1. General Description

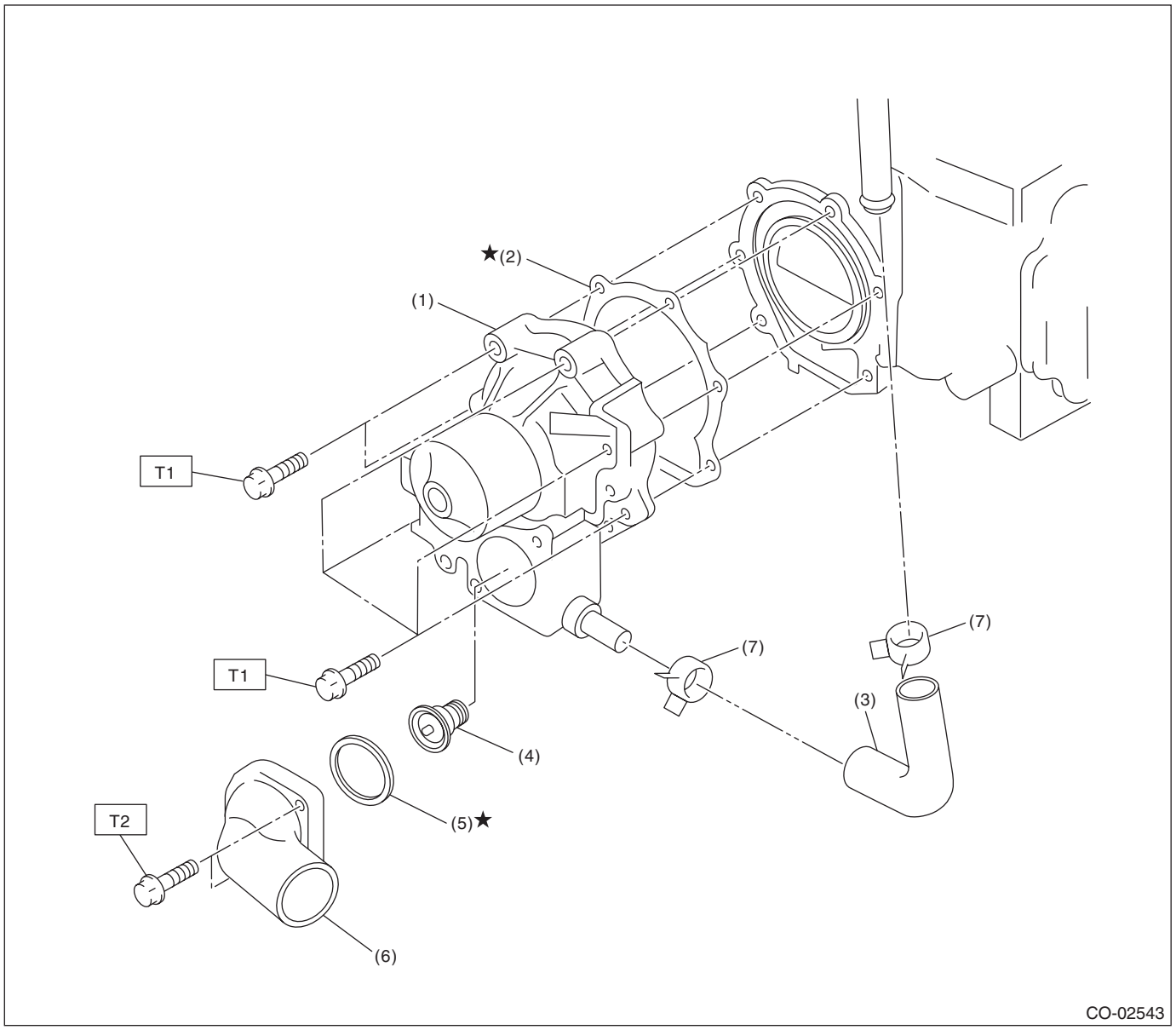
A: SPECIFICATION

Cooling system				Electric fan + Forced engine coolant circulation system
Total engine coolant capacity			ℓ (US qt, Imp qt)	AT model: Approx. 6.7 (7.1, 5.9) MT model: Approx. 6.8 (7.2, 6.0)
Water pump	Type			Centrifugal impeller type
	Discharge performance I	Discharge rate	ℓ (US gal, Imp gal) /min.	20 (5.3, 4.4)
		Pump speed — Discharge pressure		760 rpm — 2.9 kPa (0.3 mAq)
		Engine coolant temperature		80°C (176°F)
	Discharge performance II	Discharge rate	ℓ (US gal, Imp gal) /min.	100 (26.4, 22.0)
		Pump speed — Discharge pressure		3,000 rpm — 49 kPa (5.0 mAq)
		Engine coolant temperature		80°C (176°F)
	Discharge performance III	Discharge rate	ℓ (US gal, Imp gal) /min.	200 (52.8, 44.0)
		Pump speed — Discharge pressure		6,000 rpm — 225.4 kPa (23 mAq)
		Engine coolant temperature		80°C (176°F)
	Impeller diameter		mm (in)	76 (2.99)
	Number of impeller vanes			8
	Pump pulley diameter		mm (in)	60 (2.36)
	Clearance between impeller and case	Standard	mm (in)	0.5 — 1.5 (0.020 — 0.060)
Thermostat	Type			Wax pellet type
	Starting temperature to open			80 — 84°C (176 — 183°F)
	Fully opens			95°C (203°F)
	Valve lift		mm (in)	9.0 (0.354) or more
	Valve bore		mm (in)	35 (1.38)
Radiator fan	Motor input	Main fan		90 W
		Sub fan		90 W
	Fan diameter/ Blade	Main fan		300 mm (11.81 in)/4
		Sub fan		300 mm (11.81 in)/5
Radiator	Type			Down flow, pressure type
	Core dimensions	Width × Height × Thickness	mm (in)	687.4 × 340 × 16 (27.06 × 13.39 × 0.63)
	Pressure range in which cap valve is open		kPa (kg/cm^2, psi)	Above: 108±14.7 (1.1±0.15, 16±2.1) Below: –1.0 — –4.9 (–0.01 — –0.05, –0.1 — –0.7)
	Fins			Corrugated fin type
Reservoir tank	Capacity		ℓ (US qt, Imp qt)	0.45 (0.48, 0.40)

	Recommended materials	Item number	Alternative
Coolant	SUBARU SUPER COOLANT (Concentrated type)	—	—
	SUBARU SUPER COOLANT (Diluted type)	K0670Y0001	
Water for dilution	Distilled water	—	Soft water or tap water
Cooling system protective agent	Cooling system conditioner	SOA345001	—

B: COMPONENT

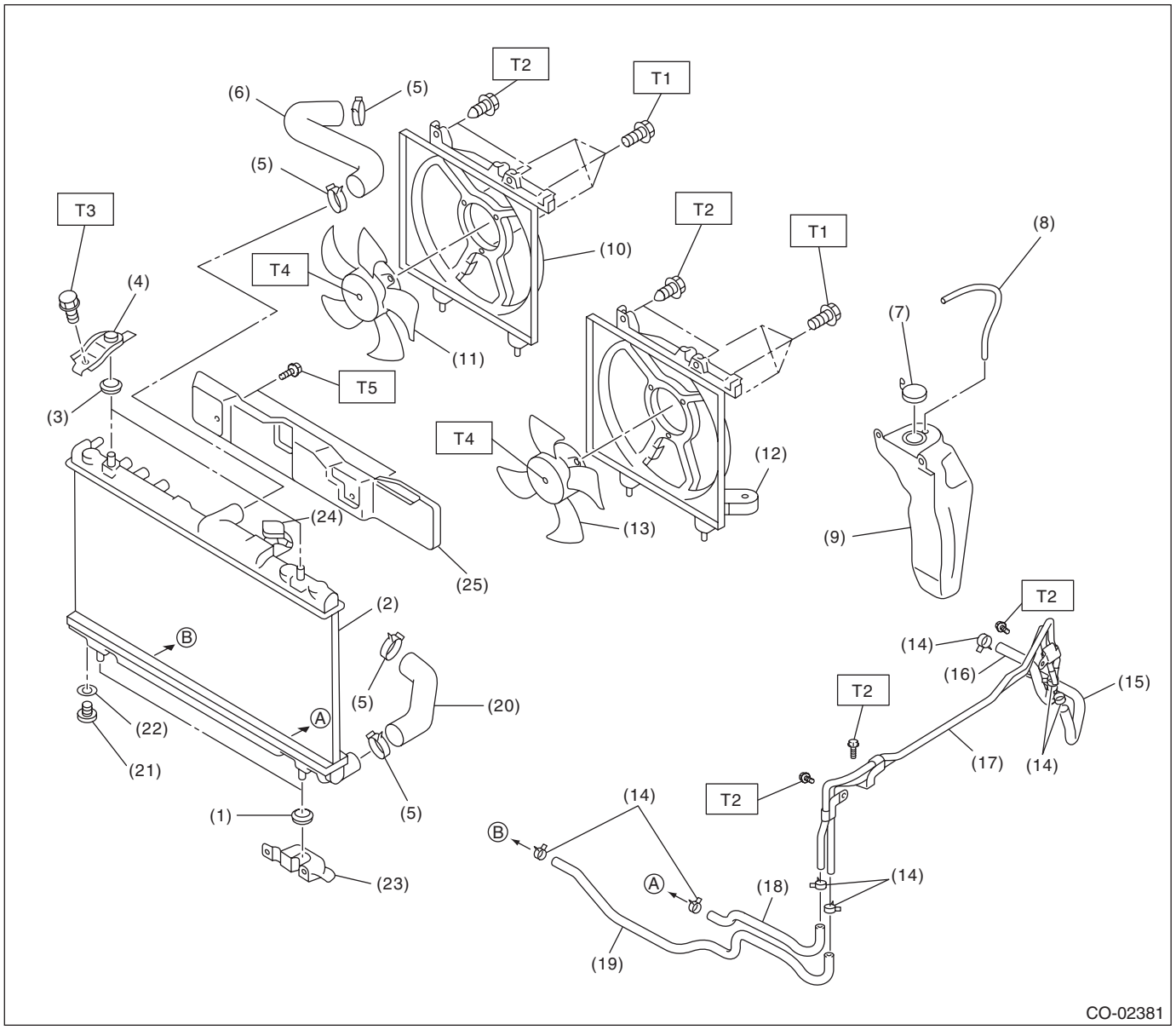
1. WATER PUMP



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

Tightening torque:N·m (kgf-m, ft-lb)
T1: First 12 (1.2, 8.9)
Second 12 (1.2, 8.9)
T2: 12 (1.2, 8.9)

2. RADIATOR & RADIATOR FAN



(1)	Radiator lower cushion	(12)	Radiator main fan shroud	(23)	Radiator lower bracket
(2)	Radiator	(13)	Radiator main fan, main fan motor ASSY	(24)	Radiator cap
(3)	Radiator upper cushion	(14)	ATF hose clip (AT model)	(25)	Heat shield cover (AT model)
(4)	Radiator upper bracket	(15)	ATF hose A (AT model)		
(5)	Clip	(16)	ATF hose B (AT model)		
(6)	Radiator inlet hose	(17)	ATF pipe (AT model)		
(7)	Engine coolant reservoir tank cap	(18)	ATF hose C (AT model)		
(8)	Over flow hose	(19)	ATF hose D (AT model)		
(9)	Engine coolant reservoir tank	(20)	Radiator outlet hose		
(10)	Radiator sub fan shroud	(21)	Radiator drain plug		
(11)	Radiator sub fan, sub fan motor ASSY	(22)	O-ring		

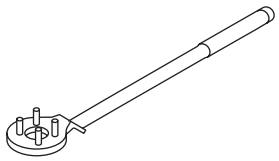
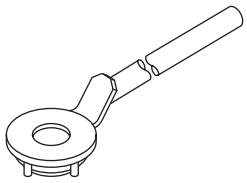
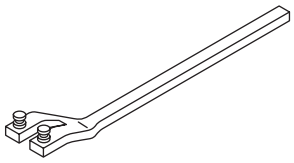
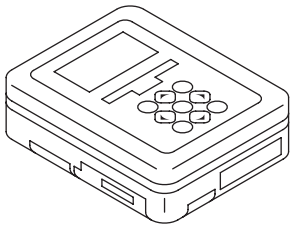
Tightening torque:N·m (kgf-m, ft-lb)
T1: 5 (0.5, 3.7)
T2: 7.5 (0.8, 5.5)
T3: 12 (1.2, 8.9)
T4: 3.4 (0.3, 2.5)
T5: 3 (0.3, 2.2)

C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• 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.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
• Prepare a container and cloth to prevent scattering of engine coolant when performing work where engine coolant can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
• Follow all government and local regulations concerning disposal of refuse when disposing engine coolant.

D: PREPARATION TOOL

1. SPECIAL TOOL

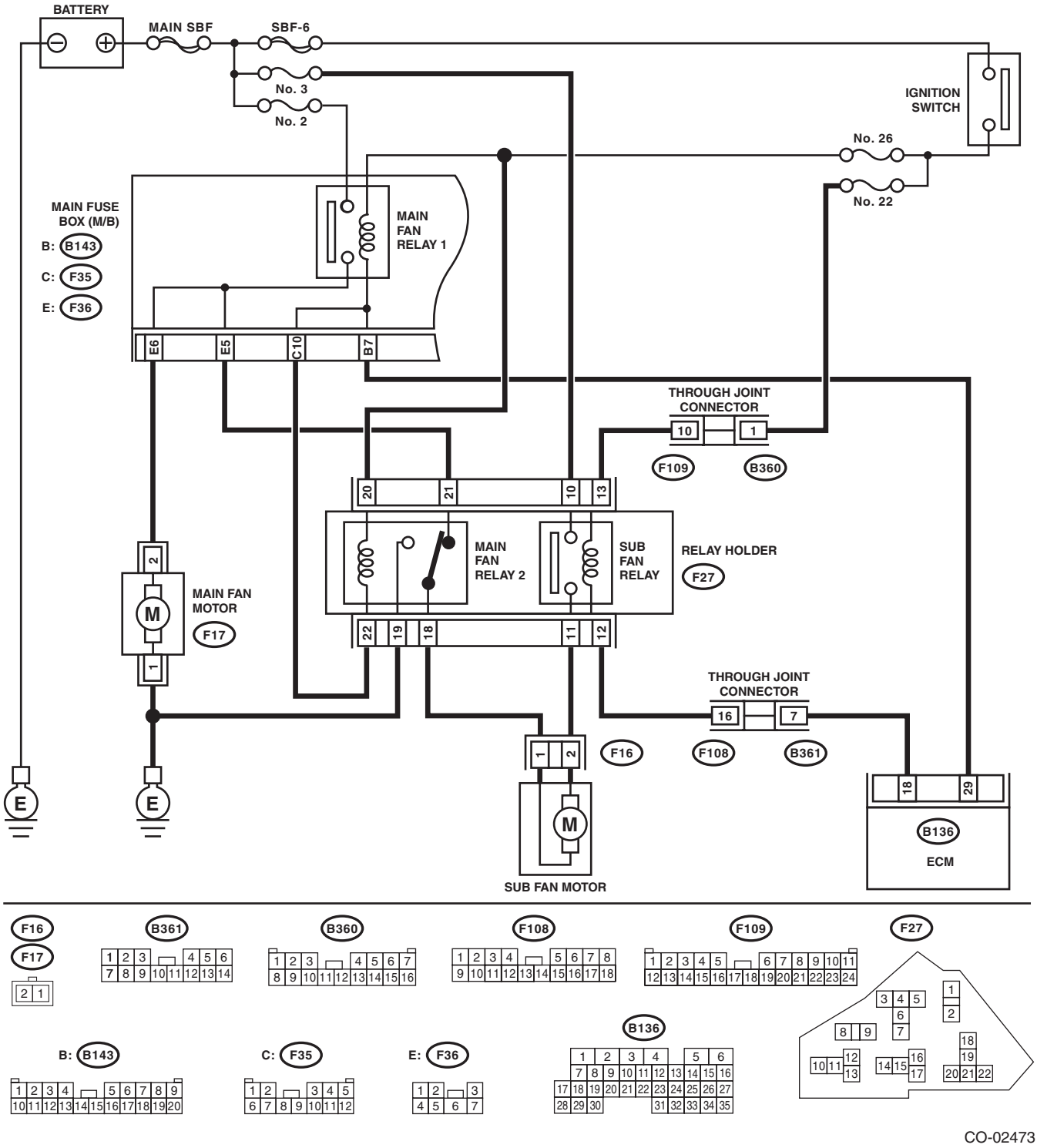
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (MT model)
 ST-499977400	499977400	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (AT model)
 ST18231AA010	18231AA010	CAM SPROCKET WRENCH	• Used for removing and installing cam sprocket. • CAM SPROCKET WRENCH (499207100) can also be used.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Radiator cap tester	Used for checking radiator and radiator cap.

2. Radiator Fan System

A: WIRING DIAGRAM



CO-02473

B: INSPECTION

OPERATING CONDITION:

Vehicle speed	A/C compressor load	Engine coolant temperature		
		Increase: 95°C (203°F) or less Decrease: 92°C (198°F) or less	Increase: 96 — 99°C (205 — 210°F) Decrease: 93 — 94°C (199 — 201°F)	Increase: 100°C (212°F) or more Decrease: 95°C (203°F) or more
		Radiator fan operation	Radiator fan operation	Radiator fan operation
During acceleration: 19 km/h (12 MPH) or less During deceleration: 10 km/h (6 MPH) or less	OFF	OFF	Low-Speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 20 — 69 km/h (12 — 43 MPH) During deceleration: 11 — 64 km/h (7 — 40 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 70 — 134 km/h (43 — 83 MPH) During deceleration: 65 — 129 km/h (40 — 80 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	Low-Speed	High-Speed	High-Speed
During acceleration: 135 km/h (84 MPH) or more During deceleration: 130 km/h (81 MPH) or more	OFF	OFF	OFF	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	OFF	Low-Speed	High-Speed

DIAGNOSIS:

Radiator main fan and radiator sub fans do not rotate under the above operating conditions.

	Step	Check	Yes	No
1	**CHECK OPERATION OF RADIATOR FAN.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Using the Subaru Select Monitor, check the forced operation of the radiator fan relay. NOTE: • When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor Refer to “Compulsory Valve Operation Check Mode” for detailed procedures. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Do the radiator main fans and radiator sub fans rotate at low speed?	Go to step **2**.	Go to step **3**.

Step		Check	Yes	No
2	**CHECK OPERATION OF RADIATOR FAN.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Using the Subaru Select Monitor, check the forced operation of the radiator fan relay. NOTE: • When performing a forced operation radiator fan relay check using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order. • Subaru Select Monitor Refer to "Compulsory Valve Operation Check Mode" for detailed procedures. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Do the radiator main fans and radiator sub fans rotate at high speed?	Radiator main fan system is normal.	Go to step **27**.
3	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the sub fan relay from the relay holder. 3) Measure the voltage between the sub fan relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 10 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Go to step **5**.
4	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between the sub fan relay terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **7**.	Go to step **6**.
5	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 3. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
6	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 22. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
7	**CHECK SUB FAN RELAY.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between sub fan relay terminals. ***Terminals*** ***No. 10 — No. 11:***	Is the resistance 1 MΩ or more?	Go to step **8**.	Replace the sub fan relay. <Ref. to AC-39, Relay and Fuse.>
8	**CHECK SUB FAN RELAY.** 1) Connect the battery to terminals No. 13 and No. 12 of the sub fan relay. 2) Measure the resistance between sub fan relay terminals. ***Terminals*** ***No. 10 — No. 11:***	Is the resistance less than 1 Ω?	Go to step **9**.	Replace the sub fan relay. <Ref. to AC-39, Relay and Fuse.>

	Step	Check	Yes	No
9	**CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR ASSEMBLY CONNECTOR.** 1) Disconnect the connector from the sub fan motor assembly. 2) Measure the resistance of harness between the sub fan relay terminal and sub fan motor assembly connector. ***Connector & terminal*** ***(F16) No. 2 — (F27) No. 11:***	Is the resistance less than 1 Ω?	Go to step **10**.	Repair the open circuit of harness between the sub fan relay terminal and sub fan motor assembly connector.
10	**CHECK HARNESS BETWEEN SUB FAN MOTOR ASSEMBLY CONNECTOR AND MAIN FAN RELAY 2 CONNECTOR.** 1) Remove main fan relay 2 from the relay holder. 2) Measure the resistance of harness between sub fan motor assembly connector and main fan relay 2 connector. ***Connector & terminal*** ***(F16) No. 1 — (F27) No. 18:***	Is the resistance less than 1 Ω?	Go to step **11**.	Repair the open circuit of harness between sub fan motor assembly connector and main fan relay 2 connector.
11	**CHECK POOR CONTACT.** Check poor contact of sub fan motor assembly connector.	Is there poor contact of sub fan motor assembly connector?	Repair the poor contact of sub fan motor assembly connector.	Go to step **12**.
12	**CHECK SUB FAN MOTOR ASSEMBLY.** Connect the battery positive (+) terminal to terminal No. 2 of the sub fan motor assembly, and the ground (–) terminal to terminal No. 1.	Does the radiator sub fan rotate?	Go to step **13**.	Replace the sub fan motor assembly. <Ref. to CO(H4SO)-25, Radiator Sub Fan and Fan Motor.>
13	**CHECK MAIN FAN RELAY 2.** Measure the resistance of main fan relay 2. ***Terminals*** ***No. 21 — No. 18:***	Is the resistance less than 1 Ω?	Go to step **14**.	Replace the main fan relay 2. <Ref. to AC-39, Relay and Fuse.>
14	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND MAIN FAN MOTOR ASSEMBLY CONNECTOR.** 1) Disconnect the connector from the main fan motor assembly. 2) Measure the resistance of harness between the main fan relay 2 terminal and main fan motor assembly connector. ***Connector & terminal*** ***(F17) No. 2 — (F27) No. 21:***	Is the resistance less than 1 Ω?	Go to step **15**.	Repair the open circuit of harness between the main fan relay 2 terminal and main fan motor assembly connector.
15	**CHECK MAIN FAN MOTOR ASSEMBLY AND GROUND CIRCUIT.** Measure the resistance between the main fan motor assembly connector and chassis ground. ***Connector & terminal*** ***(F17) No. 1 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **16**.	Repair the open circuit of harness between main fan motor assembly connector and chassis ground.
16	**CHECK POOR CONTACT.** Check poor contact of main fan motor assembly connector.	Is there poor contact of main fan motor assembly connector?	Repair the poor contact of main fan motor assembly connector.	Go to step **17**.

	Step	Check	Yes	No
17	**CHECK MAIN FAN MOTOR ASSEMBLY.** Connect the battery positive (+) terminal to terminal No. 2 of the main fan motor assembly, and the ground (–) terminal to terminal No. 1.	Does the radiator main fan rotate?	Go to step **18**.	Replace the main fan motor assembly. <Ref. to CO(H4SO)-23, Radiator Main Fan and Fan Motor.>
18	**CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.** 1) Disconnect the connectors from ECM. 2) Measure the resistance between the sub fan relay terminal and ECM connector. ***Connector & terminal*** ***(B136) No. 18 — (F27) No. 12:***	Is the resistance less than 1 Ω?	Go to step **19**.	Repair the open circuit of harness between sub fan relay terminal and ECM.
19	**CHECK POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Check the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-43, Read Diagnostic Trouble Code (DTC).>
20	**CHECK MAIN FAN RELAY 1.** 1) Turn the ignition switch to OFF. 2) Remove main fan relay 1 from the main fuse box. 3) Measure the resistance at the main fan relay 1 switch.	Is the resistance 1 MΩ or more?	Go to step **21**.	Replace the main fan relay 1. <Ref. to AC-39, Relay and Fuse.>
21	**CHECK MAIN FAN RELAY 1.** 1) Connect the main fan relay 1 coil side terminal to the battery. 2) Measure the resistance between terminals at main fan relay 1 switch side.	Is the resistance less than 1 Ω?	Go to step **22**.	Replace the main fan relay 1. <Ref. to AC-39, Relay and Fuse.>
22	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND MAIN FAN MOTOR ASSEMBLY CONNECTOR.** 1) Disconnect the connector from the main fan motor assembly. 2) Measure the resistance of harness between the main fan relay 1 terminal and main fan motor assembly connector. ***Connector & terminal*** ***(F17) No. 2 — (F36) No. 6:***	Is the resistance less than 1 Ω?	Go to step **23**.	Repair the open circuit of harness between the main fan relay 1 terminal and main fan motor assembly connector.
23	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND ECM.** 1) Disconnect the connectors from ECM. 2) Measure the resistance between the main fan relay 1 terminal and ECM connector. ***Connector & terminal*** ***(B136) No. 29 — (B143) No. 7:***	Is the resistance less than 1 Ω?	Go to step **24**.	Repair the open circuit of the harness between main fan relay 1 terminal and ECM.
24	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM.** Measure the resistance between the main fan relay 2 terminal and ECM connector. ***Connector & terminal*** ***(B136) No. 29 — (F27) No. 22:***	Is the resistance less than 1 Ω?	Go to step **25**.	Repair the open circuit of the harness between main fan relay 2 terminal and ECM.
25	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 2 and 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step **26**.

	Step	Check	Yes	No
26	**CHECK POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Repair the power supply circuit to the main fuse box.
27	**CHECK OPERATION OF RADIATOR FAN.** If the both radiator fans do not rotate at high speed in the condition of step 2, check whether the radiator sub fan is rotating.	Does the radiator sub fan rotate?	Go to step **20**.	Go to step **28**.
28	**CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2.** 1) Remove the main fan relay 2 from A/C relay holder. 2) Measure the resistance between main fan relay 2 terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 19 — Chassis ground:***	Is the resistance less than 1 Ω?	Go to step **29**.	Repair the open circuit of harness between main fan relay 2 and chassis ground.
29	**CHECK POWER SUPPLY TO MAIN FAN RELAY 2.** 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay 2 terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 20 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **30**.	Repair the power supply line.
30	**CHECK MAIN FAN RELAY 2.** 1) Turn the ignition switch to OFF. 2) Remove the main fan relay 2. 3) Measure the resistance of main fan relay 2. ***Terminals*** ***(F27) No. 18 — (F27) No. 19:***	Is the resistance 1 MΩ or more?	Go to step **31**.	Replace the main fan relay 2. <Ref. to AC-39, Relay and Fuse.>
31	**CHECK MAIN FAN RELAY 2.** 1) Connect the battery to terminals No. 20 and No. 22 of the main fan relay 2. 2) Measure the resistance of main fan relay 2. ***Terminals*** ***(F27) No. 18 — (F27) No. 19:***	Is the resistance less than 1 Ω?	Go to step **23**.	Replace the main fan relay 2. <Ref. to AC-39, Relay and Fuse.>

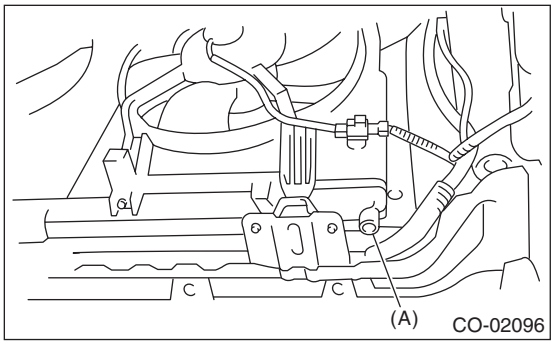
3. Engine Coolant

A: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

1) Set the vehicle on a lift.
2) Lift up the vehicle.
3) Remove the under cover RH.
4) Remove the drain plug (A) to drain engine coolant into container.

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



5) Install the drain plug.
6) Install the under cover RH.

2. FILLING OF ENGINE COOLANT

1) Pour cooling system conditioner through the filler neck.

Cooling system protective agent:
Refer to "SPECIFICATION" for cooling system protective agent. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>

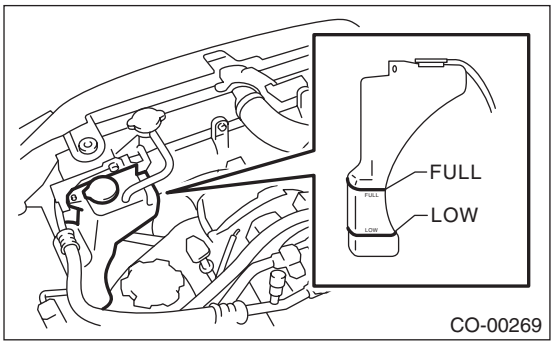
2) Pour engine coolant into the radiator up to the filler neck position.

Recommended engine coolant:
Refer to "SPECIFICATION" for recommended engine coolant. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>

Engine coolant level:
Refer to "SPECIFICATION" for engine coolant level. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>

Engine coolant concentration:
Refer to "ADJUSTMENT" for the recommended engine coolant concentration. <Ref. to CO(H4SO)-14, ADJUSTMENT, Engine Coolant.>

NOTE:
The SUBARU Super Coolant contains anti-freeze and anti-rust agents, and is especially made for Subaru engines with an aluminum cylinder block. Always use SUBARU Super Coolant, since other coolant may cause corrosion.
3) Fill engine coolant into the reservoir tank up to "FULL" level.



4) Close the radiator cap and start the engine. Race 5 to 6 times at 3,000 rpm or less, then stop the engine. (Complete this operation within 40 seconds.)
5) Wait for one minute after the engine stops, and open the radiator cap. If the engine coolant level drops, add engine coolant into radiator up to the filler neck position.
6) Perform the procedures 4) and 5) again.
7) Attach the radiator cap and reservoir tank cap properly.
8) Start the engine and operate the heater at maximum hot position and the blower speed setting to "LO".
9) Run the engine at 2,000 rpm or less until radiator fan starts and stops.

NOTE:
Be careful with the engine coolant temperature gauge to prevent overheating.
10) Stop the engine and wait until the engine coolant temperature drops to 30°C (86°F) or less.
11) Open the radiator cap. If the engine coolant level drops, add engine coolant into the radiator up to the filler neck position and the reservoir tank to "FULL" level.
12) Attach the radiator cap correctly.
13) Set the heater setting to maximum hot position and the blower speed setting to "LO" and start the engine. Perform racing at 3,000 rpm or less. If the flowing sound is heard from heater core at this time, perform the procedures from 9) again.

B: ADJUSTMENT

1. PROCEDURE TO ADJUST THE SUBARU SUPER COOLANT CONCENTRATION

CAUTION:
Use the SUBARU Super Coolant with a 50 — 60% concentration in order to obtain maximum anti-freeze and anti-rust performance.
To adjust the concentration of SUBARU Super Coolant according to temperature, find the proper SUBARU Super Coolant concentration in the table, and add dilution water to the SUBARU Super Coolant (concentrated type) until it reaches the proper dilution.

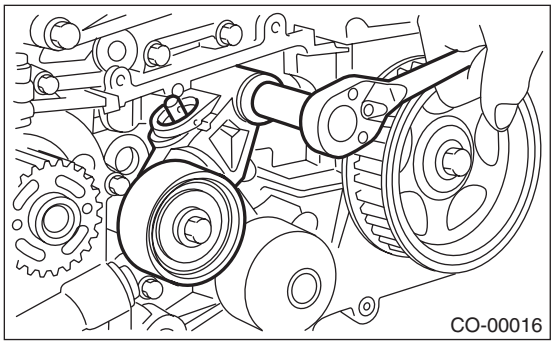
Relationship of SUBARU Super Coolant concentration and freezing temperature			
SUBARU Super Coolant concentration	50%	55%	60%
Freezing temperature	–36°C (–33°F)	–41°C (–42°F)	–50°C (–58°F)

Engine coolant and diluting water:
Refer to "SPECIFICATION" for recommended engine coolant and diluting water. <Ref. to CO(H4SO)-2, SPECIFICATION, General Description.>

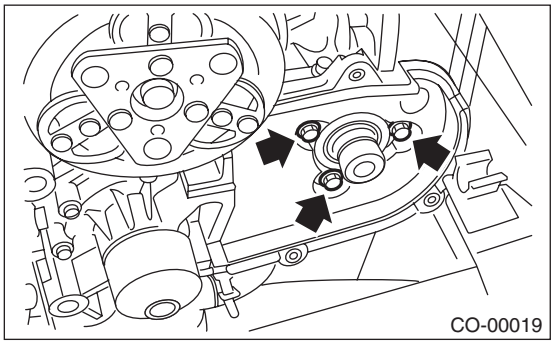
4. Water Pump

A: REMOVAL

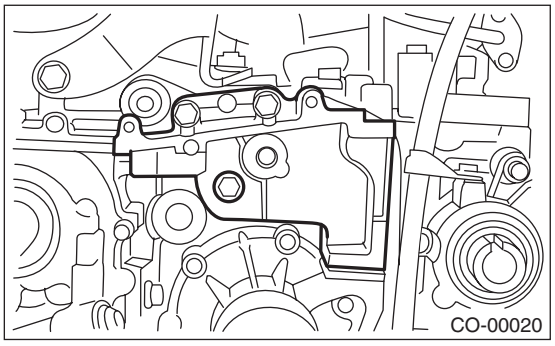
1) Remove the radiator. <Ref. to CO(H4SO)-19, REMOVAL, Radiator.>
2) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
3) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(H4SO)-49, TIMING BELT, REMOVAL, Timing Belt.>
6) Remove the automatic belt tension adjuster.


CO-00016

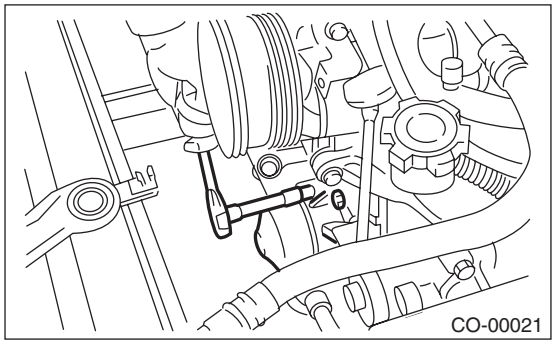
7) Remove the camshaft position sensor. <Ref. to FU(H4SO)-28, REMOVAL, Camshaft Position Sensor.>
8) Remove the cam sprocket LH. <Ref. to ME(H4SO)-54, REMOVAL, Cam Sprocket.>
9) Remove the belt cover LH No. 2.


CO-00019

10) Remove the tensioner bracket.


CO-00020

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

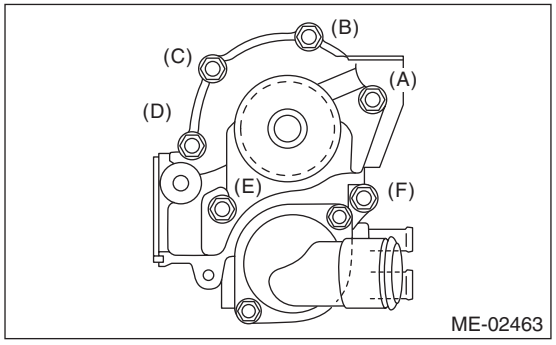

CO-00021

B: INSTALLATION

1) Install the water pump onto cylinder block LH.

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

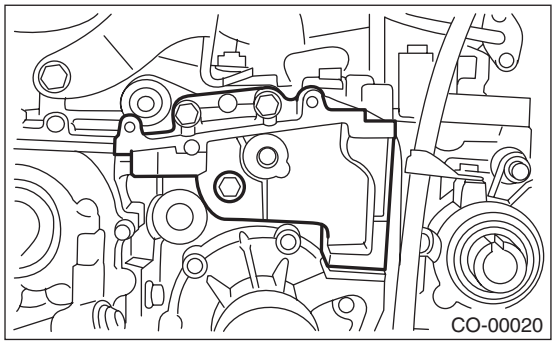
Tightening torque:
First
12 N·m (1.2 kgf-m, 8.9 ft-lb)
Second
12 N·m (1.2 kgf-m, 8.9 ft-lb)



ME-02463

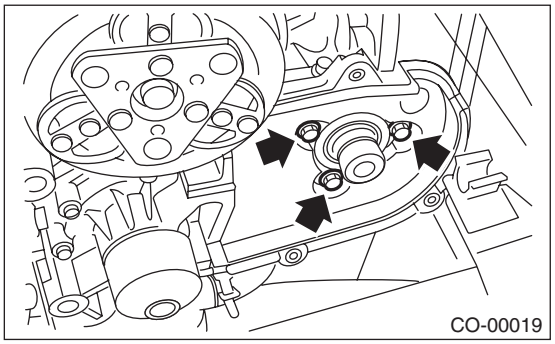
2) Install the hose to water pump.
3) Install the tensioner bracket.

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


CO-00020

4) Install the belt cover No. 2 LH.

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)

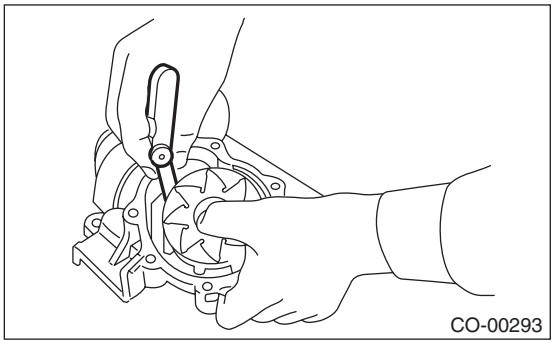


5) Install the cam sprocket LH. <Ref. to ME(H4SO)-54, INSTALLATION, Cam Sprocket.>
6) Install the camshaft position sensor. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.>
7) Install an automatic belt tension adjuster with the tension rod held by a pin. <Ref. to ME(H4SO)-50, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>
8) Install the timing belt. <Ref. to ME(H4SO)-51, TIMING BELT, INSTALLATION, Timing Belt.>
9) Install the timing belt cover. <Ref. to ME(H4SO)-48, INSTALLATION, Timing Belt Cover.>
10) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
11) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>
12) Install the radiator. <Ref. to CO(H4SO)-20, INSTALLATION, Radiator.>

C: INSPECTION

1) Check the water pump bearing for smooth rotation.
2) Check the water pump pulley for abnormalities.
3) Make sure the impeller is not deformed or damaged.
4) Inspect the clearance between impeller and pump case.

Clearance between impeller and pump case:
Standard
0.5 — 1.5 mm (0.020 — 0.060 in)

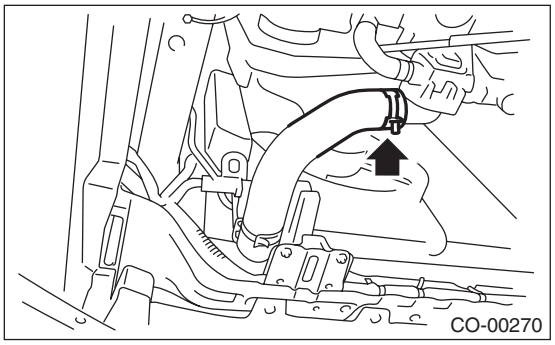


5) After water pump installation, check pulley shaft for engine coolant leaks or noise. If leaks or noise are noted, replace the water pump assembly.

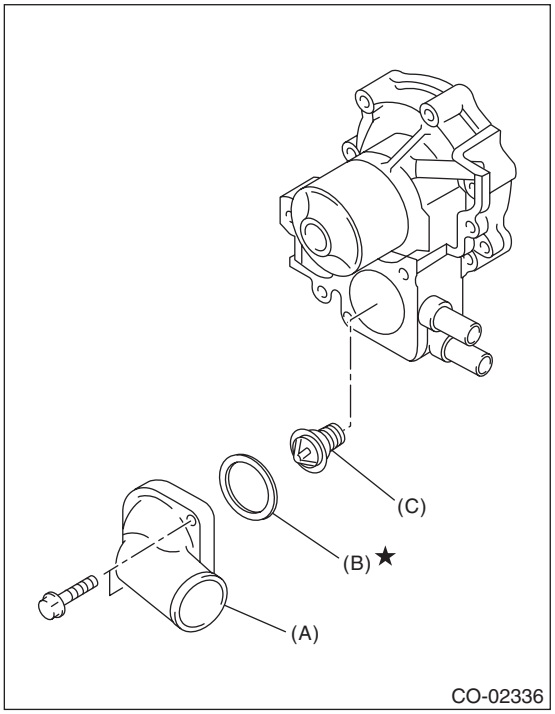
5. Thermostat

A: REMOVAL

1) Set the vehicle on a lift.
2) Lift up the vehicle.
3) Remove the under cover.
4) Drain the engine coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Remove the front exhaust pipe. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>
6) Disconnect the radiator outlet hose from thermostat cover.



7) Remove the thermostat cover, and then remove the gasket and thermostat.



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

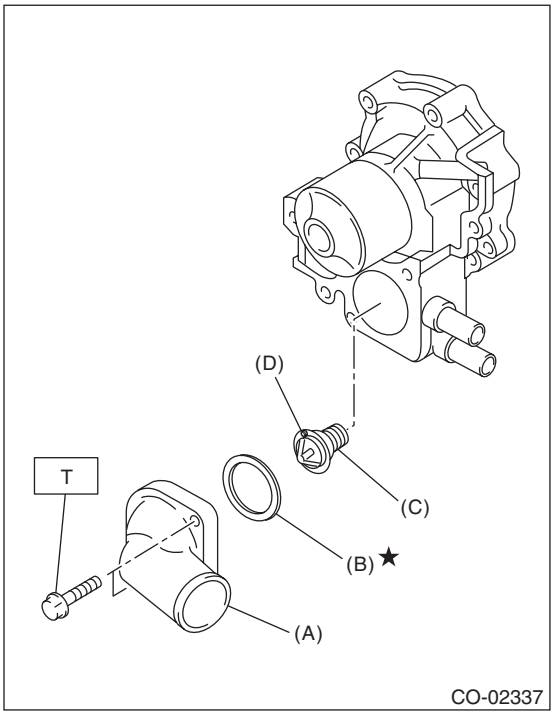
B: INSTALLATION

1) Install a gasket to thermostat.

NOTE:
Use a new gasket.
2) Install the thermostat and thermostat cover.

NOTE:
Install with the jiggle pin facing upward.

Tightening torque:
12 N·m (1.2 kgf-m, 8.9 ft-lb)



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

3) Connect the radiator outlet hose to thermostat cover.
4) Install the front exhaust pipe. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>
5) Install the under cover.
6) Lower the vehicle.
7) Fill engine coolant. <Ref. to CO(H4SO)-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.

- Inspection method

Immerse the thermostat and a 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 measured value should meet the specification.

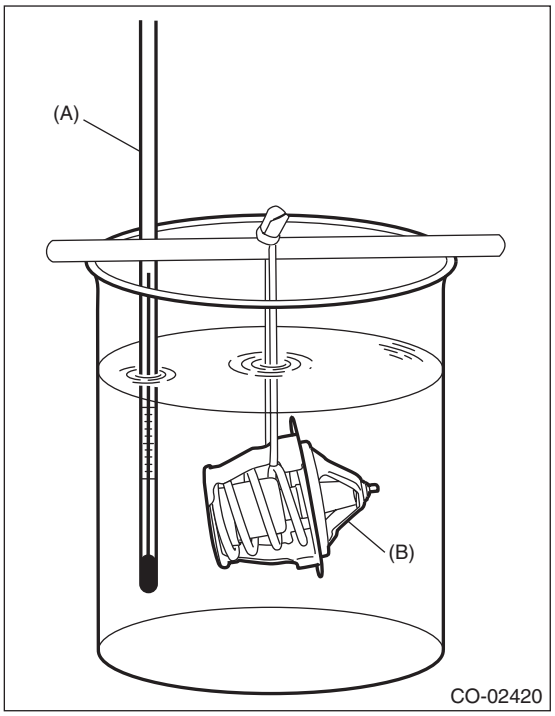
NOTE:

- Leave the thermostat in the boiling water for five minutes or more before measuring valve lift.
- Hold the thermostat with a wire or the like to avoid contacting the container.

Starting temperature to open:
80 — 84°C (176 — 183°F)

Full open temperature:
95°C (203°F)

Total valve lift:
9.0 mm (0.354 in) or more



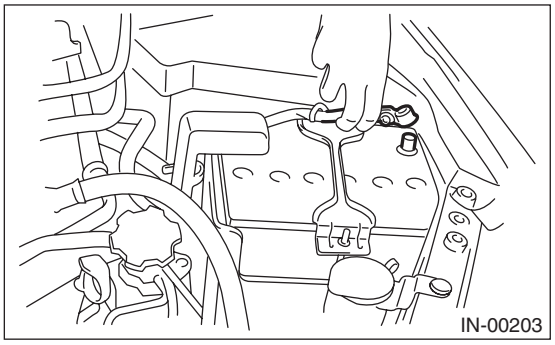
(A) Thermometer
(B) Thermostat

6. Radiator

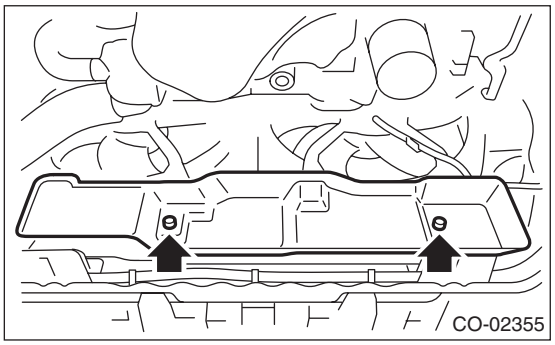
A: REMOVAL

CAUTION:
The radiator is pressurized when the engine and radiator are hot. Wait until engine and radiator cool down before working on the radiator.

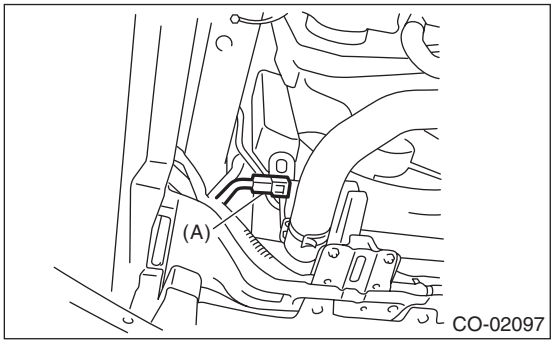
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.

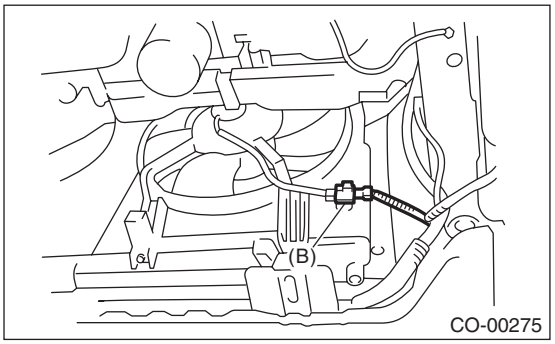


3) Lift up the vehicle.
4) Remove the under cover.
5) Remove the heat shield cover from radiator. (AT model)

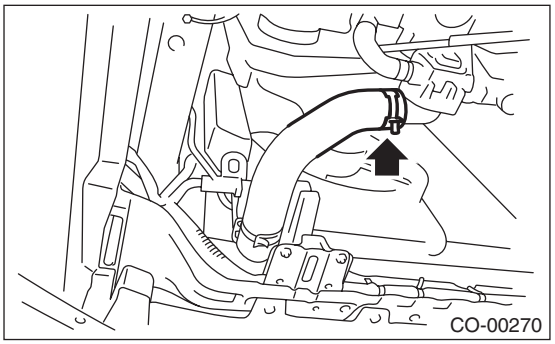


6) Drain the engine coolant.
<Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
7) Disconnect the main fan motor assembly connector (A) and sub fan motor assembly connector (B).



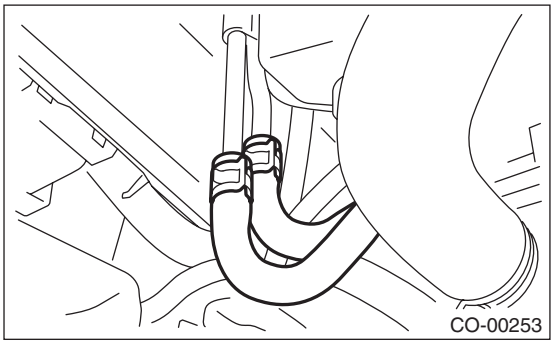


8) Disconnect the radiator outlet hose from thermostat cover.

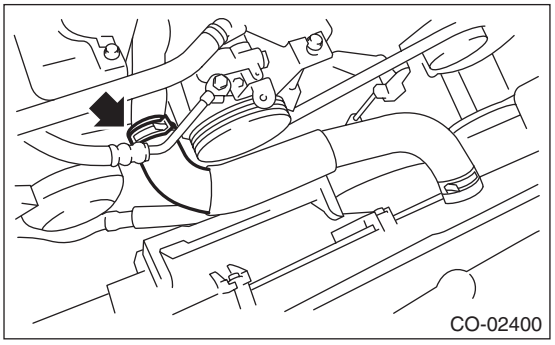


9) Disconnect the ATF cooler hoses from ATF pipes. (AT model)

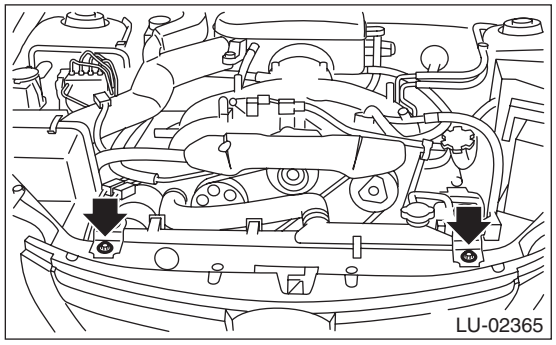
NOTE:
Plug the ATF pipe to prevent ATF from leaking.



10) Lower the vehicle.
11) Disconnect the over flow hose.
12) Remove the reservoir tank. <Ref. to CO(H4SO)-27, REMOVAL, Reservoir Tank.>
13) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
14) Disconnect the radiator inlet hose from engine.



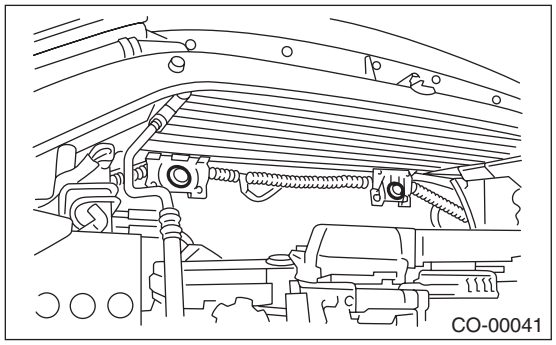
15) Remove the radiator upper brackets.



16) Lift the radiator up and remove the radiator from vehicle.

B: INSTALLATION

1) Attach the radiator lower cushion to the hole on the radiator lower bracket.

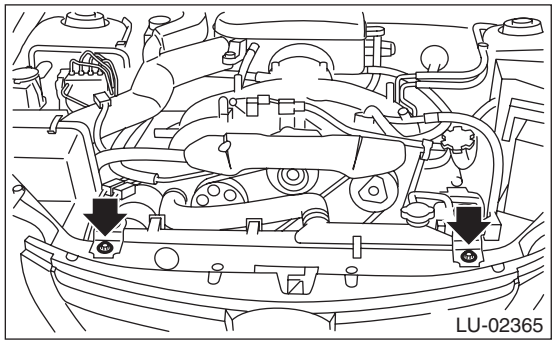


2) Install the radiator to vehicle.

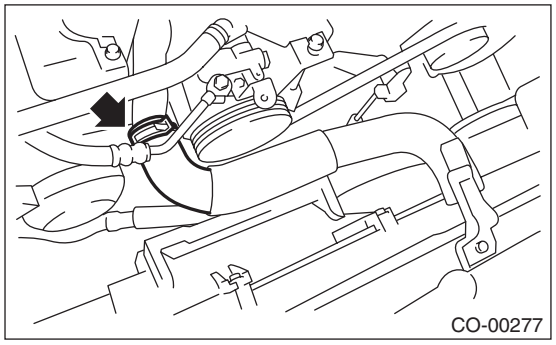
NOTE:
Make pins on the lower side of radiator be fitted into the radiator lower cushions.

3) Install the radiator upper brackets and tighten the bolts.

Tightening torque:
12 N·m (1.2 kgf-m, 8.9 ft-lb)



4) Connect the radiator inlet hose.



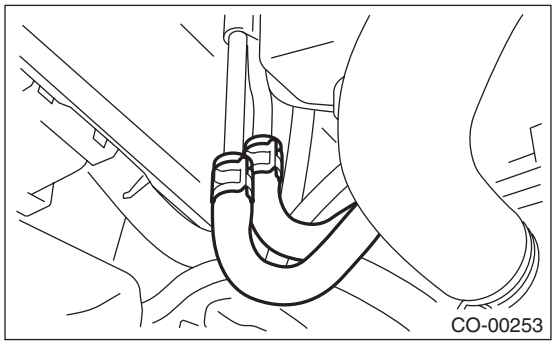
5) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>

6) Install the reservoir tank. <Ref. to CO(H4SO)-27, INSTALLATION, Reservoir Tank.>

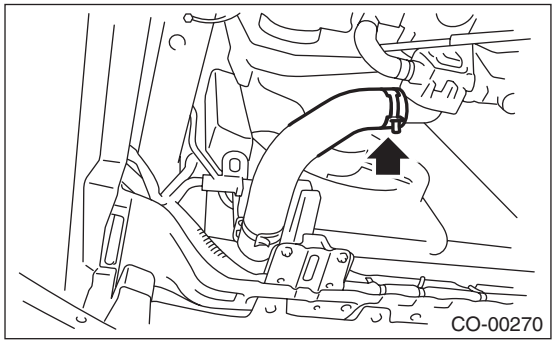
7) Connect the over flow hose.

8) Lift up the vehicle.

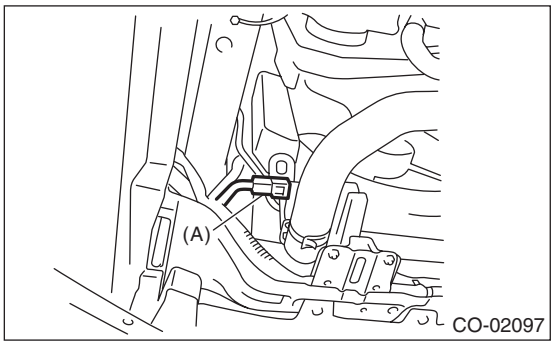
9) Connect the ATF cooler hoses. (AT model)

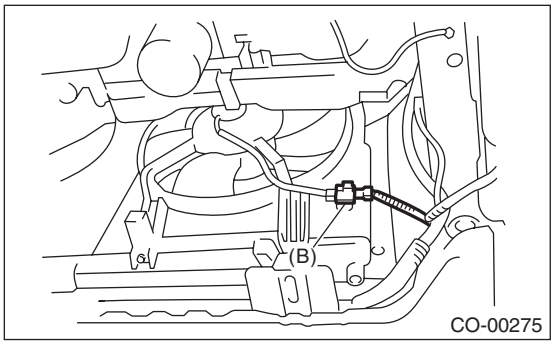


10) Connect the radiator outlet hose.



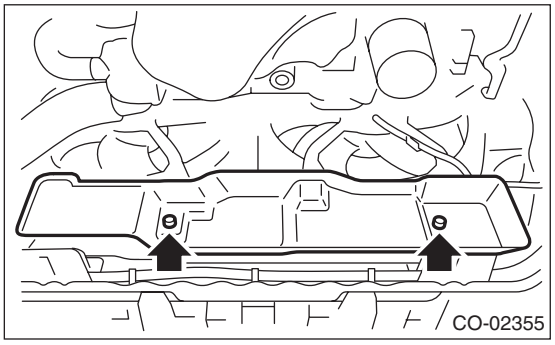
11) Connect the main fan motor assembly connector (A) and sub fan motor assembly connector (B).



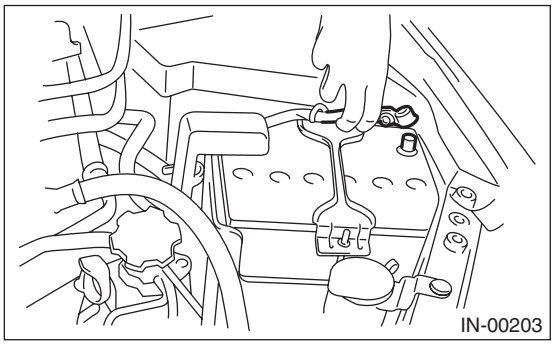


12) Install the heat shield cover. (AT model)

Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



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

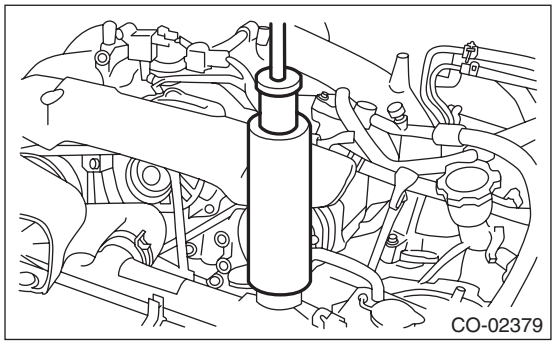


16) Fill engine coolant. <Ref. to CO(H4SO)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

17) Check the ATF level. (AT model) <Ref. to 4AT-26, INSPECTION, Automatic Transmission Fluid.>

C: INSPECTION

1) Remove the radiator cap, fill the radiator with engine coolant, and then install the tester to the installation position of cap.



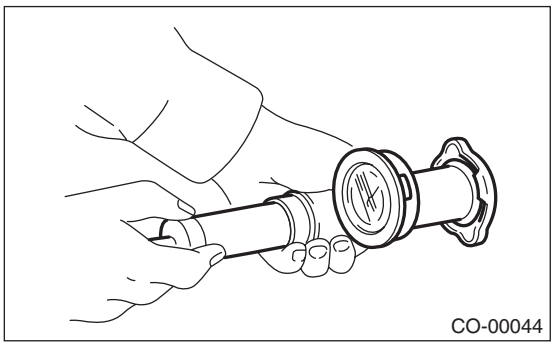
2) Apply a pressure of 157 kPa (1.6 kg/cm^2, 23 psi) to the radiator and check the following points:
- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

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

7. Radiator Cap

A: INSPECTION

1) Attach the radiator cap tester to radiator cap.



2) Increase pressure until the radiator cap tester gauge pointer stops. Radiator cap is functioning properly if it holds the service limit pressure for 5 — 6 seconds. Replace the cap if it is opened under a pressure less than the service limit value.

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

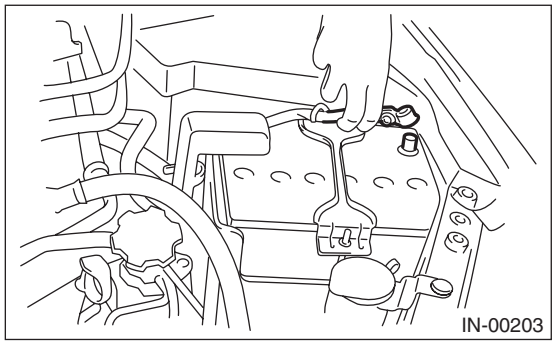
Service limit:
83 kPa (0.85 kg/cm^2, 12 psi)

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

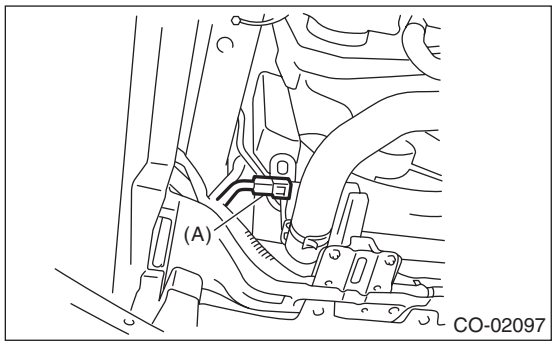
8. Radiator Main Fan and Fan Motor

A: REMOVAL

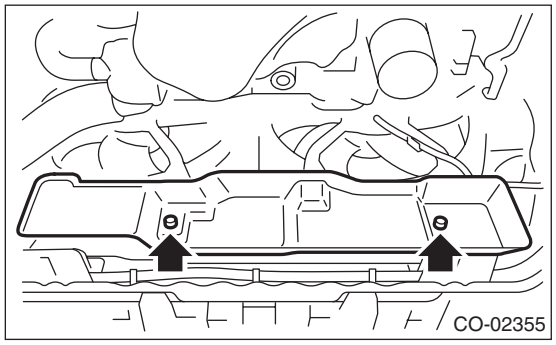
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.



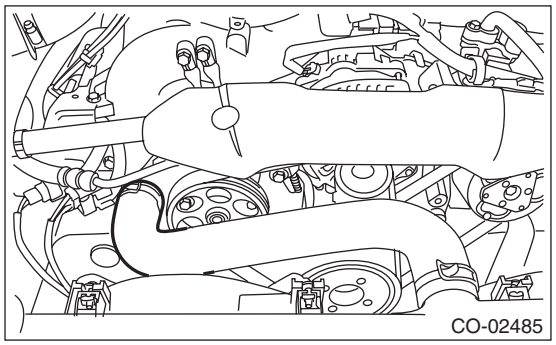
3) Lift up the vehicle.
4) Remove the under cover.
5) Disconnect the connector (A) of the main fan motor assembly.



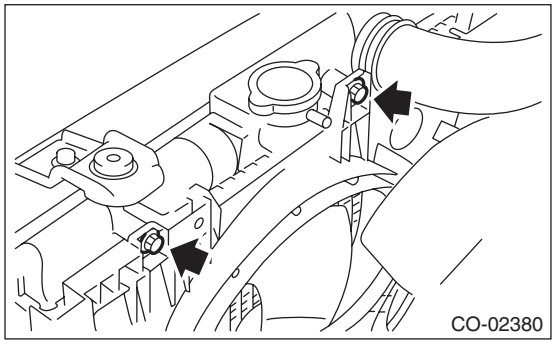
6) Remove the heat shield cover. (AT model)



7) Remove the ATF hose from the clip of the radiator main fan shroud. (AT model)
8) Lower the vehicle.
9) Drain approximately 2.0 ℓ of coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
10) Disconnect the radiator inlet hose from engine side.



11) Disconnect the over flow hose.
12) Remove the reservoir tank. <Ref. to CO(H4SO)-27, REMOVAL, Reservoir Tank.>
13) Remove the bolts which hold the radiator main fan shroud onto the radiator.



14) Remove the radiator main fan and fan motor.

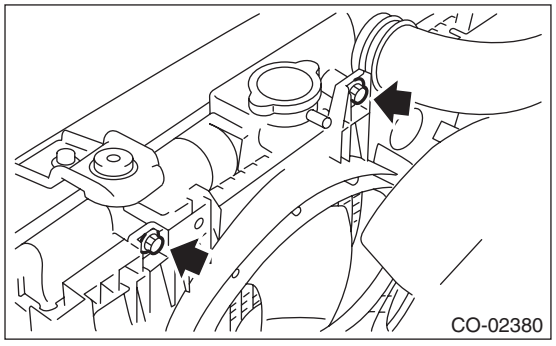
B: INSTALLATION

Install in the reverse order of removal.

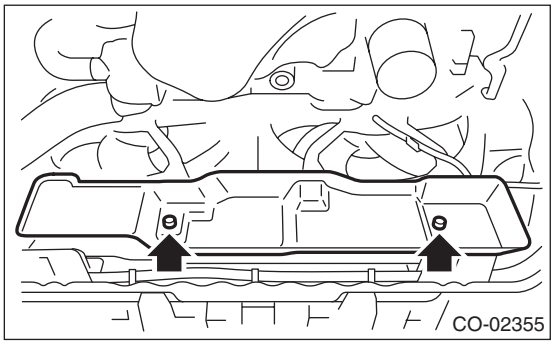
CAUTION:
Check if the radiator hose and the over flow hose are properly connected.

NOTE:
If the installation of the radiator main fan and fan motor is difficult, attempt installation after loosening the bolts which hold the radiator sub fan shroud to the radiator.

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

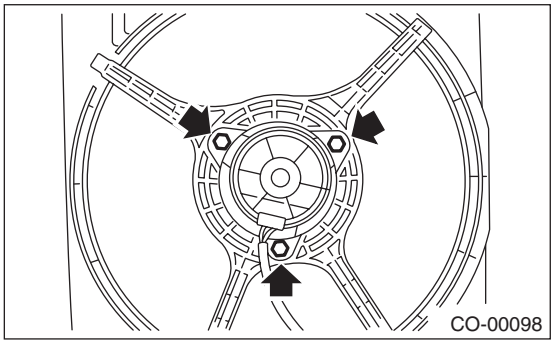


Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



C: DISASSEMBLY

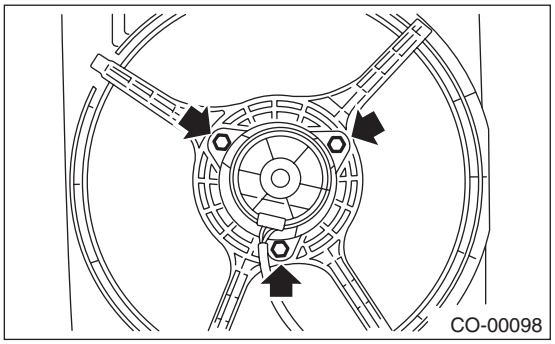
1) Remove the clip which holds the main fan motor assembly connector onto the radiator main fan shroud.
2) Remove the bolts which hold the main fan motor assembly onto the radiator main fan shroud.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

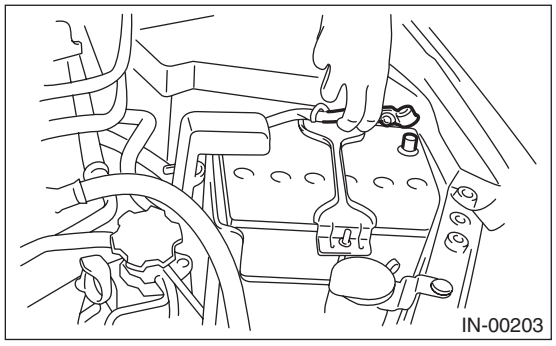
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



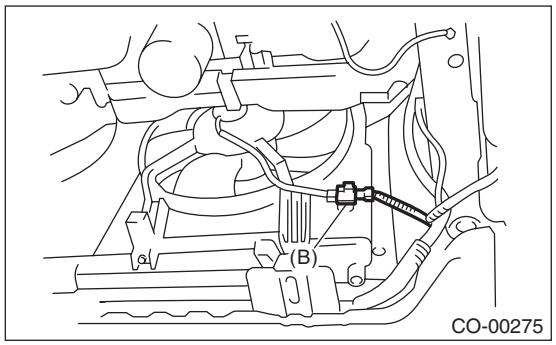
9. Radiator Sub Fan and Fan Motor

A: REMOVAL

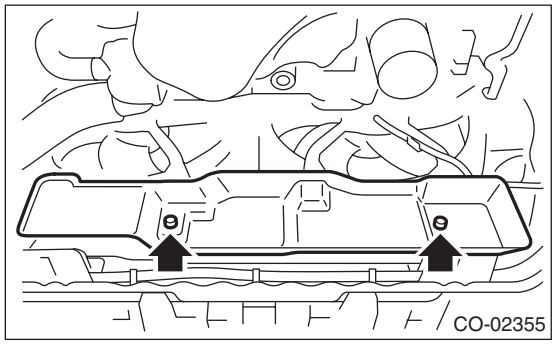
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.



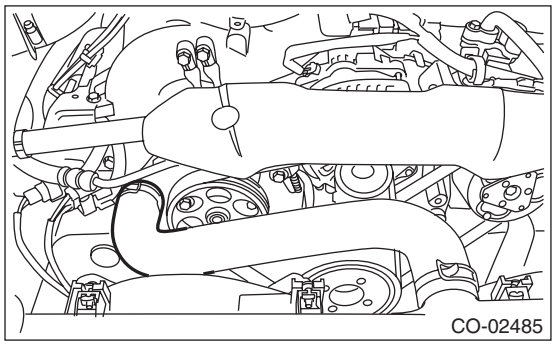
3) Lift up the vehicle.
4) Remove the under cover.
5) Remove the connector (B) of sub fan motor assembly.



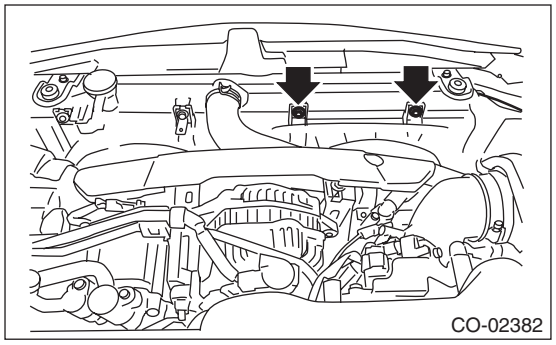
6) Remove the heat shield cover. (AT model)



7) Remove the ATF hose from the clip of the radiator sub fan shroud. (AT model)
8) Lower the vehicle.
9) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
10) Drain approximately 2.0 ℓ of coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
11) Disconnect the radiator inlet hose from engine side.



12) Remove the bolts which hold the radiator sub fan shroud onto the radiator.

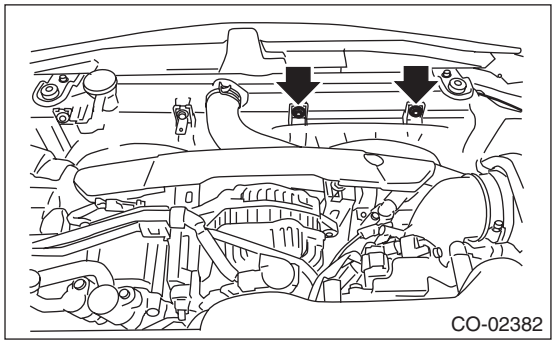


13) Remove the radiator sub fan and fan motor.

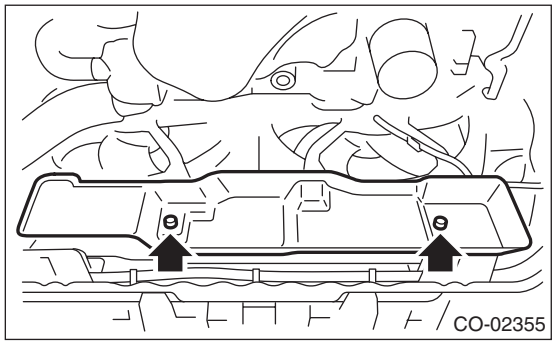
B: INSTALLATION

CAUTION:
Confirm that the radiator hose is securely connected.
Install in the reverse order of removal.

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

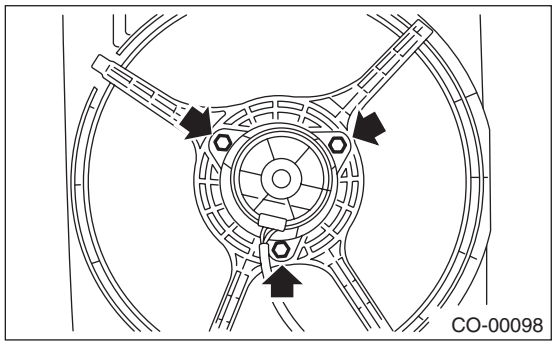


Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



C: DISASSEMBLY

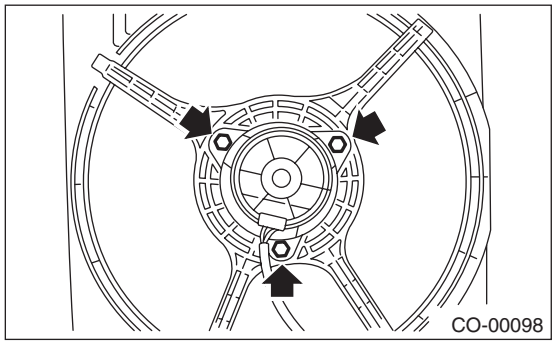
1) Remove the clip which holds the sub fan motor assembly connector onto the radiator sub fan shroud.
2) Remove the bolts which hold the sub fan motor assembly onto the radiator sub fan shroud.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

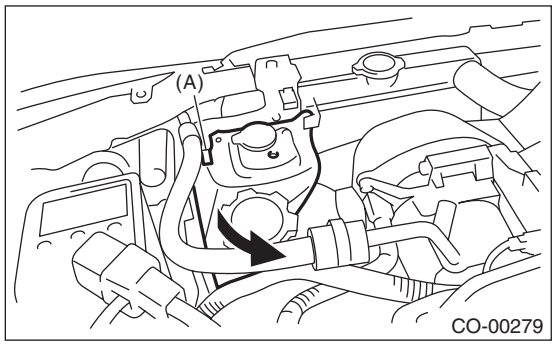
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



10.Reservoir Tank

A: REMOVAL

1) Disconnect the over flow hose connected to the radiator filler neck.
2) Push in the hook (A), and pull the reserve tank in the direction of the arrow to remove.



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

Make sure the engine coolant level is between “FULL” and “LOW”.

11.Engine Cooling System Trouble in General

A: INSPECTION

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

LUBRICATION

LU(H4SO)

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3. Engine Oil 10
4. Oil Pump 12
5. Oil Pan and Strainer 17
6. Oil Pressure Switch 21
7. Oil Pipe 23
8. Engine Oil Filter 29
9. Engine Lubrication System Trouble in General 30

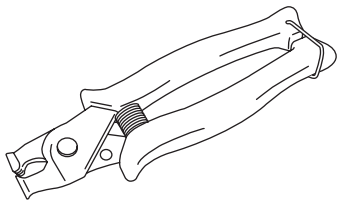
1. General Description

A: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• 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.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.

B: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18353AA000	18353AA000	CLAMP PLIERS	• Used for removing and installing the PCV hose. • This tool is made by the French company CAILLAU. (code) 54.0.000.205 To make it easier to obtain, it has been provided with a tool number.

2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance.

2. Front Catalytic Converter

A: REMOVAL

The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>

B: INSTALLATION

The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to “Front Exhaust Pipe” for the installation procedure. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>

C: INSPECTION

1) Check the connections and welds for exhaust leaks.
2) Check for hole or rust.

3. Rear Catalytic Converter

A: REMOVAL

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to “Center Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-9, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to “Center Exhaust Pipe” for the installation procedure. <Ref. to EX(H4SO)-9, INSTALLATION, Center Exhaust Pipe.>

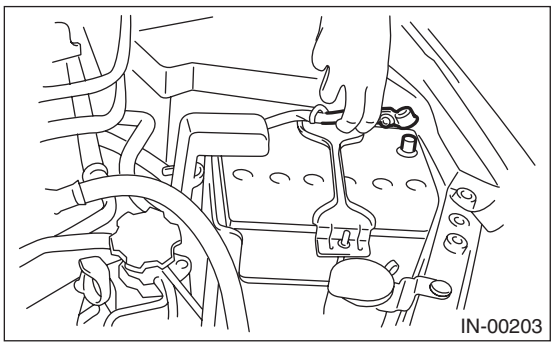
C: INSPECTION

1) Check the connections and welds for exhaust leaks.
2) Check for hole or rust.

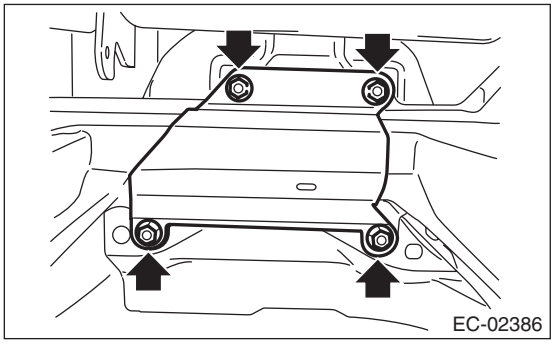
4. Canister

A: REMOVAL

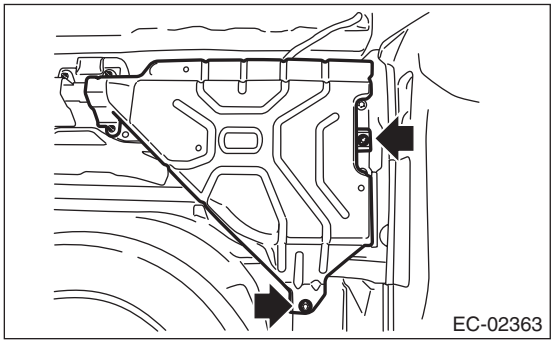
1) Disconnect the ground cable from battery.



2) Open the trunk, and remove the trunk room mat. (4 door model)
3) Open the rear gate, and remove the luggage floor mat. (5 door model)
4) Tilt the rear seat backrest forward.
5) Remove the sub trunk box and spacers. (4 door model)
6) Remove the luggage floor box and spacers. (5 door model)
7) Remove the center canister cover.

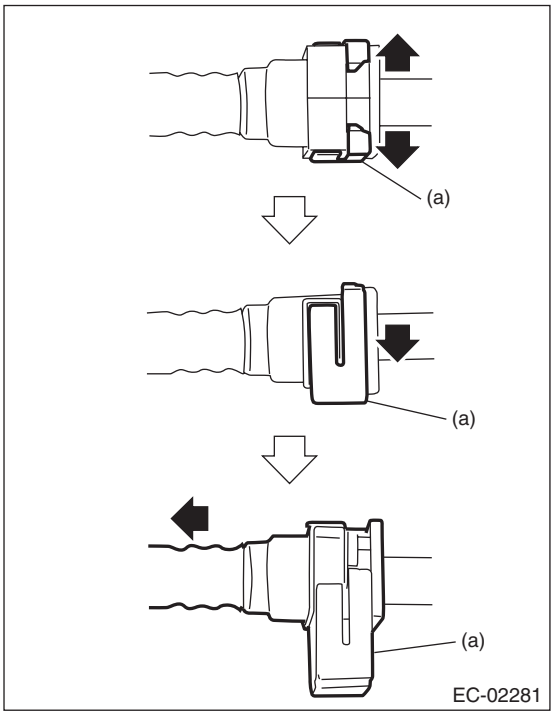


8) Remove the canister cover RH.

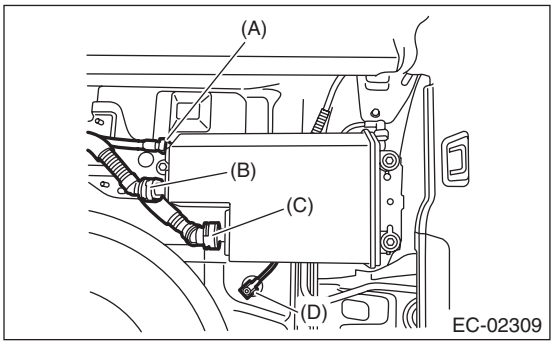


9) Disconnect the purge tube (A), vent tube (B), drain tube A (C) and PCV drain tube (D).

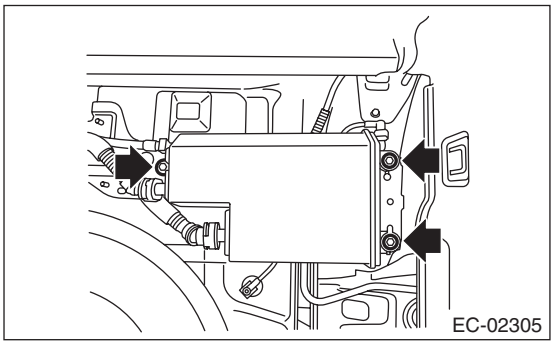
NOTE:
Disconnect the quick connector as shown in the figure.



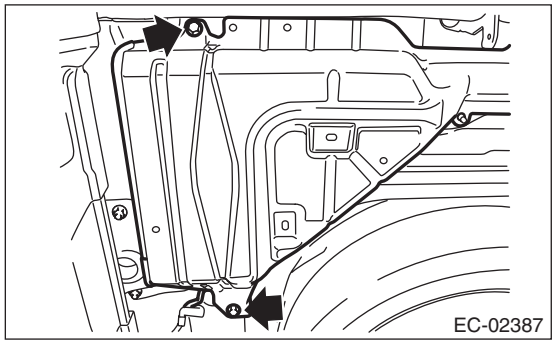
(a) Retainer



10) Remove the canister.

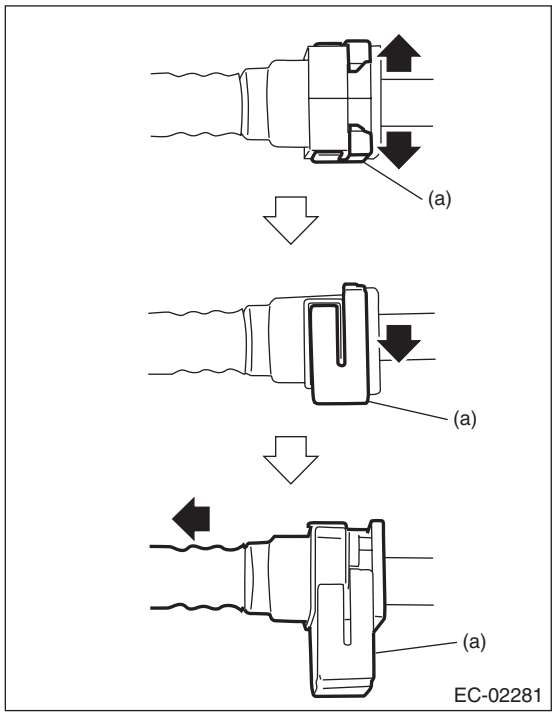


11) Remove the canister cover LH.

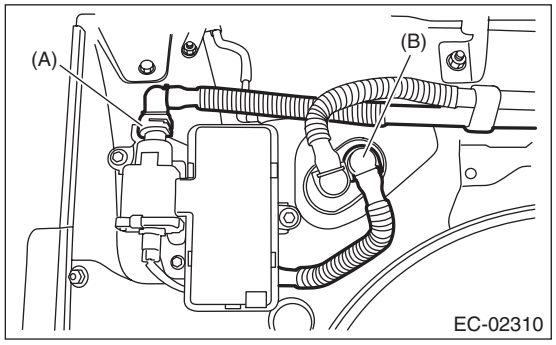


12) Disconnect drain tube A (A) and drain tube B (B).

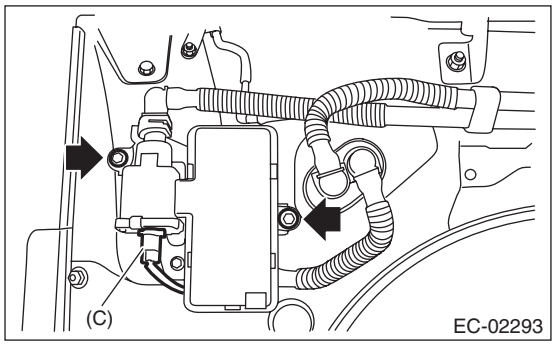
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Retainer

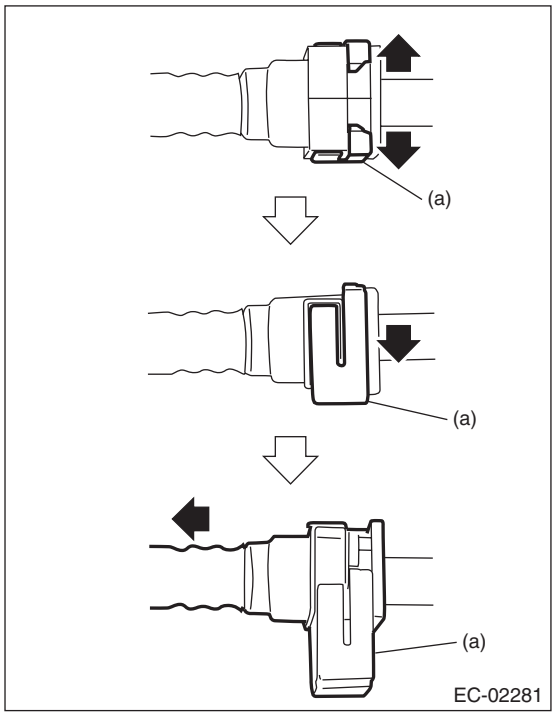


13) Disconnect connector (C) from the drain valve, and remove the drain valve.

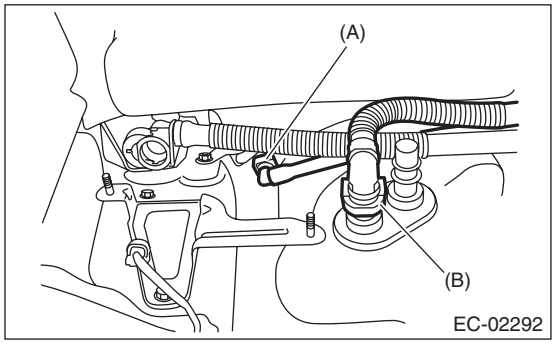


14) Disconnect purge tube (A) and vent tube (B).

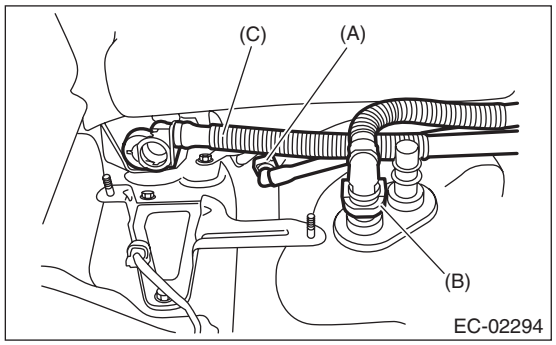
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Retainer



15) Remove purge tube (A), vent tube (B), and drain tube A (C).



B: INSTALLATION

Install in the reverse order of removal while being careful of the following.

• Connect the quick connector as shown in the figure.

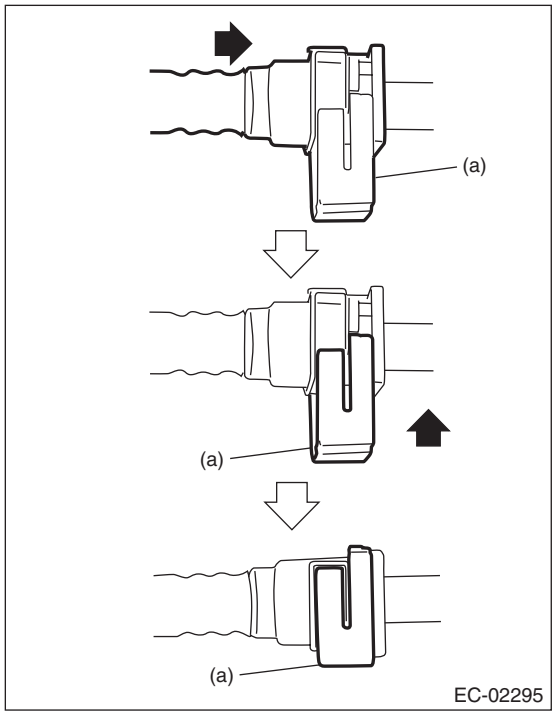
CAUTION:

• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.

• When connecting the quick connector, securely insert the pipe all the way before locking the retainer.

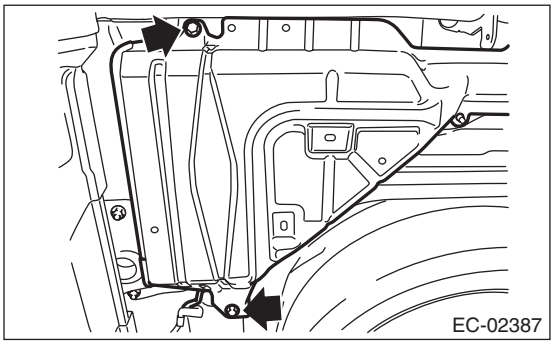
• If it is not possible to perform the push lock operation of the retainer, recheck whether the pipe is securely inserted.

• Make sure that the quick connector is securely connected.

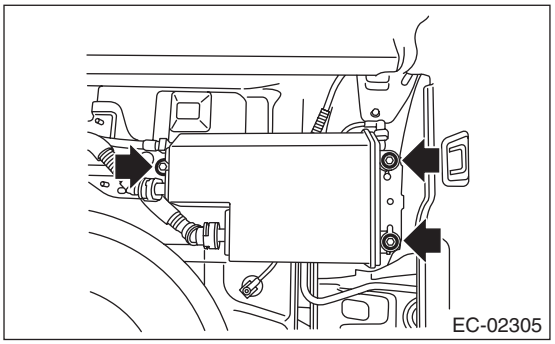


(a) Retainer

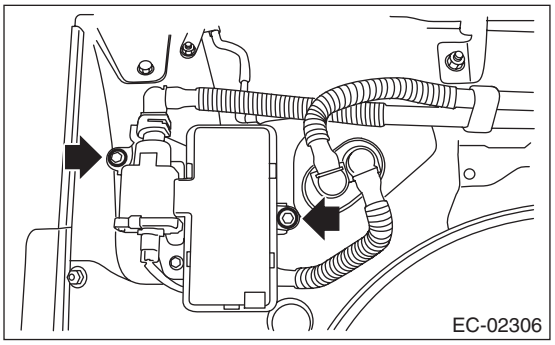
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



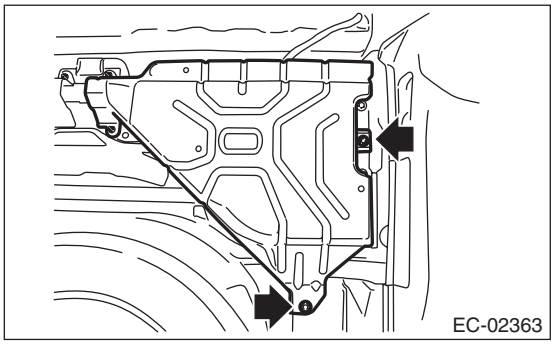
Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)

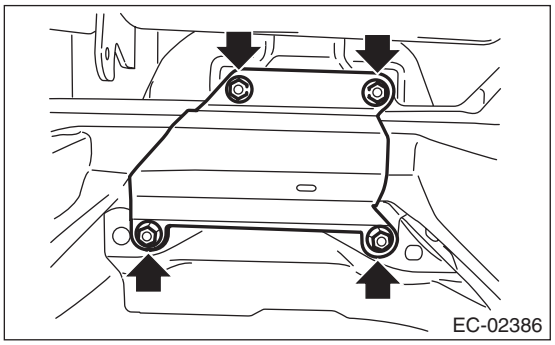


Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)





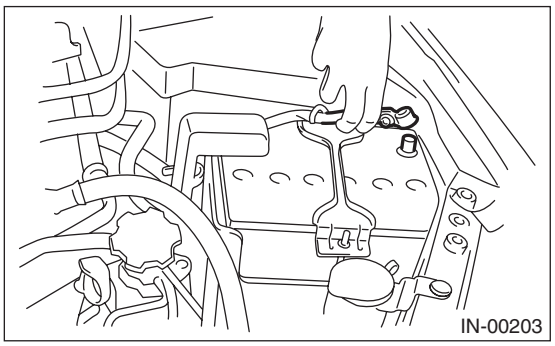
C: INSPECTION

Make sure that the canister, drain valve and tube are not cracked or loose.

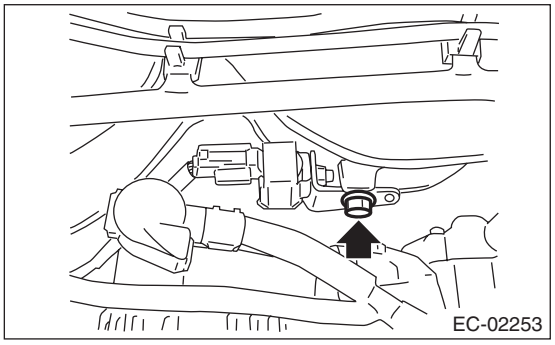
5. Purge Control Solenoid Valve

A: REMOVAL

1) Disconnect the ground cable from battery.



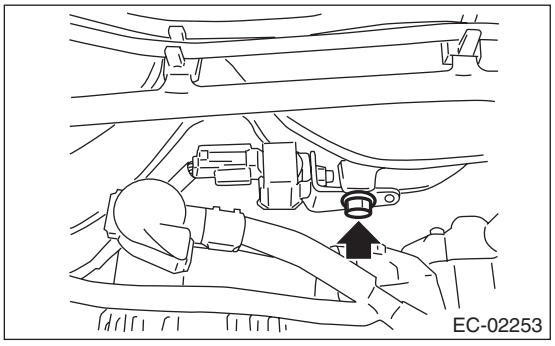
2) Disconnect the connector and evaporation hoses of purge control solenoid valve, and then remove the purge control solenoid valve.



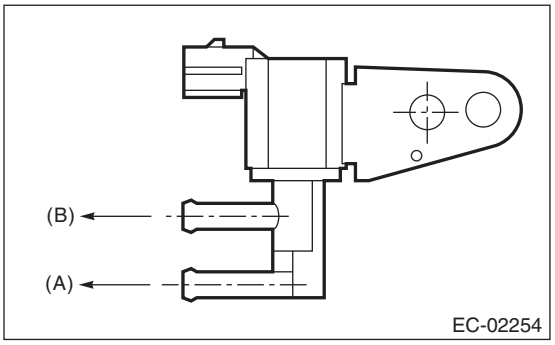
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)



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

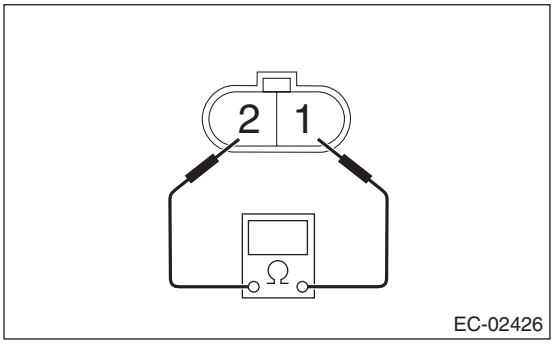


(A) To fuel pipe (intake manifold)
(B) To fuel pipe (evaporation line)

C: INSPECTION

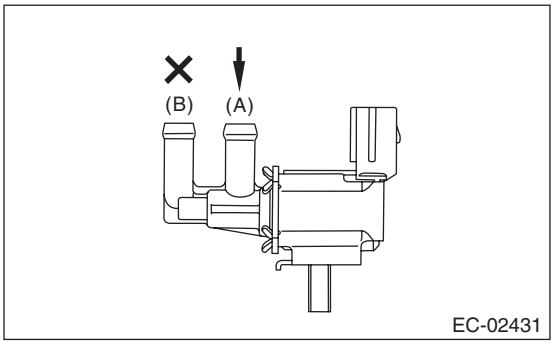
1. PURGE CONTROL SOLENOID VALVE

1) Measure the resistance between the purge control solenoid valve terminals.

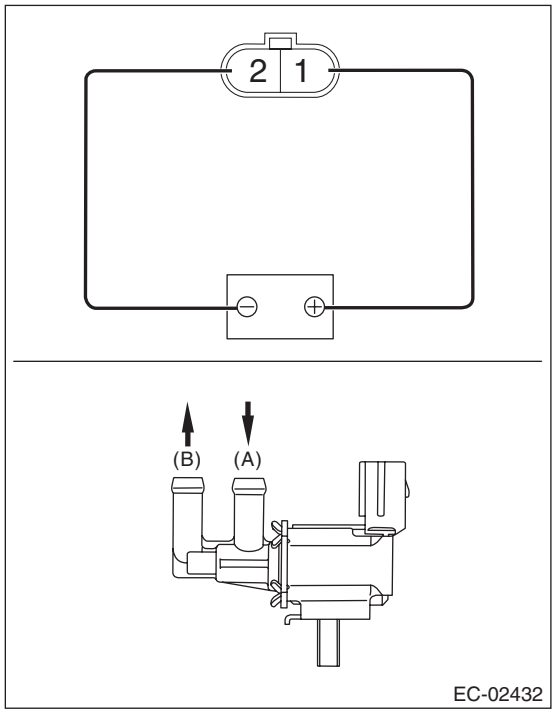


Terminal No.	Standard
1 and 2	32±2 Ω (20°C (68°F))

2) Check that air does not come out of (B) when blowing in (A).



3) Connect the terminal No. 1 to the battery positive terminal and the terminal No. 2 to the battery negative terminal. Check that air is discharged from (B), when supplying air to (A).



2. OTHER INSPECTIONS

Make sure the hoses are not cracked or loose.

6. EGR Valve

A: REMOVAL

For removal procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-35, REMOVAL, EGR Valve.>

B: INSTALLATION

For installation procedure, refer to “FU(H4SO)” section. <Ref. to FU(H4SO)-35, INSTALLATION, EGR Valve.>

C: INSPECTION

For inspection procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-35, INSPECTION, EGR Valve.>

7. Fuel Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-66, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION

For installation procedure, refer to “FU(H4SO)” section. <Ref. to FU(H4SO)-66, INSTALLATION, Fuel Level Sensor.>

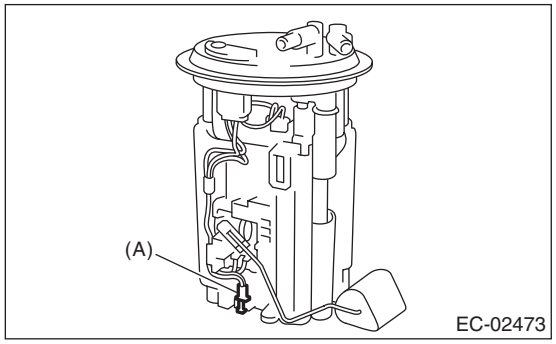
C: INSPECTION

For inspection procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-66, INSPECTION, Fuel Level Sensor.>

8. Fuel Temperature Sensor

A: REMOVAL

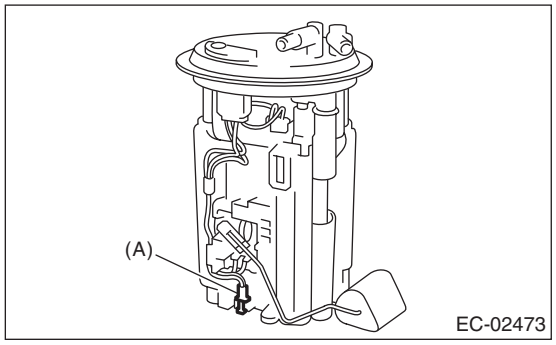
The fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, refer to “Fuel Level Sensor” for removal procedure. <Ref. to FU(H4SO)-66, REMOVAL, Fuel Level Sensor.>



(A) Fuel temperature sensor

B: INSTALLATION

The fuel temperature sensor and fuel level sensor are integrated into one unit; therefore, refer to “Fuel Level Sensor” for installation procedure. <Ref. to FU(H4SO)-66, INSTALLATION, Fuel Level Sensor.>

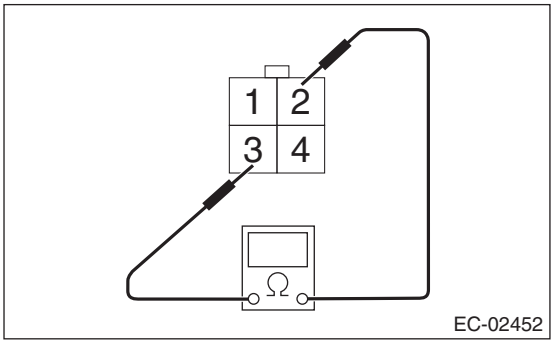


(A) Fuel temperature sensor

C: INSPECTION

Measure the resistance between fuel temperature sensor terminals.

CAUTION:
When measuring the resistance, check the circuit tester specification and be careful not to turn on electricity 3 V or more to prevent damaging the fuel temperature sensor.



Temperature	Terminal No.	Standard
–10°C (14°F)	2 and 3	11.21±0.69 kΩ (measured current 0.10 mA)
20°C (68°F)		2.502±0.08 kΩ (measured current 0.10 mA)
50°C (122°F)		0.7176±0.034 kΩ (measured current 0.10 mA)

9. Fuel Sub Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-67, REMOVAL, Fuel Sub Level Sensor.>

B: INSTALLATION

For installation procedure, refer to “FU(H4SO)” section. <Ref. to FU(H4SO)-68, INSTALLATION, Fuel Sub Level Sensor.>

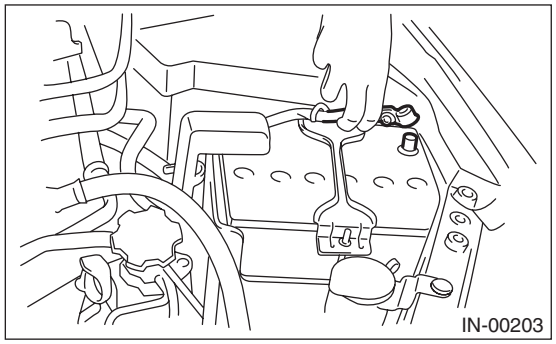
C: INSPECTION

For inspection procedures, refer to the “FU(H4SO)” section. <Ref. to FU(H4SO)-68, INSPECTION, Fuel Sub Level Sensor.>

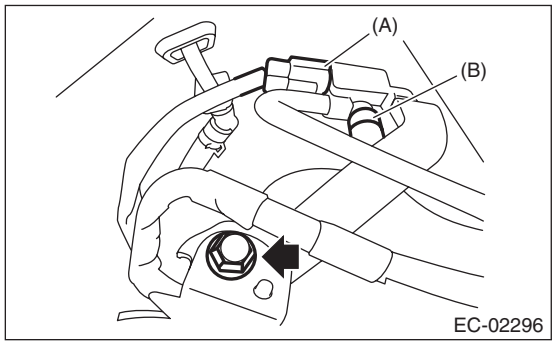
10.Fuel Tank Pressure Sensor

A: REMOVAL

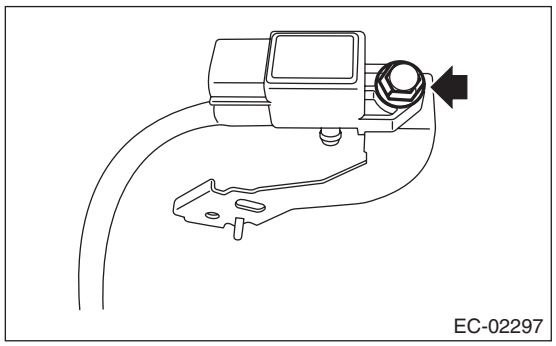
WARNING:
Place "NO OPEN FLAMES" signs near the working area.
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.



3) Open the fuel filler lid and remove the fuel filler cap.
4) Lift up the vehicle.
5) Disconnect the connector from the fuel tank pressure sensor (A).
6) Disconnect the pressure hose from the fuel tank pressure sensor (B).
7) Remove the fuel tank pressure sensor along with the bracket.



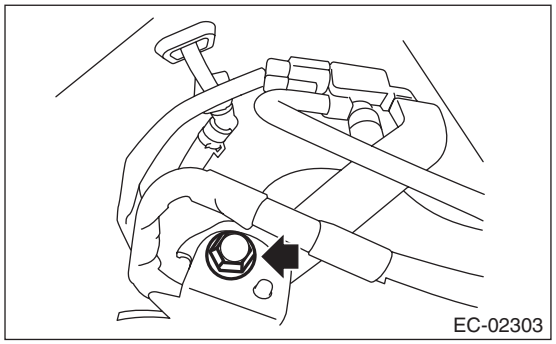
8) Remove the fuel tank pressure sensor from the bracket cover.

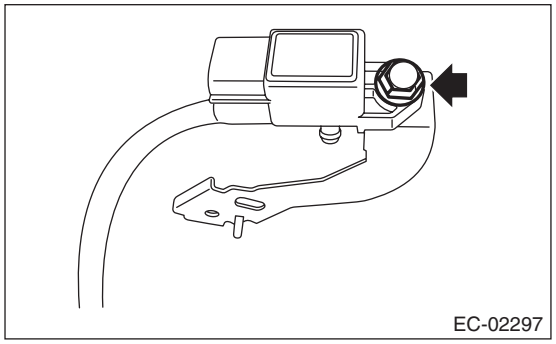


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
7.35 N·m (0.7 kgf-m, 5.4 ft-lb)

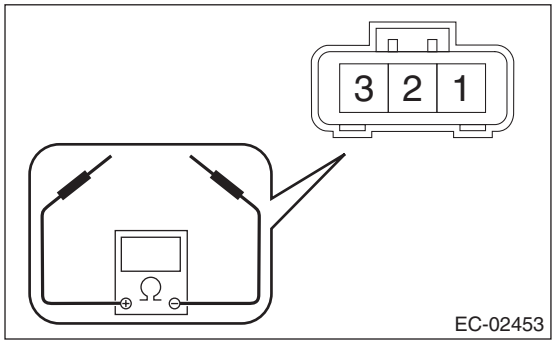




C: INSPECTION

1. FUEL TANK PRESSURE SENSOR

CAUTION:
Pay attention to polarity when measuring the resistance in fuel tank pressure sensor.
Measure the resistance between fuel tank pressure sensor terminals.



Terminal No.	Standard
3 (+) and 1 (–)	8.57 kΩ±0.5
1 (+) and 2 (–)	7.14 kΩ±0.23

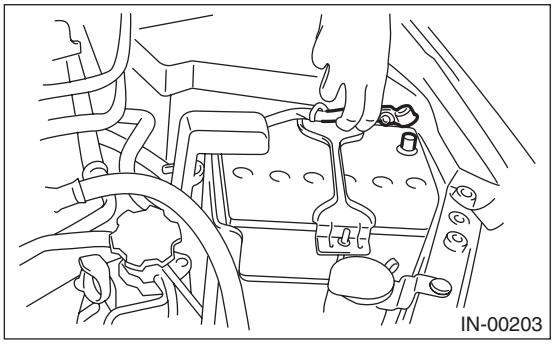
2. OTHER INSPECTIONS

Make sure the hoses are not cracked or loose.

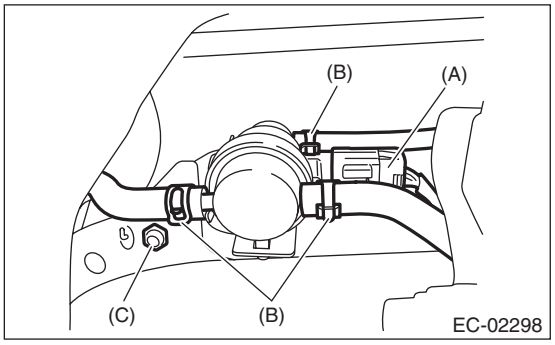
11.Pressure Control Solenoid Valve

A: REMOVAL

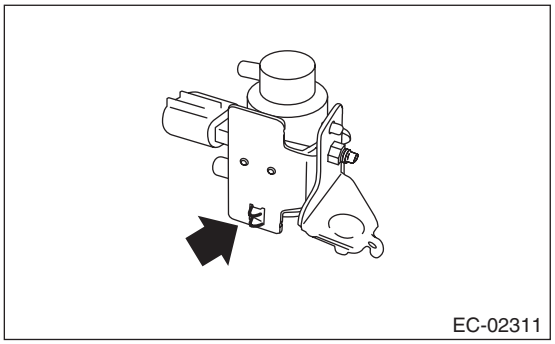
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.



3) Lift up the vehicle.
4) Disconnect connector (A) from the pressure control solenoid valve.
5) Disconnect the evaporation hose (B) from the pressure control solenoid valve.
6) Remove the nuts (C) which secure the bracket to the fuel tank.



7) Remove the pressure control solenoid valve and bracket as a unit.
8) Remove the pressure control solenoid valve from the bracket.



B: INSTALLATION

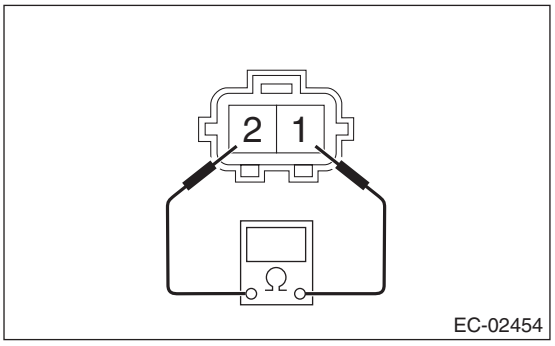
Install in the reverse order of removal.

Tightening torque:
7.35 N·m (0.7 kgf-m, 5.4 ft-lb)

C: INSPECTION

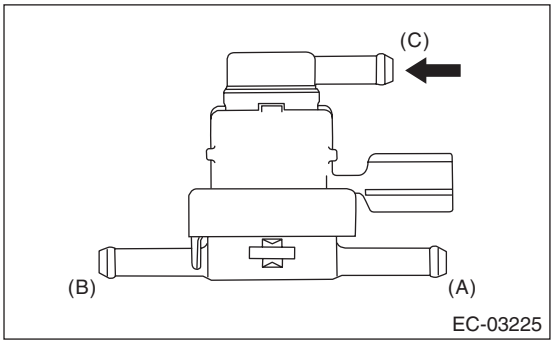
1. PRESSURE CONTROL SOLENOID VALVE

1) Check that the pressure control solenoid valve has no deformation, cracks or other damages.
2) Check the resistance between the pressure control solenoid valve terminals.



Terminal No.	Standard
1 and 2	20 — 30 Ω

3) Connect the Mighty Vac to fuel tank side of the pressure control solenoid valve.



(A) Fuel tank side
(B) Canister side
(C) Barometric pressure

4) Using the Mighty Vac, generate the positive pressure. Check that the Mighty Vac gauge needle rises at the pressure (0.55 — 1.55 kPa (0.006 — 0.016 kgf/cm^2, 0.08 — 0.23 psi)) then lowers.
5) Using the Mighty Vac, generate the negative pressure. Check that the Mighty Vac gauge needle does not rise.

2. OTHER INSPECTIONS

Check that the evaporation hose has no cracks, damage or loose part.

12.Drain Filter

A: SPECIFICATION

The drain valve is a non-disassembled part, so do not remove the drain filter from drain valve. Refer to “Canister” for removal and installation procedures. <Ref. to EC(H4SO)-5, REMOVAL, Canister.> <Ref. to EC(H4SO)-7, INSTALLATION, Canister.>

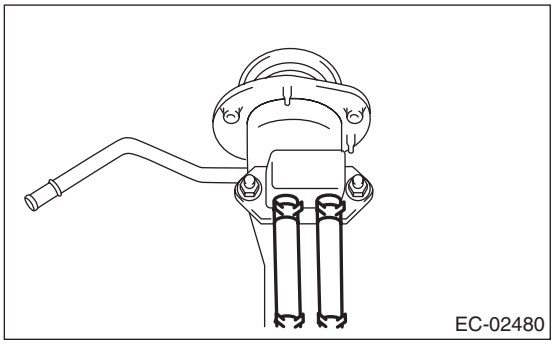
13.Shut Valve

A: REMOVAL

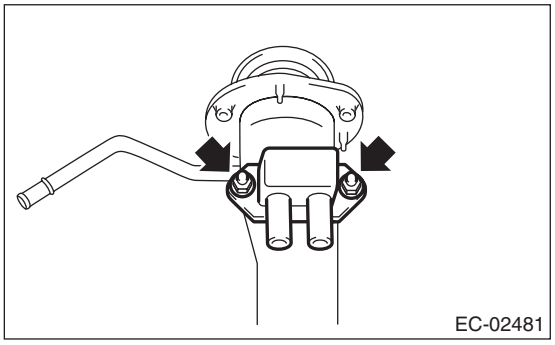
WARNING:
Place “NO OPEN FLAMES” signs near the working area.

CAUTION:
Be careful not to spill fuel.

1) Remove the fuel filler pipe. <Ref. to FU(H4SO)-61, REMOVAL, Fuel Filler Pipe.>
2) Disconnect the evaporation hose from the shut valve.



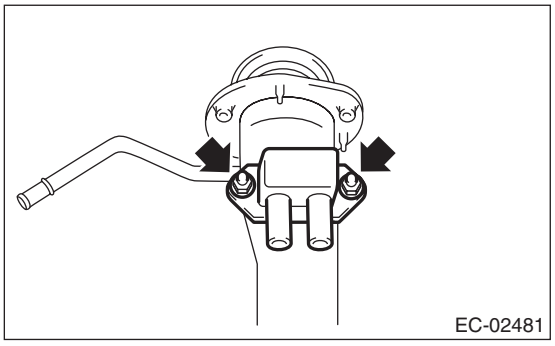
3) Remove the shut valve from the fuel filler pipe.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
4.5 N·m (0.5 kgf-m, 3.3 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

14.Drain Valve

A: REMOVAL

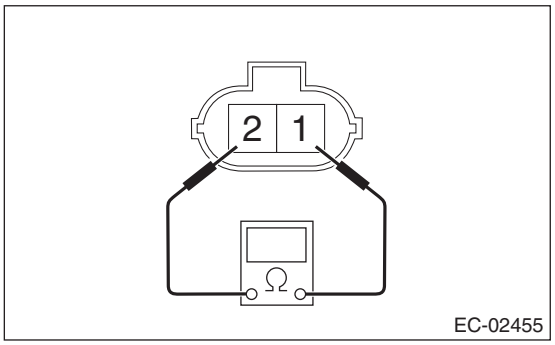
Refer to “Canister” for removal procedures. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>

B: INSTALLATION

Refer to “Canister” for installation procedures. <Ref. to EC(H4SO)-7, INSTALLATION, Canister.>

C: INSPECTION

Measure the resistance between drain valve terminals.

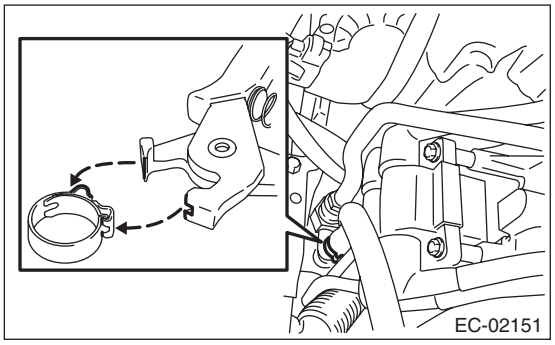


Terminal No.	Standard
1 and 2	20 — 30 Ω

15.PCV Hose Assembly

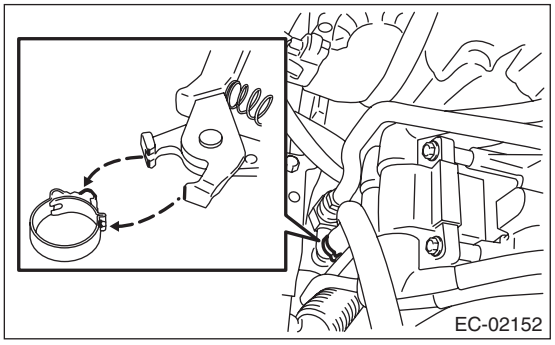
A: REMOVAL

CAUTION:
Do not remove unless the PCV hose, diagnostics connector and PCV valve are damaged.
1) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
2) Fit the depression in the ST with the protrusion on the clamp to unlock.
3) Remove the PCV hose assembly.
ST 18353AA000 CLAMP PLIERS



B: INSTALLATION

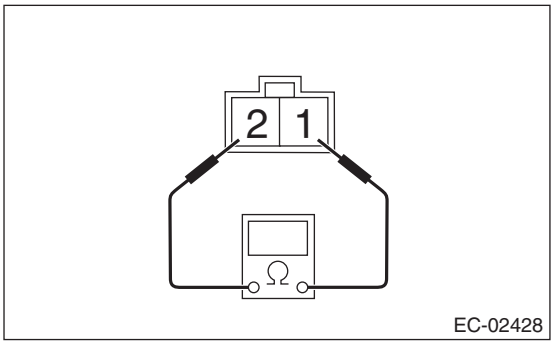
NOTE:
Replace the clamp with a new part.
1) Install the PCV hose assembly, then lock by fitting the ST on the clamp protrusion.
ST 18353AA000 CLAMP PLIERS



2) Install the air intake chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>

C: INSPECTION

1) Measure the resistance between PCV hose assembly terminals.



Terminal No.	Standard
1 and 2	Less than 1 Ω

2) Make sure that there are no cracks or other damages on PCV hose assembly.

INTAKE (INDUCTION)

IN(H4SO)

Page

1. General Description 2
2. Air Cleaner Element 4
3. Air Cleaner Case 5
4. Air Intake Chamber 7
5. Air Intake Duct 8
6. Resonator Chamber 9

1. Basic Diagnostic Procedure

A: PROCEDURE

1. ENGINE

	Step	Check	Yes	No
1	**CHECK ENGINE START FAILURE.** 1) Ask the customer when and how the trouble occurred using the interview check list. <Ref. to EN(H4SO)(diag)-4, CHECK, Check List for Interview.> 2) Start the engine.	Does the engine start?	Go to step **2**.	Inspection using "Diagnostics for Engine Start Failure". <Ref. to EN(H4SO)(diag)-71, 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 Diagnostic Table". <Ref. to EN(H4SO)(diag)-318, INSPECTION, General Diagnostic Table.>
3	**CHECK COMMUNICATION STATUS.** 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor or general scan tool to the data link connector. 3) Turn the ignition switch to ON, and run the Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed procedures, refer to "Subaru Select Monitor". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Does Subaru select monitor or general scan tool communicate with vehicle normally?	Go to step **4**.	Inspection using "Diagnostics Procedure for Subaru Select Monitor Communication". <Ref. to EN(H4SO)(diag)-86, Diagnostic Procedure for Subaru Select Monitor Communication.>
4	**CHECK DTC.** Read DTC using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor Refer to "Read Diagnostic Trouble Code" for detailed operation procedure. <Ref. to EN(H4SO)(diag)-43, Read Diagnostic Trouble Code (DTC).> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is DTC displayed on Subaru Select Monitor or general scan tool?	Record the DTC. Repair the trouble cause. <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).> Go to step **5**.	Repair the related parts. NOTE: If DTC is not shown on display although the malfunction indicator light illuminates, perform the diagnosis of malfunction indicator light circuit or combination meter. <Ref. to EN(H4SO)(diag)-61, Malfunction Indicator Light.>

	Step	Check	Yes	No
5	**CHECK FREEZE FRAME DATA.** Check the freeze frame data using the Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed procedures, refer to "Subaru Select Monitor". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is freeze frame data displayed on Subaru Select Monitor or general scan tool?	Record the freeze frame data. Repair the faulty parts, and go on to the next. Go to step **6**.	Go to step **6**.
6	**PERFORM DIAGNOSIS.** 1) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.> 2) Perform the Inspection Mode or Drive Cycle. <Ref. to EN(H4SO)(diag)-44, Inspection Mode.> <Ref. to EN(H4SO)(diag)-49, Drive Cycle.>	Is DTC displayed on Subaru Select Monitor or general scan tool?	Inspect using "Diagnostic Procedure with Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-95, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

1. List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Index
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<Ref. to GD(H4SO)-8, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	<Ref. to GD(H4SO)-10, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-11, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-13, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-15, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-17, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-19, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to GD(H4SO)-21, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	<Ref. to GD(H4SO)-23, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	<Ref. to GD(H4SO)-24, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	<Ref. to GD(H4SO)-24, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	<Ref. to GD(H4SO)-24, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to GD(H4SO)-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(H4SO)-27, 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(H4SO)-28, 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(H4SO)-29, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to GD(H4SO)-30, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<Ref. to GD(H4SO)-31, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to GD(H4SO)-34, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to GD(H4SO)-35, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to GD(H4SO)-36, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0118	Engine Coolant Temperature Circuit High	<Ref. to GD(H4SO)-37, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0122	Throttle/Pedal Position Sensor/ Switch “A” Circuit Low	<Ref. to GD(H4SO)-38, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/ SWITCH “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0123	Throttle/Pedal Position Sensor/ Switch “A” Circuit High	<Ref. to GD(H4SO)-39, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/ SWITCH “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to GD(H4SO)-40, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0126	Insufficient Engine Coolant Temperature for Stable Operation	<Ref. to GD(H4SO)-42, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to GD(H4SO)-44, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-46, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-48, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-50, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-53, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-55, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-57, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-58, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0140	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to GD(H4SO)-66, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0171	System Too Lean (Bank 1)	<Ref. to GD(H4SO)-68, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0172	System Too Rich (Bank 1)	<Ref. to GD(H4SO)-69, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0181	Fuel Temperature Sensor “A” Circuit Range/Performance	<Ref. to GD(H4SO)-70, DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0182	Fuel Temperature Sensor “A” Circuit Low Input	<Ref. to GD(H4SO)-73, DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0183	Fuel Temperature Sensor “A” Circuit High Input	<Ref. to GD(H4SO)-74, DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	<Ref. to GD(H4SO)-75, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0197	Engine Oil Temperature Sensor Low	<Ref. to GD(H4SO)-77, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0198	Engine Oil Temperature Sensor High	<Ref. to GD(H4SO)-78, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0222	Throttle/Pedal Position Sensor/ Switch “B” Circuit Low	<Ref. to GD(H4SO)-79, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/ SWITCH “B” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0223	Throttle/Pedal Position Sensor/ Switch “B” Circuit High	<Ref. to GD(H4SO)-80, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/ SWITCH “B” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0301	Cylinder 1 Misfire Detected	<Ref. to GD(H4SO)-81, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0302	Cylinder 2 Misfire Detected	<Ref. to GD(H4SO)-86, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0303	Cylinder 3 Misfire Detected	<Ref. to GD(H4SO)-86, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0304	Cylinder 4 Misfire Detected	<Ref. to GD(H4SO)-86, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-87, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-89, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0335	Crankshaft Position Sensor “A” Circuit	<Ref. to GD(H4SO)-91, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	<Ref. to GD(H4SO)-93, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0340	Camshaft Position Sensor “A” Circuit (Bank 1)	<Ref. to GD(H4SO)-95, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0341	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor)	<Ref. to GD(H4SO)-96, DTC P0341 CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0400	Exhaust Gas Recirculation Flow	<Ref. to GD(H4SO)-98, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to GD(H4SO)-101, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to GD(H4SO)-103, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to GD(H4SO)-119, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to GD(H4SO)-121, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0451	Evaporative Emission Control System Pressure Sensor	<Ref. to GD(H4SO)-123, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to GD(H4SO)-125, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to GD(H4SO)-127, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to GD(H4SO)-128, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/ Off)	<Ref. to GD(H4SO)-128, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to GD(H4SO)-129, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to GD(H4SO)-131, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0461	Fuel Level Sensor “A” Circuit Range/ Performance	<Ref. to GD(H4SO)-133, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0462	Fuel Level Sensor “A” Circuit Low	<Ref. to GD(H4SO)-135, DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0463	Fuel Level Sensor “A” Circuit High	<Ref. to GD(H4SO)-137, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to GD(H4SO)-139, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0500	Vehicle Speed Sensor “A”	<Ref. to GD(H4SO)-142, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to GD(H4SO)-143, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to GD(H4SO)-144, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0512	Starter Request Circuit	<Ref. to GD(H4SO)-145, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0513	Incorrect Immobilizer Key	<Ref. to GD(H4SO)-146, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to GD(H4SO)-147, 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(H4SO)-148, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0607	Throttle Control System Circuit Range/Performance	<Ref. to GD(H4SO)-149, DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0638	Throttle Actuator Control Range/Performance (Bank 1)	<Ref. to GD(H4SO)-151, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0700	Transmission Control System (MIL Request)	<Ref. to GD(H4SO)-153, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Park/Neutral Switch Input Circuit Low (AT Model)	<Ref. to GD(H4SO)-154, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Neutral Switch Input Circuit Low (MT Model)	<Ref. to GD(H4SO)-155, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Park/Neutral Switch Input Circuit High (AT Model)	<Ref. to GD(H4SO)-156, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to GD(H4SO)-157, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-158, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1153	O2 Sensor Circuit Range/Performance (High) (Bank 1 Sensor 1)	<Ref. to GD(H4SO)-160, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1160	Return Spring Failure	<Ref. to GD(H4SO)-162, DTC P1160 RETURN SPRING FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to GD(H4SO)-164, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to GD(H4SO)-166, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to GD(H4SO)-168, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	<Ref. to GD(H4SO)-170, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-172, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-174, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-176, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-176, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-176, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-176, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to GD(H4SO)-176, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to GD(H4SO)-176, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1560	Back-Up Voltage Circuit Malfunction	<Ref. to GD(H4SO)-177, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1570	Antenna	<Ref. to GD(H4SO)-178, DTC P1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1571	Reference Code Incompatibility	<Ref. to GD(H4SO)-178, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1572	IMM Circuit Failure	<Ref. to GD(H4SO)-178, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1574	Key Communication Failure	<Ref. to GD(H4SO)-178, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1576	EGI Control Module EEPROM	<Ref. to GD(H4SO)-178, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1577	IMM Control Module EEPROM	<Ref. to GD(H4SO)-178, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1578	Meter Failure	<Ref. to GD(H4SO)-178, DTC P1578 METER FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1602	Control Module Programming Error	<Ref. to GD(H4SO)-179, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	<Ref. to GD(H4SO)-181, 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(H4SO)-183, 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(H4SO)-185, 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(H4SO)-186, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to GD(H4SO)-187, 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(H4SO)-188, 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(H4SO)-189, 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(H4SO)-191, 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(H4SO)-193, 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(H4SO)-195, 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 Correlation	<Ref. to GD(H4SO)-197, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2138	Throttle/Pedal Position Sensor/ Switch “D”/“E” Voltage Correlation	<Ref. to GD(H4SO)-199, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2227	Atmospheric Pressure Sensor Range/Performance	<Ref. to GD(H4SO)-201, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2228	Barometric Pressure Circuit Low	<Ref. to GD(H4SO)-202, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2229	Barometric Pressure Circuit High	<Ref. to GD(H4SO)-203, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0073	CAN Failure, Bus ‘OFF’ Detection	<Ref. to GD(H4SO)-204, DTC U0073 CAN FAILURE, BUS ‘OFF’ DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0101	CAN (TCU) DATA NOT LOADED	<Ref. to GD(H4SO)-205, DTC U0101 CAN (TCU) DATA NOT LOADED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0122	CAN (VDC) DATA NOT LOADED	<Ref. to GD(H4SO)-205, DTC U0122 CAN (VDC) DATA NOT LOADED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0140	CAN (BCU) DATA NOT LOADED	<Ref. to GD(H4SO)-205, DTC U0140 CAN (BCU) DATA NOT LOADED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0402	CAN (TCU) Data Abnormal	<Ref. to GD(H4SO)-205, DTC U0402 CAN (TCU) DATA ABNORMAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0416	CAN (VDC) Data Abnormal	<Ref. to GD(H4SO)-205, DTC U0416 CAN (VDC) DATA ABNORMAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0422	CAN (BCU) Data Abnormal	<Ref. to GD(H4SO)-205, DTC U0422 CAN (BCU) DATA ABNORMAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

2. Check List for Interview

A: CHECK

1. CHECK LIST NO. 1

Check the following item when problem has occurred.

NOTE:
Use copies of this page for interviewing customers.

Customer's name		Engine No.	
Date of purchase		Fuel type	
Date of repair		Odometer reading	km
V.I.N.			miles
Weather	❑ Fine ❑ Cloudy ❑ Rainy ❑ Snowy ❑ Various/Others:		
Ambient air 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	km/h (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	Audio	❑ ON/❑ OFF
A/C compressor	❑ ON/❑ OFF	CD/Cassette	❑ ON/❑ OFF
Radiator fan	❑ ON/❑ OFF	Car phone	❑ ON/❑ OFF
Front wiper	❑ ON/❑ OFF	Wireless device	❑ ON/❑ OFF
Rear wiper	❑ ON/❑ OFF		

2. CHECK LIST NO. 2

Check the following item 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 illuminate. ❑ Yes / ❑ No
❑ Low fuel warning light ❑ Charge warning light ❑ Engine coolant temperature warning light ❑ Oil pressure warning light ❑ ATF temperature warning light or SPORT indicator light ❑ Driver's control center differential indicator light ❑ ABS warning light ❑ VDC warning light ❑ Cruise indicator light ❑ SI-CRUISE warning light ❑ Immobilizer indicator light ❑ STEERING warning light ❑ Electric parking brake warning light ❑ Glow indicator light ❑ Sedimentor warning light ❑ Others:
b) Fuel level
• Lack of fuel: ❑ Yes / ❑ No • Indicator position of fuel gauge: • Experienced running out of fuel: ❑ 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 other parts except 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 ❑ Does not shift. ❑ Excessive shift shock

2. Diagnostic Trouble Code (DTC) Detecting Criteria

A: DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Judge as NG with either Low NG or High NG.
A variable valve lift diagnosis oil pressure switch is installed for diagnosis. It is possible to determine whether the intake valve is in high mode (increase the amount of lift) or in low mode (suppressing the amount of lift) when the variable valve lift diagnosis oil pressure switch is turned ON or OFF.

- **Normal**

Oil switching solenoid valve duty	Intake valve	Variable valve lift diagnosis oil pressure switch
Large	High mode	OFF
Minimum	Low mode	ON

- **Low NG**

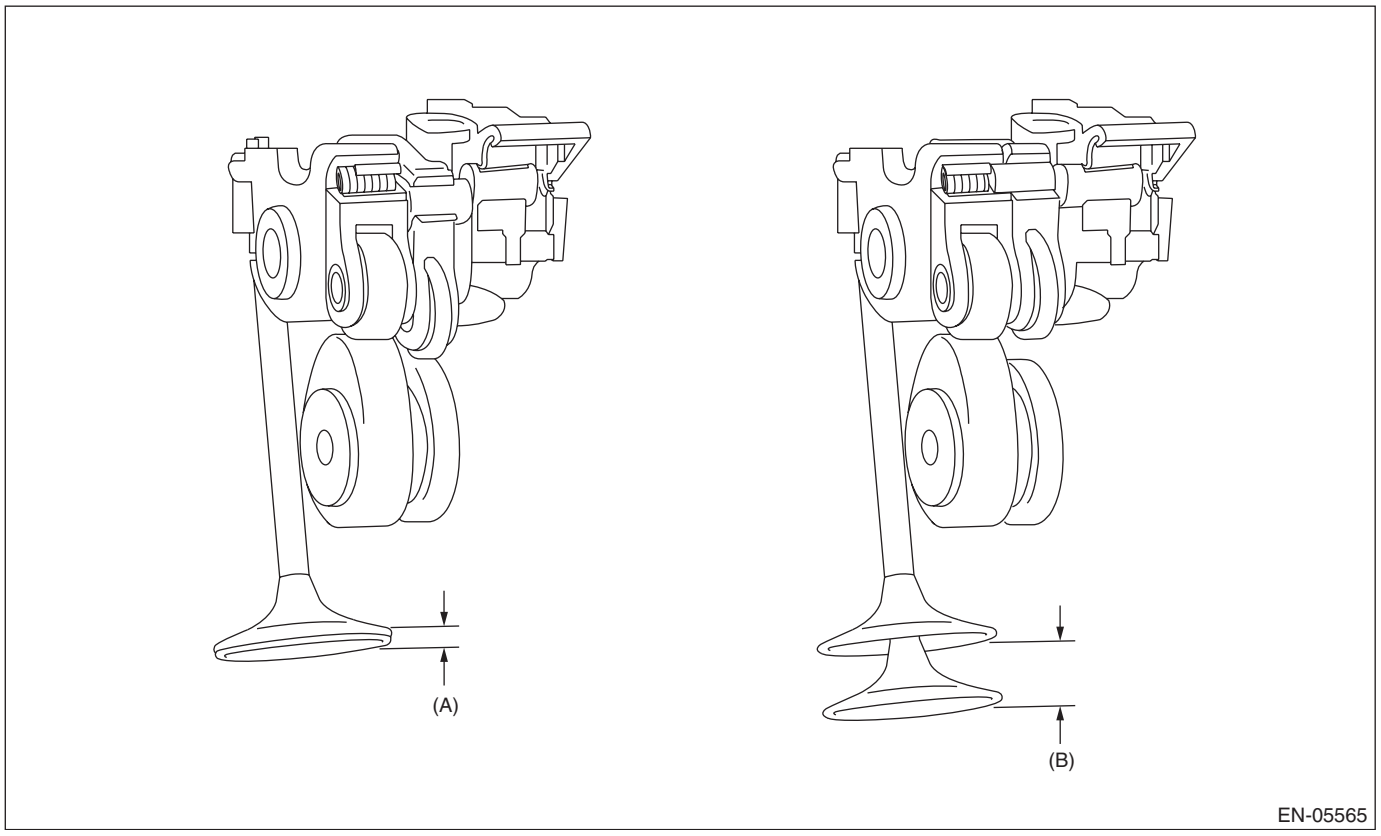
When the variable valve lift diagnosis oil pressure switch remains ON even though the intake valve tried to enter high mode (oil switching solenoid valve duty is large), this is judged as a Low NG.

- **High NG**

When the variable valve lift diagnosis oil pressure switch remains OFF even though the intake valve tried to enter low mode (oil switching solenoid valve duty is small), this is judged as a High NG.

2. COMPONENT DESCRIPTION

The variable valve lift system optimizes the intake valve lift by switching between the low lift cam and the high lift cam according to the engine speed. The amount of intake valve lift is varied by controlling the oil switching solenoid valve duty according to signals from the ECM.



(A) Low lift (B) High lift

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
After engine starting	≥ 6000 ms
Engine oil temperature	≥ 15 °C (59 °F)
Variable valve lift control	Operation

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously 6 seconds after engine start while variable valve lift is being controlled

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Duty ratio	≥ 62 %
Variable valve lift diagnosis oil pressure switch	ON
High	
Duty ratio	< 33 %
Variable valve lift diagnosis oil pressure switch	OFF

Time Needed for Diagnosis:
Low side: 784 ms
High side: 3000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Duty ratio	≥ 62 %
Variable valve lift diagnosis oil pressure switch	OFF
High	
Duty ratio	< 33 %
Variable valve lift diagnosis oil pressure switch	ON

Time Needed for Diagnosis:
Low side: 208 ms
High side: 3000 ms

B: DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

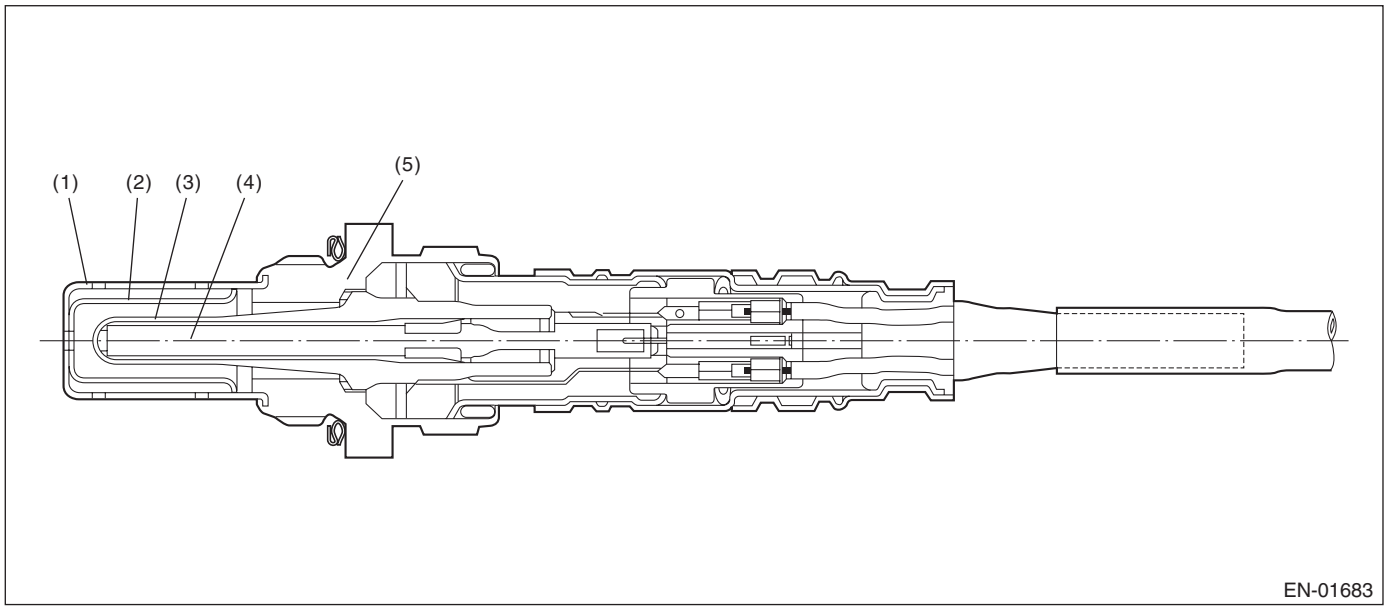
NOTE:
For the detection standard, refer to DTC P0026. <Ref. to GD(H4SO)-8, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

Detect functional errors of the front oxygen (A/F) sensor heater.
Judge as NG when it is determined that the front oxygen (A/F) sensor impedance is large when looking at engine status such as deceleration fuel cut.

2. COMPONENT DESCRIPTION



(1) Element cover (outer)
(2) Element cover (inner)
(3) Sensor element
(4) Ceramic heater
(5) Sensor housing

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Condition established time	≥ 42000 ms
Battery voltage	≥ 10.9 V
Heater current	Permitted
Control duty ≥ 35 %	Experienced
After fuel cut	≥ 20000 ms

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 42000 ms seconds or more have passed since the engine started.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	> 50 Ω

Time Needed for Diagnosis:10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Front oxygen (A/F) sensor impedance	≤ 50 Ω

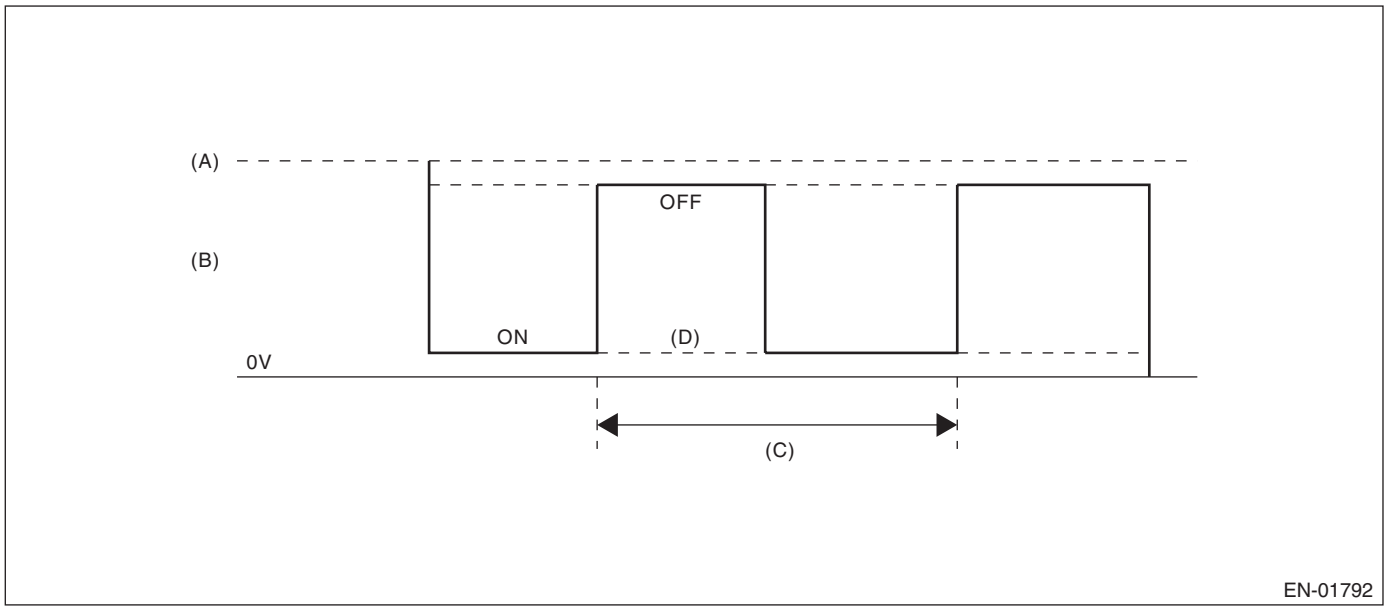
Time Needed for Diagnosis:10000 ms

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

1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.
The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains Low.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Front oxygen (A/F) sensor heater output voltage
(C) 128 ms
(D) Low error

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level Front oxygen (A/F) sensor heater control duty	Low < 87.5 %

Time Needed for Diagnosis: 4 ms × 250 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High

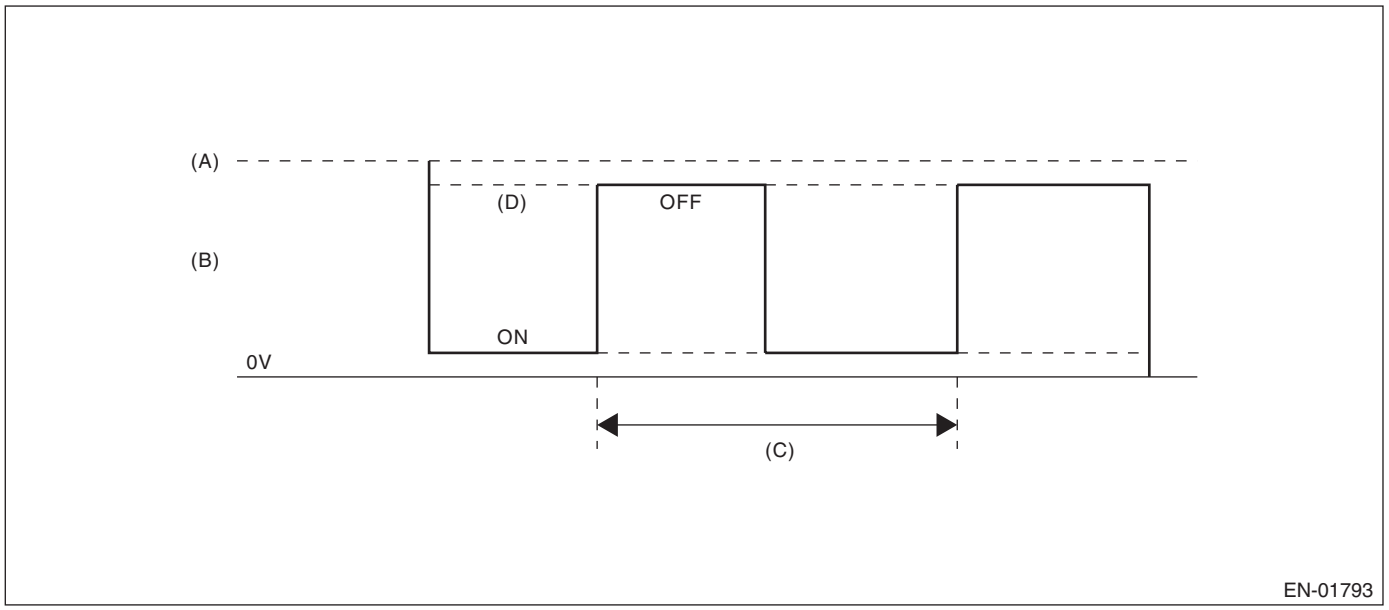
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect front oxygen (A/F) sensor heater open or short circuit.
The front oxygen (A/F) sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains High.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Front oxygen (A/F) sensor heater output voltage
(C) 128 ms
(D) High error

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level Front oxygen (A/F) sensor heater control duty	High ≥ 12.5 %

Time Needed for Diagnosis: 4 ms × 500 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

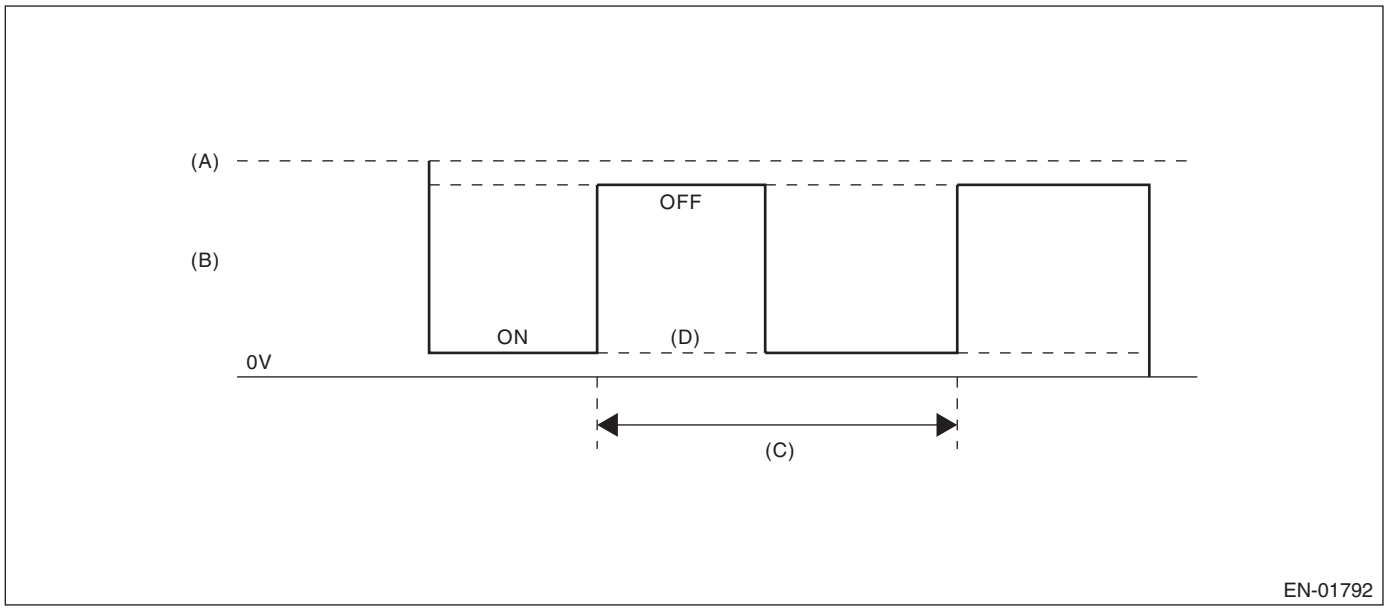
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.
The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains Low.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Output voltage of the rear oxygen sensor heater
(C) 256 ms (cycles)
(D) Low error

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after engine starting	≥ 1 second
Engine speed	< 8000 rpm

4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low
Rear oxygen sensor heater control duty	< 75 %

Time Needed for Diagnosis:8 ms × 1250 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High

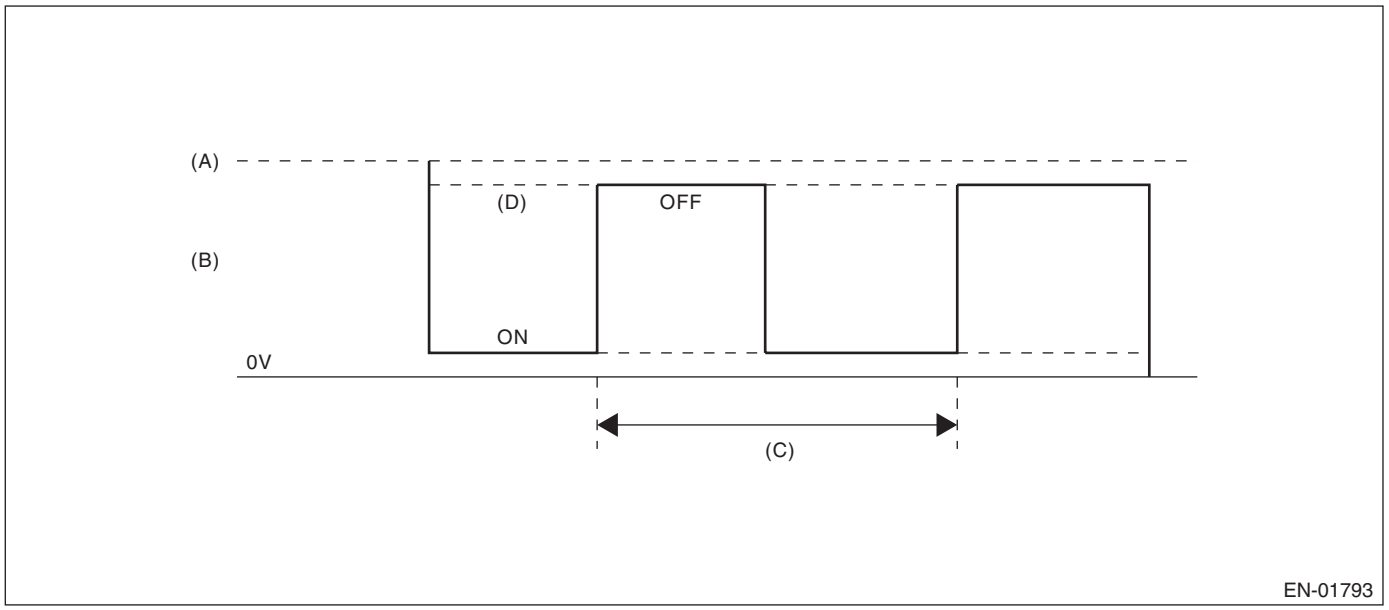
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor heater open or short circuit.
The rear oxygen sensor heater performs duty control, and the output terminal voltage at ON is 0 V, and the output terminal voltage at OFF is the battery voltage.
Judge as NG when the terminal voltage remains High.

2. COMPONENT DESCRIPTION



(A) Battery voltage
(B) Output voltage of the rear oxygen sensor heater
(C) 256 ms (cycles)
(D) High error

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after engine starting	≥ 1 second
Engine speed	< 8000 rpm

4. GENERAL DRIVING CYCLE

After starting the engine, perform the diagnosis continuously when engine is low speed.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	High
Rear oxygen sensor heater control duty	≥ 20 %

Time Needed for Diagnosis:8 ms × 1250 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage level	Low

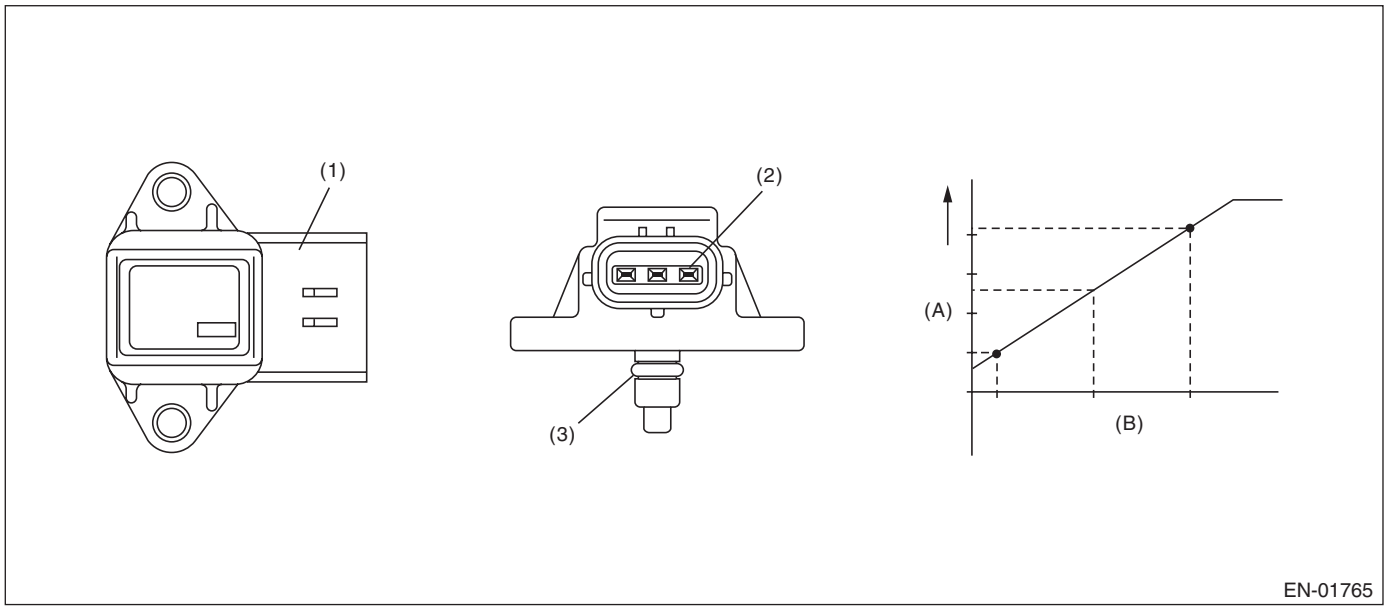
Time Needed for Diagnosis: Less than 1 second

H: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

1. OUTLINE OF DIAGNOSIS

Detect problems in the intake manifold pressure sensor output properties.
Judge as 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



(A) Output voltage
(B) Absolute pressure
(1) Connector
(2) Terminals
(3) O-ring

3. ENABLE CONDITIONS

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 as NG when Low side or High side becomes NG.
If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2500 rpm
Throttle position	≥ 12 °
Output voltage	< 1.63 V
Engine load	> 0.6 g/rev (0.02 oz/rev)
High	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.44 °
Output voltage	≥ 3.4 V
Engine load	< 0.4 g/rev (0.01 oz/rev)

Time Needed for Diagnosis:
Low side: 3000 ms
High side: 7000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.
If the duration of time while the following conditions are met is longer than the time indicated, judge as OK.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Engine speed	< 2500 rpm
Throttle position	≥ 12 °
Output voltage	≥ 1.63 V
Engine load	> 0.6 g/rev (0.02 oz/rev)
High	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.44 °
Output voltage	< 3.4 V
Engine load	< 0.4 g/rev (0.01 oz/rev)

Time Needed for Diagnosis:
Low side: Less than 1 second
High side: Less than 1 second

I: DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open circuit of the oil switching solenoid valve.
Judge as NG when the current is small even though the output duty is large.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio	≥ 30 %
Control current	< 0.026 A

Time Needed for Diagnosis:2000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
|Oil switching solenoid valve target current value – Oil switching solenoid valve current value|	< 0.08 A
Target current	≥ 0.11 A

Time Needed for Diagnosis:2000 ms

J: DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect short circuits of the oil switching solenoid valve.
Judge as a short NG when the current is large even though the output duty is small.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio	< 7 %
Control current	≥ 0.465 A

Time Needed for Diagnosis:2000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
|Oil switching solenoid valve target current value – Oil switching solenoid valve current value|	< 0.08 A

Time Needed for Diagnosis:2000 ms

K: DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0076. <Ref. to GD(H4SO)-23, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

L: DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)

1. OUTLINE OF DIAGNOSIS

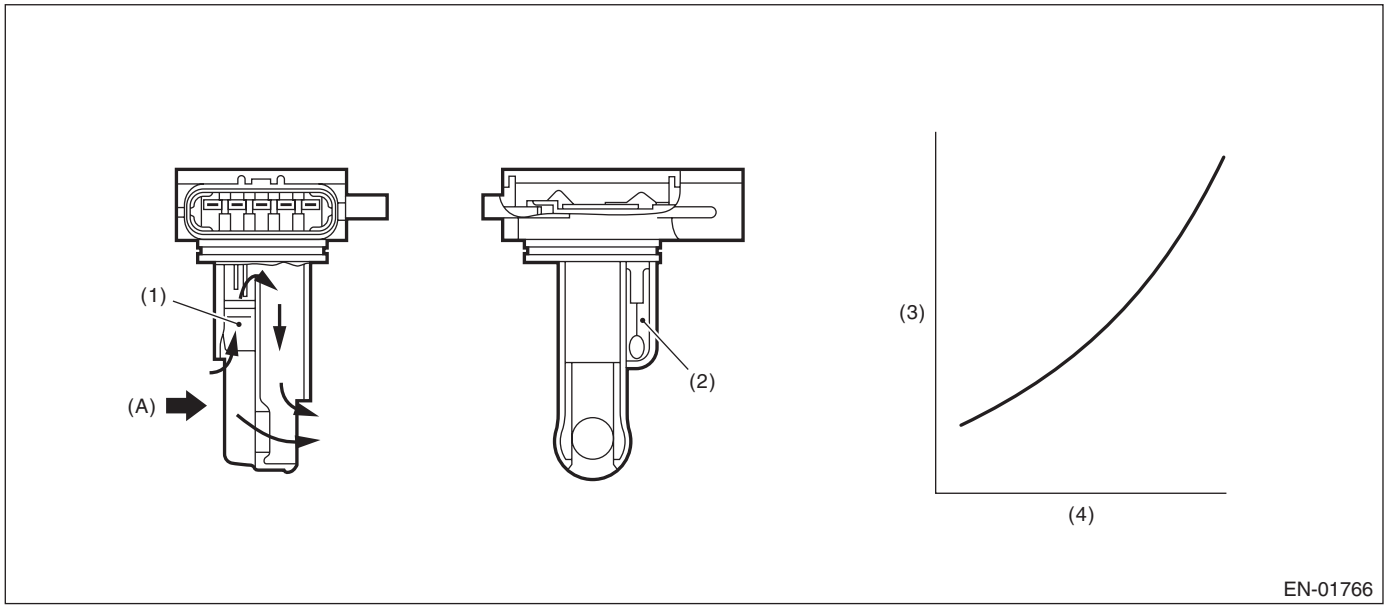
NOTE:
For the detection standard, refer to DTC P0077. <Ref. to GD(H4SO)-24, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of air flow sensor output properties.
Judge as a low side NG when the air flow voltage indicates a small value regardless of running in a state where the air flow voltage increases. Judge as a high side NG when the air flow voltage indicates a large value regardless of running in a state where the air flow voltage decreases. Judge air flow sensor property NG when the Low side or High side becomes NG.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Amount of intake air (kg (lb)/s)

3. ENABLE CONDITIONS

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 as NG when Low side or High side becomes NG.
If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Output voltage	< 1.49 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 12 °
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High (1)	
Output voltage	≥ 2.66 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 2.44 °
Intake manifold pressure	< 40 kPa (300 mmHg, 11.8 inHg)
High (2)	
Output voltage	≥ 1.45 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 2.44 °
Intake manifold pressure	< 40 kPa (300 mmHg, 11.8 inHg)
Fuel system diagnosis	Rich side malfunction

Time Needed for Diagnosis:
Low: 5000 ms
High: 10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG when both Low side and High side become OK.
Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Low	
Output voltage	≥ 1.49 V
Engine speed	≥ 2000 rpm
Throttle opening angle	≥ 12 °
Intake manifold pressure	≥ 66.7 kPa (500 mmHg, 19.7 inHg)
High	
Output voltage	< 2.66 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 2.44 °
Intake manifold pressure	< 40 kPa (300 mmHg, 11.8 inHg)
Fuel system diagnosis	Rich side normal

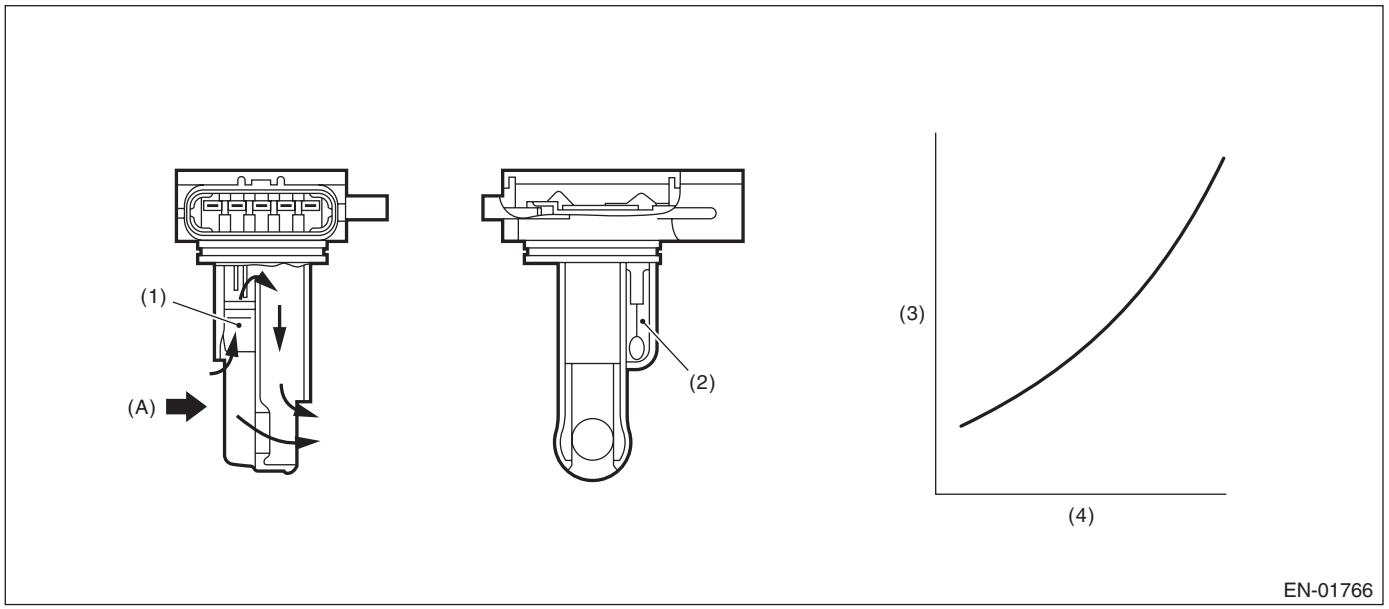
Time Needed for Diagnosis:
Low: Less than 1 second
High: Less than 1 second

N: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Amount of intake air (kg (lb)/s)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.22 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 0.22 V

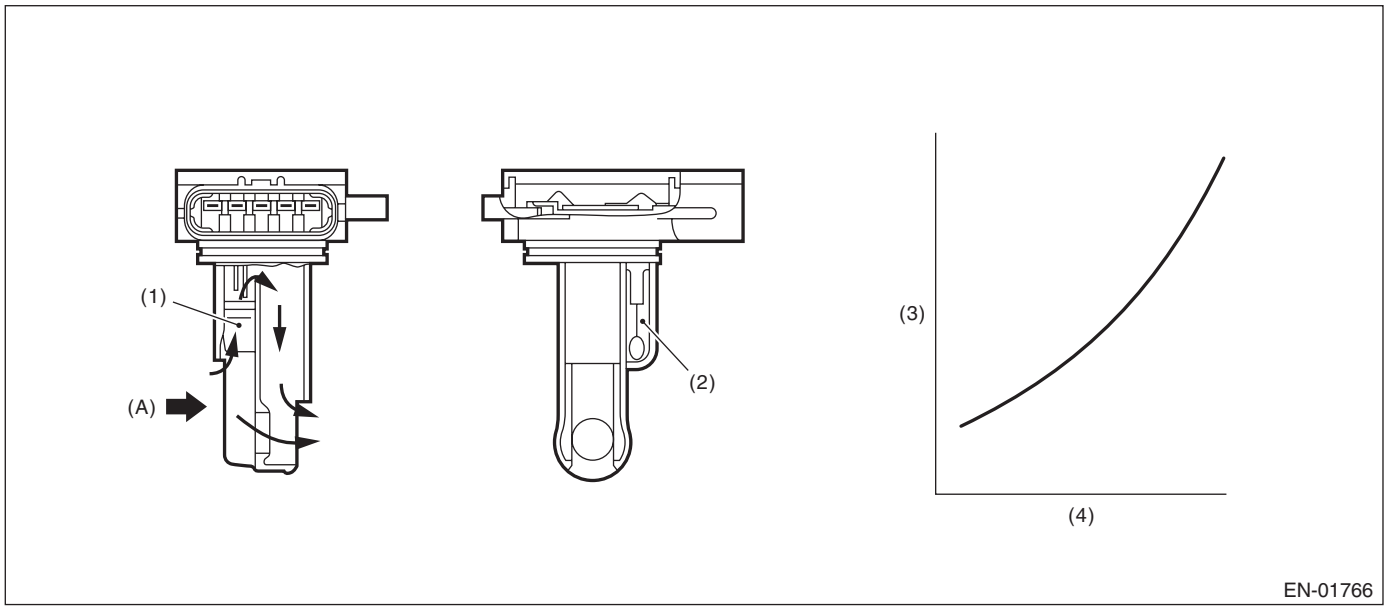
Time Needed for Diagnosis: Less than 1 second

O: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

1. OUTLINE OF DIAGNOSIS

Detect open or short circuits of the air flow sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Voltage (V)
(4) Amount of intake air (kg (lb)/s)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.179943192 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.179943192 V

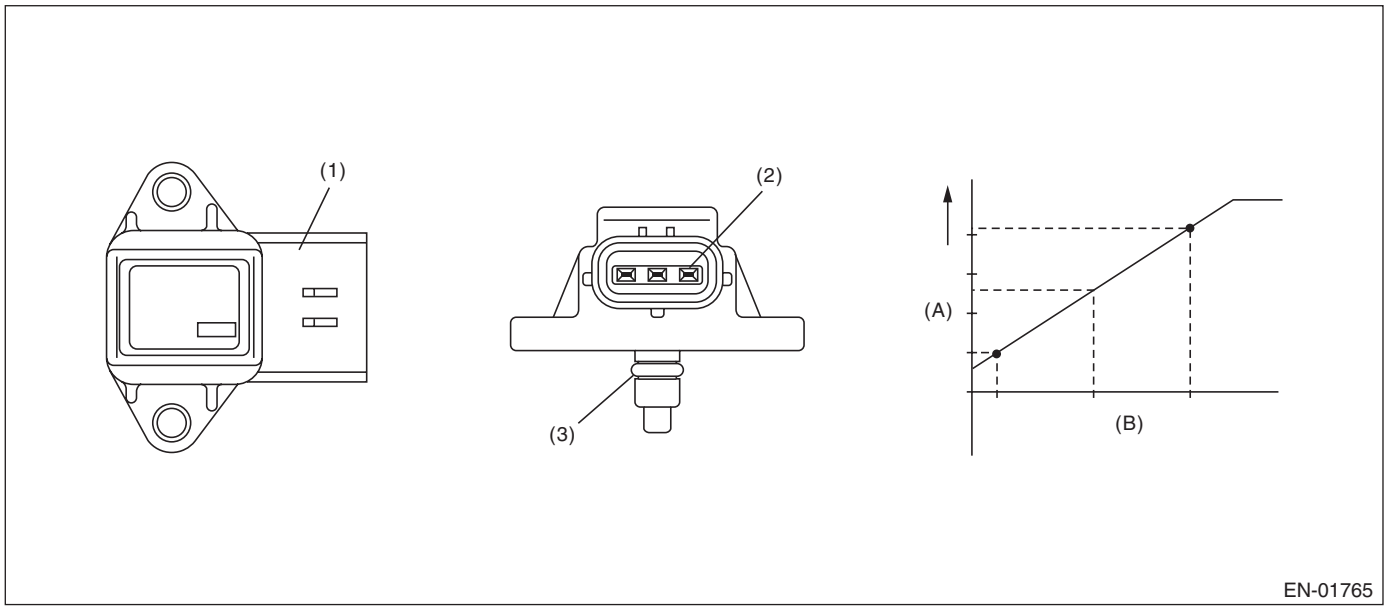
Time Needed for Diagnosis: Less than 1 second

P: 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 as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Output voltage
(B) Absolute pressure
(1) Connector
(2) Terminals
(3) O-ring

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≤ 0.573 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	> 0.573 V

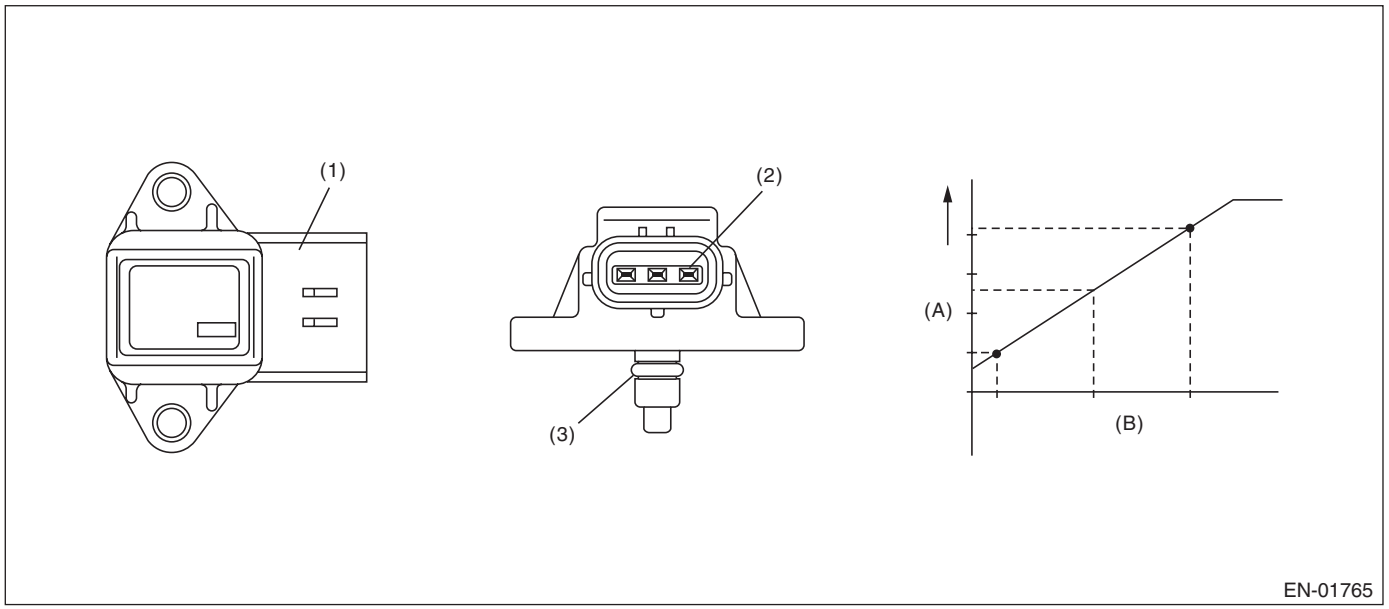
Time Needed for Diagnosis: Less than 1 second

Q: 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 as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Output voltage
(B) Absolute pressure
(1) Connector
(2) Terminals
(3) O-ring

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.38757221 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.38757221 V

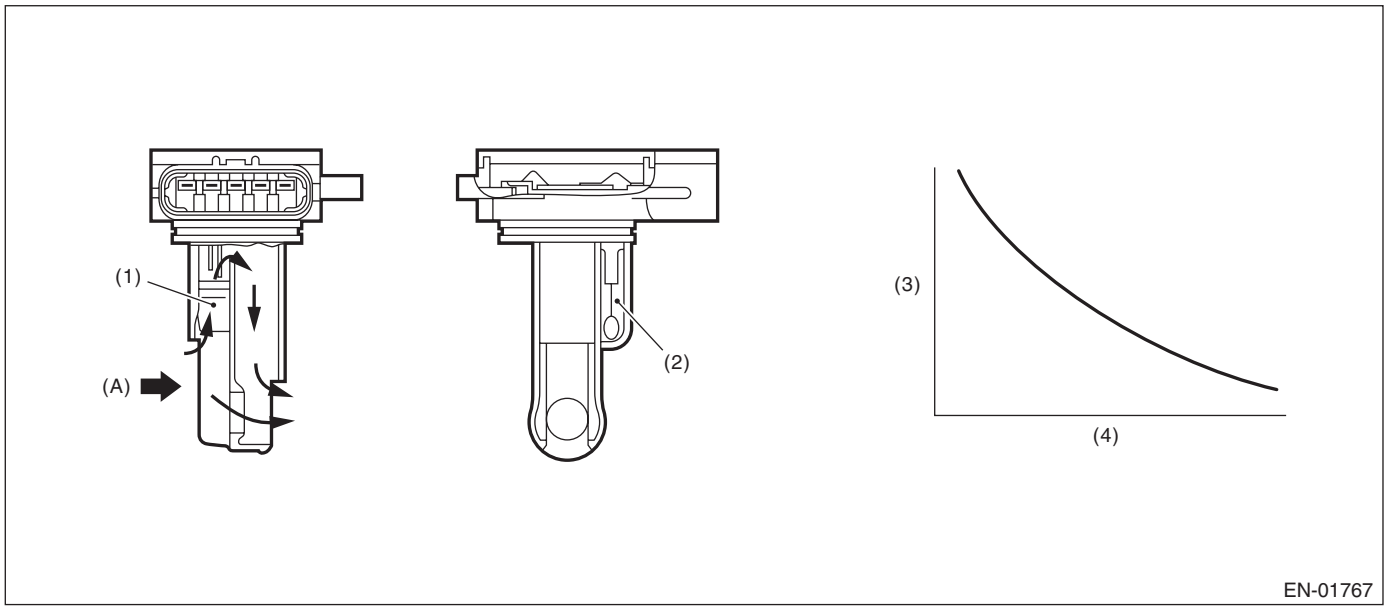
Time Needed for Diagnosis: Less than 1 second

R: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of intake air temperature sensor output property.
Judge as NG when the intake air temperature is not varied whereas it seemed to be varied from the viewpoint of engine condition.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance value (Ω)
(4) Intake air temperature °C (°F)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine coolant temperature at engine starting	< 35 °C (95 °F)
Battery voltage	≥ 10.9 V
Continuous time when the vehicle speed is less than 140 km/h (87 MPH)	≥ 600 s
Engine coolant temperature	≥ 75 °C (167 °F)
Intake air amount sum value	≥ Value of Map 1
Number of experiences under conditions below	≥ 3 time(s)
• Continuous time when vehicle speed is less than 4 km/h (2.5 MPH)	≥ Value of Map 2
• Continuous time when vehicle speed is 40 km/h (24.9 MPH) or more	≥ 15 s
and	
Establishing time of 1, 2	≥ 15 s
1. Intake air amount	≥ 10 g/s (0.35 oz/s)
2. Vehicle speed	≥ 4 km/h (2.5 MPH)

Map 1

Engine coolant temperature °C (°F)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)
Intake air amount sum value (g (oz)/s)	50000 (1763.5)	7400 (261)	6600 (232.78)	5800 (204.57)	5000 (176.35)

Map 2

Engine coolant temperature °C (°F)	–30 (–22)	0 (32)	10 (50)	20 (68)
Continuous time (s) when vehicle speed is less than 4 km/h (2.5 MPH)	250	40	32	24

4. GENERAL DRIVING CYCLE

Perform the diagnosis when the vehicle speed condition is met after warming up from a cold condition.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	< 0.02 V(Equivalent to approximately 0.5°C (0.9°F) near 25°C)

Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage difference between Max. and Min.	≥ 0.02 V

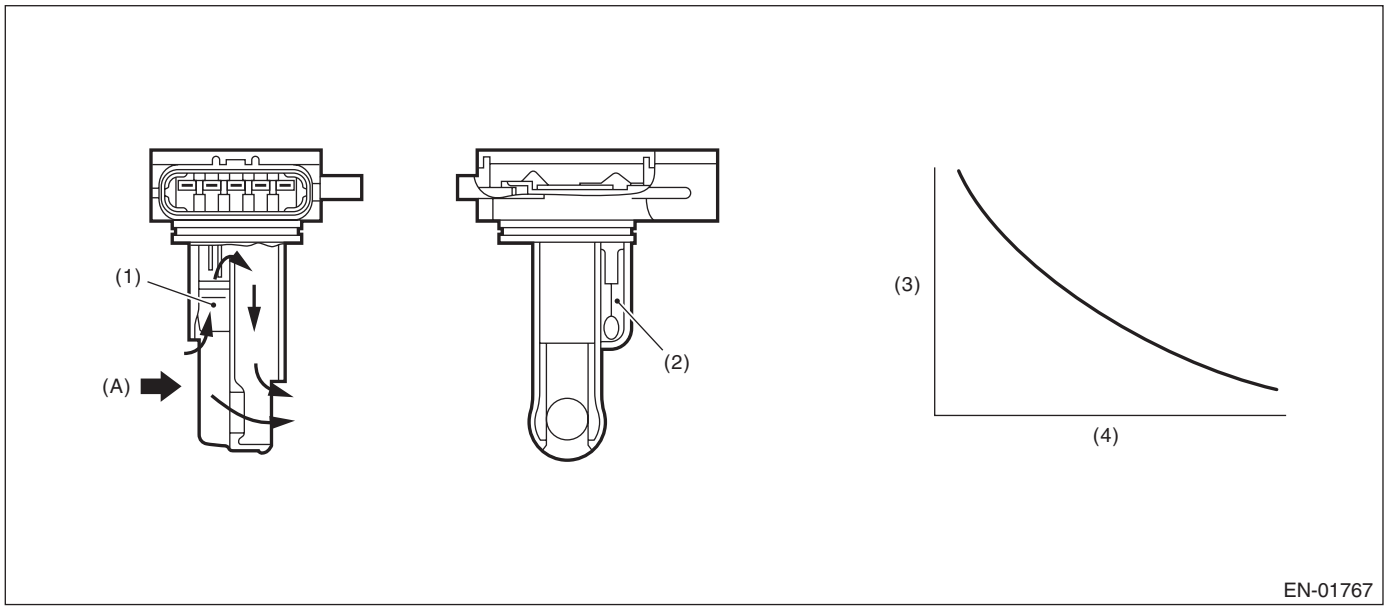
Time Needed for Diagnosis: Less than 1 second

S: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance value (Ω)
(4) Intake air temperature °C (°F)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.230975449 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.230975449 V

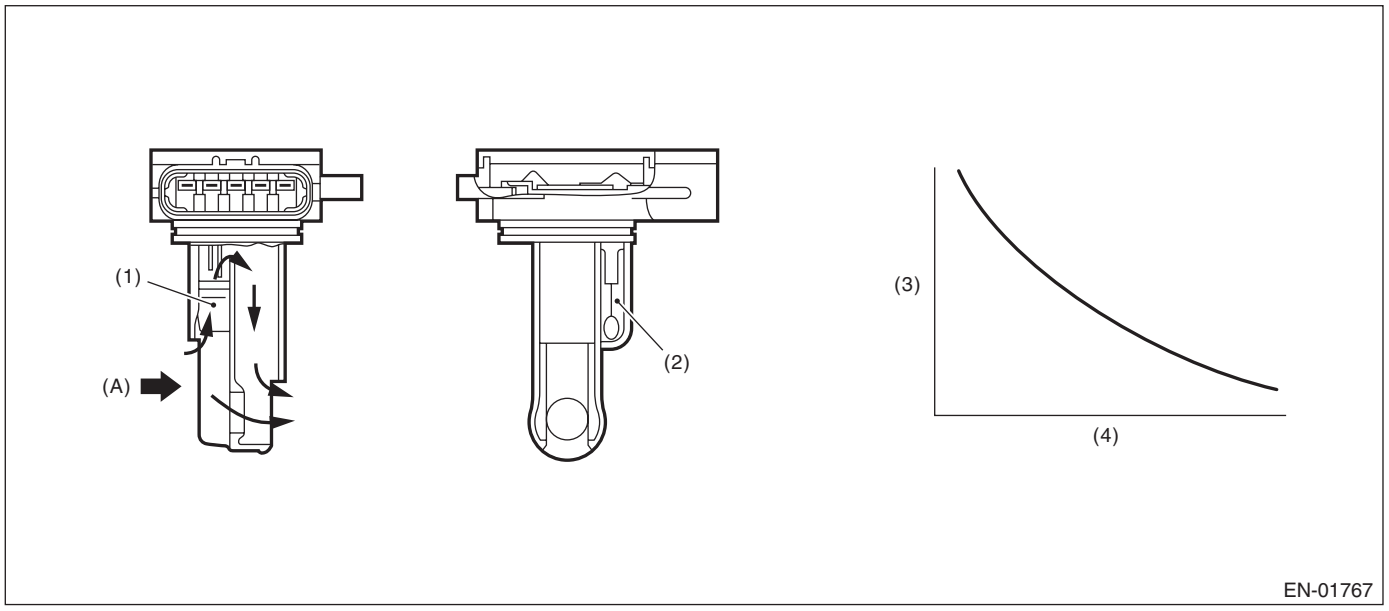
Time Needed for Diagnosis: Less than 1 second

T: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the intake air temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Air

(1) Air flow sensor
(2) Intake air temperature sensor
(3) Resistance value (Ω)
(4) Intake air temperature °C (°F)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.716 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

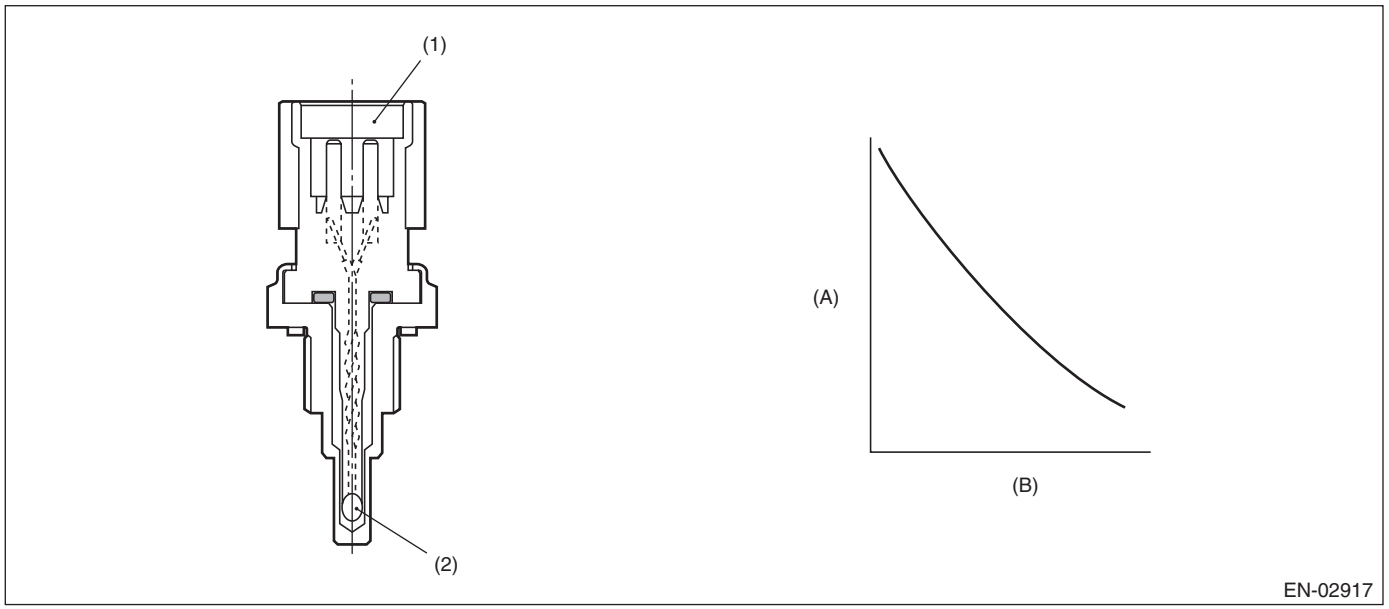
Time Needed for Diagnosis: Less than 1 second

U: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.264738528 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.264738528 V

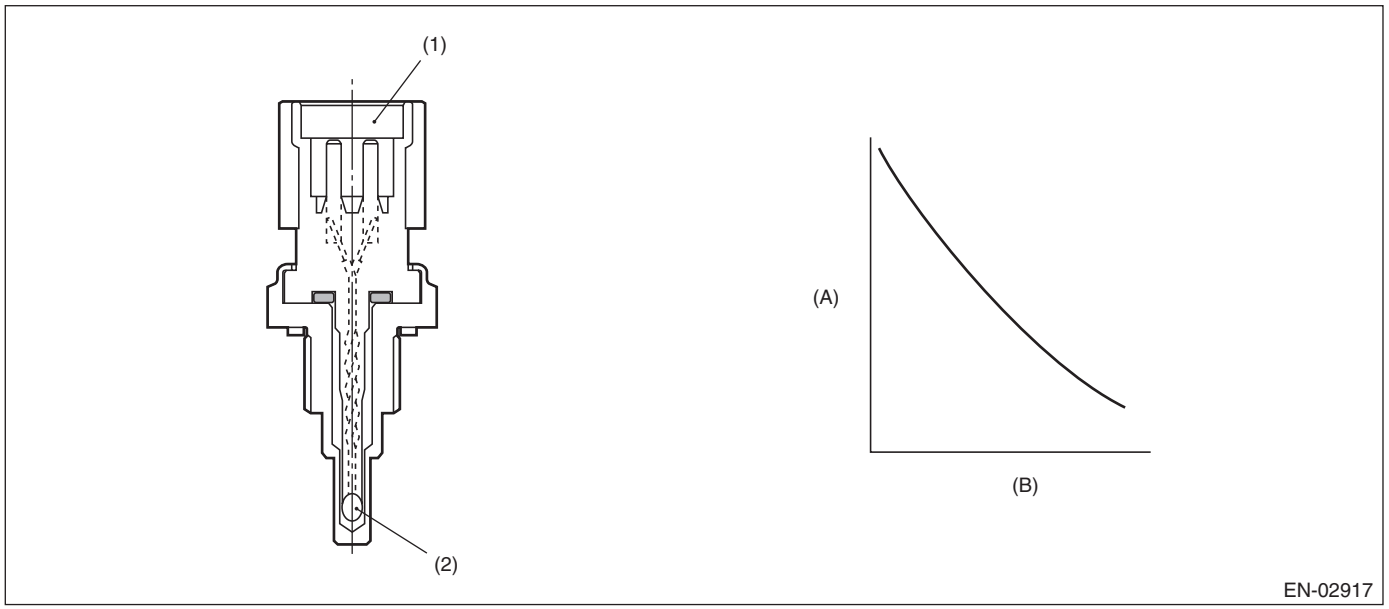
Time Needed for Diagnosis: Less than 1 second

V: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the engine coolant temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.716 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

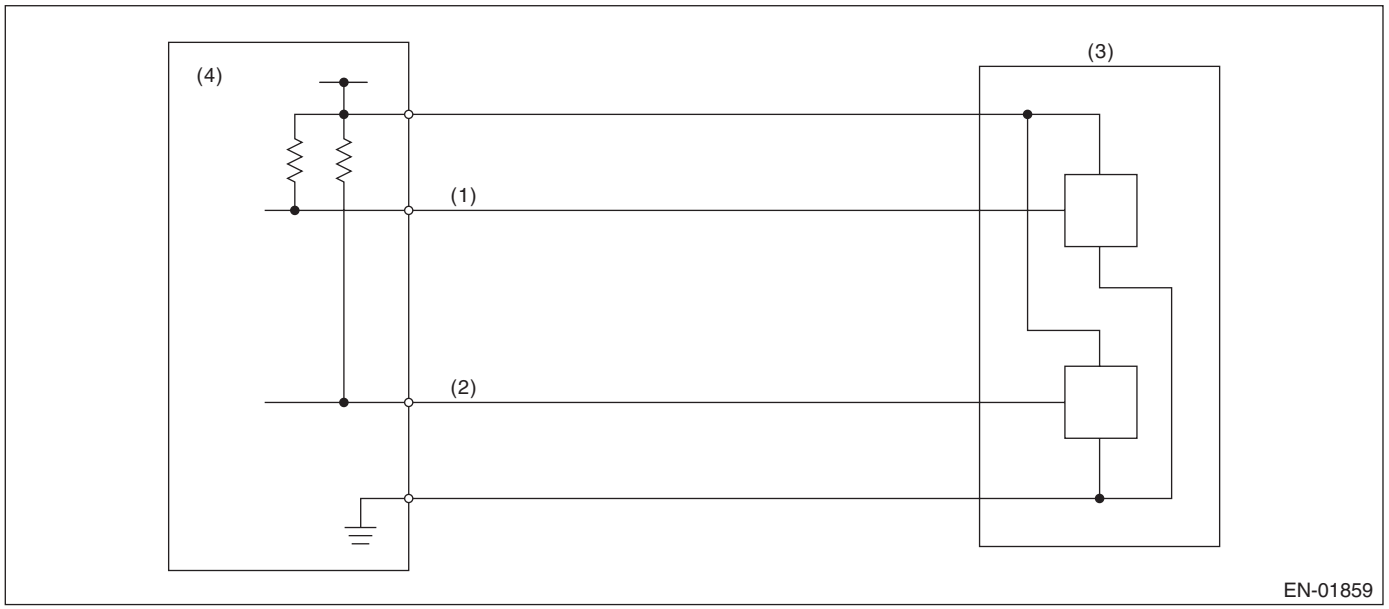
Time Needed for Diagnosis: Less than 1 second

W: DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.
Judge as NG if out of specification.

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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≤ 0.217 V

Time Needed for Diagnosis: 24 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	> 0.217 V

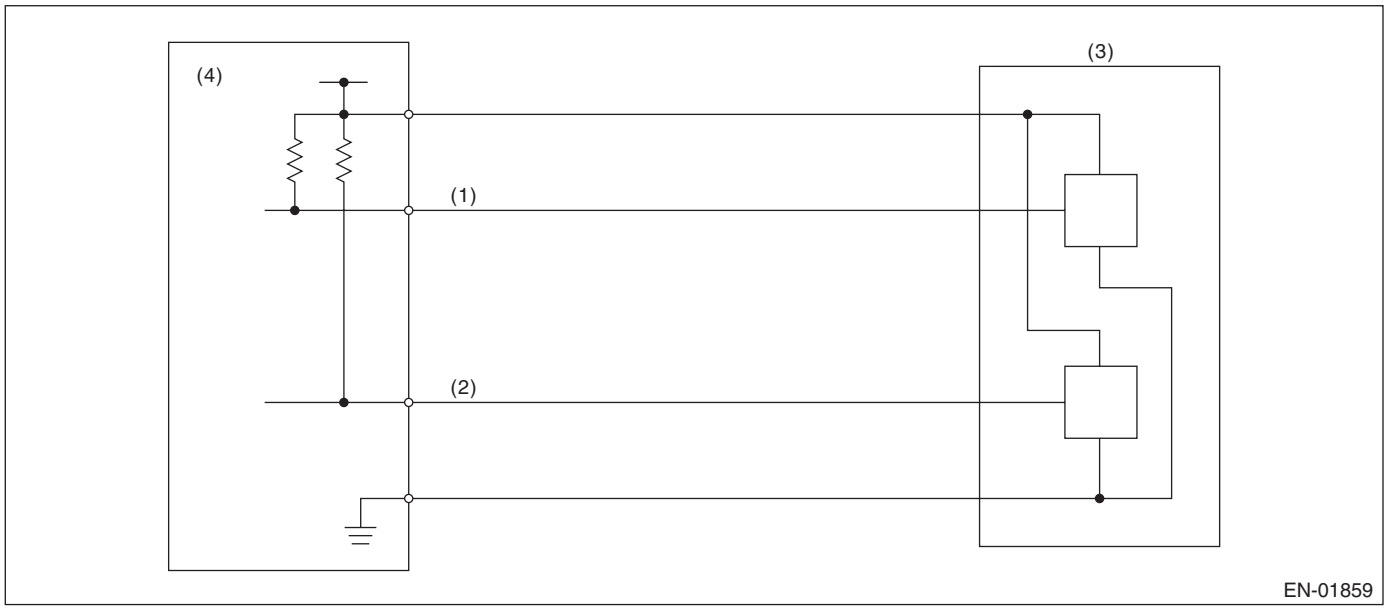
Time Needed for Diagnosis: 24 ms

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 1.
Judge as NG if out of specification.

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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 4.858 V

Time Needed for Diagnosis: 24 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	< 4.858 V

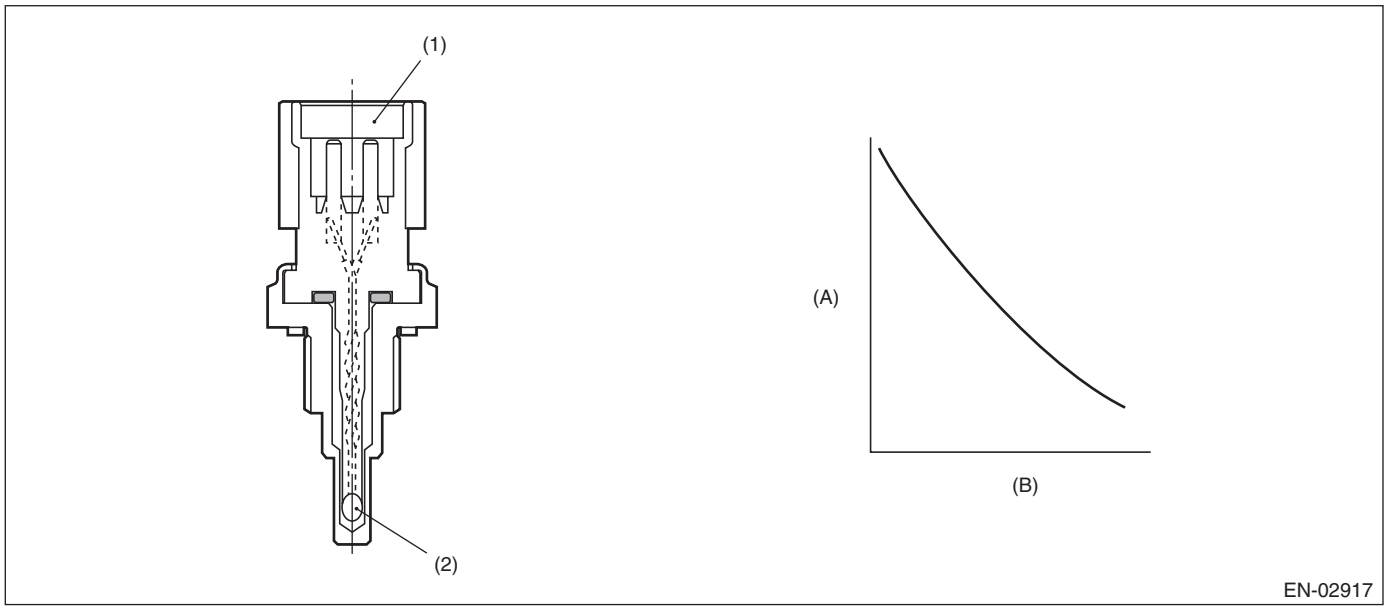
Time Needed for Diagnosis: 24 ms

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of engine coolant temperature output property.
Judge as NG when the engine coolant temperature does not rise in driving conditions where it should.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine speed	≥ Value from Map
Battery voltage	≥ 10.9 V

Map

Engine coolant temperature °C (°F)	–40 (–40)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Engine speed rpm	500	500	500	500	500	500	500	500

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Engine speed rpm	500	500	500	500	500	500	500	500

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine start.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG if the criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	< 20 °C (68 °F)
Timer for diagnosis after engine start	≥ Judgment value of timer after engine start

Timer for diagnosis after engine start
a. Timer stop at fuel cut
b. During the driving conditions except a) above, timer counts up as follows.
64 ms + TWCNT ms (at 64 ms)
TWCNT is defined as follows,
TWCNT = 0 at idle switch ON,
TWCNT show on the following table at idle switch OFF.

		Vehicle speed km/h (MPH)							
		0 (0)	8 (5)	16 (9.9)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
Temperature °C (°F)	–20 (–4)	0 ms	32.076 ms	39.977 ms	47.879 ms	82.544 ms	117.209 ms	154.214 ms	185.26 ms
	–10 (14)	0 ms	25.704 ms	33.606 ms	41.508 ms	68.52 ms	95.532 ms	125.667 ms	155.802 ms
	0 (32)	0 ms	17.646 ms	25.548 ms	33.45 ms	53.652 ms	73.855 ms	97.12 ms	120.386 ms
	10 (50)	0 ms	7.901 ms	15.802 ms	23.704 ms	37.941 ms	52.177 ms	68.573 ms	82.538 ms
	20 (68)	0 ms	7.901 ms	15.802 ms	23.704 ms	37.941 ms	52.177 ms	68.573 ms	82.538 ms

Judgment value of timer after engine starting
t = 573669 ms – 33924 ms × Ti
Ti : The lowest coolant temperature after engine start
Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature	≥ 20 °C (68 °F)

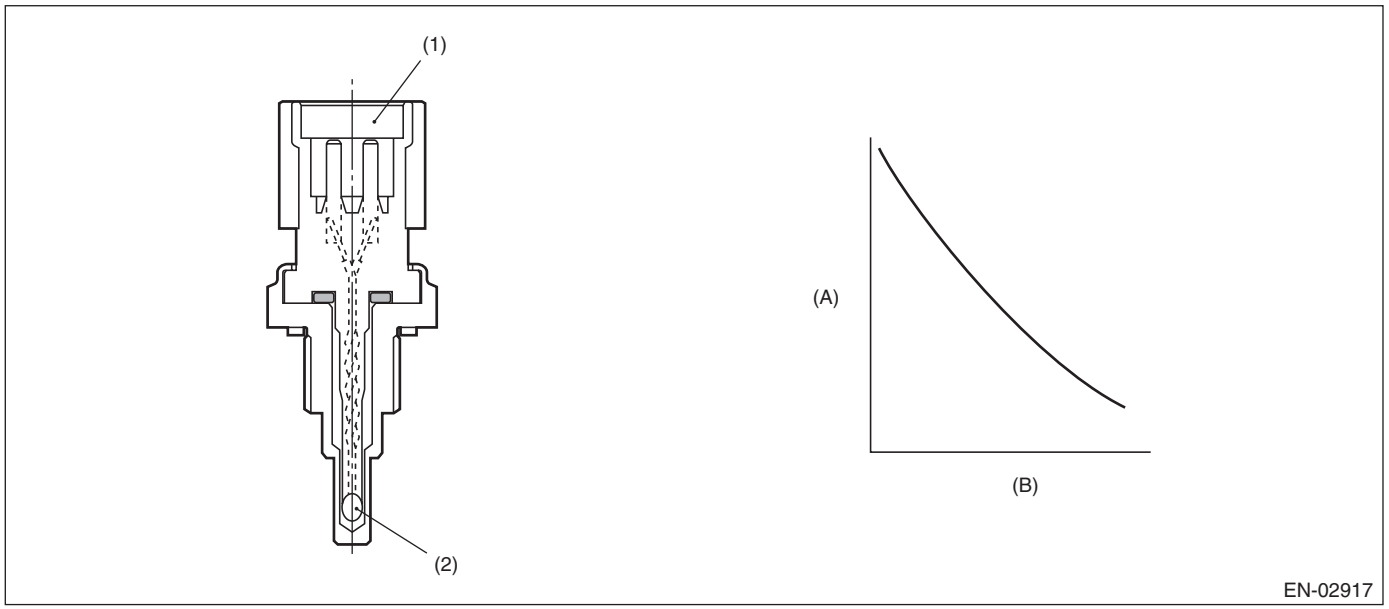
Time Needed for Diagnosis: Less than 1 second

Z: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.
Memorize the engine coolant temperature and fuel temperature at the last engine stop, and use them to judge as NG when the engine coolant temperature does not decrease when it should.

2. COMPONENT DESCRIPTION



(A) Resistance value (kΩ)
(B) Temperature °C (°F)
(1) Connector
(2) Thermistor element

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Refueling from the last engine stop till the current engine start	None
Fuel level	≥ 15 ℓ (3.96 US gal, 3.3 Imp gal)
Engine coolant temperature at the last engine stop	≥ 75 °C (167 °F)

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	< 2.5 °C (36.5 °F)
Fuel temperature at the last engine stop — Fuel temperature	≥ 5 °C (41 °F)
Intake air temperature — Fuel temperature	< 2.5 °C (36.5 °F)
Fuel temperature	< 35 °C (95 °F)

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Engine coolant temperature at the last engine stop — Minimum engine coolant temperature after the engine start	≥ 2.5 °C (36.5 °F)

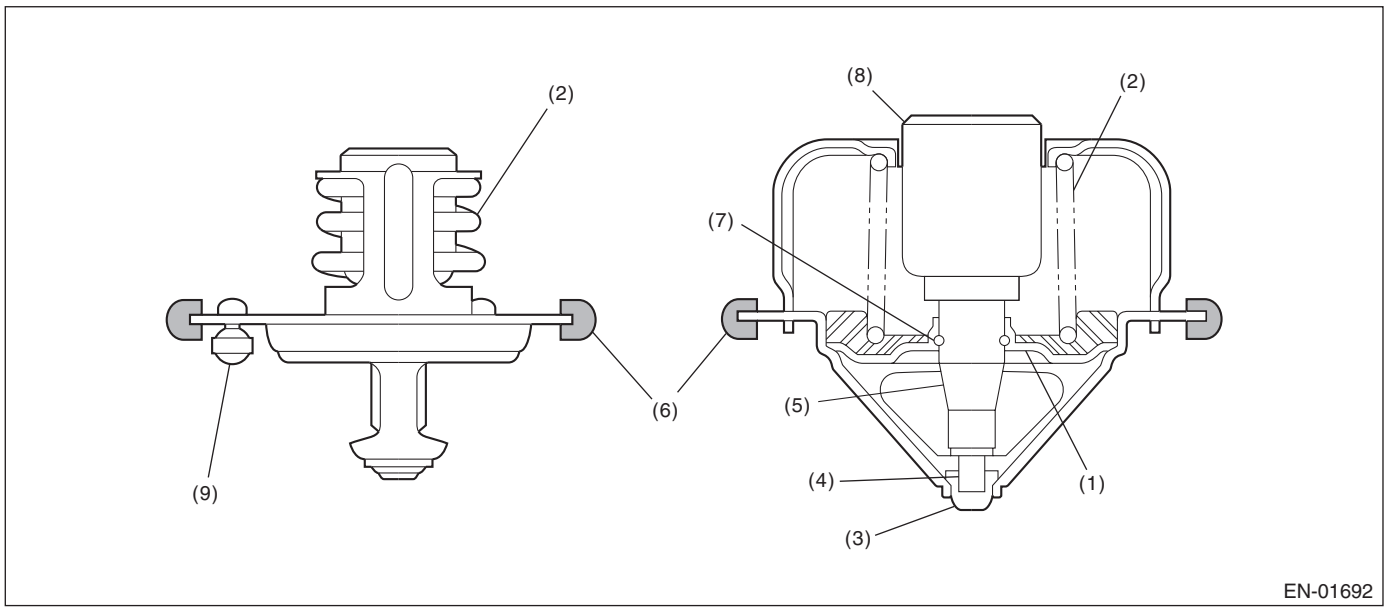
Time Needed for Diagnosis: Less than 1 second

AA:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the thermostat function.
Judge as NG when the engine coolant temperature is lower than the estimated engine coolant temperature and the difference between them is large. Judge as OK when the engine coolant temperature becomes to 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 seal
(7) Stop ring
(8) Wax element
(9) Jiggle valve

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Estimate ambient temperature	≥ –7 °C (19.4 °F)
Thermostat malfunction diagnosis	Incomplete
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) Engine coolant temperature	> 30 °C (86 °F)
Vehicle speed	≥ 30 km/h (18.6 MPH)

Time Needed for Diagnosis:64 ms × 3 time(s) × 152 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Estimate ambient temperature	≥ –7 °C (19.4 °F)
Thermostat malfunction diagnosis	Incomplete
Engine coolant temperature at engine starting	< 55 °C (131 °F)
Engine coolant temperature	≥ 75 °C (167 °F)
(Estimated – Measured) Engine coolant temperature	≤ 30 °C (86 °F)

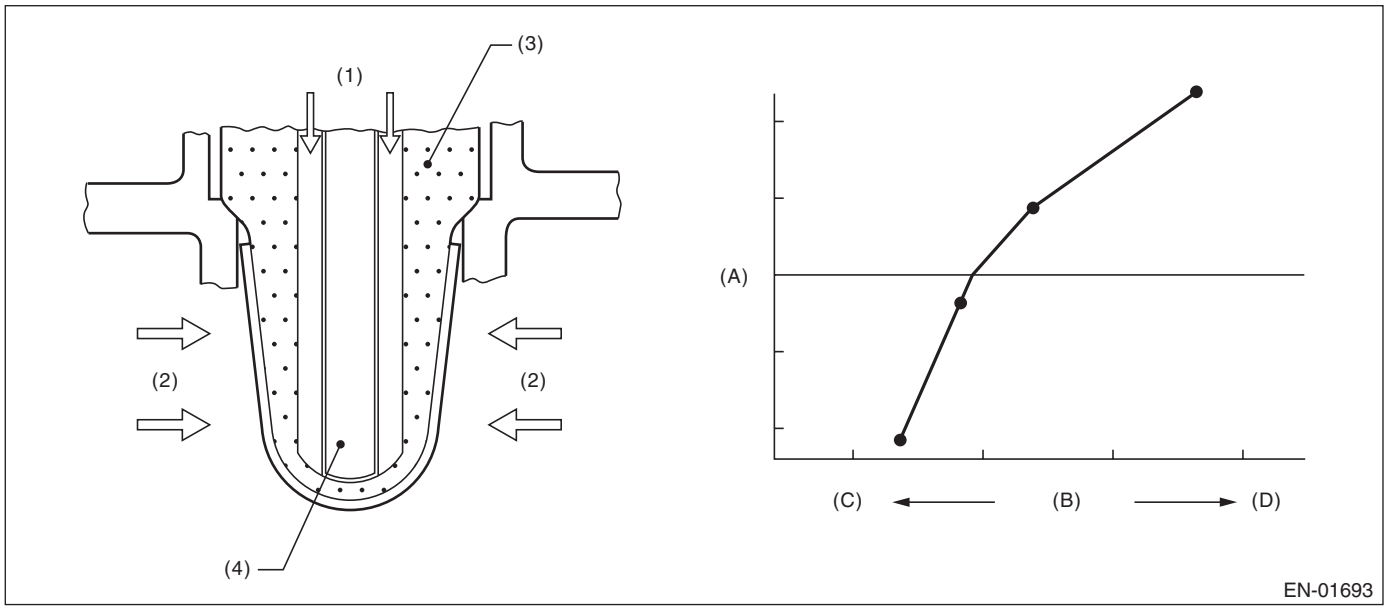
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.
Judge as NG, when the element voltage is out of the specified range.

2. COMPONENT DESCRIPTION



(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+)	< 1.128 V
or	
Input voltage (–)	< 0.23 V
or	
|Input voltage (+) – Input voltage (–)|	< 0.644 V

Time Needed for Diagnosis:
Input voltage (+): 1000 ms
Input voltage (–): 1000 ms
|Input voltage (+) – Input voltage (–)|: 1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+)	≥ 1.128 V
Input voltage (–)	≥ 0.23 V
|Input voltage (+) – Input voltage (–)|	≥ 0.644 V

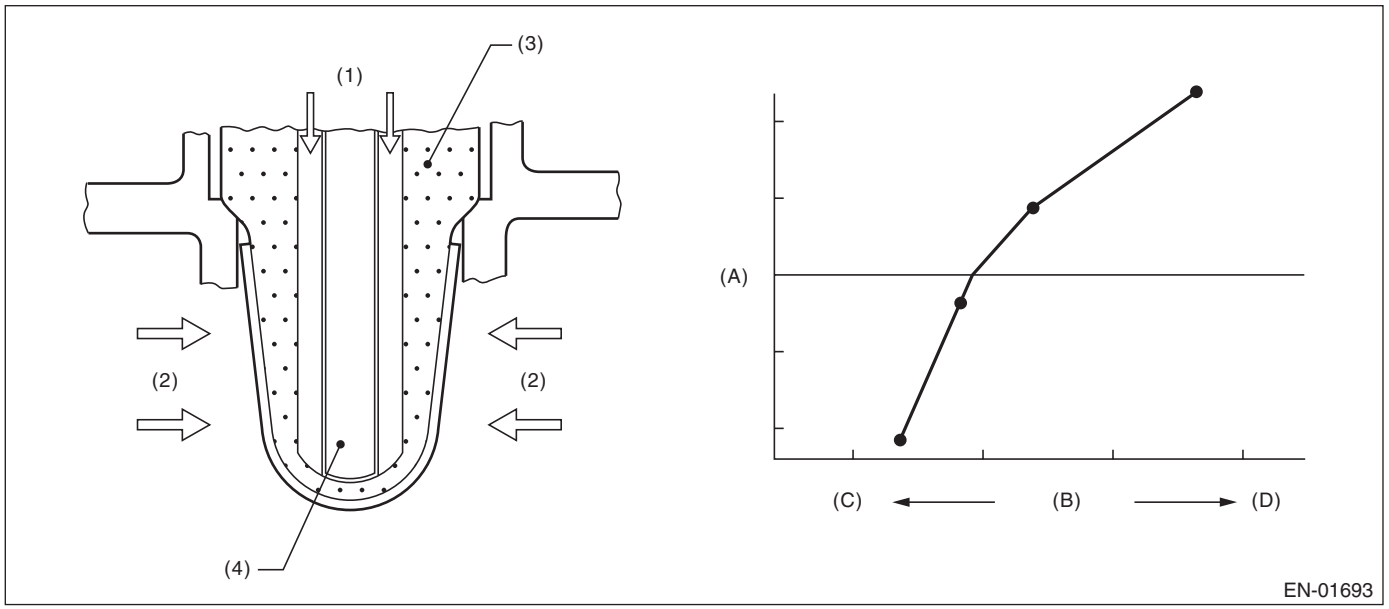
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of sensor.
Judge as NG, when the element voltage is out of the specified range.

2. COMPONENT DESCRIPTION



(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Input voltage (+)	> 3.589 V
or	
Input voltage (–)	> 3.541 V

Time Needed for Diagnosis:
Input voltage (+): 1000 ms
Input voltage (–): 1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

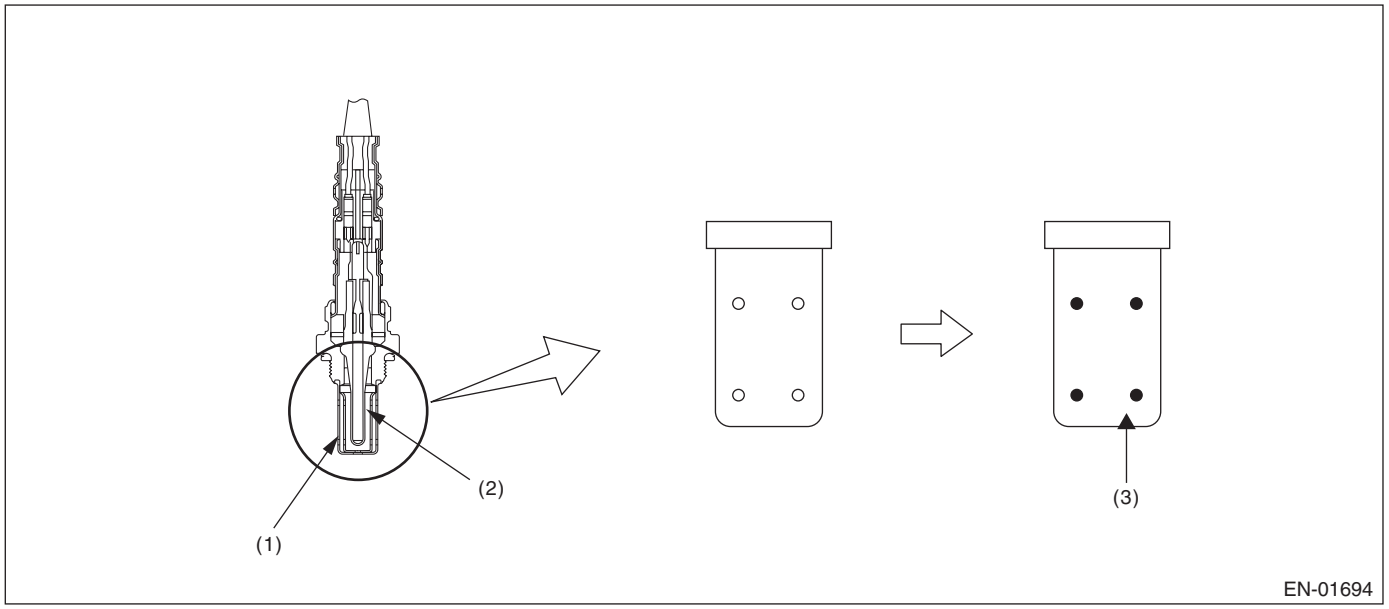
Malfunction Criteria	Threshold Value
Input voltage (+)	≤ 3.589 V
Input voltage (–)	≤ 3.541 V

Time Needed for Diagnosis: Less than 1 second

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

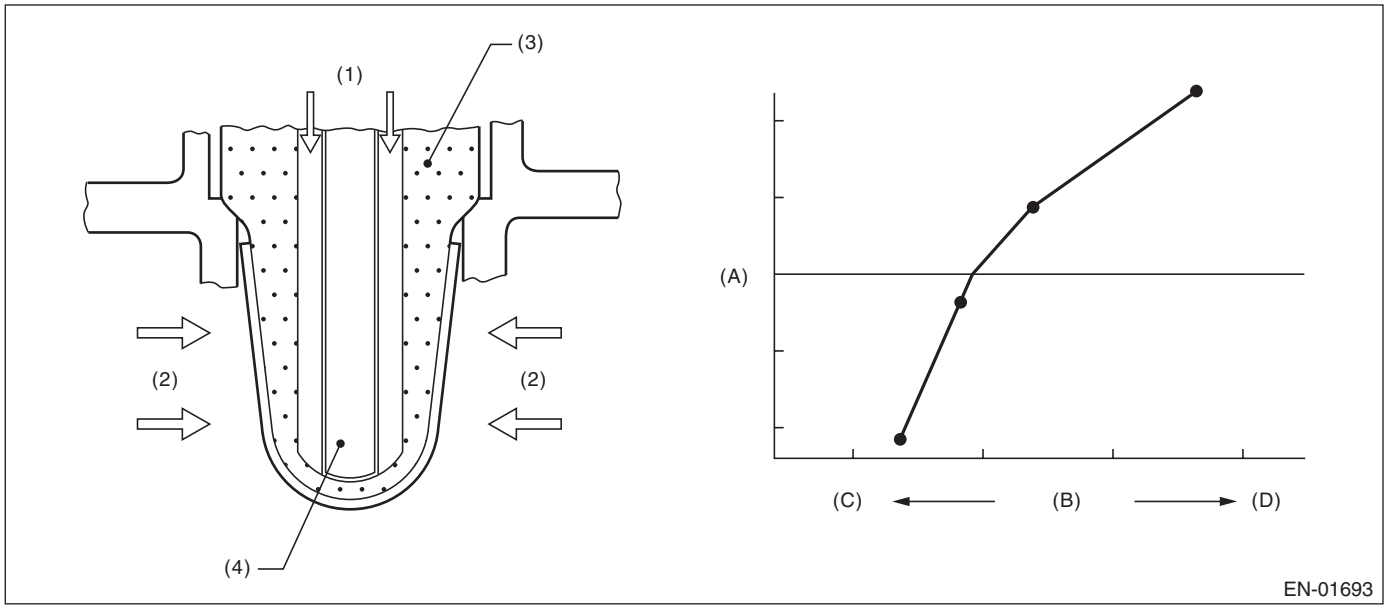
1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.
Front oxygen (A/F) sensor cover has some ventilation holes for exhaust gas. Clogged ventilation holes are diagnosed.
When the holes are clogged, the A/F output variation becomes slow comparing with the actual A/F variation because oxygen which reaches the zirconia layer is insufficient. Therefore, if the sensor cover holes are clogged, the rich to lean judgment in the ECM is delayed when the actual change from rich to lean occurs.
Judge as NG when the actual movement in comparison to the ECM control amount is slow.



(1) Cover (2) Zirconia (3) Clogging

2. COMPONENT DESCRIPTION



(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 1024 ms
Battery voltage	≥ 10.9 V
Atmospheric pressure	> 75 kPa (563 mmHg, 22.2 inHg)
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	0 Ω — 50 Ω
Elapsed time after starting the engine	≥ 120000 ms
Engine coolant temperature	≥ 75 °C (167 °F)
Engine speed	1000 rpm — 3200 rpm
Vehicle speed	10 km/h — 120 km/h (6.2 MPH — 74.6 MPH)
Amount of intake air	10 g/s — 40 g/s (0.35 oz/s — 1.41 oz/s)
Engine load	< 0.02 g/rev (0 oz/rev)
Learning value of EVAP conc. during purge	< 0.2
Total time of operating canister purge	≥ 19.9 s

4. GENERAL DRIVING CYCLE

Perform diagnosis only once at a constant speed of 10 km/h — 120 km/h (6.2 MPH — 74.6 MPH) 120000 ms or more after starting the engine.

5. DIAGNOSTIC METHOD

Calculate faf difference every 32 ms × 4 , and the λ value difference. Calculate the diagnosis value after calculating 1640 time(s).

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

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 to 32 ms × 4 × 1640 time(s). 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	> 0.45

Time Needed for Diagnosis:32 ms × 4 × 1640 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

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 to 32 ms × 4 × 1640 time(s). 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	≤ 0.45

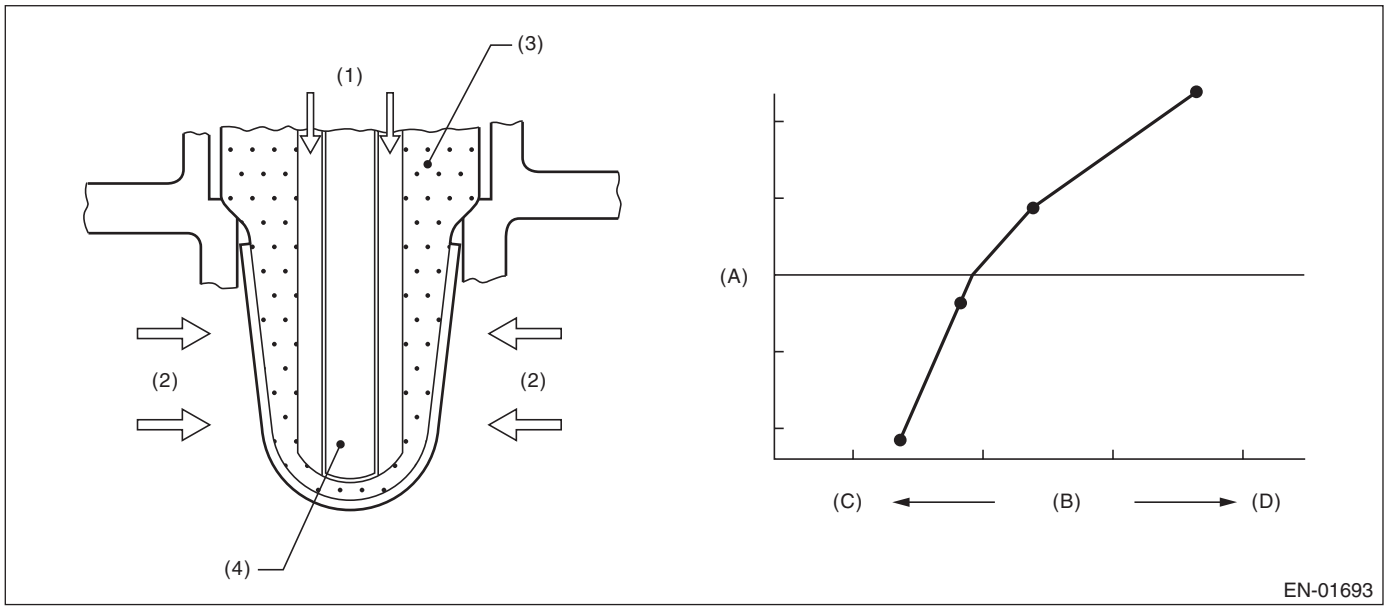
Time Needed for Diagnosis:32 ms × 4 × 1640 time(s)

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

1. OUTLINE OF DIAGNOSIS

Detect open circuits of the sensor.
Judge as NG when the impedance of the element is large.

2. COMPONENT DESCRIPTION



(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Time of heater control duty at 70 % or more	≥ 36000 ms
Front oxygen (A/F) sensor impedance.	> 500 Ω

Time Needed for Diagnosis:5000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Front oxygen (A/F) sensor impedance.	≤ 500 Ω

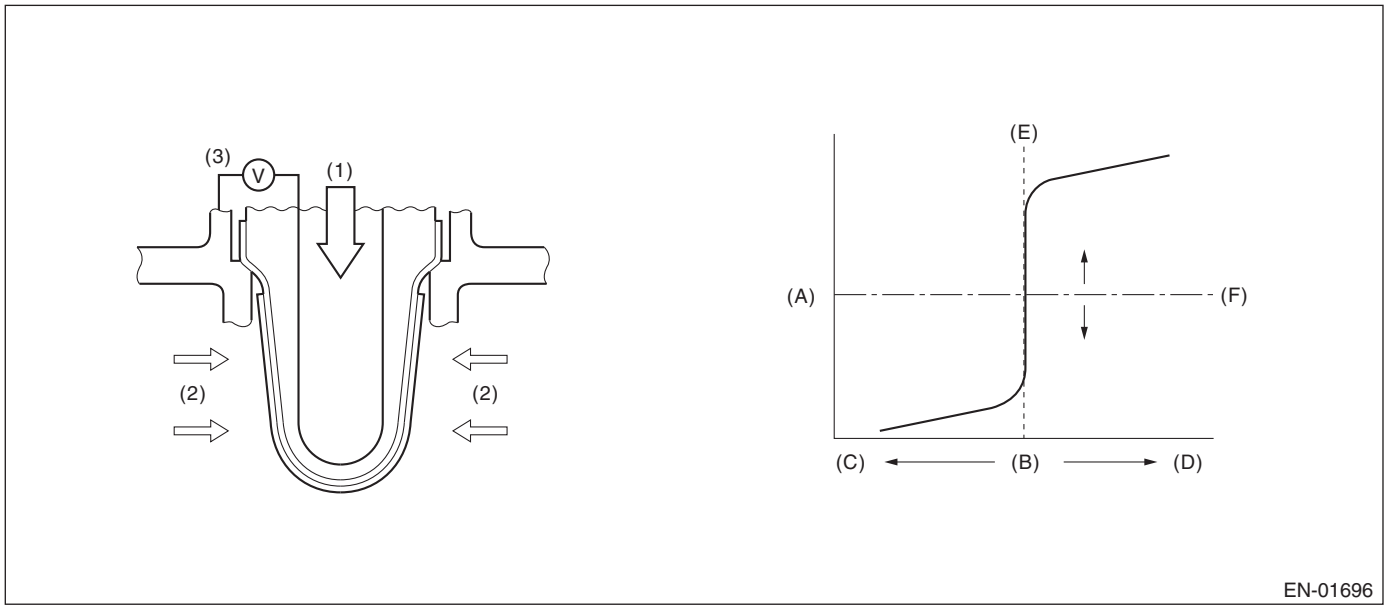
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect continuity NG of the oxygen sensor. If the oxygen sensor voltage reading is not within the probable range considering the operating conditions, judge as NG.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Rich
(D)	Lean	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITIONS

Used for abnormality judgment

Secondary Parameters	Enable Conditions
High	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 5 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)
Low (1)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 5 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)
Amount of intake air	≥ 10 g/s (0.35 oz/s)
Low (2)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 5 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)
Amount of intake air	< 10 g/s (0.35 oz/s)
Current continuation time of the rear oxygen sensor heater	≥ 30000 ms
Low (3)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 5 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)
Amount of intake air	< 10 g/s (0.35 oz/s)
Current continuation time of the rear oxygen sensor heater	≥ 30000 ms
Fuel cut	Experienced

Used for normality judgment

Secondary Parameters	Enable Conditions
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 5 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 75 °C (167 °F)

4. GENERAL DRIVING CYCLE

After starting the engine, continuously perform the diagnosis with the same engine condition.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
High Sensor output voltage	> 1.2 V	P0138
Low Sensor output voltage	< 0.03 V	P0137

Time Needed for Diagnosis

High: 2500 ms
Low (1): 20000 ms
Low (2): 40000 ms
Low (3): Value from Map

Map

Fuel Cut Time (s)	0	2000	10000
Time needed for diagnosis (s)	40000	40000	60000

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
High Sensor output voltage	≤ 1.2 V	P0138
Low Sensor output voltage	≥ 0.03 V	P0137

Time Needed for Diagnosis

High: Less than 1 second
Low (1): Less than 1 second
Low (2): Less than 1 second
Low (3): Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0137. <Ref. to GD(H4SO)-55, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

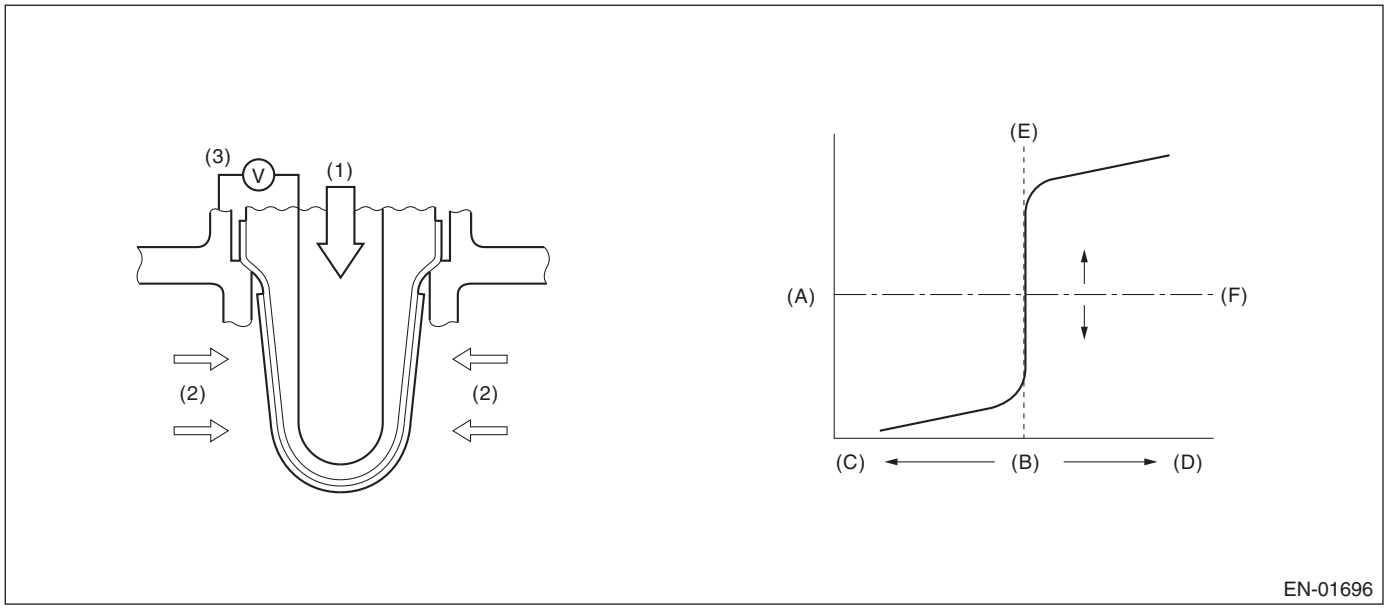
1. OUTLINE OF DIAGNOSIS

Detect the slow response of the oxygen sensor.
Judge as NG if either the rich to lean response diagnosis or lean to rich response diagnosis is NG, and judge as OK if both are OK.
[Rich → lean diagnosis response]
1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to rich to lean. If the measured response time is larger than the threshold value, it is NG. If it is smaller, it is OK. Response time calculation is categorized in two by voltage difference.
   - Response time in small voltage difference: Intermediate
   - Response time in large voltage difference: Wide
2. Judge as NG when the oxygen sensor voltage is large (rich) even after deceleration fuel cut has occurred.
[Lean → rich diagnosis response]
1. Measure the response time for oxygen sensor output changes when the A/F ratio changes to lean to rich. If the measured response time is larger than the threshold value, it is NG.
2. Judge as NG when the oxygen sensor voltage remains small when recovering from a deceleration fuel cut.

Diagnostic method

Measure the response time of the output change of the oxygen sensor when the A/F ratio changes to rich to lean. And Judge as NG when the measured response time is larger than the threshold value.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Rich
(D)	Lean	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITIONS

Rich → lean diagnosis response

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time of 5000 ms or more (intermediate) Deceleration fuel cut time of 5000 ms or more (wide)	Experienced
After fuel cut	≥ 2000 ms (Intermediate) ≥ 2000 ms (Wide)
Estimated temperature of the rear oxygen sensor element	≥ 500 °C (932 °F) (Intermediate) ≥ 500 °C (932 °F) (Wide)
Number of deceleration fuel cut	≥ 1 time(s)

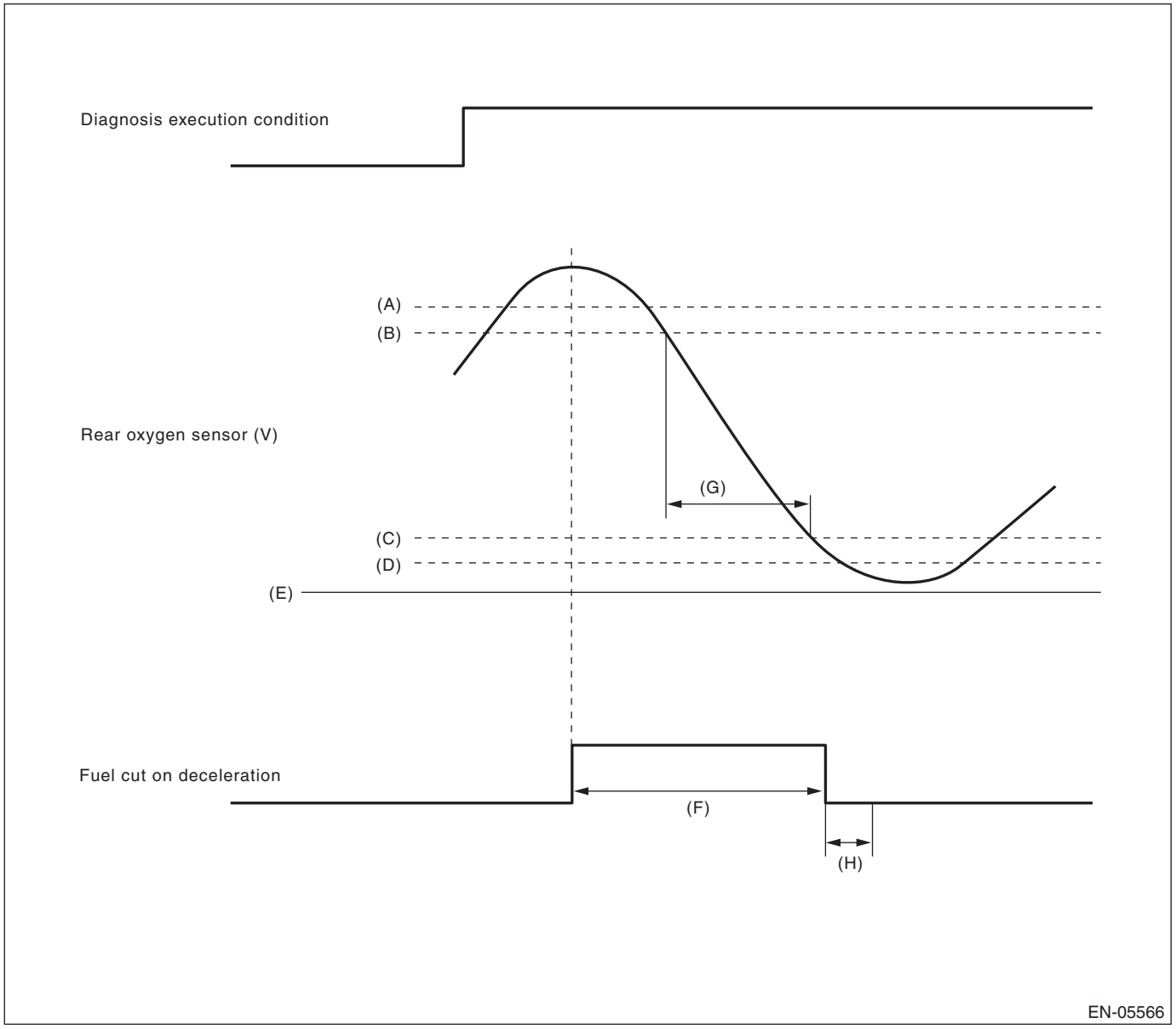
4. GENERAL DRIVING CYCLE

Perform diagnosis once during deceleration fuel cut from a constant and high speed driving, when rear oxygen sensor is warmed up sufficiently. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

5. DIAGNOSTIC METHOD

- Intermediate

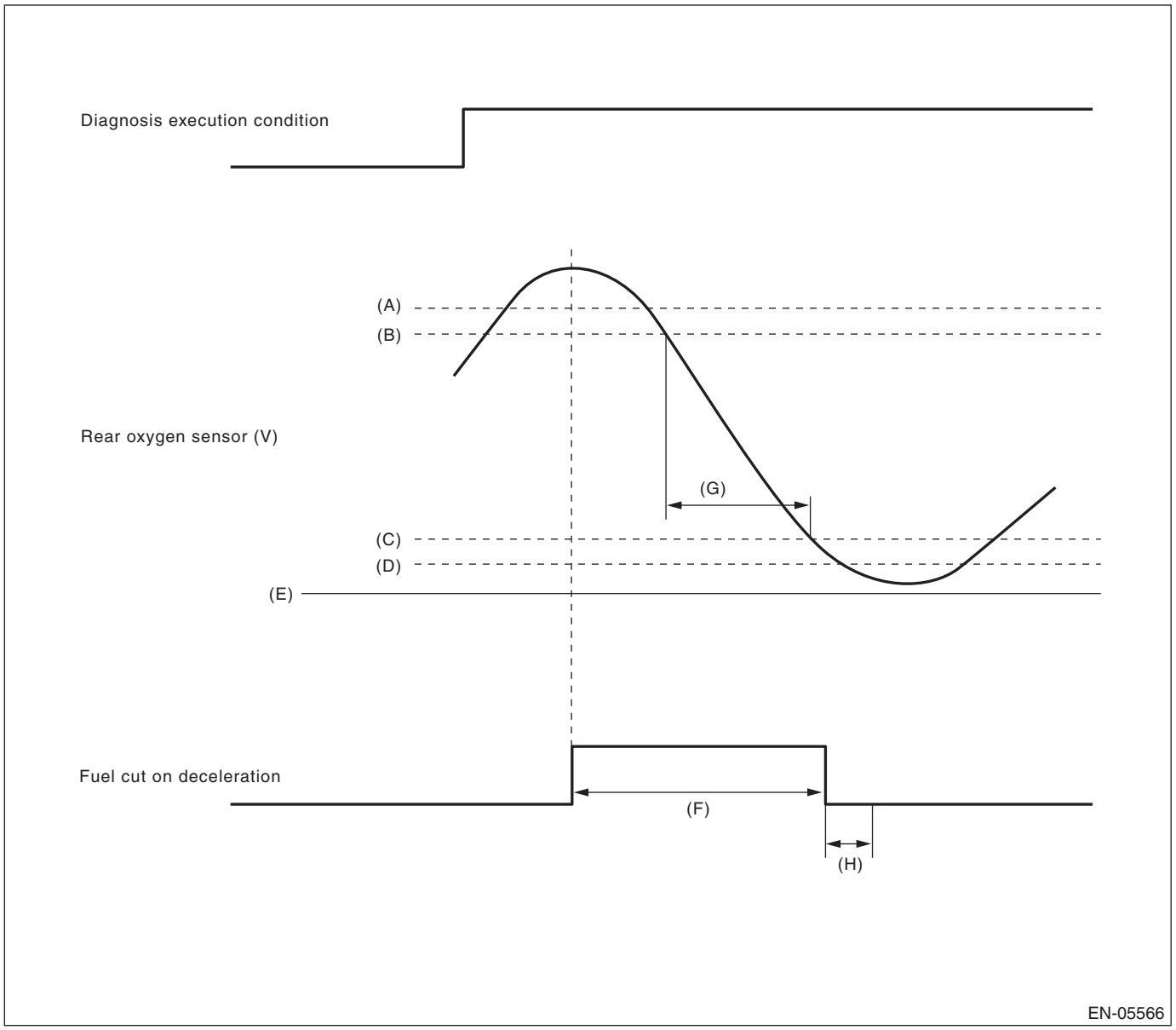
When the oxygen sensor output voltage changes from 0.55 V (rich) to 0.15 V (lean), calculate the minimum response time for output change between 0.5 V and 0.2 V for the judgment criteria.



(A) 0.55 V
(B) 0.5 V
(C) 0.2 V
(D) 0.15 V
(E) 0 V
(F) More than 5000 ms
(G) Measure the response time.
(H) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

• Wide

When the oxygen sensor output voltage changes from 0.65 V (rich) to 0.05 V (lean), calculate the minimum response time for output change between 0.6 V and 0.1 V for the judgment criteria.



(A) 0.65 V
(B) 0.6 V
(C) 0.1 V
(D) 0.05 V
(E) 0 V
(F) More than 5000 ms
(G) Measure the response time.
(H) Execute the malfunction judgment in 2000 ms from the recovery of fuel cut on deceleration.

- **Abnormality Judgment**

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.
Response time (diagnosis value) > threshold value → abnormal

NOTE:
Perform NG judgment only during fuel cut, when exhaust gas apparently changes from rich → lean. Even without deceleration fuel cut, judge as OK if the value is below the threshold.
2) Judge as NG when the oxygen sensor voltage at a deceleration fuel cut is large.
Judge as NG when oxygen sensor voltage is large even after a long period of deceleration fuel cut has completed.

Judgment value (intermediate)

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.5 V O_2 output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V	> 491 ms
or	
Longest time over 0.55 V	≥ 2000 ms

Judgment value (Wide)

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.6 V O_2 output) to lean (0.1 V) when voltage reduces from 0.65 V to 0.05 V	> Value from Map
or	
Longest time over 0.65 V	≥ 2000 ms

Map

Estimated temperature of rear oxygen sensor element when fuel cut starts °C (°F)	0 (32)	450 (842)	500 (932)	1000 (1832)
Longest time in rich status after fuel cut (ms)	2000	2000	2000	2000

Time Needed for Diagnosis:1 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• **Normality Judgment**

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.
Response time (diagnosis value) ≤ threshold value → normal
2) Do not judge as a normal condition.
Judge as OK and clear the NG if the following conditions are established.

Judgment value (intermediate)

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.5 V O_2 output) to lean (0.2 V) when voltage reduces from 0.55 V to 0.15 V	≤ 491 ms

Judgment value (Wide)

Malfunction Criteria	Threshold Value
Shortest time change from rich (0.6 V O_2 output) to lean (0.1 V) when voltage reduces from 0.65 V to 0.05 V	≤ 2000 ms

Time Needed for Diagnosis:1 time(s)

6. ENABLE CONDITIONS

Lean → rich response diagnosis

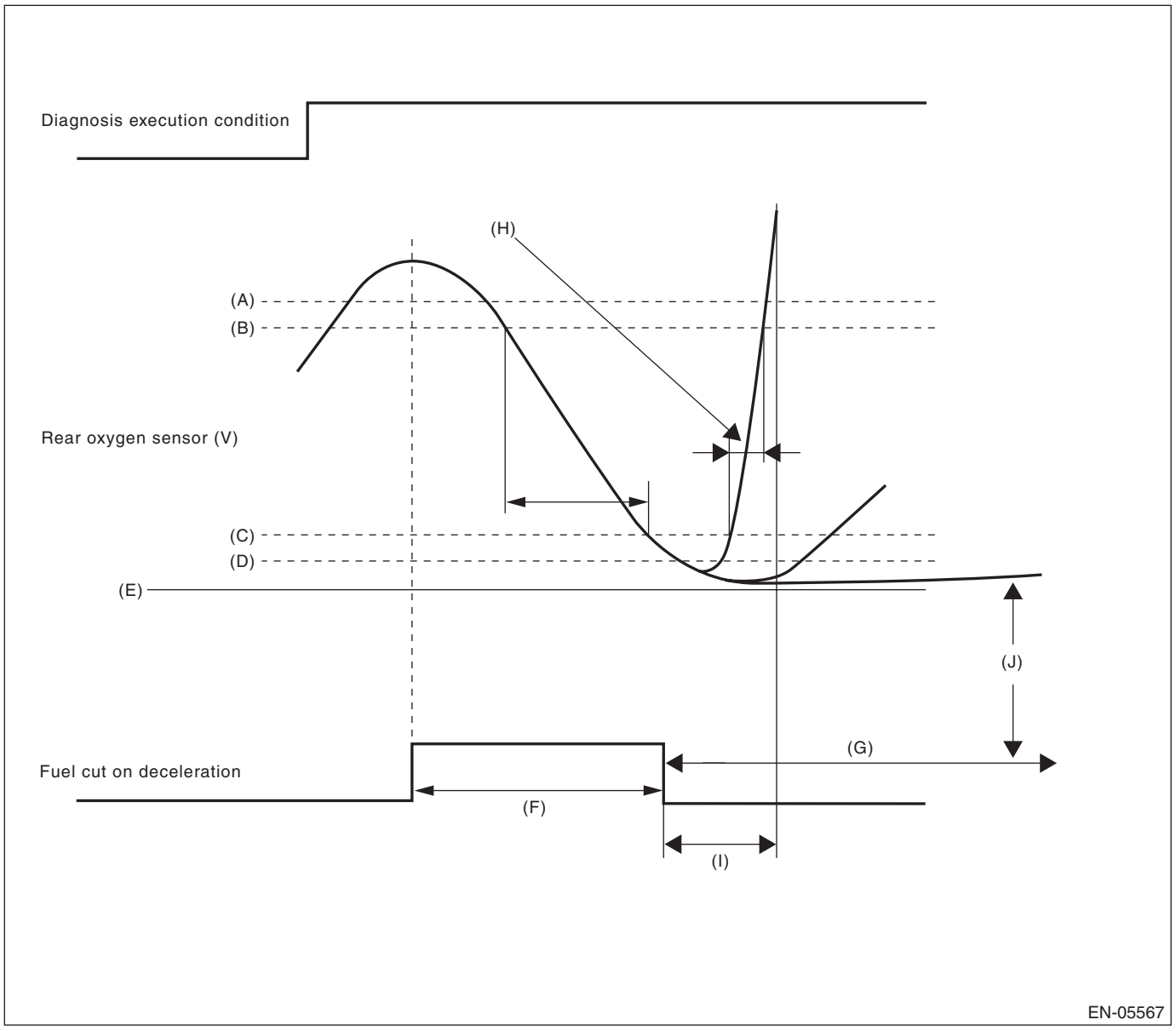
Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
A/F main feedback control condition	Completed
Deceleration fuel cut time is 6000 ms or more.	Experienced
After fuel cut	≥ 2000 ms
Number of deceleration fuel cut	≥ 1 time(s)

7. GENERAL DRIVING CYCLE

Perform diagnosis once during deceleration fuel cut from a constant and high speed driving, when rear oxygen sensor is warmed up sufficiently. (Pay attention to the oxygen sensor voltage for the timing of the deceleration.)

8. DIAGNOSTIC METHOD

When the oxygen sensor output voltage changes from 0.25 V (lean) to 0.55 V (rich), calculate the minimum response time for output change between 0.3 V and 0.5 V for the judgment criteria.



(A) 0.55 V
(B) 0.5 V
(C) 0.3 V
(D) 0.25 V
(E) 0 V
(F) More than 5 seconds
(G) More than 120000 ms
(H) Measure the response time (diagnostic value).
(I) Execute the malfunction judgment in 4000 ms from the recovery of fuel cut on deceleration.
(J) Judge NG when the voltage of rear oxygen sensor is 0.25 V or less for 120000 ms or more after recovery of fuel cut on deceleration.

• Abnormality Judgment

1) Judge as NG when the judgment value is larger than the threshold value after deceleration fuel cut.
Response time (diagnosis value) > threshold value → abnormal
2) If the oxygen sensor voltage is small after recovering from a deceleration fuel cut, and remains small, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (0.3 V O_2 output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V	> 4000 ms
or	
Longest time under 0.25 V	≥ 120000 ms

Time Needed for Diagnosis:1 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

1) Regardless of a deceleration fuel cut, if the response time (diagnosis value) when the oxygen sensor voltage has changed from rich to lean is shorter than the threshold value (judgment value), judge as a normal condition.
Response time (diagnosis value) ≤ threshold value → normal
2) Do not judge as a normal condition.
Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Shortest time change from lean (0.3 V O_2 output) to rich (0.5 V) when voltage changes from 0.25 V to 0.55 V	≤ 4000 ms

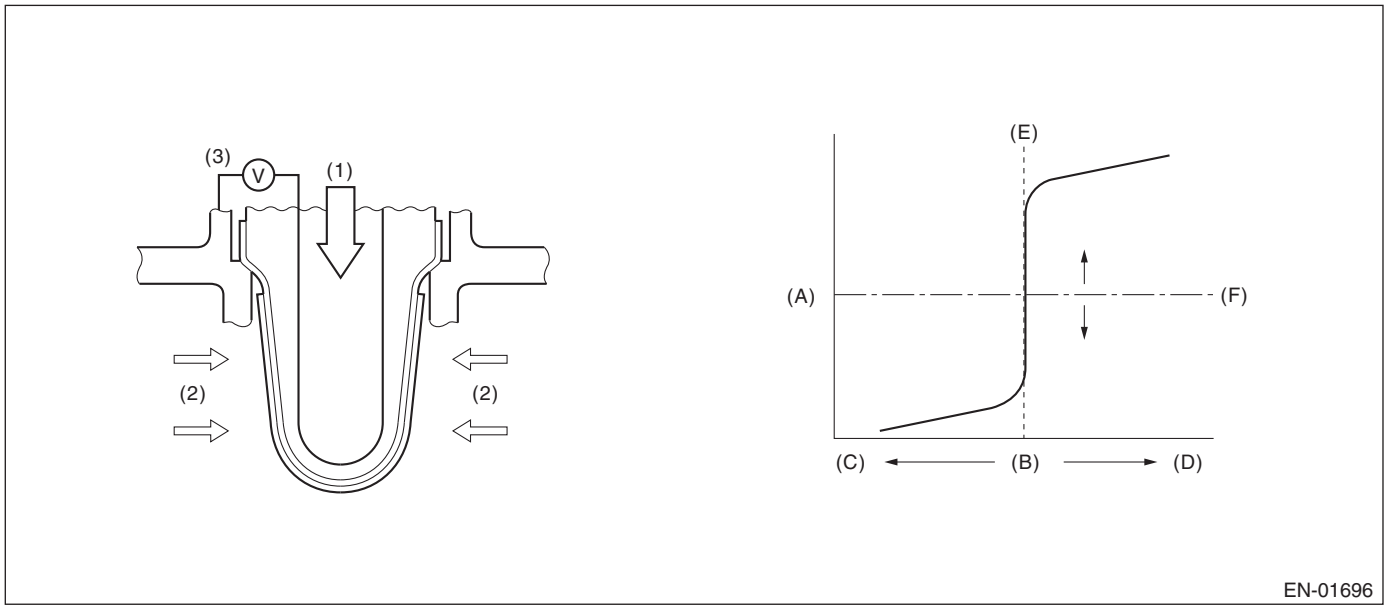
Time Needed for Diagnosis:1 time(s)

AI: DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2)

1. OUTLINE OF DIAGNOSIS

Detect the rear oxygen sensor open or short circuit. Judge as NG when the rear oxygen sensor voltage can be determined to be abnormal considering conditions such as intake air amount, engine coolant temperature, main feedback control and deceleration fuel cut.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Rich
(D)	Lean	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITION (USED ONLY FOR MALFUNCTION judgment)

Secondary Parameters	Enable Conditions
Closed loop control at the rear oxygen sensor	In operation
Target output voltage of rear oxygen sensor	≥ 0.55 V + 0.05 V
Amount of intake air	≥ 10 g/s (0.35 oz/s)
Engine coolant temperature	≥ 75 °C (167 °F)
Misfire detection every 200 rotations	< 5 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Deceleration fuel cut of 5000 ms or more.	Experienced

4. GENERAL DRIVING CYCLE

Perform the diagnosis once after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Minimum output voltage	> 0.15 V
or	
Maximum output voltage	< 0.55 V

Time Needed for Diagnosis:200000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Diagnosis of the rear oxygen sensor voltage low side	Incomplete
Minimum output voltage	≤ 0.15 V
Maximum output voltage	≥ 0.55 V

Time Needed for Diagnosis: Less than 1 second

AJ:DTC P0171 SYSTEM TOO LEAN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

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 CONDITIONS

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	≥ 75 °C (167 °F)
Engine load change	< 0.02 g/rev (0 oz/rev)
Engine load	≥ Value of Map 1

Map 1

Engine speed (rpm)	Idling	650	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g(oz)/rev)	na	0.208 (0.01)	0.201 (0.01)	0.185 (0.01)	0.183 (0.01)	0.193 (0.01)	0.206 (0.01)	0.206 (0.01)	0.225 (0.01)	0.245 (0.01)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 s × 5 time(s) or more, judge that there is a fault in the fuel system.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient (every 64 ms) flaf = main feedback learning compensation coefficient	≥ Value of Map 2

Map 2

Amount of air (g (oz)/s)	0 (0)	3.2 (0.11)	6.4 (0.23)	9.6 (0.34)	12.8 (0.45)	16 (0.56)	19.2 (0.68)
fsobdL1 (%)	1.4	1.4	1.332	1.265	1.265	1.265	1.265

Time Needed for Diagnosis:10 s × 5 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf	< 1.2

Time Needed for Diagnosis:10 s

AK:DTC P0172 SYSTEM TOO RICH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect fuel system malfunction by the amount of main feedback control.

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 CONDITIONS

Secondary Parameters	Enable Conditions
A/F main learning system	In operation
Engine coolant temperature	≥ 75 °C (167 °F)
Engine load change	≤ 0.02 g/rev (0 oz/rev)
Learning value of EVAP conc.	< 0.15
Cumulative time of canister purge after engine start	≥ 20 s
Continuous period after canister purge starting	≥ 29884 ms
Engine load	≥ Value of Map 1

Map 1

Engine speed (rpm)	Idling	650	1000	1500	2000	2500	3000	3500	4000	4500
Measured value (g(oz)/rev)	na	0.208 (0.01)	0.201 (0.01)	0.185 (0.01)	0.183 (0.01)	0.193 (0.01)	0.206 (0.01)	0.206 (0.01)	0.225 (0.01)	0.245 (0.01)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling or at a constant speed after warming up the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Compare the diagnosed value (fsobd) with the threshold value, and if a condition meeting the malfunction criteria below continues for 10 s × 5 time(s) or more, judge that there is a fault in the fuel system.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf In this case: sglmd = measured lambda tglmda = target lambda faf = main feedback compensation coefficient (every 64 ms) flaf = main feedback learning compensation coefficient	< Value of Map 2

Map 2

Amount of air (g (oz)/s)	0 (0)	3.2 (0.11)	6.4 (0.23)	9.6 (0.34)	12.8 (0.45)	16 (0.56)	19.2 (0.68)
fsobdL1 (%)	0.6	0.6	0.668	0.735	0.735	0.735	0.735

Time Needed for Diagnosis:10 s × 5 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK when the malfunction criteria below continues for 10 seconds.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf	≥ 0.8

Time Needed for Diagnosis:10 s

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

1. OUTLINE OF DIAGNOSIS

Detect faults in the fuel temperature sensor output properties.
Diagnosis is performed in two methods (drift diagnosis and stuck diagnosis). If either is NG, judge as NG. If both are OK, Judge as OK and clear the NG.

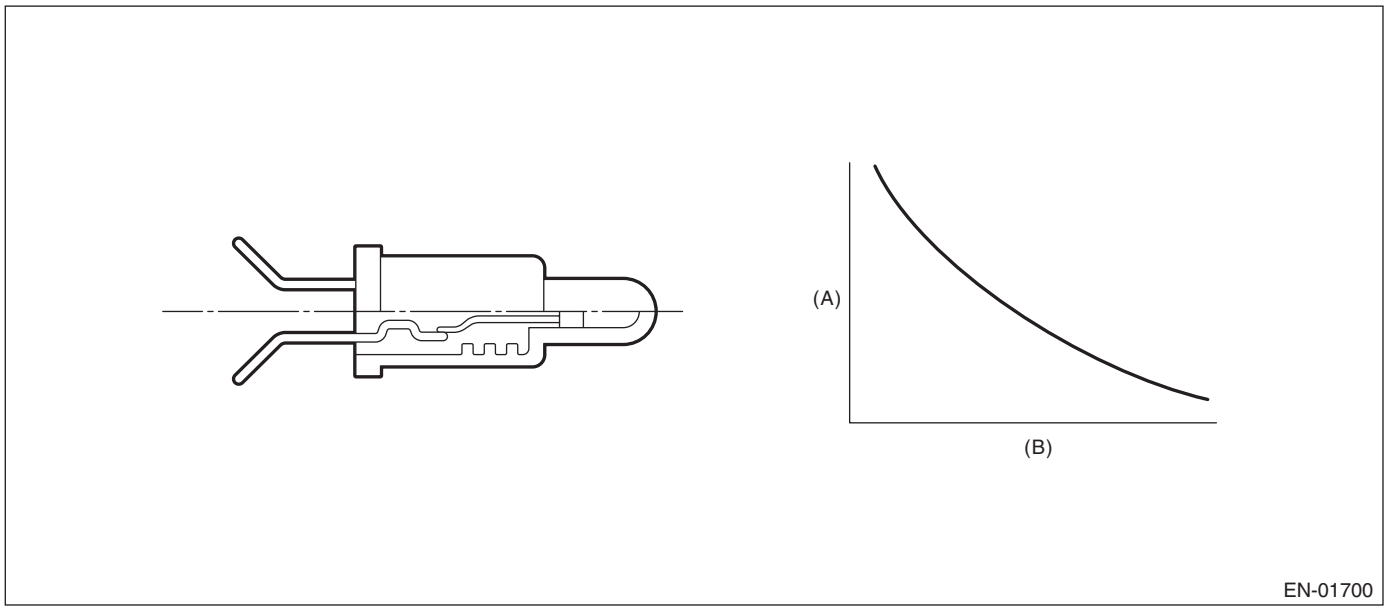
DRIFT DIAGNOSIS

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 judged as NG.

Stuck Diagnosis

As the engine warms up (cumulative amount of intake air after starting is large), if the fuel temperature which should rise does not, determine as being stuck and NG.

2. COMPONENT DESCRIPTION



(A) Resistance value (Ω) (B) Fuel temperature °C (°F)

3. ENABLE CONDITIONS

DRIFT DIAGNOSIS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	≥ 20 s
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	≥ 10 °C (50 °F)
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis:120 s
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	≥ 20 s
Engine coolant temperature – Engine coolant temperature at engine start	> 10 °C (50 °F)
Fuel temperature – Engine coolant temperature	< 10 °C (50 °F)
Battery voltage	≥ 10.9 V
Engine coolant temperature	< 75 °C (167 °F)

Time Needed for Diagnosis: Less than 1 second

6. ENABLE CONDITIONS

Stuck Diagnosis

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 20000 ms
Battery voltage	≥ 10.9 V

7. GENERAL DRIVING CYCLE

Always perform diagnosis after 20 seconds have passed since the engine started.

8. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 551043 g (19435.29 oz)
Fuel temperature difference between Max. and Min.	< 2 °C (35.6 °F)

Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel temperature difference between Max. and Min.	≥ 2 °C (35.6 °F)

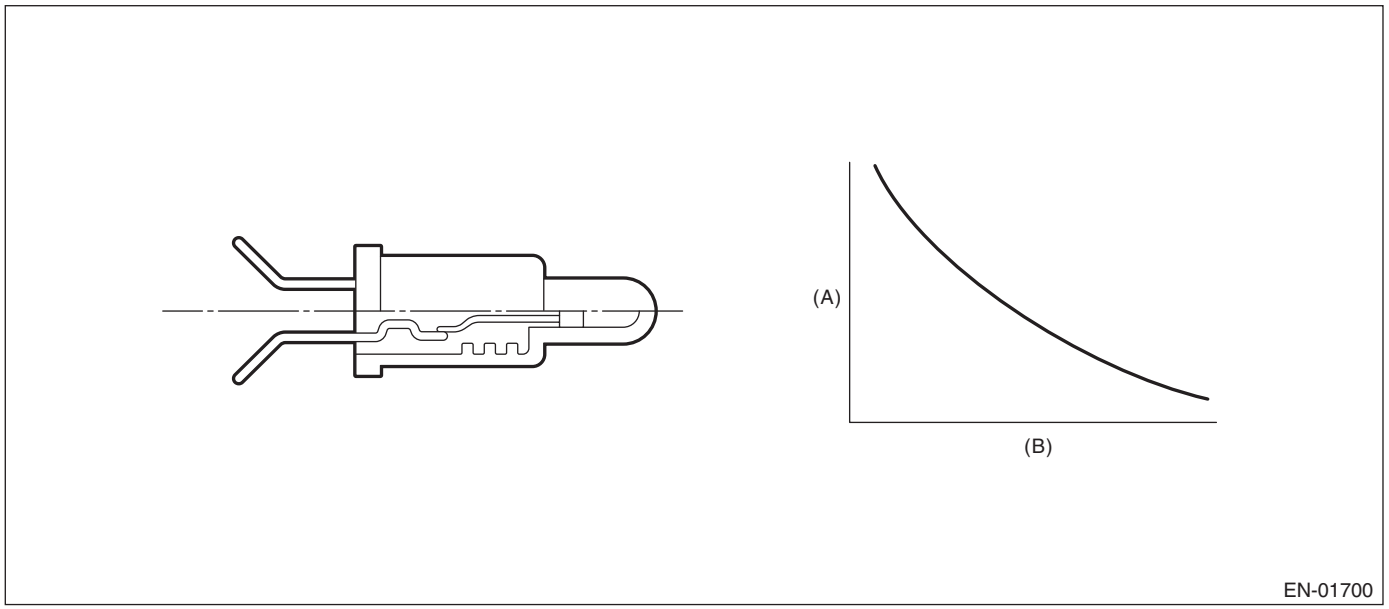
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Resistance value (Ω) (B) Fuel temperature °C (°F)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.343951474 V
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.343951474 V
Battery voltage	≥ 10.9 V

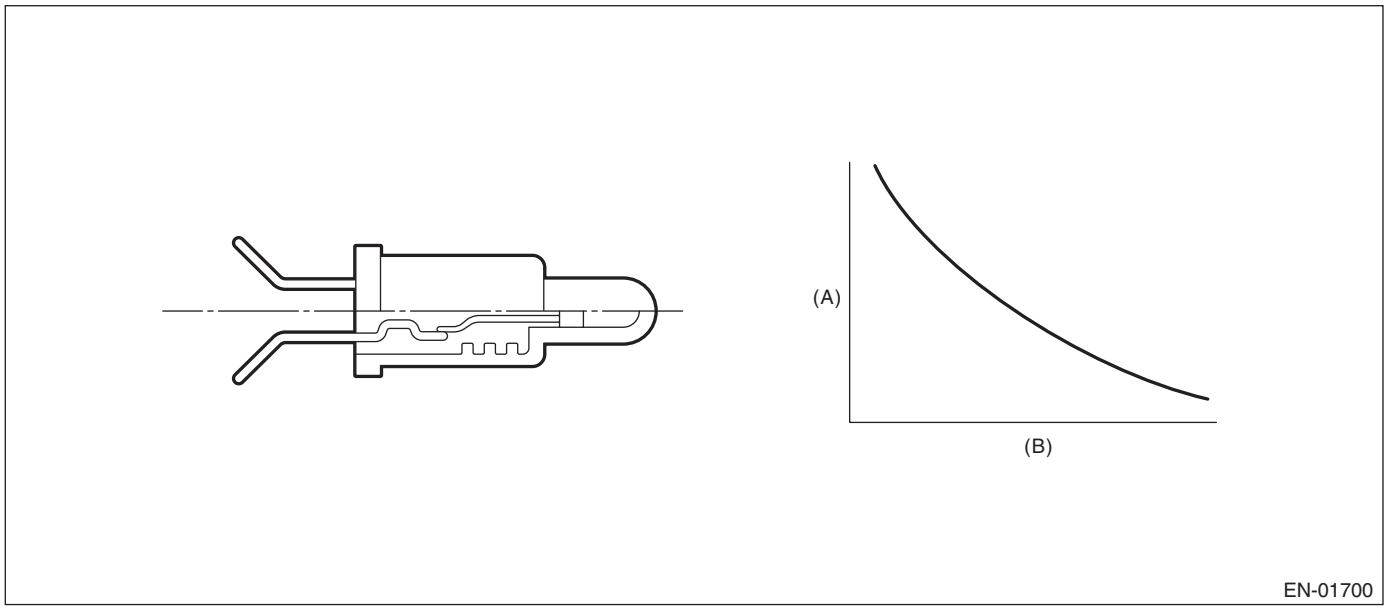
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel temperature sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Resistance value (Ω) (B) Fuel temperature °C (°F)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.716 V
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis: Less than 1 second

AO:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect for abnormal values in the oil temperature sensor output properties.
Judge as NG when the oil temperature does not rise even though the engine is running under a condition where it should rise.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ Value from Map

Map

Engine coolant temperature °C (°F)	–40 (–40)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Engine speed rpm	500	500	500	500	500	500	500	500

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Engine speed rpm	500	500	500	500	500	500	500	500

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature After engine start oil temperature sensor characteristic diagnosis timer.	< 15 °C (59 °F) ≥ Judgment value for after engine start oil temperature sensor characteristic diagnosis timer

After engine start oil temperature sensor characteristic diagnosis timer (timer for diagnosis).

a. Timer stop at fuel cut
b. During the driving conditions except a) above, timer counts up as follows.
64 ms + TOILCNT ms (at 64 ms)
Where, TOILCNT is determined as follows,
TOILCNT = 0 at idle switch ON
For TOILCNT at Idle switch off, refer to the following table.

		Vehicle speed km/h (MPH)							
		0 (0)	8 (5)	16 (9.9)	24 (14.9)	32 (19.9)	40 (24.9)	48 (29.8)	56 (34.8)
Temperature °C (°F)	–30 (–22)	64 ms	73.2 ms	83.9 ms	96.3 ms	113.2 ms	133.9 ms	160.2 ms	194.6 ms
	–20 (–4)	64 ms	73.3 ms	84 ms	96.6 ms	113.7 ms	135 ms	162 ms	197.4 ms
	–10 (14)	64 ms	73.4 ms	84.2 ms	96.9 ms	114.5 ms	136.4 ms	164.4 ms	201.5 ms
	0 (32)	64 ms	73.5 ms	84.5 ms	97.4 ms	115.6 ms	138.5 ms	168 ms	207.6 ms
	10 (50)	102.2 ms	114.8 ms	129.4 ms	146.7 ms	171.7 ms	203.4 ms	245.1 ms	302.1 ms

After engine start oil temperature characteristic diagnosis timer judgment value (t).
$t = 1882940 \text{ ms} - 43302 \text{ ms} \times Ti$ ($t \geq 2400000$)
Ti = The lowest coolant temperature after starting the engine.
Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Engine oil temperature	≥ 15 °C (59 °F)

Time Needed for Diagnosis: Less than 1 second

AP:DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.
Judge as NG when outside of the judgment value.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.166 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.166 V

Time Needed for Diagnosis: Less than 1 second

AQ:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the oil temperature sensor.
Judge as NG when outside of the judgment value.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.716 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.716 V

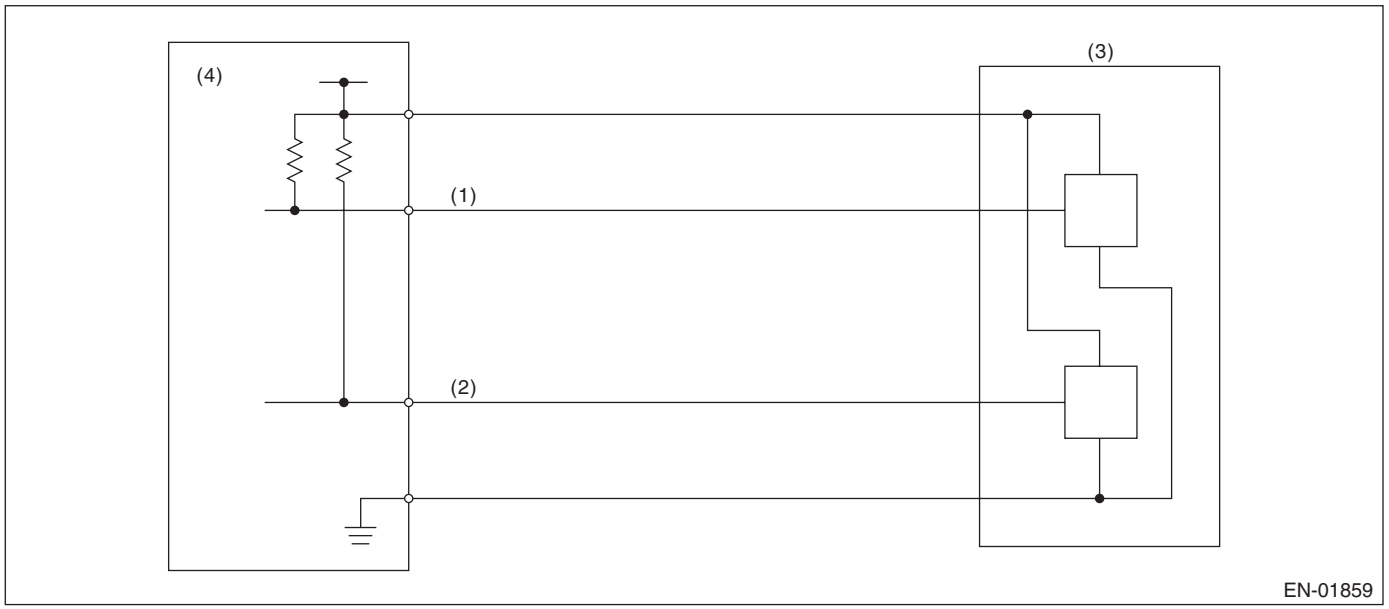
Time Needed for Diagnosis: Less than 1 second

AR:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge as NG if out of specification.

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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≤ 0.926256 V

Time Needed for Diagnosis:24 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	> 0.926256 V

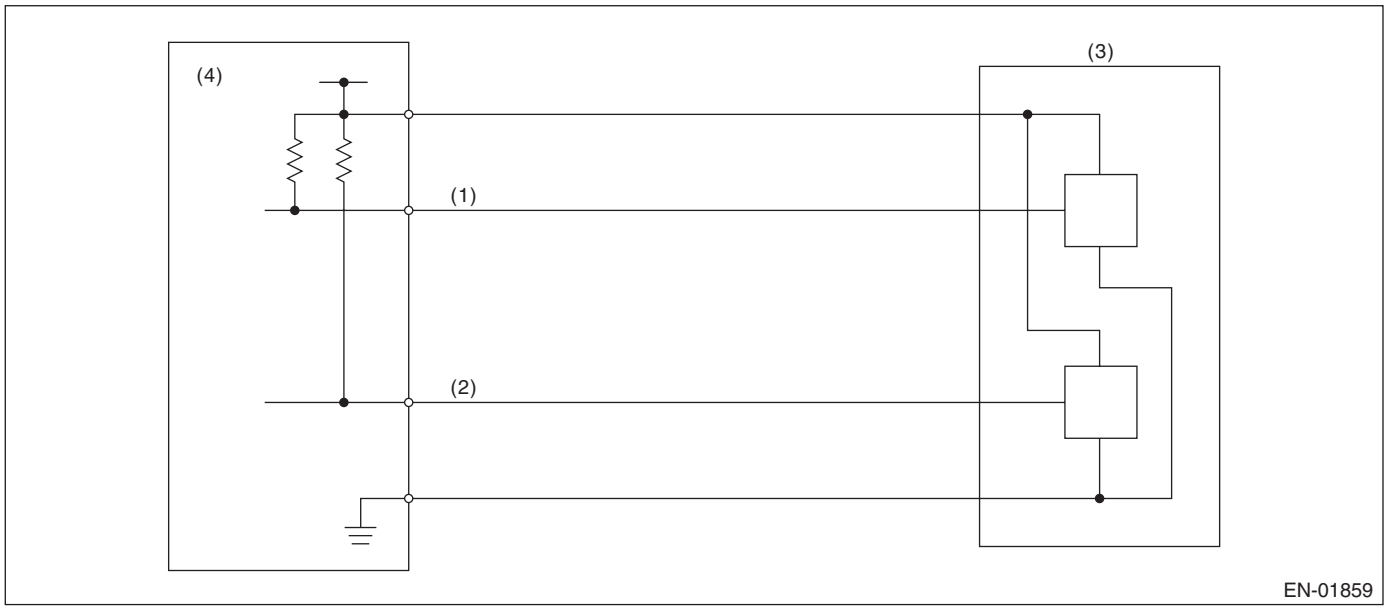
Time Needed for Diagnosis:24 ms

AS:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of throttle position sensor 2.
Judge as NG if out of specification.

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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 4.858 V

Time Needed for Diagnosis:24 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 4.858 V

Time Needed for Diagnosis:24 ms

AT:DTC P0301 CYLINDER 1 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

Detect the presence of misfire occurrence. (Revolution fluctuation method)
Monitoring Misfire which influences exhaust deterioration (1.5 times of FTP) and catalyst damage is made obligatory by the law. Misfire affecting these two has two 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 more)

2) Misfire every time: FTP 1.5 times misfire, Catalyst damage misfire

- 360° Interval Difference Method

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
All secondary parameters enable conditions	≥ 1024 ms
Intake manifold pressure change at 180°CA	< Value of Map 1
Throttle position change during 16 milliseconds	< 21 °
Fuel shut-off function	Not in operation
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Vehicle dynamic control or AT torque control	Not in operation
Evaporative system leak check	Not in operation
Engine speed	460 rpm — 6300 rpm
Intake manifold pressure	≥ Value of Map 2
Battery voltage	≥ 8 V
Fuel parameter determination	Not extremely low volatility
Elapsed time after starting the engine	≥ 0 ms
Engine load change during 32 milliseconds	< 1000 rpm

Map 1

- AT model

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)

- MT model

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)	13.3 (100, 3.9)

Map 2

- AT model

rpm	700	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	26 (195.0, 7.7)	23.9 (179.5, 7.1)	23.3 (174.7, 6.9)	23.1 (173.2, 6.8)	23.6 (176.8, 7)	25.1 (188.0, 7.4)	26.2 (196.9, 7.8)	26.6 (199.6, 7.9)	26.9 (201.5, 7.9)	30 (225.0, 8.9)	33.4 (250.4, 9.9)	37.8 (283.5, 11.2)	39.5 (296.0, 11.7)

- MT model

Vehicle speed < 64 km/h (39.8 MPH)

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	24.5 (184, 7.2)	22.7 (170.3, 6.7)	21.4 (160.2, 6.3)	21.5 (161.6, 6.4)	21.5 (161.4, 6.4)	23.2 (174.4, 6.9)	24.7 (185.5, 7.3)	25.8 (193.3, 7.6)	27.1 (203.2, 8)	28.8 (216.3, 8.5)	32.3 (242.2, 9.5)	36.3 (272, 10.7)	37.9 (284.5, 11.2)

Vehicle speed ≥ 68 km/h (42.3 MPH)

rpm	650	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6300
kPa (mmHg, inHg)	31.6 (237, 9.3)	31.6 (237, 9.3)	31.6 (237, 9.3)	31.1 (233, 9.2)	31.3 (235, 9.3)	33.1 (248, 9.8)	33.9 (254, 10)	28.8 (216, 8.5)	30.1 (226, 8.9)	33.3 (250, 9.8)	36.9 (277, 10.9)	40.1 (301, 11.9)	43.2 (324, 12.8)

3. GENERAL DRIVING CYCLE

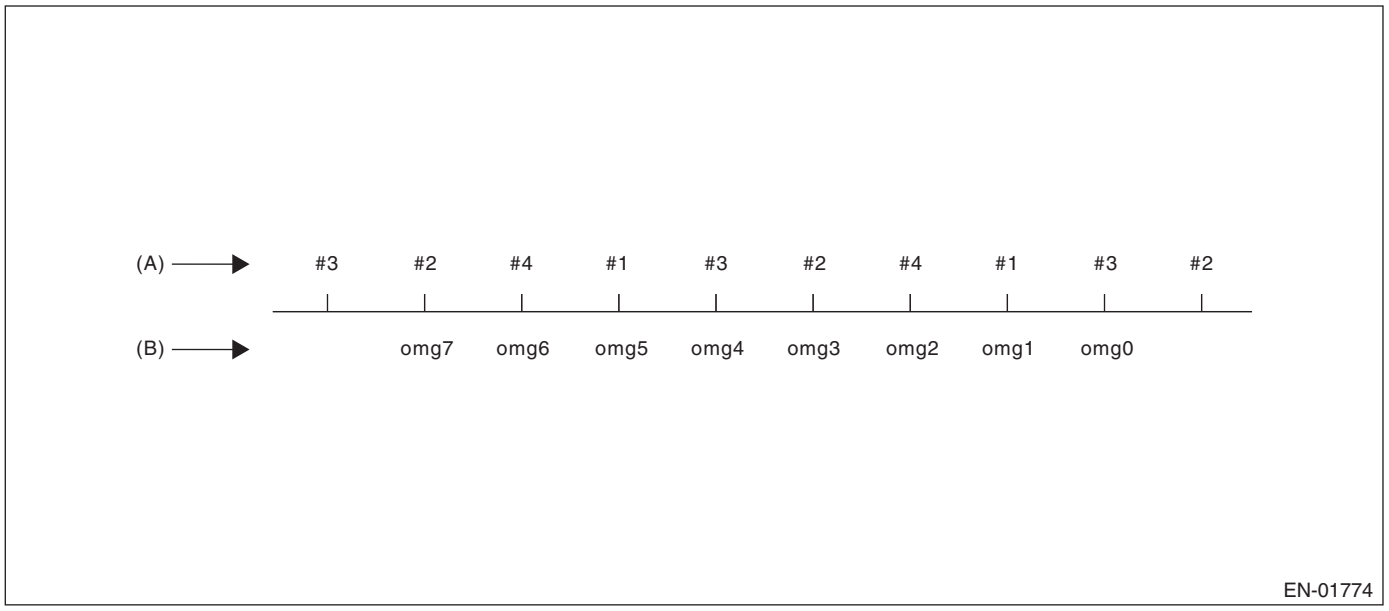
- If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, in case any engine load or breakage occurs, perform with the engine at idle.
- Perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

When a misfire occurs, the engine speed will decrease 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 a misfire is occurring or not comparing the calculated result with judgment value. Count the number of misfires, if the misfire ratio is higher during 1000 revs. or 200 revs., judge corresponding cylinders as NG.

Diagnostic value calculation (Calculate from angle speed) →	Misfire detection every single ignition (Compare diagnostic value with judgment value) →	NG judgment (Misfire occurrence judgment required by the law) (Compare number of misfire with judgment)
	• 180° Interval Difference Method • 360° Interval Difference Method • 720° Interval Difference Method	• FTP 1.5 times misfire NG judgment • Catalyst damage misfire NG judgment

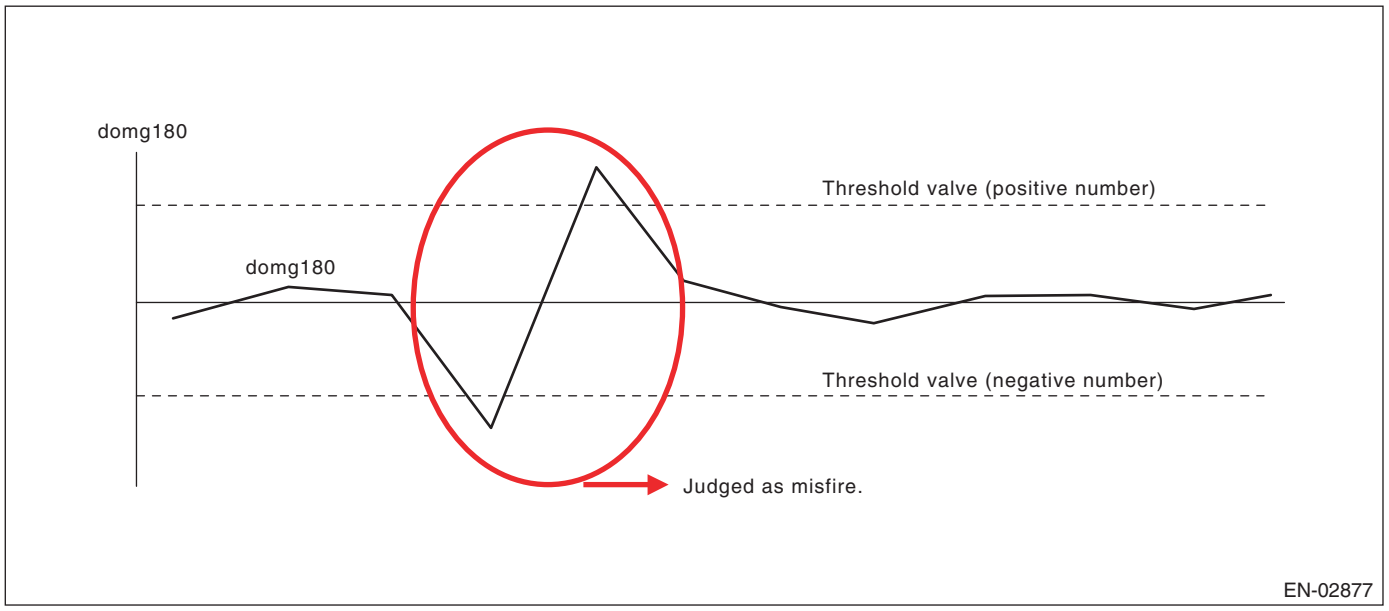
As shown in the following figure, pick a cylinder as the standard and name it omg 0. And the former crankshaft position speed is named omg 1, the second former crankshaft position speed is named omg 2, the third is named omg 3, etc.



(A) Ignition order (B) Crankshaft position speed

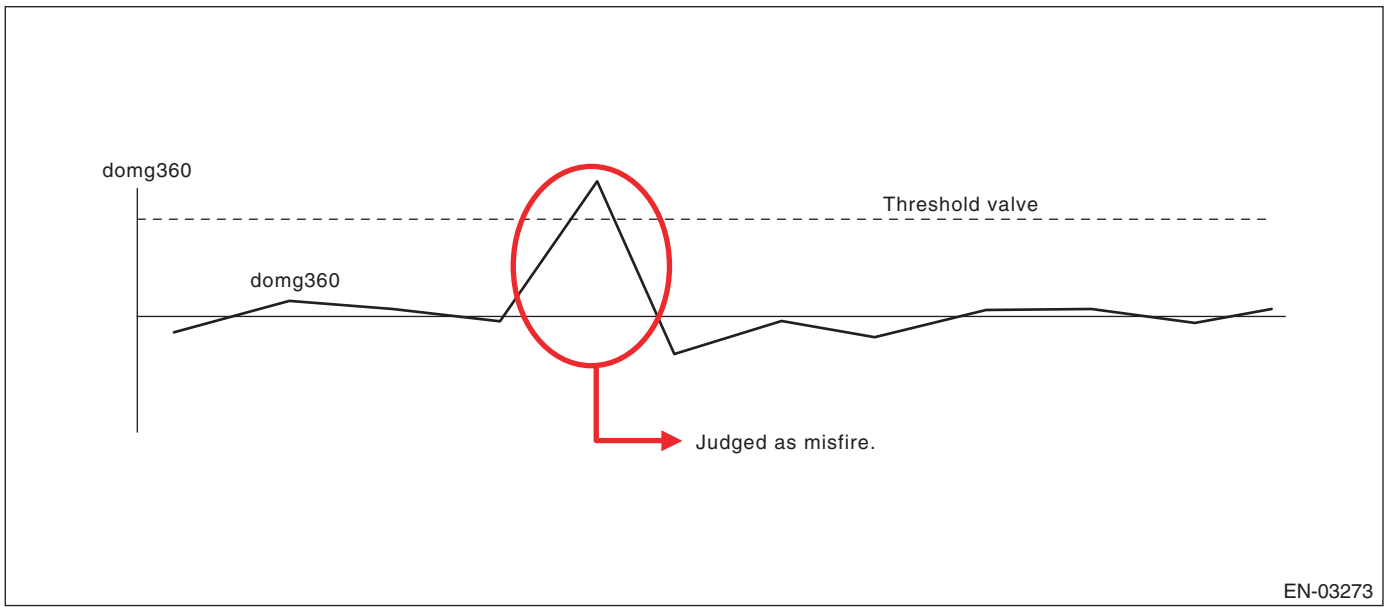
180° Interval Difference Method

Diagnostic value	domg 180 = (omg 1 – omg 0) – (omg 5 – omg 1)/4
Judge as a misfire in the following cases. • domg 180 > judgment value of positive side • domg 180 ≤ judgment value of negative side (Judgment value before 180° CA)	



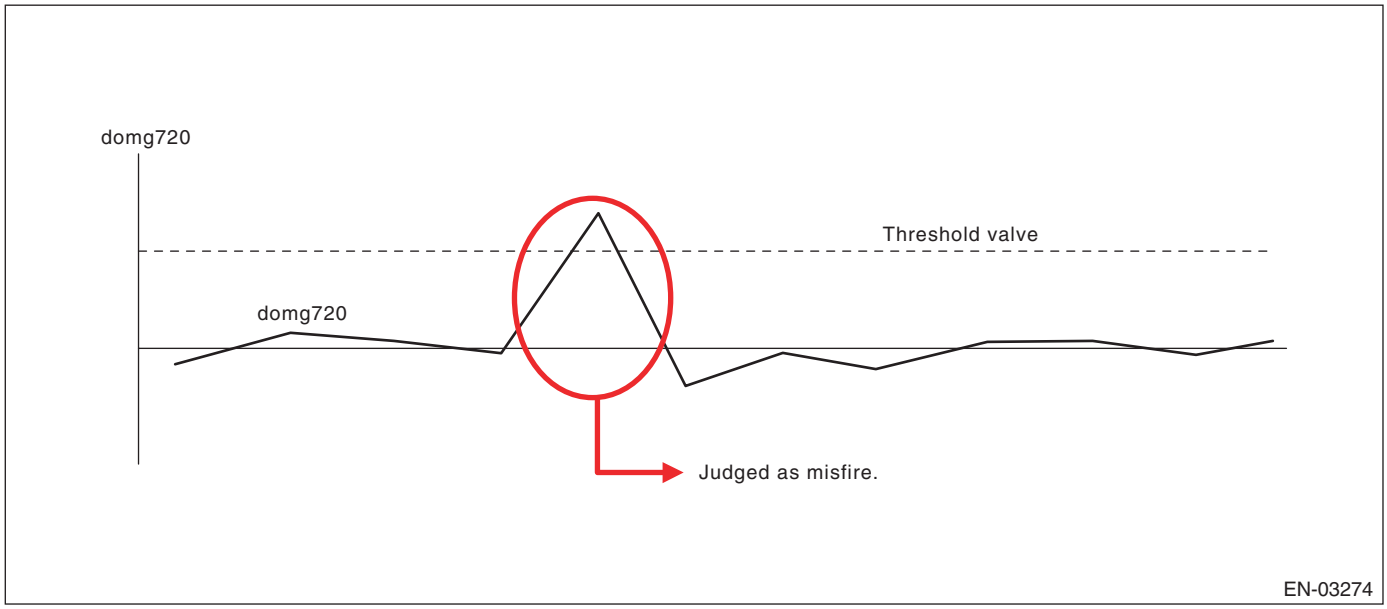
360° Interval Difference Method

Diagnostic value	domg 360 = (omg 1 – omg 0) – (omg 3 – omg 2)
Misfire judgment	domg 360 > Judgment value → Judge as misfire



720° Interval Difference Method

Diagnostic value	domg 720 = (omg 1 – omg 0) – (omg 5 – omg 4)
Misfire judgment	domg 720 > Judgment value → Judge as misfire



- **FTP 1.5 times misfire (Misfire occurrence level which influences exhaust gas)**
- **Abnormality Judgment**

Judgment Value (Judge that malfunction occurs when the misfire ratio is high in 1000 engine revs.)

Malfunction Criteria	Threshold Value
FTP emission judgment value	≥ 20 × 100/2000% in 1000 revs.

Time Needed for Diagnosis: 1000 engine revs.
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judgment Value

Malfunction Criteria	Threshold Value
FTP emission judgment value	< 20 × 100/2000% in 1000 revs.

Time Needed for Diagnosis: 1000 engine revs.

- **Catalyst damage misfire (Misfire occurrence level damaging catalyst)**
- **Abnormality Judgment**

Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire judgment value	≥ Value of Map 3

Map 3

		Intake air (g(oz)/rev)							
		0.16 (0.01)	0.28 (0.01)	0.4 (0.01)	0.52 (0.02)	0.64 (0.02)	0.76 (0.03)	0.92 (0.03)	1.1 (0.04)
Engine speed (rpm)	700	100	100	100	100	90	80	64	48
	1000	100	100	100	100	90	80	63	44
	1500	100	100	90	80	73	67	54	40
	2000	80	80	80	80	68	57	51	44
	2500	80	80	73	67	62	57	51	44
	3000	67	67	62	57	51	44	44	44
	3500	67	67	56	44	40	36	34	31
	4000	57	57	44	31	24	20	20	20
	4500	44	44	33	31	20	20	20	20
	5000	44	44	38	31	20	20	20	20
	5500	36	36	31	27	20	20	20	20
	6000	20	20	20	20	20	20	20	20
	6300	20	20	20	20	20	20	20	20

Time Needed for Diagnosis: 200 engine revs.
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judgment Value

Malfunction Criteria	Threshold Value
Catalyst damage misfire judgment value	< Value of Map 3

Time Needed for Diagnosis: 200 engine revs.

AU:DTC P0302 CYLINDER 2 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-81, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AV:DTC P0303 CYLINDER 3 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-81, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AW:DTC P0304 CYLINDER 4 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

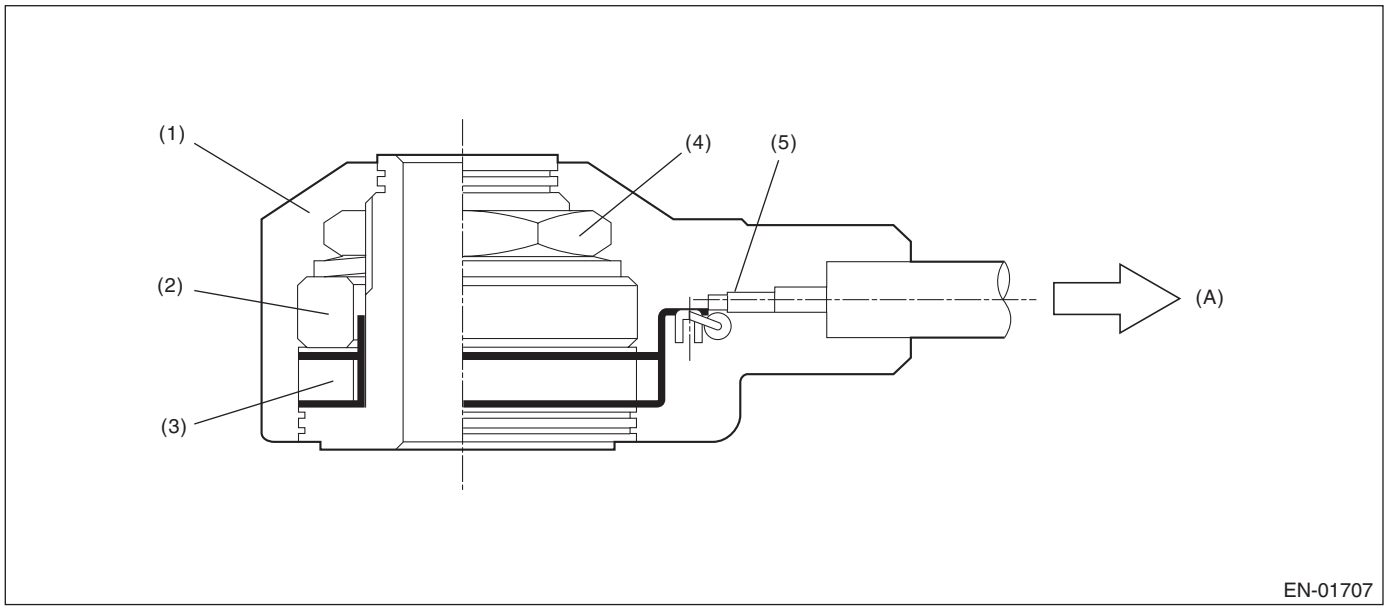
NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4SO)-81, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) To knock sensor harness

(1) Case
(2) Weight
(3) Piezoelectric element
(4) Nut
(5) Resistance

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 0.243 V

Time Needed for Diagnosis:1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 0.243 V

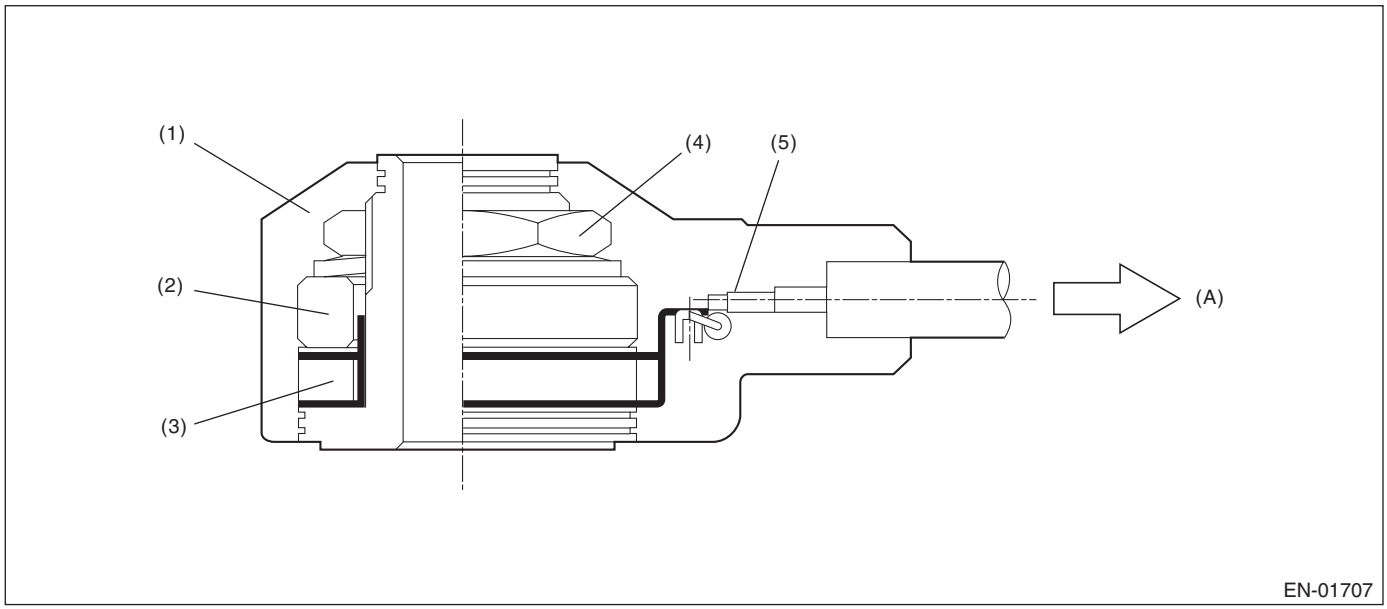
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of knock sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) To knock sensor harness

(1) Case
(2) Weight
(3) Piezoelectric element
(4) Nut
(5) Resistance

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.709 V

Time Needed for Diagnosis:1000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.709 V

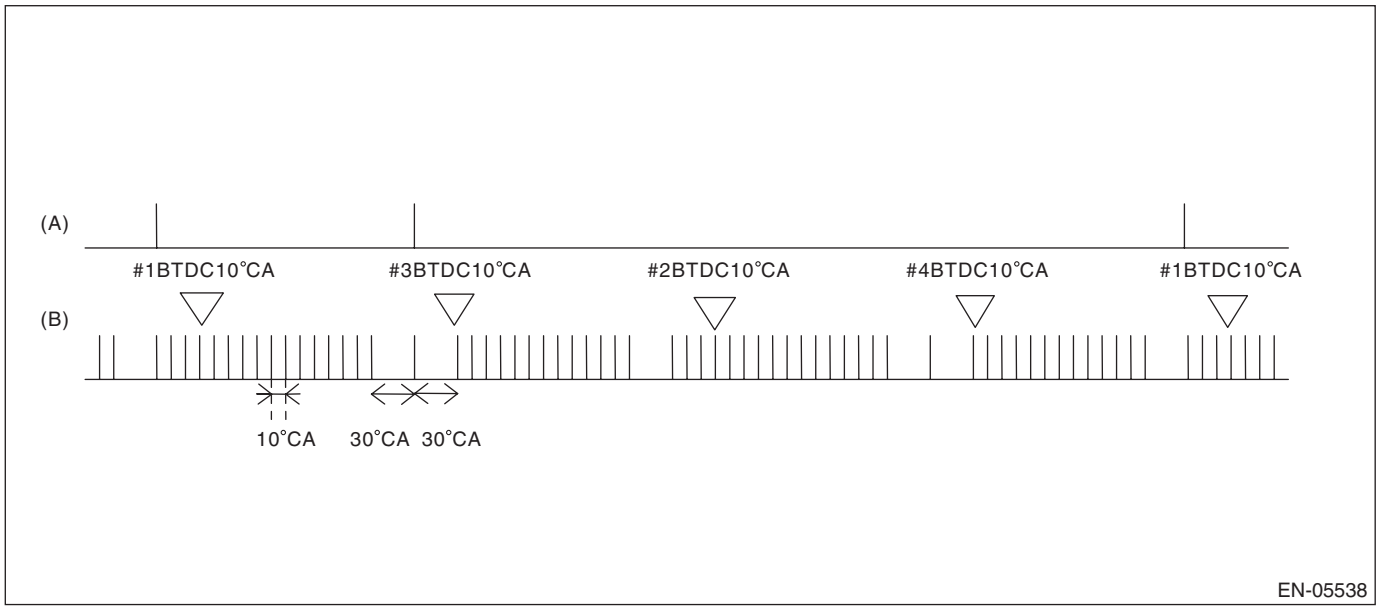
Time Needed for Diagnosis: Less than 1 second

AZ:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

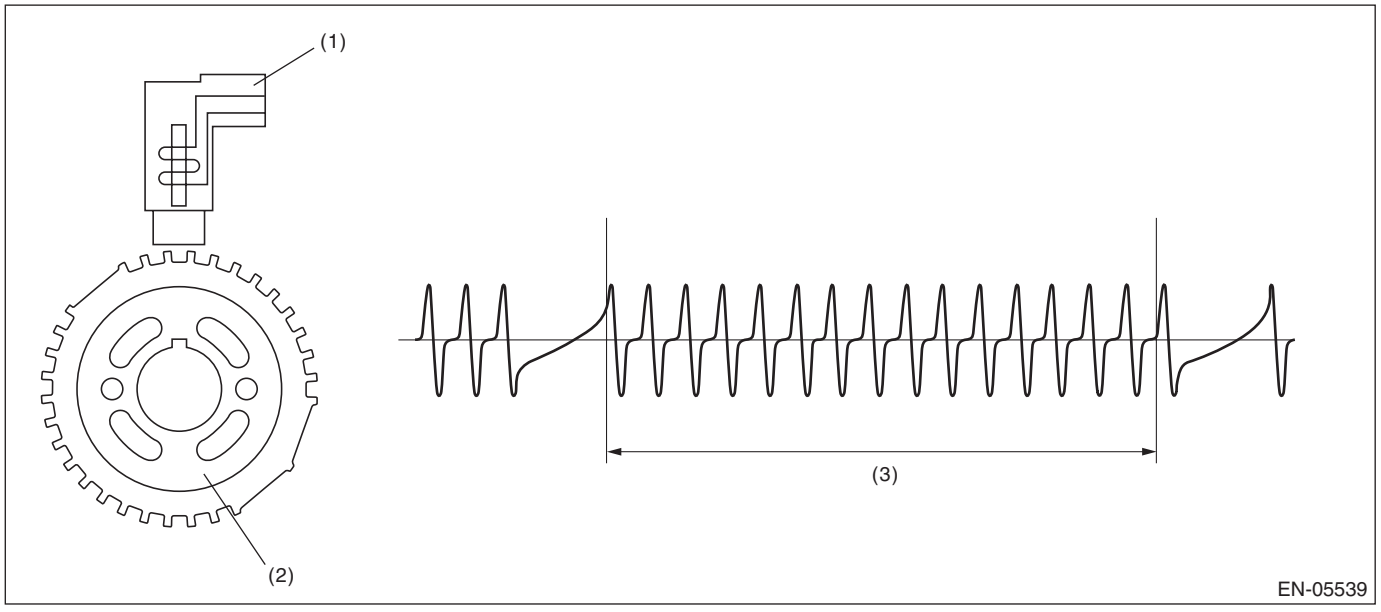
1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the crankshaft position sensor.
Judge as NG when the crank signal is not input even though the starter was rotated.

2. COMPONENT DESCRIPTION



(A) Cam signal (B) Crankshaft signal



(1) Crankshaft position sensor (2) Crank sprocket (3) Crankshaft half-turn

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Starter switch	ON
Crankshaft position sensor signal	Not detected
Battery voltage	≥ 8 V

Time Needed for Diagnosis:3000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Crankshaft position sensor signal	Input exists
Battery voltage	≥ 8 V

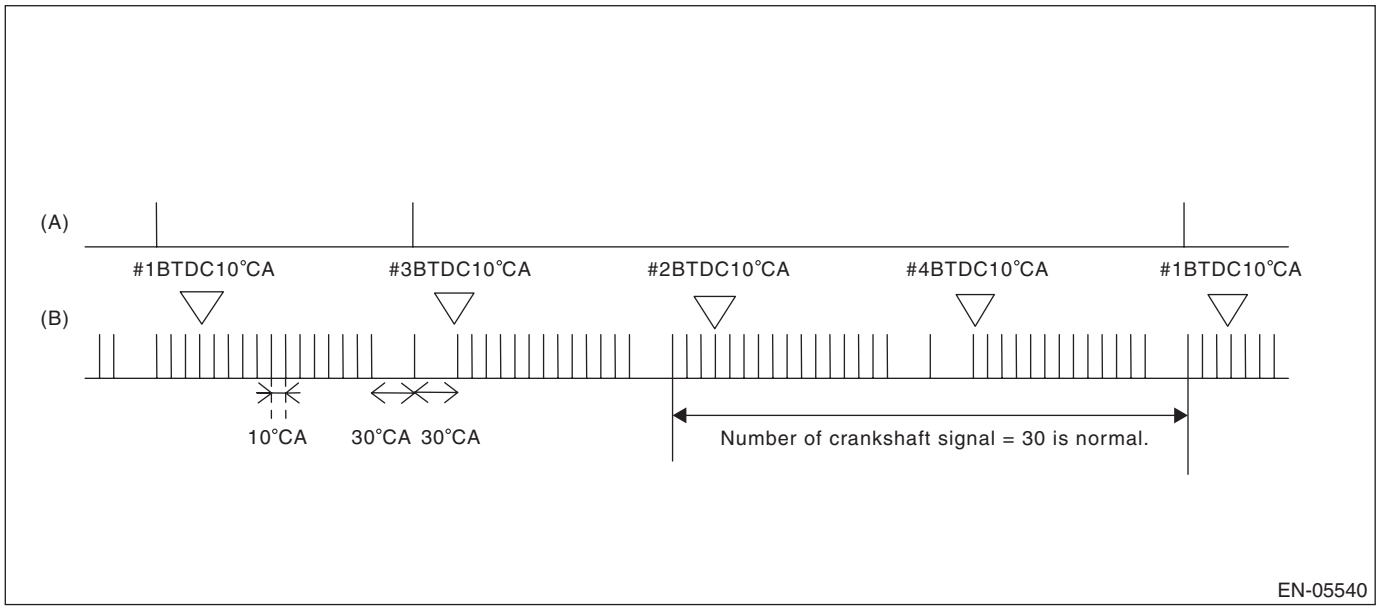
Time Needed for Diagnosis: Less than 1 second

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

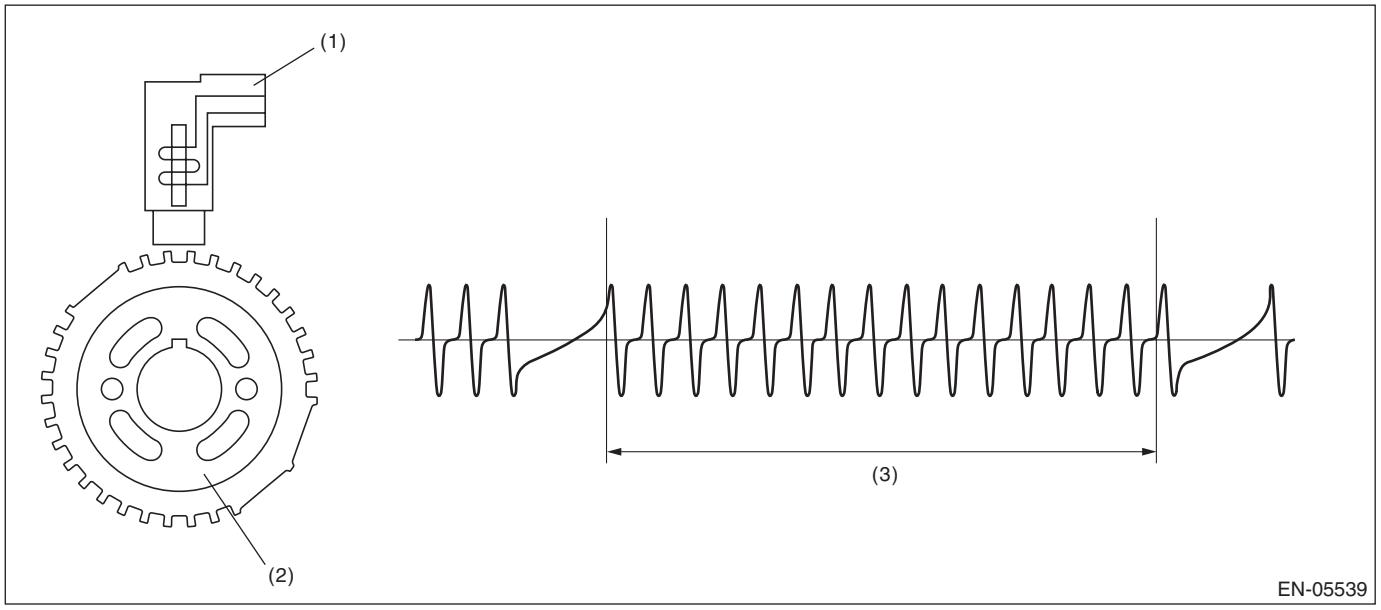
1. OUTLINE OF DIAGNOSIS

Detect for faults in crankshaft position sensor output properties.
Judge as NG when there is a problem in the number of crankshaft signals for every revolution.

2. COMPONENT DESCRIPTION



(A) Cam signal (B) Crankshaft signal



(1) Crankshaft position sensor (2) Crank sprocket (3) Crankshaft half-turn

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed	< 4000 rpm

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine speed.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number identification	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 as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Cylinder number identification	Completed
Amount of crank sensor signal during 1 rev.	= 30

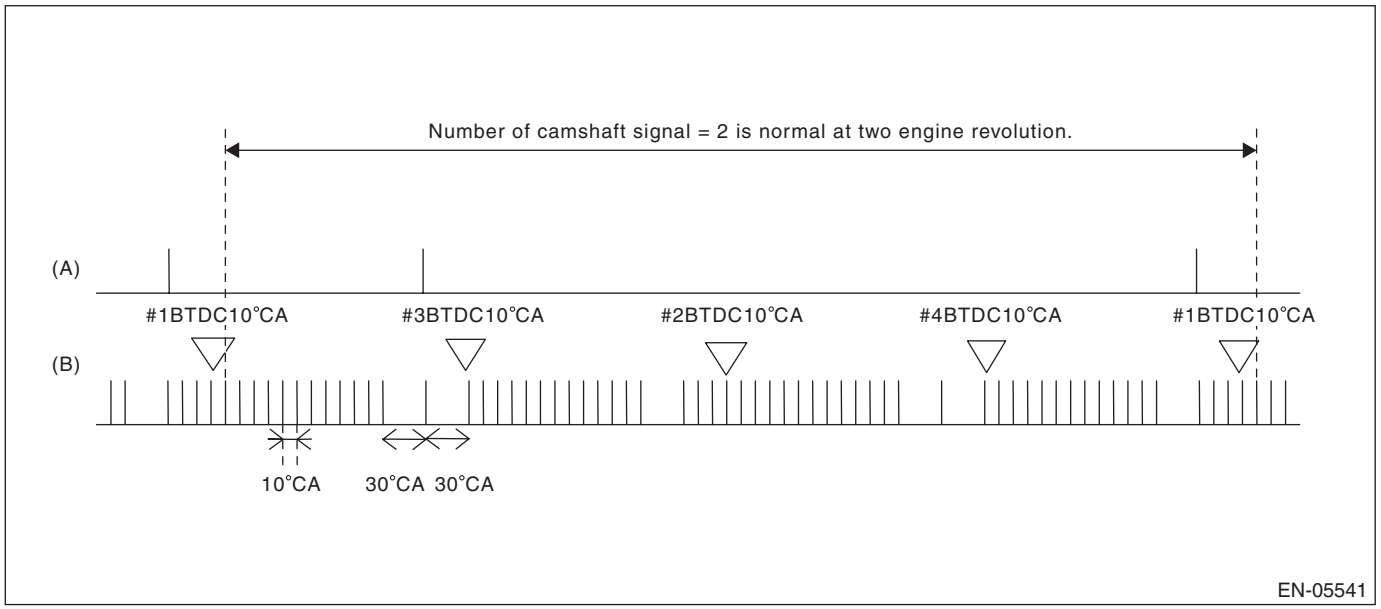
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.
Judge as NG when the number of camshaft signals remains abnormal.

2. COMPONENT DESCRIPTION



(A) Cam signal (B) Crankshaft signal

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 8 V
Amount of camshaft sensor signal during 2 revs.	Not = 2

Time Needed for Diagnosis: Two engine revs. × 4 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Voltage	≥ 8 V
Amount of camshaft sensor signal during 2 revs.	= 2

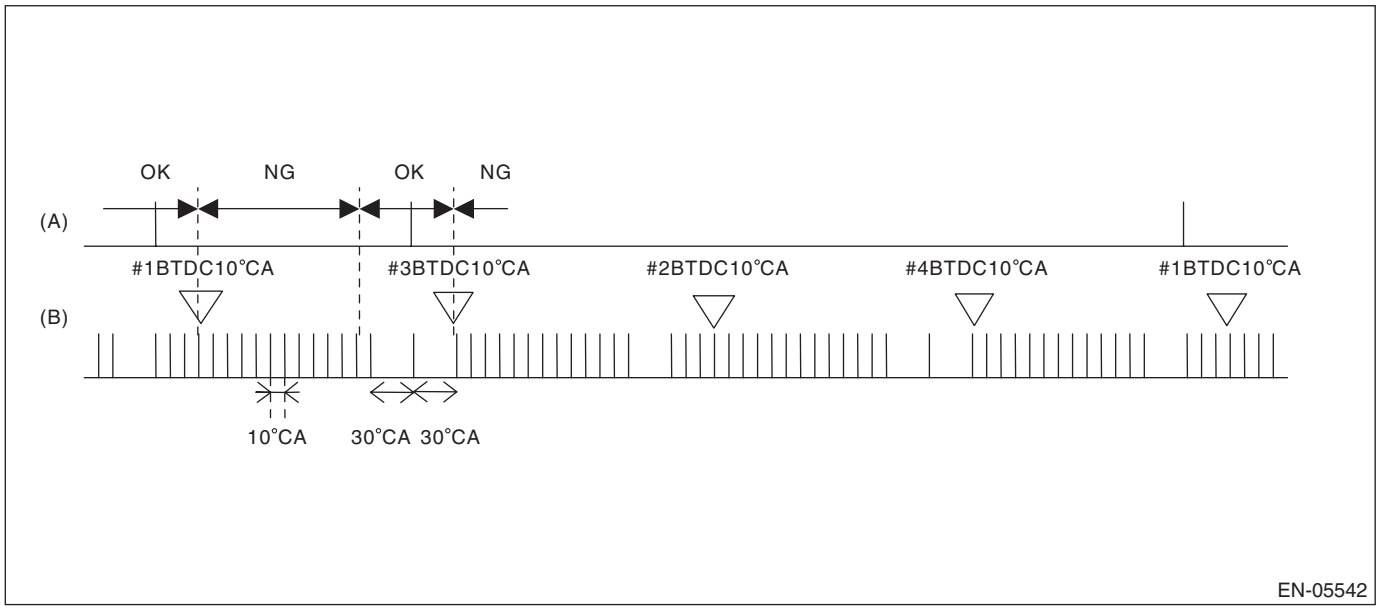
Time Needed for Diagnosis: Two engine revs.

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

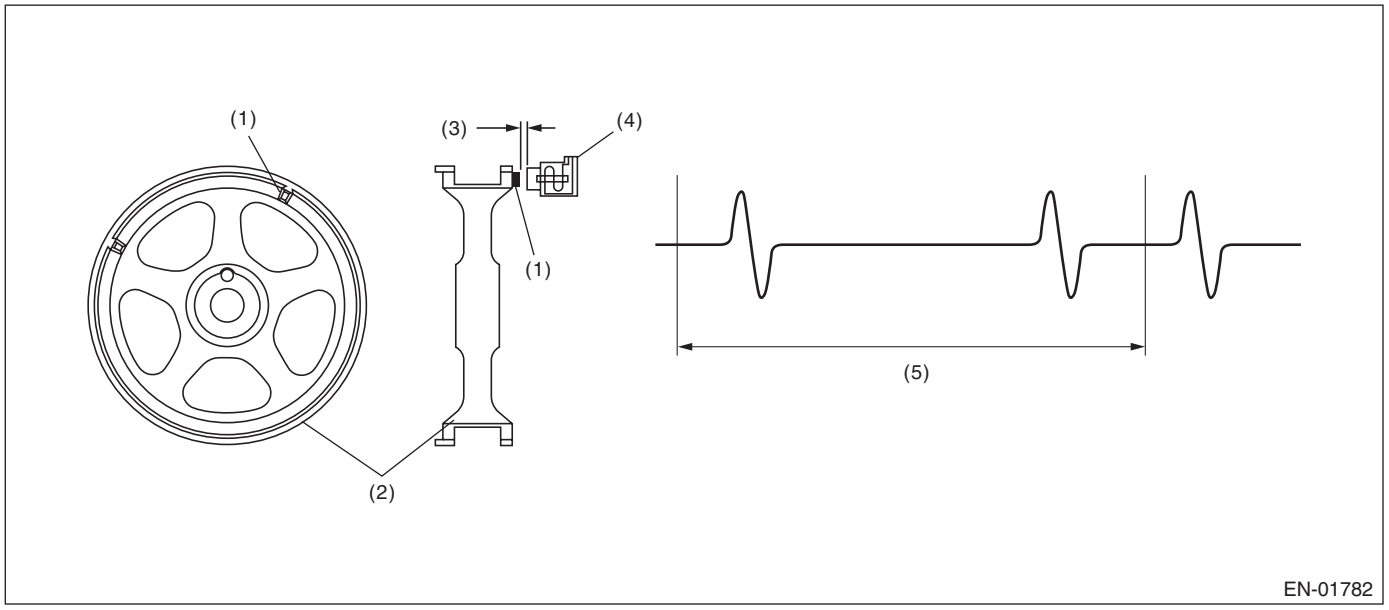
1. OUTLINE OF DIAGNOSIS

Detect the malfunction of camshaft position sensor output property.
Judge as NG when the camshaft line signal input timing is shifted from the crankshaft signal because of timing belt tooth chip etc.

2. COMPONENT DESCRIPTION



(A) Cam signal
(B) Crankshaft signal



(1) Boss
(2) Cam sprocket
(3) Air gap
(4) Camshaft position sensor
(5) Camshaft one revolution (engine two revolutions)

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Cylinder number identification	Completed
Battery voltage	≥ 8 V
Engine speed	550 rpm — 1000 rpm
Engine operation	Idling
Misfire	Not detected
Engine load change during 4 milliseconds	≤ 12799.8 rpm

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously at idle speed.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Position of camshaft position sensor signal	Not between BTDC 10°CA and BTDC 80°CA

Time Needed for Diagnosis: 10 engine revs.
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Position of camshaft position sensor signal	Between BTDC10°CA and BTDC80°CA

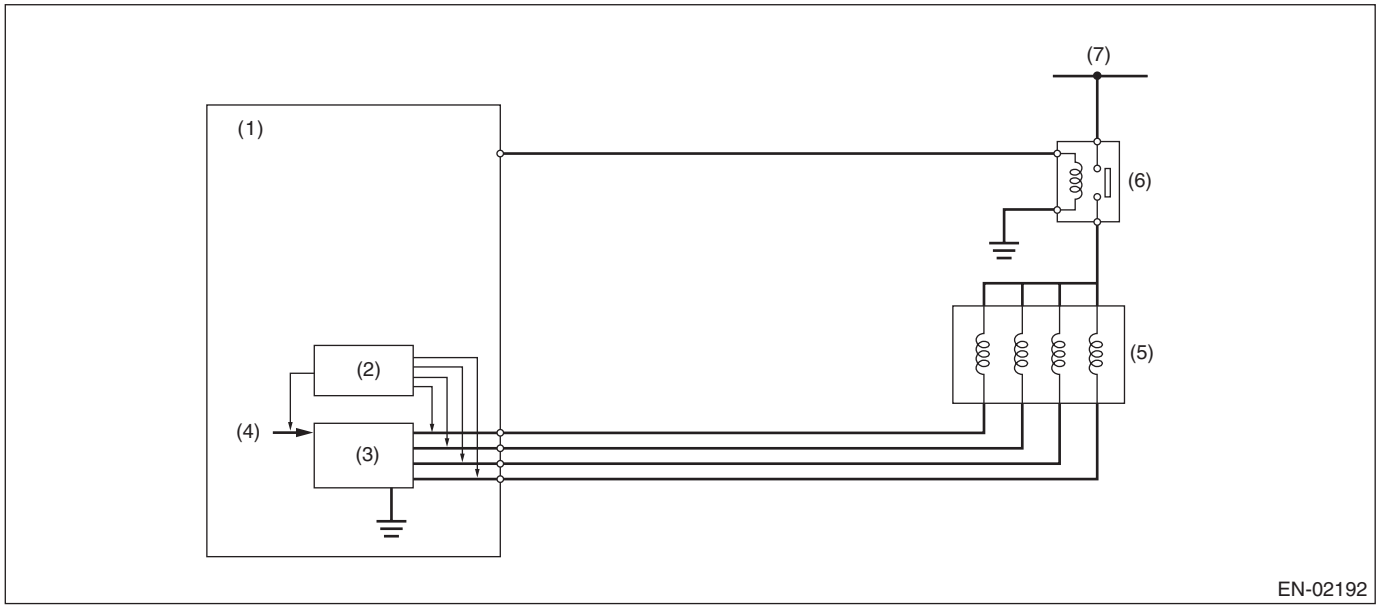
Time Needed for Diagnosis: Two engine revs.

BD:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

1. OUTLINE OF DIAGNOSIS

Detect EGR system malfunction.
Intake manifold pressure (negative pressure) is constant because the throttle valve is fully closed during deceleration fuel cut. At this time, when the EGR valve is opened/closed, the intake manifold pressure will change. EGR System OK/NG is judged by the range of this change.

2. COMPONENT DESCRIPTION



(1) ECM
(2) Detecting circuit
(3) Switching circuit
(4) CPU
(5) EGR valve
(6) Main relay
(7) Battery power supply

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 40 s
Engine coolant temperature	≥ 75 °C(167 °F)
Engine speed	1200 rpm — 2950 rpm
Intake manifold pressure (absolute pressure)	< 44 kPa (330 mmHg, 13 inHg)
Ambient air temperature	≥ 5 °C(41 °F)
Throttle position	< 0.25 °
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Vehicle speed	≥58 km/h (36 MPH)
Fuel shut-off function	In operation
Neutral switch	OFF
After neutral switch ON/OFF change	≥ Value from Map
No load change (A/C, power steering, lighting, rear defogger, heater fan and radiator fan)	≥ 5000 ms

Map

Engine coolant temperature °C (°F)	–40 (–40)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
After neutral switch change msec	0	0	0	0	0	0	0	0

Engine coolant temperature °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
After neutral switch change msec	0	0	0	0	0	0	0	0

4. GENERAL DRIVING CYCLE

During deceleration fuel cut from 53 km/h (approx. 33 MPH) or more, perform diagnosis once.
Be careful of vehicle speed and engine speed. (Diagnosis will not be completed if the vehicle speed and engine speed conditions become out of specification due to deceleration.)

5. DIAGNOSTIC METHOD

Measure the pressure values when the enable conditions are established, and perform diagnosis by calculating those results.
1. Label the intake manifold pressure value as PMOF1, which is observed when enable conditions are established, and set the EGR target step to 50 steps (nearly full open).
2. Label the intake manifold pressure value as PMON, which is observed after one second has passed since EGR target step was set to 50 steps (when the enable conditions were established), and set the EGR target step to 0.
3. Label the intake manifold pressure as PMOF2, which is observed after one second has passed since EGR target step was set to 0 (after two seconds have passed since the enable conditions were established).

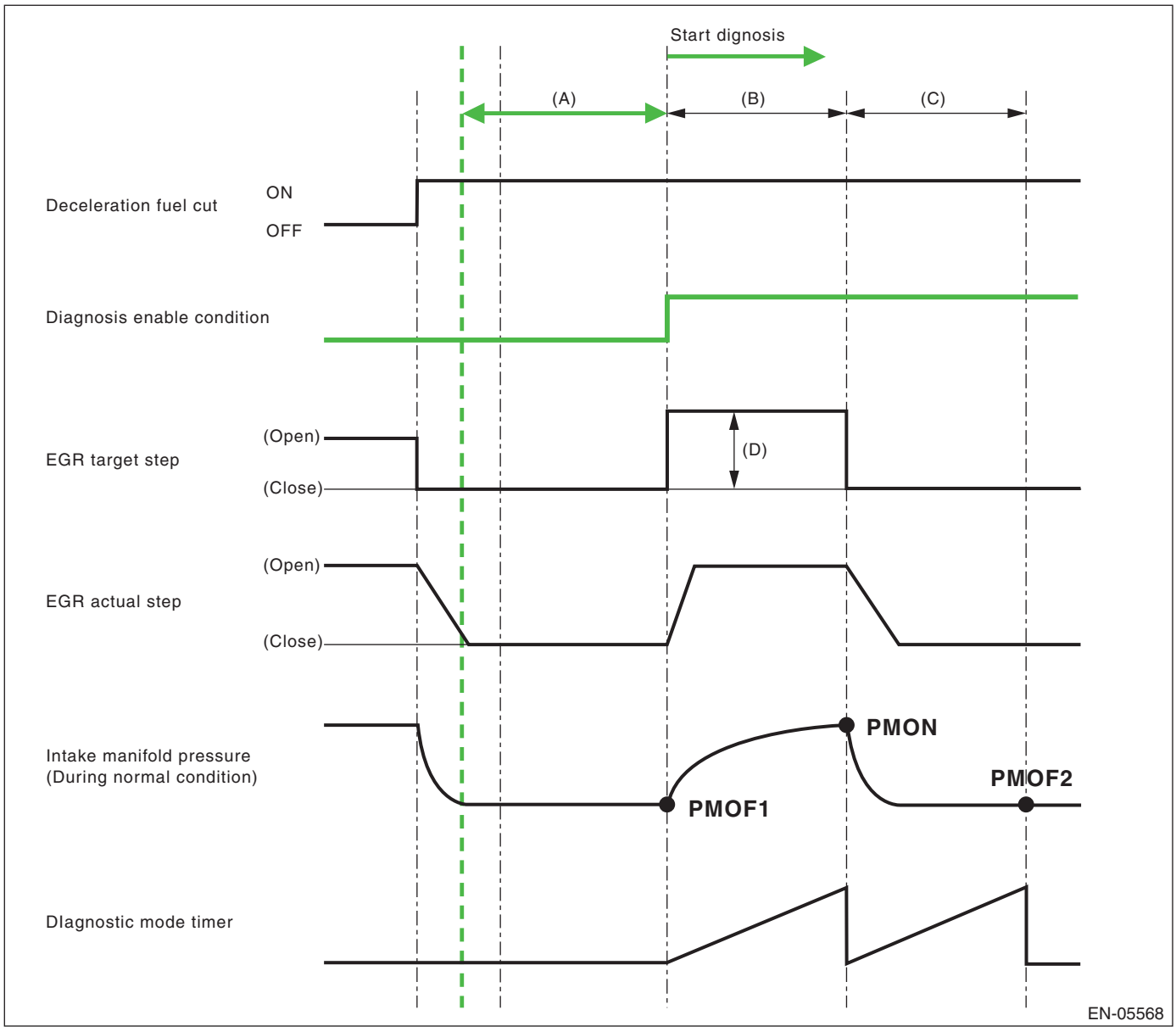
- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
PMON – (PMOF1 + PMOF2)/2	< 2.5 kPa (18.63 mmHg, 0.7 inHg)

Time Needed for Diagnosis: 1 time
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.



(A) 3000 ms
(B) 1000 ms
(C) 1000 ms
(D) 45 step(s)

- **Normality Judgment**

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
PMON – (PMOF1 + PMOF2)/2	≥ 2.5 kPa (18.63 mmHg, 0.7 inHg)

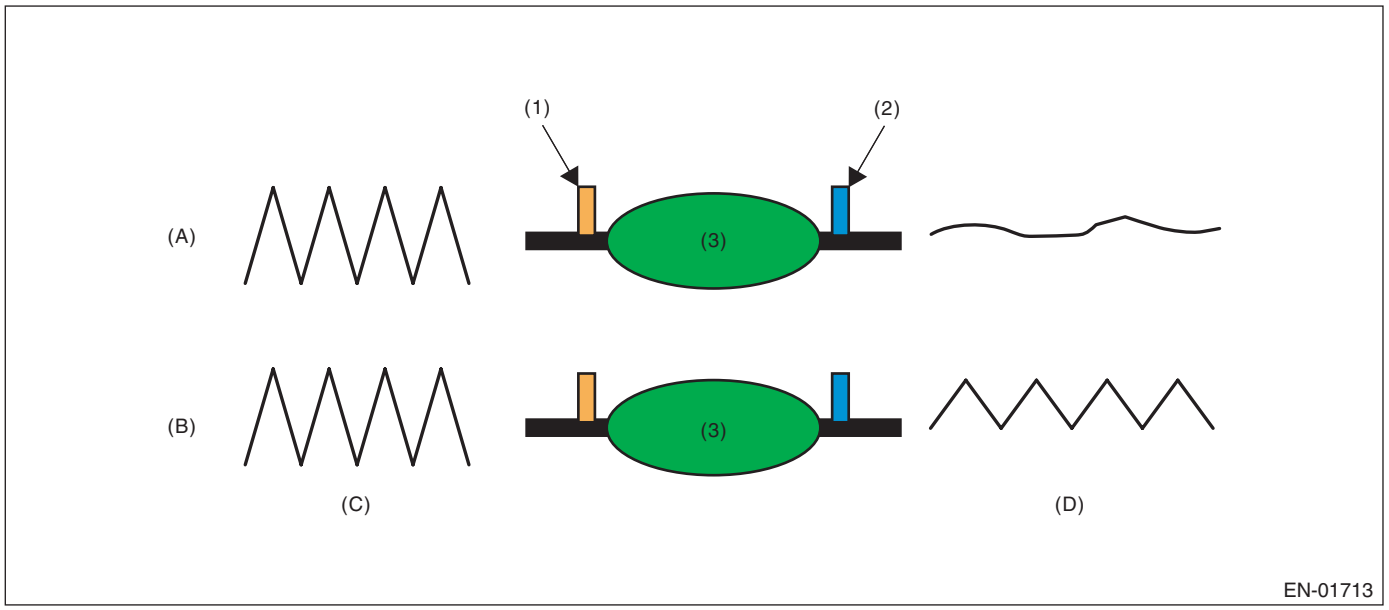
Time Needed for Diagnosis: 1 time

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

1. OUTLINE OF DIAGNOSIS

Detect the deterioration of the catalyst function.
Though the front 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 front oxygen sensor output and comparing it with the front oxygen (A/F) sensor output.

2. COMPONENT DESCRIPTION



(A) Normal
(B) Deterioration
(C) Output waveform from the front oxygen (A/F) sensor
(D) Output waveform from the front oxygen sensor
(1) Front oxygen (A/F) sensor
(2) Front oxygen sensor
(3) Catalytic converter

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Engine coolant temperature	≥ 70 °C (158 °F)
Estimated catalyst temperature	≥ 540 °C (1004 °F)
Misfire detection every 200 rotations	< 5 time(s)
Learning value of evaporation gas density	< 0.2
Sub feedback	In operation
Evaporative system diagnosis	Not in operation
Time of difference (< 0.10) between actual lambda and target lambda	≥ 1000 ms
Vehicle speed	> 70 km/h (43.5 MPH)
Amount of intake air	≥ 10 g/s (0.35 oz/s) and < 40 g/s (1.41 oz/s)
Engine load change every 0.5 engine revs.	< 0.02 g/rev (0 oz/rev)
Rear oxygen output change from 660 mV or less to 660 mV or more	Experienced after fuel cut
Elapsed time after starting the engine	≥ 205 second
Purge execution calculated time	≥ 0 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant 70 km/h (43.5 MPH) or higher.

5. DIAGNOSTIC METHOD

After establishing the execution conditions, calculate the front oxygen (A/F) sensor lambda deviation cumulative value per 32 milliseconds × 4 (Σ |(sglmd$_n$ – sglmd$_{n-1}$)|) and rear oxygen sensor output voltage deviation cumulative value (Σ |(ro2sad$_n$ – ro2sad$_{n-1}$)|), and when the front oxygen (A/F) sensor lambda deviation cumulative value (Σ |(sglmd$_n$ – sglmd$_{n-1}$)|) becomes the predetermined value or more, calculate the diagnostic value.

- **Abnormality Judgment**

If the duration of time while the following conditions are met is within the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Σ |(ro2sad$_n$ – ro2sad$_{n-1}$)| / Σ |(sglmd$_n$ – sglmd$_{n-1}$)|	> 14

Time Needed for Diagnosis: 30 — 55 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is within the predetermined time.

Judgment Value

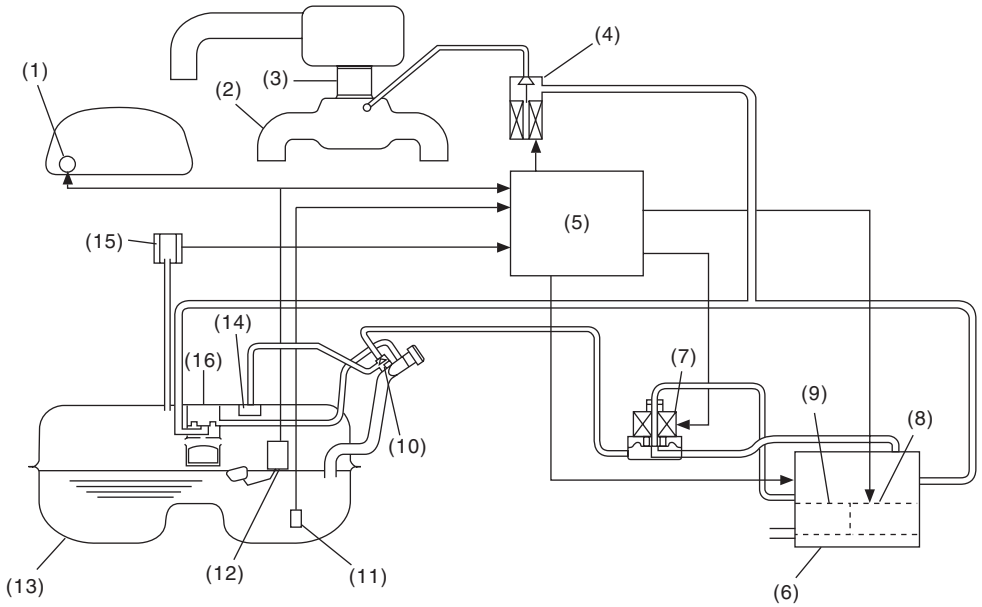
Malfunction Criteria	Threshold Value
Σ |(ro2sad$_n$ – ro2sad$_{n-1}$)| / Σ |(sglmd$_n$ – sglmd$_{n-1}$)|	≤ 14

Time Needed for Diagnosis: 30 — 55 seconds

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

1. OUTLINE OF DIAGNOSIS

Check if there is a leakage in fuel system or not, and perform the function diagnosis of valve.

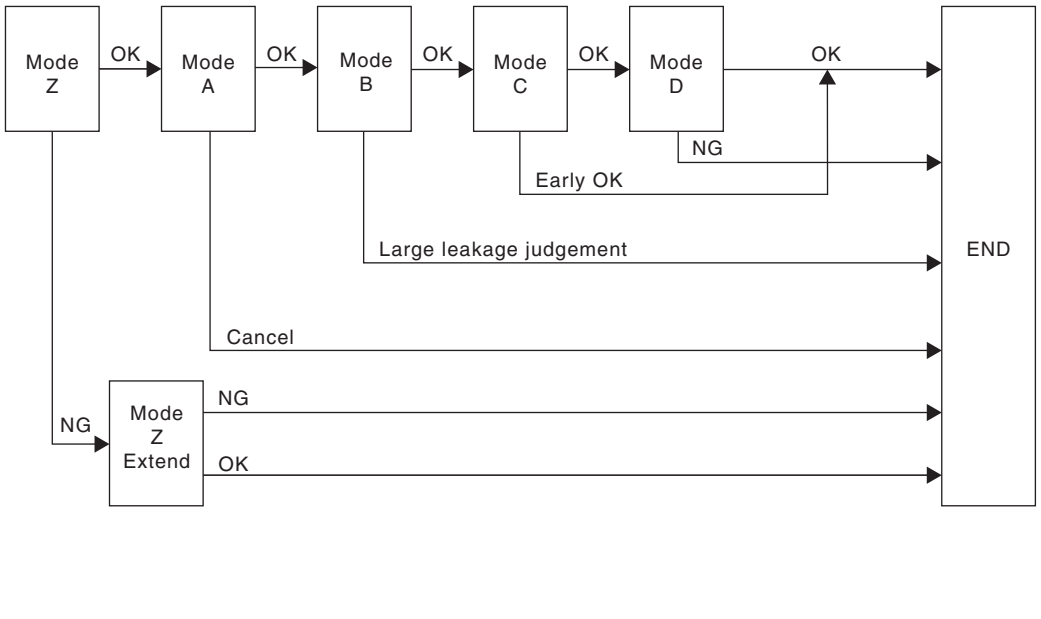


EN-04151

(1)	Fuel gauge	(7)	Pressure control valve	(12)	Fuel level sensor
(2)	Intake manifold	(8)	Drain valve	(13)	Fuel tank
(3)	Throttle body	(9)	Drain filter	(14)	Fuel cut valve
(4)	Purge control solenoid valve	(10)	Shut-off valve	(15)	Fuel tank pressure sensor
(5)	Engine control module (ECM)	(11)	Fuel temperature sensor	(16)	Vent valve
(6)	Canister				

In this system diagnosis, check for leakage and valve function is conducted by changing the fuel tank pressure and monitoring the pressure change using the fuel tank pressure sensor. When in 0.04 inch diagnosis, perform in the order of mode Z → mode A → mode B → mode C and mode D; When in 0.02 inch diagnosis, perform in the order of mode A → mode B → mode C → mode D and mode E.

0.04-inch Diagnosis

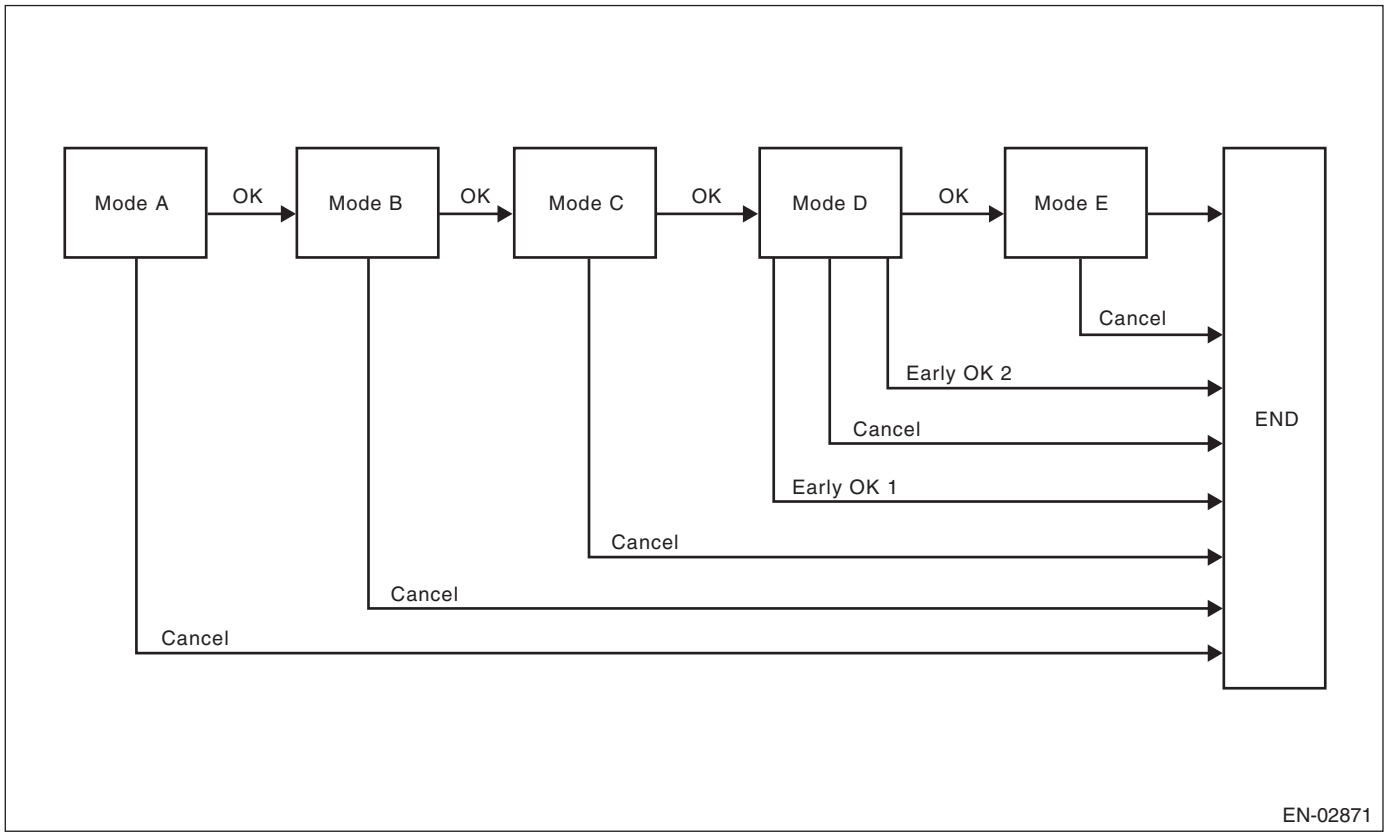


Mode	Mode Description	Diagnosis Period
Mode Z (Purge control solenoid valve opening failure diagnosis)	Perform purge control solenoid valve opening failure diagnosis from the size of tank pressure variation from diagnosis start.	0 ms + 3000 ms — 0 ms + 3000 ms + 13000 ms
Mode A (Estimated evaporation amount)	Calculate the tank pressure change amount (P1).	10000 ms
Mode B (Sealed negative pressure, large leakage judgment)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank. If the tank pressure cannot be reduced, it is diagnosed as large leak.	0 — 10000 ms + 25000 ms
Mode C (Pressure increase check, advanced OK judgment)	Wait until the tank pressure returns to the target (start level of P2 calculation). If the tank pressure does not become the value, make advanced OK judgment.	0 — 18600 ms
Mode D (Negative pressure variation measurement, evaporation leakage diagnosis)	Calculate the tank pressure variation (P2), and obtain the diagnostic value using P1 found in Mode A. Perform the evaporation diagnosis using the diagnostic value.	0 ms + 10000 ms

Mode Table for Evaporative Emission Control System Diagnosis

Mode	Behavior of tank internal pressure under normal conditions	Diagnostic item	DTC
Mode Z	Roughly the same as barometric pressure (Same as 0 kPa (0 mmHg, 0 inHg))	Purge control solenoid valve is judged to be open.	P0457
Mode A	Pressure is in proportion to amount of evaporative emission.	—	None
Mode B	Negative pressure is formed due to intake manifold negative pressure	Large leak	P0457
Mode C	Reaches target pressure	—	None
Mode D	Pressure change is small.	EVAP system large leak determination. [1.0 mm (0.04 in)]	P0442

0.02-inch Diagnosis



Mode	Mode Description	Diagnosis Period
Mode A (0 point compensation)	When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg).	0 — Value of Map 1
Mode B (Negative pressure introduced)	Decrease the pressure in the tank to the target value by introducing the intake manifold pressure to the fuel tank.	0 — Value of Map 2
Mode C (Negative pressure maintained)	Wait until the tank pressure returns to the target (start level of P2 calculation).	0 — 25290 ms + 0 + Value of Map 2
Mode D (Negative pressure change calculated)	Calculate the time it takes for the tank pressure to change to the Mode E shifting pressure. If the tank pressure does not change to the Mode E shifting pressure, make advanced OK judgment.	0 — 0 ms + 200000 ms
Mode E (Evaporation generated amount calculation)	Calculate the amount of evaporation (P1).	0 — 0 ms + 200000 ms + Value of Map 3

Map 1

Fuel level (ℓ , US gal, Imp gal)	0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Time Needed for Diagnosis (ms)	13800	13800	11400	9000	7000	5000	5000

Map 2

Fuel level (ℓ , US gal, Imp gal)	0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Time Needed for Diagnosis (ms)	20030	20030	20800	21580	21970	22360	22360

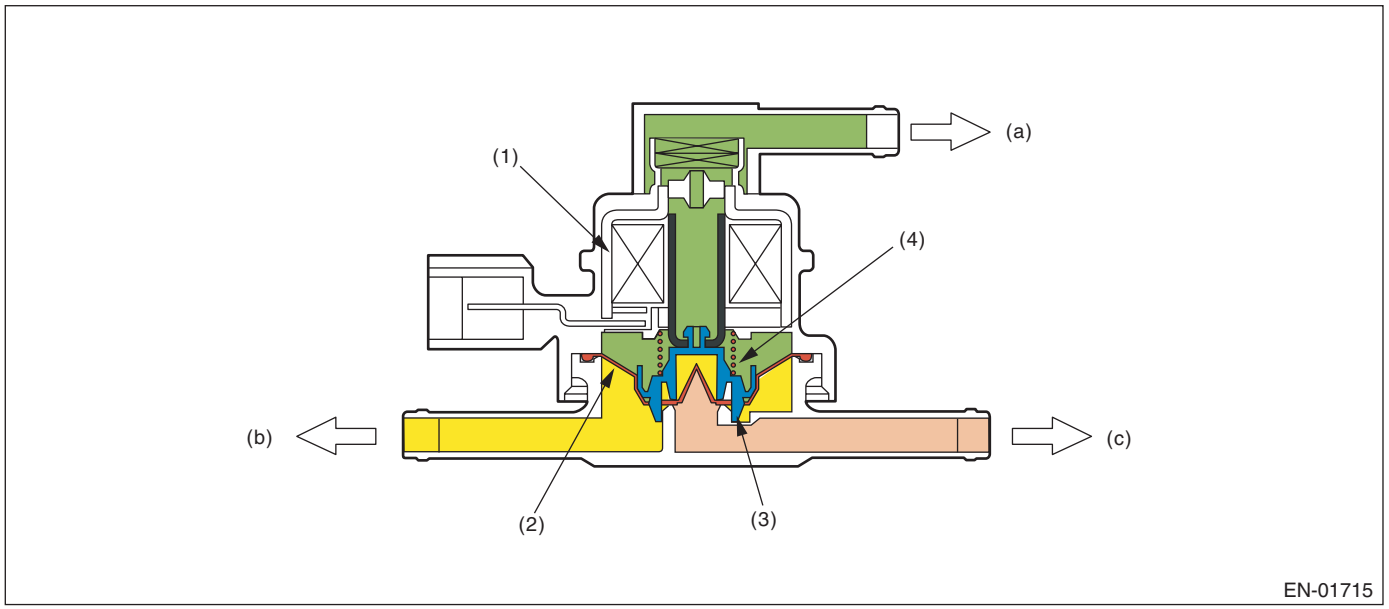
Map 3

Fuel level (ℓ , US gal, Imp gal)	0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Time Needed for Diagnosis (ms)	80000	80000	70000	60000	60000	60000	60000

2. COMPONENT DESCRIPTION

Pressure control solenoid valve

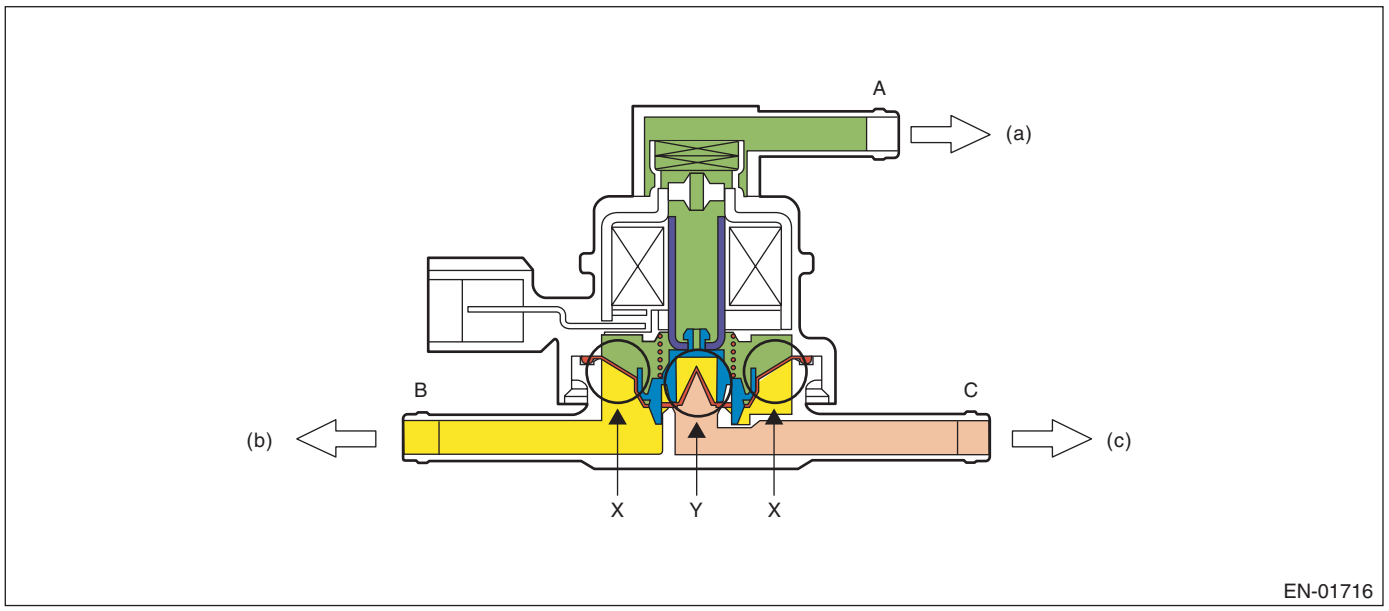
PCV controls the fuel tank pressure to be equal to the atmospheric air pressure. Normally, the solenoid is set to OFF. The valve opens and closes mechanically in accordance with the pressure difference between tank and atmospheric air, or tank and canister.
The valve is forcibly opened by setting the solenoid to ON at the time of diagnosis.



(a)	Atmospheric pressure	(b)	Fuel tank	(c)	Canister
(1)	Solenoid	(3)	Valve	(4)	Spring
(2)	Diaphragm				

Valve Operation and Air Flow

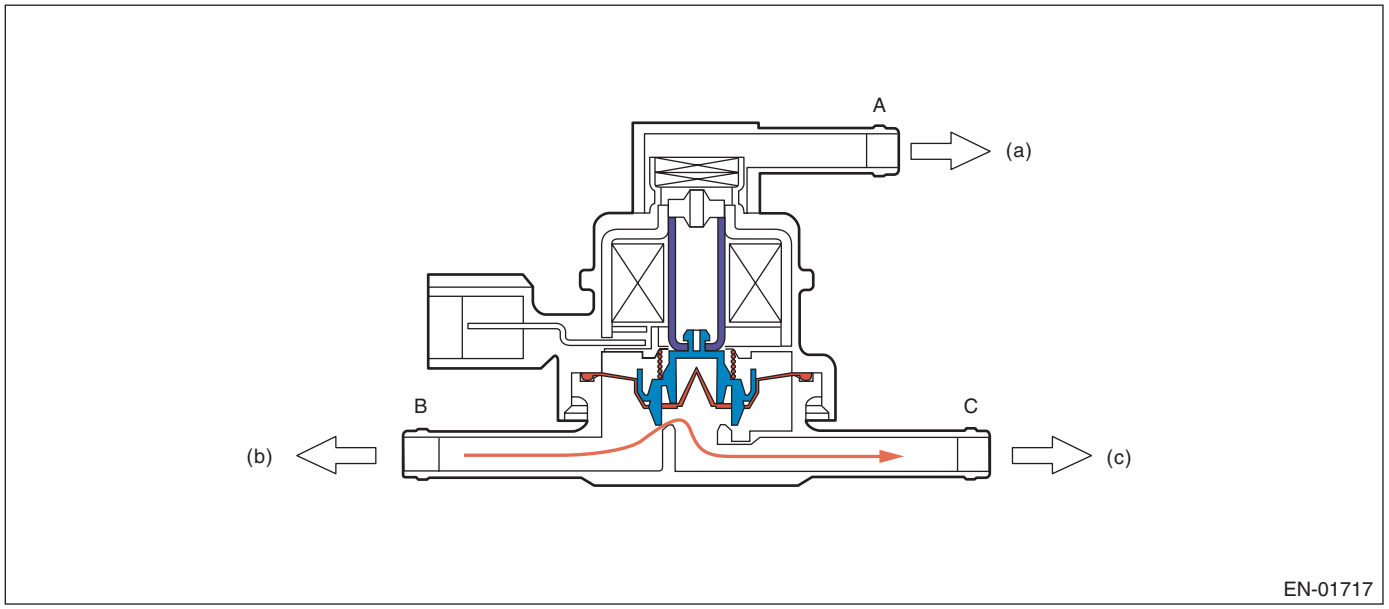
In the figure below, divided by the diaphragm, the part above X is charged with atmospheric air pressure, and the part below X is charged with tank pressure. Also, the part above Y is charged with tank pressure, and the part below Y is charged with canister pressure.
If the atmospheric air pressure port 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

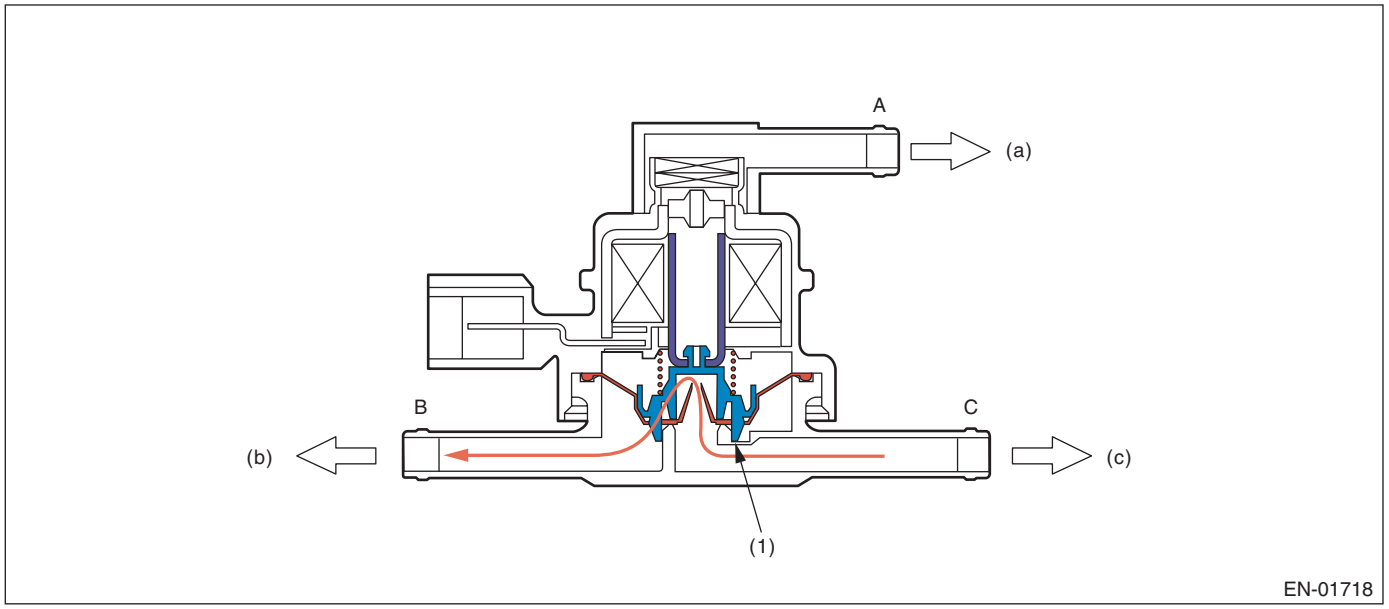
Condition of pressure	Flow
A < B (solenoid OFF)	B → C
B < C (solenoid OFF)	C → B
Solenoid ON	B ← → C

When A < B (solenoid OFF)



(a) Atmospheric pressure (b) Fuel tank (c) Canister

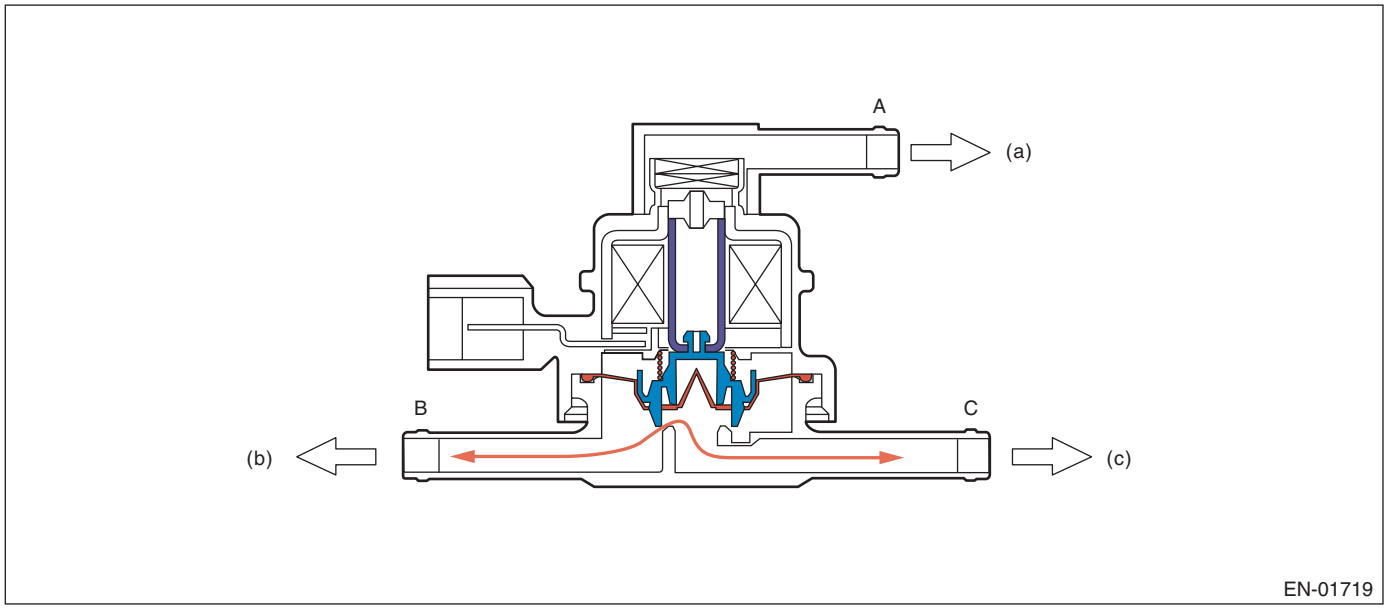
When B < C (solenoid OFF)



(a) Atmospheric pressure (b) Fuel tank (c) Canister

(1) Valve

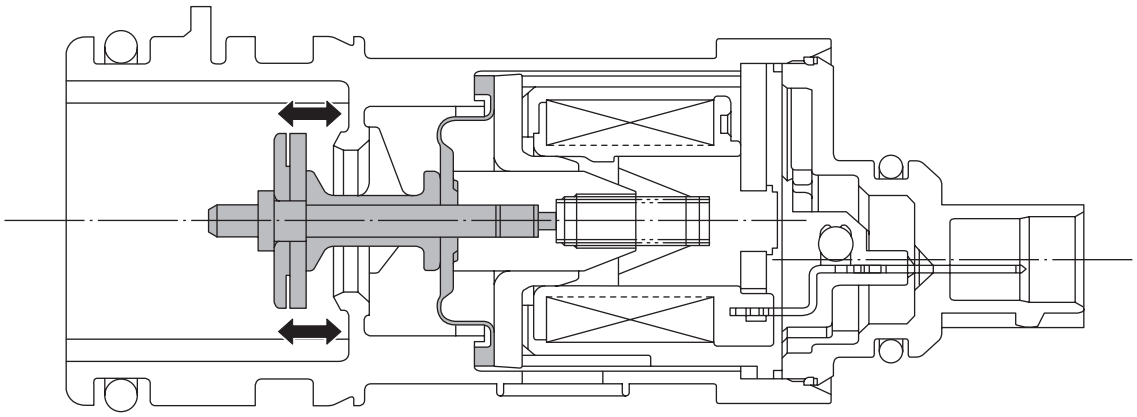
When Solenoid is ON



(a) Atmospheric pressure (b) Fuel tank (c) Canister

Drain valve

Drain valve controls the ambient air to be introduced to the canister.



3. ENABLE CONDITIONS

0.04-inch Diagnosis

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Total time of canister purge operation	≥ 120000 ms
Elapsed time after starting the engine	≥ 856 s
Learning value of evaporation gas density	< 0.08
Engine speed	1050 rpm — 6000 rpm
Fuel tank pressure	≥ –4 kPa (–30 mmHg, –1.2 inHg)
Intake manifold relative vacuum (relative pressure)	≥ – 26.7 kPa (– 200 mmHg, – 7.9 inHg)
Vehicle speed	≥ 32 km/h (19.9 MPH)
Fuel level	9.6 ℓ (2.54 US gal, 2.11 Imp gal) — 54.4 ℓ (14.37 US gal, 11.97 Imp gal)
Closed air/fuel ratio control	In operation
Fuel temperature	–10 °C (14 °F) — 45 °C (113 °F)
Intake air temperature	≥ –10 °C (14 °F)
Pressure change every one second	< 1.7 mmHg (Mode A)
	< 1.7 mmHg (Mode D)
Minimum pressure change value every one second – Maximum pressure change value every one second	< 1.7 mmHg (Mode A)
	< 1.7 mmHg (Mode D)
Change of fuel level per 128 milliseconds	< 2 ℓ (0.53 US gal, 0.44 Imp gal)
Air fuel ratio	0.76 — 1.25

0.02-inch Diagnosis

Secondary Parameters	Enable Conditions
At starting a diagnosis	
Evap. diagnosis	Incomplete
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Time since last incomplete 0.02-inch leakage diagnosis	
When cancelling in mode A	> 120000 ms
When cancelling in other than mode A	> 600000 ms
Total time of canister purge operation	≥ 120000 ms
Elapsed time after starting the engine	≥ 120 s
Fuel temperature	–10 °C (14 °F) — 55 °C (131 °F)
Fuel level	9.6 ℓ (2.54 US gal, 2.11 Imp gal) — 54.4 ℓ (14.37 US gal, 11.97 Imp gal)
Intake manifold relative vacuum (relative pressure)	≥ – 8 kPa (– 60 mmHg, – 2.4 inHg)
Fuel tank pressure	–0.7 kPa (–5 mmHg, –0.2 inHg) — 1.4 kPa (10.7 mmHg, 0.4 inHg)
Vehicle speed	50 km/h (31.1 MPH) — 510 km/h (316.9 MPH) continues for 125000 ms
Closed air/fuel ratio control	In operation
Engine speed	1050 rpm — 6000 rpm
During diagnosis	
Change of fuel level	≤ Value of Map 4
Pressure change every one second	< 0.1 kPa (0.44 mmHg, 0 inHg)
Minimum pressure change value every one second – Maximum pressure change value every one second	< 0.1 kPa (0.51 mmHg, 0 inHg) (Mode D)
| Pressure change in tank every second |	≤ 0.1 kPa (0.75 mmHg, 0 inHg)
Barometric pressure change	–0.5 kPa (–3.6 mmHg, –0.1 inHg) — 0.3 kPa (2.4 mmHg, 0.1 inHg) (Mode D) –0.3 kPa (–2.4 mmHg, –0.1 inHg) — 0.3 kPa (2.4 mmHg, 0.1 inHg) (Mode E)

Map 4

Fuel level (ℓ , US gal, Imp gal)	0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Change (ℓ , US gal, Imp gal)	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1	5, 1.32, 1.1

4. GENERAL DRIVING CYCLE

0.04-inch Diagnosis

- Perform the diagnosis only once in 856 seconds or more after starting the engine, at a constant speed of 32 km/h (20 MPH) or more.
- Pay attention to the fuel temperature and fuel level.

0.02-inch Diagnosis

- Perform the diagnosis 125 seconds or more at a constant engine speed of 50 km/h (31 MPH) or higher to judge as NG or OK.
- If judgment cannot be made, repeat the diagnosis.
- Pay attention to the fuel level.

5. DIAGNOSTIC METHOD

Purge control solenoid valve stuck open fault diagnosis

DTC
P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)
Purpose of Mode Z

When performing the leakage diagnosis of EVAP system, the purge control solenoid valve must operate normally. Therefore, mode Z is used to diagnose the purge control solenoid valve stuck open condition. Note that if a purge control solenoid valve stuck open fault is detected, the EVAP system leakage diagnosis is cancelled.

Diagnostic method

Purge control solenoid valve functional diagnosis is performed by monitoring the tank pressure in mode Z.

- **Abnormality Judgment**

If OK judgment cannot be made, extend Mode Z, and Judge as NG when the following conditions are established after predetermined amount of time.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
evptez – evptezha	> 0.9 kPa (6.5 mmHg, 0.3 inHg)	P0457
evptezini	≤ 1.4 kPa (10.7 mmHg, 0.4 inHg)	
Time of 2 ℓ (0.53 US gal, 0.44 Imp gal) or more fuel no sloshing	≥ 40000 ms	

Time Needed for Diagnosis:0 ms + 3000 ms + 13000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

When judgment for purge control solenoid valve stuck open NG is made, end the evaporative diagnosis. Cancel the evaporative diagnosis when the OK/NG judgment for purge control solenoid valve stuck open cannot be made in Mode Z.

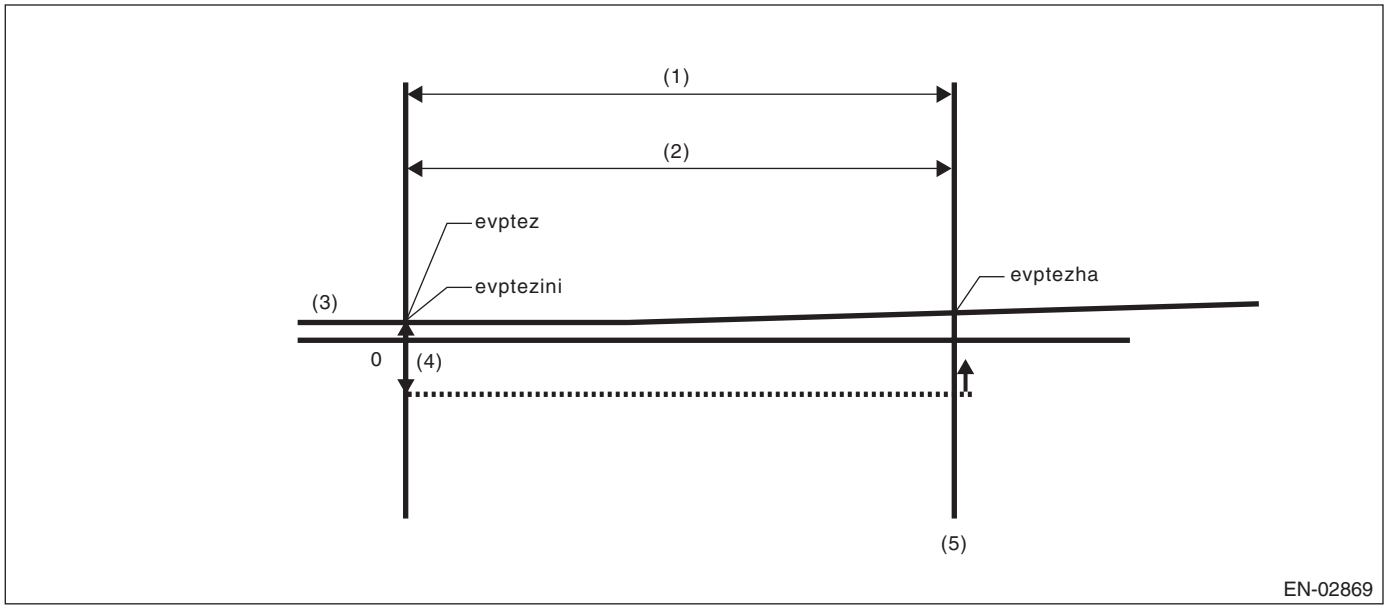
- **Normality Judgment**

Judge as OK and change to Mode A when the following conditions are established after predetermined time has passed since Mode Z started.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
evptez – evptezha	≤ 0.4 kPa (3 mmHg, 0.1 inHg)	P0457

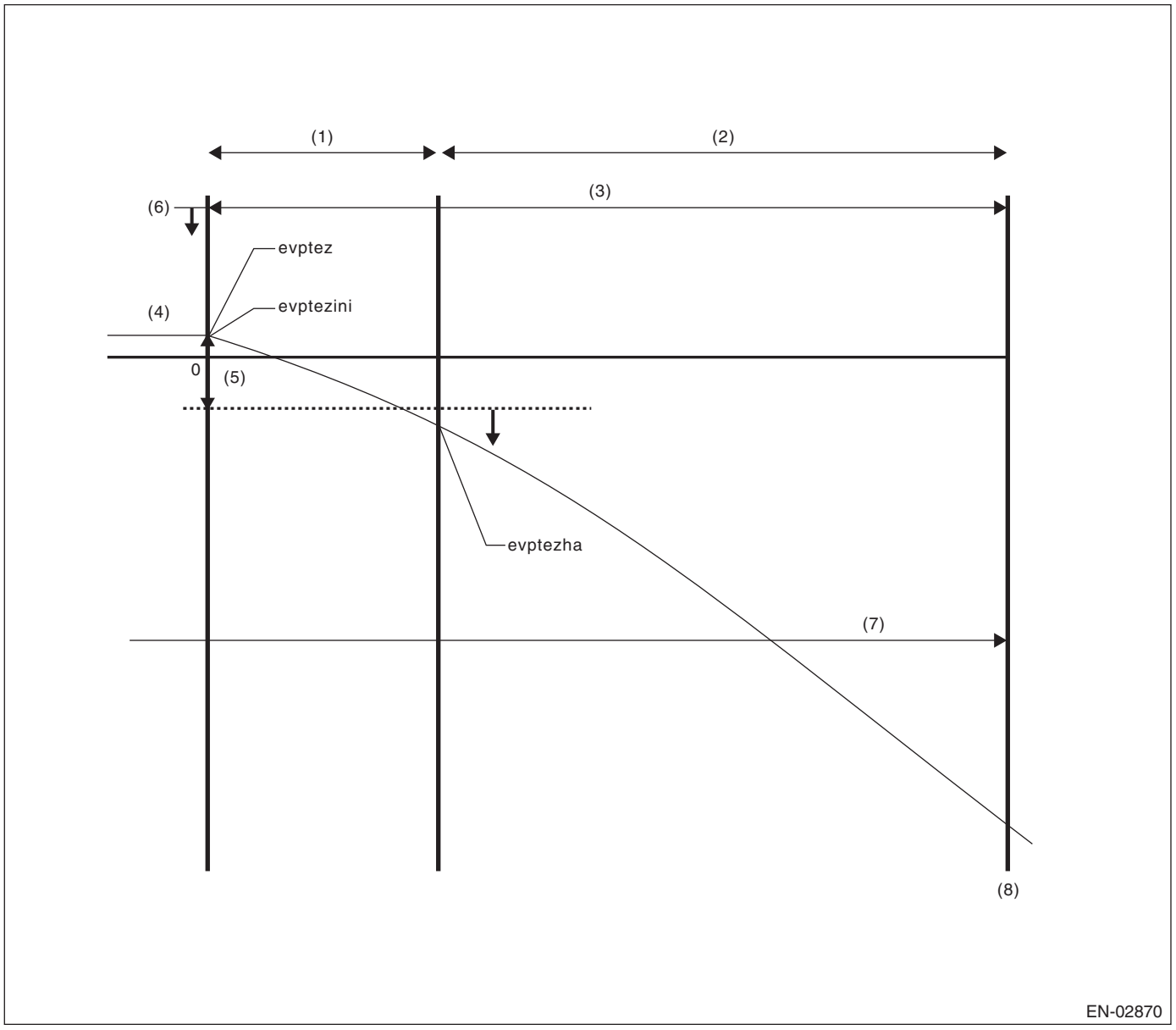
Normal



(1) Mode Z
(2) 3000 ms
(3) Fuel tank pressure
(4) 0.4 kPa (3 mmHg, 0.1 inHg)
(5) OK judgment

evptez – evptezha ≤ 0.4 kPa (3 mmHg, 0.1 inHg) Normal when above is established
Time Needed for Diagnosis:0 ms + 3000 ms

Purge control solenoid valve Open Fixation



(1) Mode Z
(2) Extended mode Z
(3) 3000 ms + 13000 ms
(4) Fuel tank pressure
(5) 0.9 kPa (6.5 mmHg, 0.3 inHg)
(6) 1.4 kPa (10.7 mmHg, 0.4 inHg)
(7) 40000 ms no fuel sloshing
(8) NG judgment

- evptezini ≤ 1.4 kPa (10.7 mmHg, 0.4 inHg)
- evptez – evptezha > 0.9 kPa (6.5 mmHg, 0.3 inHg)
- No fuel sloshing of over 2 ℓ (0.53 US gal, 0.44 Imp gal) lasts for more than 40000 ms.

Judge as abnormal when all are established.

Leak Diagnosis

DTC
P0442 Evaporative Emission Control System Leak Detected (Small Leak)
P0457 Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)

- The diagnostic 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 barometric pressure.
- The diagnosis is divided into the following five phases.

Mode A: (Estimated evaporation gas amount)
Calculate the tank pressure change amount (P1) when using mode A. After calculating P1, switch to mode B.
Mode B: (Negative pressure sealed)
Introduce negative pressure in the intake manifold to the tank.
Approx. 0 → –1.4 kPa (0 → –10.5 mmHg, 0 → –0.4 inHg)
When the pressure above (desired negative pressure) is reached, enters Mode C.
In this case, if the tank pressure does not reach the target negative pressure, judge that there is a large leakage in the system and terminate the evaporative emission control system diagnosis.
Abnormality Judgment
Judge as NG (large leakage) when the following conditions are established.
Judgment Value

Malfunction Criteria	Threshold Value	DTC
Time to reach target negative pressure	≥ 10000 ms + 25000 ms	P0457
or		
Mode B time	≥ 10000 ms	
(Min. pressure value in tank when in mode B) – (Tank pressure when mode B started)	> –0.3 kPa (–2.5 mmHg, –0.1 inHg)	

Time Needed for Diagnosis:0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms
Mode C: (Check pressure rise)
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 starting calculation of P2	Time for advanced OK judgment
–1.4 kPa (–10.5 mmHg, –0.4 inHg)	18600 ms

Time Needed for Diagnosis:0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 18600 ms
Mode D: (Measure amount of negative pressure change)
Monitor the tank pressure change amount when using mode D. In this case, the tank pressure increases, (nears barometric pressure) because evaporation occurs. 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 a small leak diagnosis according to the items below.
When Mode D is ended
Assign tank variations measured in Mode A and Mode D, P1 and P2, to the formula below, judge small leaks in the system. If the measured judgment value exceeds the threshold value, it is judged to be a malfunction.

Abnormality Judgment

Judge as NG when the following conditions are established within the predetermined time. Judge as OK and clear the NG if the following conditions are not established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
P2 – 1.5 – × P1 P2: Tank pressure that changes every 10000 ms in mode D P1: Tank pressure that changes every 10000 ms in mode A	> Value of Map 5	P0442

*1.5 –: Evaporation amount compensation value when below negative pressure (Amount of evaporation occurrence increases as a vacuum condition increases.)

Map 5 Malfunction criteria limit for evaporation diagnosis

Fuel temperature vs. Fuel level	25 °C (77 °F)	30 °C (86 °F)	35 °C (95 °F)	40 °C (104 °F)	45 °C (113 °F)
0 ℓ (0 US gal, 0 Imp gal)	0.3 kPa (2.1 mmHg, 0.1 inHg)	0.3 kPa (2.2 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.35 mmHg, 0.1 inHg)	0.3 kPa (2.4 mmHg, 0.1 inHg)
10 ℓ (2.64 US gal, 2.2 Imp gal)	0.3 kPa (2.1 mmHg, 0.1 inHg)	0.3 kPa (2.2 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.35 mmHg, 0.1 inHg)	0.3 kPa (2.4 mmHg, 0.1 inHg)
20 ℓ (5.28 US gal, 4.4 Imp gal)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.4 mmHg, 0.1 inHg)	0.3 kPa (2.5 mmHg, 0.1 inHg)	0.3 kPa (2.6 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)
30 ℓ (7.93 US gal, 6.6 Imp gal)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (3.05 mmHg, 0.1 inHg)	0.4 kPa (3.15 mmHg, 0.1 inHg)	0.4 kPa (3.25 mmHg, 0.1 inHg)	0.4 kPa (3.35 mmHg, 0.1 inHg)
40 ℓ (10.57 US gal, 8.8 Imp gal)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (3.15 mmHg, 0.1 inHg)	0.4 kPa (3.3 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)
50 ℓ (13.21 US gal, 11 Imp gal)	0.4 kPa (3.2 mmHg, 0.1 inHg)	0.4 kPa (3.3 mmHg, 0.1 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.5 kPa (3.6 mmHg, 0.1 inHg)	0.5 kPa (3.7 mmHg, 0.1 inHg)
60 ℓ (15.85 US gal, 13.2 Imp gal)	0.4 kPa (3.2 mmHg, 0.1 inHg)	0.4 kPa (3.3 mmHg, 0.1 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.5 kPa (3.6 mmHg, 0.1 inHg)	0.5 kPa (3.7 mmHg, 0.1 inHg)

Time Needed for Diagnosis:0 ms + 3000 ms + 10000 ms + 10000 ms + 25000 ms + 18600 ms + 10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Leak Diagnosis

DTC
P0456 Evaporative Emission Control System Leak Detected (very small leak)

- The diagnostic 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 barometric pressure.
- The diagnosis is divided into the following five phases.

Mode A: (0 point compensation)
When the pressure in the tank is not near 0 mmHg, wait until it returns to 0 point (near 0 mmHg). Shift to mode B when returned to the 0 point. Cancel the diagnosis when 0 point does not return in the specified time.
Mode B: (Negative pressure introduced)
Introduce negative pressure in the intake manifold to the tank.
Approx. 0 → –2 kPa (0 → –15 mmHg, 0 → –0.6 inHg)
When the pressure above (desired negative pressure) is reached, enters Mode C.
When the tank internal pressure does not reach the target negative pressure, the diagnosis is cancelled.
Mode C: (Negative pressure maintained)
Stop the introduction of negative pressure. (Wait until the tank pressure returns to the start level of P2 calculation.)
Change to Mode D either when the tank pressure returns to the start level of P2 calculation, or when the predetermined amount of time has passed.
Mode D: (Calculate the amount of negative pressure change)
Monitor the tank pressure in mode D, calculate the pressure change in the tank (P2), and measure the time (evpdset) for the tank pressure to change to the Mode E shifting pressure. When the Mode E shifting pressure is reached, Mode E is entered. If it does not change to the Mode E shifting pressure after the predetermined amount of time has passed, make advanced OK judgment or cancel the diagnosis according to the value of P2.
Normality Judgment
Judge as OK when the following conditions are established.
Judgment Value

Malfunction Criteria	Threshold Value
Advanced OK judgment 1	
Mode D time	≥ 0 ms + 10000 ms
Tank internal pressure	≤ Value of Map 6
Advanced OK judgment 2	
Mode D time	≥ 0 ms + 200000 ms
P2	≤ Value of Map 7

Map 6

Fuel level (ℓ , US gal, Imp gal)	0, 0, 0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Tank pressure (kPa, mmHg, inHgl)	–1.9, –14.62, –0.6	–1.9, –14.62, –0.6	–1.9, –14.59, –0.6	–1.9, –14.56, –0.6	–1.9, –14.42, –0.6	–1.9, –14.28, –0.6	–1.9, –14.28, –0.6

Map 7

Fuel level (ℓ , US gal, Imp gal)	0, 0, 0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Tank pressure (kPa, mmHg, inHgl)	0.9, 7, 0.3	0.9, 7, 0.3	0.9, 7.05, 0.3	0.9, 7.1, 0.3	1.1, 8.2, 0.3	1.3, 9.6, 0.4	1.3, 9.6, 0.4

Mode E: (Evaporation occurrence amount calculation)
Calculate the change of tank pressure with the time evpdset (P1) to judge as NG/OK according to the value of P1. (ambiguous determination acceptable).

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
P1	< Value of Map 8

Map 8 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 ℓ (0 US gal, 0 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.2 kPa (1.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)
10 ℓ (2.64 US gal, 2.2 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.2 kPa (1.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)
20 ℓ (5.28 US gal, 4.4 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.2 kPa (1.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)
30 ℓ (7.93 US gal, 6.6 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.2 kPa (1.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)	0.4 kPa (2.7 mmHg, 0.1 inHg)
40 ℓ (10.57 US gal, 8.8 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.2 kPa (1.85 mmHg, 0.1 inHg)	0.3 kPa (2.5 mmHg, 0.1 inHg)	0.3 kPa (2.5 mmHg, 0.1 inHg)	0.3 kPa (2.5 mmHg, 0.1 inHg)
50 ℓ (13.21 US gal, 11 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.3 kPa (2 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0 kPa (0 mmHg, 0 inHg)
60 ℓ (15.85 US gal, 13.2 Imp gal)	0 kPa (0 mmHg, 0 inHg)	0.1 kPa (0.5 mmHg, 0 inHg)	0.3 kPa (2 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0.3 kPa (2.3 mmHg, 0.1 inHg)	0 kPa (0 mmHg, 0 inHg)

Time Needed for Diagnosis: Value of Map1 + Value of Map2 + 25290 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
P1	> Value of Map 9

Map 9 Malfunction criteria limit for evaporation diagnosis

Time (evpdset) vs. Fuel level	0 ms	30000 ms	50000 ms	100000 ms	160000 ms	200000 ms
0 ℓ (0 US gal, 0 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)
10 ℓ (2.64 US gal, 2.2 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.5 kPa (3.5 mmHg, 0.1 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)	0.6 kPa (4.2 mmHg, 0.2 inHg)
20 ℓ (5.28 US gal, 4.4 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.4 kPa (3.25 mmHg, 0.1 inHg)	0.5 kPa (4.1 mmHg, 0.2 inHg)	0.5 kPa (4.1 mmHg, 0.2 inHg)	0.5 kPa (4.1 mmHg, 0.2 inHg)	0.5 kPa (4.1 mmHg, 0.2 inHg)
30 ℓ (7.93 US gal, 6.6 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.4 kPa (3 mmHg, 0.1 inHg)	0.5 kPa (3.9 mmHg, 0.2 inHg)	0.5 kPa (3.9 mmHg, 0.2 inHg)	0.5 kPa (3.9 mmHg, 0.2 inHg)	0.5 kPa (3.9 mmHg, 0.2 inHg)
40 ℓ (10.57 US gal, 8.8 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.3 kPa (2.25 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)	0.5 kPa (3.4 mmHg, 0.1 inHg)
50 ℓ (13.21 US gal, 11 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.2 kPa (1.5 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)
60 ℓ (15.85 US gal, 13.2 Imp gal)	0.1 kPa (1 mmHg, 0 inHg)	0.2 kPa (1.5 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)	0.4 kPa (2.9 mmHg, 0.1 inHg)

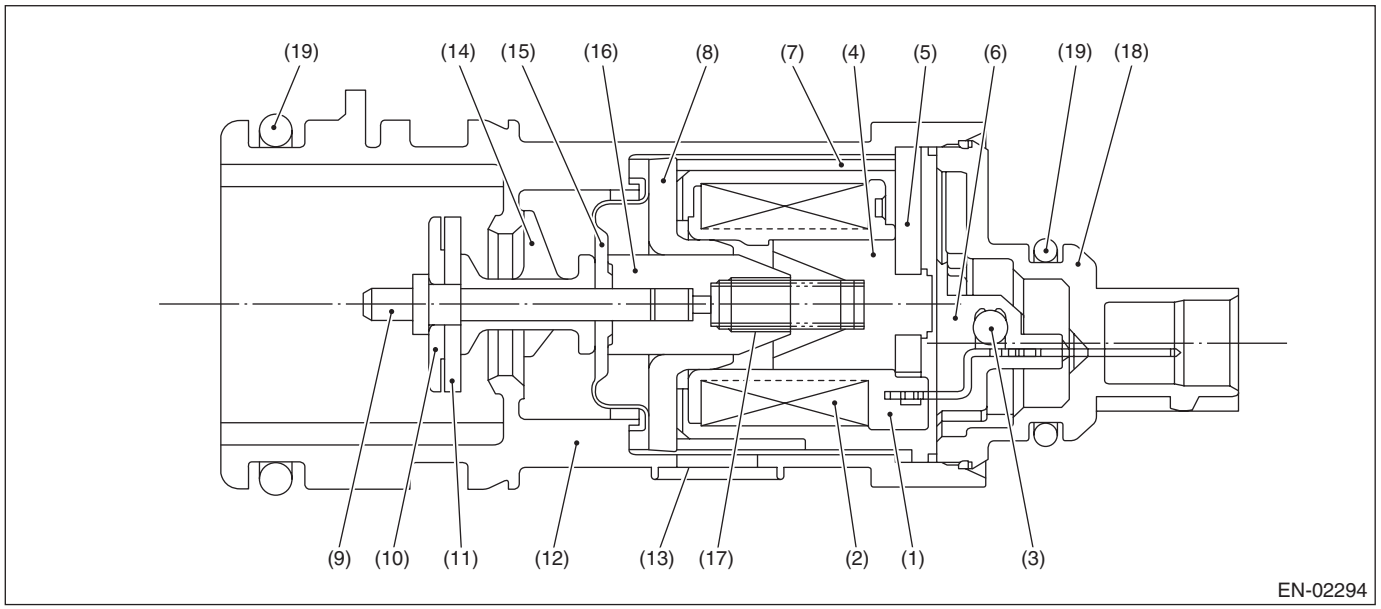
Time Needed for Diagnosis: Value of Map1 + Value of Map2 + 25290 ms + 0 + Value of Map2 + 0 ms + 200000 ms + Value of Map3 + 0 ms + 200000 ms

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

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.
Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



(1) Bobbin
(2) Coil
(3) Diode
(4) Stator core
(5) End plate
(6) Body
(7) Yoke
(8) Magnetic plate
(9) Shaft
(10) Plate
(11) Valve
(12) Housing
(13) Filter
(14) Retainer
(15) Diaphragm
(16) Movable core
(17) Spring
(18) Cover
(19) O-ring

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs OFF signal	High

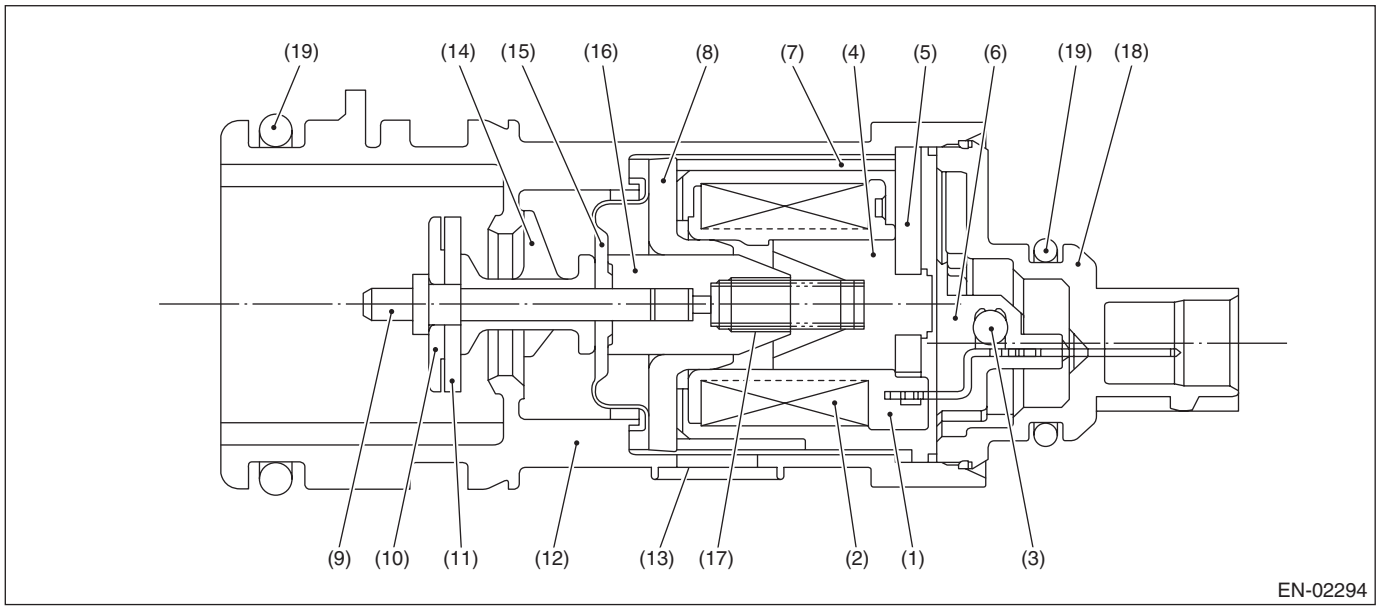
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the drain valve.
Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



(1) Bobbin
(2) Coil
(3) Diode
(4) Stator core
(5) End plate
(6) Body
(7) Yoke
(8) Magnetic plate
(9) Shaft
(10) Plate
(11) Valve
(12) Housing
(13) Filter
(14) Retainer
(15) Diaphragm
(16) Movable core
(17) Spring
(18) Cover
(19) O-ring

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs ON signal	High

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs ON signal	Low

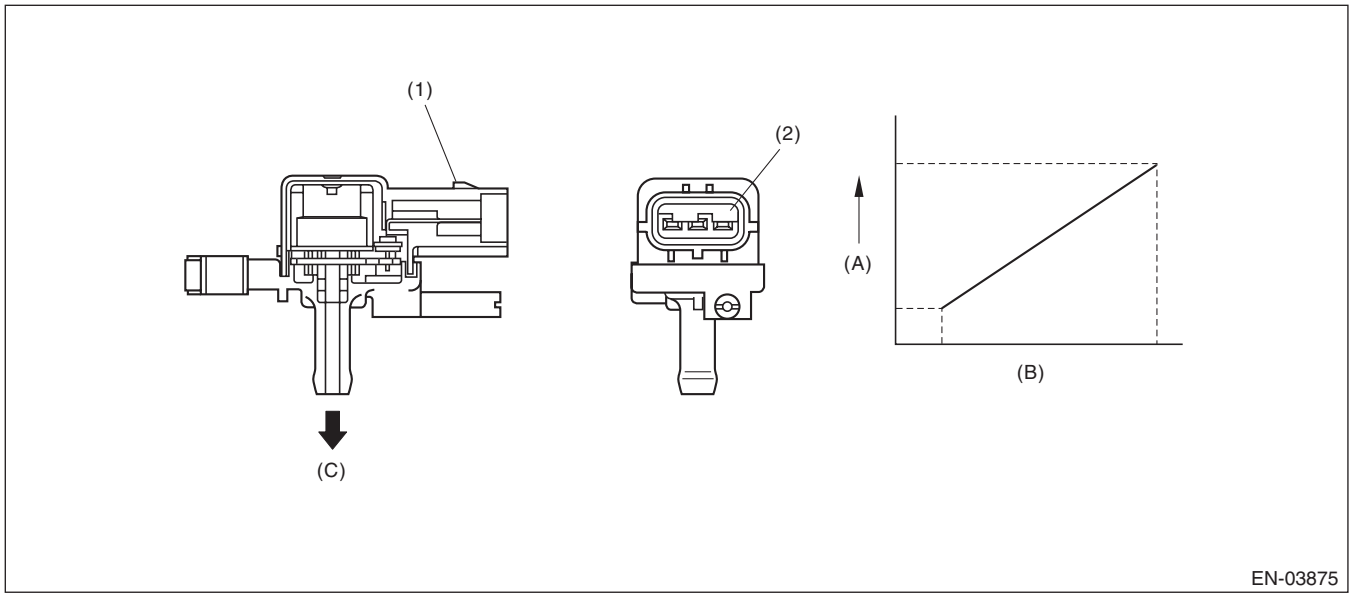
Time Needed for Diagnosis: Less than 1 second

BI: DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

1. OUTLINE OF DIAGNOSIS

Detect the tank pressure sensor output property abnormality.
Judge as NG when there is no pressure variation, which should exist in the tank, considering the engine status.

2. COMPONENT DESCRIPTION



(A) Output voltage
(B) Input voltage
(C) To fuel tank
(1) Connector
(2) Terminals

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 60 s
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Fuel temperature	< 35 °C (95 °F)
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)

4. GENERAL DRIVING CYCLE

- Perform the diagnosis continuously after 60 s have passed since the engine started.
- Pay attention to the fuel level and temperature.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Number of times that the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is 2 ℓ (0.53 US gal, 0.44 Imp gal) or more (with enable condition established)	≥ 16 time(s)
Maximum – Minimum tank pressure (with enable condition completed)	< 0 kPa (0.375 mmHg, 0 inHg)
Maximum – Minimum fuel temperature (with enable condition completed)	≥ 7 °C (44.6 °F)

If the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is less than 2 ℓ (0.53 US gal, 0.44 Imp gal), extend 60 s and make judgment with the Max. and Min. values for the fuel level in 60 s × 2. 60 s If a difference does not appear, extend the time (60 s × 3, 60 s × 4, 60 s × 5) and continue the judgment. If the difference between the Max. fuel level every 60 s and Min. fuel level every 60 s is 2 ℓ (0.53 US gal, 0.44 Imp gal) or more, the diagnosis counter counts up.

Time Needed for Diagnosis:60 s × 16 time(s) or more

Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Maximum Minimum tank pressure	≥ 0 kPa (0.375 mmHg, 0 inHg)

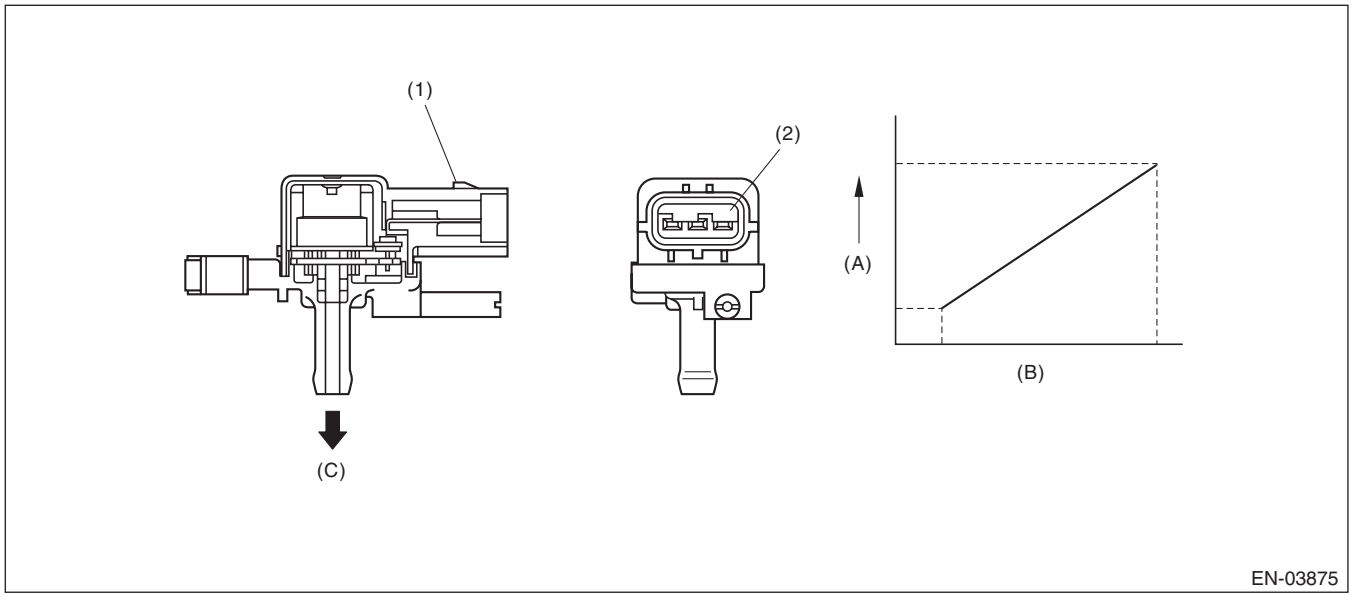
Time Needed for Diagnosis: Less than 1 second

BJ: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 as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Output voltage
(B) Input voltage
(C) To fuel tank
(1) Connector
(2) Terminals

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< –7.5 kPa (–55.9 mmHg, –2.2 inHg)
Battery voltage	≥ 10.9 V

Time Needed for Diagnosis:15000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≥ –7.5 kPa (–55.9 mmHg, –2.2 inHg)
Battery voltage	≥ 10.9 V

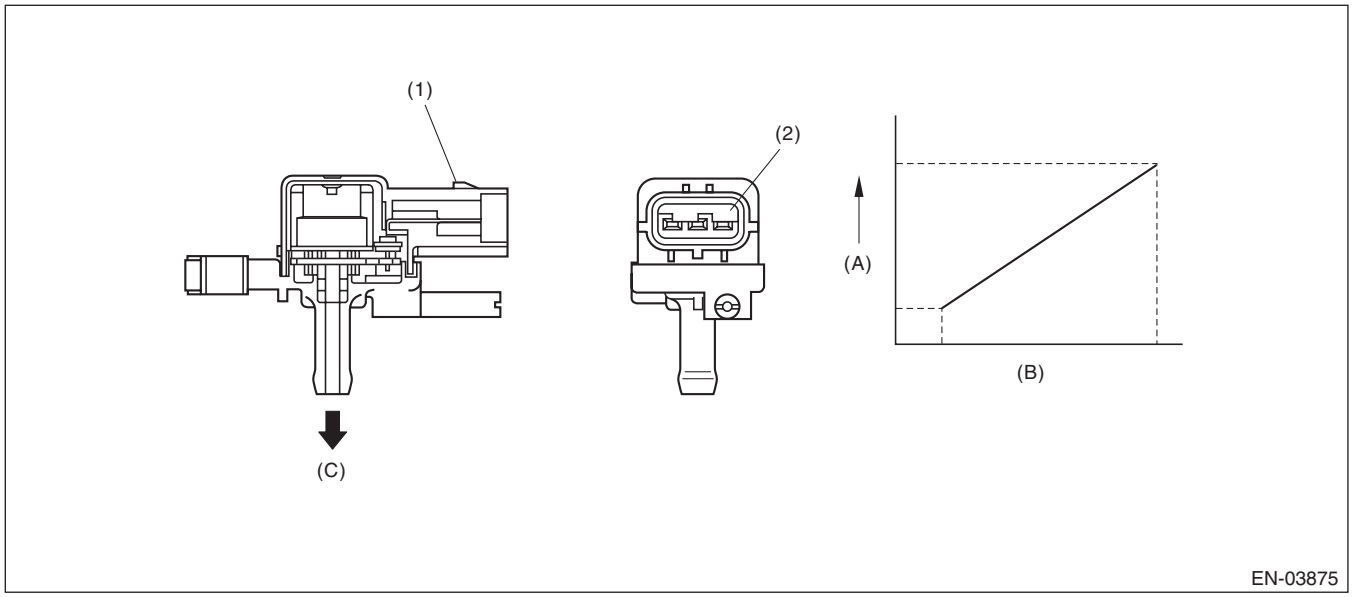
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the fuel tank pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(A) Output voltage
(B) Input voltage
(C) To fuel tank
(1) Connector
(2) Terminals

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 5000 ms
Vehicle speed	≥ 2 km/h (1.2 MPH)
All conditions of EVAP canister purge	Completed
Learning value of evaporation gas concentration (left and right)	< 0.08
Main feedback compensation coefficient (left and right)	≥ 0.9
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform the diagnosis when purging enable conditions are met without idling.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≥ 7.9 kPa (59.6 mmHg, 2.3 inHg)
Fuel temperature	< 35 °C (95 °F)
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)

Time Needed for Diagnosis:15000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	< 7.9 kPa (59.6 mmHg, 2.3 inHg)

Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0442. <Ref. to GD(H4SO)-103, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

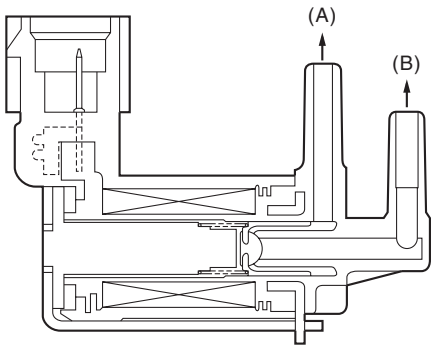
NOTE:
For the detection standard, refer to DTC P0442. <Ref. to GD(H4SO)-103, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

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

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.
Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



EN-01733

(A) To canister (B) To intake manifold

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of “ON”	< 0.75
Terminal output voltage	Low

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	High

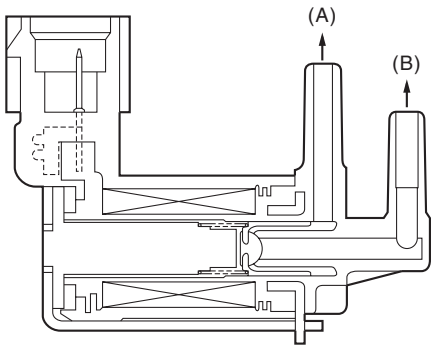
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve.
Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



EN-01733

(A) To canister (B) To intake manifold

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Duty ratio of “ON”	≥ 0.25
Terminal output voltage	High

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal output voltage	Low

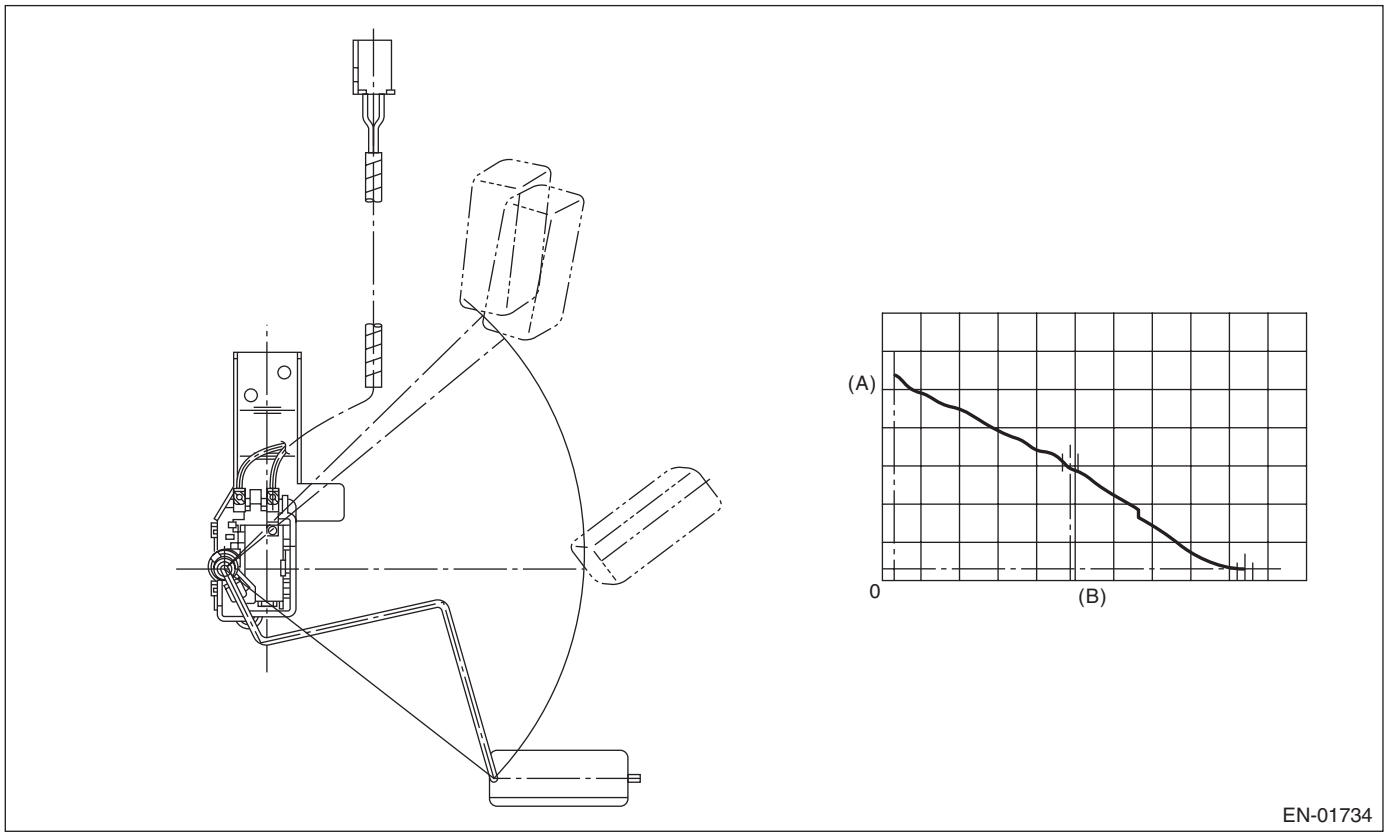
Time Needed for Diagnosis: Less than 1 second

BP:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the fuel level sensor output property.
If the fuel level does not vary in a particular driving condition / engine condition where it should, judge as NG.

2. COMPONENT DESCRIPTION



(A) Fuel level (B) Resistance

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 330957 g (11672.85 oz)
Max. – min. values of fuel level output	< 2.6 ℓ (0.69 US gal, 0.57 Imp gal)
Battery voltage	≥ 10.9 V
Engine speed	< 6000 rpm
Elapsed time after starting the engine	≥ 5000 ms

Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Accumulated amount of intake air	≥ 330957 g (11672.85 oz)
Max. – min. values of fuel level output	≥ 2.6 ℓ (0.69 US gal, 0.57 Imp gal)
Battery voltage	≥ 10.9 V
Engine speed	< 6000 rpm
Elapsed time after starting the engine	≥ 5000 ms

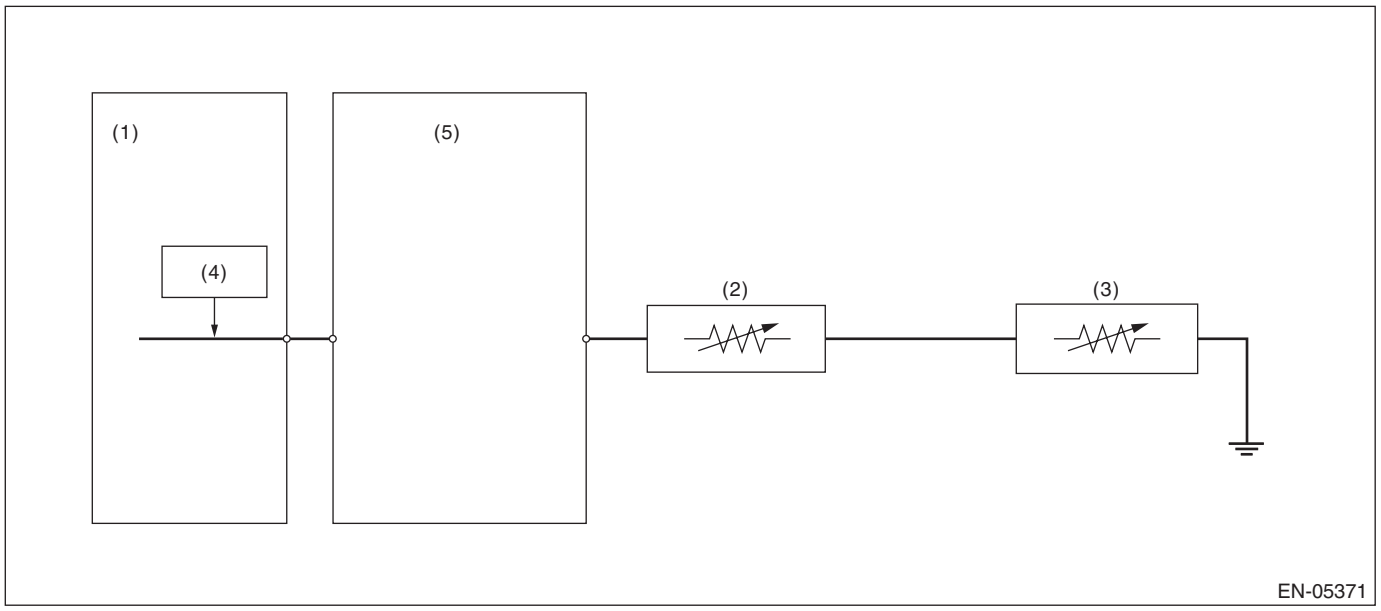
Time Needed for Diagnosis: Less than 1 second

BQ:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Fuel level sensor
(3) Fuel sub level sensor
(4) Detecting circuit
(5) Body integrated unit

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 3000 ms
Output voltage	< 0.173 V

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 3000 ms
Output voltage	≥ 0.173 V

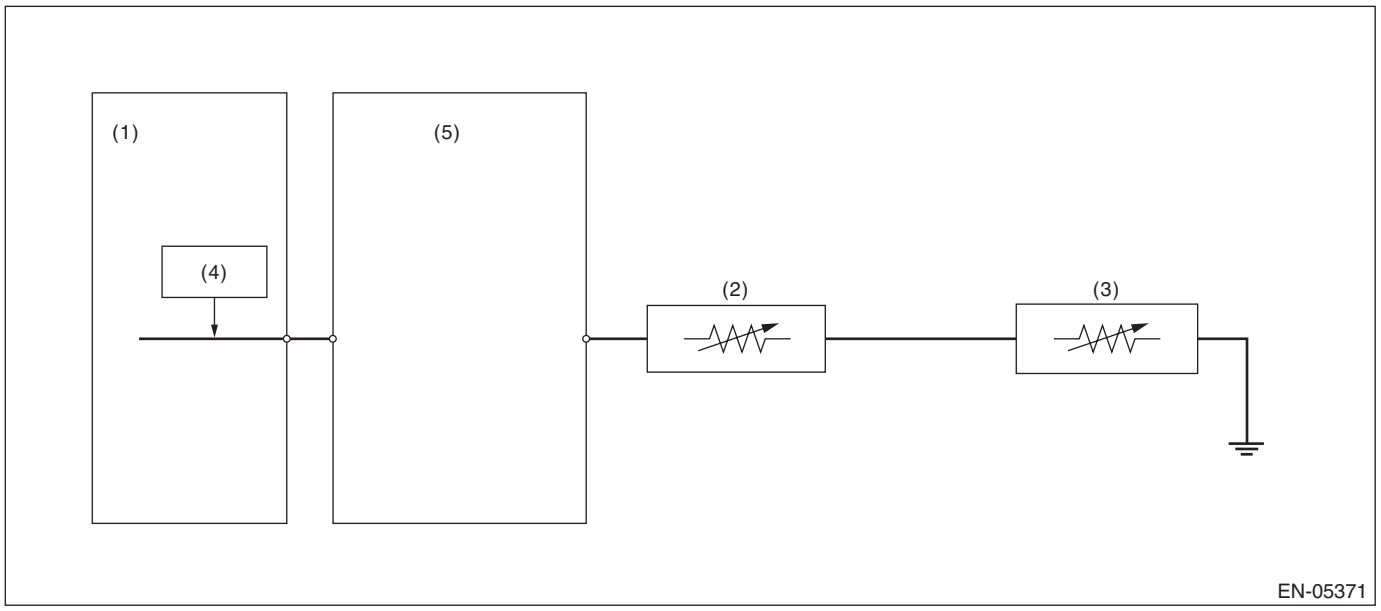
Time Needed for Diagnosis: Less than 1 second

BR:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of fuel level sensor. Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Fuel level sensor
(3) Fuel sub level sensor
(4) Detecting circuit
(5) Body integrated unit

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 3000 ms
Output voltage	≥ 7.212 V

Time Needed for Diagnosis:1000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 3000 ms
Output voltage	< 7.212 V

Time Needed for Diagnosis: Less than 1 second

BS:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

1. OUTLINE OF DIAGNOSIS

Detect the unstable output faults from the fuel level sensor caused by noise. Judge as NG when the max. value and cumulative value of output voltage variation of the fuel level sensor is larger than the threshold value.

2. ENABLE CONDITIONS

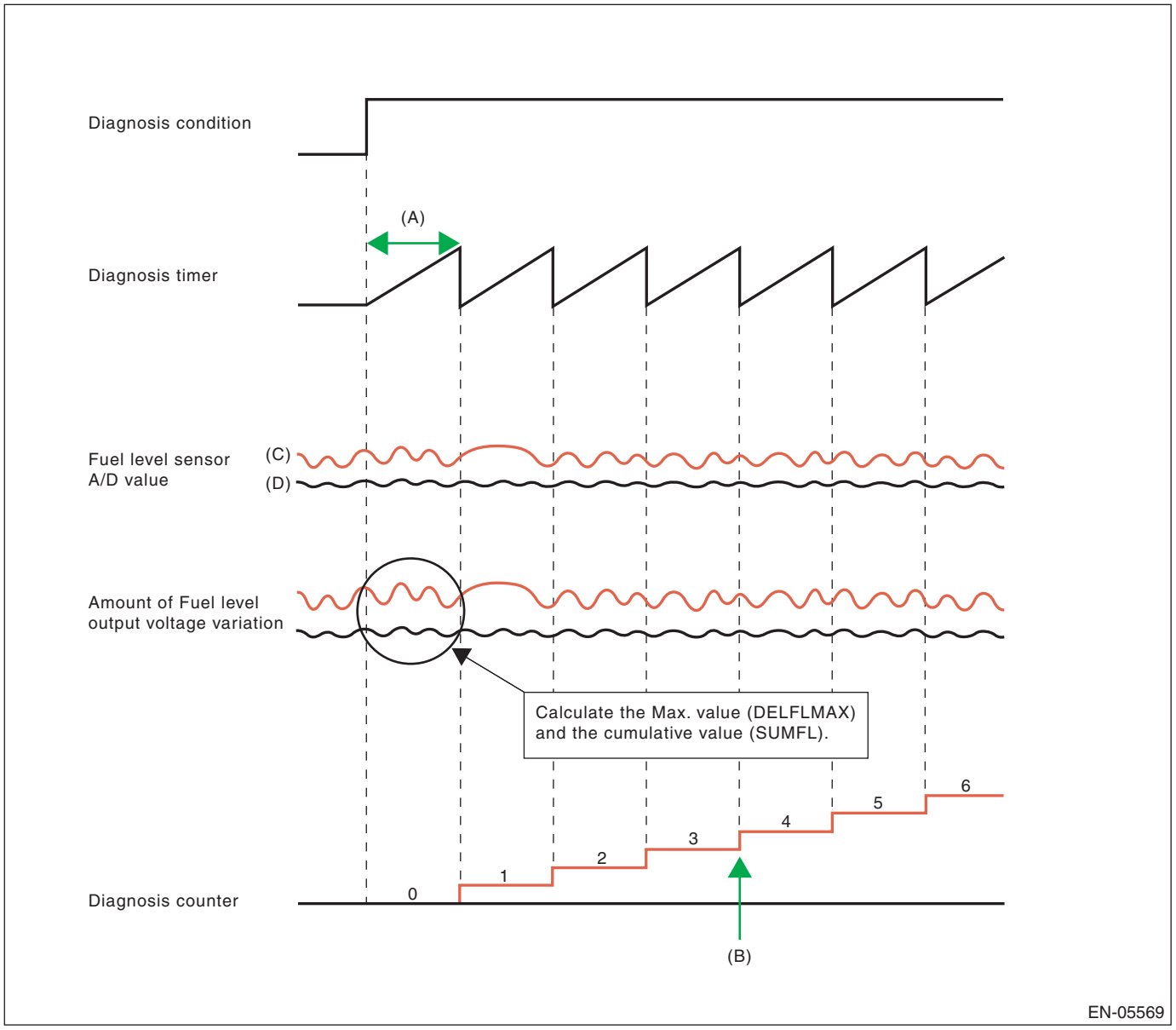
Malfunction Criteria	Threshold Value
Engine speed	≥ 500 rpm
Elapsed time after starting the engine	≥ 1 second
Battery voltage	≥ 10.9 V
Idle switch	ON
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal) and < 54.4 ℓ (14.37 US gal, 11.97 Imp gal)
Vehicle speed = 0 km/h (0 MPH)	≥ 10000 ms

3. GENERAL DRIVING CYCLE

- Always perform the diagnosis continuously at idle speed.
- 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 12.2 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, the diagnosis counter counts up. Judge as NG if the counter indicated 4 time(s).



(A) 12288 ms
(B) NG at 4 time(s) counts
(C) Malfunction
(D) Normal

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Integrated times of the condition reaching follows,	≥ 4 time(s)
DELFLMAX	≥ Value from Map
or	
SUMFL	≥ 25.92 V
At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for12288 ms	

Map

Fuel level (ℓ , US gal, Imp gal)	0, 0, 0	10, 2.64, 2.2	20, 5.28, 4.4	30, 7.93, 6.6	40, 10.57, 8.8	50, 13.21, 11	60, 15.85, 13.2
Measured voltage (V)	0.27	0.27	0.426	0.582	0.738	0.894	0.894

The diagnosis counter does not count up when the following conditions are completed within 12288 ms.

Maximum value – minimum value of change of tank pressure during 12288 ms	≥ 0 kPa (0.375 mmHg, 0 inHg)
Maximum value – minimum value of battery voltage during 12288 ms	≥ 1.09 V

Time Needed for Diagnosis:12288 ms × 4 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
DELFLMAX	< Value from Map
SUMFL	< 25.92 V
At this time, DELFLMAX: Maximum difference of sensor output for 12288 ms SUMFL: Integrated value of the sensor output deviation for12288 ms	

Time Needed for Diagnosis:12288 ms

BT:DTC P0500 VEHICLE SPEED SENSOR “A”

1. OUTLINE OF DIAGNOSIS

Judge as NG when outside of the judgment value.
Judge NG when the received data from ABSCM&H/U is abnormal vehicle speed, and the vehicle speed data is impossible.

2. COMPONENT DESCRIPTION

Vehicle speed signals are taken in to the ABS control module and hydraulic control unit, and normal/erroneous data of the ABS wheel speed sensor is received by CAN communication from the ABS control module and hydraulic control unit.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after engine starting	≥ 2000 ms

4. GENERAL DRIVING CYCLE

Always perform diagnosis more than 2000 ms after starting the engine.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Front ABS wheel speed sensor status	Malfunction
Either of the following is established	
Front left wheel speed	≥ 300 km/h (186.4 MPH)
Front right wheel speed	≥ 300 km/h (186.4 MPH)

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Front left wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)
Front right wheel speed	> 0 km/h (0 MPH) and < 300 km/h (186.4 MPH)

Time Needed for Diagnosis:2500 ms

BU:DTC P0506 IDLE AIR 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 as NG when actual engine speed is not close to target engine speed during idling.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75 °C (167 °F)
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	≥ 10.49 s
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.81 and < 1.1
After switching air conditioner to ON/OFF	≥ 5.1 s
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more.	> 5.1 s
Elapsed time after switching neutral position switch to ON/OFF	> 5.1 s
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed − Targeted engine speed	< −100 rpm
Feedback value for ISC	Max.

Time Needed for Diagnosis:10 s × 3 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed − Targeted engine speed	≥ −100 rpm

Time Needed for Diagnosis:10 s

BV:DTC P0507 IDLE AIR 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 as NG when actual engine speed is not close to target engine speed during idling.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine coolant temperature	≥ 75 °C (167 °F)
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Fuel level	≥ 9.6 ℓ (2.54 US gal, 2.11 Imp gal)
Elapsed time after starting the engine	≥ 10.49 s
Feedback of ISC	In operation
Lambda value (left and right)	≥ 0.81 and < 1.1
After switching air conditioner to ON/OFF	≥ 5.1 s
After intake manifold pressure changes by 4 kPa (30 mmHg, 1.2 inHg) or more.	> 5.1 s
Elapsed time after switching neutral position switch to ON/OFF	> 5.1 s
Vehicle speed	0 km/h (0 MPH)

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously at idling after warming up engine.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	≥ 200 rpm
Feedback value for ISC	Min.

Time Needed for Diagnosis:10 s × 3 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Actual – Target engine speed	< 200 rpm

Time Needed for Diagnosis:10 s

BW:DTC P0512 STARTER REQUEST CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of starter SW.
Judge as ON NG when the starter SW signal remains ON.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Engine condition	After engine starting
Starter OFF signal	Not detected
Battery voltage	≥ 8 V

Time Needed for Diagnosis:180000 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Starter OFF signal	Detected
Battery voltage	≥ 8 V

Time Needed for Diagnosis: Less than 1 second

BX:DTC P0513 INCORRECT IMMOBILIZER KEY

1. OUTLINE OF DIAGNOSIS

DTC	Item	Outline of Diagnosis
P0513	Incorrect Immobilizer Key	Incorrect immobilizer key (Use of unregistered key in body integrated unit)
P1570	Antenna	Faulty antenna
P1571	Reference Code Incompatibility	Reference code incompatibility between body integrated unit and ECM
P1572	IMM Circuit Failure (Except Antenna Circuit)	Communication failure between body integrated unit and ECM
P1574	Key Communication Failure	Failure of body integrated unit to verify key (transponder) ID code or transponder failure
P1576	EGI Control Module EEPROM	ECM malfunctioning
P1577	IMM Control Module EEPROM	Body integrated unit malfunctioning
P1578	Meter Failure	Reference code incompatibility between combination meter and body integrated unit

2. ENABLE CONDITIONS

When starting the engine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis only after starting the engine.

4. DIAGNOSTIC METHOD

Judge as NG when the conditions for the outline of the diagnosis of the top are established.

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of microcomputer (RAM).
When there is a problem in the main CPU normal RAM, or the sub CPU normal RAM, judge as NG. Judge as OK when both are operating properly.
If it is possible to write data to the whole area of RAM in the initial routine, and is possible to read the same data, it is judged as OK, and if not, NG.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

Diagnosis with the initial routine.

3. GENERAL DRIVING CYCLE

Perform the diagnosis as soon as the ignition switch is turned to ON.

4. DIAGNOSTIC METHOD

Abnormality Judgment

Judge as NG if the criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Main CPU normal RAM abnormal	
Write 5AA5A55A and then read. (Whole area of RAM)	5AA5A55A cannot be read.
Write A55A5AA5 and then read. (Whole area of RAM)	A55A5AA5 cannot be read.
Sub CPU normal RAM abnormal	
Write 5AA5 and then read. (Whole area of RAM)	5AA5 cannot be read.
Write A55A and then read. (Whole area of RAM)	A55A cannot be read.

Time Needed for Diagnosis: Undetermined
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

Normality Judgment

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Main CPU normal RAM abnormal	
Write 5AA5A55A and then read. (Whole area of RAM)	5AA5A55A can be read.
And write A55A5AA5 and then read. (Whole area of RAM)	A55A5AA5 can be read.
Sub CPU normal RAM abnormal	
Write 5AA5 and then read. (Whole area of RAM)	5AA5 can be read.
And write A55A and then read. (Whole area of RAM)	A55A can be read.

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

1. OUTLINE OF DIAGNOSIS

Judge as NG when SUM value of ROM is outside the standard value.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

Abnormality Judgment

Judge as NG if the criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
SUM value of ROM	Standard

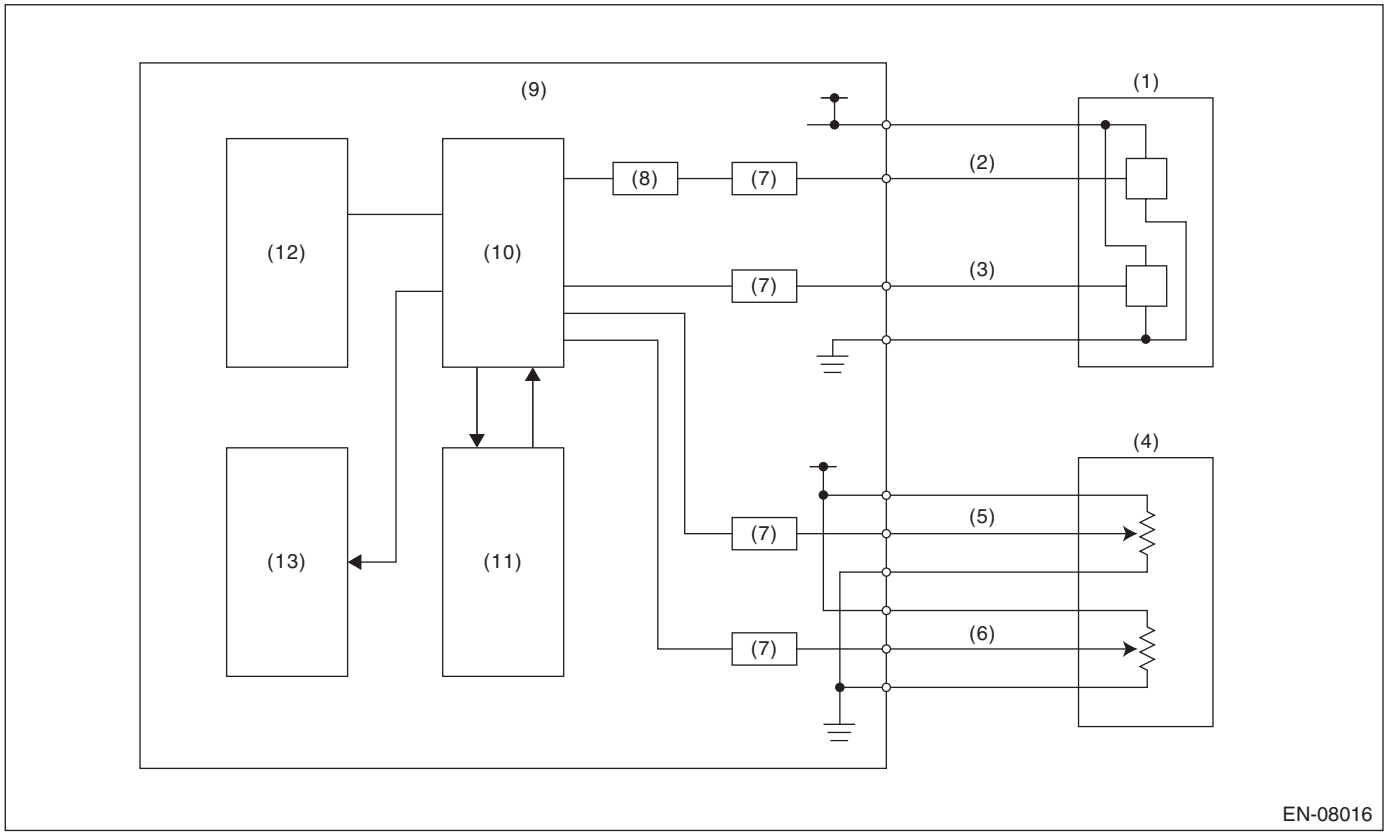
Time Needed for Diagnosis: Undetermined
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CA:DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.
(1) When the monitoring IC operates abnormally. (monitoring IC abnormal)
(2) When the input amplifier circuit of throttle position sensor 1 operates abnormally. (quadruple amplifier abnormal)
(3) When CPU operates abnormally. (instruction/flow check)
(4) When A/D converter operates abnormally. (ADC abnormal)
(5) When EEPROM operates abnormally. (EEPROM abnormal)
(6) When the output IC operates abnormally. (output driver 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) I/F circuit
(8) Amplifier circuit
(9) Engine control module (ECM)
(10) CPU
(11) Monitoring IC
(12) EEPROM
(13) Output IC

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
(1) Battery voltage	≥ 6 V
(2) Ignition switch	ON
(2) Battery voltage	≥ 6 V
(3) Ignition switch	ON
(3) ETC control	Permission
(4) Ignition switch	ON
(4) Battery voltage	≥ 6 V
(5) Starter switch	OFF
(5) Battery voltage	> 6 V
(6) Ignition switch	ON
(6) Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
(1) Operation of monitoring IC	Result and expected value are matched
(2) | Throttle position sensor 1 opening angle – (Throttle position sensor 1 opening angle after passing amplifier /4) |	< 3 °
(3) Main CPU calculation result	Result and expected value are matched
(4) | Reference voltage – read value of voltage |	< 0.078125 V
(5) Writing EEPROM	Writing completed
(6) Communication between output IC	Possible to communicate

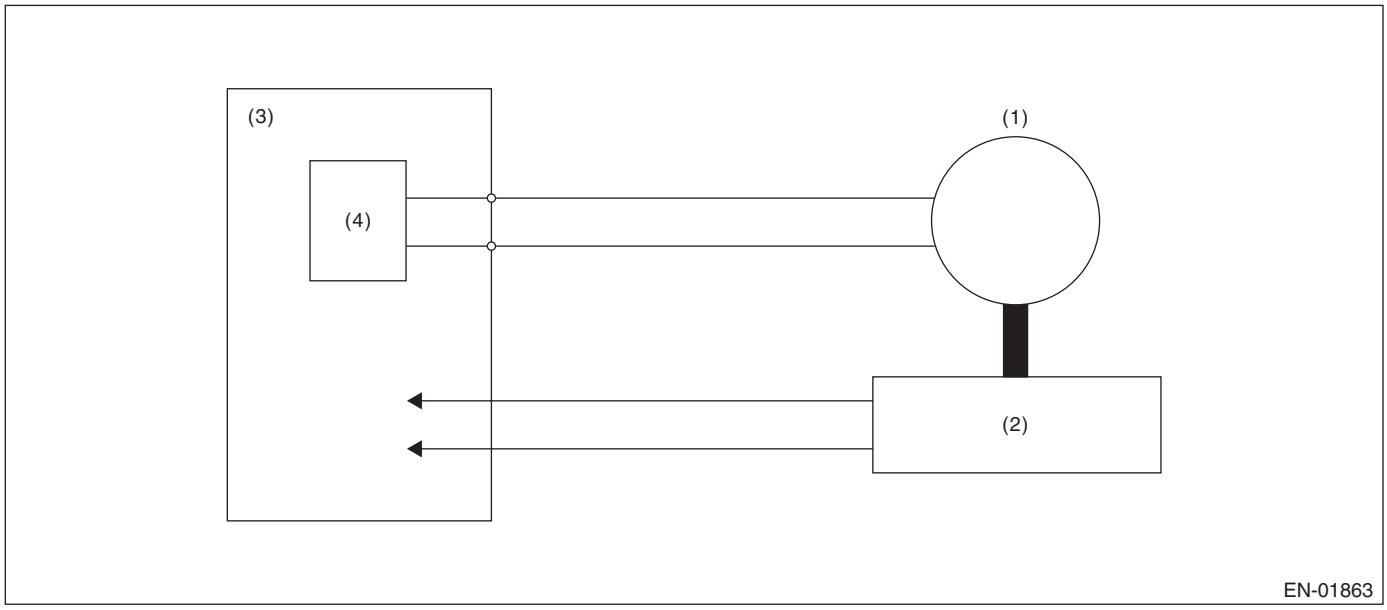
Time Needed for Diagnosis:
(1): 200 ms
(2): 24 ms
(3): 192 ms
(4): 200 ms
(5): 48 ms
(6): 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

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

1. OUTLINE OF DIAGNOSIS

Judge as NG when the target opening angle and actual opening angle is mismatched or the current to motor is the specified duty or more for specified time continuously.

2. COMPONENT DESCRIPTION



(1) Motor
(2) Throttle position sensor
(3) Engine control module (ECM)
(4) Drive circuit

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Normal operation of electronic throttle control	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously when the electronic throttle control is operating.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

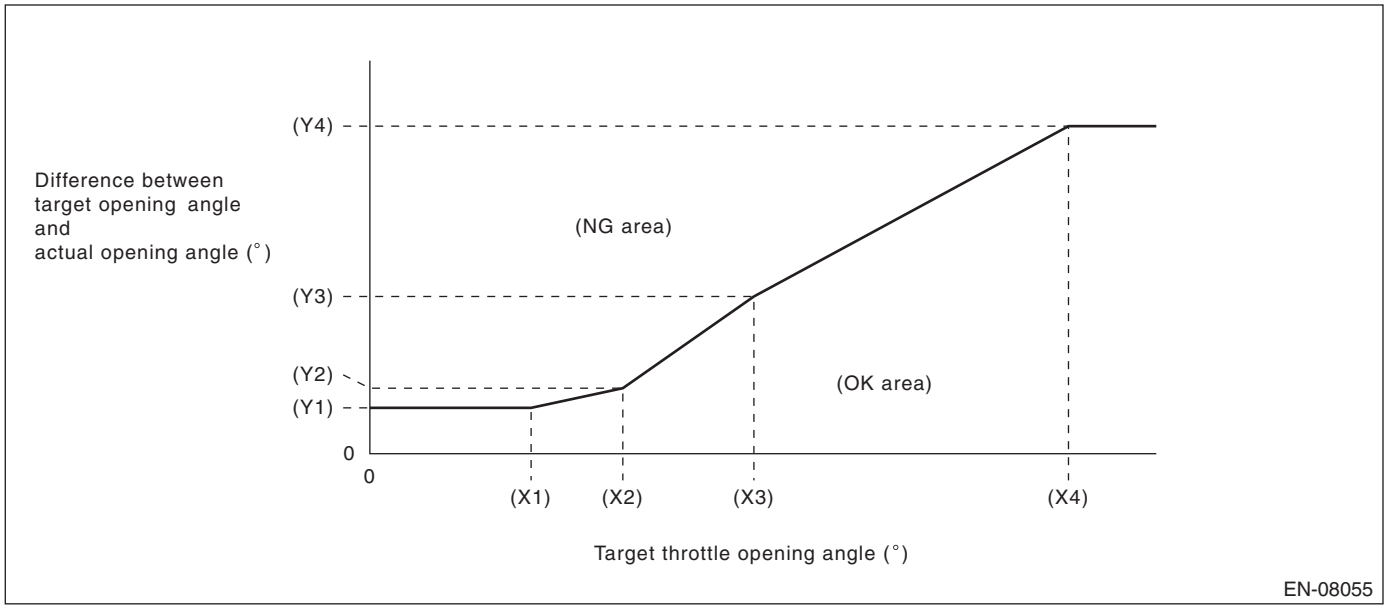
Judgment Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	Within OK area of **details of judgment value**
Output duty to drive circuit	< 95 %

Time Needed for Diagnosis:

- Difference between target opening angle and actual opening angle:
  - NG judgment: Refer to **details of judgment value**.
  - OK judgment: 2000 ms
- Output duty to drive circuit: 2000 ms

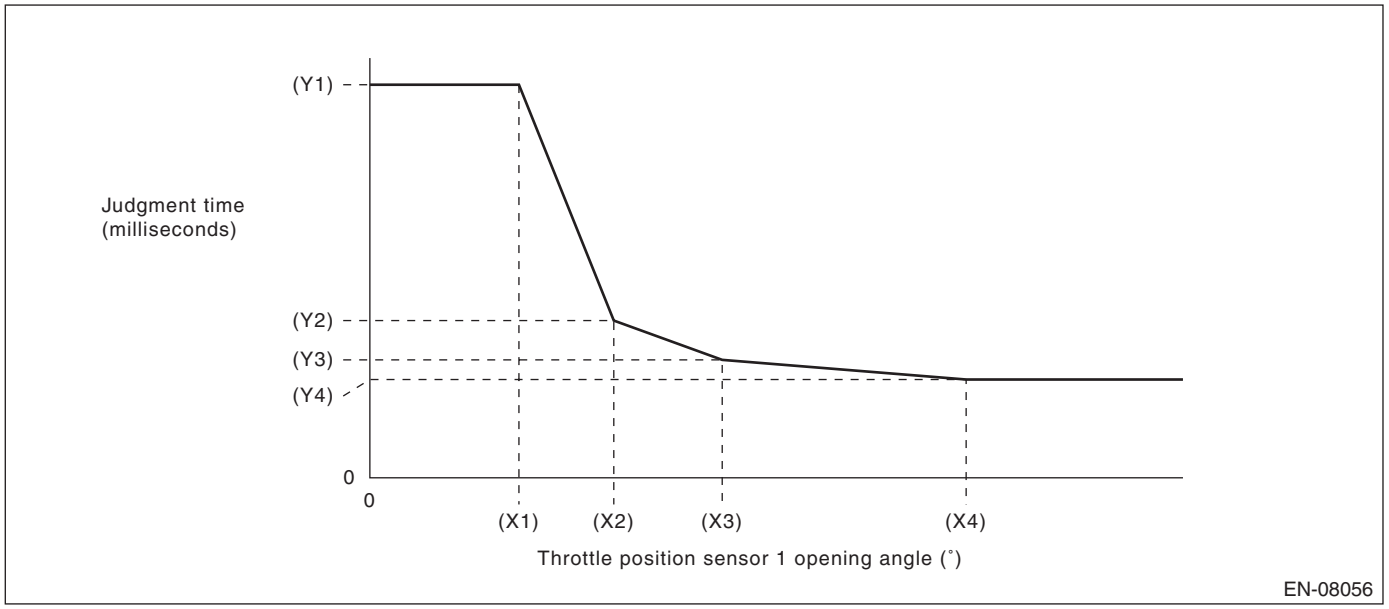
Details of Judgment Value



(X1) 6.15 °
(X2) 9.65 °
(X3) 14.65 °
(X4) 26.65 °

(Y1) 3.5 °
(Y2) 5 °
(Y3) 12 °
(Y4) 25 °

Details of Judgment time



(X1) 5.5 °
(X2) 9 °
(X3) 13 °
(X4) 22 °

(Y1) 1000 ms
(Y2) 400 ms
(Y3) 300 ms
(Y4) 250 ms

NOTE:
The judgment time of actual opening angle ≤ target opening angle is always 1000 milliseconds.
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

CC:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

1. OUTLINE OF DIAGNOSIS

Judge as NG when there is CAN communication with the TCM and there is a MIL lighting request.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
MIL lighting request from TCM	Yes

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
MIL lighting request from TCM	None

Time Needed for Diagnosis: Less than 1 second

CD:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.
Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when “P”/“N” range in TCM are “OFF” and when the other switches are “ON”	LOW (ON)

Time Needed for Diagnosis:100 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when “P”/“N” range in TCM are “OFF” and when the other switches are “ON”	HIGH (OFF)

Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.
Judge as 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 CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	LOW (ON) continues.
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis:3 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear NG when there is change in the neutral SW.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to HIGH (OFF).
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: Less than 1 second

CF:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.
Judge as NG when the ECM neutral terminal input differs from the reception data from TCM.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when “P”/“N” range in TCM are “ON” and when the other switches are “OFF”	HIGH (OFF)

Time Needed for Diagnosis:100 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal in ECM when “P”/“N” range in TCM are “ON” and when the other switches are “OFF”	LOW (ON)

Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Judge the open or short circuit of the neutral SW.
Judge as 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 CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Starter relay	OFF

3. GENERAL DRIVING CYCLE

Perform the diagnosis continuously in 2 seconds after starting the engine.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge NG when the malfunction criteria below are completed determined times or more after the neutral SW change.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	HIGH (OFF) continues.
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis:3 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear NG when there is change in the neutral SW.

Judgment Value

Malfunction Criteria	Threshold Value
Neutral switch signal (while changing from a to b below)	Changes to LOW (ON).
Driving condition change	From a) to b)
a) Engine speed 600 rpm — 900 rpm & Vehicle speed = 0 km/h (0 MPH)	
b) Engine speed 1600 rpm — 2550 rpm & Vehicle speed ≥ 64 km/h (39.8 MPH)	

Time Needed for Diagnosis: Less than 1 second

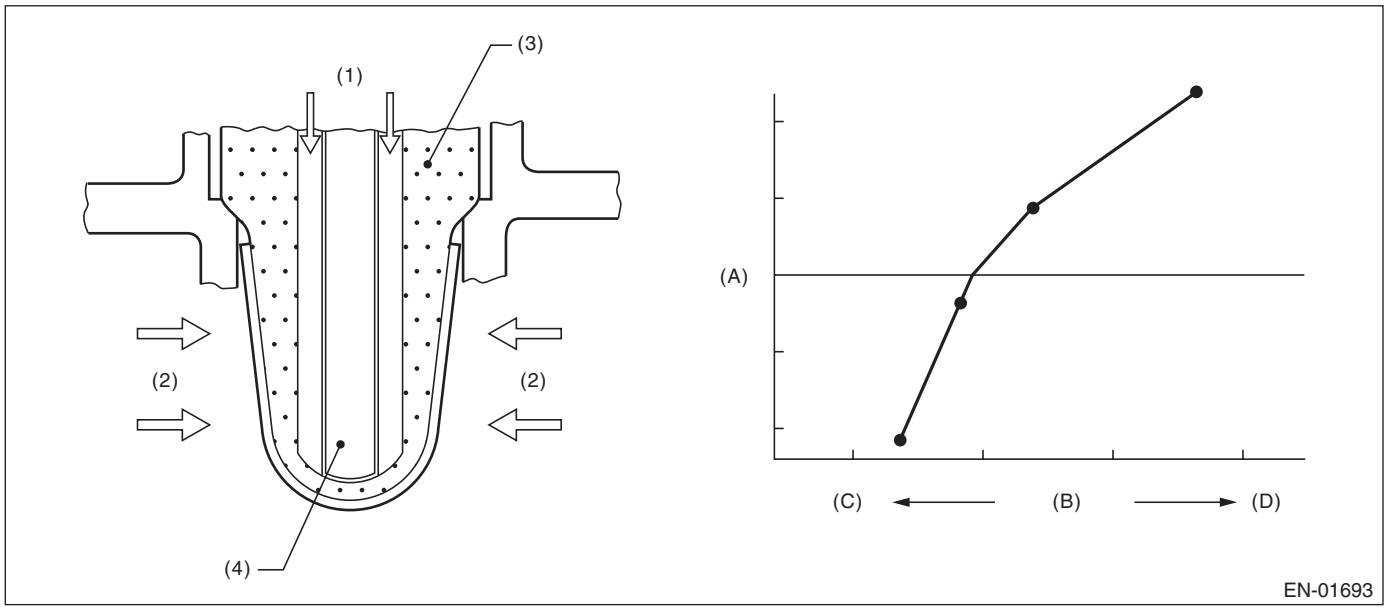
CH:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains low.
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

λ value = Actual air fuel ratio/Theoretical air fuel ratio
λ > 1: Lean
λ < 1: Rich

2. COMPONENT DESCRIPTION



(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	Execution
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.
Elapsed time after starting the engine	≥ 60000 ms
Engine coolant temperature	≥ 75 °C (167 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 6 g/s (0.21 oz/s)
Load change at 180°CA	< 0.02 g/rev (0 oz/rev)
Front oxygen (A/F) sensor impedance	0 Ω — 50 Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 s
Targeted lambda value load compensation coefficient	–0.03 — 0.000

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	< 0.85

Time Needed for Diagnosis:10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	≥ 0.85

Time Needed for Diagnosis: Less than 1 second

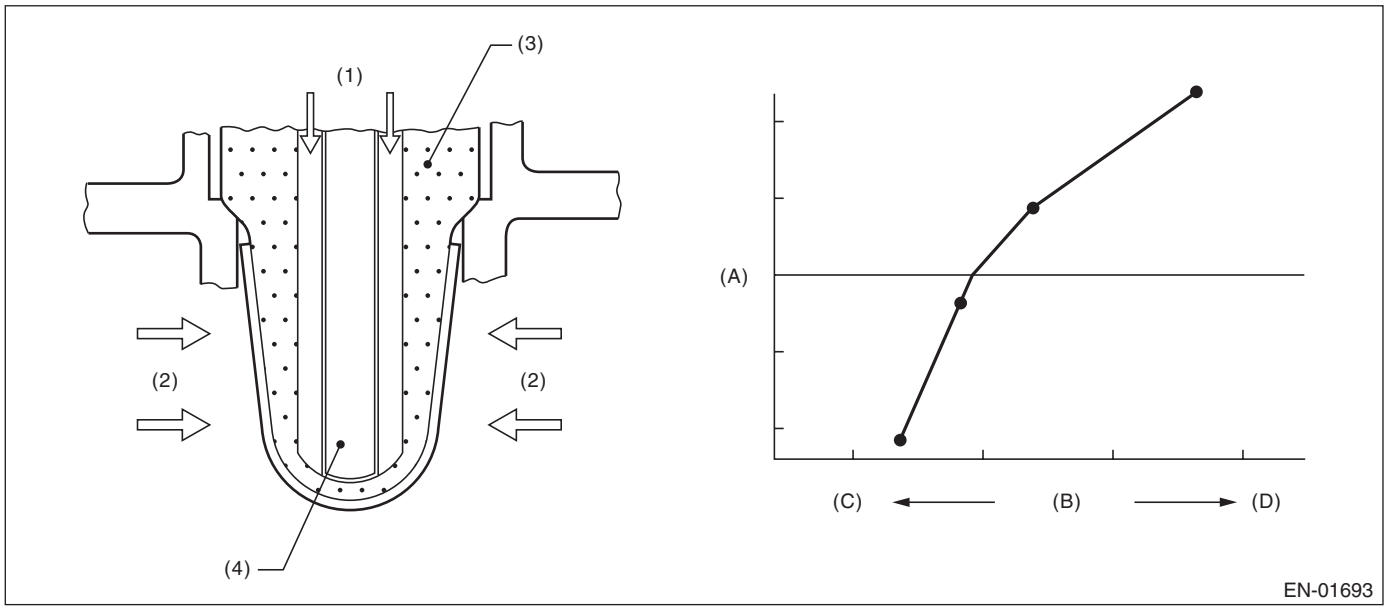
CI: DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

1. OUTLINE OF DIAGNOSIS

Detect that λ value remains high.
Judge as NG when lambda value is abnormal in accordance with λ value of front oxygen (A/F) sensor and running conditions such as vehicle speed, amount of intake air, engine coolant temperature, sub feedback control, etc.

λ value = Actual air fuel ratio/Theoretical air fuel ratio
λ > 1: Lean
λ < 1: Rich

2. COMPONENT DESCRIPTION



(A) Electromotive force
(B) Air fuel ratio
(C) Lean
(D) Rich

(1) Atmosphere
(2) Exhaust gas
(3) ZrO_2
(4) Ceramic heater

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time needed for all secondary parameters to be in enable conditions	≥ 4096 ms
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Rear oxygen sensor sub feedback	Execution
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.
Elapsed time after starting the engine	≥ 60000 ms
Engine coolant temperature	≥ 75 °C (167 °F)
Vehicle speed	≥ 20 km/h (12.4 MPH)
Amount of intake air	≥ 6 g/s (0.21 oz/s)
Load change at 180°CA	< 0.02 g/rev (0 oz/rev)
Front oxygen (A/F) sensor impedance	0 Ω — 50 Ω
Learning value of evaporation gas density	< 0.2
Total time of operating canister purge	≥ 19.9 s
Targeted lambda value load compensation coefficient	–0.03 — 0.000

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously at a constant speed of 20 km/h (12.4 MPH) or more after 60000 ms have passed since the engine started.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	> 1.15

Time Needed for Diagnosis:10000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
λ value	≤ 1.15

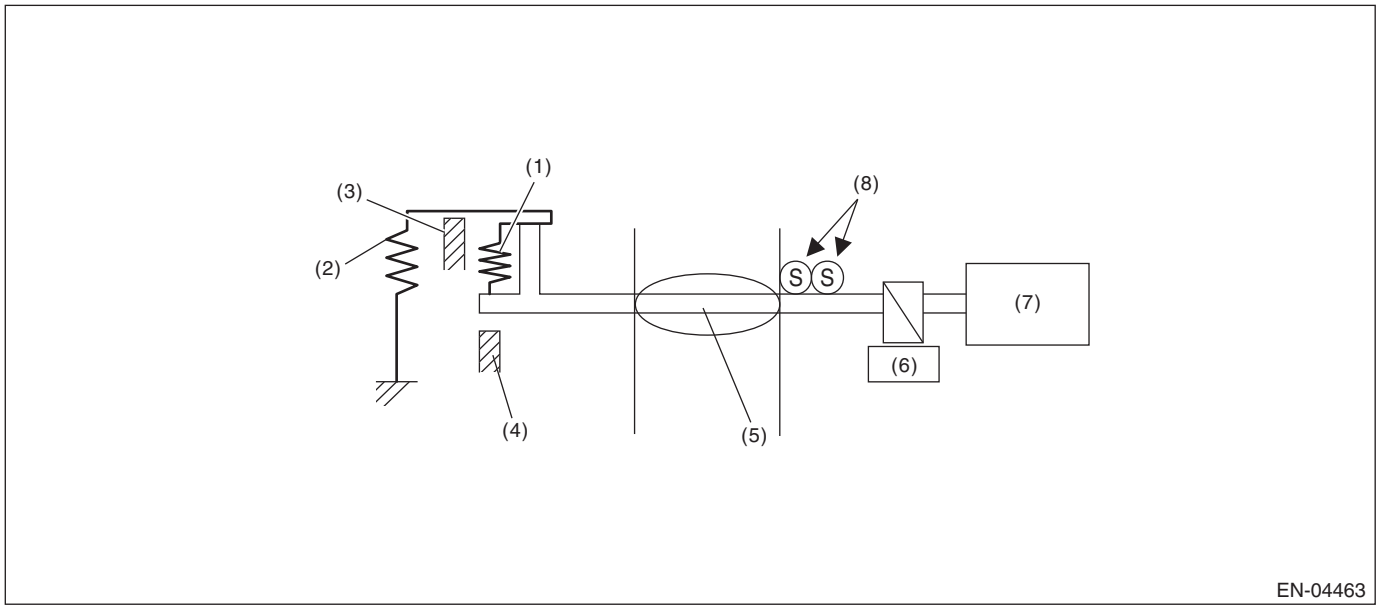
Time Needed for Diagnosis: Less than 1 second

CJ:DTC P1160 RETURN SPRING FAILURE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the valve is opened more than the default opening angle, but does not move to the close direction with the motor power stopped.

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 position sensor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 6 V
Throttle position sensor	Normal

4. GENERAL DRIVING CYCLE

- Ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Opening variation after continuity is set to OFF	< 2 °

Time Needed for Diagnosis:24 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Opening variation after continuity is set to OFF	≥ 2 °

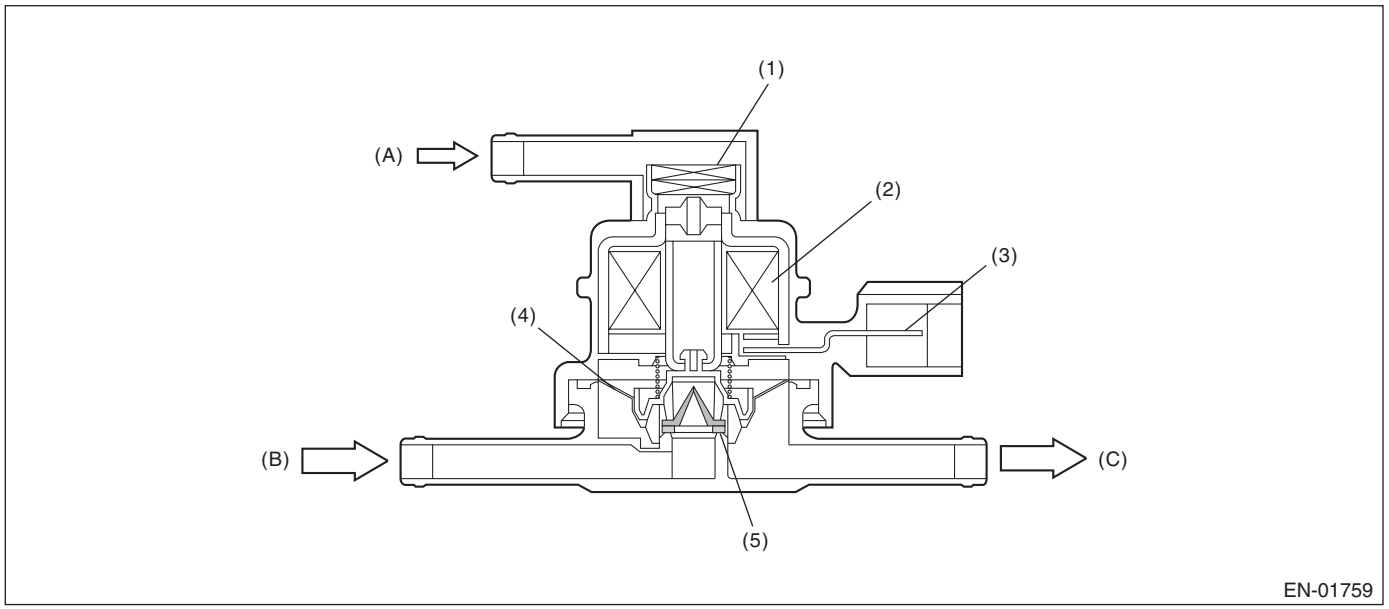
Time Needed for Diagnosis:3400 ms

CK:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.
Judge as NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A)	Atmospheric pressure	(B)	Shut-off valve	(C)	To fuel tank
(1)	Filter	(3)	Connector terminal	(5)	Valve
(2)	Coil	(4)	Diaphragm		

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs OFF signal	Low

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs OFF signal	High

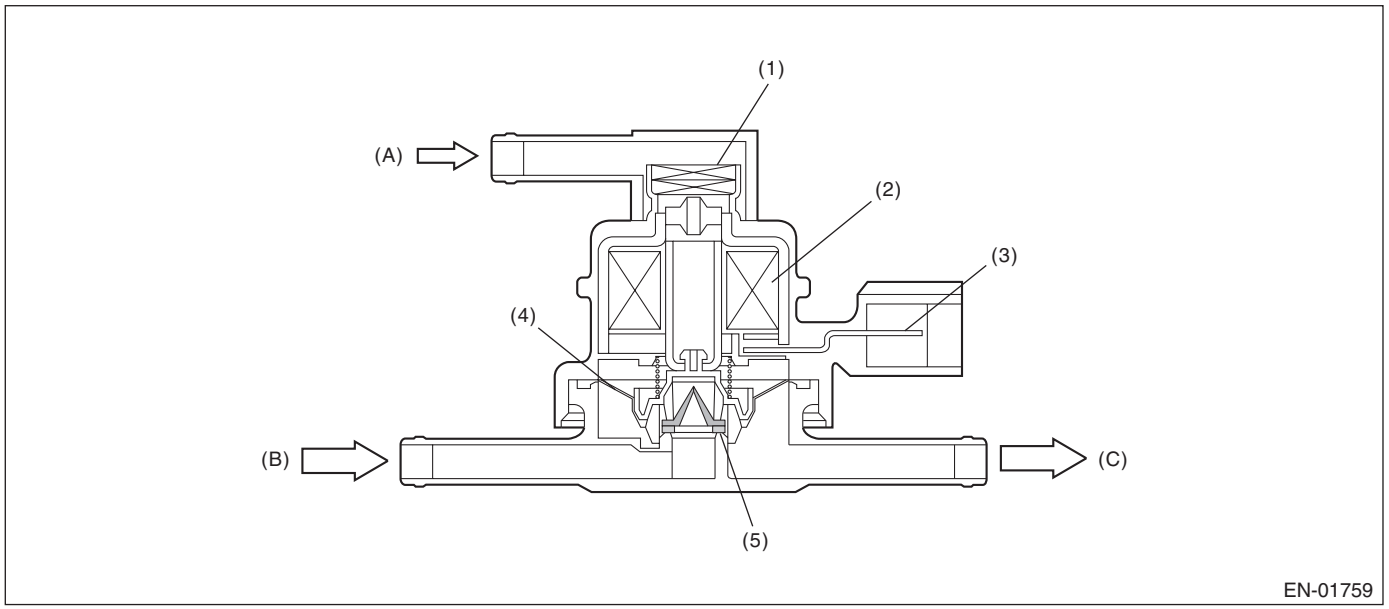
Time Needed for Diagnosis: Less than 1 second

CL:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of pressure control solenoid valve.
Judge as NG when ECM output level is different from actual terminal level.

2. COMPONENT DESCRIPTION



(A)	Atmospheric pressure	(B)	Shut-off valve	(C)	To fuel tank
(1)	Filter	(3)	Connector terminal	(5)	Valve
(2)	Coil	(4)	Diaphragm		

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis after starting the engine.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs ON signal	High

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1 second
Terminal output voltage when ECM outputs ON signal	Low

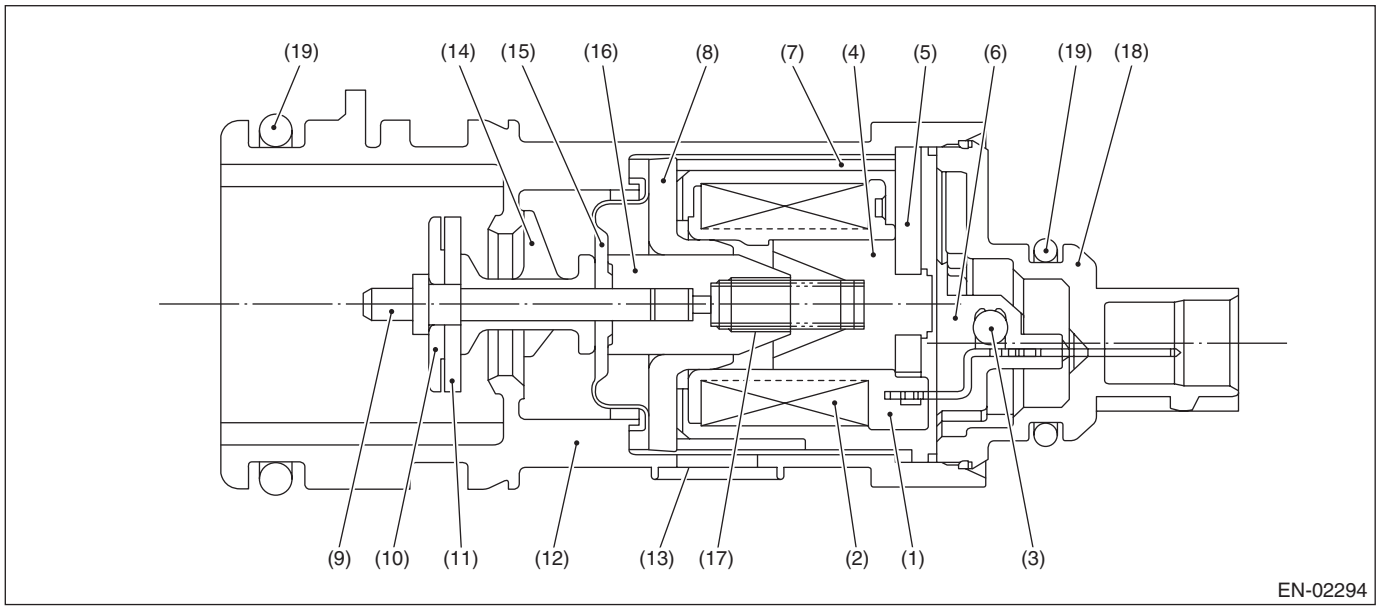
Time Needed for Diagnosis: Less than 1 second

CM:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

1. OUTLINE OF DIAGNOSIS

Detect the abnormal function (stuck closed) of the drain valve.
Judge as NG when fuel tank pressure is low.

2. COMPONENT DESCRIPTION



(1) Bobbin
(2) Coil
(3) Diode
(4) Stator core
(5) End plate
(6) Body
(7) Yoke
(8) Magnetic plate
(9) Shaft
(10) Plate
(11) Valve
(12) Housing
(13) Filter
(14) Retainer
(15) Diaphragm
(16) Movable core
(17) Spring
(18) Cover
(19) O-ring

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Drain valve	Open
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Tank pressure when starter is OFF → ON	–0.4 kPa (–3.2 mmHg, –0.1 inHg) and 1.4 kPa (10.7 mmHg, 0.4 inHg)

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	≤ –4 kPa (–30 mmHg, –1.2 inHg)

Time Needed for Diagnosis:3000 s
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Fuel tank pressure	> –4 kPa (–30 mmHg, –1.2 inHg)
Cumulative time when all the malfunction criteria below are met.	≥ 30000 s
Purge control solenoid valve duty	Not = 0
Fuel temperature	–10 °C (14 °F) — 70 °C (158 °F)
Intake manifold relative pressure	≥ –26.7 kPa (–200 mmHg, –7.9 inHg)

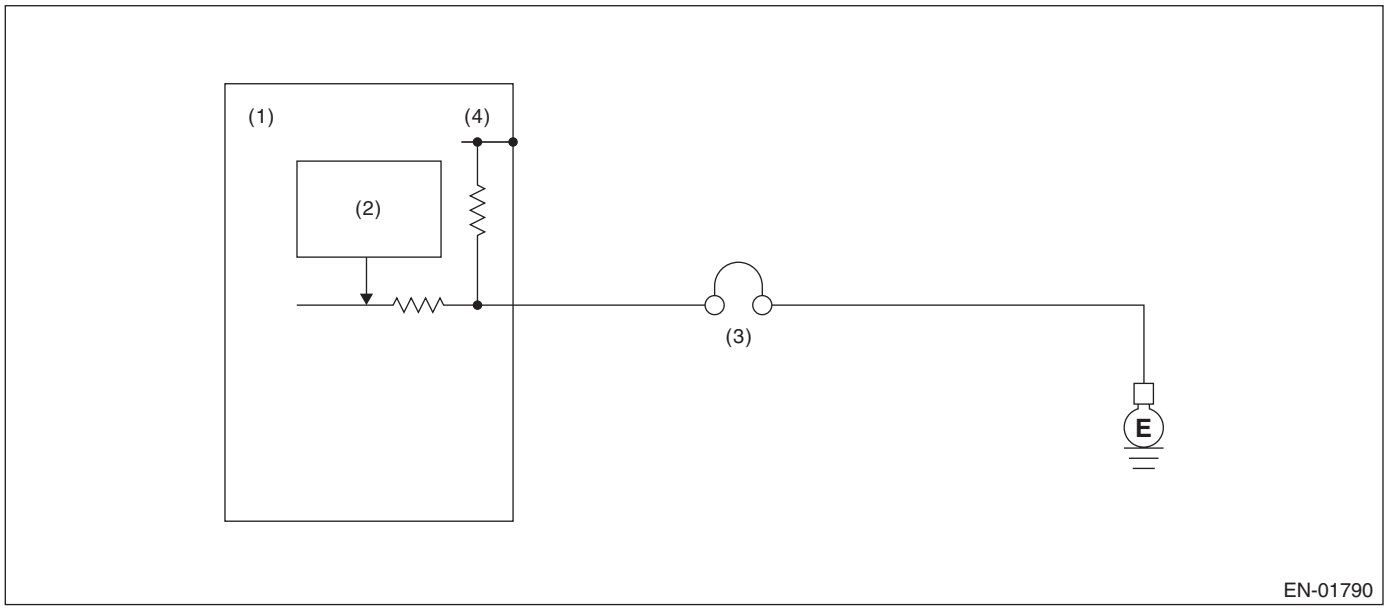
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the blow-by hose disconnection abnormality.
Judge as NG when the diagnosis terminal voltage is high.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (3) PCV diagnosis connector (4) 5 V
(2) Detecting circuit

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Engine condition	After engine starting
Positive crankcase ventilation diagnosis voltage	High

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 10.9 V
Engine condition	After engine starting
Positive crankcase ventilation diagnosis voltage	Low

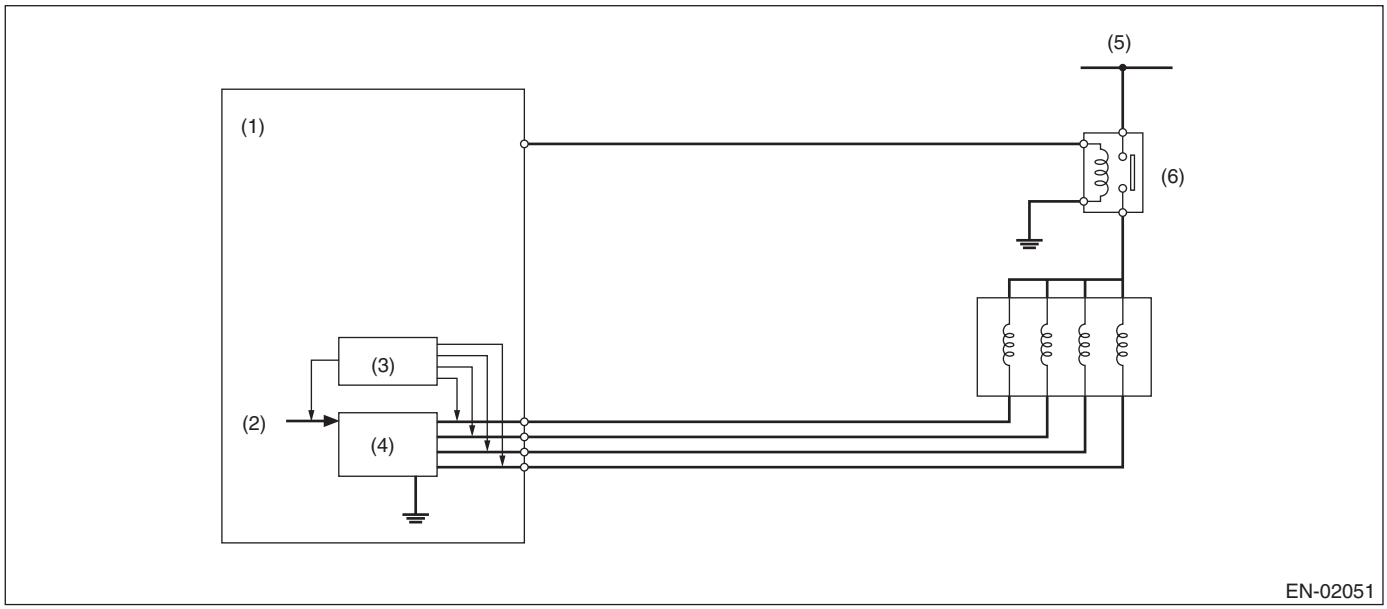
Time Needed for Diagnosis: Less than 1 second

CO:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Computer unit (CPU)
(3) Detecting circuit
(4) Switch circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 second
EGR valve target position	> 0 step
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Perform diagnosis continuously during EGR operation.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal or Terminal voltage level when EGR operates	Low level Low level

Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	High level
Terminal voltage level when EGR operates	High level

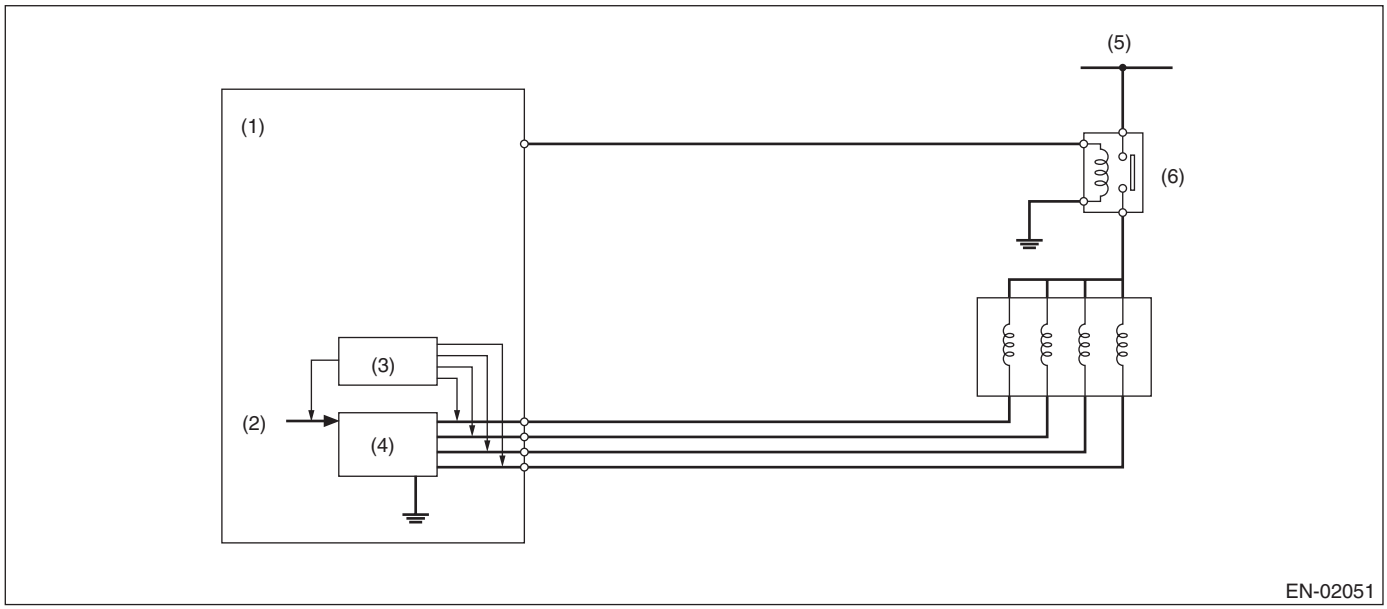
Time Needed for Diagnosis: 128 ms

CP:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

- Detects open or short circuit of EGR.
- Judge as NG when the ECM output level differs from the actual terminal level.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Computer unit (CPU)
(3) Detecting circuit
(4) Switch circuit
(5) Battery voltage
(6) Main relay

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Elapsed time after starting the engine	≥ 1 second
EGR valve target position	> 0 step
Battery voltage	≥ 10.9 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal or Terminal voltage level when EGR operates	High level High level

Time Needed for Diagnosis: 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Terminal voltage level when ECM outputs OFF signal	Low level
Terminal voltage level when EGR operates	Low level

Time Needed for Diagnosis: 128 ms

CQ:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1492. <Ref. to GD(H4SO)-172, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CR:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1493. <Ref. to GD(H4SO)-174, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CS:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1492. <Ref. to GD(H4SO)-172, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CT:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1493. <Ref. to GD(H4SO)-174, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CU:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1492. <Ref. to GD(H4SO)-172, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CV:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P1493. <Ref. to GD(H4SO)-174, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CW:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of back-up power supply circuit.
Judge as NG when the backup power voltage is low.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	Low
Battery voltage	≥ 10.9 V
Engine condition	After engine starting

Time Needed for Diagnosis:2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Voltage of back-up power supply	High
Battery voltage	≥ 10.9 V
Engine condition	After engine starting

Time Needed for Diagnosis: Less than 1 second

CX:DTC P1570 ANTENNA

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-146, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CY:DTC P1571 REFERENCE CODE INCOMPATIBILITY

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-146, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CZ:DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-146, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DA:DTC P1574 KEY COMMUNICATION FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-146, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DB:DTC P1576 EGI CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-146, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DC:DTC P1577 IMM CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-146, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DD:DTC P1578 METER FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4SO)-146, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DE:DTC P1602 CONTROL MODULE PROGRAMMING ERROR

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the catalyst advanced idling retard angle control.
Judge as NG when ECM is not controlling the angle properly during catalyst advanced idling retard angle control.
Judge as NG if there is exhaust gas temperature diagnosis, idle speed diagnosis and final ignition timing diagnosis, and if any one of them is NG.

- Exhaust gas temperature diagnosis

Judge as NG when the estimated exhausted gas temperature in 14 seconds after the cold start is below the specified value.

- Idle speed diagnosis

Judge as NG when actual engine speed is not close to target engine speed after terminating the retard angle control.

- Final ignition timing diagnosis

Judge as NG when actual retard amount is under the specified value at cold start.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Battery voltage	≥ 10.9 V
Cold start diagnosis	Incomplete
Vehicle speed	< 2 km/h (1.2 MPH)
Misfire in 200 engine revs.	< 5
Time after starting	= 14 seconds

3. GENERAL DRIVING CYCLE

Perform the diagnosis at cold start.

4. DIAGNOSTIC METHOD

• Exhaust gas temperature diagnosis

Abnormality Judgment

Calculate the estimated exhaust gas temperature when the diagnostic enable condition is established. Judge as NG when the following conditions are established after engine starting within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	< Value from Map

Map

Coolant temperature after starting the engine	–40 °C (–40 °F)	–30 °C (–22 °F)	–20 °C (–4 °F)	–10 °C (14 °F)	0 °C (32 °F)	10 °C (50 °F)	20 °C (68 °F)	30 °C (86 °F)	40 °C (104 °F)	50 °C (122 °F)
Threshold value (AT model)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	162 °C (323.6 °F)	154 °C (309.2 °F)	142 °C (287.6 °F)	142 °C (287.6 °F)
Threshold value (MT model)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	168 °C (334.4 °F)	160 °C (320 °F)	145 °C (293 °F)	145 °C (293 °F)

Time Needed for Diagnosis: 14 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

Normality Judgment
Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	≥ Value from Map

Time Needed for Diagnosis: Less than 1 second

- **Idle speed diagnosis**

Abnormality Judgment
Judge as NG when the following conditions are established after the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of (Target engine speed – Actual engine speed > –300 rpm)	≥ 6000 ms
Continuous time of (actual retard amount > 30 °CA)	≥ 0 ms

Time Needed for Diagnosis: 14 seconds
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.
Normality Judgment
Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Continuous time of (Target engine speed – Actual engine speed > –300 rpm)	< 6000 ms
Continuous time of (actual retard amount > 30 °CA)	< 0 ms

Time Needed for Diagnosis: Less than 1 second

- **Final ignition timing diagnosis**

Abnormality Judgment
Judge as NG when the following conditions are established with diagnosis enable conditions successful.

Judgment Value

Malfunction Criteria	Threshold Value
Duration time of (Standard ignition timing – Actual ignition timing ≤ 0 °CA)	> 5000 ms

Time Needed for Diagnosis:5000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.
Normality Judgment
Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Duration time of (Standard ignition timing – Actual ignition timing > 0 °CA)	> 1000 ms

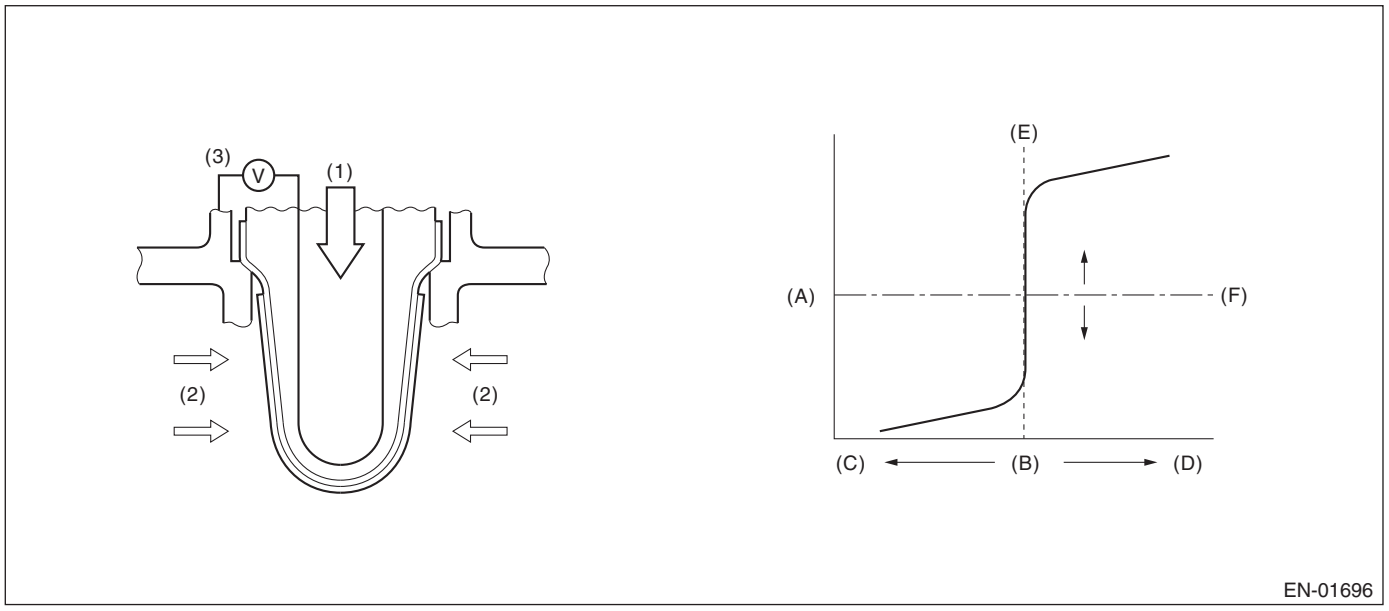
Time Needed for Diagnosis:1000 ms

DF:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.
Control the sub feedback learning and judge as NG when the learning value is in the lean zone.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Rich
(D)	Lean	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Completed
Continuous time when all conditions are established.	≥ 1 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	< –0.04

Time Needed for Diagnosis:5 s × 1 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ –0.04 + 0

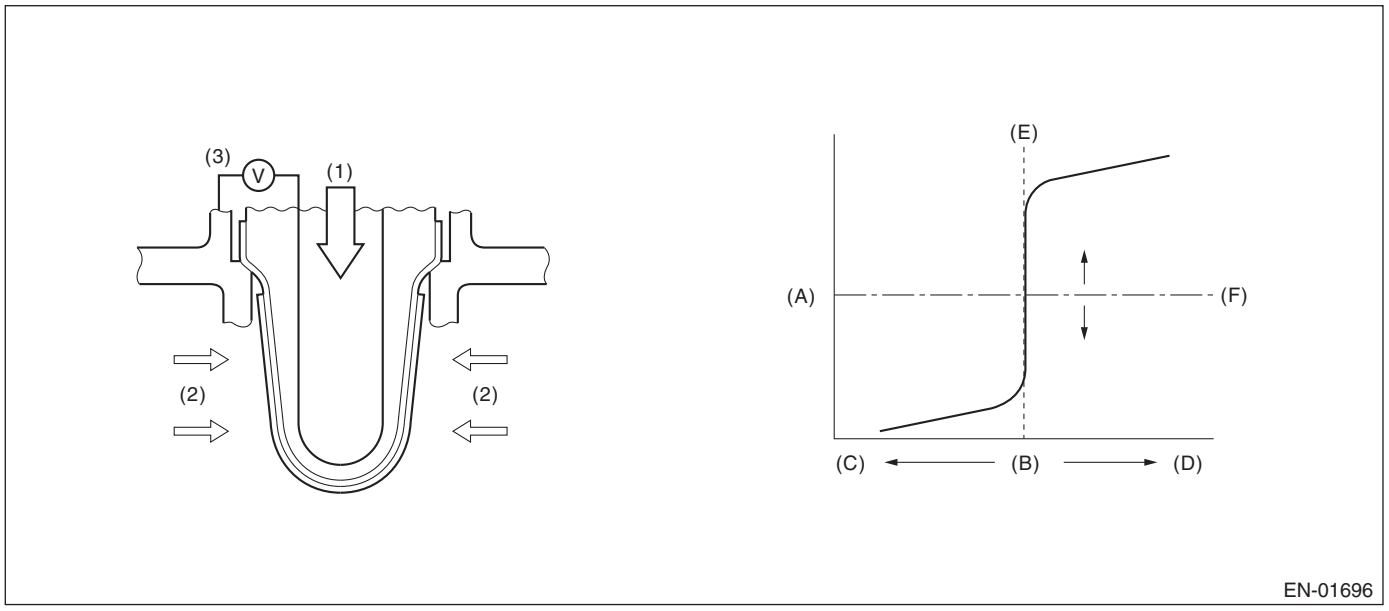
Time Needed for Diagnosis:5 s

DG:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel system from the size of the sub feedback learning value.
Sub feedback learning is being performed. When the learning value goes to the rich side, judge as NG.

2. COMPONENT DESCRIPTION



(A)	Electromotive force	(B)	Air fuel ratio	(C)	Rich
(D)	Lean	(E)	Theoretical air fuel ratio	(F)	Comparative voltage
(1)	Atmosphere	(2)	Exhaust gas	(3)	Electromotive force

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Conditions for carrying out the sub feedback learning	Completed
Continuous time when all conditions are established.	≥ 1 s

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when the vehicle is idling or running at a constant speed of 80 km/h (50 MPH) or more.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	≥ 0.04

Time Needed for Diagnosis:5 s × 1 time(s)
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sub feedback learning value	< 0.04 + –0.002

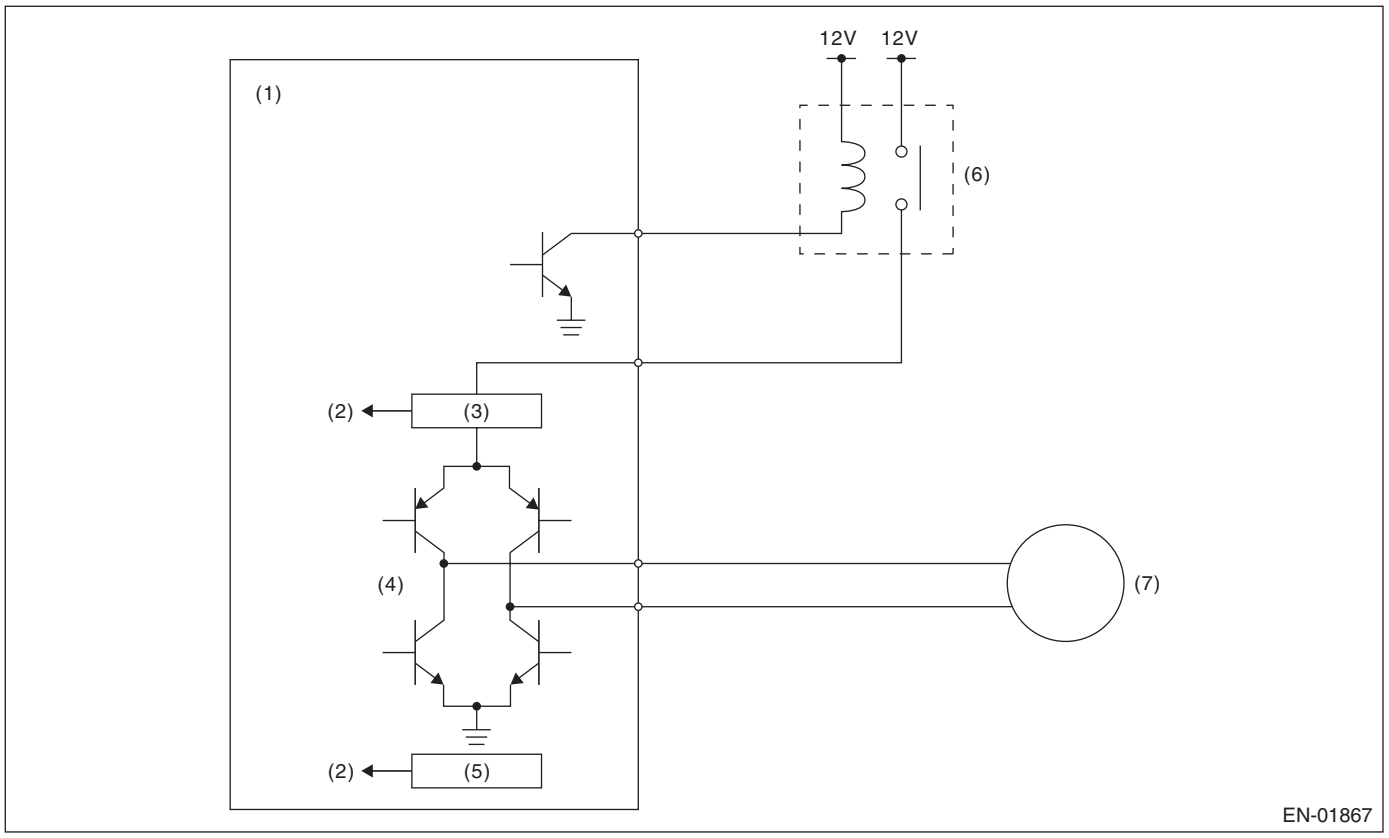
Time Needed for Diagnosis:5 s

DH:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the motor current becomes large or drive circuit is heated.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Detecting circuit
(3) Overcurrent detection circuit
(4) Drive circuit
(5) Temperature detection circuit
(6) Electronic throttle control relay
(7) Motor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Under control of electronic throttle control	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Motor current	≤ 8 A
Drive circuit inner temperature	≤ 175°C (347°F)

Time Needed for Diagnosis:

- 500 ms (NG judgment)
- 2000 ms (OK judgment)

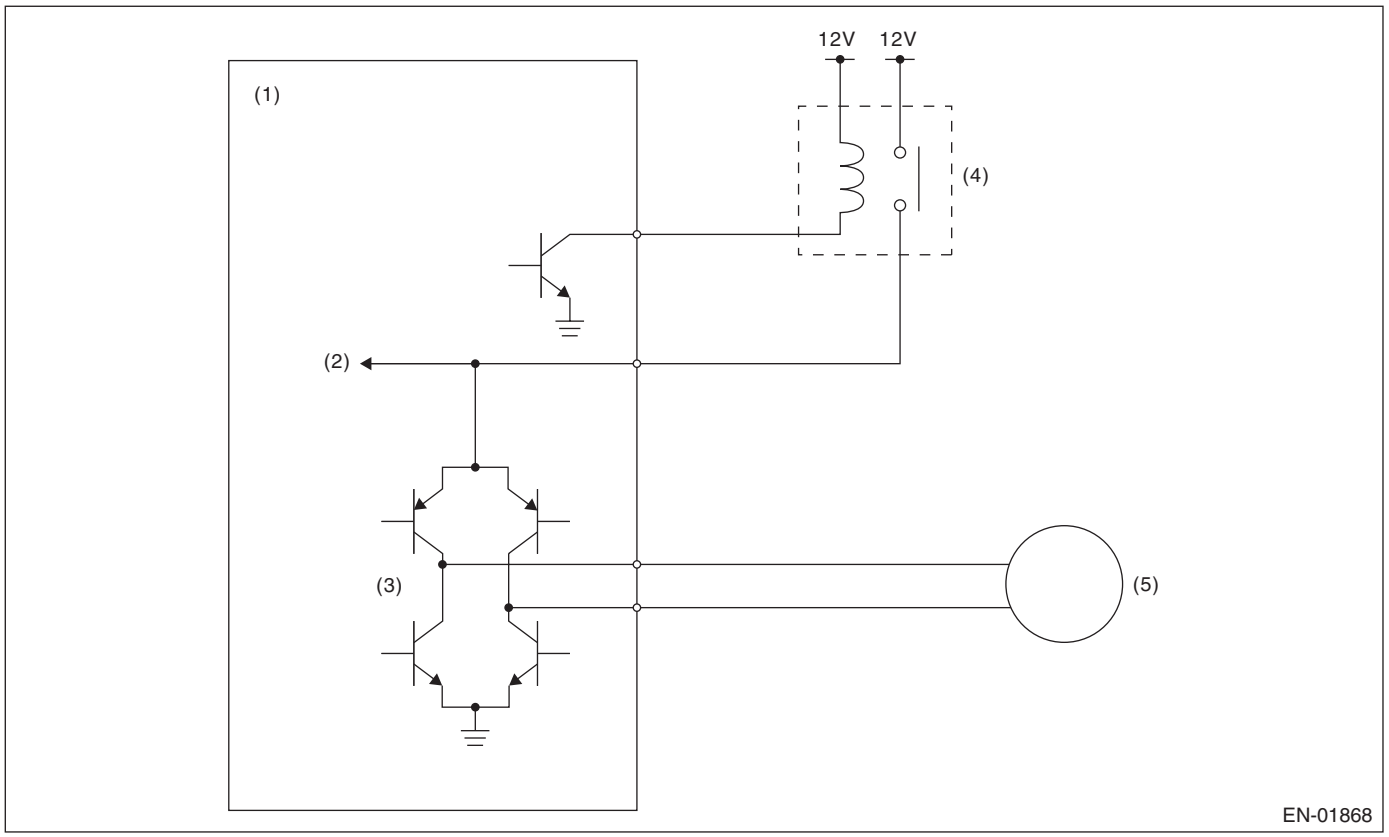
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DI: DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control 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 throttle control relay
(5) Motor

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Electronic throttle control relay output	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	≥ 5 V

Time Needed for Diagnosis:

- 400 ms (NG judgment)
- 2000 ms (OK judgment)

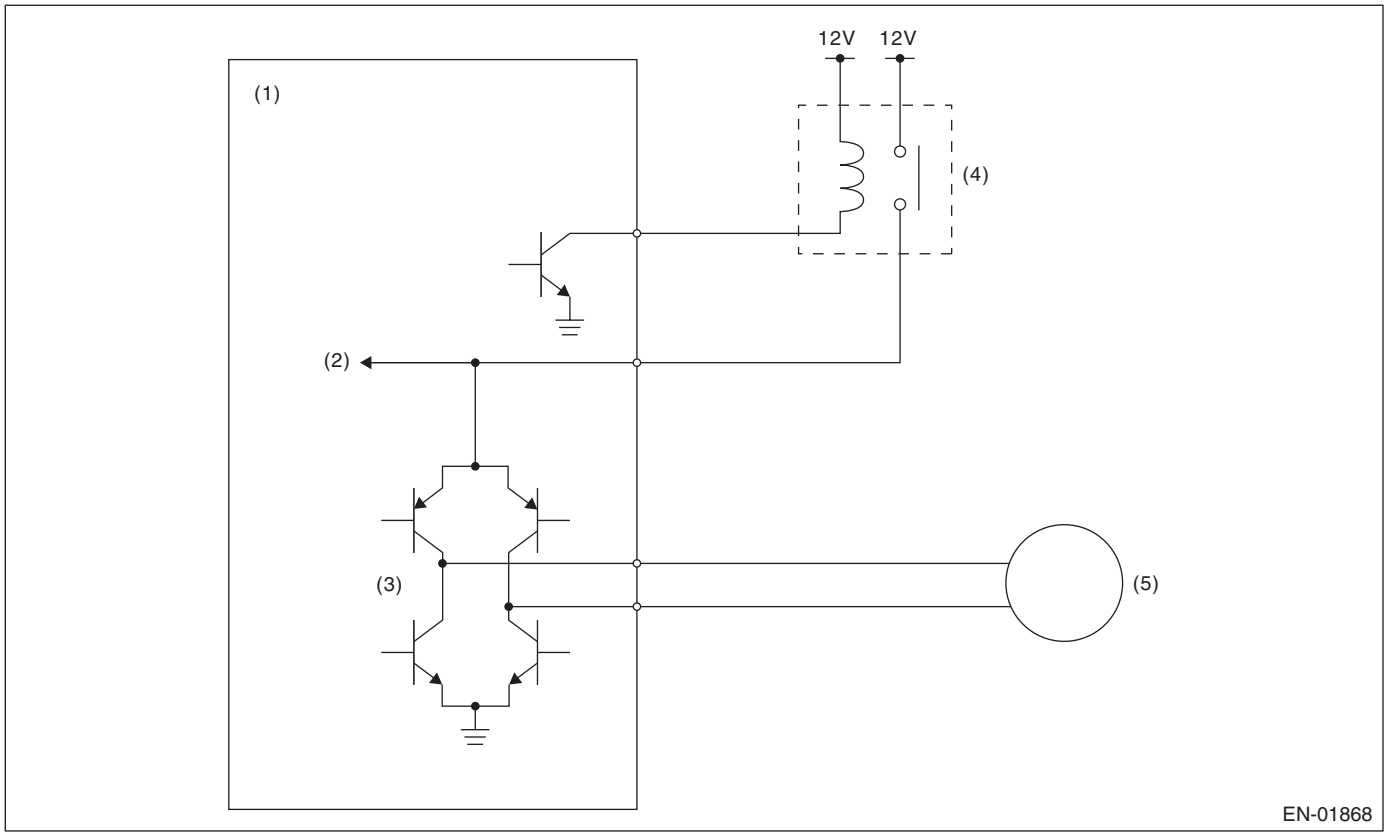
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DJ:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Judge as NG when the electronic throttle control power is supplied even when ECM sets the electronic 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 CONDITIONS

Secondary Parameters	Enable Conditions
Electronic throttle control relay output	OFF

4. GENERAL DRIVING CYCLE

- When ignition switch ON → OFF
- Ignition switch OFF → ON (Only after clearing memory)

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Motor power voltage	≤ 5 V

Time Needed for Diagnosis:

- 600 ms (NG judgment)
- 400 ms (OK judgment)

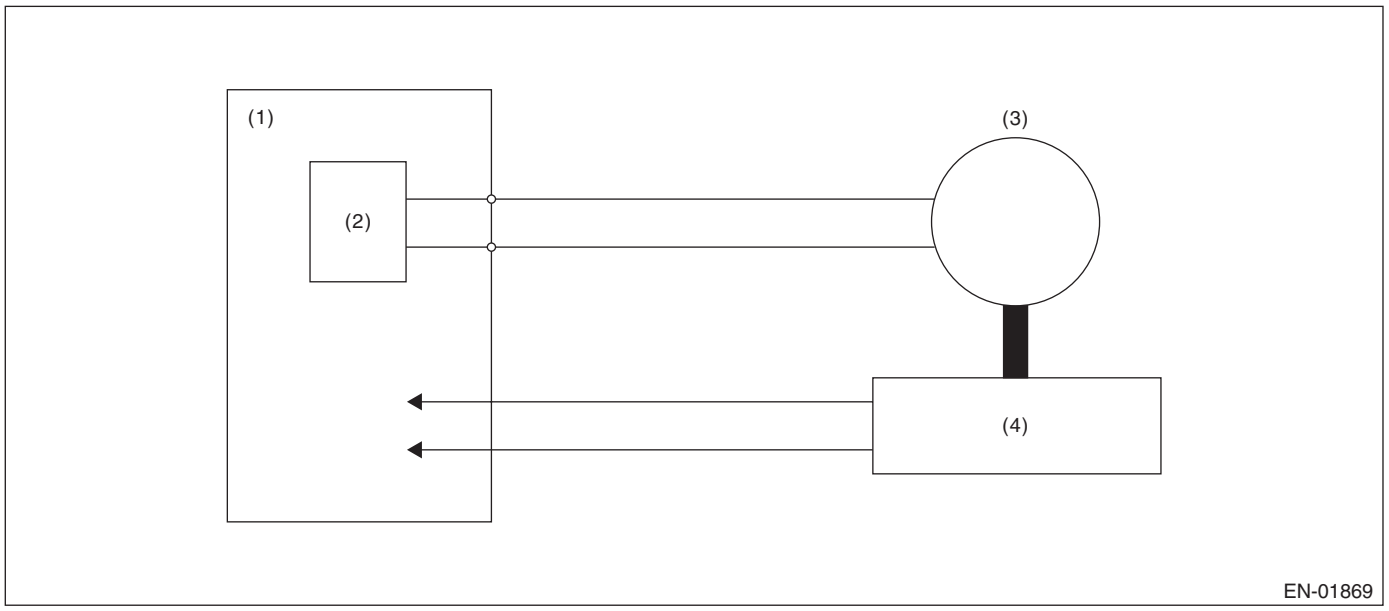
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DK:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when full 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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON → OFF
Ignition switch (only after clear memory)	OFF → ON

4. GENERAL DRIVING CYCLE

Perform the diagnosis at full closed point learning.

5. DIAGNOSTIC METHOD

Judge as OK and clear the NG when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Throttle sensor opening angle at full close point learning	10.127° or more, 19.872° or less
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	≥ 1.683°

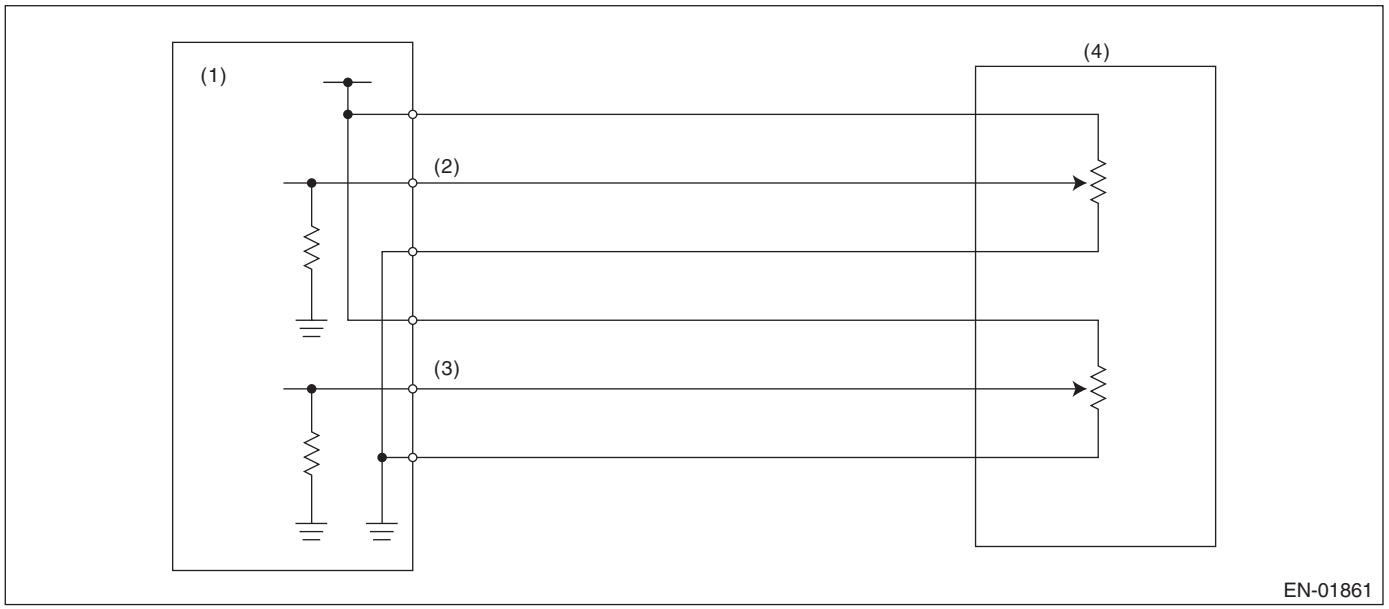
Time Needed for Diagnosis:8 — 80 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DL: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 as NG if out of specification.

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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	< 0.217 V

Time Needed for Diagnosis: 100 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 0.217 V

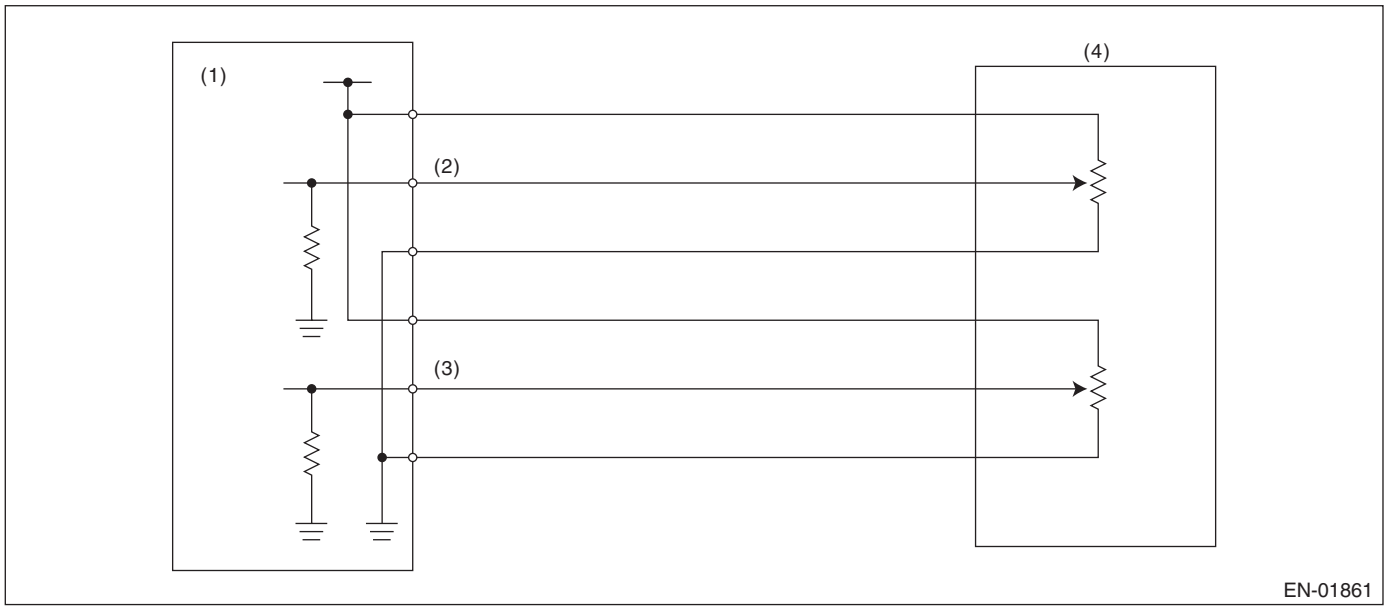
Time Needed for Diagnosis: 100 ms

DM: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 as NG if out of specification.

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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	≥ 4.783 V

Time Needed for Diagnosis: 32 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 1 input voltage	< 4.783 V

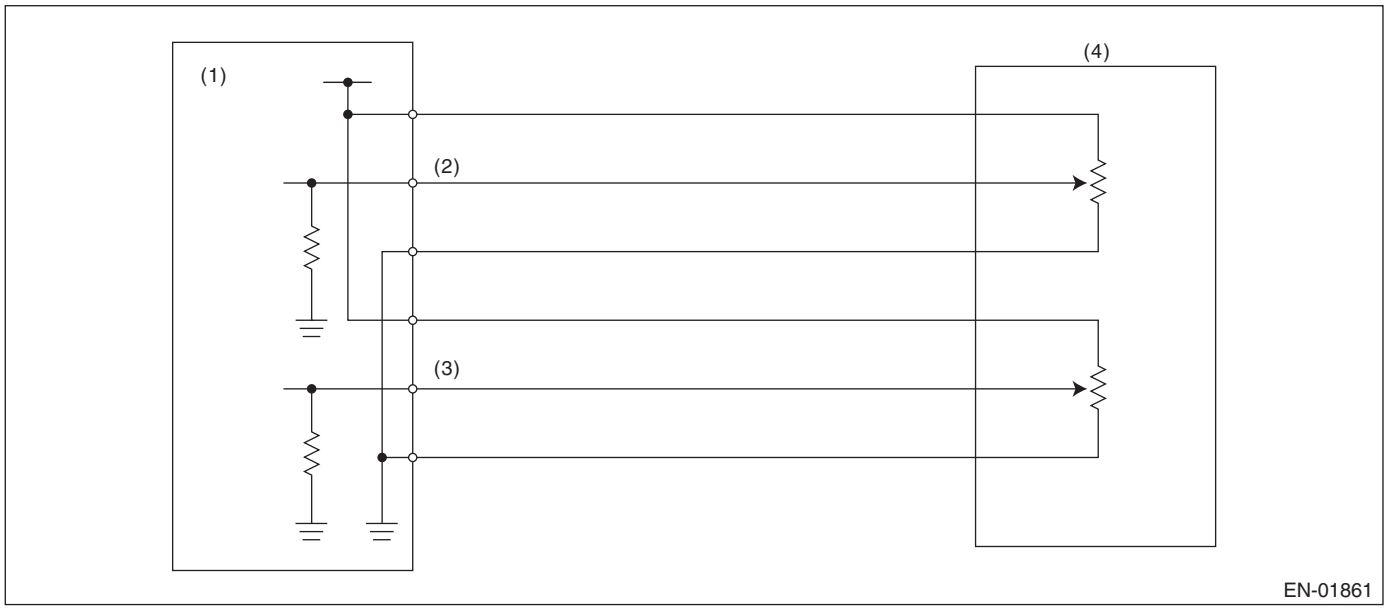
Time Needed for Diagnosis: 32 ms

DN: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 as NG if out of specification.

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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 0.217 V

Time Needed for Diagnosis: 100 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 0.217 V

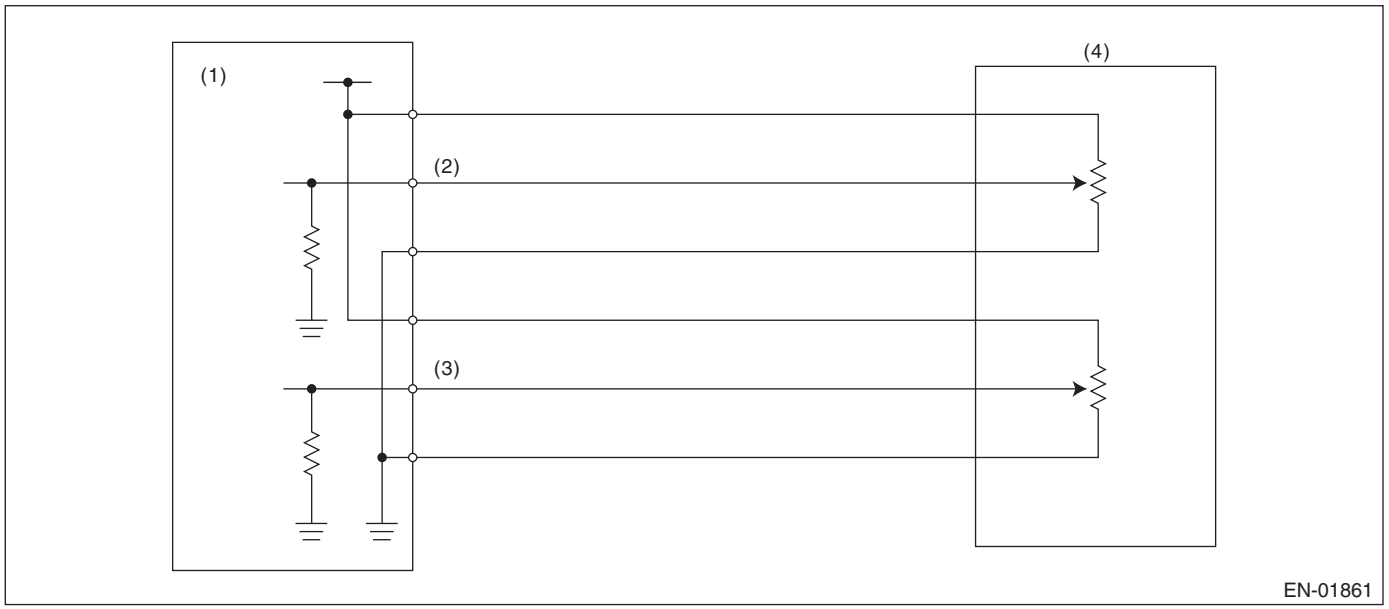
Time Needed for Diagnosis: 100 ms

DO: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 as NG if out of specification.

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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	≥ 4.783 V

Time Needed for Diagnosis: 100 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Sensor 2 input voltage	< 4.783 V

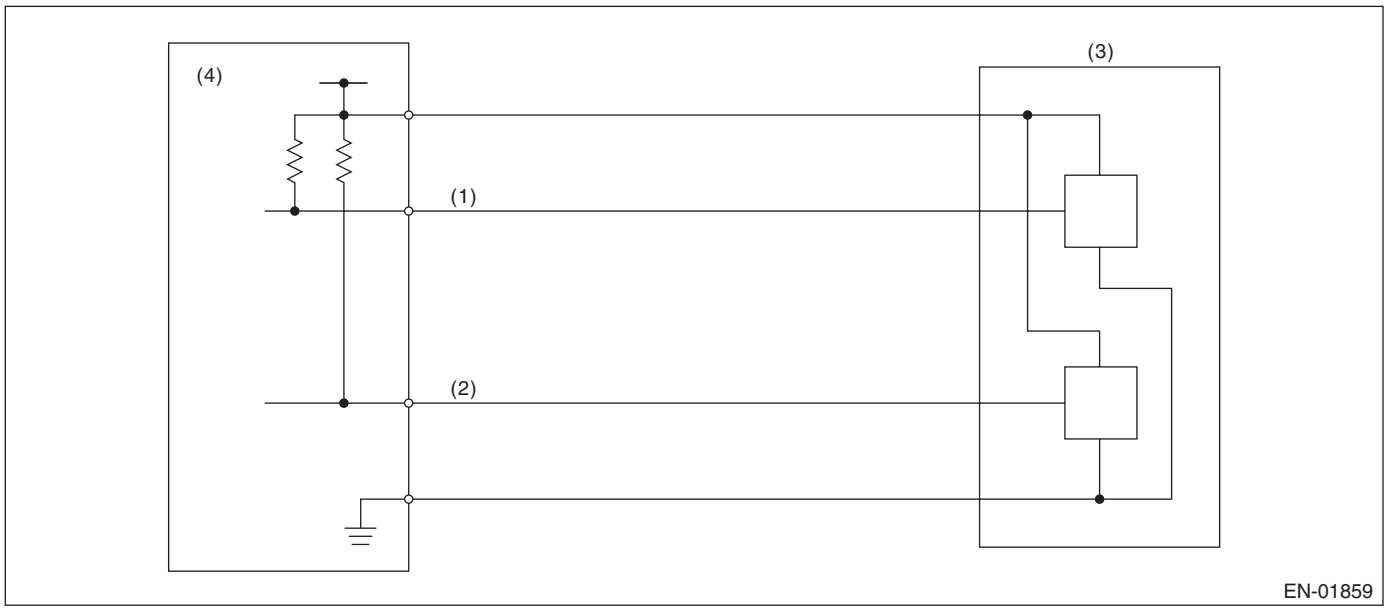
Time Needed for Diagnosis: 100 ms

DP:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

1. OUTLINE OF DIAGNOSIS

Judge as 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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

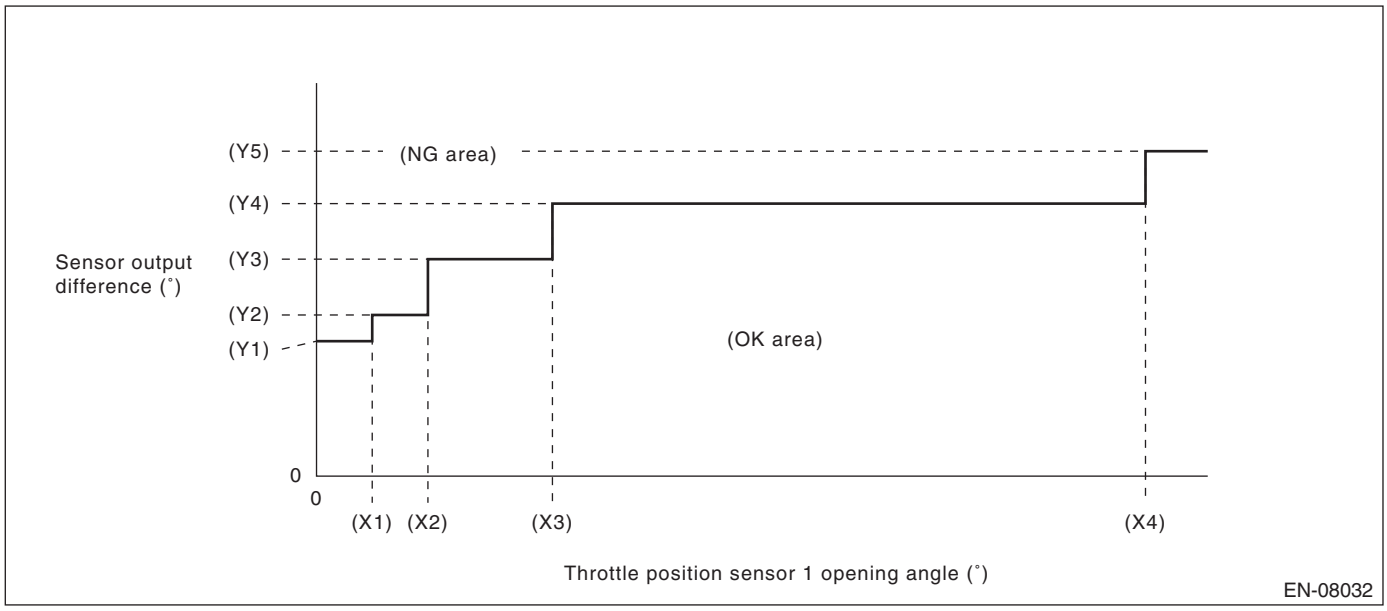
• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within NG area of **details of judgment value**

Details of Judgment Value



(X1) 2.125 °
(X2) 4.25 °
(X3) 9 °
(X4) 31.625 °

(Y1) 5.15 °
(Y2) 6.15 °
(Y3) 8.28 °
(Y4) 10.4 °
(Y5) 12.4 °

Time Needed for Diagnosis: 212 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within OK area of **details of judgment value**

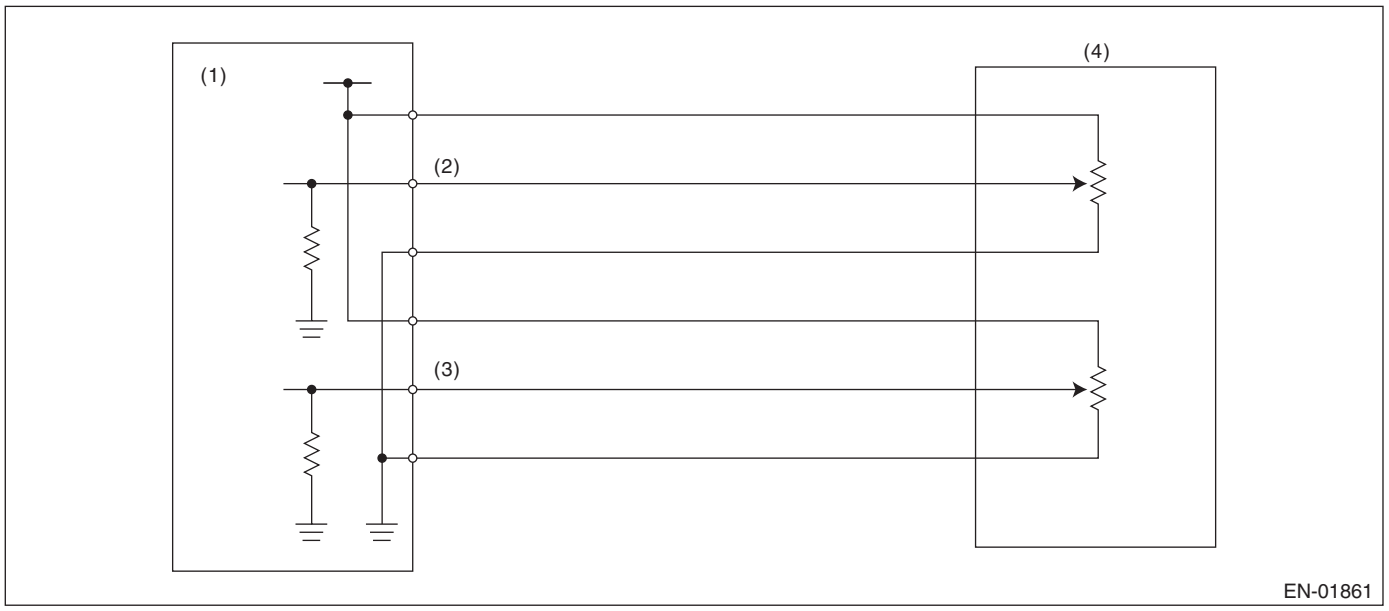
Time Needed for Diagnosis: 24 ms

DQ:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

1. OUTLINE OF DIAGNOSIS

Judge as 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 CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Battery voltage	≥ 6 V

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

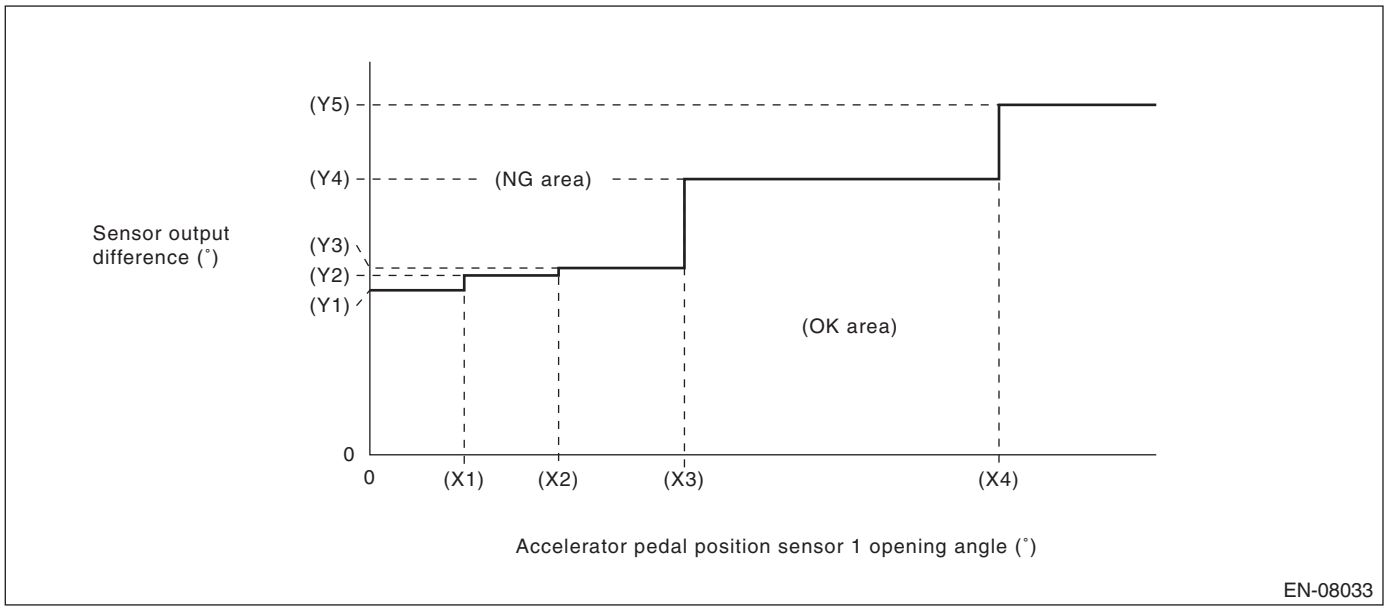
• Abnormality Judgment

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within NG area of **details of judgment value**

Details of Judgment Value



(X1) 0.6 °
(X2) 1.2 °
(X3) 2 °
(X4) 4 °

(Y1) 1.465 °
(Y2) 1.597 °
(Y3) 1.663 °
(Y4) 2.455 °
(Y5) 3.116 °

Time Needed for Diagnosis: 116 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Signal difference between two sensors	Within OK area of **details of judgment value**

Time Needed for Diagnosis: 116 ms

DR:DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of barometric pressure sensor output property.
Judge as NG when the barometric pressure sensor output is largely different from the intake manifold pressure at engine start.

2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.6 MPH)

4. GENERAL DRIVING CYCLE

Perform the diagnosis once at ignition switch ON.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
|Barometric pressure – Intake manifold pressure|	≥ 26.7 kPa (200 mmHg, 7.9 inHg)
|Intake manifold pressure at engine start – Intake manifold pressure|	< 1.3 kPa (9.99 mmHg, 0.4 inHg)

Time Needed for Diagnosis:328 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
|Barometric pressure – Intake manifold pressure|	< 26.7 kPa (200 mmHg, 7.9 inHg)

Time Needed for Diagnosis:262 ms

DS:DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 1.706646812 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 1.706646812 V

Time Needed for Diagnosis: Less than 1 second

DT:DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open/short circuit of the barometric pressure sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION

The barometric pressure sensor is built into the ECM.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

If the duration of time while the following conditions are met is longer than the time indicated, judge as NG.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	≥ 4.233789985 V

Time Needed for Diagnosis:500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Output voltage	< 4.233789985 V

Time Needed for Diagnosis: Less than 1 second

DU:DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
When CAN communications is not possible, and CAN communications with TCM, VDC CM and body integrated unit is not possible, judge as NG if data from the TCM, VDC CM and body integrated unit are not normal.

2. COMPONENT DESCRIPTION

ECM, TCM, VDC CM and body integrated unit are connected by high speed CAN.

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)

(High speed CAN)
Conforms to ISO11898
Communication Speed: 500 kbps

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting the engine.

5. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	set (error)
or	
ID received from control module connected to driving system CAN	None during 500 milliseconds
or	
Data updated from control module connected to driving system CAN	None during 2000 milliseconds

Time Needed for Diagnosis: 2 seconds
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG if the continuous time while the following conditions are established is more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	> 10.9 V
Starter switch	OFF
Engine	run
bus off flag or error warning flag	clear (No error)
ID received from control module connected to driving system CAN	Yes
Data updated from control module connected to driving system CAN	Yes

Time Needed for Diagnosis:1000 ms

DV:DTC U0101 CAN (TCU) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-204, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DW:DTC U0122 CAN (VDC) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-204, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DX:DTC U0140 CAN (BCU) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-204, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DY:DTC U0402 CAN (TCU) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-204, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DZ:DTC U0416 CAN (VDC) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-204, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

EA:DTC U0422 CAN (BCU) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0073. <Ref. to GD(H4SO)-204, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

ENGINE 2 SECTION

FUEL INJECTION (FUEL SYSTEMS)	FU(H4DOTC)
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)	EC(H4DOTC)
INTAKE (INDUCTION)	IN(H4DOTC)
MECHANICAL	ME(H4DOTC)
EXHAUST	EX(H4DOTC)
COOLING	CO(H4DOTC)
LUBRICATION	LU(H4DOTC)
SPEED CONTROL SYSTEMS	SP(H4DOTC)
IGNITION	IG(H4DOTC)
STARTING/CHARGING SYSTEMS	SC(H4DOTC)
ENGINE (DIAGNOSTICS)	EN(H4DOTC) (diag)
GENERAL DESCRIPTION	GD(H4DOTC)

This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles.
This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics.
Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

FUJI HEAVY INDUSTRIES LTD. G1980BE3

FUEL INJECTION (FUEL SYSTEMS)

FU(H4DOTC)

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3. General Description

A: CAUTION

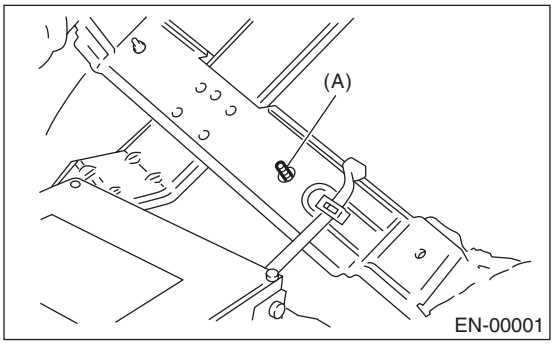
1) Airbag system wiring harness is routed near the ECM, main relay and fuel pump relay.

CAUTION:
• Do not use electrical test equipment on the airbag system circuits.
• 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. Doing so will damage the ECM instantly, and other parts will also be damaged.
3) Do not disconnect the battery terminals while the engine is running. A large counter electromotive force will be generated in the generator, and this voltage may damage electronic parts such as ECM etc.
4) Before disconnecting the connectors of each sensor and ECM, be sure to turn the ignition switch to OFF. Perform the Clear Memory Mode after connecting the connectors. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>
5) When measuring the voltage or resistance of individual sensor or all electrical control modules, use a tapered pin with a diameter of less than 0.6 mm (0.024 in). Do not insert the pin 4 mm (0.16 in) or more into the part.

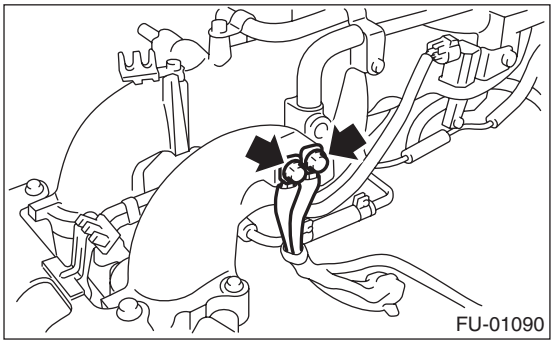
CAUTION:
When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.

NOTE:
When replacing the ECM of the models with Immobilizer, immobilizer system must be registered. To do so, all ignition keys and ID cards need to be prepared. Refer to the “PC application help for Subaru Select Monitor”.
6) Take care not to allow water to get into the connectors when servicing or washing the vehicle in rainy weather. Avoid exposure to water even if the connectors are waterproof.
7) Use ECM mounting stud bolts at the body side grounding point when measuring voltage and resistance inside the passenger compartment.



(A) Stud bolt

8) Use the engine ground terminal or engine assembly for the grounding point to chassis when measuring the voltage and resistance in engine compartment.



9) Every engine control system related part is a precision part. Do not drop them.
10) Observe the following cautions when installing a radio in vehicle.

CAUTION:
• The antenna must be kept as far apart as possible from control module.(ECM is installed under the passengers side floor mat.)
• The antenna feeder must be placed as far apart as possible from the ECM and engine control system harness.
• Carefully adjust the antenna for correct matching.
• When mounting a large power type radio, pay special attention to the three items mentioned above.
• Incorrect installation of the radio may affect the operation of ECM.

11) When disconnecting the fuel hose, release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>

12) Warning lights may illuminate when performing driving test with jacked-up or lifted-up condition, but this is not a system malfunction. The reason for this is the speed difference between the front and rear wheels. After diagnosis of engine control system, perform the VDC memory clear procedure of self-diagnosis function. <Ref. to VDC(diag)-25, Clear Memory Mode.>

B: INSPECTION

Before performing diagnostics, check the following item which might affect engine problems.

1. BATTERY

1) Measure the battery voltage and specific gravity of the electrolyte.

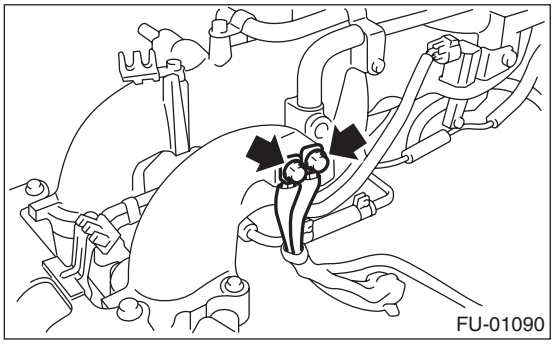
Standard voltage: 12 V

Specific gravity: 1.260 or more

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

2. ENGINE GROUND

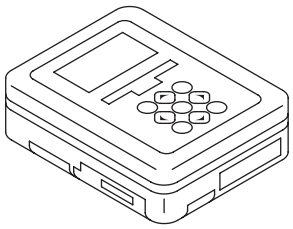
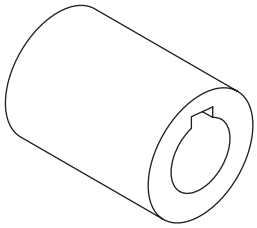
Check that the engine ground terminal has no contamination, corrosion or looseness and is properly connected to the engine.



C: NOTE

• The on-board diagnostic (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 of sensors as may disable the drive, the fail-safe function is provided to ensure the minimal drivability.
• The OBD system incorporated with the vehicles within this type of engine 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.
• Freeze frame engine condition data are stored until the DTCs are cleared. However when such malfunctions as fuel trim fault and misfire are detected with the freeze frame engine condition data stored, they are rewritten into those related to the fuel trim fault and 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 performing diagnosis, connect the Subaru Select Monitor or general scan tool to the vehicle.

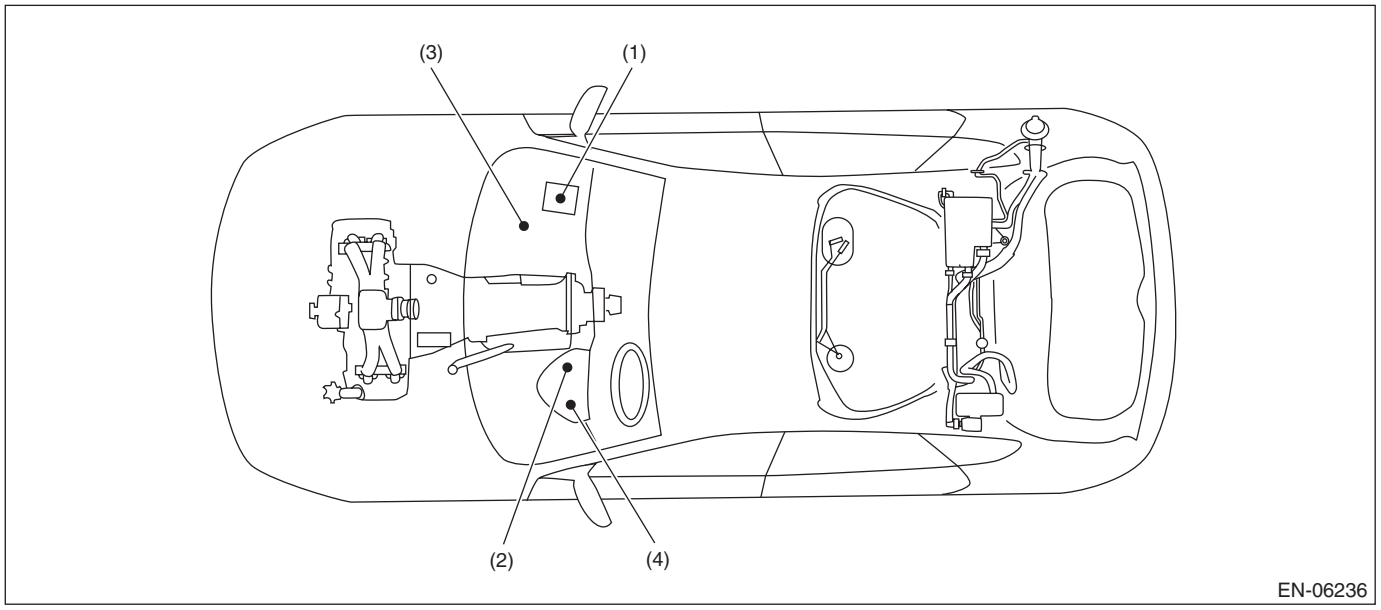
D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	CONTENTS	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

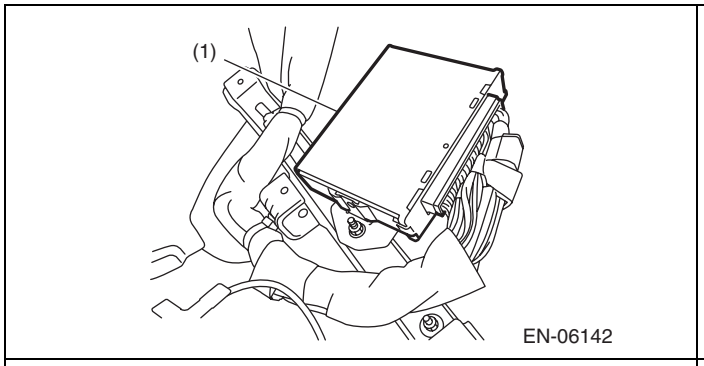
4. Electrical Component Location

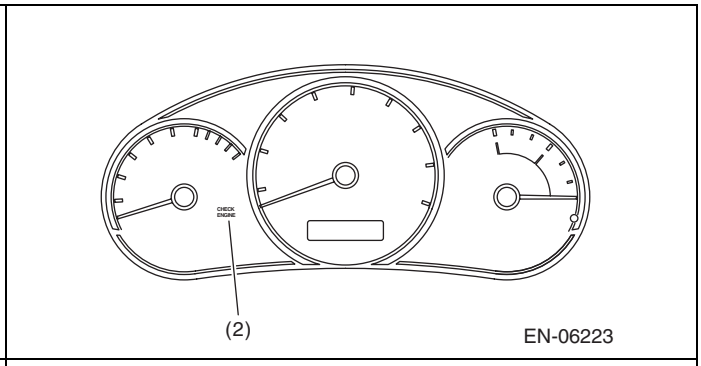
A: LOCATION

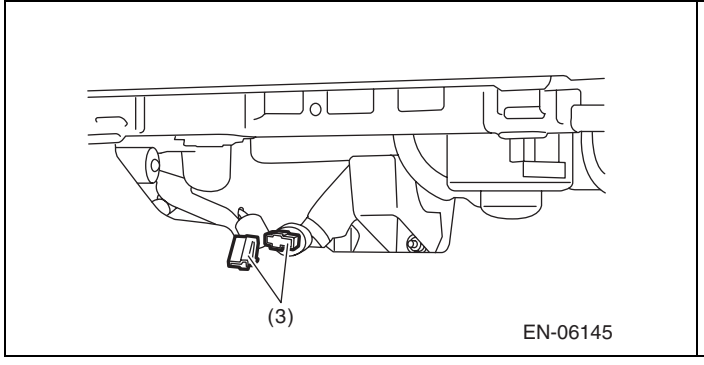
1. CONTROL MODULE

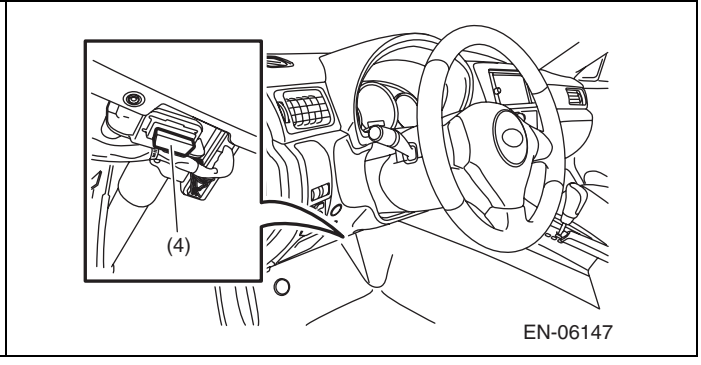


(1) Engine control module (ECM)
(2) Malfunction indicator light
(3) Delivery (test) mode connector
(4) Data link connector

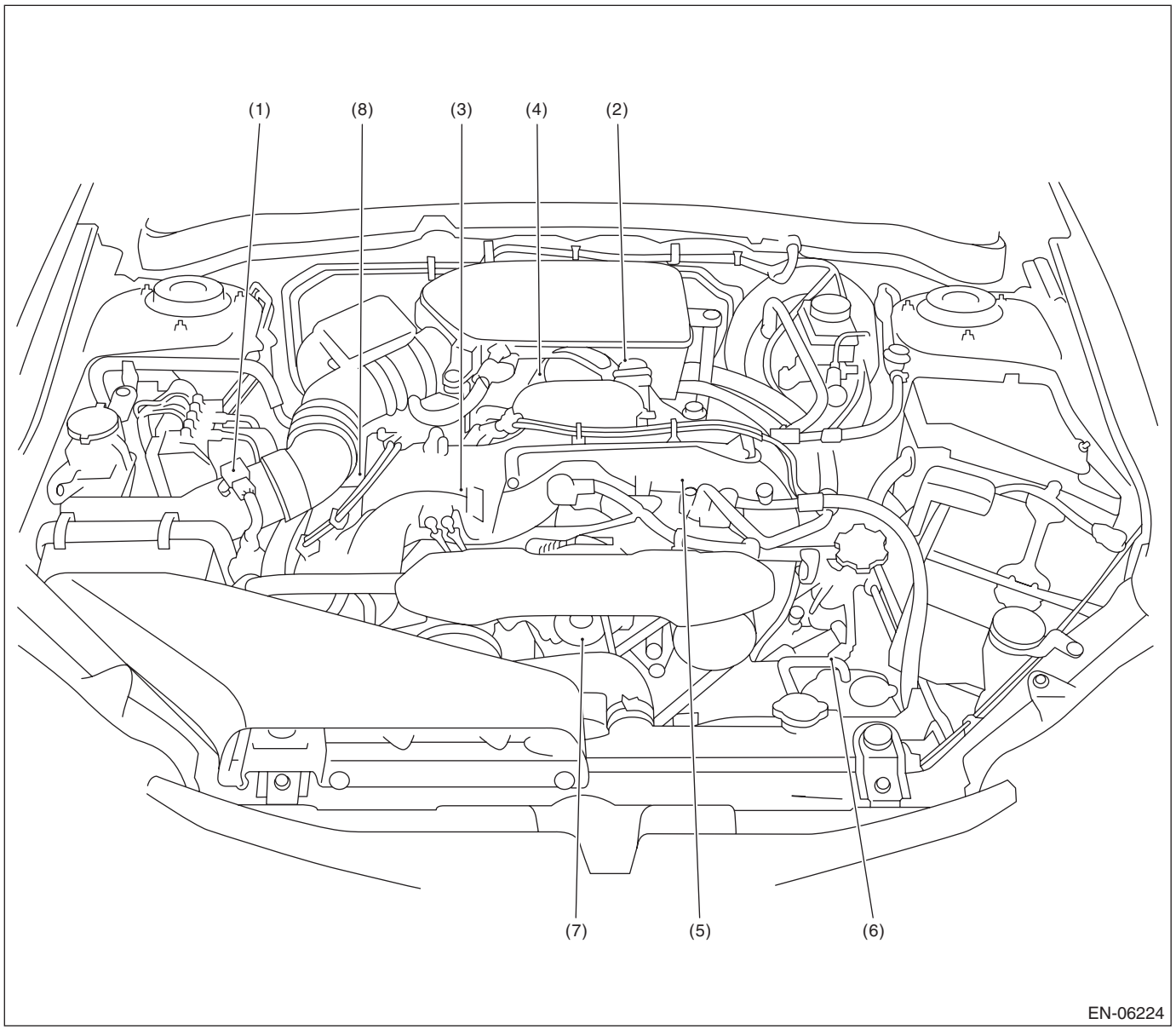




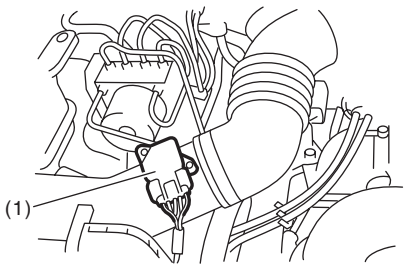




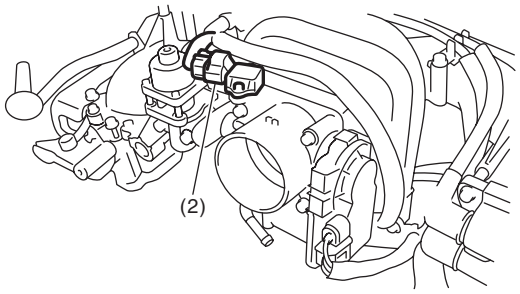
2. SENSOR



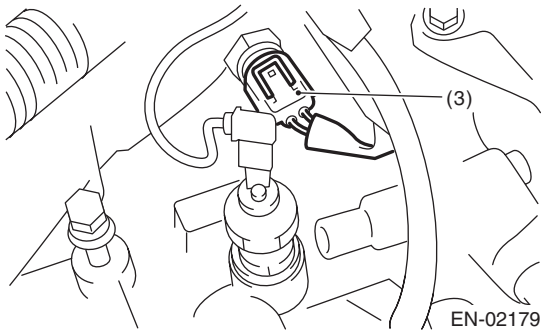
(1) Mass air flow and intake air temperature sensor
(2) Manifold absolute pressure sensor
(3) Engine coolant temperature sensor
(4) Electronic throttle control
(5) Knock sensor
(6) Camshaft position sensor
(7) Crankshaft position sensor
(8) Oil temperature sensor



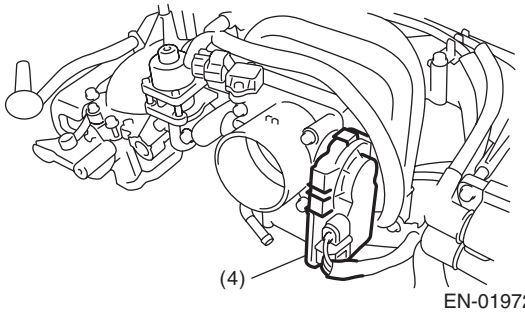
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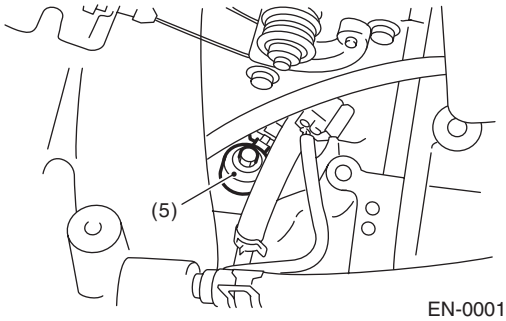
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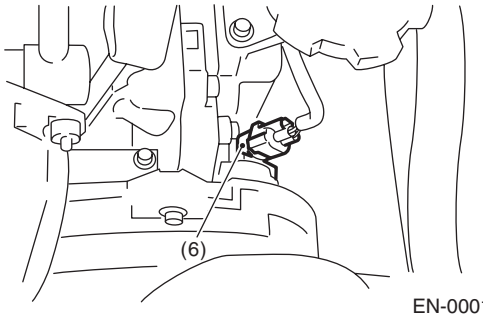
EN-02179



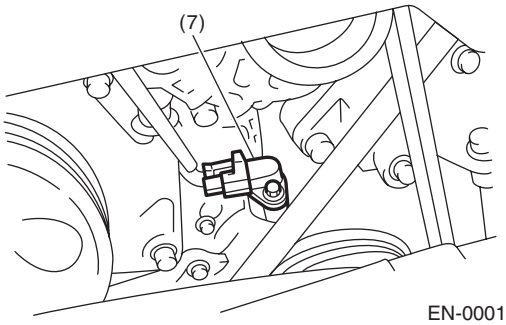
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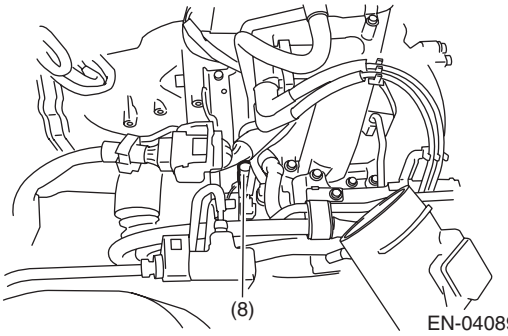
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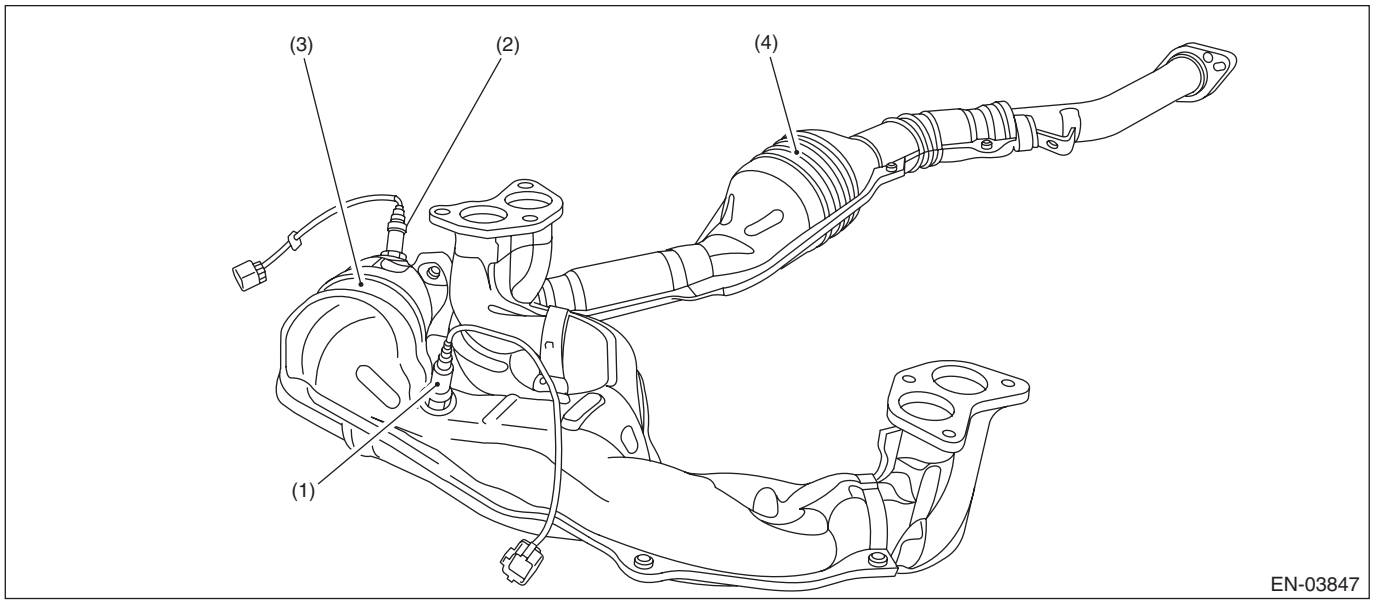
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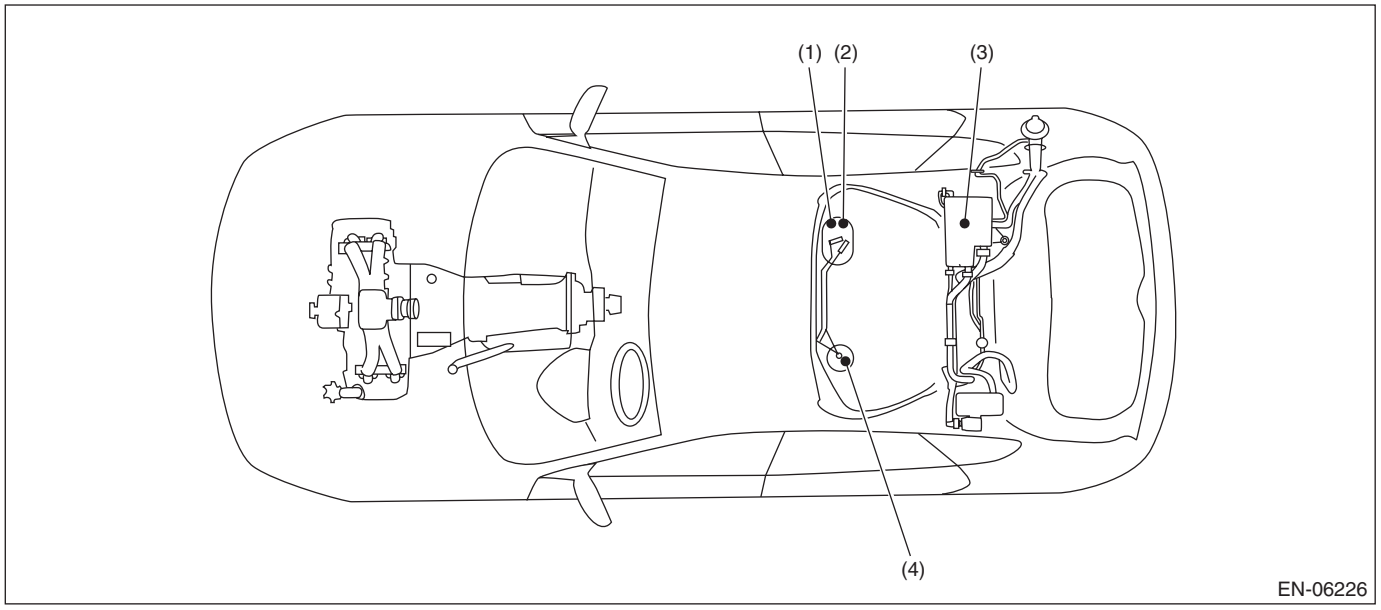
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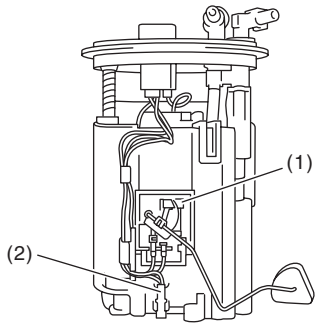
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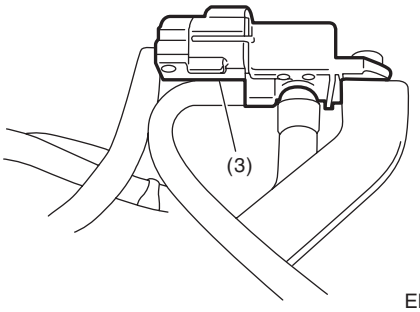
(1) Front oxygen (A/F) sensor
(2) Rear oxygen sensor
(3) Front catalytic converter
(4) Rear catalytic converter



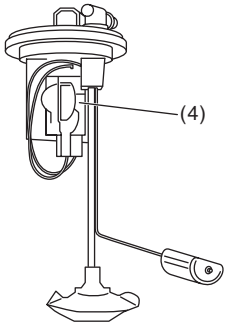
(1) Fuel level sensor
(2) Fuel temperature sensor
(3) Fuel tank pressure sensor
(4) Fuel sub level sensor



EN-05725

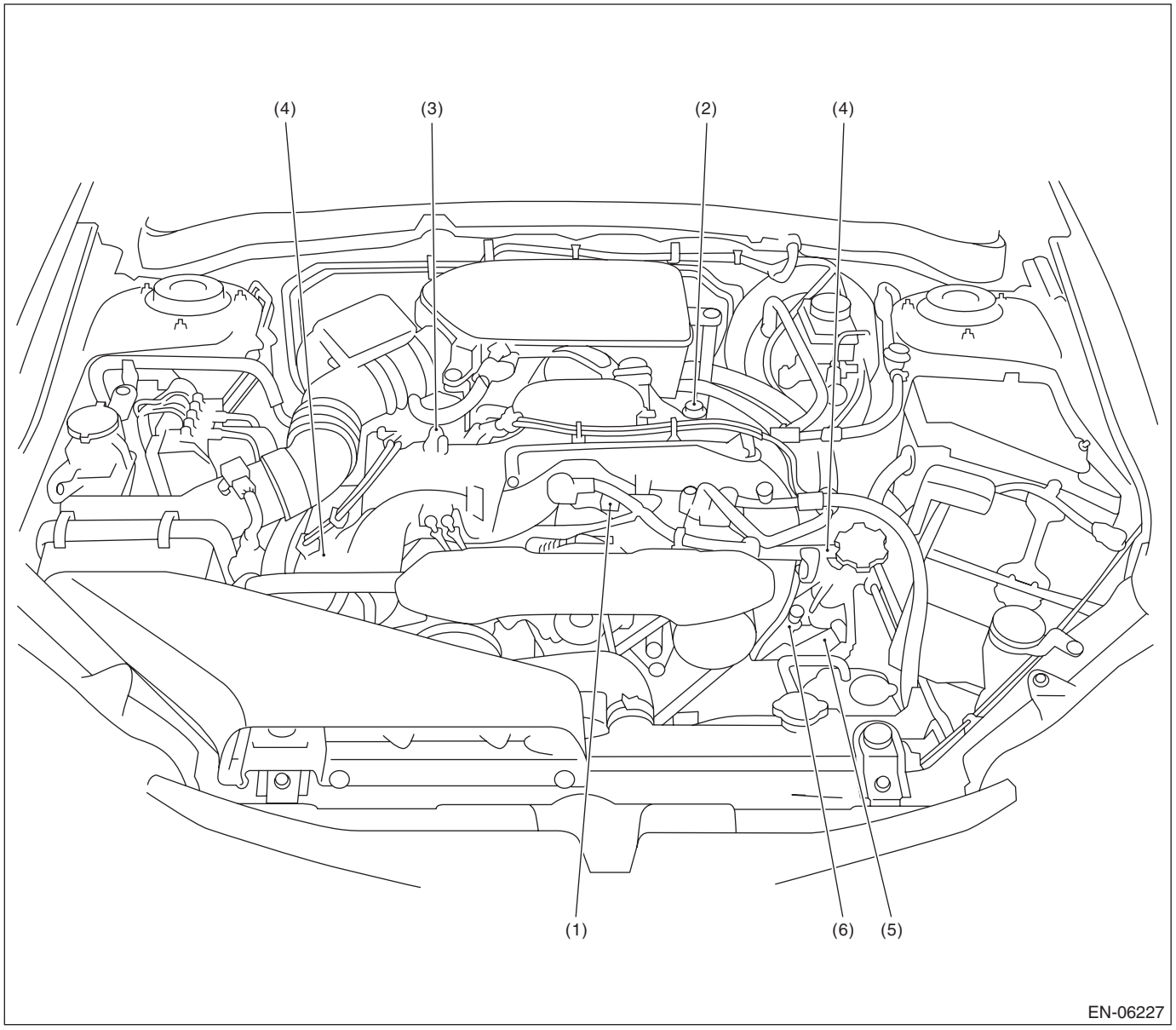


EN-06168

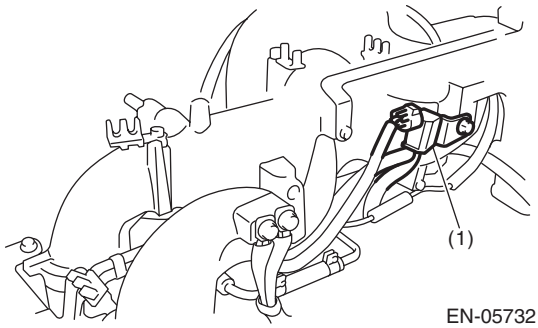


EN-03132

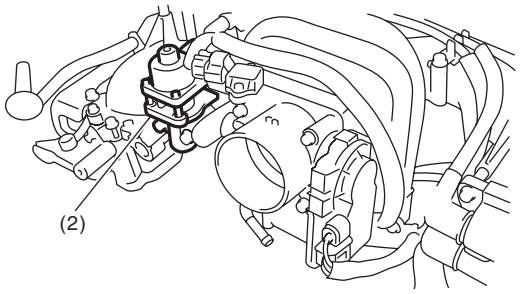
3. SOLENOID VALVE, ACTUATOR, EMISSION CONTROL SYSTEM PARTS AND IGNITION SYSTEM PARTS



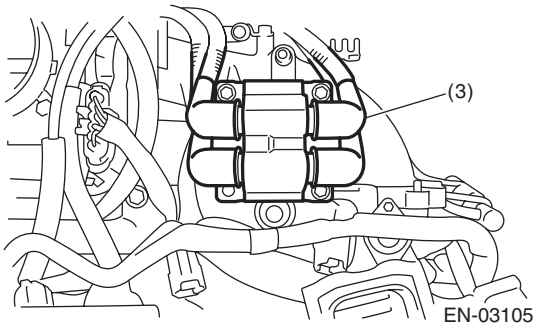
(1) Purge control solenoid valve
(2) EGR valve
(3) Ignition coil and ignitor ASSY
(4) Fuel injector
(5) Oil switching solenoid valve
(6) Variable valve lift diagnosis oil pressure switch



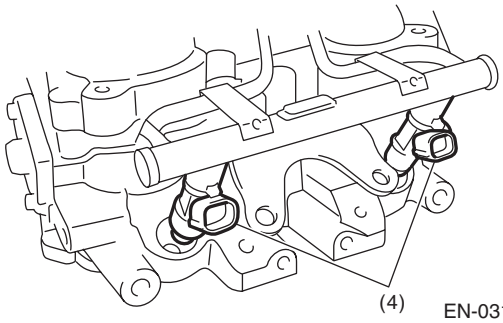
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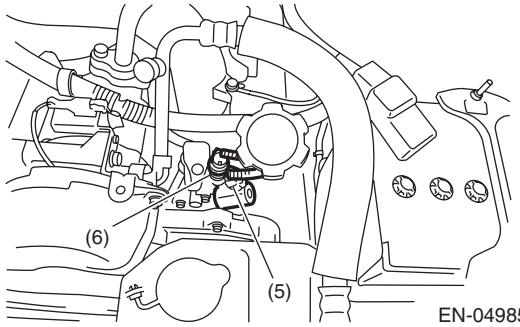
EN-01976



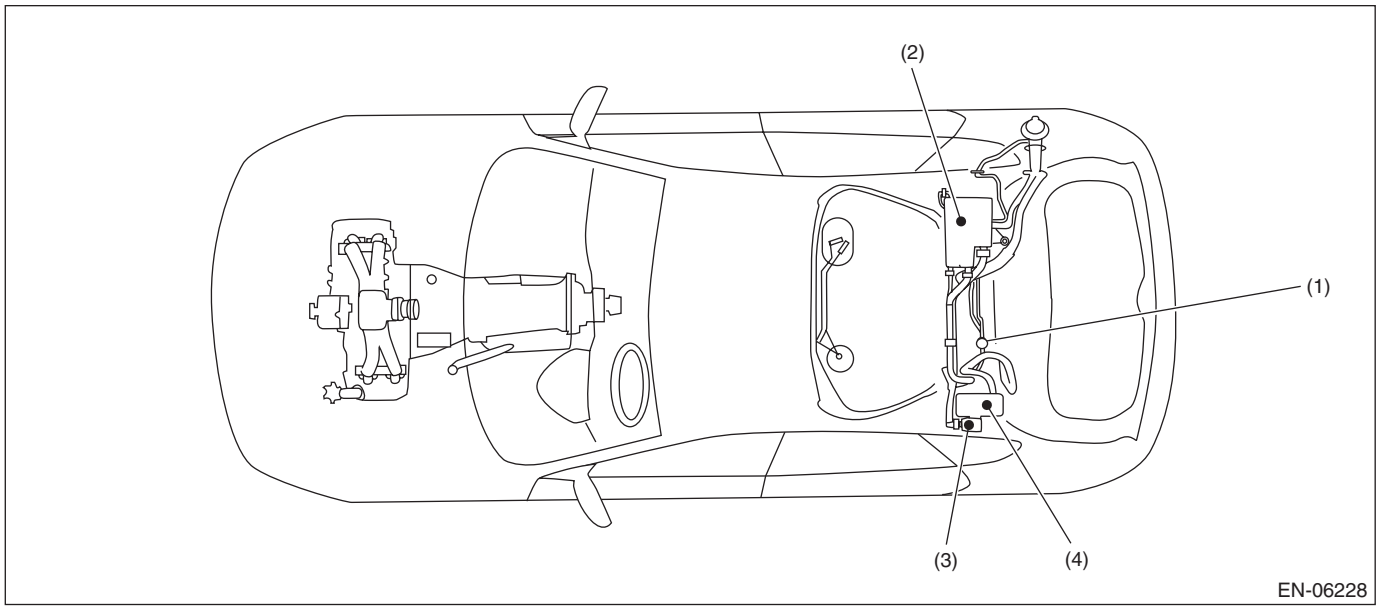
EN-03105



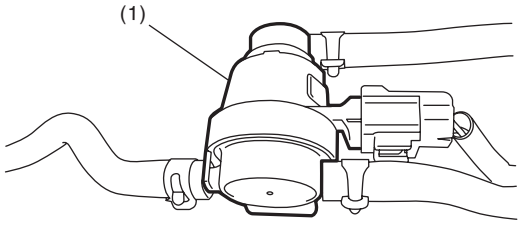
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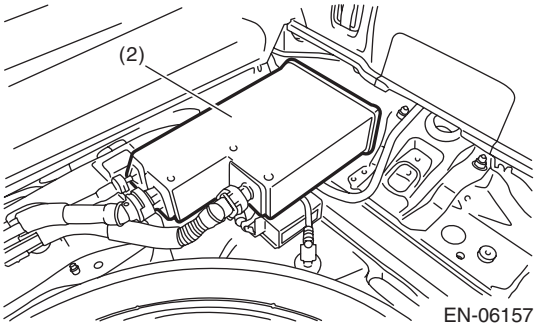


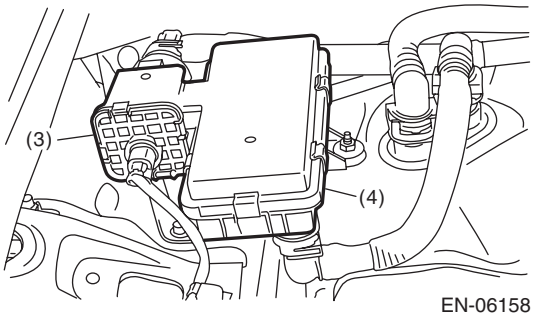
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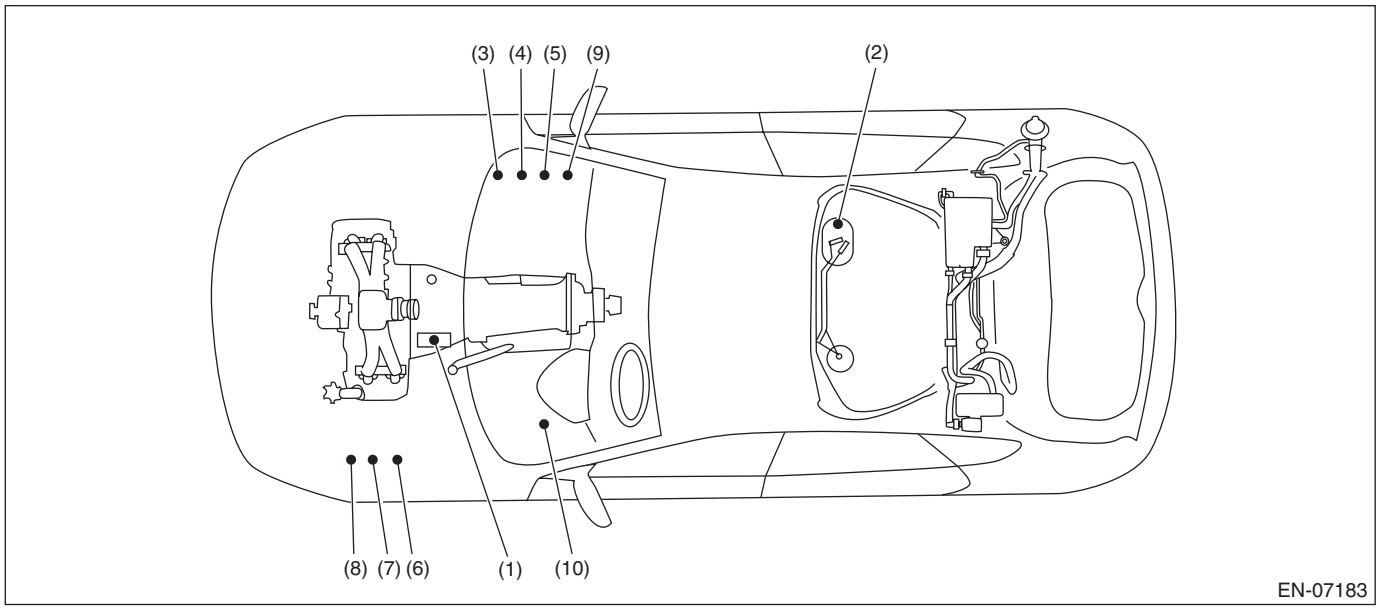


(1) Pressure control solenoid valve
(2) Canister
(3) Drain valve
(4) Drain filter

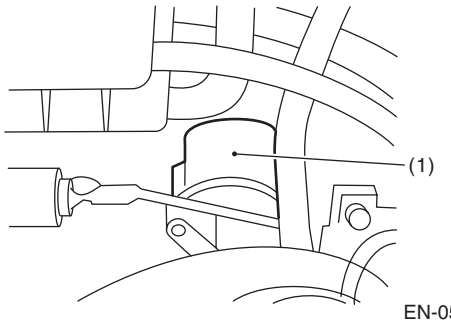


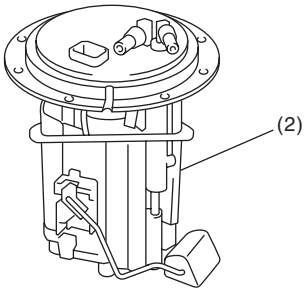


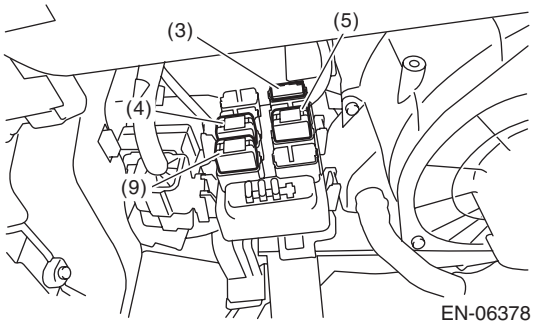


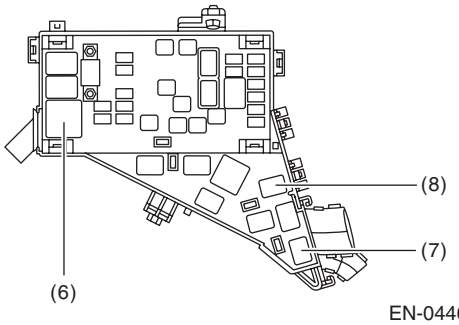


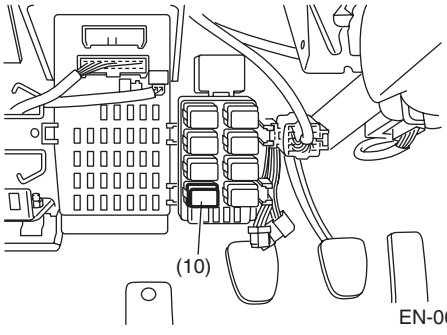
(1) Starter
(2) Fuel pump
(3) Main relay
(4) Fuel pump relay
(5) Electronic throttle control relay
(6) Radiator main fan relay 1
(7) Radiator sub fan relay
(8) Radiator main fan relay 2
(9) A/F, oxygen sensor relay
(10) Starter relay





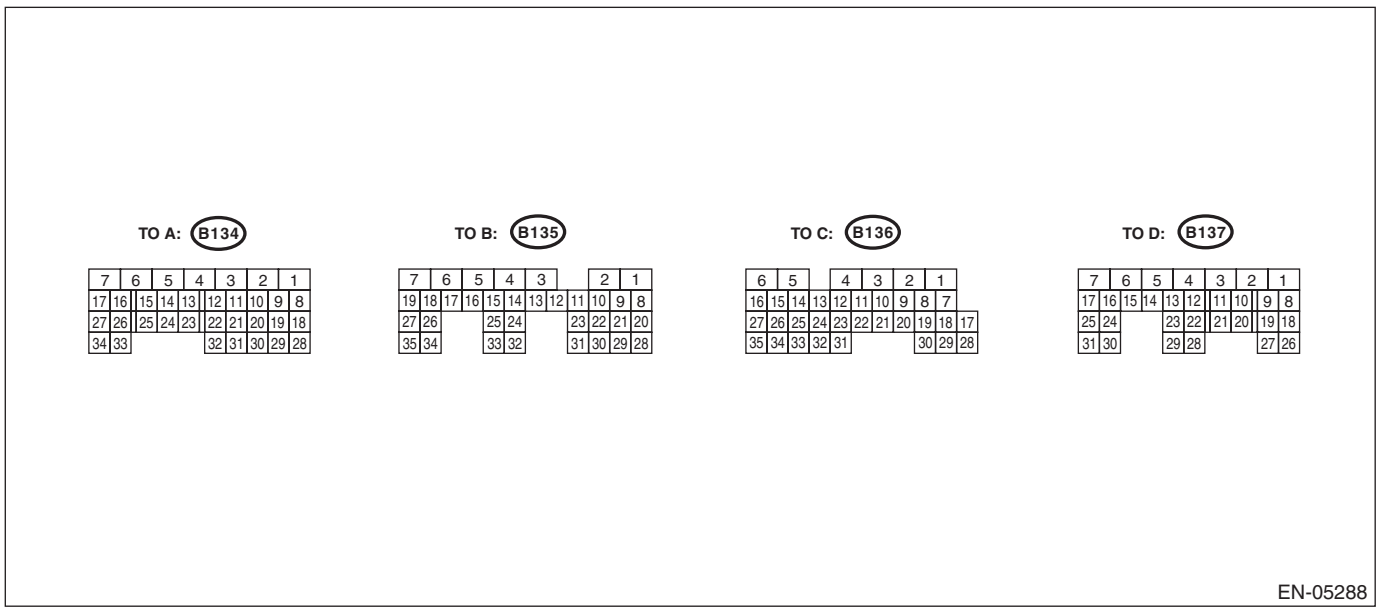






5. Engine Control Module (ECM) I/O Signal

A: ELECTRICAL SPECIFICATION



Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Crankshaft position sensor	Signal (+)	B134	13	0	–7 — +7	Waveform
	Signal (–)	B134	14	0	0	—
	Shield	B134	24	0	0	—
Camshaft position sensor	Signal (+)	B134	12	0	–7 — +7	Waveform
	Signal (–)	B134	22	0	0	—
	Shield	B134	24	0	0	—
Electronic throttle control	Main	B134	18	0.64 — 0.72 Fully opened: 3.96	0.64 — 0.72 (After engine is warmed up.)	Fully closed: 0.6 Fully opened: 3.96
	Sub	B134	28	1.51 — 1.58 Fully opened: 4.17	1.51 — 1.58 (After engine is warmed up.)	Fully closed: 1.48 Fully opened: 4.17
	Power supply	B134	19	5	5	—
	Ground (sensor)	B134	29	0	0	—
Electronic throttle control motor (+)		B137	5	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor (–)		B137	4	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor power supply		B136	1	10 — 13	12 — 14	—
Electronic throttle control motor relay		B136	21	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	When ignition switch is turned to ON: ON

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Accelerator pedal position sensor	Main sensor signal	B135	23	Fully closed: 1.0 Fully opened: 3.5	Fully closed: 1.0 Fully opened: 3.5	—
	Main power supply	B135	21	5	5	—
	Ground (Main sensor)	B135	29	0	0	—
	Sub sensor signal	B135	31	Fully closed: 1.0 Fully opened: 3.5	Fully closed: 1.0 Fully opened: 3.5	—
	Sub power supply	B135	22	5	5	—
	Ground (Sub sensor)	B135	30	0	0	—
Rear oxygen sensor	Signal	B135	4	0	0 — 0.9	—
	Shield	B135	1	0	0	—
Front oxygen (A/F) sensor heater	Signal 1	B136	3	10 — 13	1 — 14	Duty waveform
	Signal 2	B136	2	10 — 13	1 — 14	Duty waveform
Rear oxygen sensor heater signal		B136	4	10 — 13	1 — 14	Duty waveform
Engine coolant temperature sensor		B134	34	1.0 — 1.4	1.0 — 1.4	After engine is warmed up.
Starter switch		B136	32	0	0	AT model: Cranking: 8 — 14 MT model: Cranking with the clutch pedal pressed: 8 — 14
Starter relay control		B136	20	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
A/C switch		B136	24	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	—
Ignition switch		B135	19	10 — 13	12 — 14	—
Neutral position switch	AT	B136	31	ON: 0 OFF: 12±0.5		AT model: Switch is ON when select lever is shifted into “P” range or “N” range.
	MT			ON: 0 OFF: 12±0.5		MT model: Switch is ON when the shift lever is in neutral.
Delivery (test) mode connector		B135	27	10 — 13	13 — 14	When connected: 0
Knock sensor	Signal	B134	15	2.5	2.5	—
	Shield	B134	25	0	0	—
Back-up power supply		B135	5	10 — 13	12 — 14	Ignition switch “OFF”: 10 — 13
Control module power supply		B134	7	10 — 13	12 — 14	—
		B135	2	10 — 13	12 — 14	—
Ignition control	#1, #2	B137	18	0	1 — 3.4	Waveform
	#3, #4	B137	19	0	1 — 3.4	Waveform

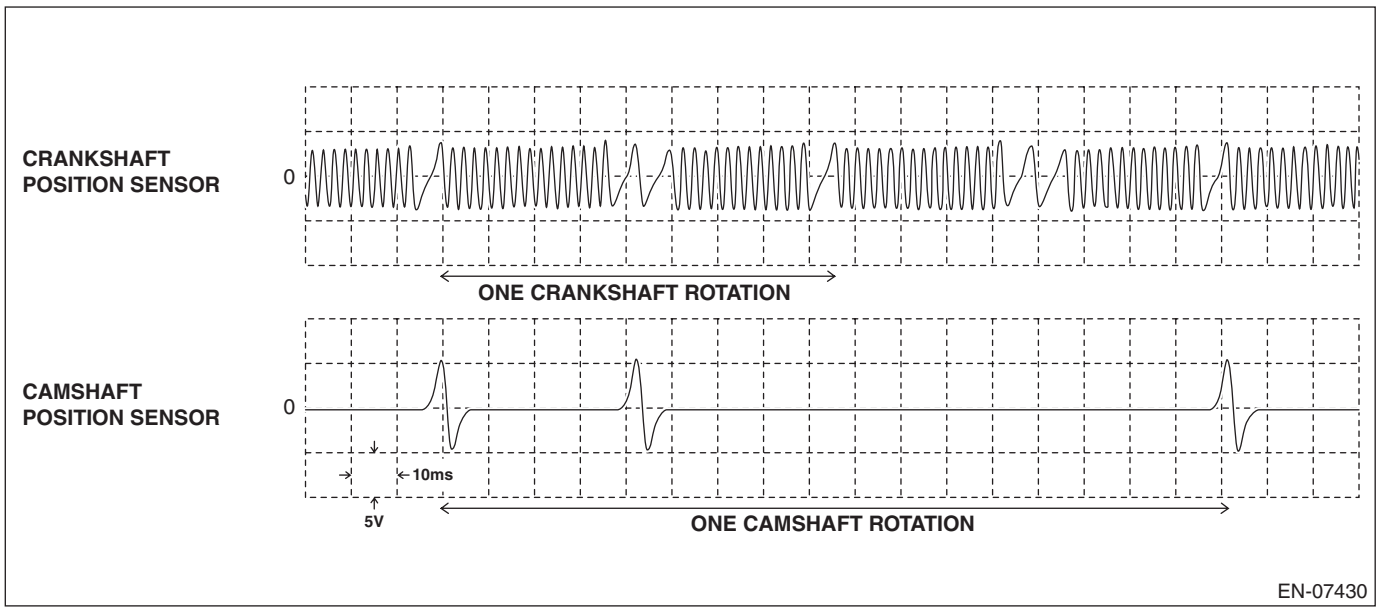
Engine Control Module (ECM) I/O Signal

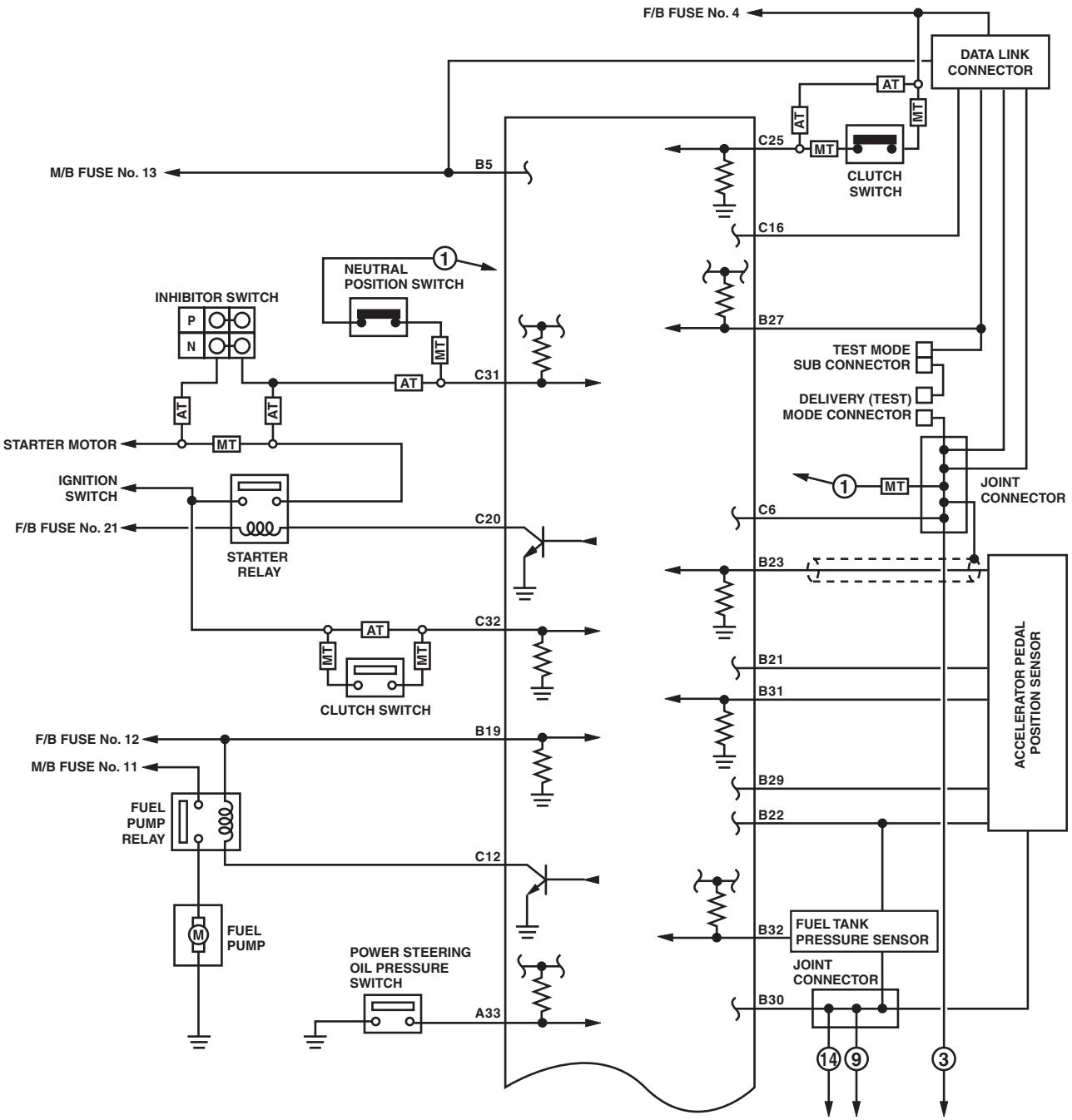
Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Fuel injector	#1	B137	8	10 — 13	1 — 14	Waveform
	#2	B137	9	10 — 13	1 — 14	Waveform
	#3	B137	10	10 — 13	1 — 14	Waveform
	#4	B137	11	10 — 13	1 — 14	Waveform
Fuel pump relay control		B136	12	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
A/C relay control		B136	9	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
Radiator fan relay 1 control		B136	18	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
Radiator fan relay 2 control		B136	29	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
Self-shutoff control		B136	23	0.5 or less	0.5 or less	—
Malfunction indicator light		B136	11	—	—	Light “ON”: 1 or less Light “OFF”: 10 — 14
Engine speed output		B136	22	—	0 — 13 or more	Waveform
Oil temperature sensor signal		B134	23	1.0 — 1.4	1.0 — 1.4	After engine is warmed up.
Blow-by leak diagnosis		B134	30	0	0	—
Purge control solenoid valve		B137	29	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	Duty waveform
EGR valve	Signal 1	B134	8	0 or 10 — 13	0 or 12 — 14	Waveform
	Signal 2	B134	9	0 or 10 — 13	0 or 12 — 14	Waveform
	Signal 3	B134	10	0 or 10 — 13	0 or 12 — 14	Waveform
	Signal 4	B134	20	0 or 10 — 13	0 or 12 — 14	Waveform
Power steering oil pressure switch		B134	33	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—
Blower fan switch		B135	11	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	Manual A/C model
A/C middle pressure switch		B136	33	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Oil switching solenoid valve RH	Signal (+)	B137	25	0	Duty waveform	Drive frequency: 300 Hz
	Signal (–)	B137	24	0	0	—
Oil switching solenoid valve LH	Signal (+)	B137	31	0	Duty waveform	Drive frequency: 300 Hz
	Signal (–)	B137	30	0	0	—
Variable valve lift diagnosis oil pressure switch RH		B134	31	0	0	—
Variable valve lift diagnosis oil pressure switch LH		B134	32	0	0	—
Front oxygen (A/F) sensor	Signal (+)	B135	9	—	2.7 — 2.9	—
	Signal (–)	B135	8	—	2.35 — 2.25	—
	Shield	B135	1	0	0	—
Manifold absolute pressure sensor		B134	6	3.4 — 3.8	1.4 — 1.8	—
Air flow sensor	Signal	B135	26	—	0.3 — 4.5	—
	Shield	B135	35	0	0	—
	Ground	B135	34	0	0	—
Intake air temperature sensor signal		B135	18	0.3 — 4.6	0.3 — 4.6	—

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Immobilizer communication 1		B136	26	1 or less ←→ 4 or more	1 or less ←→ 4 or more	—
Immobilizer communication 2		B136	34	1 or less ←→ 4 or more	1 or less ←→ 4 or more	—
SSM/GST communication line		B136	16	1 or less ←→ 4 or more	1 or less ←→ 4 or more	—
Sensor power supply		B134	19	5	5	—
		B135	22	5	5	—
Ground (sensor)		B134	29	0	0	—
		B135	30	0	0	—
Ground	(Engine 1)	B134	5	0	0	—
	(Engine 2)	B137	7	0	0	—
	(Engine 3)	B137	2	0	0	—
	(Engine 4)	B137	1	0	0	—
	(Engine 5)	B137	3	0	0	—
	(Ignition 1)	B137	26	0	0	—
	(Ignition 2)	B137	6	0	0	—
	(Body)	B136	6	0	0	—
Clutch switch		B136	25	When clutch pedal is depressed: 0 When clutch pedal is released: 10 — 13	When clutch pedal is depressed: 0 When clutch pedal is released: 12 — 14	—
Brake switch 1		B135	20	When brake pedal is depressed: 0 When brake pedal is released: 10 — 13	When brake pedal is depressed: 0 When brake pedal is released: 12 — 14	—
Brake switch 2		B135	28	When brake pedal is depressed: 10 — 13 When brake pedal is released: 0	When brake pedal is depressed: 12 — 14 When brake pedal is released: 0	—
Cruise control main switch		B135	12	ON: 0 OFF: 5	ON: 0 OFF: 5	—
Cruise control command switch		B135	24	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating CANCEL: 0 — 0.5	When operating nothing: 3.5 — 4.5 When operating RES/ACC: 2.5 — 3.5 When operating SET/COAST: 0.5 — 1.5 When operating CANCEL: 0 — 0.5	—
Fuel temperature sensor		B135	17	2.5 — 3.8	2.5 — 3.8	Ambient temperature: 25°C (77°F)
Fuel tank pressure sensor		B135	32	2.3 — 2.7	2.3 — 2.7	Value after removing fuel filler cap and installing again
Pressure control solenoid valve		B136	28	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—
Drain valve		B136	17	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—
CAN communication	(Hi)	B136	27	2.5 — 3.5	2.5 — 3.5	Waveform
	(Lo)	B136	35	1.5 — 2.5	1.5 — 2.5	Waveform
AT/MT identification line		B136	15	—	—	MT model: 1 or less

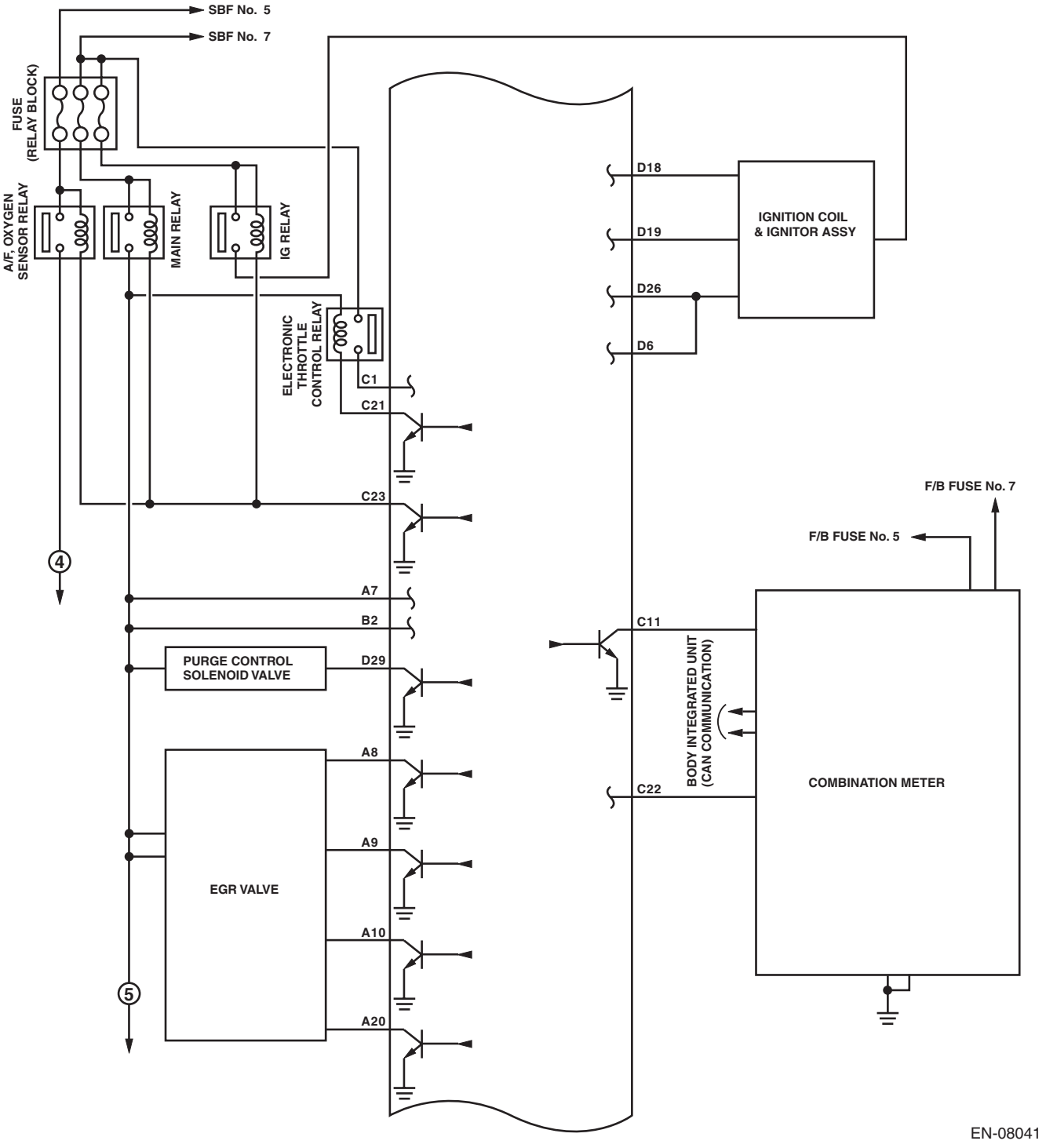
Input/output name:
- Crankshaft position sensor
- Camshaft position sensor

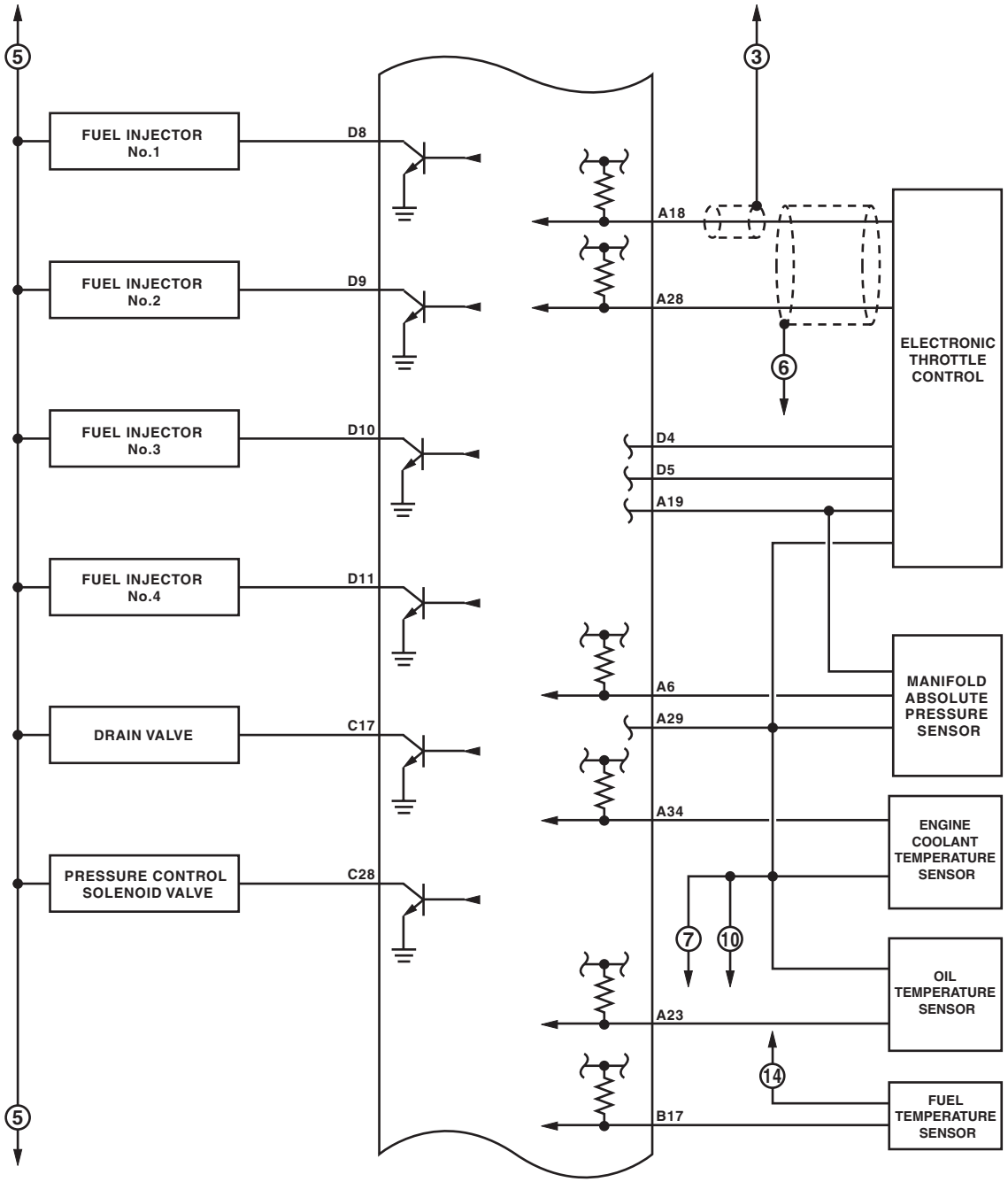
Measuring condition:
- After warming-up
- At idling



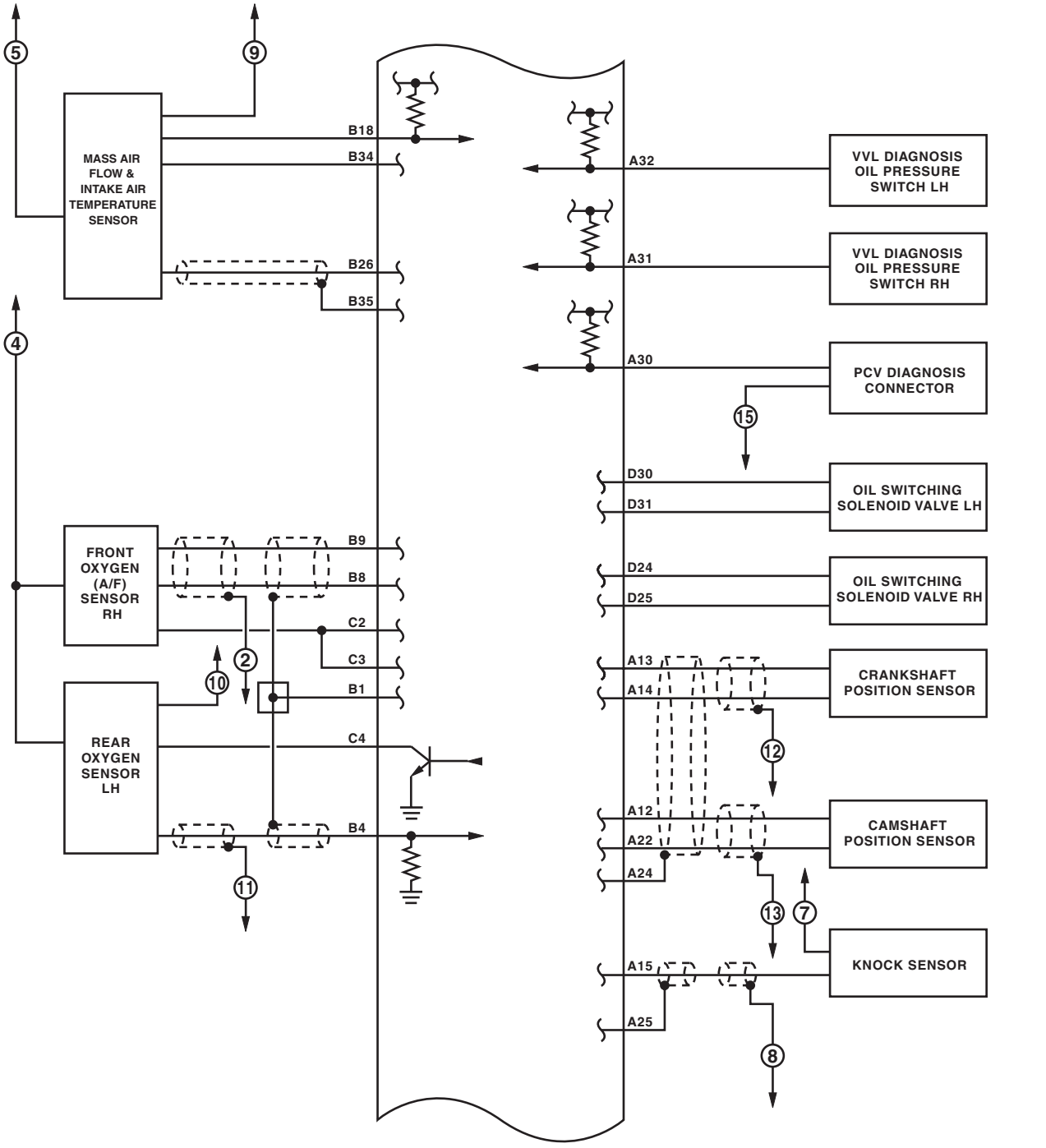

F/B FUSE No. 4
DATA LINK CONNECTOR
AT
MT
C25
CLUTCH SWITCH
M/B FUSE No. 13
B5
C16
NEUTRAL POSITION SWITCH
INHIBITOR SWITCH
P
N
B27
TEST MODE SUB CONNECTOR
DELIVERY (TEST) MODE CONNECTOR
C31
STARTER MOTOR
JOINT CONNECTOR
IGNITION SWITCH
F/B FUSE No. 21
C20
STARTER RELAY
C6
B23
C32
B21
B31
ACCELERATOR PEDAL POSITION SENSOR
CLUTCH SWITCH
F/B FUSE No. 12
B19
M/B FUSE No. 11
B29
B22
FUEL PUMP RELAY
C12
FUEL PUMP
B32
FUEL TANK PRESSURE SENSOR
POWER STEERING OIL PRESSURE SWITCH
JOINT CONNECTOR
A33
B30
14
9
3

EN-07184

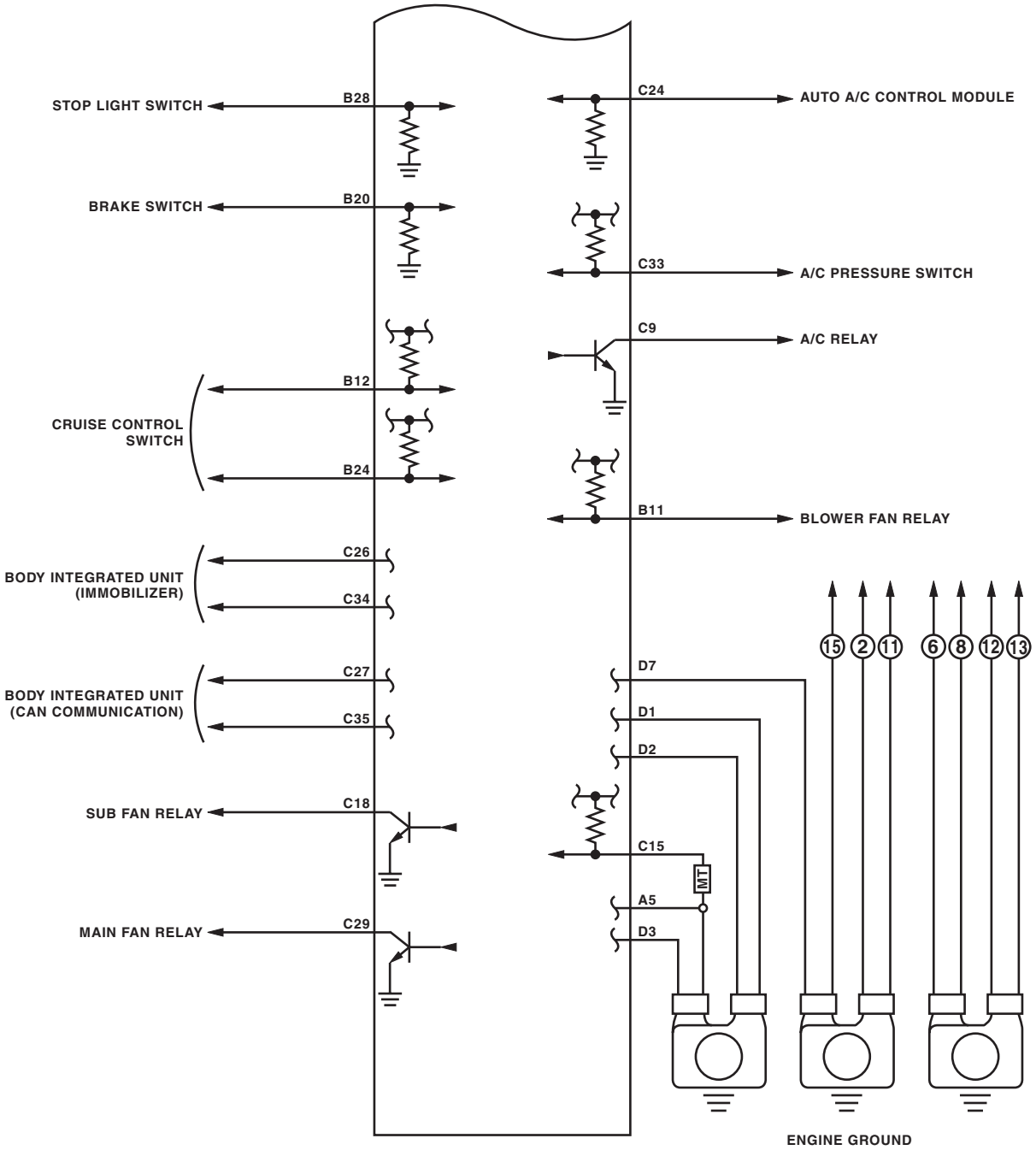

SBF No. 5
SBF No. 7
FUSE (RELAY BLOCK)
A/F, OXYGEN SENSOR RELAY
MAIN RELAY
IG RELAY
ELECTRONIC THROTTLE CONTROL RELAY
D18
D19
D26
D6
IGNITION COIL & IGNITOR ASSY
C1
C21
C23
4
A7
B2
PURGE CONTROL SOLENOID VALVE
D29
A8
A9
A10
A20
EGR VALVE
5
F/B FUSE No. 7
F/B FUSE No. 5
C11
C22
BODY INTEGRATED UNIT (CAN COMMUNICATION)
COMBINATION METER
EN-08041


5
FUEL INJECTOR No.1
D8
FUEL INJECTOR No.2
D9
FUEL INJECTOR No.3
D10
FUEL INJECTOR No.4
D11
DRAIN VALVE
C17
PRESSURE CONTROL SOLENOID VALVE
C28
5
3
A18
A28
6
ELECTRONIC THROTTLE CONTROL
D4
D5
A19
A6
A29
MANIFOLD ABSOLUTE PRESSURE SENSOR
A34
ENGINE COOLANT TEMPERATURE SENSOR
7
10
A23
OIL TEMPERATURE SENSOR
14
B17
FUEL TEMPERATURE SENSOR

EN-06232


5
9
MASS AIR FLOW & INTAKE AIR TEMPERATURE SENSOR
B18
B34
B26
B35
4
FRONT OXYGEN (A/F) SENSOR RH
B9
B8
C2
C3
2
10
B1
REAR OXYGEN SENSOR LH
C4
B4
11
A32
VVL DIAGNOSIS OIL PRESSURE SWITCH LH
A31
VVL DIAGNOSIS OIL PRESSURE SWITCH RH
A30
PCV DIAGNOSIS CONNECTOR
15
D30
D31
OIL SWITCHING SOLENOID VALVE LH
D24
D25
OIL SWITCHING SOLENOID VALVE RH
A13
A14
CRANKSHAFT POSITION SENSOR
12
A12
A22
A24
CAMSHAFT POSITION SENSOR
13
7
KNOCK SENSOR
A15
A25
8

EN-06233


STOP LIGHT SWITCH
B28
BRAKE SWITCH
B20
CRUISE CONTROL SWITCH
B12
B24
BODY INTEGRATED UNIT (IMMOBILIZER)
C26
C34
BODY INTEGRATED UNIT (CAN COMMUNICATION)
C27
C35
SUB FAN RELAY
C18
MAIN FAN RELAY
C29
C24
AUTO A/C CONTROL MODULE
C33
A/C PRESSURE SWITCH
C9
A/C RELAY
B11
BLOWER FAN RELAY
D7
D1
D2
C15
MT
A5
D3
15 2 11 6 8 12 13
ENGINE GROUND

EN-06234

6. Engine Condition Data

A: ELECTRICAL SPECIFICATION

Content	Specifications
Engine load	17.6 — 40.5 (%): Idling
	14.7 — 29.8 (%): 2,500 rpm racing

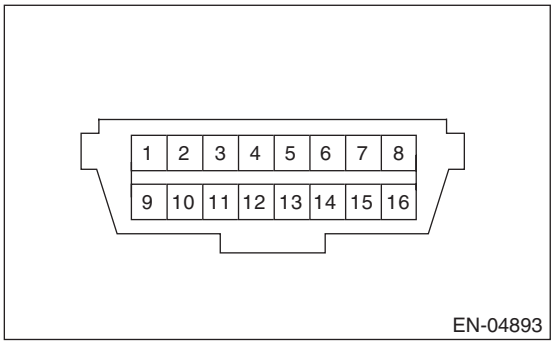
Measuring condition:
- After engine is warmed up.
- Set the select lever in “P” range or “N” range, or the shift lever in neutral.
- Turn the A/C to OFF.
- Turn all the accessory switches to OFF.

7. Data Link Connector

A: NOTE

This connector is used for Subaru Select Monitor.

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



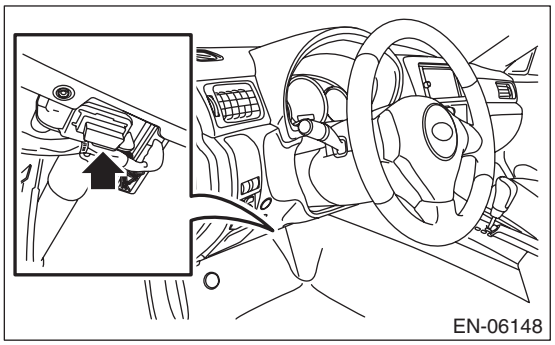
Terminal No.	Content	Terminal No.	Content
1	Blank	9	Blank
2	Blank	10	Blank
3	Blank	11	Blank
4	Ground	12	Blank
5	Ground	13	Blank
6	CAN communication (Hi)	14	CAN communication (Lo)
7	Subaru Select Monitor signal	15	Blank
8	Blank	16	Power supply

8. General Scan Tool

A: OPERATION

1. HOW TO USE GENERAL SCAN TOOL

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



3) Using the general scan tool, call up each 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 intermittently monitored systems
   (6) MODE $07: Request on-board monitoring test results for continuously monitored systems
   (7) MODE $09: Request vehicle information

NOTE:
• Read out the data according to repair procedures. (For detailed operation procedure, refer to the general scan tool operation manual.)
• For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>

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

Refer to data denoting the current operating condition of analog input/output, digital input/output or the powertrain system.
A list of the support data and PID (Parameter Identification) codes are shown in the following table.

PID	Data	Unit of measure
$01	Number of emission-related powertrain DTC, and malfunction indicator light status and diagnosis support information	—
$03	Fuel system control status	—
$04	Calculated engine load value	%
$05	Engine coolant temperature	°C
$06	Short term fuel trim	%
$07	Long term fuel trim	%
$0B	Intake manifold absolute pressure	kPa
$0C	Engine speed	rpm
$0D	Vehicle speed	MPH
$0E	Ignition timing advance	°
$0F	Intake air amount	°C
$10	Intake air amount	g/s
$11	Throttle valve opening angle	%
$13	Air fuel ratio sensor	—
$15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (Bank 1 Sensor 2)	V and %
$1C	Supporting OBD system	—
$1F	Elapsed time after starting the engine	sec
$21	Travel distance after the malfunction indicator light illuminates	miles
$24	A/F value and A/F sensor output voltage (Bank 1 Sensor 1)	— and V
$2C	Target EGR	%
$2D	EGR deviation	%
$2E	Evaporative purge	%
$2F	Fuel level	%
$30	Number of warm ups after DTC clear	—
$31	Travel distance after DTC clear	miles
$32	Fuel tank pressure	Pa
$33	Barometric pressure	kPa
$34	A/F value and A/F sensor current (Bank 1 Sensor 1)	— and mA
$3C	Catalyst temperature #1	°C
$41	Diagnostic monitor of each drive cycle	—
$42	ECM power voltage	V
$43	Absolute load	%
$44	A/F target lambda	—
$45	Relative throttle opening angle	%
$46	Ambient temperature	°C
$47	Absolute throttle opening angle 2	%
$49	Absolute accelerator opening angle 1	%
$4A	Absolute accelerator opening angle 2	%
$4C	Target throttle opening angle	%
$4D	Engine operating time while malfunction indicator lit	min
$4E	Elapsed time after DTC clear	min
$51	Fuel used	—
$5A	Relative accelerator opening angle	%
$65	Neutral status	—

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)

Refer to data denoting the operating condition when trouble is detected by 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 the freeze frame data storage required by CARB	—
$03	Fuel system control status	—
$04	Calculated engine load value	%
$05	Engine coolant temperature	°C
$06	Short term fuel trim (Bank 1 Sensor 1)	%
$07	Long term fuel trim (Bank 1 Sensor 1)	%
$0B	Intake manifold absolute pressure	kPa
$0C	Engine speed	rpm
$0D	Vehicle speed	MPH
$0E	Ignition timing advance	°
$0F	Intake air amount	°C
$10	Intake air amount	g/s
$11	Throttle valve opening angle	%
$13	Air fuel ratio sensor	—
$15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor (Bank 1 Sensor 2)	V and %
$1C	Supporting OBD system	—
$1F	Elapsed time after starting the engine	sec
$2C	Target EGR	%
$2D	EGR deviation	%
$2E	Evaporative purge	%
$2F	Fuel level	%
$32	Fuel tank pressure	Pa
$33	Barometric pressure	kPa
$42	ECM power voltage	V
$43	Absolute load	%
$44	A/F target lambda	—
$45	Relative throttle opening angle	%
$46	Ambient temperature	°C
$47	Absolute throttle opening angle 2	%
$49	Absolute accelerator opening angle 1	%
$4A	Absolute accelerator opening angle 2	%
$4C	Target throttle opening angle	%
$65	Neutral status	—

NOTE:
Refer to general scan tool manufacturer's instruction manual to access freeze frame data (MODE $02).

4. MODE $03 (EMISSION-RELATED POWERTRAIN DTC)

Refer to "List of Diagnostic Trouble Code (DTC)" for information about data denoting emission-related powertrain DTC. <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>

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

Refer 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 the emission-related diagnostic information (MODE $04).

6. MODE $06

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

OBDMID	TID	SID	Diagnostic item
$01	$81	$0A	A/F sensor continuity failure (Bank 1 Sensor 1)
	$82	$8D	
	$83	$14	
	$84	$1E	A/F sensor range failure (Bank 1 Sensor 1)
	$85	$1E	
	$86	$20	A/F sensor response failure (Bank 1 Sensor 1)
$02	$87	$0B	Oxygen sensor circuit failure (Bank 1 Sensor 2)
	$88	$0B	
	$07	$0B	Oxygen sensor drop failure (Bank 1 Sensor 2)
	$08	$0B	
	$A5	$0B	
	$05	$10	Oxygen sensor response failure (Bank 1 Sensor 2)
	$06	$10	
$21	$89	$20	Catalyst deterioration diagnosis (Bank 1)
$31	$8A	$FD	EGR system diagnosis
$39	$93	$FE	Evaporative emission control system (Cap off)
$3B	$94	$FE	Evaporative emission control system (0.04 inch leak)
	$95	$FE	
$3C	$96	$FE	Evaporative emission control system (0.02 inch leak)
	$97	$FE	
$3D	$98	$FE	Evaporative emission control system (Purge flow)
$41	$99	$24	A/F sensor heater failure (Bank 1 Sensor 1)
	$9A	$24	
	$9B	$14	A/F sensor heater characteristics failure (Bank 1 Sensor 1)
$A1	$0B	$24	Misfire monitoring (All cylinders)
	$0C	$24	
$A2	$0B	$24	Misfire monitoring (#1 cylinder)
	$0C	$24	
$A3	$0B	$24	Misfire monitoring (#2 cylinder)
	$0C	$24	
$A4	$0B	$24	Misfire monitoring (#3 cylinder)
	$0C	$24	
$A5	$0B	$24	Misfire monitoring (#4 cylinder)
	$0C	$24	

7. MODE $07

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

8. MODE $09

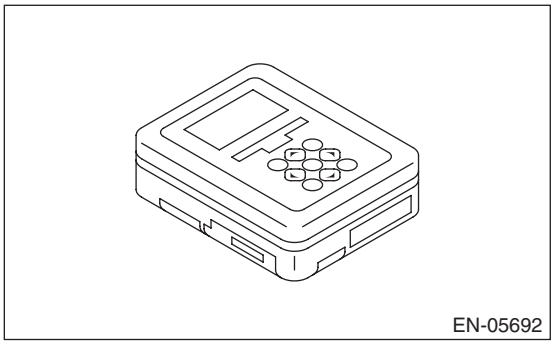
Refer to data of vehicle specification (V.I.N., calibration ID, diagnosis frequency etc.).

9. Subaru Select Monitor

A: OPERATION

1. HOW TO USE SUBARU SELECT MONITOR

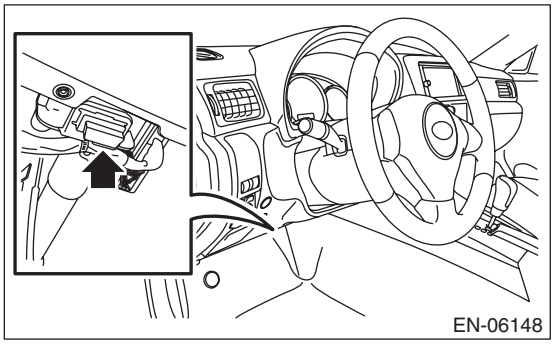
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>


EN-05692

2) Prepare PC with Subaru Select Monitor installed.
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.
4) Connect the diagnosis cable to SDI.
5) Connect SDI 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.


EN-06148

6) Start the PC.
7) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
8) Call up DTC and data, then record them.

NOTE:
For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".

2. READ CURRENT DATA FOR ENGINE (NORMAL MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {Current Data Display & Save}.
5) On «Current Data Display & Save» display, select {Normal sampling}.
6) Using the scroll key, scroll the display screen up or down until the desired data is shown.

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

Content	Display	Unit of measure	Note (at idling)
Engine load	Engine Load	%	21.0%
Engine coolant temperature signal	Coolant Temp.	°C or °F	85°C or 185°F or more (after warm up)
A/F correction 1	A/F Correction 1	%	–0.8%
A/F learning 1	A/F Learning 1	%	0.0%
Intake manifold absolute pressure	Mani. Absolute Pressure	mmHg, kPa, inHg or psig	200 — 300 mmHg, 26.7 — 40 kPa, 7.8 — 11.8 inHg or 3.8 — 5.8 psig
Engine speed signal	Engine Speed	rpm	700 rpm (Agree with the tachometer indication)
Meter vehicle speed signal	Vehicle Speed	km/h or MPH	0 km/h or 0 MPH (at parking)
Ignition timing signal	Ignition Timing	deg	14 — 16 deg
Intake air temperature signal	Intake Air Temp.	°C or °F	(Ambient air temperature)
Amount of intake air	Mass Air Flow	g/s or lb/m	2.5 g/s or 0.33 lb/m
Throttle opening angle signal	Throttle Opening Angle	%	2.0%
Rear oxygen sensor voltage	Rear O2 Sensor	V	0.1 — 0.7 V
Battery voltage	Battery Voltage	V	12 — 14 V
Mass air flow voltage	Air Flow Sensor Voltage	V	1.26 V
Injection 1 pulse width	Fuel Injection #1 Pulse	ms	2.82 ms
Atmospheric pressure signal	Atmosphere Pressure	mmHg, kPa, inHg or psig	(Atmospheric pressure)
Intake manifold relative pressure	Mani. Relative Pressure	mmHg, kPa, inHg or psig	(Air intake absolute pressure – Atmospheric pressure)
Ignition learning value	Learned Ignition Timing	deg	0 deg
Acceleration opening angle signal	Accel. Opening Angle	%	0.0%
Fuel temperature signal	Fuel Temp.	°C or °F	+20°C or +68°F
Purge control solenoid duty ratio	CPC Valve Duty Ratio	%	0 — 3%
No. of EGR steps	No. of EGR steps	STEP	0 STEP
A/F sensor current value 1	A/F Sensor #1 Current	mA	–0.2 — 0.2 mA
A/F sensor resistance value 1	A/F Sensor #1 Resistance	Ω	32 Ω
A/F sensor output lambda 1	A/F Sensor #1	—	1.0
A/F correction 3	A/F correction 3	%	0.3%
A/F learning 3	A/F learning 3	%	0.00%
Throttle motor duty	Throttle Motor Duty	%	–15%
Throttle power supply voltage	Throttle Motor Voltage	V	(Battery voltage)
Sub throttle sensor voltage	Sub-Throttle Sensor	V	1.52 V
Main throttle sensor voltage	Main-Throttle Sensor	V	0.66 V
Sub accelerator sensor voltage	Sub-Accelerator Sensor	V	0.68 V
Main accelerator sensor voltage	Main-Accelerator Sensor	V	0.68 V
Memory vehicle speed	Memorized Cruise Speed	km/h or MPH	0 km/h or 0 MPH
Fuel level sensor signal	Fuel level resistance	Ω	2 — 96 Ω
Engine oil temperature	Engine oil temperature	°C	≥ 85°C (After engine is warmed up.)

Content	Display	Unit of measure	Note (at idling)
Oil switching solenoid valve duty R	OSV Duty R	%	16.9%
Oil switching solenoid valve duty L	OSV Duty L	%	16.9%
Oil switching solenoid valve current R	OSV Current R	mA	192 mA
Oil switching solenoid valve current L	OSV Current L	mA	192 mA
Variable valve lift mode	VVL Lift Mode	—	1
#1 cylinder roughness monitor	Roughness Monitor #1	—	0
#2 cylinder roughness monitor	Roughness Monitor #2	—	0
#3 cylinder roughness monitor	Roughness Monitor #3	—	0
#4 cylinder roughness monitor	Roughness Monitor #4	—	0
Knock sensor compensation	Knocking Correction	deg	0.0 deg
Fuel tank pressure signal	Fuel Tank Pressure	mmHg, kPa, inHg or psig	+7.7 mmHg, +1.1 kPa, +0.31 inHg or +0.15 psig
AT/MT identification terminal	AT/MT identification terminal	—	AT vehicle/MT vehicle
Delivery (test) mode terminal	Test Mode Signal	—	U check
D check request flag	D-check Require Flag	—	OFF
Delivery (test) mode terminal	Delivery Mode Connector (Test Mode Connector)	—	OFF
Neutral position switch signal	Neutral Position Switch	—	Neutral
Soft idle switch signal	Idle Switch Signal	—	At idle
Ignition switch signal	Ignition Switch	—	ON input
Power steering switch signal	P/S Switch Signal	—	OFF input (At OFF)
Air conditioning switch signal	A/C Switch	—	OFF input (At OFF)
Starter switch signal	Starter Switch	—	OFF input
Rear oxygen monitor	Rear O2 Rich Signal	—	Rich/Lean
Knocking signal	Knocking Signal	—	None
Crankshaft position sensor signal	Crankshaft Position Sig.	—	Provided
Camshaft position sensor signal	Camshaft Position Sig.	—	Provided
Rear defogger switch signal	Rear Defogger SW	—	OFF input (At OFF)
Blower fan switch signal	Blower Fan SW	—	OFF input (At OFF)
Light switch signal	Light Switch	—	OFF input (At OFF)
A/C middle pressure switch signal	A/C Mid Pressure Switch	—	OFF input (At OFF)
Air conditioner compressor relay output signal	A/C Compressor Signal	—	OFF output (when OFF)
Radiator fan relay 1 signal	Radiator Fan Relay #1	—	OFF output (when OFF)
Radiator fan relay 2 signal	Radiator Fan Relay #2	—	OFF output (when OFF)
Fuel pump relay signal	Fuel Pump Relay	—	ON output
PCV hose assembly diagnosis signal	Blow-by leak Connector	—	Connected
Pressure control solenoid valve signal	PCV Solenoid Valve	—	OFF output
Drain valve signal	Vent. Solenoid Valve	—	OFF output
Variable valve lift diagnosis oil pressure switch signal 1	Eng. Oil Press. SW 1	—	ON
Variable valve lift diagnosis oil pressure switch signal 2	Eng. Oil Press. SW 2	—	ON
AT coordinate retard angle demand signal	Retard Signal from AT	—	None
AT coordinate fuel cut demand signal	Fuel Cut signal from AT	—	None
Vehicle dynamics control (VDC) torque down prohibition output	Ban of Torque Down	—	Permission
Vehicle dynamics control (VDC) torque down demand	Request Torque Down VDC	—	None
AT coordinate permission signal	Torque permission signal	—	Allowed (prohibited on MT vehicles)

Content	Display	Unit of measure	Note (at idling)
Electronic throttle control motor relay signal	ETC Motor Relay	—	ON
Clutch switch signal	Clutch Switch	—	OFF (when OFF)
Stop light switch signal	Stop Light Switch	—	OFF (when OFF)
SET/COAST switch signal	SET/COAST Switch	—	OFF (when OFF)
RES/ACC switch signal	RESUME/ACCEL Switch	—	OFF (when OFF)
Brake switch signal	Brake Switch	—	OFF input (At OFF)
Main switch signal	Main Switch	—	OFF input (At OFF)
Body integrated unit data reception	Body Int. Unit Data	—	Provided
Body integrated unit counter update	Body Int. Unit Count	—	Provided
Cruise control cancel switch signal	CC Cancel SW	—	OFF input (At OFF)
Malfunction indicator light signal	MIL On Flag	—	Off (when unlit)

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

3. READ CURRENT DATA FOR ENGINE (OBD MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {OBD System}.
5) On «OBD Menu» display, select {Current Data Display & Save}.
6) On «Current Data Display & Save» display, select {All data display}.
7) Using the scroll key, scroll the display screen up or down until the desired data is shown.

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

Content	Display	Note (at idling)	Unit of measure
Number of diagnosis code	Number of Diag. Code:	0	—
Condition of malfunction indicator light	MI(MIL)	OFF	—
Monitoring test of misfire	Misfire monitoring (Supp)	YES	—
Monitoring test of misfire	Misfire monitoring (Rdy)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Supp)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Rdy)	YES	—
Monitoring test of comprehensive component	Component monitoring (Supp)	YES	—
Monitoring test of comprehensive component	Component monitoring (Rdy)	YES	—
Test of catalyst	Catalyst Diagnosis (Supp)	YES	—
Test of catalyst	Catalyst Diagnosis (Rdy)	NO	—
Test of heating-type catalyst	Heated catalyst (Supp)	NO	—
Test of heating-type catalyst	Heated catalyst (Rdy)	N/A	—
Test of evaporative emission purge control system	Evaporative purge system (Supp)	YES	—
Test of evaporative emission purge control system	Evaporative purge system (Rdy)	NO	—
Secondary air system test	Secondary air system (Supp)	NO	—
Secondary air system test	Secondary air system (Rdy)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Supp)	NO	—
Test of air conditioning system refrigerant	A/C system refrigerant (Rdy)	N/A	—
Test of oxygen sensor	Oxygen sensor (Supp)	YES	—
Test of oxygen sensor	Oxygen sensor (Rdy)	NO	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Supp)	YES	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Rdy)	NO	—
Test of EGR system	EGR system (Supp)	YES	—
Test of EGR system	EGR system (Rdy)	NO	—
Air fuel ratio control system for bank 1	Fuel system for Bank 1	Cl_normal	—
Engine load data	Calculated load value	23.0	%
Engine coolant temperature signal	Coolant Temp.	92	°C
Short term fuel trim by front oxygen (A/F) sensor (Bank 1)	Short term fuel trim B1	–0.8	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 1)	Long term fuel trim B1	0.0	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	211	mmHg

Content	Display	Note (at idling)	Unit of measure
Engine speed signal	Engine Speed	700	rpm
Vehicle speed signal	Vehicle Speed	0	km/h
#1 Cylinder ignition timing	Ignition timing #1	16.0	°
Intake air temperature signal	Intake Air Temp.	36	°C
Amount of intake air	Mass Air Flow	2.7	g/s
Throttle position signal	Throttle Opening Angle	13	%
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	0.7	V
A/F correction (Bank 1 Sensor 2)	A/F correction #12	0.0	%
On-board diagnostic system	OBD system	OBD/OBD2	—
Front oxygen (A/F) sensor (Bank 1 Sensor 1)	Oxygen sensor #11	Support	—
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	Support	—
Time elapsed after engine start	Time Since Engine Start	—	sec
Travel distance after the malfunction indicator light illuminates	Lighted MI lamp history	—	km
A/F lambda signal (Bank 1 Sensor 1)	A/F Sensor #11	1.001	—
A/F sensor output signal (Bank 1 Sensor 1)	A/F Sensor #11	2.79	V
Target EGR	Target EGR	—	%
EGR error	EGR error	—	%
Evaporative purge	Commanded Evap Purge	0	%
Fuel level signal	Fuel Level	—	%
Number of warm ups after DTC clear	Number of warm-upsr	—	—
Travel distance after DTC clear	Meter since DTC cleared	—	km
Fuel tank pressure signal	Fuel Tank Pressure	8.8	mmHg
Atmospheric pressure signal	Atmosphere Pressure	Barometric pressure	mmHg
A/F lambda signal (Bank 1 Sensor 1)	A/F Sensor #11	1.001	—
A/F sensor current (Bank 1 Sensor 1)	A/F Sensor #11	0.00	mA
Catalytic temperature #1	Catalytic Temperature #11	—	°C
Monitoring test of misfire	Misfire monitoring (Enable)	YES	—
Monitoring test of misfire	Misfire monitoring (Comp)	NO	—
Monitoring test of fuel system	Fuel system monitoring (Enable)	YES	—
Monitoring test of fuel system	Fuel system monitoring (Comp)	NO	—
Monitoring test of comprehensive component	Component monitoring (Enable)	YES	—
Monitoring test of comprehensive component	Component monitoring (Comp)	NO	—
Test of catalyst	Catalyst Diagnosis (Enable)	YES	—
Test of catalyst	Catalyst Diagnosis (Comp)	NO	—
Test of heating-type catalyst	Heated catalyst (Enable)	N/A	—
Test of heating-type catalyst	Heated catalyst (Comp)	N/A	—
Test of evaporative emission purge control system	Evaporative purge system (Enable)	YES	—
Test of evaporative emission purge control system	Evaporative purge system (Comp)	NO	—
Secondary air system test	Secondary air system (Enable)	N/A	—

Content	Display	Note (at idling)	Unit of measure
Secondary air system test	Secondary air system (Comp)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Enable)	N/A	—
Test of air conditioning system refrigerant	A/C system refrigerant (Comp)	N/A	—
Test of oxygen sensor	Oxygen sensor (Enable)	YES	—
Test of oxygen sensor	Oxygen sensor (Comp)	NO	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Enable)	YES	—
Test of oxygen sensor heater	O2 Heater Diagnosis (Comp)	NO	—
Test of EGR system	EGR system (Enable)	YES	—
Test of EGR system	EGR system (Comp)	NO	—
ECM power voltage	Control module voltage	13.789	V
Absolute load	Absolute Load Value	22	%
A/F ratio target lambda	Target Equivalence Ratio	0.976	—
Relative throttle opening angle	Relative Throttle Pos.	2	%
Ambient temperature	Ambient Temperature	Ambient air temperature	°C
Absolute throttle opening angle 2	Absolute Throttle Pos.#2	32	%
Absolute accelerator opening angle 1	Accelerator Pedal Pos.#1	13	%
Absolute accelerator opening angle 2	Accelerator Pedal Pos.#2	13	%
Target throttle opening angle	Target Throt. Act. Cont.	0	%
Engine operating time while malfunction indicator lit	Time while MIL lighted	—	min
Time elapsed after DTC clear	Time since DTC cleared	—	min
Fuel used	Type of fuel	GAS	—
Relative accelerator opening angle	Relative Accelera. Pos.	0	%
Neutral status	AT drive status/MT gear status	NEUT	—

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

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

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {OBD System}.
5) On «OBD Menu» display, select {Freeze Frame Data Display}.

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

Contents	Display	Unit of measure
Freeze frame data DTC code	Freeze frame data	—
Air fuel ratio control system for bank 1	Fuel system for Bank 1	—
Engine load data	Calculated load value	%
Engine coolant temperature signal	Coolant Temp.	°C or °F
Short term fuel trim by front oxygen (A/F) sensor	Short term fuel trim B1	%
Long term fuel trim by front oxygen (A/F) sensor	Long term fuel trim B1	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg, kPa, inHg or psig
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH
Ignition timing advance for #1 cylinder	Ignition timing #1	°
Intake air temperature signal	Intake Air Temp.	°C or °F
Amount of intake air	Mass Air Flow	g/s or lb/m
Throttle position signal	Throttle Opening Angle	%
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	V
A/F correction (Bank 1 Sensor 2)	Short term fuel trim #12	%
On-board diagnostic system	OBD system	—
Front oxygen (A/F) sensor (Bank 1 Sensor 1)	Oxygen sensor #11	—
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	—
Time elapsed after engine start	Time Since Engine Start	sec
Target EGR	Commanded EGR	%
EGR deviation	EGR Error	%
Evaporative purge	Commanded Evap Purge	%
Fuel level signal	Fuel level	%
Fuel tank pressure signal	Fuel Tank Pressure	mmHg, kPa, inHg or psig
Barometric pressure	Atmosphere Pressure	mmHg, kPa, inHg or psig
ECM power voltage	Control module voltage	V
Absolute load	Absolute Load Value	%
A/F ratio target lambda	Target Equivalence Ratio	—
Relative throttle opening angle	Relative Throttle Pos.	%
Ambient temperature	Ambient Temperature	°C or °F
Absolute throttle opening angle 2	Absolute Throttle Pos.#2	%
Absolute accelerator opening angle 1	Accelerator Pedal Pos.#1	%
Absolute accelerator opening angle 2	Accelerator Pedal Pos.#2	%
Target throttle opening angle	Target Throt. Act. Cont.	%
Neutral status	AT drive status/MT gear status	—

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

5. V.I.N REGISTRATION

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {Entry VIN}.
5) Perform the procedures shown on the display screen.

10.Read Diagnostic Trouble Code (DTC)

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {Diagnostic Code(s) Display}.
5) On «Diagnostic Code(s) Display» display, select {Temporary Diagnostic Code(s)} or {Memorized Diagnostic Code(s)}.

NOTE:
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
• For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>

2. SUBARU SELECT MONITOR (OBD MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {OBD System}.
5) On «OBD Menu» display, select {Diagnostic Code(s) Display}.
6) Make sure DTC is shown on the screen.

NOTE:
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
• For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>

3. GENERAL SCAN TOOL

Refer to data denoting emission-related powertrain DTC.
For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>

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

11.Inspection Mode

A: PROCEDURE

Perform the diagnosis shown in the following DTC table.
When performing the diagnosis not listed in “List of Diagnostic Trouble Code (DTC)”, refer to the item on the drive cycle. <Ref. to EN(H4SO)(diag)-49, Drive Cycle.>

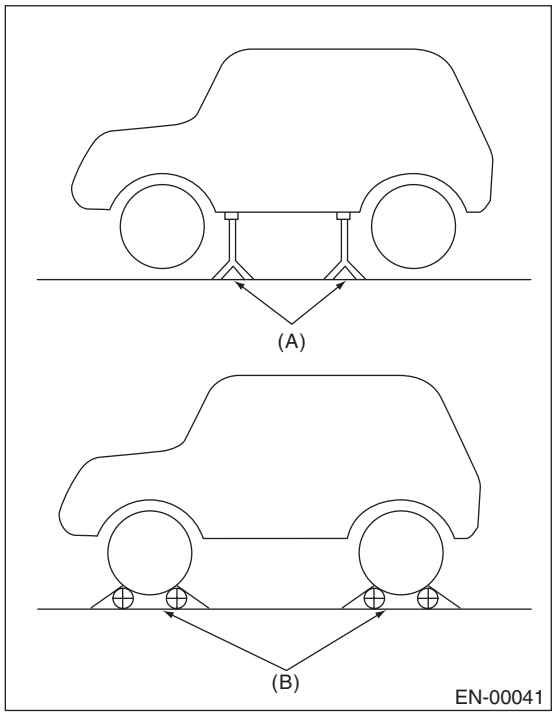
DTC	Item	Condition
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	—
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	—
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	—
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	—
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	—
P0083	Intake Valve Control Solenoid Circuit High (Bank 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 Sensor 1 Circuit Low	—
P0113	Intake Air Temperature Sensor 1 Circuit High	—
P0117	Engine Coolant Temperature Circuit Low	—
P0118	Engine Coolant Temperature Circuit High	—
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	—
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	—
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	—
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	—
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	—
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	—
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	—
P0182	Fuel Temperature Sensor “A” Circuit Low Input	—
P0183	Fuel Temperature Sensor “A” Circuit High Input	—
P0197	Engine Oil Temperature Sensor Low	—
P0198	Engine Oil Temperature Sensor High	—
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	—
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	—
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	—
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	—
P0335	Crankshaft Position Sensor “A” Circuit	—
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	—
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	—
P0341	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor)	—
P0447	Evaporative Emission Control System Vent Control Circuit Open	—
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	—
P0452	Evaporative Emission Control System Pressure Sensor Low Input	—
P0453	Evaporative Emission Control System Pressure Sensor High Input	—
P0458	Evaporative Emission System Purge Control Valve Circuit Low	—
P0462	Fuel Level Sensor “A” Circuit Low	—
P0463	Fuel Level Sensor “A” Circuit High	—
P0500	Vehicle Speed Sensor “A”	—
P0512	Starter Request Circuit	—
P0513	Incorrect Immobilizer Key	—

DTC	Item	Condition
P0604	Internal Control Module Random Access Memory (RAM) Error	—
P0605	Internal Control Module Read Only Memory (ROM) Error	—
P0607	Throttle Control System Circuit Range/Performance	—
P0638	Throttle Actuator Control Range/Performance (Bank 1)	—
P0700	Transmission Control System (MIL Request)	—
P0851	Park/Neutral Switch Input Circuit Low	—
P0852	Park/Neutral Switch Input Circuit High	—
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1)	—
P1153	O2 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	—
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	—
P1560	Back-Up Voltage Circuit Malfunction	—
P1570	Antenna	—
P1571	Reference Code Incompatibility	—
P1572	IMM Circuit Failure	—
P1574	Key Communication Failure	—
P1576	EGI Control Module EEPROM	—
P1577	IMM Control Module EEPROM	—
P1578	Meter Failure	—
P2101	Throttle Actuator Control Motor Circuit Range/Performance	—
P2102	Throttle Actuator Control Motor Circuit Low	—
P2103	Throttle Actuator Control Motor Circuit High	—
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 Correlation	—
P2138	Throttle/Pedal Position Sensor/Switch “D”/“E” Voltage Correlation	—
P2227	Atmospheric Pressure Sensor Range/Performance	—
P2228	Barometric Pressure Circuit Low	—
P2229	Barometric Pressure Circuit High	—
U0073	CAN Failure, Bus “OFF” Detection	—
U0101	CAN (TCU) Data not Loaded	—
U0122	CAN (VDC) Data not Loaded	—
U0140	CAN (BCU) Data not Loaded	—
U0402	CAN (TCU) Data Abnormal	—
U0416	CAN (VDC) Data Abnormal	—
U0422	CAN (BCU) Data Abnormal	—

1. PREPARATION FOR THE INSPECTION MODE

1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].
2) Lift up the vehicle using a garage jack and place it on rigid racks, or drive the vehicle onto free rollers.

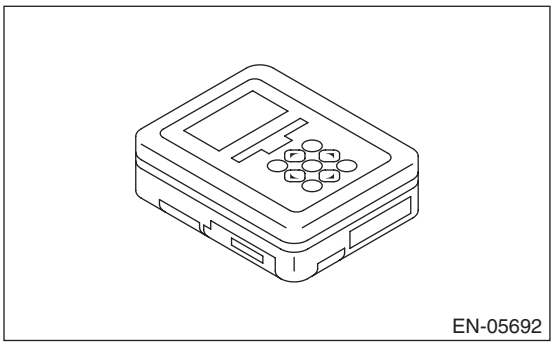
WARNING:
• Before lifting up the vehicle, ensure parking brake is applied.
• Do not use a pantograph jack in place of a rigid rack.
• Secure a rope or wire to the front or rear towing hooks to prevent the lateral runout of front wheels.
• Before rotating the wheels, make sure that there is no one in front of the vehicle. Besides while the wheels are rotating, make sure that no one approaches the vehicle front side.
• Make sure that there is nothing around the wheels. For AWD model, pay special attention to all four wheels.
• While servicing, do not depress or release the clutch pedal or accelerator pedal quickly regardless of the engine speed. Quick operation may cause the vehicle to drop off the free roller.
• To prevent the vehicle from slipping due to vibration, do not place anything between rigid rack and the vehicle.



(A) Rigid rack
(B) Free roller

2. SUBARU SELECT MONITOR

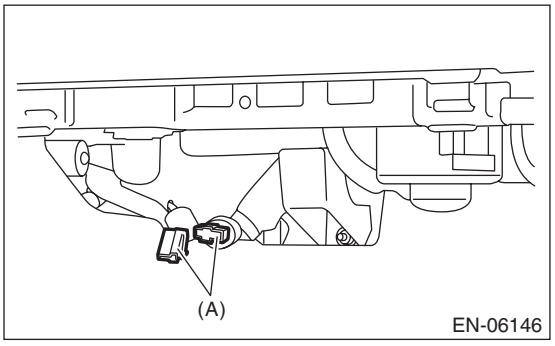
1) Check that no DTC remains after clearing memory. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>
2) Warm up the engine.
3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>



4) Prepare PC with Subaru Select Monitor installed.
5) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

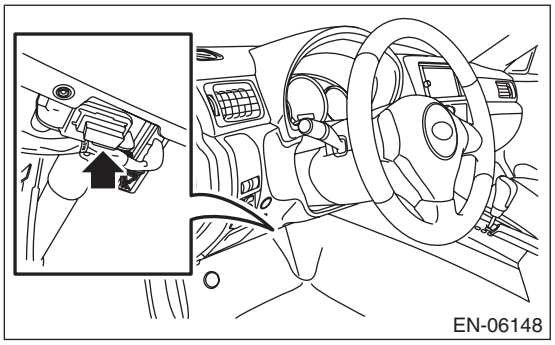
NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

6) Connect the diagnosis cable to SDI.
7) Connect the delivery (test) mode connector (A) located under the glove box.



8) Connect SDI 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.

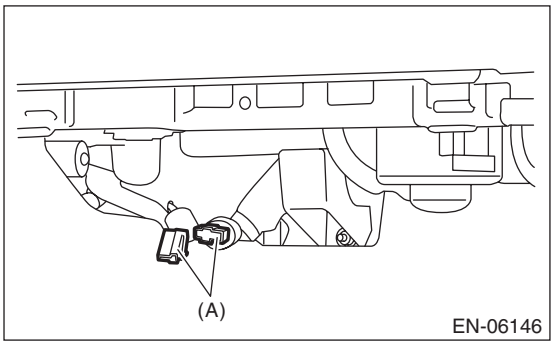


9) Start the PC.
10) Turn the ignition switch to ON (engine OFF) and run the “PC application for Subaru Select Monitor”.
11) On «Main Menu» display, select {Each System Check}.
12) On «System Selection Menu» display, select {Engine Control System}.
13) Click the [OK] button after the information of engine type has been displayed.
14) On «Engine Diagnosis» display, select {Dealer Check Mode Procedure}.
15) When the «Perform Inspection (Dealer Check) Mode?» is shown on the screen, click the [Next] button.
16) 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 procedures, refer to “PC application help for Subaru Select Monitor”.
• For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”.
<Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>
• Release the parking brake.
• The speed difference between front and rear wheels may light the ABS warning light, but this does not indicate a malfunction. When engine control system diagnosis is finished, perform the VDC memory clearance procedure of self-diagnosis function. <Ref. to VDC(diag)-25, Clear Memory Mode.>

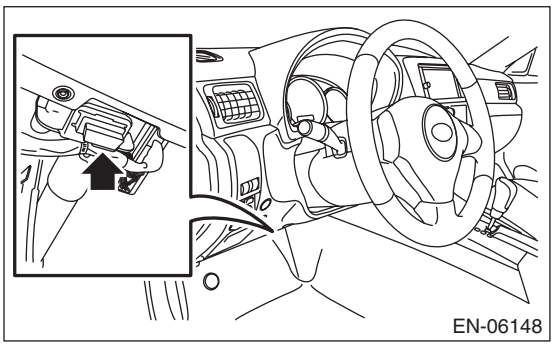
3. GENERAL SCAN TOOL

1) Check that no DTC remains after clearing memory. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>
2) Warm up the engine.
3) Connect the delivery (test) mode connector (A) located under the glove box.



4) Connect the general scan tool 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.



5) Start the engine.

NOTE:
• Ensure the selector lever is placed in “P” range before starting. (AT model)
• Depress the clutch pedal when starting engine. (MT model)
6) Turn the neutral position switch to ON using select lever or shift lever.
7) Depress the brake pedal to turn the brake switch ON. (AT model)
8) Keep the engine speed in 2,500 — 3,000 rpm range for 40 seconds.
9) Place the select lever or shift lever in D position (AT model) or 1st gear (MT model) and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

NOTE:
• For AWD model, release the parking brake.
• The speed difference between front and rear wheels may light the ABS warning light, but this indicates no malfunctions. When engine control system diagnosis is finished, perform the VDC memory clearance procedure of self-diagnosis function. <Ref. to VDC(diag)-25, Clear Memory Mode.>

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

NOTE:
• For detailed operation procedures, refer to the general scan tool operation manual.
• For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”.
<Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>

12.Drive Cycle

A: PROCEDURE

It is necessary to perform the drive cycle listed below if DTC is not found in the Inspection Mode. It is possible to complete diagnosis of the DTC by performing the indicated drive cycle. After the repair for the DTC, perform a necessary drive cycle and make sure the function recovers and the DTC is recorded.

1. PREPARATION FOR DRIVE CYCLE

1) Check that the battery voltage is 12 V or more and fuel remains approx. half [20 — 40 ℓ (5.3 — 10.6 US gal, 4.4 — 8.8 Imp gal)].
2) After performing the diagnostics and Clear Memory Mode, check that no DTC remains. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>
3) Check the delivery (test) mode connector is disconnected.

NOTE:
• Perform the drive cycle after warming up the engine except when the engine coolant temperature at engine start is specified.
• Perform the drive cycle twice if the DTC in the list is marked with *. After completing the first drive cycle, stop the engine and perform second diagnosis in same condition.

2. DRIVE CYCLE A

DTC	Item	Condition
*P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	Coolant temperature at start is less than 20°C (68°F).
*P0126	Insufficient Engine Coolant Temperature for Stable Operation	—
*P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	—
*P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	—
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle B or C as well.
*P0172	System Too Rich (Bank 1)	Diagnosis completes in drive cycle B or C as well.
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	—
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle B or C as well.
*P0420	Catalyst System Efficiency Below Threshold (Bank 1)	—
*P0442	Evaporative Emission Control System Leak Detected (Small Leak)	Engine coolant temperature at engine start is less than 30°C (86°F).
*P0451	Evaporative Emission Control System Pressure Sensor	—
*P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	Engine coolant temperature at engine start is less than 30°C (86°F).
*P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	Engine coolant temperature at engine start is less than 30°C (86°F).
*P0459	Evaporative Emission System Purge Control Valve Circuit High	—
P1443	Vent Control Solenoid Valve Function Problem	—
*P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Diagnosis completes in drive cycle B or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Diagnosis completes in drive cycle B or C as well.

Diagnostic procedure:
1) Drive for 20 minutes at a constant speed of 80 km/h (50 MPH).
2) Stop the vehicle and idle for one minute.

3. DRIVE CYCLE B

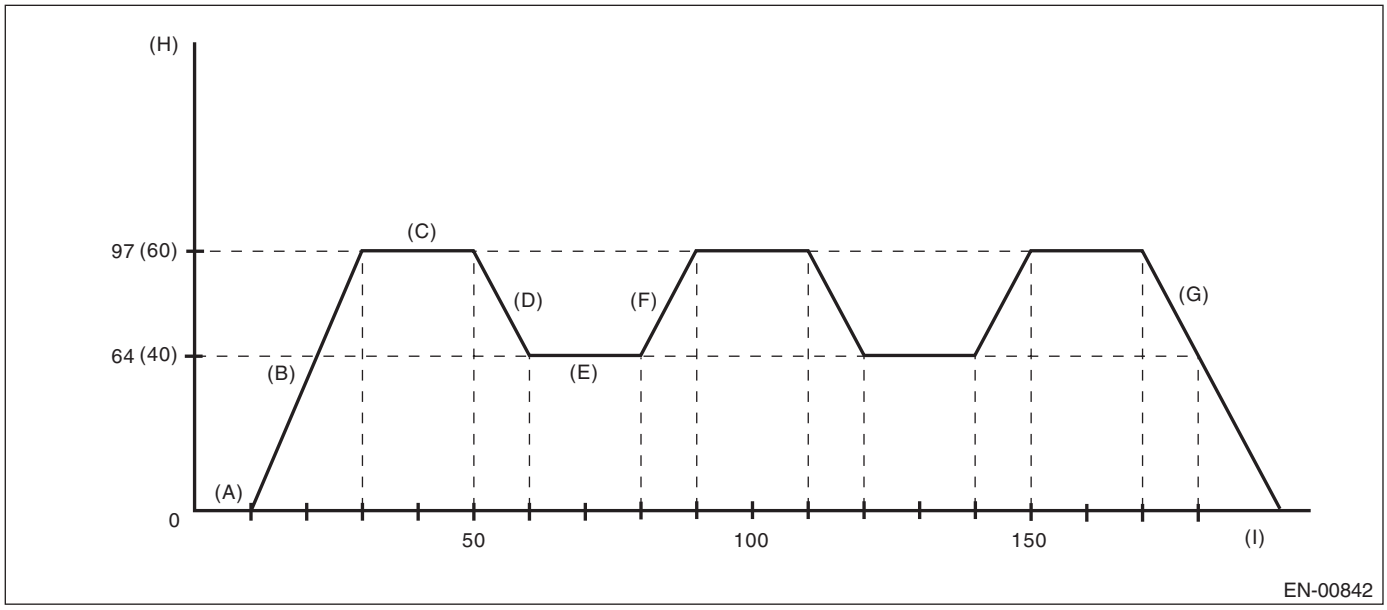
DTC	Item	Condition
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or C as well.
*P0172	System Too Rich (Bank 1)	Diagnosis completes in drive cycle A or C as well.
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle A or C as well.
*P0464	Fuel Level Sensor Circuit Intermittent	—
*P0506	Idle Air Control System RPM Lower Than Expected	—
*P0507	Idle Air Control System RPM Higher Than Expected	—
*P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Diagnosis completes in drive cycle A or C as well.

Diagnostic procedure:
1) Drive at 10 km/h (6 MPH) or more.
2) Stop the vehicle and idle for ten minutes.

4. DRIVE CYCLE C

DTC	Item	Condition
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	—
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	—
*P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	—
*P0068	MAP/MAF - Throttle Position Correlation	—
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	—
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	—
*P0101	Mass or Volume Air Flow Circuit Range/Performance	—
*P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	—
*P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	—
*P0171	System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or B as well.
*P0172	System Too Rich (Bank 1)	Diagnosis completes in drive cycle A or B as well.
*P0301	Cylinder 1 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0302	Cylinder 2 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0303	Cylinder 3 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0304	Cylinder 4 Misfire Detected	Diagnosis completes in drive cycle A or B as well.
*P0400	Exhaust Gas Recirculation Flow	—
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	—
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	—
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	—
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	—
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	—
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	—
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	—
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	—
*P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Diagnosis completes in drive cycle A or B as well.
*P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Diagnosis completes in drive cycle A or B as well.

Diagnostic procedure:
Drive according to the drive pattern described below.



(A)	Idle the engine for 10 seconds or more.	(D)	Decelerate with fully closed throttle to 64 km/h (40 MPH).	(G)	Stop vehicle with the throttle fully closed.
(B)	Accelerate to 97 km/h (60 MPH) within 20 seconds.	(E)	Drive the vehicle at 64 km/h (40 MPH) for 20 seconds.	(H)	Vehicle speed km/h (MPH)
(C)	Drive the vehicle at 97 km/h (60 MPH) for 20 seconds.	(F)	Accelerate to 97 km/h (60 MPH) within 10 seconds.	(I)	Sec.

5. DRIVE CYCLE D

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

NOTE:
In drive cycle D, one drive cycle will be established when both the drift diagnosis and stuck diagnosis have completed.
Diagnostic procedure:

DRIFT DIAGNOSIS

1) Make sure of the items below before starting the engine.
- Engine coolant temperature is less than 30°C (86°F).
- Remaining fuel is 10 ℓ (2.6 US gal, 2.2 Imp gal) or more.
- Battery voltage is 10.9 V or more.

2) Idle the engine until engine coolant temperature is at least 10°C (18°F) higher than it was when engine started.
3) After the engine has reached the state of procedure 2), idle the engine for another 5 minutes or more.

STUCK DIAGNOSIS

1) Make sure that the battery voltage is 10.9 V or more.
2) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>
3) Drive for approximately 50 ℓ (13.2 US gal, 11 Imp gal) of fuel.

NOTE:
- It is acceptable to drive the vehicle intermittently.
- Do not disconnect the battery terminals during stuck diagnosis.(Data will be cleared by disconnecting the battery terminals.)

6. DRIVE CYCLE E

DTC	Item	Condition
*P0461	Fuel Level Sensor “A” Circuit Range/Performance	—

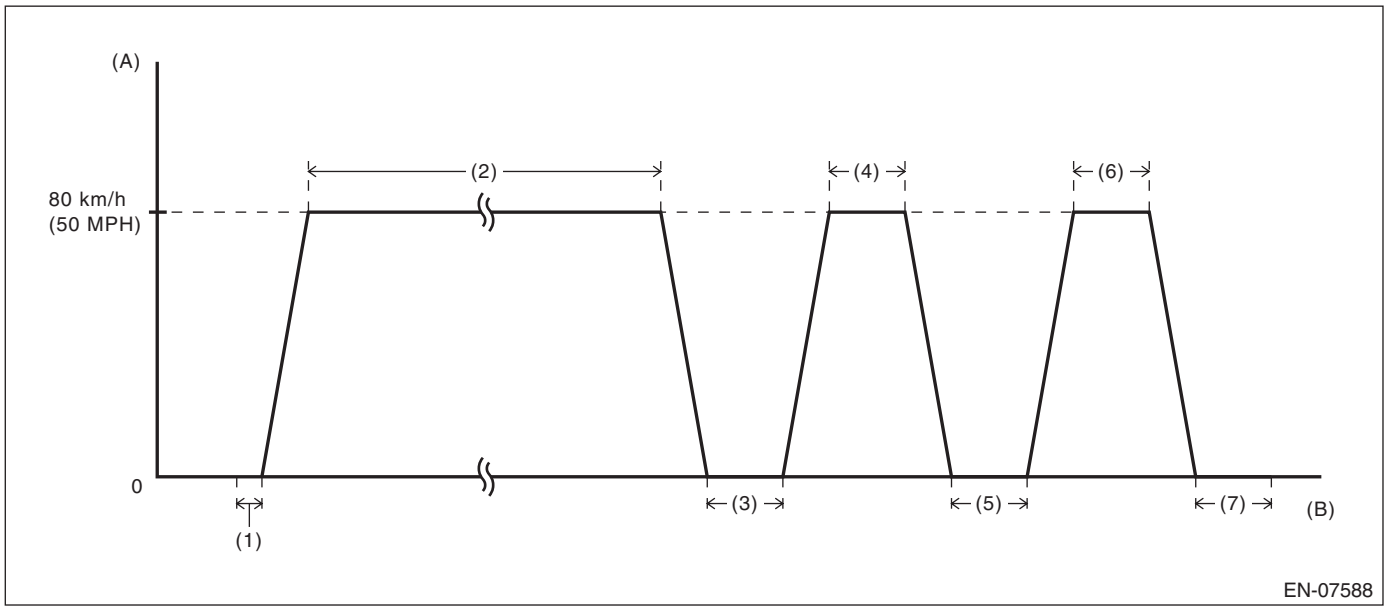
Diagnostic procedure:
1) Make sure that the battery voltage is 10.9 V or more.
2) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>
3) Drive for approximately 30 ℓ (7.9 US gal, 6.6 Imp gal) of fuel.

NOTE:
- It is acceptable to drive the vehicle intermittently.
- Do not disconnect the battery terminals while diagnosing.(Data will be cleared by disconnecting the battery terminals.)

7. DRIVE CYCLE F

DTC	Item	Condition
*P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	—

Diagnostic procedure:
1) Make sure that the engine coolant temperature is less than 30°C (86°F).
2) Drive according to the drive pattern described below.



(A) Vehicle speed
(B) Elapsed time
(1) Idle the engine for 10 seconds after engine start.
(2) Drive for 8 minutes at a constant speed of 80 km/h (50 MPH).
(3) Stop the vehicle and idle for 30 seconds.
(4) Drive for 30 seconds at a constant speed of 80 km/h (50 MPH).
(5) Stop the vehicle and idle for 30 seconds.
(6) Drive for 30 seconds at a constant speed of 80 km/h (50 MPH).
(7) Stop the vehicle and idle for 30 seconds.

NOTE:
- There is no given transition time between idling and cruising.
- Driving at constant speed only on a downhill causes smaller engine load and may result in failure to obtain a right diagnostic result.
- When the engine stops while performing drive cycle F, perform it again from the state of procedure 1).

8. DRIVE CYCLE H

DTC	Item	Condition
*P1602	Control Module Programming Error	—

1) Perform the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>
2) With the ignition switch ON, read the engine coolant temperature, intake air temperature and fuel temperature. <Ref. to EN(H4SO)(diag)-35, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>
3) If the values from step 2) satisfy the following two conditions, idle the engine for one minute.

Condition:
|Engine coolant temperature — Intake air temperature| ≤ 5°C (41°F)
|Engine coolant temperature — Fuel temperature| ≤ 2°C (36°F)

NOTE:
- If the conditions are not satisfied, turn the ignition switch to OFF and wait until the parameters are satisfied.
- For AT models, hold the select lever to “P” range or “N” range at idling, and for MT models, the shift lever in the neutral position at idling.

13.Clear Memory Mode

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {Clearing Memory}.
5) When the “Clear Memory?” is shown on the screen, click the [YES] button.
6) When “Done” and “Turn off the ignition switch.” are shown on the display screen, turn the ignition switch to OFF.

NOTE:
• Initial diagnosis of electronic throttle control is performed after memory clearance. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

2. SUBARU SELECT MONITOR (OBD MODE)

1) On «Main Menu» display, select {Each System Check}.
2) On «System Selection Menu» display, select {Engine Control System}.
3) Click the [OK] button after the information of engine type has been displayed.
4) On «Engine Diagnosis» display, select {OBD System}.
5) On «OBD Menu» display, select {Clear Diagnostic Code(s)}.
6) When the “Clear Diagnostic Code?” is shown on the screen, click the [Yes] button.
7) When “Done” and “Turn off the ignition switch.” are shown on the display screen, turn the ignition switch to OFF.

NOTE:
• Initial diagnosis of electronic throttle control is performed after memory clearance. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.
• For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

3. GENERAL SCAN TOOL

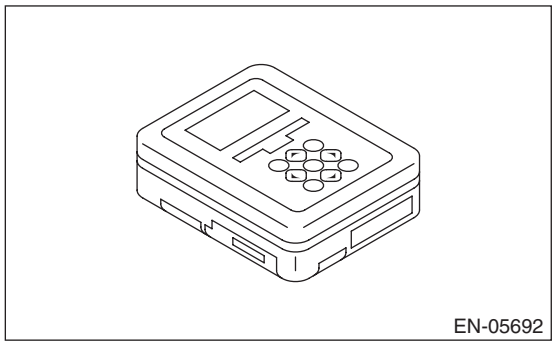
For clear memory procedures using the general scan tool, refer to “General Scan Tool Instruction Manual”.

NOTE:
Initial diagnosis of electronic throttle control is performed after memory clearance. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.

14. Compulsory Valve Operation Check Mode

A: OPERATION

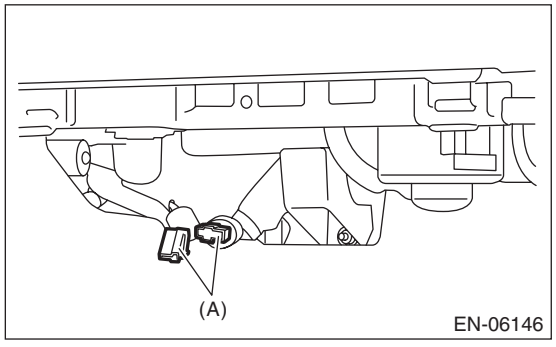
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>


EN-05692

2) Prepare PC with Subaru Select Monitor installed.
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.

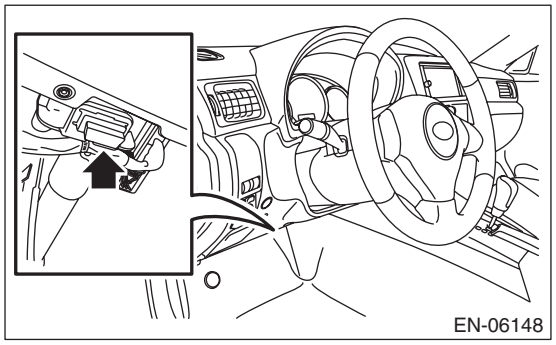
4) Connect the diagnosis cable to SDI.
5) Connect the delivery (test) mode connector (A) located under the glove box.



EN-06146

6) Connect SDI 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.


EN-06148

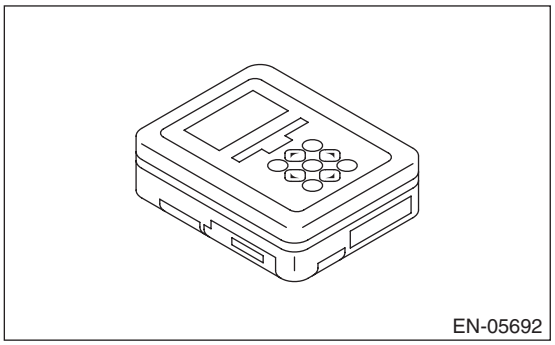
7) Start the PC.
8) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
9) On «Main Menu» display, select {Each System Check}.
10) On «System Selection Menu» display, select {Engine Control System}.
11) Click the [OK] button after the information of engine type has been displayed.
12) On «Engine Diagnosis» display, select {System Operation Check Mode}.
13) On «System Operation Check Mode» display, select {Actuator ON/OFF Operation}.
14) Select the actuator to be forcibly driven on the «Actuator ON/OFF Operation» display and click the [Next] button.
15) Clicking the [Finished] button completes the compulsory drive mode of actuator. The display will then return to the «Actuator ON/OFF Operation» screen.

NOTE:
For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".

15. System Operation Check Mode

A: OPERATION

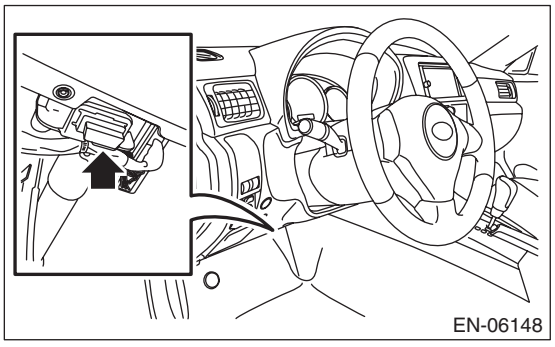
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4SO)(diag)-8, PREPARATION TOOL, General Description.>


EN-05692

2) Prepare PC with Subaru Select Monitor installed.
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

NOTE:
The dedicated port for the Subaru Select Monitor means the USB port which was used to install the Subaru Select Monitor.
4) Connect the diagnosis cable to SDI.
5) Connect SDI 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.


EN-06148

6) Start the PC.
7) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
8) On «Main Menu» display, select {Each System Check}.
9) On «System Selection Menu» display, select {Engine Control System}.
10) Click the [OK] button after the information of engine type has been displayed.
11) On «Engine Diagnosis» display, select {System Operation Check Mode}.
12) The following items are displayed on the monitor.

Display
Actuator ON/OFF Operation
Immobilizer System
Fuel Pump Control
Idling Ignition Timing Fixed
IDLE SPEED CONTROL
Injector Control
EGR VALVE CONTROL

1. FUEL PUMP CONTROL (OFF DRIVE)

CAUTION:
After executing the system operation check mode, execute the Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>.
1) On «System Operation Check Mode» display, select {Fuel Pump Control}.
2) On «Fuel Pump Control» display, select {OFF Drive}.
3) On «Start the Engine» display, start the engine and click the [OK] button.
4) On «OFF Drive» display, click the [Execution] button and execute the OFF drive.
5) Click the [Cancel] button to stop the OFF drive.
6) Click the [F12 Exit] button to end the OFF drive. The screen will return to the «Fuel Pump Control» screen.

NOTE:
For detailed operation procedures, refer to "PC application help for Subaru Select Monitor".

2. FUEL PUMP CONTROL (ON/OFF DRIVE)

CAUTION:
After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>
1) On «System Operation Check Mode» display, select {Fuel Pump Control}.
2) On «Fuel Pump Control» display, select {ON/OFF Dr.}.
3) On «Turn Ignition Switch ON with Engine OFF» display, turn the ignition switch to ON and click the [OK] button.
4) On «ON/OFF Dr.» display, click the [Execution] button and execute the ON/OFF drive.
5) Click the [Cancel] button to stop the ON/OFF drive.

6) Click the [F12 Exit] button to end the ON/OFF drive. The screen will return to the «Fuel Pump Control» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

3. IDLING IGNITION TIMING FIXED

CAUTION:
After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>
1) On «System Operation Check Mode» display, select {Fixed Idle Ignition Timing}.
2) On «Start the Engine» display, start the engine and click the [OK] button.
3) On «Fixed Idle Ignition Timing» display, click the [Execution] button and execute the idling ignition timing fixed.
4) Click the [Cancel] button to stop the idling ignition timing fixed.
5) Click the [F12 Exit] button to end the idling ignition timing fixed. The screen will return to the «System Operation Check Mode» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

4. IDLE SPEED CONTROL

CAUTION:
After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>
1) On «System Operation Check Mode» display, select {Idle Speed Control}.
2) On «Start the Engine» display, start the engine and click the [OK] button.
3) In the «Idle Speed Control» display, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.
Setting is possible in a range between 500 rpm — 2,000 rpm, in increments of 50 rpm. However, the engine speed that can actually be controlled will vary depending on the vehicle.
4) Click the [Cancel] button to stop the idle speed control.
5) Click the [F12 Exit] button to end the idle speed control. The screen will return to the «System Operation Check Mode» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

5. INJECTOR CONTROL (INJECTION STOP MODE)

CAUTION:
After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>
1) On «System Operation Check Mode» display, select {Injector Control}.
2) On «Injector Control» display, select {Injection Stop Mode}.
3) On «Injection Stop Mode» display, select the fuel injector to be stopped.
4) On «Start the Engine» display, start the engine and click the [OK] button.
5) On «Fuel Injector #» display, click the [Execution] button and execute the injection stop mode.
6) Click the [Cancel] button to stop the injection stop mode.
7) Click the [F12 Exit] button to return to the «Injection Stop Mode» display screen.
8) On «Injection Stop Mode» display, click the [Return] button to end the «Injection Stop Mode». The screen will return to the «Injector Control» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

6. INJECTOR CONTROL. (INJECTION QUANTITY CONTROL)

CAUTION:
After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>
1) On «System Operation Check Mode» display, select {Injector Control}.
2) On «Injector Control» display, select {Injection Quantity Control}.
3) On «Start the Engine» display, start the engine and click the [OK] button.
4) In the «Injection Quantity Control» display, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.
Setting is possible in a range between 0 — 20%, in increments of 1%.
5) Click the [Cancel] button to stop the injection quantity control.
6) Click the [F12 Exit] button to end the injection quantity control. The screen will return to the «Injector Control» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

7. EGR VALVE CONTROL

CAUTION:
After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>

1) On «System Operation Check Mode» display, select {EGR Valve Control}.
2) On «Start the Engine» display, start the engine and click the [OK] button.
3) In the «EGR Valve Control» display, click the [△] button or the [▽] button to change the setting values, then click the [OK] button.
Setting is possible in increments of 1 STEP. However, the STEP number that can actually be controlled will vary depending on the vehicle.
4) Click the [Cancel] button to stop the EGR valve control.
5) Click the [F12 Exit] button to end the EGR valve control. The screen will return to the «System Operation Check Mode» screen.

NOTE:
For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.

16.Malfunction Indicator Light

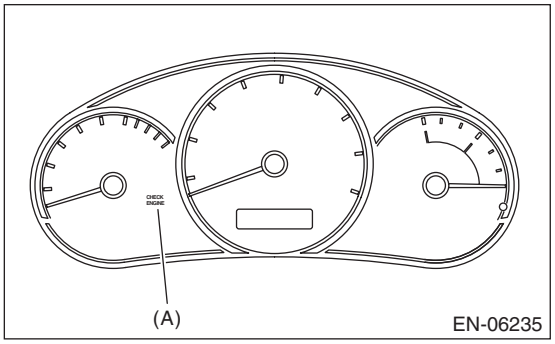
A: PROCEDURE

1. Activation of malfunction indicator light <Ref. to EN(H4SO)(diag)-62, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.>
↓
2. Malfunction indicator light does not come on <Ref. to EN(H4SO)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
↓
3. Malfunction indicator light does not go off <Ref. to EN(H4SO)(diag)-66, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF, Malfunction Indicator Light.>
↓
4. Malfunction indicator light does not blink <Ref. to EN(H4SO)(diag)-67, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK, Malfunction Indicator Light.>
↓
5. Malfunction indicator light remains blinking <Ref. to EN(H4SO)(diag)-69, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING, Malfunction Indicator Light.>

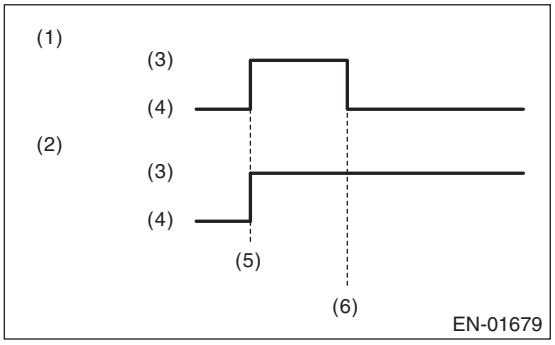
B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

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

NOTE:
If the malfunction indicator light does not illuminate, perform diagnostics of the malfunction indicator light circuit or the combination meter circuit. <Ref. to EN(H4SO)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>

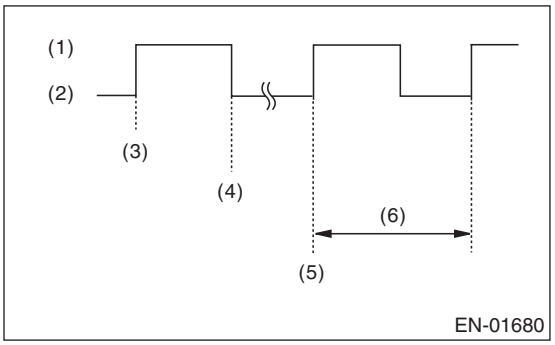


2) After starting the engine, the malfunction indicator light goes out. If it does not go off, any of the engine and emission control system has malfunction.



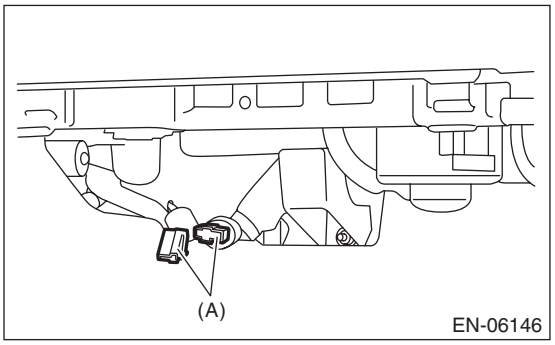
(1) No faulty
(2) Trouble occurs
(3) ON
(4) OFF
(5) Ignition switch ON
(6) Engine start

3) If the diagnostic system detects a misfire which could damage the catalyst, the malfunction indicator light will blink at a cycle of 1 Hz.



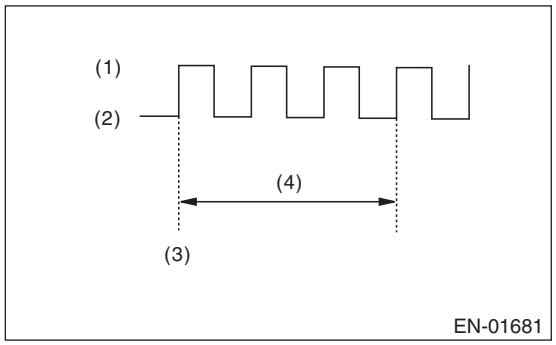
(1) ON
(2) OFF
(3) Ignition switch ON
(4) Engine start
(5) Misfire start
(6) 1 seconds

4) Turn the ignition switch to OFF, and connect the delivery (test) mode connector (A) located under the glove box.



(1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light illuminates.
(2) After the engine starts, malfunction indicator light blinks in a cycle of 0.5 Hz. (During diagnosis)

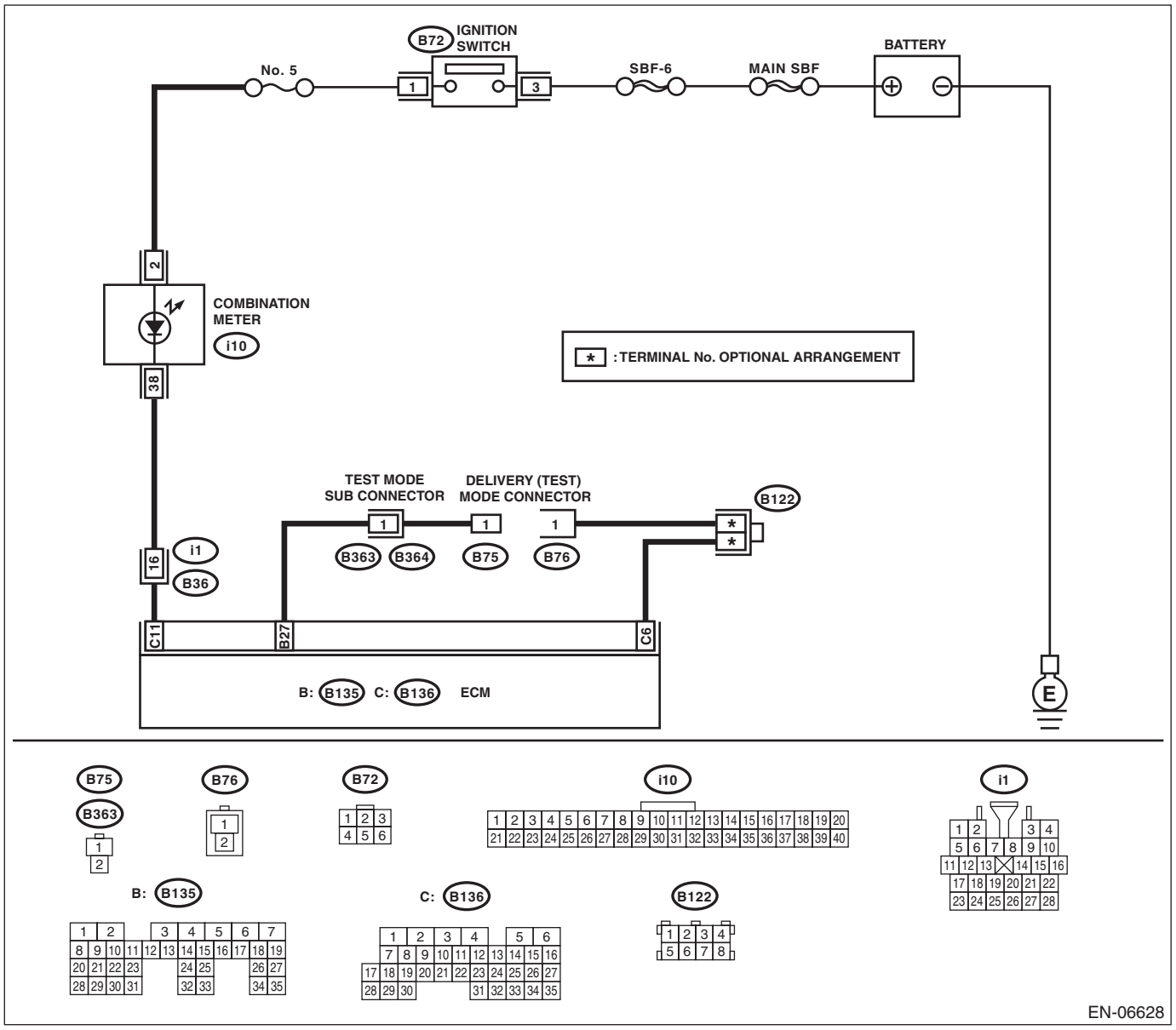
(3) Malfunction indicator light blinks at a cycle of 3 Hz after diagnosis if there is no trouble. Malfunction indicator light illuminates if faulty.



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

C: MALFUNCTION INDICATOR LIGHT DOES NOT COME ON

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



Step		Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 11 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **5**.	Go to step **2**.

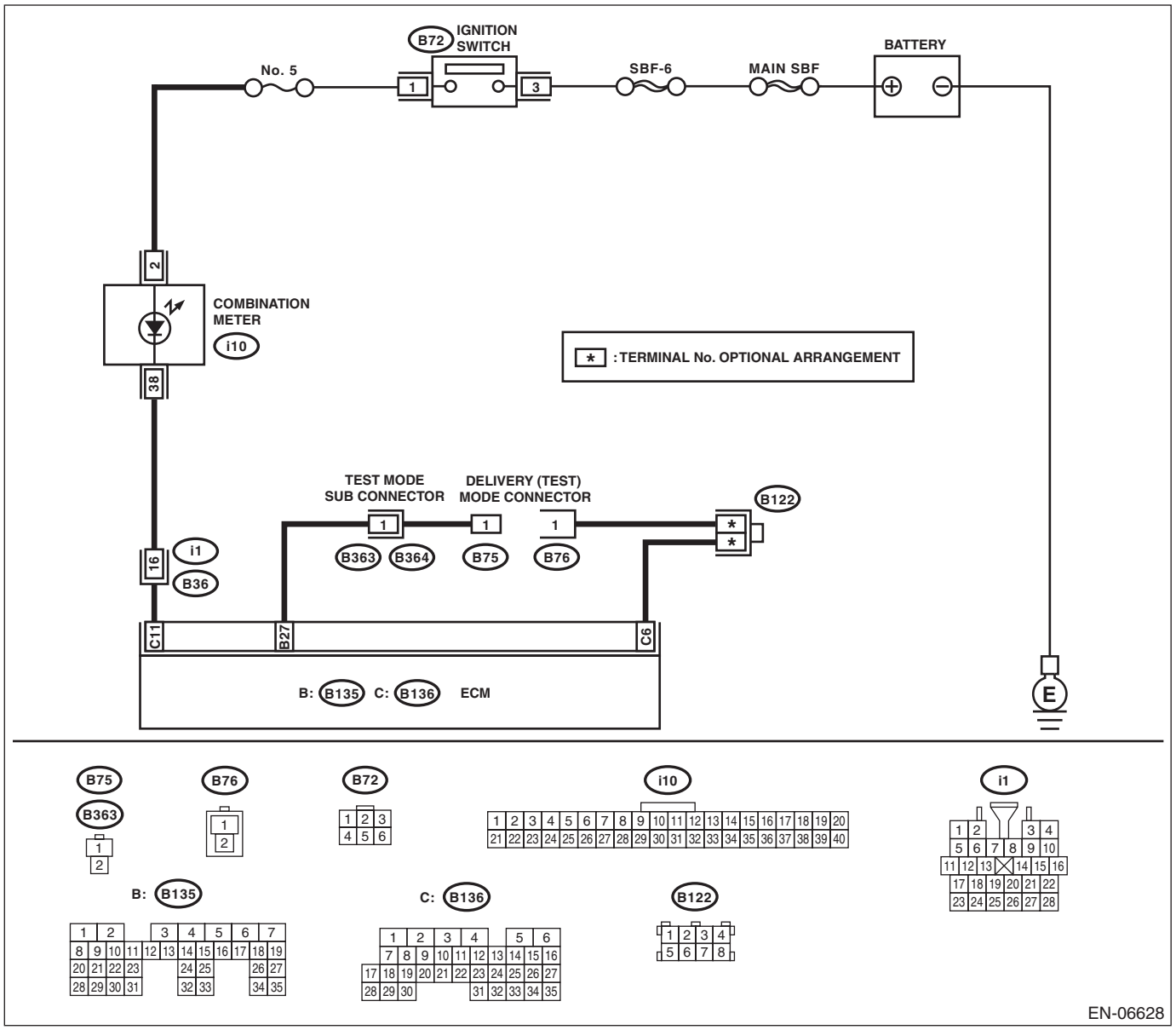
	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the combination meter. <Ref. to IDI-15, Combination Meter.> 3) Disconnect the connector from ECM and combination meter. 4) Measure the resistance of harness between ECM and combination meter connector. ***Connector & terminal*** ***(B136) No. 11 — (i10) No. 38:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and combination meter connector • Poor contact of coupling connector
3	**CHECK FOR POOR CONTACT.** Check for poor contact of combination meter connector.	Is there poor contact of combination meter connector?	Repair the poor contact of combination meter connector.	Go to step **4**.
4	**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*** ***(i10) No. 2 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Replace the meter case assembly of combination meter. <Ref. to IDI-15, Combination Meter.>	Check the following item and repair if necessary. NOTE: • Blown out of fuse (No. 5) • Open or ground short circuit of harness of power supply circuit
5	**CHECK FOR POOR CONTACT.** Check for poor connection by shaking or pulling ECM connector and harness.	Does the malfunction indicator light illuminate?	Repair the poor contact of ECM connector.	Go to step **6**.
6	**CHECK ECM CONNECTOR.** Check the connection of ECM connector.	Is the ECM connector correctly connected?	Replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>	Repair the connection of ECM connector.

D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF

DIAGNOSIS:
The malfunction indicator light circuit is shorted.

TROUBLE SYMPTOM:
Although malfunction indicator light comes on when the engine runs, DTC is not shown on the Subaru Select Monitor display.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Turn the ignition switch to ON.	Does the malfunction indicator light illuminate?	Repair the short circuit of harness between ECM and combination meter connector.	Replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>

E: MALFUNCTION INDICATOR LIGHT DOES NOT BLINK

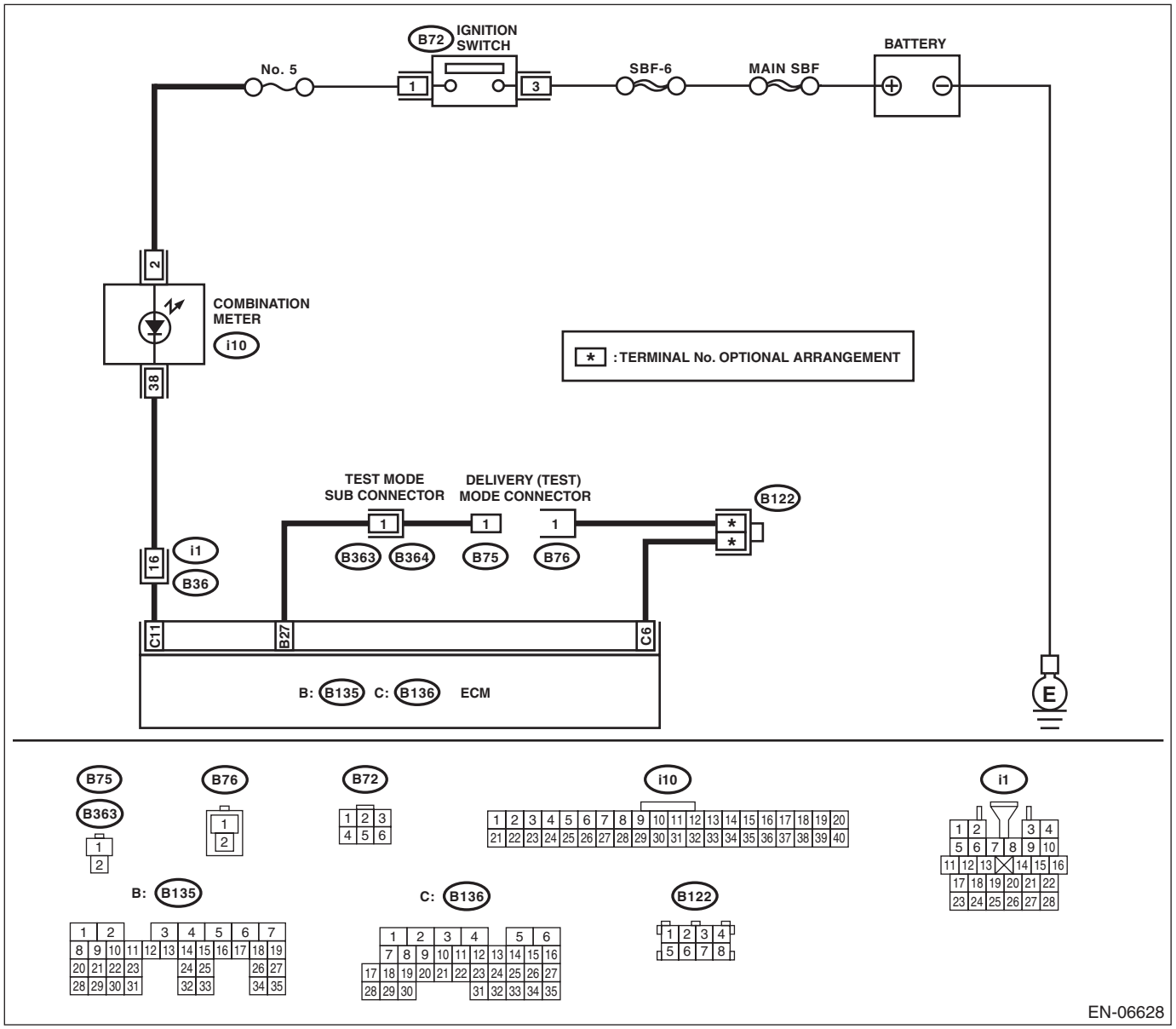
DIAGNOSIS:

- The malfunction indicator light circuit is open or shorted.
- The delivery (test) mode connector circuit is open.

TROUBLE SYMPTOM:

Malfunction indicator light does not blink during Inspection Mode.

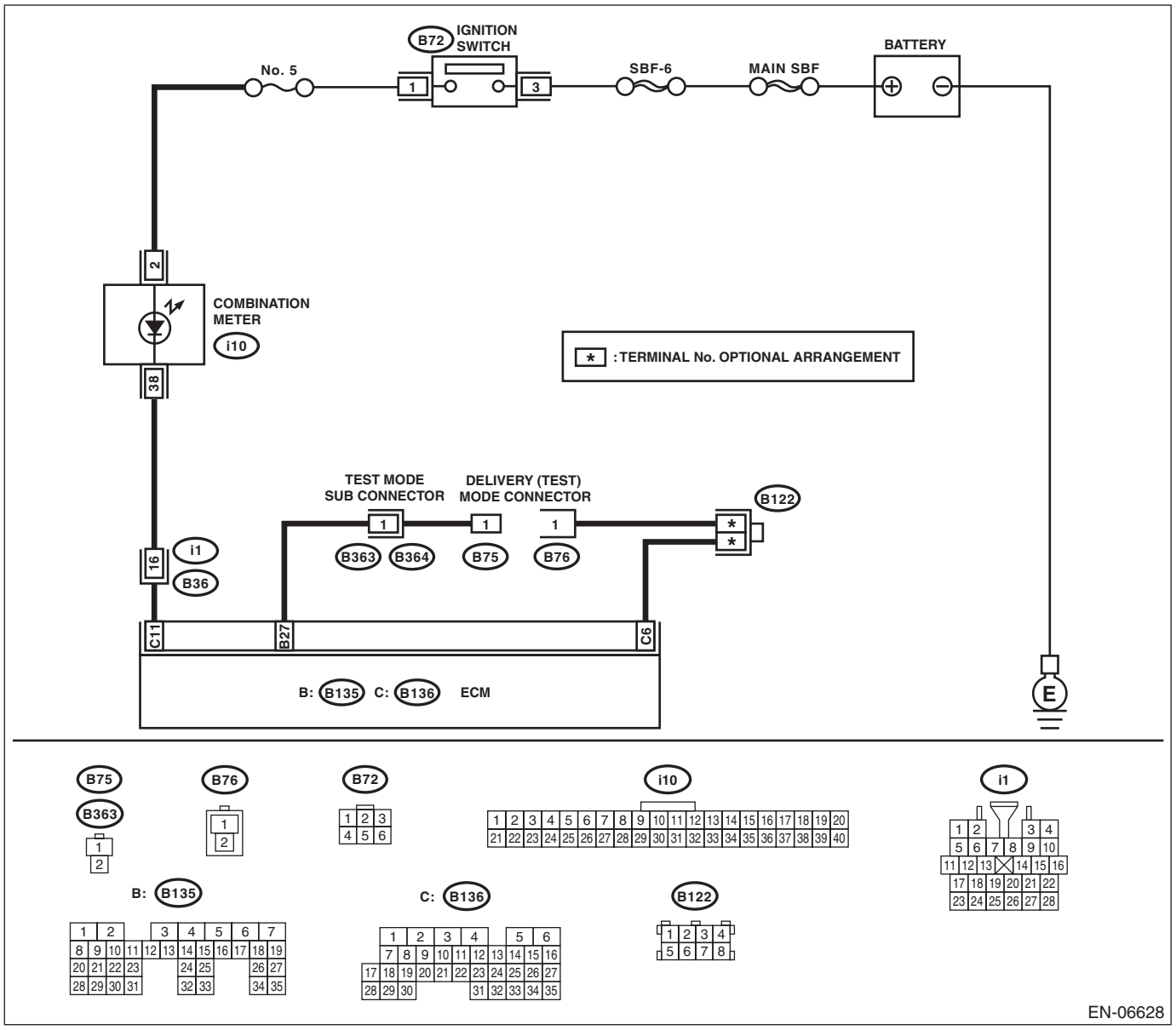
WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.** 1) Turn the ignition switch to OFF. 2) Check the delivery (test) mode connector is disconnected. 3) Turn the ignition switch to ON. (engine OFF)	Does the malfunction indicator light illuminate?	Go to step **2**.	Repair the malfunction indicator light circuit. <Ref. to EN(H4SO)(diag)-64, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
2	**CHECK HARNESS BETWEEN ECM AND COMBINATION METER CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Turn the ignition switch to ON.	Does the malfunction indicator light illuminate?	Repair the ground short circuit of harness between ECM and combination meter connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Connect the delivery (test) mode connector. 3) Measure the resistance of harness between ECM connectors. ***Connector & terminal*** ***(B135) No. 27 — (B136) No. 6:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM connector • Poor contact of each connector between ECM connector.
4	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>

F: MALFUNCTION INDICATOR LIGHT REMAINS BLINKING

DIAGNOSIS:
The delivery (test) mode connector circuit is shorted.
TROUBLE SYMPTOM:
Malfunction indicator light blinks when delivery (test) mode connector is not connected.
WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK DELIVERY (TEST) MODE CONNECTOR.** 1) Check the delivery (test) mode connector is disconnected. 2) Turn the ignition switch to ON.	Does the malfunction indicator light blink?	Go to step **2**.	System is normal. NOTE: Malfunction indicator light blinks when delivery (test) mode connector is connected.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 27 — Chassis ground:***	Is the resistance less than 5 Ω?	Repair the short circuit to ground in harness between ECM and delivery (test) mode connector.	Replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>

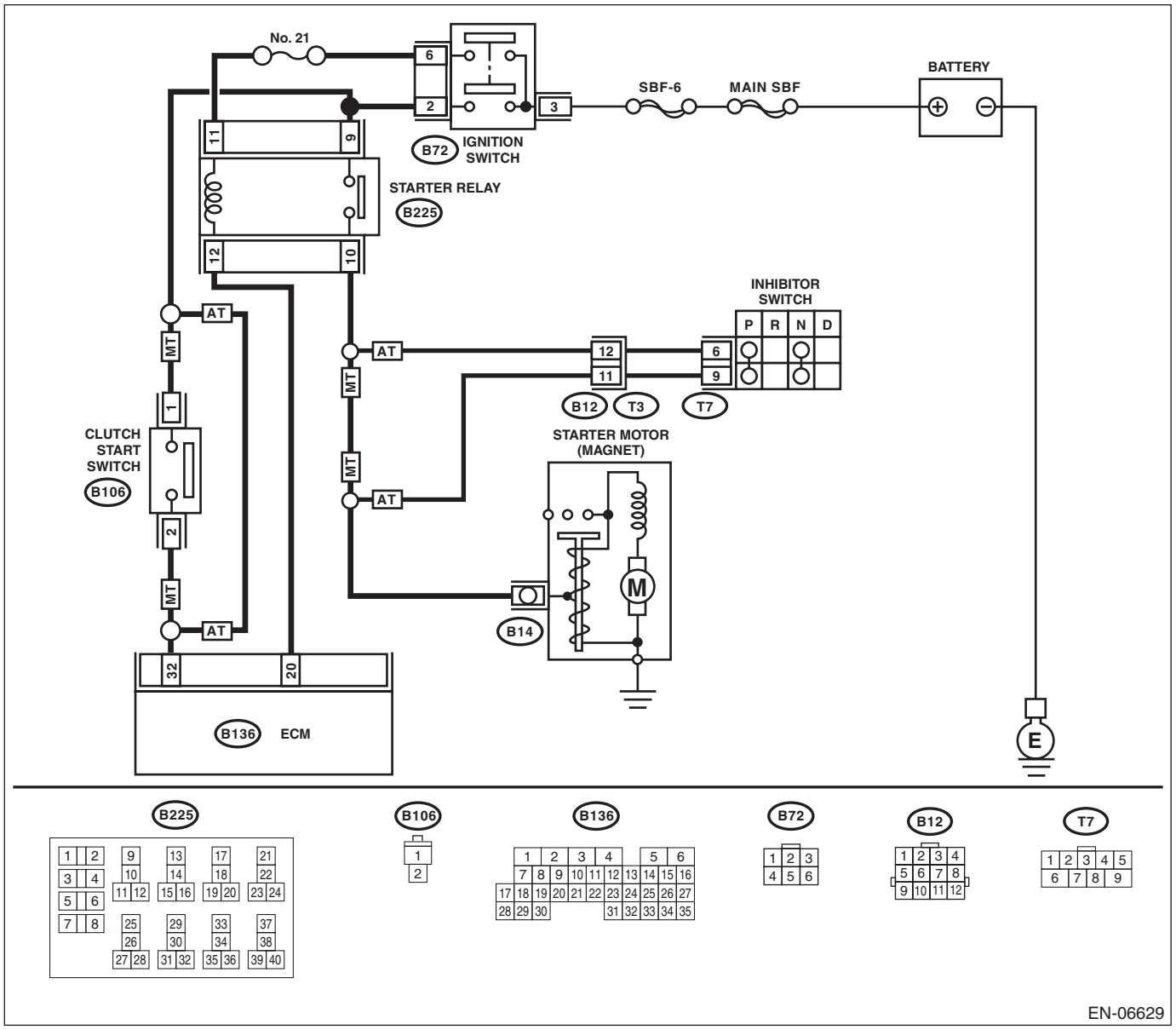
17.Diagnostics for Engine Starting Failure

A: PROCEDURE

1. Check of the fuel amount
↓
2. Inspection of starter motor circuit <Ref. to EN(H4SO)(diag)-72, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ECM power supply and ground line <Ref. to EN(H4SO)(diag)-76, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>
↓
4. Inspection of ignition control system <Ref. to EN(H4SO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel pump circuit <Ref. to EN(H4SO)(diag)-81, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
6. Inspection of fuel injector circuit <Ref. to EN(H4SO)(diag)-84, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

B: STARTER MOTOR CIRCUIT

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, Inspection Mode.>.
WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK BATTERY.** Check the battery voltage.	Is the voltage 12 V or more?	Go to step **2**.	Charge or replace the battery.
2	**CHECK OPERATION OF STARTER MOTOR.**	Does the starter motor operate?	Go to step **3**.	Go to step **4**.

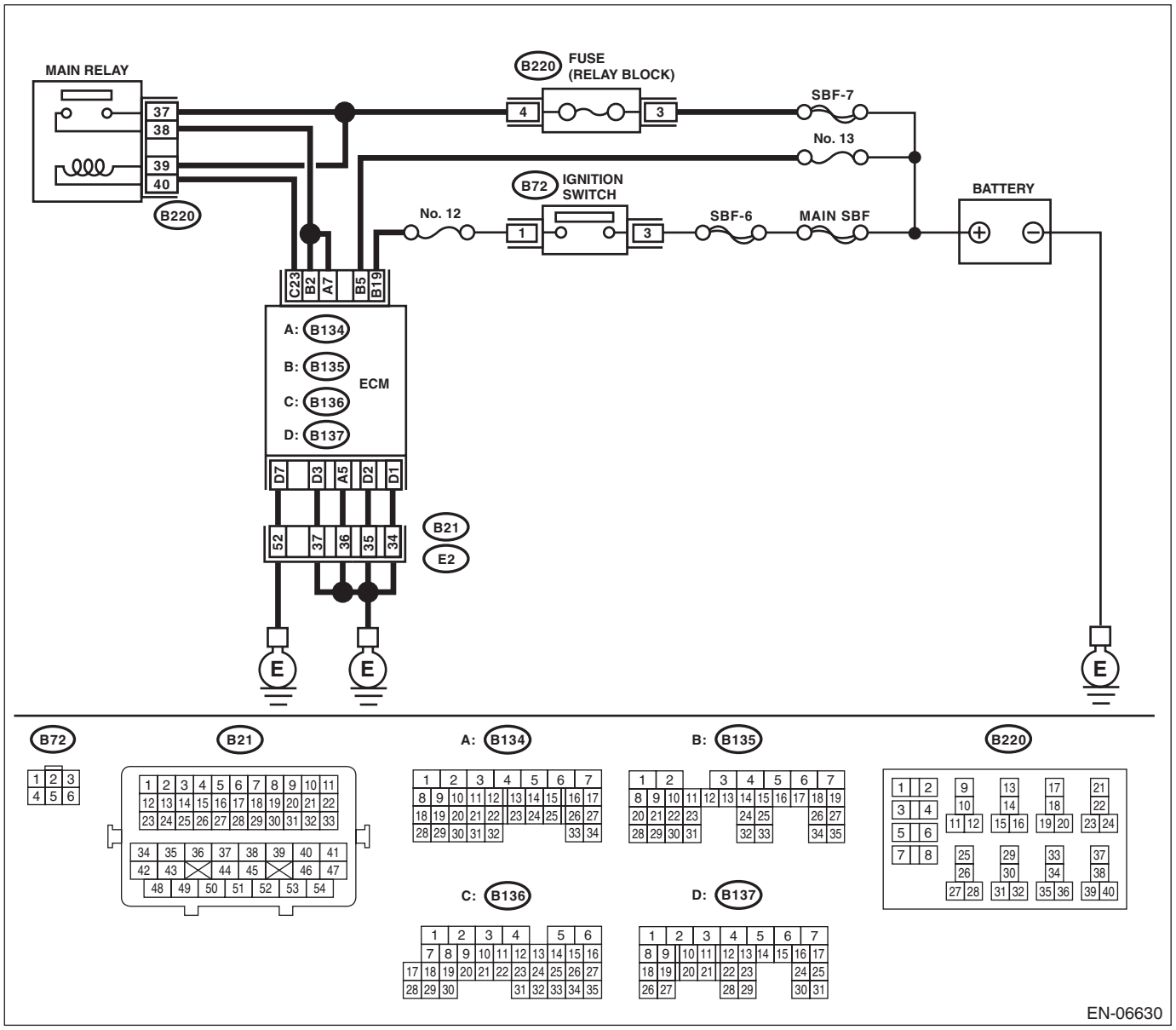
	Step	Check	Yes	No
3	**CHECK DTC.**	Is DTC displayed? <Ref. to EN(H4SO)(diag)-43, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	The circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
4	**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 voltage between the starter motor connector and the engine ground. ***Connector & terminal*** ***(B14) No. 1 (+) — Engine ground (–):*** NOTE: • For AT model, place the select lever in "P" range or "N" range. • For MT model, depress the clutch pedal.	Is the voltage 10 V or more?	Check the starter motor. <Ref. to SC(H4SO)-7, Starter.>	Go to step **5**.
5	**CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition switch. 3) Measure the power supply voltage between ignition switch connector and chassis ground. ***Connector & terminal*** ***(B72) No. 3 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **6**.	Repair the power supply circuit.
6	**CHECK IGNITION SWITCH.** Measure the resistance between ignition switch terminals after turning the ignition switch to START position. ***Terminals*** ***No. 3 — No. 2:*** ***No. 3 — No. 6:***	Is the resistance less than 1 Ω?	Go to step **7**.	Replace the ignition switch. <Ref. to SL-43, REPLACEMENT, Ignition Key Lock.>
7	**CHECK INPUT VOLTAGE OF STARTER RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the starter relay. 3) Connect the connector to ignition switch. 4) Measure the voltage between starter relay connector and chassis ground after turning the ignition switch to START position. ***Connector & terminal*** ***(B225) No. 9 (+) — Chassis ground (–):*** ***(B225) No. 11 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **8**.	Check the following item and repair if necessary. • Blown out of fuse • Open or short circuit to ground in harness between starter relay and ignition switch connector

	Step	Check	Yes	No
8	**CHECK STARTER RELAY.** 1) Connect the battery to starter relay terminals No. 11 and No. 12. 2) Measure the resistance between starter relay terminals. ***Terminals*** ***No. 9 — No. 10:***	Is the resistance less than 1 Ω?	Go to step **9**.	Replace the starter relay. <Ref. to EN(H4SO)(diag)-9, Electrical Component Location.>
9	**CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance of harness between ECM and starter relay connector. ***Connector & terminal*** ***(B136) No. 20 — (B225) No. 12:***	Is the resistance less than 1 Ω?	Go to step **10**.	Repair the open circuit of harness between ECM and starter relay connector.
10	**CHECK TRANSMISSION TYPE.**	Is the transmission type AT?	Go to step **11**.	Go to step **15**.
11	**CHECK ECM INPUT VOLTAGE.** 1) Turn the ignition switch to START. 2) Measure the input voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B136) No. 32 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **12**.	Repair the open circuit in harness between ECM and ignition switch connector.
12	**CHECK HARNESS BETWEEN STARTER RELAY AND INHIBITOR SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from inhibitor switch. 3) Measure the resistance of harness between starter relay connector and inhibitor relay connector. ***Connector & terminal*** ***(B225) No. 10 — (T7) No. 6:***	Is the resistance less than 1 Ω?	Go to step **13**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between starter relay connector and inhibitor switch connector • Poor contact of coupling connector
13	**CHECK HARNESS BETWEEN INHIBITOR SWITCH AND STARTER MOTOR.** Measure the resistance of harness between the inhibitor switch connector and starter motor. ***Connector & terminal*** ***(T7) No. 9 — (B14) No. 1:***	Is the resistance less than 1 Ω?	Go to step **14**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between inhibitor switch connector and starter motor • Poor contact of coupling connector
14	**CHECK INHIBITOR SWITCH.** 1) Place the select lever in “P” range and “N” range. 2) Measure the resistance between inhibitor switch terminals. ***Terminals*** ***No. 6 — No. 9:***	Is the resistance less than 1 Ω?	Check the engine control module (ECM) power supply and ground line. <Ref. to EN(H4SO)(diag)-76, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Replace the inhibitor switch. <Ref. to 4AT-46, Inhibitor Switch.>

	Step	Check	Yes	No
15	**CHECK HARNESS BETWEEN IGNITION SWITCH AND CLUTCH START SWITCH.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from clutch start switch. 3) Turn the ignition switch to START. 4) Measure the voltage between the clutch start switch connector and chassis ground. ***Connector & terminal*** ***(B106) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **16**.	Repair the open circuit in harness between ignition switch connector and clutch start switch connector.
16	**CHECK CLUTCH START SWITCH.** Measure the resistance between clutch start switch terminals while depressing the clutch pedal. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Go to step **17**.	Replace the clutch start switch. <Ref. to CL-27, Clutch Switch.>
17	**CHECK HARNESS BETWEEN ECM AND CLUTCH START SWITCH.** Measure the resistance of harness between ECM and clutch start switch connector. ***Connector & terminal*** ***(B136) No. 32 — (B106) No. 2:***	Is the resistance less than 1 Ω?	Go to step **18**.	Repair the open circuit of harness between ECM and clutch start switch connector.
18	**CHECK HARNESS BETWEEN STARTER RELAY AND STARTER MOTOR.** Measure the resistance of harness between starter relay connector and starter motor. ***Connector & terminal*** ***(B225) No. 10 — (B14) No. 1:***	Is the resistance less than 1 Ω?	Check the engine control module (ECM) power supply and ground line. <Ref. to EN(H4SO)(diag)-76, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Repair the open circuit of the harness between starter relay connector and starter motor.

C: CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM)

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.
WIRING DIAGRAM:

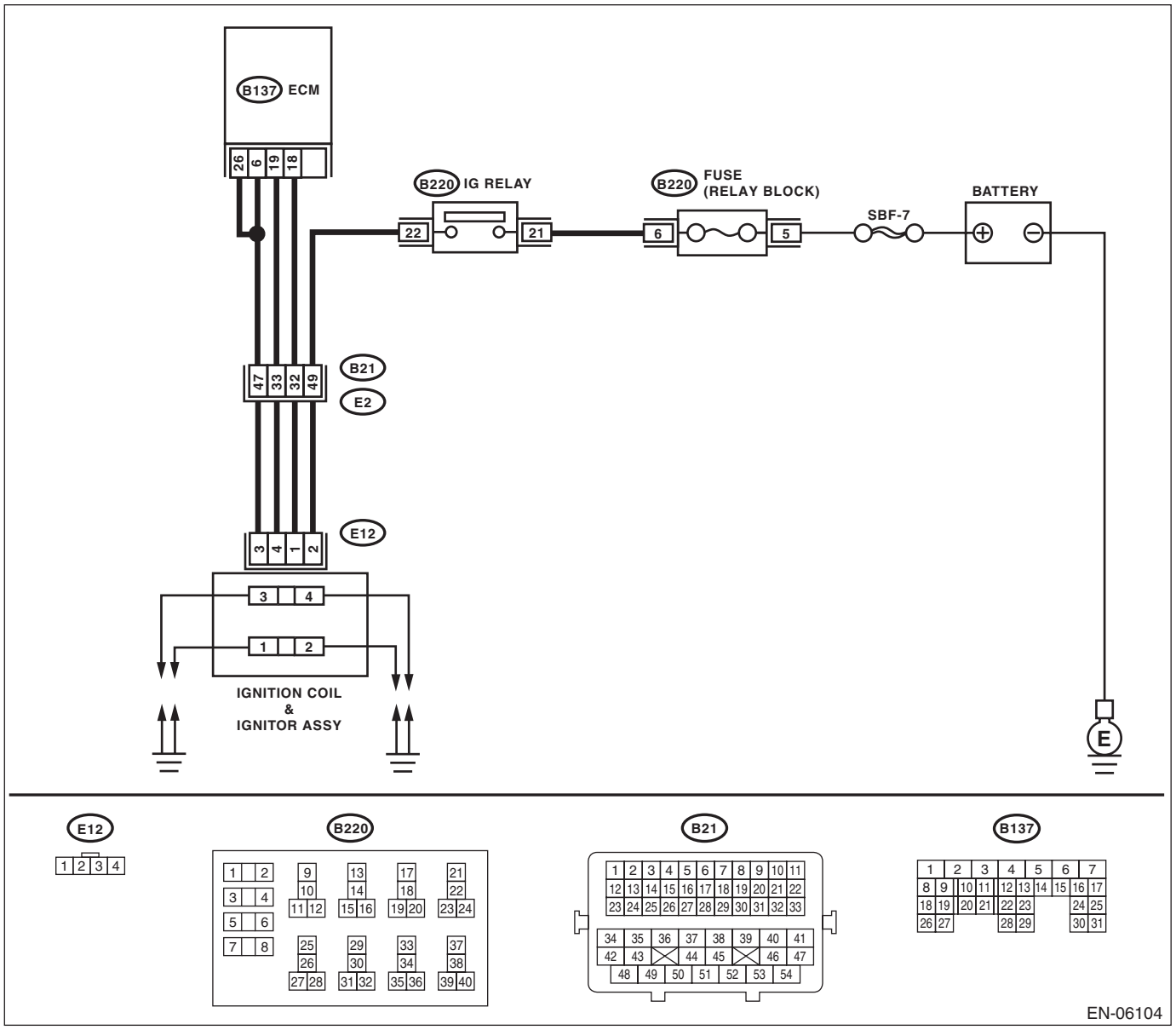


Step		Check	Yes	No
1	**CHECK MAIN RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the main relay. 3) Connect the battery to main relay terminals No. 39 and No. 40. 4) Measure the resistance between main relay terminals. ***Terminals*** ***No. 37 — No. 38:***	Is the resistance less than 1 Ω?	Go to step **2**.	Replace the main relay. <Ref. to FU(H4SO)-46, Main Relay.>

	Step	Check	Yes	No
2	**CHECK GROUND CIRCUIT FOR ECM.** 1) Disconnect the connectors from ECM. 2) Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 2 — Chassis ground:*** ***(B137) No. 3 — Chassis ground:*** ***(B137) No. 7 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM connector and engine ground terminal. • Poor contact of coupling connector
3	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 5 (+) — Chassis ground (–):*** ***(B135) No. 19 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the open or ground short circuit of harness of power supply circuit.
4	**CHECK INPUT VOLTAGE OF MAIN RELAY.** Measure the voltage between main relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 37 (+) — Chassis ground (–):*** ***(B220) No. 39 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **5**.	Repair the open or ground short circuit of harness of power supply circuit.
5	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn the ignition switch to OFF. 2) Install the main relay. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 7 (+) — Chassis ground (–):*** ***(B135) No. 2 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **6**.	Repair the open circuit in harness between ECM and main relay connector.
6	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn the ignition switch to OFF. 2) Connect the connector to ECM. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 7 (+) — Chassis ground (–):*** ***(B135) No. 2 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Check ignition control system. <Ref. to EN(H4SO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and main relay connector • Poor contact of main relay connector • Poor contact of ECM connector

D: IGNITION CONTROL SYSTEM

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, Inspection Mode.>.
WIRING DIAGRAM:



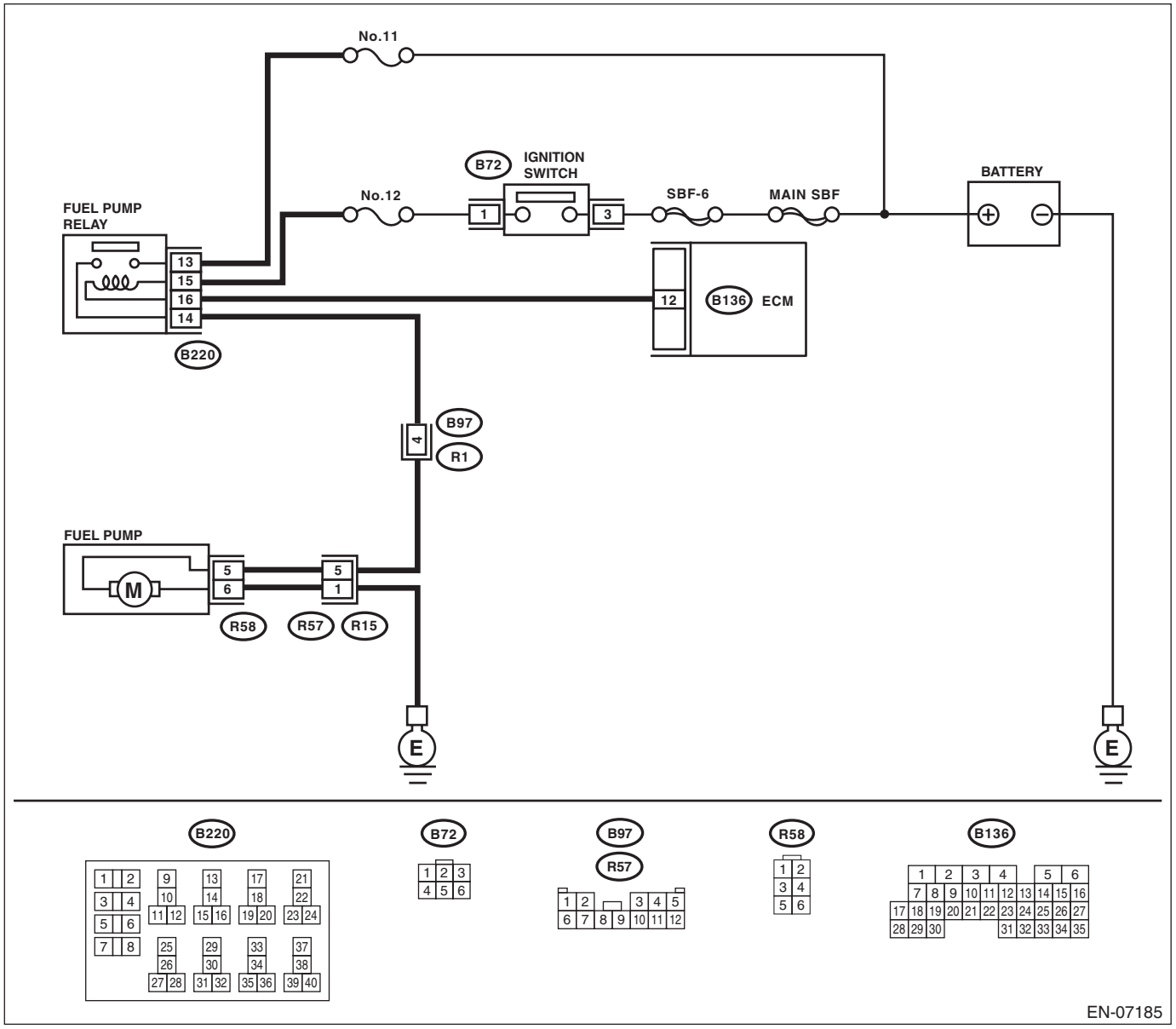
	Step	Check	Yes	No
1	**CHECK IGNITION SYSTEM FOR SPARKS.** 1) Remove the plug cord cap from each spark plug. 2) Install a new spark plug on plug cord cap. **CAUTION:** **Do not remove the spark plug from engine.** 3) Contact the spark plug thread portion to engine. 4) While opening the throttle valve fully, crank the engine to check that spark occurs at each cylinder.	Does spark occur at each cylinder?	Check fuel pump system. <Ref. to EN(H4SO)(diag)-81, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL AND IGNITOR ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ignition coil and ignitor assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between ignition coil and ignitor assembly connector and engine ground. ***Connector & terminal*** ***(E12) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ignition coil and ignitor assembly and IG relay connector • Poor contact of coupling connector • Blown out of fuse
3	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL AND IGNITOR ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between ECM and the ignition coil and ignitor assembly connector. ***Connector & terminal*** ***(E12) No. 3 — (B137) No. 6:*** ***(E12) No. 3 — (B137) No. 26:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and ignition coil and ignitor assembly connector • Poor contact of coupling connector
4	**CHECK IGNITION COIL AND IGNITOR ASSEMBLY.** 1) Remove the spark plug cords. 2) Measure the resistance between spark plug cord contact portions to check secondary coil. ***Terminals*** ***No. 1 — No. 2:*** ***No. 3 — No. 4:***	Is the resistance between 10 and 15 kΩ?	Go to step **5**.	Replace the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, Ignition Coil and Ignitor Assembly.>
5	**CHECK INPUT SIGNAL FOR IGNITION COIL AND IGNITOR ASSEMBLY.** 1) Connect the connector to the Ignition coil and ignitor assembly. 2) Check if voltage varies synchronously with engine speed when cranking, while monitoring voltage between ignition coil and ignitor assembly connector and engine ground. ***Connector & terminal*** ***(E12) No. 1 (+) — Engine ground (–):*** ***(E12) No. 4 (+) — Engine ground (–):***	Does the voltage vary 10 V or more?	Go to step **6**.	Replace the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, Ignition Coil and Ignitor Assembly.>
6	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL AND IGNITOR ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Disconnect the connector from the ignition coil and ignitor assembly. 4) Measure the resistance of harness between ECM and ignition coil and ignitor assembly connector. ***Connector & terminal*** ***(B137) No. 18 — (E12) No. 1:*** ***(B137) No. 19 — (E12) No. 4:***	Is the resistance less than 1 Ω?	Go to step **7**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and ignition coil and ignitor assembly connector • Poor contact of coupling connector

	Step	Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL AND IGNITOR ASSEMBLY CONNECTOR.** Measure the resistance of harness between ECM and engine ground. ***Connector & terminal:*** ***(B137) No. 18 — Engine ground:*** ***(B137) No. 19 — Engine ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the ground short circuit of harness between ECM and ignition coil and ignitor assembly connector.

E: FUEL PUMP CIRCUIT

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.
WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK OPERATING SOUND OF FUEL PUMP.** Check if the fuel pump operates for two seconds when turning the ignition switch to ON. NOTE: Fuel pump operation can be executed using the Subaru Select Monitor. For the procedures, refer to "Compulsory Valve Operation Check Mode". <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the fuel pump emit operating sound?	Check the fuel injector circuit. <Ref. to EN(H4SO)(diag)-84, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step **2**.

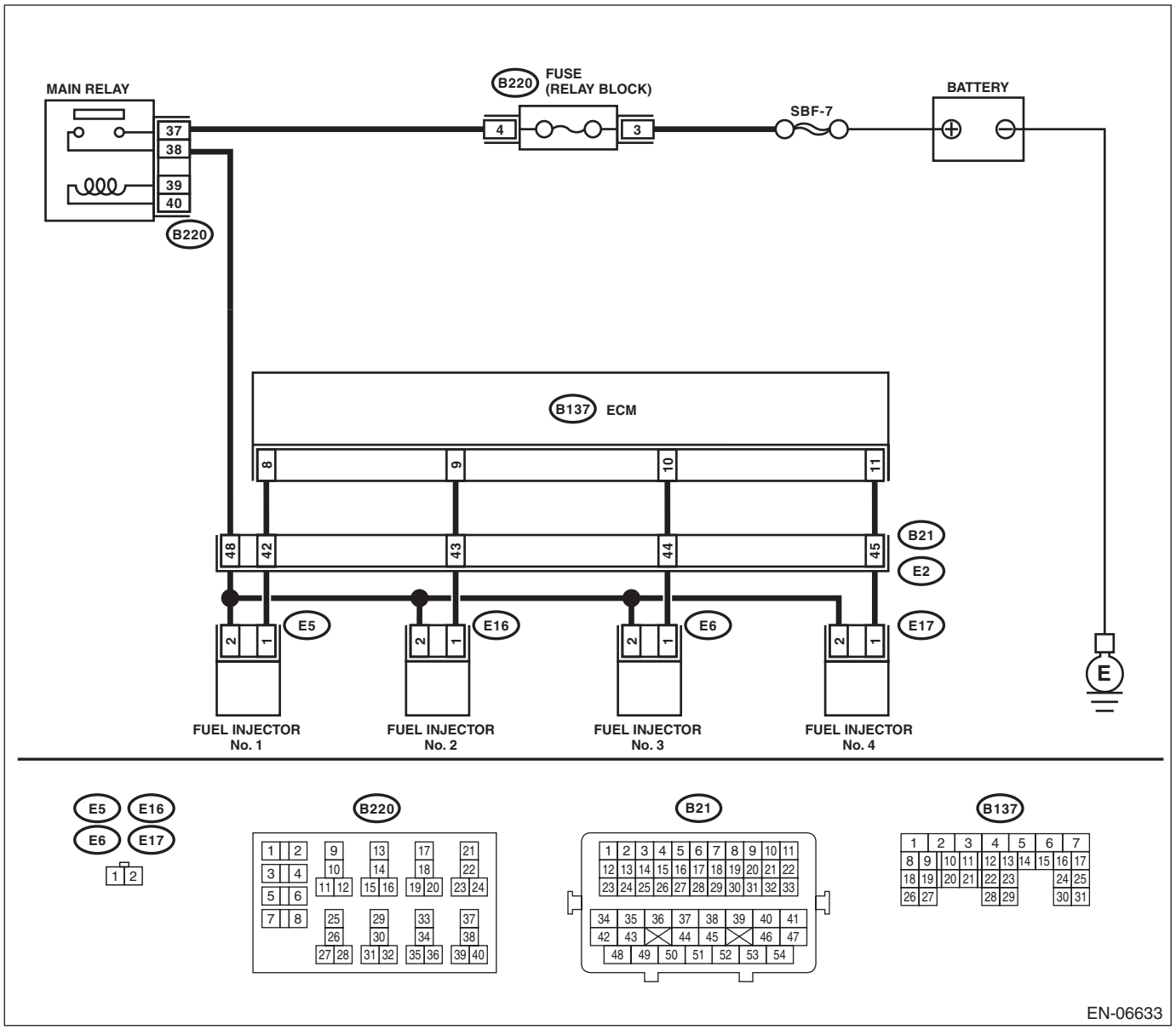
	Step	Check	Yes	No
2	**CHECK GROUND CIRCUIT OF FUEL PUMP.** 1) Turn the ignition switch to OFF. 2) Remove the fuel pump access hole lid. 3) Disconnect the connector from fuel pump. 4) Measure the resistance of harness between fuel pump and chassis ground. ***Connector & terminal*** ***(R58) No. 6 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between fuel pump connector and chassis grounding terminal • Poor contact of coupling connector
3	**CHECK POWER SUPPLY TO FUEL PUMP.** 1) Turn the ignition switch to ON. 2) Measure the voltage of power supply circuit between fuel pump connector and chassis ground. ***Connector & terminal*** ***(R58) No. 5 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Replace the fuel pump. <Ref. to FU(H4SO)-64, Fuel Pump.>	Go to step **4**.
4	**CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between fuel pump connector and fuel pump relay connector. ***Connector & terminal*** ***(R58) No. 5 — (B220) No. 14:***	Is the resistance less than 1 Ω?	Go to step **5**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between fuel pump connector and fuel pump relay connector • Poor contact of coupling connector
5	**CHECK HARNESS BETWEEN FUEL PUMP AND FUEL PUMP RELAY CONNECTOR.** Measure the resistance of harness between fuel pump connector and fuel pump relay connector. ***Connector & terminal*** ***(R58) No. 5 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **6**.	Repair the short circuit of harness between fuel pump connector and fuel pump relay connector.
6	**CHECK FUEL PUMP RELAY.** 1) Remove the fuel pump relay. 2) Connect the battery to fuel pump relay terminals No. 15 and No. 16. 3) Measure the resistance between fuel pump relay terminals. ***Terminals*** ***No. 13 — No. 14:***	Is the resistance less than 1 Ω?	Go to step **7**.	Replace the fuel pump relay. <Ref. to FU(H4SO)-48, Fuel Pump Relay.>
7	**CHECK HARNESS BETWEEN ECM AND FUEL PUMP RELAY CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Measure the resistance of harness between ECM and fuel pump relay connector. ***Connector & terminal*** ***(B136) No. 12 — (B220) No. 16:***	Is the resistance less than 1 Ω?	Go to step **8**.	Repair the open circuit of harness between ECM and fuel pump relay connector.

	Step	Check	Yes	No
8	**CHECK POWER SUPPLY OF FUEL PUMP RELAY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel pump relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 13 (+) — Chassis ground (–):*** ***(B220) No. 15 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of ECM connector.	Repair the open or ground short circuit of harness of power supply circuit.

F: FUEL INJECTOR CIRCUIT

CAUTION:
- **Check and repair only faulty parts.**
- **After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.**

WIRING DIAGRAM:



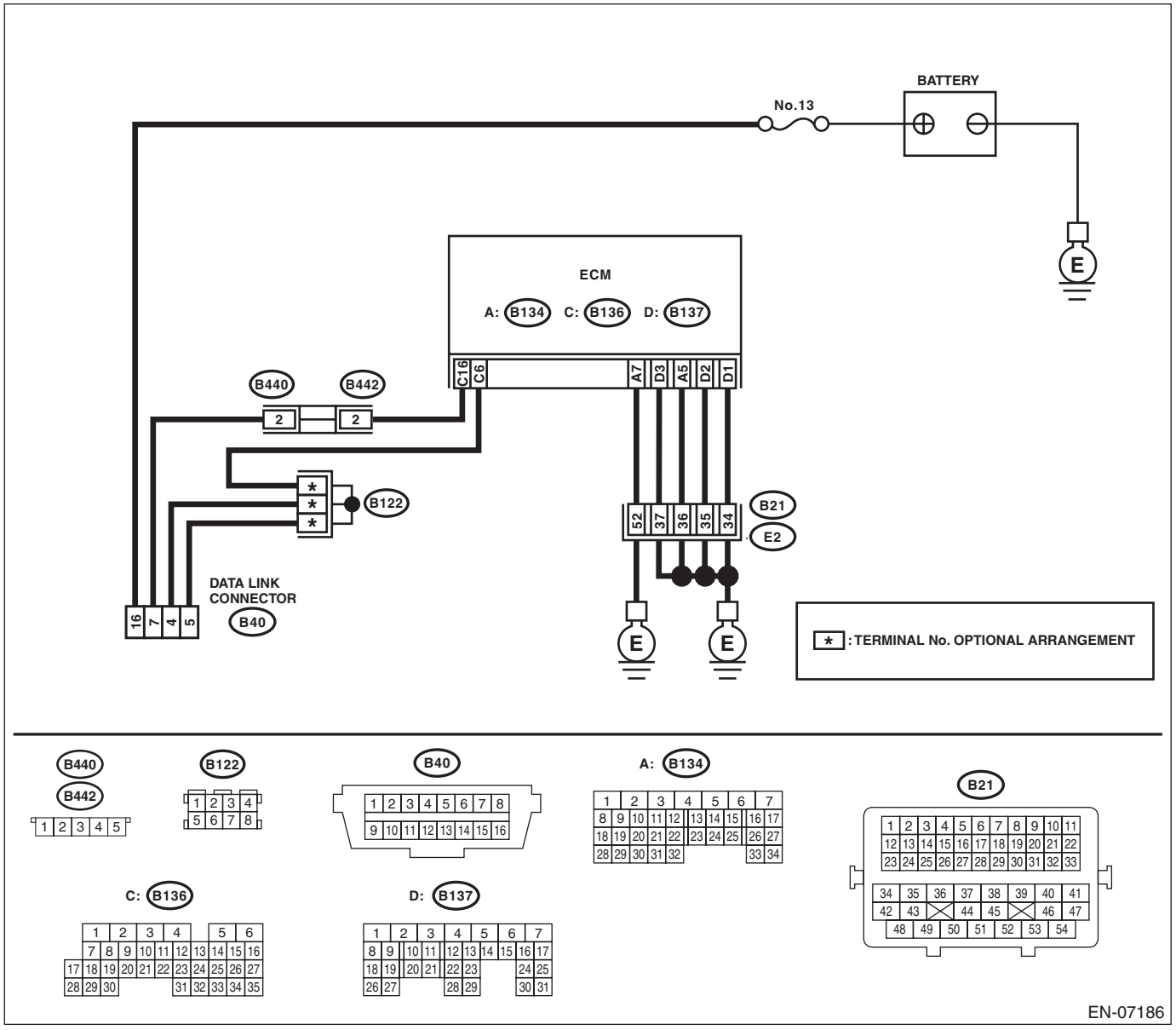
Step		Check	Yes	No
1	**CHECK OPERATION OF EACH FUEL INJECTOR.** While cranking the engine, check each fuel injector emits operating sound. Use a sound scope or attach a screwdriver to the injector to listen to sounds for this check.	Does the fuel pump emit operating sound?	Check the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.>	Go to step **2**.

	Step	Check	Yes	No
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 fuel injector terminal and engine ground. ***Connector & terminal*** ***#1 (E5) No. 2 (+) — Engine ground (–):*** ***#2 (E16) No. 2 (+) — Engine ground (–):*** ***#3 (E6) No. 2 (+) — Engine ground (–):*** ***#4 (E17) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between main relay connector and fuel injector connector • Poor contact of main relay connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance of harness between ECM and fuel injector connector. ***Connector & terminal*** ***#1 (B137) No. 8 — (E5) No. 1:*** ***#2 (B137) No. 9 — (E16) No. 1:*** ***#3 (B137) No. 10 — (E6) No. 1:*** ***#4 (B137) No. 11 — (E17) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and fuel injector connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***#1 (B137) No. 8 (+) — Chassis ground (–):*** ***#2 (B137) No. 9 (+) — Chassis ground (–):*** ***#3 (B137) No. 10 (+) — Chassis ground (–):*** ***#4 (B137) No. 11 (+) — Chassis ground (–):***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM and fuel injector connector.
5	**CHECK EACH FUEL INJECTOR.** Measure the resistance between each fuel injector terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **6**.	Replace the faulty fuel injector. <Ref. to FU(H4SO)-36, Fuel Injector.>
6	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Inspection using “General Diagnostic Table”. <Ref. to EN(H4SO)(diag)-318, INSPECTION, General Diagnostic Table.>

18.Diagnostic Procedure for Subaru Select Monitor Communication

A: COMMUNICATION FOR INITIALIZING IMPOSSIBLE

DIAGNOSIS:
Open or short circuit in data link connector
TROUBLE SYMPTOM:
Subaru Select Monitor communication failure
WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK POWER SUPPLY CIRCUIT.** Connect the SDI (Subaru Diagnosis Interface) or general scan tool to data link connector.	Does SDI or general scan tool turn ON?	Go to step **4**.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK POWER SUPPLY CIRCUIT.** Measure the voltage between data link connector and chassis ground. ***Connector & terminal*** ***(B40) No. 16 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the power supply circuit. NOTE: In this case, repair the following item: • Open or ground short circuit of harness between battery and data link connector • Blown out of fuse (M/B No. 13)
3	**CHECK HARNESS BETWEEN DATA LINK CONNECTOR AND CHASSIS GROUND.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between data link connector and chassis ground. ***Connector & terminal*** ***(B40) No. 4 — Chassis ground:*** ***(B40) No. 5 — Chassis ground:***	Is the resistance less than 5 Ω?	Repair the poor contact of data link connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and data link connector • Open circuit of harness between ECM and engine ground • Poor contact of ECM connector • Poor contact of joint connector
4	**CHECK HARNESS BETWEEN ECM AND DATA LINK CONNECTOR.** 1) Disconnect the connector from ECM, TCM, VDC CM, airbag CM and body integrated unit. **CAUTION:** **When disconnecting the connector from airbag control module, always follow the precautions on AB section. <Ref. to AB-5, CAUTION, General Description.>** 2) Measure the resistance of harness between ECM and data link connector. ***Connector & terminal*** ***(B136) No. 16 — (B40) No. 7:***	Is the resistance less than 1 Ω?	Go to step **5**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and data link connector • Poor contact of joint connector
5	**CHECK HARNESS BETWEEN ECM AND DATA LINK CONNECTOR.** Measure the resistance between data link connector and chassis ground. ***Connector & terminal*** ***(B40) No. 7 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of the ECM or data link connector.	Repair the ground short circuit of harness between ECM and data link connector.

19.List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Note
P0026	Intake Valve Control Solenoid Circuit Range/Performance (Bank 1)	<Ref. to EN(H4SO)(diag)-95, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0028	Intake Valve Control Solenoid Circuit Range/Performance (Bank 2)	<Ref. to EN(H4SO)(diag)-97, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-99, 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 2)	<Ref. to EN(H4SO)(diag)-101, 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 2)	<Ref. to EN(H4SO)(diag)-103, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-105, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-107, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0068	MAP/MAF - Throttle Position Correlation	<Ref. to EN(H4SO)(diag)-109, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0076	Intake Valve Control Solenoid Circuit Low (Bank 1)	<Ref. to EN(H4SO)(diag)-111, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0077	Intake Valve Control Solenoid Circuit High (Bank 1)	<Ref. to EN(H4SO)(diag)-113, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0082	Intake Valve Control Solenoid Circuit Low (Bank 2)	<Ref. to EN(H4SO)(diag)-115, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0083	Intake Valve Control Solenoid Circuit High (Bank 2)	<Ref. to EN(H4SO)(diag)-117, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-119, 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(H4SO)(diag)-121, 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(H4SO)(diag)-123, 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(H4SO)(diag)-125, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to EN(H4SO)(diag)-127, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P0111	Intake Air Temperature Sensor 1 Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-129, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to EN(H4SO)(diag)-131, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0113	Intake Air Temperature Sensor 1 Circuit High	<Ref. to EN(H4SO)(diag)-133, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to EN(H4SO)(diag)-135, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine Coolant Temperature Circuit High	<Ref. to EN(H4SO)(diag)-137, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0122	Throttle/Pedal Position Sensor/Switch “A” Circuit Low	<Ref. to EN(H4SO)(diag)-139, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0123	Throttle/Pedal Position Sensor/Switch “A” Circuit High	<Ref. to EN(H4SO)(diag)-141, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	<Ref. to EN(H4SO)(diag)-143, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0126	Insufficient Engine Coolant Temperature for Stable Operation	<Ref. to EN(H4SO)(diag)-144, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to EN(H4SO)(diag)-146, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-147, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-149, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-151, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to EN(H4SO)(diag)-153, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-155, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-157, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0139	O2 Sensor Circuit Slow Response (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-159, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	<Ref. to EN(H4SO)(diag)-161, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System Too Lean (Bank 1)	<Ref. to EN(H4SO)(diag)-163, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P0172	System Too Rich (Bank 1)	<Ref. to EN(H4SO)(diag)-164, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0181	Fuel Temperature Sensor “A” Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-166, DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0182	Fuel Temperature Sensor “A” Circuit Low Input	<Ref. to EN(H4SO)(diag)-168, DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0183	Fuel Temperature Sensor “A” Circuit High Input	<Ref. to EN(H4SO)(diag)-170, DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0196	Engine Oil Temperature Sensor Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-172, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0197	Engine Oil Temperature Sensor Low	<Ref. to EN(H4SO)(diag)-174, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0198	Engine Oil Temperature Sensor High	<Ref. to EN(H4SO)(diag)-176, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	<Ref. to EN(H4SO)(diag)-178, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	<Ref. to EN(H4SO)(diag)-180, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder 1 Misfire Detected	<Ref. to EN(H4SO)(diag)-182, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 Misfire Detected	<Ref. to EN(H4SO)(diag)-182, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0303	Cylinder 3 Misfire Detected	<Ref. to EN(H4SO)(diag)-182, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 Misfire Detected	<Ref. to EN(H4SO)(diag)-183, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0327	Knock Sensor 1 Circuit Low (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-189, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-191, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0335	Crankshaft Position Sensor “A” Circuit	<Ref. to EN(H4SO)(diag)-193, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-195, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-197, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0341	Camshaft Position Sensor “A” Circuit Range/Performance (Bank 1 or Single Sensor)	<Ref. to EN(H4SO)(diag)-199, DTC P0341 CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0400	Exhaust Gas Recirculation Flow	<Ref. to EN(H4SO)(diag)-201, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to EN(H4SO)(diag)-203, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P0442	Evaporative Emission Control System Leak Detected (Small Leak)	<Ref. to EN(H4SO)(diag)-207, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0447	Evaporative Emission Control System Vent Control Circuit Open	<Ref. to EN(H4SO)(diag)-210, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0448	Evaporative Emission Control System Vent Control Circuit Shorted	<Ref. to EN(H4SO)(diag)-212, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0451	Evaporative Emission Control System Pressure Sensor	<Ref. to EN(H4SO)(diag)-214, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0452	Evaporative Emission Control System Pressure Sensor Low Input	<Ref. to EN(H4SO)(diag)-216, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0453	Evaporative Emission Control System Pressure Sensor High Input	<Ref. to EN(H4SO)(diag)-218, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to EN(H4SO)(diag)-222, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0457	Evaporative Emission Control System Leak Detected (Fuel Cap Loose/Off)	<Ref. to EN(H4SO)(diag)-225, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to EN(H4SO)(diag)-228, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0459	Evaporative Emission System Purge Control Valve Circuit High	<Ref. to EN(H4SO)(diag)-230, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0461	Fuel Level Sensor “A” Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-232, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0462	Fuel Level Sensor “A” Circuit Low	<Ref. to EN(H4SO)(diag)-232, DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0463	Fuel Level Sensor “A” Circuit High	<Ref. to EN(H4SO)(diag)-232, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0464	Fuel Level Sensor Circuit Intermittent	<Ref. to EN(H4SO)(diag)-233, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0500	Vehicle Speed Sensor “A”	<Ref. to EN(H4SO)(diag)-233, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to EN(H4SO)(diag)-234, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0507	Idle Air Control System RPM Higher Than Expected	<Ref. to EN(H4SO)(diag)-236, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter Request Circuit	<Ref. to EN(H4SO)(diag)-238, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0513	Incorrect Immobilizer Key	<Ref. to IM(diag)-16, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to EN(H4SO)(diag)-240, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Note
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to EN(H4SO)(diag)-241, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0607	Throttle Control System Circuit Range/Performance	<Ref. to EN(H4SO)(diag)-242, DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0638	Throttle Actuator Control Range/Performance (Bank 1)	<Ref. to EN(H4SO)(diag)-243, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0700	Transmission Control System (MIL Request)	<Ref. to EN(H4SO)(diag)-243, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Park/Neutral Switch Input Circuit Low (AT Model)	<Ref. to EN(H4SO)(diag)-244, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Neutral Switch Input Circuit Low (MT Model)	<Ref. to EN(H4SO)(diag)-246, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Park/Neutral Switch Input Circuit High (AT Model)	<Ref. to EN(H4SO)(diag)-248, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to EN(H4SO)(diag)-250, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1152	O2 Sensor Circuit Range/Performance (Low) (Bank1 Sensor1)	<Ref. to EN(H4SO)(diag)-252, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1153	O2 Sensor Circuit Range/Performance (High) (Bank1 Sensor1)	<Ref. to EN(H4SO)(diag)-254, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1160	Return Spring Failure	<Ref. to EN(H4SO)(diag)-255, DTC P1160 RETURN SPRING FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to EN(H4SO)(diag)-256, 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(H4SO)(diag)-258, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1443	Vent Control Solenoid Valve Function Problem	<Ref. to EN(H4SO)(diag)-260, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1491	Positive Crankcase Ventilation (Blow-by) Function Problem	<Ref. to EN(H4SO)(diag)-262, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1492	EGR Solenoid Valve Signal #1 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-264, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1493	EGR Solenoid Valve Signal #1 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-264, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1494	EGR Solenoid Valve Signal #2 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-264, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1495	EGR Solenoid Valve Signal #2 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-264, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P1496	EGR Solenoid Valve Signal #3 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-264, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1497	EGR Solenoid Valve Signal #3 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-264, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1498	EGR Solenoid Valve Signal #4 Circuit Malfunction (Low Input)	<Ref. to EN(H4SO)(diag)-265, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1499	EGR Solenoid Valve Signal #4 Circuit Malfunction (High Input)	<Ref. to EN(H4SO)(diag)-268, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-Up Voltage Circuit Malfunction	<Ref. to EN(H4SO)(diag)-271, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1570	Antenna	<Ref. to IM(diag)-17, DTC P1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1571	Reference Code Incompatibility	<Ref. to IM(diag)-19, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1572	IMM Circuit Failure	<Ref. to IM(diag)-20, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1574	Key Communication Failure	<Ref. to IM(diag)-22, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1576	EGI Control Module EEPROM	<Ref. to IM(diag)-23, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1577	IMM Control Module EEPROM	<Ref. to IM(diag)-24, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1578	Meter Failure	<Ref. to IM(diag)-25, DTC P1578 METER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1602	Control Module Programming Error	<Ref. to EN(H4SO)(diag)-273, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	<Ref. to EN(H4SO)(diag)-282, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	<Ref. to EN(H4SO)(diag)-288, 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(H4SO)(diag)-294, 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(H4SO)(diag)-299, 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(H4SO)(diag)-301, 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(H4SO)(diag)-302, 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(H4SO)(diag)-303, 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(H4SO)(diag)-305, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Note
P2127	Throttle/Pedal Position Sensor/Switch “E” Circuit Low Input	<Ref. to EN(H4SO)(diag)-307, 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(H4SO)(diag)-309, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2135	Throttle/Pedal Position Sensor/Switch “A”/“B” Voltage Correlation	<Ref. to EN(H4SO)(diag)-311, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2138	Throttle/Pedal Position Sensor/Switch “D”/“E” Voltage Correlation	<Ref. to EN(H4SO)(diag)-314, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2227	Atmospheric Pressure Sensor Range/ Performance	<Ref. to EN(H4SO)(diag)-316, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2228	Barometric Pressure Circuit Low	<Ref. to EN(H4SO)(diag)-316, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2229	Barometric Pressure Circuit High	<Ref. to EN(H4SO)(diag)-317, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0073	CAN Failure, Bus “OFF” Detection	<Ref. to EN(H4SO)(diag)-317, DTC U0073 CAN FAILURE, BUS ‘OFF’ DETECTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0101	CAN (TCU) Data not Loaded	<Ref. to EN(H4SO)(diag)-317, DTC U0101 CAN (TCU) DATA NOT LOADED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0122	CAN (VDC) Data not Loaded	<Ref. to EN(H4SO)(diag)-317, DTC U0122 CAN (VDC) DATA NOT LOADED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0140	CAN (BCU) Data not Loaded	<Ref. to EN(H4SO)(diag)-317, DTC U0140 CAN (BCU) DATA NOT LOADED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0402	CAN (TCU) Data Abnormal	<Ref. to EN(H4SO)(diag)-317, DTC U0402 CAN (TCU) DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0416	CAN (VDCU) Data Abnormal	<Ref. to EN(H4SO)(diag)-317, DTC U0416 CAN (VDC) DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0422	CAN (BCU) Data Abnormal	<Ref. to EN(H4SO)(diag)-317, DTC U0422 CAN (BCU) DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

20.Diagnostic Procedure with Diagnostic Trouble Code (DTC)

A: DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-8, DTC P0026 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

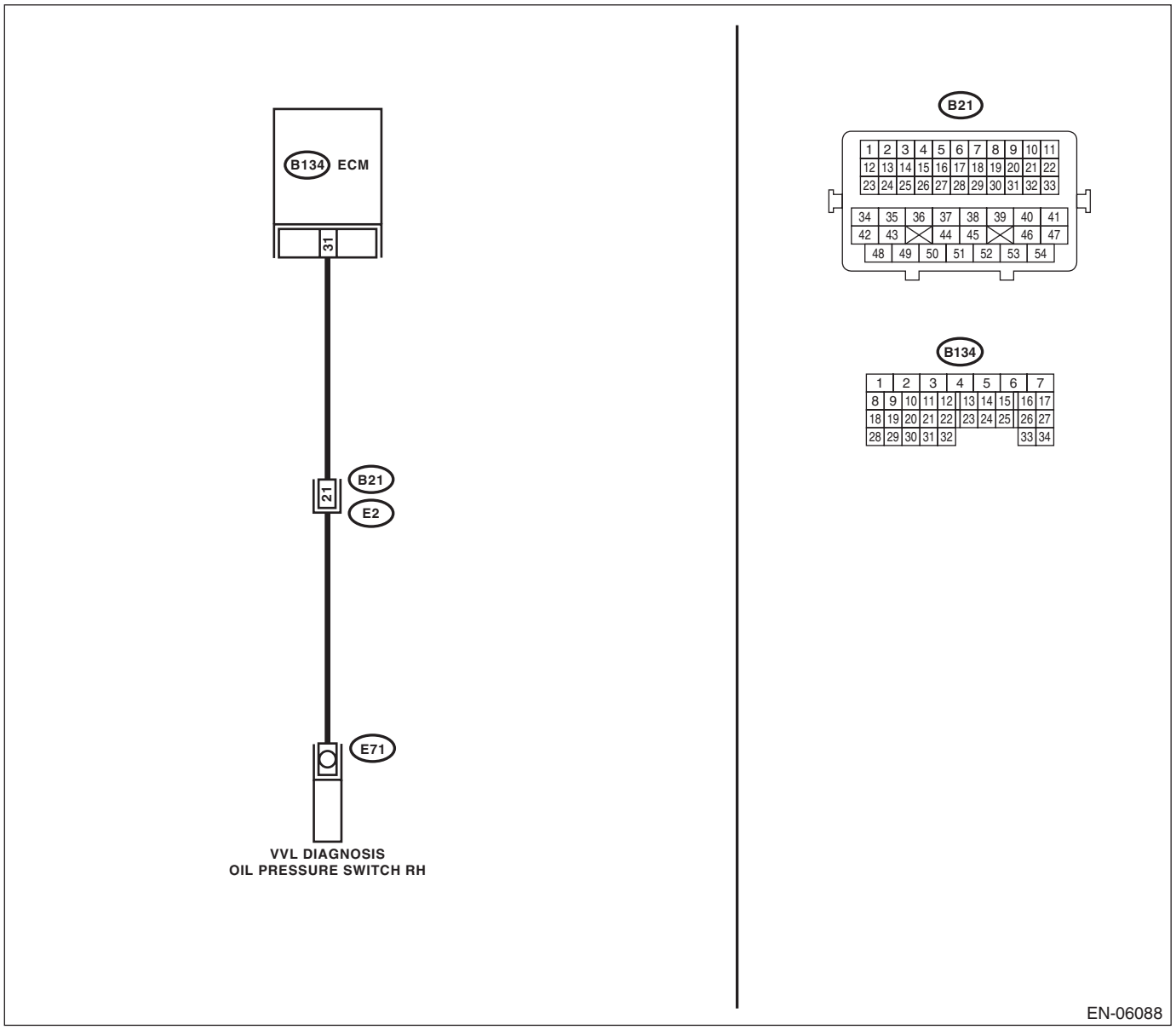
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH RH CONNECTOR.** 1) Warm up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from the ECM and variable valve lift diagnosis oil pressure RH switch. 4) Measure the resistance of harness between ECM and variable valve lift diagnosis oil pressure switch RH connector. ***Connector & terminal*** ***(B134) No. 31 — (E71) No. 1:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and variable valve lift diagnosis oil pressure switch RH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH RH CONNECTOR.** Measure the resistance between the variable valve lift diagnosis oil pressure switch RH connector and engine ground. ***Connector & terminal*** ***(E71) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the ground short circuit in harness between ECM and variable valve lift diagnosis oil pressure switch RH connector.
3	**CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH RH CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between the variable valve lift diagnosis oil pressure switch RH connector and engine ground. ***Connector & terminal*** ***(E71) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power supply in harness between ECM and variable valve lift diagnosis oil pressure switch RH connector.	Go to step **4**.
4	**CHECK DTC.** 1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC. NOTE: For detailed procedures, refer to “Clear Memory Mode”. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>	Is DTC displayed?	Replace the oil switching solenoid valve RH. <Ref. to ME(H4SO)-93, Oil Switching Solenoid Valve.> After replacing it, go on to the next. Go to step **5**.	End.
5	**CHECK DTC.** 1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC. NOTE: For detailed procedures, refer to “Clear Memory Mode”. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>	Is DTC displayed?	Check for oil routing.	End.

B: DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-10, DTC P0028 INTAKE VALVE CONTROL SOLENOID CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

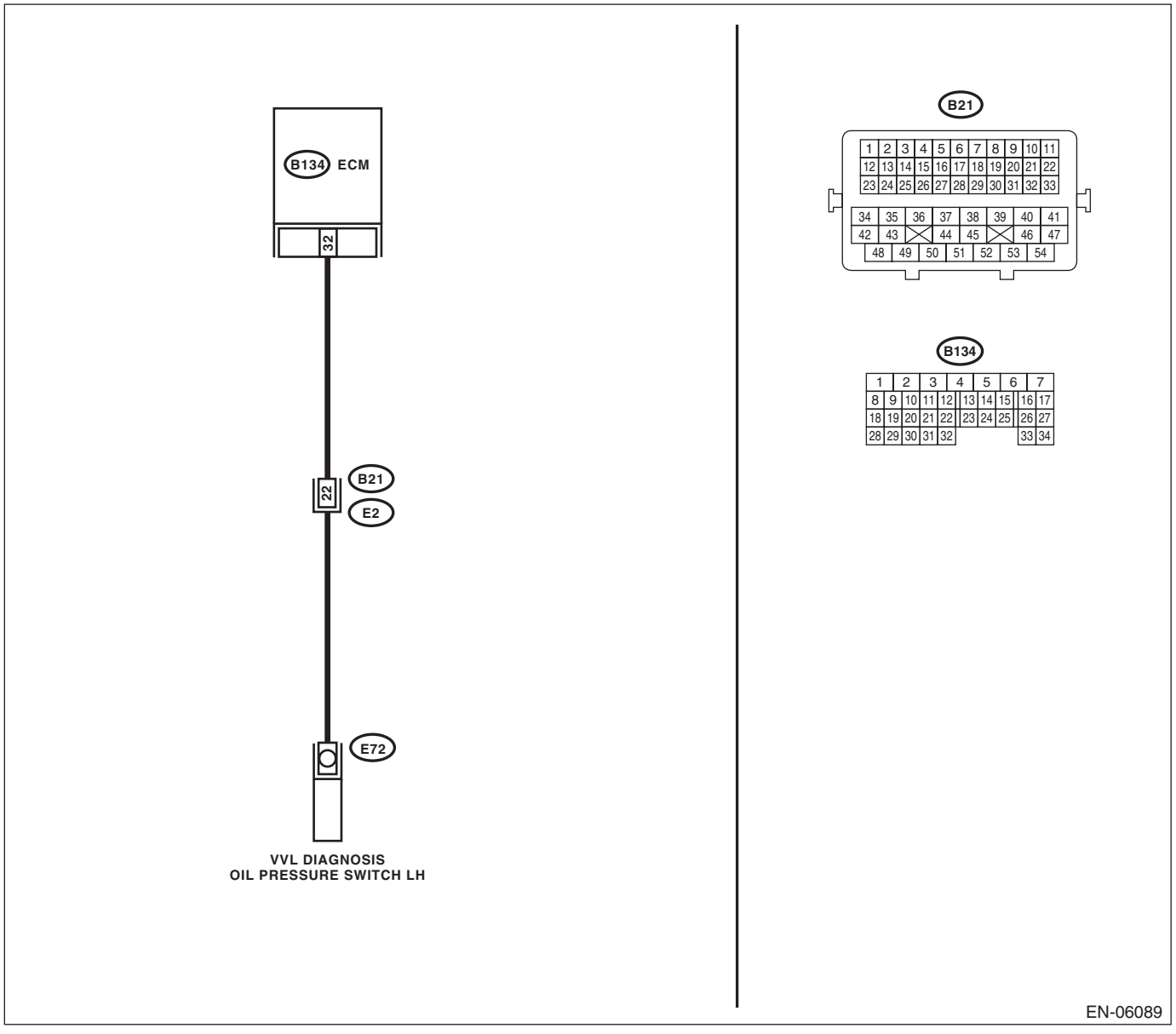
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH LH CONNECTOR.** 1) Warm up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from the ECM and variable valve lift diagnosis oil pressure switch LH. 4) Measure the resistance of harness between ECM and variable valve lift diagnosis oil pressure switch LH connector. ***Connector & terminal*** ***(B134) No. 32 — (E72) No. 1:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and variable valve lift diagnosis oil pressure switch LH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH LH CONNECTOR.** Measure the resistance between the variable valve lift diagnosis oil pressure switch LH connector and engine ground. ***Connector & terminal*** ***(E72) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the ground short circuit in harness between ECM and variable valve lift diagnosis oil pressure switch LH connector.
3	**CHECK HARNESS BETWEEN ECM AND VARIABLE VALVE LIFT DIAGNOSIS OIL PRESSURE SWITCH LH CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between the variable valve lift diagnosis oil pressure switch LH connector and engine ground. ***Connector & terminal*** ***(E72) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power supply in harness between ECM and variable valve lift diagnosis oil pressure switch LH connector.	Go to step **4**.
4	**CHECK DTC.** 1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC. NOTE: For detailed procedures, refer to “Clear Memory Mode”. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>	Is DTC displayed?	Replace the oil switching solenoid valve LH. <Ref. to ME(H4SO)-93, Oil Switching Solenoid Valve.> After replacing it, go on to the next. Go to step **5**.	End.
5	**CHECK DTC.** 1) Perform the Clear Memory Mode. 2) After idling the engine, check the DTC. NOTE: For detailed procedures, refer to “Clear Memory Mode”. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.>	Is DTC displayed?	Check for oil routing.	End.

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

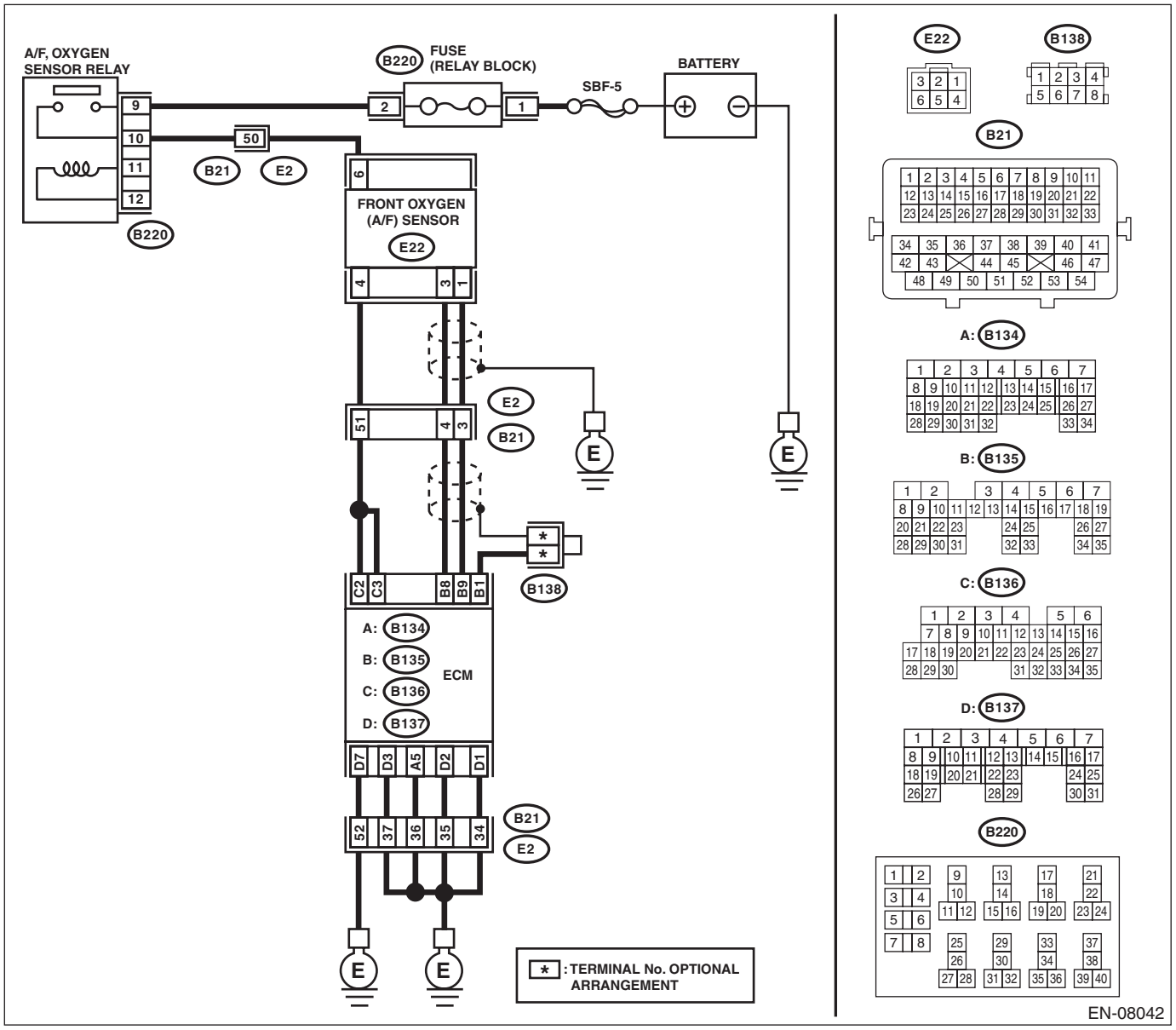
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-11, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Start and warm up the engine. 2) Turn the ignition switch to OFF. 3) Disconnect the connectors from ECM and front oxygen (A/F) sensor. 4) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 2 — (E22) No. 4:*** ***(B136) No. 3 — (E22) No. 4:*** ***(B135) No. 9 — (E22) No. 1:*** ***(B135) No. 8 — (E22) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact of coupling connector
2	**CHECK FRONT OXYGEN (A/F) SENSOR.** Measure the resistance between front oxygen (A/F) sensor terminals. ***Terminals*** ***No. 6 — No. 4:***	Is the resistance 2 — 3 Ω?	Go to step **3**.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>
3	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and front oxygen (A/F) sensor connector.	Is there poor contact of ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>

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

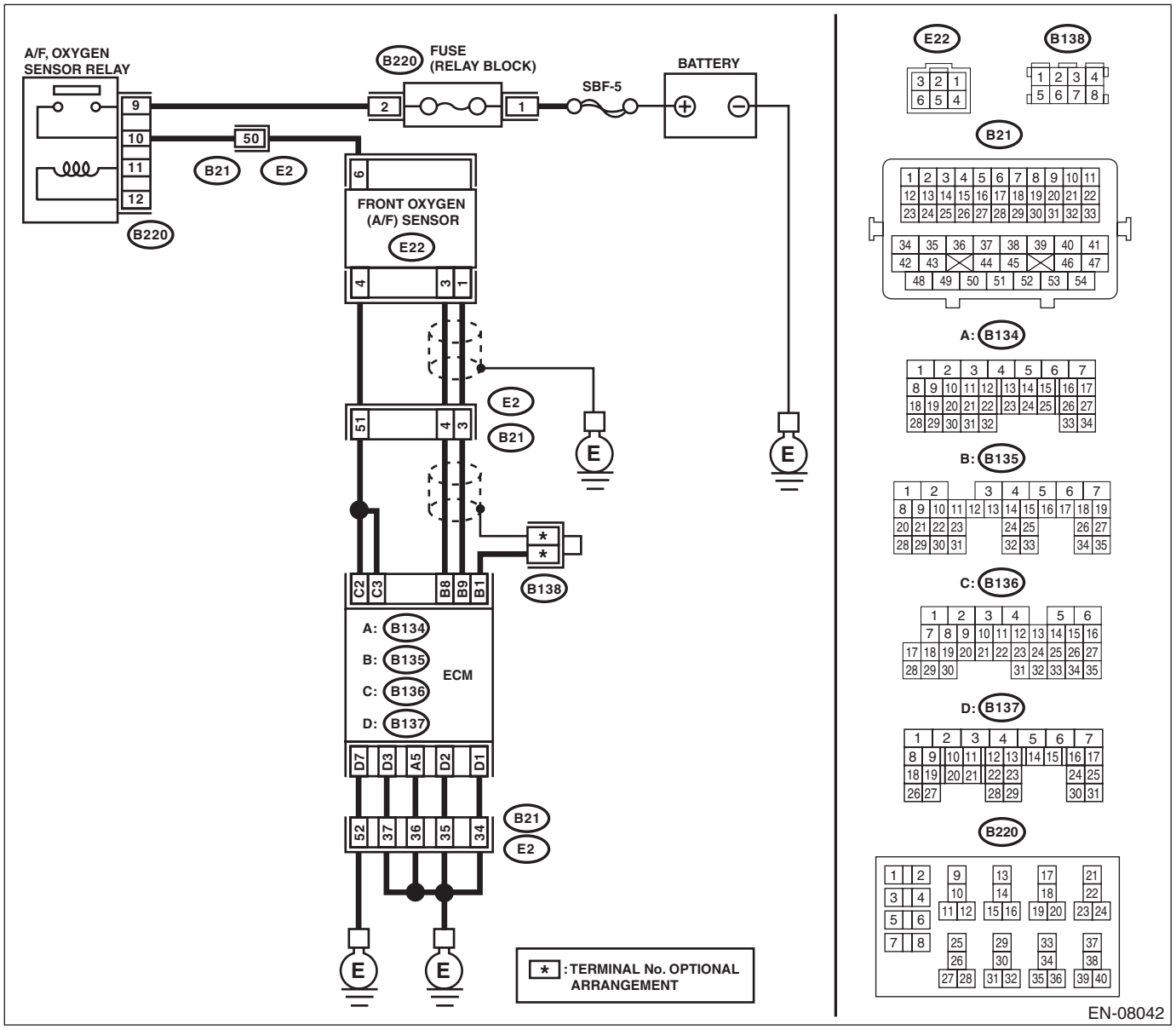
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-13, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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 connectors 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*** ***(E22) No. 6 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the power supply line. NOTE: In this case, repair the following item: • Open circuit in harness between A/F, oxygen sensor relay connector and front oxygen (A/F) sensor connector • Poor contact of A/F, oxygen sensor relay connector • Poor contact of coupling connector • Malfunction of A/F, oxygen sensor relay
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B136) No. 2 — (E22) No. 4:*** ***(B136) No. 3 — (E22) No. 4:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact of coupling connector
3	**CHECK GROUND CIRCUIT FOR ECM.** Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 2 — Chassis ground:*** ***(B137) No. 3 — Chassis ground:*** ***(B137) No. 7 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of coupling connector
4	**CHECK FRONT OXYGEN (A/F) SENSOR.** Measure the resistance between front oxygen (A/F) sensor terminals. ***Terminals*** ***No. 6 — No. 4:***	Is the resistance 2 — 3 Ω?	Repair the poor contact of ECM connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>

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

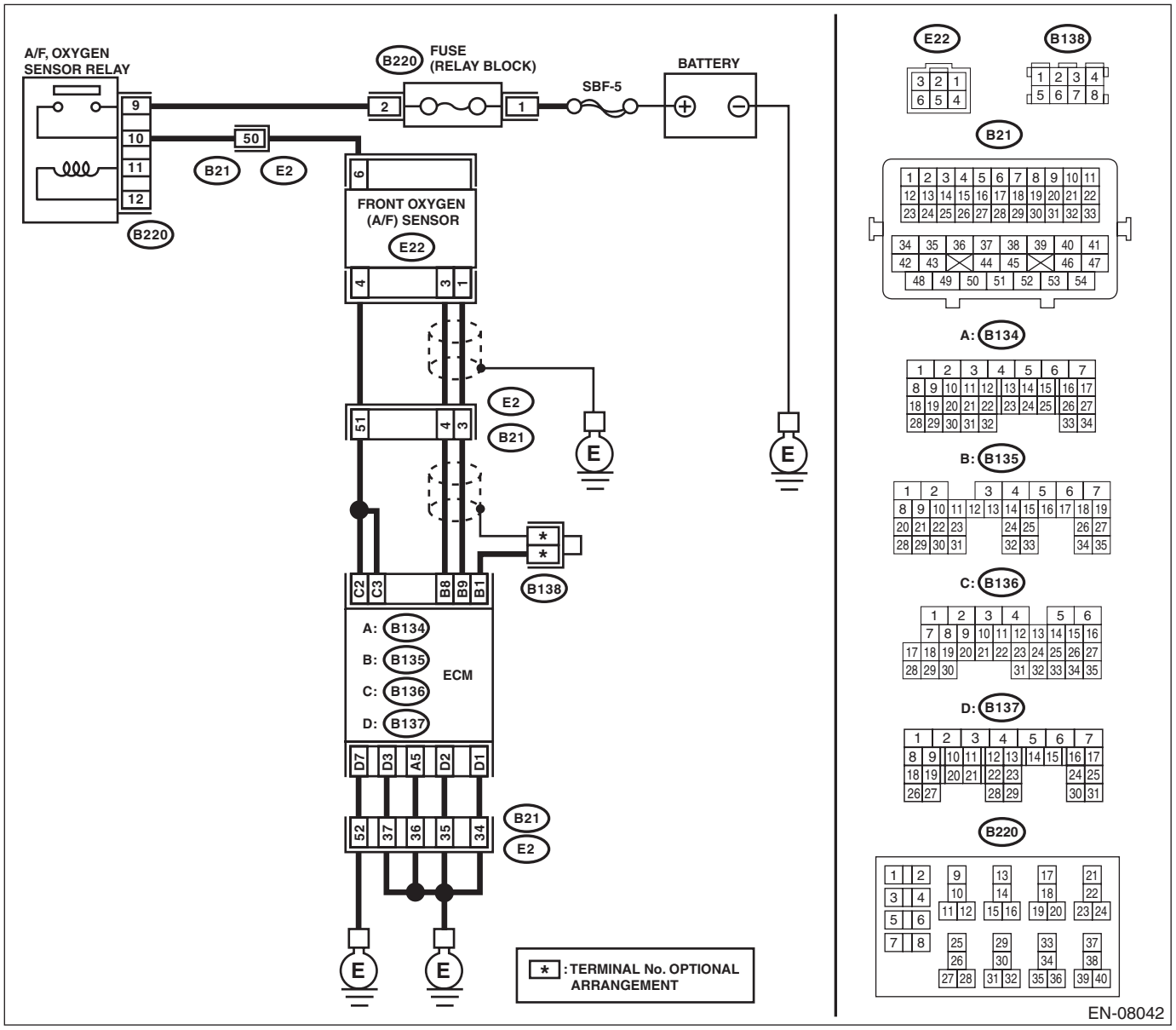
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-15, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 2 (+) — Chassis ground (–):*** ***(B136) No. 3 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector.	Go to step **2**.
2	**CHECK GROUND CIRCUIT FOR ECM.** 1) Disconnect the connectors from ECM. 2) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 2 — Chassis ground:*** ***(B137) No. 3 — Chassis ground:*** ***(B137) No. 7 — Chassis ground:***	Is the resistance less than 5 Ω?	Repair the poor contact of ECM connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of coupling connector

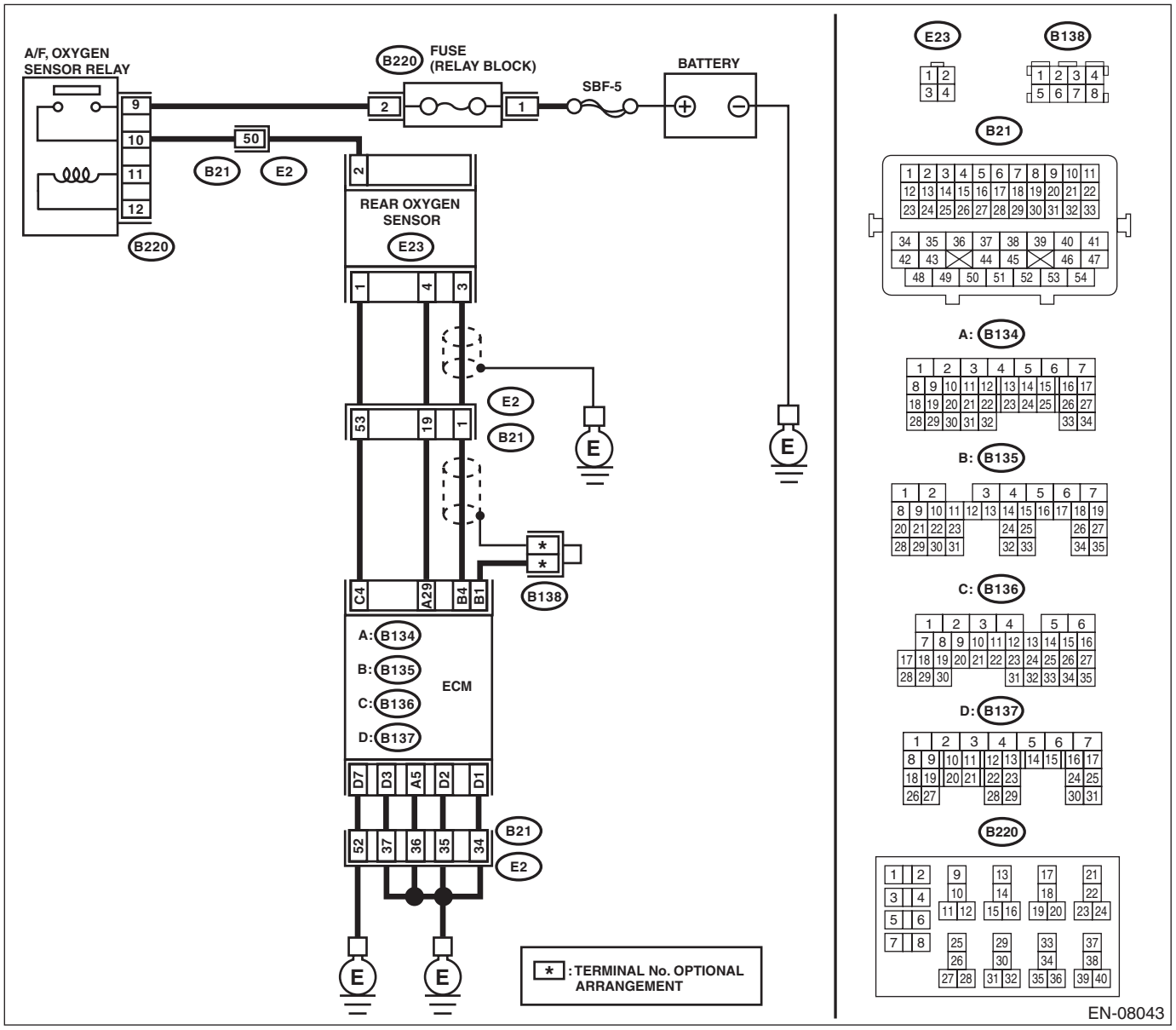
F: DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-17, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**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. ***Connector & terminal*** ***(E23) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the power supply line. Or replace the main relay. NOTE: In this case, repair the following item: • Open circuit in harness between A/F, oxygen sensor relay connector and rear oxygen sensor connector • Poor contact of A/F, oxygen sensor relay connector • Poor contact of coupling connector • Malfunction of A/F, oxygen sensor relay
2	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM and oxygen sensor connector. ***Connector & terminal*** ***(B136) No. 4 — (E23) No. 1:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of coupling connector
3	**CHECK GROUND CIRCUIT FOR ECM.** Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 2 — Chassis ground:*** ***(B137) No. 3 — Chassis ground:*** ***(B137) No. 7 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of coupling connector
4	**CHECK REAR OXYGEN SENSOR.** Measure the resistance between rear oxygen sensor terminals. ***Terminals*** ***No. 2 — No. 1:***	Is the resistance 5 — 7 Ω?	Repair the poor contact of ECM connector.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>

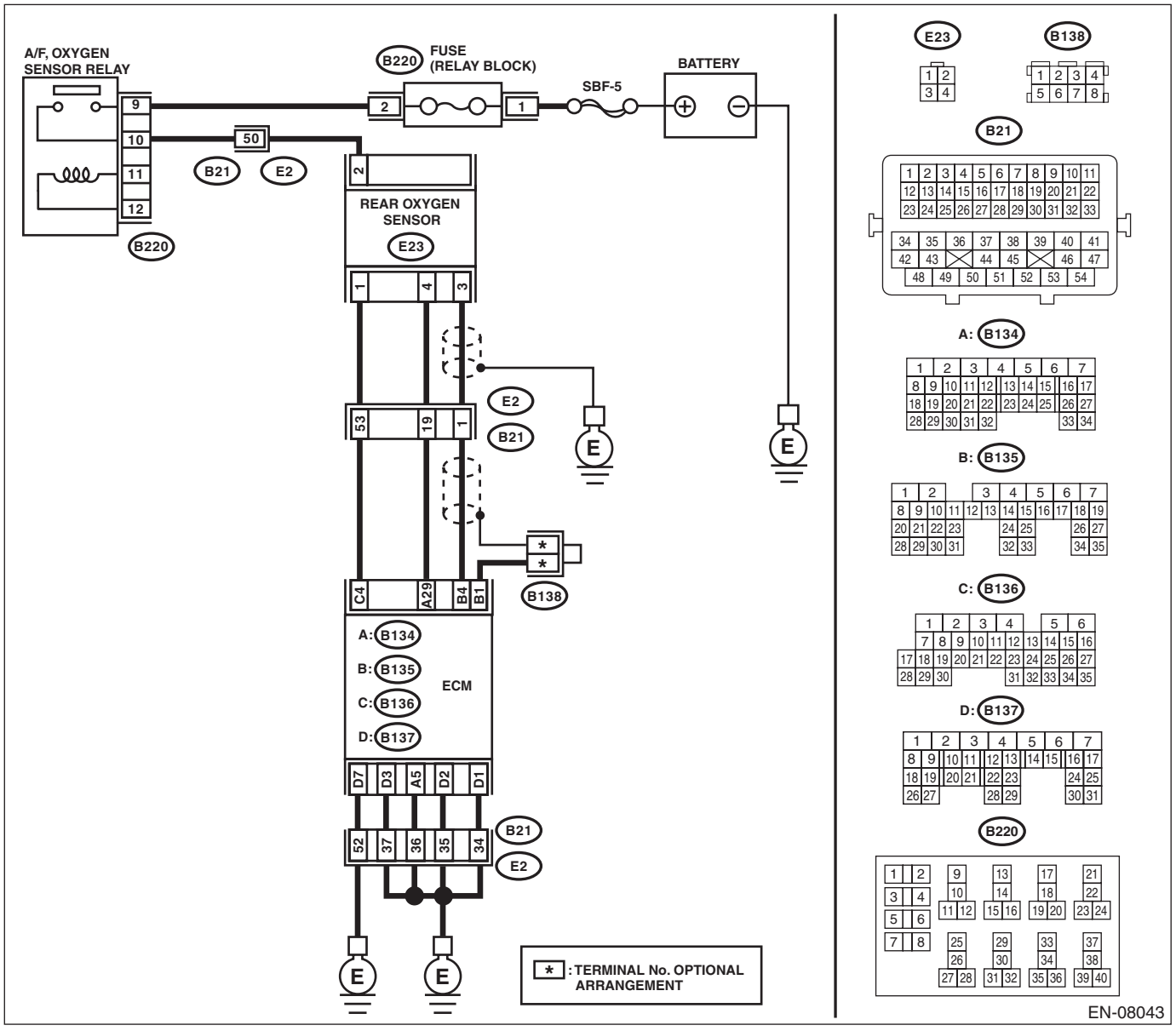
G: DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-19, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 4 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and rear oxygen sensor connector.	Go to step **2**.

Step		Check	Yes	No
2	**CHECK GROUND CIRCUIT FOR ECM.** 1) Disconnect the connectors from ECM. 2) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 2 — Chassis ground:*** ***(B137) No. 3 — Chassis ground:*** ***(B137) No. 7 — Chassis ground:***	Is the resistance less than 5 Ω?	Repair the poor contact of ECM connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of coupling connector

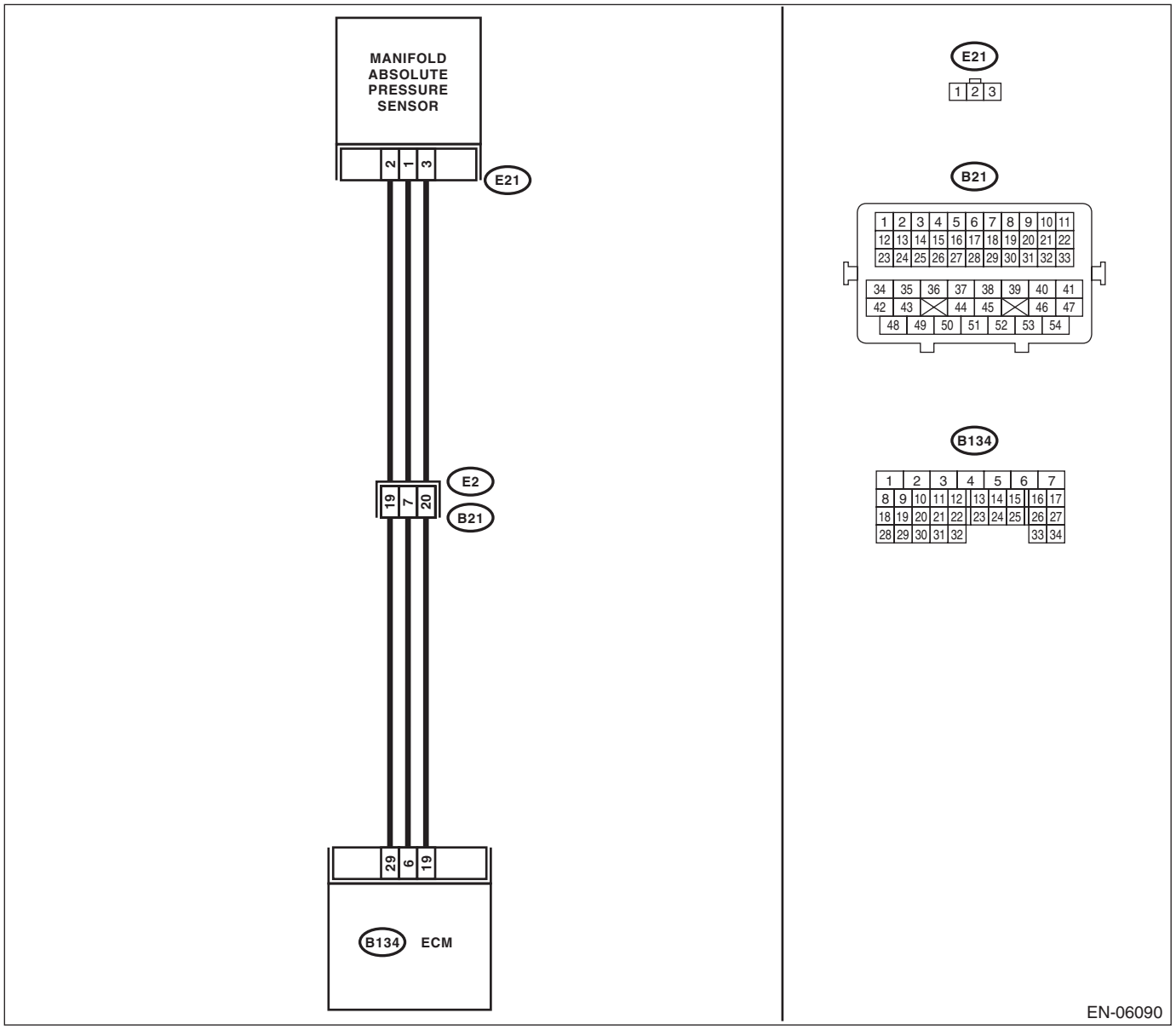
H: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-21, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**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 **2**.

	Step	Check	Yes	No
2	**CHECK MANIFOLD ABSOLUTE PRESSURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of intake manifold pressure 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the measured value 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) when the ignition is turned ON, and 20.0 — 46.7 kPa (150 — 350 mmHg, 5.91 — 13.78 inHg) during idling?	Go to step **3**.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-33, Manifold Absolute Pressure Sensor.>
3	**CHECK THROTTLE OPENING ANGLE.** Read the data of throttle position 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the measured value less than 5% when throttle is fully closed?	Go to step **4**.	Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.>
4	**CHECK THROTTLE OPENING ANGLE.**	Is the measured value 85% or more when throttle is fully open?	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-33, Manifold Absolute Pressure Sensor.>	Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.>

I: DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-23, DTC P0076 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

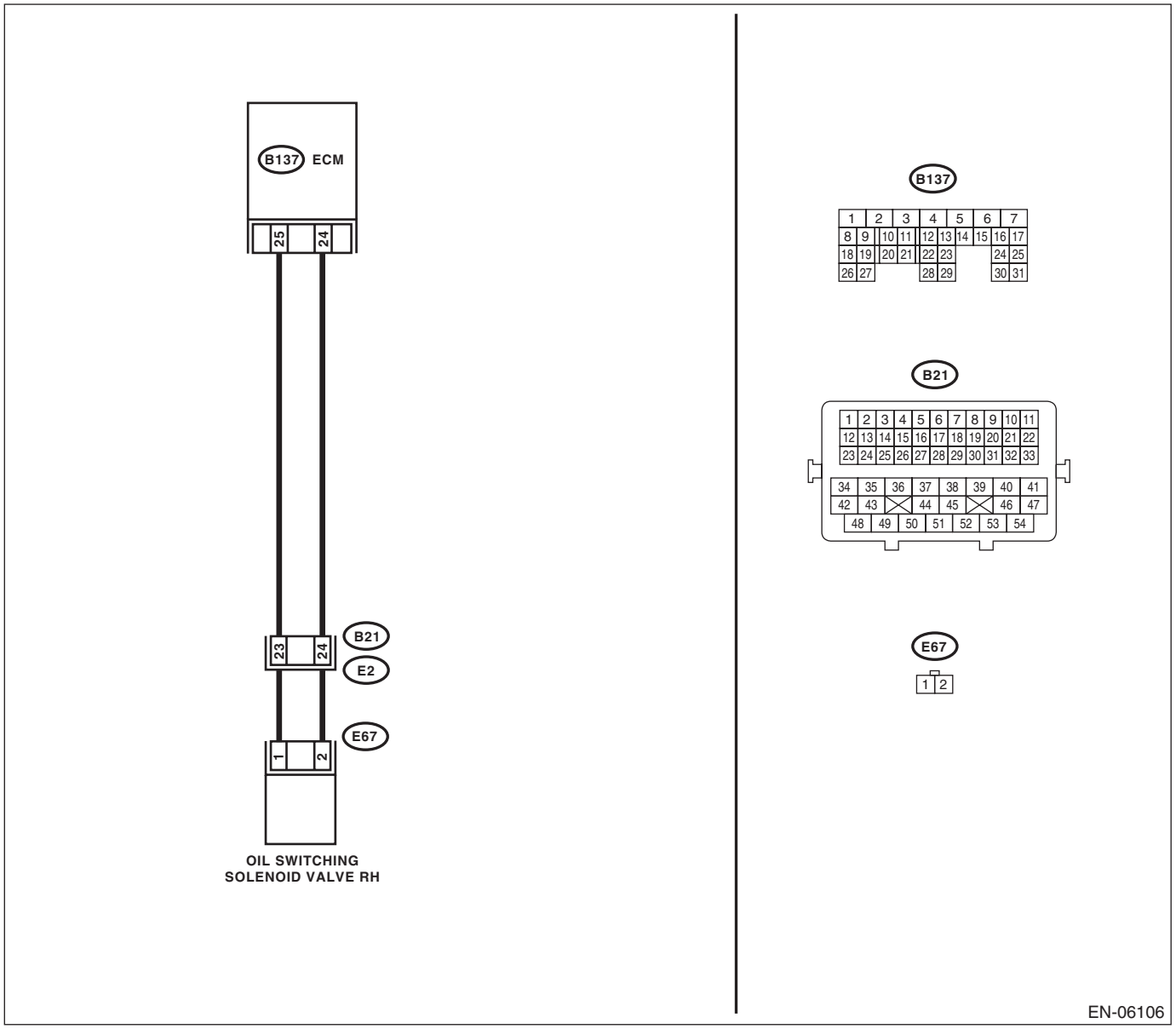
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and oil switching solenoid valve RH. 3) Measure the resistance of harness between ECM and oil switching solenoid valve RH connector. ***Connector & terminal*** ***(B137) No. 25 — (E67) No. 1:*** ***(B137) No. 24 — (E67) No. 2:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and oil switching solenoid valve RH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE RH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 25 — Chassis ground:*** ***(B137) No. 24 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM and oil switching solenoid valve RH connector.
3	**CHECK OIL SWITCHING SOLENOID VALVE RH.** Measure the resistance between oil switching solenoid valve RH terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil switching solenoid valve RH connector.	Replace the oil switching solenoid valve RH. <Ref. to ME(H4SO)-93, Oil Switching Solenoid Valve.>

J: DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-24, DTC P0077 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

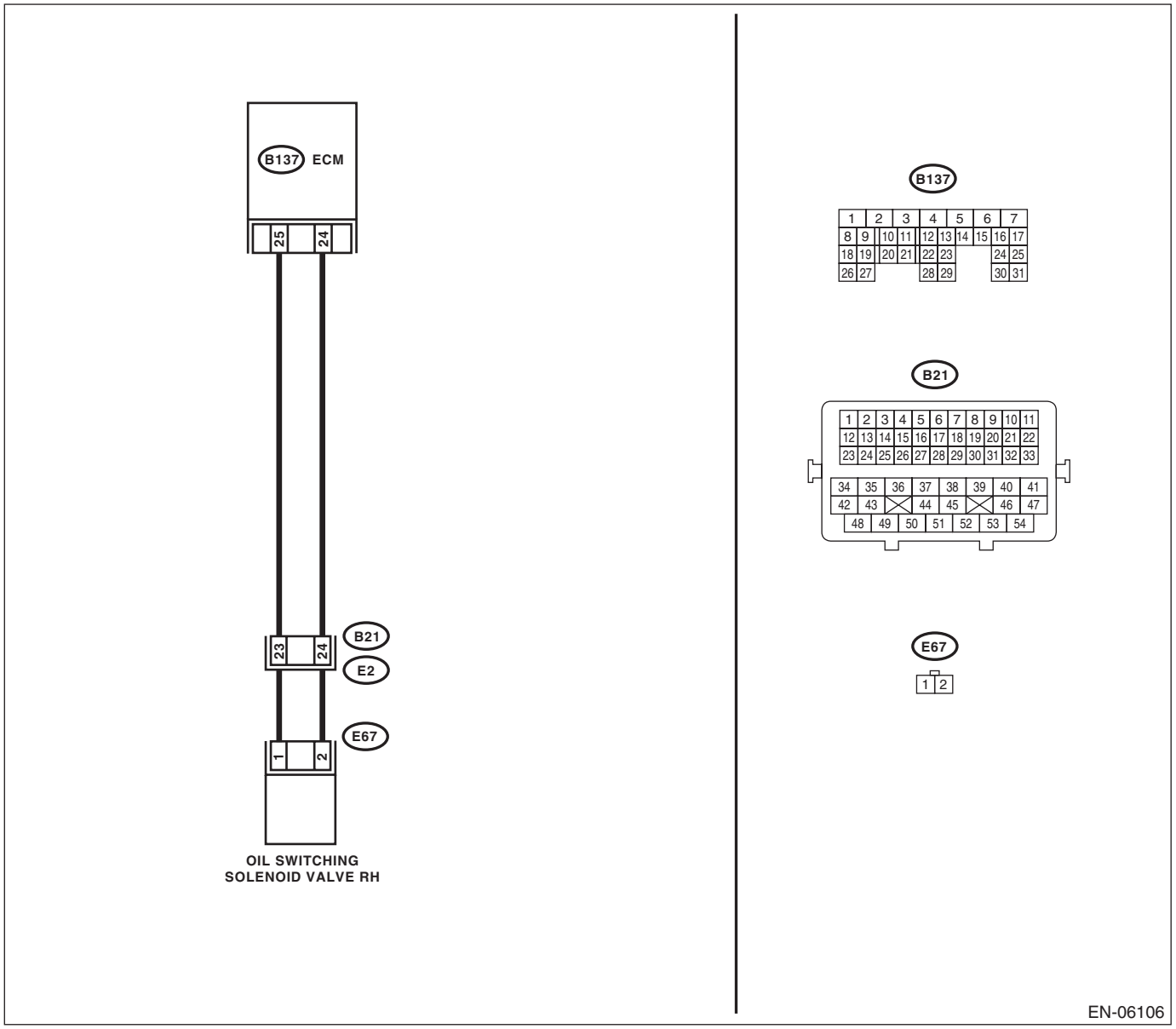
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and oil switching solenoid valve RH. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 25 (+) — Chassis ground (–):*** ***(B137) No. 24 (+) — Chassis ground (–):***	Is the voltage less than 1 V?	Go to step **2**.	Repair the short circuit to power in the harness between ECM and oil switching solenoid valve connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE RH CONNECTOR.** Measure the resistance of harness between ECM and oil switching solenoid valve RH connector. ***Connector & terminal*** ***(B137) No. 25 — (E67) No. 1:*** ***(B137) No. 24 — (E67) No. 2:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and oil switching solenoid valve RH connector • Poor contact of coupling connector
3	**CHECK OIL SWITCHING SOLENOID VALVE RH.** Measure the resistance between oil switching solenoid valve RH terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil switching solenoid valve RH connector.	Replace the oil switching solenoid valve RH. <Ref. to ME(H4SO)-93, Oil Switching Solenoid Valve.>

K: DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-24, DTC P0082 INTAKE VALVE CONTROL SOLENOID CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

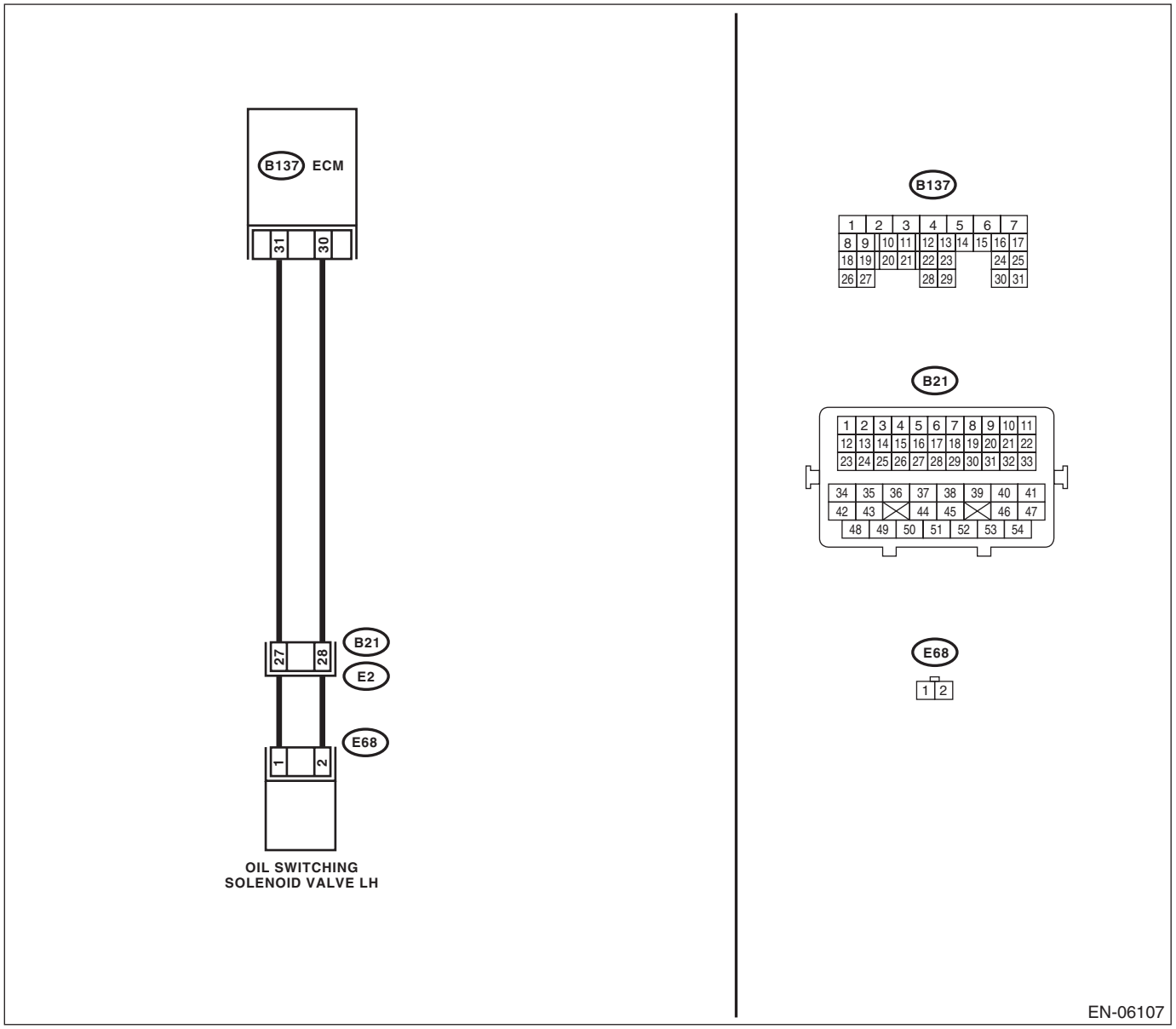
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and oil switching solenoid valve LH. 3) Measure the resistance between ECM and oil switching solenoid valve LH connector. ***Connector & terminal*** ***(B137) No. 31 — (E68) No. 1:*** ***(B137) No. 30 — (E68) No. 2:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and oil switching solenoid valve LH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE LH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 31 — Chassis ground:*** ***(B137) No. 30 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM and oil switching solenoid valve LH connector.
3	**CHECK OIL SWITCHING SOLENOID VALVE LH.** Measure the resistance between oil switching solenoid valve LH terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil switching solenoid valve LH connector.	Replace the oil switching solenoid valve LH. <Ref. to ME(H4SO)-93, Oil Switching Solenoid Valve.>

L: DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-24, DTC P0083 INTAKE VALVE CONTROL SOLENOID CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

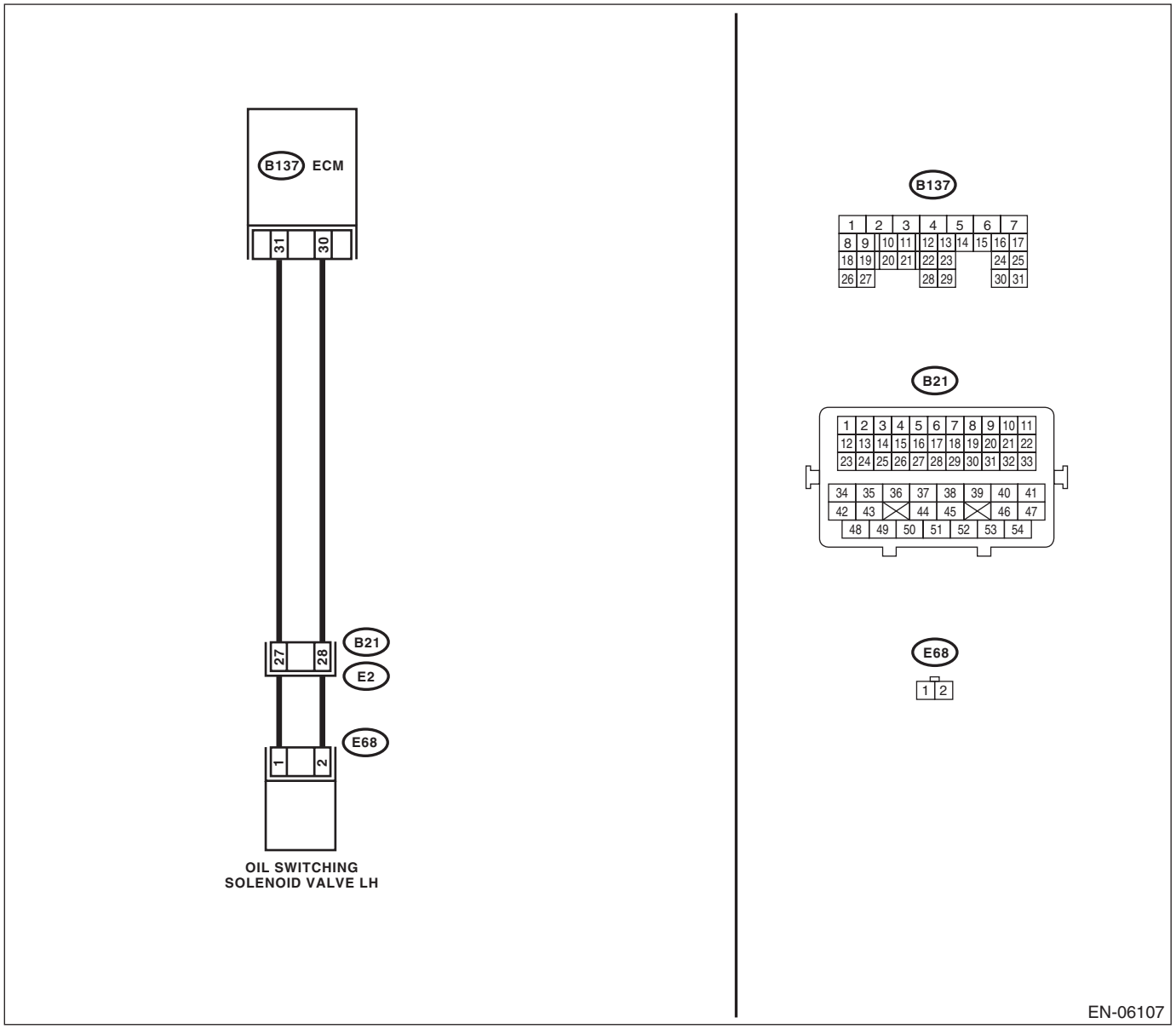
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and oil switching solenoid valve LH. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 31 (+) — Chassis ground (–):*** ***(B137) No. 30 (+) — Chassis ground (–):***	Is the voltage less than 1 V?	Go to step **2**.	Repair the short circuit to power supply in harness between ECM and oil switching solenoid valve LH connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL SWITCHING SOLENOID VALVE LH CONNECTOR.** Measure the resistance between ECM and oil switching solenoid valve LH connector. ***Connector & terminal*** ***(B137) No. 31 — (E68) No. 1:*** ***(B137) No. 30 — (E68) No. 2:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and oil switching solenoid valve LH connector • Poor contact of coupling connector
3	**CHECK OIL SWITCHING SOLENOID VALVE LH.** Measure the resistance between oil switching solenoid valve LH terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil switching solenoid valve LH connector.	Replace the oil switching solenoid valve LH. <Ref. to ME(H4SO)-93, Oil Switching Solenoid Valve.>

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-25, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

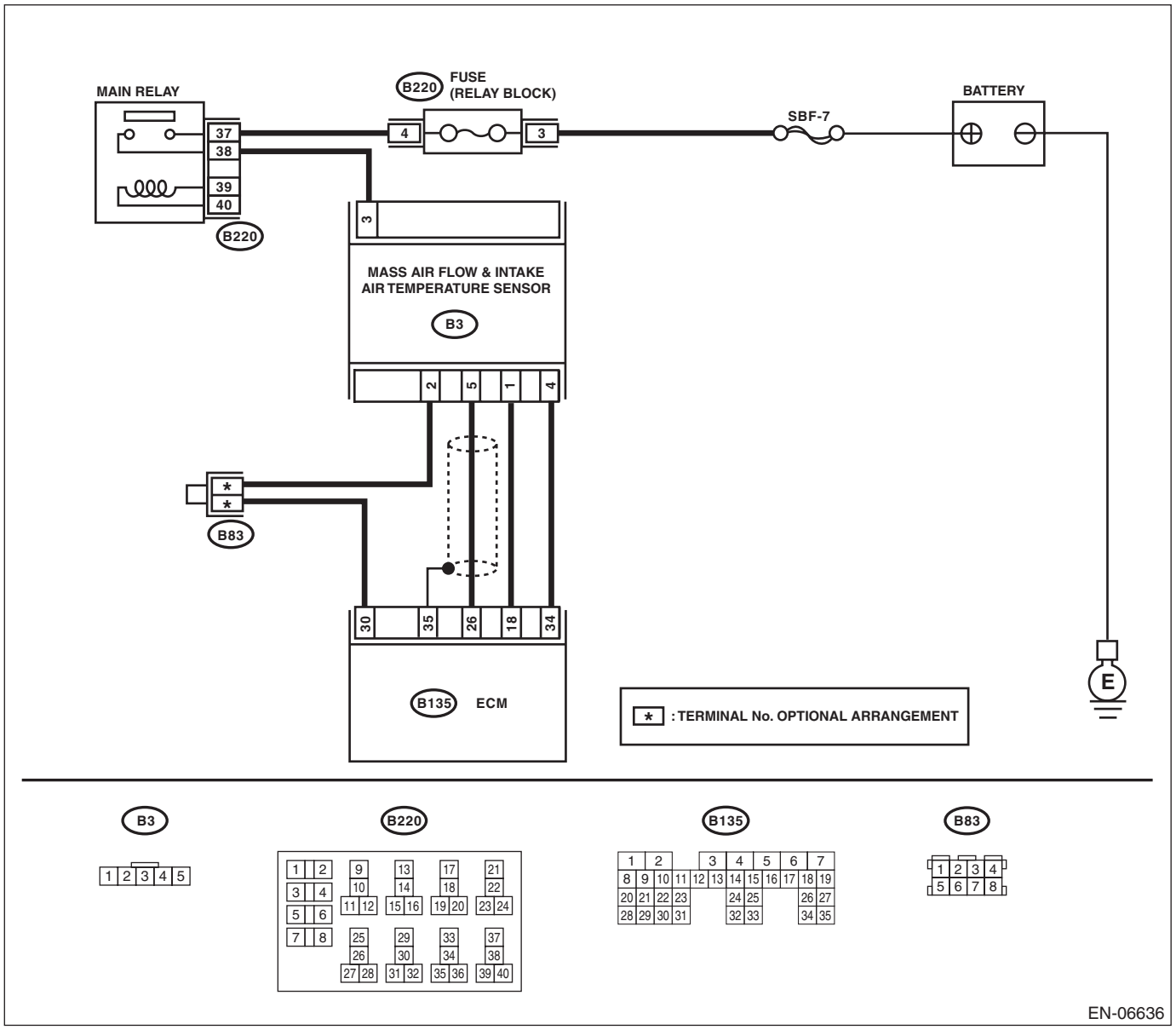
TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>

N: DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

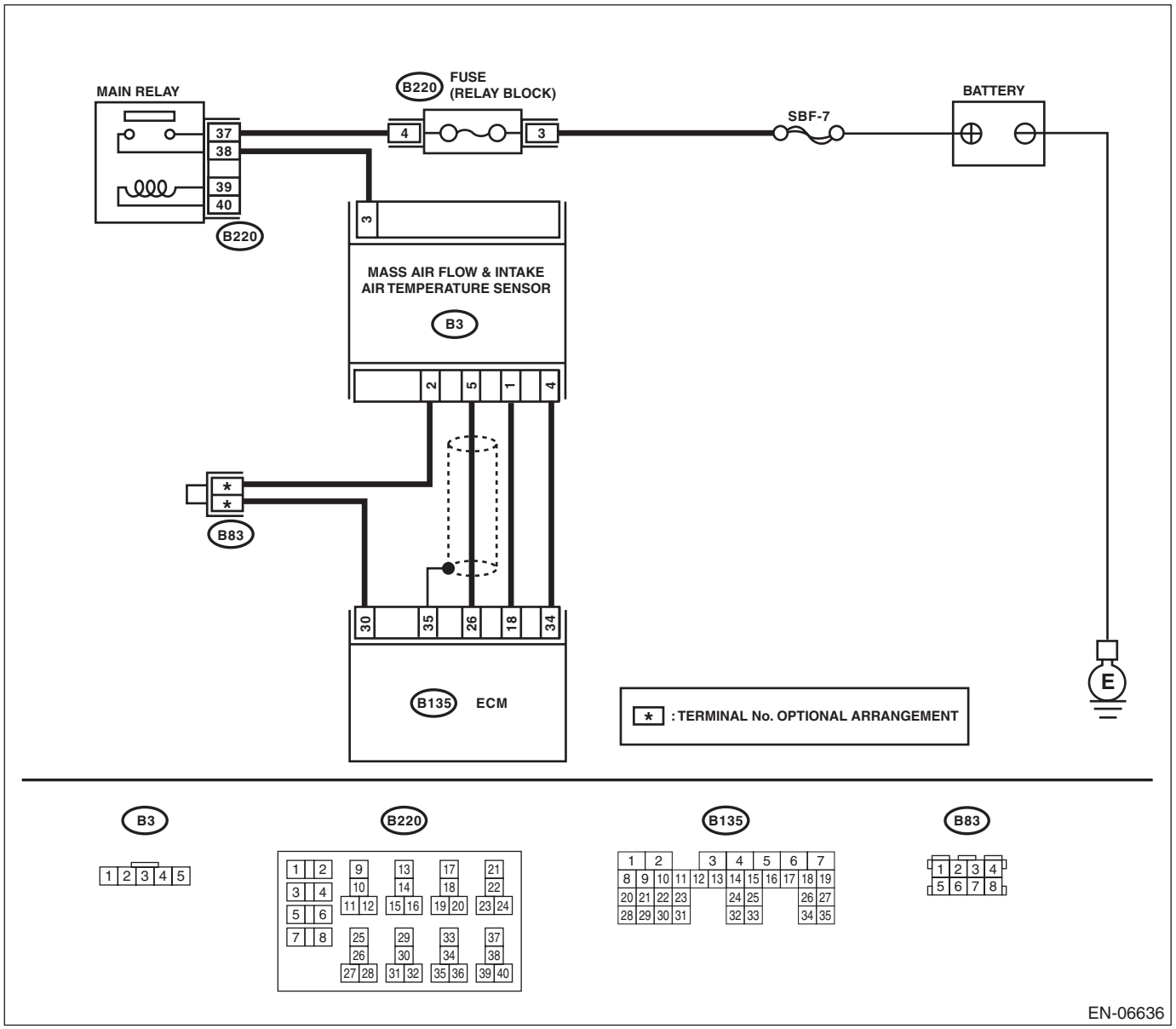
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-27, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of air flow 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage less than 0.2 V?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK POWER SUPPLY OF MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the mass air flow and intake air temperature sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground. ***Connector & terminal*** ***(B3) No. 3 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between main relay and mass air flow and intake air temperature sensor connector • Poor contact of main relay connector
3	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance of harness between ECM and the mass air flow and intake air temperature sensor connector. ***Connector & terminal*** ***(B135) No. 26 — (B3) No. 5:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the open circuit in harness between ECM and the mass air flow and intake air temperature sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 26 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM and mass air flow and intake air temperature sensor connector.
5	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and mass air flow and intake air temperature sensor connector.	Is there poor contact of ECM or mass air flow and intake air temperature sensor connector?	Repair the poor contact of ECM or mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>

O: DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

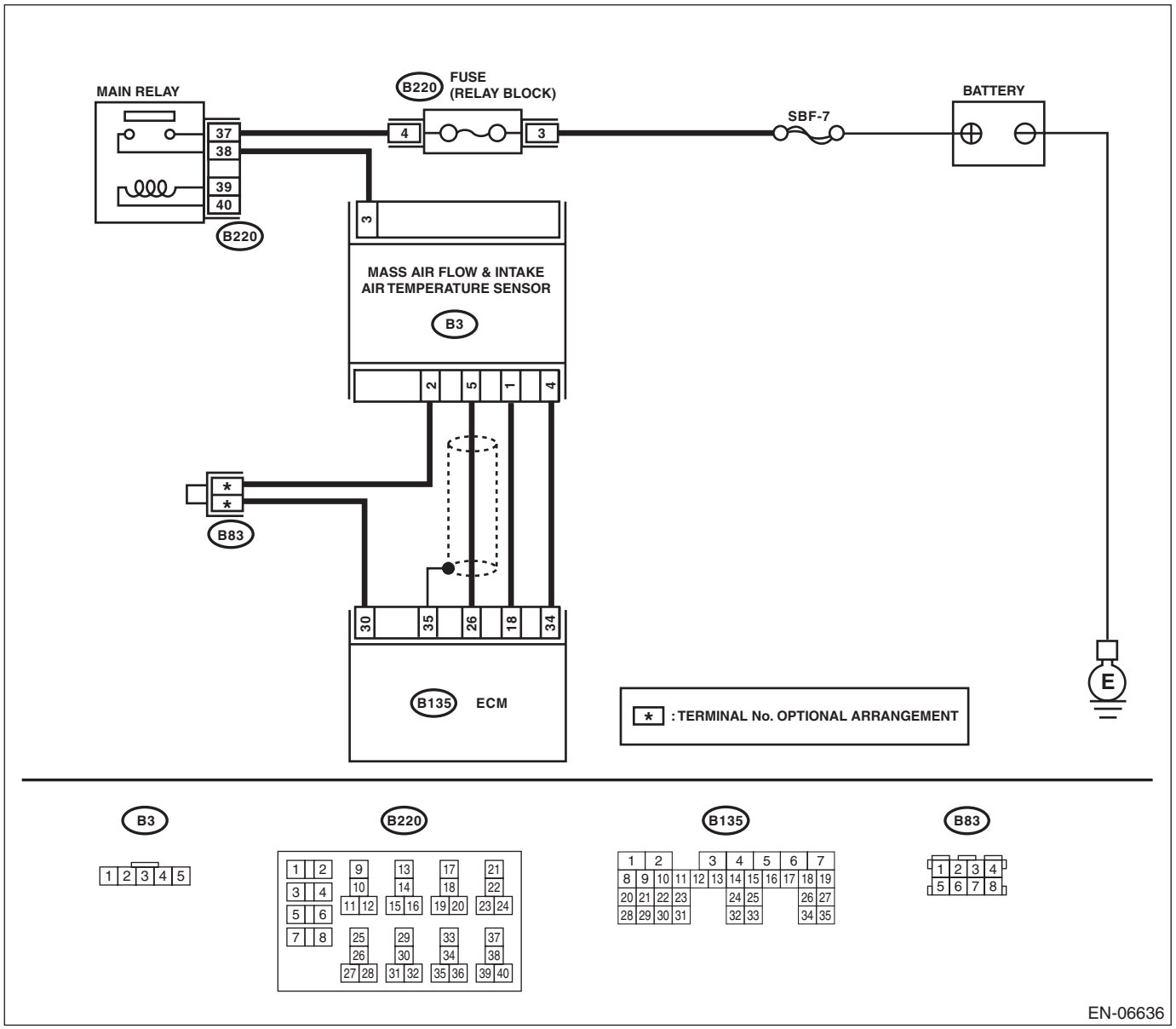
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-28, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-06636

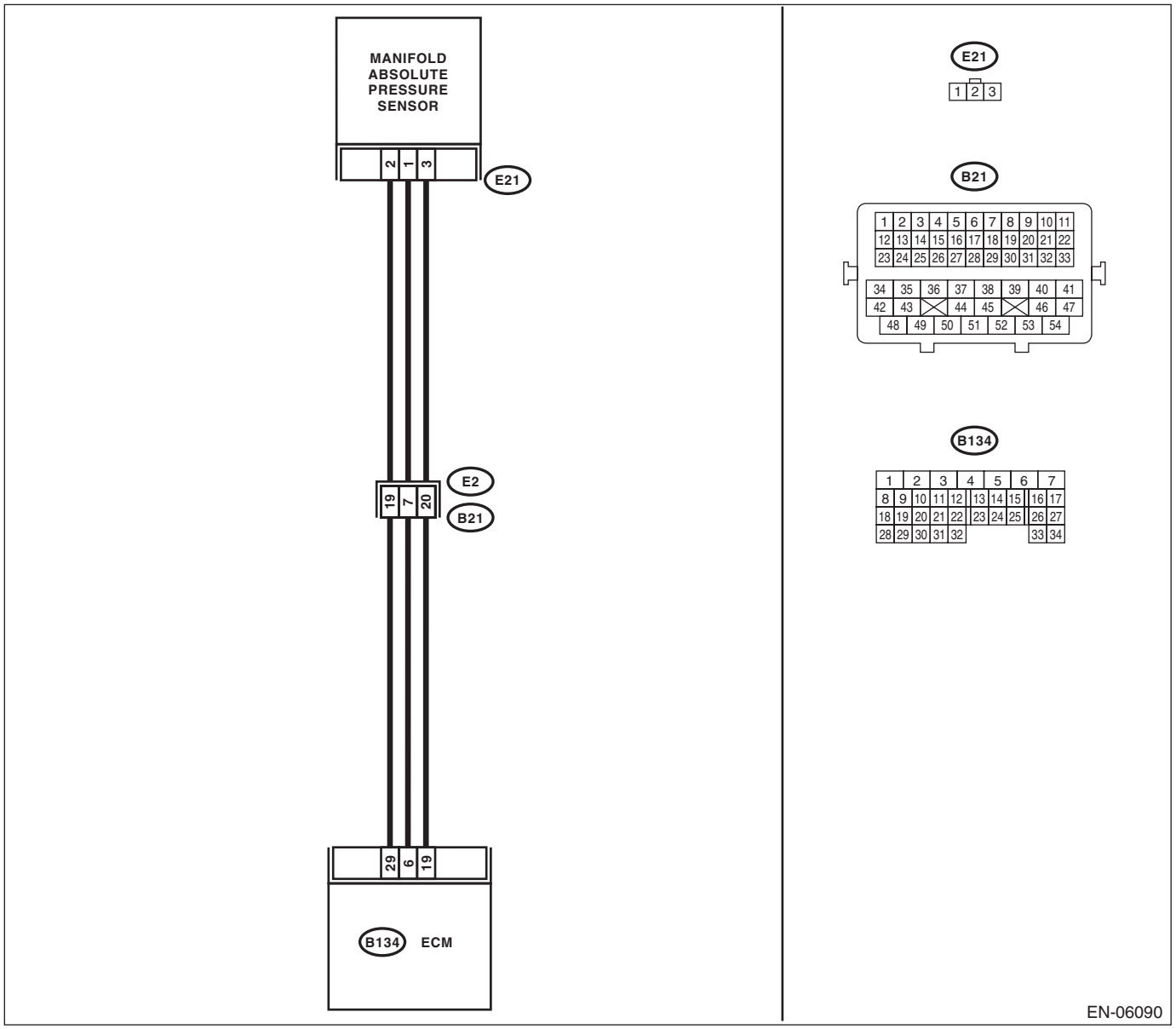
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of air flow sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 5 V or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the mass air flow and intake air temperature sensor. 3) Start the engine. 4) Read the data of air flow 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 5 V or more?	Repair the short circuit of harness to power supply between ECM and mass air flow and intake air temperature sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between mass air flow and intake air temperature sensor connector and engine ground. ***Connector & terminal*** ***(B3) No. 4 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and mass air flow and intake air temperature sensor connector. • Poor contact of ECM connector
4	**CHECK FOR POOR CONTACT.** Check for poor contact of mass air flow and intake air temperature sensor connector.	Is there poor contact of mass air flow and intake air temperature sensor connector?	Repair the poor contact of mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-29, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/ BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.
WIRING DIAGRAM:



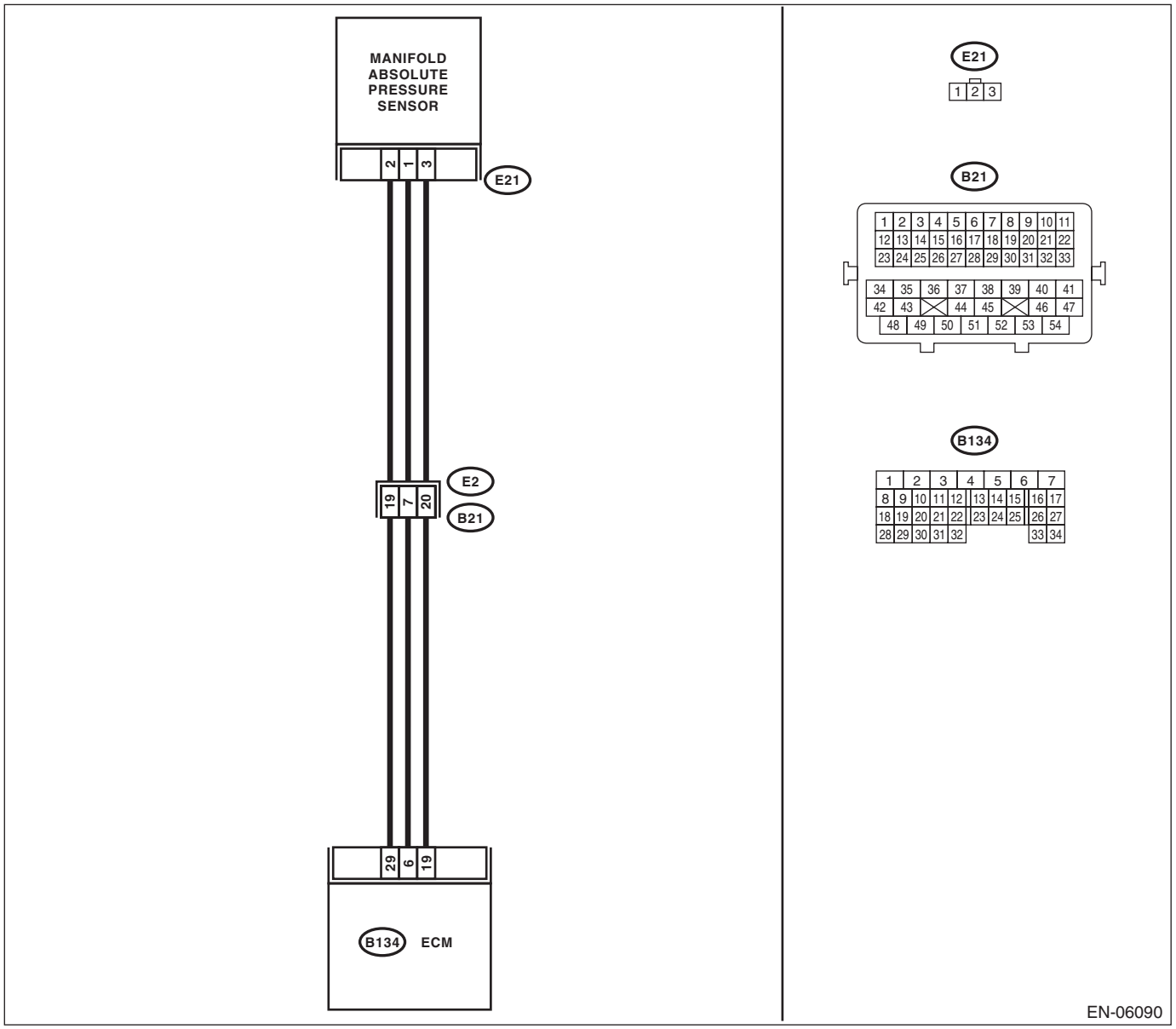
	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value less than 13.3 kPa (100 mmHg, 3.94 inHg) ?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK POWER SUPPLY OF MANIFOLD ABSOLUTE PRESSURE SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from manifold absolute pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between manifold absolute pressure sensor connector and engine ground. ***Connector & terminal*** ***(E21) No. 3 (+) — Engine ground (–):***	Is the voltage 4.5 V or more?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and manifold absolute pressure sensor connector. • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector. ***Connector & terminal*** ***(B134) No. 6 — (E21) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and manifold absolute pressure sensor connector. • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 6 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair ground short circuit of harness between ECM and manifold absolute pressure sensor connector.
5	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and manifold absolute pressure sensor connector.	Is there poor contact of ECM or manifold absolute pressure sensor connector?	Repair the poor contact of ECM or manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-33, Manifold Absolute Pressure Sensor.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-30, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/ BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.
WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of intake manifold absolute pressure signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**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) Start the engine. 4) Read the data of intake manifold absolute pressure 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 119.5 kPa (896.5 mmHg, 35.29 inHg) or more?	Repair the short circuit to power in harness between ECM and manifold absolute pressure sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between manifold absolute pressure sensor connector and engine ground. ***Connector & terminal*** ***(E21) No. 2 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and manifold absolute pressure sensor connector. • Poor contact of ECM connector • Poor contact of coupling connector
4	**CHECK FOR POOR CONTACT.** Check for poor contact of manifold absolute pressure sensor connector.	Is there poor contact of manifold absolute pressure sensor connector?	Repair the poor contact of manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4SO)-33, Manifold Absolute Pressure Sensor.>

R: DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-31, DTC P0111 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

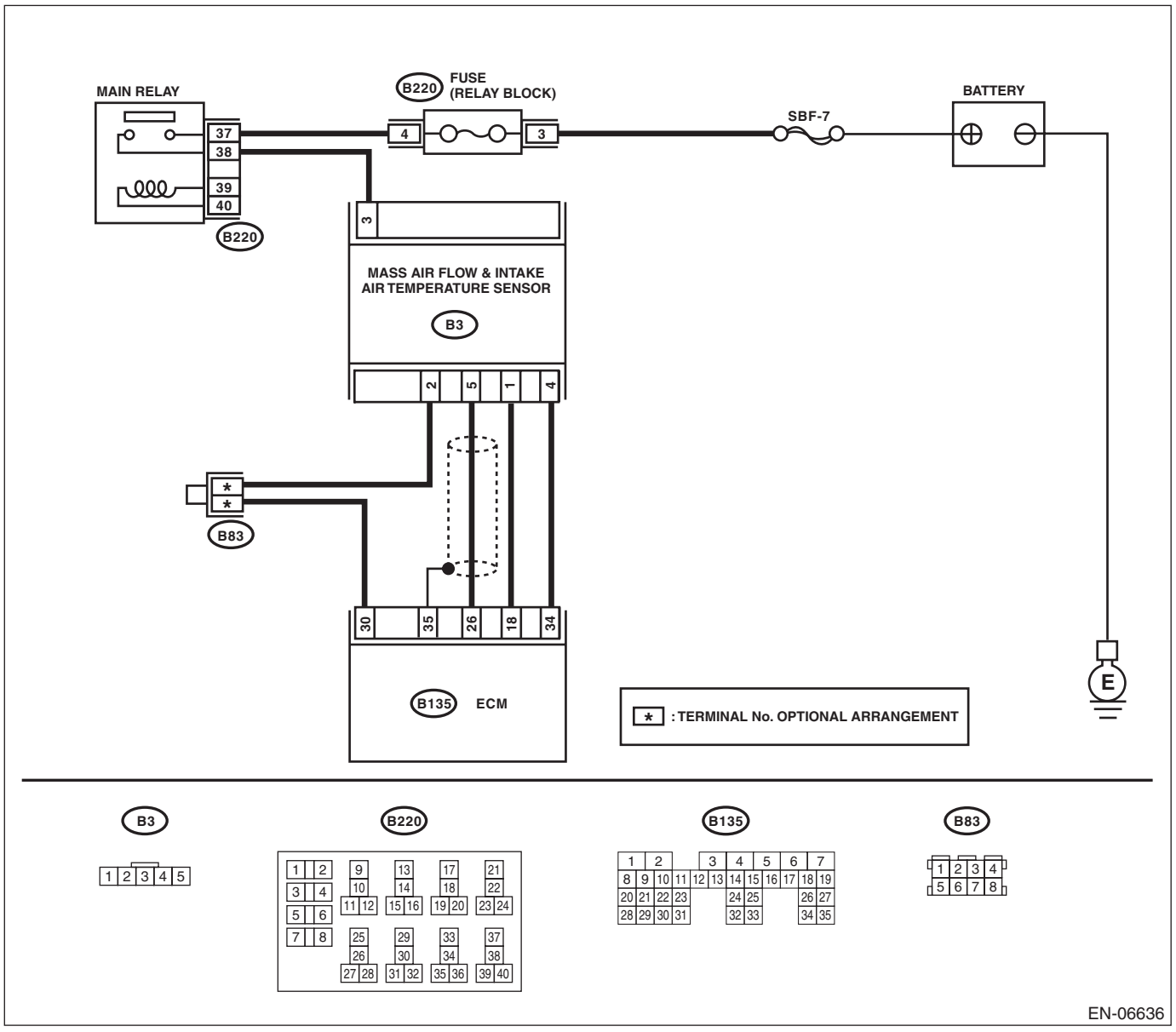
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK ENGINE COOLANT TEMPERATURE.** 1) Start the engine and warm up completely. 2) Measure the engine coolant temperature using the 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>	Check for DTC P0125. <Ref. to EN(H4SO)(diag)-143, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

S: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-34, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

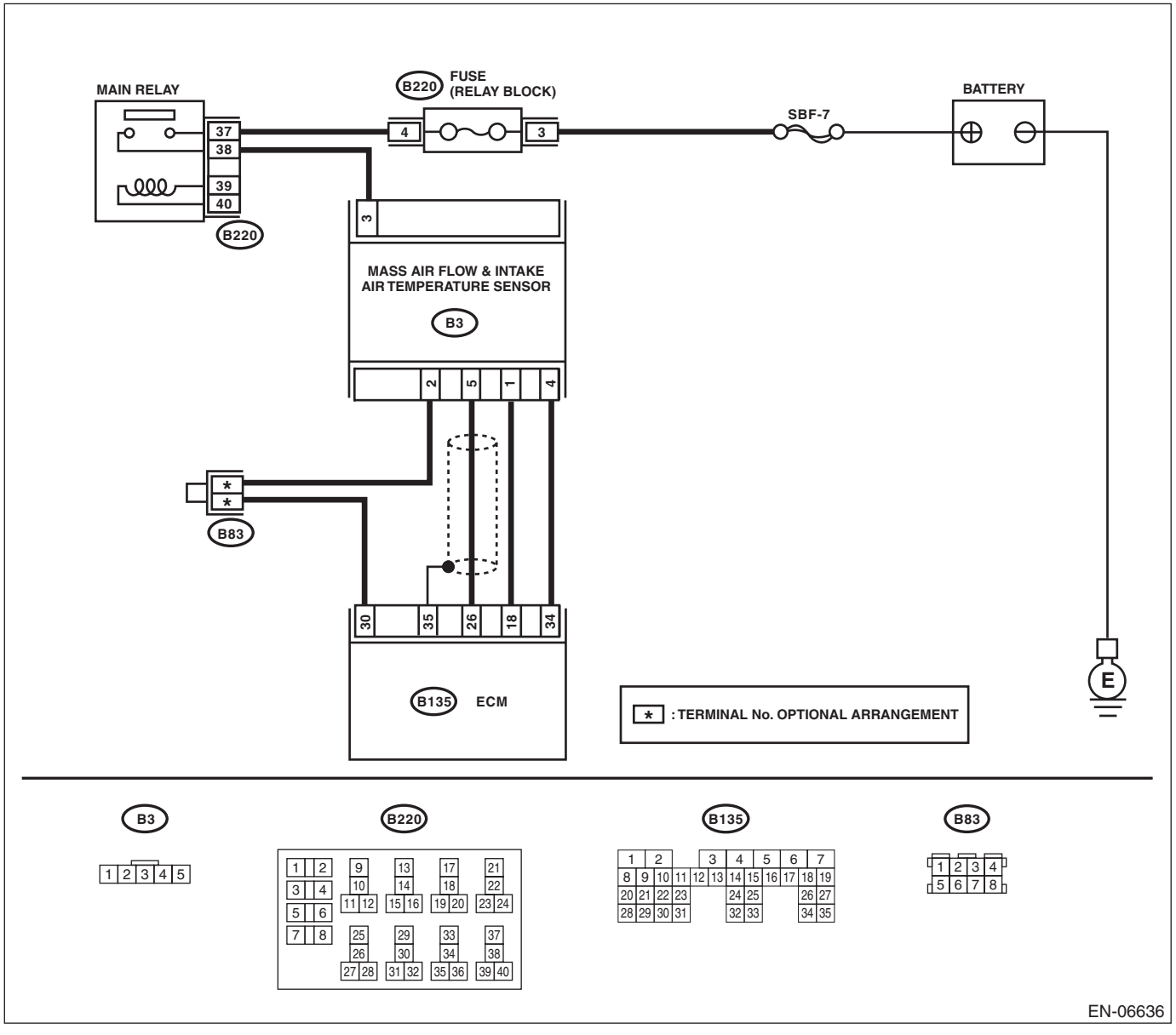
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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 general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the intake air temperature 120°C (248°F) or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the mass air flow and intake air temperature sensor. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 18 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>	Repair the short circuit to ground in harness between ECM and mass air flow and intake air temperature sensor connector.

T: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-35, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

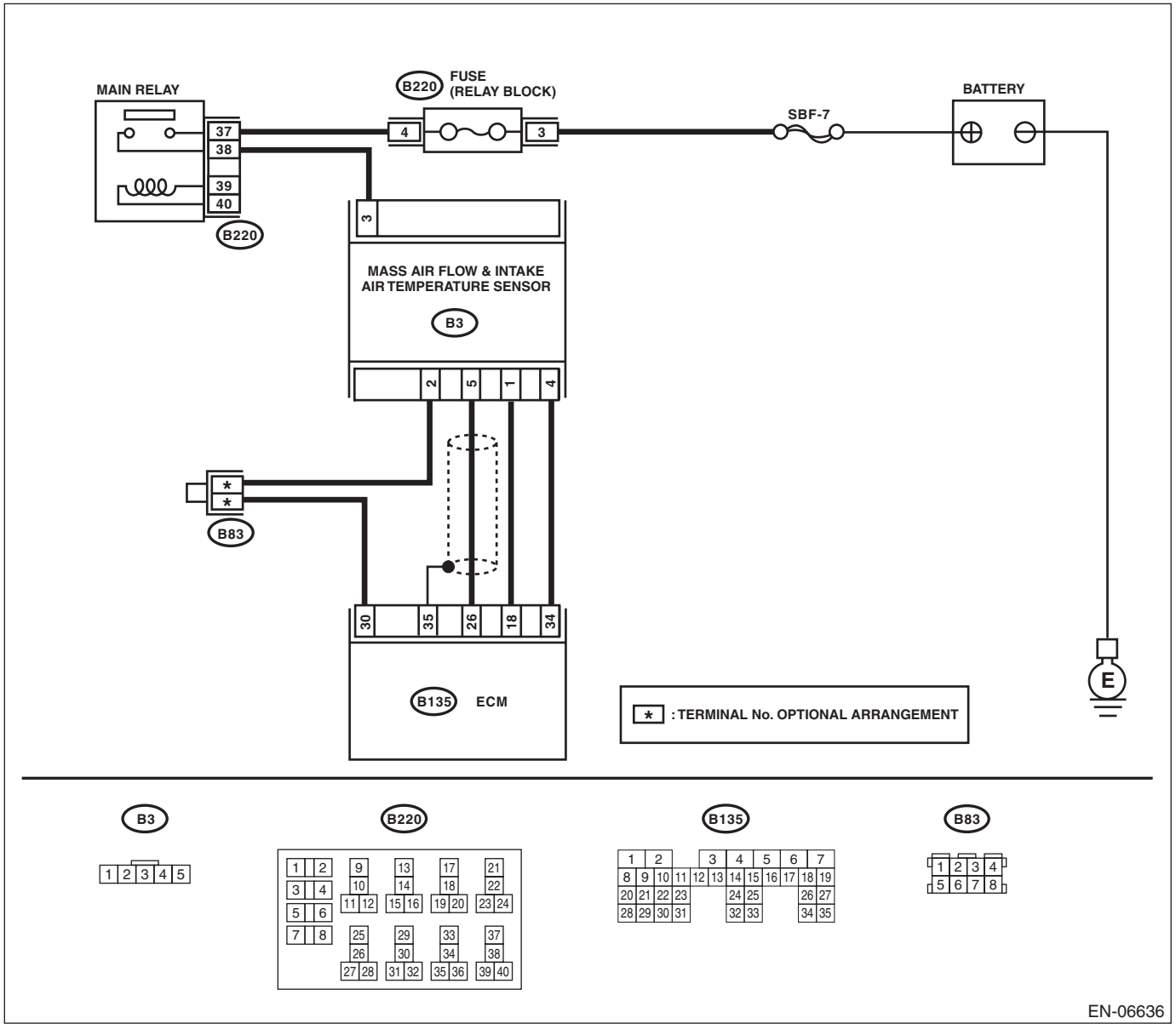
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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 general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the intake air temperature less than –40°C (–40°F) ?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and mass air flow and intake air temperature sensor connector.	Is there poor contact of ECM or mass air flow and intake air temperature sensor connector?	Repair the poor contact of ECM or mass air flow and intake air temperature sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the mass air flow and intake air temperature sensor. 3) Measure the resistance of harness between ECM and the mass air flow and intake air temperature sensor connector. ***Connector & terminal*** ***(B135) No. 18 — (B3) No. 1:*** ***(B135) No. 30 — (B3) No. 2:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and mass air flow and intake air temperature sensor connector. • Poor contact of joint connector
4	**CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR CONNECTOR.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 18 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit of harness to power supply between ECM and mass air flow and intake air temperature sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>

U: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

DTC DETECTING CONDITION:

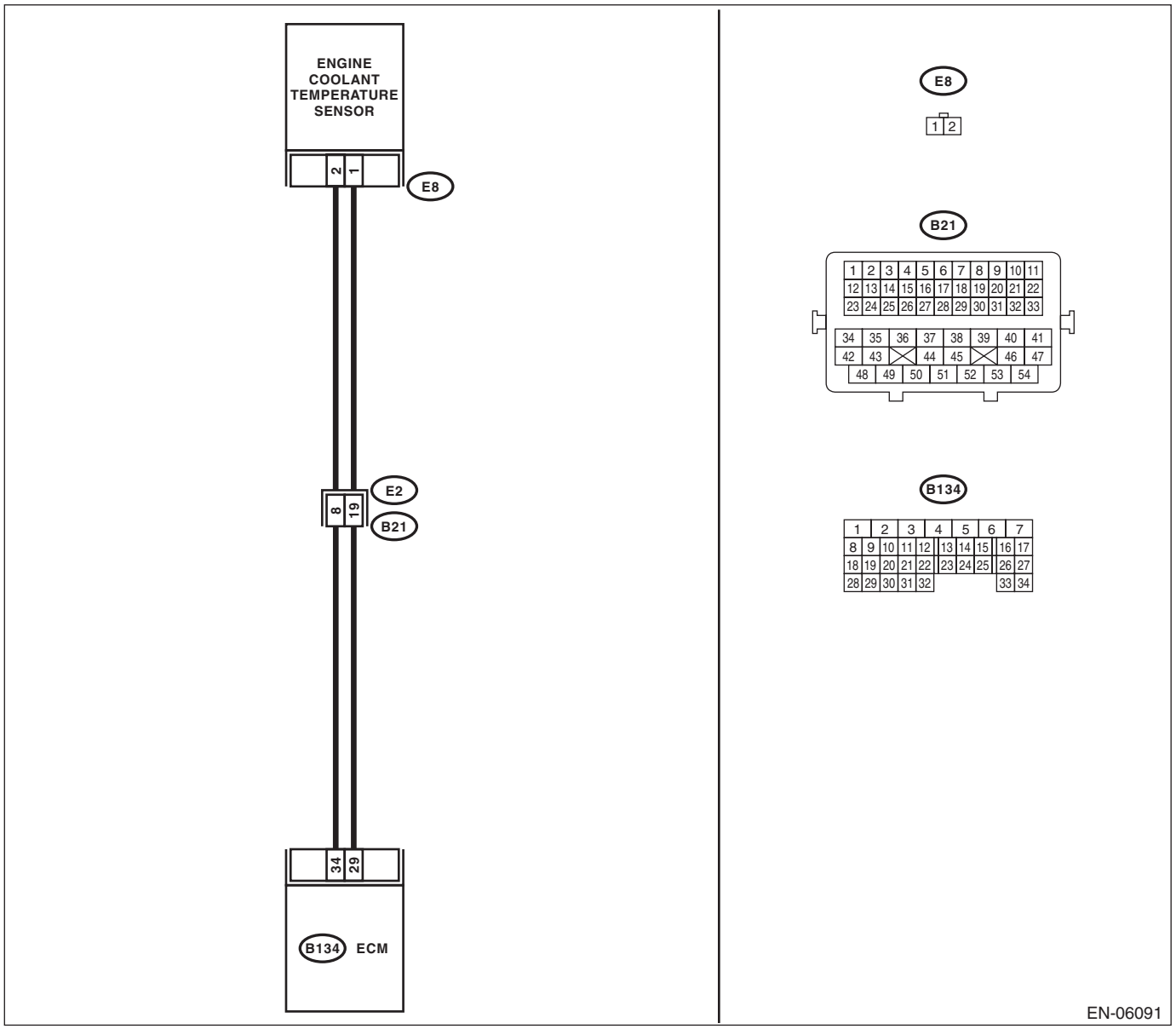
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-36, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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 procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 150°C (302°F) or higher?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and engine coolant temperature sensor. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 34 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.>	Repair short circuit in harness to ground between ECM and engine coolant temperature sensor connector.

V: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

DTC DETECTING CONDITION:

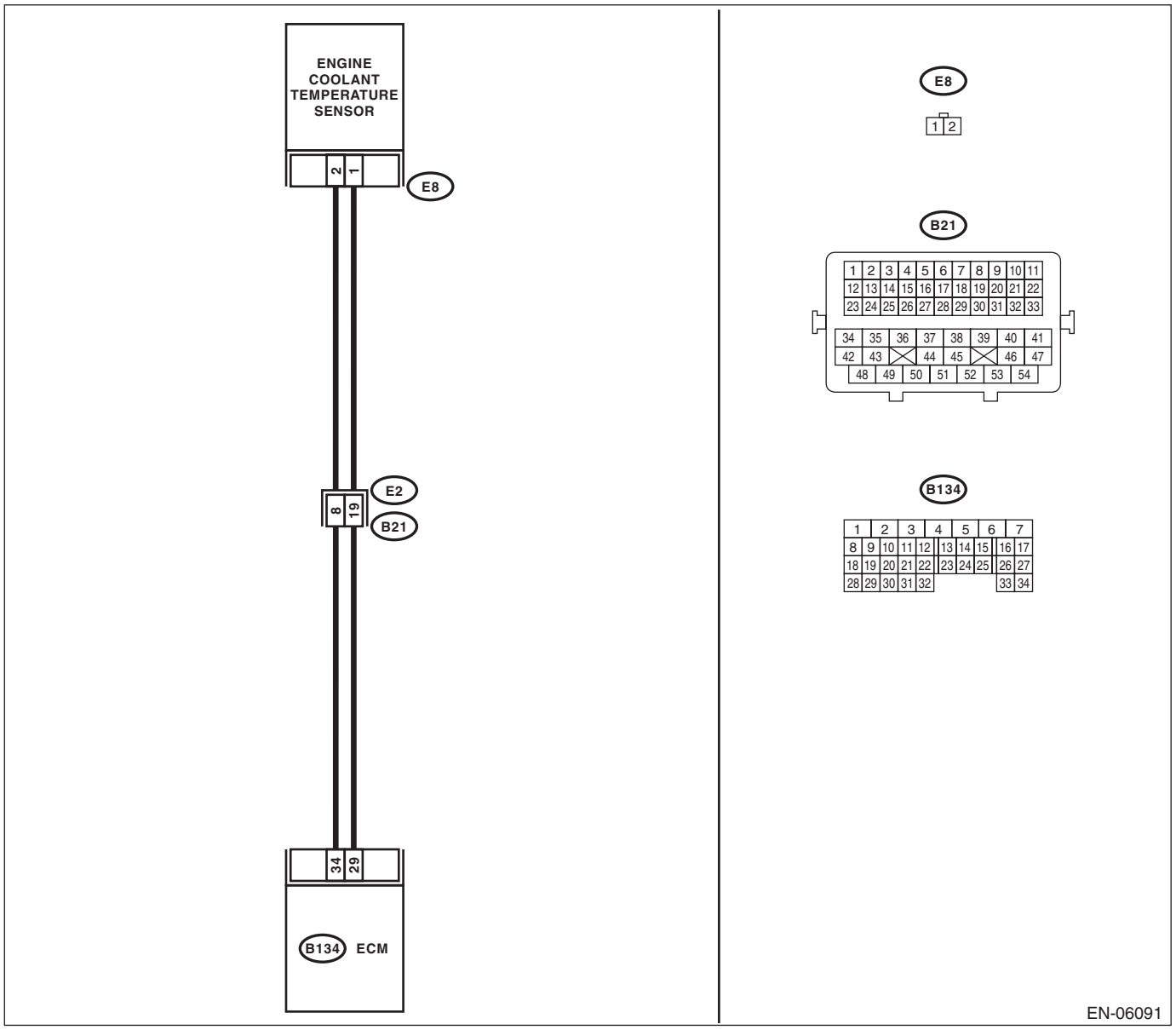
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-37, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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 procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature less than –40°C (–40°F) ?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and engine coolant temperature sensor connector.	Is there poor contact of ECM or engine coolant temperature sensor connector?	Repair the poor contact of ECM or engine coolant temperature sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and engine coolant temperature sensor. 3) Measure the resistance of harness between ECM and engine coolant temperature sensor connector. ***Connector & terminal*** ***(B134) No. 34 — (E8) No. 2:*** ***(B134) No. 29 — (E8) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and engine coolant temperature sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 34 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and engine coolant temperature sensor connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-38, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

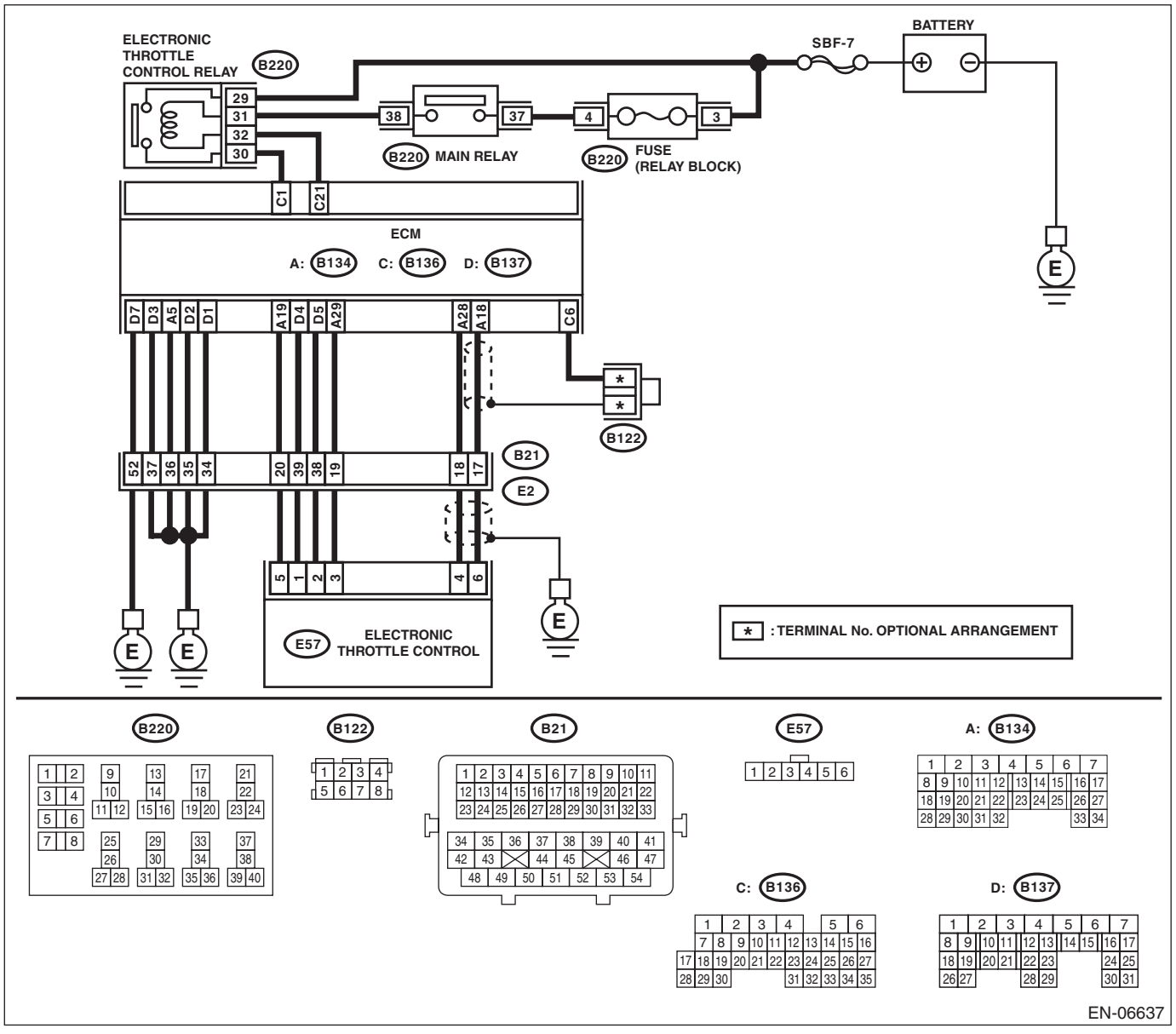
TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 18 — Chassis ground:*** ***(B134) No. 18 — (B136) No. 6:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(B134) No. 18 — Engine ground:***	Is the resistance 1 MΩ or more?	Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.>	Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>

X: DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-39, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

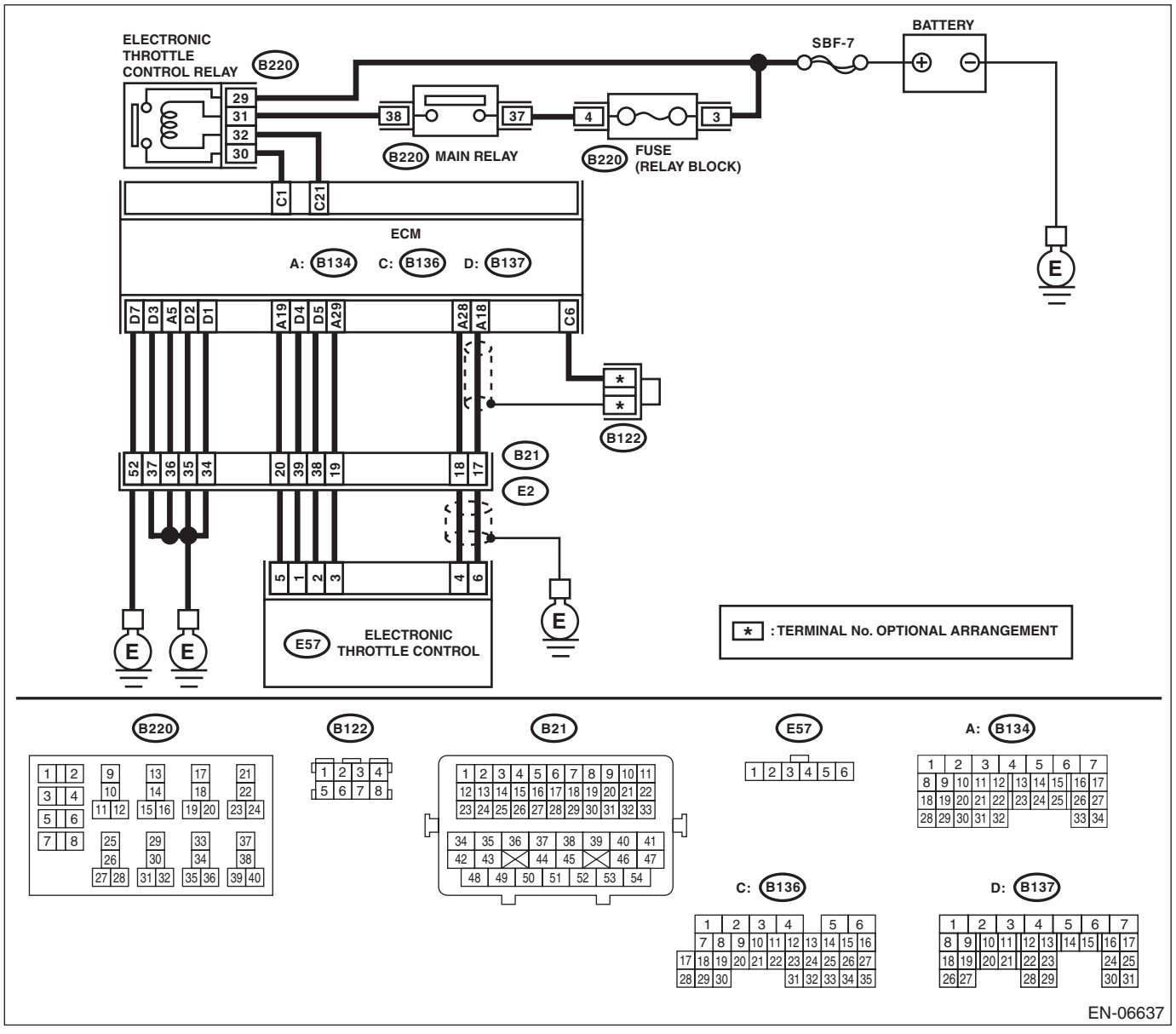
TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 18 — (E57) No. 6:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and electronic throttle control connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and electronic throttle control connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 18:***	Is the resistance 1 MΩ or more?	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.>	Repair the short circuit to power in harness between ECM and electronic throttle control connector.

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-40, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Engine does not return to idle.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK TIRE SIZE.**	Is the tire size as specified and the same size as three other wheels?	Go to step **2**.	Replace the tire.
2	**CHECK ENGINE COOLANT.** Check the following items: • Amount of engine coolant • Engine coolant freeze • Contamination of engine coolant	Is the engine coolant normal?	Go to step **3**.	Fill or replace the engine coolant. <Ref. to CO(H4SO)-13, REPLACEMENT, Engine Coolant.>
3	**CHECK THERMOSTAT.**	Does the thermostat remain opened?	Replace the thermostat. <Ref. to CO(H4SO)-17, Thermostat.>	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.>

Z: DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-42, DTC P0126 INSUFFICIENT ENGINE COOLANT TEMPERATURE FOR STABLE OPERATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

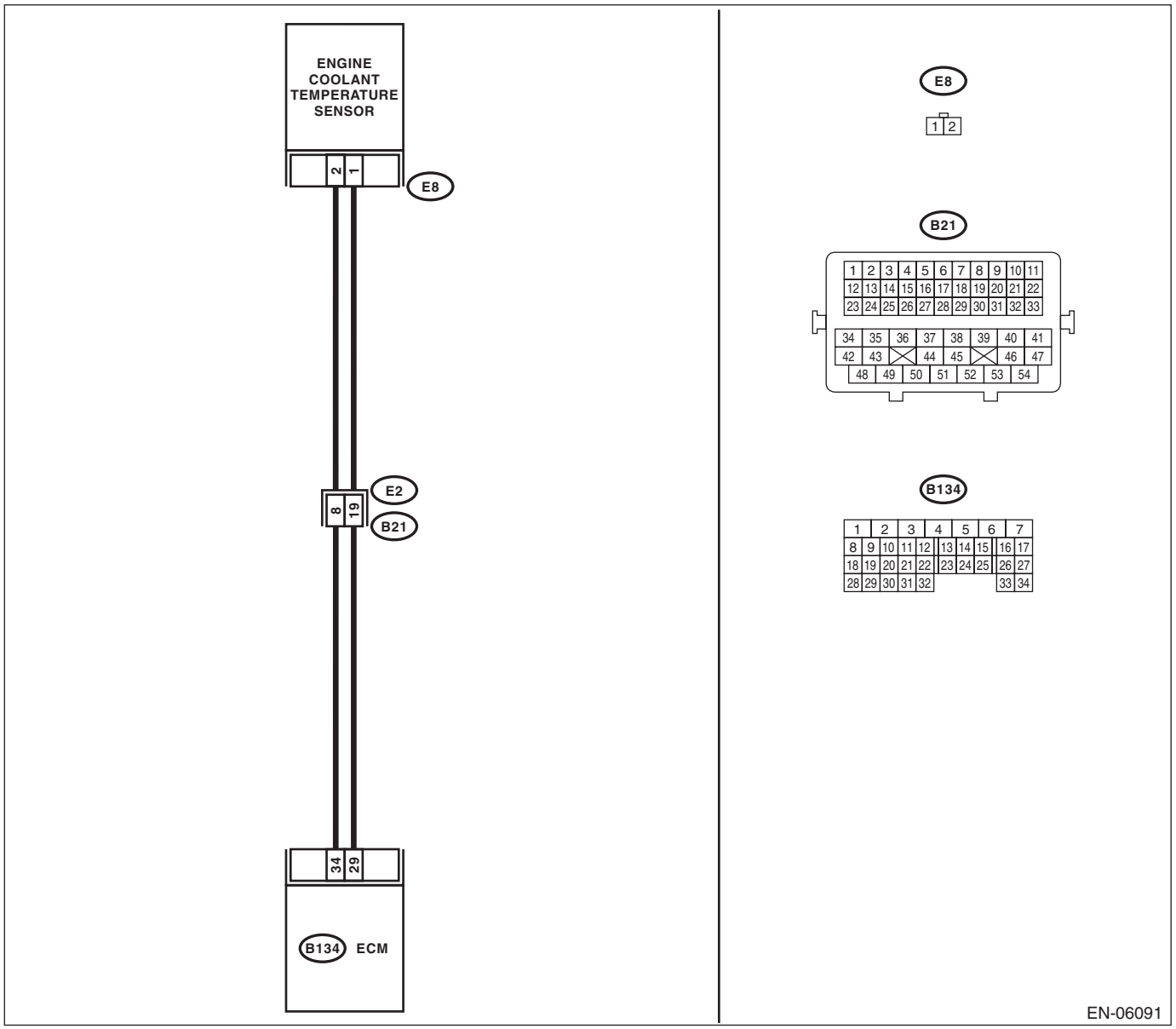
TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** Measure the resistance between engine coolant temperature sensor terminals when the engine coolant is cold and after warmed up. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance of engine coolant temperature sensor different between when engine coolant is cold and after warmed up?	Repair the poor contact of ECM connector.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.>

AA:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-44, DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Thermostat remains open.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK ENGINE COOLANT.**	Is the amount of engine coolant normal?	Go to step **2**.	Supply engine coolant. <Ref. to CO(H4SO)-13, Engine Coolant.>
2	**CHECK RADIATOR FAN.** 1) Start the engine. 2) Check the radiator fan operation.	Does the radiator fan continuously rotate for 3 minutes or more during idling?	Repair radiator fan circuit. <Ref. to CO(H4SO)-23, Radiator Main Fan and Fan Motor.> and <Ref. to CO(H4SO)-25, Radiator Sub Fan and Fan Motor.>	Replace the thermostat. <Ref. to CO(H4SO)-17, Thermostat.>

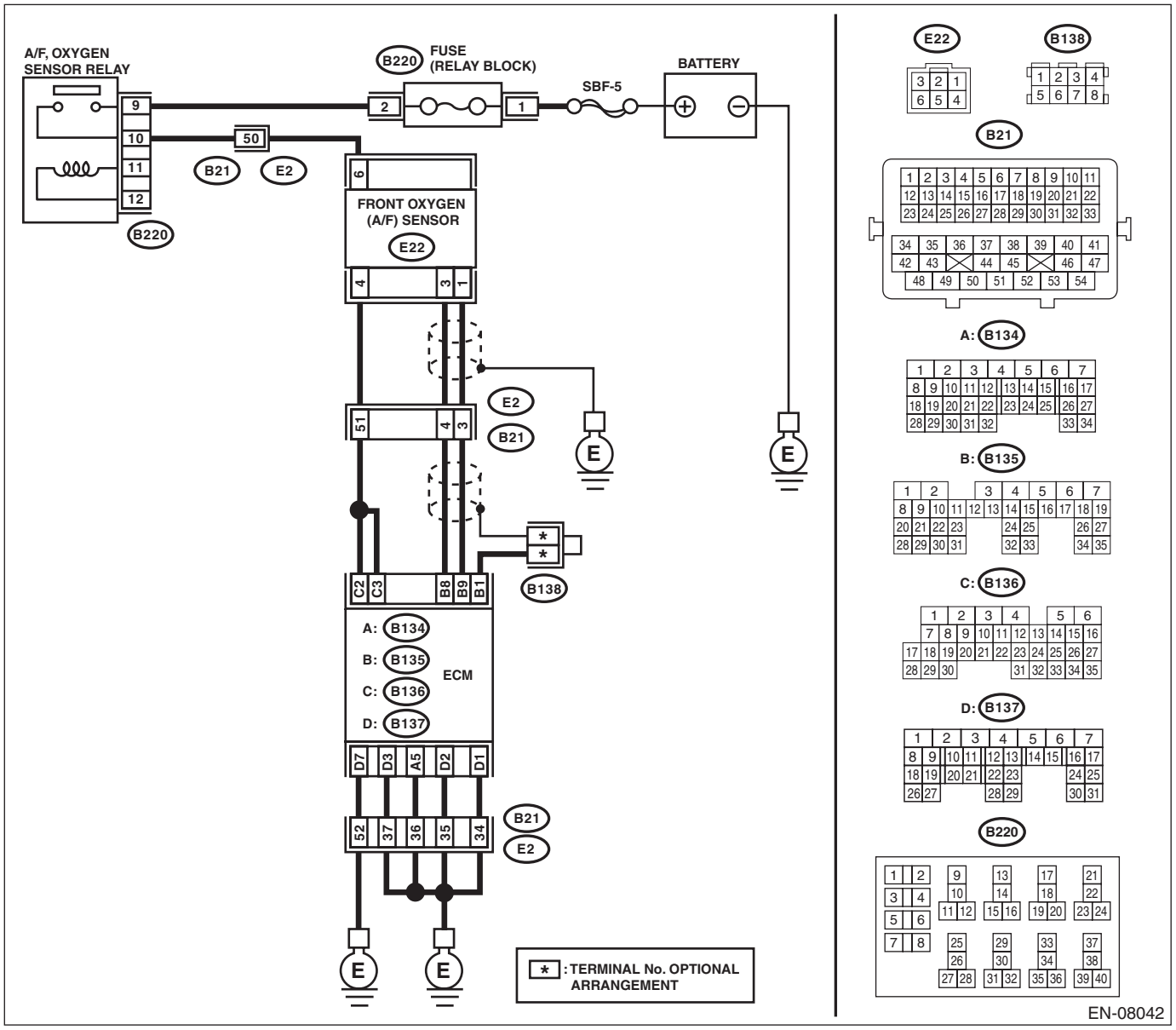
AB:DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-46, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

Step		Check	Yes	No
2	**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 between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 9 — Chassis ground:*** ***(B135) No. 8 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
3	**CHECK FOR POOR CONTACT.** Check for poor contact of the front oxygen (A/F) sensor connector.	Is there poor contact of front oxygen (A/F) sensor connector?	Repair the poor contact of front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>

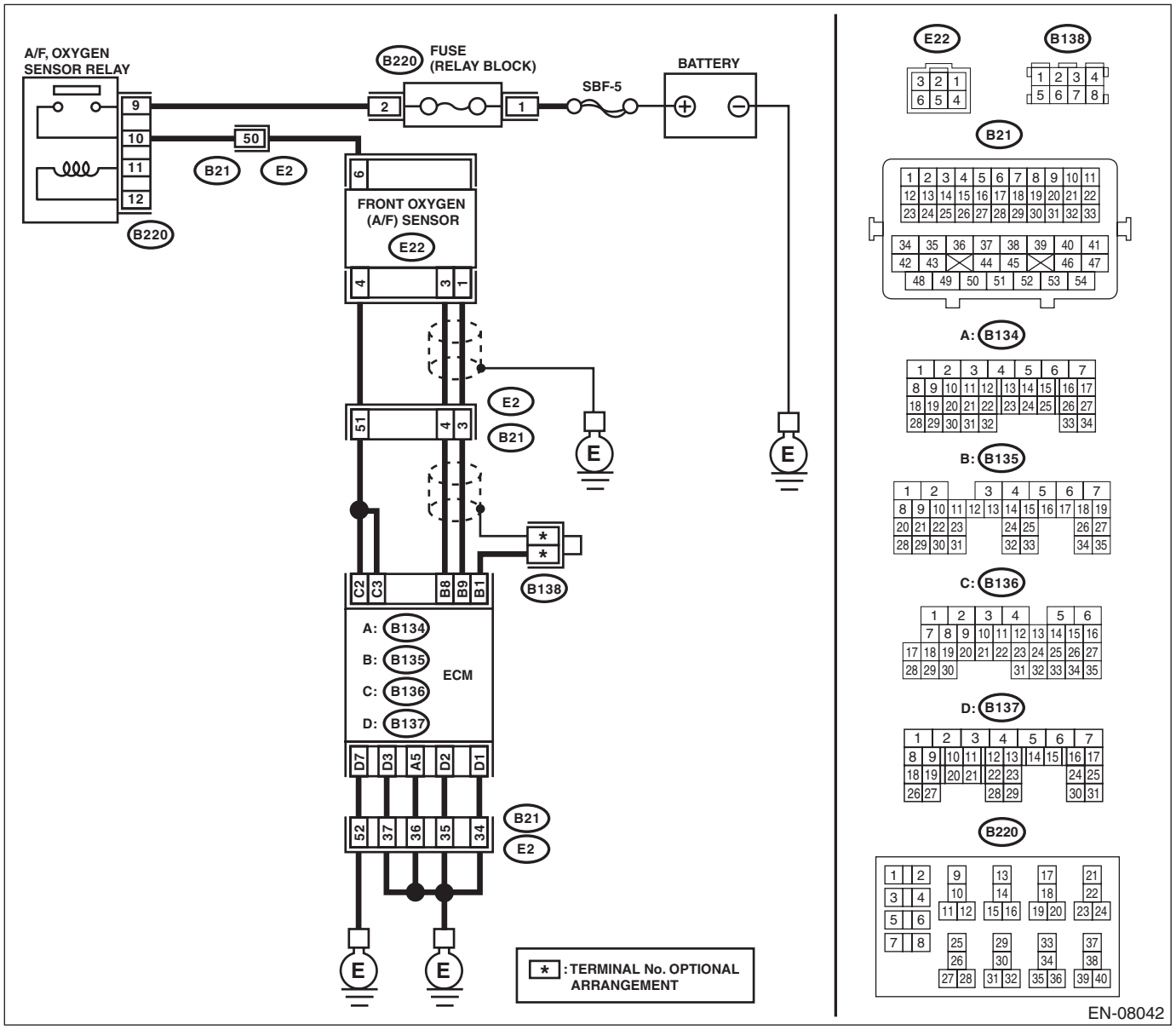
AC:DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-48, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

	Step	Check	Yes	No
2	**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) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 9 (+) — Chassis ground (–):*** ***(B135) No. 8 (+) — Chassis ground (–):***	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>

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

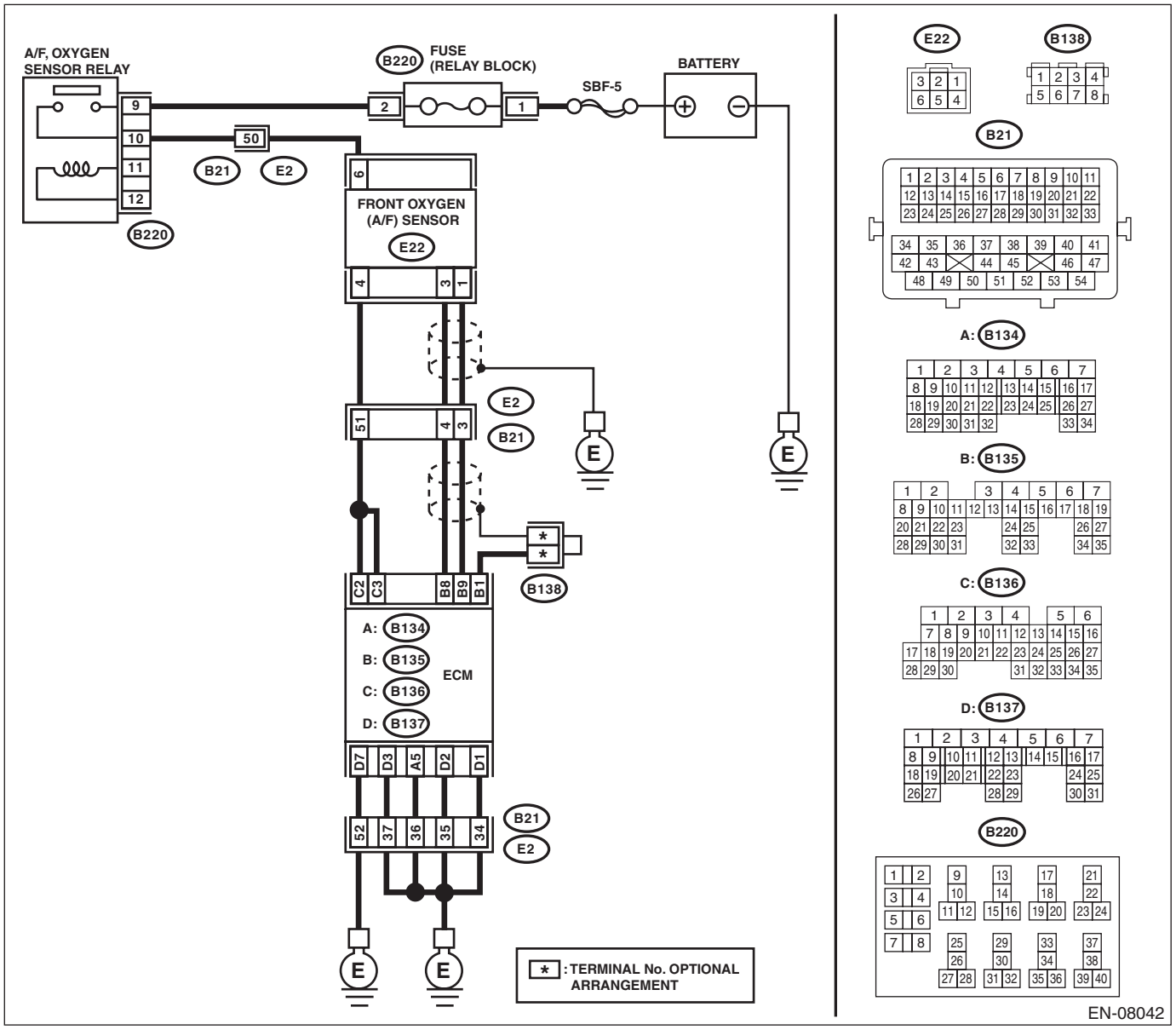
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-50, DTC P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**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 any fault in exhaust system?	Repair the exhaust system.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>

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

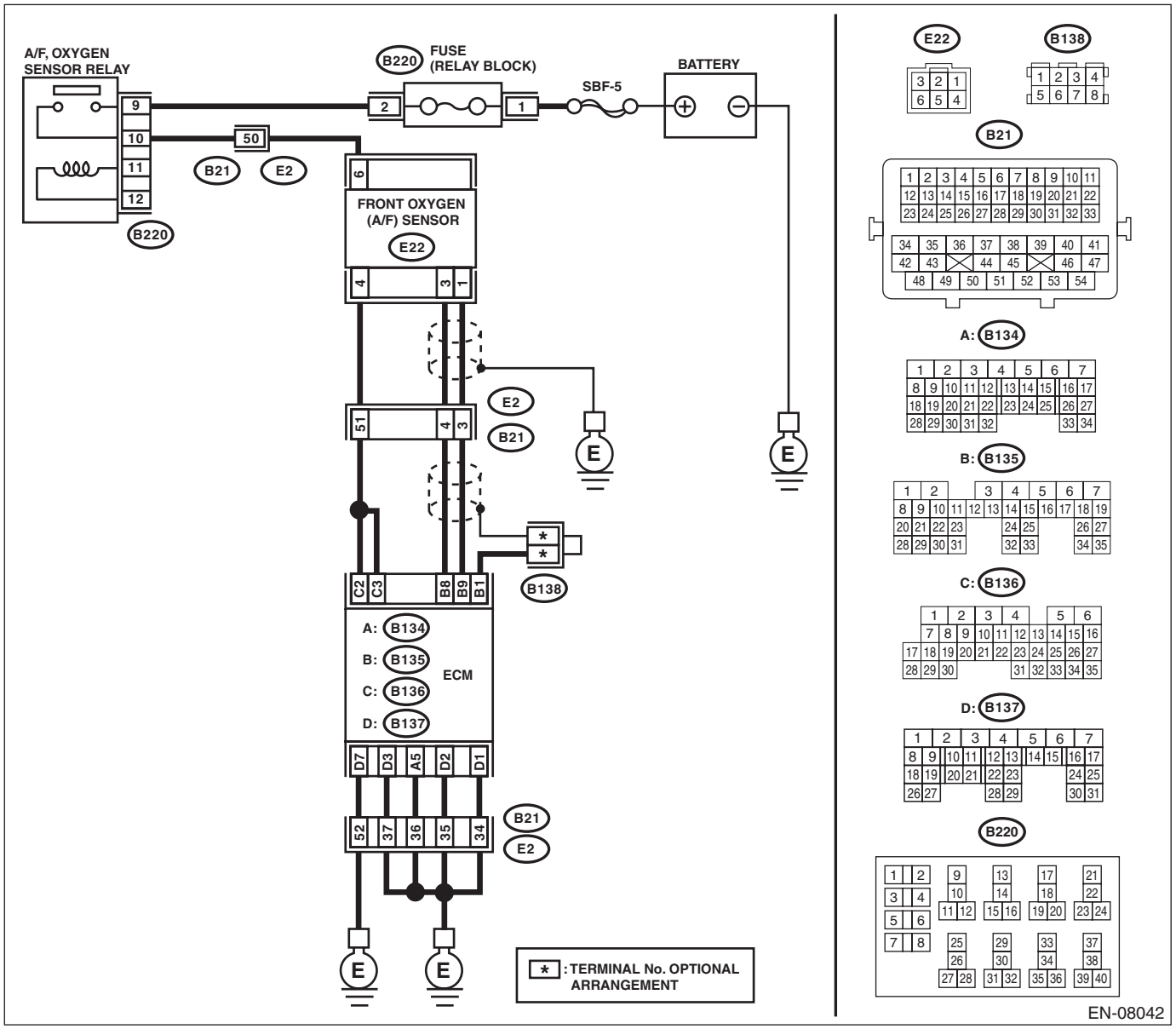
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-53, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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*** ***(B135) No. 9 — (E22) No. 1:*** ***(B135) No. 8 — (E22) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact of coupling connector
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and front oxygen (A/F) sensor connector.	Is there poor contact of ECM or front oxygen (A/F) sensor connector?	Repair the poor contact of ECM or front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>

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

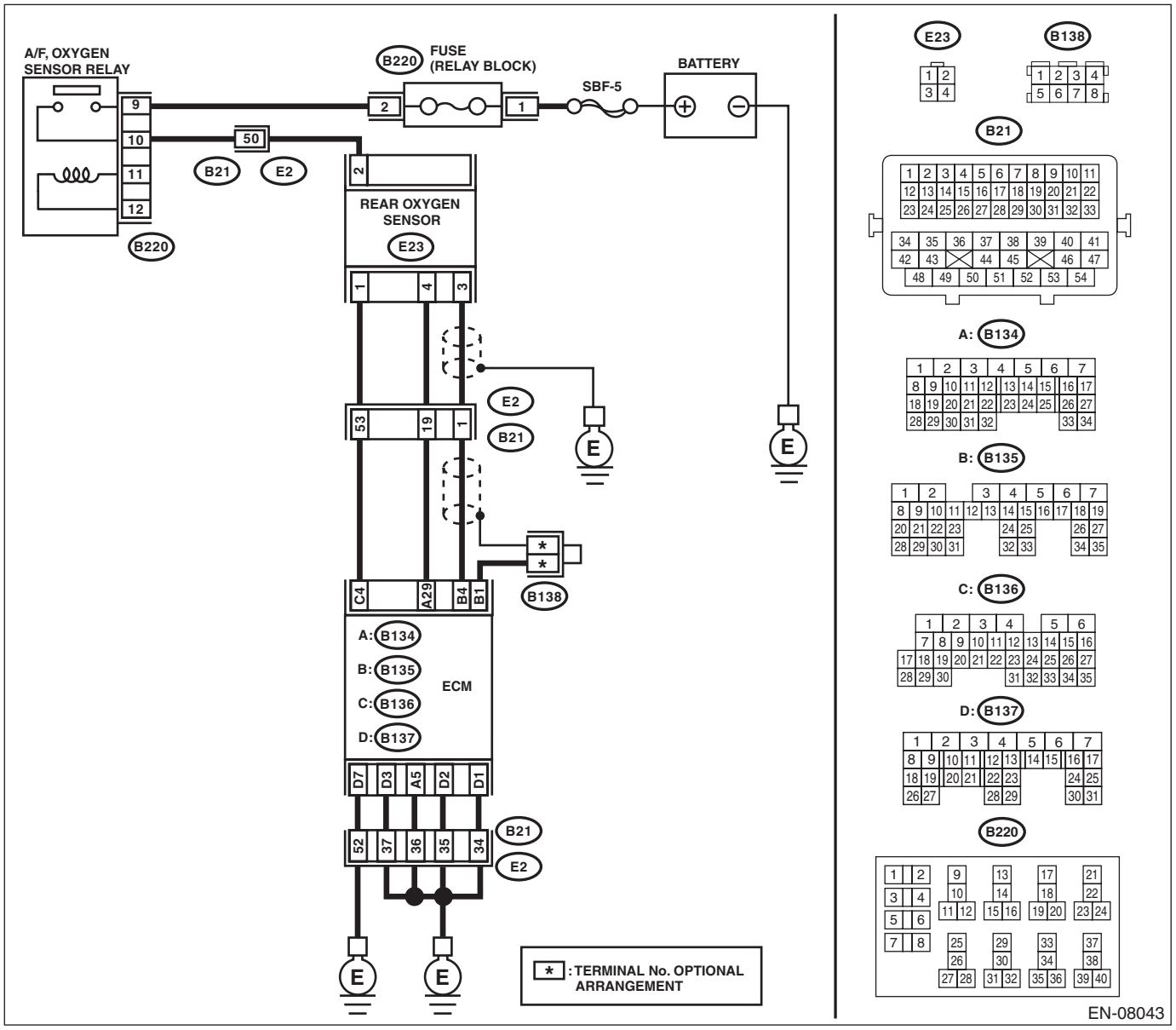
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-55, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step **5**.	Go to step **2**.
2	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **3**.
3	**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*** ***(B135) No. 4 — (E23) No. 3:*** ***(B134) No. 29 — (E23) No. 4:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E23) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of rear oxygen sensor connector • Poor contact of ECM connector
5	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. NOTE: Check the following items. • Looseness and improper fitting of exhaust system parts • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>

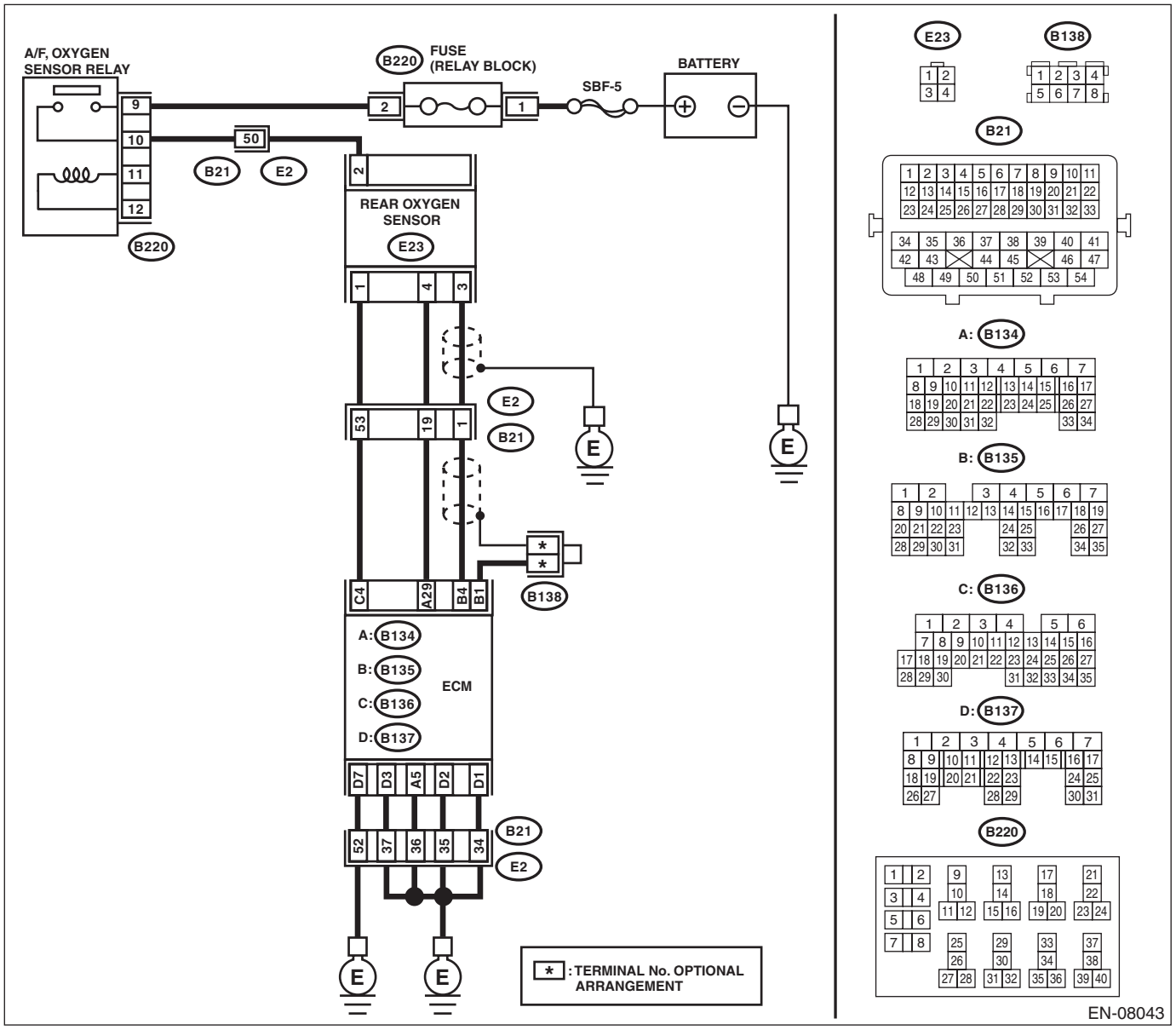
AG:DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-57, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step **5**.	Go to step **2**.
2	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **3**.
3	**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*** ***(B135) No. 4 — (E23) No. 3:*** ***(B134) No. 29 — (E23) No. 4:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E23) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of rear oxygen sensor connector • Poor contact of ECM connector
5	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. NOTE: Check the following items. • Looseness and improper fitting of exhaust system parts • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>

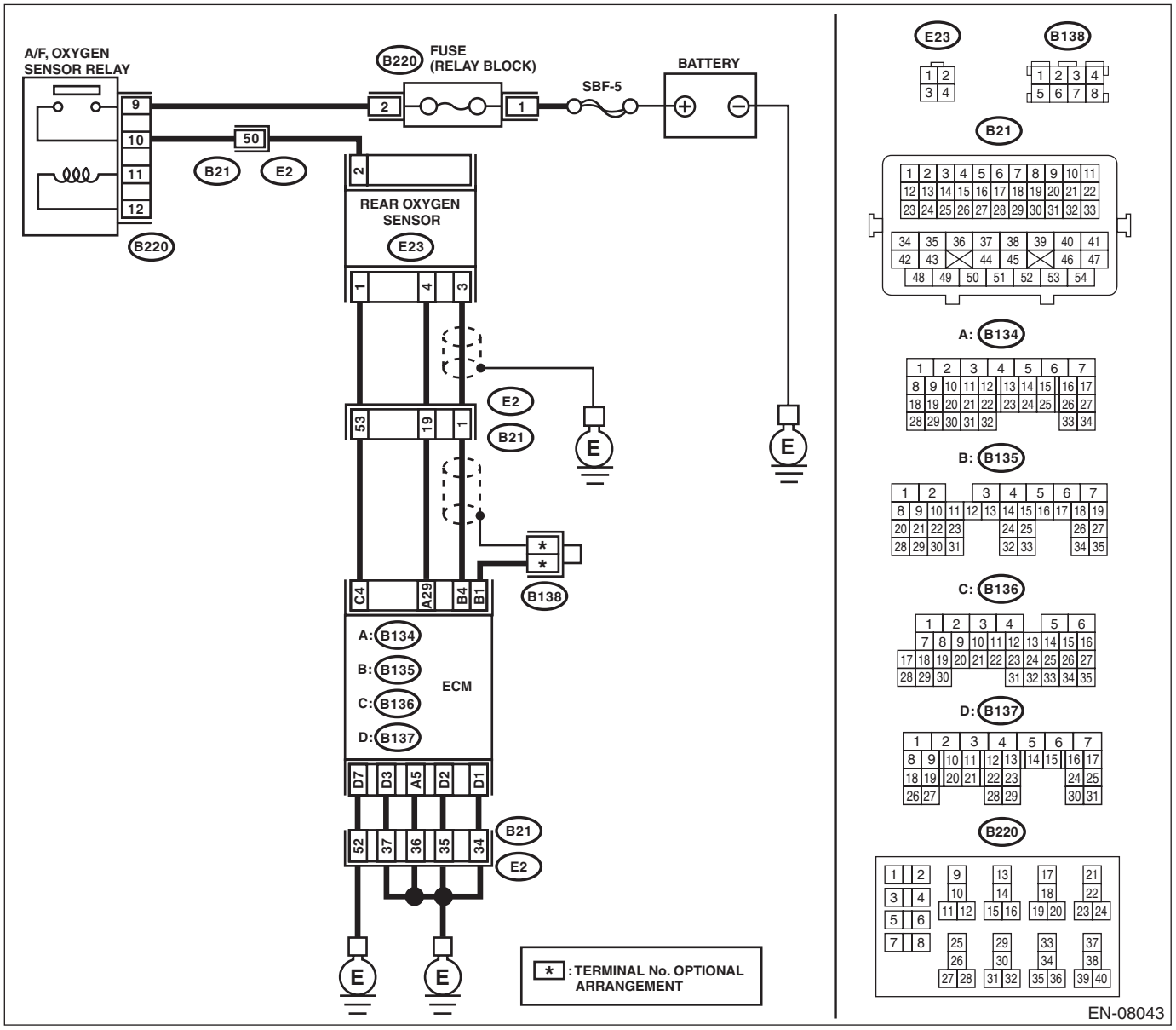
AH:DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-58, DTC P0139 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**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*** ***(B135) No. 4 — (E23) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** Measure the resistance between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E23) No. 3 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the ground short circuit of harness between ECM and rear oxygen sensor connector.
3	**CHECK REAR OXYGEN SENSOR.** Measure the resistance between rear oxygen sensor terminals. ***Terminals*** ***No. 3 — No. 4***	Is the resistance less than 1 Ω?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.

AI: DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2)

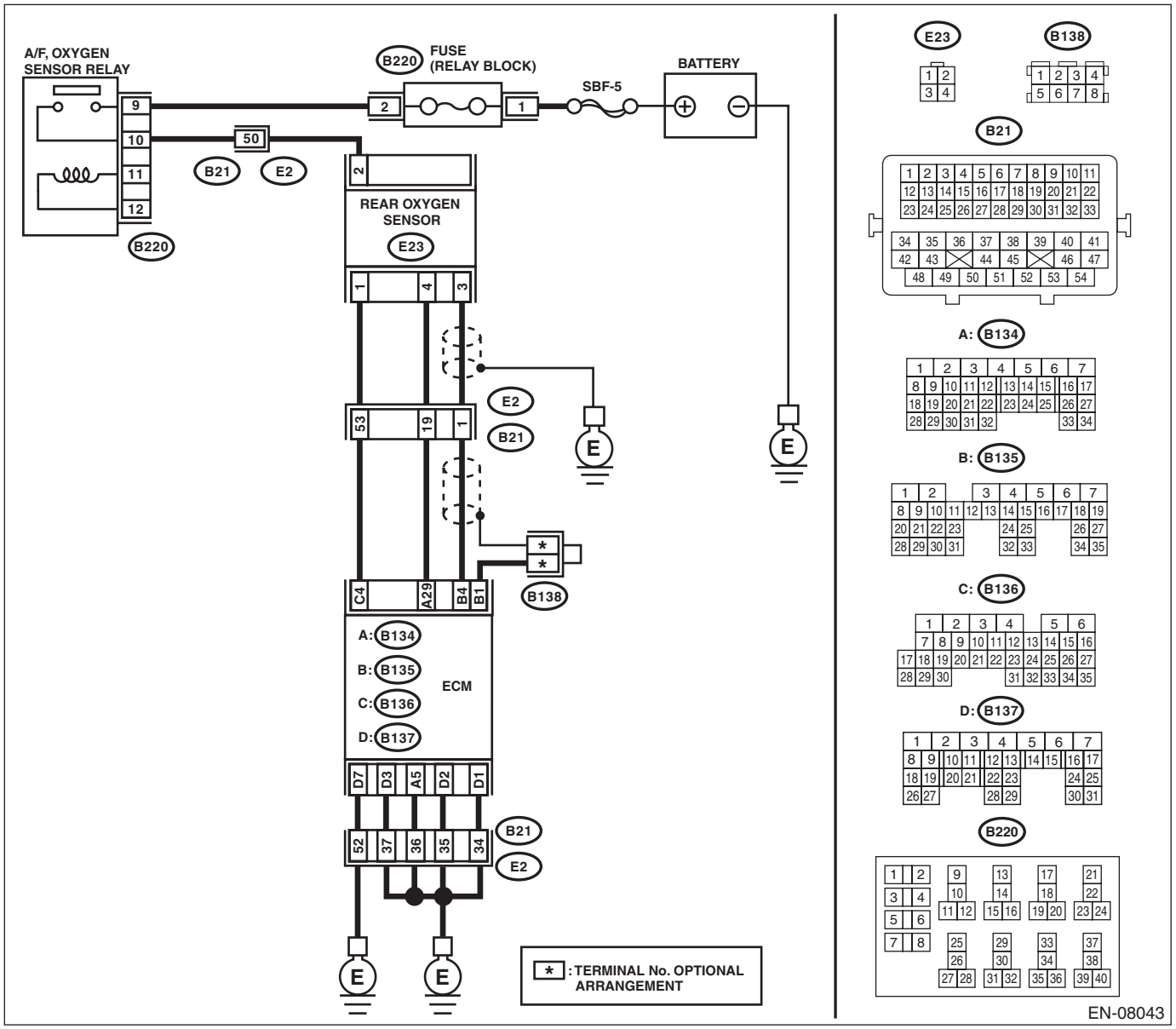
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-66, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step **6**.	Go to step **2**.
2	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step **6**.	Go to step **3**.
3	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **4**.
4	**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*** ***(B135) No. 4 — (E23) No. 3:*** ***(B134) No. 29 — (E23) No. 4:***	Is the resistance less than 1 Ω?	Go to step **5**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of coupling connector

	Step	Check	Yes	No
5	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E23) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of rear oxygen sensor connector • Poor contact of ECM connector
6	**CHECK EXHAUST SYSTEM.** Check exhaust system parts. NOTE: Check the following items. • Looseness and improper fitting of exhaust system parts • Damage (crack, hole etc.) of parts • Loose part and improper installation between front oxygen (A/F) sensor and rear oxygen sensor	Is there any fault in exhaust system?	Repair or replace faulty parts.	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>

AJ:DTC P0171 SYSTEM TOO LEAN (BANK 1)

Refer to DTC P0172 for diagnostic procedure. <Ref. to EN(H4SO)(diag)-164, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AK:DTC P0172 SYSTEM TOO RICH (BANK 1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-69, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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 OPEN FLAMES" signs near the working area.** **CAUTION:** **Be careful not to spill fuel.** Measure the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.**	Is the measured value 333.4 — 360.5 kPa (3.4 — 3.7 kg/cm^2, 48.4 — 52 psi)?	Go to step **4**.	Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
4	**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 procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step **5**.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.>

	Step	Check	Yes	No
5	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of the mass air flow and intake air 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **6**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>
6	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the data of the mass air flow and intake air 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from intake air temperature. Is the obtained value –10 — 50°C (–18 — 90°F)?	Repair the poor contact of ECM connector.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>

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

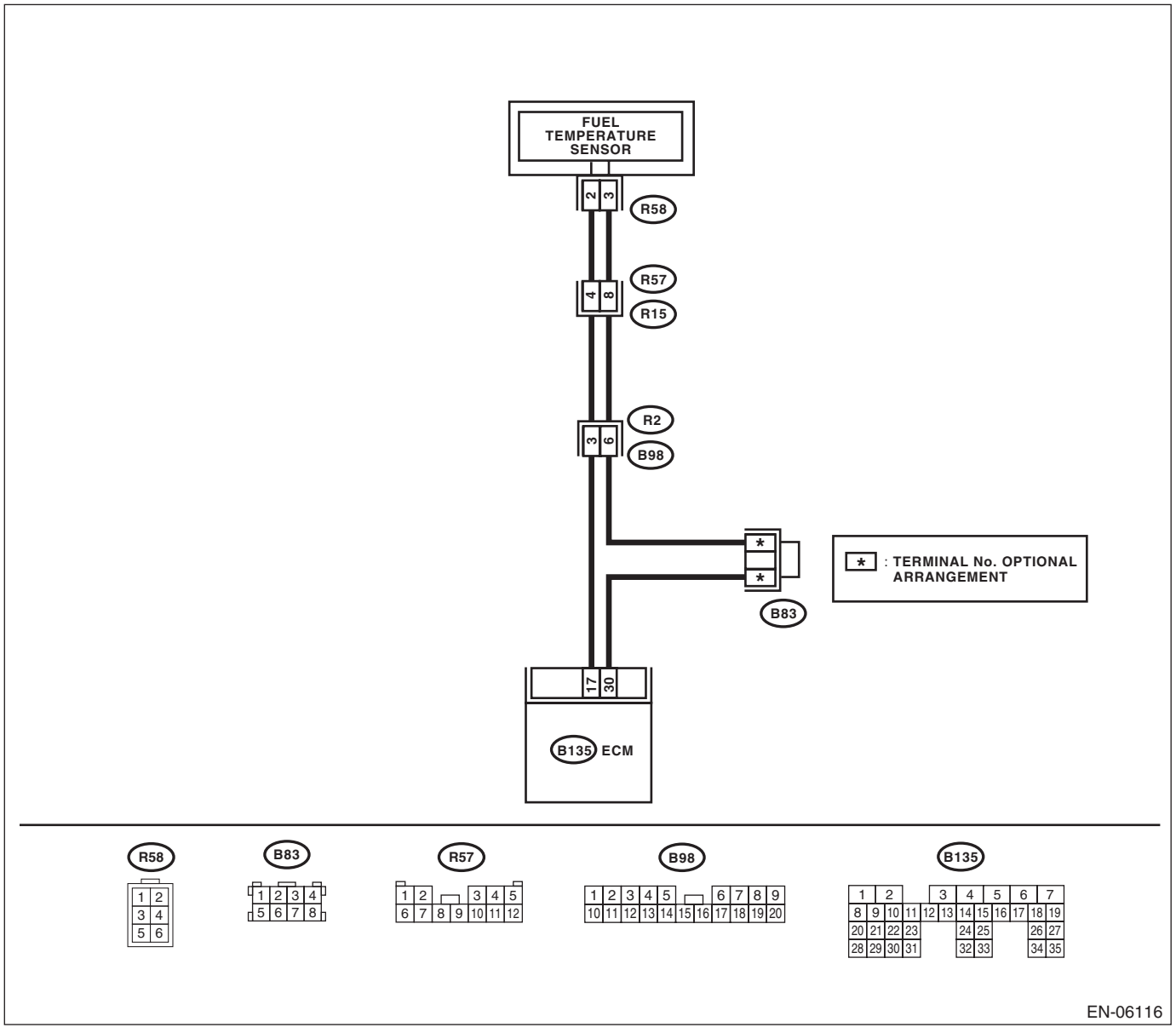
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-70, DTC P0181 FUEL TEMPERATURE SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-13, Fuel Temperature Sensor.>

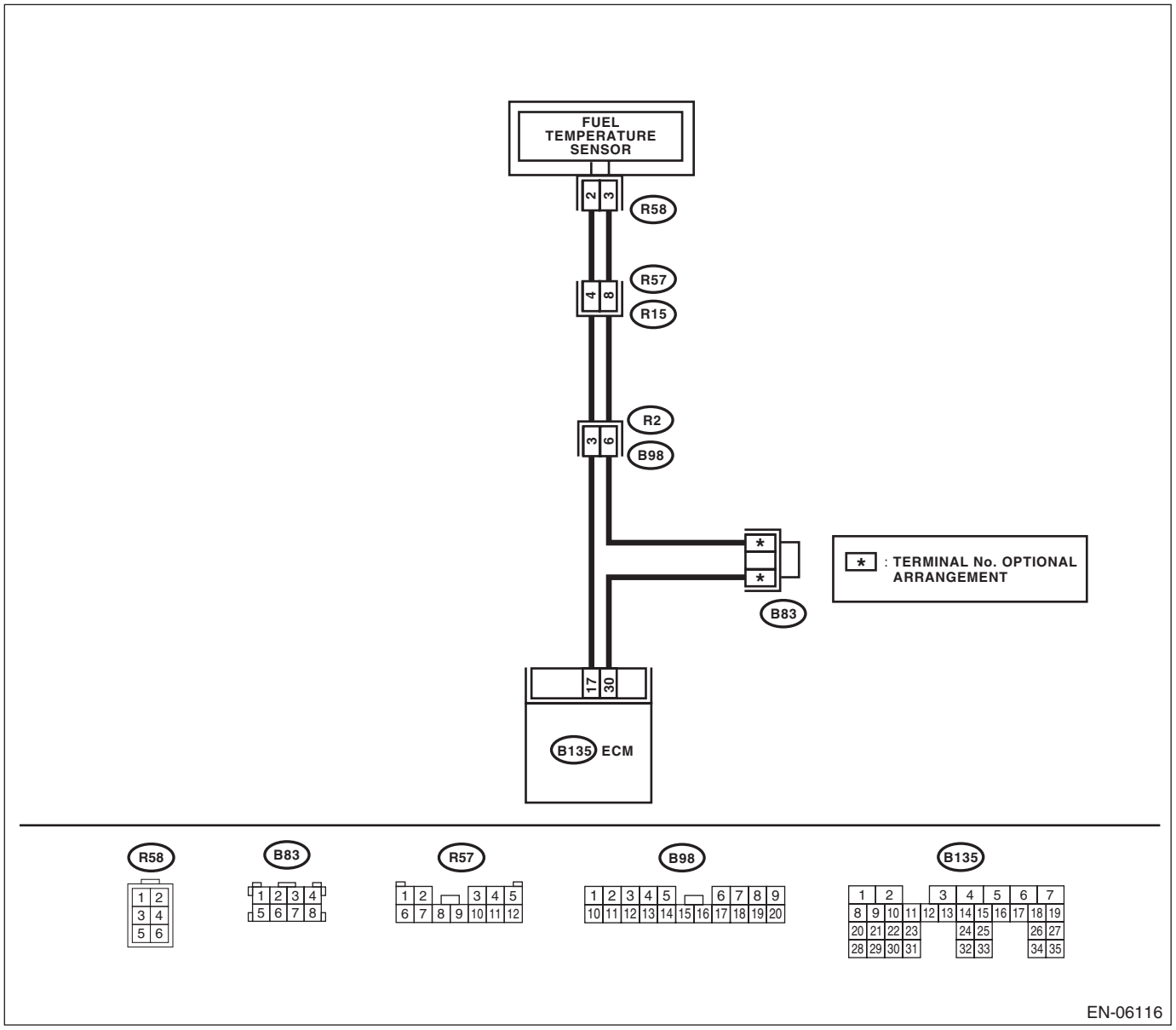
AM:DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-73, DTC P0182 FUEL TEMPERATURE SENSOR “A” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the temperature 120°C (248°F) or higher?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and fuel temperature sensor. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 17 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-13, Fuel Temperature Sensor.>	Repair the ground short circuit of harness between ECM and fuel pump connector.

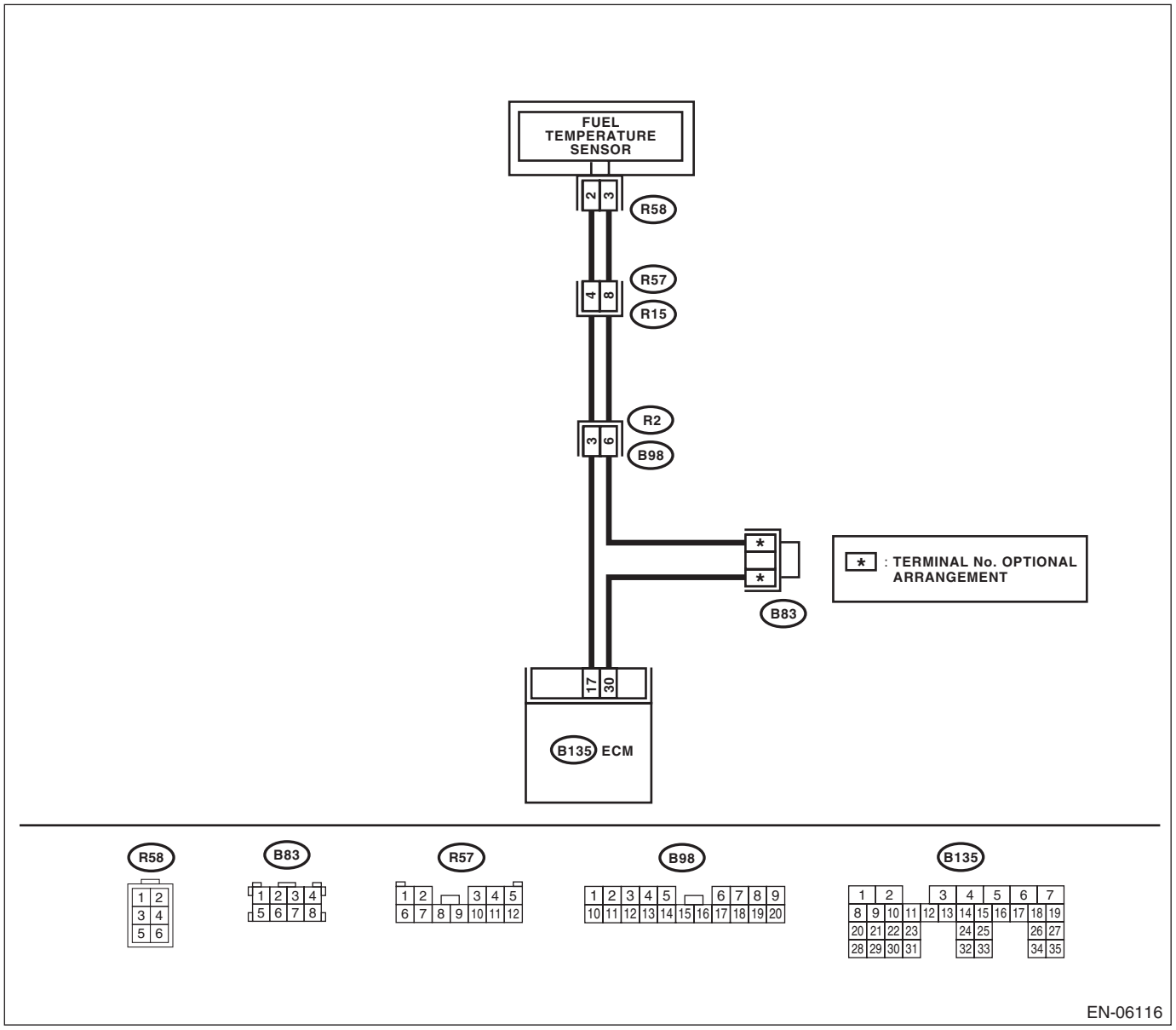
AN:DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-74, DTC P0183 FUEL TEMPERATURE SENSOR “A” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, 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. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the temperature less than –40°C (–40°F)?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK FOR POOR CONTACT.** Repair any poor contact between the ECM and fuel temperature sensor connectors.	Is there poor contact of the ECM or fuel temperature sensor connectors?	Repair any poor contact between the ECM and fuel temperature sensor connectors.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and fuel temperature sensor. 3) Measure the resistance of the harness between the ECM and fuel temperature sensor connector. ***Connector & terminal*** ***(B135) No. 17 — (R58) No. 2:*** ***(B135) No. 30 — (R58) No. 3:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and fuel temperature sensor connector • Poor contact of coupling connector • Poor contact of joint connector
4	**CHECK HARNESS BETWEEN ECM AND FUEL TEMPERATURE SENSOR CONNECTOR.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 17 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between the ECM and fuel temperature sensor connector.	Replace the fuel temperature sensor. <Ref. to EC(H4SO)-13, Fuel Temperature Sensor.>

AO:DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-75, DTC P0196 ENGINE OIL TEMPERATURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

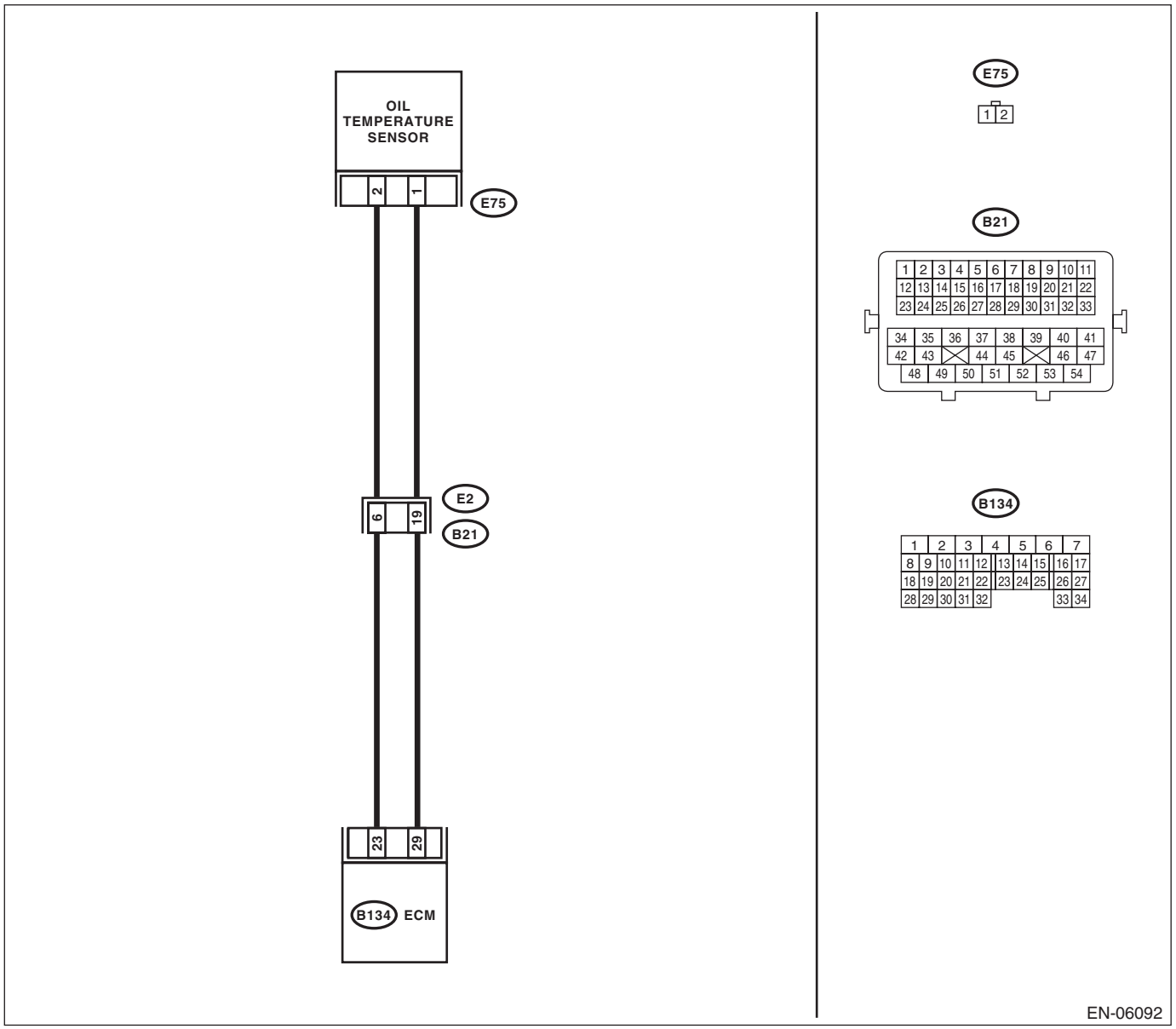
TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Replace the oil temperature sensor. <Ref. to FU(H4SO)-40, Oil Temperature Sensor.>

AP:DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW

DTC DETECTING CONDITION:

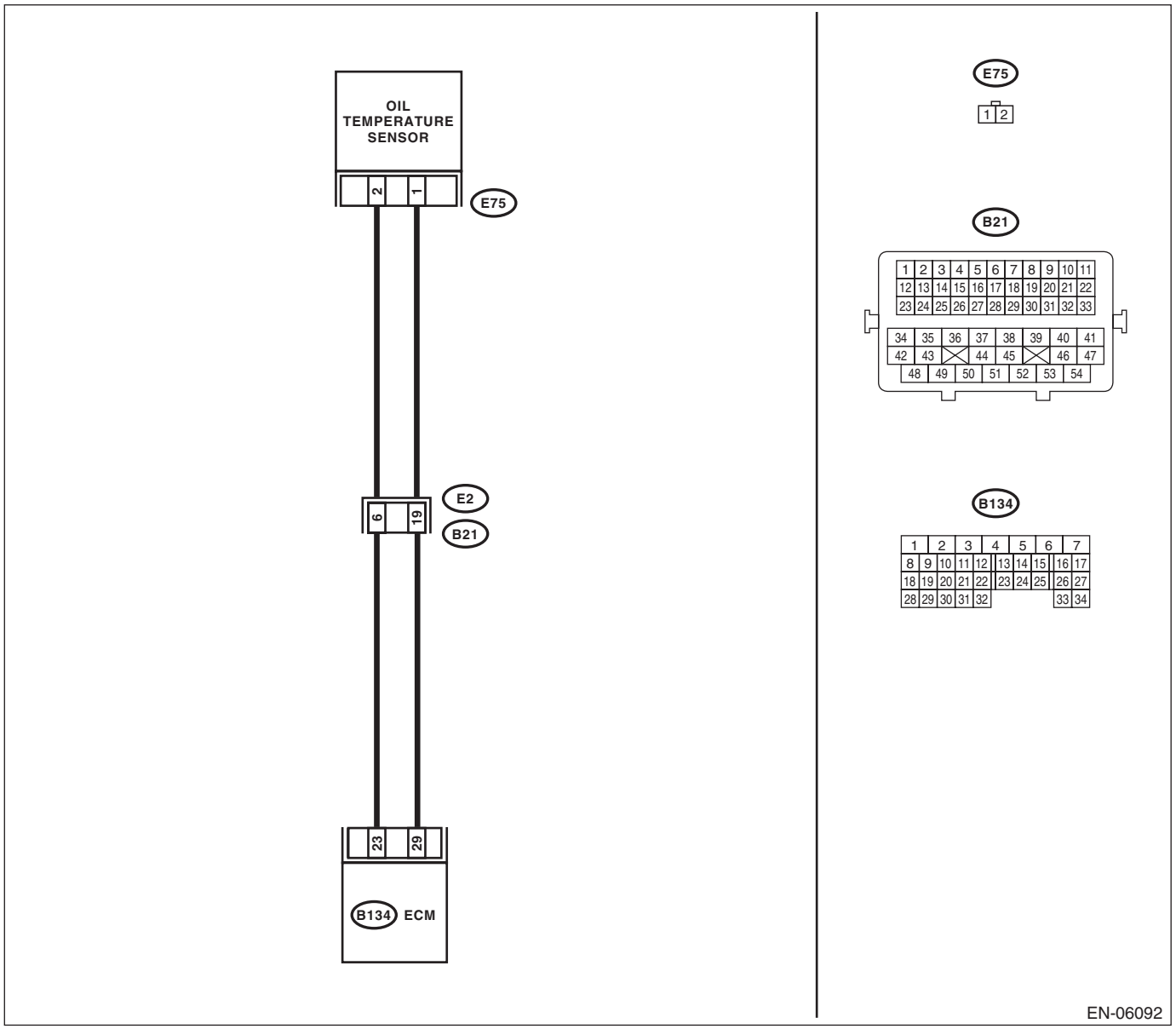
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-77, DTC P0197 ENGINE OIL TEMPERATURE SENSOR LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of the oil temperature sensor signal using the 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the oil temperature 215°C (419°F) or more?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil temperature sensor. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 23 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the oil temperature sensor. <Ref. to FU(H4SO)-40, Oil Temperature Sensor.>	Repair the short circuit to ground in harness between ECM and oil temperature sensor connector.

AQ:DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH

DTC DETECTING CONDITION:

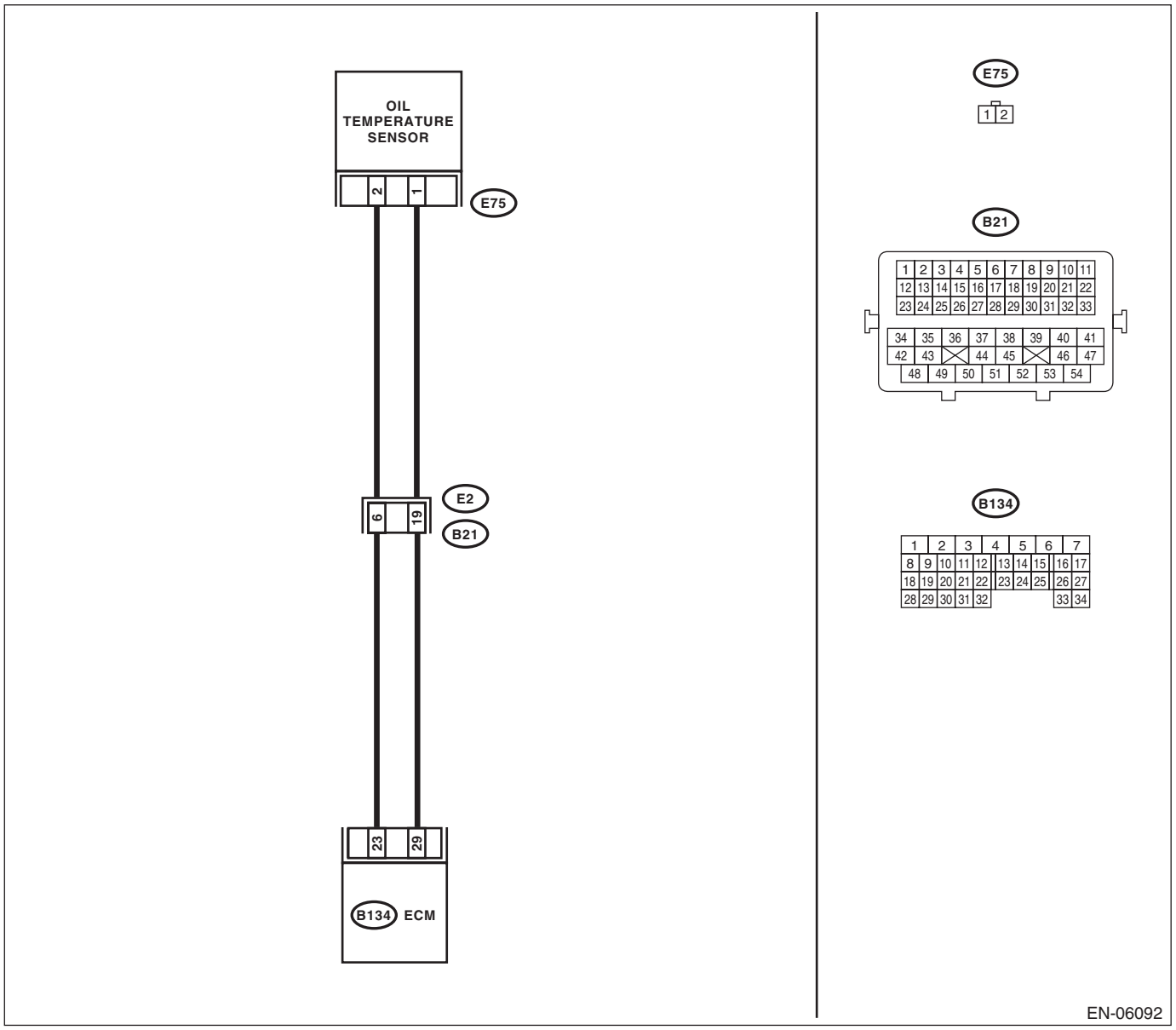
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-78, DTC P0198 ENGINE OIL TEMPERATURE SENSOR HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the data of the oil temperature sensor signal using the 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the oil temperature less than –40°C (–40°F)?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and oil temperature sensor connector.	Is there poor contact of ECM or oil temperature sensor connector?	Repair the poor contact of ECM or the oil temperature sensor connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil temperature sensor. 3) Measure the resistance of the harness between ECM and oil temperature sensor connector. ***Connector & terminal*** ***(B134) No. 23 — (E75) No. 2:*** ***(B134) No. 29 — (E75) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and oil temperature sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND OIL TEMPERATURE SENSOR CONNECTOR.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 23 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power supply in harness between ECM and oil temperature sensor connector.	Replace the oil temperature sensor. <Ref. to FU(H4SO)-40, Oil Temperature Sensor.>

AR:DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-79, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

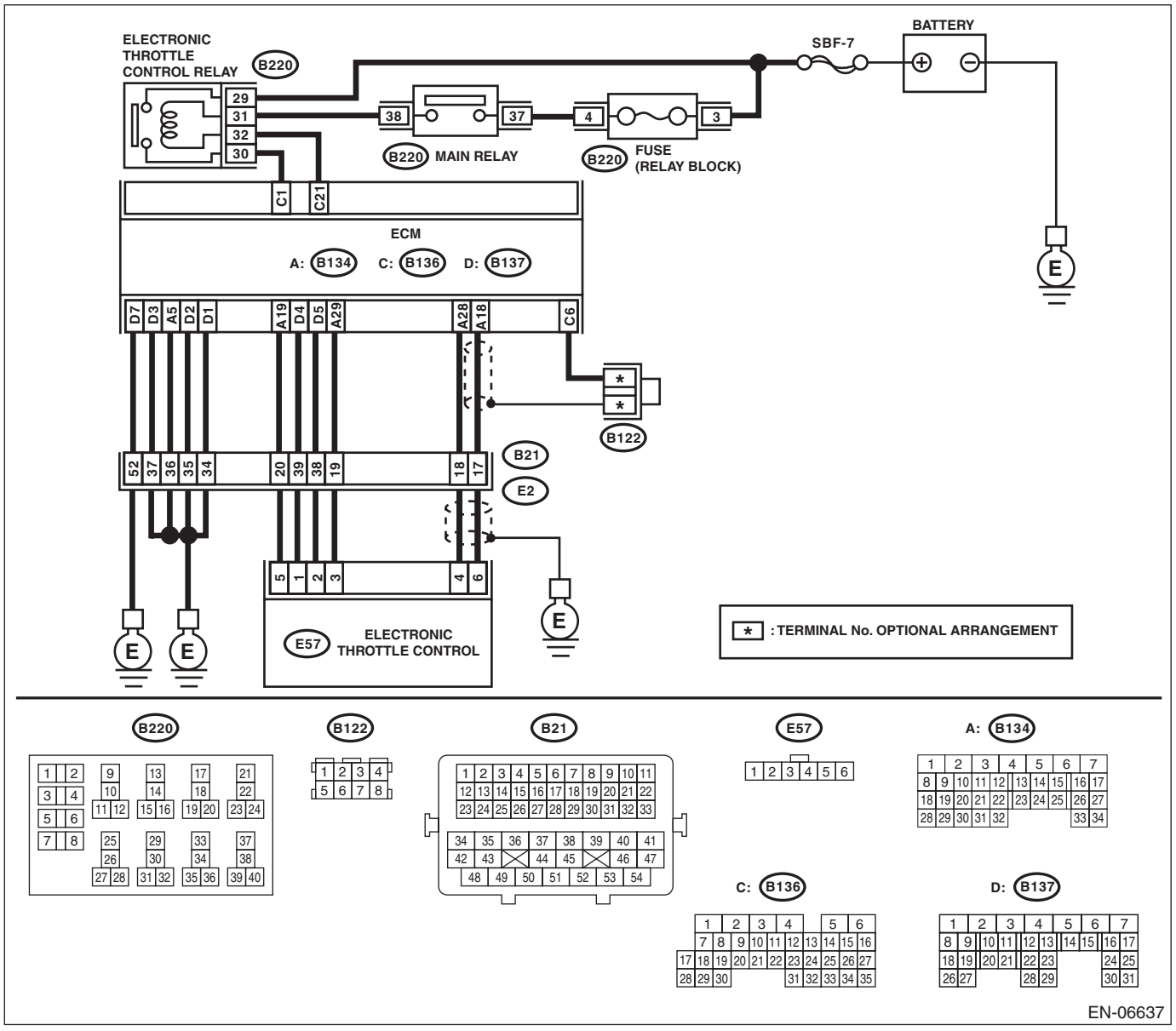
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-06637

	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 28 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 4 — Engine ground:***	Is the resistance 1 MΩ or more?	Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.>	Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>

AS:DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-80, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

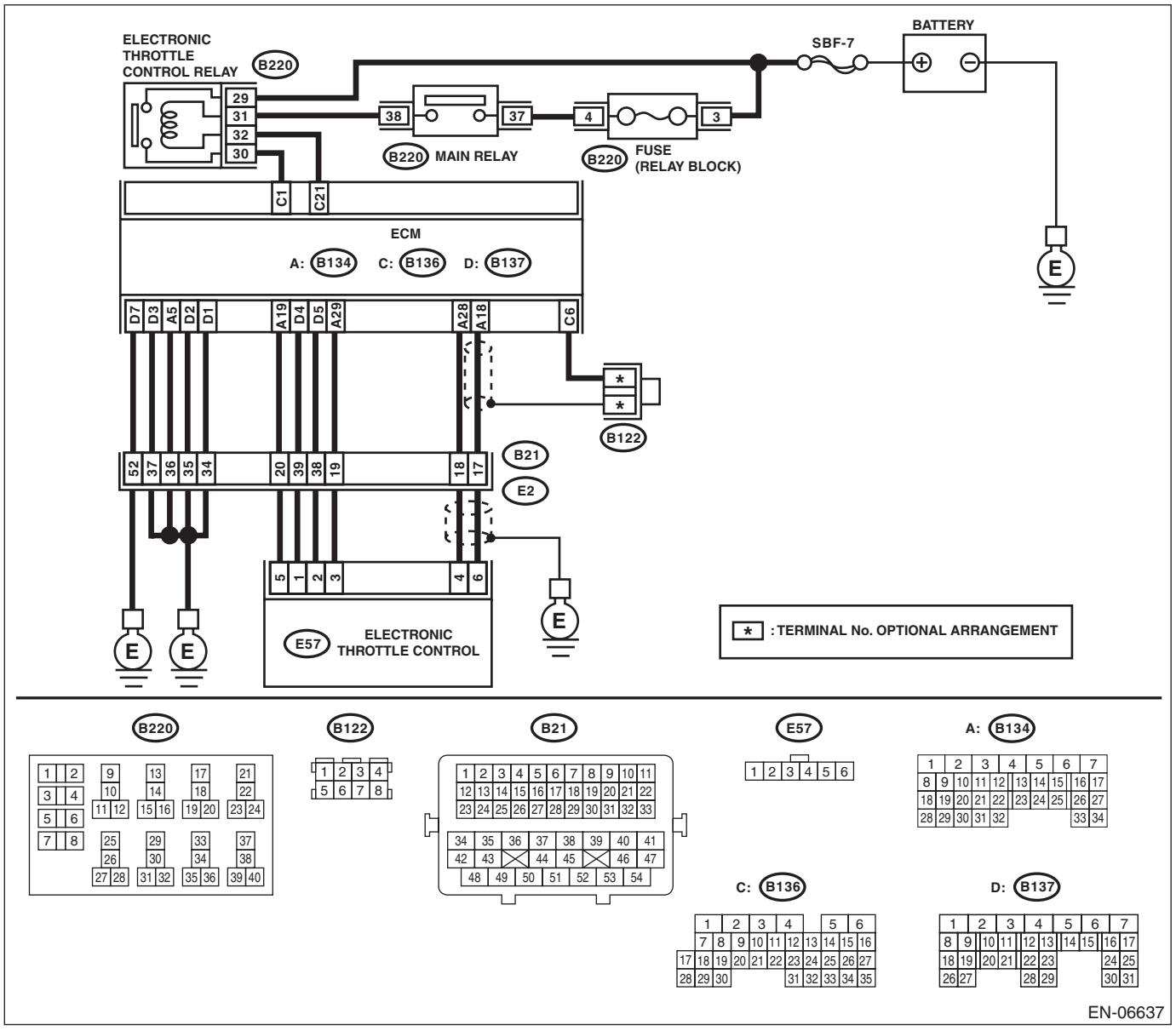
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 28 — (E57) No. 4:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and electronic throttle control connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 4 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and electronic throttle control connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 28:***	Is the resistance 1 MΩ or more?	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.>	Repair the short circuit to power in harness between ECM and electronic throttle control connector.

AT:DTC P0301 CYLINDER 1 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-183, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AU:DTC P0302 CYLINDER 2 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-183, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AV:DTC P0303 CYLINDER 3 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4SO)(diag)-183, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AW:DTC P0304 CYLINDER 4 MISFIRE DETECTED

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- Immediately at fault recognition (A misfire which could damage catalyst occurs.)
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-86, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

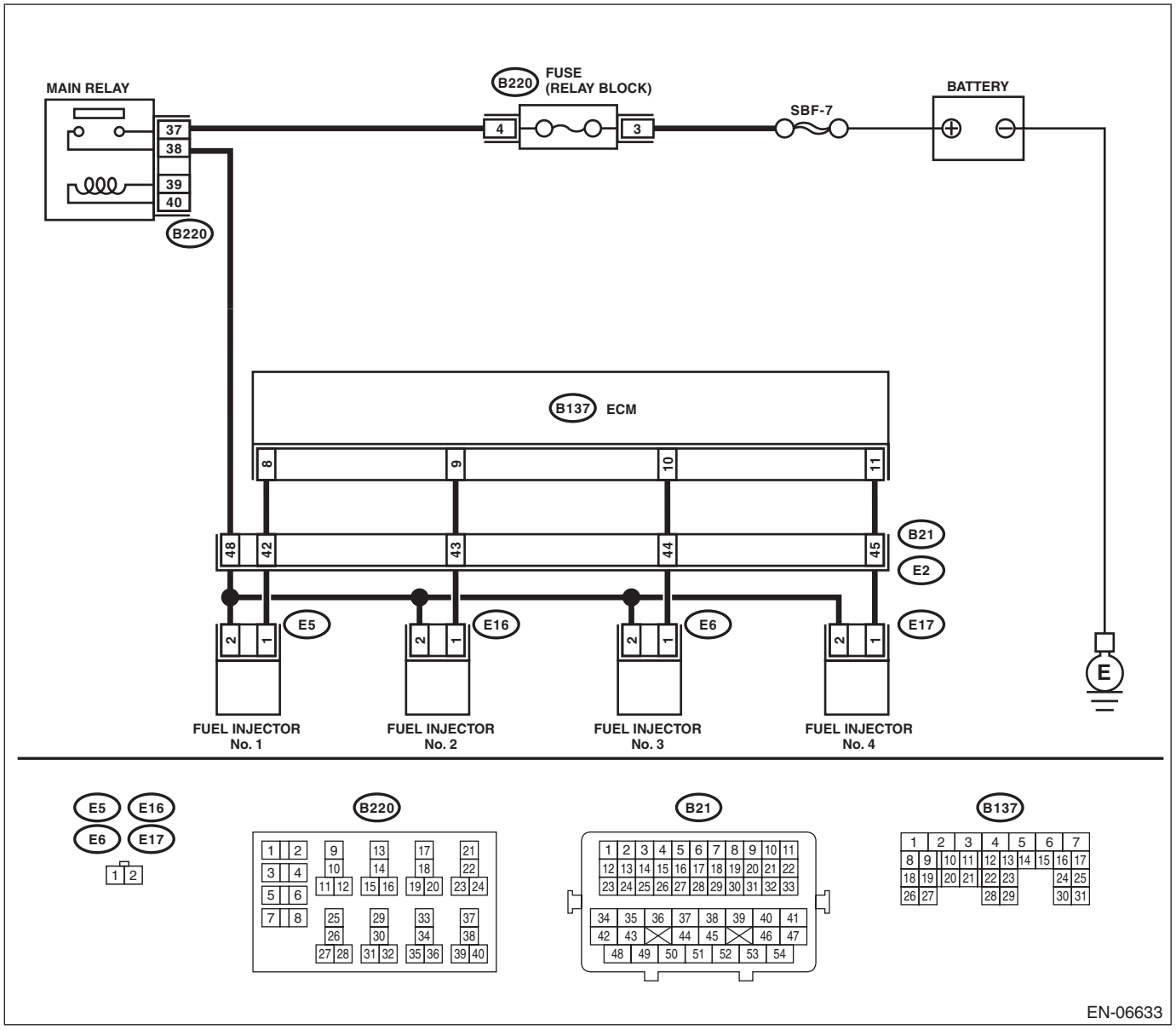
TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling
- Rough driving

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B137) No. 8 (+) — Chassis ground (–):*** ***#2 (B137) No. 9 (+) — Chassis ground (–):*** ***#3 (B137) No. 10 (+) — Chassis ground (–):*** ***#4 (B137) No. 11 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **6**.	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between fuel injector connector and engine ground on faulty cylinders. ***Connector & terminal*** ***#1 (E5) No. 1 — Engine ground:*** ***#2 (E16) No. 1 — Engine ground:*** ***#3 (E6) No. 1 — Engine ground:*** ***#4 (E17) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM and fuel injector connector.
3	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance of harness between ECM and fuel injector on faulty cylinders. ***Connector & terminal*** ***#1 (B137) No. 8 — (E5) No. 1:*** ***#2 (B137) No. 9 — (E16) No. 1:*** ***#3 (B137) No. 10 — (E6) No. 1:*** ***#4 (B137) No. 11 — (E17) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and fuel injector connector • Poor contact of coupling connector
4	**CHECK FUEL INJECTOR.** Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **5**.	Replace the faulty fuel injector. <Ref. to FU(H4SO)-36, Fuel Injector.>
5	**CHECK POWER SUPPLY LINE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. ***Connector & terminal*** ***#1 (E5) No. 2 (+) — Engine ground (–):*** ***#2 (E16) No. 2 (+) — Engine ground (–):*** ***#3 (E6) No. 2 (+) — Engine ground (–):*** ***#4 (E17) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay connector and fuel injector connector on faulty cylinders • Poor contact of coupling connector • Poor contact of main relay connector

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B137) No. 8 (+) — Chassis ground (–):*** ***#2 (B137) No. 9 (+) — Chassis ground (–):*** ***#3 (B137) No. 10 (+) — Chassis ground (–):*** ***#4 (B137) No. 11 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM and fuel injector connector.	Go to step **7**.
7	**CHECK FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Replace the faulty fuel injector. <Ref. to FU(H4SO)-36, Fuel Injector.>	Go to step **8**.
8	**CHECK INSTALLATION CONDITION 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. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.>	Go to step **9**.
9	**CHECK CRANK SPROCKET.** Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>	Is the crank sprocket rusted or does it have broken teeth?	Replace the crank sprocket. <Ref. to ME(H4SO)-55, Crank Sprocket.>	Go to step **10**.
10	**CHECK INSTALLATION CONDITION OF TIMING BELT.** Turn the crankshaft using ST, and align the alignment mark on crank sprocket with alignment mark on cylinder block. ST 499987500 CRANKSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4SO)-49, Timing Belt.>	Go to step **11**.
11	**CHECK FUEL LEVEL.**	Is the fuel meter indication higher than the “Lower” level?	Go to step **12**.	Replenish the fuel so that fuel meter indication is higher than the “Lower” level. After replenishing fuel, Go to step **12**.
12	**CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4SO)(diag)-56, Clear Memory Mode.> 2) Start the engine, and drive the vehicle 10 minutes or more.	Does the malfunction indicator light illuminate or blink?	Go to step **14**.	Go to step **13**.

	Step	Check	Yes	No
13	**CHECK CAUSE OF MISFIRE.**	Was the cause of misfire identified when the engine is running?	Finish diagnostics operation, if the engine has no abnormality.	Repair the poor contact of connector. NOTE: In this case, repair the following item: • Poor contact of ignition coil connector • Poor contact of fuel injector connector on faulty cylinders • Poor contact of ECM connector • Poor contact of coupling connector
14	**CHECK AIR INTAKE SYSTEM.**	Is there any 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 **15**.
15	**CHECK MISFIRE SYMPTOM.** 1) Turn the ignition switch to ON. 2) Read the DTC. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Does the Subaru Select Monitor or general scan tool indicate only one DTC?	Go to step **20**.	Go to step **16**.
16	**CHECK DTC.**	Is DTC P0301 and P0302 displayed on the Subaru Select Monitor or general scan tool?	Go to step **21**.	Go to step **17**.
17	**CHECK DTC.**	Is DTC P0303 and P0304 displayed on the Subaru Select Monitor or general scan tool?	Go to step **22**.	Go to step **18**.
18	**CHECK DTC.**	Is DTC P0301 and P0303 displayed on the Subaru Select Monitor or general scan tool?	Go to step **23**.	Go to step **19**.
19	**CHECK DTC.**	Is DTC P0302 and P0304 displayed on the Subaru Select Monitor or general scan tool?	Go to step **24**.	Go to step **25**.

Step		Check	Yes	No
20	ONLY ONE CYLINDER.	Is there any fault in the cylinder?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Spark plug cord • Fuel injector • Compression ratio	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-163, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
21	GROUP OF #1 AND #2 CYLINDERS.	Are there any faults in #1 and #2 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. • Spark plug • Fuel injector • Ignition coil • Compression ratio • If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #1 and #2 cylinders side. <Ref. to EN(H4SO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-163, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
22	GROUP OF #3 AND #4 CYLINDERS.	Are there any faults in #3 and #4 cylinders?	Repair or replace faulty parts. NOTE: • Check the following items. • Spark plug • Fuel injector • Ignition coil • Compression ratio • If any fault are not found, check the "IGNITION CONTROL SYSTEM" of #3 and #4 cylinders side. <Ref. to EN(H4SO)(diag)-78, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-163, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

	Step	Check	Yes	No
23	**GROUP OF #1 AND #3 CYLINDERS.**	Are there any faults in #1 and #3 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Fuel injector • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-163, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
24	**GROUP OF #2 AND #4 CYLINDERS.**	Are there any faults in #2 and #4 cylinders?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Fuel injector • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-163, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
25	**CYLINDER AT RANDOM.**	Is the engine idle rough?	Go to DTC P0171. <Ref. to EN(H4SO)(diag)-163, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Fuel injector • Compression ratio

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

DTC DETECTING CONDITION:

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

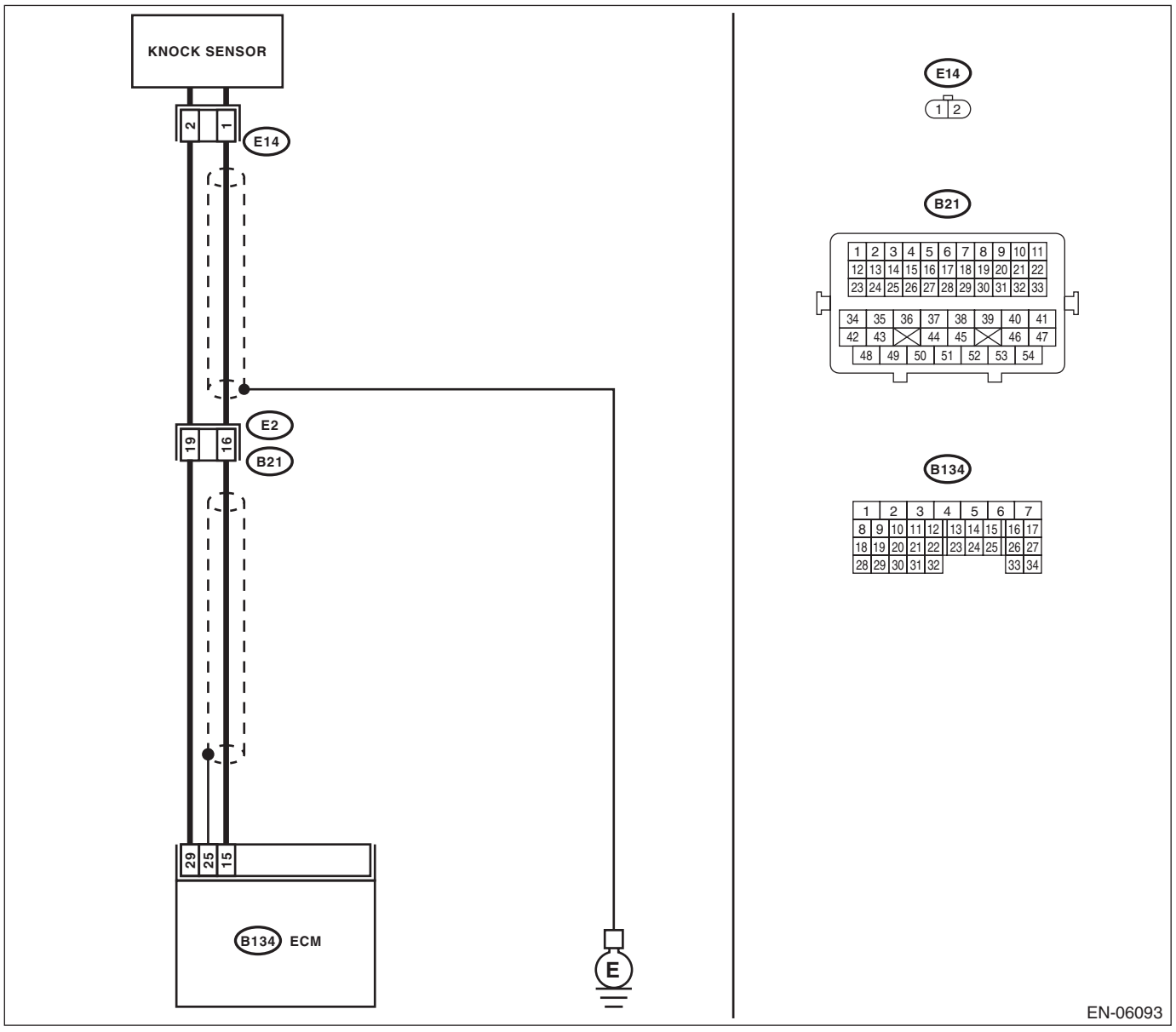
TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 15 — (B134) No. 29:***	Is the resistance 600 kΩ or more?	Go to step **2**.	Repair the poor contact of ECM connector.
2	**CHECK KNOCK SENSOR.** 1) Disconnect the connector from knock sensor. 2) Measure the resistance between knock sensor terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 600 kΩ or more?	Replace the knock sensor. <Ref. to FU(H4SO)-30, Knock Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and knock sensor connector • Poor contact of knock sensor connector • Poor contact of coupling connector

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

DTC DETECTING CONDITION:

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

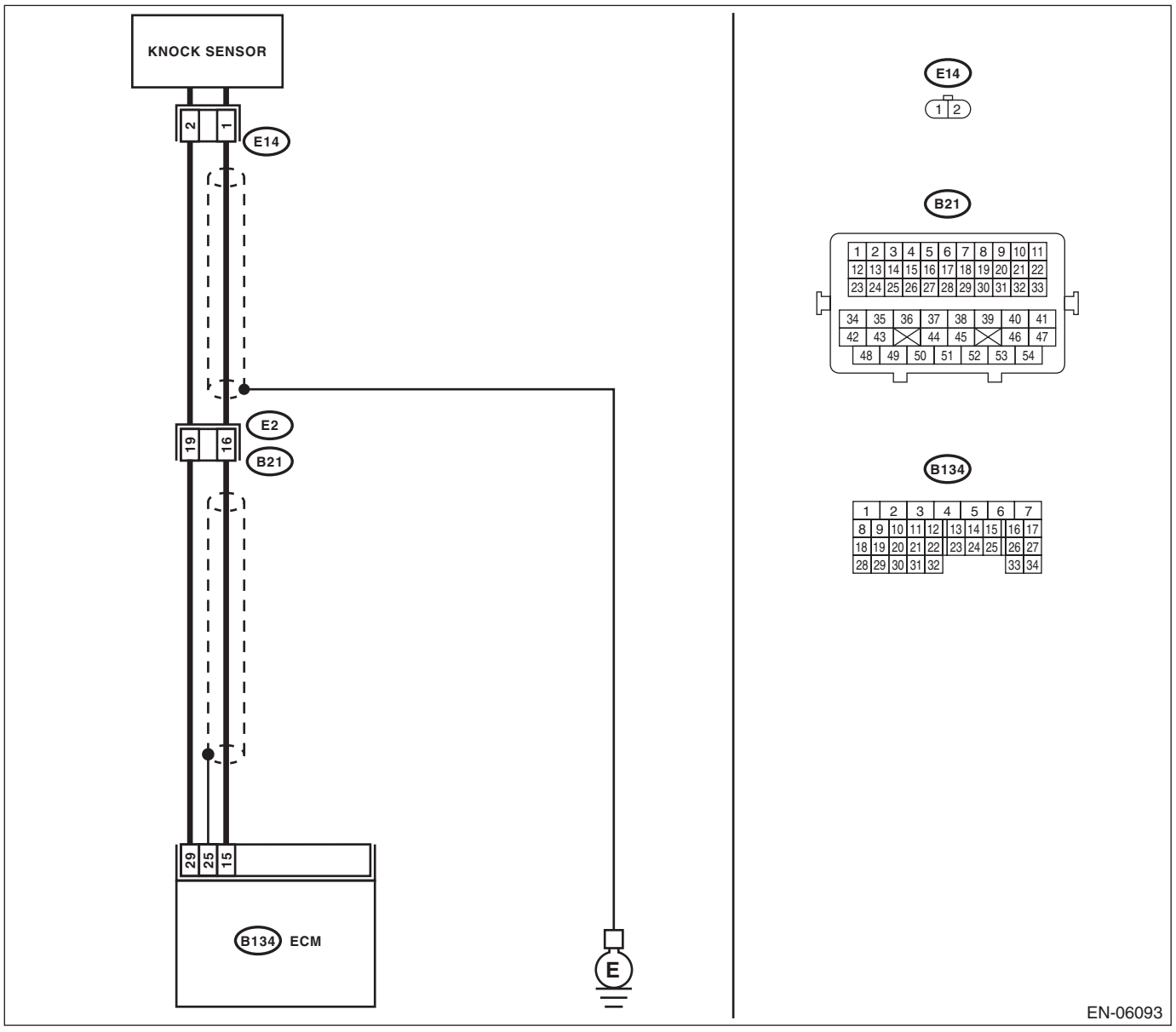
TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 15 — (B134) No. 29:***	Is the resistance less than 500 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 terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 500 kΩ?	Replace the knock sensor. <Ref. to FU(H4SO)-30, Knock Sensor.>	Repair the short circuit to ground in harness between ECM and knock sensor connector. NOTE: The harness between both connectors are shielded. Remove the shield and repair the short circuit of harness.
3	**CHECK INPUT SIGNAL OF ECM.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 15 (+) — Chassis ground (–):***	Is the voltage 2 V or more?	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.	Repair the poor contact of ECM connector.

AZ:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

DTC DETECTING CONDITION:

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

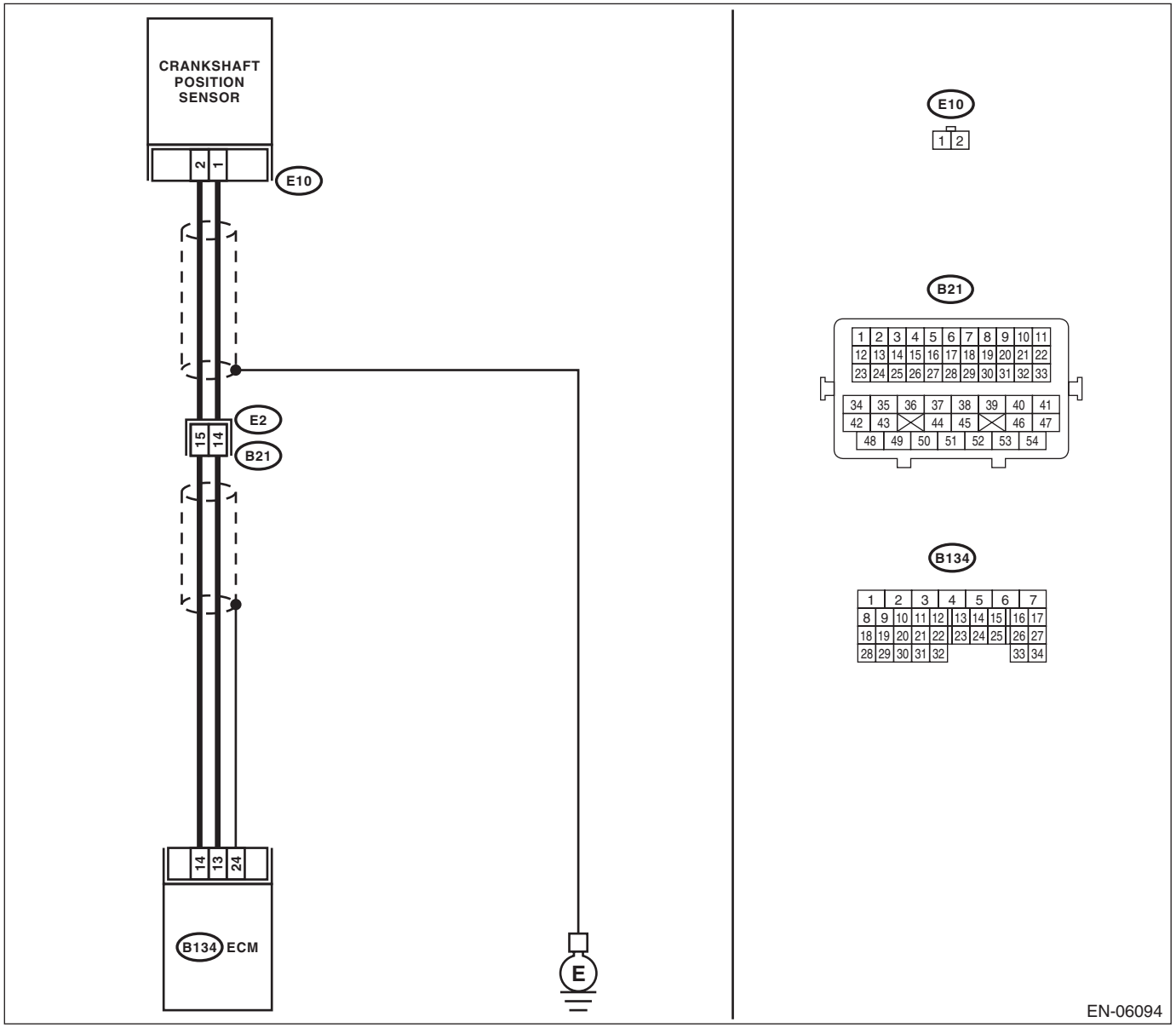
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK INSTALLATION CONDITION OF CRANKSHAFT POSITION SENSOR.**	Is the crankshaft position sensor installation bolt tightened securely?	Go to step **2**.	Tighten the crankshaft position sensor installation bolt securely. <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.>
2	**CHECK CRANKSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Remove the crankshaft position sensor. 3) Measure the resistance between terminals of crankshaft position sensor. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance between 1 and 4 kΩ?	Go to step **3**.	Replace the crankshaft position sensor. <Ref. to FU(H4SO)-26, Crankshaft Position Sensor.>
3	**CHECK HARNESS BETWEEN ECM AND CRANKSHAFT POSITION SENSOR CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Measure the resistance of harness between ECM and crankshaft position sensor connector. ***Connector & terminal*** ***(B134) No. 13 — (E10) No. 1:*** ***(B134) No. 14 — (E10) No. 2:***	Is the resistance less than 1 Ω?	Repair the poor contact of ECM and crankshaft position sensor connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and crankshaft position sensor connector • Poor contact of coupling connector

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-93, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

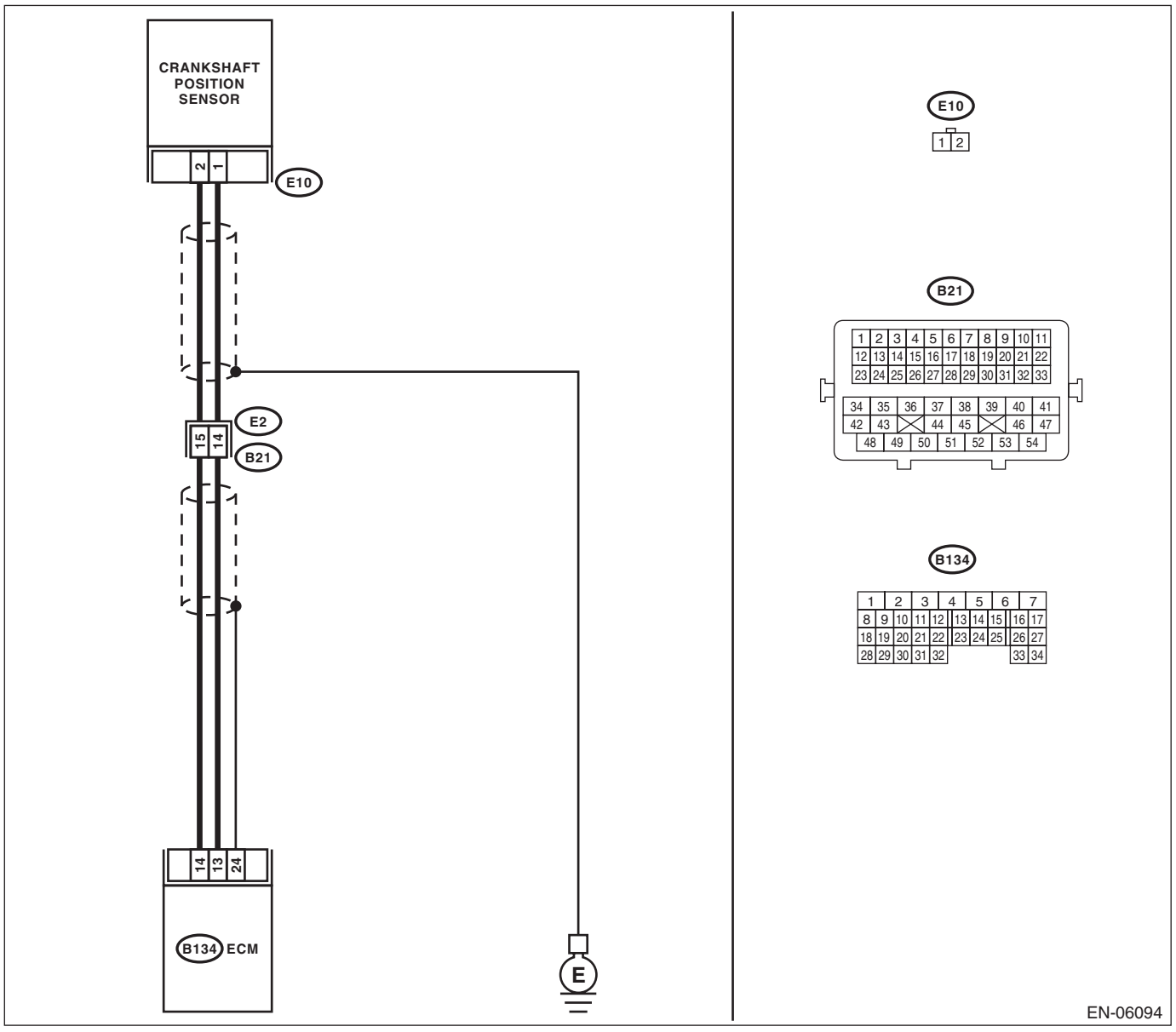
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.** Turn the ignition switch to OFF.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step **2**.	Tighten the crankshaft position sensor installation bolt securely. <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.>
2	**CHECK CRANK SPROCKET.** Remove the timing belt cover.	Are crank sprocket teeth cracked or damaged?	Replace the crank sprocket. <Ref. to ME(H4SO)-55, Crank Sprocket.>	Go to step **3**.
3	**CHECK INSTALLATION CONDITION OF TIMING BELT.** Turn the crankshaft, and align alignment mark on crank sprocket with alignment mark on cylinder block. ST 499987500 CRANKSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4SO)-49, Timing Belt.>	Replace the crankshaft position sensor. <Ref. to FU(H4SO)-26, Crankshaft Position Sensor.>

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

DTC DETECTING CONDITION:

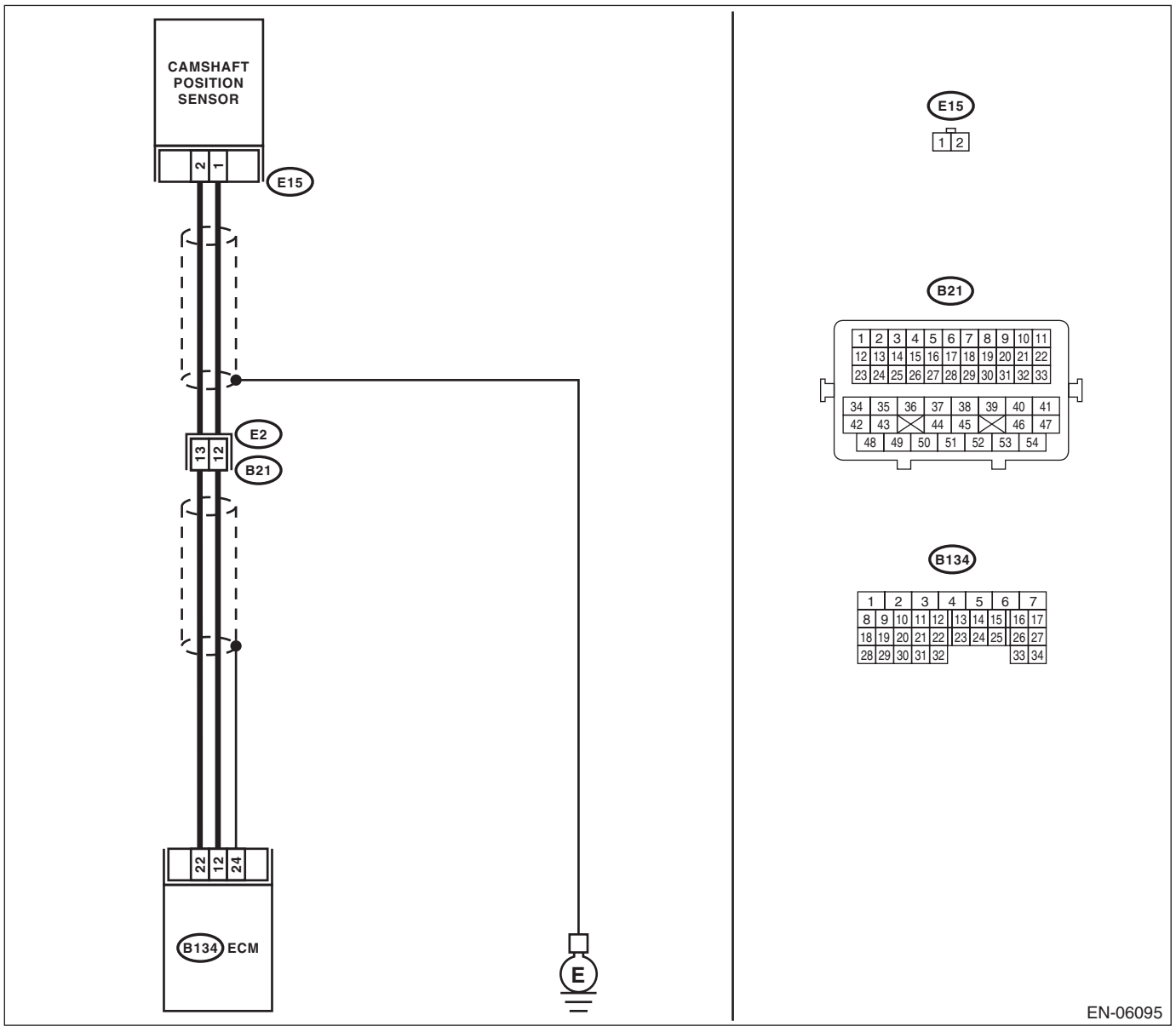
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-95, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and camshaft position sensor. 3) Measure the resistance of harness between ECM and camshaft position sensor connector. ***Connector & terminal*** ***(B134) No. 12 — (E15) No. 1:*** ***(B134) No. 22 — (E15) No. 2:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and camshaft position sensor connector • Poor contact of ECM connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E15) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair short circuit to ground in harness between ECM and camshaft position sensor connector. NOTE: The harness between both connectors are shielded. Remove the shield and repair the ground short circuit of the harness circuit.
3	**CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **4**.	Tighten the camshaft position sensor installation bolt securely. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.>
4	**CHECK CAMSHAFT POSITION SENSOR.** 1) Remove the camshaft position sensor. 2) Measure the resistance between terminals of camshaft position sensor. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance between 1 and 4 kΩ?	Repair the poor contact of ECM or camshaft position sensor connector.	Replace the camshaft position sensor. <Ref. to FU(H4SO)-28, Camshaft Position Sensor.>

BC:DTC P0341 CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-96, DTC P0341 CAMSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

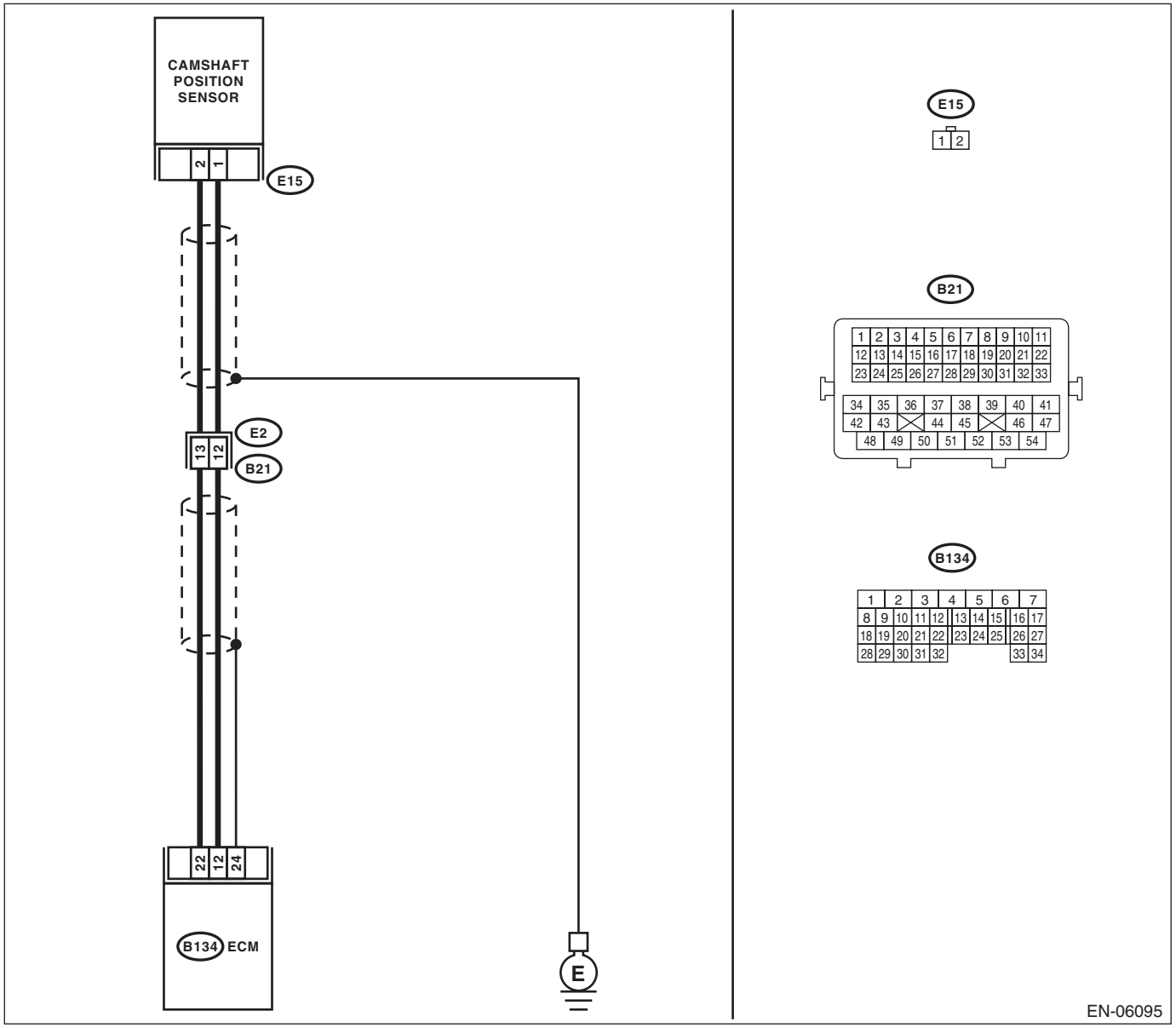
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and camshaft position sensor. 3) Measure the resistance of harness between ECM and camshaft position sensor connector. ***Connector & terminal*** ***(B134) No. 12 — (E15) No. 1:*** ***(B134) No. 22 — (E15) No. 2:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and camshaft position sensor connector • Poor contact of ECM connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E15) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair short circuit to ground in harness between ECM and camshaft position sensor connector. NOTE: The harness between both connectors are shielded. Remove the shield and repair the ground short circuit of the harness circuit.
3	**CHECK INSTALLATION CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **4**.	Tighten the camshaft position sensor installation bolt securely. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.>
4	**CHECK CAMSHAFT POSITION SENSOR.** 1) Remove the camshaft position sensor. 2) Measure the resistance between terminals of camshaft position sensor. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance between 1 and 4 kΩ?	Go to step **5**.	Replace the camshaft position sensor. <Ref. to FU(H4SO)-28, Camshaft Position Sensor.>
5	**CHECK CAM SPROCKET.** Remove the timing belt cover. <Ref. to ME(H4SO)-48, Timing Belt Cover.>	Are cam sprocket teeth cracked or damaged?	Replace the cam sprocket. <Ref. to ME(H4SO)-54, Cam Sprocket.>	Go to step **6**.
6	**CHECK INSTALLATION CONDITION OF TIMING BELT.** Turn the crankshaft using the ST, and align the alignment mark on the cam sprocket with the alignment mark on the timing belt cover LH. ST 499987500 CRANKSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4SO)-49, Timing Belt.>	Replace the camshaft position sensor. <Ref. to FU(H4SO)-28, Camshaft Position Sensor.>

BD:DTC P0400 EXHAUST GAS RECIRCULATION FLOW

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-98, DTC P0400 EXHAUST GAS RECIRCULATION FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

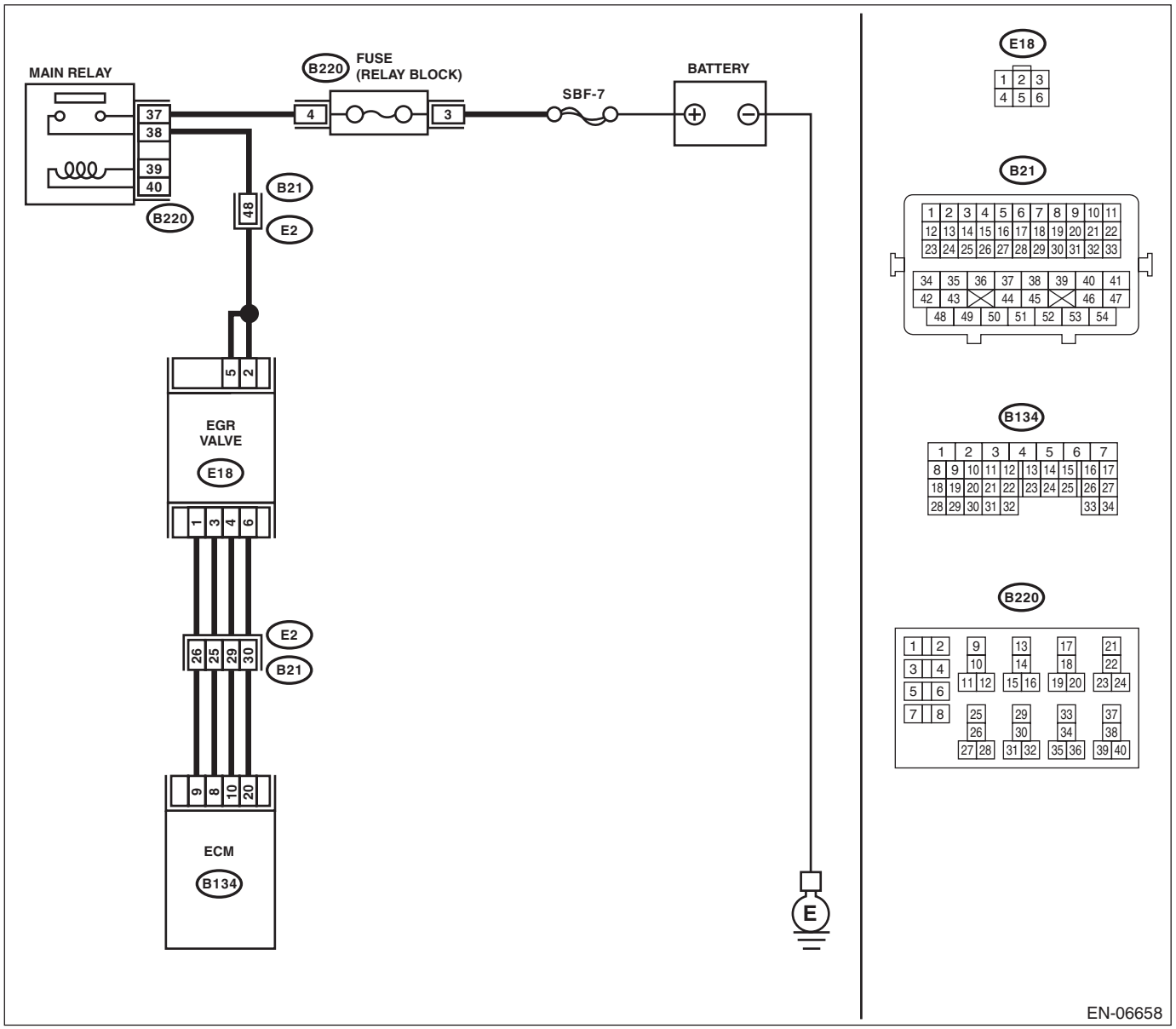
TROUBLE SYMPTOM:

- Movement performance problem when engine is low speed.
- Improper idling
- Movement performance problem

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read data of intake manifold absolute pressure 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 53.3 kPa (400 mmHg, 15.75 inHg) or more?	Make sure that the EGR valve, manifold absolute pressure sensor and throttle body are installed securely.	Go to step **2**.
2	**CHECK EGR VALVE.** Remove the EGR valve.	Are there any holes, clogged lines or foreign matters in the EGR system?	Repair the EGR system.	Replace the EGR valve. <Ref. to FU(H4SO)-35, EGR Valve.>

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-101, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

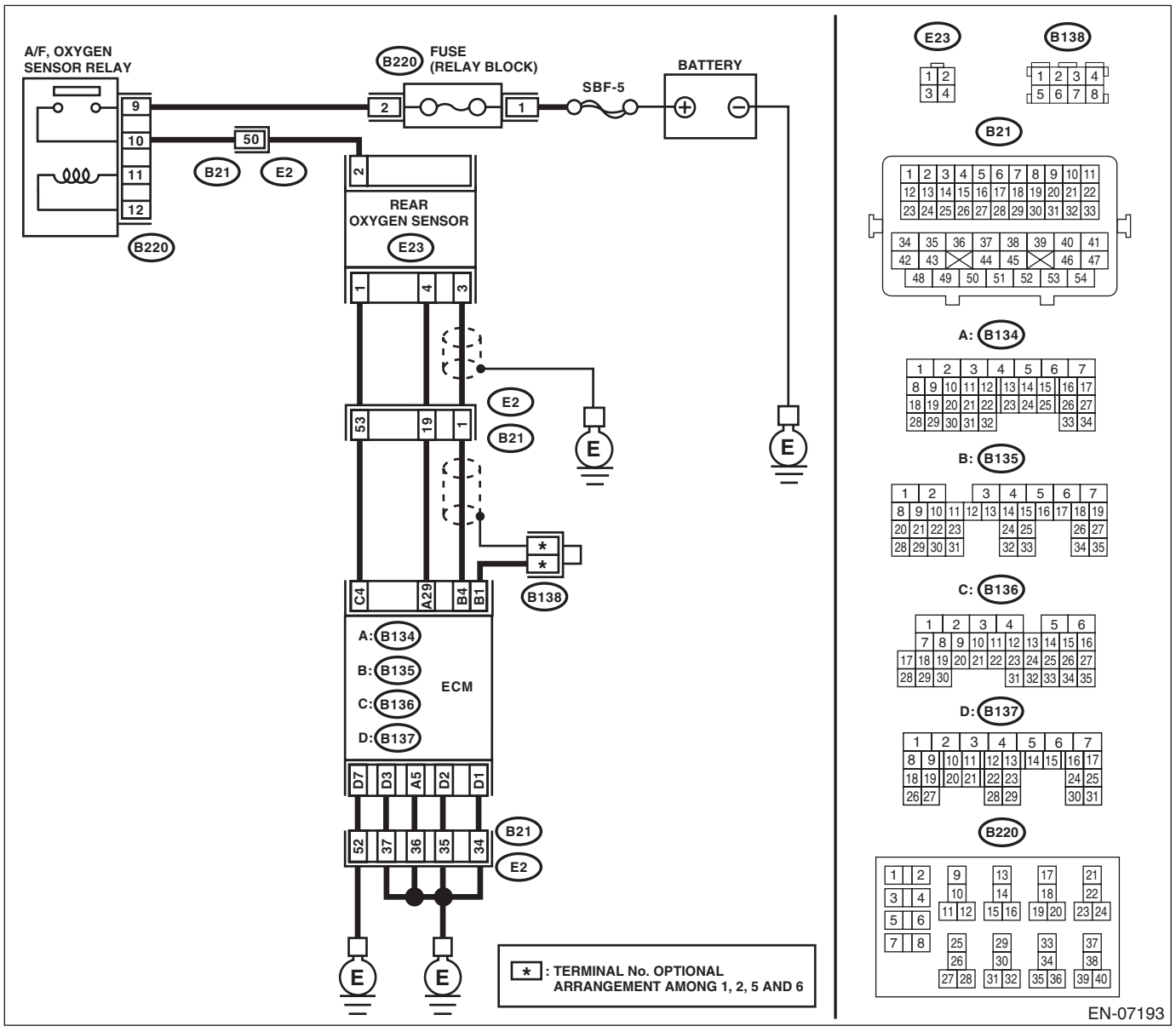
TROUBLE SYMPTOM:

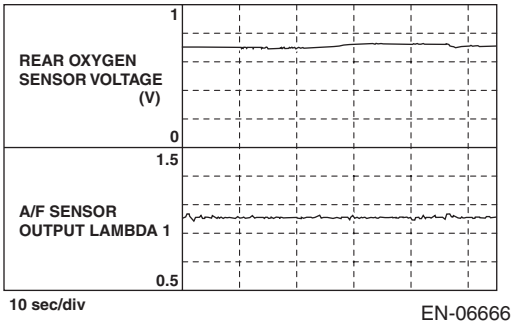
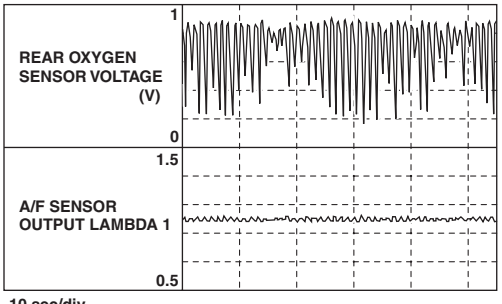
- Engine stalls.
- Idle mixture is out of specifications.

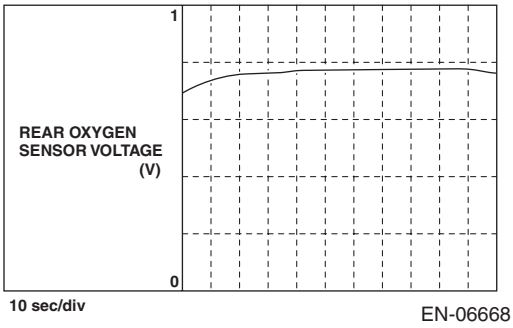
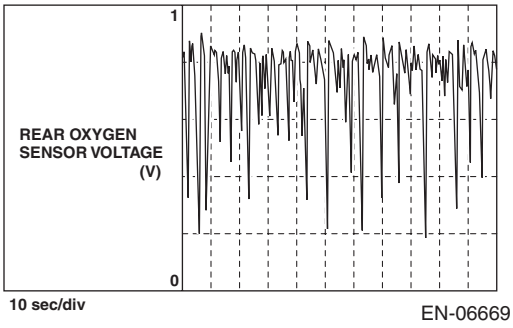
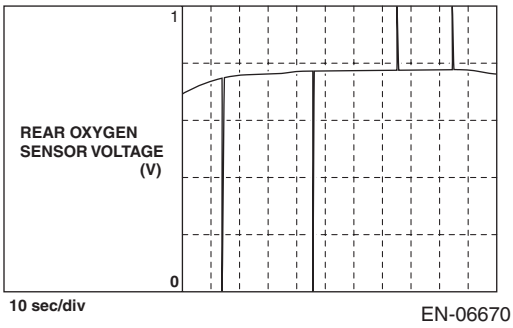
CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**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 or improperly attached 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(H4SO)-2, General Description.>	Go to step **2**.
2	**CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE DRIVING).** 1) Drive at a constant speed between 80 — 112 km/h (50 — 70 MPH). 2) After 5 minutes have elapsed in the condition of step 1), use the Subaru Select Monitor while still driving to read the waveform data. • At normal condition  EN-06666 • At abnormal condition (numerous inversion)  EN-06667	Is a normal waveform displayed?	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.	Go to step **3**.

	Step	Check	Yes	No
3	**CHECK WAVEFORM DATA ON THE SUBARU SELECT MONITOR (WHILE IDLING).** 1) Run the engine at idle. 2) In the condition of step 1), use the Subaru Select Monitor to read the waveform data. • At normal condition  EN-06668 • At abnormal condition 1 (numerous inversion)  EN-06669 • At abnormal condition 2 (noise input)  EN-06670	Is a normal waveform displayed?	Go to step **4**.	• The waveform is displayed at abnormal condition 1: Go to step **4**. • The waveform is displayed at abnormal condition 2: Go to step **5**.
4	**CHECK CATALYTIC CONVERTER.**	Is the catalytic converter damaged?	Replace the catalytic converter. <Ref. to EC(H4SO)-3, Front Catalytic Converter.>	Go to step **5**.
5	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **6**.

	Step	Check	Yes	No
6	**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*** ***(B135) No. 4 — (E23) No. 3:*** ***(B134) No. 29 — (E23) No. 4:***	Is the resistance less than 1 Ω?	Go to step **7**.	Repair the harness and connector. NOTE: Repair the following locations. • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of coupling connector
7	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E23) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Go to step **8**.	Repair the harness and connector. NOTE: Repair the following locations. • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of ECM connector • Poor contact of coupling connector
8	**CHECK REAR OXYGEN SENSOR SHIELD.** 1) Turn the ignition switch to OFF. 2) Expose the rear oxygen sensor connector body side harness sensor shield. 3) Measure the resistance between sensor shield and chassis ground.	Is the resistance less than 1 Ω?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>	Repair the open circuit of rear oxygen sensor harness.

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-103, DTC P0442 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

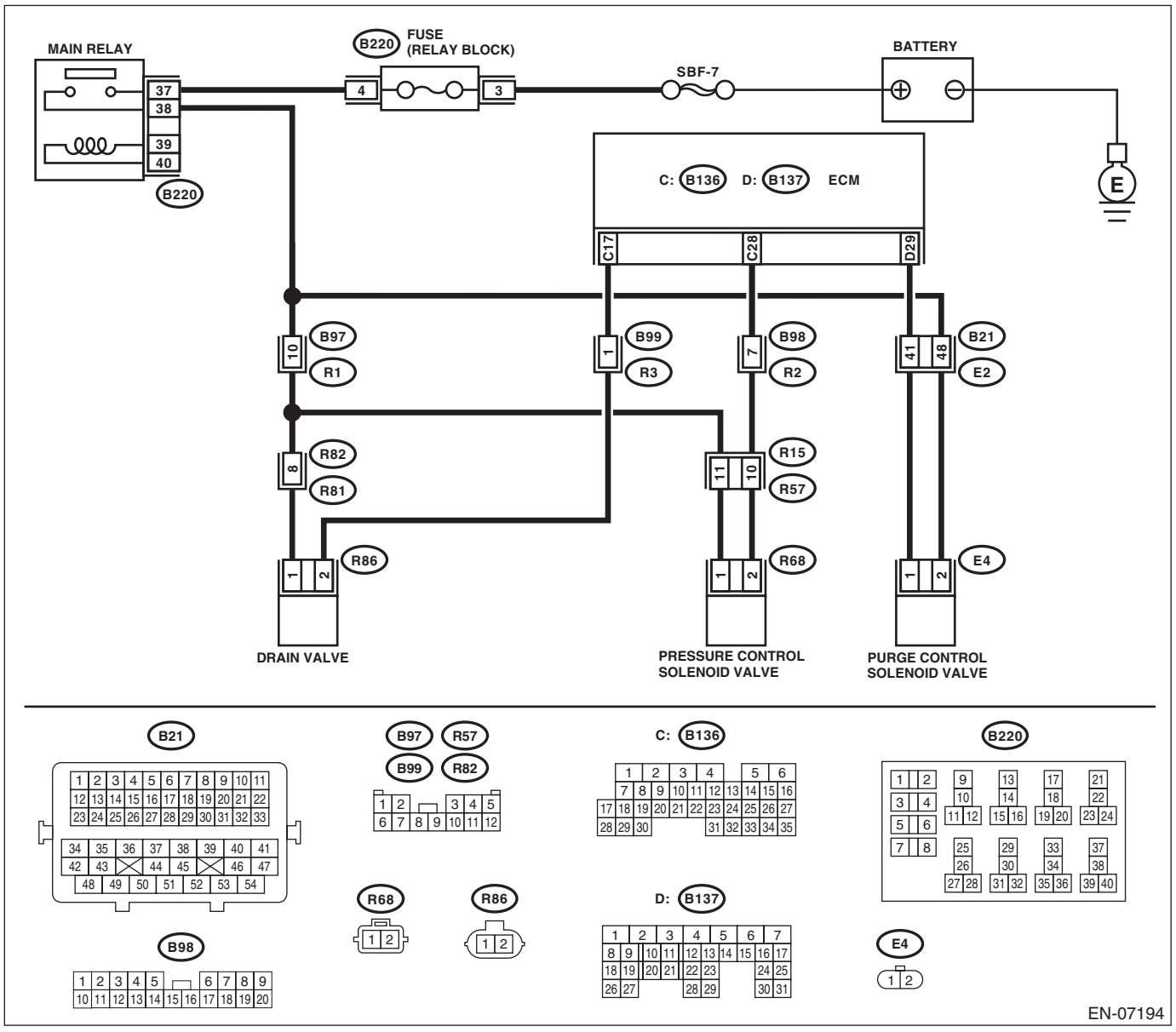
TROUBLE SYMPTOM:

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

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK FUEL FILLER CAP.** 1) Turn the 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 has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step **2**.	Tighten fuel filler cap securely.
2	**CHECK FUEL FILLER CAP.**	Is the fuel filler cap genuine?	Go to step **3**.	Replace with a genuine fuel filler cap.
3	**CHECK FUEL FILLER PIPE GASKET.**	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-61, Fuel Filler Pipe.>	Go to step **4**.
4	**CHECK DRAIN VALVE OPERATION.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform operation check for the drain valve using the Subaru Select Monitor. NOTE: The drain valve can be operated using Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step **5**.	Replace the drain valve. <Ref. to EC(H4SO)-19, Drain Valve.>
5	**PURGE CONTROL SOLENOID VALVE OPERATION CHECK.** Perform operation check for the purge control solenoid valve using the Subaru Select Monitor. NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step **6**.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.>
6	**PRESSURE CONTROL SOLENOID VALVE OPERATION CHECK.** Perform operation check for the pressure control solenoid valve using the Subaru Select Monitor. NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step **7**.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-16, Pressure Control Solenoid Valve.>
7	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.** 1) Turn the ignition switch to OFF. 2) Disconnect the delivery (test) mode connector.	Is there any hole of more than 1.0 mm (0.04 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4SO)-75, Fuel Delivery and Evaporation Lines.>	Go to step **8**.

Step		Check	Yes	No
8	**CHECK CANISTER.**	Is the canister damaged or is there a hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step **9**.
9	**CHECK FUEL TANK.** Remove the fuel tank. <Ref. to FU(H4SO)-54, Fuel Tank.>	Is the fuel tank damaged or is there any hole of more than 1.0 mm (0.04 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H4SO)-54, Fuel Tank.>	Go to step **10**.
10	**CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.**	Is there any hole of more than 1.0 mm (0.04 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of ECM connector.

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

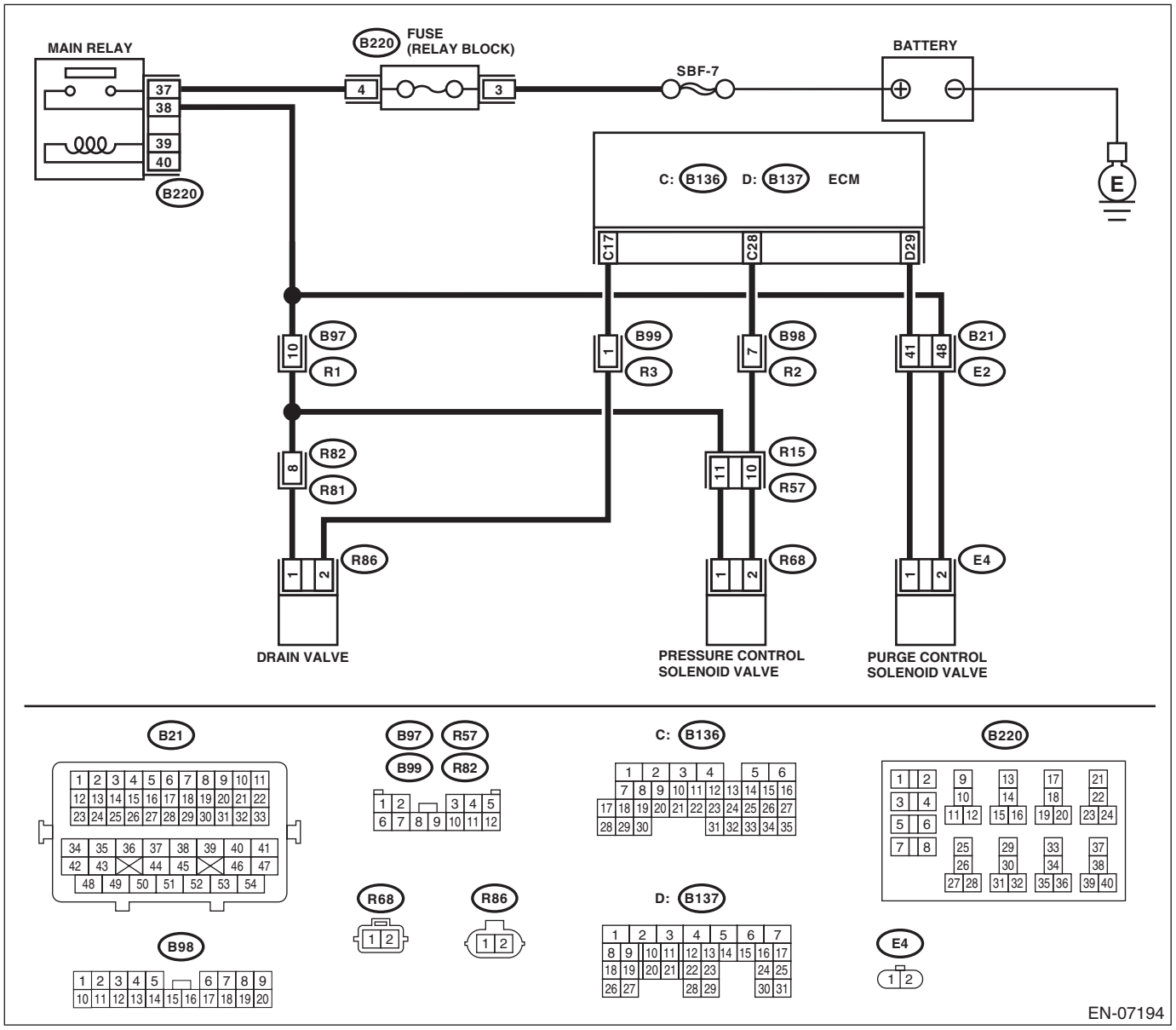
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-119, DTC P0447 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 17 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary open or short circuit of harness or temporary poor contact of connector may be the cause.
3	**CHECK POWER SUPPLY TO DRAIN VALVE.** Measure the voltage between drain valve connector and chassis ground. ***Connector & terminal*** ***(R86) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND DRAIN VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and drain valve. 3) Measure the resistance between the drain valve connector and chassis ground. ***Connector & terminal*** ***(R86) No. 2 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the ground short circuit of harness between ECM and drain valve connector.
5	**CHECK HARNESS BETWEEN ECM AND DRAIN VALVE CONNECTOR.** Measure the resistance of harness between ECM and drain valve connector. ***Connector & terminal*** ***(B136) No. 17 — (R86) No. 2:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and drain valve connector • Poor contact of coupling connector
6	**CHECK DRAIN VALVE.** Measure the resistance between drain valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 10 — 100 Ω?	Repair the poor contact of drain valve connector.	Replace the drain valve. <Ref. to EC(H4SO)-19, Drain Valve.>

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

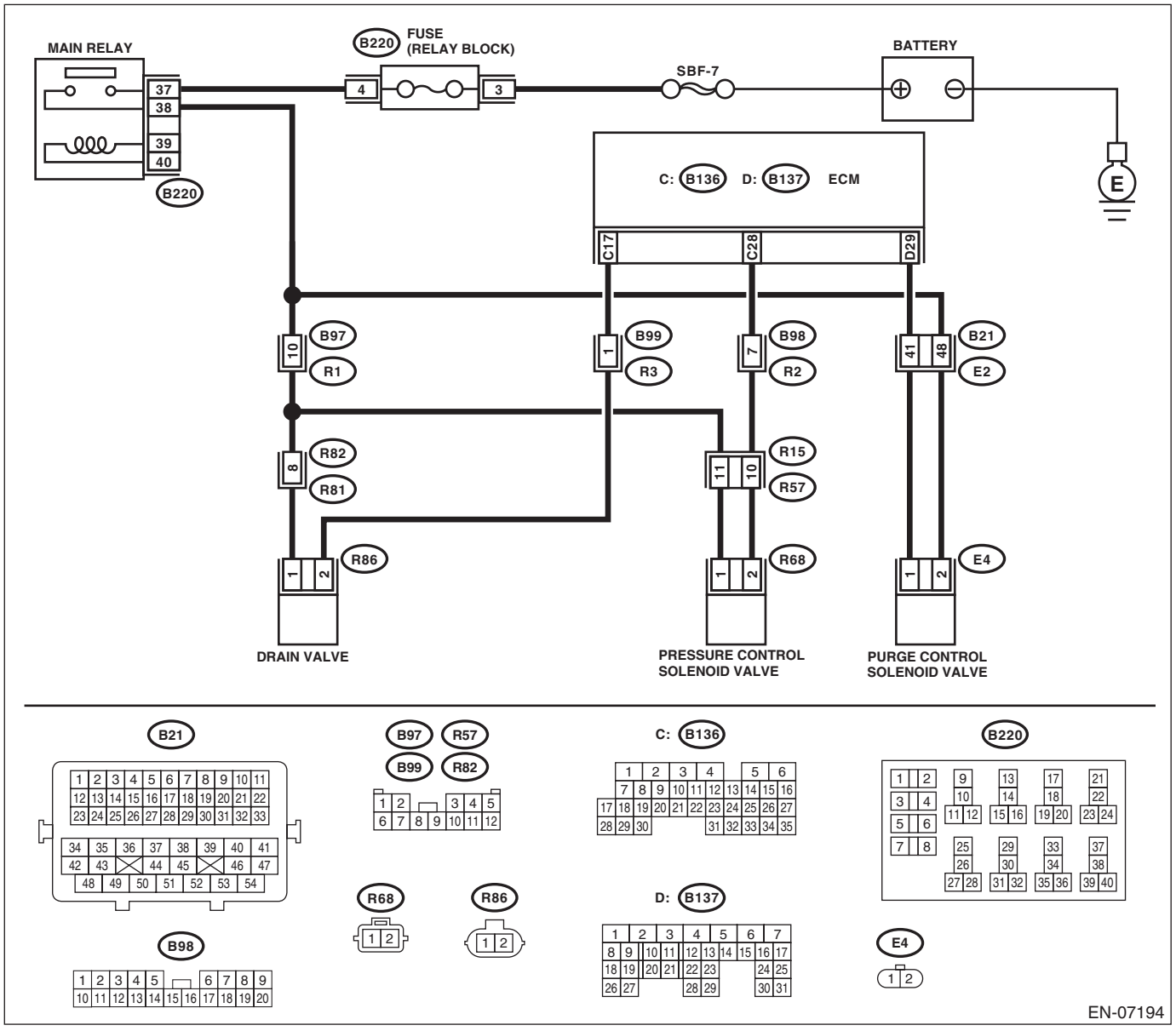
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-121, DTC P0448 EVAPORATIVE EMISSION CONTROL SYSTEM VENT CONTROL CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



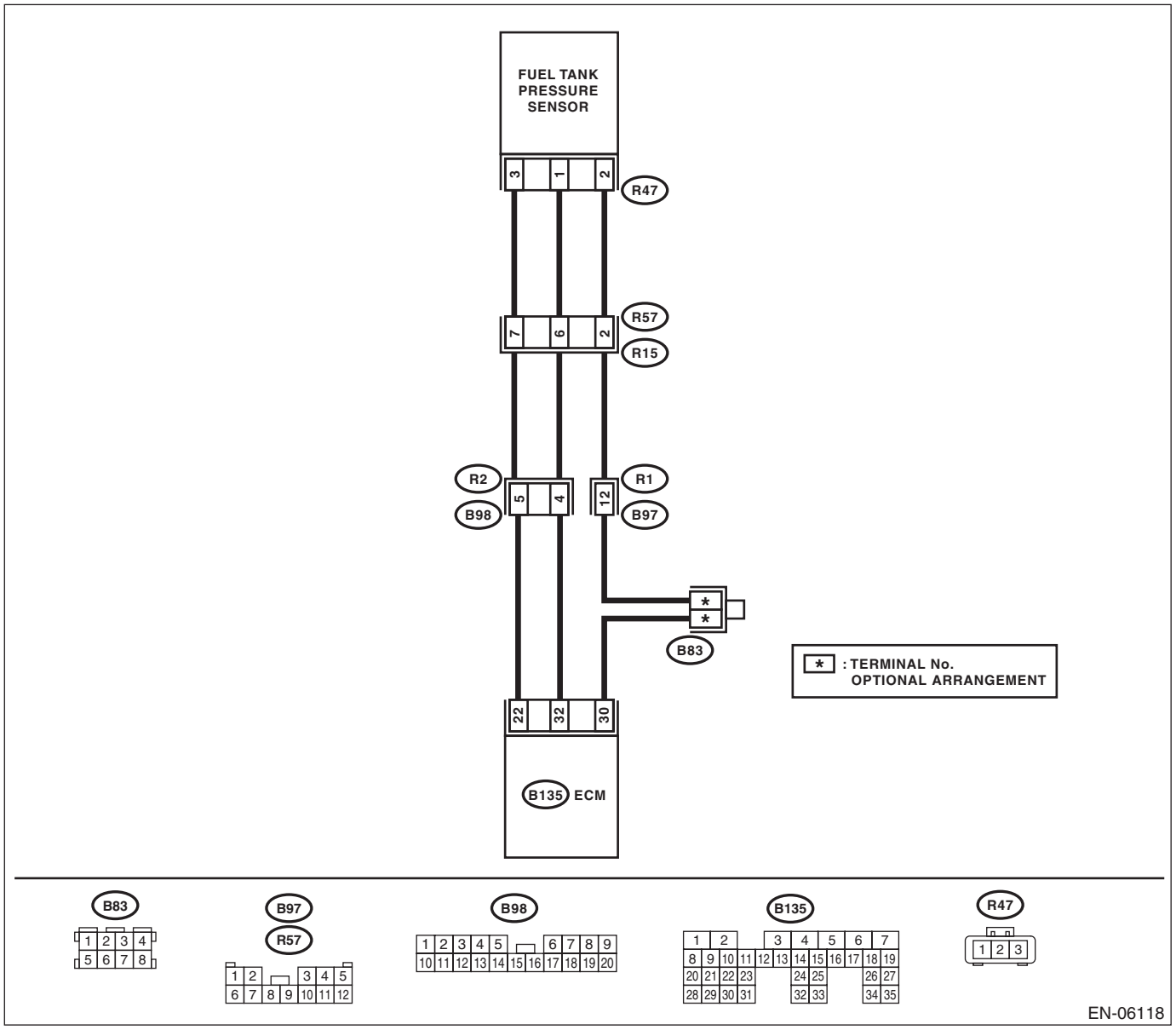
	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND DRAIN VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and drain valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 17 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and drain valve connector.	Go to step **2**.
2	**CHECK DRAIN VALVE.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between drain valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Replace the drain valve. <Ref. to EC(H4SO)-19, Drain Valve.>	Repair the poor contact of ECM connector.

BI: DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-123, DTC P0451 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.
WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK FUEL FILLER CAP.** 1) Turn the ignition switch to OFF. 2) Open the fuel flap.	Is the fuel filler cap tightened securely?	Go to step **2**.	Tighten fuel filler cap securely.

	Step	Check	Yes	No
2	**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 any fault in pressure/vacuum line?	Repair or replace the hoses and pipes.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-15, Fuel Tank Pressure Sensor.>

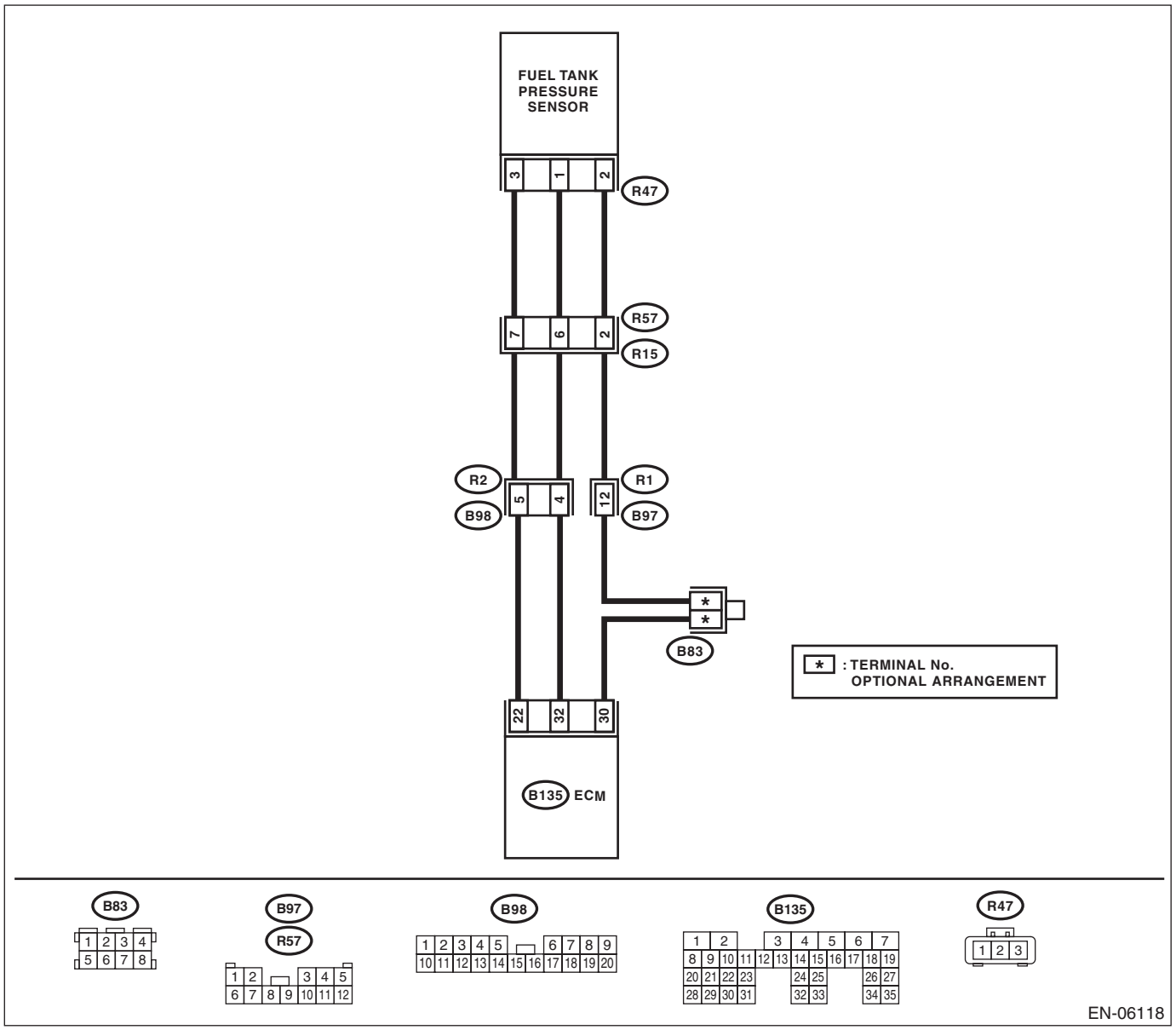
BJ:DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-125, DTC P0452 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON. 2) Read the data of fuel tank pressure sensor signal using the 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value less than –7.45 kPa (–55.9 mmHg, –2.2 inHg) ?	Go to step **2**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
2	**CHECK FUEL TANK PRESSURE SENSOR POWER SUPPLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the fuel tank pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between the fuel tank pressure sensor connector and chassis ground. ***Connector & terminal*** ***(R47) No. 3 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and fuel tank pressure sensor connector • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance of harness between the ECM and fuel tank pressure sensor connector. ***Connector & terminal*** ***(B135) No. 32 — (R47) No. 1:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and fuel tank pressure sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 32 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the ground short circuit of harness between ECM and fuel tank pressure sensor connector.
5	**CHECK FOR POOR CONTACT.** Check for poor contact between the ECM and fuel tank pressure sensor connector.	Is there poor contact of the ECM or fuel tank pressure sensor connector?	Repair the poor contact of the ECM or fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-15, Fuel Tank Pressure Sensor.>

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

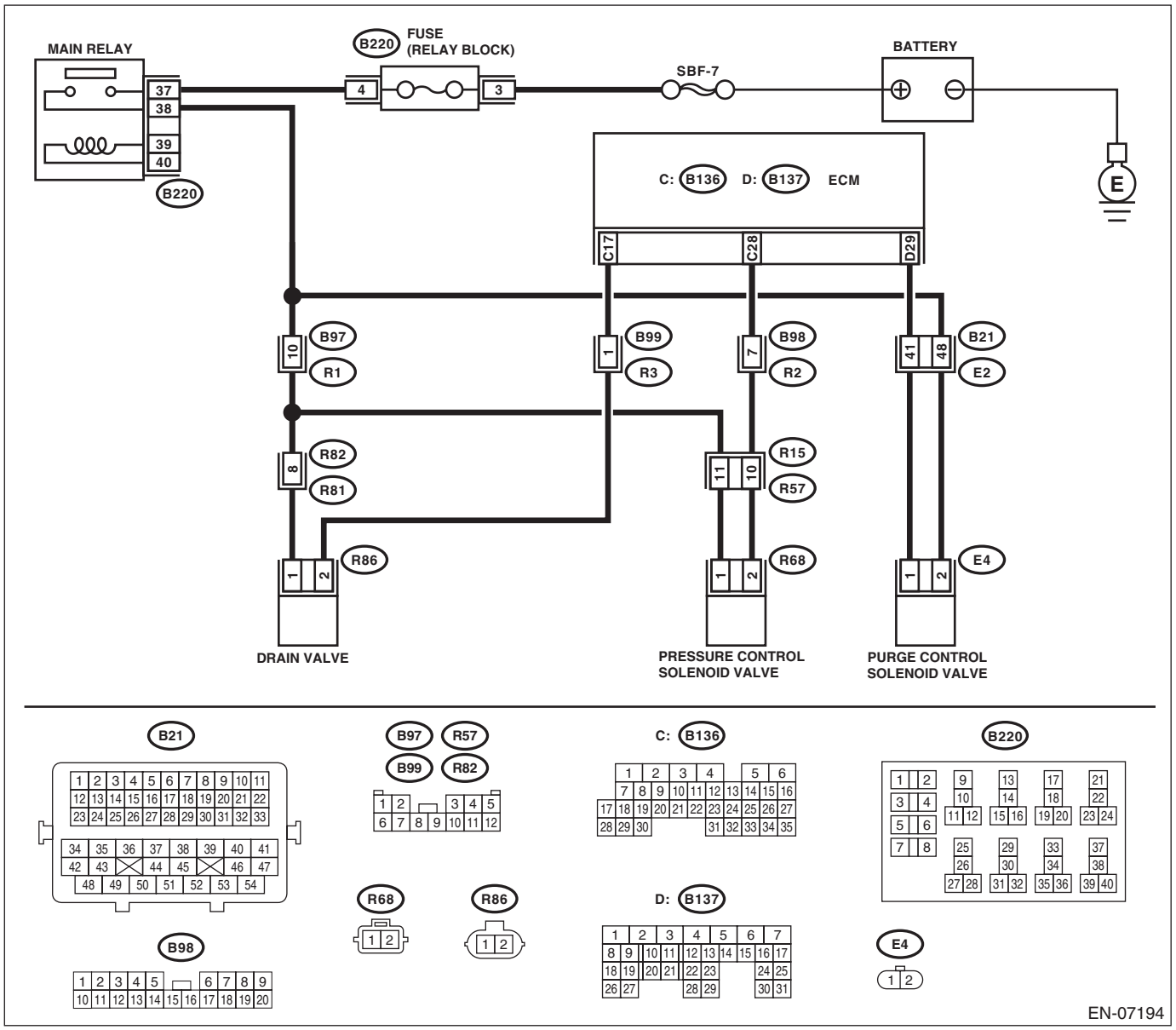
DTC DETECTING CONDITION:

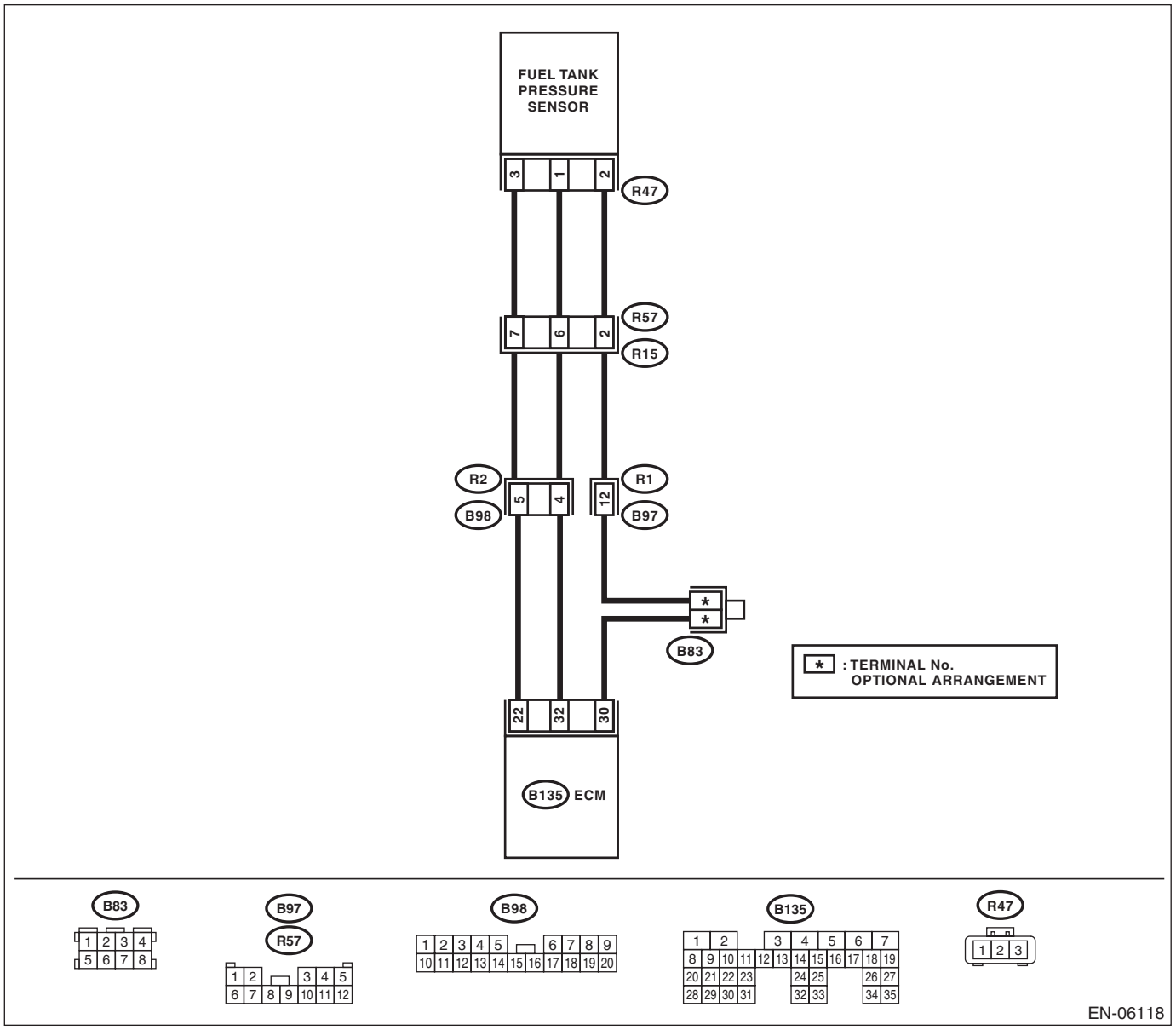
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-127, DTC P0453 EVAPORATIVE EMISSION CONTROL SYSTEM PRESSURE SENSOR HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:





Step		Check	Yes	No
1	**CHECK PRESSURE CONTROL SOLENOID VALVE AND EVAPORATION HOSE.** Check the pressure control solenoid valve and the evaporation hose. <Ref. to EC(H4SO)-16, INSPECTION, Pressure Control Solenoid Valve.>	Is the pressure control solenoid valve and the evaporation hose normal?	Go to step **2**.	Replace the pressure control solenoid valve or the evaporation hose. <Ref. to EC(H4SO)-16, Pressure Control Solenoid Valve.>
2	**CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and pressure control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 28 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and pressure control solenoid valve connector.	Go to step **3**.

	Step	Check	Yes	No
3	**CHECK PRESSURE CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between pressure control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 20 — 30 Ω?	Go to step **4**.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-16, Pressure Control Solenoid Valve.>
4	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Go to step **5**.
5	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON. 2) Read the data of fuel tank pressure sensor signal using the 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 7.95 kPa (59.6 mmHg, 2.35 inHg) or more?	Go to step **6**.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.
6	**CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the fuel tank pressure sensor. 3) Turn the ignition switch to ON. 4) Read the data of fuel tank pressure sensor signal using the 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 7.95 kPa (59.6 mmHg, 2.35 inHg) or more?	Repair the short circuit to power in the harness between ECM and fuel tank pressure sensor connector.	Go to step **7**.

	Step	Check	Yes	No
7	**CHECK HARNESS BETWEEN ECM AND FUEL TANK PRESSURE SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between fuel tank pressure sensor connector and engine ground. ***Connector & terminal*** ***(R47) No. 2 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **8**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and fuel tank pressure sensor connector • Poor contact of ECM connector • Poor contact of coupling connector • Poor contact of joint connector
8	**CHECK FOR POOR CONTACT.** Check for poor contact of the fuel tank pressure sensor connector.	Is there poor contact of fuel tank pressure sensor connector?	Repair the poor contact of fuel tank pressure sensor connector.	Replace the fuel tank pressure sensor. <Ref. to EC(H4SO)-15, Fuel Tank Pressure Sensor.>

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-128, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

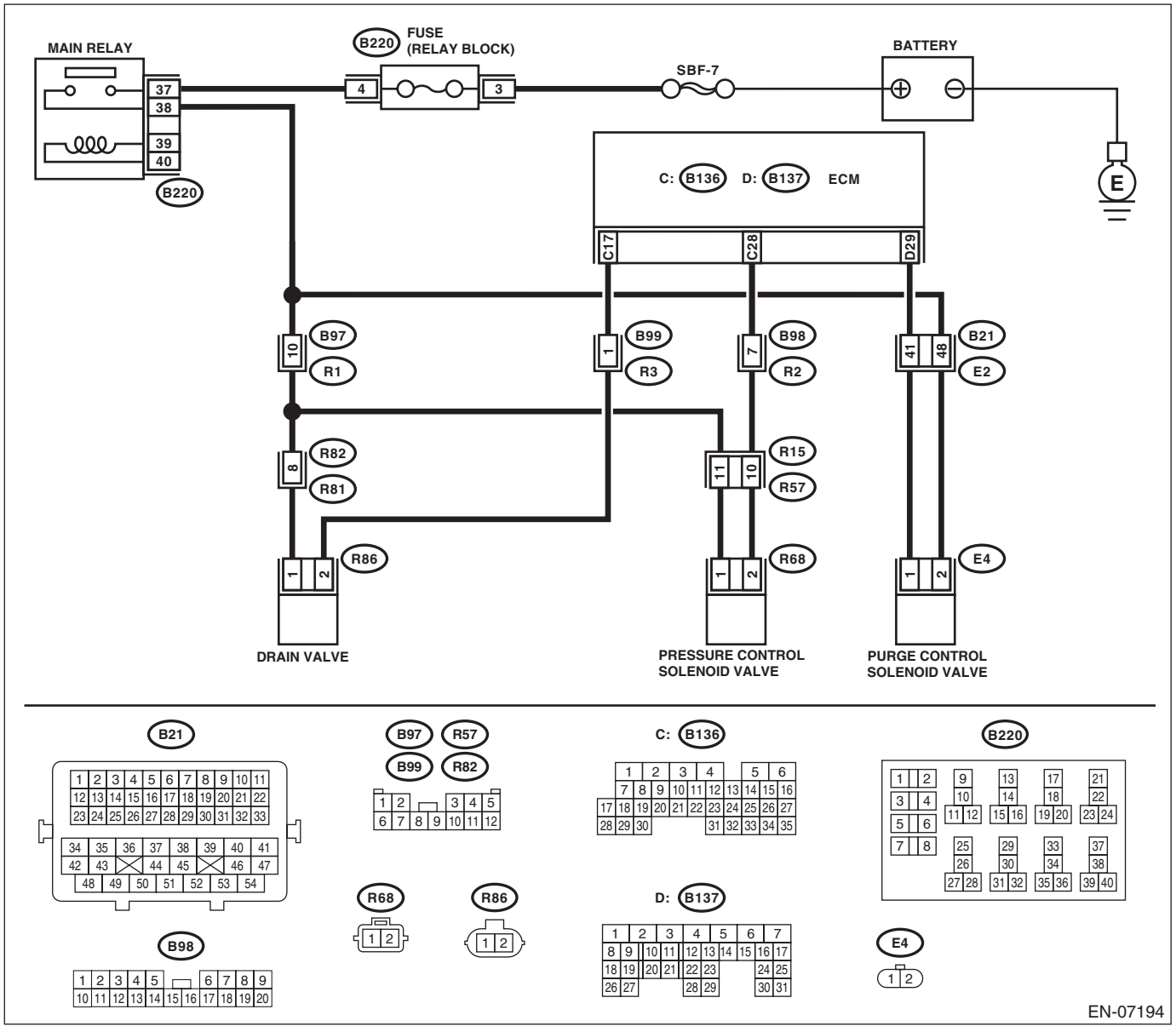
TROUBLE SYMPTOM:

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

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK FUEL FILLER CAP.** 1) Turn the 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 has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step **2**.	Tighten fuel filler cap securely.
2	**CHECK FUEL FILLER CAP.**	Is the fuel filler cap genuine?	Go to step **3**.	Replace with a genuine fuel filler cap.
3	**CHECK FUEL FILLER PIPE GASKET.**	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-61, Fuel Filler Pipe.>	Go to step **4**.
4	**CHECK DRAIN VALVE OPERATION.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform operation check for the drain valve using the Subaru Select Monitor. NOTE: Drain valve can be operated using the Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step **5**.	Replace the drain valve. <Ref. to EC(H4SO)-19, Drain Valve.>
5	**PURGE CONTROL SOLENOID VALVE OPERATION CHECK.** Perform operation check for the purge control solenoid valve using the Subaru Select Monitor. NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step **6**.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.>
6	**PRESSURE CONTROL SOLENOID VALVE OPERATION CHECK.** Perform operation check for the pressure control solenoid valve using the Subaru Select Monitor. NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step **7**.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-16, Pressure Control Solenoid Valve.>
7	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.** 1) Turn the ignition switch to OFF. 2) Check the delivery (test) mode connector is disconnected.	Is there any hole of more than 0.5 mm (0.020 in) dia. on evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4SO)-75, Fuel Delivery and Evaporation Lines.>	Go to step **8**.

Step		Check	Yes	No
8	**CHECK CANISTER.**	Is the canister damaged or is there a hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step **9**.
9	**CHECK FUEL TANK.** Remove the fuel tank. <Ref. to FU(H4SO)-54, Fuel Tank.>	Is the fuel tank damaged or is there any hole of more than 0.5 mm (0.020 in) dia. in it?	Repair or replace the fuel tank. <Ref. to FU(H4SO)-54, Fuel Tank.>	Go to step **10**.
10	**CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.**	Is there any hole of more than 0.5 mm (0.020 in) dia., crack, clogging, or disconnections, bend, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of ECM connector.

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-128, DTC P0457 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (FUEL CAP LOOSE/OFF), Diagnostic Trouble Code (DTC) Detecting Criteria.>

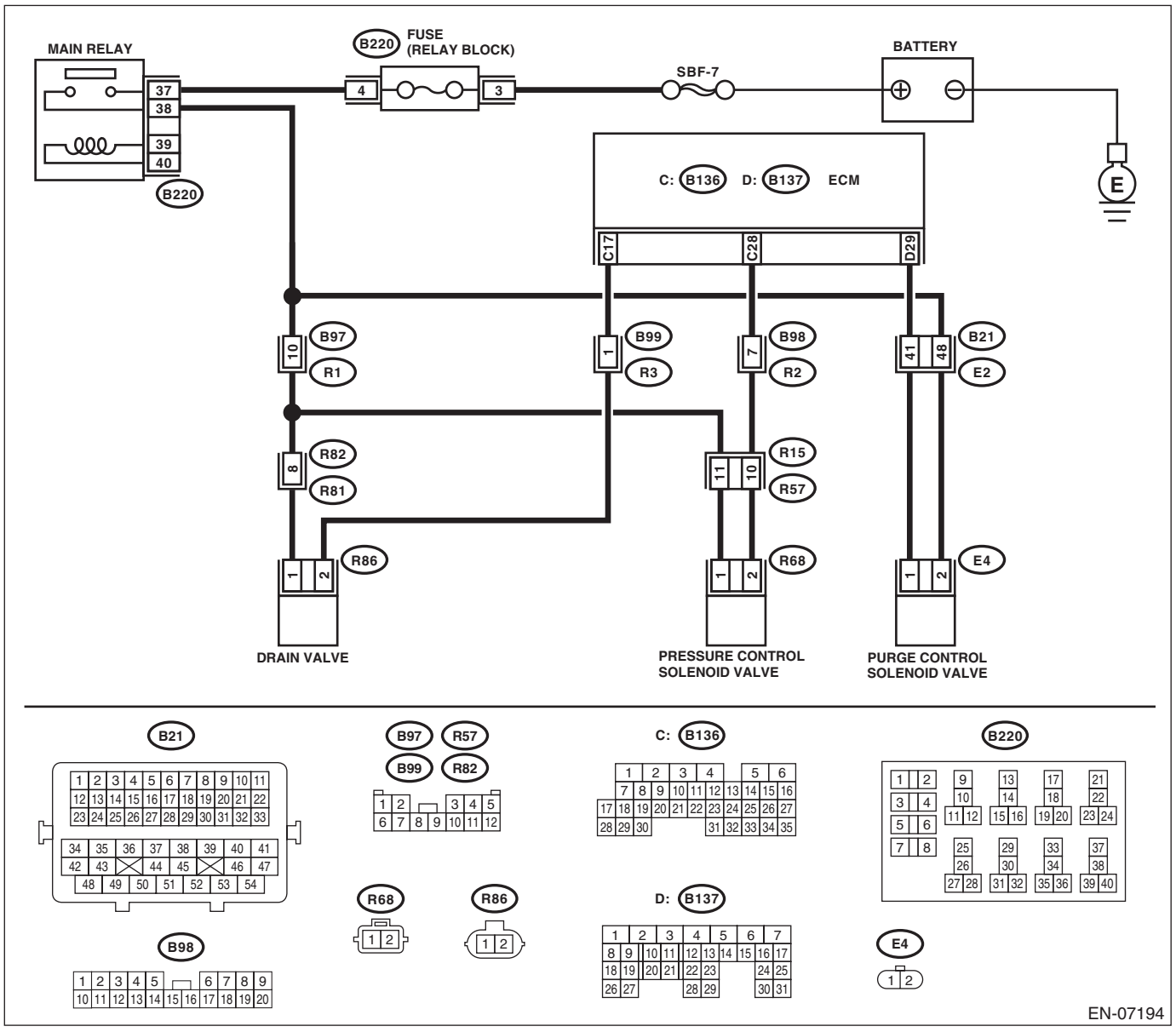
TROUBLE SYMPTOM:

- Fuel odor
- Fuel filler cap loose or lost

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK FUEL FILLER CAP.** 1) Turn the 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 has caught while tightening.	Is the fuel filler cap tightened securely?	Go to step **2**.	Tighten fuel filler cap securely.
2	**CHECK FUEL FILLER CAP.**	Is the fuel filler cap genuine?	Go to step **3**.	Replace with a genuine fuel filler cap.
3	**CHECK FUEL FILLER PIPE GASKET.**	Is there any damage to the seal between fuel filler cap and fuel filler pipe?	Repair or replace the fuel filler cap and fuel filler pipe. <Ref. to FU(H4SO)-61, Fuel Filler Pipe.>	Go to step **4**.
4	**CHECK DRAIN VALVE OPERATION.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform operation check for the drain valve using the Subaru Select Monitor. NOTE: Drain valve can be operated using the Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Go to step **5**.	Replace the drain valve. <Ref. to EC(H4SO)-19, Drain Valve.>
5	**PURGE CONTROL SOLENOID VALVE OPERATION CHECK.** Perform operation check for the purge control solenoid valve using the Subaru Select Monitor. NOTE: Purge control solenoid valve operation can be executed using Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step **6**.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.>
6	**PRESSURE CONTROL SOLENOID VALVE OPERATION CHECK.** Perform operation check for the pressure control solenoid valve using the Subaru Select Monitor. NOTE: The pressure control solenoid valve operation can be executed using the Subaru Select Monitor. For procedure, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the pressure control solenoid valve operate?	Go to step **7**.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-16, Pressure Control Solenoid Valve.>
7	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.** 1) Turn the ignition switch to OFF. 2) Check the delivery (test) mode connector is disconnected.	Is there any disconnection, damage or clogging on the evaporation line?	Repair or replace the evaporation line. <Ref. to FU(H4SO)-75, Fuel Delivery and Evaporation Lines.>	Go to step **8**.

	Step	Check	Yes	No
8	**CHECK CANISTER.**	Is the canister damaged?	Repair or replace the canister. <Ref. to EC(H4SO)-5, Canister.>	Go to step **9**.
9	**CHECK FUEL TANK.** Remove the fuel tank. <Ref. to FU(H4SO)-54, Fuel Tank.>	Is the fuel tank damaged?	Repair or replace the fuel tank. <Ref. to FU(H4SO)-54, Fuel Tank.>	Go to step **10**.
10	**CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.**	Are there holes, cracks, clogging, or disconnections, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of ECM connector.

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-129, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

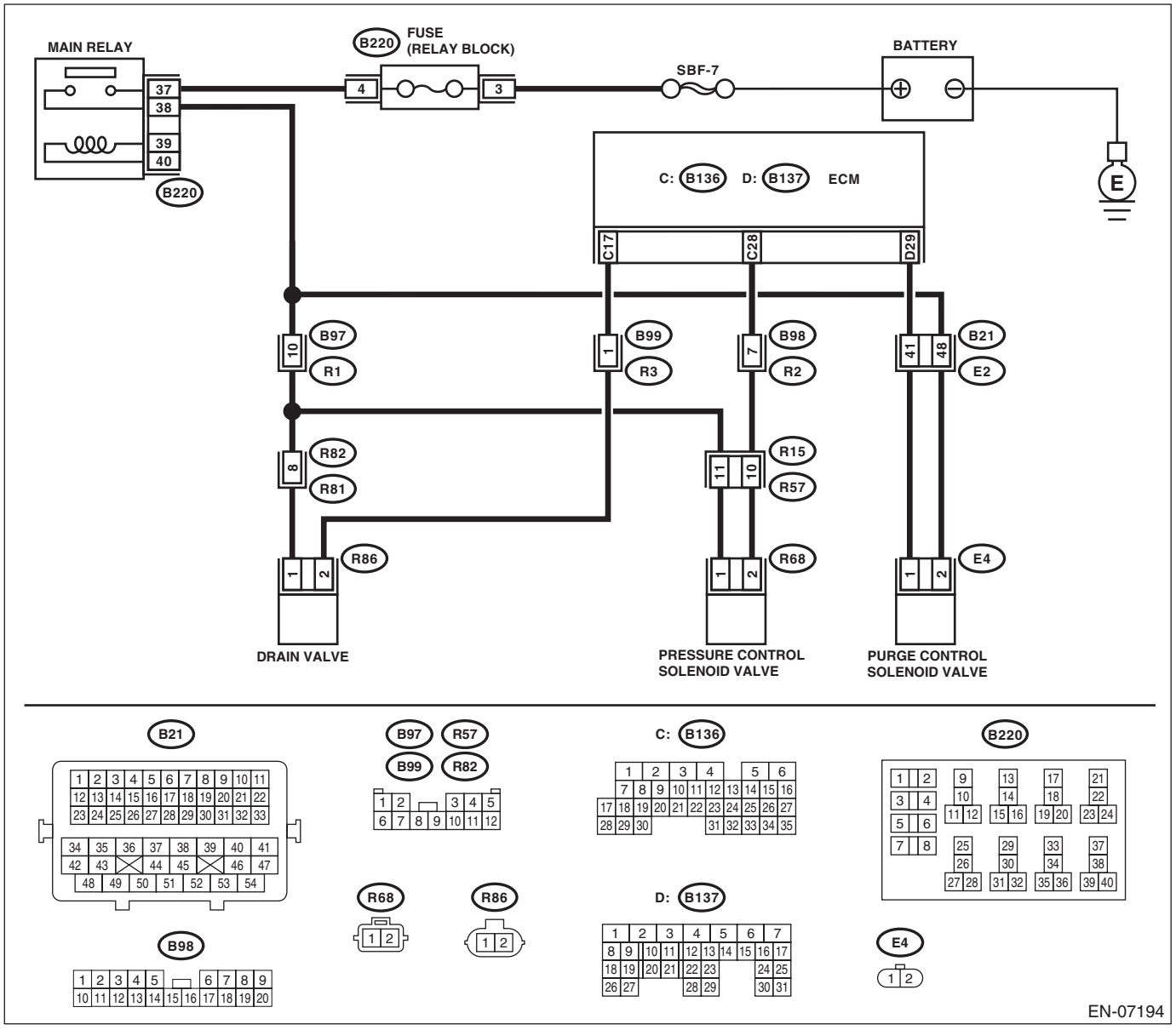
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 29 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary open or short circuit of harness or temporary poor contact of connector may be the cause.
3	**CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE.** Measure the voltage between purge control solenoid valve connector and engine ground. ***Connector & terminal*** ***(E4) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Measure the resistance between the purge control solenoid valve connector and engine ground. ***Connector & terminal*** ***(E4) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the ground short circuit of harness between ECM and purge control solenoid valve connector.
5	**CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE CONNECTOR.** Measure the resistance of harness between ECM and purge control solenoid valve. ***Connector & terminal*** ***(B137) No. 29 — (E4) No. 1:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and purge control solenoid valve connector • Poor contact of coupling connector
6	**CHECK PURGE CONTROL SOLENOID VALVE.** 1) Remove the purge control solenoid valve. 2) Measure the resistance between purge control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 10 — 100 Ω?	Repair the poor contact of purge control solenoid valve connector.	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.>

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-131, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

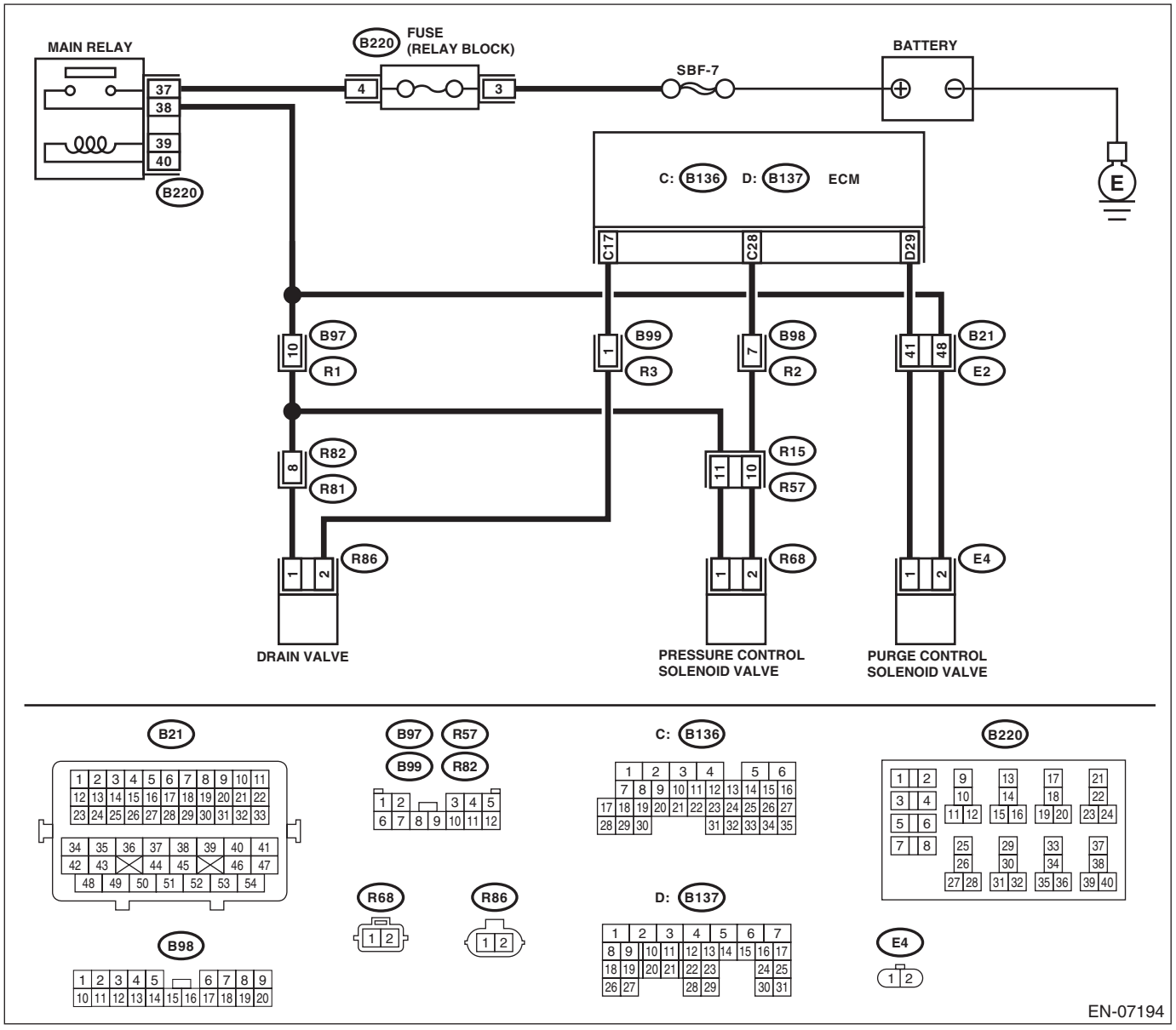
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 29 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and purge control solenoid valve connector.	Go to step **2**.
2	**CHECK PURGE CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Replace the purge control solenoid valve. <Ref. to EC(H4SO)-9, Purge Control Solenoid Valve.>	Repair the poor contact of ECM connector.

BP:DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-133, DTC P0461 FUEL LEVEL SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Replace the fuel level sensor and fuel sub level sensor. <Ref. to FU(H4SO)-66, Fuel Level Sensor.> <Ref. to FU(H4SO)-67, Fuel Sub Level Sensor.>

BQ:DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW

NOTE:
For the diagnostic procedure, refer to DTC P0463. <Ref. to EN(H4SO)(diag)-232, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BR:DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-137, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is DTC P0462 or P0463 displayed on the Subaru Select Monitor?	Check the combination meter. <Ref. to IDI-8, CHECK FUEL LEVEL SENSOR, INSPECTION, Combination Meter System.>	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.

BS:DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-139, DTC P0464 FUEL LEVEL SENSOR CIRCUIT INTERMITTENT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is DTC P0464 displayed on the display?	Check the combination meter. <Ref. to IDI-8, CHECK FUEL LEVEL SENSOR, INSPECTION, Combination Meter System.>	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.

BT:DTC P0500 VEHICLE SPEED SENSOR “A”

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-142, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK DTC OF VDC.** Check DTC of VDC.	Is DTC of VDC displayed?	Perform the diagnosis according to DTC. <Ref. to VDC(diag)-34, List of Diagnostic Trouble Code (DTC).>	Repair the poor contact of ECM connector.

BU:DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-143, DTC P0506 IDLE AIR CONTROL SYSTEM RPM LOWER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

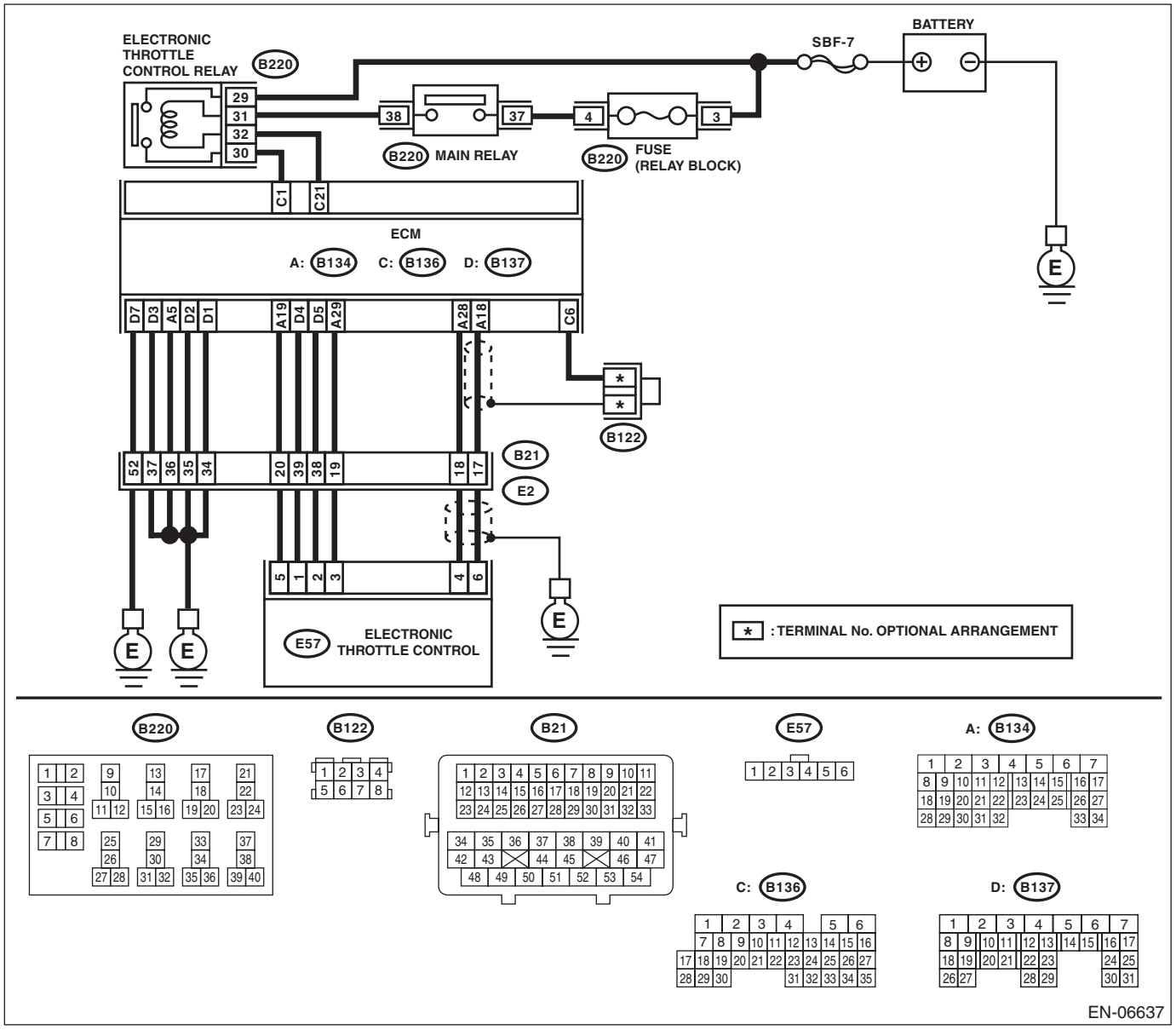
TROUBLE SYMPTOM:

- Hard to start the engine.
- Engine does not start.
- Improper idling
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK AIR CLEANER ELEMENT.** 1) Turn the ignition switch to OFF. 2) Check the air cleaner element.	Is there excessive clogging on air cleaner element?	Replace the air cleaner element. <Ref. to IN(H4SO)-4, Air Cleaner Element.>	Go to step **3**.
3	**CHECK ELECTRONIC THROTTLE CONTROL.** 1) Remove the electronic throttle control. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.> 2) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H4SO)(diag)-294, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BV:DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-144, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

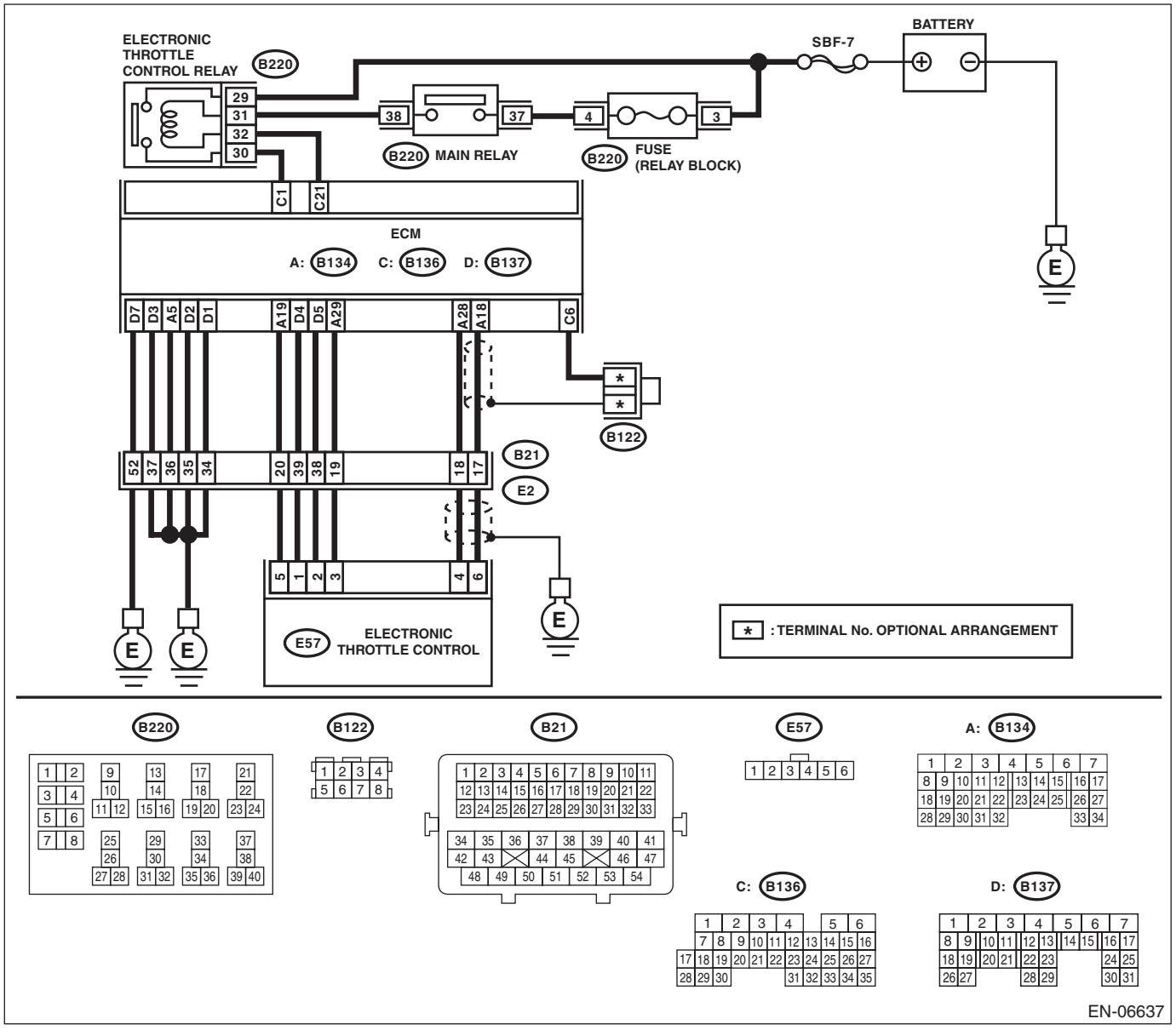
TROUBLE SYMPTOM:

Engine keeps running at higher speed than specified idle speed.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK AIR INTAKE SYSTEM.** 1) Start and idle the engine. 2) Check the following items. • Loose installation of intake manifold and throttle body • Cracks of intake manifold gasket and throttle body gasket • Disconnection of vacuum hoses	Is there any fault in air intake system?	Repair air suction and leaks.	Go to step **3**.
3	**CHECK ELECTRONIC THROTTLE CONTROL.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.> 3) Check the electronic throttle control.	Are foreign matter found inside electronic throttle control?	Remove foreign matter from electronic throttle control.	Perform the diagnosis of DTC P2101. <Ref. to EN(H4SO)(diag)-294, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BW:DTC P0512 STARTER REQUEST CIRCUIT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-145, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

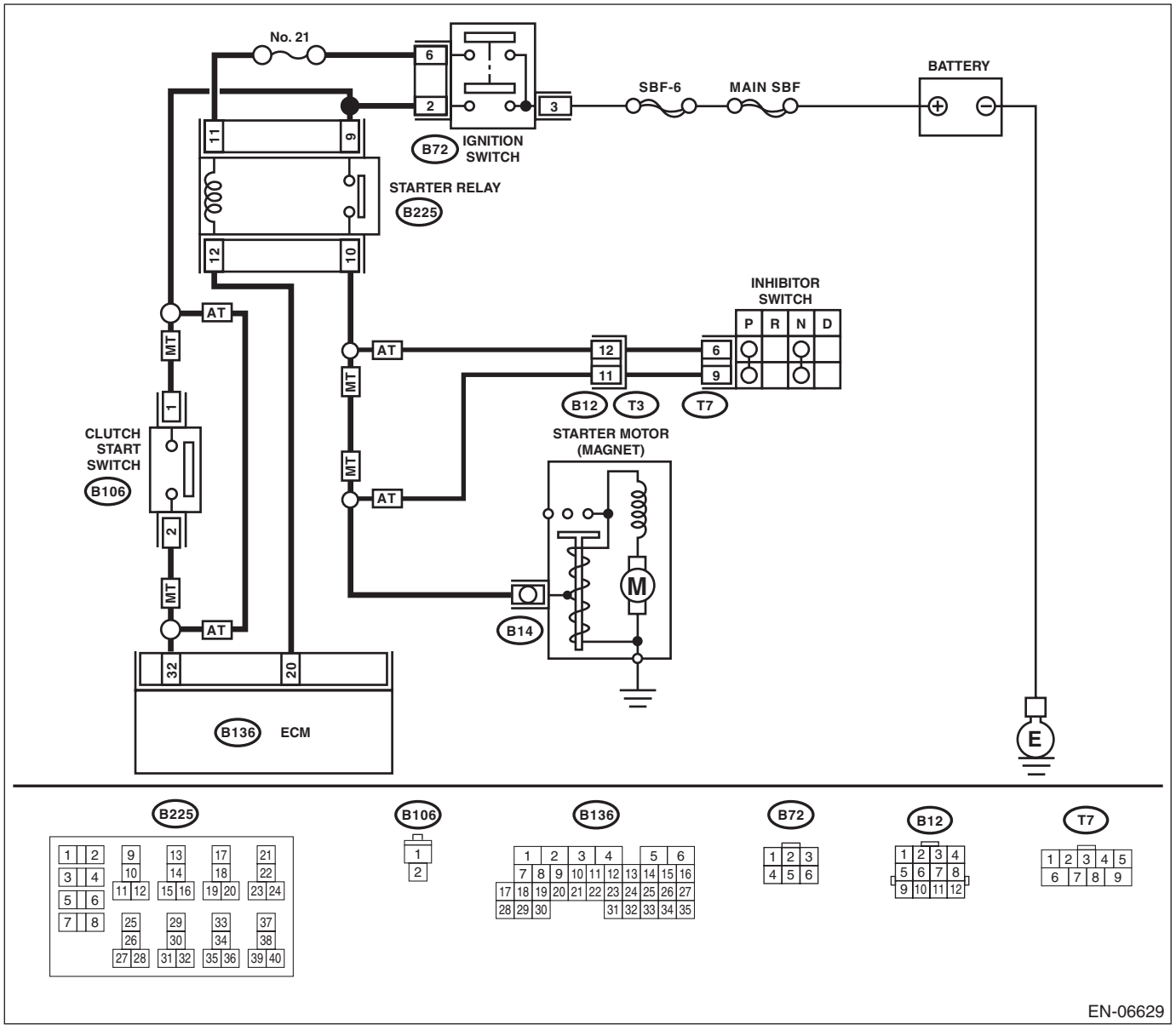
TROUBLE SYMPTOM:

Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND IGNITION SWITCH.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 32 (+) — Chassis ground (–):*** NOTE: For MT model, depress the clutch pedal.	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM and ignition switch connector.	Repair the poor contact of ECM connector.

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-147, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

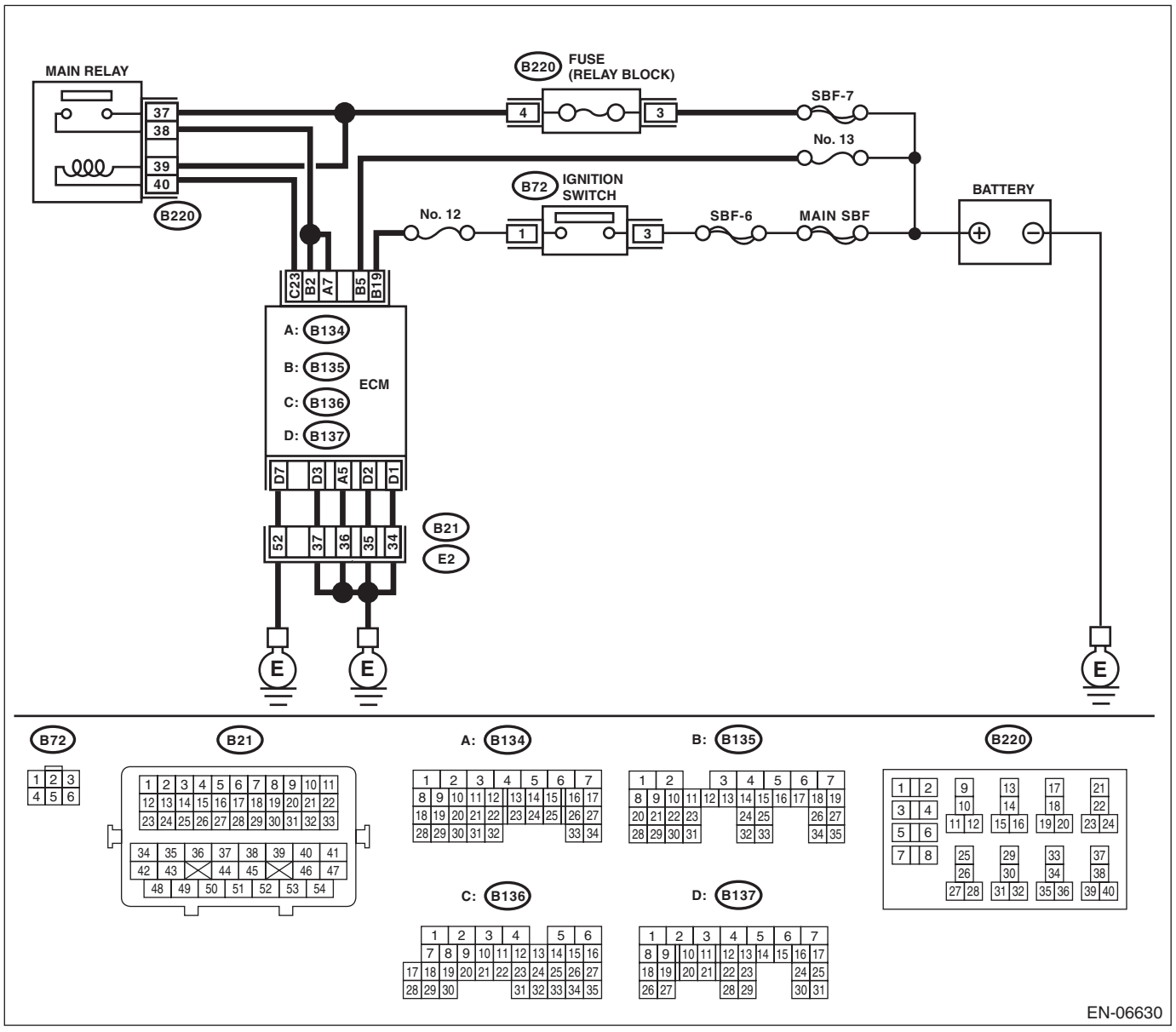
TROUBLE SYMPTOM:

- Engine does not start.
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary poor contact of connector, temporary open or short circuit of harness may be the cause.

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

NOTE:
For the diagnostic procedure, refer to DTC P0607. <Ref. to EN(H4SO)(diag)-242, DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BZ:DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-149, DTC P0607 THROTTLE CONTROL SYSTEM CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

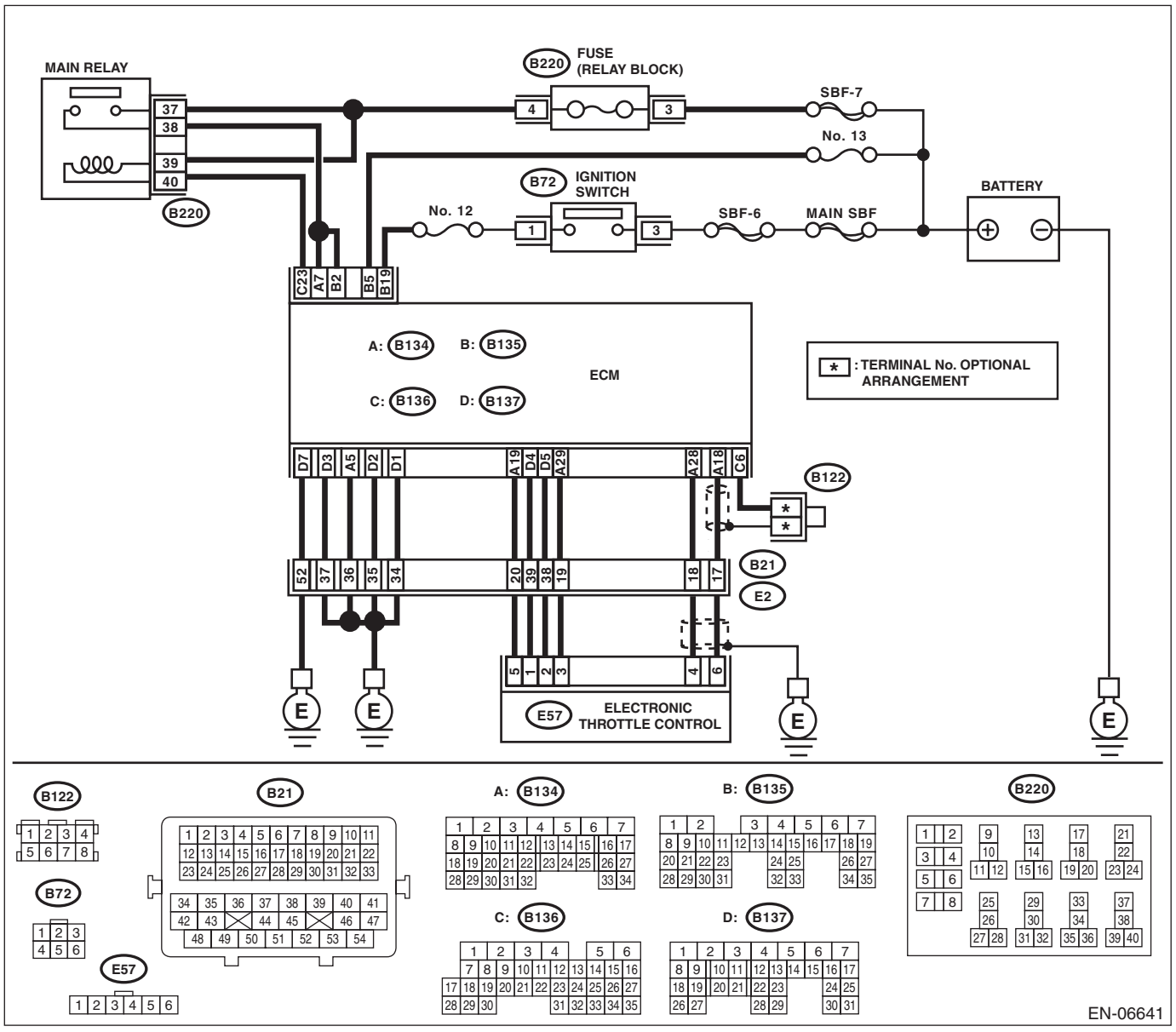
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK INPUT VOLTAGE OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 7 (+) — Chassis ground (–):*** ***(B135) No. 2 (+) — Chassis ground (–):***	Is the voltage 10 — 13 V?	Go to step **2**.	Repair the open or ground short circuit of power supply circuit.
2	**CHECK INPUT VOLTAGE OF ECM.** 1) Start the engine. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 7 (+) — Chassis ground (–):*** ***(B135) No. 2 (+) — Chassis ground (–):***	Is the voltage 13 — 15 V?	Go to step **3**.	Repair the open or ground short circuit of power supply circuit.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance of harness between ECM and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 19 — (E57) No. 5:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and electronic throttle control connector • Poor contact of coupling connector
4	**CHECK ECM GROUND HARNESS.** Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 (+) — Chassis ground (–):*** ***(B137) No. 1 (+) — Chassis ground (–):*** ***(B137) No. 2 (+) — Chassis ground (–):*** ***(B137) No. 3 (+) — Chassis ground (–):*** ***(B137) No. 7 (+) — Chassis ground (–):***	Is the voltage less than 1 V?	Repair the poor contact of ECM connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in ground circuit • Further tightening of the engine ground terminal • Poor contact of coupling connector

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

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4SO)(diag)-294, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CB:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

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

CC:DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-154, DTC P0851 PARK/NEUTRAL SWITCH INPUT CIRCUIT LOW (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

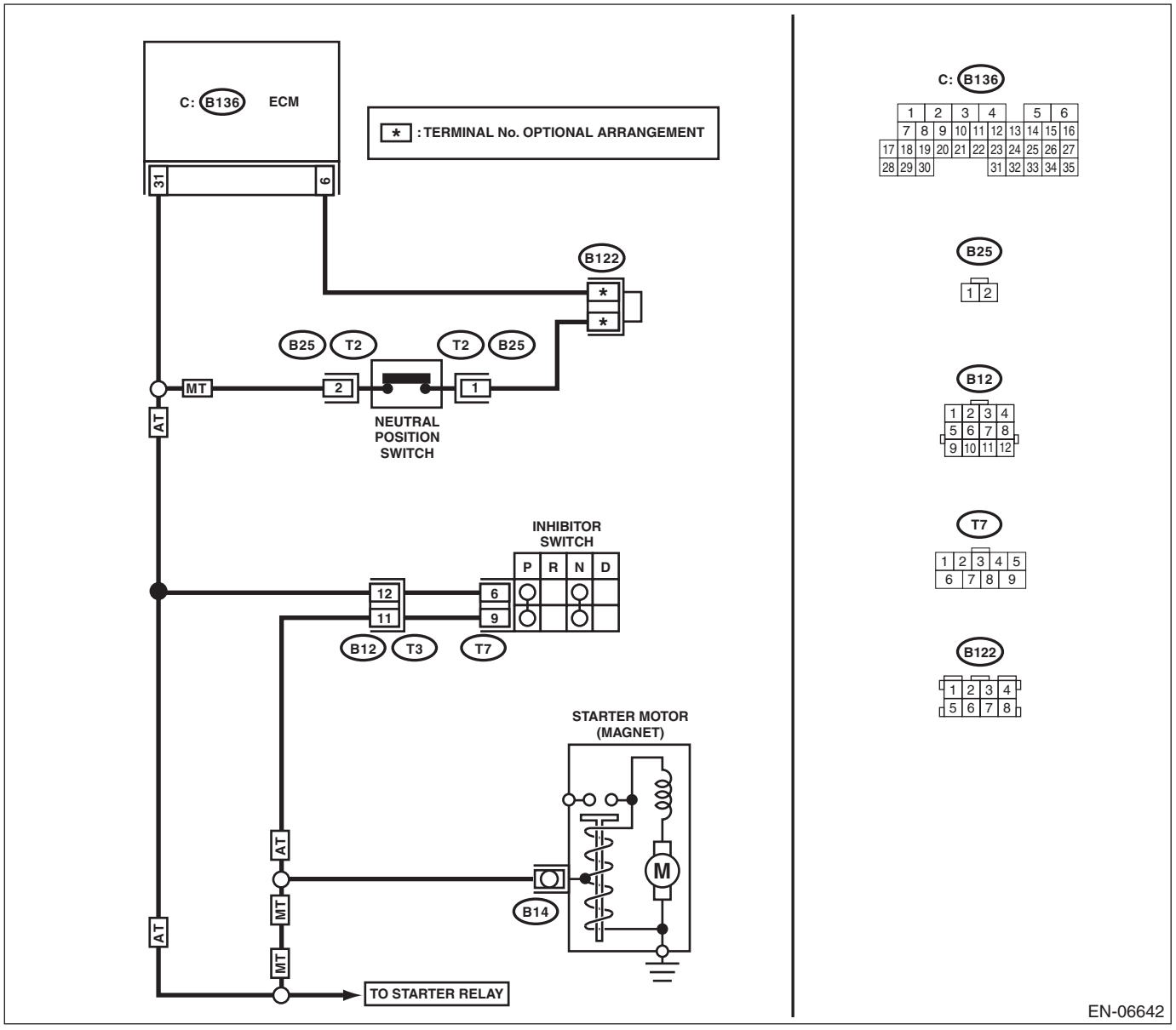
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step	Check	Yes	No
1 **CHECK SELECT CABLE.**	Is there any fault in select cable?	Repair or adjust the select cable. <Ref. to CS-24, Select Cable.>	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Place the select lever in other than "P" range and "N" range. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 31 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of ECM connector.	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 between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 31 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the ground short circuit of harness between ECM and transmission harness connector.
4	**CHECK TRANSMISSION HARNESS CONNECTOR.** 1) Disconnect the connector from inhibitor switch. 2) Measure the resistance between transmission harness connector and engine ground. ***Connector & terminal*** ***(T3) No. 12 — Engine ground:***	Is the resistance 1 MΩ or more?	Replace the inhibitor switch. <Ref. to 4AT-46, Inhibitor Switch.>	Repair short circuit to ground in harness between transmission harness connector and inhibitor switch connector.

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-155, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

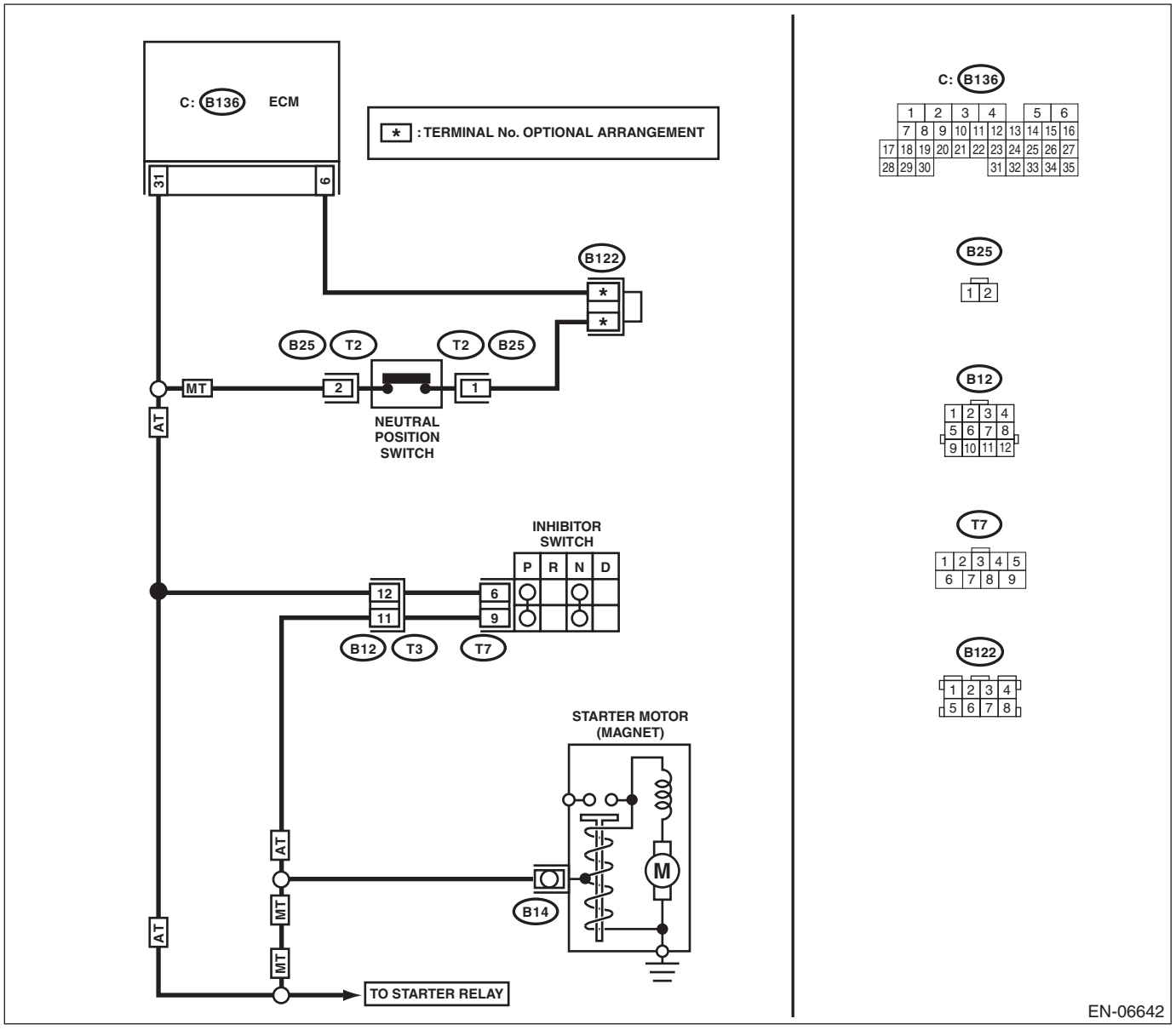
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Place the shift lever in a position other than neutral. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 31 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of ECM connector.	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and neutral position switch. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 31 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the neutral position switch. <Ref. to 5MT-32, Switches and Harness.>	Repair the short circuit to ground harness between ECM and neutral position switch connector.

CE:DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-156, DTC P0852 PARK/NEUTRAL SWITCH INPUT CIRCUIT HIGH (AT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

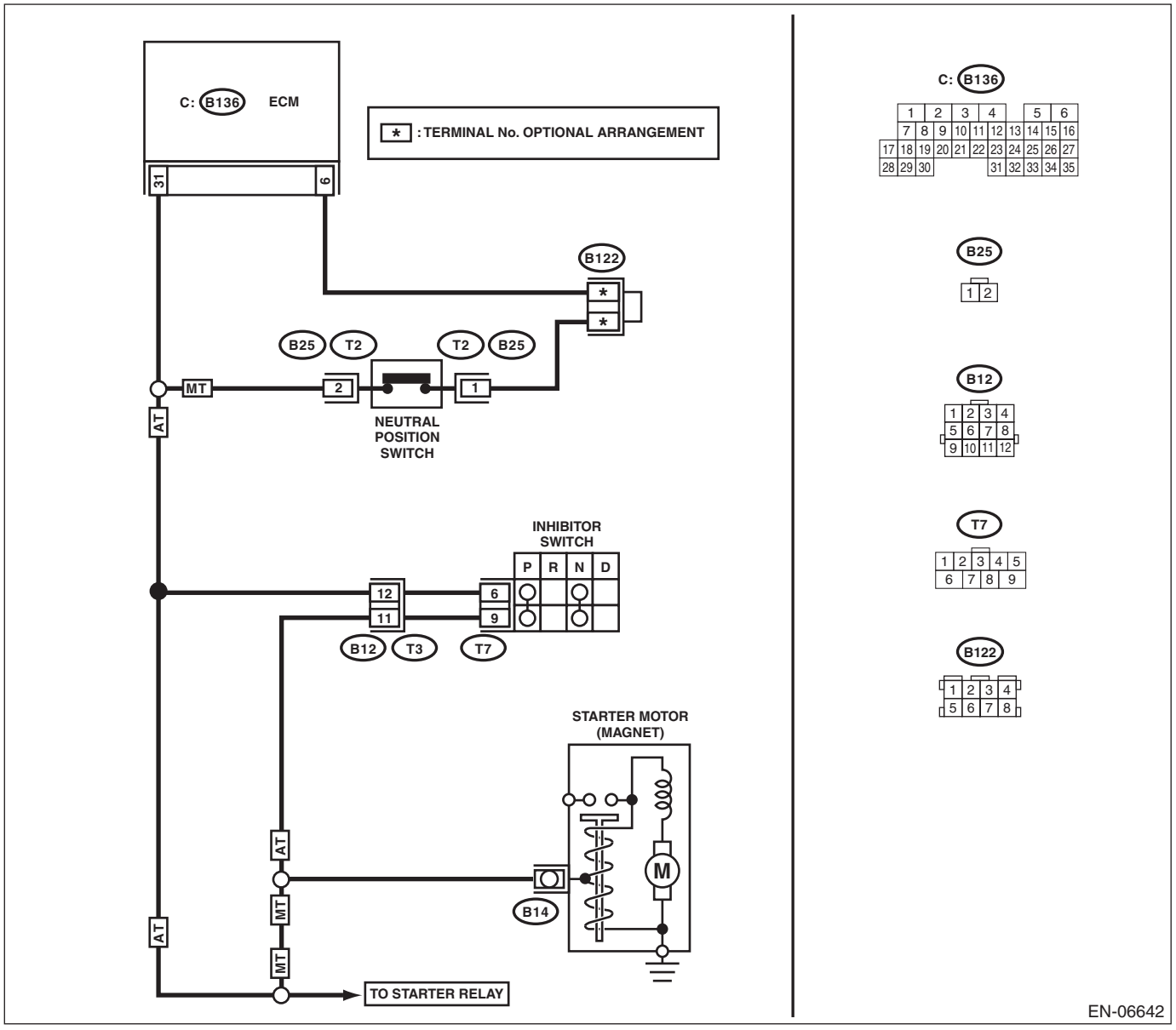
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK SELECT CABLE.**	Is there any fault in select cable?	Repair or adjust the select cable. <Ref. to CS-24, Select Cable.>	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground with select lever at "P" range and "N" range. ***Connector & terminal*** ***(B136) No. 31 (+) — Chassis ground (–):***	Is the voltage less than 1 V?	Repair the poor contact of ECM connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND INHIBITOR SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and inhibitor switch. 3) Measure the resistance of harness between ECM and inhibitor switch connector. ***Connector & terminal*** ***(B136) No. 31 — (T7) No. 6:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and inhibitor switch connector • Poor contact of coupling connector
4	**CHECK INHIBITOR SWITCH GROUND LINE.** Measure the resistance of harness between inhibitor switch connector and engine ground. ***Connector & terminal*** ***(T7) No. 9 — Engine ground:***	Is the resistance less than 5 Ω?	Replace the inhibitor switch. <Ref. to 4AT-46, Inhibitor Switch.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between inhibitor switch connector and starter motor ground line • Poor contact of coupling connector • Poor contact of starter motor connector • Poor contact of starter motor ground • Starter motor

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-157, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

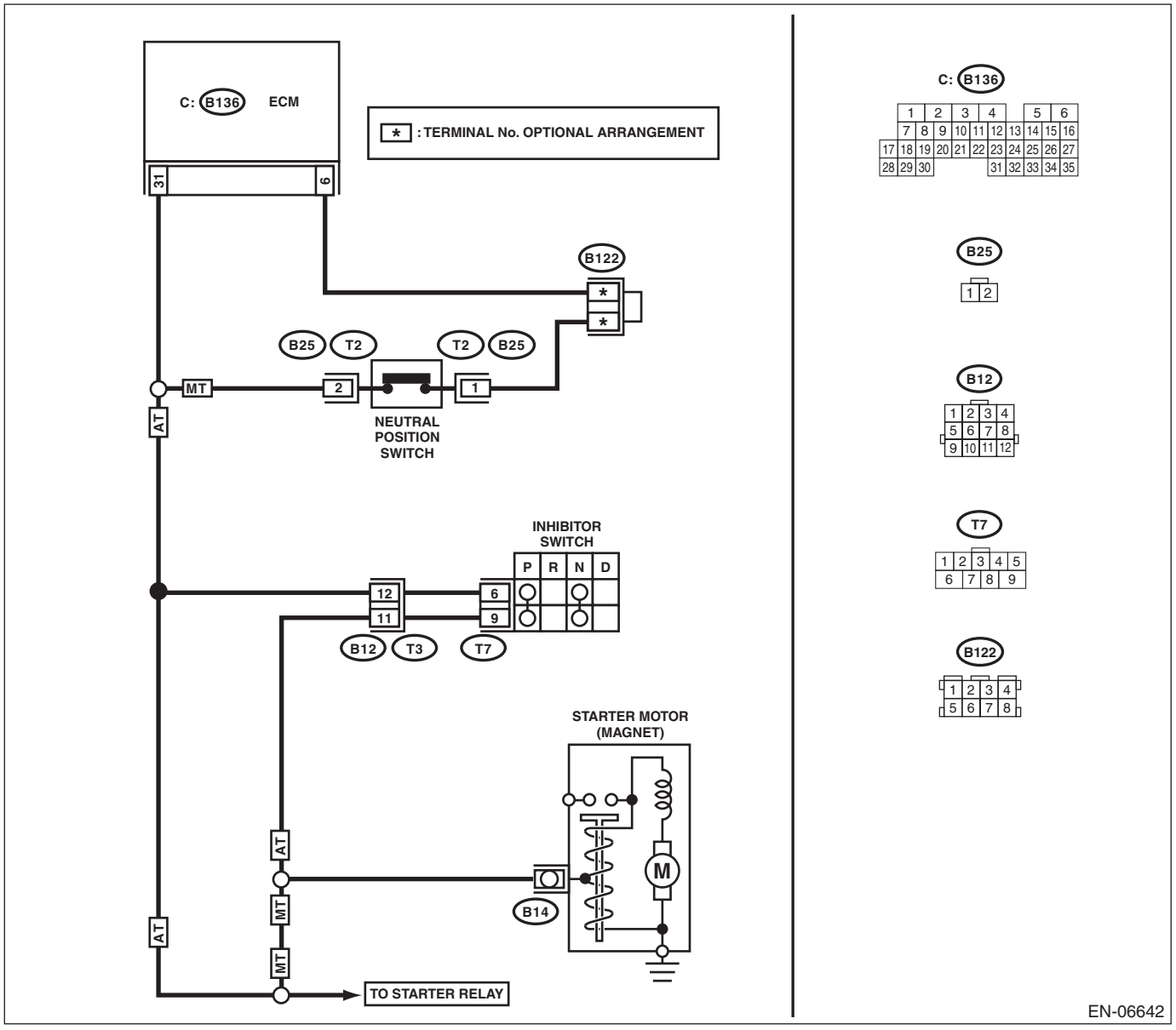
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Place the shift lever in neutral. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 31 (+) — Chassis ground (–):***	Is the voltage less than 1 V?	Repair the poor contact of ECM connector.	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and neutral position switch. 3) Measure the resistance of harness between ECM and neutral position switch connector. ***Connector & terminal*** ***(B136) No. 31 — (B25) No. 2:*** ***(B136) No. 6 — (B25) No. 1:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and neutral position switch connector • Poor contact of coupling connector
3	**CHECK NEUTRAL POSITION SWITCH.** 1) Place the shift lever in neutral. 2) Measure the resistance between neutral position switch terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Repair the poor contact of neutral position switch connector.	Replace the neutral position switch. <Ref. to 5MT-32, Switches and Harness.>

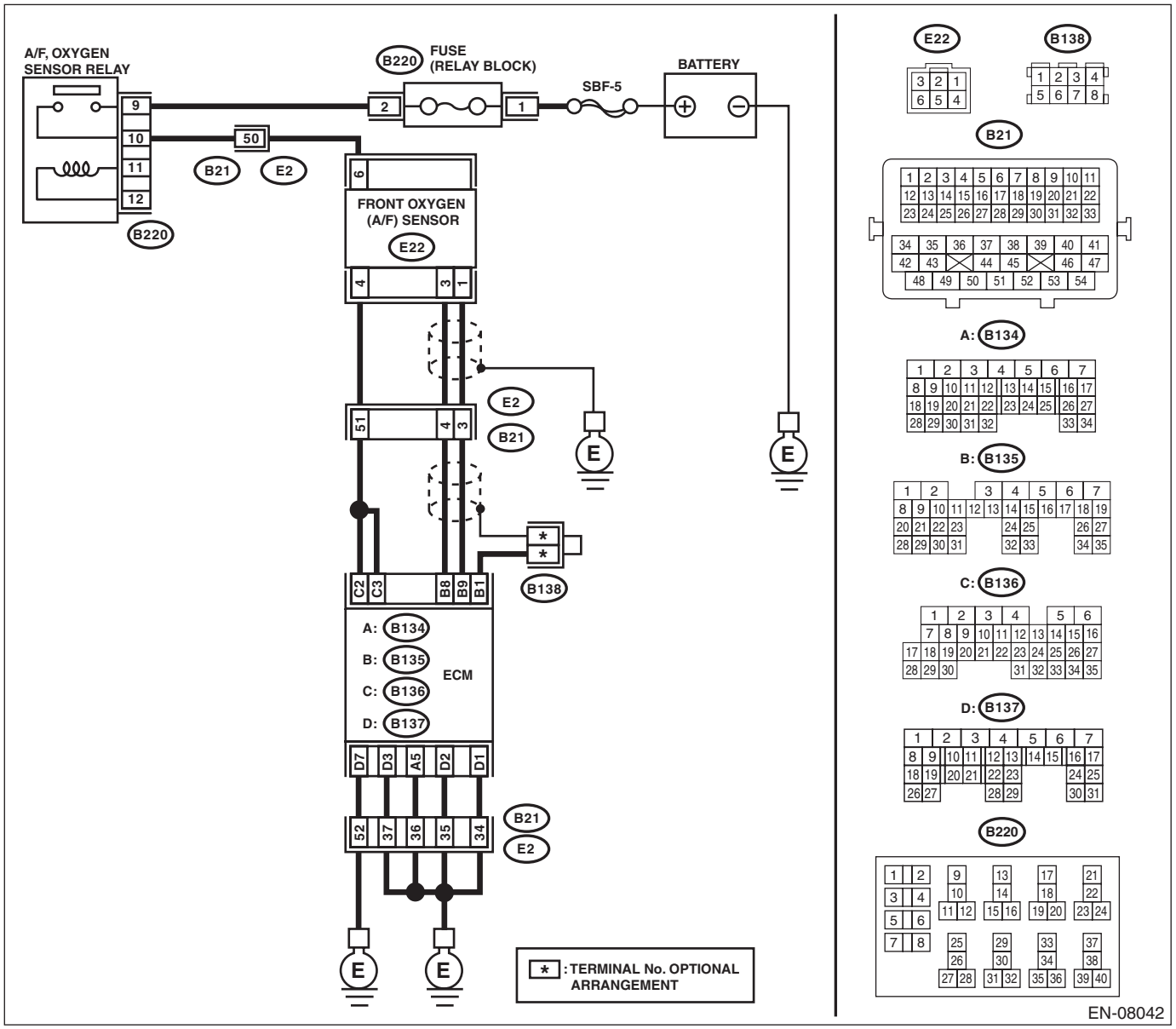
CG:DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-158, DTC P1152 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (LOW) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

	Step	Check	Yes	No
2	**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. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B135) No. 9 — (E22) No. 1:*** ***(B135) No. 8 — (E22) No. 3:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact of coupling connector
3	**CHECK FOR POOR CONTACT.** Check for poor contact of the front oxygen (A/F) sensor connector.	Is there poor contact of front oxygen (A/F) sensor connector?	Repair the poor contact of front oxygen (A/F) sensor connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>

CH:DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1)

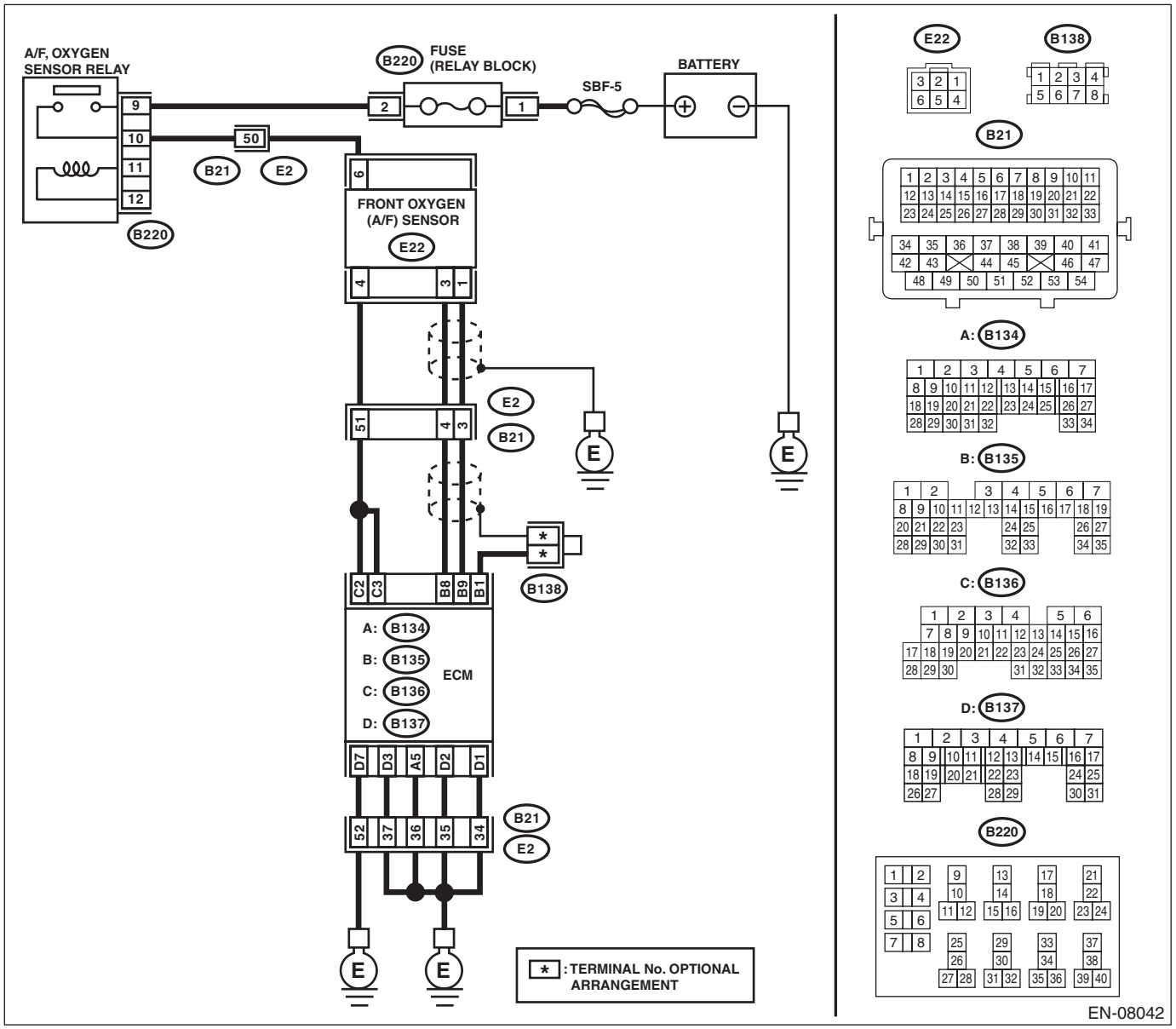
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-160, DTC P1153 O2 SENSOR CIRCUIT RANGE/PERFORMANCE (HIGH) (BANK1 SENSOR1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 9 — Chassis ground:*** ***(B135) No. 8 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
3	**CHECK OUTPUT SIGNAL FOR ECM.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 9 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **5**.	Go to step **4**.
4	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 8 (+) — Chassis ground (–):***	Is the voltage 4.95 V or more?	Go to step **5**.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>
5	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 9 (+) — Chassis ground (–):*** ***(B135) No. 8 (+) — Chassis ground (–):***	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>	Repair the poor contact of ECM connector.

CI: DTC P1160 RETURN SPRING FAILURE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4SO)(diag)-294, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CJ:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

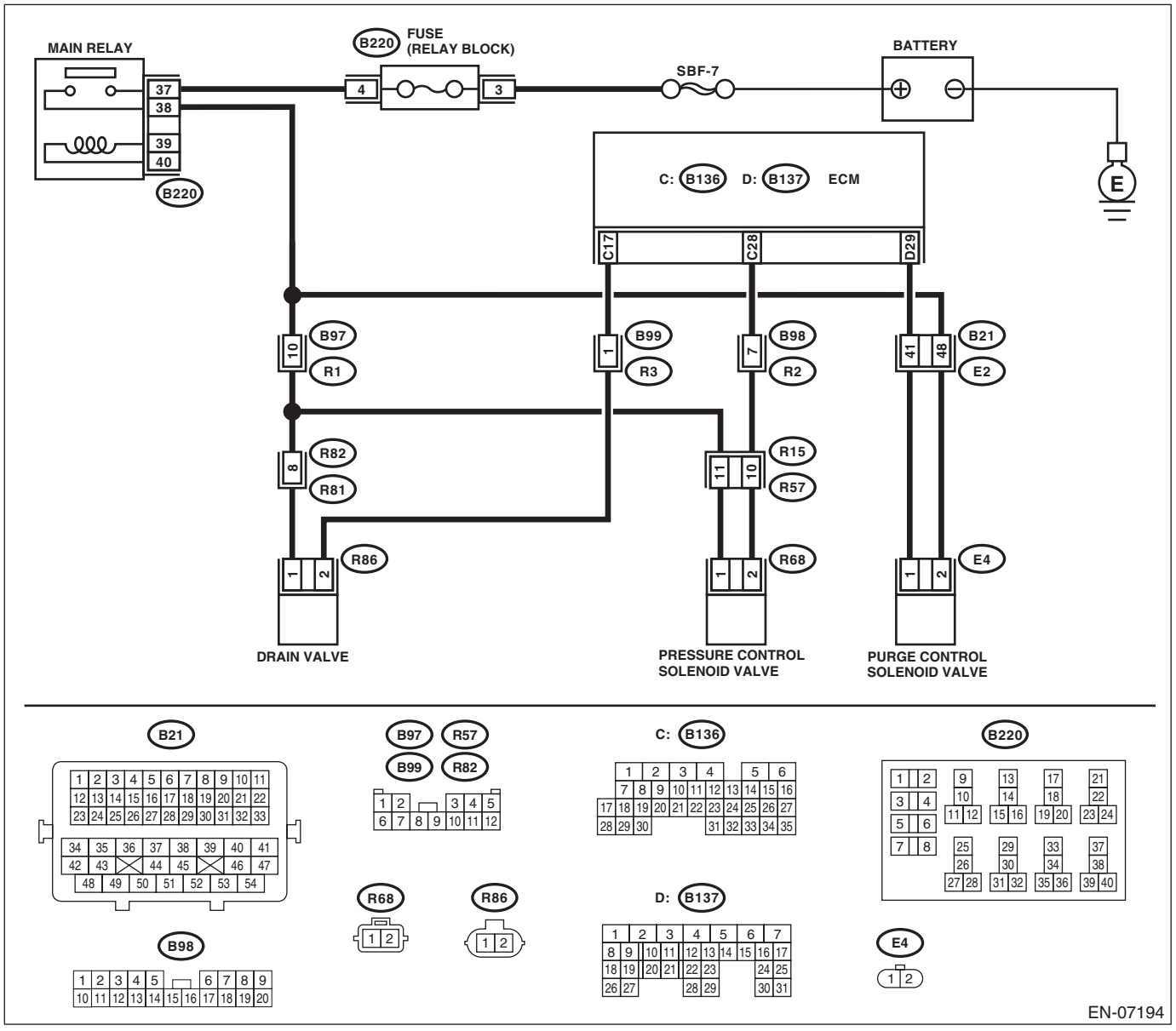
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-164, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 28 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Go to step **3**.
2	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM connector.	Is there poor contact of ECM connector?	Repair the poor contact of ECM connector.	Even if DTC is detected, the circuit has returned to a normal condition at this time. Reproduce the failure, and then perform the diagnosis again. NOTE: In this case, temporary open or short circuit of harness or temporary poor contact of connector may be the cause.
3	**CHECK POWER SUPPLY TO THE PRESSURE CONTROL SOLENOID VALVE.** Measure the voltage between pressure control solenoid valve and chassis ground. ***Connector & terminal*** ***(R68) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and pressure control solenoid valve. 3) Measure the resistance between pressure control solenoid valve and chassis ground. ***Connector & terminal*** ***(R68) No. 2 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the ground short circuit of harness between ECM and pressure control solenoid valve connector.
5	**CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE CONNECTOR.** Measure the resistance of harness between ECM and pressure control solenoid valve connector. ***Connector & terminal*** ***(B136) No. 28 — (R68) No. 2:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and pressure control solenoid valve connector • Poor contact of coupling connector
6	**CHECK PRESSURE CONTROL SOLENOID VALVE.** Measure the resistance between pressure control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 10 — 100 Ω?	Repair the poor contact of pressure control solenoid valve connector.	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-16, Pressure Control Solenoid Valve.>

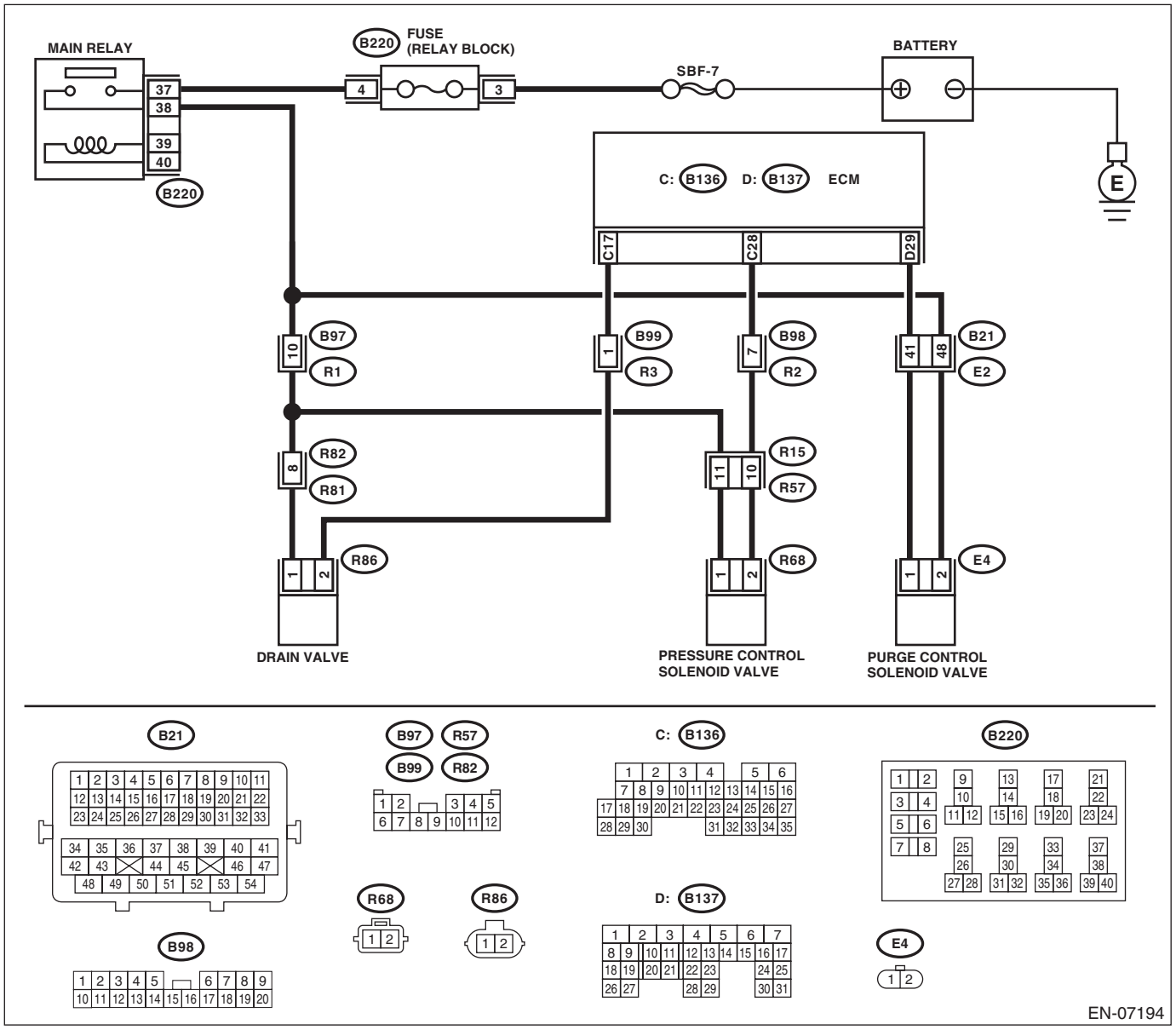
CK:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-166, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the ECM and pressure control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 28 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and pressure control solenoid valve connector.	Go to step **2**.
2	**CHECK PRESSURE CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between pressure control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Replace the pressure control solenoid valve. <Ref. to EC(H4SO)-16, Pressure Control Solenoid Valve.>	Repair the poor contact of ECM connector.

CL:DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-168, DTC P1443 VENT CONTROL SOLENOID VALVE FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

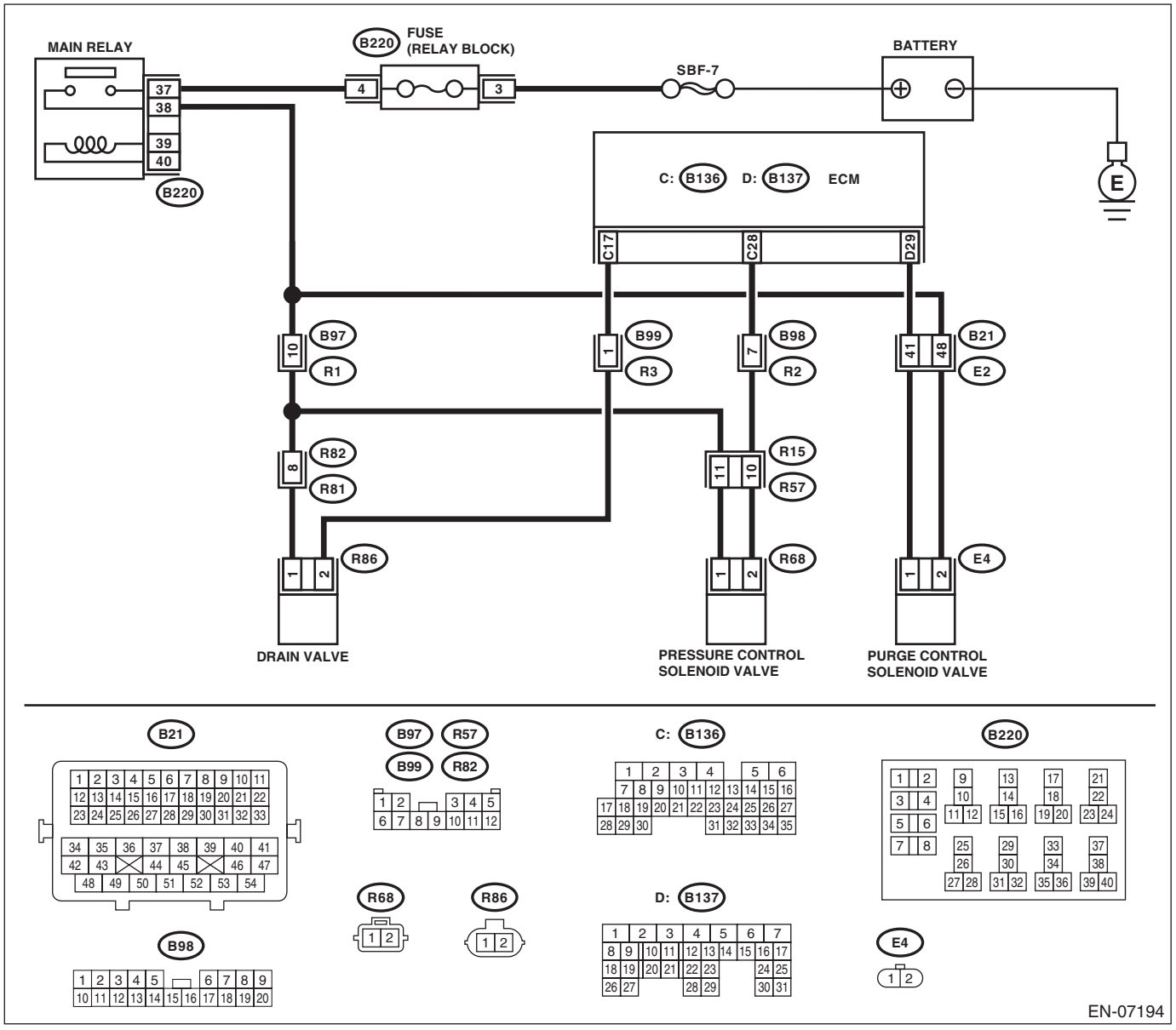
TROUBLE SYMPTOM:

Improper fuel supply

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK DRAIN HOSE.** Check the drain hose for clogging.	Is there clogging in the drain hose?	Replace the drain hose.	Go to step **3**.
3	**CHECK DRAIN VALVE OPERATION.** 1) Turn the ignition switch to OFF. 2) Connect the delivery (test) mode connector. 3) Turn the ignition switch to ON. 4) Operate the drain valve. NOTE: Drain valve can be operated using the Subaru Select Monitor. For the procedures, refer to “Compulsory Valve Operation Check Mode”. <Ref. to EN(H4SO)(diag)-57, Compulsory Valve Operation Check Mode.>	Does the drain valve operate?	Repair the poor contact of ECM connector.	Replace the drain valve. <Ref. to EC(H4SO)-19, Drain Valve.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-170, DTC P1491 POSITIVE CRANKCASE VENTILATION (BLOW-BY) FUNCTION PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

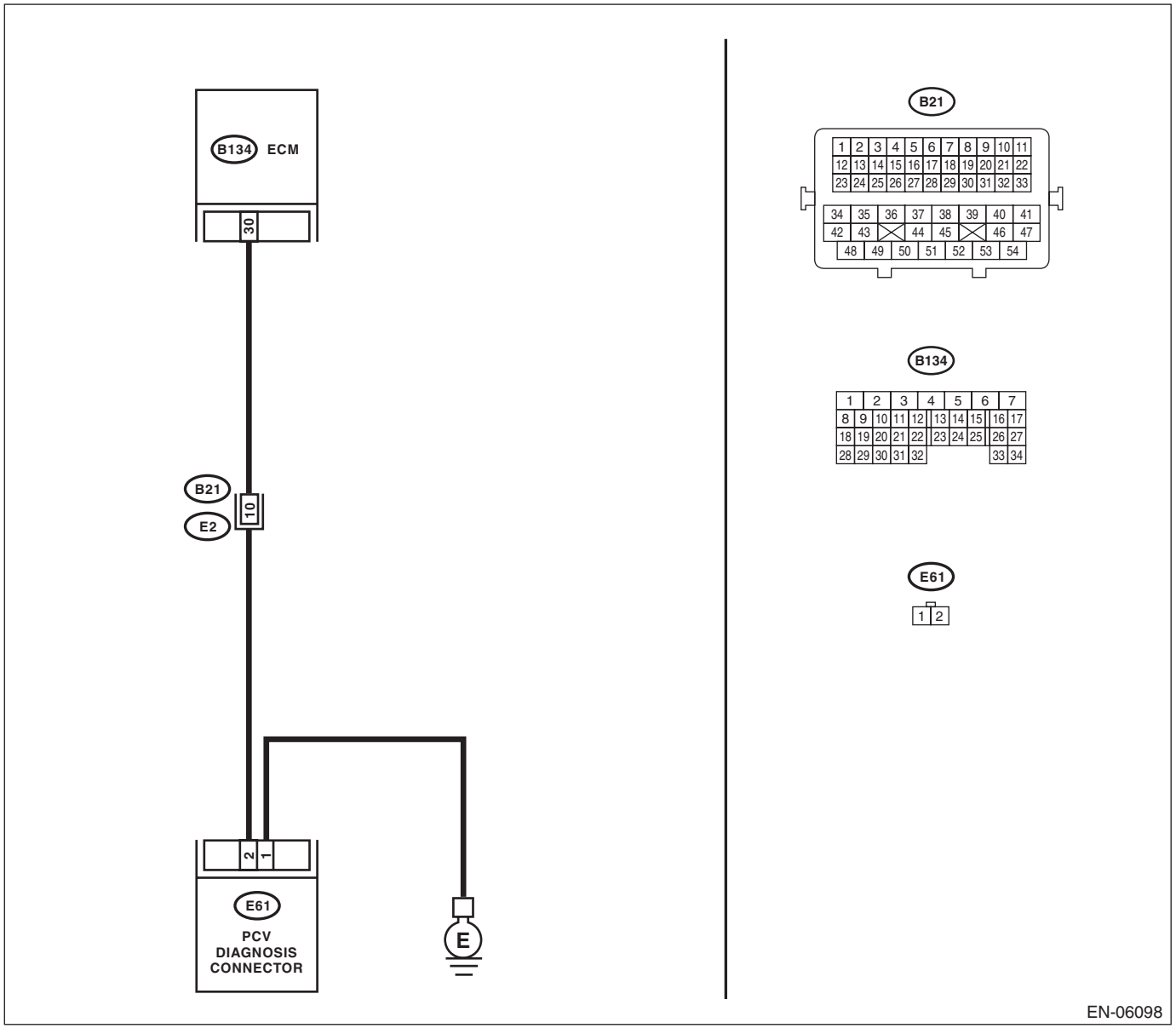
TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK BLOW-BY HOSE.** Check the blow-by hose condition.	Is there any disconnection or crack in blow-by hose?	Repair or replace the blow-by hose.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND PCV HOSE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and PCV hose assembly. 3) Measure the resistance of harness between ECM and PCV hose assembly connector. ***Connector & terminal*** ***(B134) No. 30 — (E61) No. 2:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and PCV hose assembly connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND PCV HOSE ASSEMBLY.** Measure the resistance between PCV hose assembly connector and chassis ground. ***Connector & terminal*** ***(B134) No. 30 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the short circuit to ground in harness between ECM and PCV hose assembly connector.
4	**CHECK GROUND CIRCUIT OF PCV HOSE ASSEMBLY.** Measure the resistance of harness between PCV hose assembly connector and engine ground. ***Connector & terminal*** ***(E61) No. 1 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **5**.	Repair the open circuit of harness between PCV hose assembly and engine ground.
5	**CHECK PCV HOSE ASSEMBLY.** Measure the resistance between the PCV hose assembly terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Repair the poor contact of ECM and PCV hose assembly connector.	Replace the PCV hose assembly. <Ref. to EC(H4SO)-20, PCV Hose Assembly.>

CN:DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)(diag)-265, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CO:DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)(diag)-268, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CP:DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)(diag)-265, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CQ:DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)(diag)-268, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CR:DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1498. <Ref. to EN(H4SO)(diag)-265, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CS:DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT)

NOTE:
For the diagnostic procedure, refer to DTC P1499. <Ref. to EN(H4SO)(diag)-268, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CT:DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-172, DTC P1492 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-176, DTC P1494 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-176, DTC P1496 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-176, DTC P1498 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

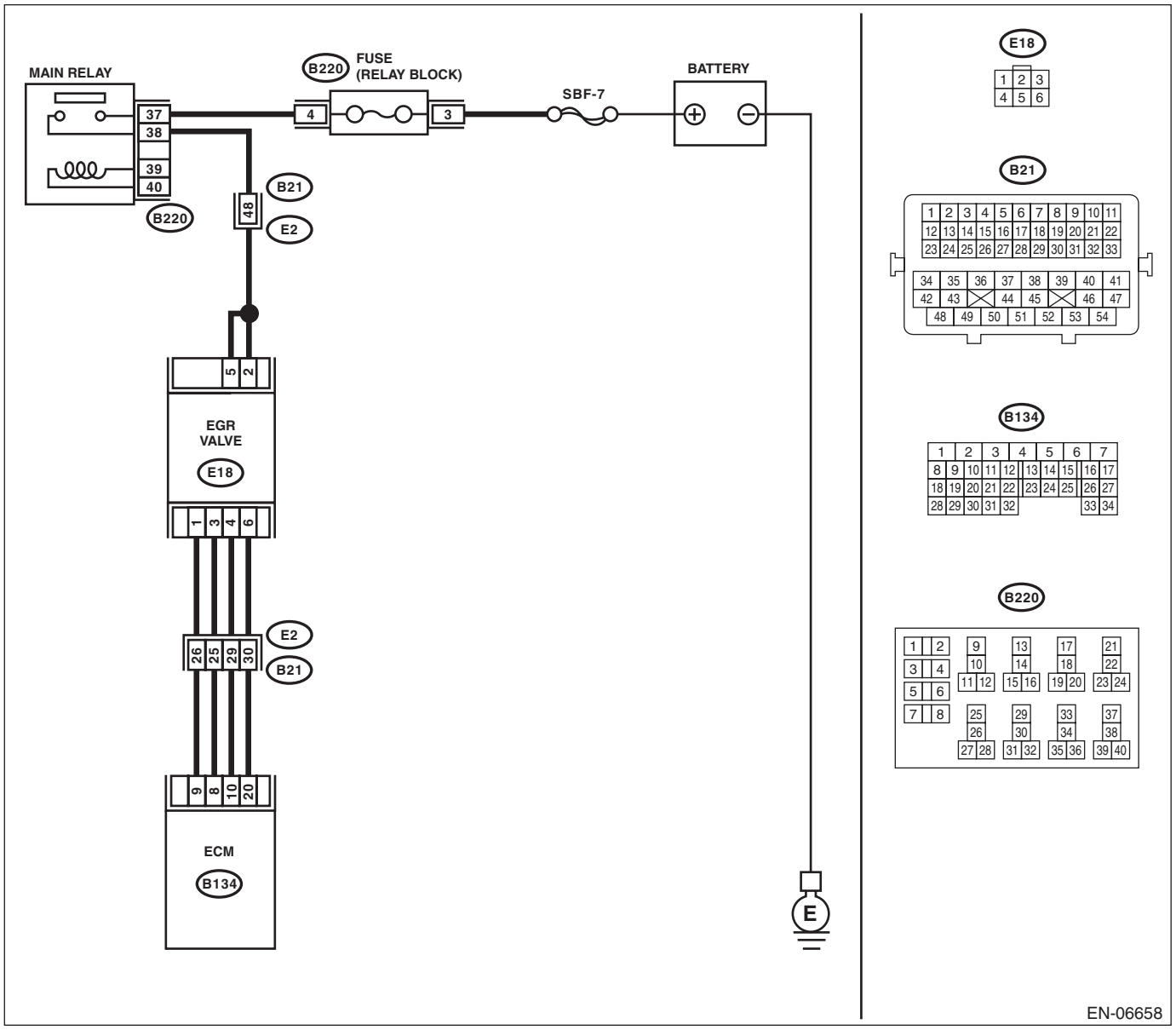
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine breathing

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK POWER SUPPLY TO EGR VALVE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from EGR valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between EGR valve connector and engine ground. ***Connector & terminal*** ***(E18) No. 2 (+) — Engine ground (–):*** ***(E18) No. 5 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between EGR valve and main relay connector • Poor contact of coupling connector

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND EGR VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM and EGR valve connector. ***Connector & terminal*** ***DTC P1492; (B134) No. 8 — (E18) No. 3:*** ***DTC P1494; (B134) No. 9 — (E18) No. 1:*** ***DTC P1496; (B134) No. 10 — (E18) No. 4:*** ***DTC P1498; (B134) No. 20 — (E18) No. 6:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and EGR valve connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND EGR VALVE CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***DTC P1492; (B134) No. 8 — Chassis ground:*** ***DTC P1494; (B134) No. 9 — Chassis ground:*** ***DTC P1496; (B134) No. 10 — Chassis ground:*** ***DTC P1498; (B134) No. 20 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the ground short in harness between ECM and EGR valve connector.
4	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and EGR valve connector.	Is there poor contact of ECM or EGR valve connector?	Repair the poor contact of ECM or EGR valve connector.	Replace the EGR valve. <Ref. to FU(H4SO)-35, EGR Valve.>

CU:DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-174, DTC P1493 EGR SOLENOID VALVE SIGNAL #1 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-176, DTC P1495 EGR SOLENOID VALVE SIGNAL #2 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-176, DTC P1497 EGR SOLENOID VALVE SIGNAL #3 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.> <Ref. to GD(H4SO)-176, DTC P1499 EGR SOLENOID VALVE SIGNAL #4 CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Trouble Code (DTC) Detecting Criteria.>

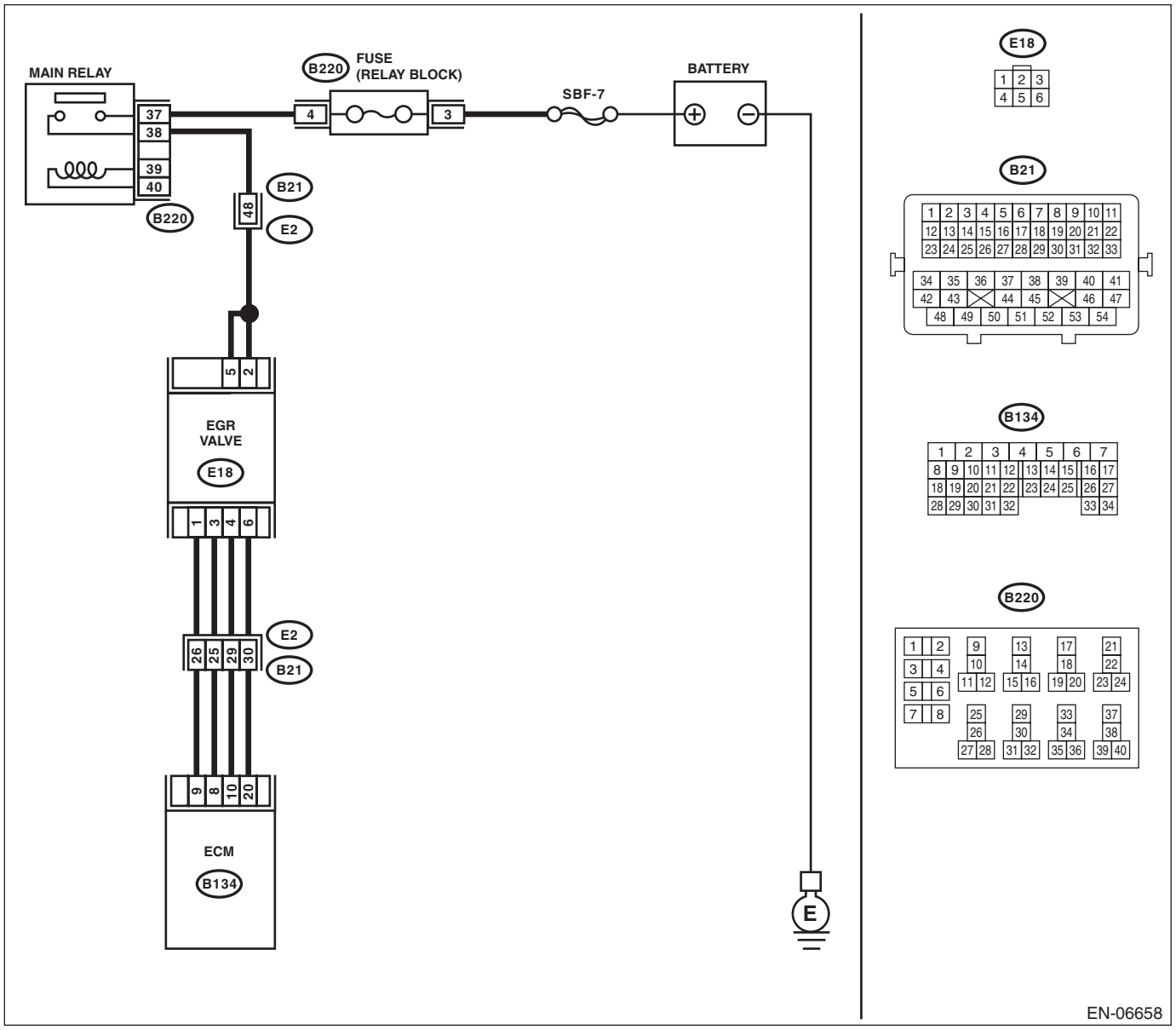
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine breathing

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND EGR VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and EGR valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***DTC P1493; (B134) No. 8 (+) — Chassis ground (–):*** ***DTC P1495; (B134) No. 9 (+) — Chassis ground (–):*** ***DTC P1497; (B134) No. 10 (+) — Chassis ground (–):*** ***DTC P1499; (B134) No. 20 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power supply in harness between ECM and EGR valve connector.	Go to step **2**.

Step		Check	Yes	No
2	**CHECK EGR VALVE.** Measure the resistance between EGR valve terminals. ***Terminals*** ***DTC P1493; No. 2 — No. 3:*** ***DTC P1493; No. 5 — No. 3:*** ***DTC P1495; No. 2 — No. 1:*** ***DTC P1495; No. 5 — No. 1:*** ***DTC P1497; No. 2 — No. 4:*** ***DTC P1497; No. 5 — No. 4:*** ***DTC P1499; No. 2 — No. 6:*** ***DTC P1499; No. 5 — No. 6:***	Is the resistance 20 Ω or more?	Repair the poor contact of ECM connector.	Replace the EGR valve. <Ref. to FU(H4SO)-35, EGR Valve.>

CV:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

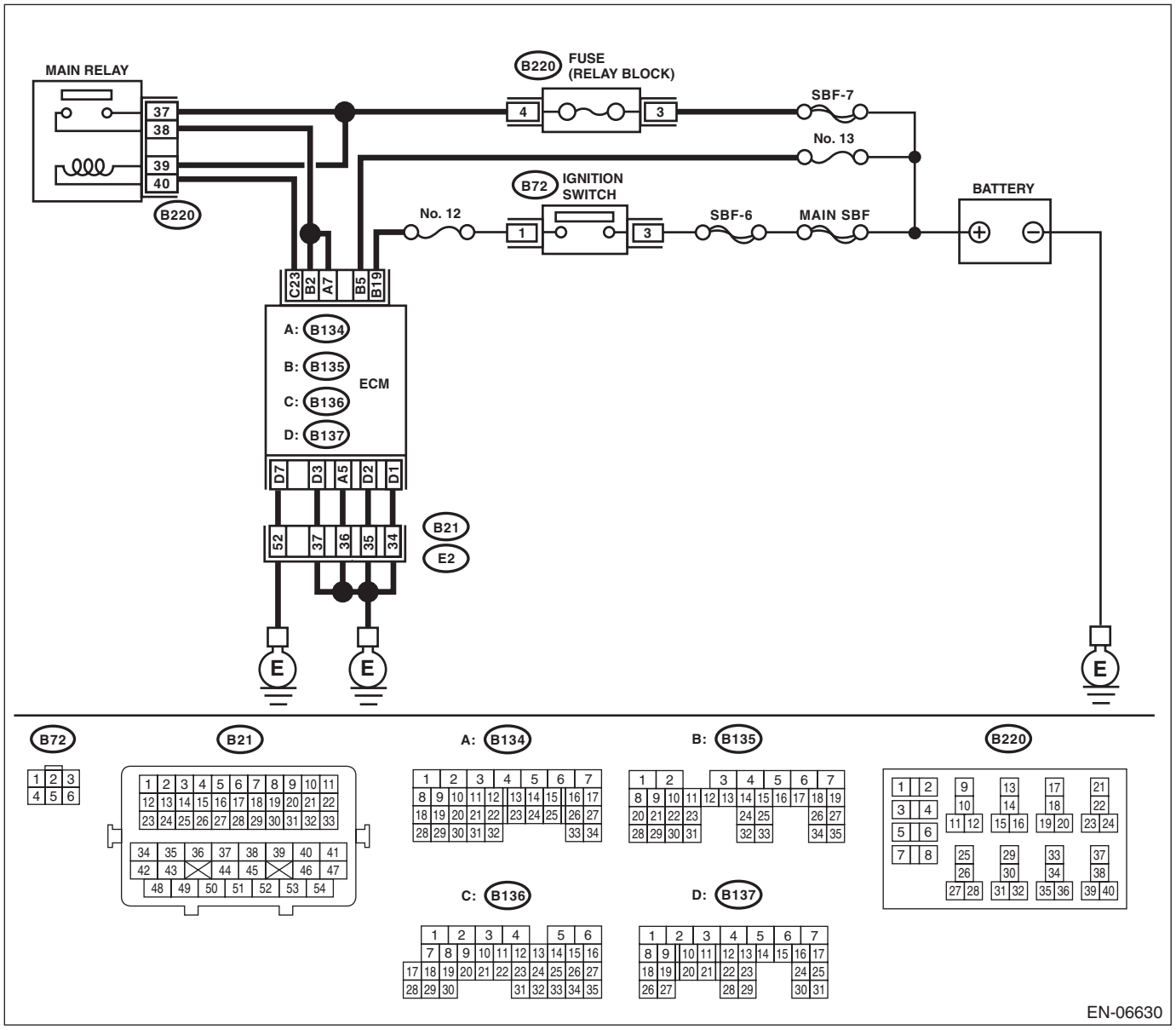
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-177, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Step		Check	Yes	No
1	**CHECK INPUT SIGNAL OF ECM.** 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 5 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of ECM connector.	Go to step **2**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 5 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the ground short circuit of harness between ECM and battery terminal.
3	**CHECK FUSE NO. 13 (MAIN FUSE BOX).**	Is the fuse blown out?	Replace the fuse.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and battery • Poor contact of ECM connector • Poor contact of battery terminal

CW:DTC P1602 CONTROL MODULE PROGRAMMING ERROR

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-179, DTC P1602 CONTROL MODULE PROGRAMMING ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

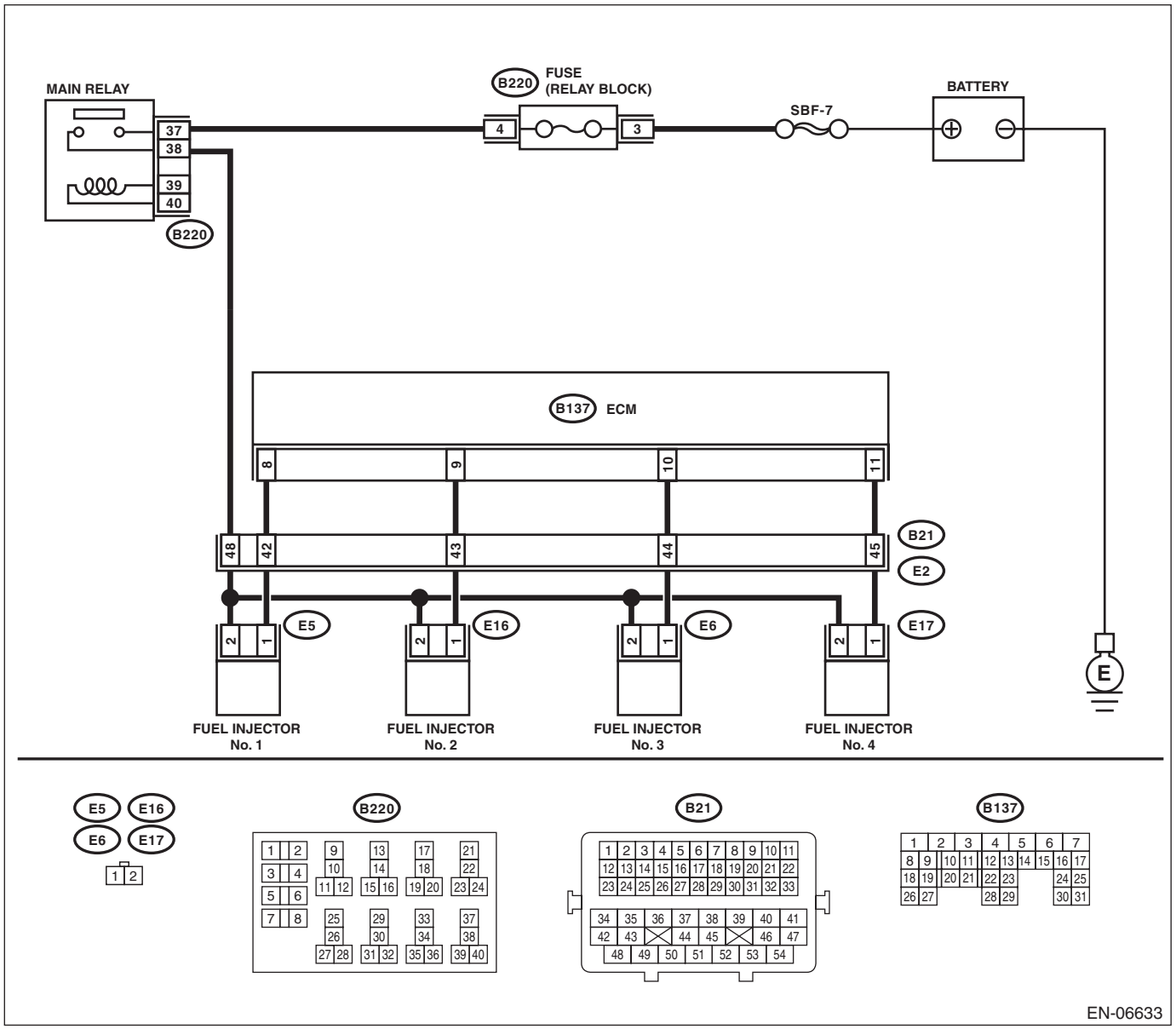
TROUBLE SYMPTOM:

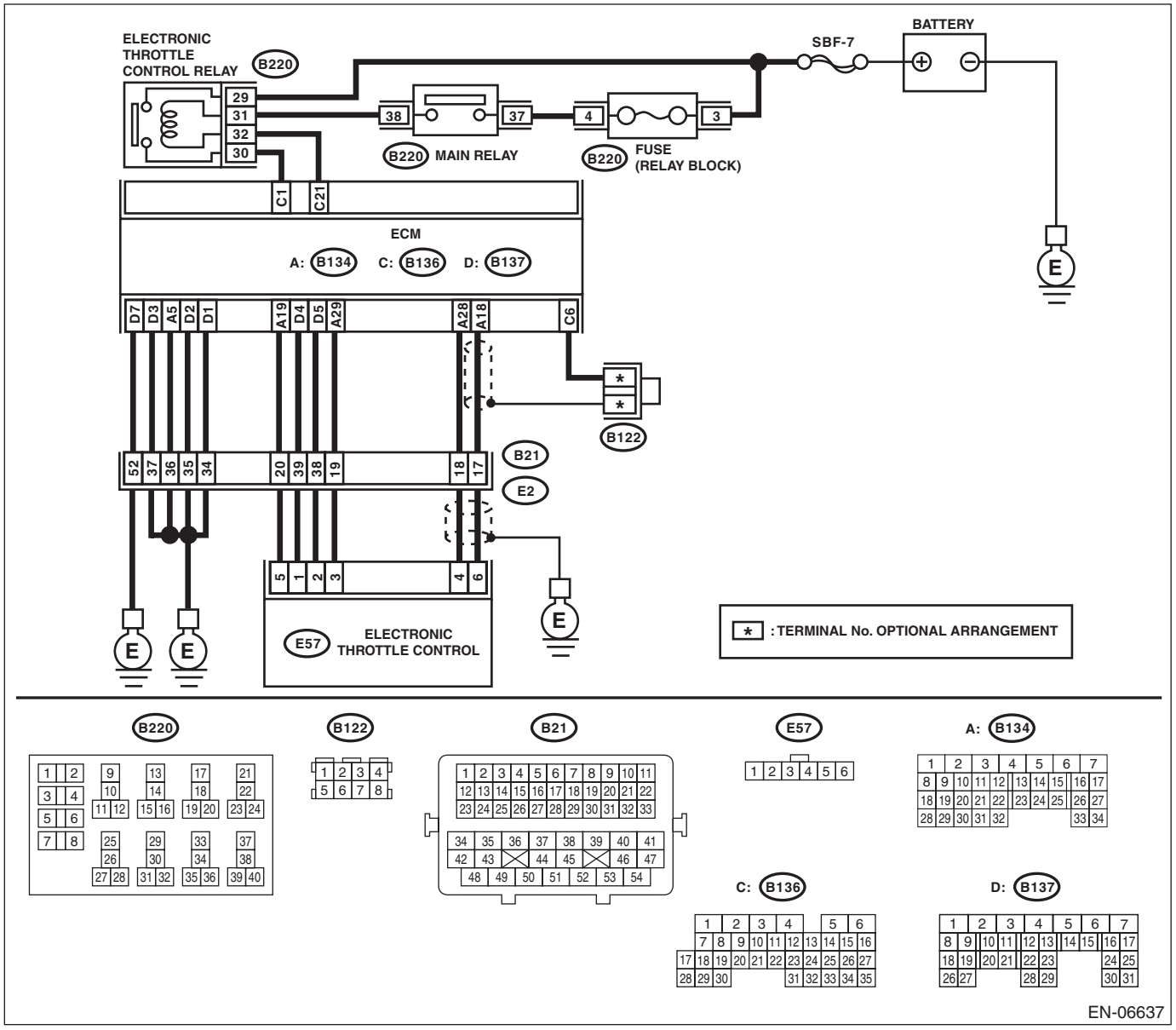
- Engine keeps running at higher speed than specified idle speed.
- Engine keeps running at a lower speed than the specified idle speed.
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:





Step		Check	Yes	No
1	**CHECK FOR 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(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK ENGINE OIL.**	Is there a proper amount of engine oil?	Go to step **3**.	Replace engine oil. <Ref. to LU(H4SO)-10, REPLACEMENT, Engine Oil.>
3	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step **4**.

	Step	Check	Yes	No
4	**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 **5**.
5	**CHECK FUEL PRESSURE.** **WARNING:** **Place "NO OPEN FLAMES" signs near the working area.** **CAUTION:** **Be careful not to spill fuel.** Measure the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.**	Is the measured value 339.5 — 360.5 kPa (3.5 — 3.7 kg/cm^2, 49 — 52 psi)?	Go to step **6**.	Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
6	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step **7**.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.>
7	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of the mass air flow and intake air 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **8**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>

	Step	Check	Yes	No
8	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the data of the mass air flow and intake air 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from intake air temperature. Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **9**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>
9	**CHECK OUTPUT SIGNAL OF ECM.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B137) No. 8 (+) — Chassis ground (–):*** ***#2 (B137) No. 9 (+) — Chassis ground (–):*** ***#3 (B137) No. 10 (+) — Chassis ground (–):*** ***#4 (B137) No. 11 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **14**.	Go to step **10**.
10	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Measure the resistance between fuel injector connector and engine ground on faulty cylinders. ***Connector & terminal*** ***#1 (E5) No. 1 — Engine ground:*** ***#2 (E16) No. 1 — Engine ground:*** ***#3 (E6) No. 1 — Engine ground:*** ***#4 (E17) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **11**.	Repair the short circuit to ground in harness between ECM and fuel injector connector.
11	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance of harness between ECM and fuel injector connector on faulty cylinders. ***Connector & terminal*** ***#1 (B137) No. 8 — (E5) No. 1:*** ***#2 (B137) No. 9 — (E16) No. 1:*** ***#3 (B137) No. 10 — (E6) No. 1:*** ***#4 (B137) No. 11 — (E17) No. 1:***	Is the resistance less than 1 Ω?	Go to step **12**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and fuel injector connector • Poor contact of coupling connector

	Step	Check	Yes	No
12	**CHECK FUEL INJECTOR.** Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **13**.	Replace the faulty fuel injector. <Ref. to FU(H4SO)-36, Fuel Injector.>
13	**CHECK POWER SUPPLY LINE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector and engine ground on faulty cylinders. ***Connector & terminal*** ***#1 (E5) No. 2 (+) — Engine ground (–):*** ***#2 (E16) No. 2 (+) — Engine ground (–):*** ***#3 (E6) No. 2 (+) — Engine ground (–):*** ***#4 (E17) No. 2 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Repair the poor contact of all connectors in fuel injector circuit.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay connector and fuel injector connector on faulty cylinders • Poor contact of coupling connector • Poor contact of main relay connector
14	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector on faulty cylinders. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground on faulty cylinders. ***Connector & terminal*** ***#1 (B137) No. 8 (+) — Chassis ground (–):*** ***#2 (B137) No. 9 (+) — Chassis ground (–):*** ***#3 (B137) No. 10 (+) — Chassis ground (–):*** ***#4 (B137) No. 11 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between the ECM and fuel injector.	Go to step **15**.
15	**CHECK FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Replace the faulty fuel injector. <Ref. to FU(H4SO)-36, Fuel Injector.>	Go to step **16**.
16	**CHECK INSTALLATION CONDITION 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. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.> <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.>	Go to step **17**.
17	**CHECK CRANK SPROCKET.** Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>	Is the crank sprocket rusted or does it have broken teeth?	Replace the crank sprocket. <Ref. to ME(H4SO)-55, Crank Sprocket.>	Go to step **18**.

	Step	Check	Yes	No
18	**CHECK INSTALLATION CONDITION OF TIMING BELT.** Turn the crankshaft using ST, and align the alignment mark on crank sprocket with alignment mark on cylinder block. ST 499987500 CRANKSHAFT SOCKET	Is the timing belt dislocated from its proper position?	Repair the installation condition of timing belt. <Ref. to ME(H4SO)-49, Timing Belt.>	Go to step **19**.
19	**CHECK ELECTRONIC THROTTLE CONTROL RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 31 and No. 32 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. ***Terminals*** ***No. 29 — No. 30:***	Is the resistance less than 1 Ω?	Go to step **20**.	Replace the electronic throttle control relay. <Ref. to FU(H4SO)-50, Electronic Throttle Control Relay.>
20	**CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.** Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 29 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **21**.	Repair the open or ground short circuit of power supply circuit.
21	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 32 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay connector.	Go to step **22**.
22	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 32 — Chassis ground:*** ***(B220) No. 30 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **23**.	Repair the short circuit in harness to ground between ECM and electronic throttle control relay connector.
23	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** Measure the resistance between ECM and electronic throttle control relay connector. ***Connector & terminal*** ***(B136) No. 21 — (B220) No. 32:*** ***(B136) No. 1 — (B220) No. 30:***	Is the resistance less than 1 Ω?	Go to step **24**.	Repair the open circuit in harness between ECM and electronic throttle control relay connector.

	Step	Check	Yes	No
24	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 18 — Chassis ground:*** ***(B134) No. 18 — (R136) No. 6:*** ***(B134) No. 28 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **25**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector.
25	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:*** ***(E57) No. 4 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **26**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>
26	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 18 — (E57) No. 6:*** ***(B134) No. 28 — (E57) No. 4:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **27**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and electronic throttle control connector • Poor contact of coupling connector
27	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **28**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
28	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (–):*** ***(E57) No. 4 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and electronic throttle control connector.	Go to step **29**.

	Step	Check	Yes	No
29	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 18:*** ***(B134) No. 19 — (B134) No. 28:***	Is the resistance 1 MΩ or more?	Go to step **30**.	Repair the short circuit to power in harness between ECM and electronic throttle control connector.
30	**CHECK SENSOR OUTPUT.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the voltage 0.81 — 0.87 V?	Go to step **31**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.>
31	**CHECK SENSOR OUTPUT.** Read the data of sub throttle sensor signal using Subaru Select Monitor. NOTE: Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the voltage 1.64 — 1.70 V?	Go to step **32**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.>
32	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and electronic throttle control connector. ***Connector & terminal*** ***(B137) No. 5 — (E57) No. 2:*** ***(B137) No. 4 — (E57) No. 1:***	Is the resistance less than 1 Ω?	Go to step **33**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and electronic throttle control connector • Poor contact of coupling connector
33	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 (+) — Engine ground (–):*** ***(E57) No. 1 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and electronic throttle control connector.	Go to step **34**.

	Step	Check	Yes	No
34	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 — Engine ground:*** ***(E57) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **35**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector.
35	**CHECK HARNESS BETWEEN ELECTRONIC THROTTLE CONTROL CONNECTOR.** Measure the resistance between electronic throttle control connectors. ***Connector & terminal*** ***(E57) No. 2 — (E57) No. 1:***	Is the resistance 1 MΩ or more?	Go to step **36**.	Repair the short circuit of harness between ECM and electronic throttle control connector.
36	**CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 2 — Chassis ground:*** ***(B137) No. 3 — Chassis ground:*** ***(B137) No. 7 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **37**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of coupling connector
37	**CHECK ELECTRONIC THROTTLE CONTROL.** Measure the resistance between electronic throttle control terminals. ***Terminals*** ***No. 2 — No. 1:***	Is the resistance 50 Ω or less?	Go to step **38**.	Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.>
38	**CHECK ELECTRONIC THROTTLE CONTROL.** Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of ECM connector.	Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.>

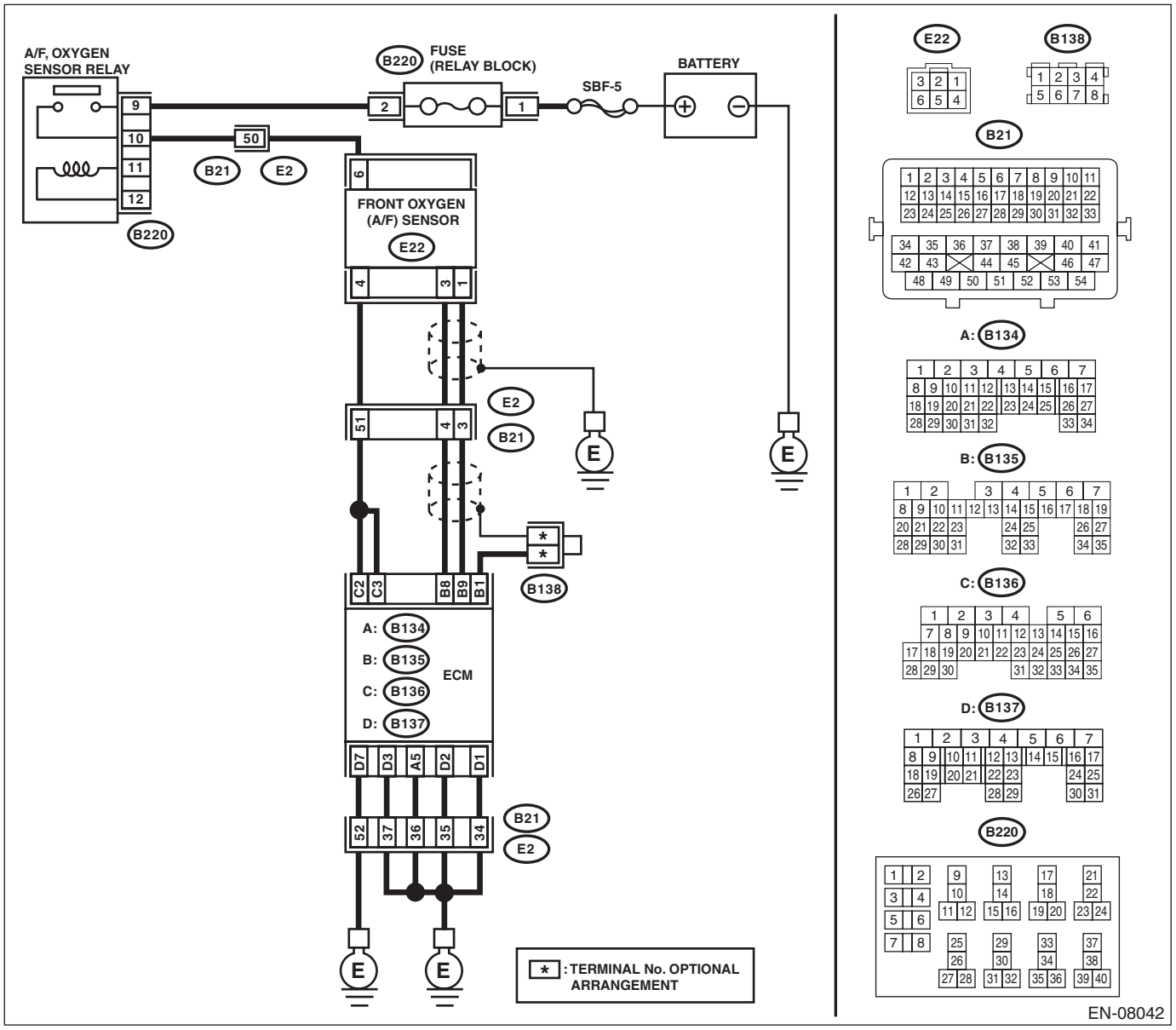
CX:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

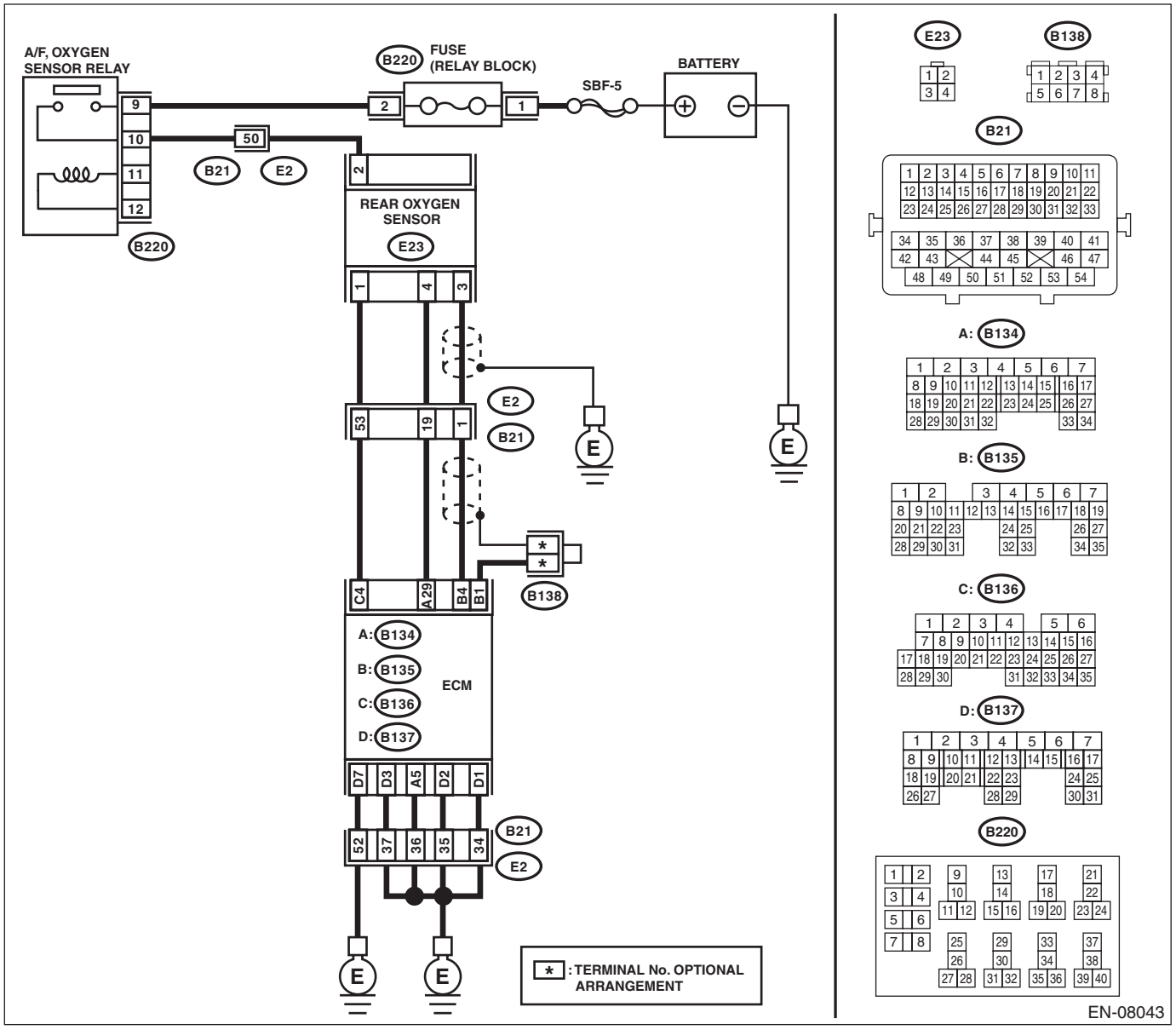
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-181, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:





Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **3**.

	Step	Check	Yes	No
3	**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. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B135) No. 9 — (E22) No. 1:*** ***(B135) No. 8 — (E22) No. 3:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact of the front oxygen (A/F) sensor connector. • Poor contact of ECM connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 9 — Chassis ground:*** ***(B135) No. 8 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
5	**CHECK OUTPUT SIGNAL FOR ECM.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E22) No. 1 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **7**.	Go to step **6**.
6	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E22) No. 3 (+) — Chassis ground (–):***	Is the voltage 4.95 V or more?	Go to step **7**.	Go to step **8**.
7	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E22) No. 1 (+) — Chassis ground (–):*** ***(E22) No. 3 (+) — Chassis ground (–):***	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>	Repair the poor contact of ECM connector.
8	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step **9**.
9	**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 **10**.

	Step	Check	Yes	No
10	**CHECK FUEL PRESSURE.** **WARNING:** **Place "NO OPEN FLAMES" signs near the working area.** **CAUTION:** **Be careful not to spill fuel.** 1) Connect the front oxygen (A/F) sensor connector. 2) Measure the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.**	Is the measured value 333.4 — 360.5 kPa (3.4 — 3.7 kg/cm^2, 48.4 — 52 psi)?	Go to step **11**.	Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
11	**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 procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step **12**.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.>
12	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of the mass air flow and intake air 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **13**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>

	Step	Check	Yes	No
13	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the data of the mass air flow and intake air 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from intake air temperature. Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **14**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>
14	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Depress the clutch pedal. (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step **15**.	Go to step **16**.
15	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Depress the clutch pedal. (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step **17**.	Go to step **16**.

	Step	Check	Yes	No
16	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **18**.
17	**CHECK FRONT OXYGEN (A/F) SENSOR USING REAR OXYGEN SENSOR SIGNAL.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more. 2) Read the data of rear oxygen 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is a voltage of 250 mV or less maintained for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>	Go to step **18**.
18	**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*** ***(B135) No. 4 — (E23) No. 3:*** ***(B135) No. 29 — (E23) No. 4:***	Is the resistance less than 1 Ω?	Go to step **19**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of coupling connector
19	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E23) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of ECM connector • Poor contact of coupling connector

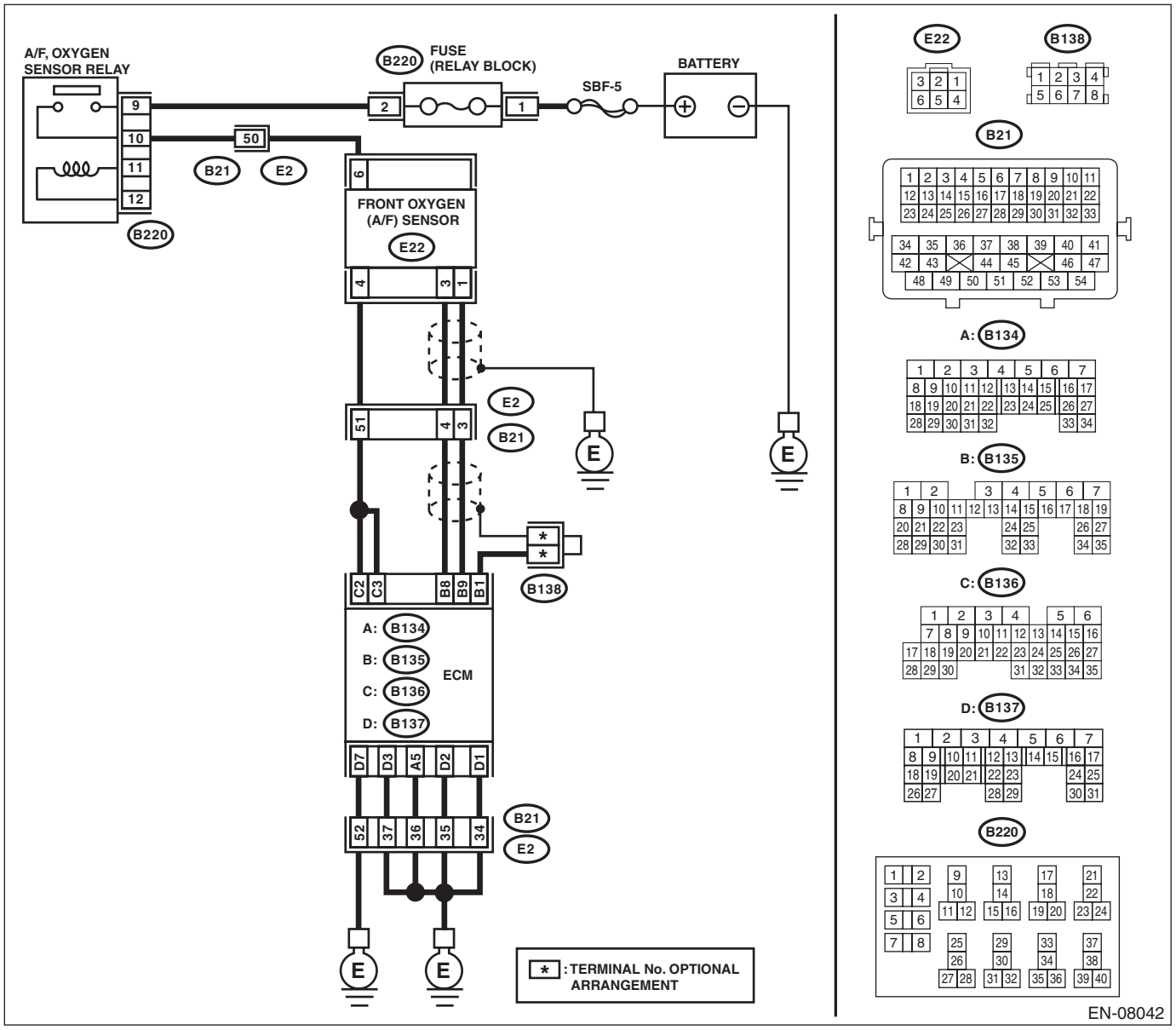
CY:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

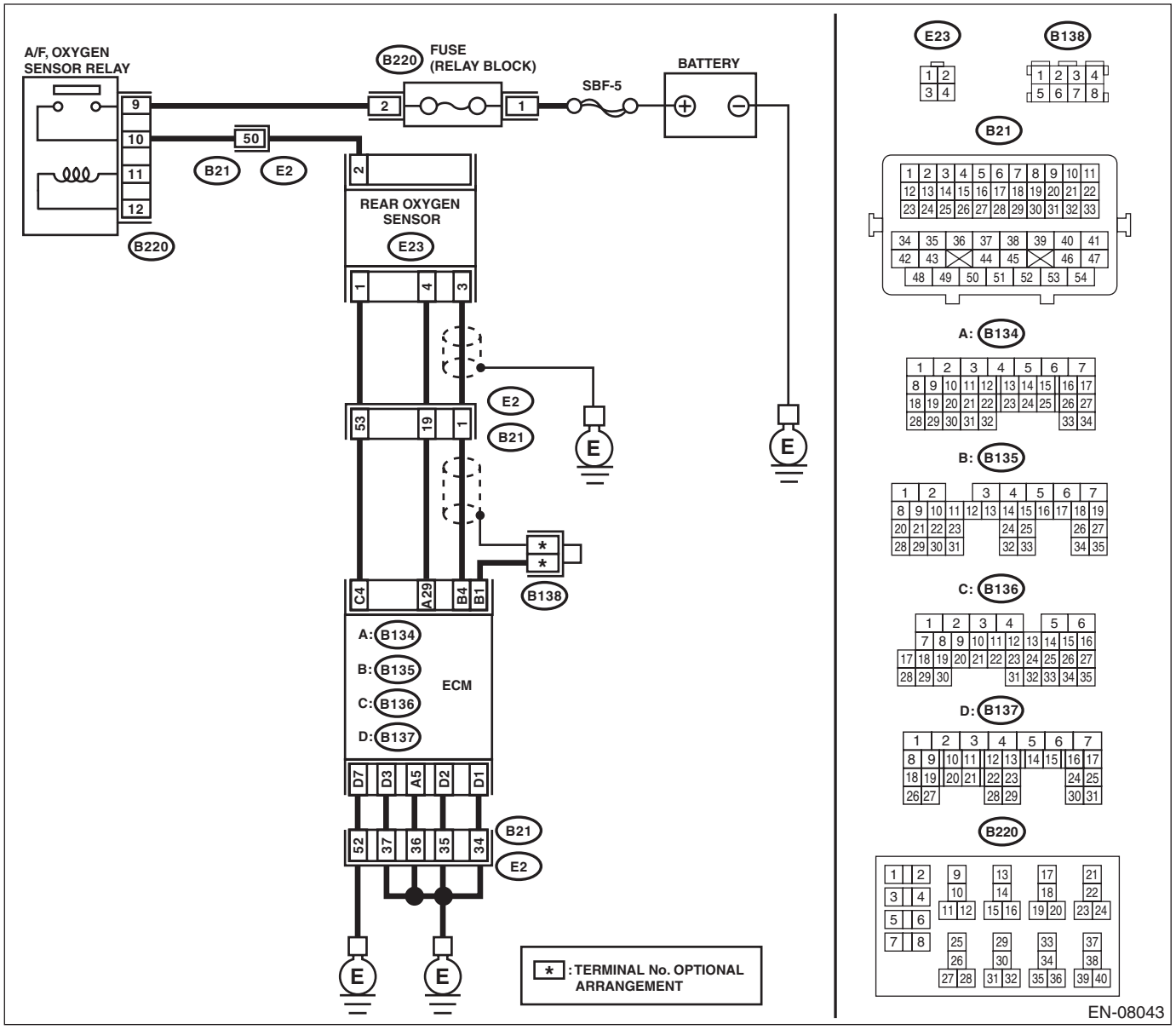
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-183, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:





Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK FRONT OXYGEN (A/F) SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **3**.

	Step	Check	Yes	No
3	**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. 3) Measure the resistance of harness between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***(B135) No. 9 — (E22) No. 1:*** ***(B135) No. 8 — (E22) No. 3:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and front oxygen (A/F) sensor connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 9 — Chassis ground:*** ***(B135) No. 8 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
5	**CHECK OUTPUT SIGNAL FOR ECM.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E22) No. 1 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **7**.	Go to step **6**.
6	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E22) No. 3 (+) — Chassis ground (–):***	Is the voltage 4.95 V or more?	Go to step **7**.	Go to step **8**.
7	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***(E22) No. 1 (+) — Chassis ground (–):*** ***(E22) No. 3 (+) — Chassis ground (–):***	Is the voltage 8 V or more?	Repair the short circuit to power in the harness between ECM and front oxygen (A/F) sensor connector. After repair, replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>	Repair the poor contact of ECM connector.
8	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step **9**.
9	**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 **10**.

	Step	Check	Yes	No
10	**CHECK FUEL PRESSURE.** **WARNING:** **Place "NO OPEN FLAMES" signs near the working area.** **CAUTION:** **Be careful not to spill fuel.** 1) Connect the front oxygen (A/F) sensor connector. 2) Measure the fuel pressure. <Ref. to ME(H4SO)-27, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.**	Is the measured value 333.4 — 360.5 kPa (3.4 — 3.7 kg/cm^2, 48.4 — 52 psi)?	Go to step **11**.	Repair the following item. Fuel pressure is too high: • Clogged fuel line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel line
11	**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 procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the engine coolant temperature 75°C (167°F) or higher?	Go to step **12**.	Replace the engine coolant temperature sensor. <Ref. to FU(H4SO)-25, Engine Coolant Temperature Sensor.>
12	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the data of the mass air flow and intake air 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the measured value 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **13**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>

	Step	Check	Yes	No
13	**CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) For AT models, set the select lever to "P" range or "N" range, and for MT models, place the shift lever in the neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Open the front hood. 6) Measure the ambient temperature. 7) Read the data of the mass air flow and intake air 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from intake air temperature. Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **14**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, Mass Air Flow and Intake Air Temperature Sensor.>
14	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and keep the engine speed at 3,000 rpm. (2 minutes maximum) 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Depress the clutch pedal. (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 490 mV or more?	Go to step **15**.	Go to step **16**.
15	**CHECK REAR OXYGEN SENSOR DATA.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), and rapidly reduce the engine speed from 3,000 rpm. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor or general scan tool. NOTE: • Depress the clutch pedal. (MT model) • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the voltage 250 mV or less?	Go to step **17**.	Go to step **16**.

	Step	Check	Yes	No
16	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **18**.
17	**CHECK FRONT OXYGEN (A/F) SENSOR USING REAR OXYGEN SENSOR SIGNAL.** 1) Warm up the engine until engine coolant temperature is higher than 75°C (167°F), then keep the engine idling for 5 minutes or more. 2) Read the data of rear oxygen 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(H4SO)(diag)-34, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is a voltage of 0.8 V or more maintained for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4SO)-41, Front Oxygen (A/F) Sensor.>	Go to step **18**.
18	**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*** ***(B135) No. 4 — (E23) No. 3:*** ***(B134) No. 29 — (E23) No. 4:***	Is the resistance less than 1 Ω?	Go to step **19**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of coupling connector
19	**CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between rear oxygen sensor connector and chassis ground. ***Connector & terminal*** ***(E23) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(H4SO)-43, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and rear oxygen sensor connector • Poor contact of ECM connector • Poor contact of coupling connector

CZ:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-185, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

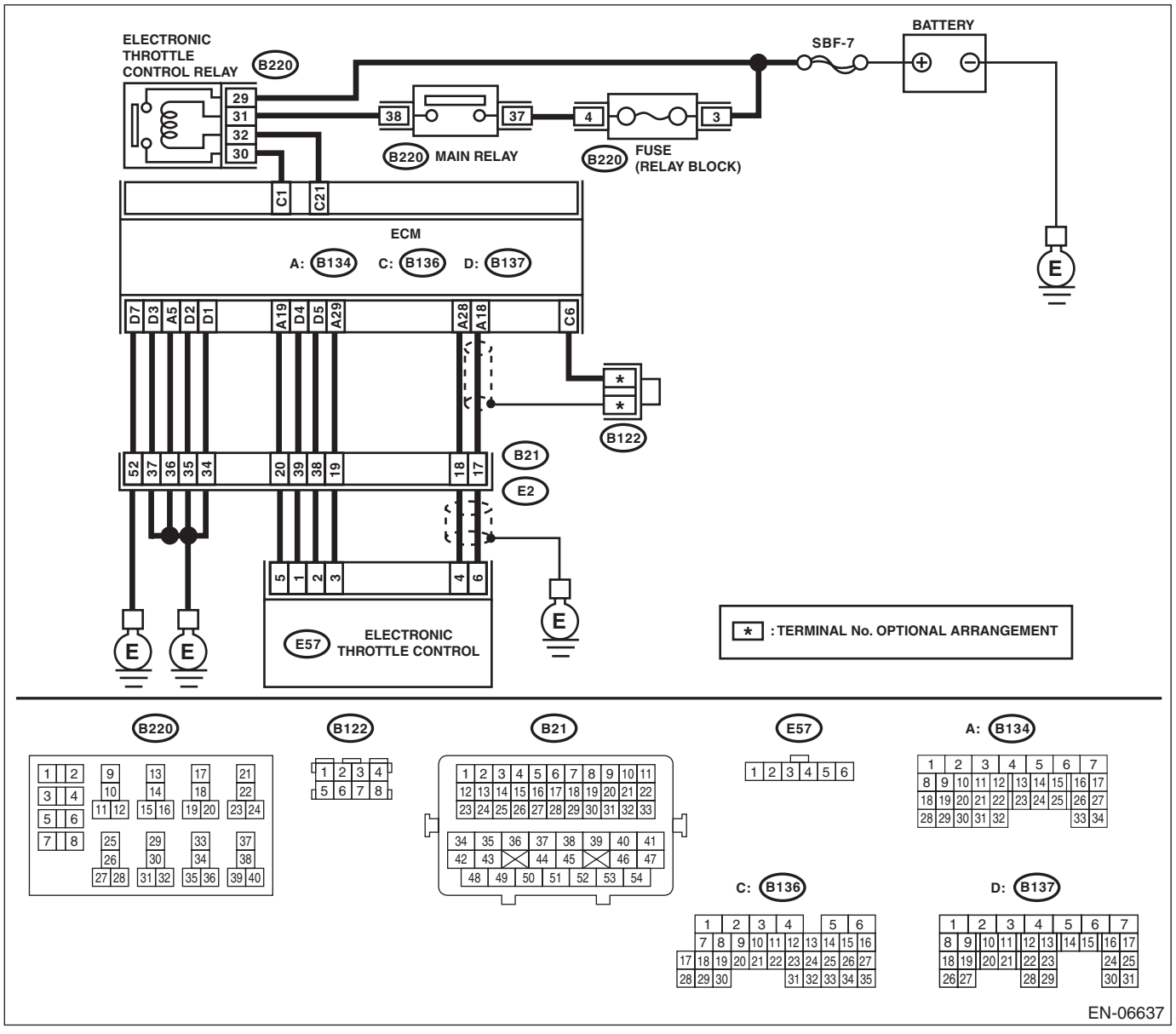
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK ELECTRONIC THROTTLE CONTROL RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 31 and No. 32 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. ***Terminals*** ***No. 29 — No. 30:***	Is the resistance less than 1 Ω?	Go to step **2**.	Replace the electronic throttle control relay. <Ref. to FU(H4SO)-50, Electronic Throttle Control Relay.>
2	**CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.** Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 29 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the open or ground short circuit of power supply circuit.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 32 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 32 — Chassis ground:*** ***(B220) No. 30 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit in harness to ground between ECM and electronic throttle control relay connector.
5	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** Measure the resistance between ECM and electronic throttle control relay connector. ***Connector & terminal*** ***(B136) No. 21 — (B220) No. 32:*** ***(B136) No. 1 — (B220) No. 30:***	Is the resistance less than 1 Ω?	Go to step **6**.	Repair the open circuit in harness between ECM and electronic throttle control relay connector.
6	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from electronic throttle control. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 18 — Chassis ground:*** ***(B134) No. 18 — (B136) No. 6:*** ***(B134) No. 28 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **7**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector.

	Step	Check	Yes	No
7	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:*** ***(E57) No. 4 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **8**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>
8	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 18 — (E57) No. 6:*** ***(B134) No. 28 — (E57) No. 4:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **9**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and electronic throttle control connector • Poor contact of coupling connector
9	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **10**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
10	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (–):*** ***(E57) No. 4 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and electronic throttle control connector.	Go to step **11**.
11	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 18:*** ***(B134) No. 19 — (B134) No. 28:***	Is the resistance 1 MΩ or more?	Go to step **12**.	Repair the short circuit to power in harness between ECM and electronic throttle control connector.

	Step	Check	Yes	No
12	**CHECK SENSOR OUTPUT.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the voltage 0.81 — 0.87 V?	Go to step **13**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.>
13	**CHECK SENSOR OUTPUT.** Read the data of sub throttle sensor signal using Subaru Select Monitor. NOTE: Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4SO)(diag)-34, Subaru Select Monitor.>	Is the voltage 1.64 — 1.70 V?	Go to step **14**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.>
14	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and electronic throttle control connector. ***Connector & terminal*** ***(B137) No. 5 — (E57) No. 2:*** ***(B137) No. 4 — (E57) No. 1:***	Is the resistance less than 1 Ω?	Go to step **15**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and electronic throttle control connector • Poor contact of coupling connector
15	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 (+) — Engine ground (–):*** ***(E57) No. 1 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and electronic throttle control connector.	Go to step **16**.
16	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 2 — Engine ground:*** ***(E57) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **17**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector.
17	**CHECK ELECTRONIC THROTTLE CONTROL CONNECTOR HARNESS.** Measure the resistance between electronic throttle control connectors. ***Connector & terminal*** ***(E57) No. 2 — (E57) No. 1:***	Is the resistance 1 MΩ or more?	Go to step **18**.	Repair the short circuit of harness between ECM and electronic throttle control connector.

	Step	Check	Yes	No
18	**CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 2 — Chassis ground:*** ***(B137) No. 3 — Chassis ground:*** ***(B137) No. 7 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **19**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of coupling connector
19	**CHECK ELECTRONIC THROTTLE CONTROL.** Measure the resistance between electronic throttle control terminals. ***Terminals*** ***No. 2 — No. 1:***	Is the resistance 50 Ω or less?	Go to step **20**.	Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.>
20	**CHECK ELECTRONIC THROTTLE CONTROL.** Move the throttle valve to the fully open and fully closed positions with fingers. Check that the valve returns to the specified position when releasing fingers.	Does the valve return to the specified position? Standard value: 3 mm (0.12 in) from fully closed position	Repair the poor contact of ECM connector.	Replace the electronic throttle control. <Ref. to FU(H4SO)-14, Throttle Body.>

DA:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-186, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

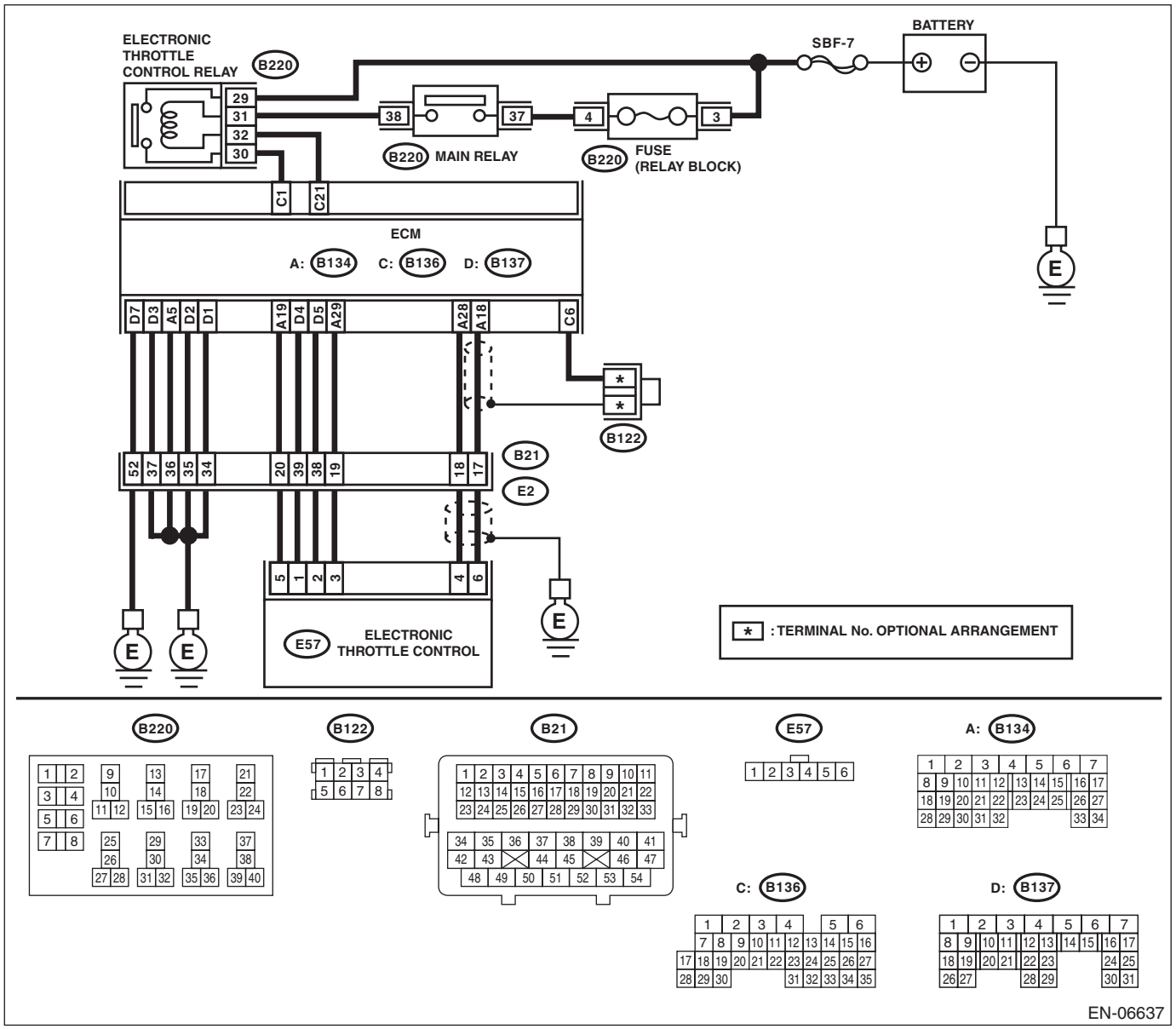
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK ELECTRONIC THROTTLE CONTROL RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Connect the battery to terminals No. 31 and No. 32 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. ***Terminals*** ***No. 29 — No. 30:***	Is the resistance less than 1 Ω?	Go to step **2**.	Replace the electronic throttle control relay. <Ref. to FU(H4SO)-50, Electronic Throttle Control Relay.>
2	**CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL RELAY.** Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 29 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **3**.	Repair the open or ground short circuit of power supply circuit.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 32 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 32 — Chassis ground:*** ***(B220) No. 30 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit in harness to ground between ECM and electronic throttle control relay connector.
5	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** Measure the resistance between ECM and electronic throttle control relay connector. ***Connector & terminal*** ***(B136) No. 21 — (B220) No. 32:*** ***(B136) No. 1 — (B220) No. 30:***	Is the resistance less than 1 Ω?	Repair the poor contact of ECM connector.	Repair the open circuit in harness between ECM and electronic throttle control relay connector.

DB:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

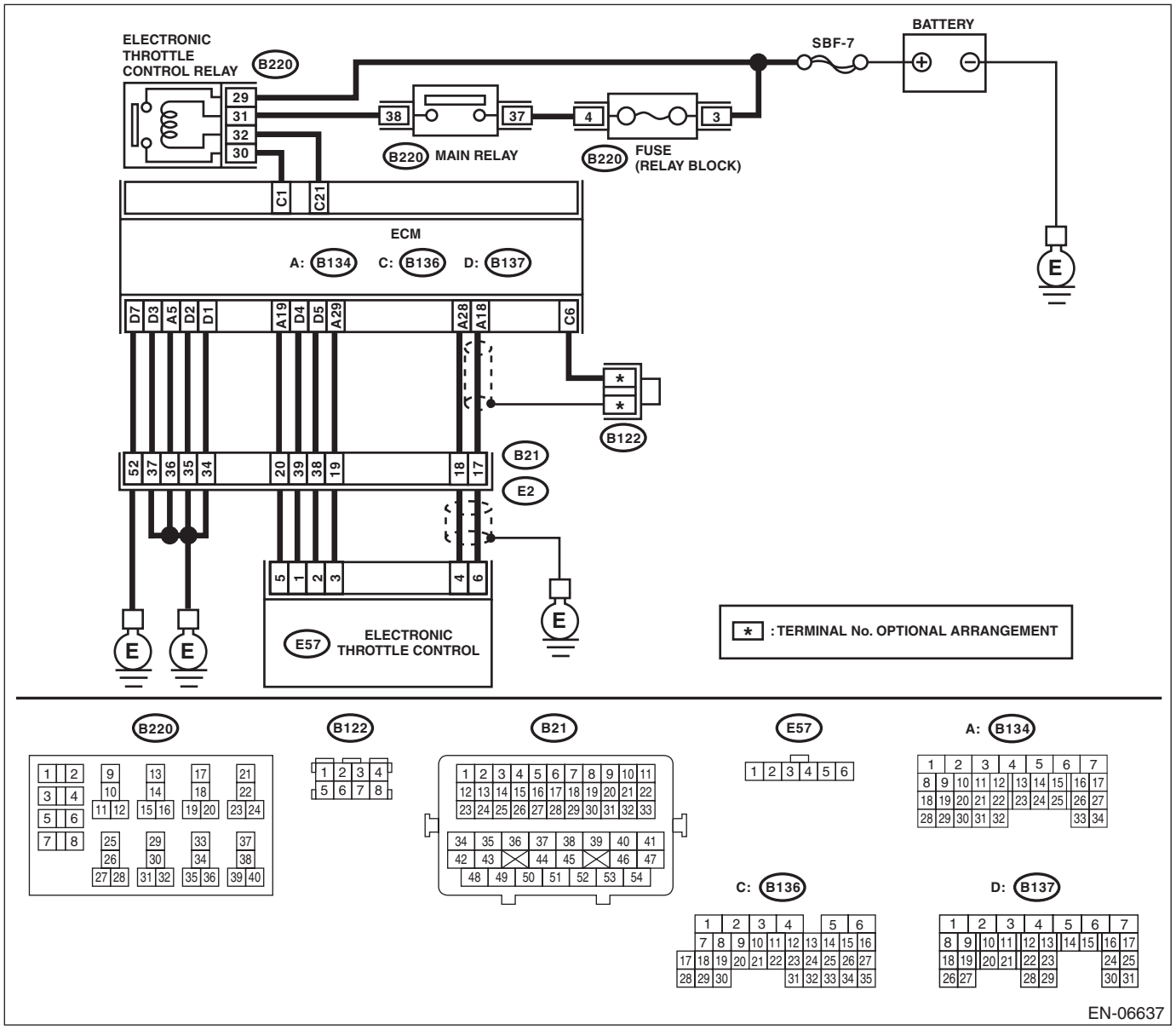
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-187, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK ELECTRONIC THROTTLE CONTROL RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the electronic throttle control relay. 3) Measure the resistance between electronic throttle control relay terminals. ***Terminals*** ***No. 29 — No. 30:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Replace the electronic throttle control relay. <Ref. to FU(H4SO)-50, Electronic Throttle Control Relay.>
2	**CHECK SHORT CIRCUIT OF ELECTRONIC THROTTLE CONTROL RELAY POWER SUPPLY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control relay connector and chassis ground. ***Connector & terminal*** ***(B220) No. 30 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and electronic throttle control relay connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 21 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the short circuit in harness to ground between ECM and electronic throttle control relay connector.

DC:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4SO)(diag)-294, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DD:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-189, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

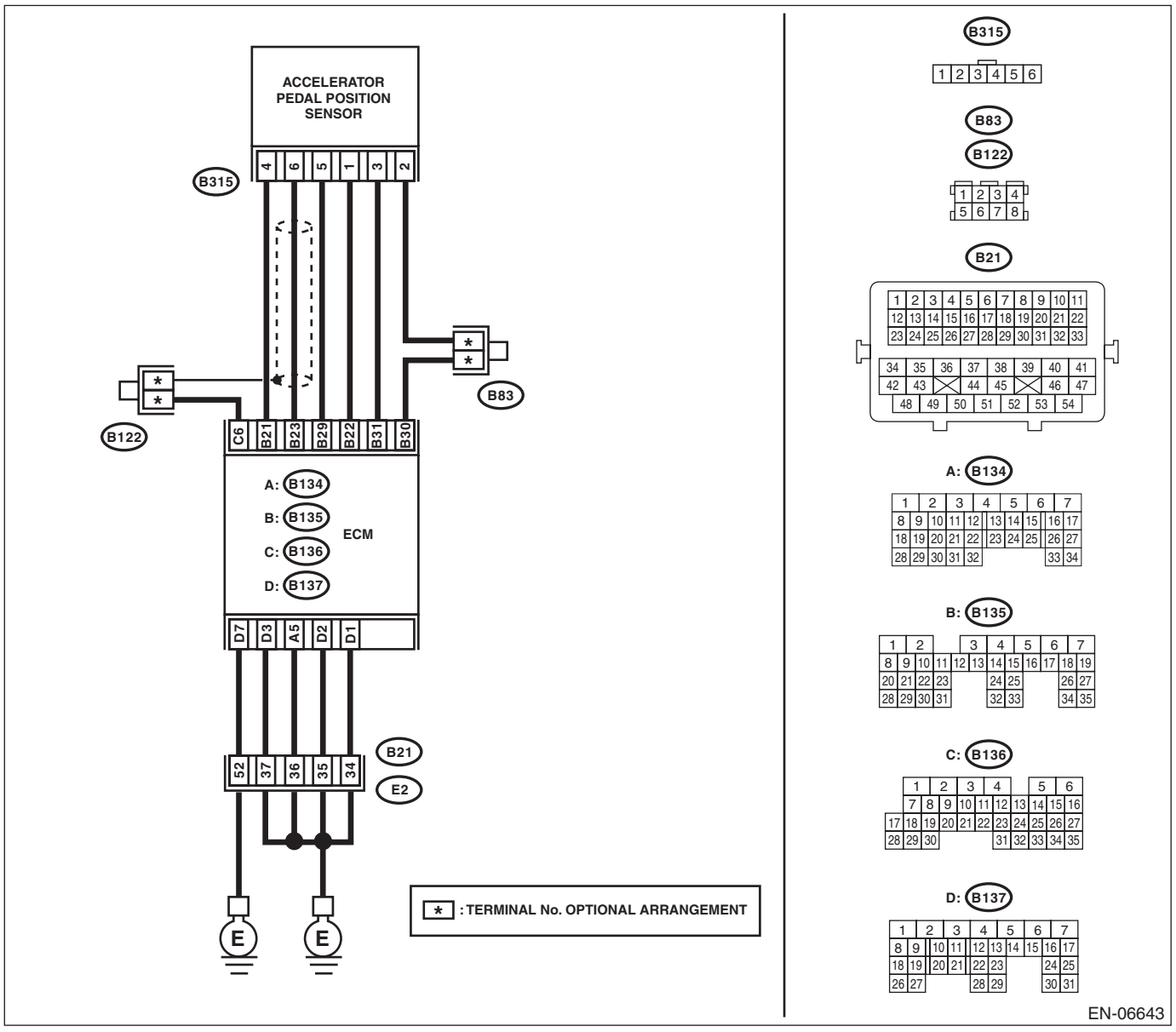
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and accelerator pedal position sensor. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 21 — Chassis ground:*** ***(B135) No. 23 — Chassis ground:*** ***(B135) No. 23 — (R136) No. 6:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the short circuit to ground in harness between ECM and accelerator pedal position sensor connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 6 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the accelerator pedal. <Ref. to SP(H4SO)-4, Accelerator Pedal.>	Repair the short circuit to ground in harness between ECM and accelerator pedal position sensor connector. Replace the ECM if defective. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>

DE:DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-191, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

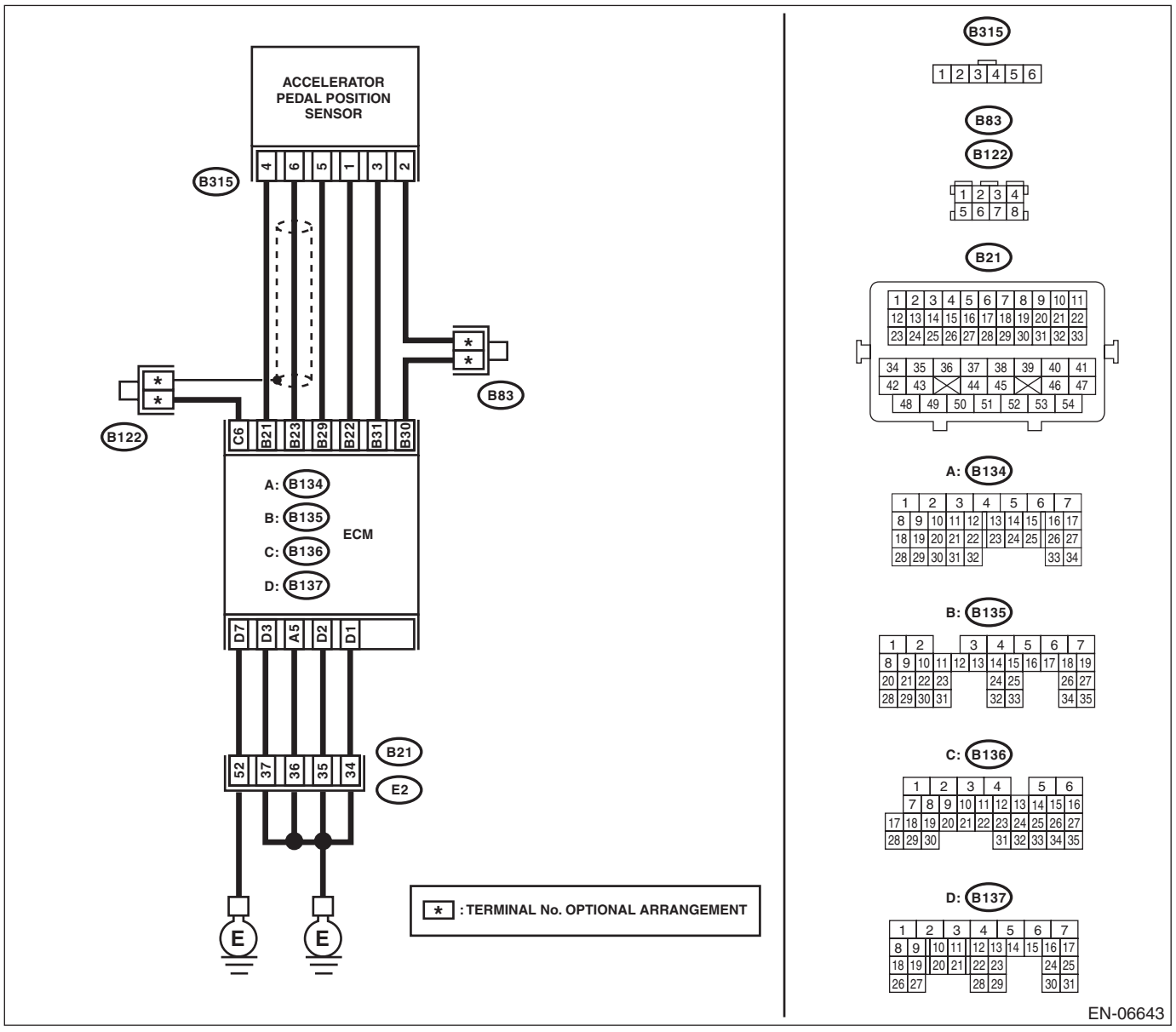
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and accelerator pedal position sensor. 3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector. ***Connector & terminal*** ***(B135) No. 23 — (B315) No. 6:*** ***(B135) No. 29 — (B315) No. 5:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the open circuit in harness between ECM and accelerator pedal position sensor connector.
2	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 5 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 6 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B135) No. 21 — (B135) No. 23:***	Is the resistance 1 MΩ or more?	Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. <Ref. to SP(H4SO)-4, Accelerator Pedal.>	Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector.

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-193, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

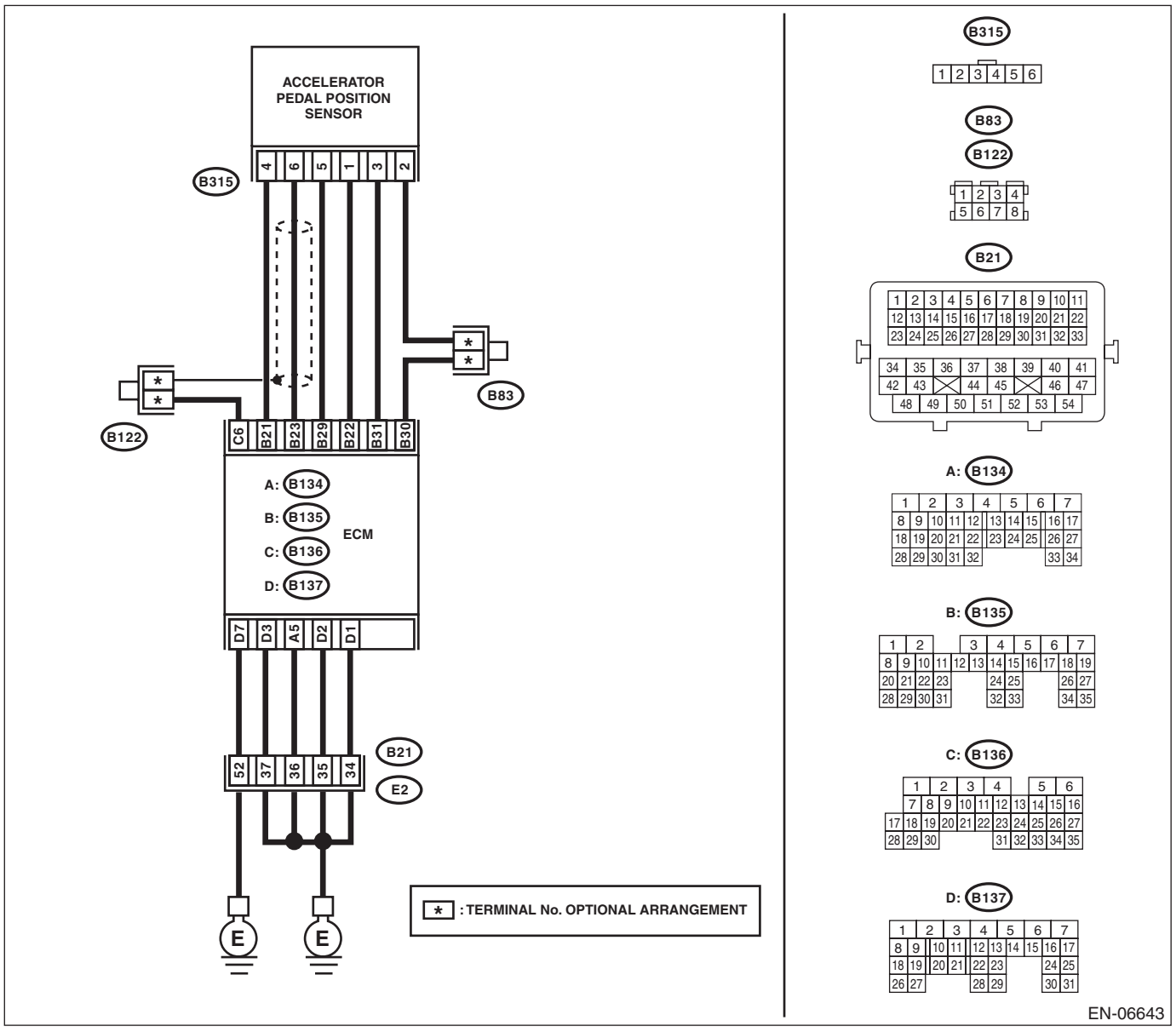
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and accelerator pedal position sensor. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 22 — Chassis ground:*** ***(B135) No. 31 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the short circuit to ground in harness between ECM and accelerator pedal position sensor connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 3 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the accelerator pedal. <Ref. to SP(H4SO)-4, Accelerator Pedal.>	Repair the short circuit to ground in harness between ECM and accelerator pedal position sensor connector. Replace the ECM if defective. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>

DG:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-195, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

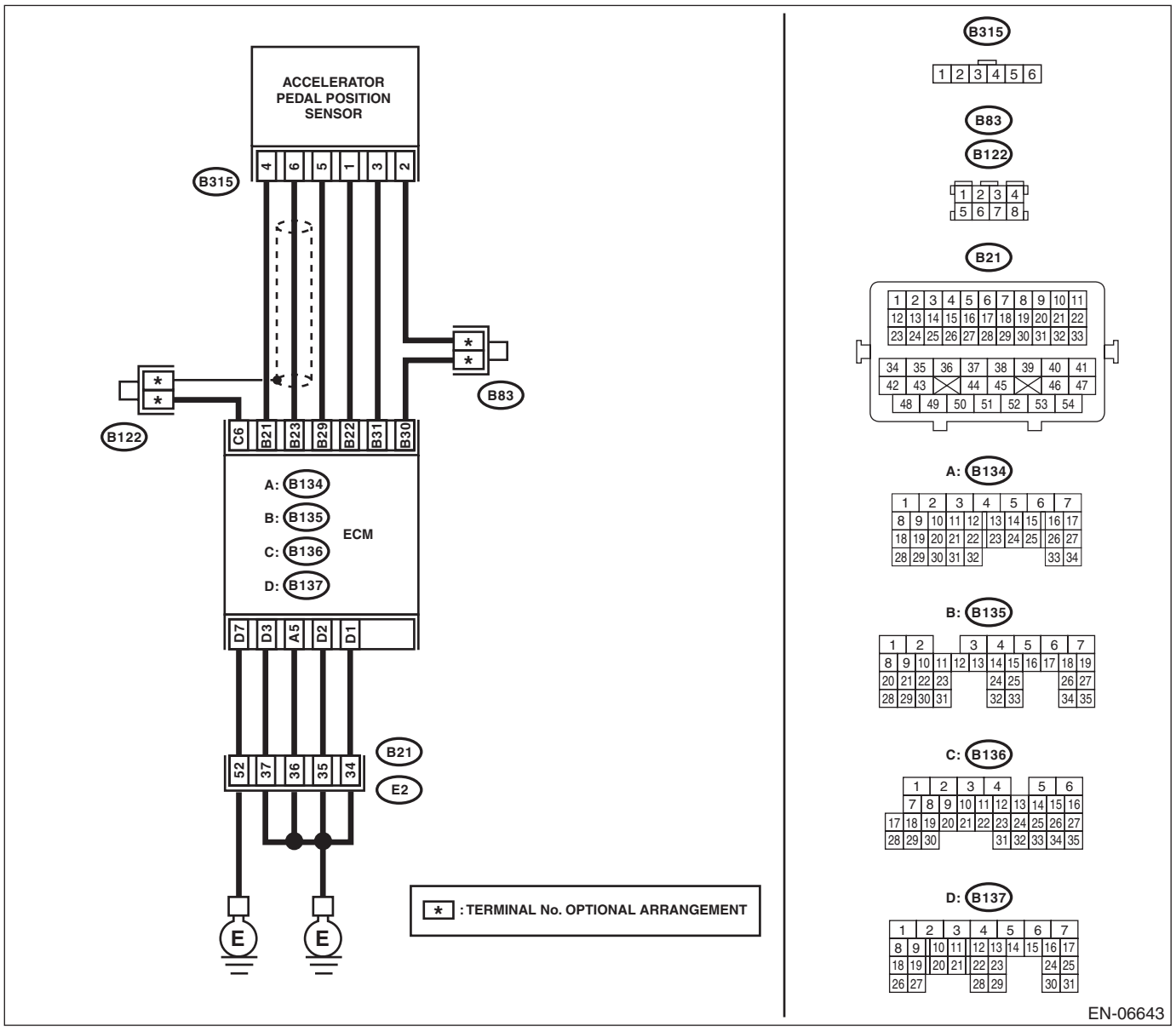
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and accelerator pedal position sensor. 3) Measure the resistance of harness between ECM and accelerator pedal position sensor connector. ***Connector & terminal*** ***(B135) No. 31 — (B315) No. 3:*** ***(B135) No. 30 — (B315) No. 2:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and accelerator pedal position sensor connector • Poor contact of joint connector
2	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 2 — Chassis ground:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 3 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector.	Go to step **4**.
4	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B135) No. 22 — (B135) No. 31:***	Is the resistance 1 MΩ or more?	Repair the poor contact of accelerator pedal position sensor connector. Replace the accelerator pedal if defective. <Ref. to SP(H4SO)-4, Accelerator Pedal.>	Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector.

DH:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-197, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

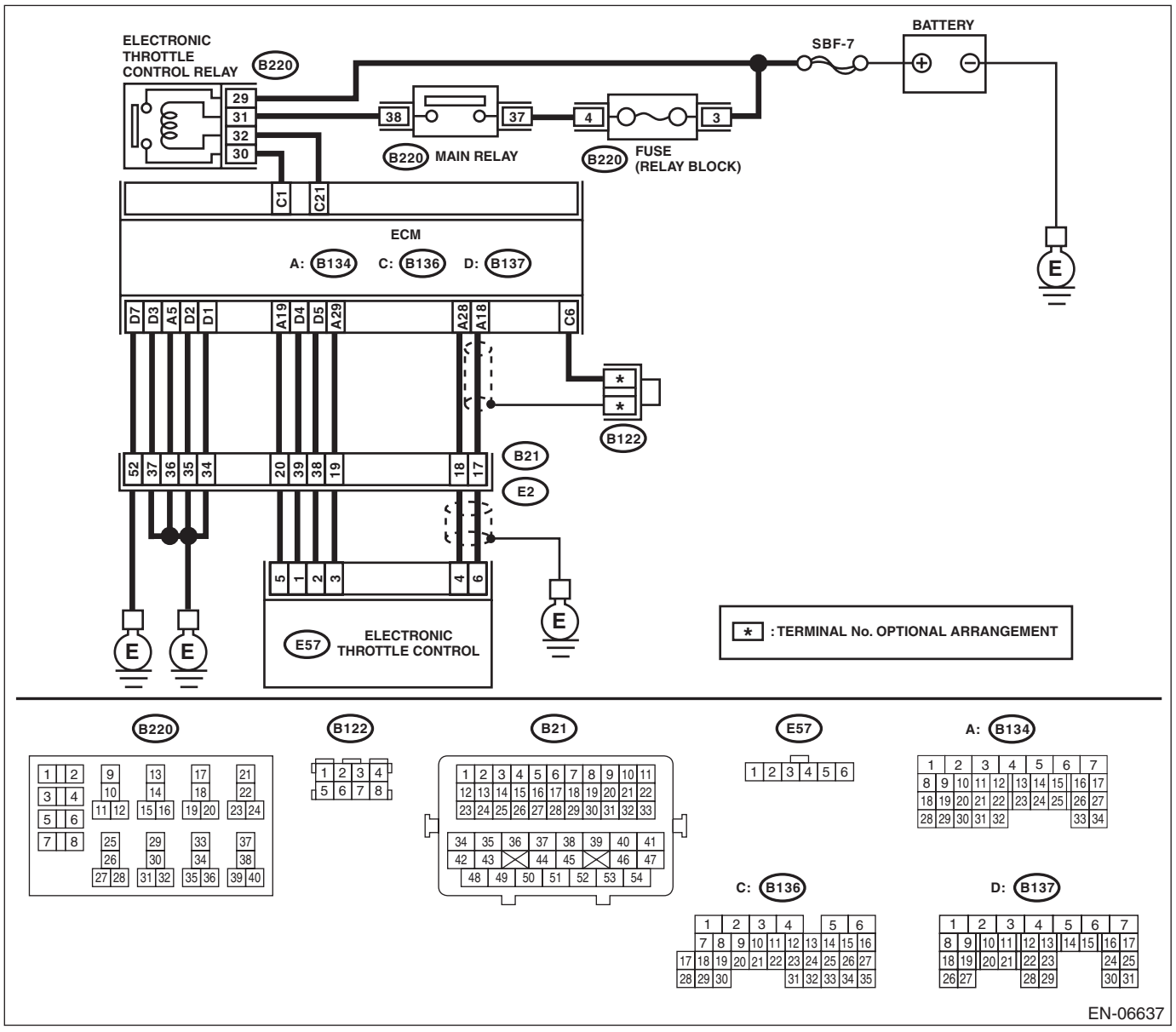
TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and electronic throttle control. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 19 — Chassis ground:*** ***(B134) No. 18 — Chassis ground:*** ***(B134) No. 18 — (R136) No. 6:*** ***(B134) No. 28 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **2**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector.
2	**CHECK SHORT CIRCUIT INSIDE THE ECM.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 — Engine ground:*** ***(E57) No. 4 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).>
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Disconnect the connectors from ECM. 2) Measure the resistance of harness between ECM and electronic throttle control connector. ***Connector & terminal*** ***(B134) No. 18 — (E57) No. 6:*** ***(B134) No. 28 — (E57) No. 4:*** ***(B134) No. 29 — (E57) No. 3:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and electronic throttle control connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Connect the connector to ECM. 2) Measure the resistance between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 3 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **5**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between ECM and engine ground • Poor contact of ECM connector • Poor contact of coupling connector
5	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control connector and engine ground. ***Connector & terminal*** ***(E57) No. 6 (+) — Engine ground (–):*** ***(E57) No. 4 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and electronic throttle control connector.	Go to step **6**.

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B134) No. 19 — (B134) No. 18:*** ***(B134) No. 19 — (B134) No. 28:***	Is the resistance 1 MΩ or more?	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(H4SO)-14, Throttle Body.>	Repair the short circuit to power in harness between ECM and electronic throttle control connector.

DI: DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

DTC DETECTING CONDITION:

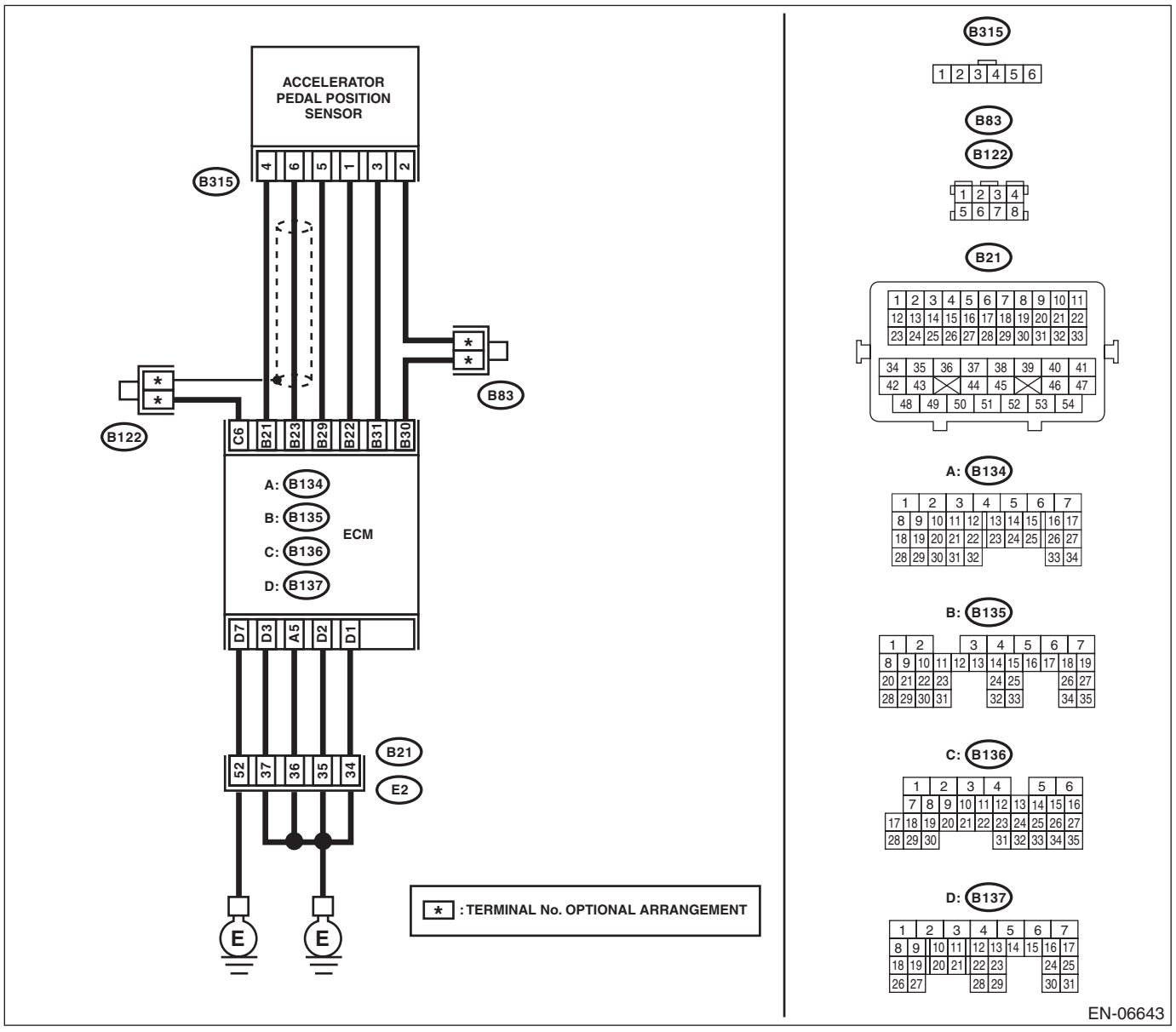
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-199, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



	Step	Check	Yes	No
1	**CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***Main accelerator pedal position sensor signal*** ***(B135) No. 23 (+) — Chassis ground (–):*** ***Sub accelerator pedal position sensor signal*** ***(B135) No. 31 (+) — Chassis ground (–):***	Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?	Go to step **3**.	Go to step **2**.
2	**CHECK ACCELERATOR PEDAL POSITION SENSOR OUTPUT.** 1) Measure the voltage between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 6 (+) — Chassis ground (–):*** ***(B315) No. 3 (+) — Chassis ground (–):***	Is the difference in measured values for the main accelerator pedal position sensor signal and the sub accelerator pedal position sensor signal 0 V?	Replace the accelerator pedal. <Ref. to SP(H4SO)-4, Accelerator Pedal.>	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and accelerator pedal position sensor connector • Short circuit to ground in harness between ECM and accelerator pedal position sensor connector
3	**CHECK HARNESS BETWEEN ECM AND ACCELERATOR PEDAL POSITION SENSOR CONNECTOR.** Measure the resistance of harness between accelerator pedal position sensor connector and chassis ground. ***Connector & terminal*** ***(B315) No. 5 — Chassis ground:*** ***(B315) No. 2 — Chassis ground:***	Is the resistance less than 5 Ω?	Repair the poor contact of ECM connector.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between ECM and accelerator pedal position sensor connector • Open circuit of harness between ECM and engine ground • Poor contact of ECM connector • Poor contact of joint connector

DJ:DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-201, DTC P2227 BAROMETRIC PRESSURE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).> NOTE: The barometric pressure sensor is built into the ECM.

DK:DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-202, DTC P2228 BAROMETRIC PRESSURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).> NOTE: The barometric pressure sensor is built into the ECM.

DL:DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4SO)-203, DTC P2229 BAROMETRIC PRESSURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	**CHECK FOR ANY OTHER DTC ON DISPLAY.**	Is any other DTC displayed?	Check DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4SO)(diag)-88, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(H4SO)-45, Engine Control Module (ECM).> NOTE: The barometric pressure sensor is built into the ECM.

DM:DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

DN:DTC U0101 CAN (TCU) DATA NOT LOADED

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

DO:DTC U0122 CAN (VDC) DATA NOT LOADED

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

DP:DTC U0140 CAN (BCU) DATA NOT LOADED

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

DQ:DTC U0402 CAN (TCU) DATA ABNORMAL

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

DR:DTC U0416 CAN (VDC) DATA ABNORMAL

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

DS:DTC U0422 CAN (BCU) DATA ABNORMAL

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

21.General Diagnostic Table

A: INSPECTION

1. ENGINE

NOTE:
Malfunction of parts other than those listed is also possible. <Ref. to ME(H4SO)-99, Engine Trouble in General.>

Symptoms	Problem parts
1. Engine stalls during idling.	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Ignition parts (*1) 4) Engine coolant temperature sensor (*2) 5) Crankshaft position sensor (*3) 6) Camshaft position sensor (*3) 7) Fuel injection parts (*4) 8) Electronic throttle control
2. Rough idling	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Engine coolant temperature sensor (*2) 4) Ignition parts (*1) 5) Air intake system (*5) 6) Fuel injection parts (*4) 7) Electronic throttle control 8) Crankshaft position sensor (*3) 9) Camshaft position sensor (*3) 10) Oxygen sensor 11) Fuel pump and fuel pump relay 12) EGR valve 13) Oil switching solenoid valve
3. Engine does not return to idle.	1) Engine coolant temperature sensor 2) Electronic throttle control 3) Manifold absolute pressure sensor 4) Mass air flow and intake air temperature sensor 5) EGR valve 6) Accelerator pedal position sensor 7) Oil temperature sensor
4. Poor acceleration	1) Manifold absolute pressure sensor 2) Mass air flow and intake air temperature sensor 3) Electronic throttle control 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 relay 10) Engine torque control signal circuit 11) Ignition parts (*1) 12) EGR valve 13) Accelerator pedal position sensor 14) Oil temperature sensor 15) Oil switching solenoid valve

Symptoms	Problem parts
5. Engine stalls, hesitates, or sputters at acceleration.	1) Manifold absolute pressure sensor 2) Mass air flow and intake air 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) Electronic throttle control 9) Fuel pump and fuel pump relay 10) EGR valve
6. Surging	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor (*2) 4) Crankshaft position sensor (*3) 5) Camshaft position sensor (*3) 6) Fuel injection parts (*4) 7) Electronic throttle control 8) Fuel pump and fuel pump relay 9) EGR valve
7. Spark knock	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor 4) Knock sensor 5) Fuel injection parts (*4) 6) Fuel pump and fuel pump relay 7) EGR valve 8) Oil switching solenoid valve
8. After burning in exhaust system	1) Mass air flow and intake air temperature sensor 2) Manifold absolute pressure sensor 3) Engine coolant temperature sensor (*2) 4) Fuel injection parts (*4) 5) Fuel pump and fuel pump relay

*1: Check ignition coil and ignitor assembly 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.

GENERAL DESCRIPTION

GD(H4SO)

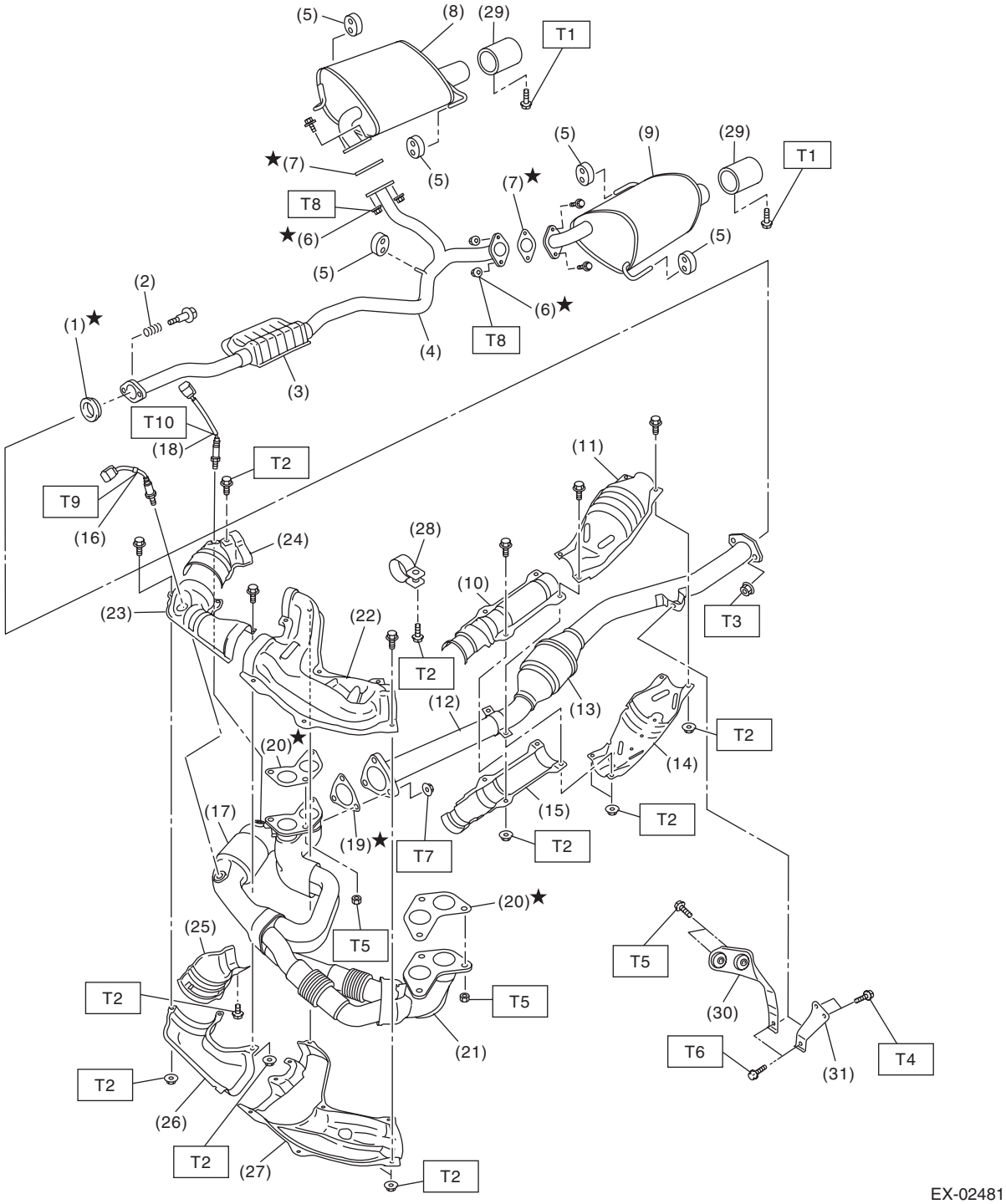
Page

1. List of Diagnostic Trouble Code (DTC) 2
2. Diagnostic Trouble Code (DTC) Detecting Criteria 8

1. General Description

A: COMPONENT

- 4 DOOR MODEL

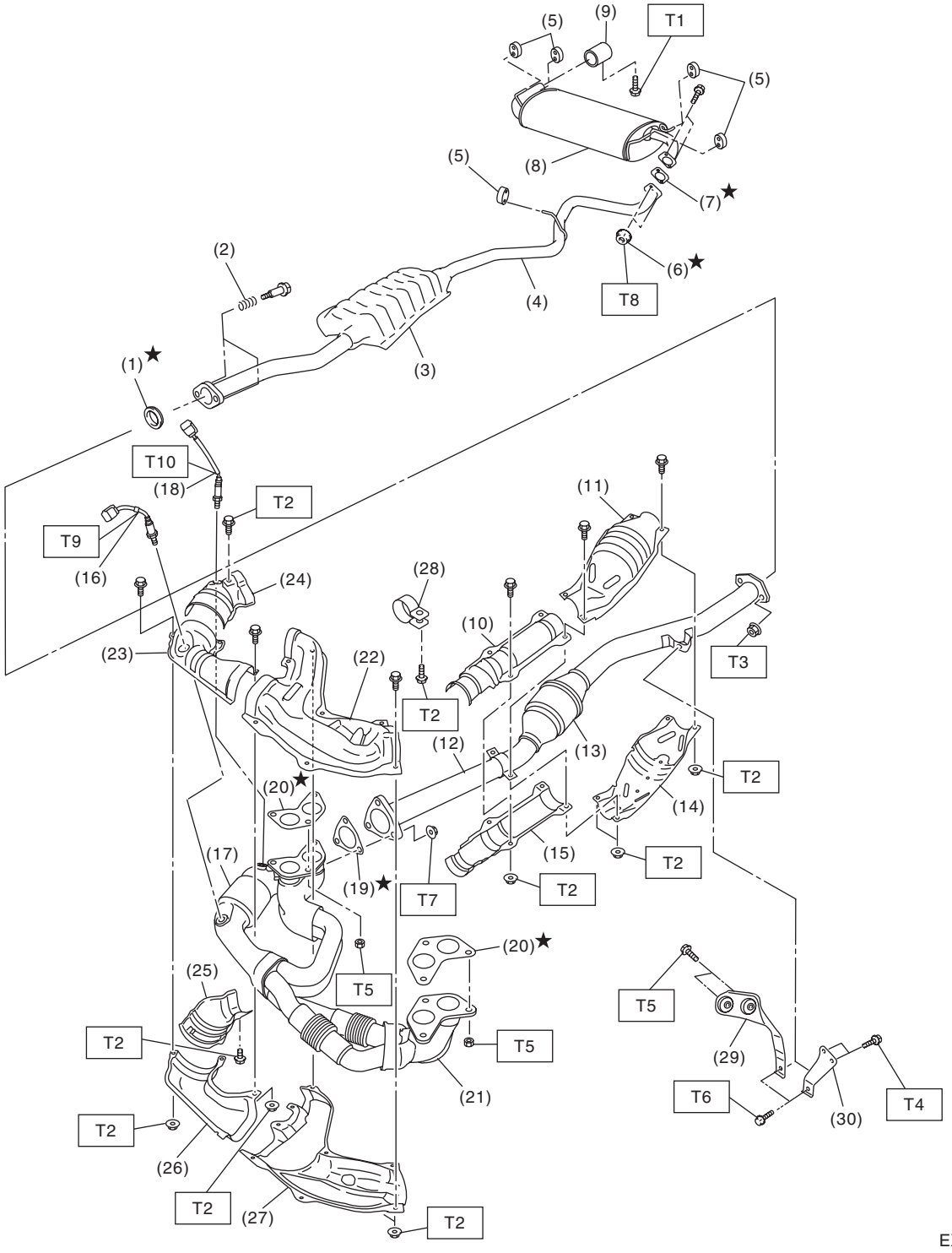


EX-02481

(1) Gasket
(2) Spring
(3) Chamber
(4) Rear exhaust pipe
(5) Cushion rubber
(6) Self-locking nut
(7) Gasket
(8) Muffler RH
(9) Muffler LH
(10) Center exhaust pipe front upper cover
(11) Rear catalytic converter upper cover
(12) Center exhaust pipe
(13) Rear catalytic converter
(14) Rear catalytic converter lower cover
(15) Center exhaust pipe front lower cover
(16) Front oxygen (A/F) sensor
(17) Front catalytic converter
(18) Rear oxygen sensor
(19) Gasket
(20) Gasket
(21) Front exhaust pipe
(22) Front exhaust pipe upper cover LH
(23) Front exhaust pipe upper cover RH
(24) Front catalytic converter upper cover
(25) Front catalytic converter lower cover
(26) Front exhaust pipe lower cover RH
(27) Front exhaust pipe lower cover LH
(28) Band
(29) Ornamental muffler tip (Models with ornamental muffler tips)
(30) Hanger bracket (MT model)
(31) Hanger bracket (AT model)

Tightening torque:N·m (kgf-m, ft-lb)	
T1:	*7.5 (0.8, 5.5)*
T2:	*13 (1.3, 9.6)*
T3:	*18 (1.8, 13.3)*
T4:	*23 (2.3, 17.0)*
T5:	*30 (3.1, 22.1)*
T6:	*35 (3.6, 25.8)*
T7:	*40 (4.1, 29.5)*
T8:	*48 (4.9, 35.4)*
T9:	*<Ref. to FU(H4SO)-41, INSTALLATION, Front Oxygen (A/F) Sensor.>*
T10:	*<Ref. to FU(H4SO)-43, INSTALLATION, Rear Oxygen Sensor.>*

- 5 DOOR MODEL


(5)
(9)
T1
(5)
(5)
(8)
(7)★
(2)
(6)★
(4)
T8
(1)★
(3)
T10
(18)
T2
(11)
T9
(16)
(24)
(28)
(10)
T3
(23)
(22)
T2
(12)
(13)
T2
(20)★
(14)
(17)
(15)
T2
(19)★
T7
T2
(20)★
(25)
T5
T5
T2
T5
(29)
(21)
T6
T4
T2
(30)
(26)
T2
(27)
T2
EX-02482

(1) Gasket
(2) Spring
(3) Chamber
(4) Rear exhaust pipe
(5) Cushion rubber
(6) Self-locking nut
(7) Gasket
(8) Muffler
(9) Ornamental muffler tip (Models with ornamental muffler tips)
(10) Center exhaust pipe front upper cover
(11) Rear catalytic converter upper cover
(12) Center exhaust pipe
(13) Rear catalytic converter
(14) Rear catalytic converter lower cover
(15) Center exhaust pipe front lower cover
(16) Front oxygen (A/F) sensor
(17) Front catalytic converter
(18) Rear oxygen sensor
(19) Gasket
(20) Gasket
(21) Front exhaust pipe
(22) Front exhaust pipe upper cover LH
(23) Front exhaust pipe upper cover RH
(24) Front catalytic converter upper cover
(25) Front catalytic converter lower cover
(26) Front exhaust pipe lower cover RH
(27) Front exhaust pipe lower cover LH
(28) Band
(29) Hanger bracket (MT model)
(30) Hanger bracket (AT model)

Tightening torque:N·m (kgf-m, ft-lb)

T1:	***7.5 (0.8, 5.5)***
T2:	***13 (1.3, 9.6)***
T3:	***18 (1.8, 13.3)***
T4:	***23 (2.3, 17.0)***
T5:	***30 (3.1, 22.1)***
T6:	***35 (3.6, 25.8)***
T7:	***40 (4.1, 29.5)***
T8:	***48 (4.9, 35.4)***
T9:	***<Ref. to FU(H4SO)-41, INSTALLATION, Front Oxygen (A/F) Sensor.>***
T10:	***<Ref. to FU(H4SO)-43, INSTALLATION, Rear Oxygen Sensor.>***

B: CAUTION

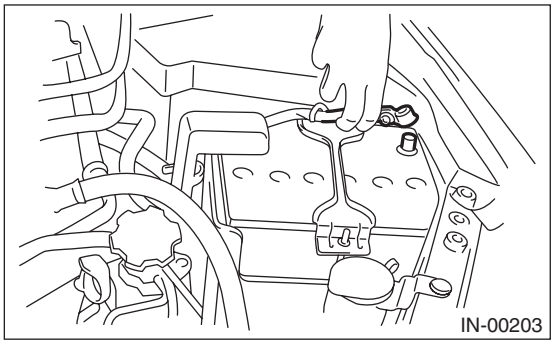
- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.
- If any fat adheres to the exhaust pipe, wipe it off. Otherwise a fire may happen.

2. Front Exhaust Pipe

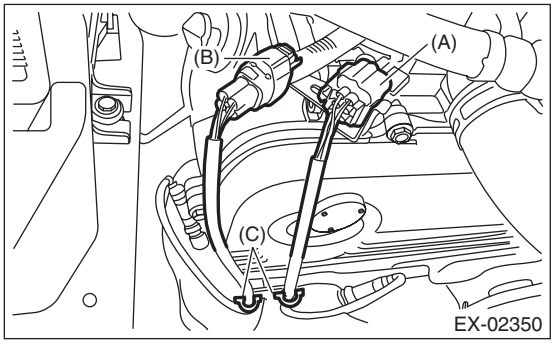
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

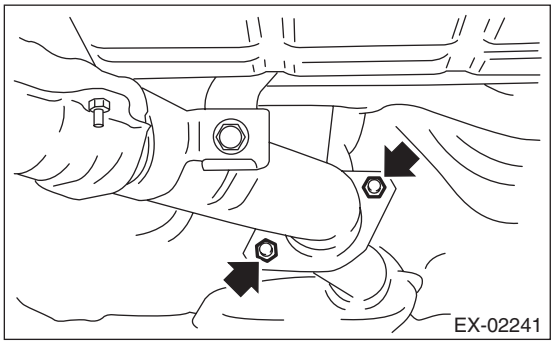
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.



3) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
4) Disconnect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B) and remove the clip (C) fastening the harness.

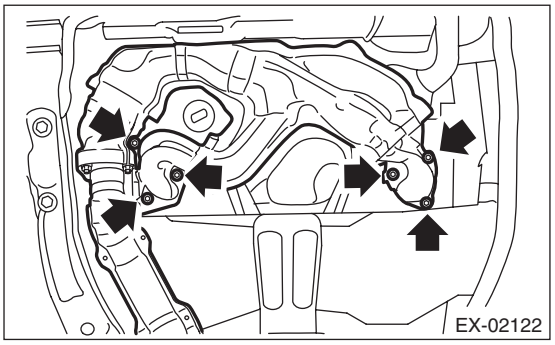


5) Lift up the vehicle.
6) Remove the under cover.
7) Remove the center exhaust pipe from rear exhaust pipe.

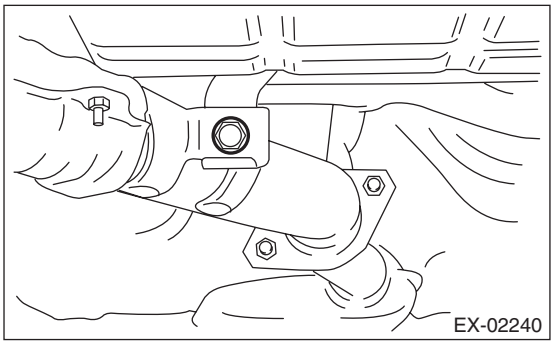


8) Remove the nuts which hold front exhaust pipe onto cylinder heads.

CAUTION:
Be careful not to drop the front and center exhaust pipe assembly.



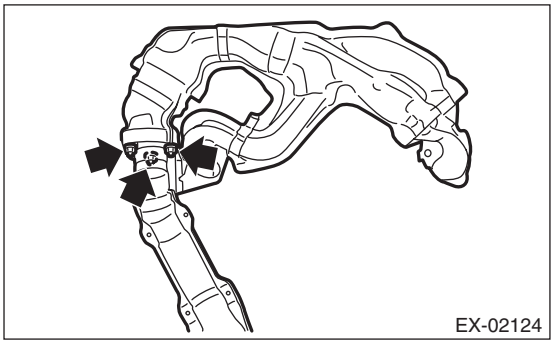
9) Remove the bolt which holds center exhaust pipe to hanger bracket.



10) Remove the front exhaust pipe and center exhaust pipe from vehicle as a unit.

CAUTION:
• The front and center exhaust pipe assemblies are very heavy. Be careful not to drop the exhaust pipes when removing.
• After removing the front and center exhaust pipe assemblies, do not pull on the rear exhaust pipe with excessive force.

11) Remove the front exhaust pipe from center exhaust pipe.



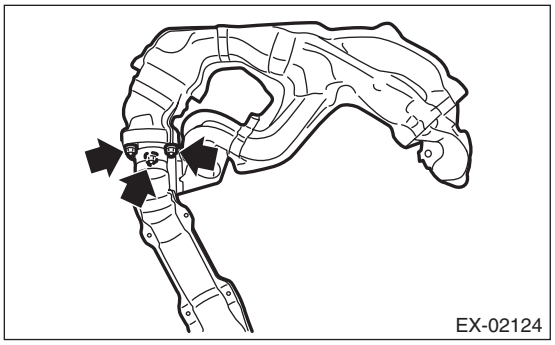
12) Remove the front oxygen (A/F) sensor and rear oxygen sensor from front exhaust pipe. <Ref. to FU(H4SO)-41, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-43, REMOVAL, Rear Oxygen Sensor.>

B: INSTALLATION

1) Install the front oxygen (A/F) sensor and rear oxygen sensor to the front exhaust pipe. <Ref. to FU(H4SO)-41, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-43, INSTALLATION, Rear Oxygen Sensor.>
2) Install the front exhaust pipe to center exhaust pipe.

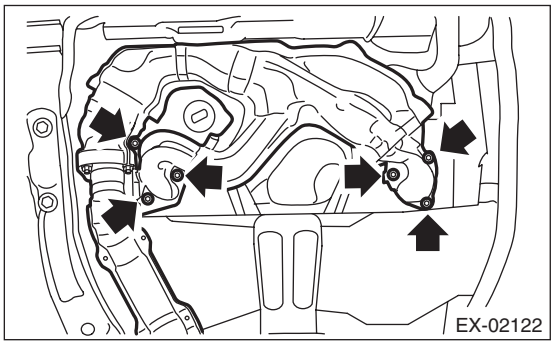
NOTE:
Use a new gasket.

Tightening torque:
40 N·m (4.1 kgf-m, 29.5 ft-lb)



3) Install the front and center exhaust pipe to the vehicle as a unit.

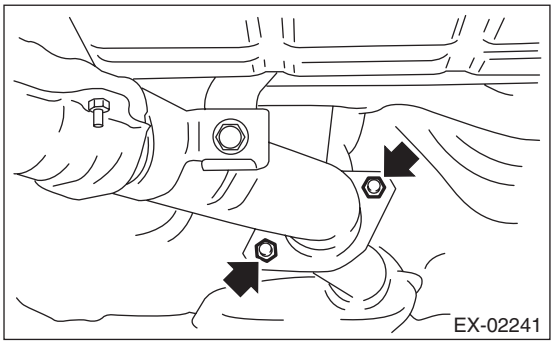
NOTE:
Use a new gasket.
4) Temporarily tighten the nuts which hold front exhaust pipe to cylinder heads.



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

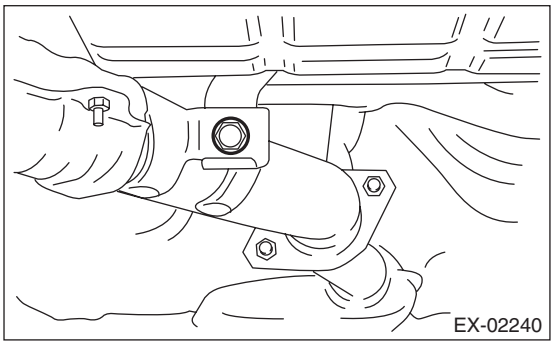
NOTE:
Use a new gasket.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



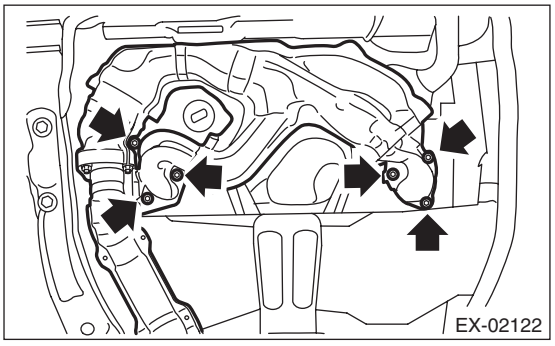
6) Tighten the bolts which hold center exhaust pipe to hanger bracket.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)



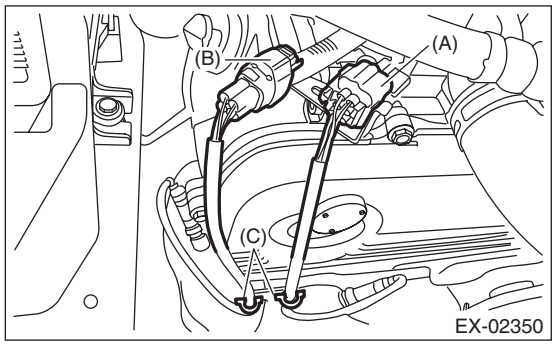
7) Tighten the nuts which hold front exhaust pipe to cylinder heads.

Tightening torque:
30 N·m (3.1 kgf-m, 22.1 ft-lb)

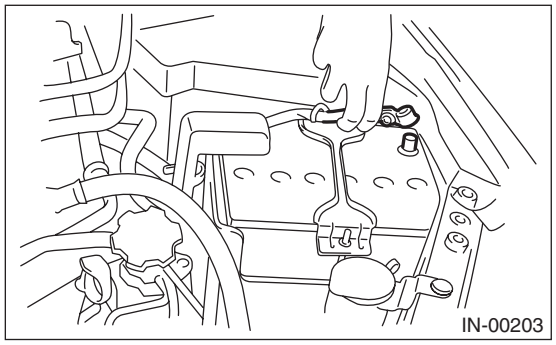


8) Install the under cover.
9) Lower the vehicle.

10) Connect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B), and fasten the harness with the clip (C).



11) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
12) Connect the ground cable to battery.



C: INSPECTION

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

3. Center Exhaust Pipe

A: REMOVAL

1) After removing the center and front exhaust pipes as one unit, separate them. Refer to “Front Exhaust Pipe” for the removal procedure. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>
2) Remove the front oxygen (A/F) sensor and rear oxygen sensor. <Ref. to FU(H4SO)-41, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-43, REMOVAL, Rear Oxygen Sensor.>

B: INSTALLATION

1) Install the front oxygen (A/F) sensor and rear oxygen sensor. <Ref. to FU(H4SO)-41, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(H4SO)-43, INSTALLATION, Rear Oxygen Sensor.>
2) Install the center exhaust pipe and front exhaust pipe as one unit. Refer to “Front Exhaust Pipe” for the installation procedure. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>

C: INSPECTION

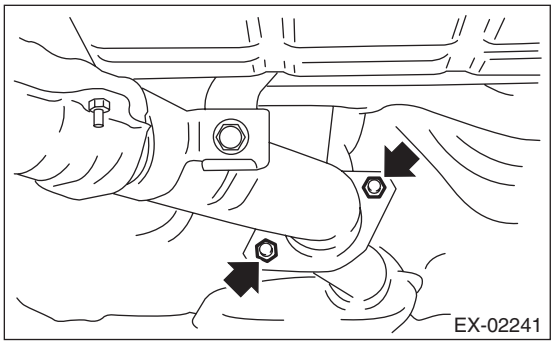
1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.

4. Rear Exhaust Pipe

A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

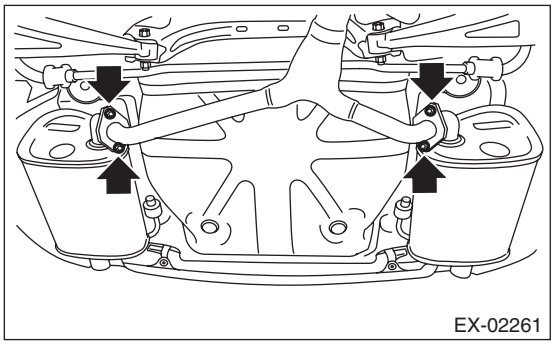
1) Set the vehicle on a lift.
2) Lift up the vehicle.
3) Remove the rear exhaust pipe from center exhaust pipe.



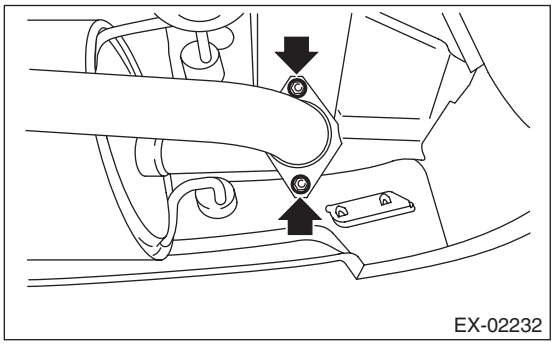
4) Remove the rear exhaust pipe from the muffler.

CAUTION:
Be careful not to drop the rear exhaust pipe.

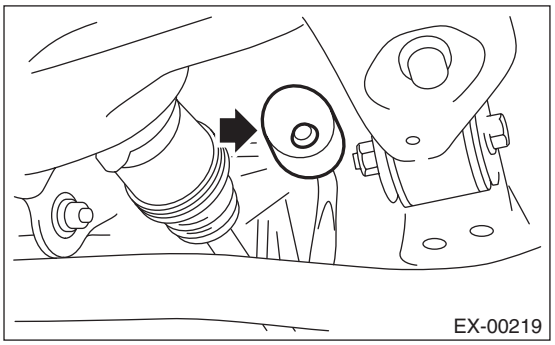
- 4 DOOR MODEL



- 5 DOOR MODEL



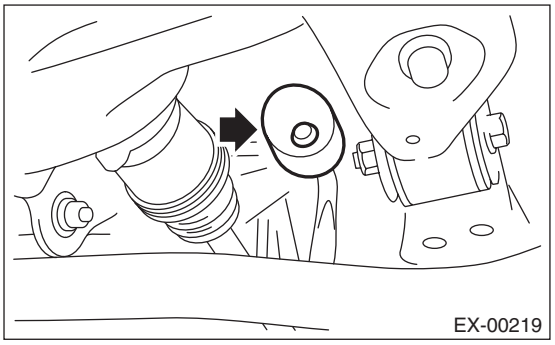
5) Apply a coat of spray type lubricant to the mating area of cushion rubber.
6) Remove the rear exhaust pipe from the cushion rubber.



B: INSTALLATION

1) Apply a coat of spray type lubricant to the mating area of cushion rubber.
2) Install the rear exhaust pipe to cushion rubber.

NOTE:
After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

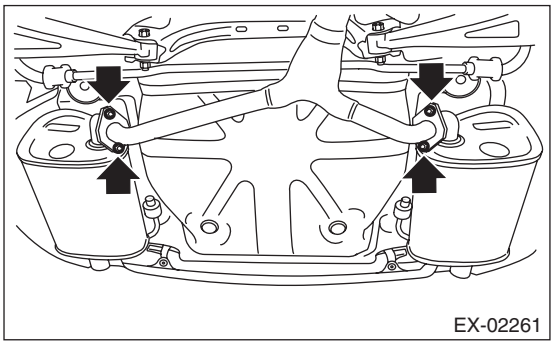


3) Install the rear exhaust pipe to the muffler.

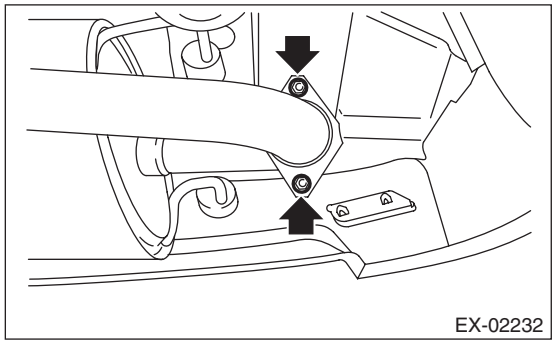
NOTE:
Use a new gasket and self-locking nut.

Tightening torque:
48 N·m (4.9 kgf-m, 35.4 ft-lb)

- 4 DOOR MODEL



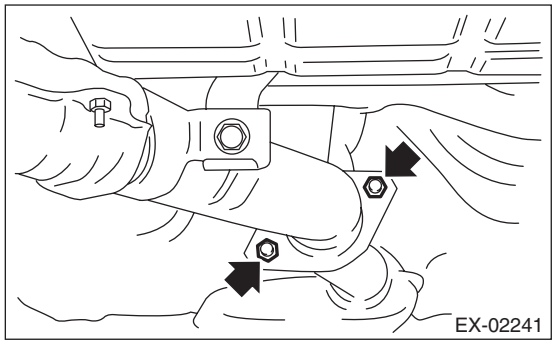
- 5 DOOR MODEL



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

NOTE:
Use a new gasket.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



5) Lower the vehicle.

C: INSPECTION

1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.
3) Check the cushion rubber for wear or crack.

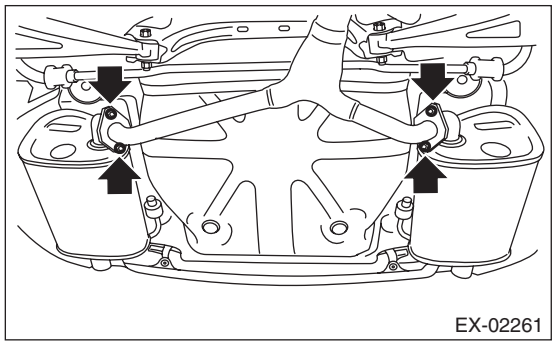
5. Muffler

A: REMOVAL

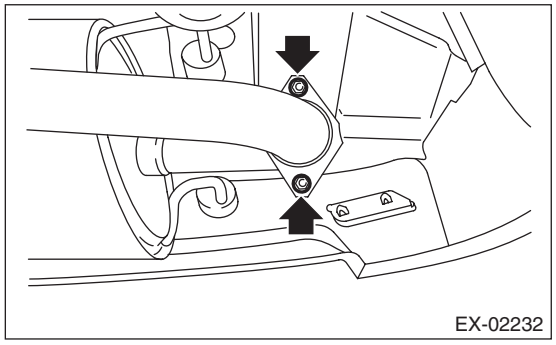
CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

1) Set the vehicle on a lift.
2) Lift up the vehicle.
3) Remove the muffler from rear exhaust pipe.

- 4 DOOR MODEL



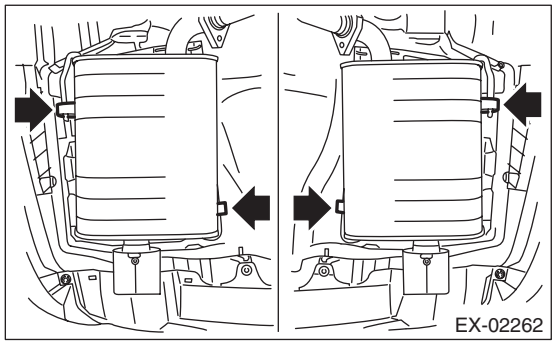
- 5 DOOR MODEL



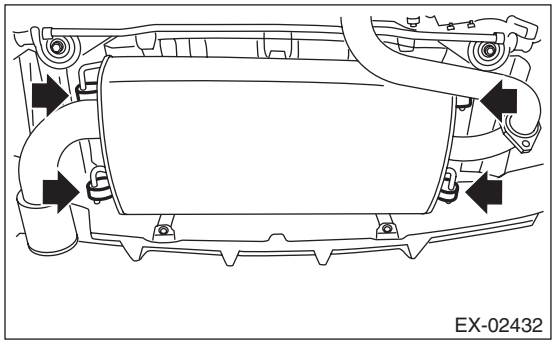
4) Apply a coat of spray type lubricant to the mating area of cushion rubber.
5) Remove the muffler from the cushion rubber.

CAUTION:
Be careful not to drop the muffler during removal.

- 4 DOOR MODEL



- 5 DOOR MODEL



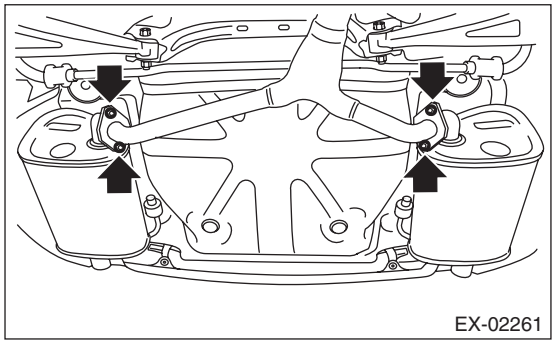
B: INSTALLATION

Install in the reverse order of removal.

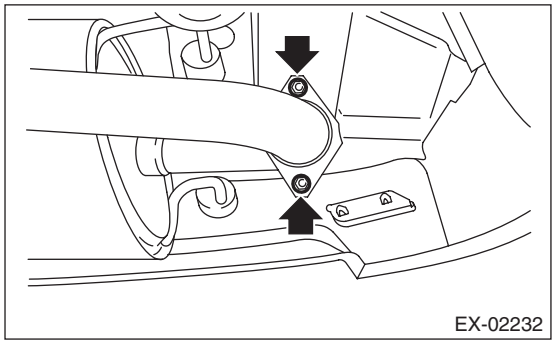
NOTE:
- Use a new gasket and self-locking nut.
- After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

Tightening torque:
48 N·m (4.9 kgf-m, 35.4 ft-lb)

- 4 DOOR MODEL



- 5 DOOR MODEL



C: INSPECTION

1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.
3) Check the cushion rubber for wear or crack.

COOLING

CO(H4SO)

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7. Radiator Cap 22
8. Radiator Main Fan and Fan Motor 23
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10. Reservoir Tank 27
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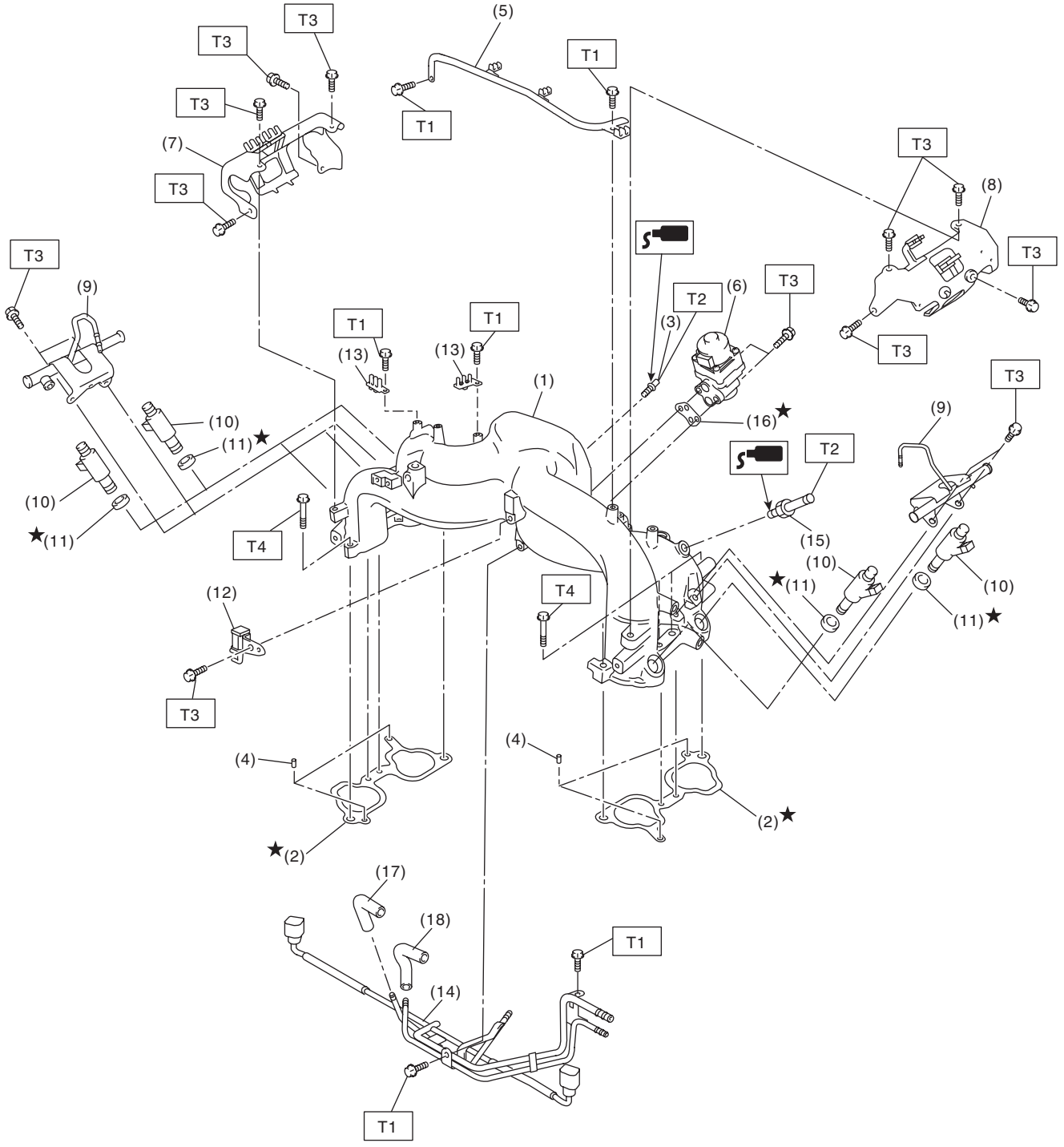
1. General Description

A: SPECIFICATION

Fuel tank	Capacity	64 ℓ (16.9 US gal, 14.1 Imp gal)
	Location	Under rear seat
Fuel pump	Type	Impeller
	Shutoff discharge pressure	550 — 850 kPa (5.6 — 8.7 kg/cm^2, 79.7 — 123.2 psi)
	Discharge rate	125 ℓ (33 US gal, 27.5 Imp gal)/h or more [12 V at 300 kPa (3.06 kg/cm^2, 43.5 psi)]
Fuel filter		In-tank type

B: COMPONENT

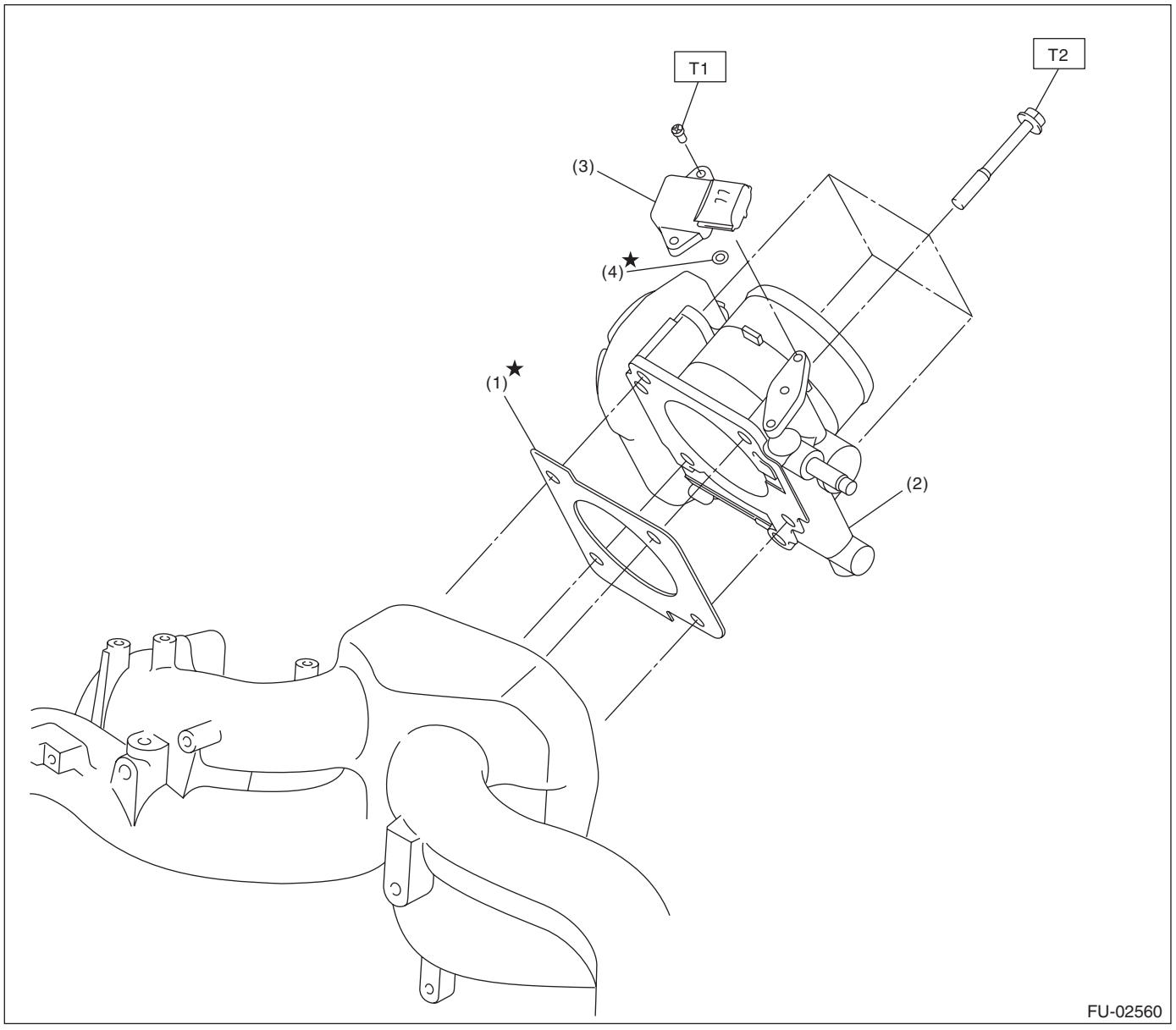
1. INTAKE MANIFOLD



(1) Intake manifold
(2) Gasket
(3) Nipple
(4) Guide pin
(5) Plug cord stay
(6) EGR valve
(7) Fuel pipe protector RH
(8) Fuel pipe protector LH
(9) Fuel injector pipe
(10) Fuel injector
(11) O-ring
(12) Purge control solenoid valve
(13) Plug cord holder
(14) Fuel pipe ASSY
(15) Nipple
(16) Gasket
(17) Evaporation hose (A)
(18) Evaporation hose (B)

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 17 (1.7, 12.5)
T3: 19 (1.9, 14.0)
T4: 25 (2.5, 18.4)

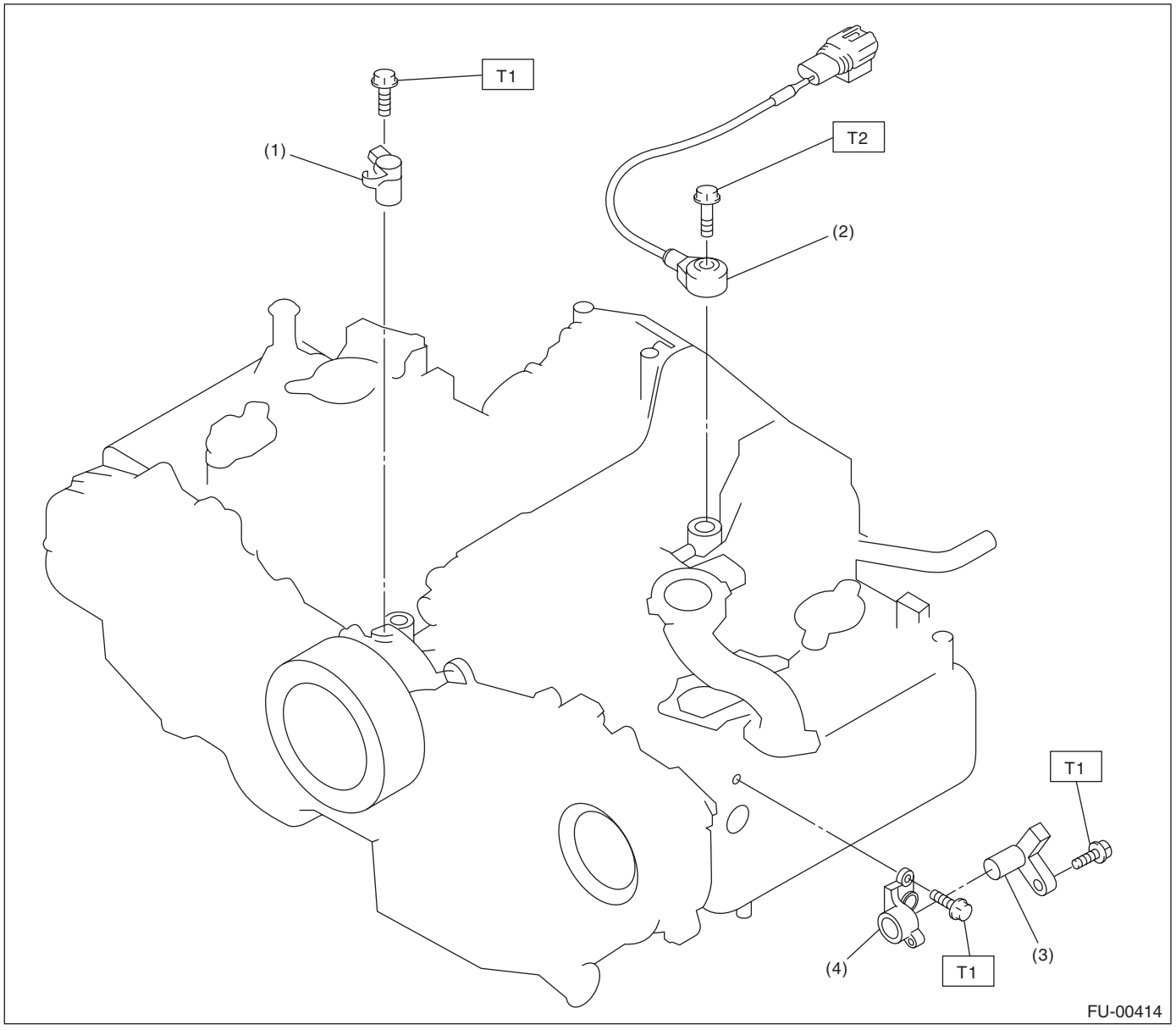
2. AIR INTAKE SYSTEM



(1) Gasket
(2) Throttle body
(3) Manifold absolute pressure sensor
(4) O-ring

Tightening torque: N·m (kgf-m, ft-lb)
T1: 2 (0.2, 1.5)
T2: 8 (0.8, 5.9)

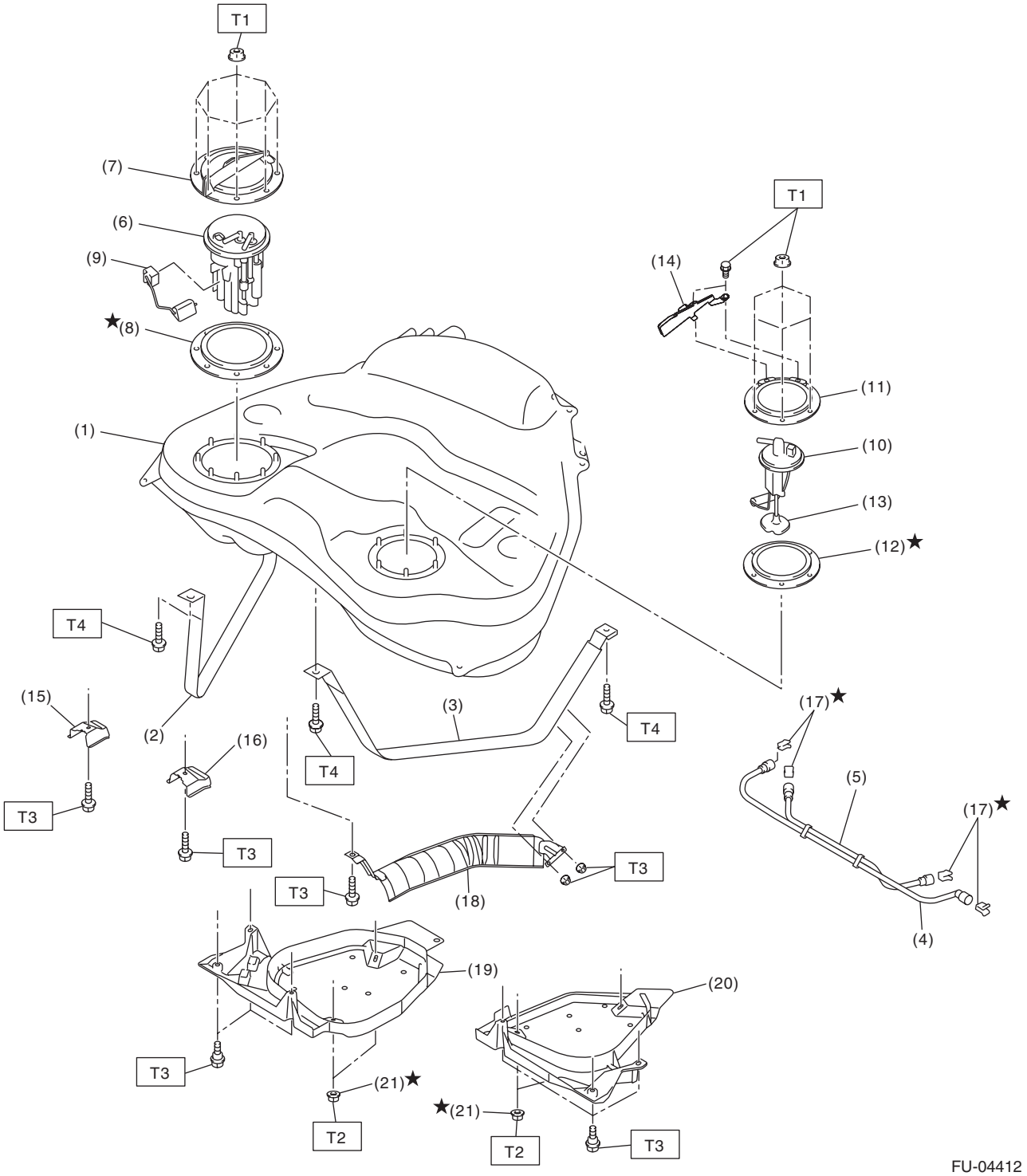
3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



(1) Crankshaft position sensor
(2) Knock sensor
(3) Camshaft position sensor
(4) Camshaft position sensor support

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 24 (2.4, 17.7)

4. FUEL TANK

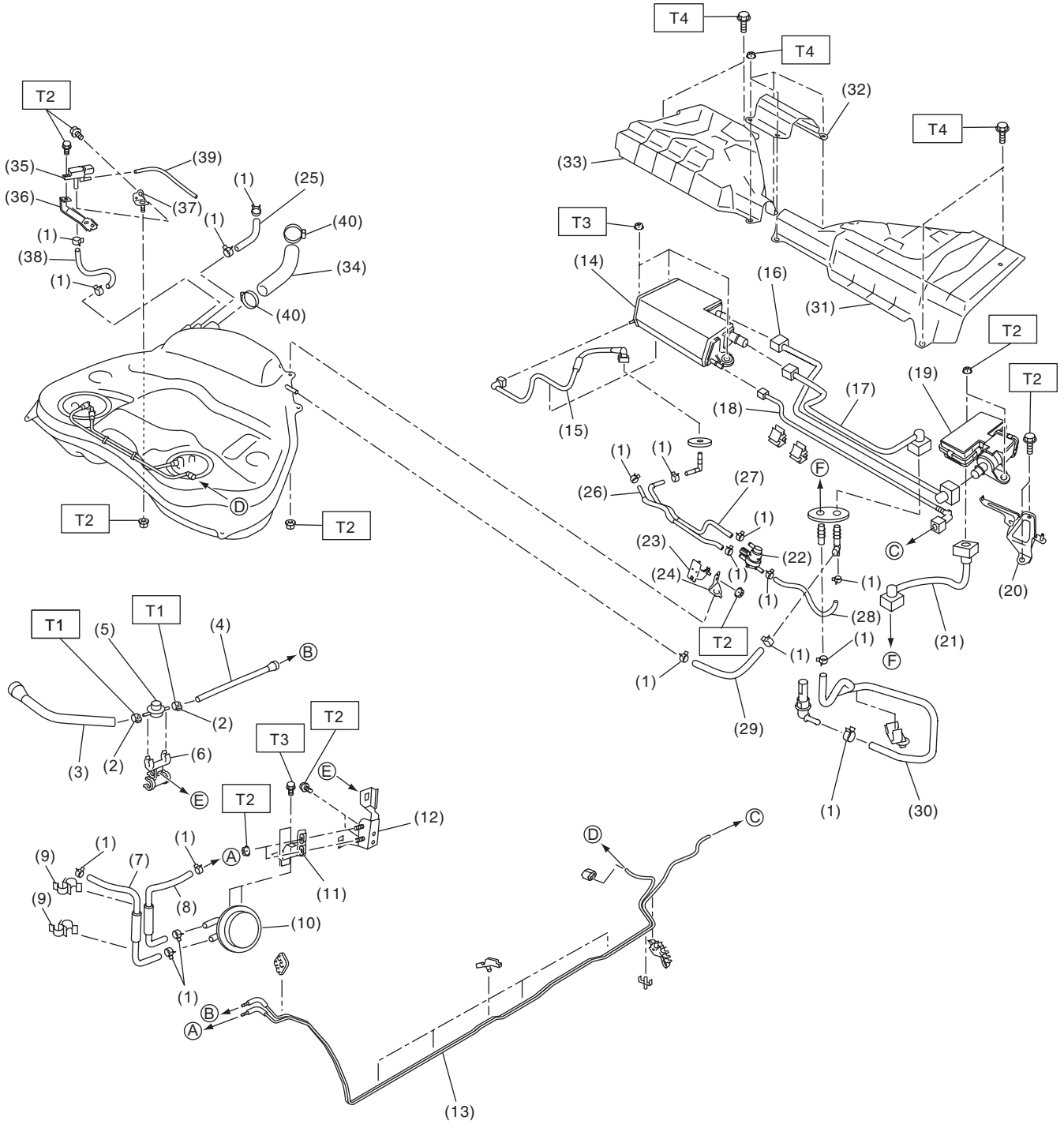

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(10)
(13)
(12)★
(17)★
(5)
(17)★
(4)
FU-04412

(1) Fuel tank
(2) Fuel tank band RH
(3) Fuel tank band LH
(4) Delivery tube
(5) Jet pump tube
(6) Fuel pump ASSY
(7) Fuel pump upper plate
(8) Fuel pump gasket
(9) Fuel level sensor
(10) Fuel sub level sensor
(11) Fuel sub level sensor upper plate
(12) Fuel sub level sensor gasket
(13) Fuel sub level sensor filter
(14) Fuel sub level sensor protector
(15) Stopper RH
(16) Stopper LH
(17) Retainer
(18) Heat shield cover
(19) Fuel tank protector RH
(20) Fuel tank protector LH
(21) Self-locking nut

Tightening torque: N·m (kgf-m, ft-lb)

T1: 4.4 (0.4, 3.2)
T2: 9 (0.9, 6.6)
T3: 18 (1.8, 13.3)
T4: 33 (3.4, 24.3)

5. FUEL LINE

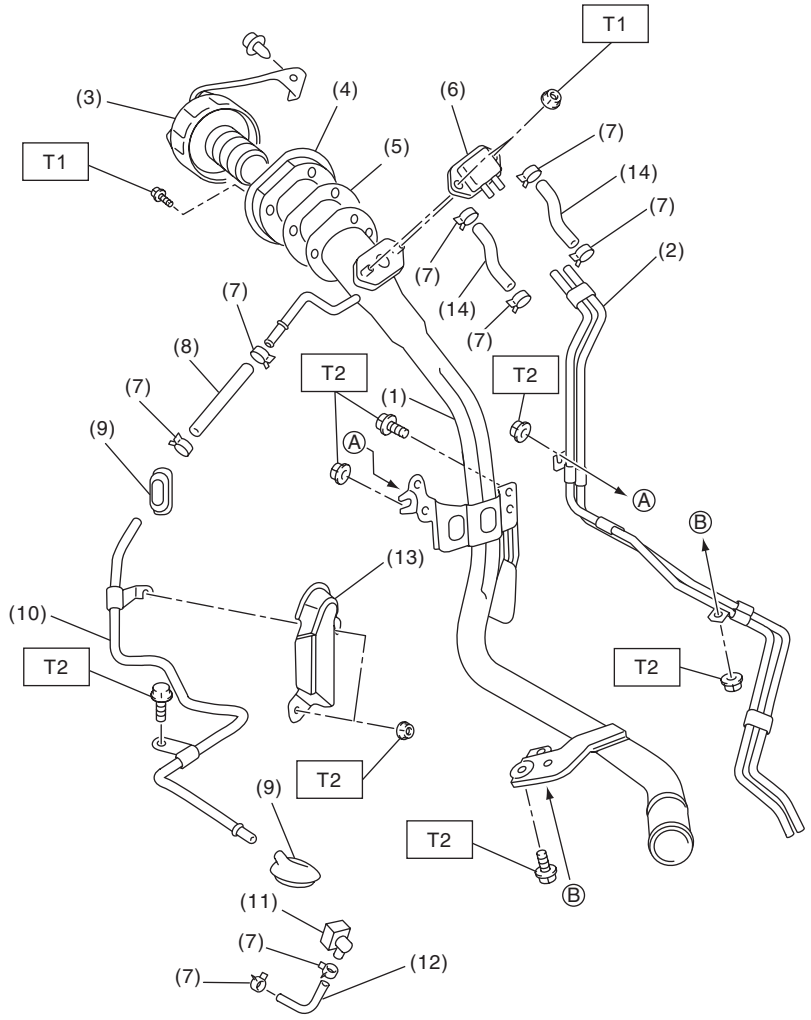

T4
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(11)
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(8)
(10)
(1)
(13)
FU-03433

(1) Clip
(2) Clamp
(3) Fuel delivery hose A
(4) Fuel delivery hose B
(5) Fuel damper
(6) Fuel damper holder
(7) Evaporation hose A
(8) Evaporation hose B
(9) Clamp
(10) Purge damper valve
(11) Purge damper valve bracket A
(12) Purge damper valve bracket B
(13) Fuel pipe ASSY
(14) Canister
(15) PCV drain tube
(16) Drain tube A
(17) Vent tube
(18) Purge tube
(19) Drain valve
(20) Drain valve bracket
(21) Drain tube B
(22) Pressure control solenoid valve
(23) Pressure control solenoid valve bracket A
(24) Pressure control solenoid valve bracket B
(25) Evaporation hose A
(26) Evaporation hose B
(27) Evaporation hose C
(28) Evaporation hose D
(29) Evaporation hose E
(30) Canister drain hose
(31) Canister cover LH
(32) Center canister cover
(33) Canister cover RH
(34) Fuel filler hose
(35) Fuel tank pressure sensor
(36) Fuel tank pressure sensor bracket A
(37) Fuel tank pressure sensor bracket B
(38) Pressure hose
(39) Vacuum hose
(40) Clamp

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1.25 (0.1, 0.9)
T2: 7.5 (0.8, 5.5)
T3: 8 (0.8, 5.9)
T4: 18 (1.8, 13.3)

6. FUEL FILLER PIPE

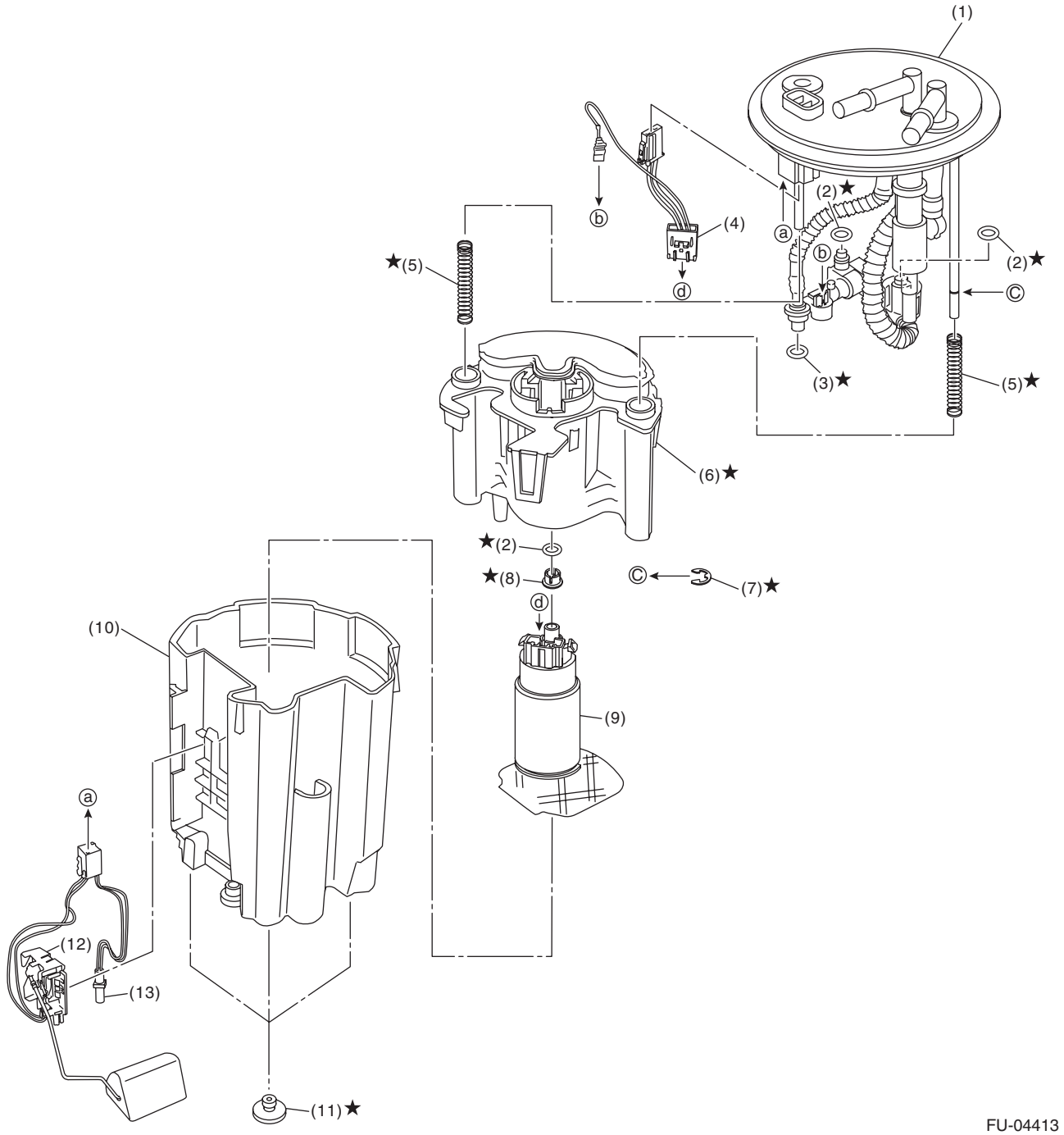


FU-04295

(1) Fuel filler pipe ASSY
(2) Evaporation pipe A
(3) Fuel filler cap
(4) Filler ring
(5) Filler pipe gasket
(6) Shut valve
(7) Clip
(8) Evaporation hose A
(9) Grommet
(10) Evaporation pipe B
(11) Quick connector
(12) Evaporation hose B
(13) Evaporation pipe protector
(14) Evaporation hose C

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.4 (0.4, 3.2)
T2: 7.5 (0.8, 5.5)

7. FUEL PUMP



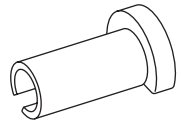
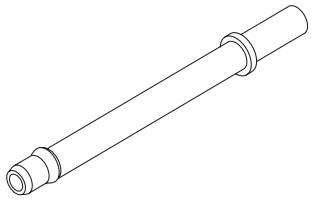
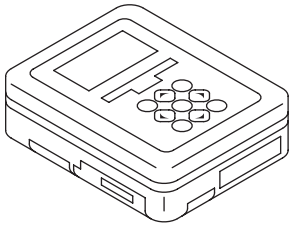
(1)	Sub tank bracket ASSY	(6)	Fuel filter	(11)	Cushion
(2)	O-ring	(7)	Clip	(12)	Fuel level sensor
(3)	O-ring	(8)	Spacer	(13)	Fuel temperature sensor
(4)	Fuel pump harness	(9)	Pump ASSY		
(5)	Spring	(10)	Sub tank		

C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• 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.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
• Place “NO OPEN FLAMES” signs near the working area.
• Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
• Follow all government and local regulations concerning disposal of refuse when disposing fuel.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing the quick connector.
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for draining fuel.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for draining fuel and each inspection.

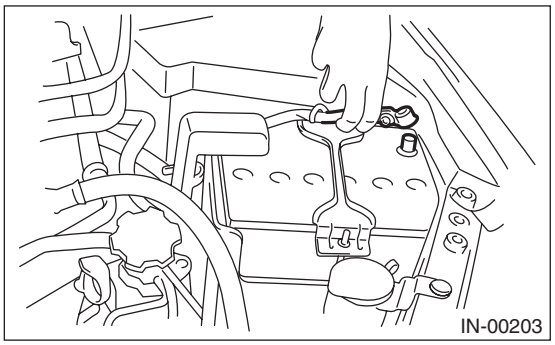
2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Oscilloscope	Used for inspecting the waveform of each sensor.

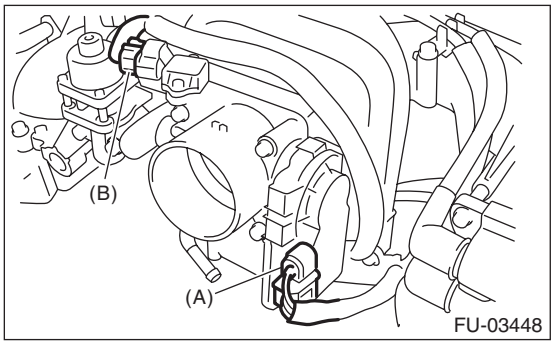
2. Throttle Body

A: REMOVAL

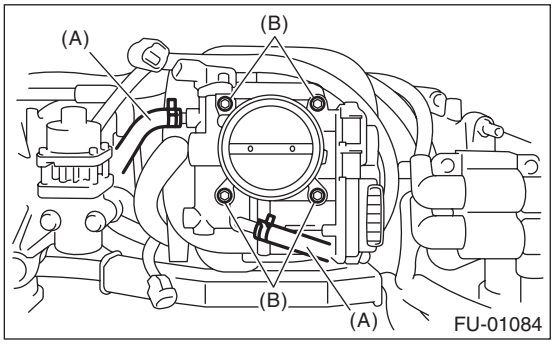
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.



3) Lift up the vehicle.
4) Remove the under cover.
5) Drain approximately 3.0 ℓ (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
6) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
7) Disconnect the throttle position sensor connector (A) and manifold absolute pressure sensor connector (B).



8) Disconnect the engine coolant hoses (A) from throttle body.
9) Remove the bolts (B) which secure the throttle body to the intake manifold, and remove the throttle body.



B: INSTALLATION

Install in the reverse order of removal.

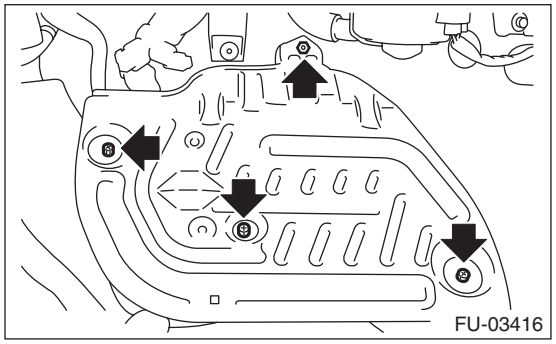
NOTE:
Use a new gasket.

Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)

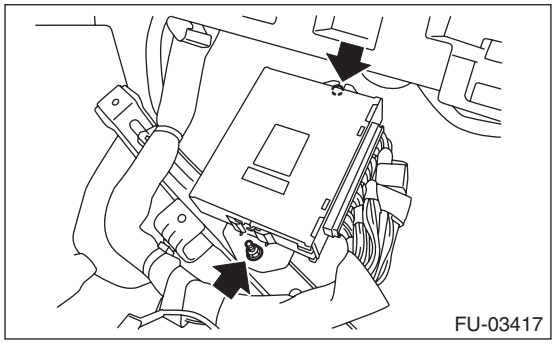
C: INSPECTION

1. THROTTLE SENSOR (METHOD WITH CIRCUIT TESTER)

1) Remove the lower inner trim of passenger's side. <Ref. to EI-55, REMOVAL, Lower Inner Trim.>
2) Turn over the floor mat of passenger's seat.
3) Remove the protect cover.

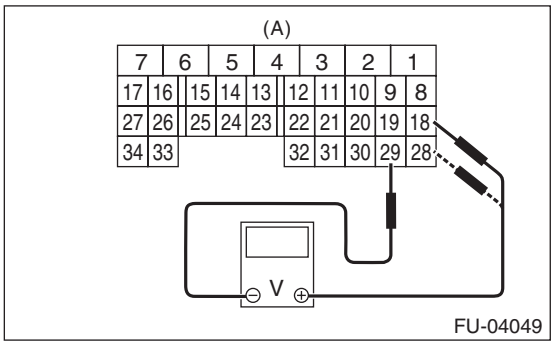


4) Remove the nuts and bolts which hold the ECM to the bracket.



5) Turn the ignition switch to ON. (engine OFF)

6) Measure the voltage between ECM connector terminals.



(A) To ECM connector

Throttle sensor	Accelerator pedal	Terminal No.	Standard
Main	Not depressed (Full closed)	18 (+) and 29 (–)	Approx. 0.6 V
	Depressed (Full opened)		Approx. 3.96 V
Sub	Not depressed (Full closed)	28 (+) and 29 (–)	Approx. 1.48 V
	Depressed (Full opened)		Approx. 4.17 V

2. THROTTLE SENSOR (METHOD WITH SUBARU SELECT MONITOR)

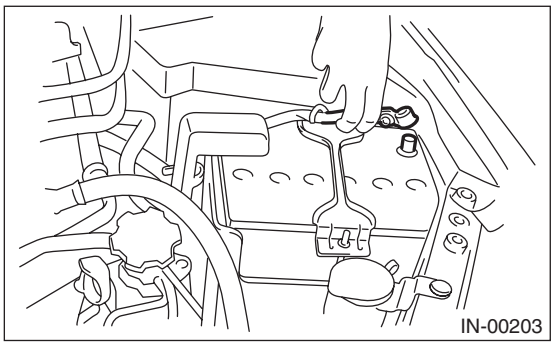
1) Turn the ignition switch to ON. (engine OFF)
2) Read the throttle opening angle signal and voltage of throttle sensor using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-35, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

Throttle sensor	Throttle opening angle signal	Standard
Main	0.0 %	Approx. 0.6 V
	100.0 %	Approx. 3.96 V
Sub	0.0 %	Approx. 1.48 V
	100.0 %	Approx. 4.17 V

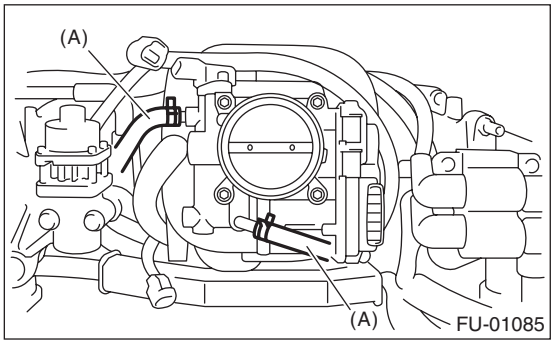
3. Intake Manifold

A: REMOVAL

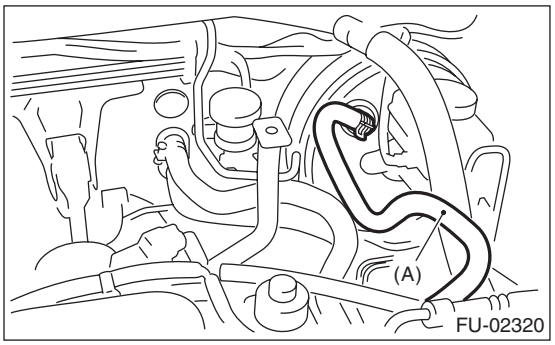
1) Set the vehicle on a lift.
2) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.



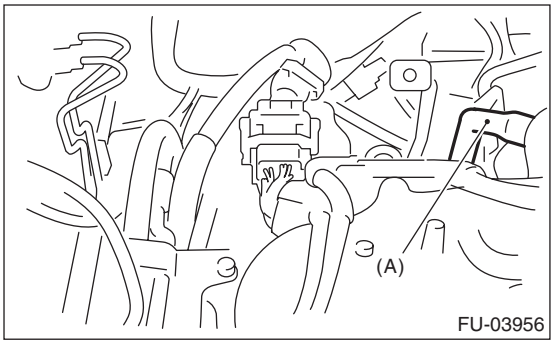
4) Open the fuel filler lid and remove the fuel filler cap.
5) Lift up the vehicle.
6) Remove the under cover RH.
7) Drain approximately 3.0 ℓ (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
8) Remove the air intake duct, air intake chamber and intake boot. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.> <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
9) Remove the generator. <Ref. to SC(H4SO)-16, REMOVAL, Generator.>
10) Disconnect the spark plug cord from the spark plug.
11) Disconnect the engine coolant hoses (A) from throttle body.



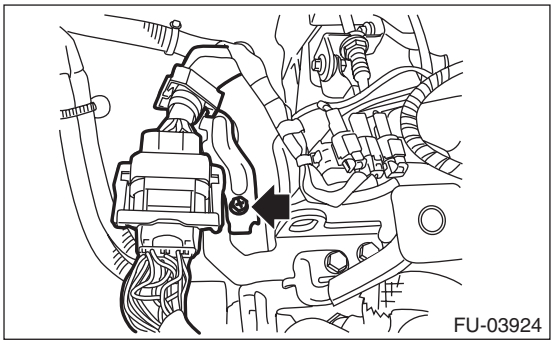
12) Disconnect the brake booster vacuum hose (A).



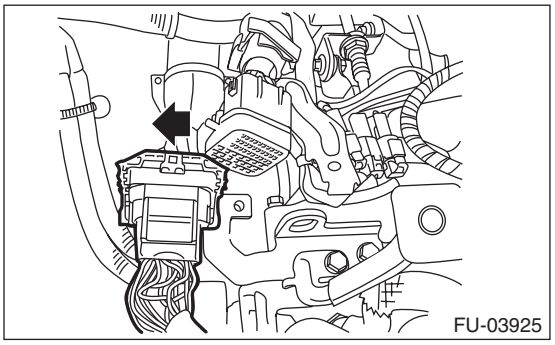
13) Disconnect the PCV hose (A) from intake manifold.



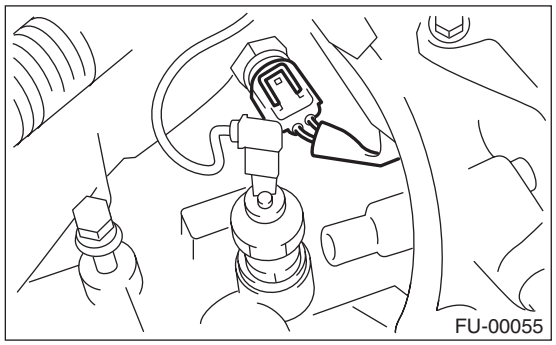
14) Remove the bolt, and disconnect the bulkhead harness connector from the engine harness connector and rear engine hanger.



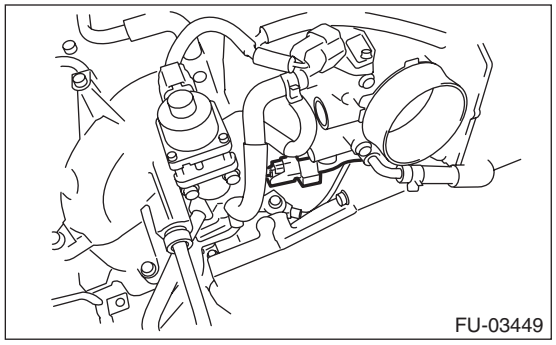
15) Slide the engine harness connector in the direction of the arrow and remove it from the rear engine hanger.



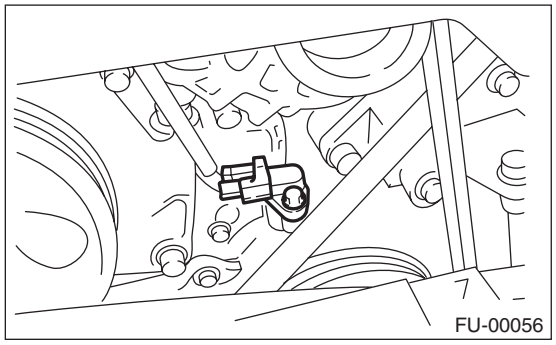
16) Disconnect the connectors from the engine coolant temperature sensor.



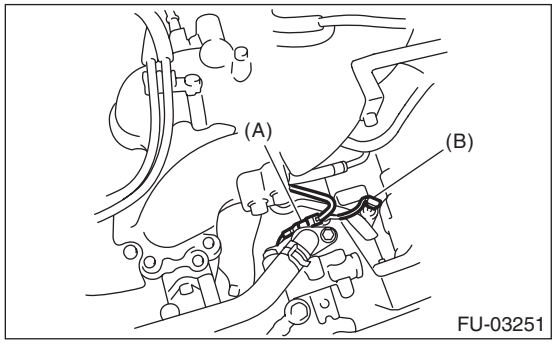
17) Disconnect the knock sensor connector.



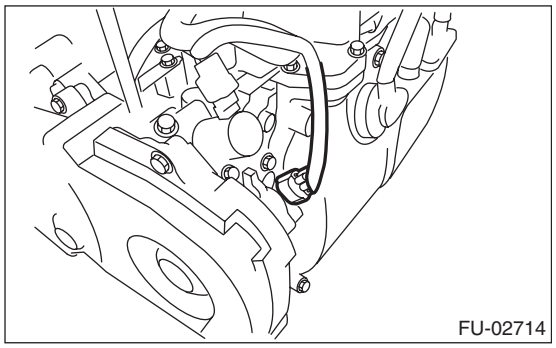
18) Disconnect the connector from crankshaft position sensor.



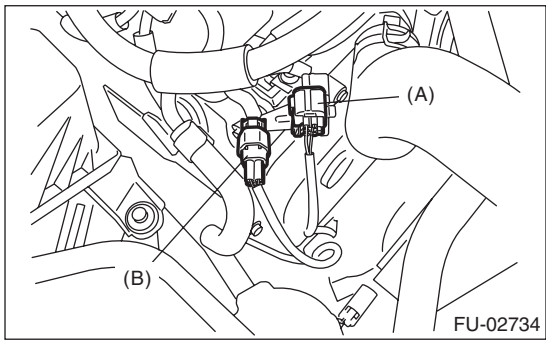
19) Disconnect the connector from power steering pump switch (A).
20) Disconnect the connector from the oil pressure switch (B).



21) Disconnect the connector from camshaft position sensor.

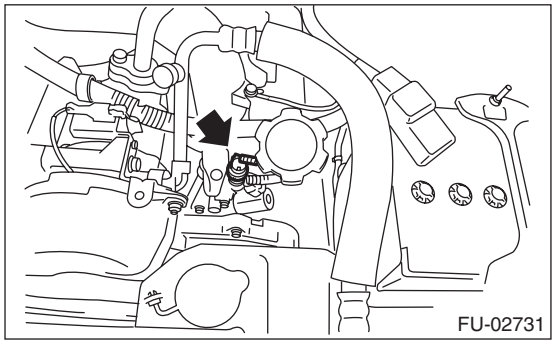


22) Disconnect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B).

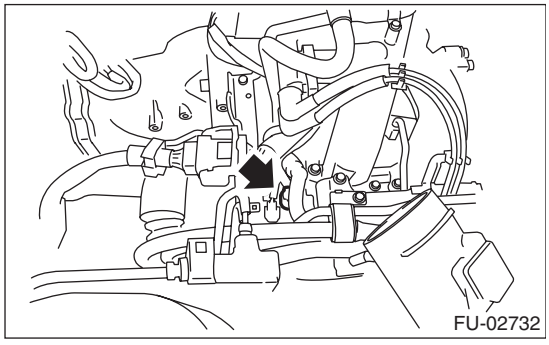


23) Disconnect the connector from the oil switching solenoid valve.
24) Disconnect the connector from the variable valve lift diagnosis oil pressure switch.

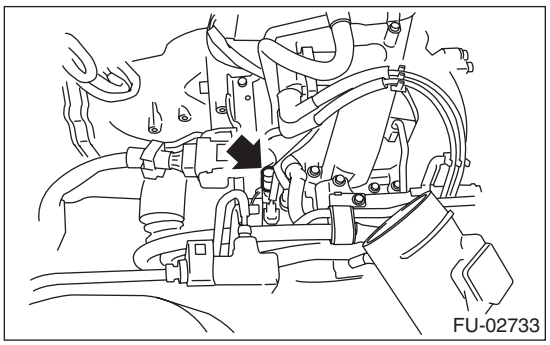
- LH side



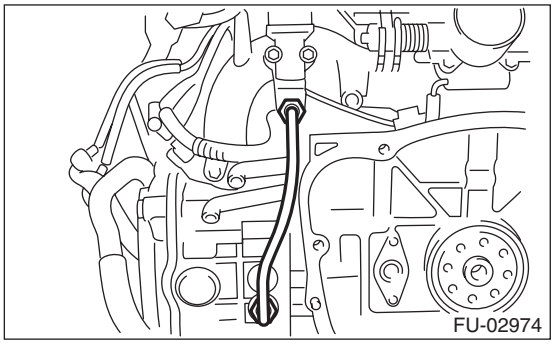
- RH side



25) Disconnect the connector from oil temperature sensor.



26) Remove the EGR pipe from intake manifold.

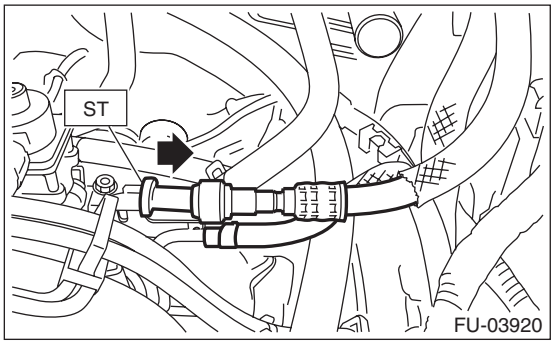


27) Disconnect the fuel hoses from the fuel pipe.
(1) Disconnect the quick connector of the fuel delivery hose by pushing the ST in the direction of the arrow.

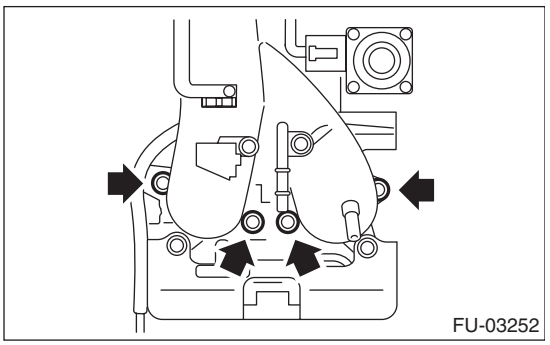
ST 42099AE000 QUICK CONNECTOR RELEASE

(2) Remove the clip and disconnect the evaporation hose from the fuel pipe.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**



28) Remove the intake manifold from cylinder head.

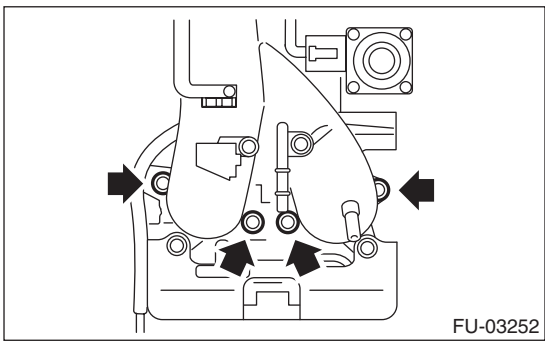


B: INSTALLATION

1) Install the intake manifold onto cylinder heads.

NOTE:
Use a new gasket.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

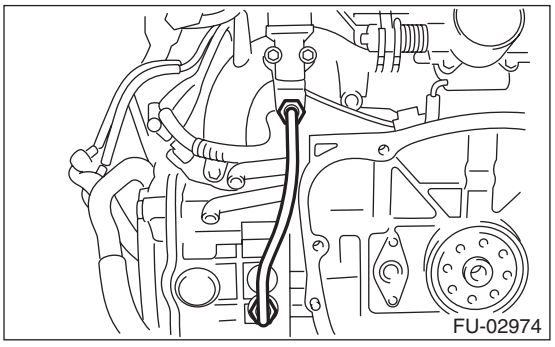


2) Connect the fuel delivery hose and evaporation hose to the fuel pipe. <Ref. to FU(H4SO)-76, INSTALLATION, Fuel Delivery and Evaporation Lines.>

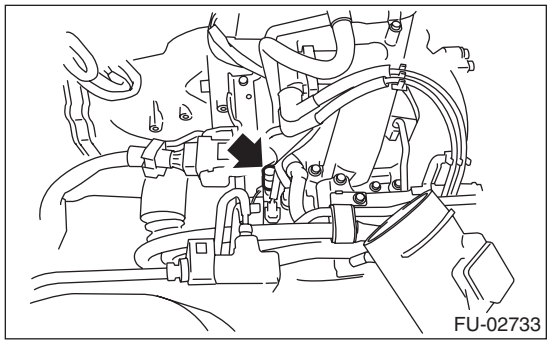
NOTE:
If fuel hoses or clamps are damaged, replace them with new parts.

3) Install the EGR pipe to intake manifold.

Tightening torque:
34 N·m (3.5 kgf-m, 25.1 ft-lb)

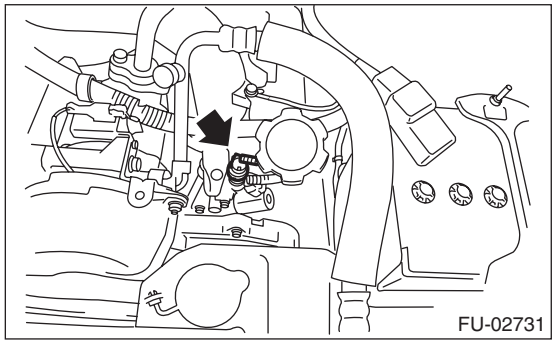


4) Connect the connector to the oil temperature sensor.

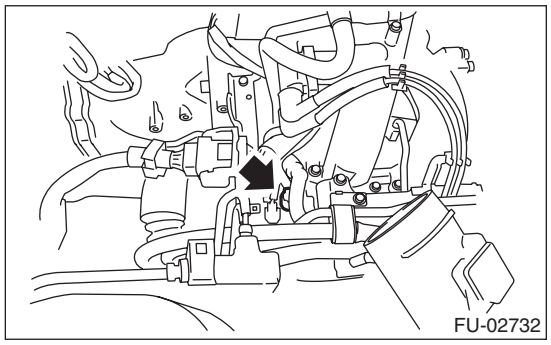


5) Connect the connector to the variable valve lift diagnosis oil pressure switch.

- LH side

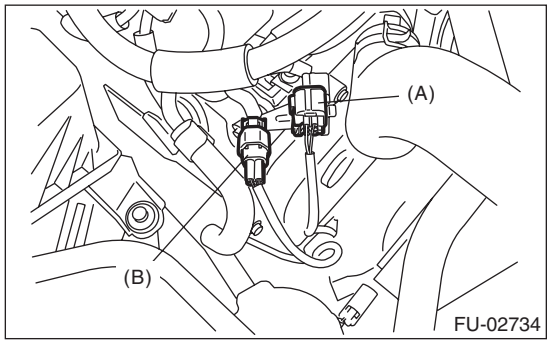


- RH side

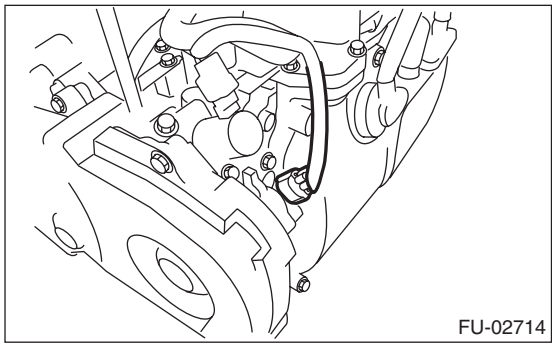


6) Connect the connector to oil switching solenoid valve.

7) Connect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B).

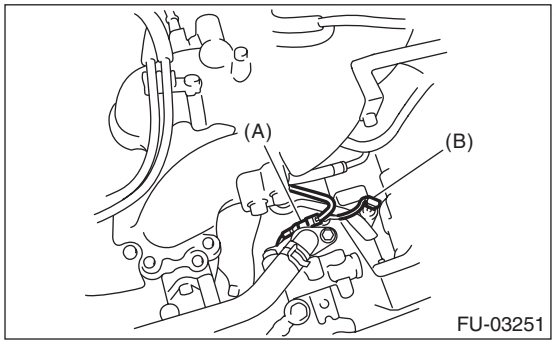


8) Connect the connectors to camshaft position sensor.

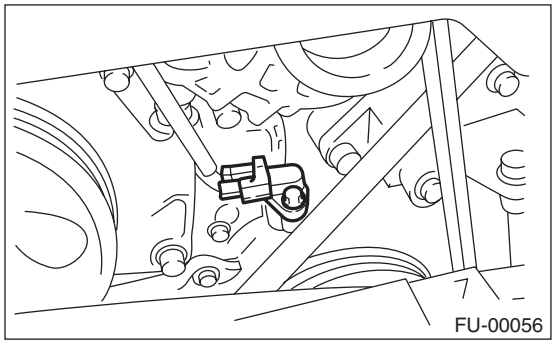


9) Connect the connector to the power steering pump switch (A).

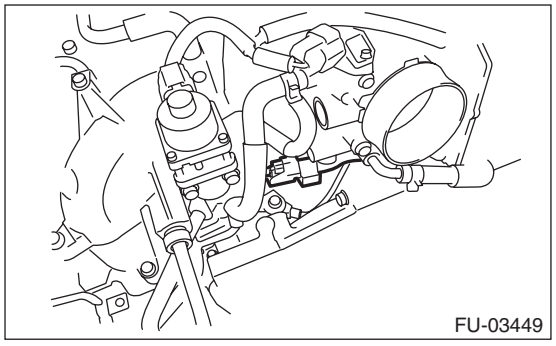
10) Connect the connector to the oil pressure switch (B).



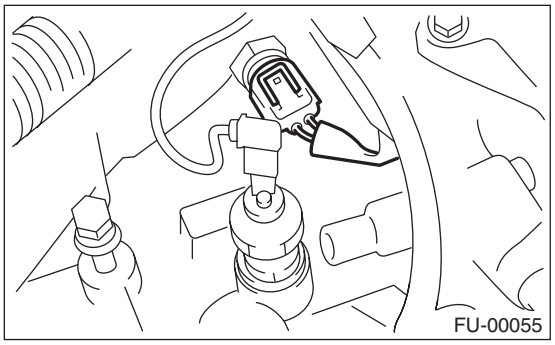
11) Connect the connector to crankshaft position sensor.



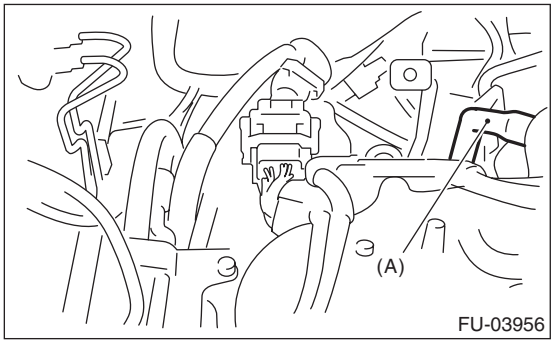
12) Connect the knock sensor connector.



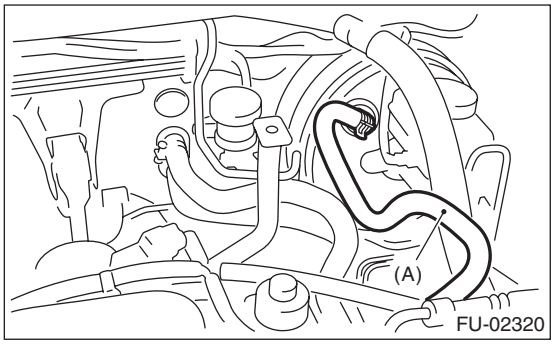
13) Connect the connector to engine coolant temperature sensor.



14) Connect the PCV hose (A) to intake manifold.

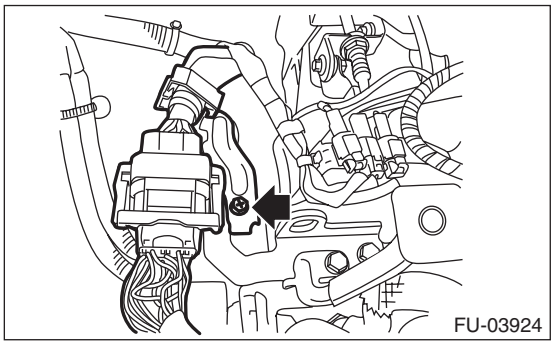


15) Connect the brake booster hose (A).

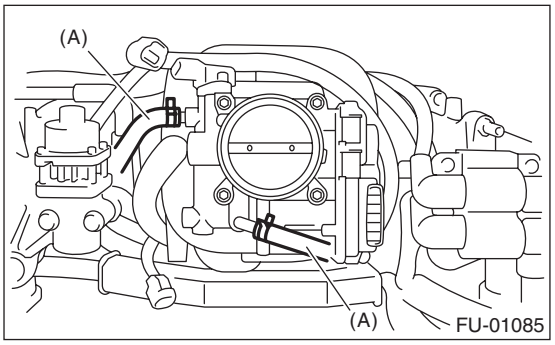


16) Connect the engine harness connector to the bulkhead harness connector and fasten to the rear engine hanger with bolt.

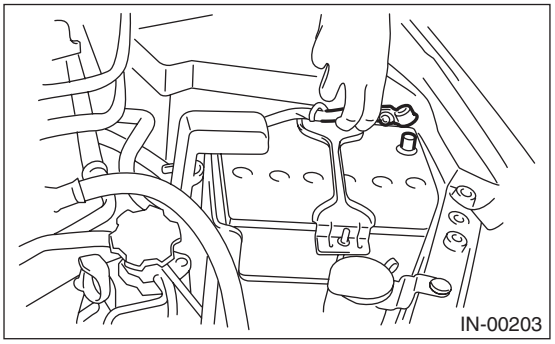
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



17) Connect the engine coolant hose (A) to throttle body.



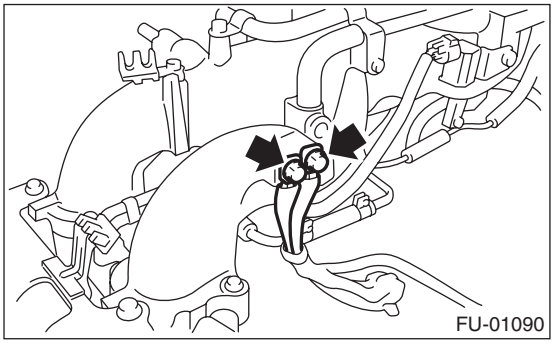
18) Connect the spark plug cords to spark plugs.
19) Install the generator. <Ref. to SC(H4SO)-16, INSTALLATION, Generator.>
20) Install the air intake duct, air intake chamber and intake boot. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
21) Connect the ground cable to battery.



22) Lift up the vehicle.
23) Install the under cover.
24) Lower the vehicle.
25) Fill engine coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

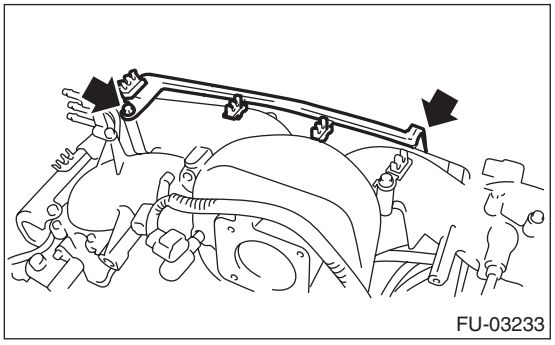
C: DISASSEMBLY

1) Disconnect the engine ground terminal from the intake manifold.

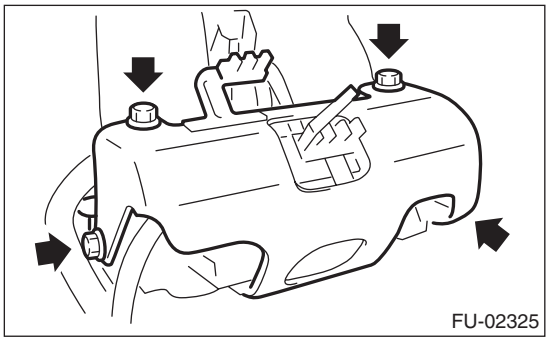


2) Remove the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, REMOVAL, Ignition Coil and Ignitor Assembly.>

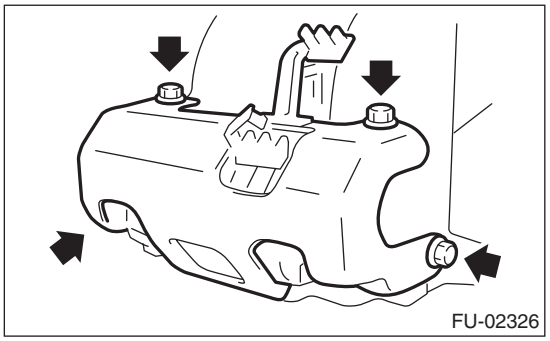
3) Remove the throttle body. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.>
4) Remove the EGR valve. <Ref. to FU(H4SO)-35, REMOVAL, EGR Valve.>
5) Remove the plug cord stay.


FU-03233

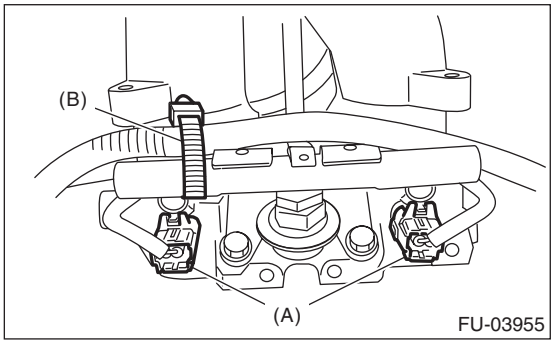
6) Remove the fuel pipe protector LH.


FU-02325

7) Remove the fuel pipe protector RH.

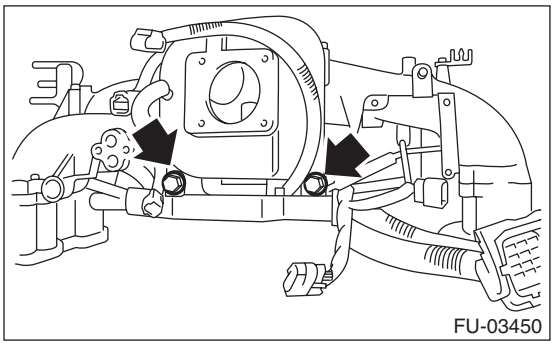

FU-02326

8) Disconnect the connectors (A) from fuel injector.
9) Remove the harness band (B) which holds the engine harness to the fuel injector pipe.



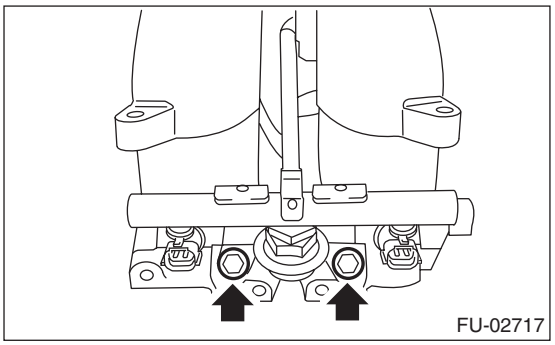
FU-03955

10) Remove the purge control solenoid valve. <Ref. to EC(H4SO)-9, REMOVAL, Purge Control Solenoid Valve.>
11) Remove the bolts which hold engine harness onto intake manifold.

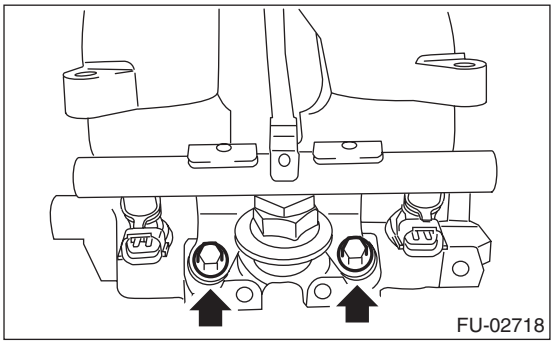

FU-03450

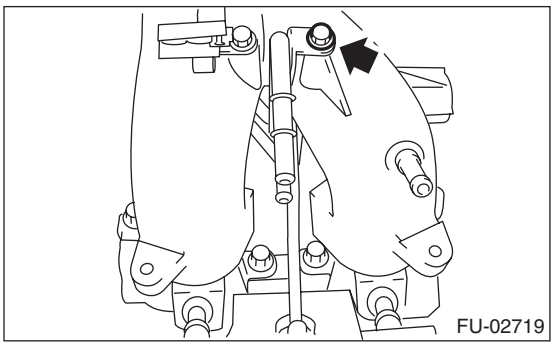
12) Remove the engine harness from intake manifold.
13) Remove the bolts which hold fuel injector pipe on the intake manifold as shown in the figure.

- RH side


FU-02717

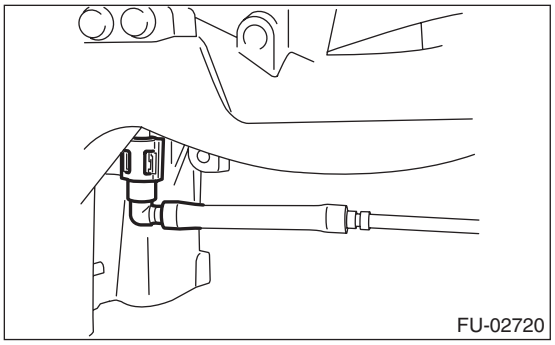
- LH side


FU-02718

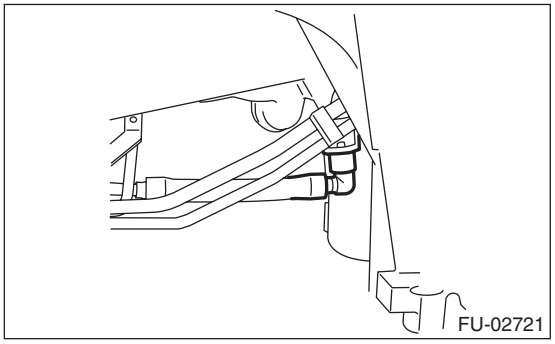

FU-02719

14) Remove the fuel injectors from the fuel injector pipe.

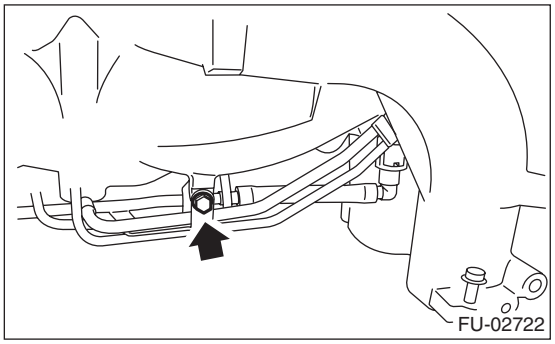
15) Disconnect the quick connector which hold the fuel injector pipe RH to the fuel pipe.



16) Disconnect the quick connector which hold the fuel injector pipe LH to the fuel pipe.



17) Remove the fuel injector pipe RH and LH.
18) Remove the bolts which hold fuel pipe onto intake manifold.



19) Remove the fuel pipe from intake manifold.

D: ASSEMBLY

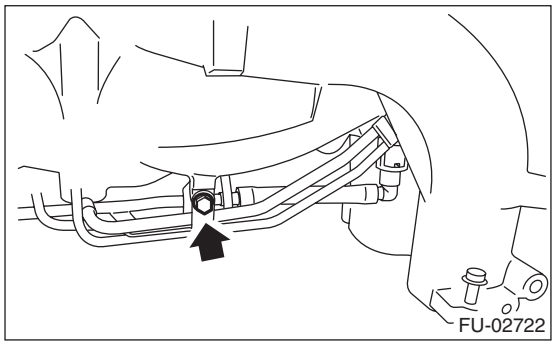
NOTE:
When assembling the nipple, apply liquid gasket.

Liquid gasket:
THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:
17 N·m (1.7 kgf-m, 12.5 ft-lb)

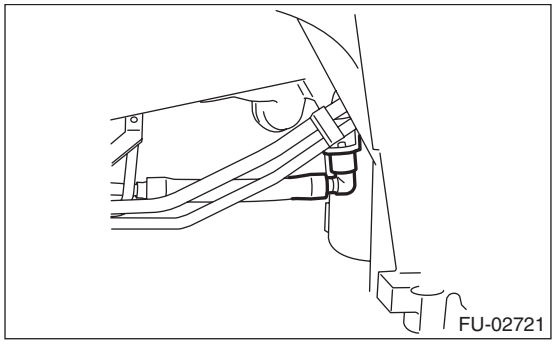
1) Secure the fuel pipe to intake manifold with bolts.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



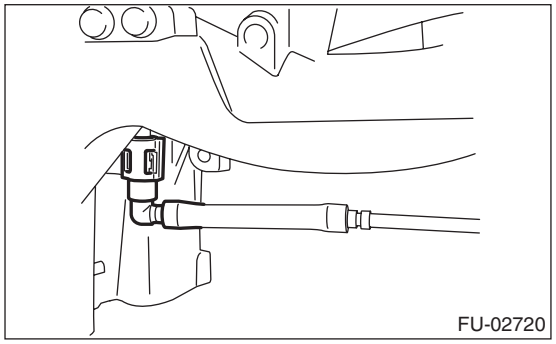
2) Connect the fuel pipe LH to the fuel pipe.

NOTE:
Connect the quick connector securely.



3) Connect the fuel pipe RH to the fuel pipe.

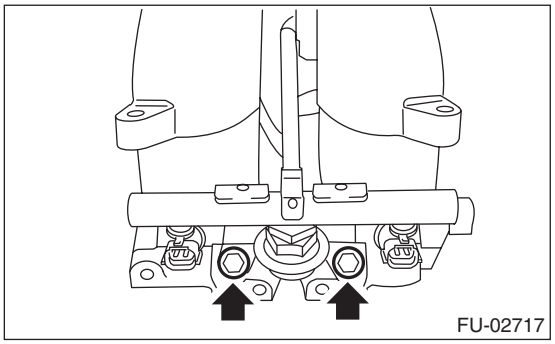
NOTE:
Connect the quick connector securely.



4) Install the fuel injector.
5) Secure the fuel injector pipe to intake manifold with bolts.

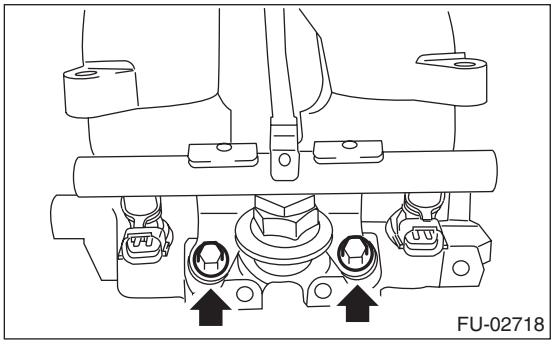
- RH side

Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)

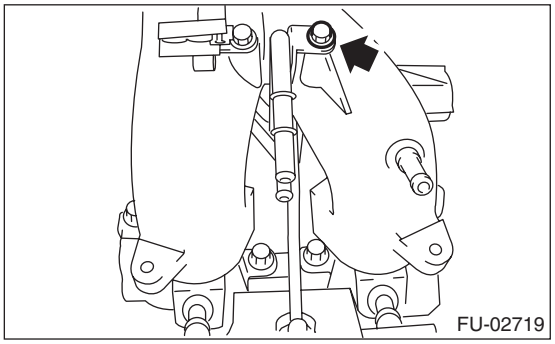


- LH side

Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)

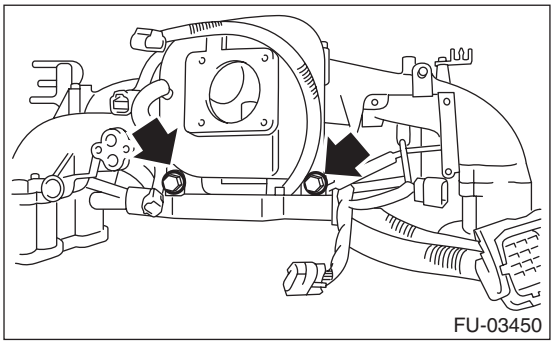


Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

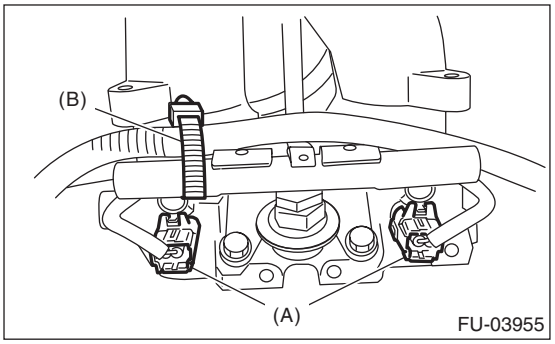


6) Install the engine harness to the intake manifold.
7) Secure the engine harness to intake manifold with bolts.

Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)

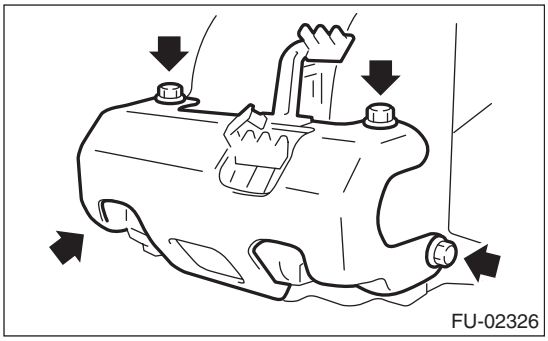


8) Install the purge control solenoid valve. <Ref. to EC(H4SO)-9, INSTALLATION, Purge Control Solenoid Valve.>
9) Connect the connectors (A) to fuel injector.
10) Hold the engine harness to fuel injector pipe by harness band (B).



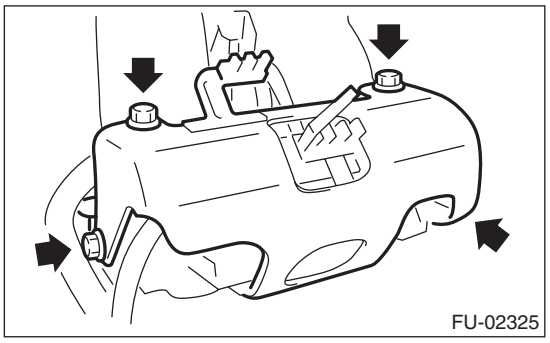
11) Install the fuel pipe protector RH.

Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)



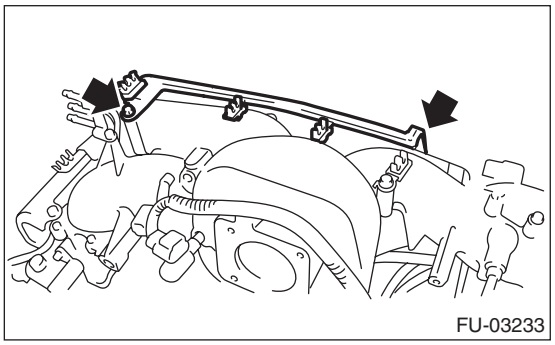
12) Install the fuel pipe protector LH.

Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)



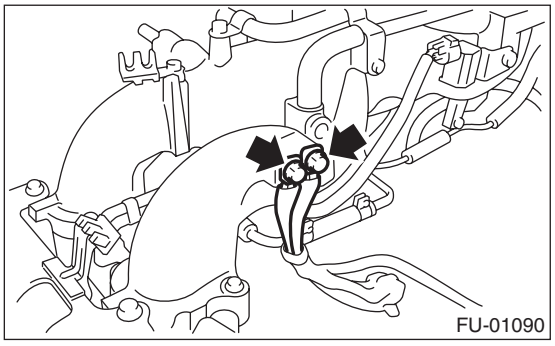
13) Install the plug cord stay.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



14) Install the EGR valve. <Ref. to FU(H4SO)-35, INSTALLATION, EGR Valve.>
15) Install the throttle body to the intake manifold. <Ref. to FU(H4SO)-14, INSTALLATION, Throttle Body.>
16) Install the ignition coil and ignitor assembly. <Ref. to IG(H4SO)-6, INSTALLATION, Ignition Coil and Ignitor Assembly.>
17) Install the engine ground terminal to intake manifold.

Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)



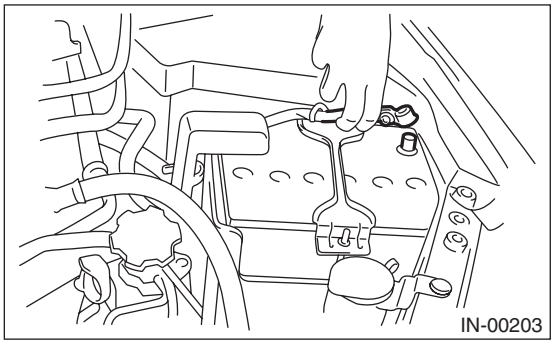
E: INSPECTION

Make sure the fuel pipe and fuel hoses are not damaged and the connections are tightened firmly.

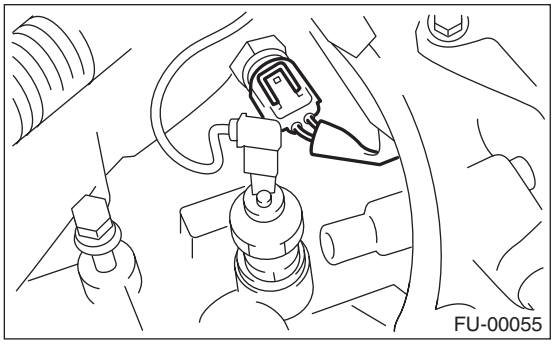
4. Engine Coolant Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the generator. <Ref. to SC(H4SO)-16, REMOVAL, Generator.>
3) Drain engine coolant. <Ref. to CO(H4SO)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the connectors from the engine coolant temperature sensor.



5) Remove the engine coolant temperature sensor.

B: INSTALLATION

Install in the reverse order of removal.

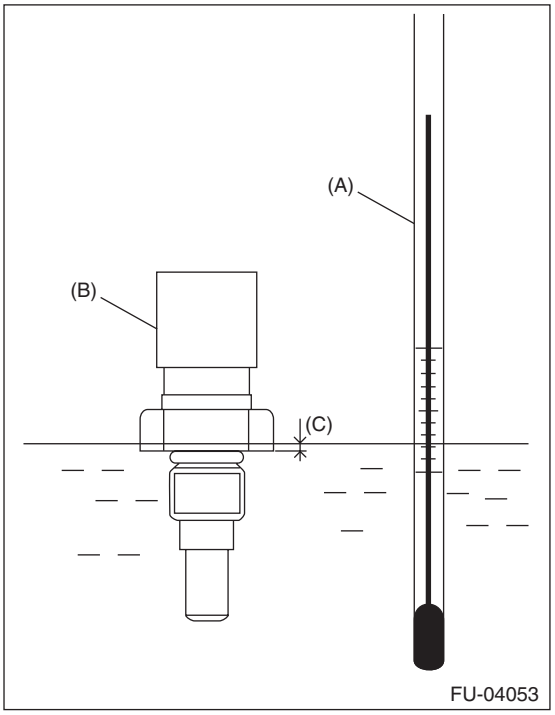
NOTE:
Use a new gasket.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

C: INSPECTION

1) Immerse the engine coolant temperature sensor and a thermometer in water.

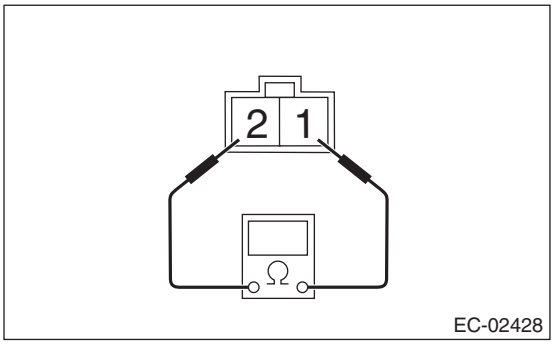
CAUTION:
Take care not to allow water to get into the engine coolant temperature sensor connector. Completely remove any water inside.



(A) Thermometer
(B) Engine coolant temperature sensor
(C) Hexagonal part height: To approx. $^1/_3$

2) Raise water temperature gradually, measure the resistance between the engine coolant temperature sensor terminals when the temperature is 20°C (68°F) and 80°C (176°F).

NOTE:
Agitate the water for even temperature distribution.

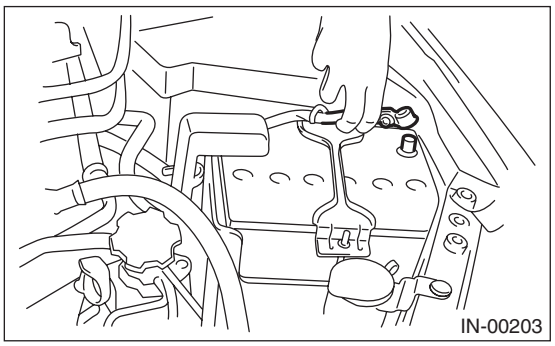


Water temperature	Terminal No.	Standard
20°C (68°F)	1 and 2	2.45±0.2 kΩ
80°C (176°F)		0.318±0.013 kΩ

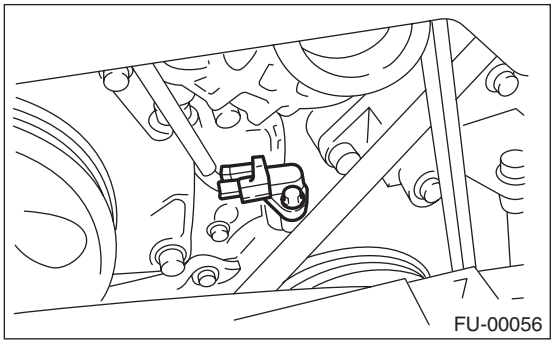
5. Crankshaft Position Sensor

A: REMOVAL

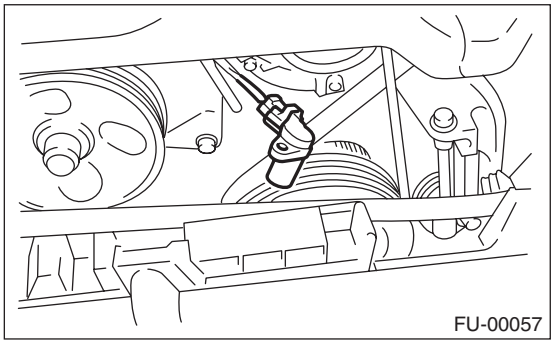
1) Disconnect the ground cable from battery.



2) Remove the bolt which secures crankshaft position sensor to cylinder block.



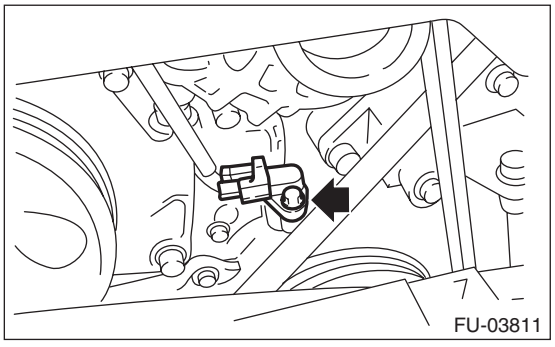
3) Remove the crankshaft position sensor, and then disconnect the connector from it.



B: INSTALLATION

Install in the reverse order of removal.

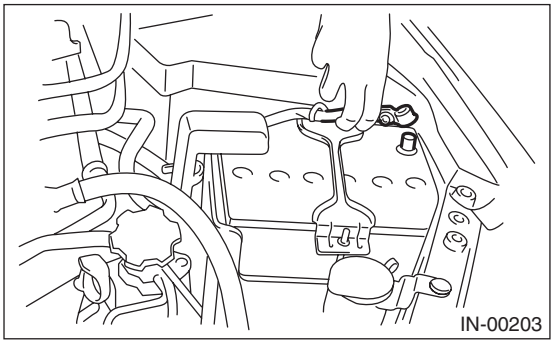
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



C: INSPECTION

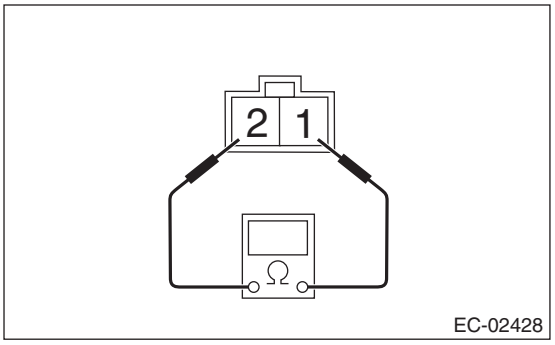
1. CRANKSHAFT POSITION SENSOR (METHOD WITH CIRCUIT TESTER)

1) Disconnect the ground cable from battery.



2) Remove the crankshaft position sensor. <Ref. to FU(H4SO)-26, REMOVAL, Crankshaft Position Sensor.>

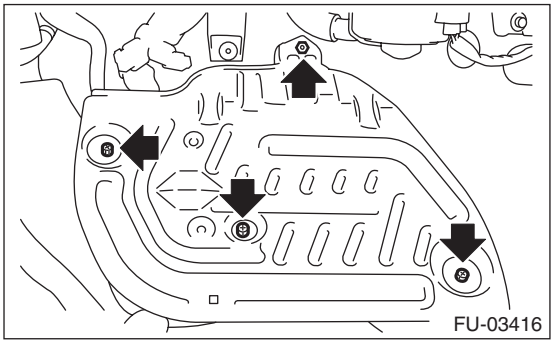
3) Measure the resistance between crankshaft position sensor terminals.



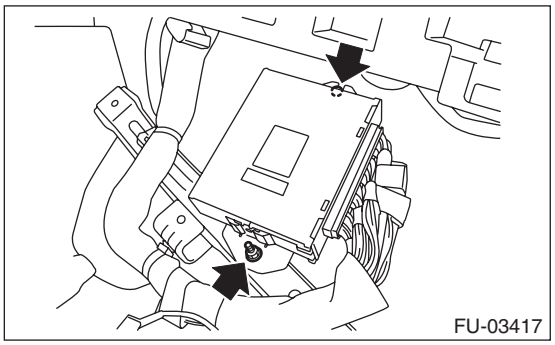
Terminal No.	Standard
1 and 2	2.04±0.204 kΩ

2. CRANKSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

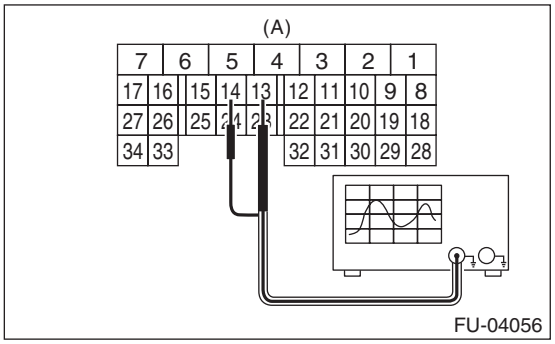
1) Prepare an oscilloscope.
2) Remove the glove box lower cover. <Ref. to EI-47, REMOVAL, Glove Box.>
3) Remove the lower inner trim of passenger's side. <Ref. to EI-55, REMOVAL, Lower Inner Trim.>
4) Turn over the floor mat of passenger's seat.
5) Remove the protect cover.



6) Remove the nuts and bolts which hold the ECM to the bracket.



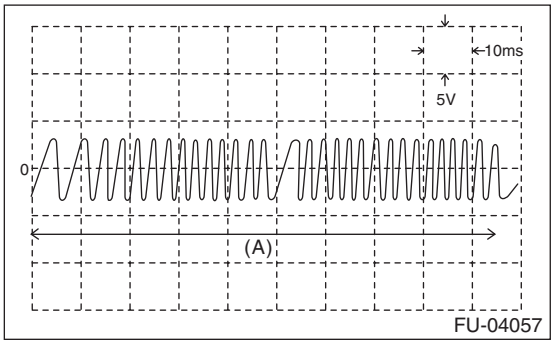
7) Connect the probe to ECM connector.



(A) To ECM connector

Terminal No.	Probe
13	+
14	–

8) Start the engine and let it idle.
9) Check the pattern is the same as the waveform and voltage shown below.

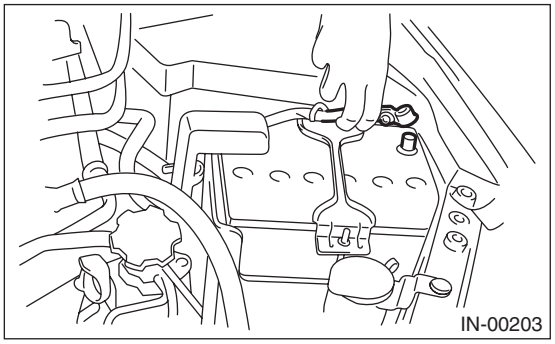


(A) One crankshaft rotation

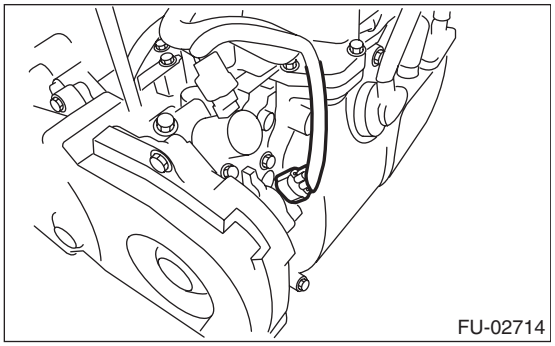
6. Camshaft Position Sensor

A: REMOVAL

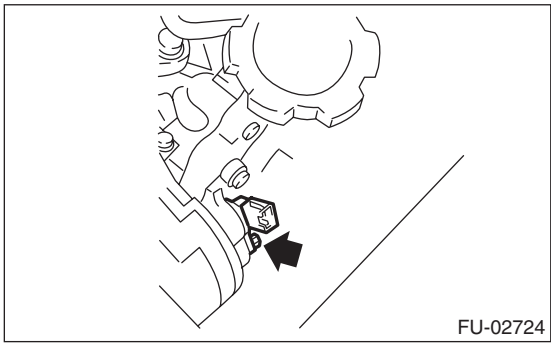
1) Disconnect the ground cable from battery.



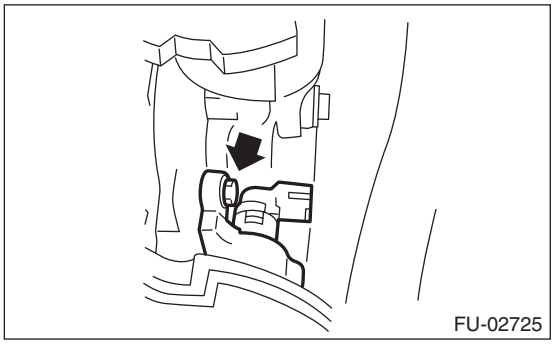
2) Disconnect the connector from camshaft position sensor.



3) Remove the bolt which secures camshaft position sensor to camshaft position sensor support.

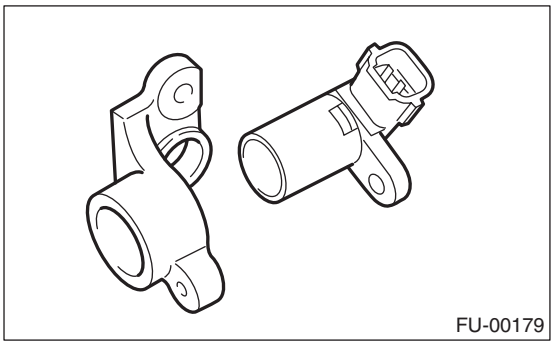


4) Remove the bolt which secures camshaft position sensor support to camshaft cap LH.



5) Remove the camshaft position sensor and the camshaft position sensor support as a unit.

6) Remove the camshaft position sensor from the camshaft position sensor support.



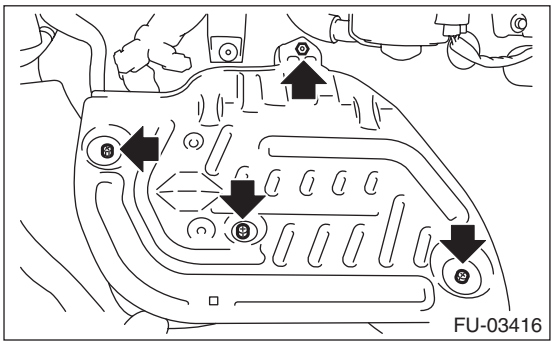
B: INSTALLATION

Install in the reverse order of removal.

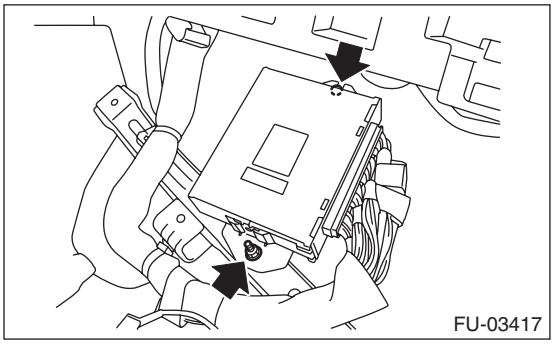
Tightening torque:
Camshaft position sensor support
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
Camshaft position sensor
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

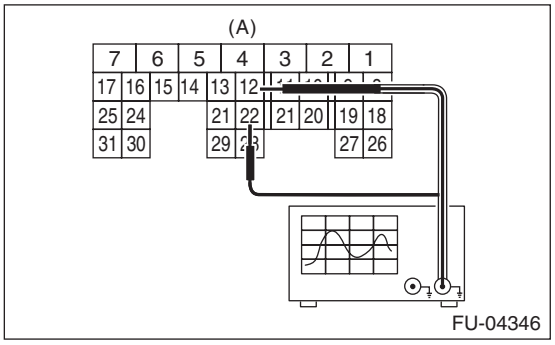
1) Prepare an oscilloscope.
2) Remove the lower inner trim of passenger's side. <Ref. to EI-55, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.



5) Remove the nuts and bolts which hold the ECM to the bracket.



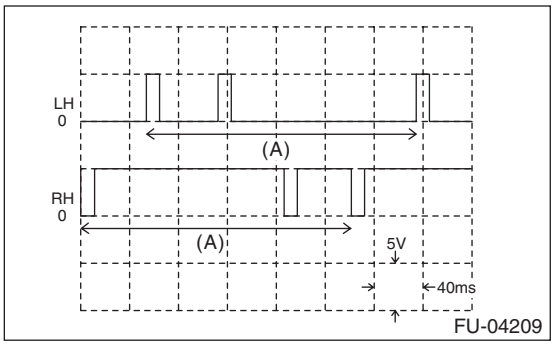
6) Connect the probe to ECM connector.



(A) To ECM connector

Terminal No.	Probe
12	+
22	–

7) Start the engine and let it idle.
8) Check the pattern is the same as the waveform and voltage shown below.

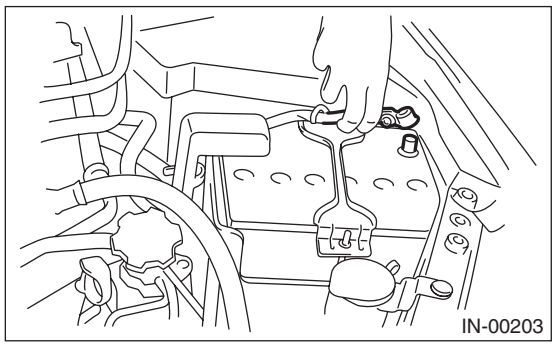


(A) One camshaft rotation

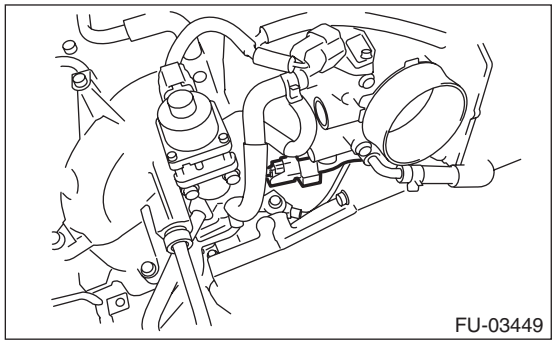
7. Knock Sensor

A: REMOVAL

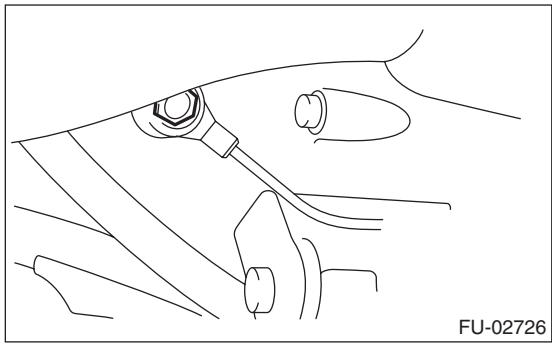
1) Disconnect the ground cable from battery.



2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
3) Disconnect the knock sensor connector.



4) Remove the knock sensor from cylinder block.

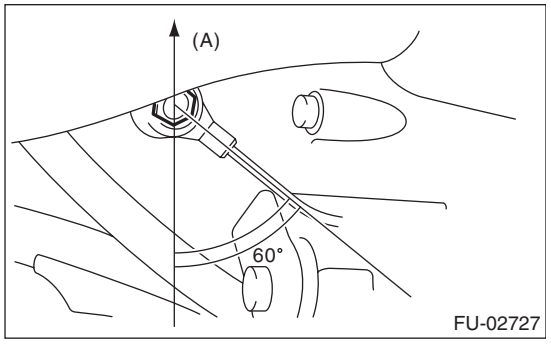


B: INSTALLATION

1) Install the knock sensor to the cylinder block.

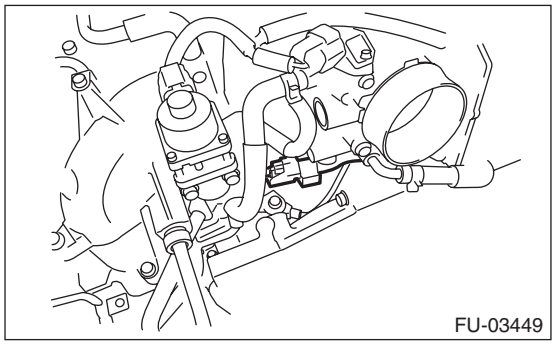
NOTE:
Extraction area of knock sensor cord must be positioned at a 60° angle relative to the engine rear.

Tightening torque:
24 N·m (2.4 kgf-m, 17.7 ft-lb)

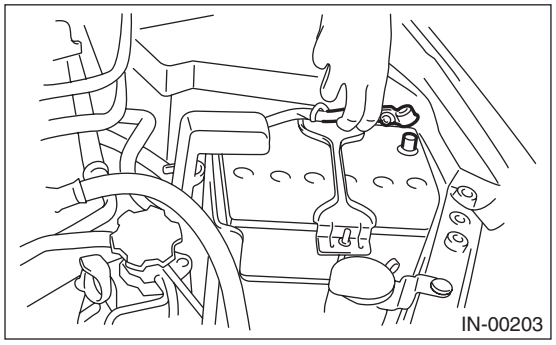


(A) Front side of vehicle

2) Connect the knock sensor connector.

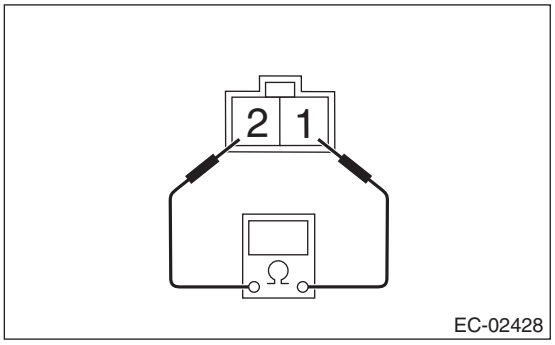


3) Install the air intake chamber. <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
4) Connect the ground cable to battery.



C: INSPECTION

Measure the resistance between knock sensor terminals.



Terminal No.	Standard
1 and 2	560±28 kΩ

8. Throttle Position Sensor

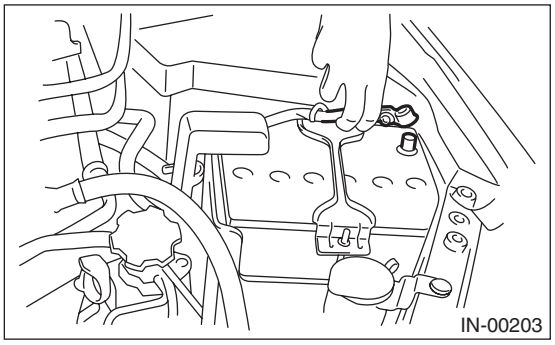
A: SPECIFICATION

Throttle body is a non-disassembled part, so do not remove the throttle position sensor from throttle body.
Refer to “Throttle Body” for removal and installation procedure. <Ref. to FU(H4SO)-14, REMOVAL, Throttle Body.> <Ref. to FU(H4SO)-14, INSTALLATION, Throttle Body.>

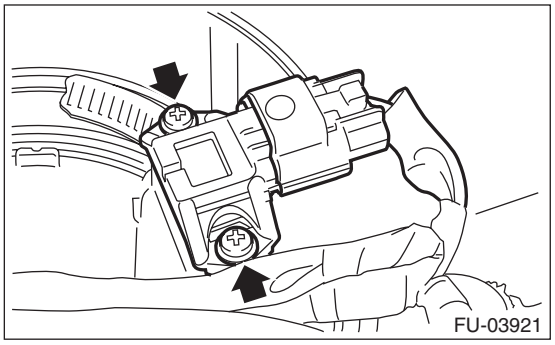
9. Manifold Absolute Pressure Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector from the manifold absolute pressure sensor and remove the manifold absolute pressure sensor from throttle body.



B: INSTALLATION

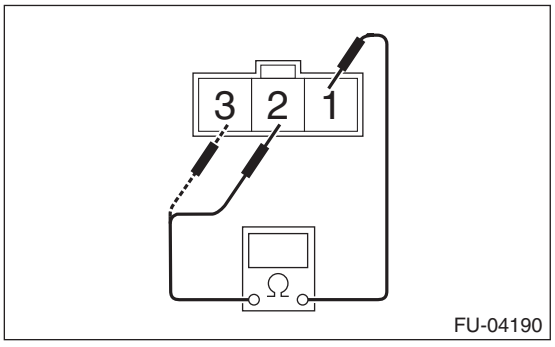
Install in the reverse order of removal.

NOTE:
Use new O-rings.

Tightening torque:
2 N·m (0.2 kgf-m, 1.5 ft-lb)

C: INSPECTION

Measure the resistance between manifold absolute pressure sensor.

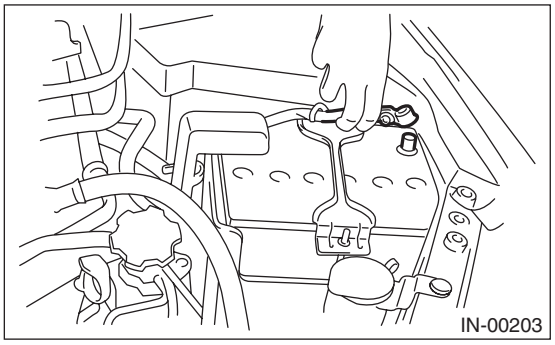


Terminal No.	Standard
1 and 2	3.5 kΩ or less
1 and 3	2.5 kΩ or less

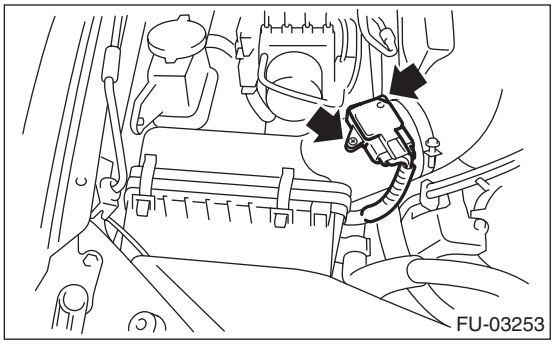
10.Mass Air Flow and Intake Air Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector from the mass air flow and intake air temperature sensor, and remove the mass air flow and intake air temperature sensor.



B: INSTALLATION

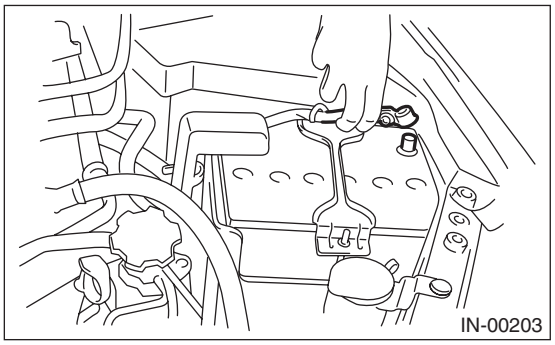
Install in the reverse order of removal.

Tightening torque:
1 N·m (0.1 kgf-m, 0.7 ft-lb)

C: INSPECTION

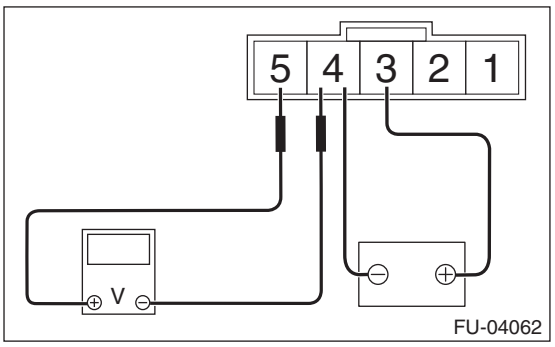
1. CHECK THE MASS AIR FLOW SENSOR UNIT

1) Disconnect the ground cable from battery.

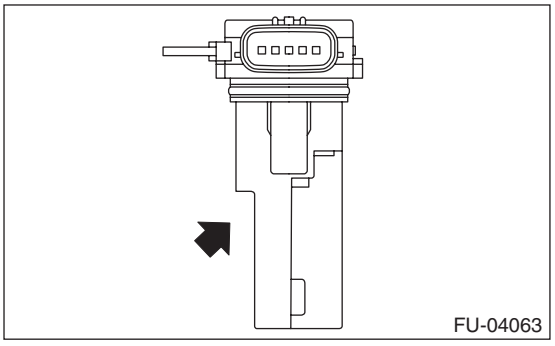


2) Remove the mass air flow and intake air temperature sensor. <Ref. to FU(H4SO)-34, REMOVAL, Mass Air Flow and Intake Air Temperature Sensor.>

3) Connect terminal No. 3 to the battery positive terminal and terminal No. 4 to the battery ground terminal, terminal No. 5 to the circuit tester positive terminal and No. 4 to the circuit tester ground terminal.

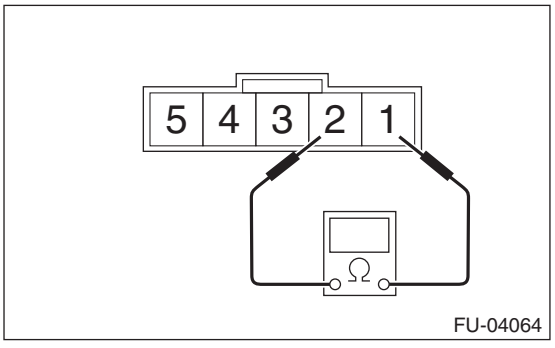


4) Check that the voltage changes when air is blown to the mass air flow sensor unit from arrow direction.



2. CHECK THE INTAKE AIR TEMPERATURE SENSOR UNIT

Measure the resistance between intake air temperature sensor terminals.



Temperature	Terminal No.	Standard
– 20°C (– 4°F)	1 and 2	16.0 ±2.4 kΩ
20°C (68°F)		2.45 ±0.24 kΩ
60°C (140°F)		0.580 ±0.087 kΩ

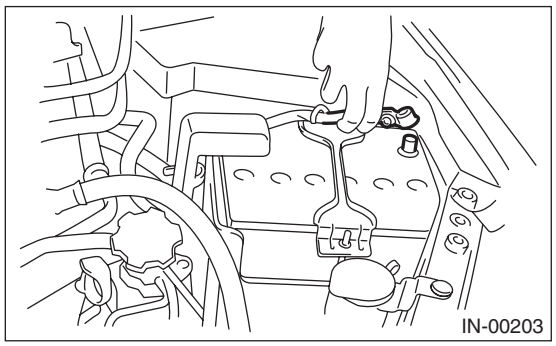
3. OTHER INSPECTIONS

Check the mass air flow and intake air temperature sensor for damage or dirt.

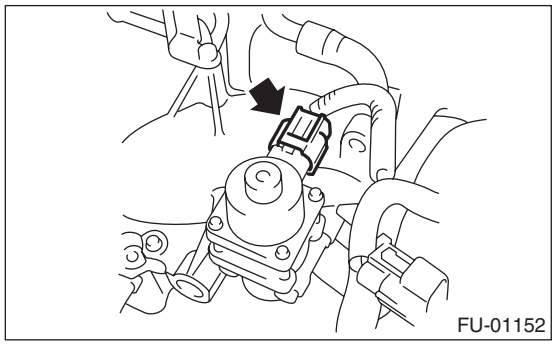
11.EGR Valve

A: REMOVAL

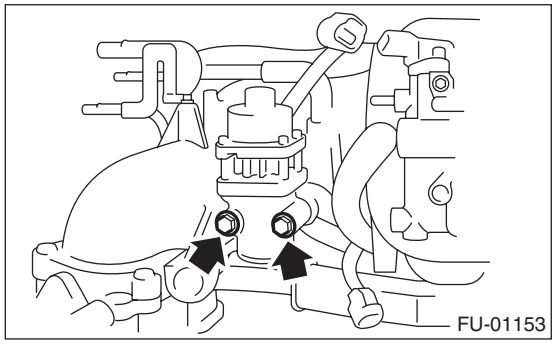
1) Disconnect the ground cable from battery.



2) Disconnect the connector from EGR valve.



3) Remove the EGR valve from intake manifold.



B: INSTALLATION

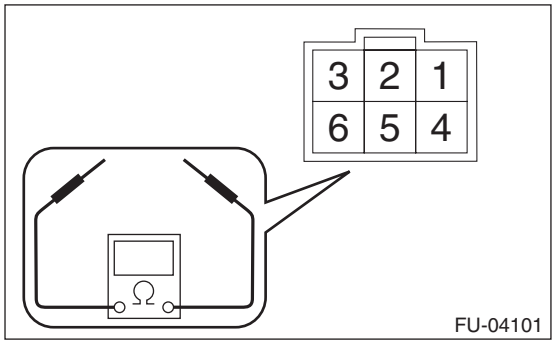
Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)

C: INSPECTION

1) Measure the resistance between EGR valve terminals.



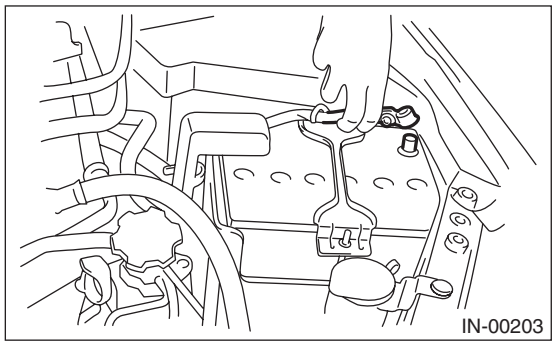
Terminal No.	Standard
2 and 1	22±2 Ω
2 and 3	22±2 Ω
5 and 4	22±2 Ω
5 and 6	22±2 Ω

12.Fuel Injector

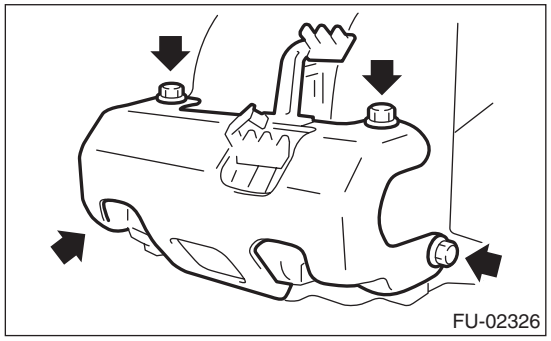
A: REMOVAL

1. RH SIDE

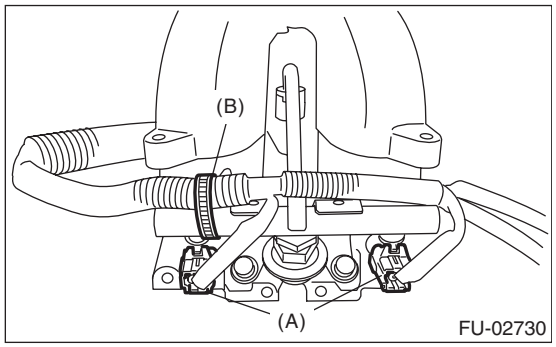
1) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



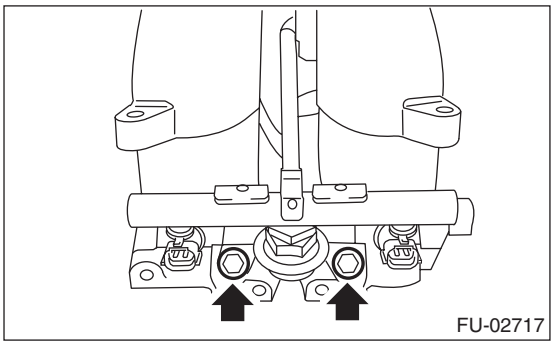
3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake boot.
5) Remove the spark plug cords from spark plugs (#1 and #3 cylinders).
6) Remove the fuel pipe protector RH.



7) Disconnect the connectors (A) from fuel injector.
8) Remove the harness band (B) which holds the engine harness to the fuel injector pipe.



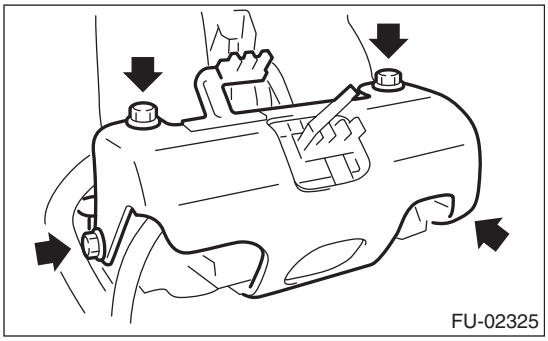
9) Remove the bolts which hold fuel injector pipe onto intake manifold.



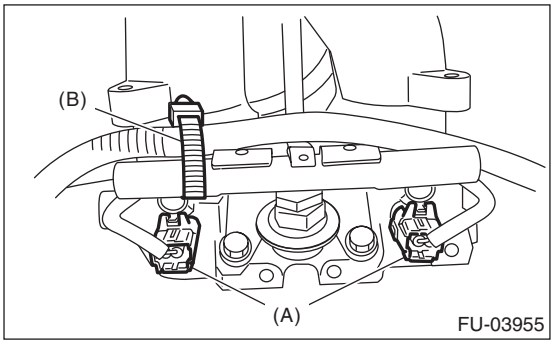
10) Remove the fuel injector while lifting up the fuel injector pipe.

2. LH SIDE

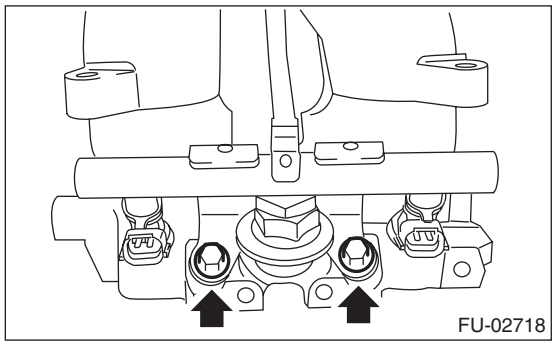
1) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Remove the battery. <Ref. to SC(H4SO)-22, REMOVAL, Battery.>
3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the spark plug cords from spark plugs (#2 and #4 cylinders).
5) Remove the fuel pipe protector LH.

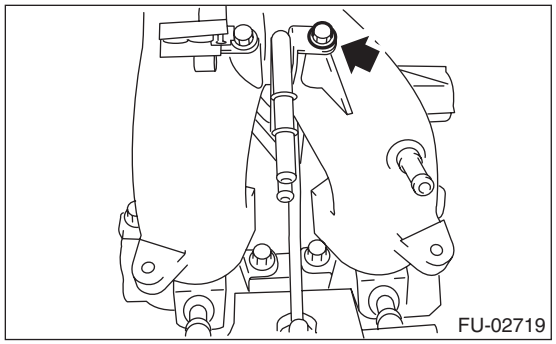


6) Disconnect the connectors (A) from fuel injector.
7) Remove the harness band (B) which holds the engine harness to the fuel injector pipe.



8) Remove the bolts which hold fuel injector pipe onto intake manifold.





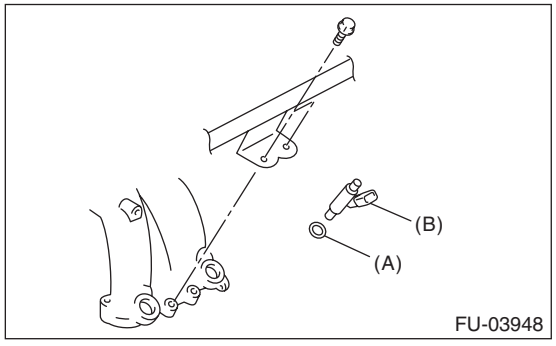
9) Remove the fuel injector while lifting up the fuel injector pipe.

B: INSTALLATION

1. RH SIDE

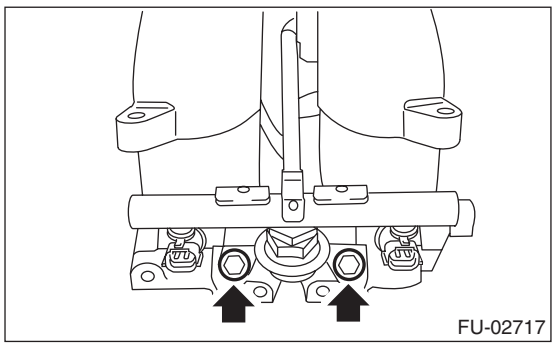
Install in the reverse order of removal.

NOTE:
Use new O-rings.

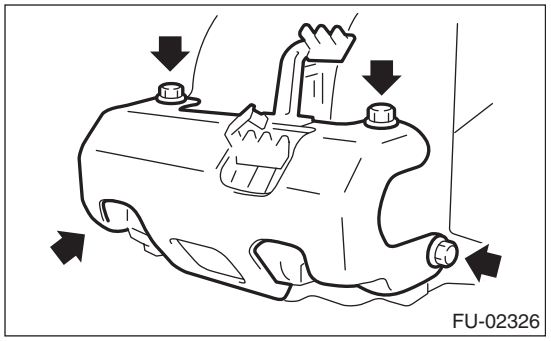


(A) O-ring
(B) Fuel injector

Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)



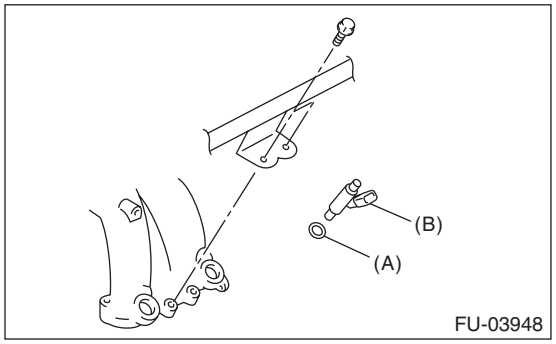
Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)



2. LH SIDE

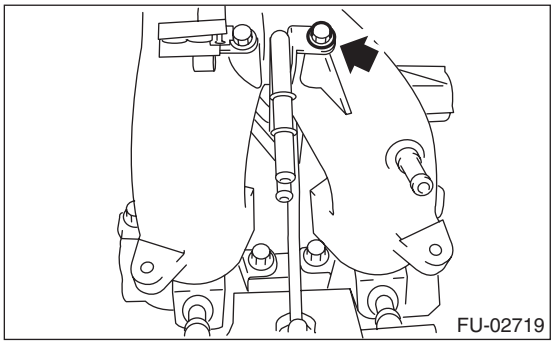
Install in the reverse order of removal.

NOTE:
Use new O-rings.

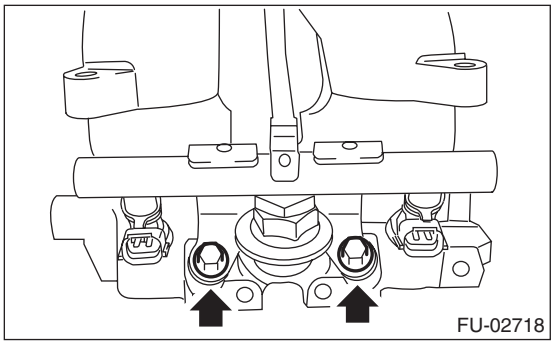


(A) O-ring
(B) Fuel injector

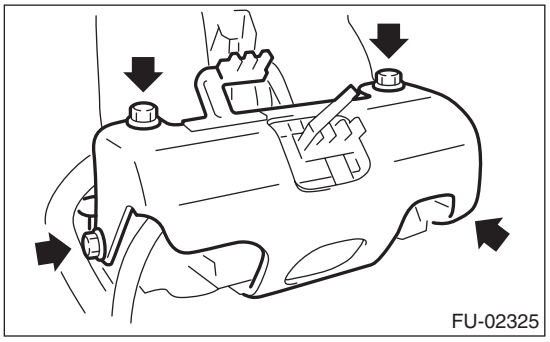
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)

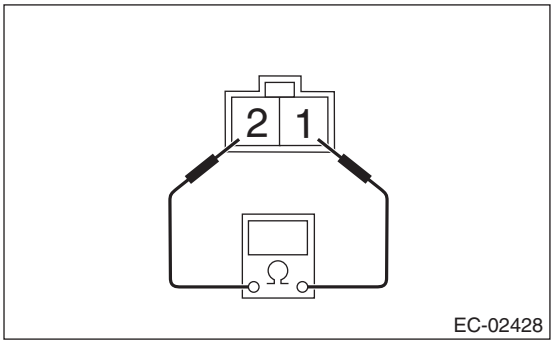


Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)



C: INSPECTION

Measure the resistance between fuel injector terminals.

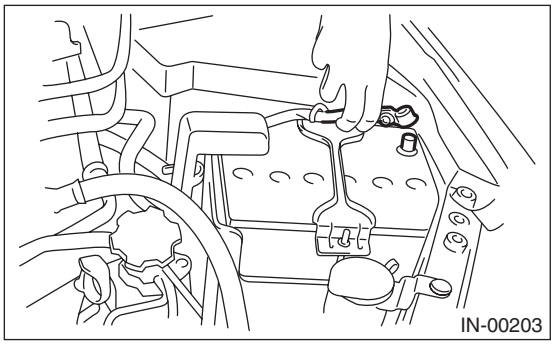


Terminal No.	Standard
1 and 2	Approx. 12.0 Ω (when 20°C (68°F))

13. Variable Valve Lift Diagnosis Oil Pressure Switch

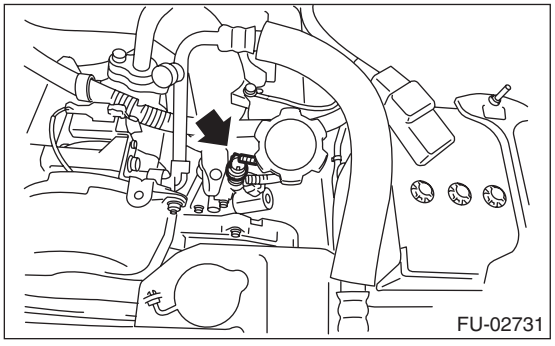
A: REMOVAL

1) Disconnect the ground cable from battery.

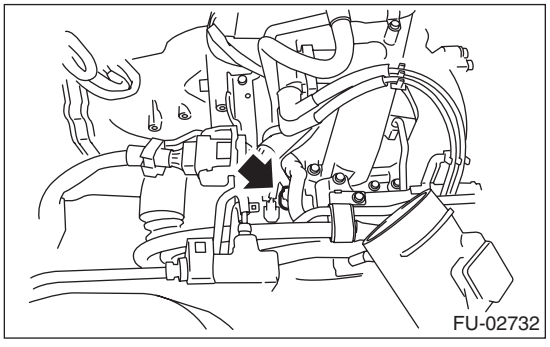


2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
3) Disconnect the connector from the variable valve lift diagnosis oil pressure switch.
4) Remove the variable valve lift diagnosis oil pressure switch.

- LH side



- RH side



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Apply liquid gasket to the variable valve lift diagnosis oil pressure switch threads.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
17 N·m (1.7 kgf-m, 12.5 ft-lb)

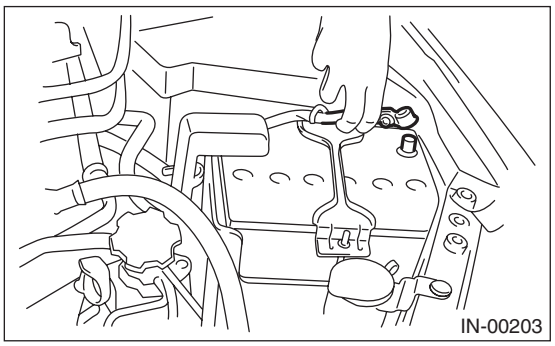
C: INSPECTION

Check the variable valve lift diagnosis oil pressure switch installation portion for oil leakage and oil seepage.

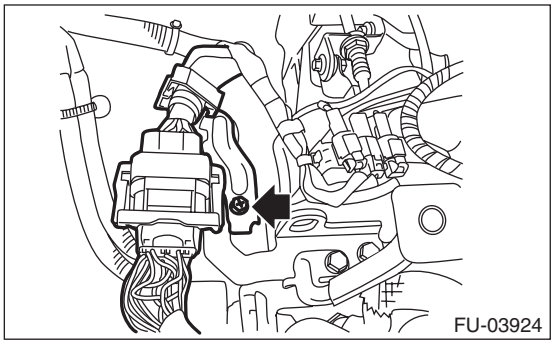
14.Oil Temperature Sensor

A: REMOVAL

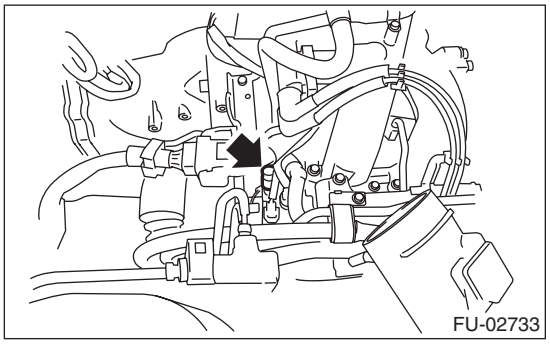
1) Disconnect the ground cable from battery.



2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
3) Remove the bolt, and remove the engine harness connector from the bulkhead harness connector and rear engine hanger.



4) Disconnect the connector from oil temperature sensor.
5) Remove the oil temperature sensor.



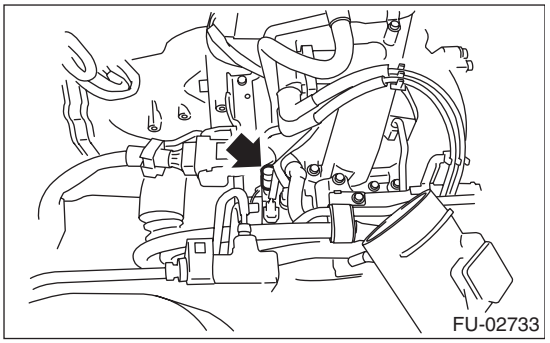
B: INSTALLATION

Install in the reverse order of removal.

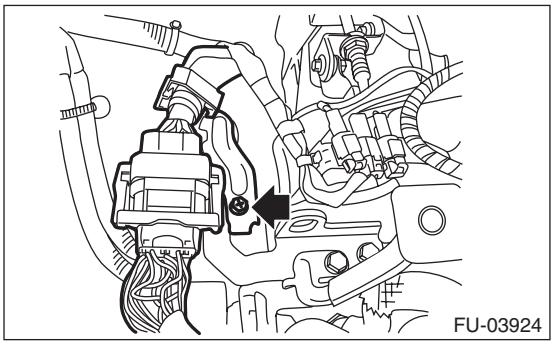
NOTE:
Apply liquid gasket to the oil temperature sensor threads.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

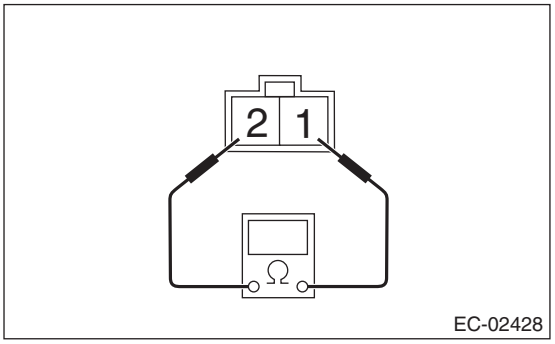


Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



C: INSPECTION

Measure the resistance between oil temperature sensor terminals.

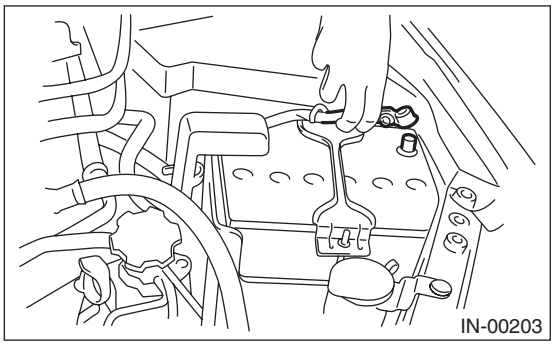


Terminal No.	Standard
1 and 2	2.45±0.2 (When 20°C (68°F))

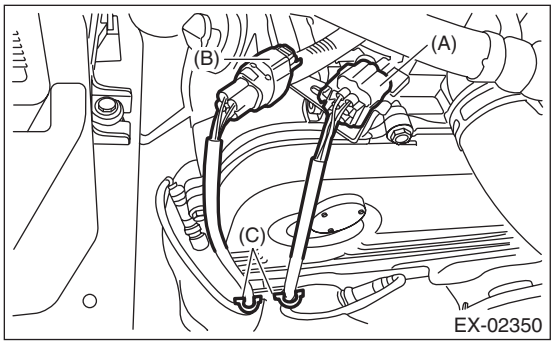
15.Front Oxygen (A/F) Sensor

A: REMOVAL

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



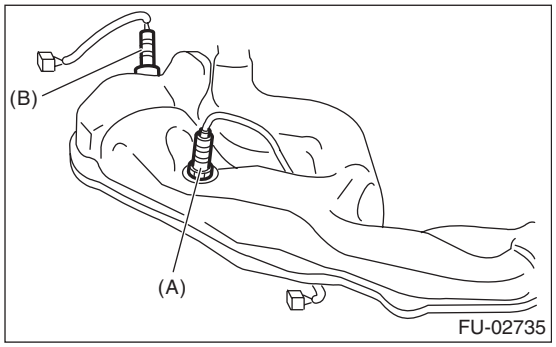
3) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
4) Remove the clip fastening the harness and disconnect the front oxygen (A/F) sensor connector.



(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

5) Lift up the vehicle.
6) Remove the under cover.
7) Apply spray-type lubricant to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.
8) Remove the front oxygen (A/F) sensor.

CAUTION:
When removing the front oxygen (A/F) sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.



(A) Front oxygen (A/F) sensor
(B) Rear oxygen sensor

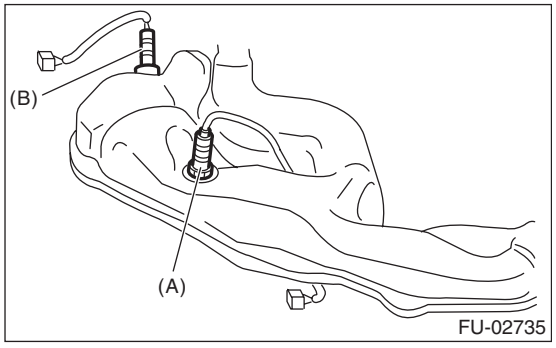
B: INSTALLATION

CAUTION:
If lubricant is spilt onto the exhaust pipe, wipe it off completely with cloth to avoid emission of smoke or causing a fire.
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.

CAUTION:
Never apply anti-seize compound to the protector of front oxygen (A/F) sensor.

Anti-seize compound:
NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent
2) Install the front oxygen (A/F) sensor.

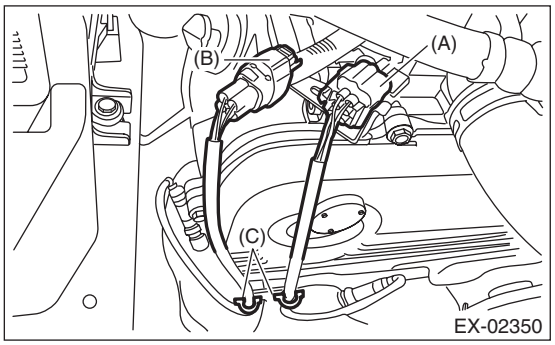
Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)



(A) Front oxygen (A/F) sensor
(B) Rear oxygen sensor

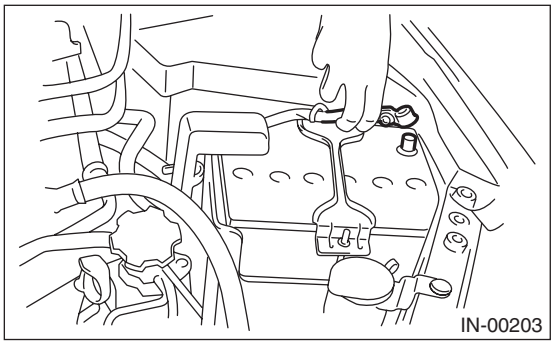
3) Install the under cover.
4) Lower the vehicle.

5) Connect the connector of front oxygen (A/F) sensor connector and fasten the harness with clips.



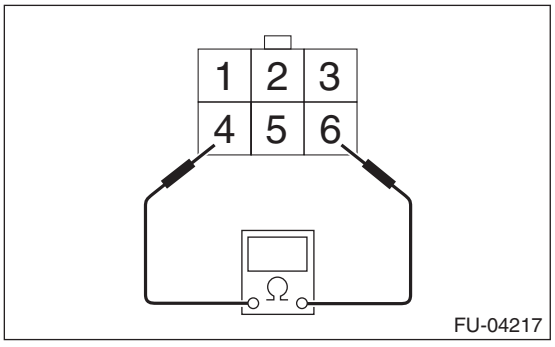
(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

6) Connect the ground cable to battery.



C: INSPECTION

Measure the resistance between front oxygen (A/F) sensor terminal.

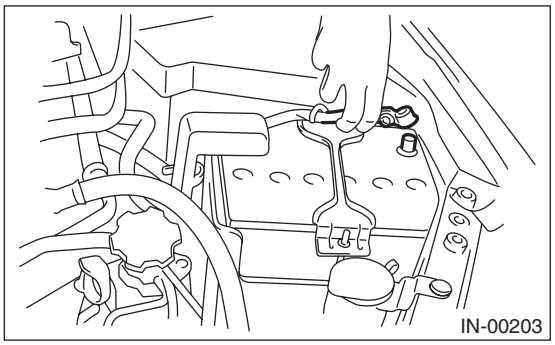


Terminal No.	Standard
4 and 6	2.4±0.24 Ω (20°C (68°F))

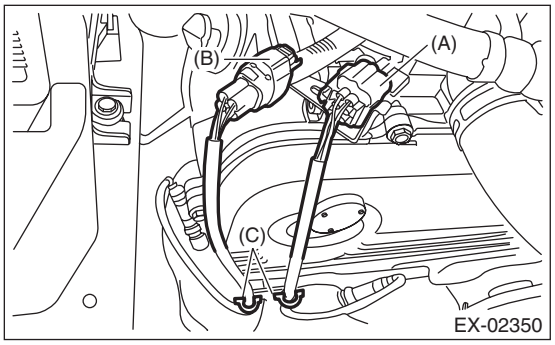
16.Rear Oxygen Sensor

A: REMOVAL

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



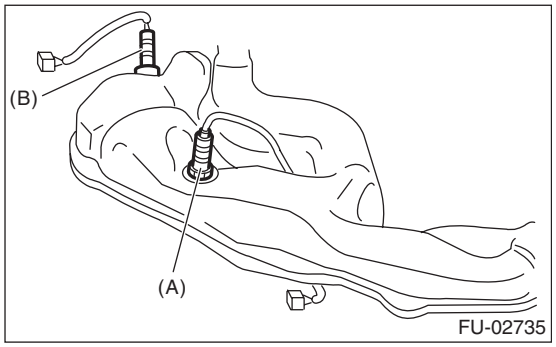
3) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
4) Remove the clip fastening the harness and disconnect the rear oxygen sensor connector.



(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

5) Lift up the vehicle.
6) Remove the under cover.
7) Apply spray-type lubricant to the threaded portion of rear oxygen sensor, and leave it for one minute or more.
8) Remove the rear oxygen sensor.

CAUTION:
When removing the rear oxygen sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.



(A) Front oxygen (A/F) sensor
(B) Rear oxygen sensor

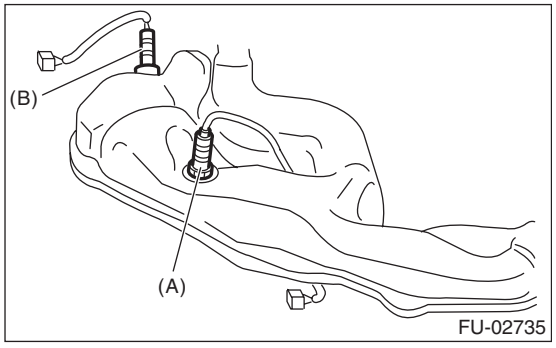
B: INSTALLATION

CAUTION:
If lubricant is spilt onto the exhaust pipe, wipe it off completely with cloth to avoid emission of smoke or causing a fire.
1) Before installing rear oxygen sensor, apply the 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 the protector of rear oxygen sensor.

Anti-seize compound:
NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent
2) Install the rear oxygen sensor.

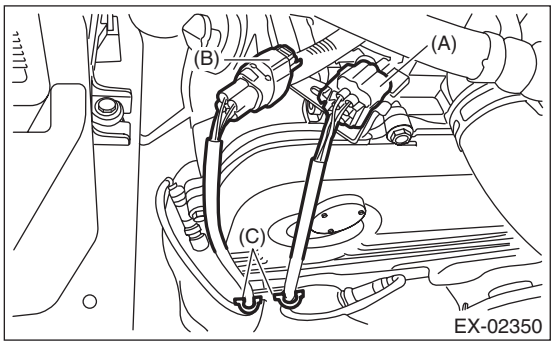
Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)



(A) Front oxygen (A/F) sensor
(B) Rear oxygen sensor

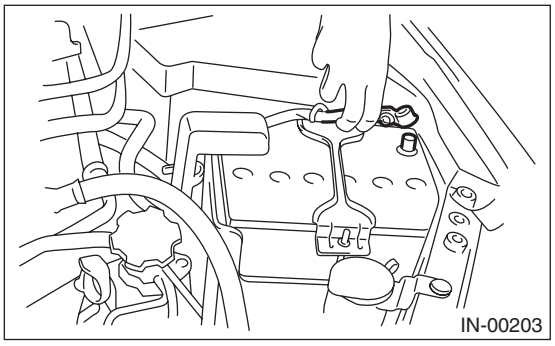
3) Install the under cover.
4) Lower the vehicle.

5) Connect the rear oxygen sensor connector and fasten the harness with clips.



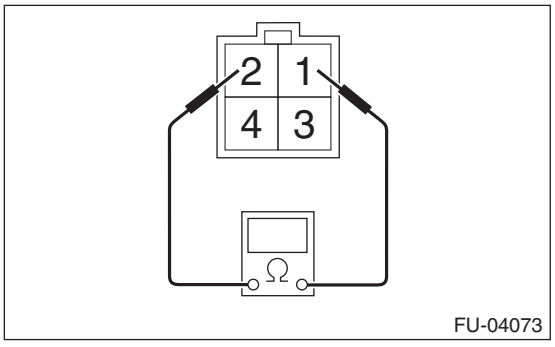
(A) Front oxygen (A/F) sensor connector
(B) Rear oxygen sensor connector
(C) Clip

6) Connect the ground cable to battery.



C: INSPECTION

Measure the resistance between rear oxygen sensor terminal.

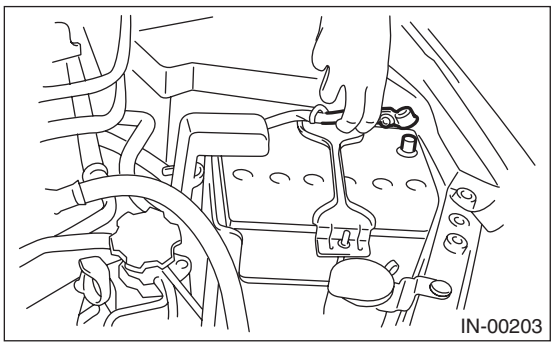


Terminal No.	Standard
1 and 2	$5.6^{+0.8}_{-0.6}$ Ω (when 20°C (68°F))

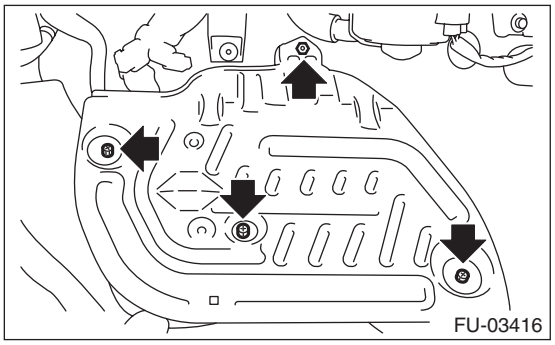
17.Engine Control Module (ECM)

A: REMOVAL

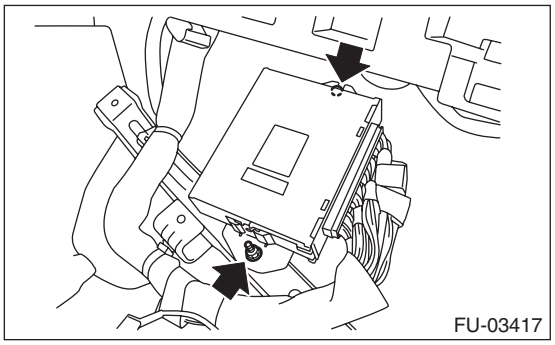
1) Disconnect the ground cable from battery.



2) Remove the lower inner trim of passenger's side. <Ref. to EI-55, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.



5) Remove the bolts and nuts which hold the ECM to the bracket.



6) Disconnect the ECM connectors, and take out the ECM.

B: INSTALLATION

Install in the reverse order of removal.

CAUTION:
• When the ECM of model with immobilizer has been replaced, be sure to perform the registration of immobilizer system. (Refer to "PC application help for Subaru Select Monitor".)
• When replacing the ECM or the bracket, replace both parts with the new ones.
• After attaching the bracket to the ECM, do not detach the bracket.
• If the bracket is attached to the ECM in the wrong direction, replace both parts with the new ones.

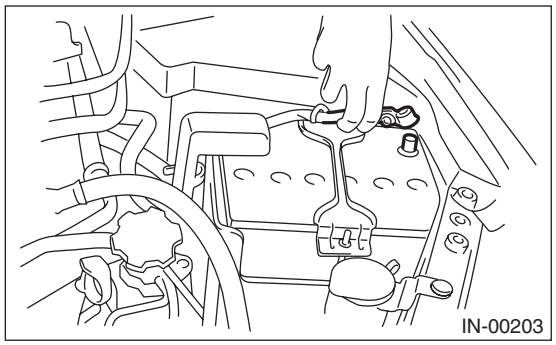
NOTE:
When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.

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

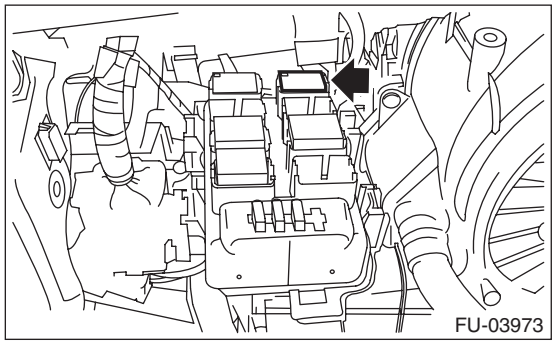
18.Main Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the main relay from the relay block on the back side of the glove box.

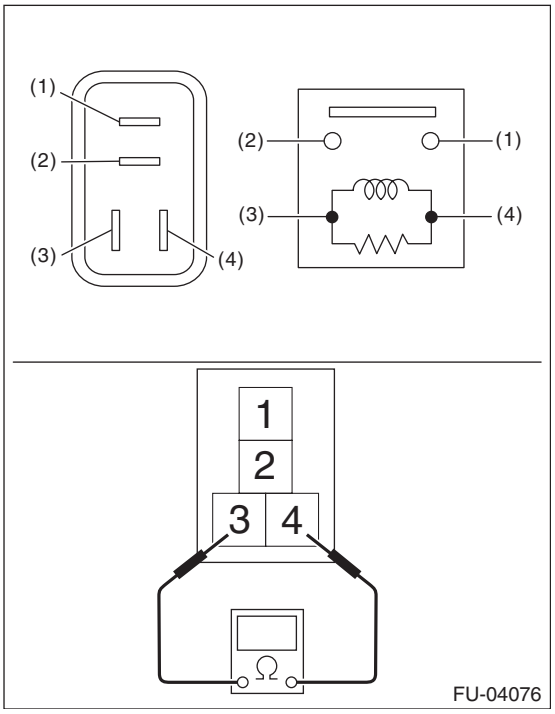


B: INSTALLATION

Install in the reverse order of removal.

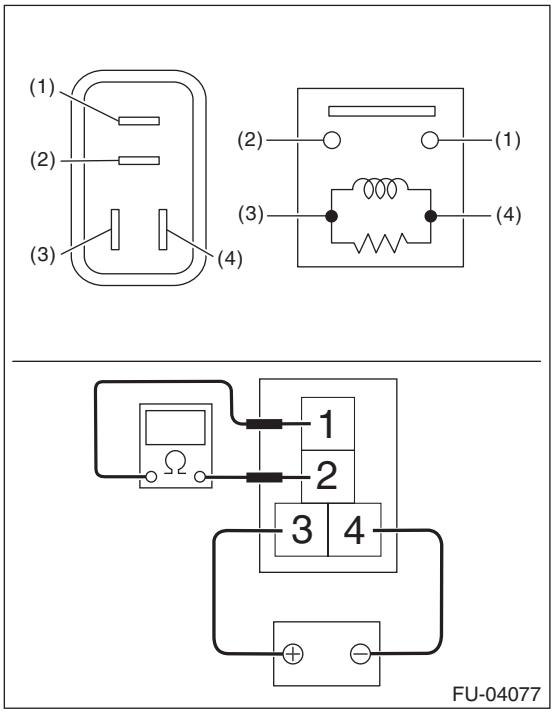
C: INSPECTION

1) Measure the resistance between main relay terminals.



Terminal No.	Standard
1 and 2	1 MΩ or more
3 and 4	130.4 — 230.8 Ω (When 20°C (68°F))

2) Connect terminal No. 3 to battery positive terminal and terminal No. 4 to the battery ground terminal, and measure the resistance between the main relay terminals.

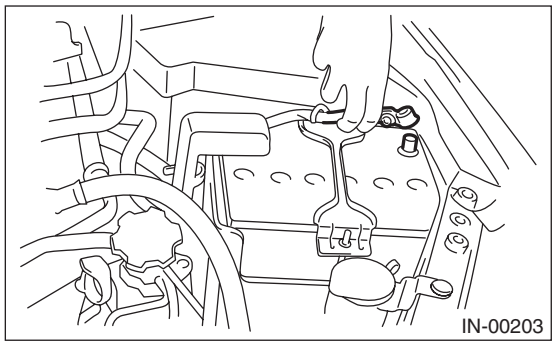


Terminal No.	Standard
1 and 2	Less than 1 Ω

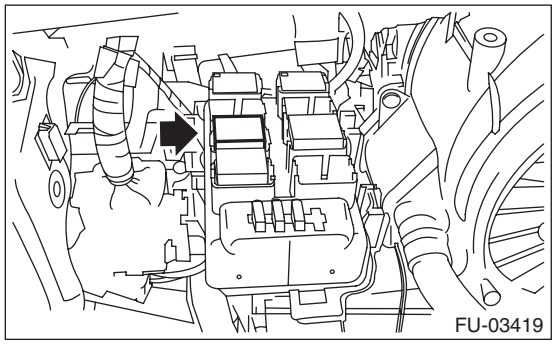
19.Fuel Pump Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the fuel pump relay from the relay block on the back side of the glove box.

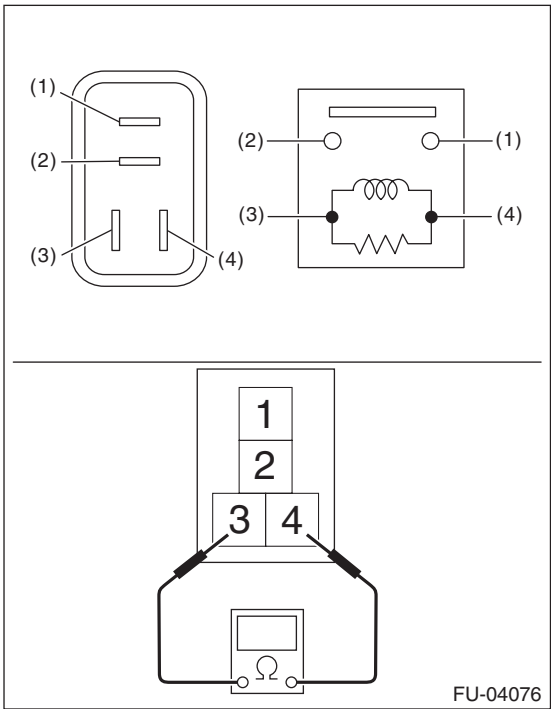


B: INSTALLATION

Install in the reverse order of removal.

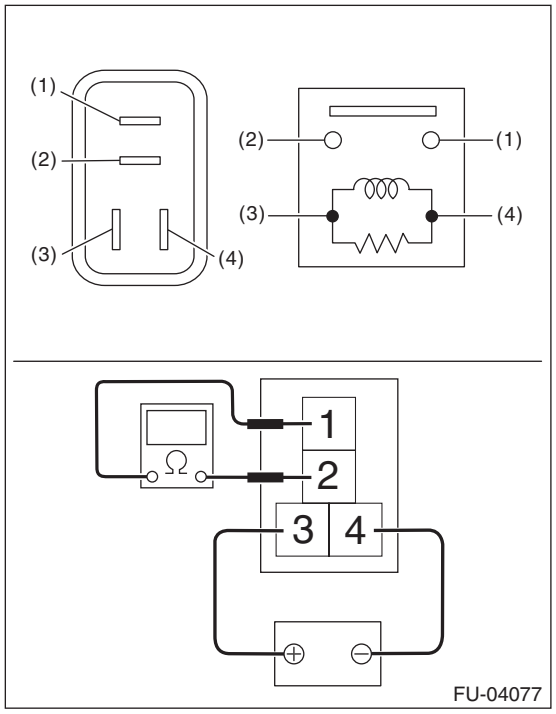
C: INSPECTION

1) Measure the resistance between fuel pump relay terminals.



Terminal No.	Standard
1 and 2	1 MΩ or more
3 and 4	93.8 — 136.4 Ω (When 20°C (68°F))

2) Connect terminal No. 3 to battery positive terminal and terminal No. 4 to the battery ground terminal, and measure the resistance between the fuel pump relay terminals.

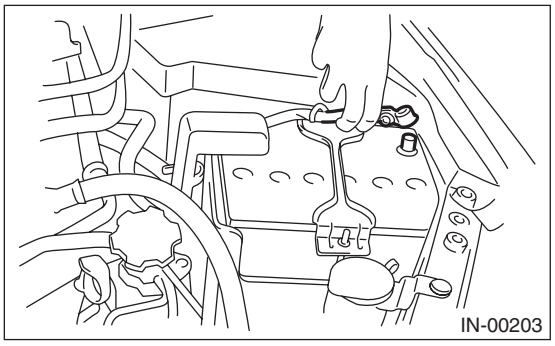


Terminal No.	Standard
1 and 2	Less than 1 Ω

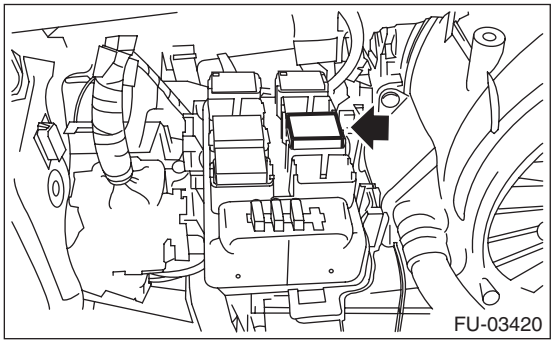
20. Electronic Throttle Control Relay

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the electronic throttle control relay from the relay block on the back side of the glove box.

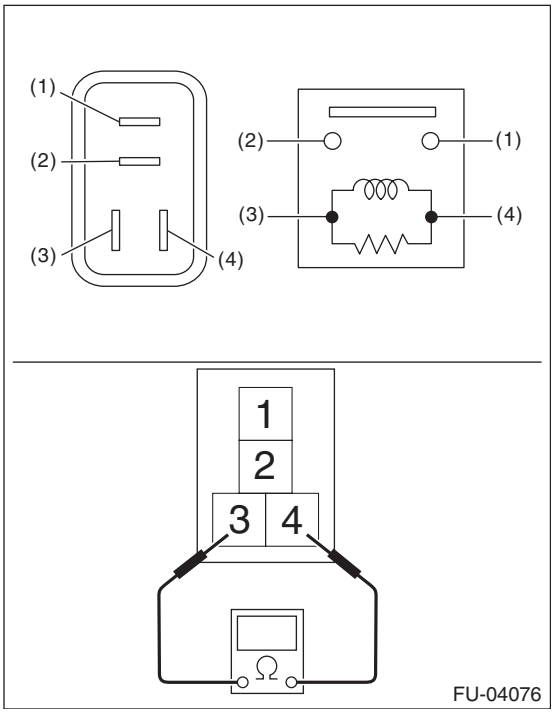


B: INSTALLATION

Install in the reverse order of removal.

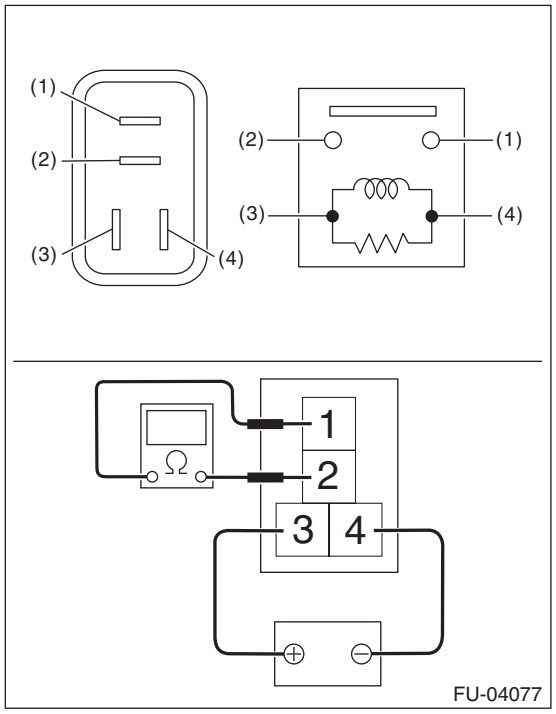
C: INSPECTION

1) Measure the resistance between electronic throttle control relay terminals.



Terminal No.	Standard
1 and 2	1 MΩ or more
3 and 4	93.8 — 136.4 Ω (When 20°C (68°F))

2) Connect terminal No. 3 to battery positive terminal and terminal No. 4 to the battery ground terminal, and measure the resistance between the electronic throttle control relay terminals.



Terminal No.	Standard
1 and 2	Less than 1 Ω

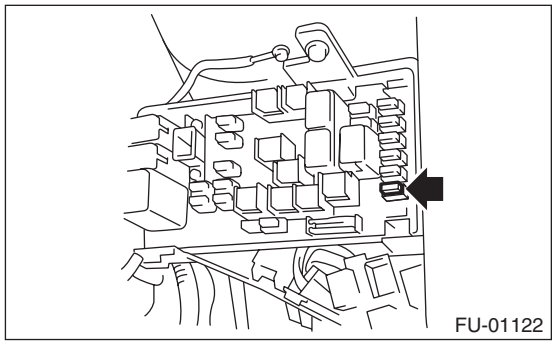
21.Fuel

A: PROCEDURE

1. RELEASING OF FUEL PRESSURE

WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.
1) Remove the fuse of fuel pump from main fuse box.



2) Start the engine and run it until it stalls.
3) After the engine stalls, crank it for five more seconds.
4) Turn the ignition switch to OFF.
5) Install the fuse of fuel pump to the main fuse box.

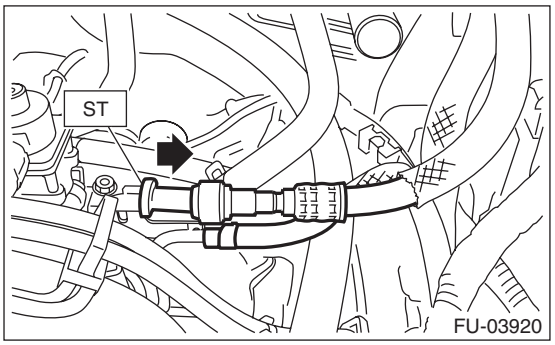
2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

NOTE:
• If the fuel pump cannot be driven, refer to the procedures for draining from the fuel filler hose. <Ref. to FU(H4SO)-52, DRAINING FUEL (THROUGH THE FUEL FILLER HOSE), PROCEDURE, Fuel.>
• Be careful not to let the battery run-out.
1) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the fuel delivery hose.
ST 42099AE000 QUICK CONNECTOR RELEASE

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.



3) Connect ST to the fuel delivery hose.
ST 18471AA000 FUEL PIPE ADAPTER
4) Connect the gasoline proof hose to ST and put the end of the hose in the container.
5) Drive the fuel pump and drain the fuel using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-58, FUEL PUMP CONTROL (ON/OFF DRIVE), OPERATION, System Operation Check Mode.>

CAUTION:
Be careful not to spill fuel.
6) Install the related parts in the reverse order after draining the fuel.

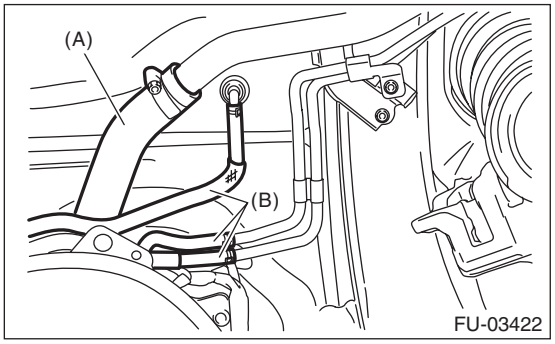
3. DRAINING FUEL (THROUGH THE FUEL FILLER HOSE)

• 4 door model

WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
• Be careful not to spill fuel.
• Fuel may remain in the fuel filler pipe. Draining the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the operation.
1) Set the vehicle on a lift.
2) Lift up the vehicle.
3) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-10, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-12, REMOVAL, Muffler.>
4) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
5) Open the fuel filler lid and remove the fuel filler cap.
6) Drain the fuel from the fuel filler pipe through the filler opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).
7) Disconnect the fuel filler hose (A) from the fuel filler pipe assembly.

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.



(A) Fuel filler hose
(B) Evaporation hose

8) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

CAUTION:
Be careful not to spill fuel.
9) Install the related parts in the reverse order after draining the fuel.

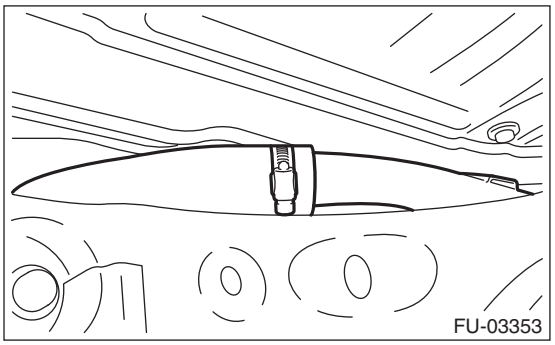
Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

• 5 door model

WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
• Be careful not to spill fuel.
• Fuel may remain in the fuel filler pipe. Draining the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the operation.
1) Set the vehicle on a lift.
2) Lift up the vehicle.
3) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-10, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-12, REMOVAL, Muffler.>
4) Open the fuel filler lid and remove the fuel filler cap.
5) Drain the fuel from the fuel filler pipe through the filler opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).
6) Disconnect the fuel filler hose from the fuel filler pipe assembly.

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.



7) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

CAUTION:
Be careful not to spill fuel.
8) Install the related parts in the reverse order after draining the fuel.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

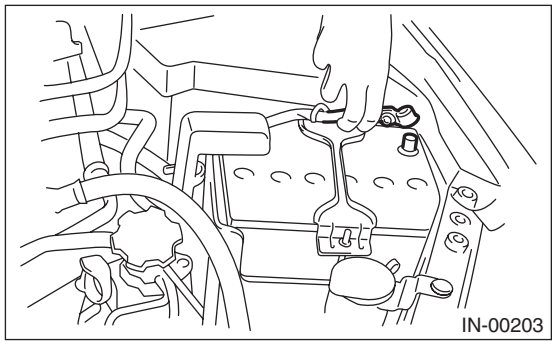
22.Fuel Tank

A: REMOVAL

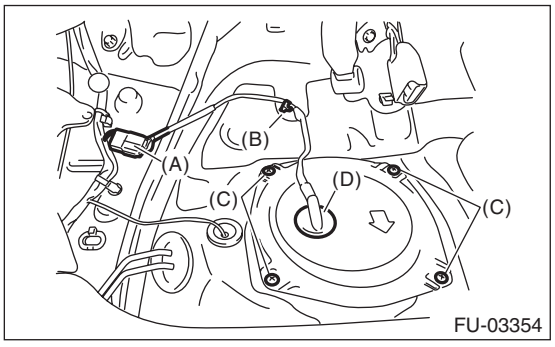
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

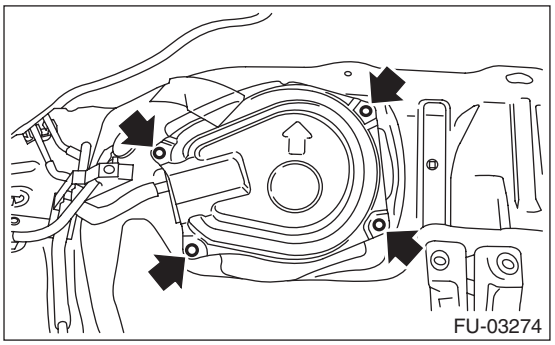
1) Set the vehicle on a lift.
2) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
3) Drain fuel. <Ref. to FU(H4SO)-52, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
4) Disconnect the ground cable from battery.



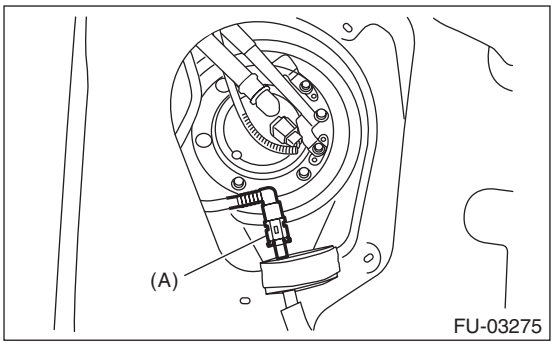
5) Remove the rear seat cushion. <Ref. to SE-12, REMOVAL, Rear Seat.>
6) Remove the service hole cover of fuel pump.
   (1) Disconnect fuel pump connector (A), and remove clip (B).
   (2) Remove the screw (C).
   (3) Push the grommet (D) down and remove the service hole cover.



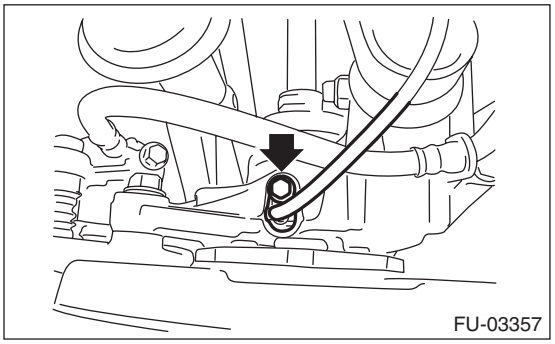
7) Remove the service hole cover of fuel sub level sensor.



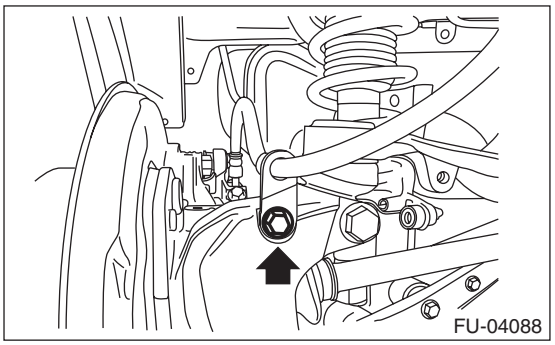
8) Disconnect the quick connector on the fuel delivery tube (A). <Ref. to FU(H4SO)-75, REMOVAL, Fuel Delivery and Evaporation Lines.>



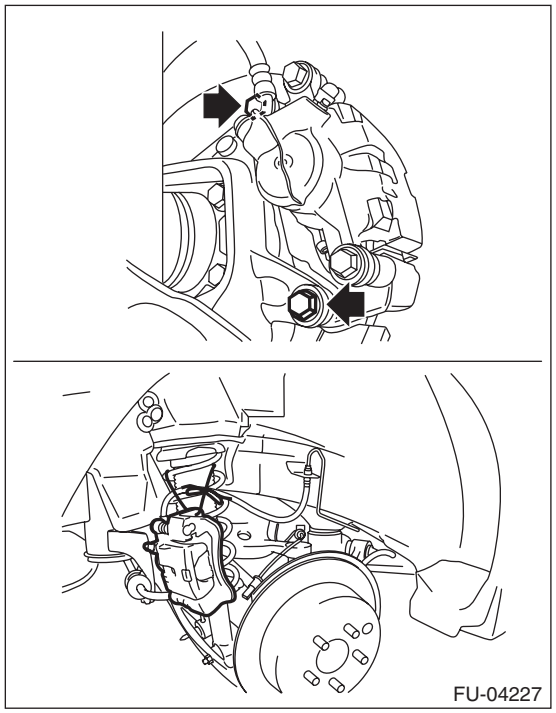
9) Remove the rear wheels.
10) Lift up the vehicle.
11) Remove the rear ABS wheel speed sensor from the rear housing.



12) Remove the rear brake hose bracket from rear housing.



13) Remove the rear disc brake assembly and tie it to the body side of the vehicle.



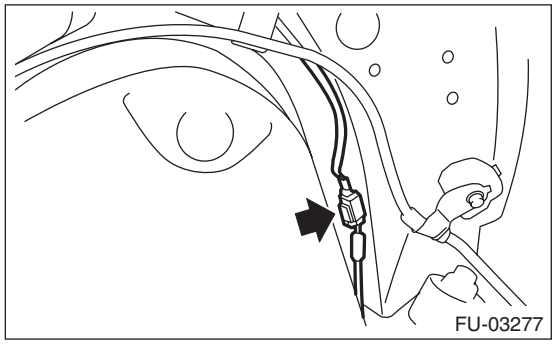
14) Remove the parking brake cable from parking brake assembly. <Ref. to PB-6, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>

15) Remove the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-10, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-12, REMOVAL, Muffler.>

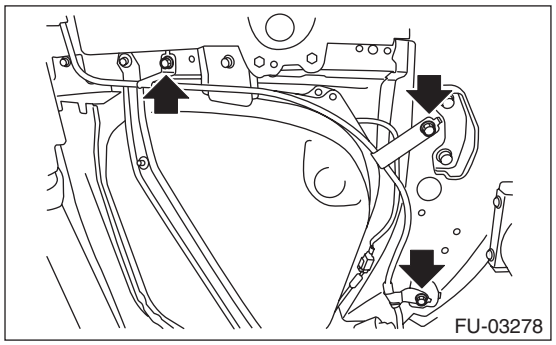
16) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

17) Remove the heat shield cover and fuel tank protector.

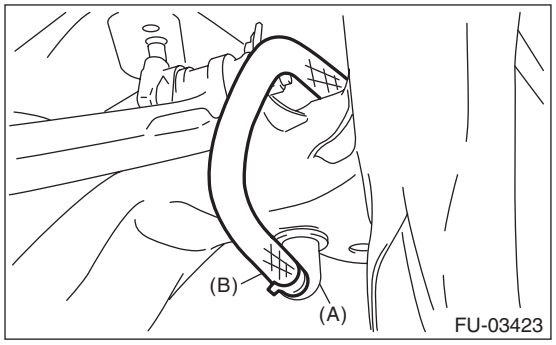
18) Disconnect the connector from the rear ABS wheel speed sensor.



19) Remove the parking brake cable clamp from the body.



20) Disconnect canister drain hose (B) from canister drain connector (A).

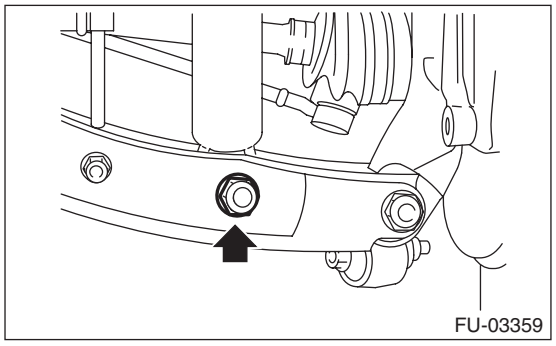


21) Remove the rear suspension assembly.

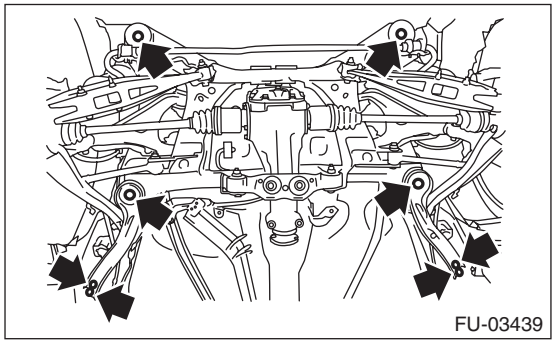
WARNING:
A helper is required to perform this work.

(1) Support the rear differential with the transmission jack.

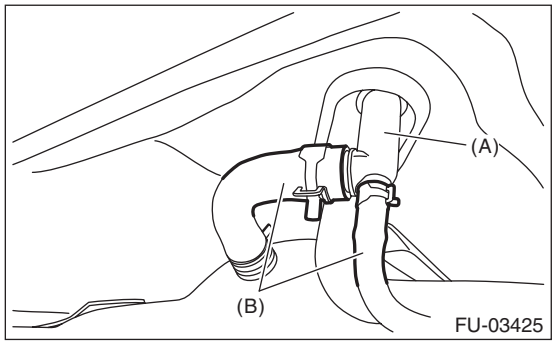
(2) Remove the bolt and nut which secures rear shock absorber to rear suspension arm.



(3) Remove the bolts which secure the rear suspension assembly to the body.

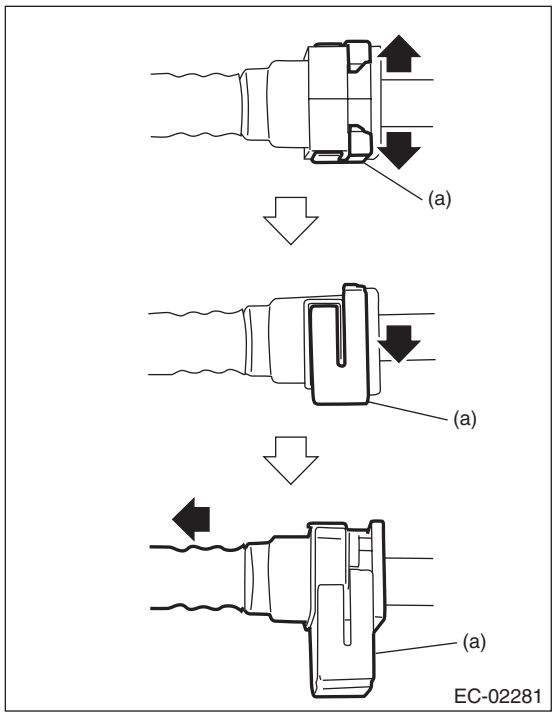


(4) Remove the rear suspension assembly.
22) Disconnect evaporation hose (B) from connector (A).

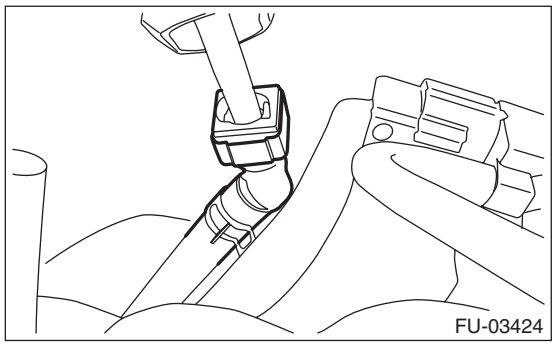


23) Disconnect the quick connector of the evaporation hose from the evaporation pipe.

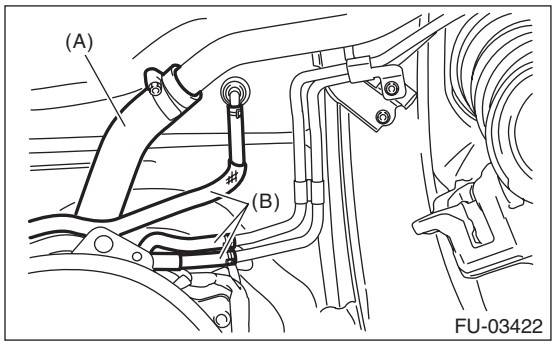
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Retainer

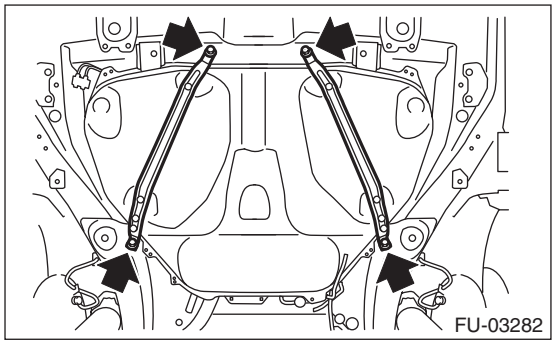


24) Disconnect the fuel filler hose (A) and evaporation hose (B).



25) Support the fuel tank with a transmission jack, remove the bolts from the fuel tank band, and remove the fuel tank from the vehicle.

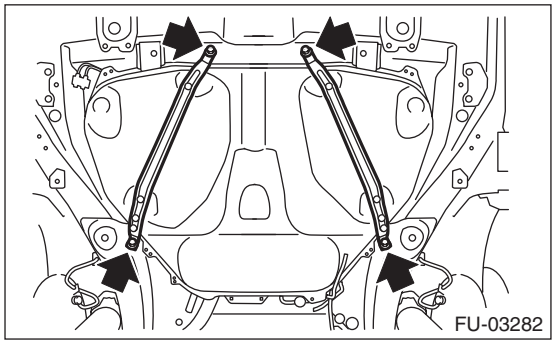
WARNING:
- **A helper is required to perform this work.**
- **Fuel may remain in the fuel tank. This will cause the left and right sides to be unbalanced. Be careful not to drop the fuel tank when removing.**



B: INSTALLATION

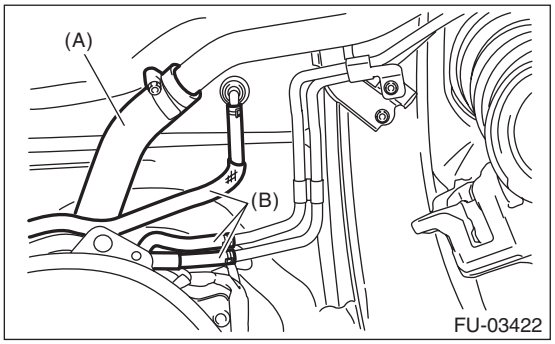
1) Support the fuel tank with a transmission jack, set the fuel tank in place, and temporarily tighten the bolts of the fuel tank band.

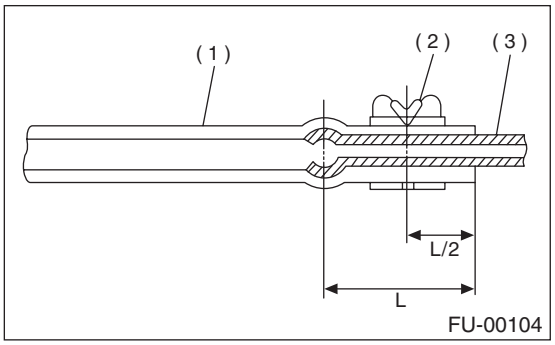
WARNING:
A helper is required to perform this work.



2) Securely insert the fuel filler hose (A) and evaporation hose (B) into the specified position, then attach the clamp or clip as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

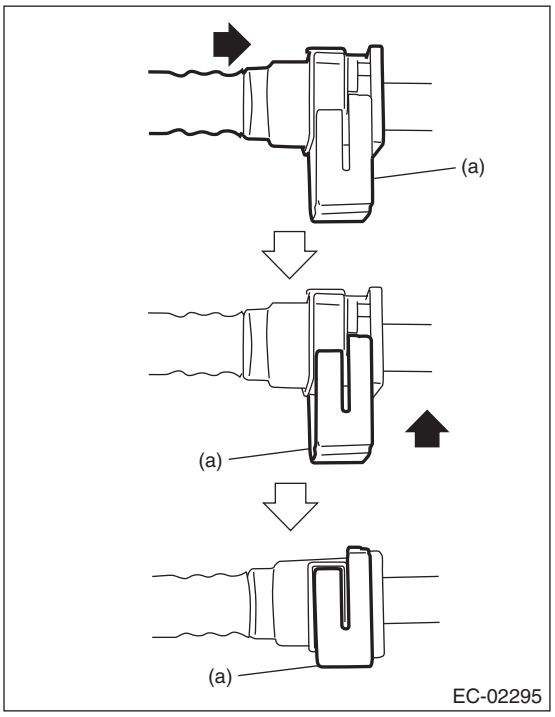




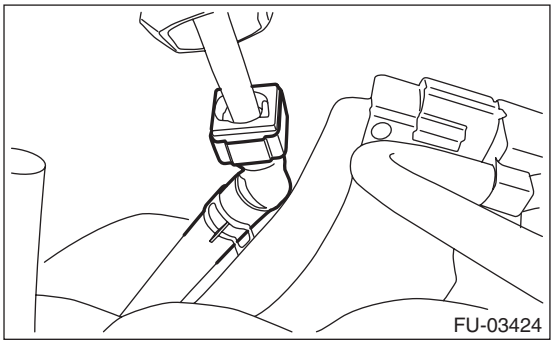
(1) Hose
(2) Clamp or clip
(3) Pipe

3) Connect the quick connector of the evaporation hose to the evaporation pipe.

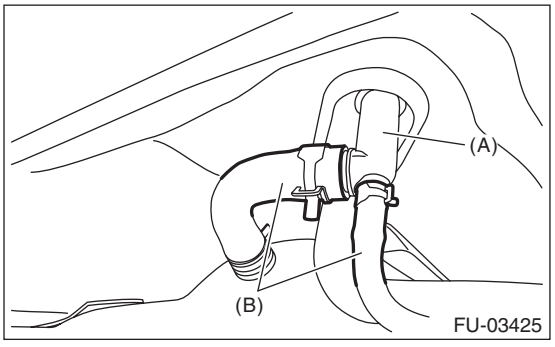
CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, securely insert the pipe all the way before locking the retainer.
• When it is difficult to lock the retainer, make sure that the pipe is securely inserted.
• Make sure that the quick connector is securely connected.



(a) Retainer

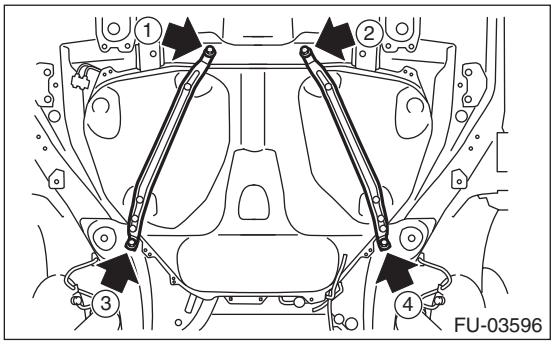


4) Connect evaporation hose (B) to connector (A).



5) Tighten the bolts of the fuel tank band in the order shown in the figure.

Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)

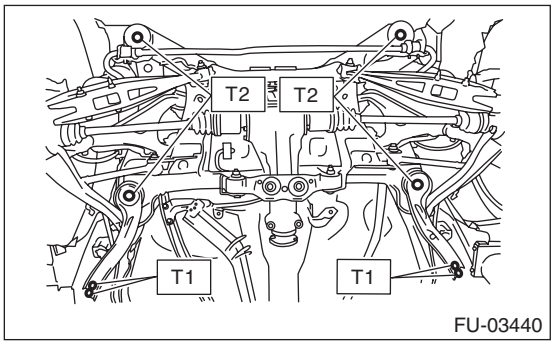


6) Install the rear suspension assembly.

WARNING:
A helper is required to perform this work.

(1) Support the rear differential with the transmission jack.
(2) Support the rear suspension assembly, and tighten the bolts which secure the rear suspension assembly to the body.

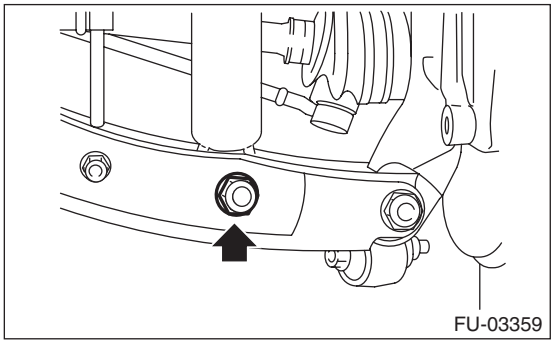
Tightening torque:
T1: 70 N·m (7.1 kgf-m, 51.6 ft-lb)
T2: 145 N·m (14.8 kgf-m, 106.9 ft-lb)



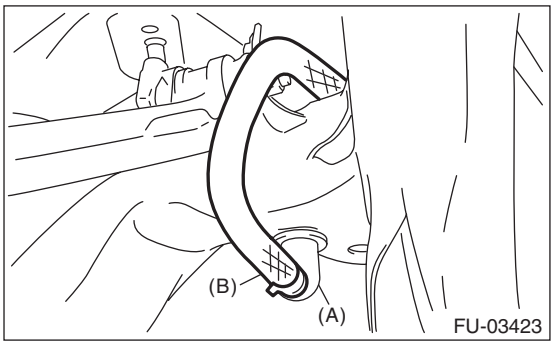
(3) Install the rear shock absorber to the rear suspension arm.

NOTE:
Use a new self-locking nut.

Tightening torque:
120 N·m (12.2 kgf-m, 88.5 ft-lb)

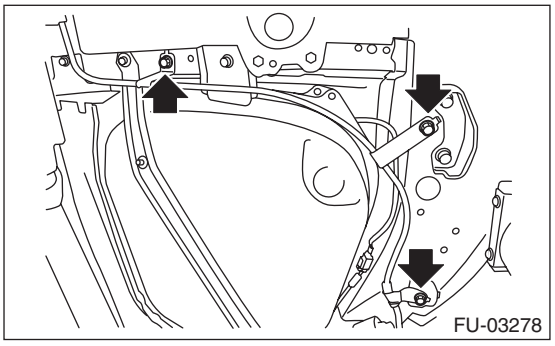


7) Connect canister drain hose (B) to canister drain connector (A).

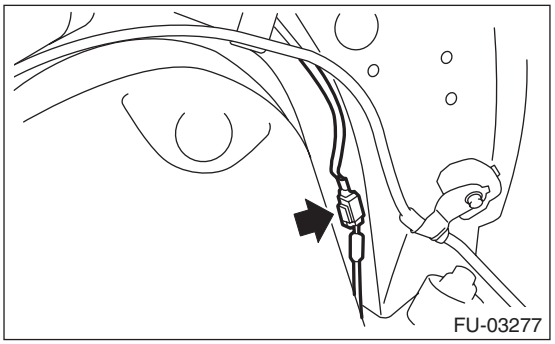


8) Install the parking brake cable clamp to the body.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



9) Connect the connector to the rear ABS wheel speed sensor.



10) Install the heat shield cover.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

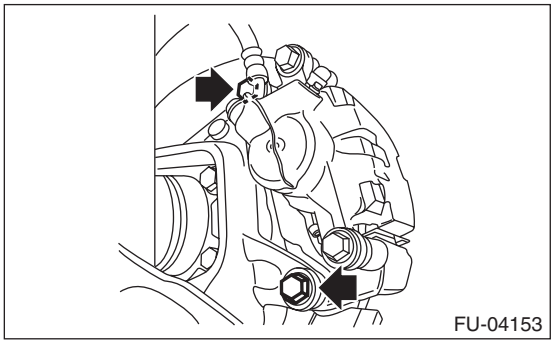
11) Install the fuel tank protector.

Tightening torque:
Nut: 9 N·m (0.9 kgf-m, 6.6 ft-lb)
Bolt: 18 N·m (1.8 kgf-m, 13.3 ft-lb)

12) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>
13) Install the rear exhaust pipe and muffler. <Ref. to EX(H4SO)-10, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(H4SO)-12, INSTALLATION, Muffler.>
14) Lower the vehicle.

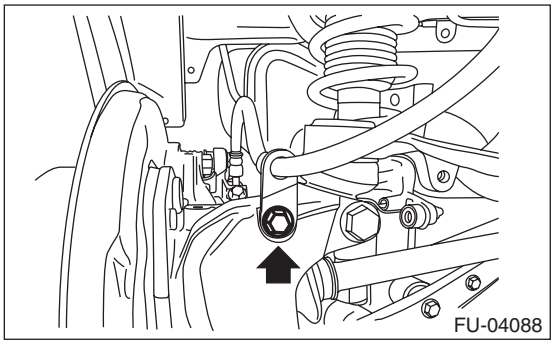
15) Connect the parking brake cable to the parking brake assembly. <Ref. to PB-7, INSTALLATION, Parking Brake Assembly (Rear Disc Brake).>
16) Install the rear disc brake assembly.

Tightening torque:
66 N·m (6.7 kgf-m, 48.7 ft-lb)


FU-04153

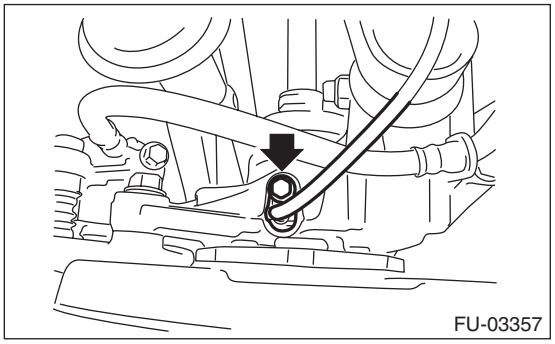
17) Install the rear brake hose bracket to the rear housing.

Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)


FU-04088

18) Attach the rear ABS wheel speed sensor to the rear housing.

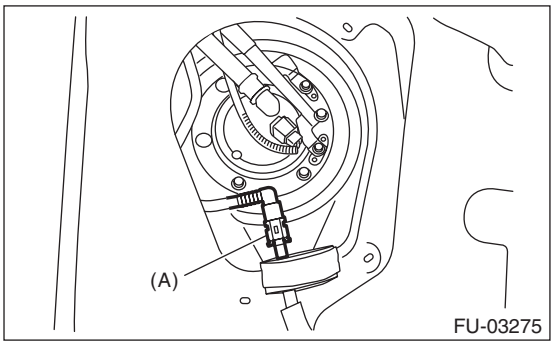
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)


FU-03357

19) Install the rear wheels.

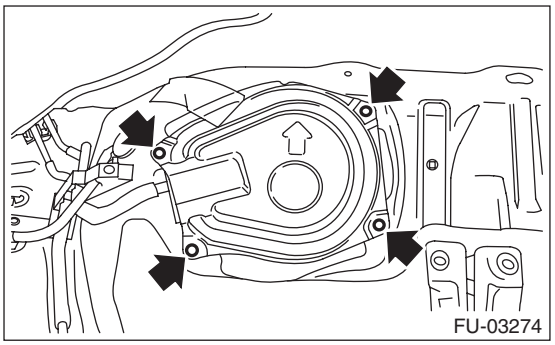
Tightening torque:
100 N·m (10.2 kgf-m, 73.8 ft-lb)

20) Connect the quick connector of the fuel delivery tube (A). <Ref. to FU(H4SO)-76, INSTALLATION, Fuel Delivery and Evaporation Lines.>

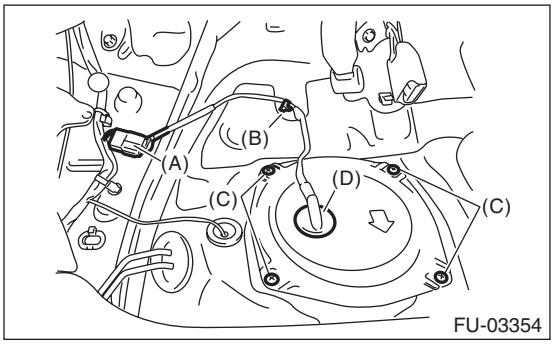


FU-03275

21) Install the service hole cover of fuel sub level sensor.


FU-03274

22) Attach the service hole cover of the fuel pump, and attach the connector and clip.

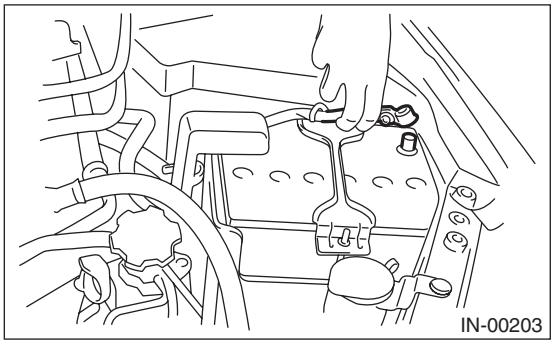


FU-03354

(A) Connector
(B) Clip
(C) Screw
(D) Grommet

23) Install the rear seat cushion. <Ref. to SE-13, INSTALLATION, Rear Seat.>

24) Connect the ground cable to battery.



25) Inspect the wheel alignment and adjust if necessary.

C: INSPECTION

1) Check that the fuel tank does not have holes, cracks or is damaged in any other way.
2) Make sure that the fuel pipe and fuel hose are not cracked and that the connections are tight.

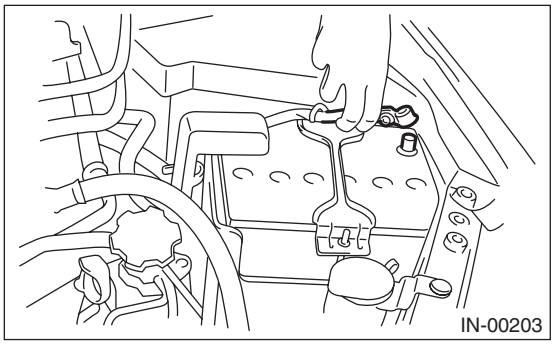
23.Fuel Filler Pipe

A: REMOVAL

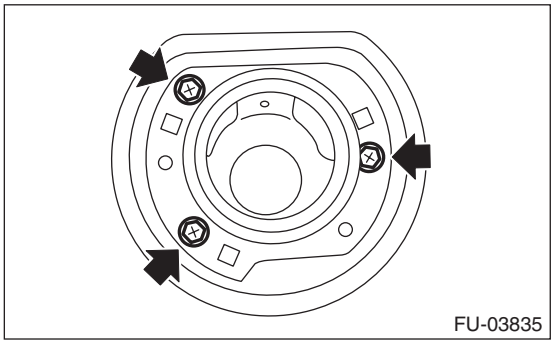
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

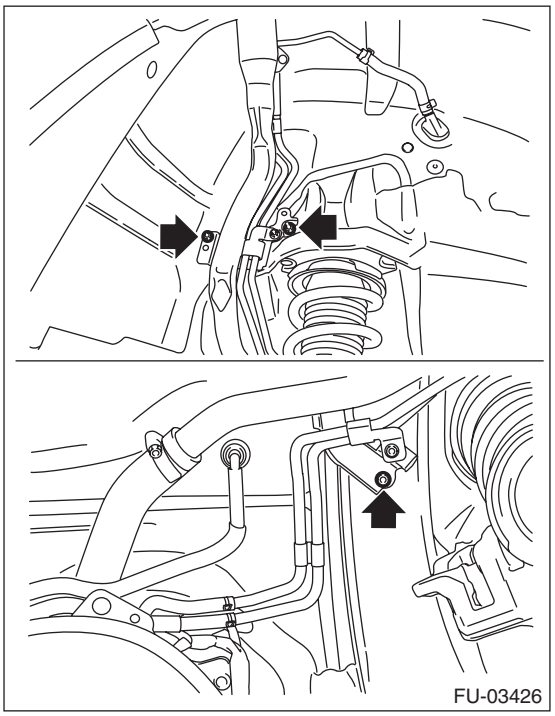
1) Set the vehicle on a lift.
2) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
3) Drain fuel. <Ref. to FU(H4SO)-52, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
4) Disconnect the ground cable from battery.



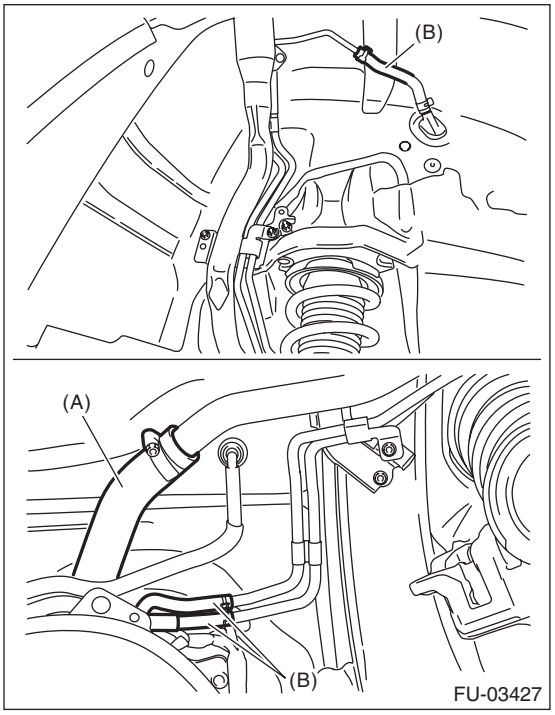
5) Open the fuel filler lid, and remove the filler cap.
6) Remove the screws which secure gasket.



7) Remove the rear wheel RH.
8) Lift up the vehicle.
9) Remove the rear mud guard RH. <Ref. to EI-28, REMOVAL, Mud Guard.>
10) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
11) Remove the bolts and nuts which hold fuel filler pipe bracket on the body.



12) Disconnect the fuel filler hose (A) and evaporation hose (B).

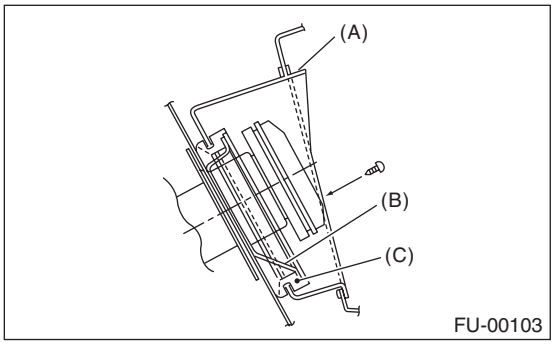


13) Remove the fuel filler pipe to the underside of the vehicle.

B: INSTALLATION

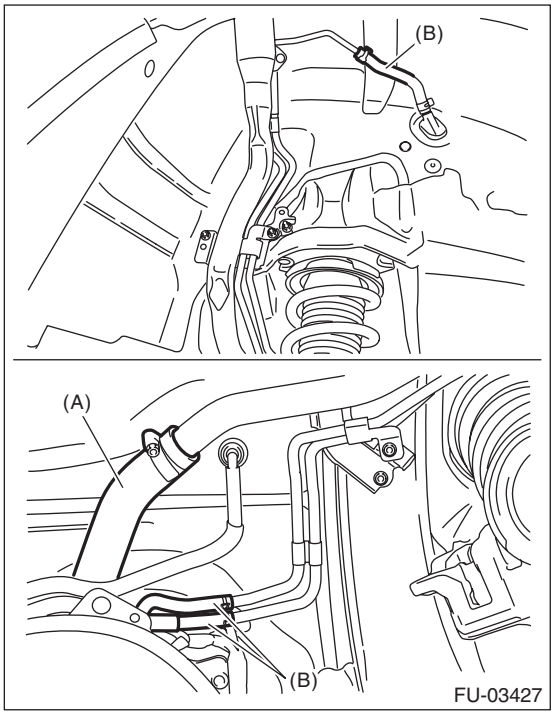
1) Open the fuel filler lid.
2) Set the fuel saucer (A) with rubber gasket (C), and insert the fuel filler pipe into hole from the inner side of apron.
3) Align the holes in fuel filler pipe neck and set the cup (B), and tighten the screws.

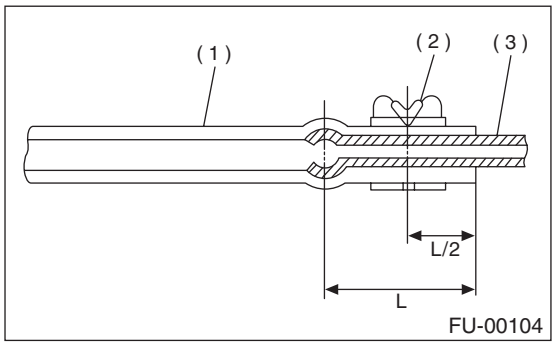
NOTE:
If the edges of rubber gasket are folded toward inside, straighten it with a flat tip screwdriver.



4) Securely insert the fuel filler hose (A) and evaporation hose (B) into the specified position, then attach the clamp or clip as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

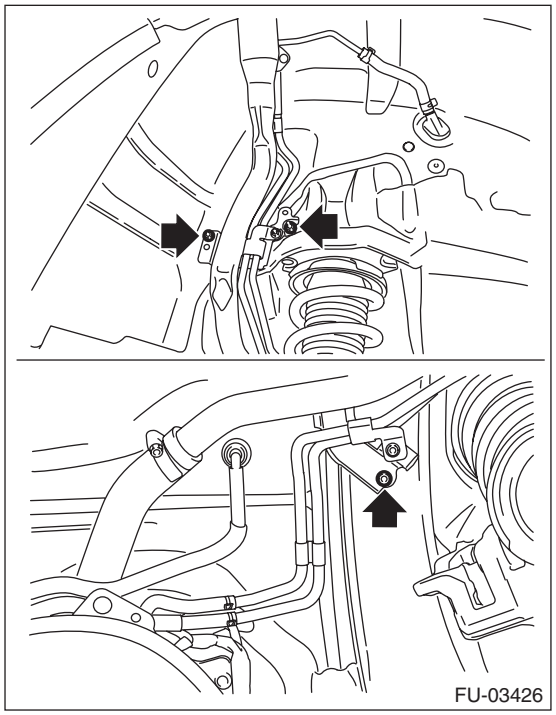




(1) Hose
(2) Clamp or clip
(3) Pipe

5) Tighten the bolts and nuts which hold fuel filler pipe bracket on the body.

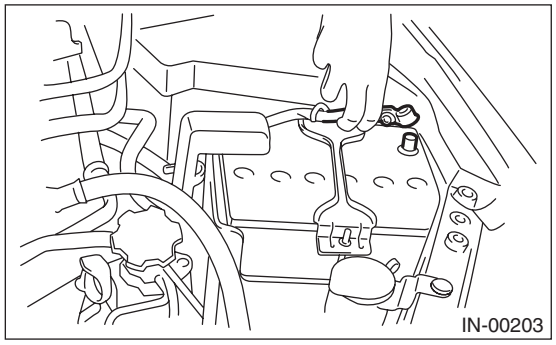
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



6) Install the rear sub frame. <Ref. to RS-18, INSTALLATION, Rear Sub Frame.>
7) Install the rear mud guard RH. <Ref. to EI-28, INSTALLATION, Mud Guard.>
8) Lower the vehicle.
9) Install the rear wheel RH.

Tightening torque:
100 N·m (10.2 kgf-m, 73.8 ft-lb)

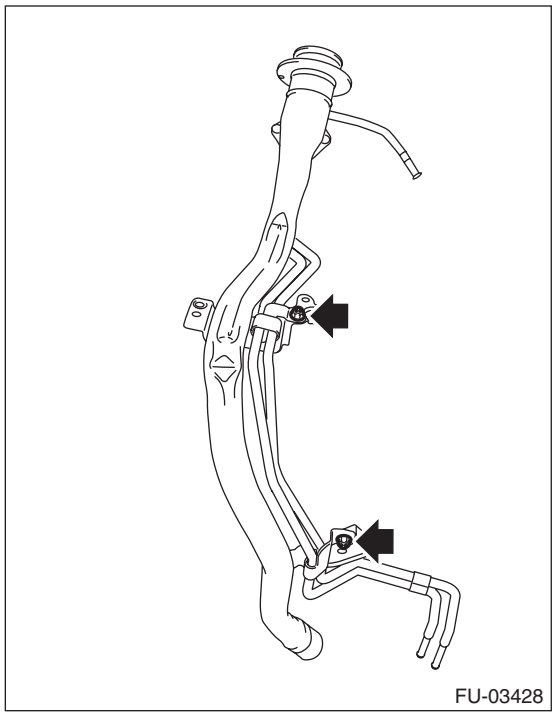
10) Connect the ground cable to battery.



11) Inspect the wheel alignment and adjust if necessary.

C: DISASSEMBLY

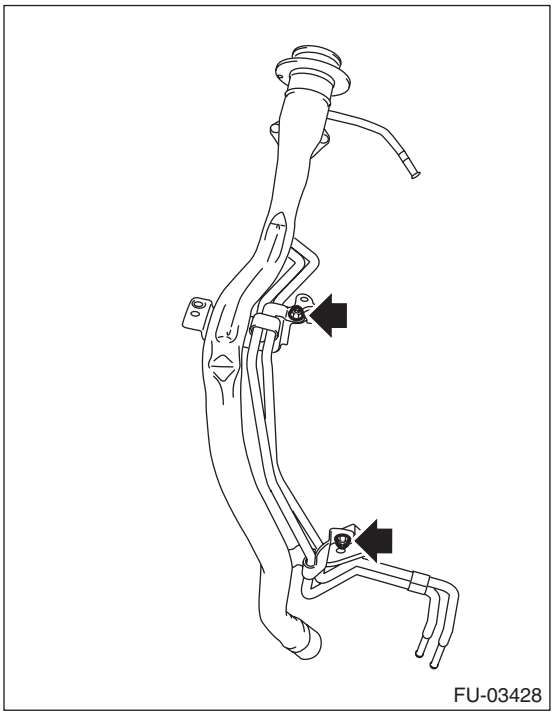
1) Remove the shut valve from the fuel filler pipe. <Ref. to EC(H4SO)-18, REMOVAL, Shut Valve.>
2) Remove the evaporation pipe from the fuel filler pipe.



D: ASSEMBLY

1) Install the evaporation pipe to the fuel filler pipe.

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



2) Install the shut valve to the fuel filler pipe. <Ref. to EC(H4SO)-18, INSTALLATION, Shut Valve.>

E: INSPECTION

1) Check that the fuel filler pipe does not have holes, cracks or is damaged in any other way.
2) Make sure that the fuel hose is not cracked and that the connections are tight.

24.Fuel Pump

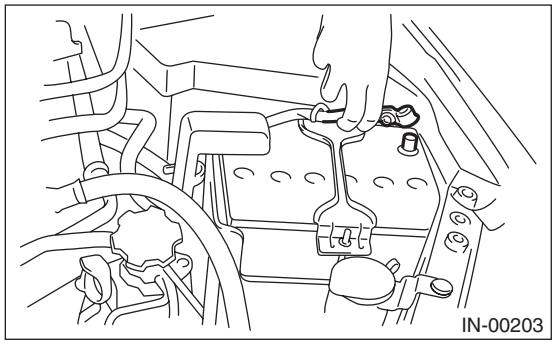
A: REMOVAL

WARNING:
Place "NO OPEN FLAMES" signs near the working area.

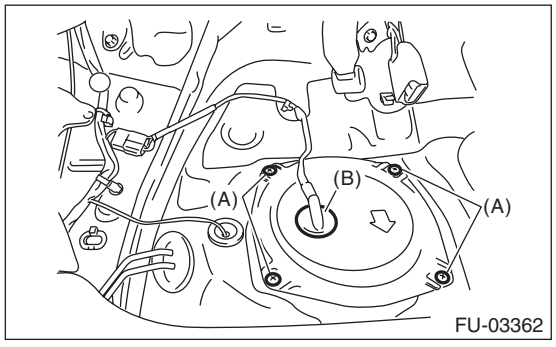
CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
Fuel pump assembly consists of fuel pump, fuel filter and fuel level sensor.

1) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4SO)-52, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.

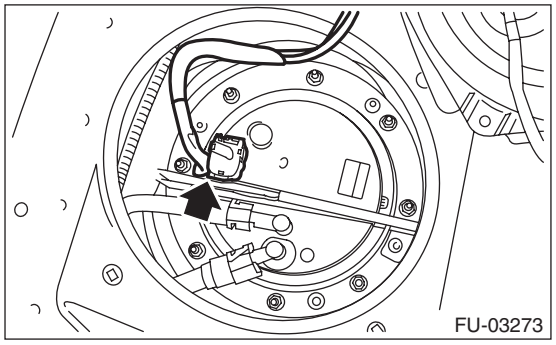

IN-00203

4) Remove the rear seat cushion. <Ref. to SE-12, REMOVAL, Rear Seat.>
5) Remove the service hole cover.
   (1) Remove the screws (A).
   (2) Push the grommet (B) down and remove service hole cover.

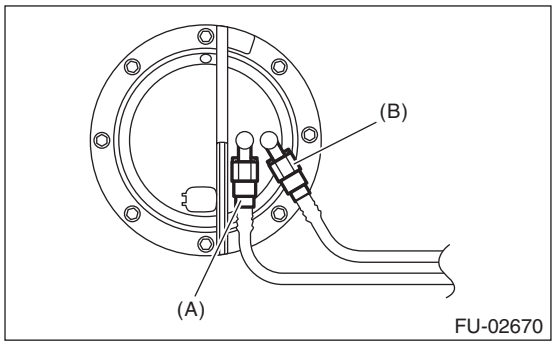


FU-03362

6) Disconnect the connector from fuel pump.

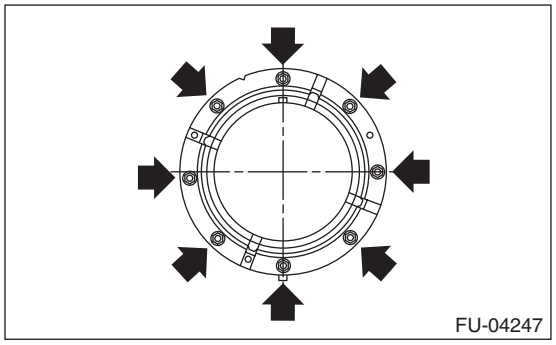

FU-03273

7) Disconnect the quick connector of fuel delivery tube (A) and jet pump tube (B). <Ref. to FU(H4SO)-75, REMOVAL, Fuel Delivery and Evaporation Lines.>



FU-02670

8) Remove the nuts which hold the fuel pump assembly to the fuel tank.


FU-04247

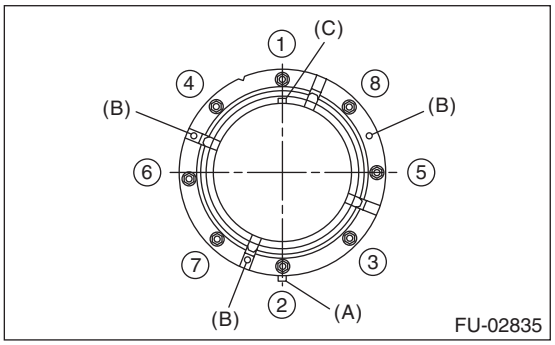
9) Remove the fuel pump assembly from the fuel tank.

B: INSTALLATION

Install in the reverse order of removal while being careful of the following.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Install with the protrusion (A) of gasket aimed at the front side of the vehicle.
- Insert the protrusion (B) of gasket into the upper plate. (3 places)
- Align the protrusion (C) of fuel pump assembly with the cutout on the upper plate.
- Tighten the nuts to the specified torque in the order as shown in the figure.

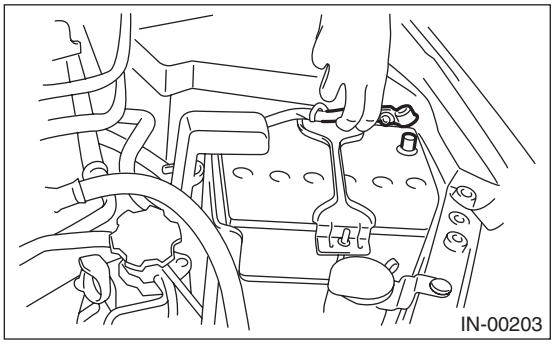
NOTE:
Use a new gasket and retainer.

Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)



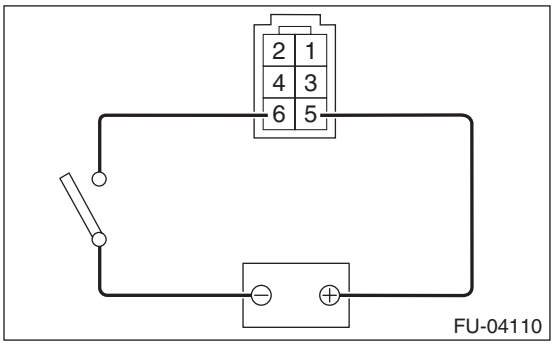
C: INSPECTION

1) Disconnect the ground cable from battery.



2) Remove the fuel pump. <Ref. to FU(H4SO)-64, REMOVAL, Fuel Pump.>
3) Connect terminal No. 5 to battery positive terminal and No. 6 terminal to the battery ground terminal, and inspect the fuel pump operation.

WARNING:
- **Wipe off fuel completely.**
- **Keep the battery as far apart from fuel pump as possible.**
- **Do not run the fuel pump for a long time under non-load condition.**



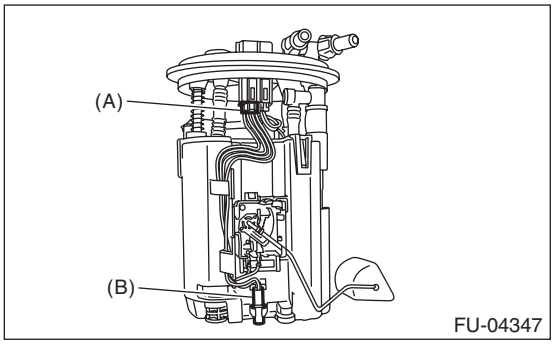
25.Fuel Level Sensor

A: REMOVAL

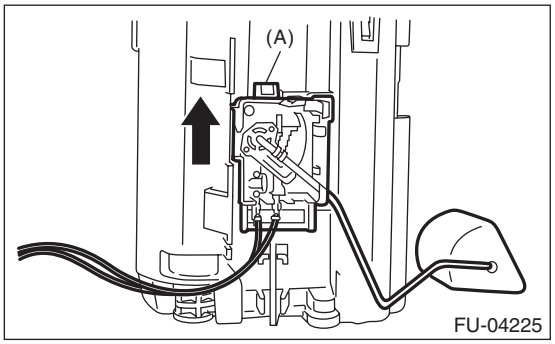
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
The fuel level sensor is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-64, REMOVAL, Fuel Pump.>
2) Disconnect the connector (A) from the sub tank bracket assembly.
3) Remove the fuel temperature sensor (B) from sub tank.



4) Slide the fuel level sensor in the direction of the arrow and remove the fuel level sensor by pressing the claw (A) of the fuel level sensor.

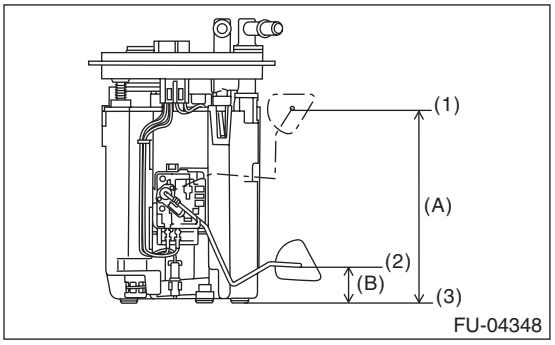


B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

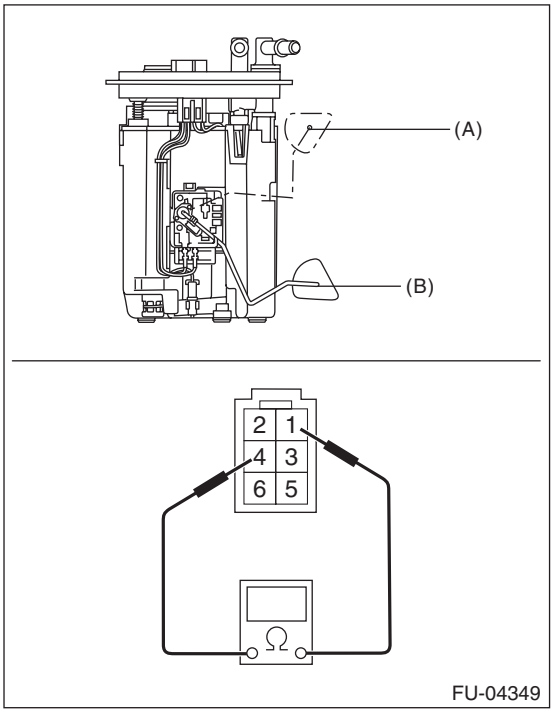
NOTE:
When inspecting the fuel level sensor, perform the work with the sensor installed to the fuel pump.
1) Measure the fuel level sensor float position.



(1) FULL
(2) EMPTY
(3) Fuel tank seating surface

Float position	Standard
FULL to Fuel tank seating surface (A)	135±4 mm (5.315±0.157 in)
EMPTY to Fuel tank seating surface (B)	23.7±4 mm (0.933±0.157 in)

2) Measure the resistance between fuel level sensor terminals.



Float position	Terminal No.	Standard
FULL (A)	1 and 4	2.0±1.0 Ω
EMPTY (B)		31.9±1.0 Ω

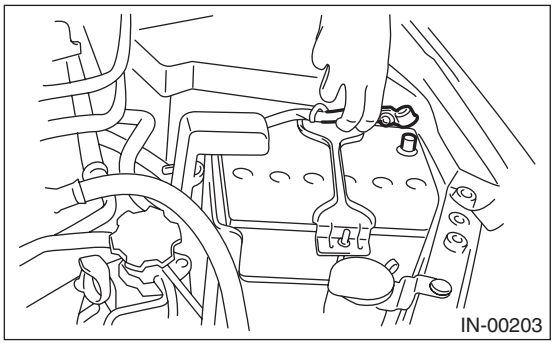
26.Fuel Sub Level Sensor

A: REMOVAL

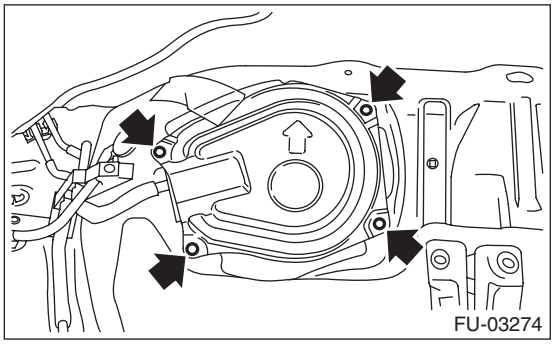
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

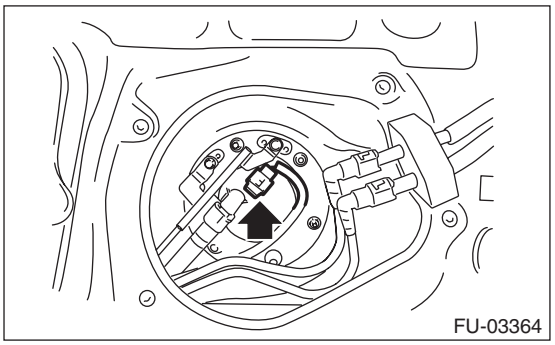
1) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(H4SO)-52, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.


IN-00203

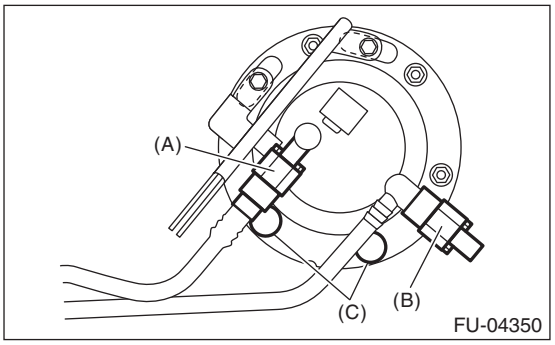
4) Remove the rear seat cushion. <Ref. to SE-12, REMOVAL, Rear Seat.>
5) Remove the service hole cover.


FU-03274

6) Disconnect the connector from the fuel sub level sensor.

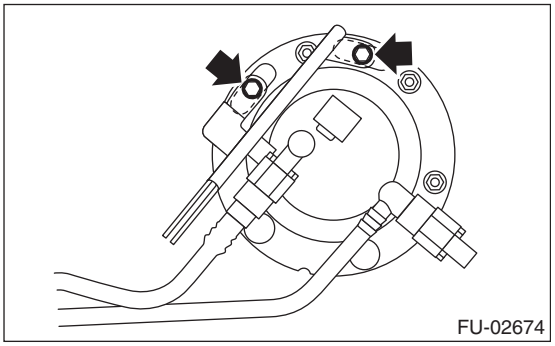

FU-03364

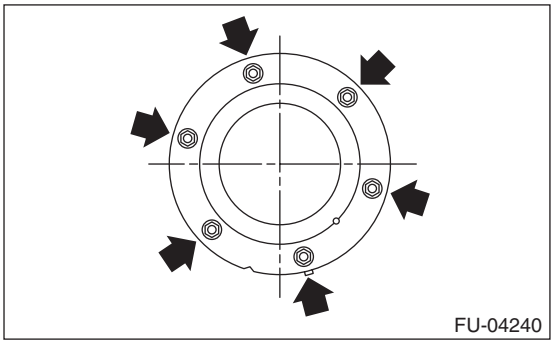
7) Disconnect the quick connector of fuel delivery tube (A) and jet pump tube (B). <Ref. to FU(H4SO)-75, REMOVAL, Fuel Delivery and Evaporation Lines.>
8) Remove the rubber cap (C) from the nut.



FU-04350

9) Remove the bolts and nuts which hold fuel sub level sensor to the fuel tank.


FU-02674


FU-04240

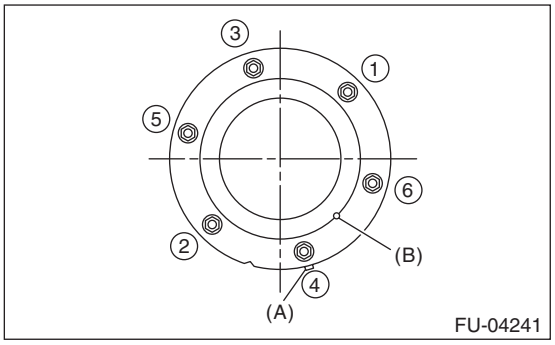
10) Remove the fuel sub level sensor.

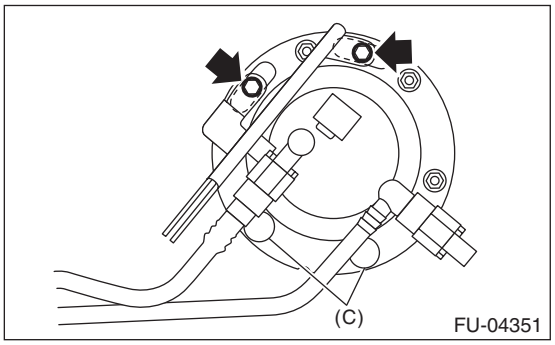
B: INSTALLATION

Install in the reverse order of removal while being careful of the following.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align protrusion (A) of the gasket to the position shown in the following figure.
- Align protrusion (B) of the fuel sub level sensor to the cut out in the fuel sub level sensor upper plate.
- Tighten the nuts and bolts to the specified torque in the order as shown in the figure.
- After tightening, install the rubber cap (C) shown in the figure.

NOTE:
- Use a new gasket and retainer.
- Do not forget to install rubber cap (C).

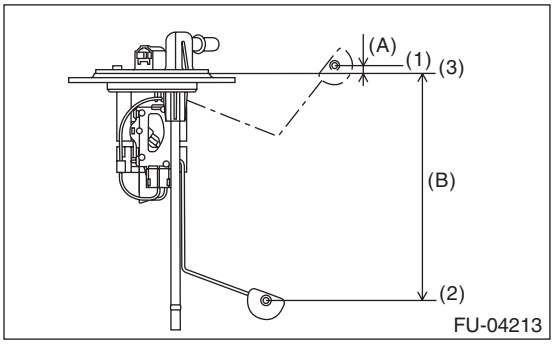
Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)





C: INSPECTION

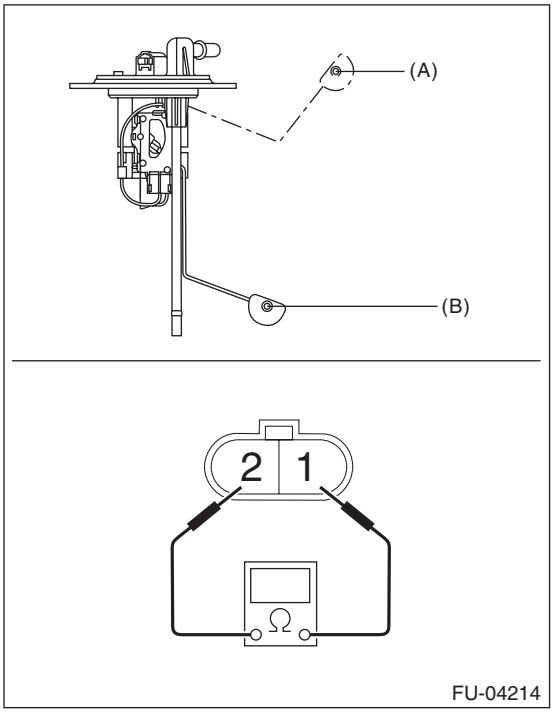
1) Measure the fuel sub level sensor float position.



(1) FULL
(2) EMPTY
(3) Datum points

Float position	Standard
FULL to Datum point (A)	5.31±3.5 mm (0.209±0.138 in)
EMPTY to Datum point (B)	160.6±3.5 mm (6.323±0.138 in)

2) Measure the resistance between fuel sub level sensor terminals.



Float position	Terminal No.	Standard
FULL (A)	1 and 2	2.0±1.0 Ω
EMPTY (B)		62.1±1.0 Ω

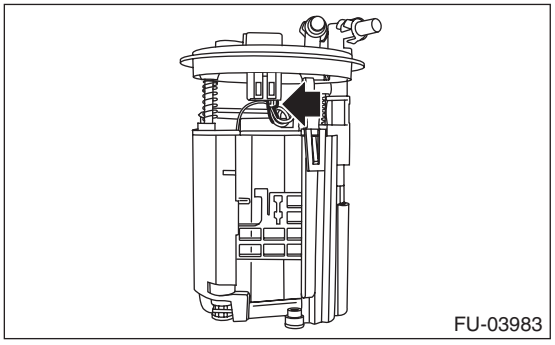
27.Fuel Filter

A: REMOVAL

WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**
- **Be careful not to drop or apply any impact to the fuel pump during work. This may deteriorate its performance.**

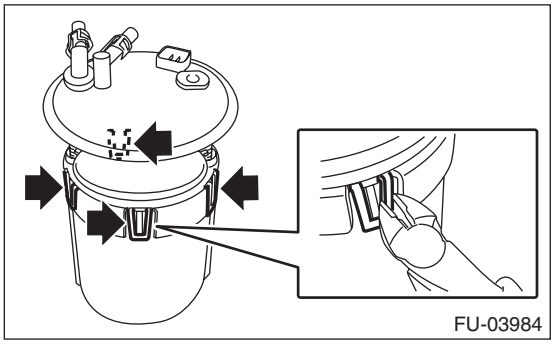
NOTE:
The fuel filter is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(H4SO)-64, REMOVAL, Fuel Pump.>
2) Remove the fuel level sensor and fuel temperature sensor. <Ref. to FU(H4SO)-66, REMOVAL, Fuel Level Sensor.>
3) Disconnect the pump assembly connector from sub tank bracket assembly.


FU-03983

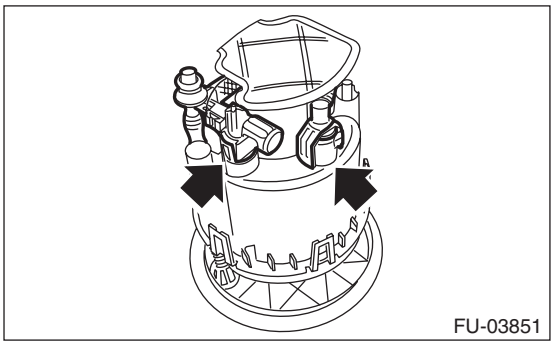
4) Cut off the tab holders connecting the sub tank bracket assembly and the sub tank in four locations, and separate the two.

CAUTION:
Be careful not to damage the sub tank.

NOTE:
If the O-ring is remaining on the sub tank, remove.

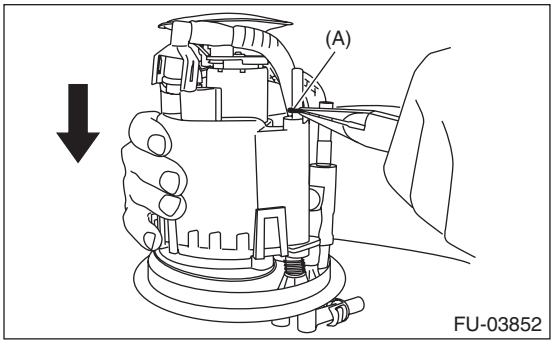

FU-03984

5) Disconnect two connectors of fuel delivery pipe from fuel filter assembly.


FU-03851

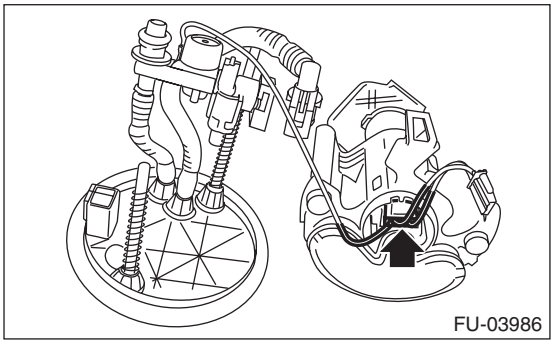
6) Push to compress the fuel filter assembly in the direction of the arrow, remove clip (A), and separate the sub tank bracket assembly and the fuel filter assembly.

CAUTION:
When separating the sub tank bracket assembly and the fuel filter assembly, be careful not to damage the ground wire.



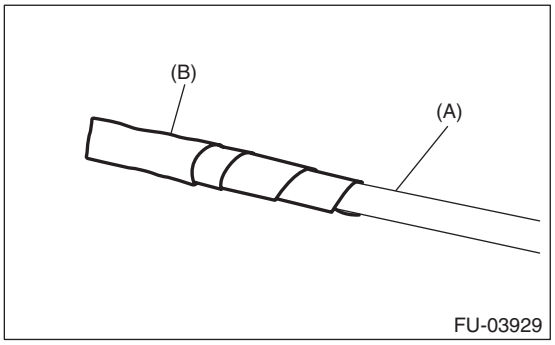
FU-03852

7) Disconnect the connector from the pump assembly.


FU-03986

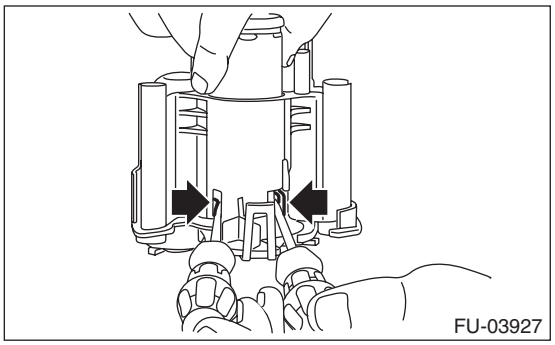
8) Lift the two tab holders connecting the pump assembly to the fuel filter using a flat tip screwdriver (with a shaft diameter of approx. 3 mm (0.12 in)), etc., and separate the fuel filter and pump assembly.

CAUTION:
• To prevent damaging the tabs of the pump assembly, wrap the tip of flat tip screwdriver (A), etc. with tape (B).



• Be careful not to drop or apply any impact to the pump assembly.

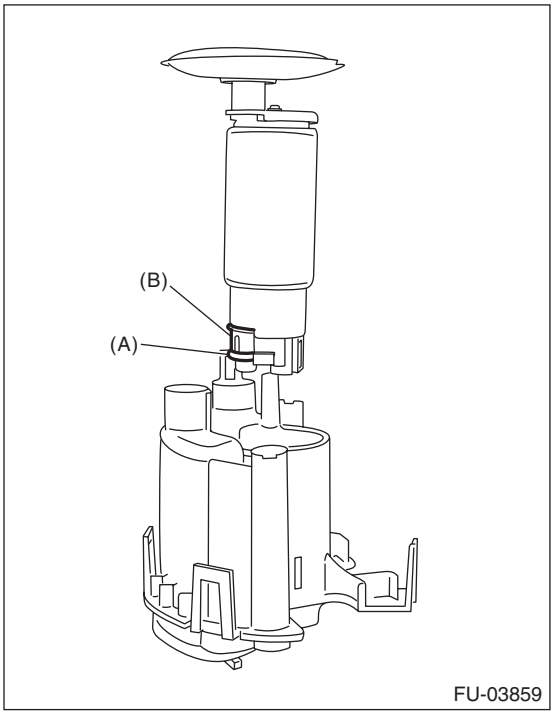
NOTE:
If the spacer and O-ring is remaining on the pump assembly, remove these.



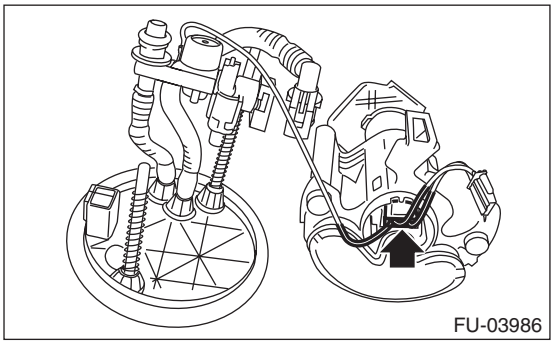
B: INSTALLATION

1) Assemble O-ring (A) and spacer (B) to the pump assembly and attach the pump assembly to the fuel filter.

NOTE:
- Use new O-rings (8 mm (0.31 in) inner diameter).
- Use a new spacer.
- Apply gasoline to the O-ring.
- Insert the pump assembly until a “pop” is heard.

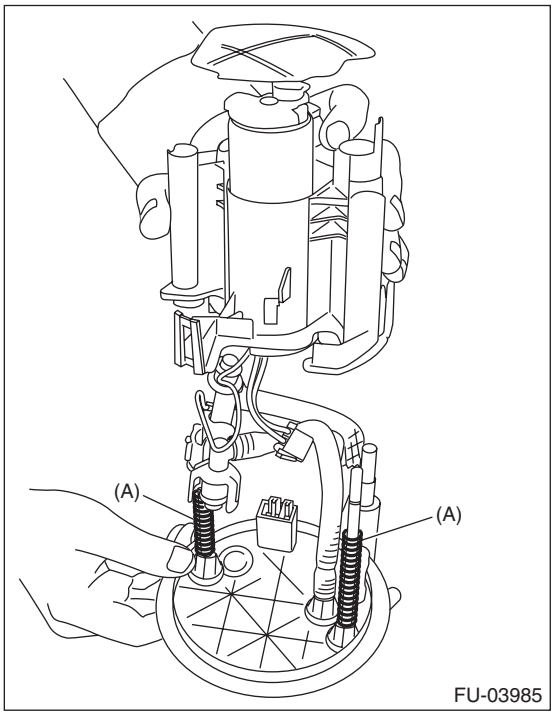


2) Connect the connector to the pump assembly.



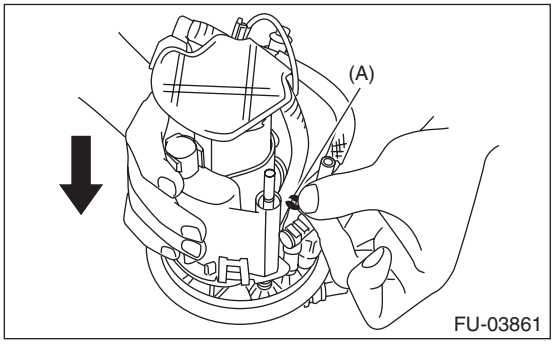
3) Attach spring (A) to the metal rod of the sub tank bracket assembly, and assemble the fuel filter assembly.

NOTE:
Use a new spring.



4) Push the fuel filter assembly in the direction of the arrow to compress, and attach clip (A).

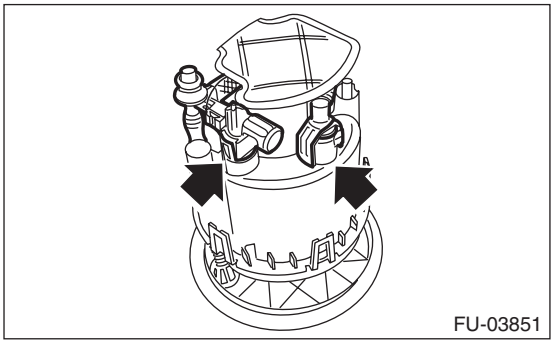
NOTE:
Use a new clip.



5) Connect the fuel piping connector to the fuel filter assembly.

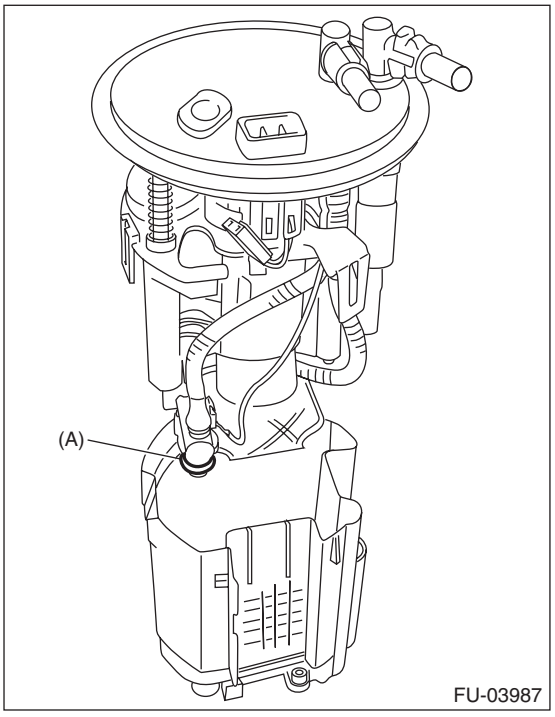
NOTE:
- Use new O-rings.
- Apply gasoline to the O-ring.
- The O-rings of the black and white connectors are identified by a difference in diameter. Be careful not to confuse the two during assembly.

O-ring inner diameter:
Black connector O-ring [Approx. 7 mm (0.28 in)]
White connector O-ring [Approx. 8 mm (0.31 in)]

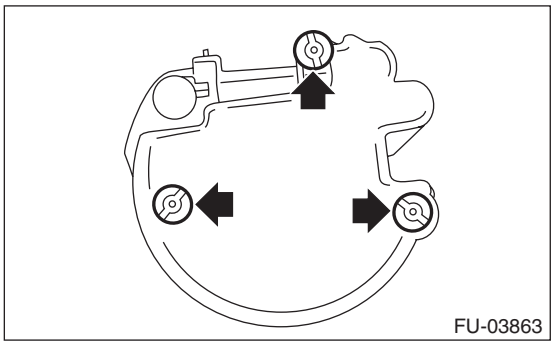


6) Attach the O-ring (A) to the fuel filter assembly, and attach the sub tank to the sub tank bracket assembly.

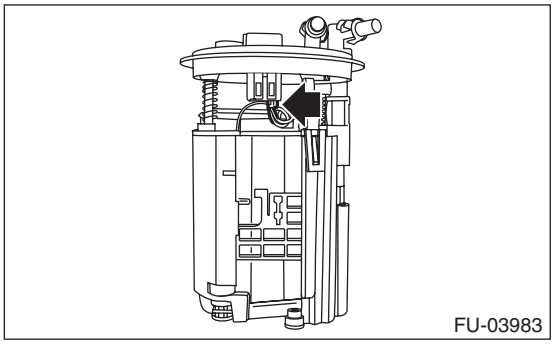
NOTE:
- Use new O-rings (8 mm (0.31 in) inner diameter).
- Apply gasoline to the O-ring.
- Insert the pump assembly until a “pop” is heard.



7) Replace the cushion on the rear face of the sub tank with a new cushion.



8) Connect the pump assembly connector to the sub tank bracket assembly.



9) Install the fuel level sensor and fuel temperature sensor. <Ref. to FU(H4SO)-66, INSTALLATION, Fuel Level Sensor.>

10) Install the fuel pump assembly. <Ref. to FU(H4SO)-65, INSTALLATION, Fuel Pump.>

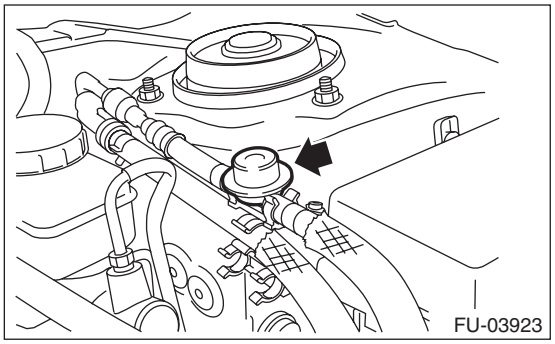
28.Fuel Damper

A: REMOVAL

WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

1) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Remove the fuel damper from the fuel delivery line.



B: INSTALLATION

CAUTION:
If fuel hoses or clamps are damaged, replace them with new parts.
Install in the reverse order of removal.

Tightening torque:
1.25 N·m (0.1 kgf-m, 0.9 ft-lb)

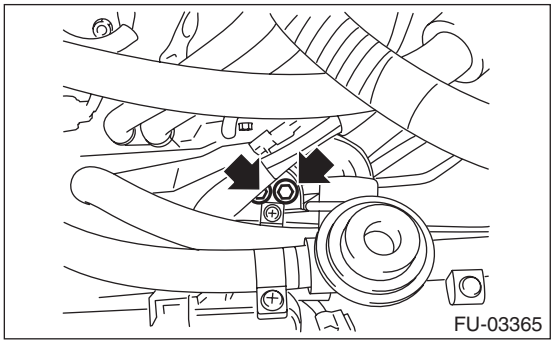
C: INSPECTION

Check that the fuel hose and fuel dumper does not have deformation, cracks and damage.

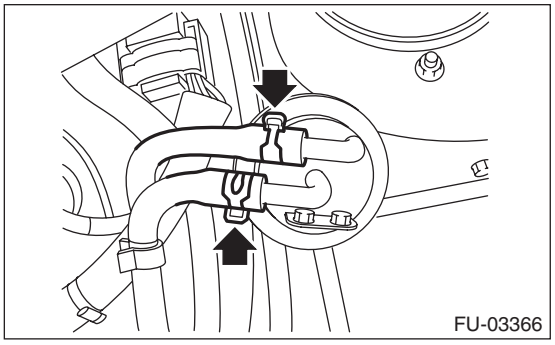
29.Purge Damper

A: REMOVAL

WARNING:
Place "NO OPEN FLAMES" signs near the working area.
1) Remove the purge damper from the purge damper stay.



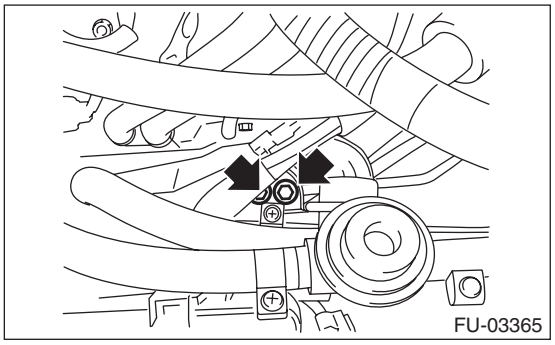
2) Disconnect the evaporation hose from the purge damper.



B: INSTALLATION

CAUTION:
If the evaporation hose is damaged, replace with a new hose.
Install in the reverse order of removal.

Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)

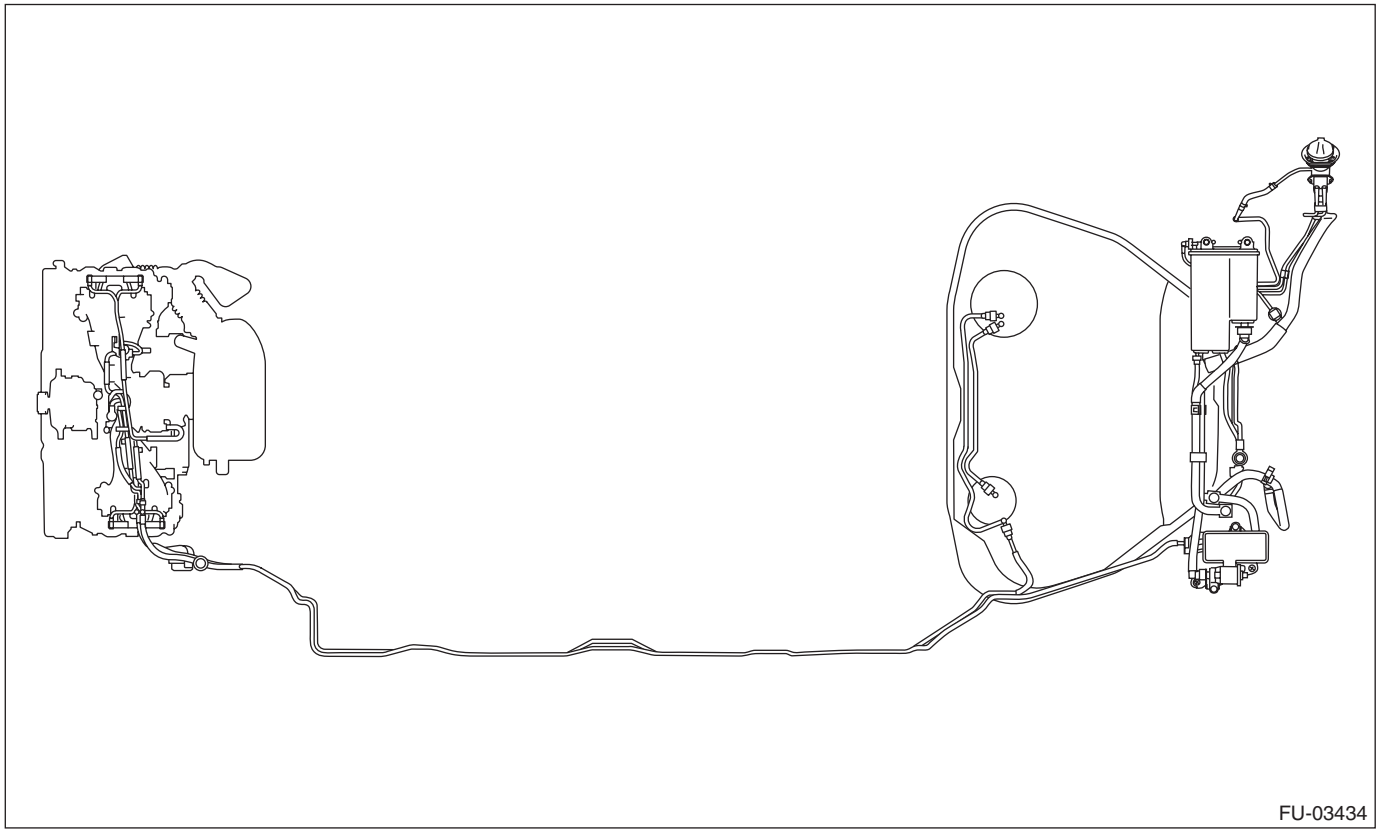


C: INSPECTION

Check that the evaporation hose and purge damper does not have deformation, cracks and damage.

30.Fuel Delivery and Evaporation Lines

A: REMOVAL



WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

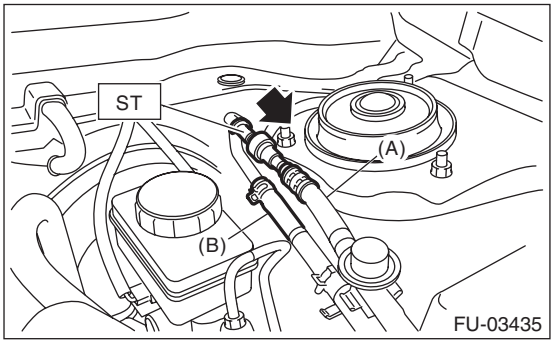
1) Set the vehicle on a lift.
2) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the floor mat. <Ref. to EI-69, REMOVAL, Floor Mat.>
5) In the engine compartment, disconnect the fuel delivery hoses and evaporation hose.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

(1) Set the ST to the fuel pipe.
(2) Disconnect the quick connector of the fuel delivery hose by pushing the ST in the direction of the arrow.

ST 42099AE000 QUICK CONNECTOR RELEASE

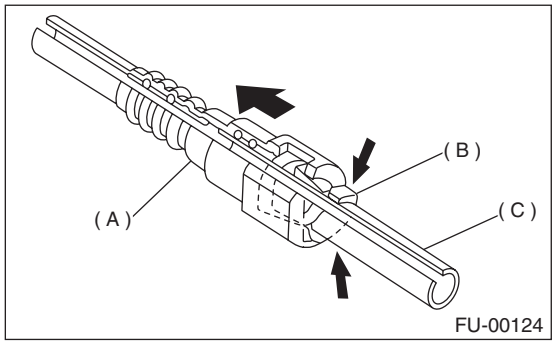
(3) Remove the clip and disconnect the evaporation hose from the fuel pipe.



(A) Fuel delivery hose
(B) Evaporation hose

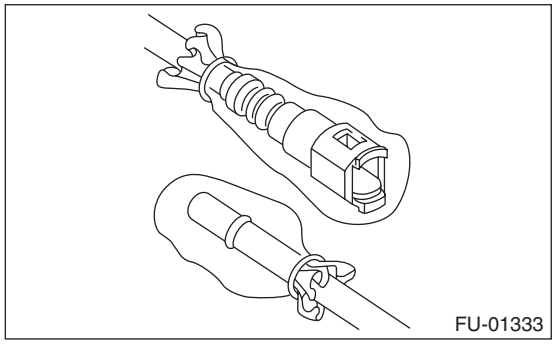
6) Remove the canister. <Ref. to EC(H4SO)-5, REMOVAL, Canister.>
7) Remove the fuel tank. <Ref. to FU(H4SO)-54, REMOVAL, Fuel Tank.>
8) Remove the fuel pipe assembly.
9) Disconnect the quick connector, and disconnect the fuel delivery tube and jet pump tube.
(1) Push the retainer in the direction of the arrow, disconnect the quick connector from pipe.

NOTE:
Clean the pipe and quick connector, if they are covered with dust.

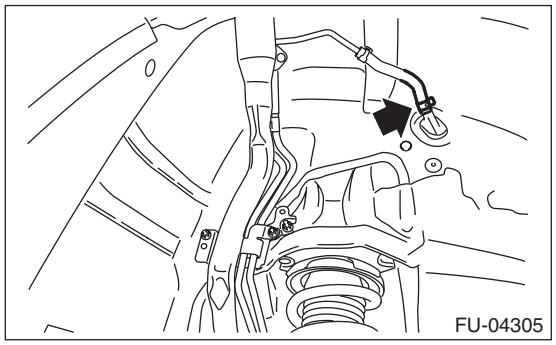


(A) Quick connector
(B) Retainer
(C) Pipe

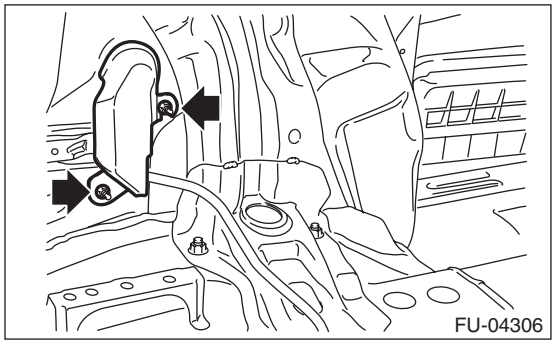
(2) To prevent from damaging or entering foreign matter, wrap the pipes and quick connectors with plastic bag etc.



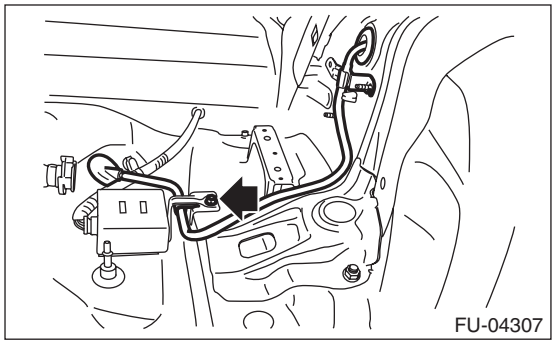
10) Remove the evaporation pipe.
(1) Remove the rear mud guard RH. <Ref. to EI-28, REMOVAL, Mud Guard.>
(2) Remove the evaporation hose.



(3) Remove the right side trunk side trim.(4 door model) <Ref. to EI-61, REMOVAL, Trunk Room Trim.>
(4) Remove the right side rear quarter trim.(5 door model) <Ref. to EI-58, REMOVAL, Rear Quarter Trim.>
(5) Remove the evaporation pipe protector.



(6) Remove the evaporation pipe from vehicle.

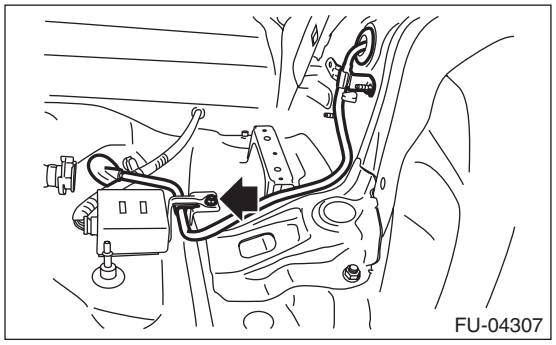


B: INSTALLATION

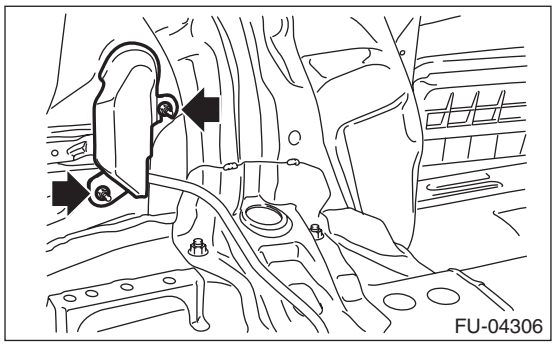
Install in the reverse order of removal while being careful of the following.

1. EVAPORATION PIPE INSTALLATION

1) Install the evaporation pipe to the vehicle.

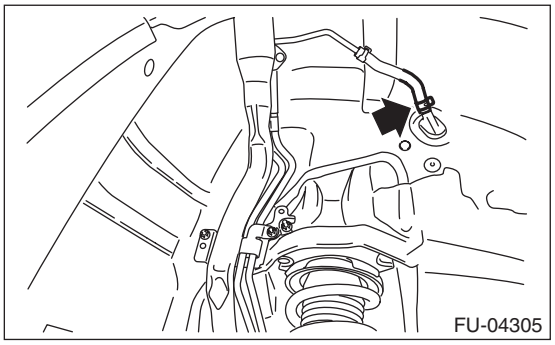


2) Install the evaporation pipe protector.



3) Install the right side trunk side trim.(4 door model) <Ref. to EI-61, INSTALLATION, Trunk Room Trim.>

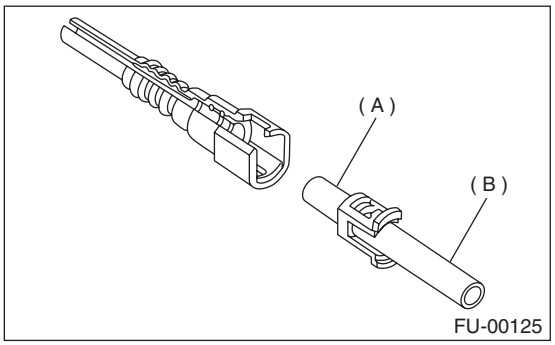
4) Install the right side rear quarter trim.(5 door model) <Ref. to EI-59, INSTALLATION, Rear Quarter Trim.>
5) Install the evaporation hose.



6) Install the rear mud guard RH. <Ref. to EI-28, INSTALLATION, Mud Guard.>

2. CONNECTING THE FUEL LINE QUICK CONNECTOR

CAUTION:
Make sure there are no damage or dust on connections. If necessary, clean seal surface of pipe.

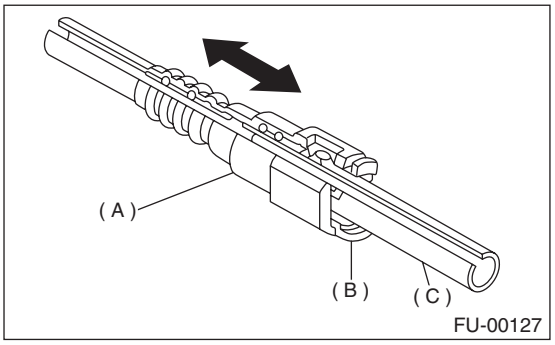


(A) Seal surface
(B) Pipe

1) Set the retainer to quick connector.

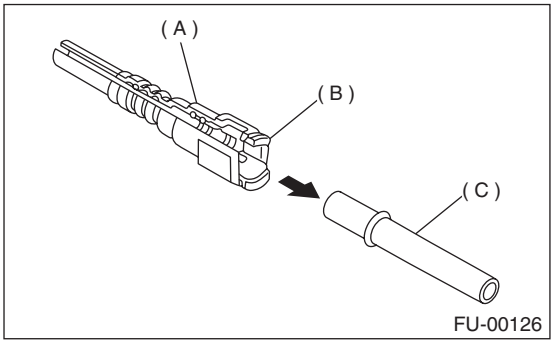
NOTE:
Use a new retainer.
2) Connect the quick connector to pipe.

CAUTION:
• Make sure that the quick connector is securely connected.



(A) Quick connector
(B) Retainer
(C) Pipe

• Make sure the two retainer pawls are engaged in their mating positions in the quick connector.
• Be sure to inspect tubes and their connections for any leakage of fuel.



(A) Quick connector
(B) Retainer
(C) Pipe

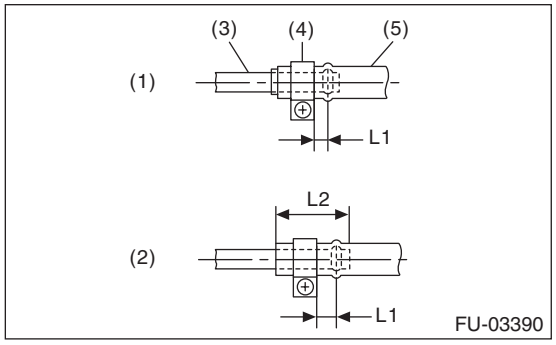
3. CONNECTING THE FUEL DELIVERY HOSE

Connect the fuel delivery hose to the pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).
Type A: When the amount to be inserted is specified.
Type B: When the amount to be inserted is not specified.

L1: 2.5±1.5 mm (0.098±0.059 in)

L2: 22.5±2.5 mm (0.886±0.098 in)

CAUTION:
Be sure to inspect hoses and their connections for any leakage of fuel.

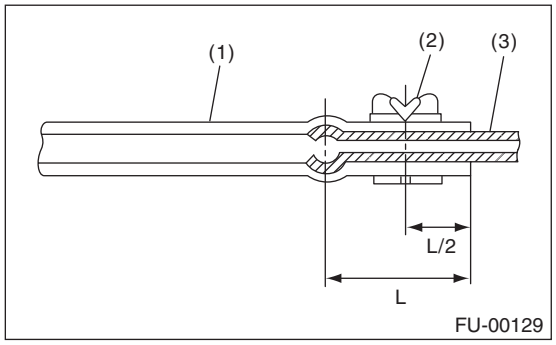


(1) Type A
(2) Type B
(3) Pipe
(4) Clamp
(5) Hose

4. EVAPORATION HOSE CONNECTION

Connect the evaporation hose to the pipe with an overlap of 15 to 20 mm (0.59 to 0.79 in).

L = 17.5±2.5 mm (0.689±0.098 in)



(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 the fuel pipe and fuel hose connections are tightened firmly.

31.Fuel System Trouble in General

A: INSPECTION

Trouble and possible cause		Corrective action
1. Insufficient fuel supply to injector		
1)	Fuel pump does not operate.	
	❍ Defective terminal contact	Inspect contact, especially ground, and tighten it securely.
	❍ Trouble in electromagnetic or electronic circuit parts	Replace the faulty parts.
2)	Decline of fuel pump function	Replace the fuel pump.
3)	Clogged fuel filter	Replace the fuel filter. Clean or replace the fuel tank if necessary.
4)	Clogged or bent fuel pipe or hose	Clean, correct or replace fuel pipe or hose.
5)	Air is mixed in fuel system.	Inspect and retighten each connection part.
6)	Clogged or bent air breather tube or pipe.	Clean, correct or replace the air breather tube or pipe.
7)	Damaged diaphragm of pressure regulator	Replace.
2. Leakage or blow out of fuel		
1)	Loose joints of the fuel pipe	Retighten.
2)	Cracked fuel pipe, hose and fuel tank	Replace.
3)	Defective welding part on the fuel tank	Replace.
4)	Clogged or bent air breather tube or air vent tube	Clean, correct or replace the 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	Retighten.
2)	Problem in tightening of the fuel saucer gasket air	Correct or replace the gasket.
3)	Inoperative fuel pump modulator or circuit	Replace.
4. Defective fuel meter indicator		
1)	Defective operation of fuel level sensor	Replace.
2)	Defective operation of fuel meter	Replace.
5. Noise		
1)	Large operation noise or vibration of fuel pump	Replace.

NOTE:
• When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill fuel fully to prevent the problem.
• In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop to 0°C (32°F) or less throughout the winter season, use a water removing agent in the fuel system to prevent freezing fuel system and accumulating water.
• When water is accumulated in fuel filter, fill the water removing agent in the fuel tank.
• Before using water removing agent, follow the cautions noted on the bottle.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

EC(H4SO)

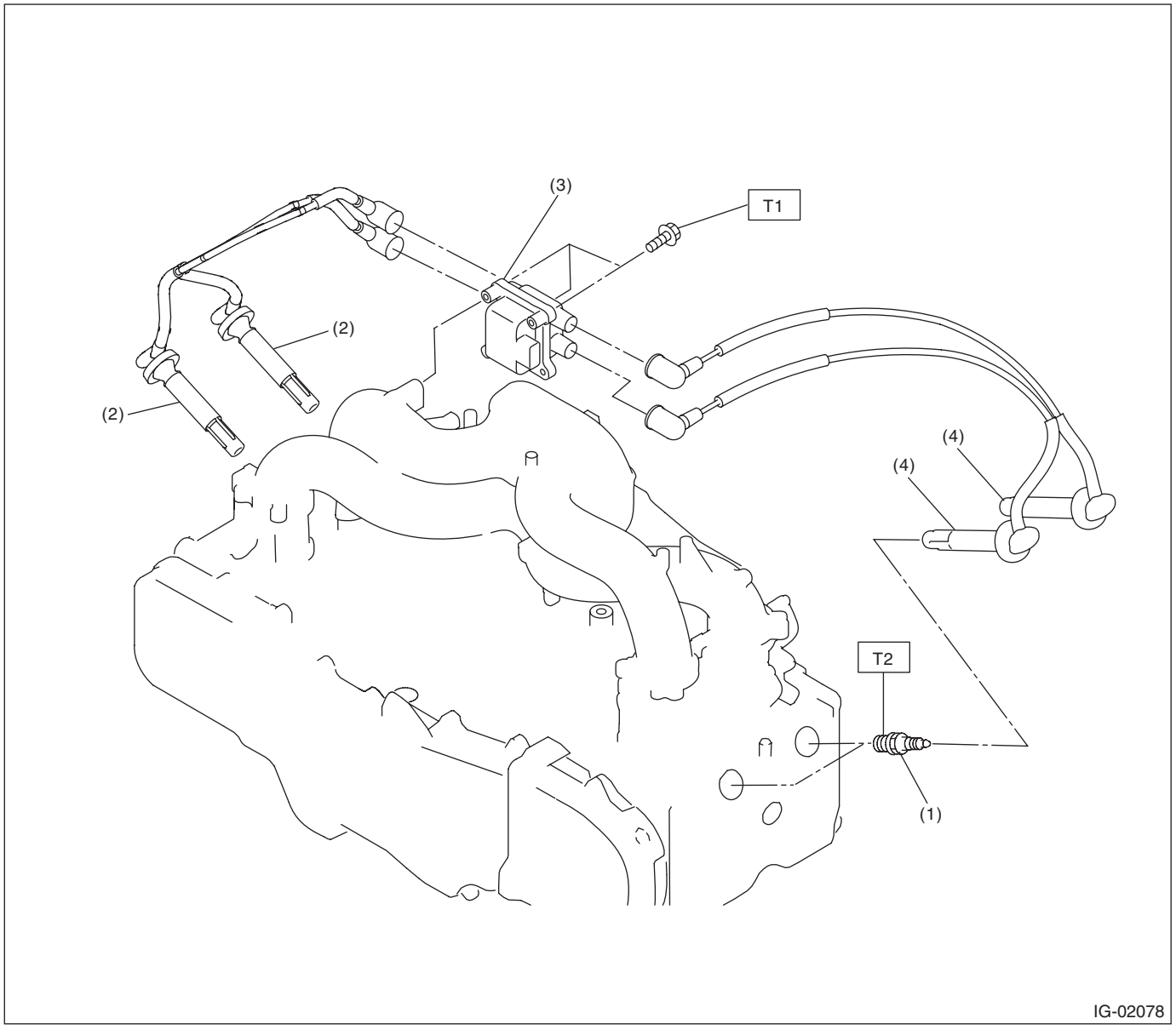
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10.	Fuel Tank Pressure Sensor	15
11.	Pressure Control Solenoid Valve	16
12.	Drain Filter	17
13.	Shut Valve	18
14.	Drain Valve	19
15.	PCV Hose Assembly	20

1. General Description

A: SPECIFICATION

Item		Specifications
Ignition coil and ignitor ASSY	Type	FH 0363
	Manufacturer	Diamond Electric
	Secondary coil resistance	11.2 kΩ±15%
Spark plug	Manufacturer and type	NGK: FR5AP-11
	Thread size (diameter, pitch, length) mm	14,1.25,19
	Spark plug gap mm (in)	1.0 — 1.1 (0.039 — 0.043)
	Electrode	Platinum

B: COMPONENT



(1) Spark plug
(2) Spark plug cord (#1, #3)
(3) Ignition coil and ignitor ASSY
(4) Spark plug cord (#2, #4)

Tightening torque:N·m (kgf-m, ft-lb)
T1: 8 (0.8, 5.9)
T2: 21 (2.1, 15.5)

C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• 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.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

D: PREPARATION TOOL

1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance.

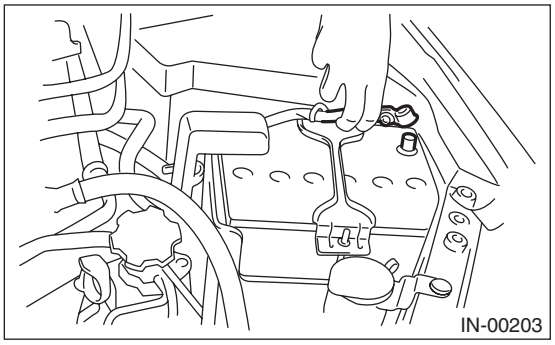
2. Spark Plug

A: REMOVAL

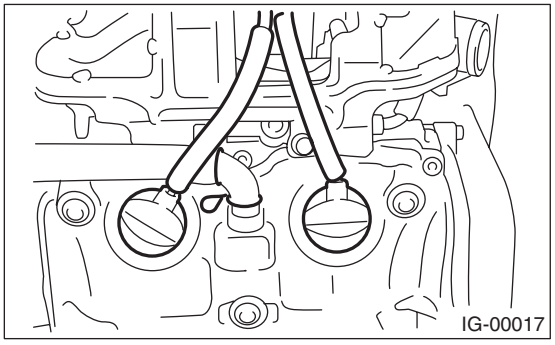
Spark plug:
Refer to "SPECIFICATION" for the spark plug. <Ref. to IG(H4SO)-2, SPECIFICATION, General Description.>

1. RH SIDE

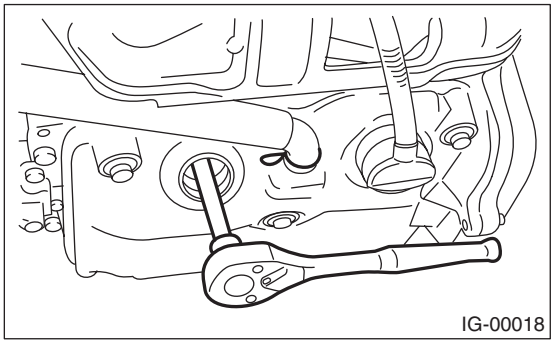
1) Disconnect the ground cable from the battery.


IN-00203

2) Remove the air cleaner case. <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>
3) Remove the spark plug cords by pulling the boot. (Do not pull the cord itself.)

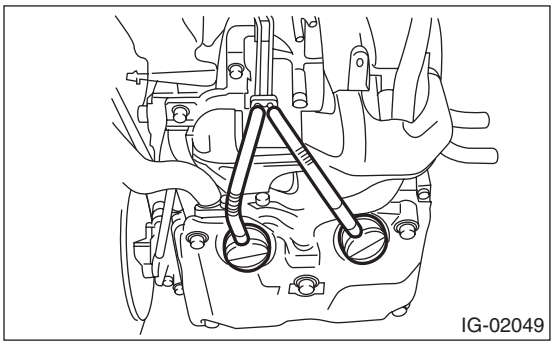

IG-00017

4) Remove the spark plug with a spark plug socket.

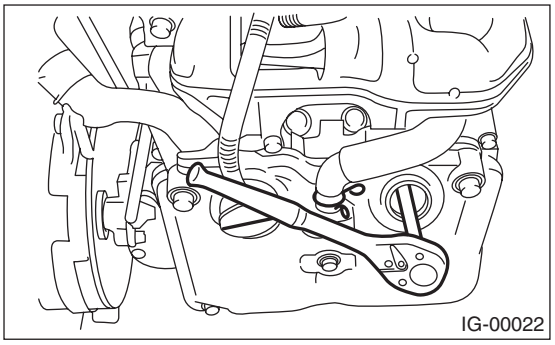

IG-00018

2. LH SIDE

1) Remove the battery. <Ref. to SC(H4SO)-22, REMOVAL, Battery.>
2) Remove the spark plug cords by pulling the boot. (Do not pull the cord itself.)


IG-02049

3) Remove the spark plug with a spark plug socket.


IG-00022

B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)

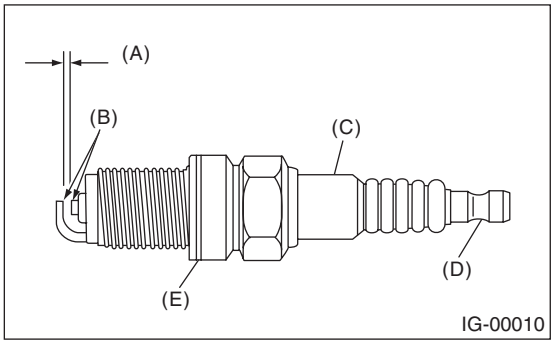
2. LH SIDE

Install in the reverse order of removal.

Tightening torque:
21 N·m (2.1 kgf-m, 15.5 ft-lb)

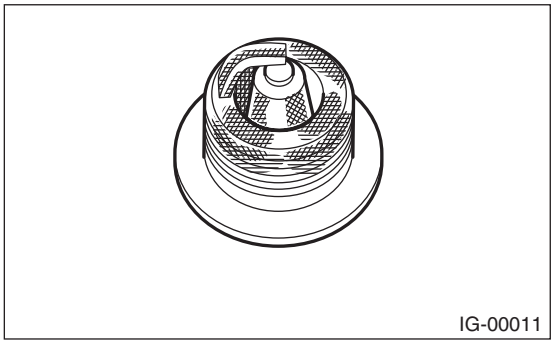
C: INSPECTION

Check the electrodes and inner and outer ceramic insulator of plugs, noting the type of deposits and the degree of electrode erosion.

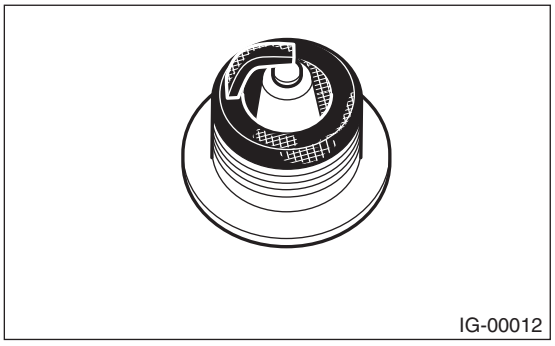


(A) Spark plug gap
(B) Carbon accumulation or wear
(C) Cracks
(D) Damage
(E) Damaged gasket

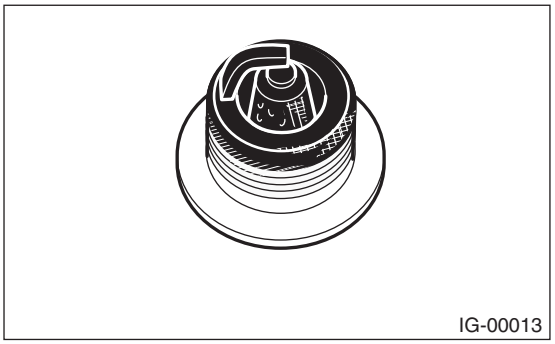
1) Normal:
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



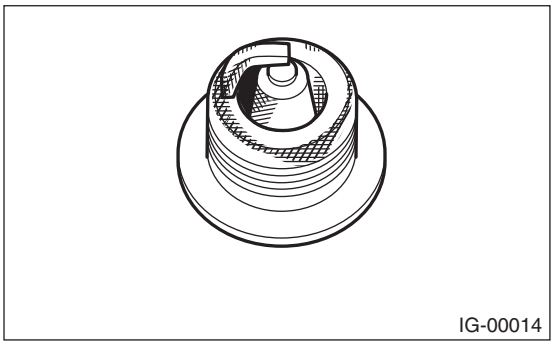
2) Carbon fouled:
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in the city, weak ignition, too rich fuel mixture and dirty air cleaner.



3) Oil fouled:
Wet black deposits show oil entrance into the combustion chamber through worn rings or pistons, or excessive clearance between valve guides and stems.



4) Overheating:
White or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, incorrect ignition timing, wrong selection of fuel, and loose spark plugs.

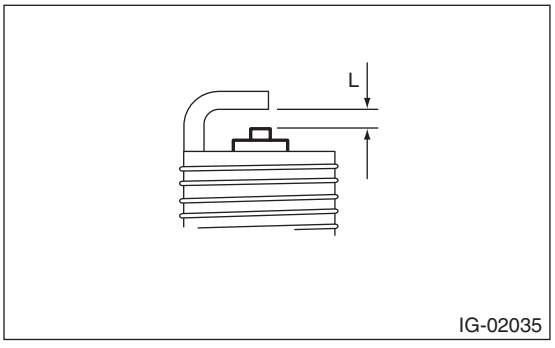


D: ADJUSTMENT

Clean spark plugs with a nylon brush, etc. Clean and remove the carbon or oxide deposits. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, measure the spark plug gap using a gap gauge.

NOTE:
- Never use plug cleaner.
- Do not use metal brush or it will wear insulator.

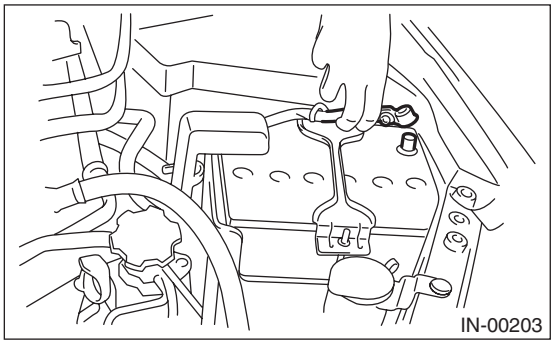
Spark plug gap L:
1.0 — 1.1 mm (0.039 — 0.043 in)



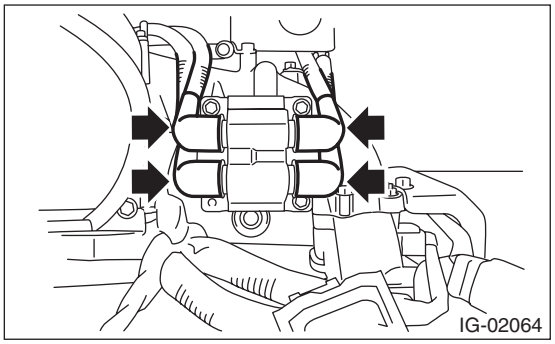
3. Ignition Coil and Ignitor Assembly

A: REMOVAL

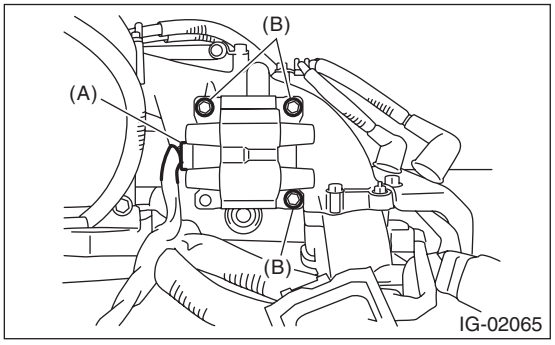
1) Disconnect the ground cable from battery.



2) Disconnect the spark plug cords from ignition coil and ignitor assembly.



3) Disconnect connector (A) from the ignition coil and ignitor assembly.
4) Remove the bolt (B) which secures the ignition coil and ignitor assembly to intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)

CAUTION:
Connect the spark plug cords to correct positions. Failure to do so will damage the unit.

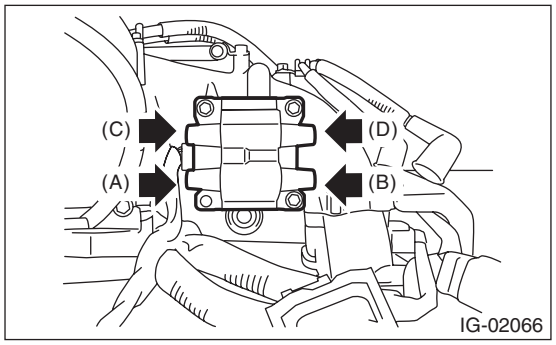
C: INSPECTION

Check the secondary coil resistance using a tester. Replace if defective.

CAUTION:
• If the resistance is extremely low, it indicates the presence of a short-circuit.
• Ignitor is integrated with the coil. Therefore the resistance of primary side coil cannot be measured.

Specified resistance:

[Secondary side]
Between (A) and (B)
11.2 kΩ±15%
Between (C) and (D)
11.2 kΩ±15%



4. Spark Plug Cord

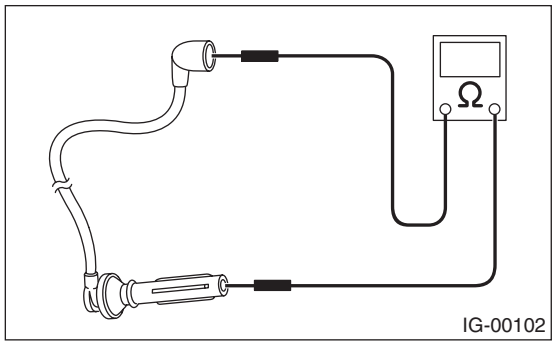
A: INSPECTION

Check the following items.

- Damage to cords, deformation, burning or rust formation of terminals
- Resistance value of cords

Specified resistance:

#1 cord: 5.0 — 12.1 kΩ
#2 cord: 8.5 — 19.9 kΩ
#3 cord: 5.4 — 13.0 kΩ
#4 cord: 8.6 — 20.2 kΩ



STARTING/CHARGING SYSTEMS

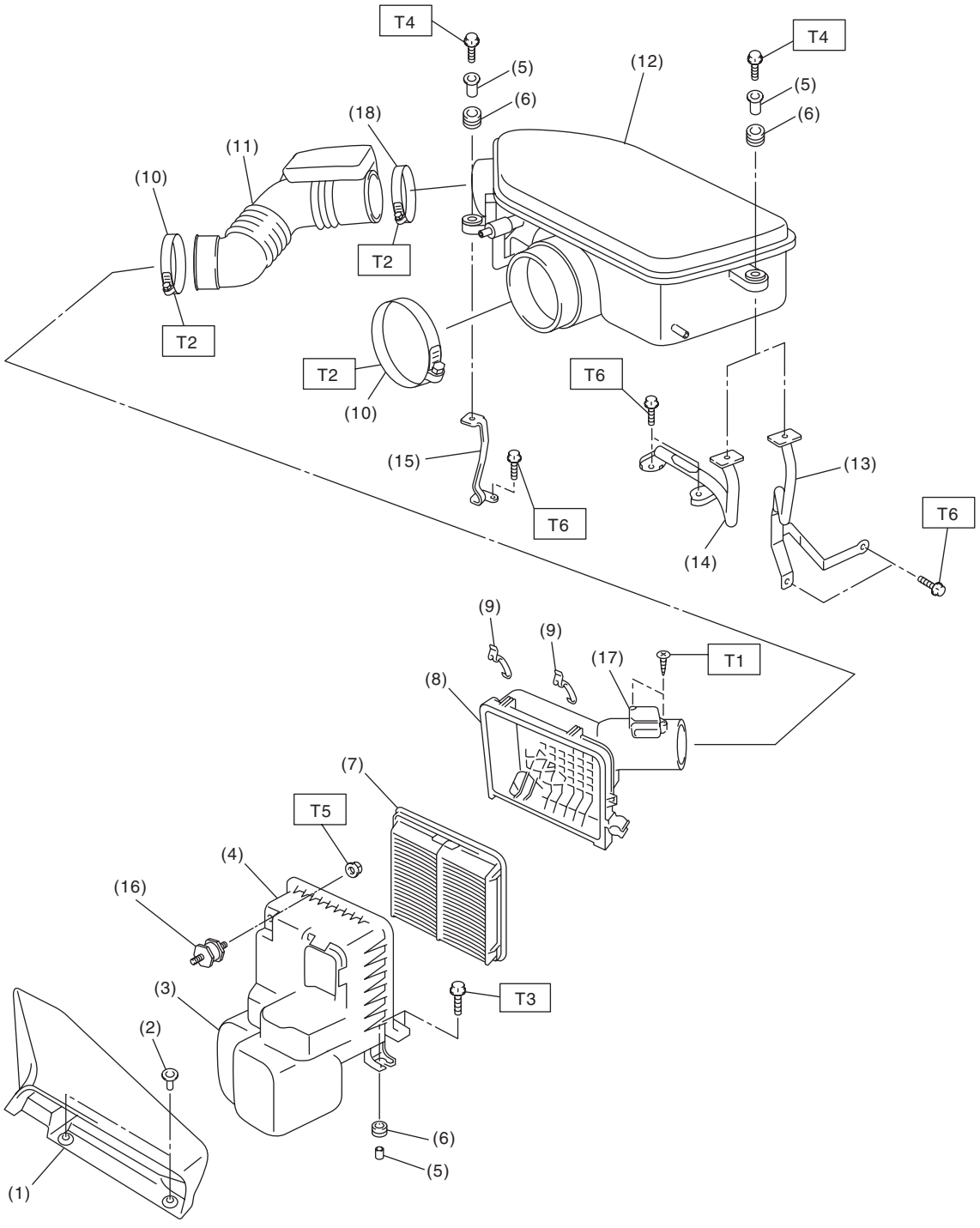
SC(H4SO)

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2. Starter 7
3. Generator 16
4. Battery 22

1. General Description

A: COMPONENT



IN-02543

(1) Air intake duct
(2) Clip
(3) Resonator chamber
(4) Air cleaner case (Front)
(5) Spacer
(6) Cushion
(7) Air cleaner element
(8) Air cleaner case (Rear)
(9) Clip
(10) Clamp
(11) Intake boot
(12) Air intake chamber
(13) Stay LH (MT model)
(14) Stay LH (AT model)
(15) Stay RH
(16) Cushion
(17) Mass air flow and intake air temperature sensor
(18) Clamp

Tightening torque:N·m (kgf-m, ft-lb)	
T1:	*1 (0.1, 0.7)*
T2:	*3 (0.3, 2.2)*
T3:	*6 (0.6, 4.4)*
T4:	*6.5 (0.7, 4.8)*
T5:	*7.5 (0.8, 5.5)*
T6:	*16 (1.6, 11.8)*

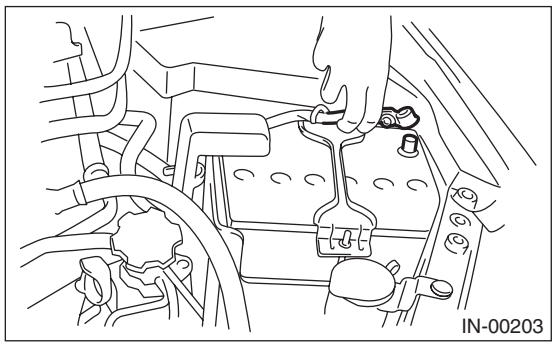
B: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- 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.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

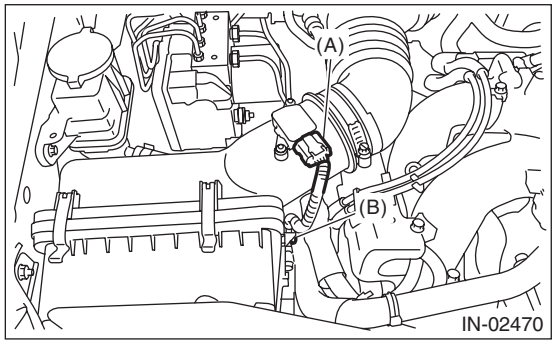
2. Air Cleaner Element

A: REMOVAL

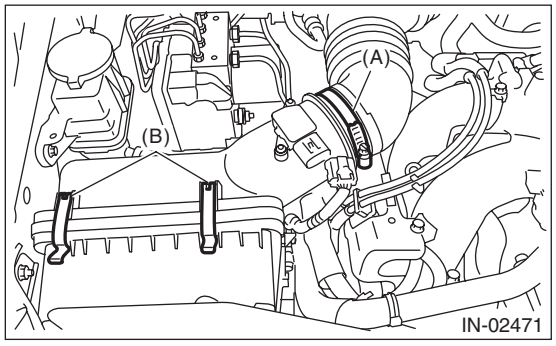
1) Disconnect the ground cable from battery.



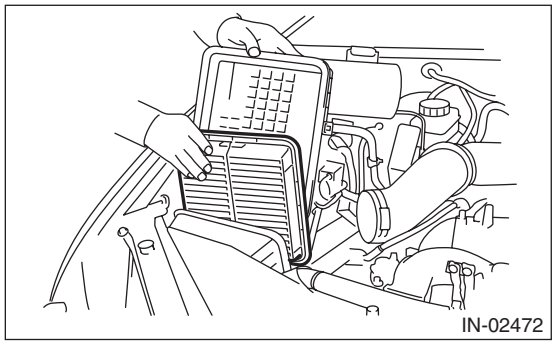
2) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B).



3) Loosen the clamp (A) which connects the air cleaner case to intake boot.
4) Remove the clips (B) securing the upper side of air cleaner case.



5) Remove the air cleaner case (rear) and air cleaner element.

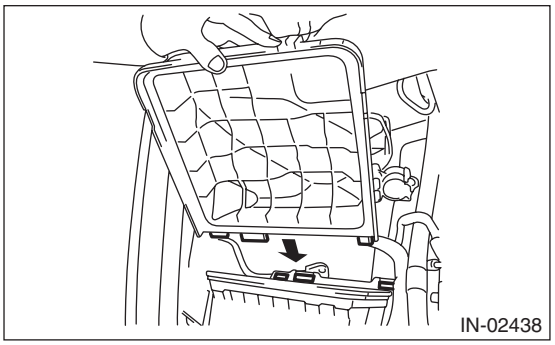


B: INSTALLATION

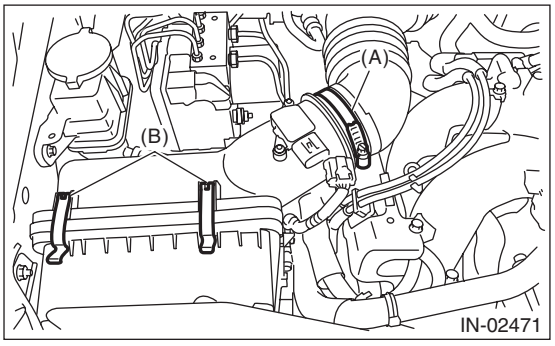
Install in the reverse order of removal.

CAUTION:
Be sure to use SUBARU genuine air cleaner element depending on the engine type when replacing the air cleaner elements. Using other air cleaner element may affect the engine performance.

NOTE:
• Check that there are no foreign objects in the air cleaner case.
• When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.



Tightening torque:
Clamp (A)
3 N·m (0.3 kgf-m, 2.2 ft-lb)



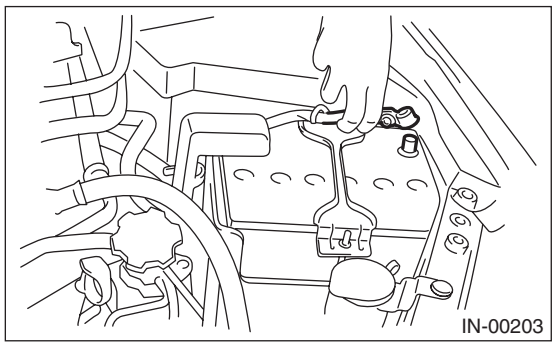
C: INSPECTION

Replace if excessively damaged or dirty.

3. Air Cleaner Case

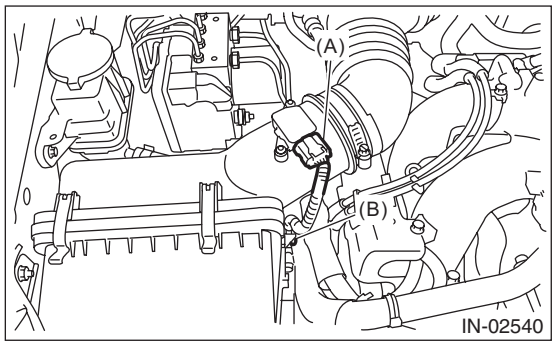
A: REMOVAL

1) Disconnect the ground cable from battery.



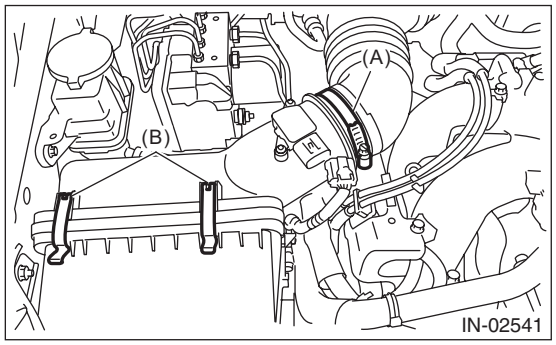
2) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>

3) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B).

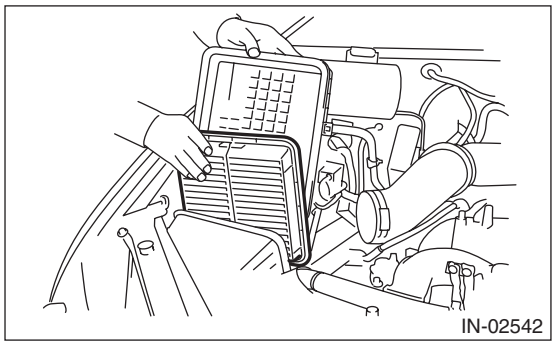


4) Loosen the clamp (A) which connects the air cleaner case to intake boot.

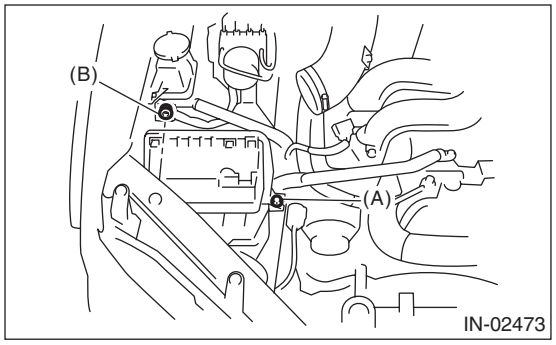
5) Remove the clips (B) from the air cleaner case (front).



6) Remove the air cleaner case (rear) and air cleaner element.



7) Remove the bolt (A) and nut (B) which secure the air cleaner case (front) to the body.

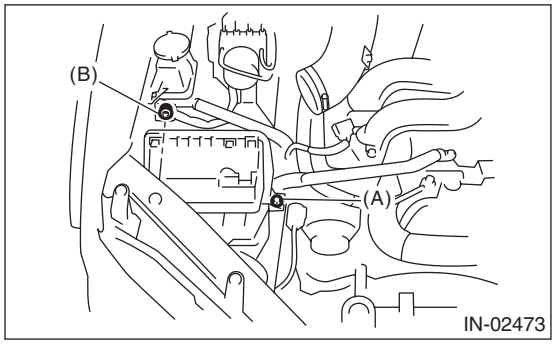


8) Remove the air cleaner case (front).

B: INSTALLATION

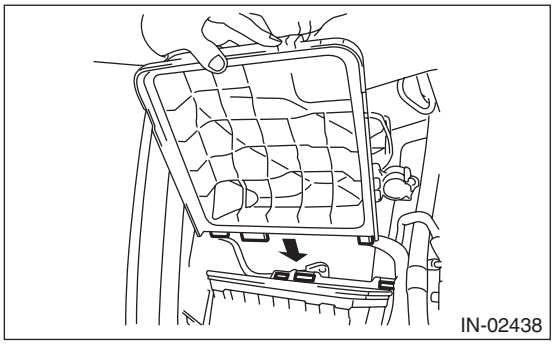
1) Install the bolt (A) and nut (B) which secure the air cleaner case (front) to the body.

Tightening torque:
Bolt (A)
6 N·m (0.6 kgf-m, 4.4 ft-lb)
Nut (B)
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



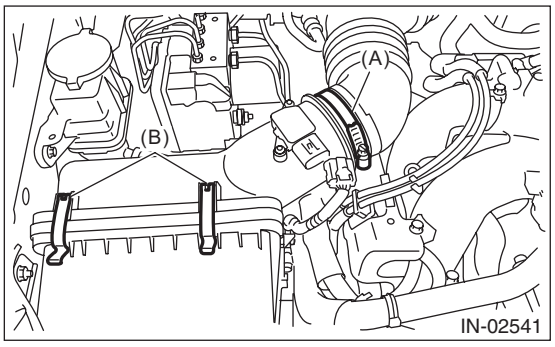
2) Install the air cleaner case (rear) and air cleaner element.

NOTE:
When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.

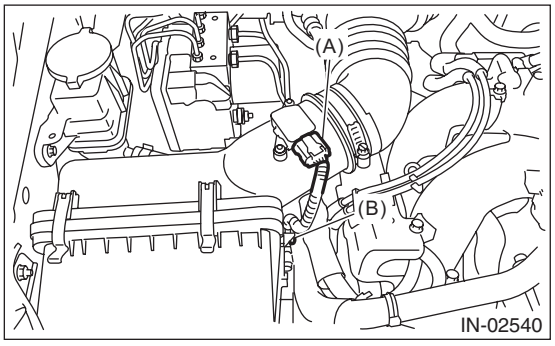


3) Install the clips (B) to the air cleaner case (front), then tighten the clamp (A) that connects the air cleaner case (rear) to the intake boot.

Tightening torque:
Clamp (A)
3 N·m (0.3 kgf-m, 2.2 ft-lb)

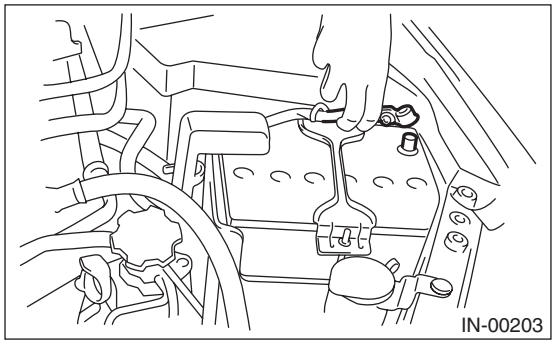


4) Connect the connector (A) to the mass air flow and intake air temperature sensor, and fasten the harness to clip (B).



5) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>

6) Connect the ground cable to battery.



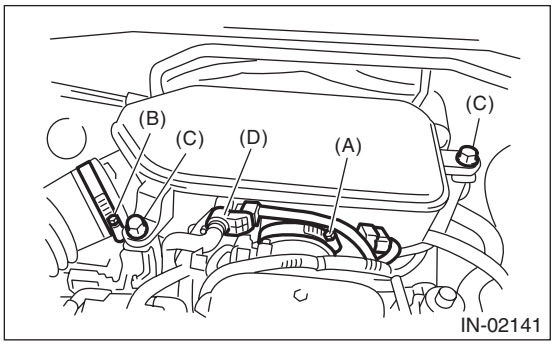
C: INSPECTION

Check for cracks or loose connections.

4. Air Intake Chamber

A: REMOVAL

1) Loosen the clamp (A) which connects air intake chamber to throttle body.
2) Loosen the clamp (B) which connects intake boot to air intake chamber.
3) Remove the bolt (C) which secures air intake chamber to the air intake chamber stay.
4) Disconnect the connector (D).

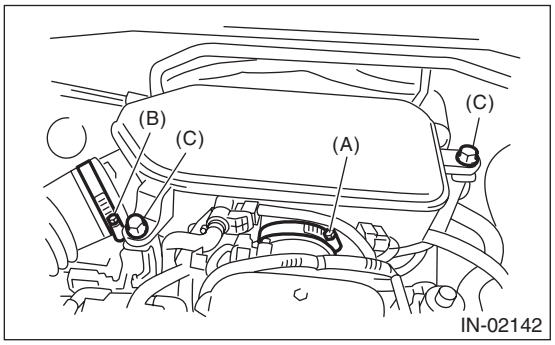


5) Disconnect the blow-by hoses, and then remove air intake chamber.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
Clamp (A), (B)
3 N·m (0.3 kgf-m, 2.2 ft-lb)
Bolt (C)
6.5 N·m (0.7 kgf-m, 4.8 ft-lb)



C: INSPECTION

1) Check for cracks or loose connections.
2) Inspect that no foreign objects are mixed in the air intake chamber.

5. Air Intake Duct

A: REMOVAL

Remove the clip which secures the air intake duct, and remove the air intake duct.



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

1) Check for cracks or loose connections.
2) Check that no foreign matter is mixed in air intake duct.

6. Resonator Chamber

A: REMOVAL

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for the removal procedure. <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.>

B: INSTALLATION

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for installation procedure. <Ref. to IN(H4SO)-5, INSTALLATION, Air Cleaner Case.>

C: INSPECTION

Check for cracks or loose connections.

MECHANICAL

ME(H4SO)

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1. General Description

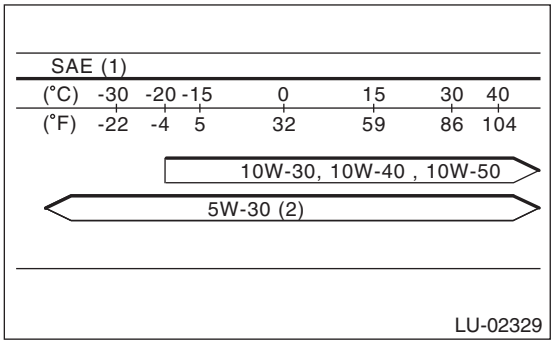
A: SPECIFICATION

Lubrication method					Forced lubrication
Oil pump	Pump type				Trochoid type
	Number of teeth	Inner rotor			9
		Outer rotor			10
	Outer rotor diameter × thickness			mm (in)	76 × 10 (2.99 × 0.39)
	Tip clearance between inner and outer rotors		Specification	mm (in)	0.04 — 0.14 (0.0016 — 0.0055)
	Side clearance between inner rotor and pump case		Specification	mm (in)	0.02 — 0.07 (0.0008 — 0.0028)
	Case clearance between outer rotor and pump case		Specification	mm (in)	0.10 — 0.175 (0.0039 — 0.0069)
	Performance (Oil temperature 80°C (176°F))	600 rpm	Discharge pressure	kPa (kg/cm^2, psi)	98 (1.0, 14)
			Discharge rate	ℓ (US qt, Imp qt)/min.	4.6 (4.9, 4.0) or more
		5,000 rpm	Discharge pressure	kPa (kg/cm^2, psi)	294 (3.0, 43)
			Discharge rate	ℓ (US qt, Imp qt)/min.	47.0 (49.7, 41.4) or more
	Relief valve working pressure			kPa (kg/cm^2, psi)	588 (6.0, 85)
Oil filter	Filter type				Full-flow filter type
	Filtration area cm^2 (sq in)	Outer diameter: 68 mm (2.68 in) (Black)			800 (124)
		Outer diameter: 67.4 mm (2.65 in) (Blue)			555 (86)
	By-pass valve opening pressure			kPa (kg/cm^2, psi)	160 (1.63, 23.2)
	Outer diameter × width mm (in)	Outer diameter: 68 mm (2.68 in) (Black)			68 × 65 (2.68 × 2.56)
		Outer diameter: 67.4 mm (2.65 in) (Blue)			67.4 × 65.3 (2.65 × 2.57)
	Installation screw specifications				M 20 × 1.5
Oil pressure switch	Type				Immersed contact point type
	Operating voltage — power consumption				12 V — 3.4 W or less
	Warning light operating pressure			kPa (kg/cm^2, psi)	14.7 (0.15, 2.1)
	Proof pressure			kPa (kg/cm^2, psi)	981 (10, 142) or more
Engine oil	Total capacity (Overhaul)			ℓ (US qt, Imp qt)	5.0 (5.3, 4.4)
	When replacing engine oil and oil filter			ℓ (US qt, Imp qt)	4.2 (4.4, 3.7)
	When replacing engine oil only			ℓ (US qt, Imp qt)	4.0 (4.2, 3.5)

Recommended oil:

Oil corresponding to either of the following standards.

- ***For API standard, oil with SM "Energy Conserving" logo***
- ***For ILSAC standard, oil with GF-4 "Star burst mark" label on the container***



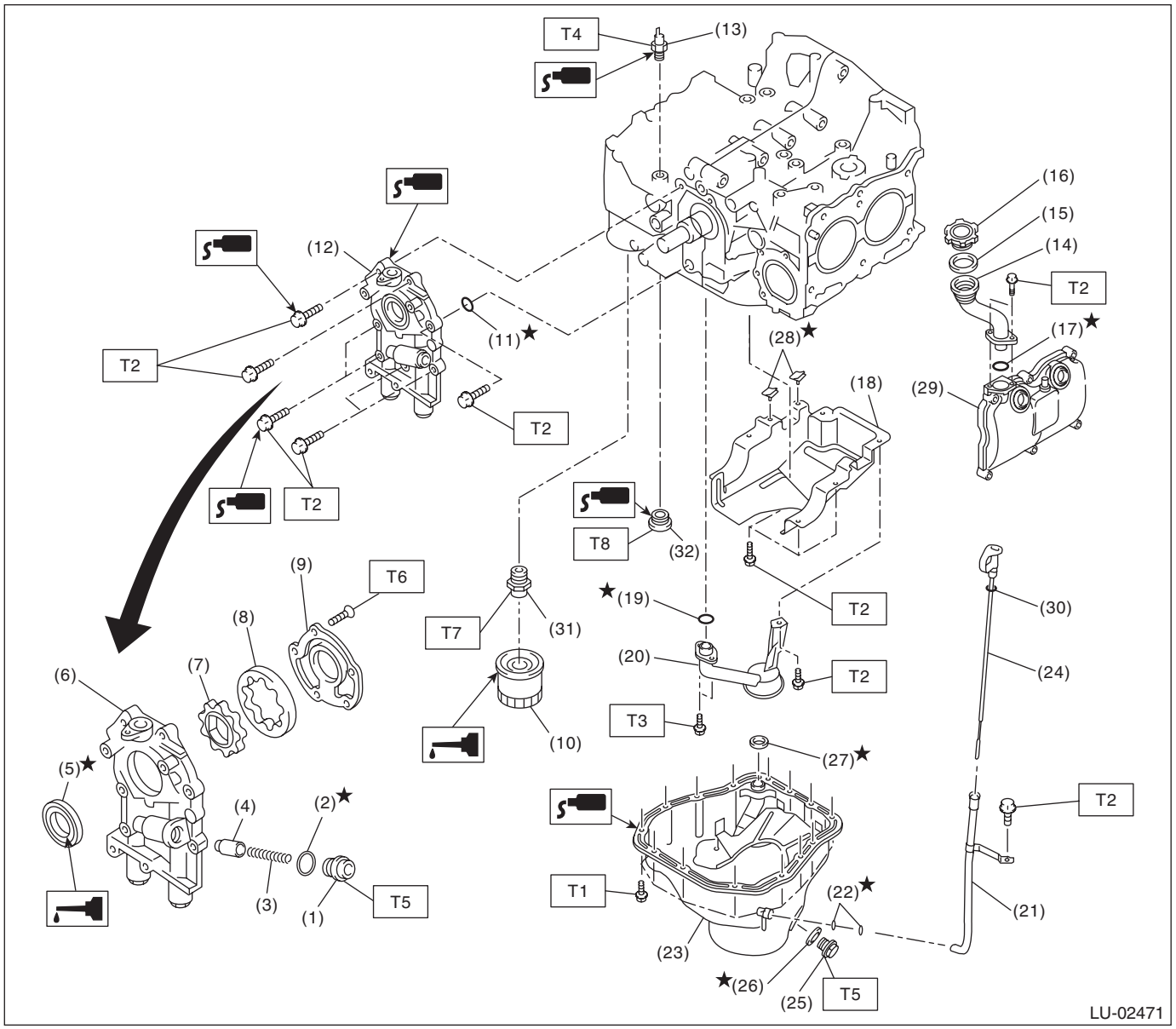
(1) SAE viscosity No. and applicable temperature
(2) Recommended

CAUTION:
It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use an oil with an API standard and SAE viscosity number specified by Subaru.

NOTE:
• The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.
• If the vehicle is used in regions of high temperatures or in other severe environments, use oil with the viscosities shown below.
API standard: SM or SL
SAE viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50

B: COMPONENT

- Non-turbo model

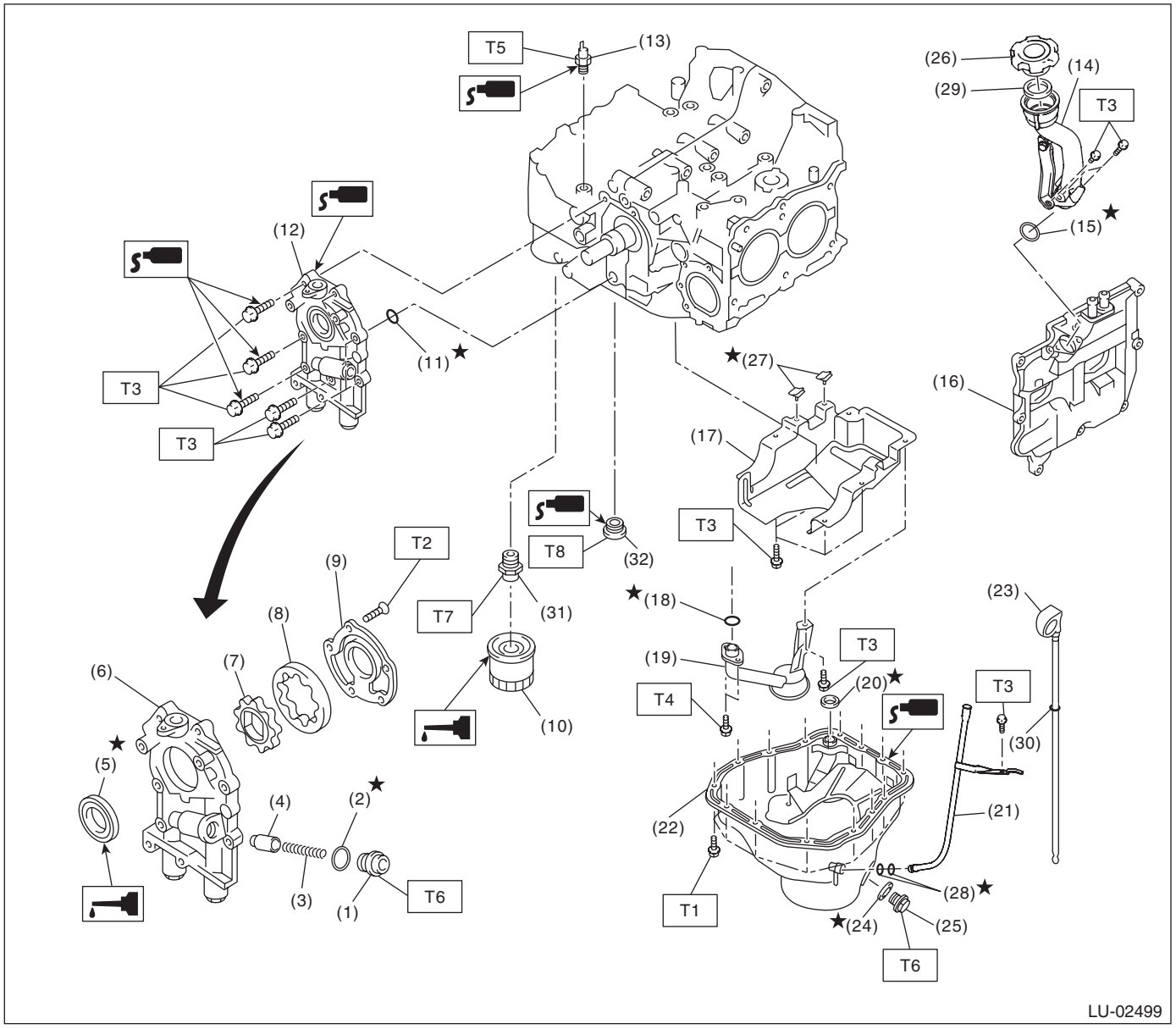


(1)	Plug	(15)	Gasket	(29)	Rocker cover
(2)	Gasket	(16)	Oil filler cap	(30)	O-ring
(3)	Relief valve spring	(17)	O-ring	(31)	Oil filter connector
(4)	Relief valve	(18)	Baffle plate	(32)	Plug
(5)	Front oil seal	(19)	O-ring		
(6)	Oil pump case	(20)	Oil strainer		
(7)	Inner rotor	(21)	Oil level gauge guide		
(8)	Outer rotor	(22)	O-ring		
(9)	Oil pump cover	(23)	Oil pan		
(10)	Oil filter	(24)	Oil level gauge		
(11)	O-ring	(25)	Drain plug		
(12)	Oil pump ASSY	(26)	Drain plug gasket		
(13)	Oil pressure switch	(27)	Gasket		
(14)	Oil filler duct	(28)	Seal		

Tightening torque:N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.7)
T2: 6.4 (0.7, 4.7)
T3: 10 (1.0, 7.4)
T4: 25 (2.5, 18.4)
T5: 44 (4.5, 32.5)
T6: 5.4 (0.6, 4.0)
T7: 45 (4.6, 33.2)
T8: 70 (7.1, 51.6)

- Turbo model



(1) Plug
(2) Gasket
(3) Relief valve spring
(4) Relief valve
(5) Front oil seal
(6) Oil pump case
(7) Inner rotor
(8) Outer rotor
(9) Oil pump cover
(10) Oil filter
(11) O-ring
(12) Oil pump ASSY
(13) Oil pressure switch
(14) Oil filler duct
(15) O-ring
(16) Rocker cover
(17) Baffle plate
(18) O-ring
(19) Oil strainer
(20) Gasket
(21) Oil level gauge guide
(22) Oil pan
(23) Oil level gauge
(24) Drain plug gasket
(25) Drain plug
(26) Oil filler cap
(27) Seal
(28) O-ring
(29) Gasket
(30) O-ring
(31) Oil filter connector
(32) Plug

Tightening torque:N·m (kgf-m, ft-lb)

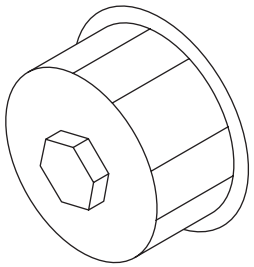
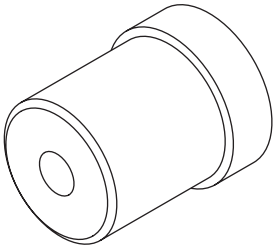
T1: 5 (0.5, 3.7)
T2: 5.4 (0.6, 4.0)
T3: 6.4 (0.7, 4.7)
T4: 10 (1.0, 7.0)
T5: 25 (2.5, 18.4)
T6: 44 (4.5, 32.5)
T7: 45 (4.6, 33.2)
T8: 70 (7.1, 51.6)

C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• 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.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
• If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.
• Prepare a container and cloth to prevent scattering of oil when performing work where oil can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
• Follow all government and local regulations concerning disposal of refuse when disposing of oil.

D: PREPARATION TOOL

1. SPECIAL TOOL

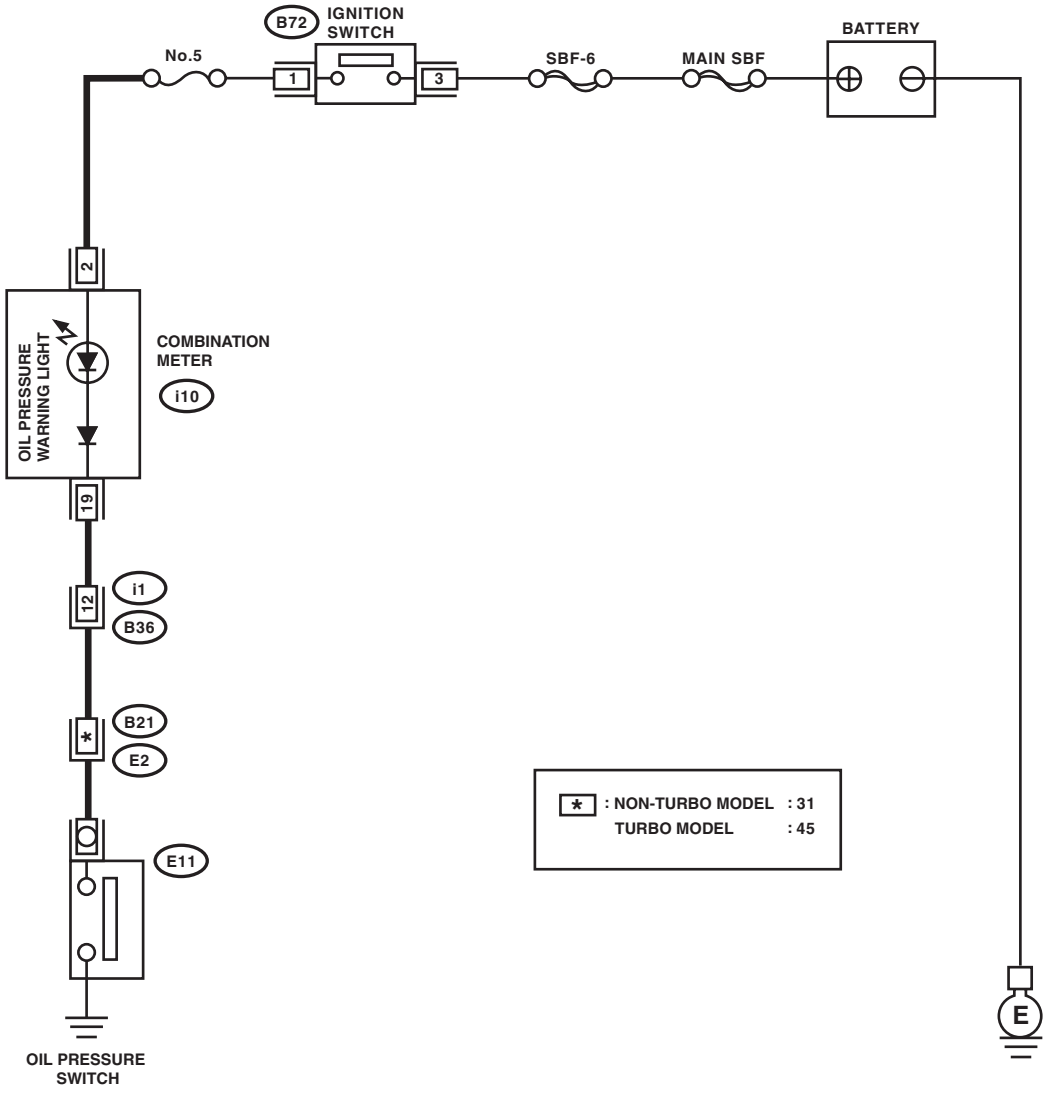
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18332AA000	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter (Black). (Outer diameter: 68 mm (2.68 in))
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil seal into oil pump.

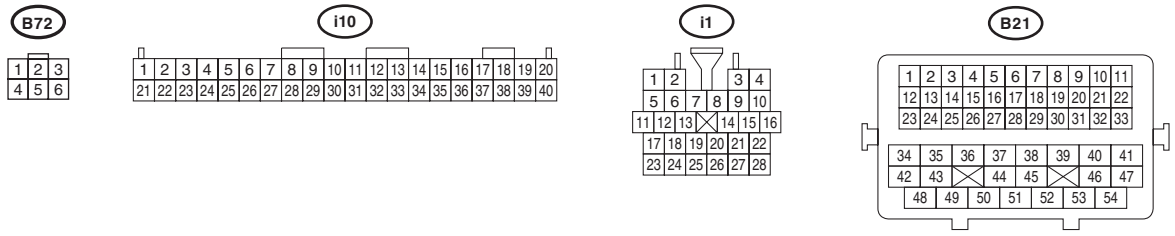
2. GENERAL TOOL

TOOL NAME	REMARKS
Oil filter wrench (65/67 mm 14 Flutes)	Used for removing and installing oil filter (Blue). (Outer diameter: 67.4 mm (2.65 in))
Circuit tester	Used for measuring resistance and voltage.

2. Oil Pressure System

A: WIRING DIAGRAM





LU-02409

B: INSPECTION

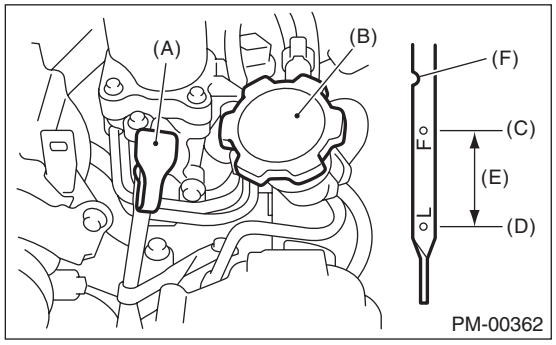
Step		Check	Yes	No
1	**CHECK COMBINATION METER.** 1) Turn the ignition switch to ON (engine OFF). 2) Check other warning lights.	Does the warning light illuminate?	Go to step **2**.	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>
2	**CHECK HARNESS CONNECTOR BETWEEN THE COMBINATION METER AND THE OIL PRESSURE SWITCH.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from oil pressure switch. 3) Turn the ignition switch to ON. 4) Measure the voltage of harness between oil pressure switch connector and chassis ground. ***Connector & terminal*** ***(E11) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	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*** ***(i10) No. 2 — No. 19:***	Is the resistance less than 10 Ω?	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between combination meter and oil pressure switch • Poor contact of combination meter connector • Poor contact of oil pressure switch connector • Poor contact of coupling connector	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>

3. Engine Oil

A: INSPECTION

CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.
1) Park the vehicle on a level surface.
2) Remove the oil level gauge and wipe away the oil.
3) Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted and properly orientated.
4) Pull out the oil level gauge again, and check the oil level. If the engine oil level is below "L" line, make sure that there is no oil leakage from the engine, then add oil to raise the level up to the "F" line.
5) Start the engine, and spread the oil in engine room.
6) After turning off the engine, wait a few minutes for the oil to return to the oil pan before checking the level.

NOTE:
• Just after driving or while the engine is warm, engine oil level shows in the range between the F line and the notch mark. This is caused by thermal expansion of engine oil.
• To prevent overfilling of engine oil, do not add oil above "F" line when the engine is cold.
• As the oil level gauge is used for daily maintenance, "F" line and "L" line is set assuming that the engine is cold.

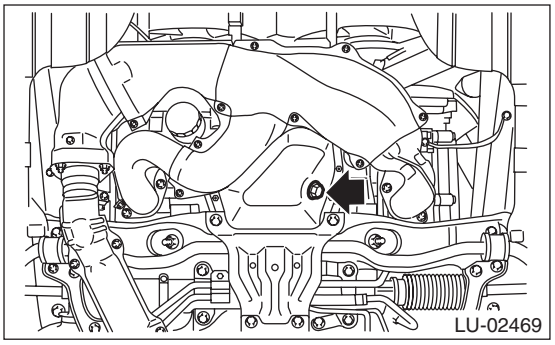


(A) Oil level gauge
(B) Engine oil filler cap
(C) "F" line
(D) "L" line
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

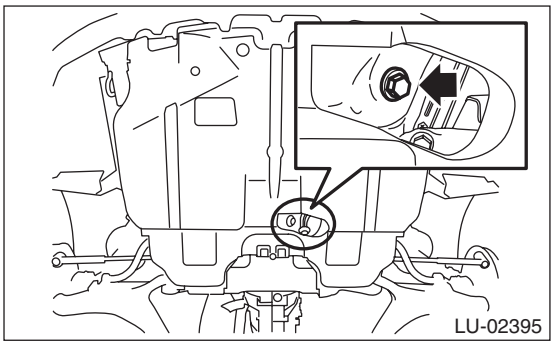
B: REPLACEMENT

CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.
1) Set the vehicle on a lift.
2) Open the engine oil filler cap for quick draining of engine oil.
3) Lift up the vehicle.
4) Drain engine oil by loosening the engine oil drain plug.

NOTE:
Prepare the container for draining of engine oil.
• Non-turbo model



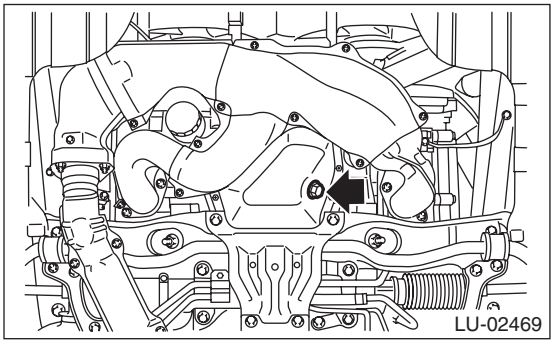
• Turbo model



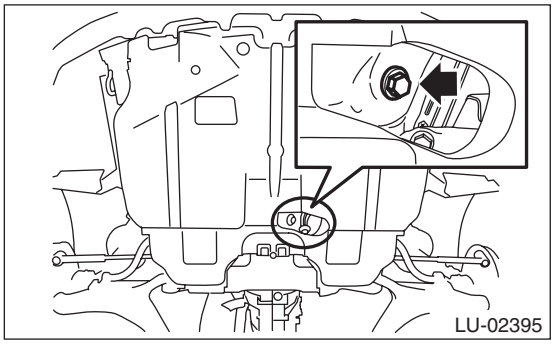
5) Tighten the engine oil drain plug after draining engine oil.

NOTE:
Use a new drain plug gasket.

Tightening torque:
44 N·m (4.5 kgf-m, 32.5 ft-lb)
• Non-turbo model



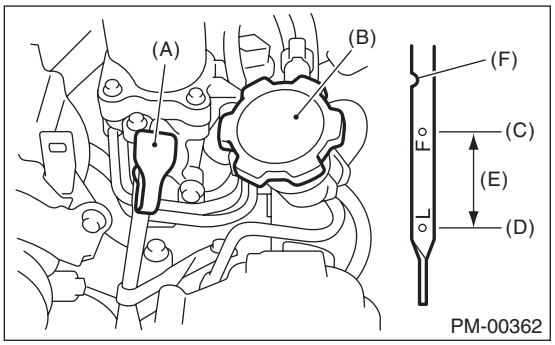
- Turbo model



6) Lower the vehicle.
7) Using engine oil of proper quality and viscosity, fill engine oil through the filler duct to the “F” line on the oil level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

Recommended oil:
Refer to “SPECIFICATION” for recommended oil. <Ref. to LU(H4SO)-2, SPECIFICATION, General Description.>

Engine oil capacity:
Refer to “SPECIFICATION” for engine oil capacity. <Ref. to LU(H4SO)-2, SPECIFICATION, General Description.>
8) Close the engine oil filler cap.
9) Start the engine, and spread the oil in engine room.
10) After stopping the engine, recheck the oil level. If necessary, add engine oil up to the “F” line on oil level gauge.

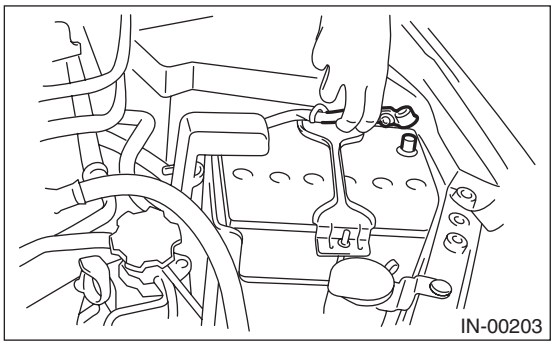


(A) Oil level gauge
(B) Engine oil filler cap
(C) “F” line
(D) “L” line
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

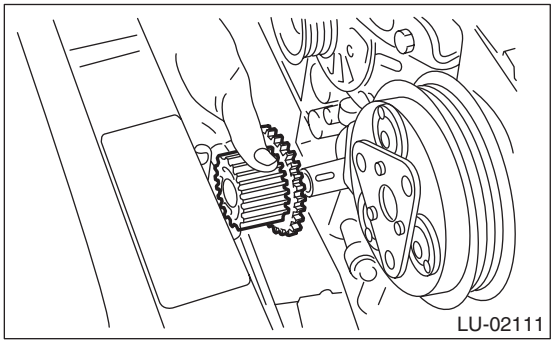
4. Oil Pump

A: REMOVAL

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

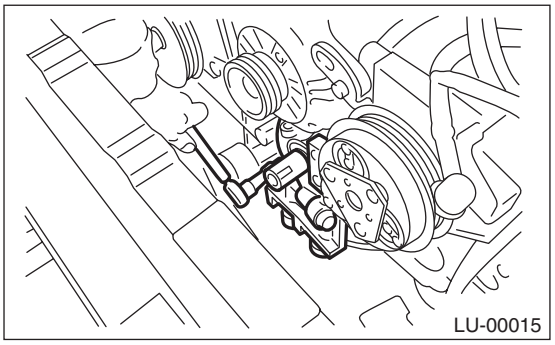


3) Remove the radiator. <Ref. to CO(H4SO)-19, REMOVAL, Radiator.> <Ref. to CO(H4DOTC)-20, REMOVAL, Radiator.>
4) Remove the crankshaft position sensor. <Ref. to FU(H4SO)-26, REMOVAL, Crankshaft Position Sensor.> <Ref. to FU(H4DOTC)-31, REMOVAL, Crankshaft Position Sensor.>
5) Remove the water pump. <Ref. to CO(H4SO)-15, REMOVAL, Water Pump.> <Ref. to CO(H4DOTC)-16, REMOVAL, Water Pump.>
6) Remove the crank sprocket. <Ref. to ME(H4SO)-55, REMOVAL, Crank Sprocket.> <Ref. to ME(H4DOTC)-60, REMOVAL, Crank Sprocket.>



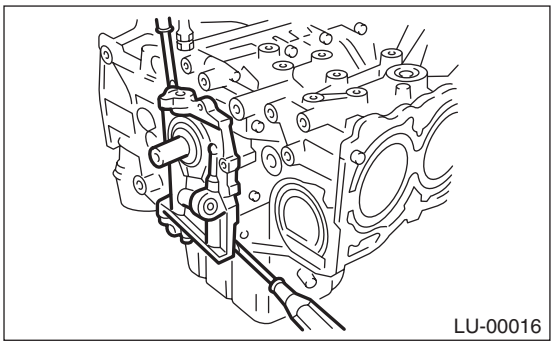
7) Remove the bolts which secure oil pump to cylinder block.

NOTE:
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



8) Remove the oil pump by using flat tip screwdriver.

CAUTION:
Be careful not to scratch mating surfaces of cylinder block and oil pump.

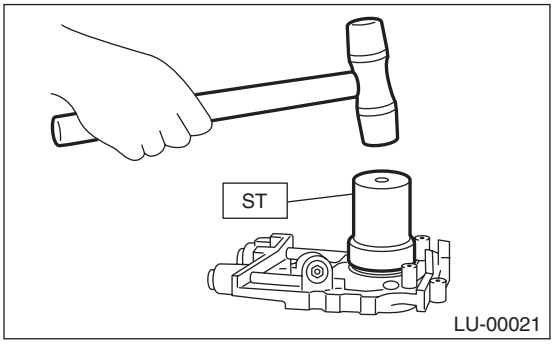


9) Remove the front oil seal from the oil pump.

B: INSTALLATION

1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

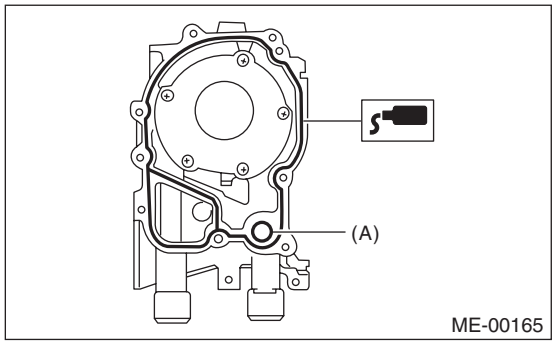
NOTE:
Use a new front oil seal.



2) Apply liquid gasket to the mating surfaces of oil pump.

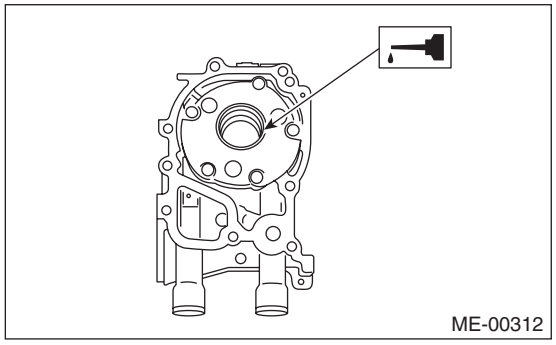
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(A) O-ring

3) Apply a coat of engine oil to the inside of front oil seal.



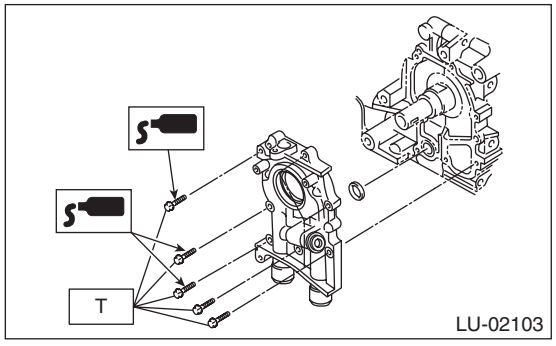
4) Install the oil pump to cylinder block. Be careful not to damage the front oil seal during installation.

NOTE:
- Make sure the front oil seal lip is not folded.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.
- Use new O-rings.
- Do not forget to assemble O-rings.

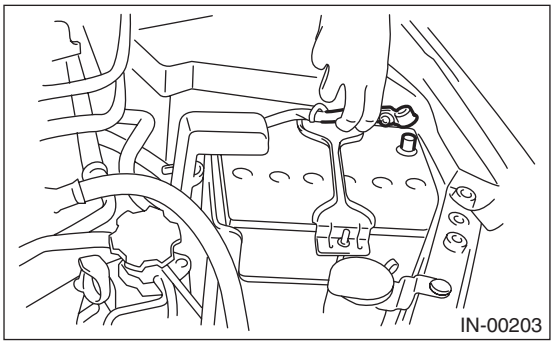
5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing bolts)

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



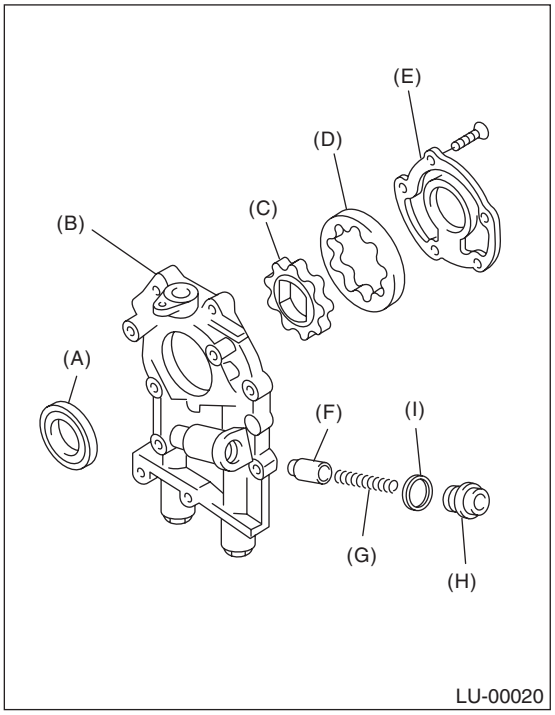
6) Install the crank sprocket. <Ref. to ME(H4SO)-55, INSTALLATION, Crank Sprocket.> <Ref. to ME(H4DOTC)-60, INSTALLATION, Crank Sprocket.>
7) Install the water pump. <Ref. to CO(H4SO)-15, INSTALLATION, Water Pump.> <Ref. to CO(H4DOTC)-16, INSTALLATION, Water Pump.>
8) Install the crankshaft position sensor. <Ref. to FU(H4SO)-26, INSTALLATION, Crankshaft Position Sensor.> <Ref. to FU(H4DOTC)-31, INSTALLATION, Crankshaft Position Sensor.>
9) Install the radiator. <Ref. to CO(H4SO)-20, INSTALLATION, Radiator.> <Ref. to CO(H4DOTC)-21, INSTALLATION, Radiator.>
10) Connect the ground cable to battery.



C: DISASSEMBLY

Remove the screw which secures oil pump cover and then disassemble oil pump. Inscribe alignment marks on the inner and outer rotors so that they can be replaced in their original positions during reassembly.

NOTE:
Before disassembling the oil pump, remove the relief valve.

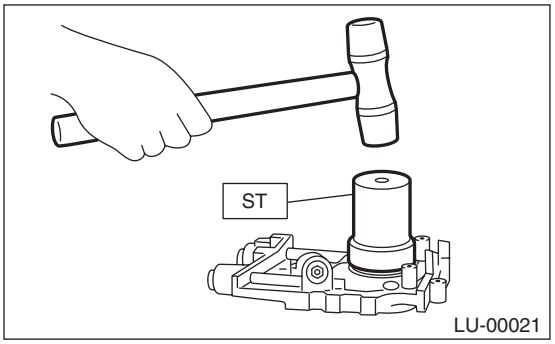


(A) Front oil seal
(B) Oil pump case
(C) Inner rotor
(D) Outer rotor
(E) Oil pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

D: ASSEMBLY

1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

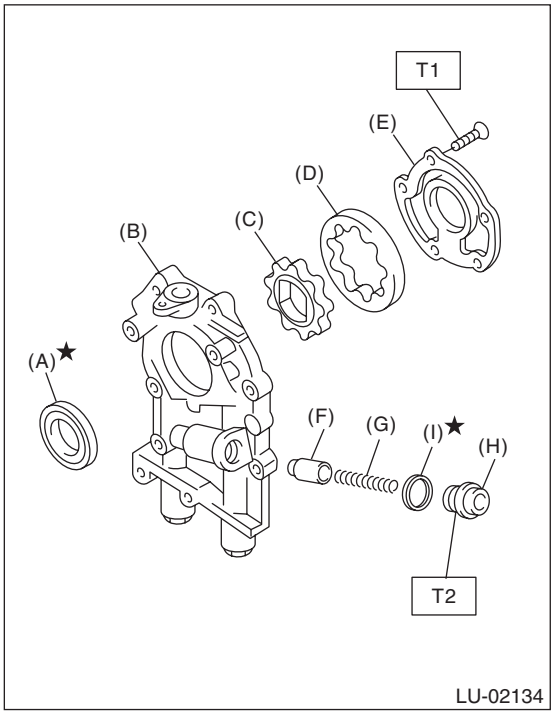
NOTE:
Use a new front oil seal.



2) Apply a coat of engine oil to inner and outer rotors.
3) Install the inner and outer rotors.
4) Assemble the oil relief valve and install relief valve spring and plug.

NOTE:
Use a new gasket.
5) Install the oil pump cover.

Tightening torque:
T1: 5.4 N·m (0.6 kgf-m, 4.0 ft-lb)
T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)



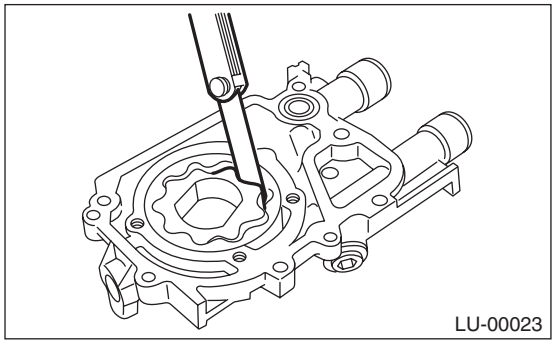
(A) Front oil seal
(B) Oil pump case
(C) Inner rotor
(D) Outer rotor
(E) Oil pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

E: INSPECTION

1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance is out of specification, replace the rotors as a set.

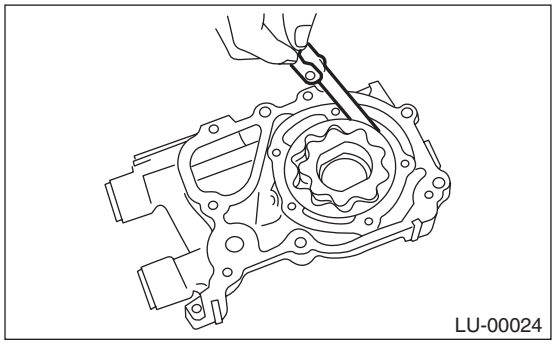
Tip clearance:
Standard:
0.04 — 0.14 mm (0.0016 — 0.0055 in)



2. CASE CLEARANCE

Measure the clearance between the outer rotor and the oil pump case. If clearance is out of standard, replace the oil pump case.

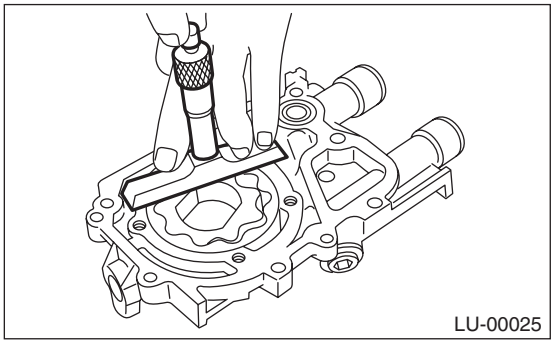
Case clearance:
Standard:
0.10 — 0.175 mm (0.0039 — 0.0069 in)



3. SIDE CLEARANCE

Measure the gap between the inner rotor and the oil pump case to measure the clearance between the oil pump inner rotor and the oil pump cover as shown in the figure. If clearance is out of standard, replace the rotor or the oil pump case.

Side clearance:
Specification:
0.02 — 0.07 mm (0.0008 — 0.0028 in)



4. OIL RELIEF VALVE

Check the valve for assembly 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 lbf)

5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks and other faults.

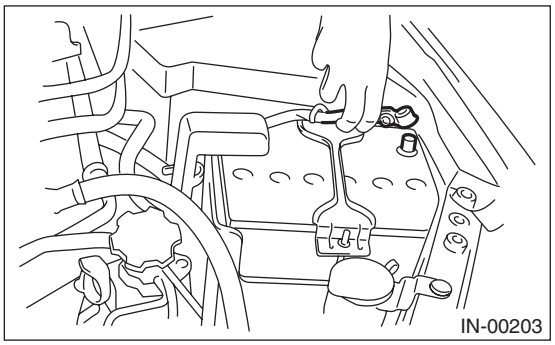
6. FRONT OIL SEAL

Check the front oil seal lips for deformation, hardening, wear, etc. and replace if defective.

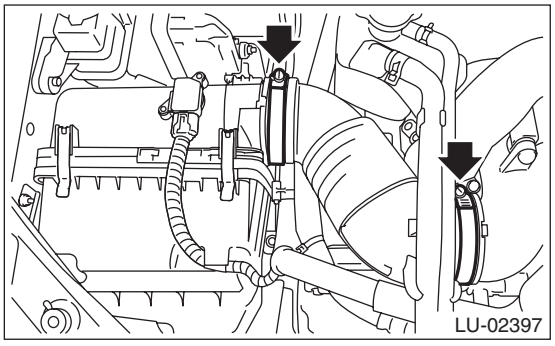
5. Oil Pan and Strainer

A: REMOVAL

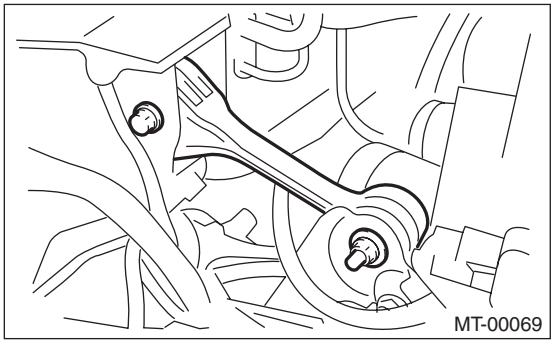
1) Set the vehicle on a lift.
2) Disconnect the ground cable from battery.


IN-00203

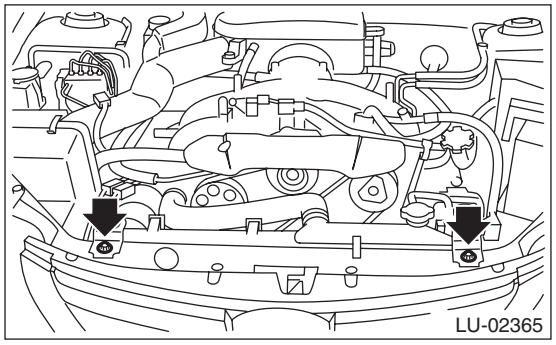
3) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.> <Ref. to IN(H4DOTC)-11, REMOVAL, Air Intake Duct.>
4) Disconnect the connectors from the mass air flow and intake air temperature sensor. (Non-turbo model)
5) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
6) Remove the air intake boot. (Turbo model)


LU-02397

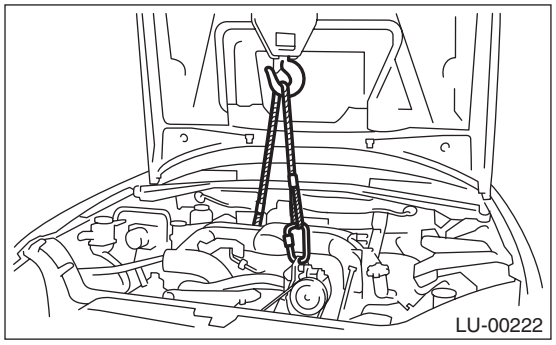
7) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-13, REMOVAL, Intercooler.>
8) Remove the pitching stopper.


MT-00069

9) Remove the radiator upper brackets.


LU-02365

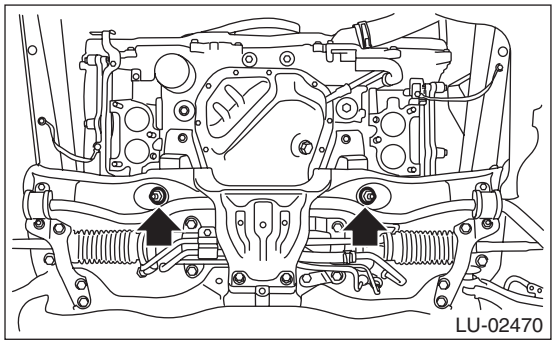
10) Support the engine with a lifting device and wire ropes.


LU-00222

11) Lift up the vehicle.

CAUTION:
When lifting up the vehicle, raise up wire ropes at the same time.

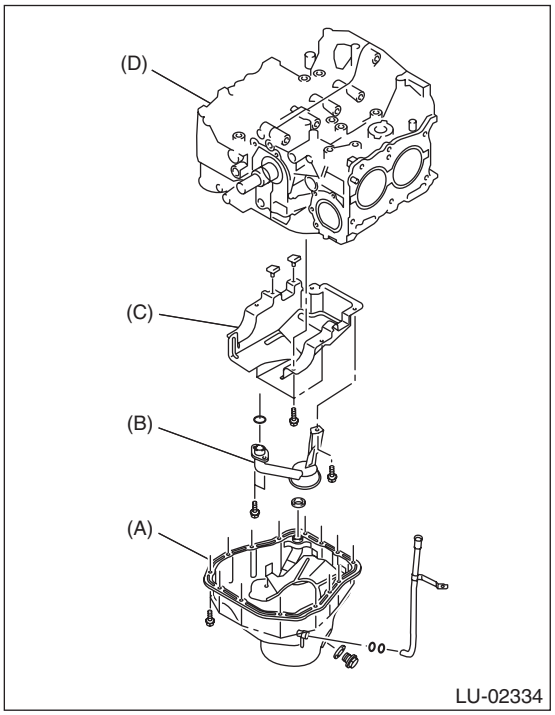
12) Remove the under cover.
13) Drain the engine oil. <Ref. to LU(H4SO)-10, REPLACEMENT, Engine Oil.>
14) Remove the front exhaust pipe. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H4DOTC)-7, REMOVAL, Front Exhaust Pipe.>
15) Remove the nuts which secure the engine mounting to the front crossmember.


LU-02470

16) Remove the bolts which secure oil pan on cylinder block with the engine raised up.
17) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

CAUTION:
Do not use a screwdriver or similar tool in place of oil pan cutter.

18) Remove the oil strainer.
19) Remove the baffle plate.

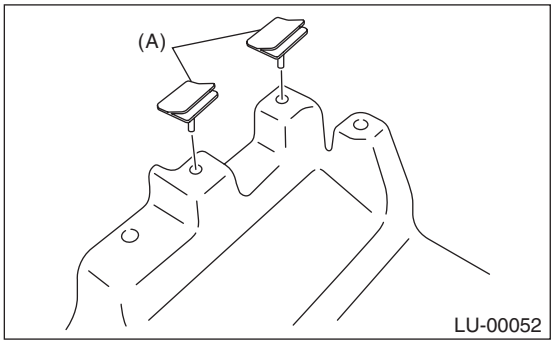


(A) Oil pan
(B) Oil strainer
(C) Baffle plate
(D) Cylinder block

B: INSTALLATION

NOTE:
Before installing the oil pan, clean the mating surface of oil pan and engine block.
1) Make sure that the seals (A) are installed securely on the baffle plate in a direction as shown in the figure below.

NOTE:
Use a new seal.



2) Install the baffle plate.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
3) Install the oil strainer to cylinder block.

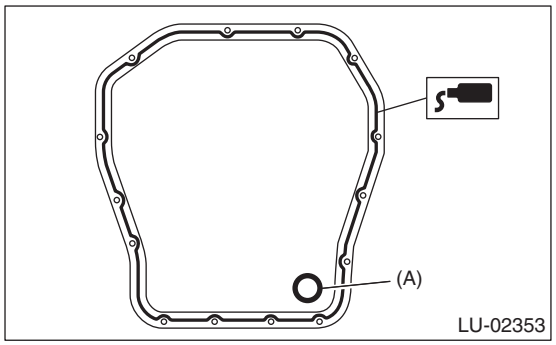
NOTE:
Use new O-rings.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)
4) Tighten the oil strainer stay together with the baffle plate.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
5) Apply liquid gasket to the mating surfaces of oil pan, and install the oil pan.

NOTE:
- Use a new gasket.
- Install within 5 min. after applying liquid gasket.

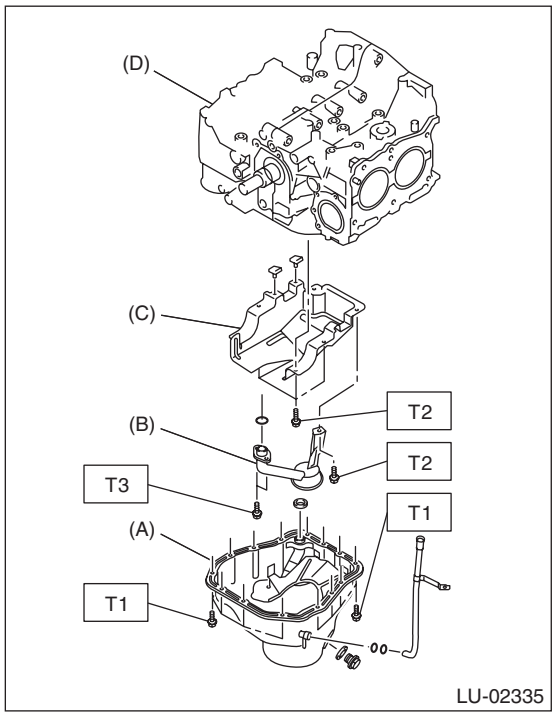
Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(A) Gasket

6) Tighten the bolts which install oil pan to cylinder block.

Tightening torque:
T1: 5 N·m (0.5 kgf-m, 3.7 ft-lb)
T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T3: 10 N·m (1.0 kgf-m, 7.4 ft-lb)



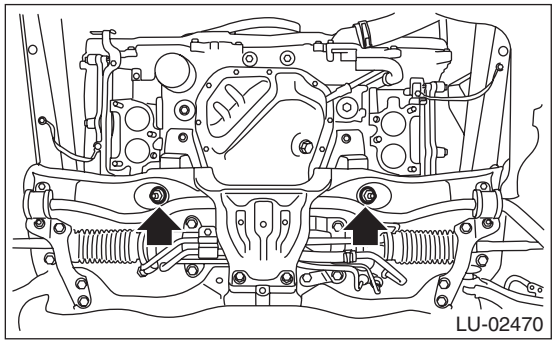
(A) Oil pan
(B) Oil strainer
(C) Baffle plate
(D) Cylinder block

7) Lower the engine onto front crossmember.
8) Tighten the nuts which install engine mounting onto front crossmember.

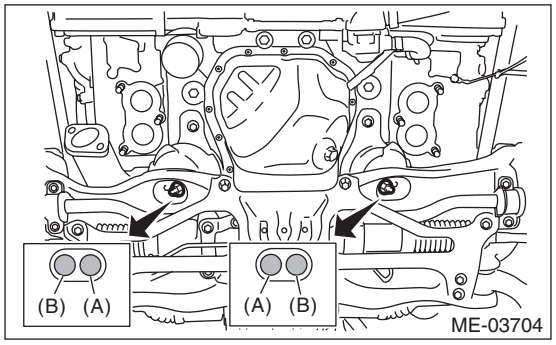
NOTE:
Make sure that the engine mounting nuts (A) and locator (B) are securely installed. (Turbo model)

Tightening torque:
85 N·m (8.7 kgf-m, 62.7 ft-lb)

- Non-turbo model

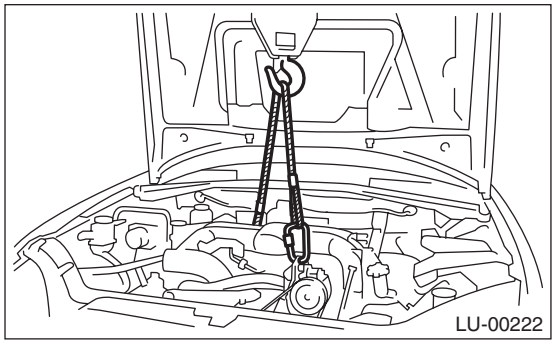


- Turbo model



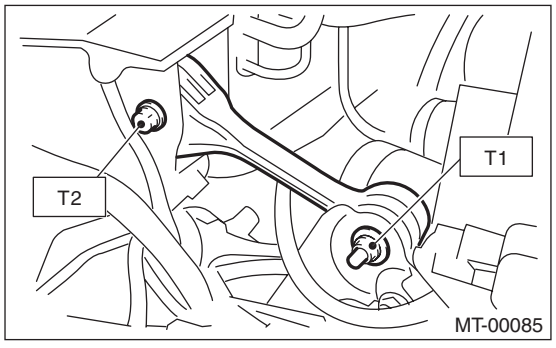
9) Install the front exhaust pipe. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(H4DOTC)-8, INSTALLATION, Front Exhaust Pipe.>
10) Install the under cover.
11) Lower the vehicle.

CAUTION:
When lowering the vehicle, lower the lift up device and wire ropes at the same time.
12) Remove the lifting device and wire ropes.



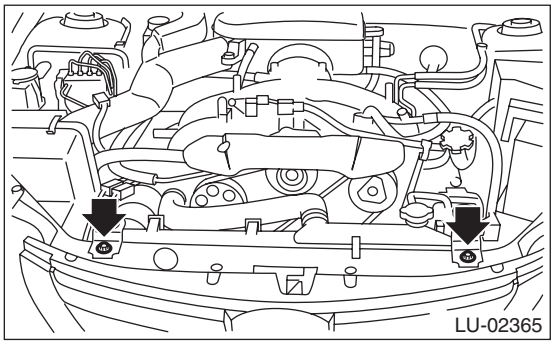
13) Install the pitching stopper.

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)

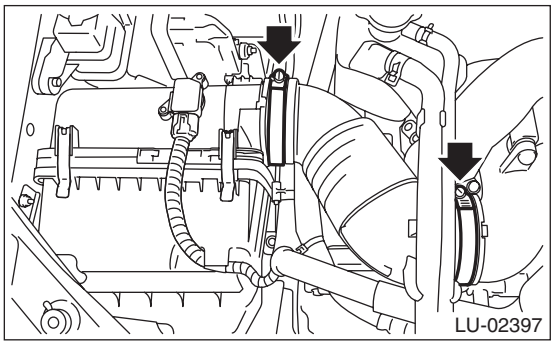


14) Install the radiator upper brackets.

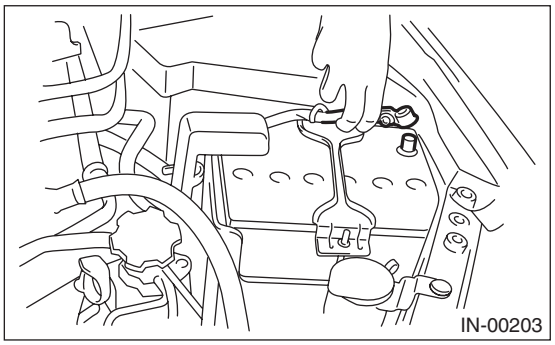
Tightening torque:
12 N·m (1.2 kgf-m, 8.9 ft-lb)



15) Install the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-13, INSTALLATION, Intercooler.>
16) Install the air intake boot. (Turbo model)



17) Install the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
18) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4DOTC)-11, INSTALLATION, Air Intake Duct.>
19) Connect the connector to the mass air flow and intake air temperature sensor. (Non-turbo model)
20) Connect the ground cable to battery.



21) Refill the engine oil. <Ref. to LU(H4SO)-10, INSPECTION, Engine Oil.>

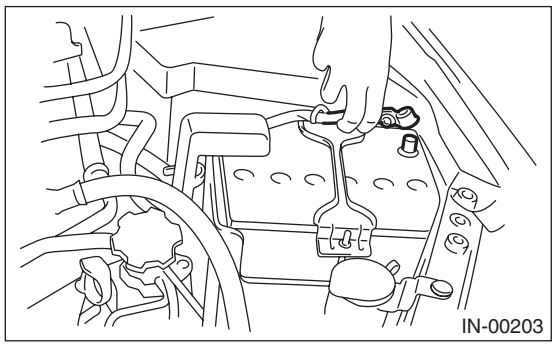
C: INSPECTION

Visually check that the oil pan, oil strainer and baffle plate are not damaged.

6. Oil Pressure Switch

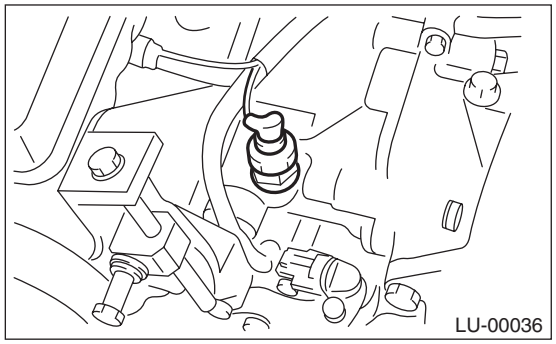
A: REMOVAL

1) Disconnect the ground cable from battery.

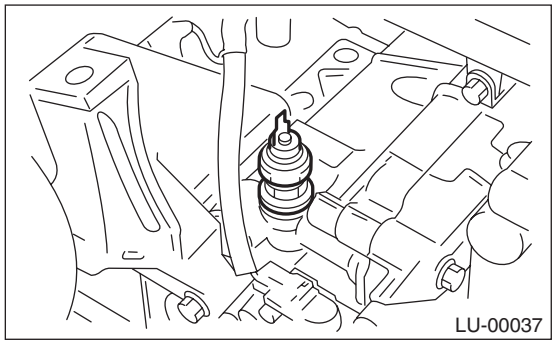


2) Remove the generator from the bracket. <Ref. to SC(H4SO)-16, REMOVAL, Generator.>

3) Disconnect the terminal from oil pressure switch.



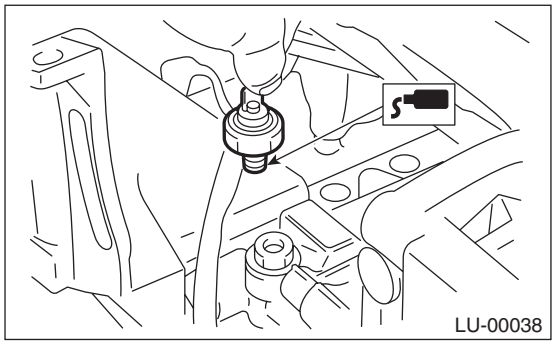
4) Remove the oil pressure switch.



B: INSTALLATION

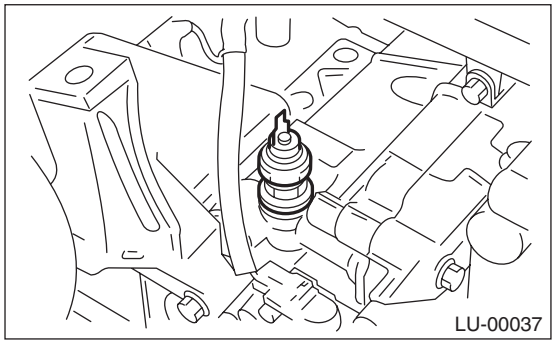
1) Apply liquid gasket to the oil pressure switch threads.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

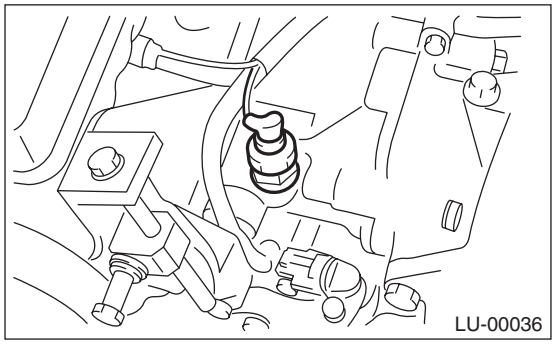


2) Install the oil pressure switch to cylinder block.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

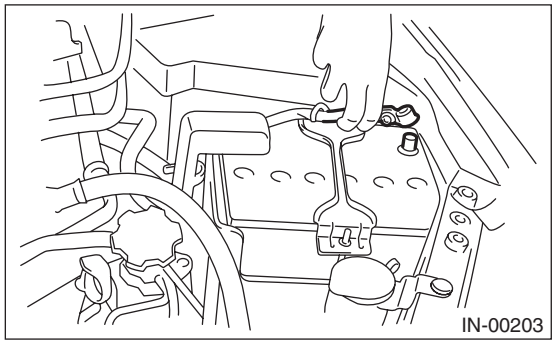


3) Connect the terminal to the oil pressure switch.



4) Install the generator to the bracket. <Ref. to SC(H4SO)-16, INSTALLATION, Generator.>

5) Connect the ground cable to battery.



C: INSPECTION

Check the oil pressure switch installation portion for oil leakage and oil seepage.

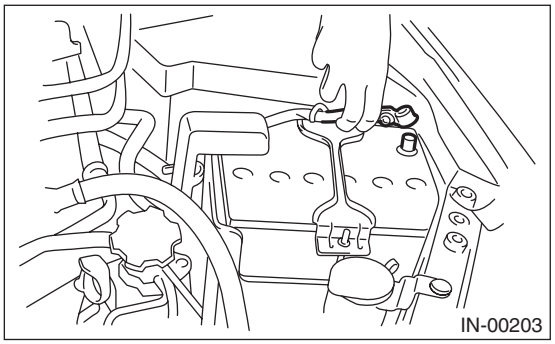
7. Oil Pipe

A: REMOVAL

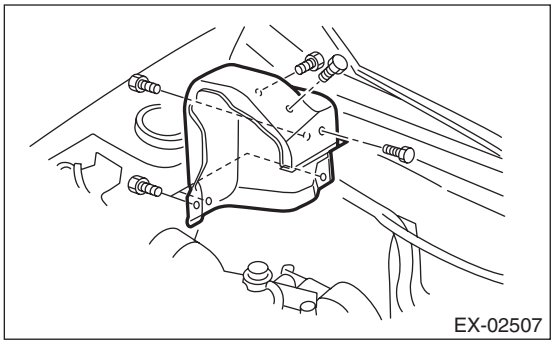
NOTE:
The oil pipe is installed on DOHC models.

1. EXCEPT FOR WRX-SS MODEL

1) Disconnect the ground cable from battery.

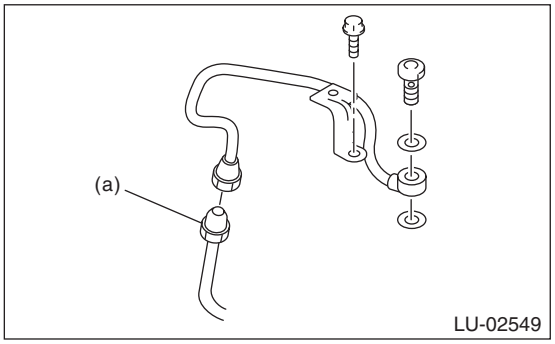


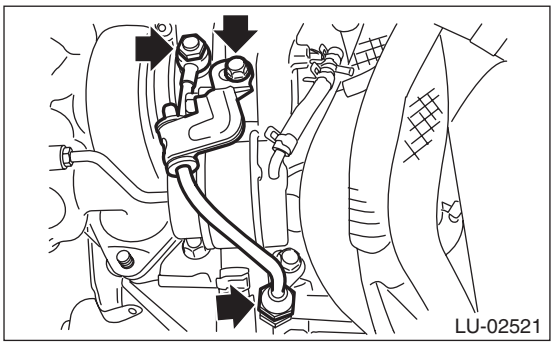
2) Remove the intercooler. <Ref. to IN(H4DOTC)-13, REMOVAL, Intercooler.>
3) Remove the intercooler bracket RH.
4) Remove the turbocharger upper cover.



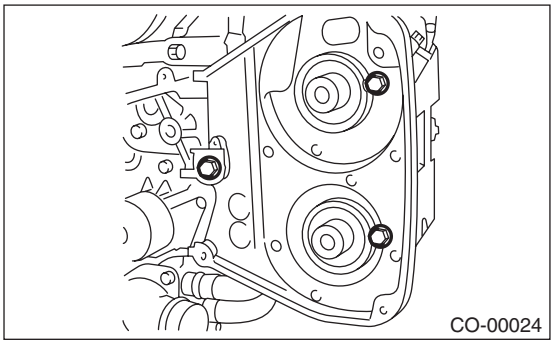
5) Remove the oil inlet pipe from the turbocharger.

CAUTION:
In order to prevent damaging the oil pipe on the cylinder head side, fix the section (a) shown in the figure when loosing the oil inlet pipe flare nut, and avoid the part from rotating together while loosening the nut.

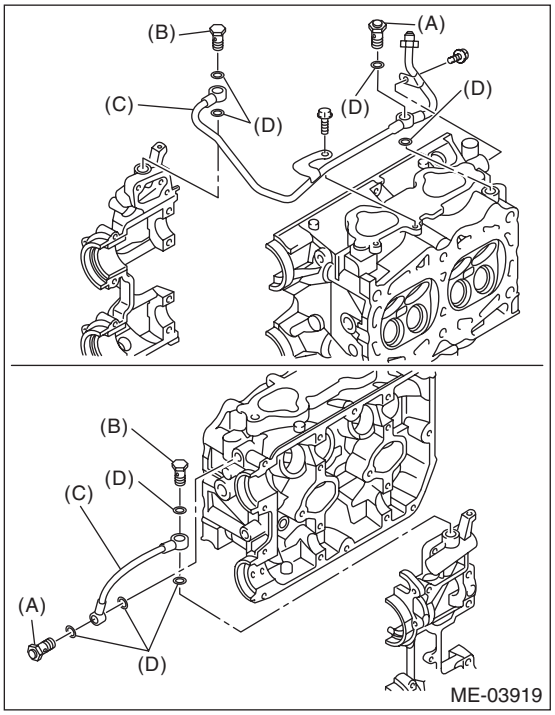




6) Remove the intake manifold. <Ref. to FU(H4DOTC)-16, REMOVAL, Intake Manifold.>
7) Remove the secondary air pump. <Ref. to EC(H4DOTC)-24, REMOVAL, Secondary Air Pump.>
8) Remove the radiator main fan and radiator sub fan. <Ref. to CO(H4DOTC)-24, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4DOTC)-26, REMOVAL, Radiator Sub Fan and Fan Motor.>
9) Remove the V-belts. <Ref. to ME(H4DOTC)-40, REMOVAL, V-belt.>
10) Remove the crank pulley. <Ref. to ME(H4DOTC)-47, REMOVAL, Crank Pulley.>
11) Remove the timing belt cover. <Ref. to ME(H4DOTC)-49, REMOVAL, Timing Belt Cover.>
12) Remove the timing belt. <Ref. to ME(H4DOTC)-50, TIMING BELT, REMOVAL, Timing Belt.>
13) Remove the cam sprocket LH. <Ref. to ME(H4DOTC)-59, REMOVAL, Cam Sprocket.>
14) Remove the belt cover No. 2 LH.



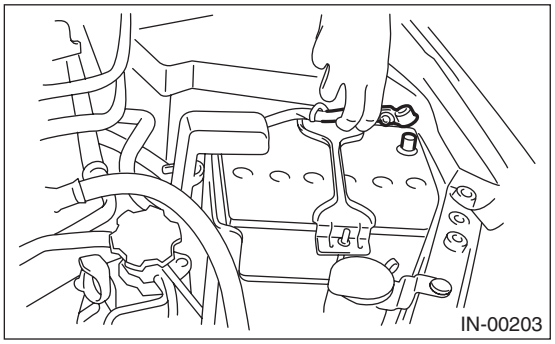
15) Remove the oil pipe.



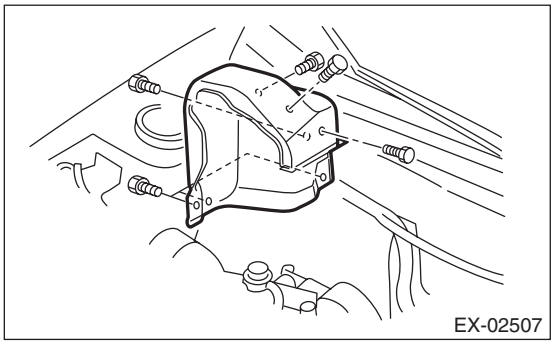
(A) Union screw with filter (with protrusion)
(B) Union screw without filter (without protrusion)
(C) Oil pipe
(D) Gasket

2. WRX-SS MODEL

1) Disconnect the ground cable from battery.

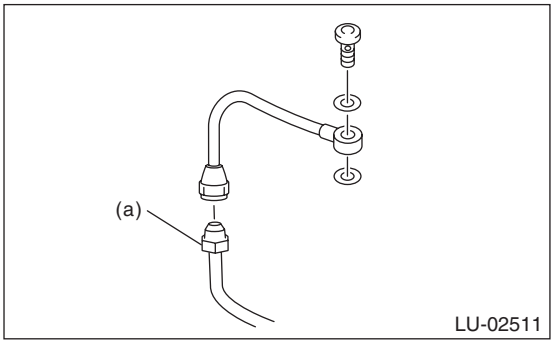


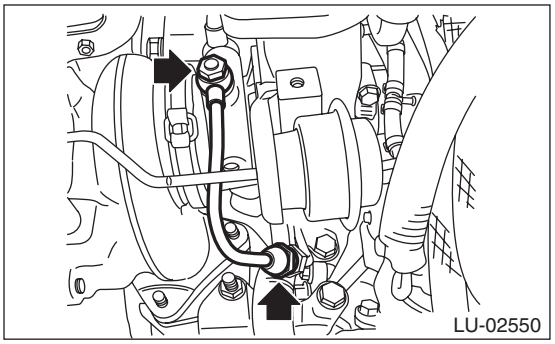
2) Remove the intercooler. <Ref. to IN(H4DOTC)-13, REMOVAL, Intercooler.>
3) Remove the turbocharger upper cover.



4) Remove the oil inlet pipe from the turbocharger.

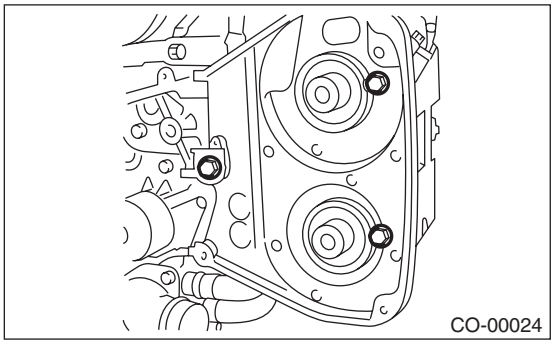
CAUTION:
In order to prevent damaging the oil pipe on the cylinder head side, fix the section (a) shown in the figure when loosing the oil inlet pipe flare nut, and avoid the part from rotating together while loosening the nut.



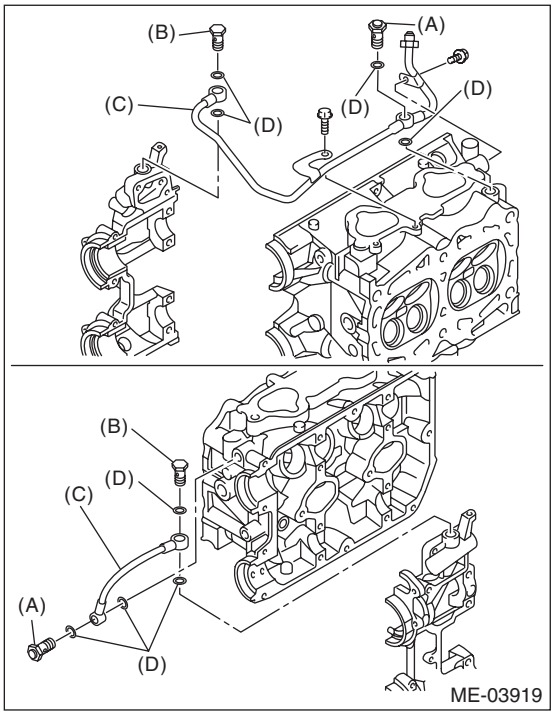


5) Remove the intake manifold. <Ref. to FU(H4DOTC)-16, REMOVAL, Intake Manifold.>
6) Remove the secondary air pump. <Ref. to EC(H4DOTC)-24, REMOVAL, Secondary Air Pump.>
7) Remove the radiator main fan and radiator sub fan. <Ref. to CO(H4DOTC)-24, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4DOTC)-26, REMOVAL, Radiator Sub Fan and Fan Motor.>
8) Remove the V-belts. <Ref. to ME(H4DOTC)-40, REMOVAL, V-belt.>
9) Remove the crank pulley. <Ref. to ME(H4DOTC)-47, REMOVAL, Crank Pulley.>
10) Remove the timing belt cover. <Ref. to ME(H4DOTC)-49, REMOVAL, Timing Belt Cover.>
11) Remove the timing belt. <Ref. to ME(H4DOTC)-50, TIMING BELT, REMOVAL, Timing Belt.>
12) Remove the cam sprocket LH. <Ref. to ME(H4DOTC)-59, REMOVAL, Cam Sprocket.>

13) Remove the belt cover No. 2 LH.



14) Remove the oil pipe.



(A) Union screw with filter (with protrusion)
(B) Union screw without filter (without protrusion)
(C) Oil pipe
(D) Gasket

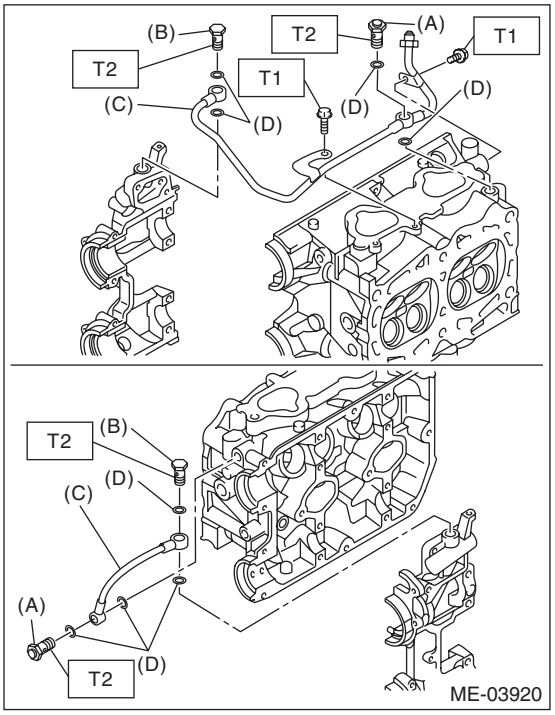
B: INSTALLATION

1. EXCEPT FOR WRX-SS MODEL

1) Inspect the union screw with filter. <Ref. to LU(H4SO)-28, INSPECTING UNION SCREW WITH FILTER, INSPECTION, Oil Pipe.>
2) Install the oil pipe.

NOTE:
• Make sure not to mix up the union screws with filter and without filter as their installation positions are different.
• Use a new gasket.

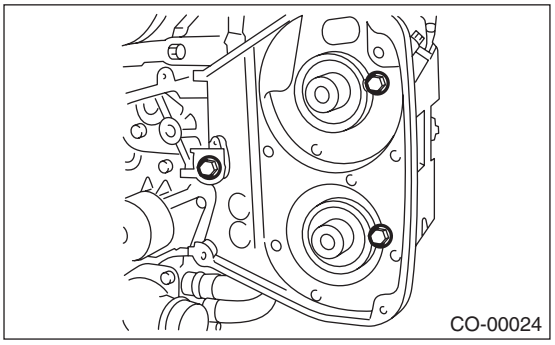
Tightening torque:
T1: 8 N·m (0.8 kgf-m, 5.9 ft-lb)
T2: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(A) Union screw with filter (with protrusion)
(B) Union screw without filter (without protrusion)
(C) Oil pipe
(D) Gasket

3) Install the belt cover No. 2 LH.

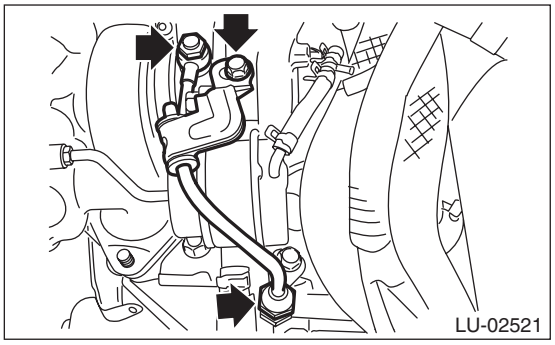
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



4) Install the cam sprocket LH. <Ref. to ME(H4DOTC)-59, INSTALLATION, Cam Sprocket.>
5) Install the timing belt. <Ref. to ME(H4DOTC)-53, TIMING BELT, INSTALLATION, Timing Belt.>
6) Install the timing belt cover. <Ref. to ME(H4DOTC)-49, INSTALLATION, Timing Belt Cover.>
7) Install the crank pulley. <Ref. to ME(H4DOTC)-47, INSTALLATION, Crank Pulley.>

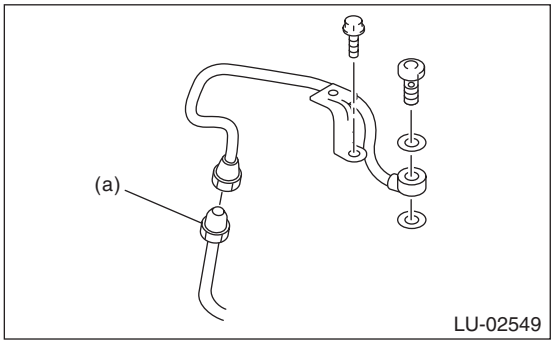
8) Install the V-belts. <Ref. to ME(H4DOTC)-40, INSTALLATION, V-belt.>
9) Install the radiator main fan and the radiator sub fan. <Ref. to CO(H4DOTC)-24, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4DOTC)-26, INSTALLATION, Radiator Sub Fan and Fan Motor.>
10) Install the secondary air pump. <Ref. to EC(H4DOTC)-24, INSTALLATION, Secondary Air Pump.>
11) Install the intake manifold. <Ref. to FU(H4DOTC)-20, INSTALLATION, Intake Manifold.>
12) Temporarily tighten the bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

NOTE:
Use a new gasket.

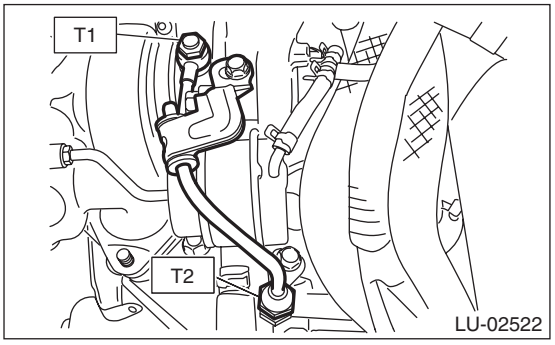


13) Tighten the union screws and flare nuts which secure the oil inlet pipe to the turbocharger.

CAUTION:
In order to prevent damaging the oil pipe on the cylinder head side, fix the section (a) shown in the figure when tightening the oil inlet pipe flare nut, and avoid the part from rotating together while tightening the nut.

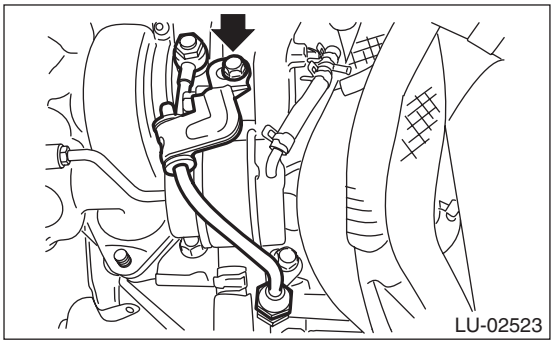


Tightening torque:
T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)



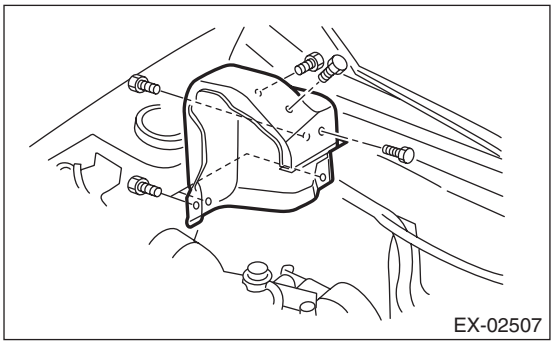
14) Tighten the bolts which hold the oil inlet pipe stay to the turbocharger.

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



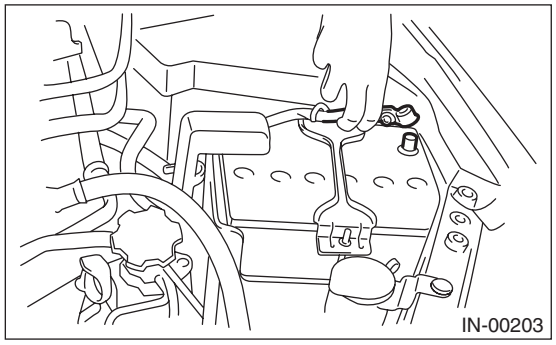
15) Install the turbocharger upper cover.

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



16) Install the intercooler bracket RH.
17) Install the intercooler. <Ref. to IN(H4DOTC)-13, INSTALLATION, Intercooler.>

18) Connect the ground cable to battery.

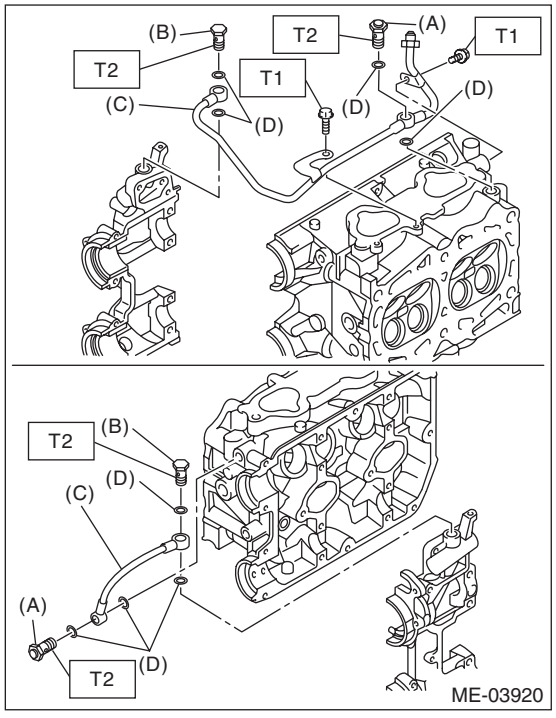


2. WRX-SS MODEL

1) Inspect the union screw with filter. <Ref. to LU(H4SO)-28, INSPECTING UNION SCREW WITH FILTER, INSPECTION, Oil Pipe.>
2) Install the oil pipe.

NOTE:
• Make sure not to mix up the union screws with filter and without filter as their installation positions are different.
• Use a new gasket.

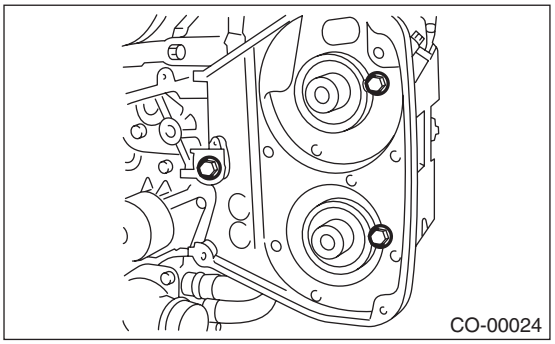
Tightening torque:
T1: 8 N·m (0.8 kgf-m, 5.9 ft-lb)
T2: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(A) Union screw with filter (with protrusion)
(B) Union screw without filter (without protrusion)
(C) Oil pipe
(D) Gasket

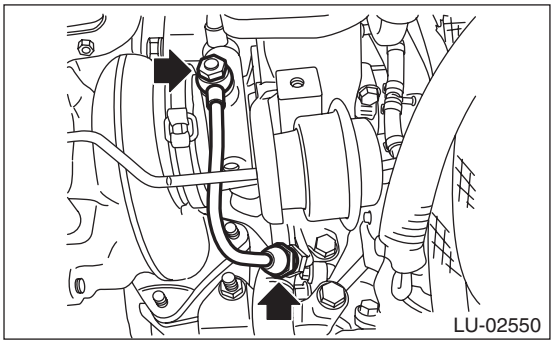
3) Install the belt cover No. 2 LH.

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



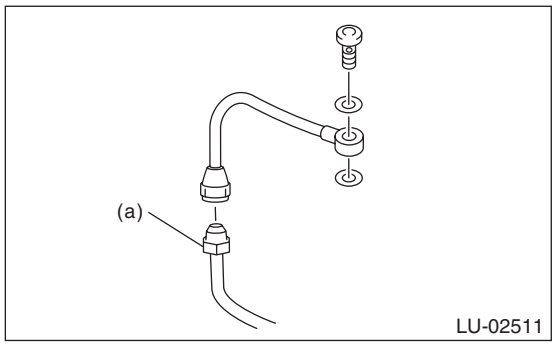
4) Install the cam sprocket LH. <Ref. to ME(H4DOTC)-59, INSTALLATION, Cam Sprocket.>
5) Install the timing belt. <Ref. to ME(H4DOTC)-53, TIMING BELT, INSTALLATION, Timing Belt.>
6) Install the timing belt cover. <Ref. to ME(H4DOTC)-49, INSTALLATION, Timing Belt Cover.>
7) Install the crank pulley. <Ref. to ME(H4DOTC)-47, INSTALLATION, Crank Pulley.>
8) Install the V-belts. <Ref. to ME(H4DOTC)-40, INSTALLATION, V-belt.>
9) Install the radiator main fan and the radiator sub fan. <Ref. to CO(H4DOTC)-24, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4DOTC)-26, INSTALLATION, Radiator Sub Fan and Fan Motor.>
10) Install the secondary air pump. <Ref. to EC(H4DOTC)-24, INSTALLATION, Secondary Air Pump.>
11) Install the intake manifold. <Ref. to FU(H4DOTC)-20, INSTALLATION, Intake Manifold.>
12) Temporarily tighten the oil inlet pipe of the turbocharger.

NOTE:
Use a new gasket.

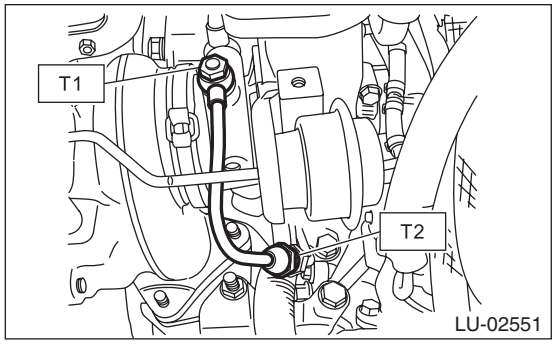


13) Tighten the oil inlet pipe of the turbocharger.

CAUTION:
In order to prevent damaging the oil pipe on the cylinder head side, fix the section (a) shown in the figure when tightening the oil inlet pipe flare nut, and avoid the part from rotating together while tightening the nut.

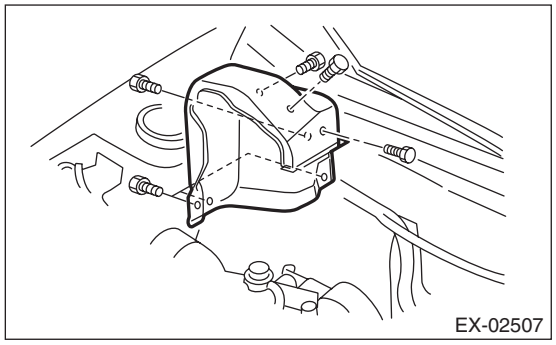


Tightening torque:
T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)



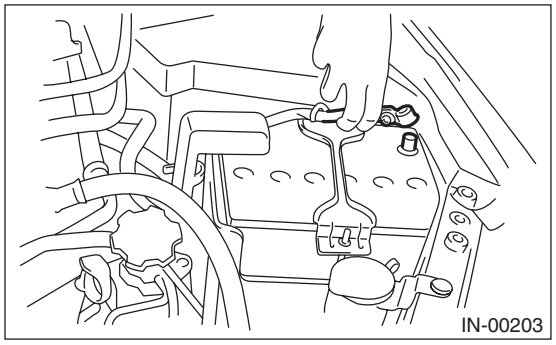
14) Install the turbocharger upper cover.

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



15) Install the intercooler. <Ref. to IN(H4DOTC)-13, INSTALLATION, Intercooler.>

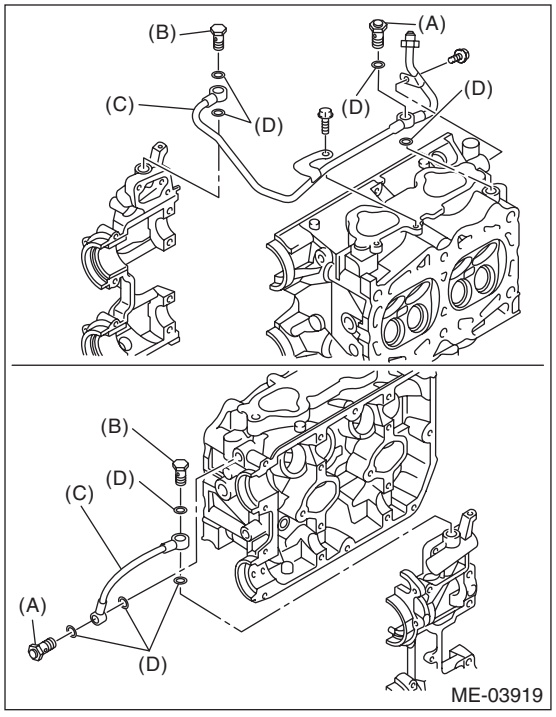
16) Connect the ground cable to battery.



C: INSPECTION

1. INSPECTING UNION SCREW WITH FILTER

Check the filter part of union screw for clogging or damage, and if defective, replace the union screw with filter with a new part.



(A) Union screw with filter (with protrusion)
(B) Union screw without filter (without protrusion)
(C) Oil pipe
(D) Gasket

2. OTHER INSPECTIONS

1) Check that the oil pipe and union screw have no deformation, cracks and other damages.
2) Check that there are no oil leaks or oil oozing from the oil pipe attachment section.

8. Engine Oil Filter

A: REMOVAL

CAUTION:
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1) Set the vehicle on a lift.
2) Lift up the vehicle.
3) Remove the under cover. (Turbo model)
4) Remove the oil filter.

• Oil filter (Black)

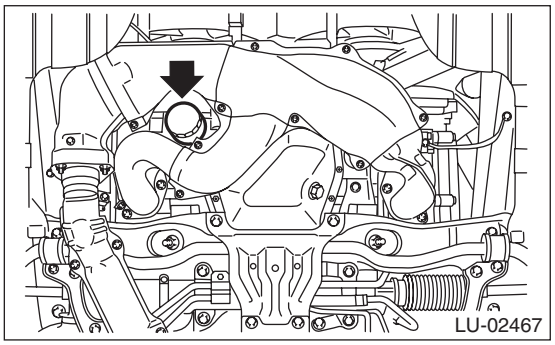
Remove using the ST.

ST 18332AA000 OIL FILTER WRENCH (OUTER DIAMETER: 68 MM (2.68 IN) FOR OIL FILTER)

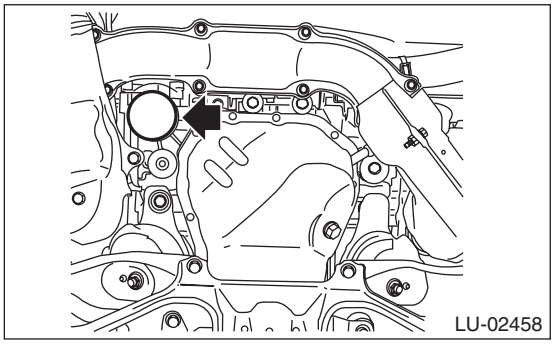
• Oil filter (Blue)

Remove using a general tool (65/67 mm 14 Flutes).

• Non-turbo model



• Turbo model



B: INSTALLATION

CAUTION:
Do not tighten excessively, or oil may leak.

1) Clean the oil filter installing surface of cylinder block.
2) Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.
3) Install the oil filter turning it by hand, being careful not to damage the seal rubber of the oil filter.

• Tighten the oil filter (Black) with an outer diameter of 68 mm (2.68 in) (approx. 1 rotation) after the seal rubber of the oil filter comes in contact with cylinder block. When using a torque wrench, tighten to 14 N·m (1.4 kgf-m, 10.3 ft-lb).
• Tighten the oil filter (Blue) with an outer diameter of 67.4 mm (2.65 in) (approx. 7/8 rotation) after the seal rubber of the oil filter comes in contact with cylinder block. When using a torque wrench, tighten to 12 N·m (1.2 kgf-m, 8.9 ft-lb).

4) Install the under cover. (Turbo model)
5) Lower the vehicle.

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(H4SO)-10, 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	Clogging of oil filter	Replace.
		Malfunction of oil by-pass valve in oil filter	Replace.
		Malfunction of oil relief valve in oil pump	Clean or replace.
		Clogged oil passage	Clean.
		Excessive tip clearance and side clearance of oil pump rotor	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil (degradation, etc.)	Replace.
		Broken pipe of oil strainer	Replace.
		Stuck oil pump rotor	Replace.
2. Warning light does not illuminate.	1) Malfunction of combination meter		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact of terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed 1. — 2.

SPEED CONTROL SYSTEMS

SP(H4SO)

Page

1. General Description 2
2. Accelerator Pedal 4

1. General Description

A: SPECIFICATION

Engine	Model			2.5 L
	Cylinder arrangement			Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine
	Valve system mechanism			Belt driven, single overhead camshaft, 4 valve/cylinder
	Bore × Stroke mm (in)			99.5 × 79.0 (3.92 × 3.11)
	Displacement cm^3 (cu in)			2,457 (149.94)
	Compression ratio			10.0
	Compression pressure (at 200 — 300 rpm) kPa (kg/cm^2, psi)			1,020 — 1,275 (10.4 — 13.0, 148 — 185)
	Number of piston rings			Pressure ring: 2, Oil ring: 1
	Intake valve timing	Constant	Open	BTDC 0°
			Close	ABDC 58°
		Low speed	Open	BTDC 0°
			Close	ABDC –10°
		High speed	Open	BTDC 14°
			Close	ABDC 62°
	Exhaust valve timing		Open	BBDC30°
			Close	ATDC14°
	Valve clearance mm (in)		Intake	0.20±0.04 (0.0079±0.0016)
			Exhaust	0.25±0.04 (0.0098±0.0016)
	Idling speed (at “P” or “N” position on AT model, or neutral position on MT model) rpm		No load	AT model: 700±100
				MT model: 650±100
			A/C ON	850±100
	Ignition order			1 → 3 → 2 → 4
	Ignition timing BTDC/rpm			AT model: 15°±10°/700
				MT model: 10°±8°/650

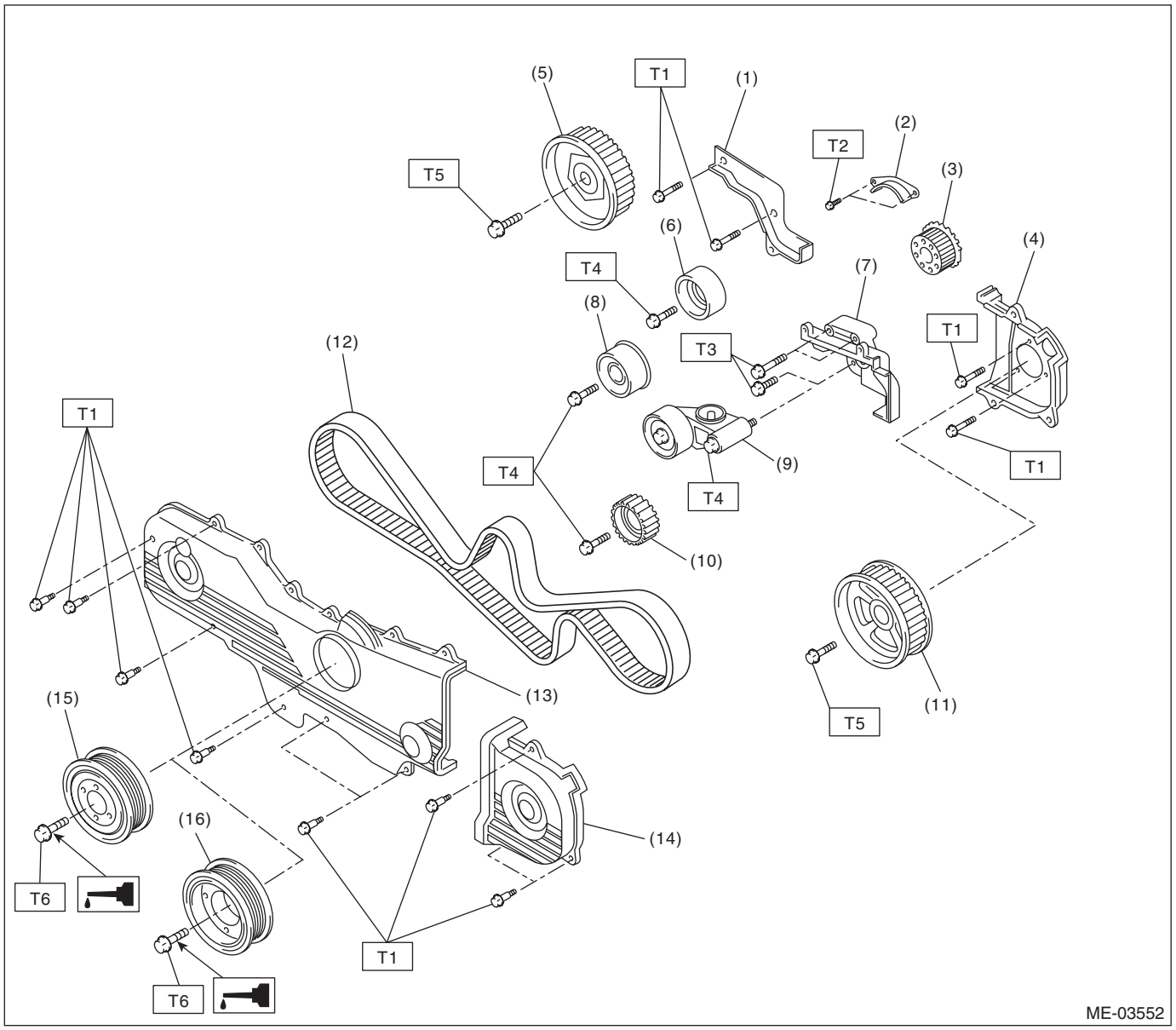
NOTE:
US: Undersize OS: Oversize

Belt tension adjuster	Protrusion of adjuster rod			mm (in)	5.2 — 6.2 (0.205 — 0.244)
Valve rocker arm	Clearance between shaft and arm			mm (in) Standard	0.020 — 0.054 (0.0008 — 0.0021)
Camshaft	Bending limit			mm (in)	0.025 (0.00098)
	Cam lobe height mm (in)	Intake	Constant	Standard	40.075 — 40.175 (1.5778 — 1.5817)
			Low speed	Standard	35.496 — 35.596 (1.3975 — 1.4014)
			High speed	Standard	40.315 — 40.415 (1.5872 — 1.5911)
		Exhaust		Standard	39.289 — 39.389 (1.5468 — 1.5507)
	Cam base circle diameter			mm (in) Standard	34.00 (1.3386)
	Base circle step of adjacent intake cams (low speed and high speed)			mm (in) Standard	0.03 (0.001)
	Journal O.D.			mm (in)	31.928 — 31.945 (1.2570 — 1.2577)
	Cylinder head journal I.D.			mm (in)	32.000 — 32.018 (1.2598 — 1.2605)
	Thrust clearance			mm (in) Standard	0.030 — 0.090 (0.0012 — 0.0035)
	Oil clearance			mm (in) Standard	0.055 — 0.090 (0.0022 — 0.0035)
Cylinder head	Warping limit (Mating surface with cylinder block)			mm (in)	0.035 (0.0014)
	Grinding limit			mm (in)	0.1 (0.004)
	Standard height			mm (in)	97.5 (3.84)
Valve seat	Seating angle between valve and valve seat				90°
	Contacting width between valve and valve seat mm (in)	Standard		Intake	0.8 — 1.4 (0.03 — 0.055)
				Exhaust	1.2 — 1.8 (0.047 — 0.071)
Valve guide	Clearance between the valve guide and valve stem mm (in)	Standard		Intake	0.035 — 0.062 (0.0014 — 0.0024)
				Exhaust	0.040 — 0.067 (0.0016 — 0.0026)
	Inside diameter			mm (in)	6.000 — 6.012 (0.2362 — 0.2367)
	Valve stem outer diameters			mm (in) Intake	5.950 — 5.965 (0.2343 — 0.2348)
				Exhaust	5.945 — 5.960 (0.2341 — 0.2346)
	Valve guide protrusion			mm (in) Intake	20.0 — 21.0 (0.787 — 0.827)
				Exhaust	16.5 — 17.5 (0.650 — 0.689)
Valve	Head edge thickness mm (in)	Standard		Intake	0.8 — 1.2 (0.03 — 0.047)
				Exhaust	1.0 — 1.4 (0.039 — 0.055)
	Overall length			mm (in) Intake	120.6 (4.75)
				Exhaust	121.7 (4.79)
Valve spring	Free length			mm (in)	55.2 (2.173)
	Tension/spring height N (kgf, lb)/mm (in)			Set	235.3 — 270.7 (24 — 27.6, 52.9 — 60.8)/45.0 (1.772)
				Lift	578.9 — 639.9 (59.1 — 65.3, 130.3 — 143.9)/ 34.7 (1.366)
	Squareness				2.5°, 2.4 mm (0.094 in) or less
Cylinder block	Warping limit (Mating surface with cylinder head)			mm (in)	0.025 (0.00098)
	Grinding limit			mm (in)	0.1 (0.004)
	Standard height			mm (in)	201.0 (7.91)
	Taper			mm (in) Standard	0.015 (0.0006)
	Out-of-roundness			mm (in) Standard	0.010 (0.0004)
	Cylinder to piston clearance at 20°C (68°F)			mm (in) Standard	–0.010 — 0.010 (–0.00039 — 0.00039)
	Cylinder inner diameter boring limit (diameter)			mm (in)	To 100.005 (3.9372)

Piston	Piston grade point mm (in)			38.2 (1.504)
	Outer diameter mm (in)	Standard	A	99.505 — 99.515 (3.9175 — 3.9179)
			B	99.495 — 99.505 (3.9171 — 3.9175)
		0.25 (0.0098) OS		99.745 — 99.765 (3.9270 — 3.9277)
		0.50 (0.0197) OS		99.995 — 100.015 (3.9368 — 3.9376)
Piston pin	Degree of fit			Piston pin must be fitted into position with thumb at 20°C (68°F).
	Clearance between piston hole and piston pin mm (in)		Standard	0.004 — 0.008 (0.0002 — 0.0003)
Piston ring	Piston ring gap mm (in)	Top ring	Standard	0.20 — 0.35 (0.0079 — 0.0138)
		Second ring	Standard	0.37 — 0.52 (0.0146 — 0.0205)
		Oil ring	Standard	0.20 — 0.50 (0.0079 — 0.0197)
	Clearance between piston ring and piston ring groove mm (in)	Top ring	Standard	0.040 — 0.080 (0.0016 — 0.0031)
		Second ring	Standard	0.030 — 0.070 (0.0012 — 0.0028)
Connecting rod and connecting rod bearing	Bend or twist per 100 mm (3.94 in) in length mm (in)		Service limit	0.10 (0.0039)
	Thrust clearance mm (in)		Standard	0.070 — 0.330 (0.0028 — 0.0130)
	Oil clearance mm (in)	Standard		0.016 — 0.044 (0.0006 — 0.0017)
	Bearing size (Thickness at center) mm (in)	Standard		1.492 — 1.501 (0.0587 — 0.0591)
		0.03 (0.0012) US		1.510 — 1.513 (0.0594 — 0.0596)
		0.05 (0.0020) US		1.520 — 1.523 (0.0598 — 0.0600)
		0.25 (0.0098) US		1.620 — 1.623 (0.0638 — 0.0639)
Bushing of small end	Clearance between piston pin and bushing mm (in)		Standard	0 — 0.022 (0 — 0.0009)
Crankshaft and crankshaft bearing	Bending limit mm (in)			0.035 (0.0014)
	Crank pin	Out-of-roundness mm (in)		0.003 (0.0001)
		Cylindricality mm (in)		0.004 (0.0002)
		Grinding limit (dia.) mm (in)		To 51.750 (2.0374)
	Crank journal	Out-of-roundness mm (in)		0.005 (0.0002)
		Cylindricality mm (in)		0.006 (0.0002)
		Grinding limit (dia.) mm (in)		To 59.758 (2.3527)
	Crank pin outer diameter mm (in)	Standard		51.984 — 52.000 (2.0466 — 2.0472)
		0.03 (0.0012) US		51.954 — 51.970 (2.0454 — 2.0461)
		0.05 (0.0020) US		51.934 — 51.950 (2.0446 — 2.0453)
		0.25 (0.0098) US		51.734 — 51.750 (2.0368 — 2.0374)
	Crank journal outer diameter mm (in)	Standard		59.992 — 60.008 (2.3619 — 2.3625)
		0.03 (0.0012) US		59.962 — 59.978 (2.3607 — 2.3613)
		0.05 (0.0020) US		59.942 — 59.958 (2.3599 — 2.3605)
		0.25 (0.0098) US		59.742 — 59.758 (2.3520 — 2.3527)
	Bearing size (Thickness at center) mm (in)	#1, #3	Standard	1.998 — 2.011 (0.0787 — 0.0792)
			0.03 (0.0012) US	2.017 — 2.020 (0.0794 — 0.0795)
			0.05 (0.0020) US	2.027 — 2.030 (0.0798 — 0.0799)
			0.25 (0.0098) US	2.127 — 2.130 (0.0837 — 0.0839)
		#2, #4, #5	Standard	2.000 — 2.013 (0.0787 — 0.0793)
			0.03 (0.0012) US	2.019 — 2.022 (0.0795 — 0.0796)
			0.05 (0.0020) US	2.029 — 2.032 (0.0799 — 0.0800)
			0.25 (0.0098) US	2.129 — 2.132 (0.0838 — 0.0839)
	Thrust clearance mm (in)	Standard		0.030 — 0.115 (0.0012 — 0.0045)
	Oil clearance mm (in)	Standard		0.010 — 0.030 (0.0004 — 0.0012)

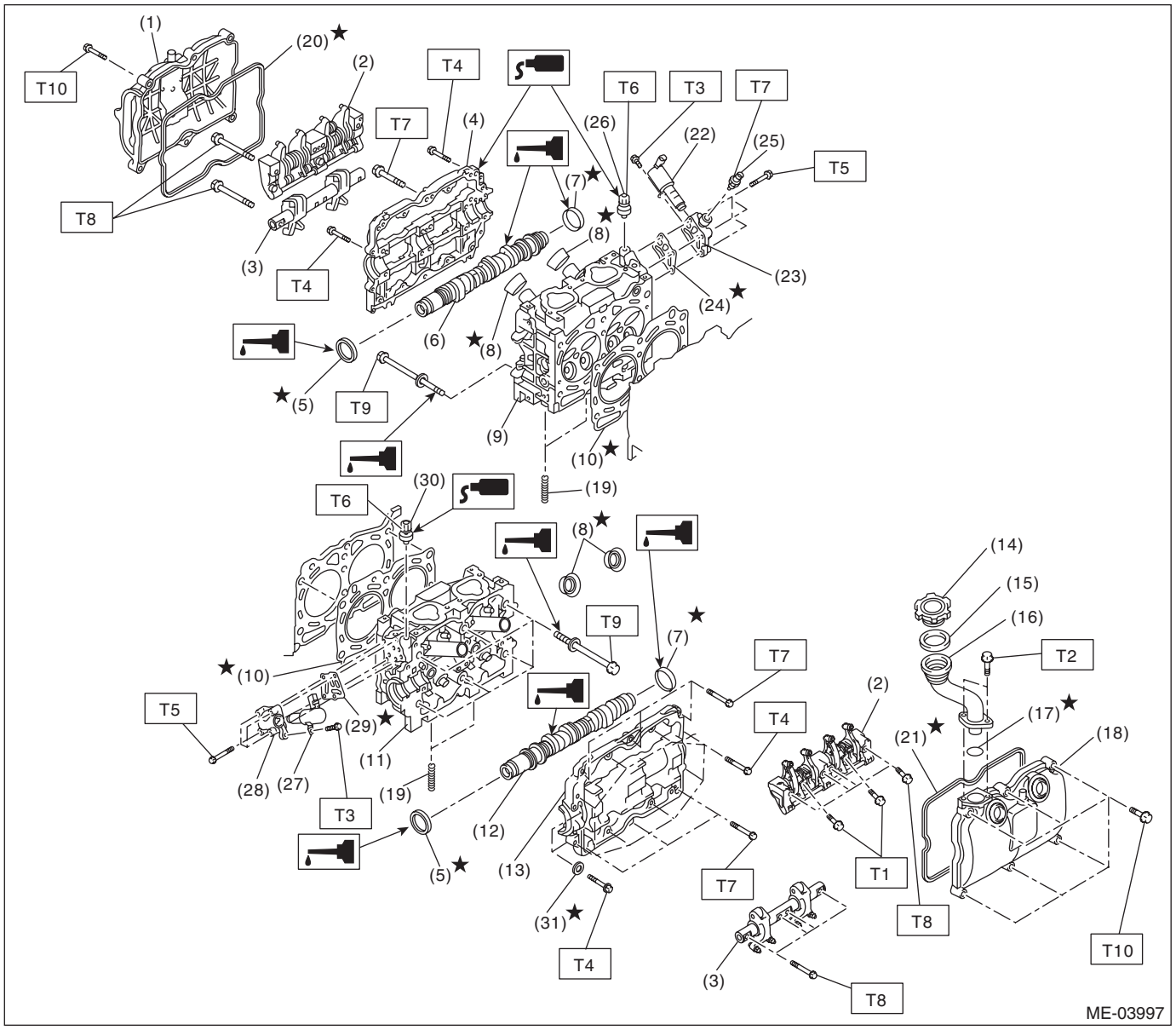
B: COMPONENT

1. TIMING BELT



(1)	Timing belt cover No. 2 RH	(9)	Automatic belt tension adjuster ASSY	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Timing belt guide (MT model)	(10)	Belt idler No. 2	***T1: 5 (0.5, 3.7)***
(3)	Crank sprocket	(11)	Cam sprocket No. 2	***T2: 9.75 (1.0, 7.2)***
(4)	Timing belt cover No. 2 LH	(12)	Timing belt	***T3: 24.5 (2.5, 18.1)***
(5)	Cam sprocket No. 1	(13)	Front timing belt cover	***T4: 39 (4.0, 28.8)***
(6)	Belt idler (A)	(14)	Timing belt cover LH	***T5: 78 (8.0, 57.5)***
(7)	Tensioner bracket	(15)	Crank pulley (MT model)	***T6: <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>***
(8)	Belt idler (B)	(16)	Crank pulley (AT model)	

2. CYLINDER HEAD AND CAMSHAFT

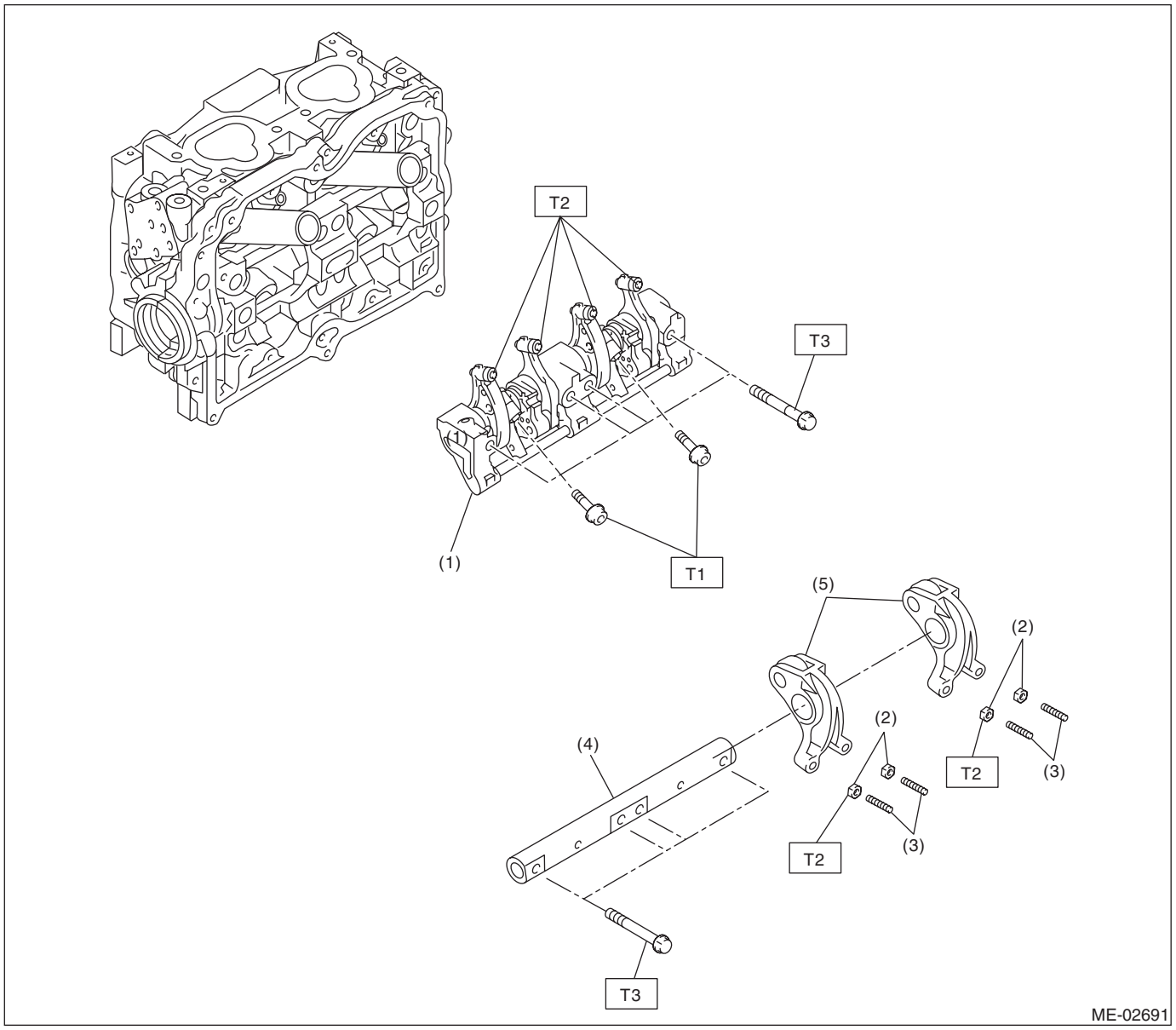


(1) Rocker cover RH
(2) Intake valve rocker ASSY
(3) Exhaust valve rocker ASSY
(4) Camshaft cap RH
(5) Oil seal
(6) Camshaft RH
(7) Plug
(8) Spark plug pipe gasket
(9) Cylinder head RH
(10) Cylinder head gasket
(11) Cylinder head LH
(12) Camshaft LH
(13) Camshaft cap LH
(14) Oil filler cap
(15) Gasket
(16) Oil filler duct
(17) O-ring
(18) Rocker cover LH
(19) Stud bolt
(20) Rocker cover gasket RH
(21) Rocker cover gasket LH
(22) Oil switching solenoid valve RH
(23) Oil switching solenoid valve holder RH
(24) Gasket
(25) Oil temperature sensor
(26) Variable valve lift diagnosis oil pressure switch RH
(27) Oil switching solenoid valve LH
(28) Oil switching solenoid valve holder LH
(29) Gasket
(30) Variable valve lift diagnosis oil pressure switch LH
(31) Seal washer

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6 (0.6, 4.4)
T2: 6.4 (0.7, 4.7)
T3: 8 (0.8, 5.9)
T4: 9.75 (1.0, 7.2)
T5: 10 (1.0, 7.4)
T6: 17 (1.7, 12.5)
T7: 18 (1.8, 13.3)
T8: 25 (2.5, 18.4)
T9: <Ref. to ME(H4SO)-64, INSTALLATION, Cylinder Head.>
T10: <Ref. to ME(H4SO)-56, INSTALLATION, Valve Rocker Assembly.>

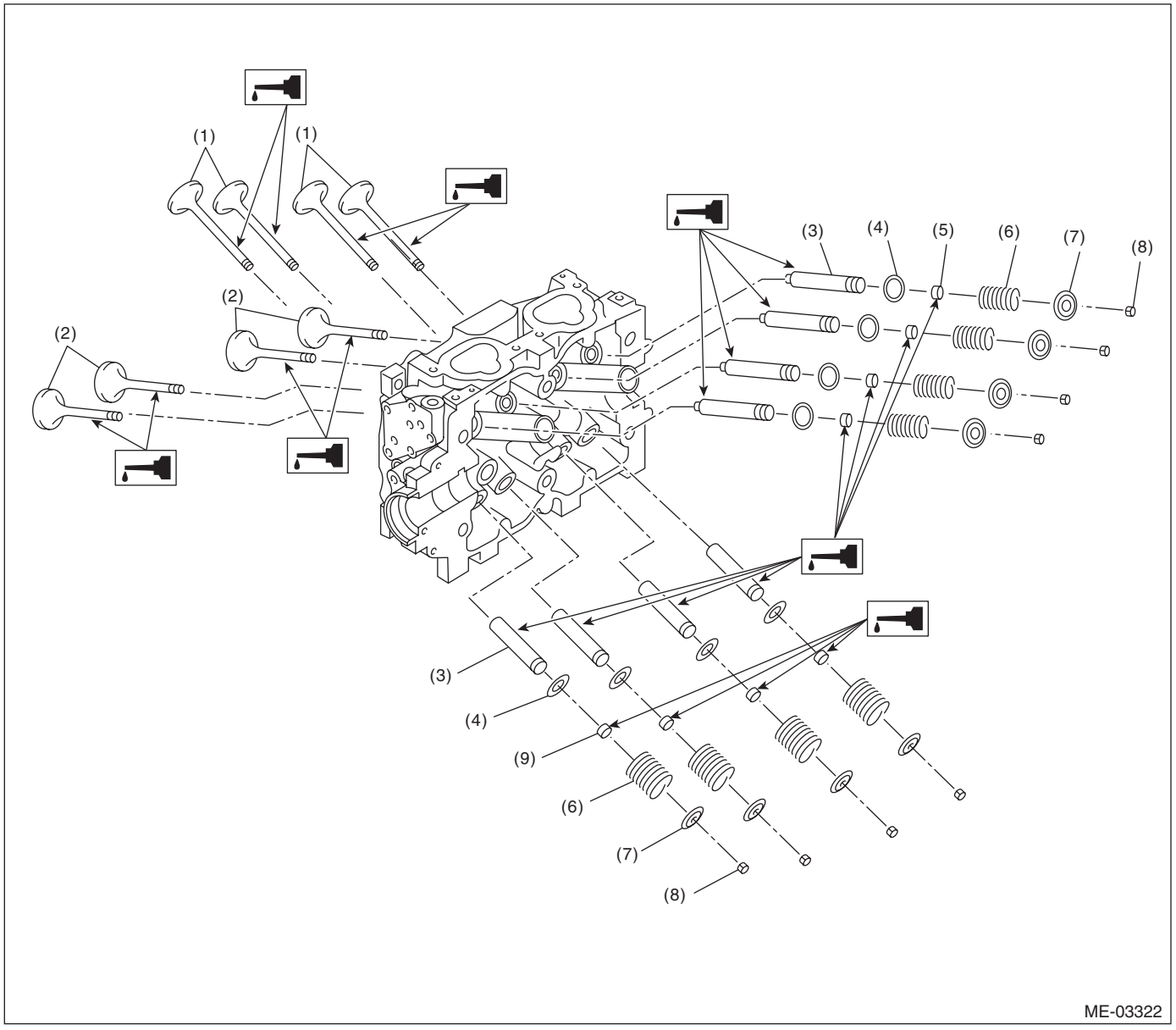
3. VALVE ROCKER ASSY



(1) Intake valve rocker ASSY
(2) Valve rocker nut
(3) Valve rocker adjusting screw
(4) Exhaust rocker shaft
(5) Exhaust valve rocker arm

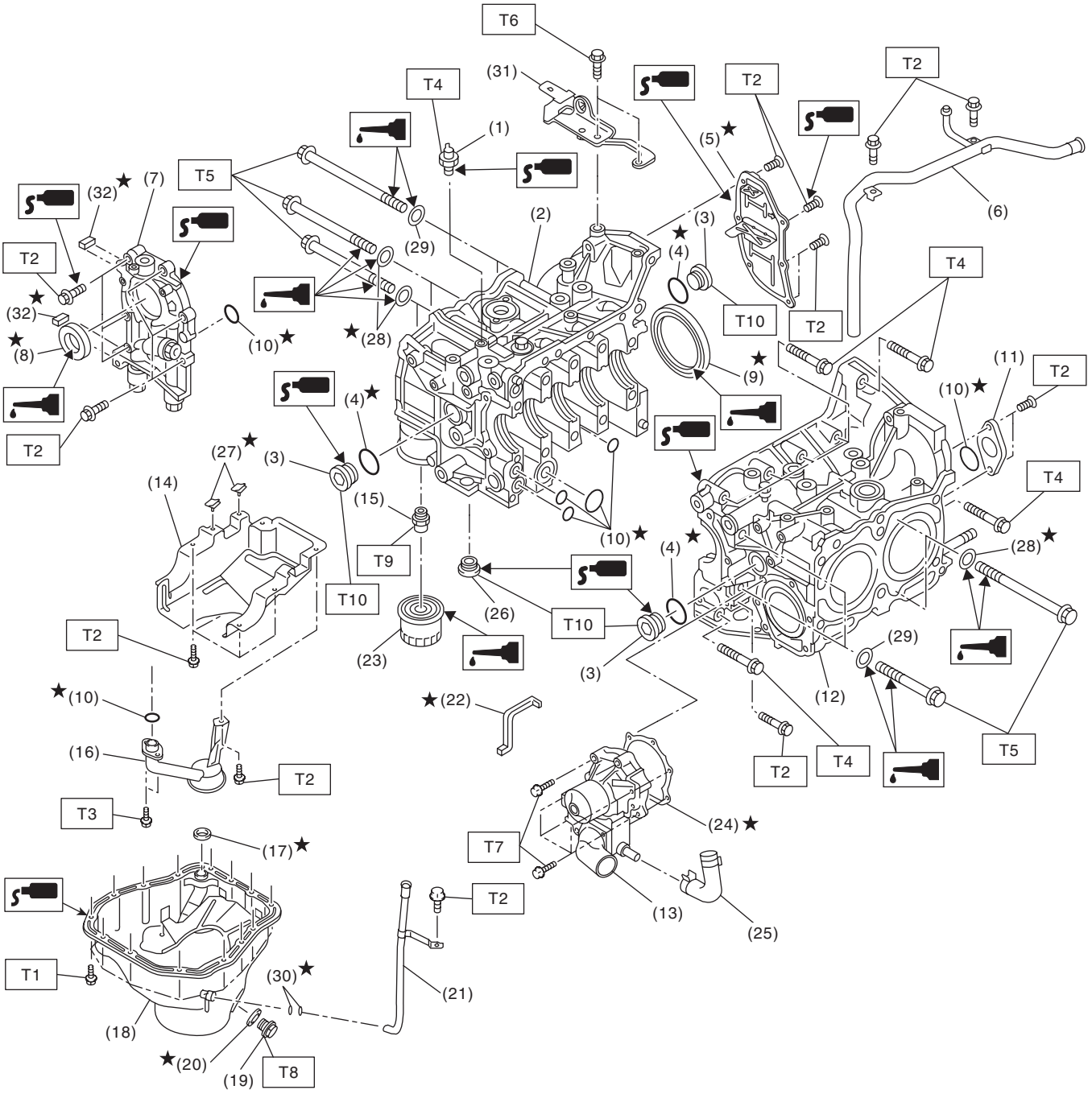
Tightening torque: N·m (kgf-m, ft-lb)
T1: 6 (0.6, 4.4)
T2: 9.75 (1.0, 7.2)
T3: 25 (2.5, 18.4)

4. CYLINDER HEAD AND VALVE ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Valve guide
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Retainer
(8) Retainer key
(9) Exhaust valve oil seal

5. CYLINDER BLOCK

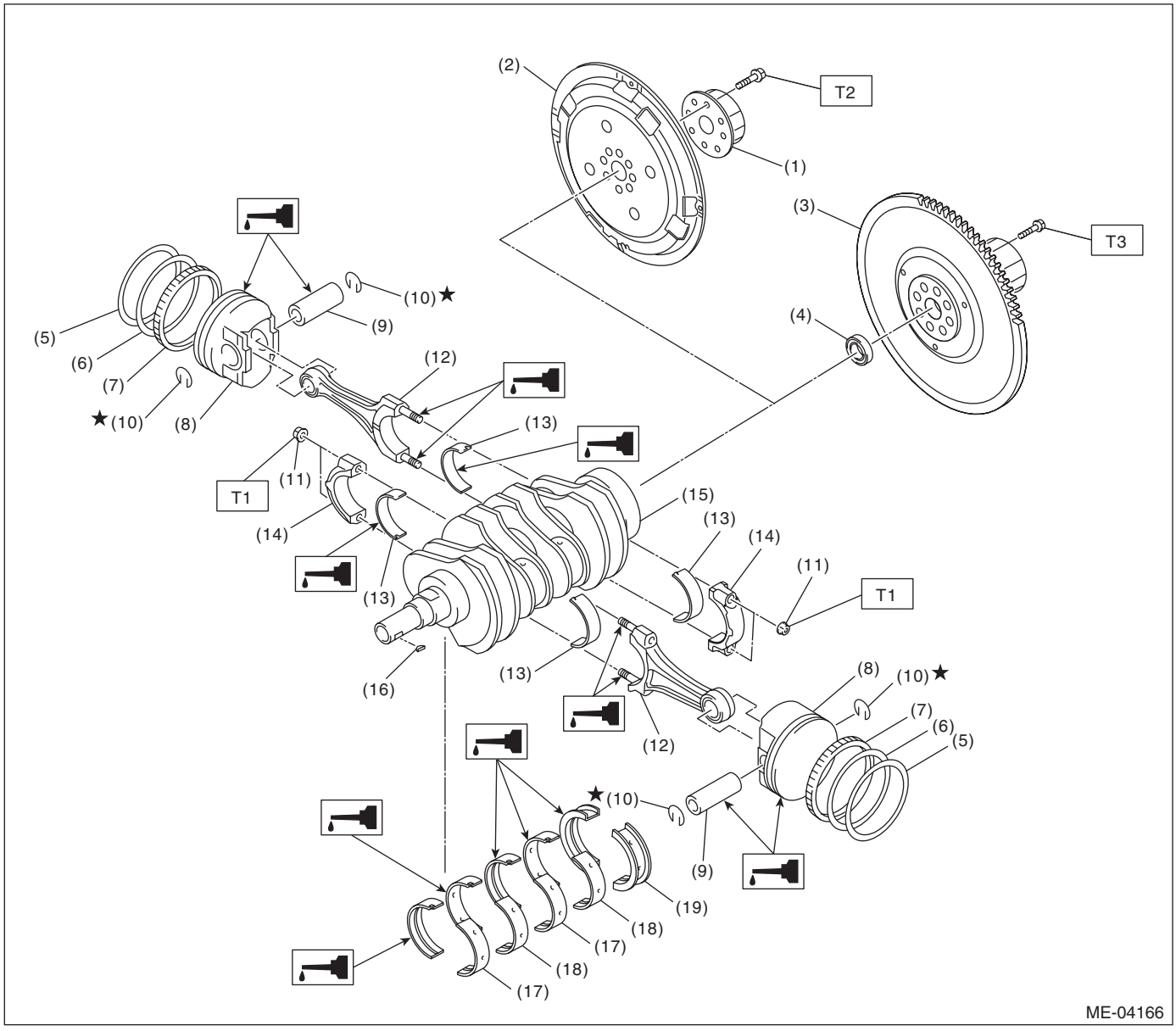


ME-03982

(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) Oil filter connector
(16) Oil strainer
(17) Gasket
(18) Oil pan
(19) Drain plug
(20) Drain plug gasket
(21) Oil level gauge guide
(22) Water pump sealing
(23) Oil filter
(24) Gasket
(25) Water pump hose
(26) Plug
(27) Seal
(28) Seal washer
(29) Washer
(30) O-ring
(31) Engine rear hanger
(32) Oil pump seal

Tightening torque: N·m (kgf-m, ft-lb)	
T1:	***5 (0.5, 3.7)***
T2:	***6.4 (0.7, 4.7)***
T3:	***10 (1.0, 7.4)***
T4:	***25 (2.5, 18.4)***
T5:	***<Ref. to ME(H4SO)-76, INSTALLATION, Cylinder Block.>***
T6:	***16 (1.6, 11.8)***
T7:	***First 12 (1.2, 8.7) Second 12 (1.2, 8.7)***
T8:	***44 (4.5, 32.5)***
T9:	***45 (4.6, 33.2)***
T10:	***70 (7.1, 51.6)***

6. CRANKSHAFT AND PISTON

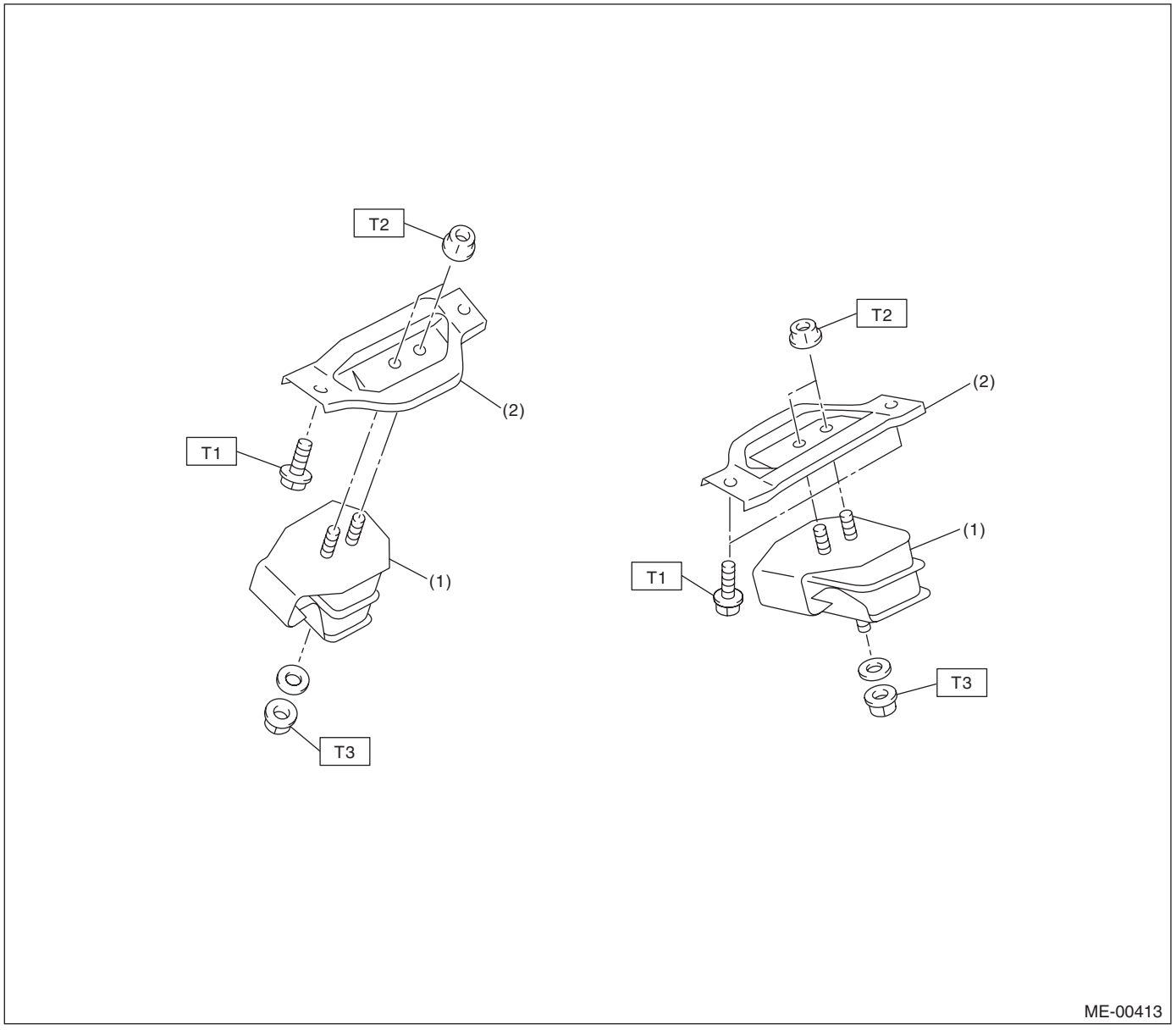


(1) Reinforcement (AT model)
(2) Drive plate (AT model)
(3) Flywheel (MT model)
(4) Ball bearing (MT model)
(5) Top ring
(6) Second ring
(7) Oil ring
(8) Piston
(9) Piston pin
(10) Snap ring
(11) Connecting rod nut
(12) Connecting rod
(13) Connecting rod bearing
(14) Connecting rod cap
(15) Crankshaft
(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: 45 (4.6, 33.2)
T2: <Ref. to 4AT-68, INSTALLATION, Drive Plate.>
T3: <Ref. to CL-12, INSTALLATION, Flywheel.>

7. ENGINE MOUNTING



(1) Front cushion rubber

(2) Front engine mounting bracket

Tightening torque: N·m (kgf-m, ft-lb)

T1: 35 (3.6, 25.8)

T2: 42 (4.3, 31.0)

T3: 85 (8.7, 62.7)

C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• 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.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
• All parts should be thoroughly cleaned, paying special attention to 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 parts 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 not to stain seats and windows with coolant or oil. Place a cover over fender, 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 TOOL

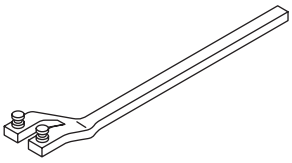
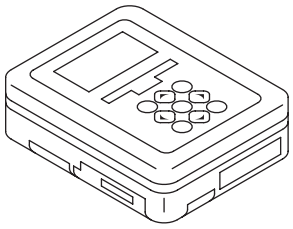
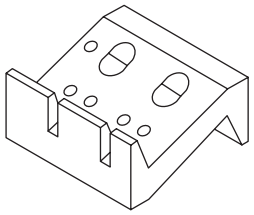
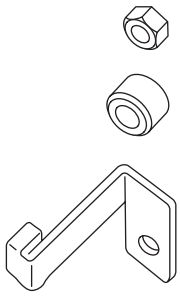
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18231AA010	18231AA010	CAM SPROCKET WRENCH	• Used for removing and installing cam sprocket. (LH side) • CAM SPROCKET WRENCH (499207100) can also be used.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for various inspections.
 ST-498267800	498267800	CYLINDER HEAD TABLE	• Used for replacing valve guides. • Used for removing and installing valve spring.
 ST-498277200	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.

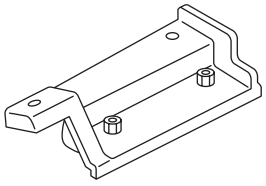
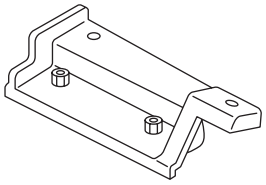
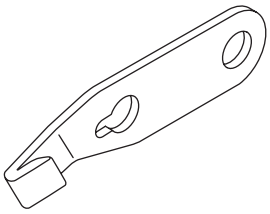
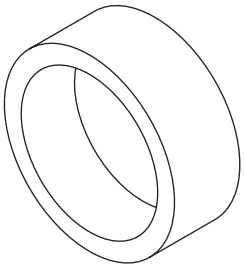
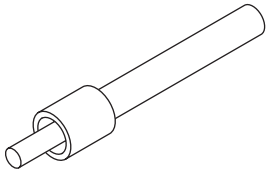
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used together with ENGINE STAND (499817100).
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used together with ENGINE STAND (499817100).
 ST-498497100	498497100	CRANKSHAFT STOPPER	Used for removing and installing the flywheel and drive plate.
 ST-498747300	498747300	PISTON GUIDE	Used for installing piston in cylinder.
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.

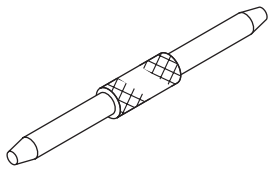
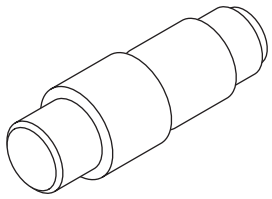
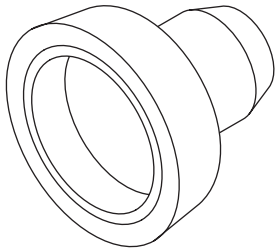
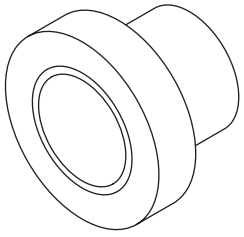
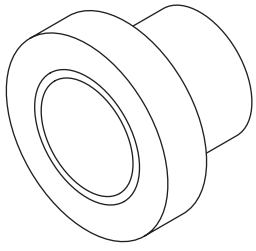
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499017100	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499037100	499037100	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and installing connecting rod bushing.
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used together with CRANKSHAFT OIL SEAL GUIDE (499597100).
 ST-499587500	499587500	OIL SEAL INSTALLER	• Used for installing the camshaft oil seal. • Used together with OIL SEAL GUIDE (499597000).
 ST-499587700	499587700	CAMSHAFT OIL SEAL INSTALLER	Used for installing cylinder head plug.

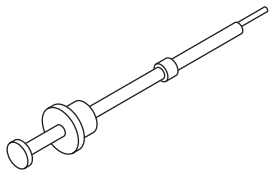
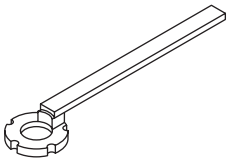
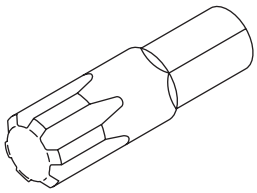
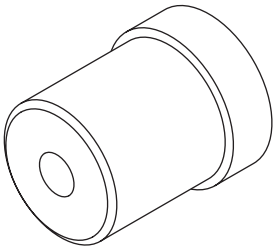
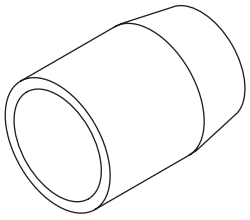
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499097700	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 ST-499207400	499207400	CAM SPROCKET WRENCH	Used for removing and installing cam sprocket. (RH side)
 ST-499497000	499497000	TORX® PLUS	Used for removing and installing camshaft cap.
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 ST-499597000	499597000	OIL SEAL GUIDE	• Used for installing the camshaft oil seal. • Used together with CAMSHAFT OIL SEAL INSTALLER (499587500).

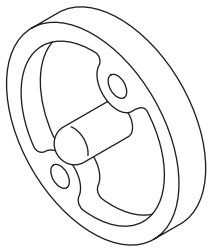
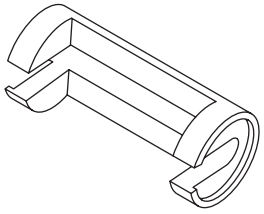
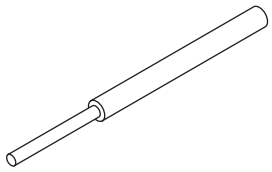
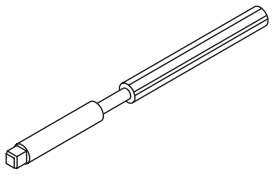
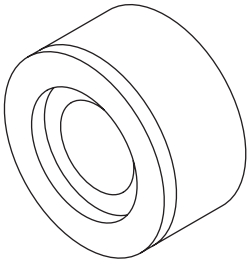
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used for installing crankshaft oil seal. • Used together with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499767700	499767700	VALVE GUIDE ADJUSTER	Used for installing valve guides. (Intake side)

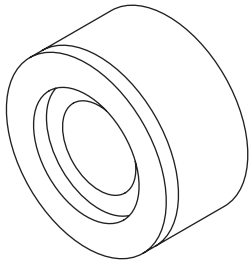
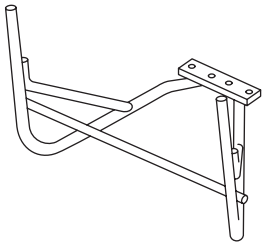
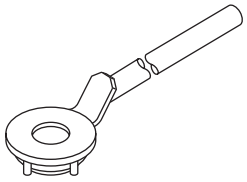
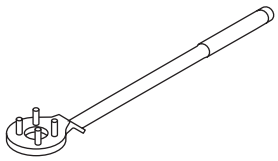
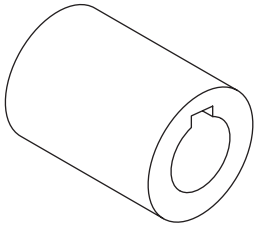
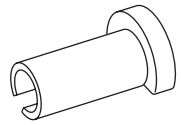
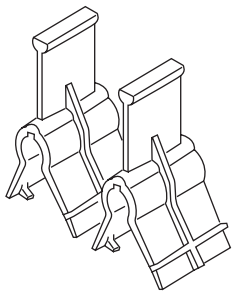
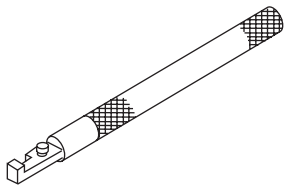
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499767800	499767800	VALVE GUIDE ADJUSTER	Used for installing valve guides. (Exhaust side)
 ST-499817100	499817100	ENGINE STAND	• Stand used for engine disassembly and assembly. • Used together with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977400	499977400	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (AT model)
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts. (MT model)
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing the quick connector.
 ST18354AA000	18354AA000	VALVE ROCKER HOLDER	Used for installing the valve rocker assembly (intake). (2-piece set)
 ST18258AA000	18258AA000	SPRING INSTALLER	Used for installing the valve rocker assembly (intake).

2. GENERAL TOOL

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Vacuum gauge	Used for measuring intake manifold vacuum.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.
Timing light	Used for measuring ignition timing.

E: PROCEDURE

It is possible to conduct the following service procedures with engine on vehicle, however, the procedures described in this section are based on the condition that the engine is removed from vehicle.

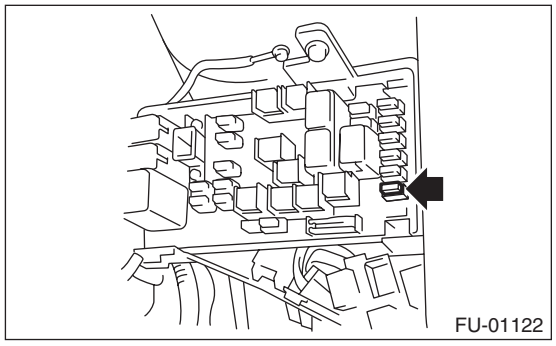
- V-belt
- Timing belt
- Valve rocker ASSY
- Camshaft
- Cylinder head

2. Compression

A: INSPECTION

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

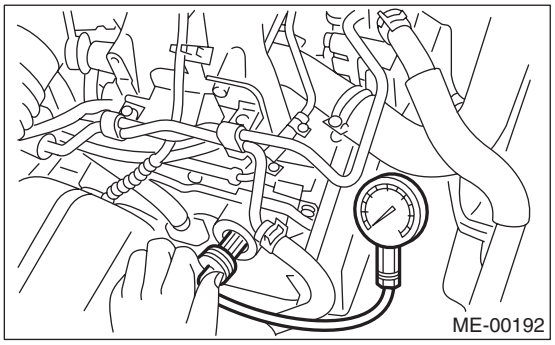
1) After warming-up the engine, turn the ignition switch to OFF.
2) Make sure that the battery is fully charged.
3) Remove the fuse of fuel pump from main fuse box.



4) Start the engine and run it until it stalls.
5) After the engine stalls, crank it for five more seconds.
6) Turn the ignition switch to OFF.
7) Remove all spark plugs. <Ref. to IG(H4SO)-4, REMOVAL, Spark Plug.>
8) Fully open the throttle valve.
9) Check the starter motor for satisfactory performance and operation.
10) Secure the compression gauge tightly against the spark plug hole.

NOTE:
When using a screw-in type compression gauge, the screw should be less than 18 mm (0.71 in) long.

11) Crank the engine by the starter motor, and read the maximum value on the gauge when the needle of compression gauge is steady.



12) Perform at least two measurements per cylinder, and make sure that the values are correct.

Compression (fully open throttle):
Standard
1,020 — 1,275 kPa (10.4 — 13.0 kgf/cm^2, 148 — 185 psi)
Difference between cylinders
49 kPa (0.5 kgf/cm^2, 7 psi) or less

13) After inspection, install the related parts in the reverse order of removal.

3. Idle Speed

A: INSPECTION

1) Before checking the idle speed, check the following item:
   (1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Read the engine idle speed using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-35, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>
4) Check the idle speed when no-loaded. (Headlight, heater fan, rear defroster, radiator fan, A/C and etc. are OFF)

Idle speed (No load and at "P" or "N" position on AT model, or neutral position on MT model):
700±100 rpm (AT model)
650±100 rpm (MT model)

5) Check the idle speed when loaded. (Turn the A/C switch to "ON" and operate the compressor for at least one minute before measurement.)

Idle speed (A/C "ON" and at "P" or "N" position on AT model, or neutral position on MT model):
850±100 rpm

NOTE:
Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted. If the prescribed idle speed cannot be maintained, refer to the General Diagnosis Table under "Engine Control System". <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>

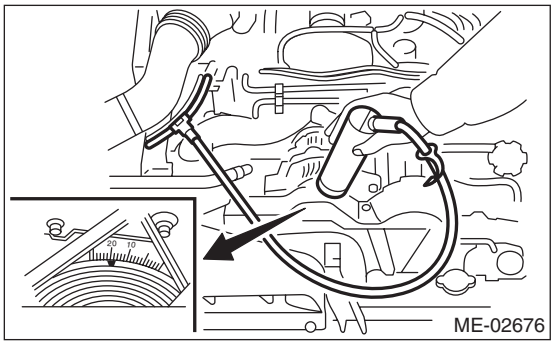
4. Ignition Timing

A: INSPECTION

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself at measurement.

1) Before checking the ignition timing, check the following item:
   (1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Stop the engine, and turn the ignition switch to OFF.
4) Connect the timing light to #1 cylinder spark plug cord, and then light the timing mark with the timing light.
5) Start the engine and check the ignition timing at idle speed as shown below.

Ignition timing [BTDC/rpm]:
15°±8°/700 (AT model)
10°±8°/650 (MT model)

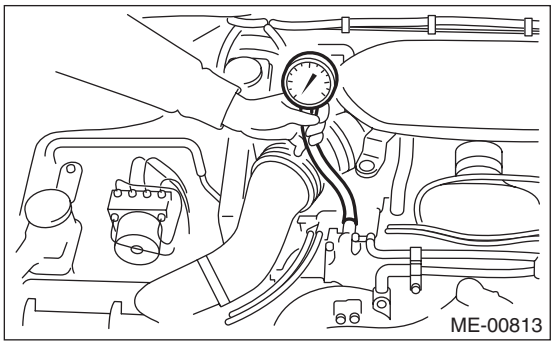


If the timing is not correct, check the ignition control system. <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>

5. Intake Manifold Vacuum

A: INSPECTION

1) Warm up the engine.
2) Disconnect the brake booster vacuum hose from the intake manifold, and install the vacuum gauge.
3) Keep the engine at idle speed and read the vacuum gauge indication.
By observing the vacuum gauge needle movement, the internal condition of the engine can be diagnosed as described below.



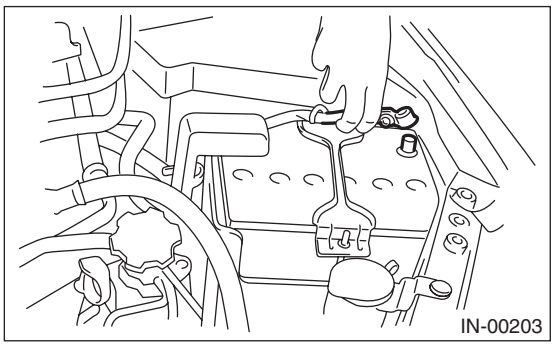
Intake manifold vacuum (at idling, A/C OFF):
–60.0 kPa (–450 mmHg, –17.72 inHg) or more

Diagnosis of engine condition by measurement of intake 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.	Air leakage around intake manifold gasket, disconnection or damage of vacuum hose
2. Needle intermittently drops to position lower than normal position.	Leakage around cylinder
3. Needle drops suddenly and intermittently from normal position.	Sticky valve
4. 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
5. Needle vibrates above and below normal position in narrow range.	Defective ignition system

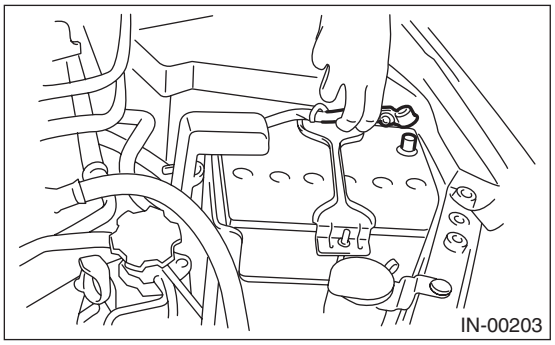
6. Engine Oil Pressure

A: INSPECTION

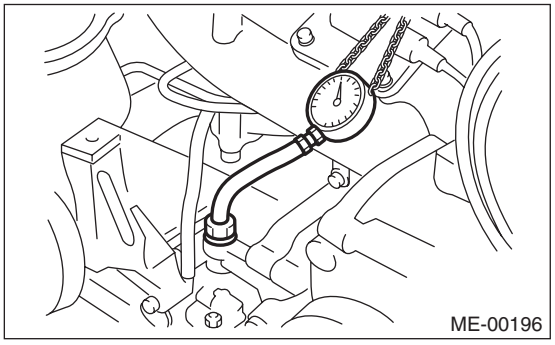
1) Disconnect the ground cable from battery.



2) Remove the oil pressure switch. <Ref. to LU(H4SO)-21, REMOVAL, Oil Pressure Switch.>
3) Install the oil pressure gauge to cylinder block.
4) Connect the ground cable to battery.



5) Start the engine, and measure the oil pressure.



Engine oil pressure:
Standard
98 kPa (1.0 kg/cm^2, 14 psi) or more at 600 rpm
294 kPa (3.0 kg/cm^2, 43 psi) or more at 5,000 rpm

- If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(H4SO)-30, INSPECTION, Engine Lubrication System Trouble in General.>
- If the oil pressure warning light is ON and oil pressure is within specification, check the oil pressure switch. <Ref. to LU(H4SO)-30, INSPECTION, Engine Lubrication System Trouble in General.>

NOTE:
Standard value is based on an engine oil temperature of 80°C (176°F).

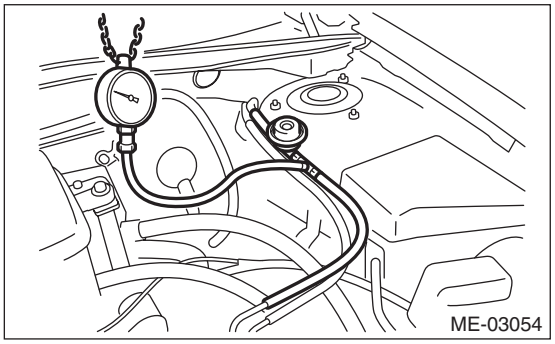
6) After measuring the oil pressure, install the oil pressure switch. <Ref. to LU(H4SO)-21, INSTALLATION, Oil Pressure Switch.>

7. Fuel Pressure

A: INSPECTION

CAUTION:
• Before removing the fuel pressure gauge, release the fuel pressure.
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

NOTE:
Check or replace the fuel pump and fuel delivery line if the fuel pressure is out of the standard.
1) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Disconnect the fuel delivery hose from the fuel damper, and connect the fuel pressure gauge.



4) Start the engine.
5) Measure the fuel pressure after warming up the engine.

NOTE:
The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kg/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.

Fuel pressure:
Standard
339.5 — 360.5 kPa (3.5 — 3.7 kg/cm^2, 49 — 52 psi)

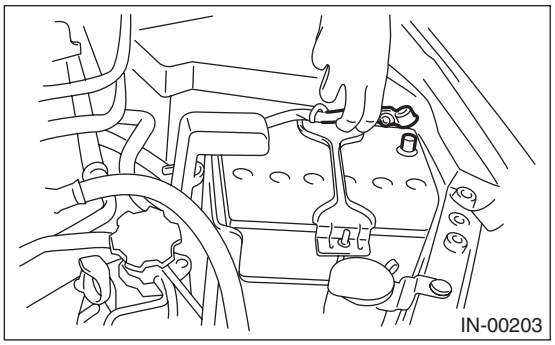
8. Valve Clearance

A: INSPECTION

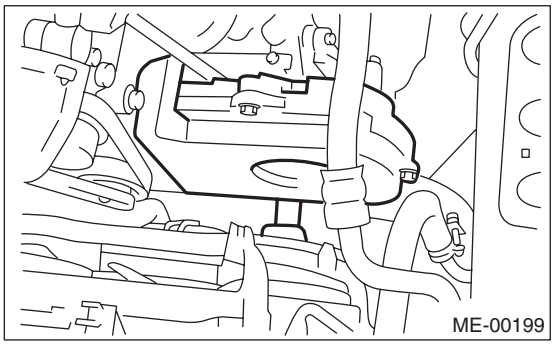
CAUTION:
If engine oil is spilt onto the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

NOTE:
Inspection and adjustment of valve clearance should be performed while engine is cold.

1) Set the vehicle on a lift.
2) Lift up the vehicle.
3) Remove the under cover.
4) Lower the vehicle.
5) Disconnect the ground cable from battery.

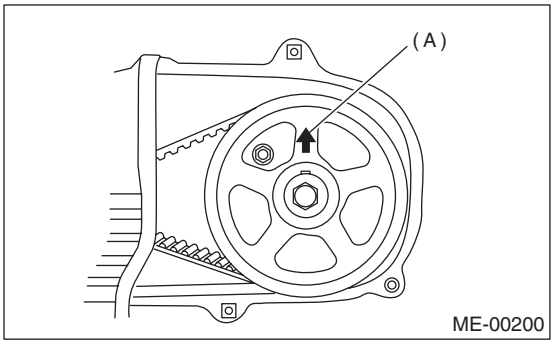


6) Remove the timing belt cover LH.



7) Remove the fuel injector. <Ref. to FU(H4SO)-36, REMOVAL, Fuel Injector.>
8) When inspecting #1 and #3 cylinders
   (1) Disconnect the spark plug cords from spark plugs on RH side. <Ref. to IG(H4SO)-4, RH SIDE, REMOVAL, Spark Plug.>
   (2) Place a suitable container under the vehicle.
   (3) Disconnect the PCV hose from the rocker cover RH.
   (4) Remove the bolts, then remove the rocker cover RH.
9) When inspecting #2 and #4 cylinders
   (1) Disconnect the spark plug cords from spark plugs on LH side. <Ref. to IG(H4SO)-4, LH SIDE, REMOVAL, Spark Plug.>
   (2) Place a suitable container under the vehicle.
   (3) Disconnect the PCV hose from the rocker cover LH.
   (4) Remove the bolts, then remove the rocker cover LH.
10) Set #1 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

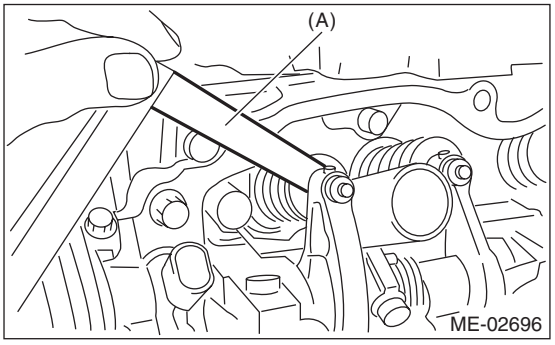
NOTE:
When the arrow mark (A) on cam sprocket LH is at the top position, the #1 cylinder piston is at top dead center of the compression stroke.



11) Measure #1 cylinder valve clearance by using thickness gauge (A).

NOTE:
• Insert the thickness gauge (A) in as horizontally as possible with respect to the valve stem end face.
• Lift up the vehicle, and then measure the exhaust valve clearances.

Valve clearance (inspection value):
Intake
0.20±0.04 mm (0.0079±0.0016 in)
Exhaust
0.25±0.04 mm (0.0098±0.0016 in)



12) Measure the valve clearance in #3, #2 and #4 cylinder in the same measurement procedure as #1 cylinder in this order.

NOTE:
• Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before measuring valve clearances.
• By rotating the crank pulley clockwise every 180° from the state that #1 cylinder piston is on the top dead center of compression stroke, #3, #2 and #4 cylinder pistons come to the top dead center of compression stroke in this order.

13) If necessary, adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
14) After inspection, install the related parts in the reverse order of removal.

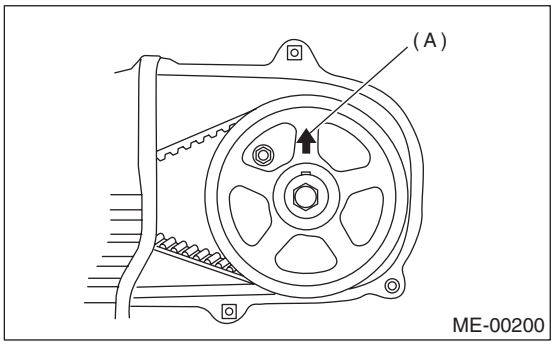
NOTE:
Use a new rocker cover gasket.

B: ADJUSTMENT

CAUTION:
If engine oil is spilt onto the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

NOTE:
Adjustment of valve clearance should be performed while engine is cold.
1) Set #1 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

NOTE:
When the arrow mark (A) on cam sprocket LH is at the top position, the #1 cylinder piston is at top dead center of the compression stroke.

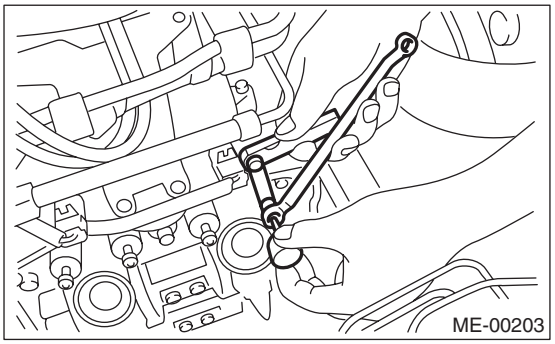


2) Adjust the #1 cylinder valve clearance.
(1) Loosen the valve rocker nut and screw.
(2) Set a suitable thickness gauge.
(3) While noting the valve clearance, tighten the valve rocker adjusting screw.
(4) When the specified valve clearance is obtained, tighten the valve rocker nut.

NOTE:
• Insert a thickness gauge in a direction as horizontal as possible with respect to the valve stem end face.
• Lift up the vehicle and adjust the exhaust valve clearances.

Valve clearance (adjustment value):
Intake
0.20±0.04 mm (0.0079±0.0016 in)
Exhaust
0.25±0.04 mm (0.0098±0.0016 in)

Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)



3) Adjust the valve clearance in #3, #2 and #4 cylinder in the same adjustment procedure as #1 cylinder in this order.

NOTE:
• Be sure to set the cylinder pistons to their respective top dead centers on compression stroke before adjusting valve clearances.
• By rotating the crank pulley clockwise every 180° from the state that #1 cylinder piston is on the top dead center of compression stroke, #3, #2 and #4 cylinder pistons come to the top dead center of compression stroke in this order.
4) Ensure the valve clearances of each cylinder are within specifications. If necessary, readjust the valve clearances.
5) After measuring, install the related parts in the reverse order of removal.

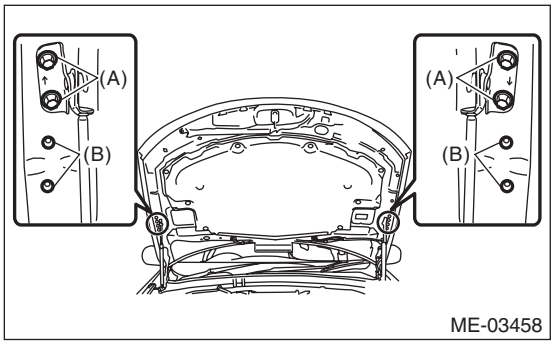
NOTE:
Use a new rocker cover gasket.

9. Engine Assembly

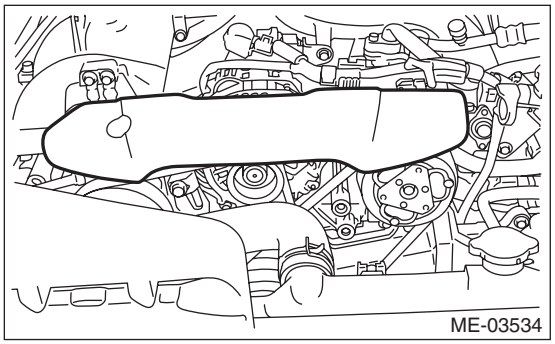
A: REMOVAL

1) Set the vehicle on a lift.
2) Change the bolt installation position from (A) to (B), then open the front hood completely.

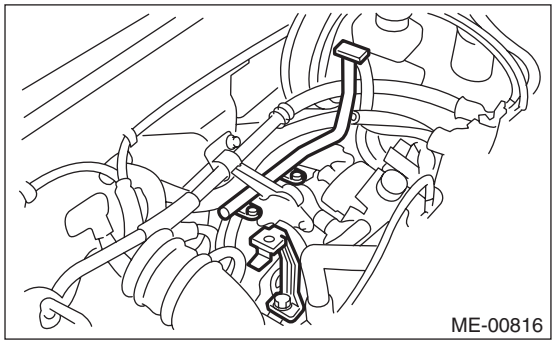
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



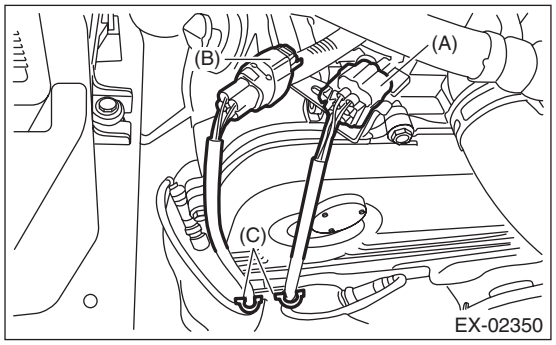
3) Remove the V-belt covers.



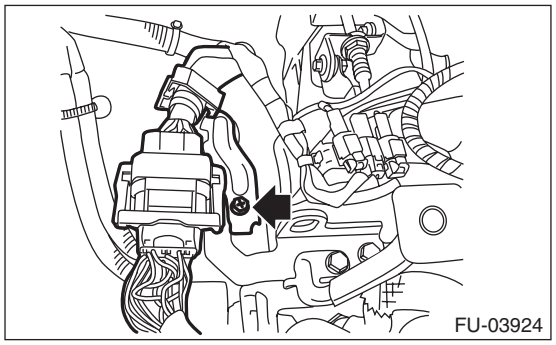
4) Collect the refrigerant from A/C system. <Ref. to AC-20, PROCEDURE, Refrigerant Recovery Procedure.>
5) Release the fuel pressure. <Ref. to FU(H4SO)-52, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
6) Remove the battery. <Ref. to SC(H4SO)-22, REMOVAL, Battery.>
7) Remove the air intake duct, air cleaner case and air intake chamber. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.> <Ref. to IN(H4SO)-5, REMOVAL, Air Cleaner Case.> <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
8) Remove the under cover.
9) Remove the radiator from vehicle. <Ref. to CO(H4SO)-19, REMOVAL, Radiator.>
10) Disconnect the A/C pressure hoses from A/C compressor. <Ref. to AC-38, REMOVAL, Hose and Pipe.>
11) Remove the air intake chamber stay.



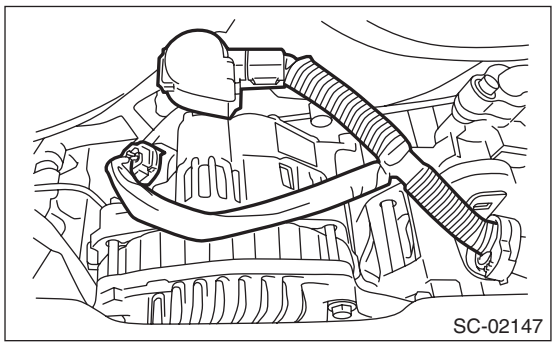
12) Disconnect the following connectors and cables.
(1) Disconnect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B) and remove the clip (C) fastening the harness.



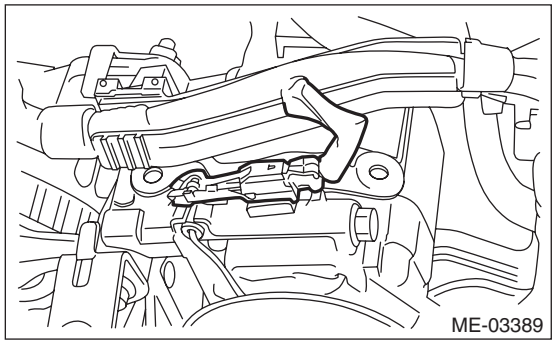
(2) Remove the bolt, and disconnect the engine harness connector from the bulkhead harness connector and rear engine hanger.



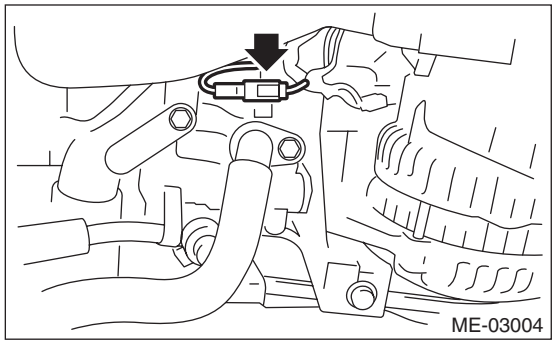
(3) Generator connector and terminal



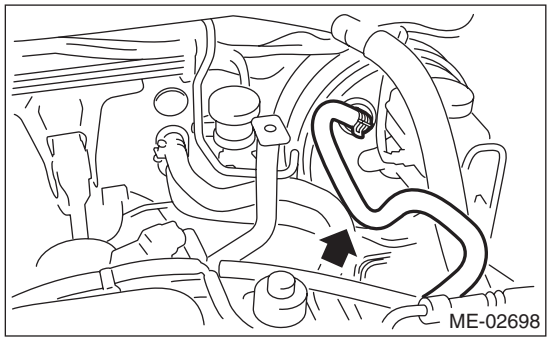
(4) A/C compressor connector



(5) Power steering pump switch connector

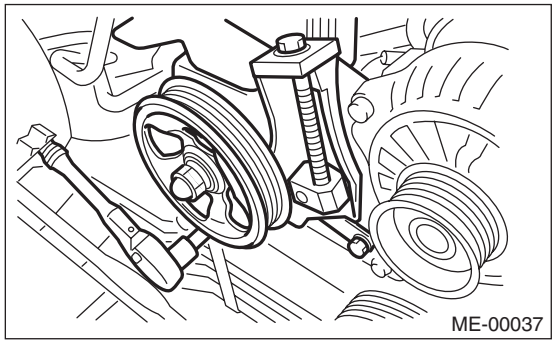


13) Disconnect the following hoses.
(1) Brake booster vacuum hose



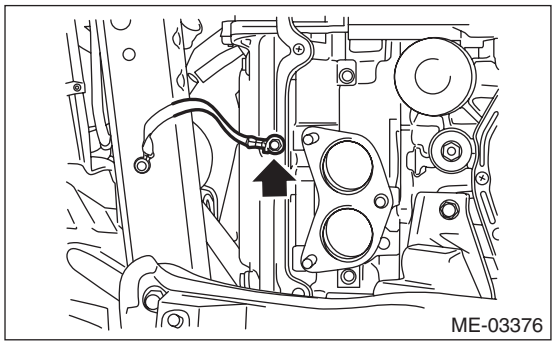
(2) Heater inlet and outlet hoses

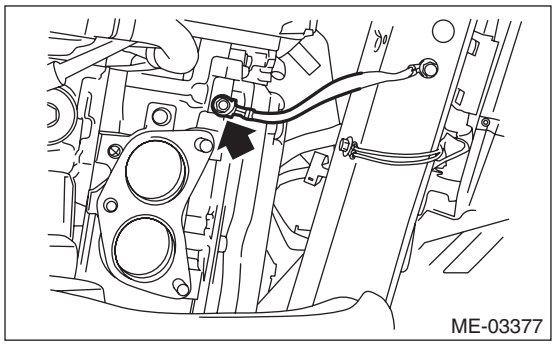
14) Remove the power steering pump.
(1) Remove the front side belts. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, REMOVAL, V-belt.>
(2) Remove the bolts which secure the power steering pump to the bracket.



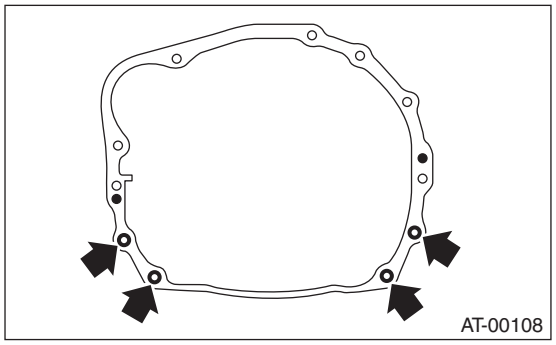
(3) Place the power steering pump on the right side wheel apron.

15) Lift up the vehicle.
16) Remove the front and center exhaust pipes. <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.>
17) Disconnect the ground cable on the engine side.

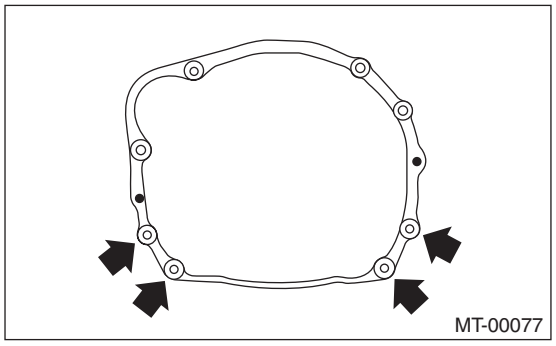




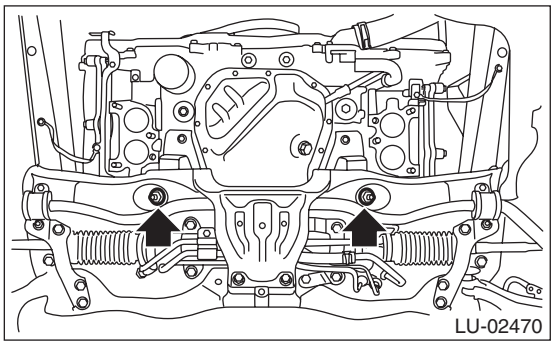
18) Remove the bolts and nuts which hold the lower side of transmission to the engine.
- AT model



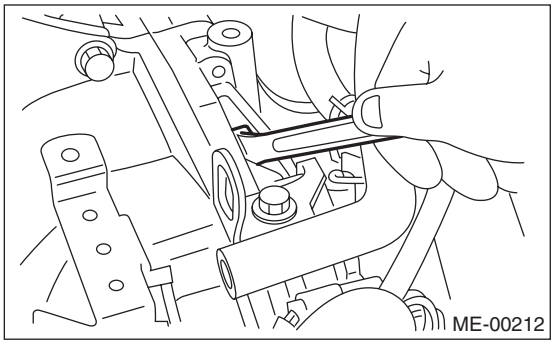
- MT model



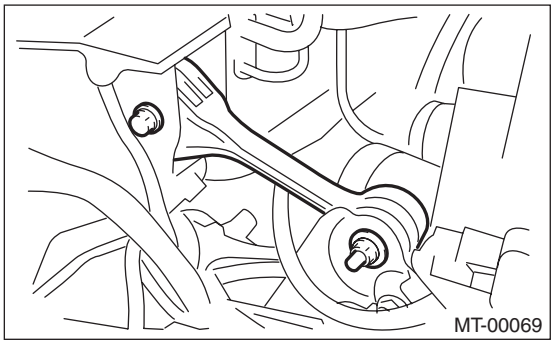
19) Remove the nuts which secure the engine mounting to the front crossmember.



20) Separate the torque converter clutch from the drive plate. (AT model)
(1) Lower the vehicle.
(2) Remove the service hole plug.
(3) Insert the wrench into the crank pulley bolt and rotate the crank pulley to remove the bolts which hold torque converter clutch to drive plate.



21) Remove the pitching stopper.

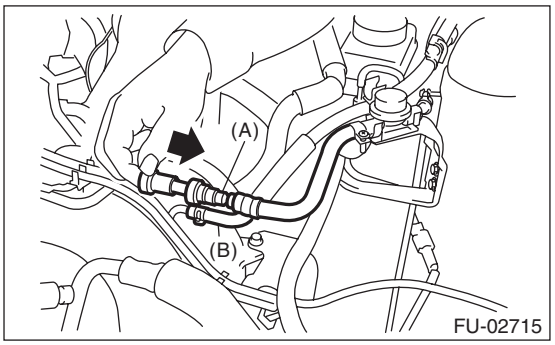


22) Disconnect the fuel delivery hose (A) and evaporation hose (B).
(1) Disconnect the quick connector of the fuel delivery hose by pushing the ST in the direction of the arrow.

ST 42099AE000 QUICK CONNECTOR RELEASE

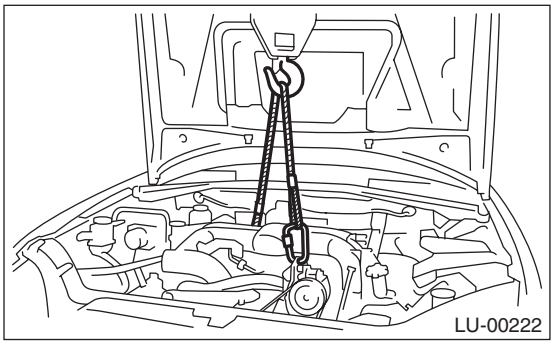
(2) Remove the clip and disconnect the evaporation hose from the pipe.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**



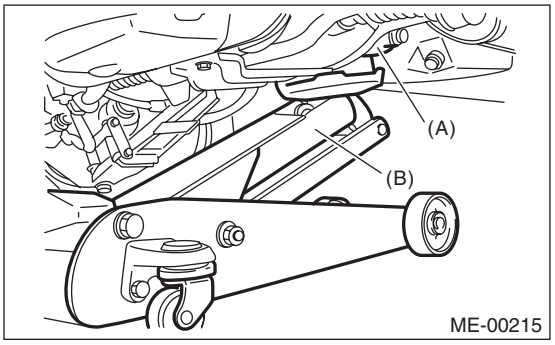
(A) Fuel delivery hose
(B) Evaporation hose

23) Support the engine with a lifting device and wire ropes.



24) Support the transmission with a garage jack.

CAUTION:
Be sure to always perform this work, in order to prevent the transmission from lowering for its own weight.



(A) Transmission
(B) Garage jack

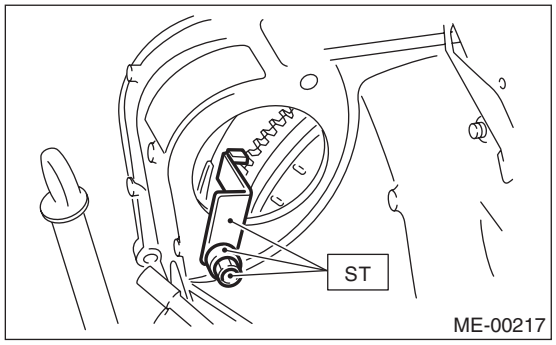
25) Separation of engine and transmission

CAUTION:
Before removing the engine away from transmission, check to be sure no work has been overlooked.

(1) Remove the starter. <Ref. to SC(H4SO)-7, REMOVAL, Starter.>

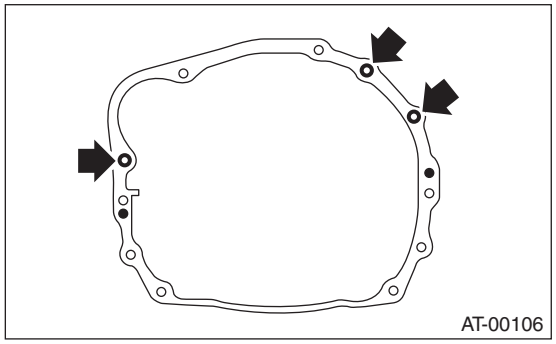
(2) Attach the ST to the torque converter clutch case. (AT model)

ST 498277200 STOPPER SET

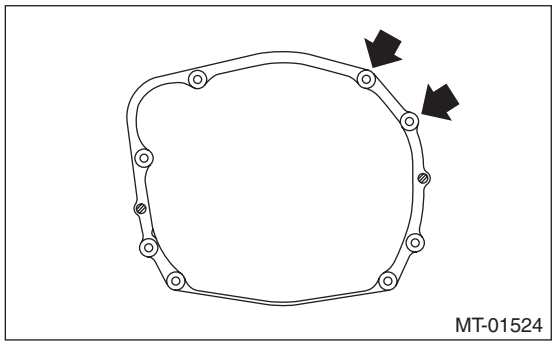


(3) Remove the bolts which hold upper side of transmission to engine.

- AT model



- MT model



26) Remove the engine from vehicle.
(1) Slightly raise the engine.
(2) Raise the transmission with garage jack.
(3) Move the engine horizontally until main shaft is withdrawn from clutch cover. (MT model)
(4) Slowly move the engine away from engine compartment.

NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

27) Remove the engine mounting from the engine.

B: INSTALLATION

1) Install the engine mounting onto the engine.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

2) Apply a small amount of grease to splines of main shaft. (MT model)

Grease:
NICHIMOLY N-130 or equivalent

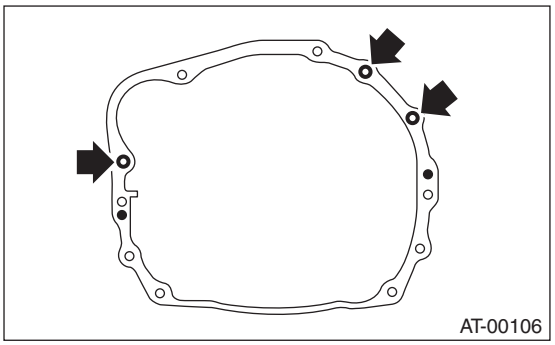
3) Position the engine in engine compartment and align it with transmission.

NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

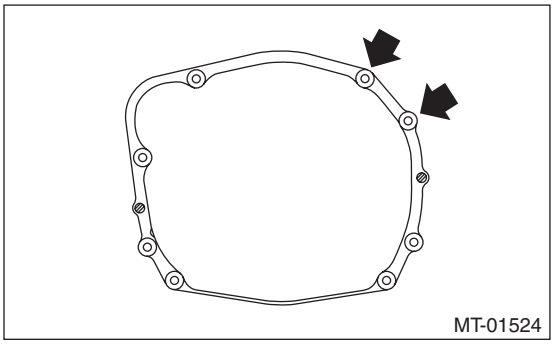
4) Tighten the bolts which hold upper side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)

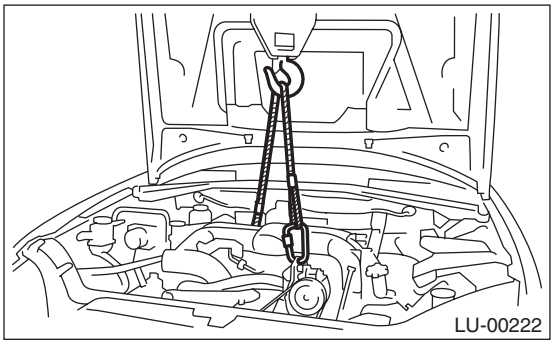
- AT model



- MT model



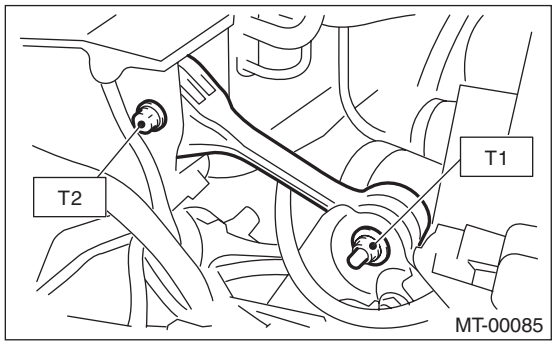
5) Remove the lifting device and wire ropes.



6) Remove the garage jack.

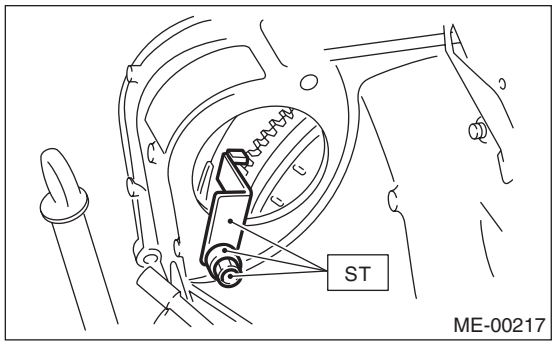
7) Install the pitching stopper.

Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



8) Remove the ST from torque converter clutch case. (AT model)

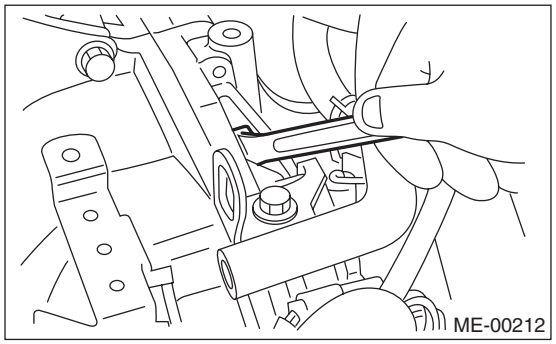
NOTE:
Be careful not to drop the ST into the torque converter clutch case when removing the ST.
ST 498277200 STOPPER SET



9) Install the starter. <Ref. to SC(H4SO)-7, INSTALLATION, Starter.>
10) Install the torque converter clutch to drive plate. (AT model)
(1) Insert the wrench into the crank pulley bolt and rotate the crank pulley to install the bolts which hold torque converter clutch to drive plate.

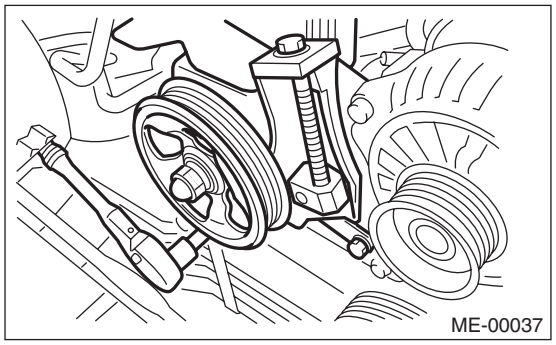
NOTE:
Be careful not to drop bolts into the torque converter clutch case.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

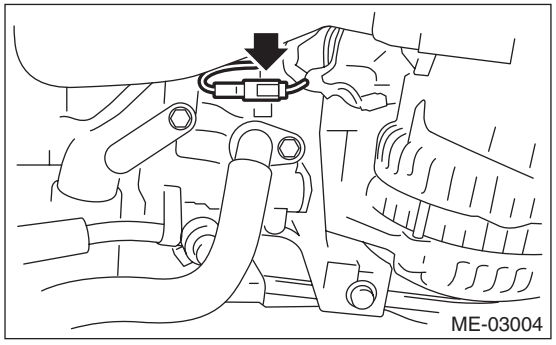


(2) Install the service hole plug.
11) Install the power steering pump.
(1) Install the power steering pump.

Tightening torque:
Refer to "COMPONENT" of "Power Steering" for the tightening torque. <Ref. to PS-3, COMPONENT, General Description.>



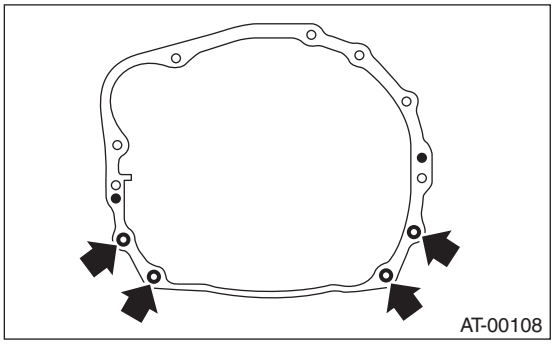
(2) Connect the power steering pump switch connector.



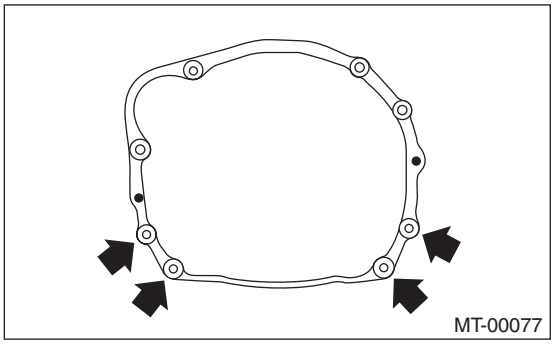
(3) Install and adjust the front side belt. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, INSTALLATION, V-belt.>
12) Lift up the vehicle.
13) Install the bolts and nuts which hold lower side of the transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)

- AT model

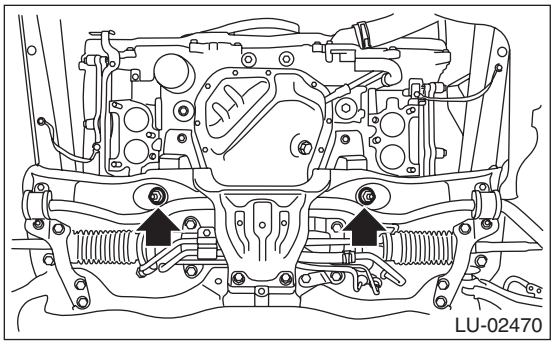


- MT model



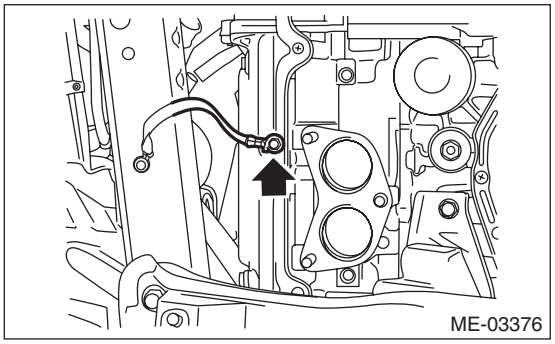
14) Install the nuts which hold the engine mounting to the crossmember.

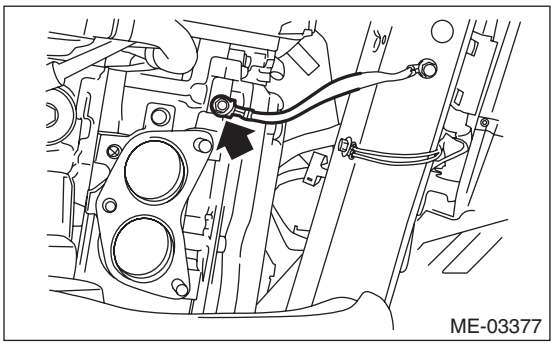
Tightening torque:
85 N·m (8.7 kgf-m, 62.7 ft-lb)



15) Connect the ground cable.

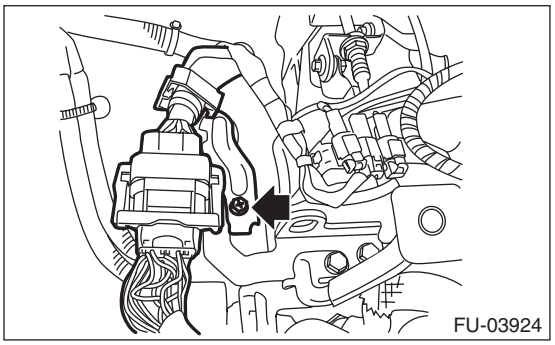
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)





16) Install the front and center exhaust pipe. <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>
17) Lower the vehicle.
18) Connect the following hoses.
(1) Fuel delivery hose and evaporation hose
(2) Heater inlet and outlet hoses
(3) Brake booster vacuum hose
19) Connect the following connectors and terminals.
(1) Front oxygen (A/F) sensor connector
(2) Rear oxygen sensor connector
(3) Engine harness connectors

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



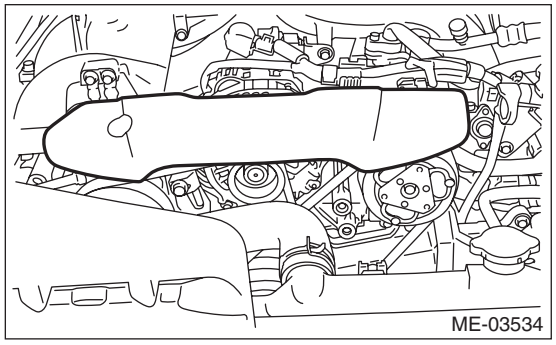
(4) Generator connector and terminal

Tightening torque:
15 N·m (1.5 kgf-m, 11.1 ft-lb)
(5) A/C compressor connector
20) Install the air intake chamber stay.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)
21) Install the A/C pressure hoses. <Ref. to AC-38, INSTALLATION, Hose and Pipe.>
22) Install the radiator to vehicle. <Ref. to CO(H4SO)-20, INSTALLATION, Radiator.>
23) Install the air intake duct, air cleaner case and air intake chamber. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.> <Ref. to IN(H4SO)-5, INSTALLATION, Air Cleaner Case.> <Ref. to IN(H4SO)-7, INSTALLATION, Air Intake Chamber.>
24) Install the under cover.

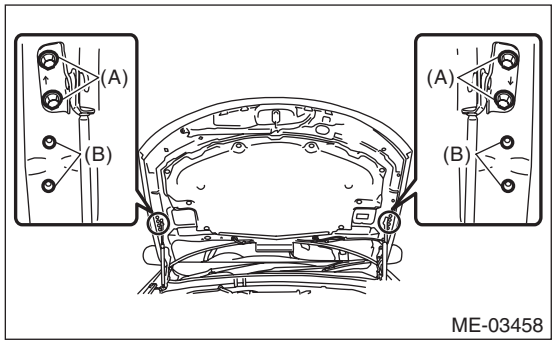
25) Install the battery. <Ref. to SC(H4SO)-22, INSTALLATION, Battery.>
26) Fill engine coolant. <Ref. to CO(H4SO)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
27) Check the ATF level and replenish it if necessary. (AT model) <Ref. to 4AT-26, INSPECTION, Automatic Transmission Fluid.>
28) Charge the A/C system with refrigerant. <Ref. to AC-21, PROCEDURE, Refrigerant Charging Procedure.>
29) Install the V-belt cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



30) Change the bolt installation position from (B) to (A), then close the front hood.

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



C: INSPECTION

1) Check that pipes, hoses, connectors and clamps are installed firmly.
2) Check the engine coolant is at specified level.
3) Check that the ATF is at specified level. (AT model)
4) Start the engine and check for exhaust gas, engine coolant, leaks of fuel, etc. Also check for noise and vibrations.

10.Engine Mounting

A: REMOVAL

1) Remove the engine assembly. <Ref. to ME(H4SO)-30, REMOVAL, Engine Assembly.>
2) Remove the engine mounting from the 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

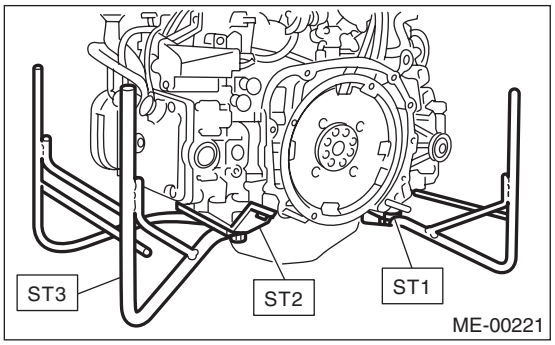
Make sure that there are no cracks or other damages.

11.Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from body, secure it to ST in the following procedure.

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	499817100	ENGINE STAND



2) In this section the procedures described under each index are all connected and stated in order. The procedure for overhauling of the engine will be completed 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.

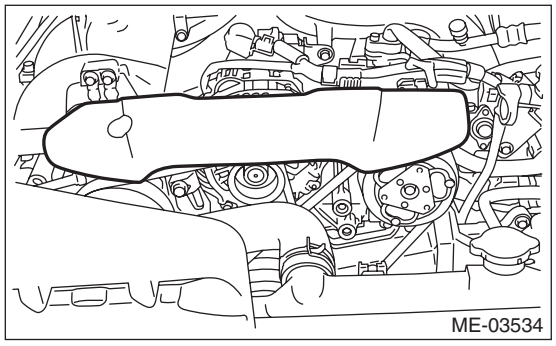
12.V-belt

A: REMOVAL

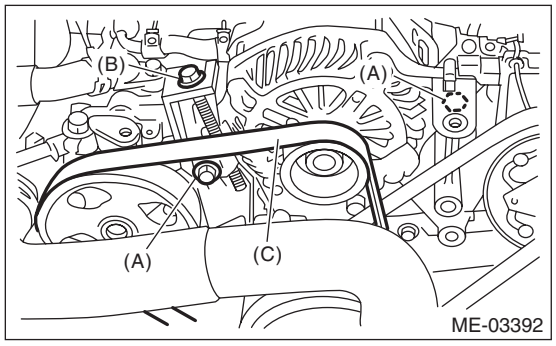
NOTE:
When replacing the single part, perform the work with the engine installed to body.

1. FRONT SIDE BELT

1) Remove the V-belt covers.

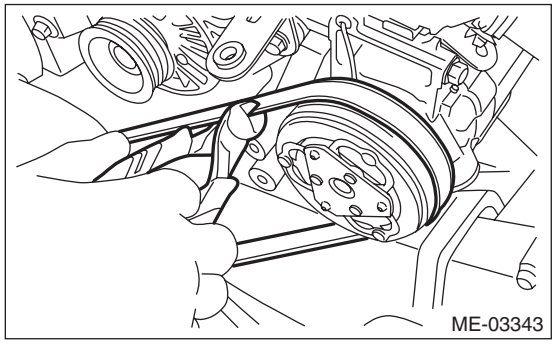


2) Remove the air intake duct. <Ref. to IN(H4SO)-8, REMOVAL, Air Intake Duct.>
3) Loosen the bolt (A).
4) Loosen the slider bolt (B).
5) Remove the front side belt (C).



2. REAR SIDE BELT

1) Remove the front side belts. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, REMOVAL, V-belt.>
2) Cut the rear side belt with a wire cutter, etc., and discard.



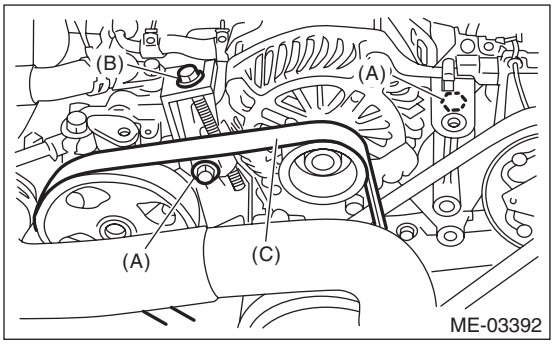
B: INSTALLATION

1. FRONT SIDE BELT

CAUTION:
• When reusing the front side belt, wipe off dust and water with cloth.
• Do not use the front side belt if there is any oil, grease or coolant on the belt.
• Be careful not to rub the belt end surface with bare hands; exposed core may cause injury.

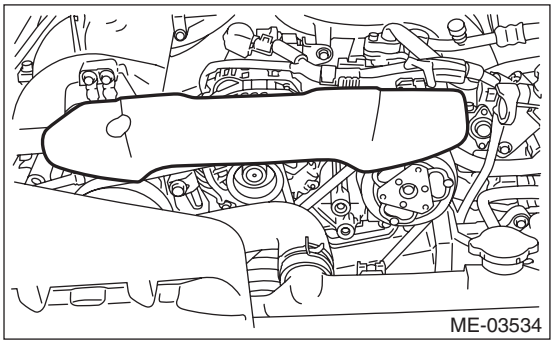
1) Wipe off any dust, oil and water on the groove of each pulley with cloth.
2) Install the front side belt (C), and adjust the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4SO)-44, INSPECTION, V-belt.>
3) Tighten the bolt (A).
4) Tighten the slider bolt (B).

Tightening torque:
Bolt (A)
25 N·m (2.5 kgf-m, 18.4 ft-lb)
Slider bolt (B)
8 N·m (0.8 kgf-m, 5.9 ft-lb)



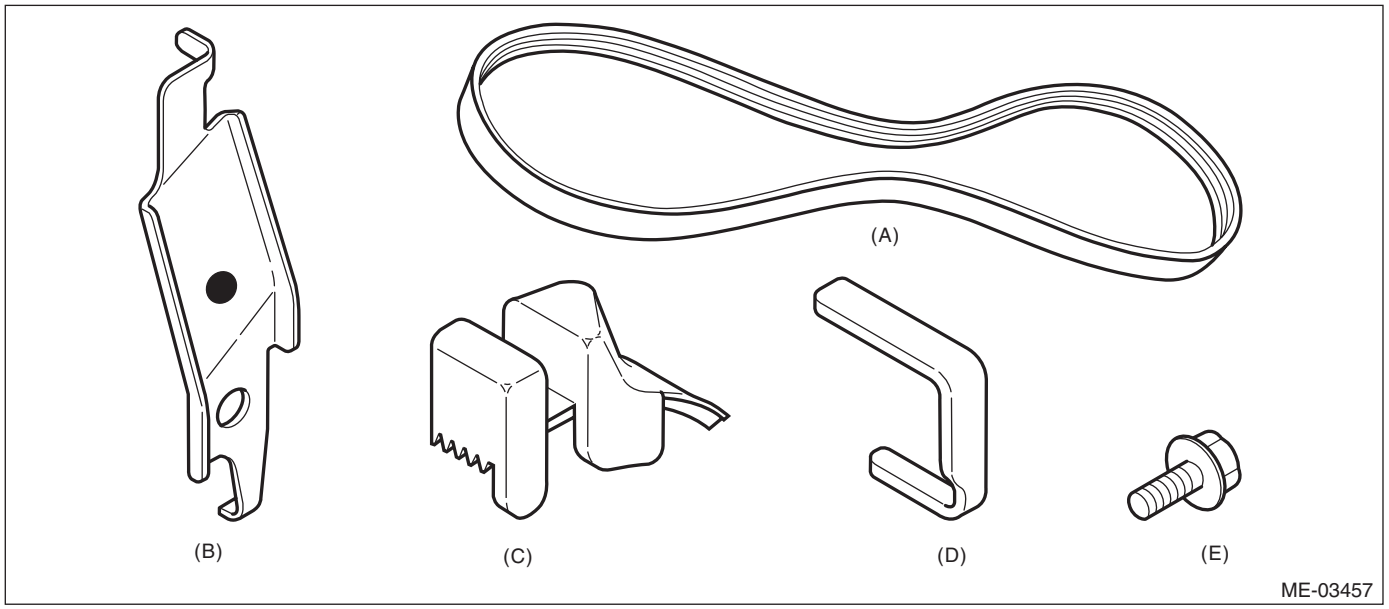
5) Install the air intake duct. <Ref. to IN(H4SO)-8, INSTALLATION, Air Intake Duct.>
6) Install the V-belt cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



2. REAR SIDE BELT

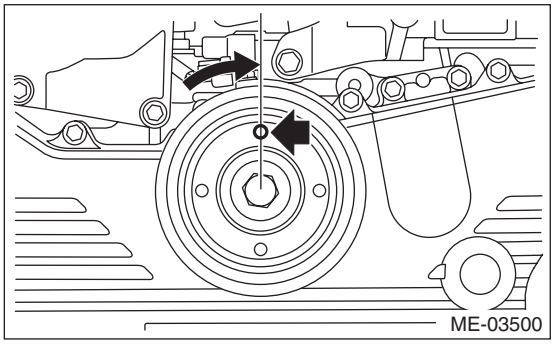
CAUTION:
- **Do not re-use the rear side belt.**
- **Be careful not to let oil, grease or coolant contact a new rear side belt.**
- **Be careful not to rub the belt end surface with bare hands; exposed core may cause injury.**
- **To install the rear side belt, always use the provided tools (belt stopper, belt guide, belt guide holder, and bolt).**



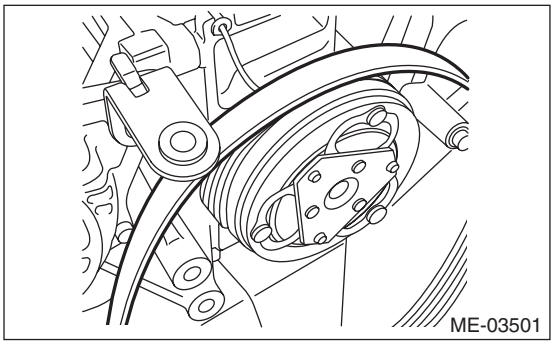
(A) Rear side belt
(B) Belt stopper
(C) Belt guide
(D) Belt guide holder
(E) Bolt

1) Wipe off any dust, oil and water on the groove of each pulley with cloth.
2) Wipe off any oil, water, dirt, and rust on the front of the crank pulley with cloth.
3) Slowly turn the crank pulley clockwise so that the service hole of the crank pulley comes around the top.

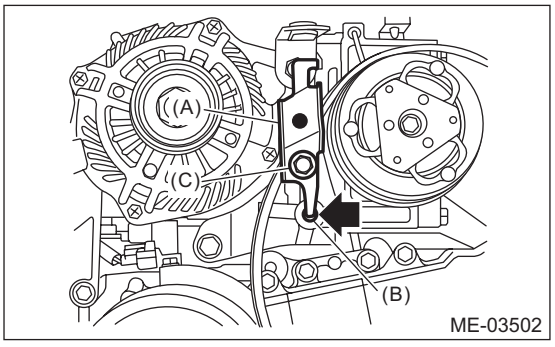
CAUTION:
Do not turn the crank pulley counterclockwise.



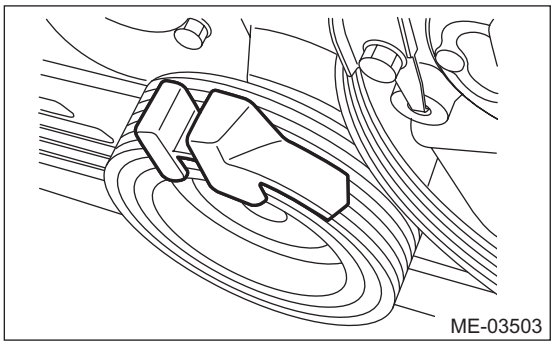
4) Hook a new rear side belt on the A/C compressor pulley.



5) As shown in the figure, insert the claw of the belt stopper (A) to the lower hole (B) of the compressor bracket, then attach with bolt (C).

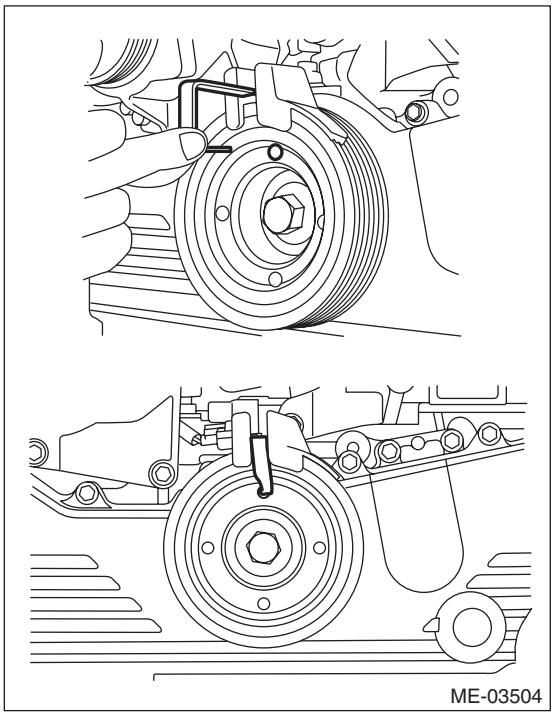


6) Place the belt guide while aligning it with the belt line of the crank pulley on the front side belt side.

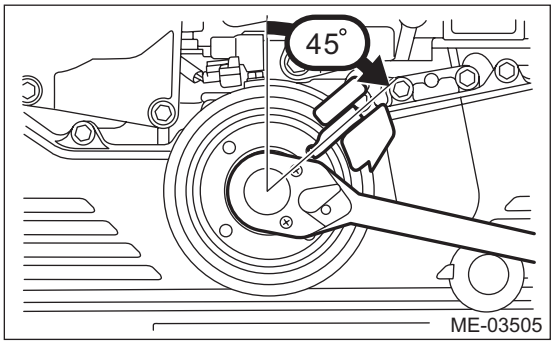


7) Insert the belt guide holder into the service hole of the crank pulley so that the belt guide comes in between.

NOTE:
Place the belt guide holder with the longer side up.

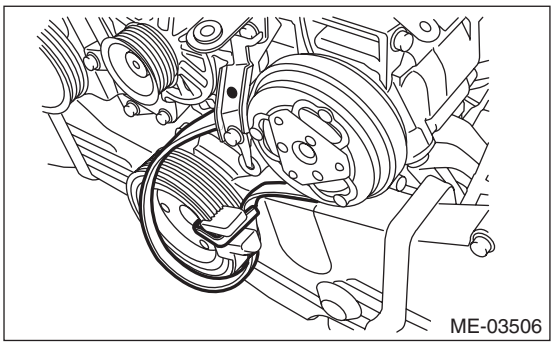


8) Slowly turn the crank pulley clockwise until the belt guide comes to approximately 45°.

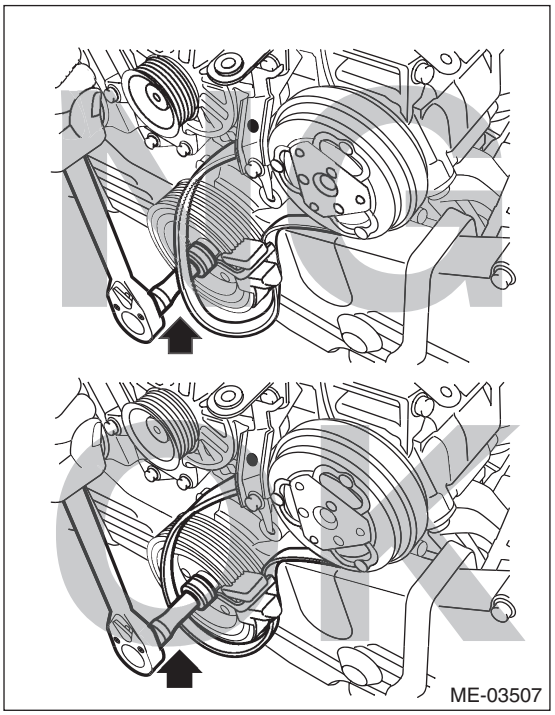


9) Place the rib surface of the rear side belt into the crank pulley groove, so that the rear side belt comes in between the belt guide holder.

CAUTION:
When it is difficult to place the rear side belt to the crank pulley groove, pull out the belt guide holder half way, then place the rear side belt into the groove so that it comes in between the belt guide holder.

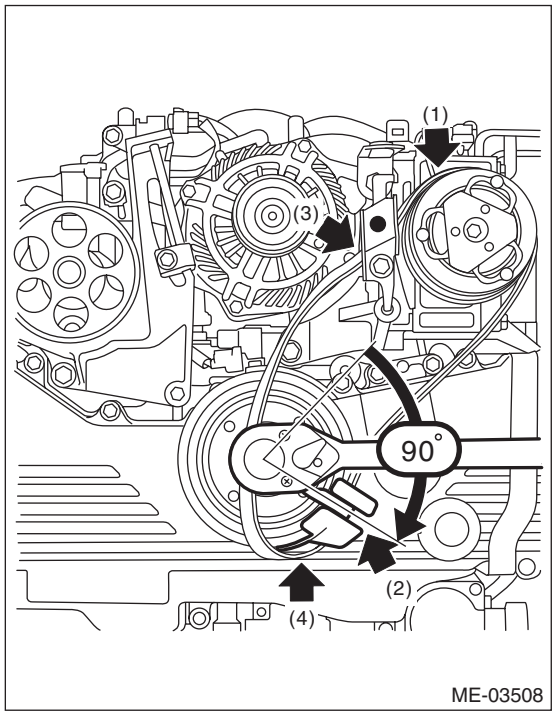


10) Place the tool through the loop of the rear side belt, and set on the crank pulley bolt.



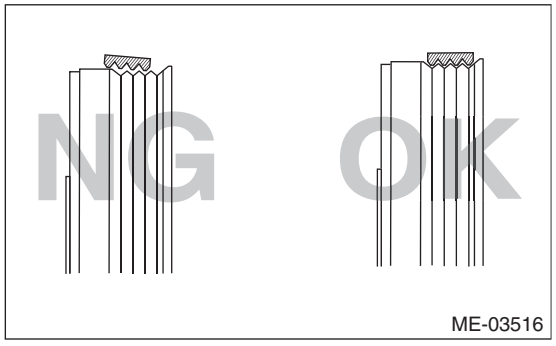
11) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.

CAUTION:
When turning the crank pulley, always make sure that the belt guide is not off from the crank pulley groove.



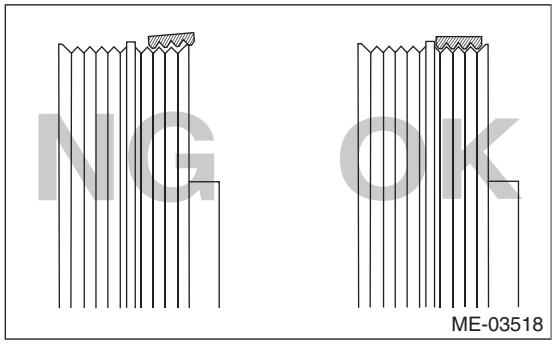
ME-03508

(1) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



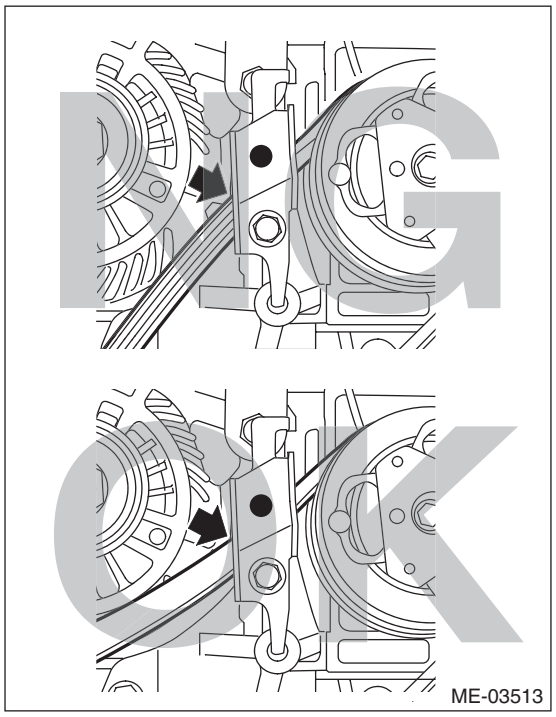
ME-03516

(2) The rib of the rear side belt is securely placed on the groove of the crank pulley.



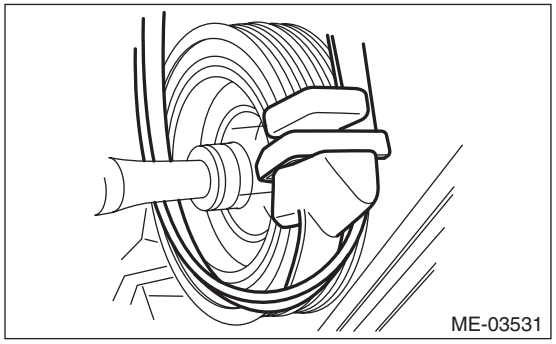
ME-03518

(3) The surface of the rear side belt is held by the belt stopper.

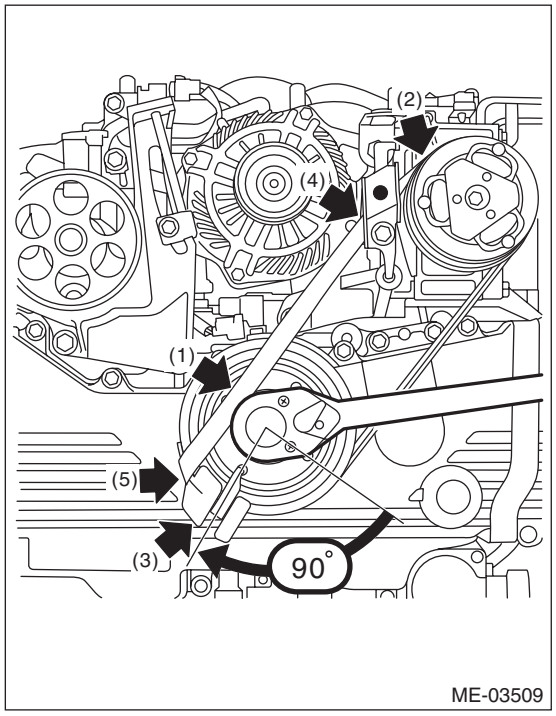


ME-03513

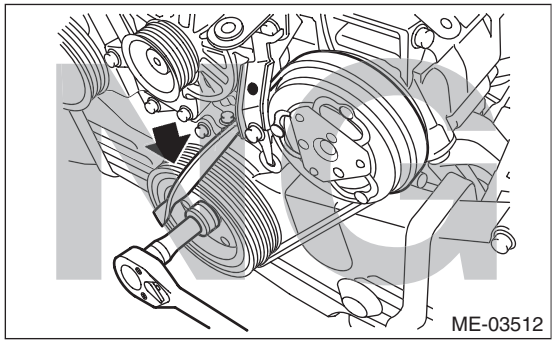
(4) The rear side belt is securely placed on the belt guide.


ME-03531

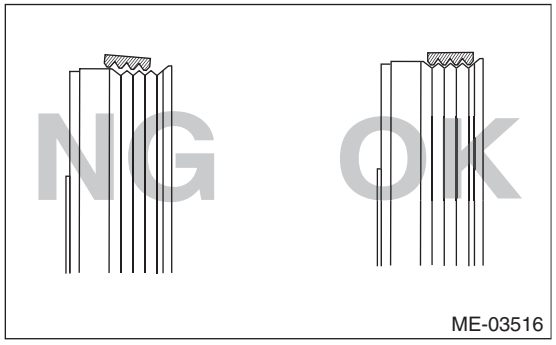
12) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.



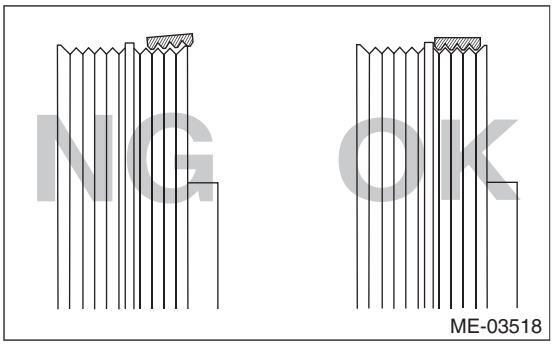
(1) The rear side belt is not twisted.



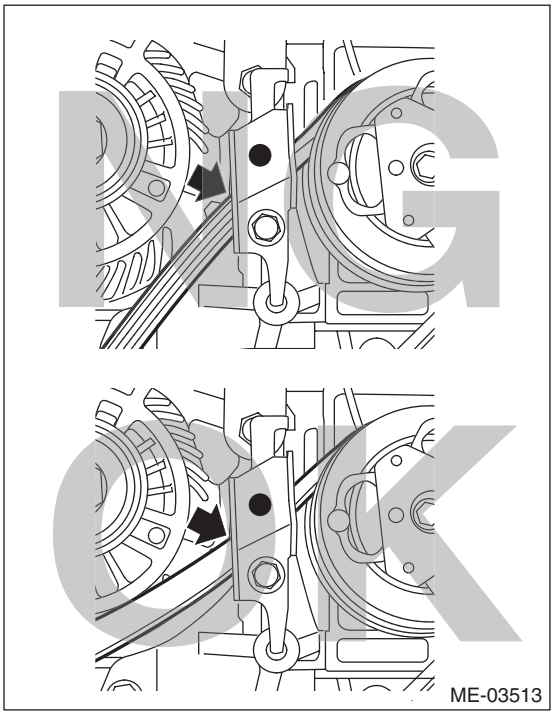
(2) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



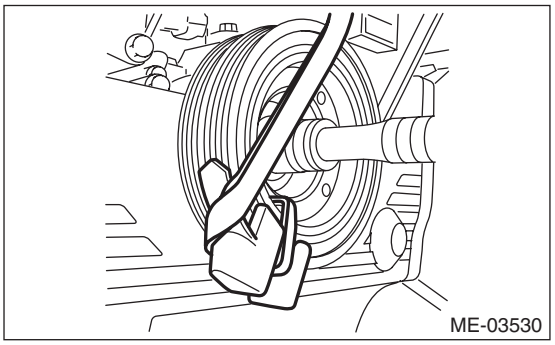
(3) The rib of the rear side belt is securely placed on the groove of the crank pulley.



(4) The surface of the rear side belt is held by the belt stopper.

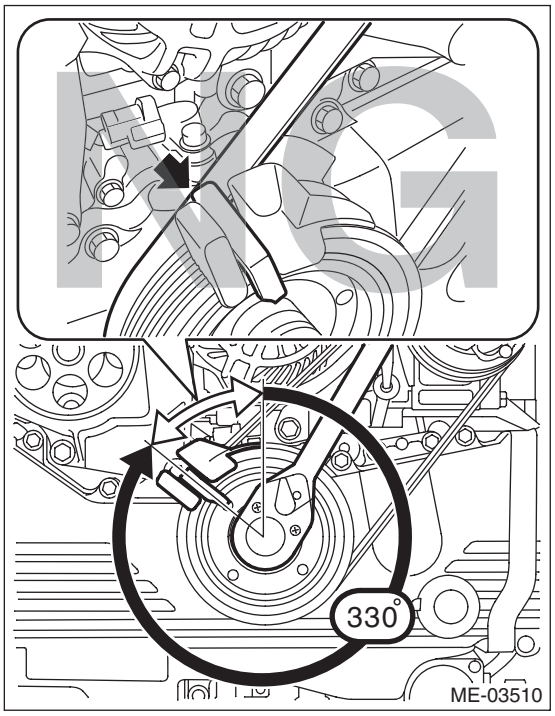


(5) The rear side belt is securely placed on the belt guide.

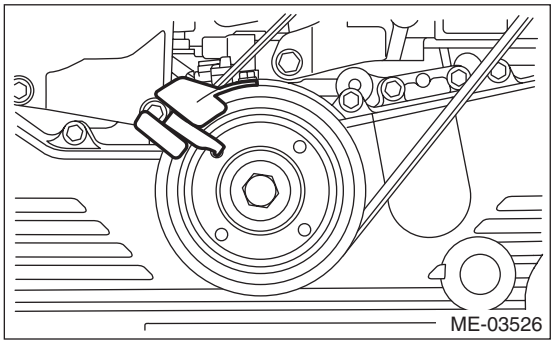


13) Slowly turn the crank pulley clockwise, and install the rear side belt.

CAUTION:
Be careful that the total of procedures 8), 11), 12) and 13) does not exceed 330°; failure to do so may cause damage to the rear side belt and fall of the belt guide holder.

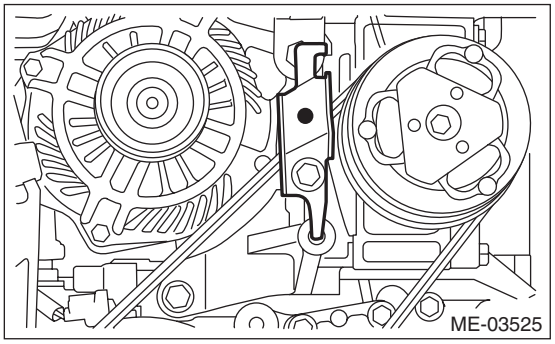


14) Remove the belt guide and belt guide holder from the crank pulley.

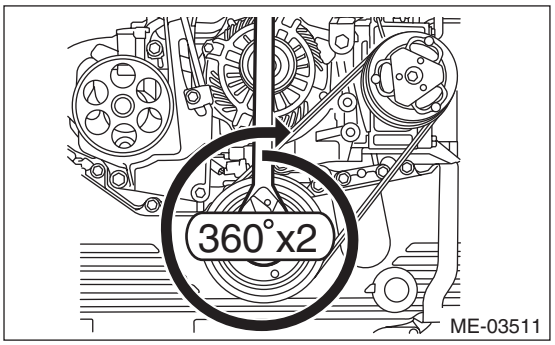


15) Remove the belt stopper from the compressor bracket.

CAUTION:
Always remove the belt stopper; failure to do so may cause smoke, fire, or belt cutting.



16) Make sure that the belt rib is securely installed on the groove of each pulley, then turn the crank pulley slowly, twice in the clockwise direction, to seat the rear side belt properly.



17) Discard the provided tools (belt stopper, belt guide, belt guide holder, and bolt) that are used.
18) Install the front side belt. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, INSTALLATION, V-belt.>

C: INSPECTION

1. FRONT SIDE BELT

CAUTION:
Check and adjust the front side belt tension so that it is within the specified range. Using the belt with a tension out of the specified range may result in a fault such as the following:
• If the front side belt tension is higher, unexpected force is generated at the power steering oil pump, generator and crankshaft bearing, causing abnormal noise due to abnormal wear of the bearing.
• If the front side belt tension is lower, the front side belt and crank pulley slip, causing abnormally high temperature on the crank pulley due to frictional heat. If this condition repeatedly occurs, the front side belt may abnormally wear, causing abnormal noise, front side belt damage or crank pulley damage.
1) Replace the front side belt, if crack, fraying or wear is found.
2) Check the front side belt tension and adjust it if necessary by changing the generator installing position.

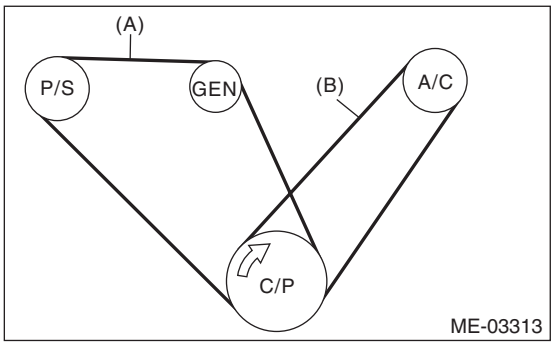
Front side belt tension (with belt tension gauge):

When installing new parts

640 — 780 N (65 — 80 kgf, 144 — 175 lbf)

At inspection

490 — 640 N (50 — 65 kgf, 110 — 144 lbf)



(A) Front side belt
(B) Rear side belt
C/P Crank pulley
GEN Generator pulley
P/S Power steering oil pump pulley
A/C A/C compressor pulley

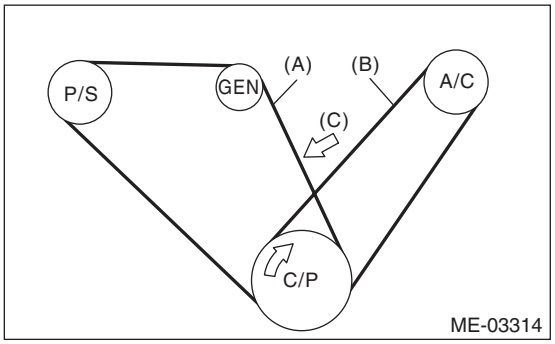
Front side belt tension (without belt tension gauge):

When installing new parts

7 — 9 mm (0.276 — 0.354 in)

At inspection

9 — 11 mm (0.354 — 0.433 in)



(A) Front side belt
(B) Rear side belt
(C) 98 N (10 kgf, 22 lbf)
C/P Crank pulley
GEN Generator pulley
P/S Power steering oil pump pulley
A/C A/C compressor pulley

2. REAR SIDE BELT

Replace the rear side belt, if crack, fraying or wear is found, or noise is emitted.

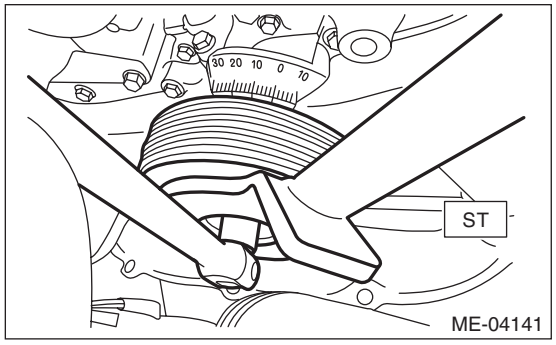
NOTE:
For the rear side belt, a stretch type belt is used, and therefore, it is not necessary to check deflection nor tension.

13.Crank Pulley

A: REMOVAL

NOTE:
Perform the work with the engine installed to body when replacing a single part.
1) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
2) Use the ST to lock the crank pulley, and remove the crank pulley bolt.

ST 499977400 CRAPNK PULLEY WRENCH (AT MODEL)
ST 499977100 CRAPNK PULLEY WRENCH (MT MODEL)



3) Remove the crank pulley.

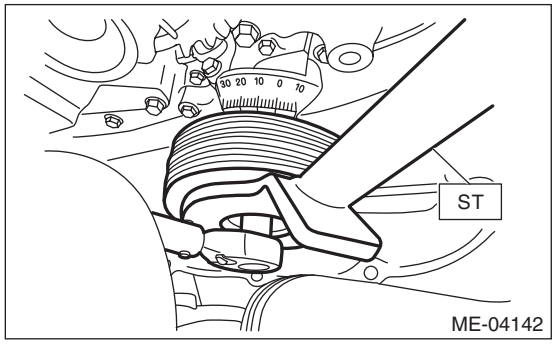
B: INSTALLATION

1. METHOD WITHOUT ANGLE GAUGE

1) Clean the crankshaft thread using compressed air.
2) Install the crank pulley.
3) Apply engine oil to the crank pulley bolt seat and thread.
4) Tighten the crank pulley bolts.
(1) Use the ST to lock the crank pulley, and temporarily tighten the crank pulley bolt.

ST 499977400 CRAPNK PULLEY WRENCH (AT MODEL)
ST 499977100 CRAPNK PULLEY WRENCH (MT MODEL)

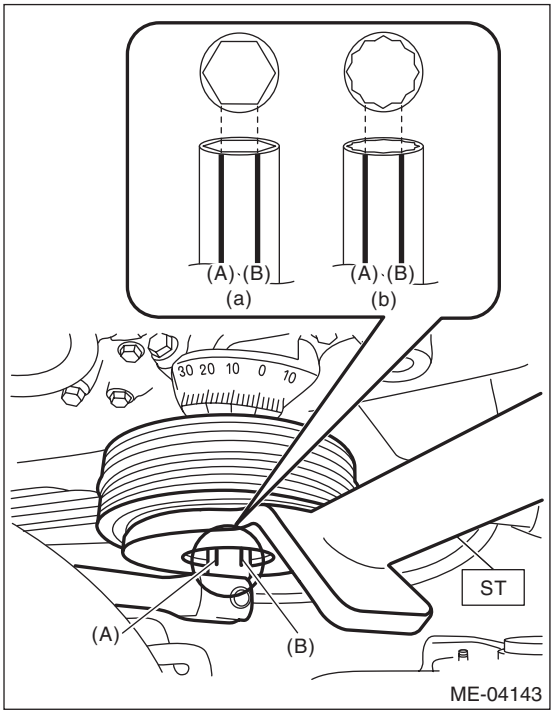
Tightening torque:
47 N·m (4.8 kgf-m, 34.7 ft-lb)



(2) Draw reference lines (A) and (B) using a marker to set the socket to the crank pulley bolt as shown in the figure.

ST 499977400 CRAPNK PULLEY WRENCH (AT MODEL)
ST 499977100 CRAPNK PULLEY WRENCH (MT MODEL)

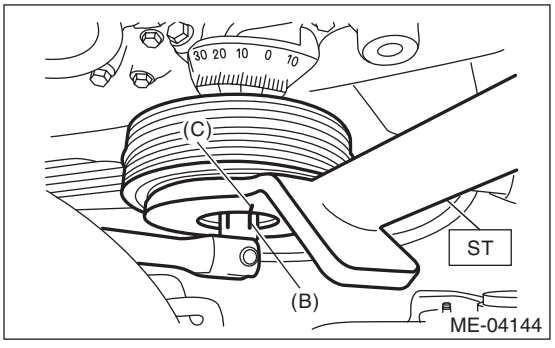
NOTE:
Set the socket onto the crank pulley bolt so that reference lines (A) and (B) is visible.



(a) When using 6-point socket
(b) When using 12-point socket

(3) Draw end line (C) on ST using a marker at the same position as reference line (B) was drawn on the socket in step (2).

ST 499977400 CRAPNK PULLEY WRENCH (AT MODEL)
ST 499977100 CRAPNK PULLEY WRENCH (MT MODEL)

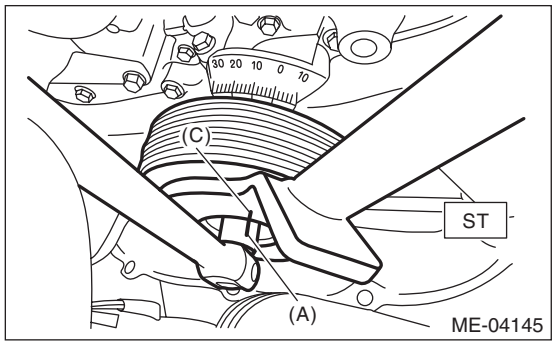


(4) Use the ST to lock the crank pulley, and tighten the crank pulley bolt to the angle where reference line (A) and end line (C) are aligned.

ST	499977400	CRAPNK PULLEY WRENCH (AT MODEL)
ST	499977100	CRAPNK PULLEY WRENCH (MT MODEL)

NOTE:
It should be approx. 60° when reference line (A) and end line (C) are aligned.

Tightening angle:
60°±5°



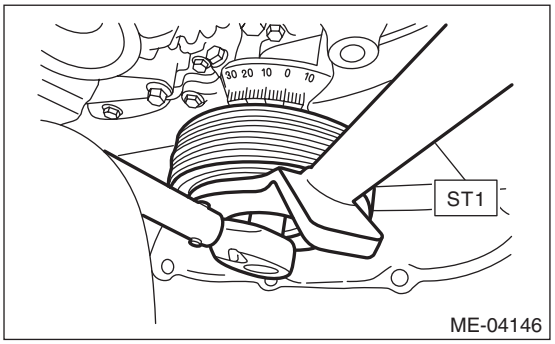
5) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

2. METHOD WITH ANGLE GAUGE

1) Clean the crankshaft thread using compressed air.
2) Install the crank pulley.
3) Apply engine oil to the crank pulley bolt seat and thread.
4) Tighten the crank pulley bolts.
(1) Remove the radiator main fan motor assembly and radiator sub motor assembly. <Ref. to CO(H4SO)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4SO)-25, REMOVAL, Radiator Sub Fan and Fan Motor.>
(2) Use the ST1 to lock the crank pulley, and temporarily tighten the crank pulley bolt.

ST	499977400	CRAPNK PULLEY WRENCH (AT MODEL)
ST	499977100	CRAPNK PULLEY WRENCH (MT MODEL)

Tightening torque:
47 N·m (4.8 kgf-m, 34.7 ft-lb)

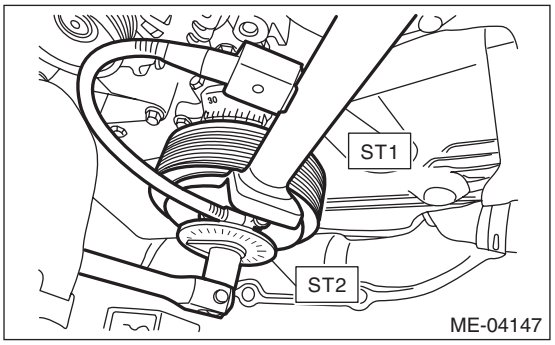


(3) Set the ST2, use the ST1 to lock the crank pulley, and tighten the crank pulley bolt to the specified angle.

ST1	499977400	CRAPNK PULLEY WRENCH (AT MODEL)
ST1	499977100	CRAPNK PULLEY WRENCH (MT MODEL)
ST2	18854AA000	ANGLE GAUGE

NOTE:
Attach the magnet used for securing the ST2 (ANGLE GAUGE) to ST1.

Tightening angle:
60°±5°



(4) Install the radiator main fan motor assembly and radiator sub motor assembly. <Ref. to CO(H4SO)-23, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(H4SO)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>

5) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

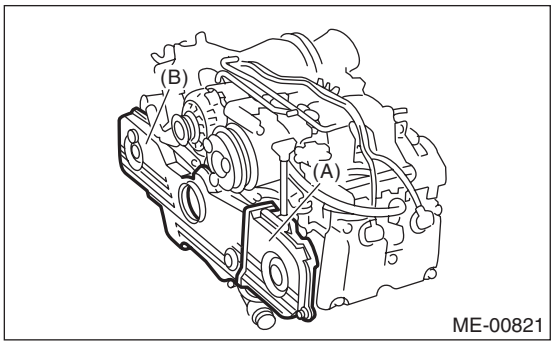
C: INSPECTION

1) Make sure the V-belt is not worn or otherwise damaged.
2) Check the tension of the front side belt. <Ref. to ME(H4SO)-44, INSPECTION, V-belt.>

14.Timing Belt Cover

A: REMOVAL

NOTE:
Perform the work with the engine installed to body when replacing a single part.
1) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
2) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover LH.
4) Remove the front timing belt cover.



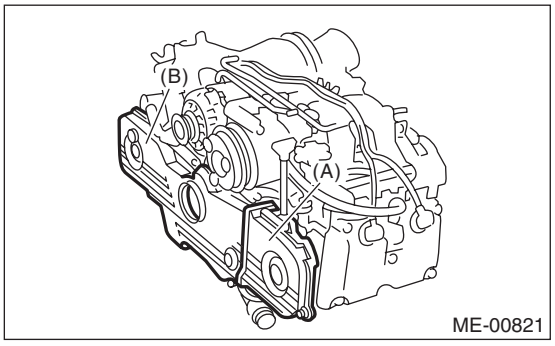
(A) Timing belt cover LH
(B) Front timing belt cover

B: INSTALLATION

1) Install the front timing belt cover.

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)
2) Install the timing belt cover LH.

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



(A) Timing belt cover LH
(B) Front timing belt cover

3) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
4) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: INSPECTION

Check the timing belt cover for damage.

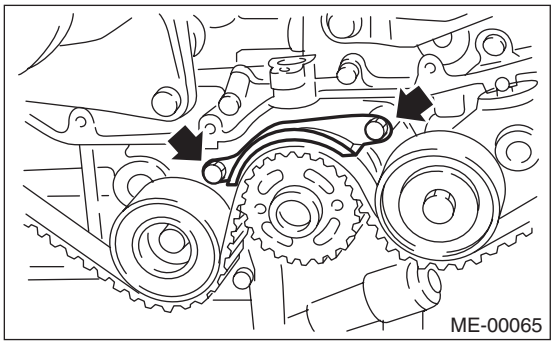
15.Timing Belt

A: REMOVAL

NOTE:
Perform the work with the engine installed to body when replacing a single part. For operation procedures, refer to “Timing Belt” in the PM section. <Ref. to PM-14, Timing Belt.>

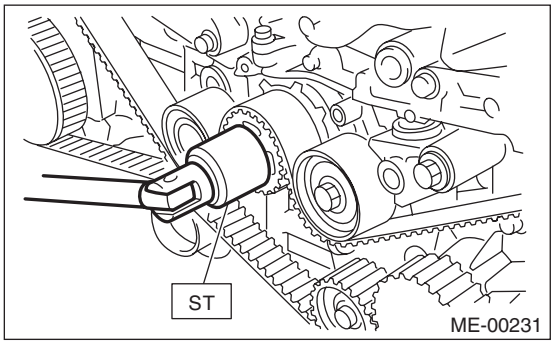
1. TIMING BELT

1) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
2) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt guide. (MT model)

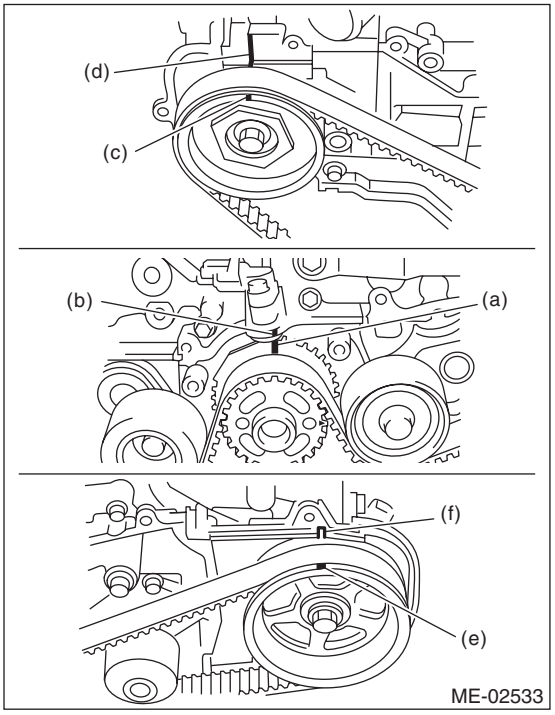

ME-00065

5) If the alignment mark or arrow mark (which indicates the direction of rotation) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.
(1) Use the ST to turn crankshaft. Align the mark (a) of sprocket to the mark (b) of oil pump, and then ensure the right side cam sprocket mark (c), cam cap and cylinder head matching surface (d) or left side cam sprocket mark (e), timing belt cover notch (f) are properly adjusted.

ST 499987500 CRANKSHAFT SOCKET

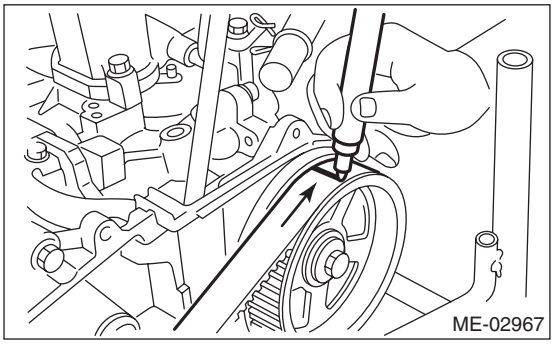


ME-00231

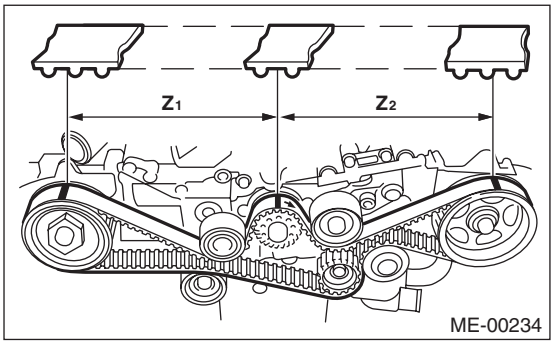


ME-02533

(2) Using white paint, put an alignment mark or an arrow mark on timing belts in relation to the crank sprocket and cam sprockets.


ME-02967

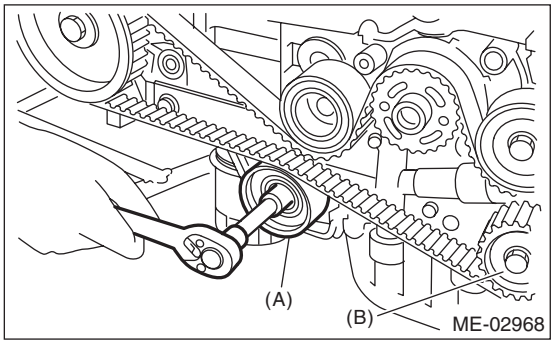
Z_1: 46.8 teeth
Z_2: 43.7 teeth



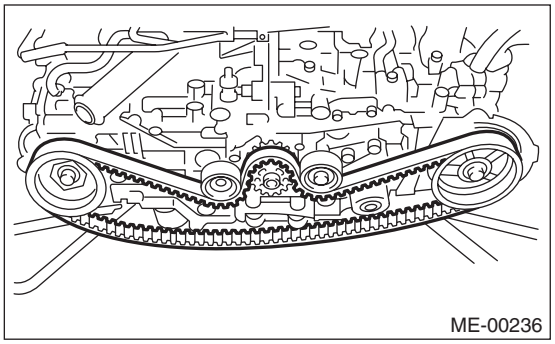
ME-00234

6) Remove the belt idler (A).

7) Remove the belt idler No. 2 (B).

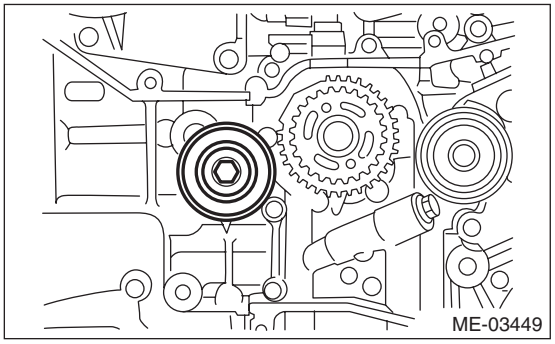


8) Remove the timing belt.

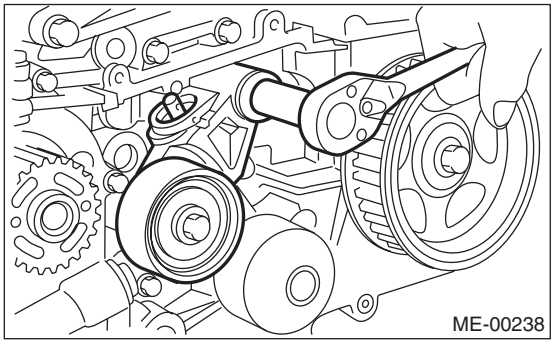


2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

1) Remove the belt idler.



2) Remove the automatic belt tension adjuster assembly.



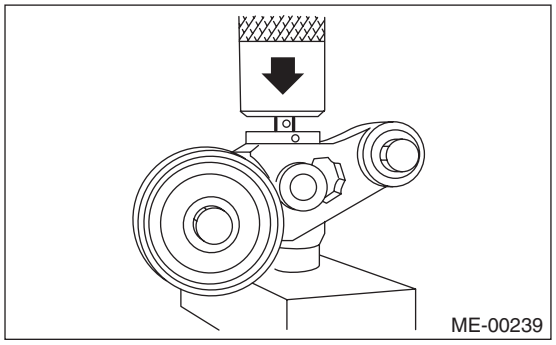
B: INSTALLATION

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

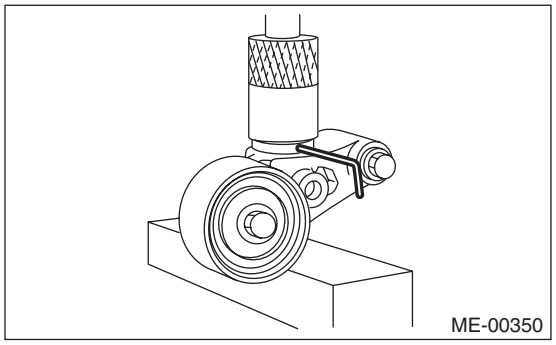
1) Prepare for installation of the automatic belt tension adjuster assembly.

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 three minutes or more.
• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
• Push in the adjuster rod to the end face of the cylinder. However, do not push in the adjuster rod below the end face of 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 vertical pressing tool.
(2) Slowly push in the adjuster rod with a pressure of 165 N (16.8 kgf, 37.1 lbf) or more until the adjuster rod is aligned with the stopper pin hole in the cylinder.

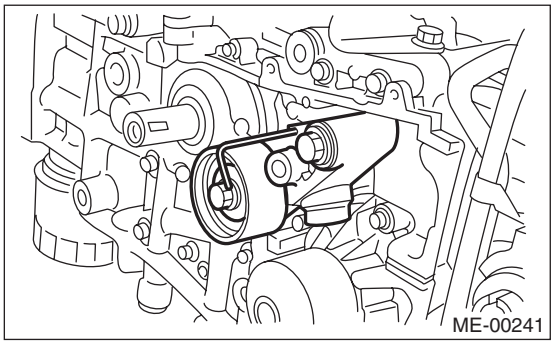


(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex wrench inserted into the stopper pin hole in cylinder, secure the adjuster rod.



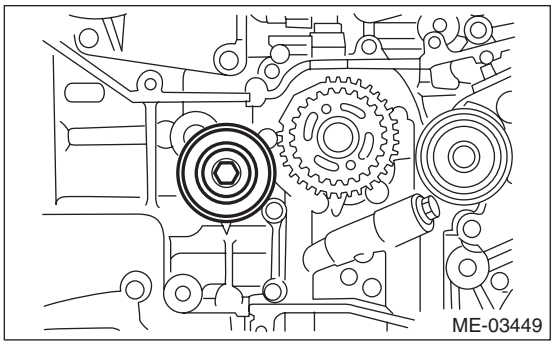
2) Install the automatic belt tension adjuster assembly.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)



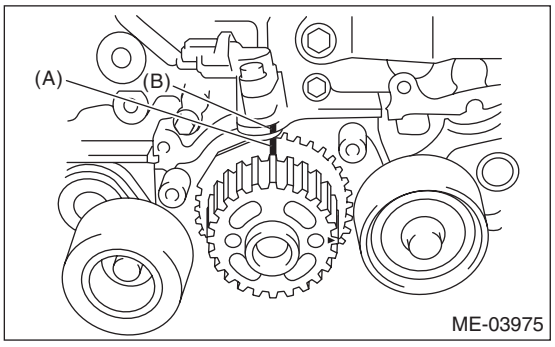
3) Install the belt idlers.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)



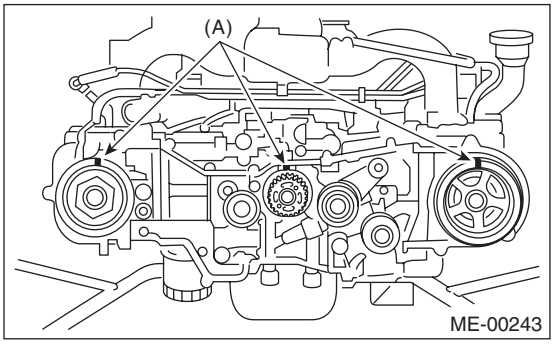
2. TIMING BELT

1) Prepare for installation of the automatic belt tension adjuster assembly. <Ref. to ME(H4SO)-50, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>
2) Align the mark (B) on oil pump with the mark (A) on crank sprocket.

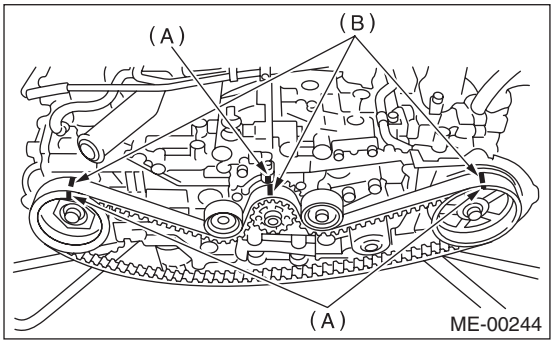


3) Turn the camshaft sprocket No. 2 using ST1, and turn the camshaft sprocket No. 1 using ST2 so that their alignment marks (A) come to top positions.
ST1 18231AA010 CAM SPROCKET WRENCH

NOTE:
CAM SPROCKET WRENCH (499207100) can also be used.
ST2 499207400 CAM SPROCKET WRENCH



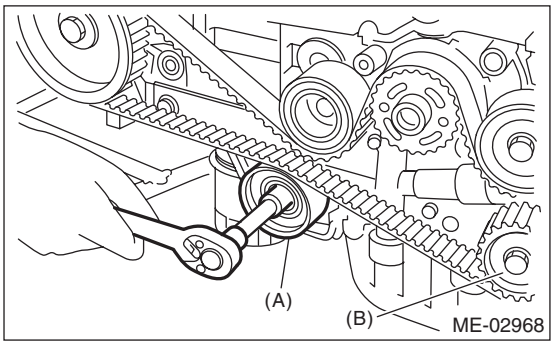
4) While aligning the alignment mark (B) on timing belt with the mark (A) on sprockets, position the timing belt properly.



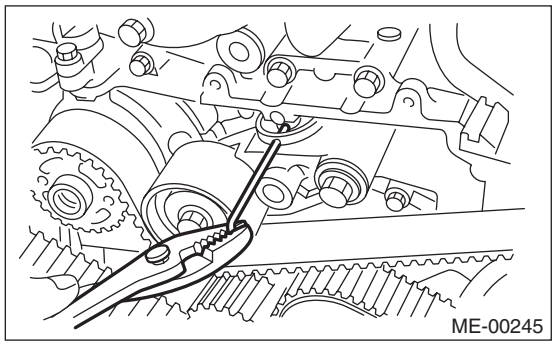
5) Install the belt idler No. 2 (B).

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)
6) Install the belt idler (A).

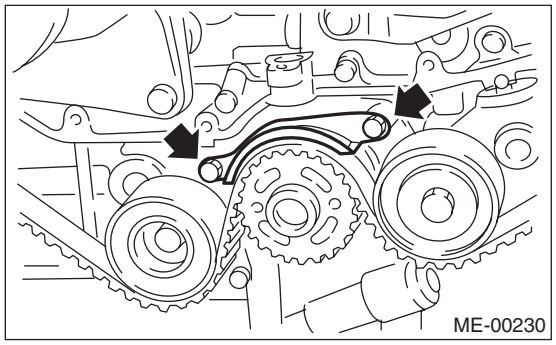
Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)



7) After ensuring the marks on timing belt and camshaft sprockets are aligned, remove the stopper pin from belt tension adjuster.

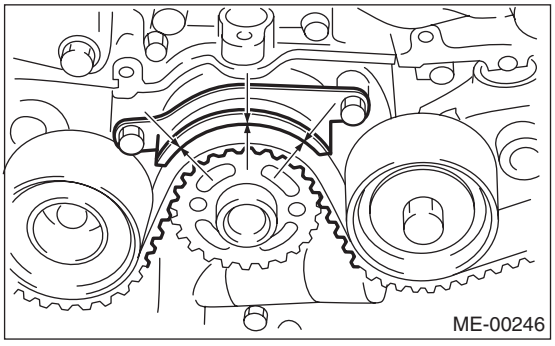


8) Install the timing belt guide. (MT model)
(1) Temporarily tighten the bolts mounting the timing belt guide.



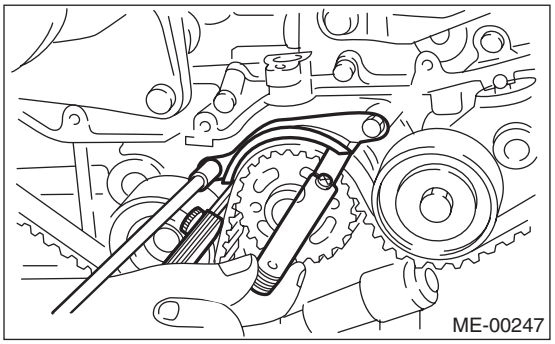
(2) Check and adjust the clearance between timing belt and timing belt guide by using thickness gauge.

Clearance:
1.0±0.5 mm (0.039±0.020 in)



(3) Tighten the bolts mounting the timing belt guide.

Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)



9) Install the timing belt cover. <Ref. to ME(H4SO)-48, INSTALLATION, Timing Belt Cover.>
10) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
11) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

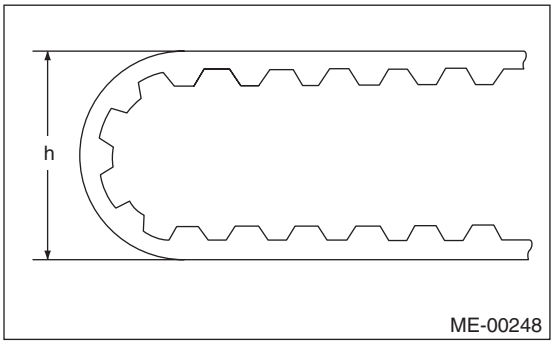
C: INSPECTION

1. TIMING BELT

1) Check the timing belt teeth for breaks, cracks or wear. If any fault is found, replace the timing belt.
2) Check the condition on the back surface of the timing belt. If cracks are found, replace the timing belt.

CAUTION:
• Be careful not to let oil, grease or coolant contact the timing belt. Remove quickly and thoroughly if this happens.
• Do not bend the timing belt sharply.

In radial diameter h:
60 mm (2.36 in) or more



2. AUTOMATIC BELT TENSION ADJUSTER

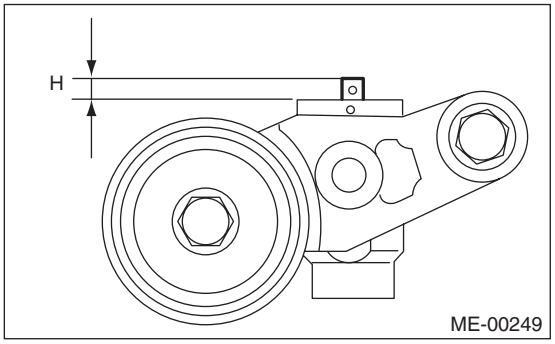
1) Visually check the oil seals for leaks, and rod ends for abnormal wear and scratches. If necessary, replace the automatic belt tension adjuster assembly.

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 165 N (16.8 kgf, 37.1 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 165 N (16.8 kgf, 37.1 lb), check it using the following procedures:
(1) Slowly press the adjuster rod down to the end surface of cylinder. Repeat this operation two to three times.
(2) With the adjuster rod moved all the way up, apply a pressure of 165 N (16.8 kgf, 37.1 lb) to it, and 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 part.

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 the adjuster rod gradually taking three minutes or more.
• Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
• Push in the adjuster rod to the end face of the cylinder. However, do not press the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.
4) Measure the amount of rod protrusion "H" from the end surface of the body. If it is not within specifications, replace the automatic belt tension adjuster assembly with a new part.

Amount of rod protrusion H:
5.2 — 6.2 mm (0.204 — 0.244 in)



3. BELT TENSION PULLEY

1) Check the mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace the automatic belt tension adjuster assembly with a new part if faulty.
2) Check the belt tension pulley for smooth rotation. Replace the automatic belt tension adjuster assembly with a new part if abnormal noise or excessive play occurs.
3) Check the belt tension pulley for grease leakage.

4. BELT IDLER

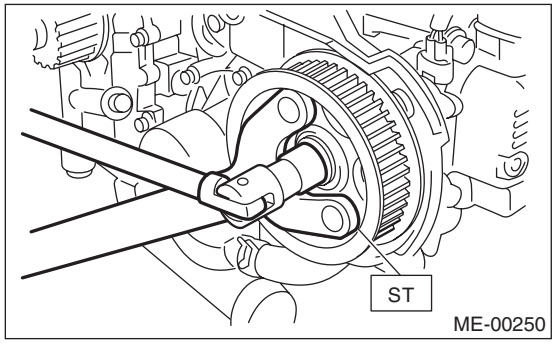
1) Check the belt idler for smooth rotation. Replace if noise or excessive play occurs.
2) Check the outer contacting surfaces of idler pulley for abnormal wear and scratches.
3) Check the belt idler for grease leakage.

16.Cam Sprocket

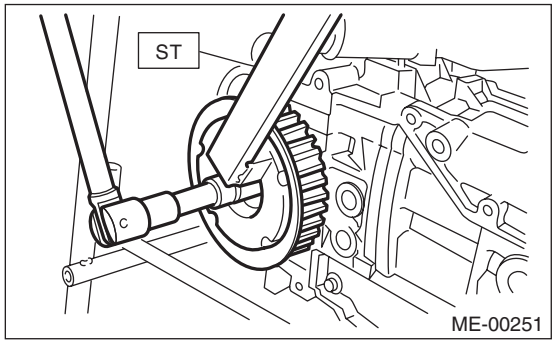
A: REMOVAL

NOTE:
Perform the work with the engine installed to body when replacing a single part.
1) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
2) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt.>
5) Remove the camshaft position sensor. <Ref. to FU(H4SO)-28, REMOVAL, Camshaft Position Sensor.>
6) Fasten the cam sprocket and remove from the camshaft using ST.
ST 18231AA010 CAM SPROCKET WRENCH

NOTE:
CAM SPROCKET WRENCH (499207100) can also be used.



ST 499207400 CAM SPROCKET WRENCH



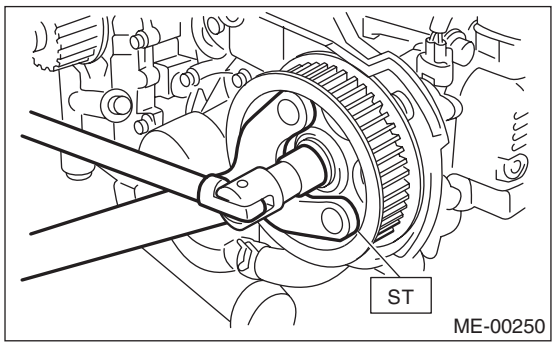
B: INSTALLATION

1) Fasten the cam sprocket and install to the camshaft using ST.

NOTE:
Do not confuse cam sprockets (LH) and (RH) during installation. They should be distinguished by the L or R indication.
ST 18231AA010 CAM SPROCKET WRENCH

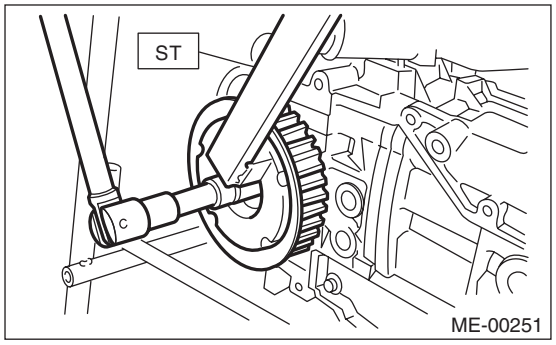
NOTE:
CAM SPROCKET WRENCH (499207100) can also be used.

Tightening torque:
78 N·m (8.0 kgf-m, 57.5 ft-lb)



ST 499207400 CAM SPROCKET WRENCH

Tightening torque:
78 N·m (8.0 kgf-m, 57.5 ft-lb)



2) Install the camshaft position sensor. <Ref. to FU(H4SO)-28, INSTALLATION, Camshaft Position Sensor.>
3) Install the timing belt. <Ref. to ME(H4SO)-50, INSTALLATION, Timing Belt.>
4) Install the timing belt cover. <Ref. to ME(H4SO)-48, INSTALLATION, Timing Belt Cover.>
5) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
6) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

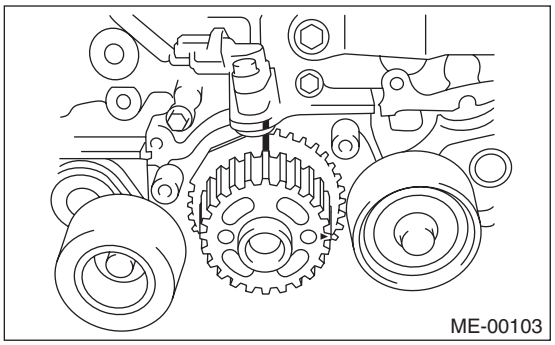
C: INSPECTION

1) Check the cam sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between cam sprocket and key.
3) Check the cam sprocket protrusion used for sensor for damage and contamination of foreign matter.

17.Crank Sprocket

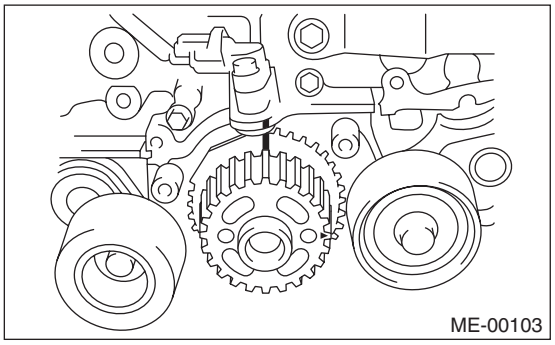
A: REMOVAL

NOTE:
Perform the work with the engine installed to body when replacing a single part.
1) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
2) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt.>
5) Remove the crank sprocket.



B: INSTALLATION

1) Install the crank sprocket.



2) Install the timing belt. <Ref. to ME(H4SO)-50, INSTALLATION, Timing Belt.>
3) Install the timing belt cover. <Ref. to ME(H4SO)-48, INSTALLATION, Timing Belt Cover.>
4) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
5) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: INSPECTION

1) Check the crank sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between crank sprocket and key.
3) Check the crank sprocket protrusion used for sensor for damage and contamination of foreign matter.

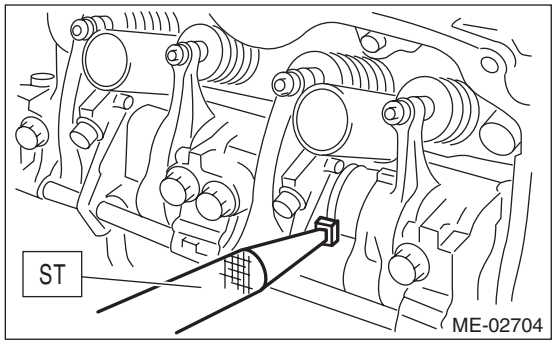
18.Valve Rocker Assembly

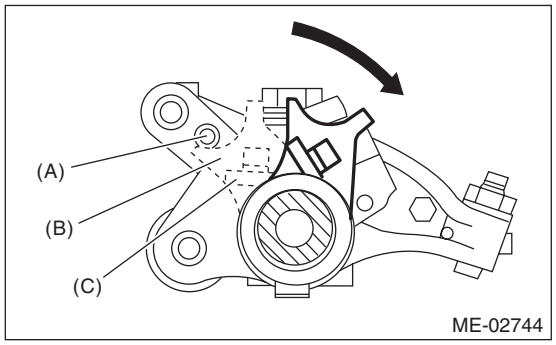
A: REMOVAL

NOTE:
Perform the work with the engine installed to body when replacing a single part. Refer to “Valve Clearance” for preparation procedures. <Ref. to ME(H4SO)-28, Valve Clearance.>

1) Remove the high tension cord.
2) Disconnect the PCV hose and remove the rocker cover.
3) Remove the valve rocker assembly.
   (1) Use the ST to rotate the spring stopper in the direction of the arrow to remove it from adjuster pin.

ST 18258AA000 SPRING INSTALLER

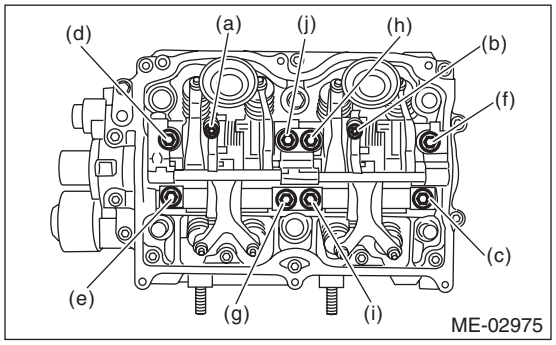




(A) Adjuster pin
(B) Spring stopper
(C) Spring

   (2) Remove the bolts (a) through (j) in alphabetical sequence.

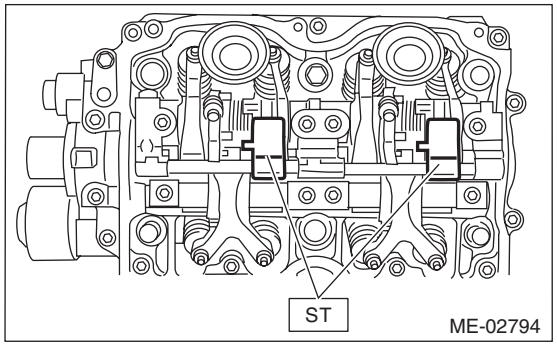
NOTE:
Leave two or three threads of bolts (i) and (j) engaged in order to retain the valve rocker assembly.



   (3) Remove the valve rocker assembly.

NOTE:
Set the ST in the position shown in the drawing to remove the intake valve rocker assembly.

ST 18354AA000 VALVE ROCKER HOLDER

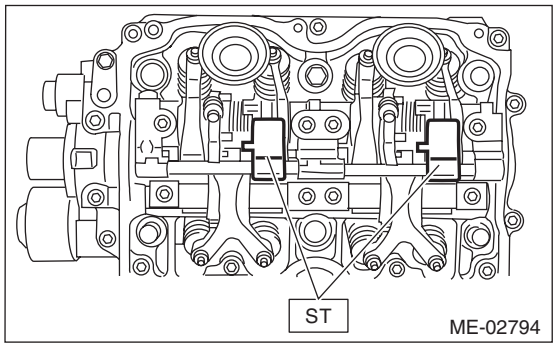


B: INSTALLATION

1) Install the valve rocker assembly.
   (1) Temporarily tighten the bolts equally in alphabetical order as shown in the figure.

NOTE:
- Do not temporarily tighten the bolts (i) and (j).
- Set the ST in the position shown in the drawing to mount the intake valve rocker assembly.

ST 18354AA000 VALVE ROCKER HOLDER

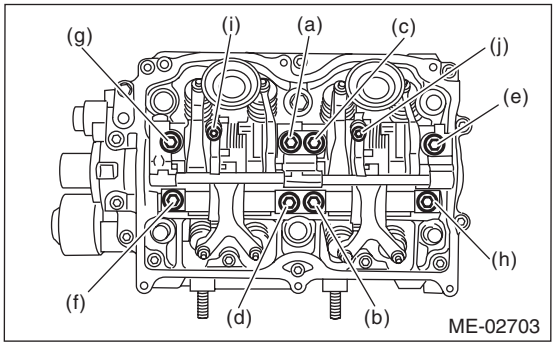


   (2) Tighten the bolts (a) through (h) to specified torque.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

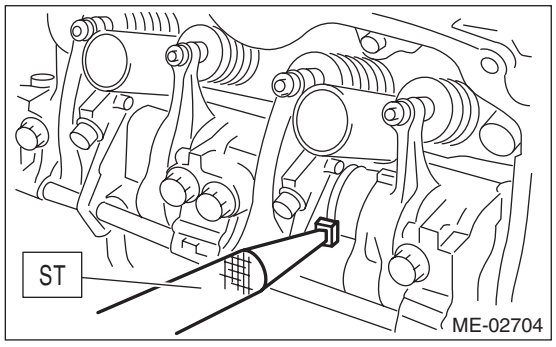
(3) Tighten the bolts (i) through (j) to specified torque.

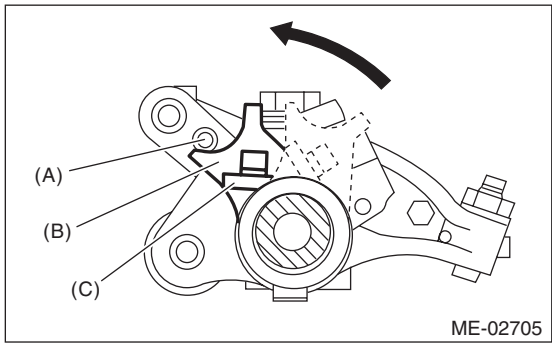
Tightening torque:
6 N·m (0.6 kgf-m, 4.4 ft-lb)



(4) Use the ST to rotate the spring stopper in the direction of the arrow to fasten the adjuster pin.

ST 18258AA000 SPRING INSTALLER





(A) Adjuster pin
(B) Spring stopper
(C) Spring

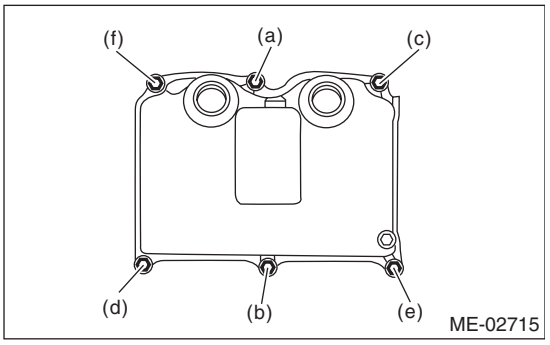
2) Remove the timing belt cover LH.
3) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
4) Install the timing belt cover LH.
5) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover.

NOTE:
Use a new rocker cover gasket.

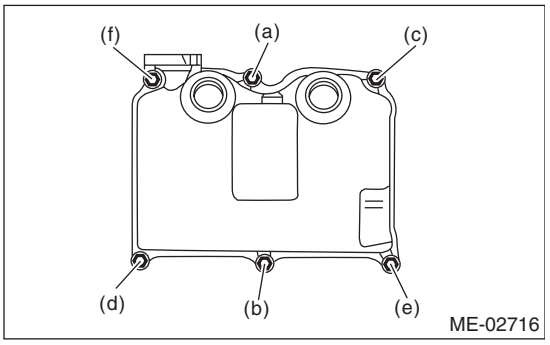
(2) Temporarily tighten the bolts in alphabetical order shown in the figure, tighten them in two stages.

Tightening torque:
1st
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
Second (only (a) and (b) are tightened)
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

RH side



LH side



(3) Connect the PCV hose.

6) Install the high tension cord.

C: DISASSEMBLY

NOTE:
Intake valve rocker assembly cannot be disassembled.

1) Remove the exhaust valve rocker arm from the rocker shaft.

NOTE:
Keep all the removed parts in order for re-installing in their original positions.

2) Remove the nut and adjusting screw from exhaust valve rocker.

D: ASSEMBLY

NOTE:
Intake valve rocker assembly cannot be disassembled.
1) Install the adjusting screw and nut to the exhaust valve rocker.
2) Insert the exhaust valve rocker arm to rocker shaft.

NOTE:
Valve rocker arms, and rocker shaft have identification marks. Make sure the parts with same markings are properly assembled.

E: INSPECTION

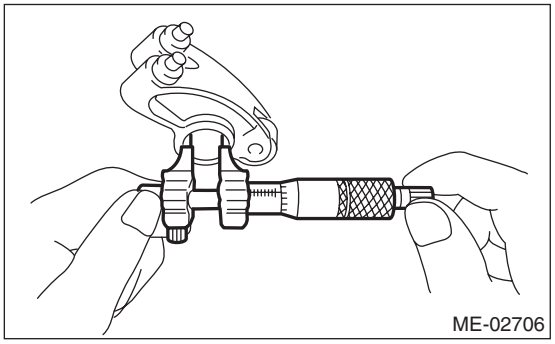
1. INTAKE VALVE ROCKER ASSY

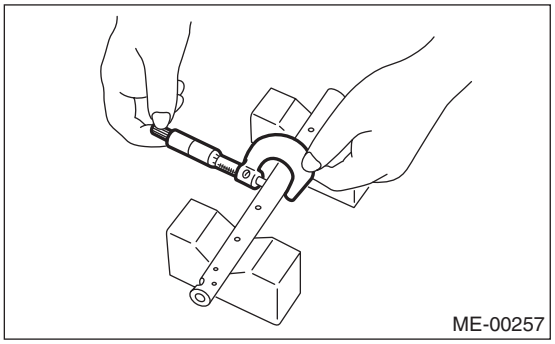
1) If the roller or valve contact surface of valve rocker arm is worn or dented excessively, replace the valve rocker assembly.
2) Check that the valve rocker arm roller rotates smoothly. If not, replace the valve rocker assembly.

2. EXHAUST VALVE ROCKER ASSY

1) Measure the inner diameter of valve rocker arm and outer diameter of valve rocker shaft, and confirm the difference (oil clearance) between the two values.

Clearance between arm and shaft:
Standard
0.020 — 0.054 mm (0.0008 — 0.0021 in)


ME-02706


ME-00257

2) If the oil clearance exceeds the limit, replace the valve rocker arm or shaft, whichever shows the greater amount of wear.

Rocker arm inside diameter:
22.020 — 22.041 mm (0.8669 — 0.8678 in)

Rocker shaft diameter:
21.987 — 22.000 mm (0.8656 — 0.8661 in)

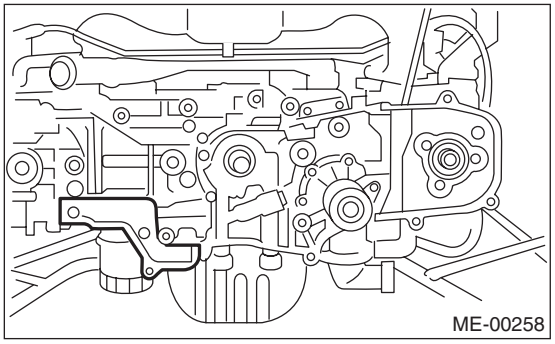
3) If the roller or valve contact surface of valve rocker arm is worn or dented excessively, replace the valve rocker arm.
4) Check that the valve rocker arm roller rotates smoothly. If not, replace the valve rocker arm.

19.Camshaft

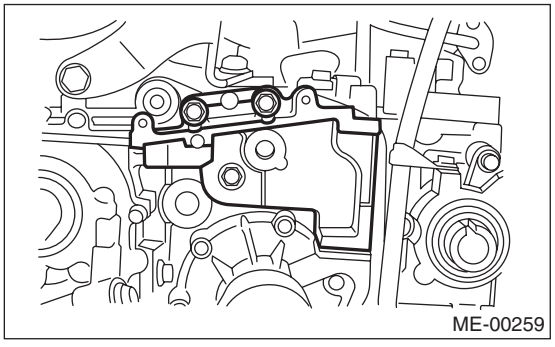
A: REMOVAL

NOTE:
Perform the work with the engine installed to body when replacing a single part. Refer to “Valve Clearance” for preparation procedures. <Ref. to ME(H4SO)-28, Valve Clearance.>
1) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
2) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>
4) Remove the timing belt. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt.>
5) Remove the cam sprocket. <Ref. to ME(H4SO)-54, REMOVAL, Cam Sprocket.>
6) Remove the timing belt cover No. 2 LH.
7) Remove the timing belt cover No. 2 RH.

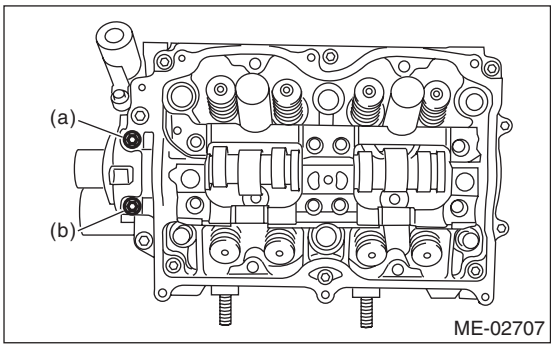
NOTE:
Do not damage or lose the seal rubber when removing the timing belt covers.


ME-00258

8) Remove the tensioner bracket.

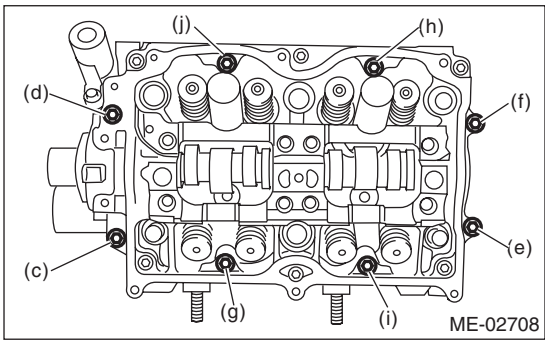

ME-00259

9) Remove the camshaft position sensor support. (LH side only)
10) Remove the valve rocker assembly. <Ref. to ME(H4SO)-56, REMOVAL, Valve Rocker Assembly.>
11) Remove the camshaft cap.
(1) Remove the bolts (a) and (b) in alphabetical sequence.



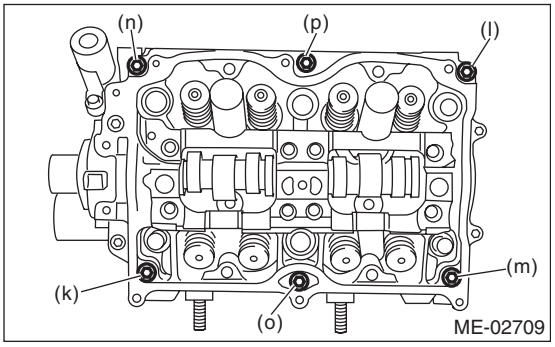
ME-02707

(2) Equally loosen the bolts (c) through (j) all the way in alphabetical sequence.



ME-02708

(3) Remove the bolts (k) through (p) in alphabetical sequence using ST.
ST 499497000 TORX® PLUS



ME-02709

(4) Remove the camshaft cap.
12) Remove the camshaft.
13) Remove the oil seal.
14) Remove the plug from rear side of camshaft.

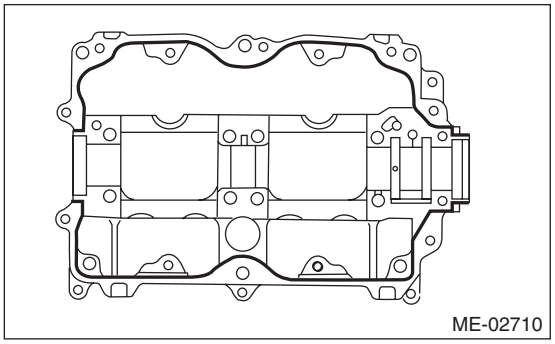
CAUTION:
Do not scratch the journal surface when removing the oil seal.
15) Similarly, remove the camshaft RH and related parts.

B: INSTALLATION

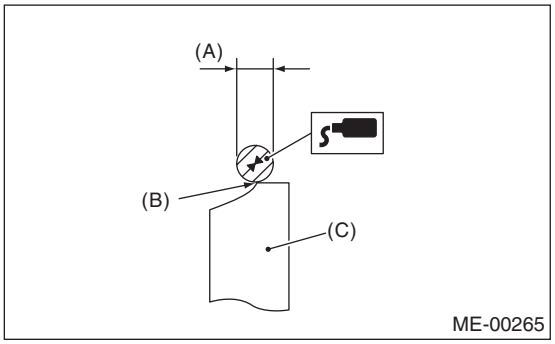
1) Apply a thin coat of engine oil to camshaft journals, and install the camshaft.
2) Install the camshaft cap.
(1) Apply liquid gasket to the mating surfaces of camshaft cap.

NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent

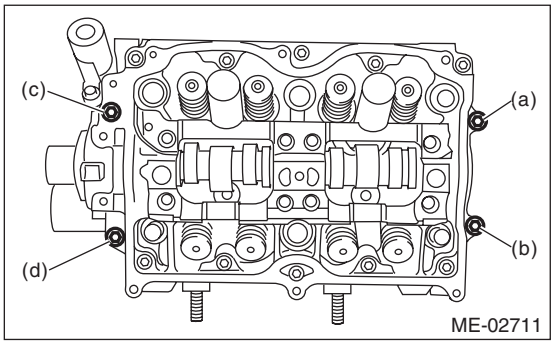

ME-02710

NOTE:
Apply a coat of liquid gasket of 3 mm (0.12 in) in diameter (A) along the edge (B) of camshaft cap (C) mating surface.



ME-00265

(2) Temporarily tighten the bolts (a) through (d) in alphabetical sequence.

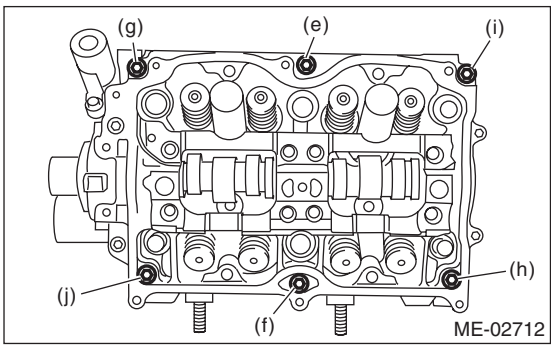


ME-02711

(3) Install the valve rocker assembly. <Ref. to ME(H4SO)-56, INSTALLATION, Valve Rocker Assembly.>

(4) Tighten the TORX® bolts (e) through (j) in alphabetical sequence using the ST.
ST 499497000 TORX® PLUS

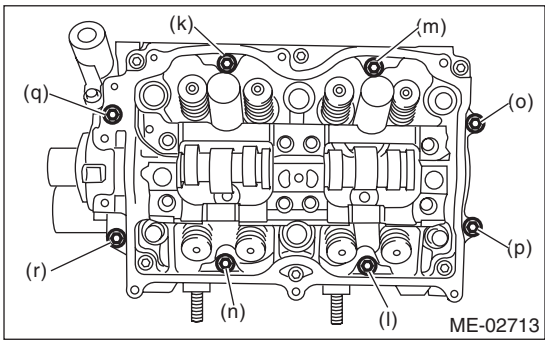
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



ME-02712

(5) Tighten the bolts (k) through (r) in alphabetical sequence.

Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)

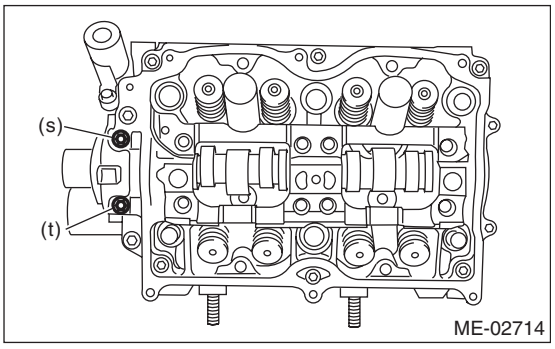


ME-02713

(6) Tighten the bolts (s) and (t) in alphabetical sequence.

NOTE:
- Use a new seal washer.
- Install and tighten the seal washer to the bolt.

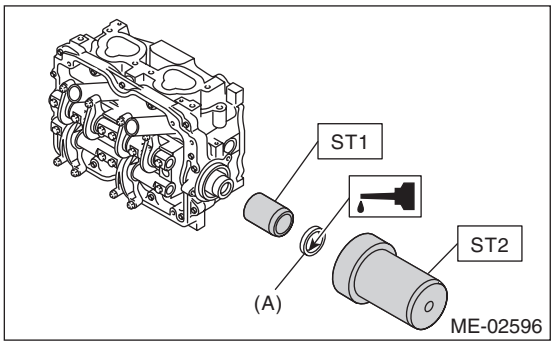
Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)



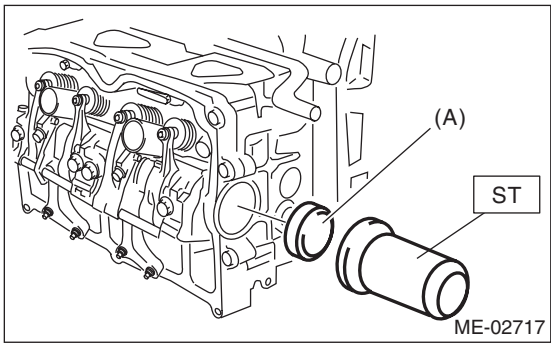
ME-02714

3) Apply a coat of engine oil to camshaft oil seal periphery and oil seal lips and install the oil seal (A) on camshaft using ST1 and ST2.

NOTE:
Use a new oil seal.
ST1 499597000 OIL SEAL GUIDE
ST2 499587500 OIL SEAL INSTALLER



4) Apply a coat of engine oil to plug periphery and install the plug (A) using ST.
ST 499587700 CAMSHAFT OIL SEAL INSTALLER

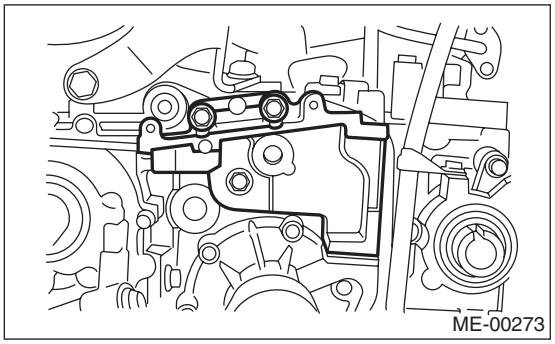


5) Install the camshaft position sensor support. (LH side only)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

6) Similarly, install the parts on right-hand side.
7) Install the tensioner bracket.

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

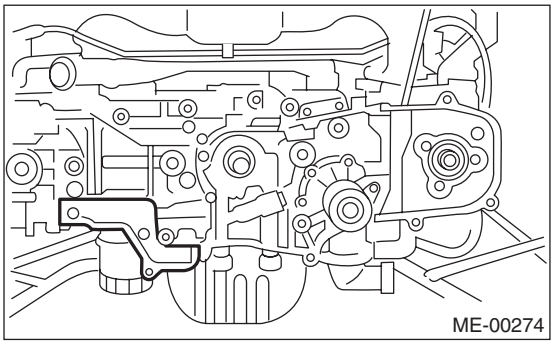


8) Install the timing belt cover No. 2 RH.

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)

9) Install the timing belt cover No. 2 LH.

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



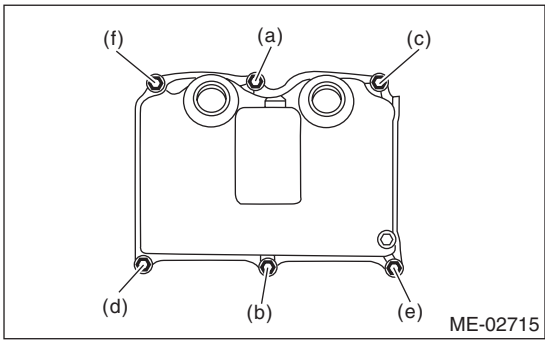
10) Install the cam sprocket. <Ref. to ME(H4SO)-54, INSTALLATION, Cam Sprocket.>
11) Install the timing belt. <Ref. to ME(H4SO)-50, INSTALLATION, Timing Belt.>
12) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
13) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover.

NOTE:
Use a new rocker cover gasket.

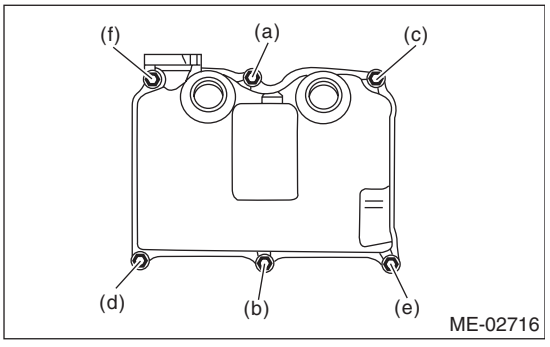
(2) Temporarily tighten the bolts in alphabetical order shown in the figure, tighten them in two stages.

Tightening torque:
1st
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
Second (only (a) and (b) are tightened)
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

RH side



LH side

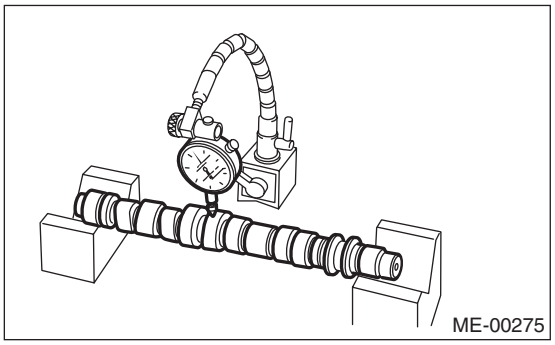


(3) Connect the PCV hose.
14) Install the high tension cord.
15) Install the timing belt cover. <Ref. to ME(H4SO)-48, INSTALLATION, Timing Belt Cover.>
16) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
17) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: INSPECTION

1) Measure the bend, and repair or replace if necessary.

Camshaft bend limit:
0.025 mm (0.00098 in)



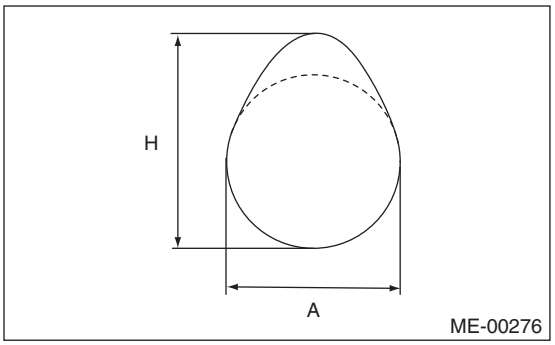
2) Check the journal for damage and wear. Replace if faulty.
3) Check the cam face condition, and remove the minor faults by grinding with oil stone. If offset wear occurs, replace it.
4) Measure the cam lobe height H, cam base circle diameter A and base circle step of adjacent intake cams (low speed and high speed). If it exceeds the standard or offset wear occurs, replace it.

Cam lobe height H:

			Unit: mm (in)
Intake	Constant	Standard	40.075 — 40.175 (1.5778 — 1.5817)
	Low speed	Standard	35.496 — 35.596 (1.3975 — 1.4014)
	High speed	Standard	40.315 — 40.415 (1.5872 — 1.5911)
Exhaust		Standard	39.289 — 39.389 (1.5468 — 1.5507)

Cam base circle diameter A:
Standard
34.00 mm (1.3386 in)

Base circle step of adjacent intake cams (low speed and high speed):
Standard
0.03 mm (0.001 in) or less



5) Measure the outer diameter of camshaft journal and inner diameter of cylinder head journal, and check the difference (oil clearance) between the two values. If the oil clearance is not within the standard, replace the camshaft or cylinder head as necessary.

		Unit: mm (in)
Oil clearance	Standard	0.055 — 0.090 (0.0022 — 0.0035)
Camshaft journal O.D.		31.928 — 31.945 (1.2570 — 1.2577)
Journal hole I.D.		32.000 — 32.018 (1.2598 — 1.2605)

6) Measure the thrust clearance with setting the dial gauge at end surface of camshaft. If the thrust clearance is not within the standard or there is offset wear, replace the camshaft caps and cylinder head as a set. If necessary, replace the camshaft.

Camshaft thrust clearance:
Standard
0.030 — 0.090 mm (0.0012 — 0.0035 in)

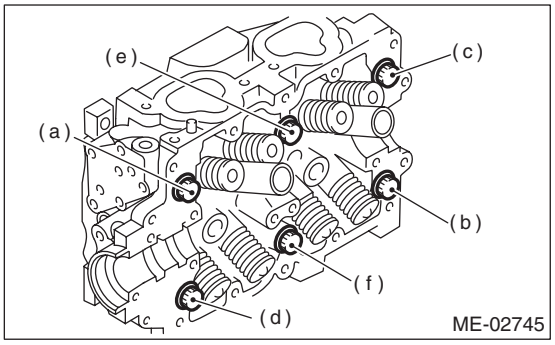
20.Cylinder Head

A: REMOVAL

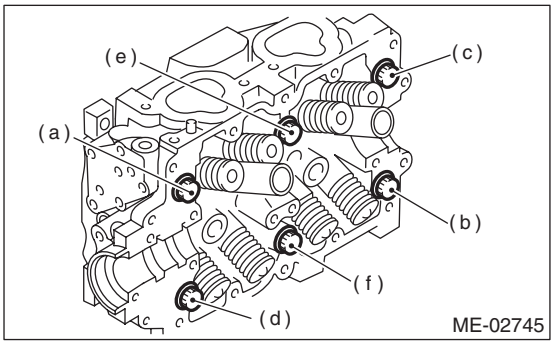
NOTE:
• Perform the work with the engine installed to body when replacing a single part. Refer to “Valve Clearance” for preparation procedures. <Ref. to ME(H4SO)-28, Valve Clearance.>
• When performing the work with the engine installed to body, the following parts must also be removed/installed.
  • Front exhaust pipe <Ref. to EX(H4SO)-6, REMOVAL, Front Exhaust Pipe.> <Ref. to EX(H4SO)-7, INSTALLATION, Front Exhaust Pipe.>

1) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
2) Remove the intake manifold. <Ref. to FU(H4SO)-16, REMOVAL, Intake Manifold.>
3) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt.>
6) Remove the cam sprocket. <Ref. to ME(H4SO)-54, REMOVAL, Cam Sprocket.>
7) Remove the bolts which secure A/C compressor bracket to cylinder head.
8) Remove the valve rocker assembly. <Ref. to ME(H4SO)-56, REMOVAL, Valve Rocker Assembly.>
9) Remove the camshaft. <Ref. to ME(H4SO)-59, REMOVAL, Camshaft.>
10) Remove the oil level gauge guide. (LH side)
11) Remove the cylinder head bolts in alphabetical sequence as shown in the figure.

NOTE:
Leave bolts (a) and (c) engaged by three or four threads to prevent the cylinder head from falling.



12) While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (a) and (c) to remove cylinder head.



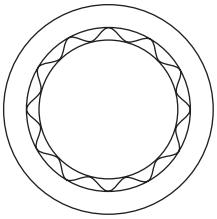
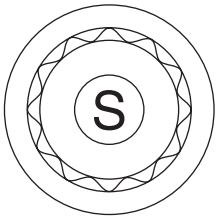
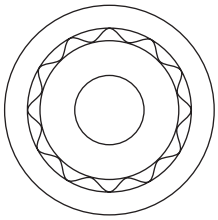
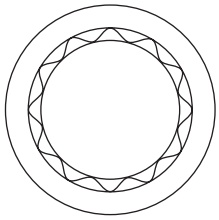
13) Remove the cylinder head gasket.

CAUTION:
Be careful not to scratch the mating surface of cylinder head and cylinder block.
14) Similarly, remove the right side cylinder head.

B: INSTALLATION

1) Install the cylinder head to the cylinder block.

CAUTION:
- **Be careful not to scratch the mating surface of cylinder head and cylinder block.**
- **Be aware that the center bolts and corner bolts are different.**

Bolt type	Center bolt	Corner bolt
Silver bolt	 FU-05486 Flat	 FU-05487 Indent + S
Black bolt	 FU-05488 ϕ7 indent	 FU-05486 Flat

NOTE:
Use a new cylinder head gasket.

(1) Clean the bolt threads and the bolt holes in the cylinder block.

CAUTION:
To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

(2) Apply a sufficient coat of engine oil to the washer and bolt thread.

(3) Tighten all bolts to 40 N·m (4.1 kgf-m, 29.5 ft-lb) in alphabetical order.

(4) Retighten all bolts to 95 N·m (9.7 kgf-m, 70.1 ft-lb) in alphabetical order.

CAUTION:
If the bolt makes stick-slip sound during tightening, repeat the procedure from step (1). In this case, the cylinder head gasket can be reused.

(5) Loosen all the bolts by 180° in the reverse order of installing, and loosen them further by 180°.

(6) Tighten all bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in alphabetical order.

(7) Retighten all bolts to 30 N·m (3.1 kgf-m, 22.1 ft-lb) in alphabetical order.

(8) Retighten all bolts to 60 N·m (6.1 kgf-m, 44.3 ft-lb) in alphabetical order.

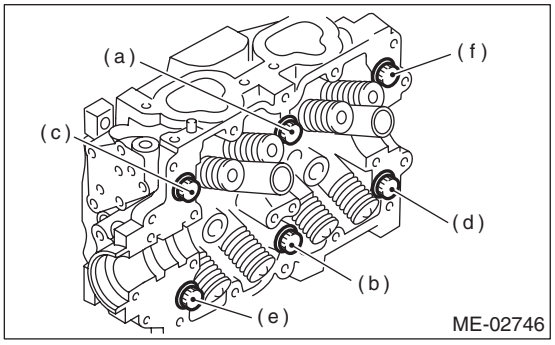
(9) Retighten all bolts by 80 — 90° in alphabetical order.

(10) Retighten all bolts by 40 — 45° in alphabetical order.

CAUTION:
The tightening angle of the bolt should not exceed 45°.

(11) Retighten bolts (a) and (b) by 40 — 45°.

CAUTION:
Make sure the total "tightening angle" of steps (10) and (11) does not exceed 90°.



2) Install the oil level gauge guide. (LH side)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

3) Install the camshaft. <Ref. to ME(H4SO)-60, INSTALLATION, Camshaft.>
4) Install the valve rocker assembly. <Ref. to ME(H4SO)-56, INSTALLATION, Valve Rocker Assembly.>
5) Install the A/C compressor bracket on cylinder head.

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)

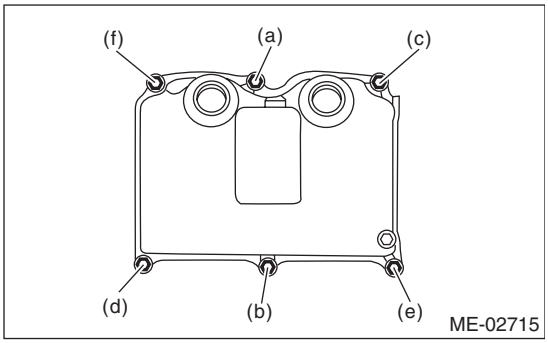
6) Install the cam sprocket. <Ref. to ME(H4SO)-54, INSTALLATION, Cam Sprocket.>
7) Install the timing belt. <Ref. to ME(H4SO)-50, INSTALLATION, Timing Belt.>
8) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
9) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover.

NOTE:
Use a new rocker cover gasket.

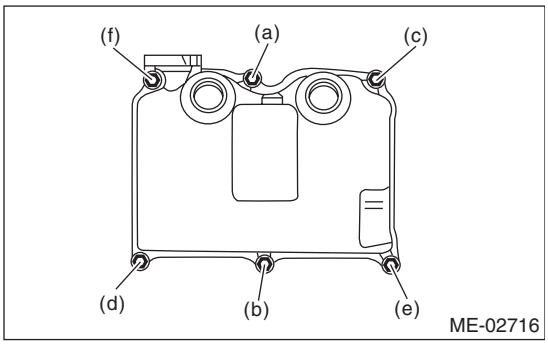
(2) Temporarily tighten the bolts in alphabetical order shown in the figure, tighten them in two stages.

Tightening torque:
1st
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
Second (only (a) and (b) are tightened)
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

RH side



LH side



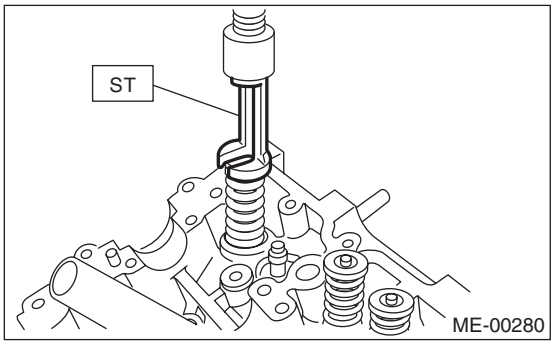
10) Install the timing belt cover. <Ref. to ME(H4SO)-48, INSTALLATION, Timing Belt Cover.>
11) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
12) Install the intake manifold. <Ref. to FU(H4SO)-18, INSTALLATION, Intake Manifold.>
13) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: DISASSEMBLY

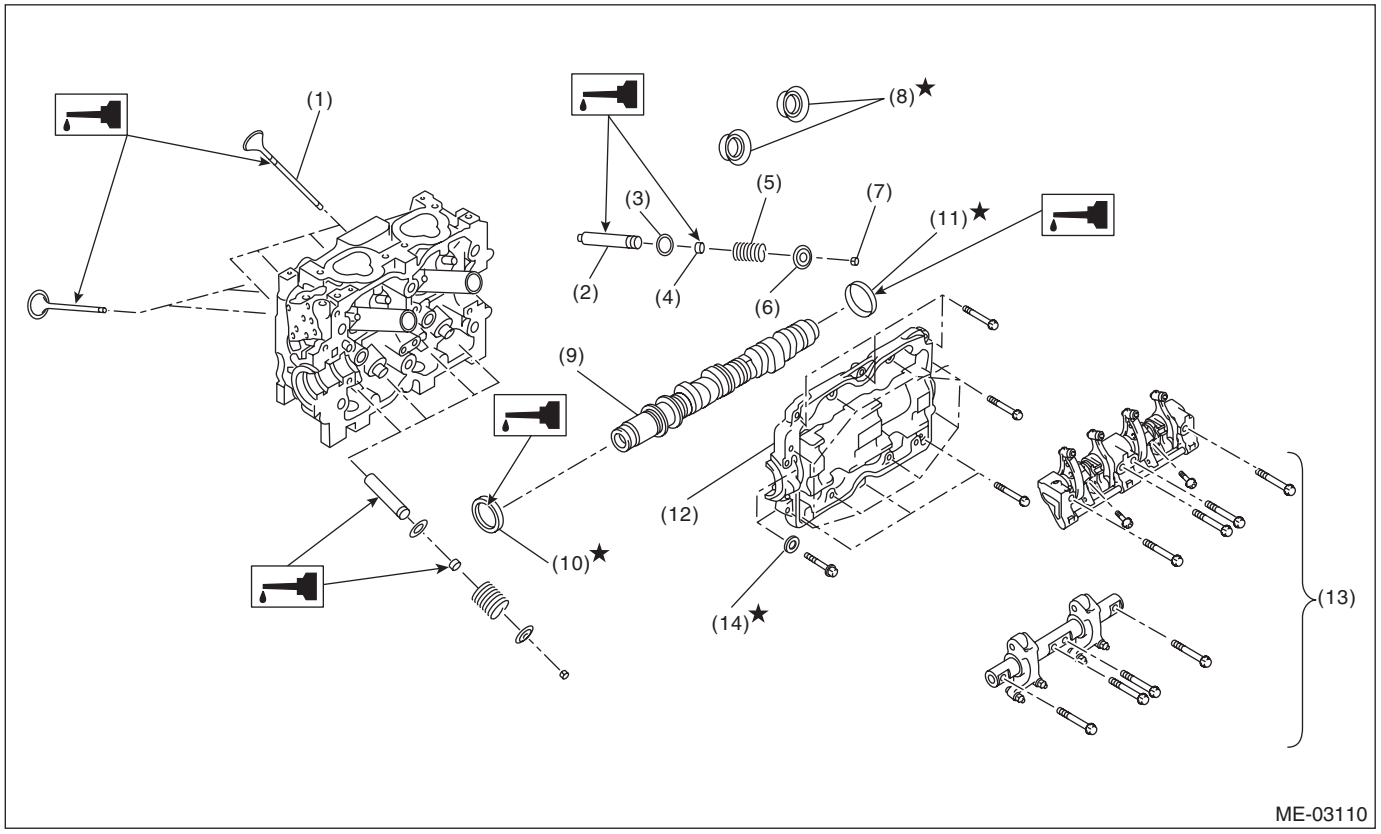
1) Place the cylinder head on the ST.
ST 498267800 CYLINDER HEAD TABLE
2) Compress the valve spring and remove the valve spring retainer key using ST. Remove each valve and valve spring.
ST 499718000 VALVE SPRING REMOVER

NOTE:
- Keep all the removed parts in order for re-installing in their original positions.
- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.

• For removal and installation procedures of the valve guide, intake valve oil seal and exhaust valve oil seal, refer to “INSPECTION”. <Ref. to ME(H4SO)-68, VALVE GUIDE, INSPECTION, Cylinder Head.> <Ref. to ME(H4SO)-71, INTAKE AND EXHAUST VALVE OIL SEAL, INSPECTION, Cylinder Head.>



D: ASSEMBLY



(1) Valve
(2) Valve guide
(3) Valve spring seat
(4) Oil seal
(5) Valve spring
(6) Retainer
(7) Retainer key
(8) Spark plug gasket
(9) Camshaft
(10) Oil seal
(11) Plug
(12) Camshaft cap
(13) Valve rocker ASSY
(14) Seal washer

1) Install the valve spring and valve.
(1) Coat the stem of each valve with engine oil and insert the valve into valve guide.

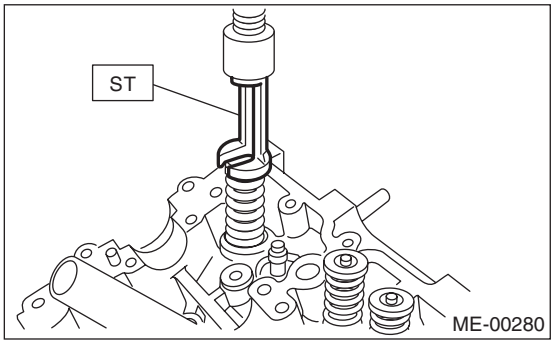
NOTE:
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

(2) Set the cylinder head on ST.
ST 498267800 CYLINDER HEAD TABLE

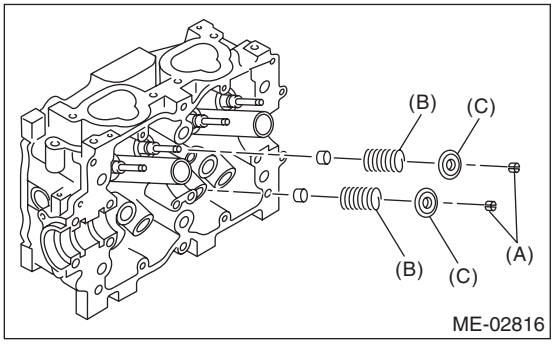
(3) Install the valve spring and retainer.

NOTE:
Be sure to install the valve spring with its close-coiled end facing the cylinder head side.

(4) Set the ST on valve spring.
ST 499718000 VALVE SPRING REMOVER



(5) Compress the valve spring and fit the valve spring retainer key.



(A) Retainer key
(B) Valve spring
(C) Retainer

(6) After installing, tap the valve spring retainers lightly with a plastic hammer for better seating.

E: INSPECTION

1. CYLINDER HEAD

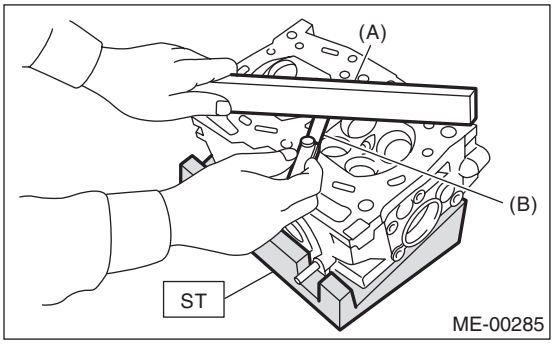
1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures.
Check that there are no marks of gas leaking or water leaking on gasket installing surface.
2) Place the cylinder head on the ST.
ST 498267800 CYLINDER HEAD TABLE
3) Measure the warping of the cylinder head surface that mates with cylinder block using a straight edge (A) and thickness gauge (B).
If the warping exceeds the limit, correct the surface by grinding it with a surface grinder.

Warping limit:
0.035 mm (0.0014 in)

Grinding limit:
0.1 mm (0.004 in)

Standard height of cylinder head:
97.5 mm (3.84 in)

NOTE:
Uneven torque for the cylinder head bolts can cause warpage. When reassembling, pay special attention to the torque so as to tighten evenly.

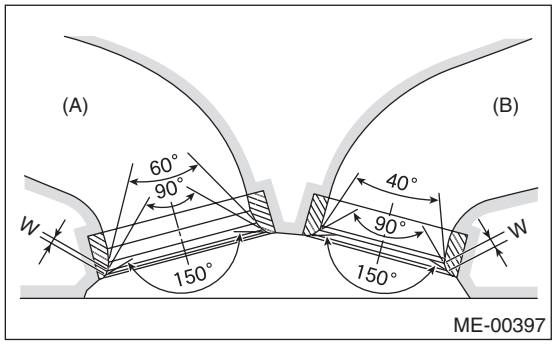


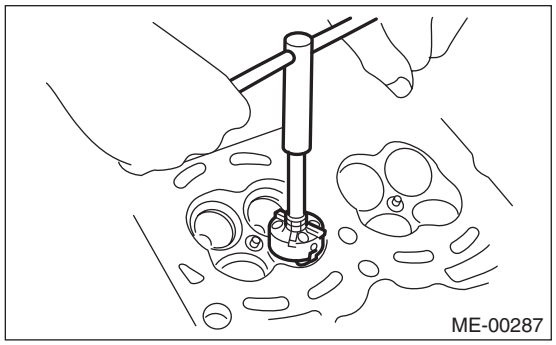
2. VALVE SEAT

Inspect the intake and exhaust valve seats, and correct the contact surfaces with a valve seat cutter if they are defective or when valve guides are replaced.

Contacting width W between valve and valve seat:

Standard:
Intake (A)
0.8 — 1.4 mm (0.03 — 0.055 in)
Exhaust (B)
1.2 — 1.8 mm (0.047 — 0.071 in)

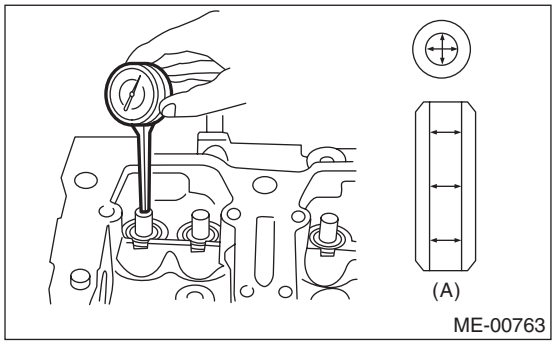




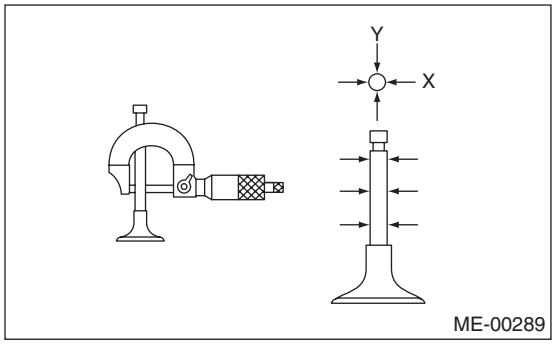
3. VALVE GUIDE

1) Check the clearance between valve guide and valve stem. The clearance can be checked by measuring respectively the outer diameter of valve stem with a micrometer and the inner diameter of valve guide with a caliper gauge.

Clearance between the valve guide and valve stem:
Standard:
Intake
0.035 — 0.062 mm (0.0014 — 0.0024 in)
Exhaust
0.040 — 0.067 mm (0.0016 — 0.0026 in)



(A) Valve guide



2) If the clearance between the valve guide and valve stem exceeds the standard, replace the valve guide or valve itself, whichever shows greater amount of wear or damage. See the following procedure for valve guide replacement.

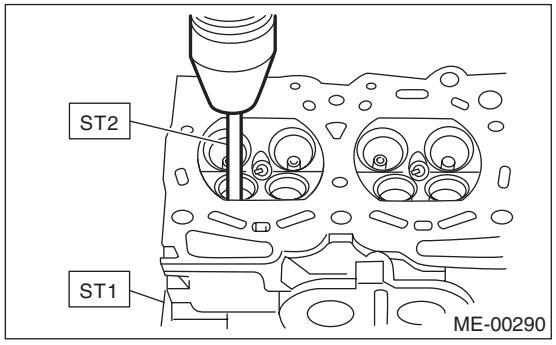
Valve guide inner diameter:
6.000 — 6.012 mm (0.2362 — 0.2367 in)

Valve stem outer diameters:
Intake
5.950 — 5.965 mm (0.2343 — 0.2348 in)
Exhaust
5.945 — 5.960 mm (0.2341 — 0.2346 in)

(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides fit the holes in ST1.

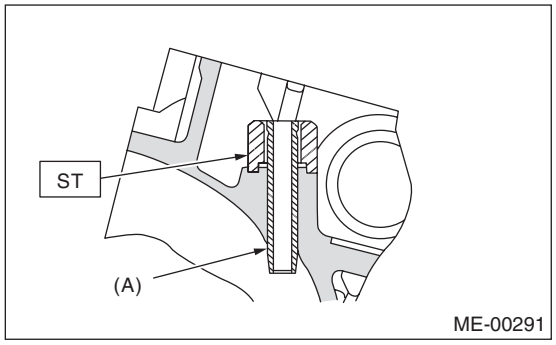
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267800 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



(3) Turn the cylinder head upside down and place the ST as shown in the figure.

Intake side
ST 499767700 VALVE GUIDE ADJUSTER
Exhaust side
ST 499767800 VALVE GUIDE ADJUSTER

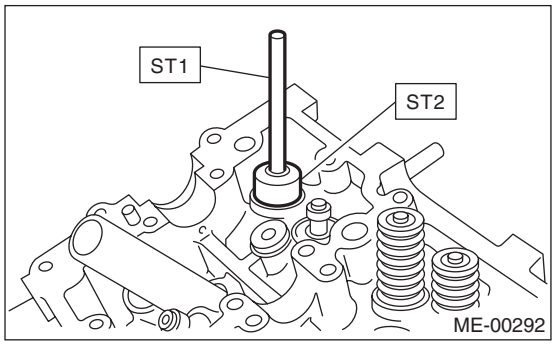


(A) Valve guide

(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.

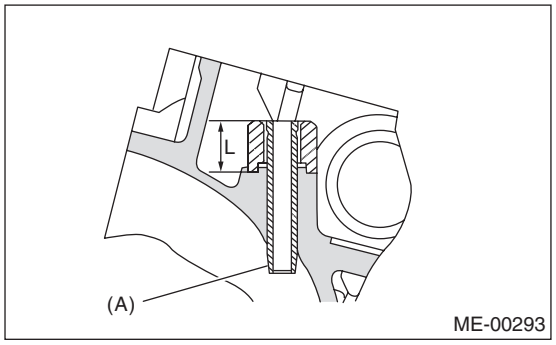
(5) Put a new valve guide, coated with sufficient oil, in the cylinder head, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER
Intake side
ST2 499767700 VALVE GUIDE ADJUSTER
Exhaust side
ST2 499767800 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

Valve guide protrusion L:
Intake
20.0 — 21.0 mm (0.787 — 0.827 in)
Exhaust
16.5 — 17.5 mm (0.650 — 0.689 in)

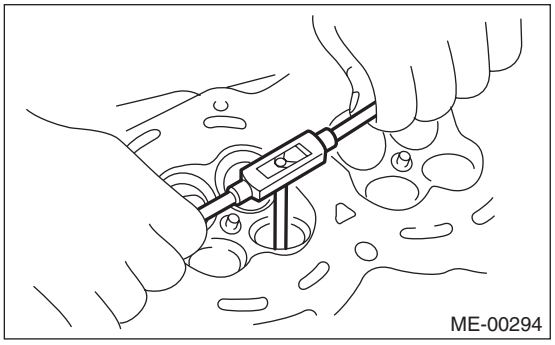


(A) Valve guide

(7) Ream the inside of valve guide using ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

NOTE:
- Apply engine oil to the ST when reaming.
- If the inner surface of valve guide is damaged, the edge of ST should be slightly ground with oil stone.

• If the inner surface of valve guide becomes lustrous and the ST does not chip, use a new ST or remedy the ST.
ST 499767400 VALVE GUIDE REAMER



(8) After reaming, clean the valve guide to remove chips.
(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

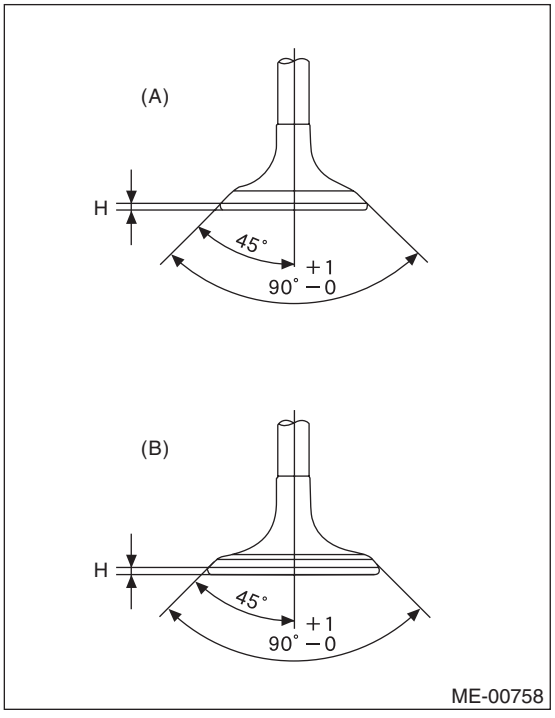
4. INTAKE AND EXHAUST VALVE

1) Inspect the flange of valve and valve stem, and replace the valve with a new part if damaged, worn, deformed, or if dimension "H" in the figure is outside of the specified limit.

Head edge thickness H:

Intake (A)
Standard:
0.8 — 1.2 mm (0.03 — 0.047 in)

Exhaust (B)
Standard:
1.0 — 1.4 mm (0.039 — 0.055 in)



2) Put a small amount of grinding compound on the valve seat surface, and lap the valve and valve seat surface. Replace with a new valve oil seal after lapping.

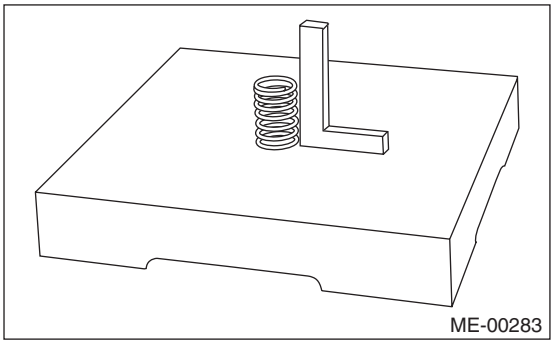
NOTE:
It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

Valve overall length:
Intake
120.6 mm (4.75 in)
Exhaust
121.7 mm (4.79 in)

5. VALVE SPRING

1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within the standard value presented in the table.
2) To measure the squareness of the valve spring, stand the valve spring on a surface plate and measure its deflection at the top of the valve spring using a try square.

Free length	mm (in)	55.2 (2.173)
Tension/spring height N (kgf, lb)/mm (in)	Set	235.3 — 270.7 (24 — 27.6, 52.9 — 60.8)/45.0 (1.772)
	Lift	578.9 — 639.9 (59.1 — 65.3, 130.3 — 143.9)/34.7 (1.366)
Squareness		2.5°, 2.4 mm (0.094 in) or less



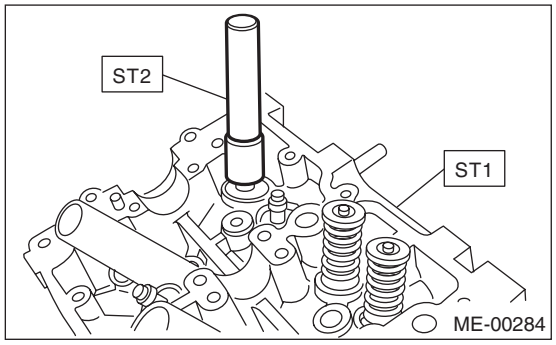
6. INTAKE AND EXHAUST VALVE OIL SEAL

1) For the following, replace the oil seal with a new part.
See the procedure 2) and subsequent for replacement procedures.
- When the lip is damaged.
- When the spring is out of the specified position.
- When readjusting the surfaces of valve and valve seat.
- When replacing the valve guide.

2) Place the cylinder head on ST1, and use ST2 to press-fit the oil seal.
ST1 498267800 CYLINDER HEAD TABLE
ST2 498857100 VALVE OIL SEAL GUIDE

NOTE:
- Apply engine oil to oil seal before press-fitting.
- When press-fitting the oil seal, do not use a hammer to strike in.
- The intake valve oil seals and exhaust valve oil seals are distinguished by their colors.

Color of rubber part:
Intake [Gray]
Exhaust [Green]

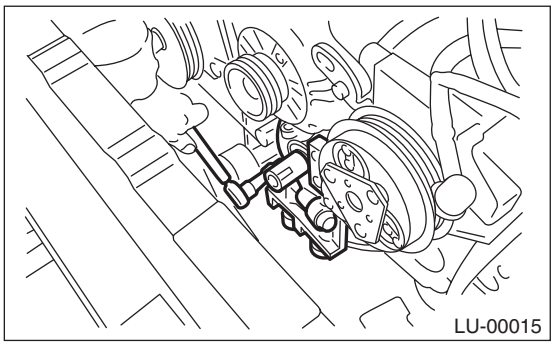


21.Cylinder Block

A: REMOVAL

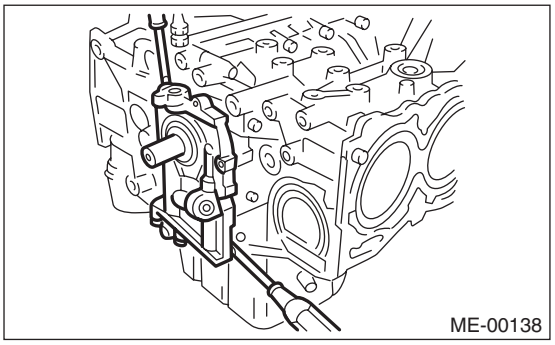
NOTE:
Before conducting this procedure, drain the engine oil completely.
1) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
2) Remove the intake manifold. <Ref. to FU(H4SO)-16, REMOVAL, Intake Manifold.>
3) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt.>
6) Remove the crank sprocket. <Ref. to ME(H4SO)-55, REMOVAL, Crank Sprocket.>
7) Remove the generator and A/C compressor with their brackets.
8) Remove the cylinder head. <Ref. to ME(H4SO)-63, REMOVAL, Cylinder Head.>
9) Remove the drive plate. (AT model) <Ref. to 4AT-68, REMOVAL, Drive Plate.>
10) Remove the clutch disc and cover. (MT model) <Ref. to CL-10, REMOVAL, Clutch Disc and Cover.>
11) Remove the flywheel. (MT model) <Ref. to CL-12, REMOVAL, Flywheel.>
12) Remove the oil separator cover.
13) Remove the water by-pass pipe for heater.
14) Remove the water pump. <Ref. to CO(H4SO)-15, REMOVAL, Water Pump.>
15) Remove the bolts which secure oil pump to cylinder block.

NOTE:
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



16) Remove the oil pump from cylinder block using a flat tip screwdriver.

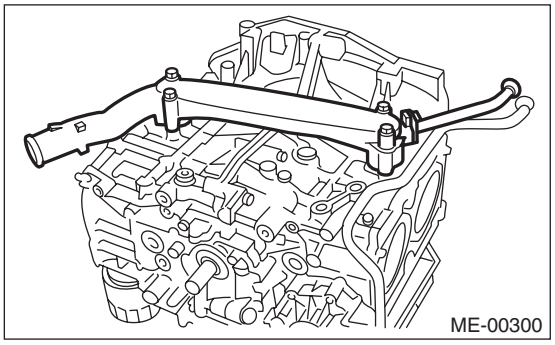
CAUTION:
Be careful not to scratch the mating surface of cylinder block and oil pump.

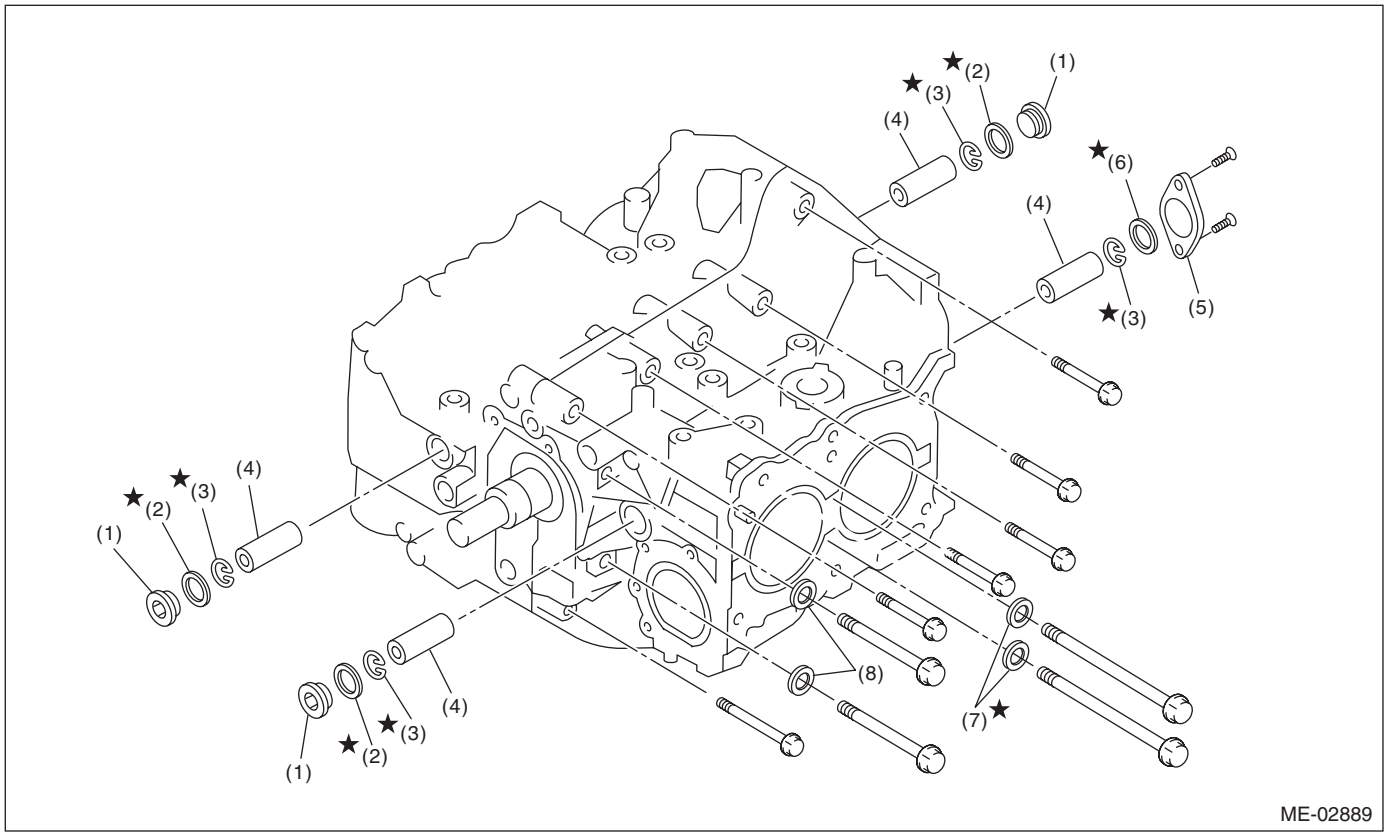


17) Remove the front oil seal from the oil pump.
18) Remove the oil pan.
(1) Set the part so that the cylinder block LH is on the upper side.
(2) Remove the bolts which secure oil pan to cylinder block.
(3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

CAUTION:
Do not use a screwdriver or similar tools in place of oil pan cutter.
19) Remove the oil strainer.
20) Remove the baffle plate.
21) Remove the oil filter. <Ref. to LU(H4SO)-29, REMOVAL, Engine Oil Filter.>

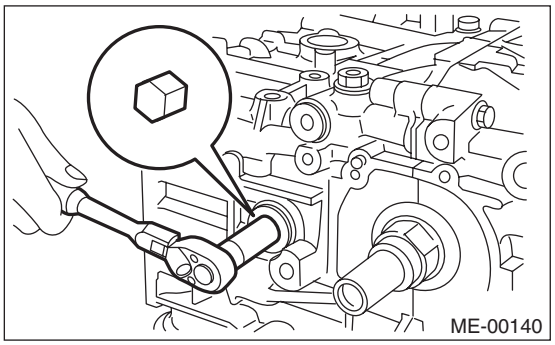
22) Remove the water pipe assembly.



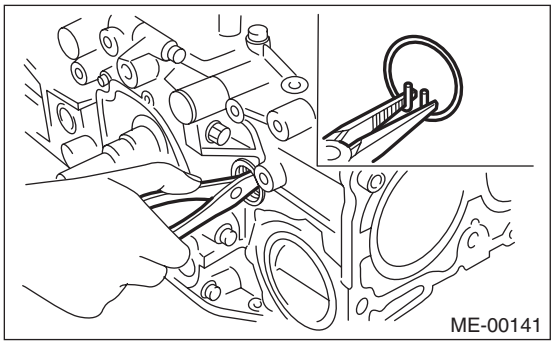


(1) Service hole plug
(2) Gasket
(3) Snap ring
(4) Piston pin
(5) Service hole cover
(6) O-ring
(7) Seal washer
(8) Washer

23) Remove the service hole plugs using a hexagon wrench [14 mm].

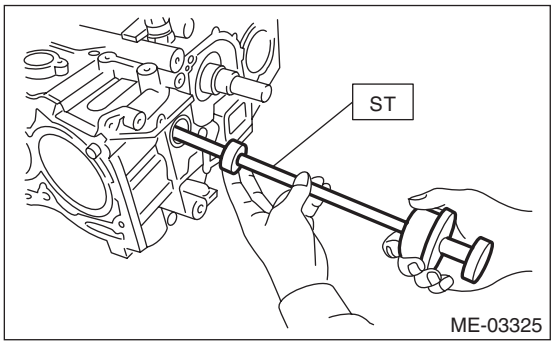


24) Remove the service hole cover.
25) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring through service hole of #1 and #2 cylinders.



26) Draw out the piston pin from #1 and #2 pistons using ST.
ST 499097700 PISTON PIN REMOVER

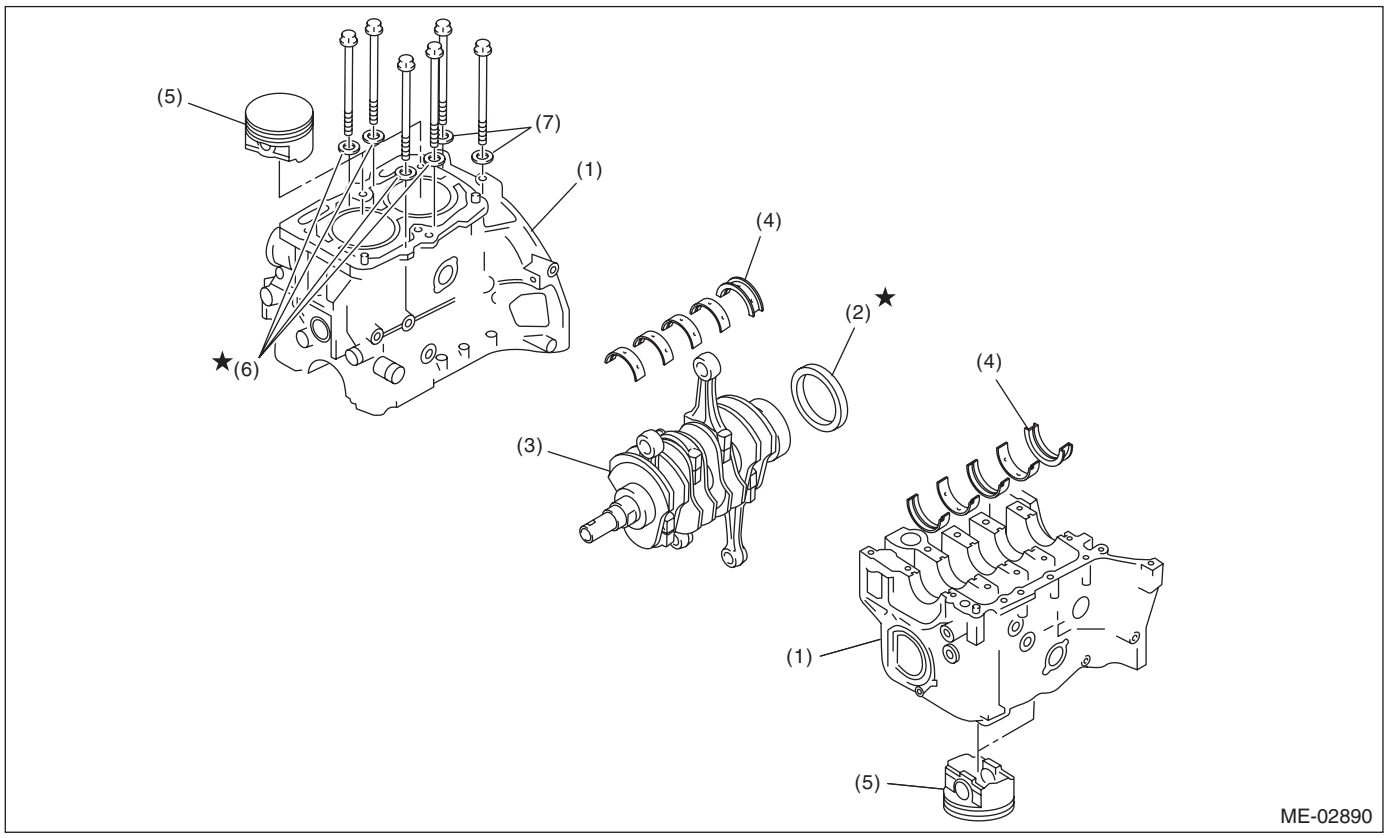
NOTE:
Be careful not to confuse the original combination of piston, piston pin and cylinder.



27) Similarly draw out the piston pins from #3 and #4 pistons.
28) Remove the cylinder block connecting bolt on the RH side.
29) Loosen the cylinder block connecting bolt on the LH side by 2 to 3 turns.
30) Set the part so that the cylinder block LH is on the upper side, and remove the cylinder block connecting bolt.

31) Separate the cylinder block LH and RH.

NOTE:
When separating the cylinder block, do not allow the connecting rod to fall or damage the cylinder block.



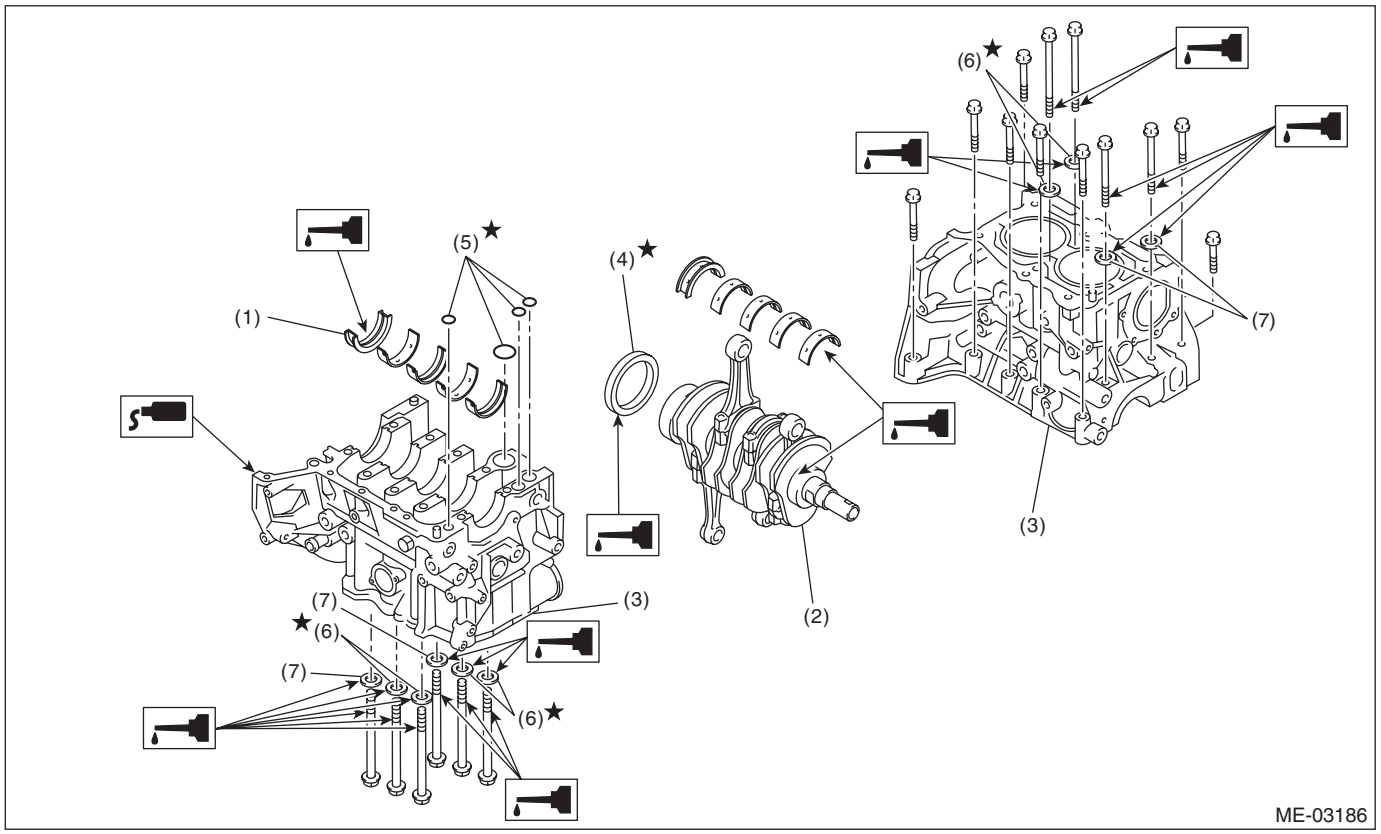
(1) Cylinder block
(2) Rear oil seal
(3) Crankshaft
(4) Crankshaft bearing
(5) Piston
(6) Seal washer
(7) Washer

32) Remove the rear oil seal.
33) Remove the crankshaft along with the connecting rods.
34) Remove the crankshaft bearings from cylinder block using a hammer handle.

NOTE:
• Press the crankshaft bearing at the end opposite to locking lip to remove.
• Be careful not to confuse the crankshaft bearing combination.
35) Remove each piston from the cylinder block using a wooden bar or hammer handle.

NOTE:
Be careful not to confuse the original combination of piston and cylinder.

B: INSTALLATION



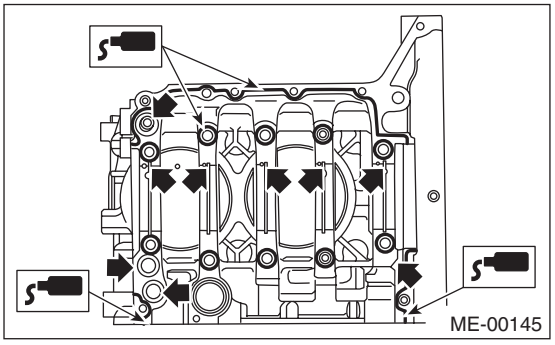
(1) Crankshaft bearing
(2) Crankshaft
(3) Cylinder block
(4) Rear oil seal
(5) O-ring
(6) Seal washer
(7) Washer

1) Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.
2) Position the crankshaft and O-ring on cylinder block RH.

NOTE:
Use new O-rings.
3) Apply liquid gasket to the mating surfaces of cylinder block RH, and position cylinder block LH.

NOTE:
- Install within 5 min. after applying liquid gasket.
- Do not allow liquid gasket to jut into O-ring grooves, oil passages, bearing grooves, etc.

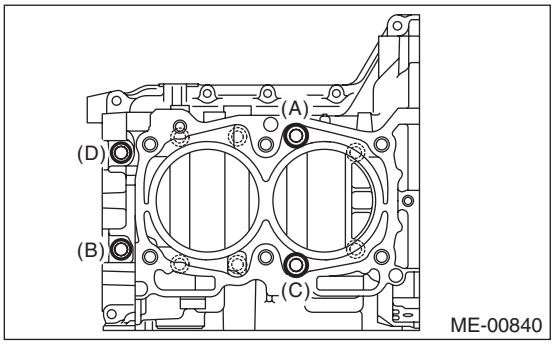
Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



4) Apply a coat of engine oil to the washer and bolt thread.

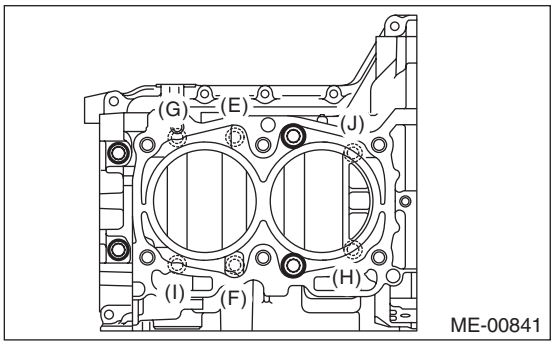
NOTE:
Use a new seal washer.
5) Tighten the 10 mm cylinder block connecting bolts on the LH side (A — D) in alphabetical order.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



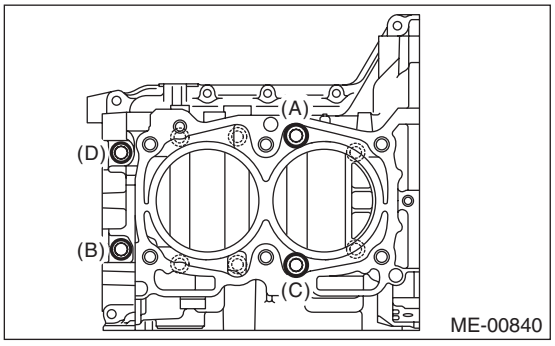
6) Tighten the 10 mm cylinder block connecting bolts on the RH side (E — J) in alphabetical order.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



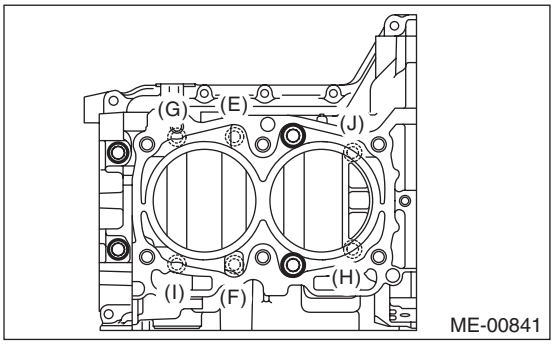
7) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



8) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

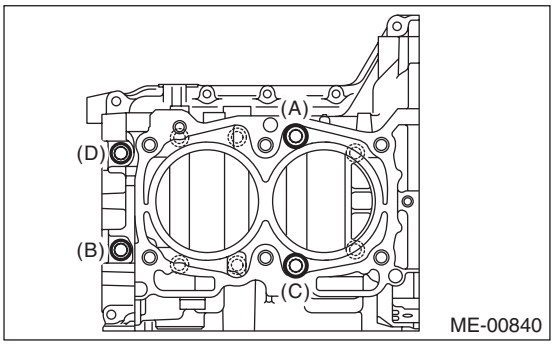
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)



9) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.
- (A), (C): Angle tightening

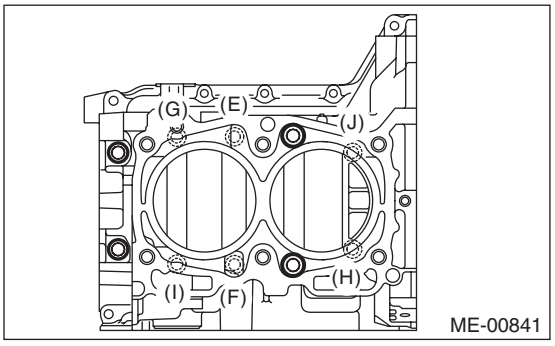
Tightening angle:
90°
- (B), (D): Torque tightening

Tightening torque:
40 N·m (4.1 kgf-m, 29.5 ft-lb)



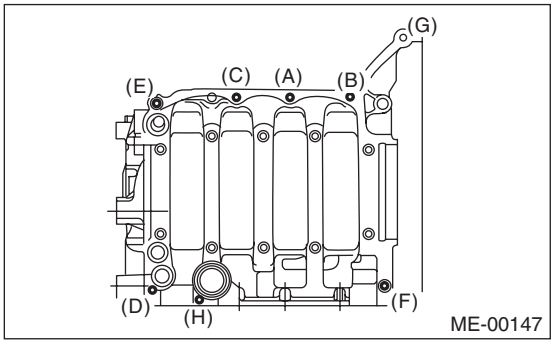
10) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

Tightening angle:
90°



11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on the LH side (A — H) in alphabetical order.

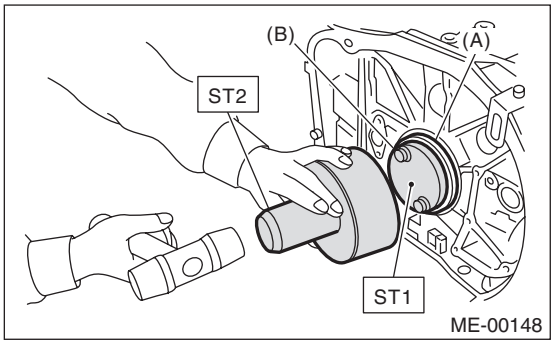
Tightening torque:
(A) — (G): 25 N·m (2.5 kgf-m, 18.4 ft-lb)
(H): 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



12) Apply a coat of engine oil to the oil seal periphery and install the rear oil seal using ST1 and ST2.

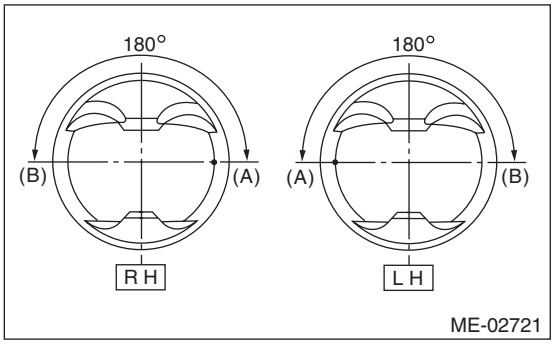
NOTE:
Use a new rear oil seal.

ST1	499597100	CRANKSHAFT OIL SEAL GUIDE
ST2	499587200	CRANKSHAFT OIL SEAL INSTALLER

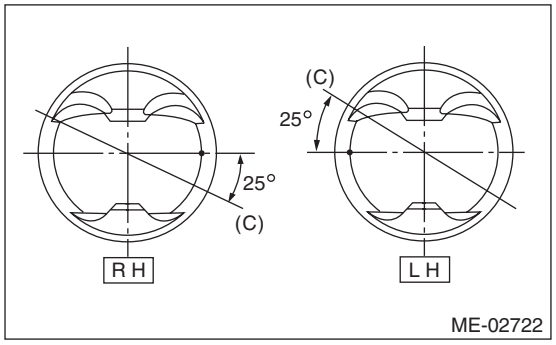


(A) Rear oil seal
(B) Flywheel attaching bolt

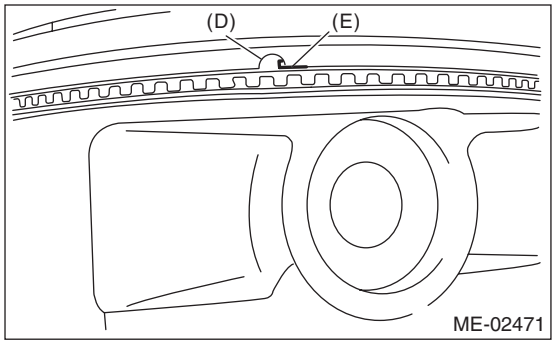
13) Position the top ring gap at (A) or (B) in the figure.
14) Position the second ring gap at 180° on the reverse side the top ring gap.



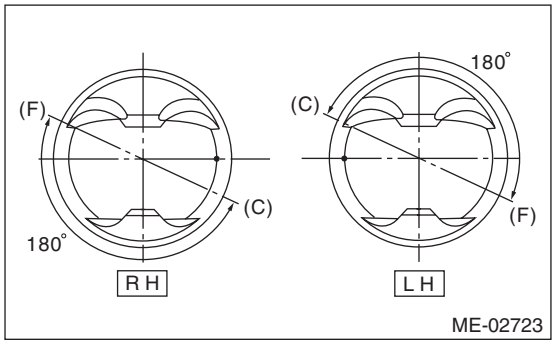
15) Position the upper rail gap at (C) in the figure.



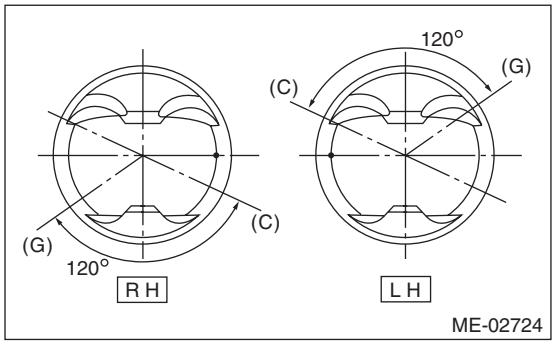
16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



17) Position the expander gap at (F) on the 180° opposite direction of (C) in the figure.



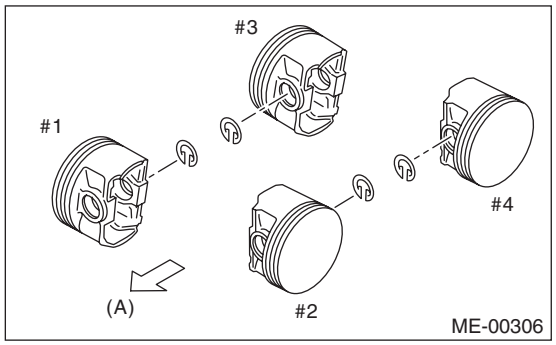
18) Set the lower rail gap at position (G), located 120° clockwise from (C).



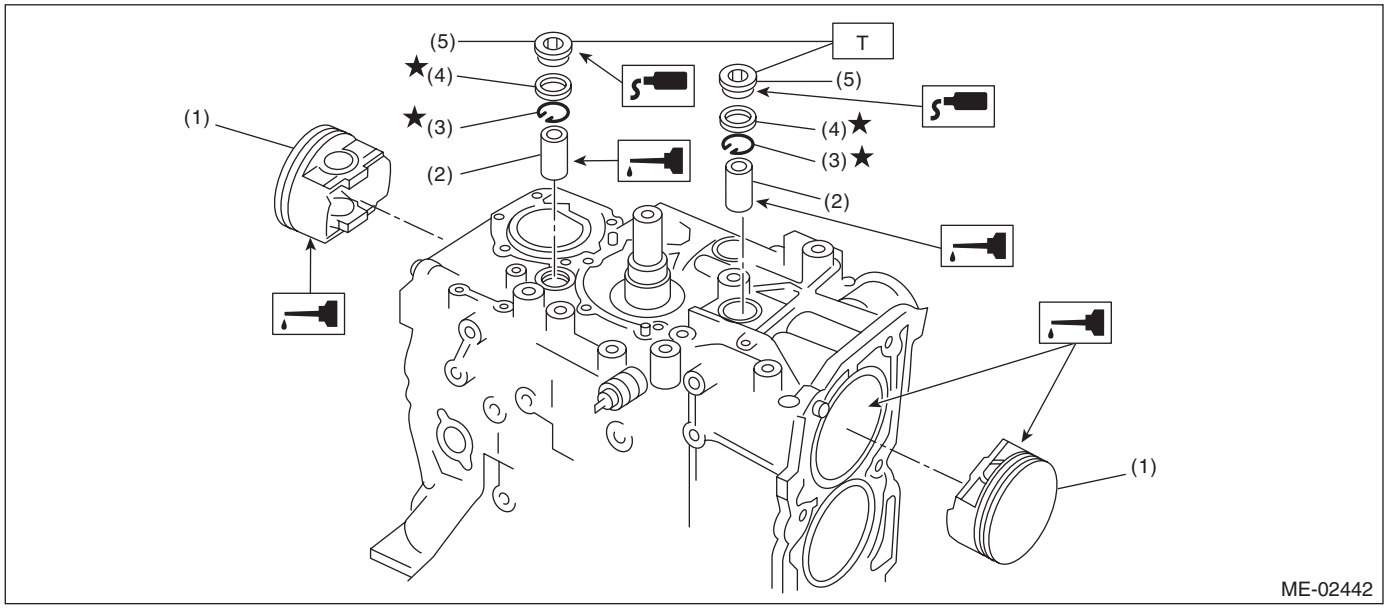
NOTE:
• Make sure ring gaps do not face the same direction.
• Make sure ring gaps are not within the piston skirt area.

19) Install the snap ring.
Before positioning the piston on the cylinder block, attach the snap ring in the service hole of the cylinder block, and the piston hole on the opposite side.

NOTE:
Use new snap rings.



(A) Front side



(1) Piston
(2) Piston pin
(3) Snap ring
(4) Gasket
(5) Service hole plug

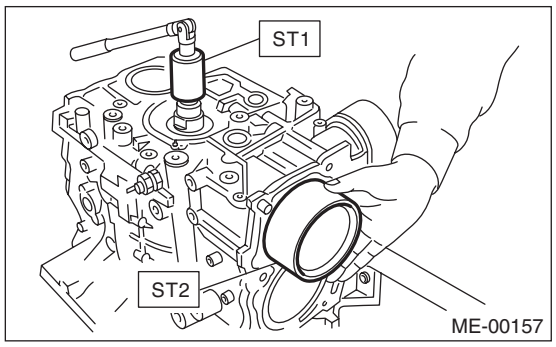
Tightening torque: N·m (kgf-m, ft-lb)
T: 70 (7.1, 51.6)

20) Install the piston.
(1) Set the parts so that the #1 and #2 cylinders are on the upper side.
(2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

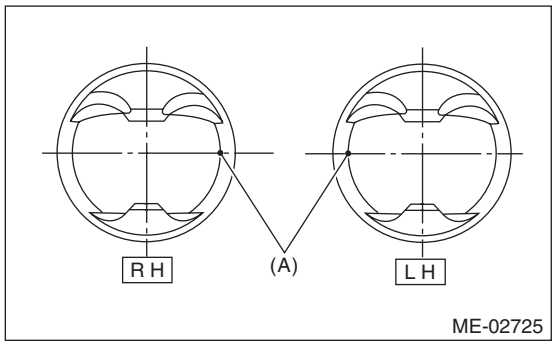
ST1 499987500 CRANKSHAFT SOCKET

(3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



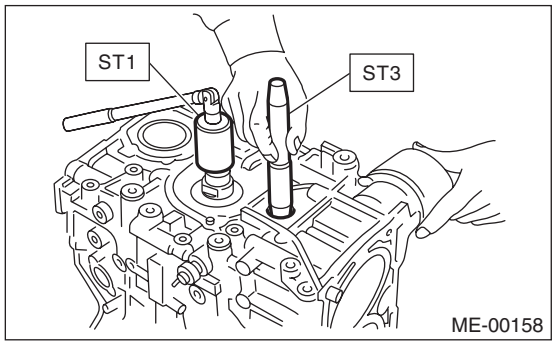
NOTE:
Face the piston front mark towards the front of the engine.



(A) Front mark

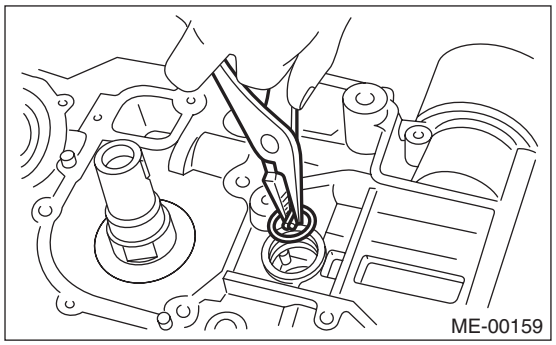
21) Install the piston pin.
(1) Apply a coat of engine oil to ST3.
(2) Insert ST3 into the service hole to align piston pin hole with connecting rod small end.

ST3 499017100 PISTON PIN GUIDE



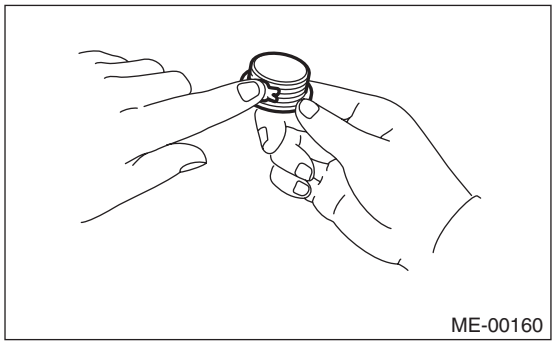
(3) Apply a coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.
(4) Install the snap ring.

NOTE:
Use new snap rings.



(5) Apply liquid gasket to the threaded portion of the service hole plug.

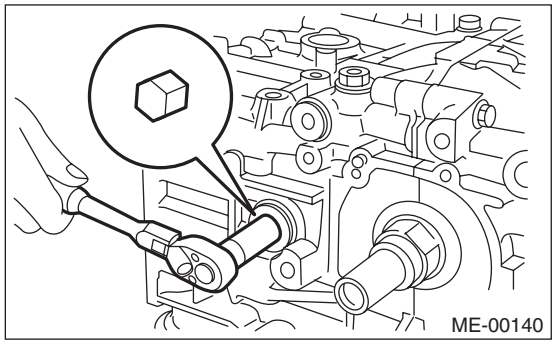
Liquid gasket:
THREE BOND 1105 (Part No. 004403010) or equivalent

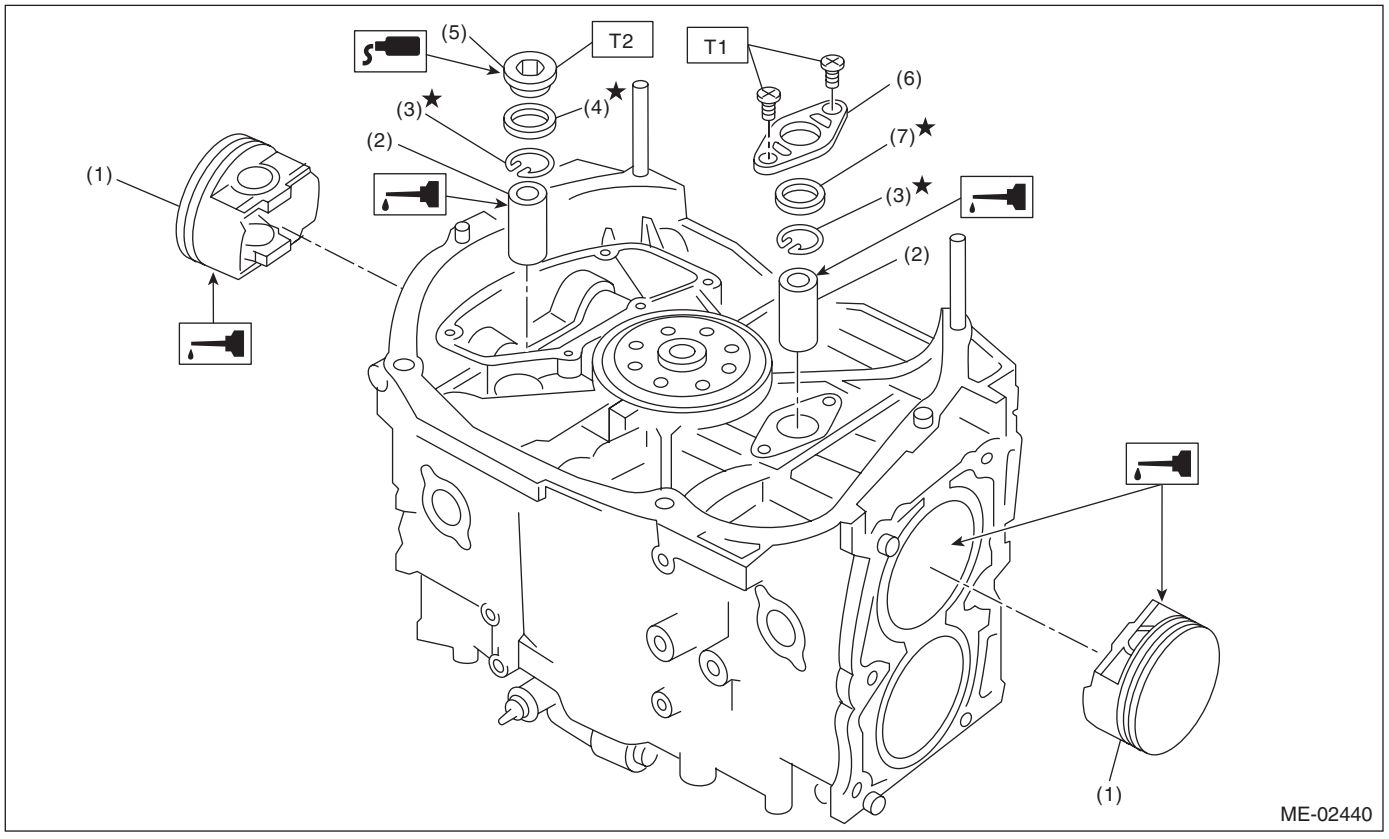


(6) Install the service hole plug and gasket.

NOTE:
Use a new gasket.

Tightening torque:
70 N·m (7.1 kgf-m, 51.6 ft-lb)





(1) Piston
(2) Piston pin
(3) Snap ring
(4) Gasket
(5) Service hole plug
(6) Service hole cover
(7) O-ring

Tightening torque: N·m (kgf-m, ft-lb)	
T1:	***6.4 (0.7, 4.7)***
T2:	***70 (7.1, 51.6)***

(7) Set the parts so that the #3 and #4 cylinders are on the upper side. Following the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.
(8) Install the service hole cover.

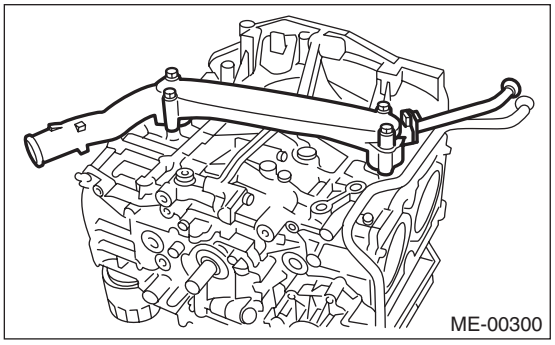
NOTE:
Use new O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

22) Install the water pipe assembly.

NOTE:
Use new O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



23) Install the baffle plate.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

24) Install the oil strainer.

NOTE:
Use new O-rings.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

25) Tighten the oil strainer stay together with the baffle plate.

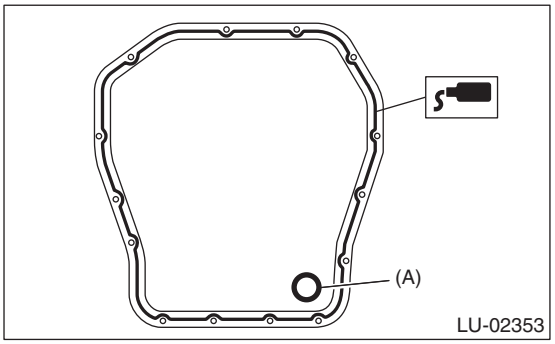
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

26) Apply liquid gasket to the mating surfaces of oil pan, and install the oil pan.

NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



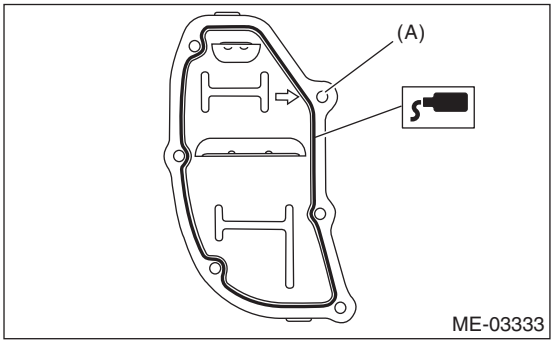
(A) Gasket

27) Apply liquid gasket to the mating surfaces of the oil separator cover and the threaded portion of bolt (A) shown in the figure (when reusing the bolt), and then install the oil separator cover.

NOTE:
- Install within 5 min. after applying liquid gasket.
- Use new oil separator cover.

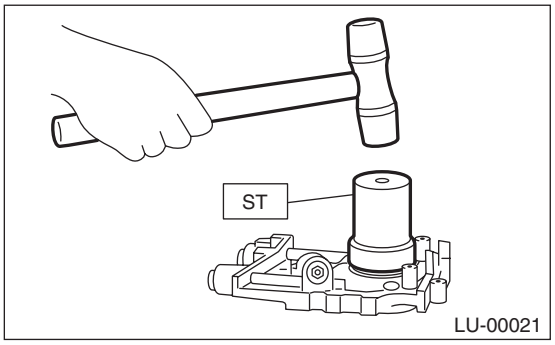
Liquid gasket:
- ***Mating surface***
  THREE BOND 1217G (Part No. K0877Y0100) or equivalent
- ***(A) bolt thread (when reusing bolts)***
  THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



28) Install the drive plate. (AT model) <Ref. to 4AT-68, INSTALLATION, Drive Plate.>
29) Install the flywheel. (MT model) <Ref. to CL-12, INSTALLATION, Flywheel.>
30) Install the clutch disc and cover. (MT model) <Ref. to CL-10, INSTALLATION, Clutch Disc and Cover.>
31) Install the oil pump.
(1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

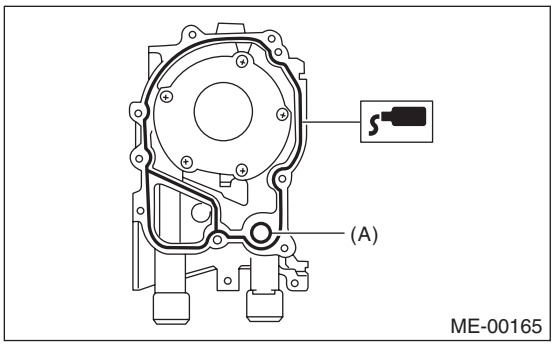
NOTE:
Use a new front oil seal.



(2) Apply liquid gasket to the mating surfaces of oil pump.

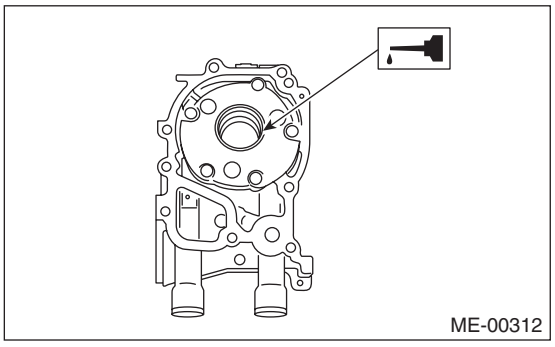
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(A) O-ring

(3) Apply a coat of engine oil to the inside of oil seal.



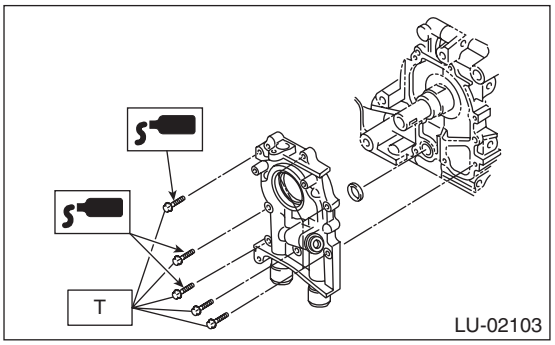
(4) Install the oil pump to cylinder block. Be careful not to damage the oil seal during installation.

NOTE:
- Make sure the oil seal lip is not folded.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.
- Use new O-rings and oil seals.
- Do not forget to assemble O-rings.

(5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing bolts)

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

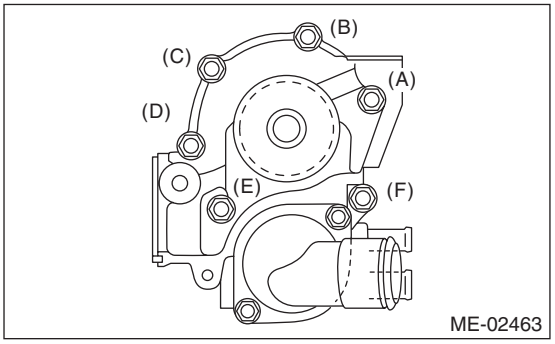
Tightening torque:
T: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



32) Install the water pump and gasket.

NOTE:
- When installing the water pump, tighten bolts in two stages in alphabetical order as shown in the figure.
- Use a new gasket.

Tightening torque:
First: 12 N·m (1.2 kgf-m, 8.9 ft-lb)
Second: 12 N·m (1.2 kgf-m, 8.9 ft-lb)



33) Install the water by-pass pipe for heater.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

34) Install the oil filter.
<Ref. to LU(H4SO)-29, INSTALLATION, Engine Oil Filter.>
35) Install the cylinder head. <Ref. to ME(H4SO)-64, INSTALLATION, Cylinder Head.>
36) Install the generator and A/C compressor with their brackets.

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)

37) Install the crank sprocket. <Ref. to ME(H4SO)-55, INSTALLATION, Crank Sprocket.>
38) Install the timing belt. <Ref. to ME(H4SO)-50, INSTALLATION, Timing Belt.>

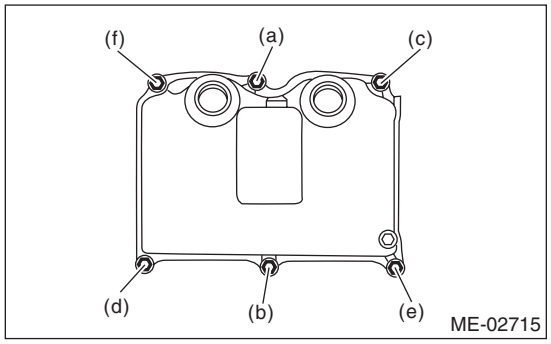
39) Adjust the valve clearance. <Ref. to ME(H4SO)-29, ADJUSTMENT, Valve Clearance.>
40) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover.

NOTE:
Use a new rocker cover gasket.

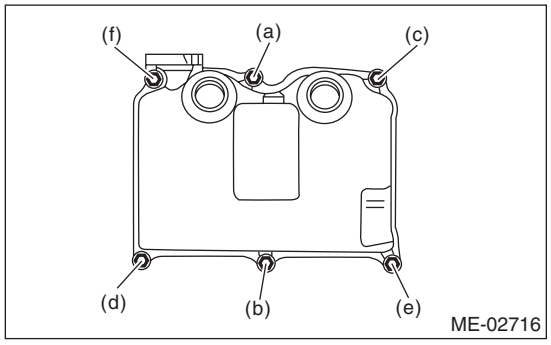
(2) Temporarily tighten the bolts in alphabetical order shown in the figure, tighten them in two stages.

Tightening torque:
1st
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
Second (only (a) and (b) are tightened)
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

RH side

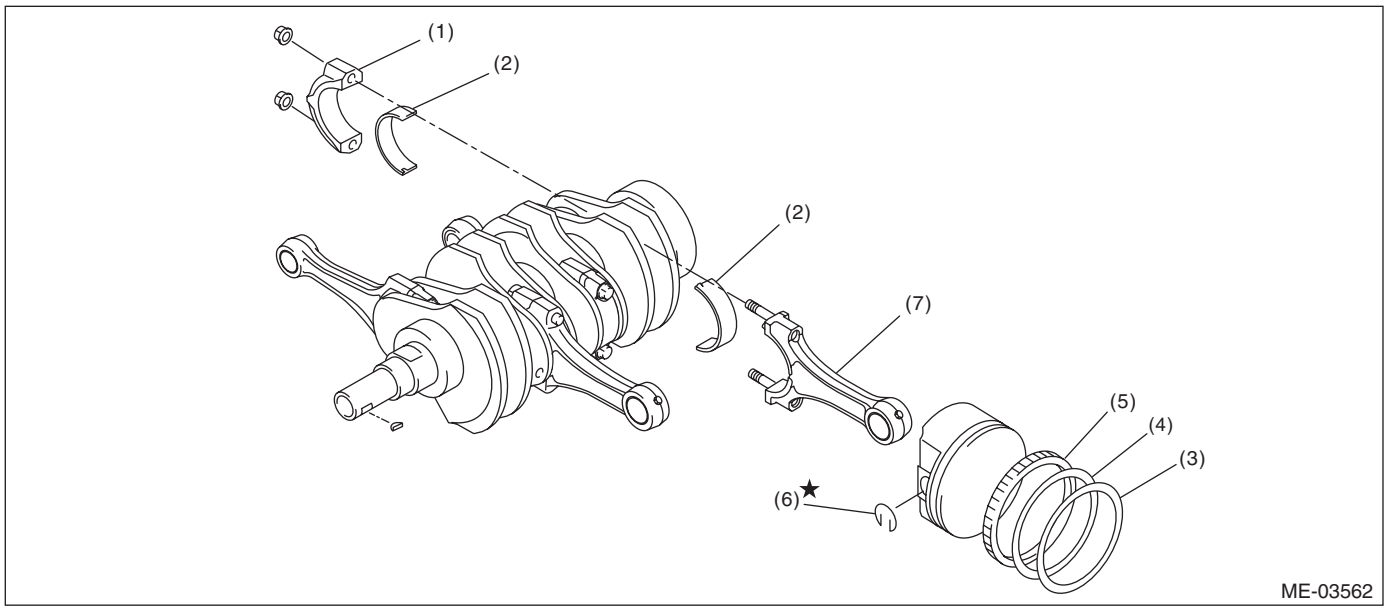


LH side



41) Install the timing belt cover. <Ref. to ME(H4SO)-48, INSTALLATION, Timing Belt Cover.>
42) Install the crank pulley. <Ref. to ME(H4SO)-46, INSTALLATION, Crank Pulley.>
43) Install the intake manifold. <Ref. to FU(H4SO)-18, INSTALLATION, Intake Manifold.>
44) Install the V-belts. <Ref. to ME(H4SO)-39, INSTALLATION, V-belt.>

C: DISASSEMBLY



(1) Connecting rod cap
(2) Connecting rod bearing
(3) Top ring
(4) Second ring
(5) Oil ring
(6) Snap ring
(7) Connecting rod

1) Remove the connecting rod cap.
2) Remove the connecting rod bearing.

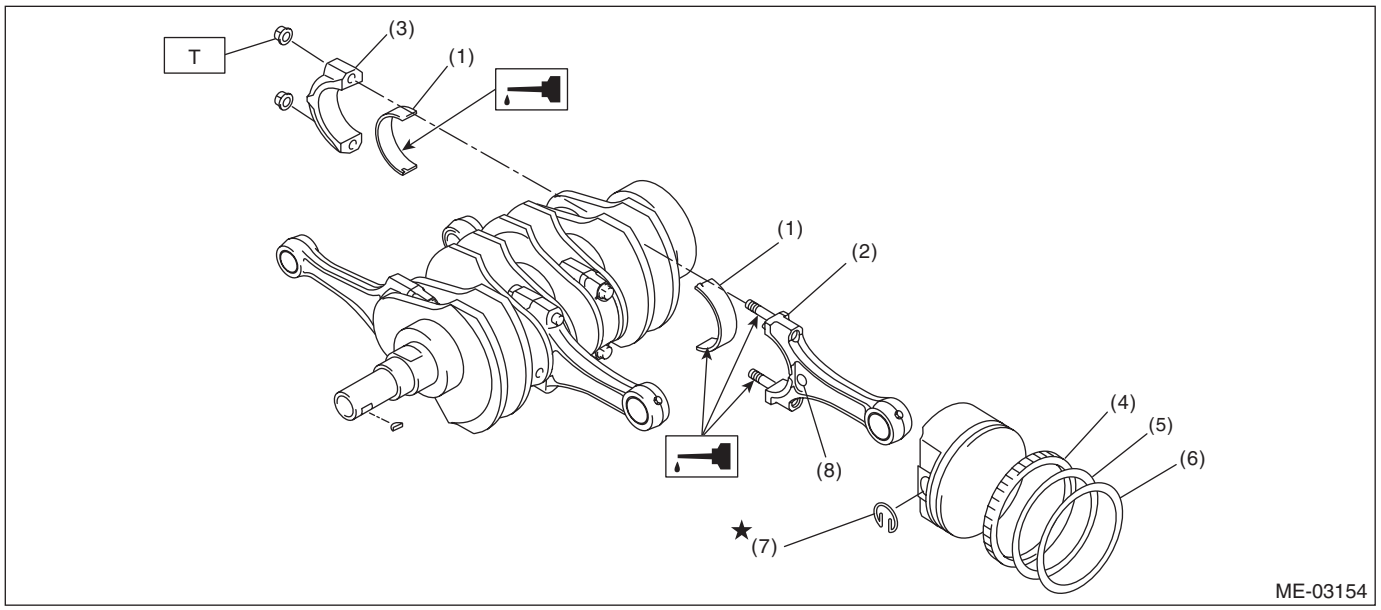
NOTE:
Keep the removed connecting rods, connecting rod caps and bearings in order so that they are kept in their original combinations/groups, and not mixed together.

3) Remove the piston rings using piston ring expander.
4) Remove the oil ring by hand.

NOTE:
Arrange the removed piston rings in proper order, to prevent confusion.

5) Remove the snap ring.

D: ASSEMBLY



(1) Connecting rod bearing
(2) Connecting rod
(3) Connecting rod cap
(4) Oil ring
(5) Second ring
(6) Top ring
(7) Snap ring
(8) Side mark

Tightening torque: N·m (kgf-m, ft-lb)
T: 45 (4.6, 33.2)

1) Apply engine oil to the surface of the connecting rod bearings, and install the connecting rod bearings on connecting rods and connecting rod caps.
2) Position each connecting rod with the side with a side mark facing forward, and install it.
3) Attach the connecting rod cap, and tighten with connecting rod nut.
Make sure the arrow on connecting rod cap faces the front during installation.

NOTE:
• 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.

Tightening torque:
45 N·m (4.6 kgf-m, 33.2 ft-lb)
4) Install the oil ring upper rail, expander and lower rail by hand.
5) Install the second ring and top ring using piston ring expander.

NOTE:
Assemble so that the piston ring mark “R” faces the top side of the piston.

E: INSPECTION

1. CYLINDER BLOCK

1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
2) Check the oil passages for clogging.
3) Inspect the cylinder head surface that mates with cylinder block for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:
0.025 mm (0.00098 in)

Grinding limit:
0.1 mm (0.004 in)

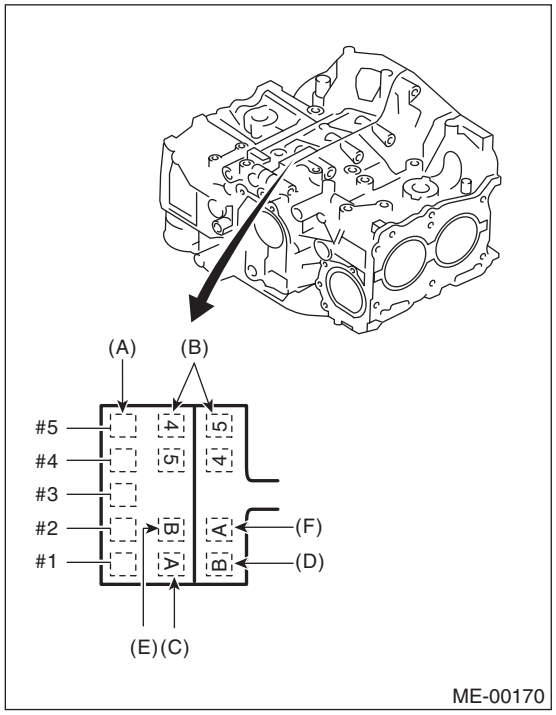
Standard height of cylinder block:
201.0 mm (7.91 in)

2. CYLINDER AND PISTON

1) The cylinder bore size is stamped on the front upper face of the cylinder block.

NOTE:
• Measurement should be performed at a temperature of 20°C (68°F).
• Standard sized pistons are classified into two grades, “A” and “B”. These grades should be used as guide lines 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)



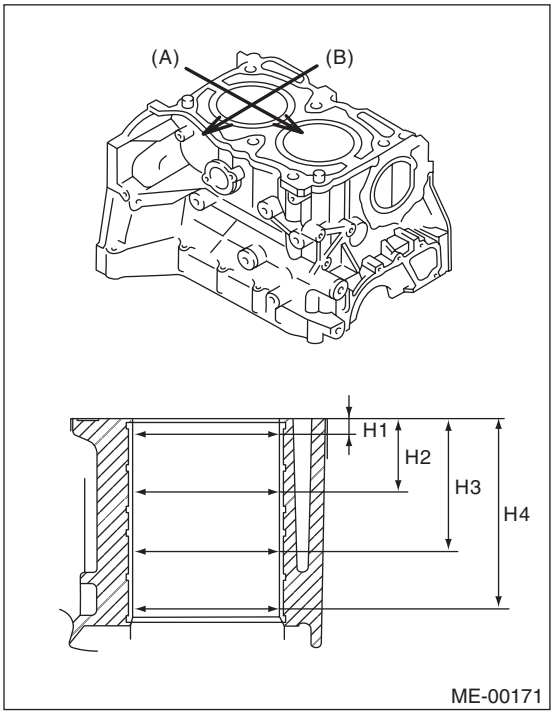
(A) Main journal size mark
(B) Cylinder block (RH) — (LH) combination mark
(C) #1 cylinder bore size mark
(D) #2 cylinder bore size mark
(E) #3 cylinder bore size mark
(F) #4 cylinder bore size mark

2) Measure inner diameter of each cylinder.
Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights as 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)

Out-of-roundness:
Standard:
0.010 mm (0.0004 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, select a suitable sized piston by measuring the piston clearance.
4) Measure outer diameter of each piston.
Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

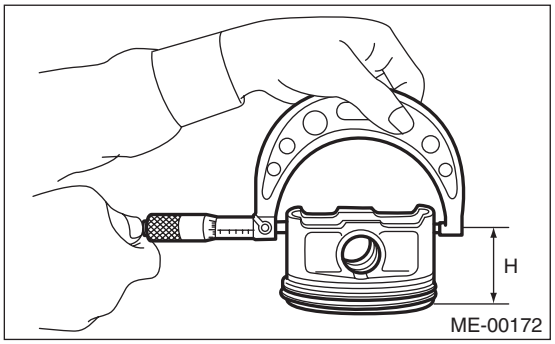
Piston grade point H:
38.2 mm (1.504 in)

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 — 3.9277 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 (–0.00039 — 0.00039 in)

6) Boring and honing
(1) If any of the measured value of taper, out-of-roundness or cylinder-to-piston clearance is out of standard or if there is any damage on the cylinder wall, rebore it to replace with an oversize piston.

CAUTION:
When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and replaced with oversize pistons.

(2) If the cylinder inner diameter exceeds the limit after boring and honing, replace the cylinder block.

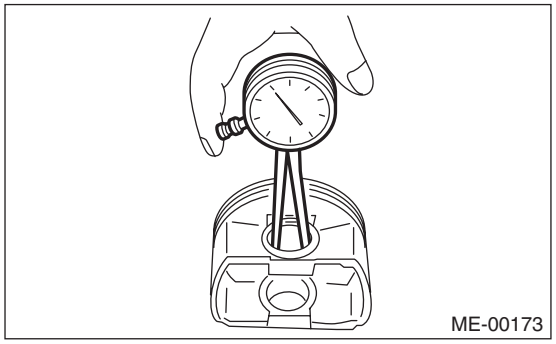
NOTE:
Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, when measuring the cylinder diameter, wait until it has cooled to room temperature.

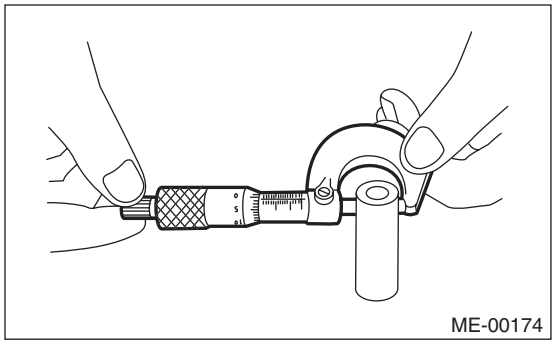
Cylinder inner diameter boring limit:
To 100.005 mm (3.9372 in)

3. PISTON AND PISTON PIN

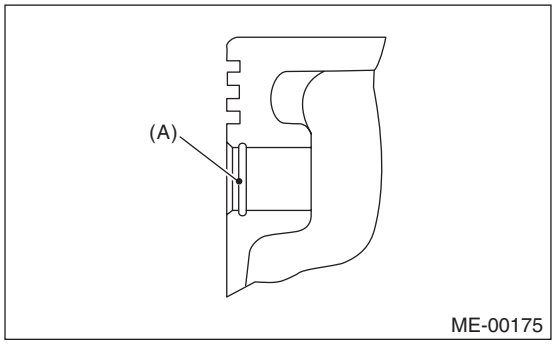
1) Check the piston and piston pin for damage, cracks or wear. Replace if faulty.
2) Check the piston ring groove for wear or damage. Replace if faulty.
3) 20Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if faulty.

Clearance between piston hole and piston pin:
Standard:
0.004 — 0.008 mm (0.0002 — 0.0003 in)





4) Check the snap ring installation groove (A) on the piston for burr. If necessary, remove burr from the groove so that the piston pin can lightly move.



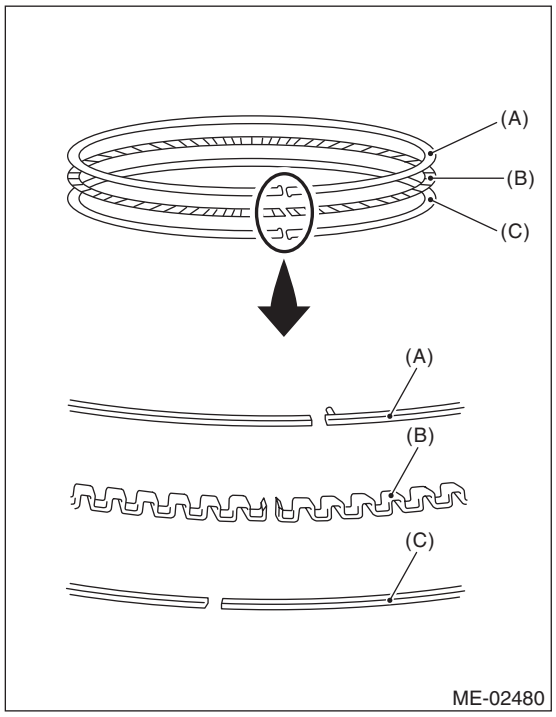
5) Check the piston pin snap ring for distortion, cracks and wear.

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 part of the same size as piston.

NOTE:
• The top ring and second ring have the mark to determine the direction for installing. When installing the ring to piston, face marks to the top side.

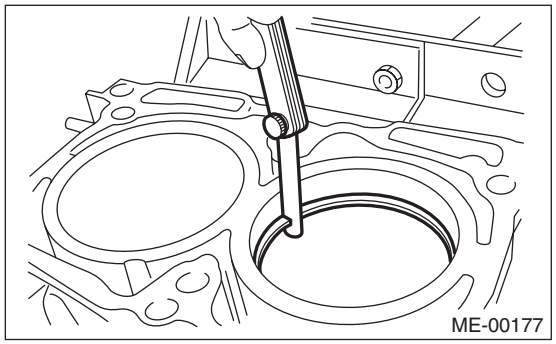
• Oil ring consists of the upper rail, expander and lower rail. When installing oil ring on piston, be careful of the direction of each rail.



(A) Upper rail
(B) Expander
(C) Lower rail

2) Using the piston, insert the piston ring and oil ring into the cylinder so that they are perpendicular to the cylinder wall, and measure the piston ring gap with a thickness gauge.

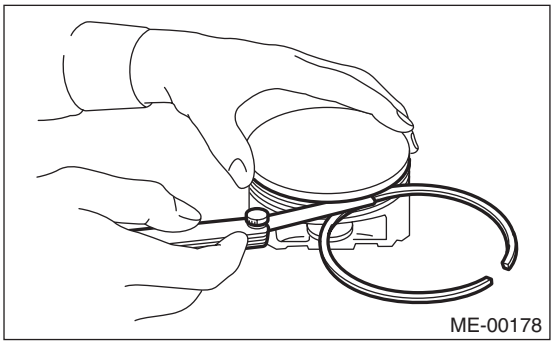
		Standard mm (in)
Piston ring gap	Top ring	0.20 — 0.35 (0.0079 — 0.0138)
	Second ring	0.37 — 0.52 (0.0146 — 0.0205)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)



3) Fit the piston ring straight into the piston ring groove, then 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.

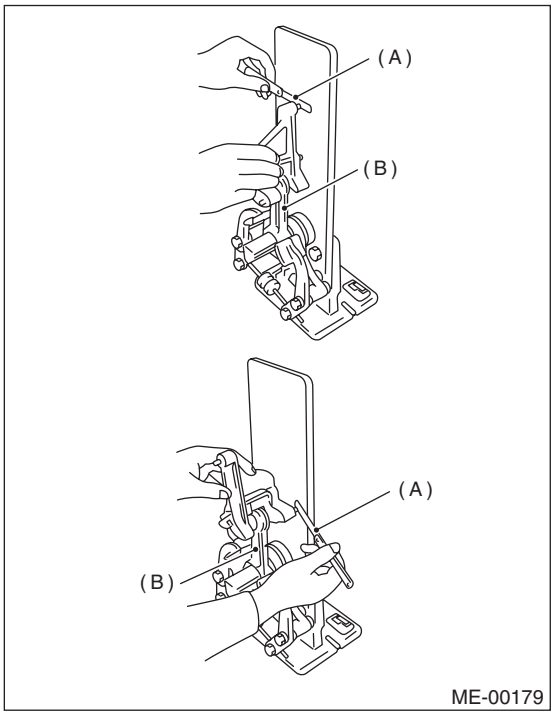
		Standard mm (in)
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)



5. CONNECTING ROD

1) Replace the connecting rod, if the large or small end thrust surface is damaged.
2) Check for bend or twist using a connecting rod aligner. Replace the connecting rod if the bend or twist exceeds the limit.

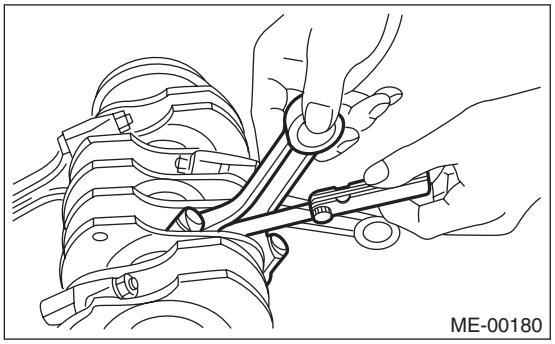
Limit of bend or twist per 100 mm (3.94 in) in length:
0.10 mm (0.0039 in)



(A) Thickness gauge
(B) Connecting rod

3) Install the connecting rod with bearings attached to the crankshaft, and measure the thrust clearance using a thickness gauge. If the thrust clearance exceeds the standard or uneven wear is found, replace the connecting rod.

Connecting rod thrust clearance:
Standard:
0.070 — 0.330 mm (0.0028 — 0.0130 in)



4) Inspect the connecting rod bearing for scar, peeling, seizure, melting, wear, etc.
5) Measure the oil clearance on each connecting rod bearing using plastigauge. If any oil clearance is not within the standard, replace the defective bearing with a new part of standard size or undersize as necessary.

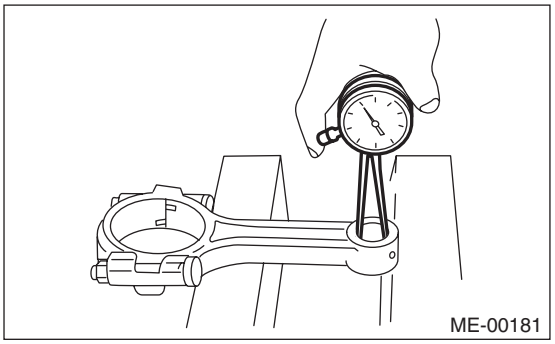
Connecting rod oil clearance:
Standard:
0.016 — 0.044 mm (0.0006 — 0.0017 in)

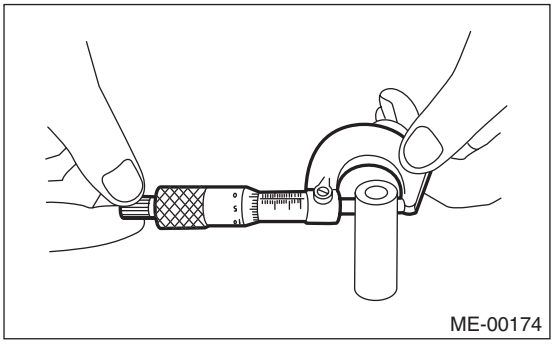
Unit: mm (in)

Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.492 — 1.501 (0.0587 — 0.0591)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) Undersize	1.510 — 1.513 (0.0594 — 0.0596)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) Undersize	1.520 — 1.523 (0.0598 — 0.0600)	51.934 — 51.950 (2.0446 — 2.0453)
0.25 (0.0098) Undersize	1.620 — 1.623 (0.0638 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

6) Inspect the bushing at connecting rod small end, and replace with a new part if worn or damaged.
7) Measure the piston pin clearance at connecting rod small end. If the measured value is not within the standard, replace it with a new part.

Clearance between piston pin and bushing:
Standard:
0 — 0.022 mm (0 — 0.0009 in)

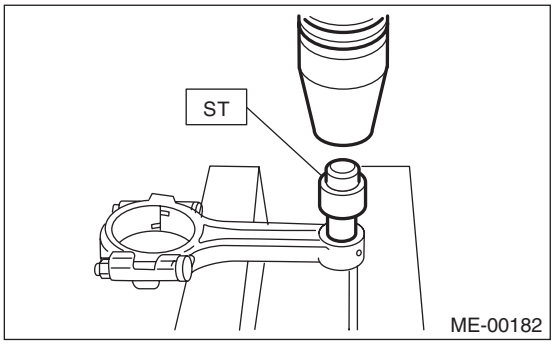




8) The replacement procedure for the connecting rod small end bushing is as follows.
(1) Remove the bushing from connecting rod with ST and press.

(2) Press the bushing with the ST after applying oil on the periphery of new bushing.

ST 499037100 CONNECTING ROD BUSHING REMOVER AND INSTALLER



(3) Make two 3 mm (0.12 in) holes in the pressed bushing to match the pre-manufactured holes on the connecting rod, then ream the inside of the bushing.

(4) After completion of reaming, clean the bushing to remove chips.

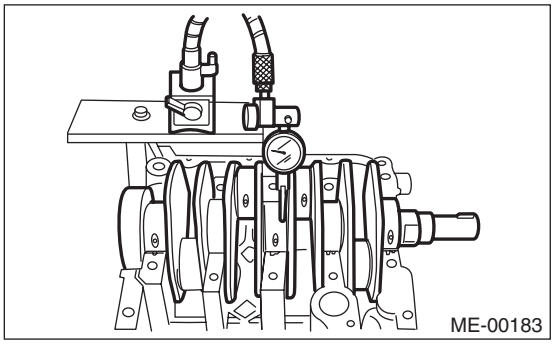
6. CRANKSHAFT AND CRANKSHAFT BEARING

1) Clean the crankshaft completely, and check it for cracks using liquid penetrant tester. If defective, replace the crankshaft.

2) Measure warping of the crankshaft. If it exceeds the limit, correct or replace it.

NOTE:
If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.

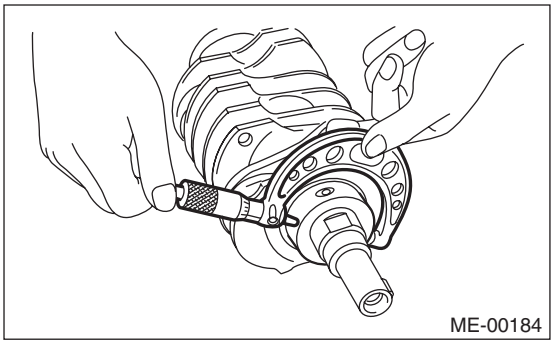
Crankshaft bend limit:
0.035 mm (0.0014 in)



3) Inspect the crank journal and crank pin for wear. If they are not within the standard, replace the bearing with a suitable (undersize) one, and replace or grind to correct the crankshaft as necessary. When grinding the crank journal or crank pin, finish them to the 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 (dia.)
To 51.750 mm (2.0374 in)

Crank journal
Out-of-roundness
0.005 mm (0.0002 in)
Cylindricality
0.006 mm (0.0002 in)
Grinding limit (dia.)
To 59.758 mm (2.3527 in)

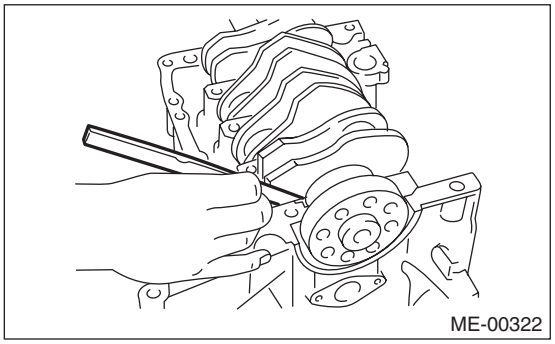


Unit: mm (in)

		Crank journal outer 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)	1.492 — 1.501 (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)	1.510 — 1.513 (0.0594 — 0.0596)
0.05 (0.0020) Undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0446 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.520 — 1.523 (0.0598 — 0.0600)
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)	1.620 — 1.623 (0.0638 — 0.0639)

4) Use a thickness gauge to measure the thrust clearance of crankshaft at #5 crank journal bearing. If clearance exceeds the standard, replace the bearing.

Crankshaft thrust clearance:
Standard:
0.030 — 0.115 mm (0.0012 — 0.0045 in)


ME-00322

5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting and wear.
6) Measure the oil clearance on each crankshaft bearing using plastigauge. If the measured value is out of standard, replace the defective bearing with an undersize one, and replace or grind to correct the crankshaft as necessary.

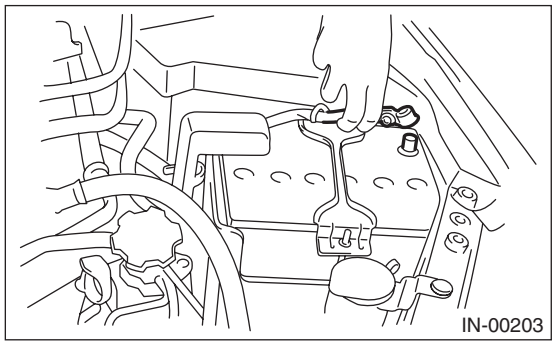
Crankshaft oil clearance:
Standard:
0.010 — 0.030 mm (0.0004 — 0.0012 in)

22.Oil Switching Solenoid Valve

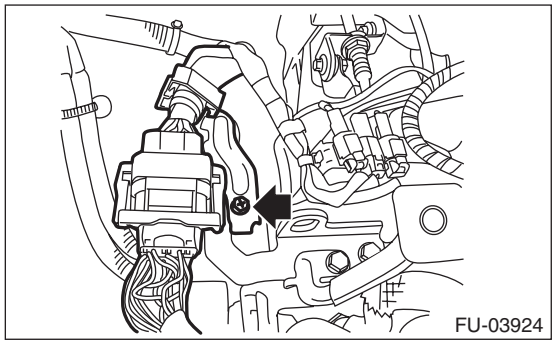
A: REMOVAL

1. RH SIDE

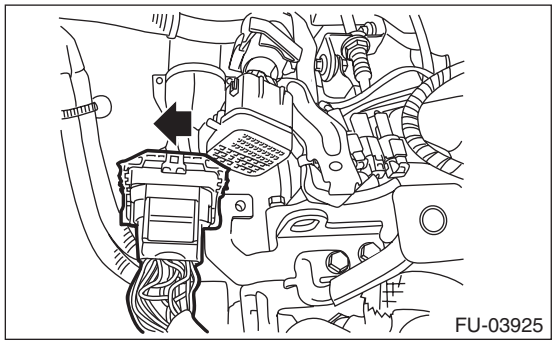
1) Disconnect the ground cable from battery.



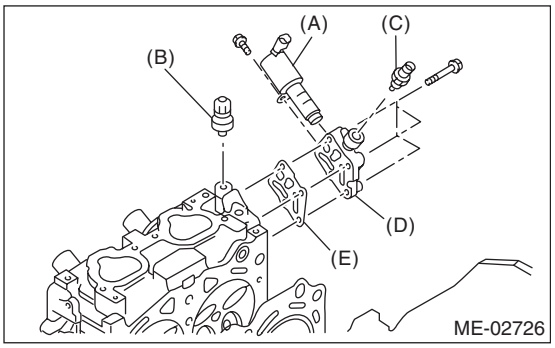
2) Remove the air intake chamber. <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
3) Remove the bolt, and disconnect the engine harness connector from the bulkhead harness connector and rear engine hanger.



4) Slide the bulkhead harness connector in the direction of the arrow and remove it from the rear engine hanger.



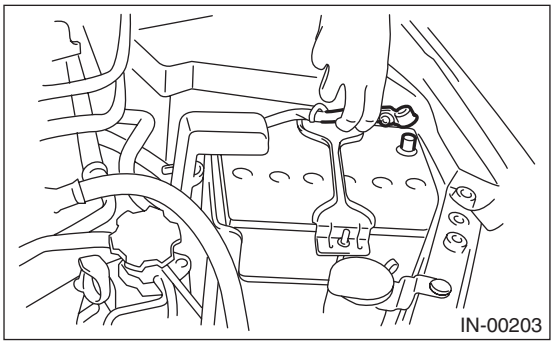
5) Disconnect the connector from the oil switching solenoid valve.
6) Remove the oil switching solenoid valve.
7) Remove the variable valve lift diagnosis oil pressure switch. <Ref. to FU(H4SO)-39, REMOVAL, Variable Valve Lift Diagnosis Oil Pressure Switch.>
8) Remove the oil temperature sensor. <Ref. to FU(H4SO)-40, REMOVAL, Oil Temperature Sensor.>
9) Remove the oil switching solenoid valve holder from the cylinder head.



(A) Oil switching solenoid valve
(B) Variable valve lift diagnosis oil pressure switch
(C) Oil temperature sensor
(D) Oil switching solenoid valve holder
(E) Gasket

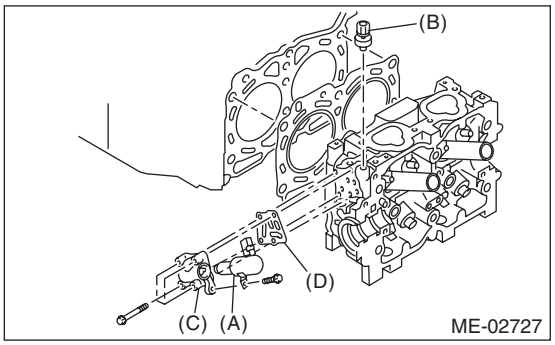
2. LH SIDE

1) Disconnect the ground cable from battery.



2) Remove the V-belts. <Ref. to ME(H4SO)-39, REMOVAL, V-belt.>
3) Remove the crank pulley. <Ref. to ME(H4SO)-46, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(H4SO)-48, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(H4SO)-49, REMOVAL, Timing Belt.>
6) Remove the cam sprocket. <Ref. to ME(H4SO)-54, REMOVAL, Cam Sprocket.>
7) Remove the timing belt cover No. 2 (LH).
8) Disconnect the connector from the oil switching solenoid valve.
9) Remove the oil switching solenoid valve.
10) Remove the variable valve lift diagnosis oil pressure switch. <Ref. to FU(H4SO)-39, REMOVAL, Variable Valve Lift Diagnosis Oil Pressure Switch.>

11) Remove the oil switching solenoid valve holder from the cylinder head.



(A) Oil switching solenoid valve
(B) Variable valve lift diagnosis oil pressure switch
(C) Oil switching solenoid valve holder
(D) Gasket

B: INSTALLATION

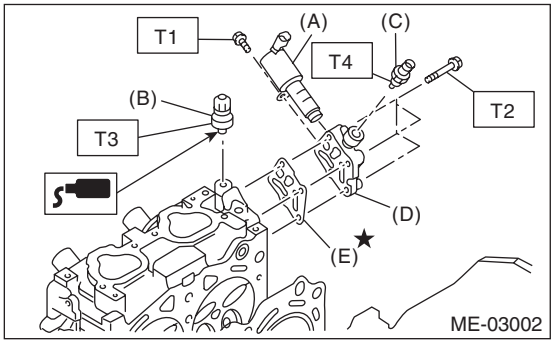
1. RH SIDE

Install in the reverse order of removal.

NOTE:
• Use a new gasket.
• Apply liquid gasket to variable valve lift diagnosis oil pressure switch threads.
• Install the oil switching solenoid valve to the holder, then install it to the cylinder head.

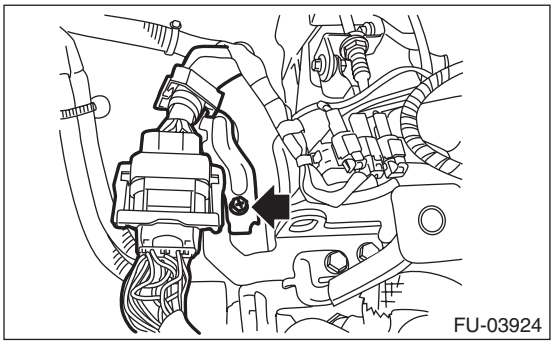
Tightening torque:
T1: 8 N·m (0.8 kgf-m, 5.9 ft-lb)
T2: 10 N·m (1.0 kgf-m, 7.4 ft-lb)
T3: 17 N·m (1.7 kgf-m, 12.5 ft-lb)
T4: 18 N·m (1.8 kgf-m, 13.3 ft-lb)

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent



(A) Oil switching solenoid valve
(B) Variable valve lift diagnosis oil pressure switch
(C) Oil temperature sensor
(D) Oil switching solenoid valve holder
(E) Gasket

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



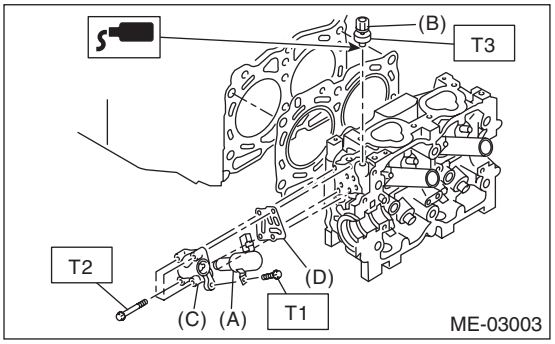
2. LH SIDE

Install in the reverse order of removal.

NOTE:
• Use a new gasket.
• Apply liquid gasket to variable valve lift diagnosis oil pressure switch threads.
• Install the oil switching solenoid valve to the holder, then install it to the cylinder head.

Tightening torque:
T1: 8 N·m (0.8 kgf-m, 5.9 ft-lb)
T2: 10 N·m (1.0 kgf-m, 7.4 ft-lb)
T3: 17 N·m (1.7 kgf-m, 12.5 ft-lb)

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent



(A) Oil switching solenoid valve
(B) Variable valve lift diagnosis oil pressure switch
(C) Oil switching solenoid valve holder
(D) Gasket

23.Intake and Exhaust Valve

A: SPECIFICATION

Refer to “Cylinder Head” for removal and installation procedures of the intake and exhaust valves. <Ref. to ME(H4SO)-63, REMOVAL, Cylinder Head.> <Ref. to ME(H4SO)-64, INSTALLATION, Cylinder Head.>

24.Piston

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of pistons. <Ref. to ME(H4SO)-72, REMOVAL, Cylinder Block.> <Ref. to ME(H4SO)-76, INSTALLATION, Cylinder Block.>

25.Connecting Rod

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of connecting rod. <Ref. to ME(H4SO)-72, REMOVAL, Cylinder Block.> <Ref. to ME(H4SO)-76, INSTALLATION, Cylinder Block.>

26.Crankshaft

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of the crankshaft. <Ref. to ME(H4SO)-72, REMOVAL, Cylinder Block.> <Ref. to ME(H4SO)-76, INSTALLATION, Cylinder Block.>

27.Engine Trouble in General

A: INSPECTION

NOTE:
The “RANK” shown in the chart shows the possibilities of the cause of trouble in order from “Very often” to “Rarely”.
A — Very often
B — Sometimes
C — Rarely

Symptoms	Problem parts etc.	Possible cause	RANK
1. Engine does not start.			
1) Starter does not turn.	Starter	Defective battery-to-starter harness	B
		Defective starter switch	C
		Defective inhibitor switch	C
		Defective starter	B
	Battery	Improper connection of terminal	A
		Run-down battery	A
		Defective charging system	B
	Friction	Seizure of crankshaft and connecting rod bearing	C
		Seized camshaft	C
		Seized or stuck piston and cylinder	C
2) Initial combustion does not occur.	Starter	Defective starter	C
	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Fuel line	Defective fuel pump and relay	A
		Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	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

Symptoms	Problem parts etc.	Possible cause	RANK
3) Initial combustion occurs.	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Defective intake manifold gasket	B
		Defective throttle body gasket	B
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	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
4) Engine stalls after initial combustion.	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	B
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	C
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Dirty air cleaner element	C
	Fuel line	Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing belt	Degradation, etc.	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	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

Symptoms	Problem parts etc.	Possible cause	RANK
2. Rough idle and engine stall	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	C
		Loosened oil filler cap	B
		Dirty air cleaner element	C
	Fuel line	Defective fuel pump and relay	C
		Clogged fuel line	C
		Lack of fuel or insufficient fuel	B
	Timing belt	Defective timing	C
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective cylinder head gasket	B
		Improper valve sealing	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	Over-heating	C
	Others	Evaporative emission control system malfunction	A
		Stuck or damaged throttle valve	B

Symptoms	Problem parts etc.	Possible cause	RANK
3. Low output, hesitation and poor acceleration	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	B
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	A
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of fuel or insufficient fuel	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective cylinder head gasket	B
		Improper valve sealing	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	Over-heating	C
		Over-cooling	C
	Others	Evaporative emission control system malfunction	A

Symptoms	Problem parts etc.	Possible cause	RANK
4. Surging	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	A
		Loosened or cracked PCV hose	A
		Loosened or cracked vacuum hose	A
		Defective intake manifold gasket	B
		Defective throttle body gasket	B
		Defective PCV valve	B
		Loosened oil filler cap	B
		Dirty air cleaner element	B
	Fuel line	Defective fuel pump and relay	B
		Clogged fuel line	B
		Lack of fuel or insufficient fuel	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	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	Over-heating	B
	Others	Evaporative emission control system malfunction	C
5. Engine does not return to idle.	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked vacuum hose	A
	Others	Stuck or damaged throttle valve	A
6. Dieseling (Run-on)	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Cooling system	Over-heating	B
	Others	Evaporative emission control system malfunction	B
7. After burning in exhaust system	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened or cracked intake duct	C
		Loosened or cracked PCV hose	C
		Loosened or cracked vacuum hose	B
		Defective PCV valve	B
		Loosened oil filler cap	C
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	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	Evaporative emission control system malfunction	C

Symptoms	Problem parts etc.	Possible cause	RANK
8. Knocking	Engine control system <Ref. to EN(H4SO)(diag)-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	Over-heating	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 gasket	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
10. Excessive fuel consumption	Engine control system <Ref. to EN(H4SO)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Dirty air cleaner element	A
	Timing belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective cylinder head gasket	C
		Improper valve sealing	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

28.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	• Valve mechanism is defective. • Incorrect valve clearance • Worn valve rocker • Worn camshaft • Broken valve spring
Heavy and dull clank	Oil pressure is low.	• Worn crankshaft main bearing • Worn connecting rod bearing (large end)
	Oil pressure is normal.	• Damaged engine mounting • Loosened flywheel mounting bolt
High-pitched clank (Spark knock)	Sound is noticeable when accelerating with an overload condition.	• Ignition timing advanced • Accumulation of carbon inside combustion chamber • Wrong heat range of spark plug • Improper octane value gasoline
Clank when engine speed is 1,000 to 2,000 rpm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	• Worn crankshaft main bearing • Worn connecting rod bearing (large end)
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*)	• Worn cam sprocket • Worn camshaft journal bore in cylinder head
Squeaky sound	—	Insufficient generator lubrication
Rubbing sound	—	Poor contact of generator brush and rotor
Gear scream when starting engine	—	• Defective ignition starter switch • Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	• Loose V-belt • Defective water pump shaft
Hissing sound	—	• Insufficient compression • Air leakage in air intake system, hose, connection or manifold
Timing belt noise	—	• Loose timing belt • Timing belt contacting with adjacent part
Valve noise	—	Incorrect valve clearance

(NOTE*)
When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory. Therefore, perform the Clear Memory Mode <Ref. to EN(H4SO)(diag)-56, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4SO)(diag)-44, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

EXHAUST

EX(H4SO)

Page

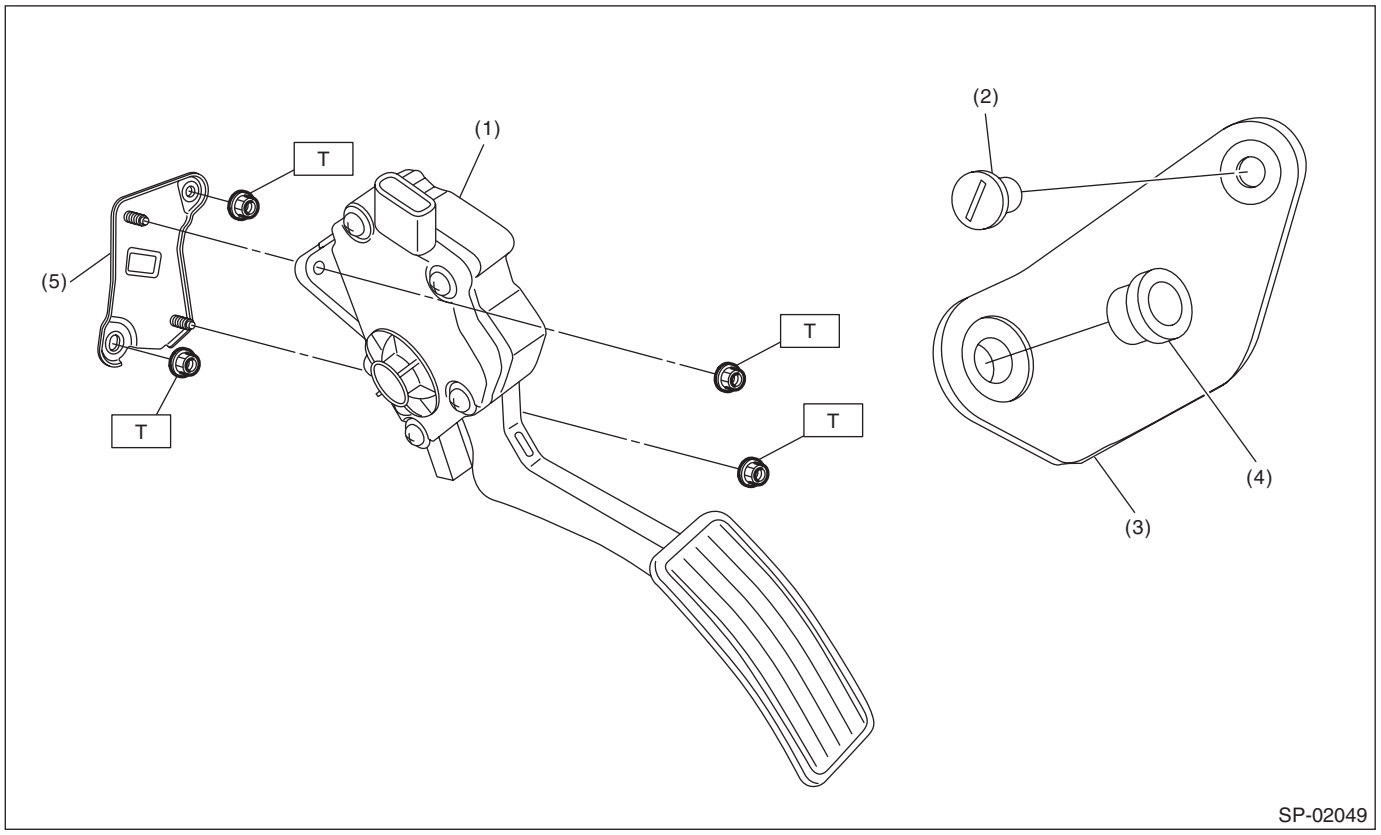
1. General Description 2
2. Front Exhaust Pipe 6
3. Center Exhaust Pipe 9
4. Rear Exhaust Pipe 10
5. Muffler 12

1. General Description

A: SPECIFICATION

Accelerator pedal	Stroke	At pedal pad	50 — 59 mm (1.97 — 2.32 in)

B: COMPONENT



(1) Accelerator pedal ASSY
(2) Clip
(3) Accelerator plate
(4) Accelerator stopper
(5) Accelerator pedal bracket

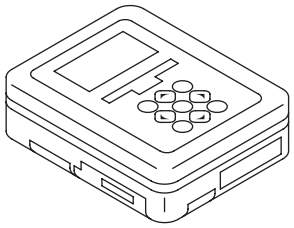
Tightening torque:N·m (kgf-m, ft-lb)
T: 18 (1.8, 13.3)

C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• Remove contamination including dirt and corrosion before removal or installation.
• Keep the parts in order and protect them from dust and dirt.
• Before removal or installation, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for inspecting the accelerator pedal.

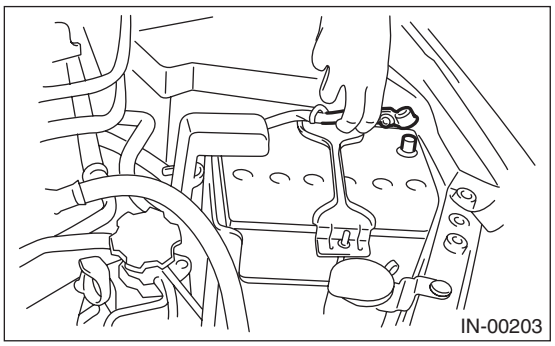
2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring voltage.

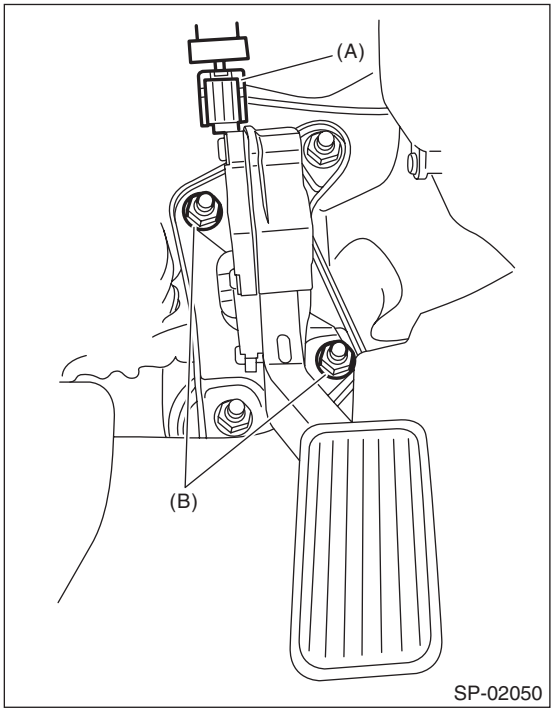
2. Accelerator Pedal

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A).
3) Remove the nut (B) securing accelerator pedal assembly.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

C: DISASSEMBLY

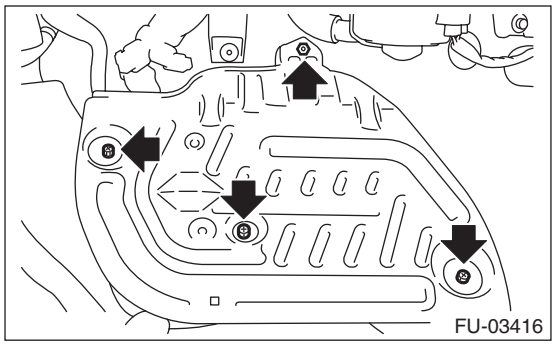
NOTE:
The accelerator pedal cannot be disassembled.

D: INSPECTION

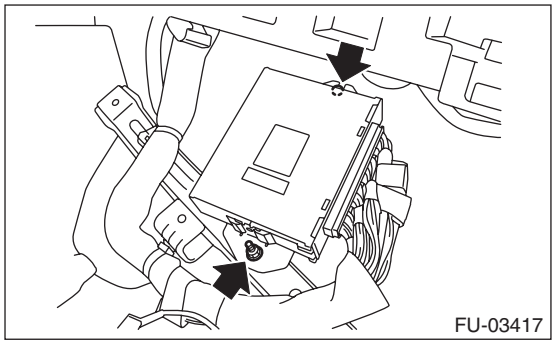
1) Check for smooth operation when the accelerator pedal is depressed.
2) Check if the accelerator pedal returns to its original position smoothly when the pedal is released.

1. ACCELERATOR PEDAL SENSOR (METHOD WITH CIRCUIT TESTER)

1) Remove the lower inner trim of passenger's side.
<Ref. to EI-55, REMOVAL, Lower Inner Trim.>
2) Turn over the floor mat of passenger's seat.
3) Remove the protect cover.

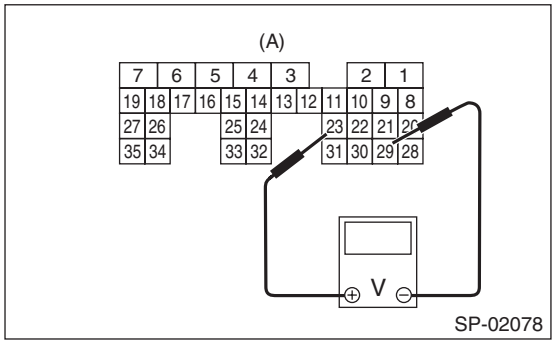


4) Remove the nuts and bolts which hold the ECM to the bracket.



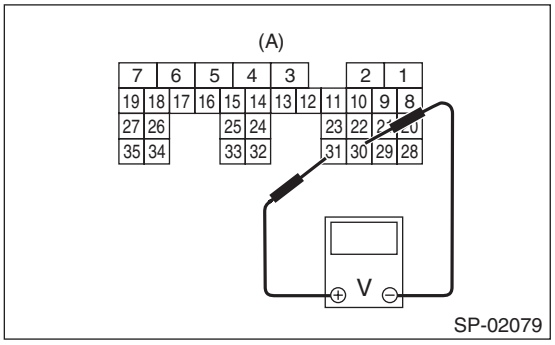
5) Turn the ignition switch to ON. (engine OFF)
6) Measure the voltage between ECM connector terminals.

- Main sensor side



(A) To ECM connector

- Sub sensor side



(A) To ECM connector

Accelerator pedal sensor	Accelerator pedal	Terminal No.	Standard
Main	Not depressed (Full closed)	23 (+) and 29 (–)	1 V
	Depressed (Full opened)		3.5 V
Sub	Not depressed (Full closed)	31 (+) and 30 (–)	1 V
	Depressed (Full opened)		3.5 V

2. ACCELERATOR PEDAL SENSOR (METHOD WITH SUBARU SELECT MONITOR)

1) Turn the ignition switch to ON. (engine OFF)
2) Read the accelerator pedal opening angle signal and voltage of accelerator pedal sensor using Subaru Select Monitor. <Ref. to EN(H4SO)(diag)-35, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.> <Ref. to EN(H4DOTC)(diag)-37, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

Accelerator pedal sensor	Accelerator pedal opening angle signal	Standard
Main	0.0 %	1 V
	100.0 %	3.5 V
Sub	0.0 %	1 V
	100.0 %	3.5 V

IGNITION

IG(H4SO)

Page

1. General Description 2
2. Spark Plug 4
3. Ignition Coil and Ignitor Assembly 6
4. Spark Plug Cord 7

1. General Description

A: SPECIFICATION

1. NON-TURBO MODEL

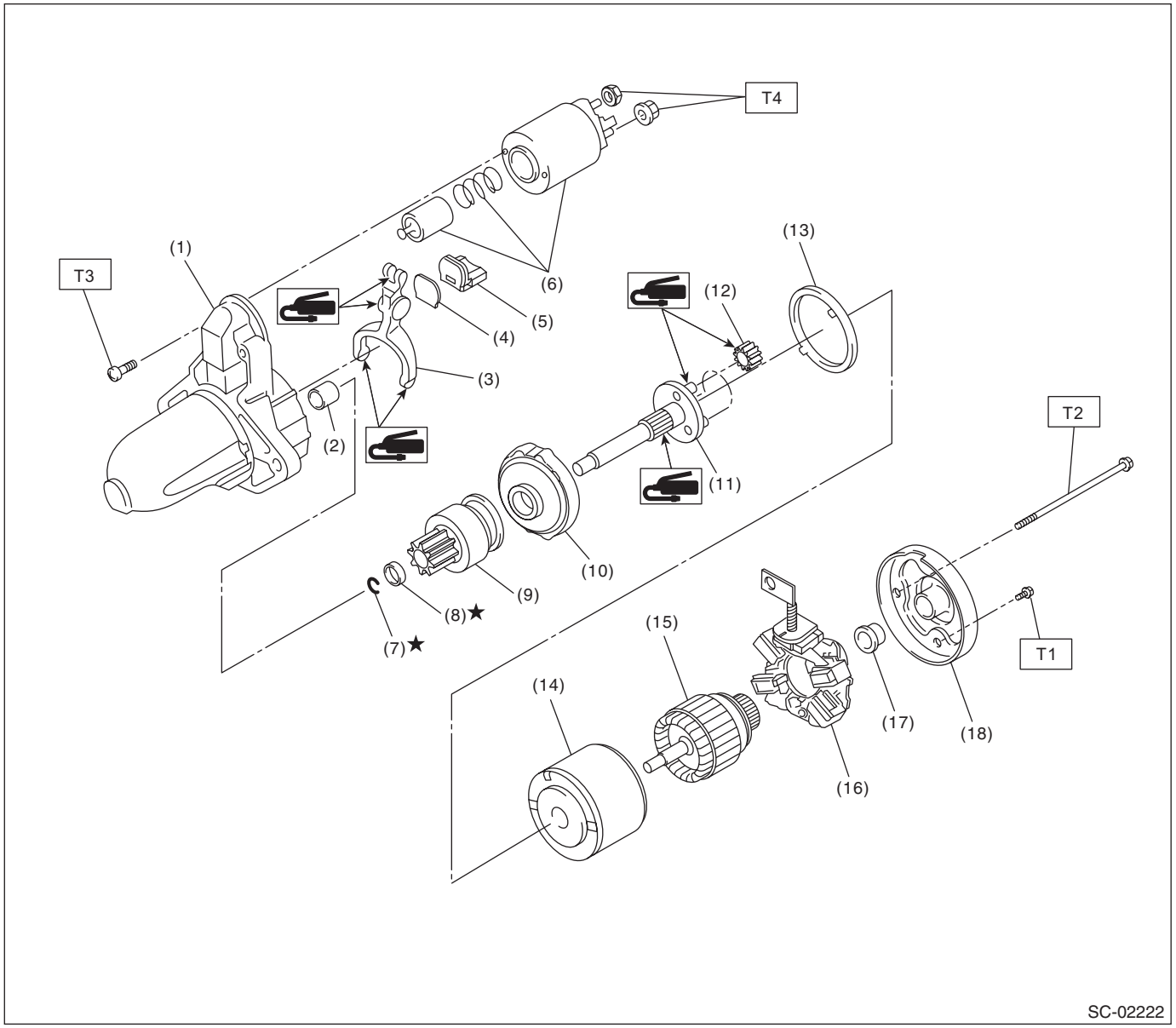
Item			Specifications	
Starter	Type		Reduction type	
	Vehicle model		MT	AT
	Model		M000T30475	M000T20175
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		8	9
	No-load characteristics	Voltage	11 V	
		Current	95 A or less	90 A or less
		Rotating speed	2,500 rpm or more	2,000 rpm or more
	Load characteristics	Voltage	7.5 V	7.7 V
		Current	300 A	400 A
		Torque	8.84 N·m (0.9 kgf-m, 6.5 ft-lb) or more	16.7 N·m (1.7 kgf-m, 12.3 ft-lb) or more
		Rotating speed	870 rpm or more	710 rpm or more
	Lock characteristics	Voltage	4 V	3.5 V
		Current	680 A or less	960 A or less
		Torque	17 N·m (1.7 kgf-m, 12.5 ft-lb) or more	31 N·m (3.2 kgf-m, 22.9 ft-lb) or more
Generator	Type		Rotating-field three-phase type, voltage regulator built-in type, with load response control system	
	Model		A2TG0391	
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 90 A	
	Polarity on ground side		Negative	
	Direction of rotation		Clockwise (when observed from pulley side)	
	Stator connection		3-phase Y-type	
	Output current		1,500 rpm — 40 A or more 2,500 rpm — 74 A or more 5,000 rpm — 84 A or more	
	Regulated voltage		14.1 — 14.8 V [20°C (68°F)]	
Battery	Type and capacity		12 V — 48 AH (55D 23L)	12 V — 52 AH (65D 23L)

2. TURBO MODEL

Item			Specifications	
Starter	Type		Reduction type	
	Vehicle model		MT	AT
	Model		M000T30475	M000T20175
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 1.0 kW	12 V — 1.4 kW
	Direction of rotation		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		8	9
	No-load characteristics	Voltage	11 V	
		Current	95 A or less	90 A or less
		Direction of rotation	2,500 rpm or more	2,000 rpm or more
	Load characteristics	Voltage	7.5 V	7.7 V
		Current	300 A	400 A
		Torque	8.84 N·m (0.9 kgf-m, 6.5 ft-lb) or more	16.7 N·m (1.7 kgf-m, 12.3 ft-lb) or more
		Rotating speed	870 rpm or more	710 rpm or more
	Lock characteristics	Voltage	4 V	3.5 V
		Current	680 A or less	960 A or less
		Torque	17 N·m (1.7 kgf-m, 12.5 ft-lb) or more	31 N·m (3.2 kgf-m, 22.9 ft-lb) or more
Generator	Type		Rotating-field three-phase type, voltage regulator built-in type, with load response control system	
	Model		A3TG0491	
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 110 A	
	Polarity on ground side		Negative	
	Direction of rotation		Clockwise (when observed from pulley side)	
	Stator connection		3-phase Y-type	
	Output current		1,500 rpm — 50 A or more 2,500 rpm — 91 A or more 5,000 rpm — 105 A or more	
	Regulated voltage		14.1 — 14.8 V [20°C (68°F)]	
Battery	Type and capacity		12 V — 48 AH (55D 23L)	12 V — 52 AH (65D 23L)

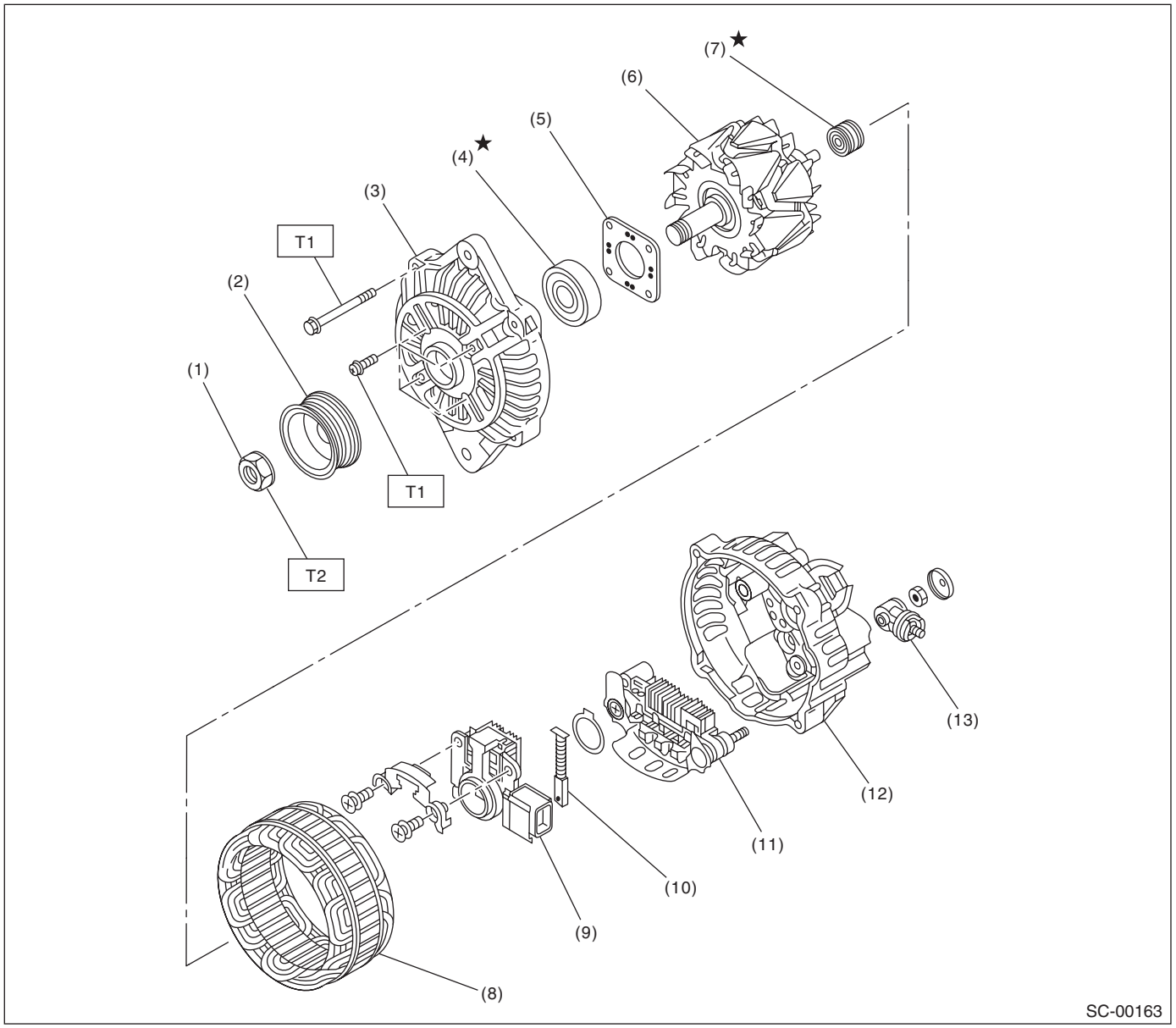
B: COMPONENT

1. STARTER



(1)	Starter housing ASSY	(9)	Overrunning clutch	(17)	Sleeve bearing
(2)	Sleeve bearing	(10)	Internal gear ASSY	(18)	Starter cover ASSY
(3)	Shift lever	(11)	Shaft		
(4)	Plate	(12)	Pinion gear	***Tightening torque:N·m (kgf-m, ft-lb)***	
(5)	Seal rubber	(13)	Seal rubber	***T1:***	***1.4 (0.1, 1.0)***
(6)	Magnet switch ASSY	(14)	Yoke ASSY	***T2:***	***6 (0.6, 4.4)***
(7)	Snap ring	(15)	Armature ASSY	***T3:***	***7.5 (0.8, 5.5)***
(8)	Stopper	(16)	Brush holder ASSY	***T4:***	***10 (1.0, 7.4)***

2. GENERATOR



(1) Pulley nut
(2) Pulley
(3) Front cover
(4) Ball bearing
(5) Bearing retainer
(6) Rotor
(7) Bearing
(8) Stator coil
(9) IC regulator with brush
(10) Brush
(11) Rectifier
(12) Rear cover
(13) Terminals

Tightening torque:N·m (kgf-m, ft-lb)
T1: 4.7 (0.5, 3.5)
T2: 108 (11.0, 79.8)

C: CAUTION

• Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
• 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.
• Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or rigid racks at the specified points.
• Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from the battery.

D: PREPARATION TOOL

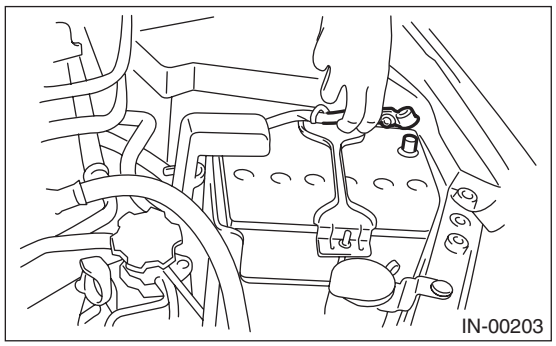
1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.

2. Starter

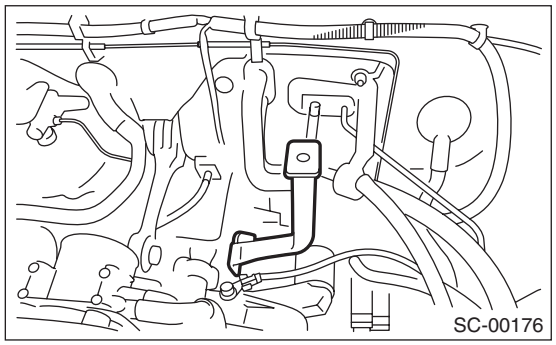
A: REMOVAL

1) Disconnect the ground cable from battery.

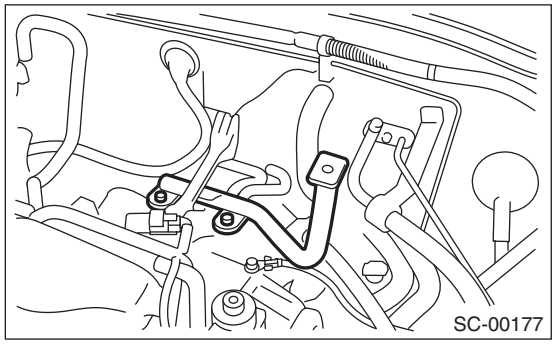


2) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO)-7, REMOVAL, Air Intake Chamber.>
3) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-13, REMOVAL, Intercooler.>
4) Remove the air intake chamber stay LH. (Non-turbo model)

- MT MODEL



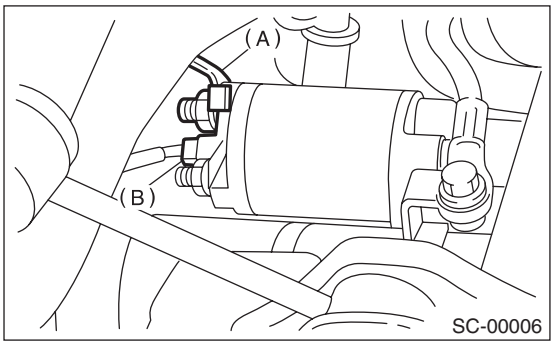
- AT MODEL



C: DISASSEMBLY

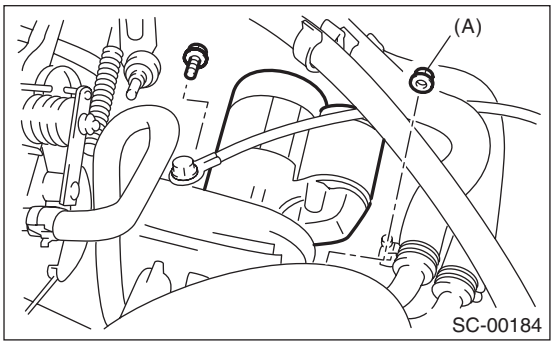
1) Remove the nuts fastening the M terminal of the magnet switch assembly, and disconnect the cable from the M terminal.

5) Disconnect the connector (B) and terminal (A) from starter.



6) Remove the starter from transmission.

NOTE:
For the MT model, a bolt is used in place (A).

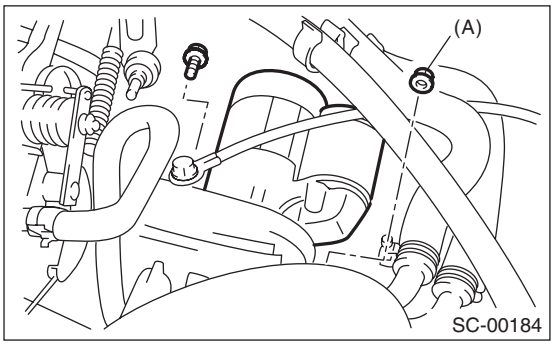


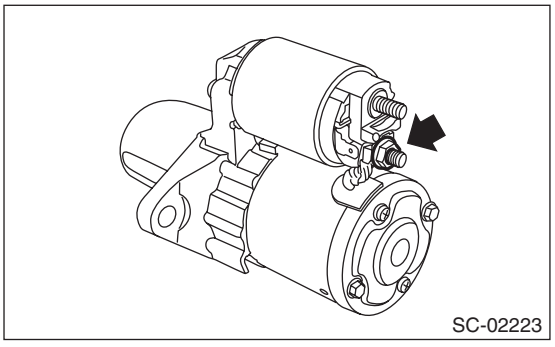
B: INSTALLATION

Install in the reverse order of removal.

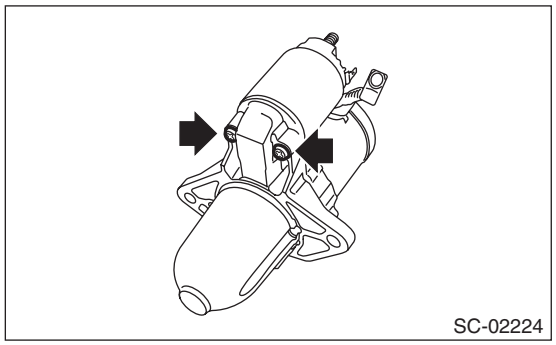
NOTE:
For the MT model, a bolt is used in place (A).

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)

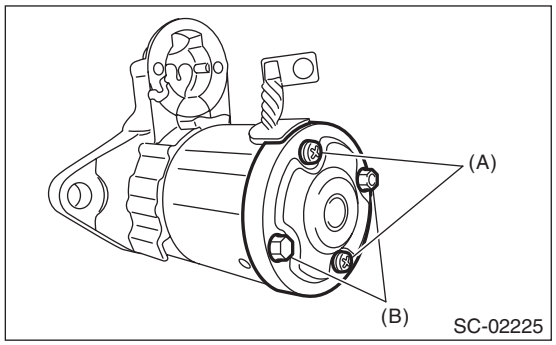




2) Remove the screws fastening the magnet switch assembly, then remove the magnet switch assembly from the starter housing assembly.


SC-02224

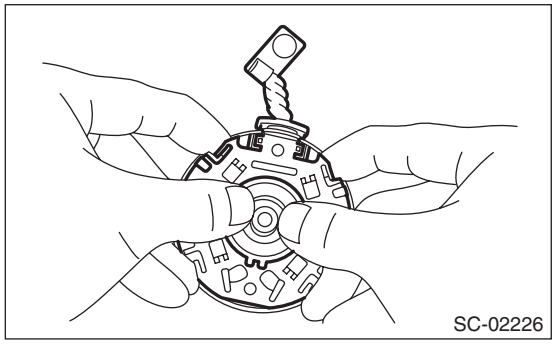
3) Remove screws (A) of the brush holder assembly, and through bolts (B) on both sides, and remove the starter cover assembly.



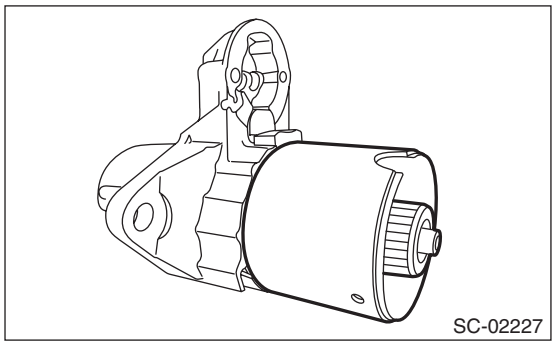
SC-02225

4) Remove the brush holder assembly from the armature assembly.

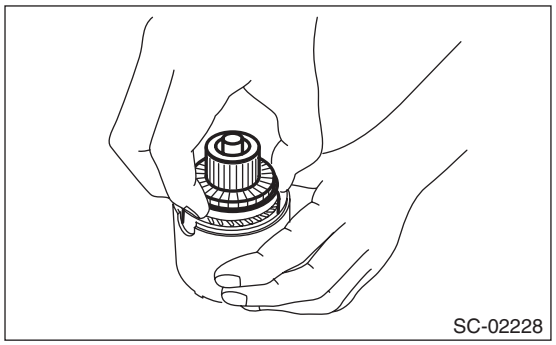
NOTE:
Hold the brush with your fingers so that the brush spring does not come flying out.


SC-02226

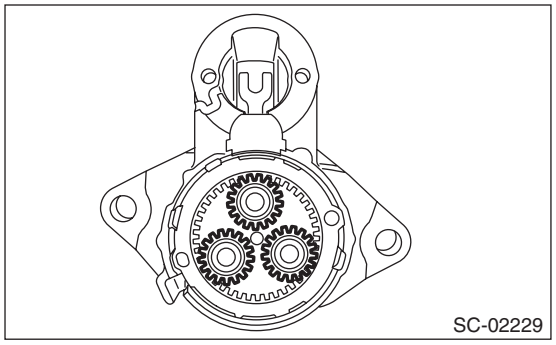
5) Remove the armature assembly and yoke assembly from the starter housing assembly together as a single unit.


SC-02227

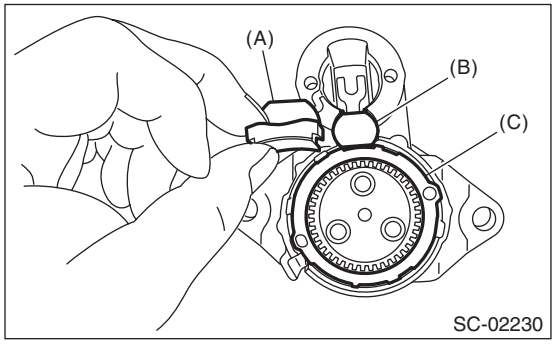
6) Separate the armature assembly and yoke assembly.


SC-02228

7) Remove the pinion gear from the internal gear assembly.

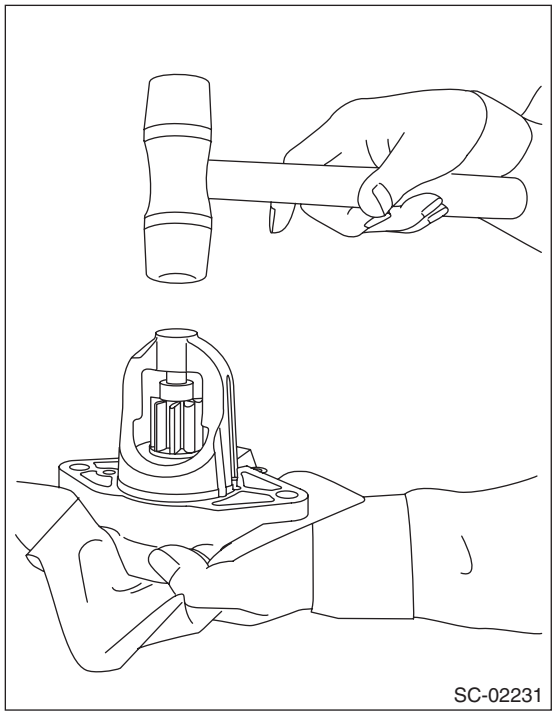

SC-02229

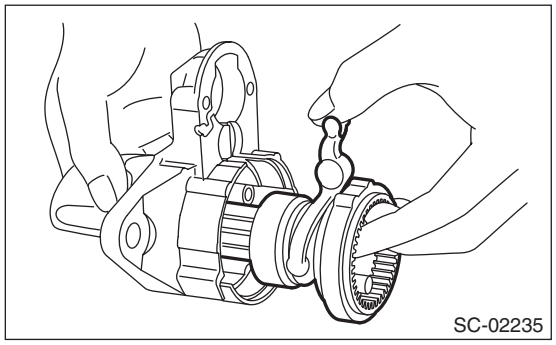
8) Remove rubber seal (A), plate (B), and rubber seal (C).



SC-02230

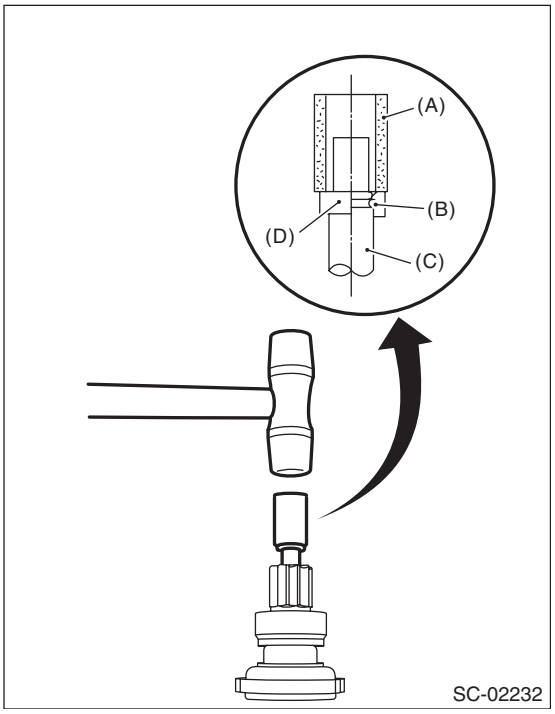
9) Lightly tap the starter housing assembly with a plastic hammer as shown in the figure, and remove the overrunning clutch, internal gear assembly, shaft and shift lever together as one unit.


SC-02231


SC-02235

10) Use the following procedures to remove the overrunning clutch from the shaft.

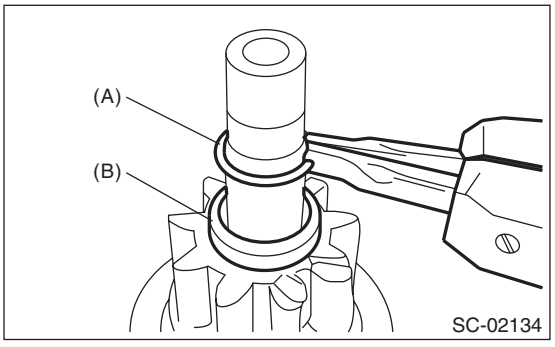
(1) Use an appropriate tool (such as a fit socket wrench), and remove the stopper from snap ring by lightly tapping the stopper with a plastic hammer.



SC-02232

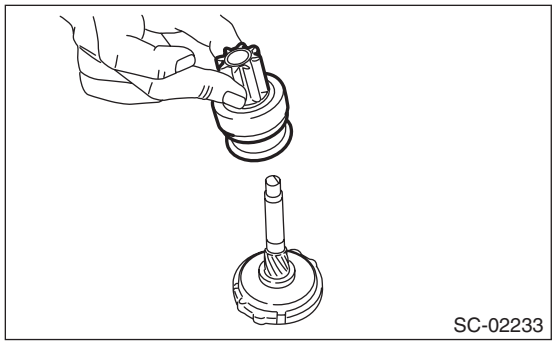
(A) Appropriate tool
(B) Snap ring
(C) Shaft
(D) Stopper

(2) Remove snap ring (A) from the shaft, and remove stopper (B).

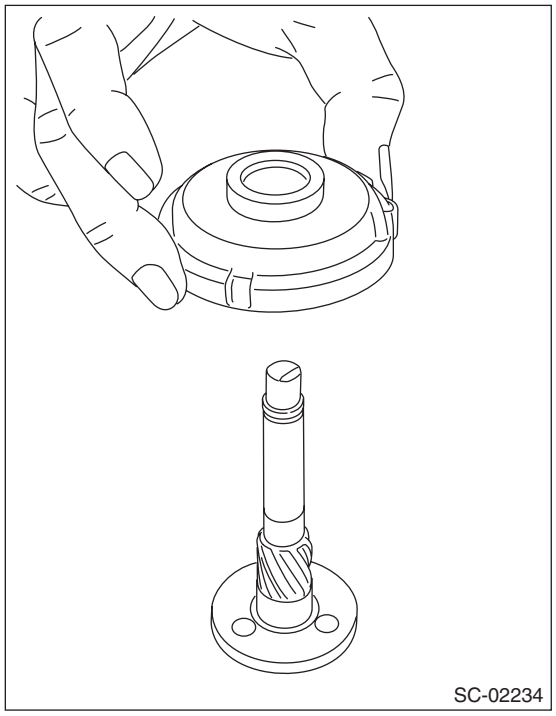


SC-02134

(3) Remove the overrunning clutch from the shaft.


SC-02233

11) Separate the internal gear assembly and shaft.

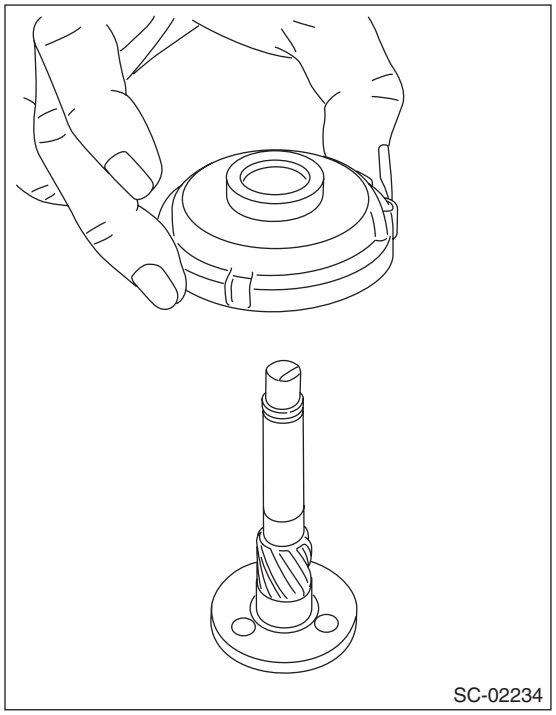

SC-02234

D: ASSEMBLY

1) Apply grease to the sliding surfaces of the internal gear assembly shaft.

Grease:
Multemp #6129 or equivalent

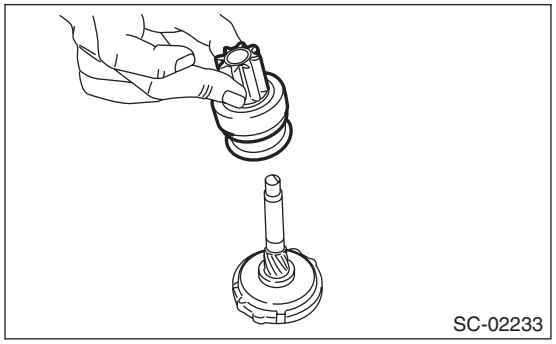
2) Assemble the shaft to the internal gear assembly.


SC-02234

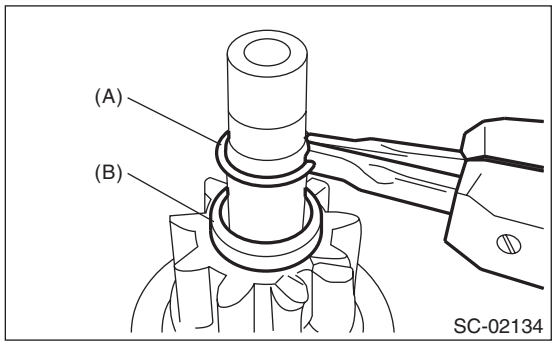
3) Assemble the overrunning clutch as follows:
(1) Apply grease to the spline portion of the shaft.

Grease:
Multemp #6129 or equivalent

(2) Install the overrunning clutch to shaft.

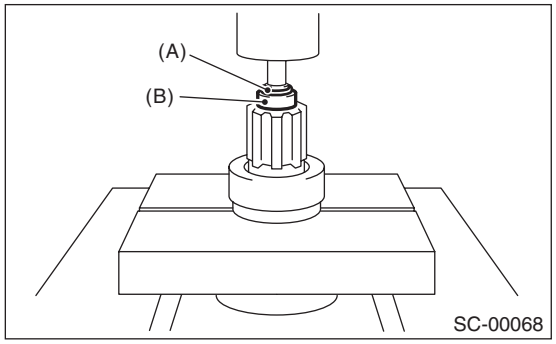

SC-02233

(3) Pass stopper (B) through the shaft assembly, and attach snap ring (A).



NOTE:
Use new stoppers and snap rings.

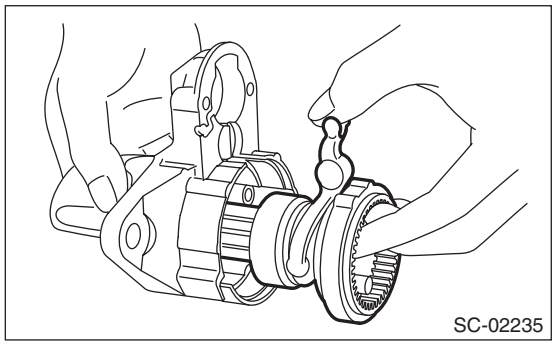
(4) Using a press, pressure fit stopper (B) into snap ring (A).



4) Assemble the overrunning clutch, internal gear assembly, shaft and shift lever as a single unit into the starter housing assembly.

NOTE:
Apply grease to the moving parts of the shift lever.

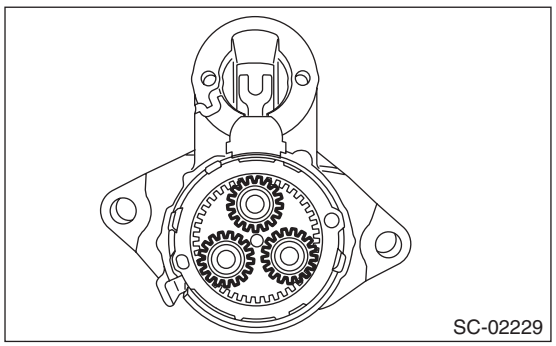
Grease:
Multemp #6129 or equivalent



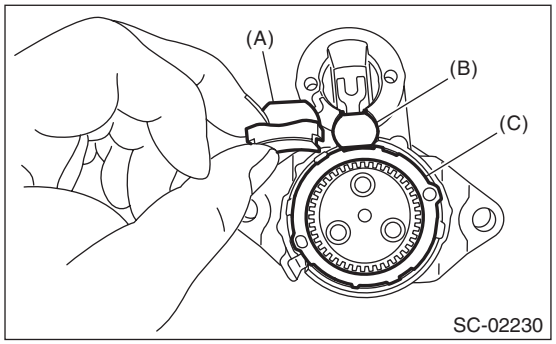
5) Apply grease to the inside of the internal gear assembly and pinion gear, and attach the pinion gear to the internal gear assembly.

NOTE:
• Apply grease evenly to the contact surfaces of each gear.
• Be careful that no debris becomes attached.

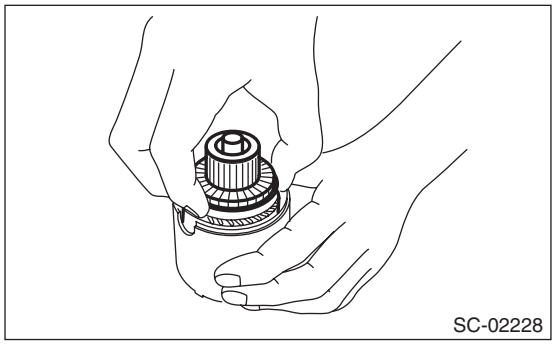
Grease:
Molykote® AG650 or equivalent



6) Attach rubber seal (A), plate (B), and rubber seal (C).

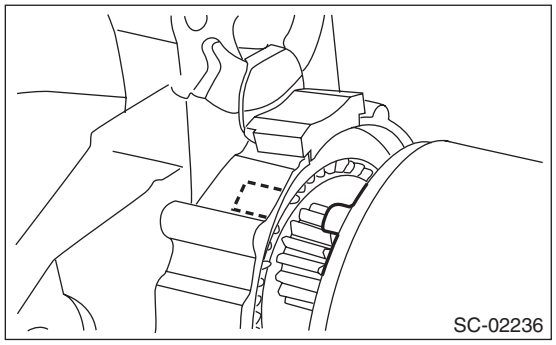


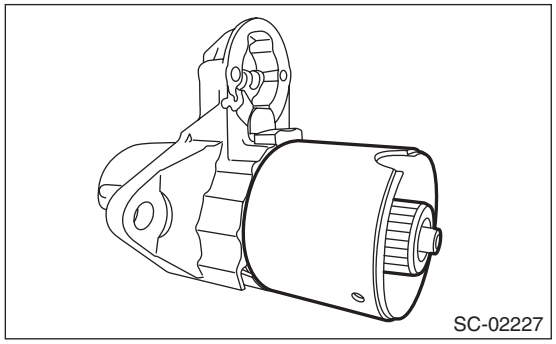
7) Assemble the armature assembly to the yoke assembly.



8) Attach the armature assembly and yoke assembly to the starter housing assembly together as a single unit.

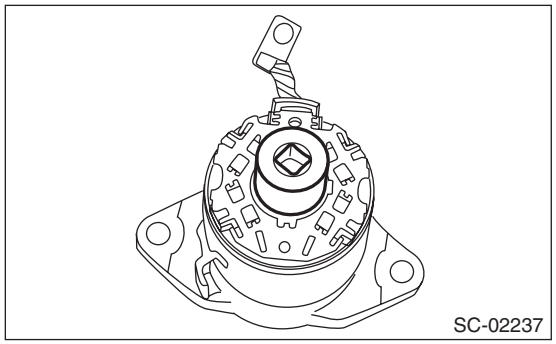
NOTE:
As shown in the figure, match the protrusion of the yoke assembly to the cut out of the starter housing assembly.


SC-02236


SC-02227

9) Use an appropriate tool (such as correctly sized socket wrenches) and attach the brush holder assembly to the armature assembly.

NOTE:
Be careful not to damage the brushes.

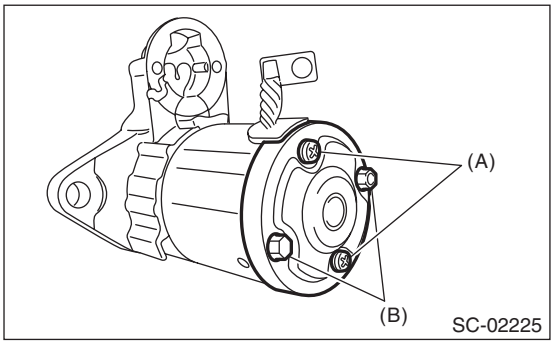

SC-02237

10) Secure starter cover assembly to the brush holder assembly with screws (A).

Tightening torque:
1.4 N·m (0.1 kgf-m, 1.0 ft-lb)

11) Install through bolts (B) on both sides.

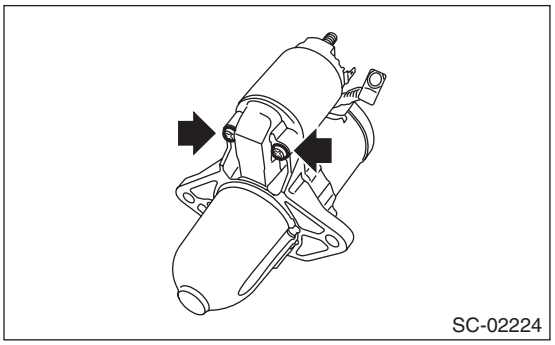
Tightening torque:
6 N·m (0.6 kgf-m, 4.4 ft-lb)



SC-02225

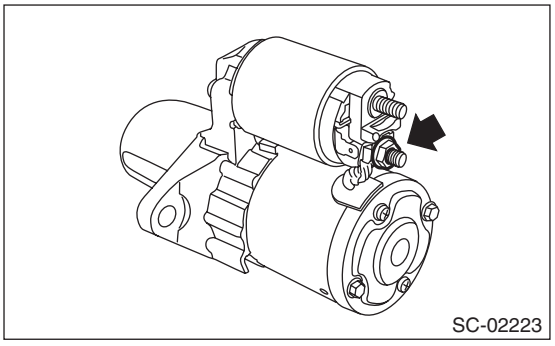
12) Attach the magnet switch assembly to the starter housing assembly.

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


SC-02224

13) Attach the cable to the M terminal of the magnet switch assembly, and secure with nuts.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

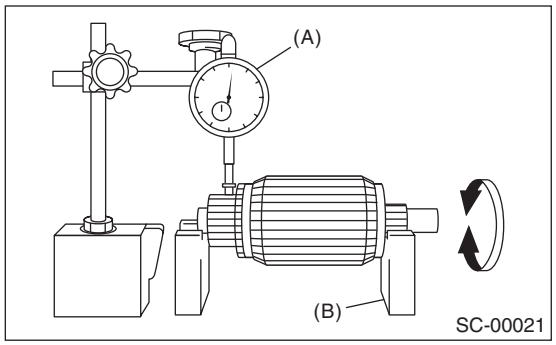

SC-02223

E: INSPECTION

1. ARMATURE

1) Check the commutator for signs of seizure or stepped wear caused by roughness of the surface. If there is light wear, use sandpaper to repair.
2) Runout test
Check for runout on the commutator. If excessive, replace it.

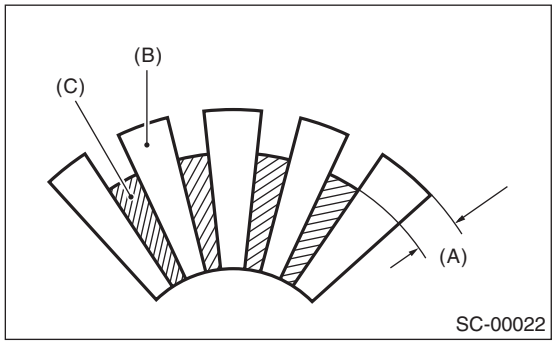
Commutator runout:
Standard
0.05 mm (0.002 in)
Service limit
0.10 mm (0.004 in) or less



(A) Dial gauge
(B) V-block

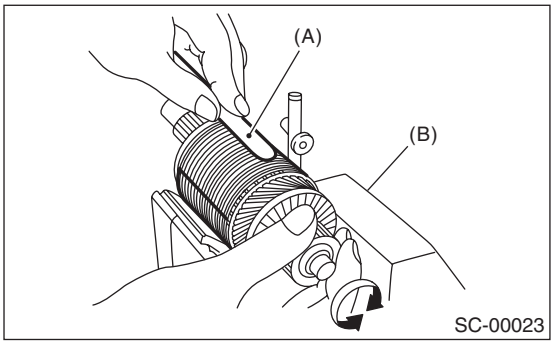
3) Depth of segment mold
Check the depth of the segment mold.

Depth of segment mold:
0.50 mm (0.020 in)



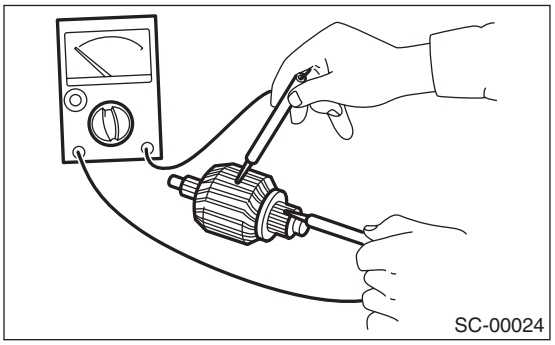
(A) Depth of mold
(B) Segment
(C) Mold

4) Armature short-circuit test
Place the armature on the growler tester to check for short circuits. While slowly turning the armature, support the steel sheet for the armature core. If the circuit of the armature is shorted, the steel sheet will vibrate, causing it to move towards the core. When the steel sheet has moved or vibrated, replace or repair the armature with the shorted circuit.



(A) Steel sheet
(B) Growler tester

5) Armature ground test
Use a circuit tester to touch the probe of one side to the commutator segment, and the other probe to the shaft. If there is no continuity, it is normal. If there is continuity, the armature is grounded.
If grounded, replace the armature.



2. YOKE

Make sure that the pole is set at the predetermined position.

3. OVERRUNNING CLUTCH

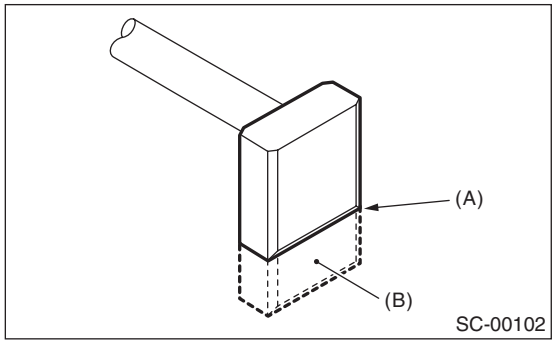
Check that there is no wear or damage to the piston teeth. Replace if it is damaged. If it rotates smoothly when rotated in the correct direction (counterclockwise) and does not return to the other direction, it is normal.

CAUTION:
To prevent spilling of grease, do not clean the overrunning clutch with oil.

4. BRUSH AND BRUSH HOLDER

1) Brush length
Measure the length of the brush. If it exceeds service limits, replace it.
Replace if there is abnormal wear or cracks.

Brush length:
Standard
12.3 mm (0.484 in)
Service limit
7.0 mm (0.276 in)



(A) Service limit line
(B) Brush

2) Brush movement
Check that the brush moves smoothly in the brush holder.
3) Brush spring force
Measure the brush spring force with a spring scale.
Replace the brush holder if below the service limit.

Brush spring force:

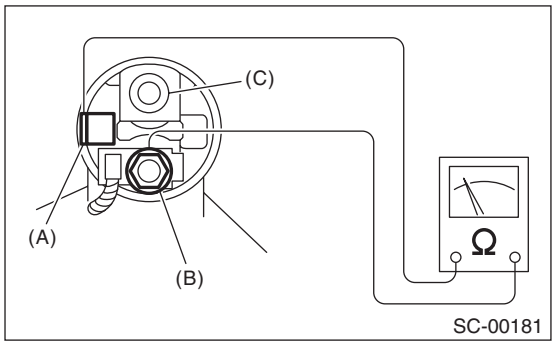
Standard
15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf) (When new)

Service limit
2.5 N (0.25 kgf, 0.56 lbf)

5. SWITCH ASSEMBLY

Using a circuit tester (set to “ohm”), check that there is continuity between terminals S and M, and between terminal S and ground.
Also check to be sure there is no continuity between M terminal and B.

Terminal/Resistance:
S — M/1 Ω or less
S — Ground/1 Ω or less
M — B/1 MΩ or more

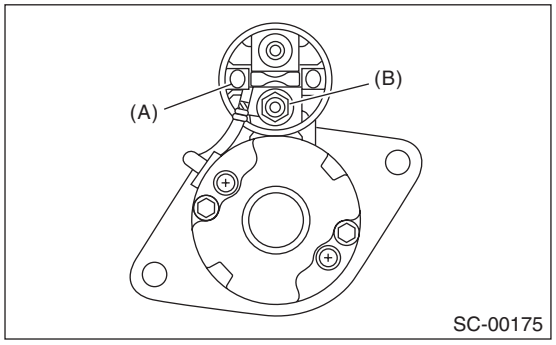


(A) S terminal
(B) M terminal
(C) B terminal

6. SWITCH ASSEMBLY OPERATION

1) Using a lead wire, connect the S terminal of switch assembly to positive terminal of battery, and starter body to ground terminal of battery. The pinion should be forced endwise on shaft.

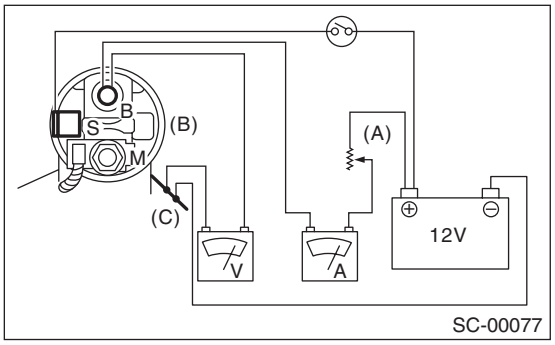
NOTE:
With the pinion forced endwise on shaft, starter motor can sometimes rotate because current flows, through pull-in coil, to motor. This is not a problem.
2) Disconnect the connector from M terminal. Then using a lead wire, connect the positive terminal of battery and M terminal and ground terminal to starter body.
In this test set up, the pinion should return to its original position even when it is pulled out with a screwdriver.



(A) S terminal
(B) M terminal

7. PERFORMANCE TEST

The starter should be submitted to performance tests whenever it has been overhauled, to assure its satisfactory performance when installed on the engine.
Three performance tests, no-load test, load test, and lock test, are presented here; however, if the load test and lock test cannot be performed, carry out at least the no-load test.
For these performance tests, use the circuit shown in figure.



(A) Variable resistance
(B) Magnet switch
(C) Starter body

1) No-load test
With switch on, adjust the variable resistance until the voltage is 11 V, read the value of ammeter to measure starter speed. Compare these values with the standard.

No-load test (standard):

Voltage/Current
MT model
Max. 11 V/95 A
AT model
Max. 11 V/90 A

Rotating speed
MT model
2,500 rpm or more
AT model
2,000 rpm or more

2) Load test
Apply the specified braking torque to starter. The condition is normal if the current draw and starter speed are within standard.

Load test (standard):

Voltage/Load
MT model
7.5 V/8.84 N·m (0.9 kgf-m, 6.5 ft-lb)
AT model
7.7 V/16.7 N·m (1.7 kgf-m, 12.3 ft-lb)

Current/Speed:
MT model
300 A/870 rpm or more
AT model
400 A/710 rpm or more

3) Lock test
With the starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to standard voltage.

Lock test (standard):

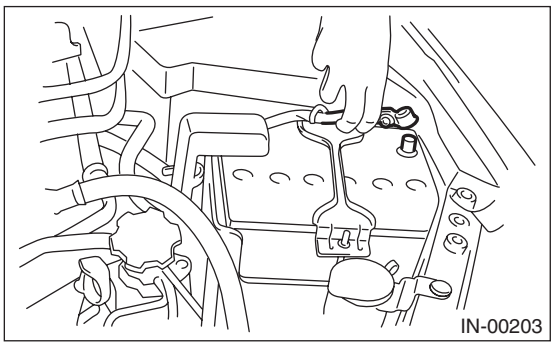
Voltage/Current
MT model
4 V/680 A or less
AT model
3.5 V/960 A or less

Torque
MT model
17 N·m (1.7 kgf-m, 12.5 ft-lb) or more
AT model
31 N·m (3.2 kgf-m, 22.9 ft-lb) or more

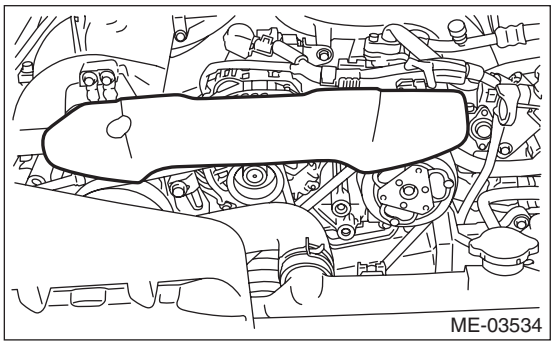
3. Generator

A: REMOVAL

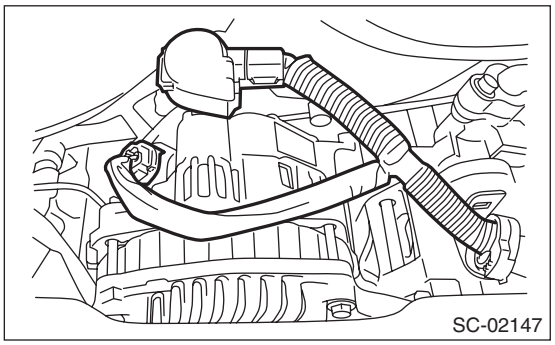
1) Disconnect the ground cable from battery.



2) Remove the V-belt covers.

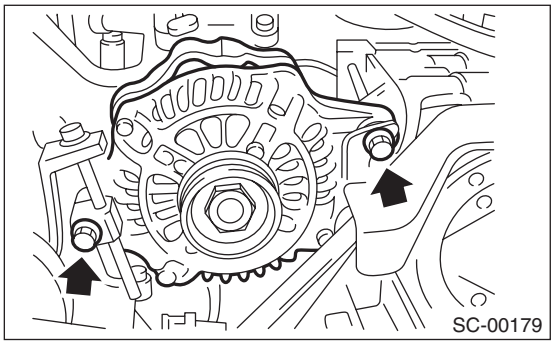


3) Disconnect the connector and terminal from generator.



4) Remove the front side belts. <Ref. to ME(H4SO)-39, FRONT SIDE BELT, REMOVAL, V-belt.> <Ref. to ME(H4DOTC)-40, FRONT SIDE BELT, REMOVAL, V-belt.>

5) Remove the bolts which secure the generator to the bracket.

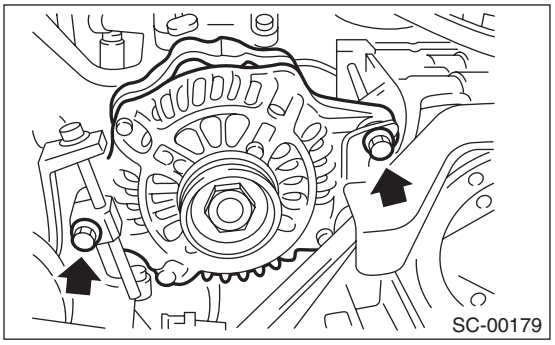


B: INSTALLATION

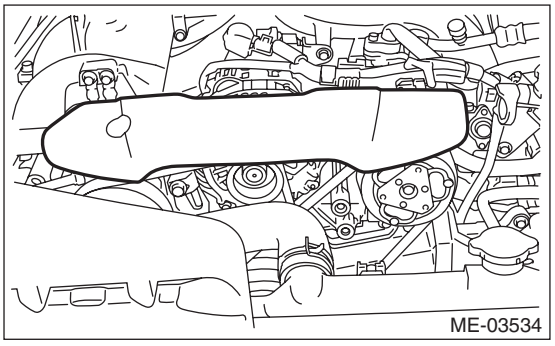
Install in the reverse order of removal.

CAUTION:
Check and adjust the front side belt tension. <Ref. to ME(H4SO)-44, FRONT SIDE BELT, INSPECTION, V-belt.> <Ref. to ME(H4DOTC)-45, FRONT SIDE BELT, INSPECTION, V-belt.>

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

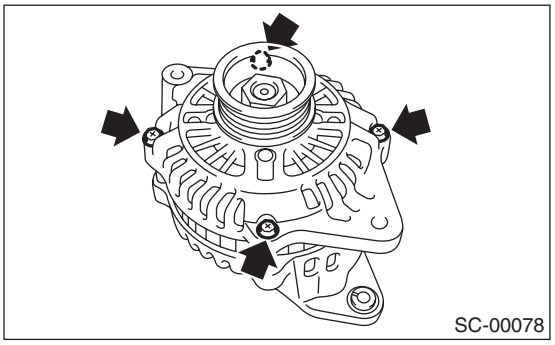


Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

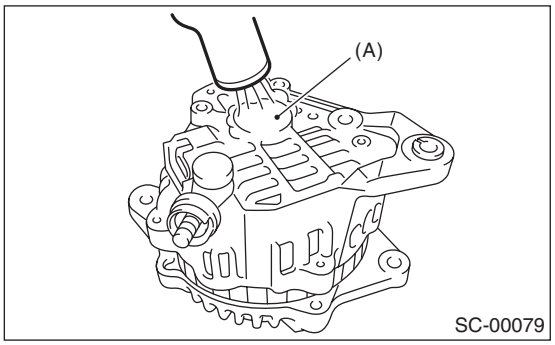


C: DISASSEMBLY

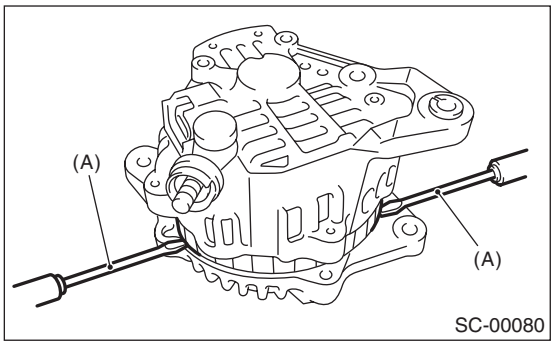
1) Remove the four through-bolts.



2) Use a drier to heat the rear cover (A) portion to 50°C (122°F).

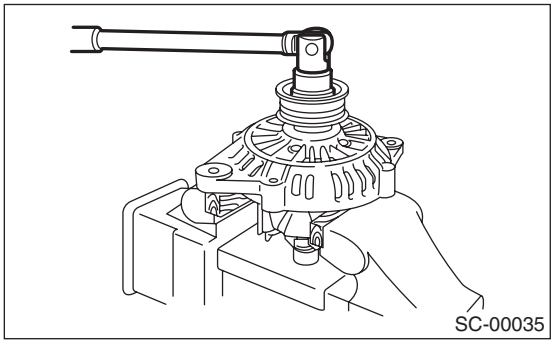


3) Insert the end of a flat tip screwdriver into the gap between stator core and front cover. Pry them apart to disassemble.

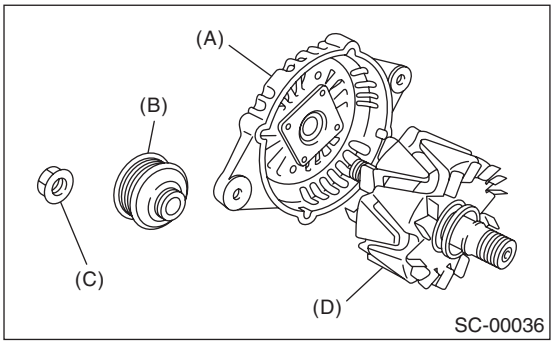


(A) Screwdriver

4) Using a vise, support the rotor and remove the pulley nut.



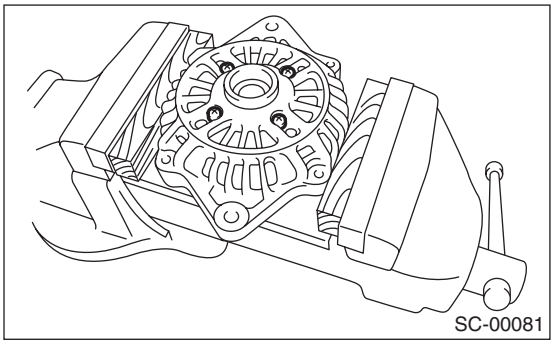
CAUTION:
When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.



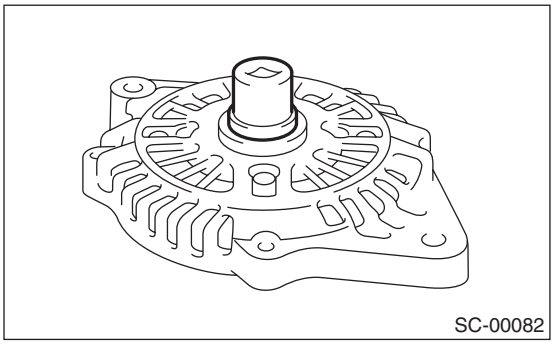
(A) Front cover
(B) Pulley
(C) Nut
(D) Rotor

5) Use the following procedures to remove the ball bearings.

(1) Remove the bolt, and then detach the bearing retainer.

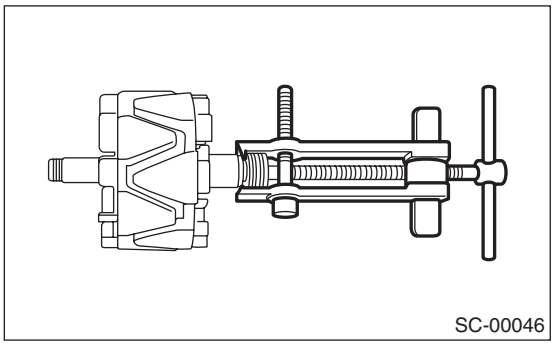


(2) Firmly attach an appropriate tool (such as a correct size socket wrench) to the bearing inner race.



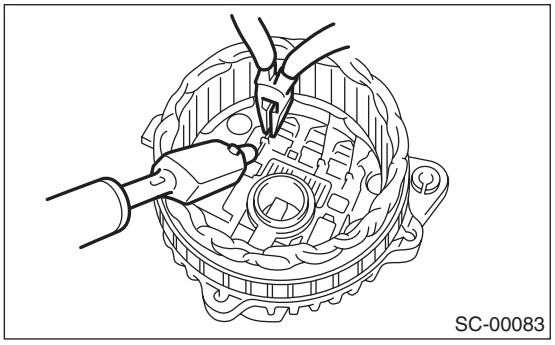
(3) Use the press to push the ball bearings out from the front cover.

6) Using the bearing puller, remove the bearings from the rotor.


SC-00046

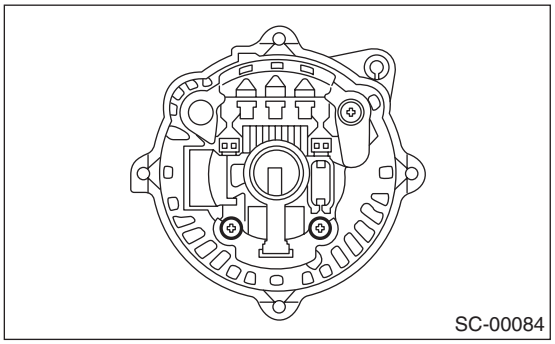
7) Disconnect the connection between the rectifier and stator coil, then remove the stator coil.

CAUTION:
The rectifier is easily damaged by heat. Do not allow a 180 — 270 W soldering iron to contact the terminals for 5 seconds or more at a time.

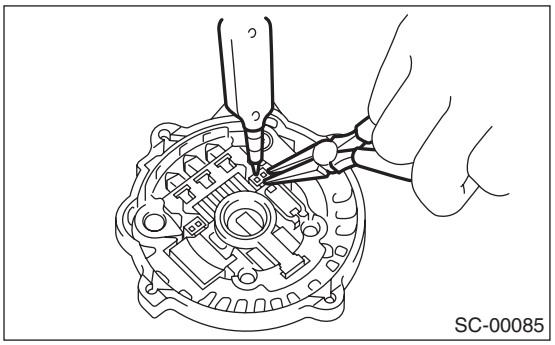

SC-00083

8) Use the following procedures to remove the IC regulator.

(1) Remove the screws which secure the IC regulator to the rear cover.

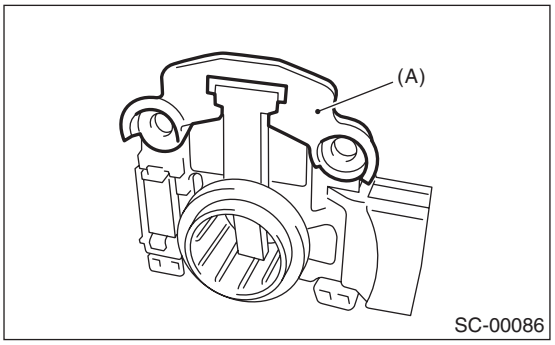

SC-00084

(2) Disconnect the connection between the IC regulator and rectifier, then remove the IC regulator.


SC-00085

9) Use the following procedures to remove the brush.

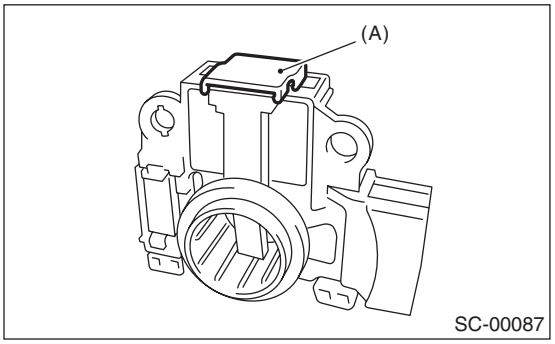
(1) Remove the cover A.



SC-00086

(A) Cover A

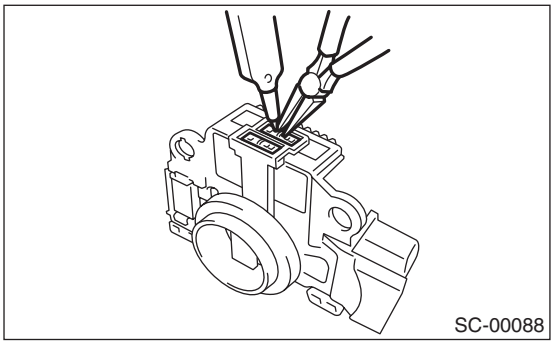
(2) Remove the cover B.



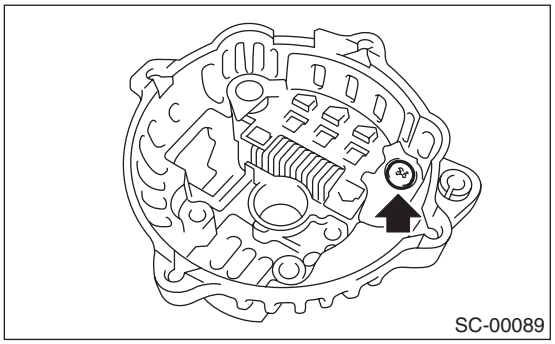
SC-00087

(A) Cover B

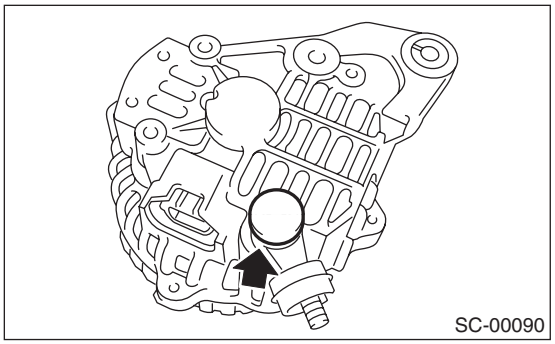
(3) Disconnect the connection and remove the brush.


SC-00088

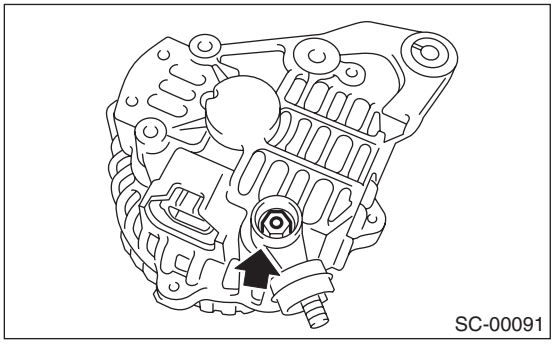
10) Remove the rectifier as follows.
(1) Remove the bolts which secure the rectifier.



(2) Remove the cover on B terminal.



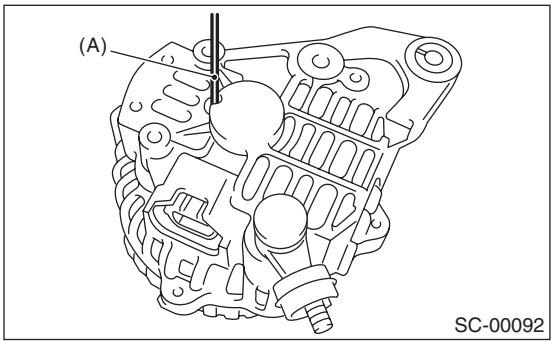
(3) Remove the nuts of B terminal, then remove the rectifier.



D: ASSEMBLY

Assemble in the reverse order of disassembly.
1) Pull-out of the brush
Before assembling, press the brush down into the brush holder, then fix the brush in that position by inserting a [1 mm (0.04 in) dia., 40 — 50 mm (1.6 — 2.0 in) long] wire through the hole as shown in the figure.

CAUTION:
After re-assembling, remove the wire.



(A) Wire

2) Install the ball bearings.
(1) Set the ball bearings in the front cover, then securely install an appropriate tool (such as a socket wrench of proper size) to the bearing outer race.
(2) Using a press to press the ball bearings into the specified location.
(3) Install the bearing retainer.
3) Using a press to install the bearings (rear side) to the rotor shaft.
4) Heat the bearing box in rear cover [50 to 60°C (122 to 140°F)], and then press the rear bearing into rear cover.

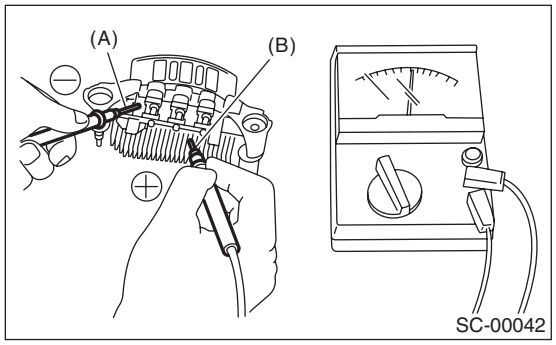
CAUTION:
Do not apply grease to the rear bearings. If there is any oil on the bearing box, remove it completely.
5) After re-assembling, manually turn the pulley to check that the rotor rotates smoothly.

E: INSPECTION

1. DIODE

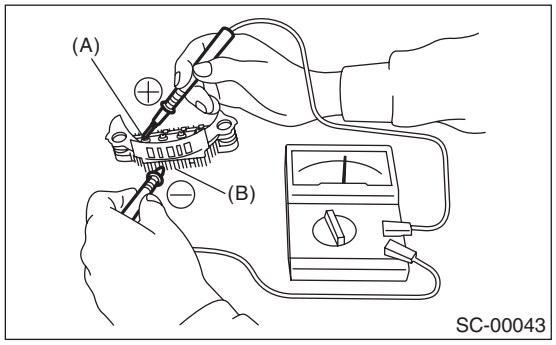
CAUTION:
There is the possibility of damaging the diodes if a mega-tester (used to measure high voltages) or a similar measuring instrument is used. Never use a mega tester or equivalent for this test.

1) Check the positive diode
Check for continuity between the diode lead and positive side heat sink. If resistance is 1 Ω or less only in the direction from the diode lead to the heat sink, the positive diode is OK.



(A) Diode lead
(B) Heat sink (positive side)

2) Check negative diode
Check for continuity between the negative side heat sink and diode lead. If resistance is 1 Ω or less only in the direction from the heat sink to the diode lead, the negative diode is OK.



(A) Diode lead
(B) Heat sink (negative side)

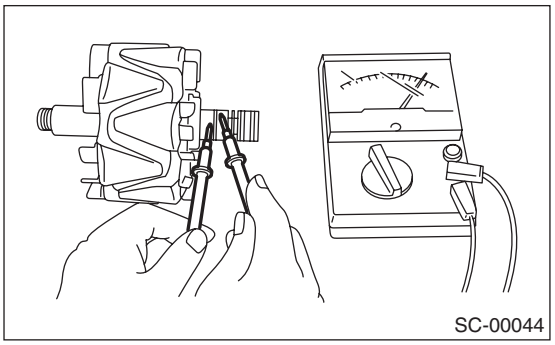
2. ROTOR

1) Slip ring surface
Inspect the slip rings for contamination or any roughness on the sliding surface. Repair the slip ring surface using a lathe or sand paper.
2) Slip ring outer diameter
Measure the slip ring outer diameter. Replace the rotor assembly if the slip ring is worn.

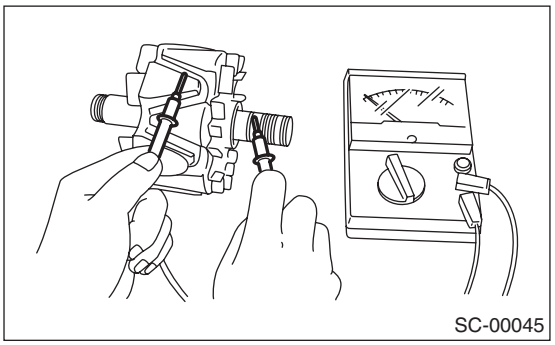
Slip ring outer diameter:
Standard
22.7 mm (0.894 in)
Limit
22.1 mm (0.870 in)

3) Continuity test
Using a circuit tester, check the resistance between slip rings.
If the resistance is not within the standard, replace the rotor assembly.

Specified resistance:
Approximately 1.8 — 2.2 Ω



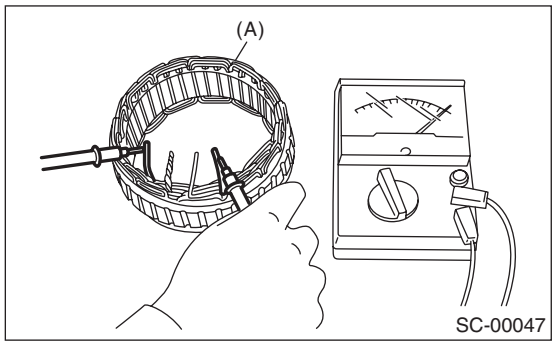
4) Insulation test
Check the continuity between slip ring and rotor core or shaft. If the resistance is 1 Ω or less, replace the rotor assembly because the rotor coil is grounded.



5) Ball bearings (rear side)
Check the rear ball bearing. If there is any noise, or the rotor does not rotate smoothly, replace the bearings.

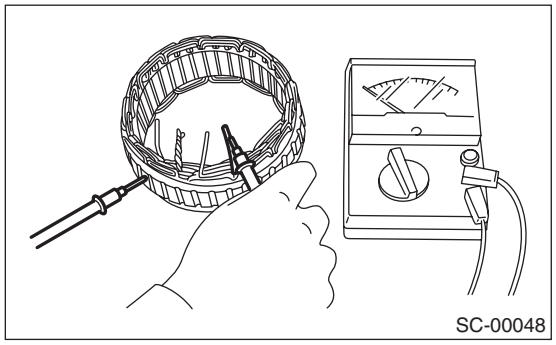
3. STATOR

1) Continuity test
Inspect continuity between the stator coil lead wire terminals. If the resistance is 1 MΩ or more, the lead wire is damaged. Replace the stator assembly.



(A) Stator

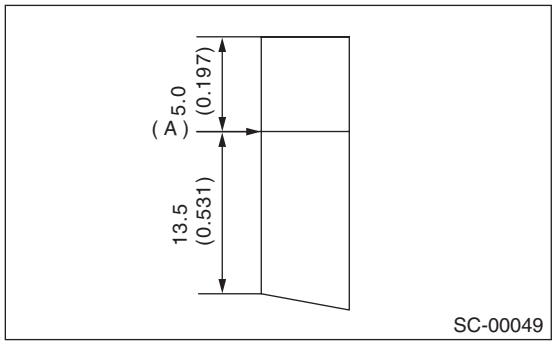
2) Insulation test
Inspect the continuity between the stator coil stator core and lead wire terminals. If the resistance is 1 Ω or less, the stator coil is grounded. Replace the stator assembly.



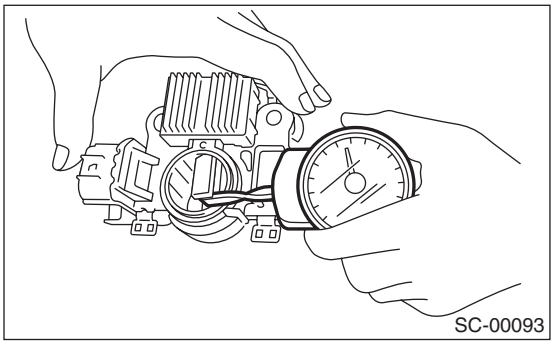
4. BRUSH

1) Measure the length of each brush. Replace the brush if wear exceeds service limits. There is a service limit mark (A) on each brush.

Brush length:
Standard
18.5 mm (0.728 in)
Service limit
5.0 mm (0.197 in)



2) Check that there is appropriate pressure on the brush spring.
Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.08 in). Then measure the pressure of brush spring. If the pressure is 2.648 N (270 g, 9.52 oz) or less, replace the brush spring with a new part. 4.609 — 5.786 N (470 — 590 g, 16.58 — 20.810 oz) pressure is required on the new spring.



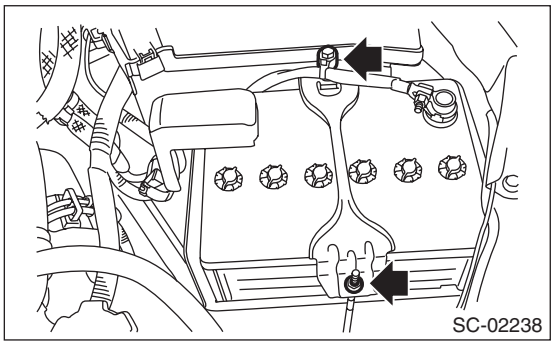
5. BEARING (FRONT SIDE)

Check the front ball bearing. Replace the ball bearings if there is resistance in the rotation, or if there is any abnormal noise.

4. Battery

A: REMOVAL

1) Disconnect the positive (+) terminal after disconnecting the negative (–) terminal of battery.
2) Remove the harness clip of the negative terminal from the battery rod.
3) Remove the flange nut from battery rod and remove battery holder.



4) Remove the battery.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
3.5 N·m (0.4 kgf-m, 2.6 ft-lb)

NOTE:
• Clean the battery cable terminals and apply grease to retard the formation of corrosion.
• Connect the positive (+) terminal, and then connect the negative (–) terminal of the battery.
• After the battery is installed, initial diagnosis of the electronic throttle control is performed. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.

C: INSPECTION

WARNING:
• Electrolyte is corrosive acid, and has toxicity; be careful of handling the fluid.
• Make sure the electrode does not come into contact with skin, eyes or clothing. Especially at contact with eyes, flush with water for 15 minutes and get prompt medical attention.
• In addition, be careful not to let the electrode contact with the coated parts.
• Be careful when handling the batteries because they produce explosive gases.
• Be sure to keep battery away from any fire.
• For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. In addition, never lean over the battery.
• Ventilate sufficiently when using or charging battery in enclosed space.
• Before starting work, remove rings, metal watch-bands, and other metal jewelry.
• Never allow metal tools to contact the positive battery terminal and anything connected to it while you are at the same time in contact with any other metallic portion of the vehicle.

1. EXTERNAL PARTS

Check the battery case, top cover, vent plugs, and terminal posts for dirt or cracks. If necessary, clean with water and wipe with a dry cloth.
Apply a thin coat of grease on the terminal posts to prevent corrosion.

2. ELECTROLYTE LEVEL

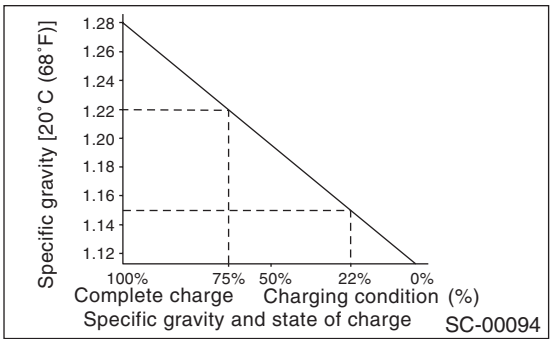
Check the electrolyte level in each cell. If the level is below MIN level, bring the level to MAX level by pouring distilled water into the battery cell. Do not fill beyond MAX level.

3. SPECIFIC GRAVITY OF ELECTROLYTE

1) Measure specific gravity of electrolyte using a hydrometer and a thermometer.
Specific gravity varies with temperature of electrolyte so that it must be corrected at 20°C (68°F) using the following calculation:

S_{20} = St + 0.0007 × (t – 20)
S_{20}: Specific gravity corrected at electrolyte temperature of 20°C
St: Measured specific gravity
t: Measured temperature (°C)
Judge whether or not the battery requires charging according to corrected specific gravity.
Standard specific gravity: 1.220 — 1.290 [at 20°C (68°F)]

2) Measuring the specific gravity of the electrolyte in the battery will disclose the state of charge of the battery. The relation between specific gravity and state of charge is as shown in the figure.



D: MEASUREMENT

WARNING:
Do not bring an open flame close to the battery when working.

CAUTION:
• Prior to charging, corroded terminals should be cleaned with a brush and common caustic soda solution.
• Be careful since battery electrolyte overflows while charging the battery.
• Observe instructions when handling the battery charger.
• Before charging the battery on the vehicle, disconnect the battery ground terminal to prevent damage of generator diodes or other electrical units.

1. JUDGEMENT OF BATTERY IN CHARGED CONDITION

1) Specific gravity of electrolyte should be held within the specific range of 1.250 — 1.290 for one hour or more.
2) Voltage per battery cell should be held at a specific value in a range of 2.5 — 2.8 V for one hour or more.

2. CHECK CONDITION OF CHARGE WITH HYDROMETER

Hydrometer indicator	State of charge	Corrective action
Green dot	65% or more	Load test
Dark dot	65% or less	Charge battery
Clear dot	Low electrolyte	Replace the battery* (If cranking is difficult)
* Check electrical system before replacement.		

3. NORMAL CHARGING

Charge the battery at the current value specified by manufacturer or at approximately 1/10 of battery's ampere-hour rating.

4. QUICK CHARGING

Quick charging is a method that the battery is charged in a short period of time with a relatively large current by using a quick charger.
Since a large current flow raises electrolyte temperature, the battery is subject to damage if the large current is used for prolonged time. For this reason, the quick charging must be carried out within a current range that will not raise the electrolyte temperature to 40°C (104°F) or more.
Also the quick charging is a temporary mean to bring battery voltage up to some level, and battery should be charged slowly with low current as a rule.

CAUTION:
• Observe the items in "3. NORMAL CHARGING".
• Never use 10 A or more when charging the battery because it will shorten the battery life.

ENGINE (DIAGNOSTICS)

EN(H4SO)(diag)

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