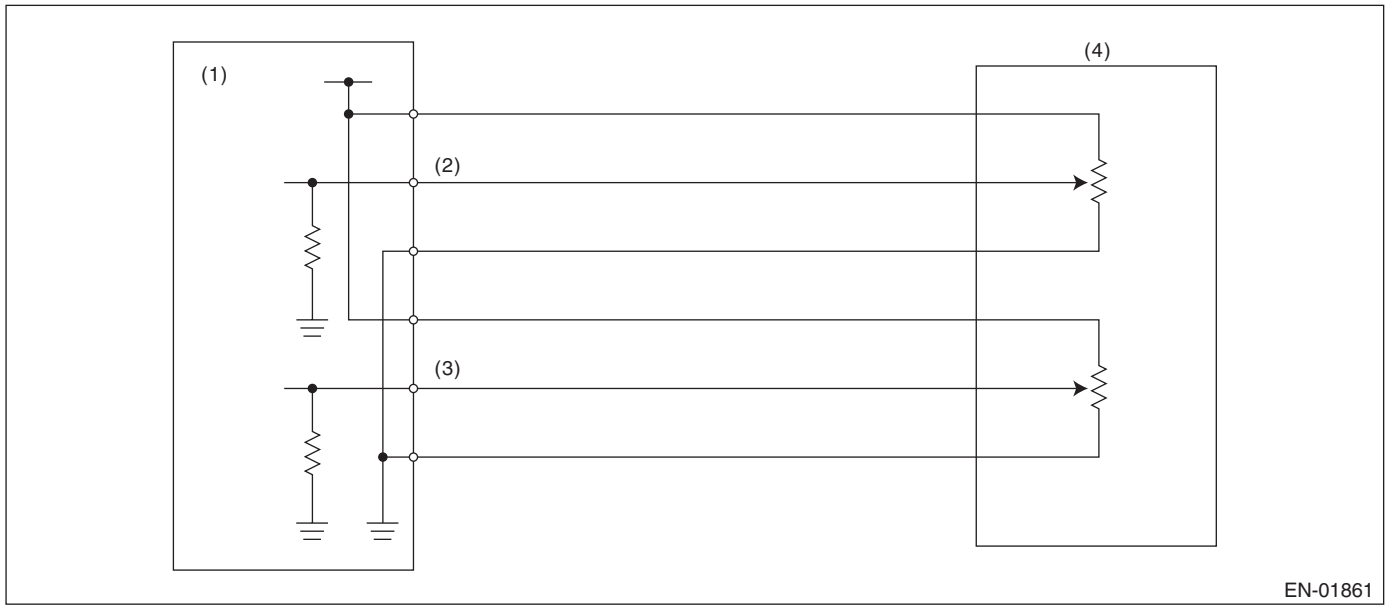
Memorize the freeze frame data. (For test mode $02)

DW:DTC P2127 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT LOW INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal.
(3) Accelerator pedal position sensor 2 signal.
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always 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
Sensor 1 input voltage	≥ 0.308 V

Time Needed for Diagnosis: 100 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed (Only engine stop)

8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Multi malfunction: Fix the throttle opening angle to 6°.

9. ECM OPERATION AT DTC SETTING

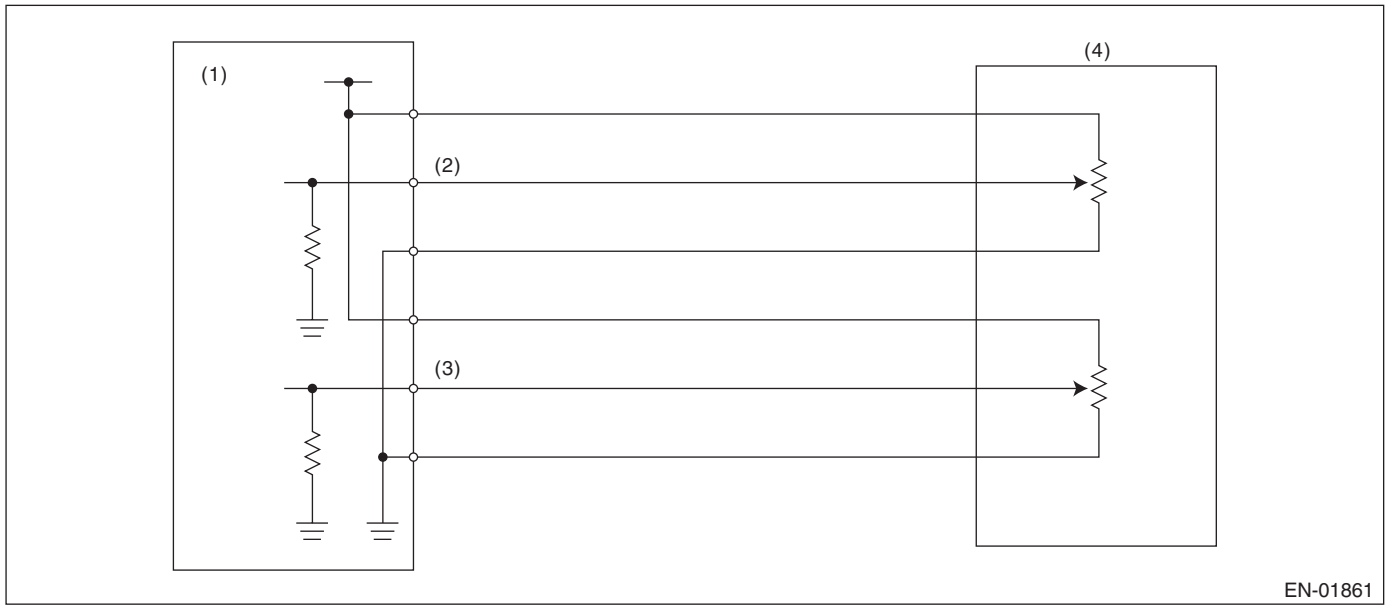
Memorize the freeze frame data. (For test mode $02)

DX:DTC P2128 — THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT —

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of accelerator pedal position sensor 2.
Judge NG when out of the standard value.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal.
(3) Accelerator pedal position sensor 2 signal.
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always 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
Sensor 1 input voltage	≥ 4.856 V

Time Needed for Diagnosis: 80 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When "Clear Memory" was performed (Only engine stop)

8. FAIL SAFE

- Single malfunction: Control with normal sensor
- Multi malfunction: Fix the throttle opening angle to 6°.

9. ECM OPERATION AT DTC SETTING

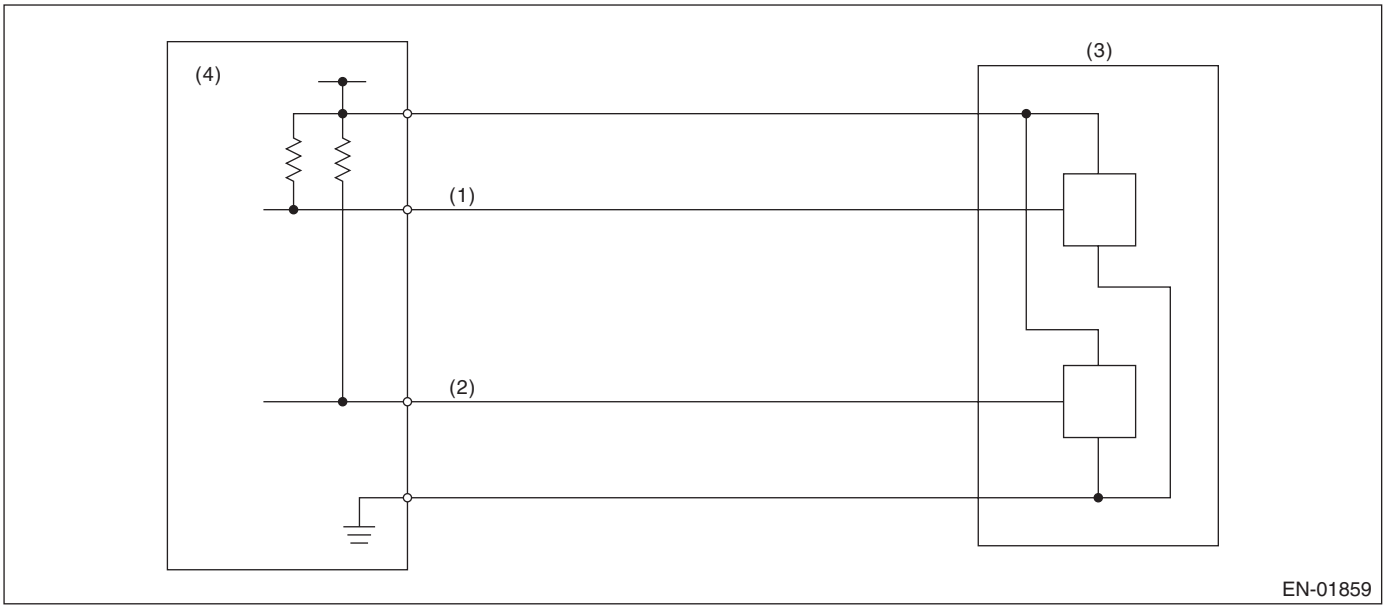
Memorize the freeze frame data. (For test mode $02)

DY:DTC P2135 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” / “B” VOLTAGE RATIONALITY —

1. OUTLINE OF DIAGNOSIS

Judge NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

2. COMPONENT DESCRIPTION



(1) Throttle position sensor 1 signal.
(2) Throttle position sensor 2 signal.
(3) Throttle position sensor
(4) Engine control module (ECM)

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

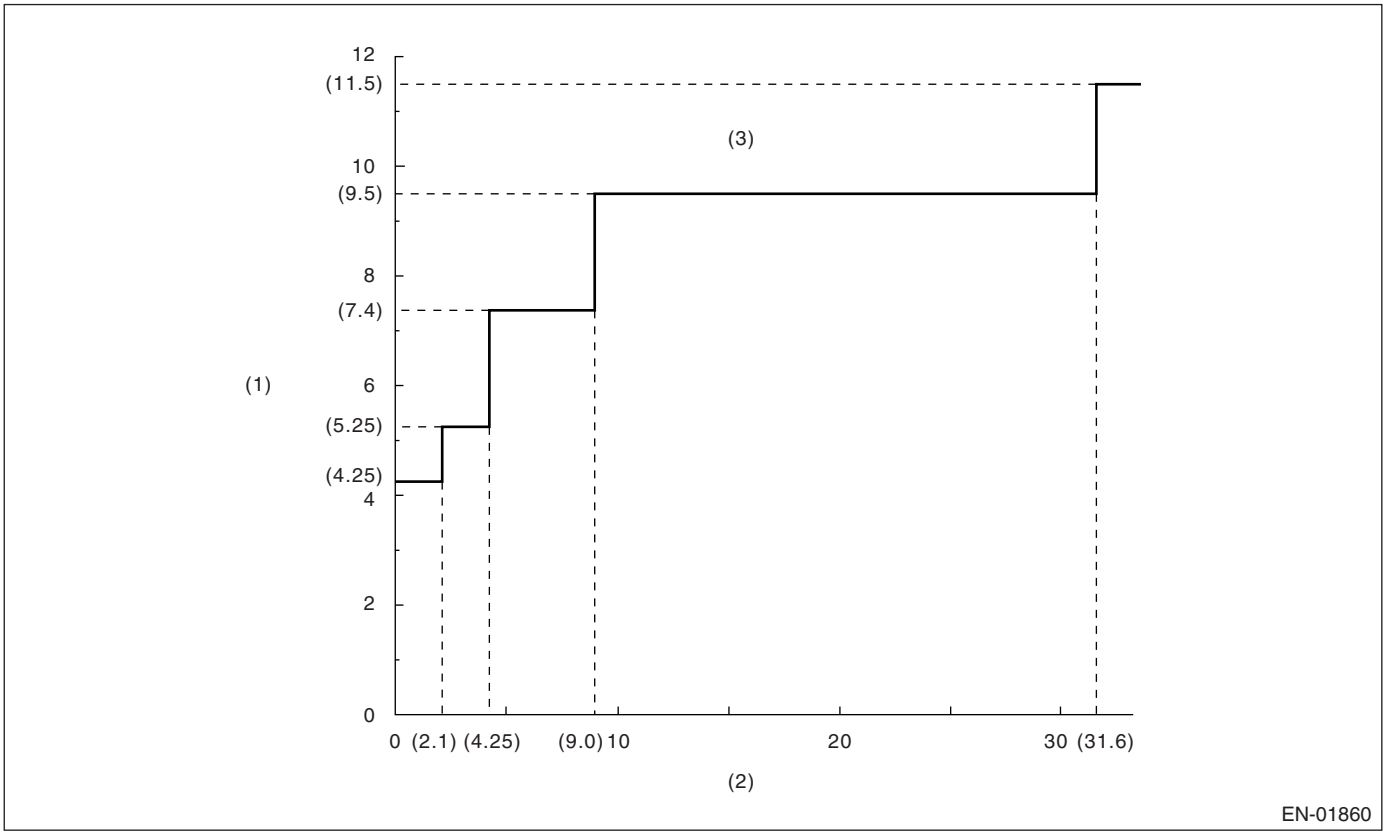
5. DIAGNOSTIC METHOD

Judge OK and clear the NG when the malfunction criteria below are completed.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	≤ 4.25

Details of Judgment Value



(1) Sensor output difference (°)
(2) Throttle position sensor 1 opening angle (°)
(3) NG area

Time Needed for Diagnosis: 212 milliseconds
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 (Only engine stop)

7. MALFUNCTION INDICATOR LIGHT CLEAR CONDITION

- When the OK driving cycle was completed 3 times in a row
- When “Clear Memory” was performed (Only engine stop)

8. FAIL SAFE

Stop the continuity to ETC motor. (Fix the throttle opening angle to 6°.)

9. ECM OPERATION AT DTC SETTING

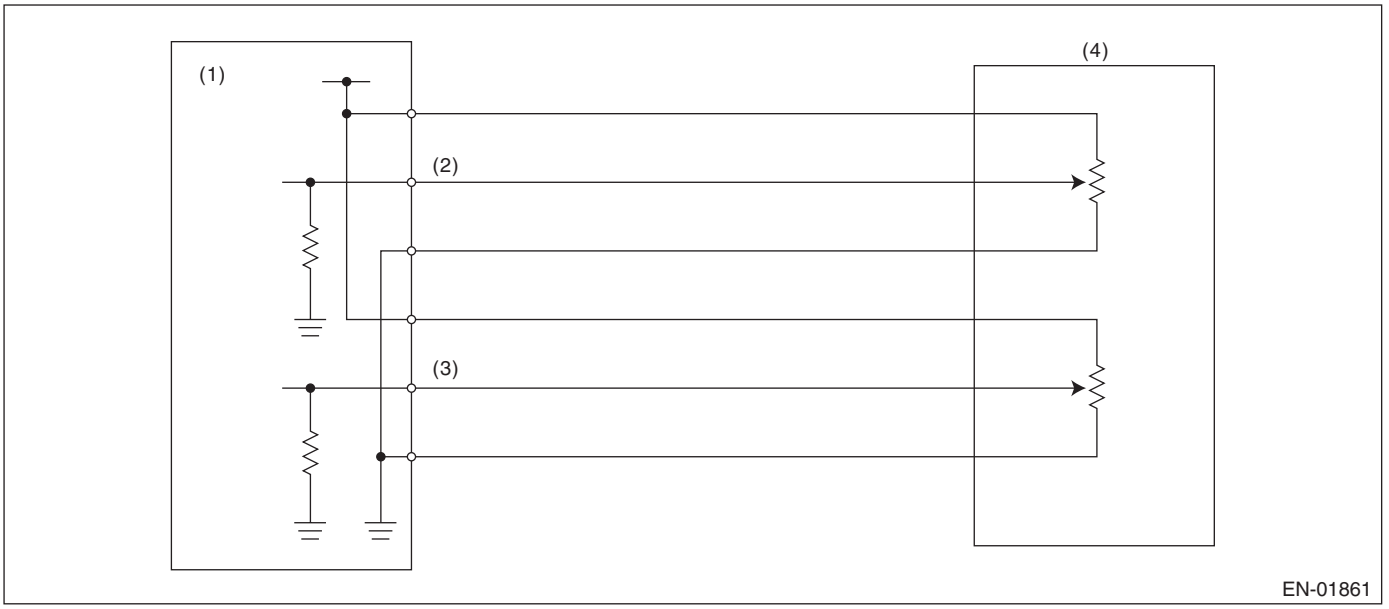
Memorize the freeze frame data. (For test mode $02)

DZ:DTC P2138 — THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” / “E” VOLTAGE RATIONALITY —

1. OUTLINE OF DIAGNOSIS

Judge NG when the signal level of throttle position sensor 1 is different from the throttle position sensor 2.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Accelerator pedal position sensor 1 signal.
(3) Accelerator pedal position sensor 2 signal.
(4) Accelerator pedal position sensor

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Ignition switch	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

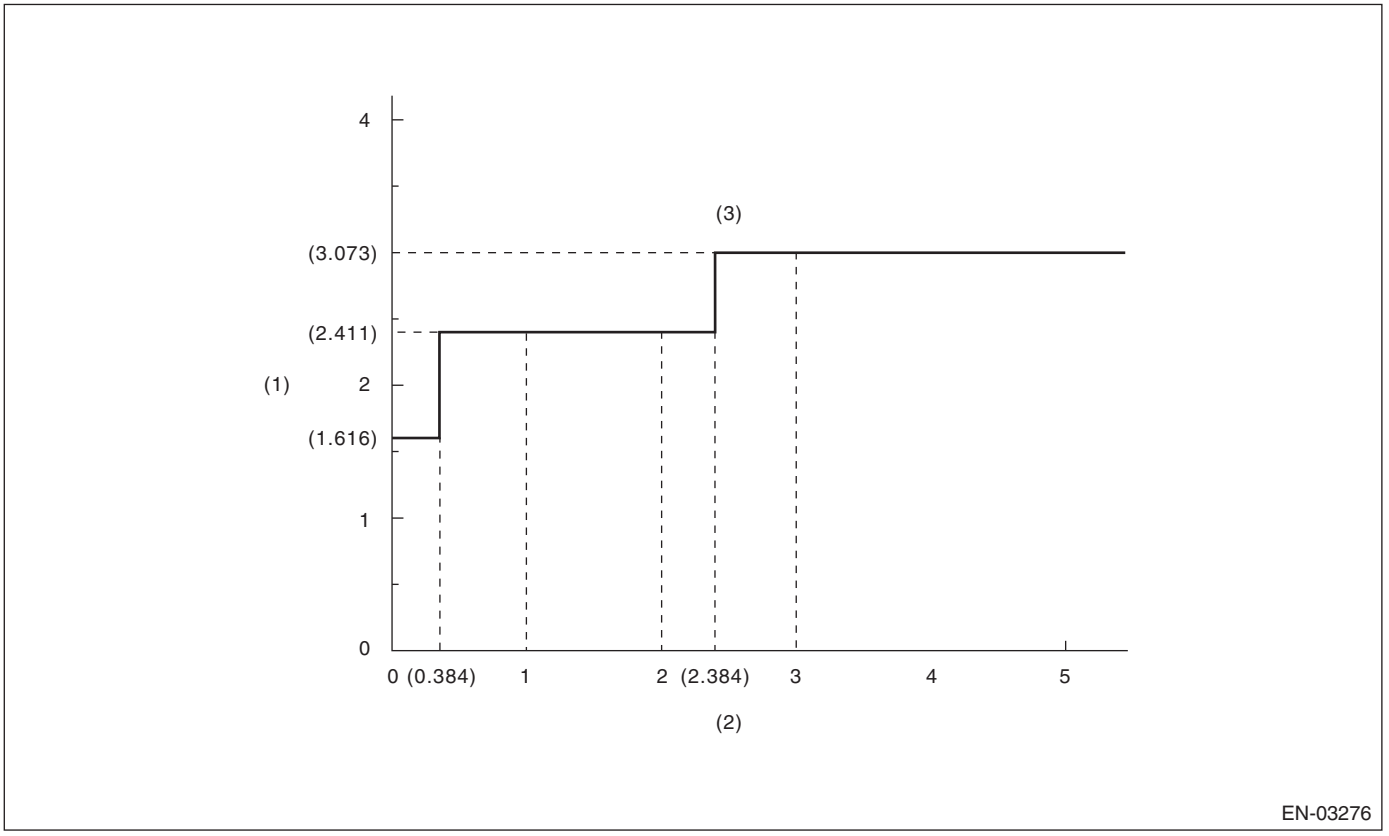
5. DIAGNOSTIC METHOD

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	≥ 1.616

Details of Judgment Value



(1) Sensor output difference (°)
(2) Accelerator pedal position sensor 2 opening angle (°)
(3) NG area

Time Needed for Diagnosis:
- 116 milliseconds (For NG)
- 1000 milliseconds (For OK)

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

Fix the throttle opening angle to 6°.

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

EA:DTC P2227 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE —

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of atmospheric pressure sensor output property. Judge NG when the atmospheric pressure sensor output is largely different from the intake manifold pressure at engine starting.

2. COMPONENT DESCRIPTION

Atmospheric pressure sensor is built in ECM.

3. ENABLE CONDITION

Secondary Parameters	Enable Conditions
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.62 MPH)

4. GENERAL DRIVING CYCLE

Perform the diagnosis once before engine starting with the ignition switch ON.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.3 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
|Atmospheric – manifold absolute pressure|	≥ 26.7 kPa (200 mmHg, 7.88 inHg)
|Intake manifold pressure at engine starting – Manifold absolute pressure|	< 1.33 kPa (10 mmHg, 2.95 inHg)

Time Needed for Diagnosis: 0.3 seconds
Malfunction Indicator Light Illumination: Detect when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge OK and clear the NG when the continuous time of completing the malfunction criteria below becomes more than 0.26 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Atmospheric – Manifold absolute pressure	< 26.7 kPa (200 mmHg, 7.88 inHg)

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 pressure sensor process: Fix the atmospheric pressure to 101 kPa (760 mmHg, 29.8 inHg).

9. ECM OPERATING AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

EB:DTC P2228 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT) —

1. OUTLINE OF DIAGNOSIS

Detect the open or 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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Output voltage	< 0.118 V

Time Needed for Diagnosis: 0.5 seconds
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
Ignition switch	ON
Output voltage	≥ 0.118 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

Atmospheric pressure sensor process: Fix the atmospheric pressure to 101.3 kPa (760 mmHg, 29.9 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

EC:DTC P2229 — ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT) —

1. OUTLINE OF DIAGNOSIS

Detect the open or 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
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the continuous time of completing the malfunction criteria below becomes more than 0.5 seconds.

• Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Output voltage	≥ 4.936 V

Time Needed for Diagnosis: 0.5 seconds
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
Ignition switch	ON
Output voltage	< 4.936 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

Atmospheric pressure sensor process: Fix the atmospheric pressure to 101.3 kPa (760 mmHg, 29.9 inHg).

9. ECM OPERATION AT DTC SETTING

Memorize the freeze frame data. (For test mode $02)

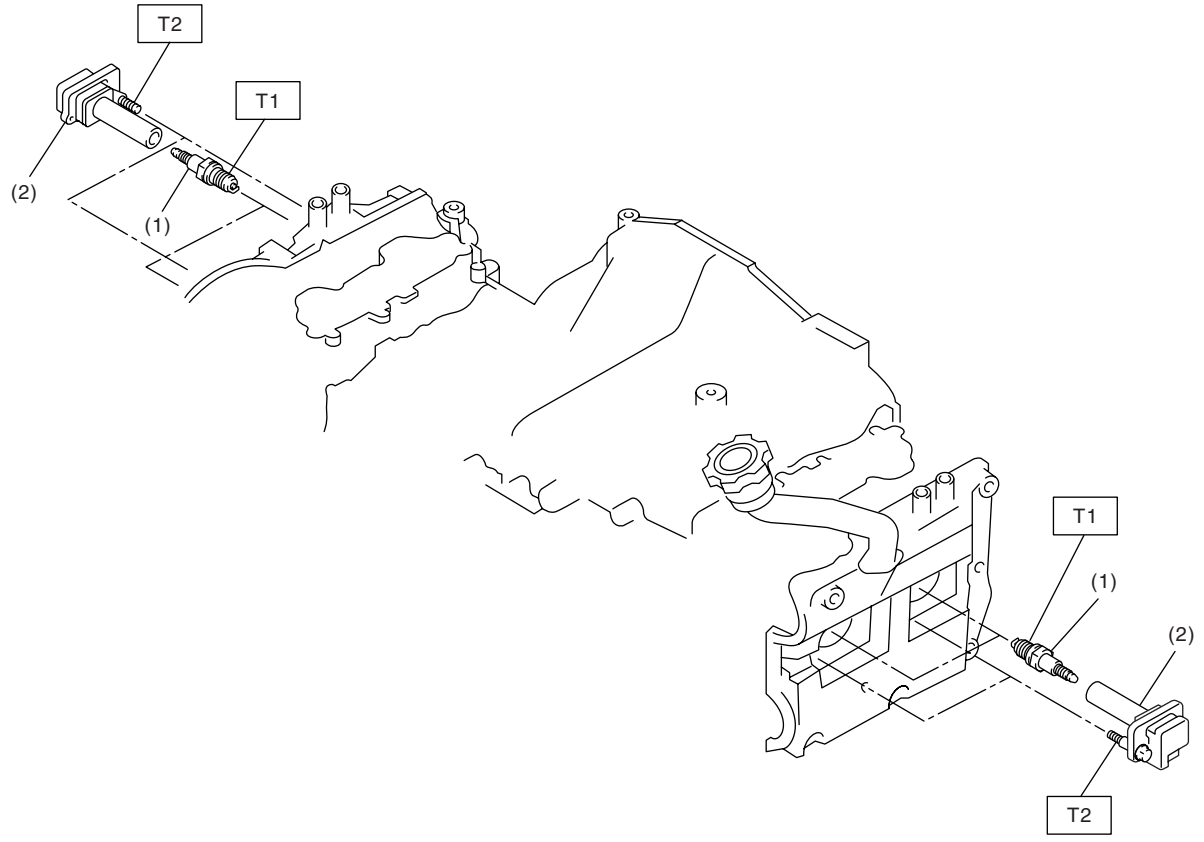
MEMO:

1. General Description

A: SPECIFICATIONS

Item		Designation
Ignition coil & ignitor assembly	Model	FK0186
	Ignition type	Direct ignition
	Manufacturer	DIAMOND
Spark plug	Type and manufacturer	NGK: ILFR6B
	Thread diameter, pitch, length mm	14, 1.25, 26.5
	Spark plug gap mm (in)	0.7 — 0.8 (0.028 — 0.031)
	Electrode	Platinum, Iridium

B: COMPONENT



(1) Spark plug
(2) Ignition coil & ignitor ASSY

Tightening torque: N·m (kgf-m, ft-lb)
T1: 21 (2.1, 15.2)
T2: 16 (1.6, 11.7)

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. Spark Plug

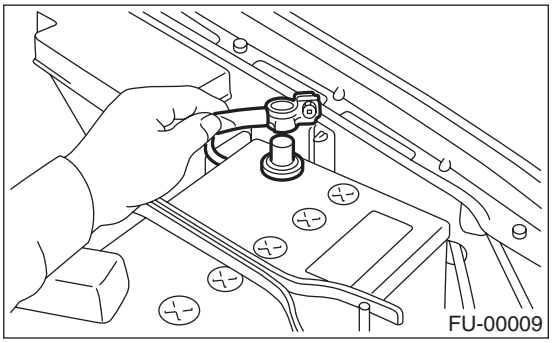
A: REMOVAL

CAUTION:
All spark plugs installed on an engine, must be of the same heat range.

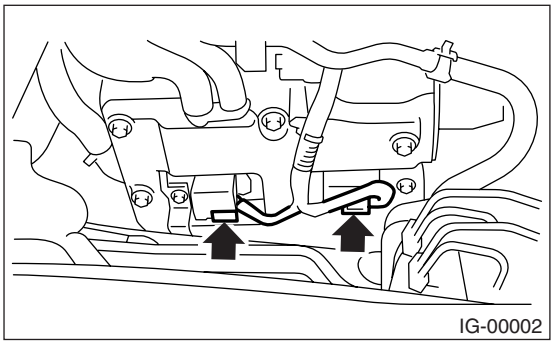
Spark plug:
NGK: ILFR6B

1. RH SIDE

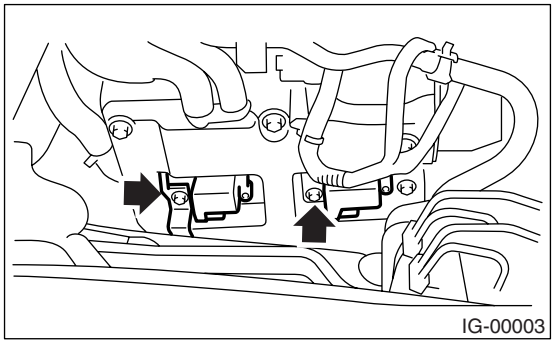
1) Disconnect the ground cable from battery.



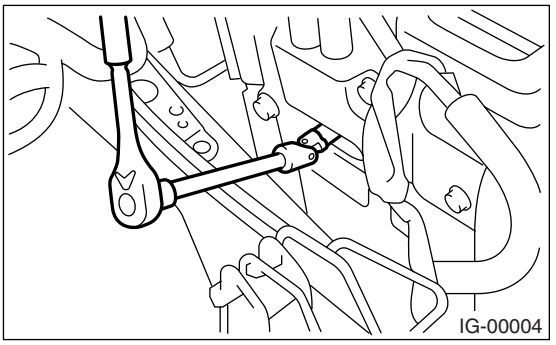
2) Remove the air cleaner lower case. <Ref. to IN(H4DOTC)-7, REMOVAL, Air Cleaner.>
3) Disconnect the connector from ignition coil.



4) Remove the ignition coil.

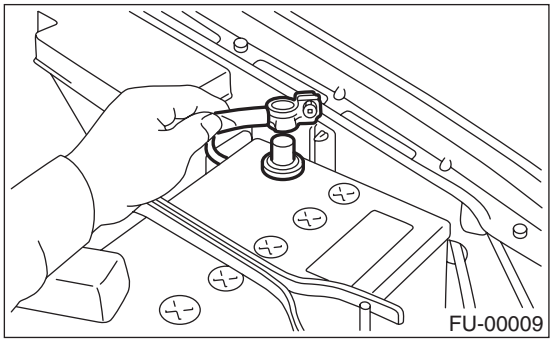


5) Remove the spark plugs with the spark plug sockets.

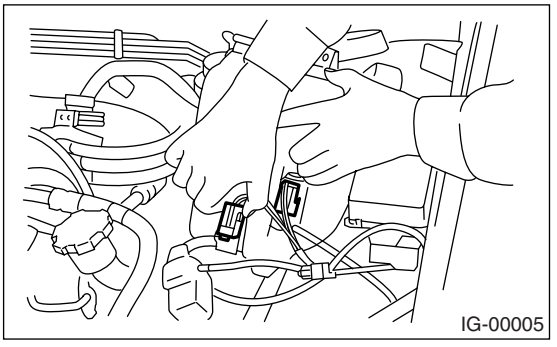


2. LH SIDE

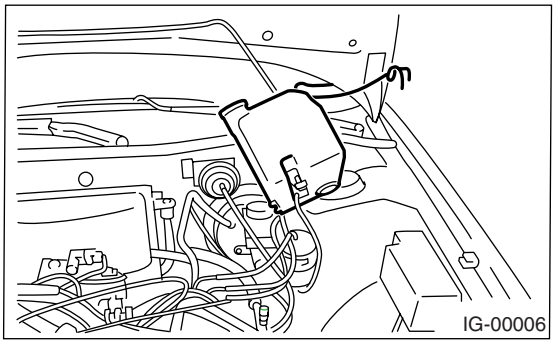
1) Disconnect the battery cables, and then remove the battery and battery carrier.



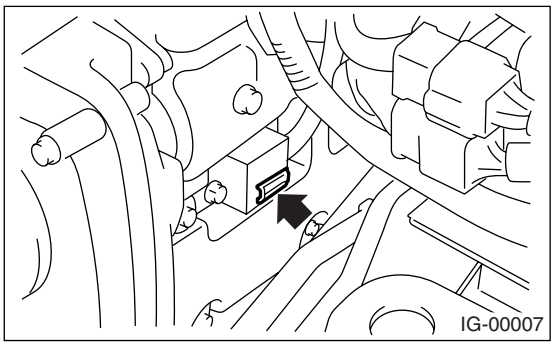
2) Disconnect the washer motor connector.



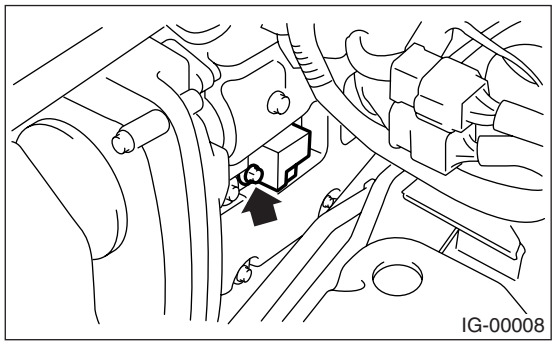
3) Disconnect the rear window glass washer hose from washer motor, then plug connection with a suitable cap.
4) Remove the two bolts which hold washer tank, then take the tank away from working area.



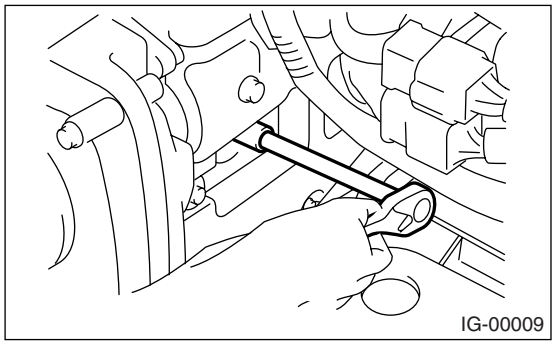
5) Disconnect the connector from ignition coil.



6) Remove the ignition coil.



7) Remove the spark plugs with the spark plug sockets.



B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.2 ft-lb)

Tightening torque (Ignition coil):
16 N·m (1.6 kgf-m, 11.7 ft-lb)

NOTE:
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.

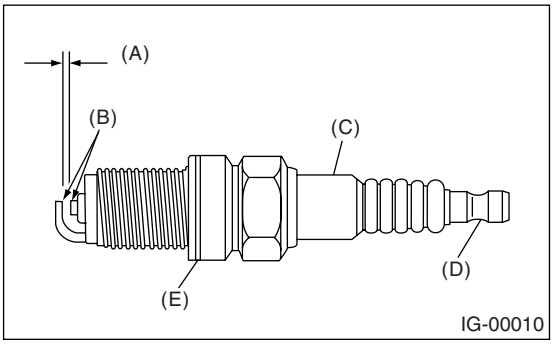
Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.2 ft-lb)

Tightening torque (Ignition coil):
16 N·m (1.6 kgf-m, 11.7 ft-lb)

NOTE:
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.

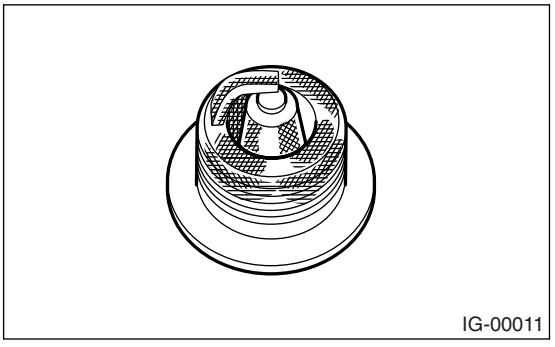
C: INSPECTION

Check the electrodes and inner and outer porcelain of plugs, noting the type of deposits and the degree of electrode erosion.

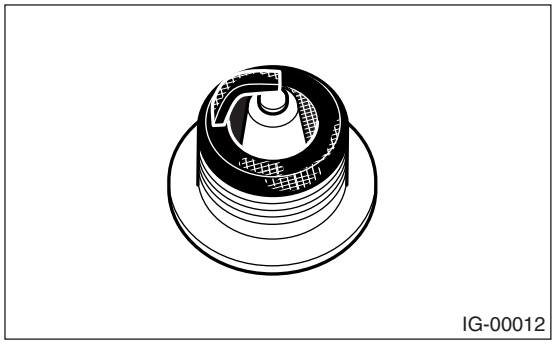


(A) Spark plug gap
(B) Carbon accumulation or wear
(C) Cracks
(D) Damage
(E) Damaged gasket

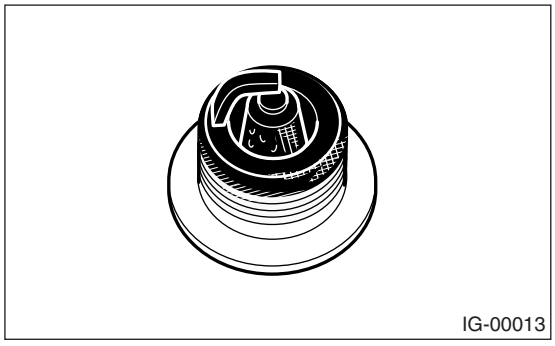
1) Normal:
Brown to grayish-tan deposits and slight electrode wear indicates correct spark plug heat range.



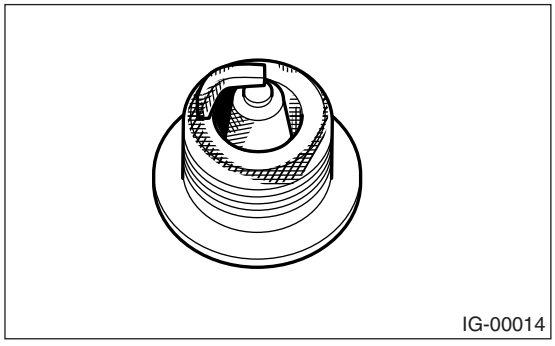
2) Carbon fouled:
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.


IG-00012

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.


IG-00013

4) Overheating:
White or light gray insulator with black or 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.

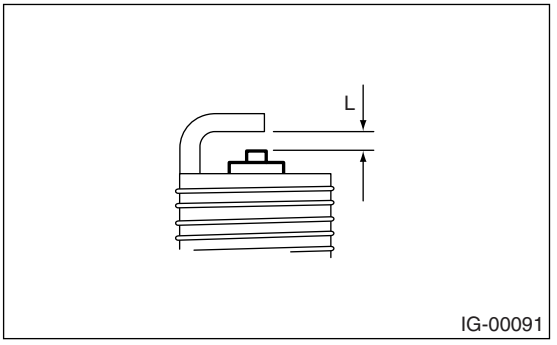

IG-00014

D: ADJUSTMENT

Clean the spark plugs with a wire brush. Clean and remove the carbon or oxide deposits, but do not wear away porcelain.
If deposits are too stubborn, replace the plugs.
After cleaning the spark plugs, correct the spark plug gap using a gap gauge.

NOTE:
Do not use spark plug cleaners, because the spark plugs are applied with iridium tips.

Spark plug gap: L
0.7 — 0.8 mm (0.028 — 0.031 in)



IG-00091

3. Ignition Coil and Ignitor ASSY

A: REMOVAL

Direct ignition type has been adopted. Refer to the “Spark Plug Removal” for removal procedure. <Ref. to IG(H4DOTC)-5, REMOVAL, Spark Plug.>

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.7 ft-lb)

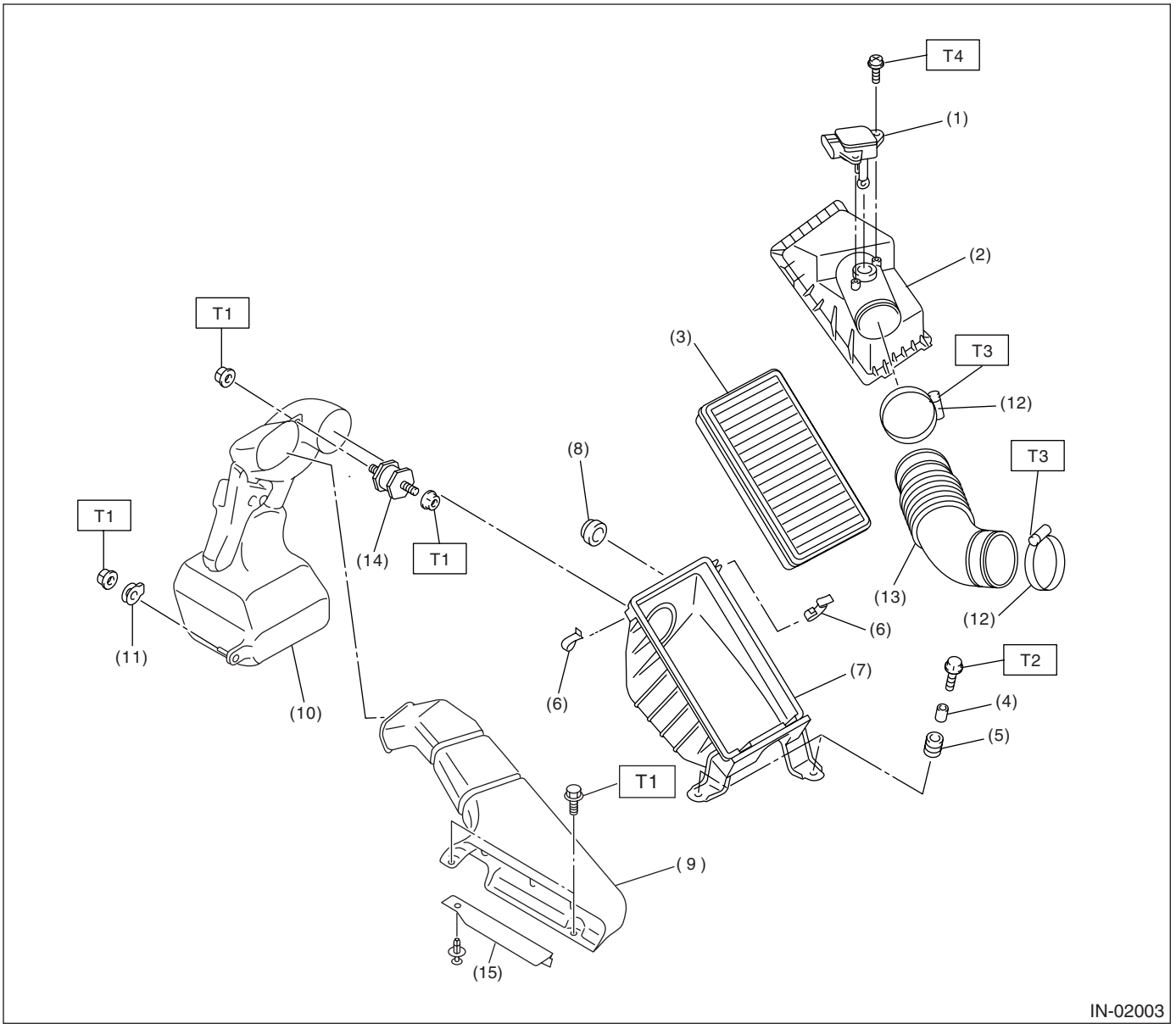
C: INSPECTION

For inspection, refer to the following. <Ref. to EN(H4DOTC)-73, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>

1. General Description

A: COMPONENT

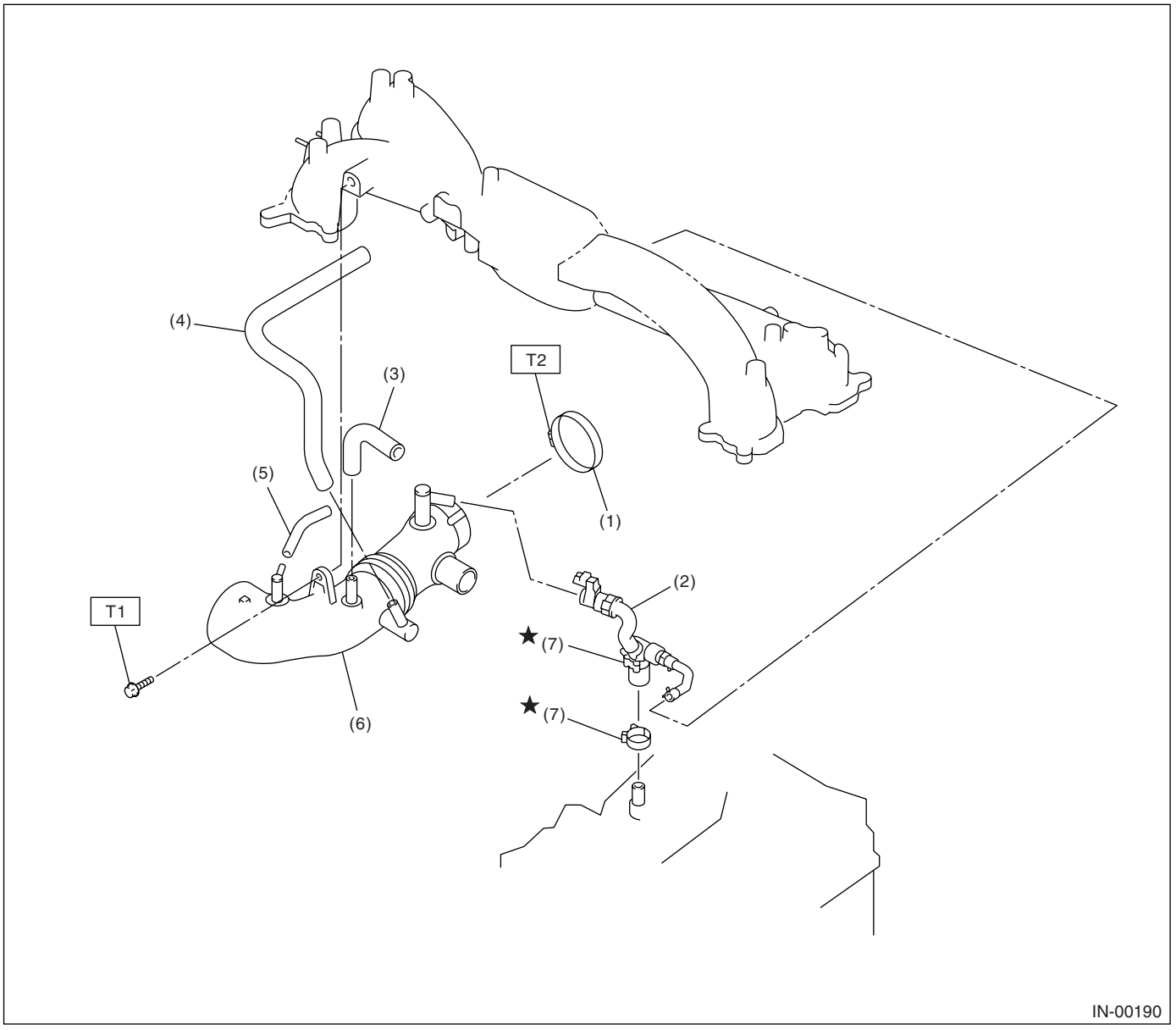
1. AIR CLEANER



(1) Mass air flow and intake air temperature sensor
(2) Air cleaner upper cover
(3) Air cleaner element
(4) Spacer
(5) Cushion
(6) Clip
(7) Air cleaner lower case
(8) Cushion
(9) Air intake duct
(10) Resonator chamber ASSY
(11) Cushion
(12) Clamp
(13) Air intake boot
(14) Cushion
(15) Plate

Tightening torque: N·m (kgf-m, ft-lb)
T1: 7.5 (0.76, 5.5)
T2: 33 (3.4, 24.6)
T3: 2.5 (0.25, 1.8)
T4: 1.0 (0.10, 1)

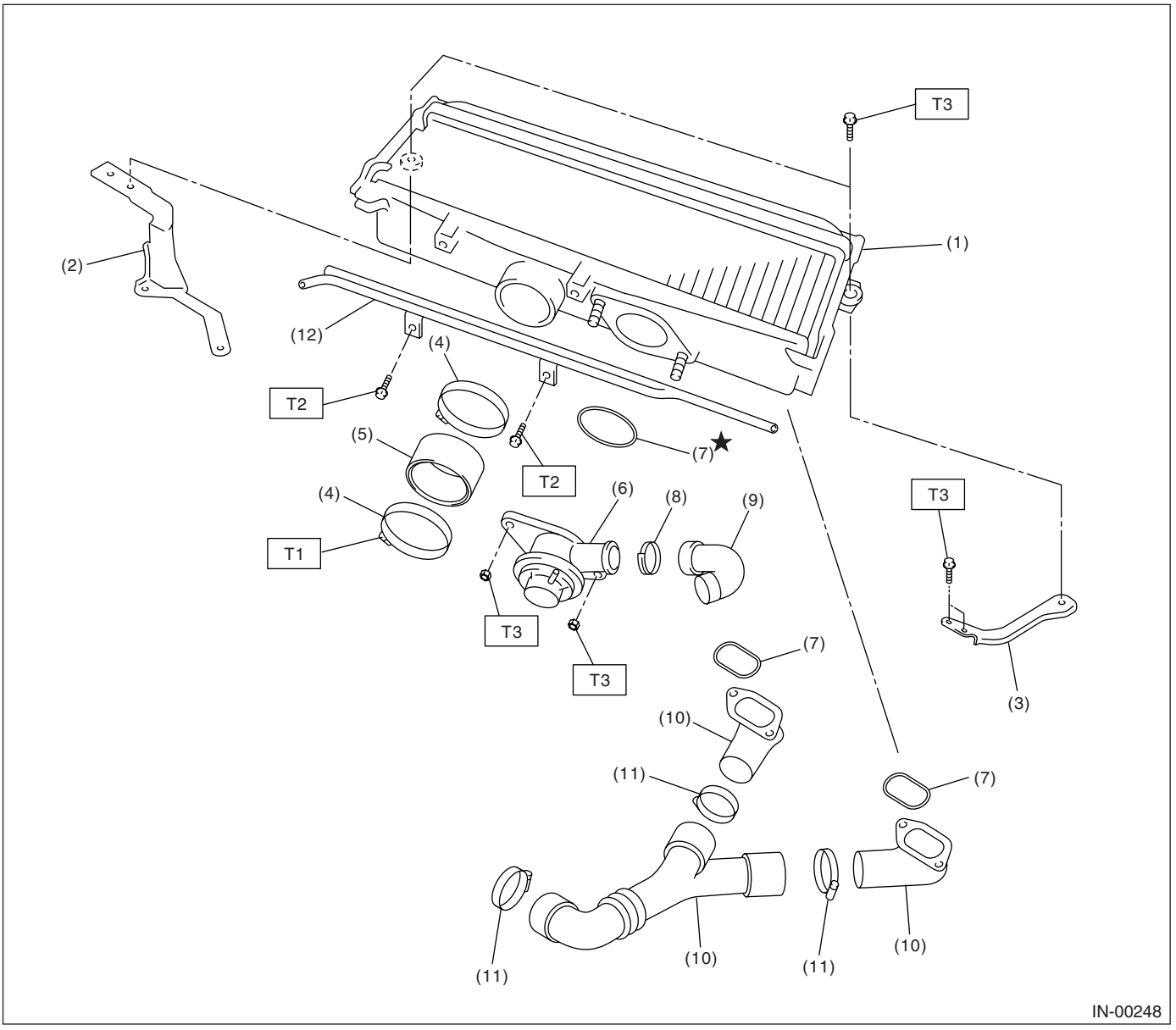
2. INTAKE DUCT



(1) Clamp
(2) PCV hose ASSY
(3) Air bypass hose A
(4) Air bypass hose B
(5) Air bypass hose C
(6) Intake duct
(7) Clamp

Tightening torque: N·m (kgf-m, ft-lb)
T1: 19 (1.9, 13.7)
T2: 3 (0.3, 2.2)

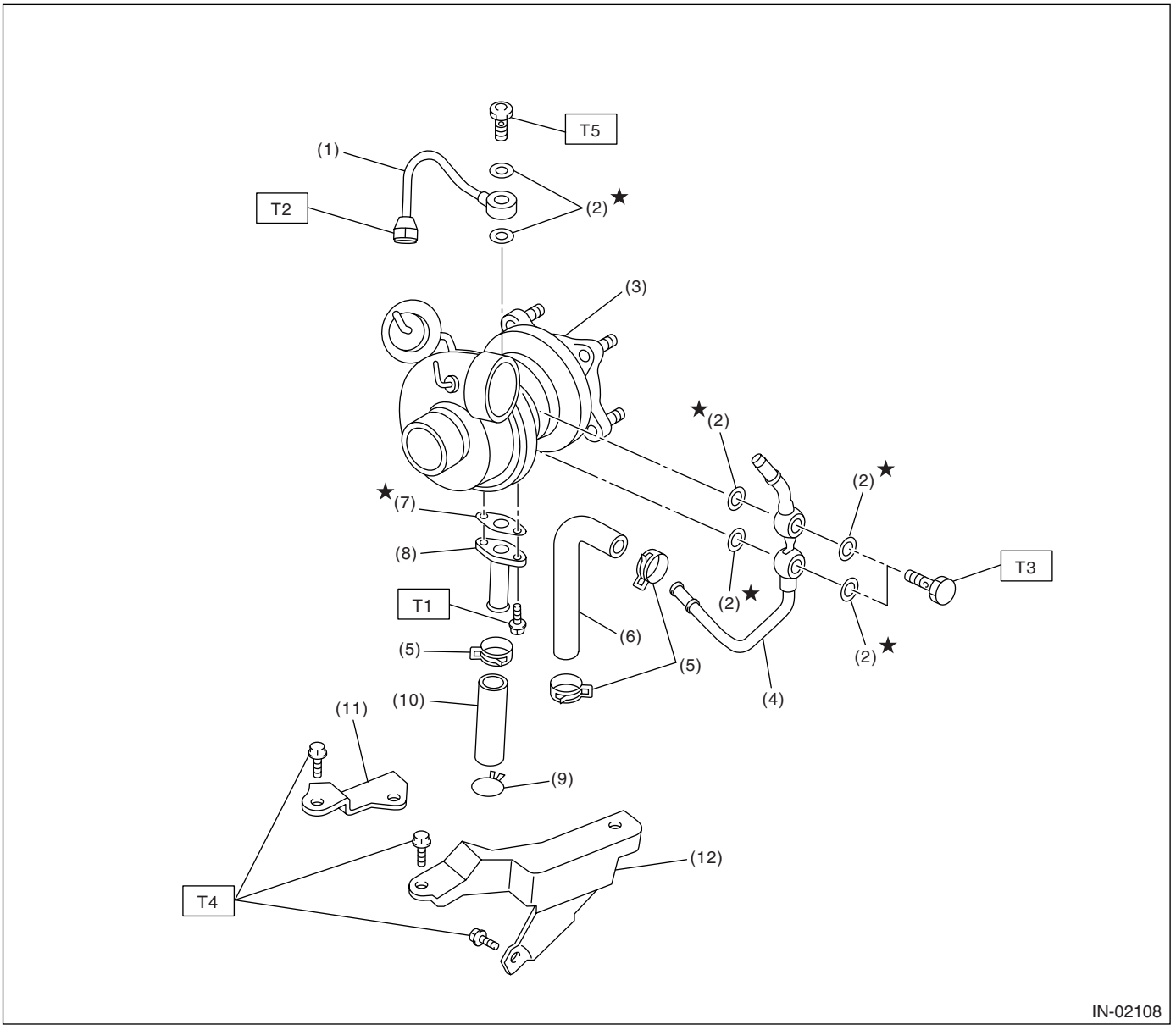
3. INTERCOOLER



(1) Intercooler
(2) Intercooler bracket RH
(3) Intercooler bracket LH
(4) Clamp
(5) Air intake duct
(6) Air bypass valve
(7) O-ring
(8) Clamp
(9) Air bypass hose A
(10) Intercooler duct
(11) Clamp
(12) PCV pipe

Tightening torque: N·m (kgf-m, ft-lb)
T1: 3 (0.3, 2.2)
T2: 6.1 (0.62, 4.2)
T3: 16 (1.6, 11.6)

4. TURBOCHARGER



(1) Oil inlet pipe
(2) Metal gasket
(3) Turbocharger
(4) Water pipe
(5) Clamp
(6) Engine coolant hose
(7) Gasket
(8) Oil outlet pipe
(9) Clip
(10) Oil outlet hose
(11) Turbocharger bracket RH
(12) Turbocharger bracket LH

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.4 (0.45, 3.3)
T2: 20 (2.0, 14.8)
T3: 33 (3.4, 24.6)
T4: 33 (3.4, 24.6)
T5: 16 (1.6, 11.6)

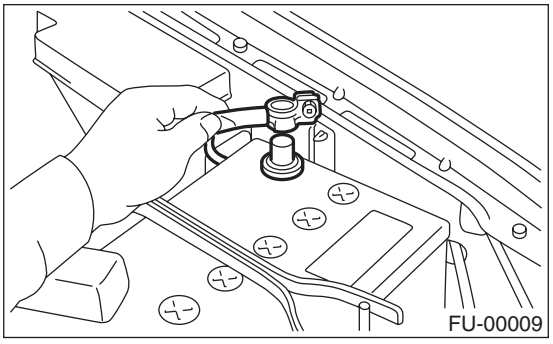
B: CAUTION

• 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.

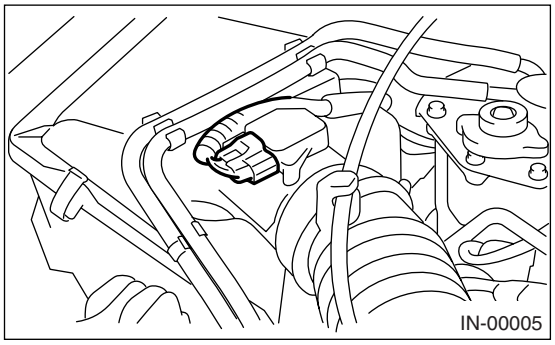
2. Air Cleaner

A: REMOVAL

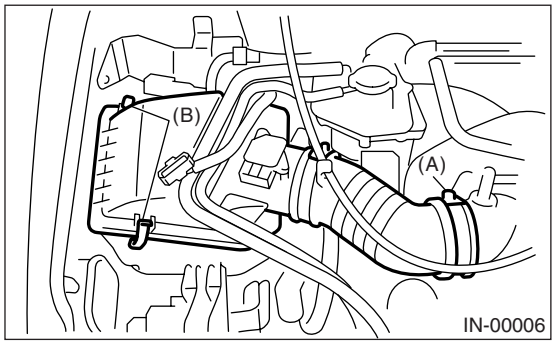
1) Disconnect the ground cable from battery.



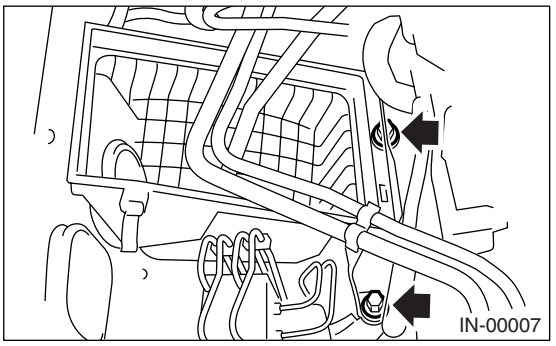
2) Disconnect the connector from mass air flow sensor.



3) Loosen the clamp (A) which connects the air intake boot and intake duct.
4) Remove the clip (B) from air cleaner upper cover.



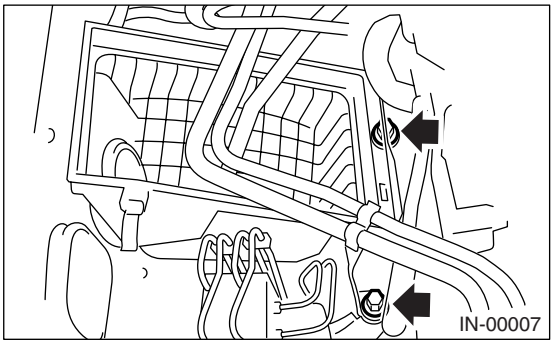
5) Remove the air cleaner upper cover.
6) Remove the air cleaner element.
7) Remove the air cleaner lower case.



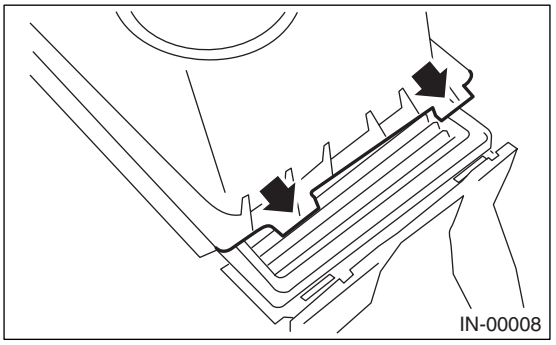
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)



NOTE:
Before installing the air cleaner upper cover, align the holes with protruding portions of air cleaner lower case, then secure the upper cover to the lower case.



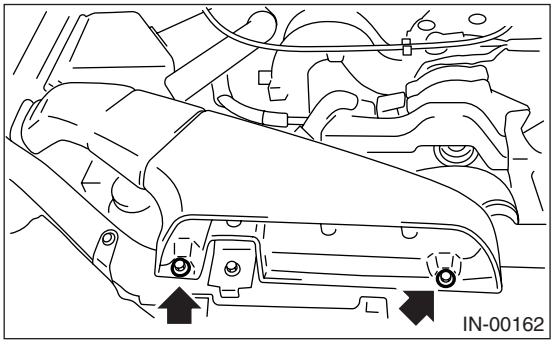
C: INSPECTION

Replace it if excessively damaged or dirty.

3. Air Intake Duct

A: REMOVAL

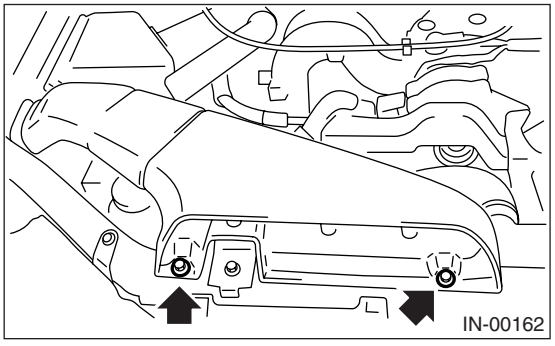
Remove the bolts which install the air intake duct on front side of body.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
7.5 N·m (0.76 kgf-m, 5.5 ft-lb)



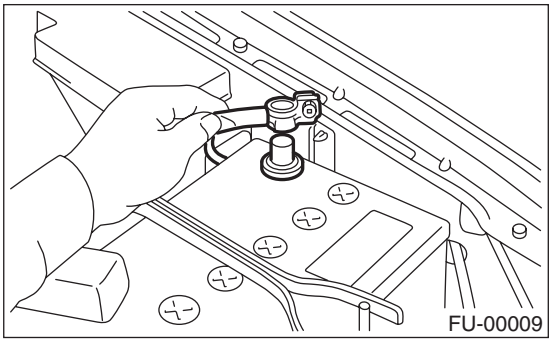
C: INSPECTION

1) Inspect for cracks and loose connections.
2) Inspect that no foreign objects are mixed in air intake duct.

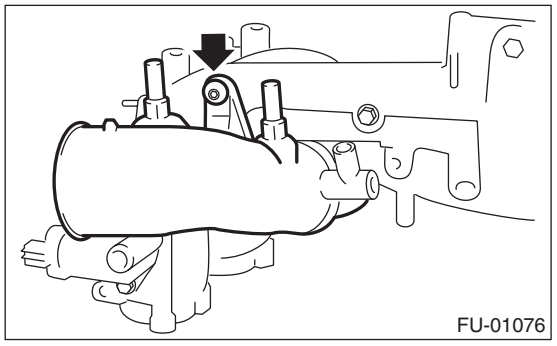
4. Intake Duct

A: REMOVAL

1) Disconnect the ground cable from battery.



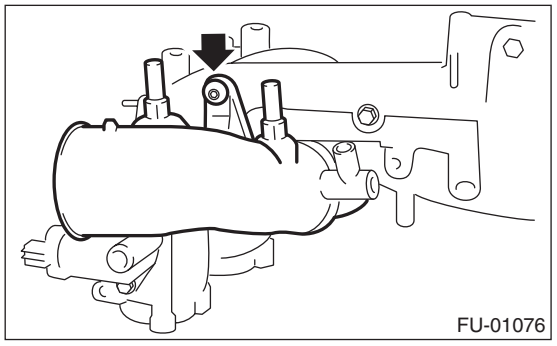
2) Remove the intake manifold.
<Ref. to FU(H4DOTC)-15, REMOVAL, Intake Manifold.>
3) Remove the sensor, engine harness and fuel pipe attached to intake manifold.
<Ref. to FU(H4DOTC)-20, DISASSEMBLY, Intake Manifold.>
4) Remove the intake duct from intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

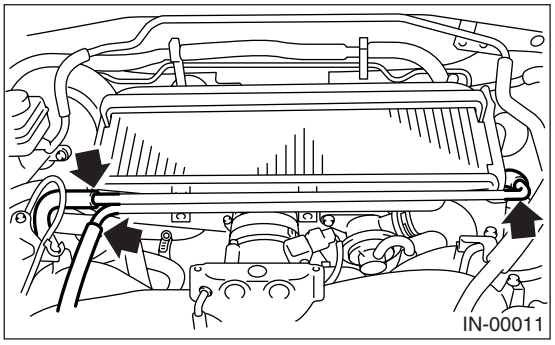
Tightening torque:
19 N·m (1.9 kgf-m, 13.7 ft-lb)



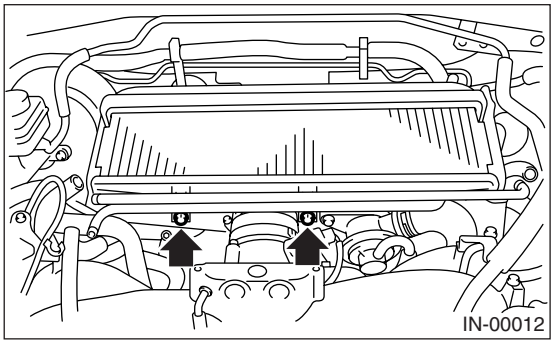
5. Intercooler

A: REMOVAL

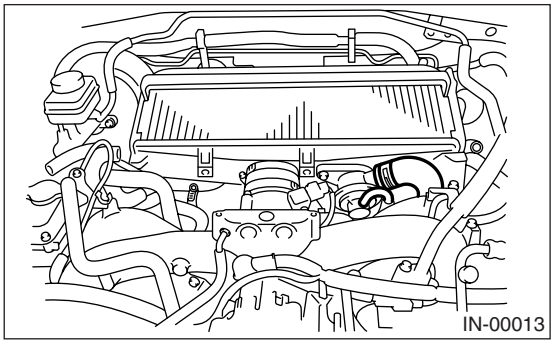
1) Disconnect PCV hose from PCV pipe.



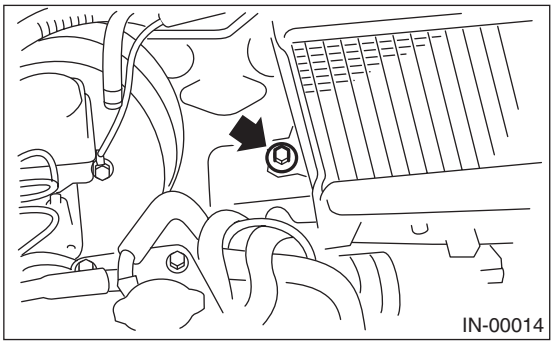
2) Remove PCV pipe from intercooler.

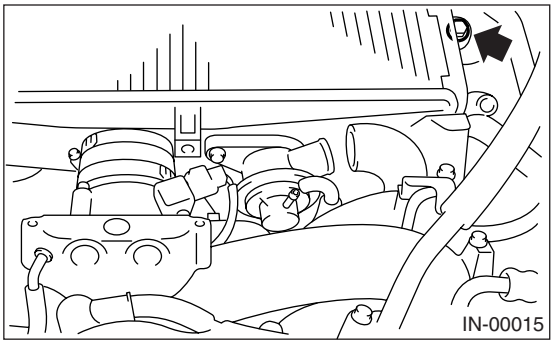


3) Disconnect hose from air bypass valve.

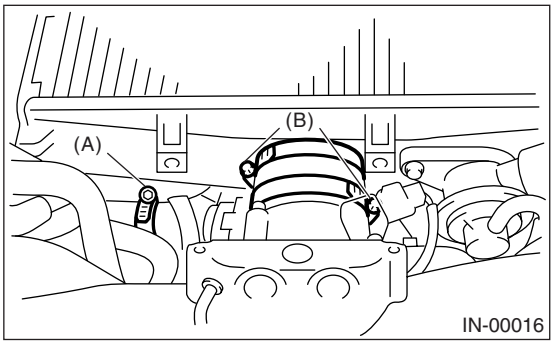


4) Remove bolt which secure intercooler to bracket.





5) Loosen clamp (A) which connects turbocharger and intercooler duct.
6) Loosen clamp (B) which connects throttle body and intercooler.

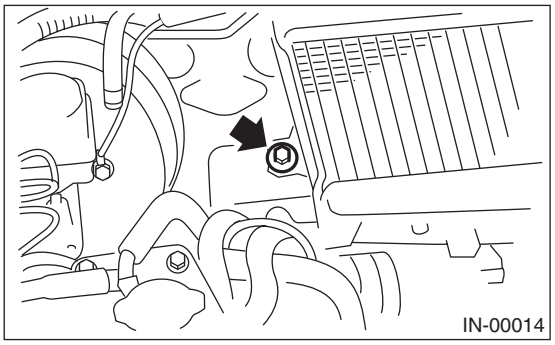


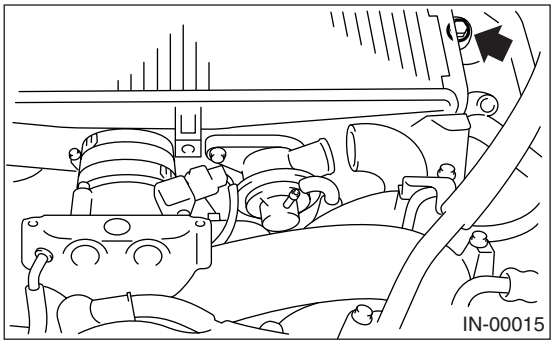
7) Disconnect intercooler duct from turbocharger.
8) Remove intercooler from throttle body.

B: INSTALLATION

Install in the reverse order of removal.

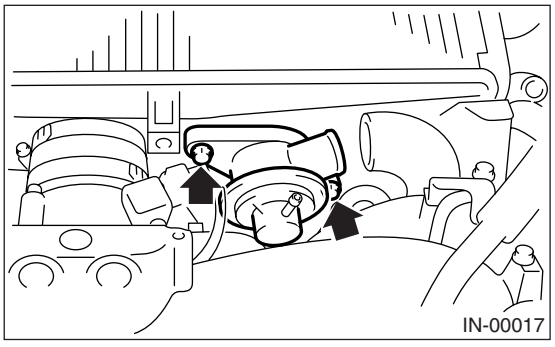
Tightening torque:
16 N·m (1.6 kgf-m, 11.6 ft-lb)



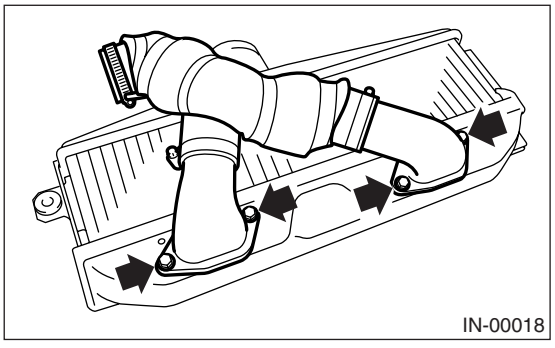


C: DISASSEMBLY

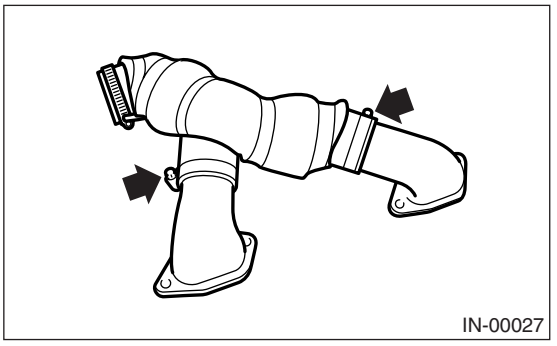
1) Remove air bypass valve from intercooler.



2) Remove intercooler duct from intercooler.



3) Separate duct.

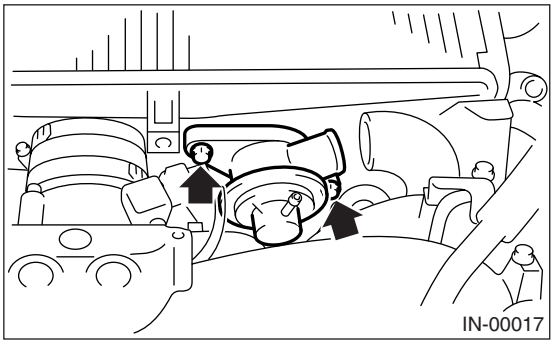


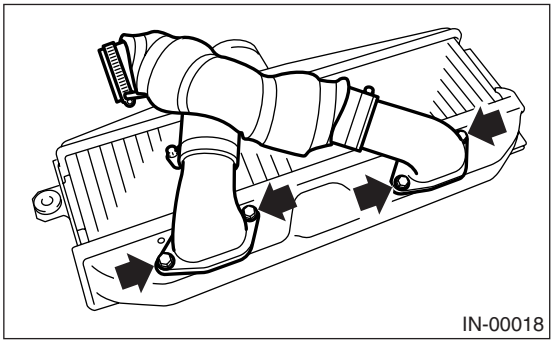
D: ASSEMBLY

To assemble, reverse order of disassembly.

NOTE:
Be careful pinching of O-ring.

Tightening torque:
16 N·m (1.6 kgf-m, 11.6 ft-lb)

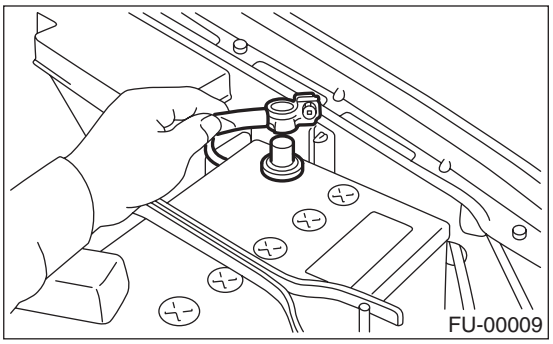




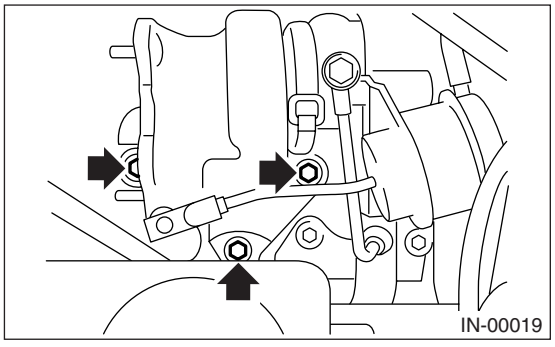
6. Turbocharger

A: REMOVAL

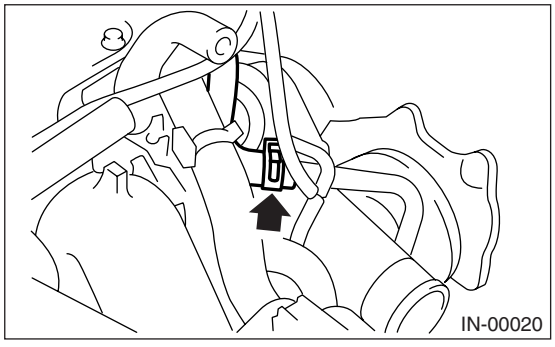
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.



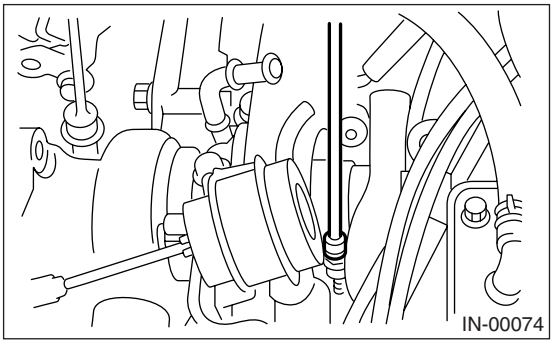
3) Remove the center exhaust pipe.
<Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
4) Lower the vehicle.
5) Separate the turbocharger joint pipe from turbocharger.



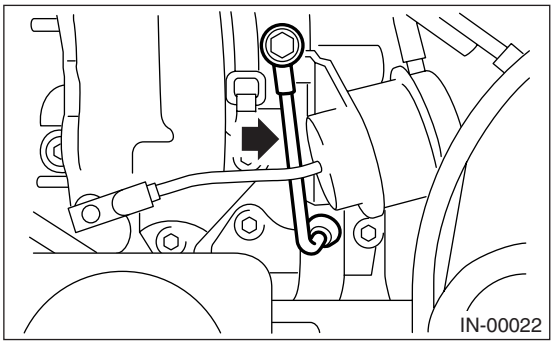
6) Disconnect the engine coolant hose which is connected to coolant filler tank.



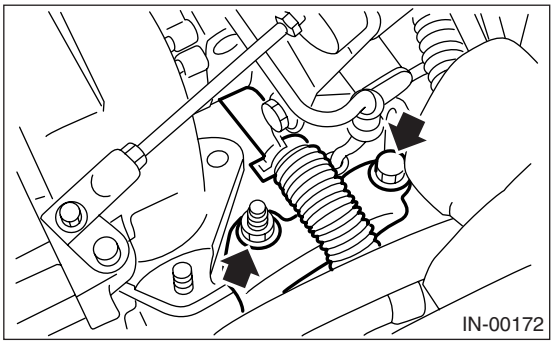
7) Loosen the clamp which secures the turbocharger to intake duct.



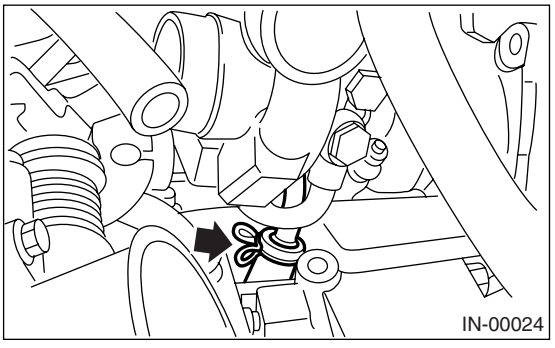
8) Remove the bolt which secures the bracket of oil pipe to turbocharger.
9) Remove the oil pipe from turbocharger.



10) Disconnect the engine coolant hose.
11) Remove the turbocharger bracket.



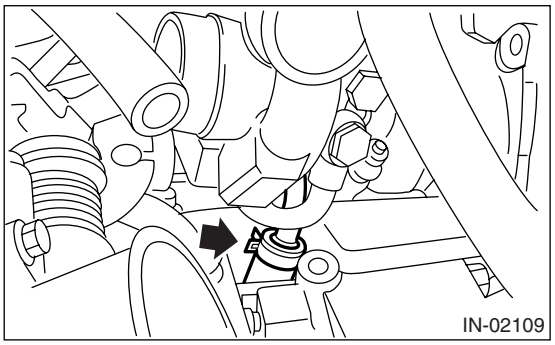
12) Disconnect the oil outlet hose from pipe.



13) Take out the turbocharger from engine compartment.

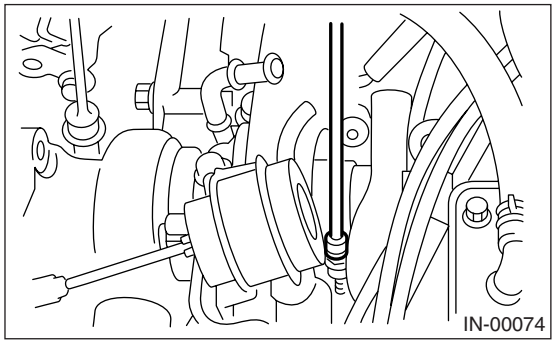
B: INSTALLATION

1) Connect the oil outlet hose to outlet pipe.



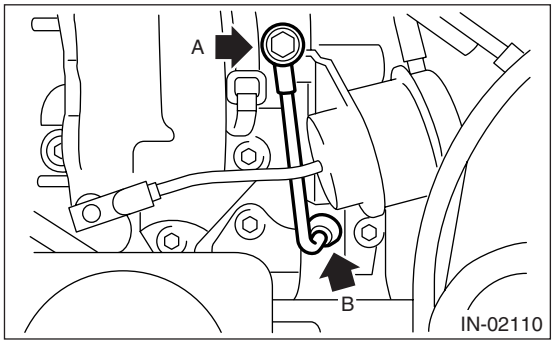
2) Install the turbocharger to intake duct.

Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



3) Install the oil pipe to turbocharger.

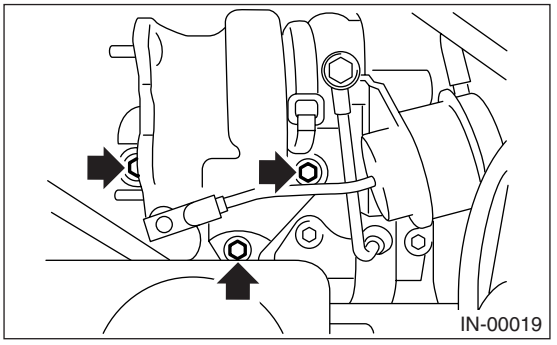
Tightening torque:
A: 20 N·m (2.0 kgf-m, 14.8 ft-lb)
B: 16 N·m (1.6 kgf-m, 11.6 ft-lb)



4) Install the joint pipe to turbocharger.

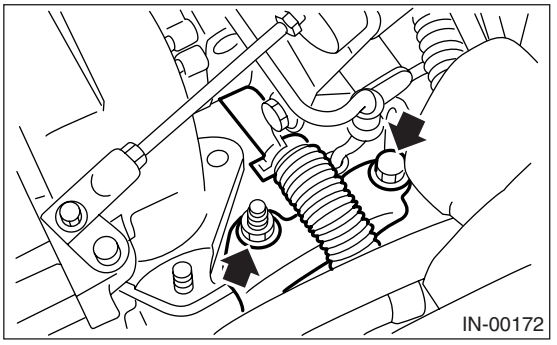
NOTE:
Replace the gasket with a new one.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

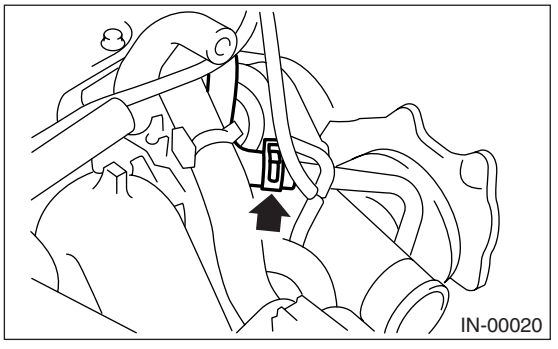


5) Connect the engine coolant hose.
6) Install the turbocharger bracket.

Tightening torque:
33 N·m (3.4 kgf-m, 24.6 ft-lb)



7) Connect the engine coolant hose which is connected to coolant filler tank.

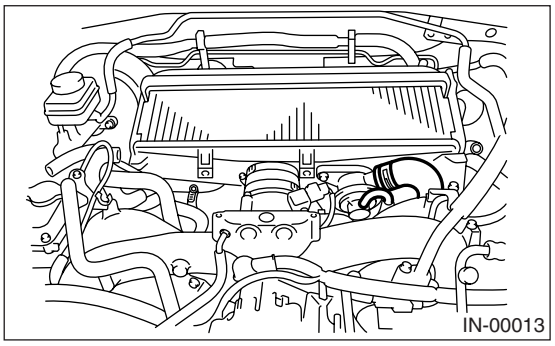


8) Lift-up the vehicle.
9) Install the center exhaust pipe.
<Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.>

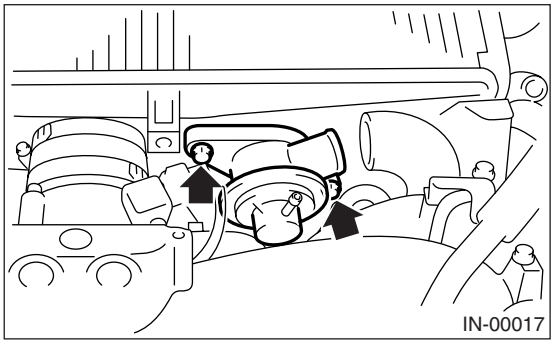
7. Air Bypass Valve

A: REMOVAL

1) Disconnect air bypass hose from air bypass valve.



2) Remove air bypass valve from intercooler.

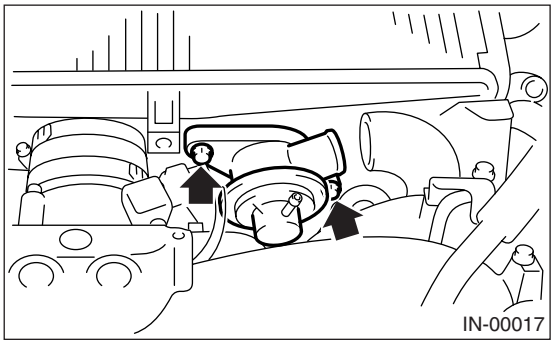


B: INSTALLATION

Install in the reverse order of removal.

CAUTION:
Be careful pinching of O-ring.

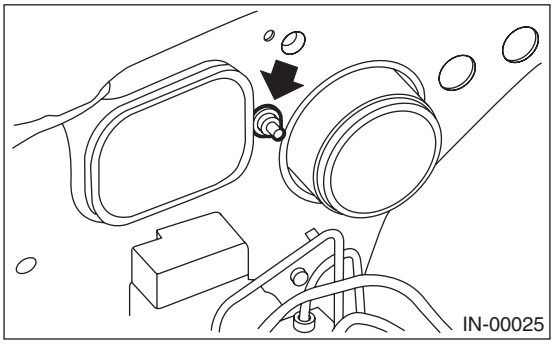
Tightening torque:
16 N·m (1.6 kgf-m, 11.6 ft-lb)



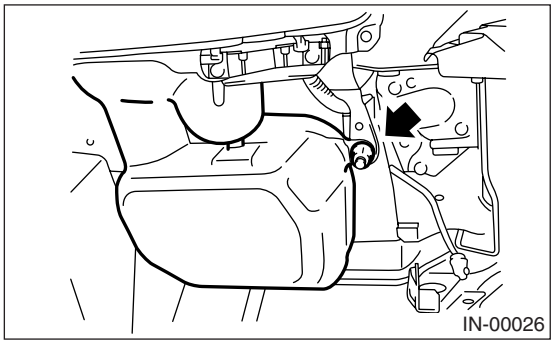
8. Resonator Chamber

A: REMOVAL

1) Set the vehicle on a lift.
2) Remove the air intake duct. <Ref. to IN(H4DOTC)-8, REMOVAL, Air Intake Duct.>
3) Remove the air cleaner lower case. <Ref. to IN(H4DOTC)-7, REMOVAL, Air Cleaner.>
4) Remove the resonator chamber mounting bolt on right side of engine compartment.



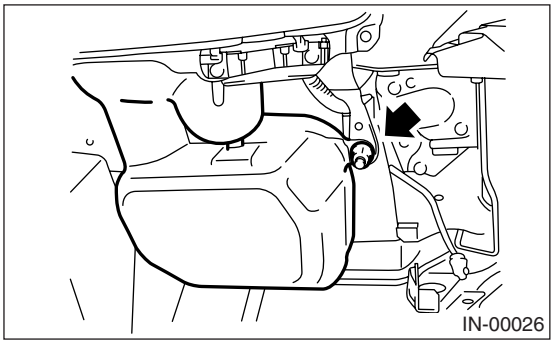
5) Remove the front right tire, and lift up the vehicle.
6) Remove the front mudguard RH.
7) Remove the resonator chamber from the inside front fender.

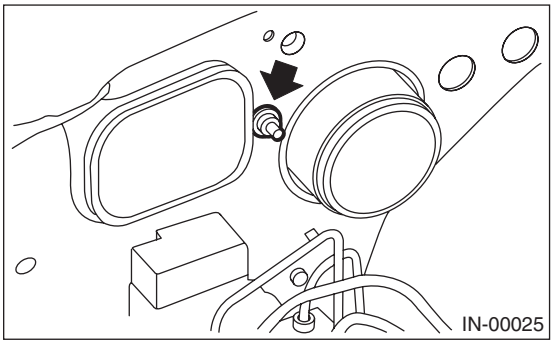


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
7.5 N·m (0.76 kgf-m, 5.5 ft-lb)





C: INSPECTION

Inspect for cracks and loose connections. Check that no foreign objects are mixed in resonator chamber.

MEMO:

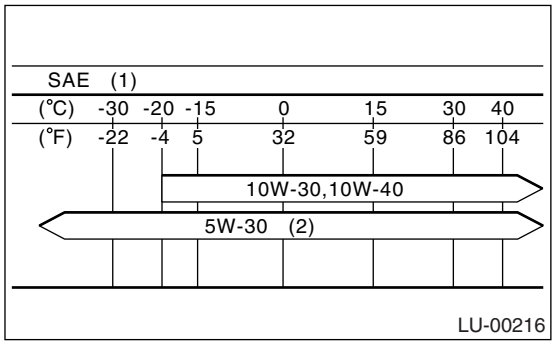
1. General Description

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 × 10 mm (3.07 × 0.39 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	4.6 ℓ (4.9 US qt, 4.0 Imp qt)/min.
		5,000 rpm	Discharge pressure	294 kPa (3.0 kg/cm^2, 43 psi)
			Discharge quantity	47.0 ℓ (49.7 US qt, 41.4 Imp qt)/min.
	Relief valve operation pressure			588 kPa (6.0 kg/cm^2, 85 psi)
Oil filter	Type			Full-flow filter type
	Filtration area			800 cm^2 (124 sq in)
	By-pass valve opening pressure			160 kPa (1.63 kg/cm^2, 23.2 psi)
	Outer diameter × width			68 × 65 mm (2.68 × 2.56 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)

Recommended oil:

API classification SL with the words "Energy Conserving" (if the oil with SL grade cannot be obtained, it is okay to use SJ grade oil).
ILSAC GF-3 or the equivalent which is indicated on the container with the new API certification mark (Star burst mark).



(1) SAE Viscosity No. and Applicable Temperature
(2) PREFERRED

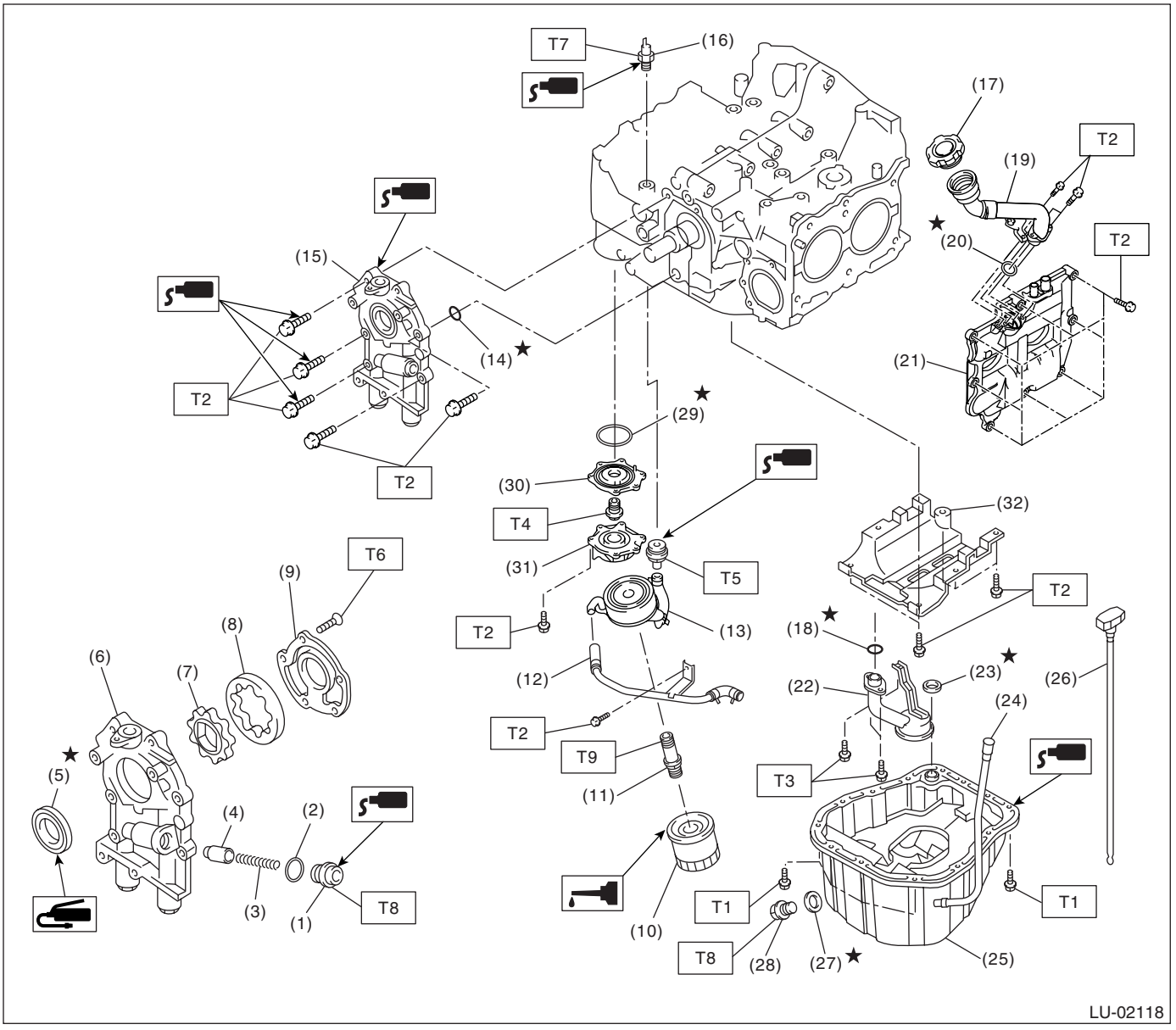
The proper viscosity helps vehicle get good cold and hot starting by reducing viscous friction and thus increasing cranking speed.

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 fol-

lowing viscosity oils may be used: API classification: SL or SJ or SH
SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50.

B: COMPONENT



(1) Plug
(2) Gasket
(3) Relief valve spring
(4) Relief valve
(5) Oil seal
(6) Oil pump case
(7) Inner rotor
(8) Outer rotor
(9) Oil pump cover
(10) Oil filter
(11) Oil cooler connector
(12) Water by-pass pipe
(13) Oil cooler
(14) O-ring
(15) Oil pump ASSY
(16) Oil pressure switch
(17) Oil filler cap
(18) O-ring
(19) Oil filler duct
(20) O-ring
(21) Rocker cover
(22) Oil strainer
(23) Gasket
(24) Oil level gauge guide
(25) Oil pan
(26) Oil level gauge
(27) Metal gasket
(28) Drain plug
(29) O-ring
(30) Adapter (1)
(31) Adapter (2)
(32) Baffle plate

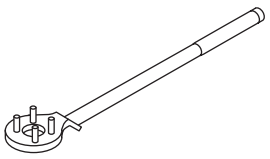
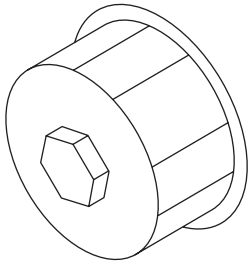
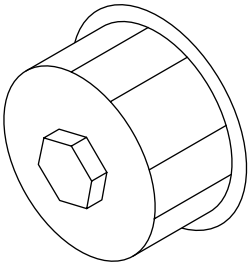
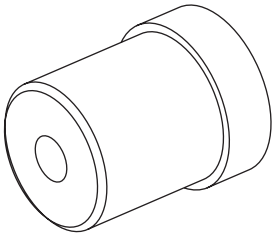
Tightening torque: N·m (kgf-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 6.4 (0.65, 4.7)
T3: 10 (1.0, 7.0)
T4: 45 (4.6, 33.2)
T5: 69 (7.0, 50.9)
T6: 5.4 (0.55, 4.0)
T7: 25 (2.5, 18.1)
T8: 44 (4.5, 32.5)
T9: 54 (5.5, 40)

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.

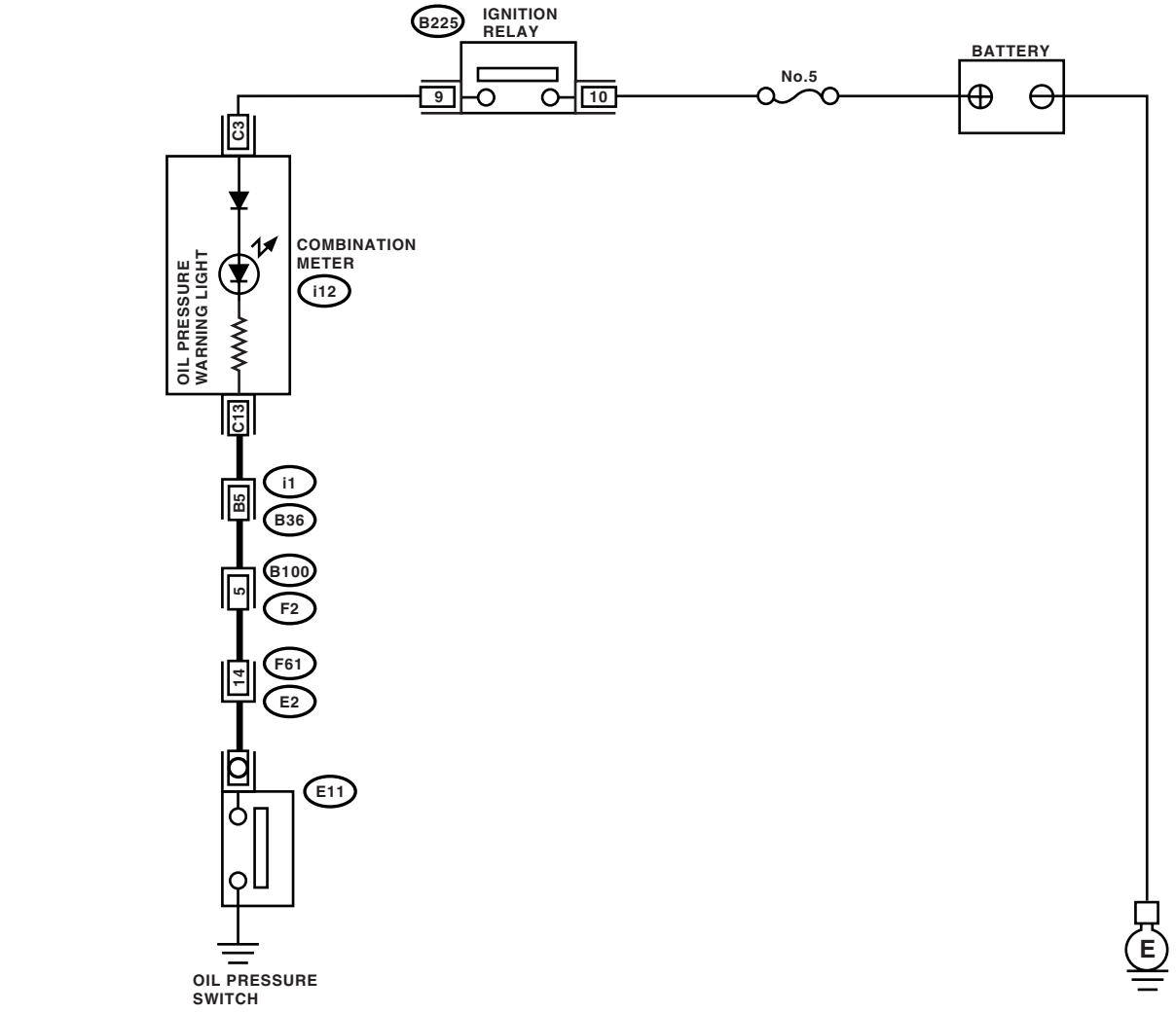
D: PREPARATION TOOL

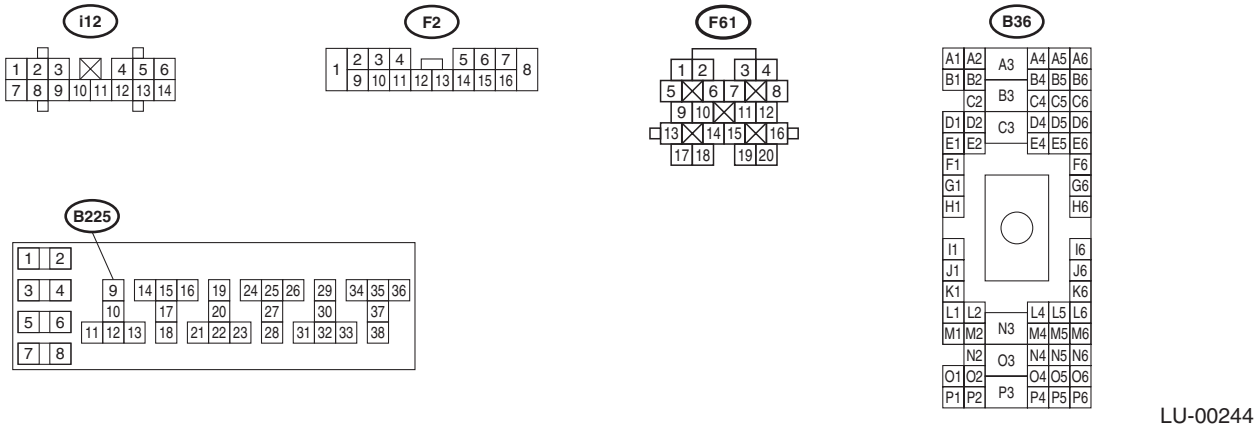
1. SPECIAL TOOLS

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	49 9977100	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt.
 ST18332AA000	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 68 mm (2.68 in))
 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 seal to oil pump.

2. Oil Pressure System

A: SCHEMATIC





LU-00244

B: INSPECTION

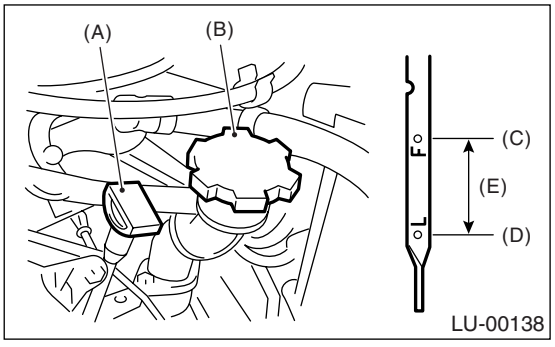
	Step	Check	Yes	No
1	**CHECK COMBINATION METER.** 1) Turn the ignition switch to ON. (engine OFF) 2) Check other warning lights.	Does the warning lights go on?	Go to step **2.**	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>
2	**CHECK HARNESS CONNECTOR 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 ON. 4) Measure the voltage of harness between the combination meter connector and chassis ground. ***Connector & terminal*** ***(E11) No. 1 (+) — Chassis ground (−):***	Is the measured value 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*** ***No. C3 — No. C13:***	Is the measured value less than 10 Ω?	Replace the harness connector between combination meter and oil pressure switch.	Repair or replace the combination meter.

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 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 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 engine oil.

NOTE:
To prevent overfilling the engine oil, do not add oil above “F” line when the engine is cold.

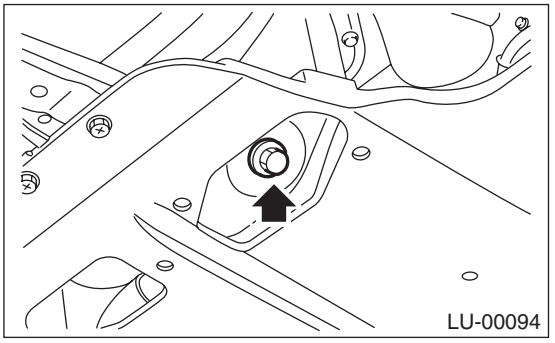


(A) Oil level gauge
(B) Engine oil filler cap
(C) Upper level
(D) Lower level
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

B: REPLACEMENT

1) Open the engine oil filler cap for quick draining of engine oil.
2) Drain the engine oil by loosening the engine oil drain plug.

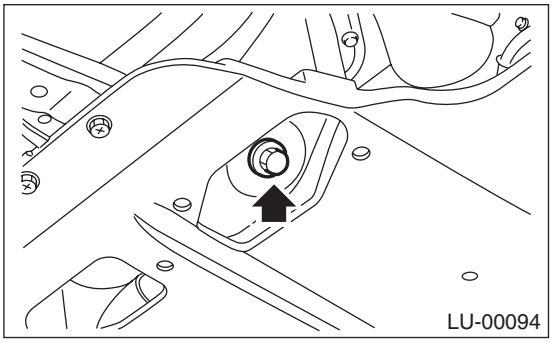
NOTE:
Use a tray to collect oil.



3) Replace the drain plug gasket.
4) Tighten the engine oil drain plug after draining engine oil.

NOTE:
Use new drain plug gasket.

Tightening torque:
44 N·m (4.5 kgf-m, 32.5 ft-lb)



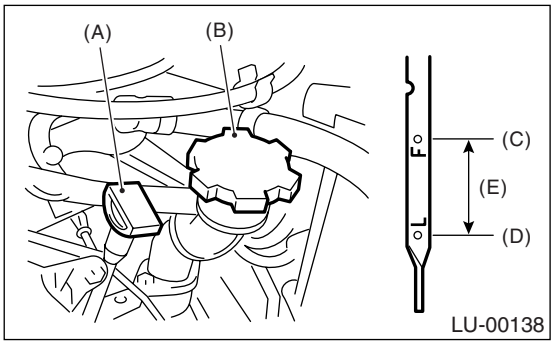
5) Install the service hole cover.
6) Using engine oil of proper quality and viscosity, fill it through the oil filler duct up to upper level on level gauge. Make sure that the vehicle is placed level when checking oil level. Use the engine oil of proper quality and viscosity, selected in accordance with the table in figure.

Recommended oil:
<Ref. to LU(H4DOTC)-2, SPECIFICATIONS, General Description.>

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)

7) Close the engine oil filler cap.
8) Start the engine and warm it up for a time.

9) After the engine stops, recheck the oil level. If necessary, add engine oil up to the upper level on level gauge.

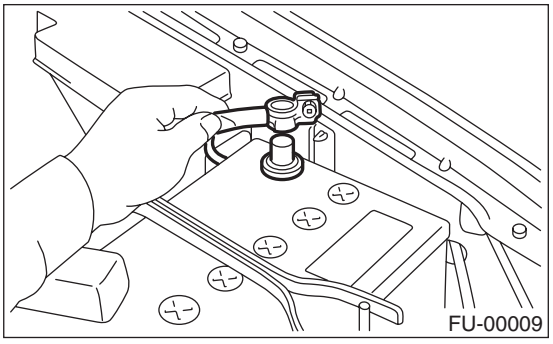


(A) Oil level gauge
(B) Engine oil filler cap
(C) Upper level
(D) Lower level
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

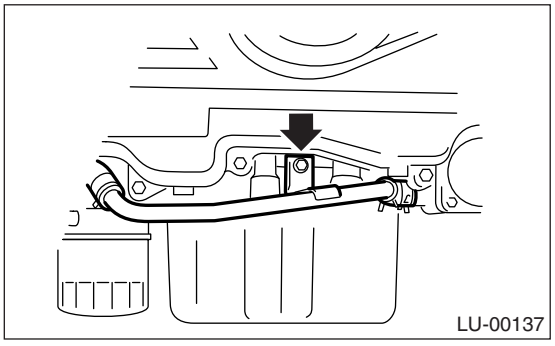
4. Oil Pump

A: REMOVAL

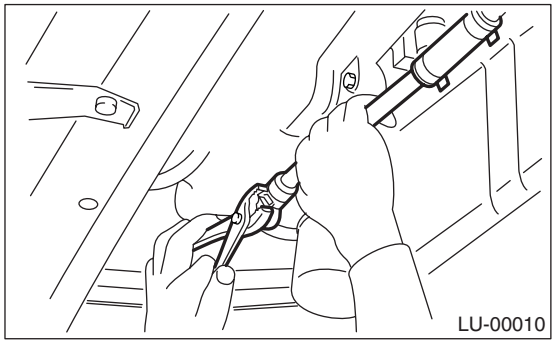
1) Disconnect ground cable from battery.



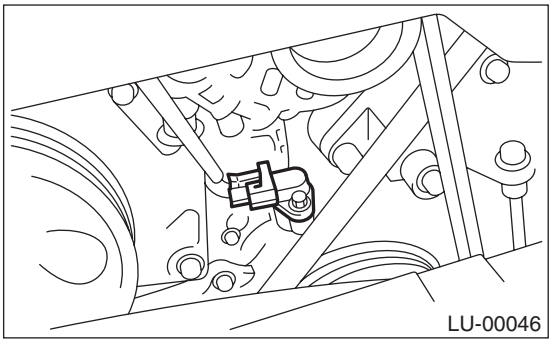
2) Lift-up the vehicle.
3) Remove the under cover.
4) Remove the bolts which install the water pipe of oil cooler to oil pump.



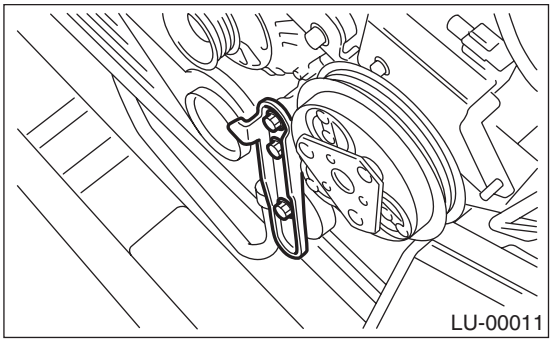
5) Remove the water pipe and hoses between oil cooler and water pump.



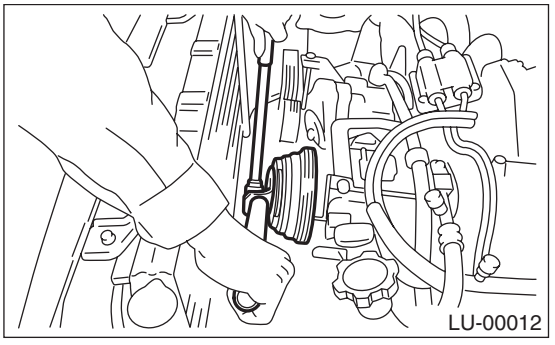
6) Lower down the vehicle.
7) Remove the radiator. <Ref. to CO(H4DOTC)-19, REMOVAL, Radiator.>
8) Remove the crankshaft position sensor.



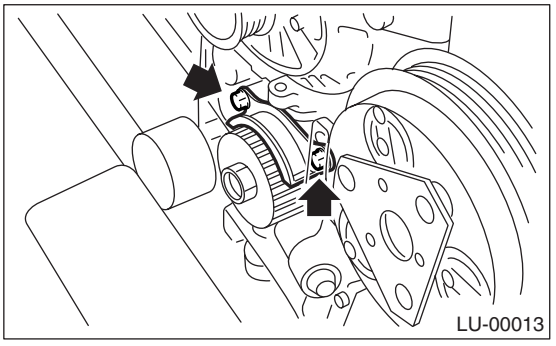
9) Remove the V-belts. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
10) Remove the rear side V-belt tensioner.



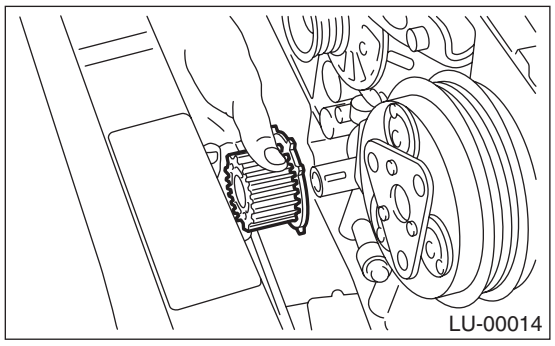
11) Remove the crankshaft pulley by using ST. <Ref. to ME(H4DOTC)-47, REMOVAL, Crankshaft Pulley.>



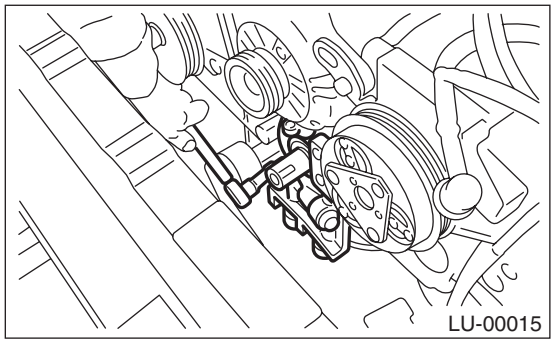
12) Remove the water pump. <Ref. to CO(H4DOTC)-15, REMOVAL, Water Pump.>
13) Remove the timing belt guide. (MT model)



14) Remove the crankshaft sprocket.



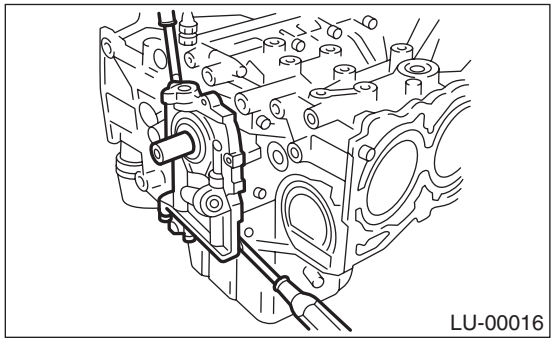
15) Remove the bolts which install the oil pump onto cylinder block.



CAUTION:
Loosen the relief valve plug before removal of oil pump when performing disassembly and inspection of oil pump.

16) Remove the oil pump using the flat tip screwdriver.

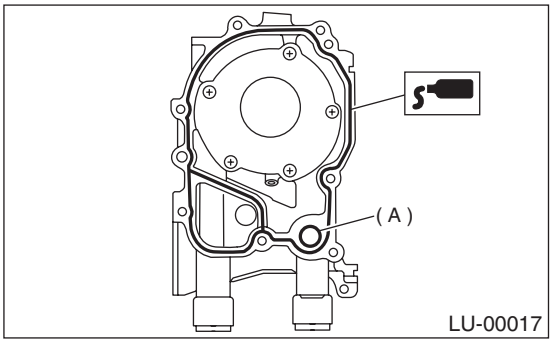
CAUTION:
Be careful not to scratch the mating surfaces of cylinder block and oil pump.



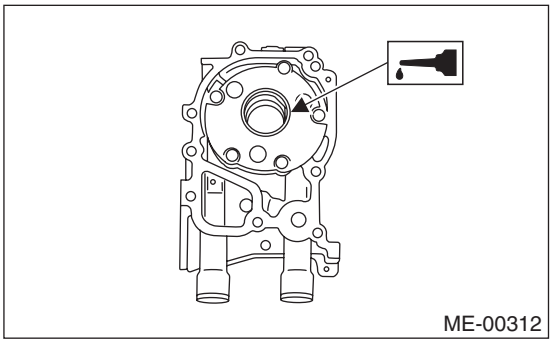
B: INSTALLATION

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.

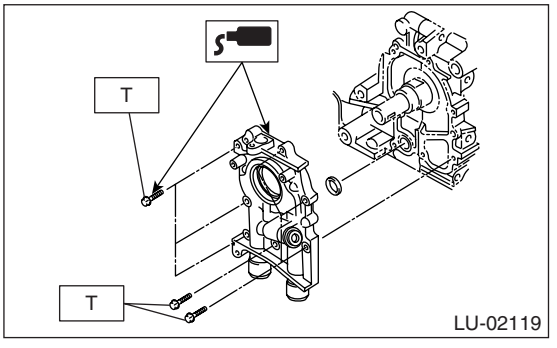


4) Position the oil pump, aligning the notched area with crankshaft, and push the oil pump straight.

CAUTION:
- **Make sure the oil seal lip is not folded.**
- **Do not to scratch the oil seal when installing the oil pump on cylinder block.**
- **Securely tighten the relief valve plug.**

5) Install the oil pump.

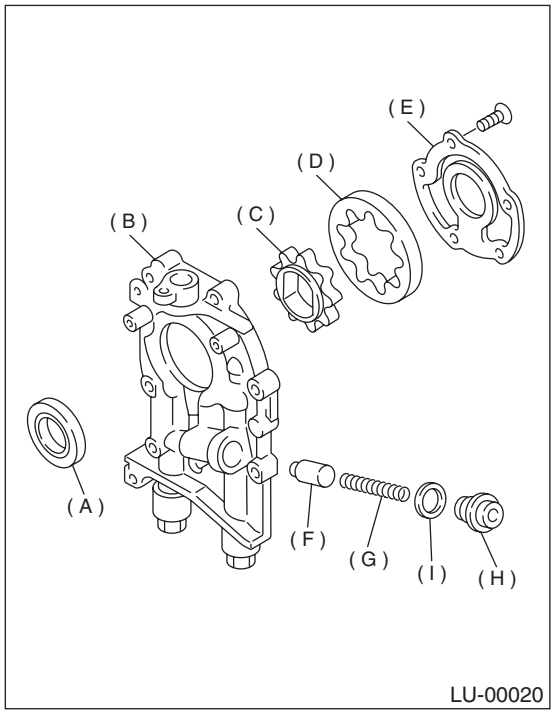
Tightening torque:
6.4 N·m (0.65 kgf -m, 4.7 ft-lb)



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.

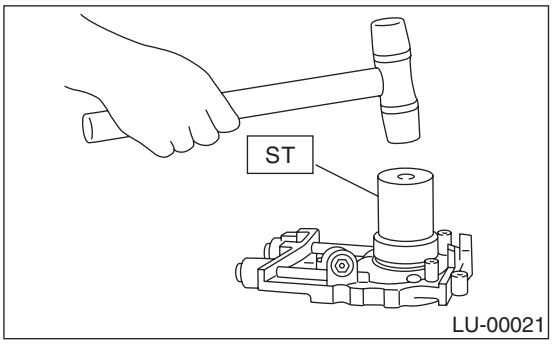


(A) Oil seal
(B) Pump case
(C) Inner rotor
(D) Outer rotor
(E) Pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

D: ASSEMBLY

1) Install the front oil seal by using ST.
ST 499587100 OIL SEAL INSTALLER

NOTE:
Use a new oil seal.

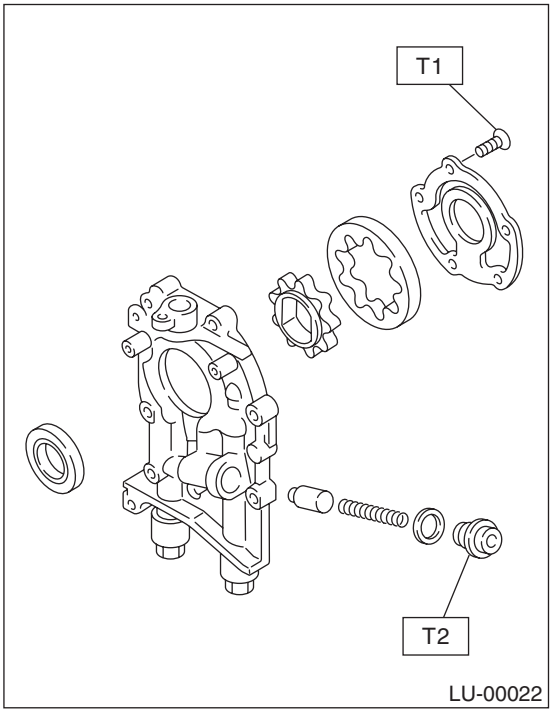


2) Apply a coat of engine oil to the inner and outer rotors.
3) Install the inner and outer rotors in their original positions.
4) Install the oil relief valve, relief valve spring and plug.

NOTE:
Use a new gasket.

5) Install the oil pump cover.

Tightening torque:
T1: 5.4 N·m (0.55 kgf-m, 4.0 ft-lb)
T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)

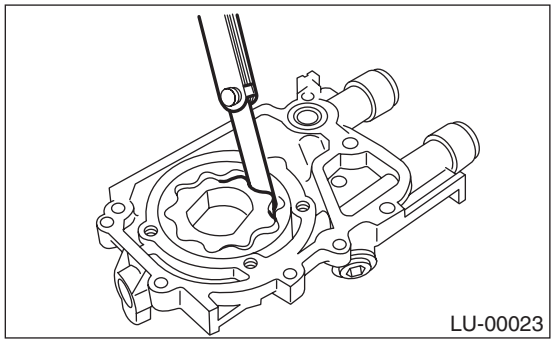


E: INSPECTION

1. TIP CLEARANCE

Measure the tip clearance of rotors. If clearance exceeds the limit, replace the rotors as a matched set.

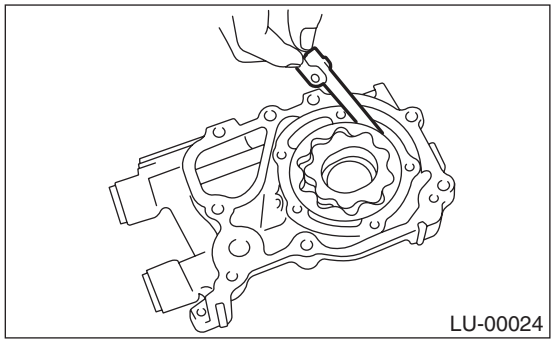
Tip clearance:
Standard
0.04 — 0.14 mm (0.0016 — 0.0055 in)
Limit
0.18 mm (0.0071 in)


LU-00023

2. CASE CLEARANCE

Measure the clearance between outer rotor and oil pump rotor housing. If clearance exceeds the limit, replace the oil pump case.

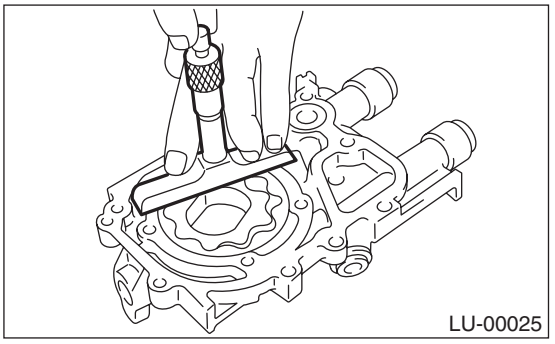
Case clearance:
Standard
0.10 — 0.175 mm (0.0039 — 0.0069 in)
Limit
0.20 mm (0.0079 in)


LU-00024

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)


LU-00025

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
73.7 mm (2.902 in)
Installed length
54.7 mm (2.154 in)
Load when installed
93.1 N (9.49 kgf, 20.88 lb)

5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks, and other faults.

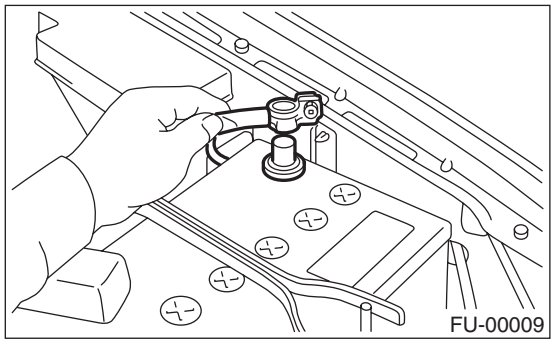
6. OIL SEAL

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

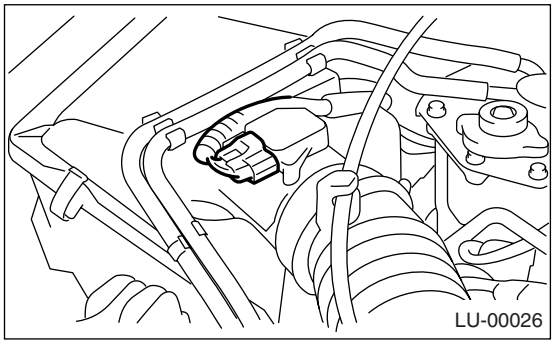
5. Oil Pan and Strainer

A: REMOVAL

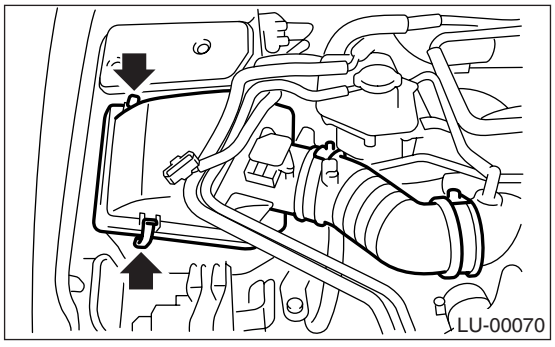
1) Set the vehicle on a lift.
2) Remove the front wheels.
3) Disconnect the ground cable from battery.



4) Disconnect the connector from mass air flow sensor.

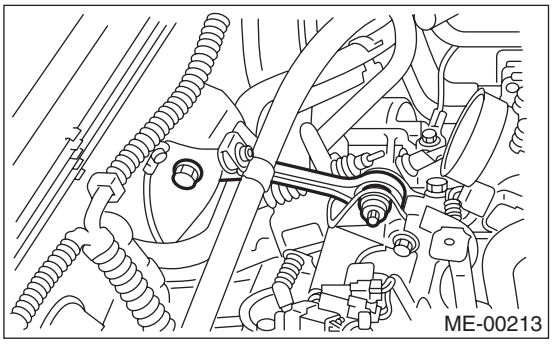


5) Remove the air intake boot and air cleaner upper cover.

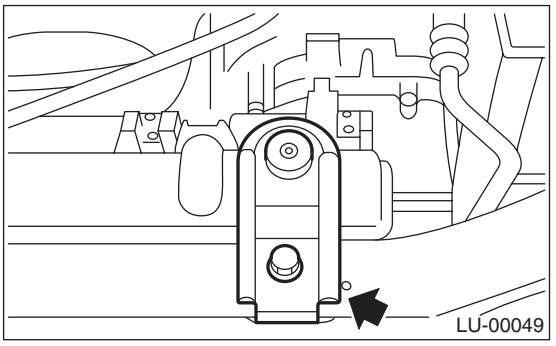


6) Remove the intercooler. <Ref. to IN(H4DOTC)-10, REMOVAL, Intercooler.>

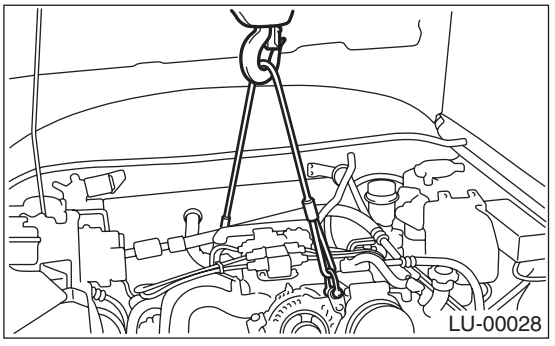
7) Remove the pitching stopper.



8) Remove the radiator upper brackets.



9) Support the engine with a lifting device and wire ropes.

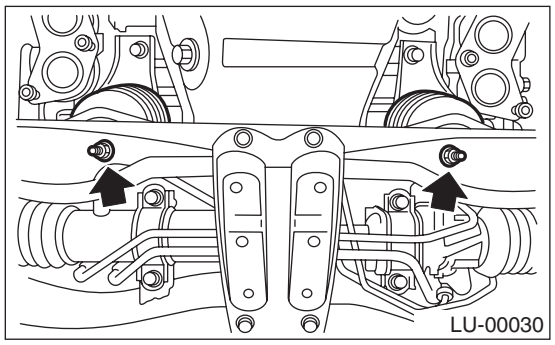


10) Lift-up the vehicle.

CAUTION:
When lifting up the vehicle, rise up the wire rope together.

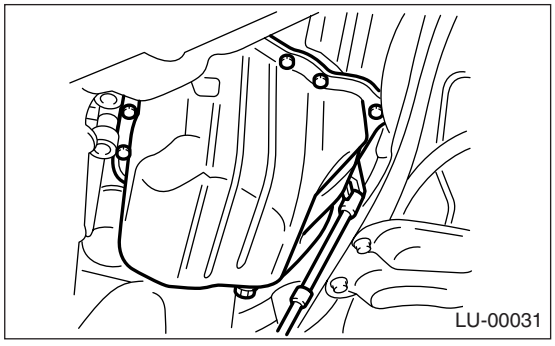
11) Remove the under cover.
12) Drain the engine oil.

13) Remove the nuts which install the front cushion rubber onto front crossmember.

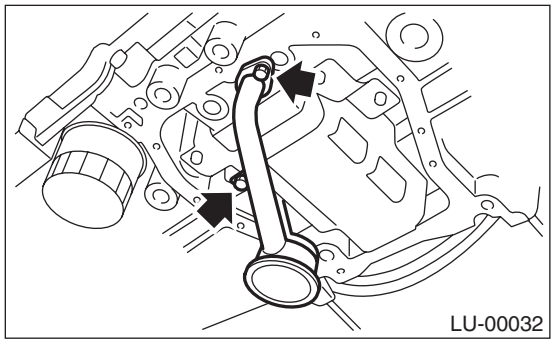


14) Remove the bolts which install the oil pan on cylinder block while raising up engine.
15) Insert the oil pan cutter blade between cylinder block-to-oil pan clearance.

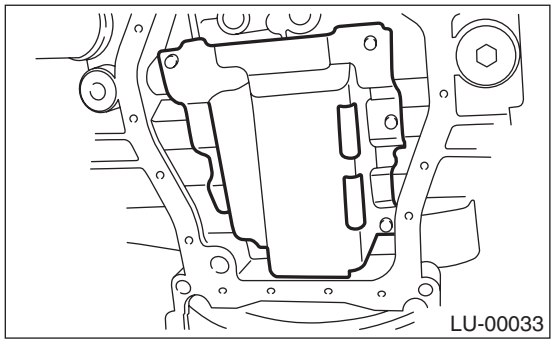
CAUTION:
Do not use a screwdriver or similar tool in place of oil pan cutter.



16) Remove the oil strainer.



17) Remove the baffle plate.

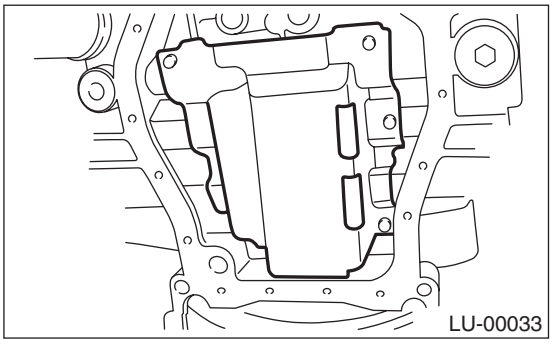


B: INSTALLATION

CAUTION:
Before installing the oil pan, clean sealant from oil pan and engine block.

1) Install the baffle plate.

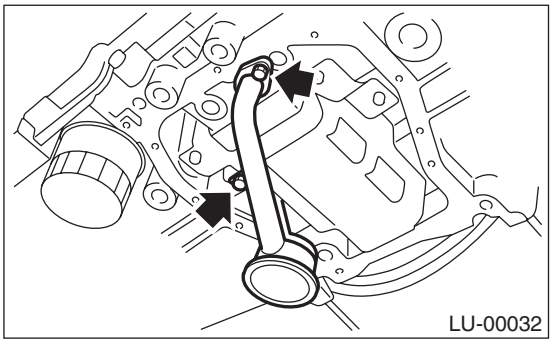
Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



2) Install the oil strainer onto baffle plate.

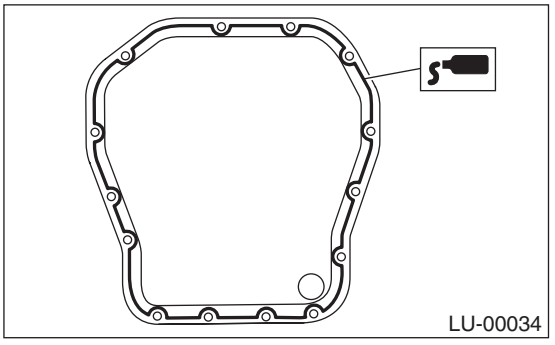
NOTE:
Replace the O-ring with a new one.

Tightening torque:
10 N·m (1.0 kgf-m, 7.2 ft-lb)



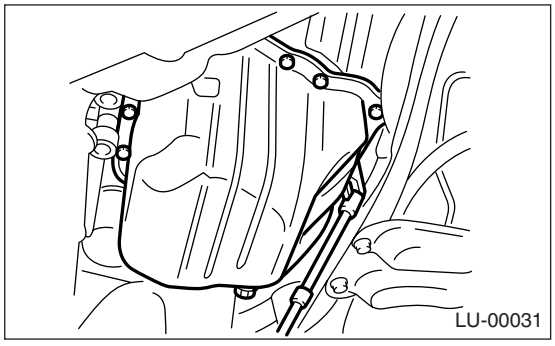
3) Apply fluid packing to the mating surfaces, and then install the oil pan.

Fluid packing:
THREE BOND 1207C (Part No. 004403012) or equivalent



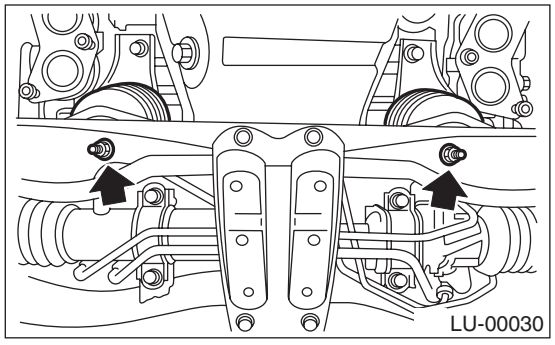
4) Tighten the bolts which install the oil pan onto cylinder block.

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



5) Lower the engine onto front crossmember.
6) Tighten the nuts which install the front cushion rubber onto front crossmember.

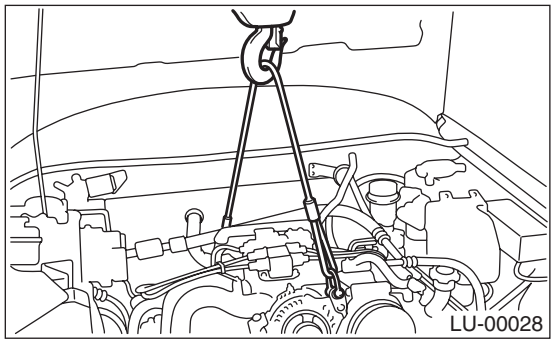
Tightening torque:
83 N·m (8.5 kgf-m, 61 ft-lb)



7) Install the under cover.
8) Lower the vehicle.

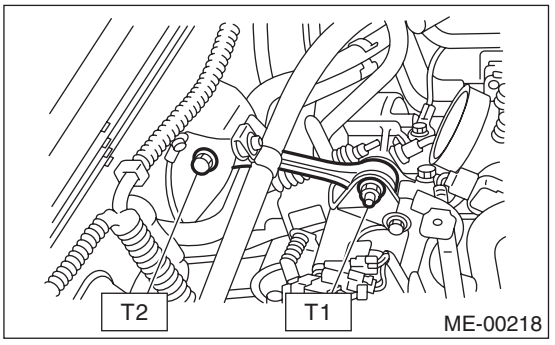
CAUTION:
When lowering the vehicle, lower the lifting device and wire rope together.

9) Remove the lifting device and steel cables.

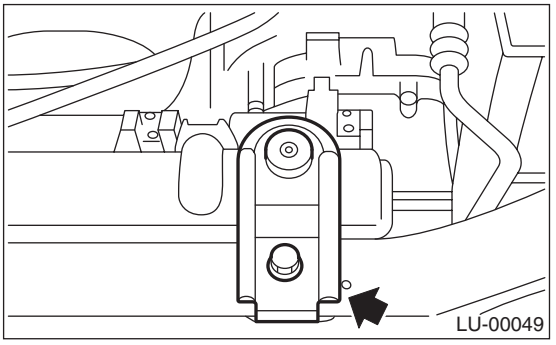


10) Install the pitching stopper.

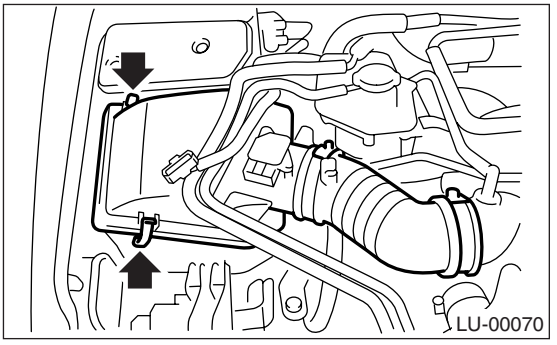
Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



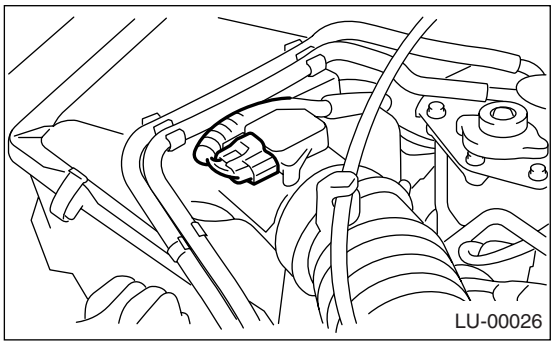
11) Install the radiator upper brackets.



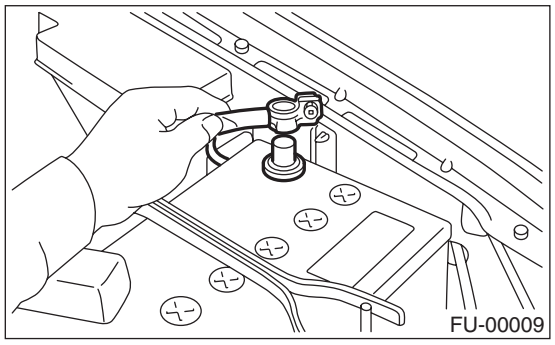
12) Install the intercooler. <Ref. to IN(H4DOTC)-11, INSTALLATION, Intercooler.>
13) Install the air intake boot and air cleaner upper cover.



14) Connect the connector to mass air flow sensor.



15) Install the front wheels.
16) Connect the battery ground cable to battery.



17) Fill engine oil. <Ref. to LU(H4DOTC)-9, INSPECTION, Engine Oil.>

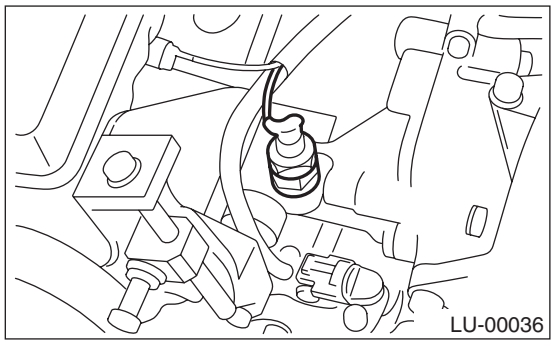
C: INSPECTION

By visual check, make sure the oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

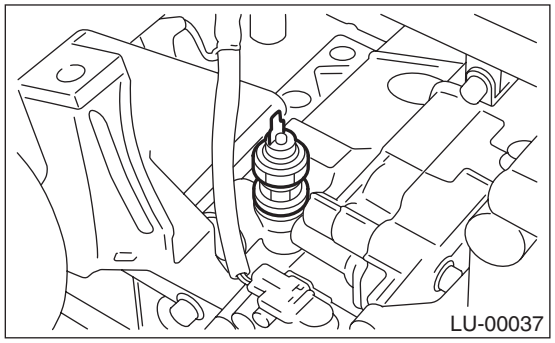
6. Oil Pressure Switch

A: REMOVAL

1) Remove the generator from bracket. <Ref. to SC(H4SO)-15, REMOVAL, Generator.>
2) Disconnect the terminal from oil pressure switch.



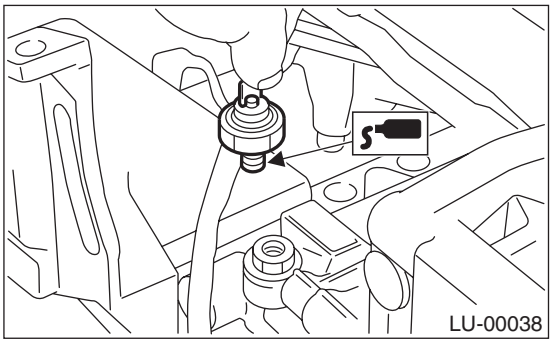
3) Remove the oil pressure switch.



B: INSTALLATION

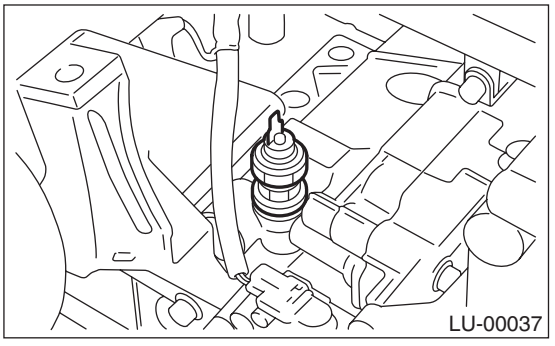
1) Apply fluid packing to the oil pressure switch threads.

Fluid packing:
THREE BOND 1324 (Part No. 004403042) or equivalent

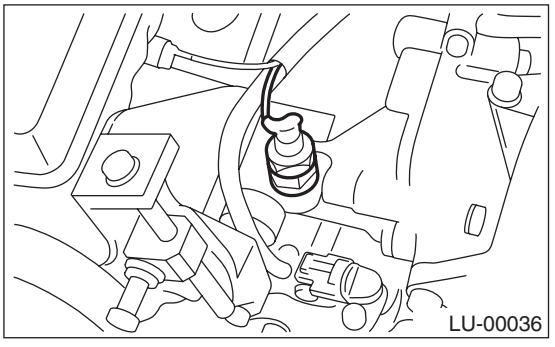


2) Install the oil pressure switch onto engine block.

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)-15, INSTALLATION, Generator.>

C: INSPECTION

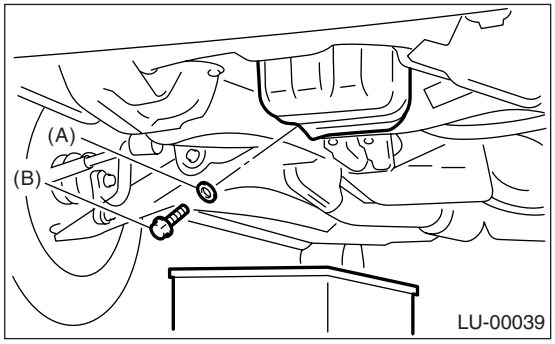
Make sure oil does not leak or seep from where the oil pressure switch is installed.

7. Engine Oil Cooler

A: REMOVAL

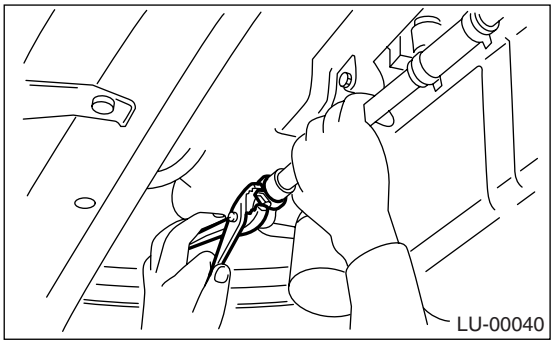
NOTE:
Engine oil cooler is equipped with turbo model only.

1) Lift-up the vehicle.
2) Remove the under cover.
3) Drain the engine oil. Set a container under the vehicle, and remove the drain plug from oil pan.

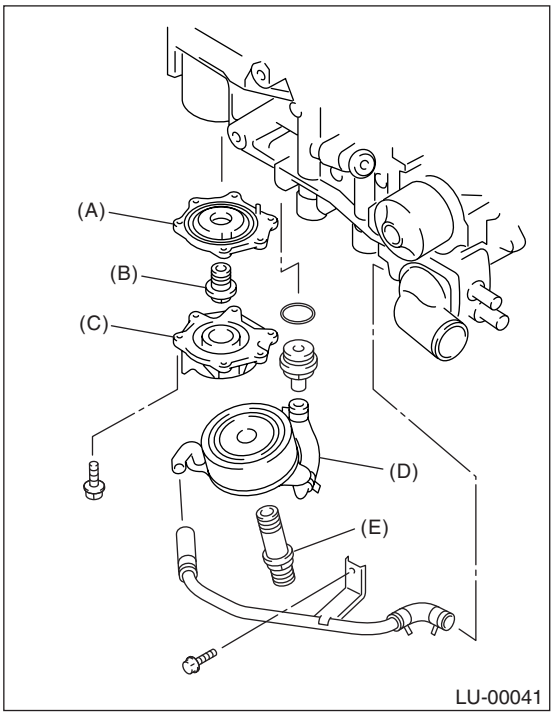


(A) Gasket
(B) Drain plug

4) Drain the engine coolant.
5) Remove the water by-pass pipe between oil cooler and water pump.



6) Remove the engine oil filter. <Ref. to LU(H4DOTC)-22, REMOVAL, Engine Oil Filter.>
7) Remove the connector and remove oil cooler.
8) Remove the adapters (1) and (2).

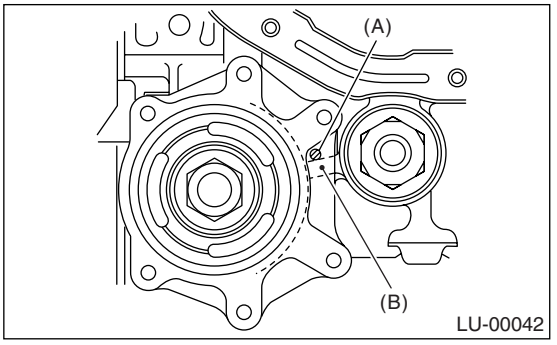


(A) Adapter (1)
(B) Adapter connector
(C) Adapter (2)
(D) Oil cooler
(E) Oil cooler connector

B: INSTALLATION

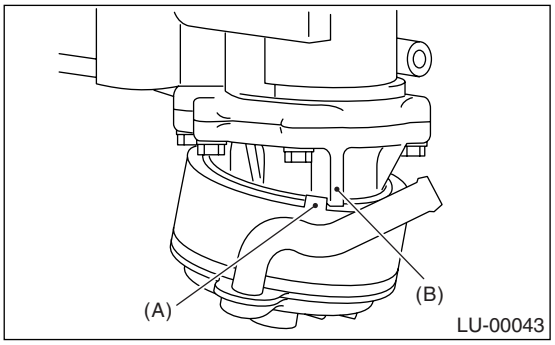
NOTE:
Engine oil cooler is equipped with turbo model only.

1) Install in the reverse order of removal.
2) Contact the knock pin (A) of adapter (1) to cylinder block rib (B) to install adapter (1).



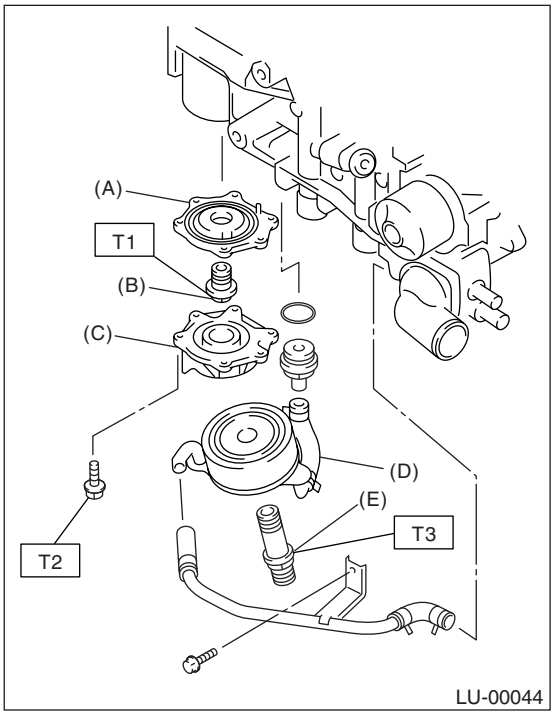
3) Install the adapter (2).

4) Contact the engine oil cooler stopper (A) to adapter (2) rib to install engine oil cooler.



Tightening torque:
T1: 45 N·m (4.6 kgf-m, 33.2 ft-lb)
T2: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)
T3: 54 N·m (5.5 kgf-m, 40 ft-lb)

NOTE:
Always use a new O-ring.



(A) Adapter (1)
(B) Adapter connector
(C) Adapter (2)
(D) Oil cooler
(E) Oil cooler connector

C: INSPECTION

1) Check that the coolant passages are not clogged using air blow method.
2) Check the mating surfaces of cylinder block, O-ring groove and oil filter for damage.

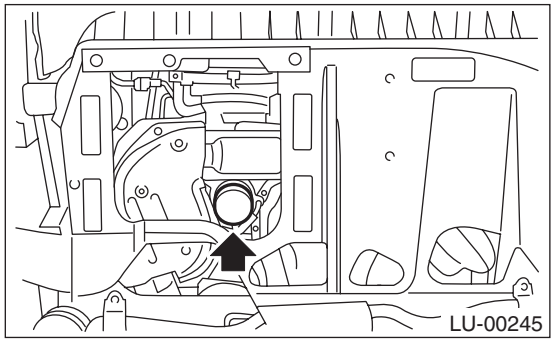
8. Engine Oil Filter

A: REMOVAL

1) Remove the service hole cover.
2) Remove the oil filter with ST.

ST	18332AA000	OIL FILTER WRENCH (Outer diameter: 68 mm (2.68 in))
ST	18332AA010	OIL FILTER WRENCH (Outer diameter: 65 mm (2.56 in))

NOTE:
Standard oil filter is one with 68 mm (2.68 in), but Subaru genuine oil filter with 65 mm (2.56 in) can be used.



B: INSTALLATION

1) Clean mounting surface of oil filer for oil cooler.
2) Get a new oil filter and apply a thin coat of engine oil to seal rubber.
3) When installing oil filter, carefully turn by hand so as not to damage seal rubber.
• Oil filter with 68 mm (2.68 in) outer diameter is further tightened (about 1 rotation) with ST after seal rubber contacts an oil cooler.
• Oil filter with 65 mm (2.56 in) outer diameter is further tightened (about 2/3 to 3/4 rotation) with ST after seal rubber contacts an 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 that 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(H4DOTC)-9, INSPECTION, Engine Oil.>

9. Engine Lubrication System Trouble in General

A: INSPECTION

Before performing diagnostics, make sure that 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) Poor contact of switch contact points		Replace.
	2) 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).

MEMO:

1. General Description

A: SPECIFICATIONS

Engine	Type			Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine	
	Valve arrangement			Belt driven, double overhead camshaft, 4-valve/cylinder	
	Bore × Stroke mm (in)			99.5 × 79.0 (3.917 × 3.110)	
	Piston displacement cm^3 (cu in)			2,457 (150)	
	Compression ratio			8.2	
	Compression pressure (at 200 — 300 rpm) kPa (kgf/cm^2, psi)			981 — 1,177 (10 — 12, 142 — 171)	
	Number of piston rings			Pressure ring: 2, Oil ring: 1	
	Intake valve timing	Opening	Max. retard	ATDC 5°	
			Min. advance	BTDC 15°	
		Closing	Max. retard	ABDC 65°	
			Min. advance	ABDC 45°	
	Exhaust valve timing	Opening		BBDC 55°	
		Closing		ATDC 5°	
	Valve clearance	Intake mm (in)		0.20±0.02 (0.0079±0.0008)	
		Exhaust mm (in)		0.35±0.02 (0.0138±0.0008)	
	Idling speed [At neutral position on MT, “P” or “N” position on AT] rpm		No load	M/T: 700±100 A/T: 700±100	
			A/C ON	A/C refrigerant pressure low	M/T: 725±100 A/T: 750±100
				A/C refrigerant pressure high	M/T: 800±100 A/T: 825±100
	Firing order			1 → 3 → 2 → 4	
	Ignition timing BTDC/rpm			MT:13°±10° AT:17°±10°	

NOTE:
STD: Standard I.D.: Inner Diameter O.D.: Outer Diameter OS: Oversize US: Undersize

Belt tension 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.			18.0 — 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	0.2 — 0.55 mm (0.0079 — 0.0217 in)
			Limit	0.81 mm (0.0319 in)
Camshaft	Bend limit			0.020 mm (0.0079 in)
	Thrust clearance		STD	0.068 — 0.116 mm (0.0027 — 0.0046 in)
			Limit	0.14 mm (0.0055 in)
	Cam lobe height	Intake	STD	46.55 — 46.65 mm (1.833 — 1.837 in)
			Limit	46.45 mm (1.829 in)
		Exhaust	STD	46.75 — 46.85 mm (1.841 — 1.844 in)
			Limit	46.65 mm (1.837 in)
	Journal O.D.	STD	Front	37.946 — 37.963 mm (1.4939 — 1.4946 in)
			Center rear	29.946 — 29.963 mm (1.1790 — 1.1796 in)
	Oil clearance		STD	0.037 — 0.072 mm (0.0015 — 0.0028 in)
			Limit	0.10 mm (0.0039 in)
Cylinder head	Surface warpage limit			0.035 mm (0.0014 in)
	Surface grinding limit			0.3 mm (0.012 in)
	Standard height			127.5 mm (5.02 in)
Valve seat	Refacing angle			90°
	Contacting width	Intake	STD	0.6 — 1.4 mm (0.024 — 0.055 in)
			Limit	1.7 mm (0.067 in)
		Exhaust	STD	1.2 — 1.8 mm (0.047 — 0.071 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			15.8 — 16.2 mm (0.622 — 0.638 in)
Valve	Head edge thickness	Intake	STD	1.0 — 1.4 mm (0.024 — 0.055 in)
			Limit	0.8 mm (0.031 in)
		Exhaust	STD	1.3 — 1.7 mm (0.051 — 0.067 in)
			Limit	0.8 mm (0.031 in)
	Stem diameter		Intake	5.955 — 5.970 mm (0.2344 — 0.2350 in)
			Exhaust	5.945 — 5.960 mm (0.2341 — 0.2346 in)
	Stem oil clearance	STD	Intake	0.030 — 0.057 mm (0.0012 — 0.0022 in)
			Exhaust	0.040 — 0.067 mm (0.0016 — 0.0026 in)
		Limit	—	0.15 mm (0.0059 in)
	Overall length		Intake	104.4 mm (4.110 in)
			Exhaust	104.65 mm (4.120 in)
Valve spring	Free length			47.32 mm (1.863 in)
	Squareness			2.5°, 2.1 mm (0.083 in)
	Tension/spring height		Set	205 — 235 N (20.9 — 24.0 kgf, 46.1 — 52.8 lb)/ 36.0 mm (1.417 in)
			Lift	426 — 490 N (43.4 — 50.0 kgf, 95.8 — 110 lb)/ 26.50 mm (1.043 in)

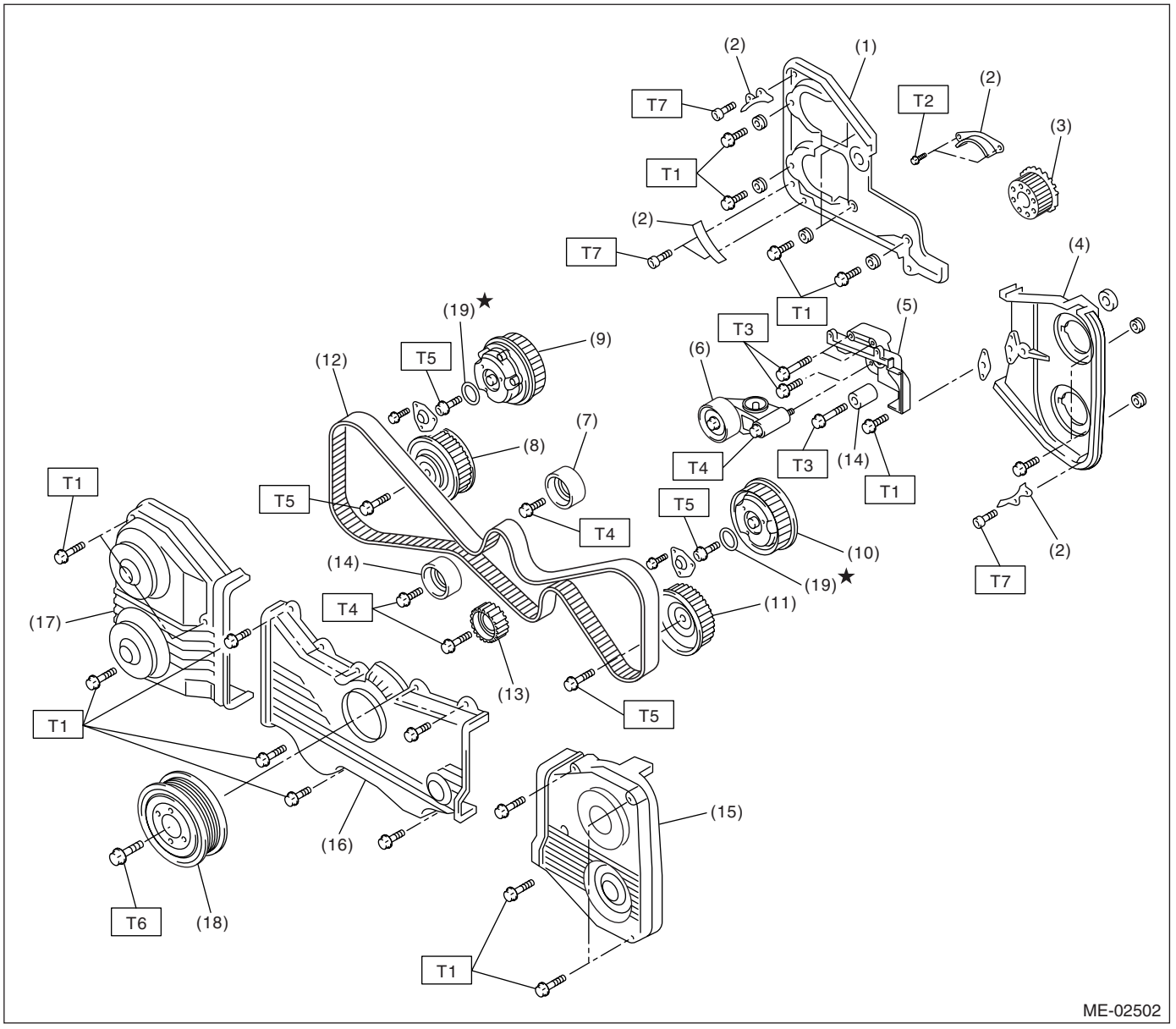
Cylinder block	Surface warpage limit (mating with cylinder head)			0.025 mm (0.0010 in)
	Surface grinding limit			0.1 mm (0.004 in)
	Standard height			201.0 mm (7.91 in)
	Cylinder bore	STD	A	99.505 — 99.515 mm (3.9175 — 3.9179 in)
			B	99.495 — 99.505 mm (3.9171 — 3.9175 in)
	Taper		STD	0.015 mm (0.0006 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 — 0.010 mm (–0.0004 — 0.0004 in)
			Limit	0.030 mm (0.0012 in)
	Enlarging (boring) limit			0.5 mm (0.020 in)
Piston	Outer diameter	STD	A	99.505 — 99.515 mm (3.9175 — 3.9179 in)
			B	99.495 — 99.505 mm (3.9171 — 3.9175 in)
		0.25 mm (0.0098 in) OS		99.745 — 99.765 mm (3.9270 — 3.9278 in)
		0.50 mm (0.0197 in) OS		99.995 — 100.015 mm (3.9368 — 3.9376 in)
Piston pin	Standard clearance between piston pin and hole in piston		STD	0.004 — 0.008 mm (0.0002 — 0.0003 in)
			Limit	0.020 mm (0.0008 in)
	Degree of fit			Piston pin must be fitted into position with thumb at 20°C (68°F).
Piston ring	Piston ring gap	Top ring	STD	0.20 — 0.25 mm (0.0079 — 0.0098 in)
			Limit	1.0 mm (0.039 in)
		Second ring	STD	0.37 — 0.52 mm (0.015 — 0.020 in)
			Limit	1.0 mm (0.039 in)
		Oil ring	STD	0.20 — 0.50 mm (0.0079 — 0.020 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	0.017 — 0.045 mm (0.0007 — 0.0018 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)

Crankshaft	Bend limit			0.035 mm (0.0014 in)
	Crank pin	Out-of-roundness		0.003 mm (0.0001 in)
		Cylindricality		0.004 mm (0.0002 in)
		Grinding limit (Diameter)		51.750 (2.0374) or less
	Crank journal	Out-of-roundness		0.005 mm (0.0002 in)
		Cylindricality		0.006 mm (0.0002 in)
		Grinding limit (Diameter)		59.750 (2.3524) or less
	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 (2.0447 — 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 — #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		STD	0.010 — 0.030 mm (0.0004 — 0.0012 in)
			Limit	0.040 mm (0.0016 in)
Crankshaft main bearing	Crankshaft main 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)

MEMO:

B: COMPONENT

1. TIMING BELT

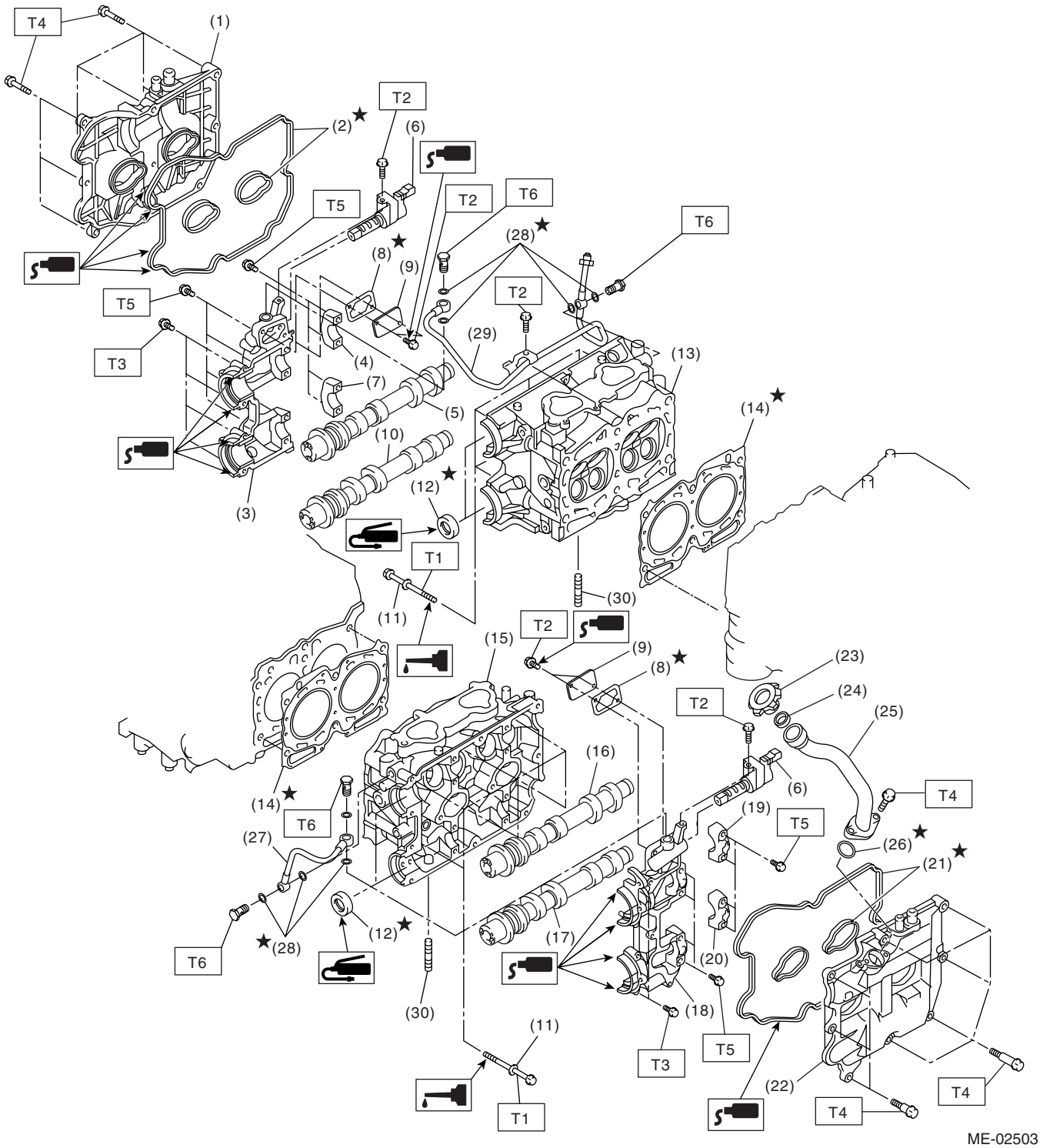


(1) Timing belt cover No. 2 (RH)
(2) Timing belt guide (MT model)
(3) Crankshaft sprocket
(4) Timing belt cover No. 2 (LH)
(5) Tensioner bracket
(6) Automatic belt tension adjuster ASSY
(7) Belt idler
(8) Exhaust camshaft sprocket (RH)
(9) Intake camshaft sprocket (RH)
(10) Intake camshaft sprocket (LH)
(11) Exhaust camshaft sprocket (LH)
(12) Timing belt
(13) Belt idler No. 2
(14) Belt idler
(15) Timing belt cover (LH)
(16) Front belt cover
(17) Timing belt cover (RH)
(18) Crankshaft pulley
(19) O-ring

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)
T2: 9.75 (0.99, 7.2)
T3: 24.5 (2.5, 18.1)
T4: 39 (4.0, 28.9)
T5: <Ref. to ME(H4DOTC)-58, INSTALLATION, Crankshaft Sprocket.>
T6: <Ref. to ME(H4DOTC)-47, INSTALLATION, Crankshaft Pulley.>
T7: 6.4 (0.65, 4.7)

2. CYLINDER HEAD AND CAMSHAFT

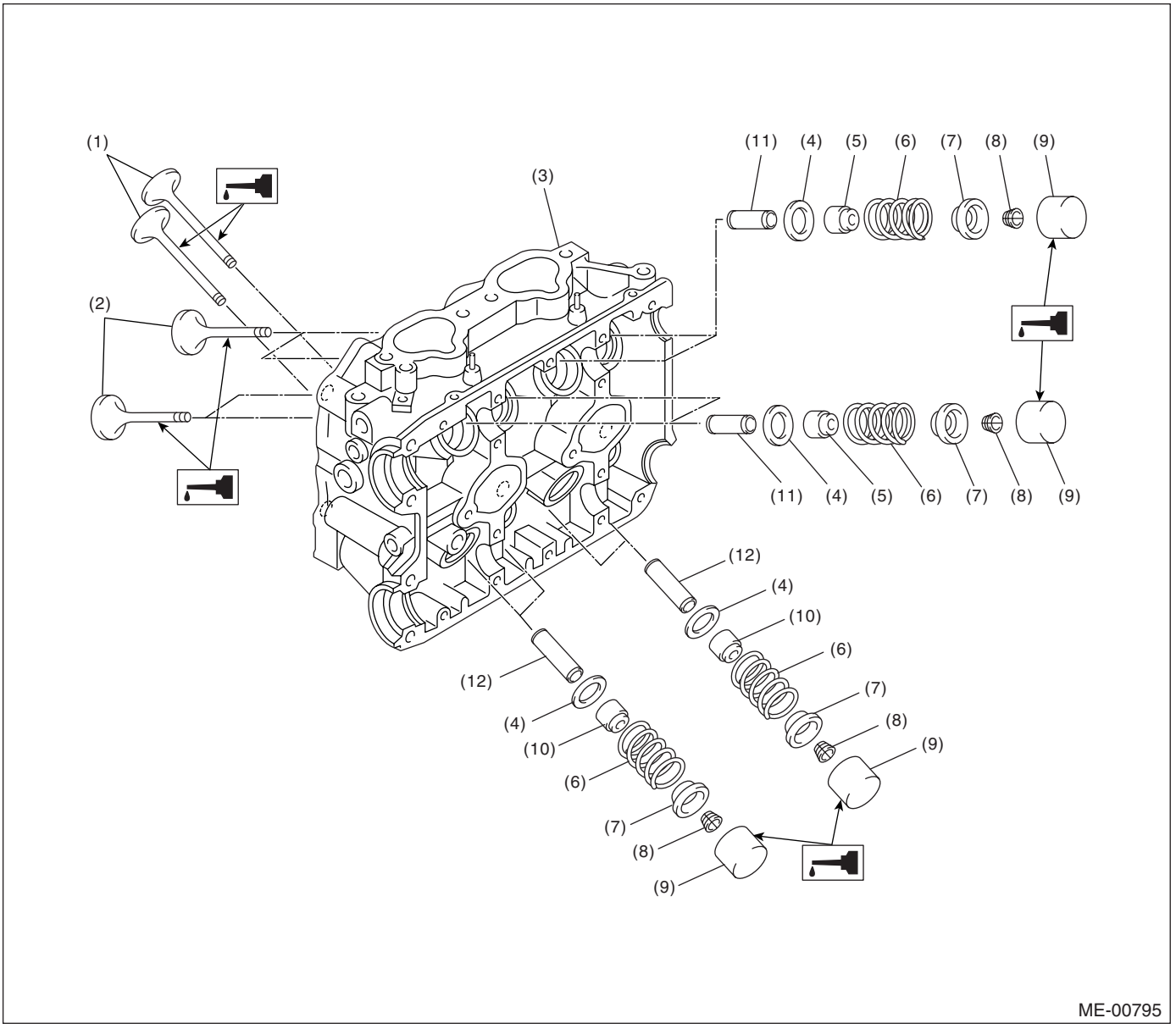


(1) Rocker cover (RH)
(2) Rocker cover gasket (RH)
(3) Camshaft cap (Front RH)
(4) Intake camshaft cap (RH)
(5) Intake camshaft (RH)
(6) Variable valve timing solenoid valve
(7) Exhaust camshaft cap (Center RH)
(8) Gasket
(9) Oil return cover
(10) Exhaust camshaft (RH)
(11) Cylinder head bolt
(12) Oil seal
(13) Cylinder head (RH)
(14) Cylinder head gasket
(15) Cylinder head (LH)
(16) Intake camshaft (LH)
(17) Exhaust camshaft (LH)
(18) Camshaft cap (Front LH)
(19) Intake camshaft cap (Rear LH)
(20) Exhaust camshaft cap (Rear LH)
(21) Rocker cover gasket (LH)
(22) Rocker cover (LH)
(23) Oil filler cap
(24) Gasket
(25) Oil filler duct
(26) O-ring
(27) Oil pipe (LH)
(28) Gasket
(29) Oil pipe (RH)
(30) Stud bolt

Tightening torque: N·m (kgf-m, ft-lb)

T1: <Ref. to ME(H4DOTC)-65, INSTALLATION, Cylinder Head Assembly.>
T2: 8 (0.8, 5.9)
T3: <Ref. to ME(H4DOTC)-60, INSTALLATION, Camshaft.>
T4: 6.4 (0.65, 4.7)
T5: <Ref. to ME(H4DOTC)-60, INSTALLATION, Camshaft.>
T6: 29 (3.0, 21.4)

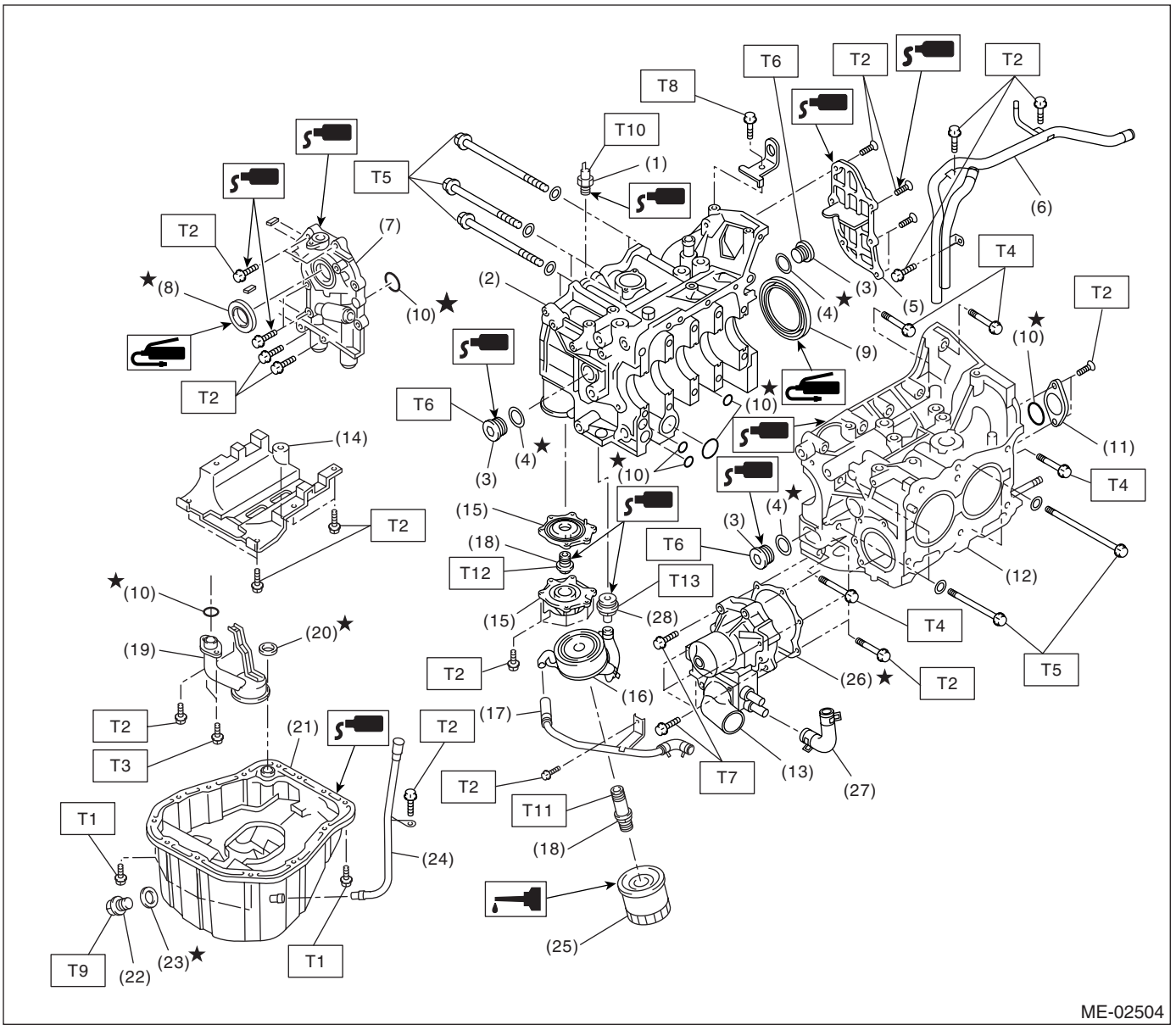
3. CYLINDER HEAD AND VALVE ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Cylinder head
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Retainer
(8) Retainer key
(9) Valve lifter
(10) Exhaust valve oil seal
(11) Intake valve guide
(12) Exhaust valve guide

MEMO:

4. CYLINDER BLOCK

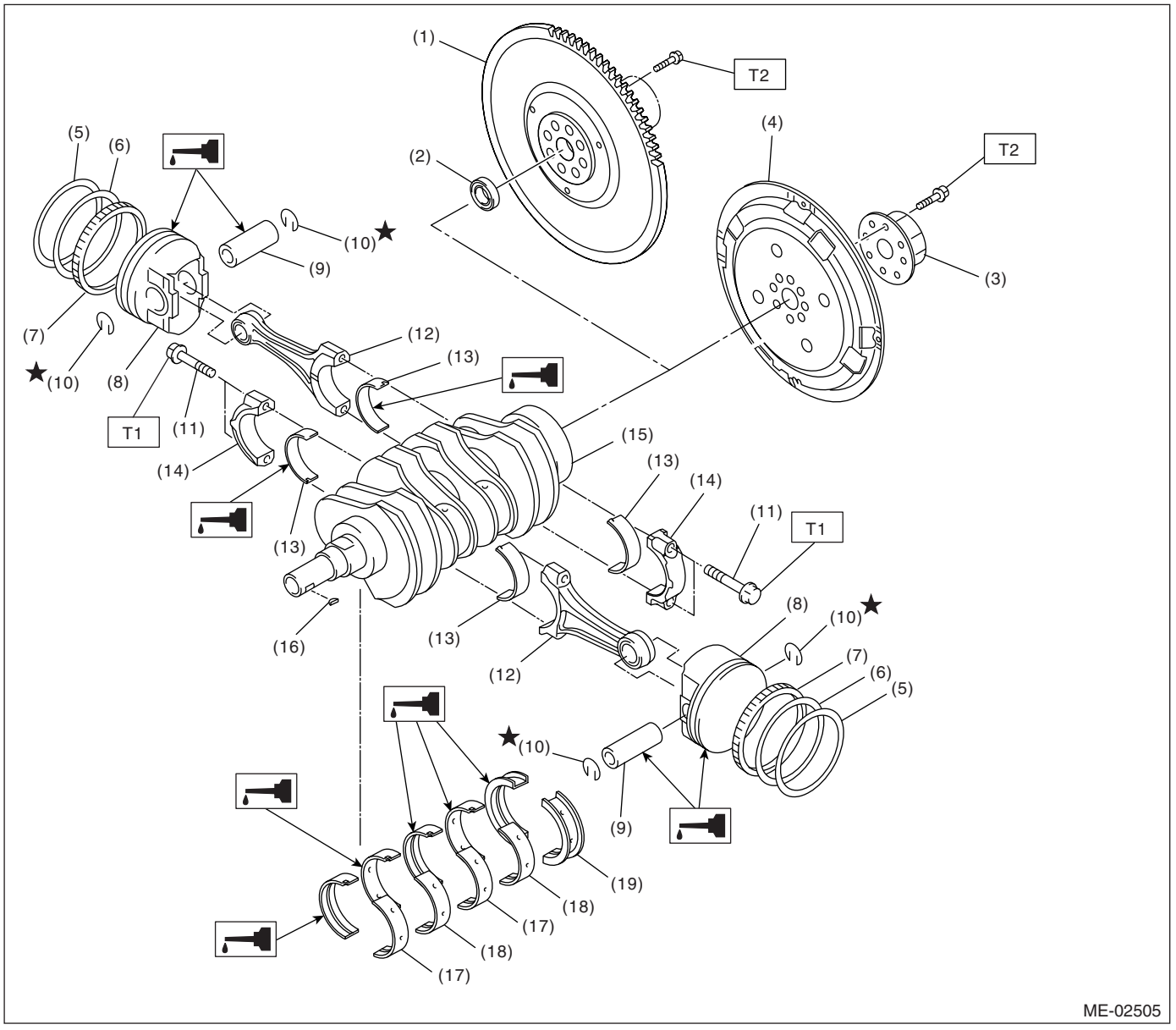


(1) Oil pressure switch
(2) Cylinder block (RH)
(3) Service hole plug
(4) Gasket
(5) Oil separator cover
(6) Water by-pass pipe
(7) Oil pump
(8) Front oil seal
(9) Rear oil seal
(10) O-ring
(11) Service hole cover
(12) Cylinder block (LH)
(13) Water pump
(14) Baffle plate
(15) Adapter
(16) Oil cooler
(17) Water by-pass pipe
(18) Connector
(19) Oil strainer
(20) Gasket
(21) Oil pan
(22) Drain plug
(23) Metal gasket
(24) Oil level gauge guide
(25) Oil filter
(26) Gasket
(27) Water pump hose
(28) Plug

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(H4DOTC)-76, 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:	***54 (5.5, 40)***
T12:	***45 (4.6, 33)***
T13:	***69 (7.0, 50.9)***

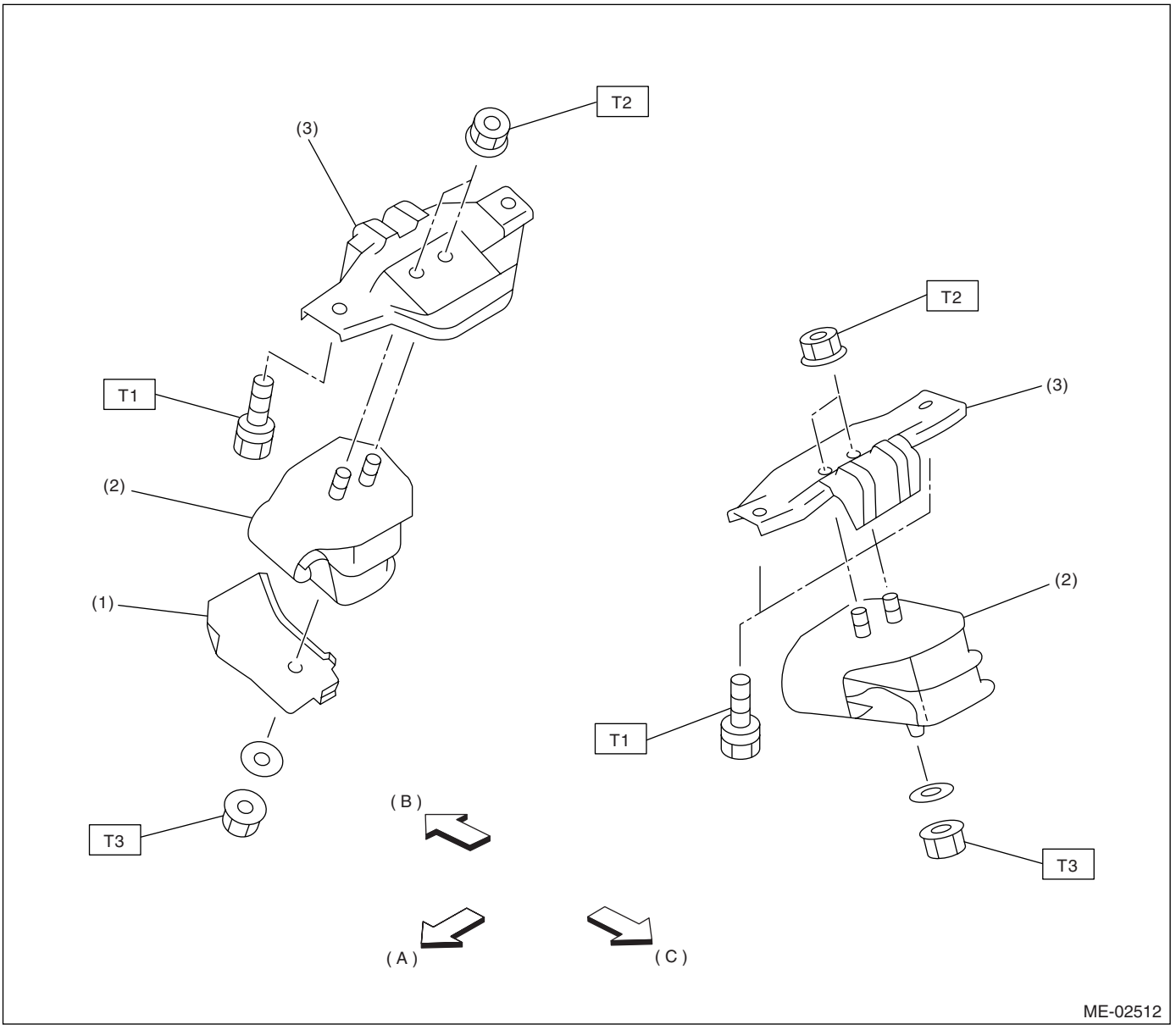
5. CRANKSHAFT AND PISTON



(1) Flywheel (MT model)
(2) Ball bearing (MT model)
(3) Reinforcement (AT model)
(4) Drive plate (AT model)
(5) Top ring
(6) Second ring
(7) Oil ring
(8) Piston
(9) Piston pin
(10) Circlip
(11) Connecting rod bolt
(12) Connecting rod
(13) Connecting rod bearing
(14) Connecting rod cap
(15) Crankshaft
(16) Woodruff key
(17) Crankshaft bearing #1, #3
(18) Crankshaft bearing #2, #4
(19) Crankshaft bearing #5

Tightening torque: N·m (kgf-m, ft-lb)
T1: 52 (5.3, 38.4)
T2: 72 (7.3, 52.8)

6. ENGINE MOUNTING



(A) Front
(B) RH
(C) LH
(1) Heat shield cover
(2) Front cushion rubber
(3) Front engine mounting bracket

Tightening torque: N·m (kgf-m, ft-lb)
T1: 35 (3.6, 25.8)
T2: 42 (4.3, 30.9)
T3: 85 (8.7, 62.7)

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 reinstalled 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 the 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

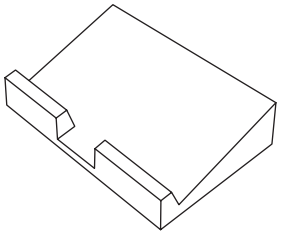
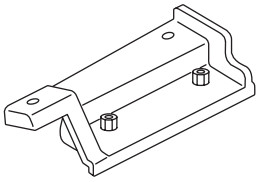
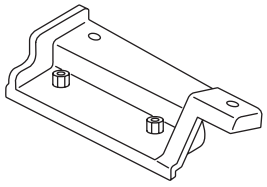
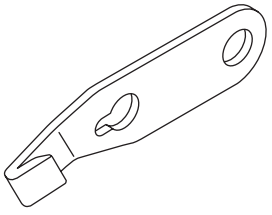
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498267600	498267600	CYLINDER HEAD TABLE	• Used for replacing valve guides. • Used for removing and installing valve springs.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).
 ST-498497100	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of flywheel when loosening and tightening crankshaft pulley bolt, etc.

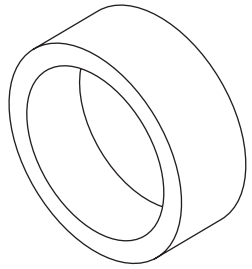
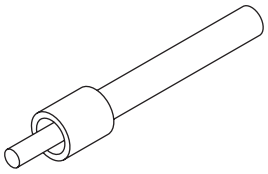
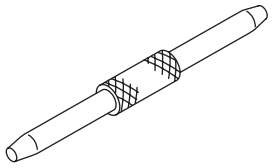
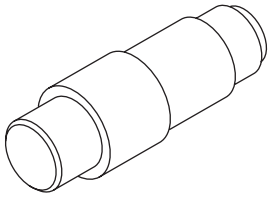
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498747300	498747300	PISTON GUIDE	Used for installing piston in cylinder for 2.5 L engine.
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 ST-499017100	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499037100	499037100	CONNECTING ROD BUSHING REMOVER & INSTALLER	Used for removing and installing connecting rod bushing.

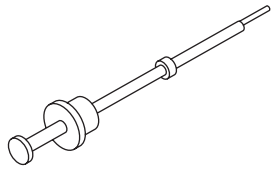
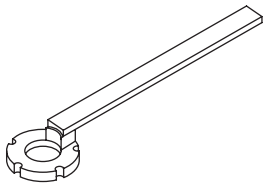
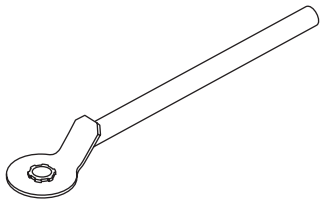
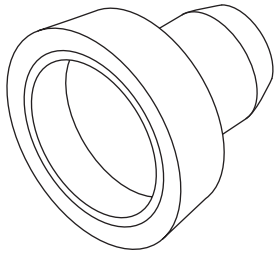
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499097700	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 ST-499207400	499207400	CAMSHAFT SPROCKET WRENCH	Used for removing and installing exhaust camshaft sprocket.
 ST-499977500	499977500	CAMSHAFT SPROCKET WRENCH	Used for removing and installing intake camshaft sprocket.
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL GUIDE (499597100).

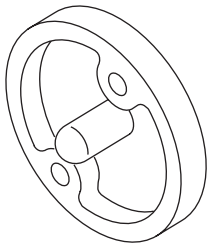
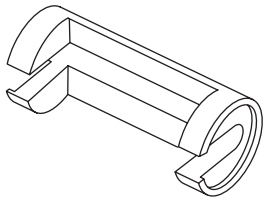
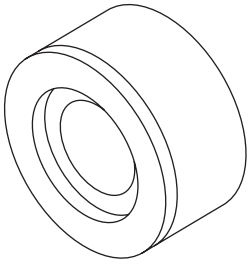
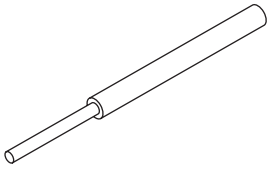
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 ST18251AA020	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake and exhaust valve guides.
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.

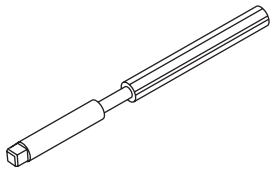
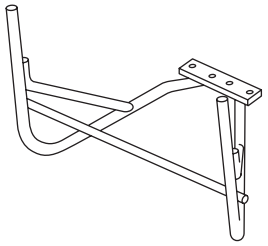
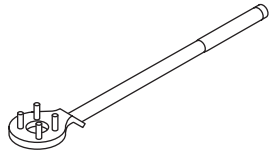
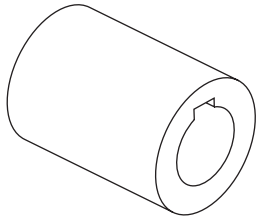
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499817000	499817000	ENGINE STAND	• Stand used for engine disassembly and assembly. • Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977100	499977100	CRANKSHAFT PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

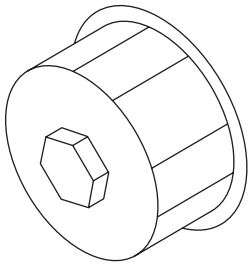
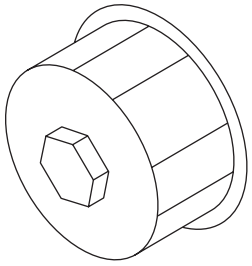
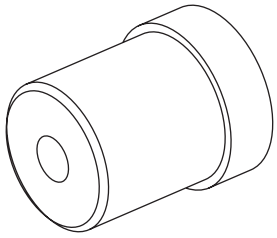
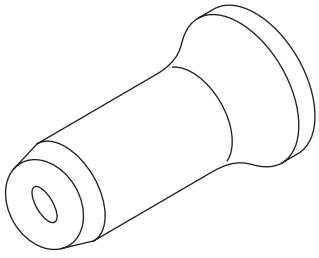
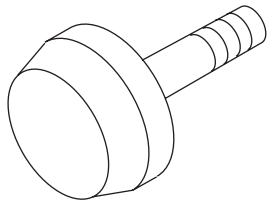
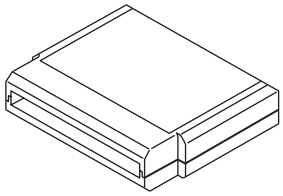
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18332AA000	18332AA000	OIL FILTER WRENCH	Used for removing and installing the oil filter. (Outer diameter : 68 mm (2.68 in))
 ST18332AA000	18332AA010	OIL FILTER WRENCH	Used for removing and installing the oil filter. (Outer diameter : 65 mm (2.56 in))
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 ST-499587600	499587600	OIL SEAL INSTALLER	Used for installing camshaft oil seal for DOHC engine.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499597200	499597200	OIL SEAL GUIDE	• Used for installing camshaft oil seal for DOHC engine. • Used with OIL SEAL GUIDE (499587600).
 ST24082AA260	24082AA260 (Newly adopted tool)	CARTRIDGE	Troubleshooting for electrical systems.
ST22771AA030	22771AA030	SUBARU SELECT MONITOR KIT	Troubleshooting for electrical systems.

2. GENERAL PURPOSE TOOLS

TOOL NAME	REMARKS
Compression Gauge	Used for measuring compression.

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
- Camshaft
- Cylinder Head

2. Compression

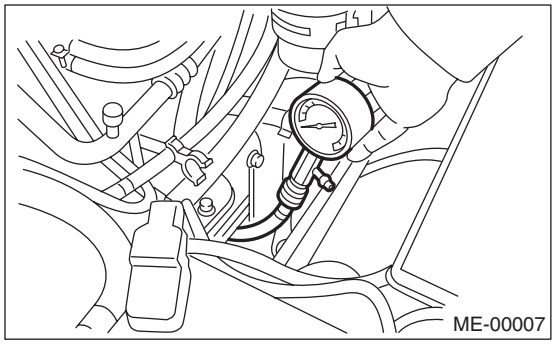
A: INSPECTION

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(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
4) Remove all the spark plugs. <Ref. to IG(H4DOTC)-5, 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
981 — 1,177 kPa (10 — 12 kgf/cm^2, 142 — 171 psi)
Limit
882 kPa (9.0 kgf/cm^2, 128 psi)
Difference between cylinders
Less than 49 kPa (0.5 kgf/cm^2, 7 psi)

3. Idle Speed

A: INSPECTION

1. USING SUBARU SELECT MONITOR

1) Before checking the 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 that 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) Insert the cartridge to SUBARU SELECT MONITOR.
5) Connect the SUBARU SELECT MONITOR to data link connector.
6) Turn the ignition switch to ON, and SUBARU SELECT MONITOR switch to ON.
7) Select the {2. Each System Check} in Main Menu.
8) Select the {Engine Control System} in Selection Menu.
9) Select the {1. Current Data Display & Save} in Engine Control System Diagnosis.
10) Select the {1.12 Data Display} in Data Display Menu.
11) Start the engine, and then read the engine idle speed.
12) 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]:
700±100 rpm

13) 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”, no load and gears in neutral]:
- ***A/C refrigerant pressure is low***
  MT: 725±100 rpm
  AT: 750±100 rpm
- ***A/C refrigerant pressure is high***
  MT: 800±100 rpm
  AT: 825±100 rpm

NOTE:
As idle speed is controlled by the automatic adjustment type, it can not be adjusted manually. If the idle speed is out of specifications, refer to General On-board Diagnosis Table under “Engine Control System”. <Ref. to EN(H4DOTC)-449, General Diagnostic Table.>

4. Ignition Timing

A: INSPECTION

1. USING SUBARU SELECT MONITOR

1) Before checking the ignition timing speed, check the following:
   (1) Ensure the air cleaner element is free from clogging, spark plugs are in good condition, and that 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) Insert the cartridge to SUBARU SELECT MONITOR.
5) Connect the SUBARU SELECT MONITOR to data link connector.
6) Turn the ignition switch to ON, and SUBARU SELECT MONITOR switch to ON.
7) Select the {2. Each System Check} in Main Menu.
8) Select the {Engine Control System} in Selection Menu.
9) Select the {1. Current Data Display & Save} in Engine Control System Diagnosis.
10) Select the {1.12 Data Display} in Data Display Menu.
11) Start the engine and check the ignition timing at idle speed.

Ignition timing [BTDC/rpm]:
MT model:
13°±10°
AT model:
17°±10°

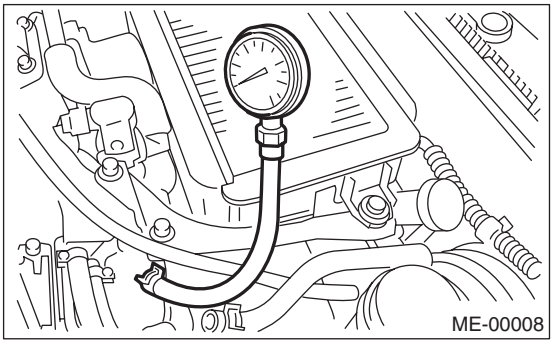
If the timing is not correct, check the ignition control system. Refer to Engine Control System. <Ref. to EN(H4DOTC)-2, Basic Diagnostic Procedure.>

5. Intake Manifold Vacuum

A: INSPECTION

1) Warm-up the engine.
2) Disconnect the brake vacuum hose, and then install the vacuum gauge to hose fitting on manifold.
3) Keep the engine at the 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.



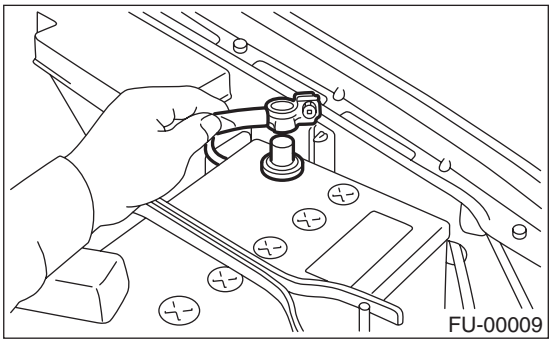
Vacuum pressure (at idling, A/C "OFF"):
Less than −60.0 kPa (−450 mmHg, −17.72 inHg)

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 or throttle chamber idle adjustment

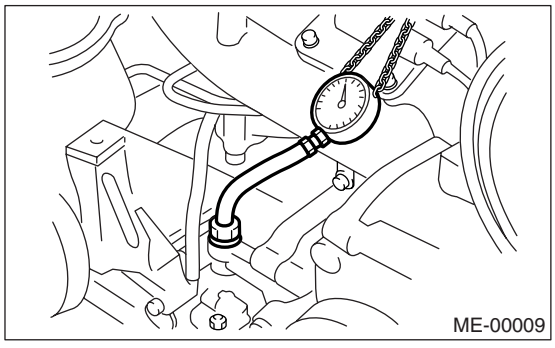
6. Engine Oil Pressure

A: INSPECTION

1) Remove the oil pressure switch from engine cylinder block. <Ref. to LU(H4DOTC)-19, Oil Pressure Switch.>
2) Connect the oil pressure gauge hose to cylinder block.
3) Connect the battery ground cable to battery.



4) Start the engine, and then measure the oil pressure.



Oil pressure:
98 kPa (1.0 kgf/cm^2, 14 psi) or more at 600 rpm
294 kPa (3.0 kgf/cm^2, 43 psi) or more at 5,000 rpm

CAUTION:
• If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(H4DOTC)-23, 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(H4DOTC)-19, Oil Pressure Switch.>

NOTE:
The specified data is based on an engine oil temperature of 80°C (176°F).

5) After measuring the oil pressure, install the oil pressure switch. <Ref. to LU(H4DOTC)-19, INSTALLATION, Oil Pressure Switch.>

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)

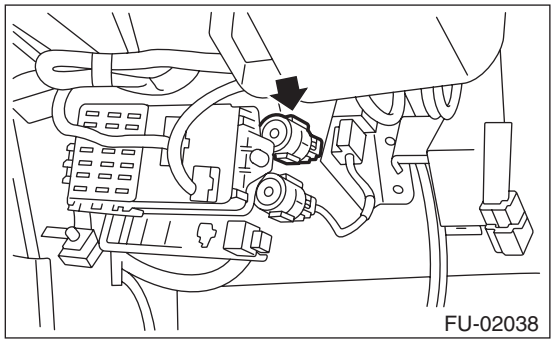
7. Fuel Pressure

A: INSPECTION

CAUTION:
Before removing the fuel pressure gauge, release the fuel pressure.

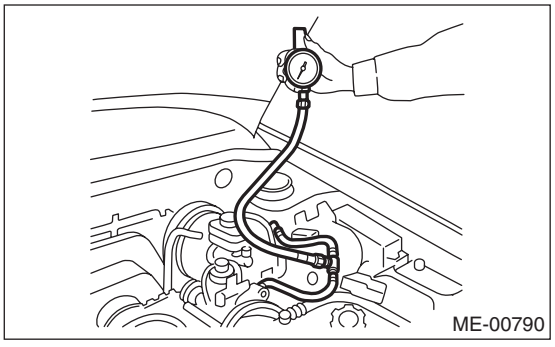
NOTE:
If out of specification, check or replace the pressure regulator and pressure regulator vacuum hose.

1) Release the fuel pressure. <Ref. to FU(H4DOTC)-48, RELEASING OF FUEL PRESSURE, OPERATION, Fuel.>
2) Open the fuel flap lid, and then remove the fuel filler cap.
3) Disconnect the fuel delivery hoses, and then connect the fuel pressure gauge.
4) Connect the connector of fuel pump relay.



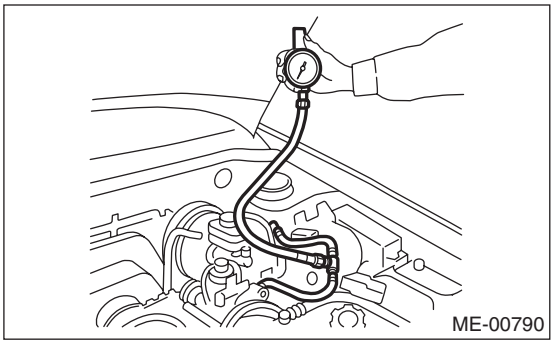
5) Start the engine.
6) Measure the fuel pressure while disconnecting the pressure regulator vacuum hose from intake manifold.

Fuel pressure:
Standard; 284 — 314 kPa (2.9 — 3.2 kgf/cm^2, 41 — 46 psi)



7) After connecting the pressure regulator vacuum hose, measure the fuel pressure.

Fuel pressure:
Standard; 230 — 260 kPa (2.35 — 2.65 kgf/cm^2, 33 — 38 psi)



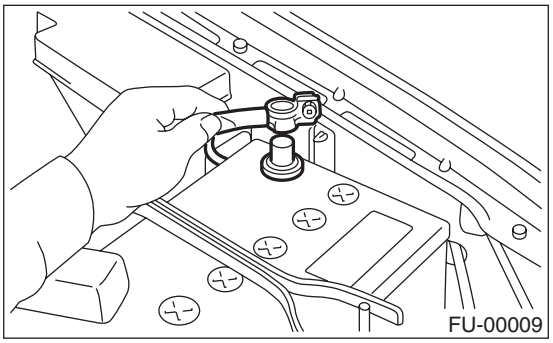
NOTE:
The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.

8. Valve Clearance

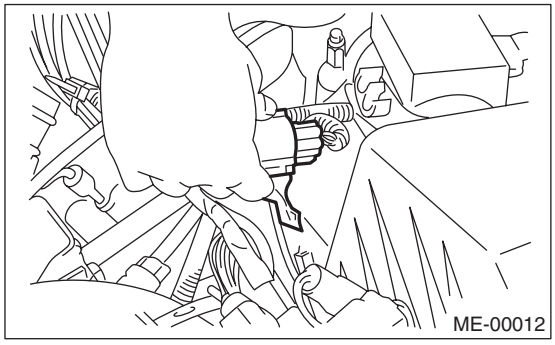
A: INSPECTION

Inspection and adjustment of the valve clearance should be performed while engine is cold.

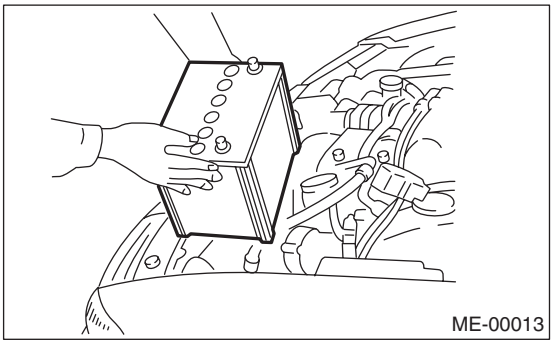
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.



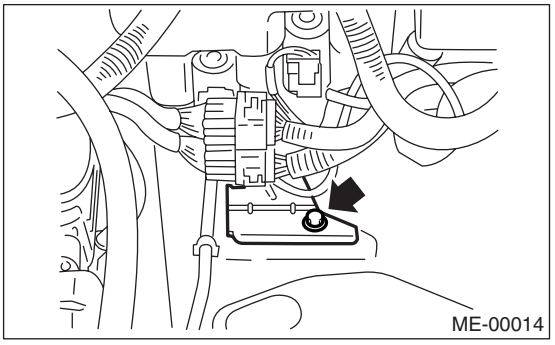
3) Remove the air intake duct. <Ref. to IN(H4DOTC)-8, REMOVAL, Air Intake Duct.>
4) Remove the bolts which secure the timing belt cover (RH).
5) Lift-up the vehicle.
6) Remove the under cover.
7) Loosen the remaining bolts which secure the timing belt cover (RH), and then remove the timing belt cover.
8) Lower the vehicle.
9) When inspecting the #1 and #3 cylinders:
   (1) Pull out the engine harness connector with bracket from air cleaner upper cover.



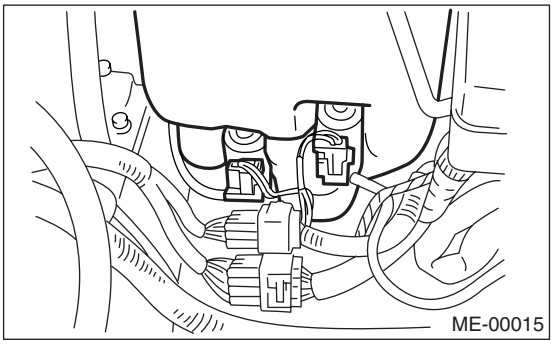
   (2) Remove the air cleaner case. <Ref. to IN(H4DOTC)-7, REMOVAL, Air Cleaner.>
   (3) Disconnect the ignition coil connector.
   (4) Remove the ignition coil.
   (5) Place a suitable container under the vehicle.
   (6) Disconnect the PCV hose from rocker cover (RH).
   (7) Remove the bolts, and then remove the rocker cover (RH).
10) When inspecting the #2 and #4 cylinders:
   (1) Disconnect the battery cable, and then remove the battery and battery carrier.



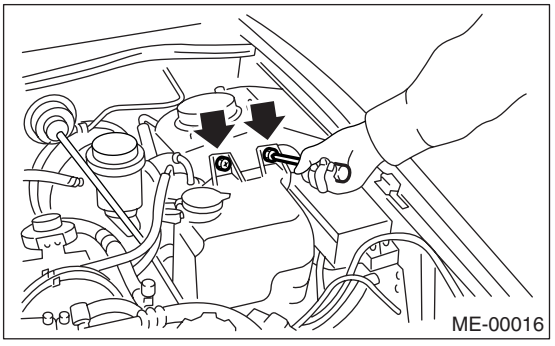
   (2) Remove the bolt which secures the engine harness bracket onto body.



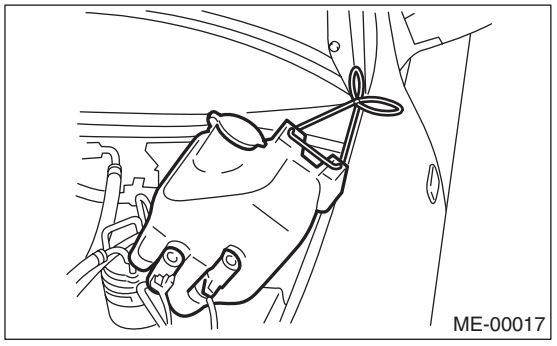
   (3) Disconnect the washer motor connectors.



   (4) Remove the washer tank mounting bolts.



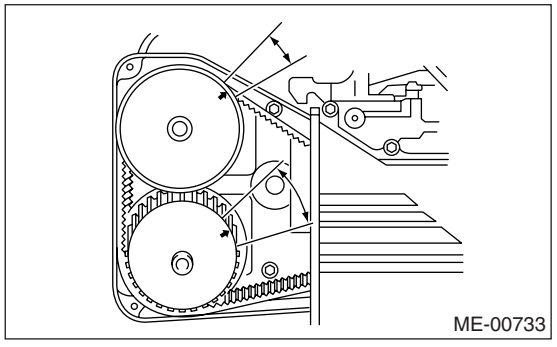
(5) Move the washer tank upward.



(6) Disconnect the ignition coil connector.
(7) Remove the ignition coil.
(8) Place a suitable container under the vehicle.
(9) Disconnect the PCV hose from rocker cover (LH).
(10) Remove the bolts, and then remove the rocker cover (LH).

11) Turn the crankshaft pulley clockwise until arrow mark on the camshaft sprocket is set to position shown in the figure.

NOTE:
Turn the crankshaft using socket wrench.

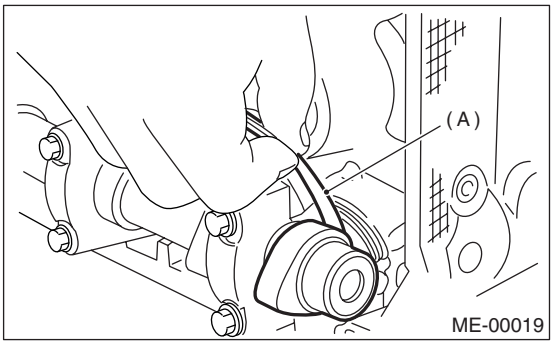


12) Measure the #1 cylinder intake valve and #3 cylinder exhaust valve clearance by using thickness gauge (A).

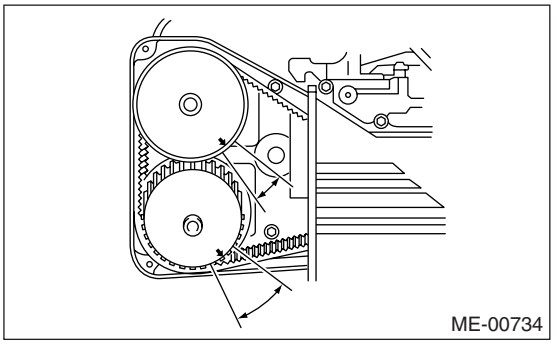
NOTE:
• Insert the thickness gauge in as horizontal a direction as possible with respect to the shim.
• Measure the exhaust valve clearances while lifting-up the vehicle.

Valve clearance:
Intake:
0.20±0.02 mm (0.0079±0.0008 in)
Exhaust:
0.35±0.02 mm (0.0138±0.0008 in)

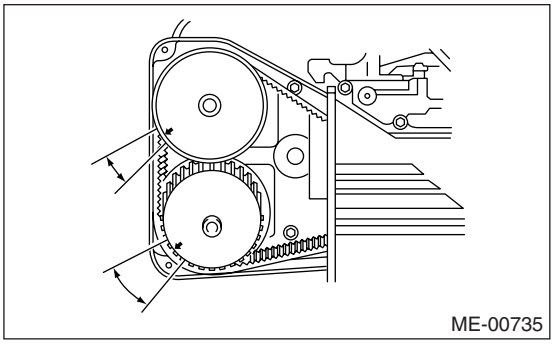
NOTE:
If the measured value is not within specification, take notes of the value in order to adjust the valve clearance later on.



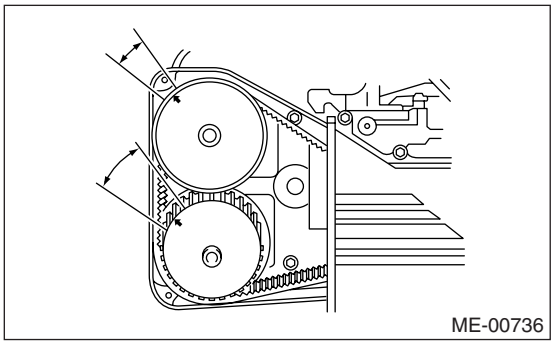
13) If necessary, adjust the valve clearance. <Ref. to ME(H4DOTC)-32, ADJUSTMENT.>
14) Further turn the crankshaft pulley clockwise. Using the same procedures described previously, and then measure the valve clearances again.
(1) Set the arrow mark on camshaft sprocket to position shown in the figure, and then measure the #2 cylinder exhaust valve and #3 cylinder intake valve clearances.



(2) Set the arrow mark on camshaft sprocket to position shown in the figure, and then measure the #2 cylinder intake valve and #4 cylinder exhaust valve clearances.

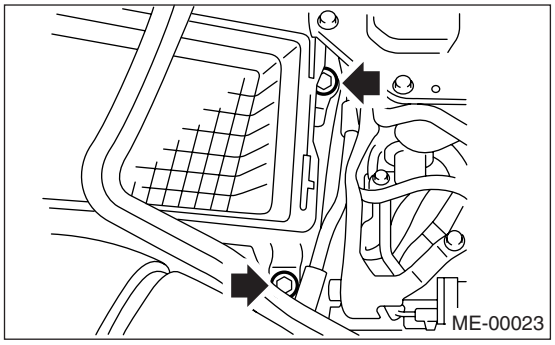


(3) Set the arrow mark on camshaft sprocket to position shown in the figure, and then measure the #1 cylinder exhaust valve and #4 cylinder intake valve clearances.



15) After inspection, install the related parts in the reverse order of removal.

Tightening torque:
33 N·m (3.4 kgf-m, 25 ft-lb)

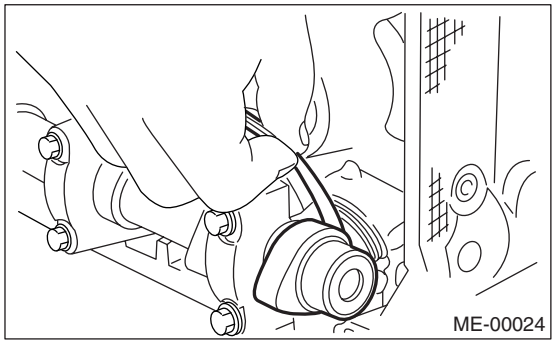


B: ADJUSTMENT

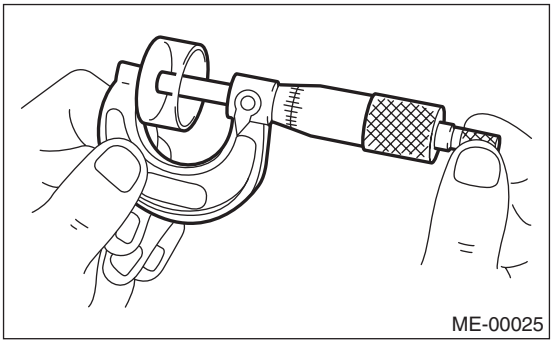
CAUTION:
Adjustment of the valve clearance should be performed while engine is cold.

1) Measure all valve clearances. <Ref. to ME(H4DOTC)-30, INSPECTION.>

NOTE:
Record each valve clearance after it has been measured.



2) Remove the camshaft. <Ref. to ME(H4DOTC)-59, REMOVAL.>
3) Remove the valve lifter.
4) Measure the thickness of valve lifter with a micrometer.



5) Select a valve lifter of suitable thickness using measured valve clearance and valve lifter thickness, by referring to the following table.

Unit: mm
Intake valve: S = (V + T) – 0.20 Exhaust valve: S = (V + T) – 0.35
S: Required thickness of valve lifter V: Measured valve clearance T: Used valve lifter thickness

Part No.	Thickness mm (in)
13228 AB101	4.68 (0.1843)
13228 AB111	4.69 (0.1846)
13228 AB121	4.70 (0.1850)
13228 AB131	4.71 (0.1854)
13228 AB141	4.72 (0.1858)
13228 AB151	4.73 (0.1862)
13228 AB161	4.74 (0.1866)
13228 AB171	4.75 (0.1870)
13228 AB181	4.76 (0.1874)
13228 AB191	4.77 (0.1878)
13228 AB201	4.78 (0.1882)
13228 AB211	4.79 (0.1886)
13228 AB221	4.80 (0.1890)
13228 AB231	4.81 (0.1894)
13228 AB241	4.82 (0.1898)
13228 AB251	4.83 (0.1902)
13228 AB261	4.84 (0.1906)
13228 AB271	4.85 (0.1909)
13228 AB281	4.86 (0.1913)
13228 AB291	4.87 (0.1917)
13228 AB301	4.88 (0.1921)
13228 AB311	4.89 (0.1925)
13228 AB321	4.90 (0.1929)
13228 AB331	4.91 (0.1933)
13228 AB341	4.92 (0.1937)
13228 AB351	4.93 (0.1941)
13228 AB361	4.94 (0.1945)
13228 AB371	4.95 (0.1949)
13228 AB381	4.96 (0.1953)
13228 AB391	4.97 (0.1957)
13228 AB401	4.98 (0.1961)
13228 AB411	4.99 (0.1965)
13228 AB421	5.00 (0.1969)
13228 AB431	5.01 (0.1972)
13228 AB441	5.02 (0.1976)
13228 AB451	5.03 (0.1980)
13228 AB461	5.04 (0.1984)
13228 AB471	5.05 (0.1988)
13228 AB481	5.06 (0.1992)
13228 AB491	5.07 (0.1996)
13228 AB501	5.08 (0.2000)
13228 AB511	5.09 (0.2004)
13228 AB521	5.10 (0.2008)
13228 AB531	5.11 (0.2012)
13228 AB541	5.12 (0.2016)
13228 AB551	5.13 (0.2020)
13228 AB561	5.14 (0.2024)
13228 AB571	5.15 (0.2028)
13228 AB581	5.16 (0.2031)
13228 AB591	5.17 (0.2035)
13228 AB601	5.18 (0.2039)

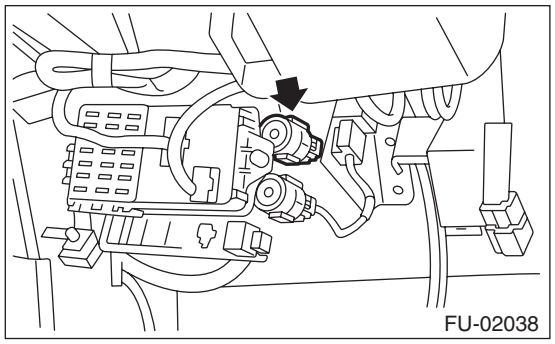
Part No.	Thickness mm (in)
13228 AB611	5.19 (0.2043)
13228 AB621	5.20 (0.2047)
13228 AB631	5.21 (0.2051)
13228 AB641	5.22 (0.2055)
13228 AB651	5.23 (0.2059)
13228 AB661	5.24 (0.2063)
13228 AB671	5.25 (0.2067)
13228 AB681	5.26 (0.2071)
13228 AB691	5.27 (0.2075)
13228 AB701	4.38 (0.1724)
13228 AB711	4.40 (0.1732)
13228 AB721	4.42 (0.1740)
13228 AB731	4.44 (0.1748)
13228 AB741	4.46 (0.1756)
13228 AB751	4.48 (0.1764)
13228 AB761	4.50 (0.1771)
13228 AB771	4.52 (0.1780)
13228 AB781	4.54 (0.1787)
13228 AB791	4.56 (0.1795)
13228 AB801	4.58 (0.1803)
13228 AB811	4.60 (0.1811)
13228 AB821	4.62 (0.1819)
13228 AB831	4.64 (0.1827)
13228 AB841	4.66 (0.1835)
13228 AB851	5.29 (0.2083)
13228 AB861	5.31 (0.2091)
13228 AB871	5.33 (0.2098)
13228 AB881	5.35 (0.2106)
13228 AB891	5.37 (0.2114)
13228 AB901	5.39 (0.2122)
13228 AB911	5.41 (0.2123)
13228 AB921	5.43 (0.2138)
13228 AB931	5.45 (0.2146)
13228 AB941	5.47 (0.2154)
13228 AB951	5.49 (0.2161)
13228 AB961	5.51 (0.2169)
13228 AB971	5.53 (0.2177)
13228 AB981	5.55 (0.2185)
13228 AB991	5.57 (0.2193)
13228 AC001	5.59 (0.2201)
13228 AC011	5.61 (0.2209)
13228 AC021	5.63 (0.2217)
13228 AC031	5.65 (0.2224)

6) Inspect all valves for clearance again at this stage. If the valve clearance is not correct, repeat the procedure over again from the first step.
7) After inspection, install the related parts in the reverse order of removal.

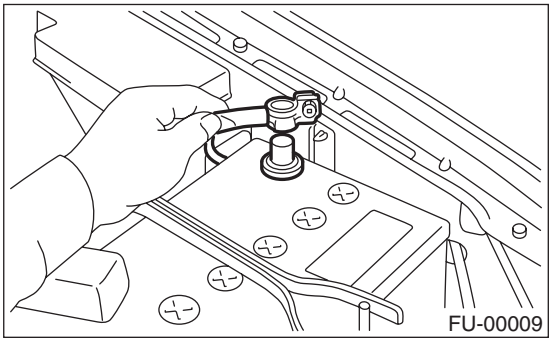
9. Engine Assembly

A: REMOVAL

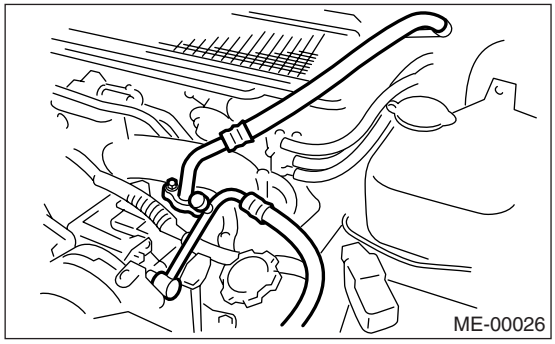
1) Set the vehicle on a lift.
2) Open the front hood fully, and then support with the hood stay.
3) Collect the refrigerant from A/C system.<Ref. to AC-17, Refrigerant Recovery Procedure.>
4) Release the fuel pressure.
   (1) Disconnect the fuel pump relay connector.


FU-02038

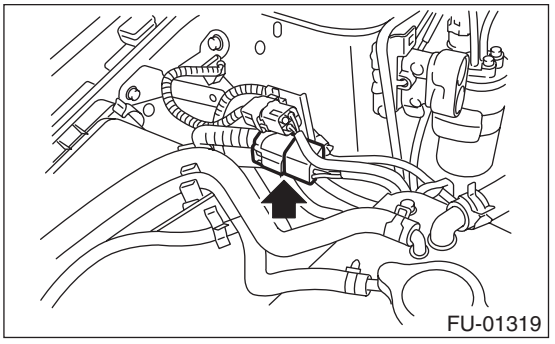
   (2) Start the engine, and run until stalls.
   (3) After the engine stalls, crank it for 5 seconds more.
   (4) Turn the ignition switch to OFF.
5) Remove the filler cap.
6) Disconnect the ground cable from battery.


FU-00009

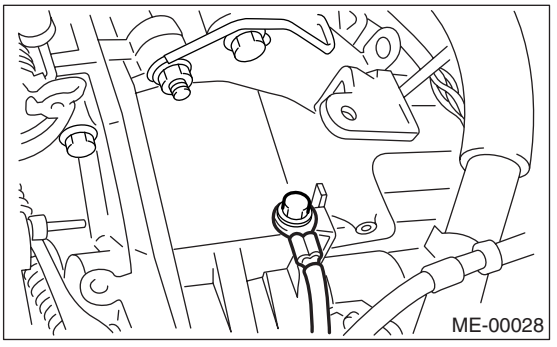
7) Remove the radiator from vehicle. <Ref. to CO(H4DOTC)-19, REMOVAL, Radiator.>
8) Remove the coolant filler tank. <Ref. to CO(H4DOTC)-29, REMOVAL, Coolant Filler Tank.>
9) Disconnect the A/C pressure hoses from A/C compressor.


ME-00026

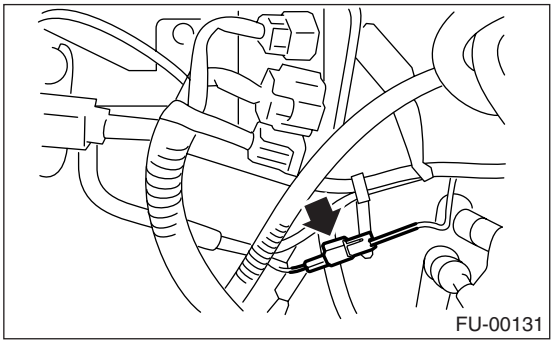
10) Remove the intercooler. <Ref. to IN(H4DOTC)-10, REMOVAL, Intercooler.>
11) Disconnect the following connectors and cable.
   (1) Engine harness connector

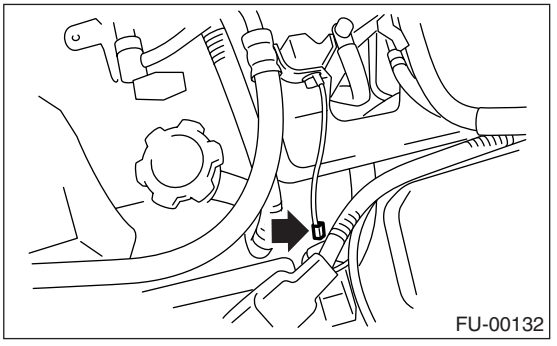

FU-01319

   (2) Engine ground terminal

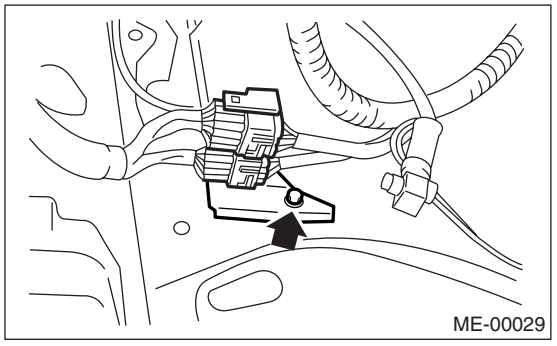

ME-00028

   (3) Disconnect engine ground cables on the left and right sides.

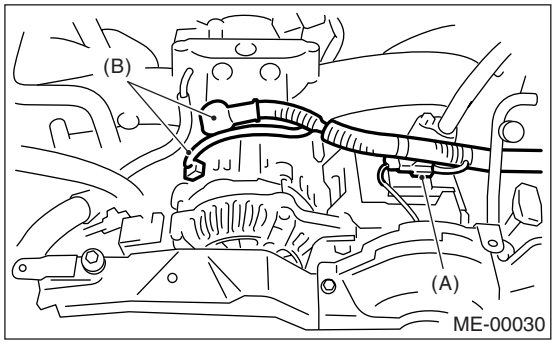

FU-00131


FU-00132

(4) Engine harness connector

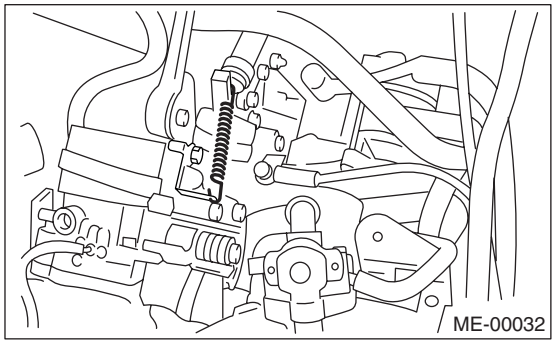


(5) Generator connector, terminal and A/C compressor connectors

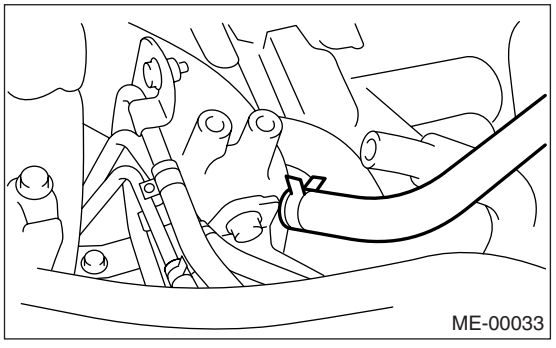


(A) A/C compressor connector
(B) Generator connector and terminal

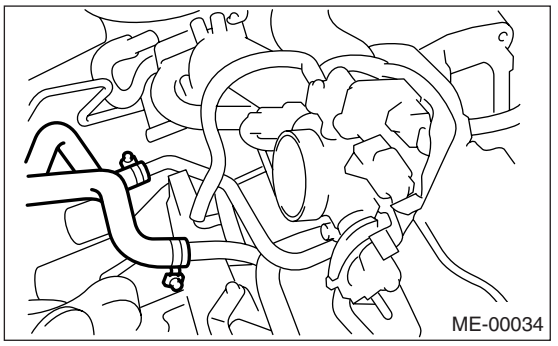
(6) Clutch release spring (MT model)



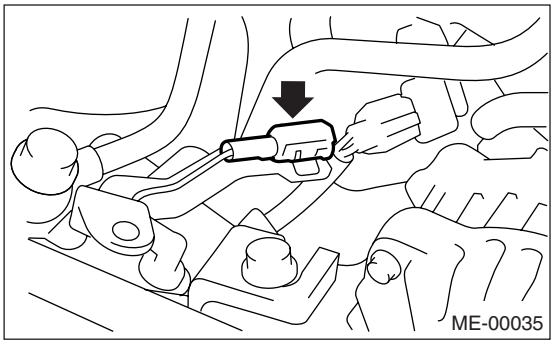
12) Disconnect the following hoses.
(1) Brake booster vacuum hose



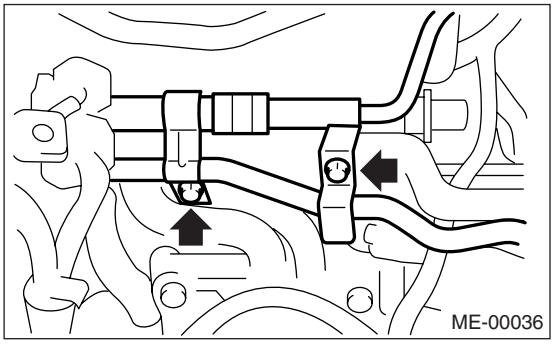
(2) Heater inlet outlet hose



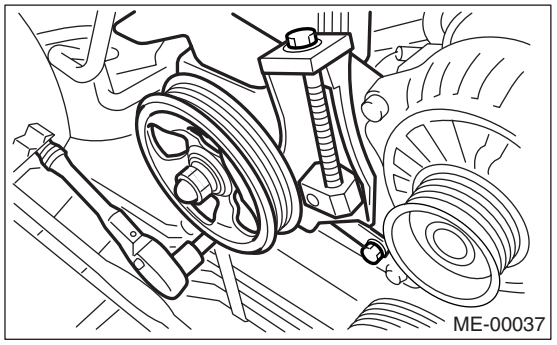
13) Remove the power steering pump from bracket.
(1) Loosen the lock bolt and slider bolt, and then remove the front side V-belt. <Ref. to ME(H4DOTC)-45, FRONT SIDE BELT, REMOVAL, V-belt.>
(2) Disconnect the power steering switch connector.



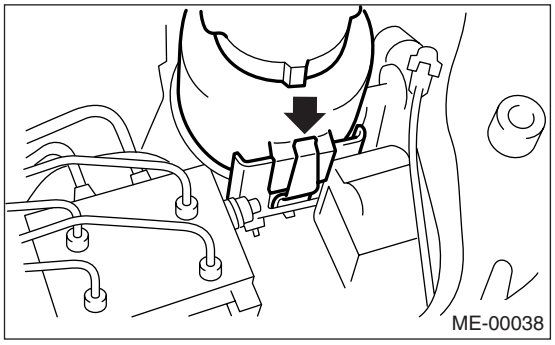
(3) Remove the pipe with bracket from intake manifold.



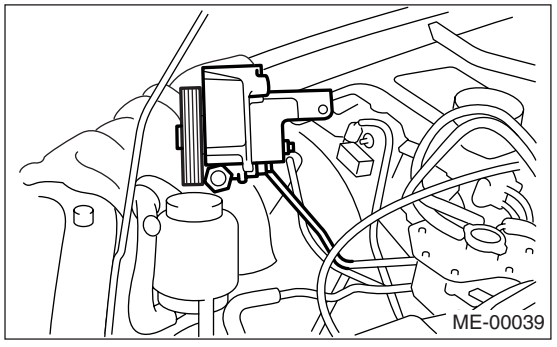
(4) Remove the power steering pump from engine.



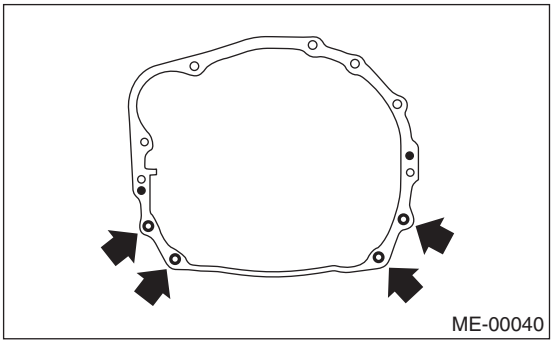
(5) Remove the power steering tank from bracket by pulling it upward.



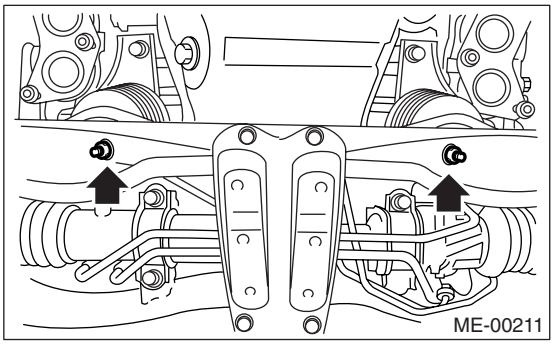
(6) Place the power steering pump on right side wheel apron.



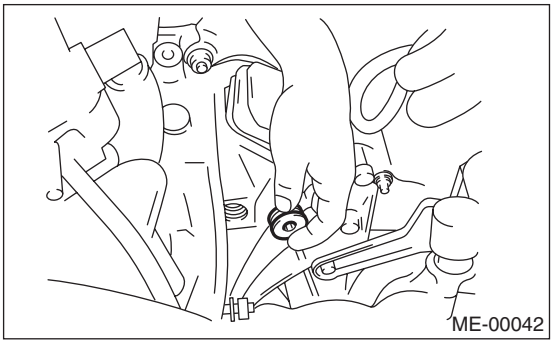
14) Lift-up the vehicle.
15) Remove ATF cooler pipe from frame. (AT model)
16) Remove the center exhaust pipe.<Ref. to EX(H4DOTC)-9, REMOVAL, Center Exhaust Pipe.>
17) Remove the nuts which hold the lower side of transmission to engine.



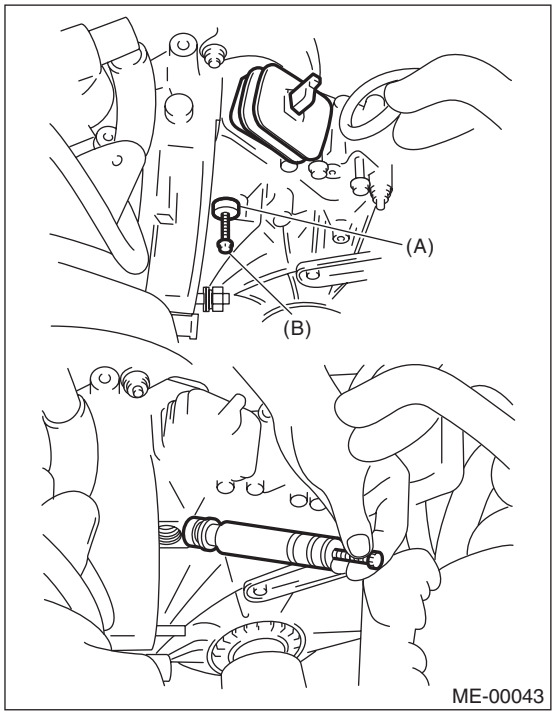
18) Remove the nuts which install the front cushion rubber onto front crossmember.



19) Lower the vehicle.
20) Separate the clutch release fork from release bearing. (MT model)
(1) Remove the clutch operating cylinder from transmission.
(2) Remove the plug using a 10 mm hexagon wrench.



(3) Screw the 6 mm dia. bolt into release fork shaft, and remove it.

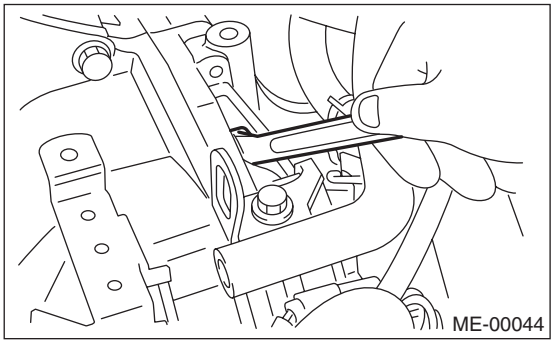


(A) Shaft
(B) Bolt

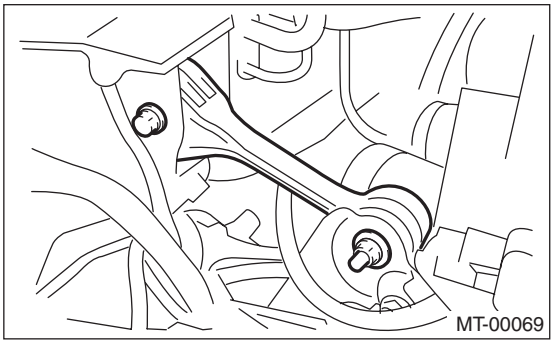
(4) Raise the release fork, and then unfasten the release bearing tabs to free release fork.

NOTE:
Step (4) is required to prevent interference with engine when removing the engine from transmission.

21) Separate torque converter clutch from drive plate. (AT model)
(1) Lower the vehicle.
(2) Remove service hole plug.
(3) Remove bolts which hold torque converter clutch to drive plate.
(4) Remove other bolts while rotating the engine using socket wrench.

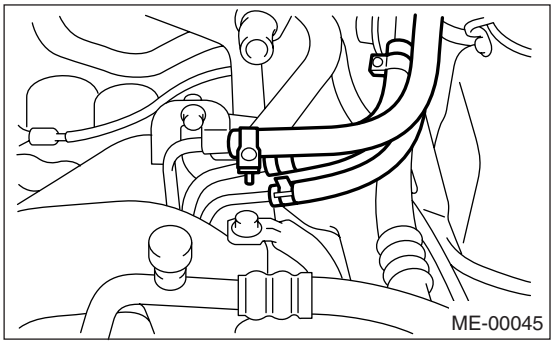


22) Remove the pitching stopper.

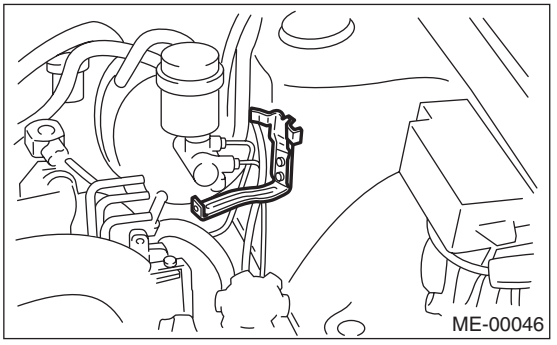


23) Disconnect the fuel delivery hose, return hose and evaporation hose.

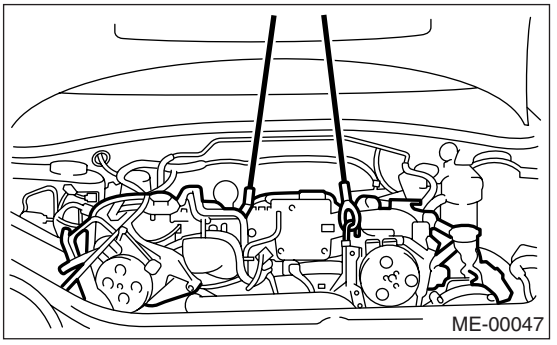
NOTE:
• Catch fuel from the hose into container.
• Disconnect the hose with its end wrapped with cloth to prevent fuel from splashing.



24) Remove fuel filter and bracket.

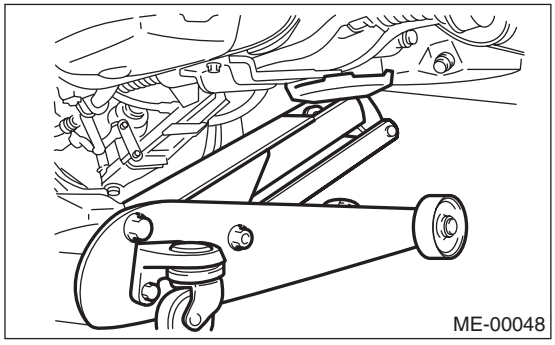


25) Support the engine with a lifting device and wire ropes.



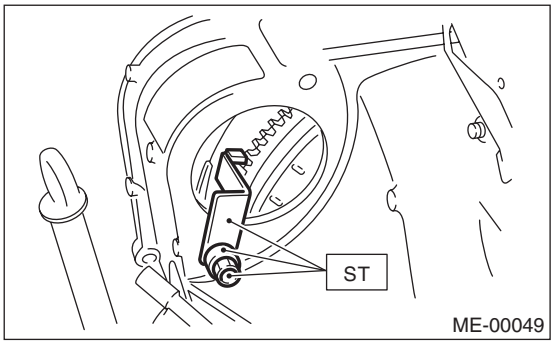
26) Support the transmission with a garage jack.

NOTE:
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 transmission lowers under its own weight.

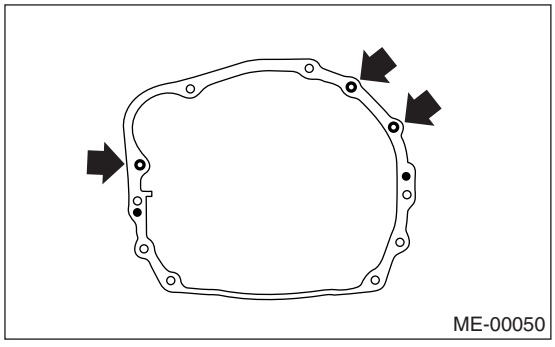


27) Separation of the engine and transmission.
(1) Remove the starter. <Ref. to SC(H4SO)-7, REMOVAL, Starter.>
(2) Install special tool to torque converter clutch case. (AT model)

ST 498277200 STOPPER SET



(3) Remove the bolts which hold the right upper side of transmission to engine.



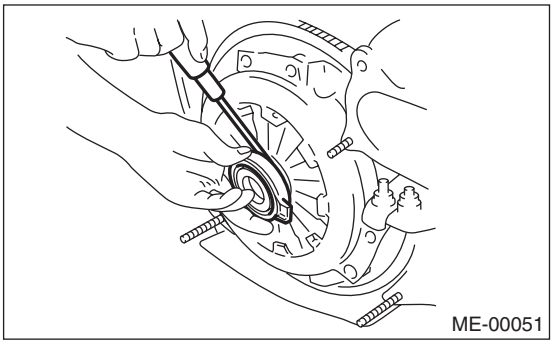
28) Remove the engine from vehicle.
(1) Slightly raise the engine.
(2) Raise the transmission with garage jack.
(3) Move the engine horizontally until the mainshaft is withdrawn from clutch cover.
(4) Slowly move the engine away from engine compartment.

NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil pressure gauge, etc.

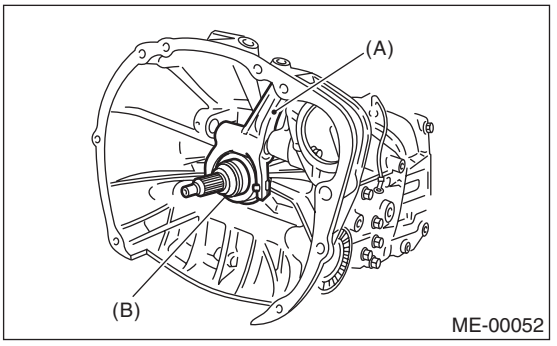
29) Remove the front cushion rubbers.

B: INSTALLATION

1) Install the clutch release fork and bearing onto transmission.
(1) Remove the release bearing from clutch cover with flat type screw driver.



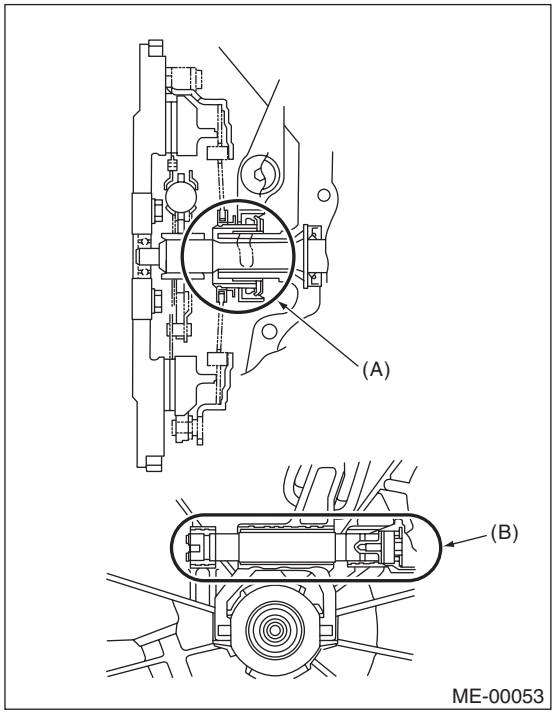
(2) Install the release bearing on transmission.
(3) Install the release fork into release bearing tab.



(A) Release fork
(B) Release bearing

(4) Apply grease to the specified points.
- Spline FX2200

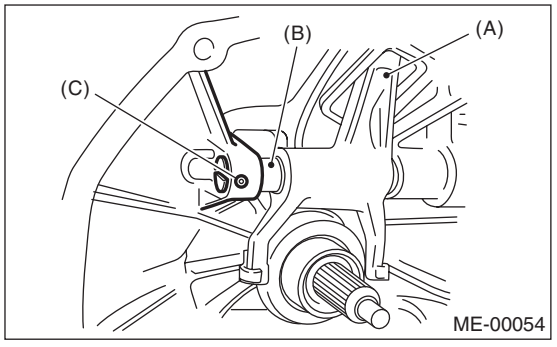
- Shaft SUNLIGHT 2



(A) Spline (FX2200)
(B) Shaft (SUNLIGHT 2)

(5) Insert the release fork shaft into release fork.

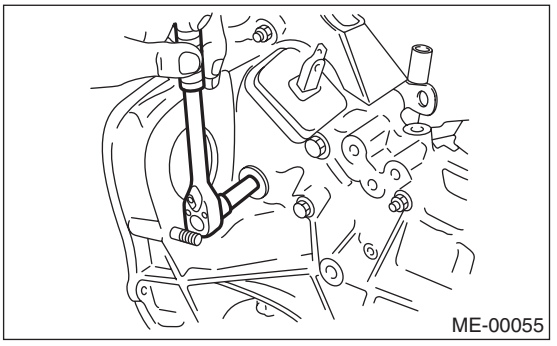
CAUTION:
Make sure the cutout portion of release fork shaft contacts spring pin.



(A) Release fork
(B) Release shaft
(C) Spring pin

(6) Tighten the plug.

Tightening torque:
44 N·m (4.5 kgf-m, 32.5 ft-lb)



2) Install the front cushion rubbers to engine.

Tightening torque:
35 N·m (3.6 kgf-m, 25.9 ft-lb)

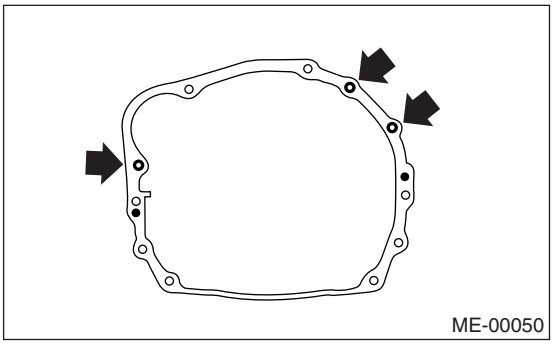
3) Install the engine onto transmission.
(1) Position the engine in engine compartment, and then align it with the transmission.

NOTE:
Be careful not to damage the adjacent parts or body panels with crank pulley, oil pressure gauge, etc.

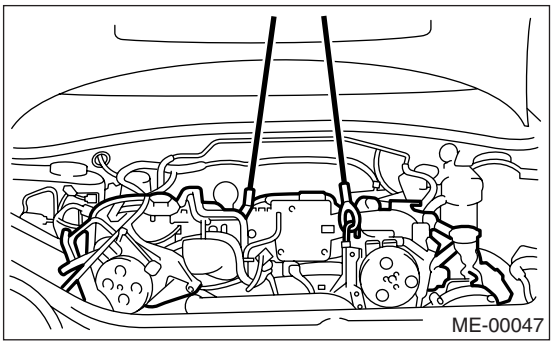
(2) Apply a small amount of grease to the splines of mainshaft. (MT model)

4) Tighten the bolts which hold the right upper side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)

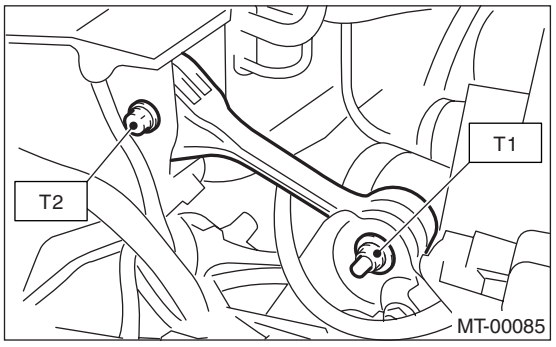


5) Remove the lifting device and wire ropes.
6) Remove the garage jack.



7) 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)



8) Remove special tool from torque converter clutch case. (AT model)

NOTE:
Be careful not to drop the special tool into the torque converter clutch case when installing it.

ST 498277200 STOPPER SET

9) Install starter. <Ref. to SC(H4SO)-7, Starter.>

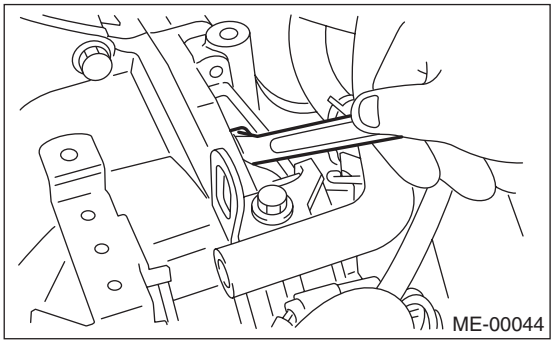
10) Install torque converter clutch to drive plate. (AT model)

(1) Tighten bolts which hold torque converter clutch to drive plate.

(2) Tighten other bolts while rotating the engine by using socket wrench.

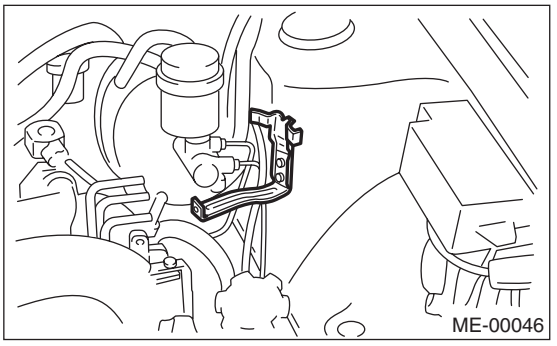
CAUTION:
Be careful not to drop bolts into torque converter clutch housing.

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)



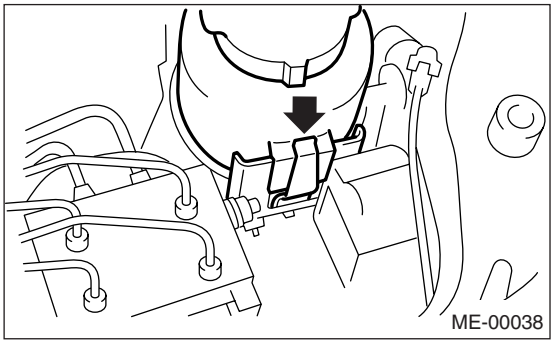
(3) Clog plug onto service hole.

11) Install fuel filter and bracket.



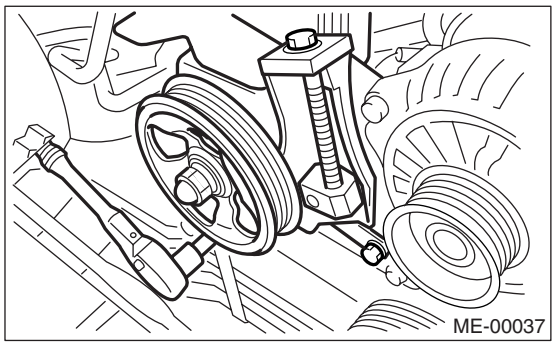
12) Install the power steering pump on bracket.

(1) Install the power steering tank on bracket.

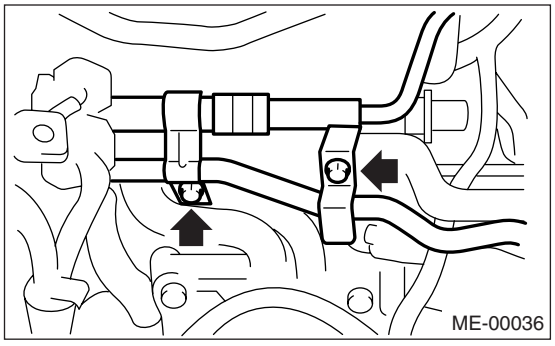


(2) Install the power steering pump.

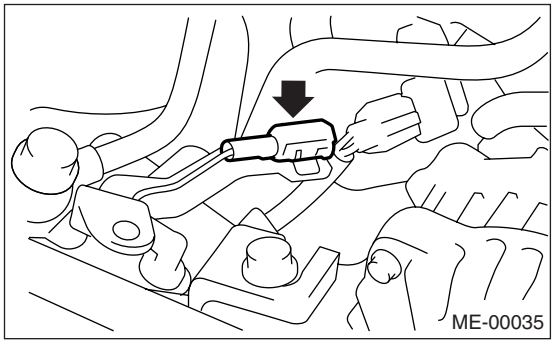
Tightening torque:
20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



(3) Install the power steering pipe bracket on intake manifold RH.



(4) Connect the power steering switch connector.

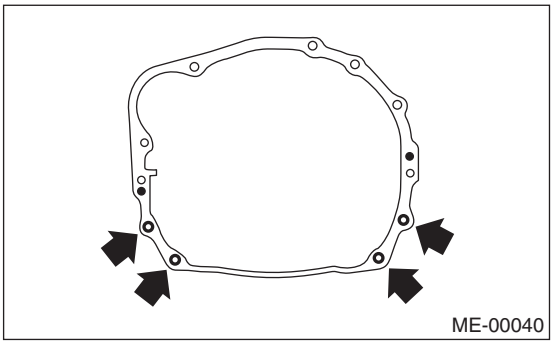


(5) Install the front side V-belt, and adjust it. <Ref. to ME(H4DOTC)-45, REAR SIDE BELT, INSTALLATION, V-belt.>

13) Lift-up the vehicle.

14) Tighten the nuts which hold the lower side of transmission to engine.

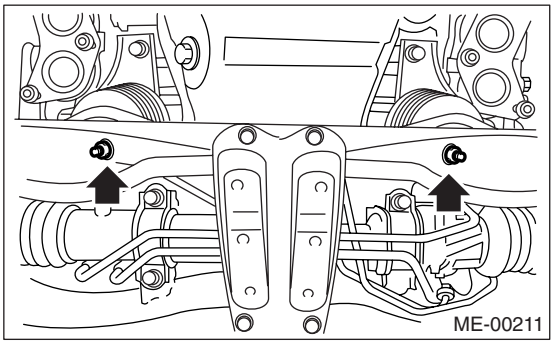
Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



15) Tighten the nuts which install the front cushion rubber onto crossmember.

Tightening torque:
75 N·m (7.7 kgf-m, 55.4 ft-lb)

NOTE:
Make sure the heat shield cover is securely installed.



16) Install ATF cooler pipe to frame. (AT model)

17) Install the center exhaust pipe. <Ref. to EX(H4DOTC)-10, INSTALLATION, Center Exhaust Pipe.>

18) Lower the vehicle.

19) Connect the following hoses:
(1) Fuel delivery hose, return hose and evaporation hose
(2) Heater inlet and outlet hoses
(3) Brake booster vacuum hose

20) Connect the following connectors and terminals:
(1) Engine ground terminal
(2) Engine harness connectors
(3) Generator connector and terminal
(4) A/C compressor connectors

21) Connect the following cables:
(1) Accelerator cable
(2) Clutch release spring

22) After connecting each cable, adjust them.

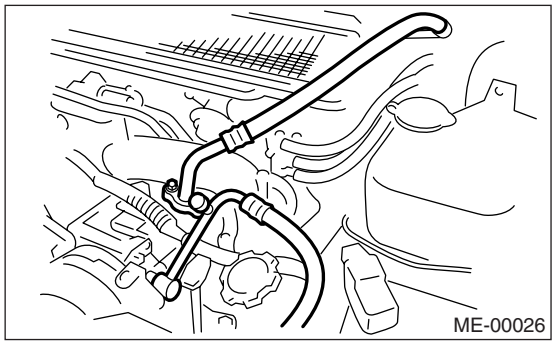
23) Install the air intake system.
(1) Install the intercooler. <Ref. to IN(H4DOTC)-11, INSTALLATION, Intercooler.>

(2) Install the air cleaner element and air cleaner upper cover.
(3) Install the engine harness connector bracket.
(4) Install the filler hose to air cleaner case.

24) Install the A/C pressure hoses.

NOTE:
Use new O-rings.

Tightening torque:
25 N·m (2.5 kgf-m, 18.1 ft-lb)



25) Install the radiator. <Ref. to CO(H4DOTC)-20, INSTALLATION, Radiator.>
26) Install the coolant filler tank. <Ref. to CO(H4DOTC)-29, INSTALLATION, Coolant Filler Tank.>
27) Install the window washer tank.
28) Install the battery in the vehicle, and then connect the cables.
29) Fill coolant.
<Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
30) Charge the A/C system with refrigerant.
<Ref. to AC-18, Refrigerant Charging Procedure.>
31) Remove the front hood stay, and close the front hood.
32) Take off the vehicle from lift arms.

10.Engine Mounting

A: REMOVAL

1) Remove the engine assembly. <Ref. to ME(H4DOTC)-34, 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

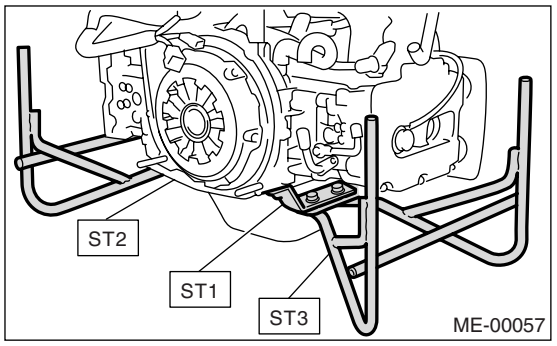
Make sure there are no cracks or other damage.

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	4998170 00	ENGINE STAND



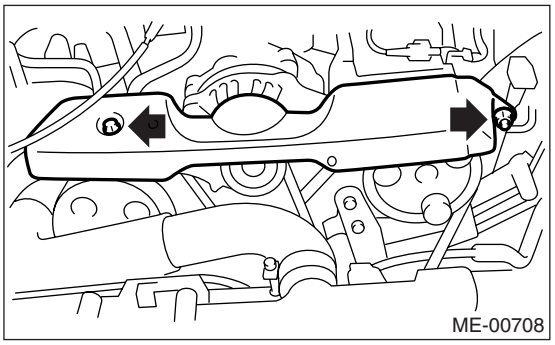
2) In this section the procedures described under each index are all connected and stated in order. It will be the complete procedure for overhauling of the engine itself when you go through all steps in the process.
Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

12.V-belt

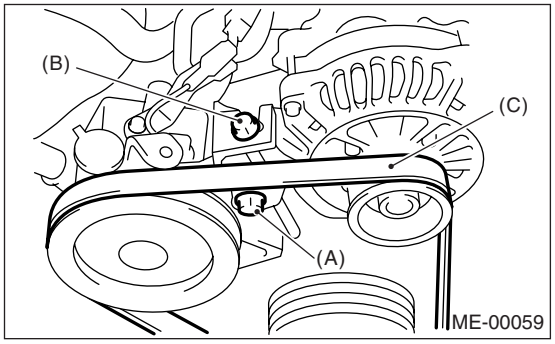
A: REMOVAL

1. FRONT SIDE BELT

1) Remove the V-belt cover.

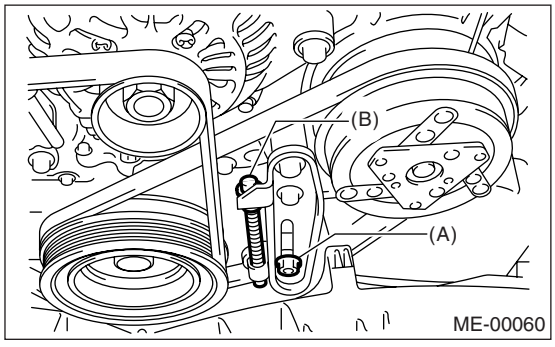


2) Loosen the lock bolt (A).
3) Loosen the slider bolt (B).
4) Remove the front side belt (C).

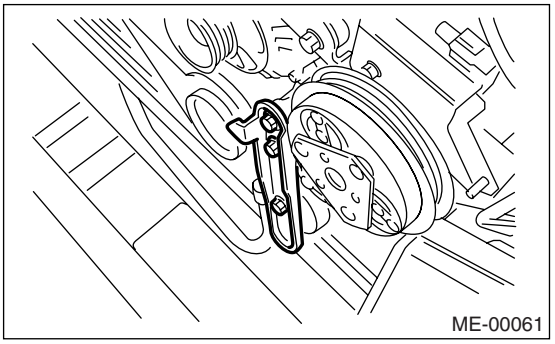


2. REAR SIDE BELT

1) Loosen the lock nut (A).
2) Loosen the slider bolt (B).



3) Remove the A/C belt.
4) Remove the A/C belt tensioner.



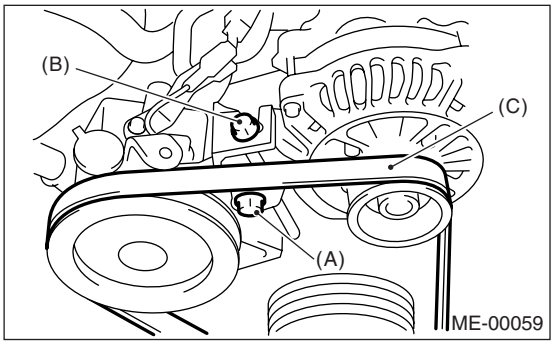
B: INSTALLATION

1. FRONT SIDE BELT

CAUTION:
Wipe off any oil or water on the belt and pulley.

1) Install the belt (C), and tighten the slider bolt so as to obtain the specified belt tension <Ref. to ME(H4DOTC)-46, INSPECTION.>
2) Tighten the lock bolt (A).
3) Tighten the slider bolt (B).

Tightening torque:
Lock bolt through bolt:
25 N·m (2.5 kgf-m, 18.1 ft-lb)
Slider bolt:
8 N·m (0.8 kgf-m, 5.5 ft-lb)

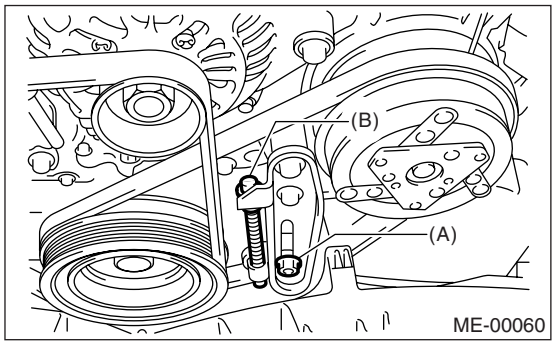


2. REAR SIDE BELT

1) Install the belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4DOTC)-46, INSPECTION.>

2) Tighten the lock nut (A).

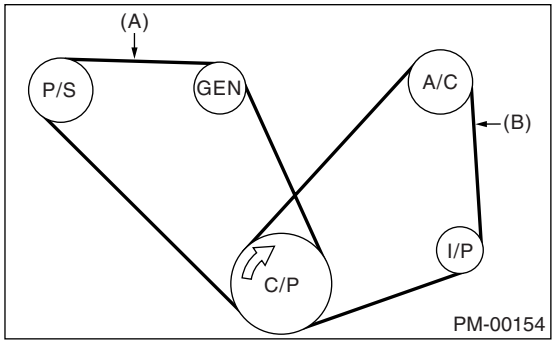
Tightening torque:
Lock nut (A);
22.6 N·m (2.3 kgf-m, 16.6 ft-lb)



C: INSPECTION

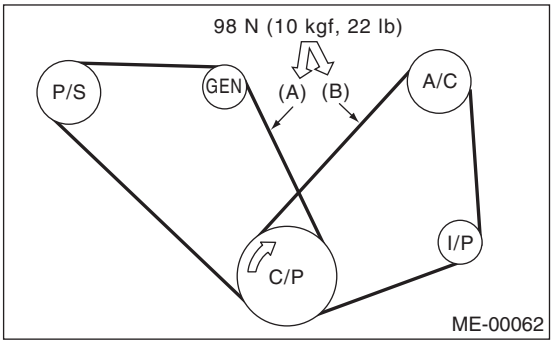
1) Replace the belts, if cracks, fraying or wear is found.
2) Check the drive belt tension and adjust it if necessary by changing generator installing position and/or idler pulley installing position.

Belt tension (With using belt tension gauge)
(A)
replaced: 618 — 755 N (63 — 77 kgf, 139 — 170 lb)
reused: 490 — 640 N (50 — 65 kgf, 110 — 144 lb)
(B)*
replaced: 740 — 880 N (75 — 90 kgf, 166 — 198 lb)
reused: 350 — 450 N (36 — 46 kgf, 78 — 101 lb)
****: with air conditioner***



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

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)
****: with air conditioner***



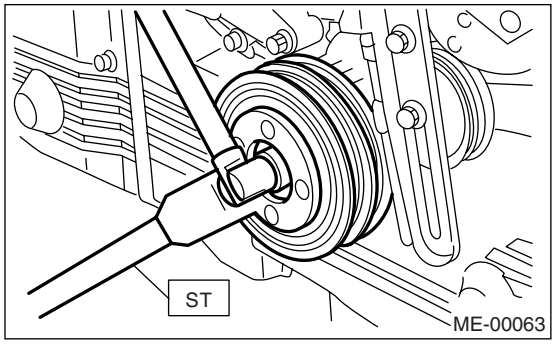
C/P Crankshaft pulley
GEN Generator
P/S Power steering oil pump pulley
A/C Air conditioning compressor pulley
I/P Idler pulley

13.Crankshaft Pulley

A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4DOTC)-45, 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

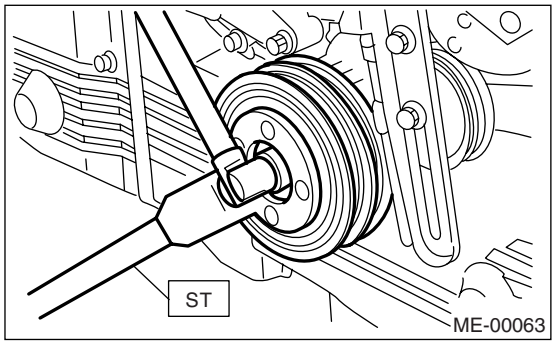
1) Install the crankshaft pulley.
2) Install the pulley bolt.

To lock the crankshaft, use ST.

ST 499977100 CRANKSHAFT PULLEY WRENCH

(1) Clean the crankshaft pulley thread using compressed air.
(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:
180 N·m (18.3 kgf-m, 132.7 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.

CAUTION:
If the tightening angle of crankshaft pulley bolt is less than 65 degrees, the bolt should be damaged. In this case, the bolt must be replaced.

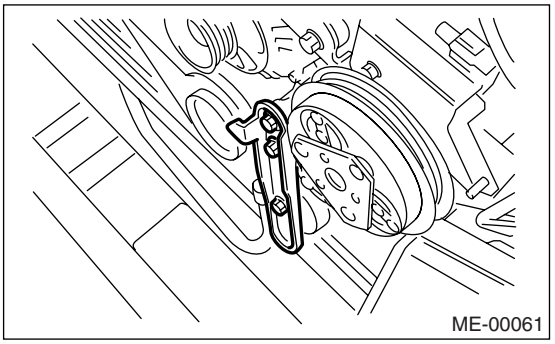
(1) Replace the crankshaft pulley bolts and clean them.

Crankshaft pulley bolt:
12369AA011

(2) Clean the crankshaft thread using compressed air.
(3) Apply engine oil to the crankshaft pulley bolt seat 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(H4DOTC)-45, INSTALLATION, V-belt.>

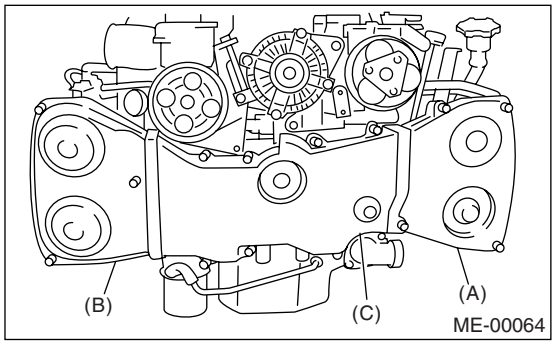
C: INSPECTION

1) Make sure the V-belt is not worn or otherwise damaged.
2) Check the tension of the belt. <Ref. to ME(H4DOTC)-46, INSPECTION, V-belt.>

14.Timing Belt Cover

A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4DOTC)-47, REMOVAL, Crankshaft Pulley.>
3) Remove the timing belt cover (LH) (A).
4) Remove the timing belt cover (RH) (B).
5) Remove the front timing belt cover (C).



B: INSTALLATION

1) Install the front timing belt cover (C).

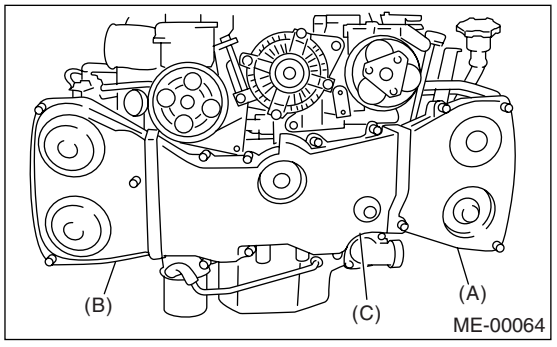
Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)

2) Install the timing belt cover (RH) (B).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)

3) Install the timing belt cover (LH) (A).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



4) Install the crankshaft pulley. <Ref. to ME(H4DOTC)-47, INSTALLATION, Crankshaft Pulley.>
5) Install the V-belt. <Ref. to ME(H4DOTC)-45, INSTALLATION, V-belt.>

C: INSPECTION

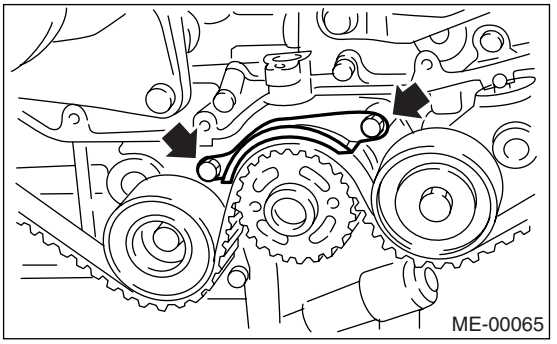
Make sure the cover is not damaged.

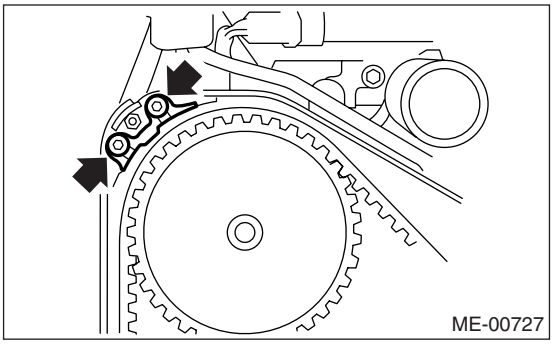
15.Timing Belt Assembly

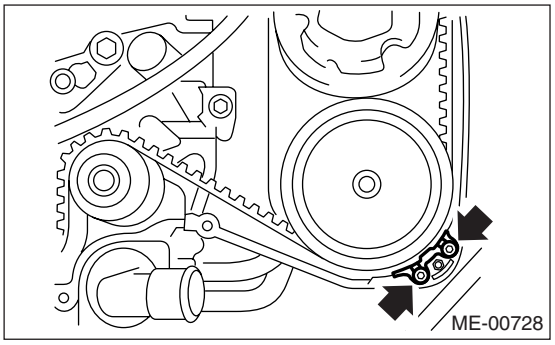
A: REMOVAL

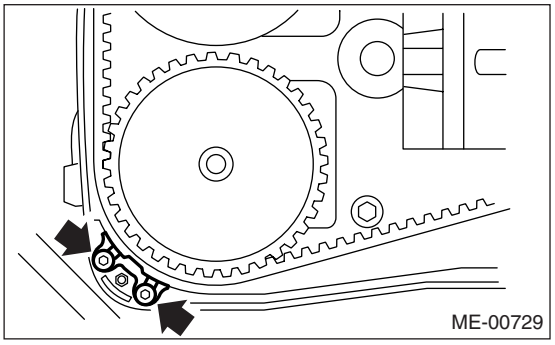
1. TIMING BELT

1) Remove the V-belt. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4DOTC)-47, REMOVAL, Crankshaft Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt guides. (MT model)



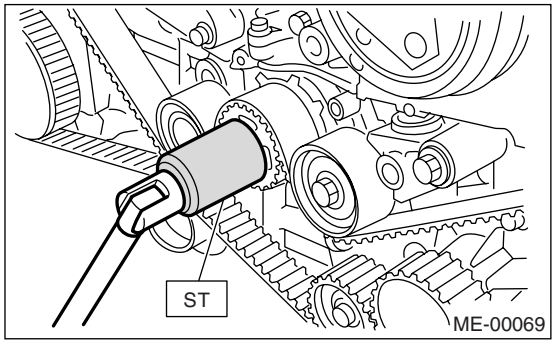




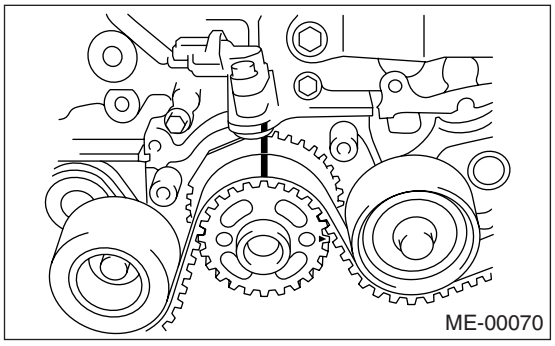


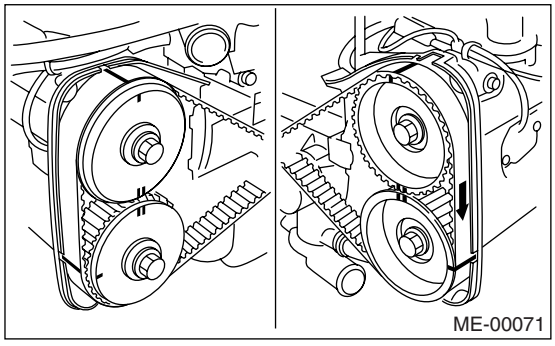
5) If the alignment mark and/or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing the timing belt as follows:
   (1) Turn the crankshaft using ST, and align the alignment marks on crankshaft sprocket, intake camshaft sprocket (LH), exhaust camshaft sprocket (LH), intake camshaft sprocket (RH) and exhaust camshaft sprocket (RH) with notches of timing belt cover and cylinder block.

ST 499987500 CRANKSHAFT SOCKET

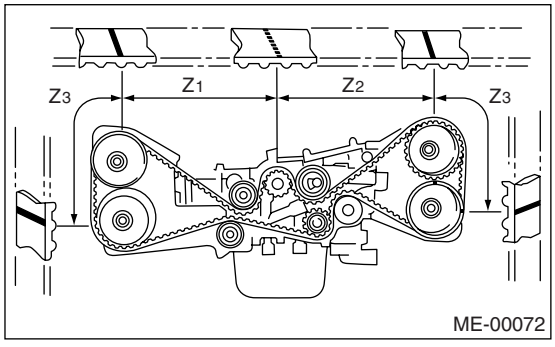


(2) Using white paint, put alignment and/or arrow marks on the timing belts in relation to the sprockets.

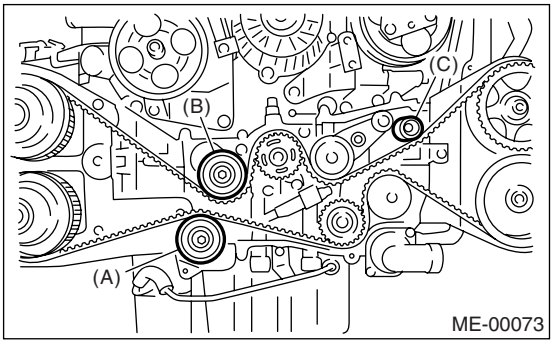




Z_1: 54.5 tooth length
Z_2: 51 tooth length
Z_3: 28 tooth length



6) Remove the belt idler (A).

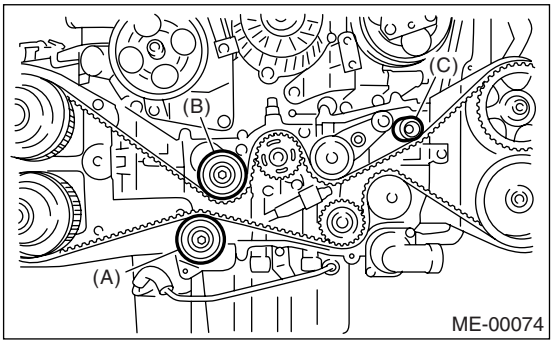


7) Remove the timing belt.

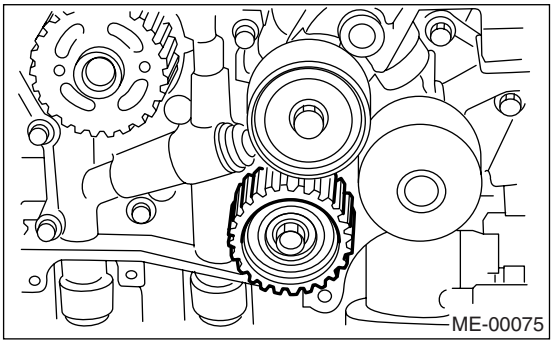
CAUTION:
After the timing belt has been removed, never rotate the intake and exhaust, camshaft sprocket. If the camshaft sprocket is rotated, the intake and exhaust valve heads strike together and valve stems are bent.

2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

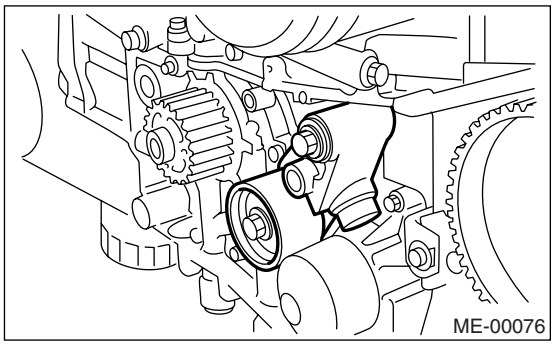
1) Remove the belt idler (B) and (C).



2) Remove the belt idler No. 2.



3) Remove the automatic belt tension adjuster assembly.



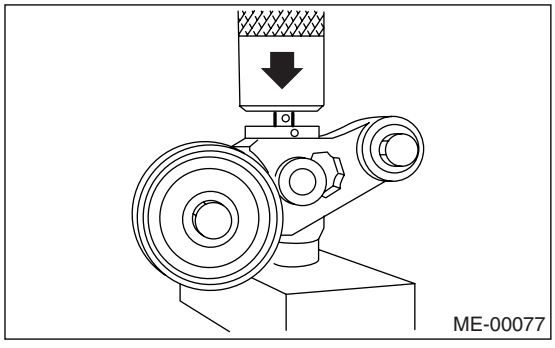
B: INSTALLATION

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

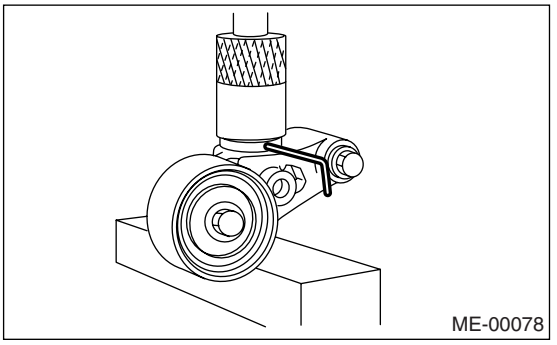
1) Preparation for installation of automatic belt tension adjuster assembly:

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) or more until the adjuster rod is aligned with the stopper pin hole in the cylinder.

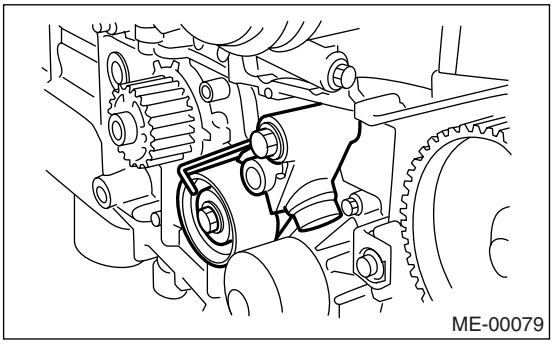


(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex bar wrench inserted into the stopper pin hole in the cylinder, secure the adjuster rod.



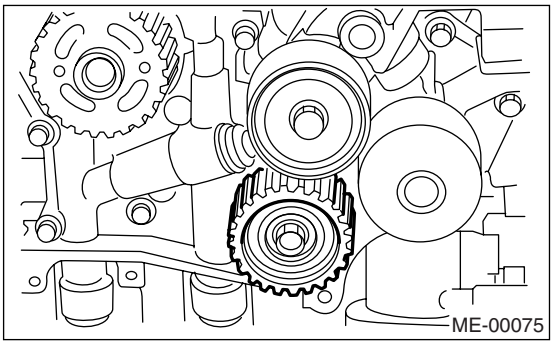
2) Install the automatic belt tension adjuster assembly.

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



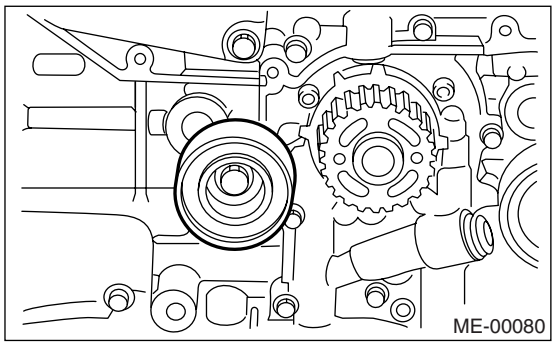
3) Install the belt idler No. 2.

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



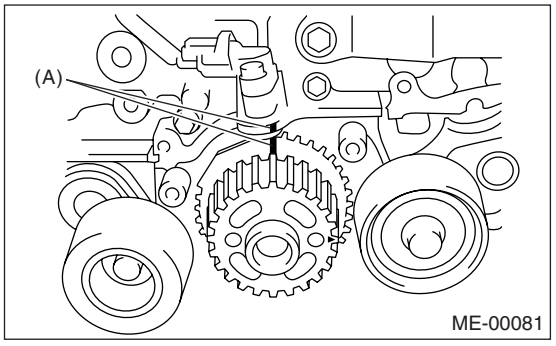
4) Install the belt idler.

Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)

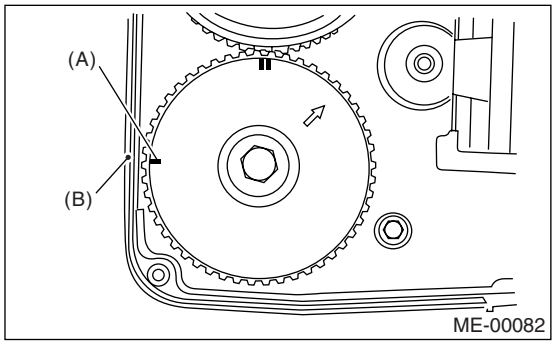


2. TIMING BELT

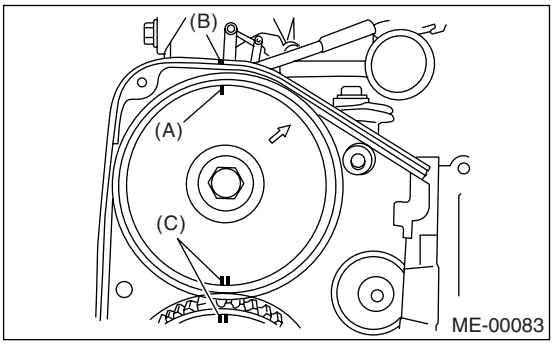
1) Preparation for installation of automatic belt tension adjuster assembly. <Ref. to ME(H4DOTC)-56, AUTOMATIC BELT TENSION ADJUSTER, INSPECTION, Timing Belt Assembly.>
2) Crankshaft and camshaft sprocket alignment.
(1) Align mark (A) on the crankshaft sprocket with mark on the oil pump cover at cylinder block.



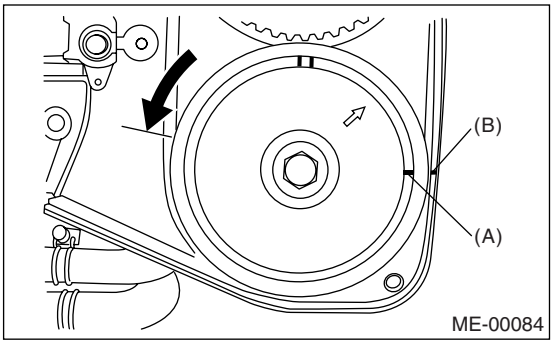
(2) Align single line mark (A) on the exhaust camshaft sprocket (RH) with notch (B) on timing belt cover.



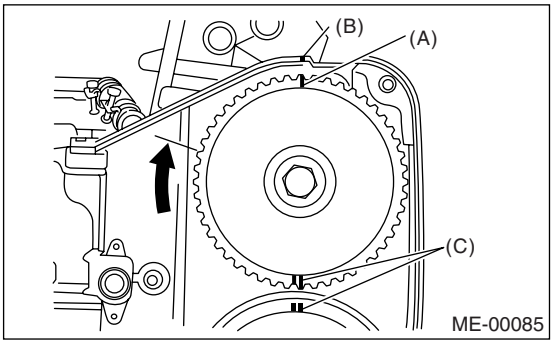
(3) Align single line mark (A) on the intake camshaft sprocket (RH) with notch (B) on timing belt cover.
(Make sure double lines (C) on intake camshaft and exhaust camshaft sprockets are aligned.)



(4) Align single line mark (A) on exhaust camshaft sprocket (LH) with notch (B) on timing belt cover by turning the sprocket counterclockwise (as viewed from front of engine).

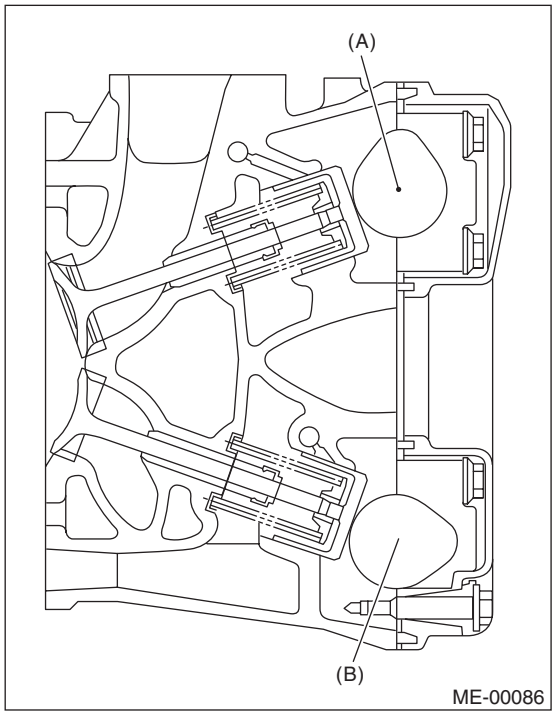


(5) Align the single line mark (A) on intake camshaft sprocket (LH) with notch (B) on timing belt cover by turning the sprocket clockwise (as viewed from front of engine).
Ensure the double lines (C) on intake and exhaust camshaft sprockets are aligned.



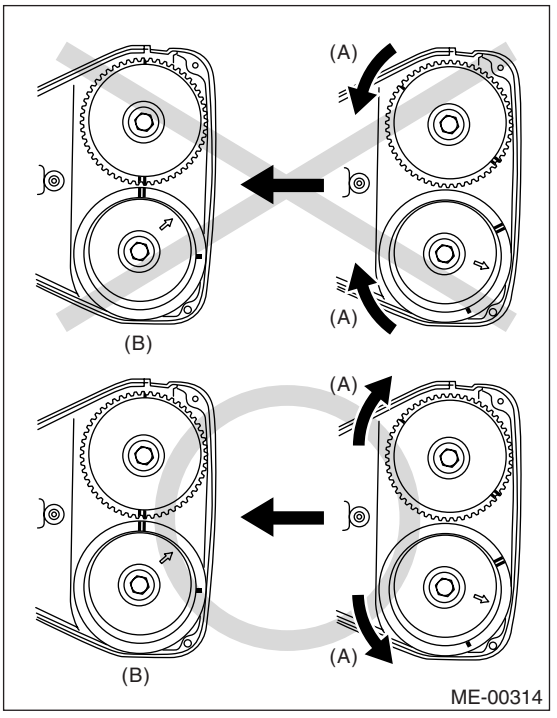
(6) Ensure the camshaft and crankshaft sprockets are positioned properly.

CAUTION:
• Intake and exhaust camshafts for this DOHC engine can be independently rotated with the timing belts removed. As can be seen from the figure, if the intake and exhaust valves are lifted simultaneously, their heads will interfere with each other, resulting in bent valves.



(A) Intake camshaft
(B) Exhaust camshaft

• When the timing belts are not installed, four camshafts are held at the "zero-lift" position, where all cams on camshafts do not push the intake and exhaust valves down. (Under this condition, all valves remain unlifted.)
• When the camshafts are rotated to install the timing belts, #2 intake and #4 exhaust cam of camshafts (LH) are held to push their corresponding valves down. (Under this condition, these valves are held lifted.) Camshafts (RH) are held so that their cams do not push valves down.
• Camshafts (LH) must be rotated from the "zero-lift" position to the position where the timing belt is to be installed at as small an angle as possible, in order to prevent mutual interference of intake and exhaust valve heads.
• Do not allow the camshafts to rotate in the direction shown on the upper half of the figure as this causes both intake and exhaust valves to lift simultaneously, resulting in interference with their heads.

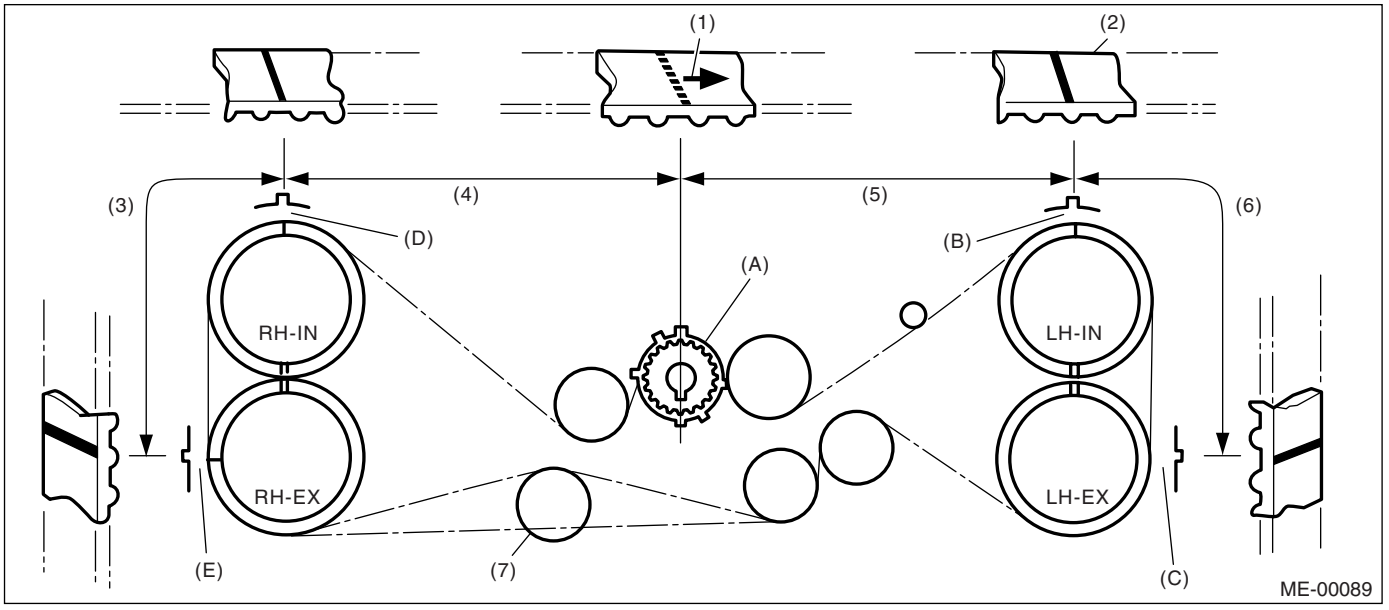


(A) Rotating direction
(B) Timing belt installation position

3) Installation of timing belt:
Align the alignment mark on timing belt with marks on sprockets in alphabetical order shown in the figure. While aligning marks, position the timing belt properly.

CAUTION:
• Disengagement of more than three timing belt teeth may result in interference between the valve and piston.

- **Ensure the belt's rotating direction is correct.**

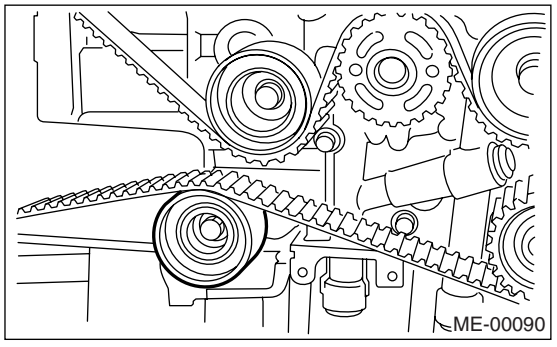


(1) Arrow mark
(2) Timing belt
(3) 28 tooth length
(4) 54.5 tooth length
(5) 51 tooth length
(6) 28 tooth length
(7) Install it in the end

4) Install the belt idlers.

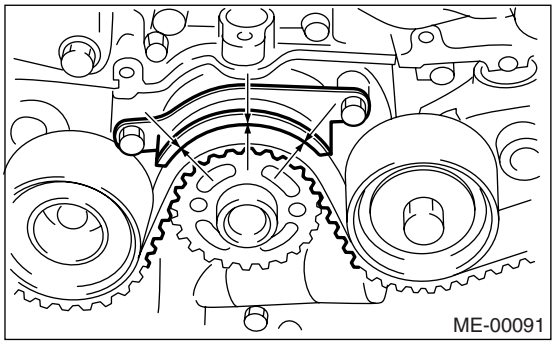
Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)

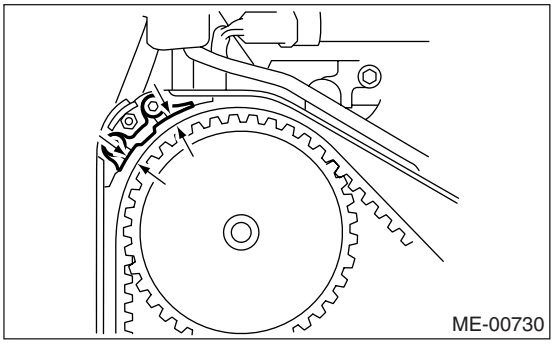
NOTE:
Make sure that the marks on the timing belt and sprockets are aligned.

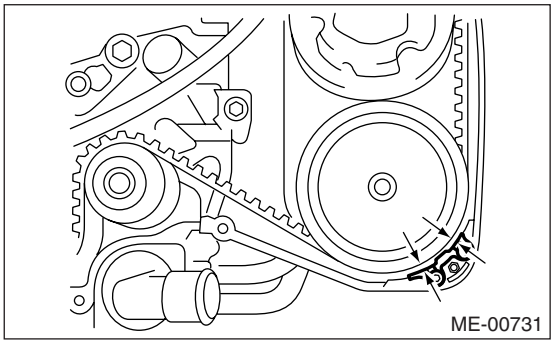


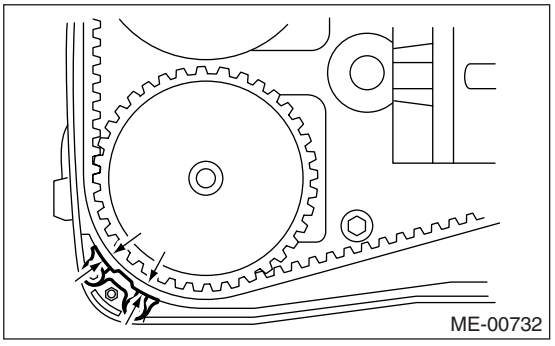
5) After ensuring that the marks on the timing belt and sprockets are aligned, remove the stopper pin from tensioner adjuster.
6) Install the timing belt guide. (MT model)
(1) Temporarily tighten the bolts.
(2) Check and adjust the clearance between timing belt and timing belt guide.

Clearance:
1.0±0.5 mm (0.039±0.020 in)



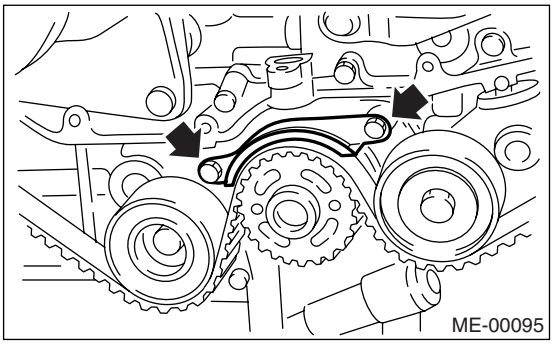




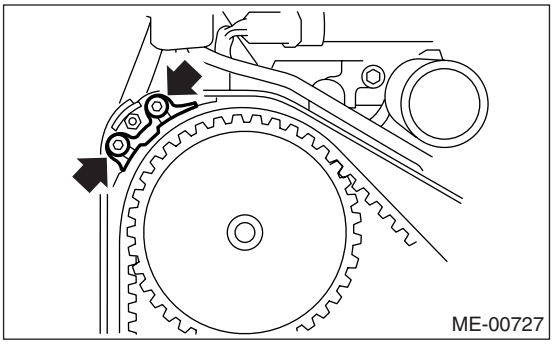


(3) Tighten the bolts.

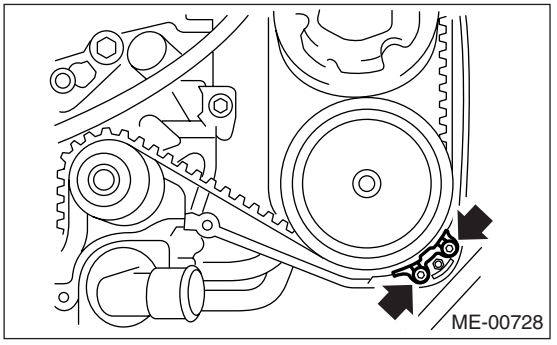
Tightening torque:
9.75 N·m (0.99 kgf-m, 7.2 ft-lb)



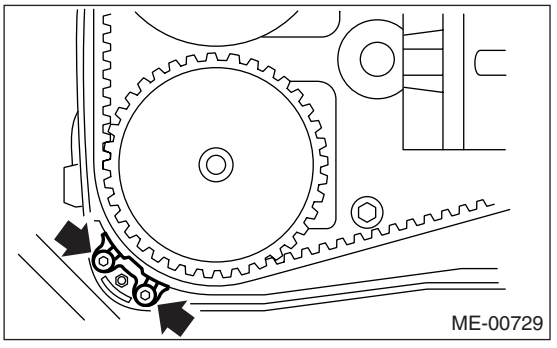
Tightening torque:
6.4 N·m (0.7 kgf-m, 5.1 ft-lb)



Tightening torque:
6.4 N·m (0.7 kgf-m, 5.1 ft-lb)



Tightening torque:
6.4 N·m (0.7 kgf-m, 5.1 ft-lb)



7) Install the timing belt cover. <Ref. to ME(H4DOTC)-48, INSTALLATION, Timing Belt Cover.>
8) Install the crankshaft pulley. <Ref. to ME(H4DOTC)-47, INSTALLATION, Crankshaft Pulley.>
9) Install the V-belt. <Ref. to ME(H4DOTC)-45, INSTALLATION, V-belt.>

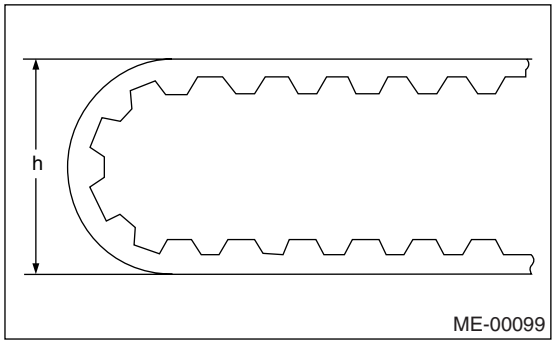
C: INSPECTION

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.

NOTE:
• 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 ADJUSTER

1) Visually check the oil seals for leaks, and rod ends for abnormal wear or scratches. If necessary, replace the automatic belt tension adjuster assembly.

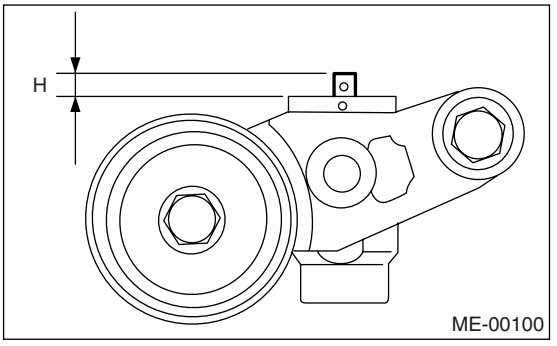
NOTE:
Slight traces of oil at rod's oil seal does not indicate a problem.

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 the 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 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 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±0.5 mm (0.224±0.020 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 belt tension pulley if faulty.
2) Check the belt tension pulley for smooth rotation. Replace if noise or excessive play is noted.
3) Check the belt tension pulley for grease leakage.

4. BELT IDLER

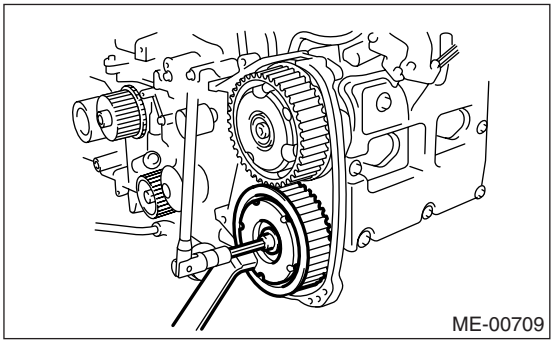
1) Check the belt idler for smooth rotation. Replace if noise or excessive play is noted.
2) Check the outer contacting surfaces of idler pulley for abnormal wear and scratches.
3) Check the belt idler for grease leakage.

16.Camshaft Sprocket

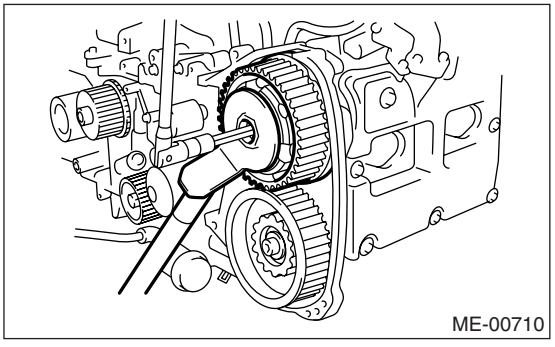
A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4DOTC)-47, REMOVAL, Crankshaft Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt assembly. <Ref. to ME(H4DOTC)-49, REMOVAL, Timing Belt Assembly.>
5) Remove the camshaft sprockets. To lock the camshaft, use ST.

ST 499207400 CAMSHAFT SPROCKET WRENCH



ST 499977500 CAMSHAFT SPROCKET WRENCH



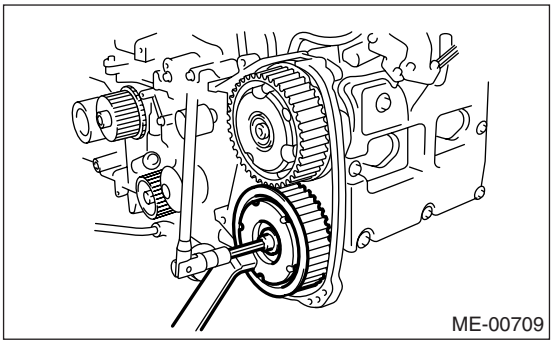
B: INSTALLATION

1) Install the camshaft sprocket. To lock the camshaft, use ST.

NOTE:
Do not confuse camshaft sprockets (RH) and (LH) during installation.

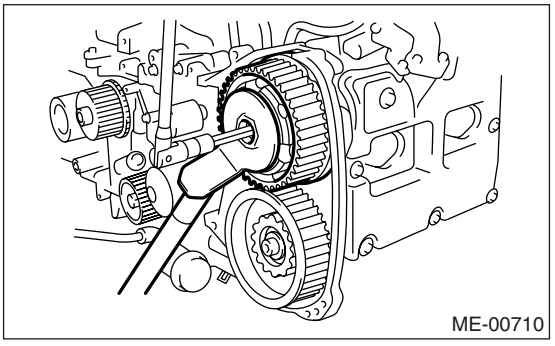
ST 499207400 CAMSHAFT SPROCKET WRENCH

Tightening torque:
30 N·m (3.1 kgf-m, 22.2 ft-lb)



ST 499977500 CAMSHAFT SPROCKET WRENCH

Tightening torque:
30 N·m (3.1 kgf-m, 22.2 ft-lb), and then tighten 45° furthermore



2) Install the timing belt assembly. <Ref. to ME(H4DOTC)-51, INSTALLATION, Timing Belt Assembly.>
3) Install the timing belt cover. <Ref. to ME(H4DOTC)-48, INSTALLATION, Timing Belt Cover.>
4) Install the crankshaft pulley. <Ref. to ME(H4DOTC)-47, INSTALLATION, Crankshaft Pulley.>
5) Install the V-belt. <Ref. to ME(H4DOTC)-45, INSTALLATION, V-belt.>

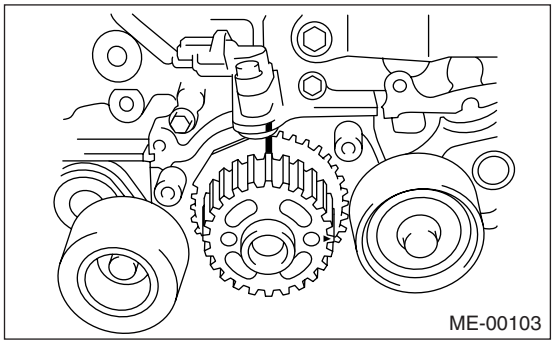
C: INSPECTION

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 used for sensor for damage and contamination of foreign matter.

17.Crankshaft Sprocket

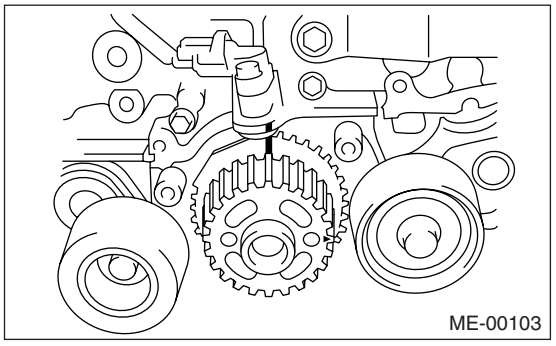
A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4DOTC)-47, REMOVAL, Crankshaft Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt assembly. <Ref. to ME(H4DOTC)-58, REMOVAL, Crankshaft Sprocket.>
5) Remove the camshaft sprocket. <Ref. to ME(H4DOTC)-57, REMOVAL, Camshaft Sprocket.>
6) Remove the crankshaft sprocket.



B: INSTALLATION

1) Install the crankshaft sprocket.



2) Install the camshaft sprocket. <Ref. to ME(H4DOTC)-57, INSTALLATION, Camshaft Sprocket.>
3) Install the timing belt assembly. <Ref. to ME(H4DOTC)-51, INSTALLATION, Timing Belt Assembly.>
4) Install the timing belt cover. <Ref. to ME(H4DOTC)-48, INSTALLATION, Timing Belt Cover.>
5) Install the crankshaft pulley. <Ref. to ME(H4DOTC)-47, INSTALLATION, Crankshaft Pulley.>
6) Install the V-belt. <Ref. to ME(H4DOTC)-45, INSTALLATION, V-belt.>

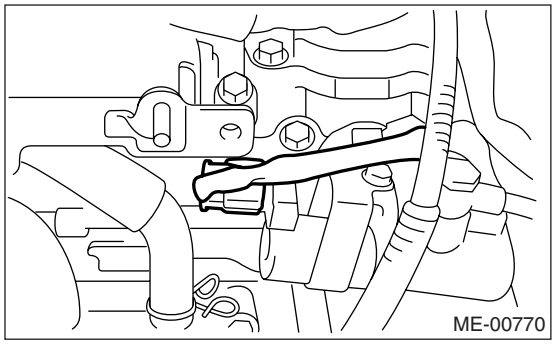
C: INSPECTION

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 used for sensor for damage and contamination of foreign matter.

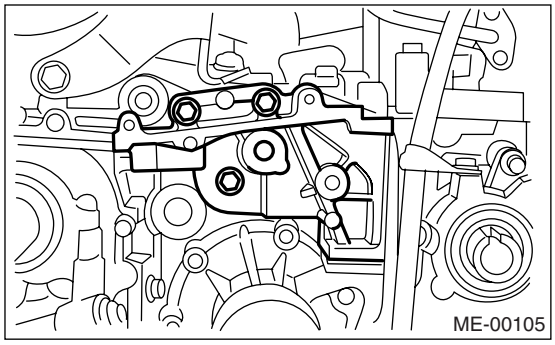
18.Camshaft

A: REMOVAL

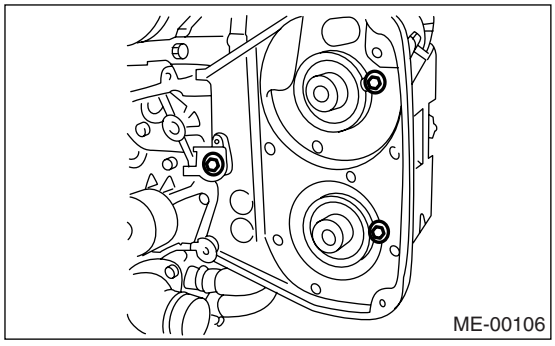
1) Remove the V-belt. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4DOTC)-47, REMOVAL, Crankshaft Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt assembly. <Ref. to ME(H4DOTC)-49, REMOVAL, Timing Belt Assembly.>
5) Remove the camshaft sprocket. <Ref. to ME(H4DOTC)-47, REMOVAL, Crankshaft Pulley.>
6) Remove the crankshaft sprocket. <Ref. to ME(H4DOTC)-58, REMOVAL, Crankshaft Sprocket.>
7) Disconnect the variable valve timing solenoid valve assembly connector.


ME-00770

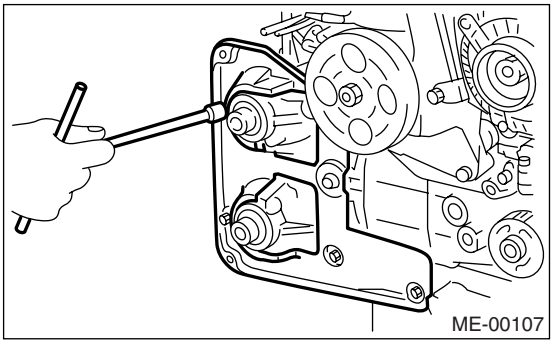
8) Remove the tensioner bracket.


ME-00105

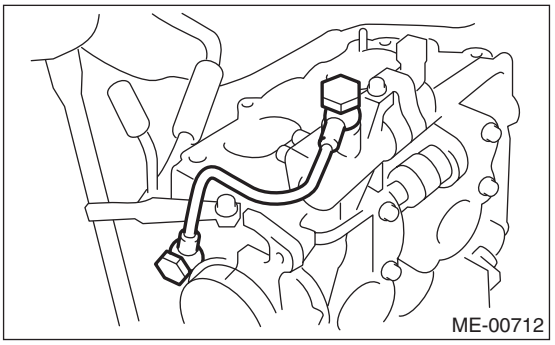
9) Remove the timing belt cover No. 2 (LH).


ME-00106

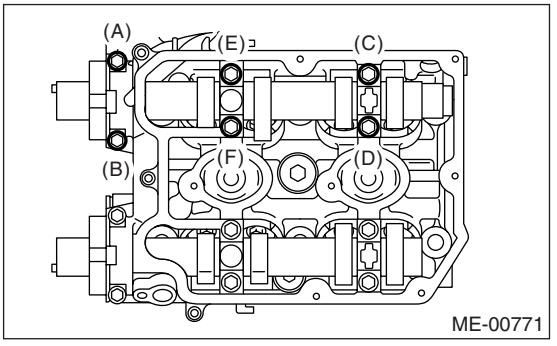
10) Remove the timing belt cover No.2 (RH).


ME-00107

11) Remove the spark plug cord.
12) Remove the oil level gauge guide. (LH side)
13) Remove the rocker cover and gasket.
14) Remove the oil pipe.

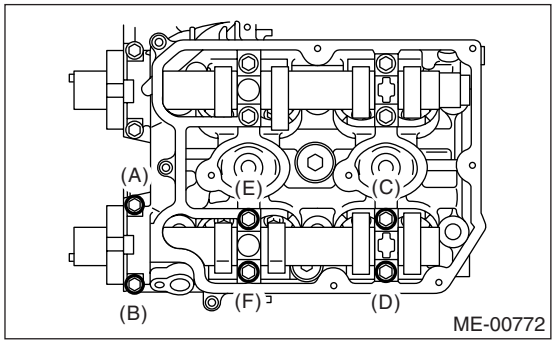

ME-00712

15) Loosen the variable valve timing solenoid valve assembly and intake camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



ME-00771

16) Loosen the exhaust camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



17) Remove the variable valve timing solenoid valve assembly, intake camshaft cap, and camshaft.
18) Remove the exhaust camshaft cap and camshaft.

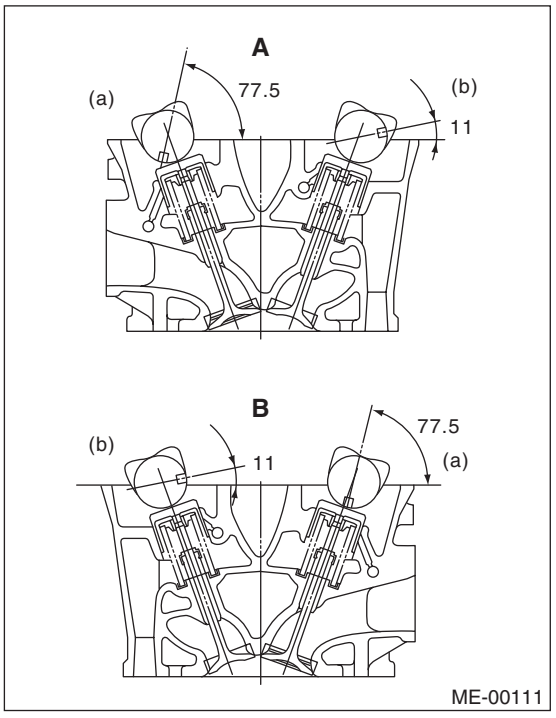
NOTE:
Arrange the camshaft caps in order so that they can be installed in their original positions.

19) Similarly, remove the camshafts (RH) and related parts.

B: INSTALLATION

1) Camshaft installation: Apply engine oil to cylinder head at camshaft bearing location before installing the camshaft. Install the camshaft so that each valve is close to or in contact with “base circle” of cam lobe.

NOTE:
• When the camshafts are positioned as shown in the figure, camshafts need to be rotated at a minimum to align with the timing belt during installation.
• Camshaft (RH) need not be rotated when set at position shown in the figure. Intake camshaft (LH): Rotate 80° clockwise. Exhaust camshaft (LH): Rotate 45° counterclockwise.

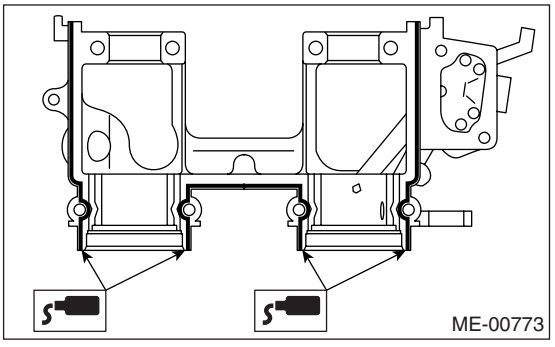


A Cylinder head (LH)
B Cylinder head (RH)
(a) Intake camshaft
(b) Exhaust camshaft

2) Camshaft cap and variable valve timing solenoid valve assembly installation:
(1) Apply fluid packing sparingly to cap mating surface.

NOTE:
Do not apply fluid packing excessively. Failure to do so may cause excess packing to come out and flow toward the oil seal, resulting in oil leaks.

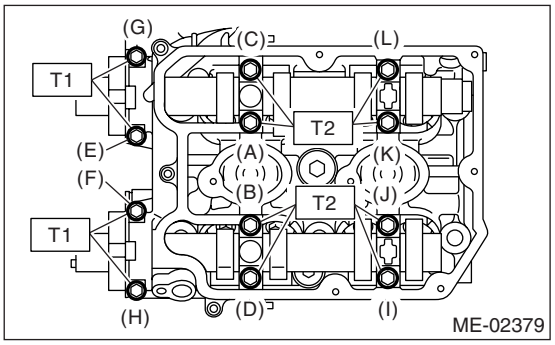
Fluid packing:
Part No. 004403007
THREE BOND 1215 or equivalent



(2) Apply engine oil to cap bearing surface and install the cap on camshaft.

(3) Gradually tighten the camshaft cap and oil control valve assembly in at least two stages in alphabetical sequence shown in the figure, and then tighten to specified torque.

Tightening torque:
T1: 10 N·m (1.0 kgf-m, 7 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.5 ft-lb)

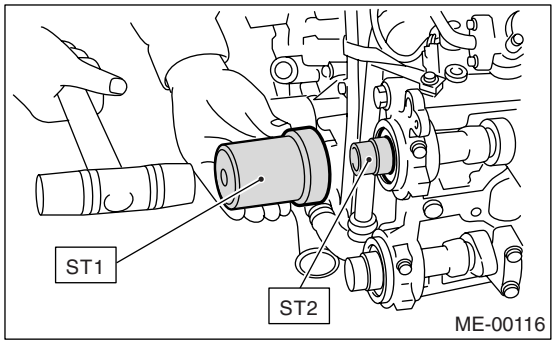


(4) After tightening cap, ensure the camshaft rotates only slightly while holding it at “base” circle.

3) Camshaft oil seal installation: Apply grease to new oil seal lips and press onto front end of camshaft by using ST1 and ST2.

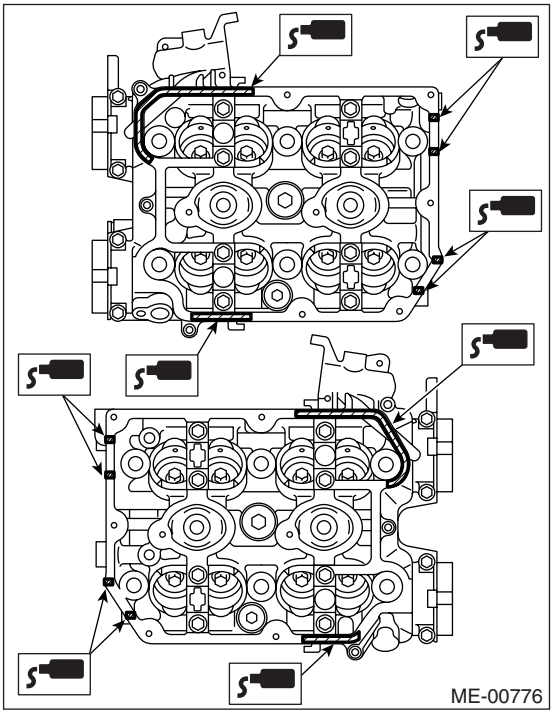
NOTE:
Use a new oil seal.

ST1 499587600 OIL SEAL GUIDE
ST2 499597200 OIL SEAL GUIDE



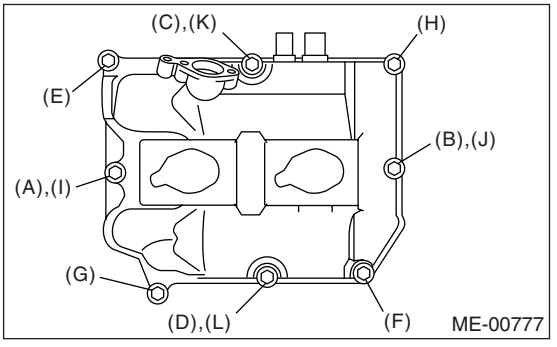
4) Rocker cover installation:
(1) Install the gasket on rocker cover. Install the peripheral gasket and ignition coil gasket.
(2) Apply fluid packing to the specified point of cylinder head.

Fluid packing:
Part No. 004403007
THREE BOND 1215 or equivalent



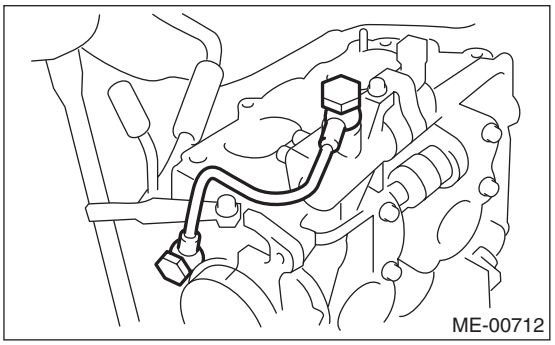
(3) Install the rocker cover on cylinder head. Ensure the gasket is properly positioned during installation.
(4) Tighten the rocker cover tightening bolt in alphabetical sequence shown in the figure, and then tighten to specified torque.

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

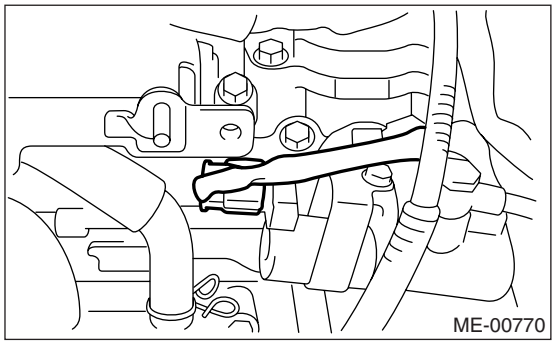


5) Install the oil pipe.

Tightening torque:
29 N·m (3.0 kgf-m, 21.4 ft-lb)

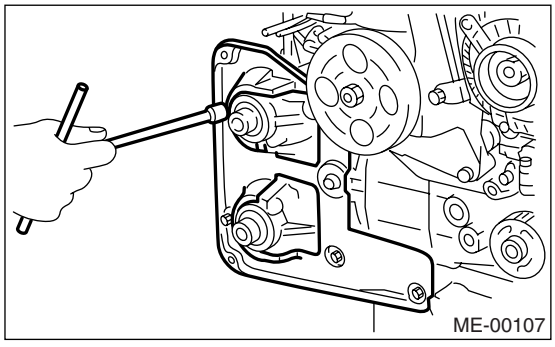


6) Connect the variable valve timing solenoid valve connector.



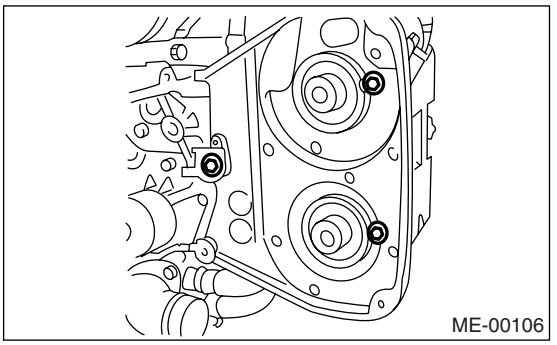
7) Install the spark plug cord.
8) Similarly, install the parts on right-hand side.
9) Install the timing belt cover No. 2 (RH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



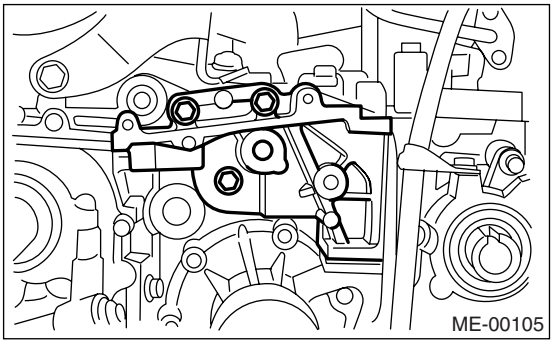
10) Install the timing belt cover No. 2 (LH).

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



11) Install the tensioner bracket.

Tightening torque:
24.5 N·m (2.5 kgf-m, 18.1 ft-lb)

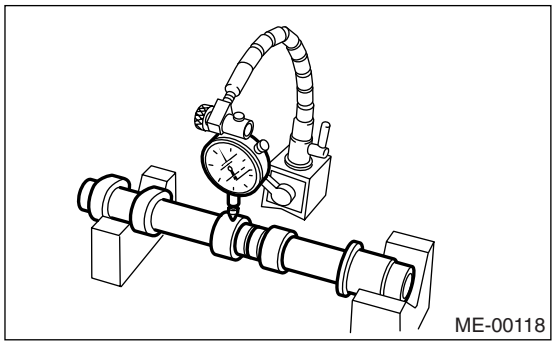


12) Install the crankshaft sprocket. <Ref. to ME(H4DOTC)-58, INSTALLATION, Crankshaft Sprocket.>
13) Install the camshaft sprockets. <Ref. to ME(H4DOTC)-57, INSTALLATION, Camshaft Sprocket.>
14) Install the timing belt assembly. <Ref. to ME(H4DOTC)-51, INSTALLATION, Timing Belt Assembly.>
15) Install the timing belt cover. <Ref. to ME(H4DOTC)-48, INSTALLATION, Timing Belt Cover.>
16) Install the crankshaft pulley. <Ref. to ME(H4DOTC)-47, INSTALLATION, Crankshaft Pulley.>
17) Install the V-belt. <Ref. to ME(H4DOTC)-45, INSTALLATION, V-belt.>

C: INSPECTION

1) Measure the bend, and repair or replace if necessary.

Limit:
0.020 mm (0.0008 in)

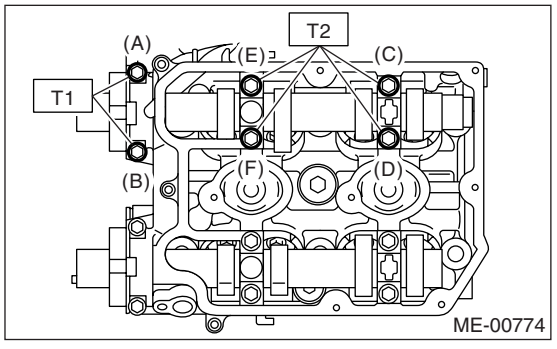


2) Check the journal for damage and wear. Replace if faulty.
3) Measure the outside diameter of camshaft journal. If the journal diameter is not as specified, check the oil clearance.

	Camshaft journal	
	Front	Center, rear
Standard	37.946 — 37.963 mm (1.4939 — 1.4946 in)	29.946 — 29.963 mm (1.1790 — 1.1796 in)

4) Measurement of the camshaft journal oil clearance:
(1) Clean the bearing caps and camshaft journals.
(2) Place the camshafts on cylinder head. (Without installing the valve rocker.)
(3) Place a plastigauge across each of the camshaft journals.
(4) Gradually tighten the cap in at least two stages in alphabetical sequence shown in the figure, and then tighten to specified torque.
Do not turn the camshaft.

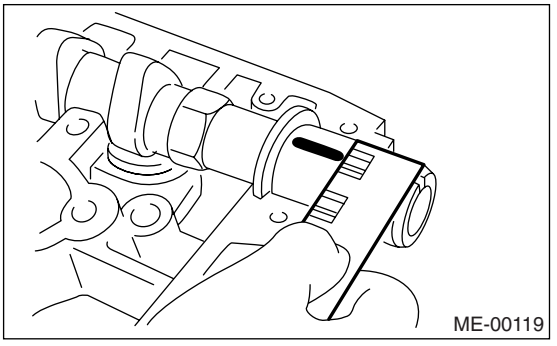
Tightening torque:
T1: 10 N·m (1.0 kgf-m, 7.2 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.5 ft-lb)



(5) Remove the bearing caps.
(6) Measure the widest point of plastigauge on each journal. If the oil clearance exceeds the limit, replace the camshaft. If necessary, replace the camshaft caps and cylinder head as a set.

Standard:
0.037 — 0.072 mm (0.0015 — 0.0028 in)

Limit:
0.10 mm (0.0039 in)



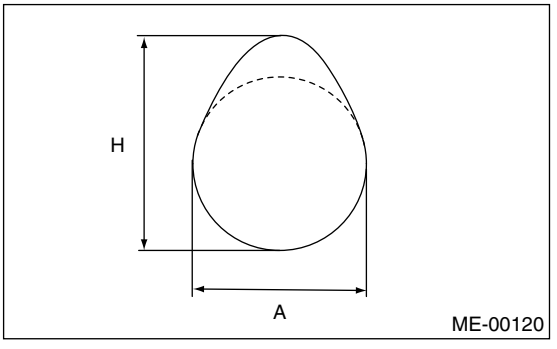
(7) Completely remove the plastigauge.
5) Check the cam face condition; remove the minor faults by grinding with oil stone. Measure the cam height H, replace if the limit has been exceeded.

Cam height: H

Standard:
Intake:
46.55 — 46.65 mm (1.833 — 1.837 in)
Exhaust:
46.75 — 46.85 mm (1.841 — 1.844 in)

Limit:
Intake:
46.45 mm (1.829 in)
Exhaust:
46.65 mm (1.837 in)

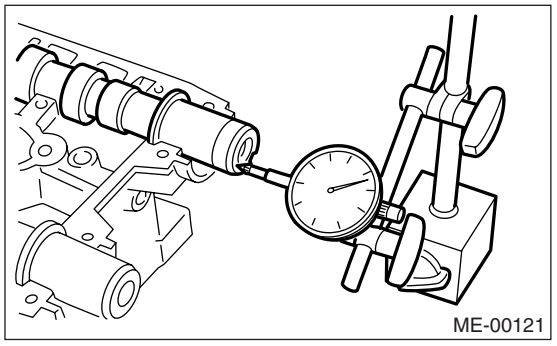
Cam base circle diameter A:
37.0 mm (1.457 in)



6) Measure the thrust clearance of camshaft with dial gauge. If the clearance exceeds the limit, replace the caps and cylinder head as a set. If necessary, replace the camshaft.

Standard:
0.068 — 0.116 mm (0.0027 — 0.0046 in)

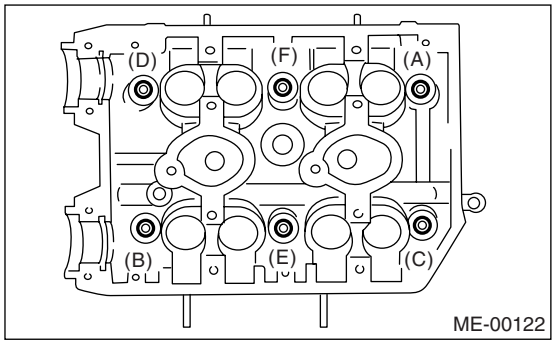
Limit:
0.14 mm (0.0055 in)


ME-00121

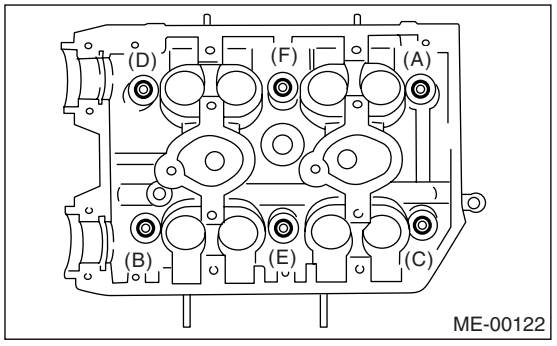
19.Cylinder Head Assembly

A: REMOVAL

1) Remove the V-belt. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
2) Remove the crankshaft pulley. <Ref. to ME(H4DOTC)-47, REMOVAL, Crankshaft Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt assembly. <Ref. to ME(H4DOTC)-49, REMOVAL, Timing Belt Assembly.>
5) Remove the camshaft sprocket. <Ref. to ME(H4DOTC)-57, REMOVAL, Camshaft Sprocket.>
6) Remove the intake manifold.<Ref. to FU(H4DOTC)-15, REMOVAL, Intake Manifold.>
7) Remove the bolt which installs the A/C compressor bracket on cylinder head.
8) Remove the camshaft. <Ref. to ME(H4DOTC)-59, REMOVAL, Camshaft.>
9) Remove the cylinder head bolts in alphabetical sequence shown in the figure.
Leave bolts (A) and (D) engaged by three or four threads to prevent the cylinder head from falling.



10) While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (A) and (D) to remove cylinder head.



11) Remove the cylinder head gasket.

CAUTION:
Do not scratch the mating surface of cylinder head and cylinder block.

12) Similarly, remove the cylinder head (RH).

B: INSTALLATION

1) Install the cylinder head and gaskets on cylinder block.

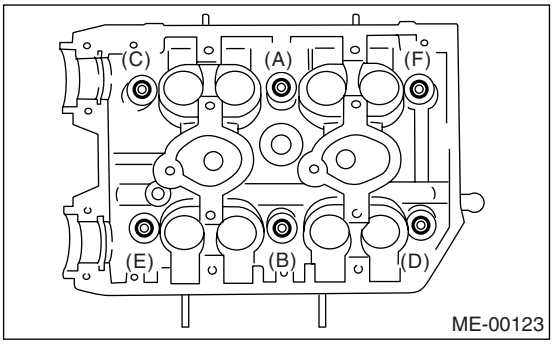
CAUTION:
- **Use new cylinder head gaskets.**
- **Be careful not to scratch the mating surface of cylinder head and cylinder block.**

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.
(3) Tighten all bolts to 69 N·m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence again.
(4) Back off all bolts by 180° first; back them off by 180° again in reverse order of installation.
(5) Tighten all bolts to 49 N·m (5.0 kgf-m, 36 ft-lb) in alphabetical sequence.
(6) Tighten all bolts 80 to 90° in alphabetical sequence.
(7) Tighten all bolts by 40 to 45° in alphabetical sequence again.

CAUTION:
Do not tighten the bolts by more than 45°.

(8) Further tighten all bolts (A) and (B) by 40 to 45°.

CAUTION:
Ensure that the total "re-tightening angle" in the previous two steps do not exceed 90°.



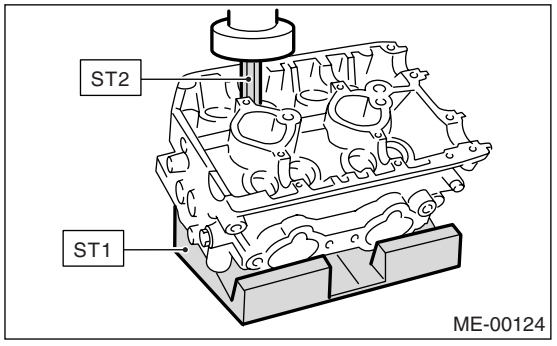
3) Install the camshaft. <Ref. to ME(H4DOTC)-60, INSTALLATION, Camshaft.>
4) Install the A/C compressor bracket on cylinder head.
5) Install the intake manifold. <Ref. to FU(H4DOTC)-17, INSTALLATION, Intake Manifold.>
6) Install the camshaft sprocket. <Ref. to ME(H4DOTC)-57, INSTALLATION, Camshaft Sprocket.>
7) Install the timing belt assembly. <Ref. to ME(H4DOTC)-51, INSTALLATION, Timing Belt Assembly.>

8) Install the timing belt cover. <Ref. to ME(H4DOTC)-48, INSTALLATION, Timing Belt Cover.>
9) Install the crankshaft pulley. <Ref. to ME(H4DOTC)-47, INSTALLATION, Crankshaft Pulley.>
10) Install the V-belt. <Ref. to ME(H4DOTC)-45, INSTALLATION, V-belt.>

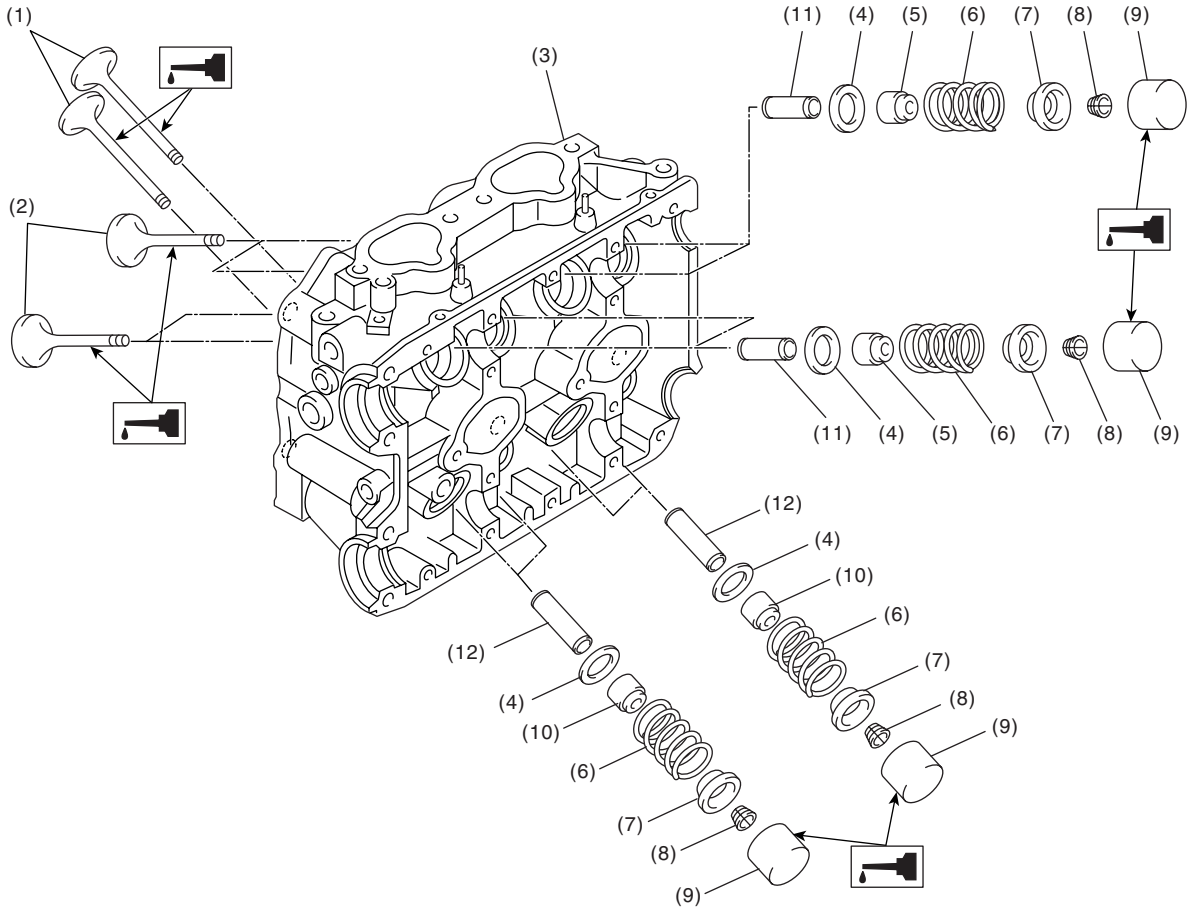
C: DISASSEMBLY

1) Remove the valve lifters.
2) Compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.
ST1 498267600 CYLINDER HEAD TABLE
ST2 499718000 VALVE SPRING REMOVER

CAUTION:
• Keep the removed parts in order for re-installing in their original positions.
• Mark each valve to prevent confusion.
• Use extreme care not to damage the lips of the intake valve oil seals and exhaust valve oil seals.



D: ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Cylinder head
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Retainer
(8) Retainer key
(9) Valve lifter
(10) Exhaust valve oil seal
(11) Intake valve guide
(12) Exhaust valve guide

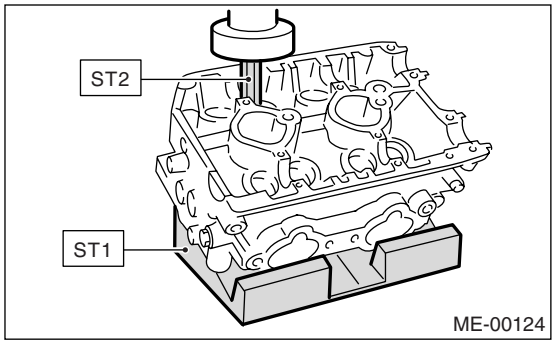
1) Installation of valve spring and valve:
(1) Coat the stem of each valve with engine oil and insert the valve into valve guide.

NOTE:
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

(2) Set the cylinder head on ST1.
(3) Install the valve spring and retainer using ST2.

ST1 4982676 00 CYLINDER HEAD TABLE
ST2 499718 000 VALVE SPRING REMOVER

NOTE:
Be sure to install the valve springs with their close-coiled end facing the seat on cylinder head.



(4) Compress the valve spring, and then fit the valve spring retainer key.
(5) After installing, tap the valve spring retainers lightly with wooden hammer for better seating.

2) Apply oil to the surface of the valve lifter.
3) Install the valve lifter.

E: INSPECTION

1. CYLINDER HEAD

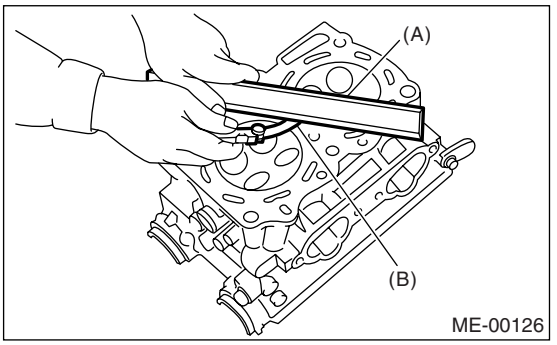
1) Make sure that no crack or other damage exists. In addition to visual inspection, inspect the important areas by means of red check.
2) Measure the warping of the cylinder head surface that mates with crankcase by using a straight edge (A) and thickness gauge (B).
If the warping exceeds 0.035 mm (0.0014 in), re-grind the surface with a surface grinder.

Warping limit:
0.035 mm (0.0014 in)

Grinding limit:
0.3 mm (0.012 in)

Standard height of cylinder head:
127.5 mm (5.02 in)

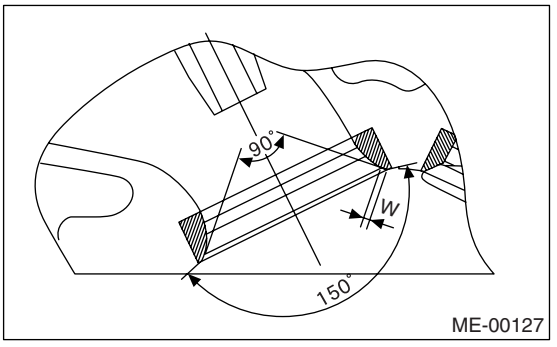
NOTE:
Uneven torque for the cylinder head nuts can cause warping. When reassembling, pay special attention to the torque so as to tighten evenly.



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
Standard 0.6 — 1.4 mm (0.024 — 0.055 in)
Limit 1.7 mm (0.067 in)
Exhaust
Standard 1.2 — 1.8 mm (0.047 — 0.071 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.

Clearance between the valve guide and valve stem:

Standard
Intake
0.030 — 0.057 mm (0.0012 — 0.0022 in)
Exhaust
0.040 — 0.067 mm (0.0016 — 0.0026 in)

Limit
0.15 mm (0.0059 in)

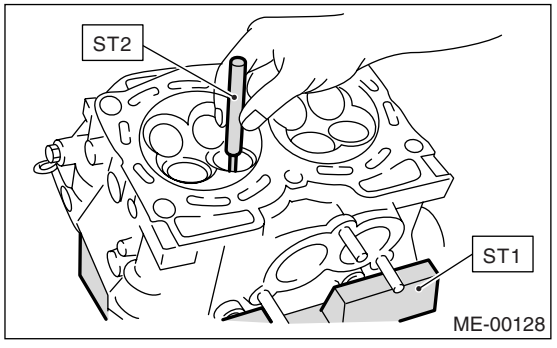
2) If the clearance between valve guide and stem exceeds the limit, replace the valve guide or valve itself whichever shows greater amount of wear. See the following procedure for valve guide replacement.

Valve guide inner diameter:
6.000 — 6.012 mm (0.2362 — 0.2367 in)

Valve stem outer diameters:
Intake
5.955 — 5.970 mm (0.2344 — 0.2350 in)
Exhaust
5.945 — 5.960 mm (0.2341 — 0.2346 in)

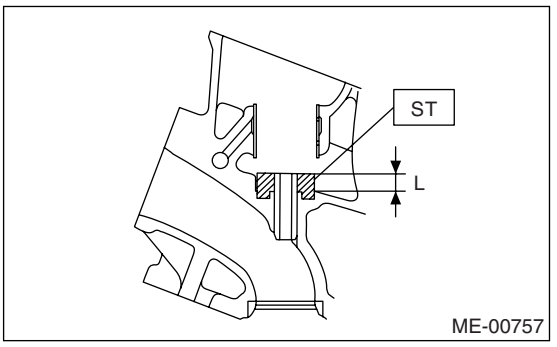
(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides enter the holes in ST1.
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267600 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



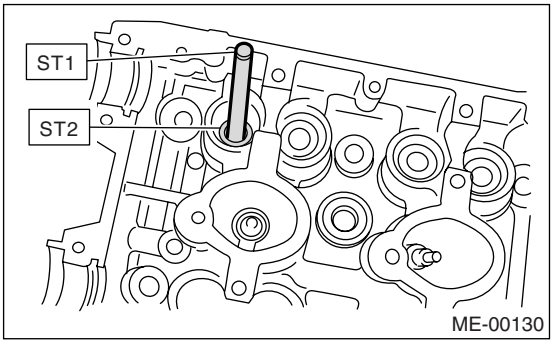
(3) Turn the cylinder head upside down and place ST as shown in the figure.

ST 18251AA020 VALVE GUIDE ADJUSTER



(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inside surface of the valve guide holes in cylinder head.
(5) Put a new valve guide, coated with sufficient oil, in cylinder, and insert 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
ST2 18251AA020 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

Valve guide protrusion: L
15.8 — 16.2 mm (0.622 — 0.638 in)

(7) Ream the inside of valve guide with ST. Gently rotate the reamer clockwise while pressing it lightly into the valve guide, and return it also rotating clockwise. After reaming, clean the valve guide to remove chips.

ST 499767400 VALVE GUIDE REAMER

NOTE:
• 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.

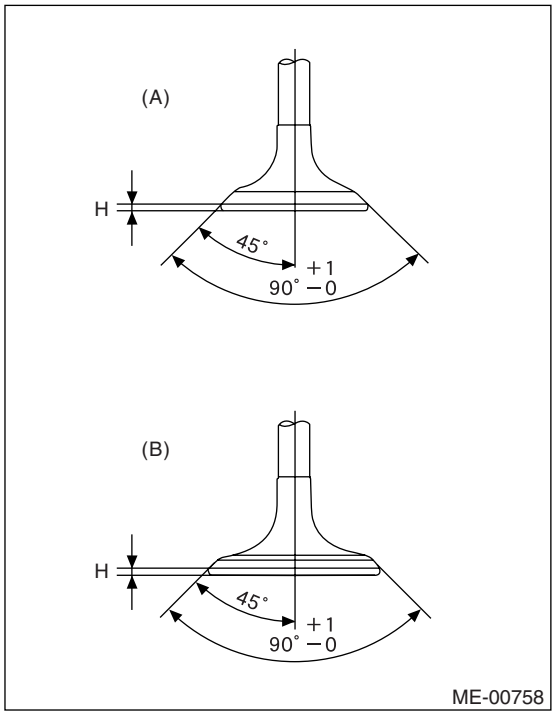
(8) Recheck the contact condition between valve and valve seat after replacing the valve guide.

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 (A)
Standard 1.0 — 1.4 mm (0.039 — 0.055 in)
Limit 0.8 mm (0.031 in)
Exhaust (B)
Standard 1.3 — 1.7 mm (0.051 — 0.067 in)
Limit 0.8 mm (0.031 in)

Valve overall length:
Intake (A)
104.4 mm (4.110 in)
Exhaust (B)
104.65 mm (4.120 in)

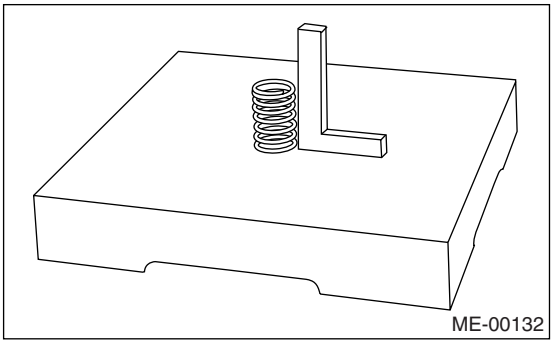


2) Put a small amount of grinding compound on the seat surface and lap the valve and seat surface. Install a new intake valve oil seal after lapping.

5. VALVE SPRINGS

1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within specifications presented in the table.
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.

		Valve spring
Free length		47.32 mm (1.863 in)
Tension/spring height	Set	205 — 235 N (20.9 — 24.0 kgf, 46.1 — 52.8 lb) /36.0 mm (1.417 in)
	Lift	426 — 490 N (43.4 — 50.0 kgf, 95.8 — 110 lb) /26.45 mm (1.041 in)
Squareness		2.5°, 2.1 mm (0.083 in)

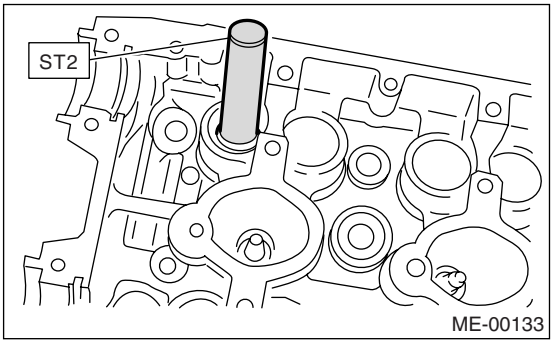


6. INTAKE AND EXHAUST VALVE OIL SEAL

Replace the oil seal with a new one, if the 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.
1) Place the cylinder head on ST1.
2) Press in the oil seal to the specified dimension indicated in the figure by using ST2.
ST1 498267600 CYLINDER HEAD TABLE
ST2 498857100 VALVE OIL SEAL GUIDE

NOTE:
• Apply engine oil to oil seal before press-fit.
• Differentiate between the intake valve oil seal and exhaust valve oil seal by noting their difference in color.

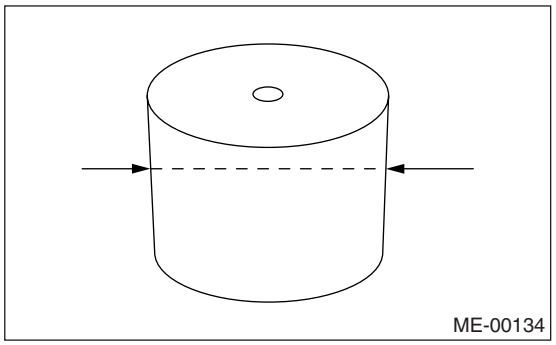
Color of rubber part:
Intake [Gray] Exhaust [Green]



7. VALVE LIFTER

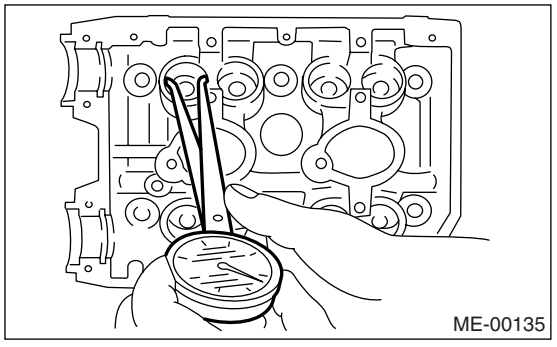
1) Visually check the valve lifter.
2) Measure the outer diameter of valve lifter.

Outer diameter:
34.959 — 34.975 mm (1.3763 — 1.3770 in)



3) Measure the inner diameter of valve lifter mating part on cylinder head.

Inner diameter:
34.994 — 35.016 mm (1.3777 — 1.3786 in)



NOTE:
If difference between outer diameter of valve lifter and inner diameter of valve lifter mating part is over the limit, replace the cylinder head.

Standard:
0.019 — 0.057 mm (0.0007 — 0.0022 in)

Limit:
0.100 mm (0.0039 in)

F: DISPOSAL

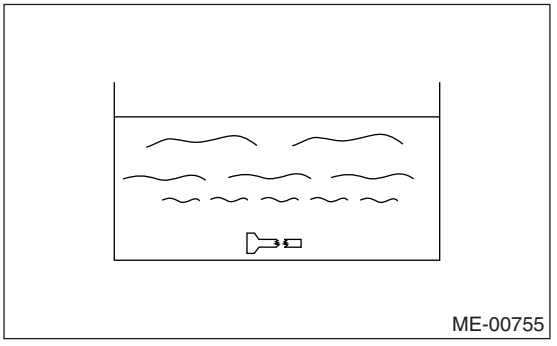
CAUTION:
• Metallic sodium is enclosed in the exhaust valve. Metallic sodium is extremely alkaline and may produce severe chemical reactions. Full consideration must therefore be given to the following points when handling or disposing of the valve.
• Since metallic sodium may cause blindness if contacted with the eyes, burns if contacted with the skin, and fire, do not deliberately take the valve apart.

1) If the valve is damaged, remove the valve and neutralize it by immersing it in water, and dispose of it in the same way that general steel materials are disposed of. The disposal method is described in the following.
(1) Wearing rubber gloves, remove the damaged valve from the cylinder head.
(2) Prepare a large receptacle (bucket or other container) in a well ventilated location, and fill the receptacle with water (at least 10 liters).
(3) Immerse the damaged valve in the receptacle.

CAUTION:
A severe reaction may occur, so stand at least 2 — 3 m from the receptacle. Because the reaction will produce hydrogen gas, moreover, keep the receptacle away from sparks or flames.

(4) Once the reaction is completed (about 4 — 5 hours have elapsed), carefully remove the valve using large pincers so that the reaction liquid does not contact your skin, and dispose of it with other parts that are being disposed of.
(5) The reaction liquid is a strong alkaline solution, so it must be disposed of in accordance with local regulations.

CAUTION:
Make sure the reaction liquid does not contact your skin. If contact with skin occurs, immediately wash the affected area with large quantities of water.

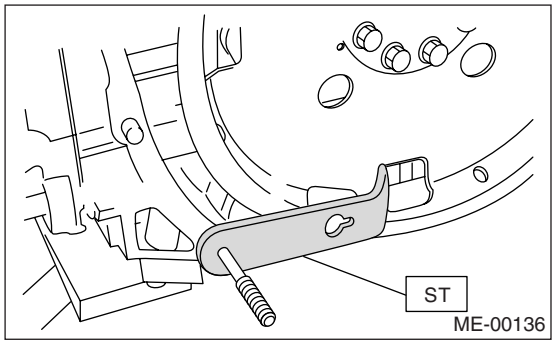


20.Cylinder Block

A: REMOVAL

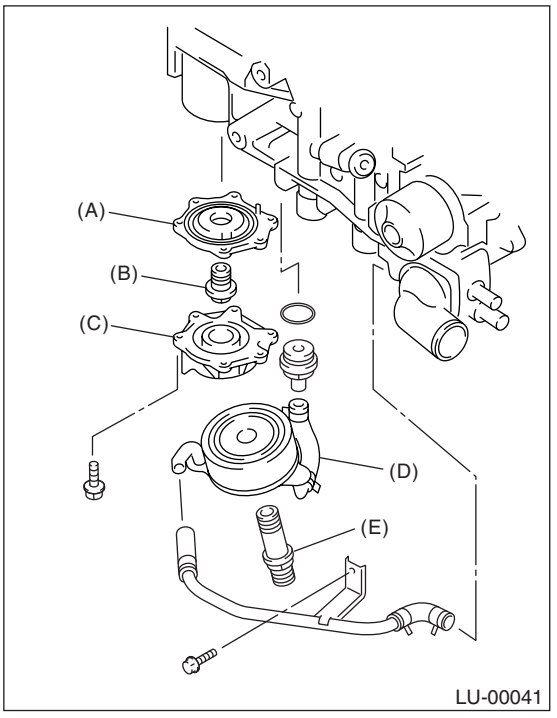
NOTE:
Before conducting this procedure, drain the engine oil completely if applicable.

1) Remove the intake manifold. <Ref. to FU(H4DOTC)-15, REMOVAL, Intake Manifold.>
2) Remove the V-belt. <Ref. to ME(H4DOTC)-45, REMOVAL, V-belt.>
3) Remove the crankshaft pulley. <Ref. to ME(H4DOTC)-47, REMOVAL, Crankshaft Pulley.>
4) Remove the timing belt cover. <Ref. to ME(H4DOTC)-48, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt assembly. <Ref. to ME(H4DOTC)-49, REMOVAL, Timing Belt Assembly.>
6) Remove the camshaft sprocket. <Ref. to ME(H4DOTC)-57, REMOVAL, Camshaft Sprocket.>
7) Remove the crankshaft sprocket. <Ref. to ME(H4DOTC)-58, REMOVAL, Crankshaft Sprocket.>
8) Remove the generator and A/C compressor with their brackets.
9) Remove the cylinder head assembly. <Ref. to ME(H4DOTC)-65, REMOVAL, Cylinder Head Assembly.>
10) Remove the clutch disc and cover.<Ref. to CL-11, REMOVAL, Clutch Disc and Cover.>
11) Remove the flywheel. (MT model) <Ref. to CL-11, REMOVAL, Clutch Disc and Cover.>
12) Remove drive plate. (AT model)
Using ST, lock crankshaft.
ST 498497100 CRANKSHAFT STOPPER



13) Remove the oil separator cover.
14) Remove the water by-pass pipe for heater.
15) Remove the oil filter.
ST 18332AA000 OIL FILTER WRENCH (Outer diameter: 68 mm (2.68 in))
ST 18332AA010 OIL FILTER WRENCH (Outer diameter: 65 mm (2.56 in))

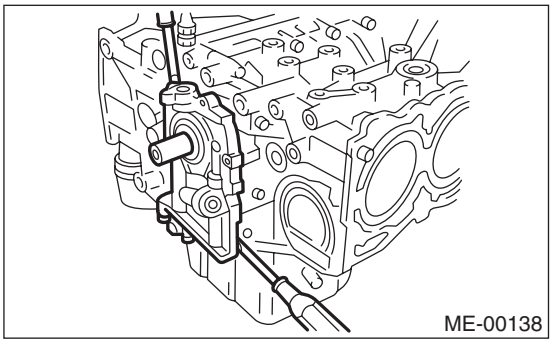
16) Remove the oil cooler.



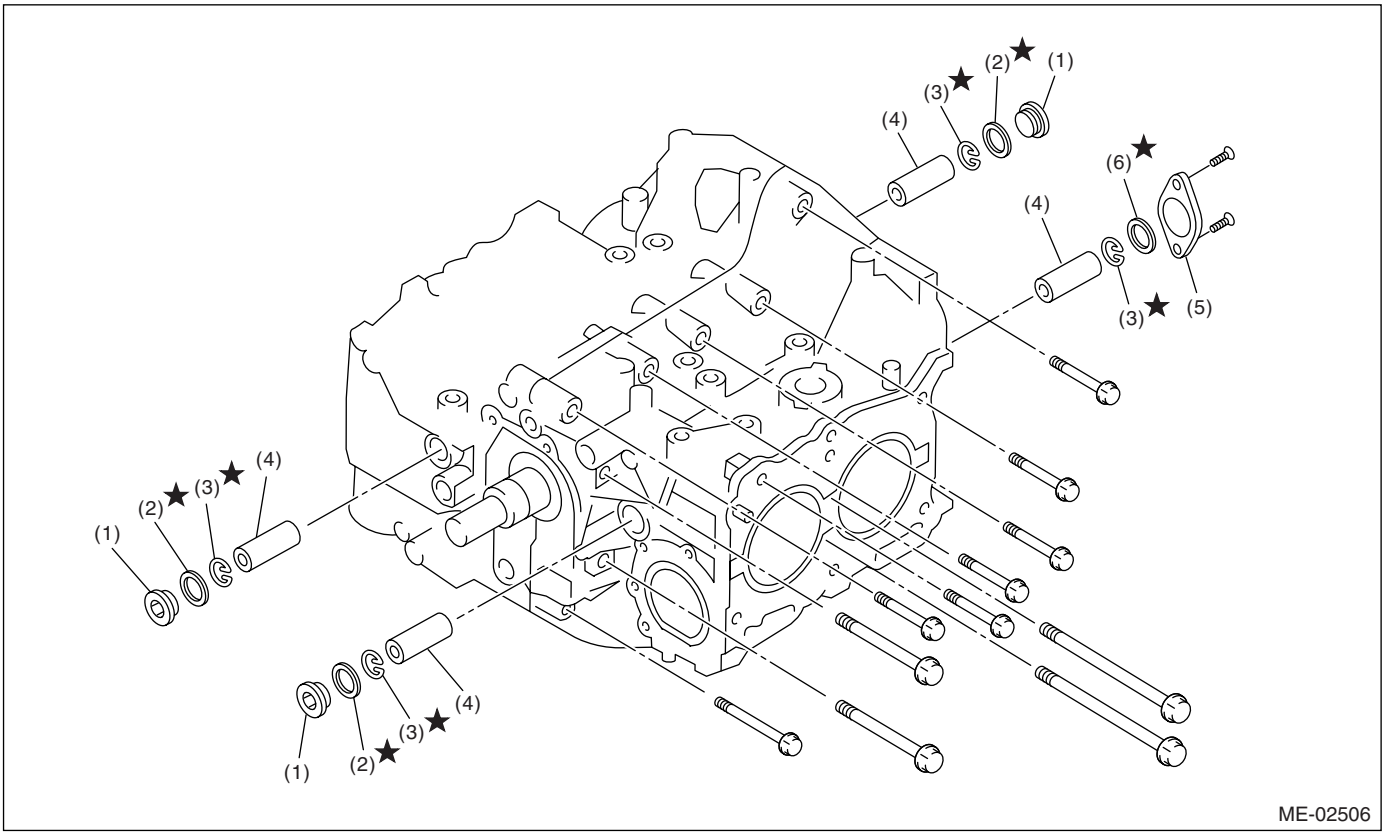
(A) Adapter (1)
(B) Adapter connector
(C) Adapter (2)
(D) Oil cooler
(E) Oil cooler connector

17) Remove the water pump.
18) Remove the oil pump from cylinder block.
Use a flat-bladed screwdriver as shown in the figure when removing the oil pump.

NOTE:
Be careful not to scratch the mating surface of cylinder block and oil pump.

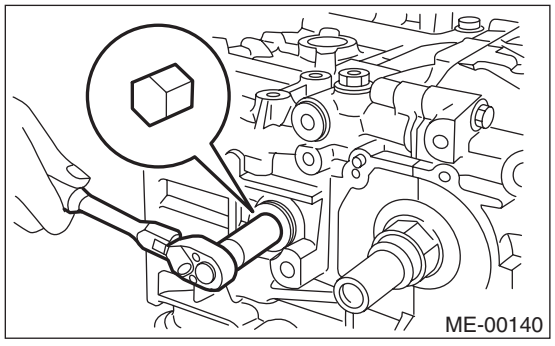


19) Removal of oil pan:
(1) Turn the cylinder block with #2 and #4 piston sides facing upward.
(2) Remove the bolts which secure oil pan to cylinder block.
(3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance, and then remove the oil pan.
Do not use a screwdriver or similar tool in place of oil pan cutter.
20) Remove the oil strainer stay.
21) Remove the oil strainer.
22) Remove the baffle plate.
23) Remove the water pipes.

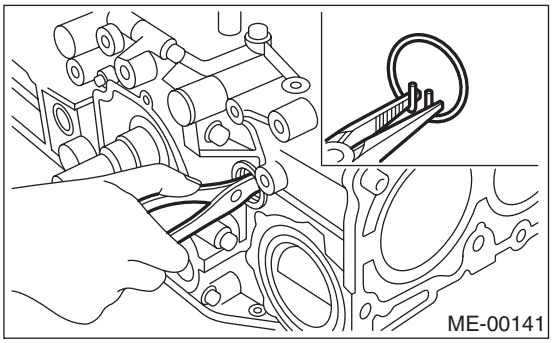


(1) Service hole plug
(2) Gasket
(3) Circlip
(4) Piston pin
(5) Service hole cover
(6) O-ring

24) Remove the service hole cover and service hole plugs using hexagon wrench [14 mm (0.55 in)].

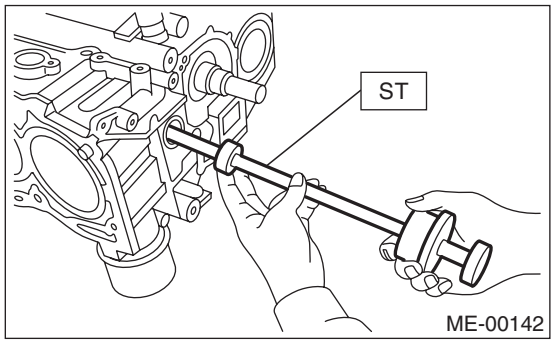


25) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, and then remove the piston circlip through service hole of #1 and #2 cylinders.



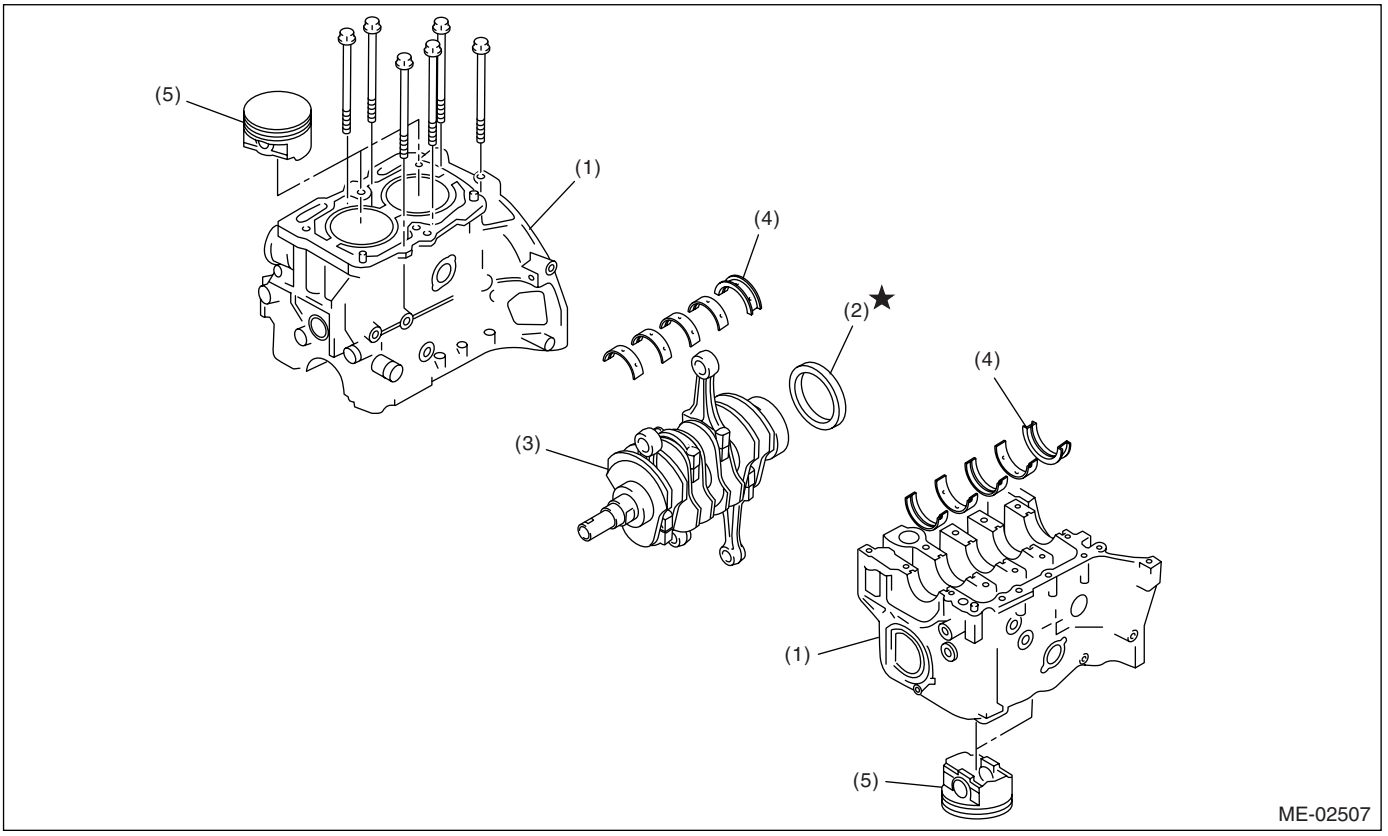
26) Draw out the piston pin from #1 and #2 pistons using ST.
ST 499097700 PISTON PIN REMOVER

CAUTION:
Be careful not to change the original combination of piston, piston pin and cylinder.



27) Similarly remove the piston pins from #3 and #4 pistons.
28) Remove the bolts which connect the cylinder block on the side of #2 and #4 cylinders.
29) Back off the bolts which connect the cylinder block on the side of #1 and #3 cylinders two or three turns.
30) Set up the cylinder block so that #1 and #3 cylinders are on the upper side, then remove the cylinder block connecting bolts.
31) Separate the cylinder blocks (LH) and (RH).

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

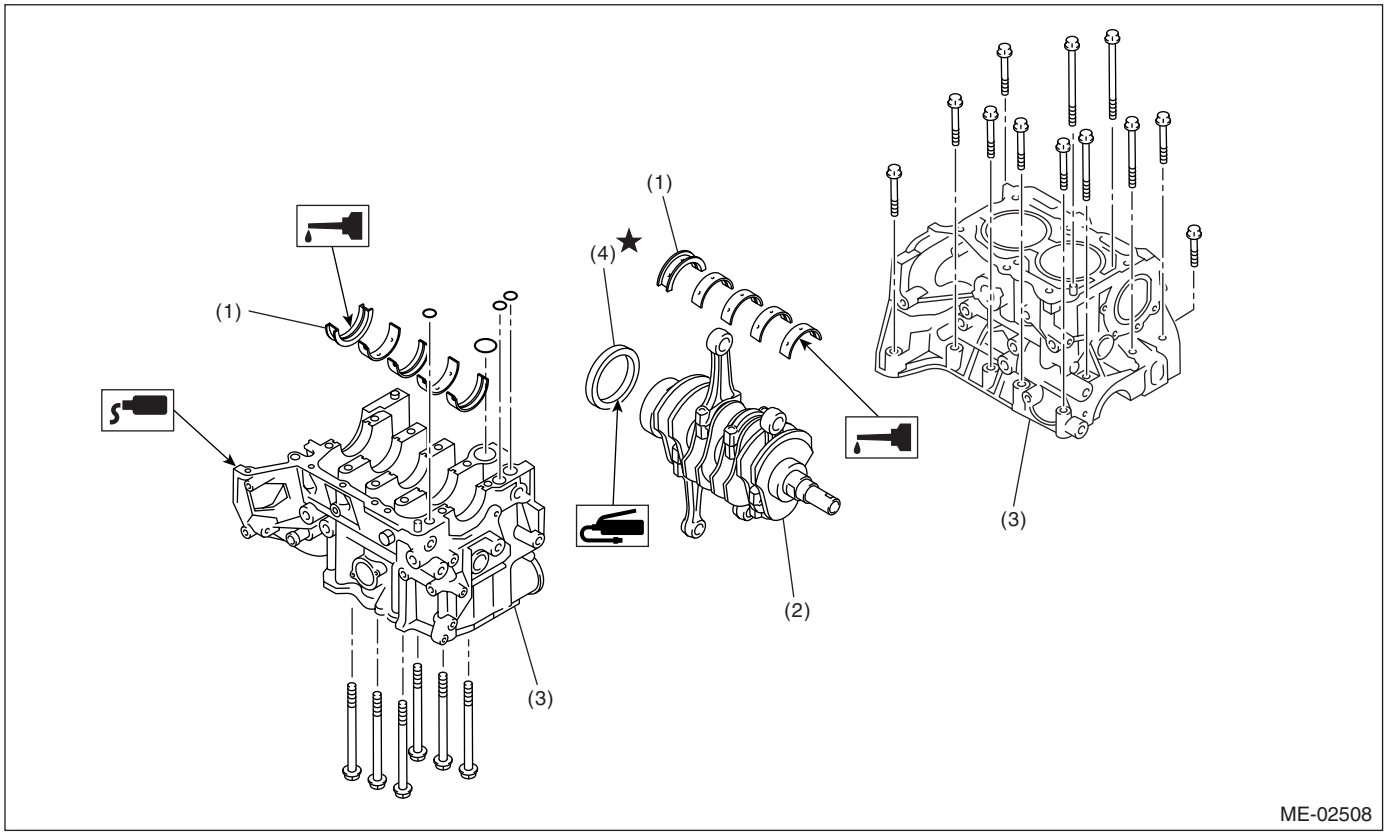
32) Remove the rear oil seal.
33) Remove the crankshaft together with connecting rod.
34) Remove the crankshaft bearings from cylinder block using a hammer handle.

CAUTION:
Do not change the combination of crankshaft bearings. Press the bearing at the end opposite to locking lip.

35) Draw out each piston from cylinder block using a wooden bar or hammer handle.

CAUTION:
Do not change the combination of piston and cylinder.

B: INSTALLATION



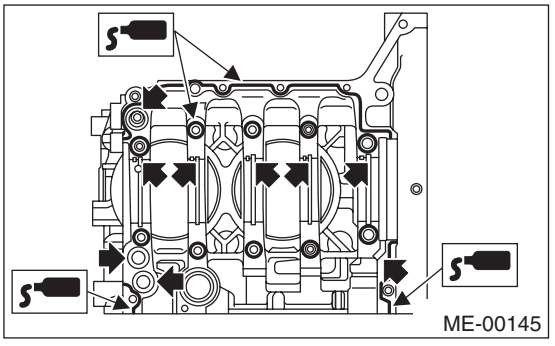
(1) Crankshaft bearing
(2) Crankshaft
(3) Cylinder block
(4) Rear oil seal

CAUTION:
• Remove oil in the mating surface of bearing and cylinder block before installation.
• Also apply a coat of engine oil to crankshaft pins.

1) Install the crankshaft on the cylinder block and apply a thin coat of engine oil to the crankshaft bearing, and then position crankshaft on the #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.

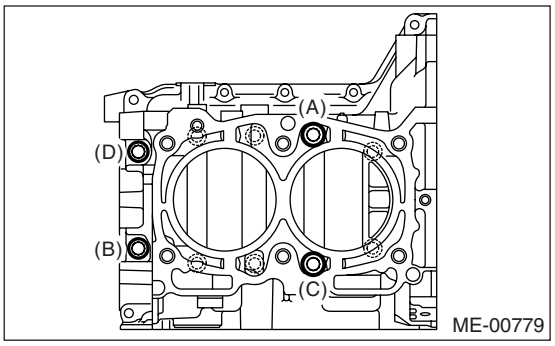
Fluid packing:
Part No. 004403007
THREE BOND 1215 or equivalent

CAUTION:
When applying fluid gasket, do not allow fluid packing to overflow to O-ring grooves, oil passages, bearing grooves, etc.



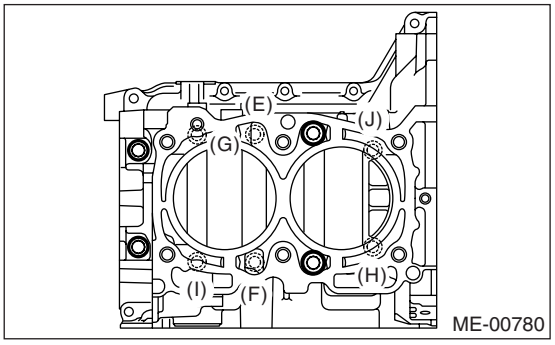
3) Apply engine oil to washers and thread of bolts.
4) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (LH side)

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



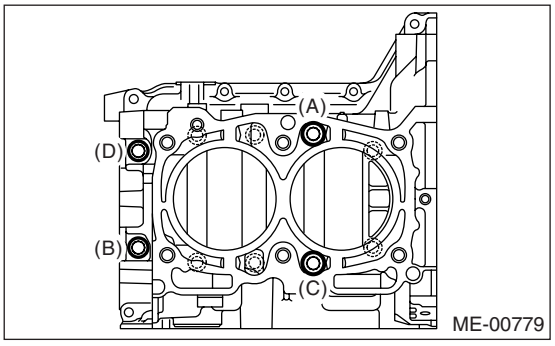
5) Tighten the 10 mm cylinder block connecting bolts in alphabetical sequence shown in the figure. (RH side)

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



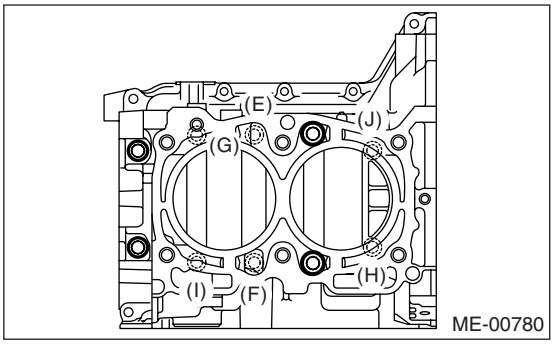
6) Further tighten the LH side bolts (A — D) in alphabetical sequence.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



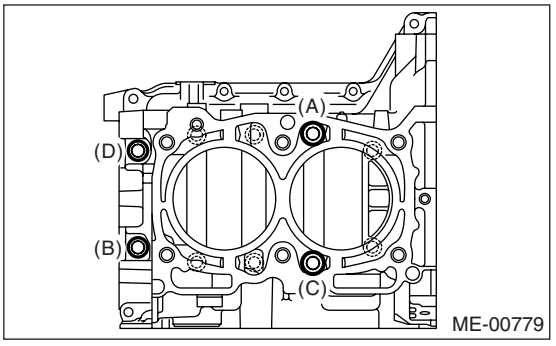
7) Further tighten the RH side bolts (E — J) in alphabetical sequence.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

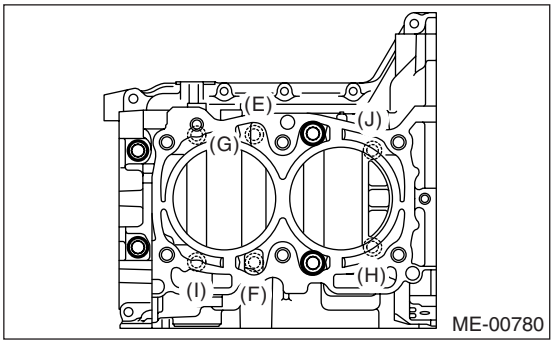


8) Further tighten the LH side bolts (A and C) by 90° in alphabetical sequence.
And further tighten bolts (B and D) in alphabetical sequence.

Tightening torque:
(B), (D): 40 N·m (4.1 kgf-m, 29.5 ft-lb)

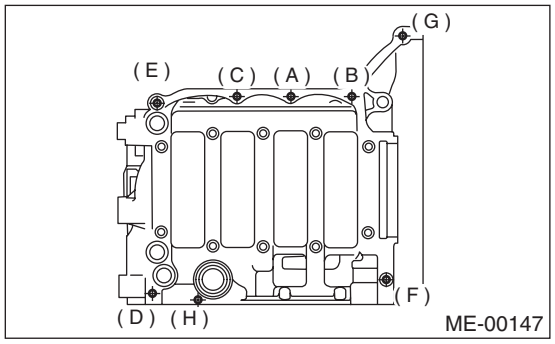


9) Further tighten the RH side bolts (E — J) by 90° in alphabetical sequence.



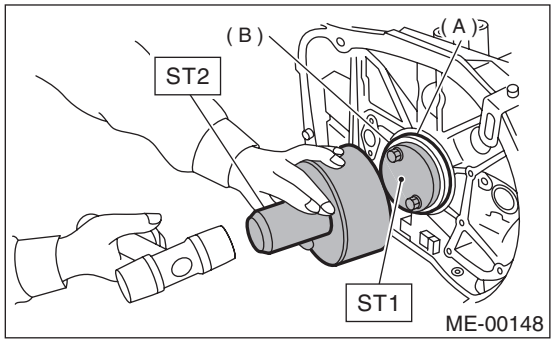
10) Tighten the 8 mm and 6 mm cylinder block connecting bolts in alphabetical sequence shown in the figure.

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)



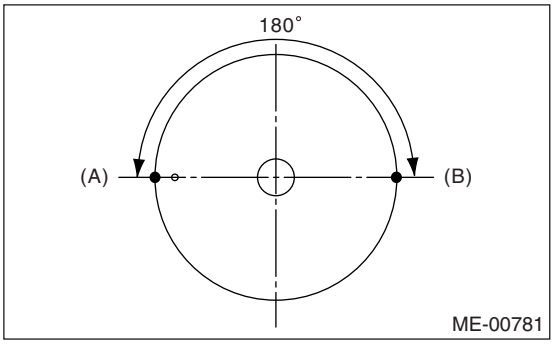
11) Install the rear oil seal using ST1 and ST2.

ST1	499597100	CRANKSHAFT OIL SEAL GUIDE
ST2	499587200	CRANKSHAFT OIL SEAL INSTALLER

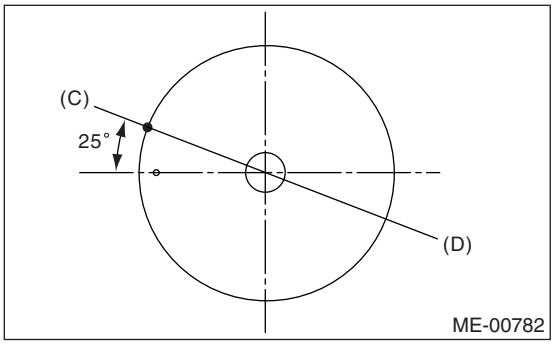


(A) Rear oil seal
(B) Flywheel attaching bolt

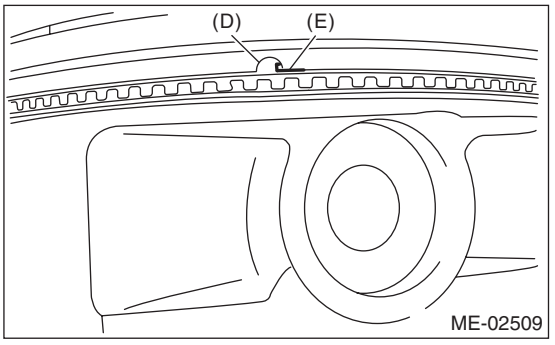
12) Position the top ring gap at (A) or (B) in the figure.
13) Position the second ring gap at 180° on the reverse side for the top ring gap.



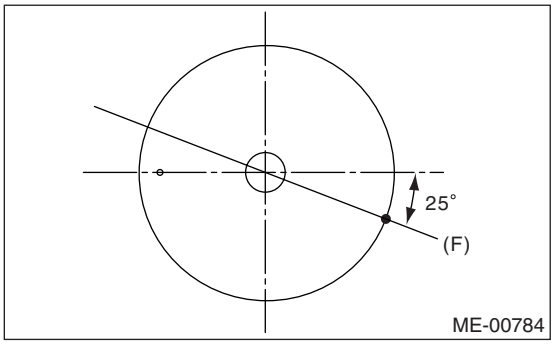
14) Position the upper rail gap at (C) in the figure.



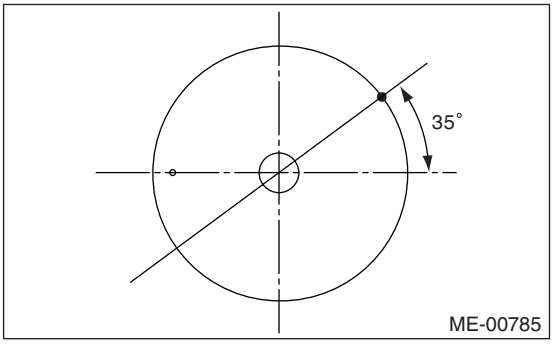
15) Align upper rail spin stopper (E) with piston side surface hole (D).



16) Position the expander gap at (F) in the figure.



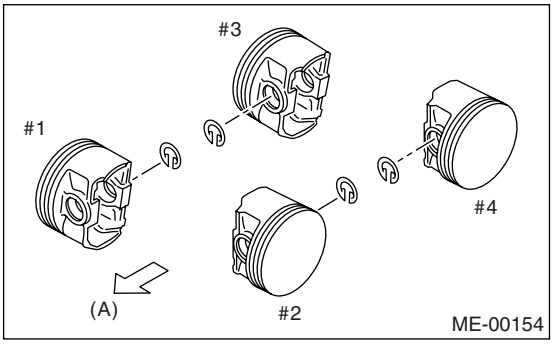
17) Position the lower rail gap at (G) in the figure.



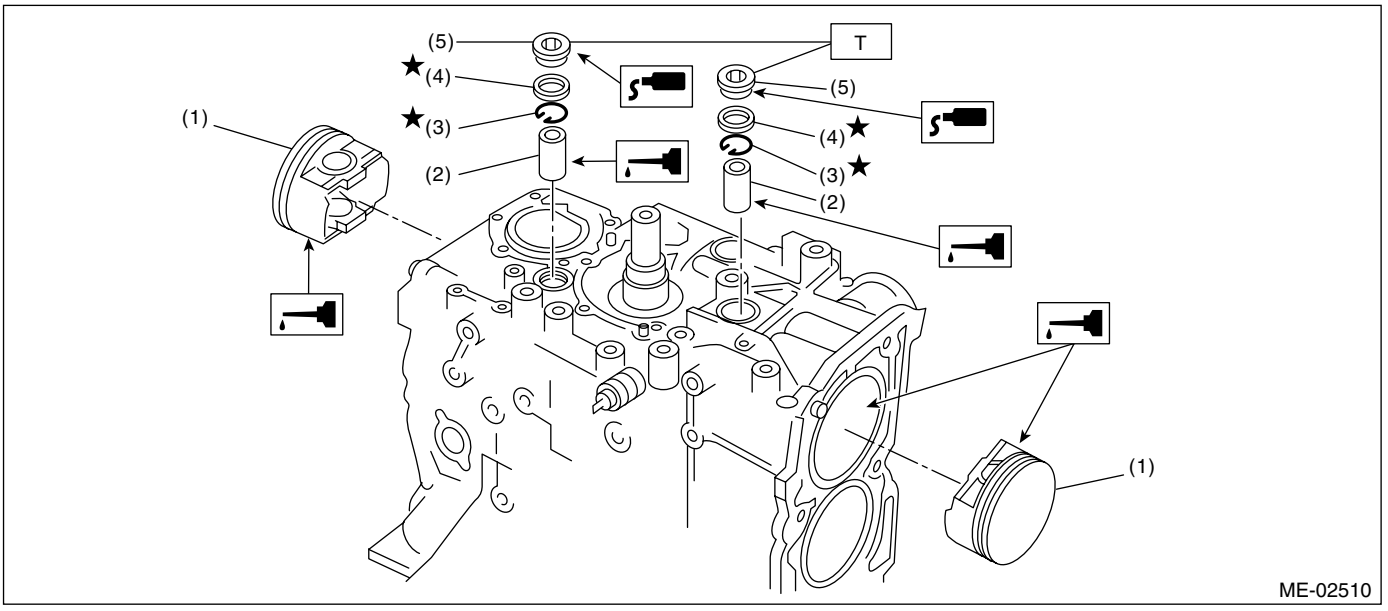
CAUTION:
• Ensure ring gaps do not face the same direction.
• Ensure ring gaps are not within the piston skirt area.

18) Install the circlip.
Install the circlips in piston holes located opposite of service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

NOTE:
Use new circlips.



(A) Front



(1) Piston
(2) Piston pin
(3) Circlip
(4) Gasket
(5) Service hole plug

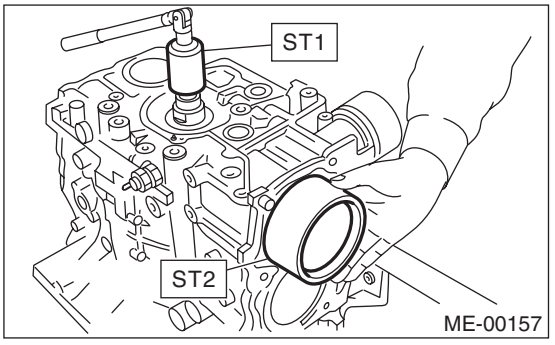
Tightening torque: N·m (kgf-m, ft-lb)
T: 70 (7.1, 51.4)

19) Installing the piston:
(1) Turn the cylinder block so that #1 and #2 cylinders face upward.
(2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

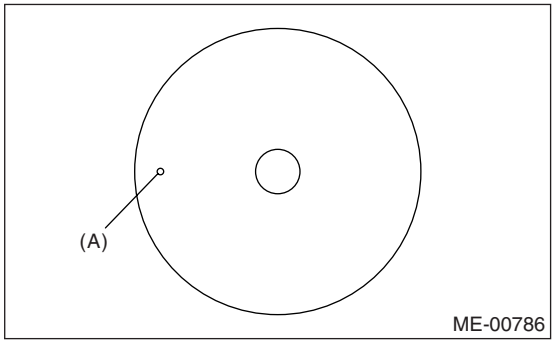
ST1 499987500 CRANKSHAFT SOCKET

(3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



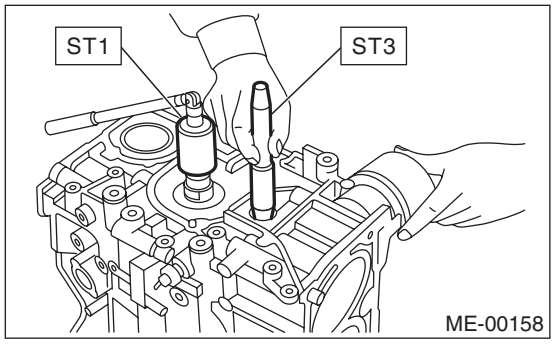
CAUTION:
Piston front mark faces towards the front of the engine.



(A) Front mark

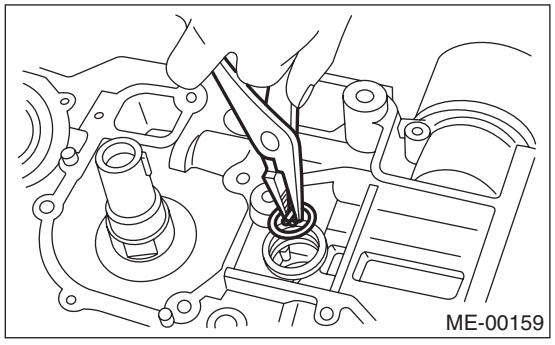
20) Installing piston pin:
(1) Apply a coat of engine oil to ST3, and then insert the ST3 into service hole to align piston pin hole with connecting rod small end.

ST3 499017100 PISTON PIN GUIDE



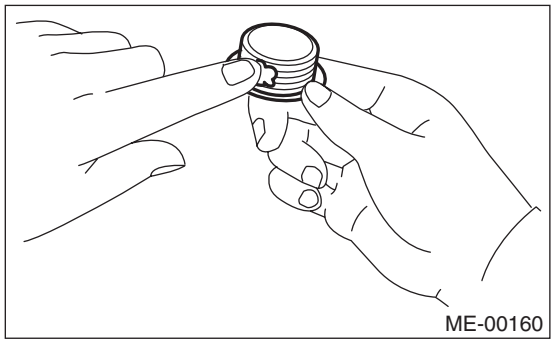
(2) Apply a coat of engine oil to the piston pin and insert piston pin into piston and connecting rod through service hole.
(3) Using the ST, install the circlip.

NOTE:
Use new circlips.



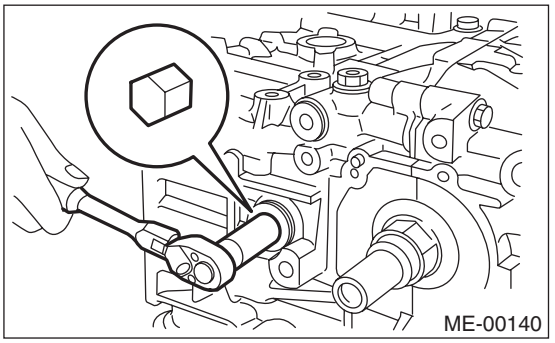
(4) Apply fluid packing around the service hole plug.

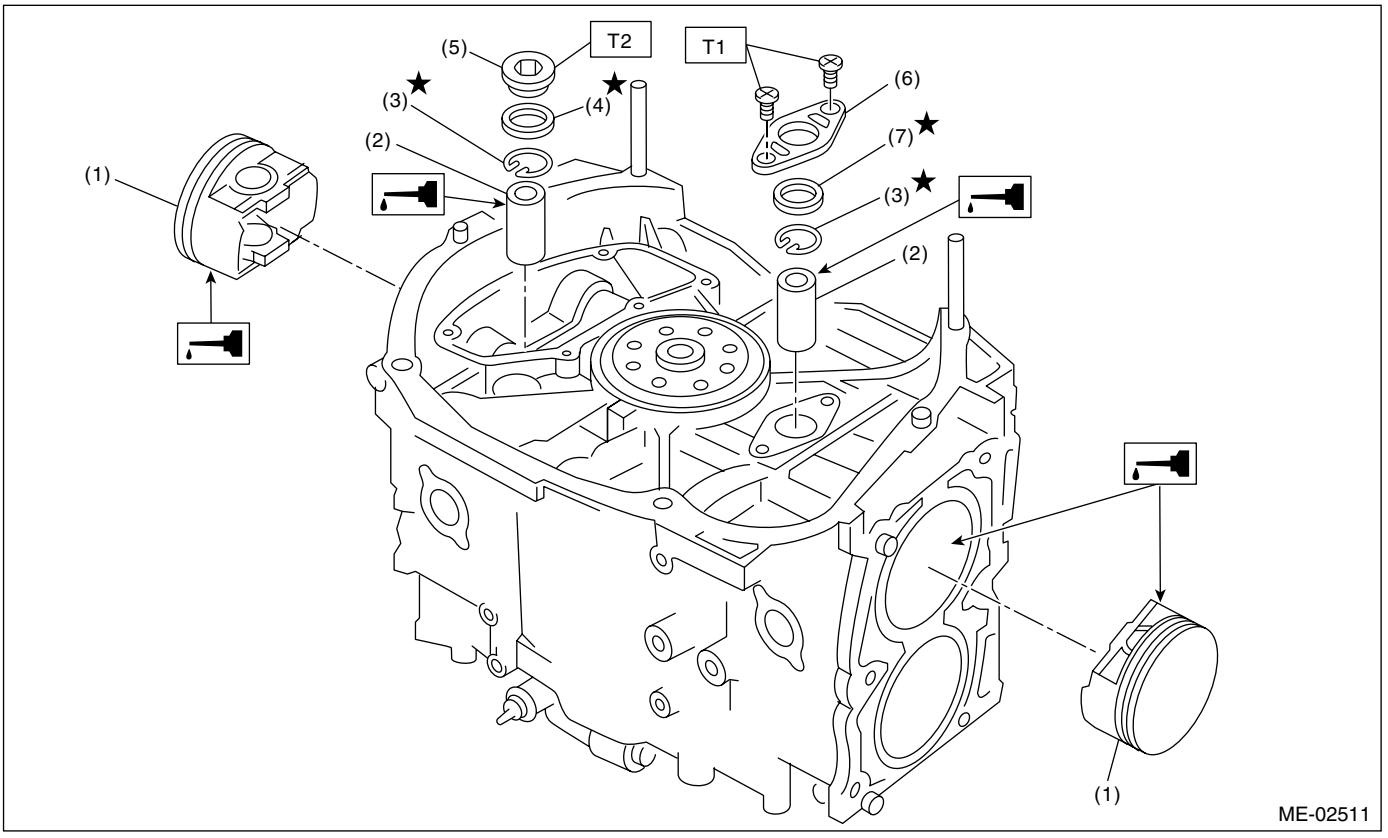
Fluid packing:
Part No. 004403007
THREE BOND 1215 or equivalent



(5) Install the service hole plug and gasket.

NOTE:
Use a new gasket.





(1) Piston
(2) Piston pin
(3) Circlip
(4) Gasket
(5) Service hole plug
(6) Service hole cover
(7) O-ring

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.65, 4.7)
T2: 70 (7.1, 51.4)

(6) Turn the cylinder block so that #3 and #4 cylinders face upward. Using the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.

21) Install the water pipe.

22) Install the baffle plate.

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

23) Install the oil strainer and O-ring

Tightening torque:
10 N·m (1.0 kgf-m, 7 ft-lb)

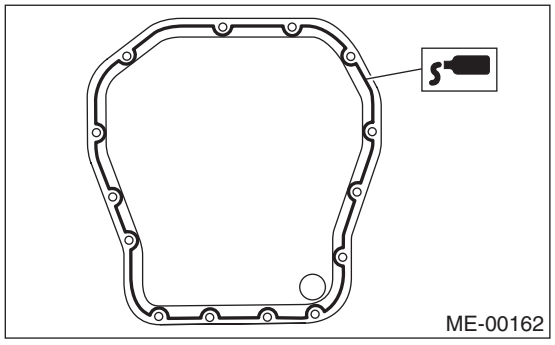
24) Install the oil strainer stay.

25) Apply fluid packing to the matching surfaces, and then install the oil pan.

NOTE:
Install the oil pan within 20 minutes after applying fluid packing.

Fluid packing:
Part No. 004403012
THREE BOND 1207C or equivalent

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)

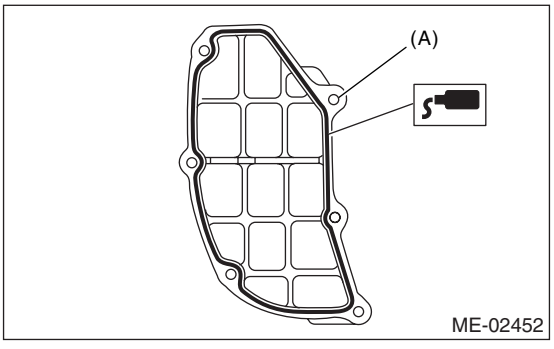


26) Apply fluid packing to the matching surfaces and the bolt thread (A) as shown in the figure, and then install the oil separator cover.

NOTE:
Install the oil pan within 20 minutes after applying fluid packing.

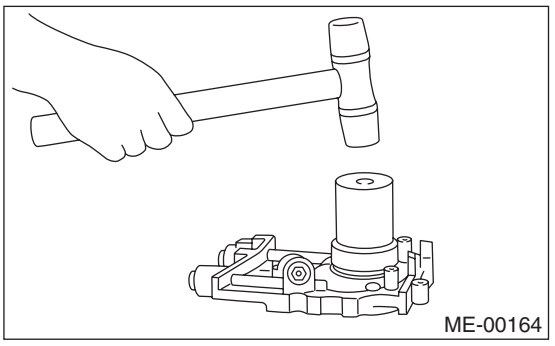
Fluid packing:
Part No. 004403012
THREE BOND 1270C or equivalent

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



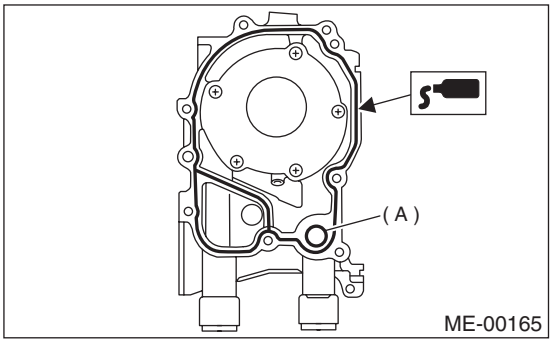
27) Install the flywheel. <Ref. to CL-11, INSTALLATION, Clutch Disc and Cover.>
28) Install the clutch disc and cover. <Ref. to CL-11, REMOVAL, Clutch Disc and Cover.>
29) Installation of oil pump:
(1) Discard the front oil seal after removal. Replace with a new one using the ST.

ST 499587100 OIL SEAL INSTALLER



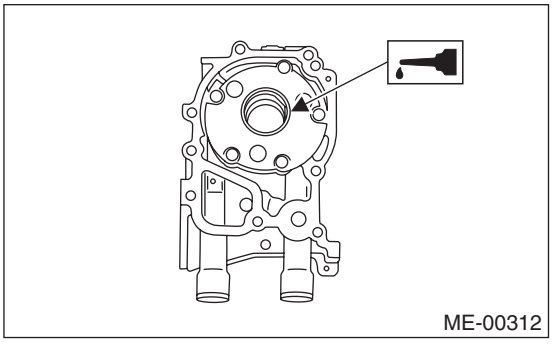
(2) Apply fluid packing to the matching surface of oil pump.

Fluid packing:
Part No. 004403007
THREE BOND 1215 or equivalent



(A) O-ring

(3) Apply a coat of engine oil to the inside of the oil seal.



(4) Install the oil pump on cylinder block. Be careful not to damage the oil seal during installation.

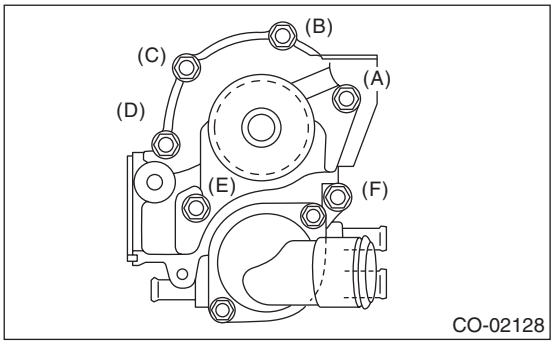
Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

CAUTION:
• Install the O-ring and seal securely when installing the oil pump.
• Align the flat surface of oil pump's inner rotor with crankshaft before installation.

30) Install the water pump and gasket.

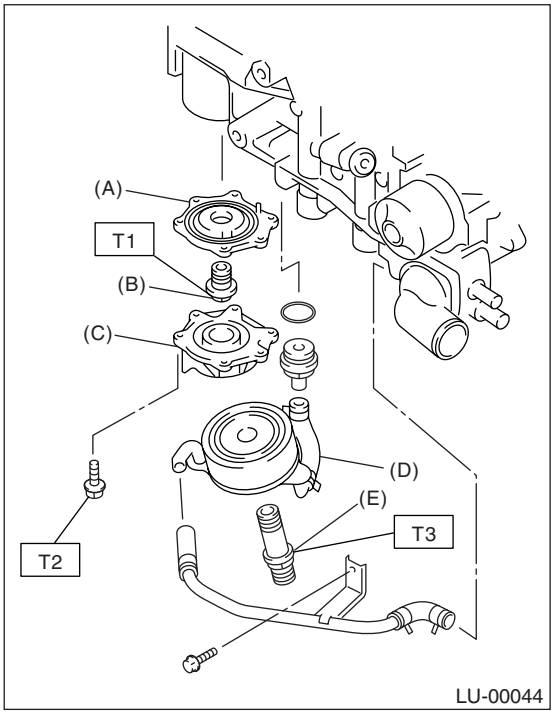
Tightening torque:
First; 12 N·m (1.2 kgf-m, 8.7 ft-lb)
Second; 12 N·m (1.2 kgf-m, 8.7 ft-lb)

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.



31) Install the water by-pass pipe for heater.
32) Install the oil cooler.

Tightening torque:
T1: 45 N·m (4.6 kgf-m, 33 ft-lb)
T2: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)
T3: 54 N·m (5.3 kgf-m, 39 ft-lb)



(A) Adapter (1)
(B) Adapter connector
(C) Adapter (2)
(D) Oil cooler
(E) Oil cooler connector

33) Prepare oil filter and apply a thin coat of engine oil to the seal rubber.
34) Install the oil filter using ST.

ST	18332AA000	OIL FILTER WRENCH [Outer diameter: 68 mm (2.68 in) for oil filter]
ST	18332AA010	OIL FILTER WRENCH [Outer diameter: 65 mm (2.56 in) for oil filter]

When installing oil filter, carefully turn by hand so as not to damage seal rubber.
• Oil filter with 68 mm (2.68 in) outer diameter is further tightened (about 1 rotation) with ST after seal rubber contacts an oil cooler.
• Oil filter with 65 mm (2.56 in) outer diameter is further tightened (about 2/3 to 3/4 rotation) with ST after seal rubber contacts an oil cooler.

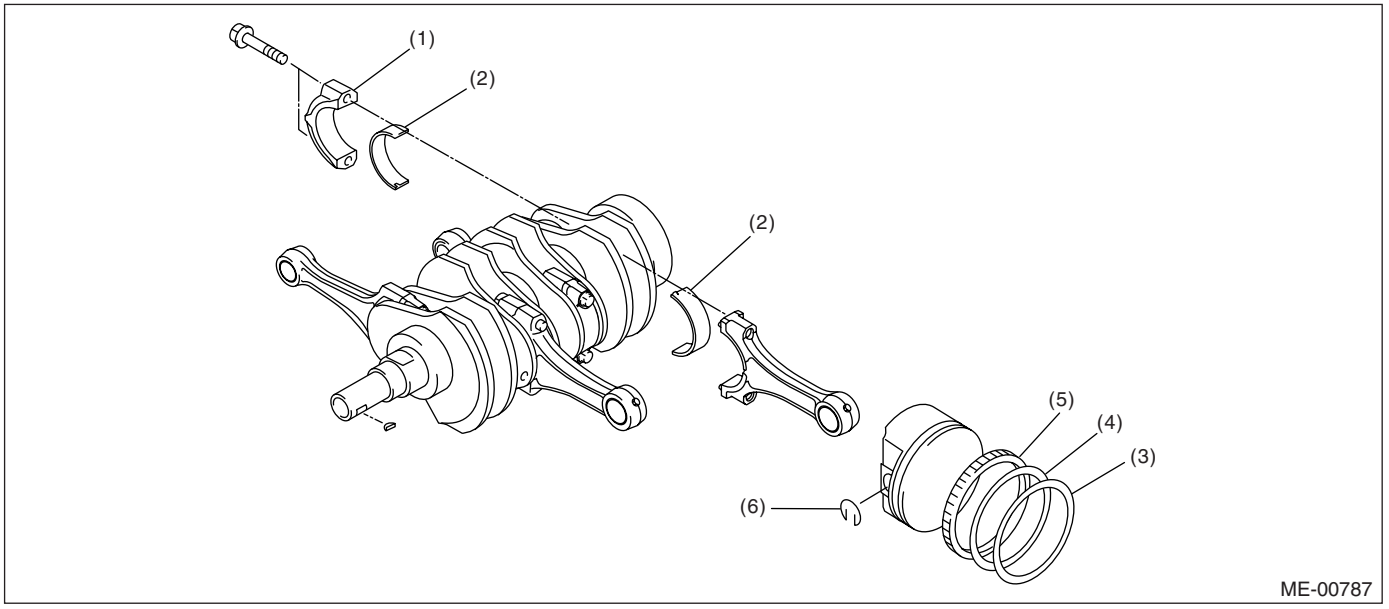
CAUTION:
• Do not tighten excessively, or oil may leak.
• It must be noted that oil filter with 80 mm (3.15 in) outer diameter is not available for TURBO model.

35) Install the water by-pass pipe between oil cooler and water pump.
36) Install the water pipe.

CAUTION:
Always use a new O-ring.

37) Install the cylinder head assembly. <Ref. to ME(H4DOTC)-65, INSTALLATION, Cylinder Head Assembly.>
38) Install the oil level gauge guide and tighten the attaching bolt (LH side).
39) Install the rocker cover.
40) Install the crankshaft sprocket. <Ref. to ME(H4DOTC)-58, INSTALLATION, Crankshaft Sprocket.>
41) Install the camshaft sprocket. <Ref. to ME(H4DOTC)-57, INSTALLATION, Camshaft Sprocket.>
42) Install the timing belt assembly. <Ref. to ME(H4DOTC)-51, INSTALLATION, Timing Belt Assembly.>
43) Install the timing belt cover. <Ref. to ME(H4DOTC)-48, INSTALLATION, Timing Belt Cover.>
44) Install the crankshaft pulley. <Ref. to ME(H4DOTC)-47, INSTALLATION, Crankshaft Pulley.>
45) Install the generator and A/C compressor brackets on cylinder head.
46) Install the V-belt. <Ref. to ME(H4DOTC)-45, INSTALLATION, V-belt.>
47) Install the intake manifold. <Ref. to FU(H4DOTC)-17, 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.

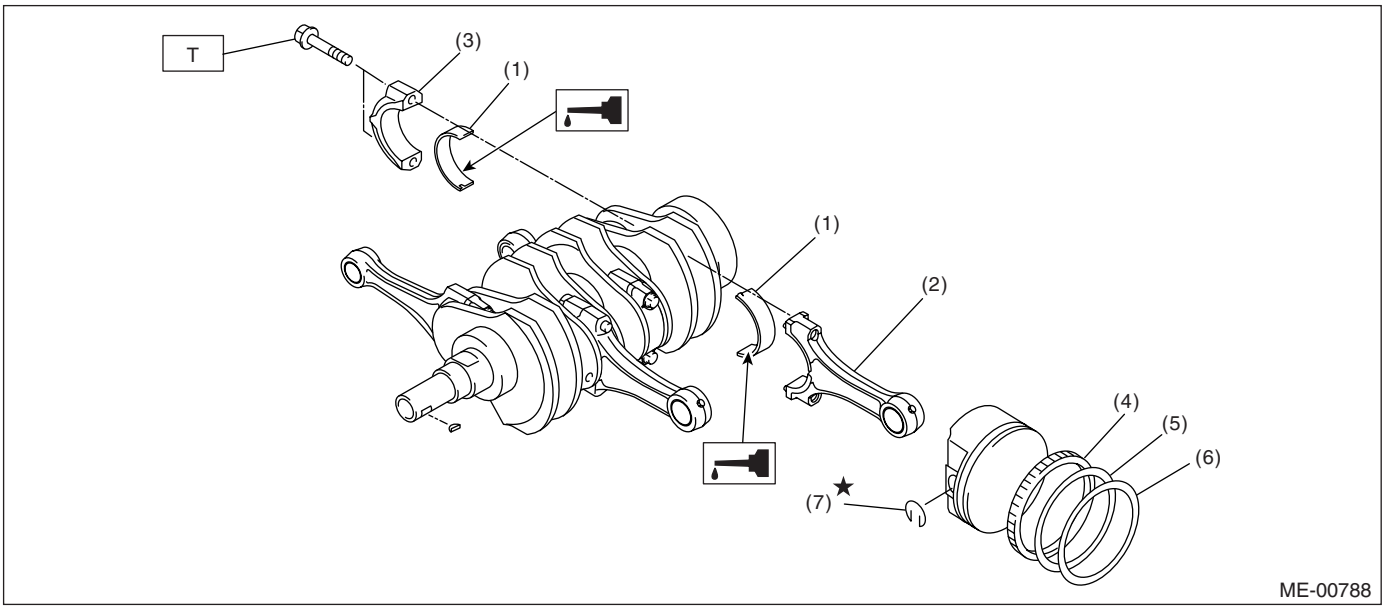
CAUTION:
Arrange the combination of the removed connecting rod, connecting rod cap and bearing so as not to change and mix up the combination of these parts.

3) Remove the piston rings using the piston ring expander.
4) Remove the oil ring by hand.

CAUTION:
• Do not use the piston ring expander, or oil ring may bend.
• Arrange the removed piston rings in proper order so as not to mix them up.

5) Remove the circlip.

D: ASSEMBLY



(1) Connecting rod bearing
(2) Connecting rod
(3) Connecting rod cap
(4) Oil ring
(5) Second ring
(6) Top ring
(7) Circlip

Tightening torque: N·m (kgf-m, ft-lb)
T: 52 (5.3, 38.4)

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 side marked facing forward, and align connecting rod with crankshaft.
4) Position connecting rod cap with the arrow facing forward, align connecting rod cap with crankshaft and tighten connecting rod bolt.

Tightening torque:
52 N·m (5.3 kgf-m, 38.4 ft-lb)

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 oil ring expander, upper rail and lower rail in this order by hand.
6) Install the second ring and top ring with a 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:
0.025 mm (0.0010 in)

Grinding limit:
0.1 mm (0.004 in)

Standard height of cylinder block:
201.0 mm (7.91 in)

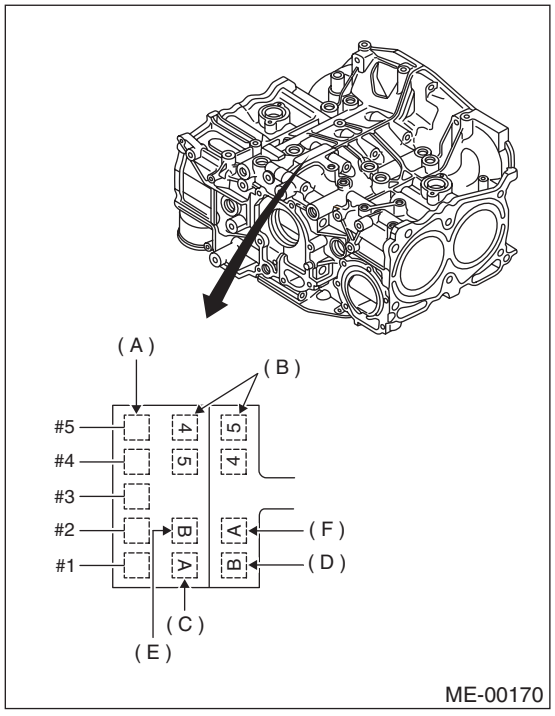
2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on cylinder block's front upper surface.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

NOTE:
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)



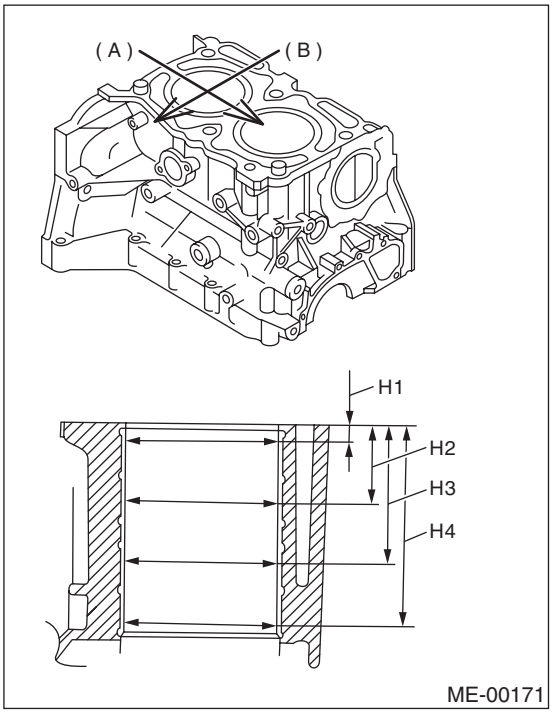
(A) Main journal size mark
(B) Cylinder block (RH)-(LH) combination mark
(C) #1 cylinder bore size mark
(D) #2 cylinder bore size mark
(E) #3 cylinder bore size mark
(F) #4 cylinder bore size mark

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 of 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)



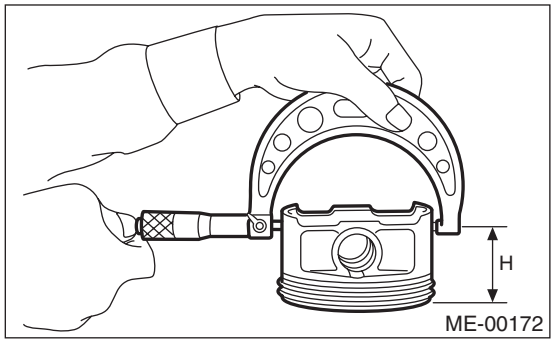
(A) Piston pin direction
(B) Thrust direction
H1: 10 mm (0.39 in)
H2: 45 mm (1.77 in)
H3: 80 mm (3.15 in)
H4: 115 mm (4.53 in)

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:
38.2 mm (1.50 in)

Piston outer diameter:
Standard
A: 99.505 — 99.515 mm
(3.9175 — 3.9179 in)
B: 99.495 — 99.505 mm
(3.9171 — 3.9175 in)
0.25 mm (0.0098 in) oversize
99.745 — 99.765 mm
(3.9270 — 3.9278 in)
0.50 mm (0.0197 in) oversize
99.995 — 100.015 mm
(3.9368 — 3.9376 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 — 0.010 mm (−0.0004 — 0.0004 in)
Limit
0.030 mm (0.0012 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 cylinder block.

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.

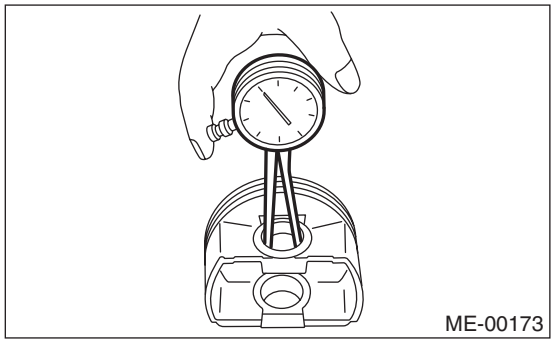
Limit of cylinder enlarging (boring):
0.5 mm (0.020 in)

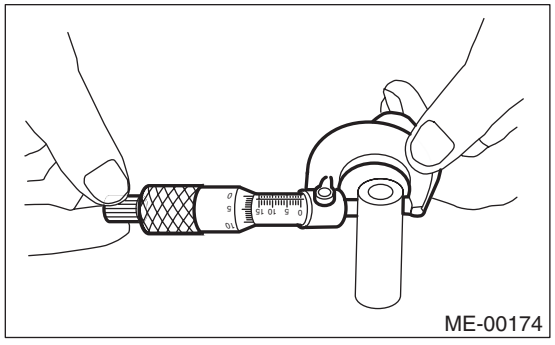
3. PISTON AND PISTON PIN

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(H4DOTC)-86, CYLINDER AND PISTON.> If any of the clearances is not within specification, replace the piston or bore the cylinder to use an oversize piston.

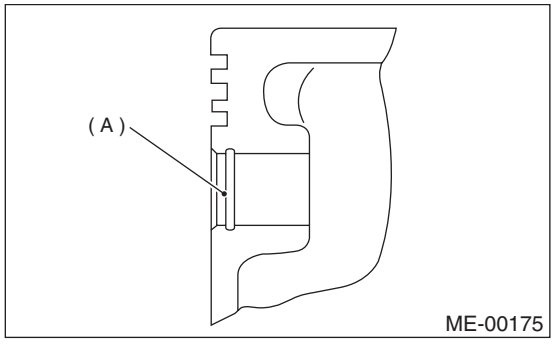
3) Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if defective.

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)


ME-00173


ME-00174

4) Check the circlip installation groove on piston for burr (A). If necessary, remove the burr from groove so that the piston pin can lightly move.



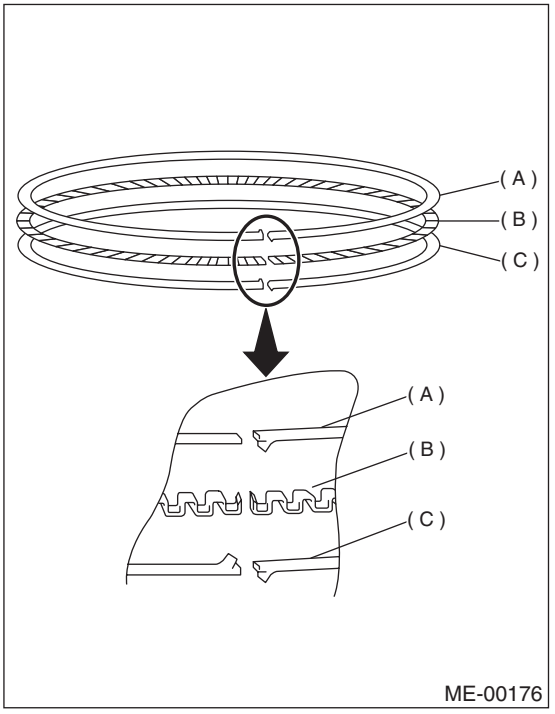
ME-00175

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 for proper direction are shown on top ring and second ring. When installing the rings to the piston, face this mark upward.
• Oil ring consists of upper rail, expander and lower rail. When installing oil ring on piston, be careful of each rail's direction.

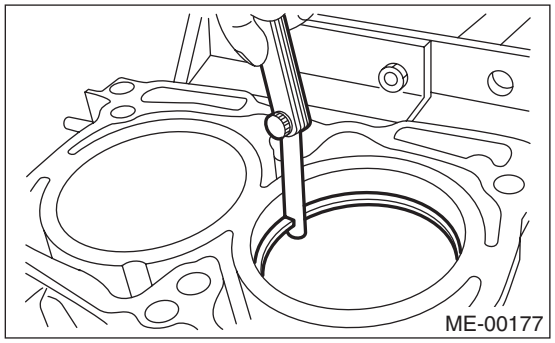


ME-00176

(A) Upper rail
(B) Expander
(C) Lower rail

2) Squarely place the piston ring and oil ring in cylinder, and then measure the piston ring gap with a thickness gauge.

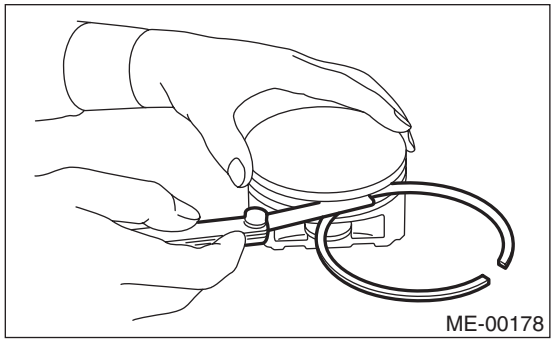
			Unit: mm (in)
		Standard	Limit
Piston ring gap	Top ring	0.20 — 0.25 (0.0079 — 0.0098)	1.0 (0.039)
	Second ring	0.37 — 0.52 (0.015 — 0.020)	1.0 (0.039)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)	1.5 (0.059)


ME-00177

3) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

NOTE:
Before measuring the clearance, clean the piston ring groove and piston ring.

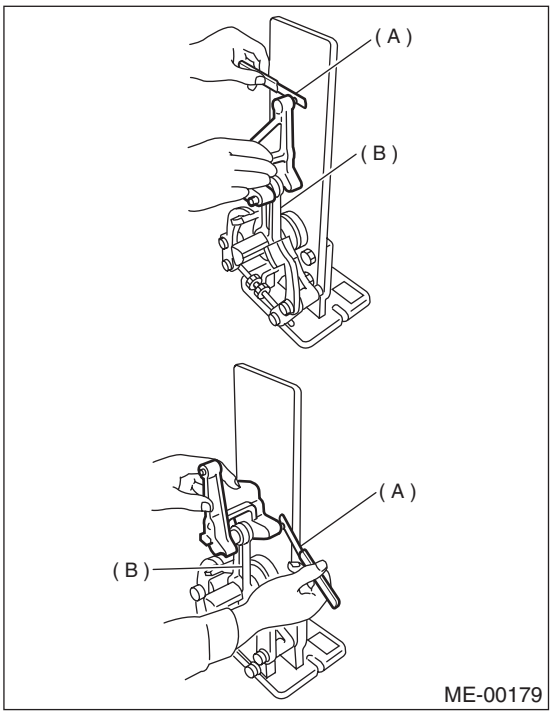
			Unit: mm (in)
		Standard	Limit
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)	0.15 (0.0059)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)	0.15 (0.0059)


ME-00178

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)

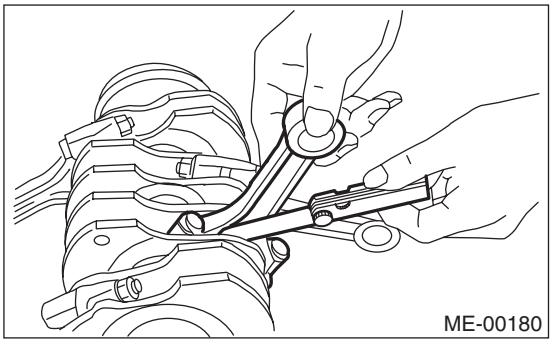


ME-00179

(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
0.40 mm (0.016 in)


ME-00180

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.)

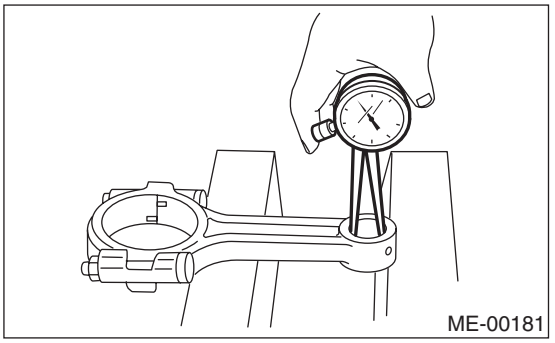
Connecting rod oil clearance:
Standard
0.017 — 0.045 mm (0.0007 — 0.0018 in)
Limit
0.050 mm (0.0020 in)

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 (2.0447 — 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 with a new one if worn or damaged.
7) Also measure the piston pin clearance at connecting rod small end, and replace with a new one if it exceeds the limit.

Clearance between piston pin and bushing:
Standard
0 — 0.022 mm (0 — 0.0009 in)
Limit
0.030 mm (0.0012 in)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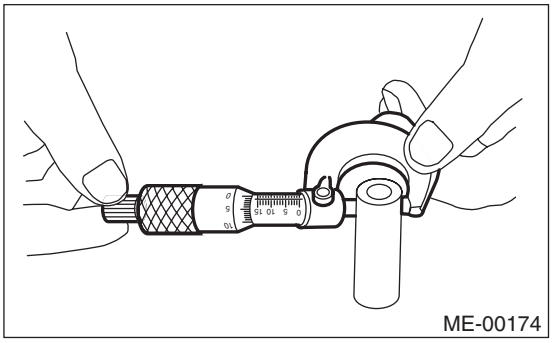
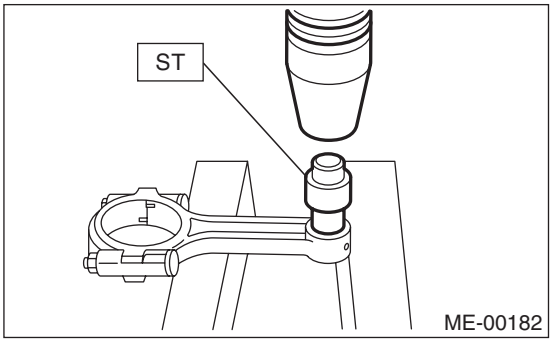

ME-00174

8) Replacement procedure of bushing at connecting rod small end 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



ME-00182

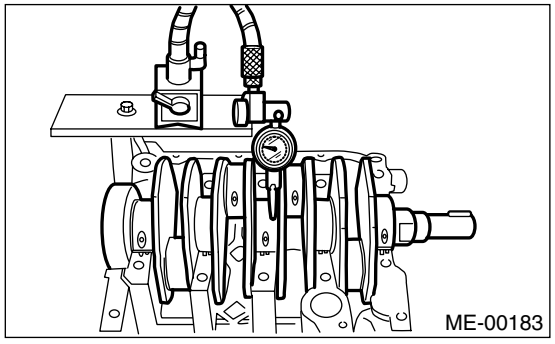
(3) Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.
(4) After the completion of reaming, clean the bushing to remove chips.

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)

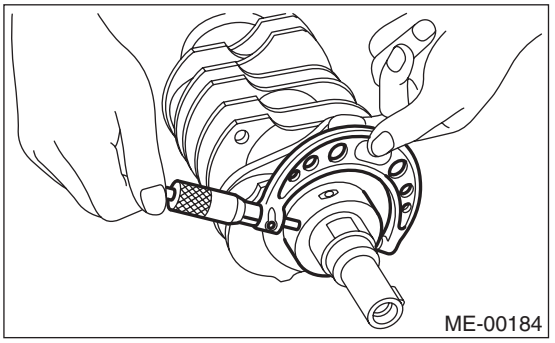


3) Inspect the crank journal and crank pin for wear. If they are not within the specifications, replace the bearing with a suitable (undersize) one, and then replace or recondition the crankshaft as necessary.

When grinding the crank journal or crank pin, finish them to specified dimensions according to the undersize bearing to be used.

Crank pin:
Out-of-roundness
0.003 mm (0.0001 in)
Cylindricality
0.004 mm (0.0002 in)
Grinding limit
51.750 mm (2.0374 in) dia. or less

Crank journal:
Out-of-roundness
0.005 mm (0.0002 in)
Cylindricality
0.006 mm (0.0002 in)
Grinding limit
59.750 mm (2.3524 in) dia.



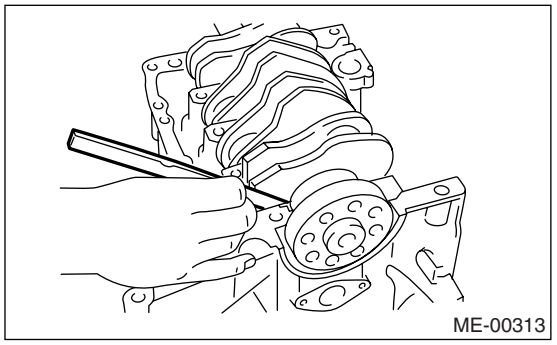
Unit: mm (in)

		Crank journal diameter		Crank pin outer diameter
		#1, #3	#2, #4, #5	
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 (2.0447 — 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 with a thickness gauge. If the clearance exceeds the limit, replace the bearing.

Crankshaft side clearance:
Standard
0.030 — 0.115 mm (0.0012 — 0.0045 in)
Limit
0.25 mm (0.0098 in)


ME-00313

5) Inspect 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 replace or recondition the crankshaft as necessary.

Unit: mm (in)	
Crankshaft oil clearance	
STD	0.010 — 0.030 (0.0004 — 0.0012)
Limit	0.040 (0.0016)

21.Intake and Exhaust Valve

A: SPECIFICATIONS

For operations related to intake and exhaust valve, refer to “19. Cylinder Head.” <Ref. to ME(H4DOTC)-65, REMOVAL, Cylinder Head Assembly.> and <Ref. to ME(H4DOTC)-65, REMOVAL, Cylinder Head Assembly.>

22.Piston

A: SPECIFICATIONS

For operations related to piston, refer to “20. Cylinder Block.” <Ref. to ME(H4DOTC)-72, REMOVAL, Cylinder Block.> and <Ref. to ME(H4DOTC)-72, REMOVAL, Cylinder Block.>

23.Connecting Rod

A: SPECIFICATIONS

For operations related to connecting rod, refer to “20. Cylinder Block.” <Ref. to ME(H4DOTC)-72, REMOVAL, Cylinder Block.> and <Ref. to ME(H4DOTC)-72, REMOVAL, Cylinder Block.>

24.Crankshaft

A: SPECIFICATIONS

For operations related to crankshaft, refer to “20. Cylinder Block.” <Ref. to ME(H4DOTC)-96, SPECIFICATIONS, Crankshaft.> and <Ref. to ME(H4DOTC)-72, REMOVAL, Cylinder Block.>

25.Engine Trouble in General

A: INSPECTION

NOTE:
"RANK" shown in the chart refers 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(H4DOTC)-2, Basic Diagnostic Procedure.>		A
	Fuel line	Defective fuel pump and relay	A
		Lack of or insufficient fuel	B
	Timing 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(H4DOTC)-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
	Timing 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

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
4) Engine stalls after initial combustion.	Engine control system <Ref. to EN(H4DOTC)-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
	Timing 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(H4DOTC)-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
	Timing 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

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
3. Low output, hesitation and poor acceleration	Engine control system <Ref. to EN(H4DOTC)-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
	Timing 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(H4DOTC)-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
	Timing 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

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
5. Engine does not return to idle.	Engine control system <Ref. to EN(H4DOTC)-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(H4DOTC)-2, Basic Diagnostic Procedure.>		A
	Cooling system	Overheating	B
	Others	Malfunction of evaporative emission control system	B
7. Afterburning in exhaust system	Engine control system <Ref. to EN(H4DOTC)-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
	Timing 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(H4DOTC)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened oil filler cap	B
	Timing 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 o-ring	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

TROUBLE	PROBLEM PARTS, ETC.	POSSIBLE CAUSE	RANK
10. Excessive fuel consumption	Engine control system <Ref. to EN(H4DOTC)-2, Basic Diagnostic Procedure.>		A
	Intake system	Dirty air cleaner element	A
	Timing 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

26.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 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 sprocket • Worn camshaft journal bore in cylinder head assembly
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 noise	—	• Incorrect valve clearance

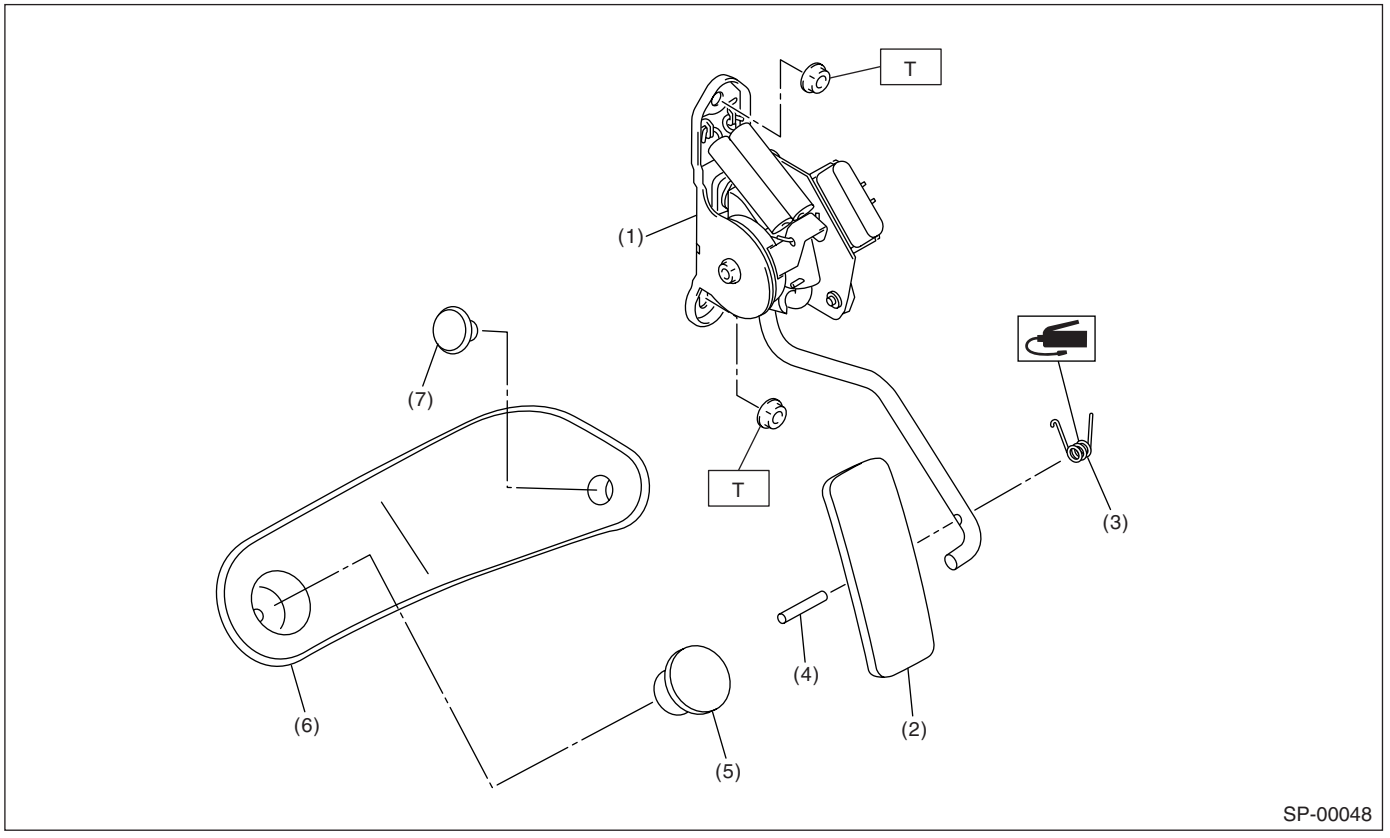
NOTE*:
When disconnecting the fuel injector connector, Malfunction Indicator Light illuminates and DTC is stored in ECM memory.
Therefore, carry out the CLEAR MEMORY MODE <Ref. to EN(H4DOTC)-52, Clear Memory Mode.> and INSPECTION MODE <Ref. to EN(H4DOTC)-39, Inspection Mode.> after connecting the fuel injector connector.

1. General Description

A: SPECIFICATION

Accelerator pedal	Stroke	At pedal pad	50 — 55 mm (1.97 — 2.17 in)

B: COMPONENT



(1) Accelerator pedal ASSY
(2) Accelerator pedal
(3) Accelerator pedal spring
(4) Spring pin
(5) Accelerator stopper
(6) Accelerator plate
(7) Clip

Tightening torque: N·m (kgf-m, ft-lb)
T: 18 (1.8, 13.0)

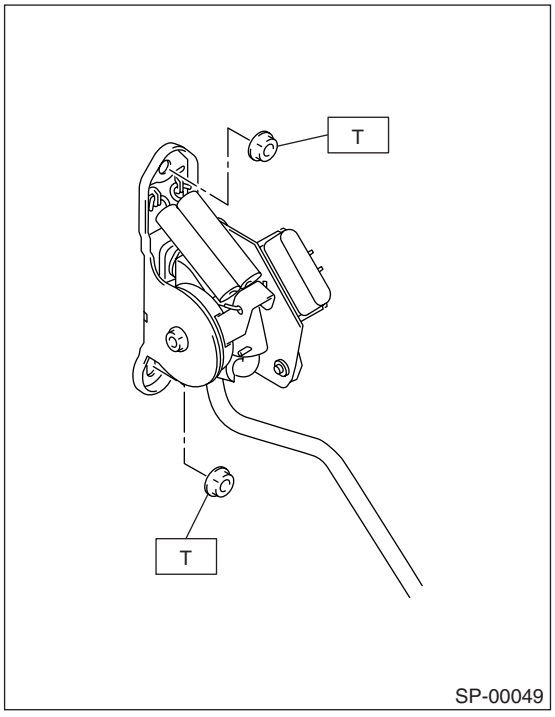
C: CAUTION

• 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 ground cable from battery.
2) Disconnect the connector.
3) Remove the nuts which securing accelerator pedal assembly.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)

C: DISASSEMBLY

NOTE:
Accelerator pedal for model with electronic throttle control system cannot be disassembled.

MEMO:

1. General Description

A: SPECIFICATION

Specifications for Turbo model are included in SC (H4SO) section. <Ref. to SC(H4SO)-2, General Description.>