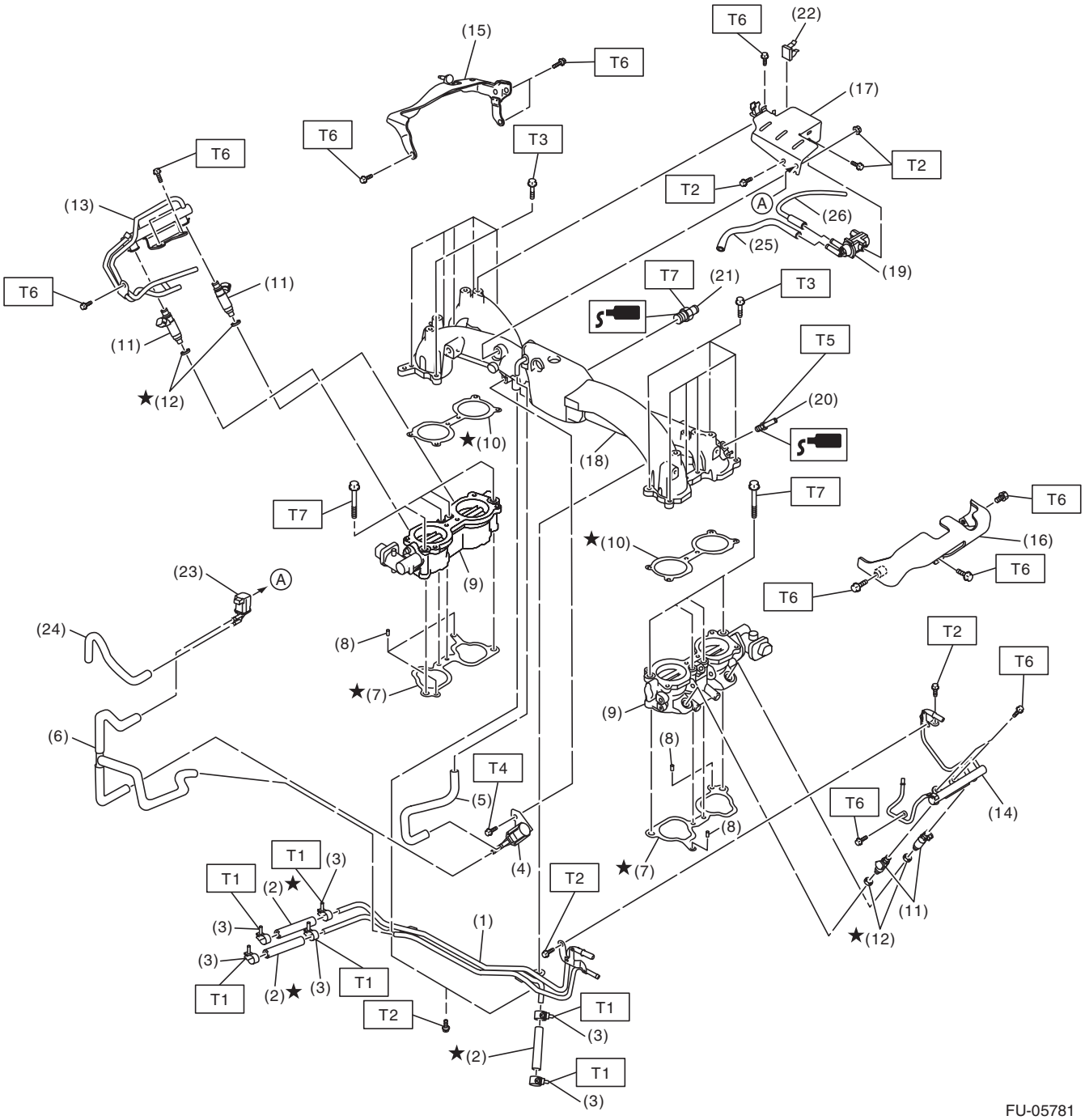
1. General Description

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	900 kPa (9.18 kg/cm^2, 130.5 psi), or less
	Discharge rate	175 L (46.2 US gal, 38.5 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

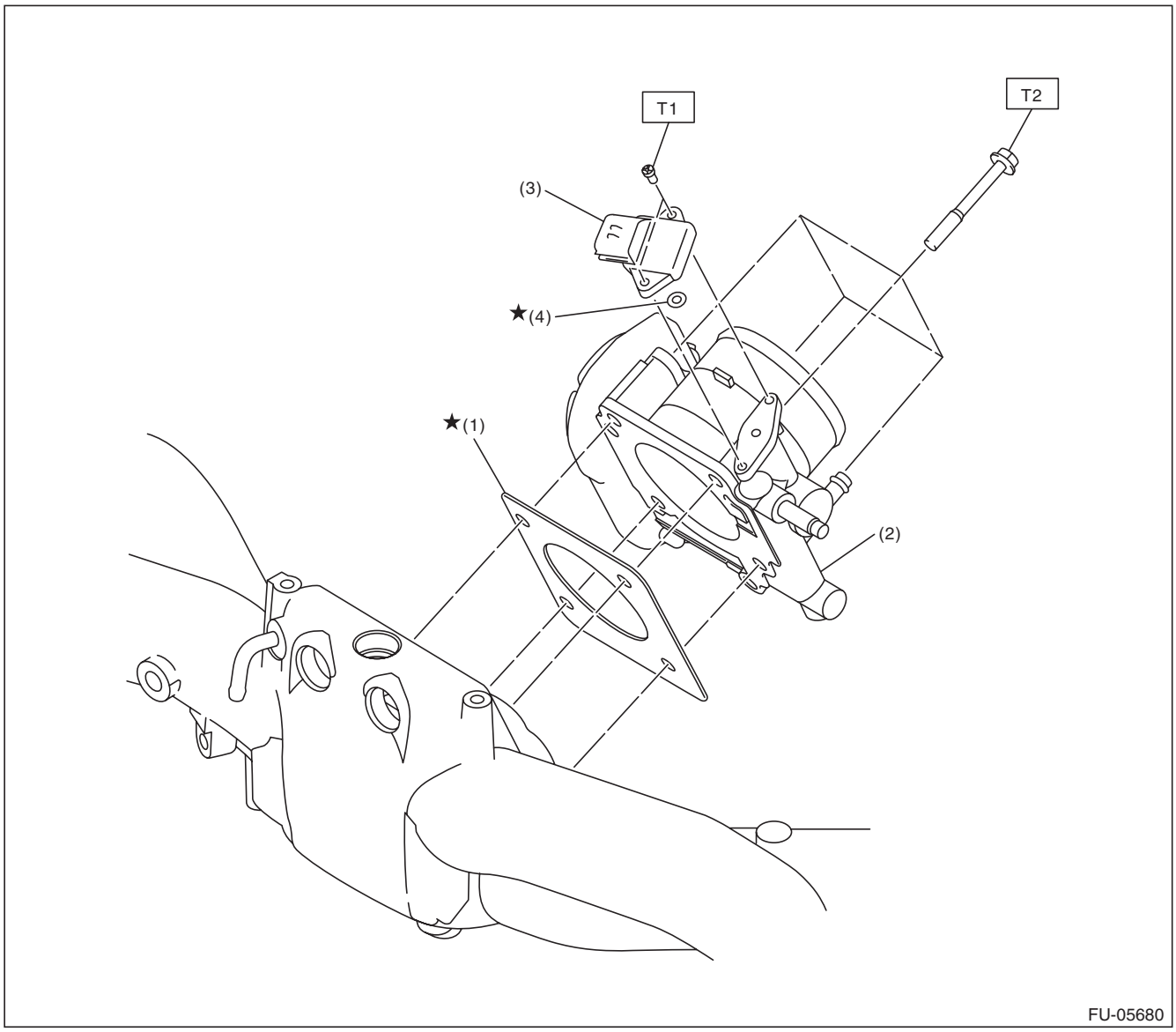


(1) Fuel pipe ASSY
(2) Fuel hose
(3) Clamp
(4) Purge control solenoid valve 1
(5) Vacuum hose A
(6) Vacuum control hose
(7) Intake manifold gasket
(8) Guide pin
(9) Tumble generator valve ASSY
(10) Tumble generator valve gasket
(11) Fuel injector
(12) O-ring
(13) Fuel injector pipe RH
(14) Fuel injector pipe LH
(15) Fuel pipe protector RH
(16) Fuel pipe protector LH
(17) Solenoid valve bracket
(18) Intake manifold
(19) Wastegate control solenoid valve
(20) Nipple
(21) Nipple
(22) Clip
(23) Purge control solenoid valve 2
(24) Vacuum hose
(25) Vacuum hose
(26) Air control hose

Tightening torque: N·m (kgf-m, ft-lb)

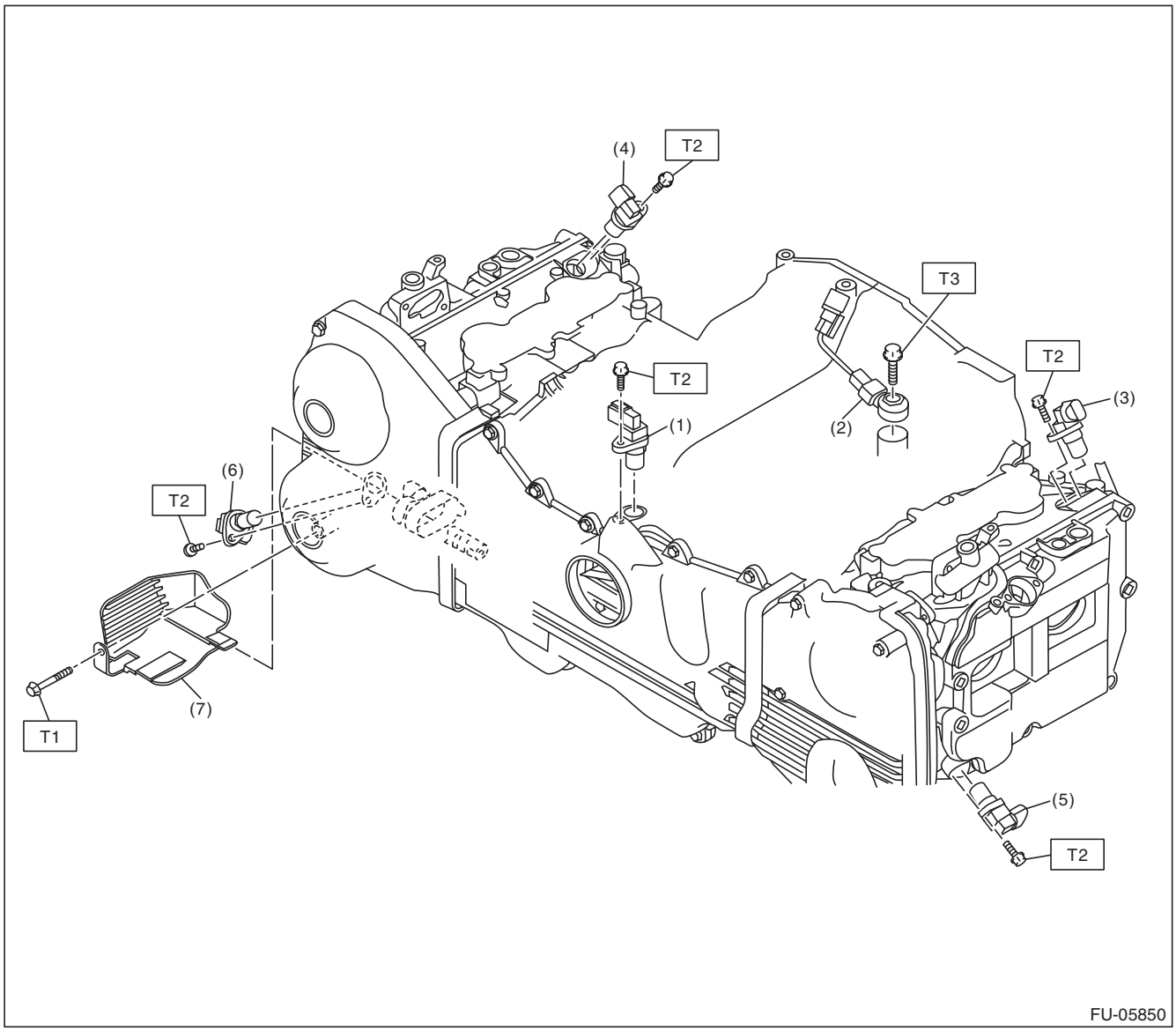
T1: 1.25 (0.1, 0.9)
T2: 6.4 (0.7, 4.7)
T3: 8.25 (0.8, 6.1)
T4: 16 (1.6, 11.8)
T5: 17 (1.7, 12.5)
T6: 19 (1.9, 14.0)
T7: 25 (2.5, 18.4)

2. AIR INTAKE SYSTEM



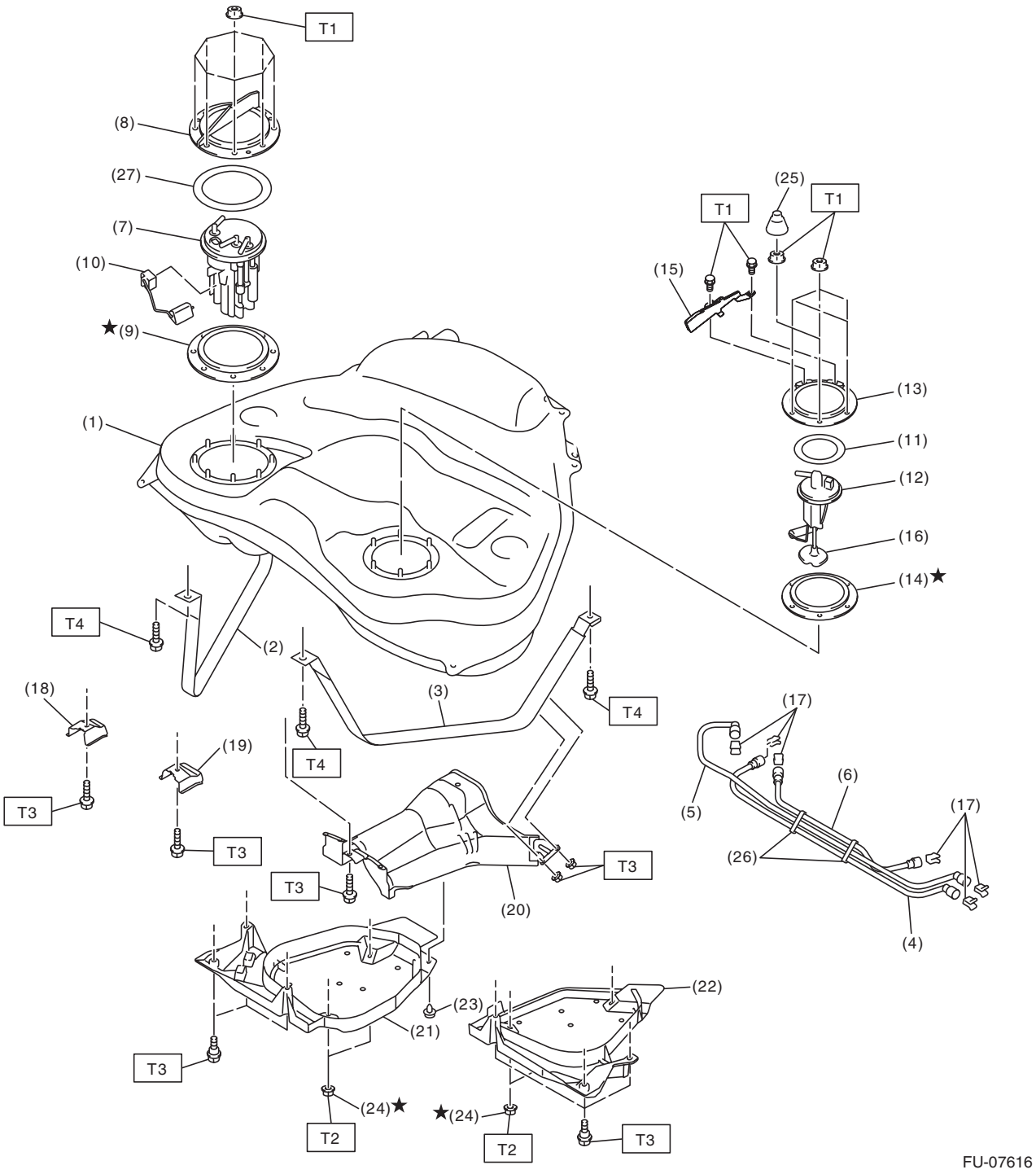
(1)	Gasket	(3)	Manifold absolute pressure sensor	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Throttle body	(4)	O-ring	***T1: 2 (0.2, 1.5)***
				T2: 8 (0.8, 5.9)

3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



(1)	Crankshaft position sensor	(5)	Exhaust camshaft position sensor LH	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Knock sensor	(6)	Exhaust camshaft position sensor RH	***T1: 5 (0.5, 3.7)***
(3)	Intake camshaft position sensor LH	(7)	Engine harness cover	***T2: 6.4 (0.7, 4.7)***
(4)	Intake camshaft position sensor RH			***T3: 24 (2.4, 17.7)***

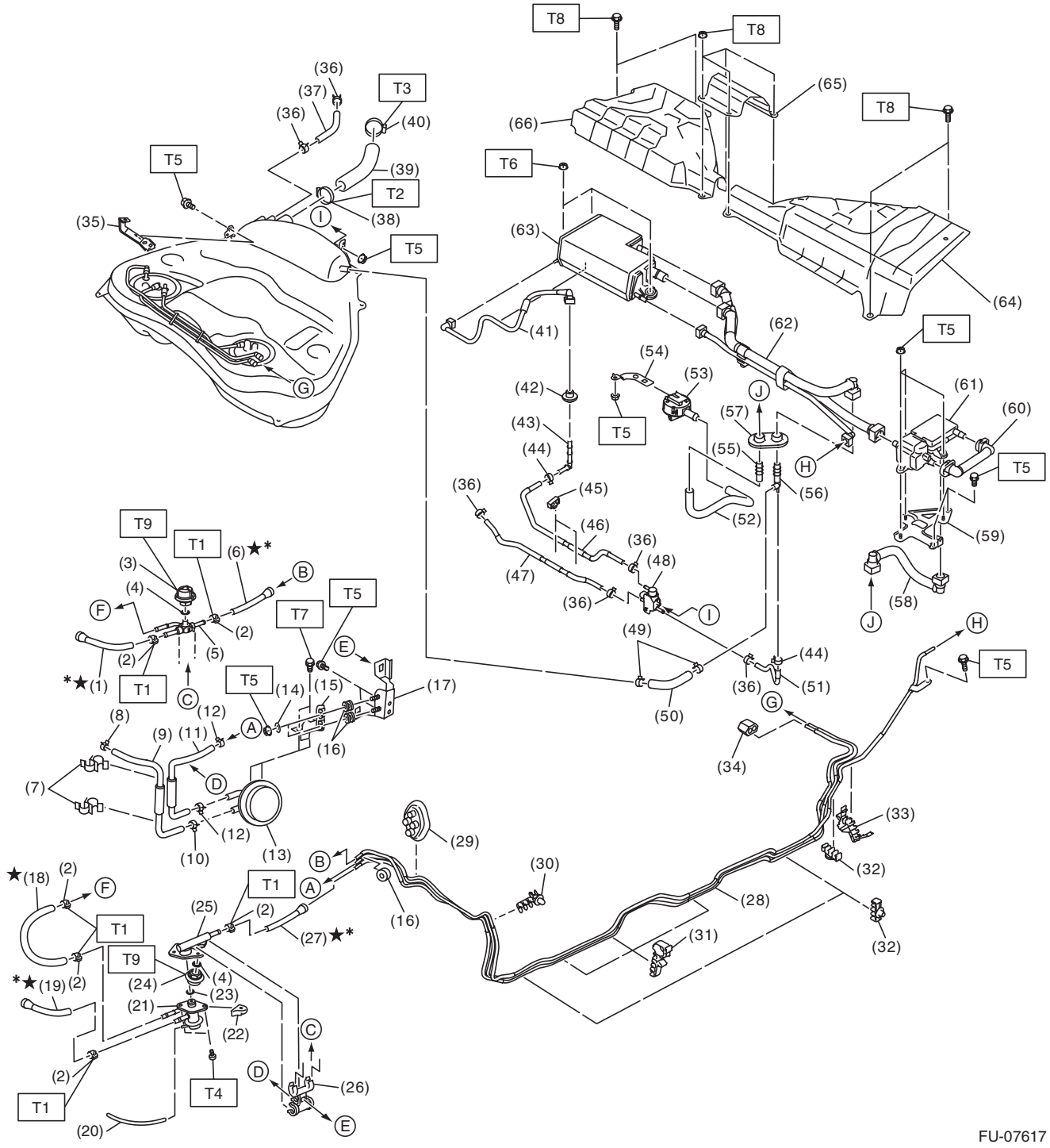
4. FUEL TANK


T1
(8)
(27)
(7)
(10)
★(9)
(1)
(25)
T1
T1
(15)
(13)
(11)
(12)
(16)
(14)★
T4
(2)
(3)
T4
T4
(18)
(19)
T3
T3
T3
T3
(20)
(17)
(6)
(5)
(17)
(26)
(4)
(22)
(23)
(21)
T3
(24)★
★(24)
T2
T2
T3
FU-07616

(1) Fuel tank
(2) Fuel tank band RH
(3) Fuel tank band LH
(4) Fuel delivery tube
(5) Fuel return tube
(6) Jet pump tube
(7) Fuel pump ASSY
(8) Fuel pump upper plate
(9) Fuel pump gasket
(10) Fuel level sensor
(11) Fuel sub level sensor upper plate cushion
(12) Fuel sub level sensor
(13) Fuel sub level sensor upper plate
(14) Fuel sub level sensor gasket
(15) Fuel sub level sensor protector
(16) Fuel sub level sensor filter
(17) Retainer
(18) Stopper RH
(19) Stopper LH
(20) Heat shield cover
(21) Fuel tank protector RH
(22) Fuel tank protector LH
(23) Clip
(24) Self-locking nut
(25) Rubber cap
(26) Tube clamp
(27) Fuel pump upper plate cushion

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



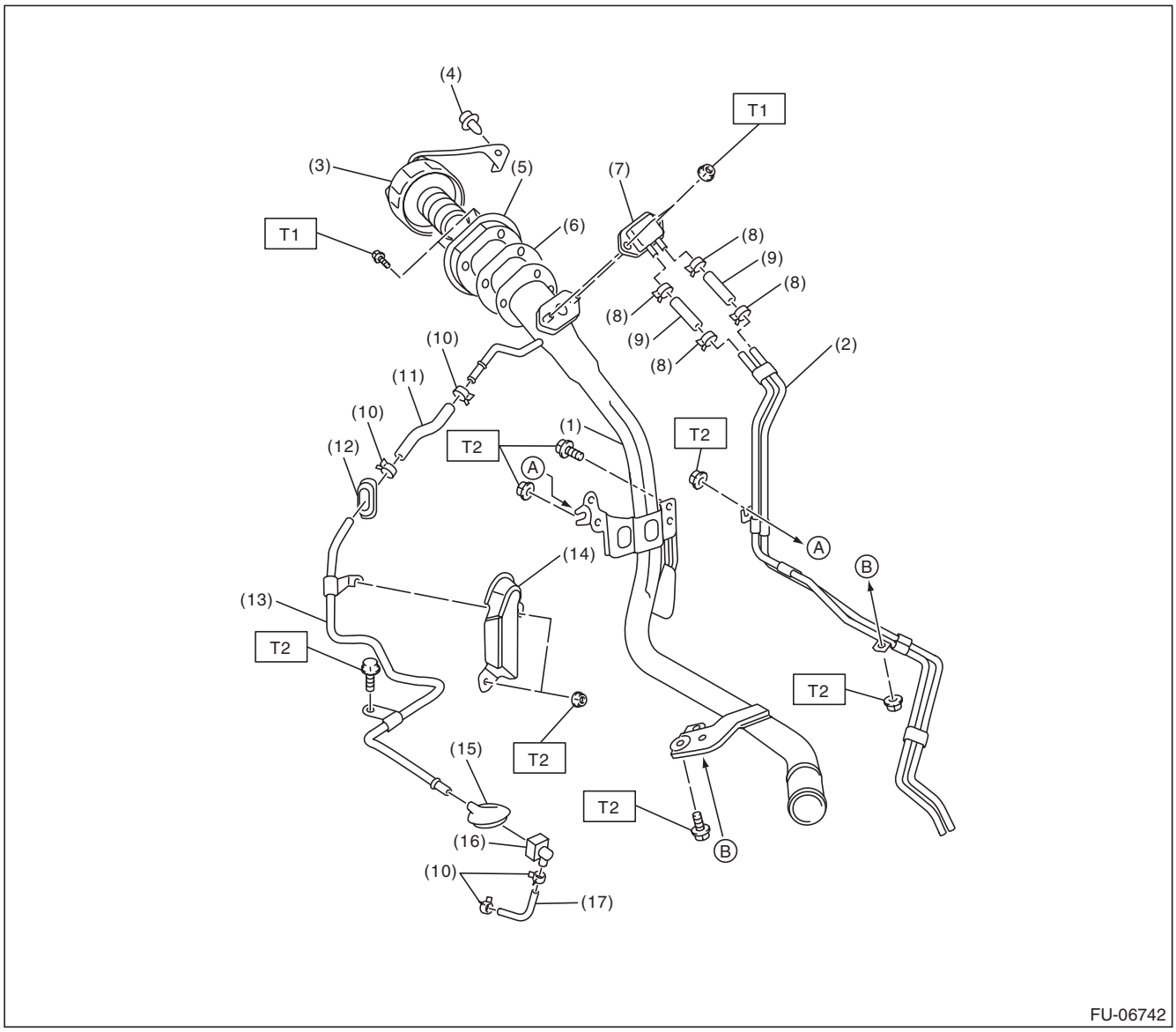
FU-07617

(1) Fuel delivery hose A
(2) Clamp
(3) Pulsation damper A
(4) Fuel pipe gasket
(5) Fuel by-pass pipe
(6) Fuel delivery hose B
(7) Hose clamp
(8) Clip
(9) Evaporation hose A
(10) Clip
(11) Evaporation hose B
(12) Clip
(13) Purge damper
(14) Collar
(15) Purge damper bracket
(16) Bushing
(17) Damper bracket
(18) Fuel hose
(19) Fuel return hose A
(20) Vacuum hose
(21) Pressure regulator
(22) Fuel pipe protector
(23) O-ring
(24) Pulsation damper B
(25) Fuel holder ASSY
(26) Damper holder
(27) Fuel return hose B
(28) Fuel pipe ASSY
(29) Fuel pipe front grommet
(30) Pipe clamp
(31) Pipe clamp
(32) Pipe clamp
(33) Pipe clamp
(34) Fuel pipe rear grommet
(35) Bracket
(36) Clip
(37) Evaporation hose C
(38) Clamp
(39) Fuel filler hose
(40) Clamp
(41) PCV drain tube
(42) Grommet
(43) Hose connector
(44) Clip
(45) Hose clamp
(46) Evaporation hose D
(47) Evaporation hose E
(48) Pressure control solenoid valve ASSY
(49) Clip
(50) Evaporation hose F
(51) Evaporation hose G
(52) Drain hose
(53) Drain separator
(54) Drain separator bracket
(55) Hose connector
(56) Hose connector
(57) Grommet
(58) Drain tube A
(59) Leak check valve ASSY bracket
(60) Drain tube B
(61) Leak check valve ASSY
(62) Canister tube ASSY
(63) Canister
(64) Canister cover LH
(65) Center canister cover
(66) Canister cover RH

Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.25 (0.1, 0.9)
T2: 2 (0.2, 1.5)
T3: 2.5 (0.3, 1.8)
T4: 6.4 (0.7, 4.7)
T5: 7.5 (0.8, 5.5)
T6: 8 (0.8, 5.9)
T7: 13 (1.3, 9.6)
T8: 18 (1.8, 13.3)
T9: 21.6 (2.2, 15.9)

* It can be reused if the quick connector side is disconnected.

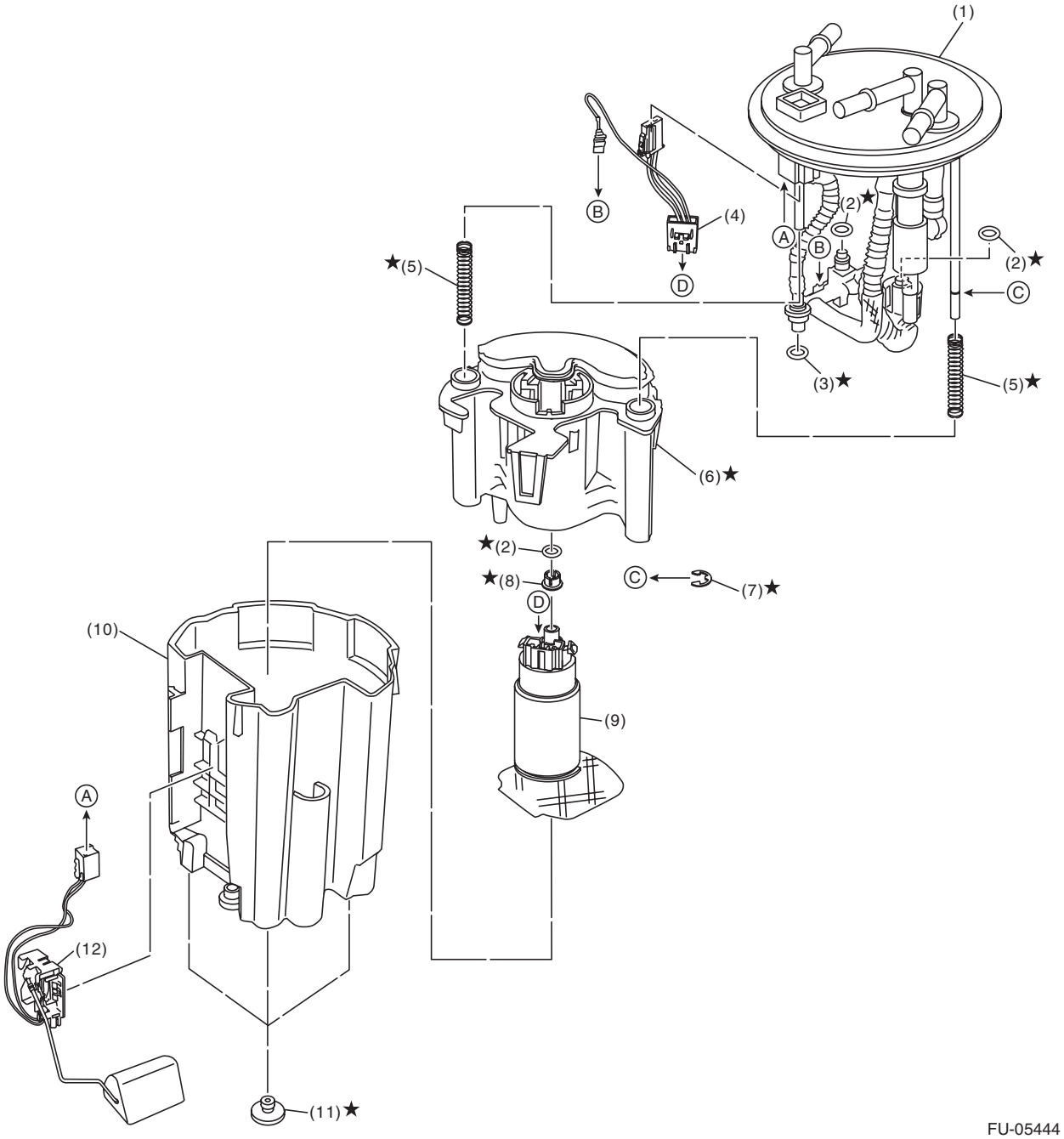
6. FUEL FILLER PIPE



(1) Fuel filler pipe
(2) Evaporation pipe A
(3) Fuel filler cap
(4) Clip
(5) Filler ring
(6) Filler pipe gasket
(7) Shut valve
(8) Clip
(9) Evaporation hose A
(10) Clip
(11) Evaporation hose B
(12) Grommet
(13) Evaporation pipe B
(14) Evaporation pipe protector
(15) Grommet
(16) Quick connector
(17) 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



FU-05444

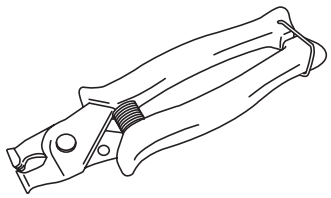
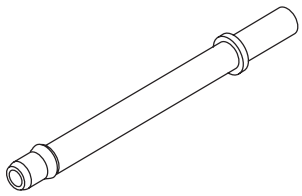
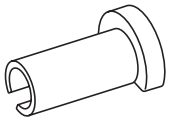
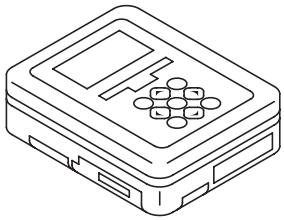
(1) Sub tank bracket ASSY
(2) O-ring
(3) O-ring
(4) Fuel pump harness
(5) Spring
(6) Fuel filter
(7) Clip
(8) Spacer
(9) Pump ASSY
(10) Sub tank
(11) Cushion
(12) Fuel level sensor

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- 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.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.
- When the suspension-related components have been removed and installed, be sure to adjust the steering angle sensor. <Ref. to VDC-13, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDC-CM&H/U).>

D: 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.
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for draining fuel.
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing the quick connector.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for draining fuel and each inspection.

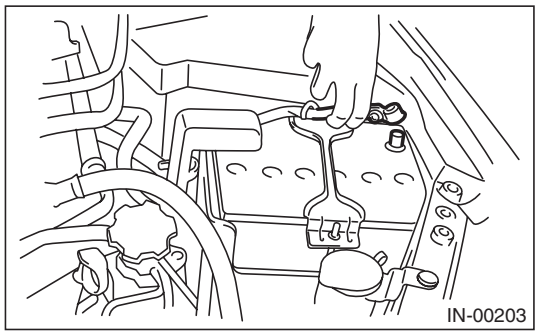
2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Oscilloscope	Used for inspecting the waveform of each sensor.

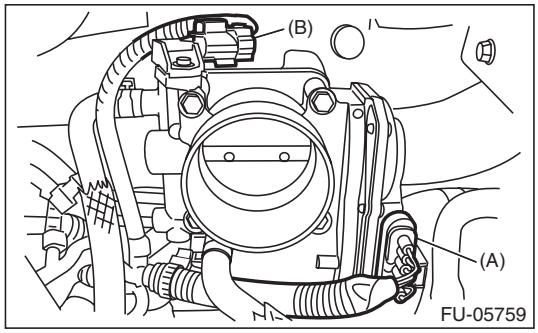
2. Throttle Body

A: REMOVAL

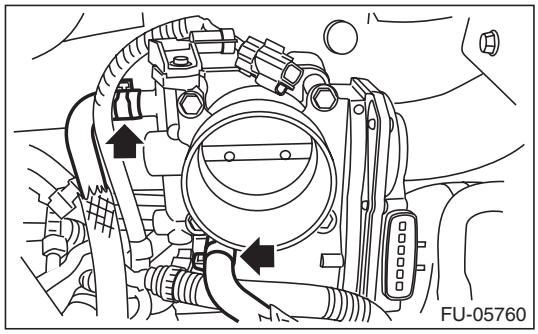
1) Disconnect the ground cable from battery.



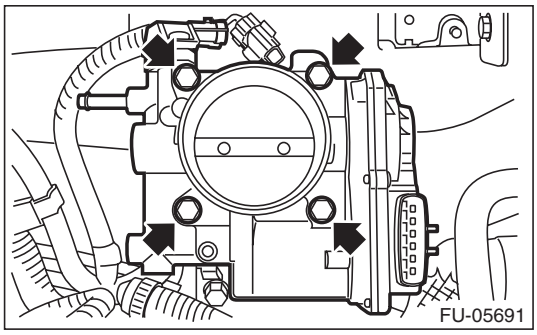
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
6) Disconnect the connector (A) from the throttle position sensor, and the connector (B) from the manifold pressure sensor.



7) Disconnect the engine coolant hose from throttle body.



8) Remove the throttle body from the intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

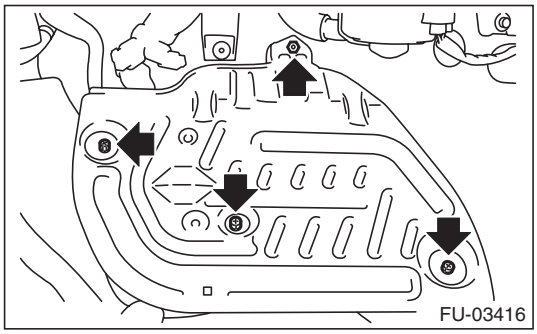
NOTE:
Use a new gasket.

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

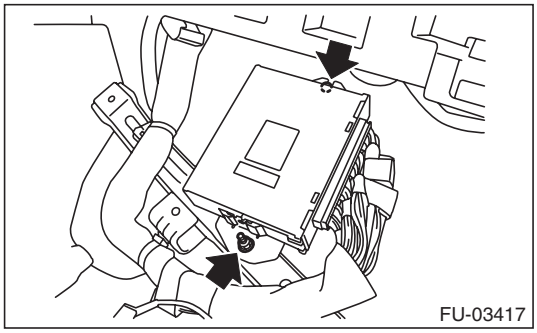
C: INSPECTION

1. THROTTLE SENSOR INSPECTION (METHOD WITH CIRCUIT TESTER)

1) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
2) Turn over the floor mat of passenger's seat.
3) Remove the protect cover.

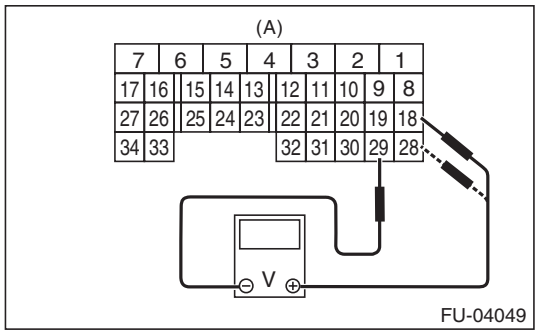


4) Remove the nuts and bolts which hold the ECM to the bracket.



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

7) After inspection, install the related parts in the reverse order of removal.

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

2. THROTTLE SENSOR INSPECTION (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(H4DOTC)(diag)-40, 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

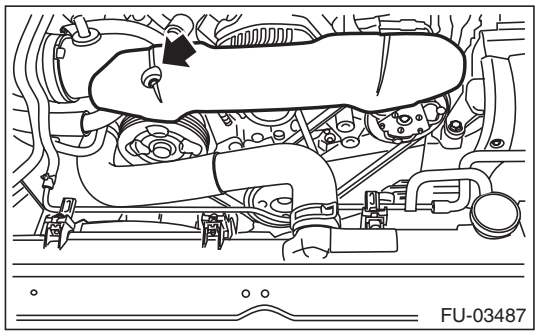
3. OTHER INSPECTIONS

1) Check that the throttle body has no deformation, cracks or other damages.
2) Check that the engine coolant hose has no cracks, damage or loose part.

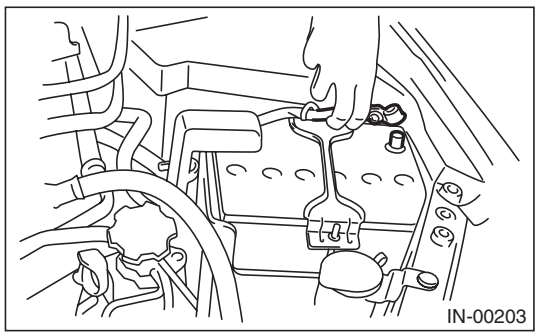
3. Intake Manifold

A: REMOVAL

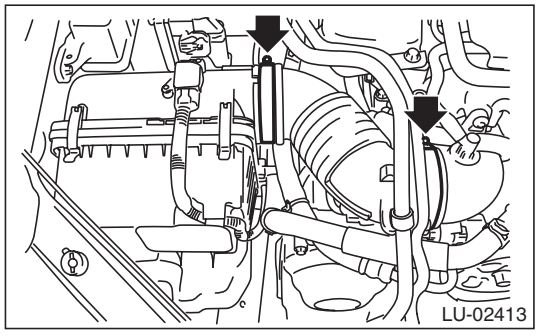
1) Remove the V-belt covers.



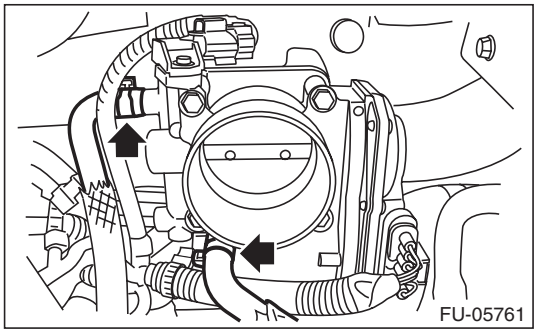
2) Collect the refrigerant from A/C system. <Ref. to AC-19, PROCEDURE, Refrigerant Recovery Procedure.>
3) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
4) Disconnect the ground cable from battery.



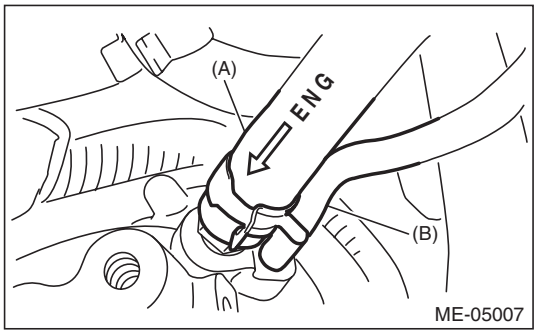
5) Open the fuel filler lid and remove the fuel filler cap.
6) Lift up the vehicle.
7) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
8) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
9) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
10) Remove the air intake boot.



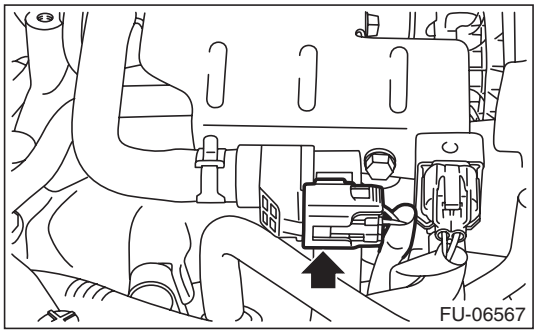
11) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
12) Remove the generator. <Ref. to SC(STI)-21, REMOVAL, Generator.>
13) Remove the coolant filler tank. <Ref. to CO(STI)-28, REMOVAL, Coolant Filler Tank.>
14) Disconnect the A/C pressure hoses from A/C compressor. <Ref. to AC-38, REMOVAL, Hose and Pipe.>
15) Disconnect the engine coolant hose from throttle body.



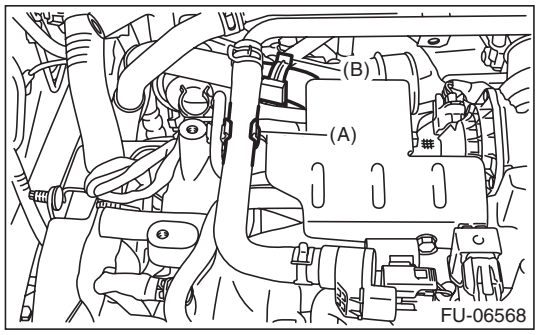
16) Disconnect the brake booster vacuum hose (A) and pressure regulator vacuum hose (B) from the intake manifold.



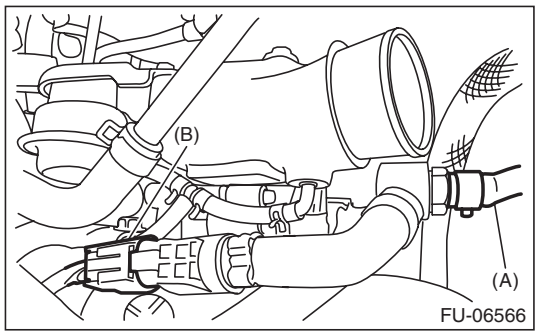
17) Disconnect the connector from the PCV hose assembly A.



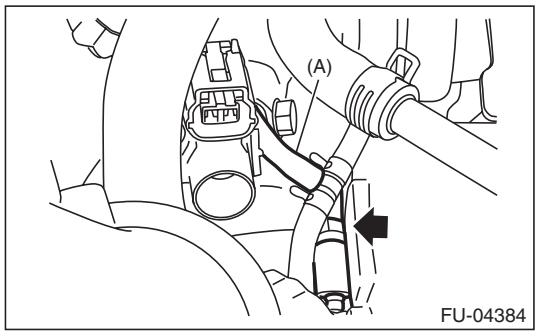
18) Remove the PCV hose assembly A from clip (A), and remove the vacuum hose from clip (B).



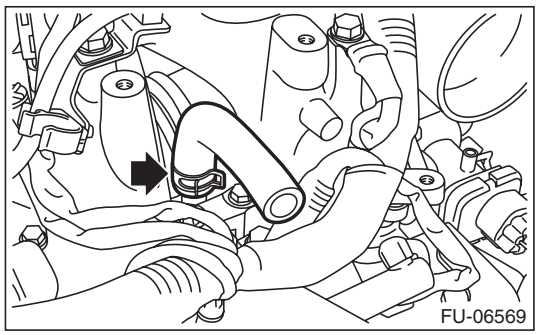
19) Disconnect the vacuum hose (A) and the connector (B) from the PCV hose assembly B.



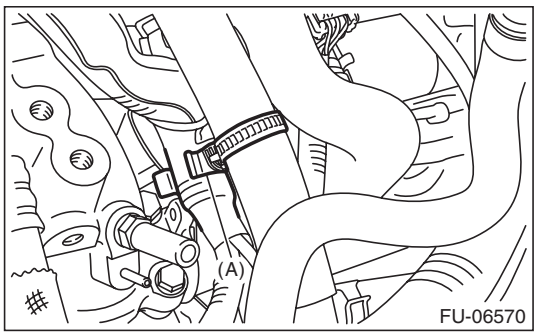
20) Disconnect the air control hose (A) from the waste gate actuator, and loosen the clamp which holds the intake duct to the turbocharger.



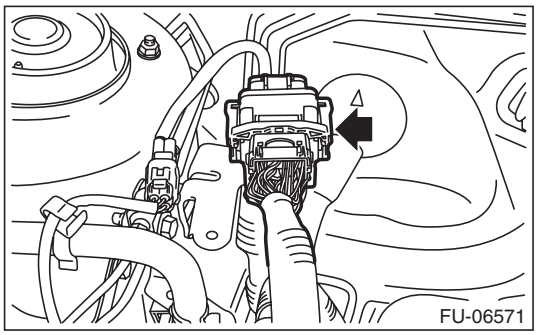
21) Remove the engine coolant hose from the water tank pipe.



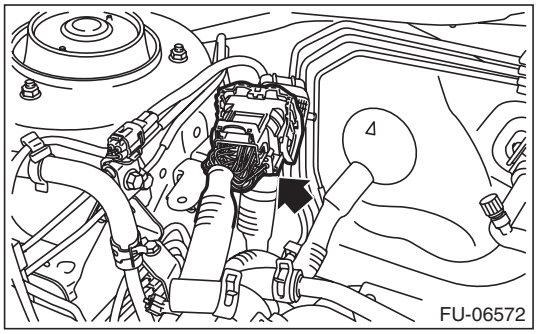
22) Remove the engine harness from clip (A).



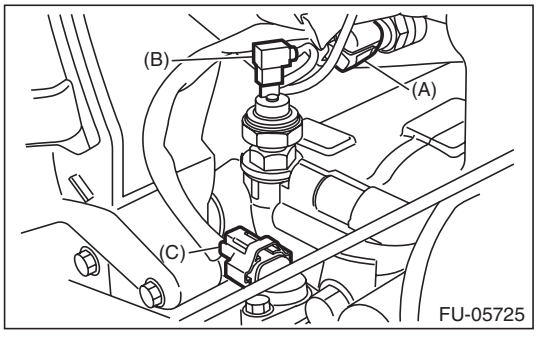
23) Disconnect the bulkhead harness connectors from the engine harness connectors.



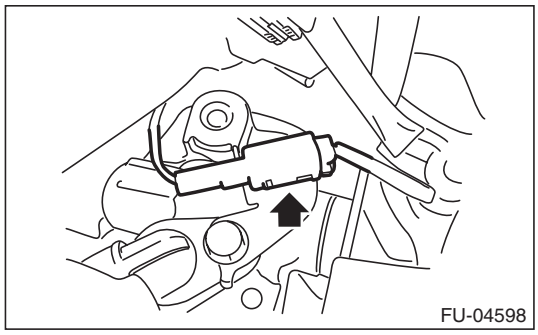
24) Remove the engine harness connector from the engine harness bracket.



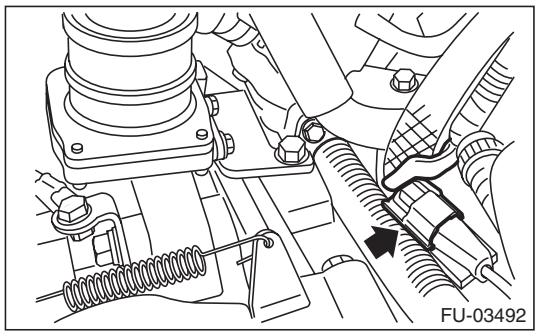
25) Disconnect the connector (A) from the engine coolant temperature sensor, connector (B) from the oil pressure switch, and connector (C) from the crankshaft position sensor.



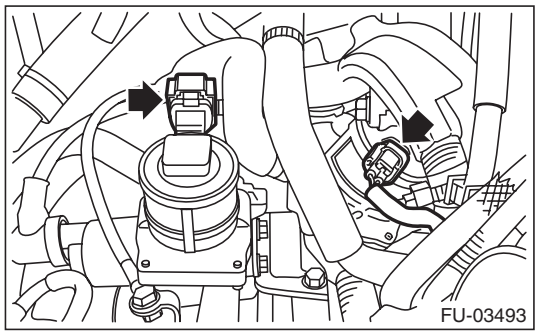
26) Disconnect the connector from power steering pump switch.



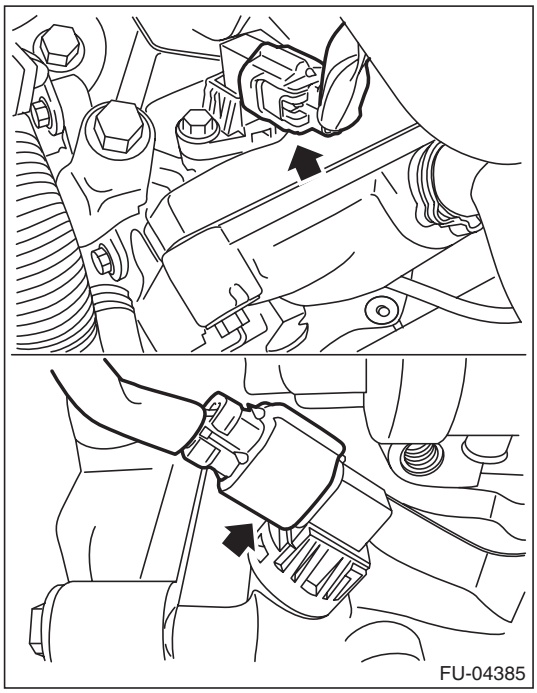
27) Disconnect the connector from the knock sensor.



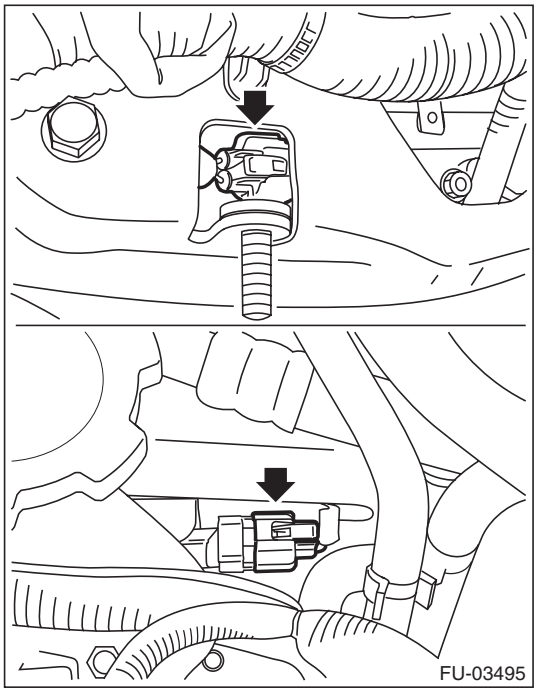
28) Disconnect the connector from the secondary air combination valve.



29) Disconnect the connector from the intake camshaft position sensor.

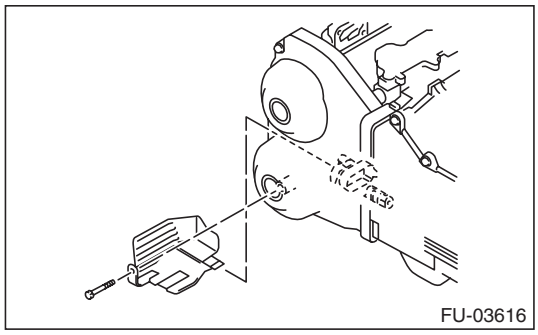


30) Disconnect the connector from the intake oil flow control solenoid valve.

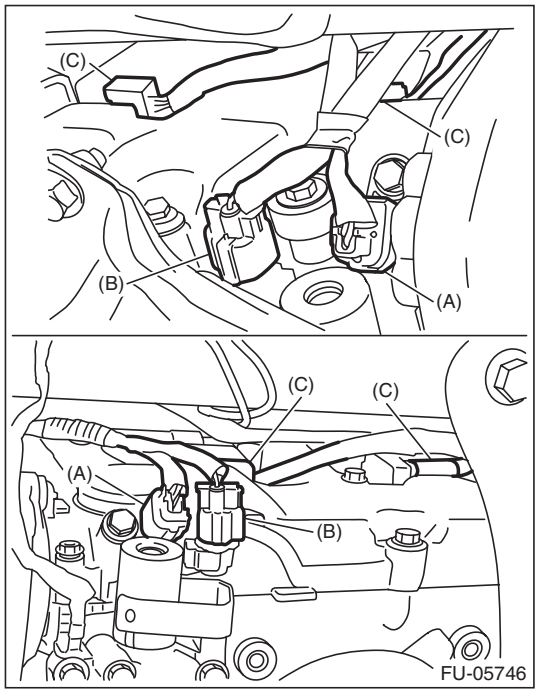


31) Lift up the vehicle.

32) Remove the engine harness cover. (right side only.)

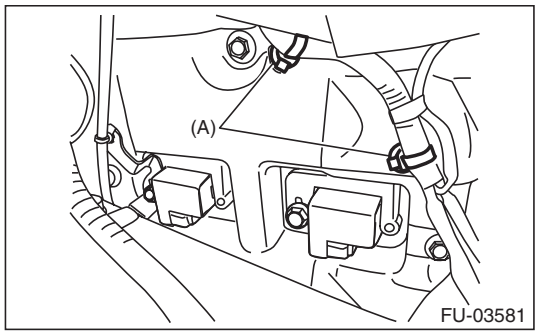


33) Disconnect connector (A) from the exhaust camshaft position sensor, connector (B) from the exhaust oil flow control solenoid valve, and connector (C) from the ignition coil.

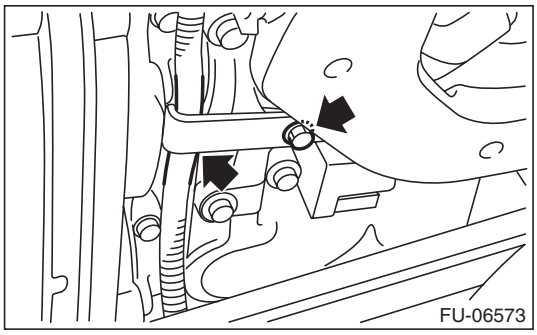


34) Lower the vehicle.

35) Remove the clip (A) which hold the engine harness to the rocker cover RH.



36) Remove the bolts that secure the air duct to the rocker cover LH, and remove the engine harness.



37) Disconnect the fuel delivery hose, fuel return hose and evaporation hose.

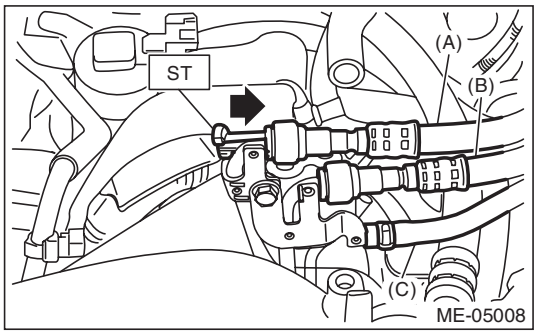
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

(1) Set the ST to the fuel pipe.

ST 42099AE000 QUICK CONNECTOR RELEASE

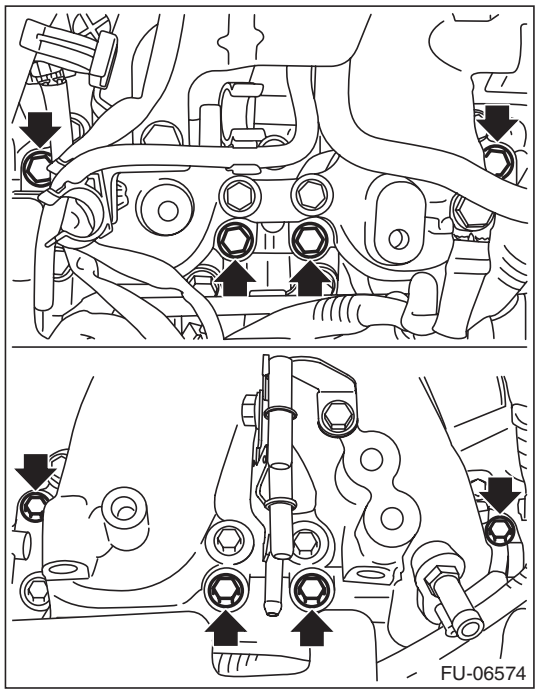
(2) Disconnect the quick connector of the fuel delivery hose and fuel return hose by pushing the ST in the direction of the arrow.

(3) Remove the clip and disconnect the evaporation hose from the fuel pipe.



(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

38) Remove the intake manifold from cylinder head.

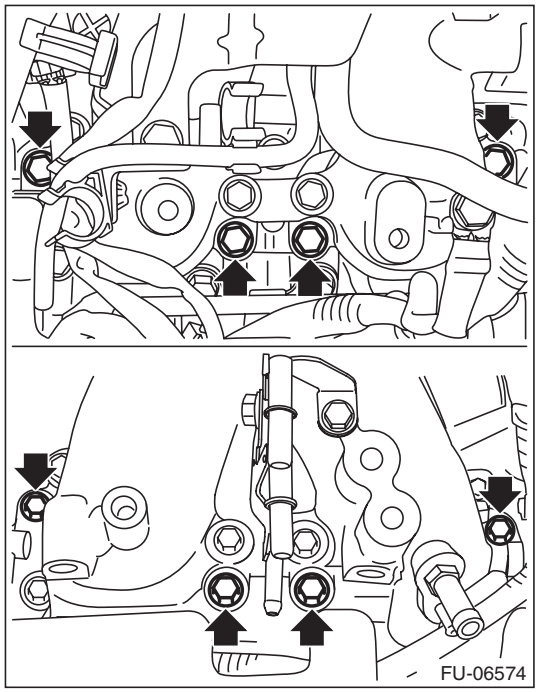


B: INSTALLATION

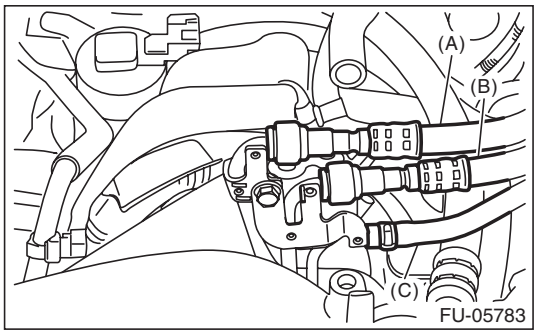
1) Install the intake manifold onto cylinder heads.

NOTE:
Use a new gasket.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)



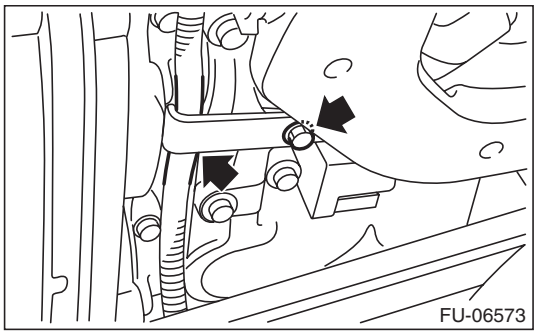
2) Connect the fuel delivery hose, fuel return hose, and evaporation hose.



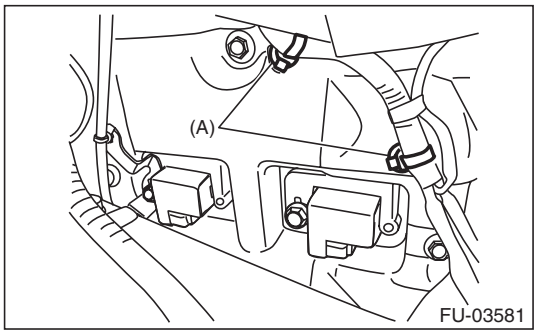
(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

3) Fix the engine harness to the rocker cover LH with the air duct.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

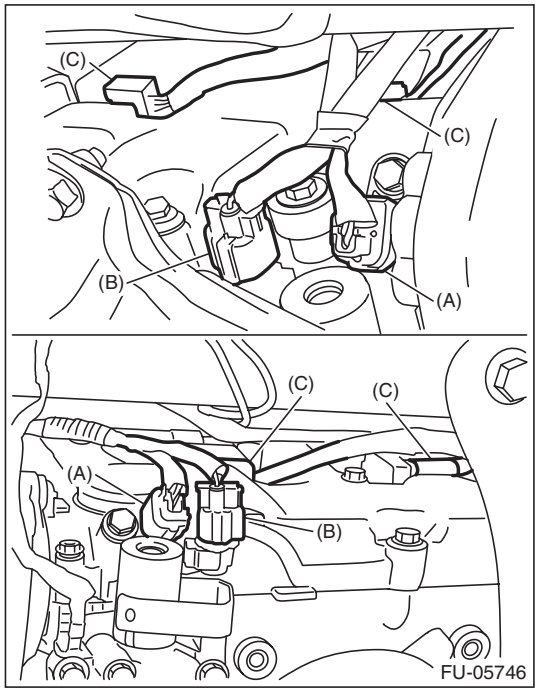


4) Fix the engine harness to the rocker cover RH with clips (A).



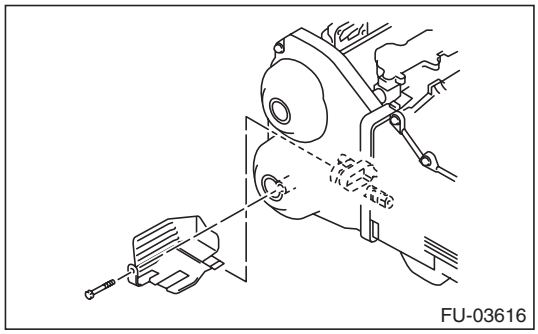
5) Lift up the vehicle.

6) Connect connector (A) to the exhaust camshaft position sensor, connector (B) to the exhaust oil flow control solenoid valve, connector (C) to the ignition coil.



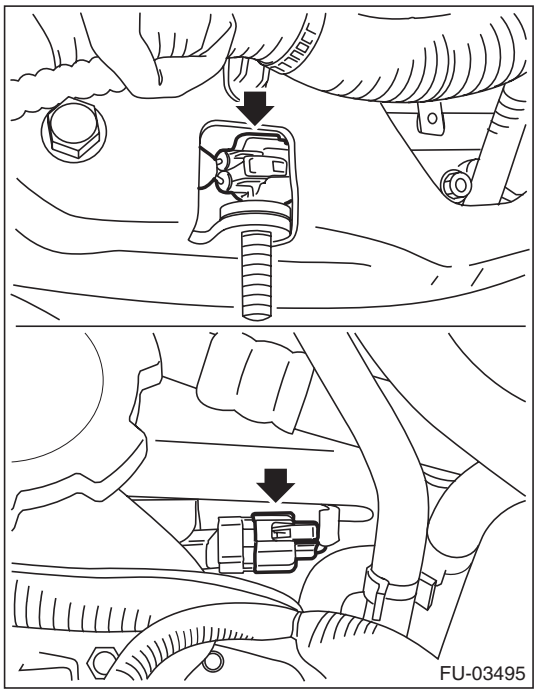
7) Install the engine harness cover. (right side only.)

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

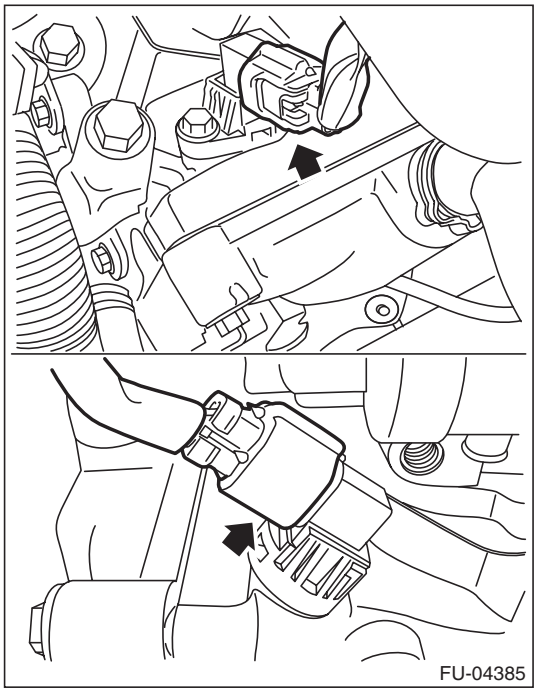


8) Lower the vehicle.

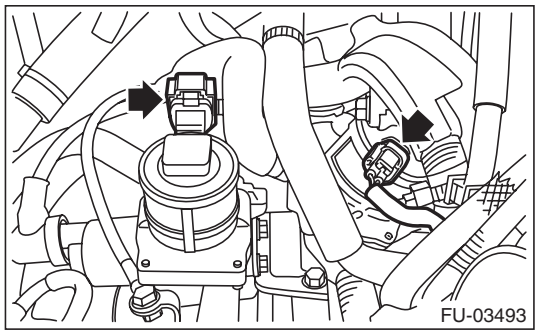
9) Connect the connector to the intake oil flow control solenoid valve.



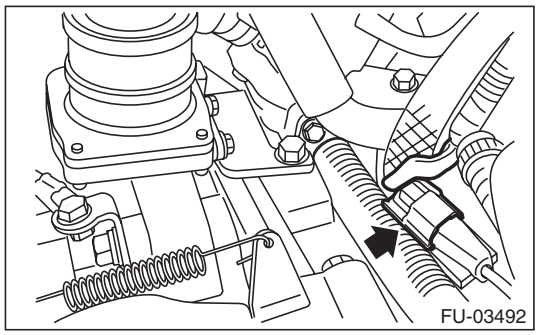
10) Connect the connector to the intake camshaft position sensor.



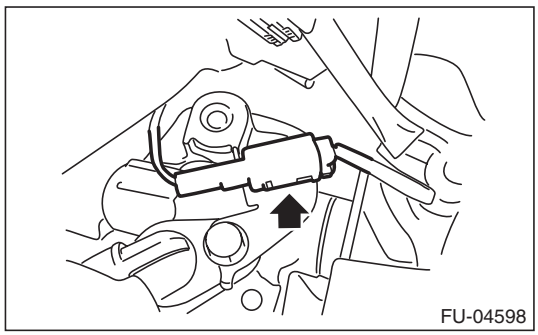
11) Connect the connector to the secondary air combination valve.



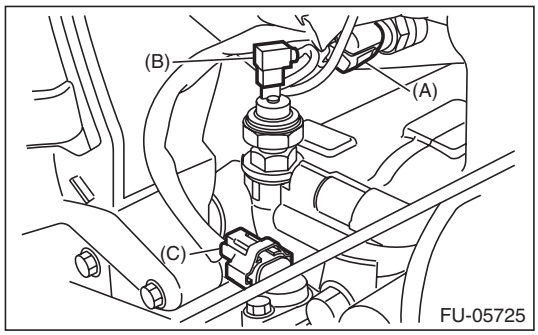
12) Connect the connector to the knock sensor.



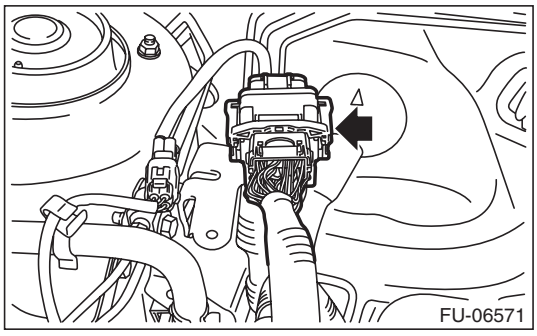
13) Connect the connector to the power steering pump switch.



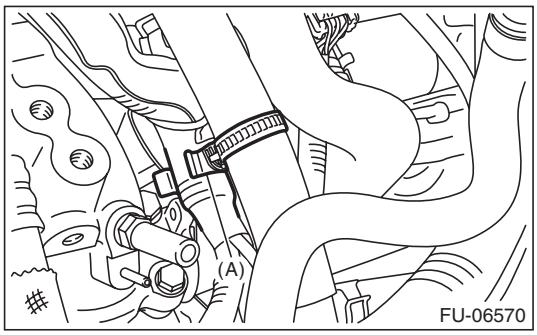
14) Connect the connector (A) to the engine coolant temperature sensor, connector (B) to the oil pressure switch, and the connector (C) to the crankshaft position sensor.



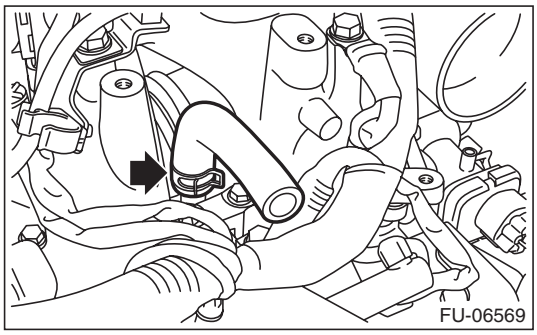
15) Install the engine harness connector to engine harness bracket, then connect the bulkhead harness connector to the engine harness connector.



16) Install the engine harness to clip (A).

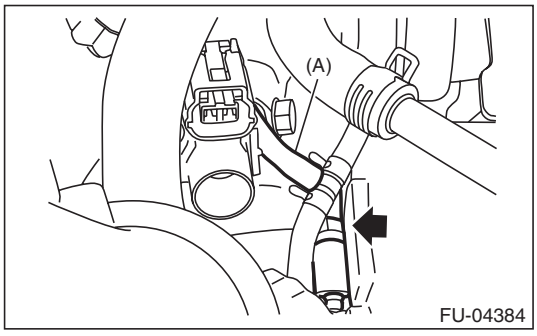


17) Install the engine coolant hose to the water tank pipe.

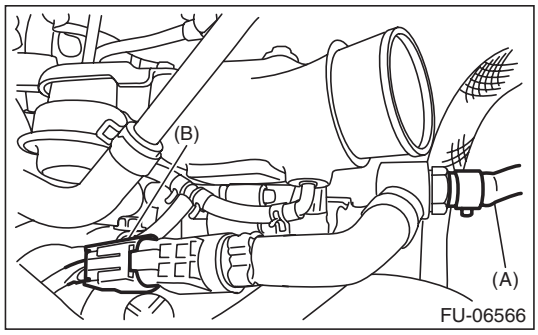


18) Connect the air control hose (A) to the wastegate actuator, and install the turbocharger to the intake duct.

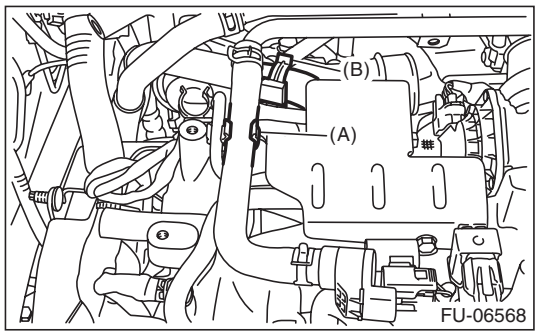
Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



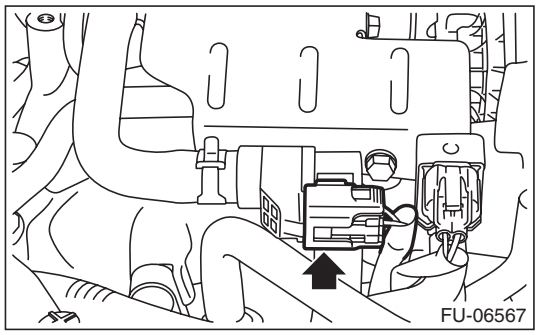
19) Connect the vacuum hose (A) and connector (B) to the PCV hose assembly B.



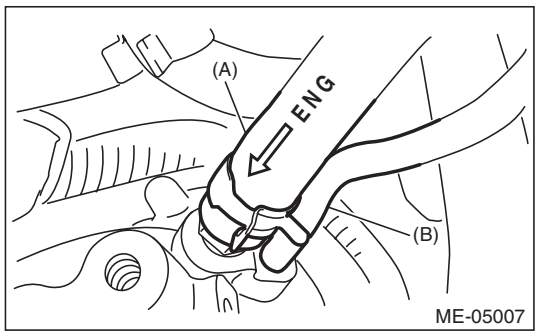
20) Install the vacuum hose to clip (B), and install the PCV hose assembly A to clip (A).



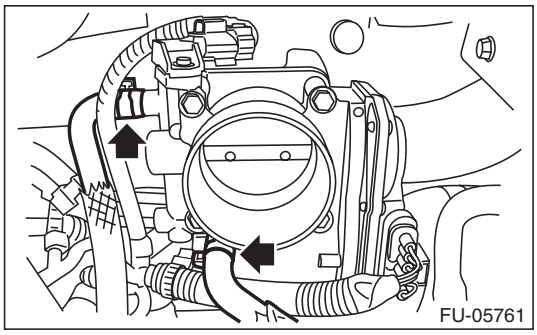
21) Connect the connector to the PCV hose assembly A.



22) Connect the brake booster vacuum hose (A) and pressure regulator vacuum hose (B) to the intake manifold.

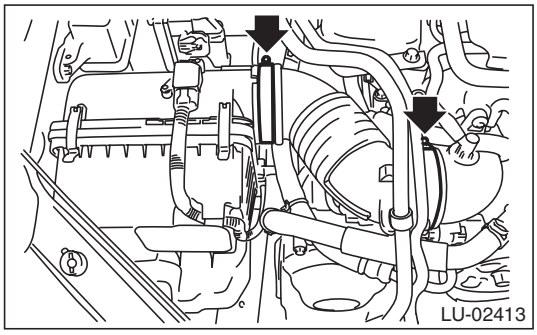


23) Connect the engine coolant hoses to throttle body.

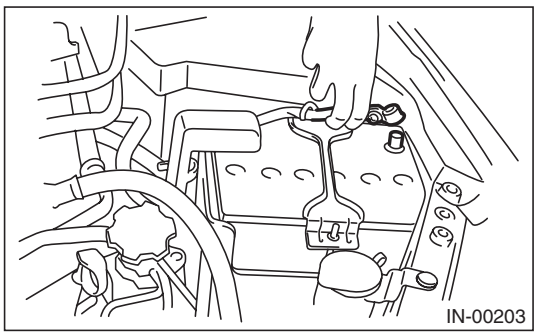


24) Install the A/C pressure hoses to A/C compressor. <Ref. to AC-38, INSTALLATION, Hose and Pipe.>
25) Install the coolant filler tank. <Ref. to CO(STI)-28, INSTALLATION, Coolant Filler Tank.>
26) Install the generator. <Ref. to SC(STI)-21, INSTALLATION, Generator.>
27) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>
28) Install the air intake boot.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



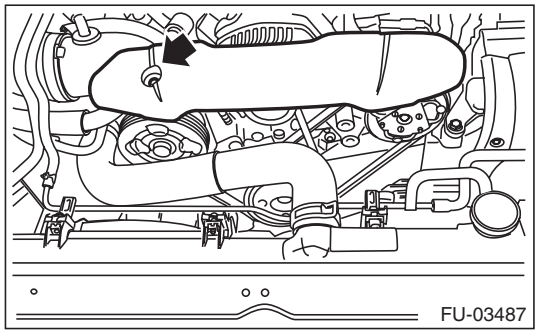
29) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
30) Connect the battery ground terminal.



31) Lift up the vehicle.

32) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
33) Lower the vehicle.
34) Install the V-belt cover.

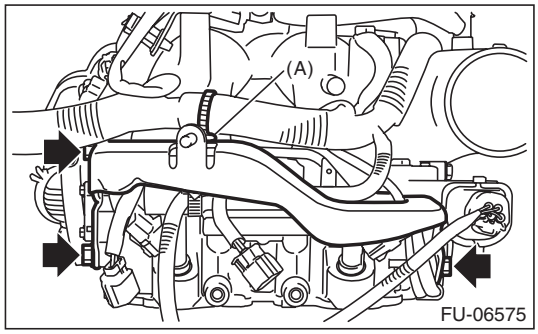
Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



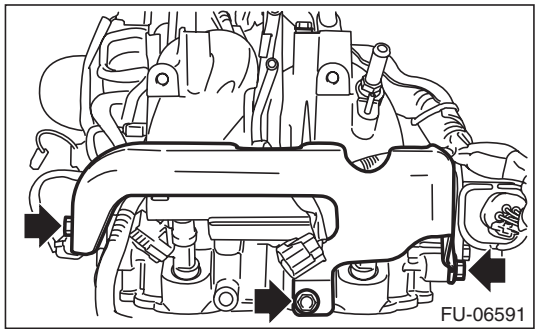
35) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
36) Charge the A/C system with refrigerant. <Ref. to AC-20, PROCEDURE, Refrigerant Charging Procedure.>

C: DISASSEMBLY

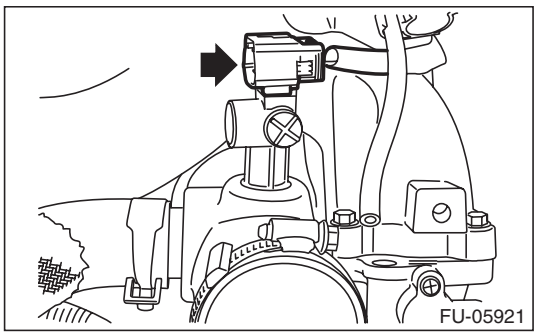
1) Remove clamp (A) holding the fuel pipe protector RH to the engine harness, and remove the fuel pipe protector RH.



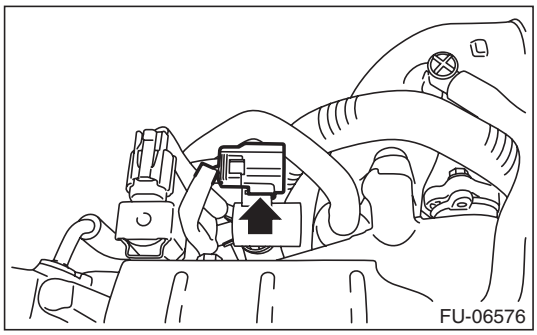
2) Remove the fuel pipe protector LH.



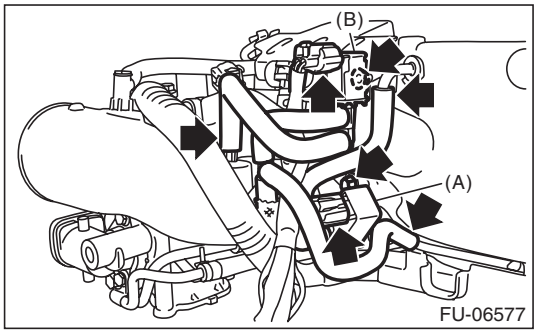
3) Remove the connector from the intake duct.



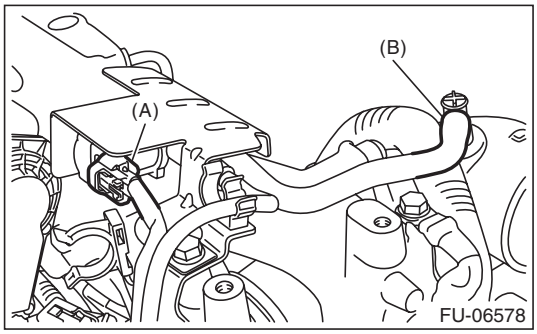
4) Remove the connector from the PCV hose assembly.



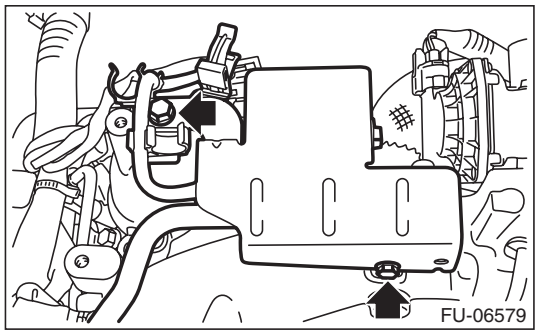
5) Remove purge control solenoid valve 1 (A) and purge control solenoid valve 2 (B).



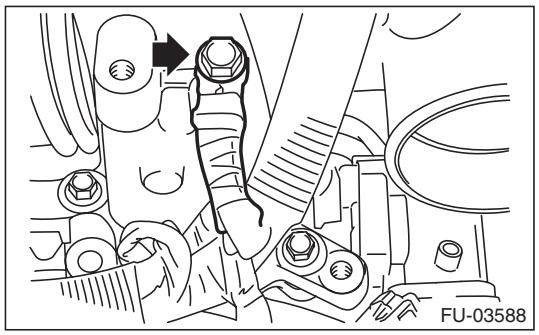
6) Disconnect the connector (A) from the wastegate control solenoid valve, and disconnect the vacuum hose (B) from the intake duct.



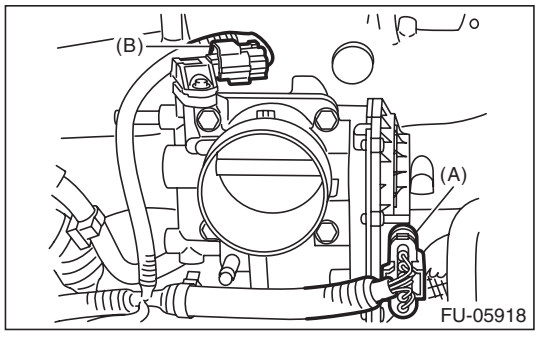
7) Remove the solenoid valve bracket together with the wastegate control solenoid valve.



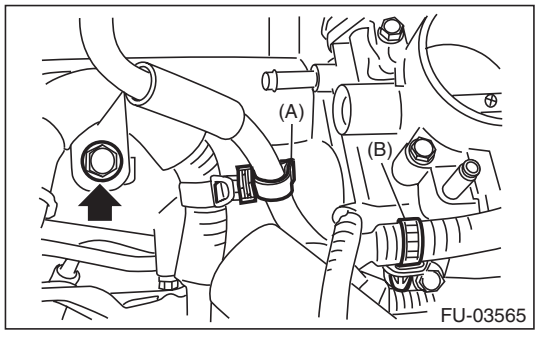
8) Remove the engine ground terminals from the intake manifold.



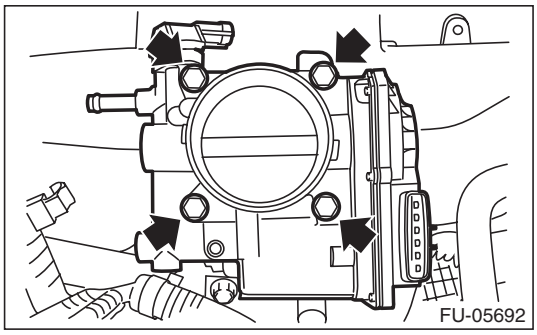
9) Disconnect the connector (A) from the throttle position sensor, and the connector (B) from the manifold pressure sensor.



10) Remove clip (A) holding the engine harness and vacuum hose, clip (B) holding the engine harness to the engine harness stay, and the bolt holding the engine harness to the intake manifold.

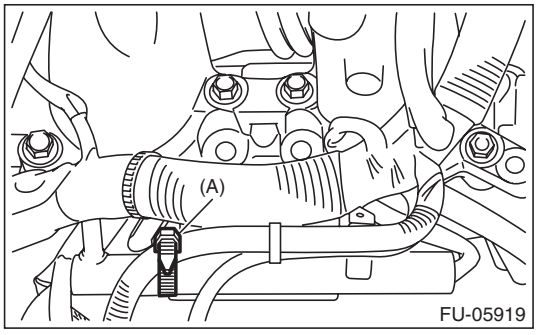


11) Remove the throttle body from the intake manifold.

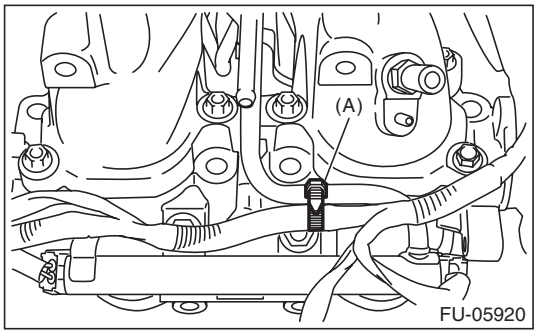


12) Remove the harness band (A) which holds the engine harness to the fuel injector pipe.

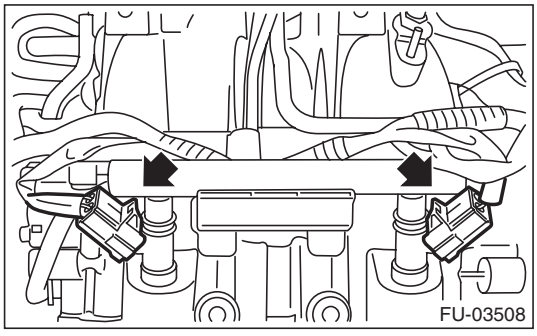
- RH side



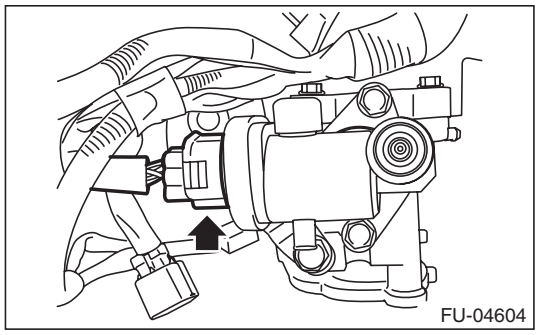
- LH side



13) Disconnect the connector from fuel injector.

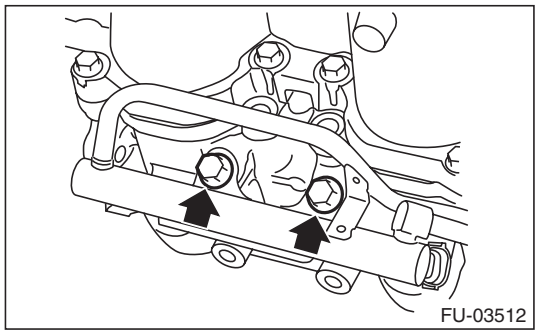


14) Disconnect the connector from the tumble generator valve assembly.

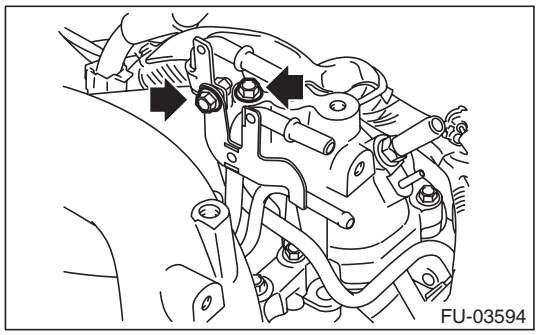


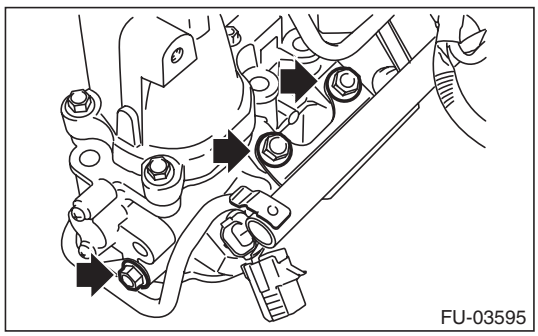
15) Remove the bolts which hold fuel injector pipe.

- RH side

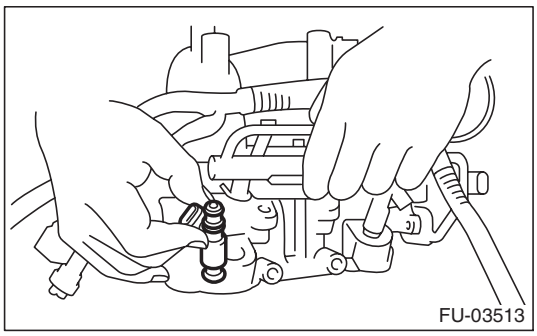


- LH side

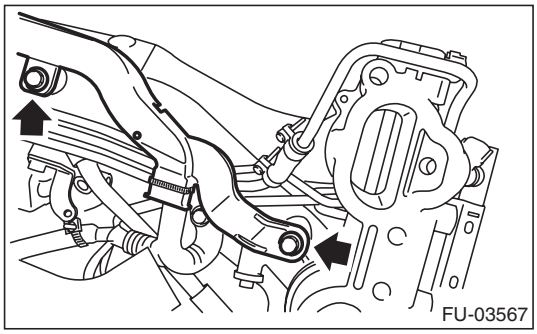




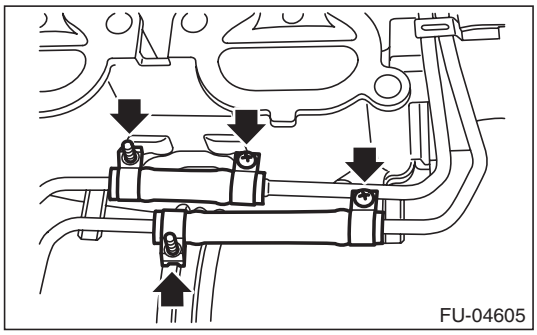
16) Remove the fuel injector.



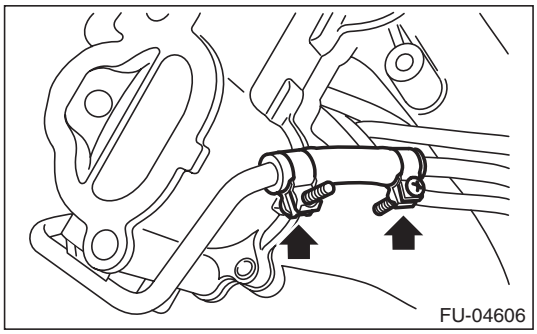
17) Remove the harness brackets holding the engine harness to the intake manifold, and remove the engine harness.



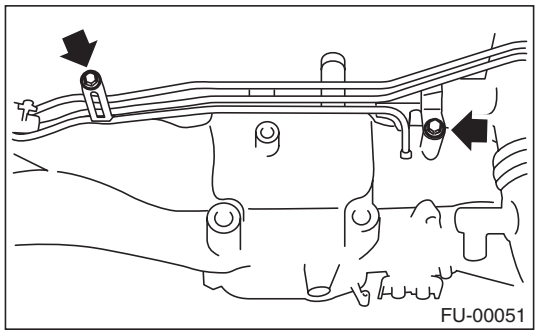
18) Loosen the clamp holding the RH side fuel hose to the fuel injector pipe RH, and remove the fuel injector pipe RH.



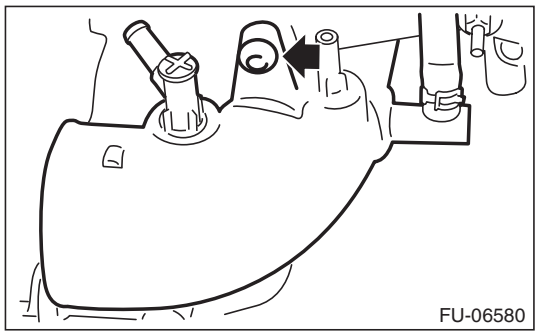
19) Loosen the clamp holding the LH side fuel hose to the fuel injector pipe LH, and remove the fuel injector pipe LH.



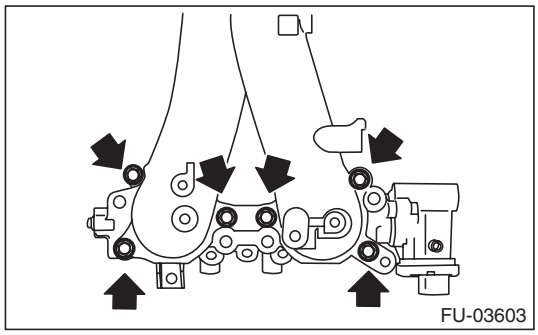
20) Remove the bolts holding the fuel pipe assembly to the intake manifold, and remove the fuel pipe assembly.



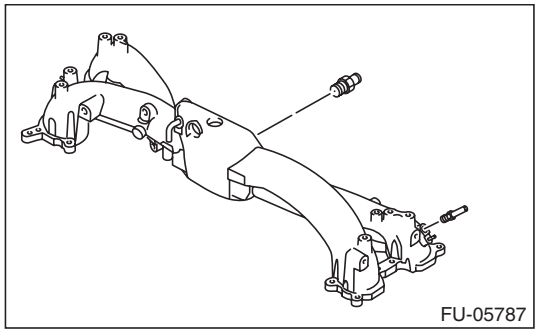
21) Remove the intake duct from intake manifold.



22) Remove the tumble generator valve assembly from the intake manifold.



23) Remove the nipple from the intake manifold.

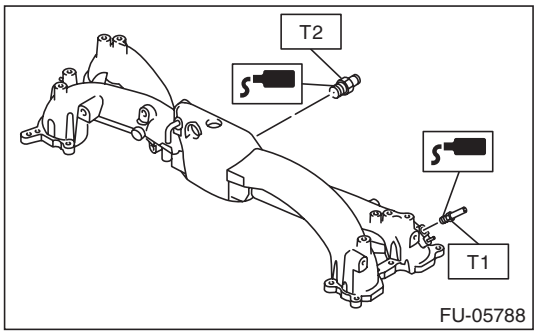


D: ASSEMBLY

1) Apply liquid gasket to the nipple threads, and install the nipple to the intake manifold.

Liquid gasket:
THREE BOND 1105 (Part No. 004403010)

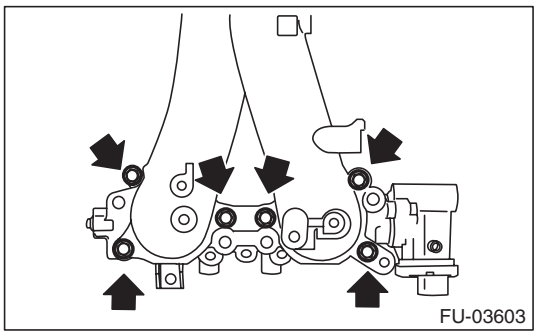
Tightening torque:
T1: 17 N·m (1.7 kgf-m, 12.5 ft-lb)
T2: 25 N·m (2.5 kgf-m, 18.4 ft-lb)



2) Install the tumble generator valve assembly onto intake manifold.

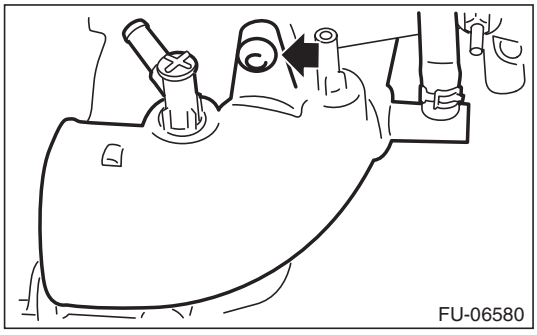
NOTE:
Use a new gasket.

Tightening torque:
8.25 N·m (0.8 kgf-m, 6.1 ft-lb)



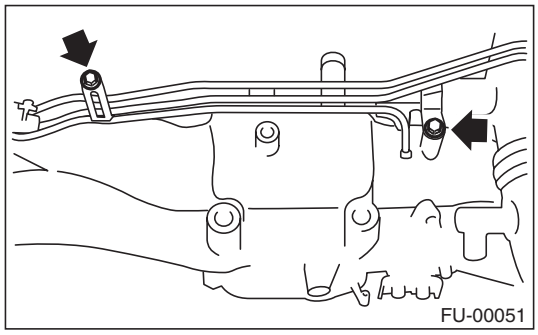
3) Install the air intake duct to the intake manifold.

Tightening torque:
17 N·m (1.7 kgf-m, 12.5 ft-lb)

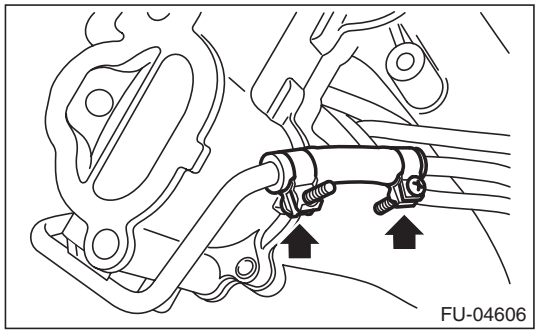


4) Install the fuel pipe assembly to the intake manifold.

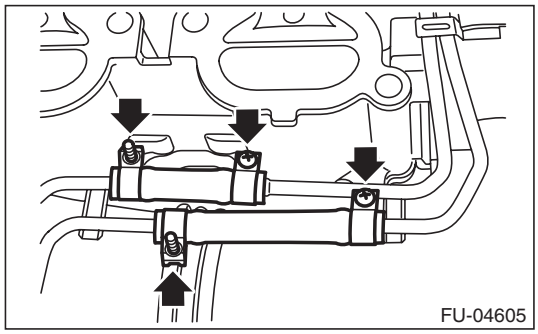
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



5) Install the fuel injector pipe LH and connect the LH side fuel hose to the fuel injector pipe LH. <Ref. to FU(STI)-96, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

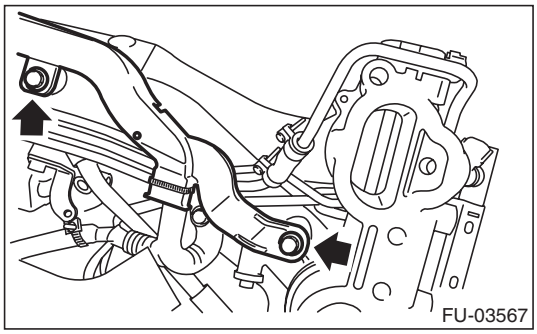


6) Install the fuel injector pipe RH and connect the RH side fuel hose to the fuel injector pipe RH. <Ref. to FU(STI)-96, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>



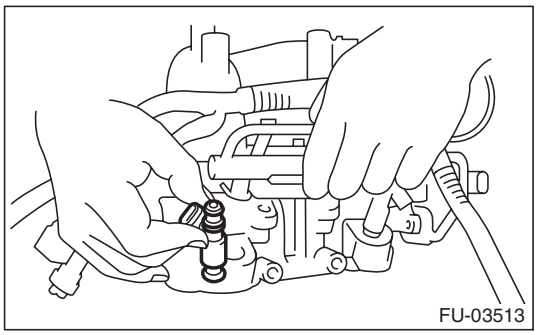
7) Install the engine harness to the intake manifold and attach the harness brackets holding the engine harness.

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



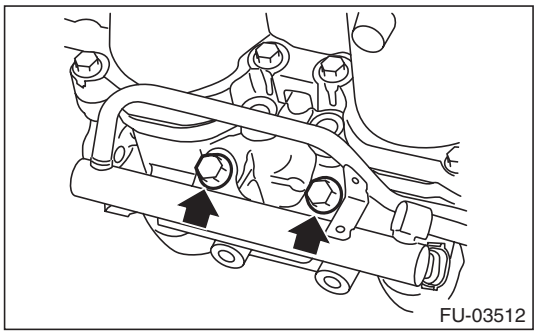
8) Install the fuel injector.

NOTE:
Use new O-rings.



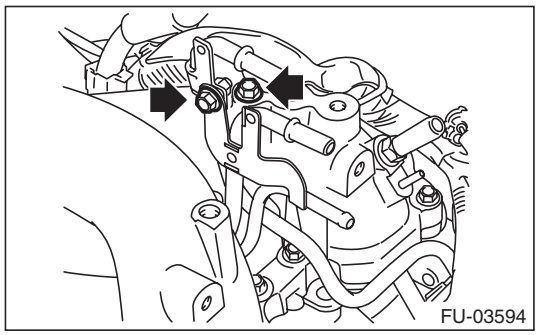
9) Install the bolts which hold fuel injector pipe.
- RH side

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

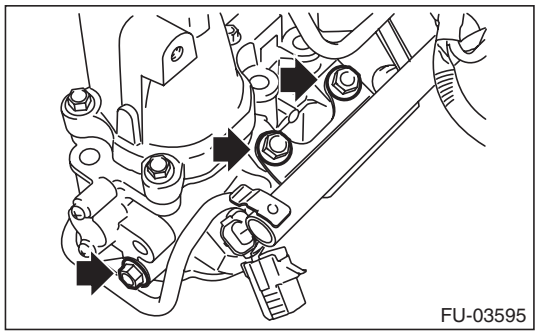


• LH side

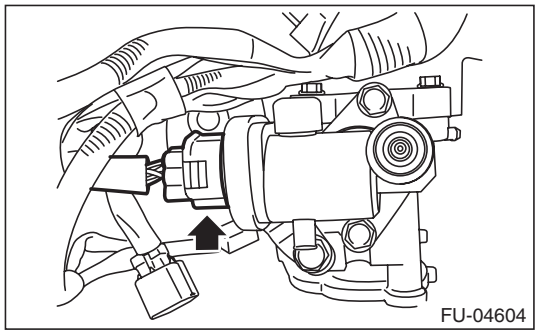
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



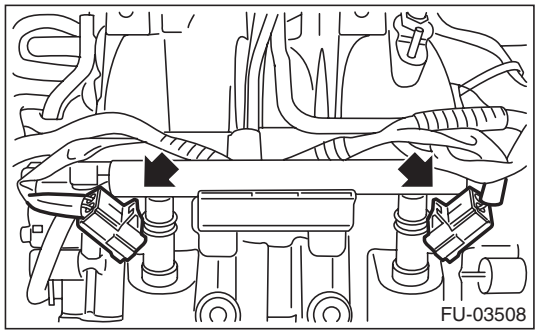
Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)



10) Connect the connector to the tumble generator valve assembly.

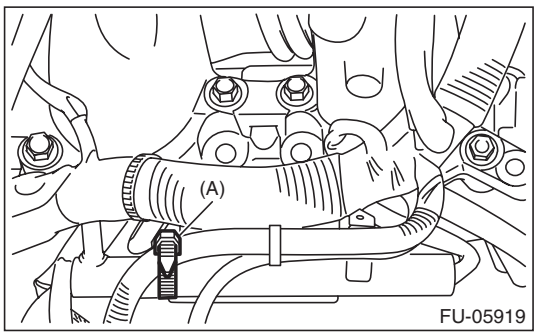


11) Connect the connectors to the fuel injector.

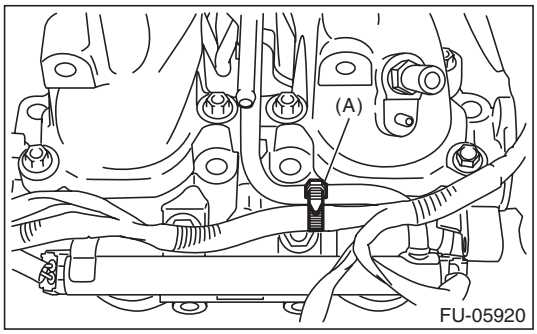


12) Secure the engine harness to the fuel injector pipe with the harness band (A).

• RH side



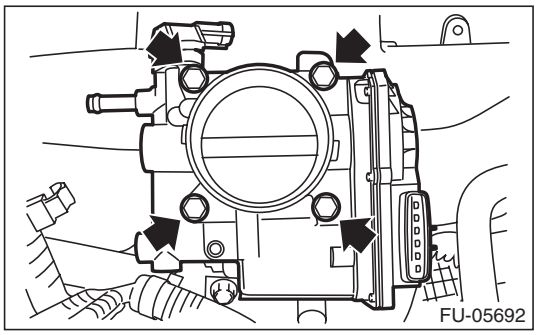
• LH side



13) Install the throttle body to the intake manifold.

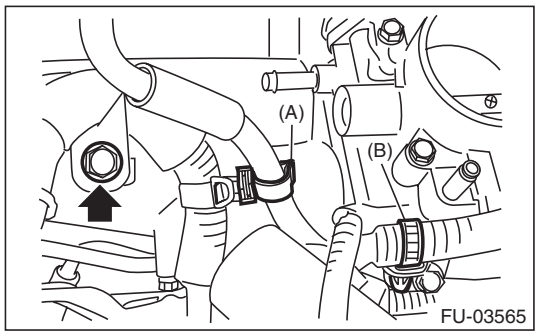
NOTE:
Use a new gasket.

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

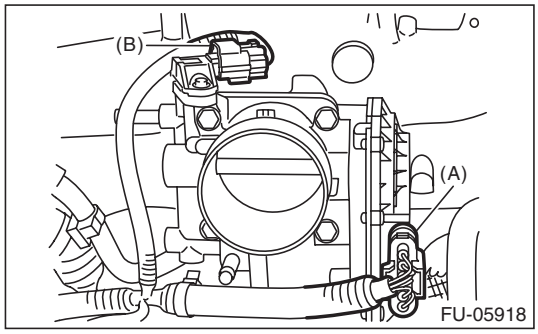


14) Secure the engine harness and vacuum hose using the clip (A), and secure the engine harness to the engine harness stay using the clip (B), and install the bolt which holds the engine harness to the intake manifold.

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

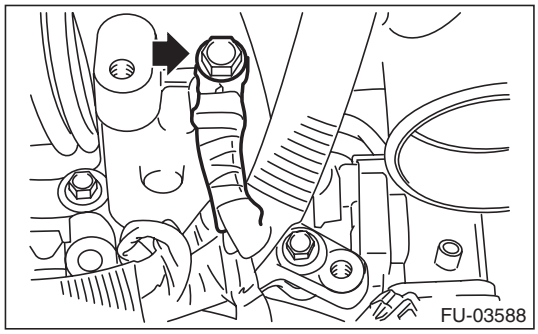


15) Connect connector (A) to the throttle position sensor and connector (B) to the manifold pressure sensor.



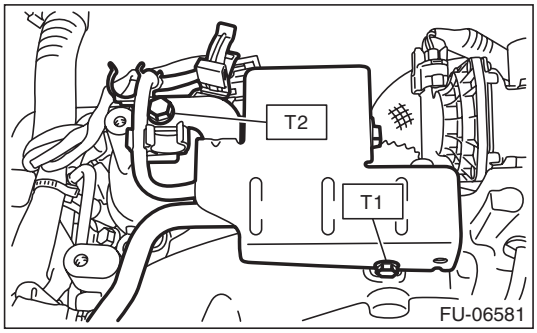
16) Install the engine ground terminal to intake manifold.

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

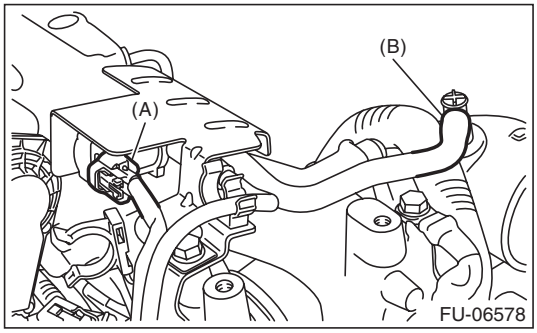


17) Install the solenoid valve bracket together with the wastegate control solenoid valve.

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)

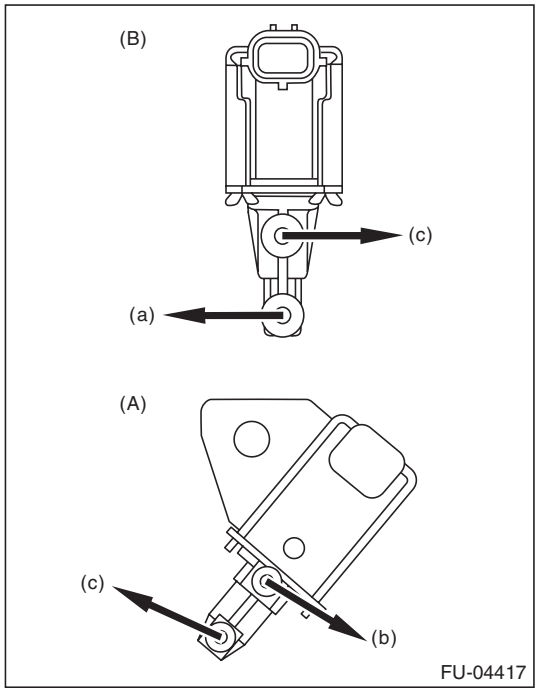


18) Connect the vacuum hose (B) to the intake duct, then connect the connector (A) to the wastegate control solenoid valve.



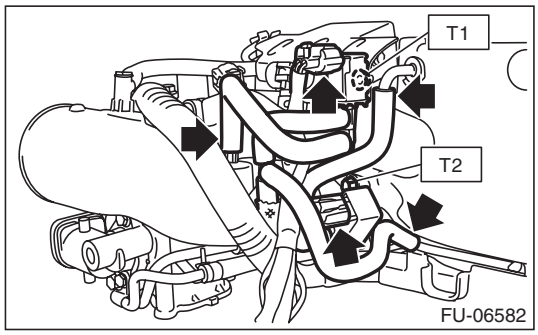
19) Install purge control solenoid valve 1 and purge control solenoid valve 2.

NOTE:
Connect the vacuum hose and vacuum control hose as shown in the figure.

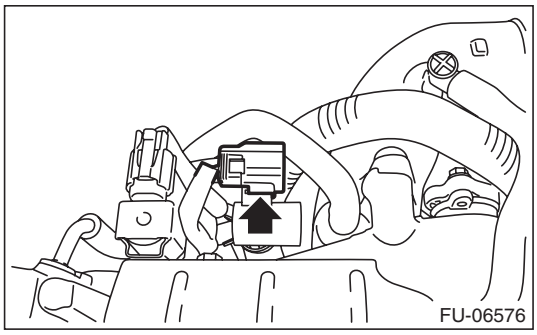


(A) Purge control solenoid valve 1
(B) Purge control solenoid valve 2
(a) To intake duct
(b) To intake manifold
(c) To branching pipe → fuel pipe

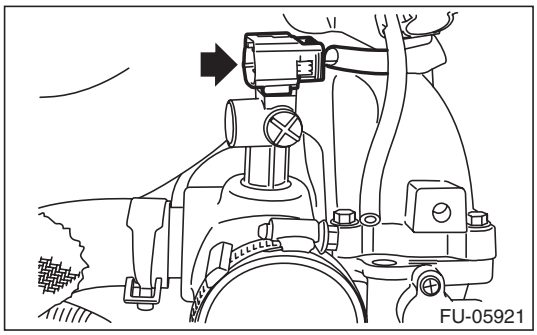
Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 16 N·m (1.6 kgf-m, 11.8 ft-lb)



20) Attach the connector to the PCV hose assembly.

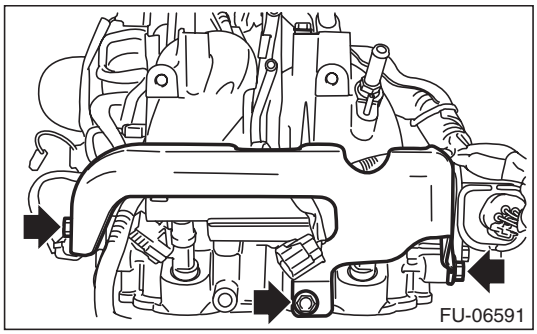


21) Install the connector to the intake duct.



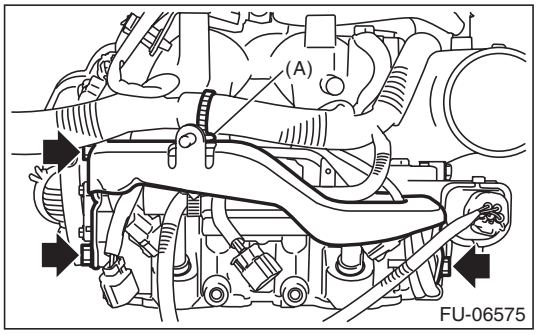
22) Install the fuel pipe protector LH.

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



23) Install the fuel pipe protector RH, and secure the engine harness to the fuel pipe protector RH using the clip (A).

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



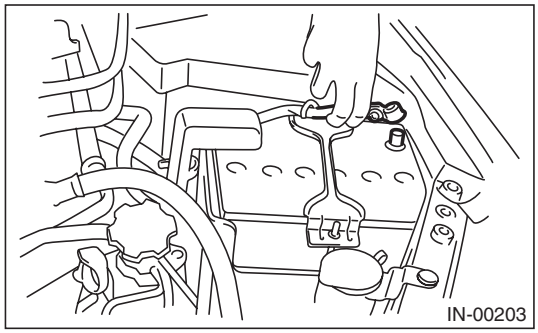
E: INSPECTION

1) Check that the intake manifold and fuel pipe have no deformation, cracks and other damages.
2) Check that the hose has no cracks, damage or loose part.

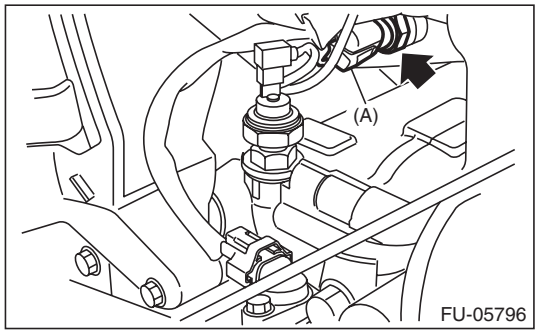
4. Engine Coolant Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the generator. <Ref. to SC(STI)-21, REMOVAL, Generator.>
3) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the connector (A) from the engine coolant temperature sensor, and remove the engine coolant temperature sensor.



B: INSTALLATION

Install in the reverse order of removal.

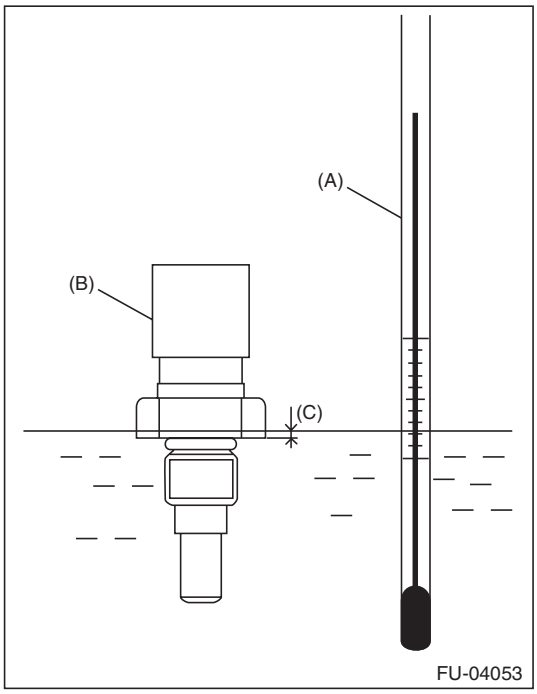
NOTE:
Use a new gasket.

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

C: INSPECTION

1) Check that the engine coolant temperature sensor has no deformation, cracks or other damages.
2) Immerse the engine coolant temperature sensor and a thermometer in water.

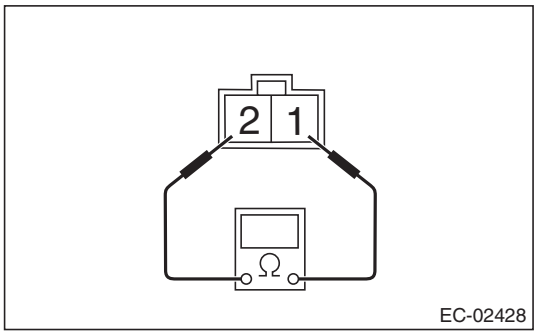
CAUTION:
Take care not to allow water to get into the engine coolant temperature sensor connector. Completely remove any water inside.



(A) Thermometer
(B) Engine coolant temperature sensor
(C) Hexagonal part height: To approx. $^1/_3$

3) 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.

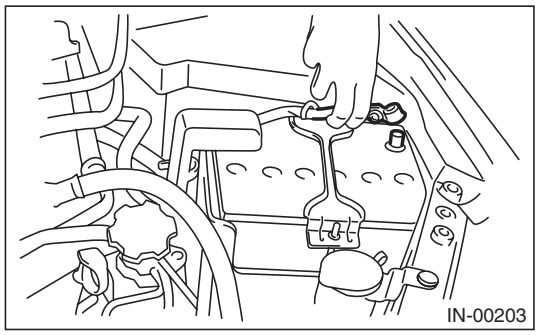


Water temperature	Terminal No.	Standard
20°C (68°F)	1 and 2	2.45±0.2 kΩ
80°C (176°F)		0.318±0.013 kΩ

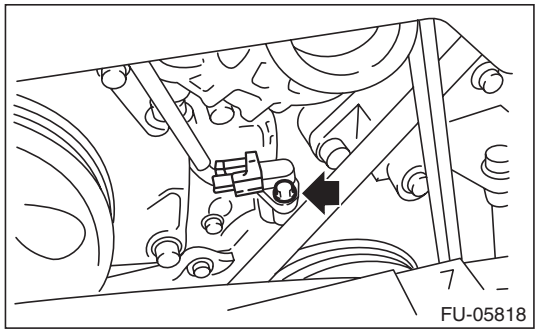
5. Crankshaft Position Sensor

A: REMOVAL

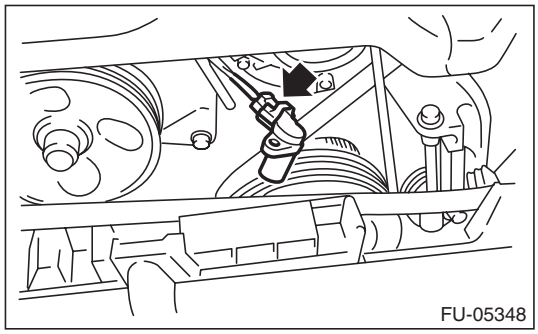
1) Disconnect the ground cable from battery.



2) Remove the bolt which secures crankshaft position sensor to oil pump.



3) Remove the crankshaft position sensor, and disconnect the connector from the crankshaft position sensor.



B: INSTALLATION

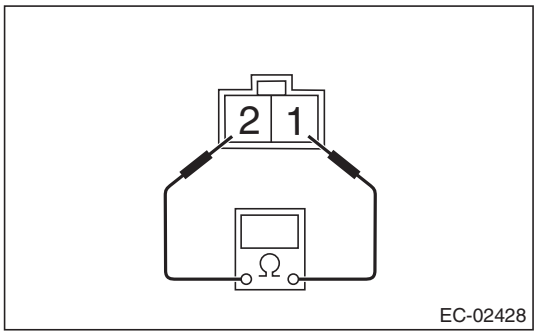
Install in the reverse order of removal.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

1. CRANKSHAFT POSITION SENSOR (METHOD WITH CIRCUIT TESTER)

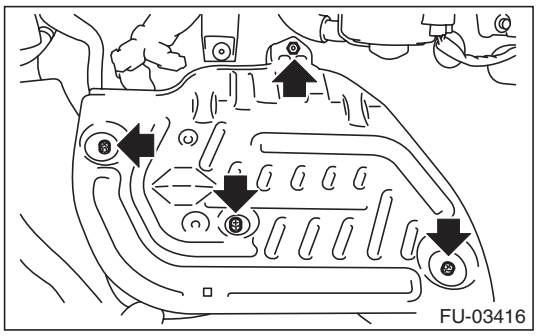
Measure the resistance between crankshaft position sensor terminals.



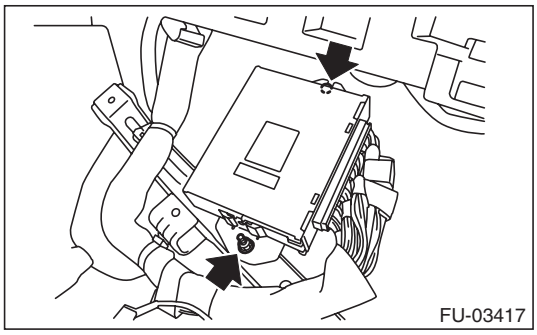
Terminal No.	Standard
1 and 2	2.04±0.204 kΩ

2. CRANKSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

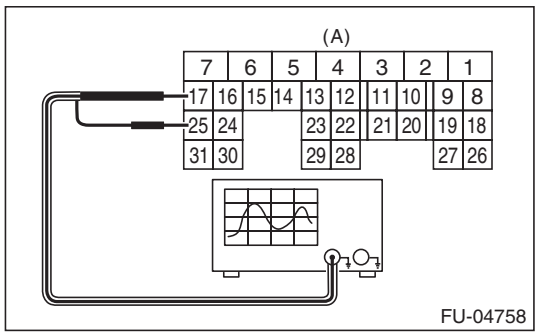
1) Prepare an oscilloscope.
2) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.



5) Remove the nuts and bolts which hold the ECM to the bracket.



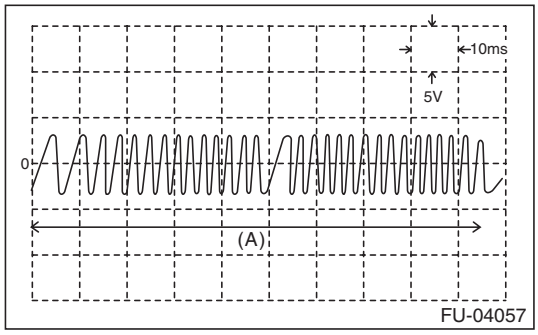
6) Connect the probe to ECM connector.



(A) To ECM connector

Terminal No.	Probe
17	+
25	–

7) Start the engine and let it idle.
8) Check the pattern is the same as the waveform and voltage shown below.



(A) One crankshaft rotation

9) After inspection, install the related parts in the reverse order of removal.

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

3. OTHER INSPECTIONS

Check that the crankshaft position sensor has no deformation, cracks or other damages.

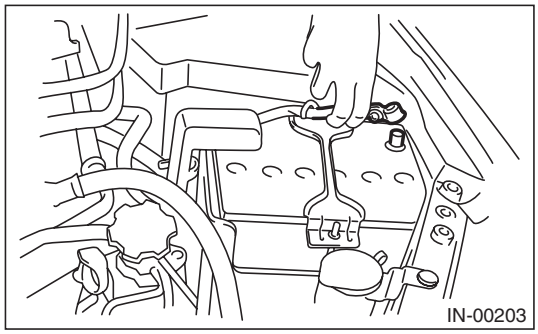
6. Camshaft Position Sensor

A: REMOVAL

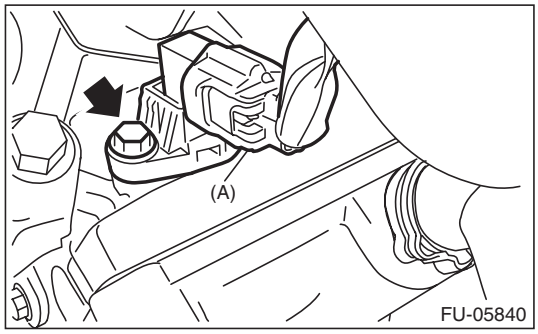
1. INTAKE SIDE

• Camshaft position sensor RH

1) Disconnect the ground cable from battery.

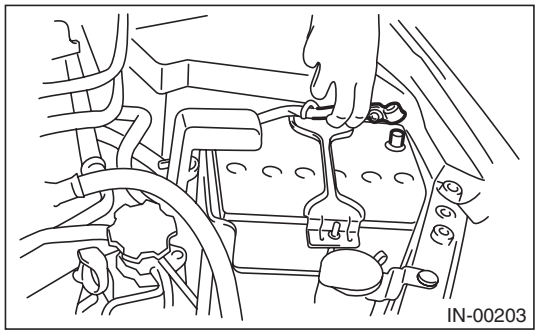


2) Disconnect the connector (A) from the camshaft position sensor RH, and remove the camshaft position sensor RH from the rear side of the cylinder head.



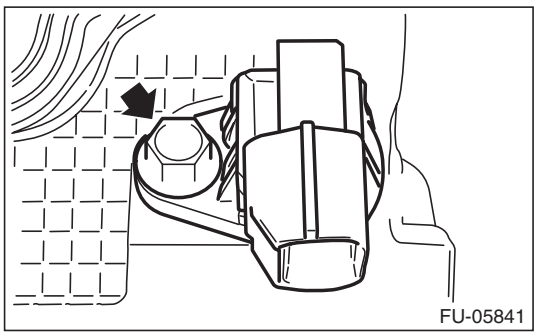
• Camshaft position sensor LH

1) Disconnect the ground cable from battery.



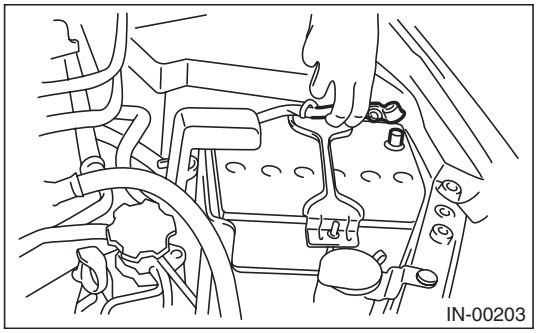
2) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>

3) Remove the camshaft position sensor LH.



2. EXHAUST SIDE

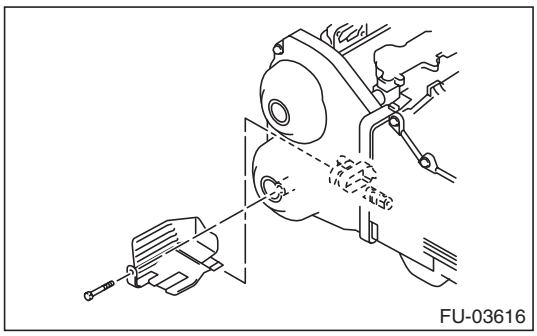
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.

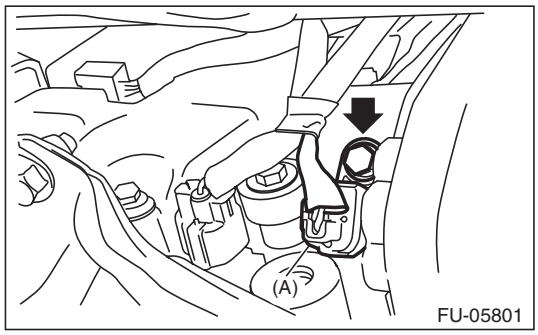
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>

4) Remove the engine harness cover. (right side only.)

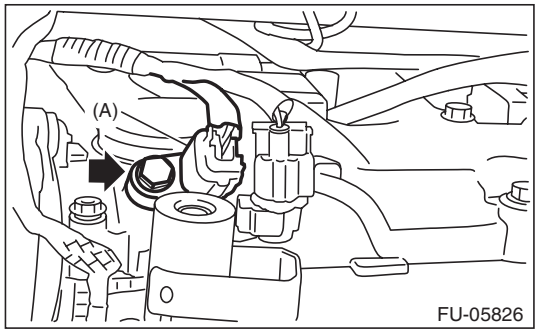


5) Disconnect connector (A) from the camshaft position sensor, and remove the camshaft position sensor from under the cylinder head.

- RH side



- LH side



B: INSTALLATION

1. INTAKE SIDE

Install in the reverse order of removal.

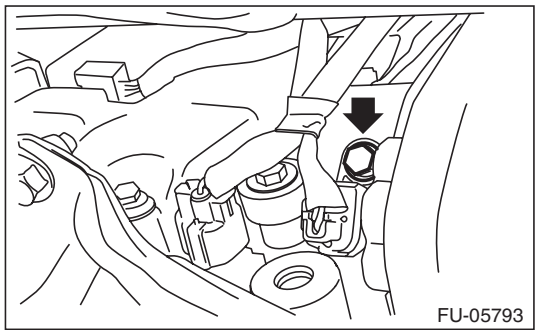
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

2. EXHAUST SIDE

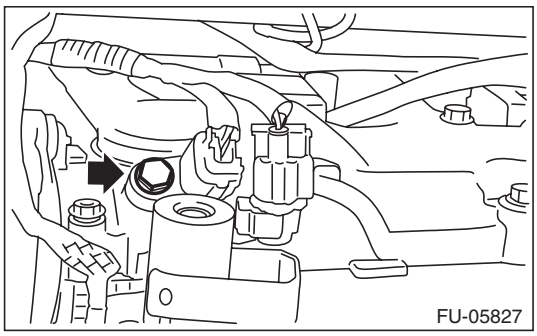
Install in the reverse order of removal.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

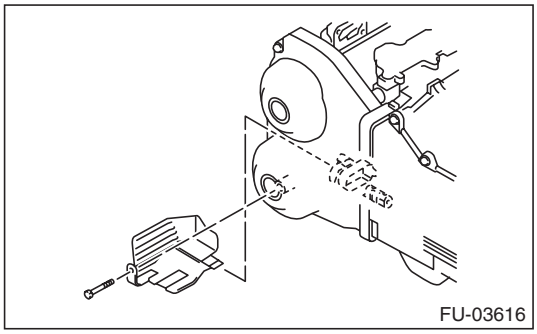
- RH side



- LH side



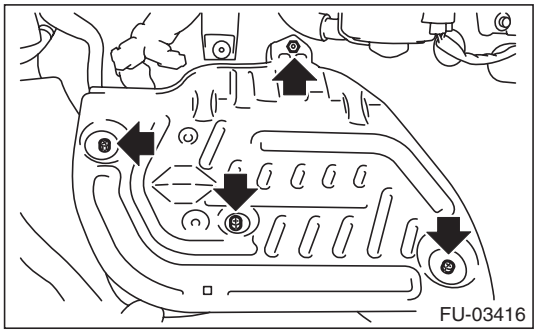
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



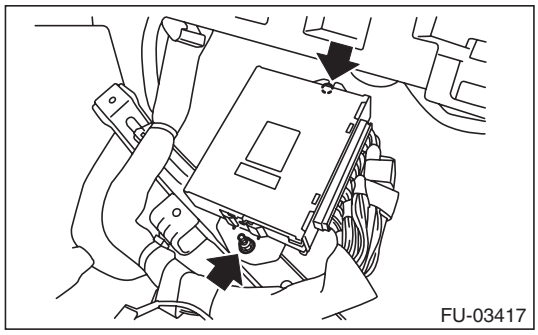
C: INSPECTION

1. CAMSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

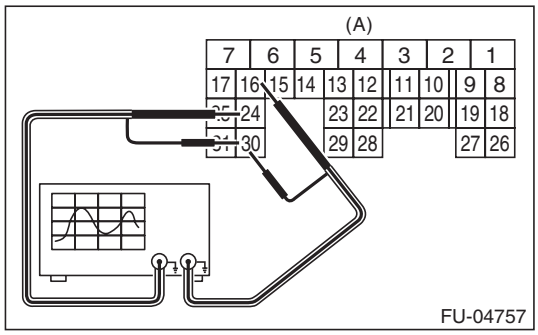
1) Prepare an oscilloscope.
2) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.



5) Remove the nuts and bolts which hold the ECM to the bracket.

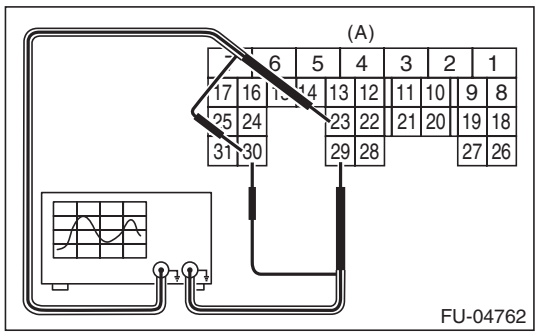


6) Connect the probe to ECM connector.
- Intake camshaft position sensor



(A) To ECM connector

- Exhaust camshaft position sensor

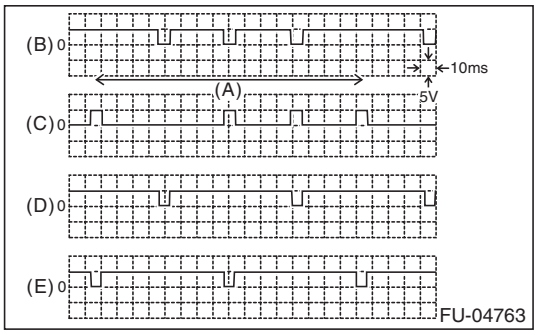


(A) To ECM connector

Camshaft position sensor		Terminal No.	Probe
Intake	RH	24	+
	LH	16	+
Exhaust	RH	23	+
	LH	29	+
RH and LH		30	–

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
(B) Intake camshaft position sensor RH
(C) Intake camshaft position sensor LH
(D) Exhaust camshaft position sensor RH
(E) Exhaust camshaft position sensor LH

9) After inspection, install the related parts in the reverse order of removal.

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

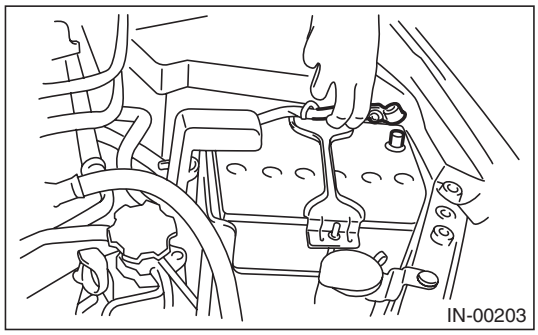
2. OTHER INSPECTIONS

Check that the camshaft position sensor has no deformation, cracks or other damages.

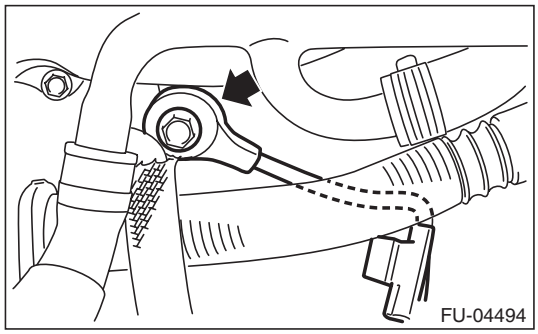
7. Knock Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
3) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
4) Remove the secondary air combination valve RH. <Ref. to EC(STI)-29, REMOVAL, Secondary Air Combination Valve.>
5) Remove the knock sensor from cylinder block.

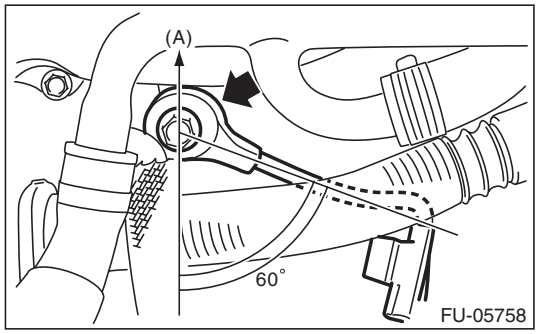


B: INSTALLATION

1) Install the knock sensor to the cylinder block.

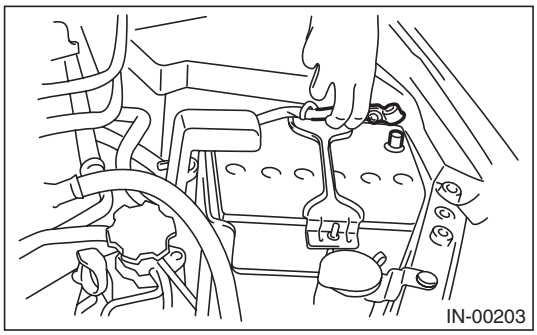
NOTE:
The portion of the knock sensor cord that is pulled out must be positioned at a 60° angle relative to the engine rear.

Tightening torque:
24 N·m (2.4 kgf-m, 17.7 ft-lb)



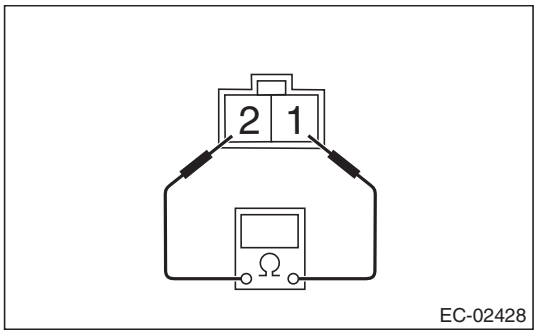
(A) Front side of vehicle

2) Install the secondary air combination valve RH. <Ref. to EC(STI)-30, SECONDARY AIR COMBINATION VALVE RH, INSTALLATION, Secondary Air Combination Valve.>
3) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.>
4) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>
5) Connect the battery ground terminal.



C: INSPECTION

1) Check that the knock sensor has no deformation, cracks or other damages.
2) Measure the resistance between knock sensor terminals.



Terminal No.	Standard
1 and 2	560±28 kΩ

8. Throttle Position Sensor

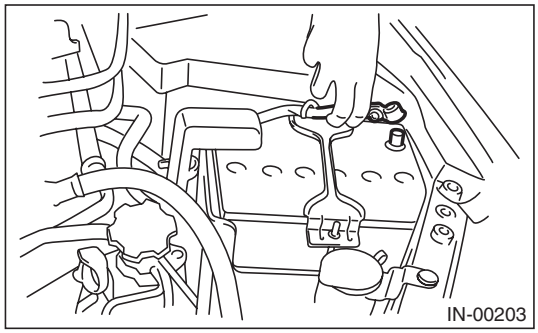
A: SPECIFICATION

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(STI)-15, REMOVAL, Throttle Body.> <Ref. to FU(STI)-15, INSTALLATION, Throttle Body.>

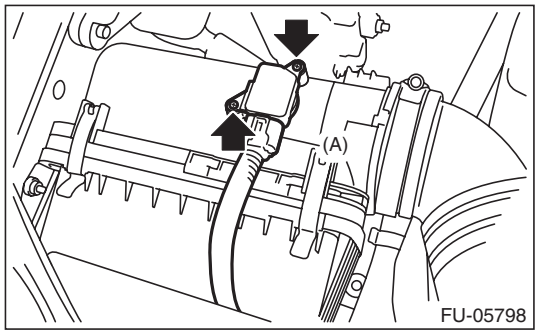
9. Mass Air Flow and Intake Air Temperature Sensor

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 mass air flow and intake air temperature sensor.



B: INSTALLATION

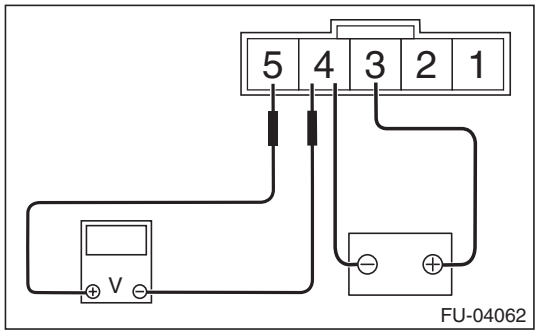
Install in the reverse order of removal.

Tightening torque:
1 N·m (0.1 kgf-m, 0.7 ft-lb)

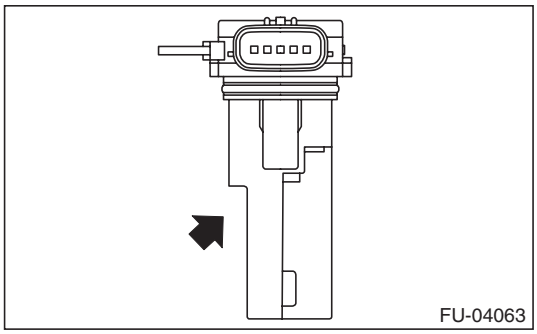
C: INSPECTION

1. CHECK THE MASS AIR FLOW SENSOR UNIT

1) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, the circuit tester positive terminal to terminal No. 5 and the circuit tester ground terminal to terminal No. 4.

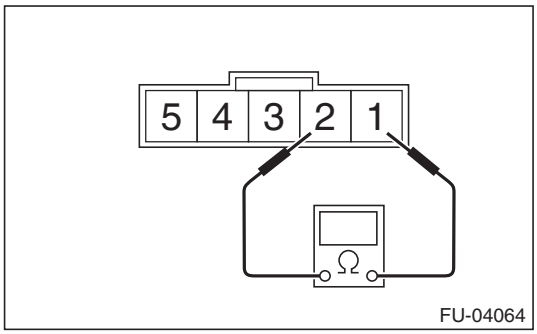


2) Check the voltage changes when air is blown to the mass air flow sensor unit in arrow direction.



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

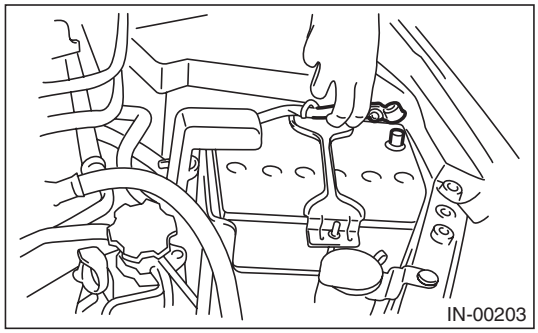
3. OTHER INSPECTIONS

1) Check that the mass air flow and intake air temperature sensor has no deformation, cracks or other damages.
2) Check that the mass air flow and intake air temperature sensor has no dirt.

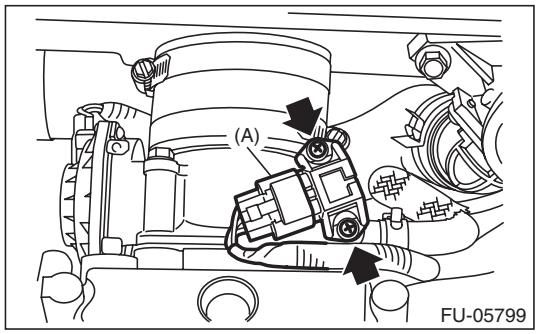
10. Manifold Absolute Pressure Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A) 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.

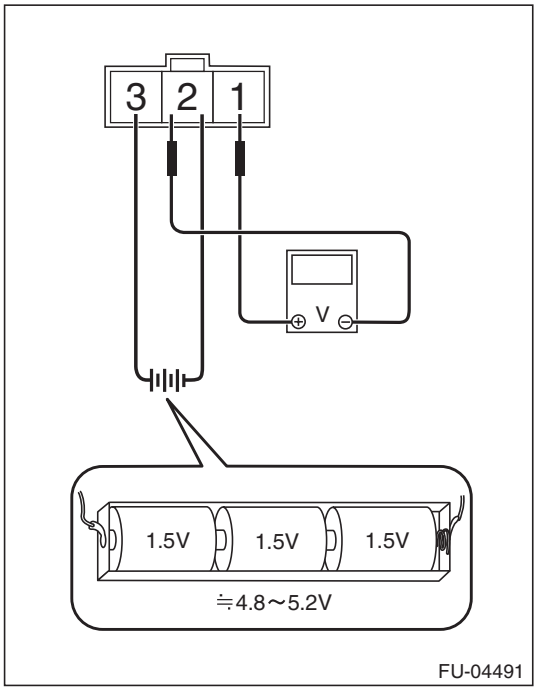
NOTE:
Use new O-rings.

Tightening torque:
2 N·m (0.2 kgf-m, 1.5 ft-lb)

C: INSPECTION

1) Check that the manifold absolute pressure sensor has no deformation, cracks or other damages.
2) Connect dry-cell battery positive terminal to terminal No. 3 and dry-cell battery ground terminal to terminal No. 2, circuit tester positive terminal to terminal No. 1 and the circuit tester negative terminal to terminal No. 2.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.

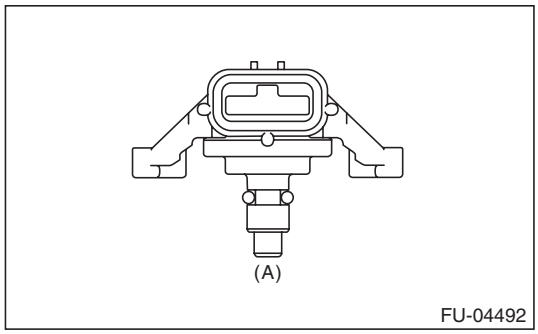


3) Check the voltage at a normal atmospheric pressure.

NOTE:
The atmospheric pressure at higher altitude is lower than normal. Therefore, the voltage is lower than the standard value.

Terminal No.	Standard
1 (+) and 2 (–)	Approx. 2.0 V (when 25°C (77°F))

4) Connect the Mighty Vac to the pressure port (A) of manifold absolute pressure sensor.



5) Check the voltage when generating vacuum and positive pressure using Mighty Vac.

CAUTION:
Do not apply vacuum of less than –88 — 200 kPa (–0.9 — 2.04 kgf/cm^2, –12.8 — 29.0 psi). Doing so may damage the manifold absolute pressure sensor.

NOTE:
When vacuum occurs at the pressure port of manifold absolute pressure sensor, the voltage will drop from the value as in step 3). When positive pressure occurs, on the other hand, the voltage will rise.

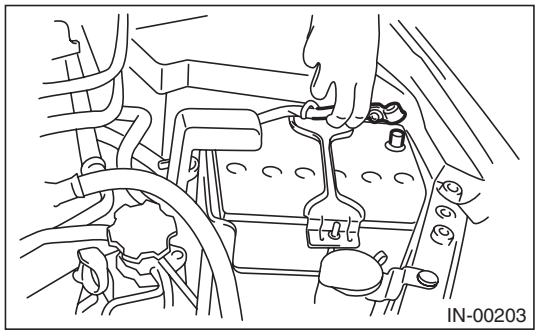
Pressure	Terminal No.	Standard
–88 kPa (–0.9 kgf/cm^2, –12.8 psi)	1 (+) and 2 (–)	Approx. 0.8 V (when 25°C (77°F))
181 kPa (1.85 kgf/cm^2, 26.2 psi)		Approx. 4.7 V (when 25°C (77°F))

11.Fuel Injector

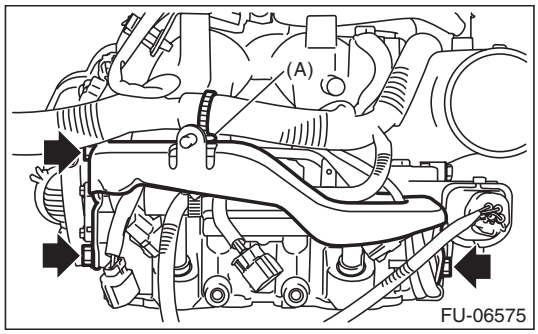
A: REMOVAL

1. RH SIDE

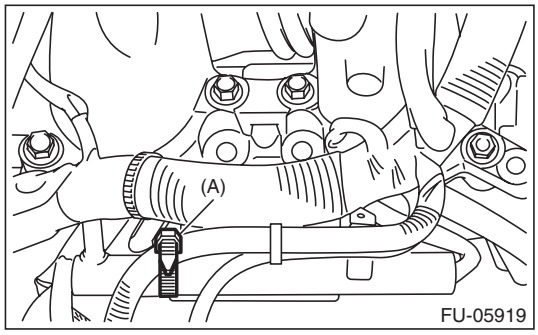
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



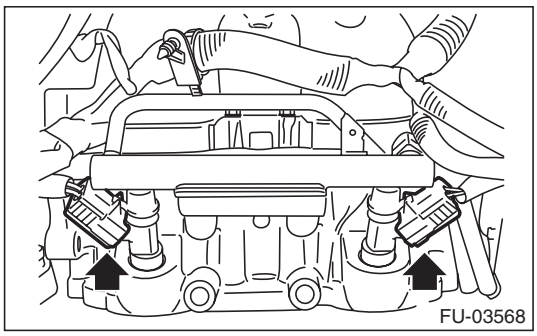
3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
5) Remove clip (A) holding the engine harness to the fuel pipe protector RH, and remove the fuel pipe protector RH from the intake manifold.



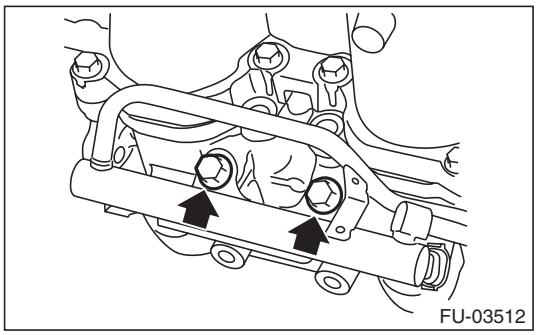
6) Remove the harness band (A) which holds the engine harness to the fuel injector pipe RH.



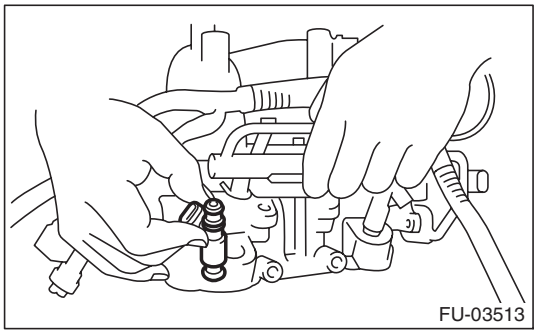
7) Disconnect the connector from fuel injector.



8) Remove the bolts which hold fuel injector pipe RH.

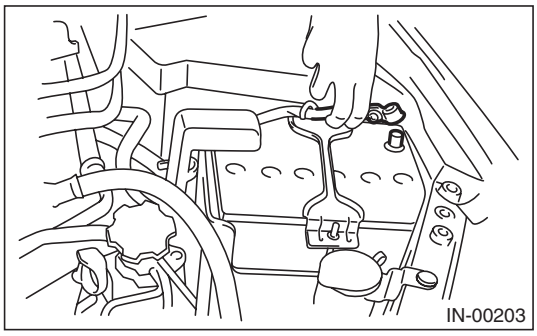


9) Remove the fuel injector.



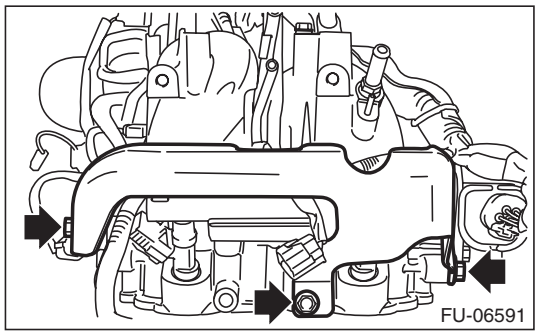
2. LH SIDE

1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.

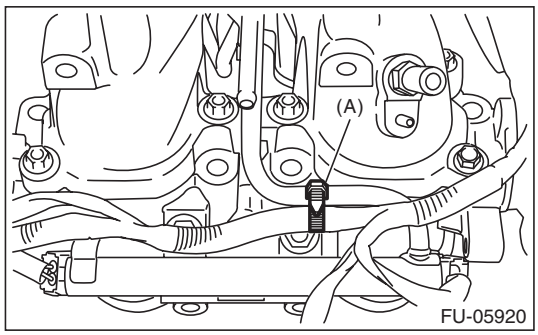


3) Open the fuel filler lid and remove the fuel filler cap.

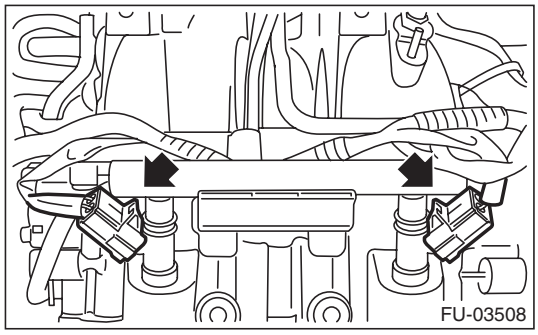
4) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
5) Remove the fuel pipe protector LH from the intake manifold.



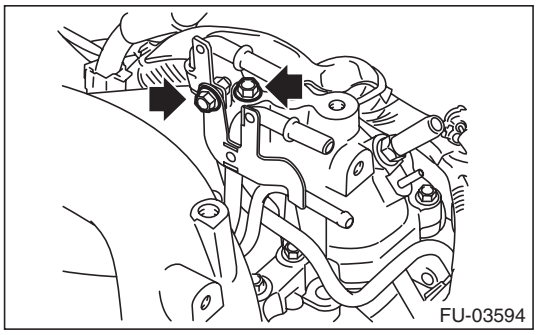
6) Remove the harness band (A) which holds the engine harness to the fuel injector pipe LH.

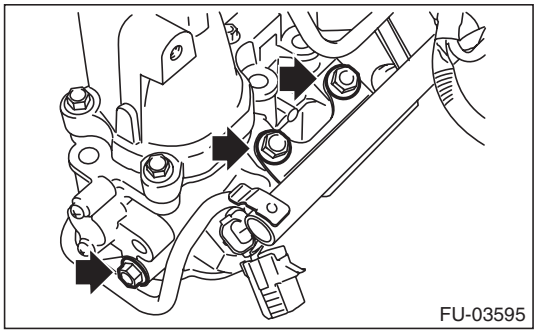


7) Disconnect the connector from fuel injector.

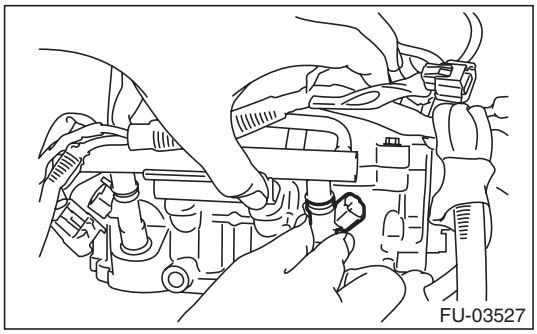


8) Remove the bolts which hold fuel injector pipe LH.





9) Remove the fuel injector.



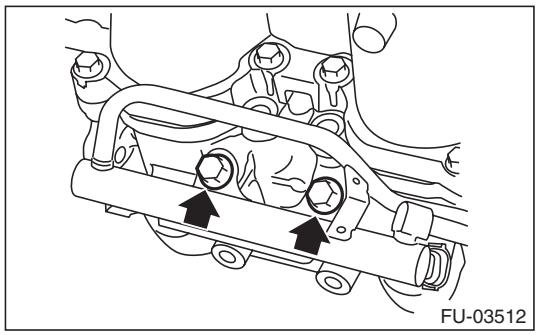
B: INSTALLATION

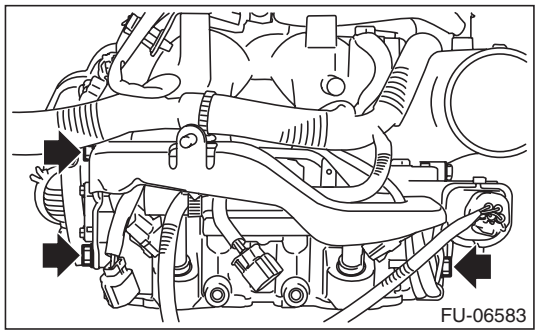
1. RH SIDE

Install in the reverse order of removal.

NOTE:
Use new O-rings.

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


FU-03512

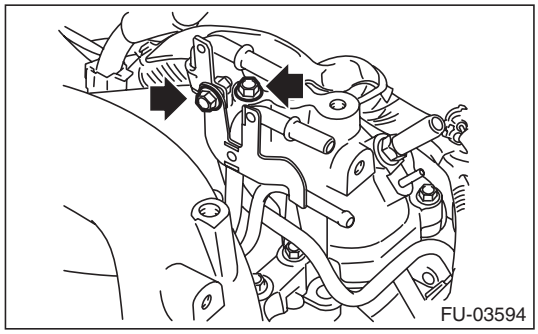

FU-06583

2. LH SIDE

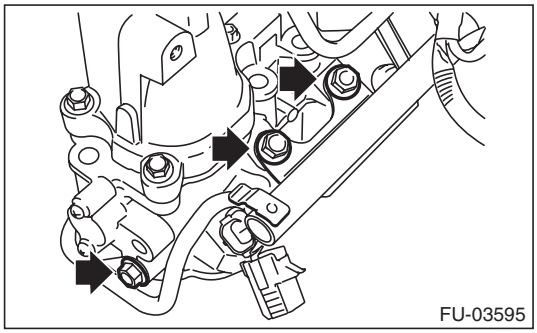
Install in the reverse order of removal.

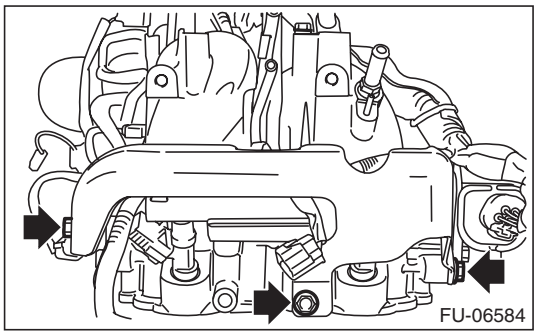
NOTE:
Use new O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)


FU-03594

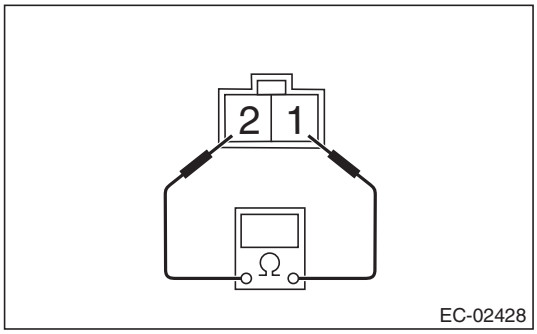
Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)


FU-03595


FU-06584

C: INSPECTION

1) Check that the fuel injector has no deformation, cracks or other damages.
2) Measure the resistance between fuel injector terminals.



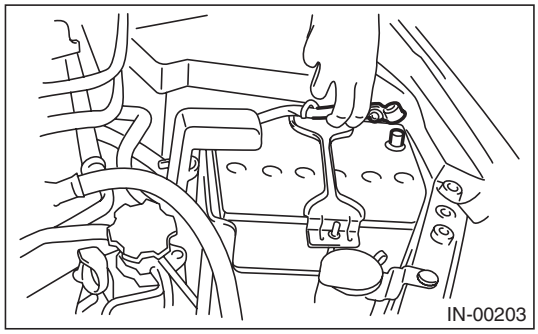
EC-02428

Terminal No.	Standard
1 and 2	Approx. 12.0 Ω (when 20°C (68°F))

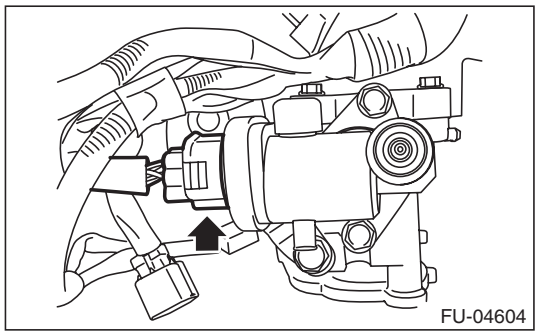
12. Tumble Generator Valve Assembly

A: REMOVAL

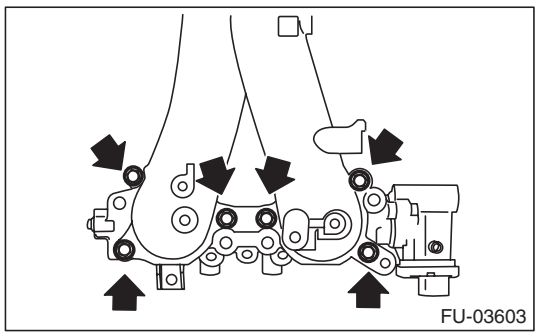
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
5) Disconnect the connector from the tumble generator valve assembly.



6) Remove the fuel injector. <Ref. to FU(STI)-45, REMOVAL, Fuel Injector.>
7) Remove the tumble generator valve assembly from the intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
8.25 N·m (0.8 kgf-m, 6.1 ft-lb)

C: INSPECTION

1) Check that the tumble generator valve assembly has no deformation, cracks or other damages.
2) Check tumble generator valve for contamination or clogging.

13. Tumble Generator Valve Actuator

A: SPECIFICATION

The tumble generator valve assembly cannot be disassembled.
Refer to “Tumble Generator Valve Assembly” for removal and installation procedures. <Ref. to FU(STI)-48, REMOVAL, Tumble Generator Valve Assembly.> <Ref. to FU(STI)-48, INSTALLATION, Tumble Generator Valve Assembly.>

14. Oil Flow Control Solenoid Valve

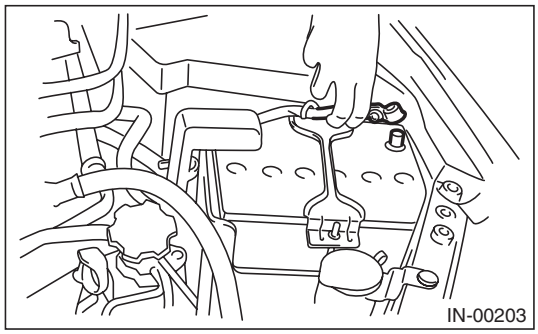
A: REMOVAL

1. INTAKE SIDE

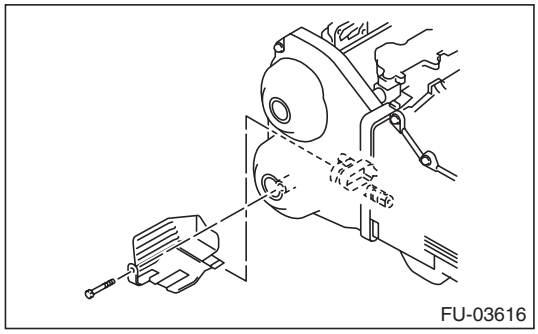
Oil flow control solenoid valve is a unit with front camshaft cap.
Refer to “Camshaft” for removal procedures. <Ref. to ME(STI)-60, REMOVAL, Camshaft.>

2. EXHAUST SIDE

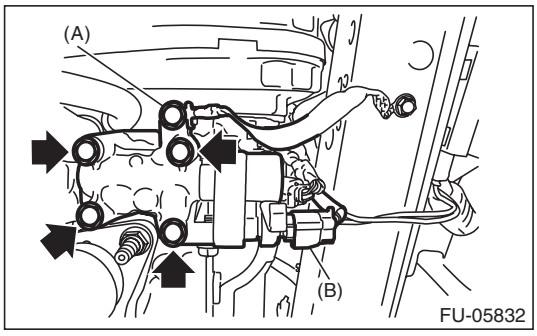
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Remove the front exhaust pipe. (right side only.) <Ref. to EX(STI)-6, REMOVAL, Front Exhaust Pipe.>
5) Remove the engine harness cover. (right side only.)



6) Disconnect the ground cable (A). (left side only)
7) Disconnect the connector (B) from the oil flow control solenoid valve, and remove the oil flow control solenoid valve from the cylinder head.



B: INSTALLATION

1. INTAKE SIDE

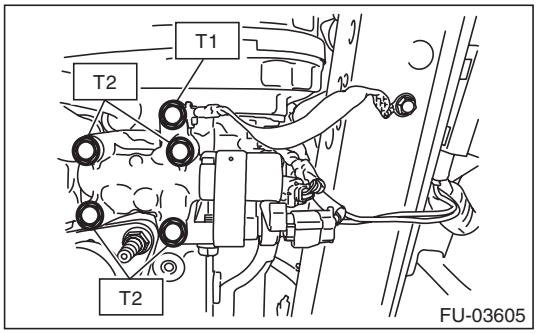
Refer to “Camshaft” for installation procedure. <Ref. to ME(STI)-63, INSTALLATION, Camshaft.>

2. EXHAUST SIDE

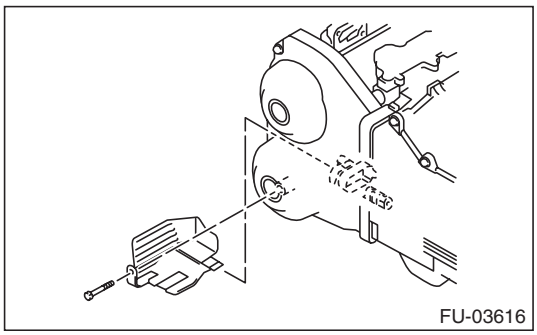
Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
T1: 7.5 N·m (0.8 kgf-m, 5.5 ft-lb)
T2: 10 N·m (1.0 kgf-m, 7.4 ft-lb)



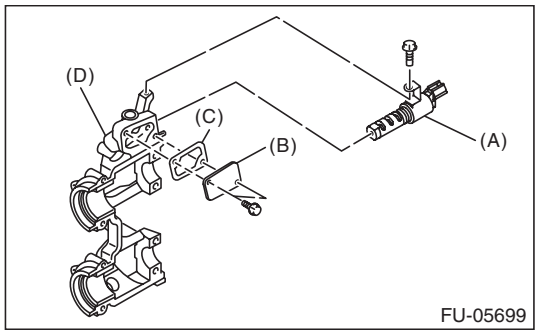
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



C: DISASSEMBLY

1. INTAKE SIDE

1) Remove the two mounting bolts securing oil return cover, and remove the oil return cover and gasket.
2) Remove the bolt securing oil flow control solenoid valve, and remove the oil flow control solenoid valve.



(A) Oil flow control solenoid valve
(B) Oil return cover
(C) Gasket
(D) Front camshaft cap

2. EXHAUST SIDE

The oil flow control solenoid valve on the exhaust side cannot be disassembled.

D: ASSEMBLY

1. INTAKE SIDE

1) Install the oil flow control solenoid valve.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

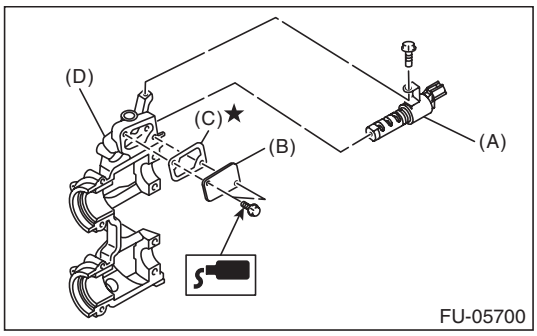
2) Apply liquid gasket to the two bolts securing oil return cover.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042)

3) Attach the oil return cover and gasket.

Tightening torque:
9 N·m (0.9 kgf-m, 6.6 ft-lb)

NOTE:
Use a new gasket.



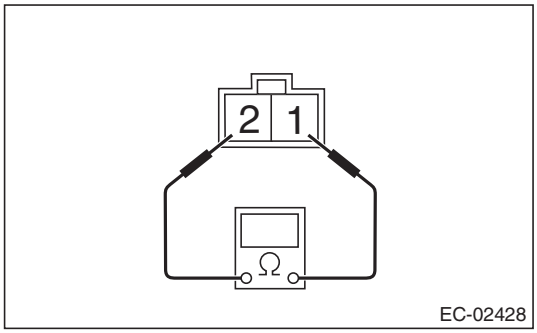
(A) Oil flow control solenoid valve
(B) Oil return cover
(C) Gasket
(D) Front camshaft cap

2. EXHAUST SIDE

The oil flow control solenoid valve on the exhaust side cannot be disassembled.

E: INSPECTION

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

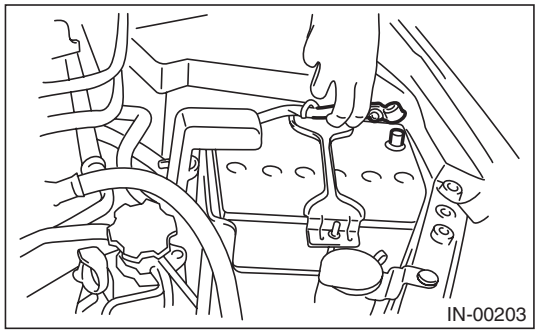


Terminal No.	Standard
1 and 2	7.4±0.5 Ω (when 20°C (68°F))

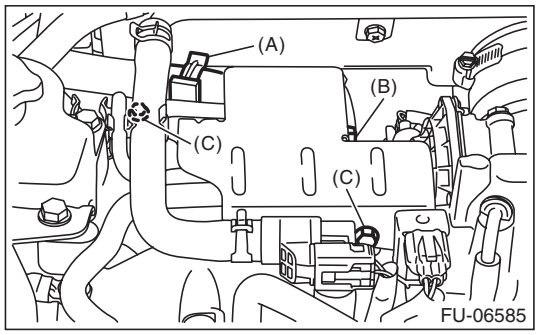
15. Wastegate Control Solenoid Valve

A: REMOVAL

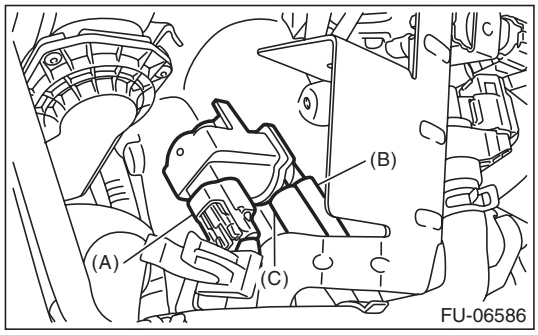
1) Disconnect the ground cable from battery.



2) Remove the vacuum hose from clip (A), and remove the bolt (B) which secures the wastegate control solenoid valve.
3) Remove the bolts (C) which secure solenoid valve bracket onto intake manifold.



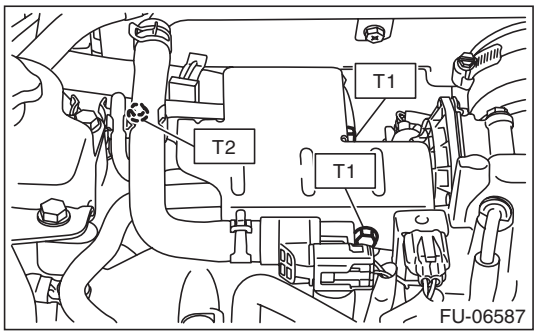
4) Disconnect the connector (A) from the wastegate control solenoid valve.
5) Disconnect the vacuum hose (B) and air control hose (C) from the wastegate control solenoid valve, and remove the wastegate control solenoid valve.



B: INSTALLATION

Install in the reverse order of removal.

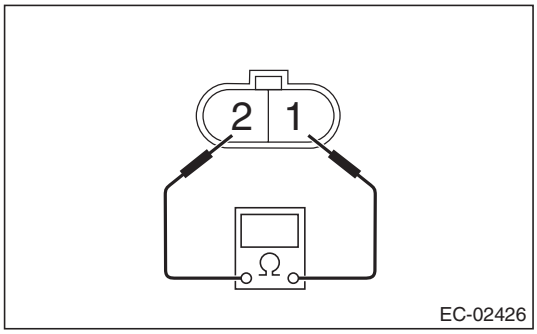
Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)



C: INSPECTION

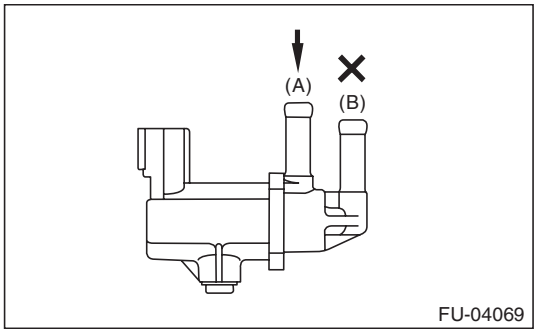
1. WASTEGATE CONTROL SOLENOID VALVE

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

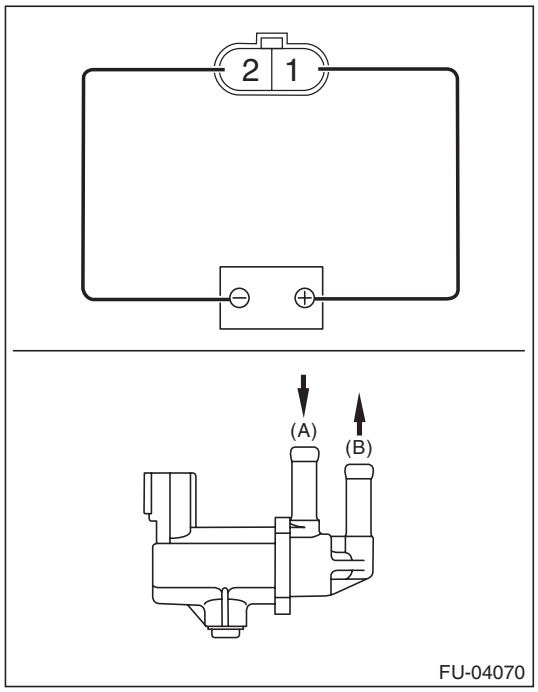


Terminal No.	Standard
1 and 2	28±2 Ω (when 20°C (68°F))

3) Check that air does not come out from (B) when air is blown into (A).



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



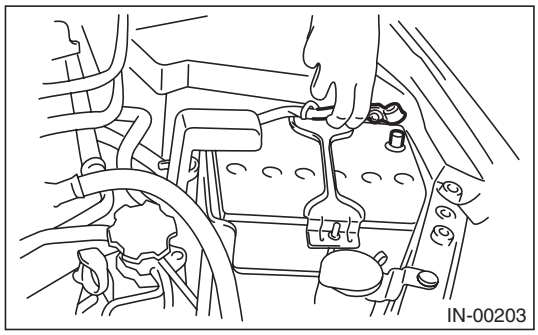
2. OTHER INSPECTIONS

Check that the vacuum hose and air control hose have no cracks, damage or loose part.

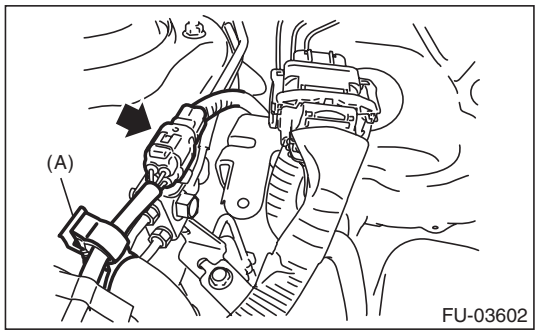
16.Front Oxygen (A/F) Sensor

A: REMOVAL

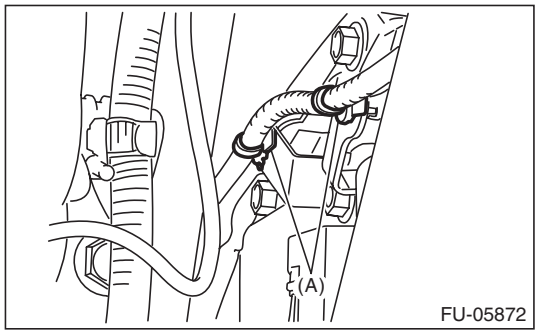
1) Disconnect the ground cable from battery.



2) Disconnect the connector from the front oxygen (A/F) sensor, and remove the clip (A) holding the return hose and front oxygen (A/F) sensor harness.

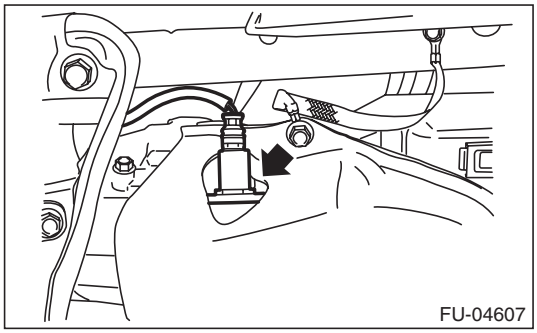


3) Remove the clips (A) holding the front oxygen (A/F) sensor harness to the engine harness stay.



4) Lift up the vehicle.
5) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
6) Apply spray-type lubricant to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.
7) 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.



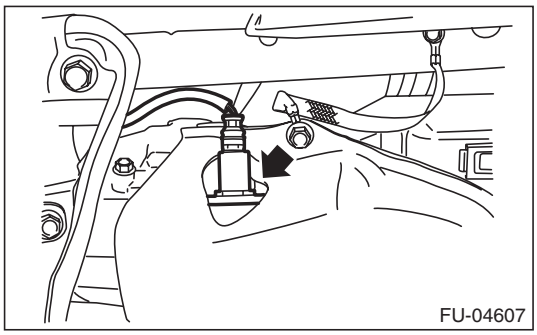
B: INSTALLATION

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.

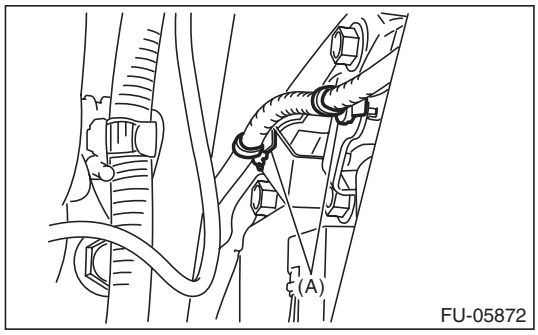
Anti-seize compound:
NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent
2) Install the front oxygen (A/F) sensor.

Tightening torque:
30 N·m (3.1 kgf-m, 22.1 ft-lb)

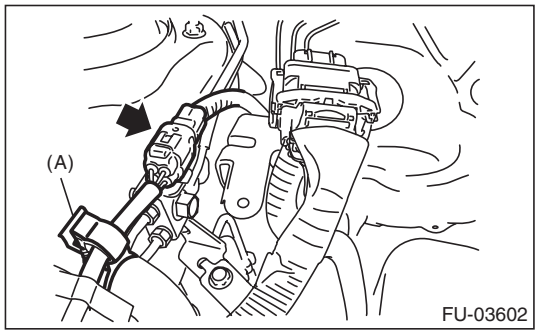


3) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
4) Lower the vehicle.

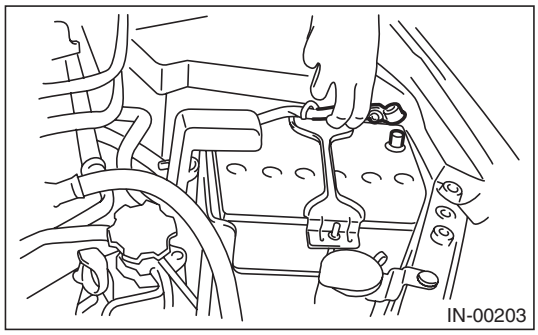
5) Secure the front oxygen (A/F) sensor harness to the engine harness stay using the clips (A).



6) Connect the connector to the front oxygen (A/F) sensor, and secure the return hose and front oxygen (A/F) sensor harness using the clip (A).

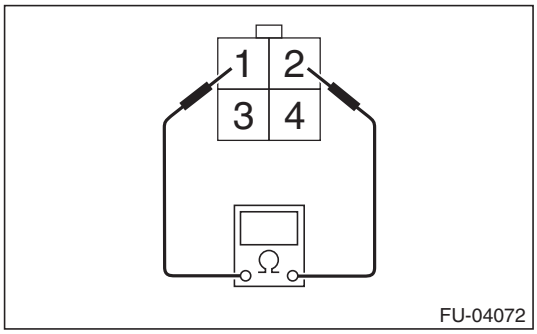


7) Connect the battery ground terminal.



C: INSPECTION

1) Check that the front oxygen (A/F) sensor has no deformation, cracks or other damages.
2) Measure the resistance between front oxygen (A/F) sensor terminals.

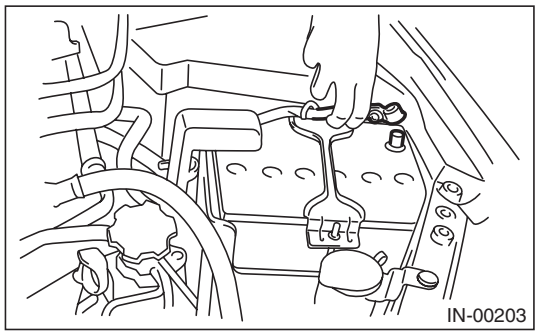


Terminal No.	Standard
1 and 2	2.4±0.24 Ω (when 20°C (68°F))

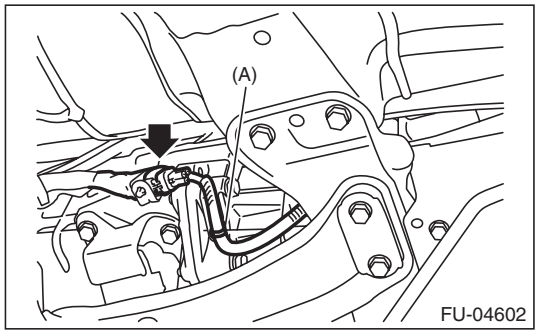
17. Rear Oxygen Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.

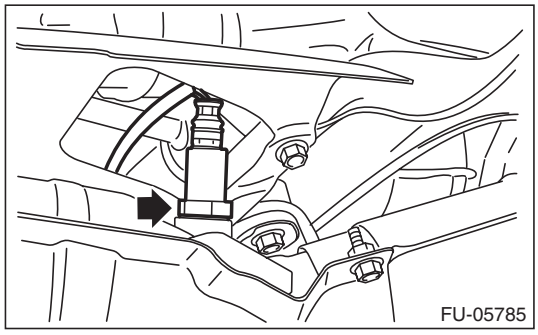


2) Lift up the vehicle.
3) Remove the transmission under cover.
4) Disconnect the connector from the rear oxygen sensor, and remove the clip (A) holding the rear oxygen sensor harness.



5) Apply spray-type lubricant to the threaded portion of rear oxygen sensor, and leave it for one minute or more.
6) Remove the rear oxygen sensor.

CAUTION:
When removing the rear oxygen sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.



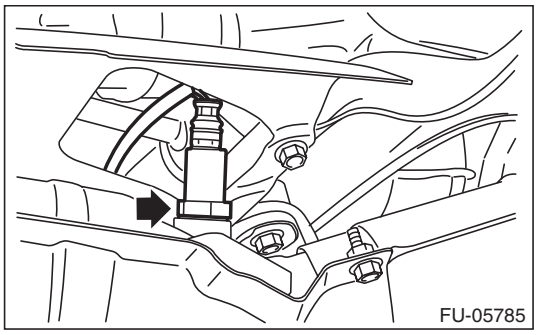
B: INSTALLATION

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.

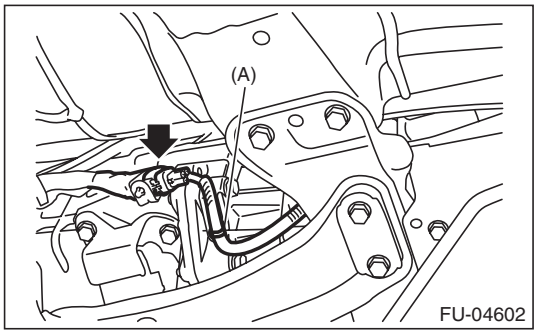
CAUTION:
Never apply anti-seize compound to the protector of rear oxygen sensor.

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)



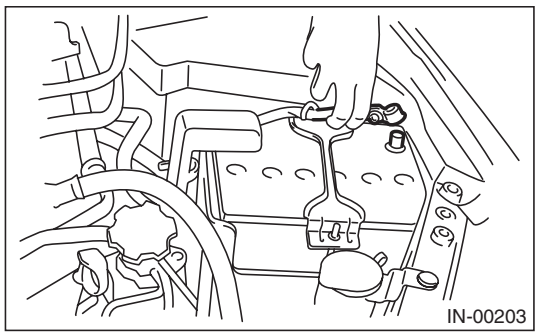
3) Connect the connector to the rear oxygen sensor, and hold the rear oxygen sensor harness with the clip (A).



4) Install the transmission under cover.

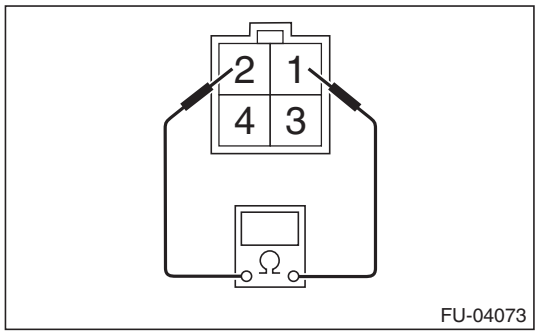
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)
5) Lower the vehicle.

6) Connect the battery ground terminal.



C: INSPECTION

1) Check that the rear oxygen sensor has no deformation, cracks or other damages.
2) Measure the resistance between rear oxygen sensor terminals.

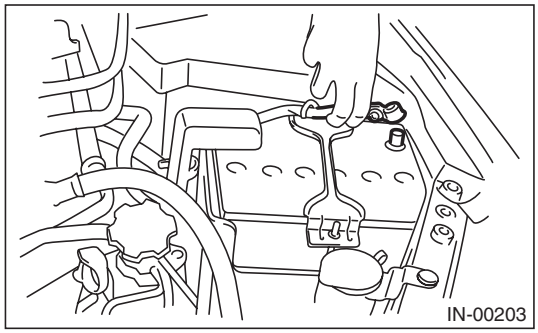


Terminal No.	Standard
1 and 2	$5.6^{+0.8}_{-0.6}$ Ω (when 20°C (68°F))

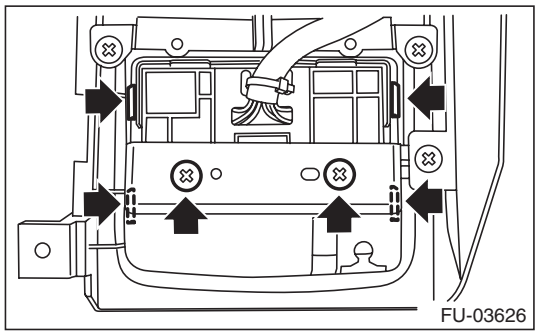
18.SI-DRIVE (SUBARU Intelligent Drive) Selector

A: REMOVAL

1) Disconnect the ground cable from the battery.



2) Remove the console box. <Ref. to EI-51, REMOVAL, Console Box.>
3) Remove the multi-selector switch connector from the console box.
4) Remove the screws and tabs holding the multi-selector switch to the console box and the multi-selector switch.



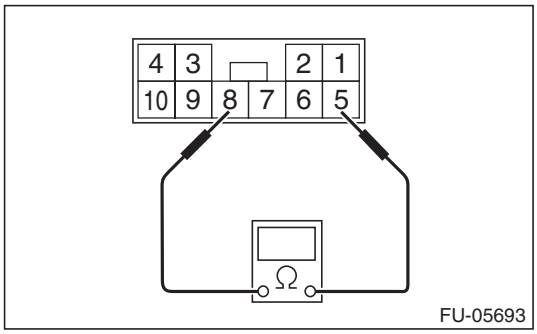
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
1.5 N·m (0.2 kgf-m, 1.1 ft-lb)

C: INSPECTION

1) Check that the multi select switch does not have deformation, cracks, or damage.
2) Check the resistance between the terminals at the SI-DRIVE selector.

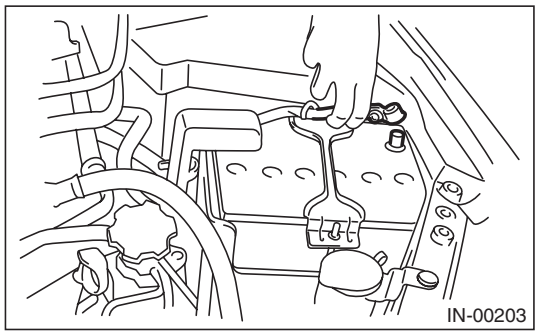


Switch position	Terminal No.	Standard
Sport (When turning the SI-DRIVE selector to the left)	5 and 8	Less than 1 Ω
Intelligent (When pressing the SI-DRIVE selector)		1±0.05 kΩ
Sport Sharp (When turning the SI-DRIVE selector to the right)		3.67±0.1835 kΩ

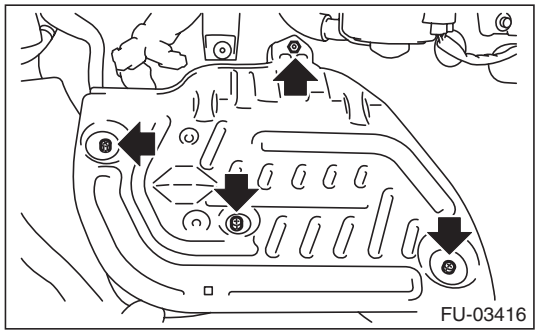
19. Engine Control Module (ECM)

A: REMOVAL

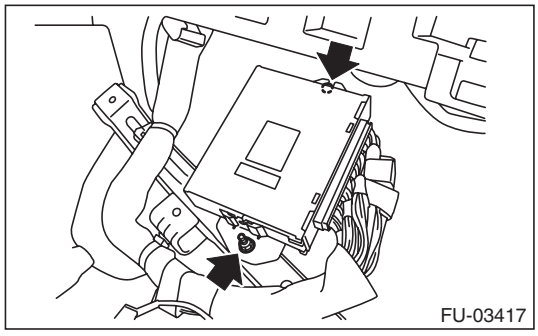
1) Disconnect the ground cable from battery.



2) Remove the lower inner trim of passenger's side. <Ref. to EI-57, 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) 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 bracket, replace both parts with new parts.
• After installing the bracket to the ECM, do not separate the bracket.
• If the bracket has been installed to the ECM in the wrong direction, replace both parts with new parts.

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)

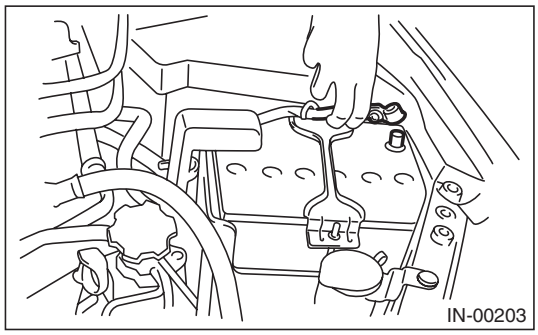
C: INSPECTION

Check that the ECM has no deformation, cracks or other damages.

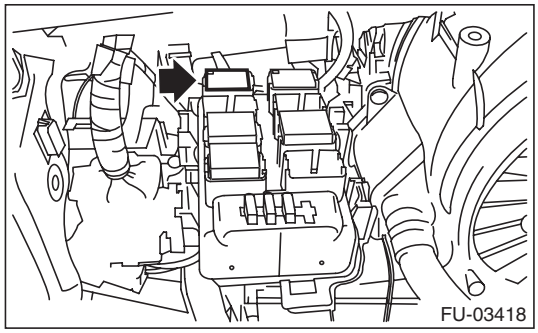
20.Main Relay

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.

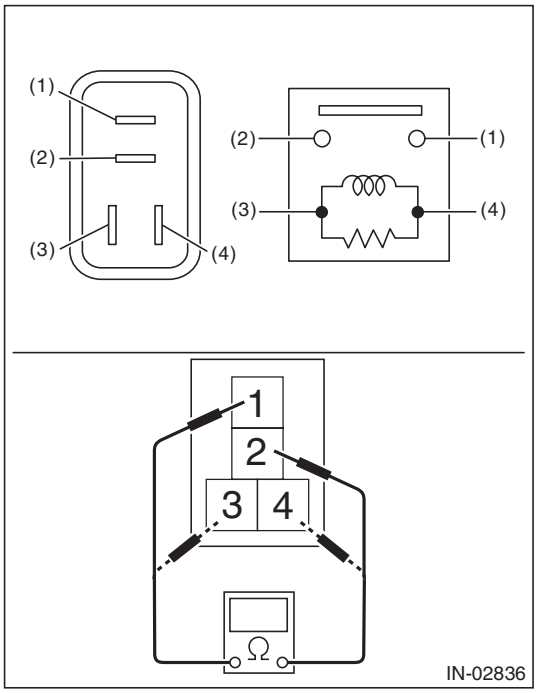


B: INSTALLATION

Install in the reverse order of removal.

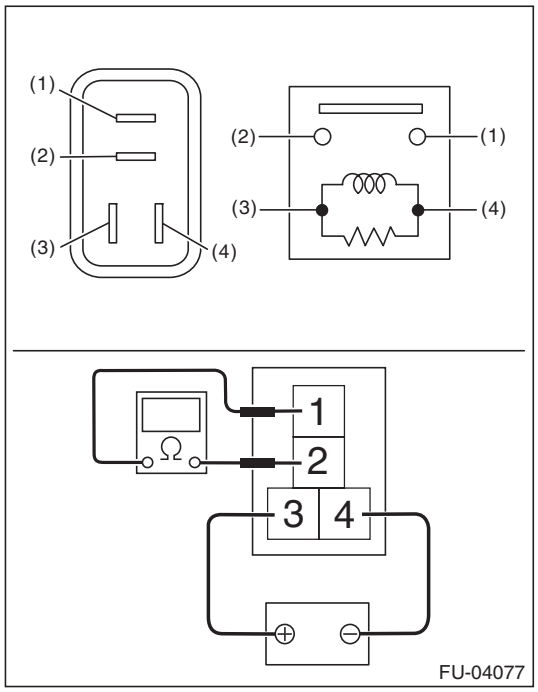
C: INSPECTION

1) Check that the main relay has no deformation, cracks or other damages.
2) 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))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the main relay terminals.

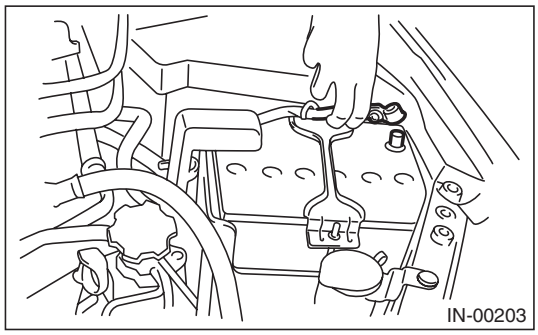


Terminal No.	Standard
1 and 2	Less than 1 Ω

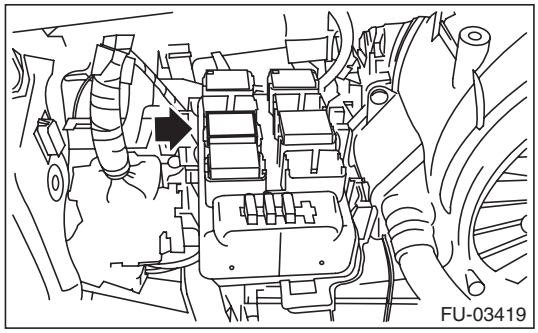
21.Fuel Pump Relay

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.

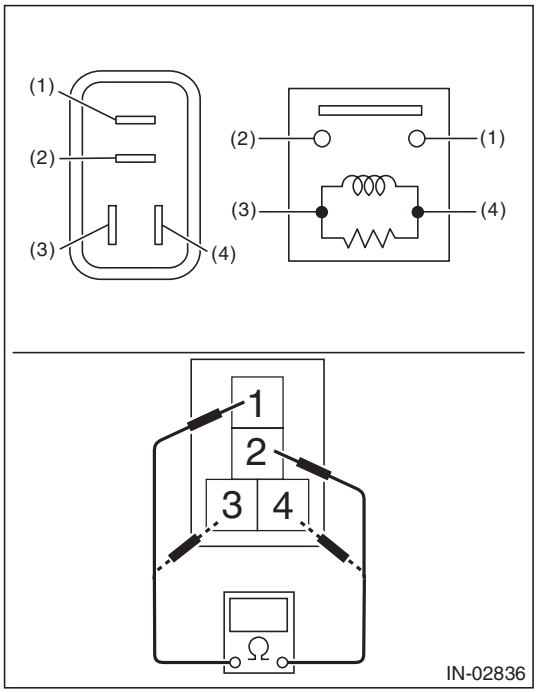


B: INSTALLATION

Install in the reverse order of removal.

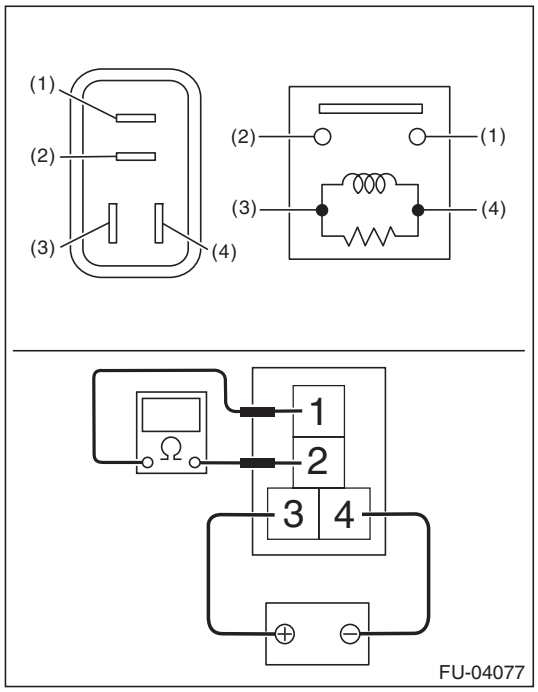
C: INSPECTION

1) Check that the fuel pump relay has no deformation, cracks or other damages.
2) 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))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the fuel pump relay terminals.

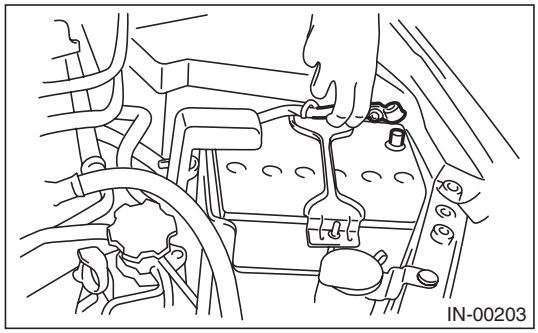


Terminal No.	Standard
1 and 2	Less than 1 Ω

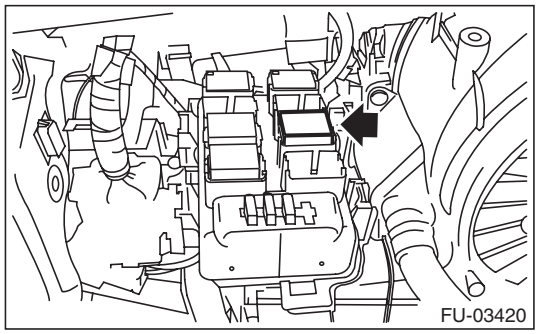
22. Electronic Throttle Control Relay

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.

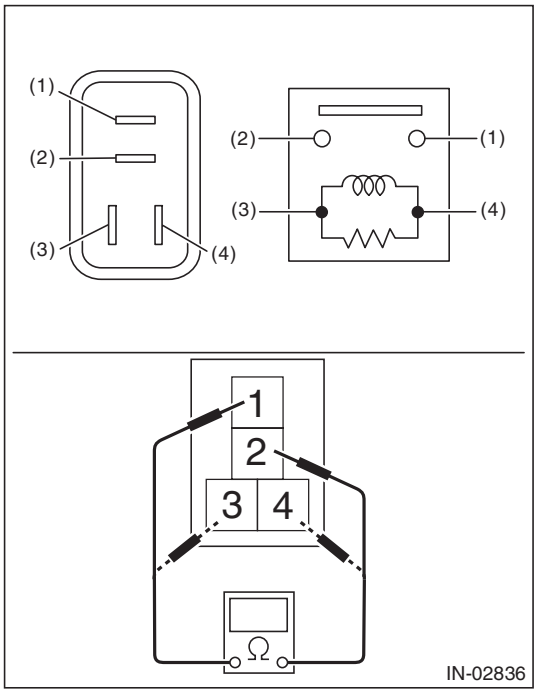


B: INSTALLATION

Install in the reverse order of removal.

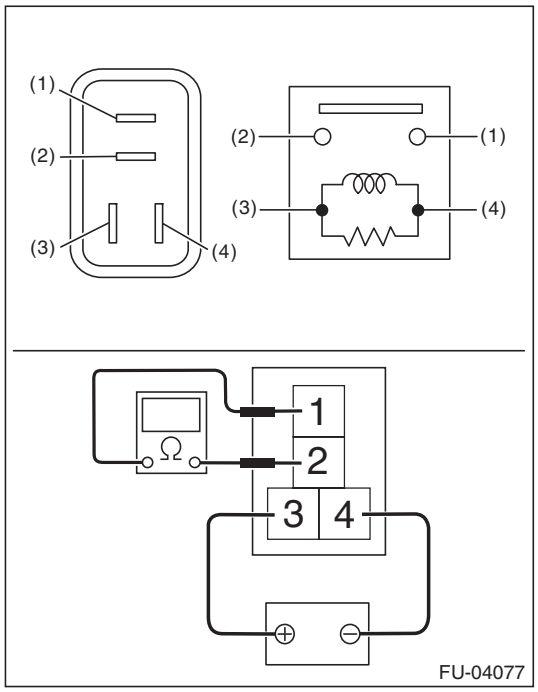
C: INSPECTION

1) Check that the electronic throttle control relay has no deformation, cracks or other damages.
2) 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))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the electronic throttle control relay terminals.

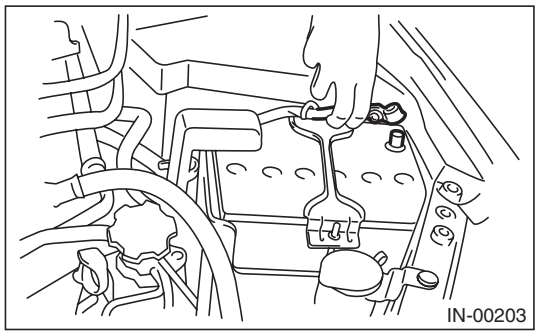


Terminal No.	Standard
1 and 2	Less than 1 Ω

23.Fuel Pump Control Unit

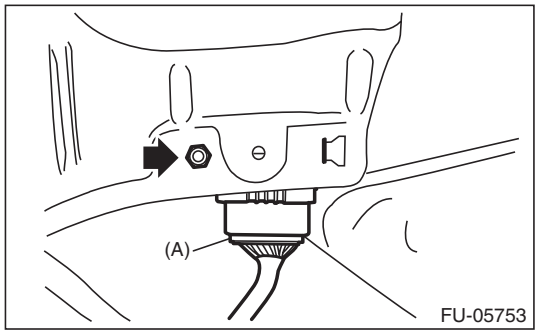
A: REMOVAL

1) Disconnect the ground cable from battery.

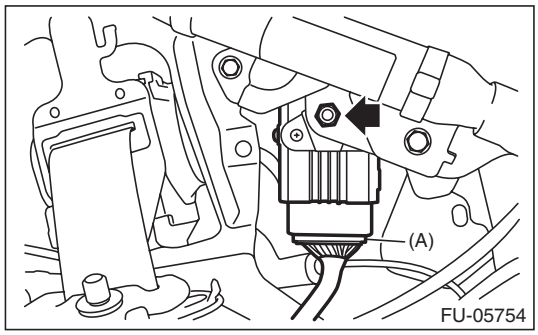


2) Remove the right side trunk side trim. (4 door model) <Ref. to EI-63, REMOVAL, Trunk Room Trim.>
3) Remove the right side rear quarter trim. (5 door model) <Ref. to EI-60, REMOVAL, Rear Quarter Trim.>
4) Disconnect the connector (A) from the fuel pump control unit, and remove the fuel pump control unit.

- 4 door model



- 5 door model



B: INSTALLATION

Install in the reverse order of removal.

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

C: INSPECTION

Check that the fuel pump control unit has no deformation, cracks or other damages.

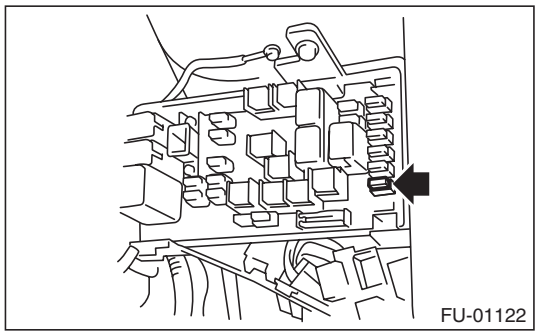
24. Fuel

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.

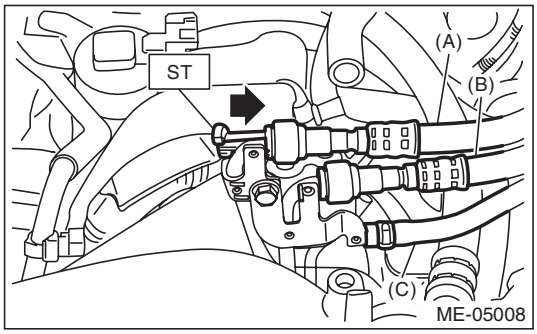
2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

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(STI)-67, 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(STI)-67, 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.



(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

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(H4DOTC)(diag)-64, 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)

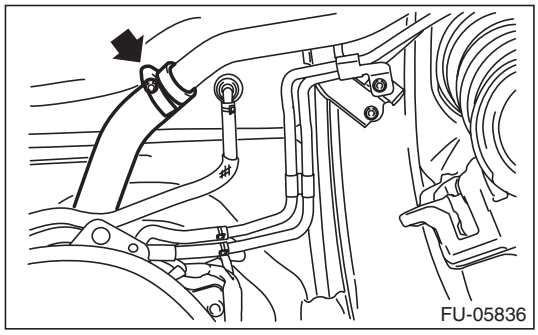
• 4 door model

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) Lift up the vehicle.
2) Remove the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, REMOVAL, Muffler.>
3) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
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.

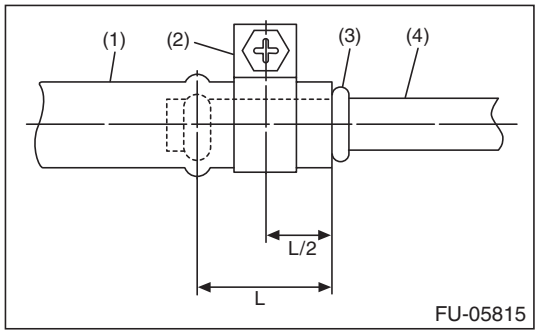


7) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

CAUTION:
Be careful not to spill fuel.
8) Install the related parts in the reverse order after draining the fuel.

NOTE:
Correctly insert the fuel filler hose to spool, and then install the clamp as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



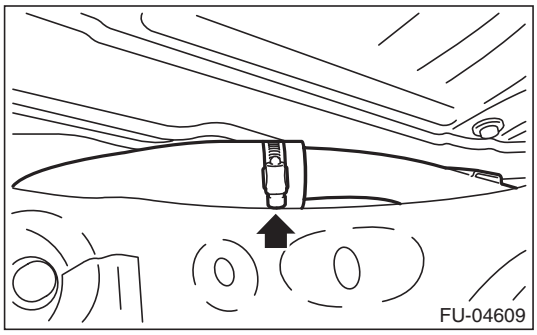
(1) Fuel filler hose
(2) Clamp
(3) Spool
(4) Fuel filler pipe

• 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) Lift up the vehicle.
2) Remove the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, REMOVAL, Muffler.>
3) Open the fuel filler lid and remove the fuel filler cap.
4) 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).
5) 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.



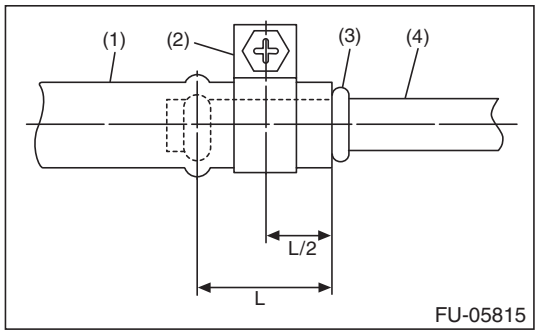
6) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

CAUTION:
Be careful not to spill fuel.

7) Install the related parts in the reverse order after draining the fuel.

NOTE:
Correctly insert the fuel filler hose to spool, and then install the clamp as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



(1) Fuel filler hose
(2) Clamp
(3) Spool
(4) Fuel filler pipe

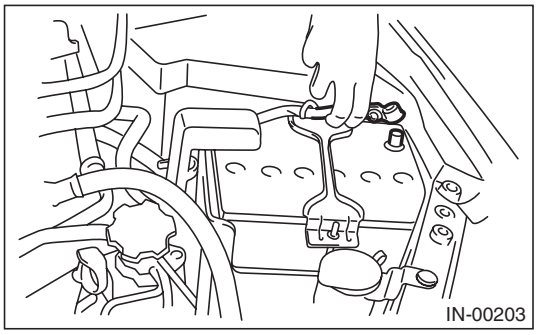
25.Fuel Tank

A: REMOVAL

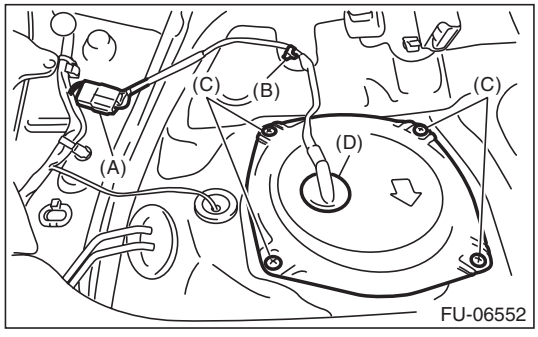
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

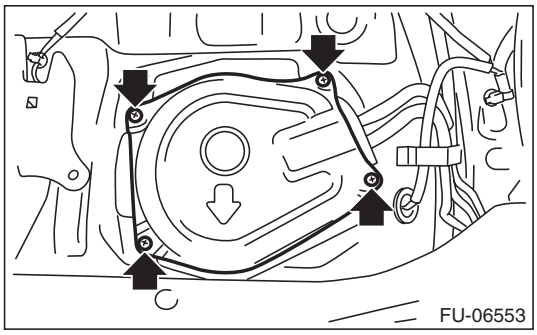
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(STI)-67, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.



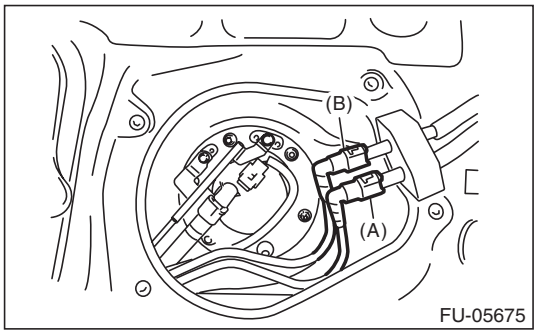
4) Remove the rear seat cushion. <Ref. to SE-14, REMOVAL, Rear Seat.>
5) Remove the service hole cover of fuel pump.
   (1) Disconnect fuel pump connector (A), and remove clip (B).
   (2) Remove the screw (C).
   (3) Push the grommet (D) down and remove the service hole cover.



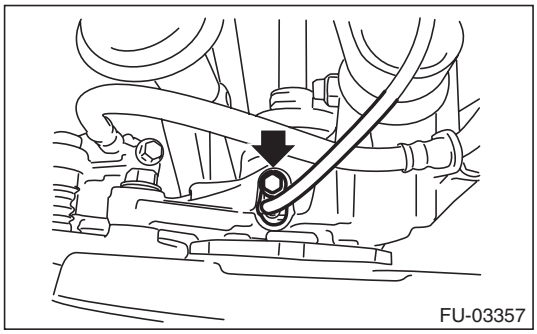
6) Remove the service hole cover of fuel sub level sensor.



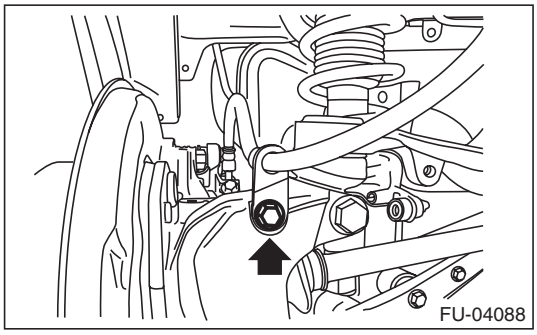
7) Disconnect the quick connector of fuel delivery tube (A) and fuel return tube (B). <Ref. to FU(STI)-93, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



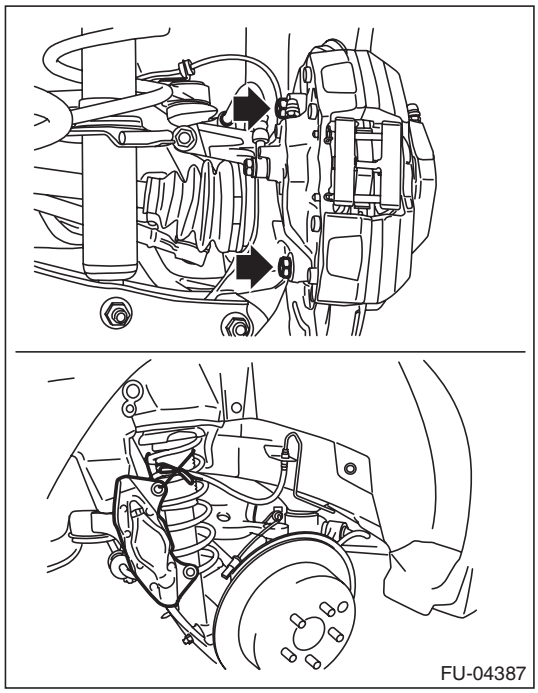
8) Remove the rear wheels.
9) Lift up the vehicle.
10) Remove the rear ABS wheel speed sensor from the rear housing.



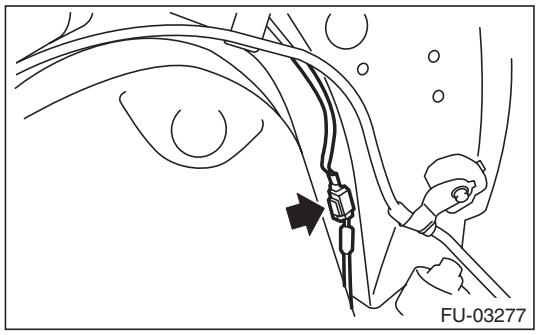
11) Remove the rear brake hose bracket from rear housing.



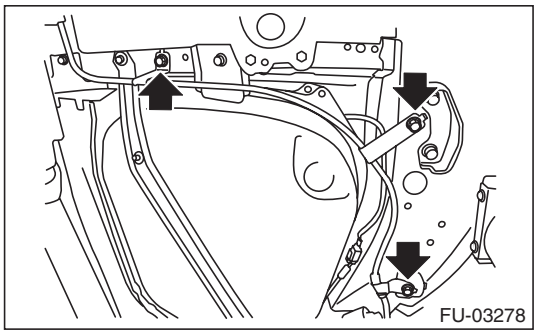
12) Remove the rear disc brake assembly and tie it to the body side of the vehicle.



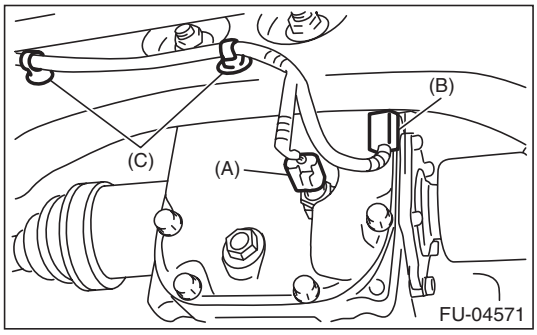
13) Remove the parking brake cable from parking brake assembly. <Ref. to PB-6, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>
14) Remove the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, REMOVAL, Muffler.>
15) Remove the propeller shaft. <Ref. to DS-11, REMOVAL, Propeller Shaft.>
16) Remove the heat shield cover and fuel tank protector.
17) Disconnect the connector from the rear ABS wheel speed sensor.



18) Remove the parking brake cable clamp from the body.



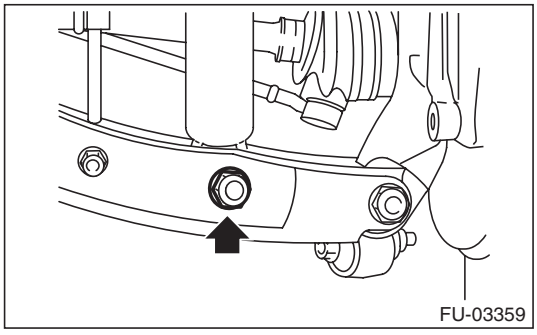
19) Disconnect the connectors from oil temperature switch (A) and ground (B), and remove the clips (C) which secure the harness.



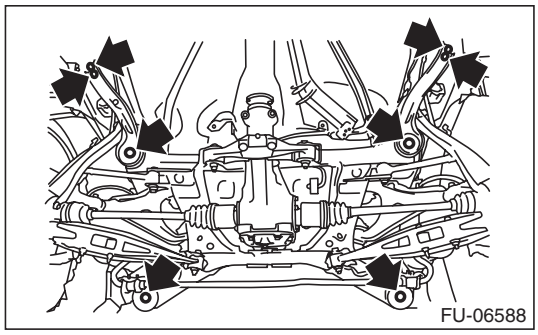
20) Remove the rear suspension assembly.

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.

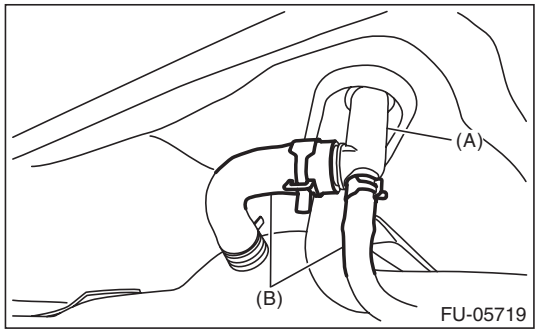


(3) Remove the bolts which secure the rear suspension assembly to the body.



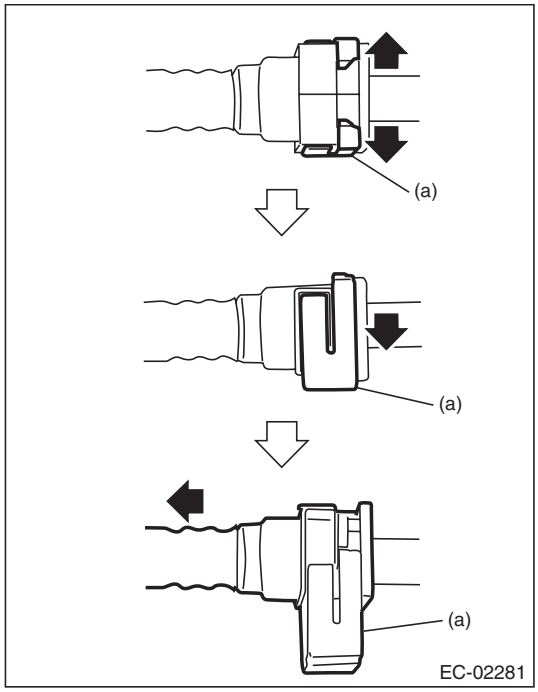
(4) Remove the rear suspension assembly.

21) Disconnect the evaporation hose (B) from hose connector (A).

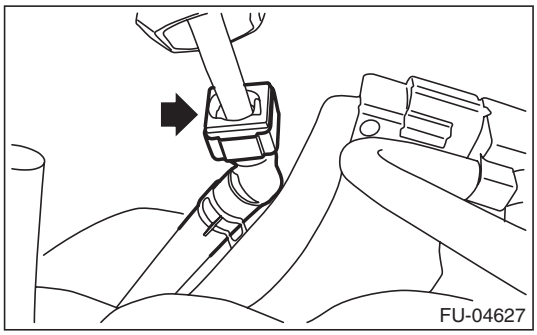


22) Disconnect the quick connector of the evaporation hose from the evaporation pipe.

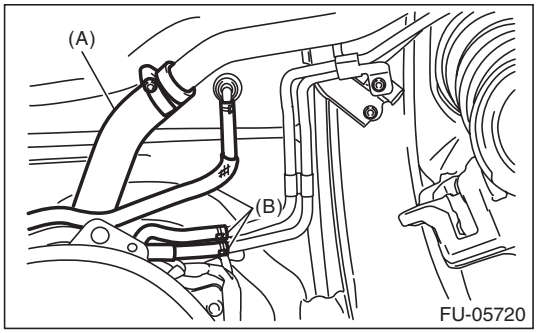
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Retainer

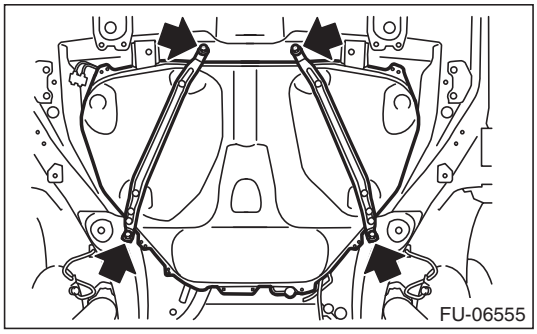


23) Disconnect the fuel filler hose (A) and evaporation hose (B).



24) Support the fuel tank with a transmission jack, remove the fuel tank band, and remove the fuel tank from the vehicle.

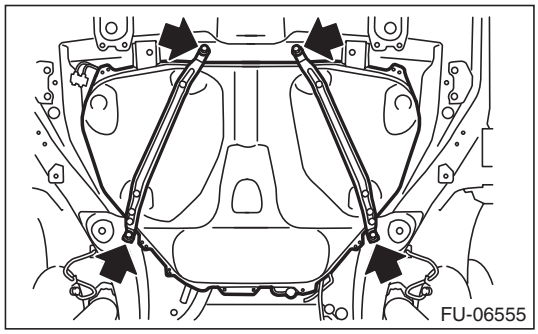
WARNING:
- **A helper is required to perform this work.**
- **Fuel may remain in the fuel tank. This will cause the left and right sides to be unbalanced. Be careful not to drop the fuel tank.**



B: INSTALLATION

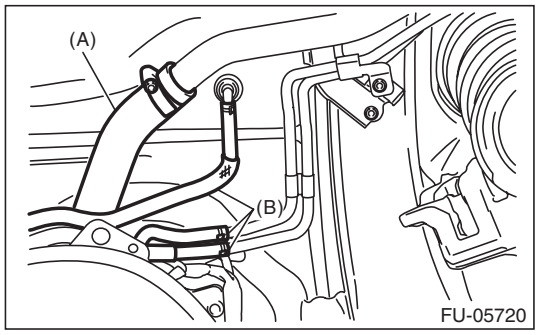
1) Support the fuel tank with a transmission jack, set the fuel tank and the fuel tank band in place, and temporarily tighten the bolts of the fuel tank band.

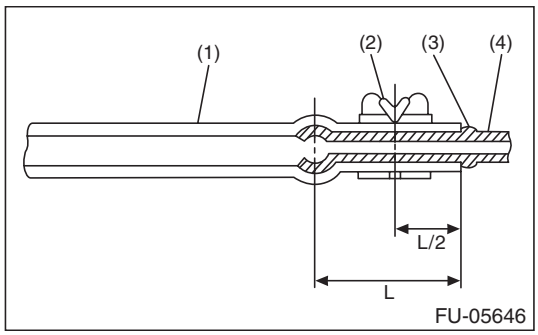
WARNING:
A helper is required to perform this work.



2) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, 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)

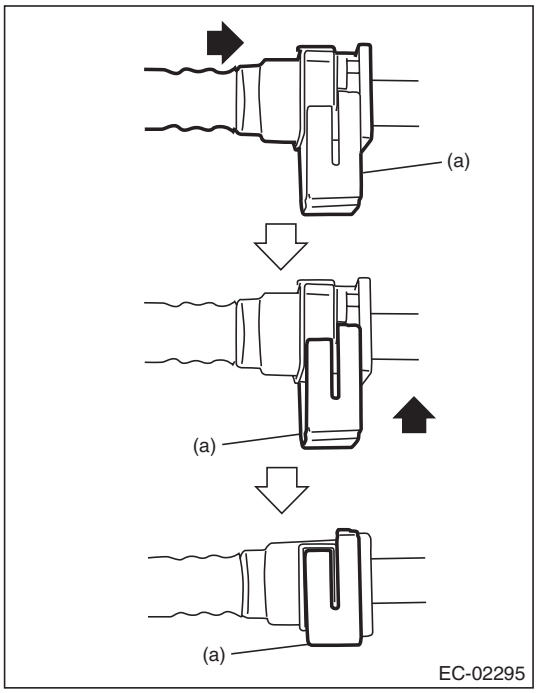




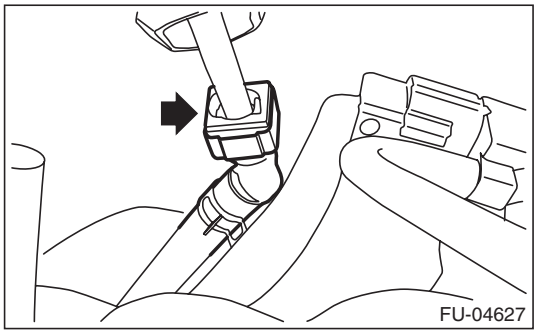
(1) Hose
(2) Clamp or clip
(3) Spool
(4) Pipe

3) Connect the quick connector of the evaporation hose to the evaporation pipe.

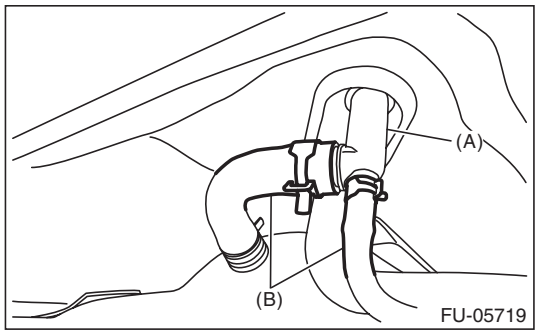
CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, securely insert the pipe all the way before locking the retainer.
• When it is difficult to lock the retainer, make sure that the pipe is securely inserted.
• Make sure that the quick connector is securely connected.



(a) Retainer

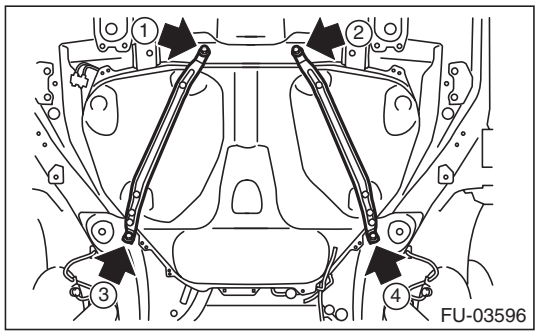


4) Connect the evaporation hose (B) to hose connector (A).



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)

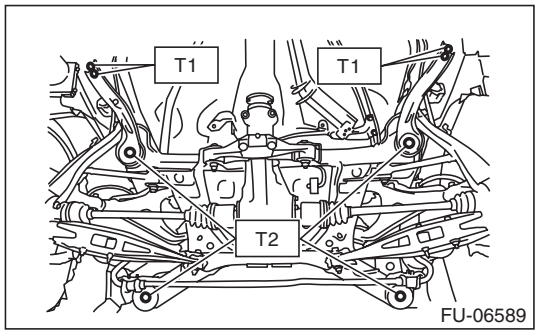


6) Install the rear suspension assembly.

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 install the rear suspension assembly to the body.

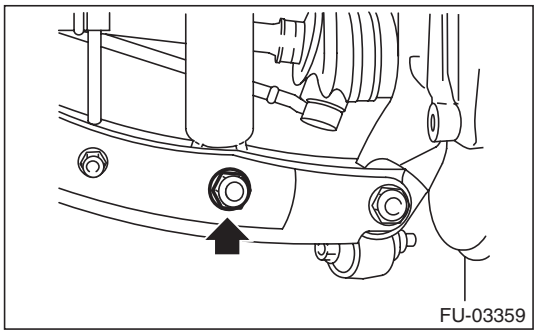
Tightening torque:
T1: 70 N·m (7.1 kgf-m, 51.6 ft-lb)
T2: 145 N·m (14.8 kgf-m, 106.9 ft-lb)



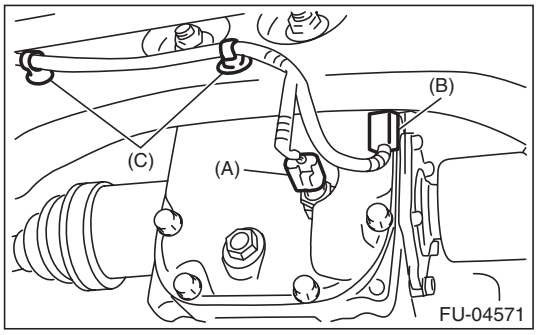
(3) Install the rear shock absorber to the rear suspension arm.

NOTE:
Use a new self-locking nut.

Tightening torque:
120 N·m (12.2 kgf-m, 88.5 ft-lb)

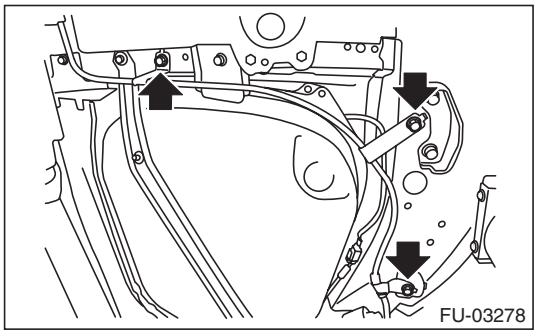


7) Connect the connectors to oil temperature switch (A) and ground (B), and secure the harness with clips (C).



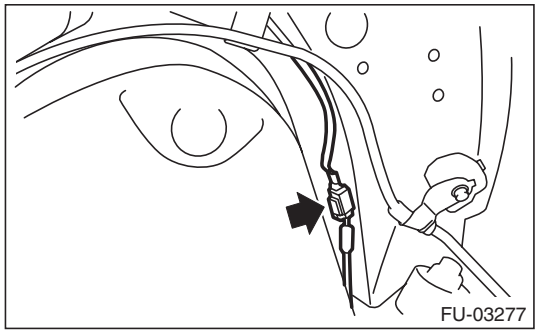
8) Install the parking brake cable clamp to the body.

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



9) Connect the connector to the rear ABS wheel speed sensor.

NOTE:
Prevent the harness identification (line) from being twisted when installing. (RH: White line, LH: Yellow line)


FU-03277

10) Install the heat shield cover.

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

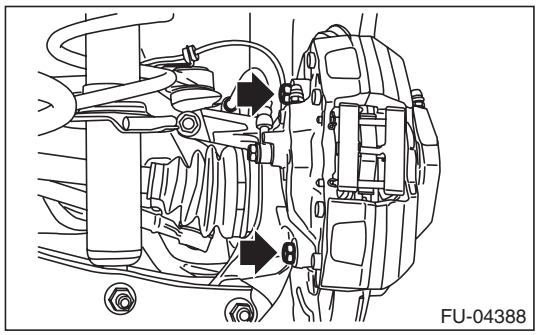
11) Install the fuel tank protector.

NOTE:
Use a new self-locking nut.

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)

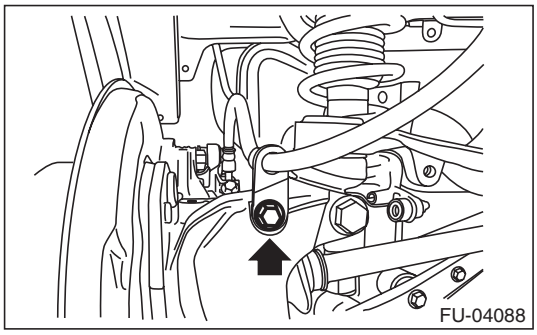
12) Install the propeller shaft. <Ref. to DS-12, INSTALLATION, Propeller Shaft.>
13) Install the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, INSTALLATION, Muffler.>
14) Lower the vehicle.
15) Connect the parking brake cable to the parking brake assembly. <Ref. to PB-7, INSTALLATION, Parking Brake Assembly (Rear Disc Brake).>
16) Install the rear disc brake assembly.

Tightening torque:
65 N·m (6.6 kgf-m, 47.9 ft-lb)


FU-04388

17) Install the rear brake hose bracket to the rear housing.

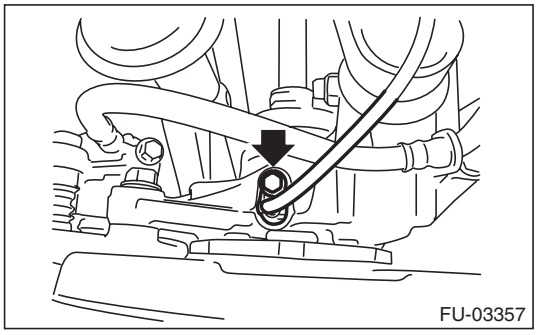
Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)


FU-04088

18) Attach the rear ABS wheel speed sensor to the rear housing.

NOTE:
Prevent the harness identification (line) from being twisted when installing. (RH: White line, LH: Yellow line)

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

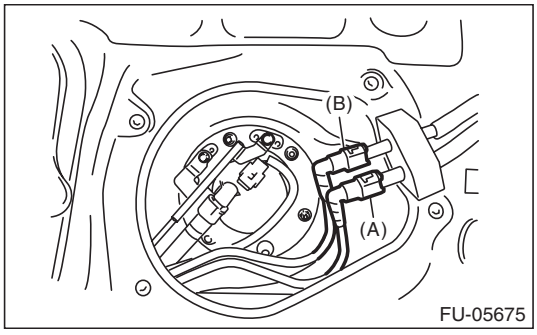

FU-03357

19) Install the rear wheels.

Tightening torque:
100 N·m (10.2 kgf-m, 73.8 ft-lb)

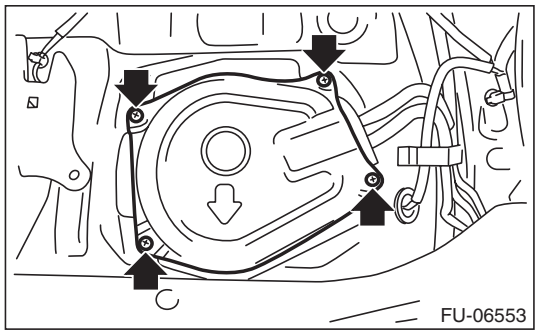
20) Connect the quick connector of fuel delivery tube (A) and fuel return tube (B). <Ref. to FU(STI)-95, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

NOTE:
When connecting, be careful not to reverse the delivery side and return side.

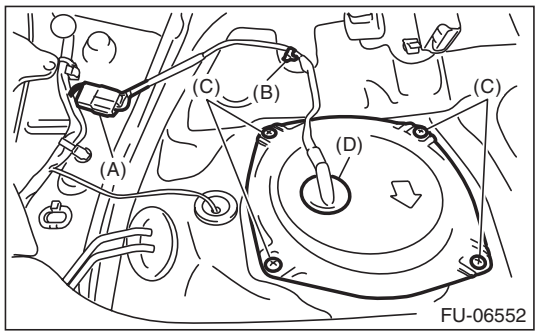


FU-05675

21) Install the service hole cover of fuel sub level sensor.

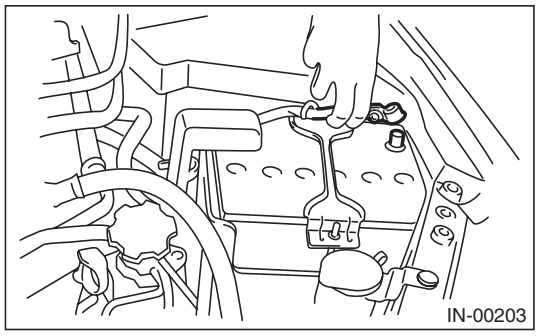


22) Attach the service hole cover of the fuel pump, and attach the connector and clip.



(A) Connector
(B) Clip
(C) Screw
(D) Grommet

23) Install the rear seat cushion. <Ref. to SE-15, INSTALLATION, Rear Seat.>
24) Connect the battery ground terminal.



25) Inspect the wheel alignment and adjust if necessary.

C: INSPECTION

1) Check that the fuel tank and fuel pipe have no deformation, cracks and other damages.
2) Check that the fuel hose has no cracks, damage or loose part.

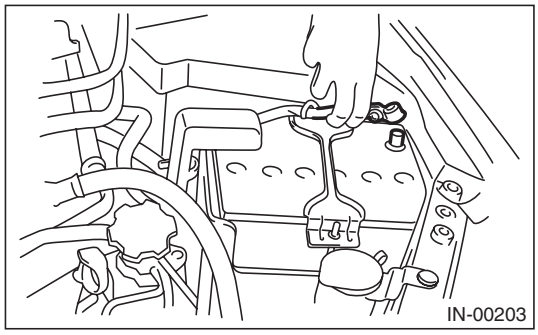
26.Fuel Filler Pipe

A: REMOVAL

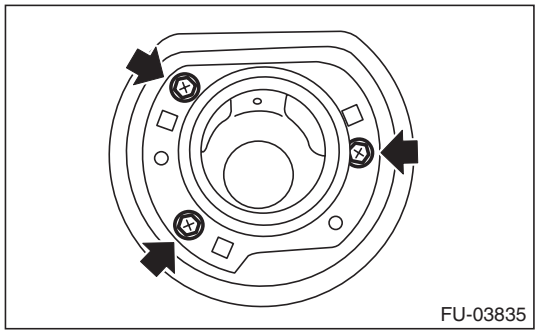
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

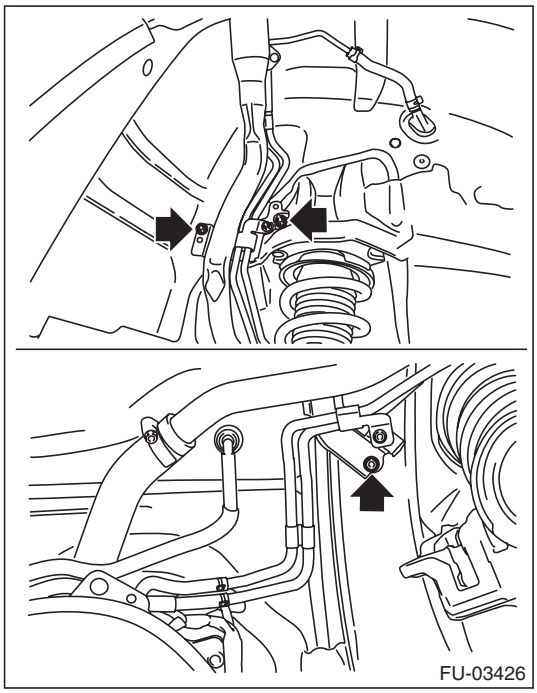
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(STI)-67, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.



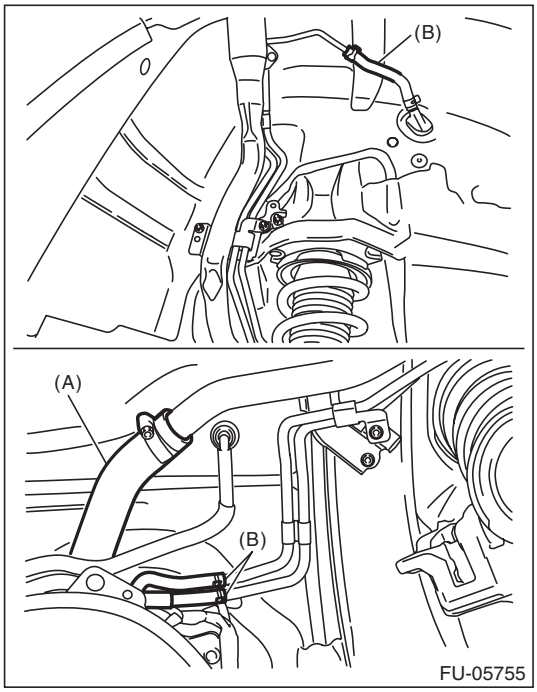
4) Open the fuel filler lid, and remove the filler cap.
5) Remove the screws which secure the fuel filler ring, and then remove the fuel filler ring.



6) Remove the rear wheel RH.
7) Lift up the vehicle.
8) Remove the rear mud guard RH. <Ref. to EI-30, REAR MUD GUARD, REMOVAL, Mud Guard.>
9) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
10) Remove the bolts and nuts which secure fuel filler pipe assembly onto the vehicle body.



11) Disconnect the fuel filler hose (A) and evaporation hose (B) from the fuel filler pipe assembly.

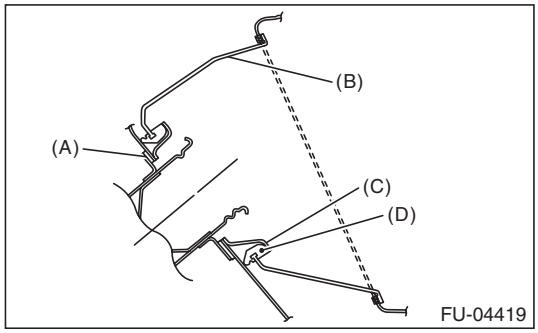


12) Remove the fuel filler pipe assembly from the underside of the vehicle.

B: INSTALLATION

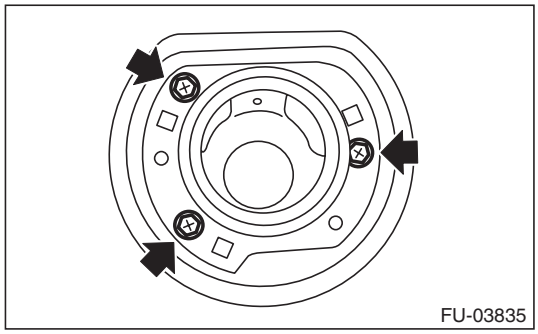
1) Open the fuel filler lid.
2) Attach the fuel filler pipe gasket to the fuel filler pipe assembly, and insert the fuel filler pipe assembly from inside of the rear fender.
3) Install the fuel filler ring to the fuel filler pipe assembly.

NOTE:
If the edges of rubber gasket are folded toward inside, straighten it with a flat tip screwdriver.



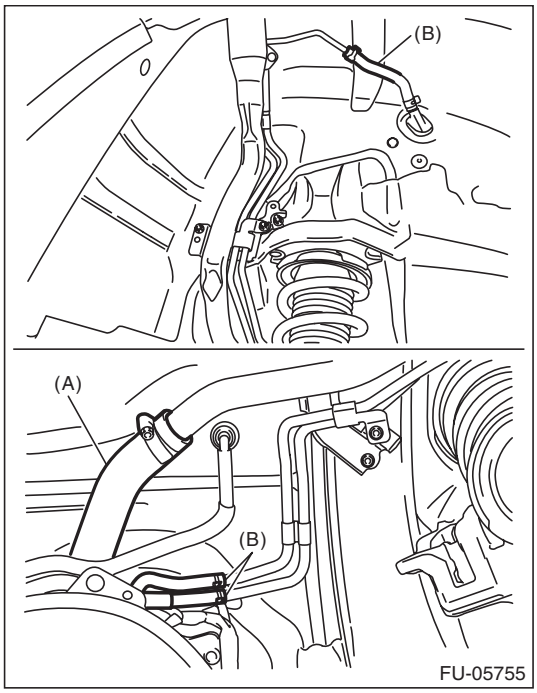
(A) Fuel filler pipe gasket
(B) Fuel saucer
(C) Fuel filler ring
(D) Rubber gasket

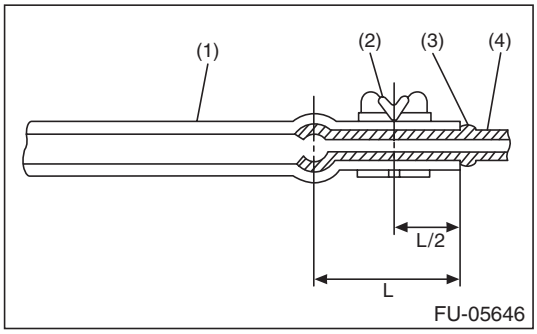
Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)



4) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, 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)

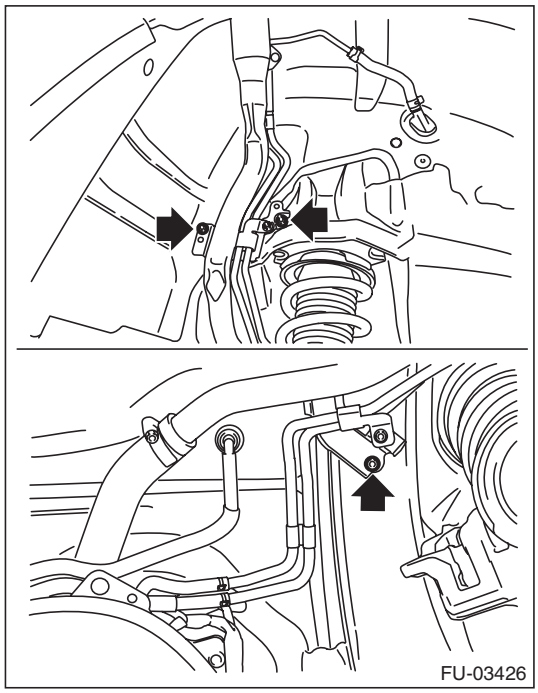




(1) Hose
(2) Clamp or clip
(3) Spool
(4) Pipe

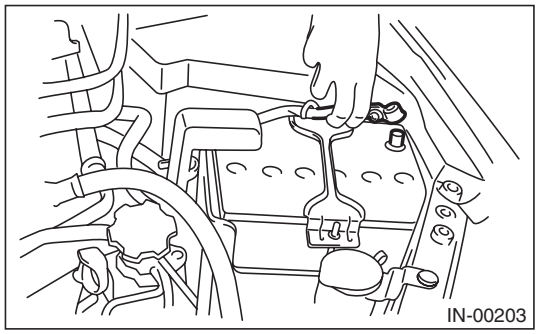
5) Install the fuel filler pipe assembly to vehicle body.

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-30, INSTALLATION, Mud Guard.>
8) Lower the vehicle.
9) Install the rear wheel RH.

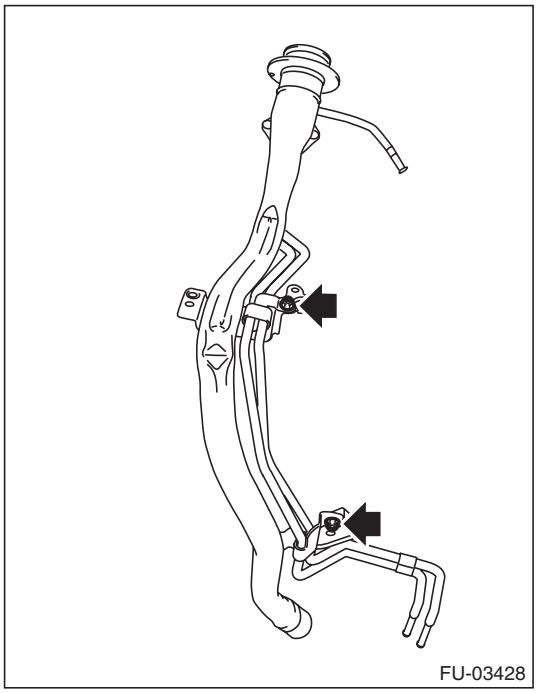
Tightening torque:
100 N·m (10.2 kgf-m, 73.8 ft-lb)
10) Connect the battery ground terminal.



11) Inspect the wheel alignment and adjust if necessary.

C: DISASSEMBLY

1) Remove the shut valve from the fuel filler pipe. <Ref. to EC(STI)-18, REMOVAL, Shut Valve.>
2) Remove the evaporation pipe from the fuel filler pipe.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

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

E: INSPECTION

1) Check that the fuel filler pipe and evaporation pipe have no deformation, cracks or other damages.
2) Check that the hose has no cracks, damage or loose part.

27.Fuel Pump

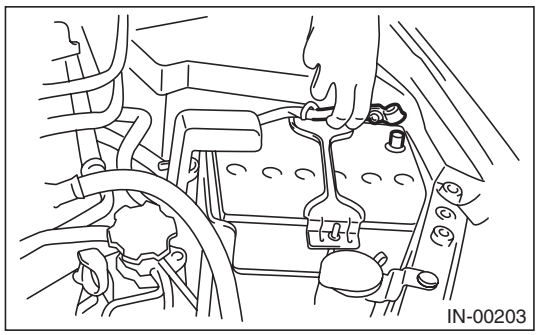
A: REMOVAL

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

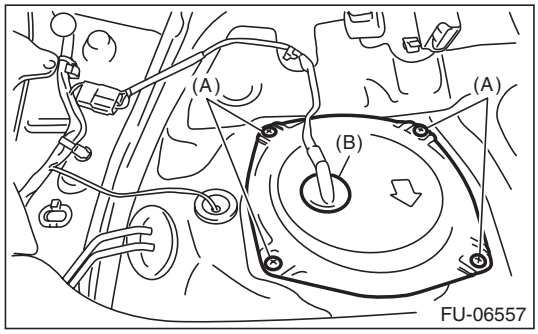
CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
Fuel pump assembly consists of fuel pump, fuel filter and fuel level sensor.

1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(STI)-67, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.

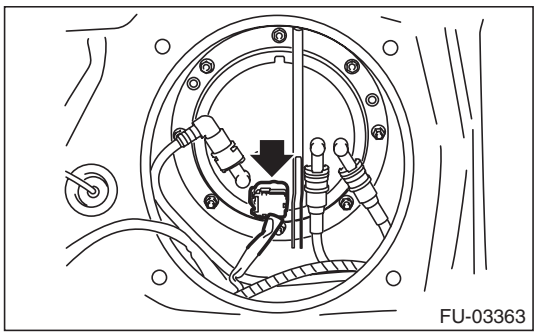

IN-00203

4) Remove the rear seat cushion. <Ref. to SE-14, 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.

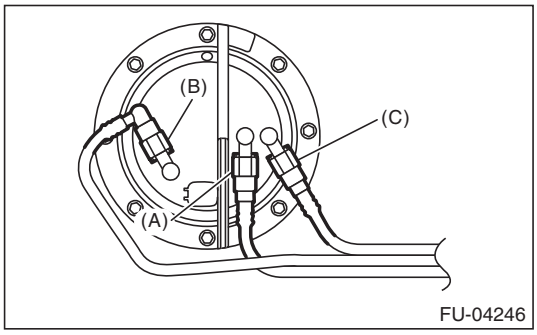


FU-06557

6) Disconnect the connector from fuel pump.

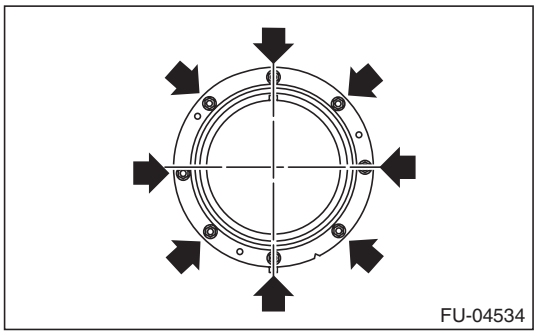

FU-03363

7) Disconnect the quick connectors of fuel delivery tube (A), fuel return tube (B), and jet pump tube (C). <Ref. to FU(STI)-93, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



FU-04246

8) Remove the nuts which hold the fuel pump upper plate to the fuel tank.


FU-04534

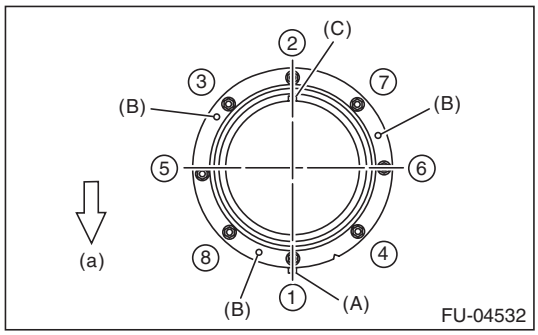
9) Remove the fuel pump assembly from the fuel tank.

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.
• Align protrusion (A) of the gasket to the position shown in the figure.
• Insert the protrusion (B) of gasket to the fuel pump upper plate. (3 places)
• Align the protrusion (C) of fuel pump assembly with the cutout on the fuel pump upper plate.
• Tighten the nuts to the specified torque in the order as shown in the figure.

NOTE:
Use a new gasket.

Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)

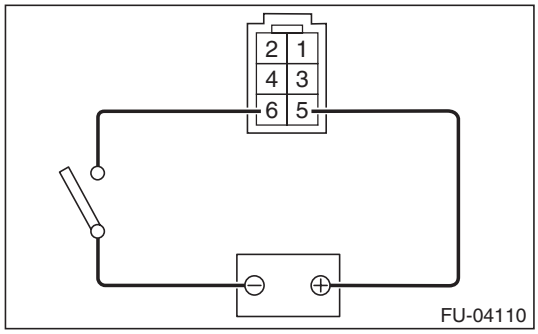


(a) Front side of vehicle

C: INSPECTION

1) Check that the fuel pump has no deformation, cracks or other damages.
2) Connect the battery positive terminal to terminal No. 5 and the battery ground terminal to terminal No. 6, 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.



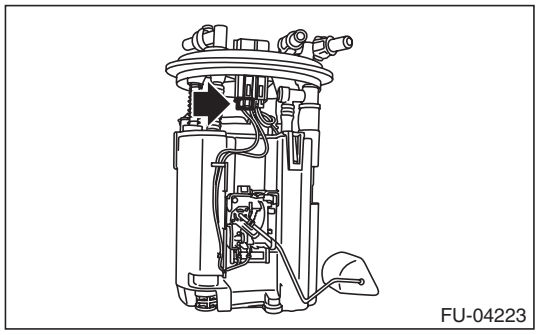
28.Fuel Level Sensor

A: REMOVAL

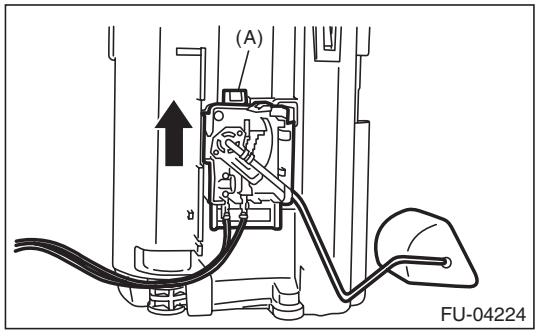
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

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(STI)-80, REMOVAL, Fuel Pump.>
2) Disconnect the fuel level sensor connector.


FU-04223

3) 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.



FU-04224

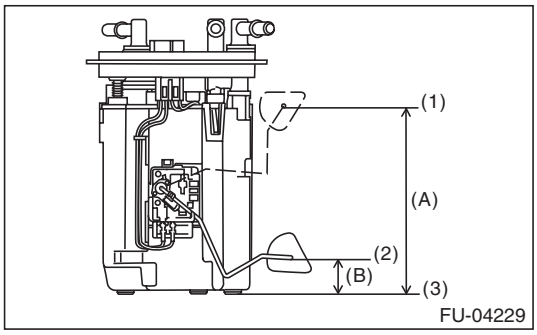
B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

1) Check that the fuel level sensor has no damage.
2) Measure the fuel level sensor float position.

NOTE:
When inspecting the fuel level sensor, perform the work with the sensor installed to the fuel pump.

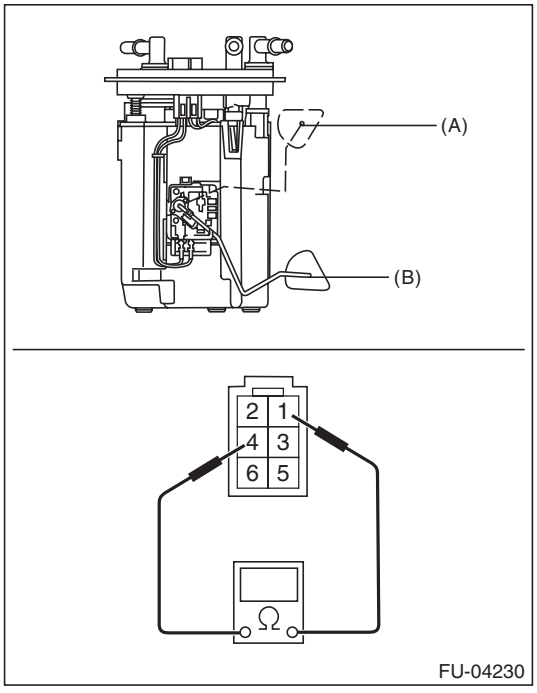


FU-04229

(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)

3) Measure the resistance between fuel level sensor terminals.



FU-04230

Float position	Terminal No.	Standard
FULL (A)	1 and 4	2.0±1.0 Ω
EMPTY (B)		31.9±1.0 Ω

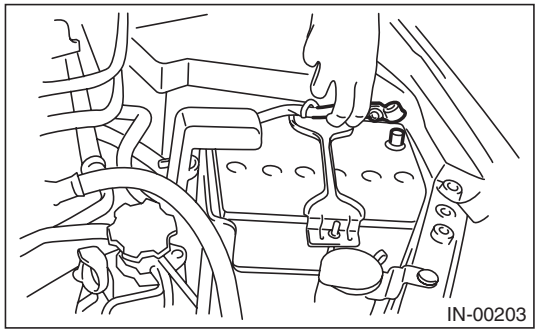
29.Fuel Sub Level Sensor

A: REMOVAL

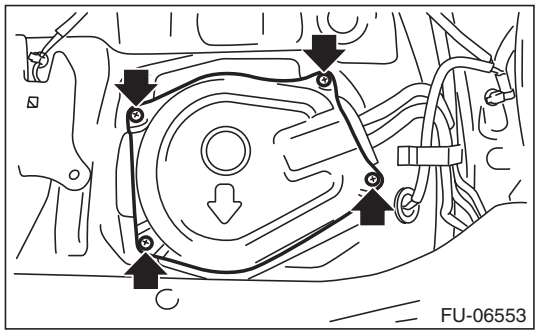
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

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.**

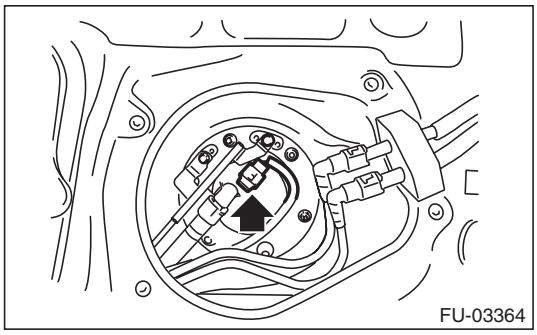
1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(STI)-67, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.


IN-00203

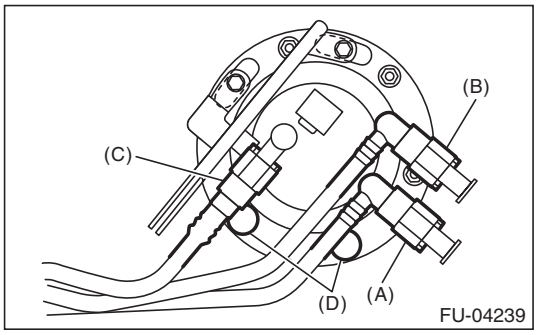
4) Remove the rear seat cushion. <Ref. to SE-14, REMOVAL, Rear Seat.>
5) Remove the service hole cover.


FU-06553

6) Disconnect the connector from the fuel sub level sensor.

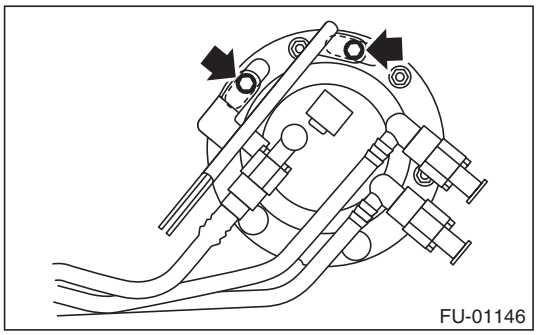

FU-03364

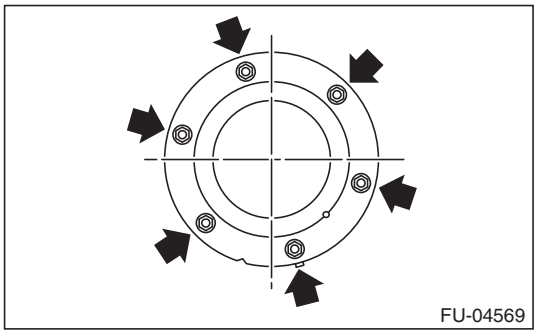
7) Disconnect the quick connectors of fuel delivery tube (A), fuel return tube (B), and jet pump tube (C). <Ref. to FU(STI)-93, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>
8) Remove the rubber cap (D) from the nut.



FU-04239

9) Remove the bolts and nuts which hold fuel sub level sensor protector and fuel sub level sensor upper plate to the fuel tank.


FU-01146


FU-04569

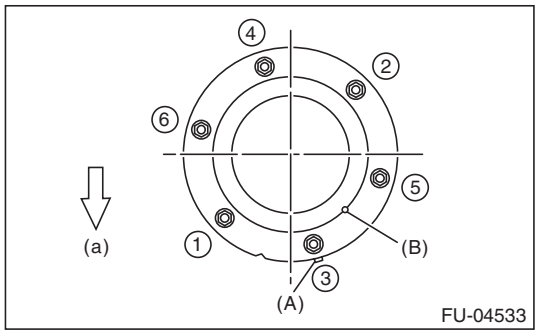
10) Remove the fuel sub level sensor from the fuel tank.

B: INSTALLATION

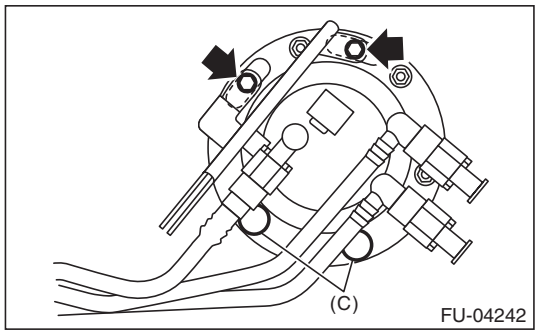
Install in the reverse order of removal while being careful of the following.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align protrusion (A) of the gasket to the position shown in the figure.
- Align protrusion (B) of the fuel sub level sensor to the cutout 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) at the position shown in the figure.

NOTE:
- Use a new gasket.
- Do not forget to install rubber cap (C).

Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)

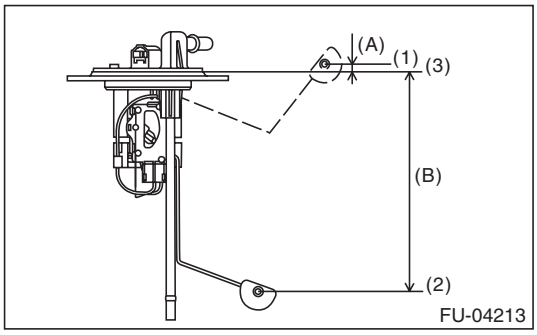


(a) Front side of vehicle



C: INSPECTION

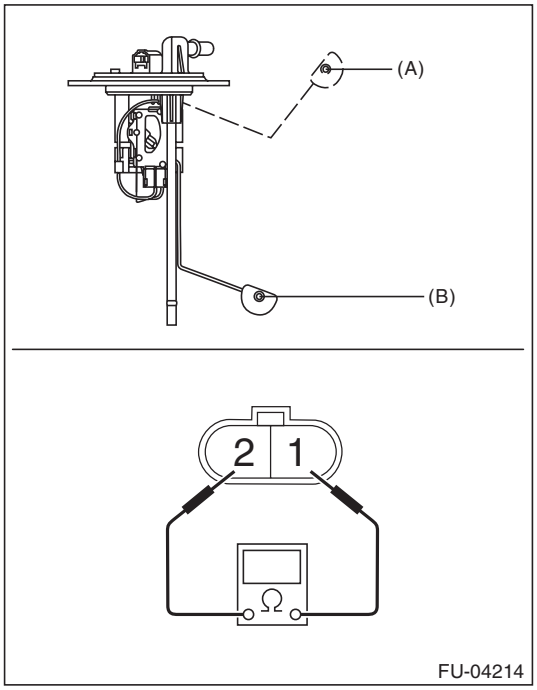
1) Check that the fuel sub level sensor has no damage.
2) Measure the fuel sub level sensor float position.



(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)

3) Measure the resistance between fuel sub level sensor terminals.



Float position	Terminal No.	Standard
FULL (A)	1 and 2	$2.0^{+0.5}_{-1.0}$ Ω
EMPTY (B)		62.1±1.0 Ω

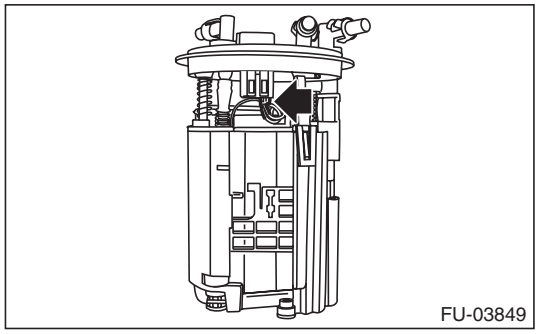
30. Fuel Filter

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.**

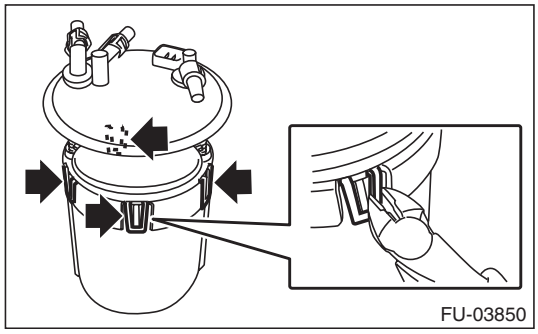
NOTE:
The fuel filter is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(STI)-80, REMOVAL, Fuel Pump.>
2) Remove the fuel level sensor. <Ref. to FU(STI)-82, REMOVAL, Fuel Level Sensor.>
3) Disconnect the pump assembly connector from sub tank bracket assembly.


FU-03849

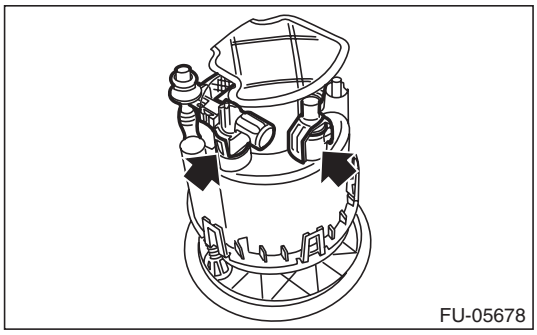
4) Cut off the tab holders connecting the sub tank bracket assembly and the sub tank in four locations, and separate the sub tank bracket assembly and the sub tank.

CAUTION:
Be careful not to damage the sub tank.

NOTE:
If the O-ring is remaining on the sub tank, remove.

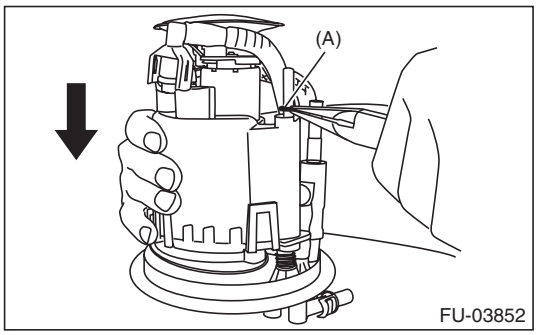

FU-03850

5) Disconnect two connectors of fuel delivery pipe from fuel filter assembly.


FU-05678

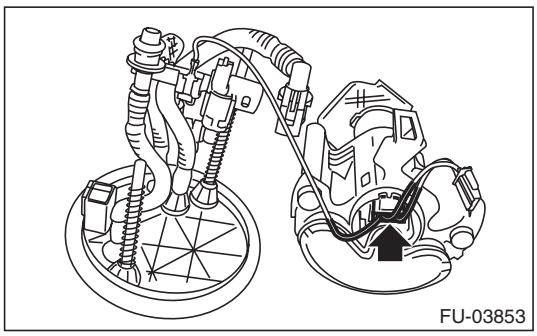
6) Push to compress the fuel filter assembly in the direction of the arrow, remove clip (A), and separate the sub tank bracket assembly and the fuel filter assembly.

CAUTION:
When separating the sub tank bracket assembly and the fuel filter assembly, be careful not to damage the ground wire.



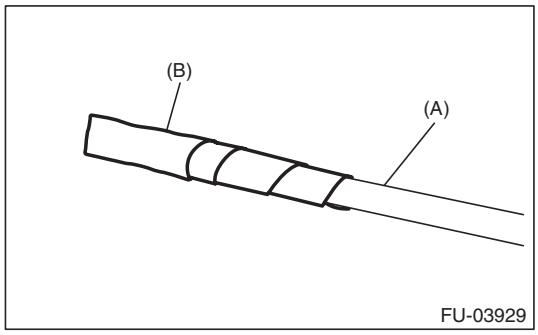
FU-03852

7) Disconnect the connector from the pump assembly.


FU-03853

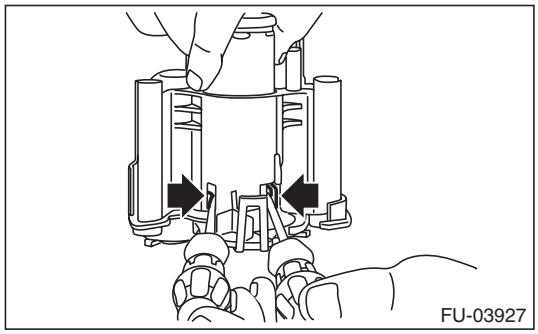
8) Lift the two tab holders connecting the pump assembly to the fuel filter using a flat tip screwdriver (with a shaft diameter of approx. 3 mm (0.12 in)), etc., and separate the fuel filter and pump assembly.

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.

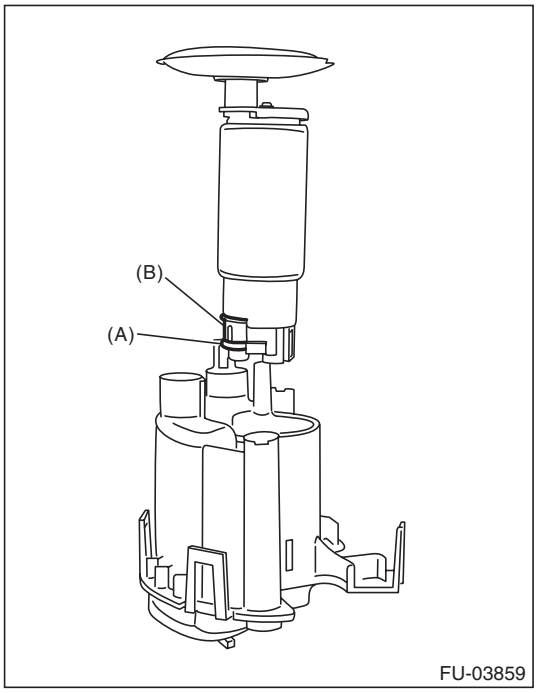
NOTE:
If the spacer and O-ring is remaining on the pump assembly, remove these.



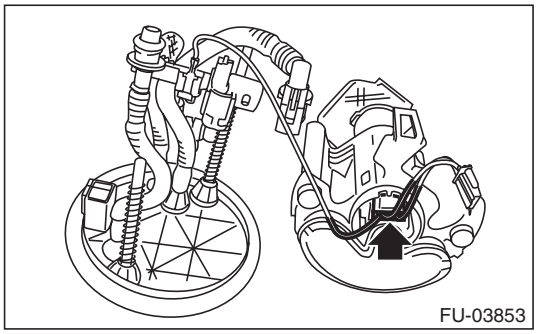
B: INSTALLATION

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 click is heard.

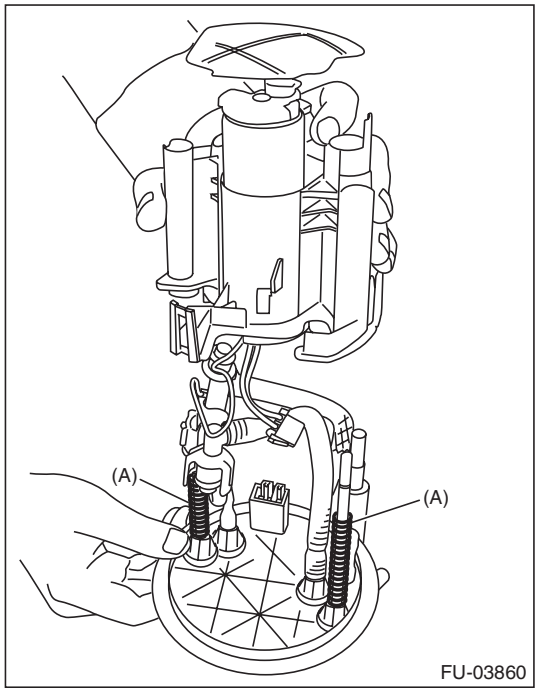


2) Connect the connector to the pump assembly.



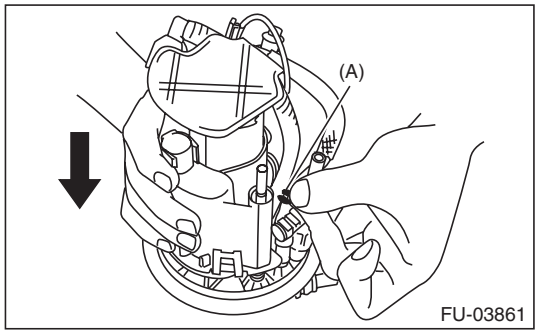
3) Attach spring (A) to the metal rod of the sub tank bracket assembly, and assemble the fuel filter assembly.

NOTE:
Use a new spring.



4) Push the fuel filter assembly in the direction of the arrow to compress, and attach clip (A).

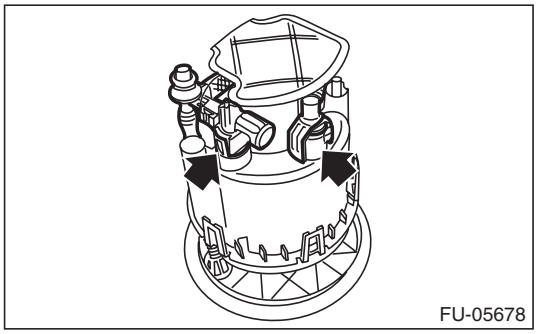
NOTE:
Use a new clip.



5) Connect the fuel piping connector to the fuel filter assembly.

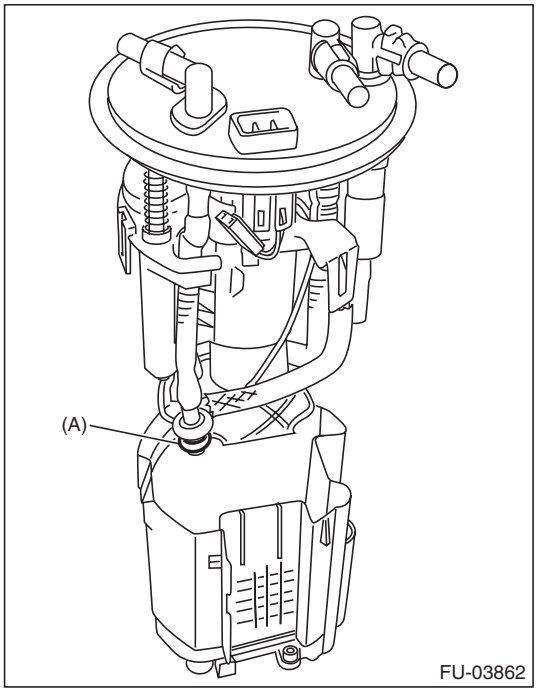
NOTE:
- Use new O-rings.
- Apply gasoline to the O-ring.
- The O-rings of the black and white connectors are identified by a difference in diameter. Be careful not to confuse the two during assembly.

O-ring inner diameter:
Black connector O-ring [Approx. 7 mm (0.28 in)]
White connector O-ring [Approx. 8 mm (0.31 in)]

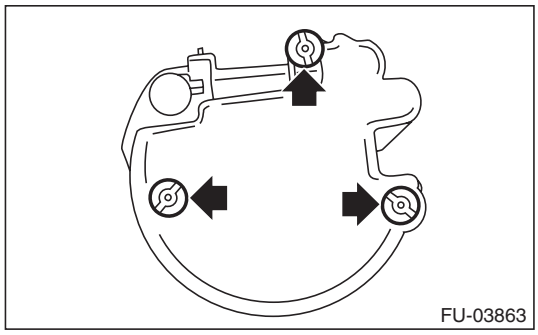


6) Attach the O-ring (A) to the fuel filter assembly, and attach the sub tank to the sub tank bracket assembly.

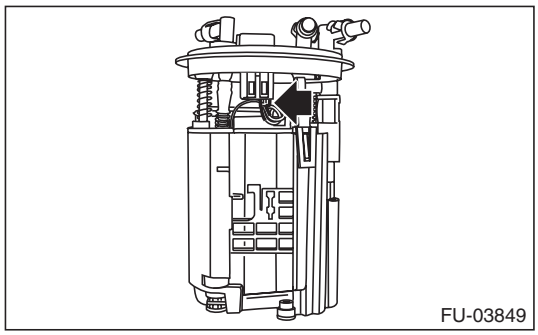
NOTE:
- Use new O-rings (8 mm (0.31 in) inner diameter).
- Apply gasoline to the O-ring.
- Insert the pump assembly until a “pop” is heard.



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. <Ref. to FU(STI)-82, INSTALLATION, Fuel Level Sensor.>
10) Inspect the fuel level sensor. <Ref. to FU(STI)-82, INSPECTION, Fuel Level Sensor.>
11) Install the fuel pump assembly. <Ref. to FU(STI)-81, INSTALLATION, Fuel Pump.>

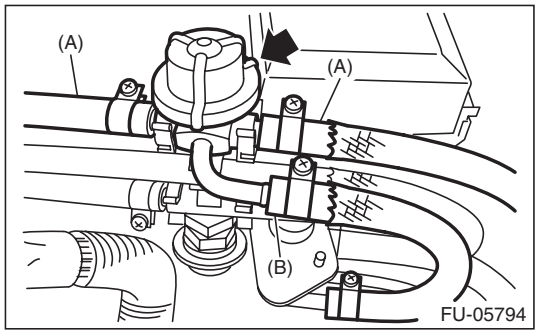
31.Pulsation Damper Assembly

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(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the fuel delivery hose (A) and fuel hose (B) from the pulsation damper assembly, and remove the pulsation damper assembly.



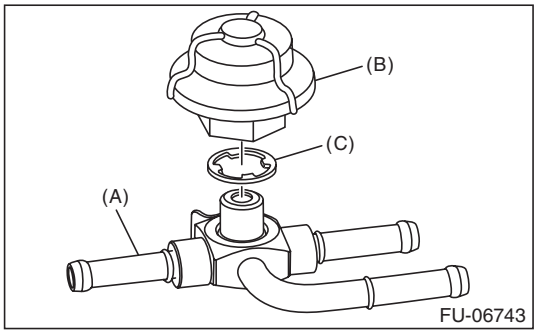
B: INSTALLATION

Install in the reverse order of removal.

NOTE:
For the information about connecting the fuel delivery hose and fuel hose, refer to "Fuel Delivery, Return & Evaporation Lines". <Ref. to FU(STI)-96, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

C: DISASSEMBLY

Remove the pulsation damper and fuel pipe gasket from the fuel by-pass pipe.



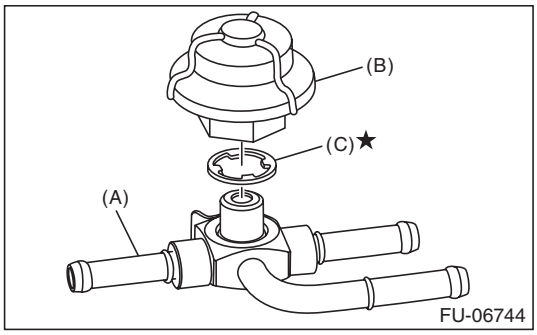
(A) Fuel by-pass pipe
(B) Pulsation damper
(C) Fuel pipe gasket

D: ASSEMBLY

Install the fuel pipe gasket and pulsation damper to the fuel by-pass pipe.

NOTE:
Use a new fuel pipe gasket.

Tightening torque:
21.6 N·m (2.2 kgf-m, 15.9 ft-lb)



(A) Fuel by-pass pipe
(B) Pulsation damper
(C) Fuel pipe gasket

E: INSPECTION

1) Check that the pulsation damper assembly has no deformation, cracks or other damages.
2) Check that the fuel delivery hose and fuel hose have no cracks, damage or loose part.

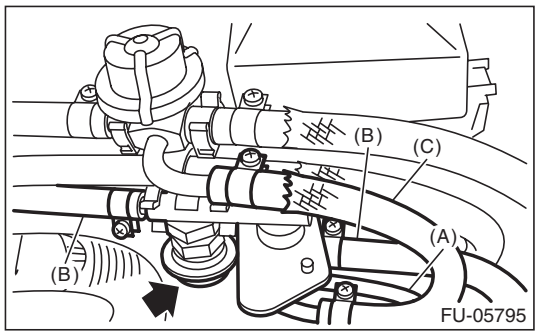
32. Pressure Regulator & Damper Assembly

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(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the vacuum hose (A) from the pressure regulator and damper assembly.
3) Disconnect the fuel return hose (B) and fuel hose (C) from the pressure regulator & damper assembly, and remove the fuel regulator & damper assembly.



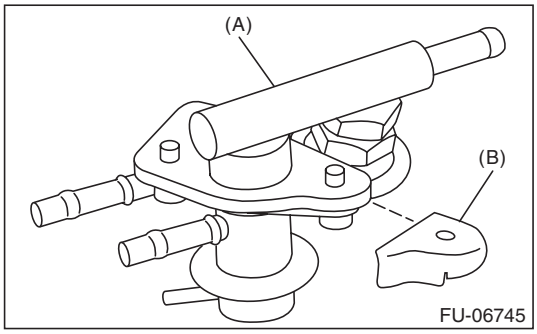
B: INSTALLATION

Install in the reverse order of removal.

NOTE:
For the information about connecting the fuel return hose and fuel hose, refer to "Fuel Delivery, Return & Evaporation Lines". <Ref. to FU(STI)-96, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

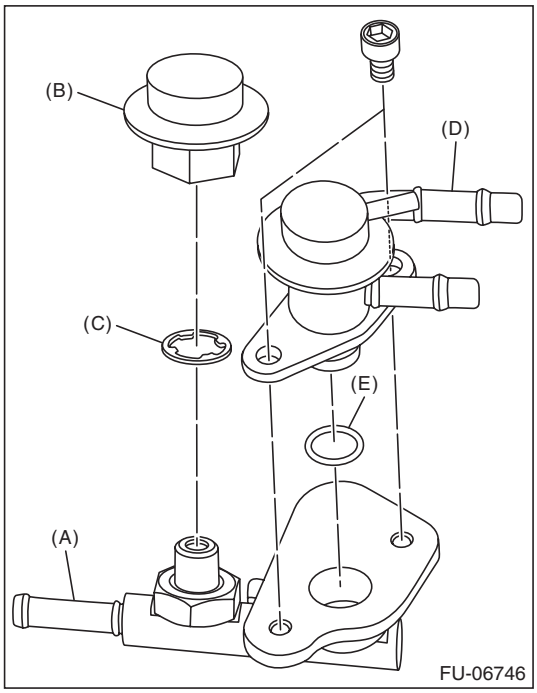
C: DISASSEMBLY

1) Remove the fuel pipe protector from the pressure regulator and damper assembly.



(A) Pressure regulator & damper ASSY
(B) Fuel pipe protector

2) Remove the pulsation damper and fuel pipe gasket from the fuel holder assembly, and remove the pressure regulator from the fuel holder assembly.



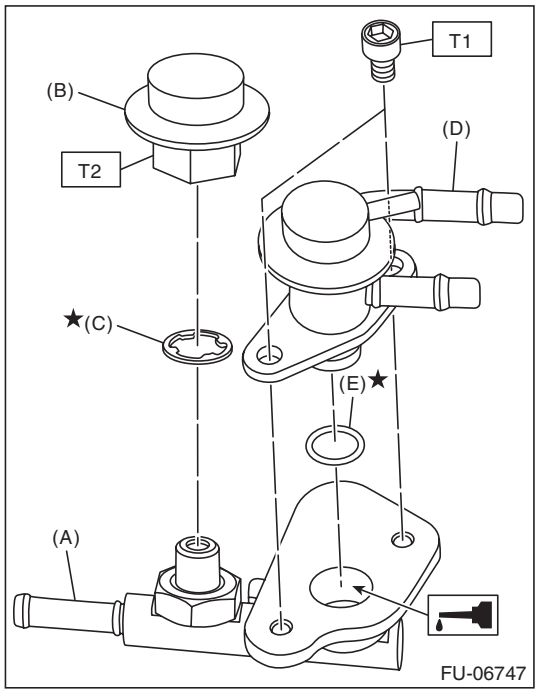
(A) Fuel holder ASSY
(B) Pulsation damper
(C) Fuel pipe gasket
(D) Pressure regulator
(E) O-ring

D: ASSEMBLY

1) Install the pressure regulator to the fuel holder assembly, and install the fuel pipe gasket and pulsation damper to the fuel holder assembly.

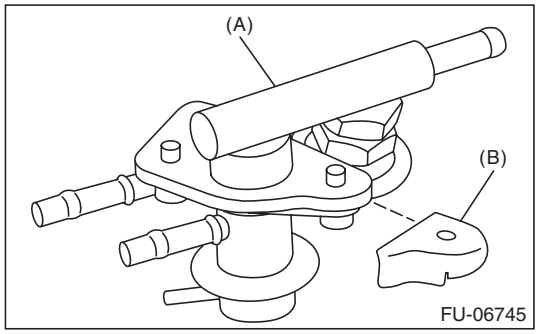
NOTE:
- Use new O-rings and fuel pipe gaskets.
- Apply a thin coat of engine oil to the pressure regulator installation hole of fuel holder assembly.

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 21.6 N·m (2.2 kgf-m, 15.9 ft-lb)



(A) Fuel holder ASSY
(B) Pulsation damper
(C) Fuel pipe gasket
(D) Pressure regulator
(E) O-ring

2) Install the fuel pipe protector to the pressure regulator and damper assembly.



(A) Pressure regulator & damper ASSY
(B) Fuel pipe protector

E: INSPECTION

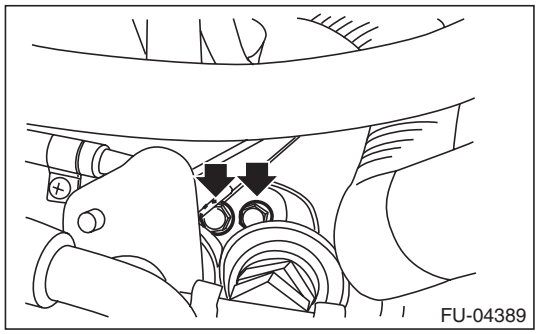
1) Check that the pressure regulator and damper assembly has no deformation, cracks or other damages.
2) Check that the vacuum hose, fuel return hose and fuel hose have no cracks, damage or loose part.

33. Purge Damper

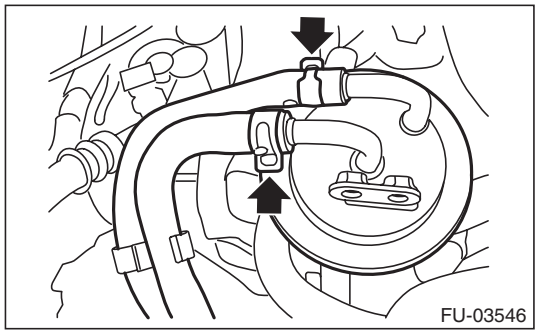
A: REMOVAL

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

1) Remove the bolts which secure the purge damper to the purge damper bracket.



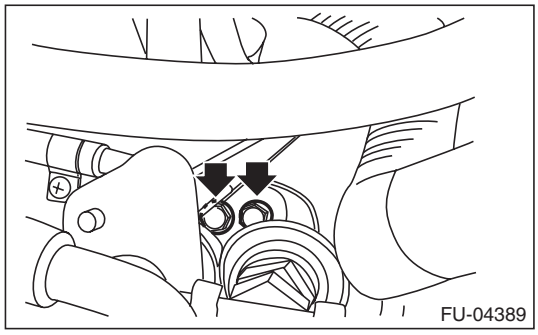
2) Disconnect the evaporation hose from the purge damper and remove the purge damper.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

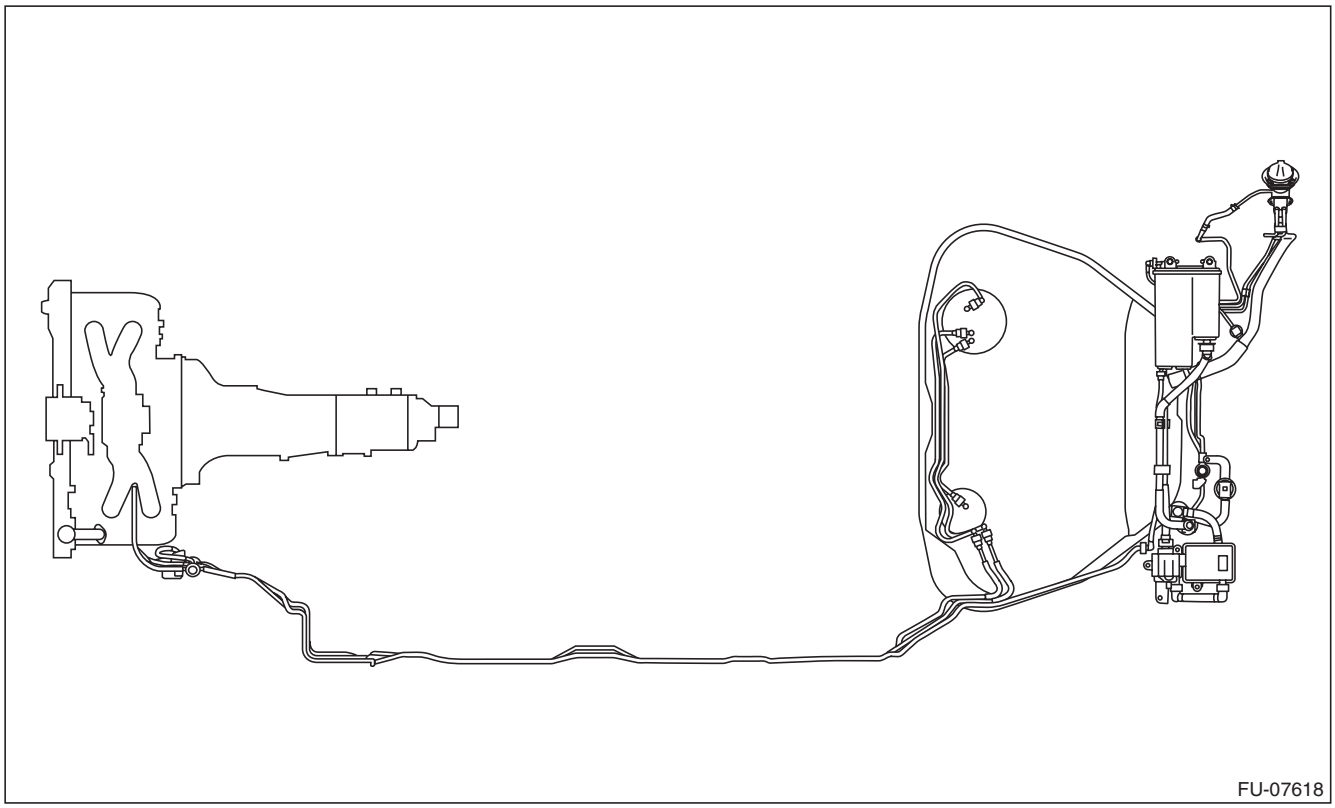


C: INSPECTION

1) Check that the purge damper has no deformation, cracks or other damages.
2) Check that the evaporation hose has no cracks, damage or loose part.

34.Fuel Delivery, Return and Evaporation Lines

A: REMOVAL



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

CAUTION:
Be careful not to spill fuel.

1) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Remove the floor mat. <Ref. to EI-71, REMOVAL, Floor Mat.>
4) In the engine compartment, disconnect the fuel delivery hoses, fuel return hoses and evaporation hoses.

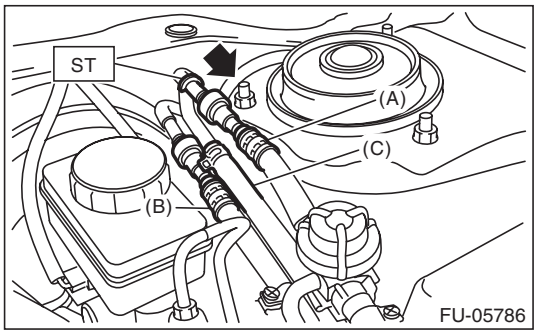
CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

(1) Set the ST to the fuel pipe.

ST 42099AE000 QUICK CONNECTOR RELEASE

(2) Disconnect the quick connector of the fuel delivery hose and fuel return hose by pushing the ST in the direction of the arrow.

(3) Remove the clip and disconnect the evaporation hose from the fuel pipe.



(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

5) Remove the canister. <Ref. to EC(STI)-7, REMOVAL, Canister.>
6) Remove the fuel tank. <Ref. to FU(STI)-70, REMOVAL, Fuel Tank.>
7) Remove the fuel pipe assembly from vehicle.
8) Disconnect the quick connector, then disconnect the fuel delivery tube, fuel return tube and jet pump tube from the fuel tank.

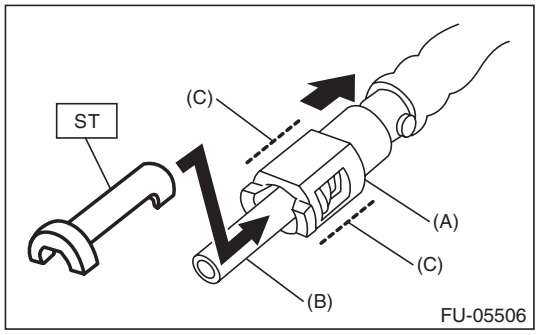
• When using ST

1. Attach ST to the pipe and push ST in the direction of arrow mark to disconnect the quick connector.

ST 42099AE000 QUICK CONNECTOR RELEASE

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**
- **To disconnect the connector, hold (C) shown in the figure and pull in axial direction.**
- **If the connector and pipe are sticking to each other, push and pull the connector with ST pushed, and then pull the connector after it starts moving freely.**
- **When disconnecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.**

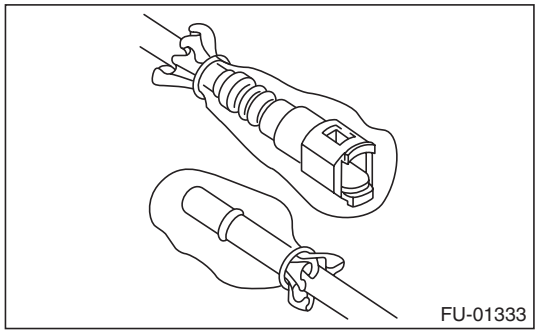
NOTE:
Clean the pipe and quick connector, if they are covered with dust.



(A) Quick connector
(B) Pipe
(C) Connector holding position

2. To prevent from damaging or entering foreign matter, wrap the pipes and quick connectors with plastic bag etc.

CAUTION:
When reusing the retainer, do not disconnect the retainer from the connector.

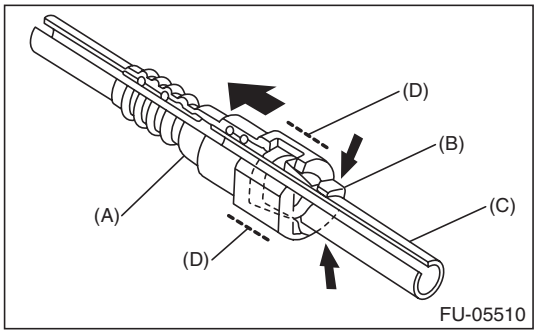


• When not using ST

1. Push the retainer in the direction of the arrow, disconnect the quick connector from pipe.

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**
- **To disconnect the connector, hold (D) shown in the figure and pull in axial direction.**
- **If the connector and pipe are sticking to each other, push and pull the connector with the retainer pushed in the direction of the arrow, and then pull the connector after it starts moving freely.**
- **When disconnecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.**

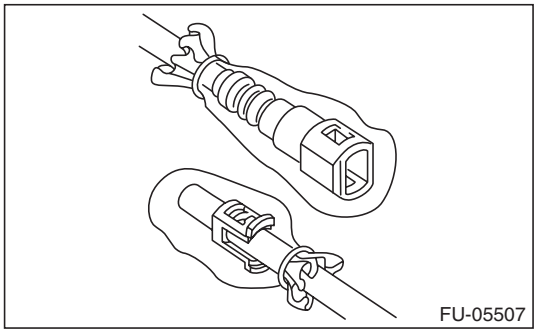
NOTE:
Clean the pipe and quick connector, if they are covered with dust.



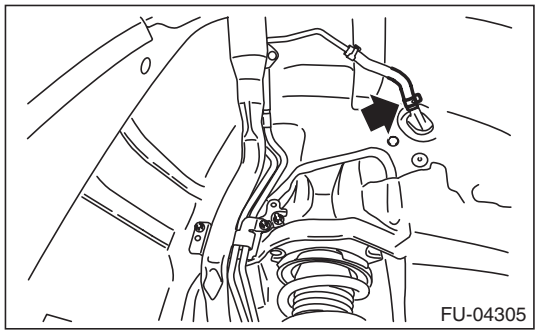
(A) Quick connector
(B) Retainer
(C) Pipe
(D) Connector holding position

2. To prevent from damaging or entering foreign matter, wrap the pipes and quick connectors with plastic bag etc.

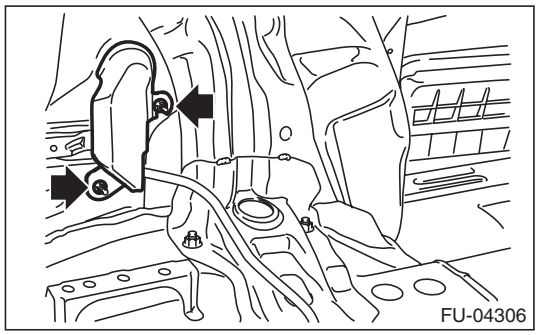
CAUTION:
When reusing the retainer, do not disconnect the retainer from the pipe.



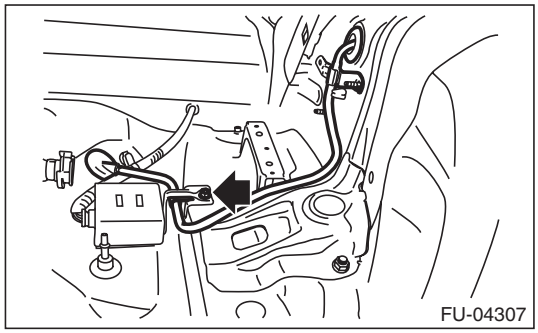
9) Remove the evaporation pipe.
(1) Remove the rear mud guard RH. <Ref. to EI-30, REMOVAL, Mud Guard.>
(2) Disconnect the evaporation hose.



(3) Remove the right side rear quarter trim. <Ref. to EI-60, REMOVAL, Rear Quarter Trim.>
(4) Remove the evaporation pipe protector.



(5) Remove the evaporation pipe from vehicle.

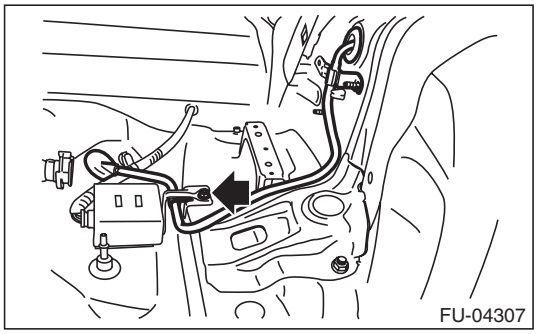


B: INSTALLATION

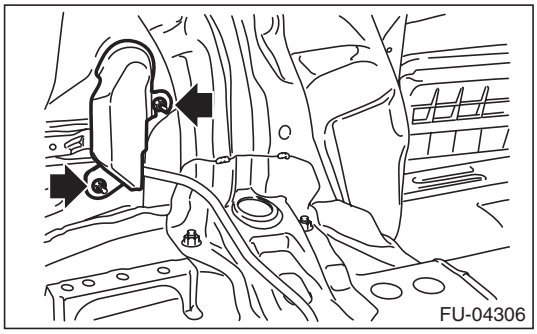
Install in the reverse order of removal while being careful of the following.

1. EVAPORATION PIPE INSTALLATION

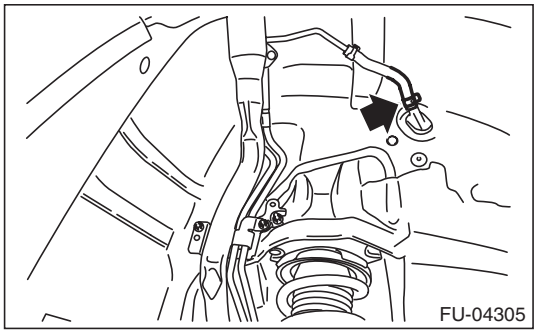
1) Install the evaporation pipe to the vehicle.



2) Install the evaporation pipe protector.



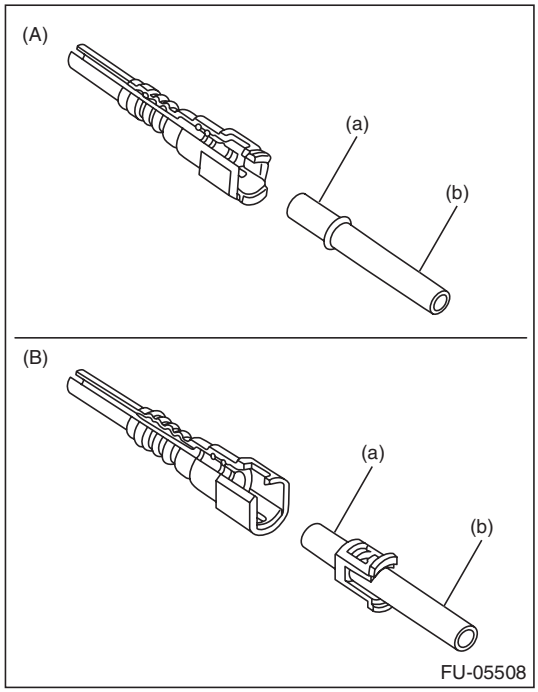
3) Install the right side rear quarter trim. <Ref. to EI-61, INSTALLATION, Rear Quarter Trim.>
4) Connect the evaporation hose.



5) Install the rear mud guard RH. <Ref. to EI-30, INSTALLATION, Mud Guard.>

2. CONNECTING THE FUEL LINE QUICK CONNECTOR

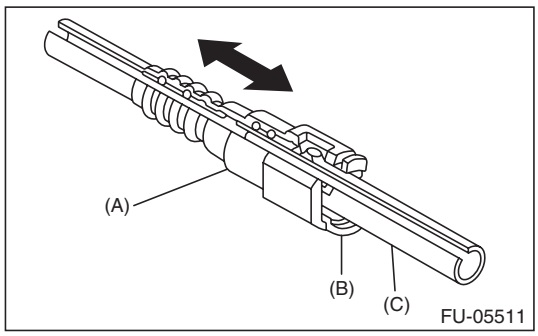
CAUTION:
• Make sure there are no damage or dust on connections. If necessary, clean seal surface of pipe.



(A) When removed using the ST
(B) When removed without using the ST
(a) Seal surface
(b) Pipe

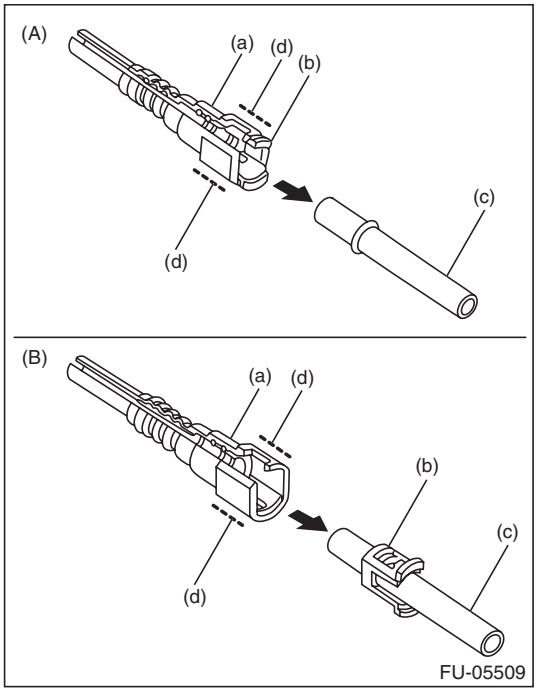
• When reusing the retainer, make sure that neither scratches nor deformation exist on the retainer. If it is faulty, use a new part.
1) Connect the quick connector to pipe.

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.
• To connect the connector, hold (d) shown in the figure and push in axial direction.
• When connecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.



(A) When removed using the ST
(B) When removed without using the ST
(a) Quick connector
(b) Retainer
(c) Pipe
(d) Connector holding position

3. CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE

Connect the fuel delivery hose, fuel return hose, and fuel hose as shown in the figure.

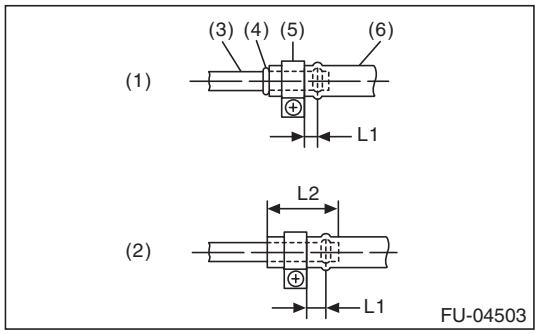
CAUTION:
• If the connection portion has a spool or stopper, do not allow the end of the hose to bend or ride over by inserting the hose too deep.
• Be sure to inspect hoses and their connections for any leakage of fuel.

NOTE:
Use new fuel delivery hose, fuel return hose, and fuel hose.

Tightening torque:
1.25 N·m (0.1 kgf-m, 0.9 ft-lb)

L1: 2.5±1.5 mm (0.098±0.059 in)

L2: 22.5±2.5 mm (0.886±0.098 in)

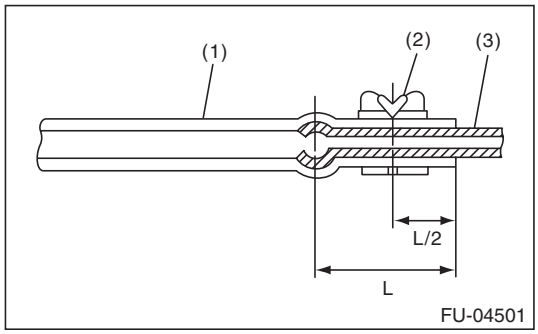


(1) When there is a spool or bump
(2) When there is no spool or bump
(3) Pipe
(4) Spool or bump
(5) Clamp
(6) Hose

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) Check that the fuel pipe has no deformation, cracks or other damages.
2) Check that the hose and tube have no cracks, damage or loose part.

35.Fuel System Trouble in General

A: INSPECTION

Trouble	Possible cause	Corrective action
Insufficient fuel supply to fuel injector	a. 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.
	b. Decline of fuel pump function	Replace the fuel pump.
	c. Clogged fuel filter	Replace the fuel filter. Clean or replace the fuel tank if necessary.
	d. Clogged or bent fuel line pipe, hose or tube	Clean, correct or replace the fuel line pipe, hose or tube.
	e. Air is mixed in fuel system.	Check the fuel line connections, correct or replace the defective part.
	f. Damaged diaphragm of pressure regulator	Replace the pressure regulator.
Leakage or blow out of fuel	a. Loose connections of fuel line pipe, hose or tube	Check the fuel line connections, correct or replace the defective part.
	b. Cracked fuel line pipe, hose or tube	Replace the fuel line pipe, hose or tube.
	c. Cracked fuel tank or defective welding part	Replace the fuel tank.
	d. Clogged or bent fuel line pipe, hose or tube	Clean, correct or replace the fuel line pipe, hose or tube.
Gasoline smell inside of compartment	a. Loose connections of fuel line pipe, hose or tube	Check the fuel line connections, correct or replace the defective part.
	b. Defective gasket of fuel saucer or fuel filler pipe assembly	Correct or replace the gasket.
	c. Defective canister	Replace the canister.
Defective fuel gauge	a. Defective operation of fuel level sensor	Replace the fuel level sensor.
	b. Defective operation of combination meter	Replace the combination meter.
	c. Defective operation of integrated unit	Replace the integrated unit.
Noise	a. Large operation noise or vibration of fuel pump	Replace the fuel pump.

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(STI)

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3.	Rear Catalytic Converter	6
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7.	Fuel Sub Level Sensor	15
8.	Pressure Control Solenoid Valve Assembly	16
9.	Drain Filter	17
10.	Shut Valve	18
11.	Leak Check Valve Assembly	19
12.	Drain Separator	23
13.	PCV Hose Assembly	24
14.	PCV Valve	26
15.	Secondary Air Pump	27
16.	Secondary Air Combination Valve	29

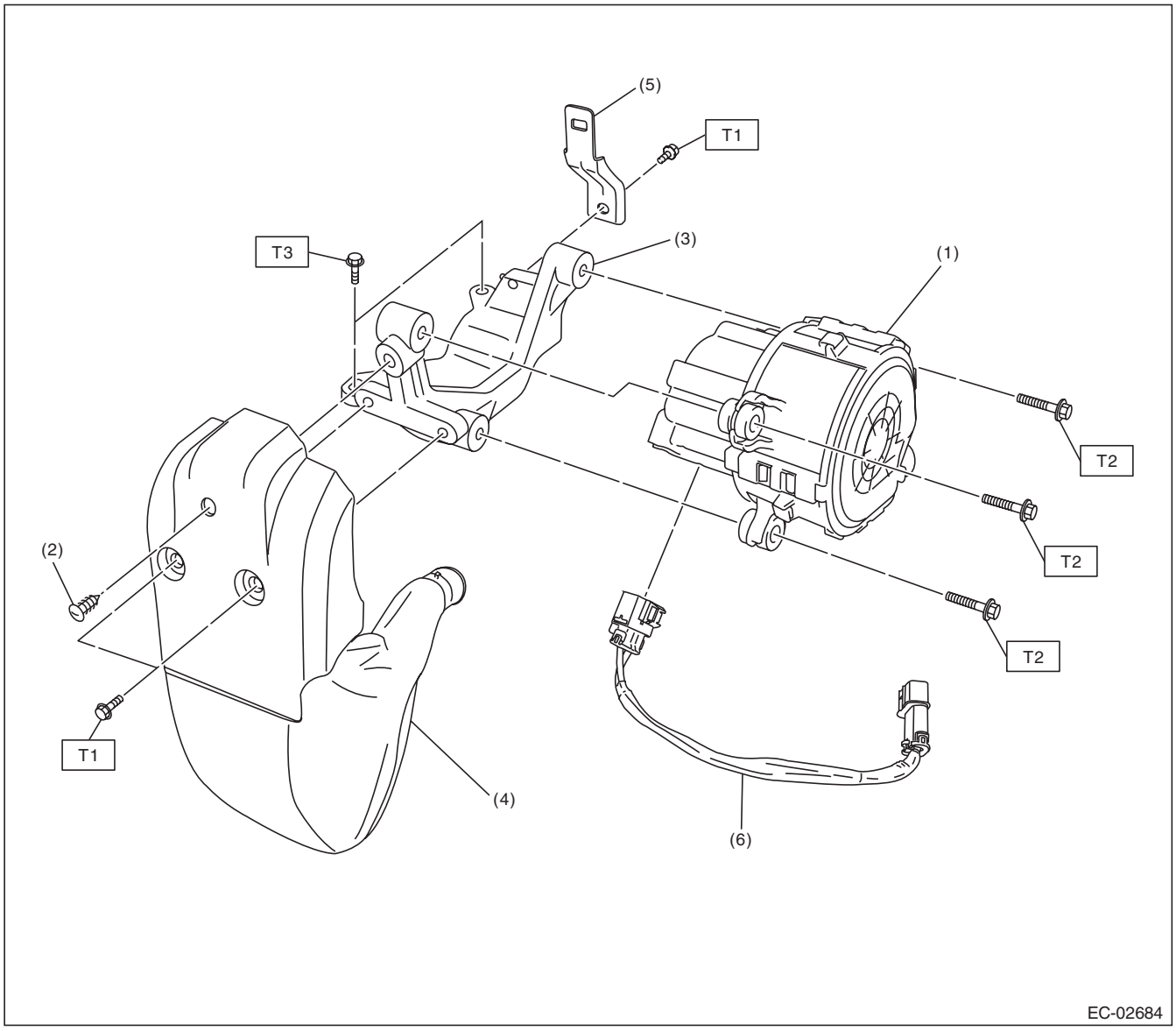
1. General Description

A: COMPONENT

1. CANISTER, PURGE CONTROL SOLENOID VALVE, PRESSURE CONTROL SOLENOID VALVE ASSEMBLY, SHUT VALVE, LEAK CHECK VALVE, AND DRAIN SEPARATOR

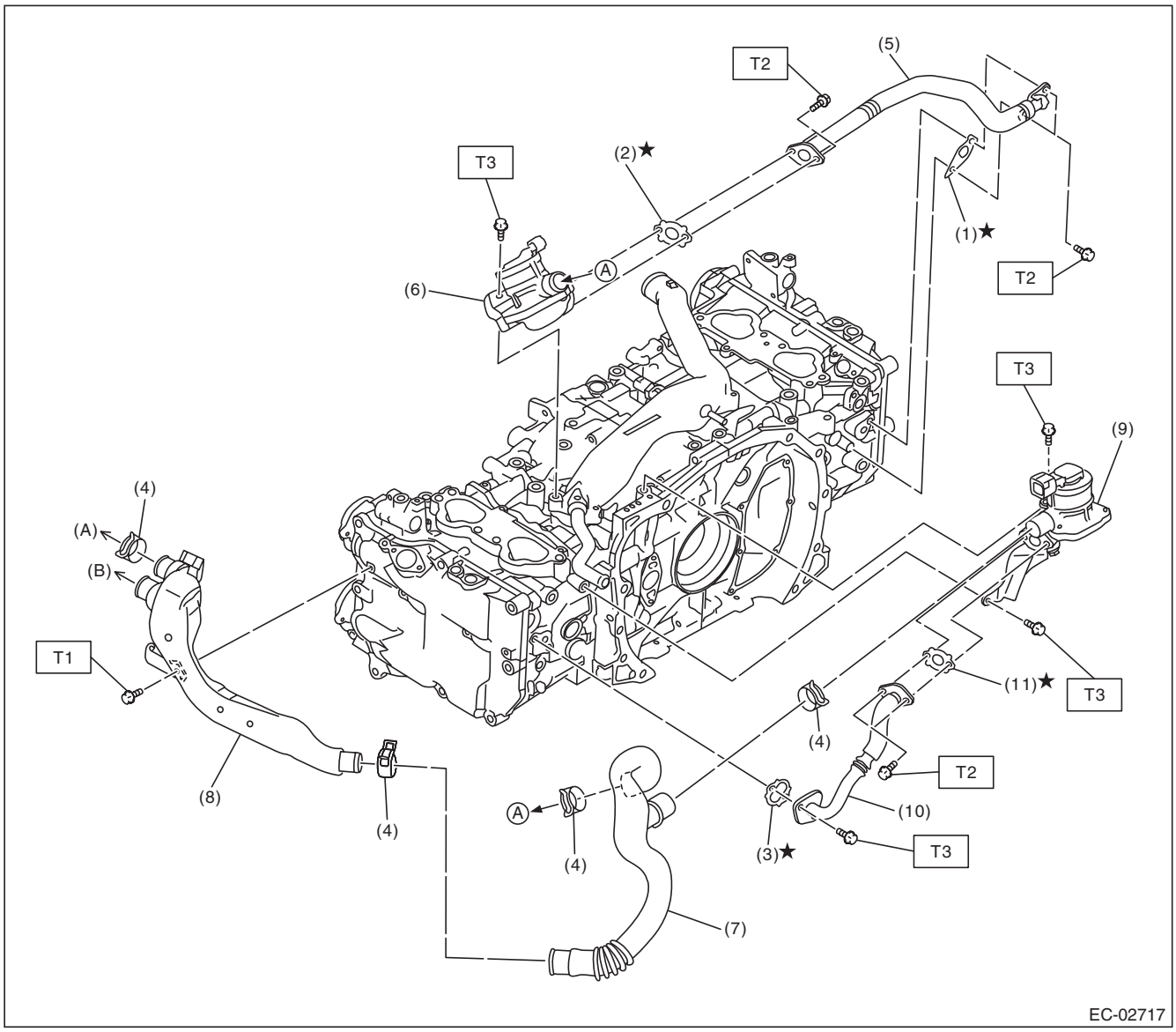
For components of canister, purge control solenoid valve, pressure control solenoid valve assembly, shut valve, leak check valve, and drain separator, refer to FU (STI). <Ref. to FU(STI)-3, COMPONENT, General Description.>

2. SECONDARY AIR PUMP



(1)	Secondary air pump	(4)	Resonator	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Clip	(5)	Harness stay	***T1: 6.4 (0.7, 4.7)***
(3)	Secondary air pump bracket	(6)	Secondary air pump harness	***T2: 9 (0.9, 6.6)***
				T3: 19 (1.9, 14.0)

3. SECONDARY AIR COMBINATION VALVE



(A)	To secondary air pump	(B)	To resonator

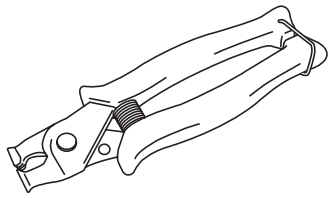
(1)	Gasket	(7)	Air duct A	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Gasket	(8)	Air duct B	***T1: 6.4 (0.7, 4.7)***
(3)	Gasket	(9)	Secondary air combination valve LH	***T2: 9 (0.9, 6.6)***
(4)	Clip	(10)	Secondary air pipe LH	***T3: 19 (1.9, 14.0)***
(5)	Secondary air pipe RH	(11)	Gasket	
(6)	Secondary air combination valve RH			

B: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

C: 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.
Mighty Vac	Used for inspecting the fuel tank pressure sensor.

2. Front Catalytic Converter

A: REMOVAL

The front catalytic converter is integrated into the center exhaust pipe (front). Refer to “Center Exhaust Pipe” for removal procedures. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

The front catalytic converter is integrated into the center exhaust pipe (front). Refer to “Center Exhaust Pipe” for installation procedures. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>

C: INSPECTION

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

3. Rear Catalytic Converter

A: REMOVAL

The rear catalytic converter is integrated into the center exhaust pipe (rear). Refer to “Center Exhaust Pipe” for removal procedures. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

The rear catalytic converter is integrated into the center exhaust pipe (rear). Refer to “Center Exhaust Pipe” for installation procedures. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>

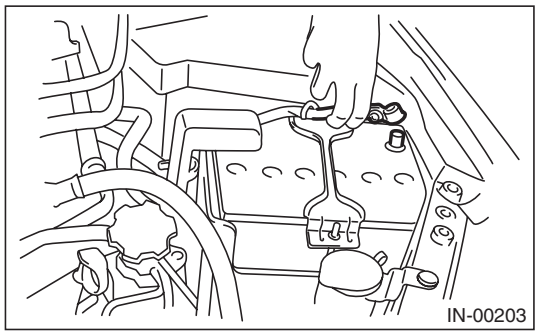
C: INSPECTION

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

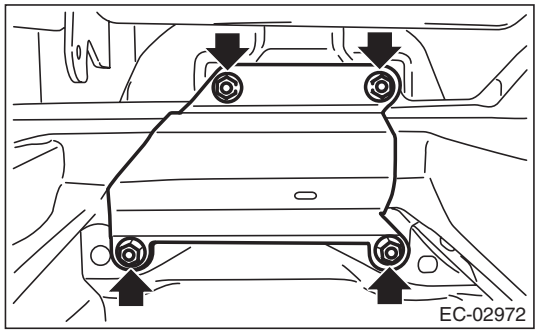
4. Canister

A: REMOVAL

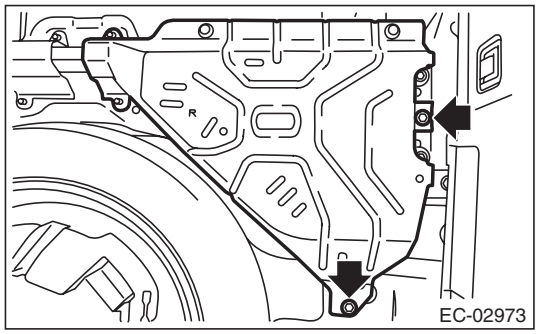
1) Disconnect the ground cable from battery.



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.

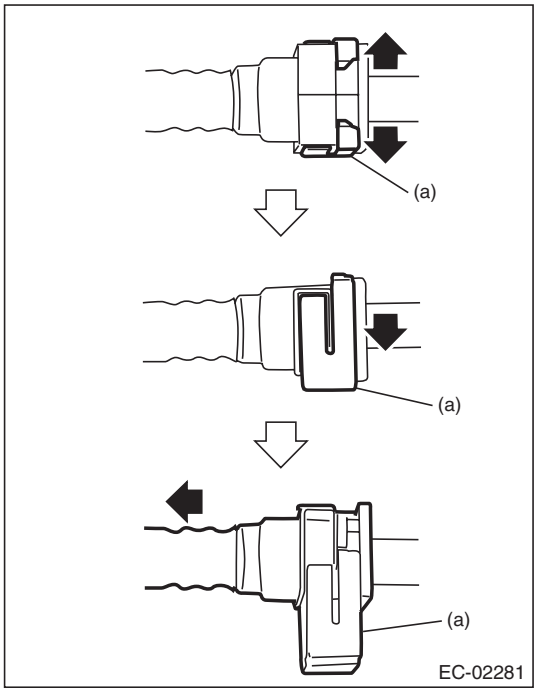


8) Remove the canister cover RH.

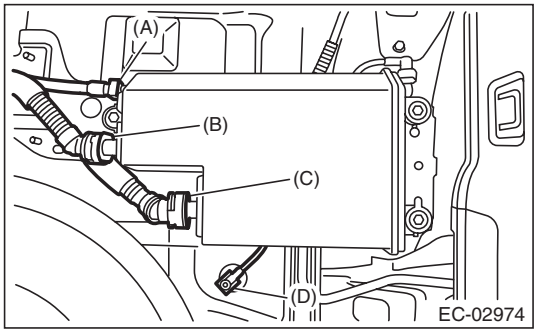


9) Disconnect the purge tube (A), vent tube (B), drain tube A (C) and PCV drain tube (D).

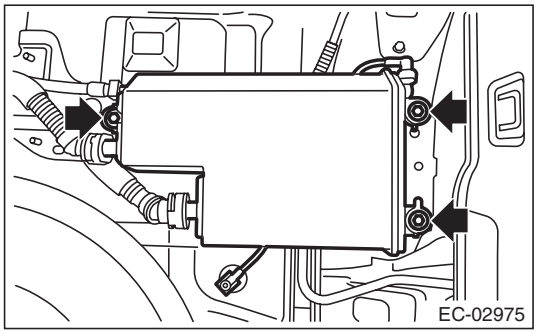
NOTE:
Disconnect the quick connector as shown in the figure.



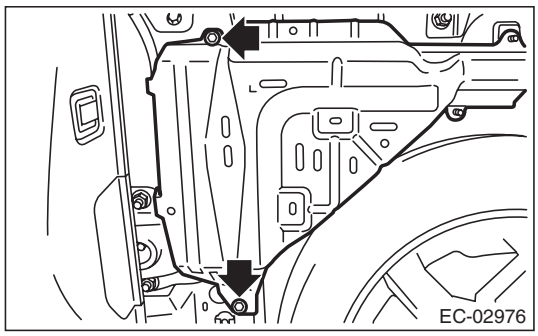
(a) Retainer



10) Remove the canister.

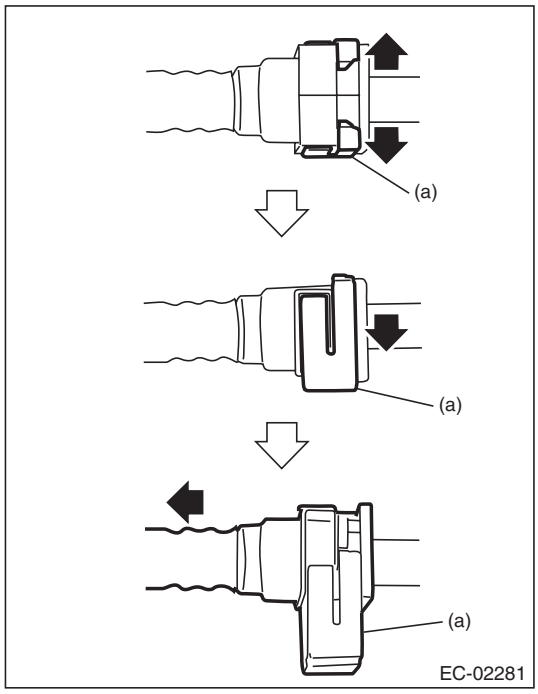


11) Remove the canister cover LH.

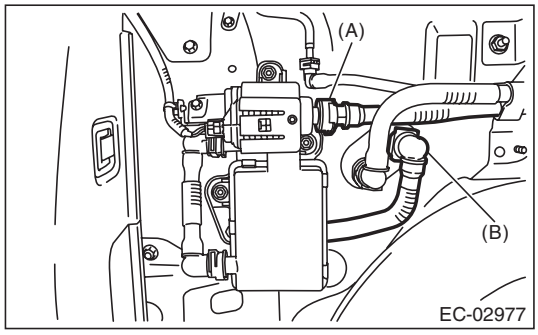


12) Disconnect drain tube A (A) and drain tube B (B).

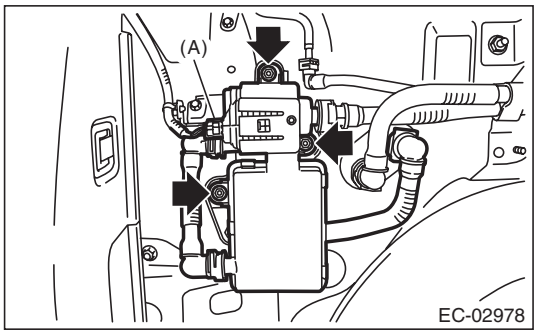
NOTE:
Disconnect the quick connector as shown in the figure.



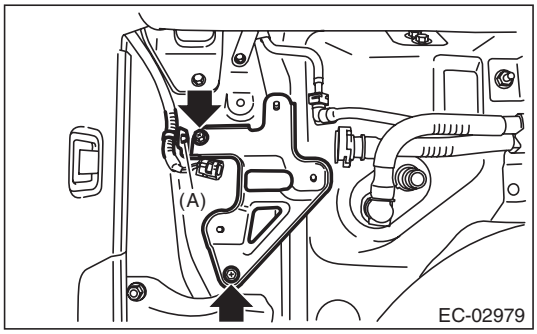
(a) Retainer



13) Disconnect the connector (A) from leak check valve assembly, and remove the leak check valve assembly.

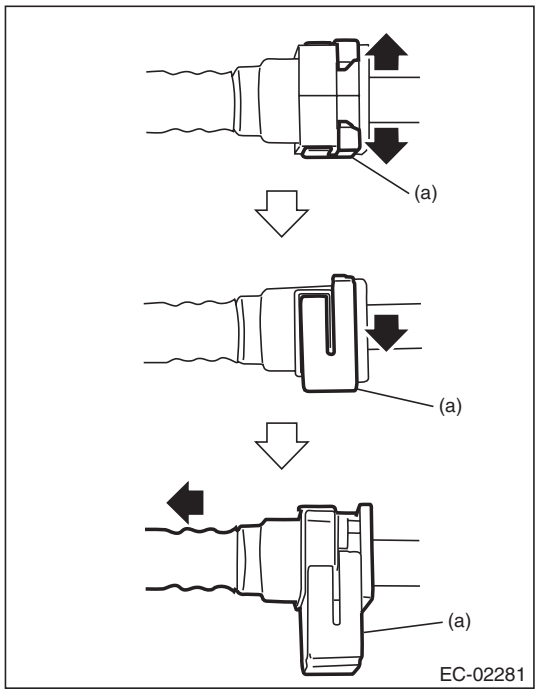


14) Remove the clip (A), which secures the leak check valve assembly harness, from the valve bracket, and remove the valve bracket.

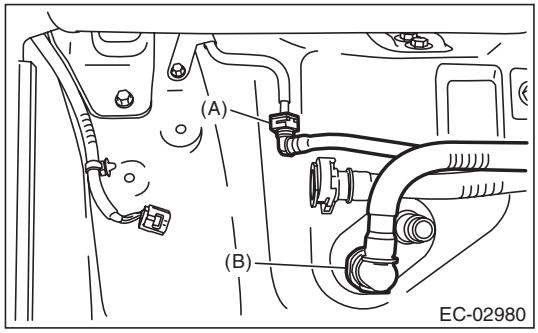


15) Disconnect purge tube (A) and vent tube (B).

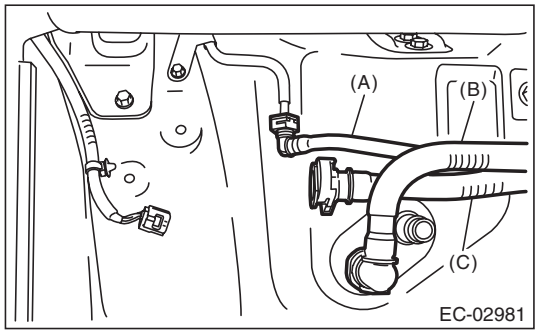
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Retainer



16) 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.

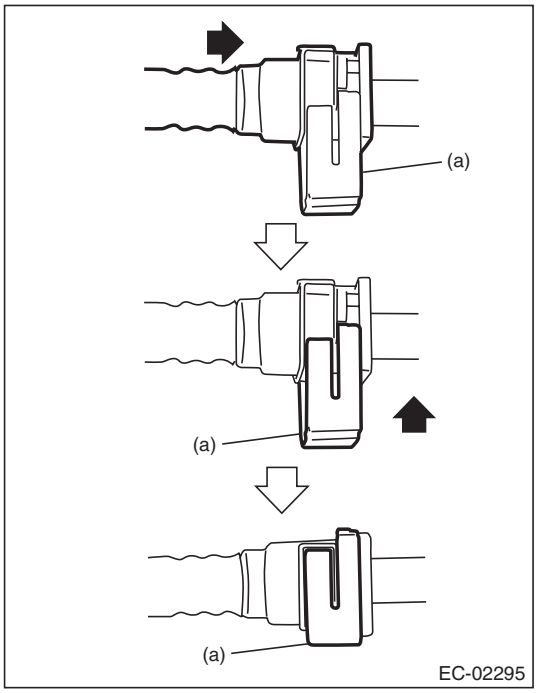
CAUTION:

• 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.

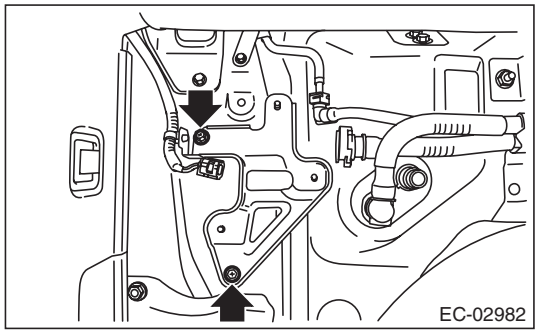
• When it is difficult to lock the retainer, make sure that the pipe is securely inserted.

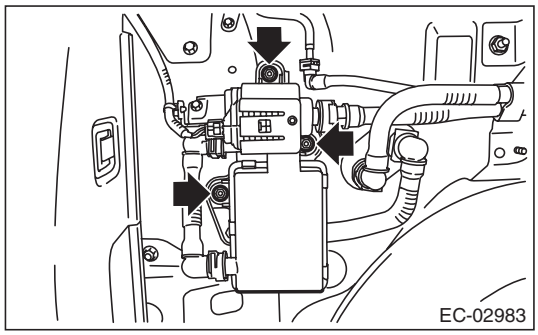
• Make sure that the quick connector is securely connected.



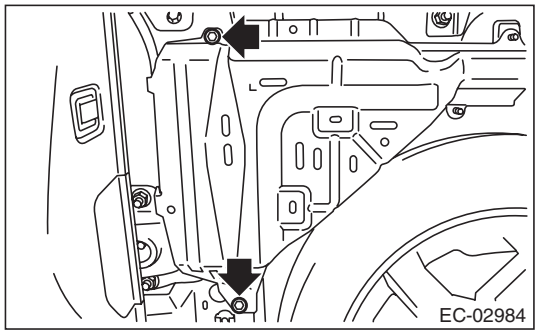
(a) Retainer

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

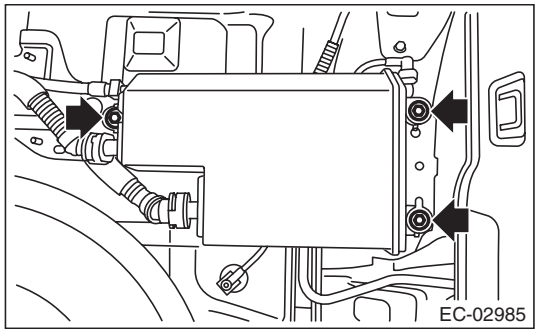




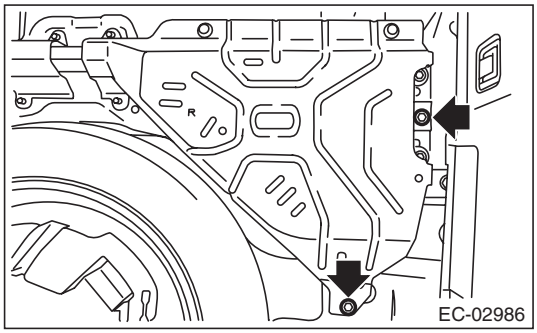
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

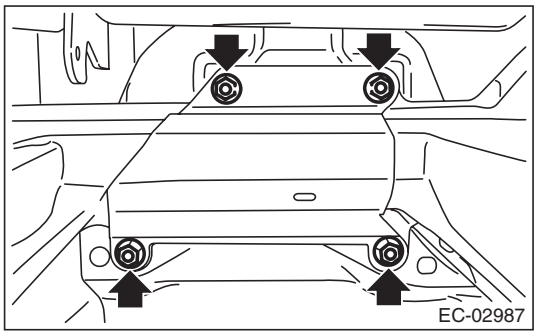


Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



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





C: INSPECTION

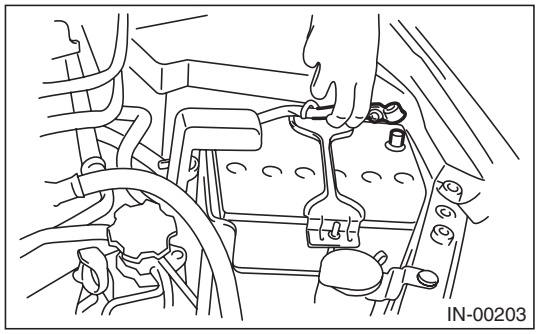
1) Check that the canister and leak check valve assembly have no deformation, cracks or other damages.
2) Check that the tube has no cracks, damage or loose part.

5. Purge Control Solenoid Valve

A: REMOVAL

1. PURGE CONTROL SOLENOID VALVE 1

1) Disconnect the ground cable from battery.



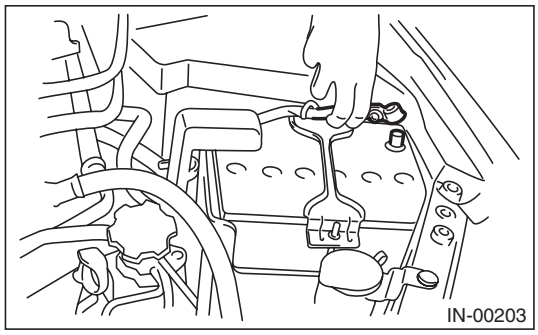
2) Remove the bolts which secure purge control solenoid valve 1 to the intake manifold, and disconnect the connector from the purge control solenoid valve 1.



3) Disconnect the vacuum hose and the vacuum control hose from purge control solenoid valve 1.

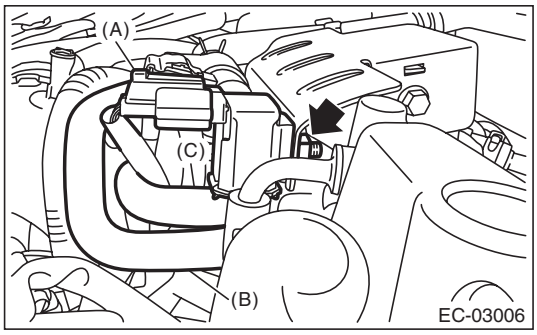
2. PURGE CONTROL SOLENOID VALVE 2

1) Disconnect the ground cable from battery.



2) Disconnect connector (A), vacuum hose (B), and vacuum control hose (C) from purge control solenoid valve 2.

3) Remove purge control solenoid valve 2 from the solenoid valve bracket.

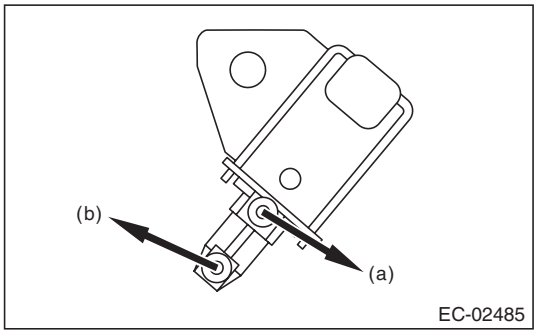


B: INSTALLATION

1. PURGE CONTROL SOLENOID VALVE 1

Install in the reverse order of removal.

NOTE:
Connect the vacuum hose and vacuum control hose as shown in the figure.



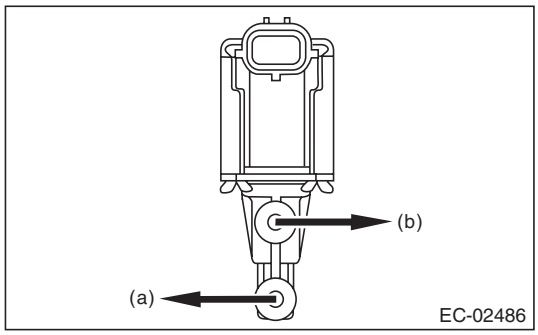
(a) To intake manifold
(b) To branching pipe → fuel pipe

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

2. PURGE CONTROL SOLENOID VALVE 2

Install in the reverse order of removal.

NOTE:
Connect the vacuum hose and vacuum control hose as shown in the figure.



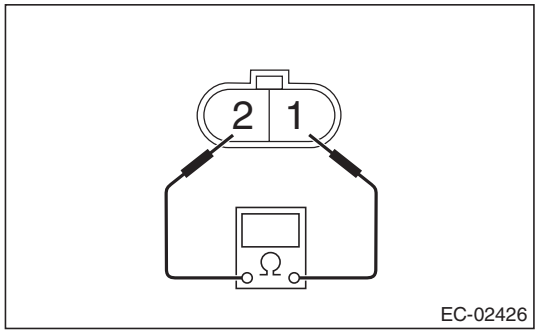
(a) To intake duct
(b) To branching pipe → fuel pipe

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

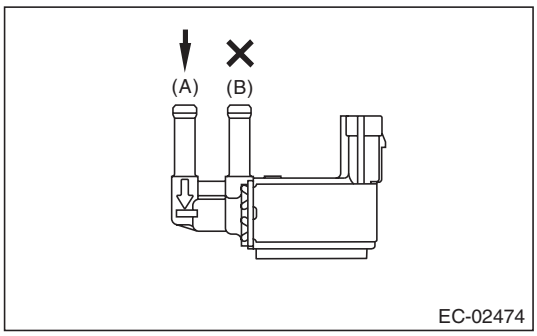
1. PURGE CONTROL SOLENOID VALVE

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

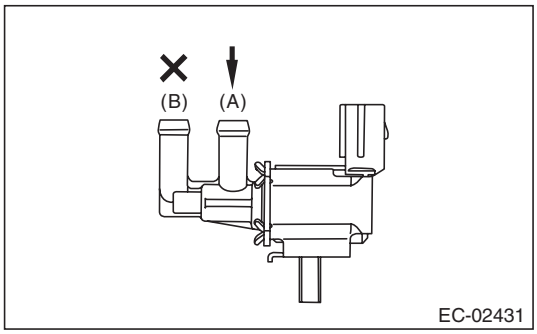


	Terminal No.	Standard
Purge control solenoid valve 1	1 and 2	32±2 Ω (when 20°C (68°F))
Purge control solenoid valve 2		24±3 Ω (when 20°C (68°F))

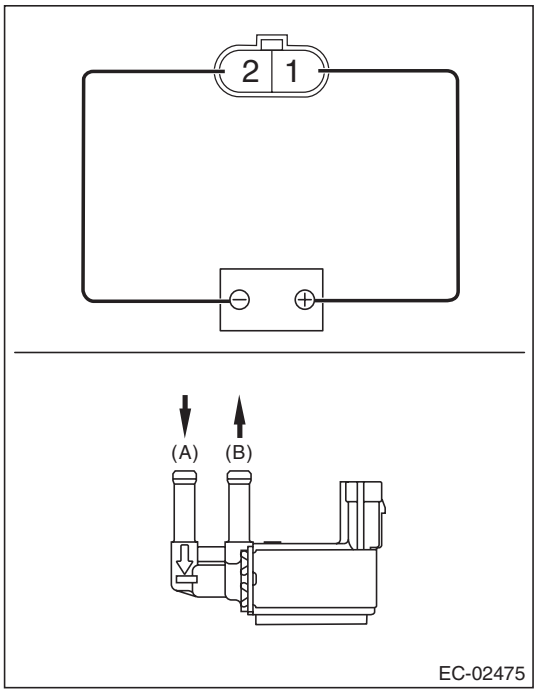
3) Check that air does not come out from (B) when air is blown into (A).
• Purge control solenoid valve 1



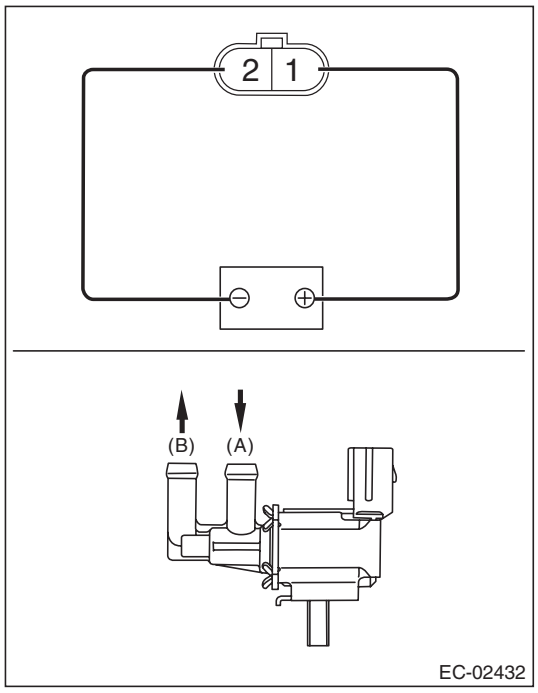
• Purge control solenoid valve 2



4) Connect the battery positive terminal to the terminal No. 1 and the battery negative terminal to the terminal No. 2. Check that air is discharged from (B), when supplying air to (A).
• Purge control solenoid valve 1



- Purge control solenoid valve 2



2. OTHER INSPECTIONS

Make sure the vacuum hoses and vacuum control hoses are not cracked or loose.

6. Fuel Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-82, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION

For installation procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-82, INSTALLATION, Fuel Level Sensor.>

C: INSPECTION

For inspection procedures, refer to the “FU(STI)” section. Ref. to FU(STI)-82, INSPECTION, Fuel Level Sensor.>

7. Fuel Sub Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-83, REMOVAL, Fuel Sub Level Sensor.>

B: INSTALLATION

For installation procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-84, INSTALLATION, Fuel Sub Level Sensor.>

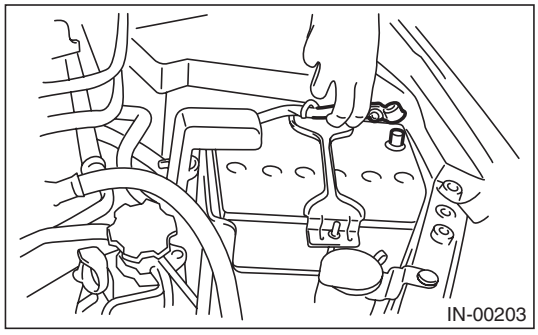
C: INSPECTION

For inspection procedures, refer to the “FU(STI)” section. <Ref. to FU(STI)-84, INSPECTION, Fuel Sub Level Sensor.>

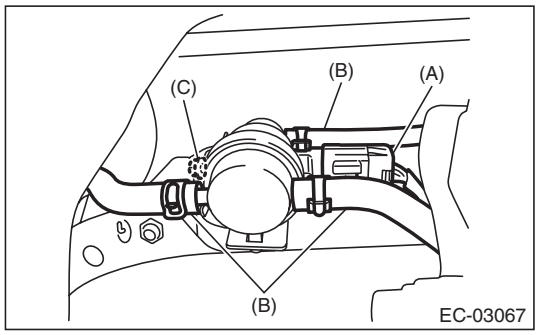
8. Pressure Control Solenoid Valve Assembly

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Disconnect the connector (A) and evaporation hose (B) from the pressure control solenoid valve assembly.
4) Remove the nut (C) securing the bracket to the fuel tank and remove the pressure control solenoid valve assembly.



B: INSTALLATION

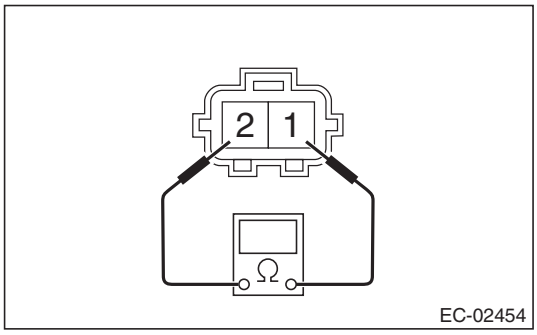
Install in the reverse order of removal.

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

C: INSPECTION

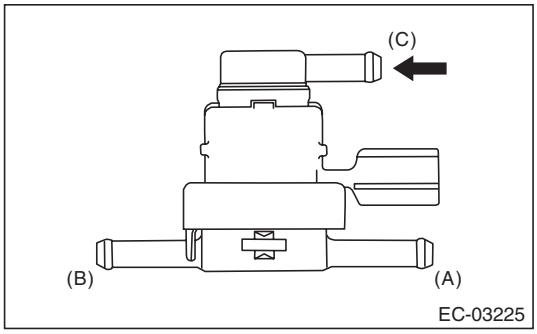
1. PRESSURE CONTROL SOLENOID VALVE ASSEMBLY

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



(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.

9. Drain Filter

A: SPECIFICATION

The leak check valve assembly is a non-disassembled part. Do not remove the drain filter from the leak check valve assembly. Refer to “Canister” for removal and installation procedures. <Ref. to EC(STI)-7, REMOVAL, Canister.> <Ref. to EC(STI)-9, INSTALLATION, Canister.>

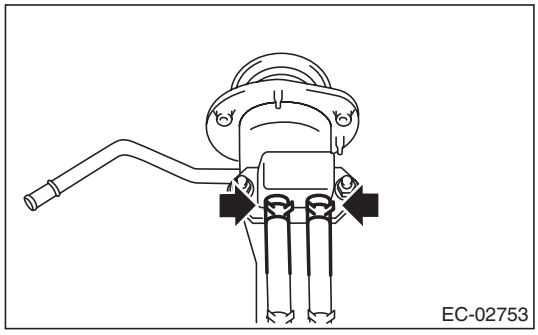
10.Shut Valve

A: REMOVAL

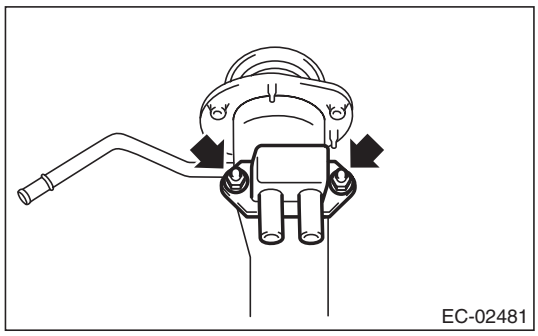
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

1) Remove the fuel filler pipe. <Ref. to FU(STI)-77, 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

1) Check that the shut valve has no deformation, cracks or other damages.
2) Check that the evaporation hose has no cracks, damage or loose part.

11.Leak Check Valve Assembly

A: REMOVAL

Refer to “Canister” for removal procedures. <Ref. to EC(STI)-7, REMOVAL, Canister.>

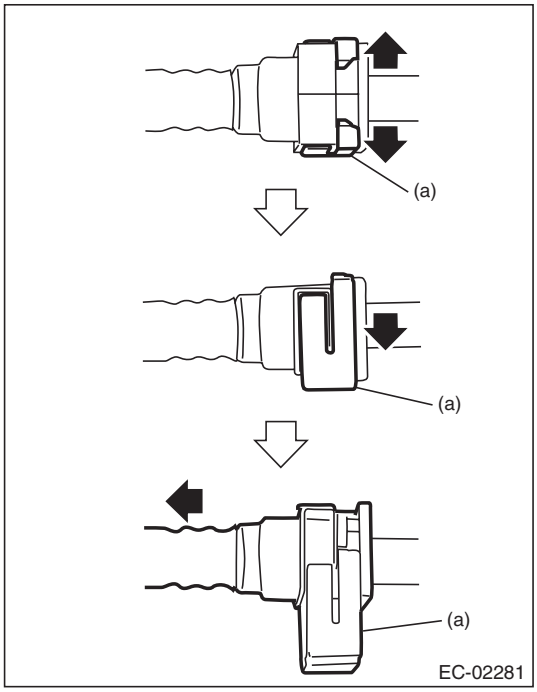
B: INSTALLATION

Refer to “Canister” for installation procedures. <Ref. to EC(STI)-9, INSTALLATION, Canister.>

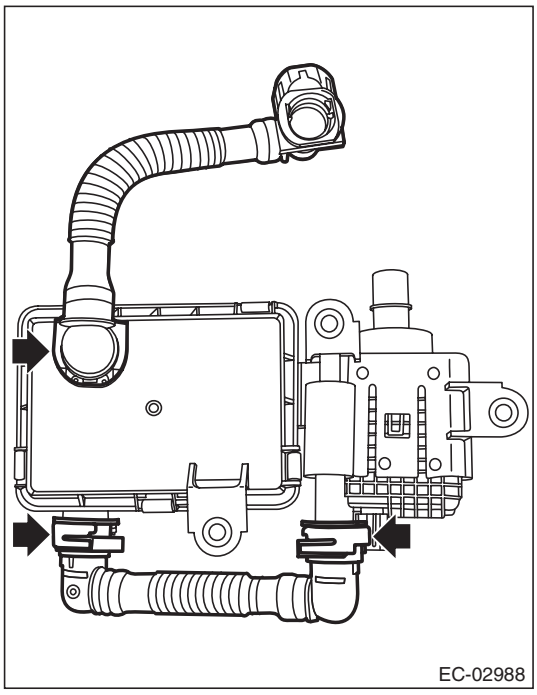
C: DISASSEMBLY

Disconnect the drain tube from the leak check valve assembly.

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



(a) Retainer



D: ASSEMBLY

Assemble the parts in the reverse order of disassembly while being careful of the following.

• Connect the quick connector as shown in the figure.

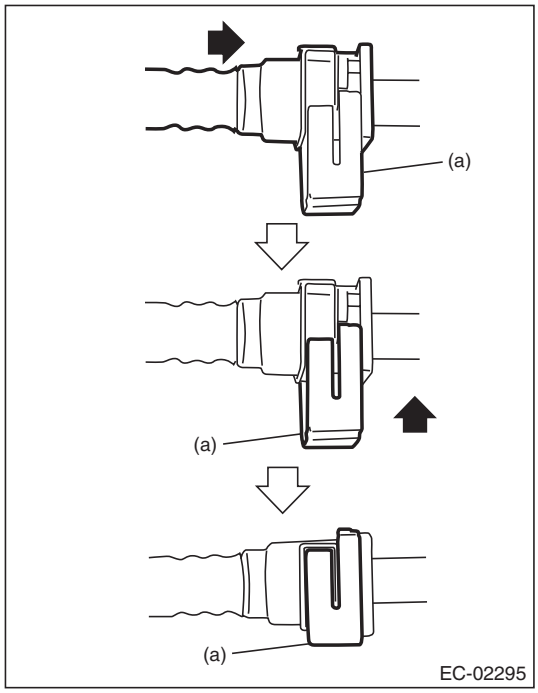
CAUTION:

• 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.

• 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.

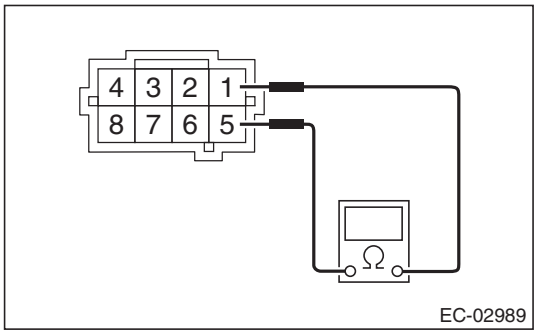


(a) Retainer

E: INSPECTION

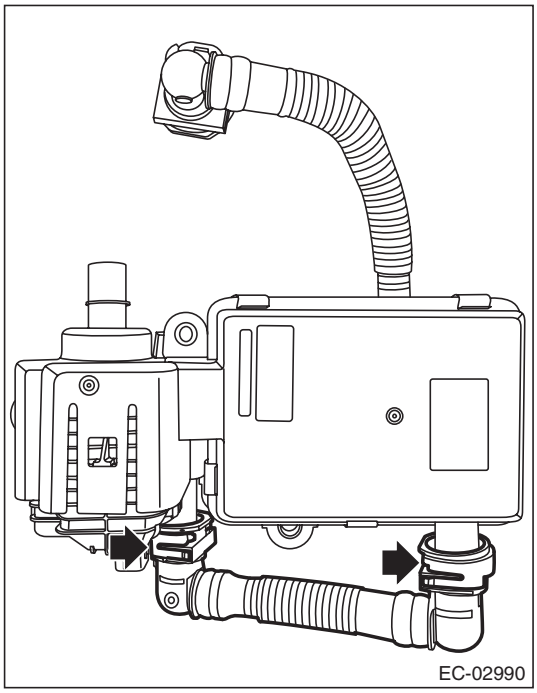
1. CHECK SWITCHING VALVE

1) Check the resistance between switching valve terminals.

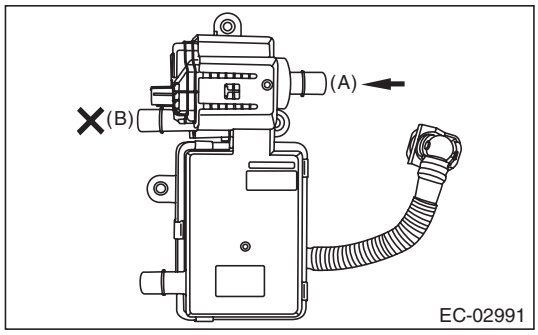


Terminal No.	Standard
1 and 5	27^{+3}_{-2} Ω (when 20°C (68°F))
	31±4 Ω (when 60°C (140°F))

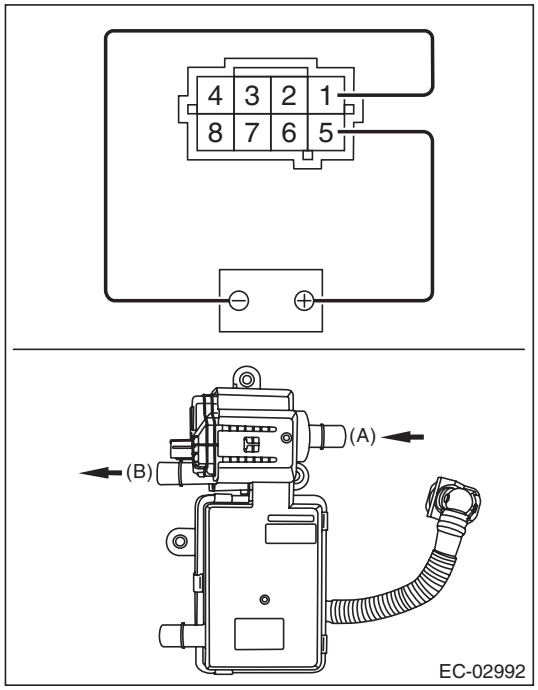
2) Disconnect the drain tube from the leak check valve assembly.



3) Check that air does not come out from (B) when air is blown into (A).



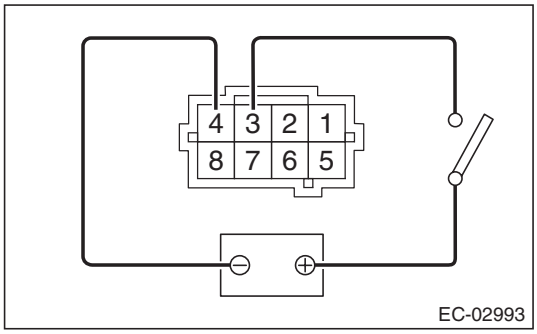
4) Connect the battery positive terminal to the terminal No. 5 and the battery negative terminal to the terminal No. 1. Check that air is discharged from (B), when supplying air to (A).



2. CHECK VACUUM PUMP

1) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, and inspect the vacuum pump operation.

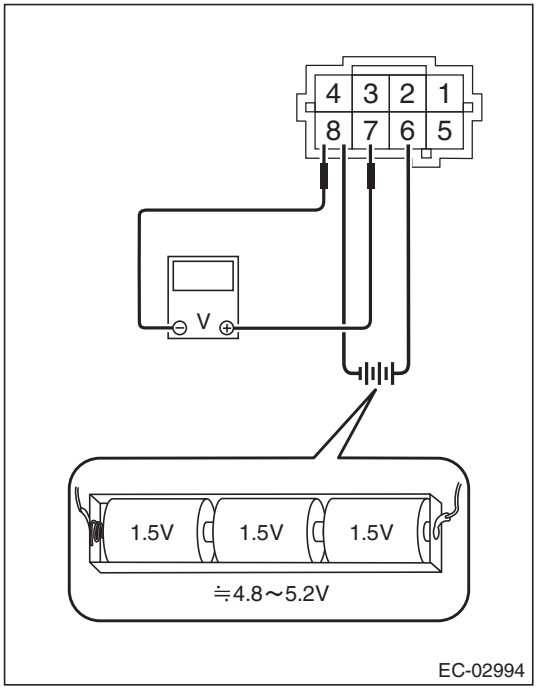
CAUTION:
Do not operate the vacuum pump for 5 minutes or more.



3. CHECK PRESSURE SENSOR

1) Connect dry-cell battery positive terminal to terminal No. 6 and dry-cell battery ground terminal to terminal No. 8, circuit tester positive terminal to terminal No. 7 and the circuit tester negative terminal to terminal No. 8.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.

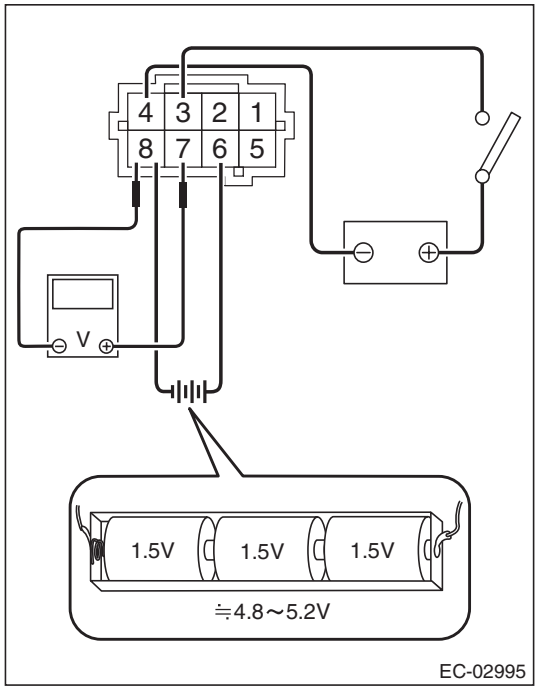


2) Check the voltage at a normal atmospheric pressure.

NOTE:
The atmospheric pressure at higher altitude is lower than normal. Therefore, the voltage is lower than the standard value.

Terminal No.	Standard
7 (+) and 8 (–)	Approx. 3.5 V (when 25°C (77°F))

3) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, and check that there is a voltage drop from the voltage measured in step 2) when the vacuum pump is operated.



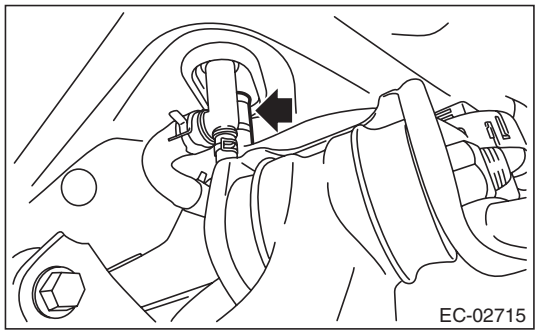
4. OTHER INSPECTIONS

Check that the drain tube has no cracks, damage or loose part.

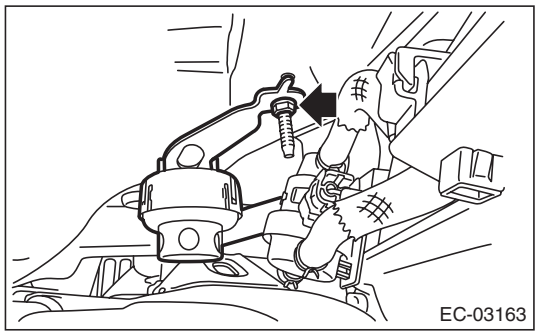
12.Drain Separator

A: REMOVAL

1) Lift up the vehicle.
2) Remove the rear differential. <Ref. to DI-23, REMOVAL, Rear Differential (T-type).>
3) Disconnect the drain hose from the connector.



4) Remove the drain separator from the vehicle.



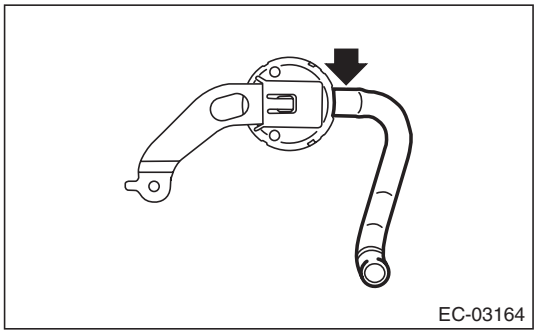
B: INSTALLATION

Install in the reverse order of removal.

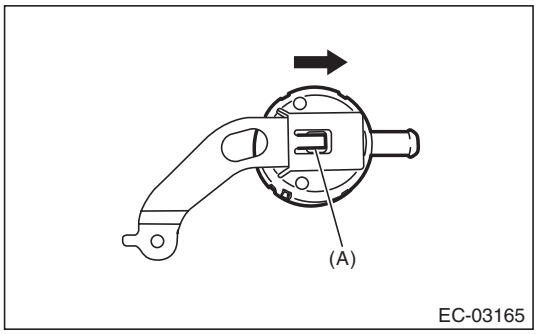
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the drain hose from the drain separator.



2) Lift up the claw (A) of the drain separator and slide the drain separator in the direction of the arrow to remove the drain separator.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

E: INSPECTION

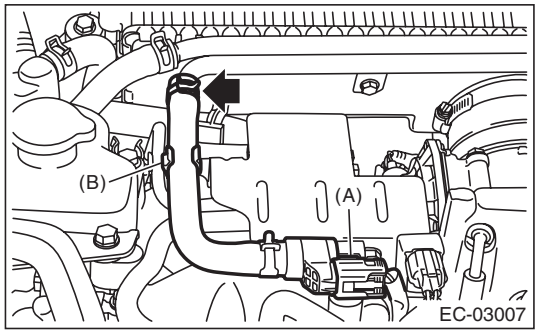
1) Check that the drain separator and drain separator bracket have no deformation, crack, or other damage.
2) Check that the drain hose has no crack, damage, or looseness.
3) Check that no foreign substances are clogged in the drain separator.

13.PCV Hose Assembly

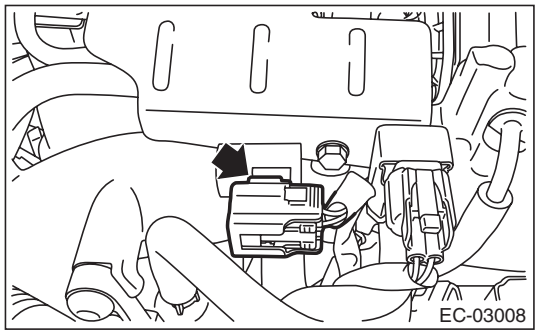
A: REMOVAL

CAUTION:
Do not remove unless the hose and the diagnostics connector are broken.

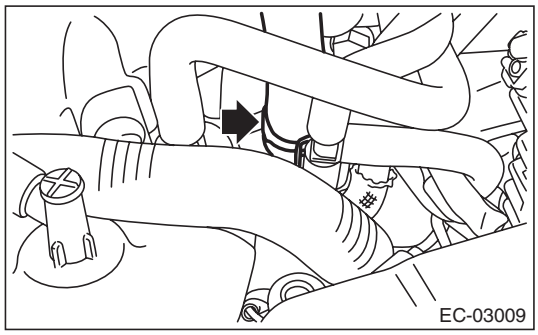
1) Disconnect the connector (A) from the PCV hose assembly A.
2) Remove the PCV hose assembly A from the clip (B), and remove the PCV hose assembly A from the PCV pipe.



3) Remove the connector from the PCV hose assembly B.

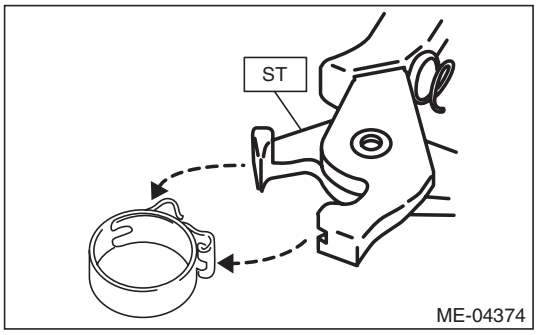


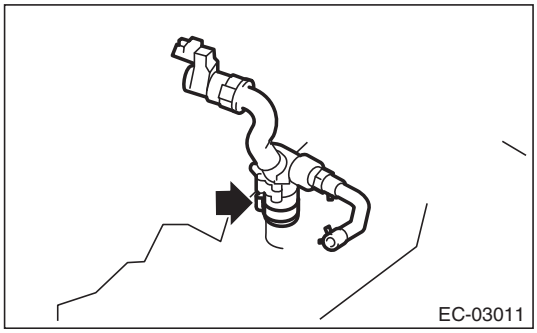
4) Remove the PCV hose assembly B from the intake duct.



5) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
6) Remove the turbocharger. <Ref. to IN(STI)-15, REMOVAL, Turbocharger.>
7) Remove the PCV hose assembly C from the cylinder block RH.

NOTE:
Pinch the clamp of the PCV hose assembly C by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS

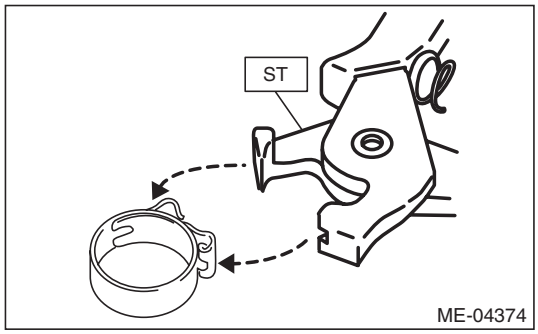


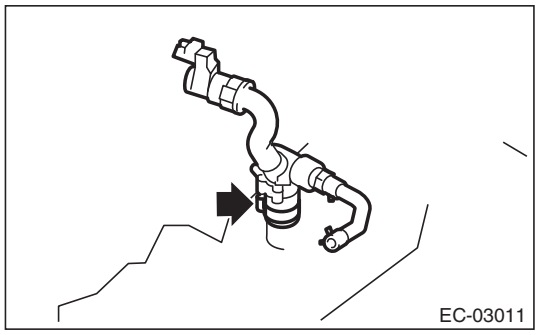


B: INSTALLATION

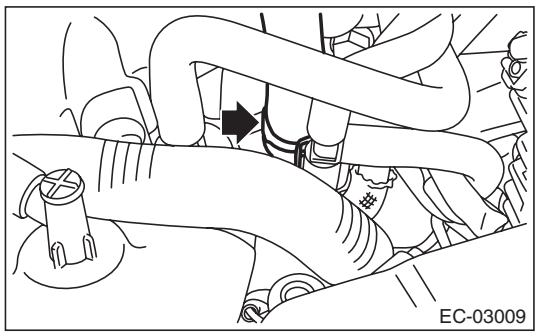
1) Install the PCV hose assembly C onto the cylinder block RH.

NOTE:
Use a new clamp for the PCV hose assembly C, fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS

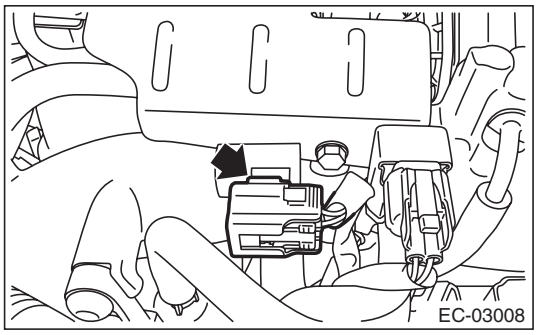




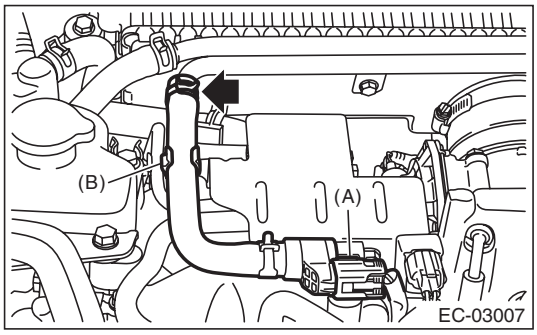
2) Install the turbocharger. <Ref. to IN(STI)-16, INSTALLATION, Turbocharger.>
3) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.>
4) Install the PCV hose assembly B onto the intake duct.



5) Connect the connector to the PCV hose assembly B.



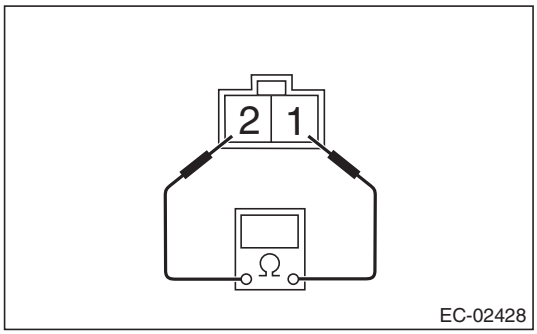
6) Install the PCV hose assembly A to the PCV pipe, and install the PCV hose assembly A to the clip (B).
7) Connect the connector (A) to the PCV hose assembly A.



C: INSPECTION

1. DIAGNOSIS CONNECTOR

1) Check that the diagnosis connector has no deformation, cracks and any other damage.
2) Check the resistance between the diagnosis connector terminals.



Terminal No.	Standard
1 and 2	Less than 1 Ω

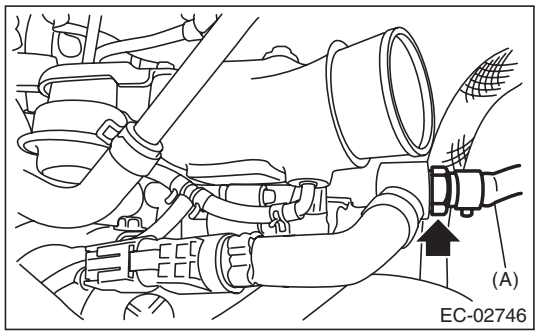
2. OTHER INSPECTIONS

1) Check that the PCV connector has no deformation, cracks or other damages.
2) Check that the hose has no cracks, damage or loose part.

14.PCV Valve

A: REMOVAL

CAUTION:
Do not remove unless the PCV valve is broken.
1) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
2) Disconnect the vacuum hose (A) from the PCV valve and remove the PCV valve from the PCV connector.



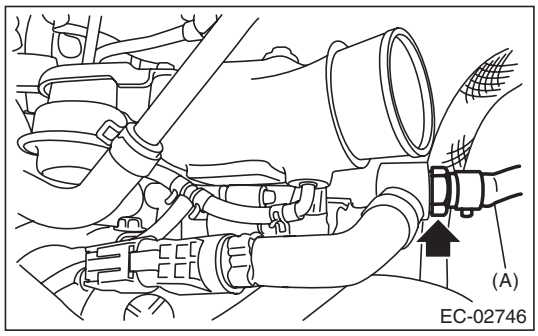
B: INSTALLATION

1) Install the PCV valve to the PCV connector and connect the vacuum hose (A) to the PCV valve.

NOTE:
Apply liquid gasket to the bolt threads of PCV valve.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
22.5 N·m (2.3 kgf-m, 16.6 ft-lb)

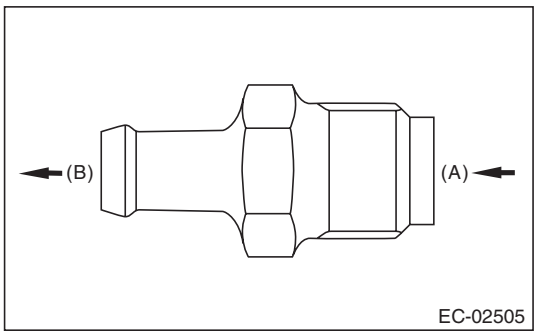


2) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>

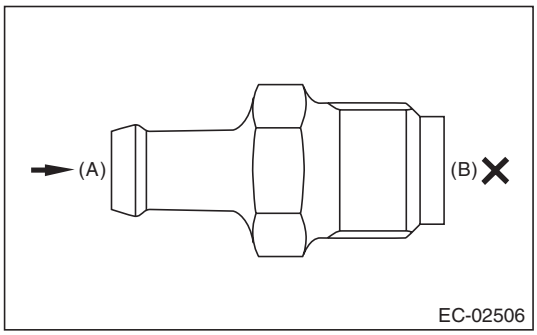
C: INSPECTION

1. PCV VALVE

1) Check that the PCV valve has no deformation, cracks or other damages.
2) Check that air is discharged from (B) when air is blown into (A).



3) Check that air does not come out from (B) when air is blown into (A).



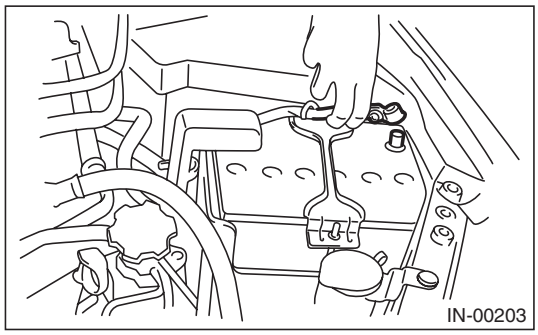
2. OTHER INSPECTIONS

Check the vacuum hose for cracks, damage or looseness.

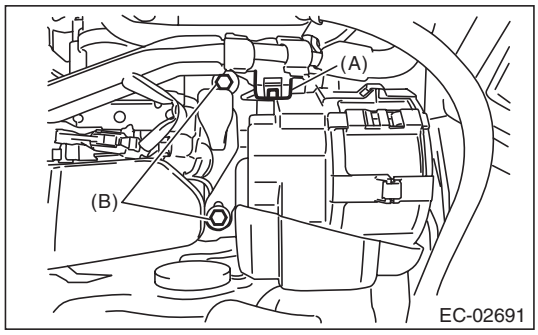
15.Secondary Air Pump

A: REMOVAL

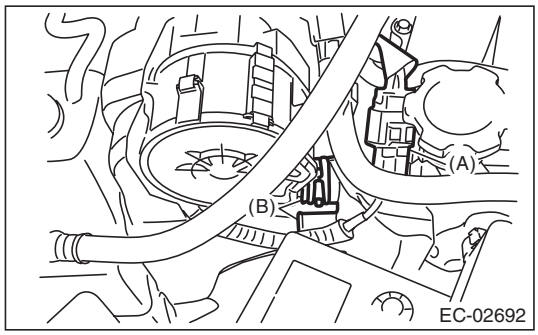
1) Disconnect the ground cable from battery.



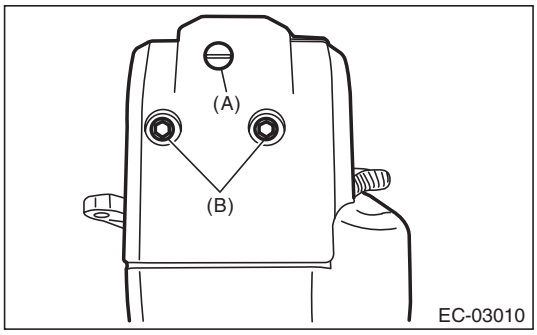
2) Remove the clip (A) which holds the harness on the harness stay and remove the bolt (B) which holds the secondary air pump on the vehicle.



3) Disconnect the connector (A) and air duct (B) from secondary air pump.



4) Remove the secondary air pump from the vehicle and the resonator from the secondary air pump.

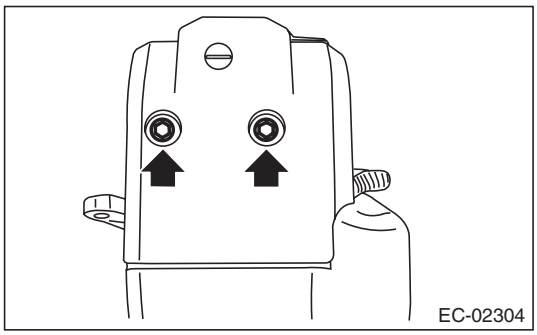


(A) Clip
(B) Bolt

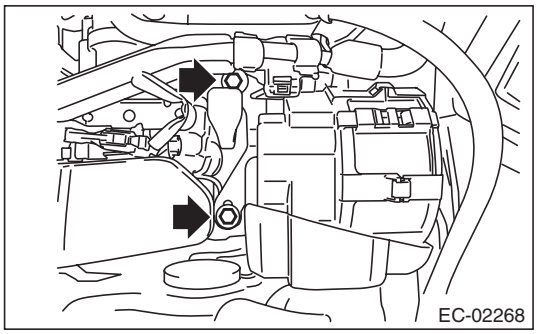
B: INSTALLATION

Install in the reverse order of removal.

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)

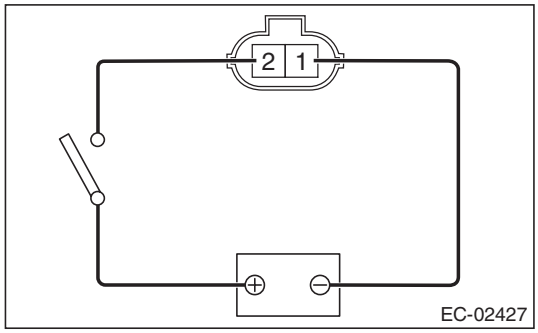


C: INSPECTION

1. SECONDARY AIR PUMP

1) Check that the secondary air pump has no deformation, cracks or other damages.
2) Connect battery positive terminal to the terminal No. 2 and battery negative terminal to the terminal No. 1, and inspect the secondary air pump operation.

CAUTION:
Do not operate the secondary air pump continuously for 80 seconds or more.



2. OTHER INSPECTIONS

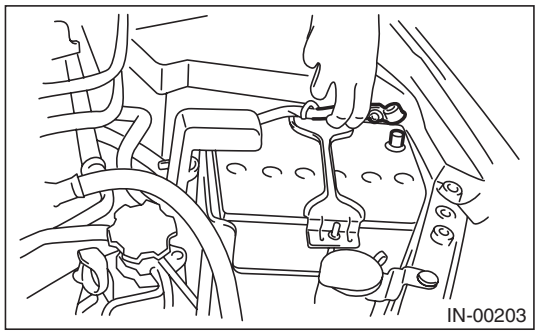
Check that the air duct or resonator has no cracks, damage or loose part.

16.Secondary Air Combination Valve

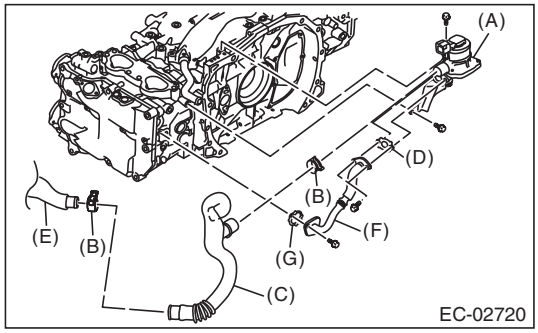
A: REMOVAL

1. SECONDARY AIR COMBINATION VALVE LH

1) Disconnect the ground cable from battery.



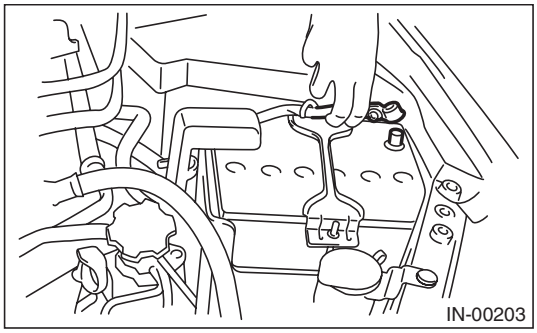
2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
3) Disconnect the connector from the secondary air combination valve LH.
4) Disconnect the air duct A.
5) Remove the secondary air pipe LH.
6) Remove the secondary air combination valve LH.



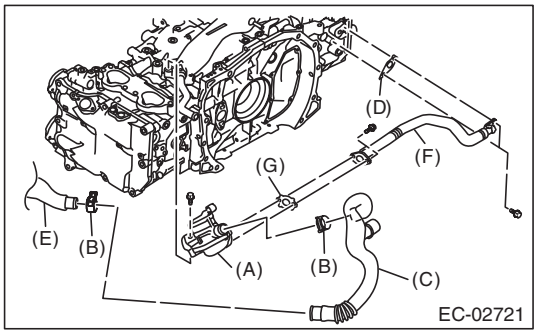
(A) Secondary air combination valve LH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe LH
(G) Gasket

2. SECONDARY AIR COMBINATION VALVE RH

1) Disconnect the ground cable from battery.



2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
3) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
4) Disconnect the air duct A.
5) Disconnect the secondary air pipe RH.
6) Remove the secondary air combination valve RH.



(A) Secondary air combination valve RH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe RH
(G) Gasket

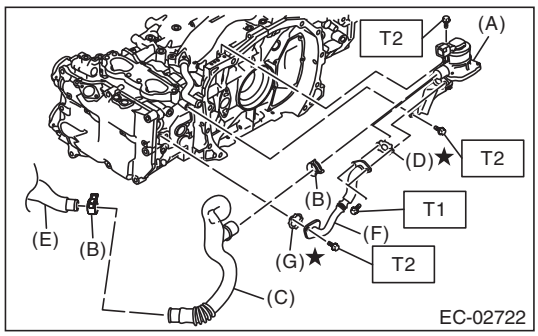
B: INSTALLATION

1. SECONDARY AIR COMBINATION VALVE LH

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
T1: 9 N·m (0.9 kgf-m, 6.6 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)



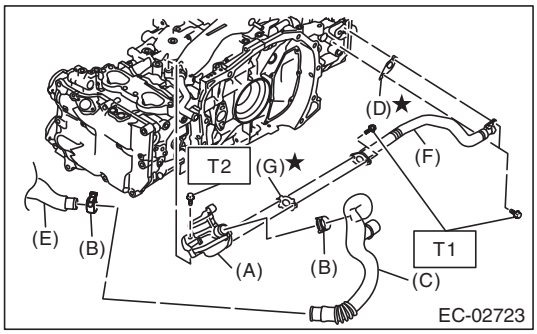
(A) Secondary air combination valve LH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe LH
(G) Gasket

2. SECONDARY AIR COMBINATION VALVE RH

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
T1: 9 N·m (0.9 kgf-m, 6.6 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)

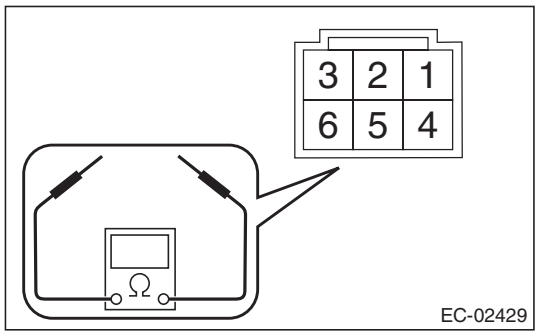


(A) Secondary air combination valve RH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe RH
(G) Gasket

C: INSPECTION

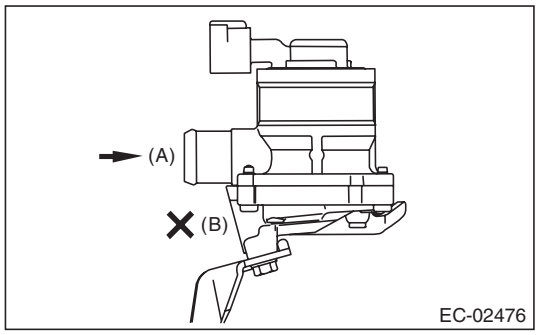
1. SECONDARY AIR COMBINATION VALVE LH

1) Check that the secondary air combination valve LH has no deformation, cracks or other damages.
2) Check the resistance between the terminals of secondary air combination valve LH.

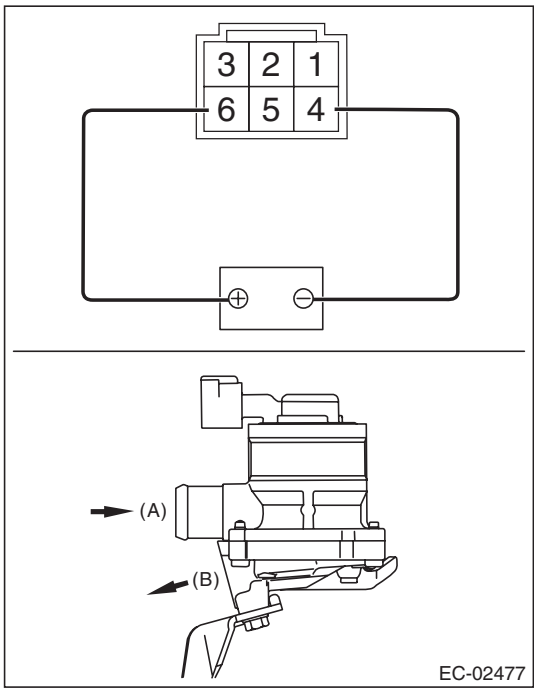


Terminal No.	Standard
4 and 6	5.0±0.5 Ω (when 20°C (68°F))
2 and 3	15 kΩ or less
1 and 2	4.5 kΩ or less

3) Check that air does not come out from (B) when air is blown into (A).

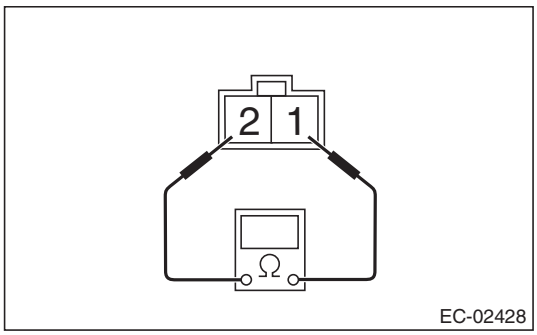


4) Connect the battery positive terminal to the terminal No. 6 and the battery negative terminal to the terminal No. 4. Check that air is discharged from (B), when supplying air to (A).



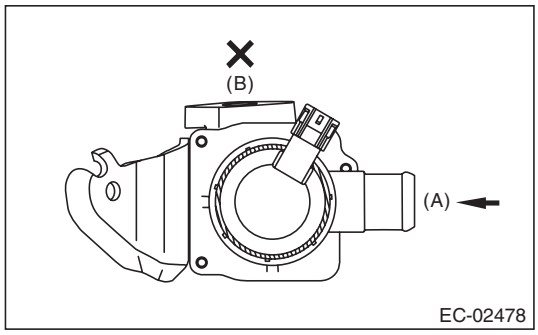
2. SECONDARY AIR COMBINATION VALVE RH

1) Check that the secondary air combination valve RH has no deformation, cracks or other damages.
2) Check the resistance between the terminals of secondary air combination valve RH.

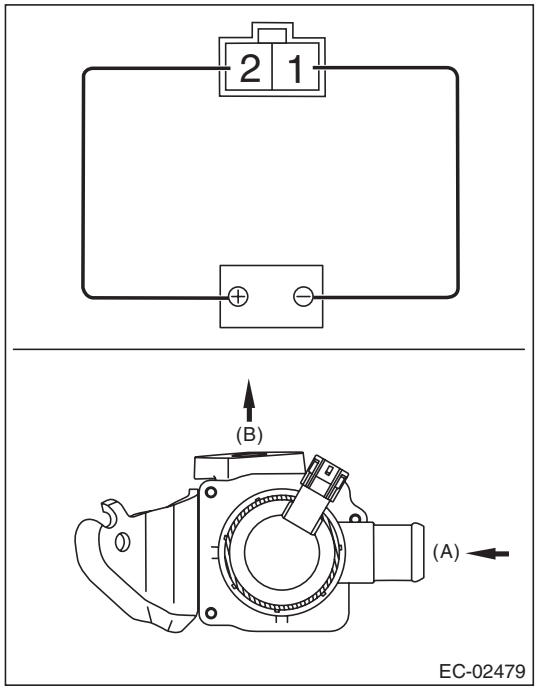


Terminal No.	Standard
1 and 2	5.0±0.5 Ω (when 20°C (68°F))

3) Check that air does not come out from (B) when air is blown into (A).



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



3. OTHER INSPECTIONS

1) Check that the secondary air pipe has no deformation, cracks or other damages.
2) Check that the air duct has no cracks, damage or loose part.

INTAKE (INDUCTION)

IN(STI)

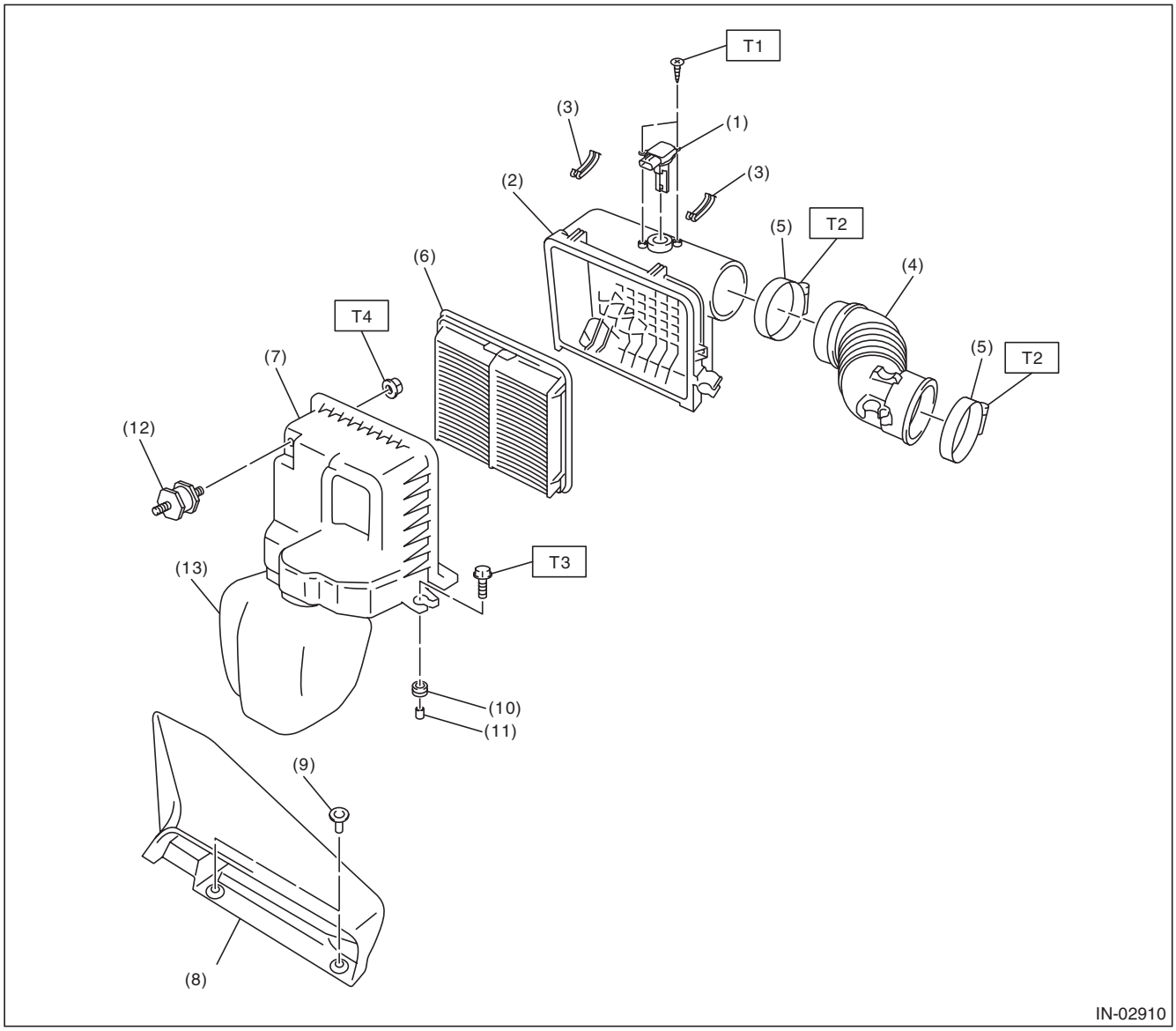
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2. Air Cleaner Element 7
3. Air Cleaner Case 8
4. Air Intake Duct 10
5. Intake Duct 11
6. Intercooler 12
7. Turbocharger 15
8. Air By-pass Valve 19
9. Resonator Chamber 20

1. General Description

A: COMPONENT

1. AIR CLEANER

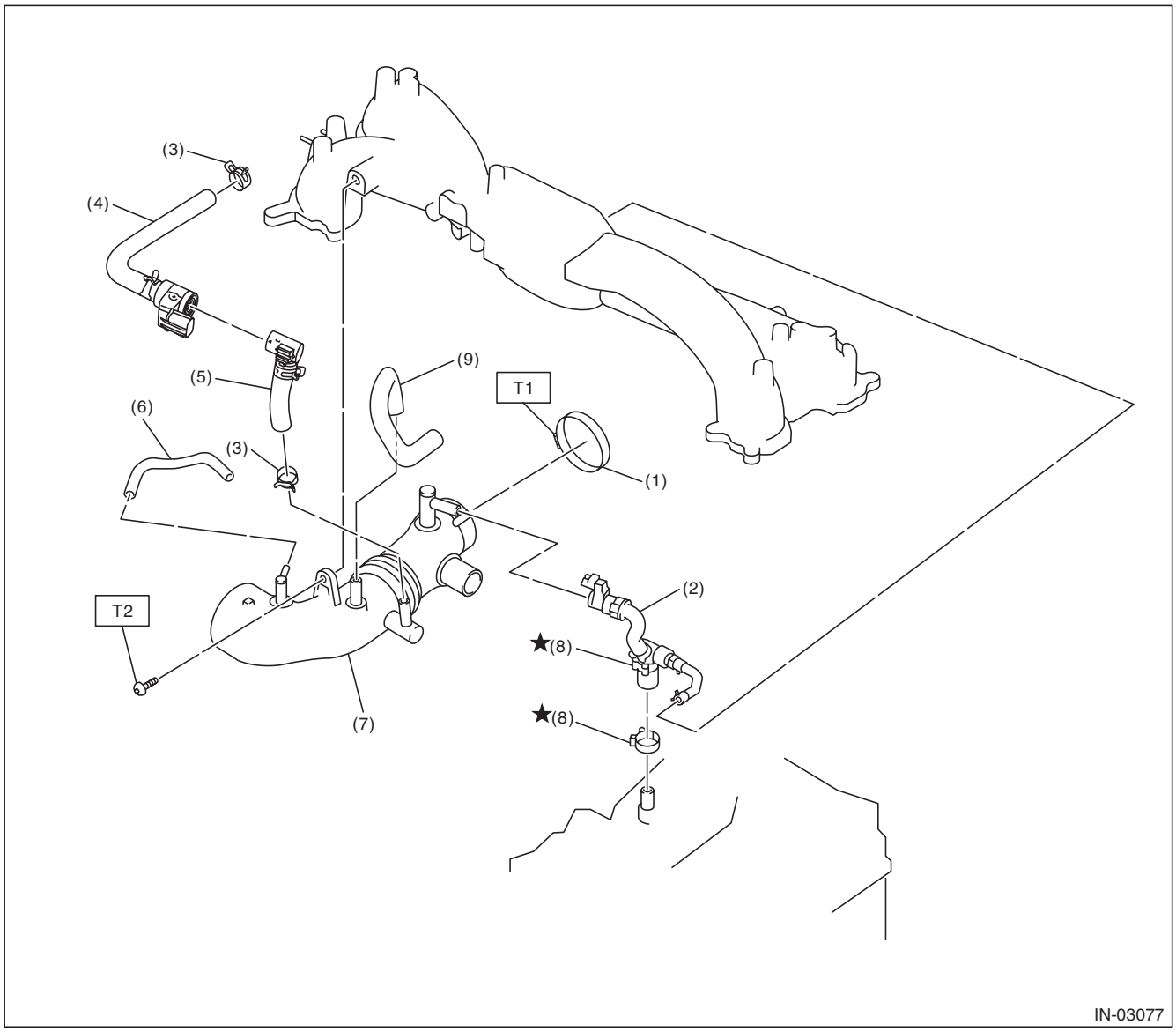


(1)	Mass air flow and intake air temperature sensor	(8)	Air intake duct	
(2)	Air cleaner case (rear)	(9)	Clip	
(3)	Clip	(10)	Cushion	
(4)	Air intake boot	(11)	Spacer	
(5)	Clamp	(12)	Cushion	
(6)	Air cleaner element	(13)	Resonator chamber	
(7)	Air cleaner case (front)			

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1 (0.1, 0.7)
T2: 2.5 (0.3, 1.8)
T3: 6 (0.6, 4.4)
T4: 7.5 (0.8, 5.5)

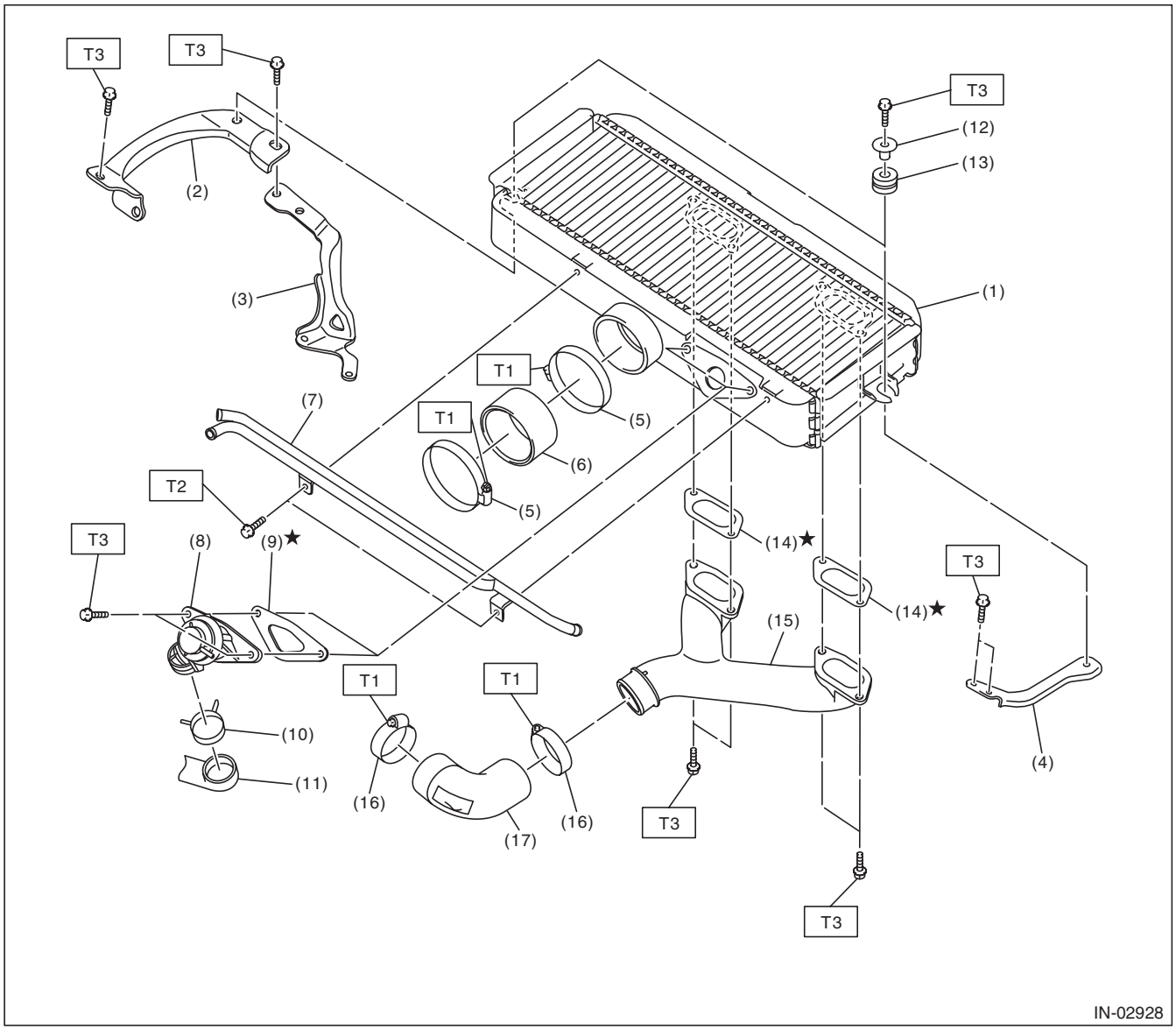
2. INTAKE DUCT



(1) Clamp
(2) PCV hose ASSY A
(3) Clip
(4) PCV hose ASSY B
(5) PCV hose ASSY C
(6) Vacuum hose A
(7) Intake duct
(8) Clamp
(9) Vacuum hose B

Tightening torque: N·m (kgf-m, ft-lb)
T1: 3 (0.3, 2.2)
T2: 17 (1.7, 12.5)

3. INTERCOOLER

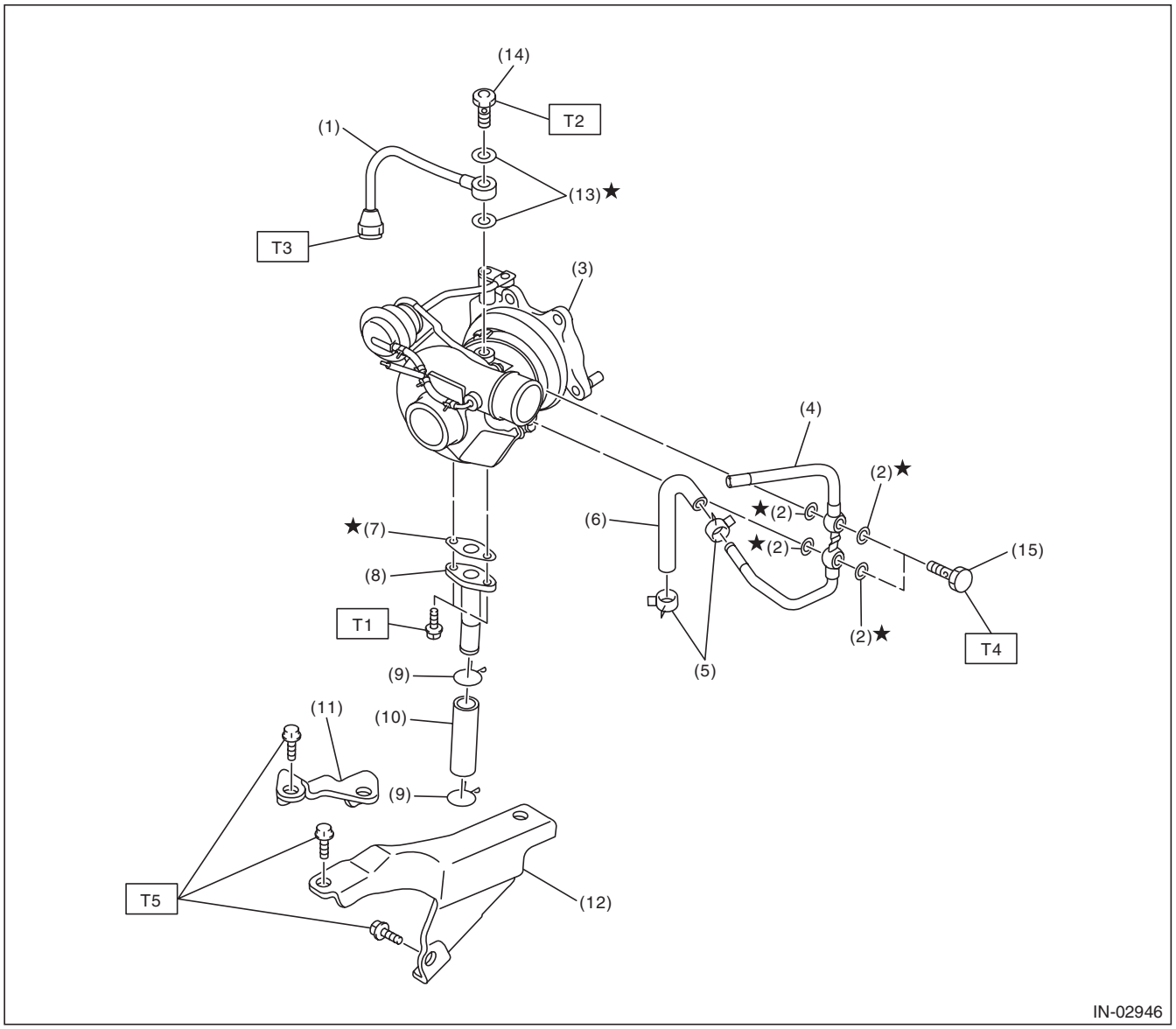


IN-02928

(1) Intercooler
(2) Intercooler stay A
(3) Intercooler stay B
(4) Intercooler stay C
(5) Clamp
(6) Air duct hose
(7) PCV pipe
(8) Air by-pass valve
(9) Gasket
(10) Clip
(11) Air by-pass hose
(12) Spacer
(13) Cushion
(14) Gasket
(15) Intercooler duct
(16) Clamp
(17) Intake duct

Tightening torque: N·m (kgf-m, ft-lb)
T1: 3 (0.3, 2.2)
T2: 5.5 (0.6, 4.1)
T3: 16 (1.6, 11.8)

4. TURBOCHARGER



(1) Oil inlet pipe
(2) Gasket
(3) Turbocharger
(4) Water pipe
(5) Clip
(6) Engine coolant hose
(7) Gasket
(8) Oil outlet pipe
(9) Clip
(10) Oil outlet hose
(11) Turbocharger stay RH
(12) Turbocharger stay LH
(13) Gasket
(14) Union bolt A
(15) Union bolt B

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.9 (0.5, 3.6)
T2: 16 (1.6, 11.8)
T3: 20 (2.0, 14.8)
T4: 23 (2.3, 17.0)
T5: 33 (3.4, 24.3)

B: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

C: PREPARATION TOOL

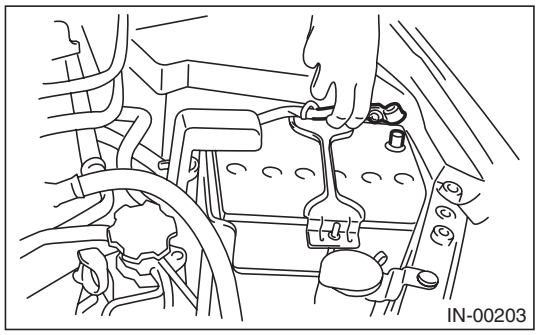
1. GENERAL TOOL

TOOL NAME	REMARKS
Mighty Vac	Used for checking waste gate actuator and air by-pass valve.

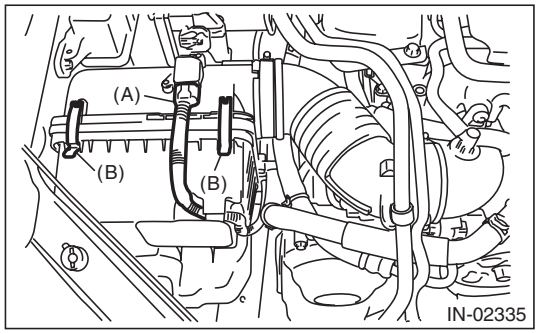
2. Air Cleaner Element

A: REMOVAL

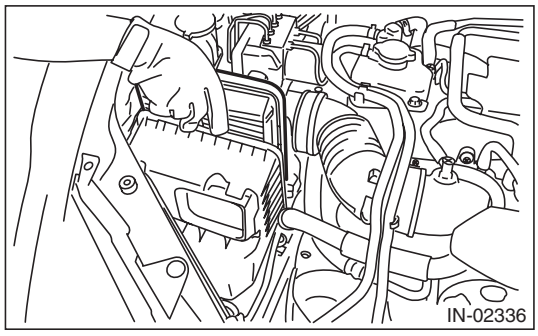
1) Disconnect the ground cable from battery.



2) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
3) Disconnect the connector (A) from air flow and intake air temperature sensor.
4) Remove the clips (B) from the air cleaner case (front).



5) Open the air cleaner case, and remove the air cleaner element.

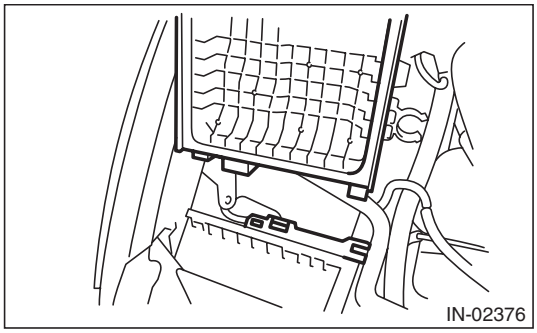


B: INSTALLATION

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.
• If the protrusion of the air cleaner case (rear) is removed when removing the air cleaner element, align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.



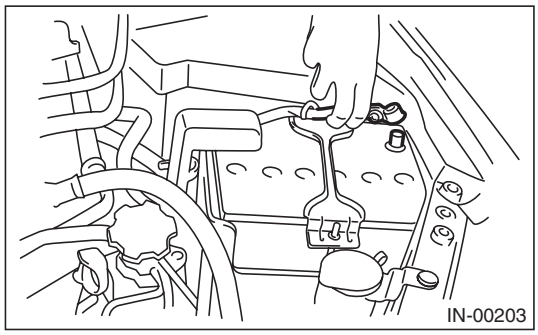
C: INSPECTION

1) Check that the air cleaner element has no deformation, cracks or other damages.
2) Check the air cleaner element for excessive dirt.

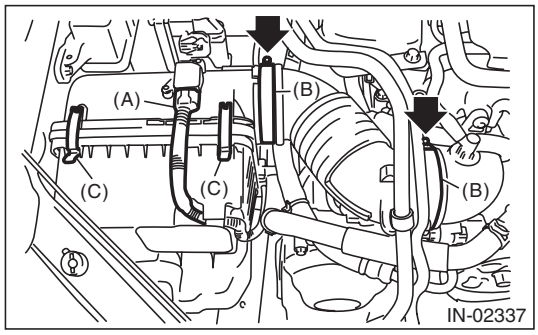
3. Air Cleaner Case

A: REMOVAL

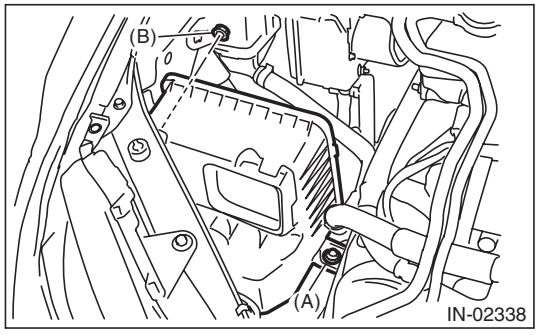
1) Disconnect the ground cable from battery.



2) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
3) Disconnect the connector (A) from air flow and intake air temperature sensor.
4) Loosen the clamp (B) which holds the air intake boot.
5) Remove the clip (C) from the air cleaner case (front).



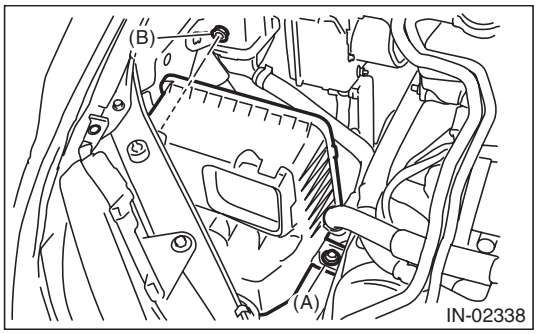
6) Remove the air cleaner case (rear) and air intake boot.
7) Remove the air cleaner element.
8) Remove bolts (A) and nuts (B) which secure the air cleaner case (front) to the body, and remove the air cleaner case (front).



B: INSTALLATION

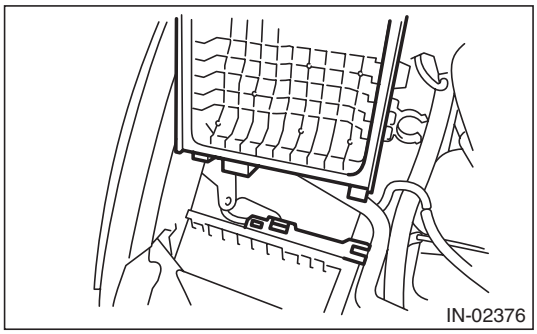
1) Install the bolt (A) and nut (B) which secure the air cleaner case (front) to the body.

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)

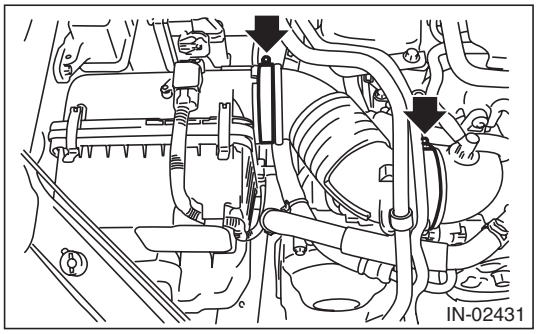


2) Install the air cleaner element.
3) Install the air cleaner case (rear) and air intake boot.

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.

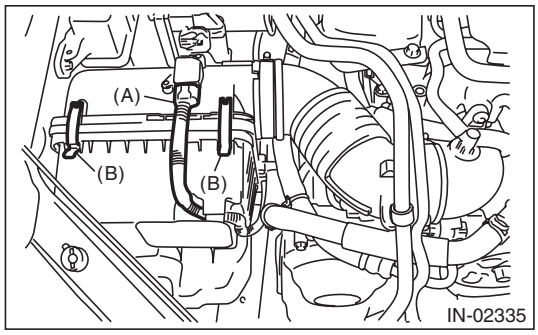


Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

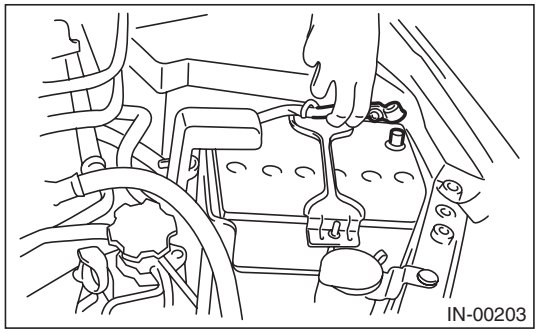


4) Install the clip (B) to the air cleaner case (front).

5) Connect the connector (A) to the mass air flow and intake air temperature sensor.



6) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
7) Connect the ground cable to battery.



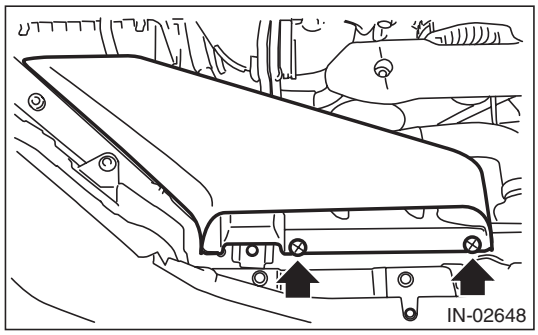
C: INSPECTION

1) Check that the air cleaner case has no deformation, cracks or other damages.
2) Check that the air intake boot has no cracks, damage or loose part.

4. 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.

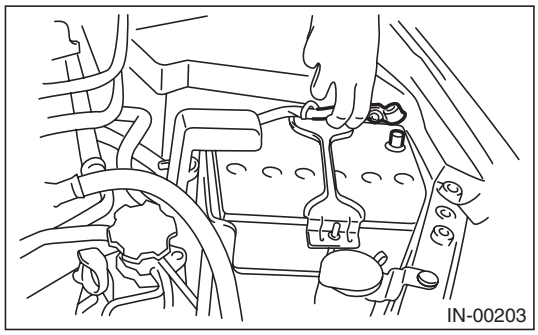
C: INSPECTION

1) Check that the air intake duct has no deformation, cracks or other damages.
2) Inspect that no foreign objects are mixed in the air intake duct.

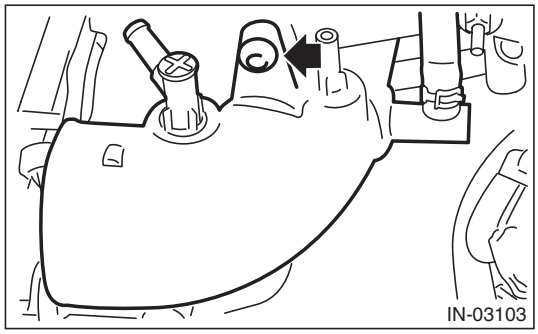
5. Intake Duct

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
3) Remove the sensor, engine harness and fuel pipe from the intake manifold. <Ref. to FU(STI)-25, DISASSEMBLY, Intake Manifold.>
4) Remove the intake duct from intake manifold.



5) Remove the PCV hose assembly and air by-pass hose from the intake duct.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
17 N·m (1.7 kgf-m, 12.5 ft-lb)

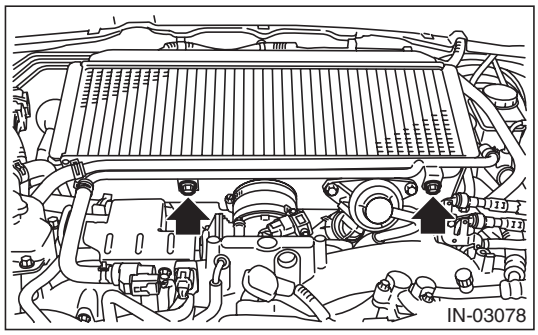
C: INSPECTION

Check that the intake duct has no deformation, cracks or other damages.

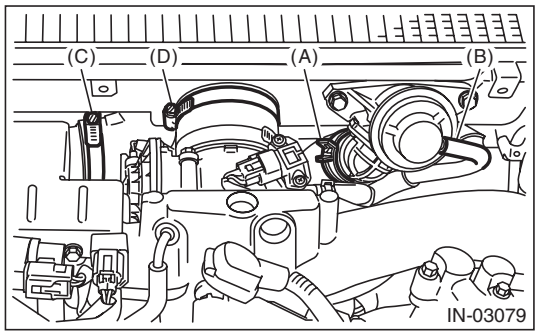
6. Intercooler

A: REMOVAL

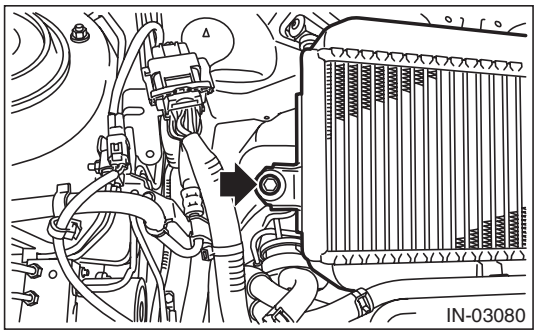
1) Remove the bolts holding the PCV pipe to the intercooler.

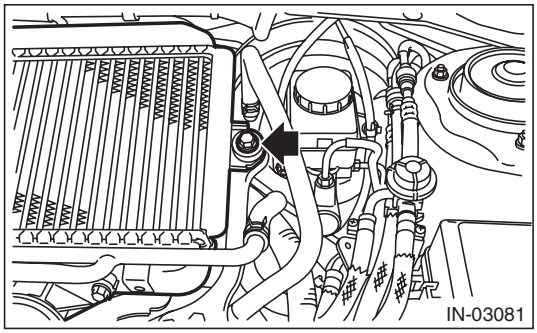


2) Remove the clip (A) which holds the air by-pass hose on the air by-pass valve and disconnect vacuum hose (B) from the air by-pass valve.
3) Loosen the clamp (C) holding the intake duct to the turbocharger.
4) Loosen the clamp (D) holding the air duct hose to the intercooler.

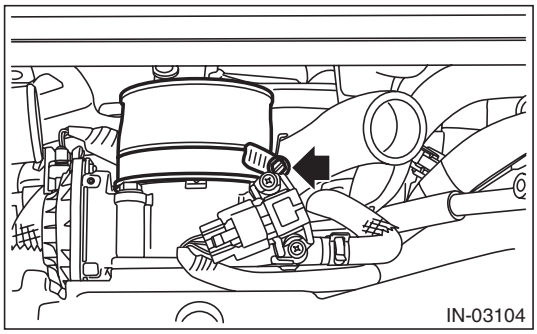


5) Remove the bolts which secure the intercooler to the intercooler stay, and remove the intercooler.

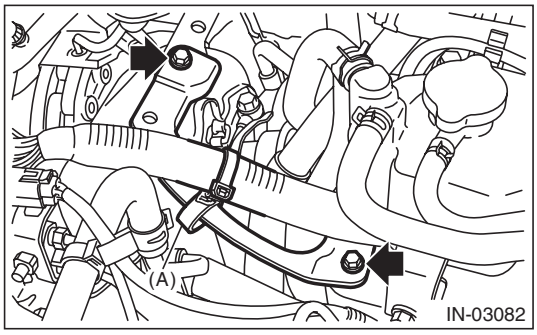




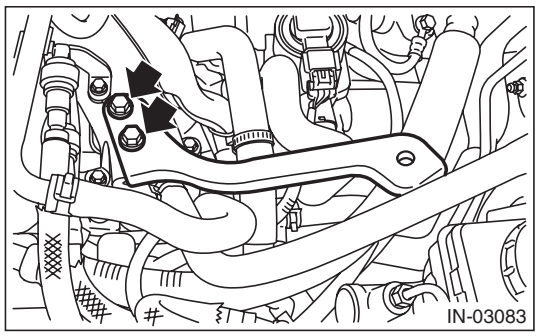
6) Remove the air duct hose from the throttle body.



7) Remove clip (A) holding the engine harness to the intercooler stay RH, and remove the intercooler stay RH.



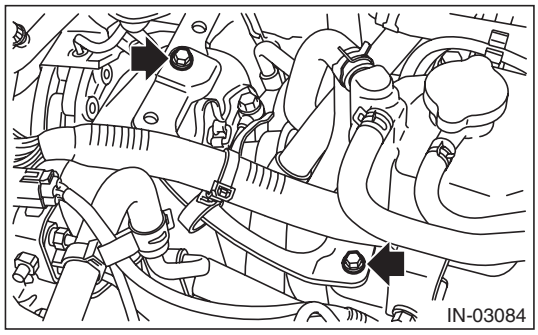
8) Remove the intercooler stay LH.

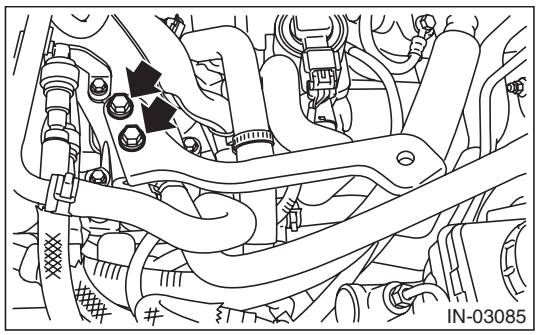


B: INSTALLATION

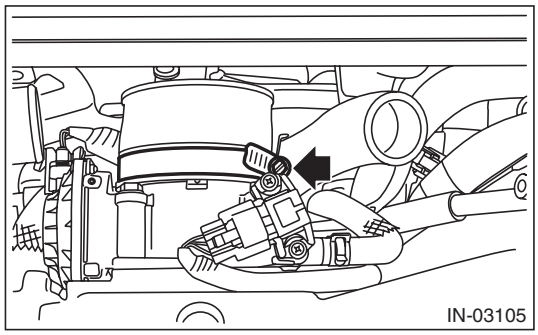
Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

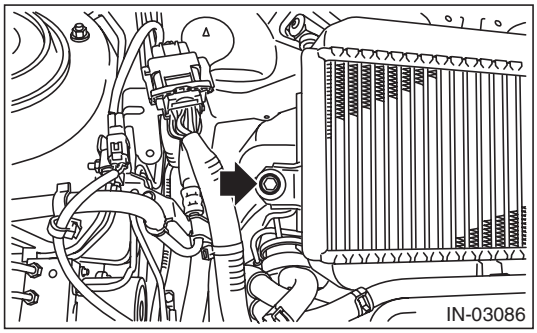


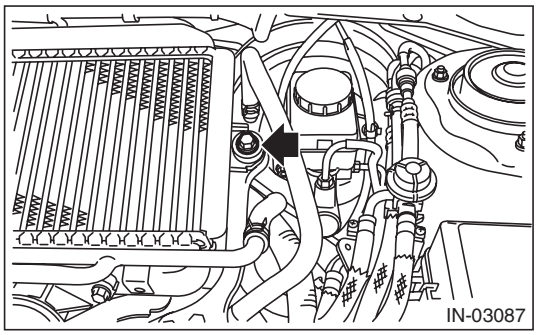


Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)

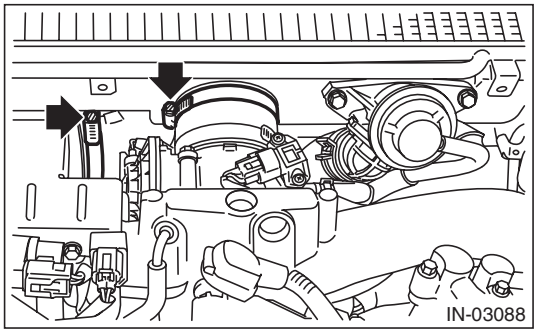


Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

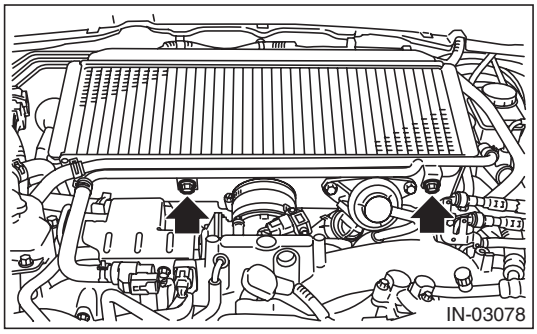




Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)

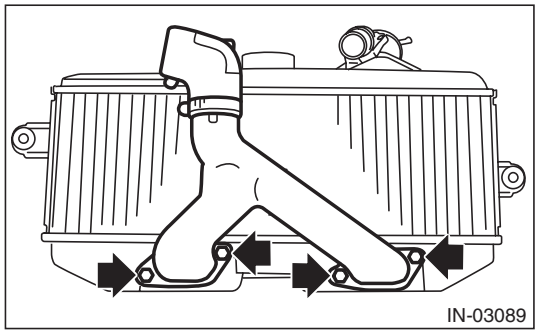


Tightening torque:
5.5 N·m (0.6 kgf-m, 4.1 ft-lb)

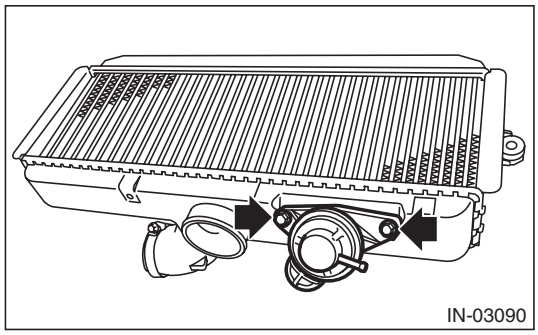


C: DISASSEMBLY

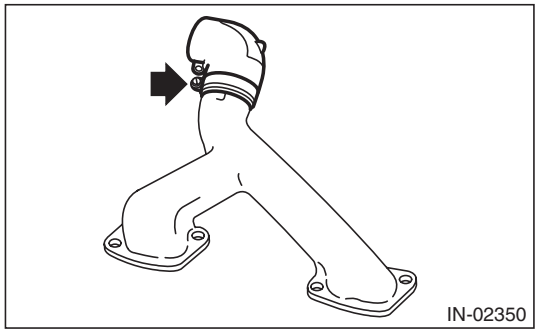
1) Remove the intercooler duct from the intercooler.



2) Remove the air by-pass valve from intercooler.



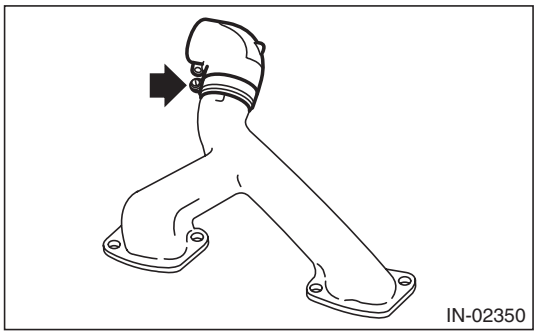
3) Remove the intake duct from intercooler duct.



D: ASSEMBLY

1) Install the intake duct to the intercooler duct.

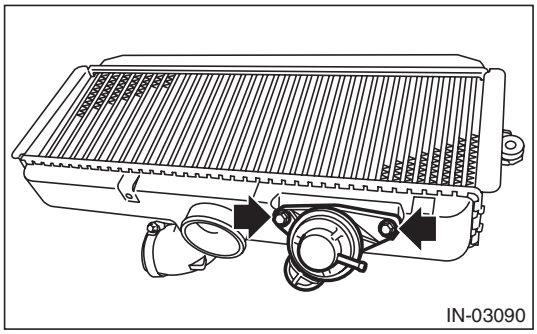
Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



2) Install the air by-pass valve to the intercooler.

NOTE:
Use a new gasket.

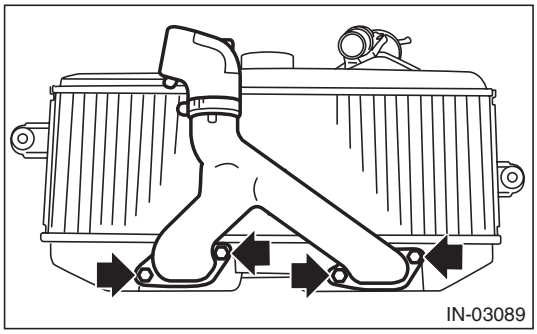
Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)



3) Install the intercooler duct to the intercooler.

NOTE:
Use a new gasket.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)



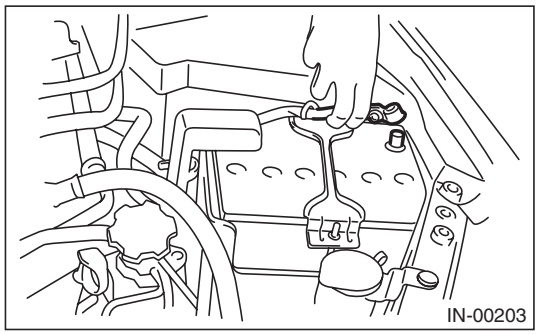
E: INSPECTION

1) Check that the intercooler and intercooler duct have no deformation, cracks or other damages.
2) Check that the hose and intake duct have no cracks, damage or loose part.

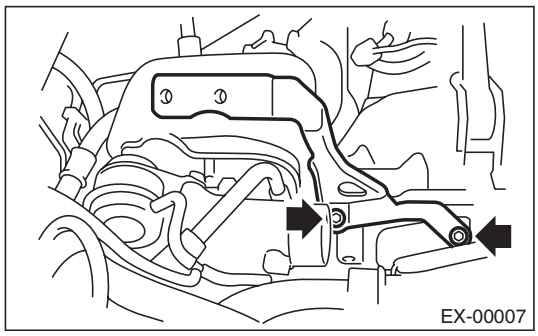
7. Turbocharger

A: REMOVAL

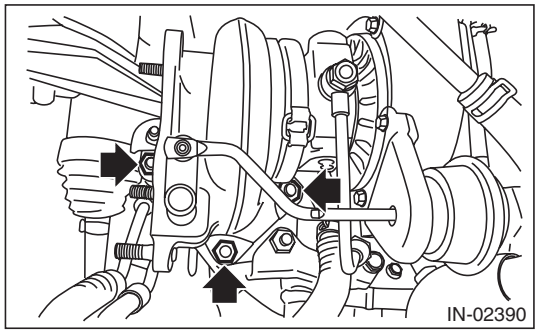
1) Disconnect the ground cable from battery.



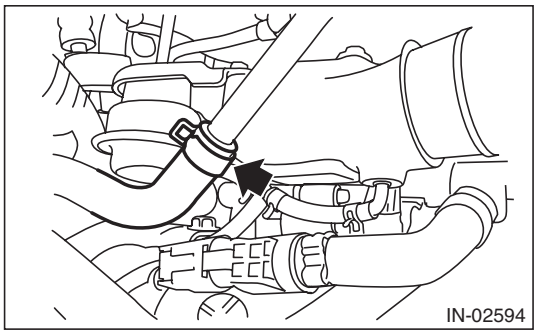
2) Lift up the vehicle.
3) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Lower the vehicle.
5) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
6) Remove the intercooler stay.



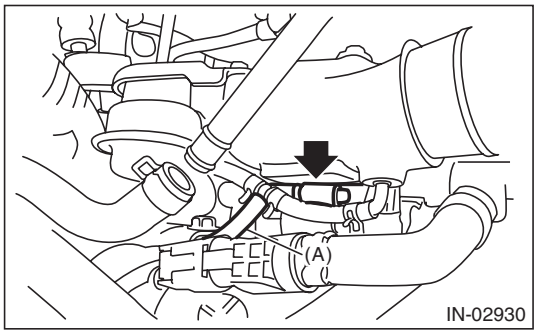
7) Remove the center exhaust pipe. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>
8) Lower the vehicle.
9) Remove the joint pipe from the turbocharger.



10) Disconnect the engine coolant hose from the upper side of the water pipe.

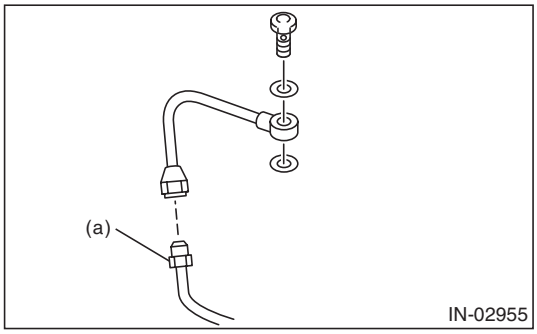


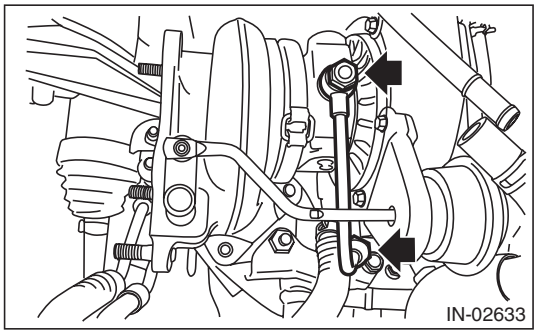
11) Disconnect the air control hose (A), and loosen the clamp holding the intake duct to the turbocharger.



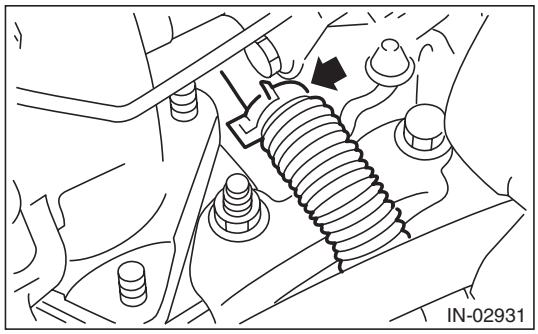
12) Remove the oil inlet pipe from the turbocharger.

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.

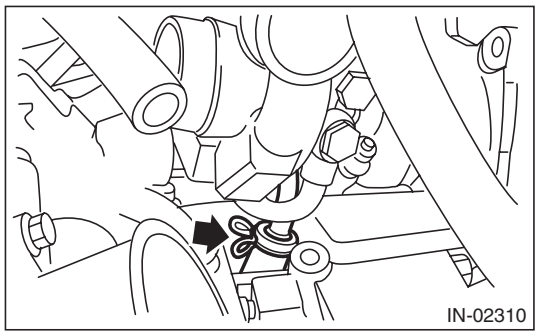




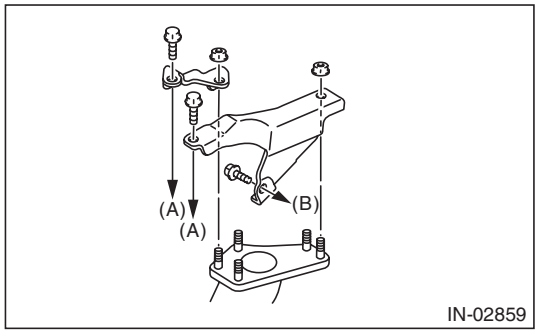
13) Disconnect the engine coolant hose from the lower side of the water pipe.



14) Disconnect the oil outlet hose from the oil outlet pipe, and remove the turbocharger.



15) Remove the turbocharger stay.

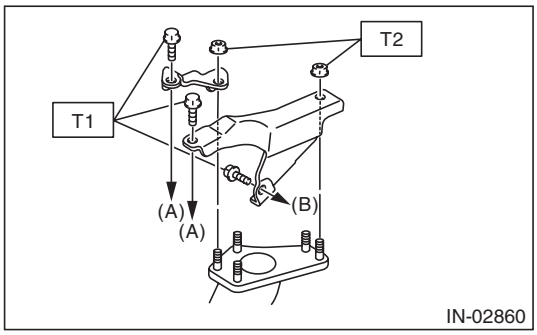


(A) To cylinder head RH
(B) To cylinder block RH

B: INSTALLATION

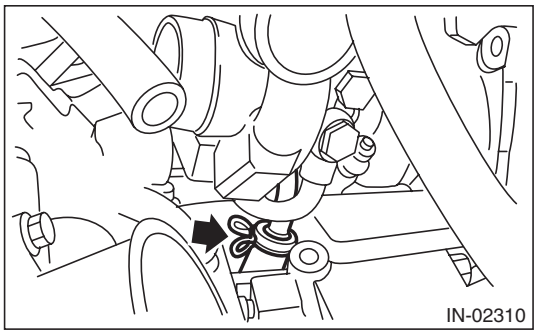
1) Install the turbocharger stay.

Tightening torque:
T1: 33 N·m (3.4 kgf-m, 24.3 ft-lb)
T2: 42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

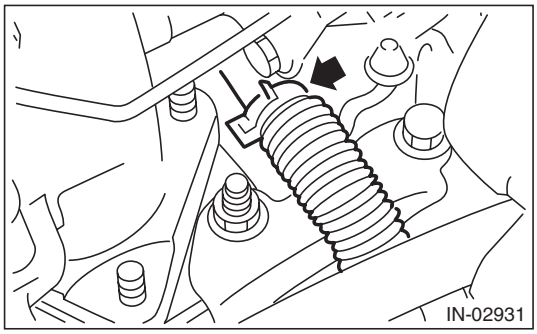


(A) To cylinder head RH
(B) To cylinder block RH

2) Connect the oil outlet hose to the oil outlet pipe.

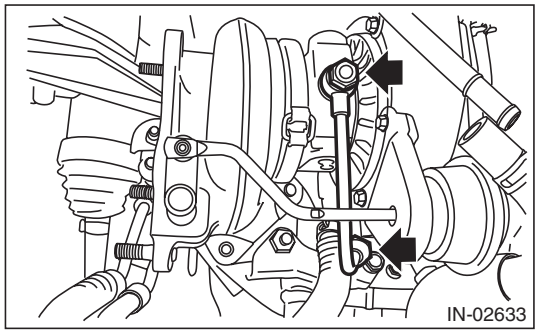


3) Connect the engine coolant hose to the lower side of the water pipe.



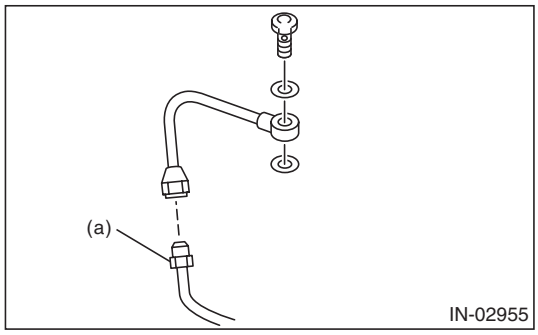
4) Temporarily tighten the union bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

NOTE:
Use a new gasket.

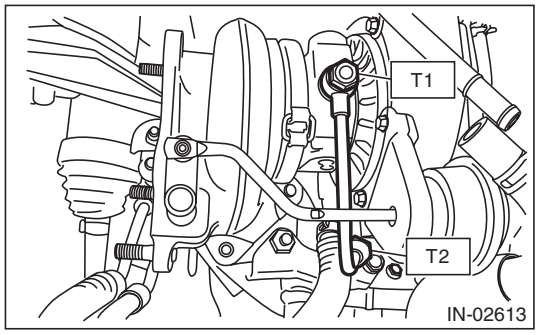


5) Tighten the union bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

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.

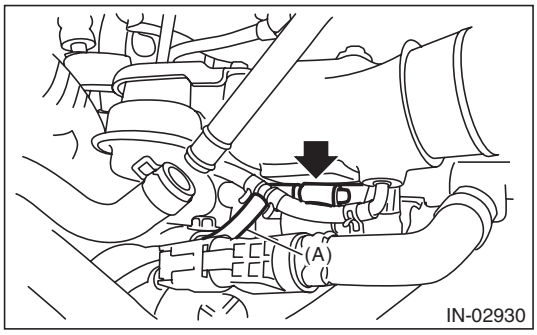


Tightening torque:
T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)

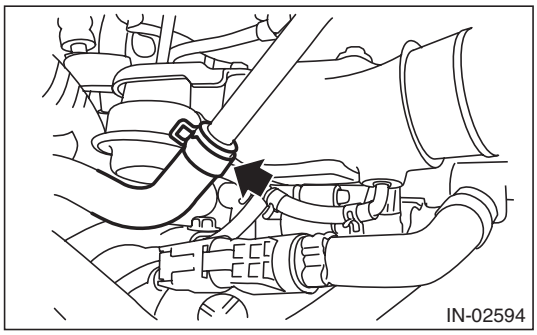


6) Connect the air control hose (A), and install the intake duct to the turbocharger.

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



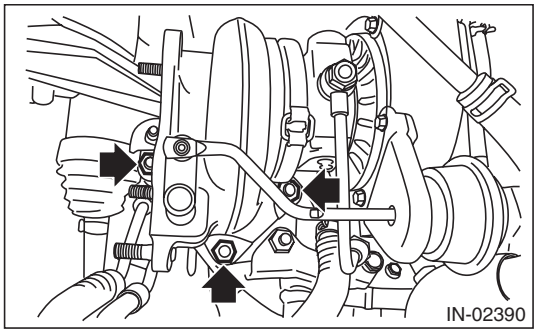
7) Connect the engine coolant hoses to the upper side of the water pipe.



8) Install the joint pipe to turbocharger.

NOTE:
Use a new gasket.

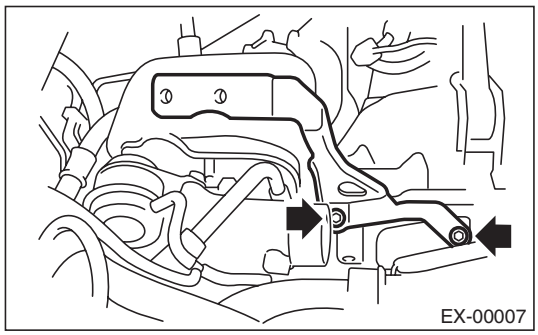
Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



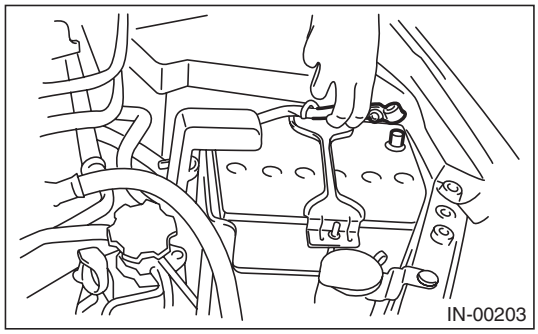
9) Lift up the vehicle.
10) Install the center exhaust pipe. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>
11) Lower the vehicle.

12) Install the intercooler stay.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)



13) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>
14) Connect the battery ground terminal.

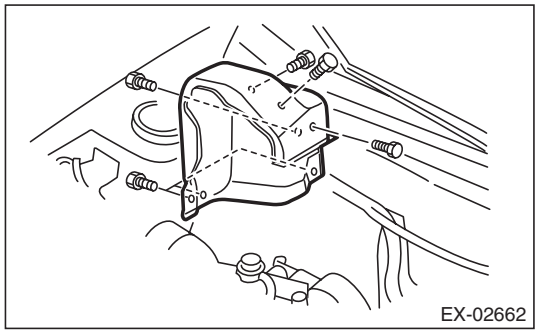


15) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

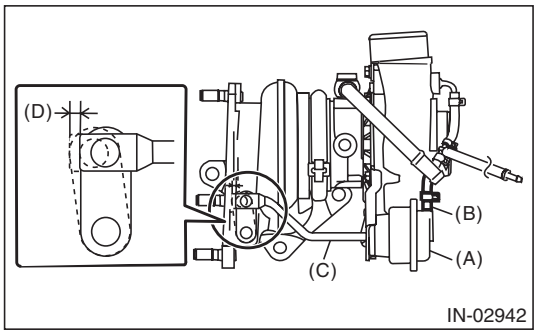
C: INSPECTION

1. WASTE GATE ACTUATOR

1) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
2) Remove the turbocharger upper cover.



3) Remove the boost hose (B) from the waste gate actuator (A) of the turbocharger, and connect the Mighty Vac to the waste gate actuator (A).



(A) Waste gate actuator
(B) Boost hose
(C) Control rod
(D) Control rod stroke

4) Pressurize slowly with the Mighty Vac, and measure the pressure when the control rod stroke (D) becomes 2 mm (0.08 in). If it is not within the standard, replace the turbocharger assembly.

CAUTION:
Do not pressurize over 89.9 kPa (0.92 kgf/cm^2, 13.0 psi) to prevent damaging the waste gate actuator.

Operating pressure (control rod stroke 2 mm (0.08 in)):
Standard
74.7 — 80.8 kPa (0.76 — 0.82 kgf/cm^2, 10.8 — 11.7 psi)

5) After inspection, install the related parts in the reverse order of removal.

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

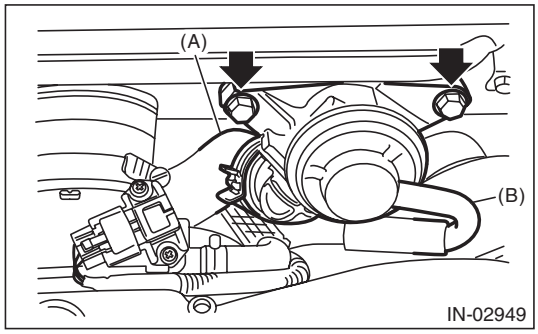
2. OTHER INSPECTIONS

1) Check that the turbocharger, turbocharger stay and pipe have no deformation, cracks or other damages.
2) Check that the hose and intake duct have no cracks, damage or loose part.
3) Check that there are no oil leakage or water leakage from the pipe attachment section.

8. Air By-pass Valve

A: REMOVAL

Remove the air by-pass valve from the intercooler, and then disconnect air by-pass hose (A) and vacuum hose (B) from the air by-pass valve.



B: INSTALLATION

Install in the reverse order of removal.

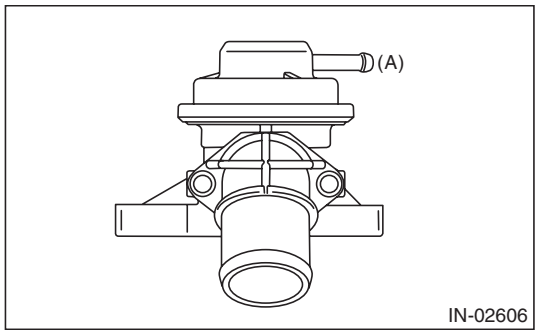
NOTE:
Use a new gasket.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

C: INSPECTION

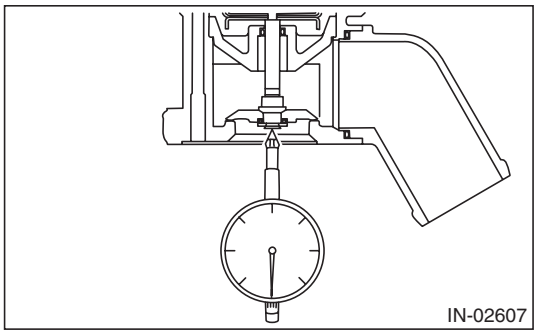
1. AIR BY-PASS VALVE

1) Check that the air by-pass valve has no deformation, cracks or other damages.
2) Connect the Mighty Vac to the nipple (A) of the air by-pass valve.



3) Using the Mighty Vac, generate the negative pressure to –93.3 kPa (–0.95 kgf/cm^2, –13.5 psi). Check that the Mighty Vac gauge needle holds 10 seconds without falling by –92.6 kPa (–0.94 kgf/cm^2, –13.4 psi).

4) Set a dial gauge to the end of valve rod of the air by-pass valve.



5) Slowly generate negative pressure with the Mighty Vac and check the pressure when the needle of the dial gauge (valve stroke) becomes 0.5 mm (0.02 in). If it is not within the standard, replace the air by-pass valve.

Opening pressure (valve stroke 0.5 mm (0.02 in)):
Standard
–62.7 — –70.7 kPa (–0.64 — –0.72 kgf/cm^2, –9.09 — –10.3 psi)

6) Increase negative pressure more than 5) and check the pressure when the needle of the dial gauge (valve stroke) becomes 7.5 mm (0.3 in). If it is not within the standard, replace the air by-pass valve.

Full open pressure (valve stroke 7.5 mm (0.3 in)):
Standard
–102.7 — –117.3 kPa (–1.05 — –1.20 kgf/cm^2, –14.9 — –17.0 psi)

2. OTHER INSPECTIONS

Check that the vacuum hose and air by-pass pipe have no cracks, damage or loose part.

9. Resonator Chamber

A: REMOVAL

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to “Air Cleaner Case” for removal procedure. <Ref. to IN(STI)-8, 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(STI)-8, INSTALLATION, Air Cleaner Case.>

C: INSPECTION

Check that the resonator chamber has no deformation, cracks or other damages.

MECHANICAL

ME(STI)

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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, double 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				8.2
	Compression pressure (at 200 — 300 rpm)		kPa (kg/cm^2, psi)	Standard	981 — 1,177 (10 — 12, 142 — 171)
	Number of piston rings				Pressure ring: 2, Oil ring: 1
	Intake valve timing		Open	Max. retard	ATDC 5°
				Min. advance	BTDC 25°
			Close	Max. retard	ABDC 65°
				Min. advance	ABDC 35°
	Exhaust valve timing		Open	Max. retard	BBDC 32°
				Min. advance	BBDC 72°
			Close	Max. retard	ATDC 28°
				Min. advance	BTDC 12°
	Valve clearance mm (in)	Inspection value	Intake		$0.20^{+0.04}_{-0.06}$ ($0.0079^{+0.0016}_{-0.0024}$)
			Exhaust		0.35±0.05 (0.0138±0.0020)
		Adjustment value	Intake		$0.20^{+0.01}_{-0.03}$ ($0.0079^{+0.0004}_{-0.0012}$)
			Exhaust		0.35±0.02 (0.0138±0.0008)
	Idle speed (Gear shift lever in neutral position)		rpm	No load	Standard	700±100
				A/C ON	Standard	750±100
	Ignition order				$1 \rightarrow 3 \rightarrow 2 \rightarrow 4$
	Ignition timing		BTDC/rpm	Standard	15°±10°/700

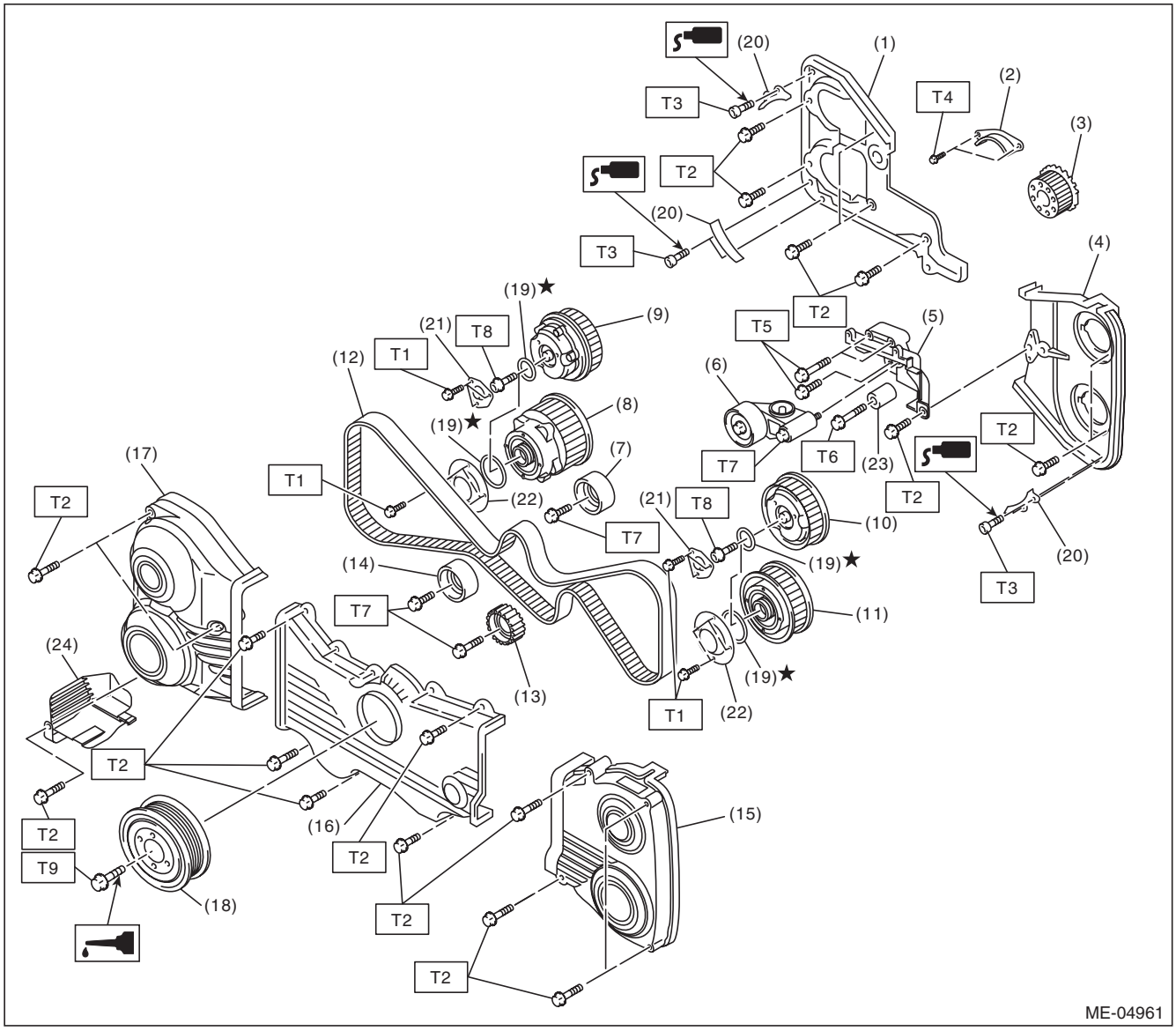
NOTE:
OS: Oversize US: Undersize

Belt tension adjuster	Adjuster rod protrusion amount		mm (in)	5.2 — 6.2 (0.205 — 0.244)
Camshaft	Bending limit		mm (in)	0.020 (0.00079)
	Cam lobe height mm (in)	Intake	Standard	46.55 — 46.65 (1.833 — 1.837)
		Exhaust	Standard	46.75 — 46.85 (1.841 — 1.844)
	Cam base circle diameter mm (in)		Standard	37.0 (1.457)
	Journal O.D. mm (in)	Front	Standard	37.946 — 37.963 (1.4939 — 1.4946)
		Center, rear	Standard	29.946 — 29.963 (1.1790 — 1.1796)
	Oil clearance mm (in)		Standard	0.037 — 0.072 (0.0015 — 0.0028)
	Thrust clearance mm (in)		Standard	0.068 — 0.116 (0.0027 — 0.0047)
Cylinder head	Warping limit (Mating surface with cylinder block)		mm (in)	0.035 (0.0014)
	Grinding limit		mm (in)	0.3 (0.012)
	Standard height		mm (in)	127.5 (5.02)
Valve seat	Seating angle between valve and valve seat			90°
	Contacting width between valve and valve seat mm (in)	Intake	Standard	0.6 — 1.4 (0.024 — 0.055)
		Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)
Valve guide	Clearance between the valve guide and valve stem mm (in)	Intake	Standard	0.030 — 0.057 (0.0012 — 0.0022)
		Exhaust	Standard	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		5.955 — 5.970 (0.2344 — 0.2350)
		Exhaust		5.945 — 5.960 (0.2341 — 0.2346)
	Valve guide protrusion amount		mm (in)	15.8 — 16.2 (0.622 — 0.638)
Valve	Head edge thickness mm (in)	Intake	Standard	1.0 — 1.4 (0.039 — 0.055)
		Exhaust	Standard	1.3 — 1.7 (0.051 — 0.067)
	Overall length mm (in)	Intake		104.4 (4.110)
		Exhaust		104.65 (4.1201)
Valve spring	Free length		mm (in)	53.48 (2.106)
	Tension/spring height N (kgf, lb)/mm (in)		Set	204.6 — 235.4 (20.86 — 24.00, 46.00 — 52.93)/36.0 (1.417)
			Lift	363.5 — 401.7 (37.07 — 40.96, 81.73 — 90.32)/26.7 (1.051)
	Squareness			2.5°, 2.3 mm (0.091 in) or less
Valve lifter	Outer diameter mm (in)		Standard	34.959 — 34.975 (1.3763 — 1.3770)
	Valve lifter mating surface inner diameter mm (in)		Standard	34.994 — 35.016 (1.3777 — 1.3786)
	Valve lifter and valve lifter mating surface clearance mm (in)		Standard	0.019 — 0.057 (0.0007 — 0.0022)
Cylinder block	Warping limit (Mating surface with cylinder head)		mm (in)	0.025 (0.0098)
	Grinding limit		mm (in)	0.1 (0.004)
	Standard height		mm (in)	201.0 (7.91)
	Cylindricality mm (in)		Limit	0.015 (0.0006)
	Out-of-roundness mm (in)		Limit	0.010 (0.0004)
	Clearance between cylinder and piston 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 (1.50)
	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 — 3.9278)
			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 pin 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	0.23 — 0.28 (0.0091 — 0.0110)
		Second ring		Standard	0.37 — 0.52 (0.015 — 0.0203)
		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)	Limit	0.1 (0.0039)
	Thrust clearance		mm (in)	Standard	0.070 — 0.330 (0.0028 — 0.0130)
	Oil clearance		mm (in)	Standard	0.017 — 0.045 (0.0007 — 0.0018)
	Bearing size (Thickness at center) mm (in)		Standard		1.490 — 1.506 (0.0587 — 0.0593)
			0.03 (0.0012) US		1.504 — 1.512 (0.0592 — 0.0595)
			0.05 (0.0020) US		1.514 — 1.522 (0.0596 — 0.0599)
			0.25 (0.0098) US		1.614 — 1.622 (0.0635 — 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	Cylindricality	mm (in)	Limit	0.006 (0.0002)
		Out-of-roundness	mm (in)	Limit	0.005 (0.0002)
		Grinding limit (dia.)		mm (in)	To 51.750 (2.0374)
	Crank journal	Cylindricality	mm (in)	Limit	0.006 (0.0002)
		Out-of-roundness	mm (in)	Limit	0.005 (0.0002)
		Grinding limit (dia.)		mm (in)	To 59.758 (2.3527)
	Crank pin outer diameter mm (in)		Standard		51.976 — 52.000 (2.0463 — 2.0472)
			0.03 (0.0012) US		51.954 — 51.970 (2.0454 — 2.0461)
			0.05 (0.0020) US		51.934 — 51.950 (2.0447 — 2.0453)
			0.25 (0.0098) US		51.734 — 51.750 (2.0368 — 2.0374)
	Crank journal outer diameter mm (in)		Standard		59.984 — 60.008 (2.3616 — 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 — 2.015 (0.0787 — 0.0793)
			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 — 2.017 (0.0787 — 0.0794)
			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 (0.00039 — 0.0012)

B: COMPONENT

1. TIMING BELT

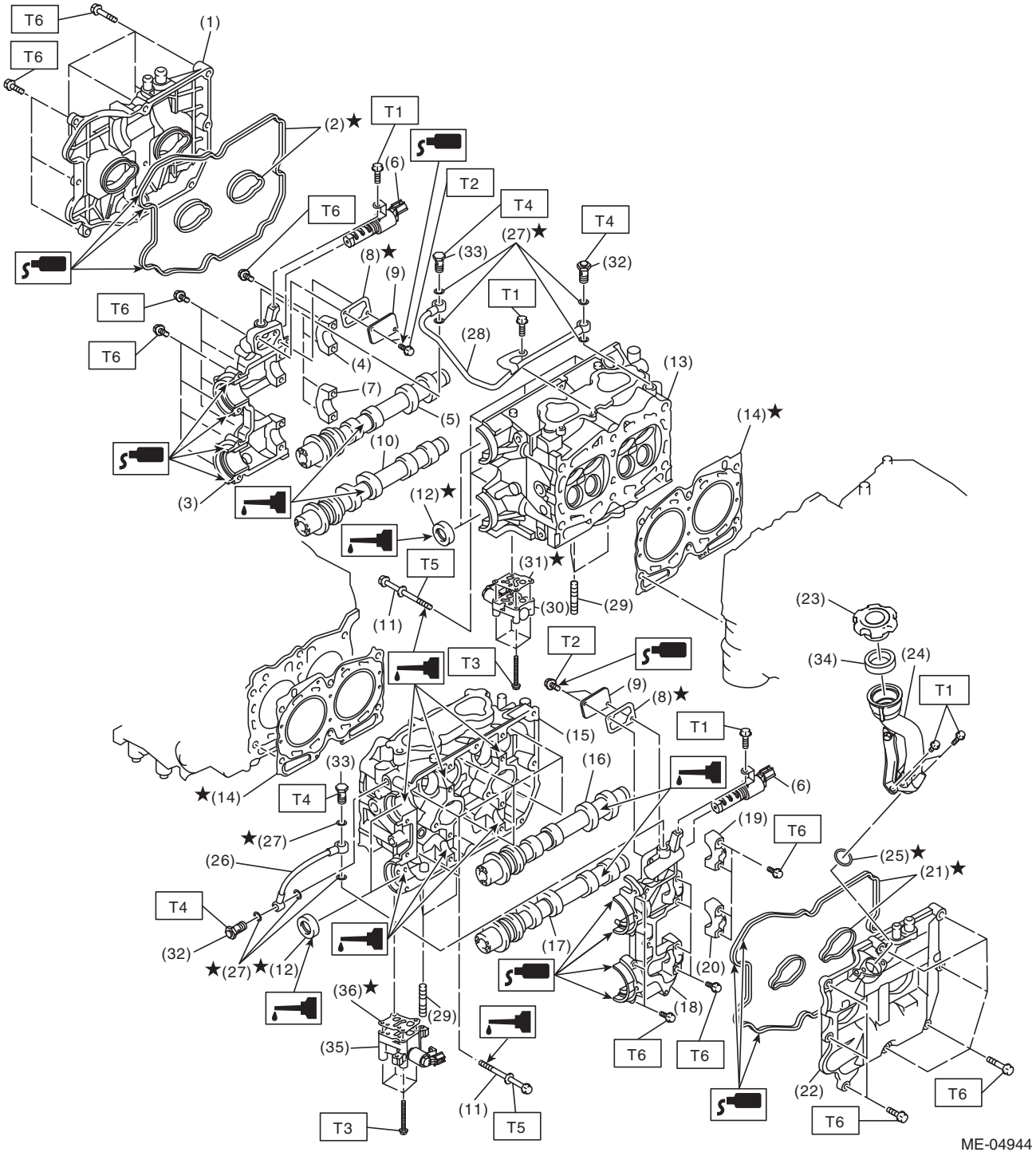


(1) Timing belt cover No. 2 RH
(2) Timing belt guide
(3) Crank sprocket
(4) Timing belt cover No. 2 LH
(5) Tensioner bracket
(6) Automatic belt tension adjuster ASSY
(7) Belt idler
(8) Exhaust cam sprocket RH
(9) Intake cam sprocket RH
(10) Intake cam sprocket LH
(11) Exhaust cam sprocket LH
(12) Timing belt
(13) Belt idler No. 2
(14) Belt idler
(15) Timing belt cover LH
(16) Front belt cover
(17) Timing belt cover RH
(18) Crank pulley
(19) O-ring
(20) Timing belt guide
(21) Intake actuator cover
(22) Exhaust actuator cover
(23) Belt idler
(24) Engine harness cover

Tightening torque: N·m (kgf-m, ft-lb)

T1: 3.4 (0.3, 2.5)
T2: 5 (0.5, 3.7)
T3: 6.4 (0.7, 4.7)
T4: 9.75 (1.0, 7.2)
T5: 24.5 (2.5, 18.1)
T6: 25 (2.5, 18.4)
T7: 39 (4.0, 28.8)
T8: <Ref. to ME(STI)-58, INSTALLATION, Cam Sprocket.>
T9: <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>

2. CYLINDER HEAD AND CAMSHAFT

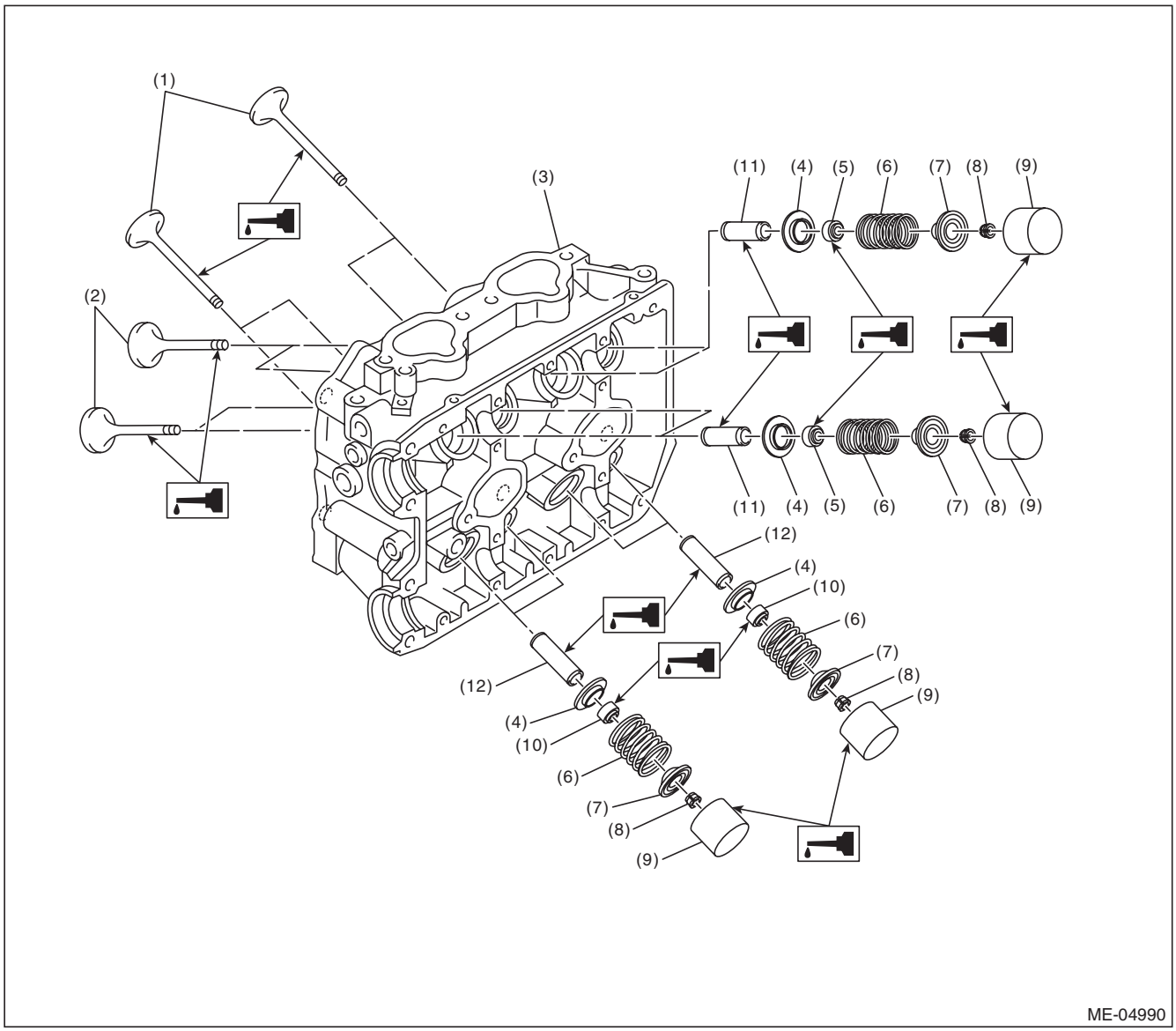


(1) Rocker cover RH
(2) Rocker cover gasket RH
(3) Front camshaft cap RH
(4) Intake camshaft cap RH
(5) Intake camshaft RH
(6) Intake oil flow control solenoid valve
(7) Exhaust camshaft cap RH
(8) Gasket
(9) Oil return cover
(10) Exhaust camshaft RH
(11) Cylinder head bolt
(12) Oil seal
(13) Cylinder head RH
(14) Cylinder head gasket
(15) Cylinder head LH
(16) Intake camshaft LH
(17) Exhaust camshaft LH
(18) Front camshaft cap LH
(19) Intake camshaft cap LH
(20) Exhaust camshaft cap LH
(21) Rocker cover gasket LH
(22) Rocker cover LH
(23) Oil filler cap
(24) Oil filler duct
(25) O-ring
(26) Oil pipe LH
(27) Gasket
(28) Oil pipe RH
(29) Stud bolt
(30) Exhaust oil flow control solenoid valve RH
(31) Gasket RH
(32) Union bolt with filter (with protrusion)
(33) Union bolt without filter (without protrusion)
(34) Gasket
(35) Exhaust oil flow control solenoid valve LH
(36) Gasket LH

Tightening torque: N·m (kgf-m, ft-lb)

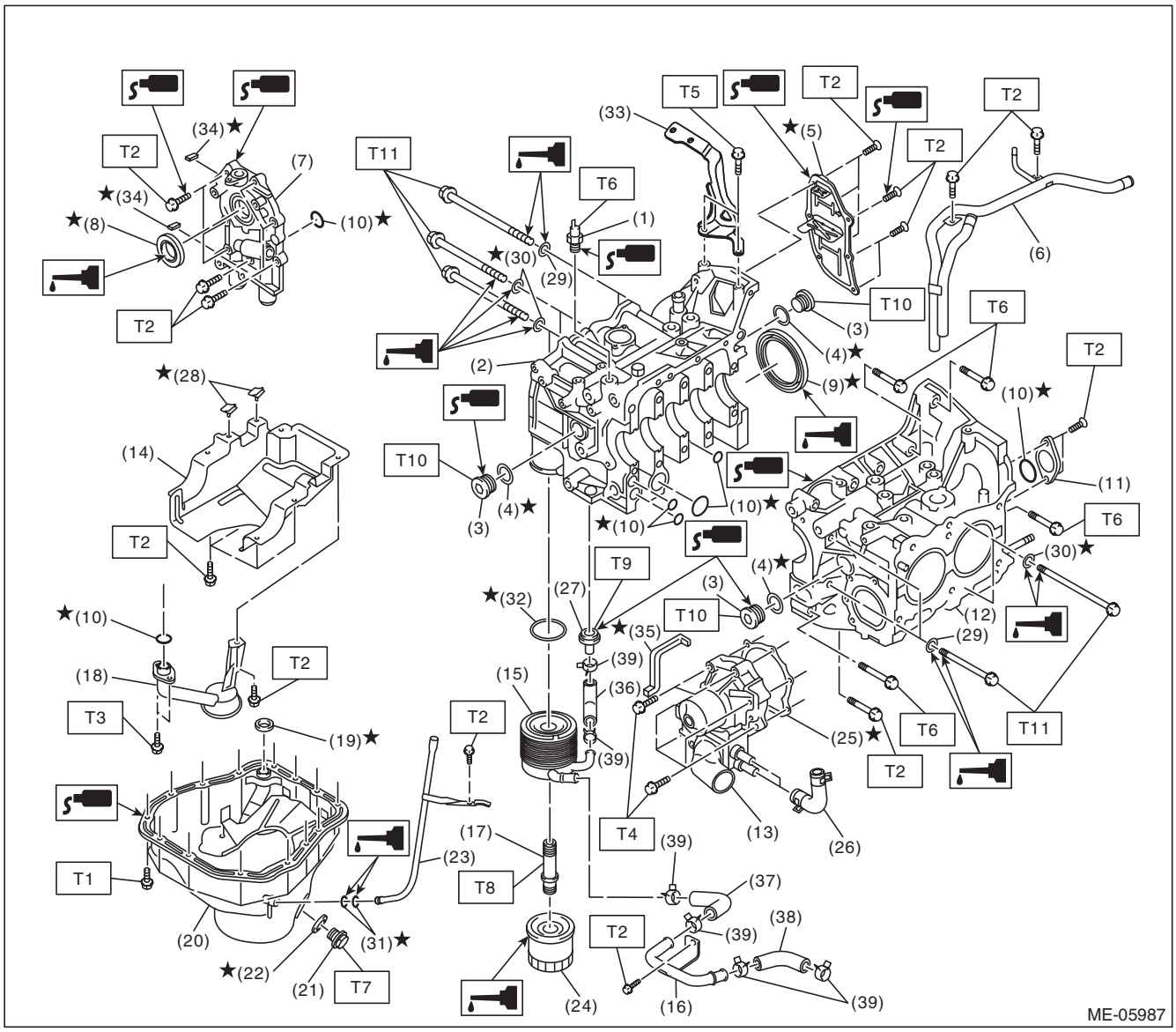
T1: 6.4 (0.7, 4.7)
T2: 9 (0.9, 6.6)
T3: 10 (1.0, 7.4)
T4: 29 (3.0, 21.4)
T5: <Ref. to ME(STI)-69, INSTALLATION, Cylinder Head.>
T6: <Ref. to ME(STI)-63, INSTALLATION, Camshaft.>

3. CYLINDER HEAD AND VALVE ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Cylinder head
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Valve spring retainer
(8) Valve spring retainer key
(9) Valve lifter
(10) Exhaust valve oil seal
(11) Intake valve guide
(12) Exhaust valve guide

4. CYLINDER BLOCK

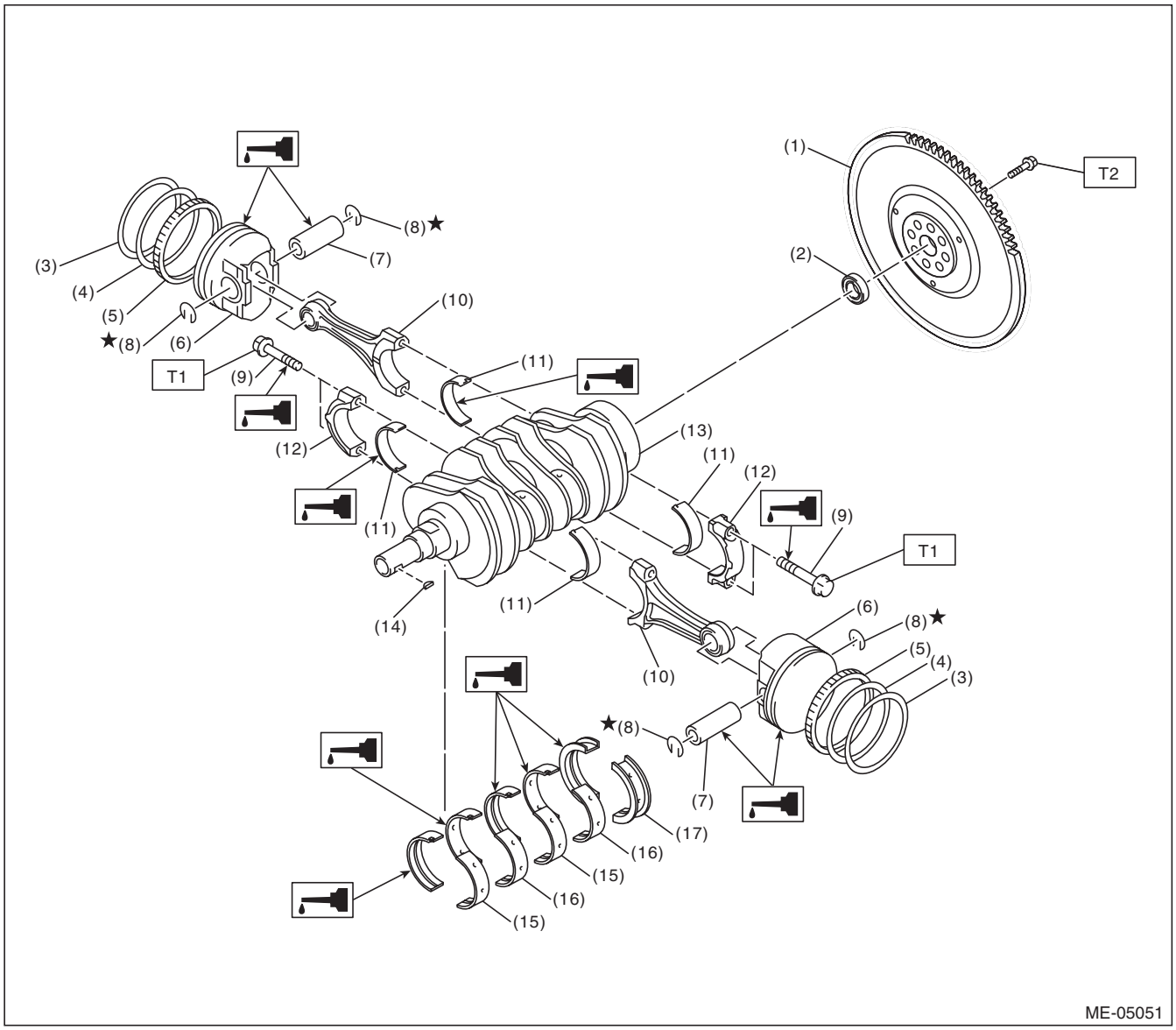


(1) Oil pressure switch
(2) Cylinder block RH
(3) Service hole plug
(4) Gasket
(5) Oil separator cover
(6) Water by-pass pipe
(7) Oil pump
(8) Front oil seal
(9) Rear oil seal
(10) O-ring
(11) Service hole cover
(12) Cylinder block LH
(13) Water pump
(14) Baffle plate
(15) Oil cooler
(16) Oil cooler pipe
(17) Connector
(18) Oil strainer
(19) Gasket
(20) Oil pan
(21) Drain plug
(22) Drain plug gasket
(23) Oil level gauge guide
(24) Oil filter
(25) Gasket
(26) Water pump hose
(27) Nipple
(28) Seal
(29) Washer
(30) Seal washer
(31) O-ring
(32) Gasket
(33) Intercooler stay (engine rear hanger)
(34) Oil pump seal
(35) Water pump sealing
(36) Oil cooler hose A
(37) Oil cooler hose B
(38) Oil cooler hose C
(39) Clip

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:	***First 12 (1.2, 8.9)***
	Second 12 (1.2, 8.9)
T5:	***16 (1.6, 11.8)***
T6:	***25 (2.5, 18.4)***
T7:	***44 (4.5, 32.5)***
T8:	***54 (5.5, 39.8)***
T9:	***69 (7.0, 50.9)***
T10:	***70 (7.1, 51.6)***
T11:	***<Ref. to ME(STI)-83, INSTALLATION, Cylinder Block.>***

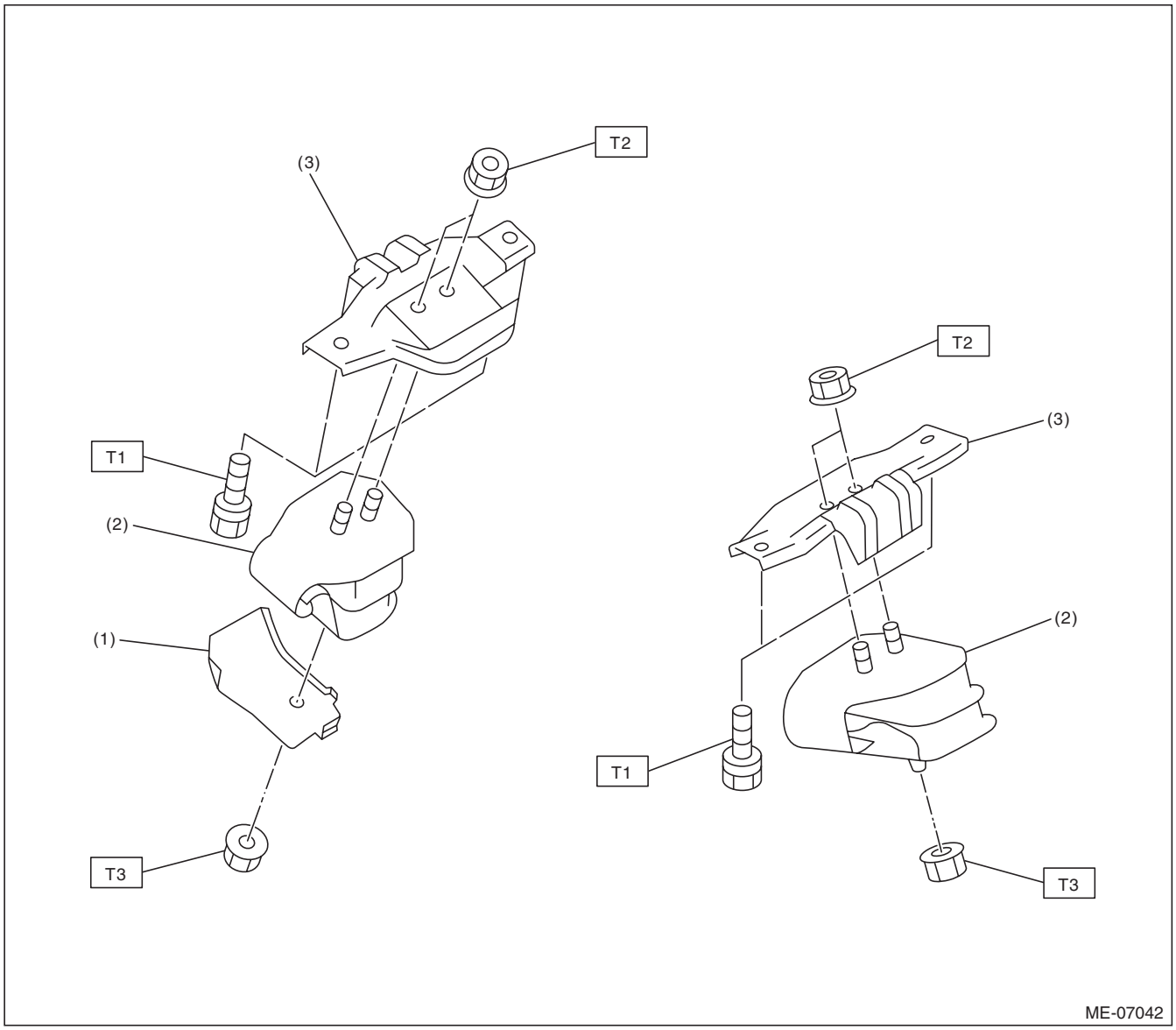
5. CRANKSHAFT AND PISTON



(1) Flywheel
(2) Ball bearing
(3) Top ring
(4) Second ring
(5) Oil ring
(6) Piston
(7) Piston pin
(8) Snap ring
(9) Connecting rod bolt
(10) Connecting rod
(11) Connecting rod bearing
(12) Connecting rod cap
(13) Crankshaft
(14) Woodruff key
(15) Crankshaft bearing #1, #3
(16) Crankshaft bearing #2, #4
(17) Crankshaft bearing #5

Tightening torque: N·m (kgf-m, ft-lb)
T1: 52 (5.3, 38.4)
T2: <Ref. to CL-14, INSTALLATION, Flywheel.>

6. ENGINE MOUNTING



(1) Heat shield cover
(2) Front cushion rubber
(3) Front engine mounting bracket

Tightening torque: N·m (kgf-m, ft-lb)
T1: 35 (3.6, 25.8)
T2: 42 (4.3, 31.0)
T3: 45 (4.6, 33.2)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use. When lifting up the vehicle, make sure to support the vehicle at the jack-up points.
- Be careful not to let any oil or grease contact the clutch disc or flywheel.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil when being assembled.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

1. SPECIAL TOOL

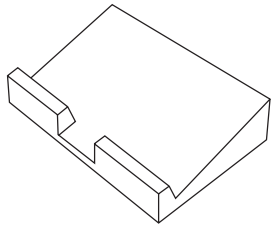
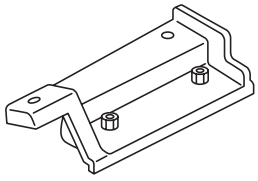
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498267600	498267600	CYLINDER HEAD TABLE	• Used for replacing valve guides. • Used for removing and installing valve spring.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used together with ENGINE STAND (499817100).

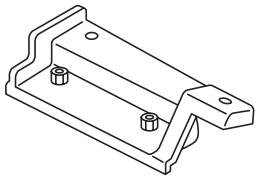
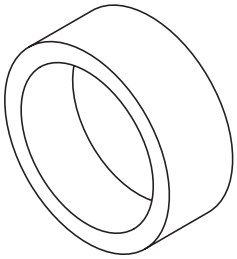
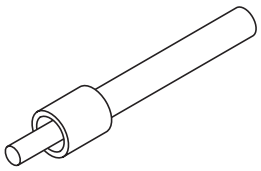
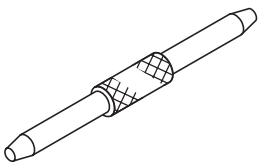
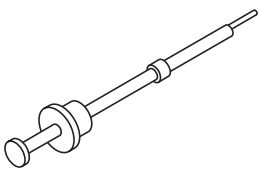
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used together with ENGINE STAND (499817100).
 ST-498747300	498747300	PISTON GUIDE	Used for installing the piston into the cylinder.
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake valve guide oil seals and exhaust valve guide oil seals.
 ST-499017100	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499097700	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.

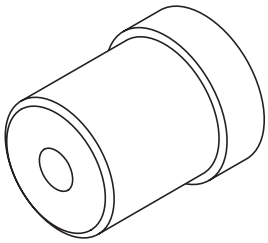
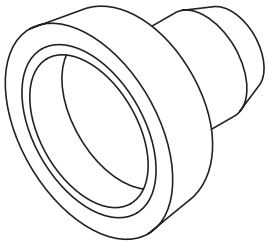
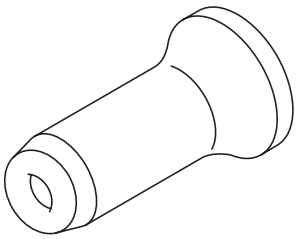
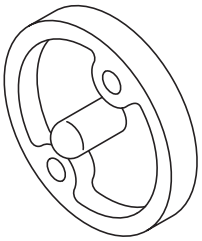
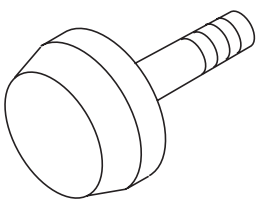
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used together with CRANKSHAFT OIL SEAL GUIDE (499597100).
 ST-499587600	499587600	OIL SEAL INSTALLER	Used for installing the camshaft oil seal.
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used for installing crankshaft oil seal. • Used together with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 ST-499597200	499597200	OIL SEAL GUIDE	• Used for installing the camshaft oil seal. • Used together with OIL SEAL INSTALLER (499587600).

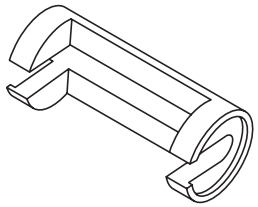
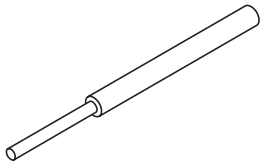
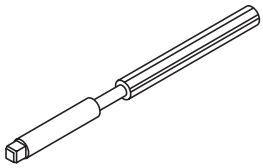
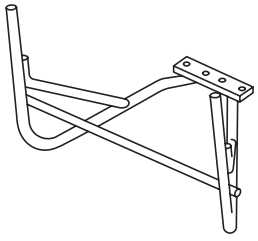
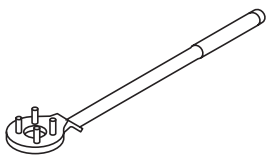
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499817100	499817100	ENGINE STAND	• Used for disassembling and assembling engine. • Used together with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for removing and installing the crank pulley.

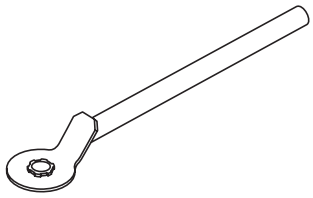
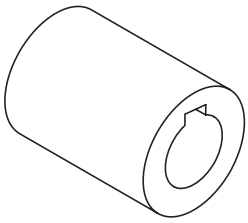
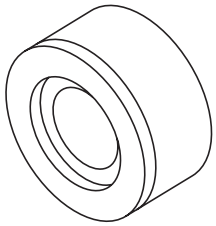
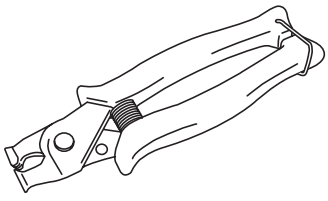
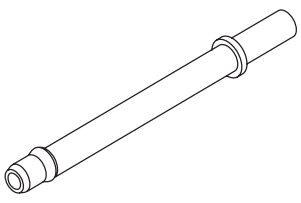
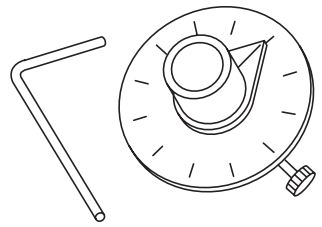
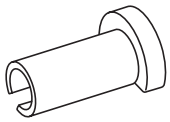
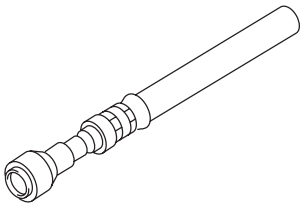
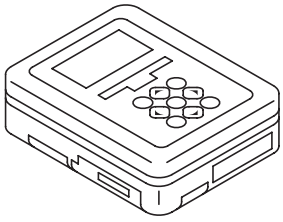
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket and exhaust cam sprocket.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 ST18251AA020	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake valve guides and exhaust valve guides.
 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.
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for inspecting the fuel pressure.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18854AA000	18854AA000	ANGLE GAUGE	Used for installing the crank pulley.
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing the quick connector.
 ST42075AG690	42075AG690	FUEL HOSE	Used for inspecting the fuel pressure. NOTE: This is the SUBARU genuine part.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for various inspections.

2. GENERAL TOOL

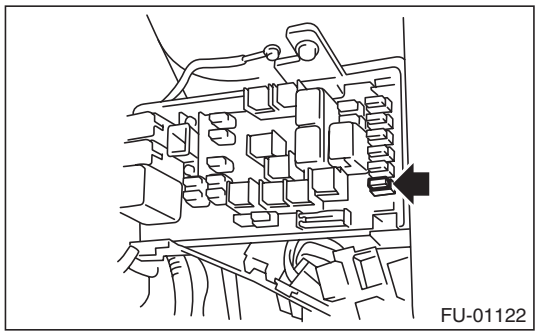
TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Timing light	Used for measuring ignition timing.
Vacuum gauge	Used for measuring intake manifold vacuum.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.

2. Compression

A: INSPECTION

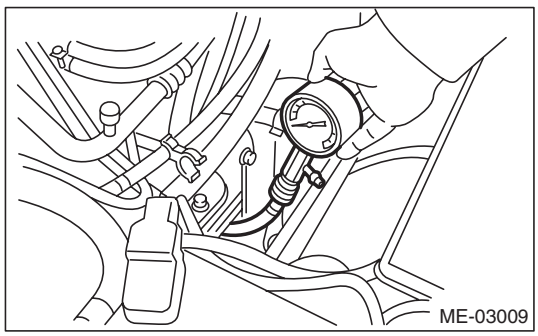
CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

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(STI)-4, REMOVAL, Spark Plug.>
8) Fully open the throttle valve.
9) Check the starter motor for satisfactory performance and operation.
10) Install the compression gauge to 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 starter motor and read the value when the needle of the compression gauge becomes stable.

NOTE:
• Perform at least two measurements per cylinder, and make sure that the values are correct.
• If the compression pressure is out of standard, check or adjust the pistons, valves and cylinders.

Compression (fully open throttle):
Standard
981 — 1,177 kPa (10 — 12 kgf/cm^2, 142 — 171 psi)
Difference between cylinders
49 kPa (0.5 kgf/cm^2, 7 psi) or less

12) 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(H4DOTC)(diag)-40, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

NOTE:
• Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted.
• If idle speed is out of standard, refer to the General Diagnosis Table under “Engine Control System”. <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>
   (1) 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 gear shift lever in neutral position):
Standard
700±100 rpm
   (2) 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 gear shift lever in neutral position):
Standard
750±100 rpm

4. Ignition Timing

A: INSPECTION

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself at measurement.

1. METHOD WITH SUBARU SELECT MONITOR

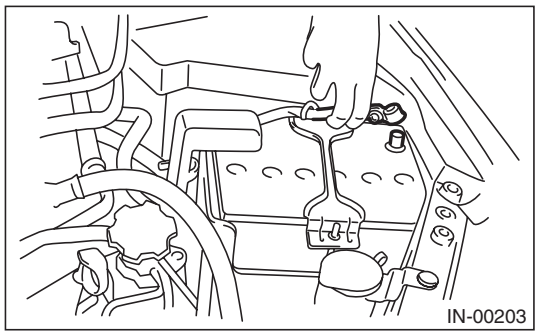
1) Before checking the ignition timing, check the following item:
   (1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Read the ignition timing using Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-40, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

NOTE:
If ignition timing is out of standard, check the ignition control system. Refer to “Engine Control System”. <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

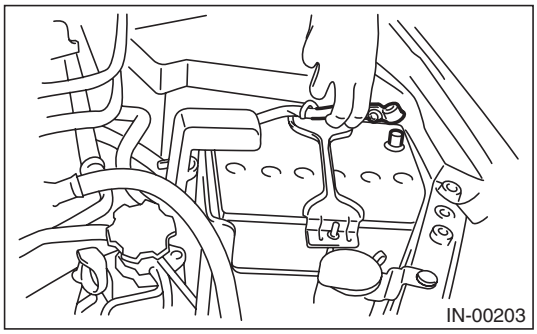
Ignition timing [BTDC/rpm]:
Standard
15°±10°/700

2. METHOD WITH TIMING LIGHT

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) Disconnect the ground cable from battery.



5) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
6) Remove the air cleaner case. <Ref. to IN(STI)-8, REMOVAL, Air Cleaner Case.>
7) Connect the timing light to the power wire of #1 ignition coil.
8) Install the air cleaner case. <Ref. to IN(STI)-8, INSTALLATION, Air Cleaner Case.>
9) Connect the battery ground terminal.



10) Start the engine, turn the timing light to the crank pulley, and check the ignition timing through the timing belt cover gauge.

NOTE:
If ignition timing is out of standard, check the ignition control system. Refer to “Engine Control System”. <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

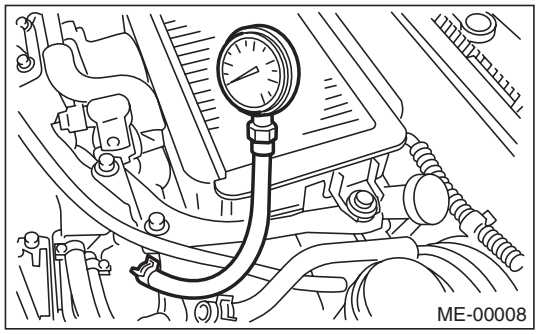
Ignition timing [BTDC/rpm]:
Standard
15°±10°/700

11) After inspection, install the related parts in the reverse order of removal.

5. Intake Manifold Vacuum

A: INSPECTION

1) Warm up the engine.
2) Disconnect the brake booster vacuum hose from the intake manifold, and attach the vacuum gauge.



3) Keep the engine at idle speed and read the vacuum gauge indication.

NOTE:
Condition of engine inside can be diagnosed by observing the behavior of the vacuum gauge needle as described in table below.

Intake manifold vacuum (at idling, A/C OFF):
Standard
–65.3 kPa (–490 mmHg, –19.29 inHg) or more

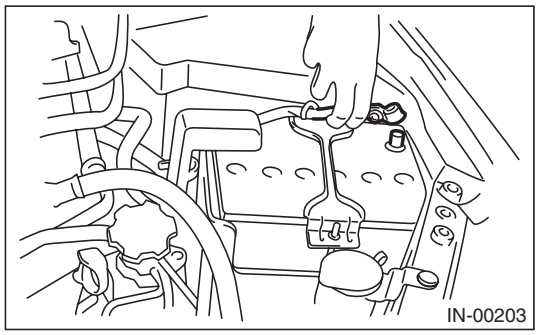
4) After inspection, install the related parts in the reverse order of removal.

Diagnosis of engine condition by inspection of intake manifold vacuum	
Vacuum gauge needle behavior	Possible engine condition
1. Needle is steady but lower than standard value. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket, disconnection or damage of vacuum hose
2. Needle intermittently drops to position lower than standard value.	Leakage around cylinder
3. Needle drops suddenly and intermittently from standard value.	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 standard value in narrow range.	Defective ignition system

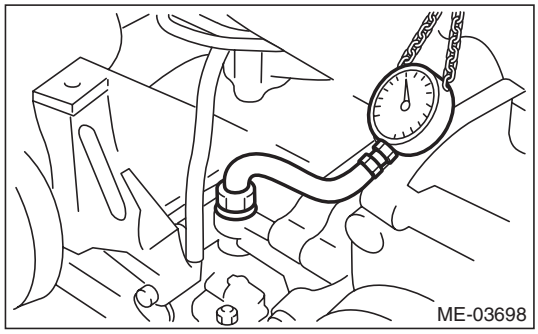
6. Engine Oil Pressure

A: INSPECTION

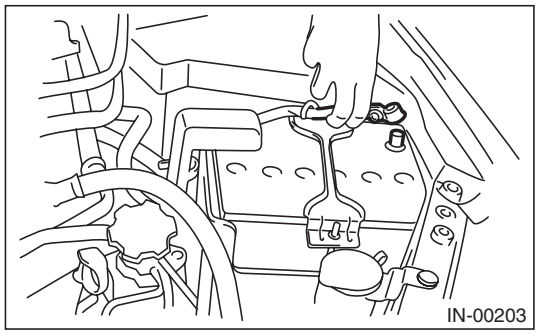
1) Disconnect the ground cable from battery.



2) Remove the oil pressure switch. <Ref. to LU(STI)-22, REMOVAL, Oil Pressure Switch.>
3) Install the oil pressure gauge to cylinder block.



4) Connect the battery ground terminal.



5) Start the engine, and check the oil pressure.

NOTE:
• Standard value is based on an engine oil temperature of 80°C (176°F).
• If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(STI)-32, 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(STI)-32, INSPECTION, Engine Lubrication System Trouble in General.>

Engine oil pressure:
Standard
98 kPa (1.0 kgf/cm^2, 14 psi) or more (at 600 rpm)
392 kPa (4.0 kgf/cm^2, 57 psi) or more (at 6,000 rpm)

6) After inspection, install the related parts in the reverse order of removal.

7. Fuel Pressure

A: INSPECTION

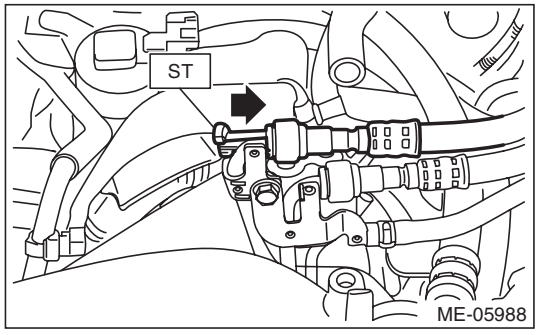
CAUTION:
• Before removing the fuel pressure gauge, release the fuel pressure.
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

1) Release the fuel pressure. <Ref. to FU(STI)-67, 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 delivery pipe, and connect the fuel pressure gauge.

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

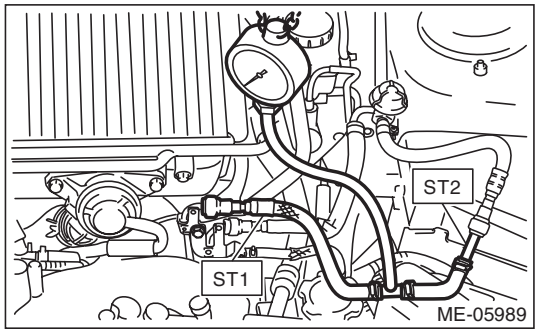
(1) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the quick connector of the fuel delivery hose.

ST 42099AE000 QUICK CONNECTOR RELEASE



(2) Connect the fuel pressure gauge with ST1 and ST2.

NOTE:
ST1 is a SUBARU genuine part.
ST1 42075AG690 FUEL HOSE
ST2 18471AA000 FUEL PIPE ADAPTER



4) Start the engine.
5) Check the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold.

NOTE:
• The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.
• If the fuel pressure is out of specification, check or replace the fuel pump, fuel line, pressure regulator & damper assembly, and pressure regulator vacuum hose.

Fuel pressure:
Standard
284 — 314 kPa (2.9 — 3.2 kgf/cm^2, 41 — 46 psi)

6) After connecting the vacuum hose to the pressure regulator, check the fuel pressure again.

NOTE:
• The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.
• If the fuel pressure is out of specification, check or replace the fuel pump, fuel line, pressure regulator & damper assembly, and pressure regulator vacuum hose.

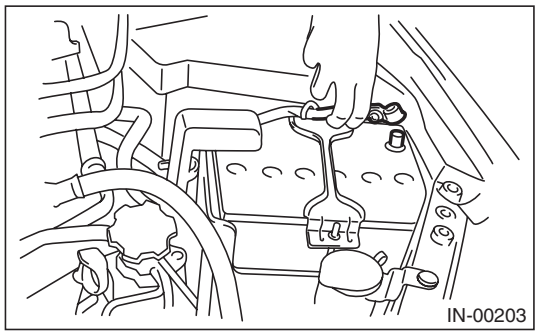
Fuel pressure:
Standard
230 — 260 kPa (2.4 — 2.7 kgf/cm^2, 33 — 38 psi)

7) After inspection, install the related parts in the reverse order of removal.

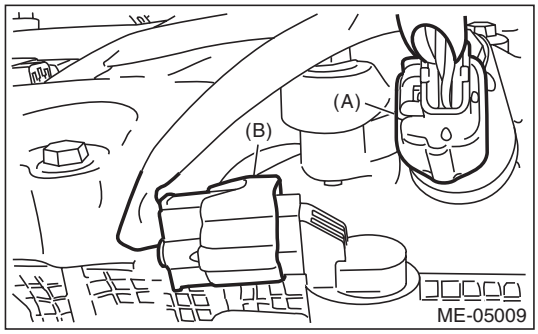
8. Valve Clearance

A: INSPECTION

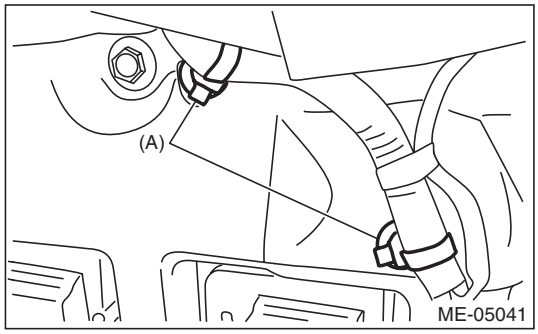
1) Disconnect the ground cable from battery.



2) Remove the engine from vehicle. <Ref. to ME(STI)-29, REMOVAL, Engine Assembly.>
3) Remove the timing belt cover RH. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.>
4) When inspecting #1 and #3 cylinders
(1) Disconnect the connector (A) from the exhaust camshaft position sensor RH and the connector (B) form the exhaust oil flow control solenoid valve RH.

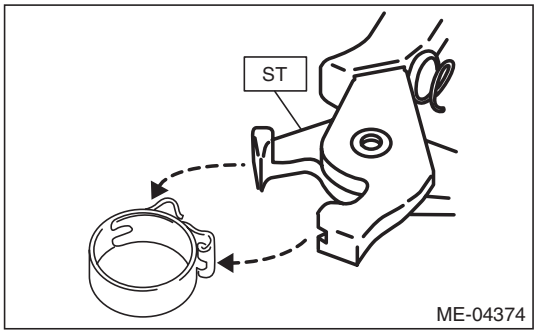


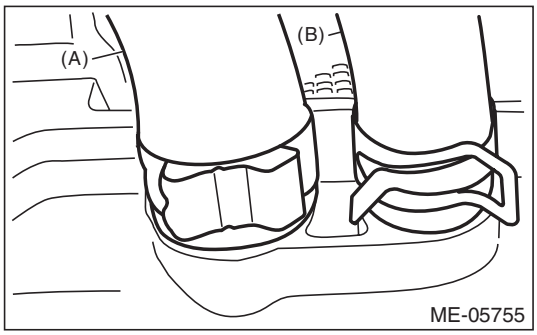
(2) Remove the clip (A) which hold the engine harness to the rocker cover RH.



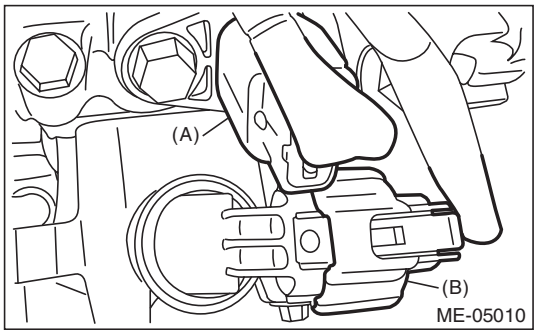
(3) Remove the ignition coil. <Ref. to IG(STI)-7, REMOVAL, Ignition Coil.>
(4) Disconnect PCV hose (A) and vacuum hose (B) from the rocker cover RH.

NOTE:
Pinch the clamp of the PCV hose (A) by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS

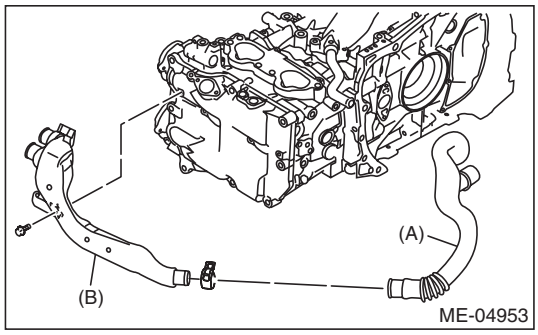




(5) Remove the rocker cover RH.
5) When inspecting #2 and #4 cylinders
(1) Remove the secondary air pump. <Ref. to EC(STI)-27, REMOVAL, Secondary Air Pump.>
(2) Disconnect the connector (A) from the exhaust camshaft position sensor LH and the connector (B) form the exhaust oil flow control solenoid valve LH.

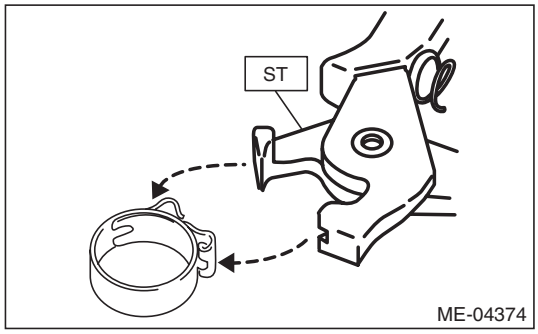


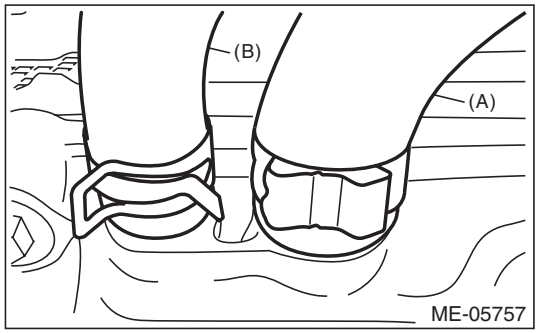
(3) Remove the air duct B (B) from the rocker cover LH and the air duct A (A).



(4) Remove the ignition coil. <Ref. to IG(STI)-7, REMOVAL, Ignition Coil.>
(5) Disconnect PCV hose (A) and vacuum hose (B) from the rocker cover LH.

NOTE:
Pinch the clamp of the PCV hose (A) by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS



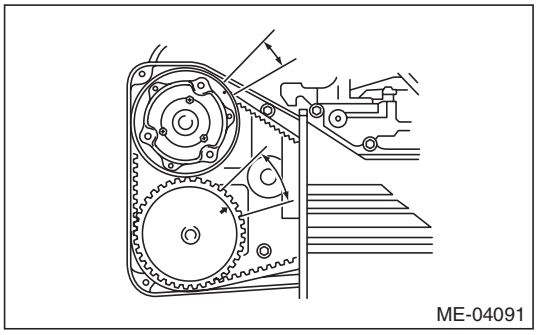


(6) Remove the rocker cover LH.

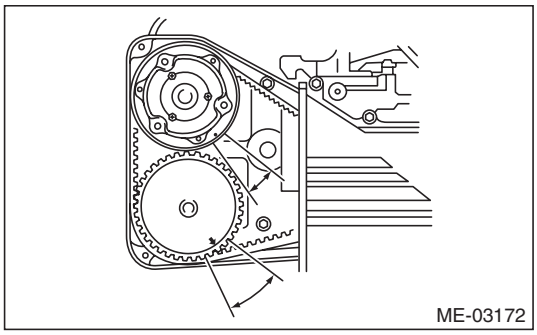
6) Turn the crank pulley clockwise until the round mark and arrow mark on the cam sprocket are set to position shown in the figure.

NOTE:
Turn the crank pulley using a socket wrench.

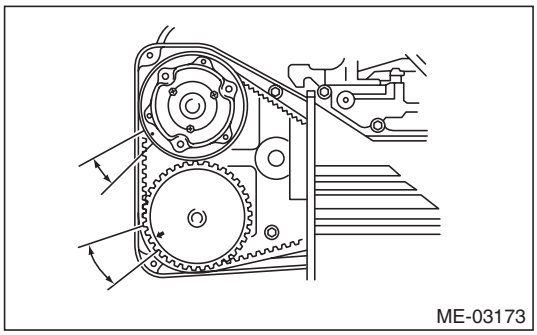
• Measurement of clearance of #1 cylinder intake valve and #3 cylinder exhaust valve



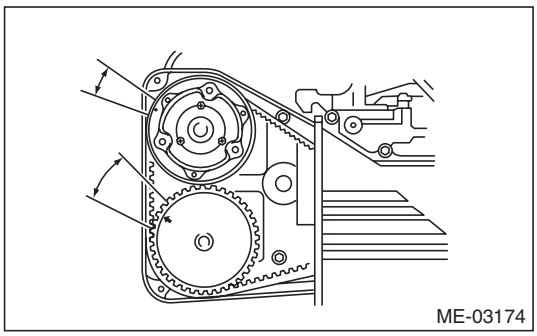
• Measurement of clearance of #2 cylinder exhaust valve and #3 cylinder intake valve



• Measurement of clearance of #2 cylinder intake valve and #4 cylinder exhaust valve



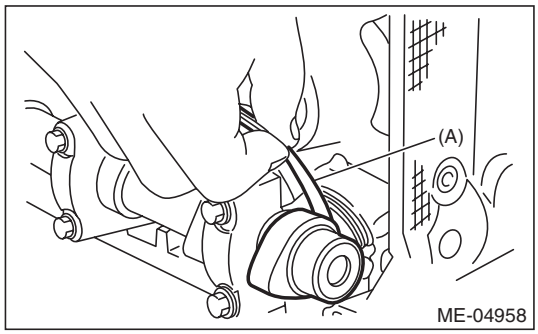
• Measurement of clearance of #1 cylinder exhaust valve and #4 cylinder intake valve



7) Measure the clearance of intake valve and exhaust valve using thickness gauge (A).

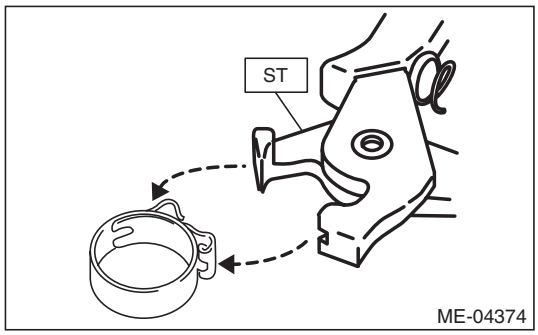
NOTE:
• Insert a thickness gauge in a direction as horizontal as possible with respect to the valve lifter.
• Lift up the vehicle, and then measure the exhaust valve clearances.
• If the measured value is not within the inspection value, take notes of the value in order to adjust the valve clearance later on.

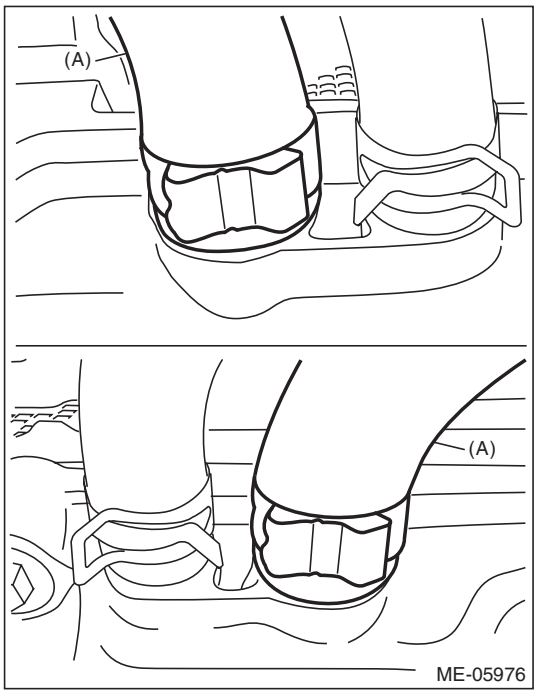
Valve clearance (inspection value):
Intake
$0.20^{+0.04}_{-0.06}$ mm ($0.0079^{+0.0016}_{-0.0024}$ in)
Exhaust
0.35±0.05 mm (0.0138±0.0020 in)



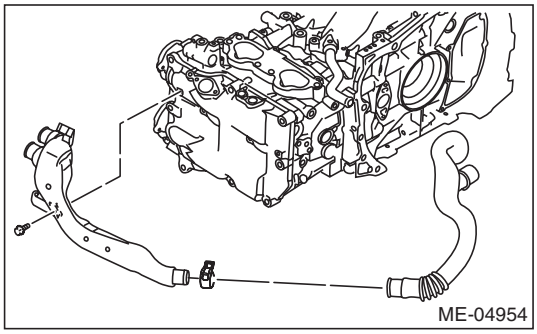
8) If necessary, adjust the valve clearance. <Ref. to ME(STI)-28, ADJUSTMENT, Valve Clearance.>
9) After inspection, install the related parts in the reverse order of removal.

NOTE:
• Refer to “Camshaft” when installing the rocker cover. <Ref. to ME(STI)-63, INSTALLATION, Camshaft.>
• Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS





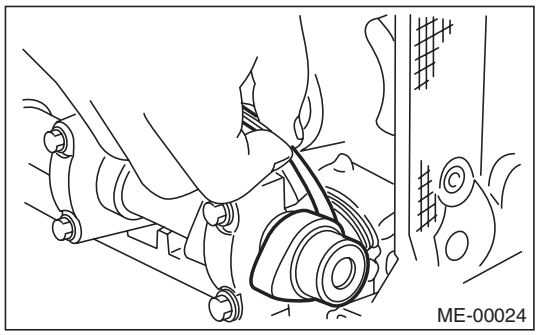
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



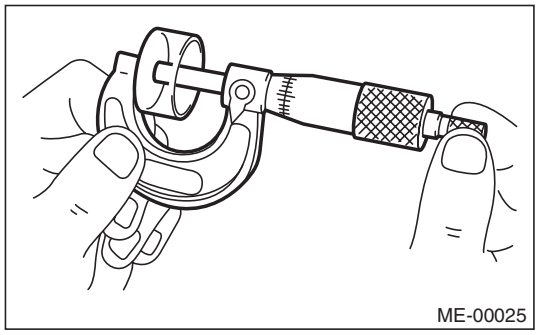
B: ADJUSTMENT

1) Measure all the valve clearances. <Ref. to ME(STI)-25, INSPECTION, Valve Clearance.>

NOTE:
Record the measured value of each valve clearance.



2) Remove the camshaft. <Ref. to ME(STI)-60, REMOVAL, Camshaft.>
3) Remove the valve lifter.
4) Measure the thickness of valve lifter using micrometer.



5) Select a valve lifter of suitable thickness using the measured valve clearance and valve lifter thickness, and install it.

NOTE:
Use a new valve lifter.

Unit: mm (in)
Intake valve: S = (V + T) – 0.19 (0.0075) Exhaust valve: S = (V + T) – 0.35 (0.0138)
S: Valve lifter thickness required V: Measured valve clearance T: Valve lifter thickness to be used

6) Install the camshaft. <Ref. to ME(STI)-63, INSTALLATION, Camshaft.>
7) Install the cam sprocket. <Ref. to ME(STI)-58, INSTALLATION, Cam Sprocket.>
8) Install the timing belt. <Ref. to ME(STI)-52, TIMING BELT, INSTALLATION, Timing Belt.>
9) Measure all valves for valve clearance again at this time. If the valve clearance is not within the adjustment value, repeat the procedure over again from step 2).

Valve clearance (adjustment value):
Intake
$0.20^{+0.01}_{-0.03}$ mm ($0.0079^{+0.0004}_{-0.0012}$ in)
Exhaust
0.35±0.02 mm (0.0138±0.0008 in)

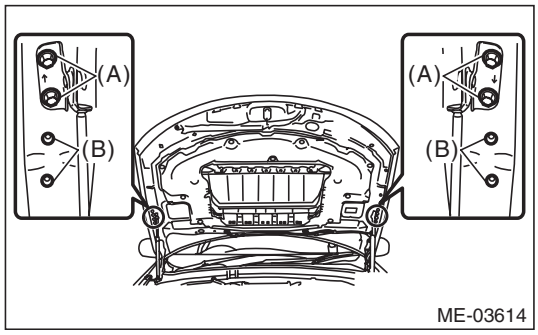
10) After adjustment, install the related parts in the reverse order of removal.

9. Engine Assembly

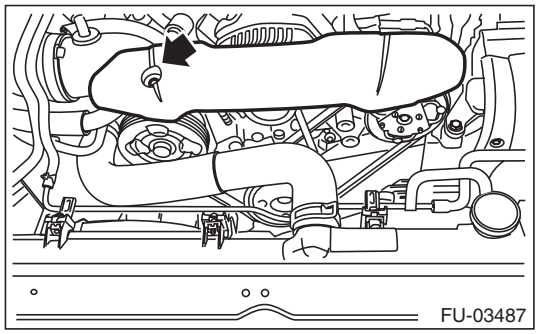
A: REMOVAL

1) Change the bolt installation position from (A) to (B), then open the front hood completely.

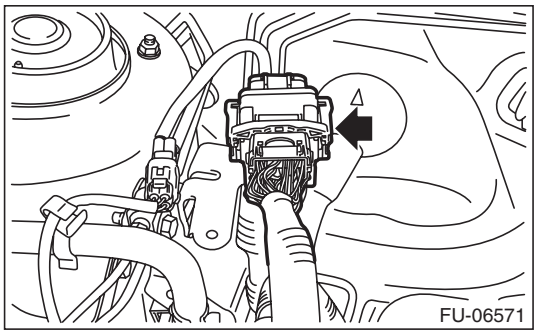
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



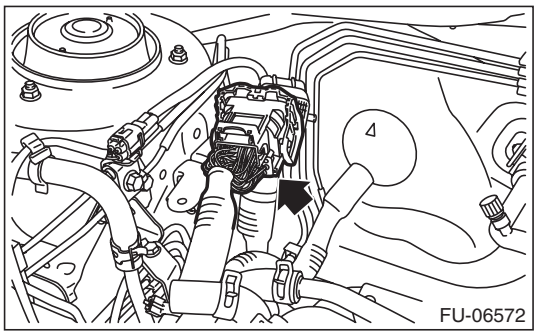
2) Remove the V-belt covers.



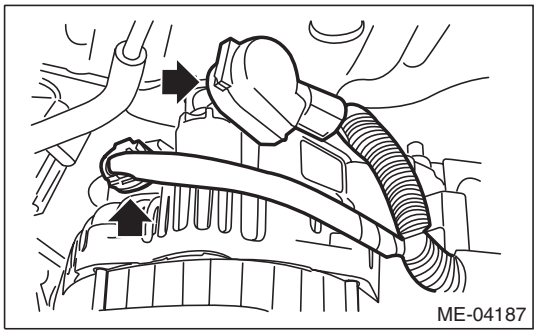
3) Collect the refrigerant from A/C system. <Ref. to AC-19, Refrigerant Recovery Procedure.>
4) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
5) Remove the battery. <Ref. to SC(STI)-27, REMOVAL, Battery.>
6) Open the fuel filler lid and remove the fuel filler cap.
7) Remove the air intake duct and air cleaner case. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.> <Ref. to IN(STI)-8, REMOVAL, Air Cleaner Case.>
8) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.>
9) Remove the radiator. <Ref. to CO(STI)-19, REMOVAL, Radiator.>
10) Remove the coolant filler tank. <Ref. to CO(STI)-28, REMOVAL, Coolant Filler Tank.>
11) Disconnect the bulkhead harness connectors from the engine harness connectors.



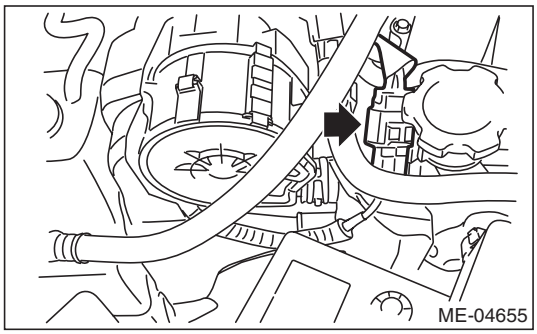
12) Remove the engine harness connector from the engine harness bracket.



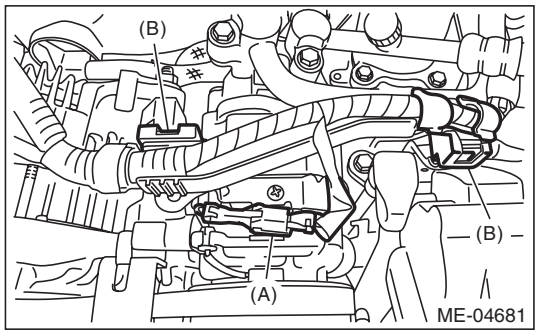
13) Disconnect the following connectors and terminals.
(1) Generator connector and terminal



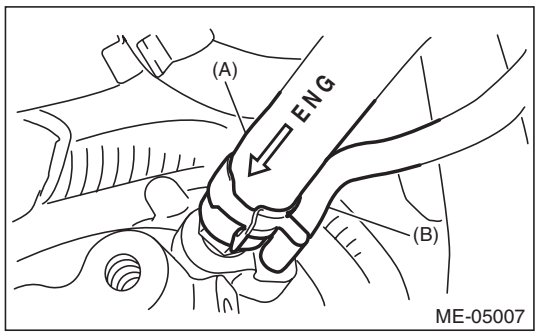
(2) Secondary air pump connector



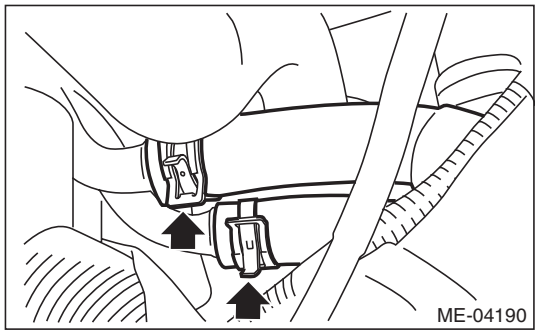
14) Disconnect the connector (A) from the A/C compressor, and remove the clip (B) securing the generator cord.



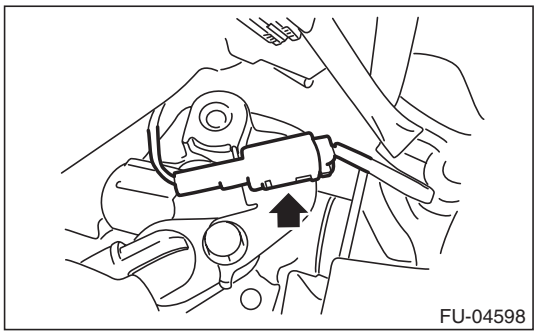
15) Disconnect the following hoses.
(1) A/C pressure hose <Ref. to AC-38, REMOVAL, Hose and Pipe.>
(2) Brake booster vacuum hose (A) and pressure regulator vacuum hose (B)



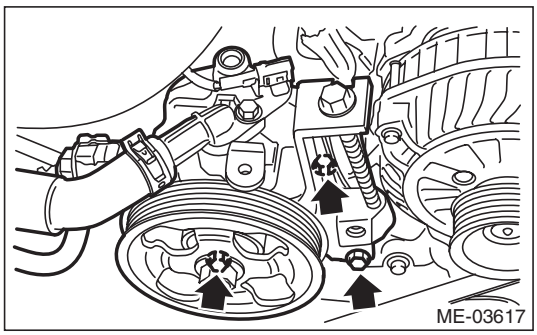
(3) Heater inlet hose and heater outlet hose



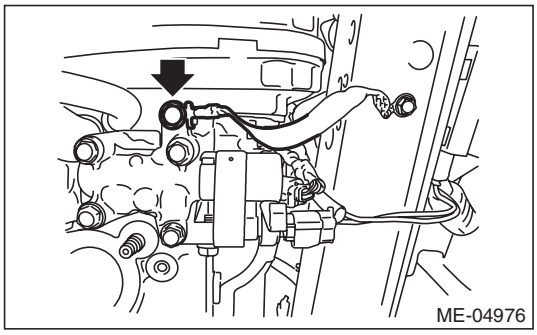
16) Remove the power steering pump.
(1) Remove the front side belts. <Ref. to ME(STI)-39, FRONT SIDE BELT, REMOVAL, V-belt.>
(2) Disconnect the connector from power steering pump switch.



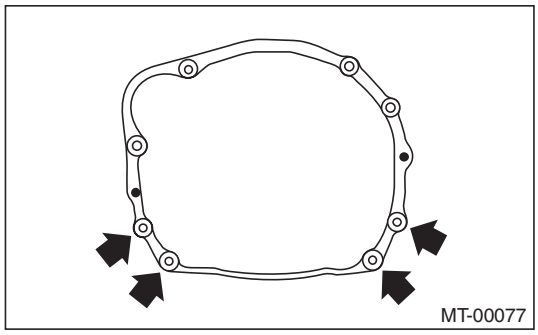
(3) Remove the power steering pump from the engine.



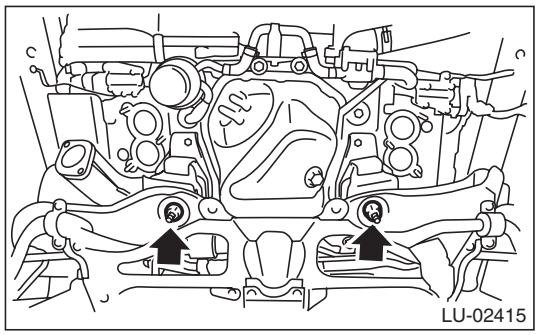
(4) Place the power steering pump on the right side wheel apron.
17) Remove the center exhaust pipe. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>
18) Remove the turbocharger. <Ref. to IN(STI)-15, REMOVAL, Turbocharger.>
19) Remove the joint pipe and front exhaust pipe. <Ref. to EX(STI)-12, REMOVAL, Joint Pipe.> <Ref. to EX(STI)-6, REMOVAL, Front Exhaust Pipe.>
20) Disconnect the ground cable on the engine side.



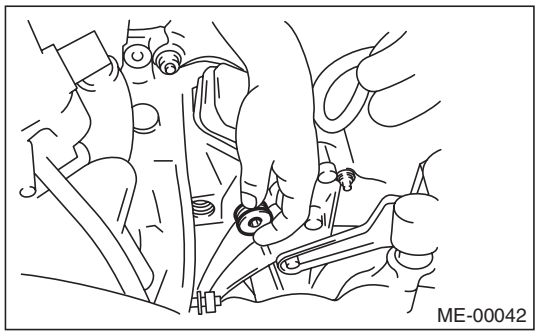
21) Remove the bolts and nuts which hold the lower side of transmission to the engine.



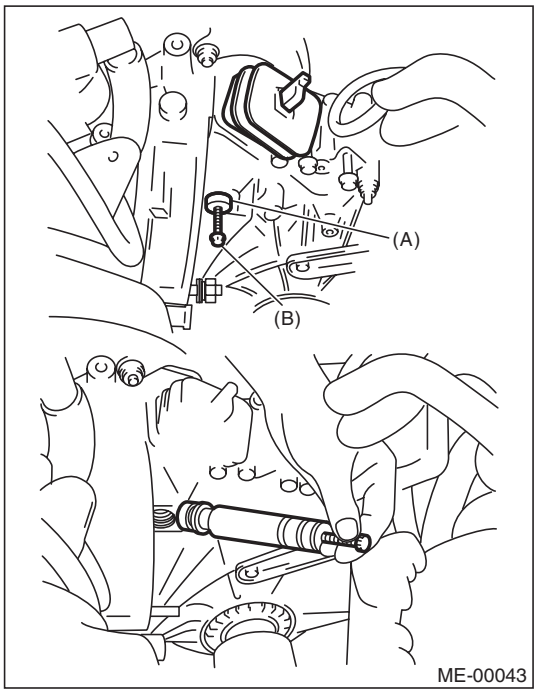
22) Remove the nuts which secure the engine mounting to the front crossmember.



23) Lower the vehicle.
24) Remove the starter. <Ref. to SC(STI)-8, REMOVAL, Starter.>
25) Separate the clutch release fork from the release bearing.
(1) Remove the clutch operating cylinder from the transmission.
(2) Remove the service hole plug using a hexagon wrench (10 mm).



(3) Screw-in the 6 mm dia. bolt into the release fork shaft to remove.

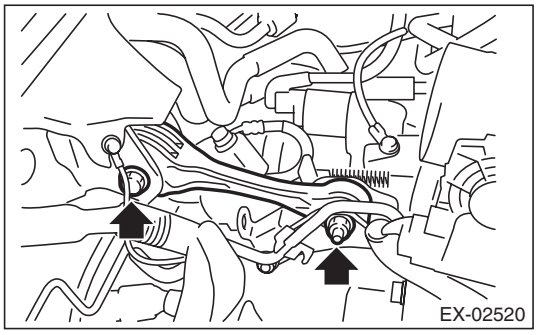


(A) Release fork shaft
(B) Bolt

(4) Raise the release fork, unlock the release bearing tab, then remove the release fork.

NOTE:
Step (4) is required to avoid interference with the engine when removing the engine from the transmission.

26) Remove the pitching stopper.



27) Disconnect the fuel delivery hose, fuel return hose and evaporation hose.

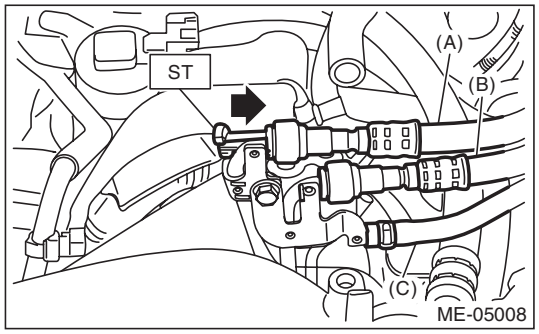
CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

(1) Set the ST to the fuel pipe.

ST 42099AE000 QUICK CONNECTOR RELEASE

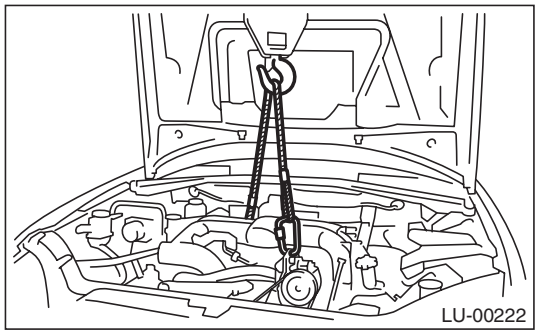
(2) Disconnect the quick connector of the fuel delivery hose and fuel return hose by pushing the ST in the direction of the arrow.

(3) Remove the clip and disconnect the evaporation hose from the fuel pipe.



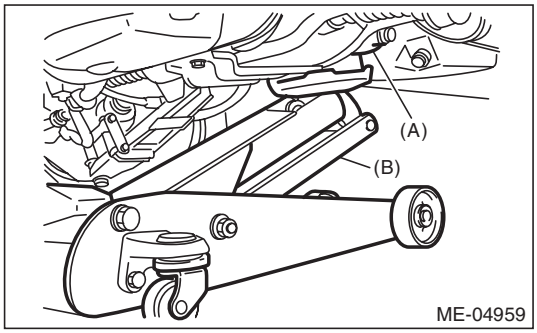
(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

28) Support the engine with a lifting device and wire ropes.



29) Support the transmission with a garage jack.

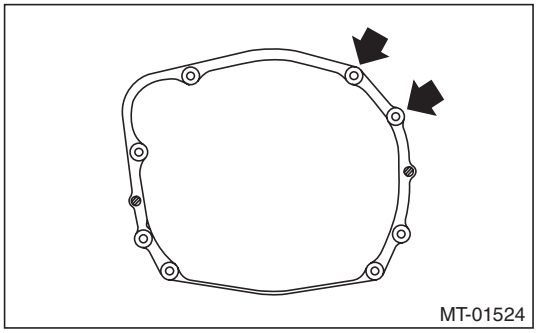
CAUTION:
Be sure to perform this procedure to prevent the transmission from lowering by its own weight.



(A) Transmission
(B) Garage jack

30) Remove the bolts which hold the upper side of the transmission to the engine.

CAUTION:
Before removing the engine away from transmission, check to be sure no work has been overlooked.



31) Remove the engine from the vehicle.

NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

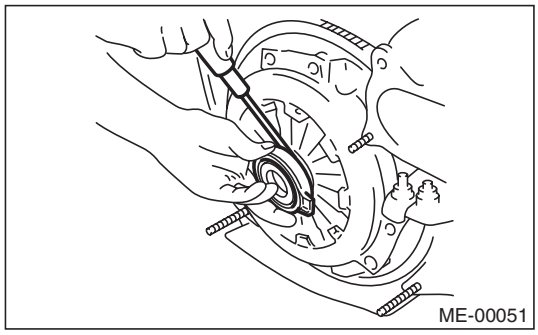
(1) Slightly raise the engine.
(2) Raise the transmission with garage jack.
(3) Move the engine horizontally until main shaft is withdrawn from clutch cover.
(4) Slowly move the engine away from engine compartment.

32) Remove the engine mounting from the engine.

B: INSTALLATION

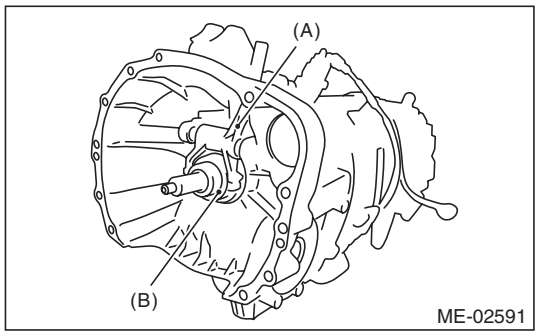
1) Install the clutch release fork and bearing to the transmission.

(1) Using a flat tip screwdriver, remove the release bearing from the clutch cover.



(2) Attach the release bearing to the transmission.

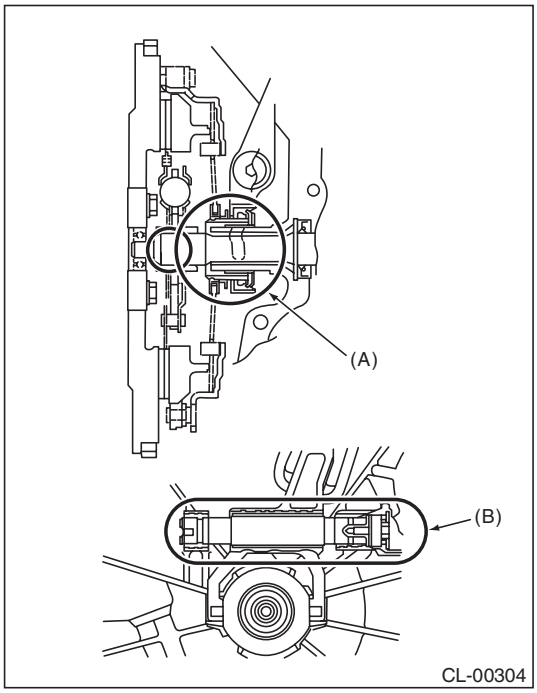
(3) Install the release fork into the release bearing tab.



(A) Release fork
(B) Release bearing

(4) Apply grease to the specified areas.

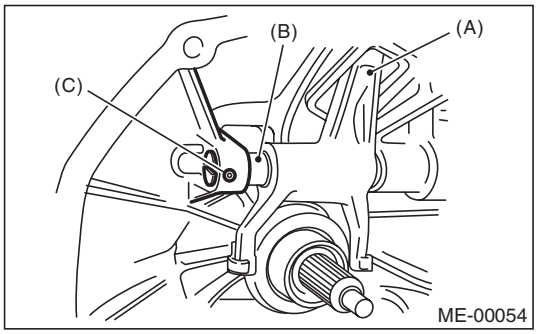
Grease:
Spline part
NICHIMOLY N-130 or equivalent
Shaft part
KOPR-KOTE or equivalent



(A) Spline
(B) Shaft

(5) Insert the release shaft to release fork.

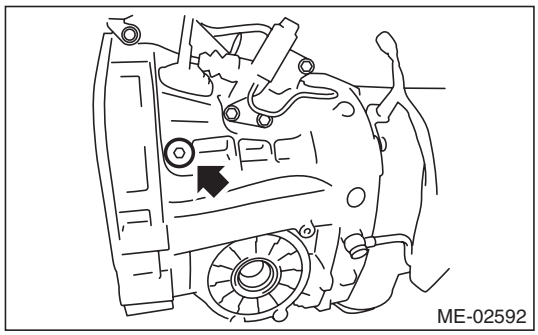
NOTE:
Allow the cutout portion of release shaft to come into contact with the spring pin.



(A) Release fork
(B) Release shaft
(C) Spring pin

(6) Install the service hole plug.

Tightening torque:
44 N·m (4.5 kgf-m, 32.5 ft-lb)



2) Install the engine mounting onto the engine.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

3) Apply a small amount of grease to splines of main shaft.

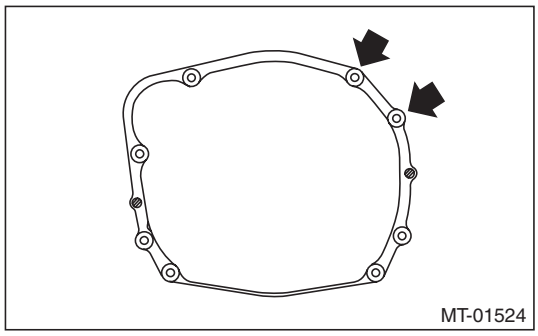
Grease:
NICHIMOLY N-130 or equivalent

4) Position the engine in engine compartment and align it with transmission.

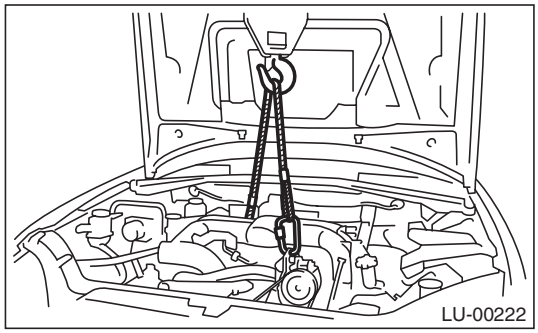
NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

5) Install the bolts which hold upper side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



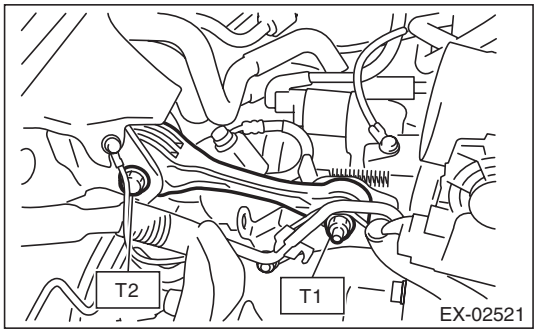
6) Remove the lifting device and wire ropes.



7) Remove the garage jack.

8) 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)

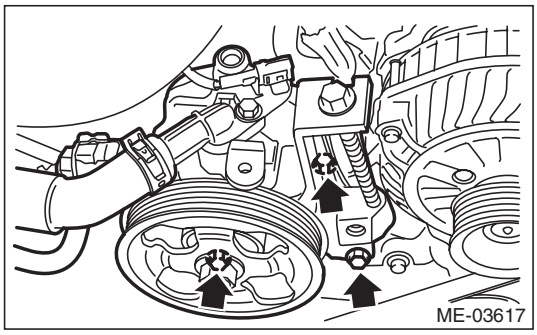


9) Install the starter. <Ref. to SC(STI)-8, INSTALLATION, Starter.>

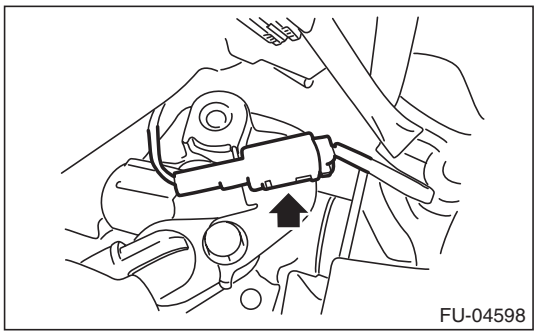
10) Install the power steering pump.

(1) Install the power steering pump onto the engine.

Tightening torque:
Refer to "COMPONENT" of "Power Steering" for the tightening torque. <Ref. to PS-4, COMPONENT, General Description.>



(2) Connect the connector to the power steering pump switch.

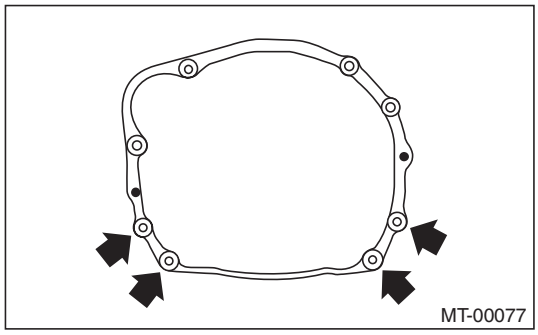


(3) Install the front side belt. <Ref. to ME(STI)-39, FRONT SIDE BELT, INSTALLATION, V-belt.>

11) Lift up the vehicle.

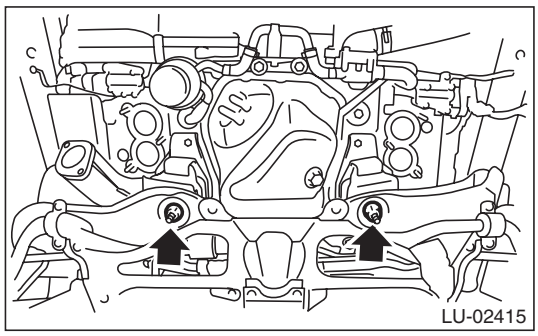
12) Install the bolts and nuts which hold lower side of the transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



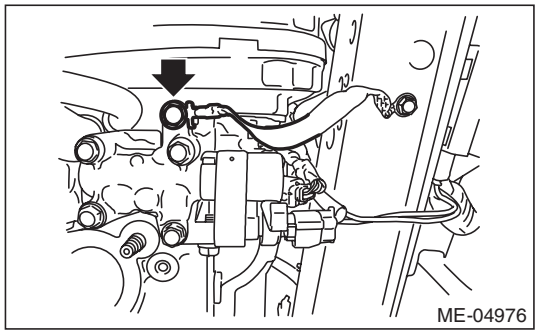
13) Install the nuts which hold the engine mounting to the crossmember.

Tightening torque:
45 N·m (4.6 kgf-m, 33.2 ft-lb)

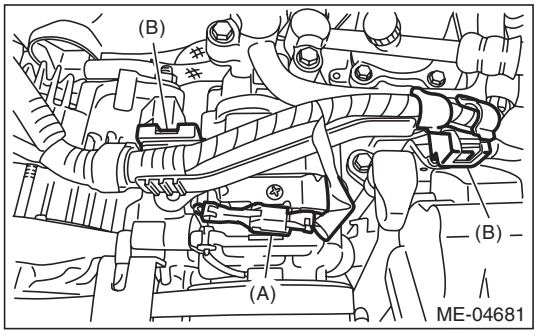


14) Connect the ground cable.

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



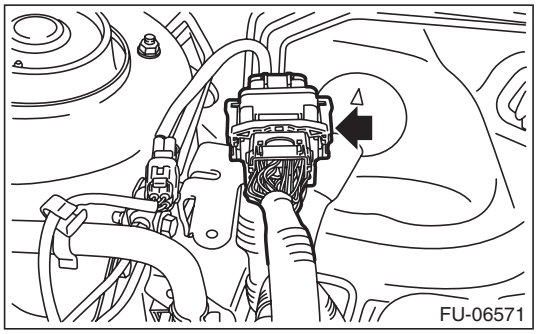
15) Install the joint pipe and front exhaust pipe. <Ref. to EX(STI)-6, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(STI)-12, INSTALLATION, Joint Pipe.>
16) Install the turbocharger. <Ref. to IN(STI)-16, INSTALLATION, Turbocharger.>
17) Install the center exhaust pipe. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>
18) Connect the following hoses.
(1) Fuel delivery hose, fuel return hose and evaporation hose
(2) Heater inlet hose and heater outlet hose
(3) Brake booster vacuum hose and pressure regulator vacuum hose
(4) A/C pressure hose <Ref. to AC-38, INSTALLATION, Hose and Pipe.>
19) Secure the generator cord using the clip (B) and connect the connector (A) to A/C compressor.



20) Connect the following connectors and terminals.
(1) Generator connector and terminal

Tightening torque:
15 N·m (1.5 kgf-m, 11.1 ft-lb)
(2) Secondary air pump connector

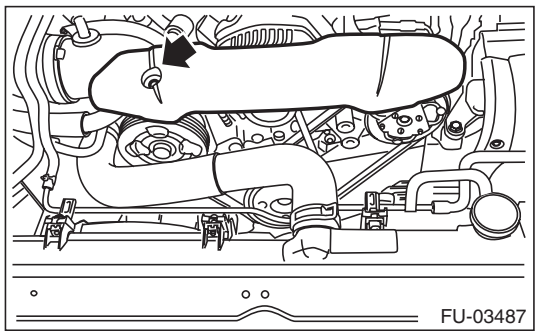
21) Install the engine harness connector to engine harness bracket, then connect the bulkhead harness connector to the engine harness connector.



22) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.>
23) Install the radiator. <Ref. to CO(STI)-20, INSTALLATION, Radiator.>
24) Install the coolant filler tank. <Ref. to CO(STI)-28, INSTALLATION, Coolant Filler Tank.>
25) Install the air cleaner case and air intake duct. <Ref. to IN(STI)-8, INSTALLATION, Air Cleaner Case.> <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
26) Install the battery. <Ref. to SC(STI)-27, INSTALLATION, Battery.>
27) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

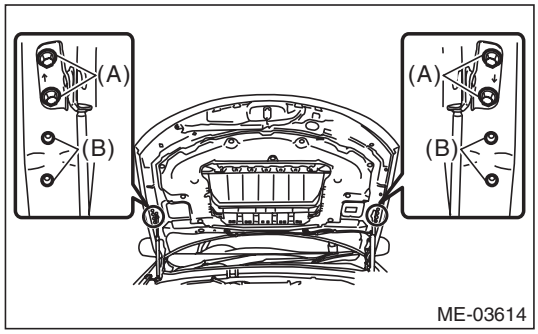
28) Charge the A/C system with refrigerant. <Ref. to AC-20, PROCEDURE, Refrigerant Charging Procedure.>
29) Install the V-belt cover.

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) 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 from the vehicle. <Ref. to ME(STI)-29, REMOVAL, Engine Assembly.>
2) Remove the engine mounting from the engine.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

C: INSPECTION

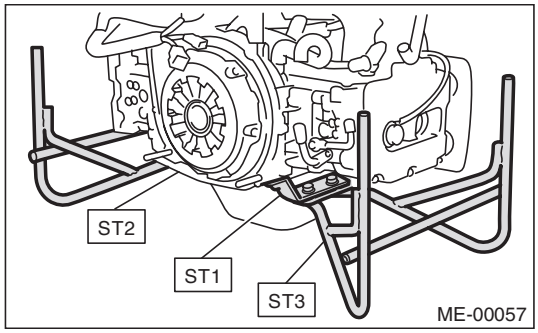
Make sure that no crack or other damages do not exist.

11.Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from vehicle body, attach the ST to the engine as shown in the figure.

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.

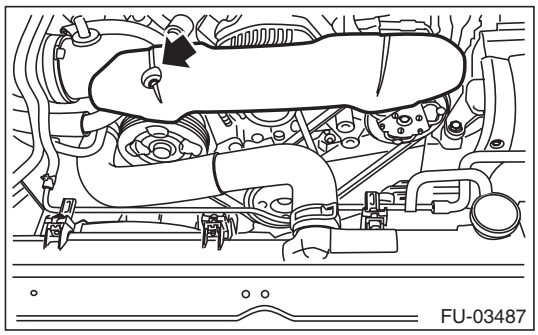
12.V-belt

A: REMOVAL

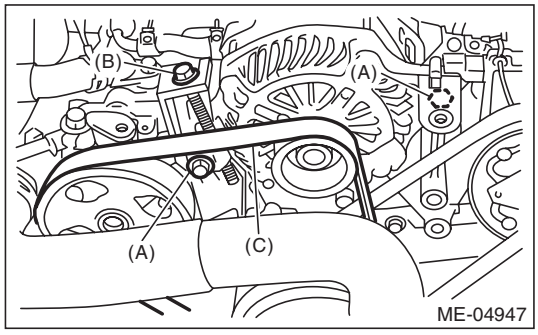
NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.

1. FRONT SIDE BELT

1) Remove the V-belt covers.

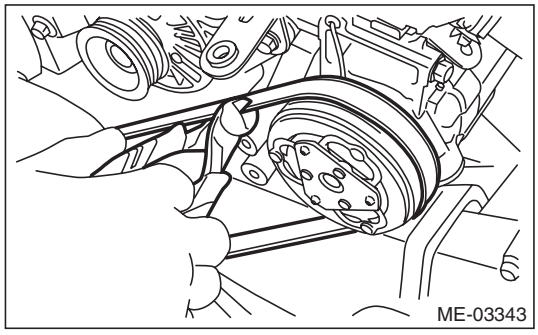


2) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
3) Loosen the bolt (A).
4) Loosen the slider bolt (B).
5) Remove the front side belt (C).



2. REAR SIDE BELT

1) Remove the front side belts. <Ref. to ME(STI)-39, FRONT SIDE BELT, REMOVAL, V-belt.>
2) Cut the rear side belt with a wire cutter, etc., and discard.

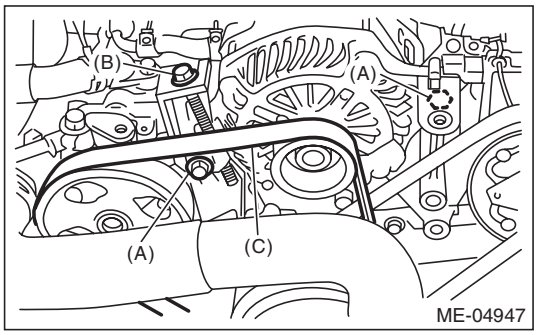


B: INSTALLATION

1. FRONT SIDE BELT

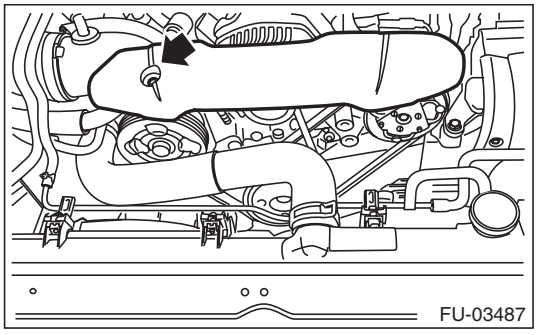
CAUTION:
• When reusing the front side belt, wipe off dust and water with cloth.
• Do not use the front side belt if there is any oil, grease or coolant on the belt.
• Be careful not to rub the belt end surface with bare hands; exposed core may cause injury.
1) Wipe off any dust, oil and water on the 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(STI)-45, 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)



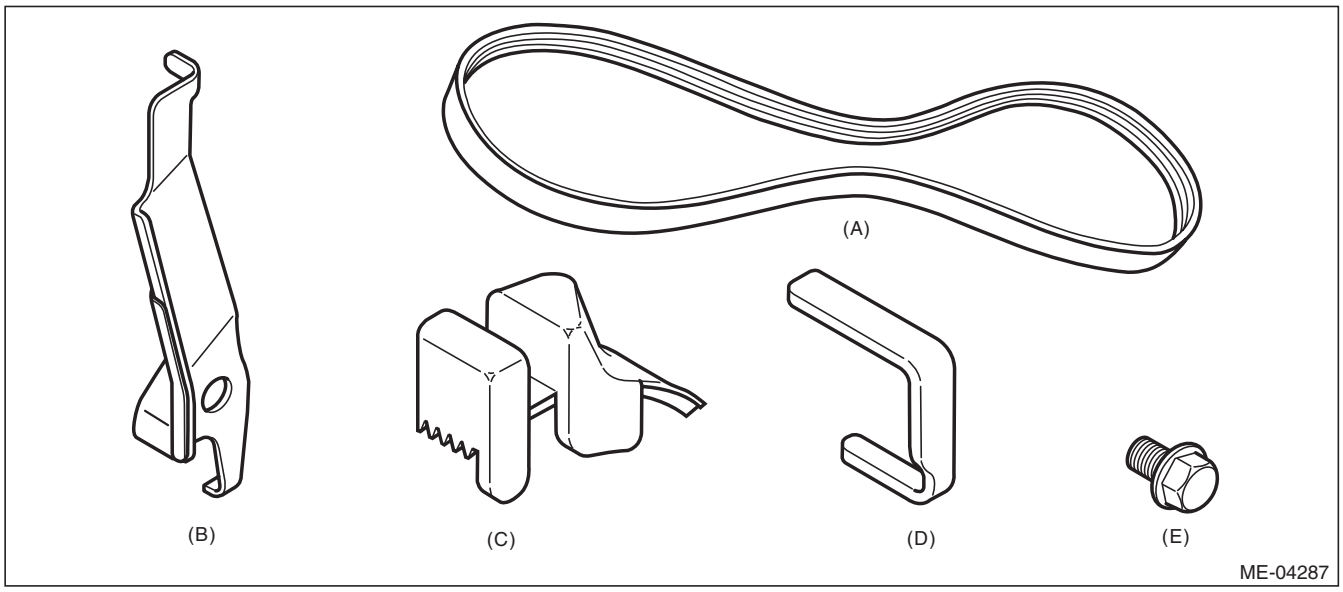
5) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
6) Install the V-belt cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



2. REAR SIDE BELT

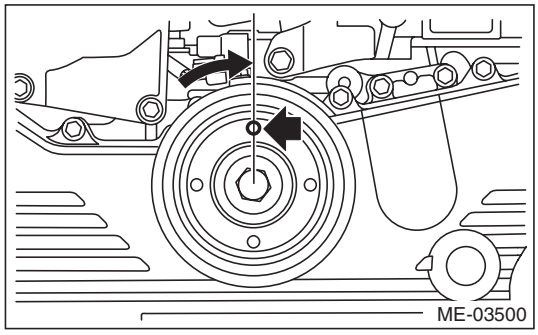
CAUTION:
- **Do not re-use the rear side belt.**
- **Be careful not to let oil, grease or coolant contact a new rear side belt.**
- **Be careful not to rub the belt end surface with bare hands; exposed core may cause injury.**
- **To install the rear side belt, always use the provided tools (belt stopper, belt guide, belt guide holder, and bolt).**



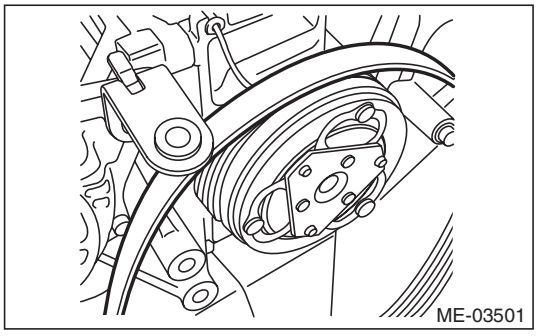
(A) Rear side belt
(B) Belt stopper
(C) Belt guide
(D) Belt guide holder
(E) Bolt

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.

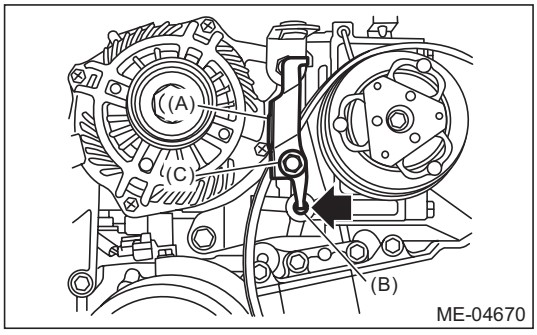
CAUTION:
Do not turn the crank pulley counterclockwise.



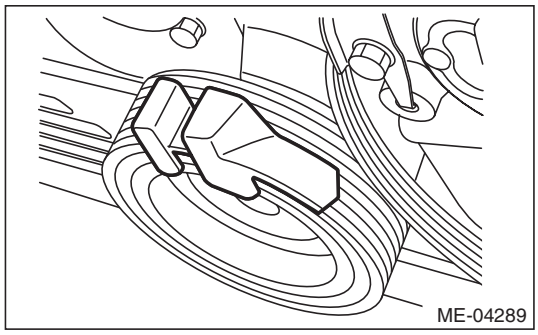
4) Hook a new rear side belt on the A/C compressor pulley.



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).

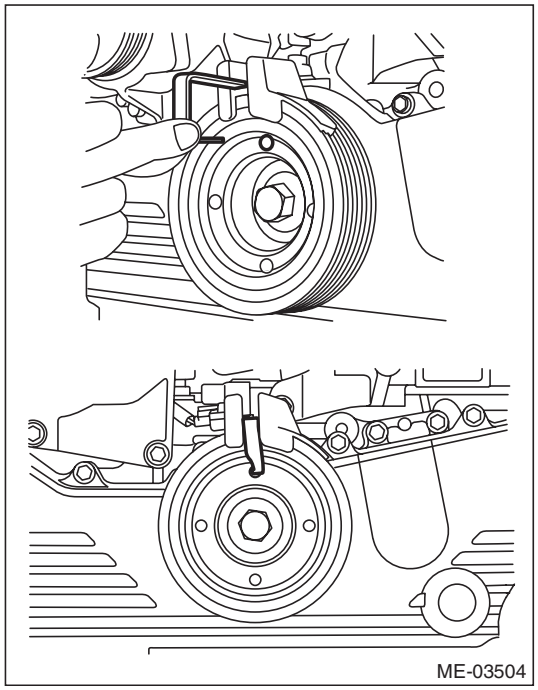


6) Place the belt guide while aligning it with the belt line of the crank pulley on the front side belt side.

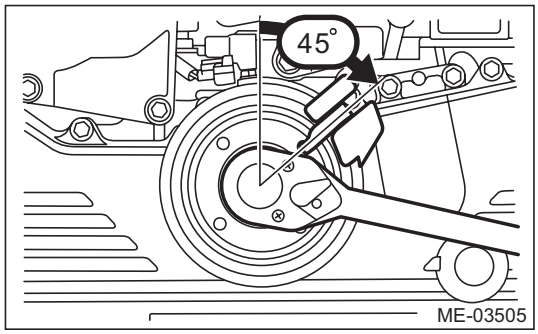


7) Insert the belt guide holder into the service hole of the crank pulley so that the belt guide comes in between.

NOTE:
Place the belt guide holder with the longer side up.

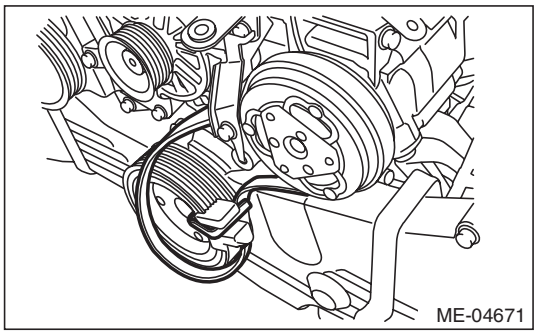


8) Slowly turn the crank pulley clockwise until the belt guide comes to approximately 45°.

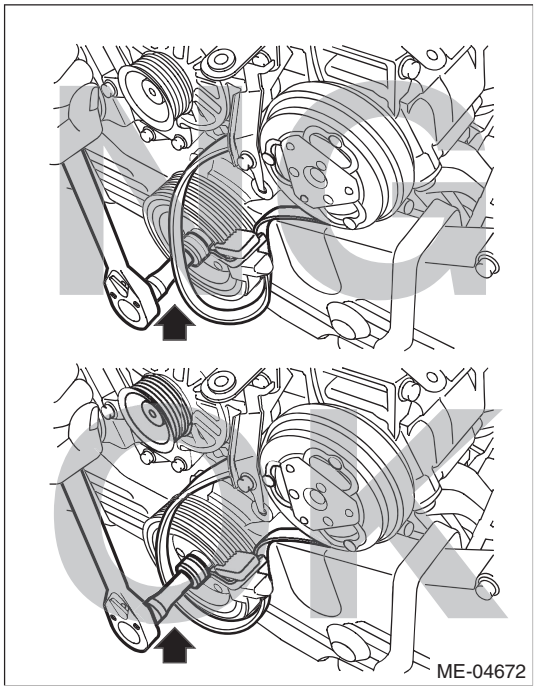


9) Place the rib surface of the rear side belt into the crank pulley groove, so that the rear side belt comes in between the belt guide holder.

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.

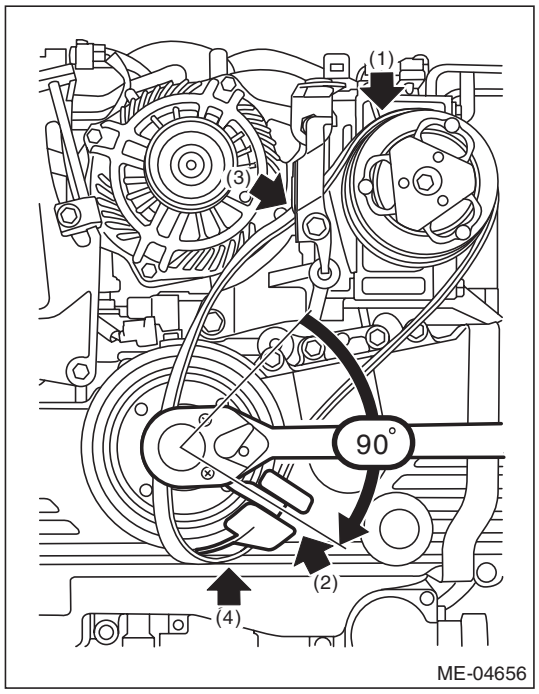


10) Place the tool through the loop of the rear side belt, and set on the crank pulley bolt.

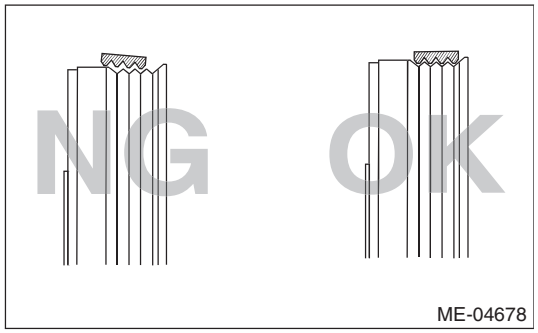


11) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.

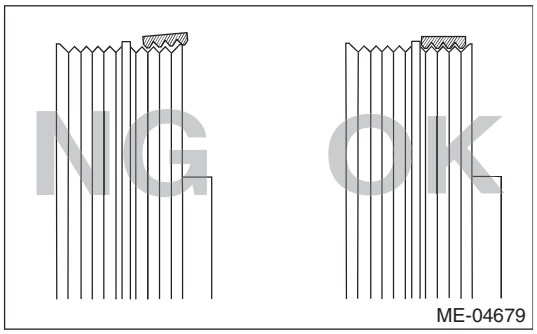
CAUTION:
When turning the crank pulley, always make sure that the belt guide is not off from the crank pulley groove.



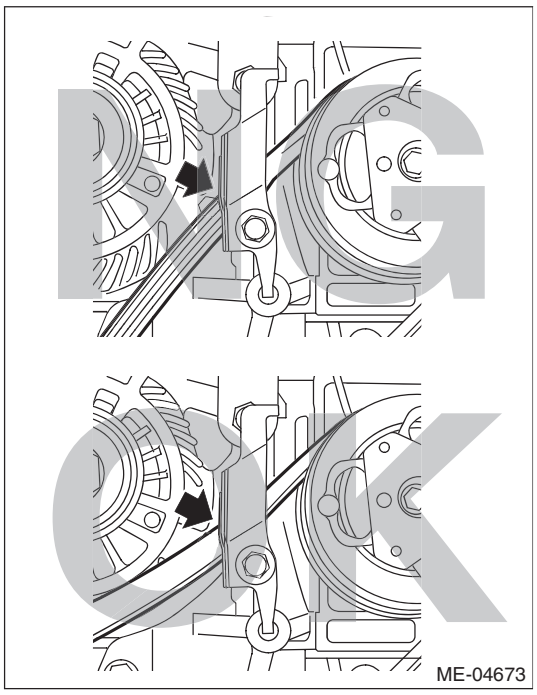
(1) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



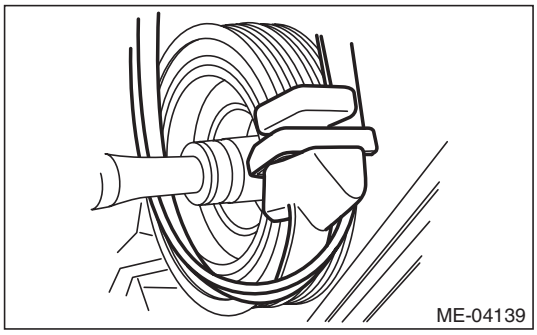
(2) The rib of the rear side belt is securely placed on the groove of the crank pulley.



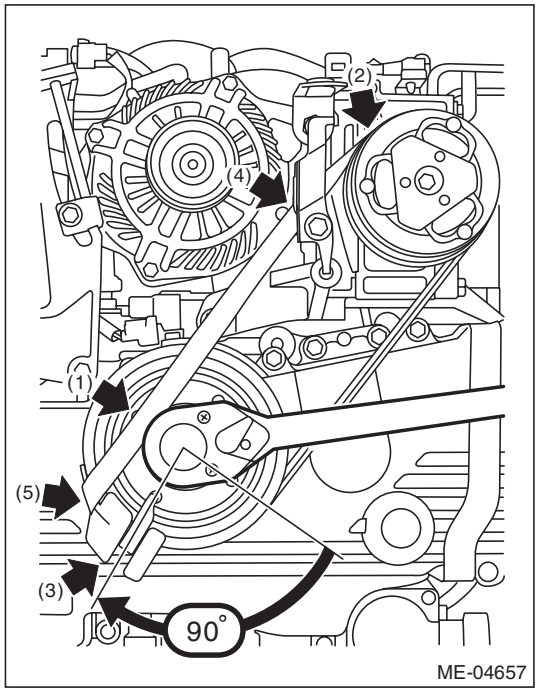
(3) The surface of the rear side belt is held by the belt stopper.



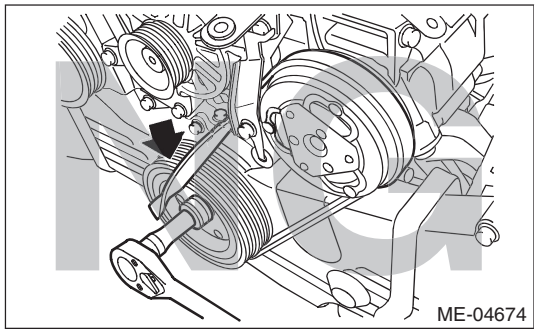
(4) The rear side belt is securely placed on the belt guide.



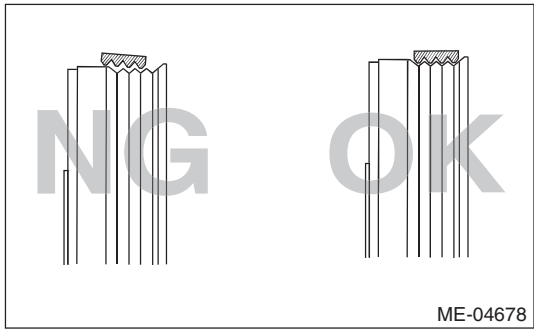
12) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.



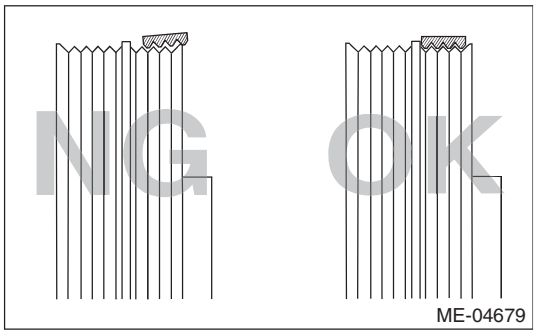
(1) The rear side belt is not twisted.



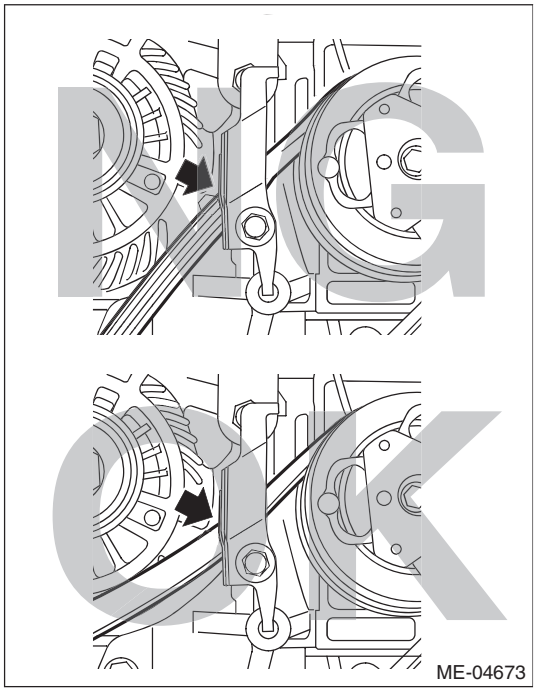
(2) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



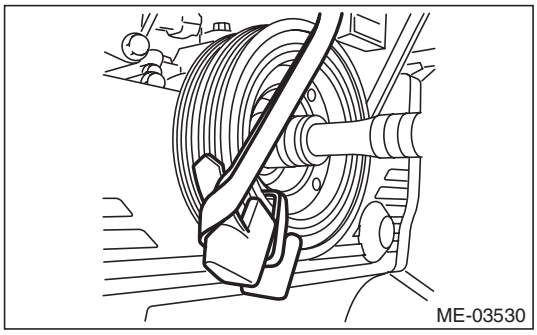
(3) The rib of the rear side belt is securely placed on the groove of the crank pulley.



(4) The surface of the rear side belt is held by the belt stopper.

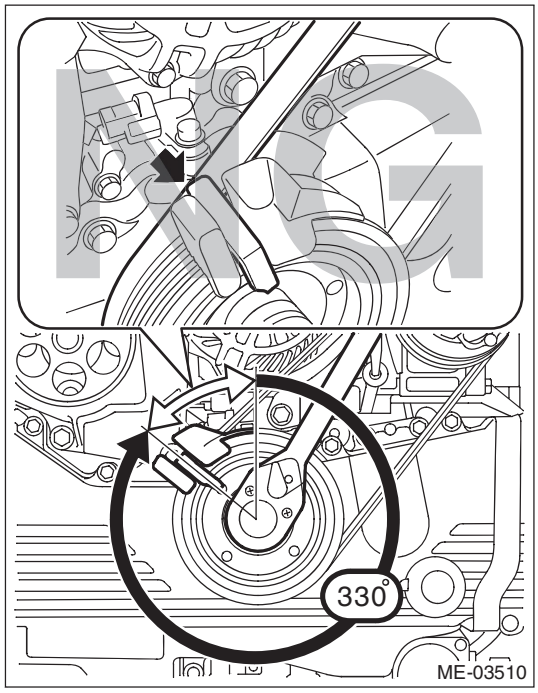


(5) The rear side belt is securely placed on the belt guide.

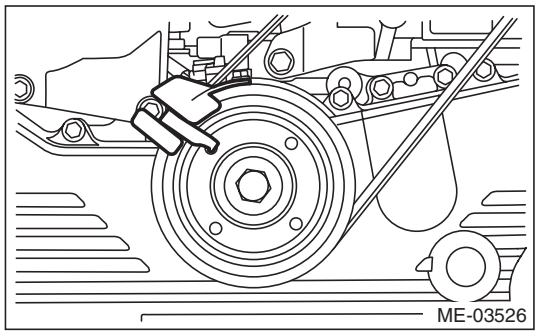


13) Slowly turn the crank pulley clockwise, and install the rear side belt.

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.

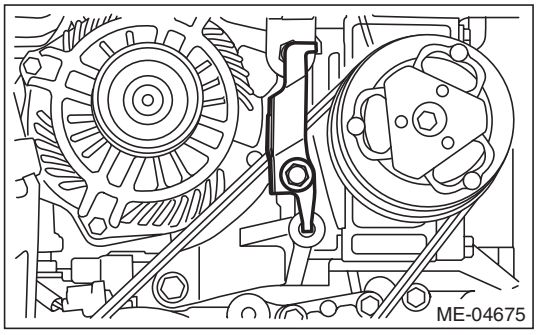


14) Remove the belt guide and belt guide holder from the crank pulley.

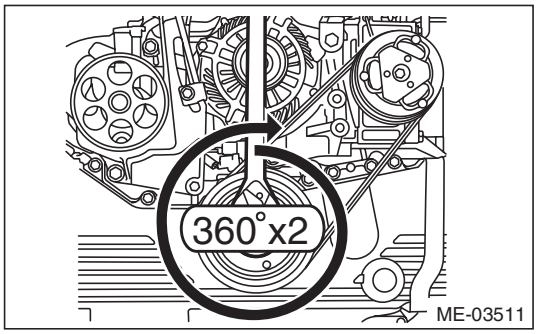


15) Remove the belt stopper from the compressor bracket.

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.



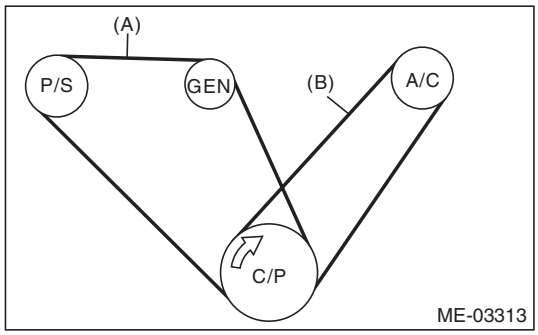
17) Discard the provided tools (belt stopper, belt guide, belt guide holder, and bolt) that are used.
18) Install the front side belt. <Ref. to ME(STI)-39, FRONT SIDE BELT, INSTALLATION, V-belt.>

C: INSPECTION

1. FRONT SIDE BELT

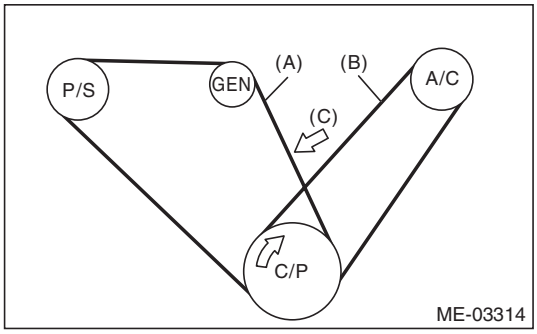
CAUTION:
Check and adjust the front side belt tension so that it is within the specified range. Using the belt with a tension out of the specified range may result in a fault such as the following:
• If the front side belt tension is higher, unexpected force is generated at the power steering oil pump, 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

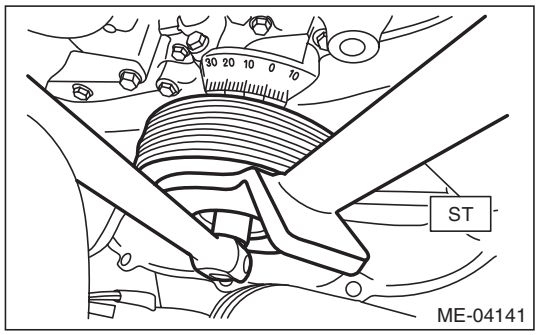
Replace the rear side belt, if crack, fraying or wear is found, or noise is emitted.

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:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the V-belts. <Ref. to ME(STI)-39, REMOVAL, V-belt.>
2) Use the ST to lock the crank pulley, and remove the crank pulley bolt.
ST 499977100 CRANK PULLEY WRENCH



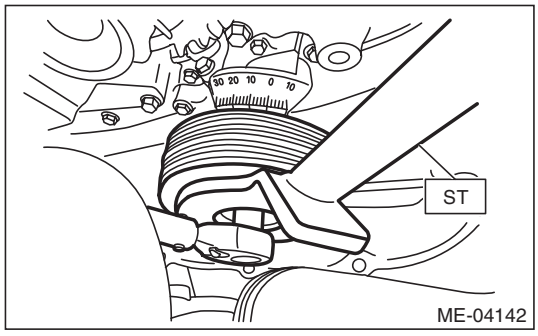
3) Remove the crank pulley.

B: INSTALLATION

1. METHOD WITHOUT ANGLE GAUGE

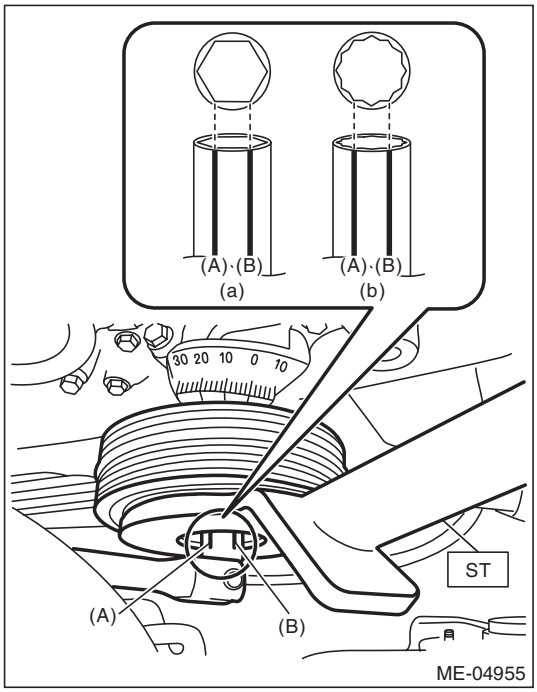
1) Clean the crankshaft thread using compressed air.
2) Install the crank pulley.
3) Apply engine oil to the crank pulley bolt seat and thread.
4) Tighten the crank pulley bolts.
(1) Use the ST to lock the crank pulley, and temporarily tighten the crank pulley bolt.
ST 499977100 CRANK PULLEY WRENCH

Tightening torque:
47 N·m (4.8 kgf-m, 34.7 ft-lb)



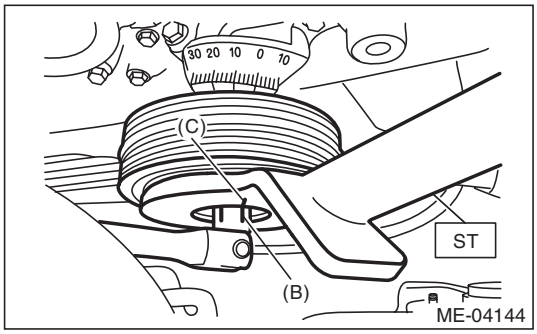
(2) Draw reference lines (A) and (B) using a marker to set the socket to the crank pulley bolt as shown in the figure.

NOTE:
Set the socket onto the crank pulley bolt so that reference lines (A) and (B) is visible.
ST 499977100 CRANK PULLEY WRENCH



(a) When using 6-point socket
(b) When using 12-point socket

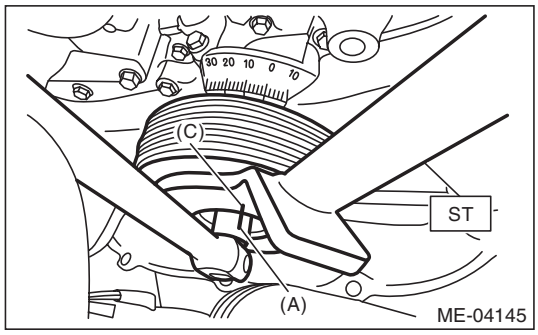
(3) Draw end line (C) on ST using a marker at the same position as reference line (B) drawn on the socket in step (2).
ST 499977100 CRANK PULLEY WRENCH



(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.

NOTE:
It should be approx. 60° when reference line (A) and end line (C) are aligned.
ST 499977100 CRANK PULLEY WRENCH

Tightening angle:
60°±5°

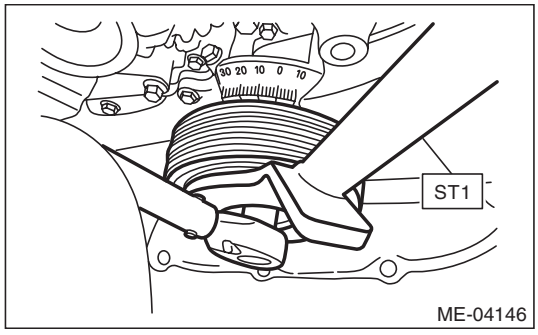


5) Install the V-belts. <Ref. to ME(STI)-39, INSTALLATION, V-belt.>

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 fan motor assembly. <Ref. to CO(STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.>
(2) Use the ST1 to lock the crank pulley, and temporarily tighten the crank pulley bolt.
ST1 499977100 CRANK PULLEY WRENCH

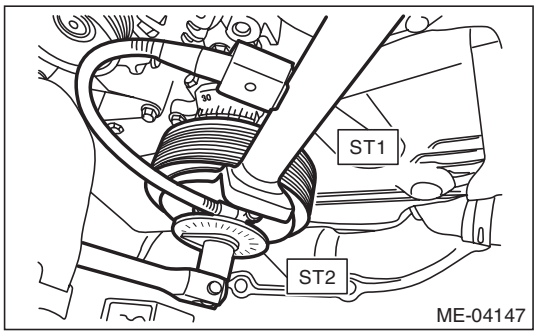
Tightening torque:
47 N·m (4.8 kgf-m, 34.7 ft-lb)



(3) Set the ST2, use the ST1 to lock the crank pulley, and tighten the crank pulley bolt to the specified angle.

NOTE:
Attach the magnet used for securing the ST2 (ANGLE GAUGE) to ST1.
ST1 499977100 CRANK PULLEY WRENCH
ST2 18854AA000 ANGLE GAUGE

Tightening angle:
60°±5°



(4) Install the radiator main fan motor assembly and radiator sub fan motor assembly. <Ref. to CO(STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>

5) Install the V-belts. <Ref. to ME(STI)-39, INSTALLATION, V-belt.>

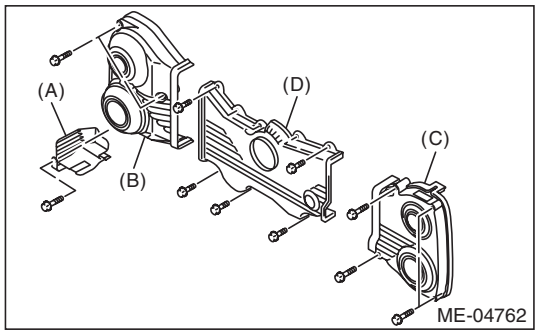
C: INSPECTION

1) Check that the crank pulley has no deformation, cracks or other damages.

14.Timing Belt Cover

A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the secondary air pump. <Ref. to EC(STI)-27, REMOVAL, Secondary Air Pump.>
2) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover RH (B) together with the engine harness cover (A).
4) Remove the timing belt cover LH (C).
5) Remove the front timing belt cover (D).

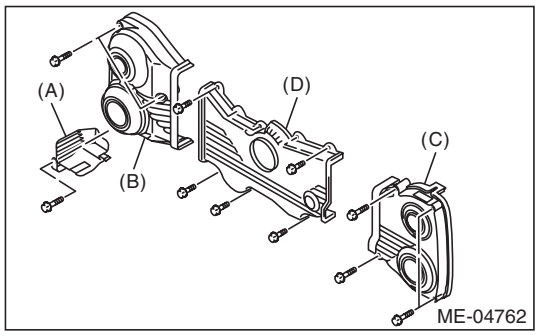


B: INSTALLATION

1) Install the front timing belt cover (D).

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)
2) Install the timing belt cover LH (C).

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



3) Install the timing belt cover RH (B) together with the engine harness cover (A).

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)
4) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>
5) Install the secondary air pump. <Ref. to EC(STI)-27, INSTALLATION, Secondary Air Pump.>

C: INSPECTION

Check the timing belt cover for damage.

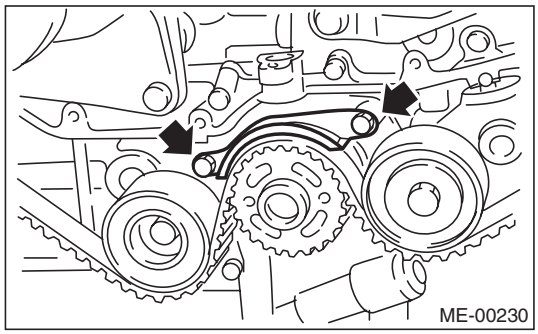
15.Timing Belt

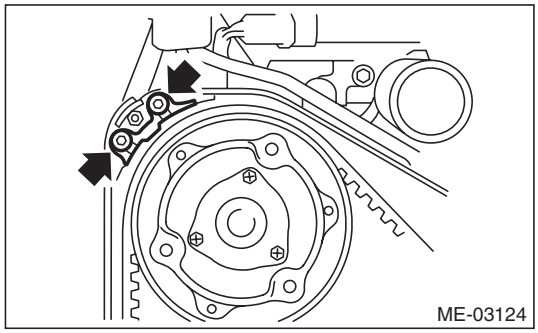
A: REMOVAL

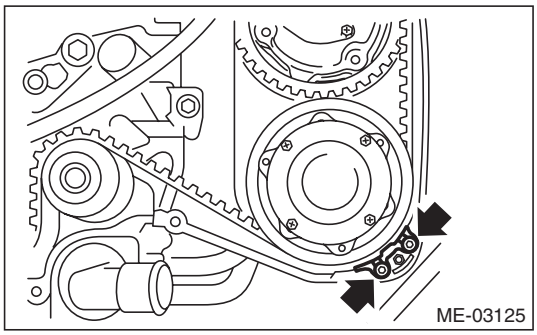
NOTE:
• When replacing a single part, perform the work with the engine assembly installed to body.
• When performing the work with the engine installed to body, the following parts must also be removed/installed.
  • Radiator main fan motor assembly <Ref. to CO(STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.>
  • Radiator sub fan motor assembly <Ref. to CO(STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.> <Ref. to CO(STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>
• When performing the work with the engine installed to body, protect the radiator with cardboards or blankets.

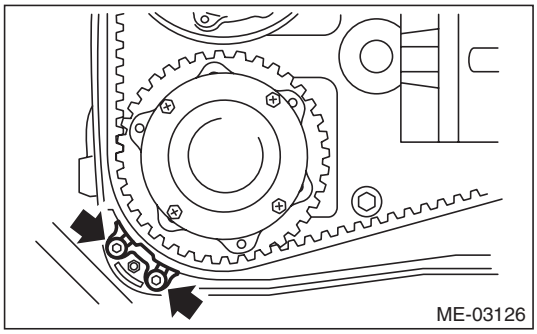
1. TIMING BELT

1) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt guide.


ME-00230

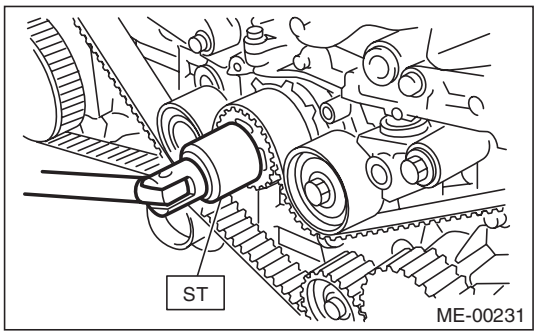

ME-03124


ME-03125


ME-03126

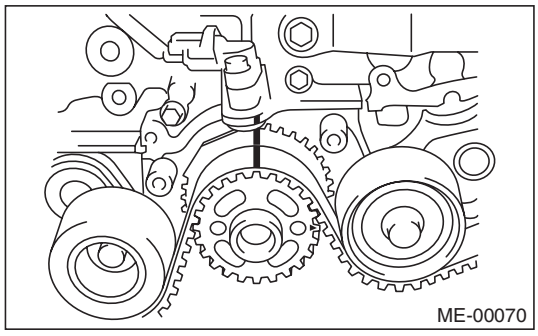
4) If the alignment mark or arrow mark (which indicates the direction of rotation) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.
  (1) Turn the crankshaft using ST, and align the alignment marks on crank sprocket, intake cam sprocket LH, exhaust cam sprocket LH, intake cam sprocket RH and exhaust cam sprocket RH with marks on oil pump and notches of timing belt cover.

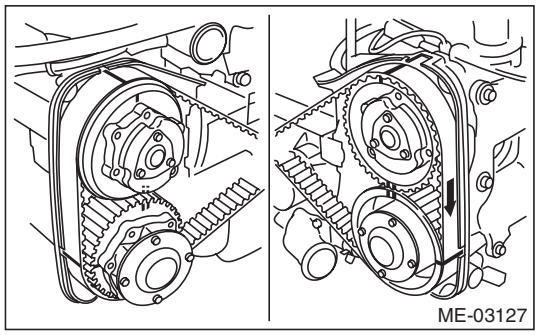
ST 499987500 CRANKSHAFT SOCKET



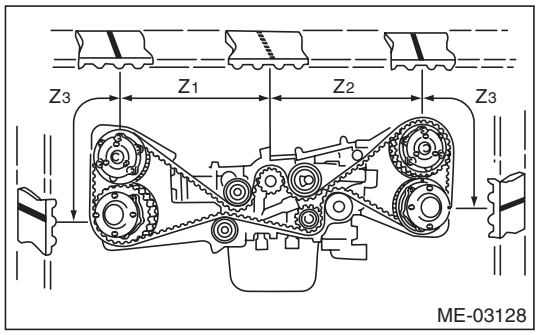
ME-00231

(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-00070

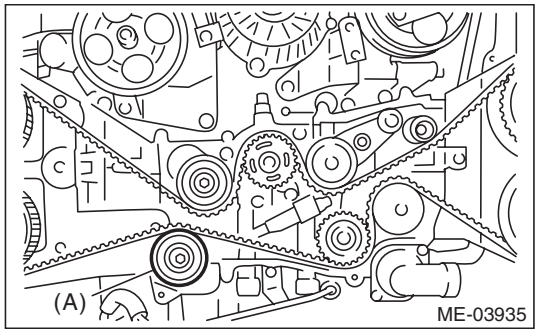

ME-03127

Z_1: 54.5 teeth
Z_2: 51 teeth
Z_3: 28 teeth



ME-03128

5) Remove the belt idler (A).



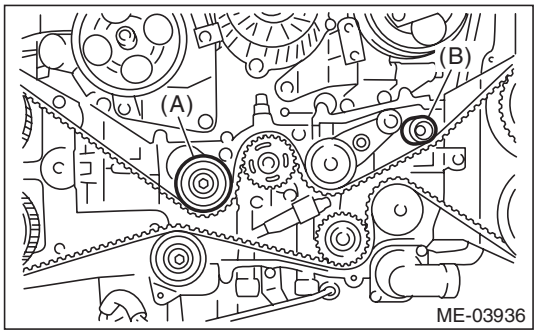
ME-03935

6) Remove the timing belt.

CAUTION:
After the timing belt has been removed, never rotate the intake and exhaust sprocket. If the cam sprocket is rotated, the intake and exhaust valve heads strike together and valve stems are bent.

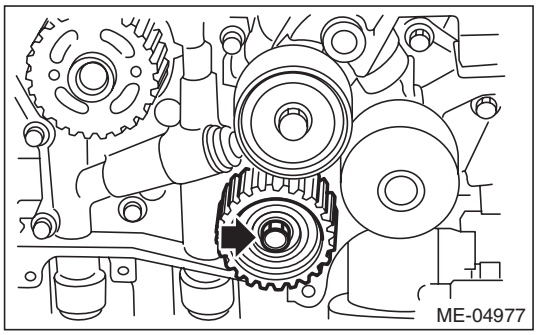
2. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

1) Remove the belt idler (A) and (B).

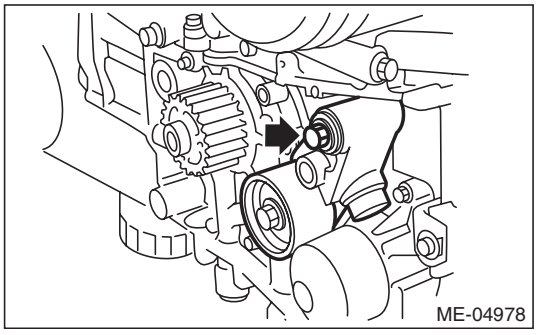


ME-03936

2) Remove the belt idler No. 2.


ME-04977

3) Remove the automatic belt tension adjuster assembly.


ME-04978

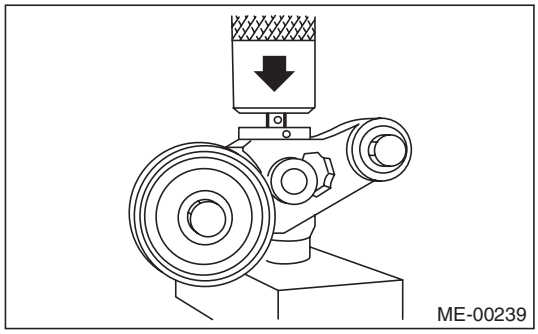
B: INSTALLATION

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

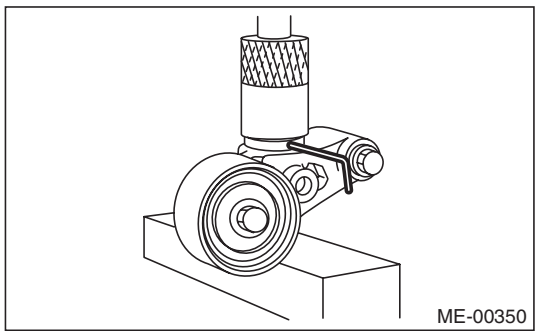
1) Prepare for installation of the automatic belt tension adjuster assembly.

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 lbf).
• 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.
• 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.

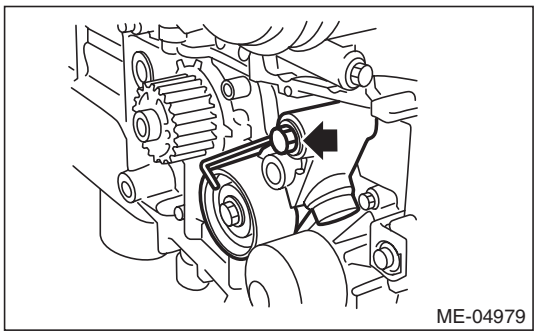

ME-00239

(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (nominal) dia. hex wrench inserted into the stopper pin hole in cylinder, secure the adjuster rod.


ME-00350

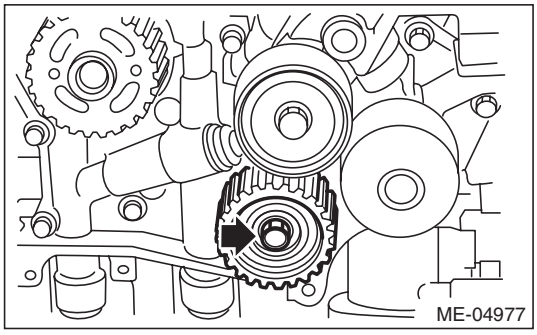
2) Install the automatic belt tension adjuster assembly.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)


ME-04979

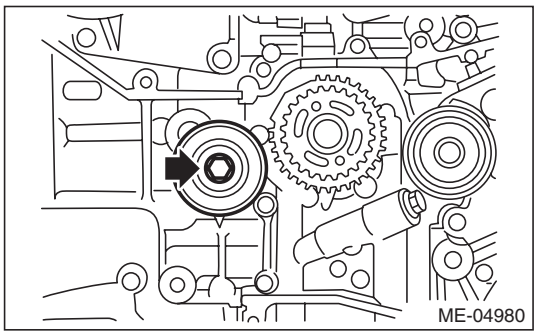
3) Install the belt idler No. 2.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)

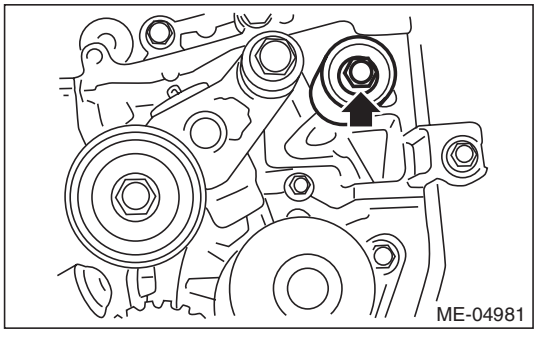

ME-04977

4) Install the belt idlers.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)


ME-04980

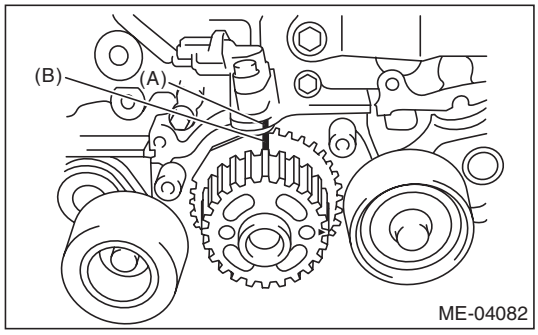
Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)


ME-04981

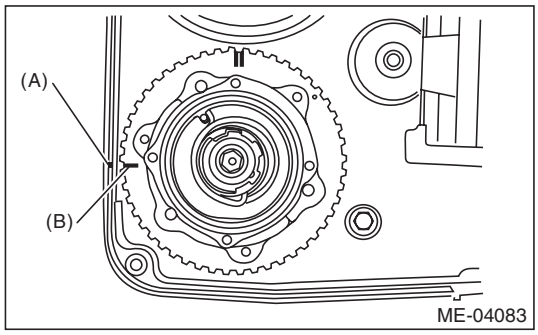
2. TIMING BELT

1) Prepare for installation of the automatic belt tension adjuster assembly. <Ref. to ME(STI)-51, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

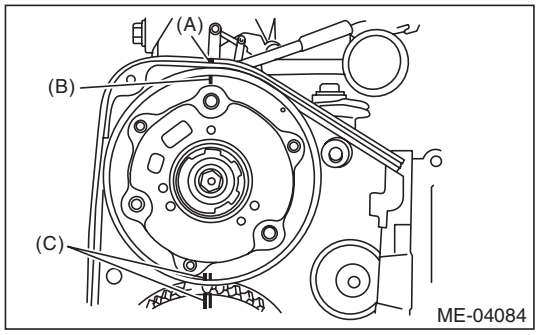
2) Align the mark (B) on crank sprocket with the mark (A) on oil pump.



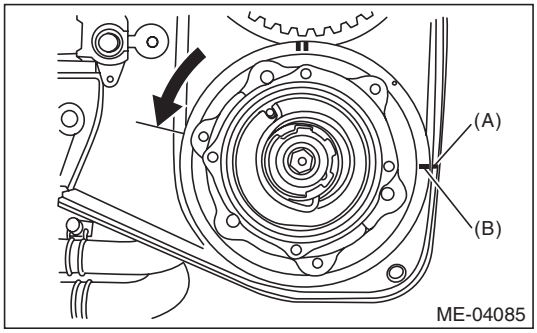
3) Align the single line mark (B) on the exhaust cam sprocket RH with notch (A) on the timing belt cover.



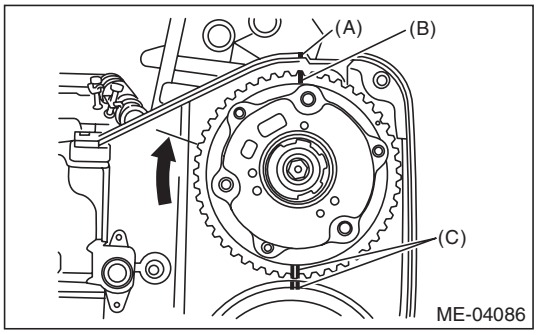
4) Align the single line mark (B) on the intake cam sprocket RH with notch (A) on the timing belt cover. Make sure that the double line marks (C) on intake and exhaust cam sprockets are aligned.



5) Align the single line mark (B) on exhaust cam sprocket LH with notch (A) on the timing belt cover by turning the sprocket counterclockwise (as viewed from front of engine).

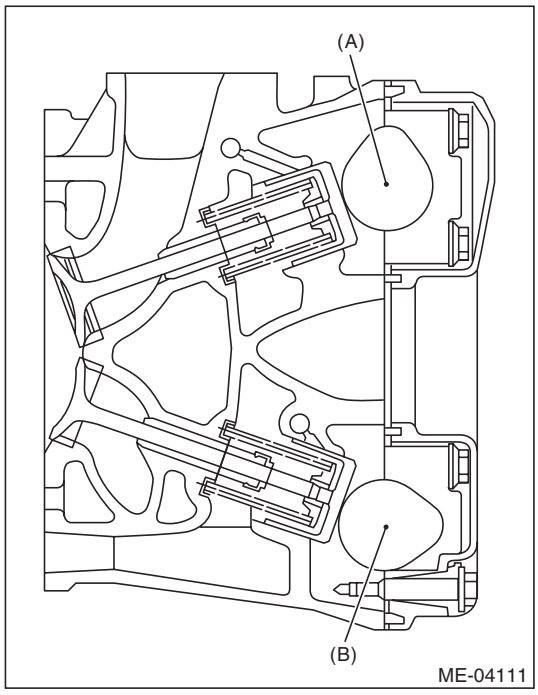


6) Align the single line mark (B) on intake cam sprocket LH with notch (A) on the timing belt cover by turning the sprocket clockwise (as viewed from front of engine). Make sure the double line marks (C) on the intake and exhaust cam sprockets are aligned.



7) Make sure that the cam and crank sprockets are positioned properly.

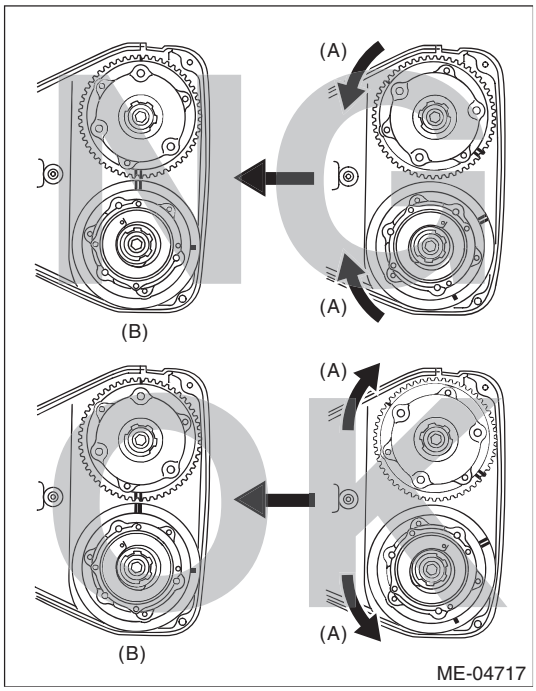
CAUTION:
• Intake and exhaust camshafts for this DOHC engine can be independently rotated with the timing belts removed. As can be seen from the figure, if the intake and exhaust valves are lifted simultaneously, heads will interfere with each other, resulting in bent valves.



(A) Intake camshaft
(B) Exhaust camshaft

• When the timing belts are not installed, four camshafts are held at the "zero-lift" position, where all cams on camshafts are not pushing down on the intake and exhaust valves. (Under this condition, all valves remain unlifted.)
• When the camshafts are rotated to install the timing belts, #2 intake and #4 exhaust cam of camshaft LH are held, pushing their corresponding valves down. (Under this condition, these valves are held lifted.) Camshaft RH are held so that their cams do not push the valves down.
• Camshafts LH must be rotated from the zero-lift position to the position where the timing belt is to be installed with the smallest possible angle, in order to prevent mutual interference of intake and exhaust valve heads.

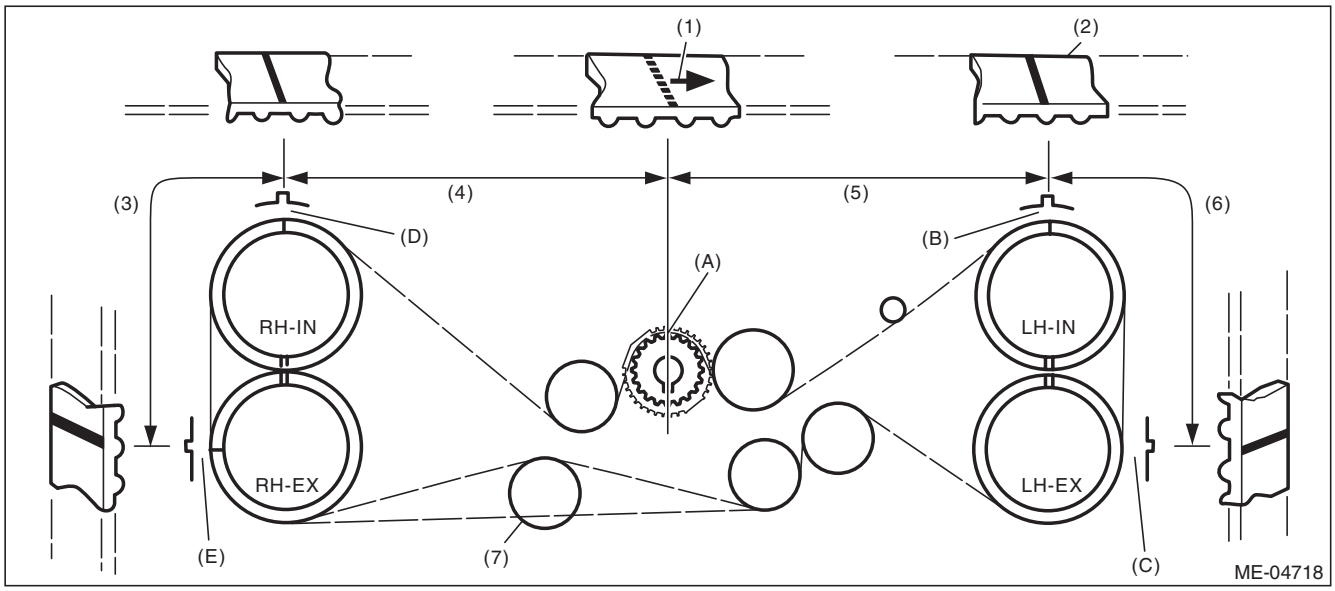
• Do not allow the camshafts to rotate in the direction shown in the upper figure. Doing this may cause both the intake and exhaust valves to lift simultaneously, resulting in mutual interference of valve heads.



(A) Direction of rotation
(B) Timing belt installation position

8) Align the alignment mark on the timing belt with marks on the sprockets in the alphabetical order shown in the figure. While aligning marks, position the timing belt properly, and install the timing belt.

CAUTION:
- **If the timing belt slips by 1 or more teeth, the valve and piston may hit each other.**
- **Make sure that the direction of belt rotation is correct.**

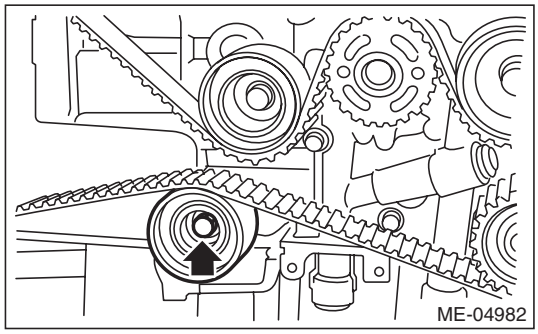


(1) Arrow mark
(2) Timing belt
(3) 28 teeth
(4) 54.5 teeth
(5) 51 teeth
(6) 28 teeth
(7) Install it in the end

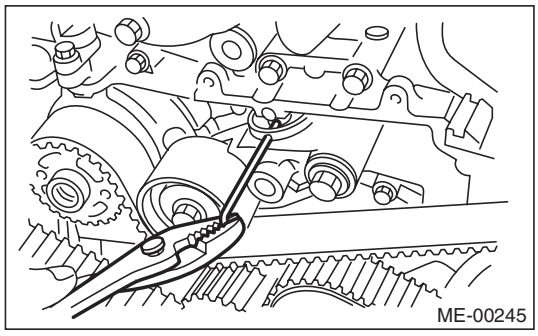
9) Install the belt idlers.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)

NOTE:
Make sure that the marks on the timing belt and sprockets are aligned.



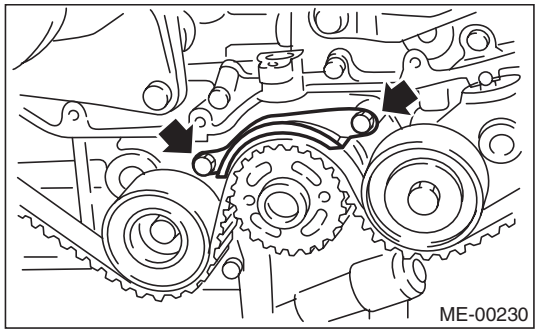
10) After ensuring that the marks on the timing belt and sprockets are aligned, remove the stopper pin from tensioner adjuster.

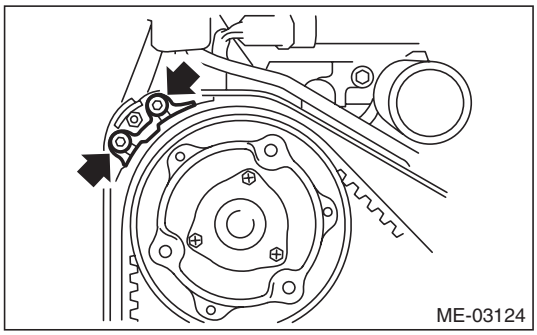

ME-00245

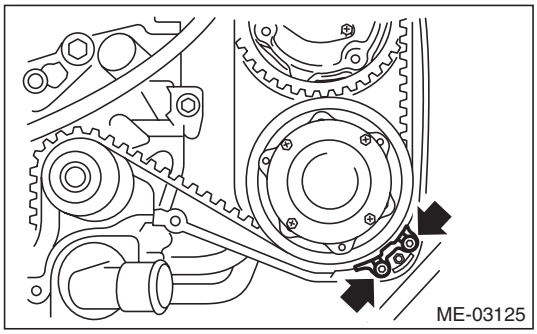
11) Install the timing belt guide.
(1) Temporarily tighten the bolts mounting the timing belt guide.

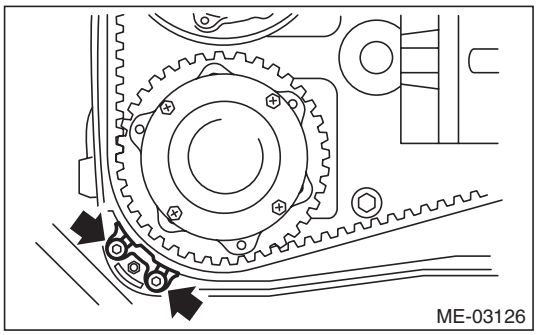
NOTE:
• Before installing the timing belt guide, clean the timing belt guide mounting bolt holes of the timing belt cover No. 2.
• Apply liquid gasket to the thread of the timing belt guide mounting bolt on the cam sprocket section. (when reusing bolts)

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent


ME-00230

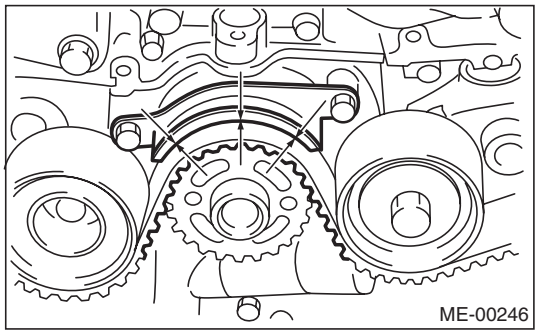

ME-03124

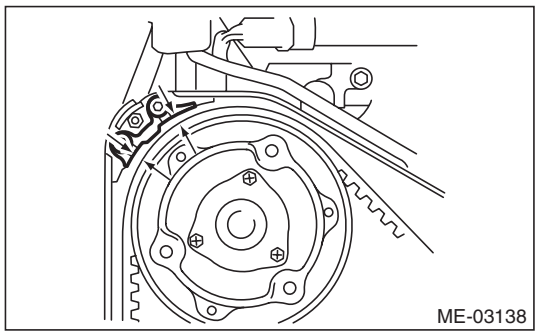

ME-03125

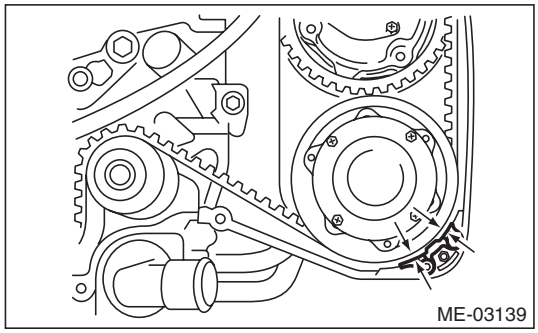

ME-03126

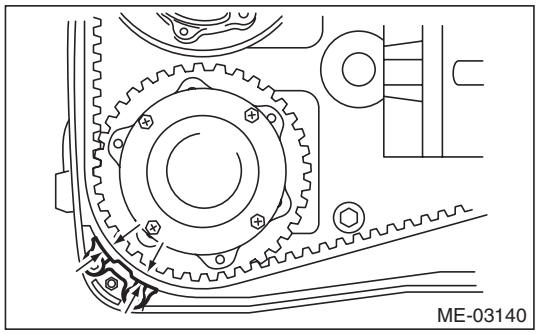
(2) Adjust the clearance between timing belt and timing belt guide using a thickness gauge and tighten.

Clearance:
1.0±0.5 mm (0.039±0.020 in)

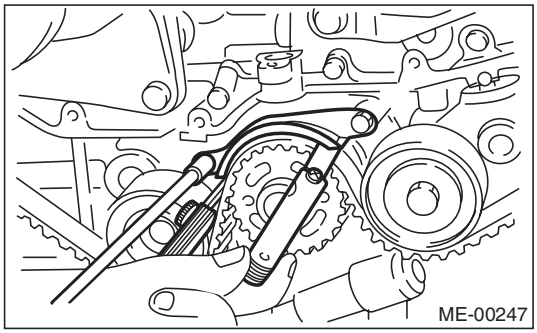

ME-00246


ME-03138

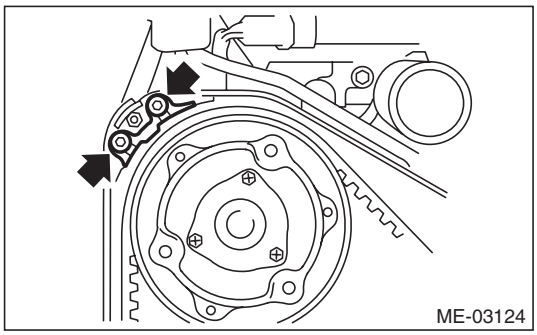

ME-03139

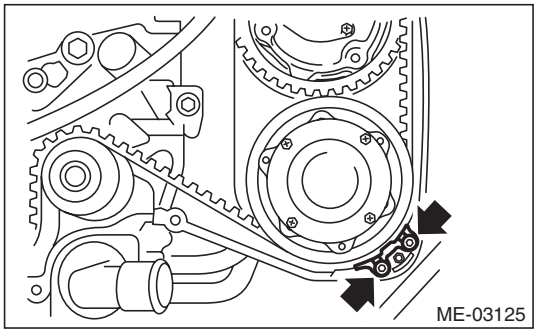

ME-03140

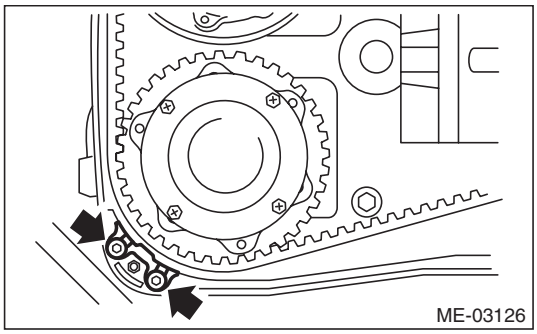
Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)


ME-00247

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)


ME-03124


ME-03125


ME-03126

12) Install the timing belt cover. <Ref. to ME(STI)-48, INSTALLATION, Timing Belt Cover.>
13) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>

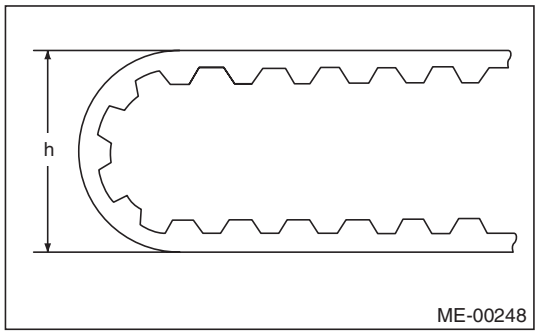
C: INSPECTION

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



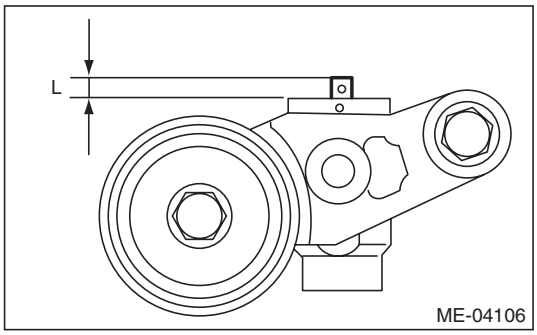
2. AUTOMATIC BELT TENSION ADJUSTER

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 the rod 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 lbf) is applied to it. This is to check adjuster rod stiffness.
3) If the adjuster rod is not stiff enough and moves freely when applying 165 N (16.8 kgf, 37.1 lbf), 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 lbf) 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-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 lbf).
• 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 adjuster rod protrusion "L" from the end surface of the cylinder. If it is not within specifications, replace the automatic belt tension adjuster assembly with a new part.

Protrusion amount of adjuster rod L:
5.2 — 6.2 mm (0.205 — 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.

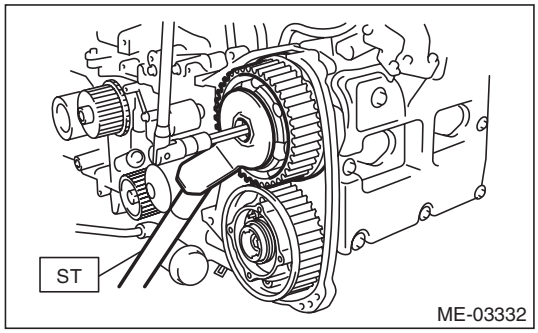
4. BELT IDLER

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:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt. <Ref. to ME(STI)-49, REMOVAL, Timing Belt.>
4) Remove the actuator covers of the intake and exhaust cam sprockets.
5) Use the ST to lock the cam sprocket, and remove the cam sprocket bolt.
ST 499977500 CAM SPROCKET WRENCH



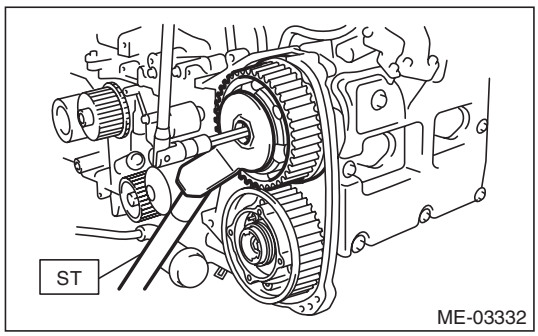
6) Remove the cam sprocket.

B: INSTALLATION

1) Install the cam sprocket.
2) Use the ST to lock the cam sprocket, and install the cam sprocket bolt.

NOTE:
Do not confuse cam sprockets (LH) and (RH), and (INT) and (EXH) during installation.
ST 499977500 CAM SPROCKET WRENCH

Tightening torque:
Tighten to 30 N·m (3.1 kgf-m, 22.1 ft-lb) of torque, and then tighten further by 45°.



3) Attach the actuator covers of the intake and exhaust cam sprockets.

NOTE:
Use new O-rings.

Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)
4) Install the timing belt. <Ref. to ME(STI)-51, INSTALLATION, Timing Belt.>
5) Install the timing belt cover. <Ref. to ME(STI)-48, INSTALLATION, Timing Belt Cover.>
6) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>

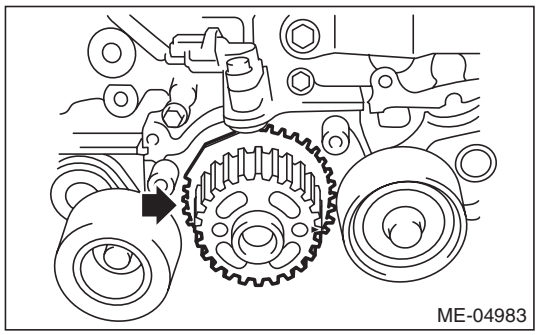
C: INSPECTION

1) Check the cam sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between cam sprocket and key.

17.Crank Sprocket

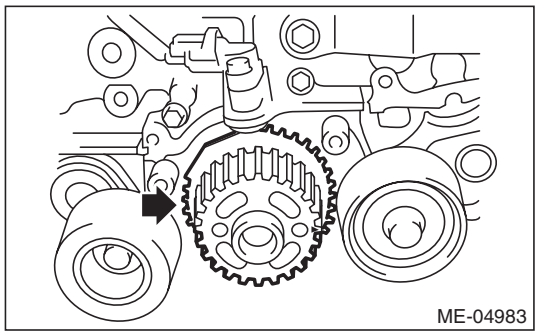
A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt. <Ref. to ME(STI)-49, REMOVAL, Timing Belt.>
4) Remove the crank sprocket.



B: INSTALLATION

1) Install the crank sprocket.



2) Install the timing belt. <Ref. to ME(STI)-51, INSTALLATION, Timing Belt.>
3) Install the timing belt cover. <Ref. to ME(STI)-48, INSTALLATION, Timing Belt Cover.>
4) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>

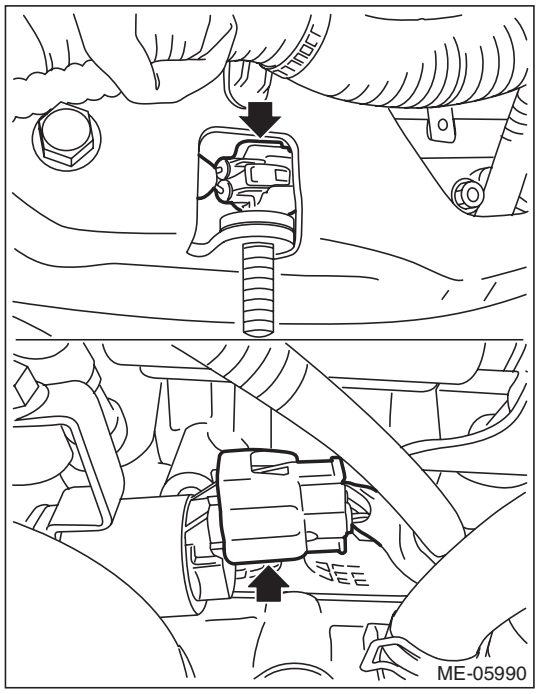
C: INSPECTION

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.

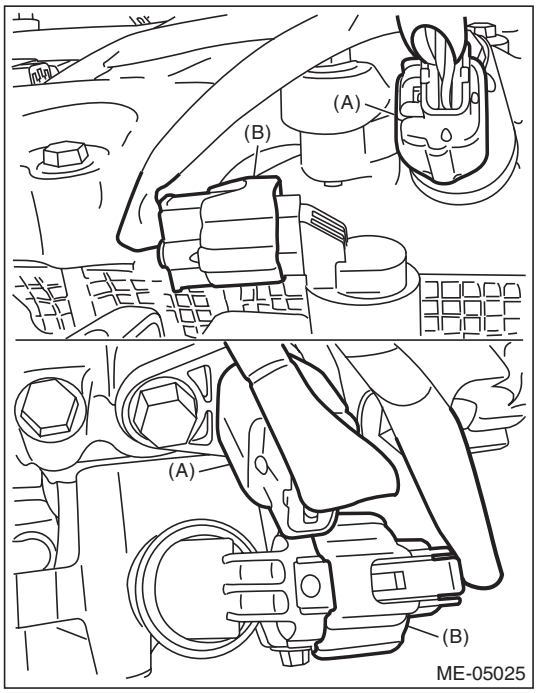
18.Camshaft

A: REMOVAL

1) Remove the engine from the vehicle. <Ref. to ME(STI)-29, REMOVAL, Engine Assembly.>
2) Remove the rear side belt. <Ref. to ME(STI)-39, REAR SIDE BELT, REMOVAL, V-belt.>
3) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(STI)-49, REMOVAL, Timing Belt.>
6) Remove the cam sprocket. <Ref. to ME(STI)-58, REMOVAL, Cam Sprocket.>
7) Disconnect the connector from the intake oil flow control solenoid valve.


ME-05990

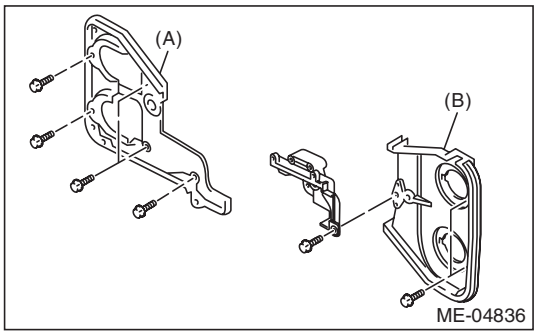
8) Disconnect the connector (A) from the exhaust camshaft position sensor and the connector (B) form the exhaust oil flow control solenoid valve.



ME-05025

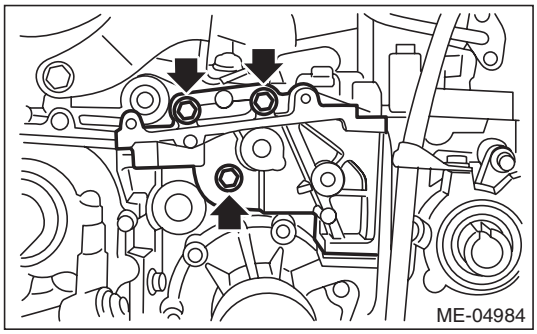
9) Remove the timing belt cover No. 2 RH (A) and timing belt cover No. 2 LH (B).

NOTE:
When removing the timing belt cover, be careful not to damage the seal rubber.

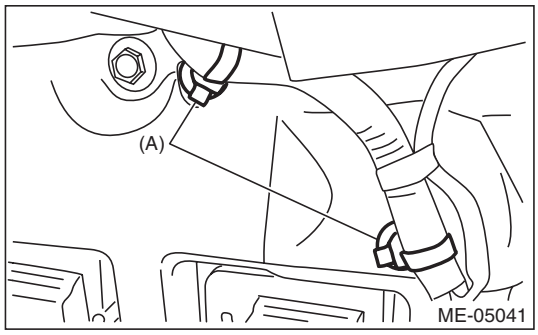


ME-04836

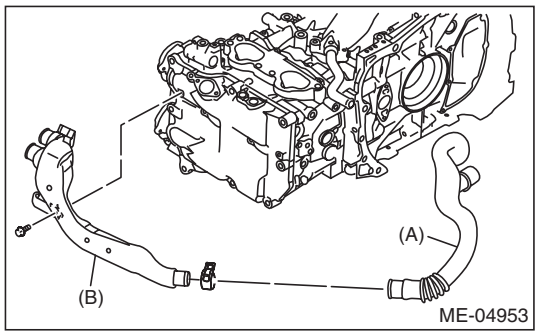
10) Remove the tensioner bracket.


ME-04984

11) Remove the clip (A) which hold the engine harness to the rocker cover RH.



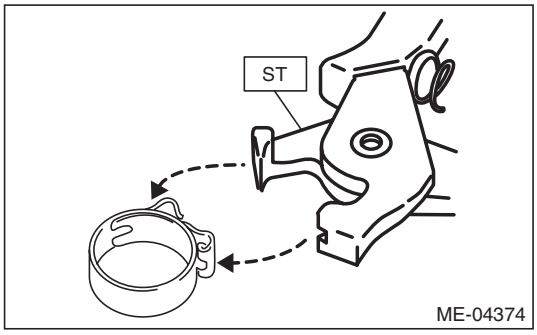
12) Remove the air duct B (B) from the rocker cover LH and the air duct A (A).

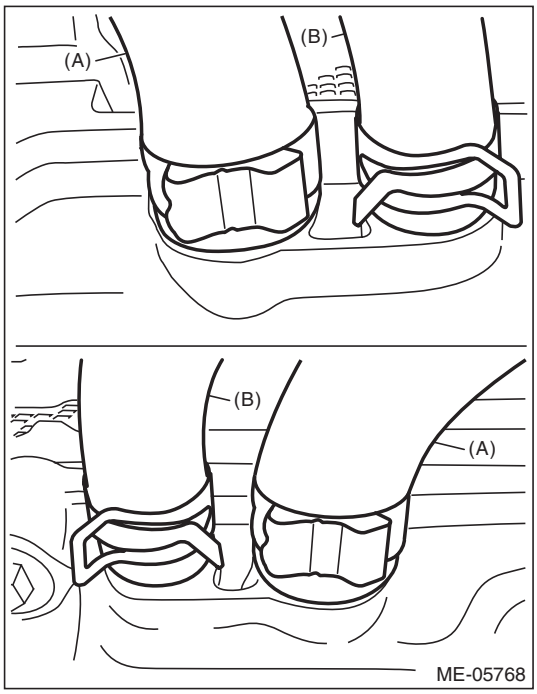


13) Remove the ignition coil. <Ref. to IG(STI)-7, REMOVAL, Ignition Coil.>

14) Disconnect PCV hose (A) and vacuum hose (B) from the rocker cover.

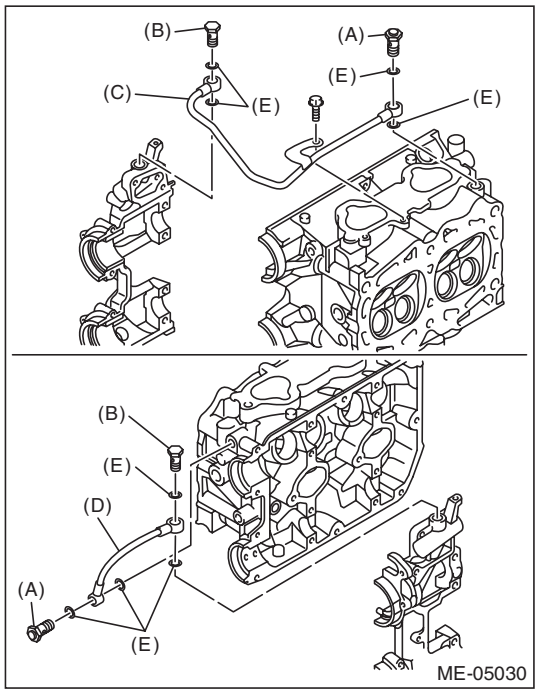
NOTE:
Pinch the clamp of the PCV hose (A) by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS





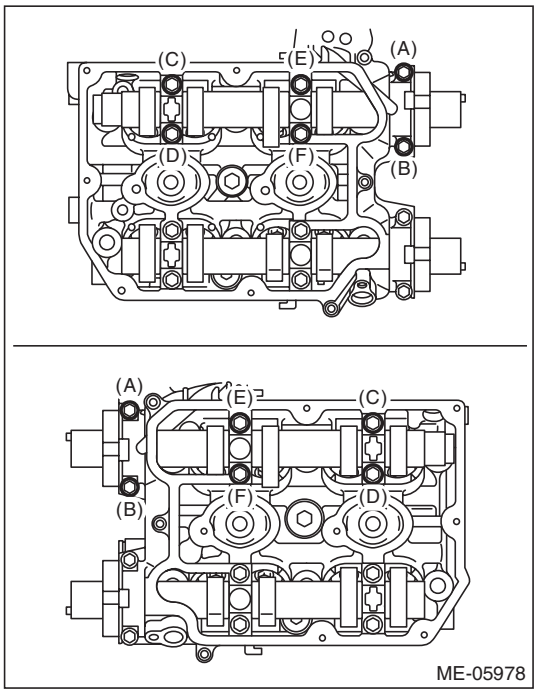
15) Remove the rocker cover.

16) Remove the union bolt without filter (without protrusion) which secures the oil pipe to the front camshaft cap.

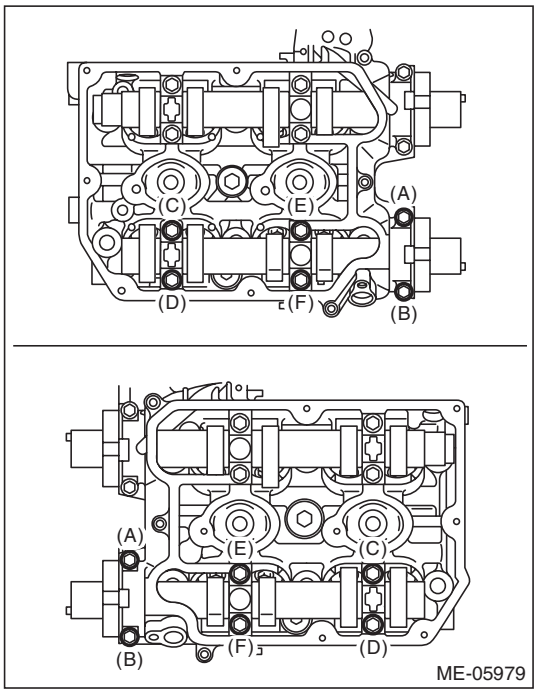


(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

17) Loosen the upper side of the front camshaft cap and the intake camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



18) Loosen the lower side of the front camshaft cap and the exhaust camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



19) Remove the front camshaft cap.
20) Remove the intake camshaft caps and intake camshaft.

21) Remove the exhaust camshaft caps and exhaust camshaft.

NOTE:
Arrange camshaft caps in order so that they can be installed in their original positions.

22) Remove the oil seal.

CAUTION:
Do not scratch the journal surface when removing the oil seal.

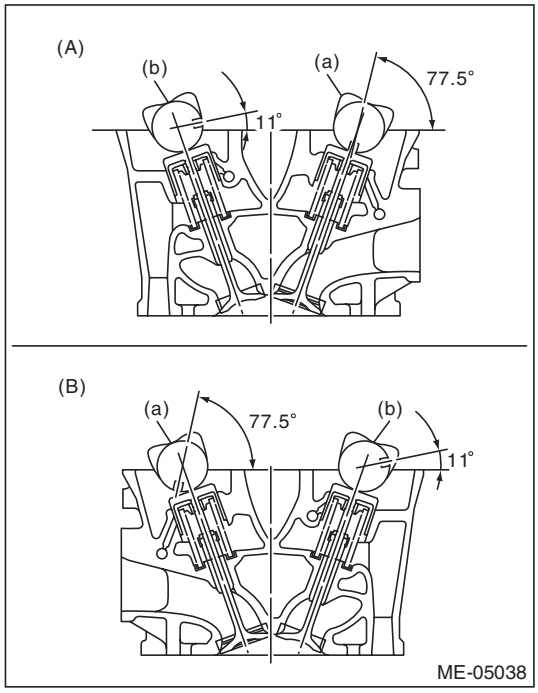
B: INSTALLATION

1) Install the camshaft.
Apply engine oil to the cylinder head at camshaft journal installation location before installing the camshaft. Install the camshaft so that each valve is close to or in contact with base circle of the cam lobe.

NOTE:
• Set the camshaft to the position shown in the figure.
• When set at the position shown in the figure, it is not necessary to rotate the camshaft RH when installing the timing belt, but it is necessary to rotate the camshaft LH slightly.

Intake camshaft LH:
Rotate 80° clockwise.

Exhaust camshaft LH:
Rotate 45° counterclockwise.



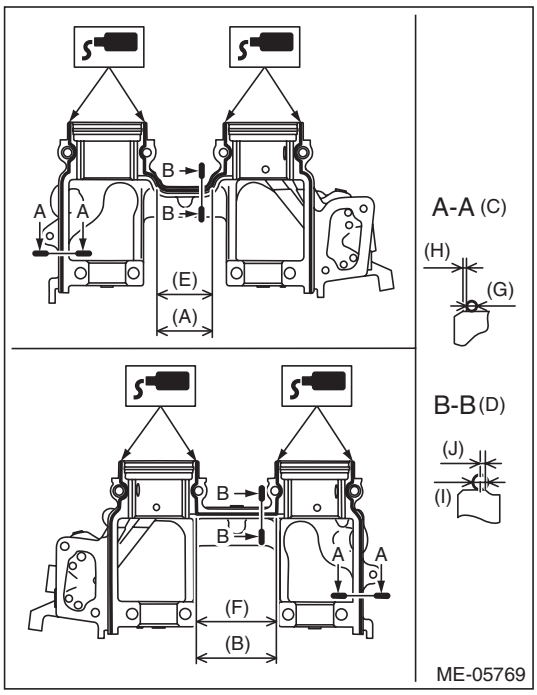
(A) Cylinder head RH
(B) Cylinder head LH
(a) Intake camshaft
(b) Exhaust camshaft

2) Install the camshaft cap.
(1) Apply small amount of liquid gasket to the mating surface of cap.

NOTE:
• Install within 5 min. after applying liquid gasket.
• Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to come out and flow toward oil seal, resulting in oil leak.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent

Liquid gasket applying diameter:
Mating surfaces other than ranges A and B
2±0.5 mm (0.0787±0.0197 in)
Mating surfaces of ranges A and B
3±1 mm (0.1181±0.0394 in)

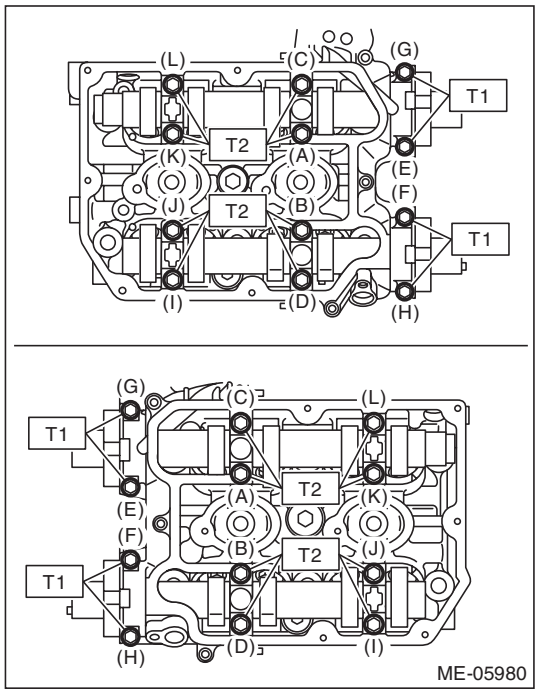


(A) Range A
(B) Range B
(C) Liquid gasket applying position of mating surfaces of ranges other than A and B
(D) Liquid gasket applying position of mating surfaces of ranges A and B
(E) 44.8 mm (1.7638 in)
(F) 65 mm (2.5591 in)
(G) ϕ2±0.5 mm (0.0787±0.0197 in)
(H) 0.5±0.5 mm (0.0197±0.0197 in)
(I) ϕ3±1 mm (0.1181±0.0394 in)
(J) 1 mm (0.0394 in) or less

(2) Apply a thin coat of engine oil to the cap journal surface, and install the camshaft cap to the camshaft.

(3) Gradually tighten the camshaft cap in at least two steps, in alphabetical order shown in the figure, and then tighten to the specified torque.

Tightening torque:
T1: 9.75 N·m (1.0 kgf-m, 7.2 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)

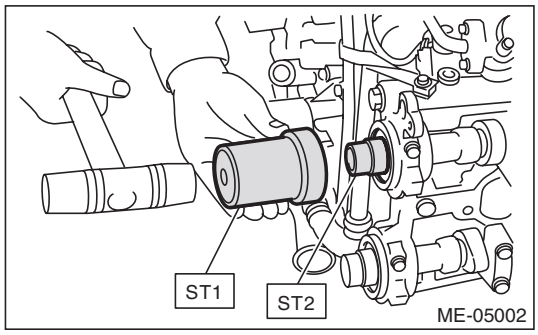


(4) After tightening the camshaft cap, ensure the camshaft rotates only slightly while holding it at base circle.

3) Apply a thin coat of engine oil to the periphery of the camshaft oil seal and oil seal lip, and install the oil seal on the camshaft using ST1 and ST2.

NOTE:
Use a new oil seal.

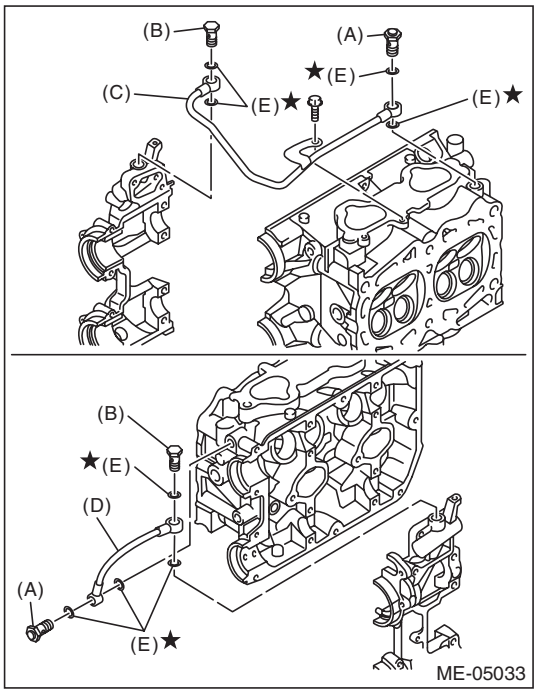
ST1	499587600	OIL SEAL INSTALLER
ST2	499597200	OIL SEAL GUIDE



4) Install the oil pipe to the front camshaft cap using the union bolt without filter (without protrusion).

NOTE:
Use a new gasket.

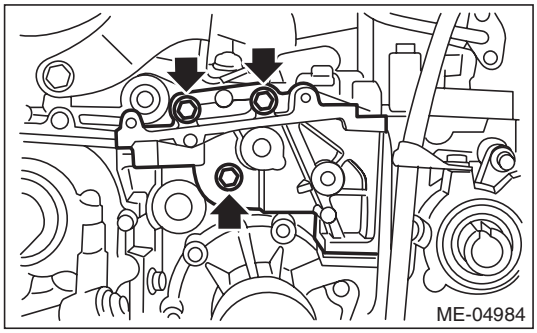
Tightening torque:
29 N·m (3.0 kgf-m, 21.4 ft-lb)



(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

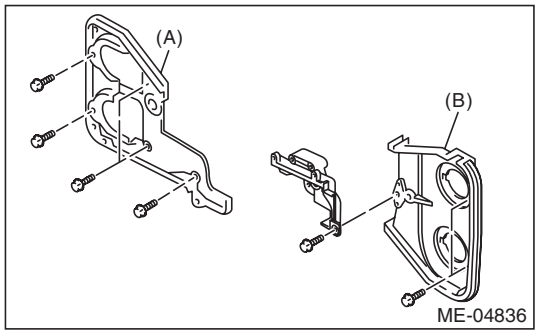
5) Install the tensioner bracket.

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



6) Install the timing belt cover No. 2 RH (A) and timing belt cover No. 2 LH (B).

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



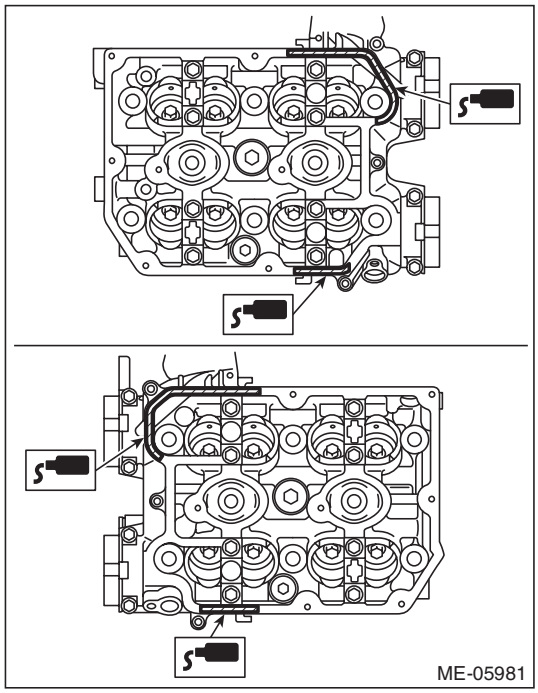
7) Install the cam sprocket. <Ref. to ME(STI)-58, INSTALLATION, Cam Sprocket.>
8) Install the timing belt. <Ref. to ME(STI)-51, INSTALLATION, Timing Belt.>
9) Adjust the valve clearance. <Ref. to ME(STI)-28, ADJUSTMENT, Valve Clearance.>
10) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:
Use a new rocker cover gasket.

(2) Apply liquid gasket to the specified point of the cylinder head.

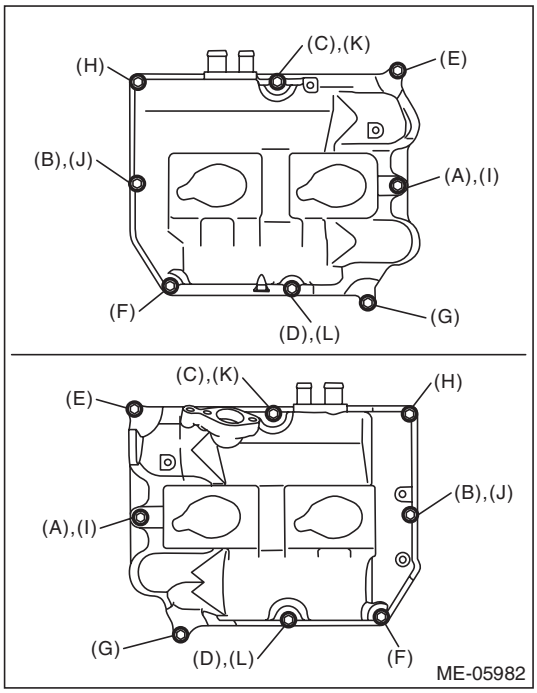
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



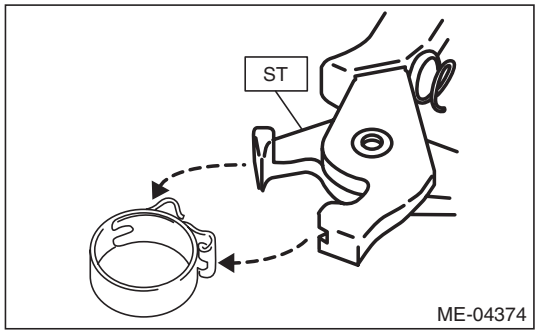
(3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.
(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

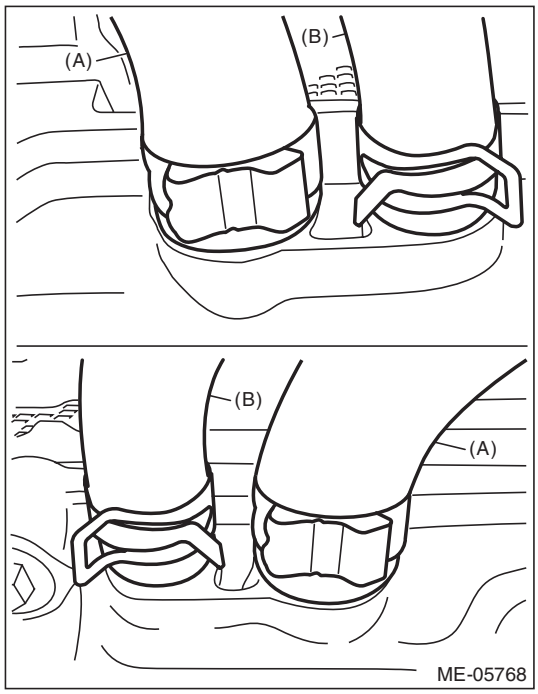
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



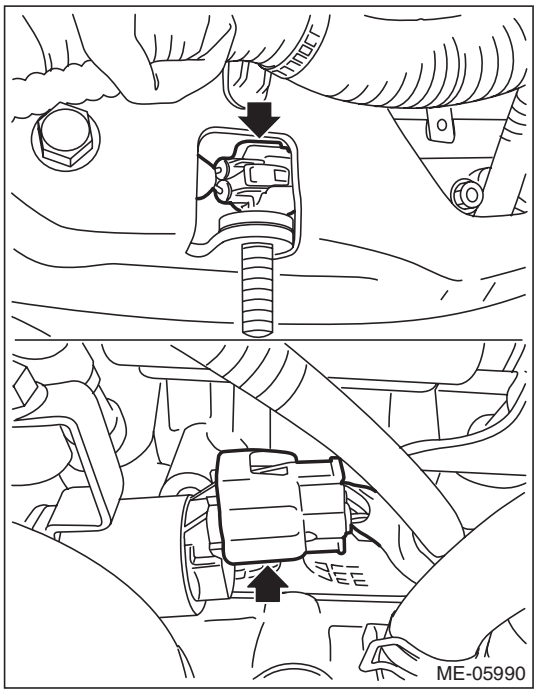
11) Connect the PCV hose (A) and vacuum hose (B) to the rocker cover.

NOTE:
Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS

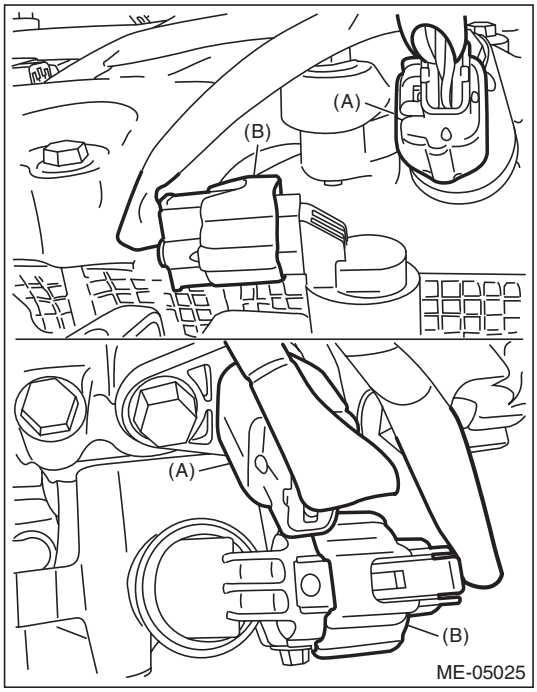




12) Connect the connector to the intake oil flow control solenoid valve.



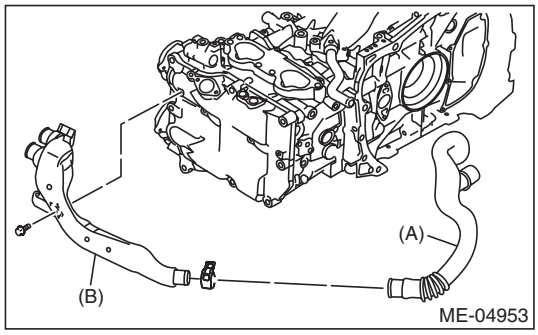
13) Connect the connector (A) to the exhaust camshaft position sensor and the connector (B) to the exhaust oil flow control solenoid valve.



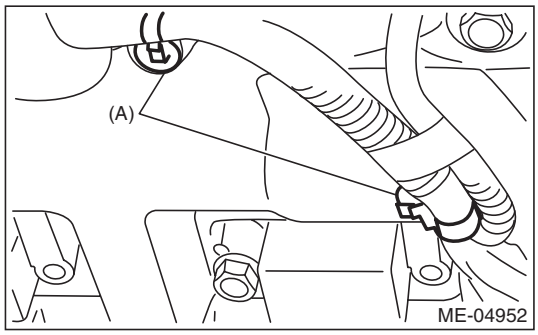
14) Install the ignition coil. <Ref. to IG(STI)-7, INSTALLATION, Ignition Coil.>

15) Install the air duct B (B) to the rocker cover LH and the air duct A (A).

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



16) Fix the engine harness to the rocker cover RH with clips (A).

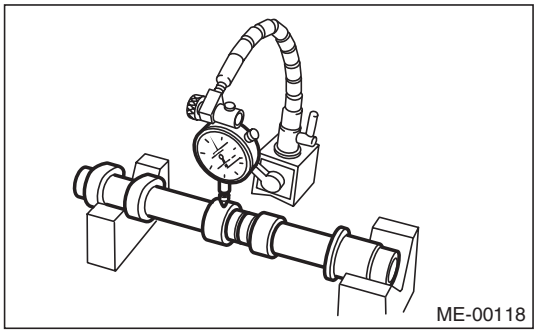


17) Install the timing belt cover. <Ref. to ME(STI)-48, INSTALLATION, Timing Belt Cover.>
18) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>
19) Install the rear side belt. <Ref. to ME(STI)-40, REAR SIDE BELT, INSTALLATION, V-belt.>
20) Install the engine to the vehicle. <Ref. to ME(STI)-33, INSTALLATION, Engine Assembly.>

C: INSPECTION

1) Measure the bend, and repair or replace if necessary.

Camshaft bend limit:
0.020 mm (0.00079 in)

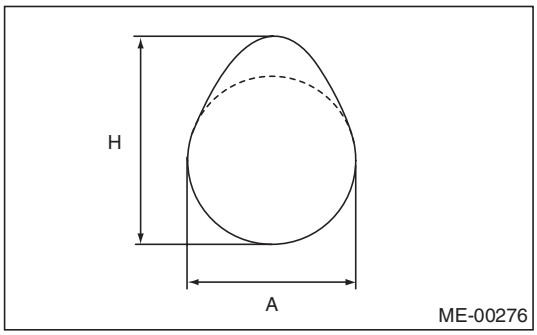


2) Check the journal for damage and wear. Replace if faulty.
3) Check the cutout portion used for camshaft sensor for damage. Replace if faulty.
4) Check the cam face condition, and remove the minor faults by grinding with oil stone. If offset wear occurs, replace it.
5) Measure the cam lobe height “H” and cam base circle diameter “A”. If it exceeds the standard or offset wear occurs, replace it.

Cam lobe height H:

Standard
Intake
46.55 — 46.65 mm (1.833 — 1.837 in)
Exhaust
46.75 — 46.85 mm (1.841 — 1.844 in)

Cam base circle diameter A:
Standard
37.0 mm (1.457 in)

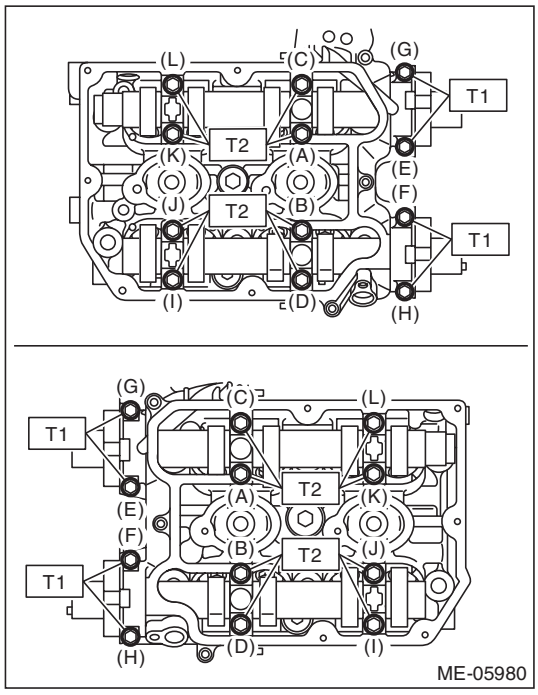


6) Measure the outside diameter of camshaft journal. If the journal diameter is not within specification, check the oil clearance.

	Camshaft journal	
	Front	Center, rear
Standard mm (in)	37.946 — 37.963 (1.4939 — 1.4946)	29.946 — 29.963 (1.1790 — 1.1796)

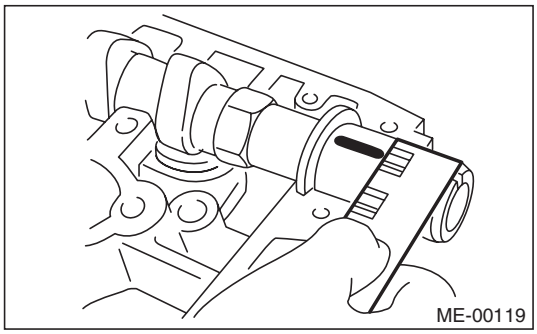
7) Measure the oil clearance of camshaft journal.
(1) Clean the camshaft cap and cylinder head camshaft journal.
(2) Place the camshaft on cylinder head. (Without installing the valve lifter)
(3) Place a plastigauge across each camshaft journals.
(4) Gradually tighten the camshaft cap in at least two steps, in alphabetical order shown in the figure, and then tighten to the specified torque. Do not turn the camshaft.

Tightening torque:
T1: 9.75 N·m (1.0 kgf-m, 7.2 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)



(5) Remove the camshaft cap.
(6) Measure the widest point of the plastigauge on each journal. If oil clearance exceeds the standard, replace the camshaft. If necessary, replace the camshaft caps and cylinder head as a set.

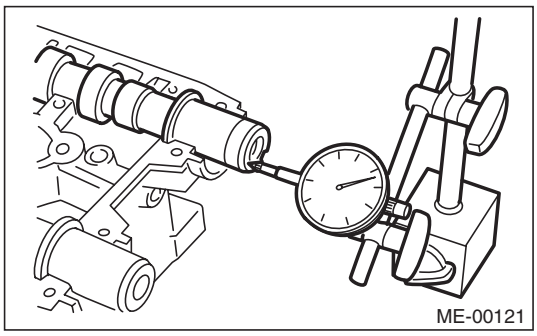
Camshaft oil clearance:
Standard
0.037 — 0.072 mm (0.0015 — 0.0028 in)



(7) Completely remove the plastigauge.

8) 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
0.068 — 0.116 mm (0.0027 — 0.0047 in)

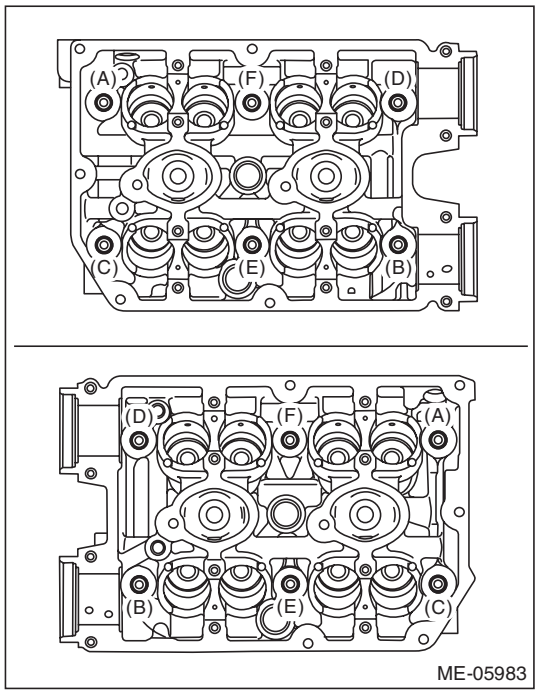


19.Cylinder Head

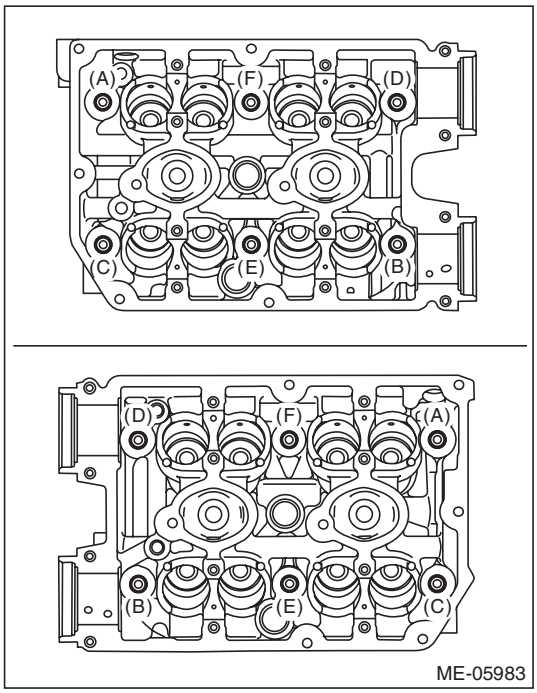
A: REMOVAL

1) Remove the engine from the vehicle. <Ref. to ME(STI)-29, REMOVAL, Engine Assembly.>
2) Remove the rear side belt. <Ref. to ME(STI)-39, REAR SIDE BELT, REMOVAL, V-belt.>
3) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
4) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.>
5) Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.>
6) Remove the timing belt. <Ref. to ME(STI)-49, REMOVAL, Timing Belt.>
7) Remove the cam sprocket. <Ref. to ME(STI)-58, REMOVAL, Cam Sprocket.>
8) Remove the secondary air combination valve. <Ref. to EC(STI)-29, REMOVAL, Secondary Air Combination Valve.>
9) Remove the bolts which secure A/C compressor bracket to cylinder head.
10) Remove the oil pipe. <Ref. to LU(STI)-25, REMOVAL, Oil Pipe.>
11) Remove the camshaft. <Ref. to ME(STI)-60, REMOVAL, Camshaft.>
12) Remove the oil level gauge guide. (LH side only)
13) Remove the cylinder head bolts in alphabetical order shown in the figure.

NOTE:
Leave the bolts (A) and (D) engaged by three or four threads to prevent the cylinder head from falling.



14) While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (A) and (D) to remove cylinder head.



15) Remove the cylinder head gasket.

CAUTION:
Be careful not to scratch the mating surface of cylinder head and cylinder block.

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.

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.

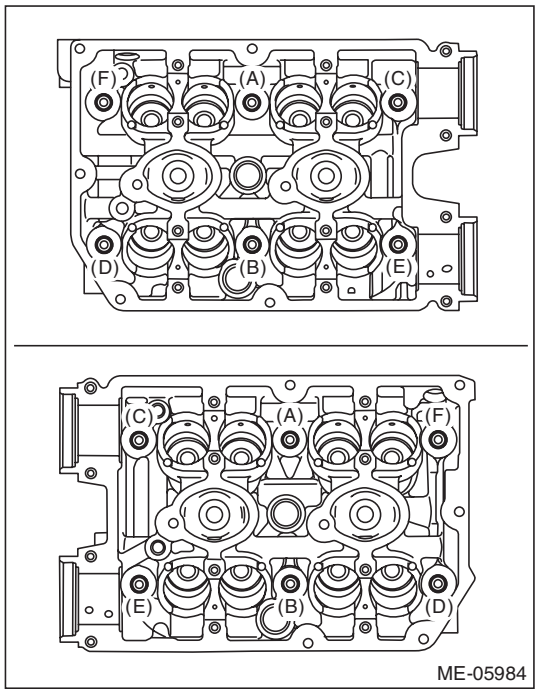
CAUTION:
If the bolt makes stick-slip sound during tightening, repeat the procedure from step (1). In this case, the cylinder head gasket can be reused.

(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 70 N·m (7.1 kgf-m, 51.6 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 only)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

3) Install the camshaft. <Ref. to ME(STI)-63, INSTALLATION, Camshaft.>
4) Install the oil pipe. <Ref. to LU(STI)-27, INSTALLATION, Oil Pipe.>
5) Install the A/C compressor bracket on cylinder head.

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)

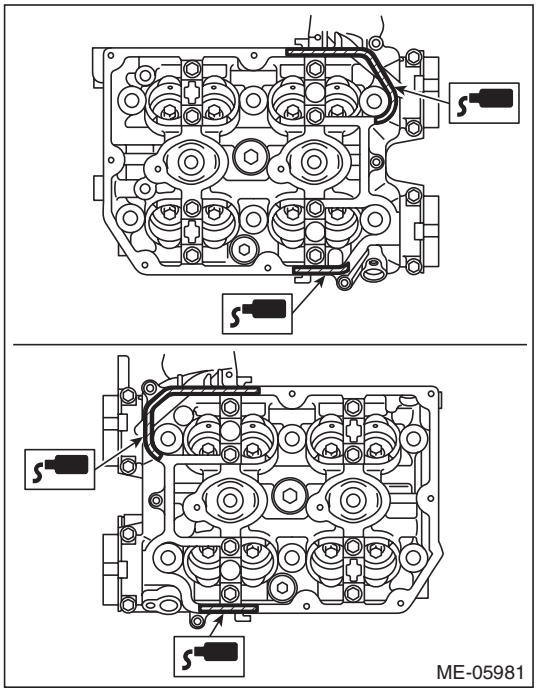
6) Install the secondary air combination valve. <Ref. to EC(STI)-30, INSTALLATION, Secondary Air Combination Valve.>
7) Install the cam sprocket. <Ref. to ME(STI)-58, INSTALLATION, Cam Sprocket.>
8) Install the timing belt. <Ref. to ME(STI)-51, INSTALLATION, Timing Belt.>
9) Adjust the valve clearance. <Ref. to ME(STI)-28, ADJUSTMENT, Valve Clearance.>
10) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:
Use a new rocker cover gasket.

(2) Apply liquid gasket to the specified point of the cylinder head.

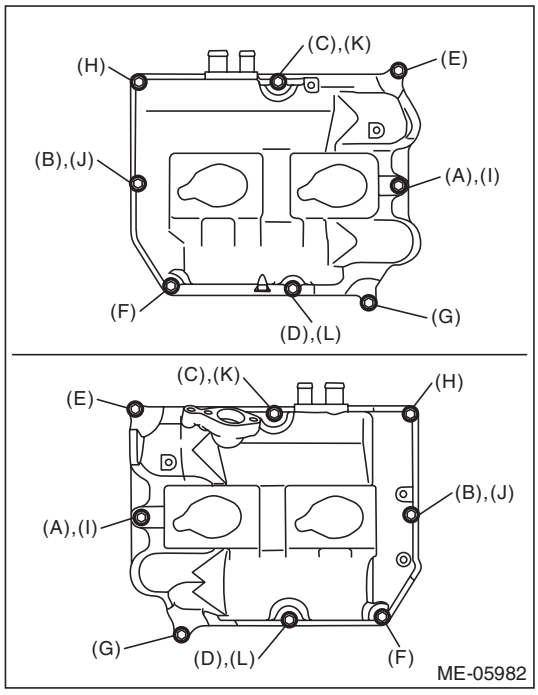
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



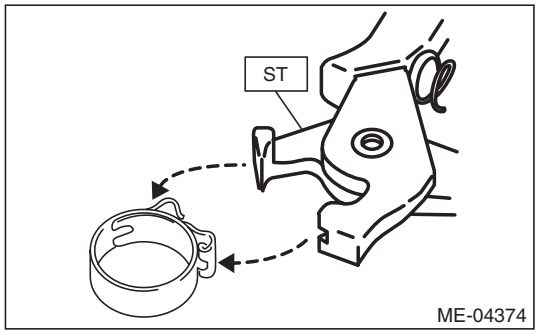
(3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.
(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

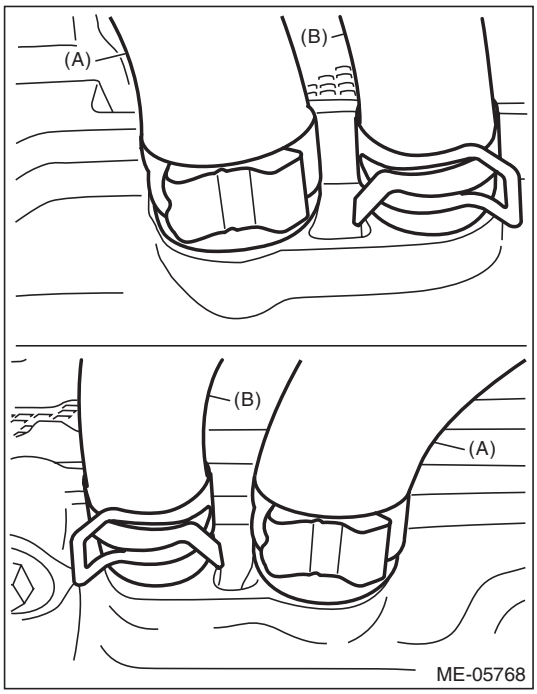
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



11) Connect the PCV hose (A) and vacuum hose (B) to the rocker cover.

NOTE:
Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS



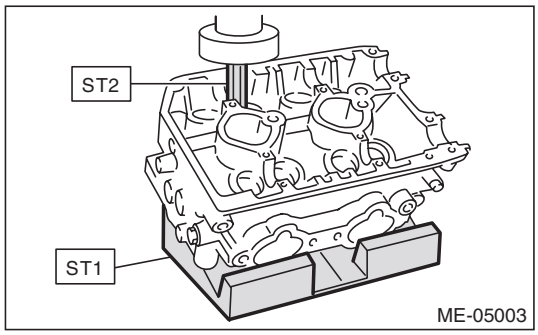


12) Install the timing belt cover. <Ref. to ME(STI)-48, INSTALLATION, Timing Belt Cover.>
13) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>
14) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.>
15) Install the rear side belt. <Ref. to ME(STI)-40, REAR SIDE BELT, INSTALLATION, V-belt.>
16) Install the engine to the vehicle. <Ref. to ME(STI)-33, INSTALLATION, Engine Assembly.>

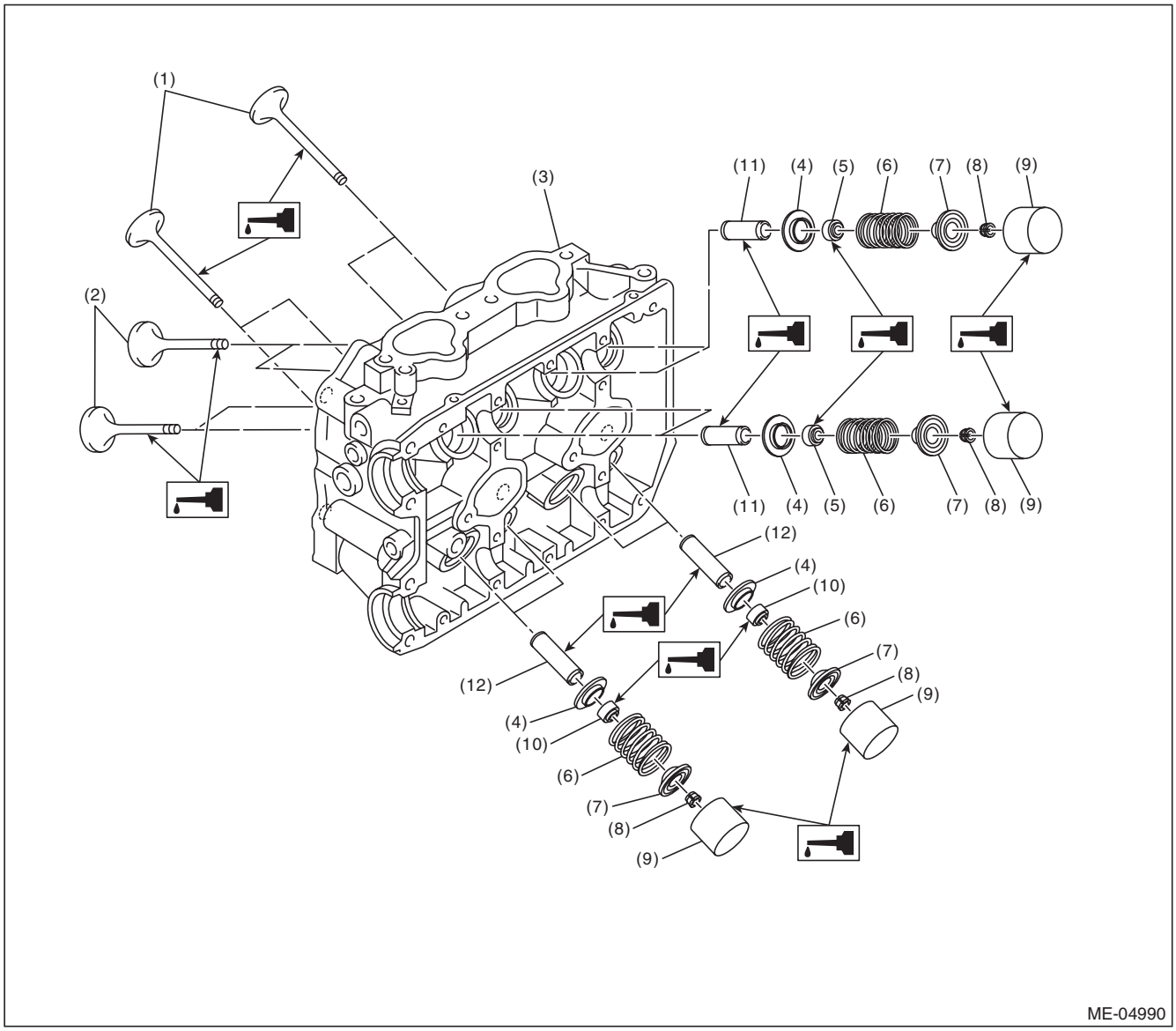
C: DISASSEMBLY

1) Remove the valve lifter.
2) Place the cylinder head on ST1.
ST1 498267600 CYLINDER HEAD TABLE
3) Using ST2, compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.
ST2 499718000 VALVE SPRING REMOVER

NOTE:
- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.
- Keep all the removed parts in order for re-installing in their original positions.
- For removal and installation procedures of the valve guide, intake valve oil seal and exhaust valve oil seal, refer to “INSPECTION”. <Ref. to ME(STI)-75, VALVE GUIDE, INSPECTION, Cylinder Head.> <Ref. to ME(STI)-77, INTAKE AND EXHAUST VALVE OIL SEAL, INSPECTION, Cylinder Head.>



D: ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Cylinder head
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Valve spring retainer
(8) Valve spring retainer key
(9) Valve lifter
(10) Exhaust valve oil seal
(11) Intake valve guide
(12) Exhaust valve guide

1) Install the valve spring and valve.
(1) Coat the valve stem of each valve with engine oil and insert the valve into valve guide.

NOTE:
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

(2) Set the cylinder head on ST1.

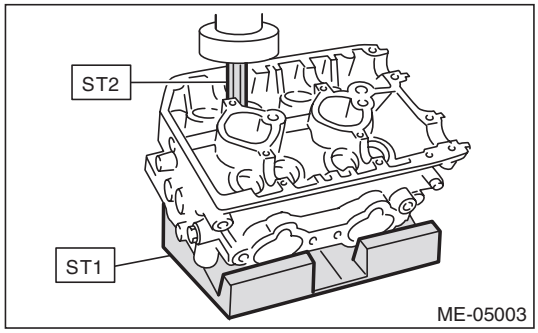
ST1 498267600 CYLINDER HEAD TABLE

(3) Install the valve spring and valve spring retainer.

NOTE:
Be sure to install the valve spring with its close-coiled end facing the cylinder head side.

(4) Set the ST2 on valve spring.

ST2 499718000 VALVE SPRING REMOVER



(5) Compress the valve spring and fit the valve spring retainer key.
(6) After installing, tap the valve spring retainers lightly with a plastic hammer for better seating.

2) Apply oil to the surface of valve lifter.
3) Install the valve lifter.

E: INSPECTION

1. CYLINDER HEAD

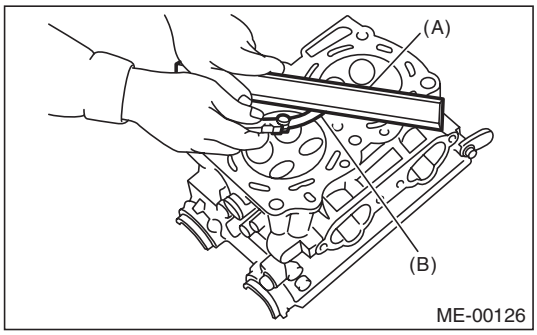
1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
2) Measure the warping of the cylinder head surface that mates with cylinder block using a straight edge (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:
0.3 mm (0.012 in)

Standard height of cylinder head:
127.5 mm (5.02 in)

NOTE:
Uneven torque for the cylinder head bolts can cause warping. When reinstalling, pay special attention to the torque so as to tighten evenly.

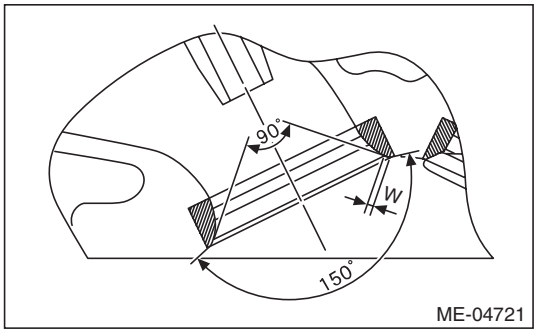


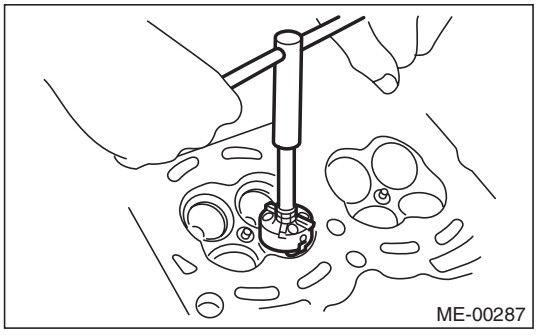
2. VALVE SEAT

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
0.6 — 1.4 mm (0.024 — 0.055 in)
Exhaust
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
0.030 — 0.057 mm (0.0012 — 0.0022 in)
Exhaust
0.040 — 0.067 mm (0.0016 — 0.0026 in)

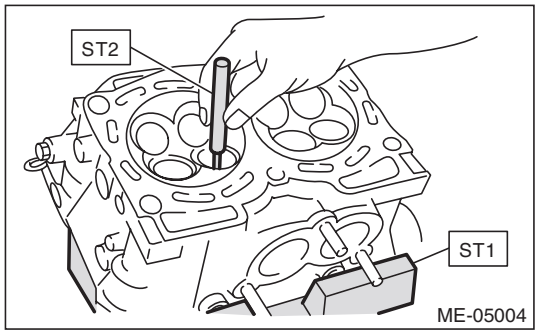
2) If the clearance between valve guide and valve stem exceeds the standard, replace the valve guide or valve itself, whichever shows the greater amount of wear or damage. See the following procedure for valve guide replacement.

Valve guide inner diameter:
6.000 — 6.012 mm (0.2362 — 0.2367 in)

Valve stem outer diameters:
Intake
5.955 — 5.970 mm (0.2344 — 0.2350 in)
Exhaust
5.945 — 5.960 mm (0.2341 — 0.2346 in)

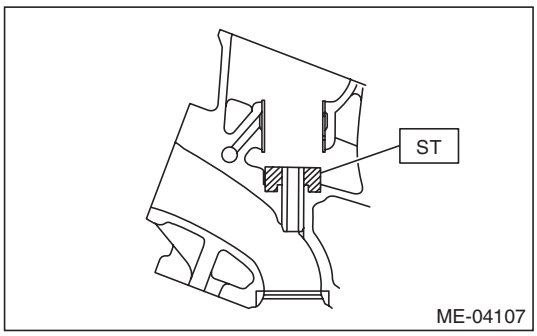
(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides fit the holes in ST1.
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267600 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



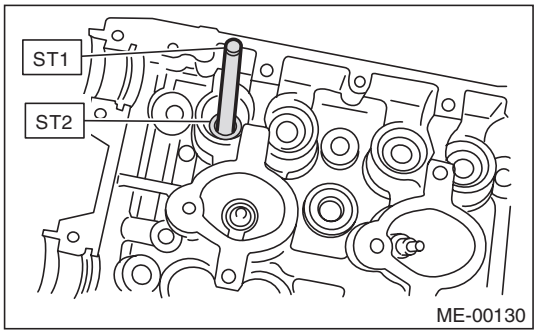
(3) Turn the cylinder head upside down and place the ST as shown in the figure.

ST 18251AA020 VALVE GUIDE ADJUSTER



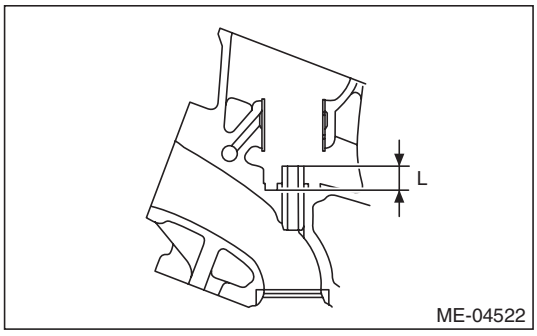
(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.
(5) Put a new valve guide, coated with sufficient oil, in the cylinder head, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER
ST2 18251AA020 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion amount "L".

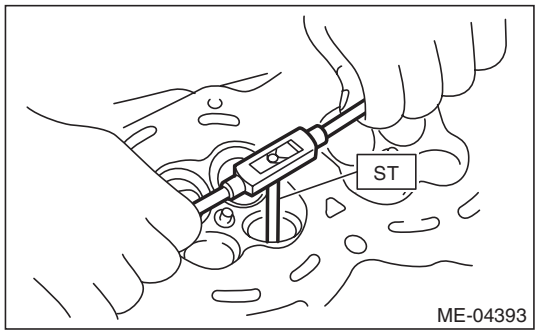
Valve guide protrusion amount L:
15.8 — 16.2 mm (0.622 — 0.638 in)



(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



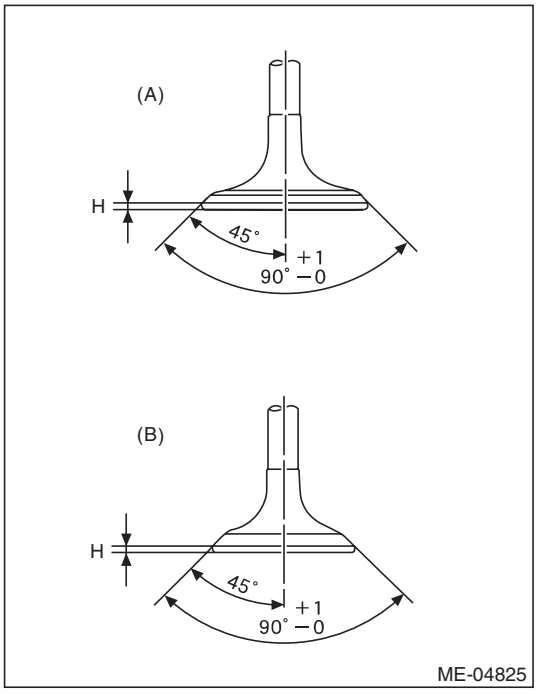
(8) After reaming, clean the valve guide to remove chips.
(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

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:

Standard
Intake (A)
1.0 — 1.4 mm (0.039 — 0.055 in)
Exhaust (B)
1.3 — 1.7 mm (0.051 — 0.067 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.

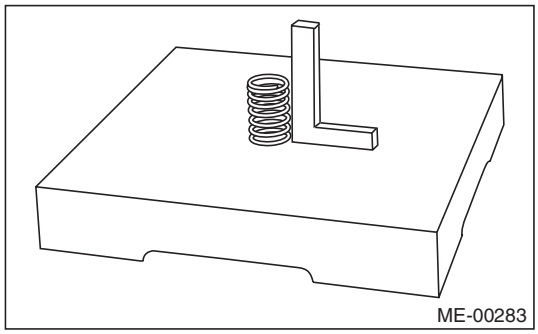
NOTE:
It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

Valve overall length:
Intake
104.4 mm (4.110 in)
Exhaust
104.65 mm (4.1201 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)	53.48 (2.106)
Tension/spring height N (kgf, lbf)/mm (in)	Set	204.6 — 235.4 (20.86 — 24.00, 46.00 — 52.93)/36.0 (1.417)
	Lift	363.5 — 401.7 (37.07 — 40.96, 81.73 — 90.32)/26.7 (1.051)
Squareness		2.5°, 2.3 mm (0.091 in) or less


ME-00283

6. INTAKE AND EXHAUST VALVE OIL SEAL

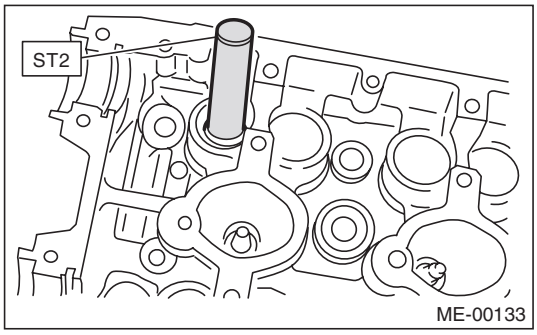
1) For the following, replace the oil seal with a new part. See the procedure 2) and subsequent for replacement procedures.
- When the lip is damaged.
- When the spring is out of the specified position.
- When readjusting the surfaces of valve and valve seat.
- When replacing the valve guide.

2) Place the cylinder head on ST1, and use ST2 to press-fit the oil seal.

ST1 498267600 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]

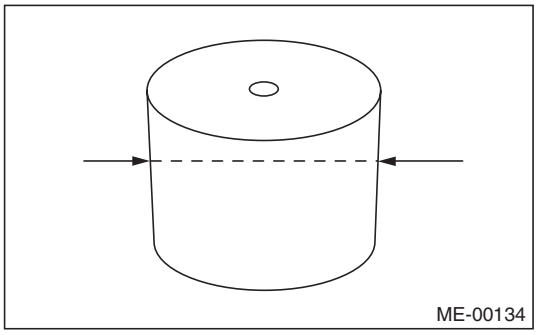


ME-00133

7. VALVE LIFTER

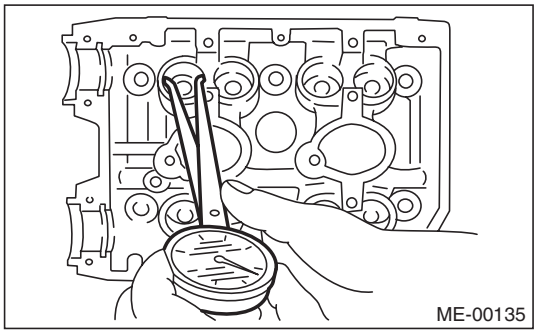
1) Check the valve lifter visually.
2) Measure the outer diameter of valve lifter.

Outer diameter of valve lifter:
Standard
34.959 — 34.975 mm (1.3763 — 1.3770 in)


ME-00134

3) Measure the inner diameter of valve lifter mating surface on cylinder head.

Valve lifter mating surface inner diameter:
Standard
34.994 — 35.016 mm (1.3777 — 1.3786 in)


ME-00135

4) Check the clearance between valve lifter and valve lifter mating surface. The clearance can be checked by measuring the outer diameter of valve lifter and the inner diameter of valve lifter. If it exceeds the standard or offset wear occurs, replace the cylinder head.

Valve lifter and valve lifter mating surface clearance:

Standard

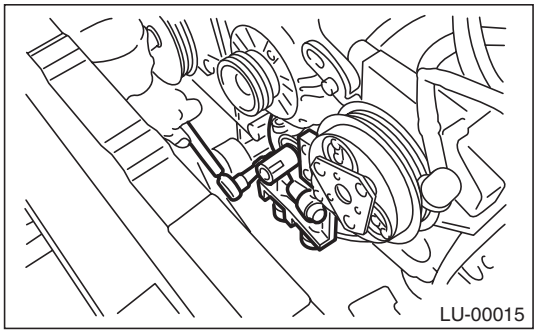
0.019 — 0.057 mm (0.0007 — 0.0022 in)

20.Cylinder Block

A: REMOVAL

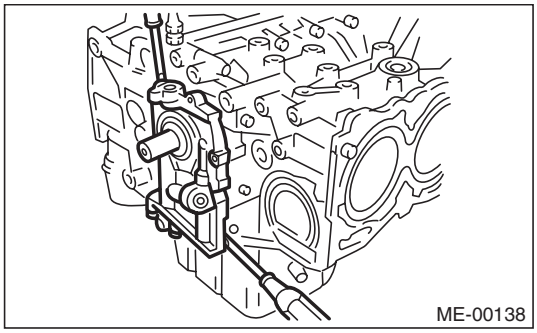
NOTE:
Before conducting this procedure, drain the engine oil completely.
1) Remove the engine from the vehicle. <Ref. to ME(STI)-29, REMOVAL, Engine Assembly.>
2) Remove the rear side belt. <Ref. to ME(STI)-39, REAR SIDE BELT, REMOVAL, V-belt.>
3) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
4) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.>
5) Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.>
6) Remove the timing belt. <Ref. to ME(STI)-49, REMOVAL, Timing Belt.>
7) Remove the cam sprocket. <Ref. to ME(STI)-58, REMOVAL, Cam Sprocket.>
8) Remove the crank sprocket. <Ref. to ME(STI)-59, REMOVAL, Crank Sprocket.>
9) Remove the generator and A/C compressor with their brackets.
10) Remove the camshaft. <Ref. to ME(STI)-60, REMOVAL, Camshaft.>
11) Remove the cylinder head. <Ref. to ME(STI)-69, REMOVAL, Cylinder Head.>
12) Remove the clutch disc and cover. <Ref. to CL-11, REMOVAL, Clutch Disc and Cover.>
13) Remove the flywheel. <Ref. to CL-14, REMOVAL, Flywheel.>
14) Remove the oil separator cover.
15) Remove the water by-pass pipe for heater.
16) Remove the oil filter. <Ref. to LU(STI)-31, REMOVAL, Engine Oil Filter.>
17) Remove the oil cooler. <Ref. to LU(STI)-24, REMOVAL, Engine Oil Cooler.>
18) Remove the water pump. <Ref. to CO(STI)-15, REMOVAL, Water Pump.>
19) 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.


LU-00015

20) Remove the oil pump from cylinder block using a flat tip screwdriver.

CAUTION:
Be careful not to scratch the mating surface of the cylinder block and oil pump.

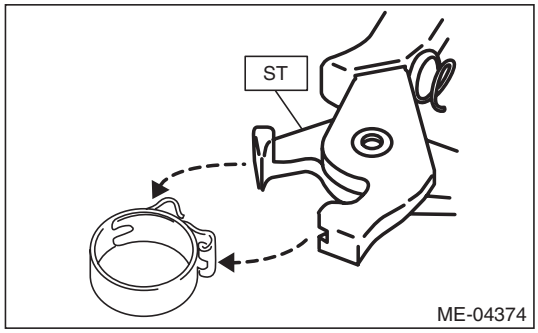

ME-00138

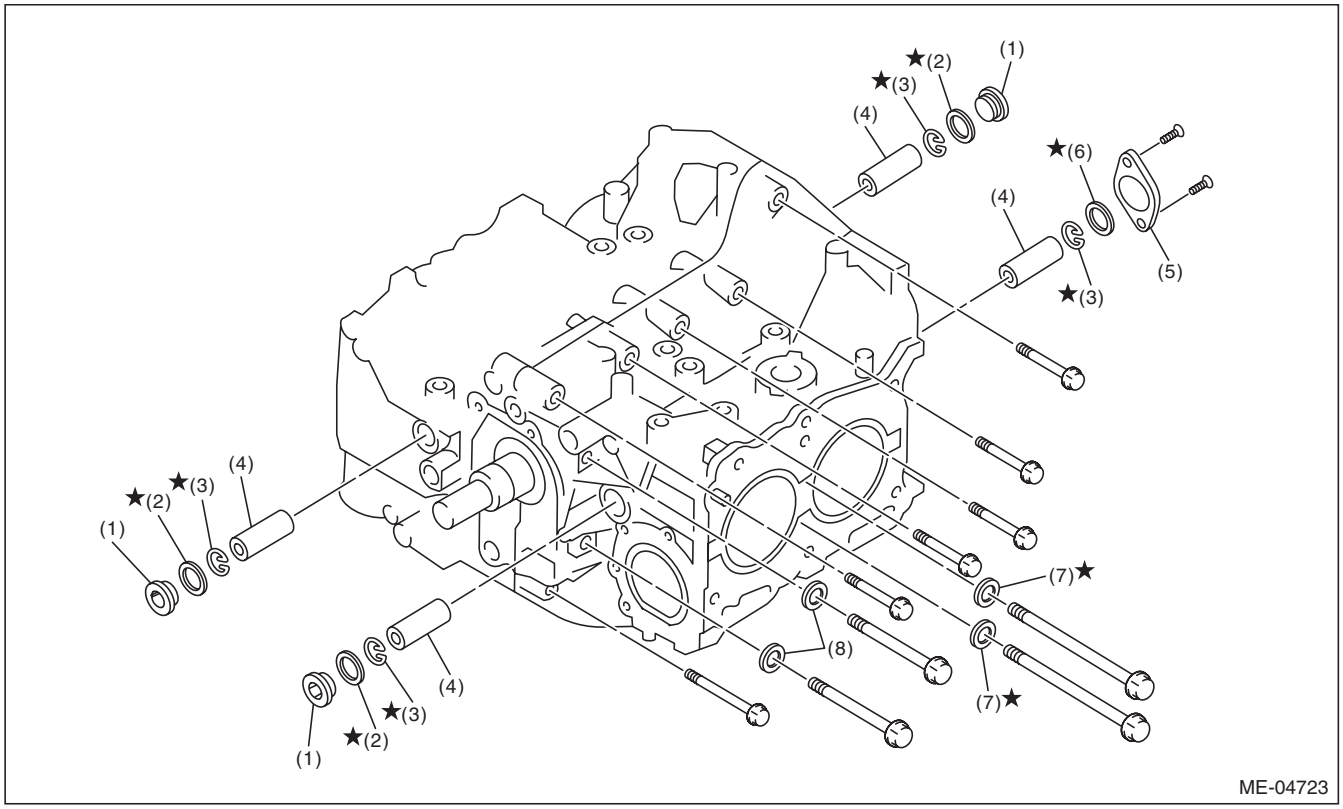
21) Remove the front oil seal from the oil pump.
22) Remove the oil pan.
(1) Set the part so that the cylinder block LH is on the upper side.
(2) Remove the bolts which secure oil pan to cylinder block.
(3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

CAUTION:
Do not use a screwdriver or similar tools in place of oil pan cutter.

23) Remove the oil strainer.
24) Remove the baffle plate.
25) Remove the water tank pipe assembly from the cylinder block RH.

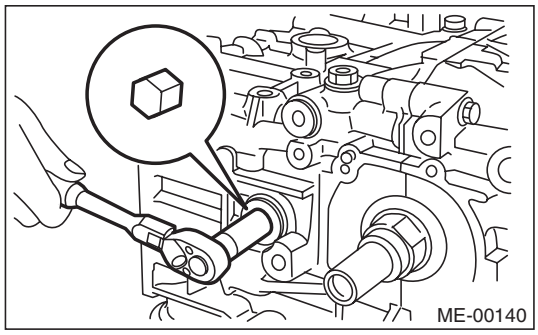
NOTE:
Pinch the clamp of the water tank pipe assembly by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS



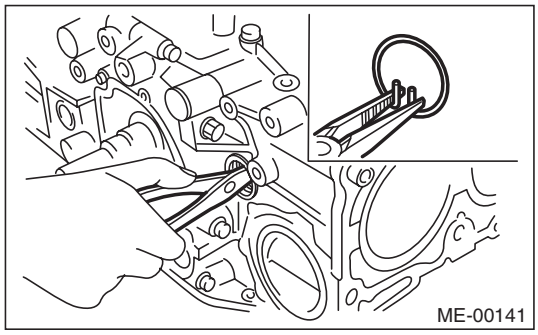


(1) Service hole plug
(2) Gasket
(3) Snap ring
(4) Piston pin
(5) Service hole cover
(6) O-ring
(7) Seal washer
(8) Washer

26) Remove the service hole plugs using a hexagon wrench [14 mm].



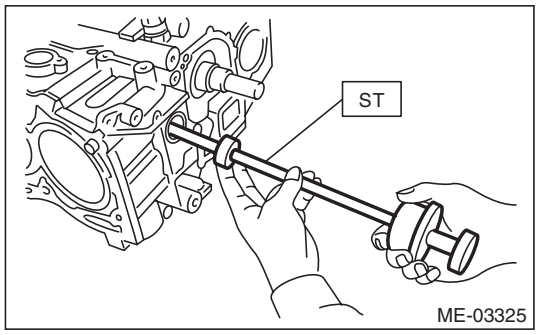
27) Remove the service hole cover.
28) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring through service hole of #1 and #2 cylinders.



29) Draw out the piston pin from #1 and #2 pistons using ST.

ST	499097700	PISTON PIN REMOVER ASSY

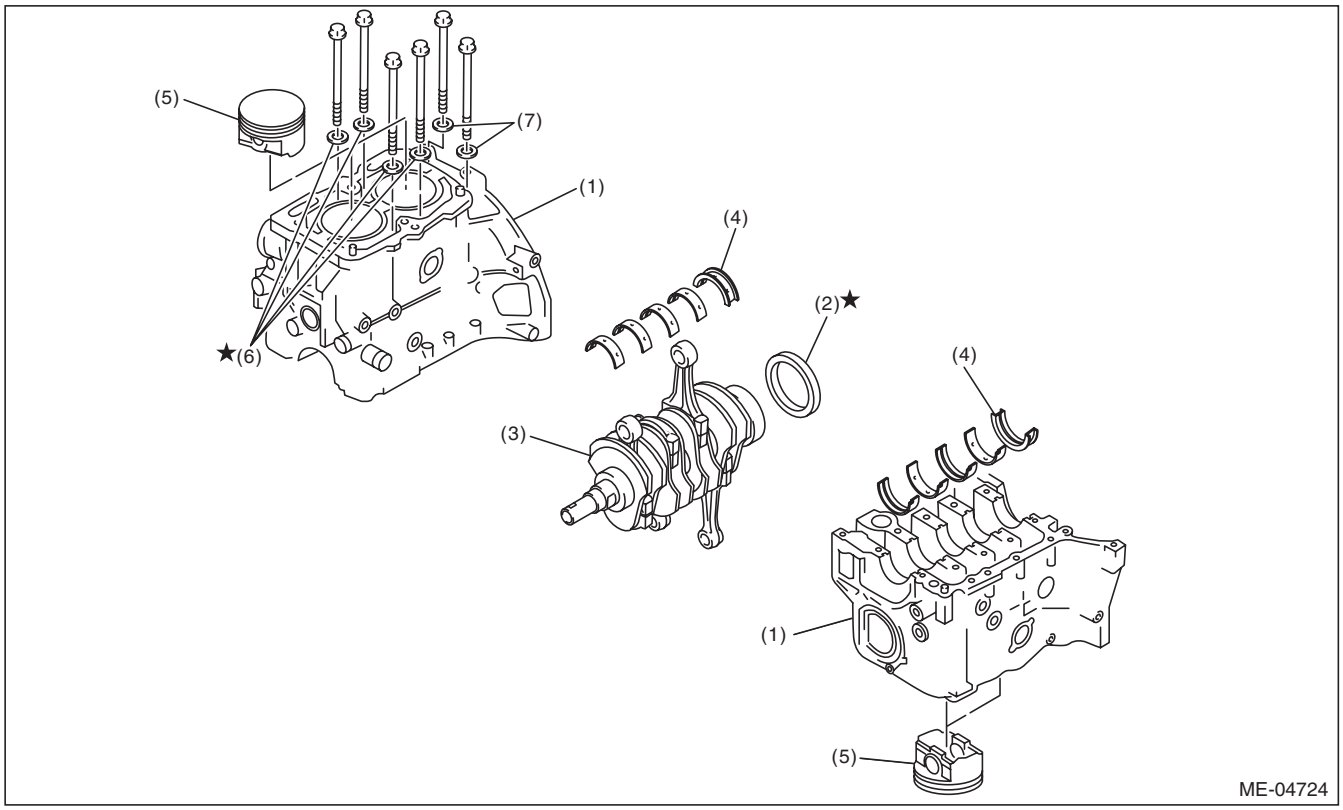
NOTE:
Be careful not to confuse the original combination of piston, piston pin and cylinder.



30) Similarly draw out the piston pins from #3 and #4 pistons.
31) Remove the cylinder block connecting bolt on the RH side.
32) Loosen the cylinder block connecting bolt on the LH side by 2 to 3 turns.
33) Set the part so that the cylinder block LH is on the upper side, and remove the cylinder block connecting bolt.

34) 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

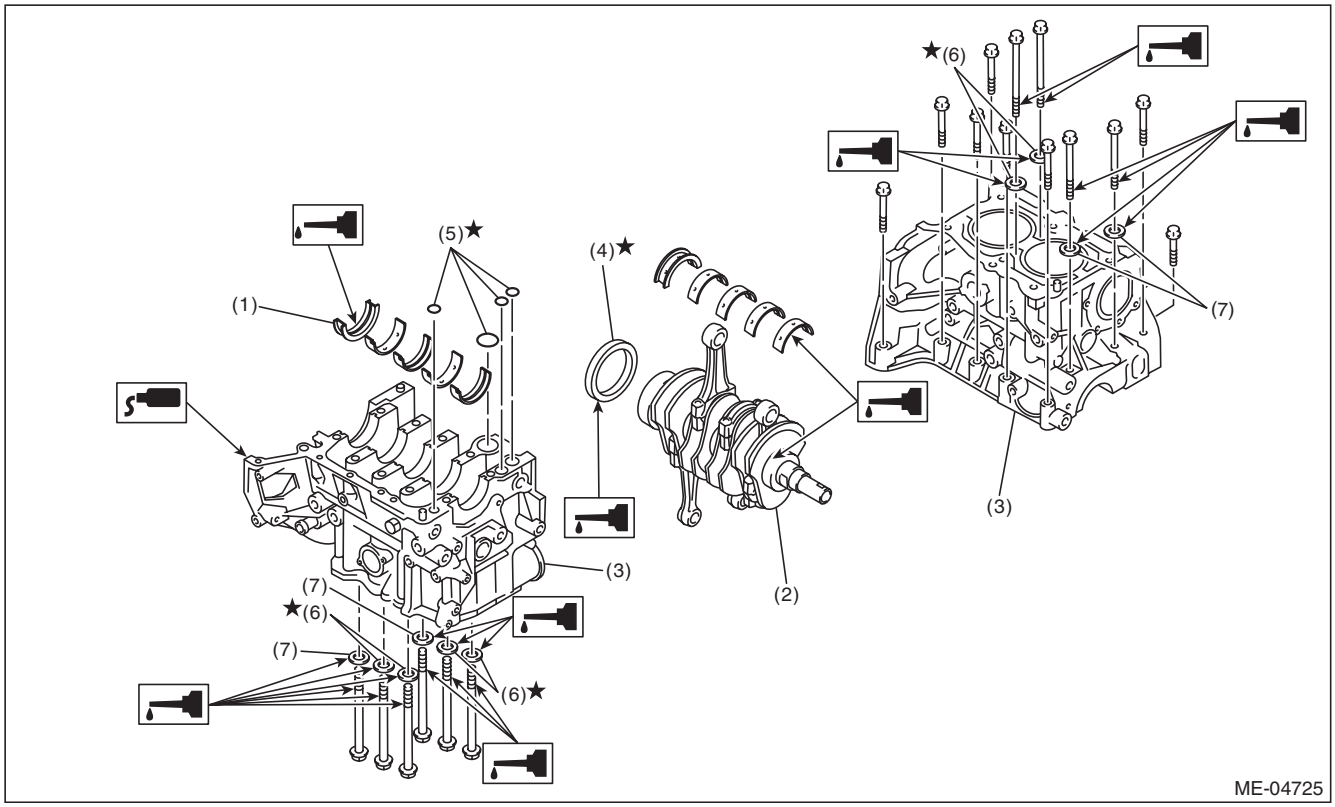
35) Remove the rear oil seal.
36) Remove the crankshaft together with connecting rod.
37) Remove the crankshaft bearings from cylinder block using a hammer handle.

NOTE:
• Press the crankshaft bearing at the end opposite to locking lip to remove.
• Be careful not to confuse the crankshaft bearing combination.

38) 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

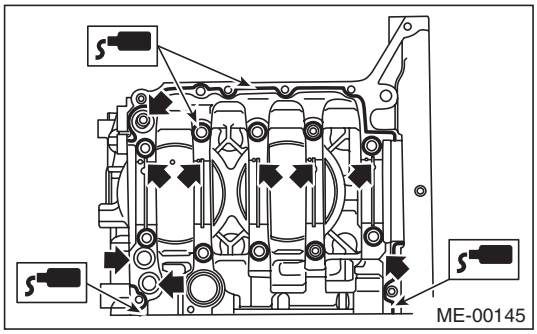
1) Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.
2) Position the crankshaft and O-ring on cylinder block RH.

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

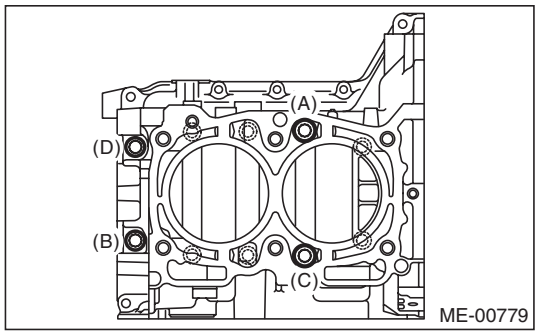


4) Apply a coat of engine oil to the washer and bolt thread.

NOTE:
Use a new seal washer.

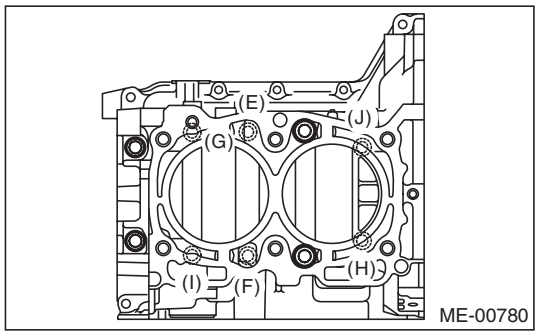
5) Tighten the 10 mm cylinder block connecting bolts on the LH side (A — D) in alphabetical order.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



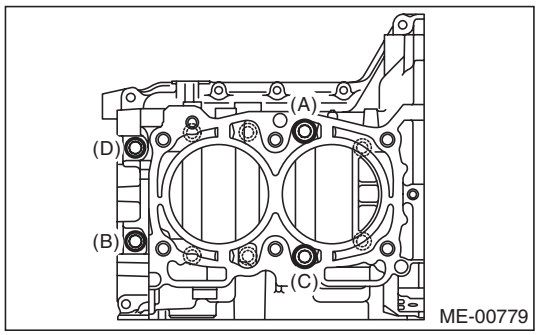
6) Tighten the 10 mm cylinder block connecting bolts on the RH side (E — J) in alphabetical order.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



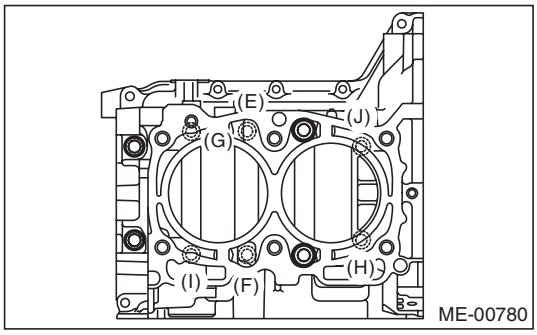
7) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

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)



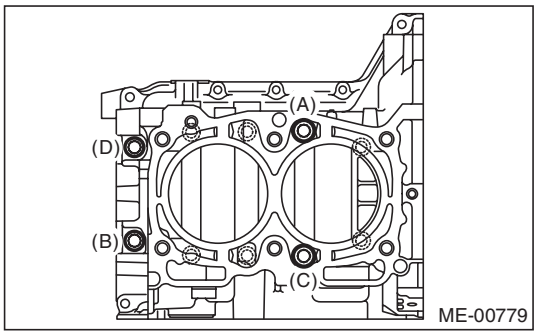
9) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

- (A), (C): Angle tightening

Tightening angle:
90°

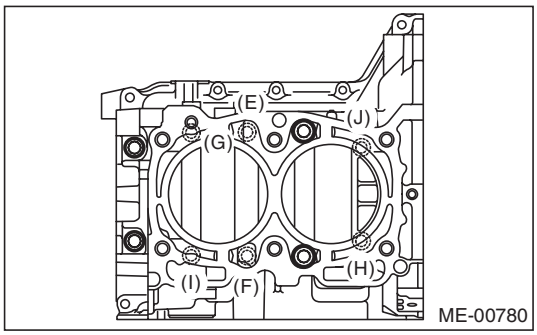
- (B), (D): Torque tightening

Tightening torque:
40 N·m (4.1 kgf-m, 29.5 ft-lb)



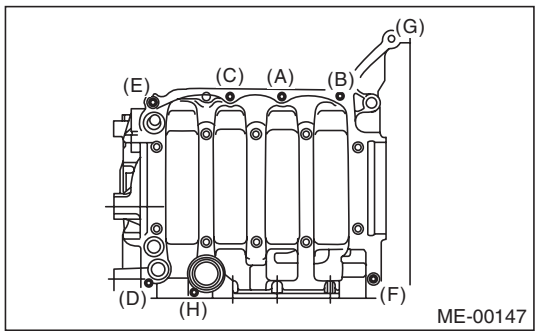
10) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

Tightening angle:
90°



11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on the LH side (A — H) in alphabetical order.

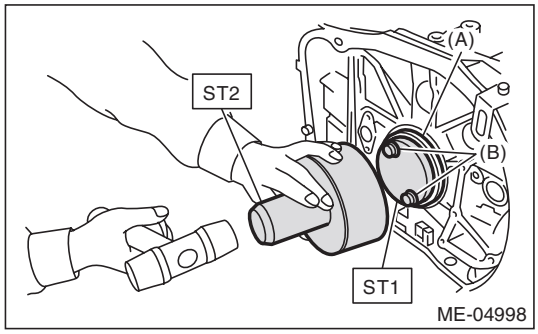
Tightening torque:
(A) — (G): 25 N·m (2.5 kgf-m, 18.4 ft-lb)
(H): 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



12) Apply a coat of engine oil to the oil seal inner periphery and outer periphery, and install the rear oil seal using ST1 and ST2.

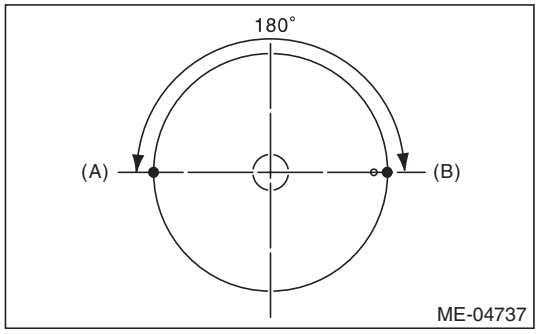
NOTE:
Use a new rear oil seal.

ST1	499597100	CRANKSHAFT OIL SEAL GUIDE
ST2	499587200	CRANKSHAFT OIL SEAL INSTALLER

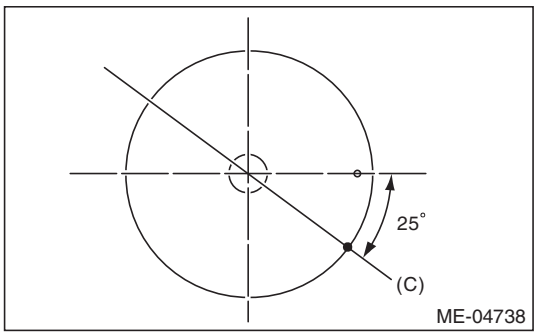


(A) Rear oil seal
(B) Flywheel attachment bolt

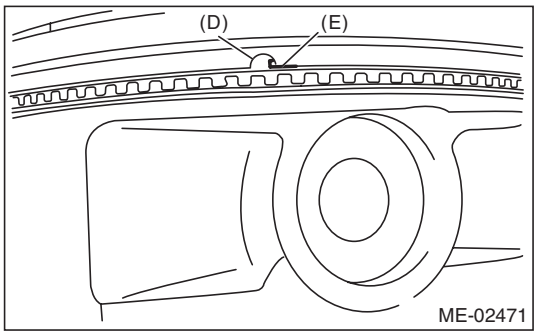
13) Position the top ring gap at (A) or (B) in the figure.
14) Position the second ring gap at 180° on the reverse side the top ring gap.



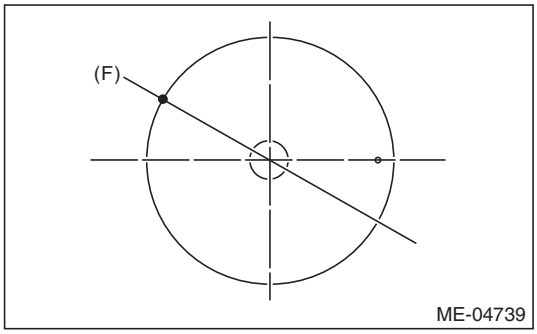
15) Position the upper rail gap at (C) in the figure.



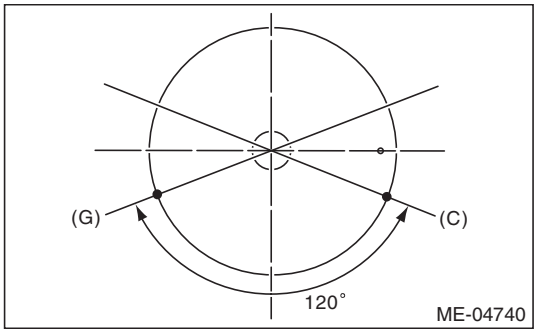
16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



17) Position the expander gap at (F) in the figure on the 180° opposite direction of (C).



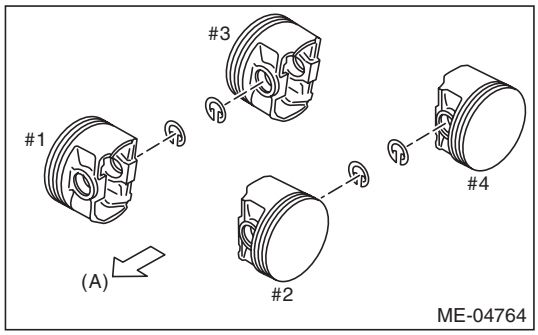
18) Set the lower rail gap at position (G), located 120° clockwise from (C) in the figure.



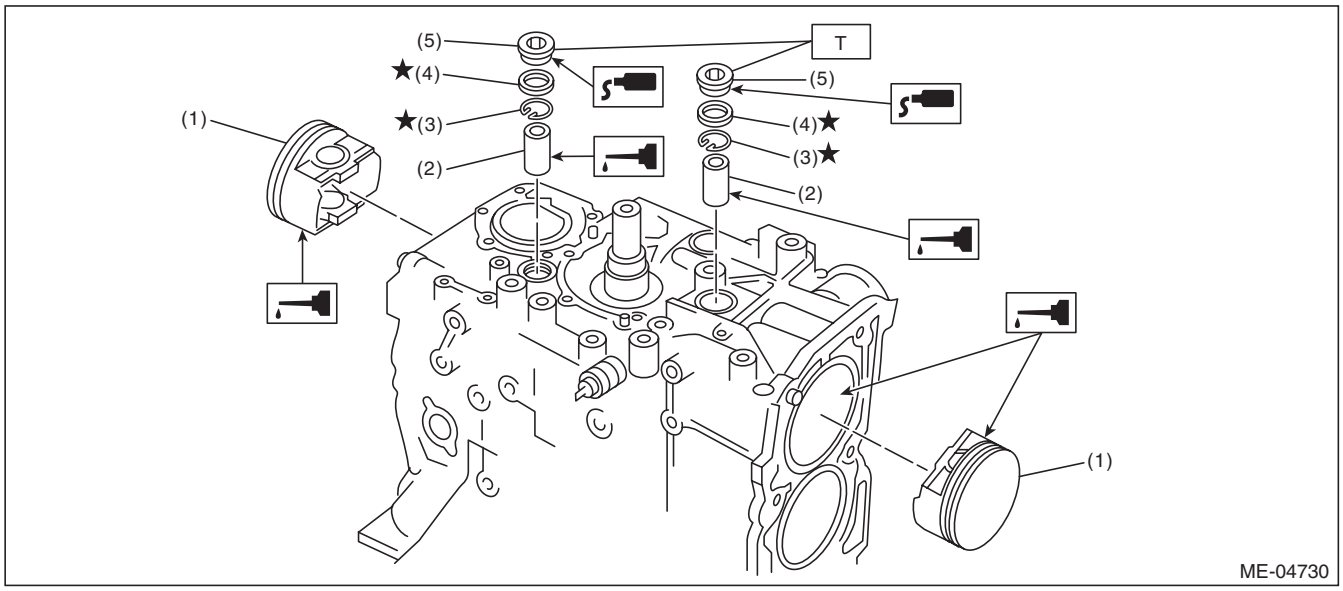
NOTE:
• Make sure ring gaps do not face the same direction.
• Make sure ring gaps are not within the piston skirt area.

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

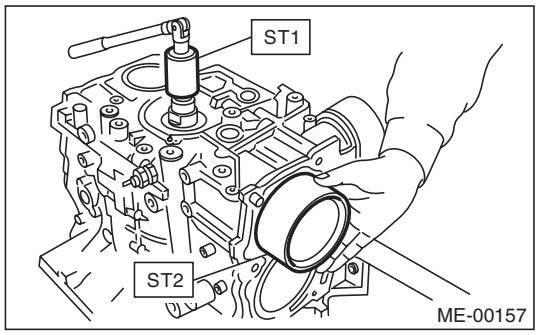
Tightening torque: N·m (kgf-m, ft-lb)
T: 70 (7.1, 51.6)

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.

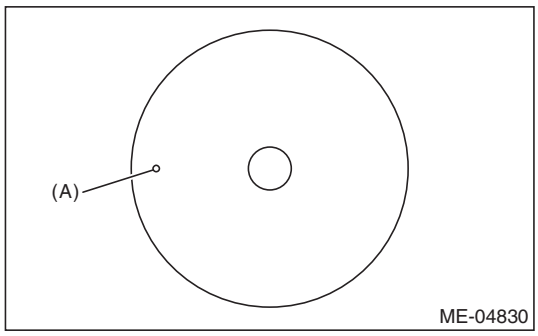
ST1 499987500 CRANKSHAFT SOCKET

(3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 498747300 PISTON GUIDE



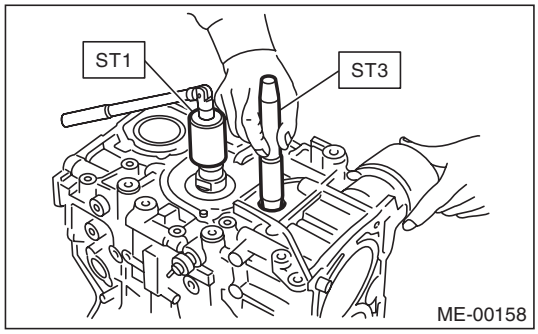
NOTE:
Face the piston front mark towards the front of the engine.



(A) Front mark

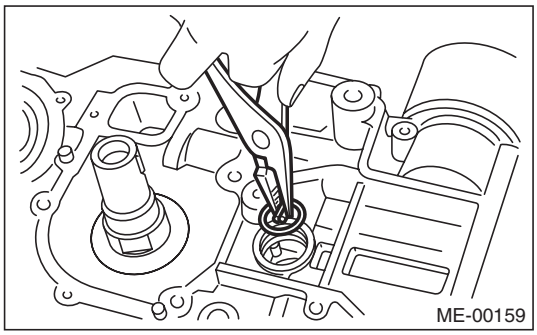
21) Install the piston pin.
(1) Apply a coat of engine oil to ST3.
(2) Insert ST3 into the service hole to align the piston pin hole and the connecting rod small end.

ST3 499017100 PISTON PIN GUIDE



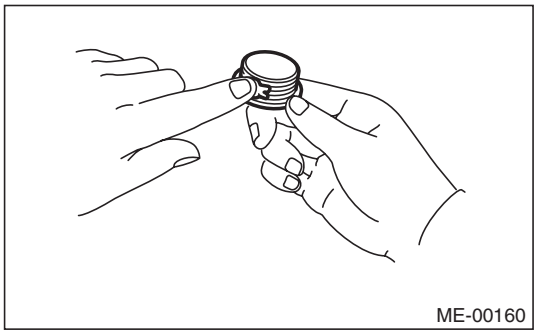
(3) Apply a thin coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.
(4) Install the snap ring.

NOTE:
Use new snap rings.



(5) Apply liquid gasket to the threaded portion of the service hole plug.

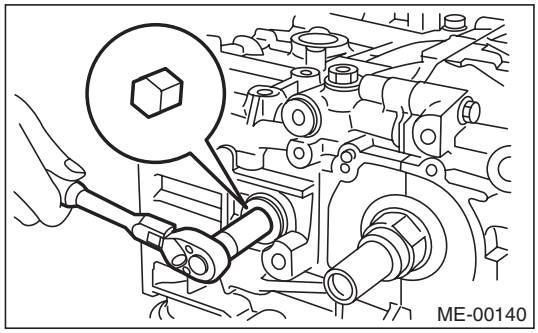
Liquid gasket:
THREE BOND 1105 (Part No. 004403010) or equivalent

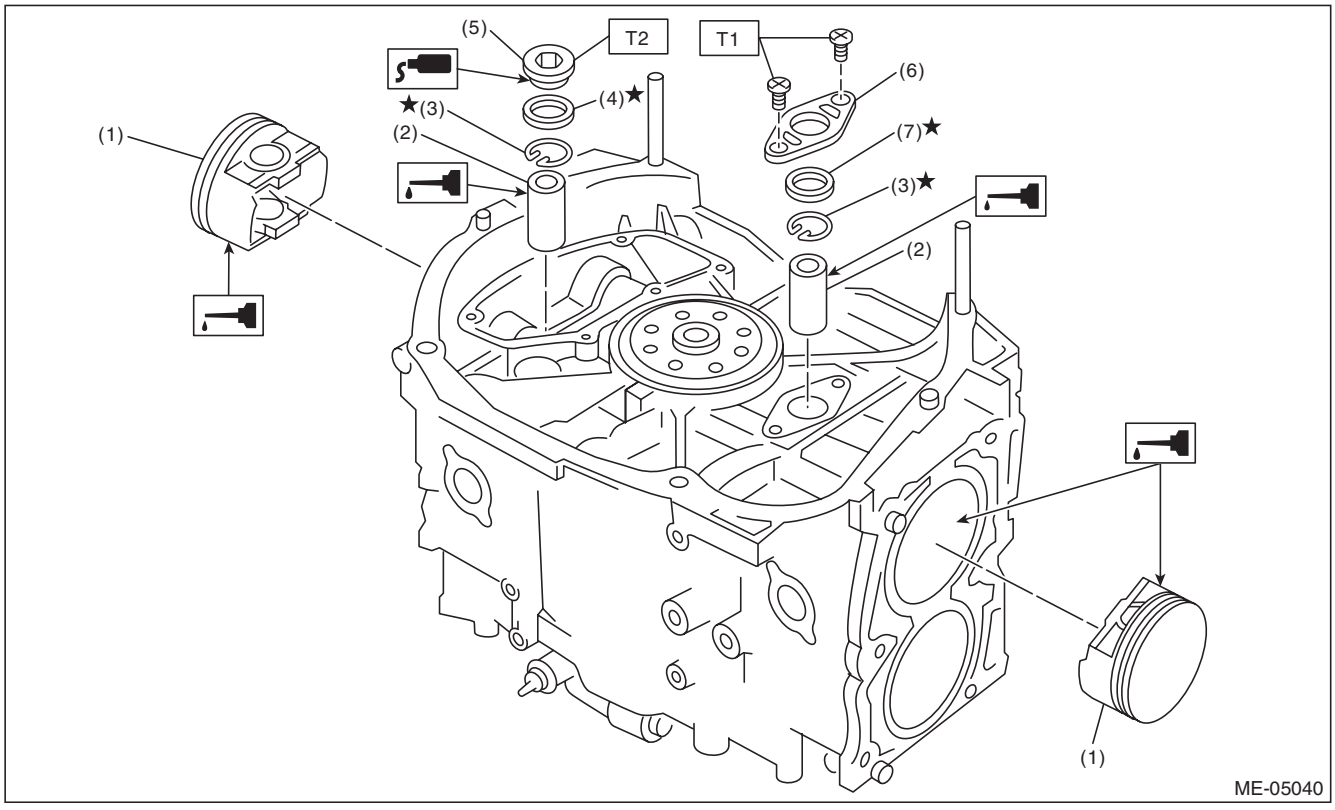


(6) Install the service hole plug and gasket.

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)

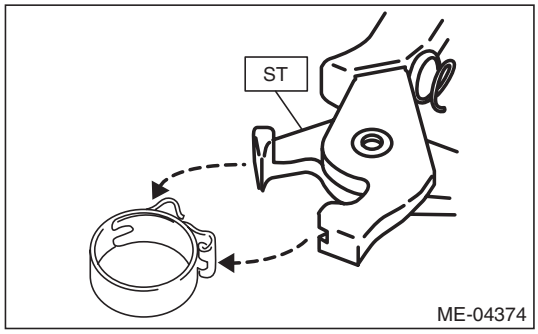
(7) Set the parts so that the #3 and #4 cylinders are on the upper side. Following the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.
(8) Install the service hole cover.

NOTE:
Use new O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

22) Install the water tank pipe assembly onto the cylinder block RH.

NOTE:
Use a new clamp for the water tank pipe assembly clamp, fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS



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.

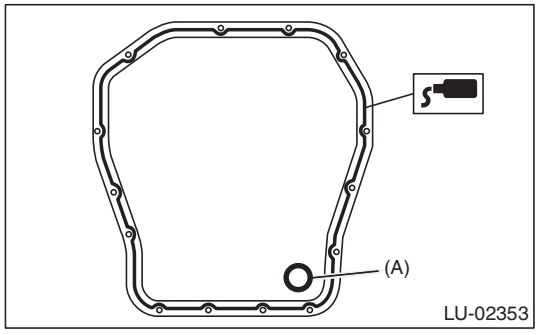
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

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)



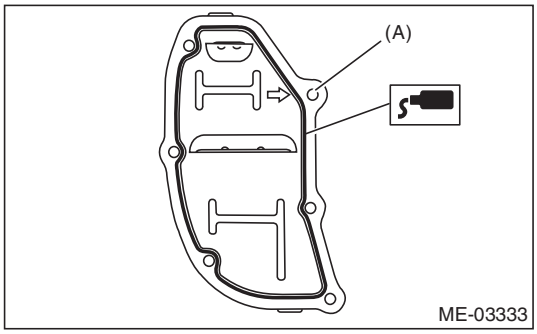
(A) Gasket

27) Apply liquid gasket to the mating surface of 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.

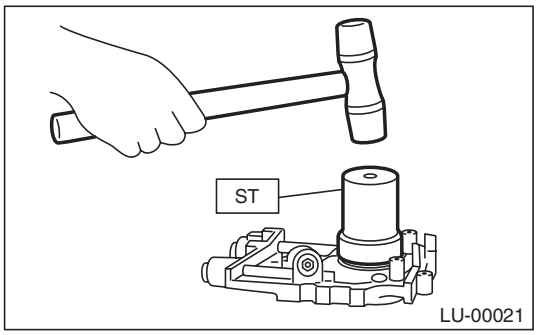
Liquid gasket:
Mating surface
THREE BOND 1217G (Part No. K0877Y0100) or equivalent
Bolt thread (A) (when reusing the bolt)
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



28) Install the flywheel. <Ref. to CL-14, INSTALLATION, Flywheel.>
29) Install the clutch disc and cover. <Ref. to CL-11, INSTALLATION, Clutch Disc and Cover.>
30) Install the oil pump.
(1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

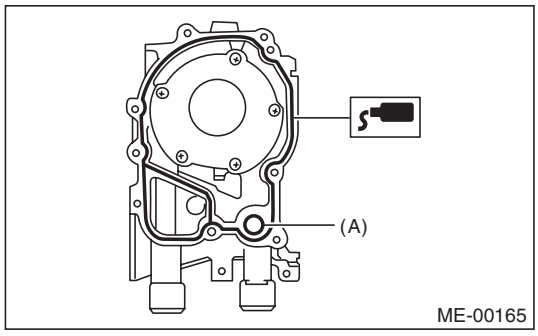
NOTE:
Use a new front oil seal.



(2) Apply liquid gasket to the mating surfaces of oil pump.

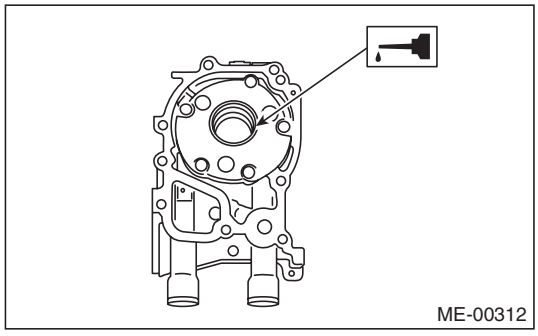
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(A) O-ring

(3) Apply a thin coat of engine oil to the inside of front oil seal.



(4) Install the oil pump to cylinder block.

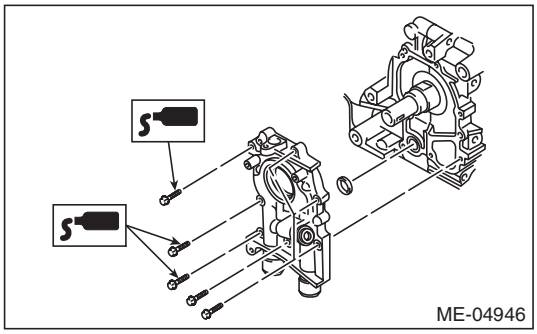
CAUTION:
• Be careful not to damage the front oil seal during installation.
• Make sure the front oil seal lip is not folded.

NOTE:
• Align the flat surface of oil pump's inner rotor with that of 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

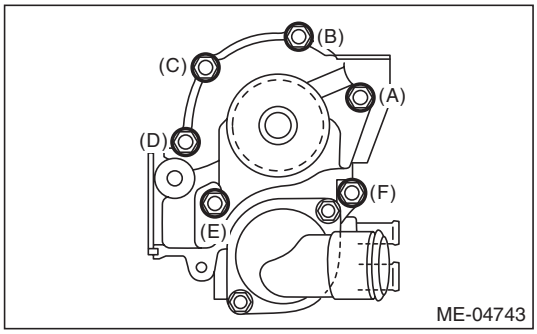
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



31) 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)



32) Install the water by-pass pipe for heater.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

33) Install the oil cooler. <Ref. to LU(STI)-24, INSTALLATION, Engine Oil Cooler.>

34) Install the oil filter. <Ref. to LU(STI)-31, INSTALLATION, Engine Oil Filter.>

35) Install the cylinder head. <Ref. to ME(STI)-69, INSTALLATION, Cylinder Head.>

36) Install the camshaft. <Ref. to ME(STI)-63, INSTALLATION, Camshaft.>
37) Install the generator and A/C compressor with their brackets.

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)

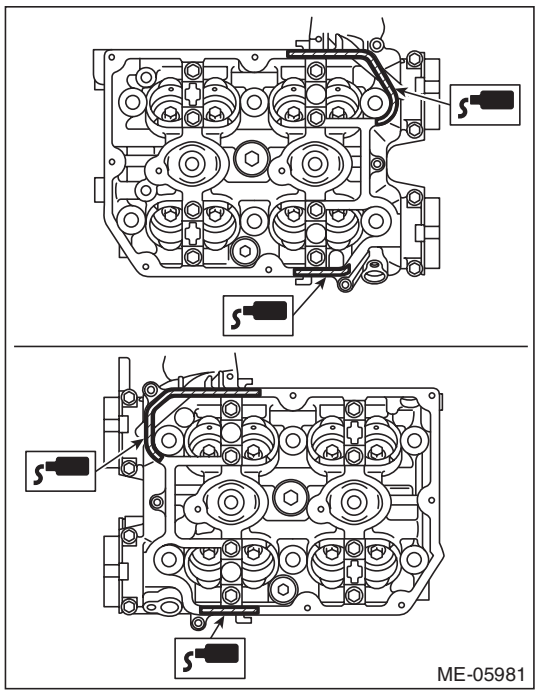
38) Install the crank sprocket. <Ref. to ME(STI)-59, INSTALLATION, Crank Sprocket.>
39) Install the cam sprocket. <Ref. to ME(STI)-58, INSTALLATION, Cam Sprocket.>
40) Install the timing belt. <Ref. to ME(STI)-51, INSTALLATION, Timing Belt.>
41) Adjust the valve clearance. <Ref. to ME(STI)-28, ADJUSTMENT, Valve Clearance.>
42) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:
Use a new rocker cover gasket.

(2) Apply liquid gasket to the specified point of the cylinder head.

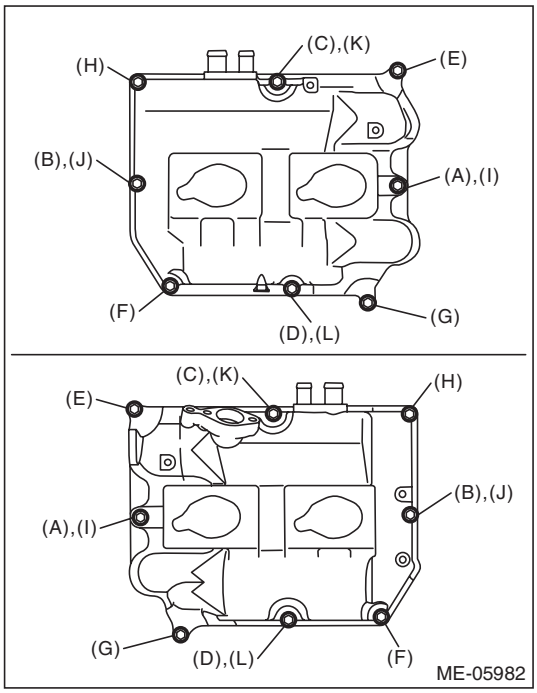
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



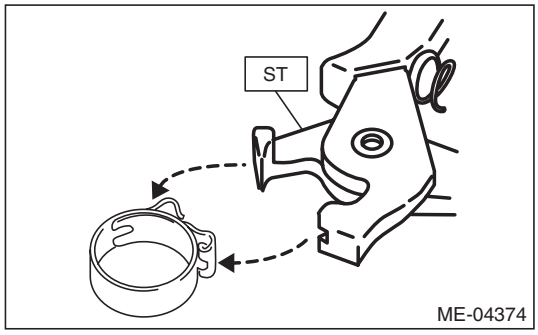
(3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.
(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

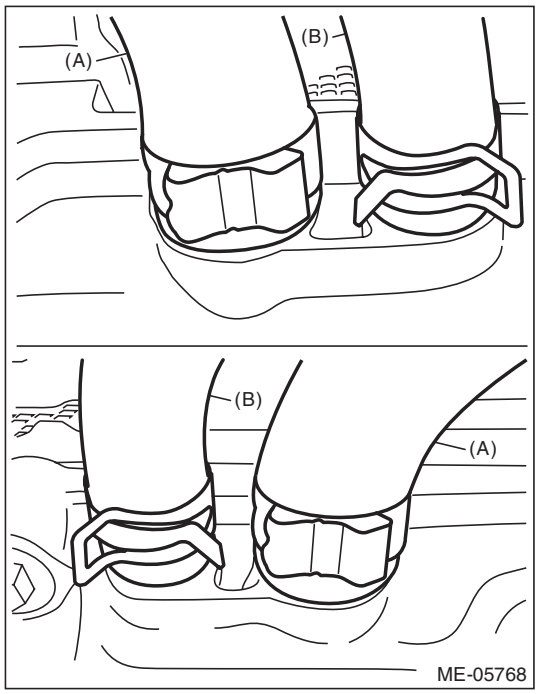
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



43) Connect the PCV hose (A) and vacuum hose (B) to the rocker cover.

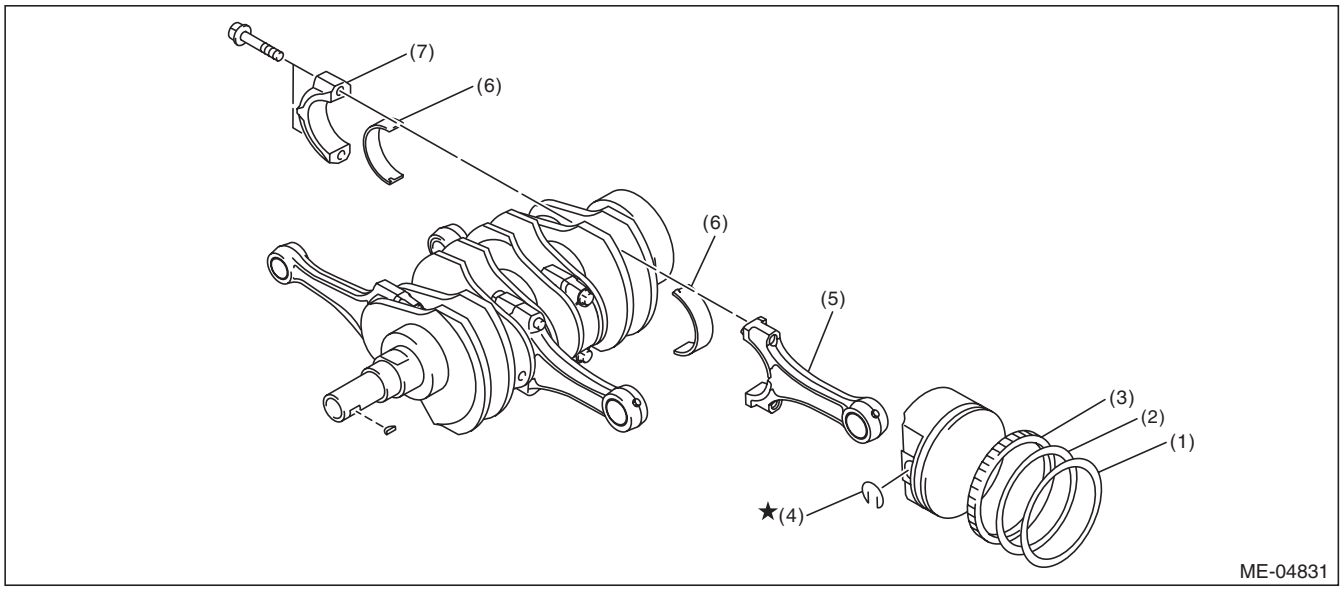
NOTE:
Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS





44) Install the timing belt cover. <Ref. to ME(STI)-48, INSTALLATION, Timing Belt Cover.>
45) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>
46) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.>
47) Install the rear side belt. <Ref. to ME(STI)-40, REAR SIDE BELT, INSTALLATION, V-belt.>
48) Install the engine to the vehicle. <Ref. to ME(STI)-33, INSTALLATION, Engine Assembly.>

C: DISASSEMBLY



(1) Top ring
(2) Second ring
(3) Oil ring
(4) Snap ring
(5) Connecting rod
(6) Connecting rod bearing
(7) Connecting rod cap

1) Remove the connecting rod cap.
2) Remove the connecting rod bearing.

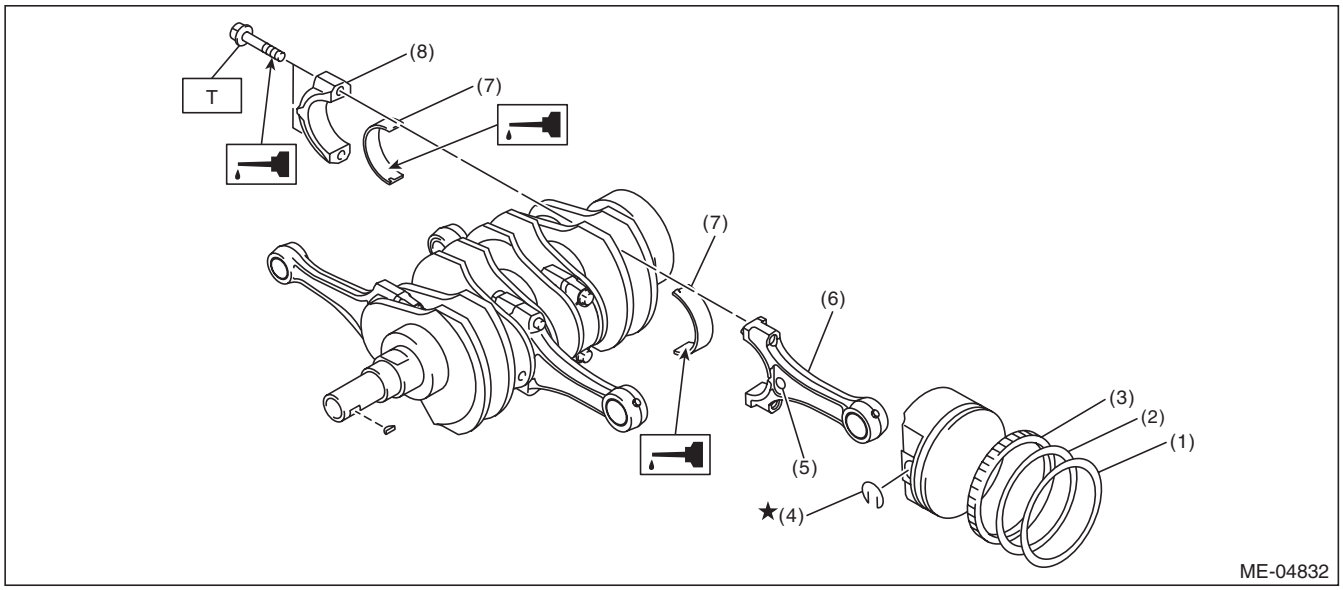
NOTE:
Keep the removed connecting rods, connecting rod caps and bearings in order so that they are kept in their original combinations/groups, and not mixed together.

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) Top ring
(2) Second ring
(3) Oil ring
(4) Snap ring
(5) Side mark
(6) Connecting rod
(7) Connecting rod bearing
(8) Connecting rod cap

Tightening torque: N·m (kgf-m, ft-lb)
T: 52 (5.3, 38.4)

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 it with connecting rod bolt. 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 bolts, apply oil on the threads.

Tightening torque:
52 N·m (5.3 kgf-m, 38.4 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 block surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:
0.025 mm (0.00098 in)

Grinding limit:
0.1 mm (0.004 in)

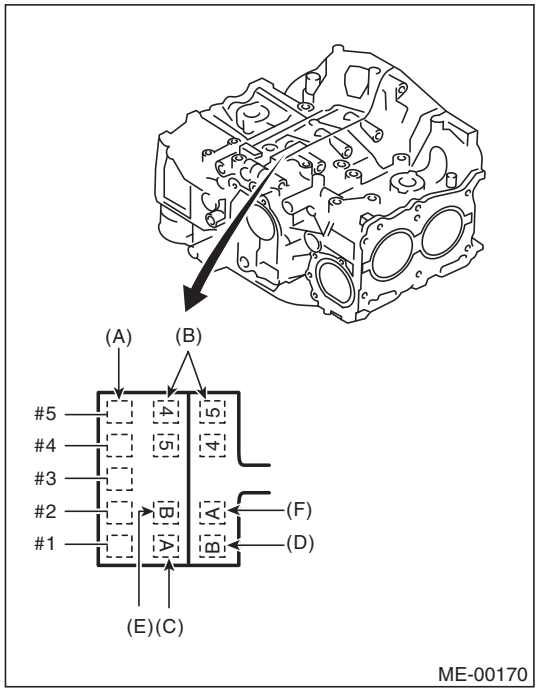
Standard height of cylinder block:
201.0 mm (7.91 in)

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)



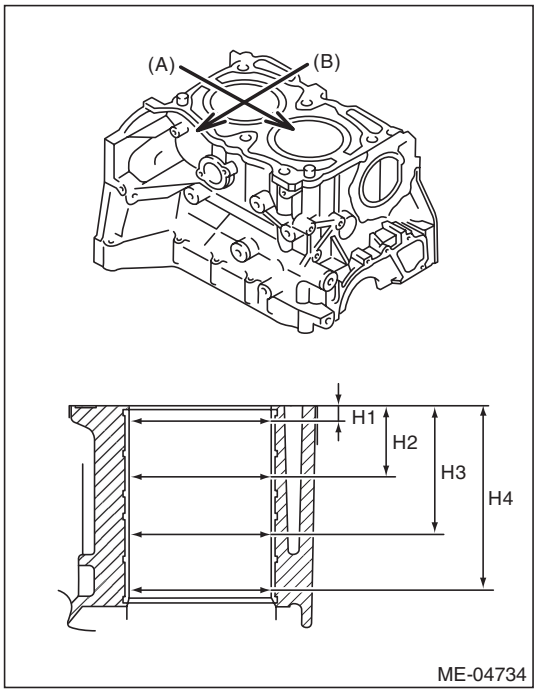
(A) Main journal size mark
(B) Cylinder block (RH) – (LH) combination mark
(C) #1 cylinder bore size mark
(D) #2 cylinder bore size mark
(E) #3 cylinder bore size mark
(F) #4 cylinder bore size mark

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).

Cylindricality:
Limit
0.015 mm (0.0006 in)

Out-of-roundness:
Limit
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.

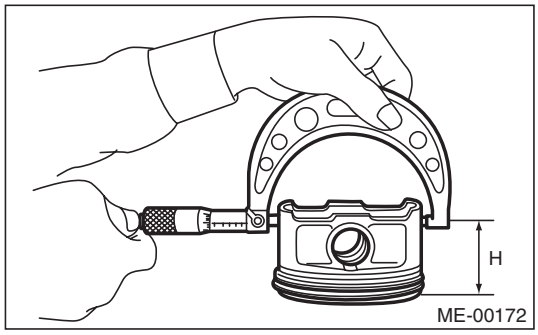
4) Measure outer diameter of each piston.
Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

Piston grade point H:
38.2 mm (1.50 in)

Piston outer diameter:

Standard
A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)
B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)
0.25 mm (0.0098 in) oversize
99.745 — 99.765 mm (3.9270 — 3.9278 in)
0.50 mm (0.0197 in) oversize
99.995 — 100.015 mm (3.9368 — 3.9376 in)



5) Calculate the clearance between cylinder and piston.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

Clearance between cylinder and piston 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 cylindricality, 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.

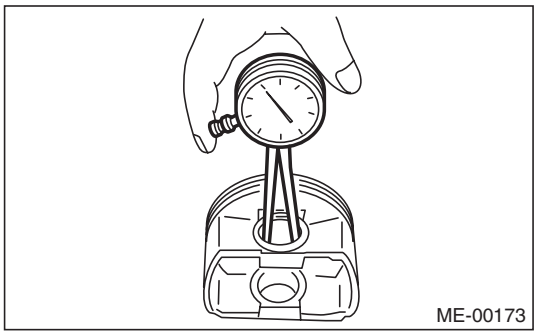
NOTE:
Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, when measuring the cylinder diameter, wait until it has cooled to room temperature.

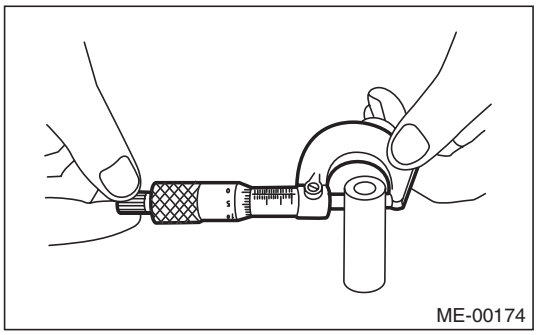
Cylinder inner diameter boring limit (diameter):
To 100.005 mm (3.9372 in)

3. PISTON AND PISTON PIN

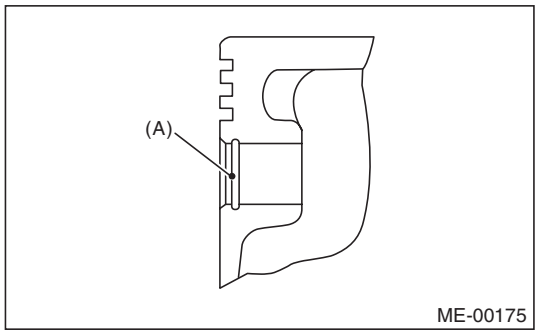
1) Check the piston and piston pin for damage, cracks or wear. Replace if faulty.
2) Check the piston ring groove for wear or damage. Replace if faulty.
3) Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if faulty.

Clearance between piston pin 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.

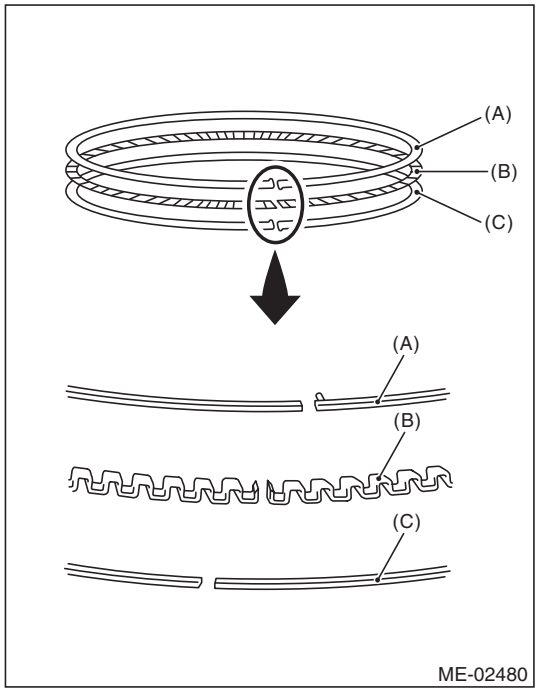


5) Check the snap ring for distortion, cracks and wear.

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.

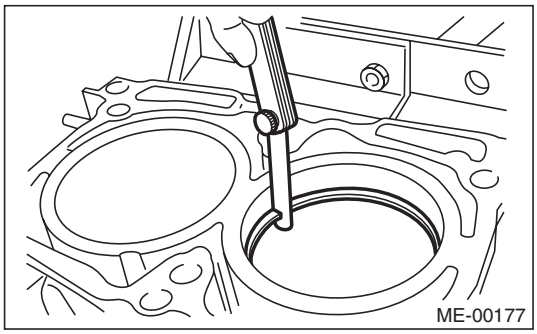
NOTE:
• The top ring and second ring have the mark to determine the direction for installing. When installing the ring to piston, face marks to the top side.
• Oil ring consists of the upper rail, expander and lower rail. When installing oil ring on piston, be careful of the direction of each rail.



(A) Upper rail
(B) Expander
(C) Lower rail

2) Using the piston, insert the piston ring and oil ring into the cylinder block so that they are perpendicular to the cylinder wall, and measure the piston ring gap using a thickness gauge.

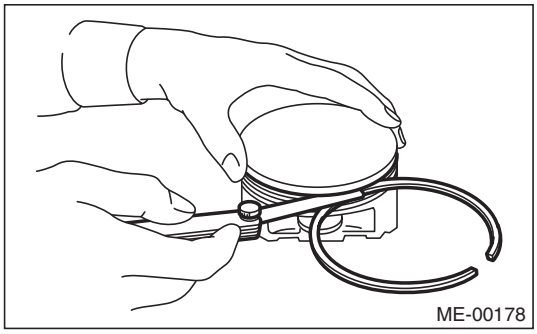
		Standard mm (in)
Piston ring gap	Top ring	0.23 — 0.28 (0.0091 — 0.0110)
	Second ring	0.37 — 0.52 (0.015 — 0.020)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)



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.

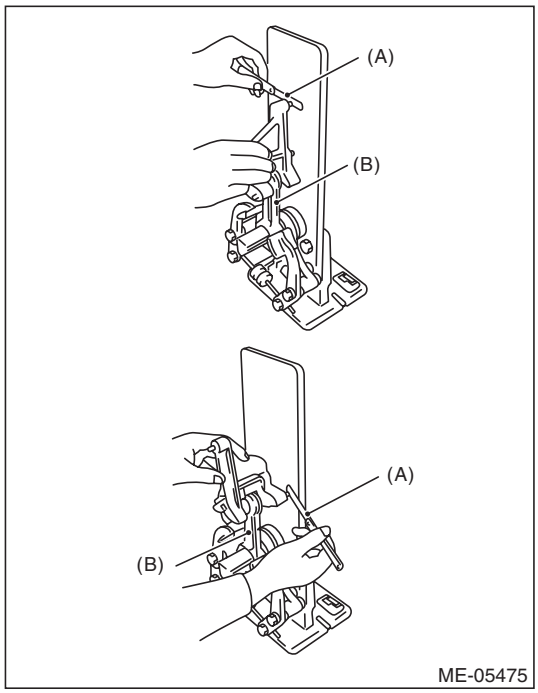
		Standard mm (in)
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)



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.

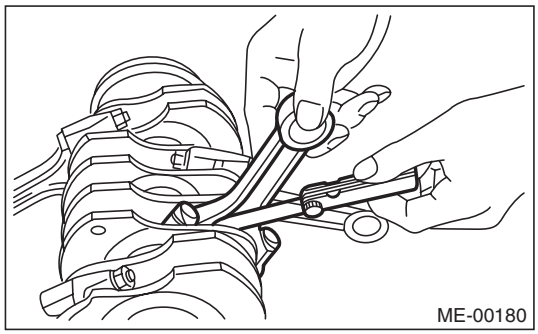
Limit of bend or twist per 100 mm (3.94 in) in length:
0.10 mm (0.0039 in)



(A) Thickness gauge
(B) Connecting rod

3) Install the connecting rod with bearings attached to the crankshaft, and using a thickness gauge, measure the thrust clearance. 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.

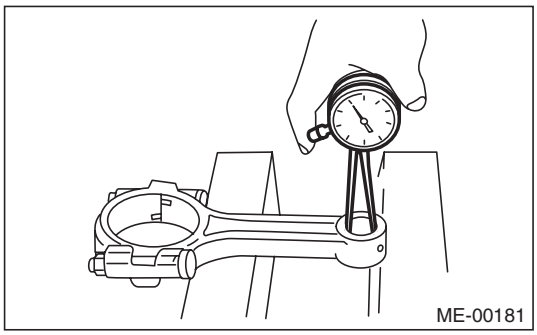
Connecting rod oil clearance:
Standard
0.017 — 0.045 mm (0.0007 — 0.0018 in)

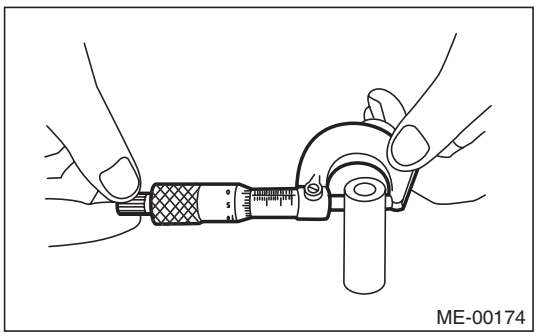
Unit: mm (in)

Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.506 (0.0587 — 0.0593)	51.976 — 52.000 (2.0463 — 2.0472)
0.03 (0.0012) Undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) Undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0447 — 2.0453)
0.25 (0.0098) Undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

6) Inspect the bushing at connecting rod small end, and replace the connecting rod if it is worn or damaged.
7) Measure the piston pin clearance at connecting rod small end. If the measured value is not within the standard, replace the connecting rod and piston pin as a set.

Clearance between piston pin and bushing:
Standard
0 — 0.022 mm (0 — 0.0009 in)



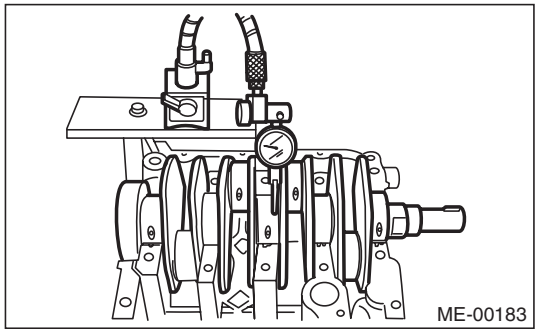


6. CRANKSHAFT AND CRANKSHAFT BEARING

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.

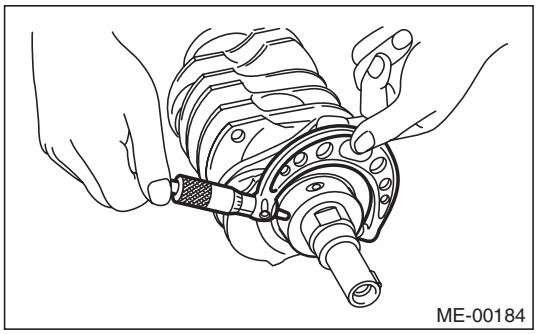
Crankshaft bend limit:
0.035 mm (0.0014 in)


ME-00183

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:
Cylindricality
Limit
0.006 mm (0.0002 in)
Out-of-roundness
Limit
0.005 mm (0.0002 in)
Grinding limit (dia.)
To 51.750 mm (2.0374 in)

Crank journal:
Cylindricality
Limit
0.006 mm (0.0002 in)
Out-of-roundness
Limit
0.005 mm (0.0002 in)
Grinding limit (dia.)
To 59.758 mm (2.3527 in)

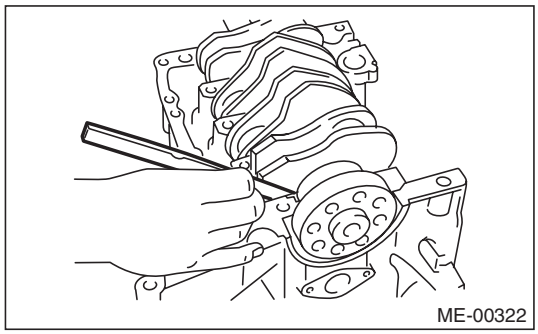

ME-00184

Unit: mm (in)

		Crank journal diameter		Crank pin outer diameter
		#1, #3	#2, #4, #5	
Standard	Journal O.D.	59.984 — 60.008 (2.3616 — 2.3625)	59.984 — 60.008 (2.3616 — 2.3625)	51.976 — 52.000 (2.0463 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.015 (0.0787 — 0.0793)	2.000 — 2.017 (0.0787 — 0.0794)	1.490 — 1.506 (0.0587 — 0.0593)
0.03 (0.0012) Undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) Undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0447 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) Undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

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 (0.00039 — 0.0012 in)

21.Intake and Exhaust Valve

A: SPECIFICATION

Refer to “Cylinder Head” for removal and installation procedures of the intake and exhaust valves. <Ref. to ME(STI)-69, REMOVAL, Cylinder Head.> <Ref. to ME(STI)-69, INSTALLATION, Cylinder Head.>

22.Piston

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of pistons. <Ref. to ME(STI)-79, REMOVAL, Cylinder Block.> <Ref. to ME(STI)-83, INSTALLATION, Cylinder Block.>

23.Connecting Rod

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of connecting rod. <Ref. to ME(STI)-79, REMOVAL, Cylinder Block.> <Ref. to ME(STI)-83, INSTALLATION, Cylinder Block.>

24.Crankshaft

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of the crankshaft. <Ref. to ME(STI)-79, REMOVAL, Cylinder Block.> <Ref. to ME(STI)-83, INSTALLATION, Cylinder Block.>

25.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 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
	Immobilizer system <Ref. to IM(diag)-2, Basic Diagnostic Procedure.>		A
2) Initial combustion does not occur.	Starter	Defective starter	C
	Engine control system <Ref. to EN(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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

26.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	• Valve mechanism is defective. • Incorrect valve clearance • Worn camshaft • Broken valve spring
Heavy and dull clank	Oil pressure is low.	• Worn crankshaft main bearing • Worn connecting rod bearing (large end)
	Oil pressure is normal.	• Loosened flywheel mounting bolt • Damaged engine mounting
High-pitched clank	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 between 1,000 and 2,000 rpms.	Sound is reduced when the fuel injector connector of the noisy cylinder is disconnected.*	• 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 the fuel injector connector of the noisy cylinder is disconnected.*	• 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.*	• Unusually worn valve lifter • 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

* 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

EXHAUST

EX(STI)

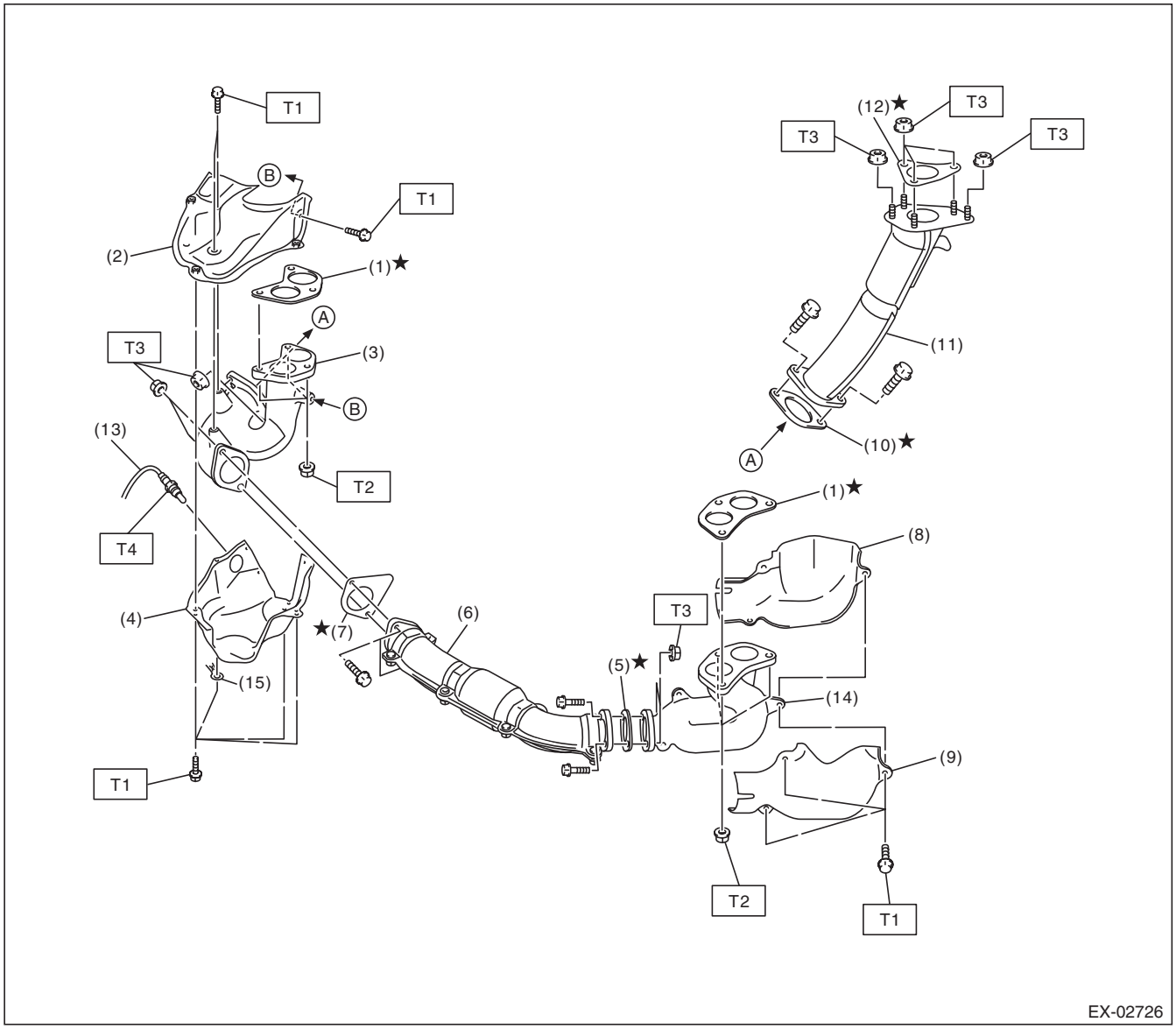
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2. Front Exhaust Pipe 6
3. Center Exhaust Pipe 8
4. Joint Pipe 12
5. Rear Exhaust Pipe 13
6. Muffler 15

1. General Description

A: COMPONENT

1. FRONT EXHAUST PIPE



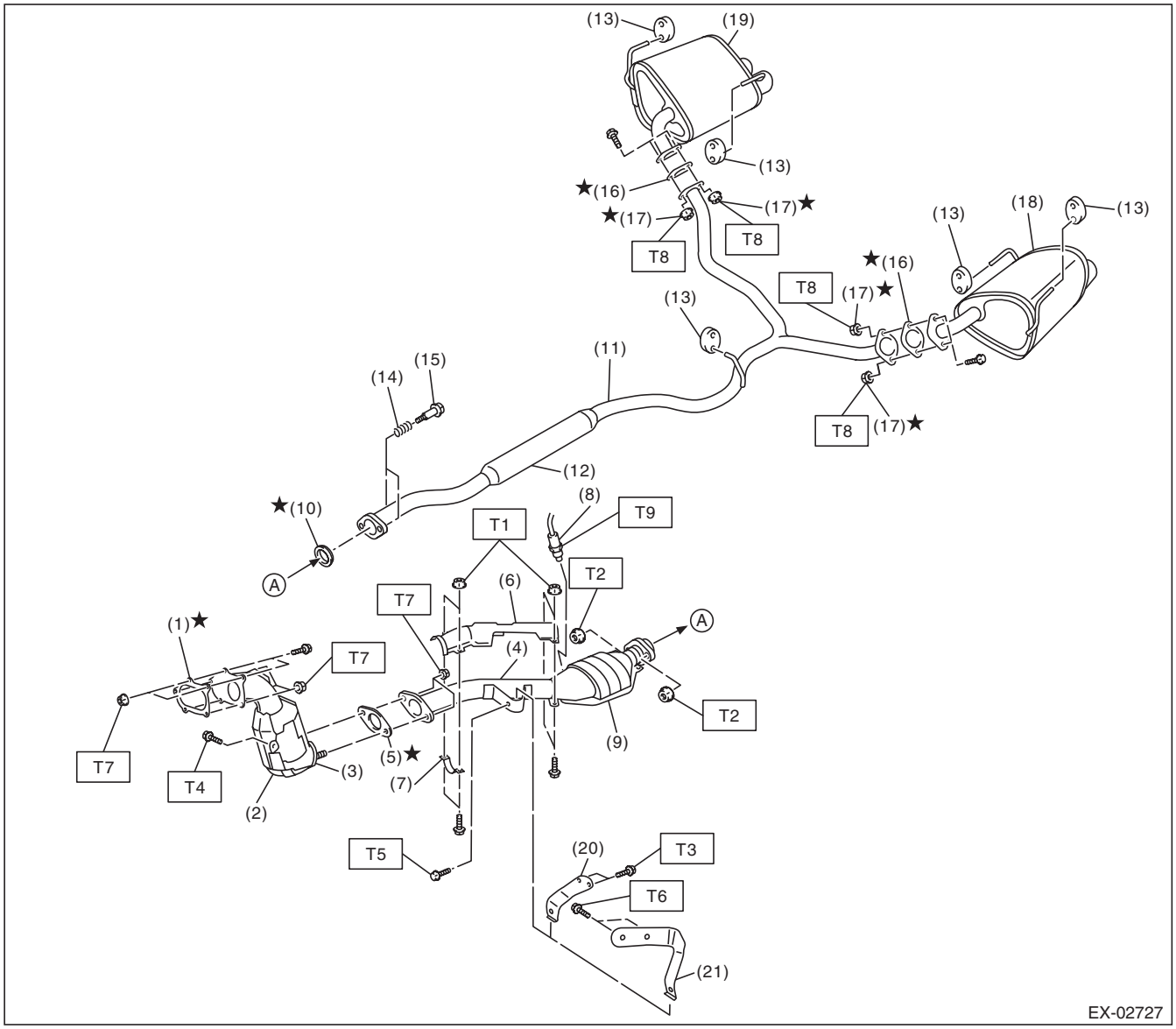
(1) Gasket
(2) Exhaust manifold RH upper cover
(3) Exhaust manifold RH
(4) Exhaust manifold RH lower cover
(5) Gasket
(6) Front exhaust pipe
(7) Gasket
(8) Exhaust manifold LH inner cover
(9) Exhaust manifold LH outer cover
(10) Gasket
(11) Joint pipe
(12) Gasket
(13) Front oxygen (A/F) sensor
(14) Exhaust manifold LH
(15) Ground cable

Tightening torque: N·m (kgf-m, ft-lb)

T1: 19 (1.9, 14.0)
T2: 40 (4.1, 29.5)
T3: 42.5 (4.3, 31.3)
T4: <Ref. to FU(STI)-54, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, INSTALLATION, Front Oxygen (A/F) Sensor.>

2. CENTER AND REAR EXHAUST PIPE, AND MUFFLER

- 4 door model



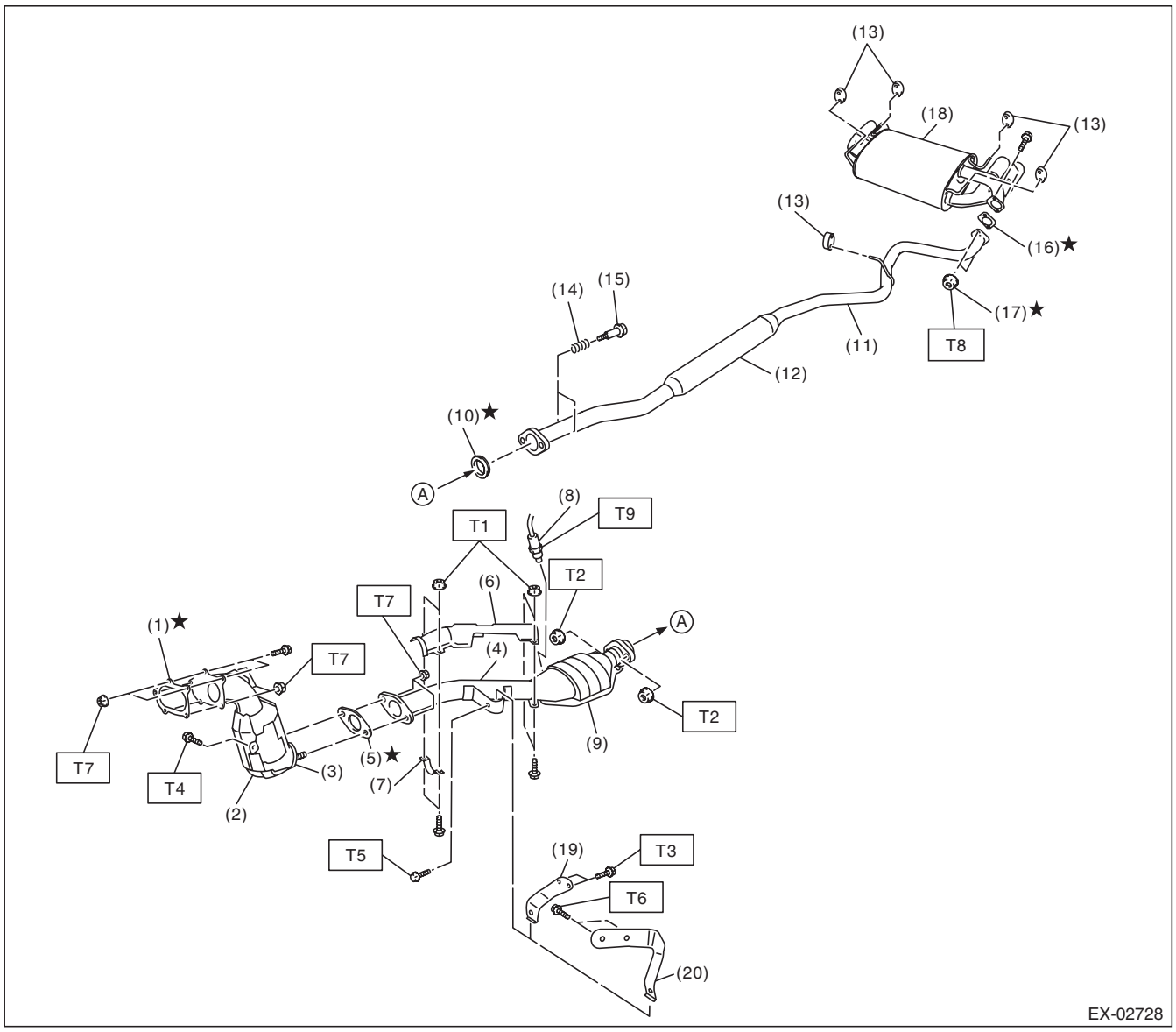
(1)	Gasket	(12)	Chamber
(2)	Front catalytic converter	(13)	Cushion rubber
(3)	Center exhaust pipe (front)	(14)	Spring
(4)	Center exhaust pipe (rear)	(15)	Bolt
(5)	Gasket	(16)	Gasket
(6)	Center exhaust pipe upper cover	(17)	Self-locking nut
(7)	Clamp	(18)	Muffler LH
(8)	Rear oxygen sensor	(19)	Muffler RH
(9)	Rear catalytic converter	(20)	Hanger bracket (5MT model)
(10)	Gasket	(21)	Hanger bracket (6MT model)
(11)	Rear exhaust pipe		

Tightening torque: N·m (kgf-m, ft-lb)

- ***T1: 13 (1.3, 9.6)***
- ***T2: 18 (1.8, 13.3)***
- ***T3: 23 (2.3, 17.0)***
- ***T4: 30 (3.1, 22.1)***
- ***T5: 35 (3.6, 25.8)***
- ***T6: 40 (4.1, 29.5)***
- ***T7: 42.5 (4.3, 31.3)***
- ***T8: 48 (4.9, 35.4)***
- ***T9: <Ref. to FU(STI)-56, INSTALLATION, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, INSTALLATION, Rear Oxygen Sensor.>***

EXHAUST

- 5 door model



(1)	Gasket	(11)	Rear exhaust pipe
(2)	Front catalytic converter	(12)	Chamber
(3)	Center exhaust pipe (front)	(13)	Cushion rubber
(4)	Center exhaust pipe (rear)	(14)	Spring
(5)	Gasket	(15)	Bolt
(6)	Center exhaust pipe upper cover	(16)	Gasket
(7)	Clamp	(17)	Self-locking nut
(8)	Rear oxygen sensor	(18)	Muffler
(9)	Rear catalytic converter	(19)	Hanger bracket (5MT model)
(10)	Gasket	(20)	Hanger bracket (6MT model)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 13 (1.3, 9.6)
T2: 18 (1.8, 13.3)
T3: 23 (2.3, 17.0)
T4: 30 (3.1, 22.1)
T5: 35 (3.6, 25.8)
T6: 40 (4.1, 29.5)
T7: 42.5 (4.3, 31.3)
T8: 48 (4.9, 35.4)
T9: <Ref. to FU(STI)-56, INSTALLATION, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, INSTALLATION, Rear Oxygen Sensor.>

B: CAUTION

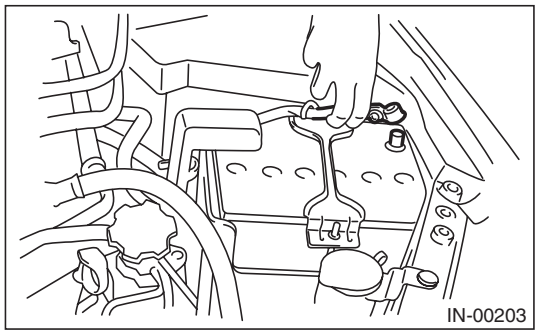
- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- If any fat adheres to the exhaust pipe, wipe it off. Otherwise a fire may happen.

2. Front Exhaust Pipe

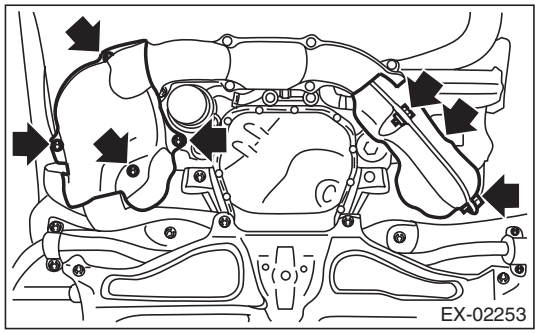
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

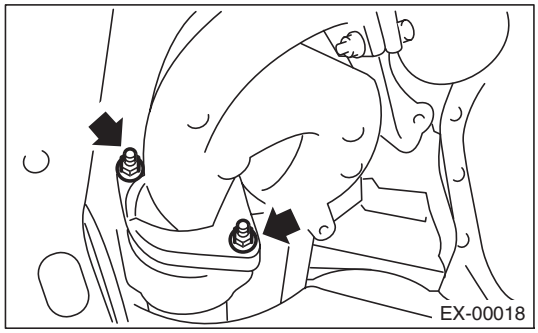
1) Disconnect the ground cable from battery.



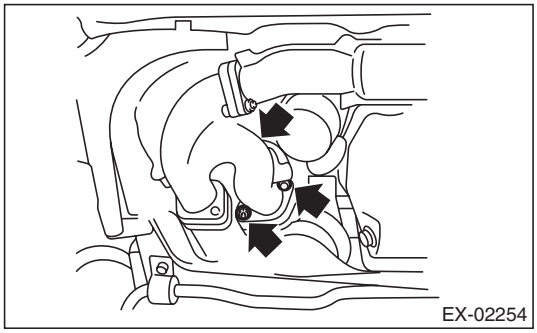
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Remove the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, REMOVAL, Front Oxygen (A/F) Sensor.>
5) Remove the exhaust manifold RH lower cover and exhaust manifold LH cover.

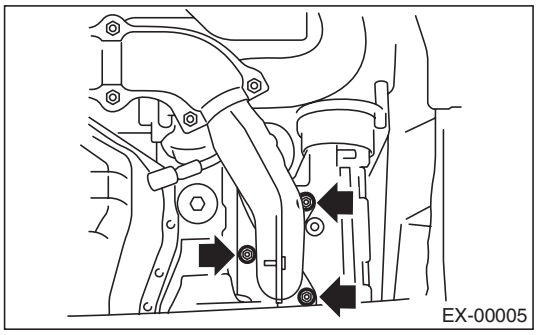


6) Remove the bolts and nuts which hold joint pipe onto exhaust manifold RH.



7) While holding the front exhaust pipe with one hand, remove the nuts which hold the exhaust manifold to the cylinder head exhaust port and remove the front exhaust pipe.



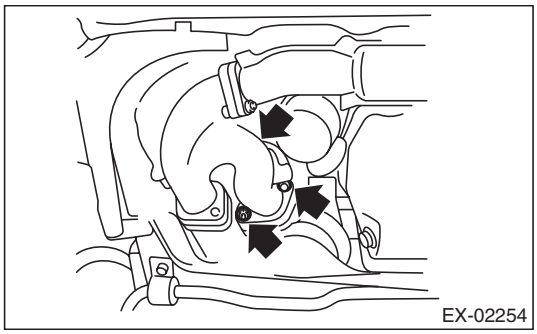


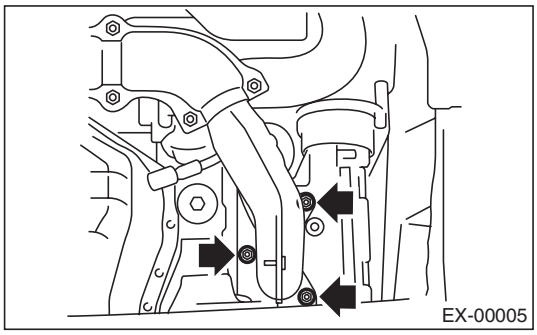
B: INSTALLATION

1) Install the front exhaust pipe.

NOTE:
Use a new gasket.

Tightening torque:
40 N·m (4.1 kgf-m, 29.5 ft-lb)

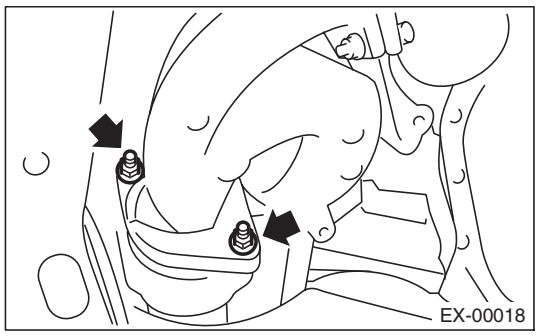




2) Install the joint pipe to the exhaust manifold RH.

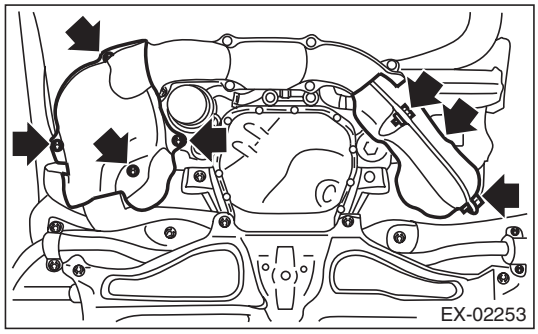
NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

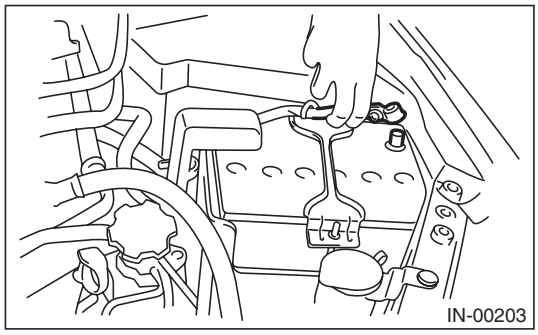


3) Install the exhaust manifold RH lower cover and exhaust manifold LH cover.

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

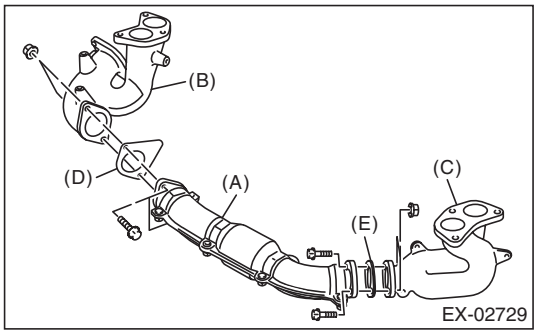


4) Install the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, INSTALLATION, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, INSTALLATION, Front Oxygen (A/F) Sensor.>
5) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
6) Lower the vehicle.
7) Connect the battery ground terminal.



C: DISASSEMBLY

1) Remove the exhaust manifold RH upper cover.
2) Remove the exhaust manifold RH and the exhaust manifold LH from the front exhaust pipe.



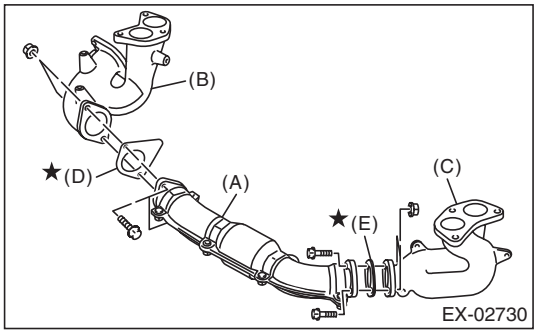
(A) Front exhaust pipe
(B) Exhaust manifold RH
(C) Exhaust manifold LH
(D) Gasket
(E) Gasket

D: ASSEMBLY

1) Install the exhaust manifold RH and the exhaust manifold LH to the front exhaust pipe.

NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



(A) Front exhaust pipe
(B) Exhaust manifold RH
(C) Exhaust manifold LH
(D) Gasket
(E) Gasket

2) Install the exhaust manifold RH upper cover.

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

E: INSPECTION

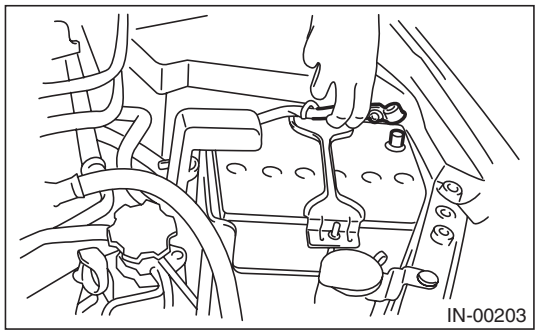
1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.

3. Center Exhaust Pipe

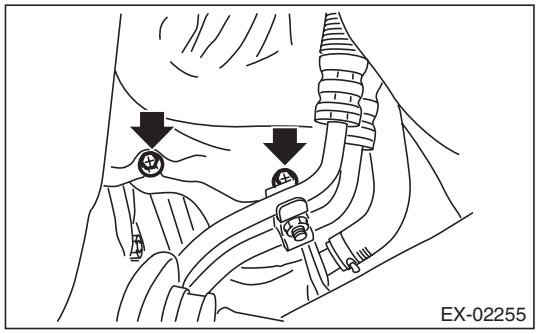
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

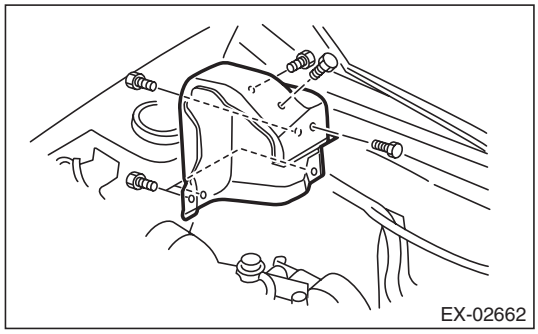
1) Disconnect the ground cable from battery.



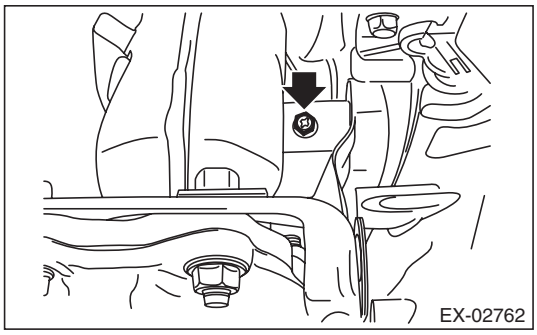
2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.> <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
3) Lift up the vehicle.
4) Remove the transmission under cover. (6MT model)
5) Remove the bolts which secure the lower side of the turbocharger lower cover.



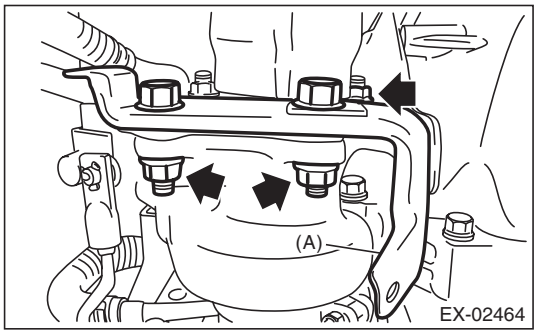
6) Lower the vehicle.
7) Remove the turbocharger upper cover.



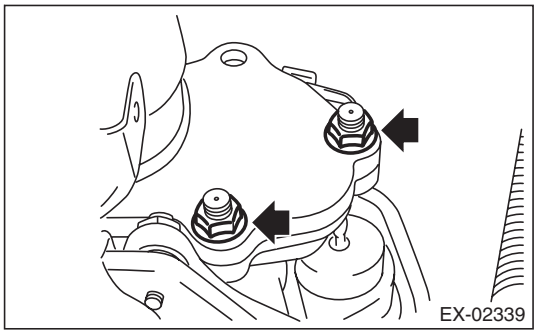
8) Remove the bolts which hold the upper side of the turbocharger lower cover.



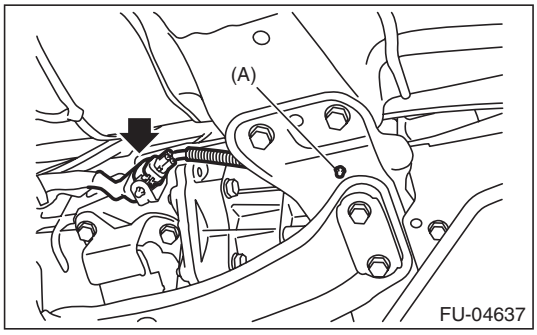
9) Remove the upper side bolts and nuts that hold the center exhaust pipe on the turbocharger, and remove the turbocharger cover stay (A).



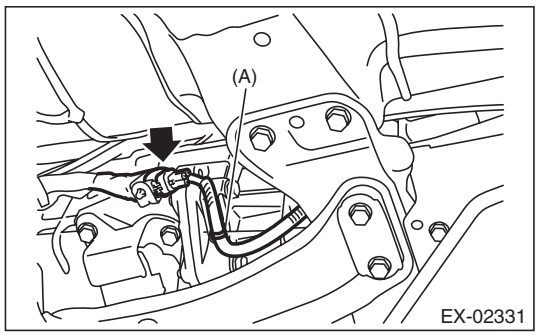
10) Lift up the vehicle.
11) Remove the lower side nuts (two places) that hold the center exhaust pipe on the turbocharger.



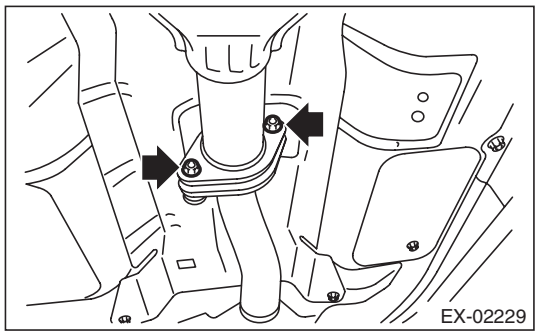
12) Disconnect the connector from the rear oxygen sensor, and remove the clip (A) holding the rear oxygen sensor harness.
• 5MT model



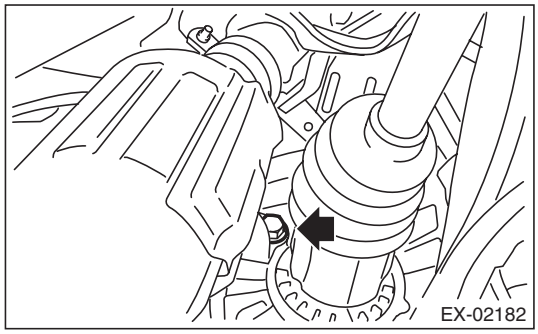
- 6MT model



13) Remove the rear exhaust pipe from center exhaust pipe.

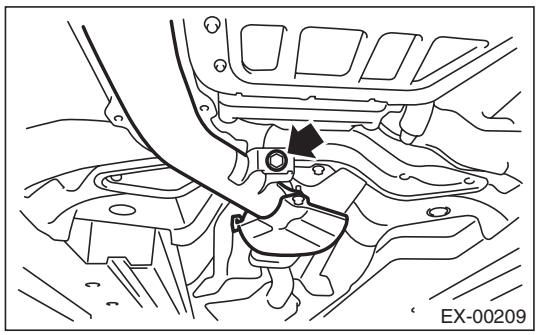


14) Remove the bolt which holds center exhaust pipe to transmission.



15) Remove the bolt which holds center exhaust pipe to hanger bracket, and remove the center exhaust pipe.

CAUTION:
Be careful not to drop the center exhaust pipe.



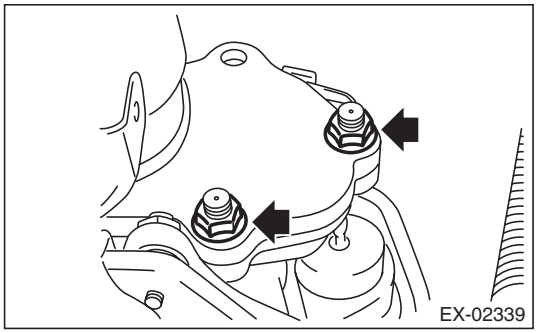
16) Remove the turbocharger lower cover.

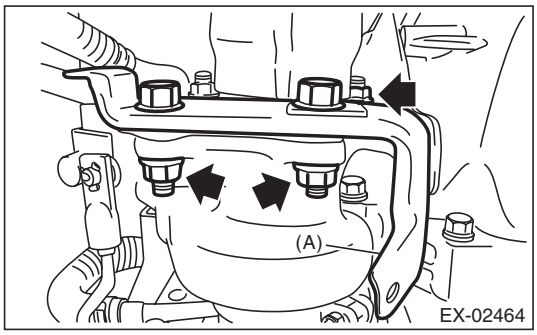
B: INSTALLATION

1) Set the turbocharger lower cover, and temporarily tighten the bolts that hold the lower side of the turbocharger lower cover.
2) Install the center exhaust pipe and temporarily tighten the bolt which holds center exhaust pipe to hanger bracket.
3) Temporarily tighten the bolt which holds the center exhaust pipe to the transmission.
4) Install the center exhaust pipe along with the turbocharger cover stay (A) to the turbocharger.

NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

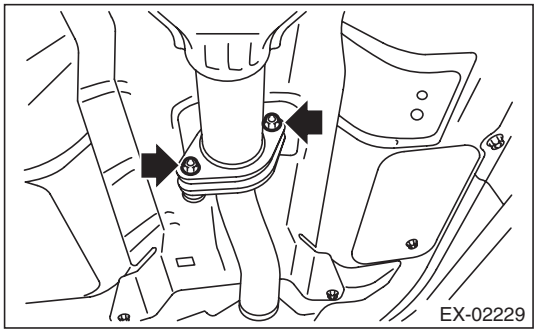




5) Install the rear exhaust pipe to center exhaust pipe.

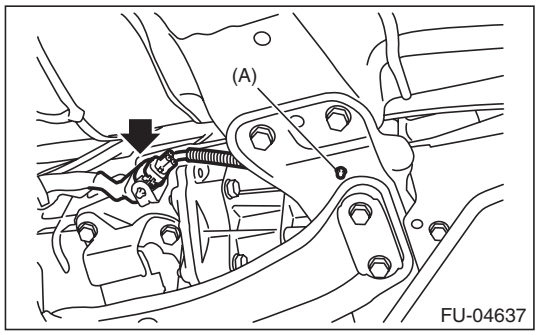
NOTE:
Use a new gasket.

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

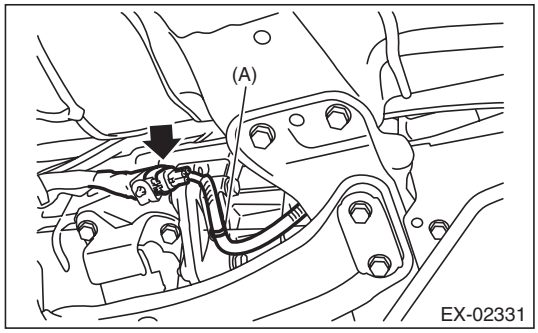


6) Connect the connector to the rear oxygen sensor, and hold the rear oxygen sensor harness with the clip (A).

- 5MT model

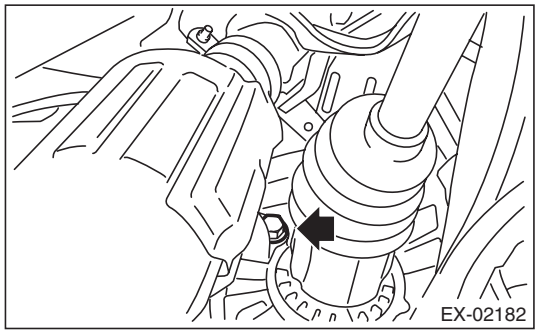


- 6MT model



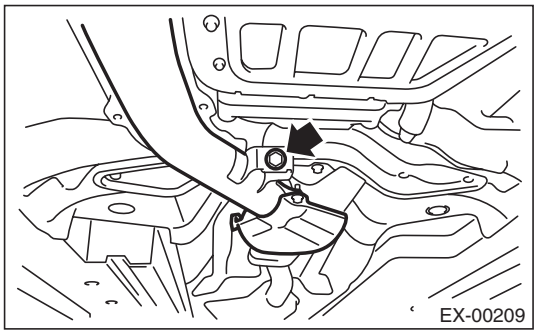
7) Tighten the bolt which holds center exhaust pipe to transmission.

Tightening torque:
30 N·m (3.1 kgf-m, 22.1 ft-lb)



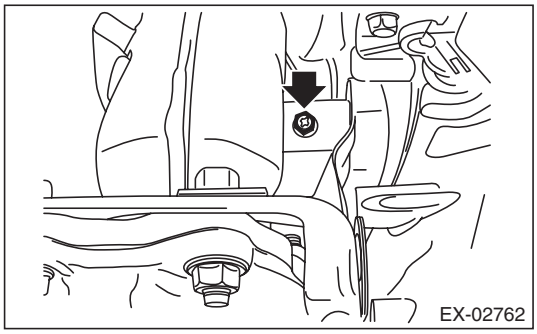
8) Tighten the bolts which secure the center exhaust pipe to the hanger bracket.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)



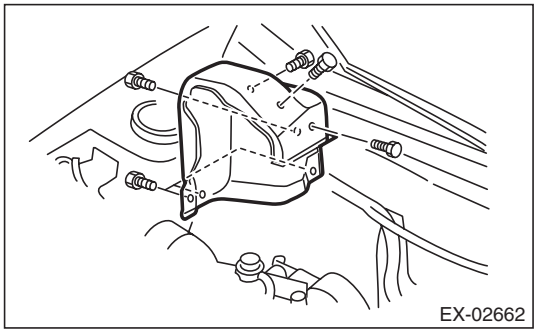
9) Lower the vehicle.
10) Attach the bolt which holds the upper side of the turbocharger lower cover.

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



11) Attach the turbocharger upper cover.

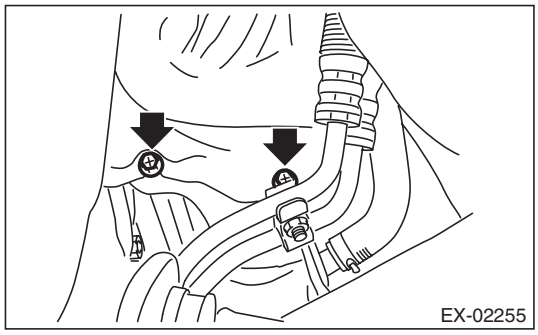
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



12) Lift up the vehicle.

13) Tighten the bolts that secure the lower side of the turbocharger lower cover.

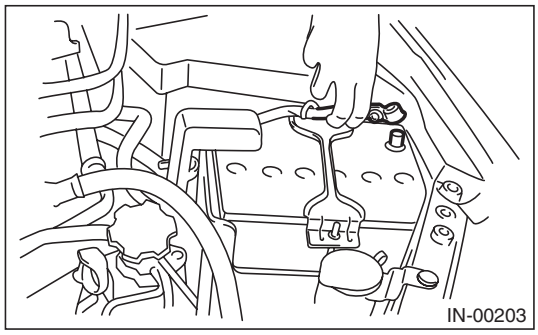
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



14) Install the transmission under cover. (6MT model)

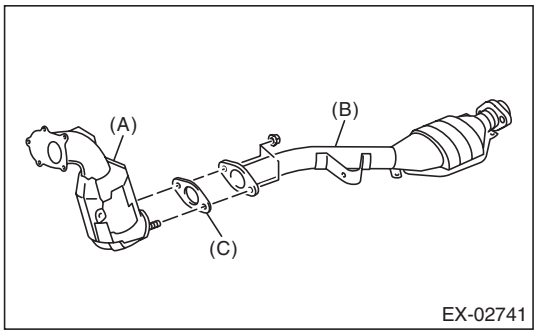
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

15) Lower the vehicle.
16) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.> <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>
17) Connect the battery ground terminal.



C: DISASSEMBLY

1) Remove the rear O_2 sensor from the center exhaust pipe (rear). <Ref. to FU(STI)-56, REMOVAL, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, REMOVAL, Rear Oxygen Sensor.>
2) Remove the center exhaust pipe upper cover.
3) Remove the center exhaust pipe (rear) from the center exhaust pipe (front).



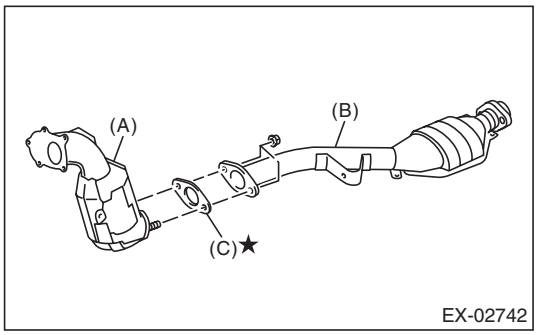
(A) Center exhaust pipe (front)
(B) Center exhaust pipe (rear)
(C) Gasket

D: ASSEMBLY

1) Assemble the center exhaust pipe (rear) to the center exhaust pipe (front).

NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



(A) Center exhaust pipe (front)
(B) Center exhaust pipe (rear)
(C) Gasket

2) Install the center exhaust pipe upper cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

3) Install the rear O_2 sensor to the center exhaust pipe (rear). <Ref. to FU(STI)-56, INSTALLATION, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, INSTALLATION, Rear Oxygen Sensor.>

E: INSPECTION

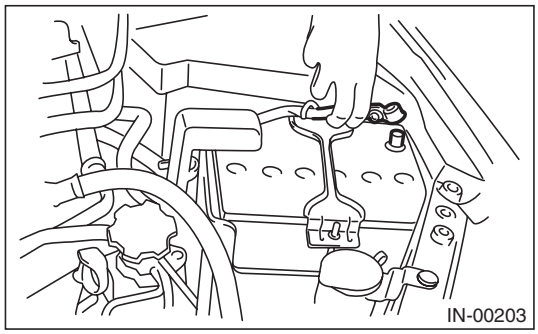
1) Check the connections and welds for exhaust leaks.
2) Make sure there are no holes or rusting.

4. Joint Pipe

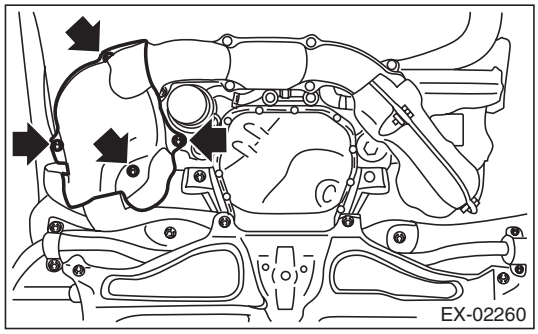
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

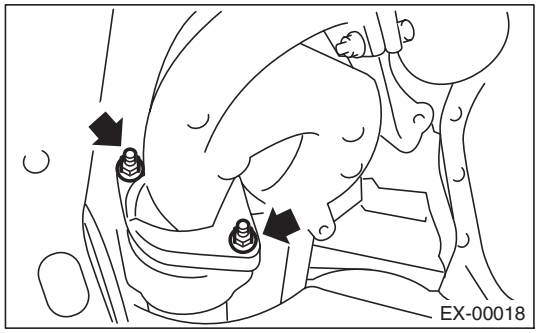
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Remove the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, REMOVAL, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, REMOVAL, Front Oxygen (A/F) Sensor.>
5) Remove the exhaust manifold RH lower cover.



6) Remove the bolts and nuts which hold exhaust manifold RH onto joint pipe.



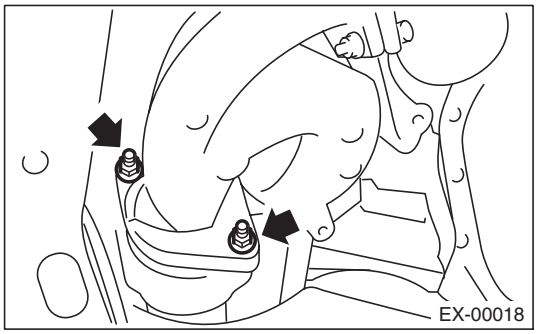
7) Remove the center exhaust pipe. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>
8) Remove the turbocharger. <Ref. to IN(STI)-15, REMOVAL, Turbocharger.> <Ref. to IN(w/o STI)-14, REMOVAL, Turbocharger.>
9) Take off the joint pipe in the upward direction.

B: INSTALLATION

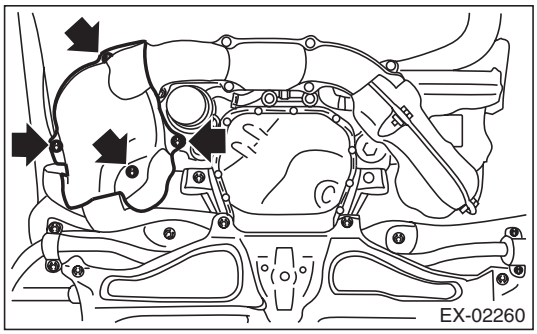
Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



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



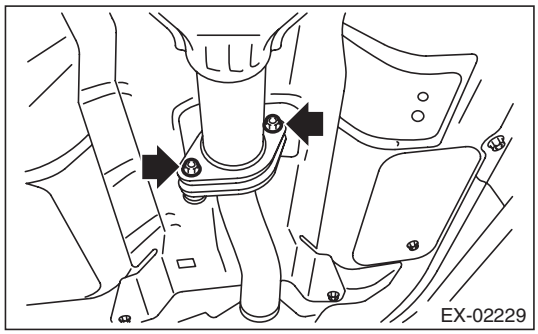
C: INSPECTION

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

5. Rear Exhaust Pipe

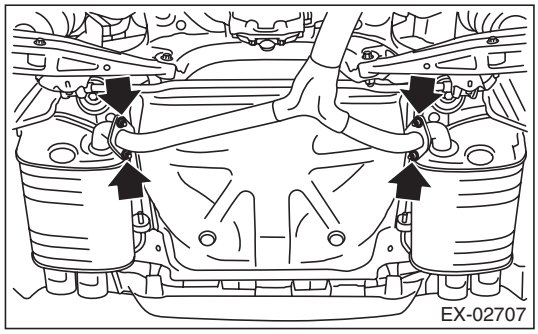
A: REMOVAL

CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
1) Lift up the vehicle.
2) Remove the center exhaust pipe from rear exhaust pipe.

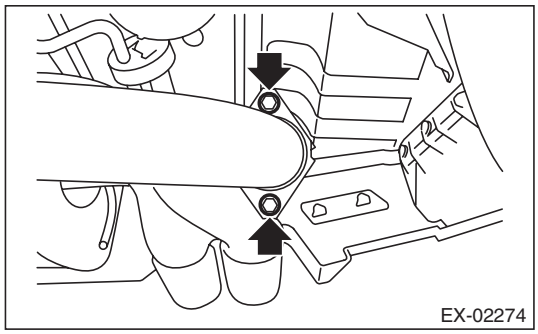


3) Remove the muffler from rear exhaust pipe.

CAUTION:
Be careful not to drop the rear exhaust pipe.
- 4 door model

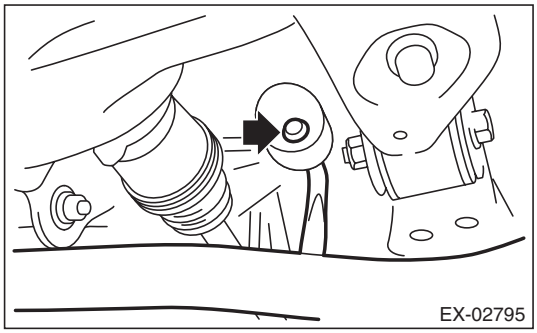


- 5 door model



4) Apply a coat of spray type lubricant to the mating area of cushion rubber.
5) Remove the rear exhaust pipe from the cushion rubber.

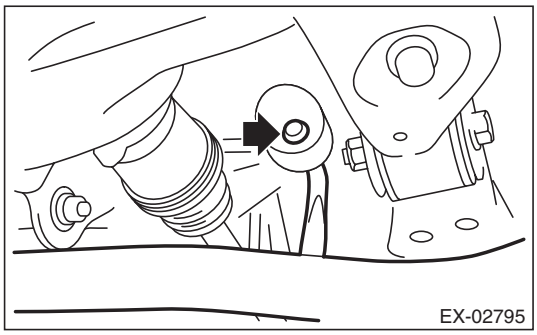
CAUTION:
Be careful not to let the muffler contact the rear bumper.



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.

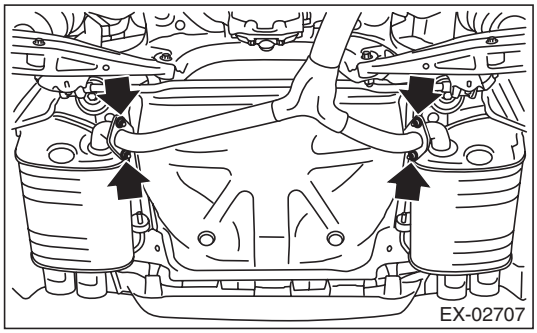
NOTE:
After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.



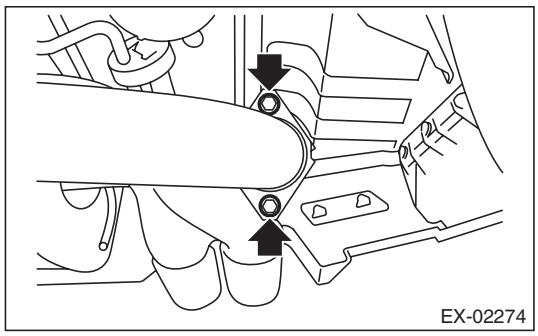
3) Install the rear exhaust pipe to the muffler.

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



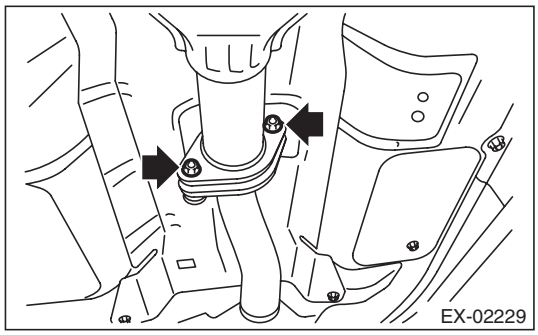
- 5 door model



4) Install the 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)



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.

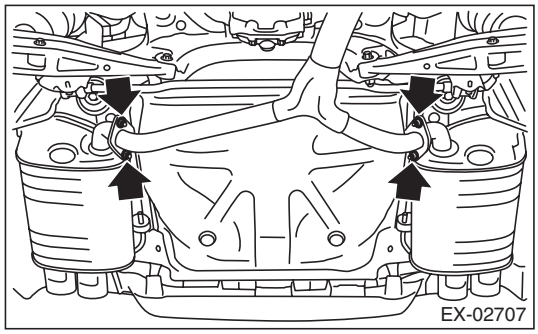
6. Muffler

A: REMOVAL

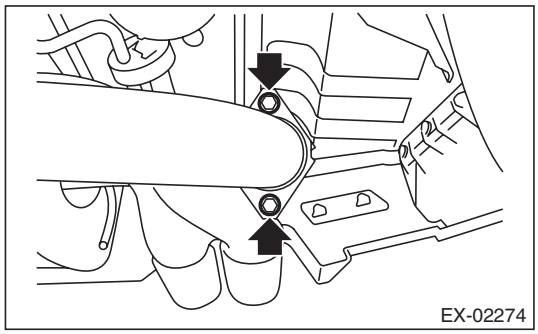
CAUTION:
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

1) Lift up the vehicle.
2) Remove the rear exhaust pipe from the muffler.

• 4 door model



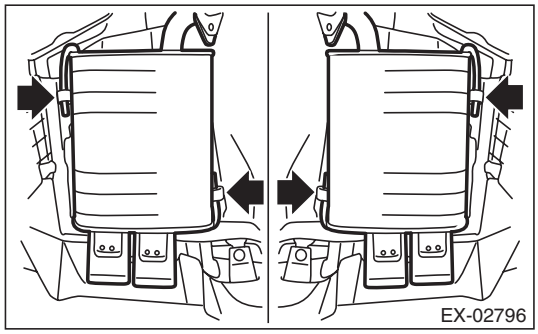
• 5 door model



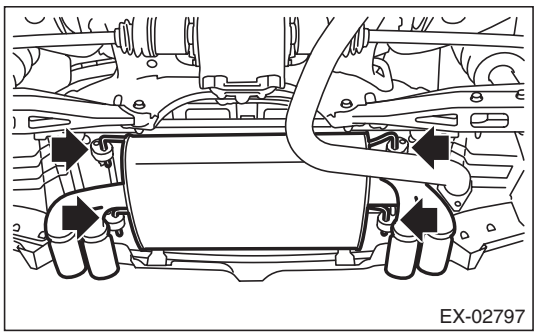
3) Apply a coat of spray type lubricant to the mating area of cushion rubber.
4) Remove the muffler from the cushion rubber.

CAUTION:
Be careful not to drop the muffler during removal.

• 4 door model



• 5 door model



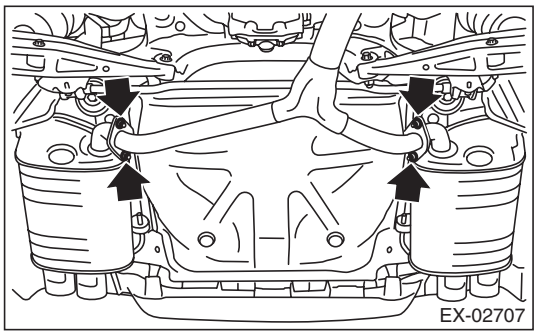
B: INSTALLATION

Install in the reverse order of removal.

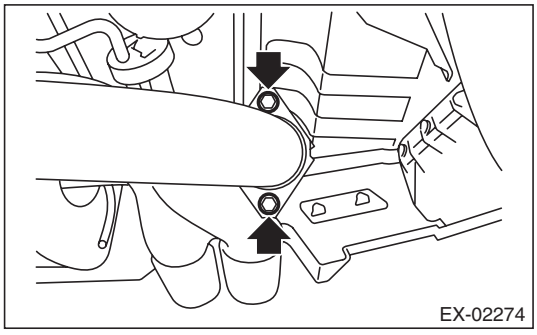
NOTE:
• Use a new gasket and self-locking nut.
• After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

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(STI)

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1. General Description

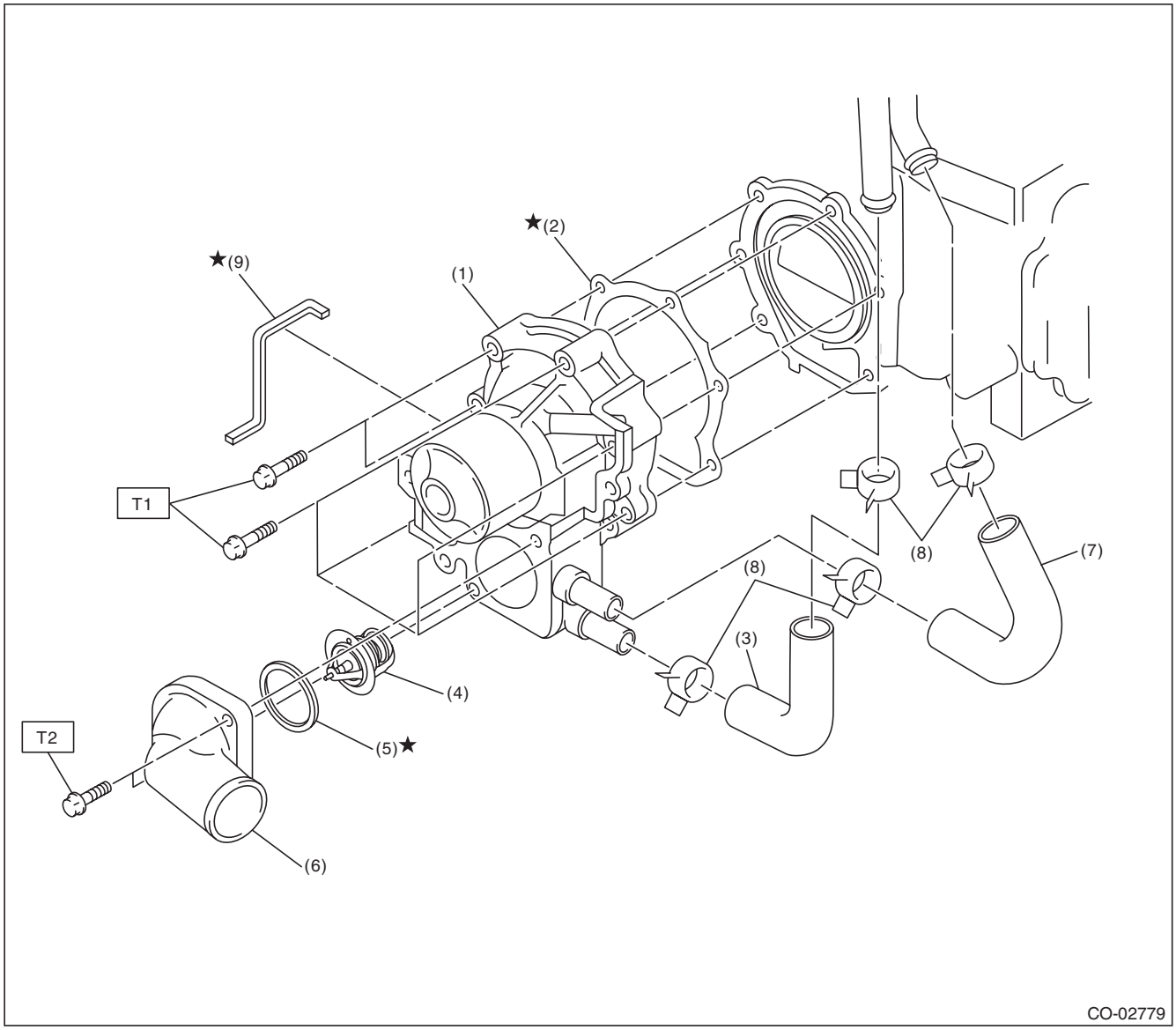
A: SPECIFICATION

Cooling system					Electric fan + Forced engine coolant circulation system
Total engine coolant capacity			L (US qt, Imp qt)		Approx. 7.7 (8.1, 6.8)
Water pump	Type				Centrifugal impeller type
	Discharge performance	Discharge rate	L (US gal, Imp gal)/min.		200 (52.8, 44.0)
		Pump speed — Discharge pressure			6,000 rpm — 225.4 kPa (23.0 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 pump case		mm (in)	Standard	0.5 — 1.5 (0.020 — 0.059)
Thermostat	Type				Wax pellet type
	Starting temperature to open				76 — 80°C (169 — 176°F)
	Fully opens				91°C (196°F)
	Valve lift		mm (in)		9.0 (0.354) or more
	Valve bore		mm (in)		35 (1.38)
Radiator fan	Motor input	Main fan	W		120
		Sub fan	W		120
	Fan diameter / Blade	Main fan			318.5 mm (12.54 in)/9
		Sub fan			318.5 mm (12.54 in)/11
Radiator	Type				Down flow
	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	Coolant filler tank side	kPa (kg/cm^2, psi)	Positive pressure side	Standard	93 — 123 (0.95 — 1.25, 14 — 18)
					Limit	83 (0.85, 12)
				Negative pressure side	Standard	–1.0 — –4.9 (–0.01 — –0.05, –0.1 — –0.7)
		Radiator side	kPa (kg/cm^2, psi)	Positive pressure side only	Standard	122 — 152 (1.24 — 1.55, 18 — 22)
					Limit	112 (1.14, 16)
	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

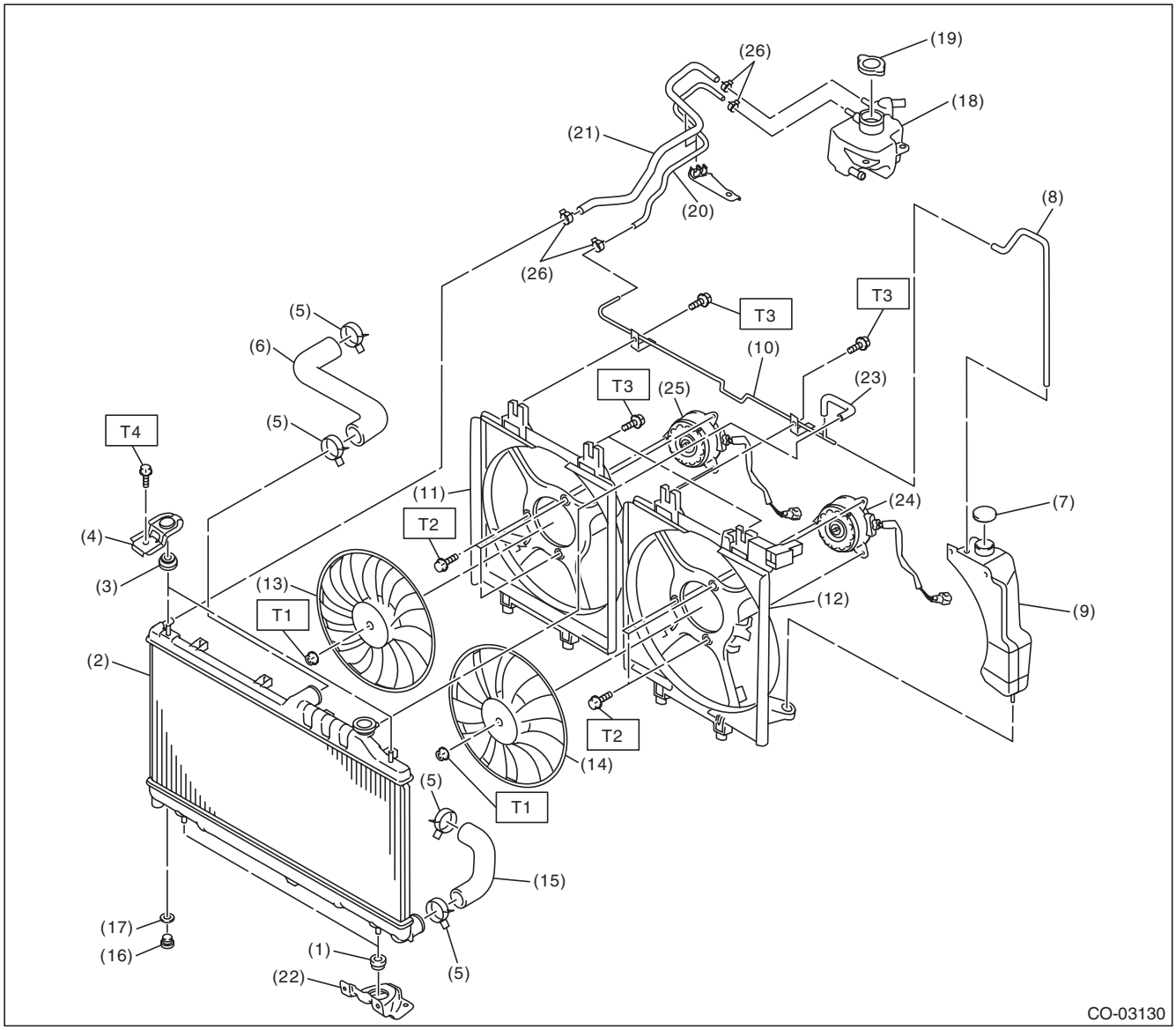
1. WATER PUMP



(1)	Water pump ASSY	(6)	Thermostat cover
(2)	Gasket	(7)	Coolant filler by-pass hose
(3)	Heater by-pass hose	(8)	Clip
(4)	Thermostat	(9)	Water pump sealing
(5)	Gasket		

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 AND RADIATOR FAN



(1) Radiator lower cushion
(2) Radiator
(3) Radiator upper cushion
(4) Radiator upper bracket
(5) Clip
(6) Radiator inlet hose
(7) Engine coolant reservoir tank cap
(8) Over flow hose A
(9) Engine coolant reservoir tank
(10) Over flow pipe
(11) Radiator sub fan shroud
(12) Radiator main fan shroud
(13) Radiator sub fan
(14) Radiator main fan
(15) Radiator outlet hose
(16) Radiator drain plug
(17) O-ring
(18) Engine coolant filler tank
(19) Radiator cap (coolant filler tank cap)
(20) Engine coolant hose A
(21) Engine coolant hose B
(22) Radiator lower bracket
(23) Over flow hose B
(24) Main fan motor
(25) Sub fan motor
(26) Clip

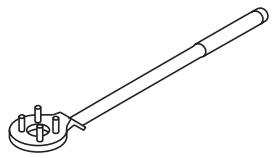
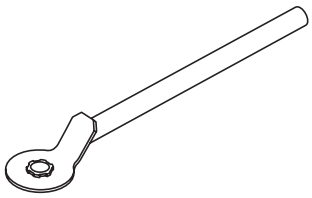
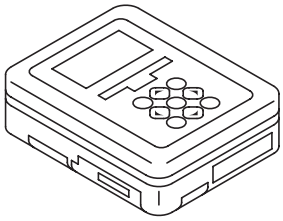
Tightening torque: N·m (kgf-m, ft-lb)	
T1:	*3.4 (0.3, 2.5)*
T2:	*4.41 (0.45, 3.25)*
T3:	*7.5 (0.8, 5.5)*
T4:	*12 (1.2, 8.9)*

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- 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.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- 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 for removing and installing the crank pulley.
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket and exhaust cam sprocket.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

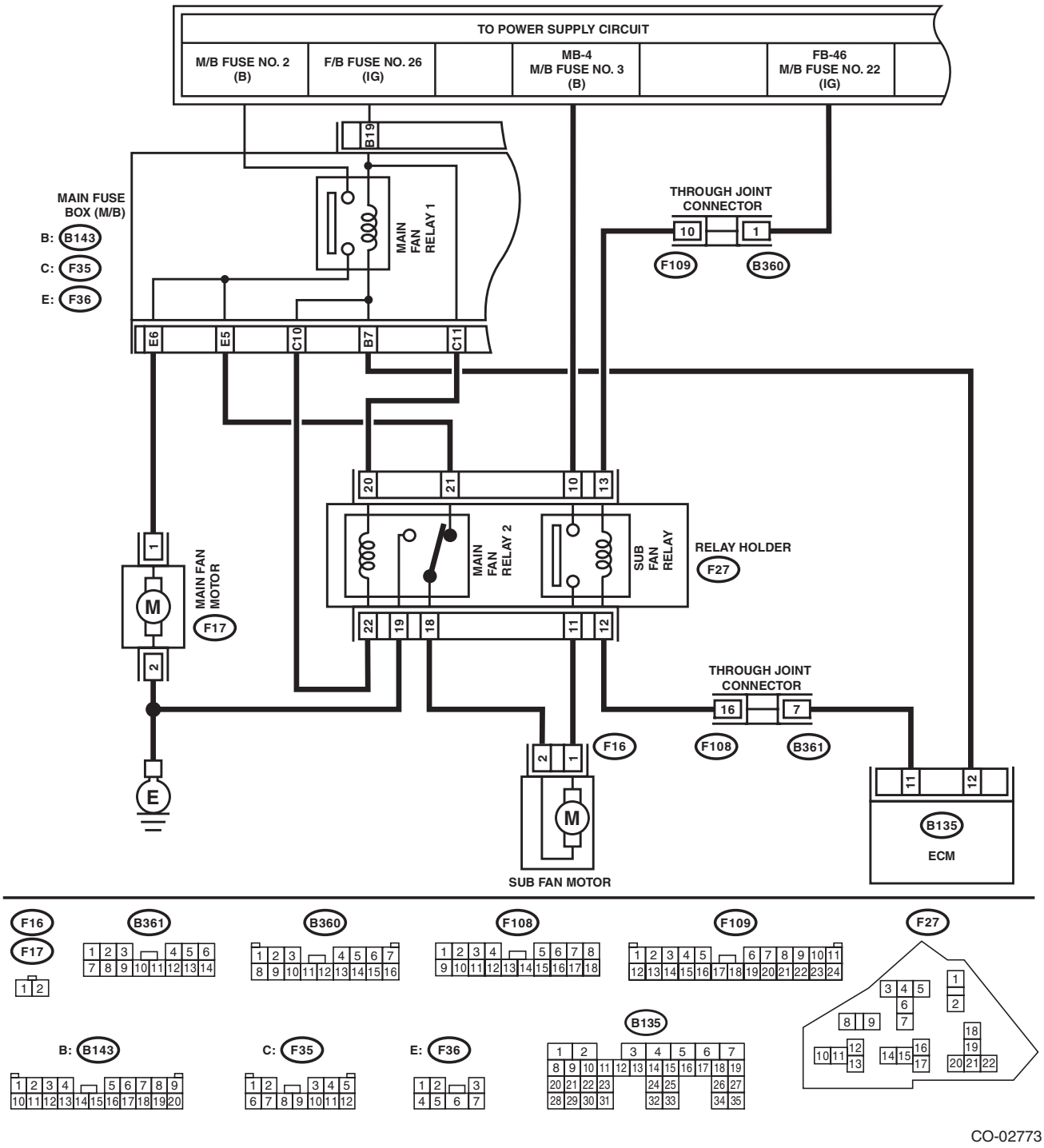
2. GENERAL TOOL

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

Radiator Fan System <Ref. to WI-64, WIRING DIAGRAM, Radiator Fan System.>



CO-02773

B: INSPECTION

OPERATING CONDITION:

Vehicle speed	A/C compressor load	Engine coolant temperature		
		Increase: 89°C (192°F) or less Decrease: 87°C (189°F) or less	Increase: 90 — 95°C (194 — 203°F) Decrease: 88 — 90°C (190 — 194°F)	Increase: 96°C (205°F) or more Decrease: 91°C (196°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 — 105 km/h (43 — 65 MPH) During deceleration: 65 — 100 km/h (40 — 62 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 106 km/h (66 MPH) or more During deceleration: 101 km/h (63 MPH) or more	OFF	OFF	High-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-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) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. 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(H4DOTC)(diag)-63, 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**.
2	**CHECK OPERATION OF RADIATOR FAN.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. 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(H4DOTC)(diag)-63, 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 sub fan relay connector 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 sub fan relay connector 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.

	Step	Check	Yes	No
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.
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.
9	**CHECK HARNESS BETWEEN SUB FAN RELAY CONNECTOR AND SUB FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the sub fan motor. 2) Measure the resistance of harness between sub fan relay connector and sub fan motor connector. ***Connector & terminal*** ***(F16) No. 1 — (F27) No. 11:***	Is the resistance less than 1 Ω?	Go to step **10**.	Repair the open circuit of harness between sub fan relay connector and sub fan motor connector.
10	**CHECK HARNESS BETWEEN SUB FAN MOTOR 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 connector and main fan relay 2 connector. ***Connector & terminal*** ***(F16) No. 2 — (F27) No. 18:***	Is the resistance less than 1 Ω?	Go to step **11**.	Repair the open circuit of the harness between sub fan motor connector and main fan relay 2 connector.
11	**CHECK FOR POOR CONTACT.** Check poor contact of sub fan motor connector.	Is there poor contact of the sub fan motor connector?	Repair the poor contact of sub fan motor connector.	Go to step **12**.
12	**CHECK SUB FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 of the sub fan motor, and the ground (–) terminal to terminal No. 2.	Does the radiator sub fan rotate?	Go to step **13**.	Replace the sub fan motor.
13	**CHECK MAIN FAN RELAY 2.** Measure the resistance between main fan relay 2 terminals. ***Terminals*** ***No. 21 — No. 18:***	Is the resistance less than 1 Ω?	Go to step **14**.	Replace the main fan relay 2.
14	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 CONNECTOR AND MAIN FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 2 connector and main fan motor connector. ***Connector & terminal*** ***(F17) No. 1 — (F27) No. 21:***	Is the resistance less than 1 Ω?	Go to step **15**.	Repair the open circuit of the harness between main fan relay 2 connector and main fan motor connector.

	Step	Check	Yes	No
15	**CHECK MAIN FAN MOTOR AND GROUND CIRCUIT.** Measure the resistance between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 2 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **16**.	Repair the open circuit of the harness between main fan motor connector and chassis ground.
16	**CHECK FOR POOR CONTACT.** Check poor contact of main fan motor connector.	Is there poor contact of the main fan motor connector?	Repair the poor contact of main fan motor connector.	Go to step **17**.
17	**CHECK MAIN FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 of the main fan motor, and the ground (–) terminal to terminal No. 2.	Does the radiator main fan rotate?	Go to step **18**.	Replace the main fan motor.
18	**CHECK HARNESS BETWEEN SUB FAN RELAY CONNECTOR AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between the sub fan relay connector and ECM connector. ***Connector & terminal*** ***(B135) No. 11 — (F27) No. 12:***	Is the resistance less than 1 Ω?	Go to step **19**.	Repair the open circuit of harness between sub fan relay connector and ECM.
19	**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.	Check the DTC. Repair the trouble cause. <Ref. to EN(H4DOTC)(diag)-47, 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 between terminals of main fan relay 1 switch.	Is the resistance 1 MΩ or more?	Go to step **21**.	Replace the main fan relay 1.
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 of main fan relay 1 switch.	Is the resistance less than 1 Ω?	Go to step **22**.	Replace the main fan relay 1.
22	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 CONNECTOR AND MAIN FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 1 connector and main fan motor connector. ***Connector & terminal*** ***(F17) No. 1 — (F36) No. 6:***	Is the resistance less than 1 Ω?	Go to step **23**.	Repair the open circuit of the harness between main fan relay 1 connector and main fan motor connector.
23	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 CONNECTOR AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between the main fan relay 1 connector and ECM connector. ***Connector & terminal*** ***(B135) No. 12 — (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 connector and ECM.

	Step	Check	Yes	No
24	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 CONNECTOR AND ECM.** Measure the resistance between the main fan relay 2 connector and ECM connector. ***Connector & terminal*** ***(B135) No. 12 — (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 connector and ECM.
25	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 2 and No. 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step **26**.
26	**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.	Repair the power supply circuit to the main fuse box.
27	**CHECK OPERATION OF RADIATOR FAN.** If the both 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 main fan relay 2 from the relay holder. 2) Measure the resistance between main fan relay 2 connector 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 connector 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 connector 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 between main fan relay 2 terminals. ***Terminals*** ***No. 18 — No. 19:***	Is the resistance 1 MΩ or more?	Go to step **31**.	Replace the main fan relay 2.
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 between main fan relay 2 terminals. ***Terminals*** ***No. 18 — No. 19:***	Is the resistance less than 1 Ω?	Go to step **23**.	Replace the main fan relay 2.

3. Engine Coolant

A: INSPECTION

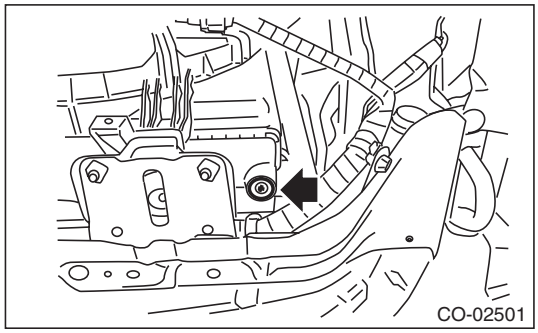
NOTE:
When adding the engine coolant, always use SUBARU Super Coolant.
1) Park the vehicle on a level surface.
2) Check the engine coolant amount, and if the coolant level is low, check for the coolant leakage, and then add the engine coolant.
(1) Make sure the engine coolant level in the reservoir tank is between “FULL” and “LOW” with the engine in a cold condition.
(2) Open the cap of coolant filler tank, and check that the engine coolant is filled up to the filler neck position.

B: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Remove the drain plug to drain engine coolant into container.

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



4) Install the drain plug.
5) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>

2. FILLING OF ENGINE COOLANT

1) Pour cooling system conditioner through the filler neck of coolant filler tank.

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

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

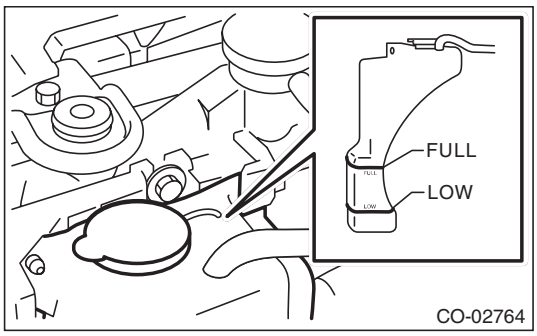
Recommended engine coolant:
Refer to “SPECIFICATION” for recommended engine coolant. <Ref. to CO(STI)-2, SPECIFICATION, General Description.>

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

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

CAUTION:
Do not confuse the cap of coolant filler tank and cap of radiator.

NOTE:
• When pouring the engine coolant, the radiator side cap must not be removed.
• The SUBARU Super Coolant contains anti-freeze and anti-rust agents, and is especially made for Subaru engines with an aluminum cylinder block. Be sure to 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 coolant filler tank 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, then open the coolant filler tank cap. If the engine coolant level drops, add engine coolant into coolant filler tank up to the filler neck position.
6) Perform the procedures 4) and 5) again.
7) Install the coolant filler tank 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 to prevent overheating.
10) Stop the engine and wait until the engine coolant temperature lowers to 30°C (86°F) or less.
11) Open the coolant filler tank cap. If the engine coolant level drops, add engine coolant into the coolant filler tank up to the filler neck position and the reservoir tank to "FULL" level.
12) Install the coolant filler tank cap and reservoir tank cap properly.
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 the heater core, repeat the procedures from step 9).

C: ADJUSTMENT

1. PROCEDURE TO ADJUST THE CONCENTRATION OF THE SUBARU SUPER COOLANT

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, select the proper Subaru Super Coolant concentration from the table, and add the amount of diluting water corresponding to the required concentration to the Subaru Super Coolant (concentrated type).

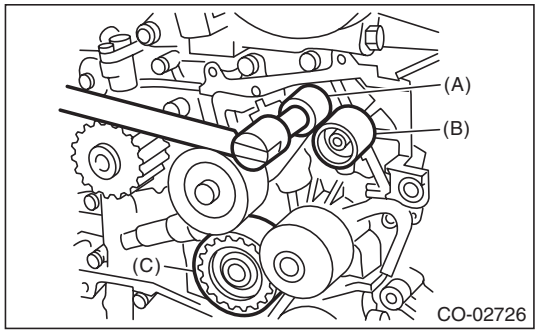
Relationship of Subaru Super Coolant concentration and freezing temperature			
Subaru Super Coolant concentration	50%	55%	60%
Freezing temp.	–36°C (–33°F)	–41°C (–42°F)	–50°C (–58°F)

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

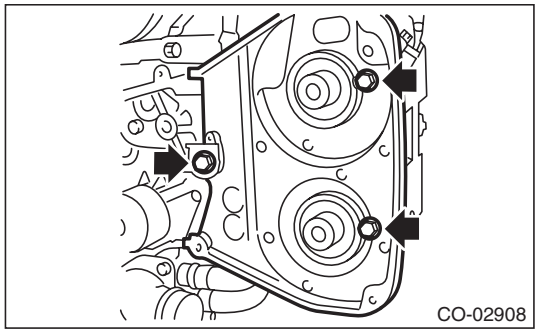
4. Water Pump

A: REMOVAL

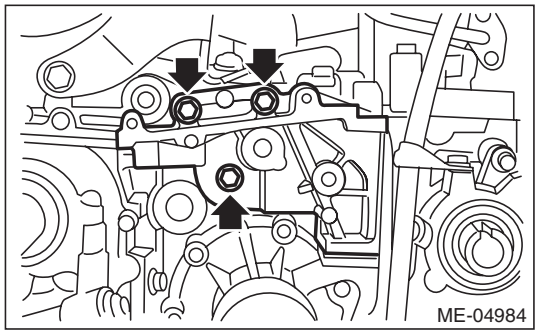
1) Remove the radiator. <Ref. to CO(STI)-19, REMOVAL, Radiator.>
2) Remove the V-belts. <Ref. to ME(STI)-39, REMOVAL, V-belt.>
3) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(STI)-49, REMOVAL, Timing Belt.>
6) Remove the automatic belt tension adjuster (A).
7) Remove the belt idler (B).
8) Remove the belt idler No. 2 (C).



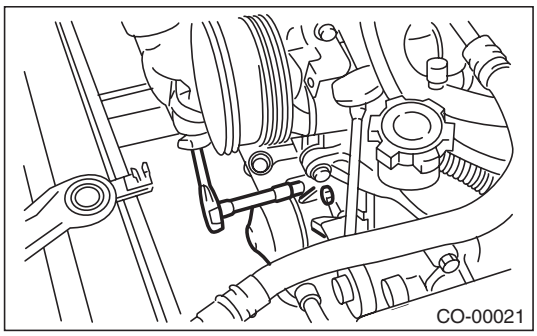
9) Remove the cam sprocket LH. <Ref. to ME(STI)-58, REMOVAL, Cam Sprocket.>
10) Remove the belt cover No. 2 LH.



11) Remove the tensioner bracket.



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

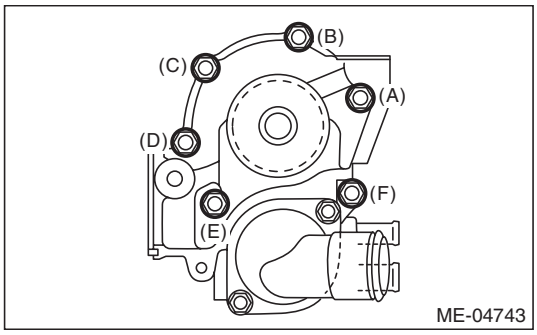


B: INSTALLATION

1) Install the water pump onto cylinder block LH.

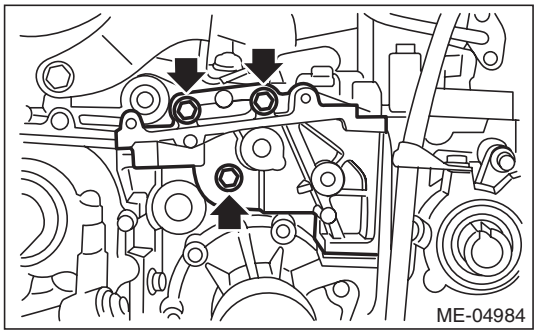
NOTE:
- Use a new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in figure.

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)



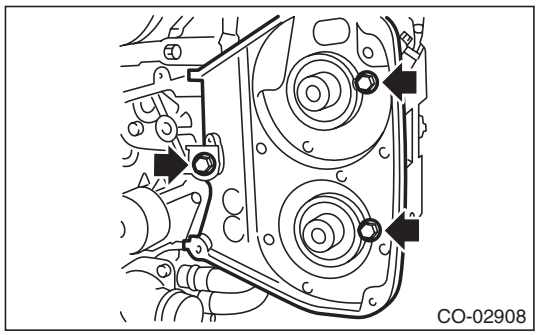
2) Install the hose to water pump.
3) Install the tensioner bracket.

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



4) Install the belt cover No. 2 LH.

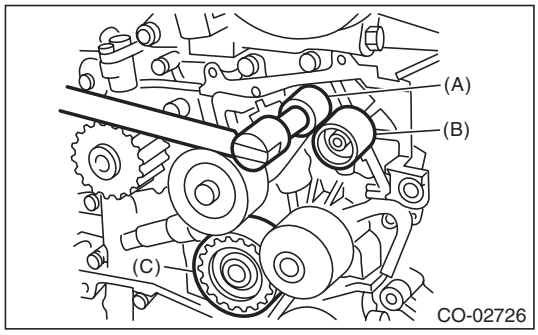
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



5) Install the cam sprocket LH. <Ref. to ME(STI)-58, INSTALLATION, Cam Sprocket.>
6) Install the belt idler No. 2 (C).

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)
7) Install the belt idler (B).

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)
8) Install the automatic belt tension adjuster (A) with the tension rod held by a pin. <Ref. to ME(STI)-51, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

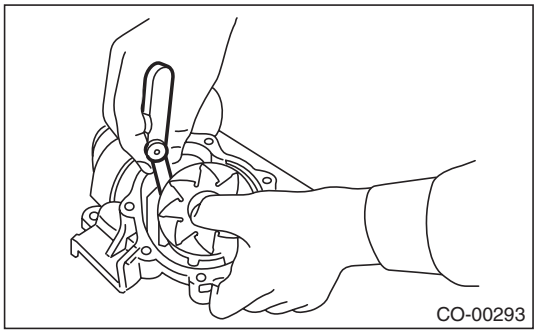


9) Install the timing belt. <Ref. to ME(STI)-52, TIMING BELT, INSTALLATION, Timing Belt.>
10) Install the timing belt cover. <Ref. to ME(STI)-48, INSTALLATION, Timing Belt Cover.>
11) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.>
12) Install the V-belts. <Ref. to ME(STI)-39, INSTALLATION, V-belt.>
13) Install the radiator. <Ref. to CO(STI)-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 abnormally 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 — 0.059 in)

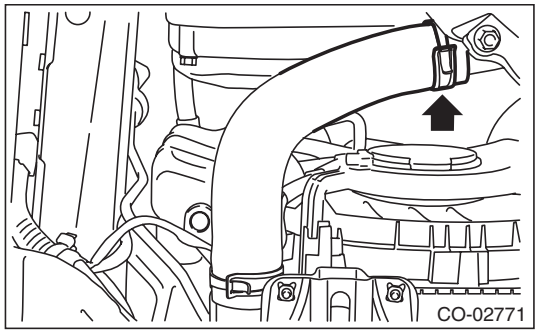


5) After water pump installation, check pulley shaft for engine coolant leaks or noise. If leaks or noise are noted, replace the water pump assembly.

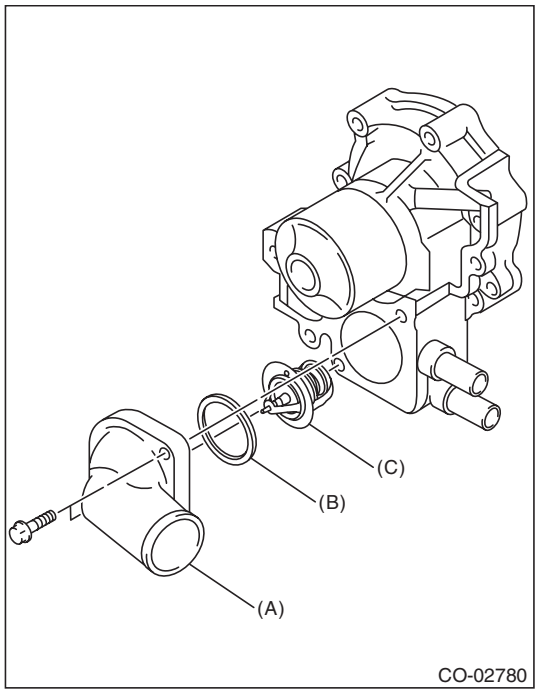
5. Thermostat

A: REMOVAL

1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the radiator outlet hose from thermostat cover.



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



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

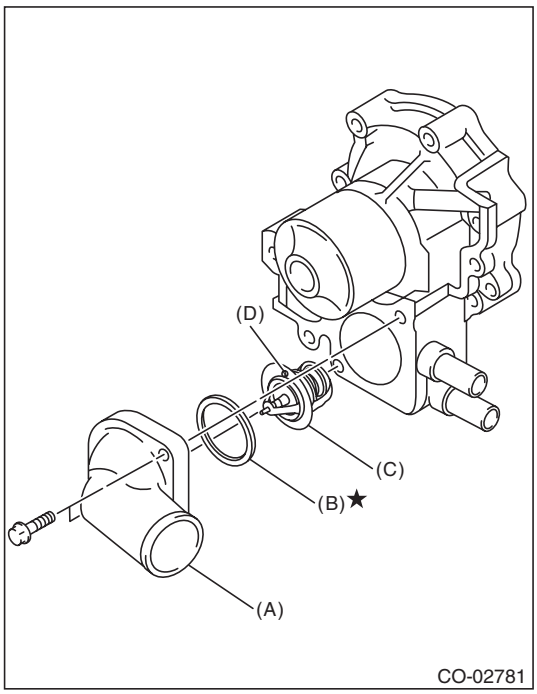
B: INSTALLATION

1) Install a gasket to thermostat.

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

NOTE:
Install the parts 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 under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
5) Lower the vehicle.
6) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

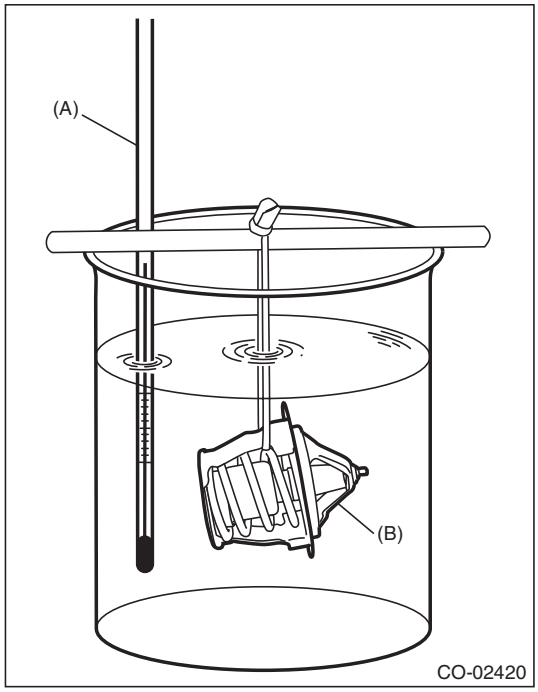
1) Check that the thermostat does not have deformation, cracks or damage.
2) Check that the thermostat valve closes completely at an ambient temperature.
3) Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and check the temperature and valve lift when the valve begins to open and when the valve is fully opened. Replace the thermostat if faulty.

NOTE:
• During the test, agitate the water for even temperature distribution.
• Leave the thermostat in the boiling water for five minutes or more before measuring the valve lift.
• Hold the thermostat with a wire or the like to avoid contacting the container.

Starting temperature to open:
76 — 80°C (169 — 176°F)

Full open temperature:
91°C (196°F)

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



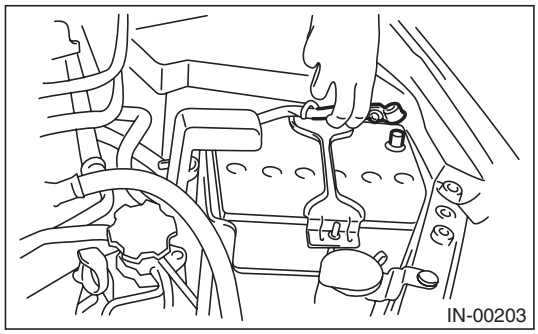
(A) Thermometer
(B) Thermostat

6. Radiator

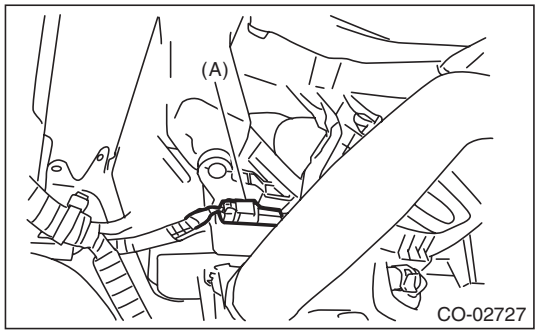
A: REMOVAL

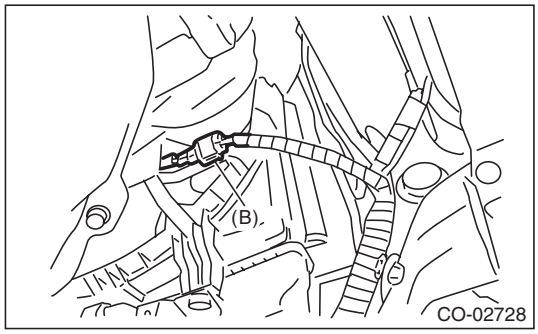
CAUTION:
The radiator is pressurized when the engine and radiator are hot. Wait until engine and radiator cool down before working on the radiator.

1) Disconnect the ground cable from battery.

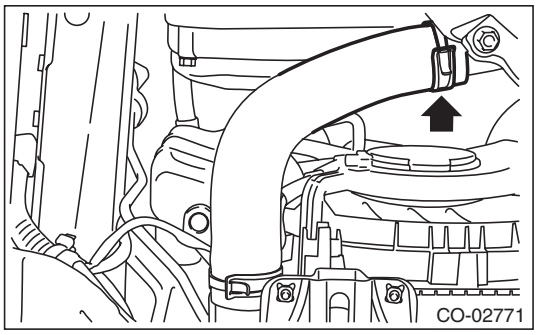


2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Disconnect the connector (A) from the main fan motor and the connector (B) from the sub fan motor.

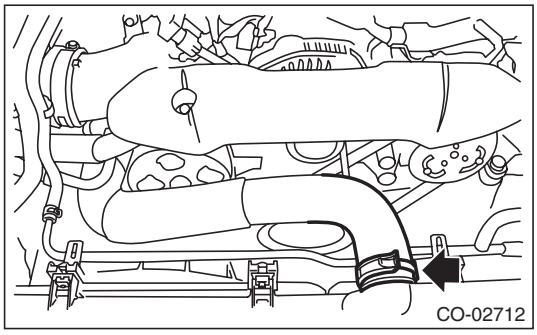




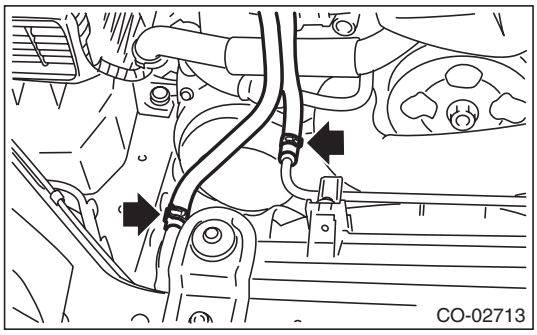
6) Disconnect the radiator outlet hose from thermostat cover.



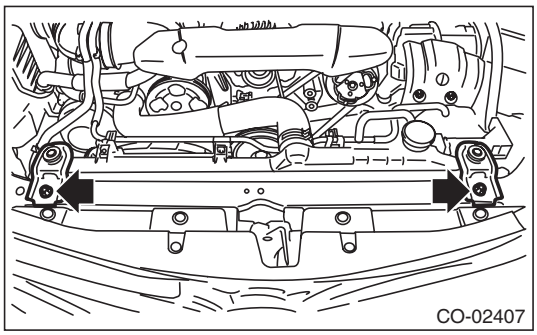
7) Lower the vehicle.
8) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
9) Remove the reservoir tank. <Ref. to CO(STI)-27, REMOVAL, Reservoir Tank.>
10) Disconnect the radiator inlet hose from the radiator.



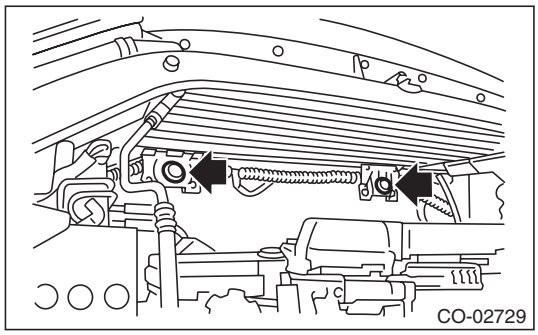
11) Disconnect the two engine coolant hoses from the radiator and over flow pipe.



12) Remove the radiator upper brackets.

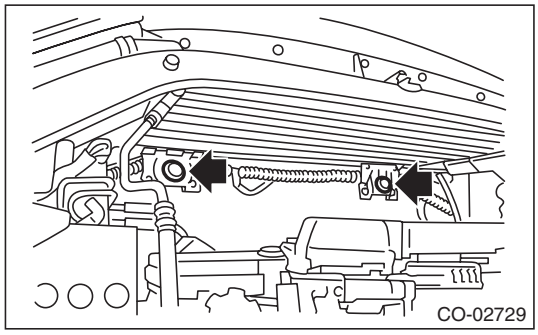


13) Move the radiator to the left while lifting it upward.
14) Lift the radiator up and remove the radiator from vehicle.
15) Remove the radiator lower cushion from the radiator lower bracket.



B: INSTALLATION

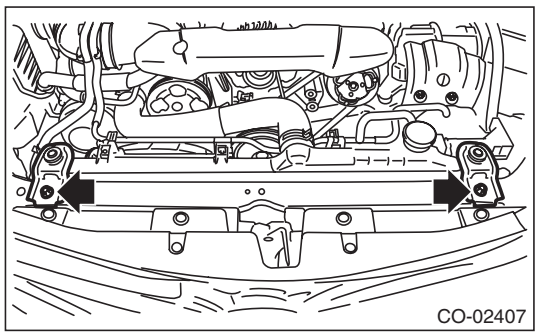
1) Attach the radiator lower cushion to the radiator lower bracket.



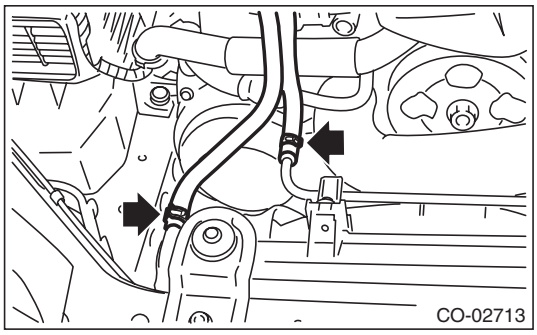
2) Install the radiator to vehicle.

NOTE:
Make pins on the lower side of radiator be fitted into the radiator lower cushions.
3) Install the radiator upper brackets.

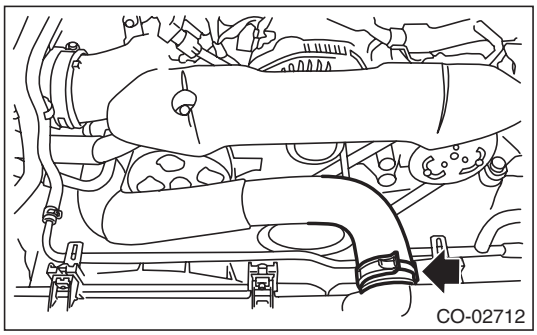
Tightening torque:
12 N·m (1.2 kgf-m, 8.9 ft-lb)



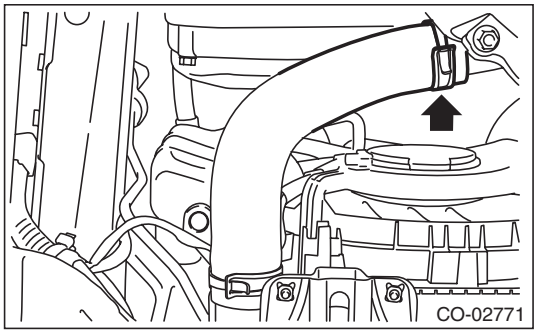
4) Connect the two engine coolant hoses to the radiator and over flow pipe.



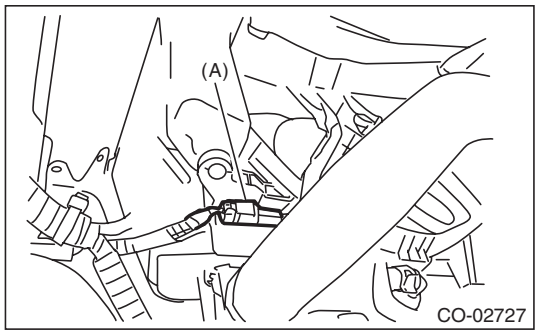
5) Connect the radiator inlet hose.

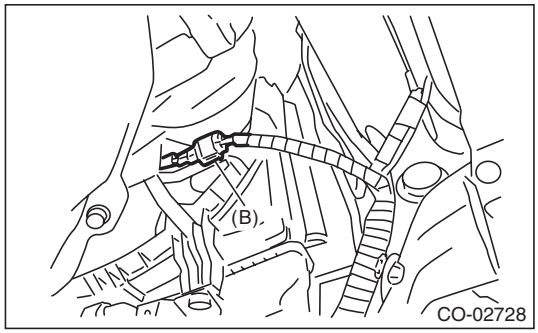


6) Install the reservoir tank. <Ref. to CO(STI)-27, INSTALLATION, Reservoir Tank.>
7) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.>
8) Lift up the vehicle.
9) Connect the radiator outlet hose.

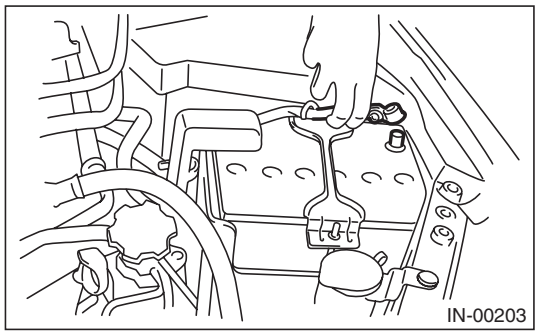


10) Connect the connector (A) to the main fan motor and the connector (B) to the sub fan motor.





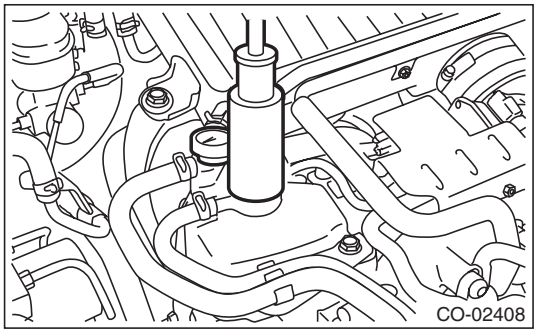
11) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
12) Lower the vehicle.
13) Connect the battery ground terminal.



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

C: INSPECTION

1) Check that the radiator does not have deformation, cracks or damage.
2) Check that the hose has no cracks, damage or loose part.
3) Remove the coolant filler tank cap, fill the coolant filler tank with engine coolant, then install the radiator cap tester to the filler neck of coolant filler tank.



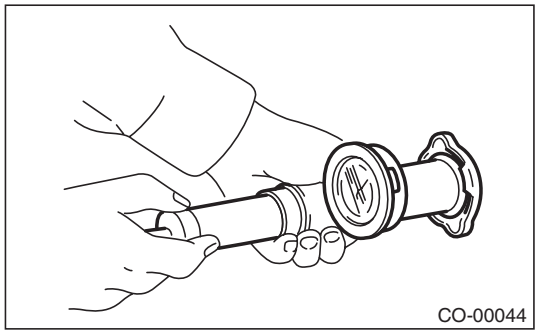
4) Apply a pressure of 122 kPa (1.2 kg/cm^2, 18 psi) to the radiator and check the following points:
- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

CAUTION:
• Inspection must be carried out at the side of coolant filler tank, not at the side of radiator.
• Engine should be turned off.
• Wipe engine coolant from check points in advance.
• Be careful not to deform the filler neck of the coolant filler tank when installing and removing the radiator cap tester.
• Be careful of engine coolant from spurting out when removing the radiator cap tester.

7. Radiator Cap

A: INSPECTION

1) Check that the radiator cap does not have deformation, cracks or damage.
2) Attach the radiator cap tester to radiator cap.



3) Increase pressure until the radiator cap tester gauge needle stops. Radiator cap is functioning properly if it holds the service limit pressure for 5 — 6 seconds. Replace the radiator cap if its valve opens at less than the service limit.

Coolant filler tank side:
Standard
93 — 123 kPa (0.95 — 1.25 kg/cm^2, 14 — 18 psi)
Limit
83 kPa (0.85 kg/cm^2, 12 psi)

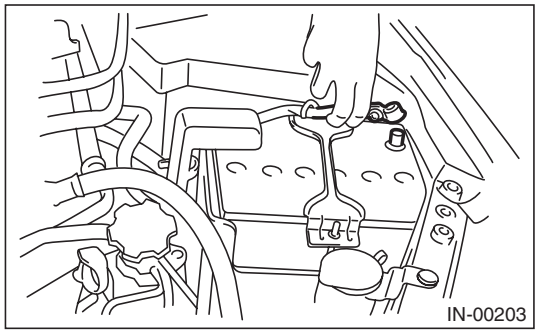
Radiator side:
Standard
122 — 152 kPa (1.24 — 1.55 kg/cm^2, 18 — 22 psi)
Limit
112 kPa (1.14 kg/cm^2, 16 psi)

CAUTION:
• Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.
• Do not confuse the cap of coolant filler tank and cap of radiator.

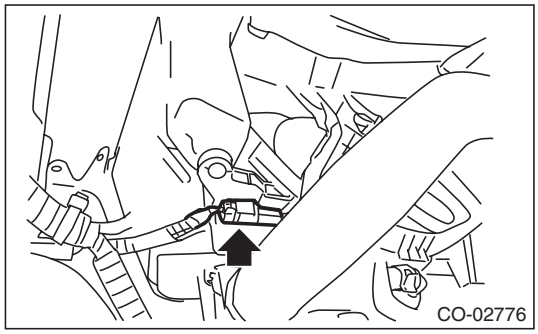
8. Radiator Main Fan and Fan Motor

A: REMOVAL

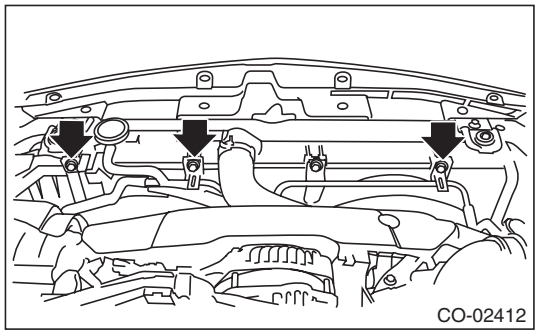
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Disconnect the connector from the main fan motor.



5) Lower the vehicle.
6) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
7) Remove the reservoir tank. <Ref. to CO(STI)-27, REMOVAL, Reservoir Tank.>
8) Remove the bolts which secure the radiator main fan motor assembly and the over flow pipe.



9) Remove the radiator main fan motor assembly from the upper side of the vehicle.

B: INSTALLATION

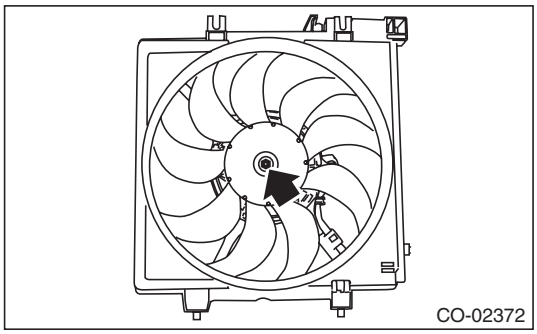
Install in the reverse order of removal.

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

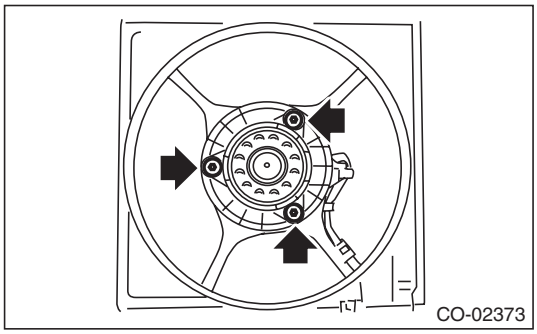
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the clip which holds the main fan motor connector onto the radiator main fan shroud.
2) Disconnect the radiator main fan from the main fan motor.



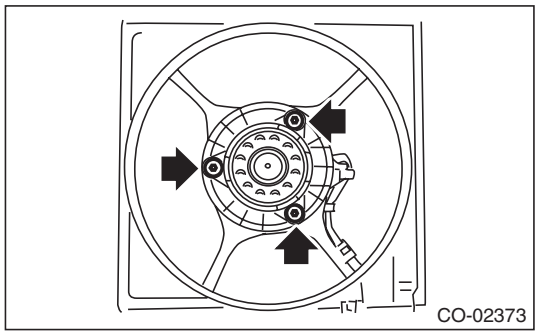
3) Disconnect the main fan motor from the radiator main fan shroud.



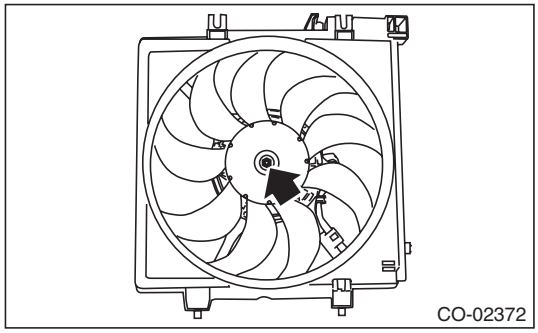
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



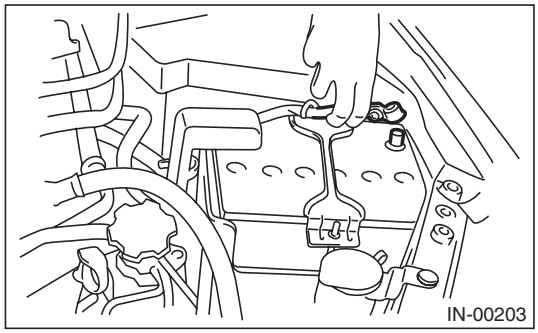
E: INSPECTION

Check that the radiator main fan, radiator main fan shroud and main fan motor do not have deformation, cracks or damage.

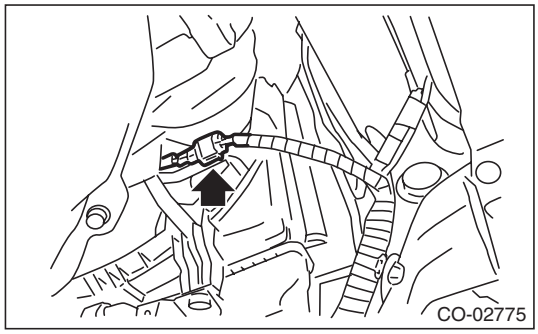
9. Radiator Sub Fan and Fan Motor

A: REMOVAL

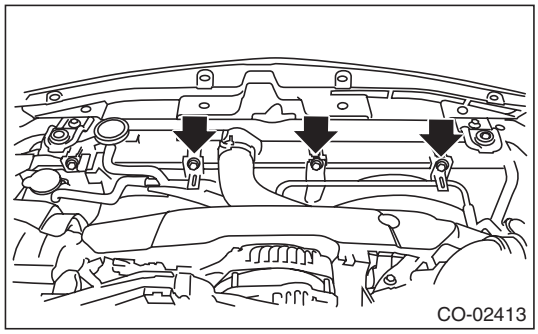
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Disconnect the connector from the sub fan motor.



5) Lower the vehicle.
6) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.>
7) Remove the bolts which secure the radiator sub fan motor assembly and the over flow pipe.



8) Raise the radiator sub fan motor assembly slightly, remove the pin at the lower part of the radiator sub fan motor assembly from the radiator hole, and remove the radiator sub fan motor assembly from the lower side of the vehicle.

B: INSTALLATION

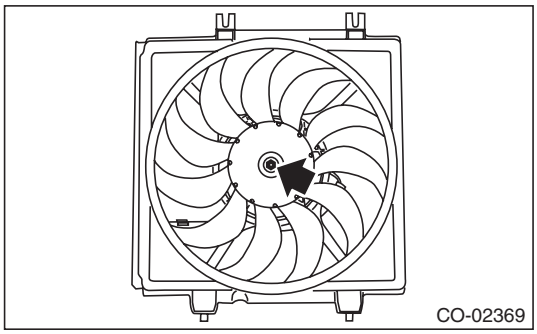
Install in the reverse order of removal.

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

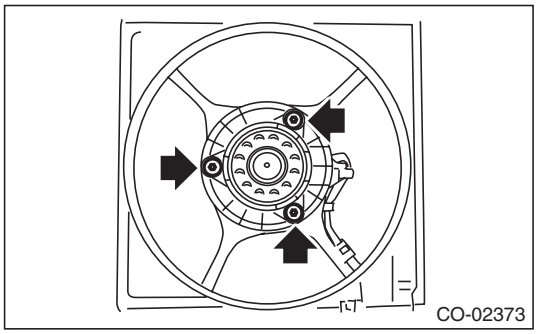
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the clip which holds the sub fan motor connector onto the radiator sub fan shroud.
2) Disconnect the radiator sub fan from the sub fan motor.



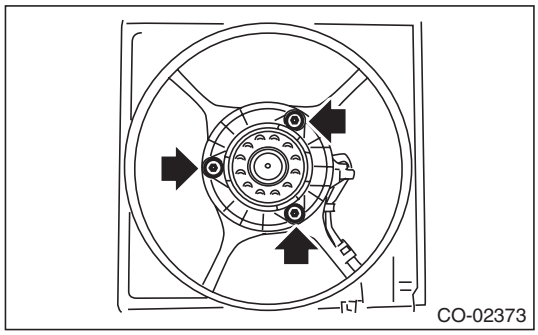
3) Disconnect the sub fan motor from the radiator sub fan shroud.



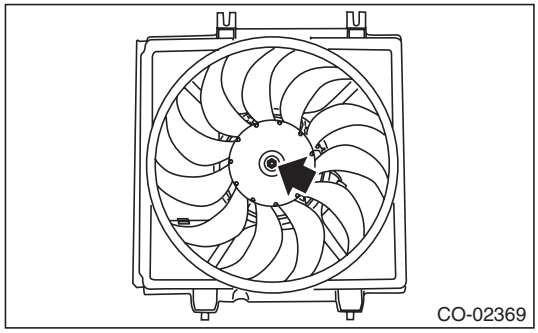
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



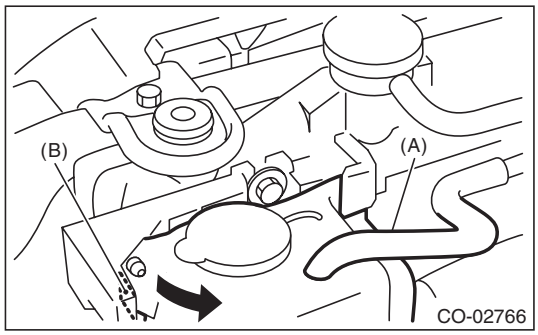
E: INSPECTION

Check that the radiator sub fan, radiator sub fan shroud and sub fan motor do not have deformation, cracks or damage.

10.Reservoir Tank

A: REMOVAL

1) Pull out the over flow hose (A).
2) Pull out the reservoir tank to the arrow direction while pushing the claw (B).



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

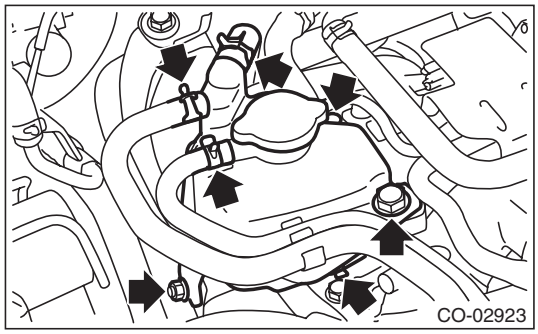
1) Check that the reservoir tank does not have deformation, cracks or damage.
2) Make sure the over flow hoses are not cracked, damaged or loose.
3) Make sure the engine coolant level is between “FULL” and “LOW”.

11.Coolant Filler Tank

A: REMOVAL

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

1) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
2) Disconnect the engine coolant hoses from coolant filler tank.
3) Remove the bolt and nut which secure the coolant filler tank.
4) Remove the coolant filler tank.



B: INSTALLATION

1) Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

C: INSPECTION

1) Check that the coolant filler tank does not have deformation, cracks or damage.
2) Check that the engine coolant hose has no cracks, damage or loose part.

12.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(H4DOTC)(diag)-2, PROCEDURE, 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(H4DOTC)(diag)-2, PROCEDURE, 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 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(STI)

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1. General Description

A: SPECIFICATION

1. STI MODEL

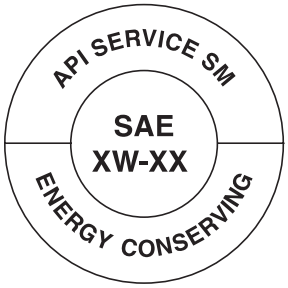
Lubrication method					Forced lubrication
Oil pump	Pump type				Trochoid type
	Number of teeth	Inner rotor			9
		Outer rotor			10
	Outer rotor diameter × thickness			mm (in)	78 × 11 (3.07 × 0.43)
	Tip clearance between inner and outer rotors		mm (in)	Standard	0.04 — 0.14 (0.0016 — 0.0055)
	Case clearance between outer rotor and pump case		mm (in)	Standard	0.10 — 0.175 (0.0039 — 0.0069)
	Side clearance between inner rotor and pump case		mm (in)	Standard	0.02 — 0.07 (0.0008 — 0.0028)
	Relief valve spring	Free length		mm (in)	73.7 (2.902)
		Installed length		mm (in)	54.7 (2.154)
		Load when installed		N (kgf, lbf)	93.1 (9.49, 20.93)
	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.	6.4 (6.8, 5.6) or more
		6,000 rpm	Discharge pressure	kPa (kg/cm^2, psi)	392 (4.0, 56.8)
			Discharge rate	L (US qt, Imp qt)/min.	63.0 (66.6, 55.4) or more
	Relief valve working pressure			kPa (kg/cm^2, psi)	538 (5.5, 78)
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 (at overhaul)			L (US qt, Imp qt)	5.0 (5.3, 4.4)
	When replacing engine oil and oil filter			L (US qt, Imp qt)	4.3 (4.5, 3.8)
	When replacing engine oil only			L (US qt, Imp qt)	4.0 (4.2, 3.5)

2. EXCEPT FOR STI MODEL

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			mm (in)	Standard	0.04 — 0.14 (0.0016 — 0.0055)
	Case clearance between outer rotor and pump case			mm (in)	Standard	0.10 — 0.175 (0.0039 — 0.0069)
	Side clearance between inner rotor and pump case			mm (in)	Standard	0.02 — 0.07 (0.0008 — 0.0028)
	Relief valve spring	Free length		mm (in)		73.7 (2.902)
		Installed length		mm (in)		54.7 (2.154)
		Load when installed		N (kgf, lbf)		93.1 (9.49, 20.93)
	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 (at 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)

Specified oil:

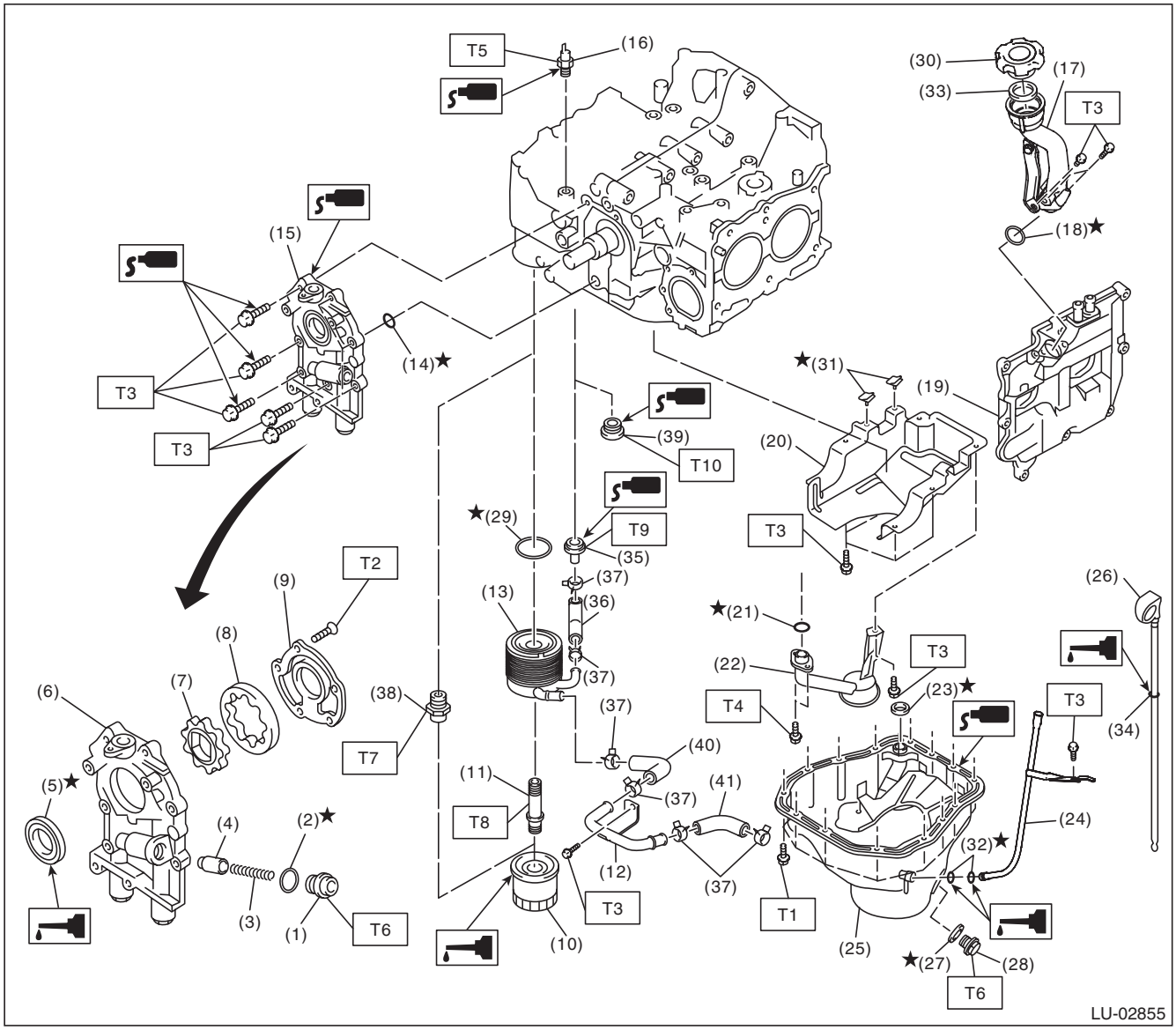
CAUTION:
- **Use 5W-30 (synthetic oil).**
- **It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use the following engine oil specified by Subaru.**

Engine oil standard		SAE viscosity No.
 RM-00076 Those with the API standard SM "Energy Conserving" or SN "Resource Conserving" logo.	or	 RM-00002 Those with the ILSAC standard GF-4 or GF-5 "starburst mark" displayed on top of the container.	5W-30 (synthetic oil)

NOTE:
The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.

B: COMPONENT

1. OIL PUMP AND OIL PAN

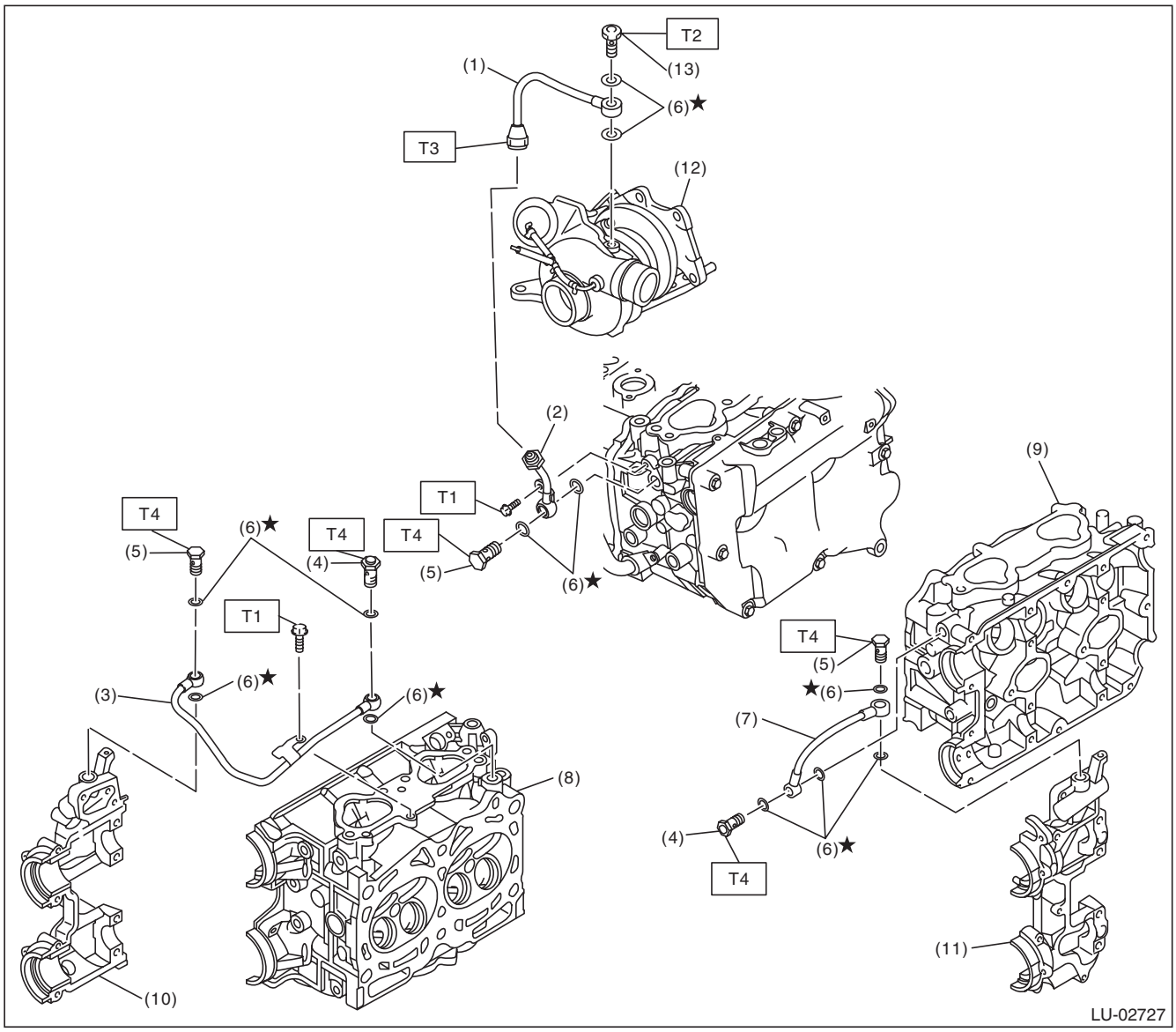


(1) Plug
(2) Gasket
(3) Relief valve spring
(4) Relief valve
(5) Front oil seal
(6) Oil pump case
(7) Inner rotor
(8) Outer rotor
(9) Oil pump cover
(10) Oil filter
(11) Oil cooler connector (model with oil cooler)
(12) Oil cooler pipe (model with oil cooler)
(13) Oil cooler (model with oil cooler)
(14) O-ring
(15) Oil pump ASSY
(16) Oil pressure switch
(17) Oil filler duct
(18) O-ring
(19) Rocker cover
(20) Baffle plate
(21) O-ring
(22) Oil strainer
(23) Gasket
(24) Oil level gauge guide
(25) Oil pan
(26) Oil level gauge
(27) Drain plug gasket
(28) Drain plug
(29) Gasket (model with oil cooler)
(30) Oil filler cap
(31) Seal
(32) O-ring
(33) Gasket
(34) O-ring
(35) Nipple (model with oil cooler)
(36) Oil cooler hose A (model with oil cooler)
(37) Clip (model with oil cooler)
(38) Oil filter connector (model without oil cooler)
(39) Plug (model without oil cooler)
(40) Oil cooler hose B (model with oil cooler)
(41) Oil cooler hose C (model with oil cooler)

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: 54 (5.5, 39.8)
T9: 69 (7.0, 50.9)
T10: 70 (7.1, 51.6)

2. OIL PIPE



(1)	Oil inlet pipe	(8)	Cylinder head RH
(2)	Turbocharger oil pipe	(9)	Cylinder head LH
(3)	Oil pipe RH	(10)	Front camshaft cap RH
(4)	Union bolt with filter (with protrusion)	(11)	Front camshaft cap LH
(5)	Union bolt without filter (without protrusion)	(12)	Turbocharger
(6)	Gasket	(13)	Union bolt without filter (with protrusion)
(7)	Oil pipe LH		

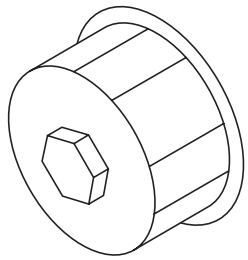
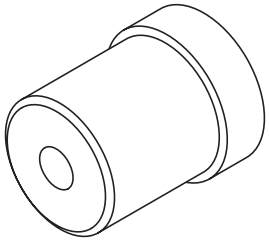
Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 16 (1.6, 11.8)
T3: 20 (2.0, 14.8)
T4: 29 (3.0, 21.4)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Prepare a container and cloth when performing work which oil possibly spills. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- 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.
- 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.

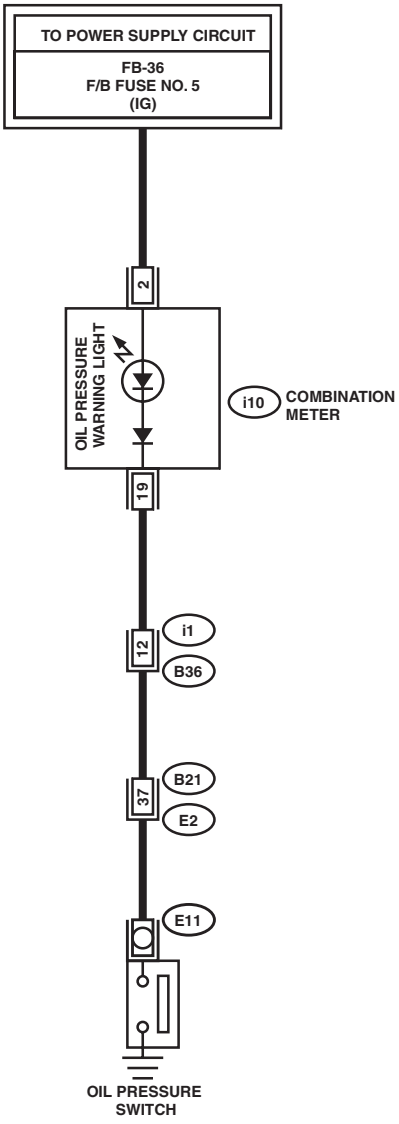
2. GENERAL TOOL

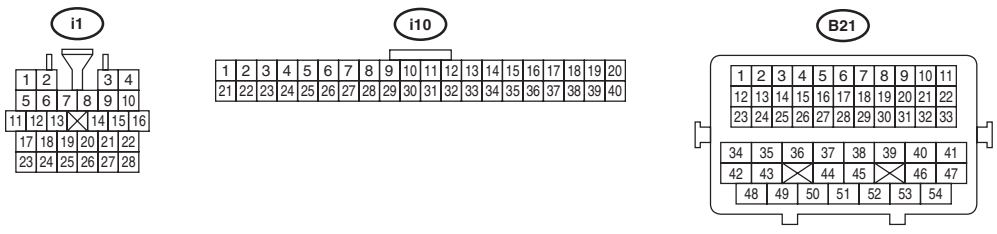
TOOL NAME	REMARKS
Oil filter wrench (65/67 mm 14 Flutes)	Used for removing and installing oil filter (Blue). (Outer diameter: 67.4 mm (2.65 in))
Circuit tester	Used for measuring resistance and voltage.

2. Oil Pressure System

A: WIRING DIAGRAM

Oil pressure warning system <Ref. to WI-152, WIRING DIAGRAM, Oil Pressure Warning Light System.>





LU-02703

B: INSPECTION

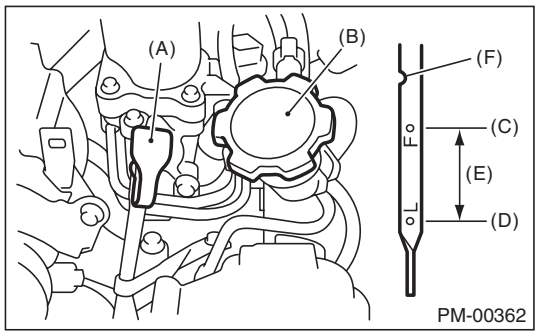
Step		Check	Yes	No
1	**CHECK COMBINATION METER.** 1) Turn the ignition switch to ON (engine OFF). 2) Check other warning lights.	Does the warning light illuminate?	Go to step **2**.	Repair or replace the combination meter. <Ref. to IDI-5, INSPECTION, Combination Meter System.>
2	**CHECK POWER SUPPLY TO 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 between oil pressure switch harness connector and chassis ground. ***Connector & terminal*** ***(E11) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Replace the oil pressure switch. <Ref. to LU(STI)-22, Oil Pressure Switch.>	Go to step **3**.
3	**CHECK COMBINATION METER.** 1) Turn the ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of combination meter. ***Terminals*** ***No. 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-5, 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.

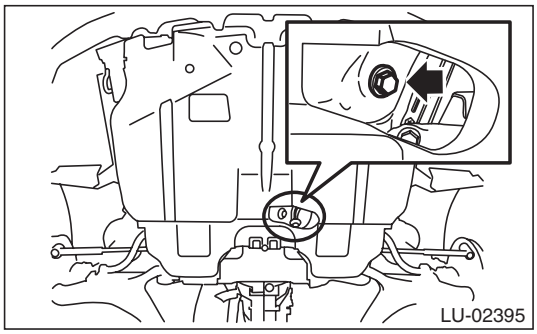


(A) Oil level gauge
(B) Engine oil filler cap
(C) "F" line
(D) "L" line
(E) Approx. 1.0 L (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

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) Open the engine oil filler cap for quick draining of engine oil.
2) Lift up the vehicle.
3) Drain engine oil by loosening the engine oil drain plug.

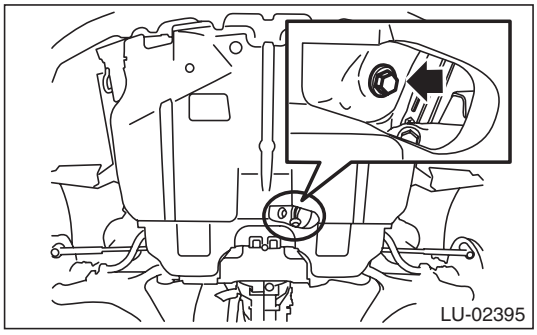
NOTE:
Prepare the container for draining of engine oil.



4) 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)

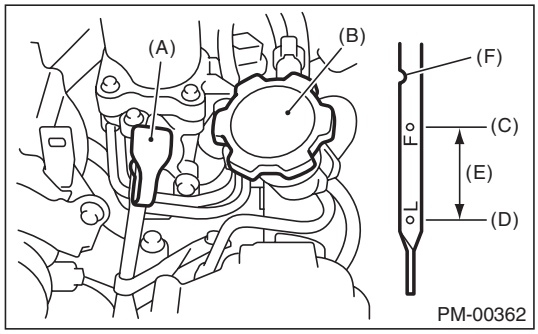


5) Lower the vehicle.
6) Using engine oil of proper quality and viscosity, fill engine oil through the filler duct to the "F" line on the oil level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

Recommended oil:
Refer to "SPECIFICATION" for recommended oil. <Ref. to LU(STI)-2, SPECIFICATION, General Description.>

Engine oil capacity:
Refer to "SPECIFICATION" for engine oil capacity. <Ref. to LU(STI)-2, SPECIFICATION, General Description.>

7) Close the engine oil filler cap.
8) Start the engine to circulate the oil in engine.
9) After stopping the engine, recheck the oil level. If necessary, add engine oil up to the “F” line on oil level gauge.

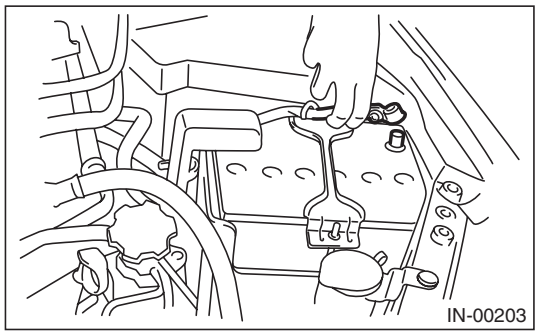


(A) Oil level gauge
(B) Engine oil filler cap
(C) “F” line
(D) “L” line
(E) Approx. 1.0 L (1.1 US qt, 0.9 Imp qt)
(F) Notch mark

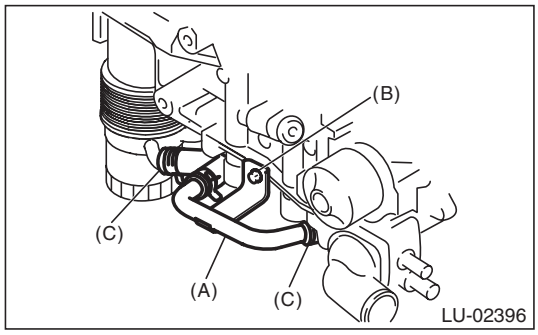
4. Oil Pump

A: REMOVAL

1) Disconnect the ground cable from battery.

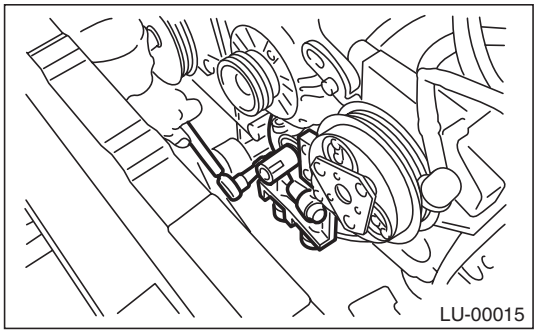


2) Remove the radiator. <Ref. to CO(STI)-19, REMOVAL, Radiator.> <Ref. to CO(w/o STI)-19, REMOVAL, Radiator.>
3) Lift up the vehicle.
4) Remove the bolt (B) which secures oil cooler pipe (A) to oil pump. (Model with oil cooler)
5) Remove the oil cooler pipe (A) and hose (C). (Model with oil cooler)



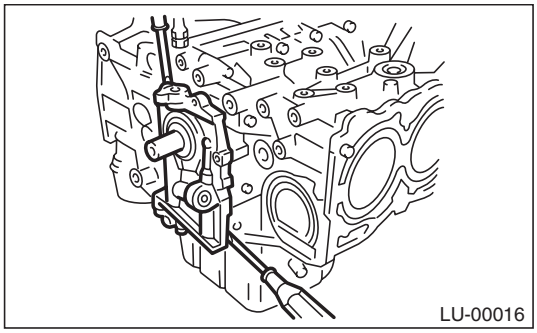
6) Lower the vehicle.
7) Remove the crankshaft position sensor.
<Ref. to FU(STI)-35, REMOVAL, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-35, REMOVAL, Crankshaft Position Sensor.>
8) Remove the water pump. <Ref. to CO(STI)-15, REMOVAL, Water Pump.> <Ref. to CO(w/o STI)-15, REMOVAL, Water Pump.>
9) Remove the crank sprocket. <Ref. to ME(STI)-59, REMOVAL, Crank Sprocket.> <Ref. to ME(w/o STI)-58, REMOVAL, Crank Sprocket.>
10) Remove the bolts which install oil pump onto cylinder block.

NOTE:
When disassembling and checking the oil pump, loosen the relief valve plug before removing the oil pump.



11) Remove the oil pump by using flat tip screwdriver.

CAUTION:
Be careful not to scratch mating surfaces of cylinder block and oil pump.

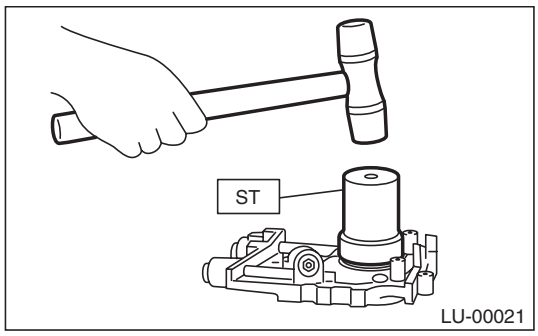


12) Remove the front oil seal from the oil pump.

B: INSTALLATION

1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

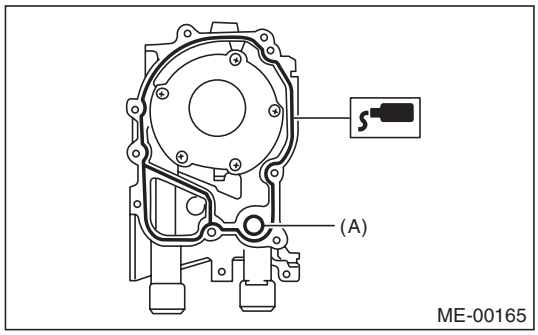
NOTE:
Use a new front oil seal.



2) Apply liquid gasket to the mating surfaces of oil pump.

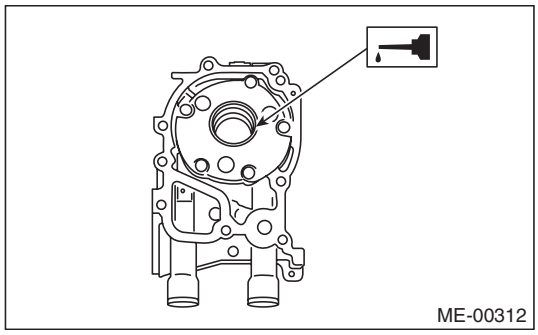
NOTE:
Install within 5 min. after applying liquid gasket.

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.

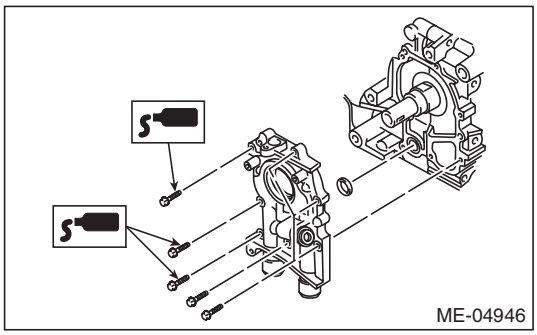
CAUTION:
• Be careful not to damage the front oil seal during installation.
• Make sure the front oil seal lip is not folded.

NOTE:
• Align the flat surface of oil pump's inner rotor with that of crankshaft before installation.
• Use new O-rings.
• Do not forget to install O-rings.

5) Apply liquid gasket to the three bolts thread shown in figure. (when reusing bolts)

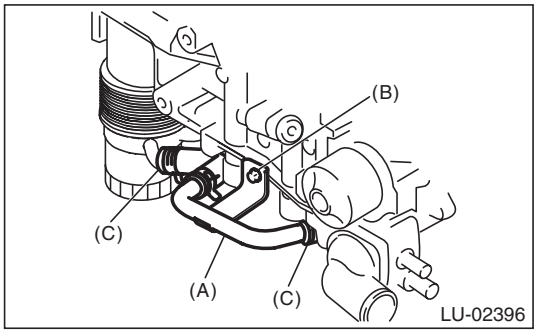
Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



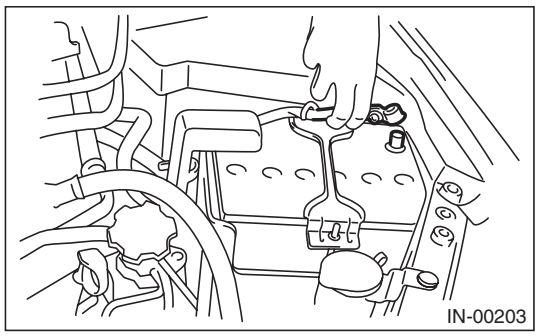
6) Install the crank sprocket. <Ref. to ME(STI)-59, INSTALLATION, Crank Sprocket.> <Ref. to ME(w/o STI)-58, INSTALLATION, Crank Sprocket.>
7) Install the water pump. <Ref. to CO(STI)-15, INSTALLATION, Water Pump.> <Ref. to CO(w/o STI)-15, INSTALLATION, Water Pump.>
8) Install the crankshaft position sensor. <Ref. to FU(STI)-35, INSTALLATION, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-35, INSTALLATION, Crankshaft Position Sensor.>
9) Lift up the vehicle.
10) Install oil cooler pipe (A) and hose (C). (Model with oil cooler)
11) Install the oil cooler pipe (A) to oil pump using the bolts (B). (Model with oil cooler)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



12) Lower the vehicle.
13) Install the radiator. <Ref. to CO(STI)-20, INSTALLATION, Radiator.> <Ref. to CO(w/o STI)-20, INSTALLATION, Radiator.>

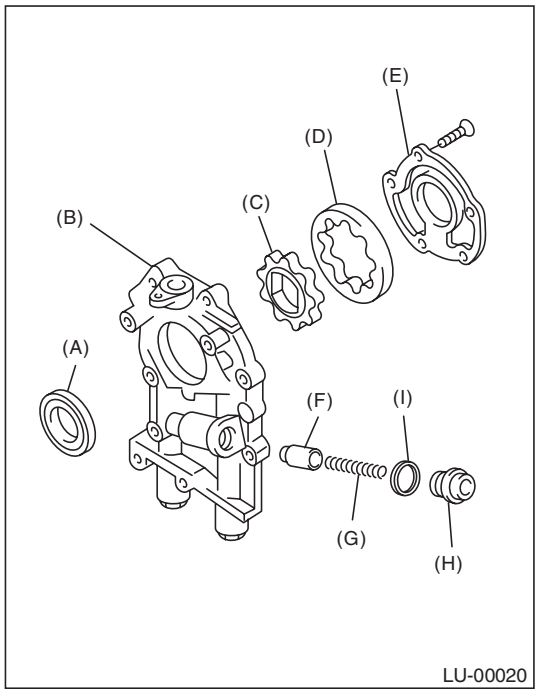
14) Connect the battery ground terminal.



C: DISASSEMBLY

Remove the screw which secures oil pump cover and then disassemble oil pump. Inscribe alignment marks on the inner rotor and outer rotor so that they can be replaced in their original positions during reassembly.

NOTE:
Before disassembling the oil pump, remove the relief valve.

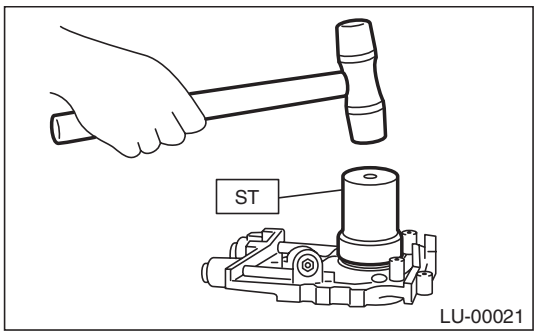


(A) Front oil seal
(B) Oil pump case
(C) Inner rotor
(D) Outer rotor
(E) Oil pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

D: ASSEMBLY

1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

NOTE:
Use a new front oil seal.

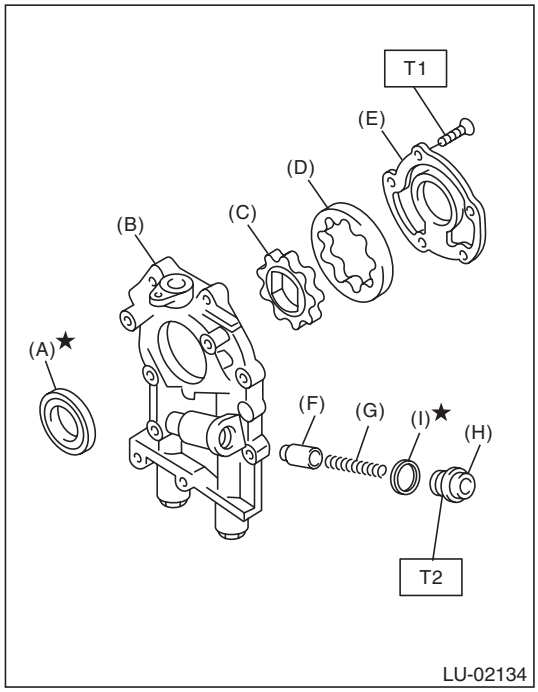


2) Apply a coat of engine oil to the inner rotor and outer rotor.
3) Install the inner rotor and outer rotor.
4) Assemble the oil relief valve and install relief valve spring and plug.

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)



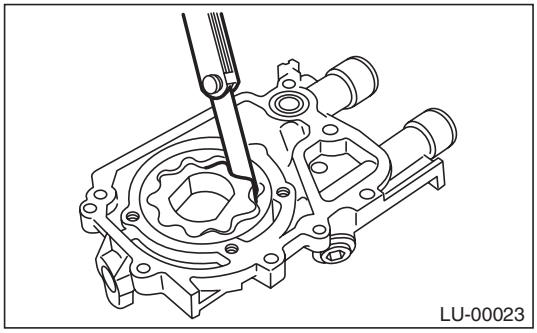
(A) Front oil seal
(B) Oil pump case
(C) Inner rotor
(D) Outer rotor
(E) Oil pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

E: INSPECTION

1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance is out of standard, replace the rotors as a set.

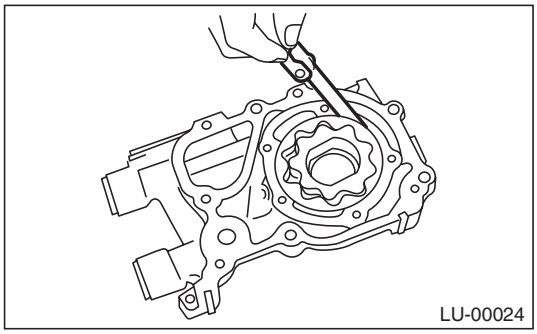
Tip clearance between inner and outer rotors:
Standard
0.04 — 0.14 mm (0.0016 — 0.0055 in)



2. CASE CLEARANCE

Measure the clearance between outer rotor and oil pump case. If clearance exceeds the standard, replace the oil pump case.

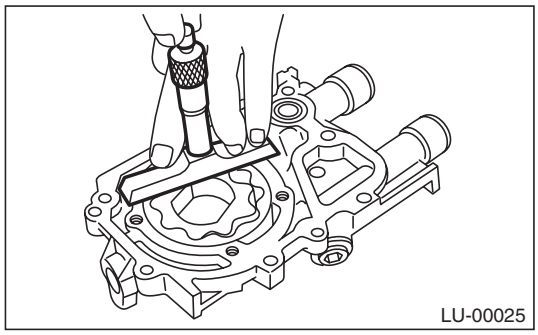
Case clearance between outer rotor and pump case:
Standard
0.10 — 0.175 mm (0.0039 — 0.0069 in)



3. SIDE CLEARANCE

Measure the gap between the inner rotor and the oil pump case to measure the clearance between the 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 between inner rotor and pump case:
Standard
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, 20.93 lbf)

5. OIL PUMP CASE

Check for worn shaft hole, clogged oil passage, worn rotor chamber, cracks and other faults.

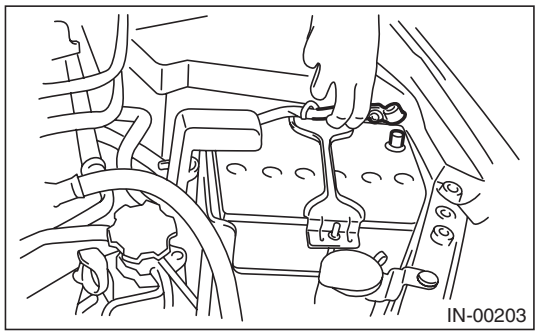
6. FRONT OIL SEAL

Check the front oil seal lips for deformation, hardening, wear, etc. and replace if defective.

5. Oil Pan and Strainer

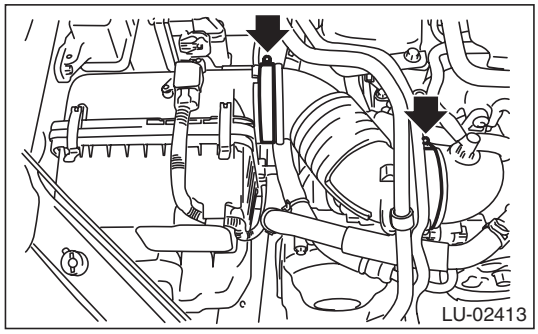
A: REMOVAL

1) Disconnect the ground cable from battery.



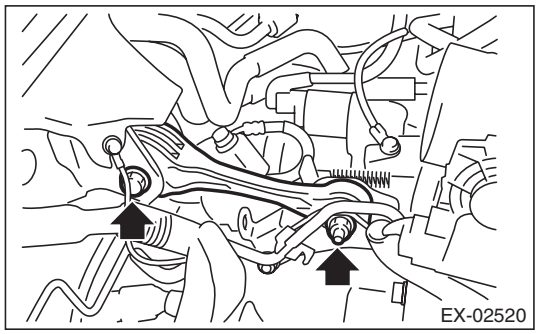
2) Remove the air intake duct. <Ref. to IN(STI)-10, REMOVAL, Air Intake Duct.> <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.>

3) Remove the air intake boot.

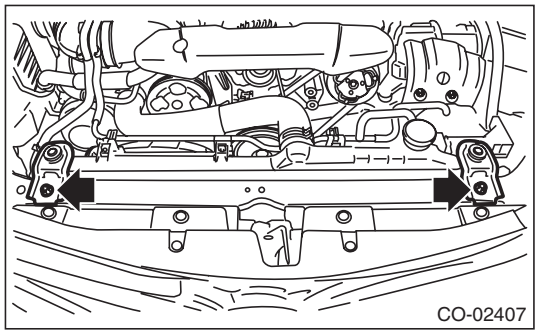


4) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.> <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>

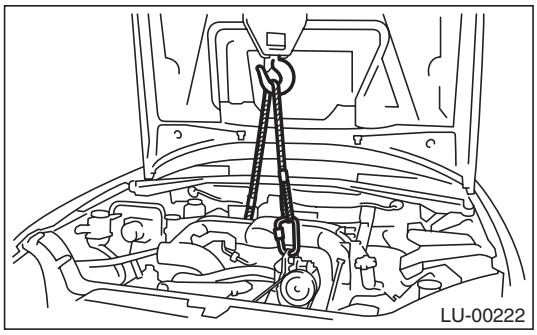
5) Remove the pitching stopper.



6) Remove the radiator upper brackets.



7) Support the engine with a lifting device and wire ropes.



8) Lift up the vehicle.

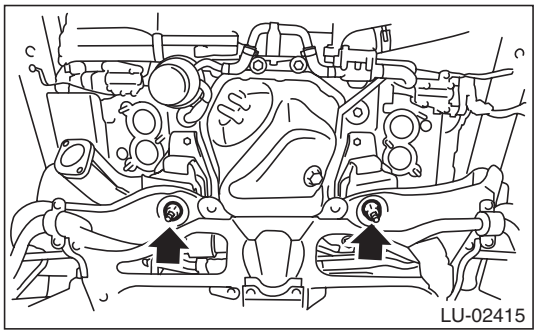
CAUTION:
When lifting up the vehicle, raise up wire ropes at the same time.

9) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>

10) Drain the engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.>

11) Remove the front exhaust pipe. <Ref. to EX(STI)-6, REMOVAL, Front Exhaust Pipe.>

12) Remove the nuts which secure the engine mounting to the front crossmember.



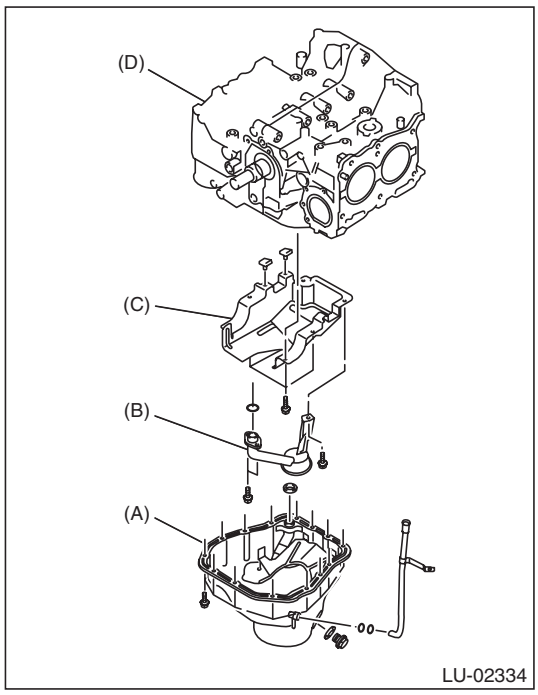
13) Remove the bolts which secure oil pan on cylinder block with the engine raised up.

14) 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.

15) Remove the oil strainer.

16) Remove the baffle plate.

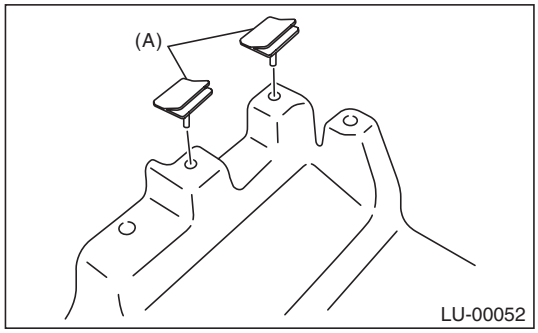


(A) Oil pan
(B) Oil strainer
(C) Baffle plate
(D) Cylinder block

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)

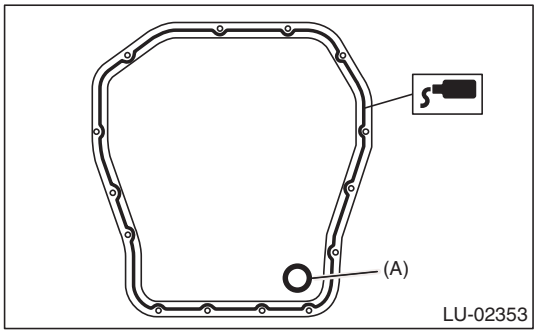
4) Tighten the oil strainer stay together with the baffle plate.

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.

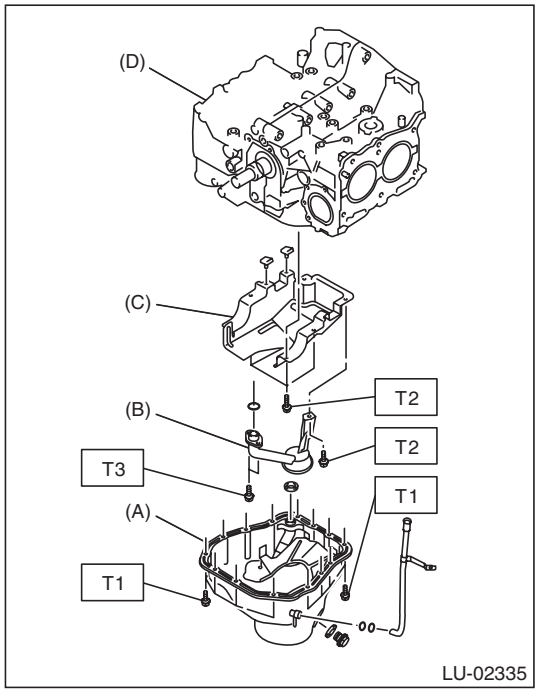
Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(A) Gasket

6) Tighten the bolts which install oil pan to cylinder block.

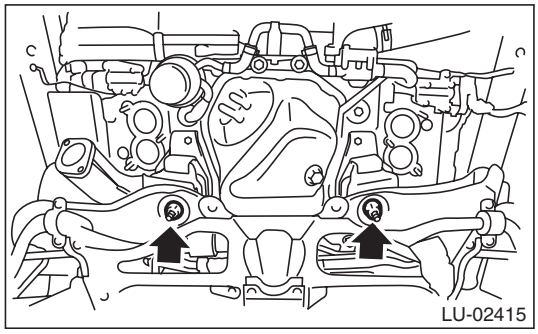
Tightening torque:
T1: 5 N·m (0.5 kgf-m, 3.7 ft-lb)
T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T3: 10 N·m (1.0 kgf-m, 7.4 ft-lb)



(A) Oil pan
(B) Oil strainer
(C) Baffle plate
(D) Cylinder block

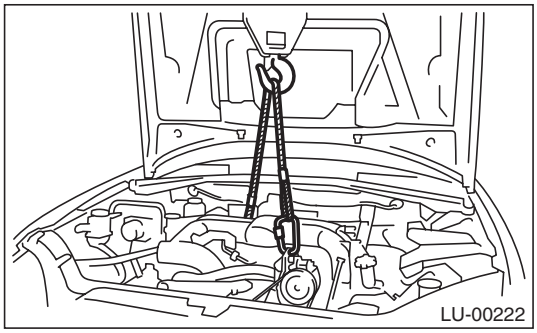
7) Lower the engine onto front crossmember.
8) Install the nuts which hold the engine mounting to the front crossmember.

Tightening torque:
45 N·m (4.6 kgf-m, 33.2 ft-lb)



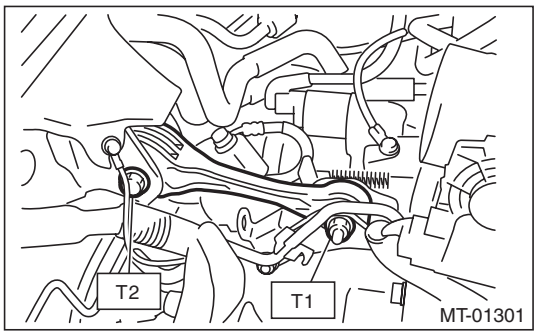
9) Install the front exhaust pipe. <Ref. to EX(STI)-6, INSTALLATION, Front Exhaust Pipe.>
10) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
11) Lower the vehicle.

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.



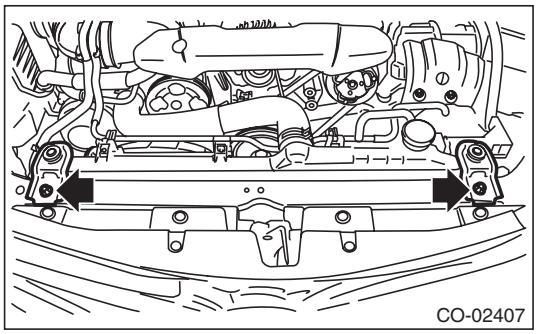
13) Install the pitching stopper.

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)



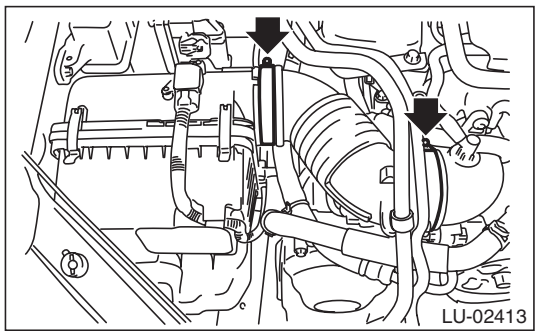
14) Install the radiator upper brackets.

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

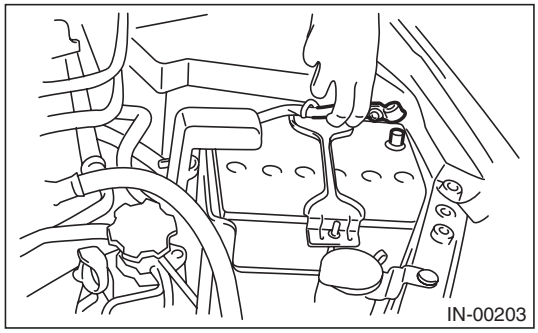


15) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.> <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>
16) Install the air intake boot.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



17) Install the air intake duct. <Ref. to IN(STI)-10, INSTALLATION, Air Intake Duct.> <Ref. to IN(w/o STI)-10, INSTALLATION, Air Intake Duct.>
18) Connect the battery ground terminal.



19) Refill the engine oil. <Ref. to LU(STI)-11, INSPECTION, Engine Oil.>

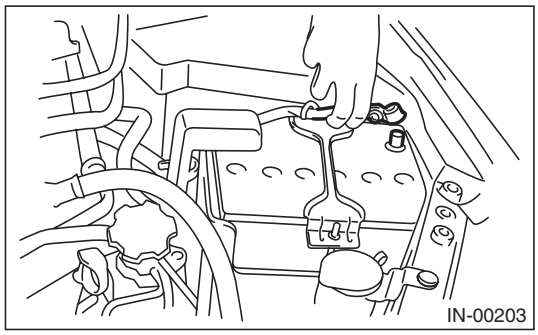
C: INSPECTION

Check that the oil pan, oil strainer and baffle plate do not have deformation, cracks or damage.

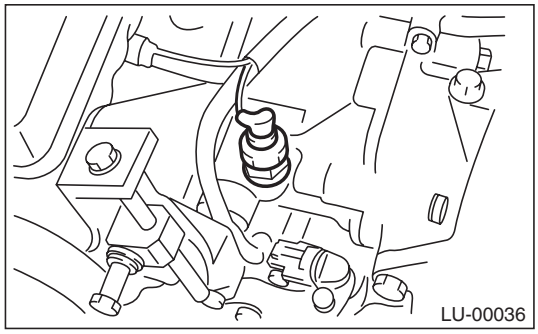
6. Oil Pressure Switch

A: REMOVAL

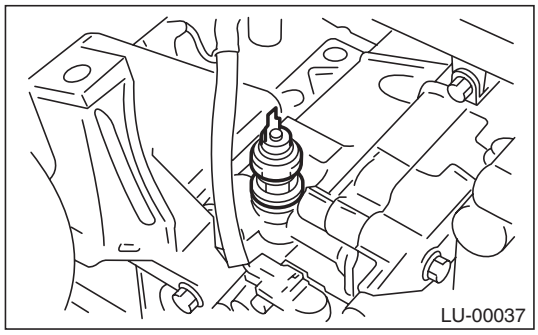
1) Disconnect the ground cable from battery.



2) Remove the generator from the bracket. <Ref. to SC(STI)-21, REMOVAL, Generator.>
3) Disconnect the terminal from oil pressure switch.



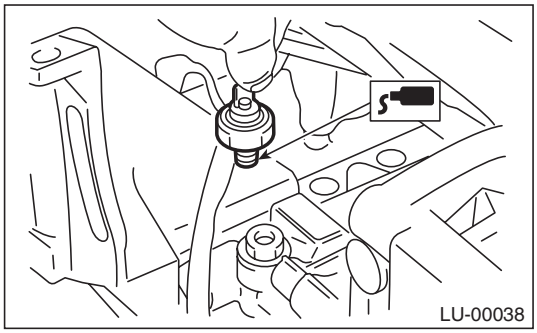
4) Remove the oil pressure switch.



B: INSTALLATION

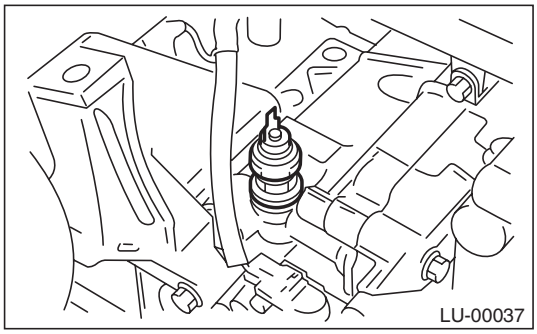
1) Apply liquid gasket to the oil pressure switch threads.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

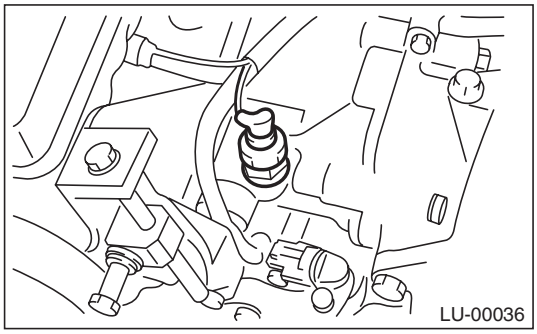


2) Install the oil pressure switch to cylinder block.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

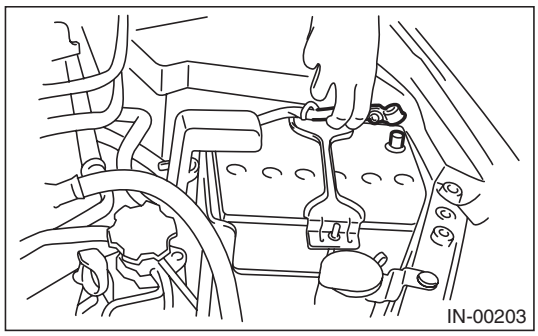


3) Connect the terminal to the oil pressure switch.



4) Install the generator to the bracket. <Ref. to SC(STI)-21, INSTALLATION, Generator.>

5) Connect the ground cable to battery.



C: INSPECTION

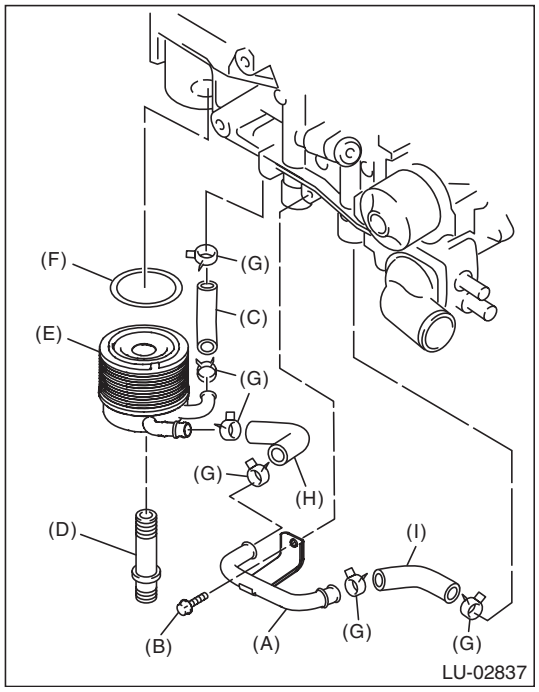
1) Check that the oil pressure switch does not have deformation, cracks or damage.
2) Check that there are no oil leaks or oil oozing from the oil pressure switch installation portion.

7. Engine Oil Cooler

A: REMOVAL

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:
STI model is equipped with engine oil cooler.
1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Remove the engine oil filter. <Ref. to LU(STI)-31, REMOVAL, Engine Oil Filter.>
5) Remove the bolt (B) holding the oil cooler pipe (A) to the oil pump.
6) Remove the oil cooler pipe (A), oil cooler hose A (C), oil cooler hose B (H), and oil cooler hose C (I).
7) Remove the oil cooler connector (D) and oil cooler (E).



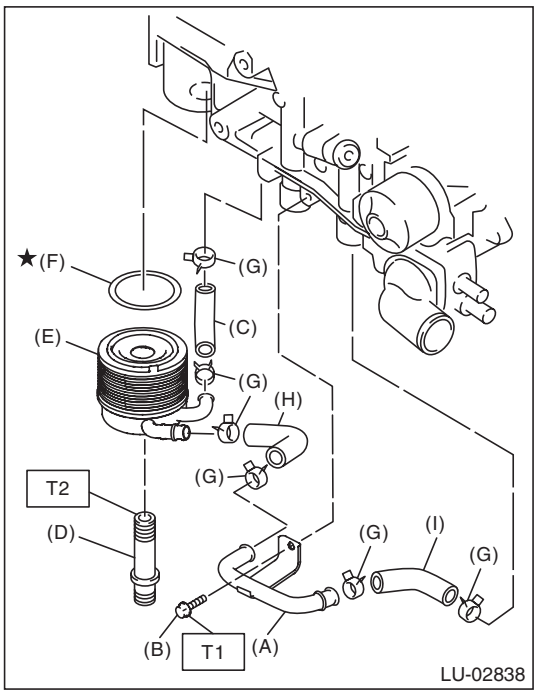
(A) Oil cooler pipe
(B) Bolt
(C) Oil cooler hose A
(D) Oil cooler connector
(E) Oil cooler
(F) Gasket
(G) Clip
(H) Oil cooler hose B
(I) Oil cooler hose C

B: INSTALLATION

Install in the reverse order of removal.

NOTE:
- Use a new gasket.
- After installing, check the engine oil level and replenish it if necessary. <Ref. to LU(STI)-11, INSPECTION, Engine Oil.>

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 54 N·m (5.5 kgf-m, 39.8 ft-lb)



(A) Oil cooler pipe
(B) Bolt
(C) Oil cooler hose A
(D) Oil cooler connector
(E) Oil cooler
(F) Gasket
(G) Clip
(H) Oil cooler hose B
(I) Oil cooler hose C

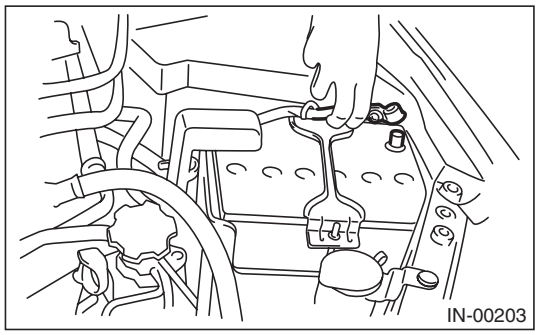
C: INSPECTION

1) Check that the engine oil cooler, oil cooler pipe and oil cooler connector do not have deformation, cracks or damage.
2) Make sure the oil cooler hoses are not cracked, damaged or loose.
3) Blow with compressed air to make sure the coolant passages are not clogged.
4) Make sure the mating surfaces of the cylinder block do not have damage.

8. Oil Pipe

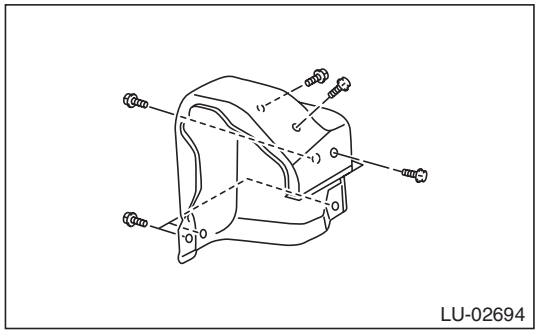
A: REMOVAL

1) Disconnect the ground cable from battery.



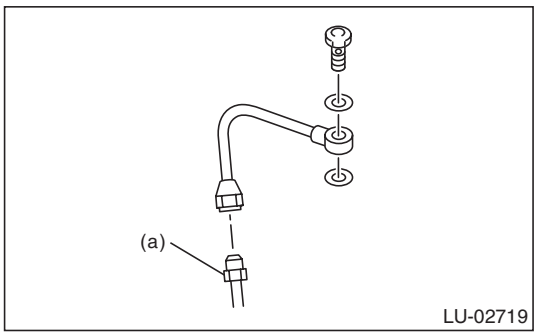
2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.> <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>

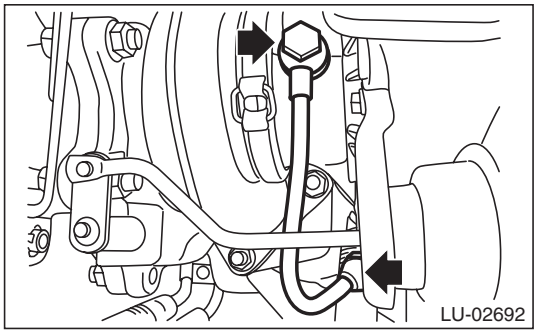
3) Remove the turbocharger upper cover.



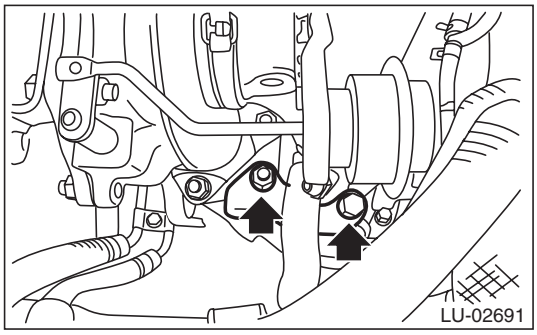
4) Remove the oil inlet pipe from the turbocharger.

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.

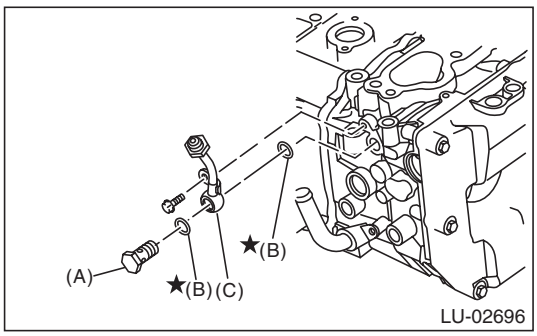




5) Remove the turbocharger stay.



6) Remove the turbocharger oil pipe.

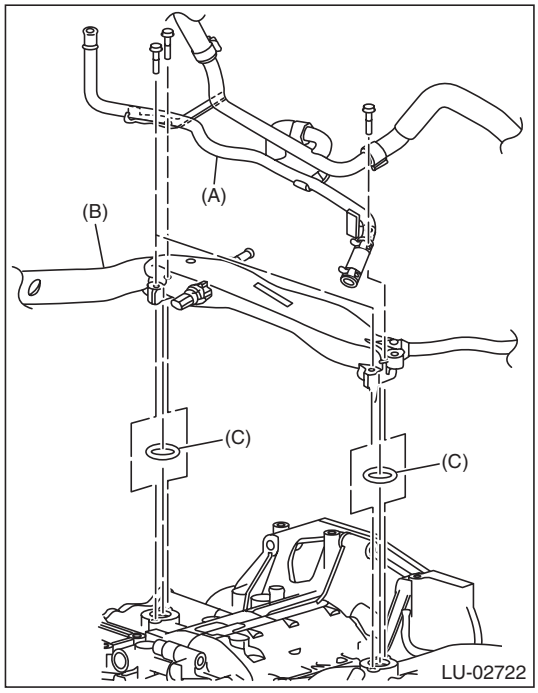


(A) Union bolt without filter (without protrusion)
(B) Gasket
(C) Turbocharger oil pipe

7) Drain engine coolant. <Ref. to CO(STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.> <Ref. to CO(w/o STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
8) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.> <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
9) Remove the secondary air pump. (Oil pipe LH only) <Ref. to EC(STI)-27, REMOVAL, Secondary Air Pump.> <Ref. to EC(w/o STI)-29, REMOVAL, Secondary Air Pump.>
10) Remove the blow-by pipe and water pipe assembly. (Oil pipe RH only)

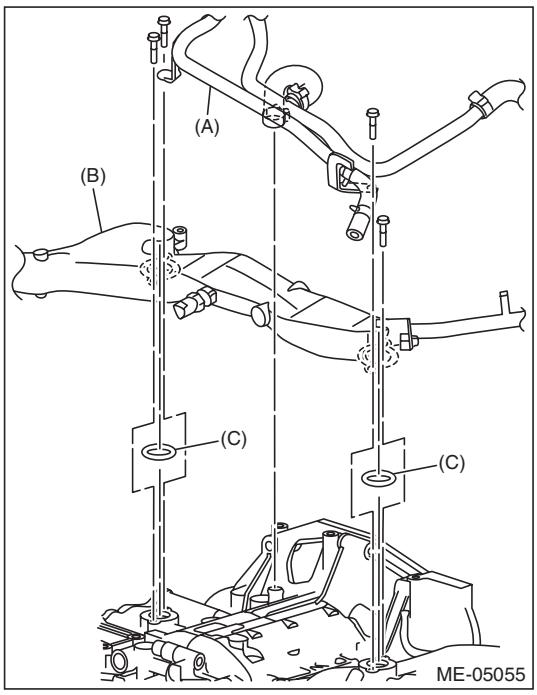
NOTE:
Do not remove the vacuum hose, radiator inlet hose, and heater outlet hose.

- STI model



(A) Water tank pipe ASSY
(B) Water pipe ASSY
(C) O-ring

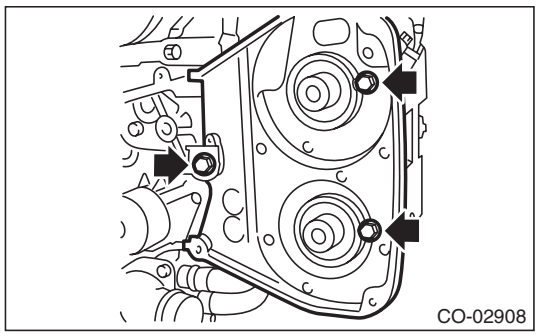
- Except for STI model



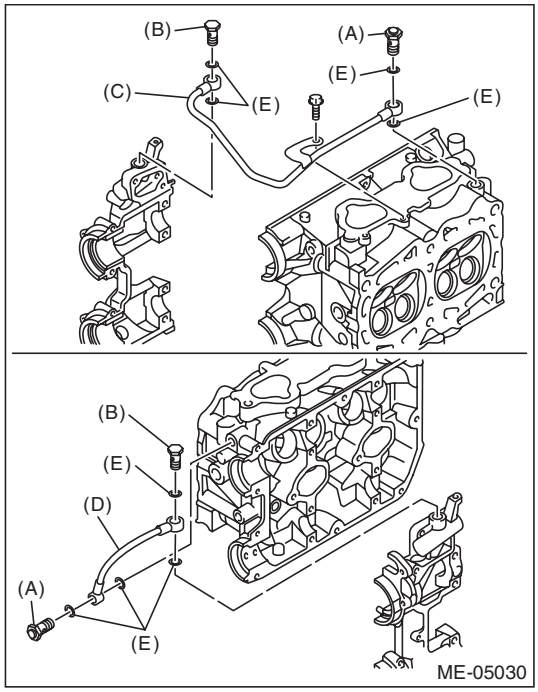
(A) Water tank pipe ASSY
(B) Water pipe ASSY
(C) O-ring

11) Remove the radiator main fan and radiator sub fan. <Ref. to CO(STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.> <Ref. to CO(w/o STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(w/o STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.>
12) Remove the V-belts. <Ref. to ME(STI)-39, REMOVAL, V-belt.> <Ref. to ME(w/o STI)-38, REMOVAL, V-belt.>
13) Remove the crank pulley. <Ref. to ME(STI)-46, REMOVAL, Crank Pulley.> <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
14) Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.> <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
15) Remove the timing belt. <Ref. to ME(STI)-49, REMOVAL, Timing Belt.> <Ref. to ME(w/o STI)-48, REMOVAL, Timing Belt.>
16) Remove the cam sprocket LH. <Ref. to ME(STI)-58, REMOVAL, Cam Sprocket.> <Ref. to ME(w/o STI)-57, REMOVAL, Cam Sprocket.>

17) Remove the timing belt cover No. 2 LH.



18) Remove the oil pipe.



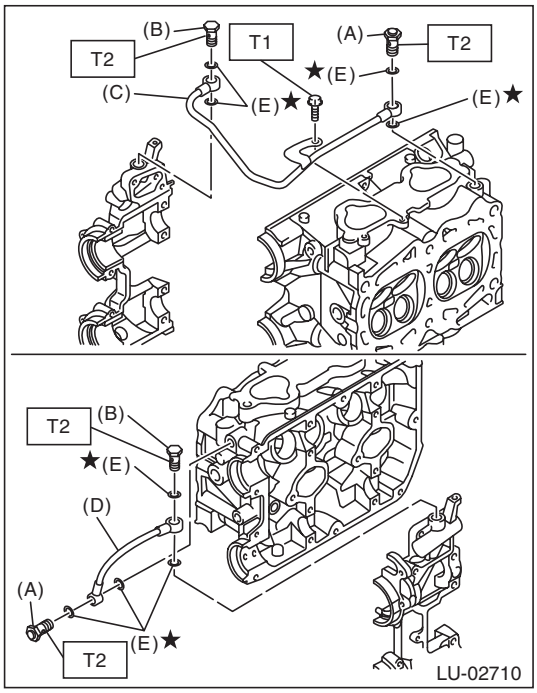
(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

B: INSTALLATION

1) Inspect the union bolt with filter. <Ref. to LU(STI)-30, INSPECTING UNION BOLT WITH FILTER, INSPECTION, Oil Pipe.>
2) Install the oil pipe.

NOTE:
- Be careful of the install location of the union bolt; the location will differ depending on the presence of filter.
- Use a new gasket.

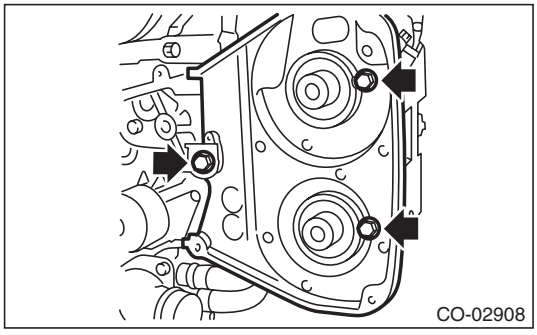
Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

3) Install the timing belt cover No. 2 LH.

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

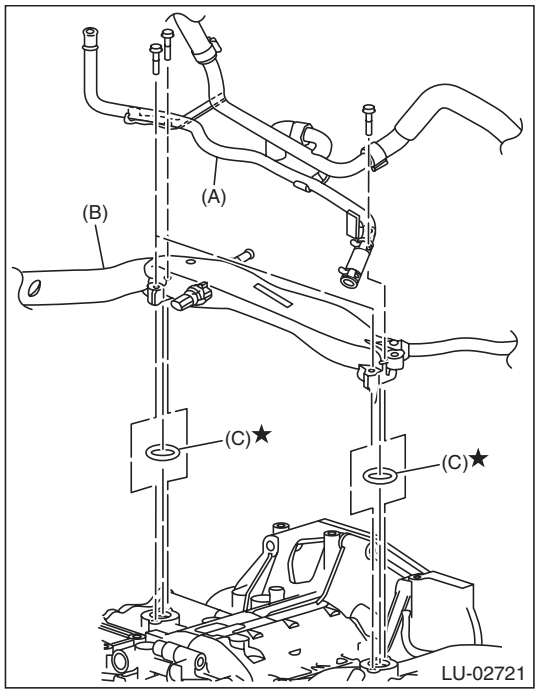


4) Install the cam sprocket LH. <Ref. to ME(STI)-58, INSTALLATION, Cam Sprocket.> <Ref. to ME(w/o STI)-57, INSTALLATION, Cam Sprocket.>
5) Install the timing belt. <Ref. to ME(STI)-52, TIMING BELT, INSTALLATION, Timing Belt.> <Ref. to ME(w/o STI)-51, TIMING BELT, INSTALLATION, Timing Belt.>

6) Install the timing belt cover. <Ref. to ME(STI)-48, INSTALLATION, Timing Belt Cover.> <Ref. to ME(w/o STI)-47, INSTALLATION, Timing Belt Cover.>
7) Install the crank pulley. <Ref. to ME(STI)-46, INSTALLATION, Crank Pulley.> <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>
8) Install the V-belts. <Ref. to ME(STI)-39, INSTALLATION, V-belt.> <Ref. to ME(w/o STI)-38, INSTALLATION, V-belt.>
9) Install the radiator main fan and the radiator sub fan. <Ref. to CO(STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.> <Ref. to CO(w/o STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(w/o STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>
10) Install the blow-by pipe and water pipe assembly. (Oil pipe RH only)

- STI model

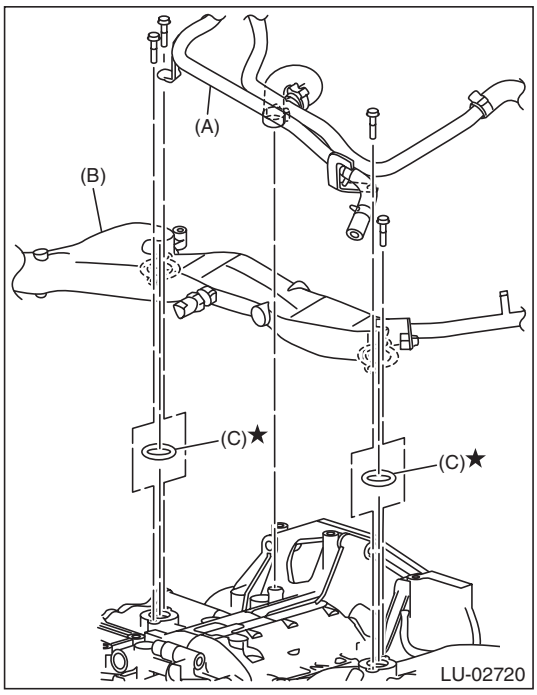
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(A) Water tank pipe ASSY
(B) Water pipe ASSY
(C) O-ring

- Except for STI model

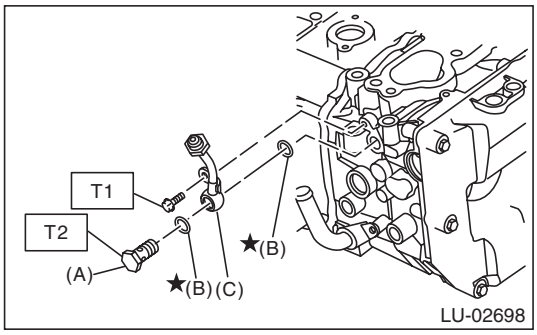
Tightening torque:
6.5 N·m (0.7 kgf-m, 4.8 ft-lb)



(A) Water tank pipe ASSY
(B) Water pipe ASSY
(C) O-ring

11) Install the secondary air pump. (Oil pipe LH only) <Ref. to EC(STI)-27, INSTALLATION, Secondary Air Pump.> <Ref. to EC(w/o STI)-29, INSTALLATION, Secondary Air Pump.>
12) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.> <Ref. to FU(w/o STI)-22, INSTALLATION, Intake Manifold.>
13) Install the turbocharger oil pipe.

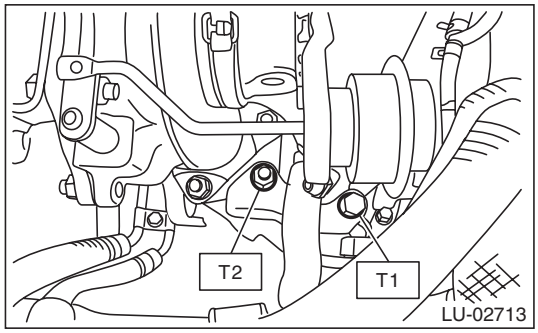
Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 29 N·m (3.0 kgf-m, 21.4 ft-lb)



(A) Union bolt without filter (without protrusion)
(B) Gasket
(C) Turbocharger oil pipe

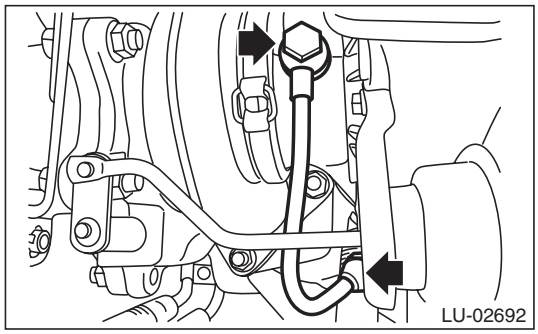
14) Install the turbocharger stay.

Tightening torque:
T1: 33 N·m (3.4 kgf-m, 24.3 ft-lb)
T2: 42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



15) Temporarily tighten the bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

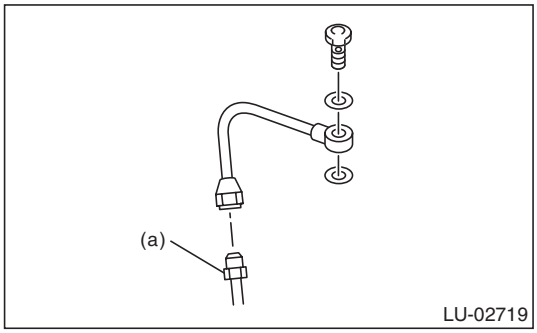
NOTE:
Use a new gasket.

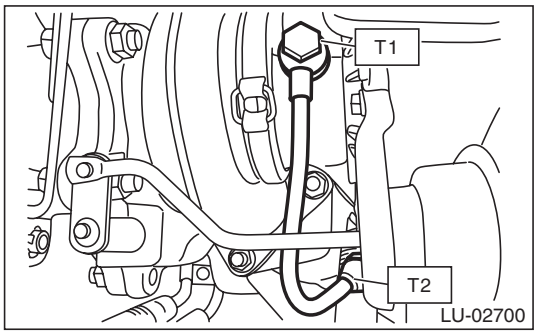


16) Tighten the union bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

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.

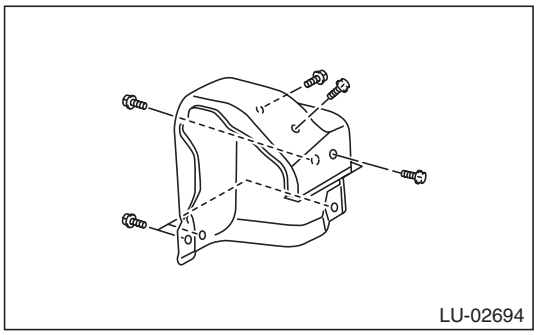
Tightening torque:
T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)



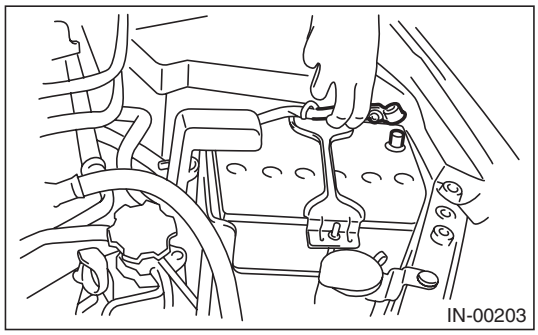


17) Attach the turbocharger upper cover.

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



18) Install the intercooler. <Ref. to IN(STI)-13, INSTALLATION, Intercooler.> <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>
19) Connect the battery ground terminal.

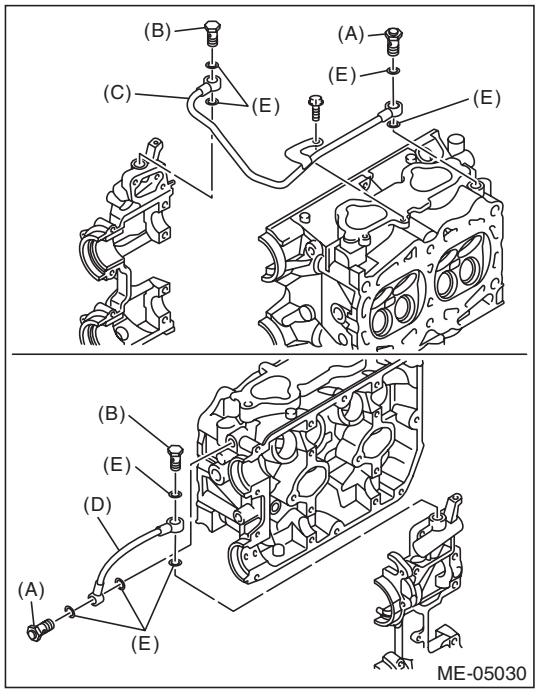


20) Fill engine coolant. <Ref. to CO(STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.> <Ref. to CO(w/o STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

1. INSPECTING UNION BOLT WITH FILTER

Check the filter part of union bolt for clogging or damage, and if defective, replace the union bolt with filter with the new part.



(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

2. OTHER INSPECTIONS

1) Check that the oil pipe and union bolt have no deformation, cracks and other damages.
2) Check that there are no oil leaks or oil oozing from the oil pipe attachment section.

9. 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) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Remove the oil filter.

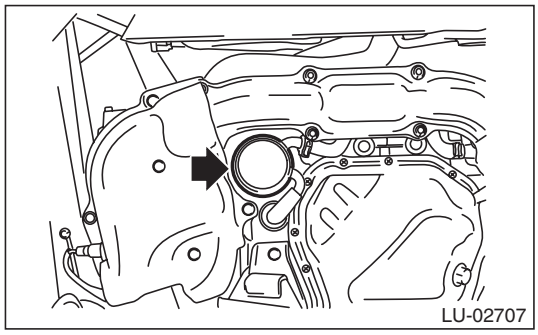
• Oil filter (Black)

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).


LU-02707

B: INSTALLATION

CAUTION:
Do not tighten excessively, or oil may leak.

1) Clean the oil filter installation surface on cylinder block or oil cooler.
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 the cylinder block or oil cooler. 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 or oil cooler. When using a torque wrench, tighten to 12 N·m (1.2 kgf-m, 8.9 ft-lb).

4) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
5) Lower the vehicle.
6) After installing, check the engine oil level and replenish it if necessary. <Ref. to LU(STI)-11, INSPECTION, Engine Oil.>

C: INSPECTION

1) After installing the oil filter, run the engine and check for oil leakage 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(STI)-11, INSPECTION, Engine Oil.>

10. 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
Warning light remains ON.	a. Oil pressure switch failure	
	❍ Cracked diaphragm or oil leakage within switch	Replace.
	❍ Broken spring or seized contacts	Replace.
	b. 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.
	c. No oil pressure	
	❍ Insufficient engine oil (degradation, etc.)	Replace.
	❍ Broken pipe of oil strainer	Replace.
	❍ Stuck oil pump rotor	Replace.
Warning light does not illuminate.	a. Malfunction of combination meter	Replace.
	b. Poor contact of switch contact points	Replace.
	c. Disconnection of wiring	Repair.
Warning light flickers momentarily.	a. Defective terminal contact	Repair.
	b. Defective wiring harness	Repair.
	c. Oil pressure switch failure	
	❍ Cracked diaphragm or oil leakage within switch	Replace.
	❍ Broken spring or seized contacts	Replace.
	d. 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.

SPEED CONTROL SYSTEMS

SP(STI)

Page

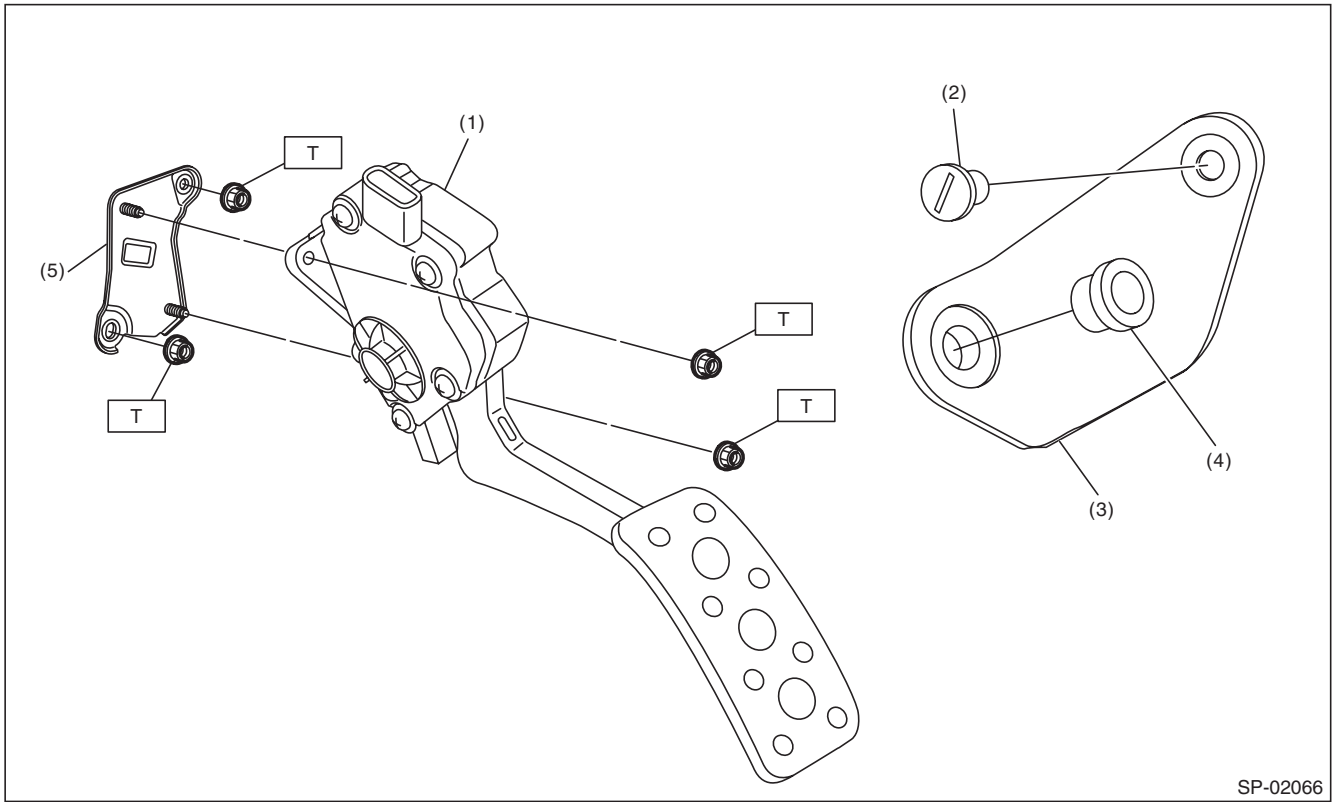
1. General Description 2
2. Accelerator Pedal 4

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

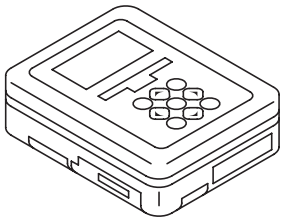
Tightening torque: N·m (kgf-m, ft-lb)
T: 18 (1.8, 13.3)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for inspecting the accelerator pedal.

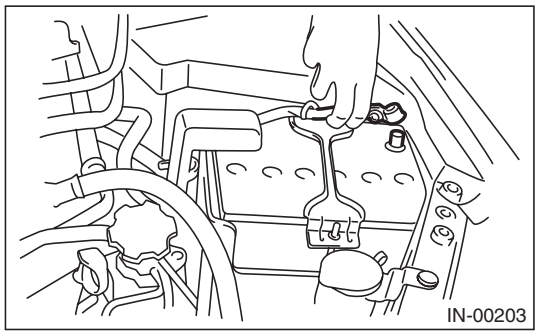
2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring voltage.

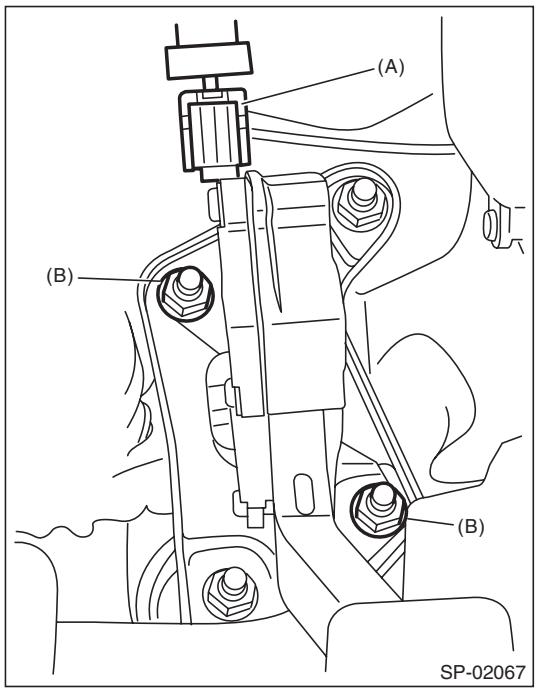
2. Accelerator Pedal

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Disconnect the connector (A).
3) Remove the nut (B) securing accelerator pedal assembly, and remove the 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)

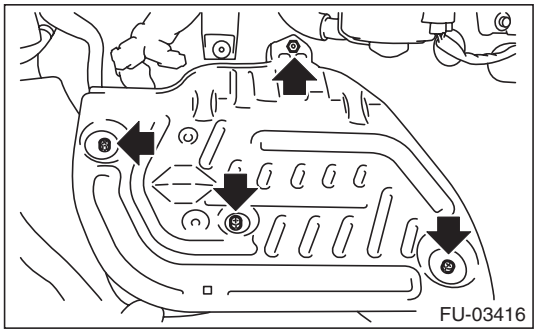
C: DISASSEMBLY

NOTE:
The accelerator pedal cannot be disassembled.

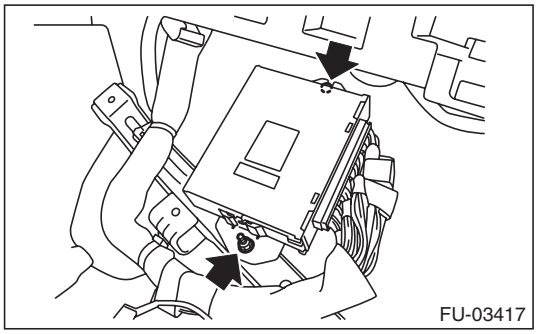
D: INSPECTION

1. CHECK ACCELERATOR PEDAL SENSOR AREA (METHOD WITH CIRCUIT TESTER)

1) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
2) Turn over the floor mat of passenger's seat.
3) Remove the protect cover.

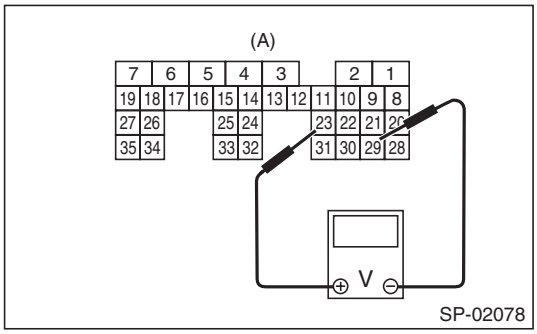


4) Remove the nuts and bolts which hold the ECM to the bracket.



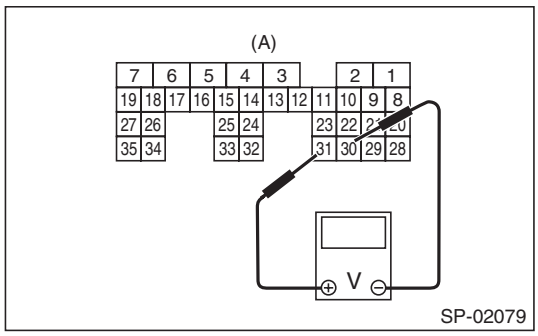
5) Turn the ignition switch to ON. (engine OFF)
6) Measure the voltage between ECM connector terminals.

- 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 (–)	0.4 — 1.0 V
	Depressed (Full opened)		2.4 — 3.7 V
Sub	Not depressed (Full closed)	31 (+) and 30 (–)	0.3 — 1.1 V
	Depressed (Full opened)		2.3 — 3.8 V

7) After inspection, install the related parts in the reverse order of removal.

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

2. CHECK ACCELERATOR PEDAL SENSOR AREA (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(H4DOTC)(diag)-40, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

Accelerator pedal sensor	Accelerator pedal opening angle signal	Standard
Main	0.0%	0.4 — 1.0 V
	100.0%	2.4 — 3.7 V
Sub	0.0%	0.3 — 1.1 V
	100.0%	2.3 — 3.8 V

3. OTHER INSPECTIONS

1) Check that the accelerator pedal does not have deformation, cracks or damage.
2) Check for smooth operation when the accelerator pedal is depressed.
3) Check if the accelerator pedal returns to its original position smoothly when the pedal is released.

IGNITION

IG(STI)

Page

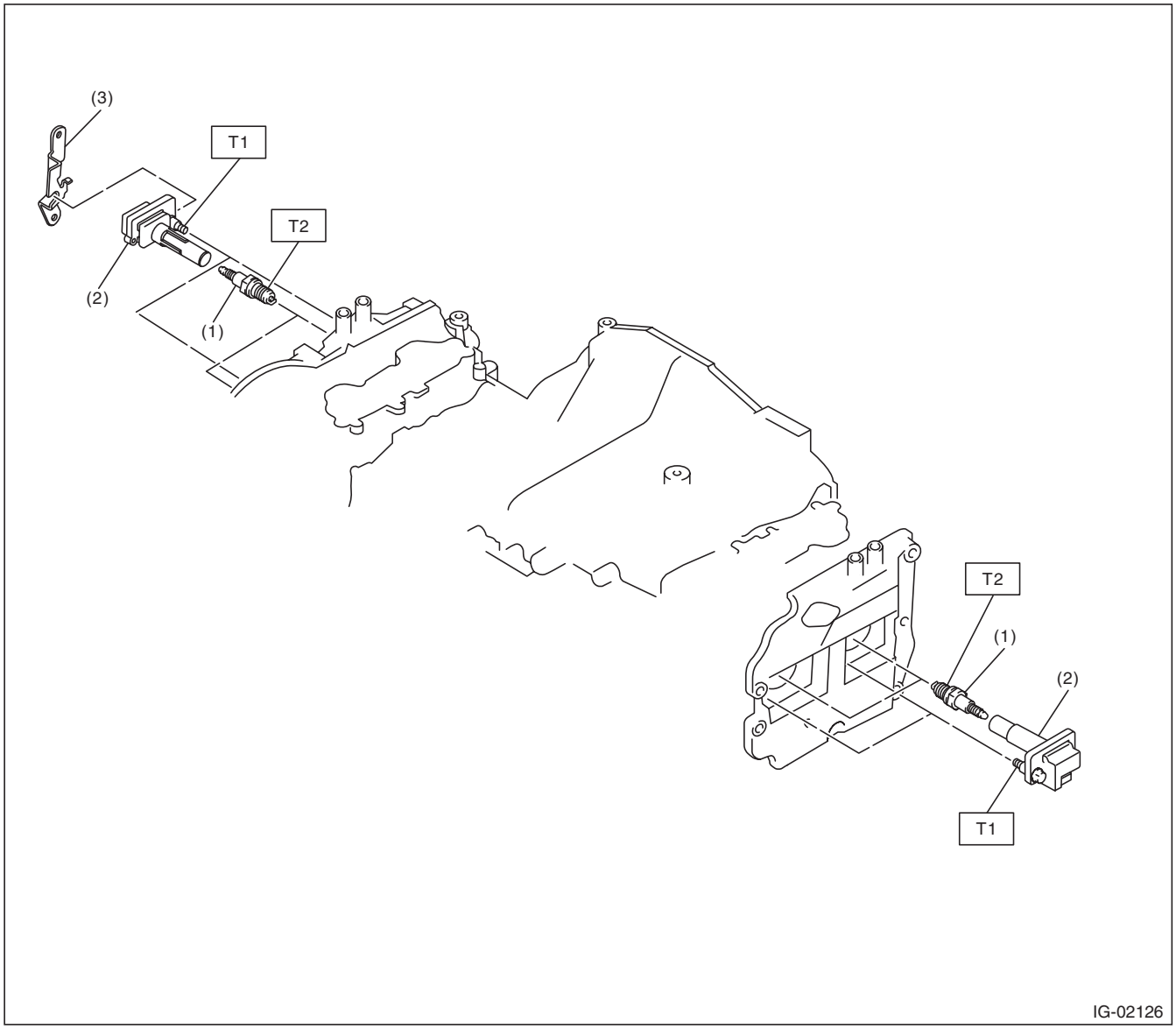
1. General Description 2
2. Spark Plug 4
3. Ignition Coil 7

1. General Description

A: SPECIFICATION

Item			Specifications
Ignition coil	Type		FK0368
	Ignition system		Independent ignition coil
	Manufacturer		Diamond Electric
Spark plug	Manufacturer and type		NGK: SILFR6A
	Thread size (diameter, pitch, length) mm		14, 1.25, 26.5
	Spark plug gap mm (in)	Standard	0.7 — 0.8 (0.028 — 0.031)
	Electrode		Iridium

B: COMPONENT



(1) Spark plug
(2) Ignition coil
(3) Engine harness stay (#3 ignition coil side only)

Tightening torque: N·m (kgf-m, ft-lb)

T1: 16 (1.6, 11.8)
T2: 21 (2.1, 15.5)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

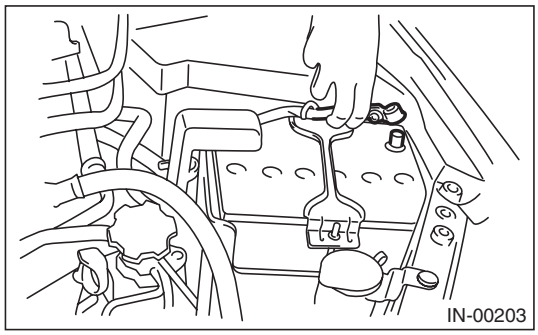
2. Spark Plug

A: REMOVAL

Spark plug:
Refer to "SPECIFICATION" for the spark plug. <Ref. to IG(STI)-2, SPECIFICATION, General Description.>

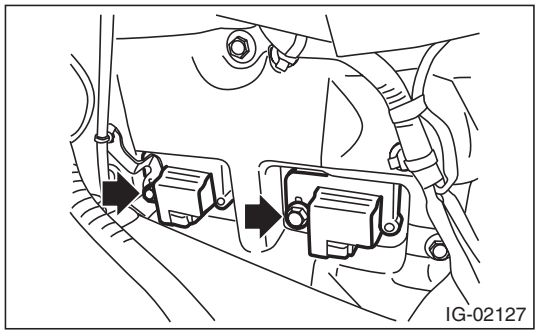
1. RH SIDE

1) Disconnect the ground cable from battery.


IN-00203

2) Remove the air cleaner case. <Ref. to IN(STI)-8, REMOVAL, Air Cleaner Case.>
3) Disconnect the connector from ignition coil.
4) Remove the ignition coil.

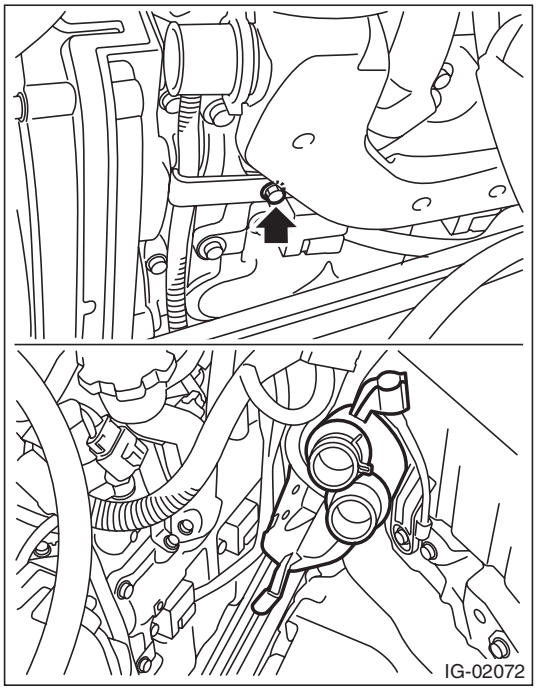
NOTE:
Turn #3 ignition coil by 180 degrees to remove it.


IG-02127

5) Remove the spark plug with a spark plug socket.

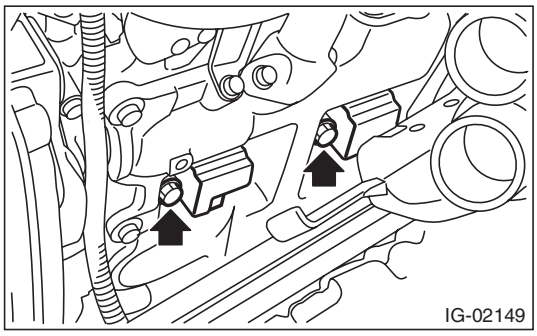
2. LH SIDE

1) Remove the battery. <Ref. to SC(STI)-27, REMOVAL, Battery.>
2) Remove the secondary air pump. <Ref. to EC(STI)-27, REMOVAL, Secondary Air Pump.>
3) Remove the bolts that secure the air duct to the rocker cover LH, and lift the air duct.


IG-02072

4) Disconnect the connector from ignition coil.
5) Remove the ignition coil.

NOTE:
Turn #4 ignition coil by 180° to remove it.


IG-02149

6) Remove the spark plug with a spark plug socket.

B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.5 ft-lb)

Tightening torque (Ignition coil):
16 N·m (1.6 kgf-m, 11.8 ft-lb)

2. LH SIDE

Install in the reverse order of removal.

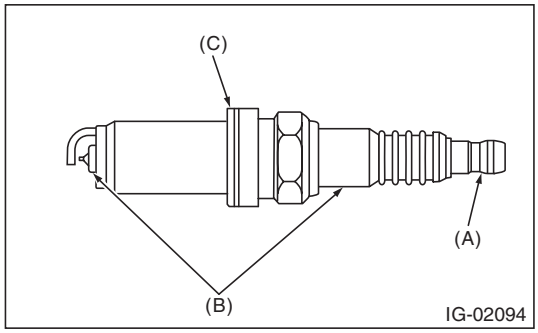
Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.5 ft-lb)

Tightening torque (Ignition coil):
16 N·m (1.6 kgf-m, 11.8 ft-lb)

Tightening torque (Air duct):
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

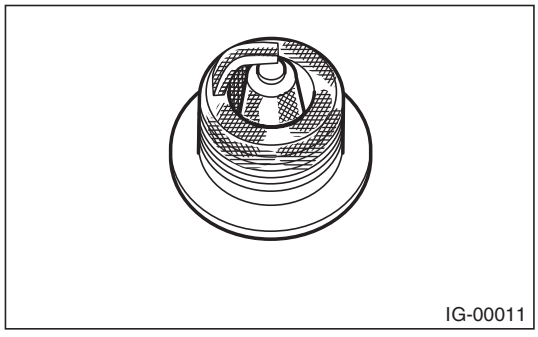
1) Check the spark plug for abnormalities. If defective, replace the spark plug.



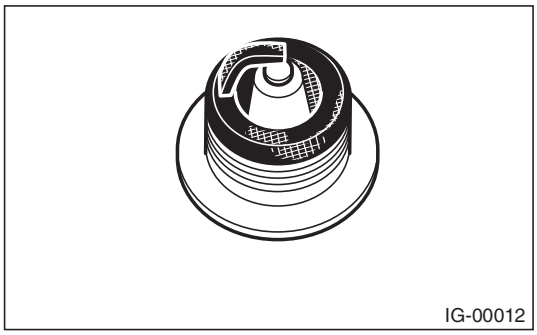
(A) Terminal damage
(B) Crack or damage in insulator
(C) Damaged gasket

2) Check the spark plug electrode and condition of the insulator. If abnormal, check and repair the cause and replace the spark plug.

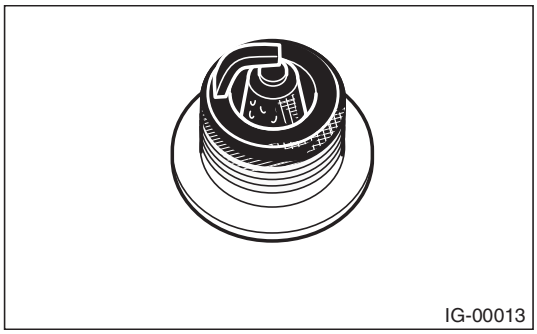
(1) Normal:
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



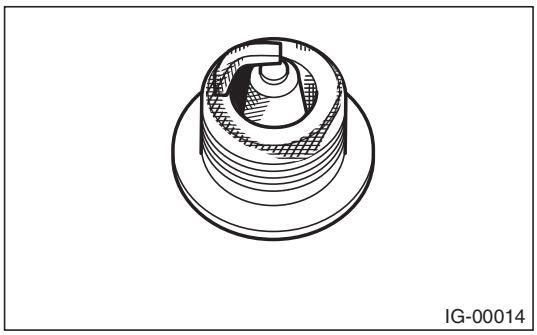
(2) Carbon fouled:
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in the city, weak ignition, too rich fuel mixture, etc.



(3) Oil fouled:
Wet black deposits show oil entrance into combustion chamber through worn piston rings or increased clearance between valve guides and valve stems.



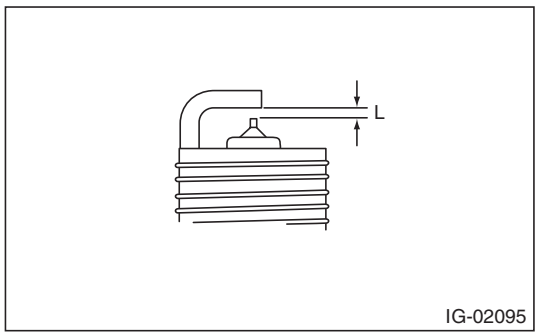
(4) Overheating:
A white or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, wrong selection of fuel, or loose spark plugs.



3) Using a nylon brush, etc., clean and remove the carbon or oxide deposits from the spark plug. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, check the spark plug gap “L” using a gap gauge. If it is not within the standard, replace the spark plug.

NOTE:
- Never use a plug cleaner.
- Do not use a metal brush as it may damage the electrode area.

Spark plug gap L:
Standard
0.7 — 0.8 mm (0.028 — 0.031 in)



3. Ignition Coil

A: REMOVAL

Direct ignition type is adopted. Refer to “Spark Plug” for removal procedure. <Ref. to IG(STI)-4, REMOVAL, Spark Plug.>

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

C: INSPECTION

For inspection procedure, refer to “Diagnostics for Engine Starting Failure”. <Ref. to EN(H4DOTC)(diag)-79, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>

STARTING/CHARGING SYSTEMS

SC(STI)

Page

1. General Description 2
2. Starter 8
3. Generator 21
4. Battery 27

1. General Description

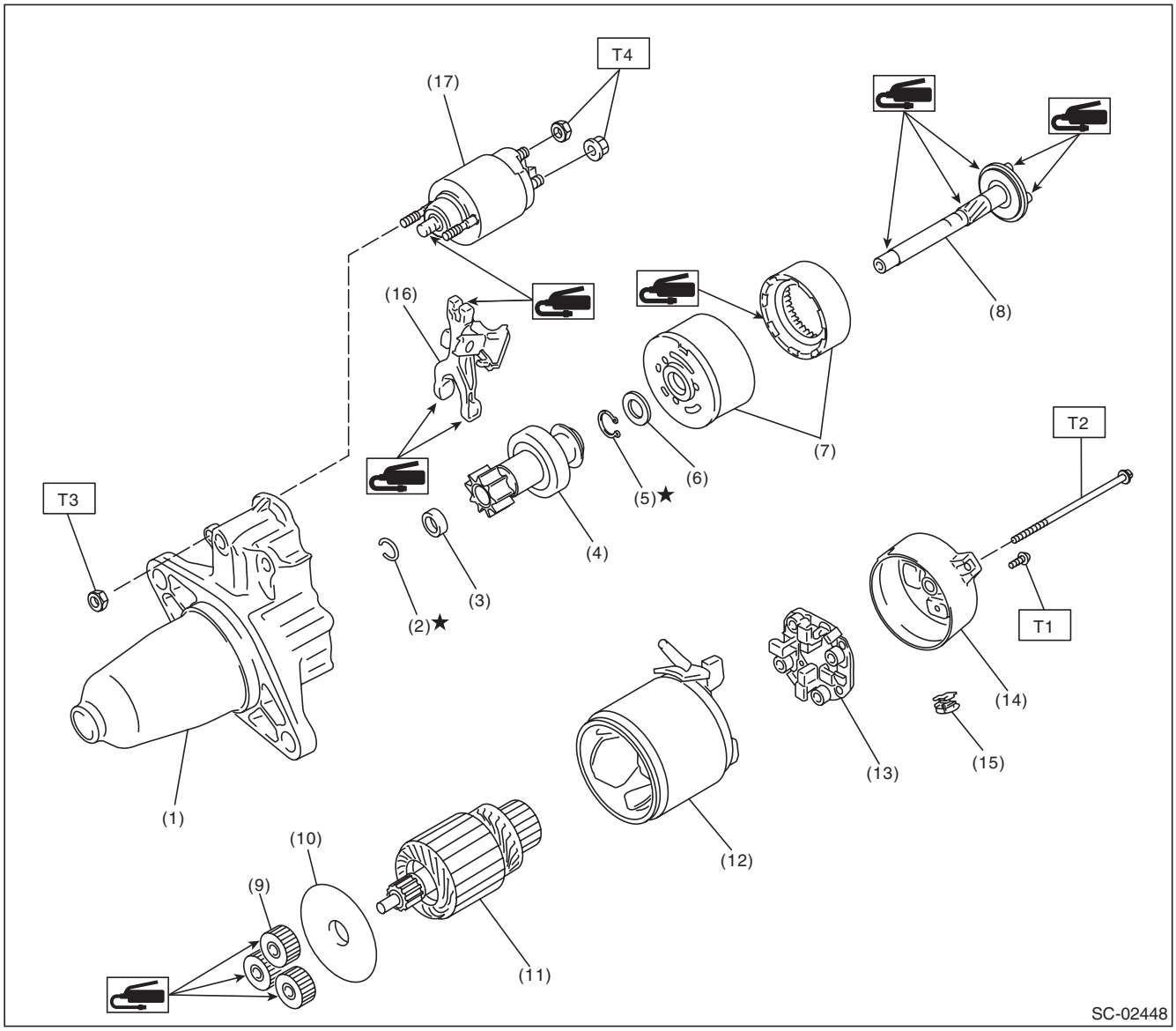
A: SPECIFICATION

Item			Specifications	
Vehicle model			6MT	5MT
Starter	Type		Reduction type	
	Model		428000-5760	M000T30475
	Manufacturer		DENSO	Mitsubishi Electric
	Voltage and output		12 V — 1.0 kW	
	Direction of rotation		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		9	8
	Armature commutator runout	Standard	0.05 mm (0.0020 in)	0.05 mm (0.0020 in)
		Limit	0.10 mm (0.0039 in)	0.10 mm (0.0039 in)
	Armature depth of segment mold	Standard	0.5 mm (0.020 in)	0.5 mm (0.020 in)
	Brush length	Standard	12.3 mm (0.484 in)	12.3 mm (0.484 in)
		Limit	7.0 mm (0.276 in)	7.0 mm (0.276 in)
	Brush spring force	Standard	15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf)	15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf)
		Limit	2.5 N (0.25 kgf, 0.56 lbf)	2.5 N (0.25 kgf, 0.56 lbf)
	No-load characteristics	Voltage	11 V	11 V
		Current	90 A or less	95 A or less
		Rotating speed	2,860 rpm or more	2,500 rpm or more
	Load characteristics	Voltage	8 V	7.5 V
		Current	280 A	300 A
		Torque	9.3 N·m (0.9 kgf-m, 6.9 ft-lb) or more	8.84 N·m (0.9 kgf-m, 6.5 ft-lb) or more
		Rotating speed	860 rpm or more	870 rpm or more
	Lock characteristics	Voltage	4 V	4 V
		Current	515 A or less	680 A or less
		Torque	16 N·m (1.6 kgf-m, 11.8 ft-lb) or more	17 N·m (1.7 kgf-m, 12.5 ft-lb) or more
Generator	Type		Rotating-field three-phase type, voltage regulator built-in type, with load response control system	
	Model		A003TG6591	
	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 △ 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)]	
	Rotor slip ring outer diameter	Standard	22.7 mm (0.894 in)	
		Limit	22.1 mm (0.870 in)	
	Brush length	Standard	18.5 mm (0.728 in)	
		Limit	5.0 mm (0.197 in)	
Battery	Type and capacity		12 V — 48 AH (55D23L)	12 V — 48 AH (55D23L)

B: COMPONENT

1. STARTER

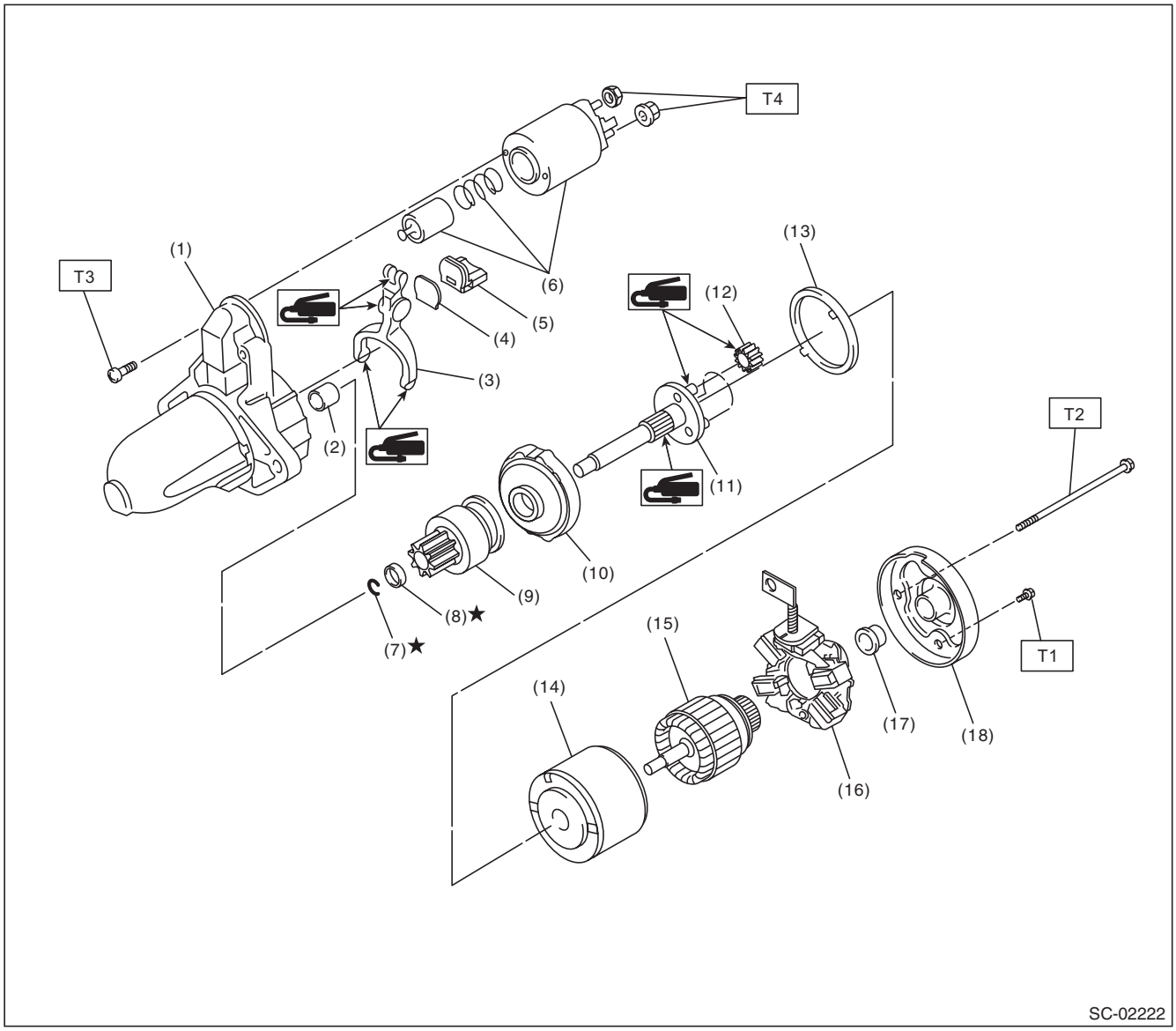
- STI model



(1) Starter housing ASSY
(2) Snap ring
(3) Stopper
(4) Overrunning clutch
(5) Snap ring
(6) Washer
(7) Internal gear ASSY
(8) Shaft
(9) Pinion gear
(10) Starter plate
(11) Armature
(12) Yoke ASSY
(13) Brush holder ASSY
(14) Starter cover ASSY
(15) Drain duct
(16) Shift lever
(17) Magnet switch ASSY

Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.4 (0.1, 1.0)
T2: 6 (0.6, 4.4)
T3: 7.5 (0.8, 5.5)
T4: 10 (1.0, 7.4)

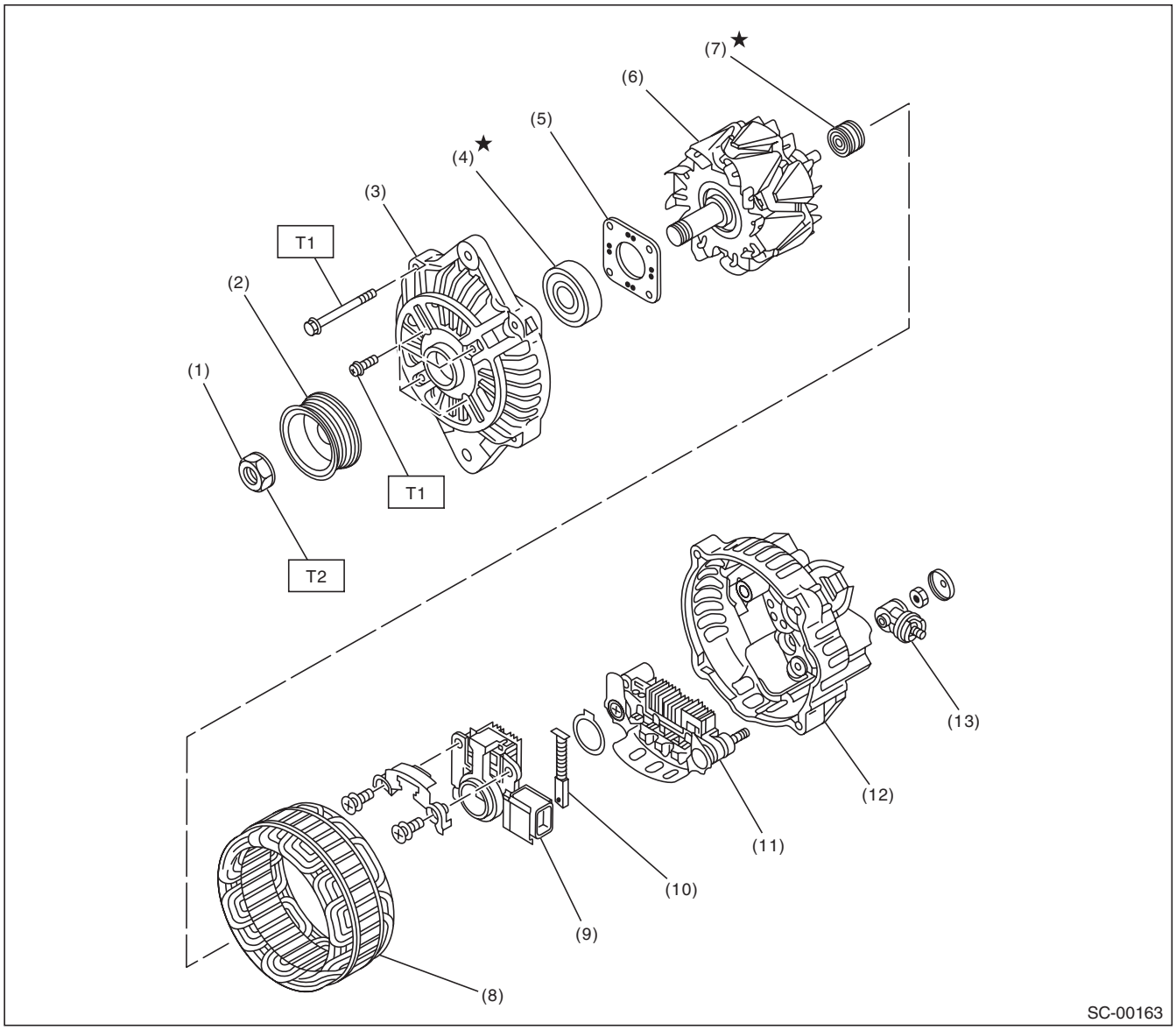
- Except for STI model



(1) Starter housing ASSY
(2) Sleeve bearing
(3) Shift lever
(4) Plate
(5) Seal rubber
(6) Magnet switch ASSY
(7) Snap ring
(8) Stopper
(9) Overrunning clutch
(10) Internal gear ASSY
(11) Shaft
(12) Pinion gear
(13) Seal rubber
(14) Yoke ASSY
(15) Armature ASSY
(16) Brush holder ASSY
(17) Sleeve bearing
(18) Starter cover ASSY

Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.4 (0.1, 1.0)
T2: 6 (0.6, 4.4)
T3: 7.5 (0.8, 5.5)
T4: 10 (1.0, 7.4)

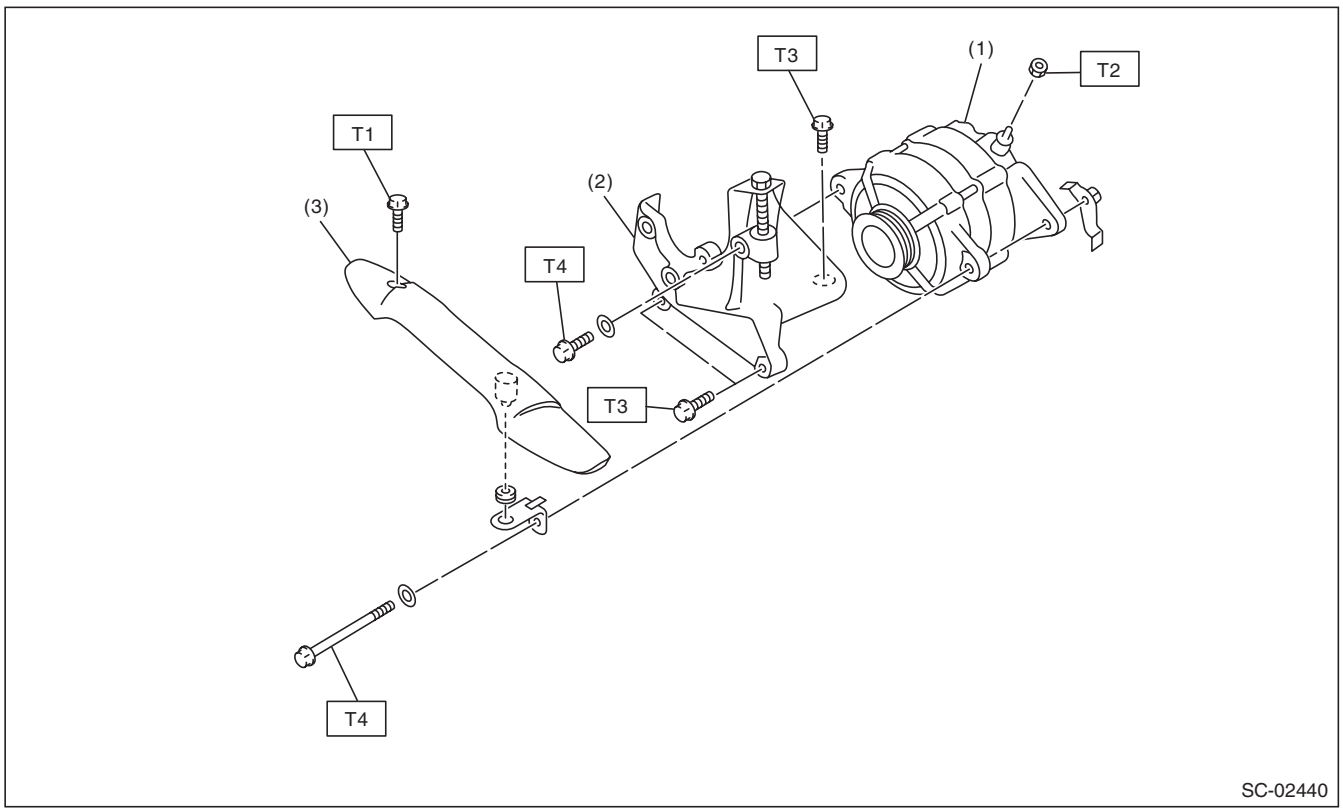
2. GENERATOR



(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)

3. GENERATOR BRACKET



(1) Generator
(2) Power steering pump bracket
(3) V-belt cover

Tightening torque: N·m (kgf-m, ft-lb)
T1: 13 (1.3, 9.6)
T2: 16 (1.6, 11.8)
T3: 22 (2.2, 16.2)
T4: 25 (2.5, 18.4)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

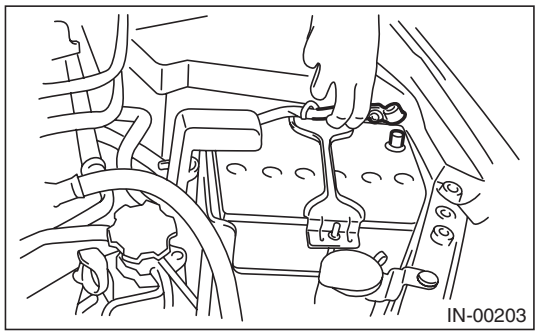
1. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance, voltage and current.

2. Starter

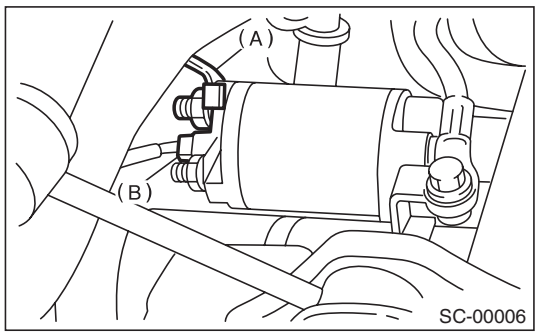
A: REMOVAL

1) Disconnect the ground cable from battery.

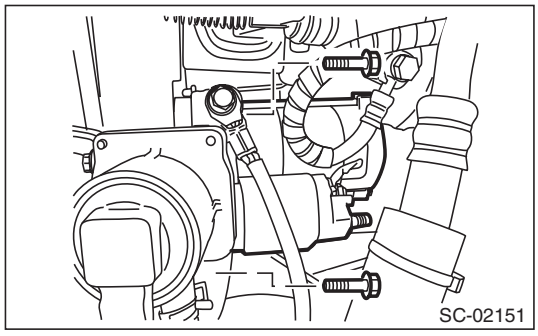


2) Remove the intercooler. <Ref. to IN(STI)-12, REMOVAL, Intercooler.> <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>

3) Disconnect the connector (B) and terminal (A) from starter.



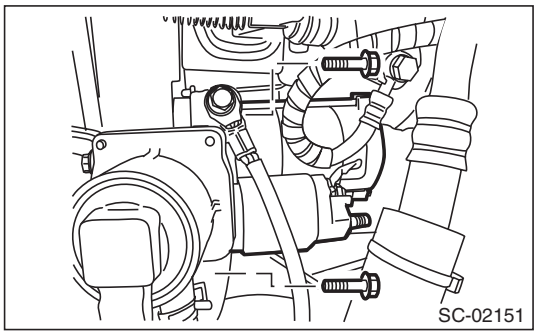
4) Remove the starter from transmission.



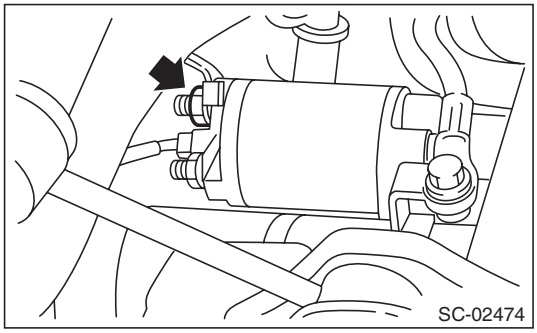
B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



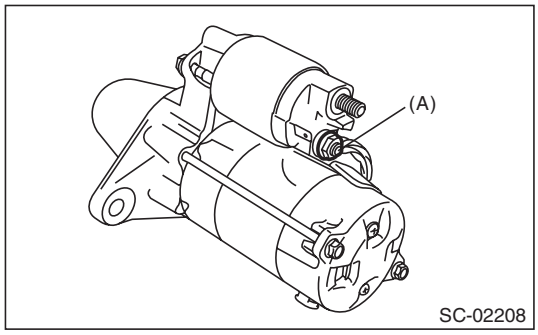
Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



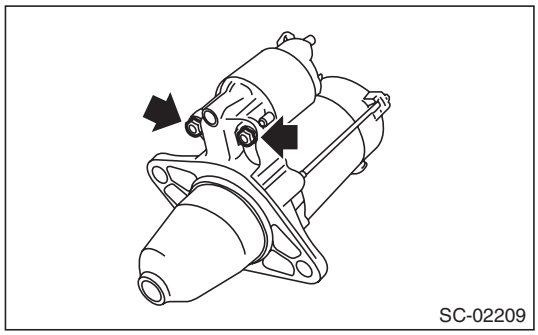
C: DISASSEMBLY

1. STI MODEL

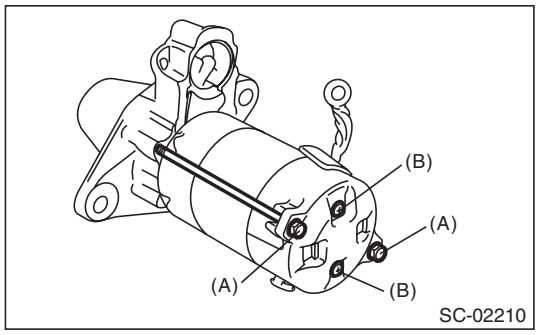
1) Disconnect cable from terminal M (A) of the magnet switch assembly.



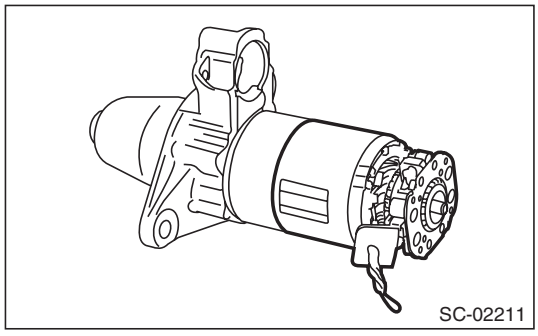
2) Remove the magnet switch assembly from the starter housing assembly.



3) Remove through bolts (A) on both sides and the brush holder screws (B), and remove the starter cover assembly.

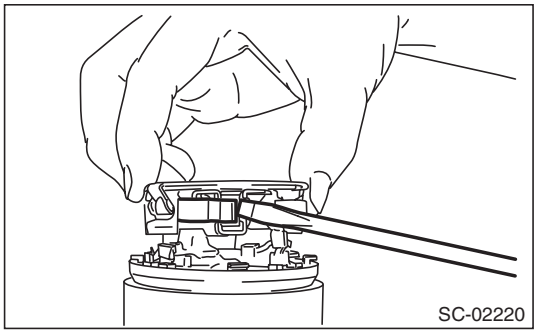


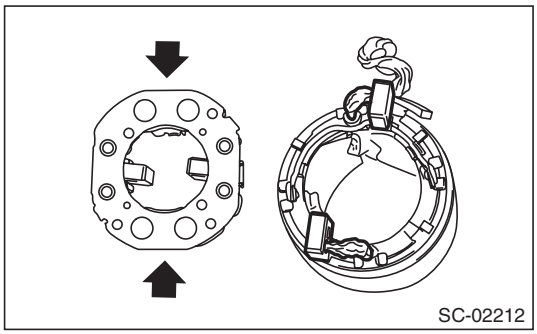
4) Remove the yoke assembly and brush holder assembly as a unit.



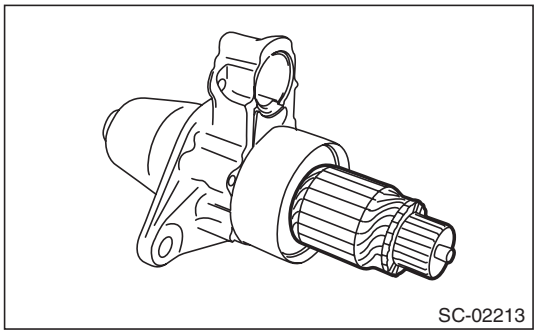
5) Remove the two brushes wired to the yoke assembly, and separate the yoke assembly and the brush holder assembly.

NOTE:
As shown in the figure, use a flat tip screwdriver, etc. to hold the brush spring and remove the brush.

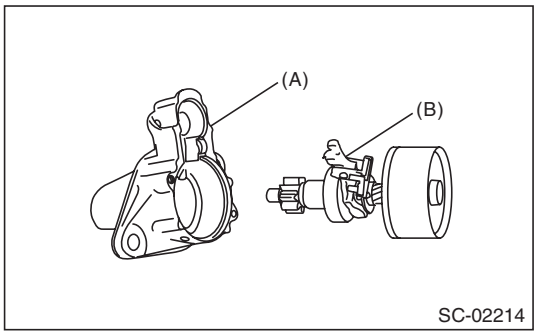




6) Remove the armature from the internal gear assembly.

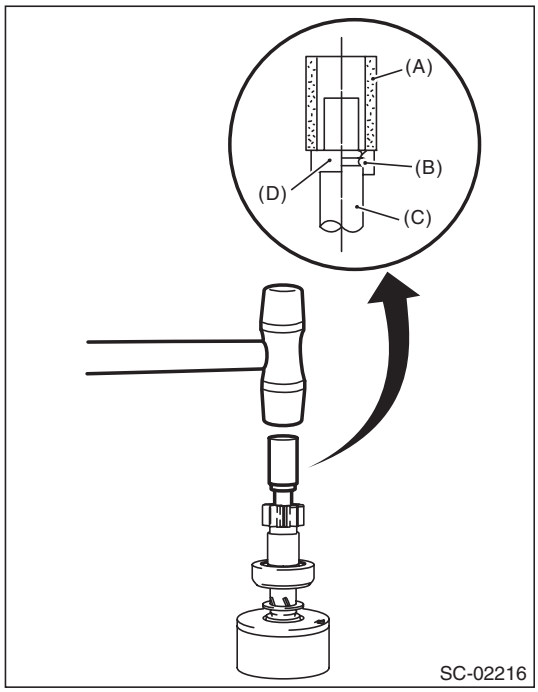


7) Remove the starter housing assembly (A) then remove the shift lever (B).



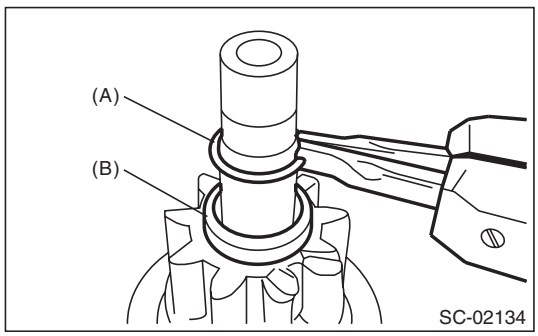
8) Use the following procedures to remove the overrunning clutch from the shaft.

(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.

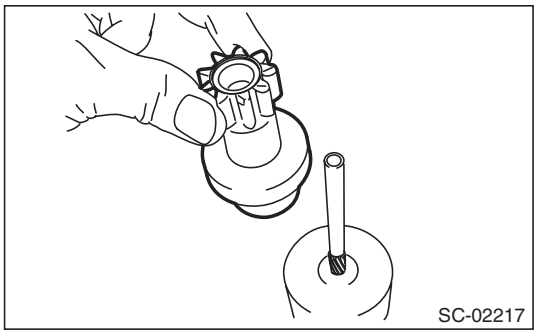


(A) Appropriate tool
(B) Snap ring
(C) Shaft
(D) Stopper

(2) Remove snap ring (A) from the shaft, and remove stopper (B).

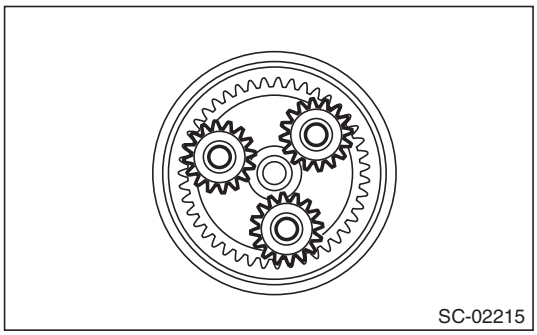


(3) Remove the overrunning clutch from the shaft.

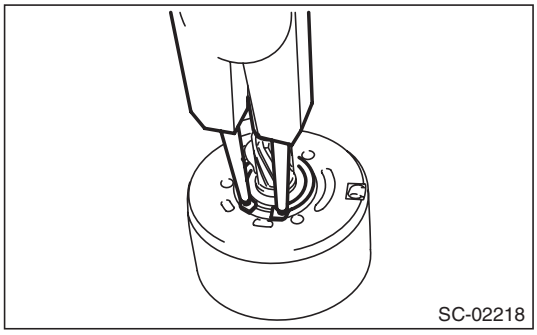


9) Use the following procedures to remove the shaft.

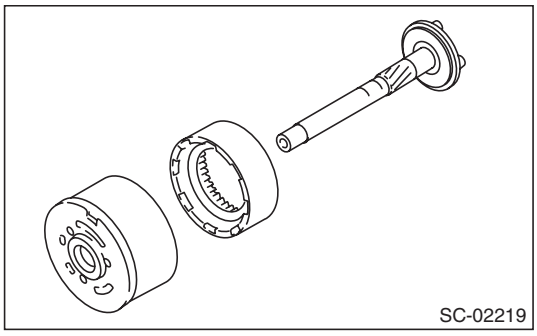
(1) Remove the starter plate, and remove the pinion gear.



(2) Remove the snap ring from the shaft.

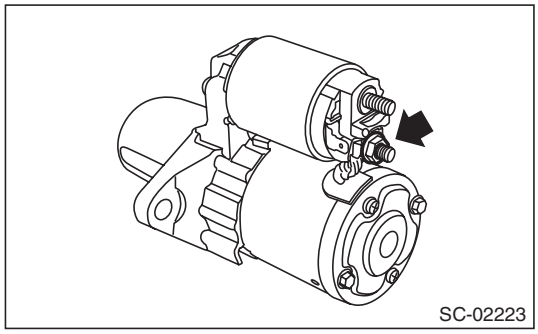


(3) Remove the shaft from the internal gear assembly.

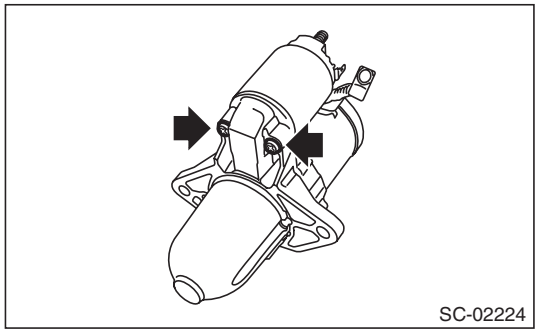


2. EXCEPT FOR STI MODEL

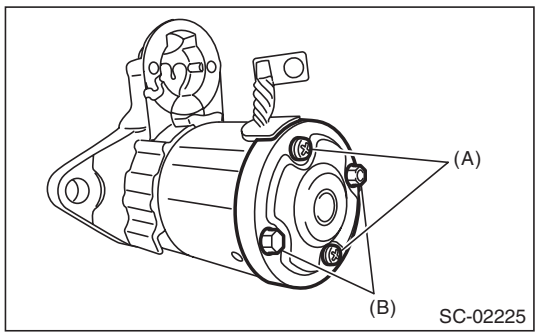
1) Disconnect the cable from the terminal M of the magnet switch assembly.



2) Remove the magnet switch assembly from the starter housing assembly.

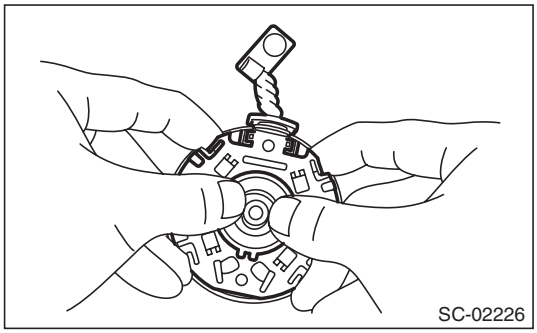


3) Remove screws (A) of the brush holder assembly, and through bolts (B) on both sides, and remove the starter cover assembly.

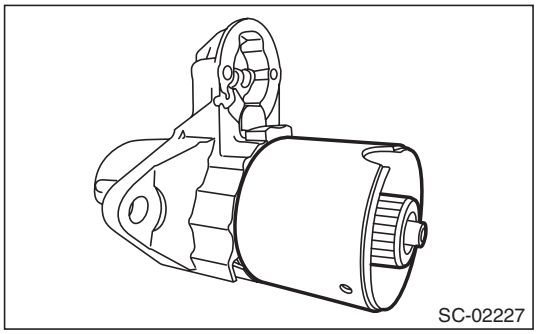


4) Remove the brush holder assembly from the armature assembly.

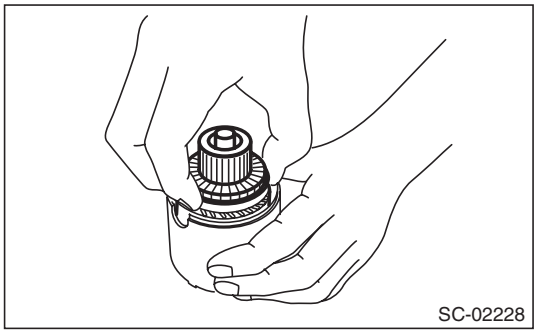
NOTE:
Hold the brush with your fingers so that the brush spring does not come flying out.



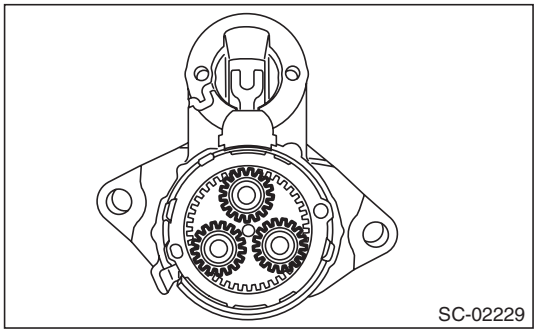
5) Remove the armature assembly and yoke assembly from the starter housing assembly together as a single unit.



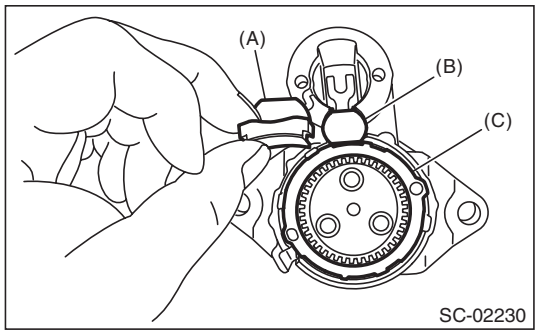
6) Separate the armature assembly and yoke assembly.



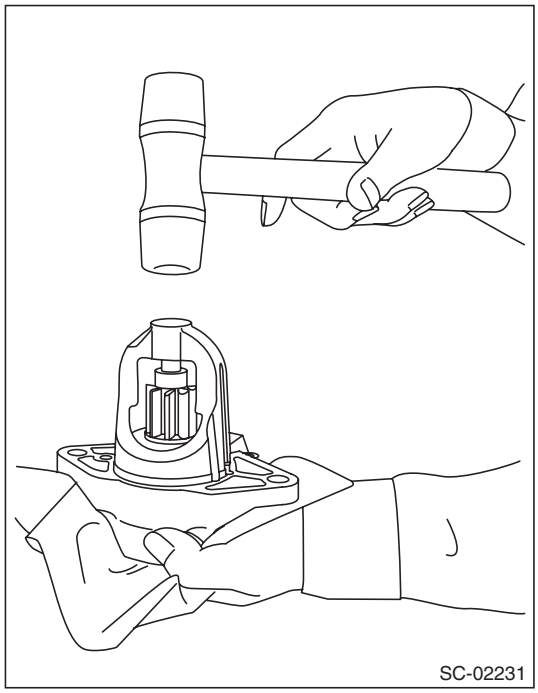
7) Remove the pinion gear from the internal gear assembly.

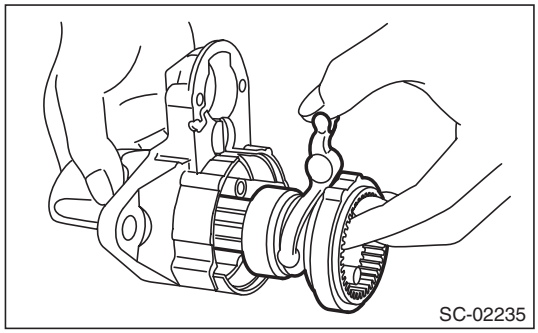


8) Remove seal rubber (A), plate (B), and seal rubber (C).



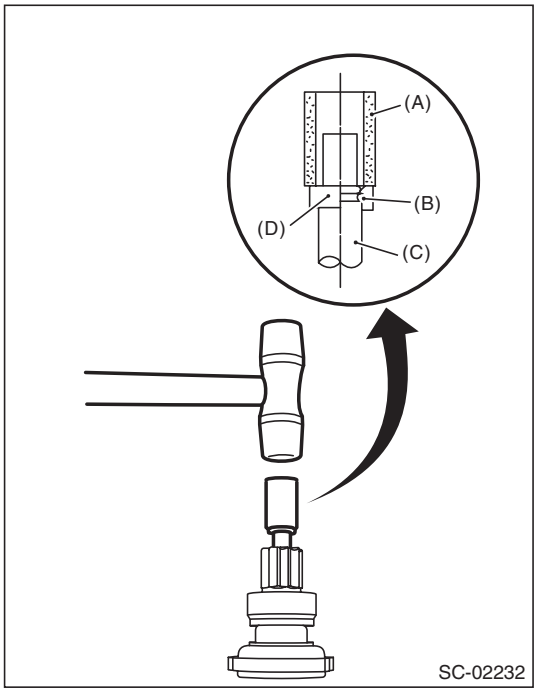
9) Lightly tap the starter housing assembly with a plastic hammer as shown in the figure, and remove the overrunning clutch, internal gear assembly, shaft and shift lever together as one unit.





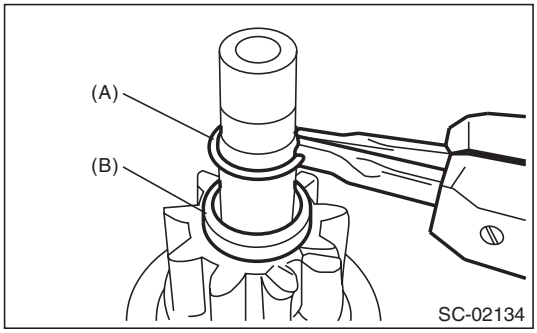
10) Use the following procedures to remove the overrunning clutch from the shaft.

(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.

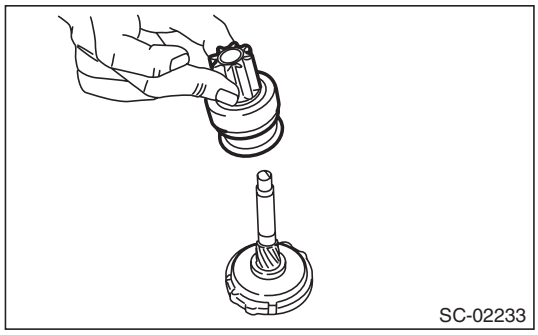


(A) Appropriate tool
(B) Snap ring
(C) Shaft
(D) Stopper

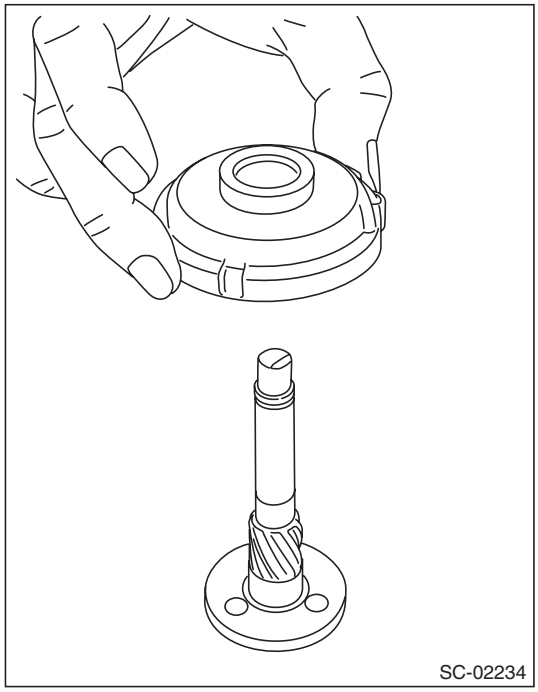
(2) Remove snap ring (A) from the shaft, and remove stopper (B).



(3) Remove the overrunning clutch from the shaft.


SC-02233

11) Separate the internal gear assembly and shaft.


SC-02234

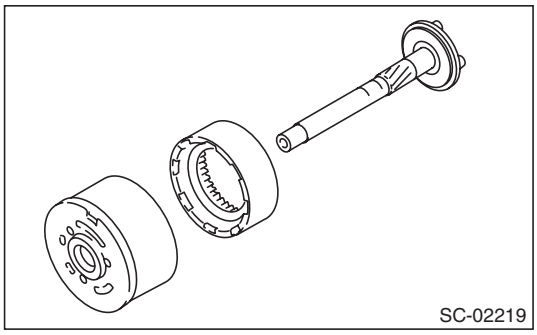
D: ASSEMBLY

1. STI MODEL

1) Use the following procedures to install the shaft.
(1) Apply grease to the shaft sliding surfaces of the internal gear assembly.

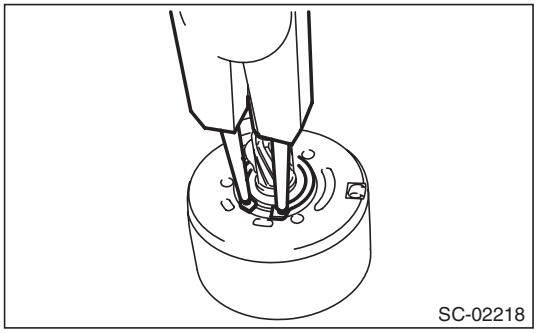
Grease:
DENSO HL50

(2) Assemble the shaft to the internal gear assembly.


SC-02219

(3) Install the snap ring to shaft.

NOTE:
Use new snap rings.


SC-02218

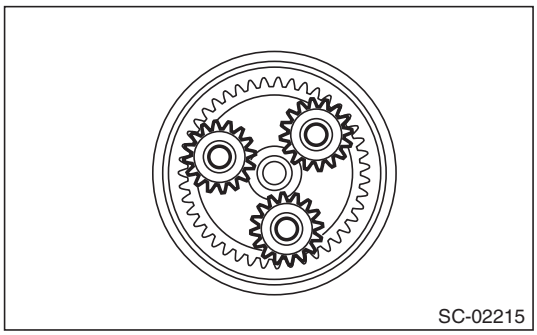
(4) Apply grease to the pinion gear attachment area.

Grease:
DENSO HL50

(5) Attach the pinion gear to the pin.
(6) Apply grease to the pinion gear, internal gear assembly, and on top of the shaft pin.

NOTE:
- Apply grease so that it contacts each gear.
- Be careful not to allow dirt to get in.

Grease:
DENSO HL50

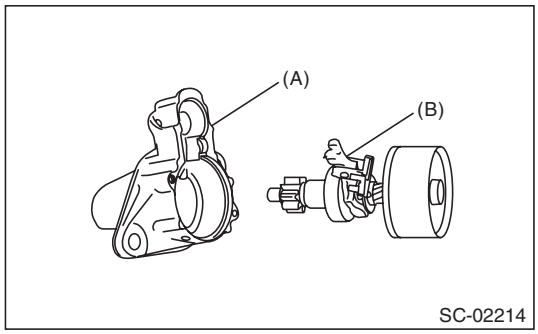

SC-02215

(7) Install the starter plate.

2) Assemble the overrunning clutch and shift lever (B) to the starter housing (A) as a unit.

NOTE:
Apply grease to the contact portion of the shift lever.

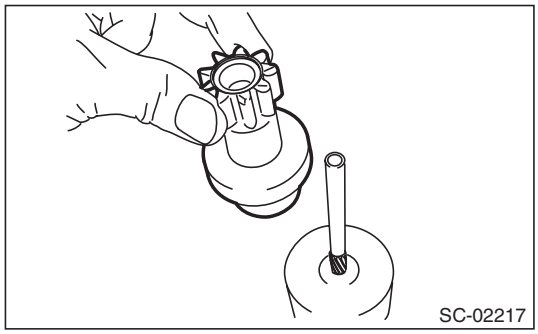
Grease:
DENSO HL50



3) Assemble the overrunning clutch as follows:
(1) Apply grease to the spline portion of the shaft.

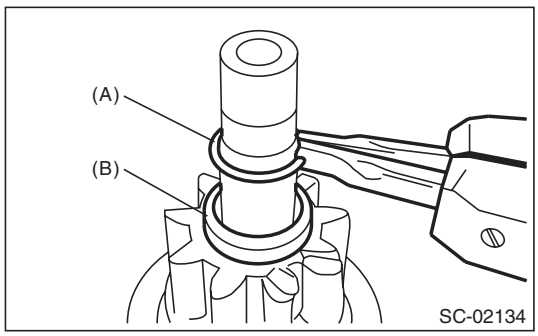
Grease:
DENSO HL50

(2) Install the overrunning clutch to shaft.

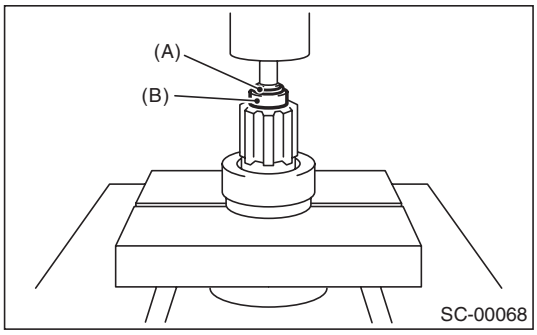


(3) Pass stopper (B) through the shaft, and attach snap ring (A).

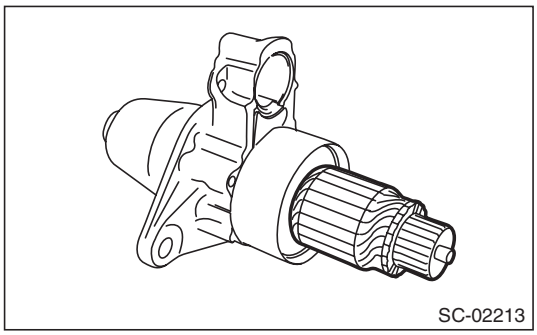
NOTE:
Use new snap rings.



(4) Using a press, pressure fit stopper (B) into snap ring (A).

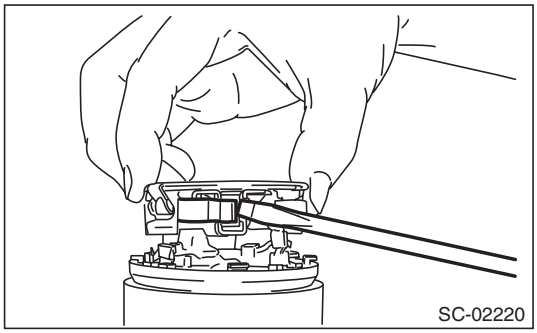


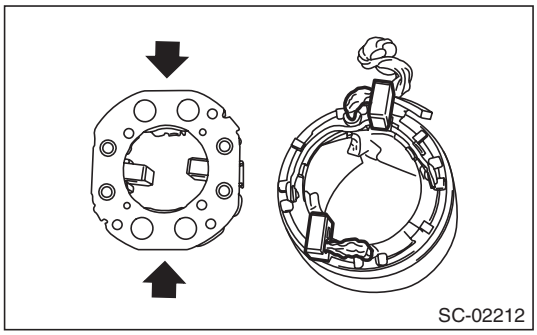
4) Install the armature to the internal gear assembly.



5) Attach the two brushes wired to the yoke assembly to the brush holder assembly.

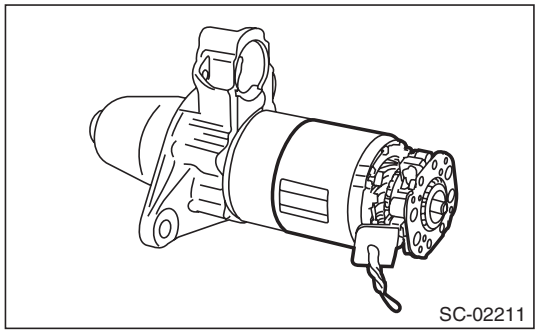
NOTE:
As shown in the figure, use a flat tip screwdriver, etc. to hold the brush spring and insert the brush while being careful not to damage the brush.





6) Install the yoke assembly and brush holder assembly as a single unit to the armature.

NOTE:
Spread the brush with your fingers, being careful not to damage the brush.

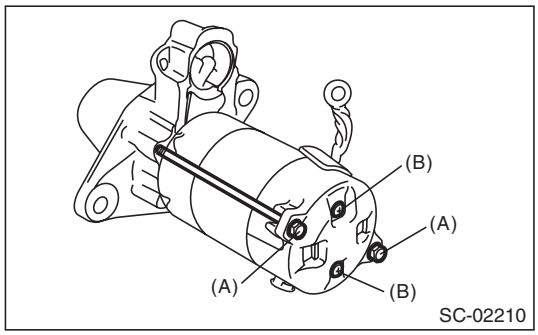

SC-02211

7) Install starter cover assembly to the brush holder assembly with screws (B).

Tightening torque:
1.4 N·m (0.1 kgf-m, 1.0 ft-lb)

8) Tighten the through bolts (A) on both sides.

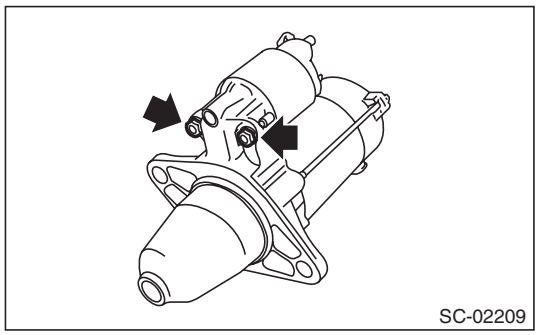
Tightening torque:
6 N·m (0.6 kgf-m, 4.4 ft-lb)



SC-02210

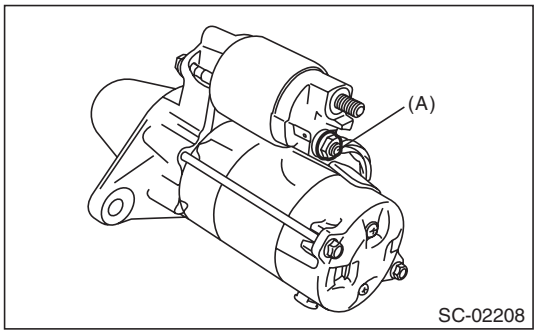
9) Attach the magnet switch assembly to the starter housing assembly.

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


SC-02209

10) Connect terminal M (A) to magnet switch assembly.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



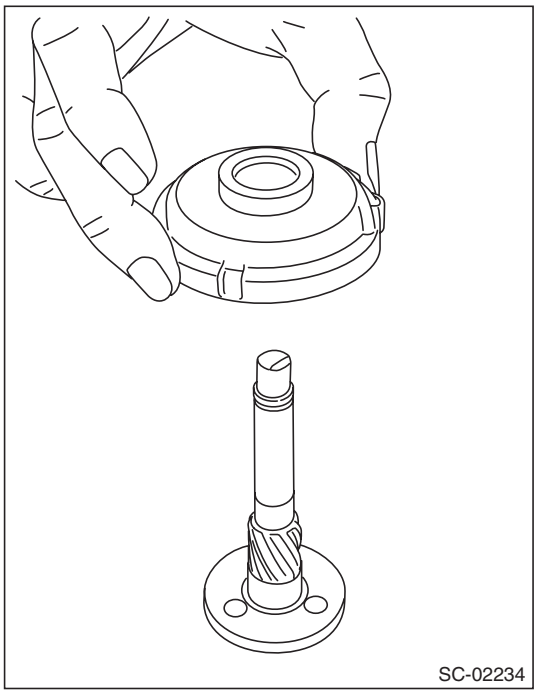
SC-02208

2. EXCEPT FOR STI MODEL

1) Apply grease to the shaft sliding surfaces of the internal gear assembly.

Grease:
Multemp #6129 or equivalent

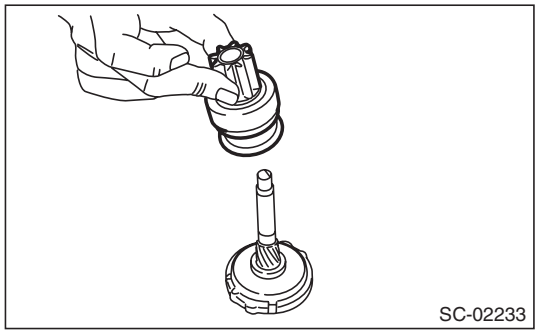
2) Assemble the shaft to the internal gear assembly.


SC-02234

3) Assemble the overrunning clutch as follows:
(1) Apply grease to the spline portion of the shaft.

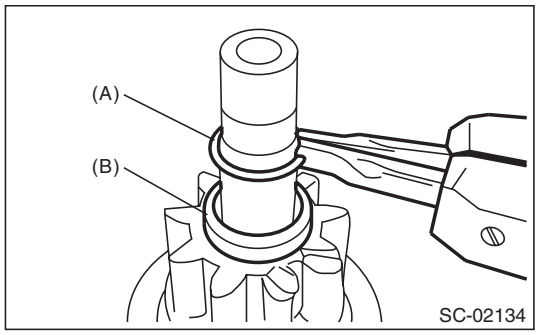
Grease:
Multemp #6129 or equivalent

(2) Install the overrunning clutch to shaft.

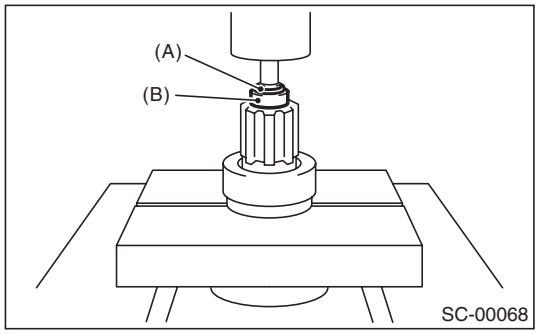


(3) Pass stopper (B) through the shaft assembly, and attach snap ring (A).

NOTE:
Use new stoppers and snap rings.



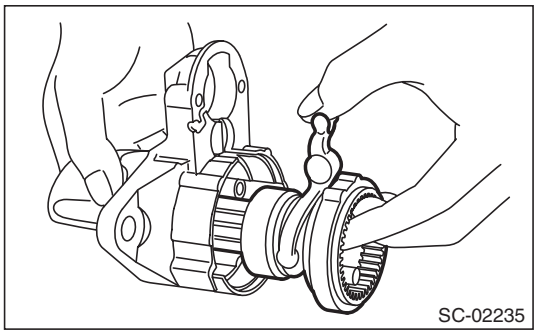
(4) Using a press, pressure fit stopper (B) into snap ring (A).



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.

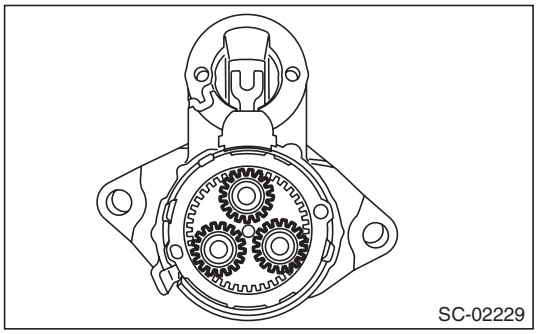
Grease:
Multemp #6129 or equivalent



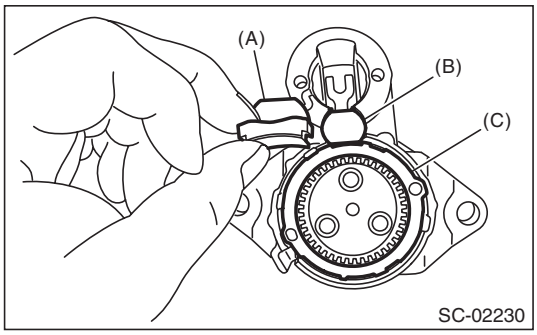
5) Apply grease to the inside of the internal gear assembly and pinion gear, and attach the pinion gear to the internal gear assembly.

NOTE:
• Apply grease evenly to the contact surfaces of each gear.
• Be careful that no debris becomes attached.

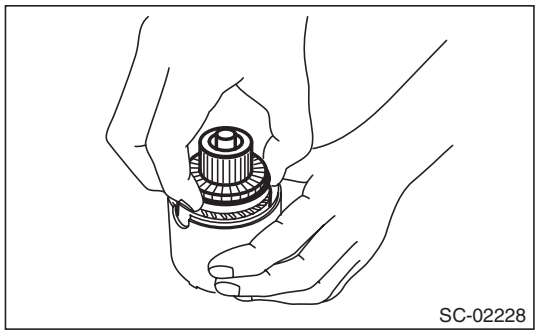
Grease:
Molykote® AG650 or equivalent



6) Install seal rubber (A), plate (B), and seal rubber (C).

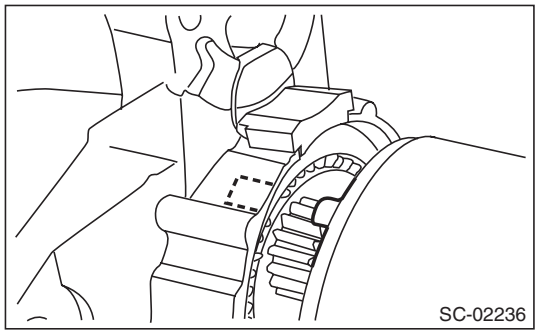


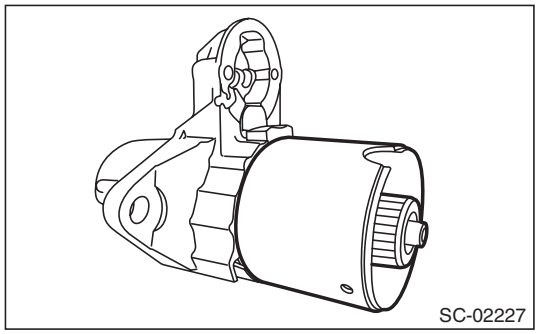
7) Assemble the armature assembly to the yoke assembly.



8) Attach the armature assembly and yoke assembly to the starter housing assembly together as a single unit.

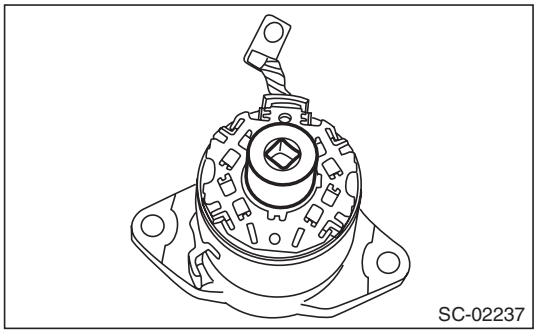
NOTE:
As shown in the figure, match the protrusion of the yoke assembly to the cut out of the starter housing assembly.





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.

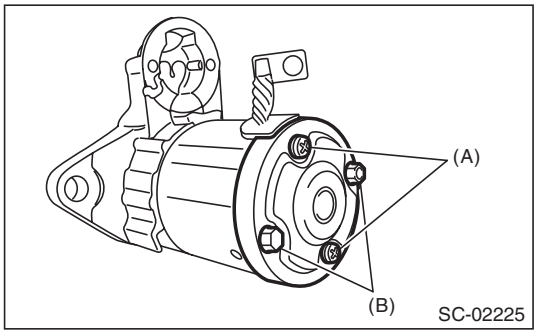


10) Secure starter cover assembly to the brush holder assembly with screws (A).

Tightening torque:
1.4 N·m (0.1 kgf-m, 1.0 ft-lb)

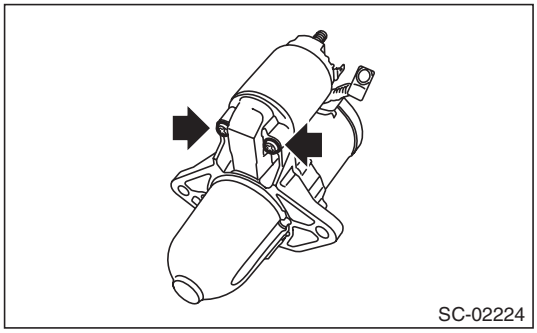
11) Install through bolts (B) on both sides.

Tightening torque:
6 N·m (0.6 kgf-m, 4.4 ft-lb)



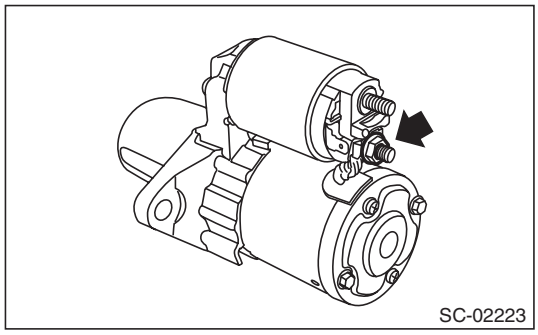
12) Attach the magnet switch assembly to the starter housing assembly.

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



13) Attach the cable to the terminal M of the magnet switch assembly, and secure with nuts.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)

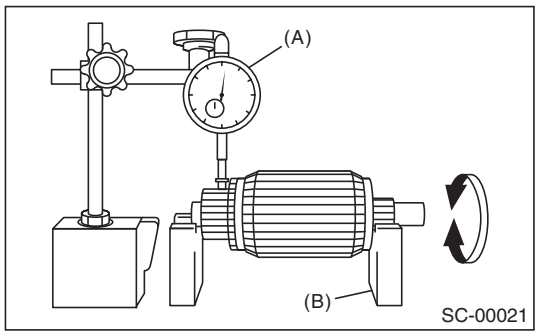


E: INSPECTION

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) Check for runout on the commutator. If excessive, replace the armature.

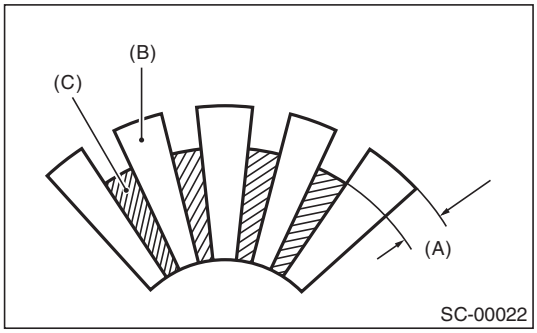
Commutator runout:
Standard
0.05 mm (0.0020 in)
Limit
0.10 mm (0.0039 in)



(A) Dial gauge
(B) V-block

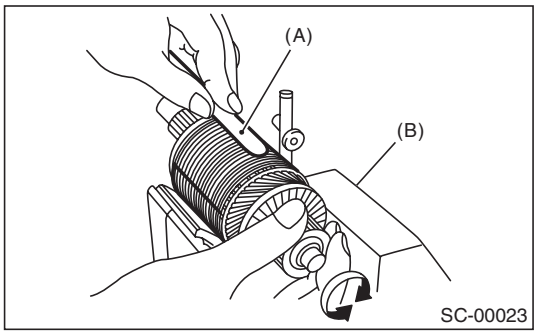
3) Check the depth of the segment mold. If it is not within the standard, replace the armature.

Depth of segment mold:
Standard
0.5 mm (0.020 in)



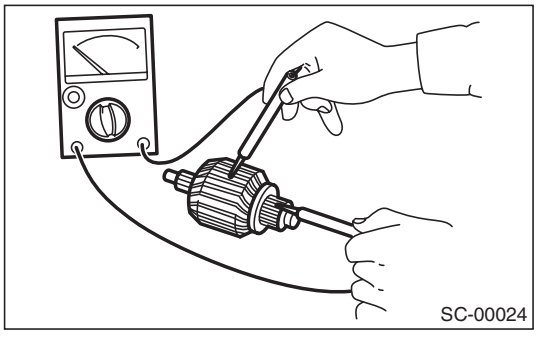
(A) Depth of mold
(B) Segment
(C) Mold

4) 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 the armature.



(A) Steel sheet
(B) Growler tester

5) 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 continuity, replace the armature.



2. YOKE

Make sure that the pole is set at the predetermined position.

3. OVERRUNNING CLUTCH

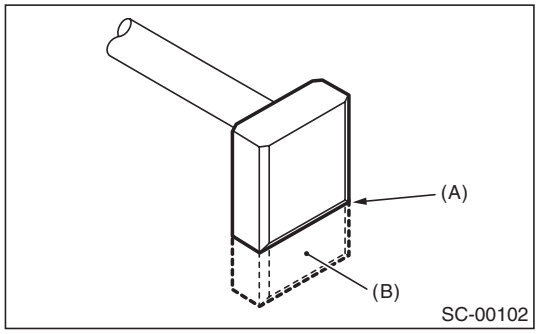
Check that there is no wear or damage to the piston teeth. Replace the overrunning clutch if it is damaged.
Check that it rotates smoothly when rotated in the correct direction (counterclockwise) and does not return to the other direction. Replace the overrunning clutch if any fault is found.

CAUTION:
To prevent spilling of grease, do not clean the overrunning clutch with oil.

4. BRUSH AND BRUSH HOLDER

1) Measure the length of the brush. Replace if it exceeds service limits or there is abnormal wear or cracks.

Brush length:
Standard
12.3 mm (0.484 in)
Limit
7.0 mm (0.276 in)



(A) Service limit line
(B) Brush

2) Check that the brush moves smoothly in the brush holder.
3) Measure the brush spring force with a spring scale. Replace the brush holder if below the service limit.

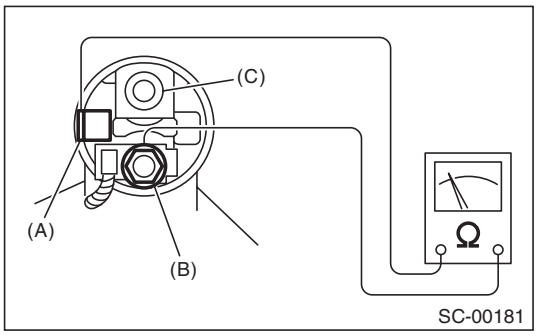
Brush spring force:
Standard
15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lbf) (When new)
Limit
2.5 N (0.25 kgf, 0.56 lbf)

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.

Resistance between switch assembly terminals:

Terminals	Standard
S — M	1 Ω or less
S — Ground	1 Ω or less
M — B	1 MΩ or more

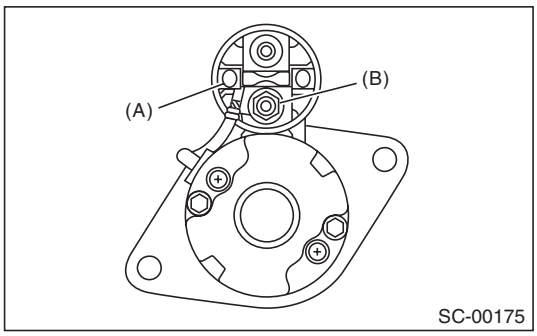


(A) S terminal
(B) M terminal
(C) B terminal

6. SWITCH ASSEMBLY OPERATION

1) Using a lead wire, connect the terminal S of switch assembly to positive terminal of battery, and starter body to ground terminal of battery. The pinion should be forced endwise on shaft.

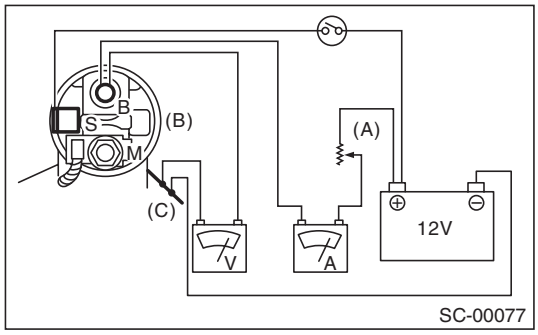
NOTE:
With the pinion forced endwise on shaft, starter motor can sometimes rotate because current flows, through pull-in coil, to motor. This is not a problem.
2) Disconnect the connector from terminal M. Then using a lead wire, connect the positive terminal of battery and terminal M, and ground terminal to starter body.
In this test set up, the pinion should return to its original position even when it is pulled out with a screwdriver.



(A) Terminal S
(B) Terminal M

7. 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) Adjust the variable resistance with the switch on until the voltage is 11 V, and read the value displayed by the ammeter to measure starter speed. Compare these values with the standard.

No-load test (standard):

Voltage/Current
6MT
Max. 11 V/90 A or less
5MT
Max. 11 V/95 A or less

Rotating speed
6MT
2,860 rpm or more
5MT
2,500 rpm or more

2) 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
6MT
8 V/9.3 N·m (0.9 kgf-m, 6.9 ft-lb) or more
5MT
7.5 V/8.84 N·m (0.9 kgf-m, 6.5 ft-lb) or more

Current/Speed
6MT
280 A/860 rpm or more
5MT
300 A/870 rpm or more

3) 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
6MT
4 V/515 A or less
5MT
4 V/680 A or less

Torque
6MT
16 N·m (1.6 kgf-m, 11.8 ft-lb) or more
5MT
17 N·m (1.7 kgf-m, 12.5 ft-lb) or more

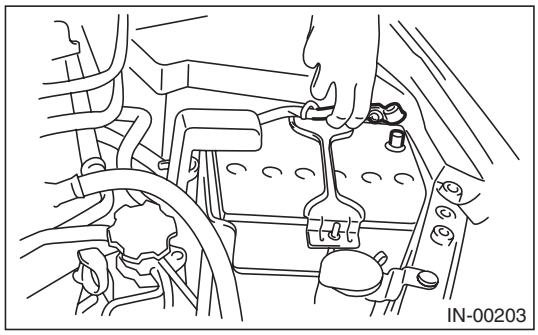
8. OTHER INSPECTIONS

Check that the starter does not have deformation, cracks and any other damage.

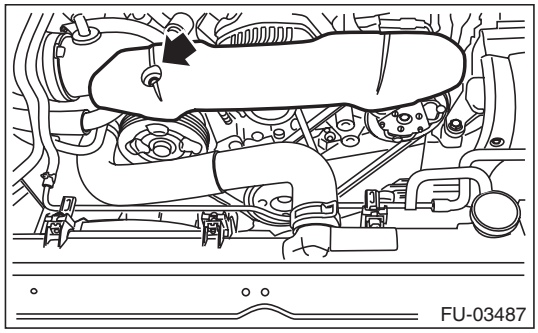
3. Generator

A: REMOVAL

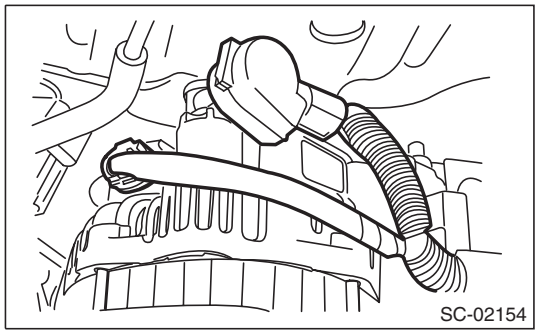
1) Disconnect the ground cable from battery.



2) Remove the V-belt covers.

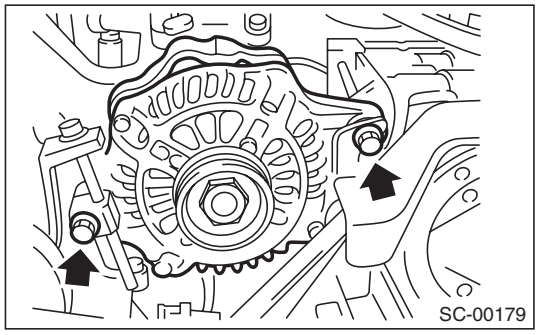


3) Disconnect the connector and terminal from generator.



4) Remove the front side belts. <Ref. to ME(STI)-39, FRONT SIDE BELT, REMOVAL, V-belt.> <Ref. to ME(w/o STI)-38, FRONT SIDE BELT, REMOVAL, V-belt.>

5) Remove the bolts which install the generator onto bracket.

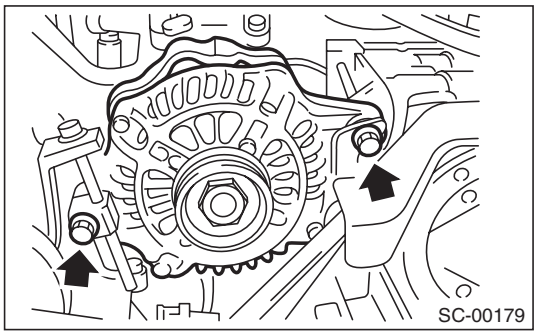


B: INSTALLATION

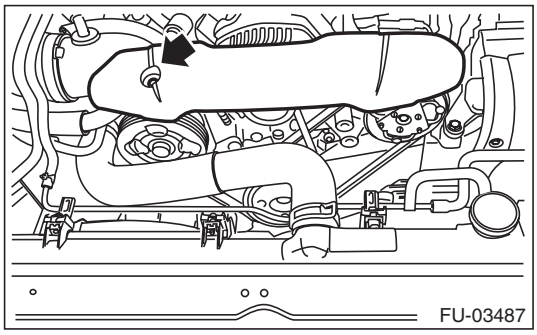
Install in the reverse order of removal.

CAUTION:
Check and adjust the front side belt tension. <Ref. to ME(STI)-45, FRONT SIDE BELT, INSPECTION, V-belt.> <Ref. to ME(w/o STI)-44, FRONT SIDE BELT, INSPECTION, V-belt.>

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

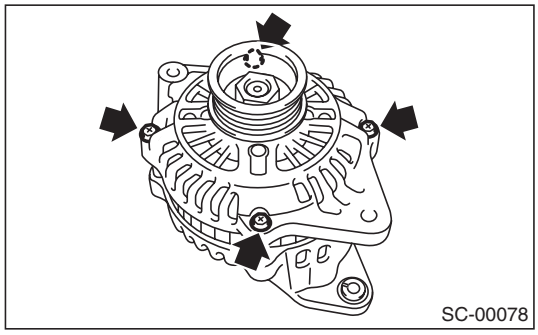


Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

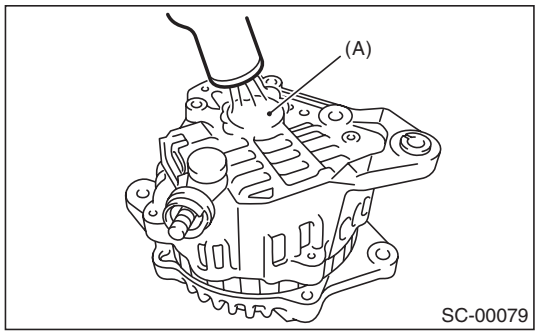


C: DISASSEMBLY

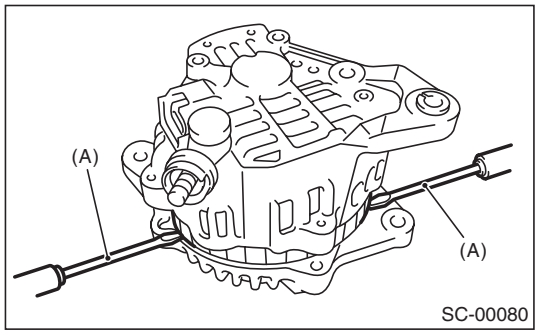
1) Remove the four through-bolts.



2) Use a drier to heat the rear cover (A) portion to 50°C (122°F).



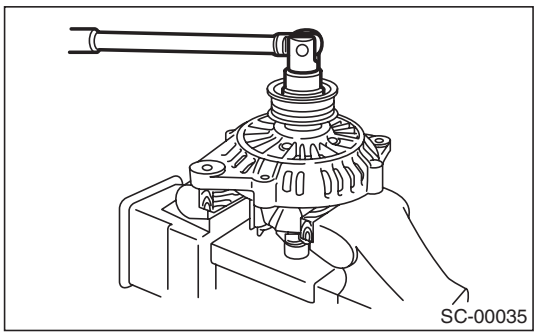
3) Insert the end of a flat tip screwdriver into the gap between stator core and front cover. Pry them apart to disassemble.

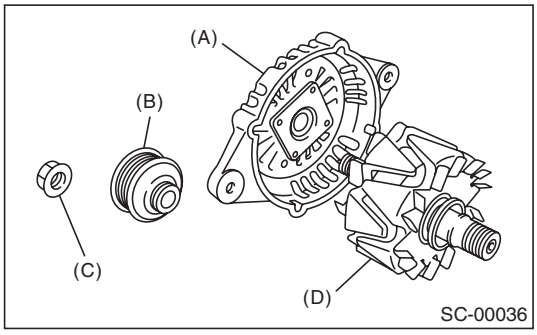


(A) Screwdriver

4) Using a vise, support the rotor and remove the pulley nut, and remove the rotor from the front cover.

CAUTION:
When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.

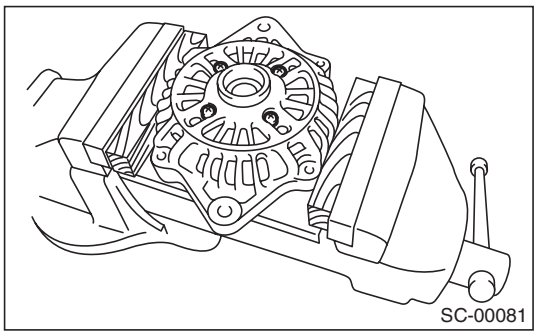




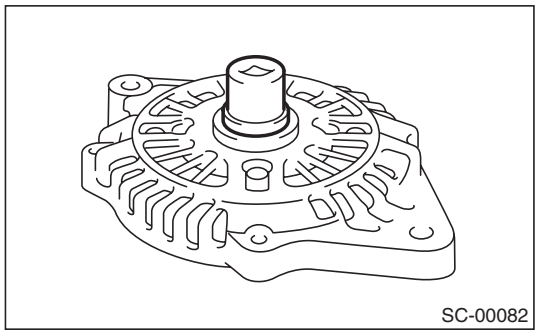
(A) Front cover
(B) Pulley
(C) Pulley nut
(D) Rotor

5) Use the following procedures to remove the ball bearings.

(1) Remove the bolt, and then detach the bearing retainer.

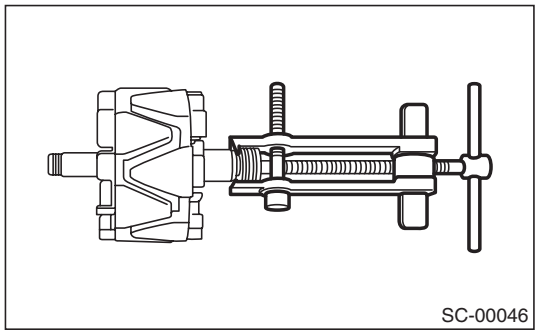


(2) Firmly attach an appropriate tool (such as a correct size socket wrench) to the bearing inner race.


SC-00082

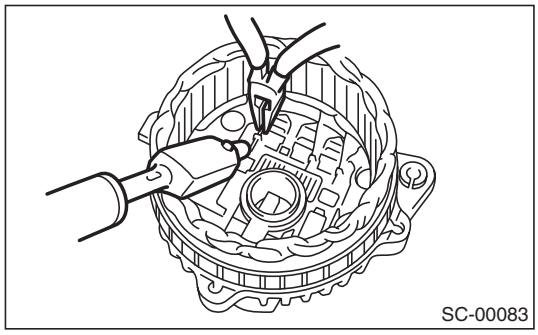
(3) Use the press to push the ball bearings out from the front cover.

6) Using the bearing puller, remove the bearings from the rotor.


SC-00046

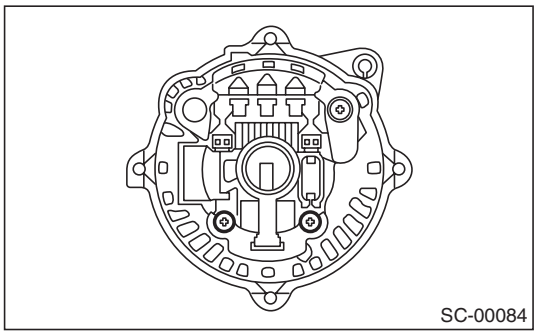
7) Disconnect the connection between the rectifier and stator coil, then remove the stator coil.

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.

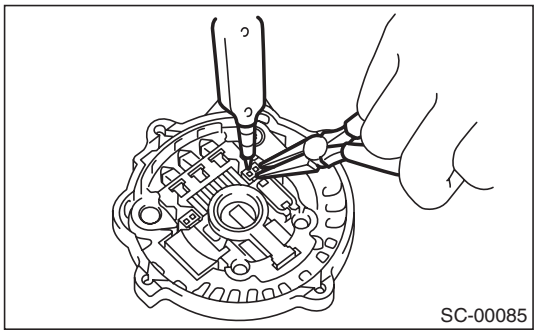

SC-00083

8) Use the following procedures to remove the IC regulator.

(1) Remove the screws which secure the IC regulator to the rear cover.

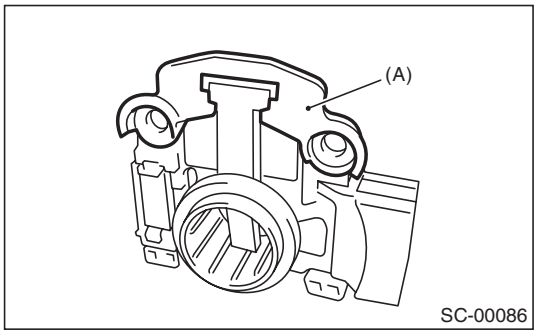

SC-00084

(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.

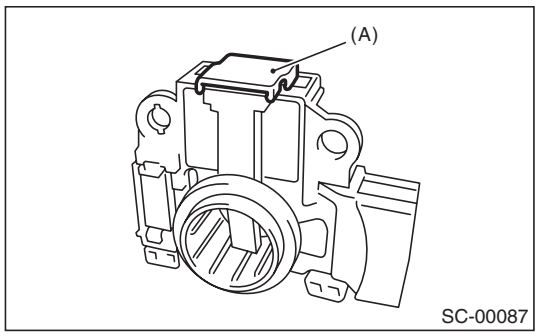
(1) Remove the cover A.



SC-00086

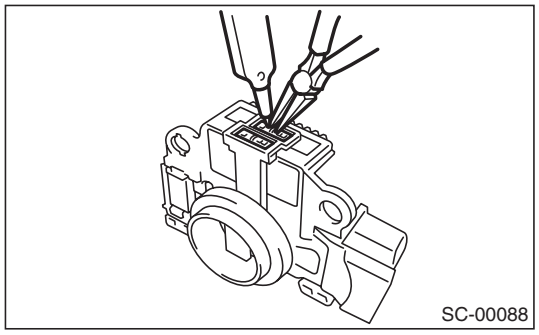
(A) Cover A

(2) Remove the cover B.

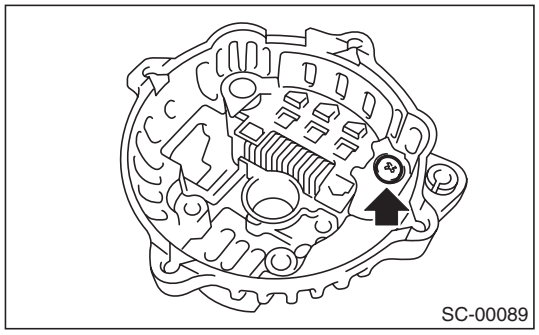


(A) Cover B

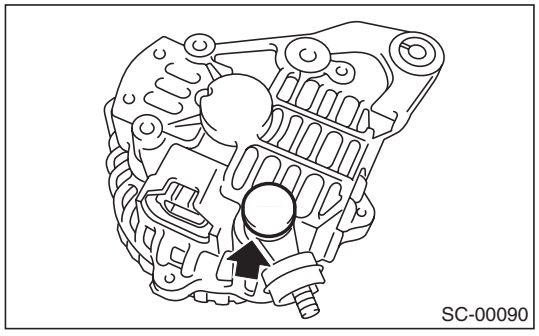
(3) Disconnect the connection and remove the brush.



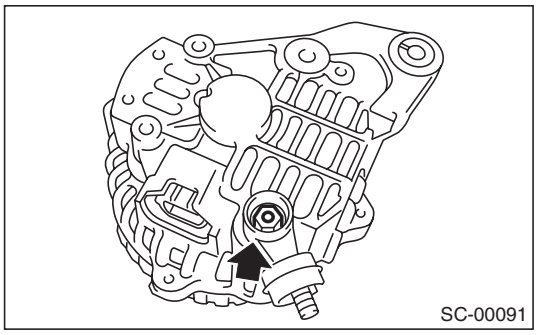
10) Remove the rectifier as follows.
(1) Remove the bolts which secure the rectifier.



(2) Remove the cover on terminal B.



(3) Remove the nuts of terminal B, then remove the rectifier.



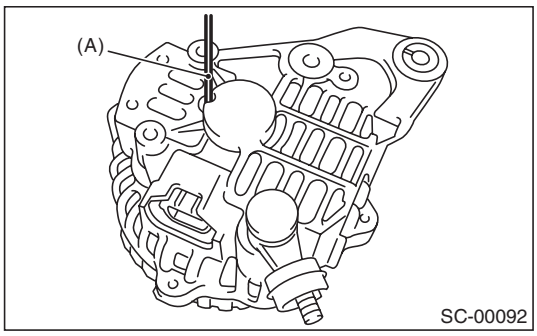
D: ASSEMBLY

Assemble in the reverse order of disassembly.

NOTE:
• Refer to component for tightening torque of each part. <Ref. to SC(STI)-5, GENERATOR, COMPONENT, General Description.>
• After assembling, manually turn the pulley to check that the rotor rotates smoothly.

1) Push of the brush
Before assembling the front and rear parts, press the brush down into the brush holder, then fix the brush in that position by inserting a [1 mm (0.08 in) dia., 40 — 50 mm (1.6 — 2.0 in) long] wire through the hole as shown in the figure.

CAUTION:
After 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) Install the bearings.

CAUTION:
Do not apply grease to the bearings. If there is any oil on the bearing box, remove it completely.

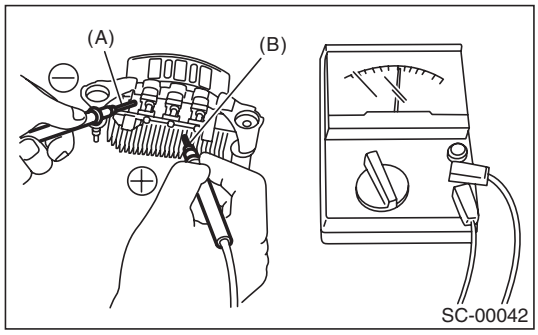
(1) Use a press to install the bearings to the rotor shaft.
(2) Heat the bearing box in rear cover at 50 to 60°C (122 to 140°F), and then press the bearing into rear cover.

E: INSPECTION

1. DIODE

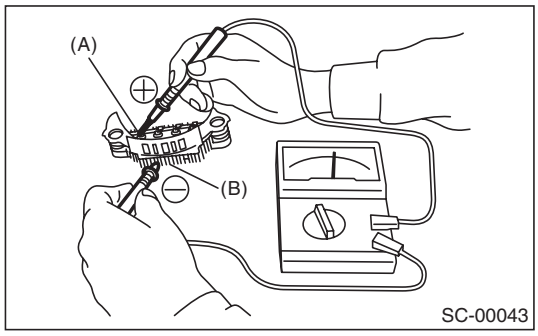
CAUTION:
There is the possibility of damaging the diodes if a mega-tester (used to measure high voltages) or a similar measuring instrument is used. Never use a mega tester or equivalent for this test.

1) Check for continuity between the diode lead and positive side heat sink. If resistance is 1 Ω or more only in the direction from the diode lead to the heat sink, replace the rectifier.



(A) Diode lead
(B) Heat sink (positive side)

2) Check for continuity between the negative side heat sink and diode lead. If resistance is 1 Ω or more only in the direction from the heat sink to the diode lead, replace the rectifier.



(A) Diode lead
(B) Heat sink (negative side)

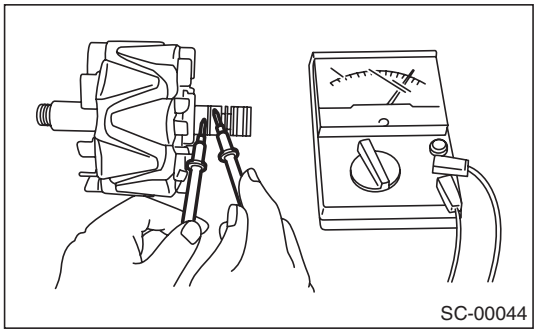
2. ROTOR

1) 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) Measure the slip ring outer diameter. Replace the rotor if the slip ring is worn.

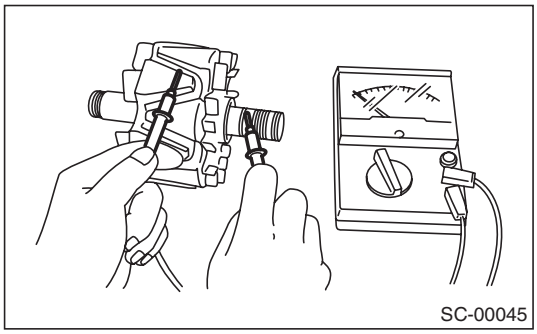
Slip ring outer diameter:
Standard
22.7 mm (0.894 in)
Limit
22.1 mm (0.870 in)

3) Using a circuit tester, check the resistance between slip rings. If resistance exceeds the standard, replace the rotor.

Standard:
Approx. 1.8 — 2.2 Ω



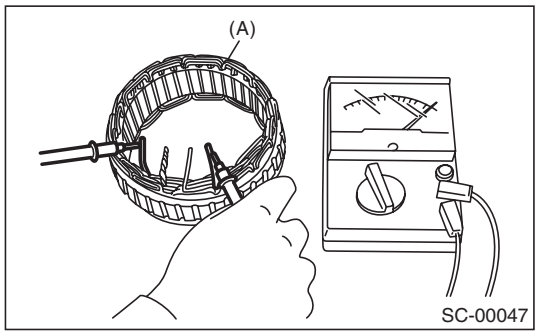
4) Check the continuity between slip ring and rotor core or shaft. If there is continuity, replace the rotor because the rotor coil is grounded.



5) Check the bearings. If there is any noise, or the rotor does not rotate smoothly, replace the bearings.

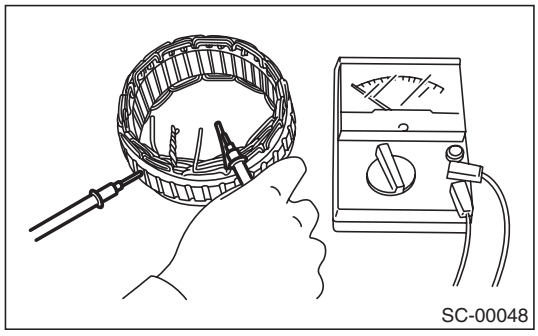
3. STATOR COIL

1) Inspect continuity between the stator coil lead wire terminals. If the resistance is 1 MΩ or more, replace the stator coil.



(A) Stator coil

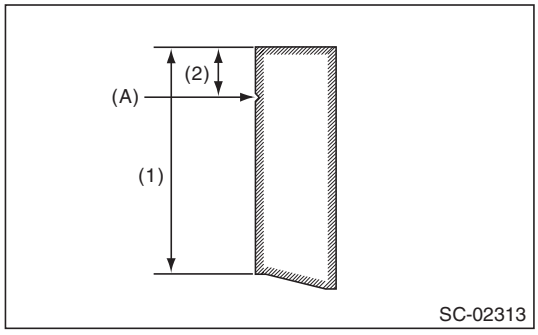
2) Inspect the continuity between the stator coil stator core and lead wire terminals. If the resistance is 1 Ω or less, replace the stator coil.



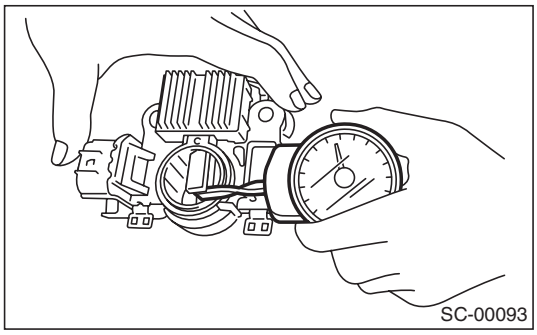
4. BRUSH

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 (1)
18.5 mm (0.728 in)
Limit (2)
5.0 mm (0.197 in)



2) 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. BALL BEARING

Check the ball bearings. Replace the ball bearings if there is resistance in the rotation, or if there is any abnormal noise.

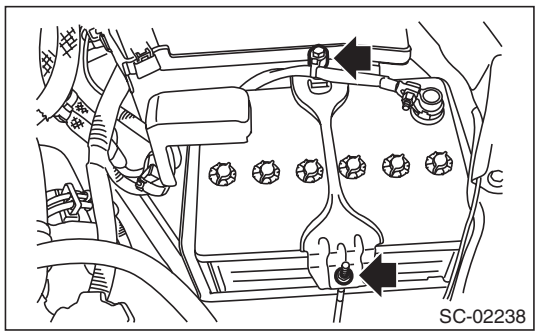
6. OTHER INSPECTIONS

Check that the generator does not have deformation, cracks and any other damage.

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

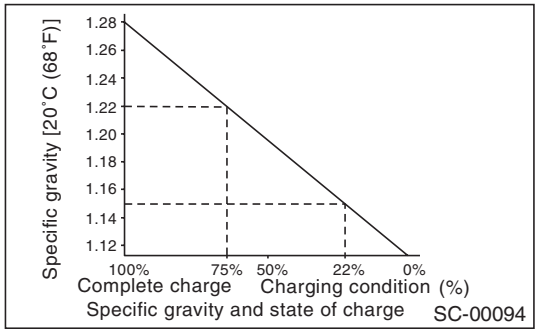
Check the electrolyte level in each cell. If the level is below MIN level, bring the level to MAX level by pouring distilled water into the battery cell. Do not fill beyond MAX level.

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 (68°F)
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.



Specific gravity and state of charge

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. JUDGMENT 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

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.
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, 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.

ENGINE 2 SECTION

FUEL INJECTION (FUEL SYSTEMS)	FU(w/o STI)
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)	EC(w/o STI)
INTAKE (INDUCTION)	IN(w/o STI)
MECHANICAL	ME(w/o STI)
EXHAUST	EX(w/o STI)
COOLING	CO(w/o STI)
LUBRICATION	LU(w/o STI)
SPEED CONTROL SYSTEMS	SP(w/o STI)
IGNITION	IG(w/o STI)
STARTING/CHARGING SYSTEMS	SC(w/o STI)

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.

G1150BE3

FUEL INJECTION (FUEL SYSTEMS)

FU(w/o STI)

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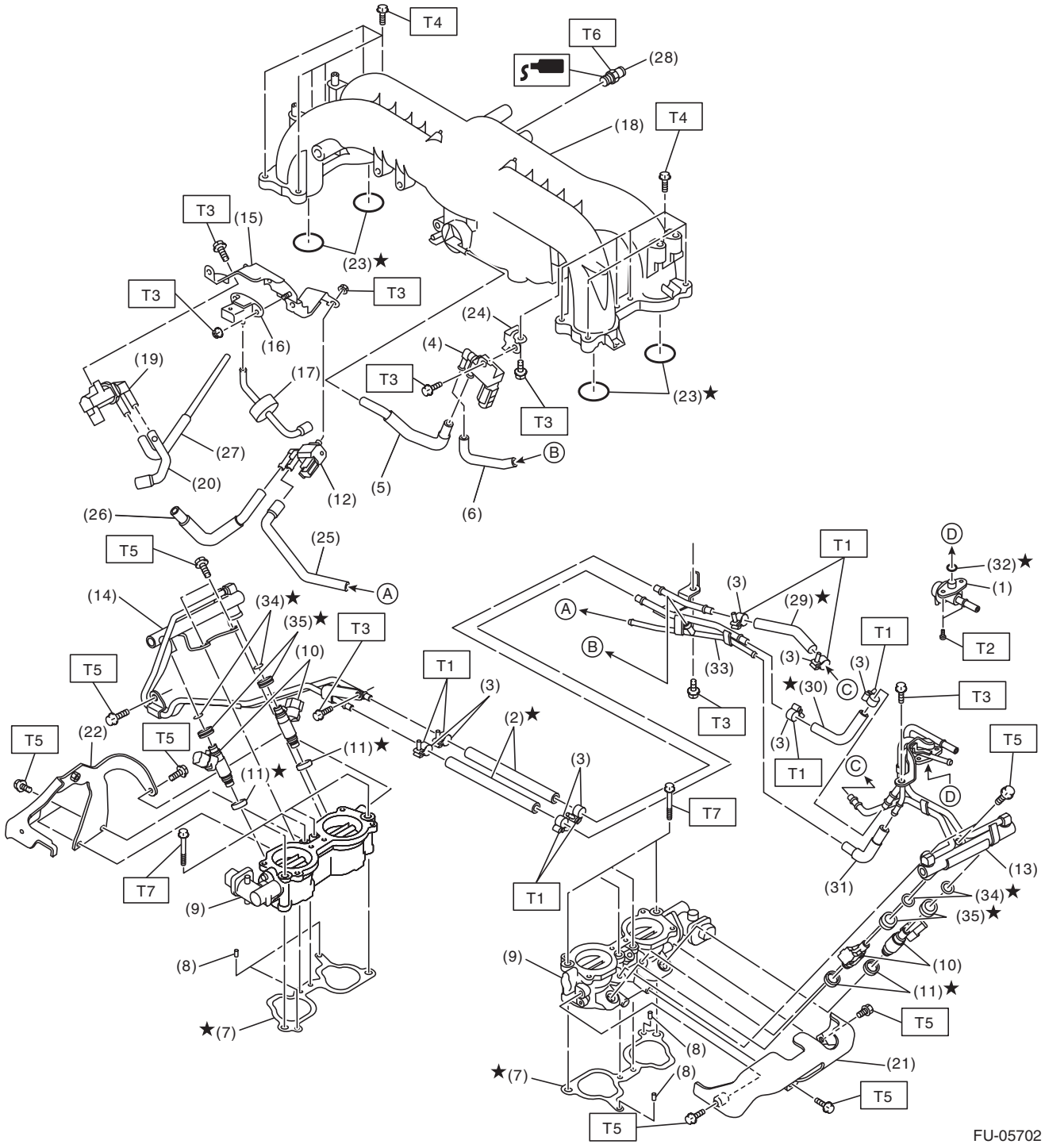
1. General Description

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 (5.61 — 8.67 kgf/cm^2, 79.8 — 123.3 psi)
	Discharge rate	155 L (40.9 US gal, 34.1 Imp gal)/h or more [12 V at 300 kPa (3.06 kgf/cm^2, 43.5 psi)]
Fuel filter		In-tank type

B: COMPONENT

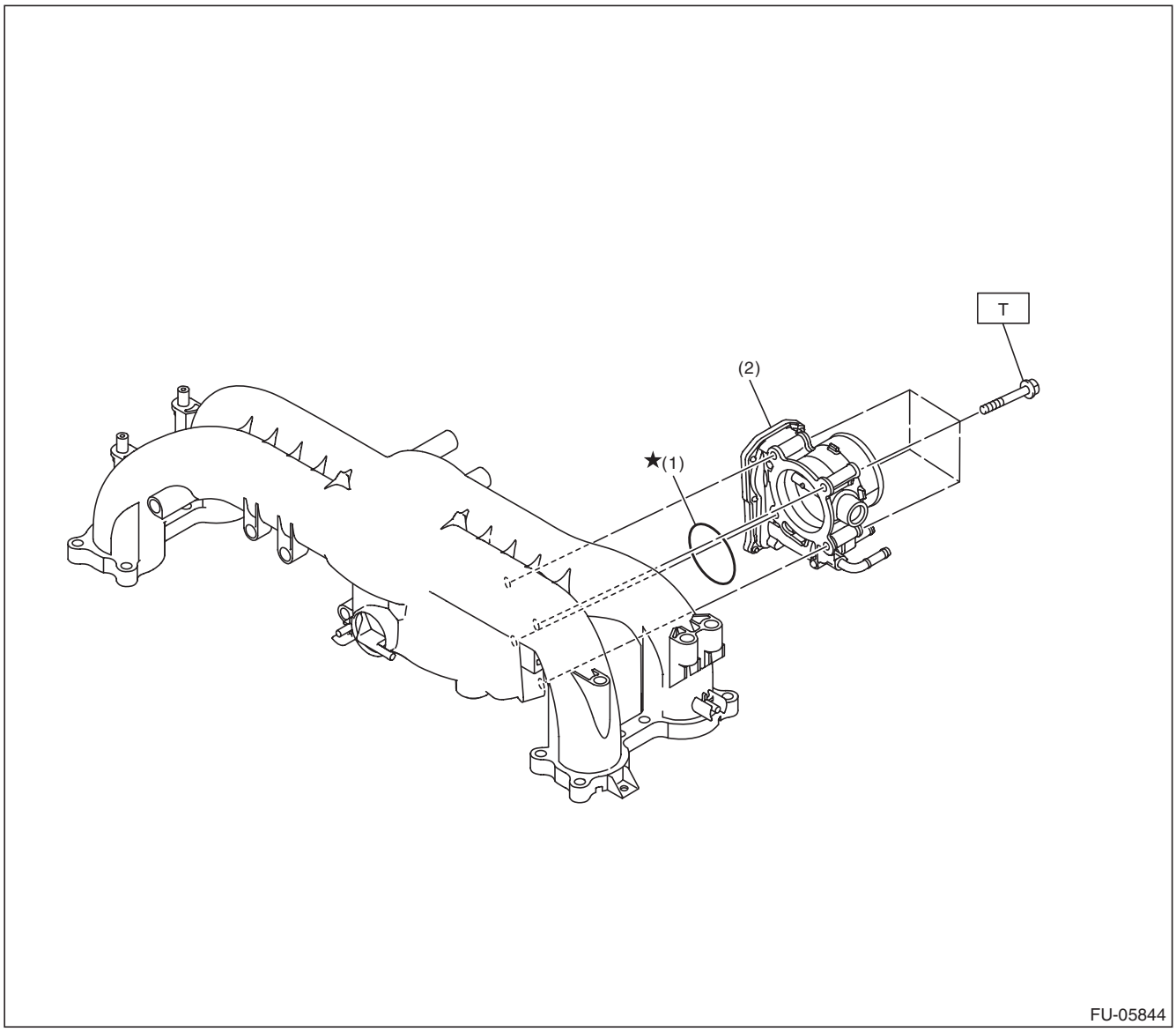
1. INTAKE MANIFOLD



(1) Pressure regulator
(2) Fuel hose A
(3) Clamp
(4) Purge control solenoid valve 1
(5) Vacuum hose D
(6) Vacuum hose C
(7) Intake manifold gasket
(8) Guide pin
(9) Tumble generator valve ASSY
(10) Fuel injector
(11) Seal ring
(12) Purge control solenoid valve 2
(13) Fuel injector pipe LH
(14) Fuel injector pipe RH
(15) Solenoid valve bracket
(16) Manifold absolute pressure sensor
(17) Filter
(18) Intake manifold
(19) Wastegate control solenoid valve ASSY
(20) Vacuum hose
(21) Fuel pipe protector LH
(22) Fuel pipe protector RH
(23) O-ring
(24) Solenoid valve bracket
(25) Vacuum hose B
(26) Vacuum hose A
(27) Air control hose
(28) Nipple
(29) Fuel hose B
(30) Fuel hose C
(31) Vacuum hose
(32) O-ring
(33) Fuel pipe
(34) O-ring
(35) Rubber

Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.25 (0.1, 0.9)
T2: 3.5 (0.4, 2.6)
T3: 6.4 (0.7, 4.7)
T4: 8.3 (0.8, 6.1)
T5: 19 (1.9, 14.0)
T6: 23 (2.3, 17.0)
T7: 25 (2.5, 18.4)

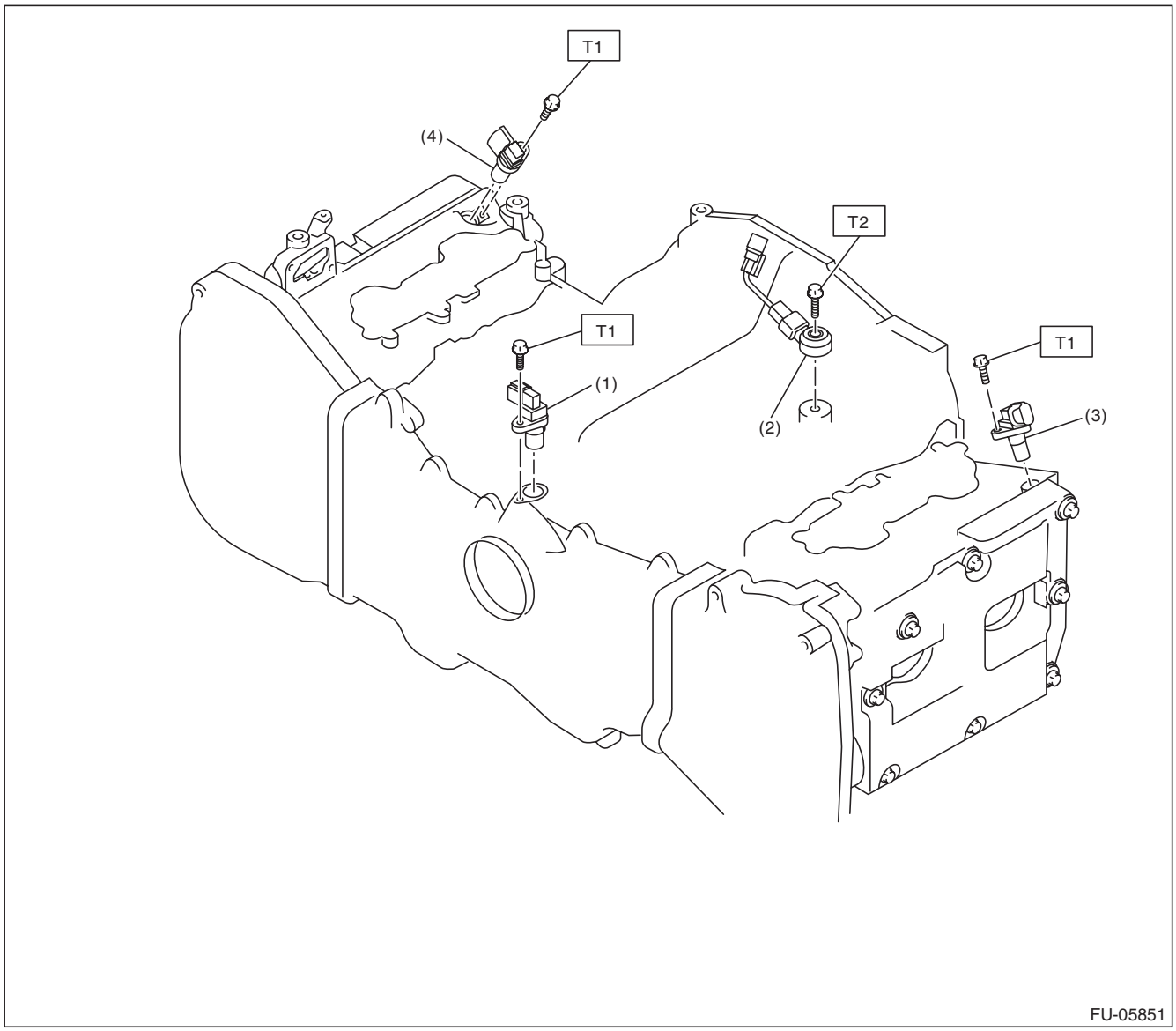
2. AIR INTAKE SYSTEM



(1) O-ring
(2) Throttle body

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

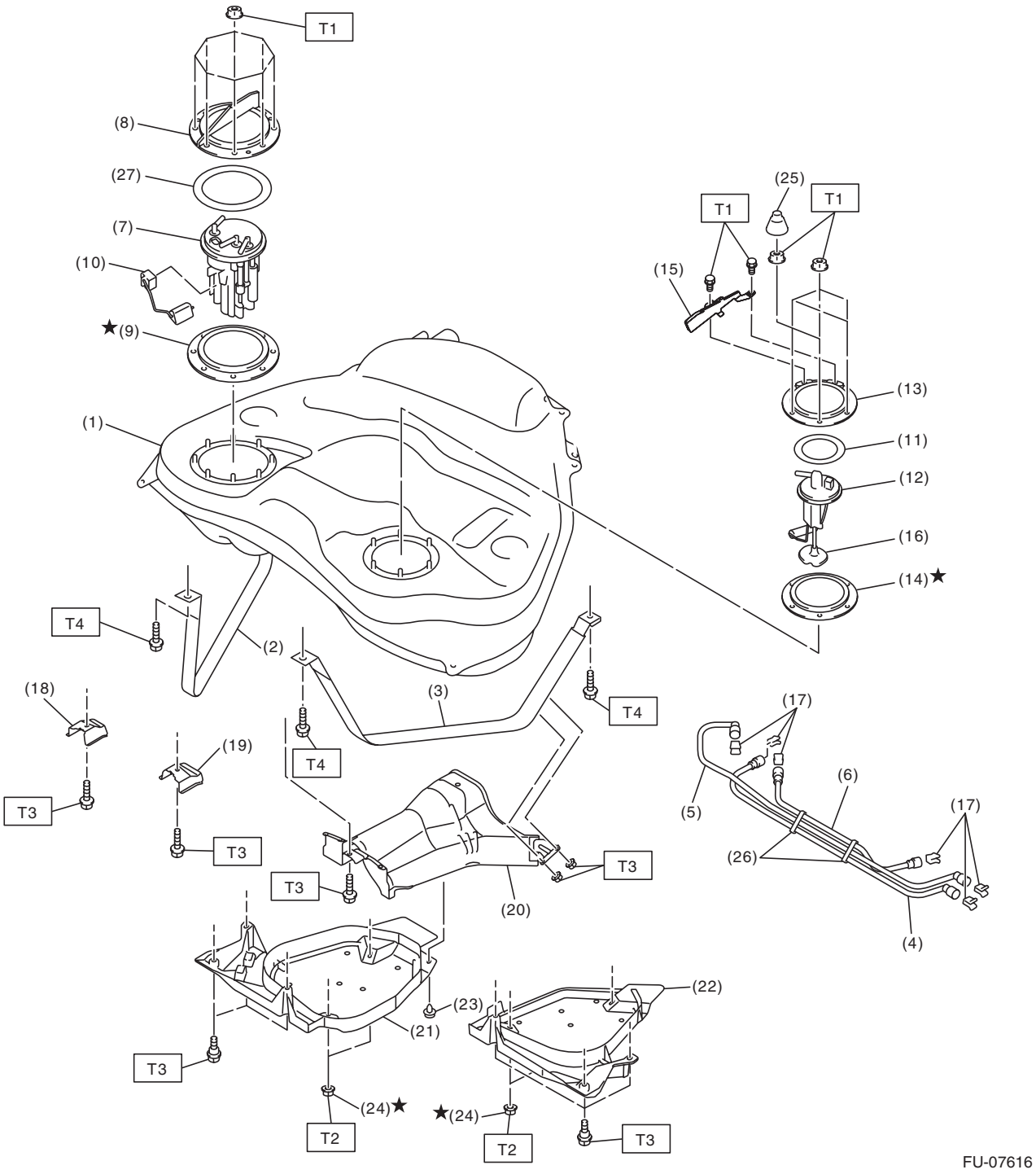
3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



(1) Crankshaft position sensor
(2) Knock sensor
(3) Camshaft position sensor LH
(4) Camshaft position sensor RH

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 24 (2.4, 17.7)

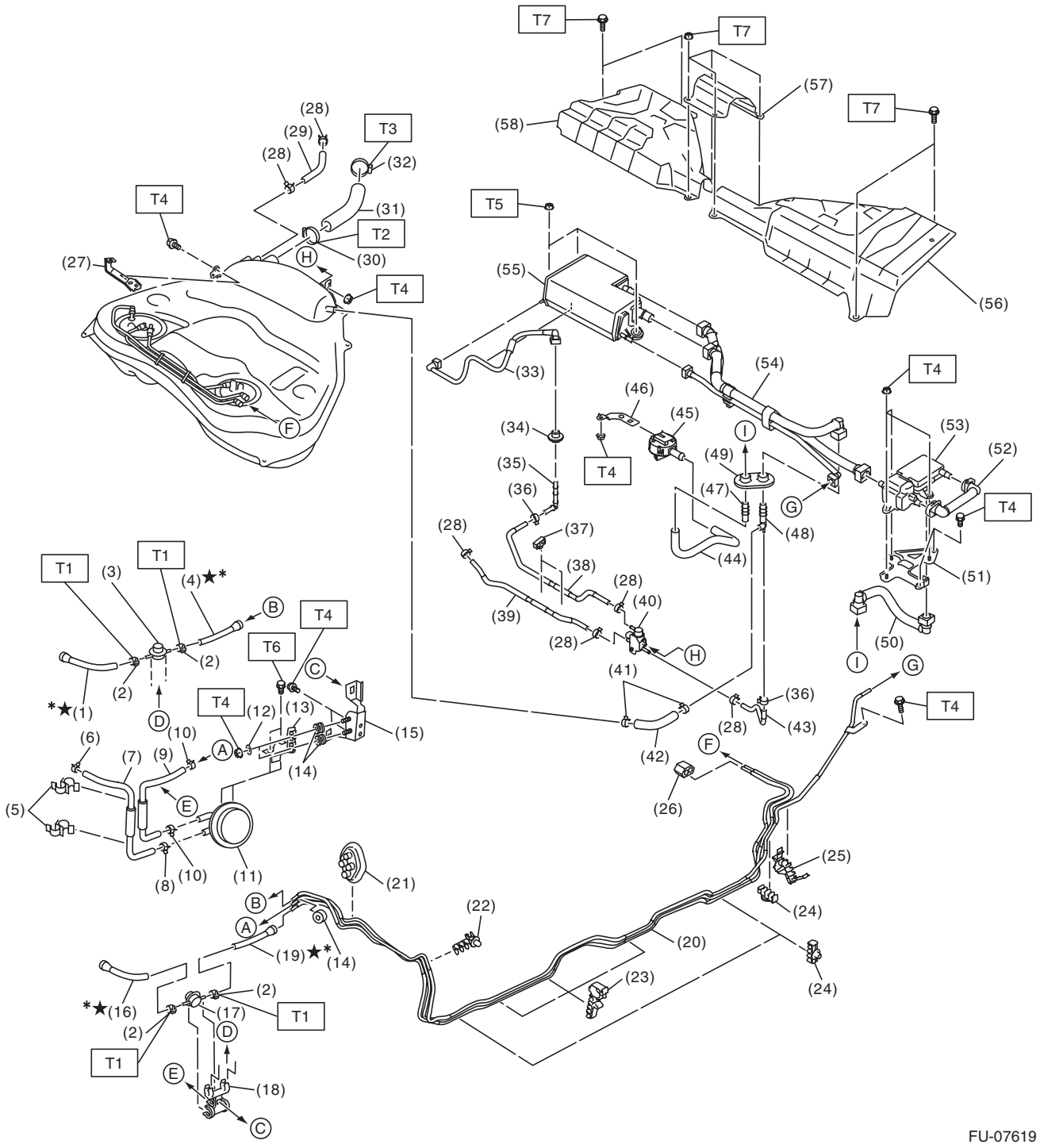
4. FUEL TANK


T1
(8)
(27)
(7)
(10)
★(9)
(1)
(25)
T1
T1
(15)
(13)
(11)
(12)
(16)
(14)★
T4
(2)
(3)
T4
T4
(18)
(19)
T3
T3
T3
T3
(20)
(17)
(6)
(5)
(17)
(26)
(4)
(22)
(23)
(21)
T3
(24)★
★(24)
T2
T2
T3
FU-07616

(1) Fuel tank
(2) Fuel tank band RH
(3) Fuel tank band LH
(4) Fuel delivery tube
(5) Fuel return tube
(6) Jet pump tube
(7) Fuel pump ASSY
(8) Fuel pump upper plate
(9) Fuel pump gasket
(10) Fuel level sensor
(11) Fuel sub level sensor upper plate cushion
(12) Fuel sub level sensor
(13) Fuel sub level sensor upper plate
(14) Fuel sub level sensor gasket
(15) Fuel sub level sensor protector
(16) Fuel sub level sensor filter
(17) Retainer
(18) Stopper RH
(19) Stopper LH
(20) Heat shield cover
(21) Fuel tank protector RH
(22) Fuel tank protector LH
(23) Clip
(24) Self-locking nut
(25) Rubber cap
(26) Tube clamp
(27) Fuel pump upper plate cushion

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

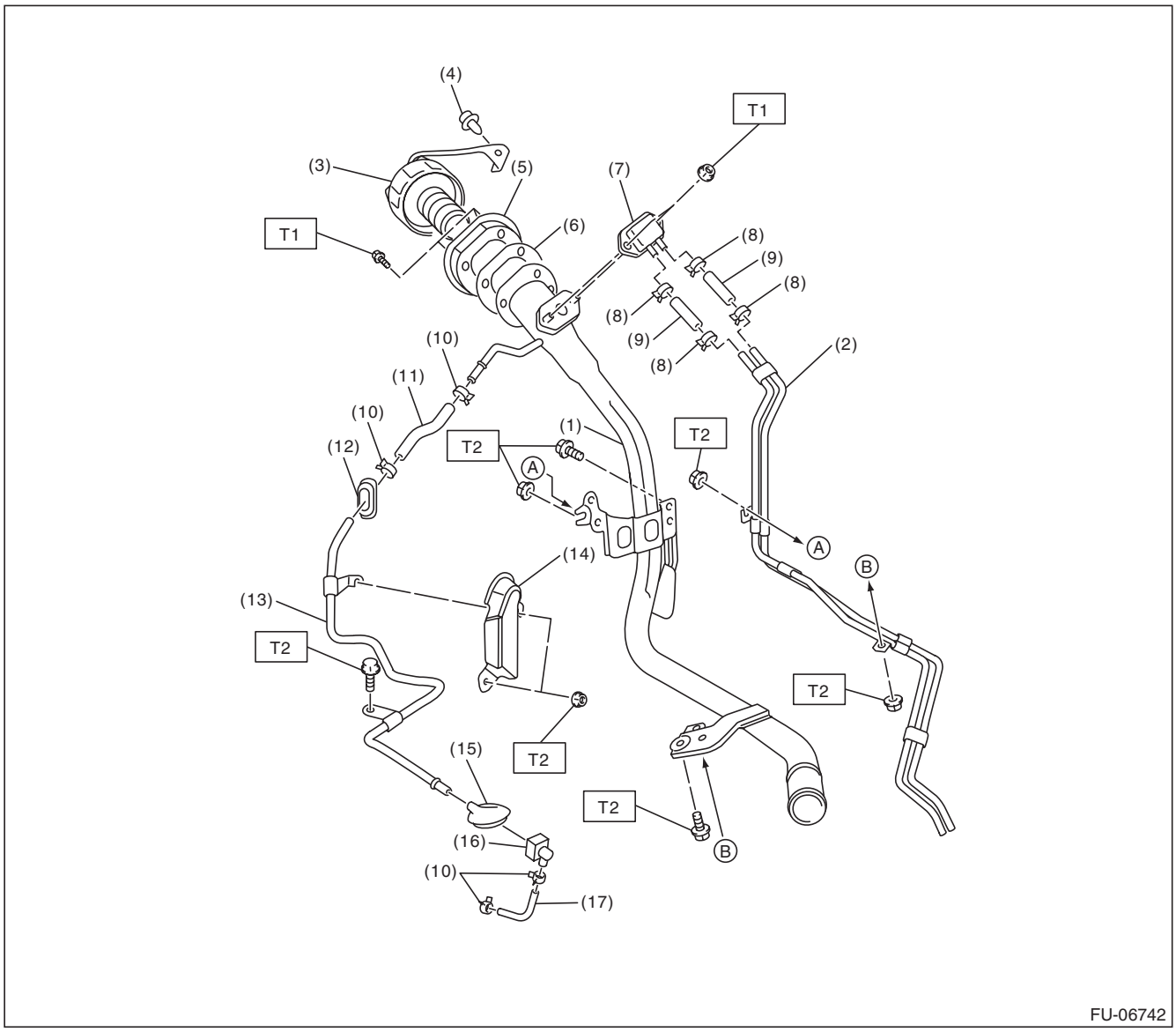

T7
T7
(57)
(58)
T7
T3
(28)
(29)
(28)
(32)
T4
(31)
T5
T2
(27)
(30)
(55)
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T4
(33)
(54)
T4
(46)
(45)
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(35)
T4
(49)
(36)
(47)
T4
(28)
(37)
(48)
(44)
(38)
(51)
T1
T1
(3)
(4)★*
(28)
(40)
(39)
(50)
B
T4
T6
(2)
C
(41)
(36)
*★(1)
(2)
(28)
(43)
T4
D
T4
(12)
(13)
(15)
(6)
(10)
A
(42)
F
(7)
(9)
(14)
(26)
(5)
E
(25)
(8)
(10)
(11)
(21)
B
(24)
(22)
A
(20)
(19)★*
(14)
(24)
(23)
(2)
*★(16)
(17)
T1
(2)
D
T1
E
(18)
C
FU-07619

(1) Fuel delivery hose A
(2) Clamp
(3) Fuel damper A
(4) Fuel delivery hose B
(5) Hose clamp
(6) Clip
(7) Evaporation hose A
(8) Clip
(9) Evaporation hose B
(10) Clip
(11) Purge damper
(12) Collar
(13) Purge damper bracket
(14) Bushing
(15) Damper bracket
(16) Fuel return hose A
(17) Fuel damper B
(18) Fuel damper holder
(19) Fuel return hose B
(20) Fuel pipe ASSY
(21) Fuel pipe front grommet
(22) Pipe clamp
(23) Pipe clamp
(24) Pipe clamp
(25) Pipe clamp
(26) Fuel pipe rear grommet
(27) Bracket
(28) Clip
(29) Evaporation hose C
(30) Clamp
(31) Fuel filler hose
(32) Clamp
(33) PCV drain tube
(34) Grommet
(35) Hose connector
(36) Clip
(37) Hose clamp
(38) Evaporation hose D
(39) Evaporation hose E
(40) Pressure control solenoid valve ASSY
(41) Clip
(42) Evaporation hose F
(43) Evaporation hose G
(44) Drain hose
(45) Drain separator
(46) Drain separator bracket
(47) Hose connector
(48) Hose connector
(49) Grommet
(50) Drain tube A
(51) Leak check valve ASSY bracket
(52) Drain tube B
(53) Leak check valve ASSY
(54) Canister tube ASSY
(55) Canister
(56) Canister cover LH
(57) Center canister cover
(58) Canister cover RH

Tightening torque: N·m (kgf-m, ft-lb)
T1: 1.25 (0.1, 0.9)
T2: 2 (0.2, 1.5)
T3: 2.5 (0.3, 1.8)
T4: 7.5 (0.8, 5.5)
T5: 8 (0.8, 5.9)
T6: 13 (1.3, 9.6)
T7: 18 (1.8, 13.3)

* It can be reused if the quick connector side is disconnected.

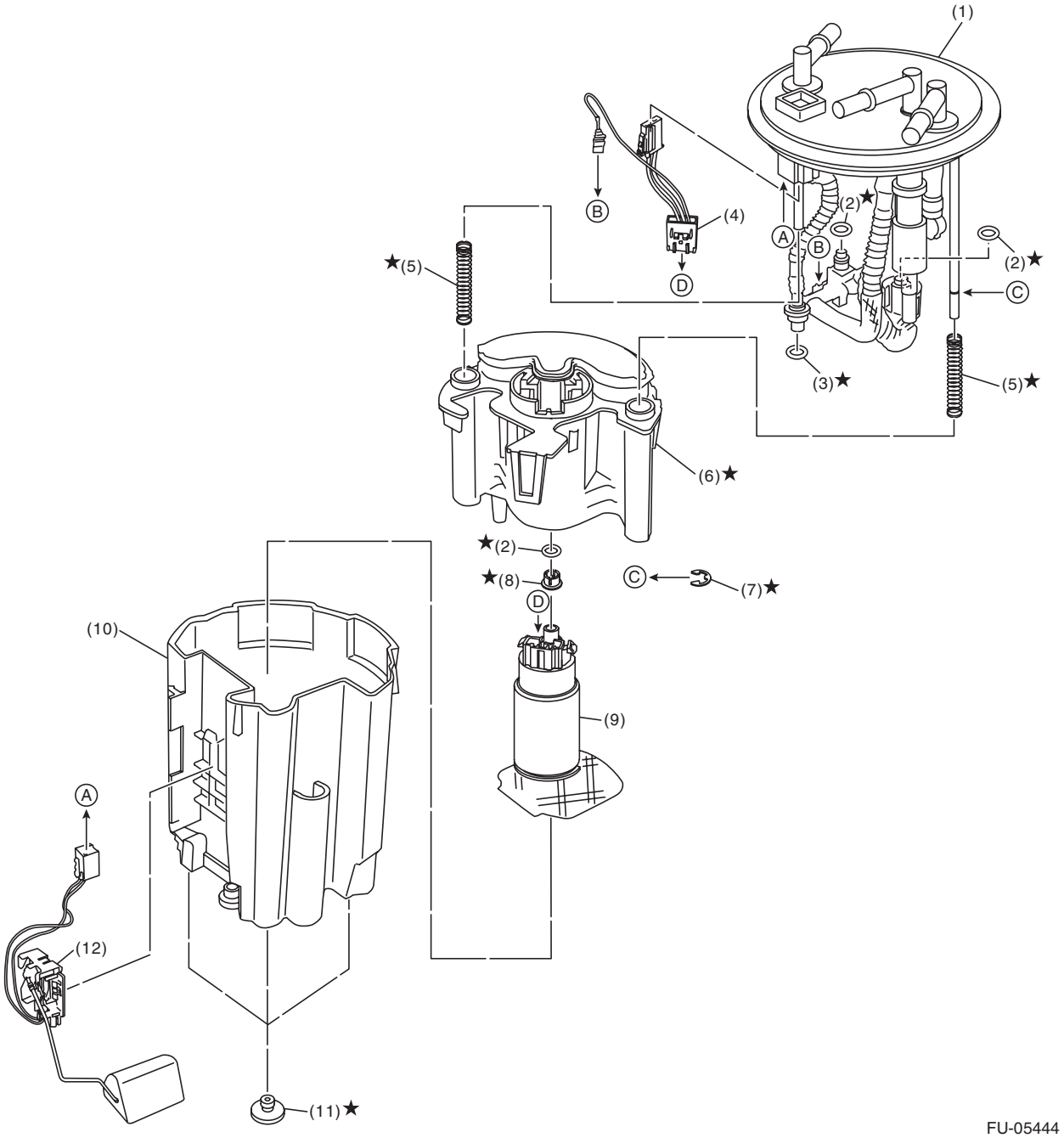
6. FUEL FILLER PIPE



(1) Fuel filler pipe
(2) Evaporation pipe A
(3) Fuel filler cap
(4) Clip
(5) Filler ring
(6) Filler pipe gasket
(7) Shut valve
(8) Clip
(9) Evaporation hose A
(10) Clip
(11) Evaporation hose B
(12) Grommet
(13) Evaporation pipe B
(14) Evaporation pipe protector
(15) Grommet
(16) Quick connector
(17) 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	(5)	Spring	(9)	Pump ASSY
(2)	O-ring	(6)	Fuel filter	(10)	Sub tank
(3)	O-ring	(7)	Clip	(11)	Cushion
(4)	Fuel pump harness	(8)	Spacer	(12)	Fuel level sensor

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- 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.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.
- When the suspension-related components have been removed and installed, be sure to adjust the steering angle sensor. <Ref. to VDC-13, ADJUSTMENT, VDC Control Module and Hydraulic Control Unit (VDC-CM&H/U).>

D: PREPARATION TOOL

1. SPECIAL TOOL

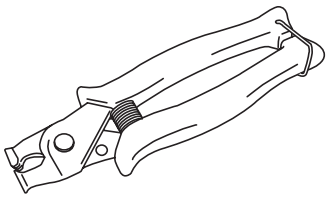
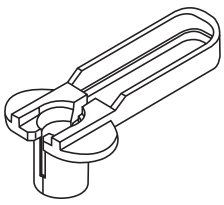
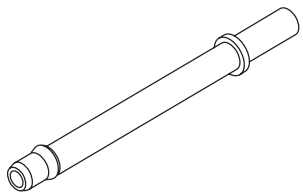
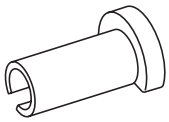
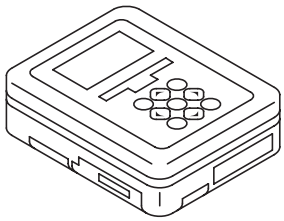
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18353AA000	18353AA000	CLAMP PLIERS	• Used for removing and installing the PCV hose. • This tool is made by the French company CAILLAU. (code) 54.0.000.205 To make it easier to obtain, it has been provided with a tool number.
 ST18371AA000	18371AA000	CONNECTOR REMOVER	Used for disconnecting the quick connector on the fuel return hose side of the engine compartment (intake manifold).

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for draining fuel.
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing the quick connector.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for draining fuel and each inspection.

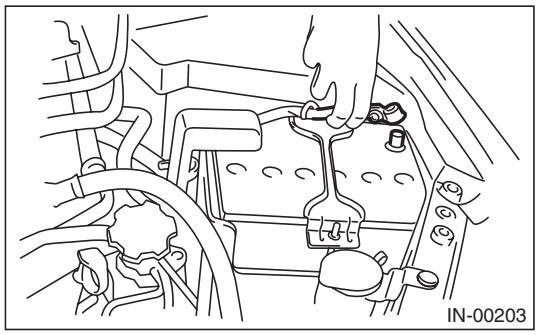
2. GENERAL TOOL

TOOL NAME	REMARKS
Circuit tester	Used for measuring resistance and voltage.
Oscilloscope	Used for inspecting the waveform of each sensor.

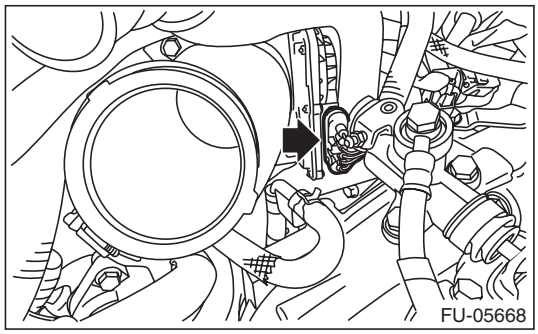
2. Throttle Body

A: REMOVAL

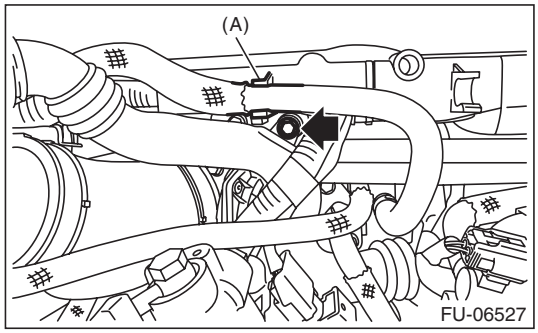
1) Disconnect the ground cable from battery.



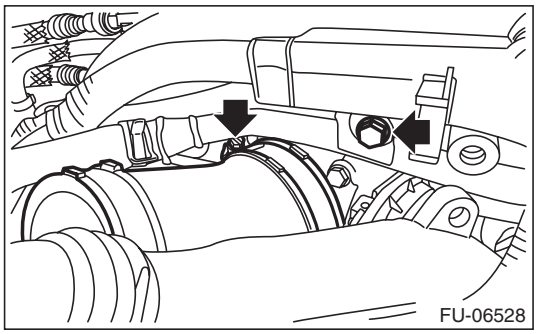
2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(w/o STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Remove the intercooler. <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
6) Disconnect the connectors from the throttle position sensor.



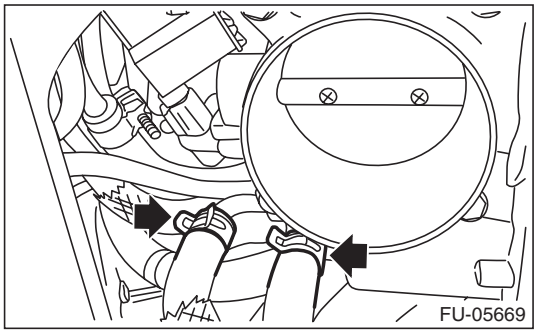
7) Remove the brake booster vacuum hose from the clip (A), and remove the bolts securing the air bypass pipe to the intake manifold.



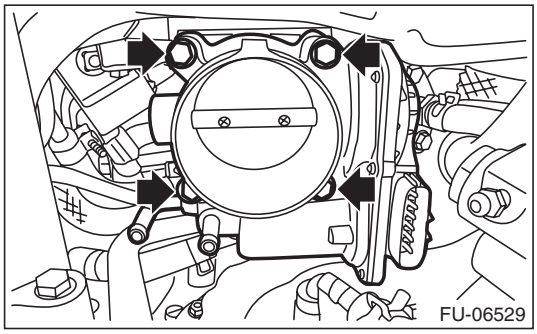
8) Remove the bolts securing the PCV pipe assembly to the intake manifold, and remove the intake duct from the throttle body.



9) Disconnect the engine coolant hose from throttle body.



10) Remove the throttle body from the intake manifold.

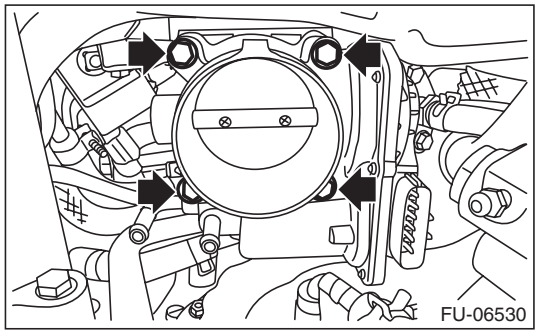


B: INSTALLATION

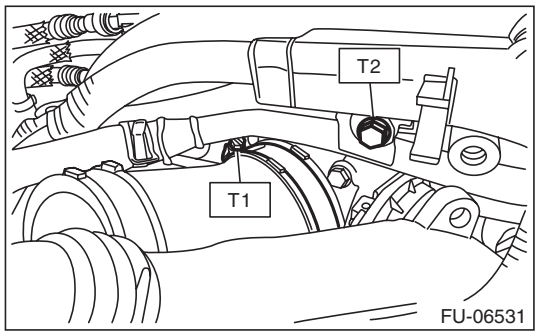
Install in the reverse order of removal.

NOTE:
Use new O-rings.

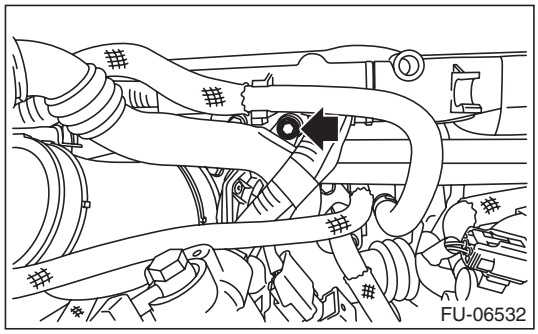
Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



Tightening torque:
T1: 3 N·m (0.3 kgf-m, 2.2 ft-lb)
T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



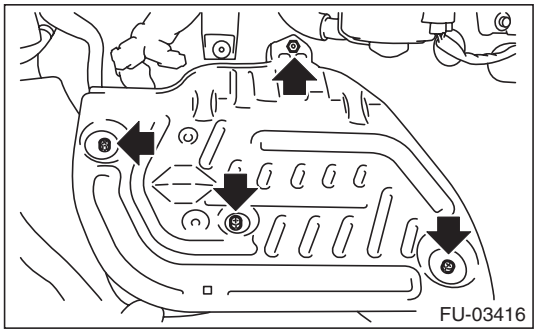
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



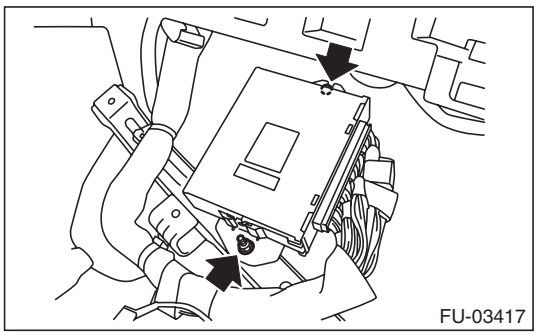
C: INSPECTION

1. THROTTLE SENSOR INSPECTION (METHOD WITH CIRCUIT TESTER)

1) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
2) Turn over the floor mat of passenger's seat.
3) Remove the protect cover.

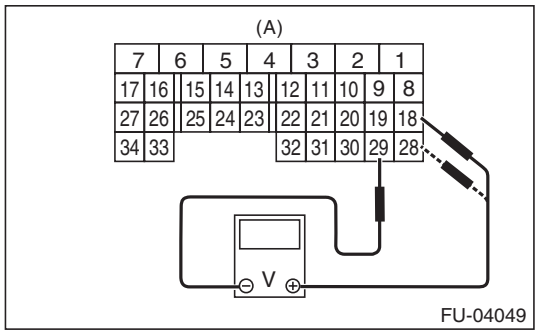


4) Remove the nuts and bolts which hold the ECM to the bracket.



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

7) After inspection, install the related parts in the reverse order of removal.

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

2. THROTTLE SENSOR INSPECTION (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(H4DOTC)(diag)-40, 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

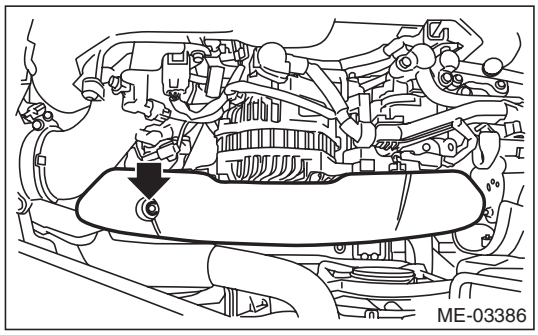
3. OTHER INSPECTIONS

1) Check that the throttle body has no deformation, cracks or other damages.
2) Check that the engine coolant hose has no cracks, damage or loose part.

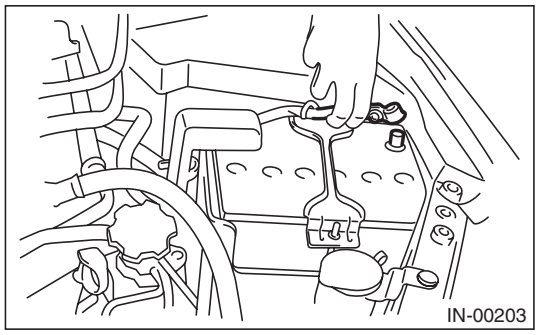
3. Intake Manifold

A: REMOVAL

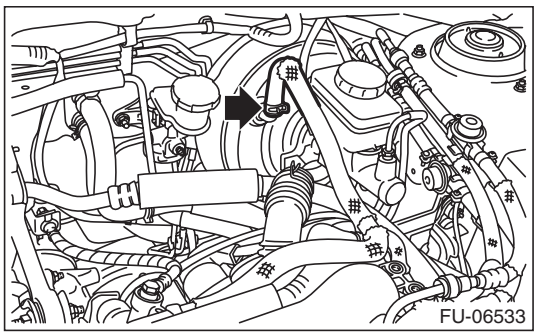
1) Remove the V-belt covers.



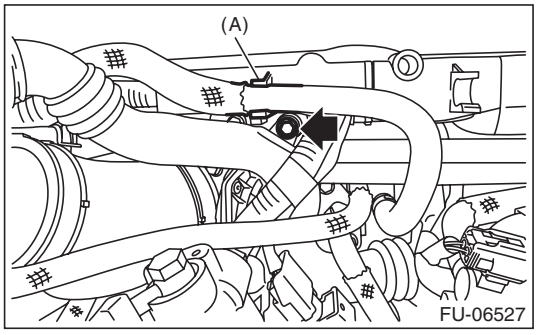
2) Collect the refrigerant from A/C system. <Ref. to AC-19, PROCEDURE, Refrigerant Recovery Procedure.>
3) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
4) Disconnect the ground cable from battery.



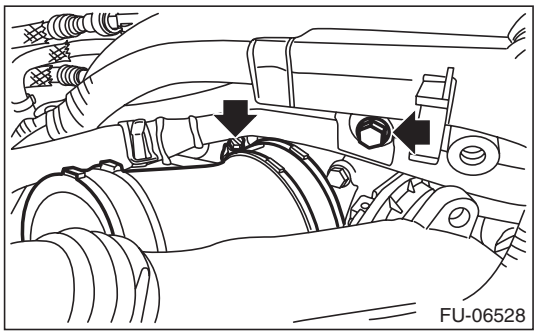
5) Open the fuel filler lid and remove the fuel filler cap.
6) Lift up the vehicle.
7) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
8) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(w/o STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
9) Remove the air intake duct and air cleaner case. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.> <Ref. to IN(w/o STI)-8, REMOVAL, Air Cleaner Case.>
10) Remove the intercooler. <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
11) Remove the generator. <Ref. to SC(STI)-21, REMOVAL, Generator.>
12) Remove the coolant filler tank. <Ref. to CO(w/o STI)-28, REMOVAL, Coolant Filler Tank.>
13) Disconnect the A/C pressure hoses from A/C compressor. <Ref. to AC-38, REMOVAL, Hose and Pipe.>
14) Disconnect the brake booster vacuum hose.



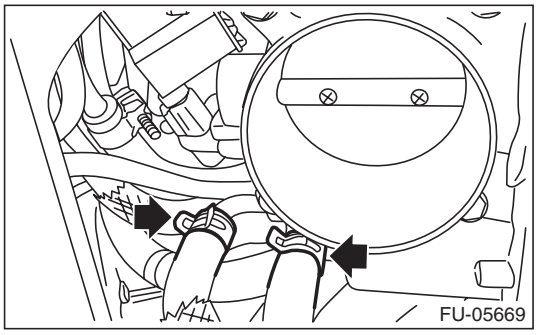
15) Remove the brake booster vacuum hose from the clip (A), and remove the bolts securing the air bypass pipe to the intake manifold.



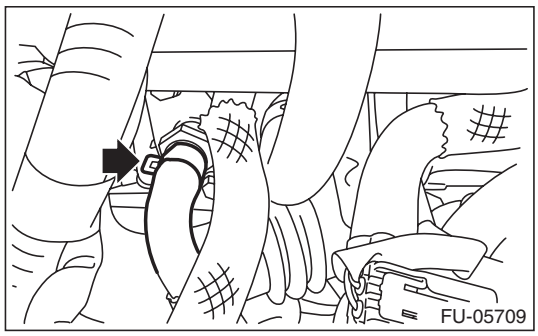
16) Remove the bolts securing the PCV pipe assembly to the intake manifold, and remove the intake duct from the throttle body.



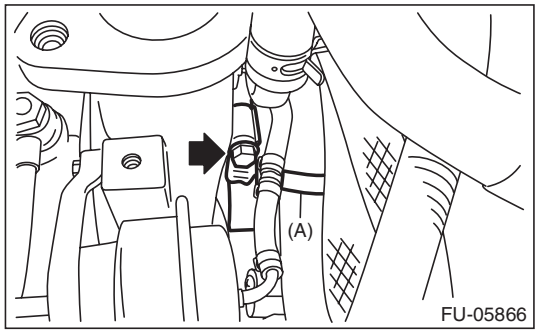
17) Disconnect the engine coolant hose from throttle body.



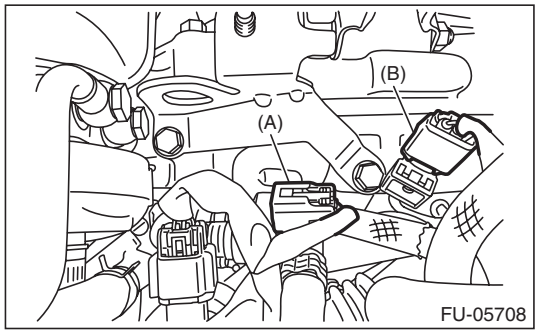
18) Disconnect the vacuum hose from nipple.



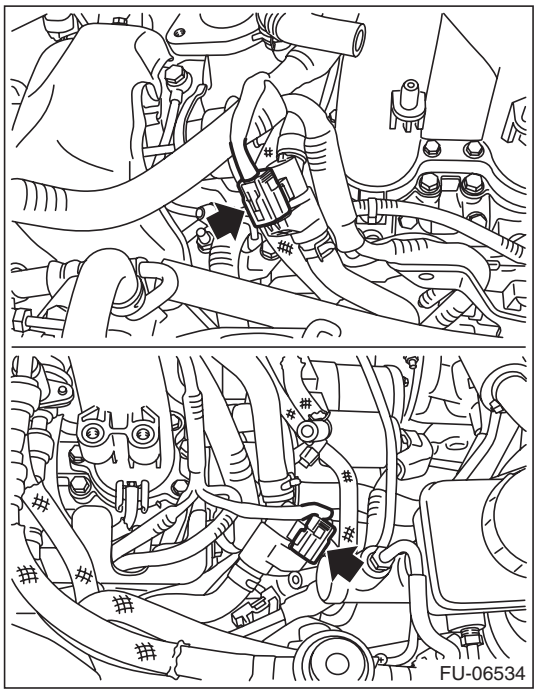
19) Disconnect the air control hose (A) from the waste gate actuator, and loosen the clamp which holds the intake duct to the turbocharger.



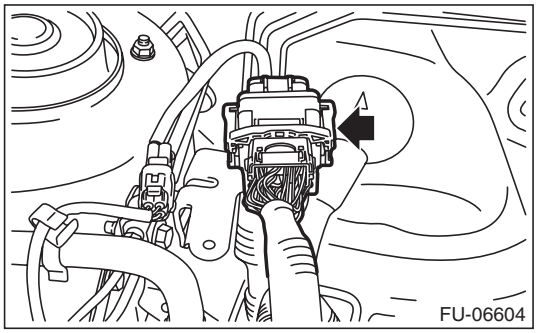
20) Disconnect the connector (A) from the PCV hose assembly A and the connector (B) from the knock sensor.



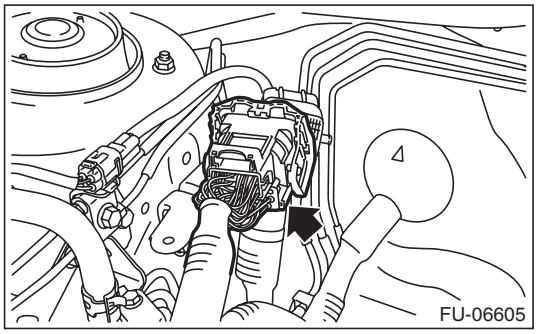
21) Disconnect the connector from the PCV hose assembly B and PCV hose assembly C.



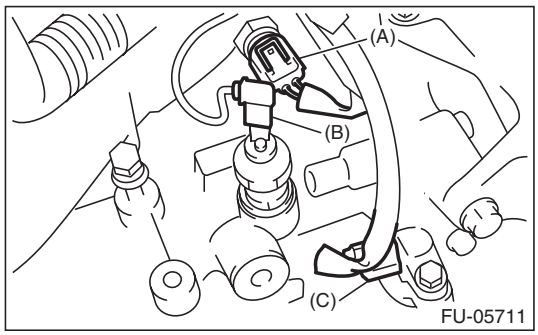
22) Disconnect the bulkhead harness connectors from the engine harness connectors.



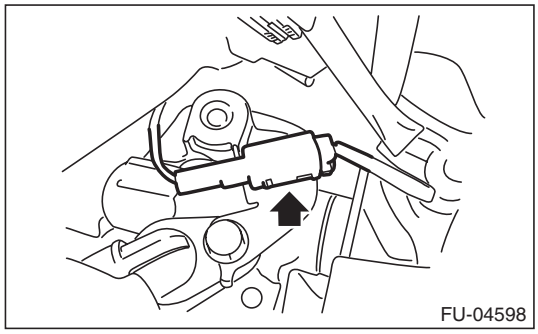
23) Remove the engine harness connector from the engine harness bracket.



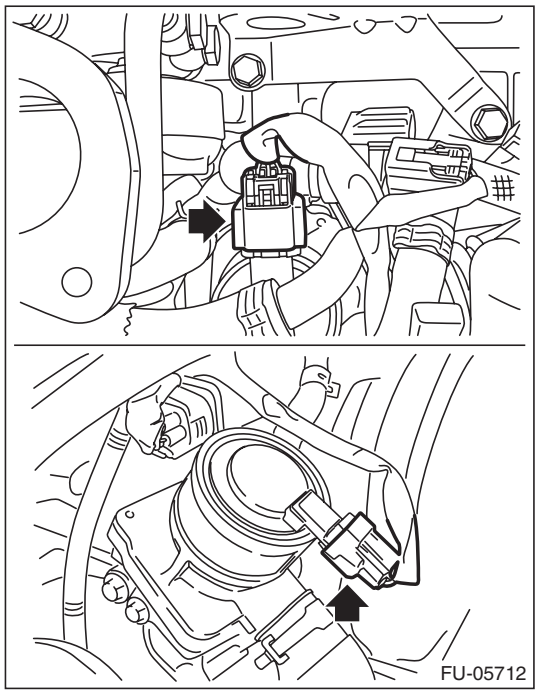
24) Disconnect the connector (A) from the engine coolant temperature sensor, connector (B) from the oil pressure switch, and connector (C) from the crankshaft position sensor.



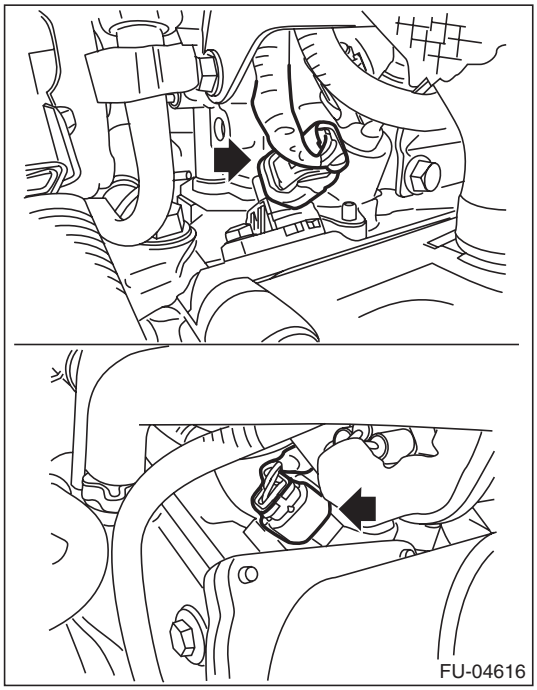
25) Disconnect the connector from power steering pump switch.



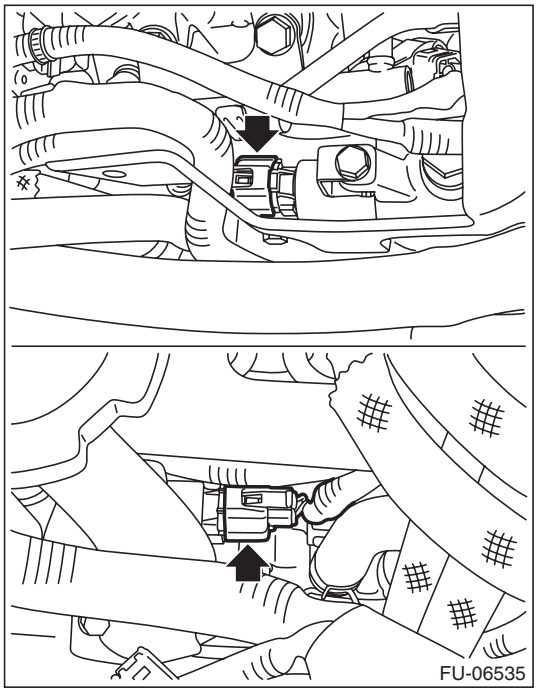
26) Disconnect the connector from the secondary air combination valve.



27) Disconnect the connector from camshaft position sensor.

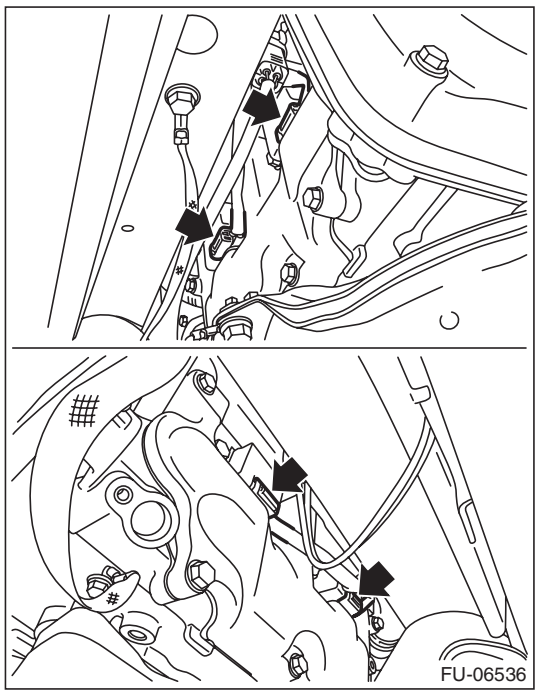


28) Disconnect the connector from the oil flow control solenoid valve.



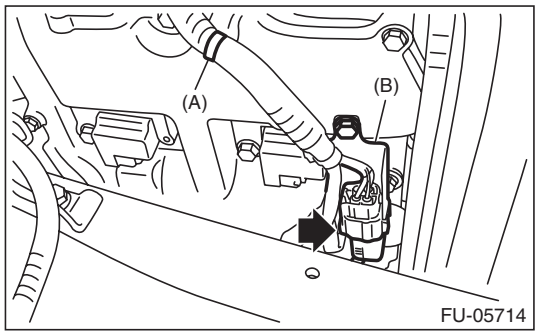
29) Lift up the vehicle.

30) Disconnect the connector from ignition coil.



31) Lower the vehicle.

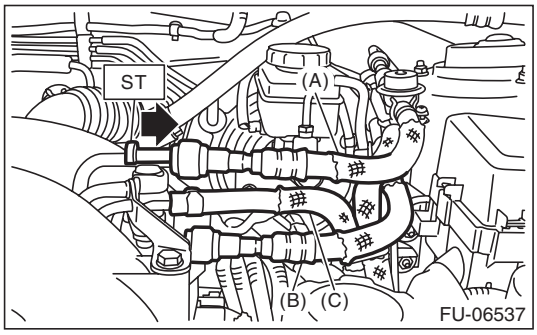
32) Disconnect the connector from the front oxygen (A/F) sensor, and remove the clip (A) and stay (B) which hold the engine harness to the rocker cover RH.



33) 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.**



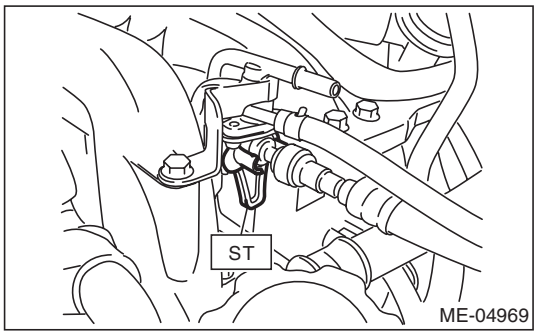
(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

34) Disconnect the fuel return hose using the ST.

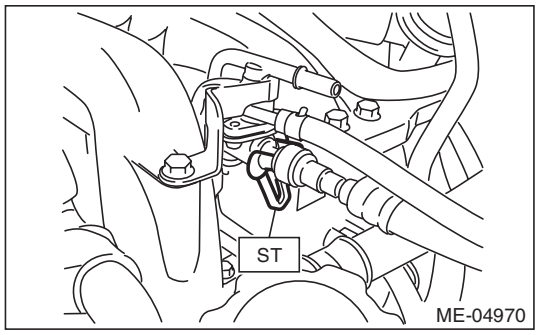
ST 18371AA000 CONNECTOR REMOVER

CAUTION:
- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**

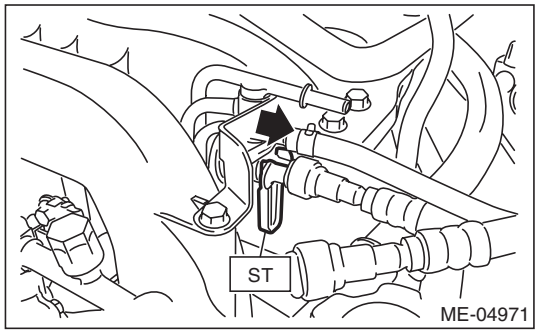
(1) Attach ST to the fuel return pipe as shown in the figure.



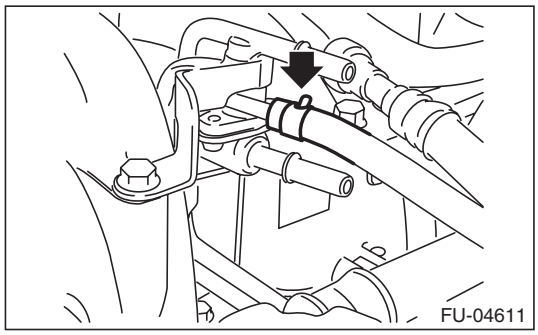
(2) Insert the front side of ST into the quick connector.



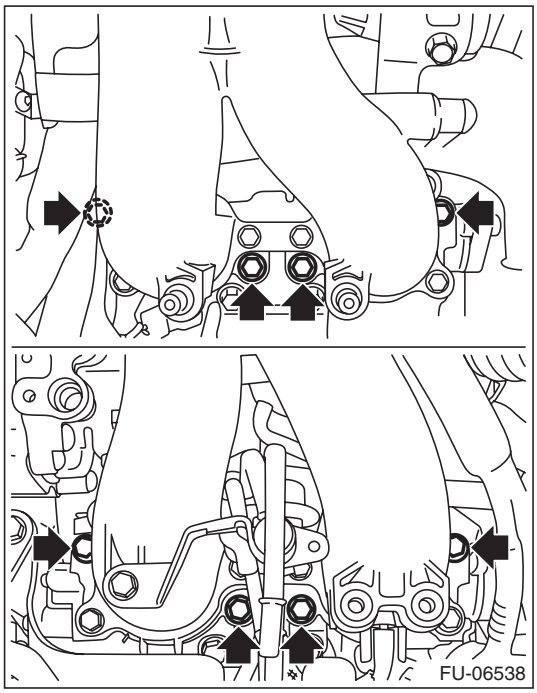
(3) Insert the back side of ST into the quick connector and push ST in the direction of arrow mark to disconnect the fuel return hose.



35) Remove the clip and disconnect the evaporation hose from the fuel pipe.



36) Remove the intake manifold from cylinder head.

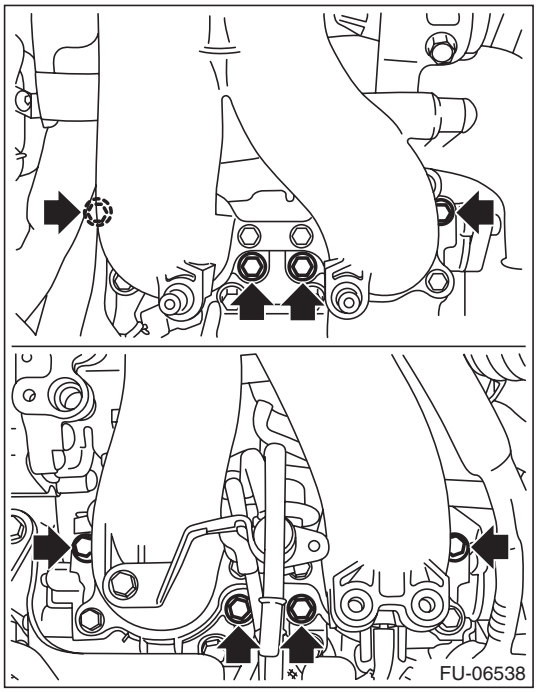


B: INSTALLATION

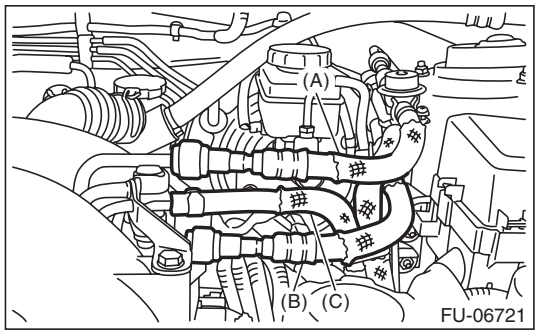
1) Install the intake manifold onto cylinder heads.

NOTE:
Use a new gasket.

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)



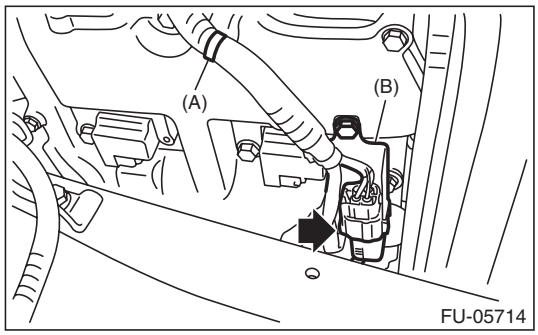
2) Connect the fuel delivery hose, fuel return hose, and evaporation hose.



(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

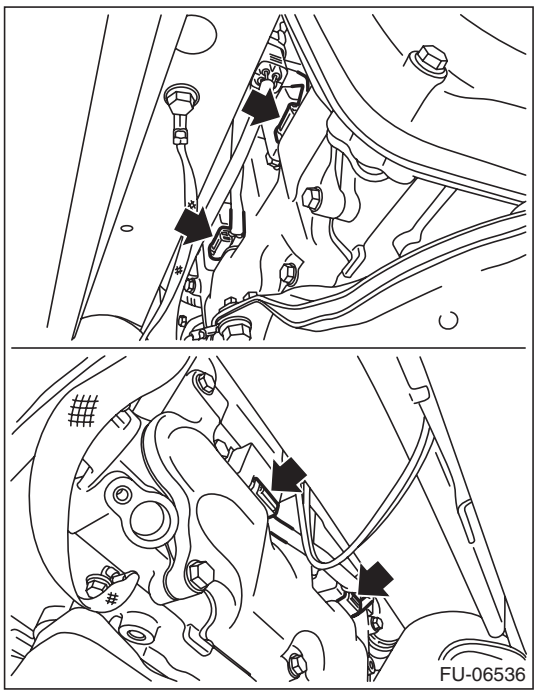
3) Connect the front oxygen (A/F) sensor connector, and secure the engine harness to the rocker cover RH with clip (A) and stay (B).

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

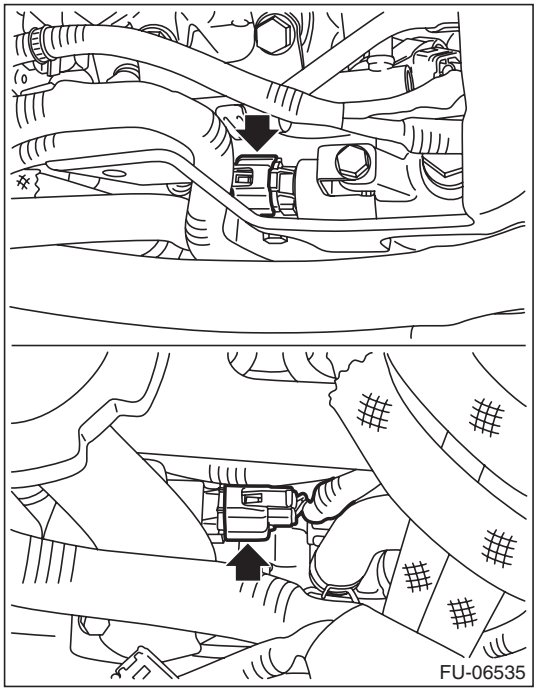


4) Lift up the vehicle.

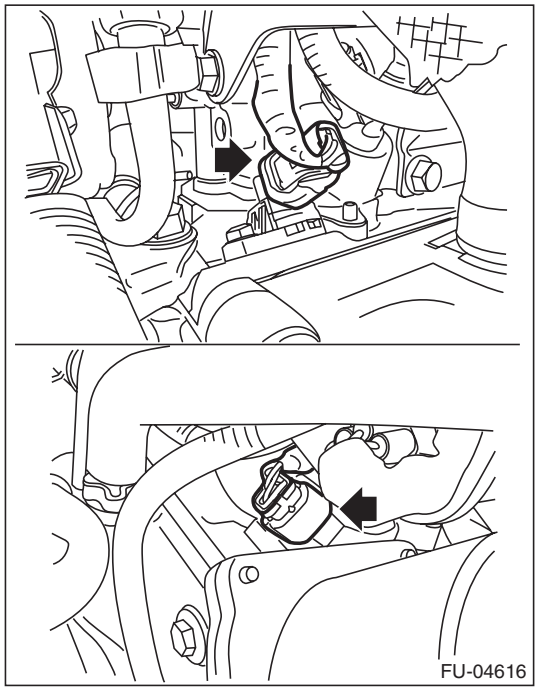
5) Connect the connector to the ignition coil.



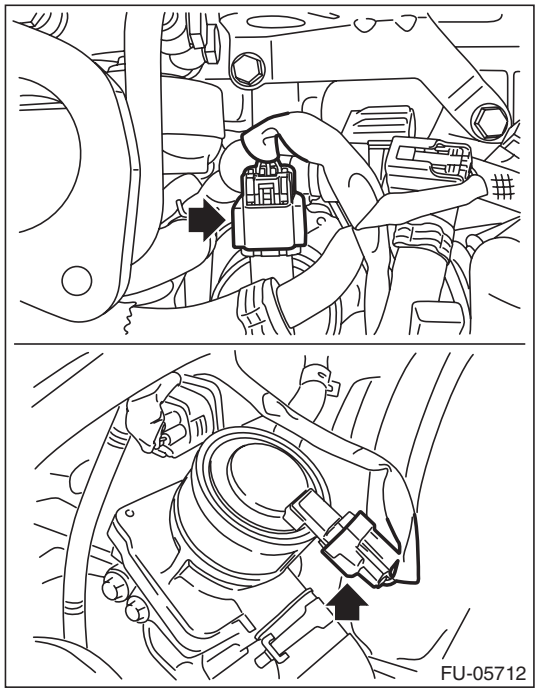
6) Lower the vehicle.
7) Connect the connector to oil flow control solenoid valve.



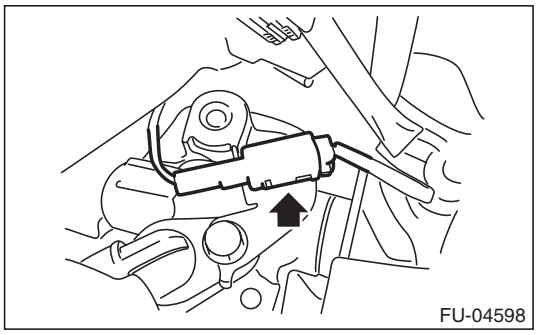
8) Connect the connectors to camshaft position sensor.



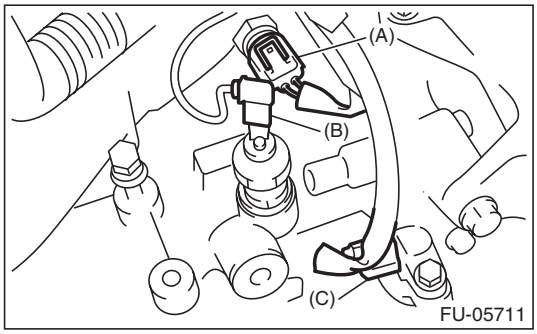
9) Connect the connector to the secondary air combination valve.



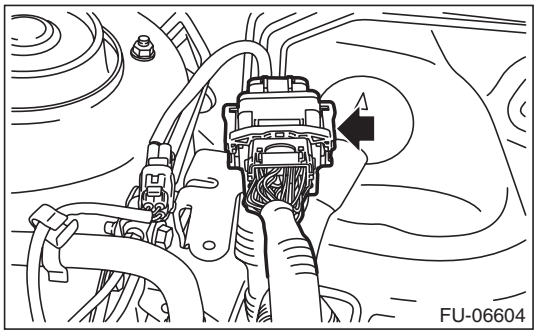
10) Connect the connector to the power steering pump switch.



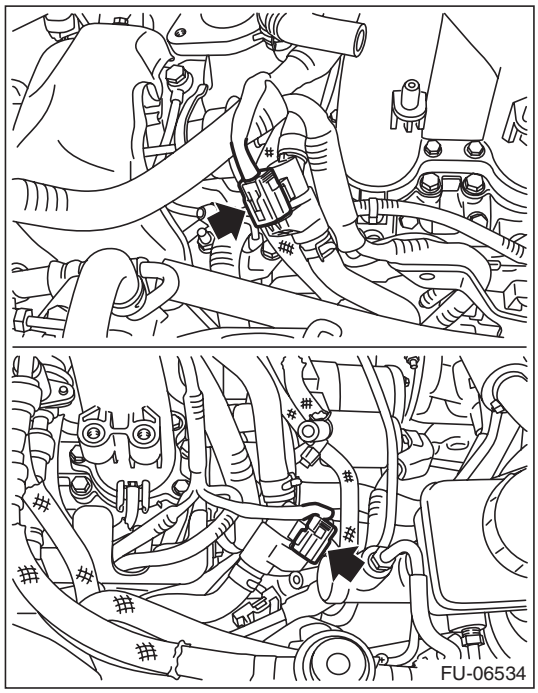
11) Connect the connector (A) to the engine coolant temperature sensor, connector (B) to the oil pressure switch, and the connector (C) to the crankshaft position sensor.



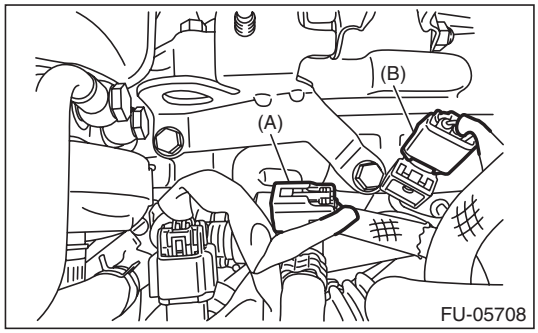
12) Install the engine harness connector to engine harness bracket, then connect the bulkhead harness connector to the engine harness connector.



13) Connect the connector to the PCV hose assembly B and PCV hose assembly C.

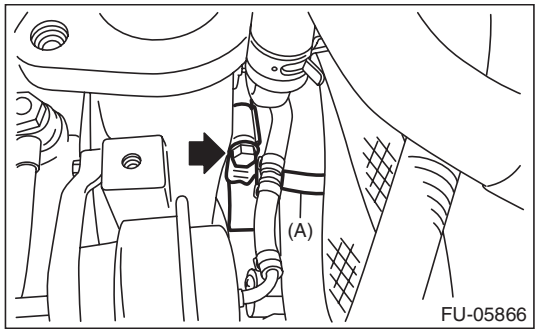


14) Connect the connector (A) to the PCV hose assembly A and the connector (B) to the knock sensor.

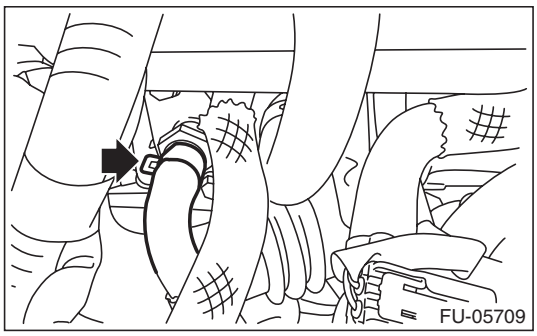


15) Connect the air control hose (A) to the wastegate actuator, and install the turbocharger to the intake duct.

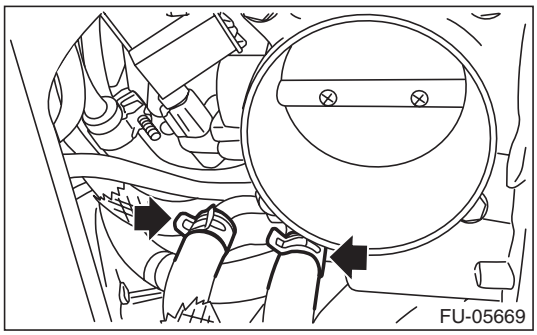
Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



16) Connect the vacuum hose to the nipple.

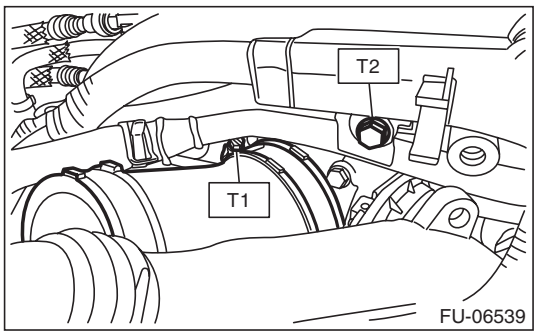


17) Connect the engine coolant hoses to throttle body.



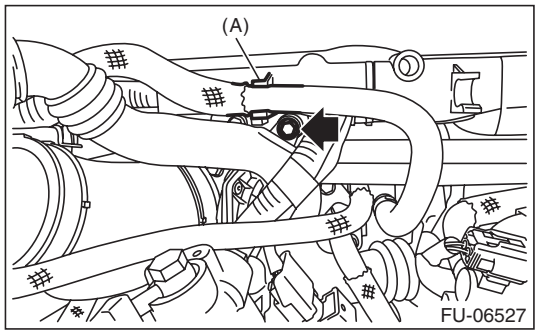
18) Install the intake duct to the throttle body, and install the bolts which secure the PCV pipe assembly to the intake manifold.

Tightening torque:
T1: 3 N·m (0.3 kgf-m, 2.2 ft-lb)
T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

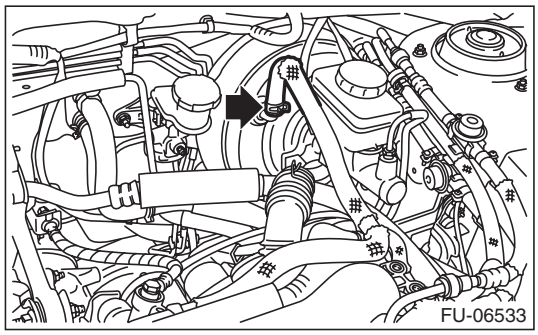


19) Install the bolts which secure the air bypass pipe to the intake manifold, and install the brake booster vacuum hose to the clip (A).

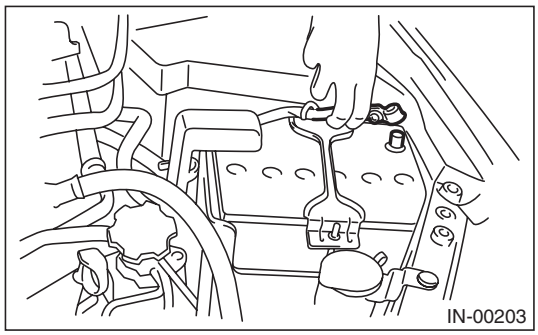
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



20) Connect the brake booster vacuum hose.

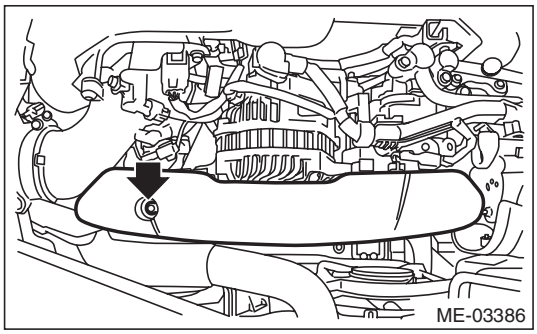


21) Install the A/C pressure hoses to A/C compressor. <Ref. to AC-38, INSTALLATION, Hose and Pipe.>
22) Install the coolant filler tank. <Ref. to CO(w/o STI)-28, INSTALLATION, Coolant Filler Tank.>
23) Install the generator. <Ref. to SC(STI)-21, INSTALLATION, Generator.>
24) Install the intercooler. <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>
25) Install the air intake duct and air cleaner case. <Ref. to IN(w/o STI)-8, INSTALLATION, Air Cleaner Case.> <Ref. to IN(w/o STI)-10, INSTALLATION, Air Intake Duct.>
26) Connect the battery ground terminal.



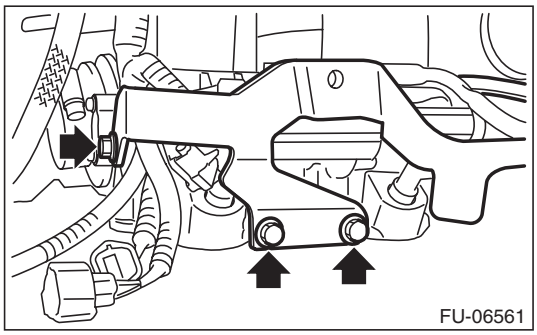
27) Lift up the vehicle.
28) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
29) Lower the vehicle.
30) Fill engine coolant. <Ref. to CO(w/o STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
31) Charge the A/C system with refrigerant. <Ref. to AC-20, PROCEDURE, Refrigerant Charging Procedure.>
32) Install the V-belt cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

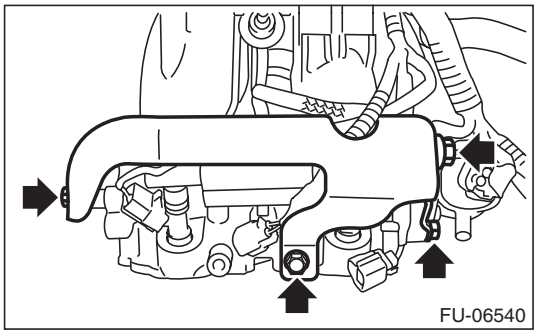


C: DISASSEMBLY

1) Remove the fuel pipe protector RH from the intake manifold.

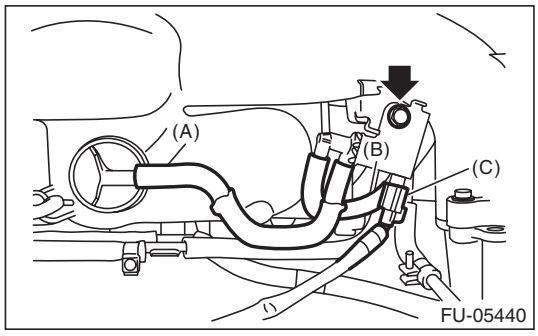


2) Remove the engine ground terminal from the fuel pipe protector LH and remove the fuel pipe protector LH from the intake manifold.

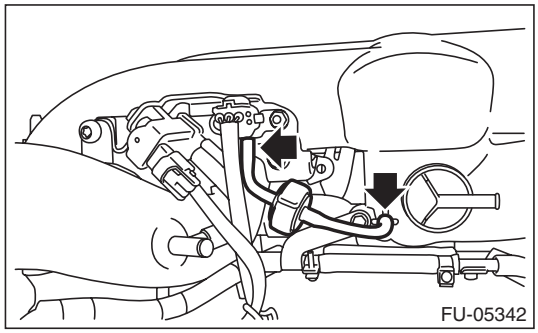


3) Disconnect the vacuum hose (A) from intake manifold.

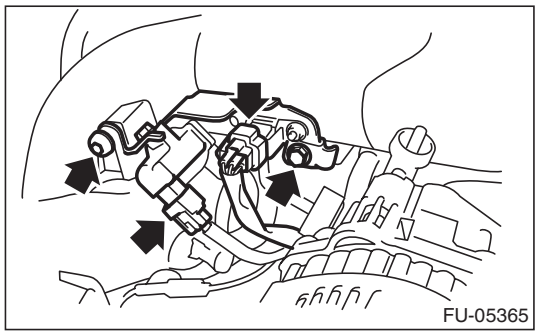
4) Disconnect the vacuum hose (B) and the connector (C) from the fuel pipe, and remove the purge control solenoid valve 1 from the intake manifold.



5) Disconnect the filter assembly.

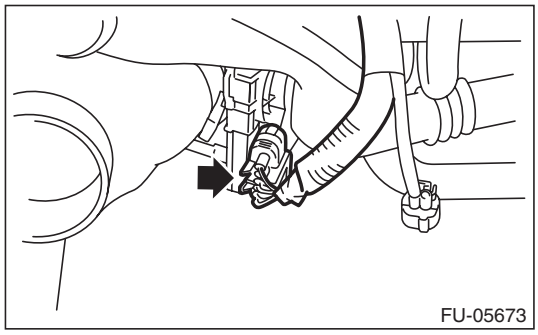


6) Disconnect the connector from the wastegate control solenoid valve and the manifold absolute pressure sensor, and remove the solenoid valve bracket assembly from the intake manifold.

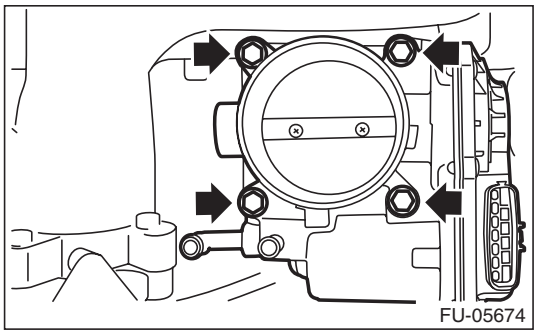


7) Disconnect the connector from the purge control solenoid valve 2, and disconnect the vacuum hose from the intake duct and the fuel pipe.

8) Disconnect the connectors from the throttle position sensor.

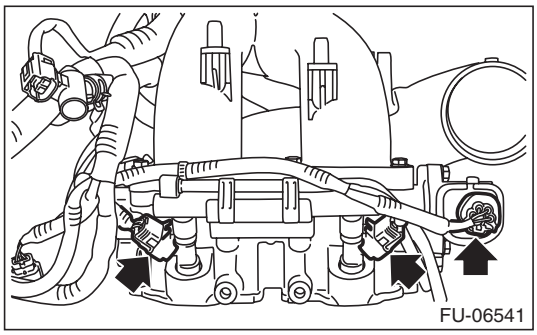


9) Remove the throttle body from the intake manifold.

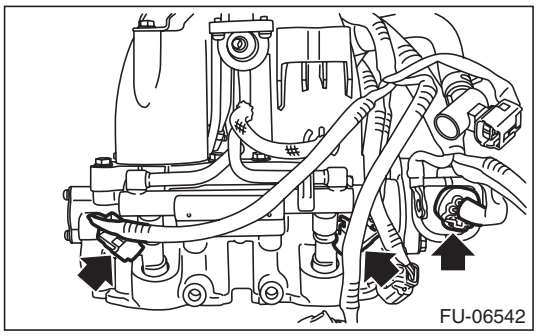


10) Disconnect the connector from the fuel injector and tumble generator valve assembly.

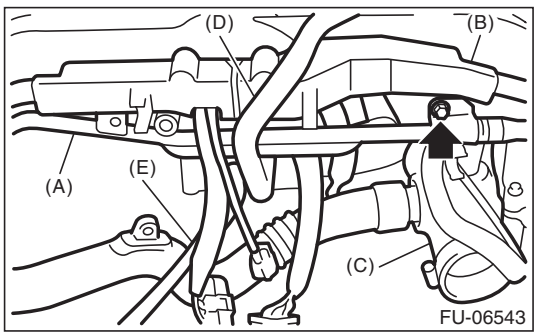
- RH side



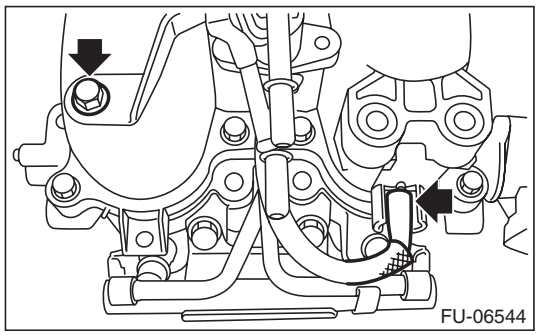
- LH side



11) Remove the PCV pipe (A), harness assembly (B), intake duct (C), brake booster vacuum hose (D) and vacuum hose (E) from the intake manifold.

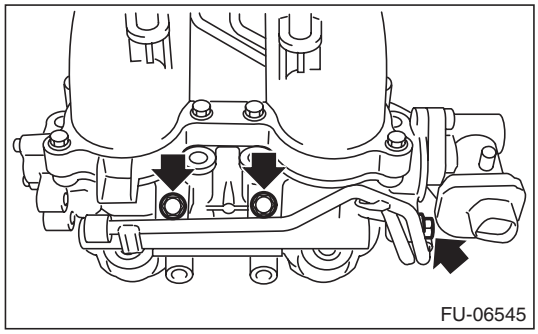


12) Remove the bolt which secures the fuel injector pipe LH onto the intake manifold, and disconnect the pressure regulator vacuum hose from the intake manifold.

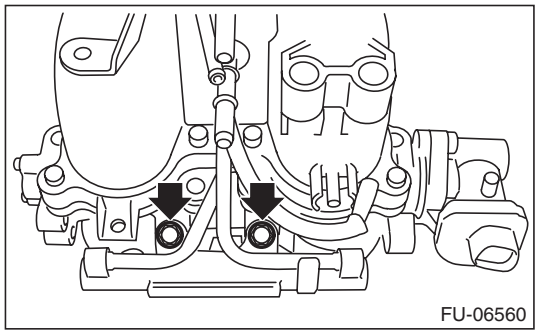

FU-06544

13) Remove the bolts which hold fuel injector pipe onto intake manifold.

- RH side

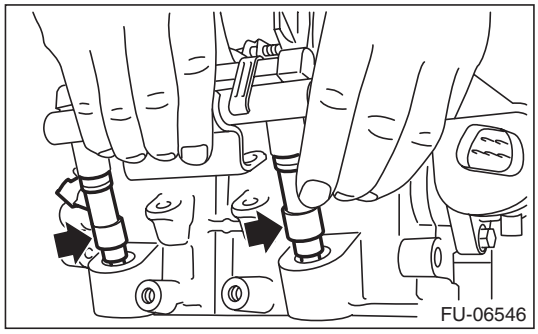

FU-06545

- LH side

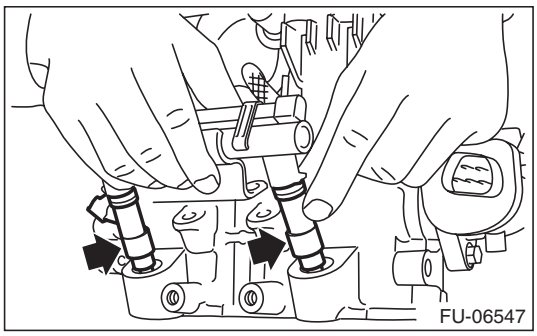

FU-06560

14) Remove the fuel injector.

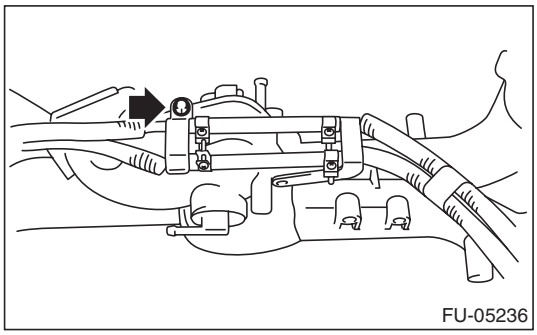
- RH side


FU-06546

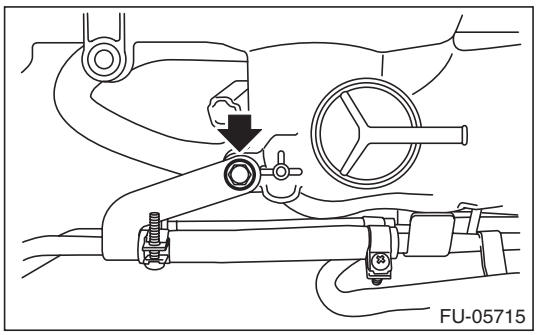
- LH side


FU-06547

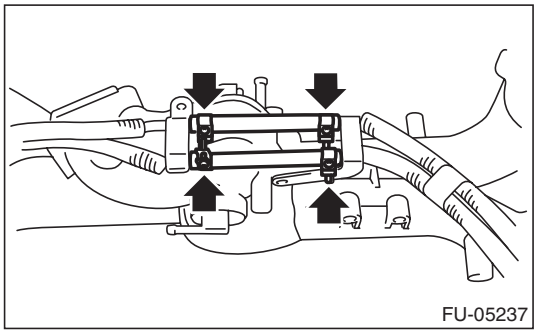
15) Remove the bolts which hold fuel pipe onto intake manifold.


FU-05236

16) Remove the bolt which holds fuel injector pipe RH onto intake manifold.

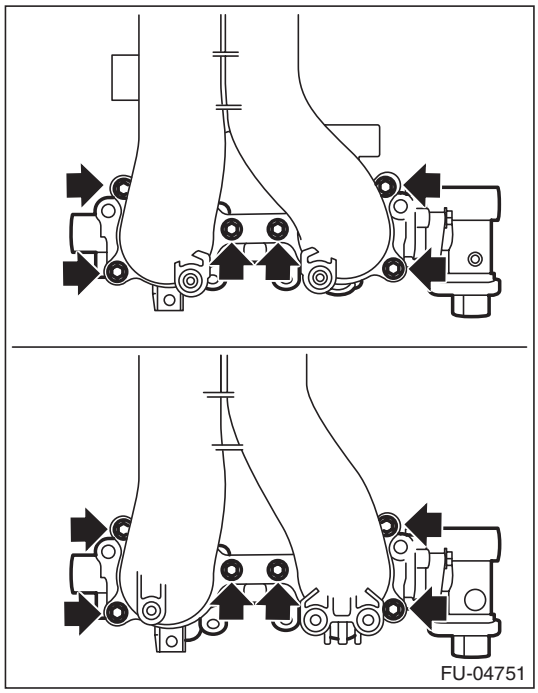

FU-05715

17) Loosen the clamp which holds the fuel hose to the fuel injector pipe RH and the fuel pipe, and then disconnect the pipe from the fuel hose.

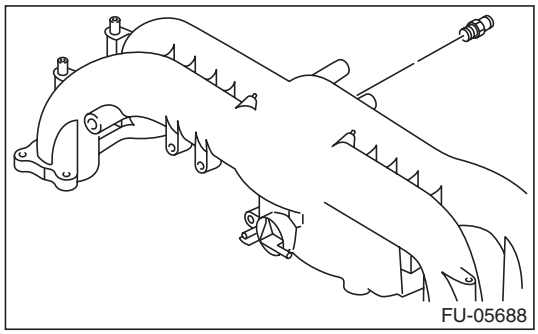

FU-05237

18) Remove the fuel injector pipe and the fuel pipe.

19) Remove the tumble generator valve assembly from the intake manifold.



20) Remove the nipple from the intake manifold.

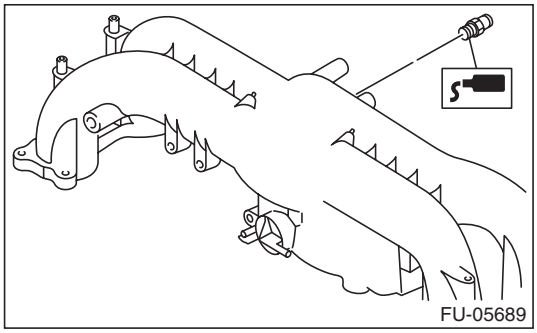


D: ASSEMBLY

1) Apply liquid gasket to the nipple threads, and install the nipple to the intake manifold.

Liquid gasket:
THREE BOND 1105 (Part No. 004403010) or equivalent

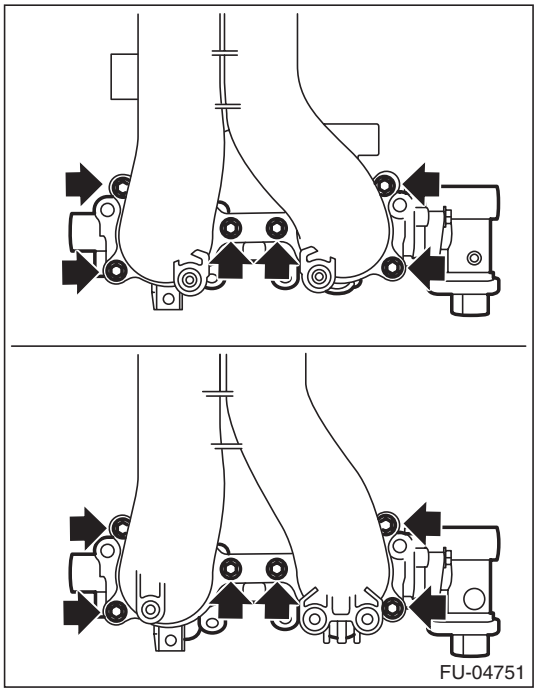
Tightening torque:
23 N·m (2.3 kgf-m, 17.0 ft-lb)



2) Install the tumble generator valve assembly onto intake manifold.

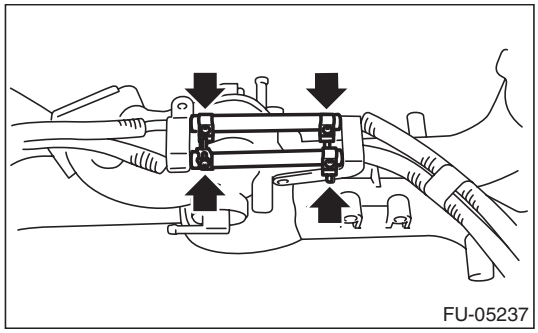
NOTE:
Use new O-rings.

Tightening torque:
8.3 N·m (0.8 kgf-m, 6.1 ft-lb)



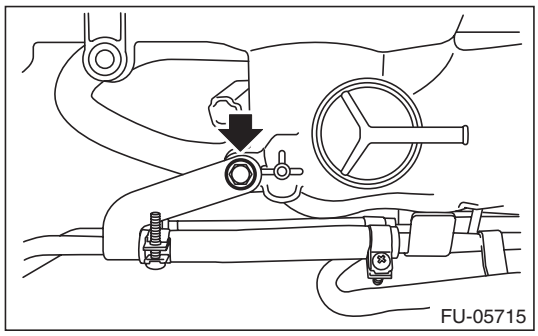
3) Install the fuel injector pipe.

4) Connect fuel hoses to the fuel injector pipe and the fuel pipe. <Ref. to FU(w/o STI)-93, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>


FU-05237

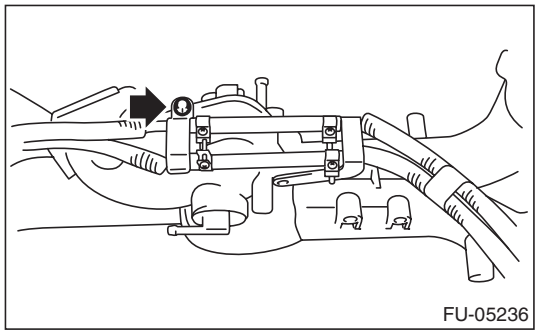
5) Secure the fuel injector pipe RH to intake manifold with bolt.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)


FU-05715

6) Secure the fuel pipe to intake manifold with bolts.

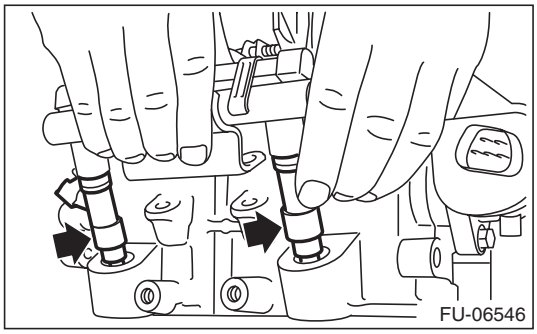
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)


FU-05236

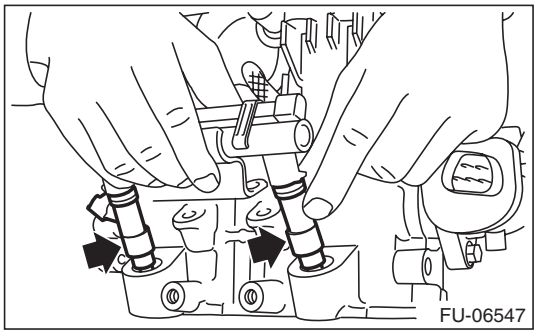
7) Install the fuel injector.

NOTE:
Use new O-rings, rubbers and seal rings.

- RH side


FU-06546

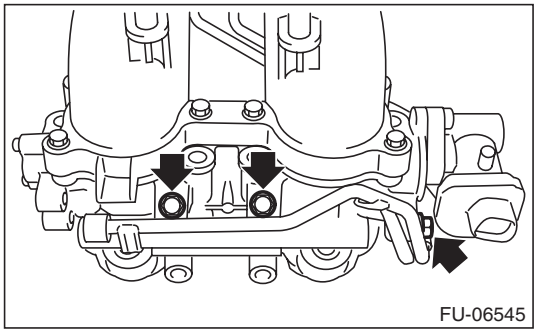
- LH side


FU-06547

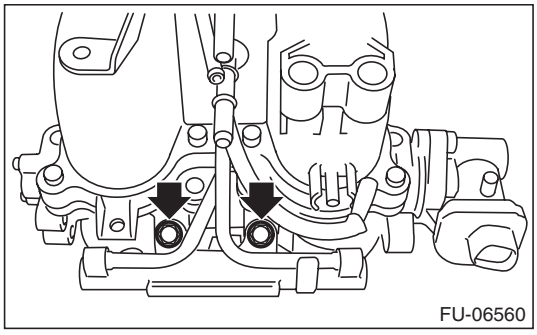
8) Secure the fuel injector pipe to intake manifold with bolts.

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

- RH side

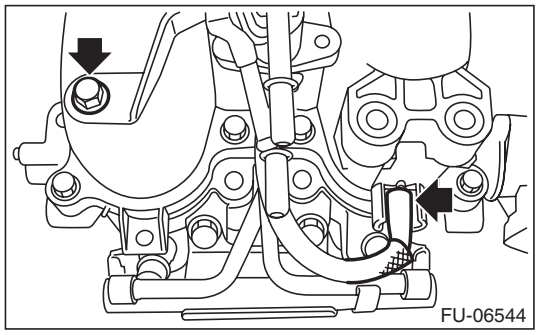

FU-06545

- LH side


FU-06560

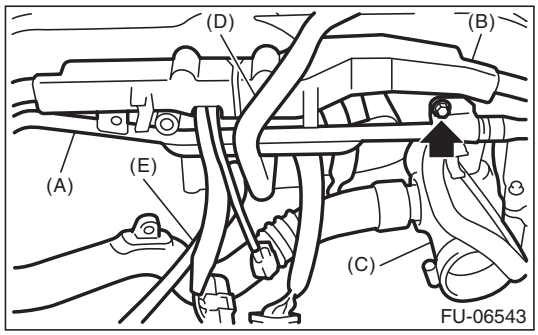
9) Secure the fuel injector pipe LH to intake manifold with bolt, and connect the pressure regulator vacuum hose to the intake manifold.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



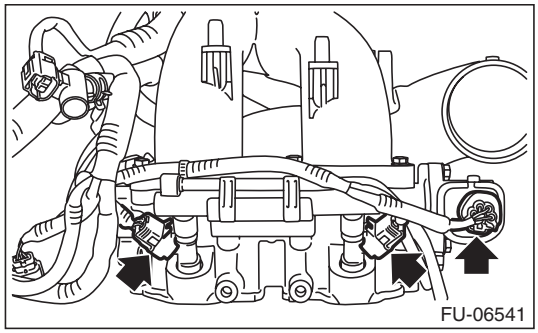
10) Install the PCV pipe (A), harness assembly (B), intake duct (C), brake booster vacuum hose (D) and vacuum hose (E) to the intake manifold.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

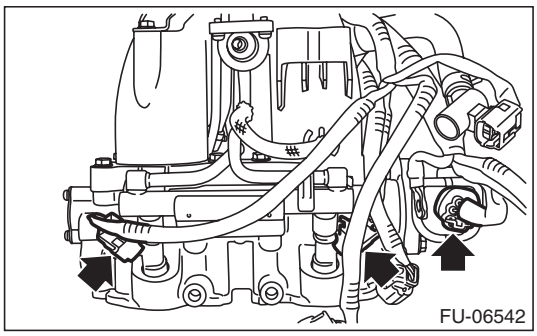


11) Connect the connector to the fuel injector and the tumble generator valve assembly.

• RH side



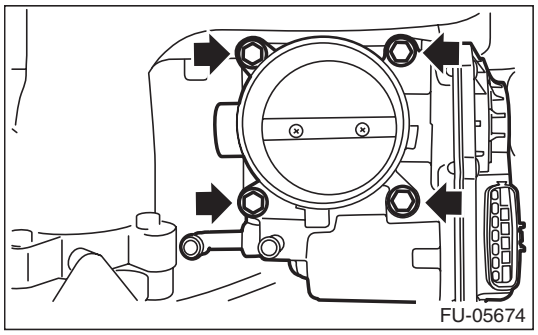
• LH side



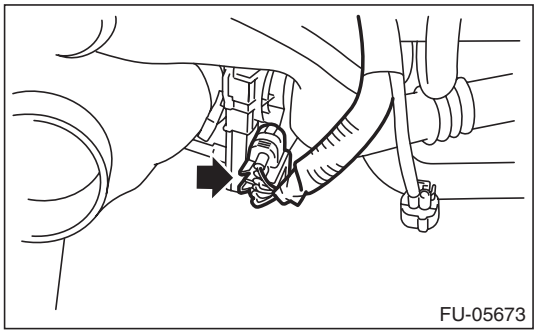
12) Install the throttle body to the intake manifold.

NOTE:
Use new O-rings.

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

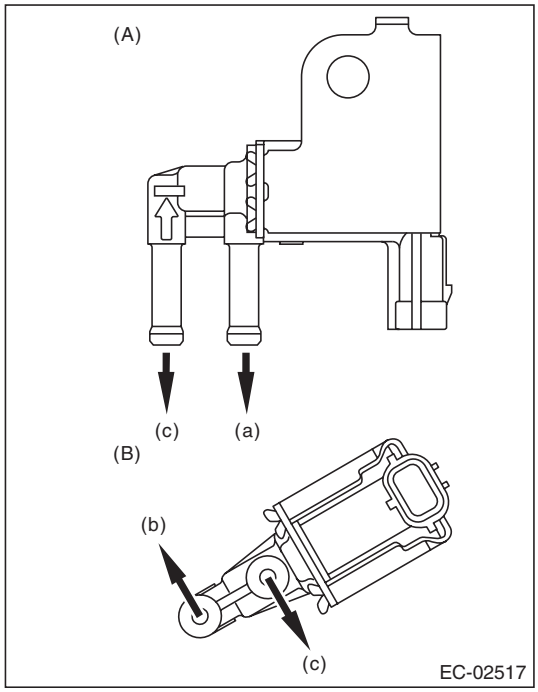


13) Connect the connector to the throttle position sensor.



14) Connect the vacuum hose to the intake duct and the fuel pipe, then connect the connector to the purge control solenoid valve 2.

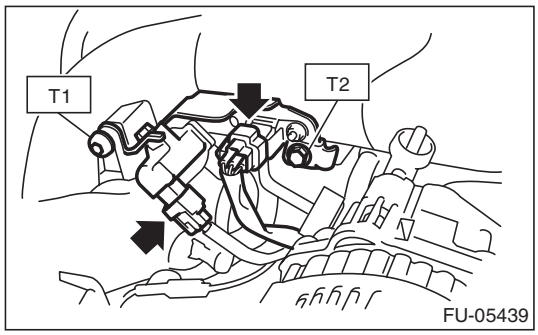
NOTE:
Connect the vacuum hose as shown in the figure.



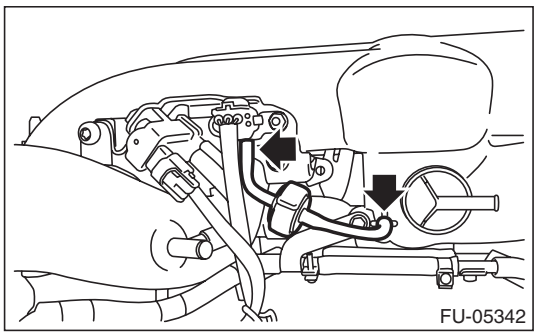
(A) Purge control solenoid valve 1
(B) Purge control solenoid valve 2
(a) To intake manifold
(b) To intake duct
(c) To fuel pipe

15) Install the solenoid valve bracket assembly to the intake manifold, and connect the connector to the wastegate control solenoid valve and the manifold absolute pressure sensor.

Tightening torque:
T1: 17 N·m (1.7 kgf-m, 12.5 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)

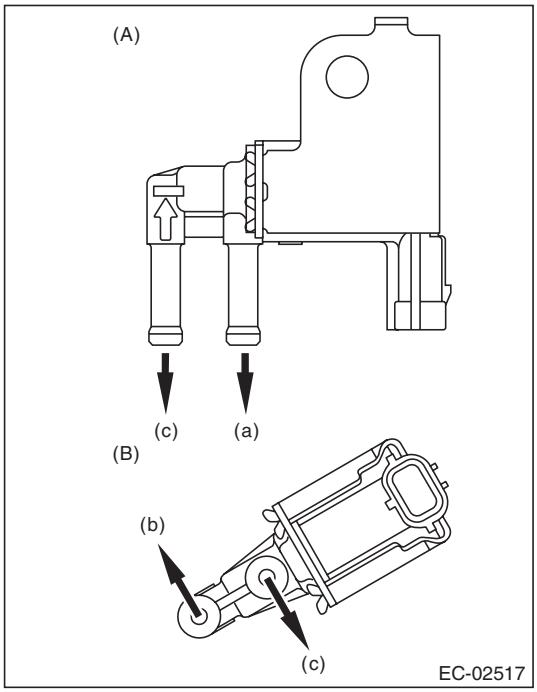


16) Connect the filter assembly.



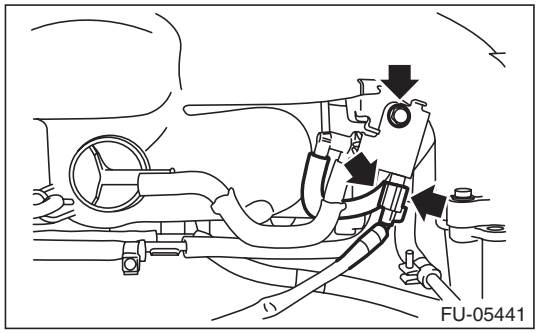
17) Connect the vacuum hose and the connector the fuel pipe, and install the purge control solenoid valve 1 to the intake manifold.

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



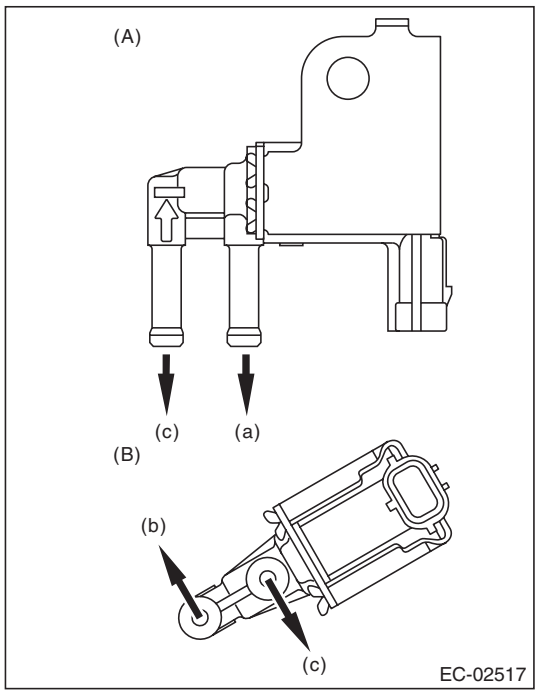
(A) Purge control solenoid valve 1
(B) Purge control solenoid valve 2
(a) To intake manifold
(b) To intake duct
(c) To fuel pipe

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

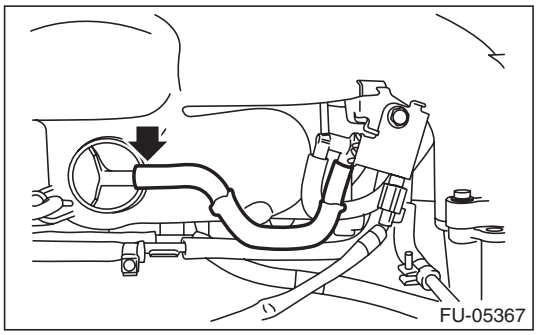


18) Connect the vacuum hose to the intake manifold.

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

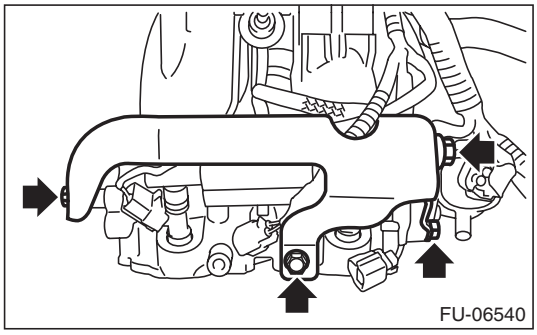


(A) Purge control solenoid valve 1
(B) Purge control solenoid valve 2
(a) To intake manifold
(b) To intake duct
(c) To fuel pipe



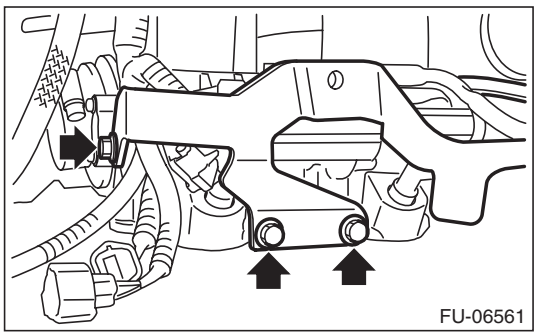
19) Install the fuel pipe protector LH to the intake manifold, and install the engine ground terminal to the fuel pipe protector LH.

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



20) Install the fuel pipe protector RH to the intake manifold.

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



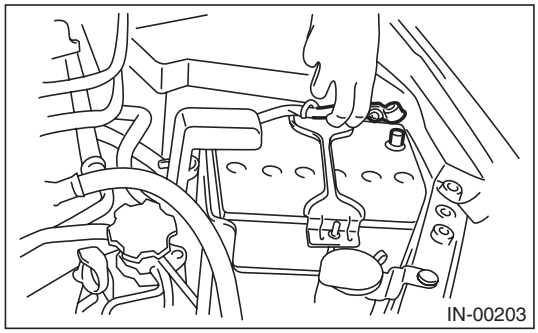
E: INSPECTION

1) Check that the intake manifold and fuel pipe have no deformation, cracks and other damages.
2) Check that the hose has no cracks, damage or loose part.

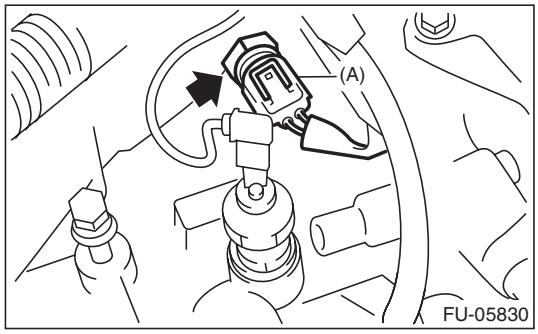
4. Engine Coolant Temperature Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the generator. <Ref. to SC(STI)-21, REMOVAL, Generator.>
3) Drain engine coolant. <Ref. to CO(w/o STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the connector (A) from the engine coolant temperature sensor, and remove the engine coolant temperature sensor.



B: INSTALLATION

Install in the reverse order of removal.

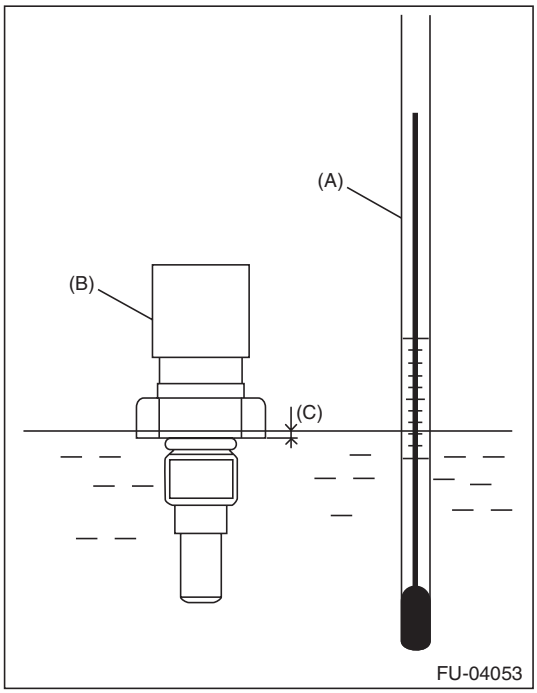
NOTE:
Use a new gasket.

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

C: INSPECTION

1) Check that the engine coolant temperature sensor has no deformation, cracks or other damages.
2) Immerse the engine coolant temperature sensor and a thermometer in water.

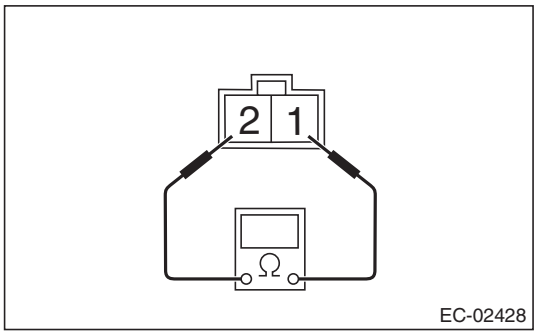
CAUTION:
Take care not to allow water to get into the engine coolant temperature sensor connector. Completely remove any water inside.



(A) Thermometer
(B) Engine coolant temperature sensor
(C) Hexagonal part height: to approx. $^1/_3$

3) 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.

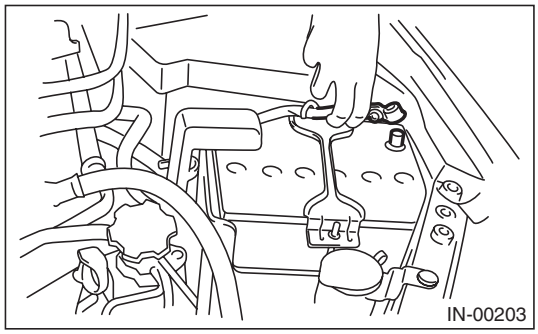


Water temperature	Terminal No.	Standard
20°C (68°F)	1 and 2	2.45±0.2 kΩ
80°C (176°F)		0.318±0.013 kΩ

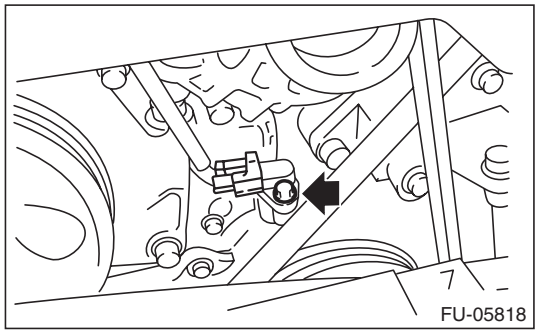
5. Crankshaft Position Sensor

A: REMOVAL

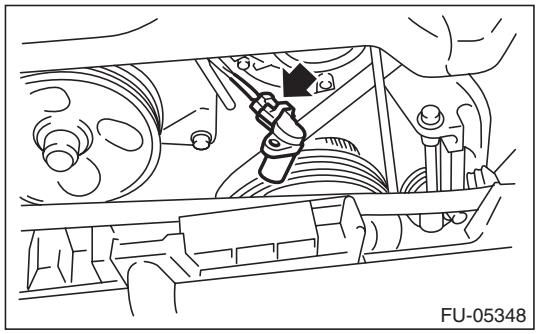
1) Remove the collector cover.
2) Disconnect the ground cable from battery.



3) Remove the bolt which secures crankshaft position sensor to oil pump.



4) Remove the crankshaft position sensor, and disconnect the connector from the crankshaft position sensor.



B: INSTALLATION

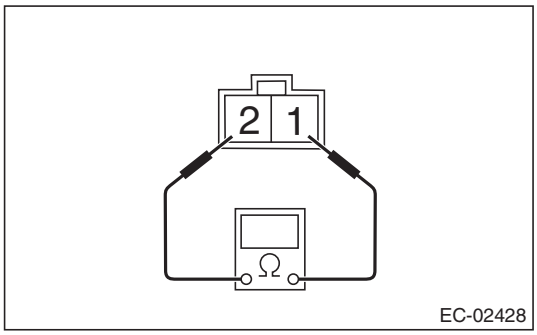
Install in the reverse order of removal.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

1. CRANKSHAFT POSITION SENSOR (METHOD WITH CIRCUIT TESTER)

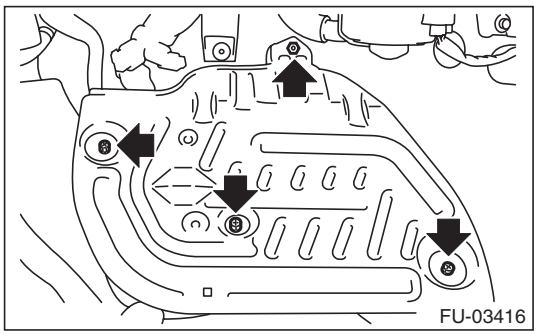
Measure the resistance between crankshaft position sensor terminals.



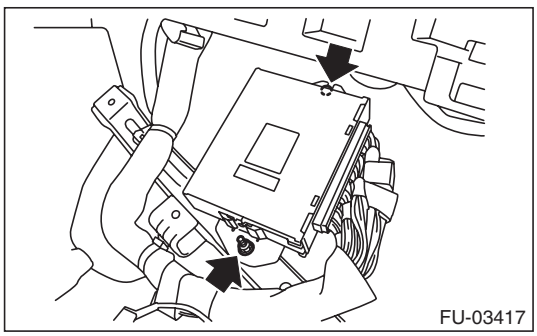
Terminal No.	Standard
1 and 2	2.04±0.204 kΩ

2. CRANKSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

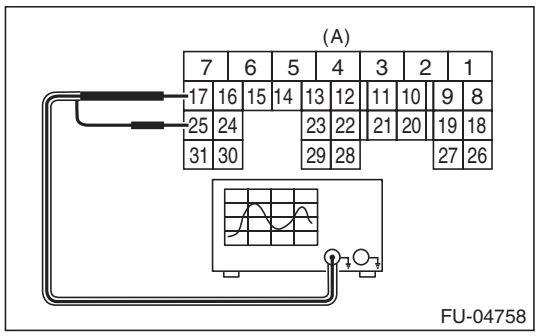
1) Prepare an oscilloscope.
2) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.



5) Remove the nuts and bolts which hold the ECM to the bracket.



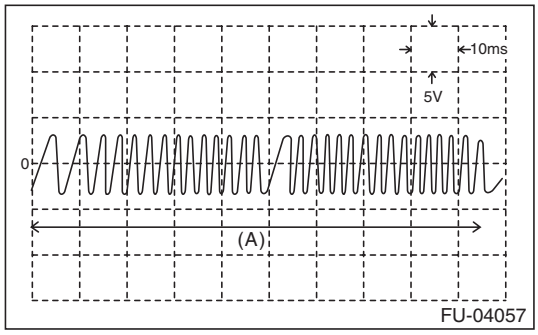
6) Connect the probe to ECM connector.



(A) To ECM connector

Terminal No.	Probe
17	+
25	–

7) Start the engine and let it idle.
8) Check the pattern is the same as the waveform and voltage shown below.



(A) One crankshaft rotation

9) After inspection, install the related parts in the reverse order of removal.

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

3. OTHER INSPECTIONS

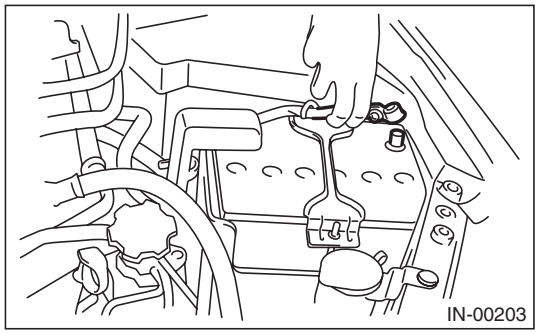
Check that the crankshaft position sensor has no deformation, cracks or other damages.

6. Camshaft Position Sensor

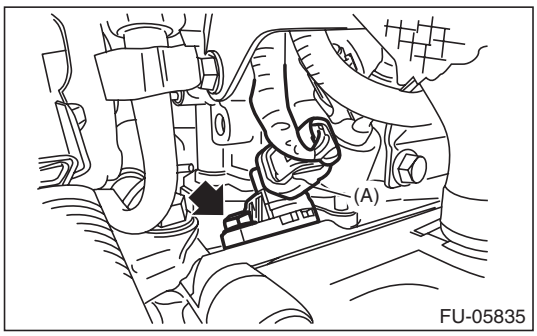
A: REMOVAL

1. CAMSHAFT POSITION SENSOR RH

1) Disconnect the ground cable from battery.

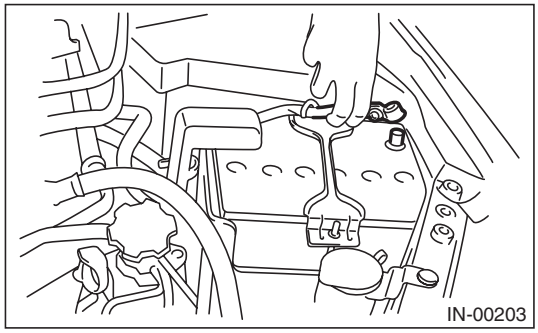


2) Disconnect the connector (A) from the camshaft position sensor RH, and remove the camshaft position sensor RH from the rear side of the cylinder head.



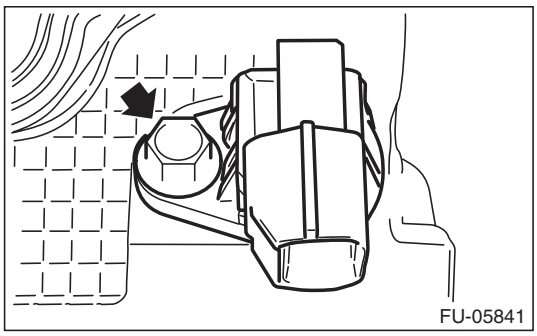
2. CAMSHAFT POSITION SENSOR LH

1) Remove the collector cover.
2) Disconnect the ground cable from battery.



3) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>

4) Remove the camshaft position sensor LH.



B: INSTALLATION

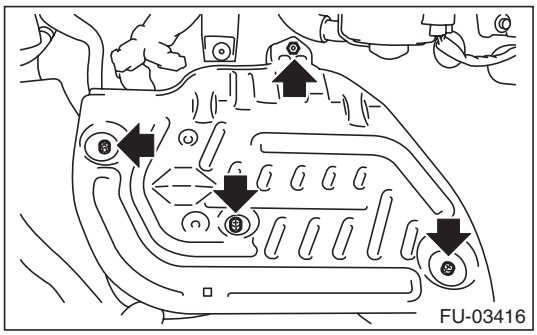
Install in the reverse order of removal.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

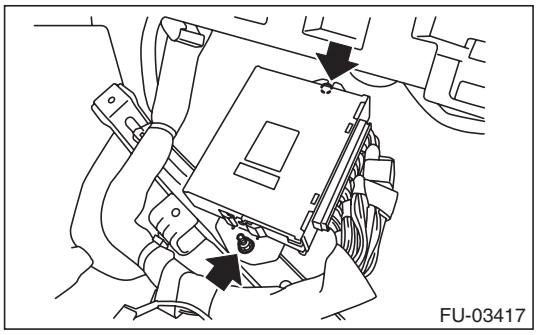
C: INSPECTION

1. CAMSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

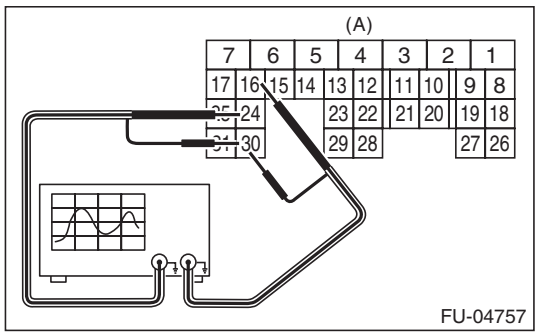
1) Prepare an oscilloscope.
2) Remove the lower inner trim of passenger's side. <Ref. to EI-57, REMOVAL, Lower Inner Trim.>
3) Turn over the floor mat of passenger's seat.
4) Remove the protect cover.



5) Remove the nuts and bolts which hold the ECM to the bracket.



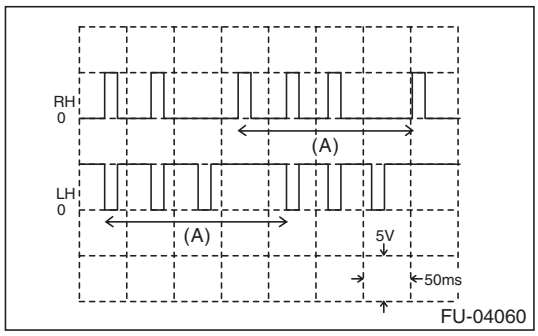
6) Connect the probe to ECM connector.



(A) To ECM connector

Camshaft position sensor	Terminal No.	Probe
RH	24	+
LH	16	+
RH and LH	30	–

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

9) After inspection, install the related parts in the reverse order of removal.

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

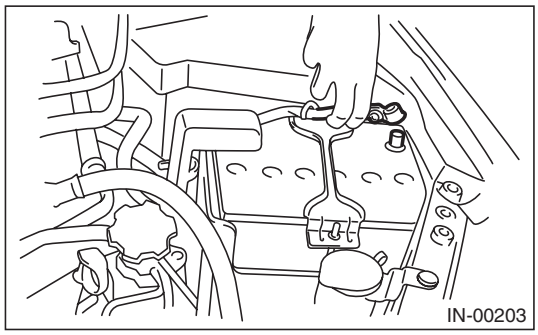
2. OTHER INSPECTIONS

Check that the camshaft position sensor has no deformation, cracks or other damages.

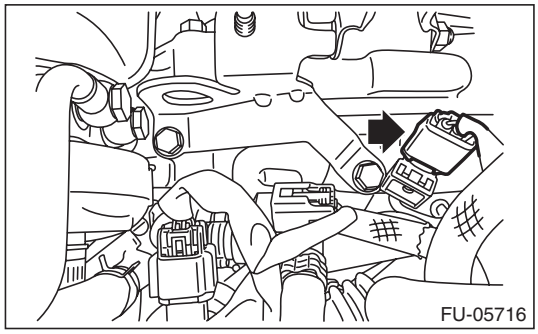
7. Knock Sensor

A: REMOVAL

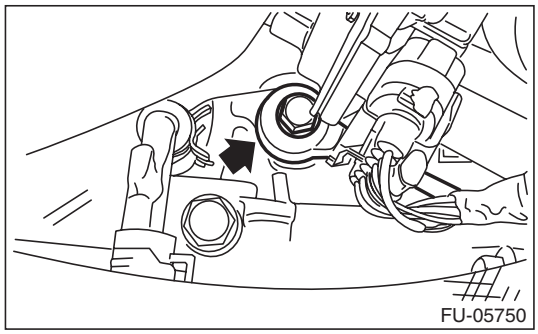
1) Disconnect the ground cable from battery.



2) Remove the intercooler. <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
3) Disconnect the connector from the knock sensor.



4) Remove the knock sensor from cylinder block.

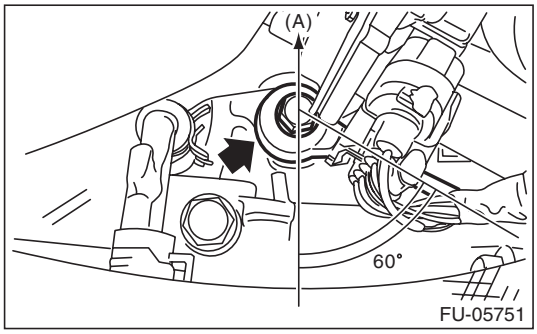


B: INSTALLATION

1) Install the knock sensor to the cylinder block.

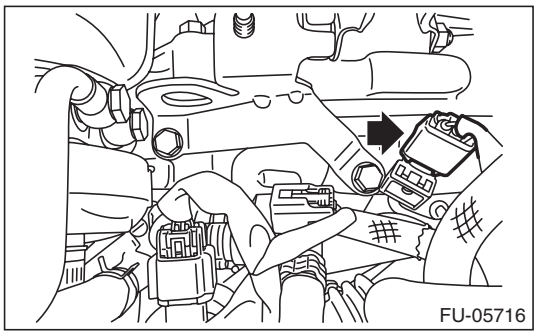
NOTE:
The portion of the knock sensor cord that is pulled out must be positioned at a 60° angle relative to the engine rear.

Tightening torque:
24 N·m (2.4 kgf-m, 17.7 ft-lb)

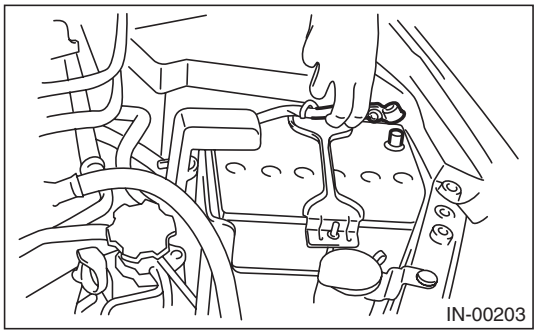


(A) Front side of vehicle

2) Connect the connector to the knock sensor.

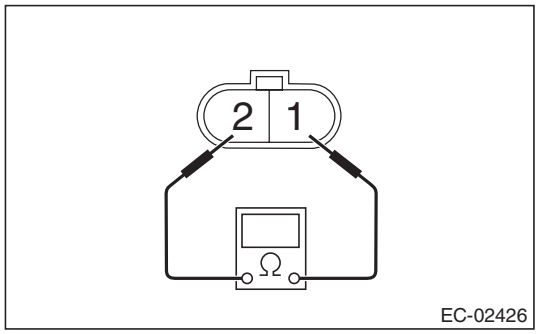


3) Install the intercooler. <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>
4) Connect the battery ground terminal.



C: INSPECTION

1) Check that the knock sensor has no deformation, cracks or other damages.
2) Measure the resistance between knock sensor terminals.



Terminal No.	Standard
1 and 2	560±28 kΩ

8. Throttle Position Sensor

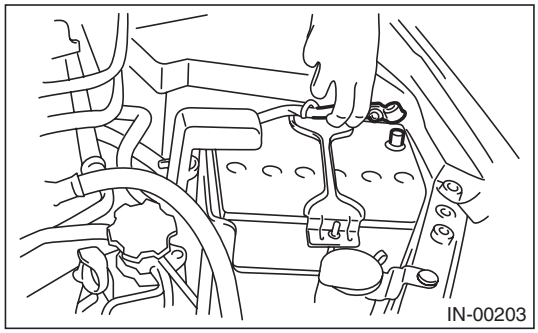
A: SPECIFICATION

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(w/o STI)-15, REMOVAL, Throttle Body.> <Ref. to FU(w/o STI)-16, INSTALLATION, Throttle Body.>

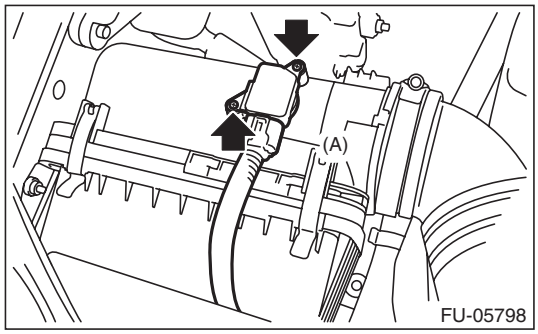
9. Mass Air Flow and Intake Air Temperature Sensor

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 mass air flow and intake air temperature sensor.



B: INSTALLATION

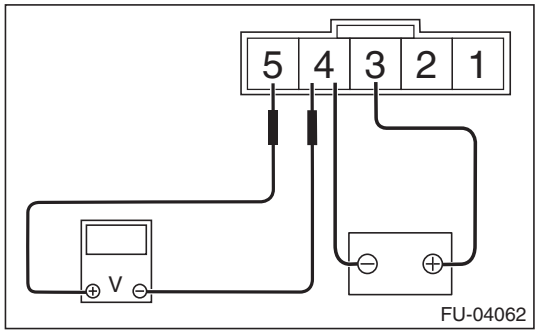
Install in the reverse order of removal.

Tightening torque:
1 N·m (0.1 kgf-m, 0.7 ft-lb)

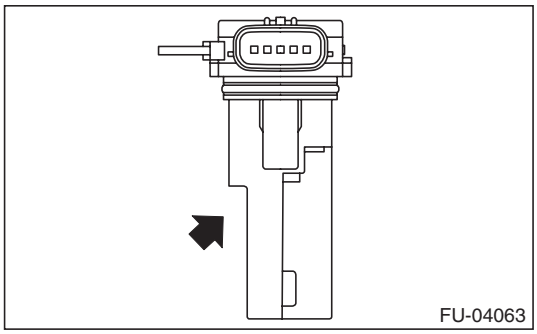
C: INSPECTION

1. CHECK THE MASS AIR FLOW SENSOR UNIT

1) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, the circuit tester positive terminal to terminal No. 5 and the circuit tester ground terminal to terminal No. 4.

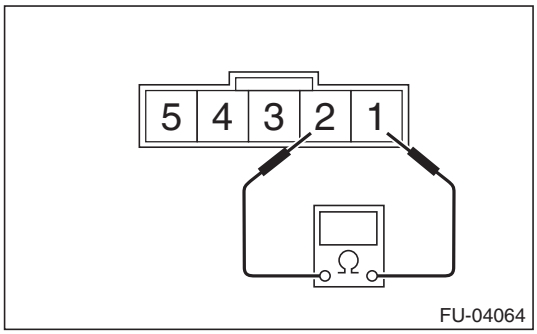


2) Check the voltage changes when air is blown to the mass air flow sensor unit in arrow direction.



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

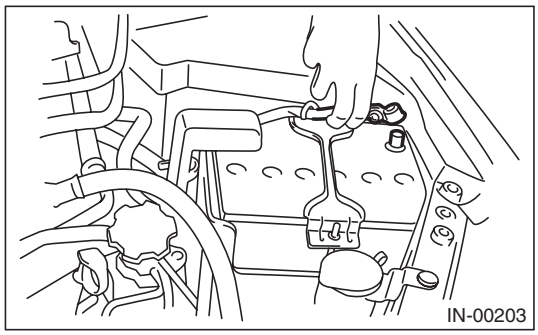
3. OTHER INSPECTIONS

1) Check that the mass air flow and intake air temperature sensor has no deformation, cracks or other damages.
2) Check that the mass air flow and intake air temperature sensor has no dirt.

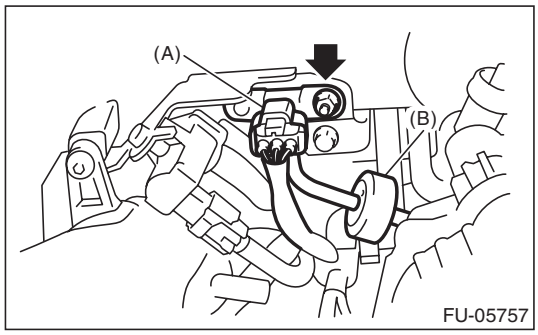
10. Manifold Absolute Pressure Sensor

A: REMOVAL

1) Remove the collector cover.
2) Disconnect the ground cable from battery.



3) Disconnect the connector (A) from manifold absolute pressure sensor, and remove the filter assembly (B) from intake manifold.
4) Remove the manifold absolute pressure sensor from the solenoid valve bracket.



B: INSTALLATION

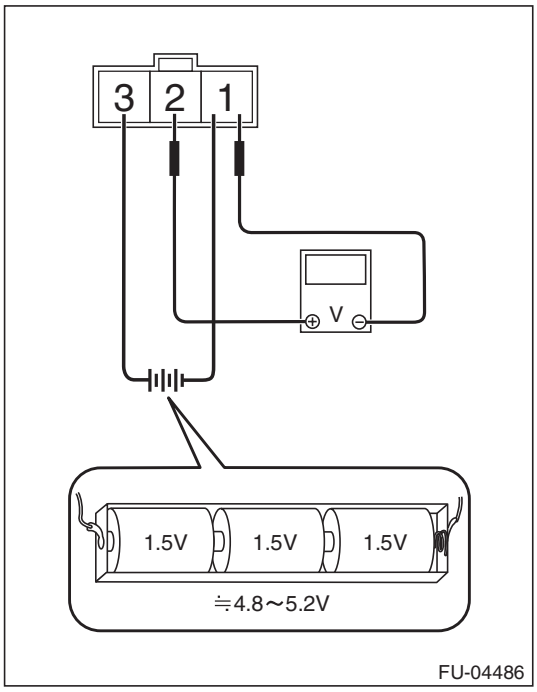
Install in the reverse order of removal.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

1) Check that the manifold absolute pressure sensor has no deformation, cracks or other damages.
2) Connect dry-cell battery positive terminal to terminal No. 3 and dry-cell battery ground terminal to terminal No. 1, circuit tester positive terminal to terminal No. 2 and the circuit tester negative terminal to terminal No. 1.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.

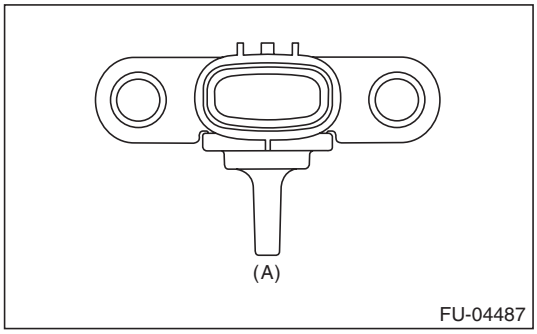


3) Check the voltage at a normal atmospheric pressure.

NOTE:
The atmospheric pressure at higher altitude is lower than normal. Therefore, the voltage is lower than the standard value.

Terminal No.	Standard
2 (+) and 1 (–)	Approx. 2.2 V (when 25°C (77°F))

4) Connect the Mighty Vac to the pressure port (A) of manifold absolute pressure sensor.



5) Check the voltage when generating vacuum and positive pressure using Mighty Vac.

CAUTION:
Do not apply vacuum of less than –88 — 200 kPa (–0.9 — 2.04 kgf/cm^2, –12.8 — 29.0 psi). Doing so may damage the manifold absolute pressure sensor.

NOTE:
When vacuum occurs at the pressure port of manifold absolute pressure sensor, the voltage will drop from the value as in step 3). When positive pressure occurs, on the other hand, the voltage will rise.

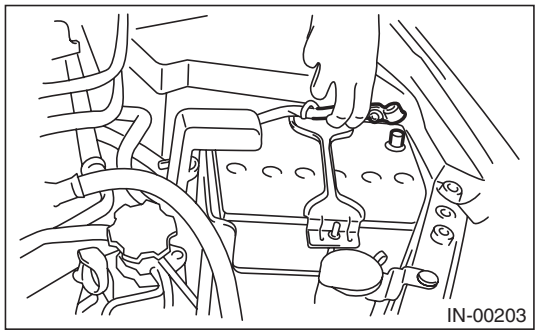
Pressure	Terminal No.	Standard
–88 kPa (–0.9 kgf/cm^2, –12.8 psi)	2 (+) and 1 (–)	Approx. 1.0 V (when 25°C (77°F))
152 kPa (1.55 kgf/cm^2, 22.0 psi)		Approx. 4.5 V (when 25°C (77°F))

11.Fuel Injector

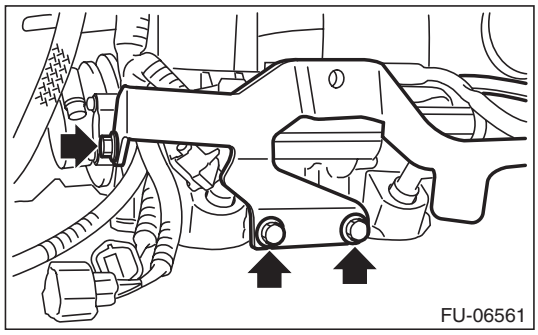
A: REMOVAL

1. RH SIDE

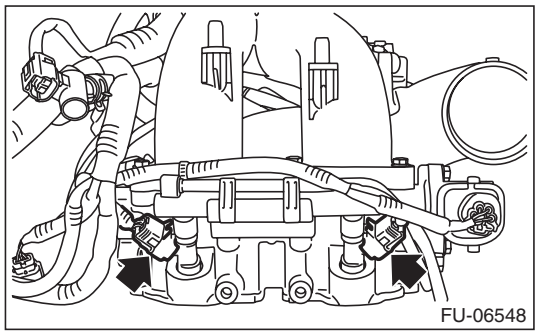
1) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



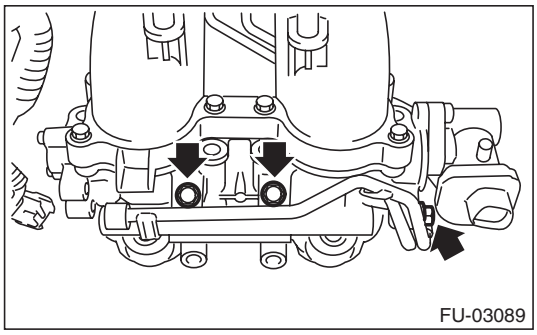
3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
5) Remove the fuel pipe protector RH from the intake manifold.



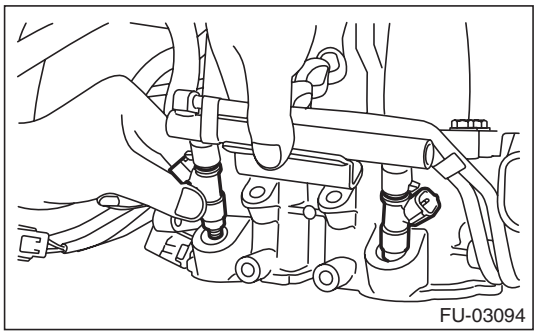
6) Disconnect the connector from fuel injector.



7) Remove the bolt which holds fuel injector pipe RH onto intake manifold.

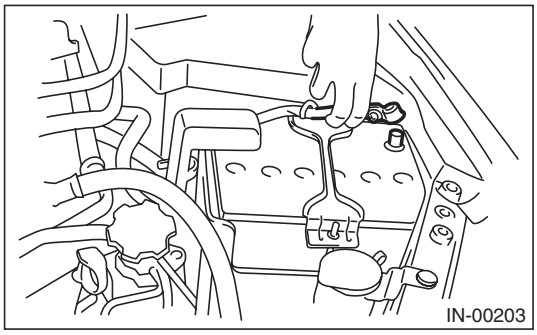


8) Remove the fuel injector.



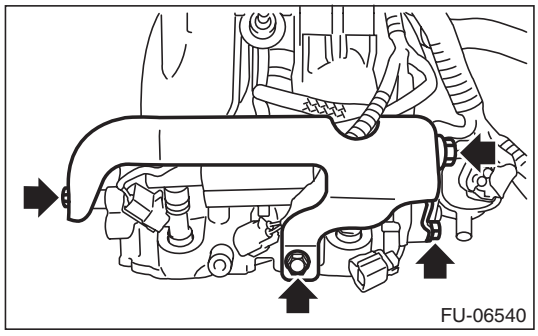
2. LH SIDE

1) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.

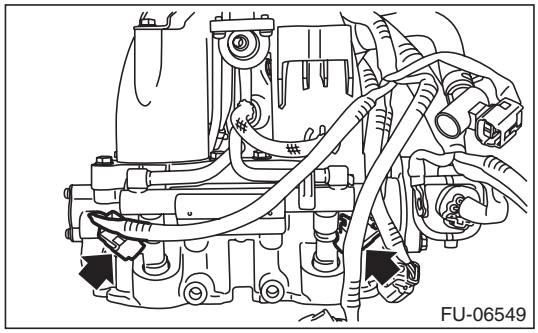


3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>

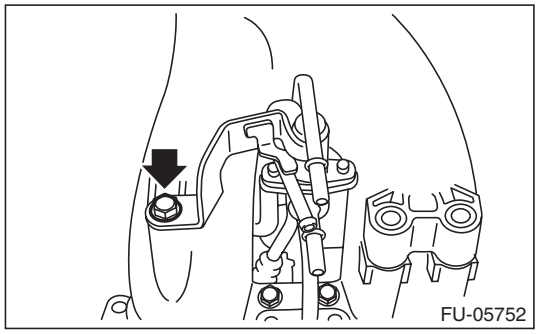
5) Remove the engine ground terminal from the fuel pipe protector LH and remove the fuel pipe protector LH from the intake manifold.

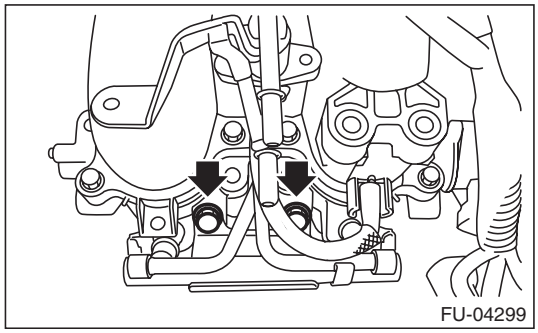

FU-06540

6) Disconnect the connector from fuel injector.

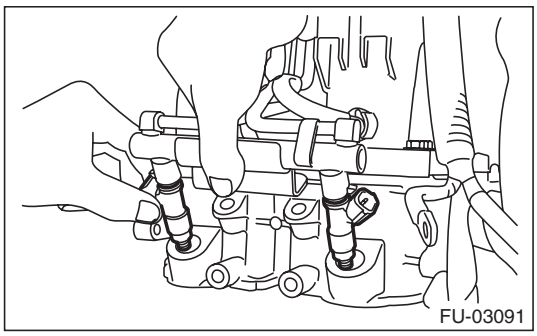

FU-06549

7) Remove the bolt which holds fuel injector pipe LH onto intake manifold.


FU-05752


FU-04299

8) Remove the fuel injector.


FU-03091

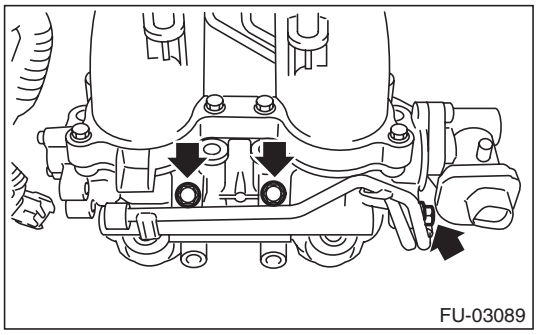
B: INSTALLATION

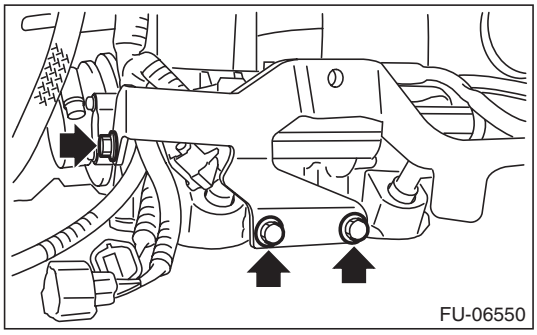
1. RH SIDE

Install in the reverse order of removal.

NOTE:
Use new O-rings, rubbers and seal rings.

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


FU-03089

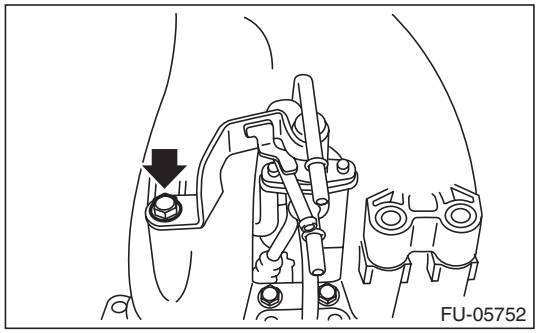

FU-06550

2. LH SIDE

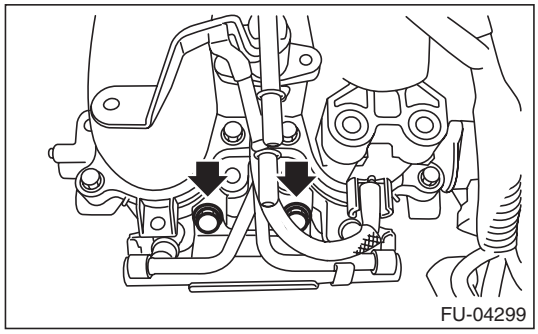
Install in the reverse order of removal.

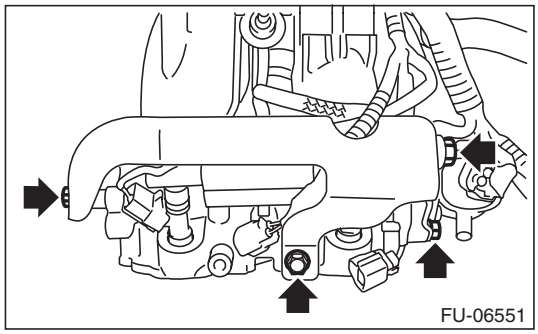
NOTE:
Use new O-rings, rubbers and seal rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



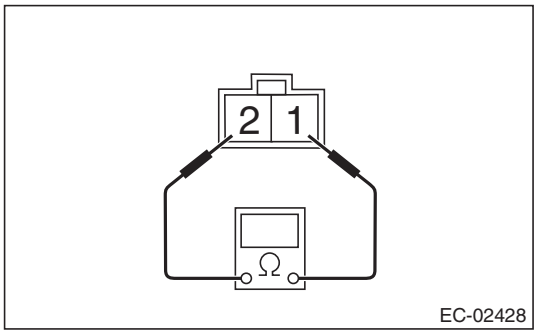
Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)





C: INSPECTION

1) Check that the fuel injector has no deformation, cracks or other damages.
2) Measure the resistance between fuel injector terminals.

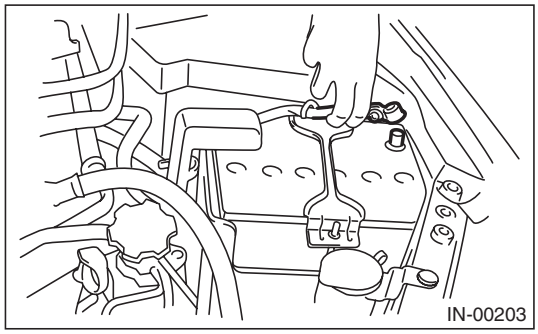


Terminal No.	Standard
1 and 2	Approx. 12.0 Ω (when 20°C (68°F))

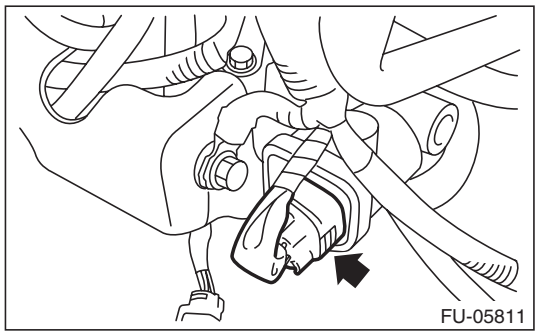
12. Tumble Generator Valve Assembly

A: REMOVAL

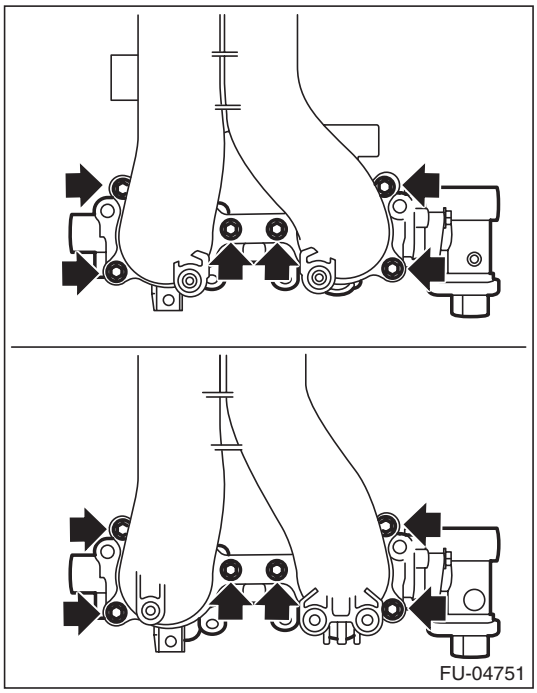
1) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the ground cable from battery.



3) Open the fuel filler lid and remove the fuel filler cap.
4) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
5) Disconnect the connector from the tumble generator valve assembly.



6) Remove the fuel injector. <Ref. to FU(w/o STI)-45, REMOVAL, Fuel Injector.>
7) Remove the tumble generator valve assembly from the intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
8.3 N·m (0.8 kgf-m, 6.1 ft-lb)

C: INSPECTION

1) Check that the tumble generator valve assembly has no deformation, cracks or other damages.
2) Check tumble generator valve for contamination or clogging.

13. Tumble Generator Valve Actuator

A: SPECIFICATION

The tumble generator valve assembly cannot be disassembled.
Refer to “Tumble Generator Valve Assembly” for removal and installation procedures. <Ref. to FU(w/o STI)-48, REMOVAL, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, INSTALLATION, Tumble Generator Valve Assembly.>

14. Oil Flow Control Solenoid Valve

A: REMOVAL

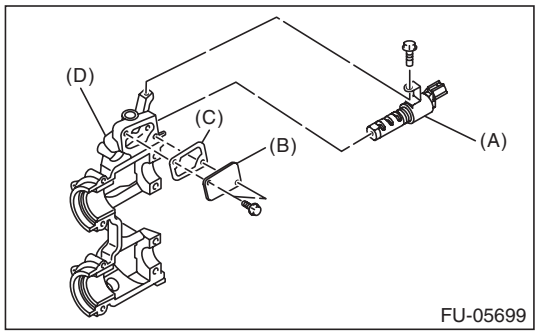
Oil flow control solenoid valve is a unit with front camshaft cap.
Refer to “Camshaft” for removal procedures. <Ref. to ME(w/o STI)-59, REMOVAL, Camshaft.>

B: INSTALLATION

Refer to “Camshaft” for installation procedure. <Ref. to ME(w/o STI)-61, INSTALLATION, Camshaft.>

C: DISASSEMBLY

1) Remove the two mounting bolts securing oil return cover, and remove the oil return cover and gasket.
2) Remove the bolt securing oil flow control solenoid valve, and remove the oil flow control solenoid valve.



(A) Oil flow control solenoid valve
(B) Oil return cover
(C) Gasket
(D) Front camshaft cap

D: ASSEMBLY

1) Install the oil flow control solenoid valve.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

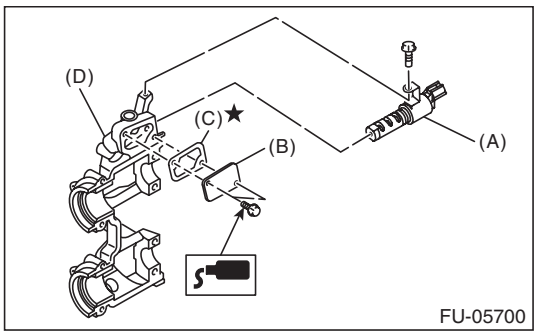
2) Apply liquid gasket to the two bolts securing oil return cover.

Liquid gasket:
THREE BOND 1324 (Part No. 004403042) or equivalent

3) Attach the oil return cover and gasket.

NOTE:
Use a new gasket.

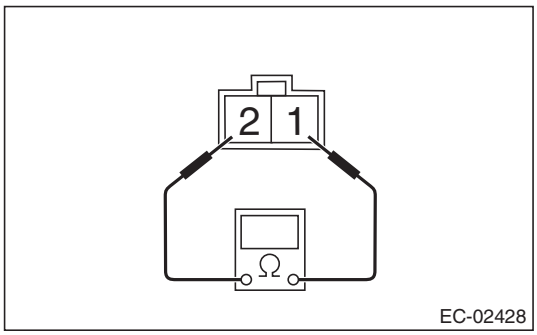
Tightening torque:
9 N·m (0.9 kgf-m, 6.6 ft-lb)



(A) Oil flow control solenoid valve
(B) Oil return cover
(C) Gasket
(D) Front camshaft cap

E: INSPECTION

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

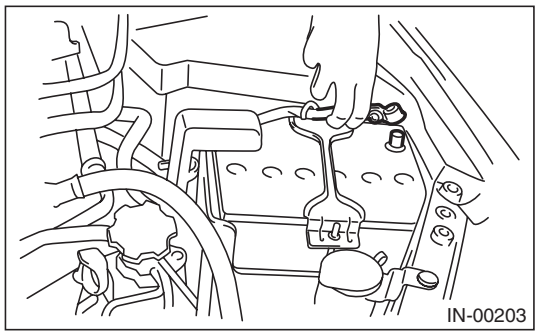


Terminal No.	Standard
1 and 2	7.4±0.5 Ω (when 20°C (68°F))

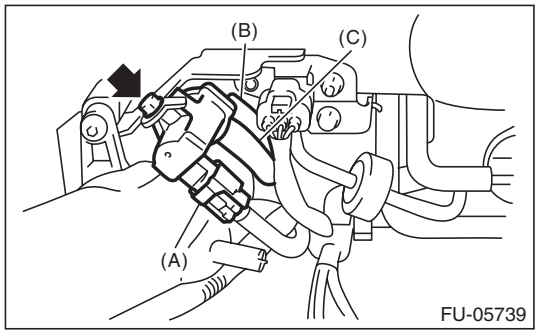
15. Wastegate Control Solenoid Valve

A: REMOVAL

1) Remove the collector cover.
2) Disconnect the ground cable from battery.



3) Disconnect the connector (A) from the wastegate control solenoid valve.
4) Disconnect the vacuum hose (B) and air control hose (C) from the wastegate control solenoid valve.
5) Remove the wastegate control solenoid valve from the bracket.



B: INSTALLATION

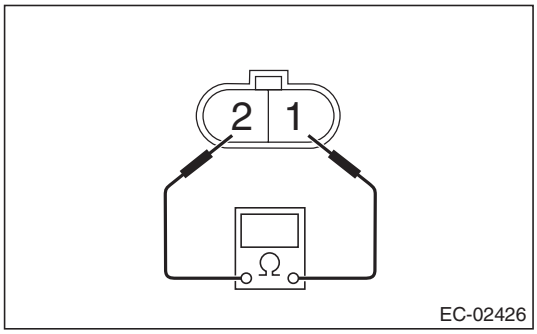
Install in the reverse order of removal.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

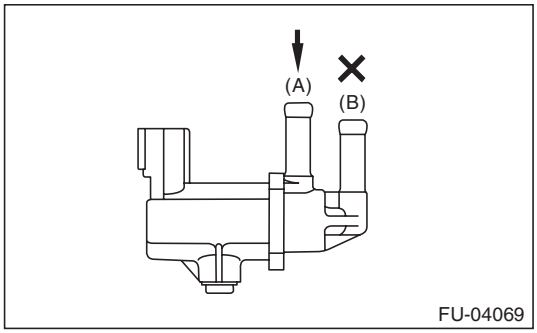
1. WASTEGATE CONTROL SOLENOID VALVE

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

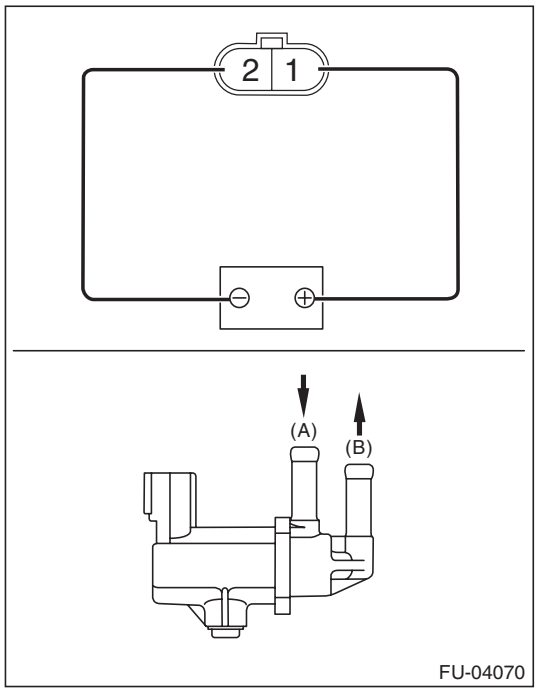


Terminal No.	Standard
1 and 2	28±2 Ω (when 20°C (68°F))

3) Check that air does not come out from (B) when air is blown into (A).



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



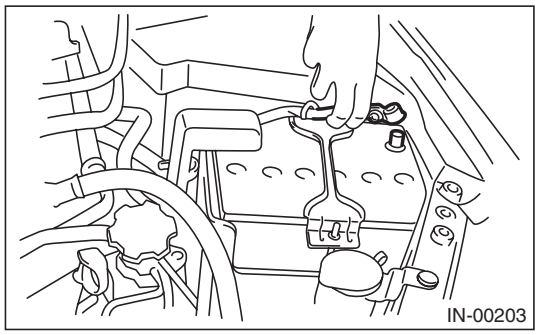
2. OTHER INSPECTIONS

Check that the vacuum hose and air control hose have no cracks, damage or loose part.

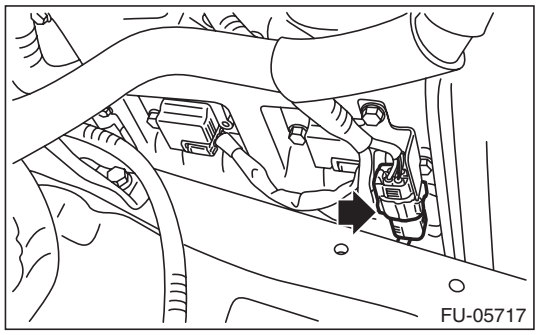
16.Front Oxygen (A/F) Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.

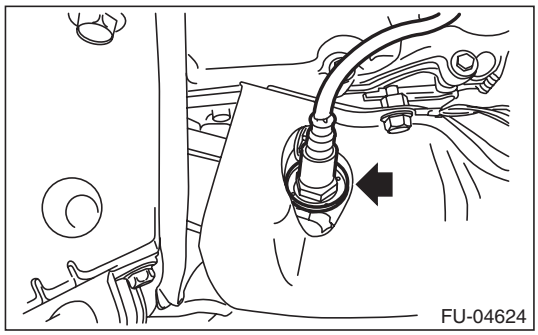


2) Remove the air intake duct (rear) and air cleaner case. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.> <Ref. to IN(w/o STI)-8, REMOVAL, Air Cleaner Case.>
3) Disconnect the connectors from front oxygen (A/F) sensor.



4) Lift up the vehicle.
5) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
6) Apply spray-type lubricant to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.
7) 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.



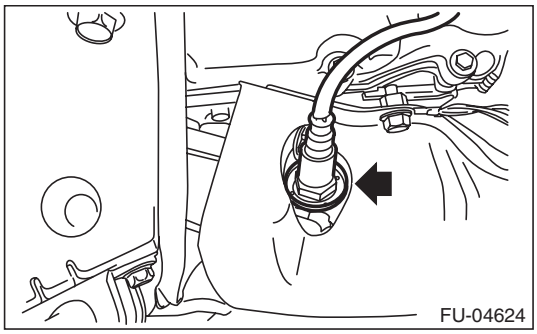
B: INSTALLATION

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.

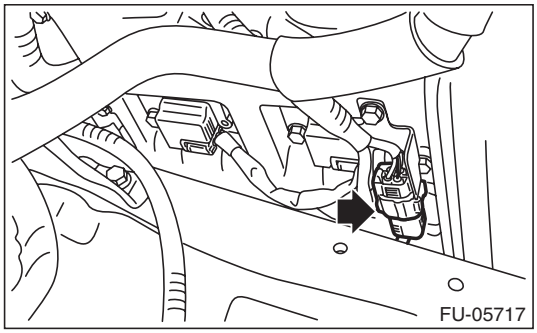
CAUTION:
Never apply anti-seize compound to the protector of front oxygen (A/F) sensor.

Anti-seize compound:
NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent
2) Install the front oxygen (A/F) sensor.

Tightening torque:
30 N·m (3.1 kgf-m, 22.1 ft-lb)

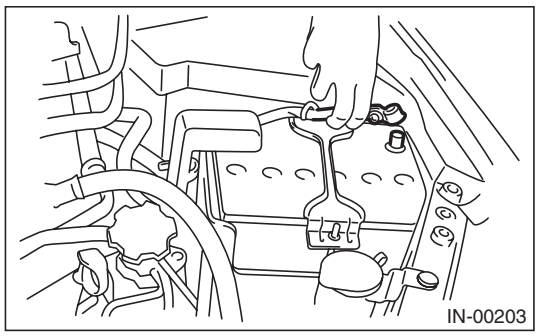


3) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
4) Lower the vehicle.
5) Connect the connector of front oxygen (A/F) sensor.



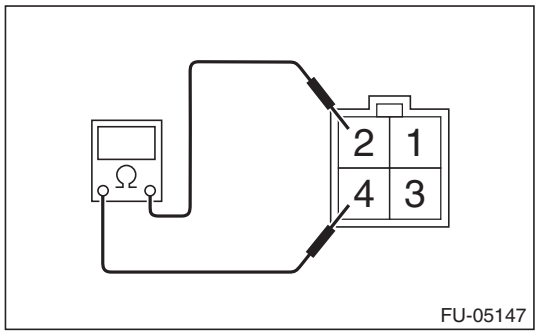
6) Install the air intake duct (rear) and air cleaner case. <Ref. to IN(w/o STI)-8, INSTALLATION, Air Cleaner Case.> <Ref. to IN(w/o STI)-10, INSTALLATION, Air Intake Duct.>

7) Connect the battery ground terminal.



C: INSPECTION

1) Check that the front oxygen (A/F) sensor has no deformation, cracks or other damages.
2) Measure the resistance between front oxygen (A/F) sensor terminals.

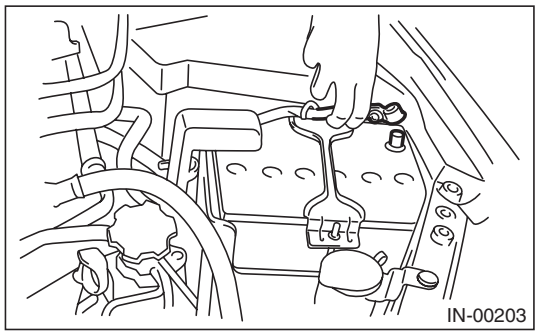


Terminal No.	Standard
2 and 4	2.4±0.24 Ω (when 20°C (68°F))

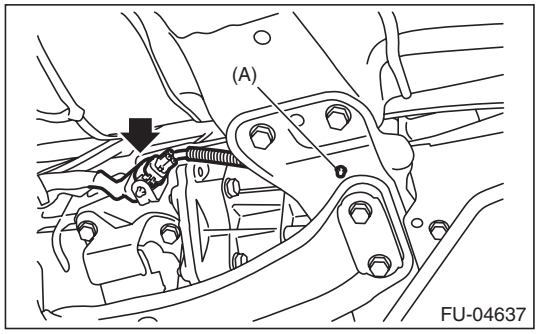
17.Rear Oxygen Sensor

A: REMOVAL

1) Disconnect the ground cable from battery.

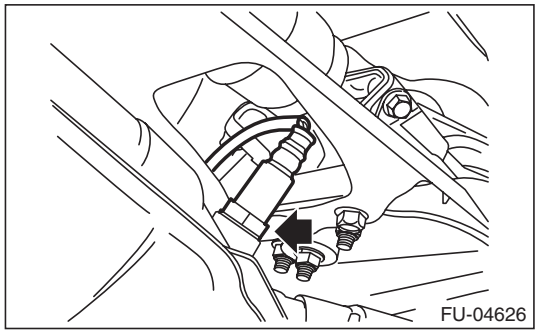


2) Lift up the vehicle.
3) Disconnect the connector from the rear oxygen sensor, and remove the clip (A) holding the rear oxygen sensor harness.



4) Apply spray-type lubricant to the threaded portion of rear oxygen sensor, and leave it for one minute or more.
5) Remove the rear oxygen sensor.

CAUTION:
When removing the rear oxygen sensor, wait until exhaust pipe cools, otherwise it will damage the exhaust pipe.



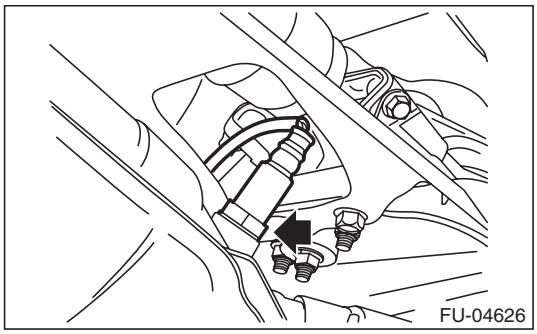
B: INSTALLATION

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.

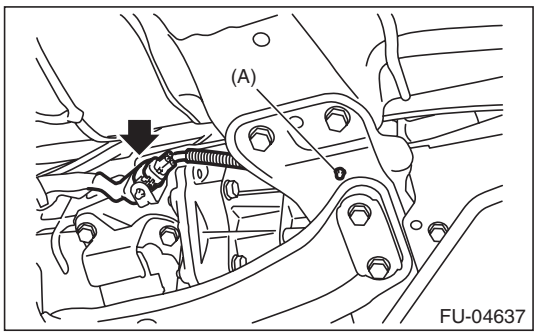
CAUTION:
Never apply anti-seize compound to the protector of rear oxygen sensor.

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)

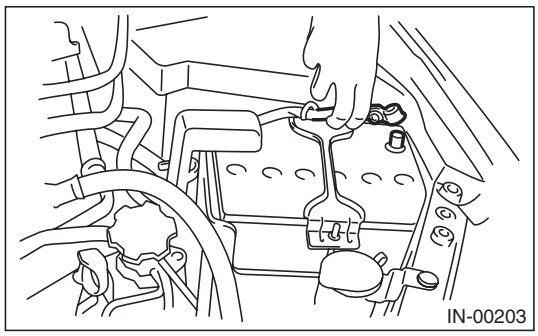


3) Connect the connector to the rear oxygen sensor, and hold the rear oxygen sensor harness with the clip (A).



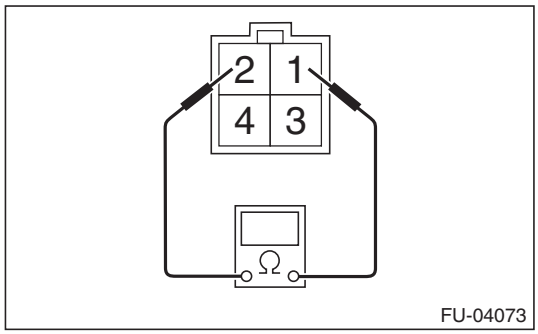
4) Lower the vehicle.

5) Connect the battery ground terminal.



C: INSPECTION

1) Check that the rear oxygen sensor has no deformation, cracks or other damages.
2) Measure the resistance between rear oxygen sensor terminals.

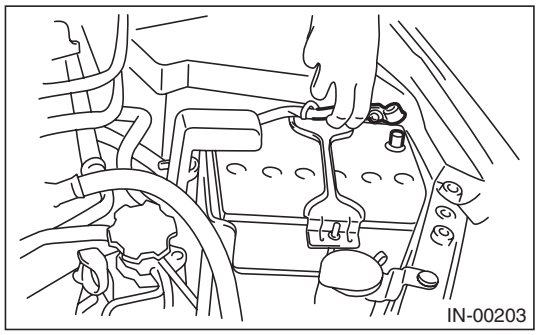


Terminal No.	Standard
1 and 2	$5.6^{+0.8}_{-0.6}$ Ω (when 20°C (68°F))

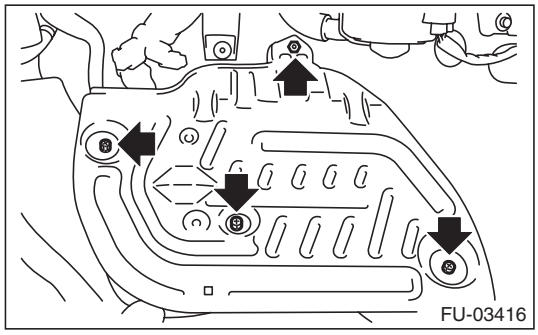
18.Engine Control Module (ECM)

A: REMOVAL

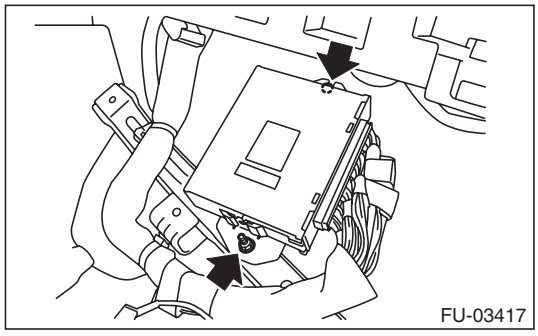
1) Disconnect the ground cable from battery.



2) Remove the lower inner trim of passenger's side. <Ref. to EI-57, 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) 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".)
• If replacing ECM or the bracket, replace both parts with new parts at a time.
• After installing the bracket to ECM, do not separate the bracket.
• If the bracket has been installed to ECM in the wrong direction, replace both parts to new parts.

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)

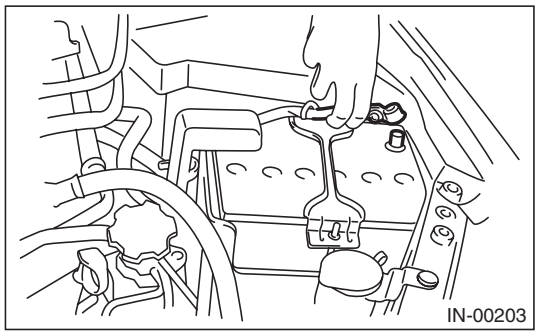
C: INSPECTION

Check that the ECM has no deformation, cracks or other damages.

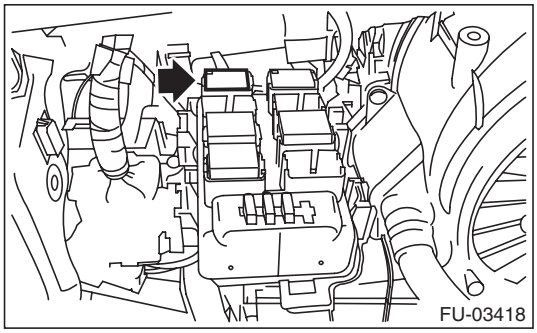
19.Main Relay

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.

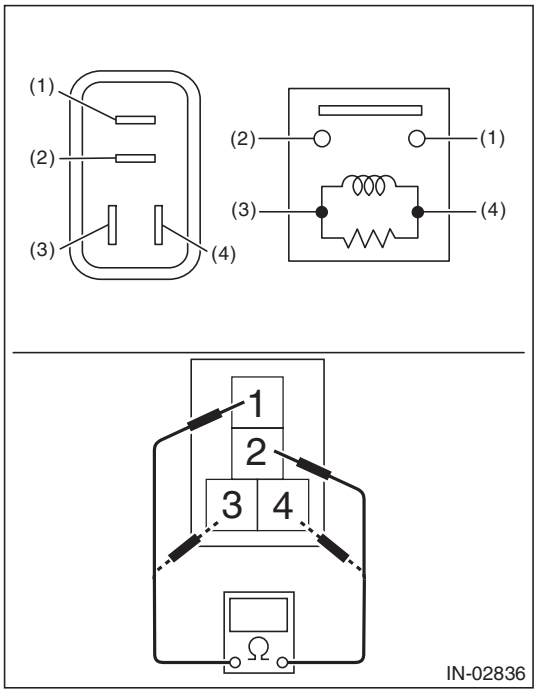


B: INSTALLATION

Install in the reverse order of removal.

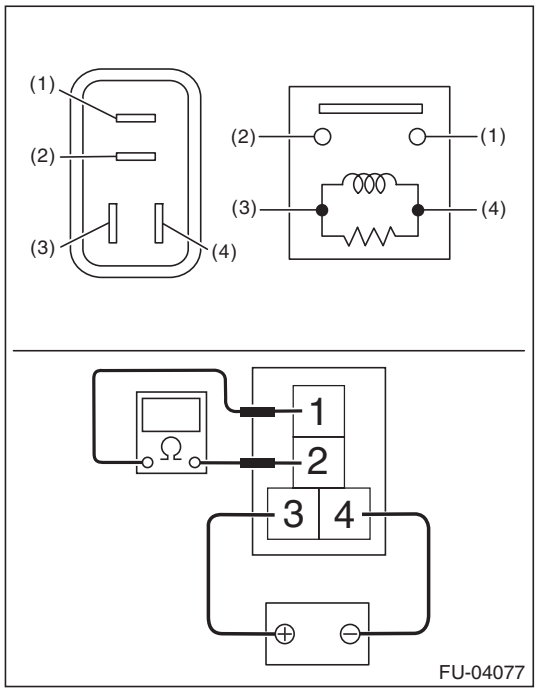
C: INSPECTION

1) Check that the main relay has no deformation, cracks or other damages.
2) 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))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the main relay terminals.

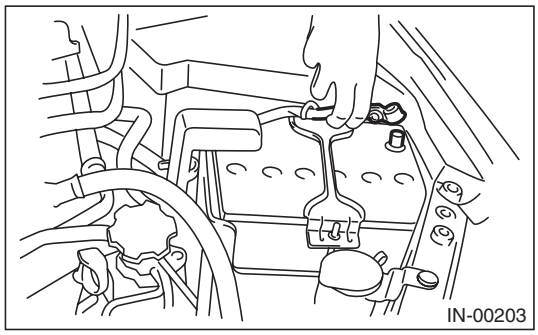


Terminal No.	Standard
1 and 2	Less than 1 Ω

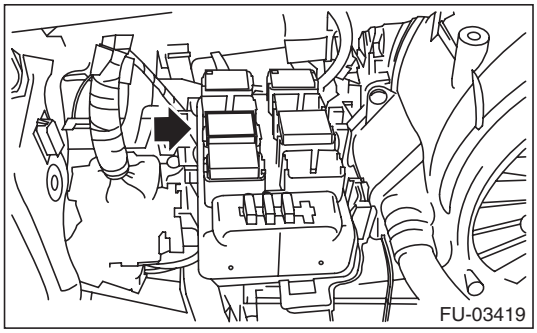
20.Fuel Pump Relay

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.

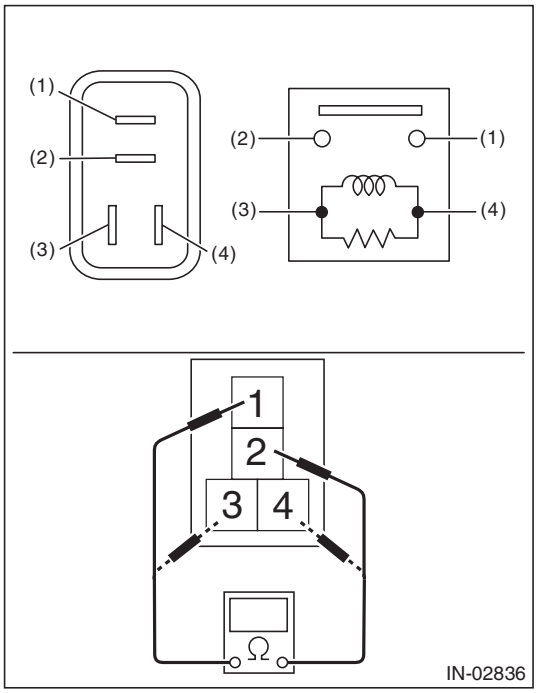


B: INSTALLATION

Install in the reverse order of removal.

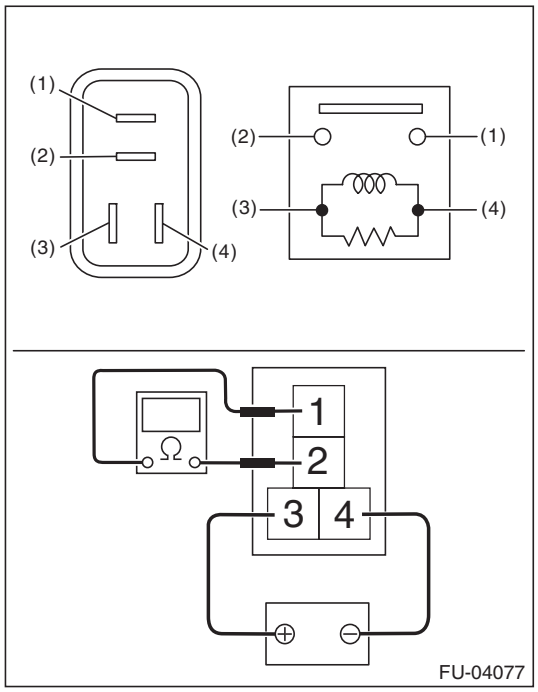
C: INSPECTION

1) Check that the fuel pump relay has no deformation, cracks or other damages.
2) 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))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the fuel pump relay terminals.

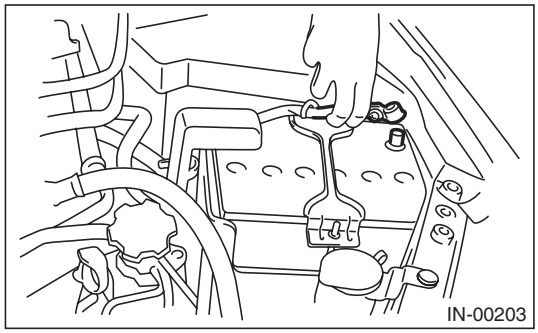


Terminal No.	Standard
1 and 2	Less than 1 Ω

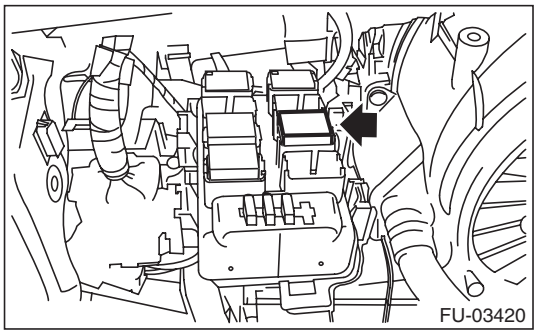
21. Electronic Throttle Control Relay

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.

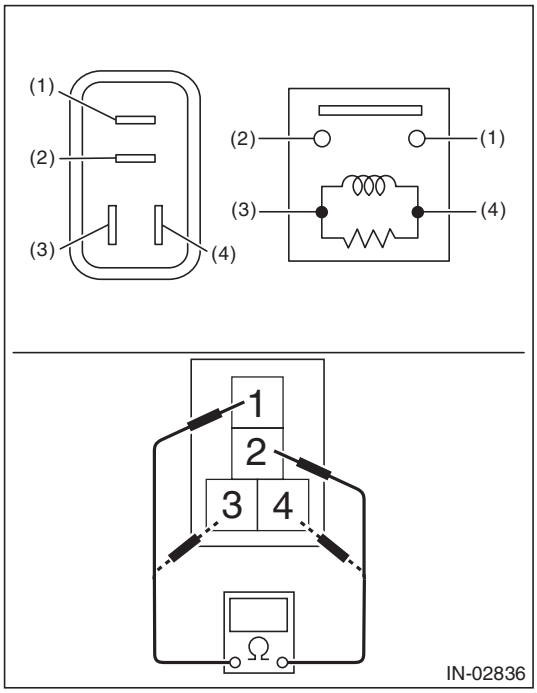


B: INSTALLATION

Install in the reverse order of removal.

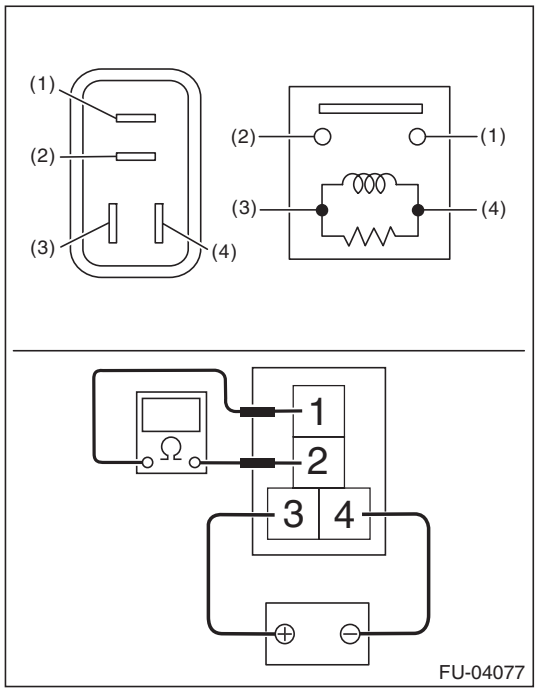
C: INSPECTION

1) Check that the electronic throttle control relay has no deformation, cracks or other damages.
2) 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))

3) Connect battery positive terminal to terminal No. 3 and battery ground terminal to terminal No. 4, and measure the resistance between the electronic throttle control relay terminals.

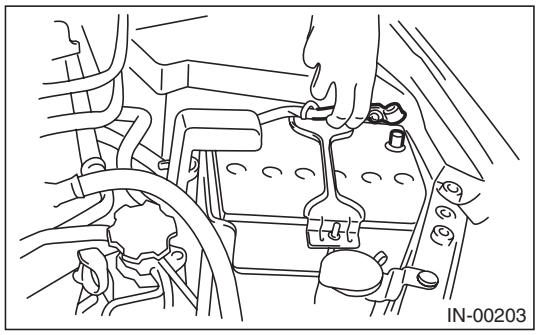


Terminal No.	Standard
1 and 2	Less than 1 Ω

22.Fuel Pump Control Unit

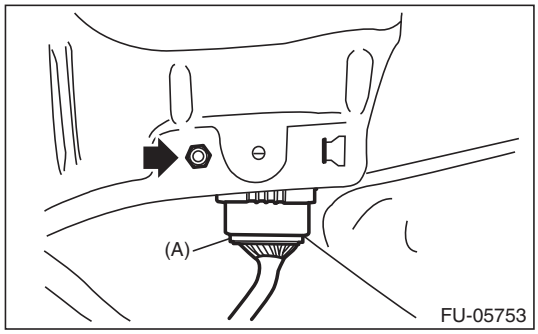
A: REMOVAL

1) Disconnect the ground cable from battery.

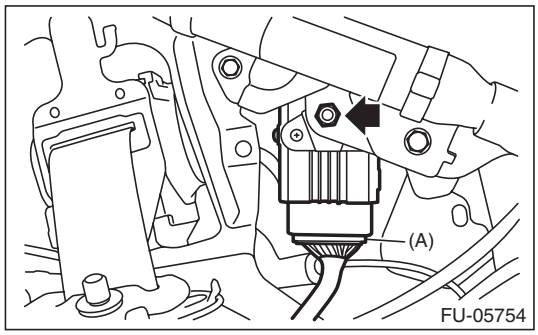


2) Remove the right side trunk side trim. (4 door model) <Ref. to EI-63, REMOVAL, Trunk Room Trim.>
3) Remove the right side rear quarter trim. (5 door model) <Ref. to EI-60, REMOVAL, Rear Quarter Trim.>
4) Disconnect the connector (A) from the fuel pump control unit, and remove the fuel pump control unit.

- 4 door model



- 5 door model



B: INSTALLATION

Install in the reverse order of removal.

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

C: INSPECTION

Check that the fuel pump control unit has no deformation, cracks or other damages.

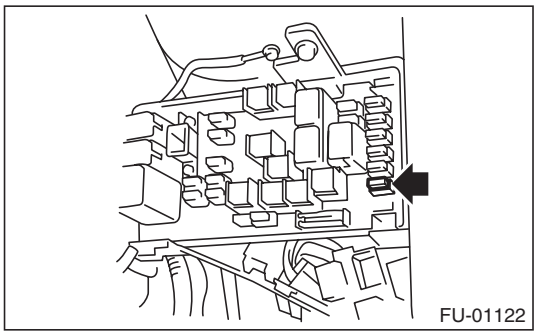
23. Fuel

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.

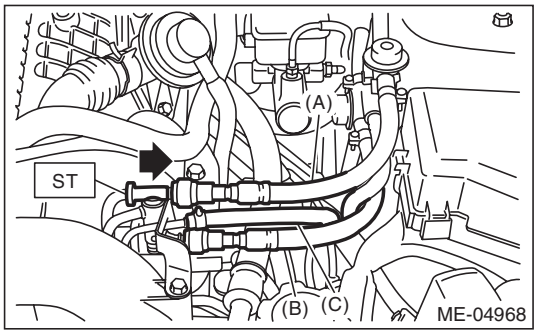
2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

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(w/o STI)-65, 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(w/o STI)-65, 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.



(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

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(H4DOTC)(diag)-64, 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)

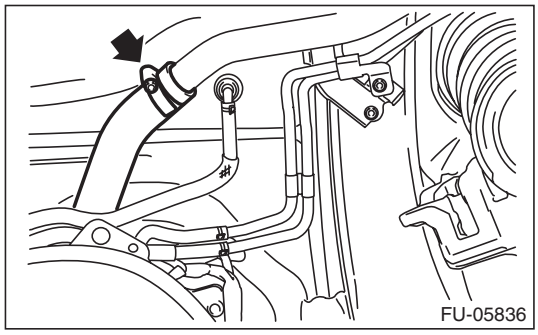
• 4 door model

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) Lift up the vehicle.
2) Remove the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, REMOVAL, Muffler.>
3) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
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.

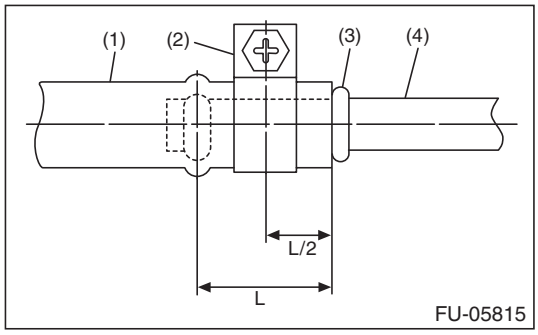


7) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

CAUTION:
Be careful not to spill fuel.
8) Install the related parts in the reverse order after draining the fuel.

NOTE:
Correctly insert the fuel filler hose to spool, and then install the clamp as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



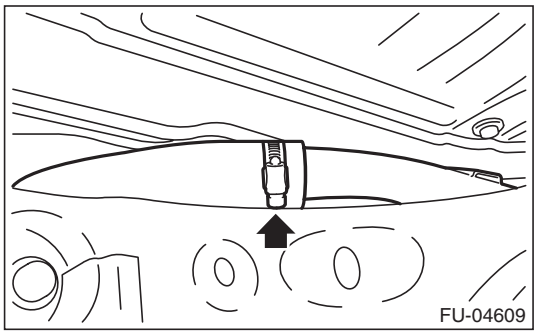
(1) Fuel filler hose
(2) Clamp
(3) Spool
(4) Fuel filler pipe

• 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) Lift up the vehicle.
2) Remove the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, REMOVAL, Muffler.>
3) Open the fuel filler lid and remove the fuel filler cap.
4) 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).
5) 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.



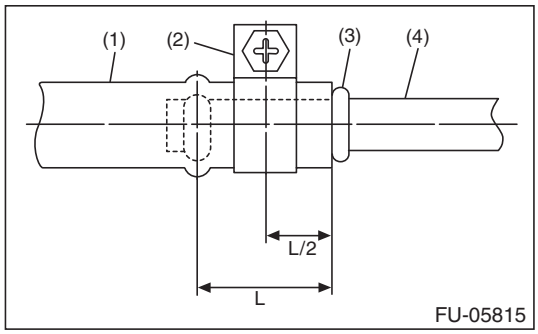
6) Set the container under the vehicle and insert the gasoline proof hose (ø10 or less) into the fuel filler hose to drain the fuel.

CAUTION:
Be careful not to spill fuel.

7) Install the related parts in the reverse order after draining the fuel.

NOTE:
Correctly insert the fuel filler hose to spool, and then install the clamp as shown in the figure.

Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



(1) Fuel filler hose
(2) Clamp
(3) Spool
(4) Fuel filler pipe

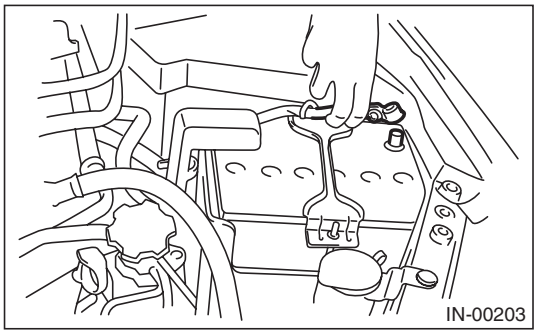
24.Fuel Tank

A: REMOVAL

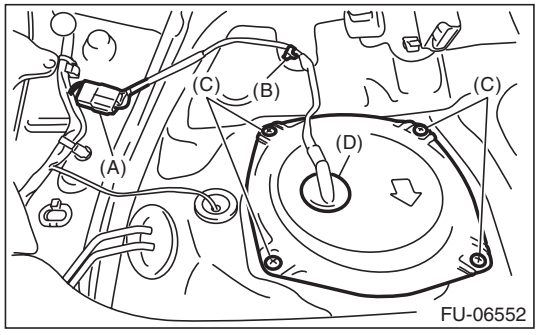
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

1) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(w/o STI)-65, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.

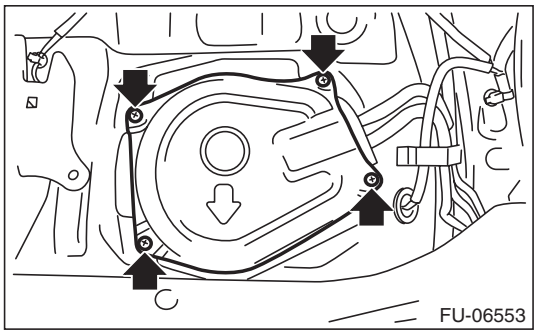

IN-00203

4) Remove the rear seat cushion. <Ref. to SE-14, REMOVAL, Rear Seat.>
5) 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.

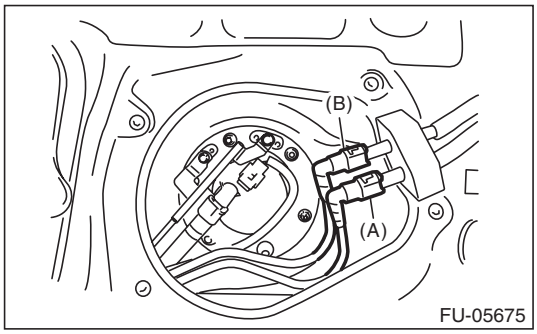


FU-06552

6) Remove the service hole cover of fuel sub level sensor.

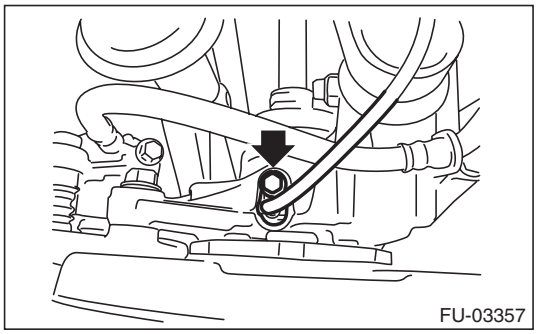

FU-06553

7) Disconnect the quick connector of fuel delivery tube (A) and fuel return tube (B). <Ref. to FU(w/o STI)-89, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>

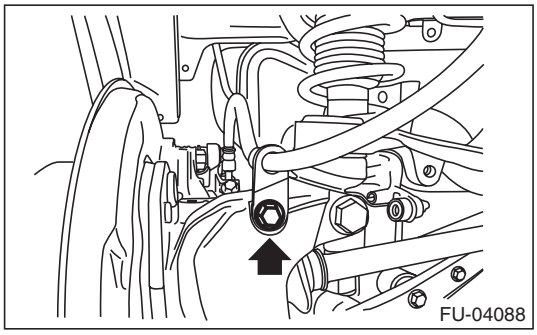


FU-05675

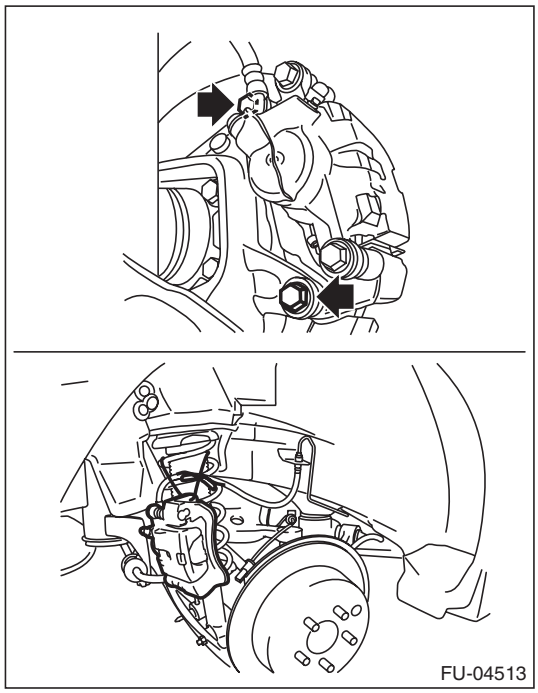
8) Remove the rear wheels.
9) Lift up the vehicle.
10) Remove the rear ABS wheel speed sensor from the rear housing.


FU-03357

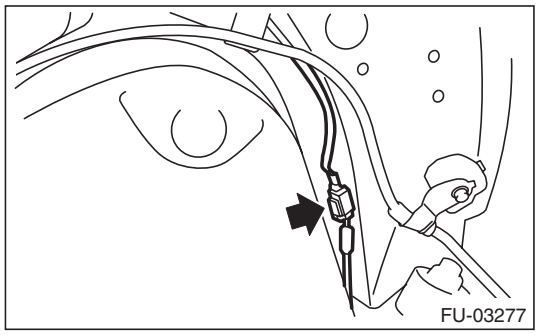
11) Remove the rear brake hose bracket from rear housing.


FU-04088

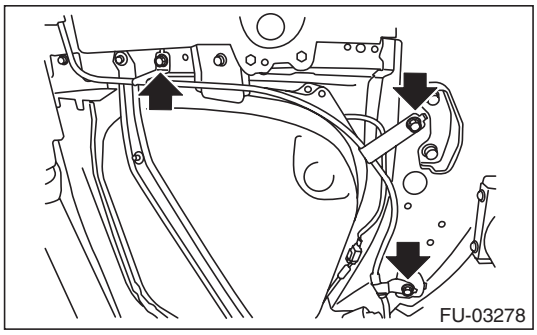
12) Remove the rear disc brake assembly and tie it to the body side of the vehicle.



13) Remove the parking brake cable from parking brake assembly. <Ref. to PB-6, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>
14) Remove the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, REMOVAL, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, REMOVAL, Muffler.>
15) Remove the propeller shaft. <Ref. to DS-11, REMOVAL, Propeller Shaft.>
16) Remove the heat shield cover and fuel tank protector.
17) Disconnect the connector from the rear ABS wheel speed sensor.



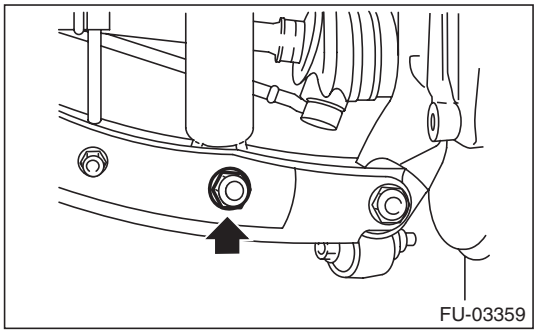
18) Remove the parking brake cable clamp from the body.



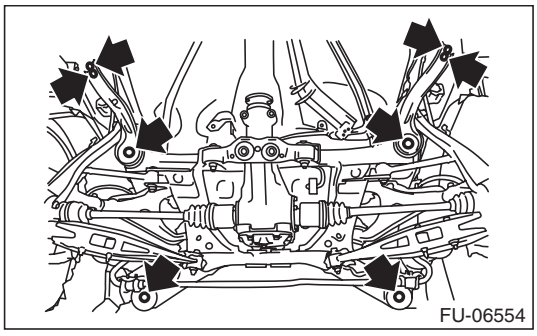
19) Remove the rear suspension assembly.

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.

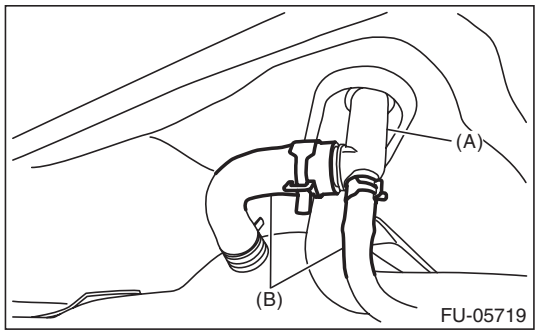


(3) Remove the bolts which secure the rear suspension assembly to the body.



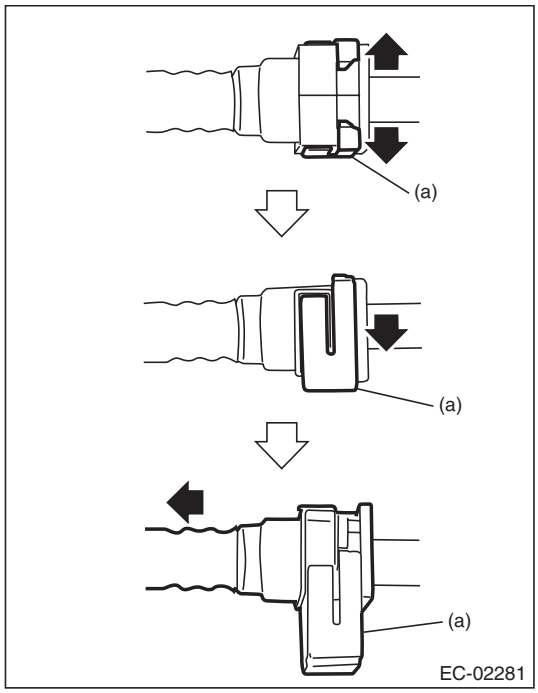
(4) Remove the rear suspension assembly.

20) Disconnect the evaporation hose (B) from hose connector (A).

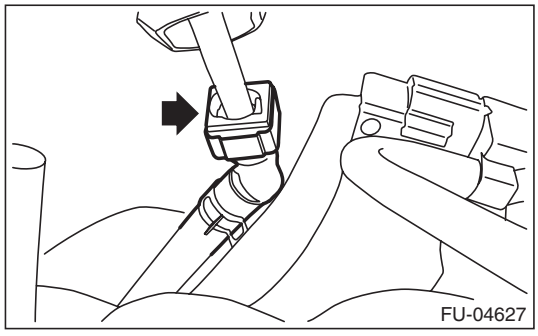


21) Disconnect the quick connector of the evaporation hose from the evaporation pipe.

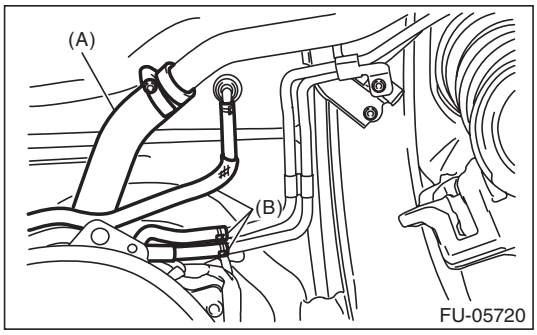
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Retainer

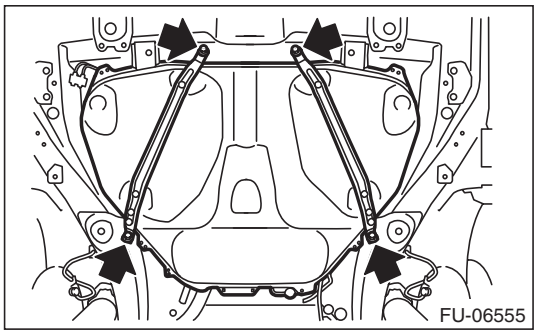


22) Disconnect the fuel filler hose (A) and evaporation hose (B).



23) Support the fuel tank with a transmission jack, remove the fuel tank band, and remove the fuel tank from the vehicle.

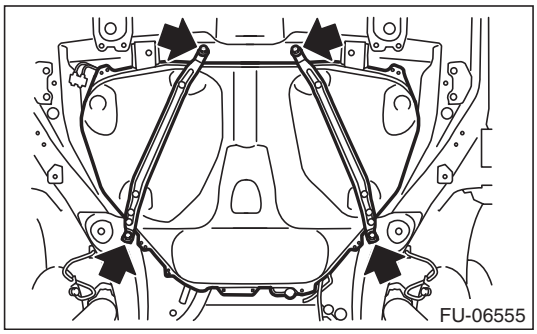
WARNING:
- **A helper is required to perform this work.**
- **Fuel may remain in the fuel tank. This will cause the left and right sides to be unbalanced. Be careful not to drop the fuel tank.**



B: INSTALLATION

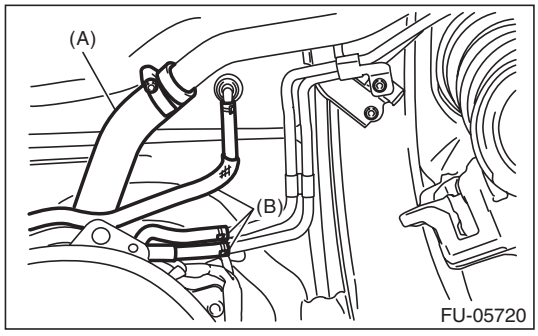
1) Support the fuel tank with a transmission jack, set the fuel tank and the fuel tank band in place, and temporarily tighten the bolts of the fuel tank band.

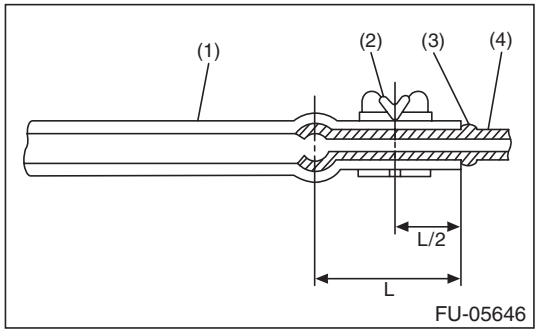
WARNING:
A helper is required to perform this work.



2) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, 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)

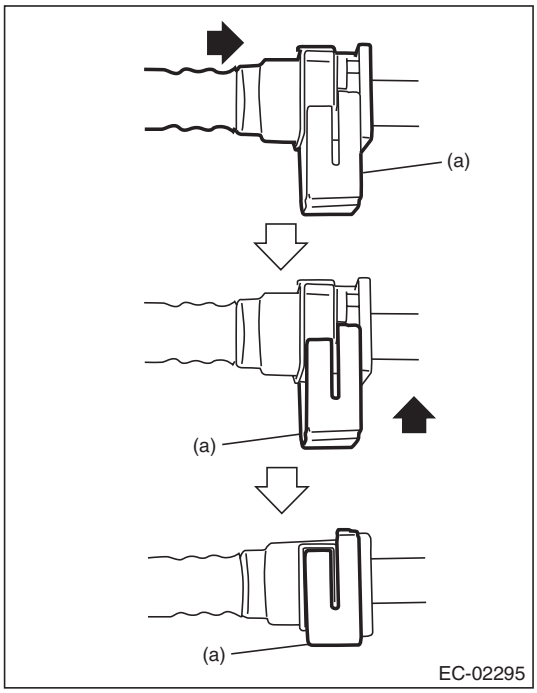




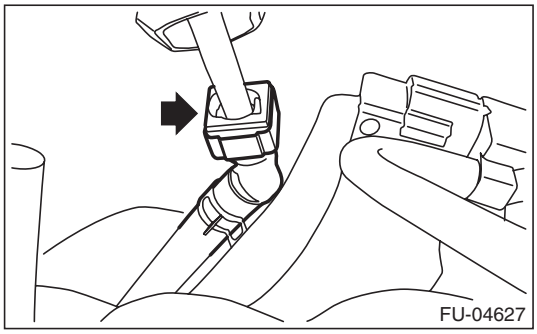
(1) Hose
(2) Clamp or clip
(3) Spool
(4) Pipe

3) Connect the quick connector of the evaporation hose to the evaporation pipe.

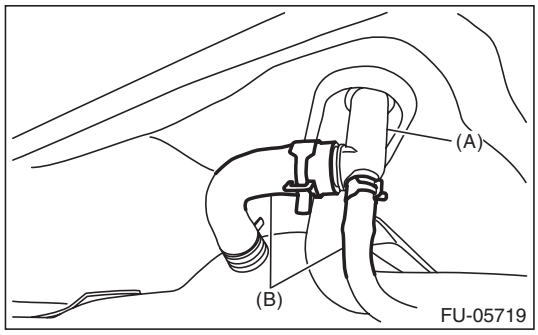
CAUTION:
• Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
• When connecting the quick connector, securely insert the pipe all the way before locking the retainer.
• When it is difficult to lock the retainer, make sure that the pipe is securely inserted.
• Make sure that the quick connector is securely connected.



(a) Retainer

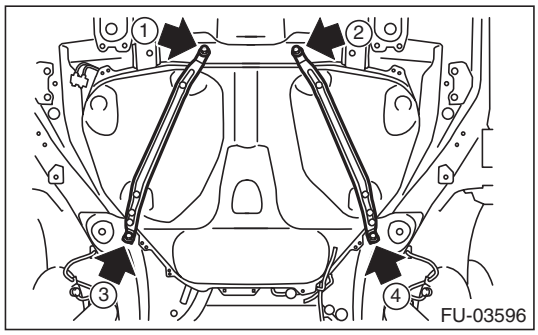


4) Connect the evaporation hose (B) to hose connector (A).



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)

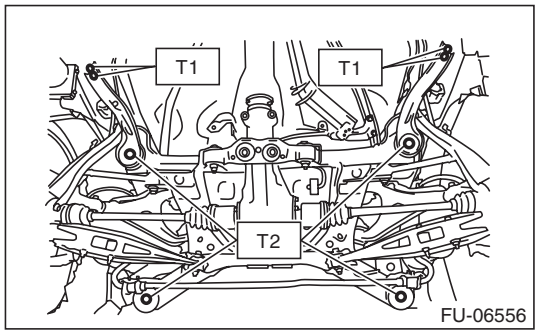


6) Install the rear suspension assembly.

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 install the rear suspension assembly to the body.

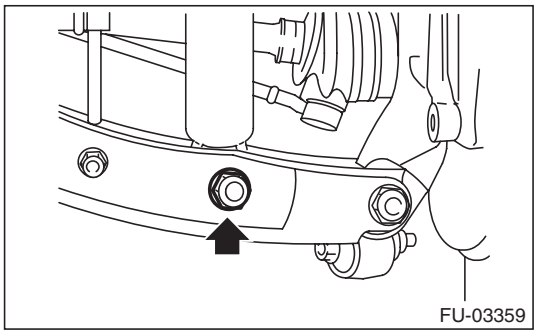
Tightening torque:
T1: 70 N·m (7.1 kgf-m, 51.6 ft-lb)
T2: 145 N·m (14.8 kgf-m, 106.9 ft-lb)



(3) Install the rear shock absorber to the rear suspension arm.

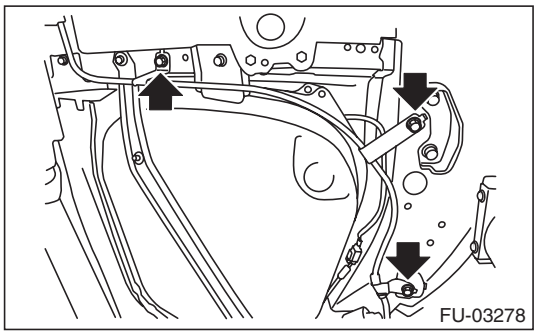
NOTE:
Use a new self-locking nut.

Tightening torque:
120 N·m (12.2 kgf-m, 88.5 ft-lb)



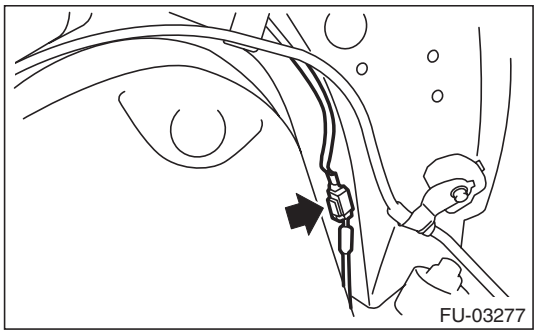
7) Install the parking brake cable clamp to the body.

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



8) Connect the connector to the rear ABS wheel speed sensor.

NOTE:
Prevent the harness identification (line) from being twisted when installing. (RH: White line, LH: Yellow line)



9) Install the heat shield cover.

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

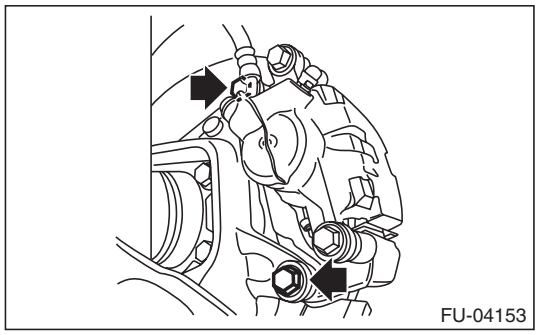
10) Install the fuel tank protector.

NOTE:
Use a new self-locking nut.

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)

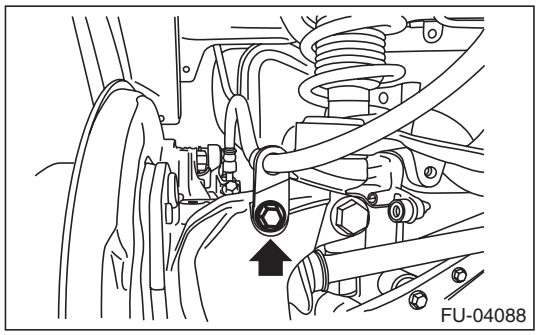
11) Install the propeller shaft. <Ref. to DS-12, INSTALLATION, Propeller Shaft.>
12) Install the rear exhaust pipe and muffler. <Ref. to EX(STI)-13, INSTALLATION, Rear Exhaust Pipe.> <Ref. to EX(STI)-15, INSTALLATION, Muffler.>
13) Lower the vehicle.
14) Connect the parking brake cable to the parking brake assembly. <Ref. to PB-7, INSTALLATION, Parking Brake Assembly (Rear Disc Brake).>
15) Install the rear disc brake assembly.

Tightening torque:
66 N·m (6.7 kgf-m, 48.7 ft-lb)


FU-04153

16) Install the rear brake hose bracket to the rear housing.

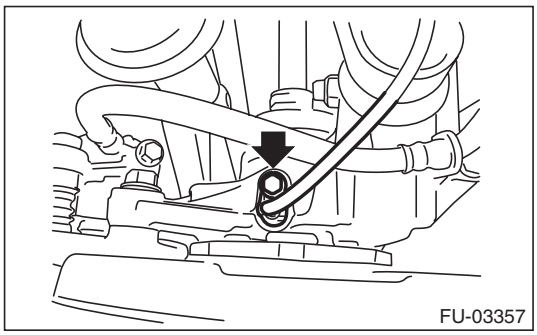
Tightening torque:
33 N·m (3.4 kgf-m, 24.3 ft-lb)


FU-04088

17) Attach the rear ABS wheel speed sensor to the rear housing.

NOTE:
Prevent the harness identification (line) from being twisted when installing. (RH: White line, LH: Yellow line)

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

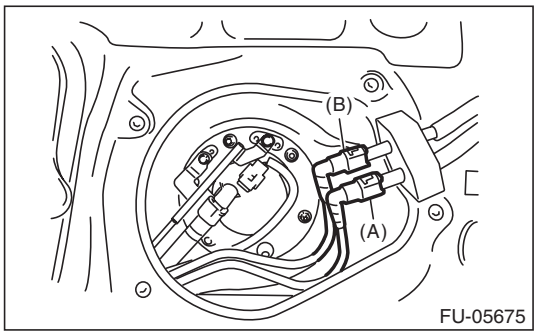

FU-03357

18) Install the rear wheels.

Tightening torque:
100 N·m (10.2 kgf-m, 73.8 ft-lb)

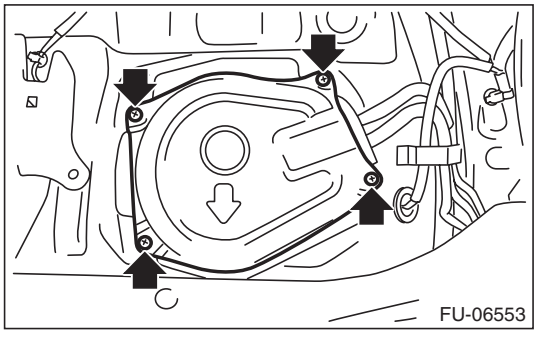
19) Connect the quick connector of fuel delivery tube (A) and fuel return tube (B). <Ref. to FU(w/o STI)-92, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

NOTE:
When connecting, be careful not to reverse the delivery side and return side.

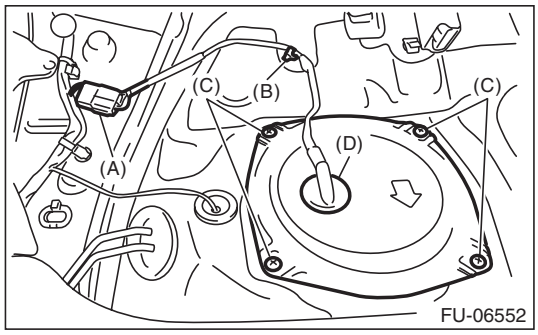


FU-05675

20) Install the service hole cover of fuel sub level sensor.

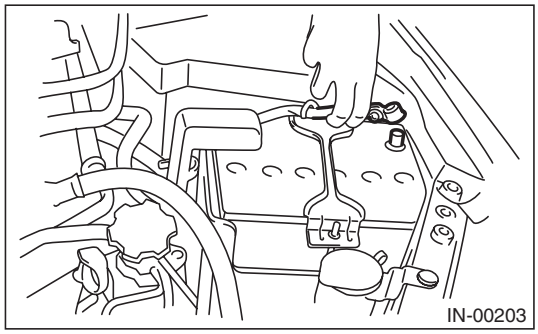

FU-06553

21) Attach the service hole cover of the fuel pump, and attach the connector and clip.



(A) Connector
(B) Clip
(C) Screw
(D) Grommet

22) Install the rear seat cushion. <Ref. to SE-15, INSTALLATION, Rear Seat.>
23) Connect the battery ground terminal.



24) Inspect the wheel alignment and adjust if necessary.

C: INSPECTION

1) Check that the fuel tank and fuel pipe have no deformation, cracks and other damages.
2) Check that the fuel hose has no cracks, damage or loose part.

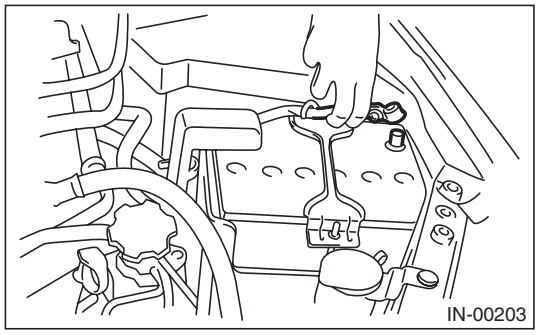
25.Fuel Filler Pipe

A: REMOVAL

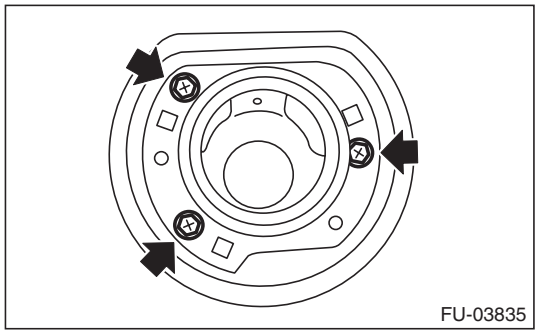
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

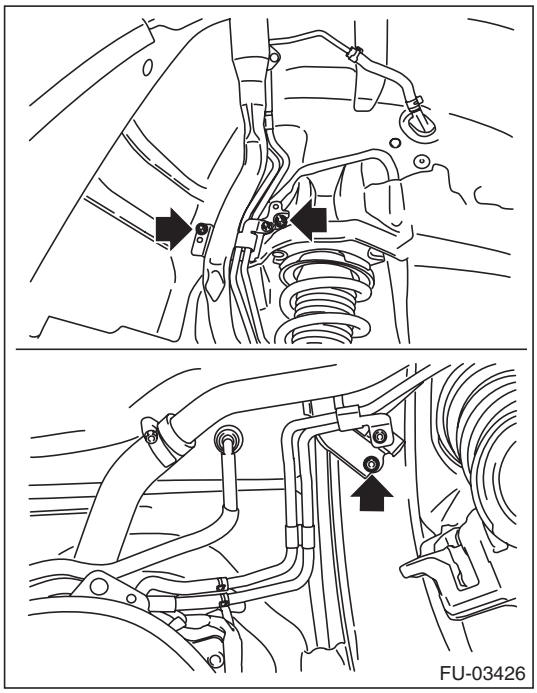
1) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(w/o STI)-65, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.



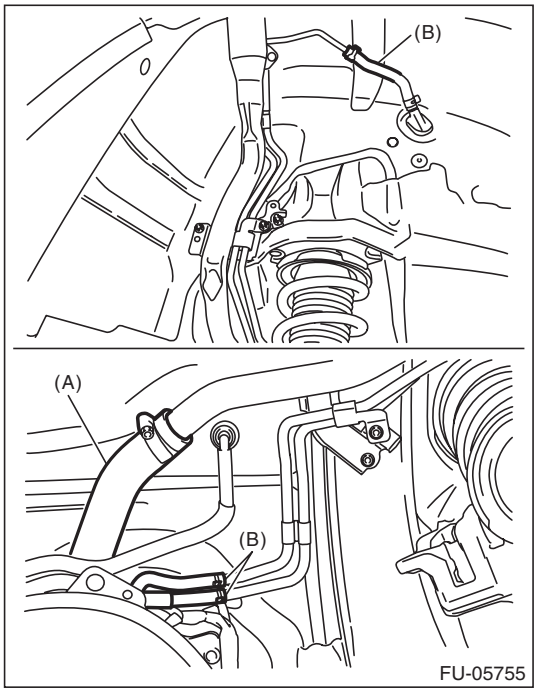
4) Open the fuel filler lid, and remove the filler cap.
5) Remove the screws which secure the fuel filler ring, and then remove the fuel filler ring.



6) Remove the rear wheel RH.
7) Lift up the vehicle.
8) Remove the rear mud guard RH. <Ref. to EI-30, REAR MUD GUARD, REMOVAL, Mud Guard.>
9) Remove the rear sub frame. <Ref. to RS-17, REMOVAL, Rear Sub Frame.>
10) Remove the bolts and nuts which secure fuel filler pipe assembly onto the vehicle body.



11) Disconnect the fuel filler hose (A) and evaporation hose (B) from the fuel filler pipe assembly.

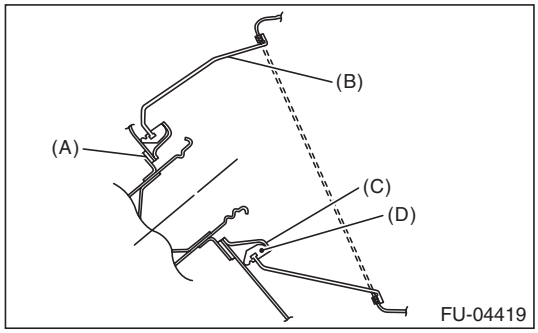


12) Remove the fuel filler pipe assembly from the underside of the vehicle.

B: INSTALLATION

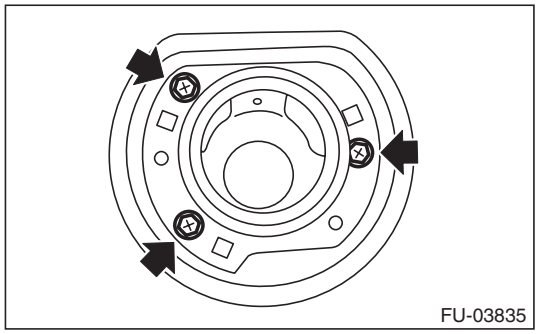
1) Open the fuel filler lid.
2) Attach the fuel filler pipe gasket to the fuel filler pipe assembly, and insert the fuel filler pipe assembly from inside of the rear fender.
3) Install the fuel filler ring to the fuel filler pipe assembly.

NOTE:
If the edges of rubber gasket are folded toward inside, straighten it with a flat tip screwdriver.



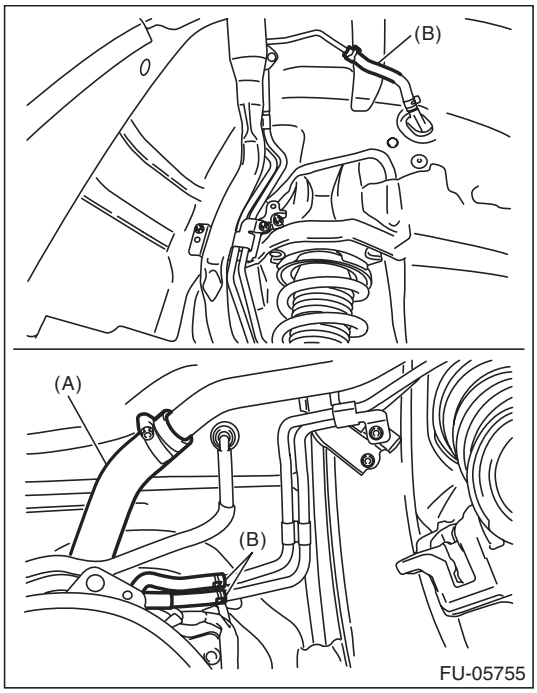
(A) Fuel filler pipe gasket
(B) Fuel saucer
(C) Fuel filler ring
(D) Rubber gasket

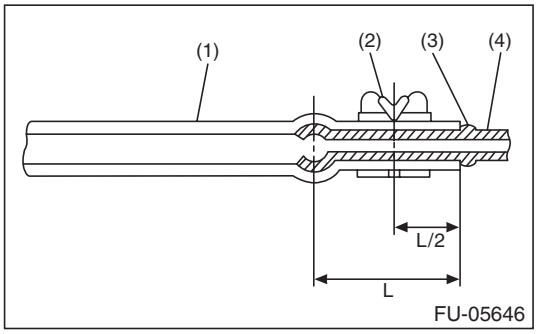
Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)



4) Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, 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)

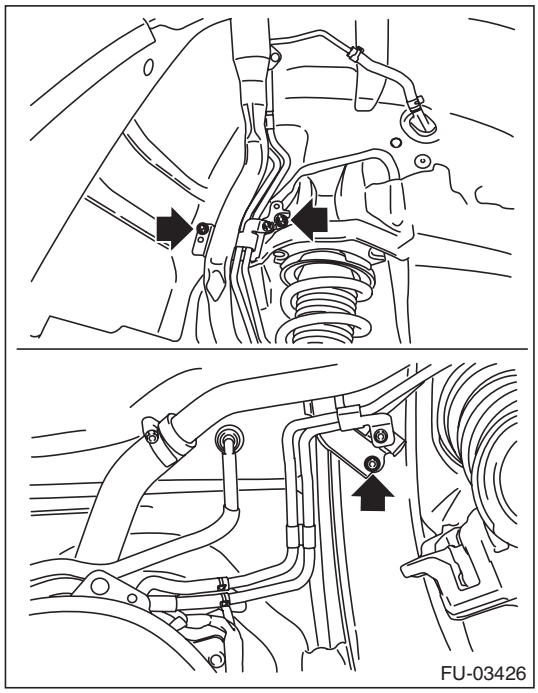




(1) Hose
(2) Clamp or clip
(3) Spool
(4) Pipe

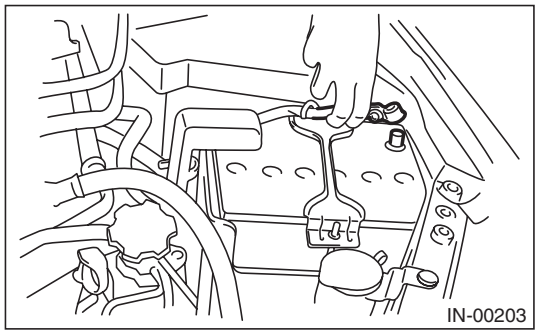
5) Install the fuel filler pipe assembly to vehicle body.

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-30, INSTALLATION, Mud Guard.>
8) Lower the vehicle.
9) Install the rear wheel RH.

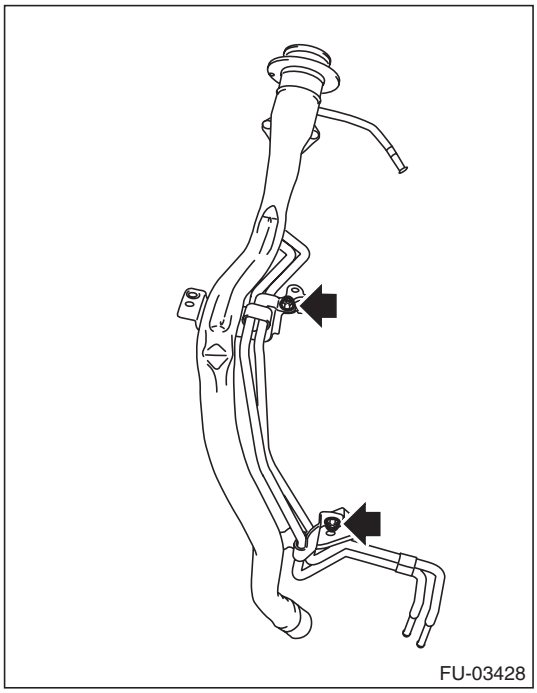
Tightening torque:
100 N·m (10.2 kgf-m, 73.8 ft-lb)
10) Connect the battery ground terminal.



11) Inspect the wheel alignment and adjust if necessary.

C: DISASSEMBLY

1) Remove the shut valve from the fuel filler pipe. <Ref. to EC(w/o STI)-19, REMOVAL, Shut Valve.>
2) Remove the evaporation pipe from the fuel filler pipe.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

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

E: INSPECTION

1) Check that the fuel filler pipe and evaporation pipe have no deformation, cracks or other damages.
2) Check that the hose has no cracks, damage or loose part.

26.Fuel Pump

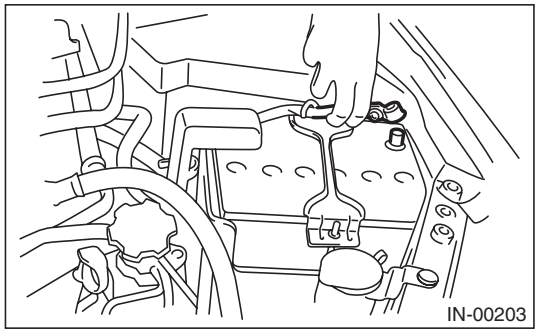
A: REMOVAL

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

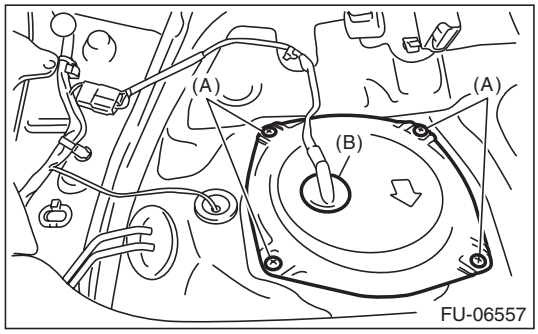
CAUTION:
- **Be careful not to spill fuel.**
- **If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.**

NOTE:
Fuel pump assembly consists of fuel pump, fuel filter and fuel level sensor.

1) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(w/o STI)-65, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.

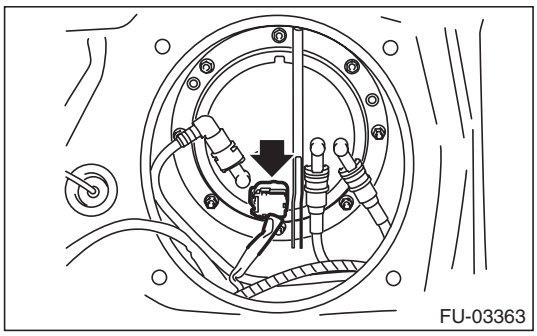

IN-00203

4) Remove the rear seat cushion. <Ref. to SE-14, 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.

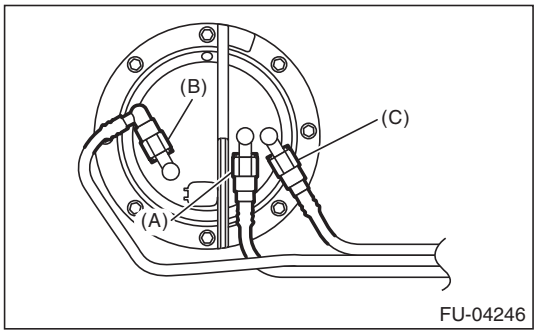


FU-06557

6) Disconnect the connector from fuel pump.

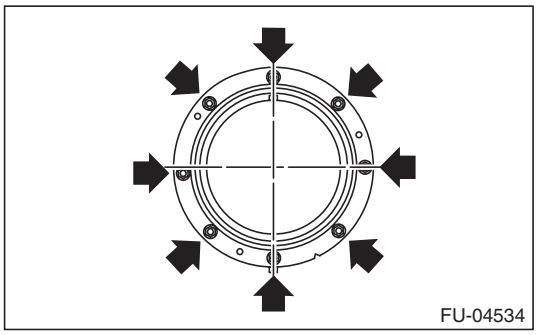

FU-03363

7) Disconnect the quick connectors of fuel delivery tube (A), fuel return tube (B), and jet pump tube (C). <Ref. to FU(w/o STI)-89, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



FU-04246

8) Remove the nuts which hold the fuel pump upper plate to the fuel tank.


FU-04534

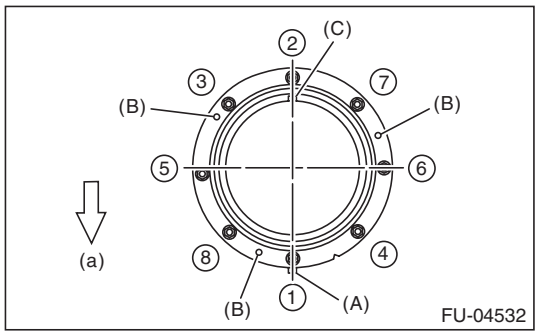
9) Remove the fuel pump assembly from the fuel tank.

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.
• Align protrusion (A) of the gasket to the position shown in the figure.
• Insert the protrusion (B) of gasket to the fuel pump upper plate. (3 places)
• Align the protrusion (C) of fuel pump assembly with the cutout on the fuel pump upper plate.
• Tighten the nuts to the specified torque in the order as shown in the figure.

NOTE:
Use a new gasket.

Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)

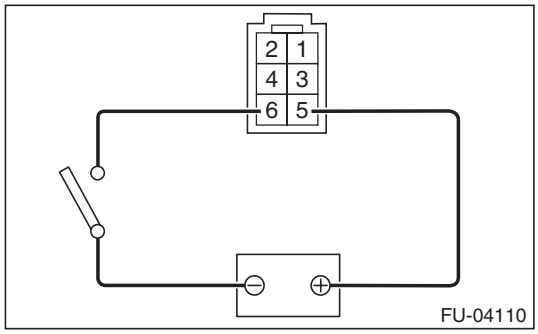


(a) Front side of vehicle

C: INSPECTION

1) Check that the fuel pump has no deformation, cracks or other damages.
2) Connect the battery positive terminal to terminal No. 5 and the battery ground terminal to terminal No. 6, 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.



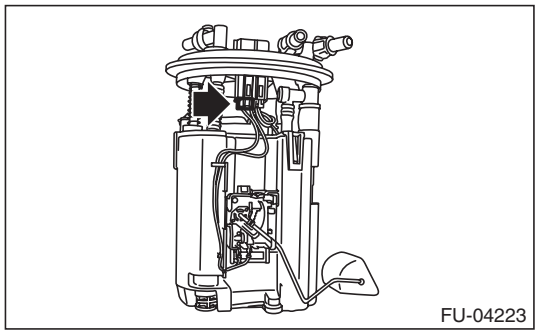
27.Fuel Level Sensor

A: REMOVAL

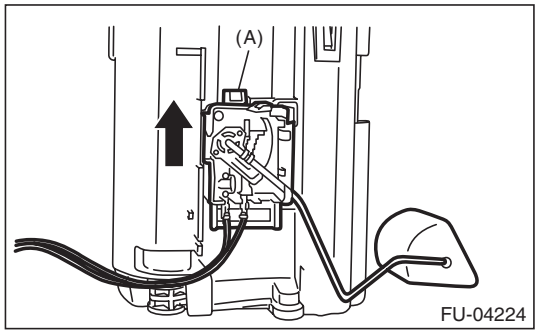
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

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(w/o STI)-78, REMOVAL, Fuel Pump.>
2) Disconnect the fuel level sensor connector.


FU-04223

3) 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.



FU-04224

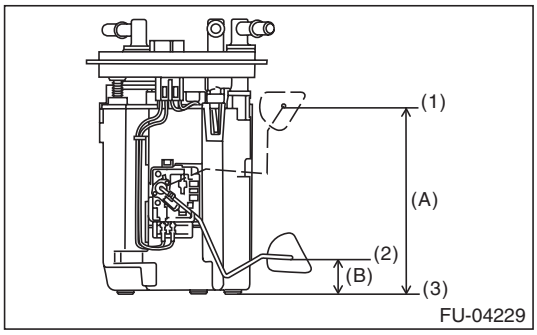
B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

1) Check that the fuel level sensor has no damage.
2) Measure the fuel level sensor float position.

NOTE:
When inspecting the fuel level sensor, perform the work with the sensor installed to the fuel pump.

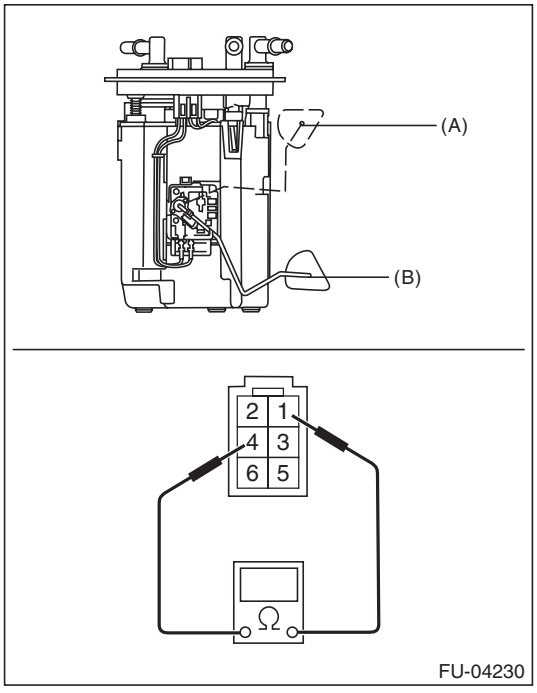


FU-04229

(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)

3) Measure the resistance between fuel level sensor terminals.



FU-04230

Float position	Terminal No.	Standard
FULL (A)	1 and 4	2.0±1.0 Ω
EMPTY (B)		31.9±1.0 Ω

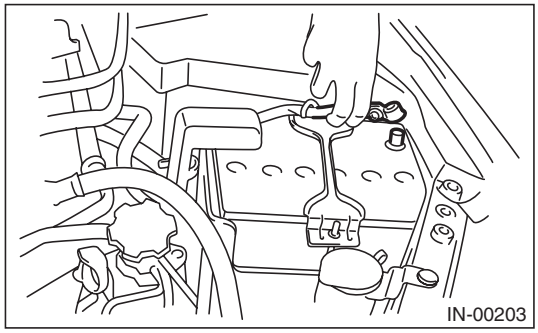
28.Fuel Sub Level Sensor

A: REMOVAL

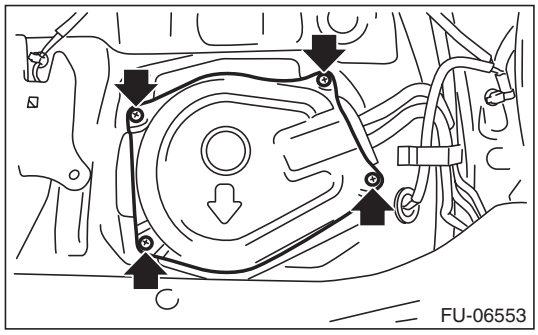
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

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.**

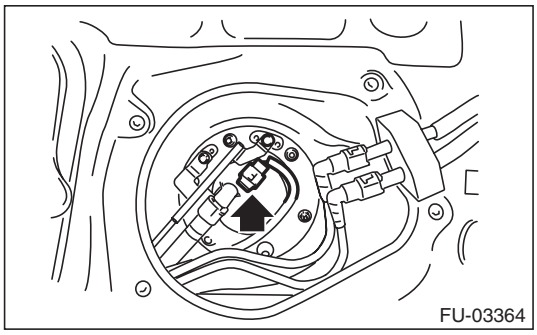
1) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Drain fuel. <Ref. to FU(w/o STI)-65, DRAINING FUEL (WITH SUBARU SELECT MONITOR), PROCEDURE, Fuel.>
3) Disconnect the ground cable from battery.


IN-00203

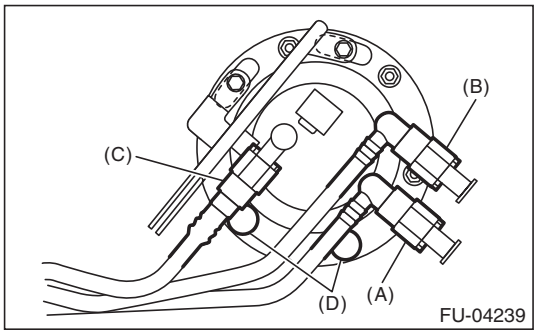
4) Remove the rear seat cushion. <Ref. to SE-14, REMOVAL, Rear Seat.>
5) Remove the service hole cover.


FU-06553

6) Disconnect the connector from the fuel sub level sensor.

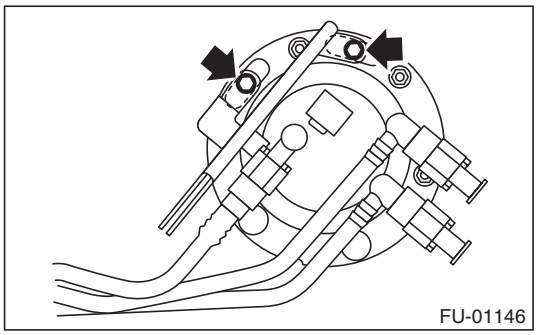

FU-03364

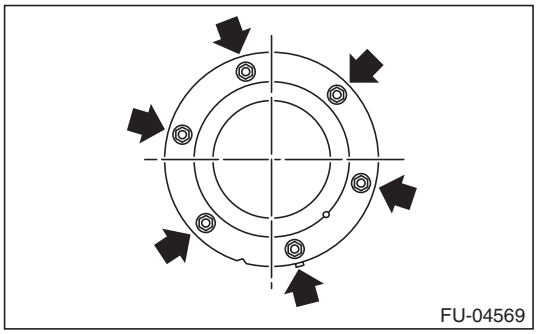
7) Disconnect the quick connectors of fuel delivery tube (A), fuel return tube (B), and jet pump tube (C). <Ref. to FU(w/o STI)-89, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>
8) Remove the rubber cap (D) from the nut.



FU-04239

9) Remove the bolts and nuts which hold fuel sub level sensor protector and fuel sub level sensor upper plate to the fuel tank.


FU-01146


FU-04569

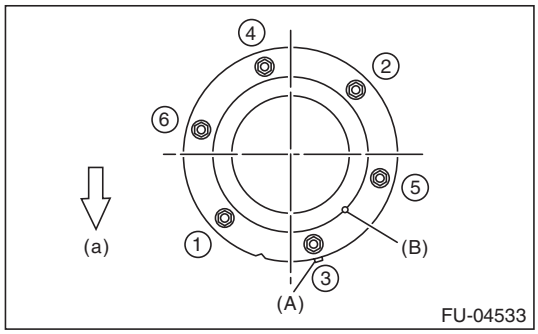
10) Remove the fuel sub level sensor from the fuel tank.

B: INSTALLATION

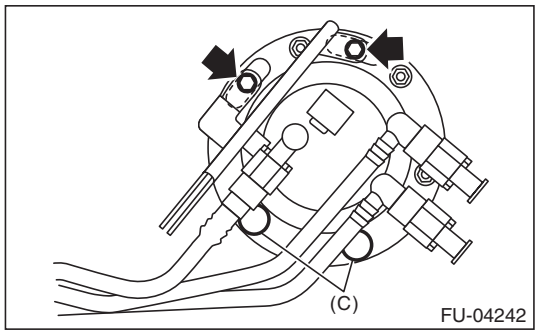
Install in the reverse order of removal while being careful of the following.
- Make sure the sealing portion is free from fuel or foreign matter before installation.
- Align protrusion (A) of the gasket to the position shown in the figure.
- Align protrusion (B) of the fuel sub level sensor to the cutout 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) at the position shown in the figure.

NOTE:
- Use a new gasket.
- Do not forget to install rubber cap (C).

Tightening torque:
4.4 N·m (0.4 kgf-m, 3.2 ft-lb)

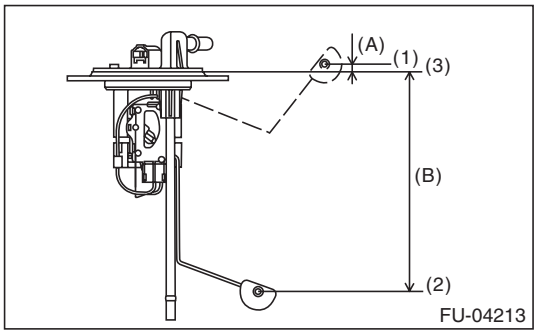


(a) Front side of vehicle



C: INSPECTION

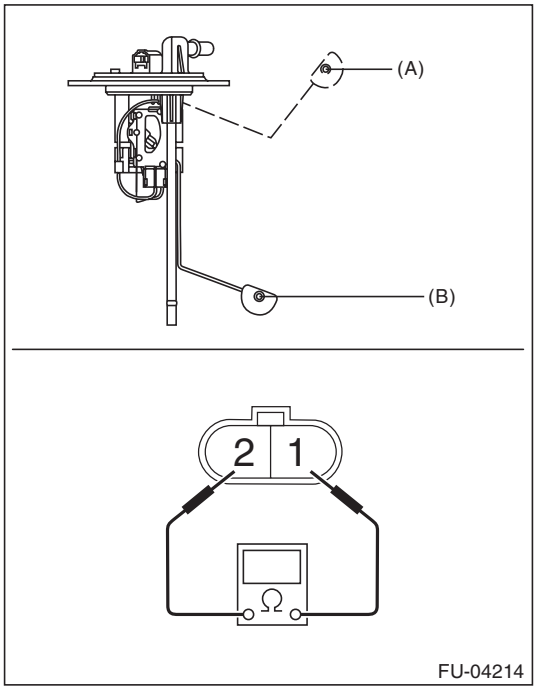
1) Check that the fuel sub level sensor has no damage.
2) Measure the fuel sub level sensor float position.



(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)

3) Measure the resistance between fuel sub level sensor terminals.



Float position	Terminal No.	Standard
FULL (A)	1 and 2	$2.0^{+0.5}_{-1.0}$ Ω
EMPTY (B)		62.1±1.0 Ω

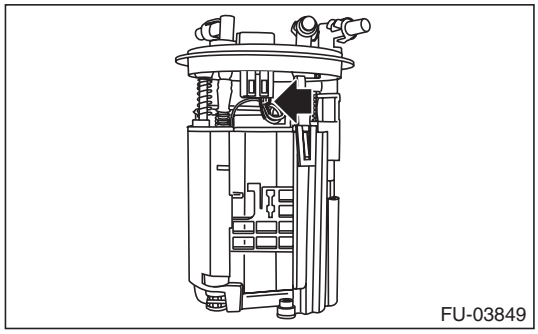
29. Fuel Filter

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.**

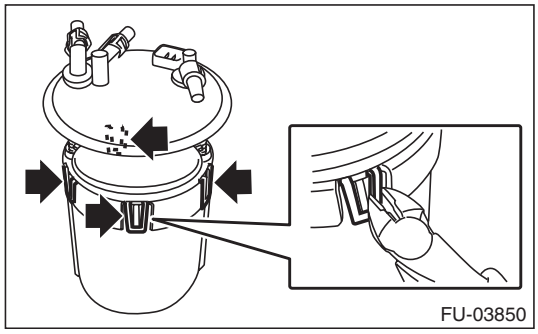
NOTE:
The fuel filter is built in fuel pump assembly.
1) Remove the fuel pump assembly. <Ref. to FU(w/o STI)-78, REMOVAL, Fuel Pump.>
2) Remove the fuel level sensor. <Ref. to FU(w/o STI)-80, REMOVAL, Fuel Level Sensor.>
3) Disconnect the pump assembly connector from sub tank bracket assembly.


FU-03849

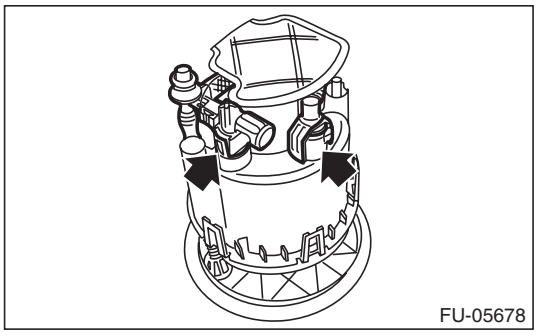
4) Cut off the tab holders connecting the sub tank bracket assembly and the sub tank in four locations, and separate the sub tank bracket assembly and the sub tank.

CAUTION:
Be careful not to damage the sub tank.

NOTE:
If the O-ring is remaining on the sub tank, remove.

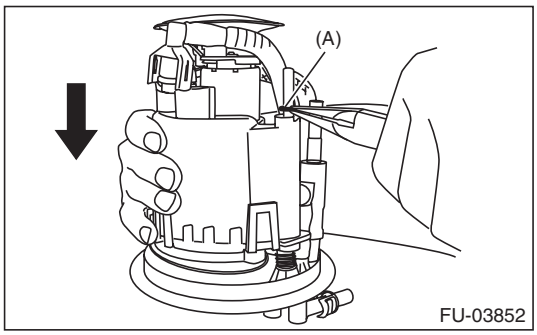

FU-03850

5) Disconnect two connectors of fuel delivery pipe from fuel filter assembly.


FU-05678

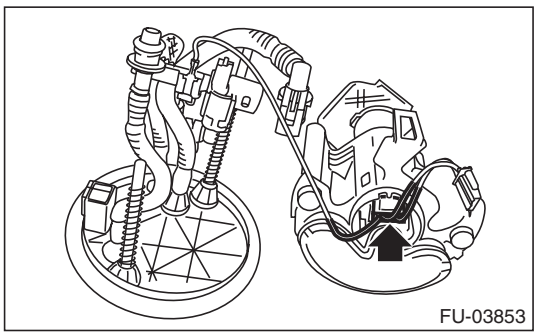
6) Push to compress the fuel filter assembly in the direction of the arrow, remove clip (A), and separate the sub tank bracket assembly and the fuel filter assembly.

CAUTION:
When separating the sub tank bracket assembly and the fuel filter assembly, be careful not to damage the ground wire.



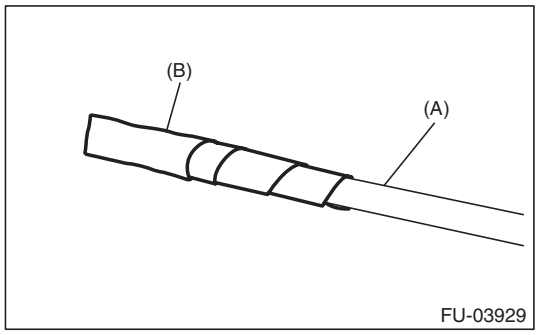
FU-03852

7) Disconnect the connector from the pump assembly.


FU-03853

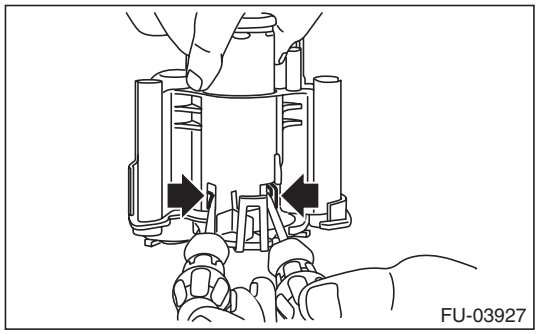
8) Lift the two tab holders connecting the pump assembly to the fuel filter using a flat tip screwdriver (with a shaft diameter of approx. 3 mm (0.12 in)), etc., and separate the fuel filter and pump assembly.

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.

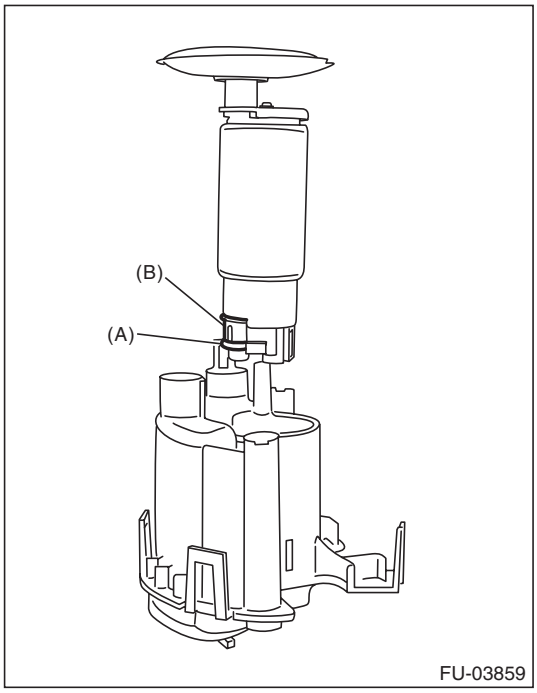
NOTE:
If the spacer and O-ring is remaining on the pump assembly, remove these.



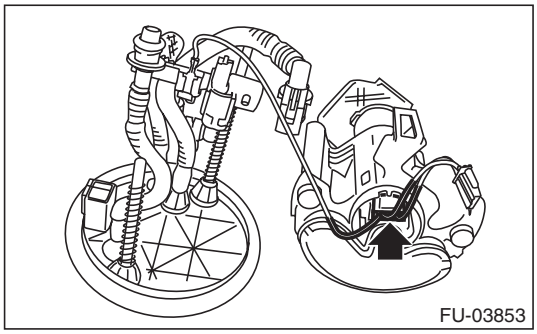
B: INSTALLATION

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 click is heard.

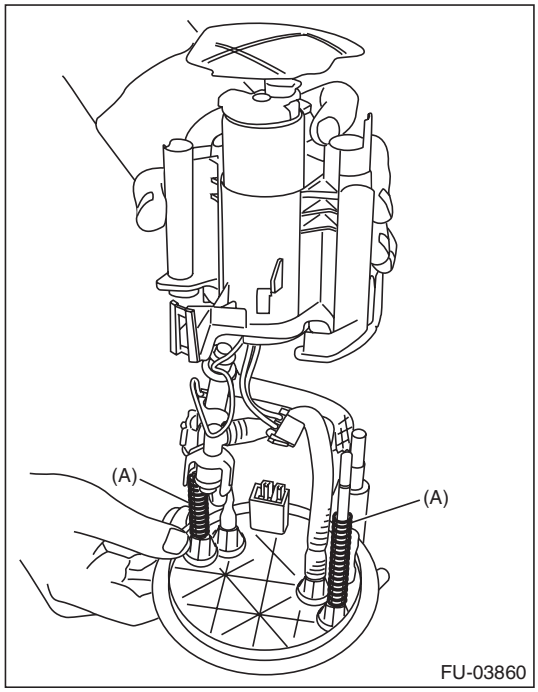


2) Connect the connector to the pump assembly.



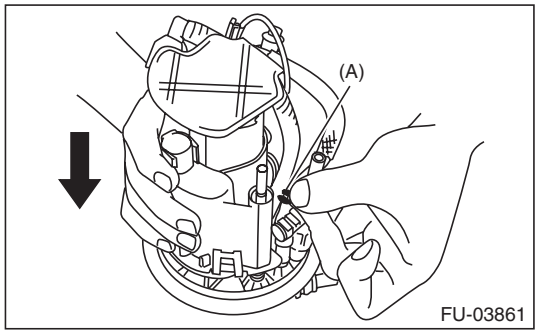
3) Attach spring (A) to the metal rod of the sub tank bracket assembly, and assemble the fuel filter assembly.

NOTE:
Use a new spring.



4) Push the fuel filter assembly in the direction of the arrow to compress, and attach clip (A).

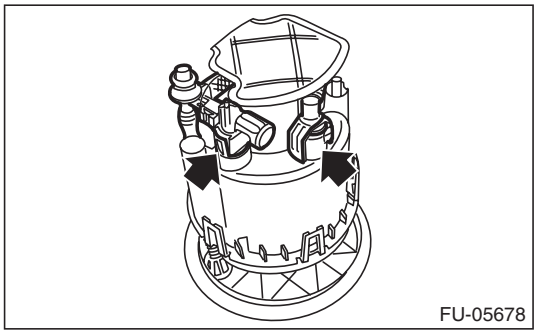
NOTE:
Use a new clip.



5) Connect the fuel piping connector to the fuel filter assembly.

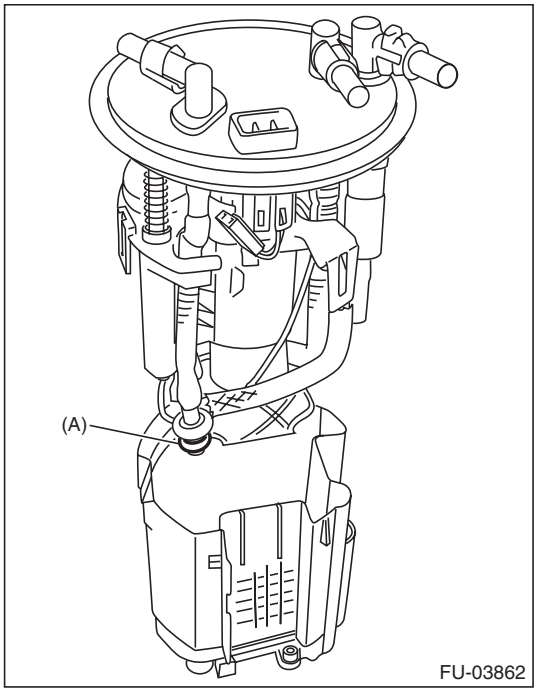
NOTE:
- Use new O-rings.
- Apply gasoline to the O-ring.
- The O-rings of the black and white connectors are identified by a difference in diameter. Be careful not to confuse the two during assembly.

O-ring inner diameter:
Black connector O-ring [Approx. 7 mm (0.28 in)]
White connector O-ring [Approx. 8 mm (0.31 in)]

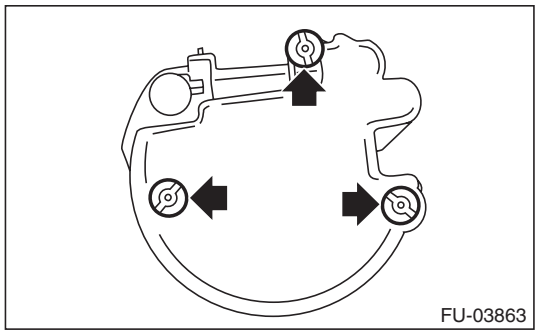


6) Attach the O-ring (A) to the fuel filter assembly, and attach the sub tank to the sub tank bracket assembly.

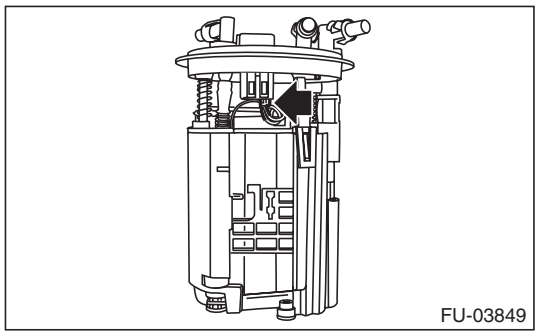
NOTE:
- Use new O-rings (8 mm (0.31 in) inner diameter).
- Apply gasoline to the O-ring.
- Insert the pump assembly until a “pop” is heard.



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. <Ref. to FU(w/o STI)-80, INSTALLATION, Fuel Level Sensor.>
10) Inspect the fuel level sensor. <Ref. to FU(w/o STI)-80, INSPECTION, Fuel Level Sensor.>
11) Install the fuel pump assembly. <Ref. to FU(w/o STI)-79, INSTALLATION, Fuel Pump.>

30. Fuel Damper

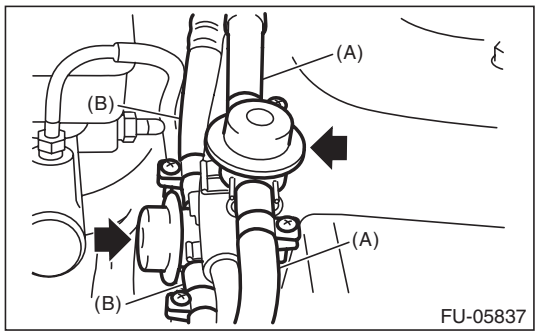
A: REMOVAL

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(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Disconnect the fuel delivery hose (A) and fuel return hose (B) from the fuel damper, and remove the fuel damper.

NOTE:
Fuel dampers on delivery side and return side are different. Be careful not to confuse them.



B: INSTALLATION

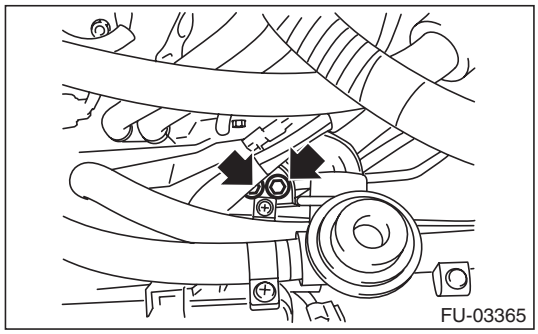
Install in the reverse order of removal.

NOTE:
- Fuel dampers on delivery side and return side are different. Be careful not to confuse them.
- For the information about connecting the fuel delivery hose and fuel return hose, refer to "Fuel Delivery, Return and Evaporation Lines". <Ref. to FU(w/o STI)-93, CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

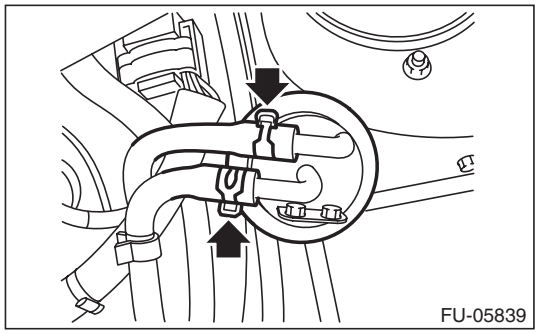
31.Purge Damper

A: REMOVAL

WARNING:
Place "NO OPEN FLAMES" signs near the working area.
1) Remove the bolts which secure the purge damper to the purge damper bracket.



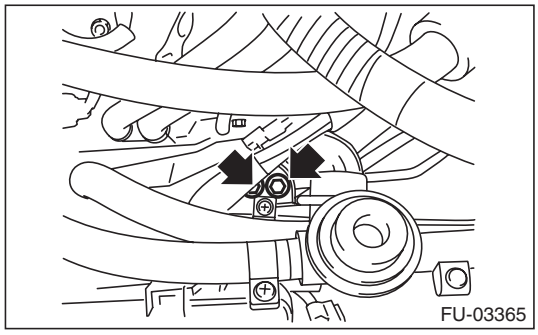
2) Disconnect the evaporation hose from the purge damper and remove the purge damper.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)

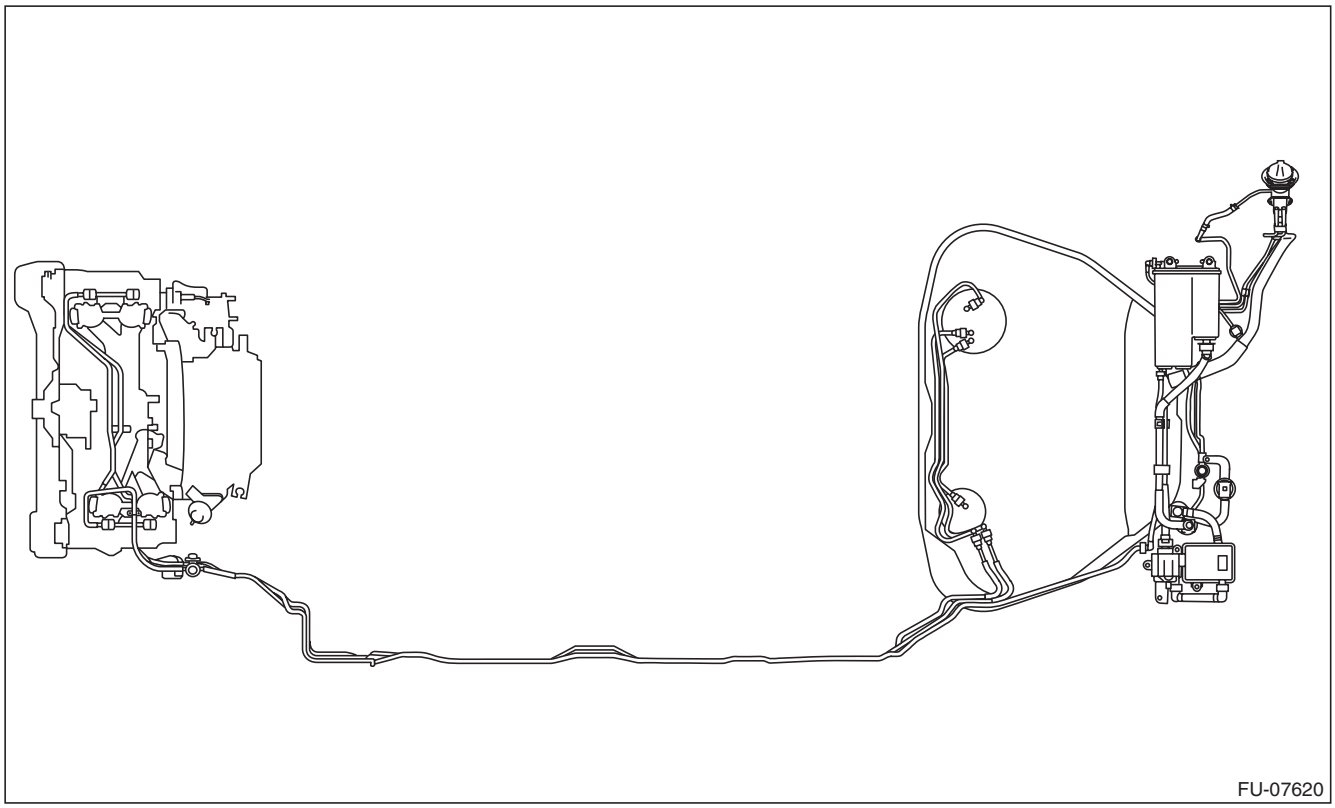


C: INSPECTION

1) Check that the purge damper has no deformation, cracks or other damages.
2) Check that the evaporation hose has no cracks, damage or loose part.

32.Fuel Delivery, Return and Evaporation Lines

A: REMOVAL



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

CAUTION:
Be careful not to spill fuel.

1) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
2) Open the fuel filler lid and remove the fuel filler cap.
3) Remove the floor mat. <Ref. to EI-71, REMOVAL, Floor Mat.>

4) In the engine compartment, disconnect the fuel delivery hoses, fuel return hoses and evaporation hoses.

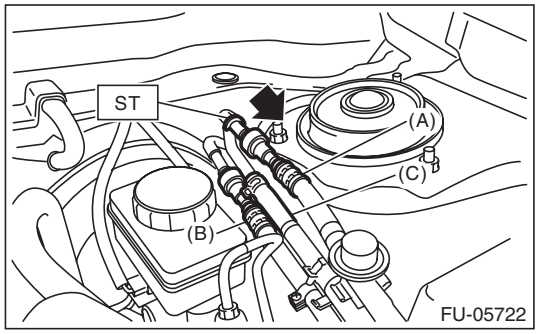
CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

(1) Set the ST to the fuel pipe.

ST 42099AE000 QUICK CONNECTOR RELEASE

(2) Disconnect the quick connector of the fuel delivery hose and fuel return hose by pushing the ST in the direction of the arrow.

(3) Remove the clip and disconnect the evaporation hose from the fuel pipe.



(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

5) Remove the canister. <Ref. to EC(w/o STI)-7, REMOVAL, Canister.>
6) Remove the fuel tank. <Ref. to FU(w/o STI)-68, REMOVAL, Fuel Tank.>
7) Remove the fuel pipe assembly from vehicle.
8) Disconnect the quick connector, then disconnect the fuel delivery tube, fuel return tube and jet pump tube from the fuel tank.

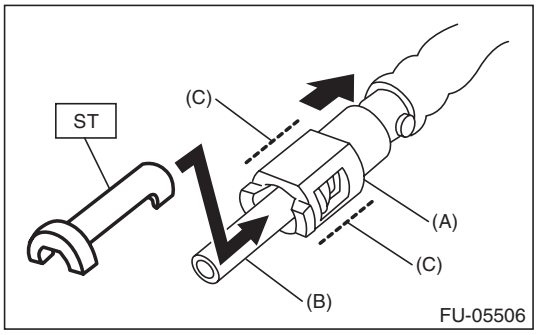
• When using ST

1. Attach ST to the pipe and push ST in the direction of arrow mark to disconnect the quick connector.

ST 42099AE000 QUICK CONNECTOR RELEASE

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.
• To disconnect the connector, hold (C) shown in the figure and pull in axial direction.
• If the connector and pipe are sticking to each other, push and pull the connector with ST pushed, and then pull the connector after it starts moving freely.
• When disconnecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.

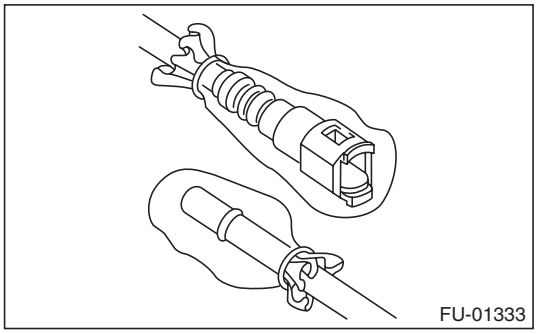
NOTE:
Clean the pipe and quick connector, if they are covered with dust.



(A) Quick connector
(B) Pipe
(C) Connector holding position

2. To prevent from damaging or entering foreign matter, wrap the pipes and quick connectors with plastic bag etc.

CAUTION:
When reusing the retainer, do not disconnect the retainer from the connector.



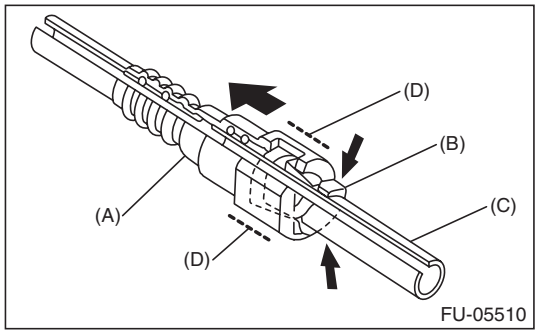
• When not using ST

1. Push the retainer in the direction of the arrow, disconnect the quick connector from pipe.

CAUTION:

- **Be careful not to spill fuel.**
- **Catch the fuel from hoses using a container or cloth.**
- **To disconnect the connector, hold (D) shown in the figure and pull in axial direction.**
- **If the connector and pipe are sticking to each other, push and pull the connector with the retainer pushed in the direction of the arrow, and then pull the connector after it starts moving freely.**
- **When disconnecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.**

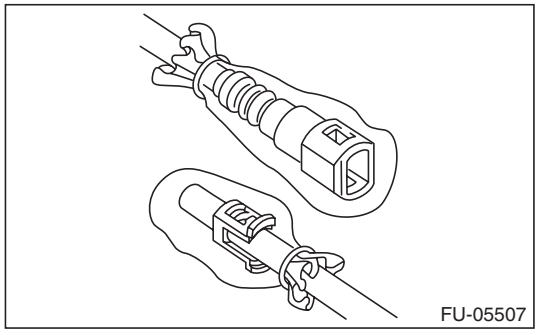
NOTE:
Clean the pipe and quick connector, if they are covered with dust.



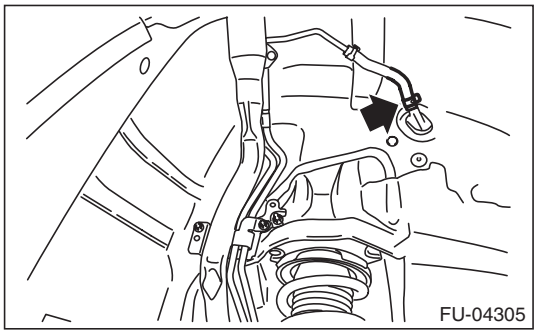
(A) Quick connector
(B) Retainer
(C) Pipe
(D) Connector holding position

2. To prevent from damaging or entering foreign matter, wrap the pipes and quick connectors with plastic bag etc.

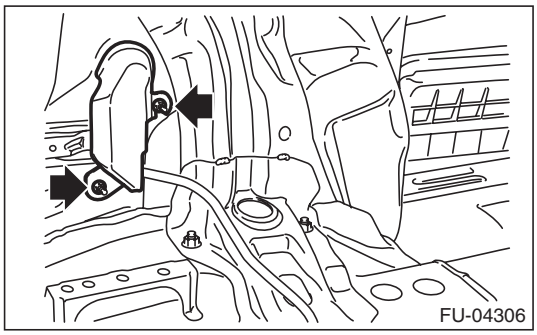
CAUTION:
When reusing the retainer, do not disconnect the retainer from the pipe.



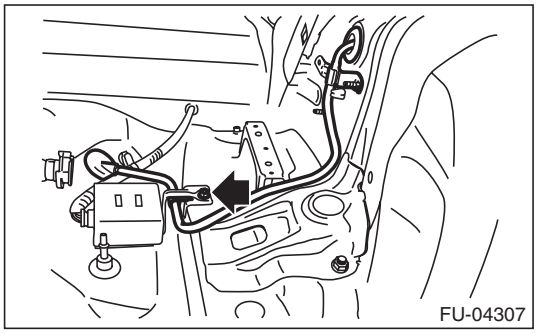
9) Remove the evaporation pipe.
(1) Remove the rear mud guard RH. <Ref. to EI-30, REMOVAL, Mud Guard.>
(2) Disconnect the evaporation hose.



(3) Remove the right side rear quarter trim. <Ref. to EI-60, REMOVAL, Rear Quarter Trim.>
(4) Remove the evaporation pipe protector.



(5) Remove the evaporation pipe from vehicle.

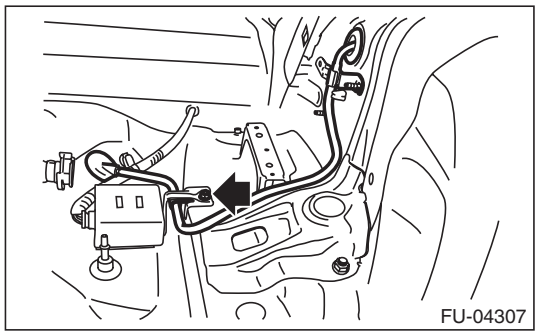


B: INSTALLATION

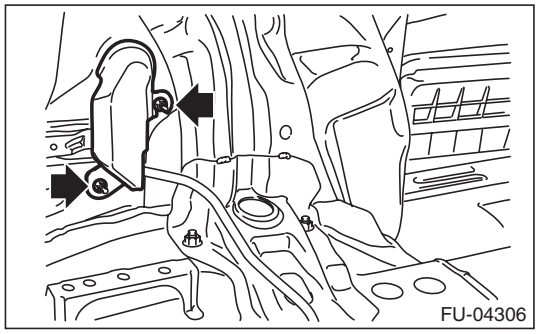
Install in the reverse order of removal while being careful of the following.

1. EVAPORATION PIPE INSTALLATION

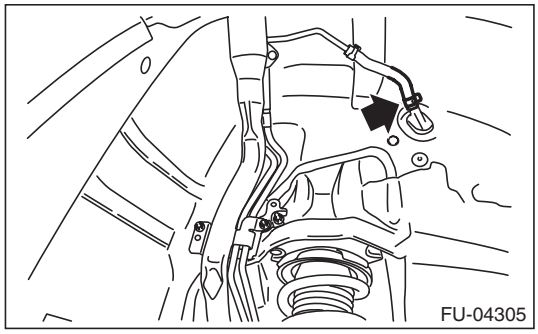
1) Install the evaporation pipe to the vehicle.



2) Install the evaporation pipe protector.



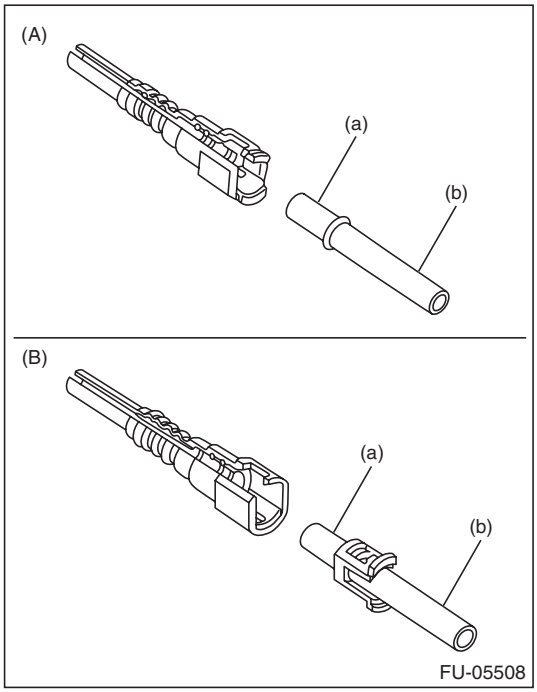
3) Install the right side rear quarter trim. <Ref. to EI-61, INSTALLATION, Rear Quarter Trim.>
4) Connect the evaporation hose.



5) Install the rear mud guard RH. <Ref. to EI-30, INSTALLATION, Mud Guard.>

2. CONNECTING THE FUEL LINE QUICK CONNECTOR

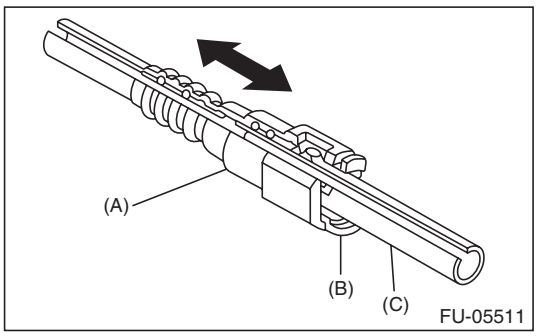
CAUTION:
• Make sure there are no damage or dust on connections. If necessary, clean seal surface of pipe.



(A) When removed using the ST
(B) When removed without using the ST
(a) Seal surface
(b) Pipe

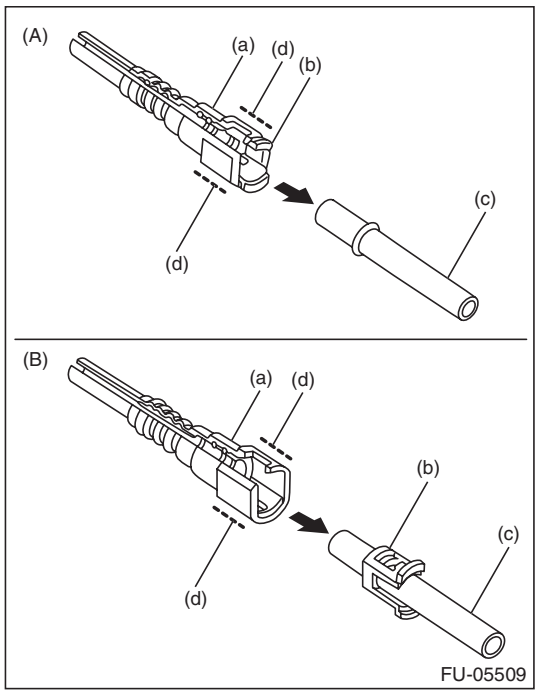
• When reusing the retainer, make sure that neither scratches nor deformation exist on the retainer. If it is faulty, use a new part.
1) Connect the quick connector to pipe.

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.
• To connect the connector, hold (d) shown in the figure and push in axial direction.
• When connecting the connector, do not bend or twist the tube forcibly. If the tube is bent, replace with a new part.



(A) When removed using the ST
(B) When removed without using the ST
(a) Quick connector
(b) Retainer
(c) Pipe
(d) Connector holding position

3. CONNECTING FUEL DELIVERY HOSE, FUEL RETURN HOSE AND FUEL HOSE

Connect the fuel delivery hose, fuel return hose, and fuel hose as shown in the figure.

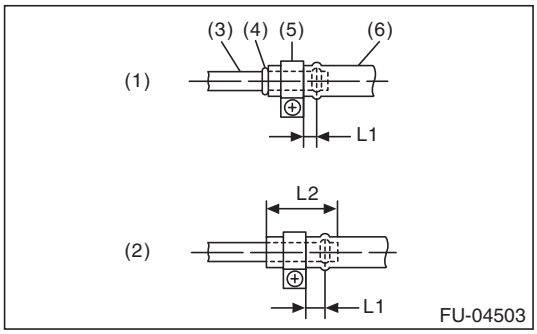
CAUTION:
• If the connection portion has a spool or stopper, do not allow the end of the hose to bend or ride over by inserting the hose too deep.
• Be sure to inspect hoses and their connections for any leakage of fuel.

NOTE:
Use new fuel delivery hose, fuel return hose, and fuel hose.

Tightening torque:
1.25 N·m (0.1 kgf-m, 0.9 ft-lb)

L1: 2.5±1.5 mm (0.098±0.059 in)

L2: 22.5±2.5 mm (0.886±0.098 in)

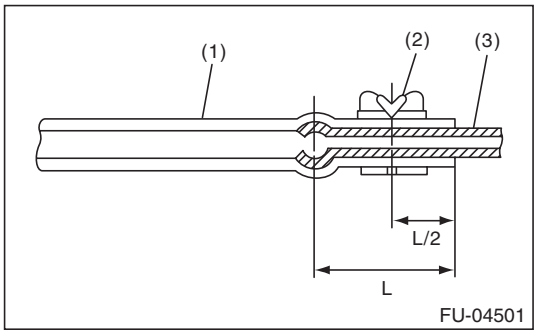


(1) When there is a spool or bump
(2) When there is no spool or bump
(3) Pipe
(4) Spool or bump
(5) Clamp
(6) Hose

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) Check that the fuel pipe has no deformation, cracks or other damages.
2) Check that the hose and tube have no cracks, damage or loose part.

33.Fuel System Trouble in General

A: INSPECTION

Trouble	Possible cause	Corrective action
Insufficient fuel supply to fuel injector	a. 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.
	b. Decline of fuel pump function	Replace the fuel pump.
	c. Clogged fuel filter	Replace the fuel filter. Clean or replace the fuel tank if necessary.
	d. Clogged or bent fuel line pipe, hose or tube	Clean, correct or replace the fuel line pipe, hose or tube.
	e. Air is mixed in fuel system.	Check the fuel line connections, correct or replace the defective part.
	f. Damaged diaphragm of pressure regulator	Replace the pressure regulator.
Leakage or blow out of fuel	a. Loose connections of fuel line pipe, hose or tube	Check the fuel line connections, correct or replace the defective part.
	b. Cracked fuel line pipe, hose or tube	Replace the fuel line pipe, hose or tube.
	c. Cracked fuel tank or defective welding part	Replace the fuel tank.
	d. Clogged or bent fuel line pipe, hose or tube	Clean, correct or replace the fuel line pipe, hose or tube.
Gasoline smell inside of compartment	a. Loose connections of fuel line pipe, hose or tube	Check the fuel line connections, correct or replace the defective part.
	b. Defective gasket of fuel saucer or fuel filler pipe assembly	Correct or replace the gasket.
	c. Defective canister	Replace the canister.
Defective fuel gauge	a. Defective operation of fuel level sensor	Replace the fuel level sensor.
	b. Defective operation of combination meter	Replace the combination meter.
	c. Defective operation of integrated unit	Replace the integrated unit.
Noise	a. Large operation noise or vibration of fuel pump	Replace the fuel pump.

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(w/o STI)

		Page
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3.	Rear Catalytic Converter	6
4.	Canister	7
5.	Purge Control Solenoid Valve	11
6.	Fuel Level Sensor	15
7.	Fuel Sub Level Sensor	16
8.	Pressure Control Solenoid Valve Assembly	17
9.	Drain Filter	18
10.	Shut Valve	19
11.	Leak Check Valve Assembly	20
12.	Drain Separator	24
13.	PCV Hose Assembly	25
14.	PCV Valve	27
15.	Secondary Air Pump	29
16.	Secondary Air Combination Valve	30

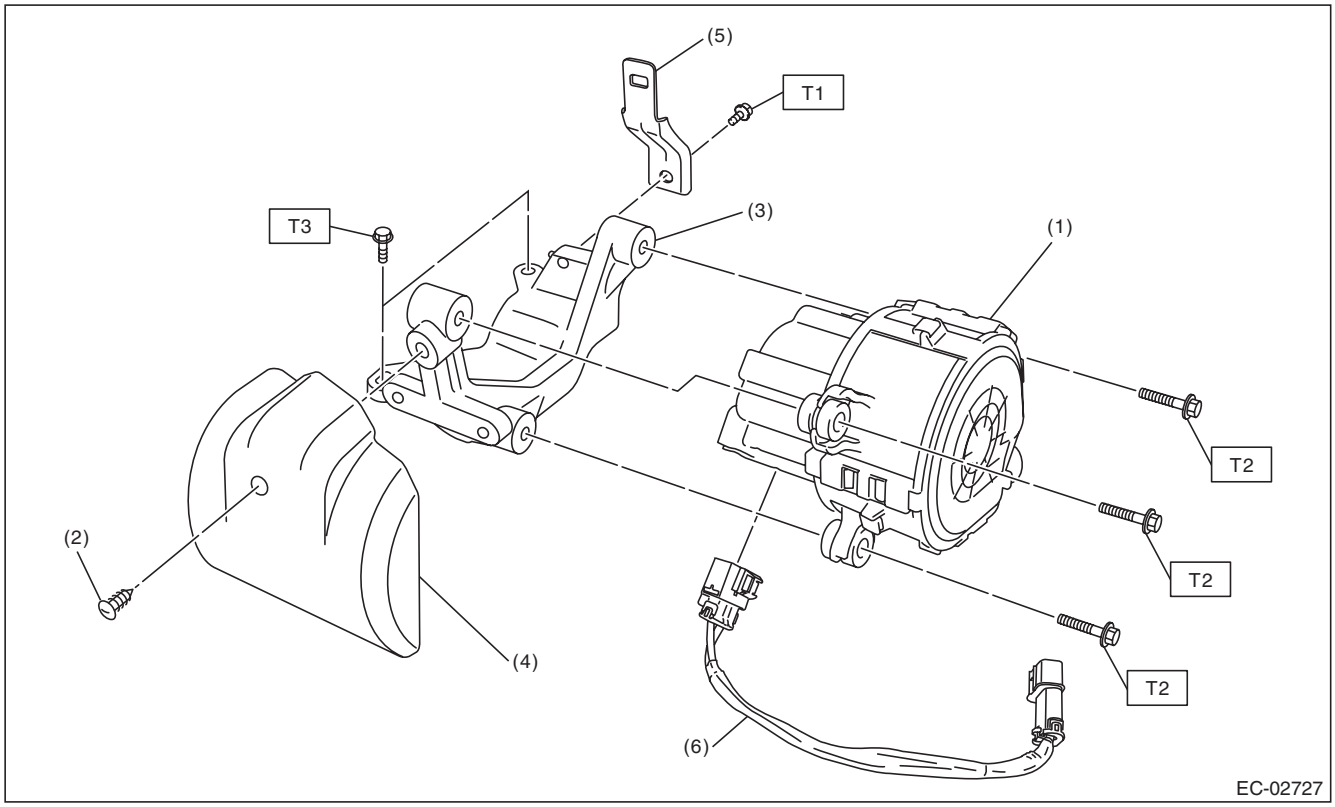
1. General Description

A: COMPONENT

1. CANISTER, PURGE CONTROL SOLENOID VALVE, PRESSURE CONTROL SOLENOID VALVE ASSEMBLY, SHUT VALVE, LEAK CHECK VALVE, AND DRAIN SEPARATOR

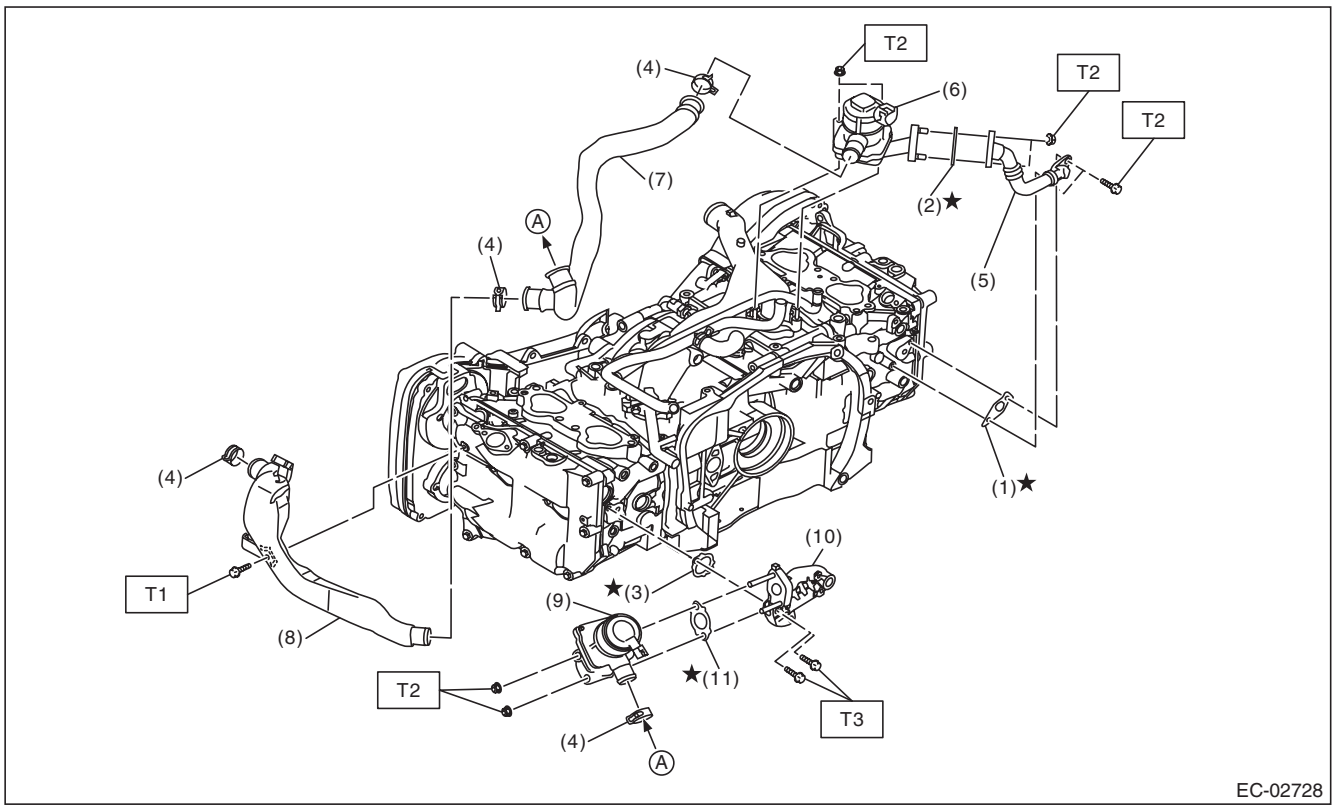
For components of canister, purge control solenoid valve, pressure control solenoid valve assembly, shut valve, leak check valve, and drain separator, refer to FU (w/o STI). <Ref. to FU(w/o STI)-3, COMPONENT, General Description.>

2. SECONDARY AIR PUMP



(1)	Secondary air pump	(4)	Secondary air pump cover	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Clip	(5)	Harness stay	***T1: 6.4 (0.7, 4.7)***
(3)	Secondary air pump bracket	(6)	Secondary air pump harness	***T2: 9 (0.9, 6.6)***
				T3: 19 (1.9, 14.0)

3. SECONDARY AIR COMBINATION VALVE



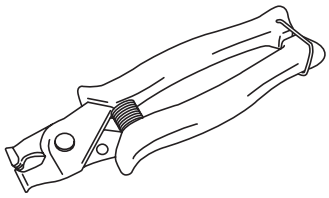
(1)	Gasket	(7)	Air duct A	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Gasket	(8)	Air duct B	***T1: 6.4 (0.7, 4.7)***
(3)	Gasket	(9)	Secondary air combination valve LH	***T2: 9 (0.9, 6.6)***
(4)	Clip	(10)	Secondary air pipe LH	***T3: 19 (1.9, 14.0)***
(5)	Secondary air pipe RH	(11)	Gasket	
(6)	Secondary air combination valve RH			

B: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

C: 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 and voltage.
Mighty Vac	Used for inspecting the fuel tank pressure sensor.

2. Front Catalytic Converter

A: REMOVAL

The front catalytic converter is integrated into the center exhaust pipe (front). Refer to “Center Exhaust Pipe” for removal procedures. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

The front catalytic converter is integrated into the center exhaust pipe (front). Refer to “Center Exhaust Pipe” for installation procedures. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>

C: INSPECTION

1) Check the connections and welded parts for exhaust leaks.
2) Make sure there are no holes or rusting.

3. Rear Catalytic Converter

A: REMOVAL

The rear catalytic converter is integrated into the center exhaust pipe (rear). Refer to “Center Exhaust Pipe” for removal procedures. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>

B: INSTALLATION

The rear catalytic converter is integrated into the center exhaust pipe (rear). Refer to “Center Exhaust Pipe” for installation procedures. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>

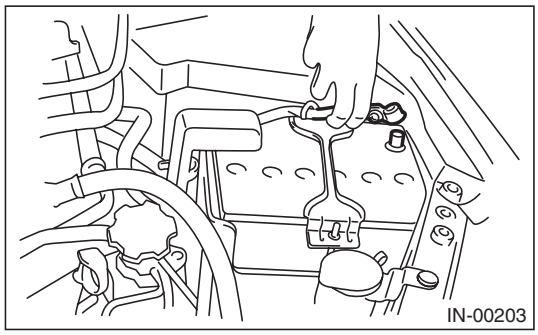
C: INSPECTION

1) Check the connections and welded parts for exhaust leaks.
2) Make sure there are no holes or rusting.

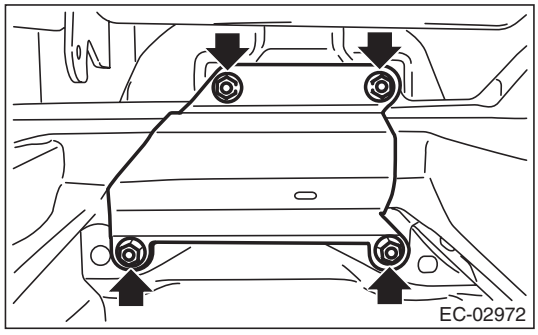
4. Canister

A: REMOVAL

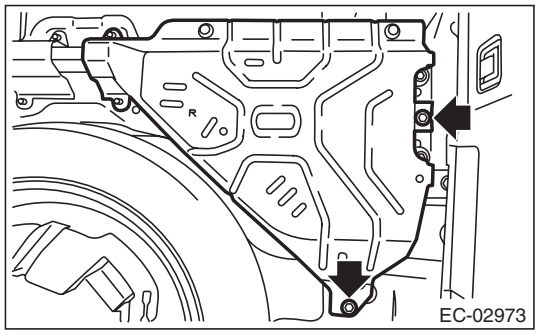
1) Disconnect the ground cable from battery.



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.

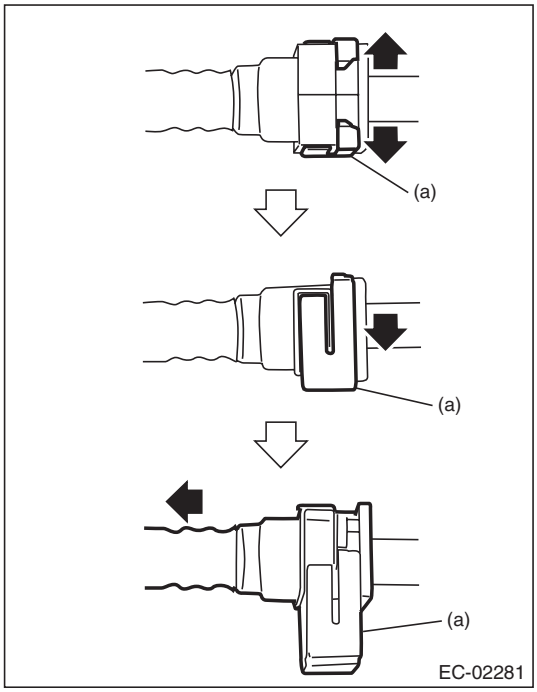


8) Remove the canister cover RH.

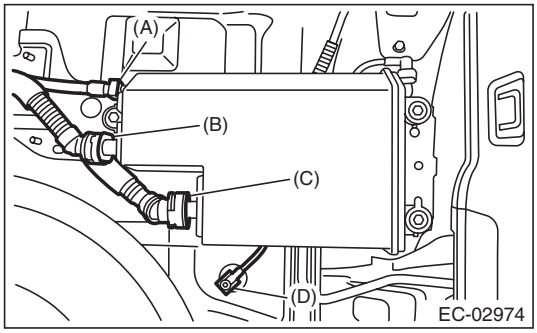


9) Disconnect the purge tube (A), vent tube (B), drain tube A (C) and PCV drain tube (D).

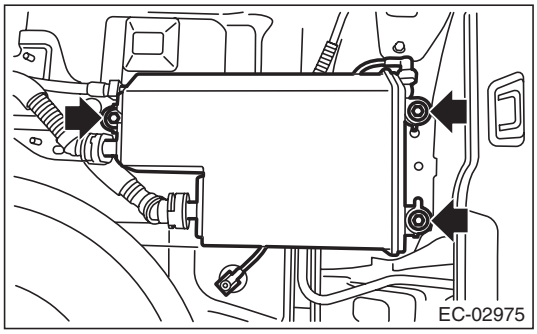
NOTE:
Disconnect the quick connector as shown in the figure.



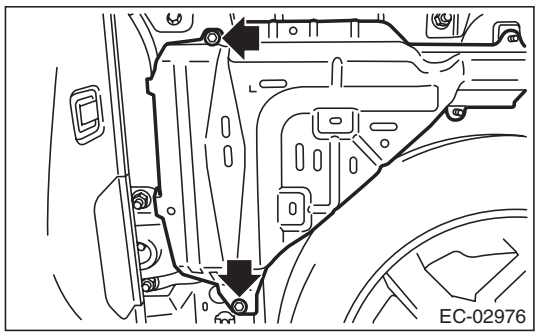
(a) Retainer



10) Remove the canister.

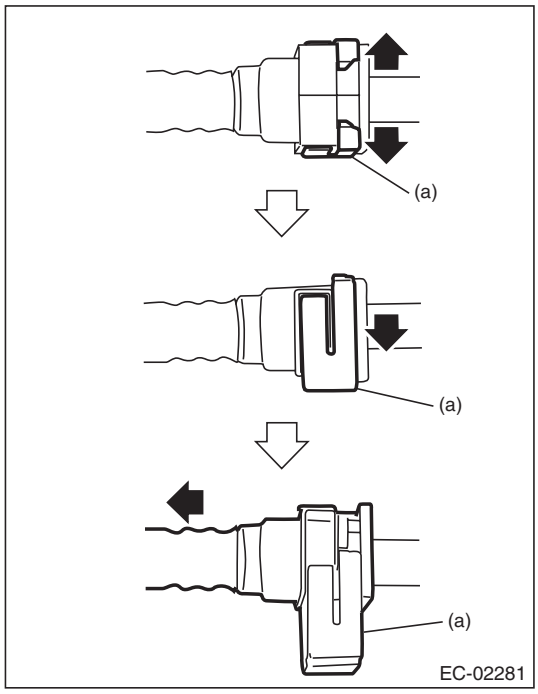


11) Remove the canister cover LH.

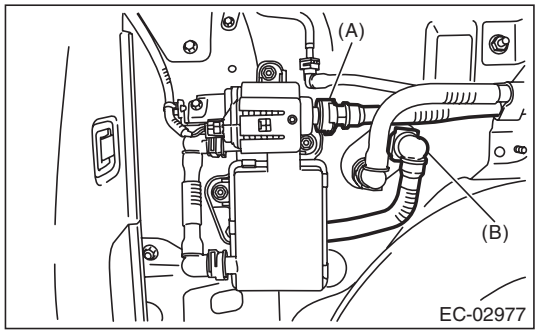


12) Disconnect drain tube A (A) and drain tube B (B).

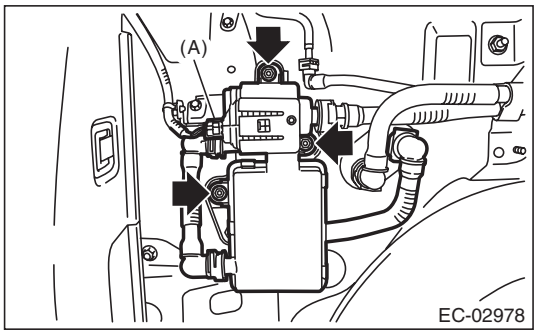
NOTE:
Disconnect the quick connector as shown in the figure.



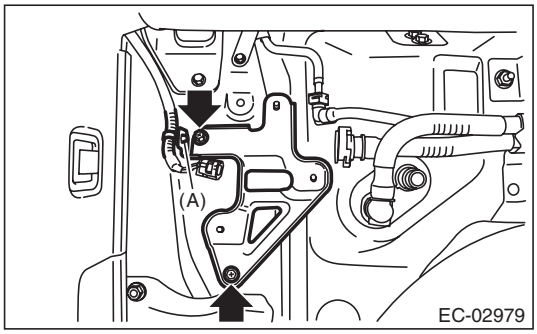
(a) Retainer



13) Disconnect the connector (A) from leak check valve assembly, and remove the leak check valve assembly.

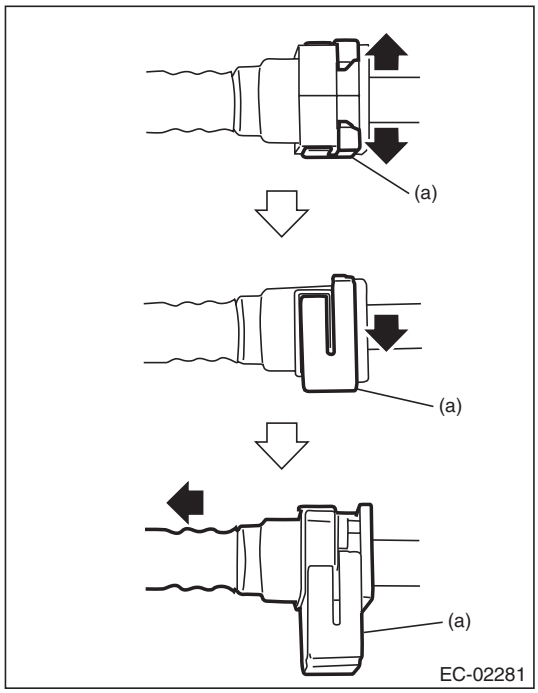


14) Remove the clip (A), which secures the leak check valve assembly harness, from the valve bracket, and remove the valve bracket.

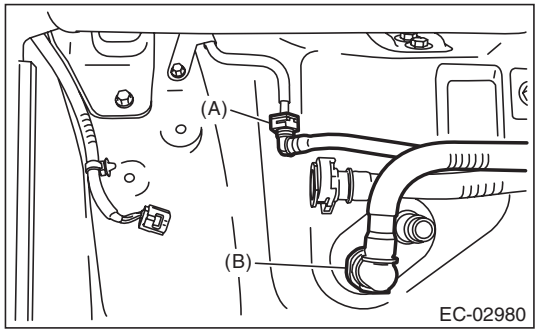


15) Disconnect purge tube (A) and vent tube (B).

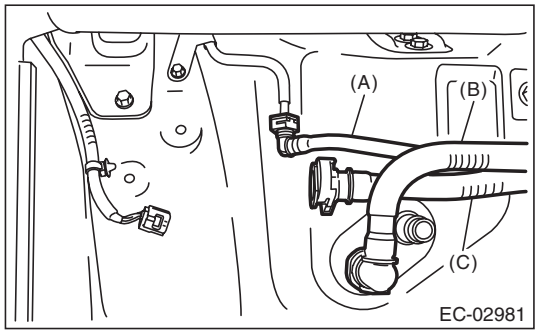
NOTE:
Disconnect the quick connector as shown in the figure.



(a) Retainer



16) 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.

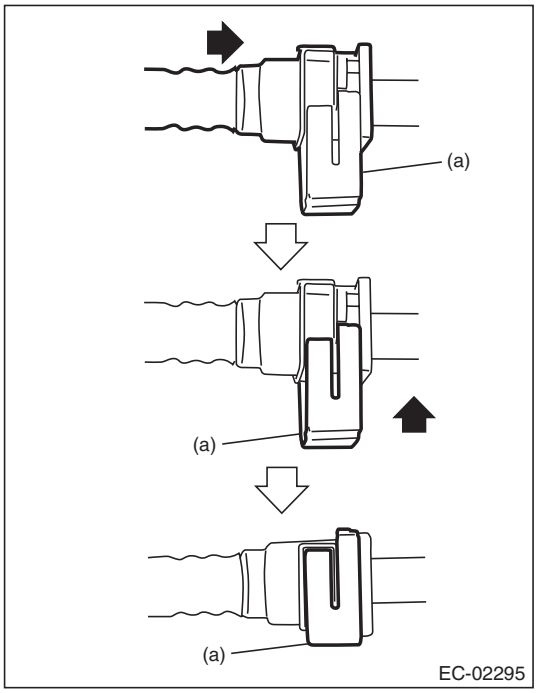
CAUTION:

• 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.

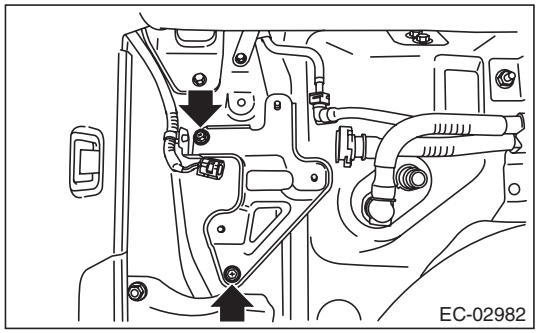
• When it is difficult to lock the retainer, make sure that the pipe is securely inserted.

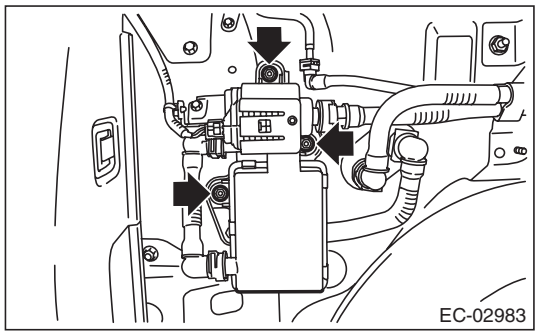
• Make sure that the quick connector is securely connected.



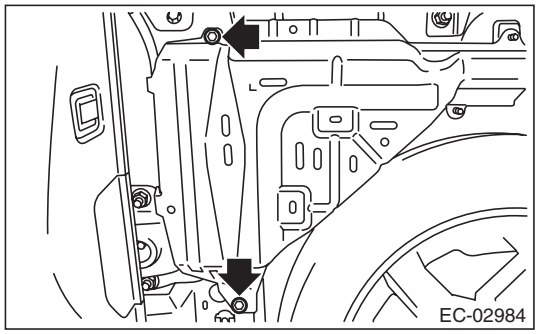
(a) Retainer

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

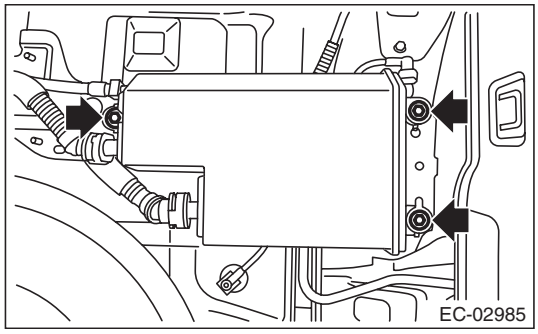




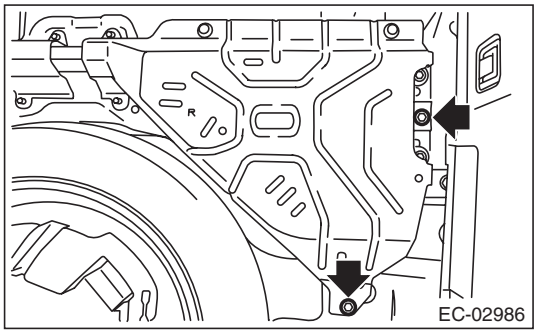
Tightening torque:
18 N·m (1.8 kgf-m, 13.3 ft-lb)

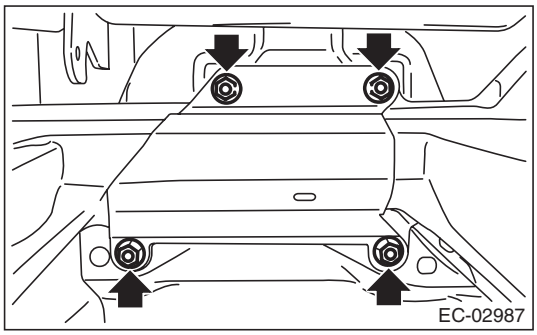


Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



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





C: INSPECTION

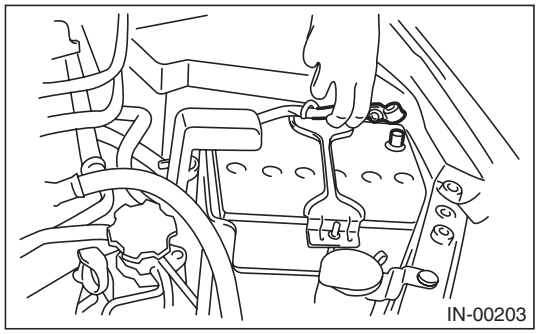
1) Check that the canister and leak check valve assembly have no deformation, cracks or other damages.
2) Check that the tube has no cracks, damage or loose part.

5. Purge Control Solenoid Valve

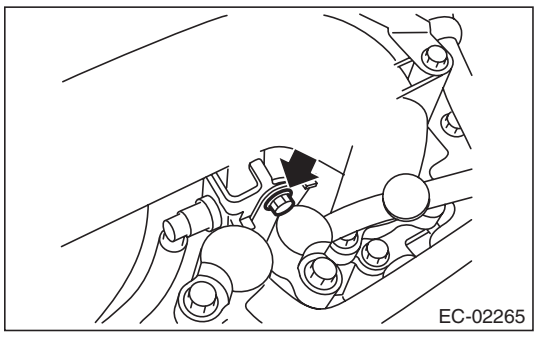
A: REMOVAL

1. PURGE CONTROL SOLENOID VALVE 1

1) Disconnect the ground cable from battery.



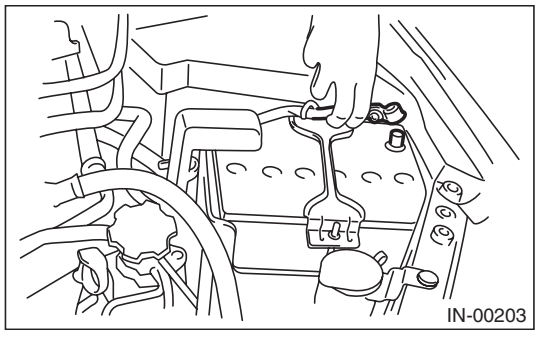
2) Remove the bolts which secure purge control solenoid valve 1 to the intake manifold, and disconnect the connector from the purge control solenoid valve 1.



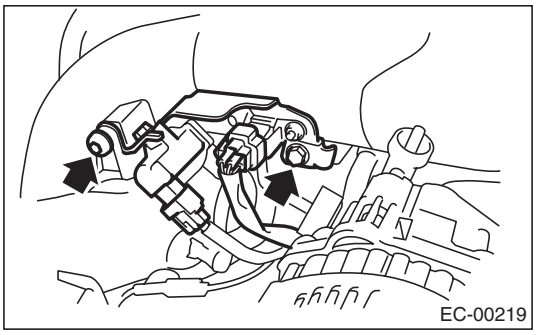
3) Disconnect the vacuum hose from purge control solenoid valve 1.

2. PURGE CONTROL SOLENOID VALVE 2

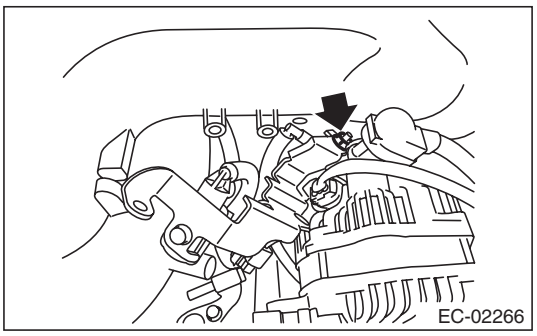
1) Disconnect the ground cable from battery.



2) Remove the solenoid valve bracket assembly from the intake manifold.



3) Disconnect the connector and the vacuum hose from purge control solenoid valve 2.
4) Remove the purge control solenoid valve 2 from the solenoid valve bracket assembly.

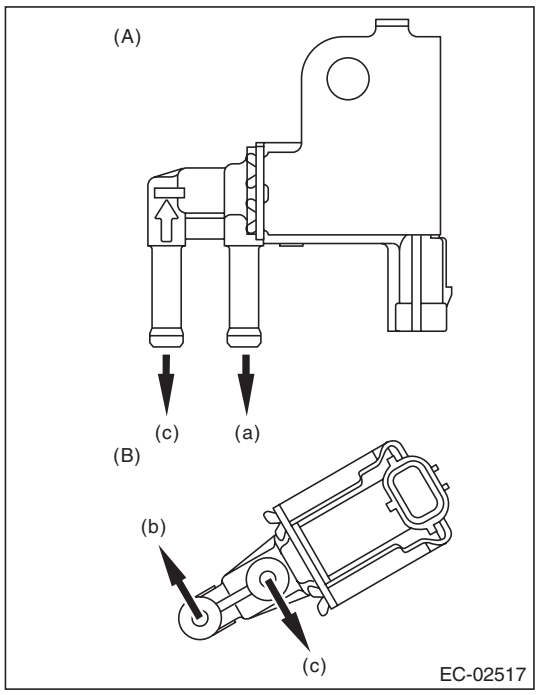


B: INSTALLATION

1. PURGE CONTROL SOLENOID VALVE 1

Install in the reverse order of removal.

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



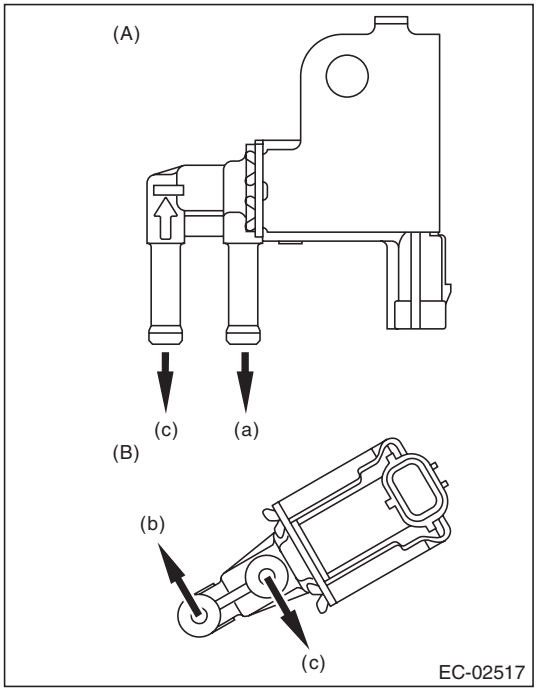
(A) Purge control solenoid valve 1
(B) Purge control solenoid valve 2
(a) To intake manifold
(b) To intake duct
(c) To fuel pipe

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

2. PURGE CONTROL SOLENOID VALVE 2

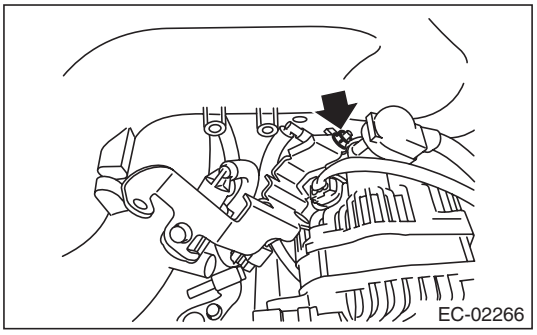
Install in the reverse order of removal.

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

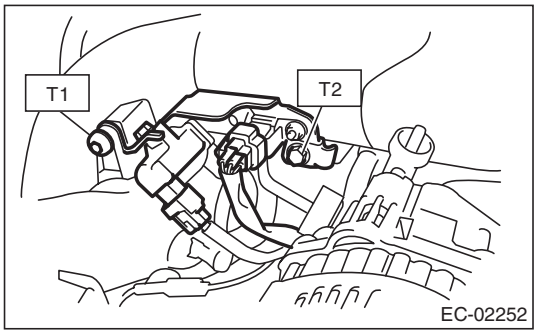


(A) Purge control solenoid valve 1
(B) Purge control solenoid valve 2
(a) To intake manifold
(b) To intake duct
(c) To fuel pipe

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



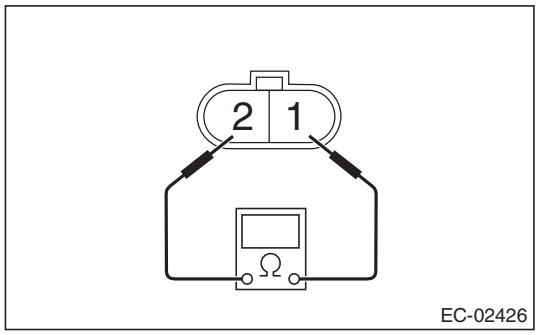
Tightening torque:
T1: 17 N·m (1.7 kgf-m, 12.5 ft-lb)
T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)



C: INSPECTION

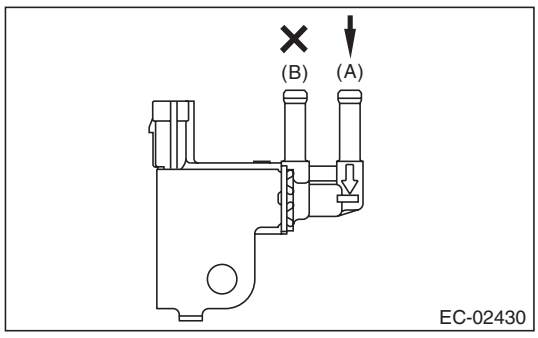
1. PURGE CONTROL SOLENOID VALVE

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

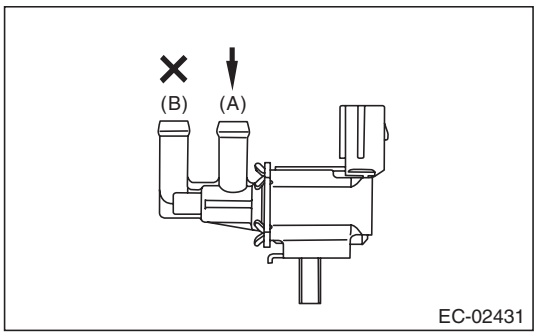


	Terminal No.	Standard
Purge control solenoid valve 1	1 and 2	32±2 Ω (when 20°C (68°F))
Purge control solenoid valve 2		24±3 Ω (when 20°C (68°F))

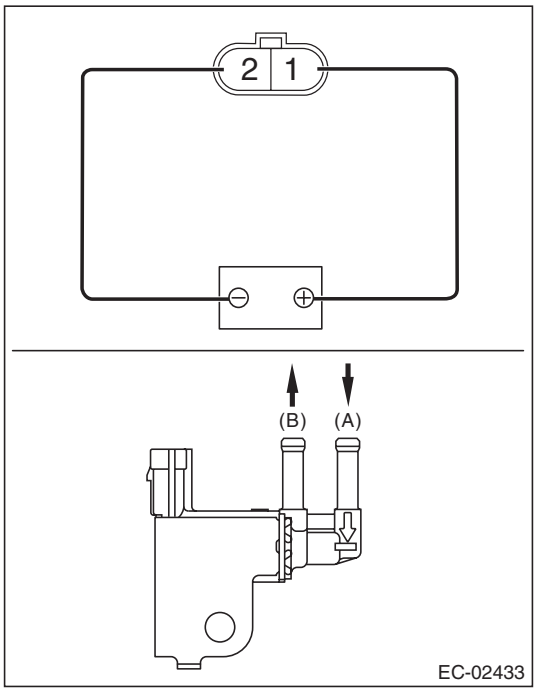
3) Check that air does not come out from (B) when air is blown into (A).
- Purge control solenoid valve 1



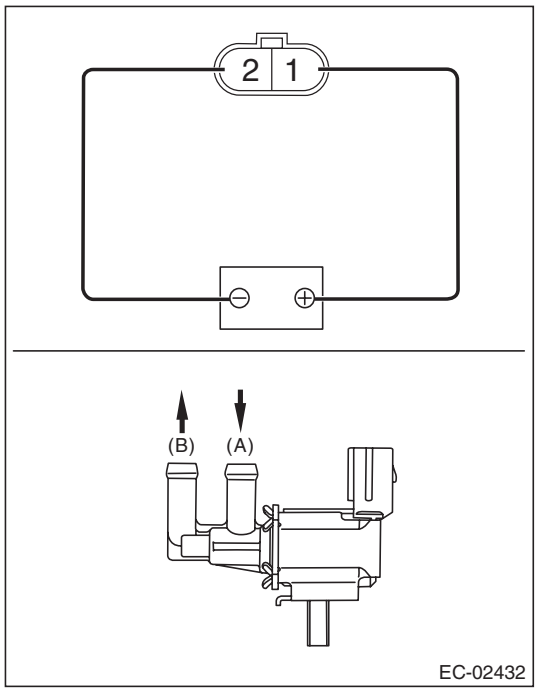
- Purge control solenoid valve 2



4) Connect the battery positive terminal to the terminal No. 1 and the battery negative terminal to the terminal No. 2. Check that air is discharged from (B), when supplying air to (A).
- Purge control solenoid valve 1



- Purge control solenoid valve 2



2. OTHER INSPECTIONS

Check the vacuum hose for cracks, damage or looseness.

6. Fuel Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU(w/o STI)” section. <Ref. to FU(w/o STI)-80, REMOVAL, Fuel Level Sensor.>

B: INSTALLATION

For installation procedures, refer to the “FU(w/o STI)” section. <Ref. to FU(w/o STI)-80, INSTALLATION, Fuel Level Sensor.>

C: INSPECTION

For inspection procedures, refer to the “FU(w/o STI)” section. <Ref. to FU(w/o STI)-80, INSPECTION, Fuel Level Sensor.>

7. Fuel Sub Level Sensor

A: REMOVAL

For removal procedures, refer to the “FU(w/o STI)” section. <Ref. to FU(w/o STI)-81, REMOVAL, Fuel Sub Level Sensor.>

B: INSTALLATION

For installation procedures, refer to the “FU(w/o STI)” section. <Ref. to FU(w/o STI)-82, INSTALLATION, Fuel Sub Level Sensor.>

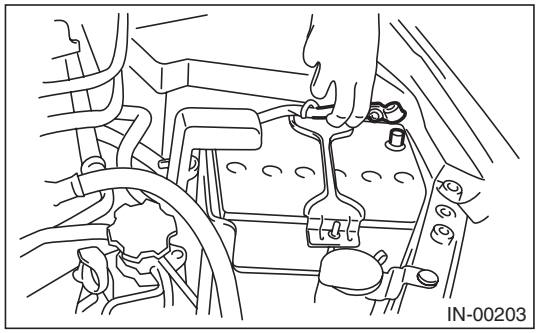
C: INSPECTION

For inspection procedures, refer to the “FU(w/o STI)” section. <Ref. to FU(w/o STI)-82, INSPECTION, Fuel Sub Level Sensor.>

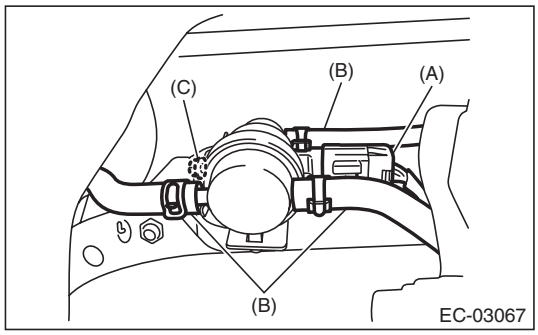
8. Pressure Control Solenoid Valve Assembly

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Disconnect the connector (A) and evaporation hose (B) from the pressure control solenoid valve assembly.
4) Remove the nut (C) securing the bracket to the fuel tank and remove the pressure control solenoid valve assembly.



B: INSTALLATION

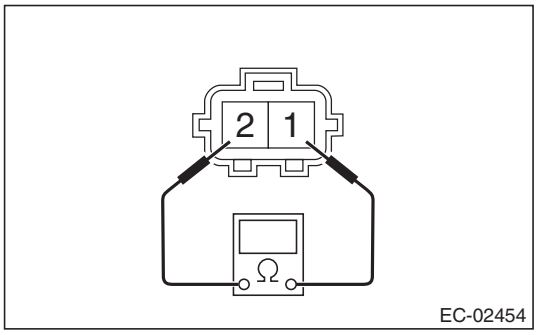
Install in the reverse order of removal.

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

C: INSPECTION

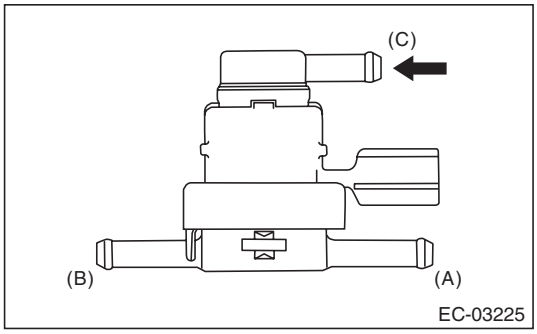
1. PRESSURE CONTROL SOLENOID VALVE ASSEMBLY

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



(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.

9. Drain Filter

A: SPECIFICATION

The leak check valve assembly is a non-disassembled part. Do not remove the drain filter from the leak check valve assembly. Refer to “Canister” for removal and installation procedures. <Ref. to EC(w/o STI)-7, REMOVAL, Canister.> <Ref. to EC(w/o STI)-9, INSTALLATION, Canister.>

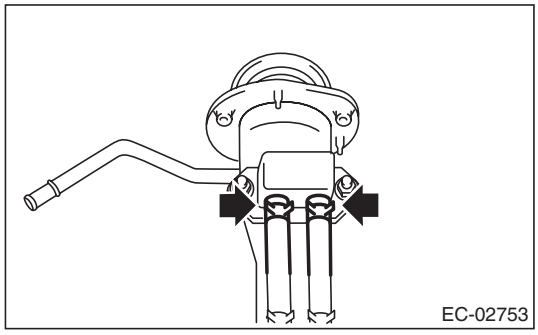
10.Shut Valve

A: REMOVAL

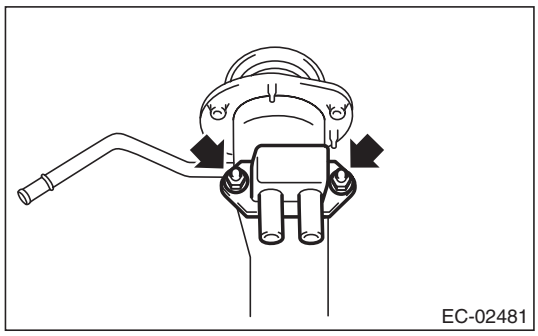
WARNING:
Place "NO OPEN FLAMES" signs near the working area.

CAUTION:
Be careful not to spill fuel.

1) Remove the fuel filler pipe. <Ref. to FU(w/o STI)-75, 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

1) Check that the shut valve has no deformation, cracks or other damages.
2) Check that the evaporation hose has no cracks, damage or loose part.

11.Leak Check Valve Assembly

A: REMOVAL

Refer to “Canister” for removal procedures. <Ref. to EC(w/o STI)-7, REMOVAL, Canister.>

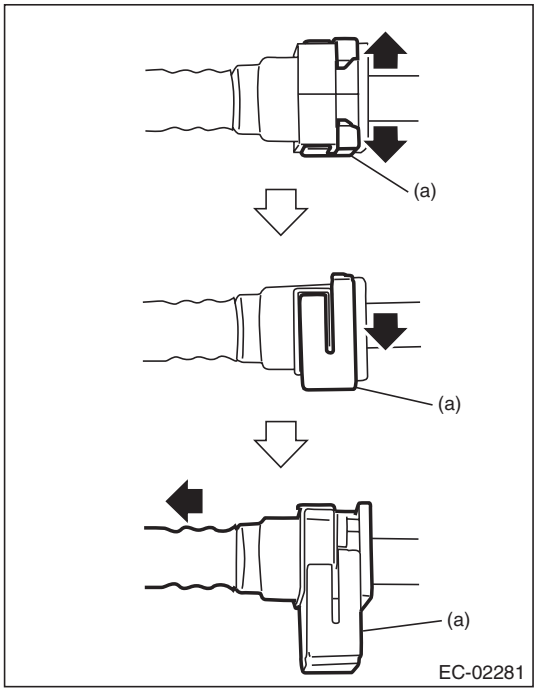
B: INSTALLATION

Refer to “Canister” for installation procedures. <Ref. to EC(w/o STI)-9, INSTALLATION, Canister.>

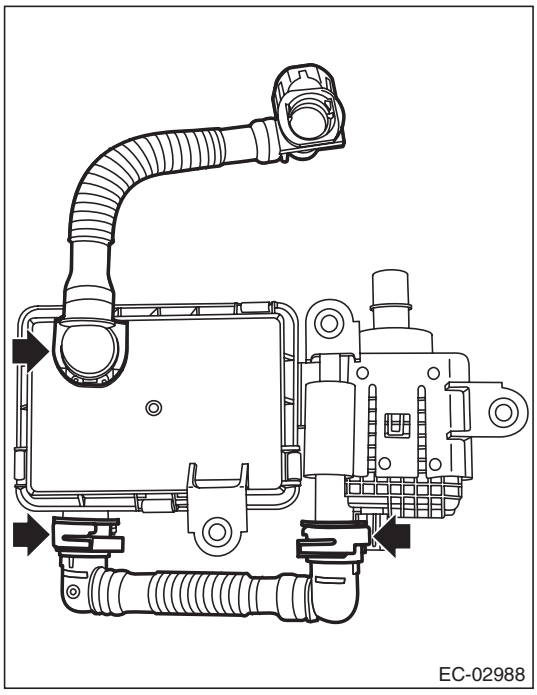
C: DISASSEMBLY

Disconnect the drain tube from the leak check valve assembly.

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



(a) Retainer



D: ASSEMBLY

Assemble the parts in the reverse order of disassembly while being careful of the following.

• Connect the quick connector as shown in the figure.

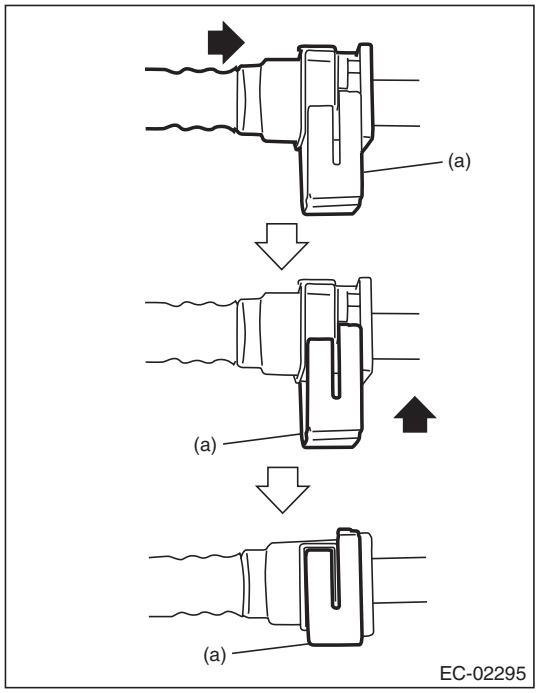
CAUTION:

• 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.

• 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.

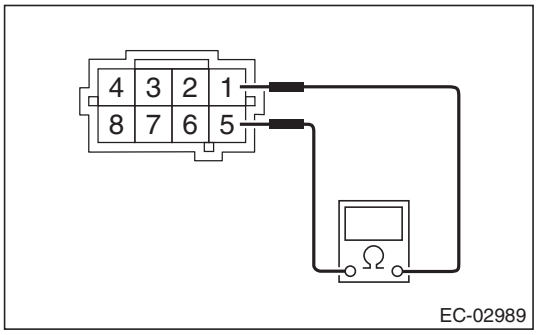


(a) Retainer

E: INSPECTION

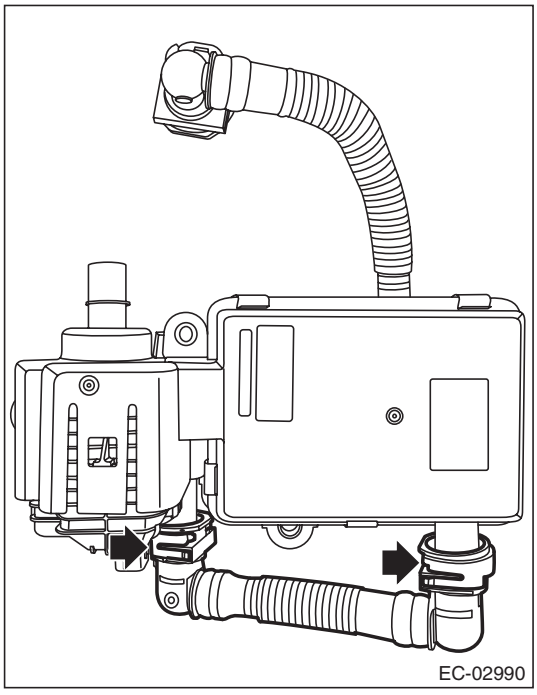
1. CHECK SWITCHING VALVE

1) Check the resistance between switching valve terminals.

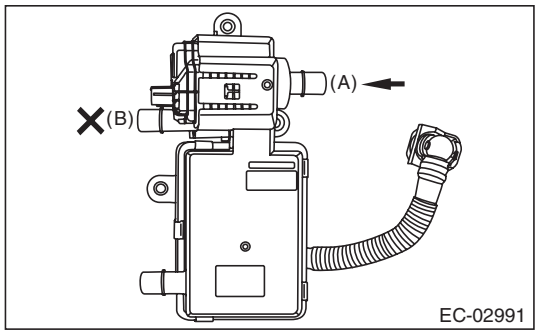


Terminal No.	Standard
1 and 5	27^{+3}_{-2} Ω (when 20°C (68°F))
	31±4 Ω (when 60°C (140°F))

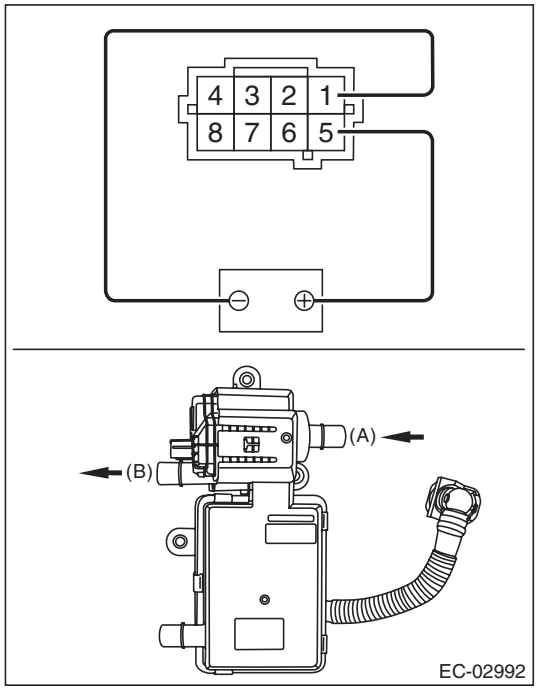
2) Disconnect the drain tube from the leak check valve assembly.



3) Check that air does not come out from (B) when air is blown into (A).



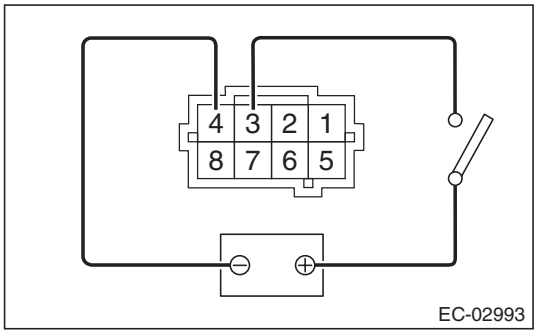
4) Connect the battery positive terminal to the terminal No. 5 and the battery negative terminal to the terminal No. 1. Check that air is discharged from (B), when supplying air to (A).



2. CHECK VACUUM PUMP

1) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, and inspect the vacuum pump operation.

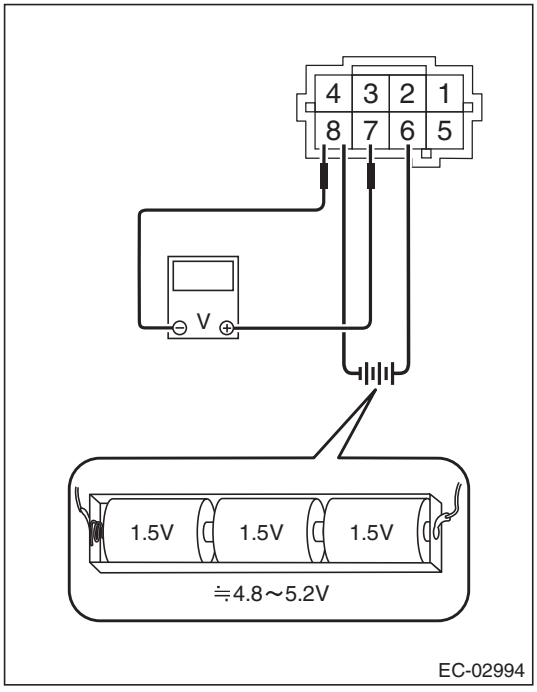
CAUTION:
Do not operate the vacuum pump for 5 minutes or more.



3. CHECK PRESSURE SENSOR

1) Connect dry-cell battery positive terminal to terminal No. 6 and dry-cell battery ground terminal to terminal No. 8, circuit tester positive terminal to terminal No. 7 and the circuit tester negative terminal to terminal No. 8.

NOTE:
- Use new dry-cell batteries.
- Using circuit tester, check the voltage of a single dry-cell battery is 1.6 V or more. And also check the voltage of three batteries in series is between 4.8 V and 5.2 V.

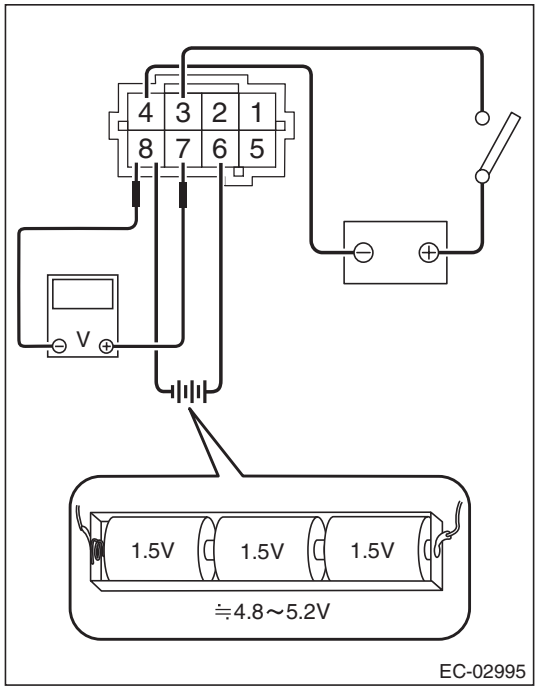


2) Check the voltage at a normal atmospheric pressure.

NOTE:
The atmospheric pressure at higher altitude is lower than normal. Therefore, the voltage is lower than the standard value.

Terminal No.	Standard
7 (+) and 8 (–)	Approx. 3.5 V (when 25°C (77°F))

3) Connect the battery positive terminal to terminal No. 3 and the battery ground terminal to terminal No. 4, and check that there is a voltage drop from the voltage measured in step 2) when the vacuum pump is operated.



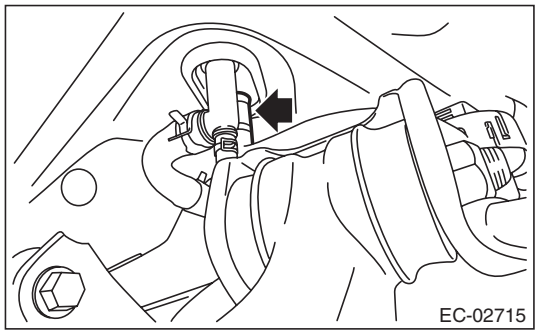
4. OTHER INSPECTIONS

Check that the drain tube has no cracks, damage or loose part.

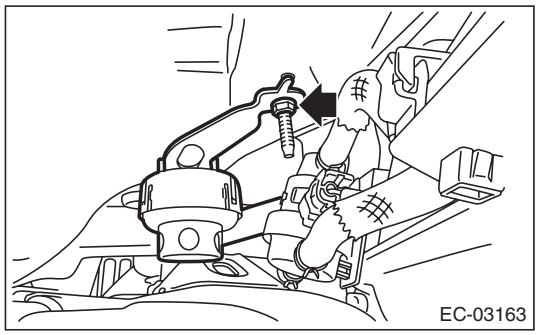
12.Drain Separator

A: REMOVAL

1) Lift up the vehicle.
2) Remove the rear differential. <Ref. to DI-23, REMOVAL, Rear Differential (T-type).>
3) Disconnect the drain hose from the connector.



4) Remove the drain separator from the vehicle.



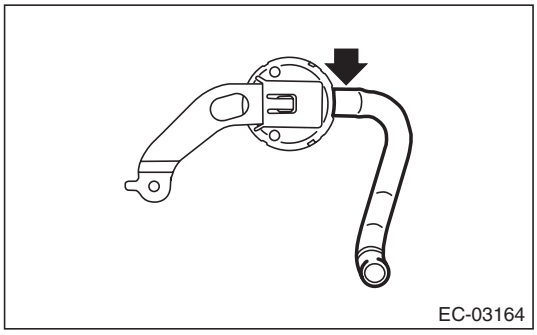
B: INSTALLATION

Install in the reverse order of removal.

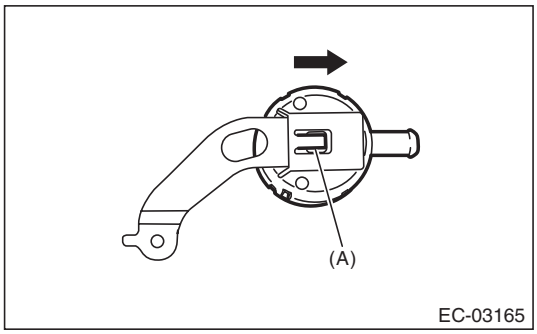
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the drain hose from the drain separator.



2) Lift up the claw (A) of the drain separator and slide the drain separator in the direction of the arrow to remove the drain separator.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

E: INSPECTION

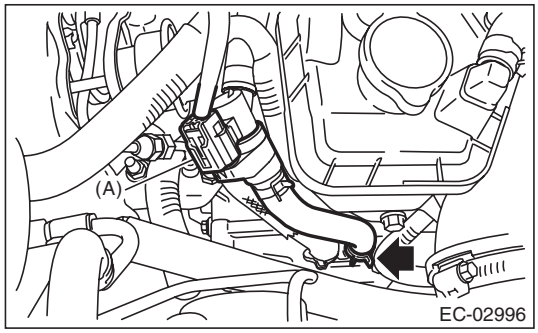
1) Check that the drain separator and drain separator bracket have no deformation, crack, or other damage.
2) Check that the drain hose has no crack, damage, or looseness.
3) Check that no foreign substances are clogged in the drain separator.

13.PCV Hose Assembly

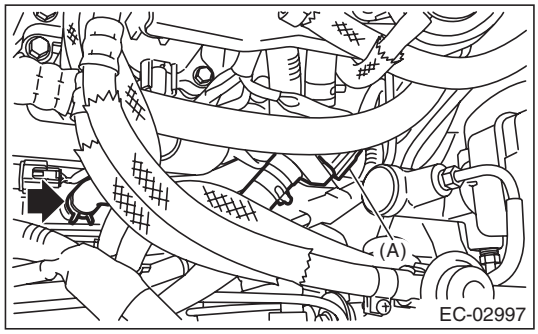
A: REMOVAL

CAUTION:
Do not remove unless the hose and the diagnostics connector are broken.

1) Disconnect the connector (A) from the PCV hose assembly A, and remove the PCV hose assembly A from the rocker cover RH.

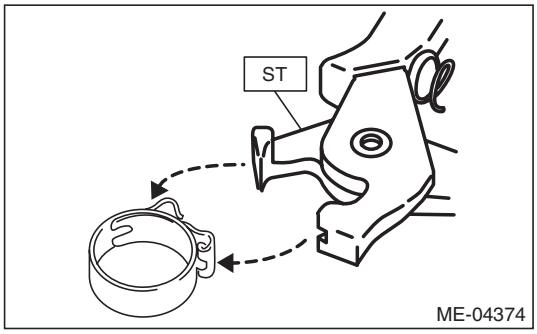


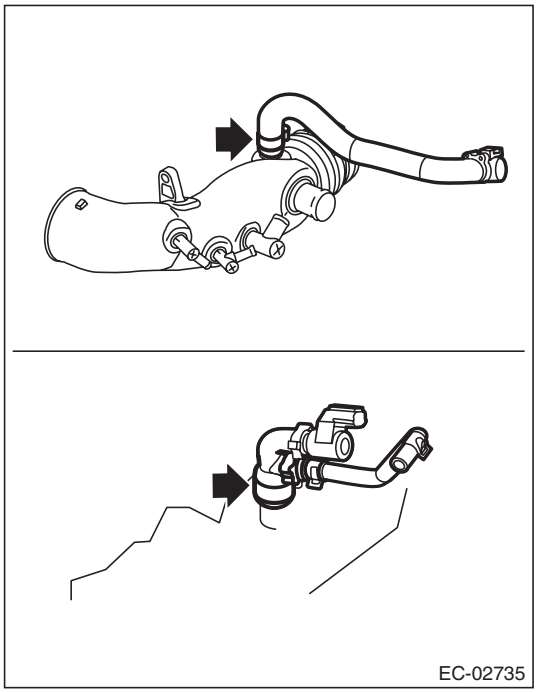
2) Disconnect the connector (A) from the PCV hose assembly B, and remove the PCV hose assembly B from the rocker cover LH.



3) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
4) Remove the turbocharger. <Ref. to IN(w/o STI)-14, REMOVAL, Turbocharger.>
5) Remove the intake duct. <Ref. to IN(w/o STI)-11, REMOVAL, Intake Duct.>
6) Remove the PCV hose assembly C from the intake duct and the cylinder block RH.

NOTE:
Pinch the clamp of the PCV hose assembly C by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS

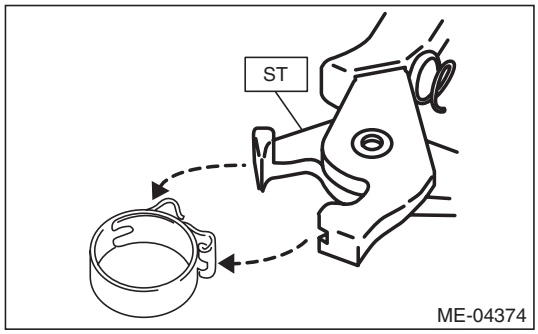


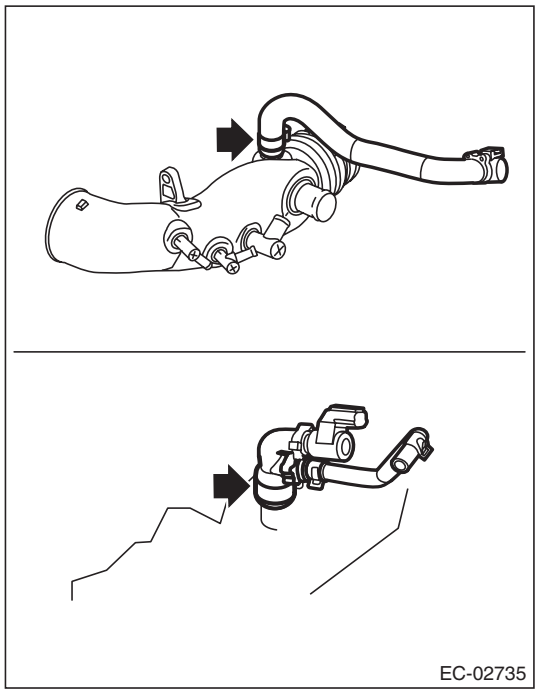


B: INSTALLATION

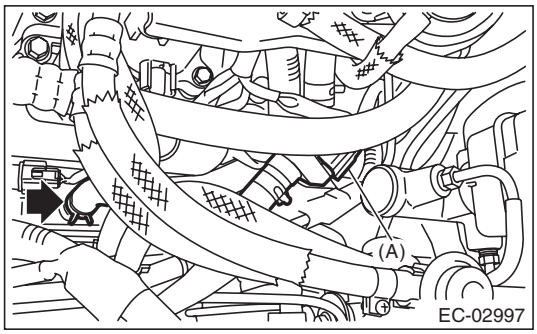
1) Install the PCV hose assembly C to the intake duct and the cylinder block RH.

NOTE:
Use a new clamp for the PCV hose assembly C, fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS

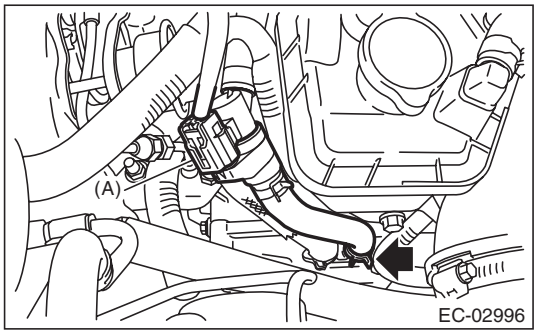




2) Install the intake duct. <Ref. to IN(w/o STI)-11, INSTALLATION, Intake Duct.>
3) Install the turbocharger. <Ref. to IN(w/o STI)-15, INSTALLATION, Turbocharger.>
4) Install the intake manifold. <Ref. to FU(w/o STI)-22, INSTALLATION, Intake Manifold.>
5) Install the PCV hose assembly B to the rocker cover LH, and connect the connector (A) to the PCV hose assembly B.



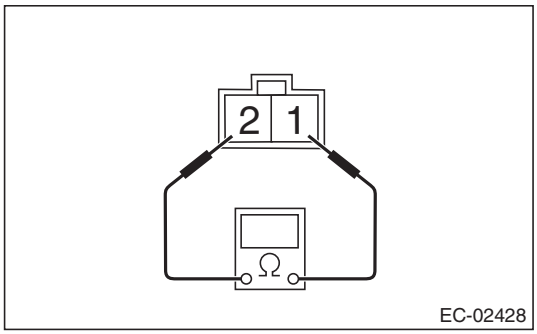
6) Install the PCV hose assembly A to the rocker cover RH, and connect the connector (A) to the PCV hose assembly A.



C: INSPECTION

1. DIAGNOSIS CONNECTOR

1) Check that the diagnosis connector has no deformation, cracks and any other damage.
2) Check the resistance between the diagnosis connector terminals.



Terminal No.	Standard
1 and 2	Less than 1 Ω

2. OTHER INSPECTIONS

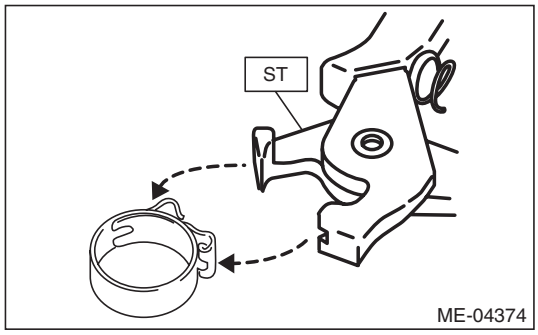
1) Check that the PCV connector has no deformation, cracks or other damages.
2) Check that the hose has no cracks, damage or loose part.

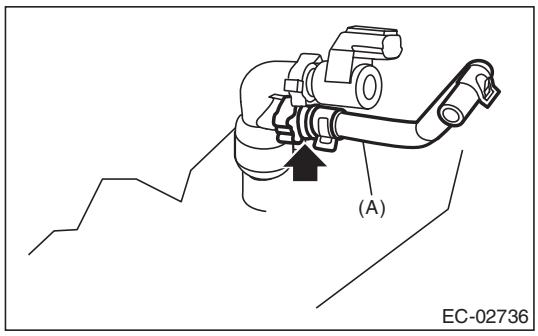
14.PCV Valve

A: REMOVAL

CAUTION:
Do not remove unless the PCV valve is broken.
1) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
2) Remove the secondary air combination valve RH. <Ref. to EC(w/o STI)-30, REMOVAL, Secondary Air Combination Valve.>
3) Disconnect the vacuum hose (A) from the PCV valve and remove the PCV valve from the PCV connector.

NOTE:
Pinch the clamp of the PCV connector by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS

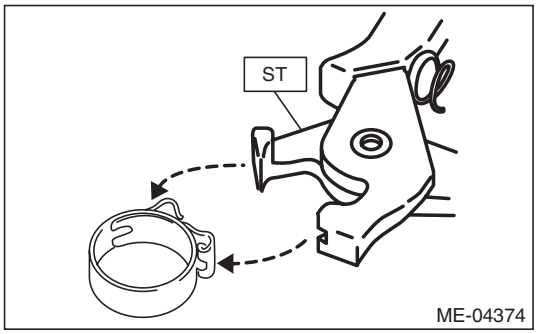


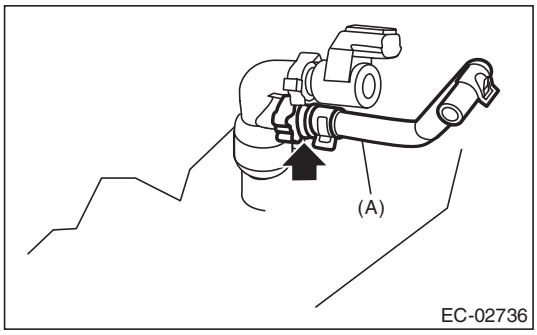


B: INSTALLATION

1) Install the PCV valve to the PCV connector and connect the vacuum hose (A) to the PCV valve.

NOTE:
Use a new clamp for the PCV connector clamp, fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS



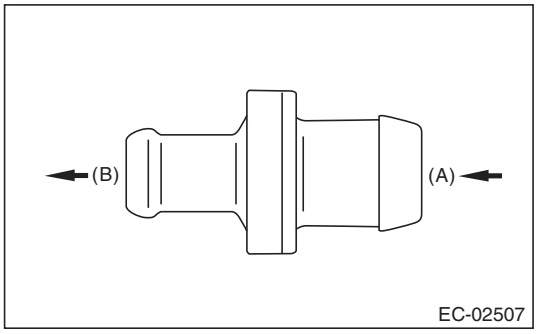


2) Install the secondary air combination valve RH. <Ref. to EC(w/o STI)-31, INSTALLATION, Secondary Air Combination Valve.>
3) Install the intake manifold. <Ref. to FU(w/o STI)-22, INSTALLATION, Intake Manifold.>
4) Install the collector cover.

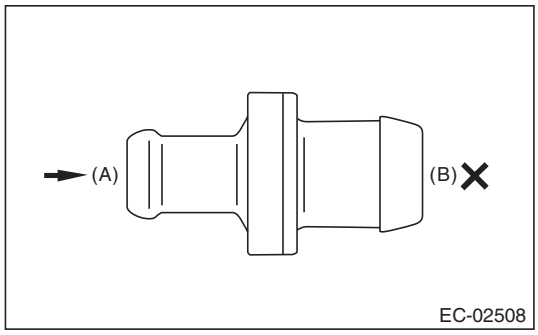
C: INSPECTION

1. PCV VALVE

1) Check that the PCV valve has no deformation, cracks or other damages.
2) Check that air is discharged from (B) when air is blown into (A).



3) Check that air does not come out from (B) when air is blown into (A).



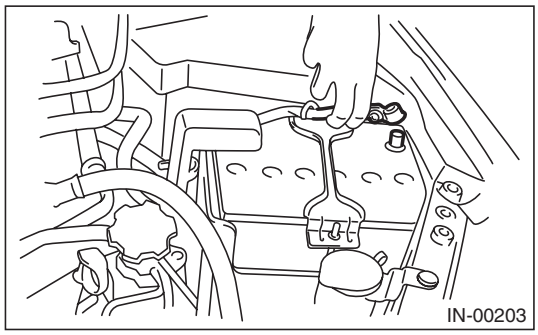
2. OTHER INSPECTIONS

Check the vacuum hose for cracks, damage or looseness.

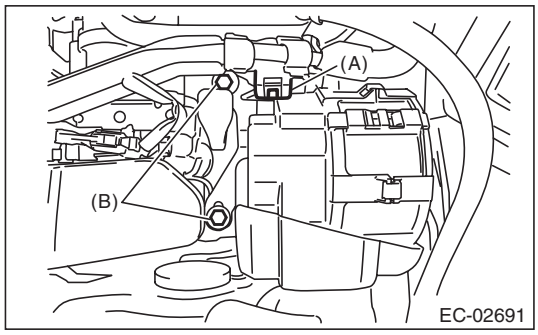
15.Secondary Air Pump

A: REMOVAL

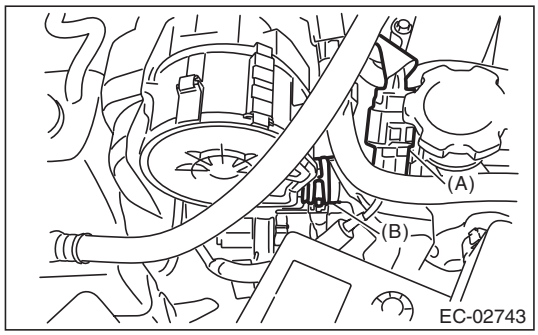
1) Disconnect the ground cable from battery.



2) Remove the clip (A) which holds the harness on the harness stay and remove the bolt (B) which holds the secondary air pump on the vehicle.



3) Disconnect the connector (A) and air duct (B) from secondary air pump and remove the secondary air pump.



B: INSTALLATION

Install in the reverse order of removal.

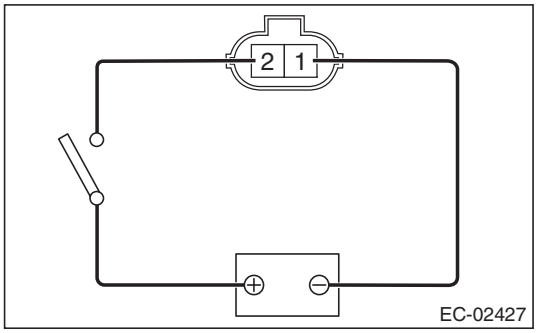
Tightening torque:
19 N·m (1.9 kgf-m, 14.0 ft-lb)

C: INSPECTION

1. SECONDARY AIR PUMP

1) Check that the secondary air pump has no deformation, cracks or other damages.
2) Connect battery positive terminal to the terminal No. 2 and battery negative terminal to the terminal No. 1, and inspect the secondary air pump operation.

CAUTION:
Do not operate the secondary air pump continuously for 80 seconds or more.



2. OTHER INSPECTIONS

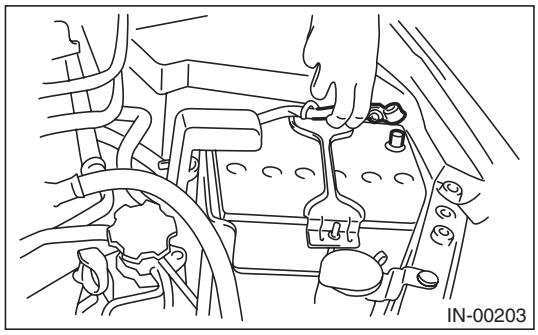
Check that the air duct has no cracks, damage or loose part.

16.Secondary Air Combination Valve

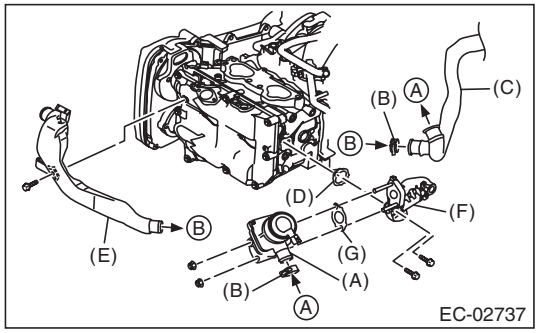
A: REMOVAL

1. SECONDARY AIR COMBINATION VALVE LH

1) Disconnect the ground cable from battery.



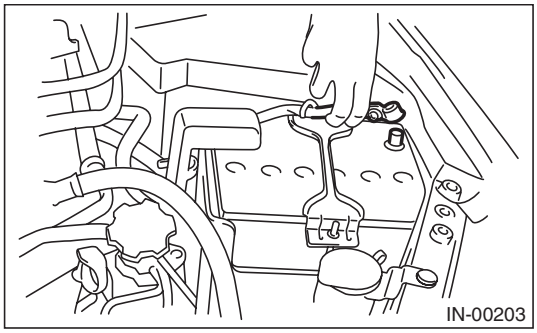
2) Remove the intercooler. <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
3) Disconnect the connector from the secondary air combination valve LH.
4) Disconnect the air duct A.
5) Remove the secondary air pipe LH.
6) Remove the secondary air combination valve LH.



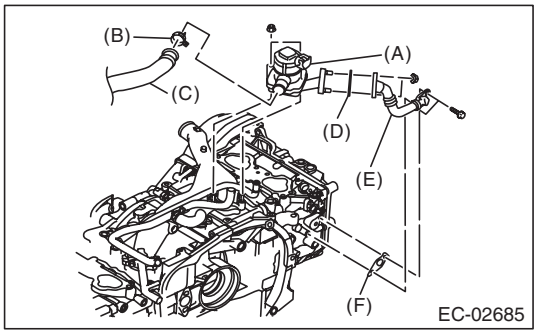
(A) Secondary air combination valve LH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe LH
(G) Gasket

2. SECONDARY AIR COMBINATION VALVE RH

1) Disconnect the ground cable from battery.



2) Remove the intercooler. <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
3) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
4) Disconnect the air duct A.
5) Disconnect the secondary air pipe RH.
6) Remove the secondary air combination valve RH.



(A) Secondary air combination valve RH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Secondary air pipe RH
(F) Gasket

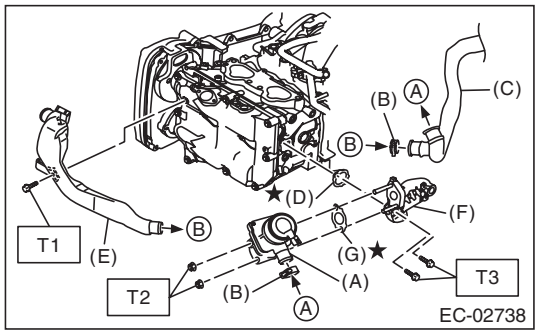
B: INSTALLATION

1. SECONDARY AIR COMBINATION VALVE LH

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 9 N·m (0.9 kgf-m, 6.6 ft-lb)
T3: 19 N·m (1.9 kgf-m, 14.0 ft-lb)



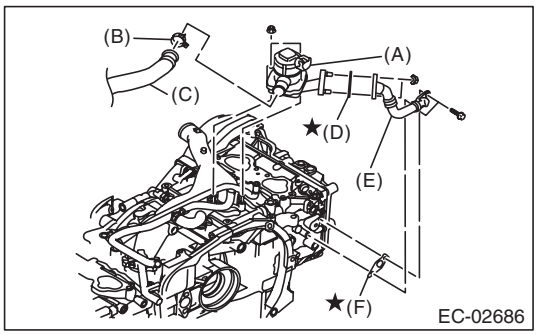
(A) Secondary air combination valve LH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Air duct B
(F) Secondary air pipe LH
(G) Gasket

2. SECONDARY AIR COMBINATION VALVE RH

Install in the reverse order of removal.

NOTE:
Use a new gasket.

Tightening torque:
9 N·m (0.9 kgf-m, 6.6 ft-lb)

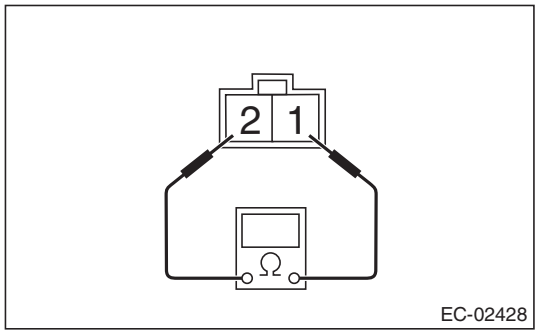


(A) Secondary air combination valve RH
(B) Clip
(C) Air duct A
(D) Gasket
(E) Secondary air pipe RH
(F) Gasket

C: INSPECTION

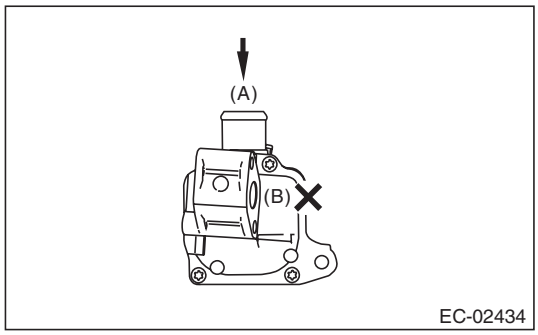
1. SECONDARY AIR COMBINATION VALVE LH

1) Check that the secondary air combination valve LH has no deformation, cracks or other damages.
2) Check the resistance between the terminals of secondary air combination valve LH.

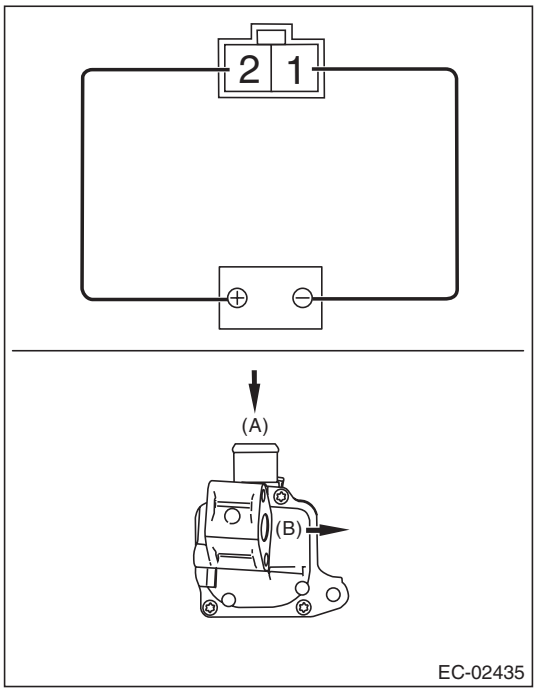


Terminal No.	Standard
1 and 2	5.0±0.5 Ω (when 20°C (68°F))

3) Check that air does not come out from (B) when air is blown into (A).

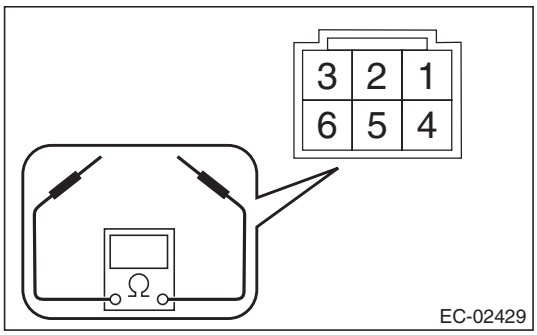


4) Connect the battery positive terminal to the terminal No. 2 and the battery negative terminal to the terminal No. 1. Check that air is discharged from (B), when supplying air to (A).



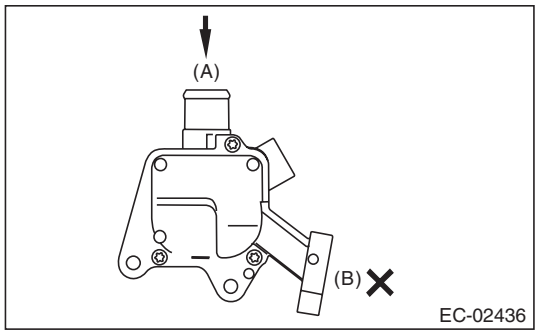
2. SECONDARY AIR COMBINATION VALVE RH

1) Check that the secondary air combination valve RH has no deformation, cracks or other damages.
2) Check the resistance between the terminals of secondary air combination valve RH.

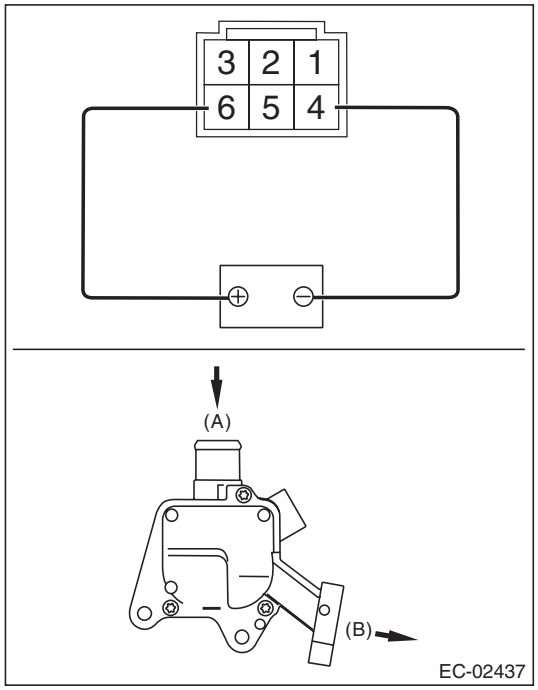


Terminal No.	Standard
4 and 6	5.0±0.5 Ω (when 20°C (68°F))
2 and 3	15 kΩ or less
1 and 2	4.5 kΩ or less

3) Check that air does not come out from (B) when air is blown into (A).



4) Connect the battery positive terminal to the terminal No. 6 and the battery negative terminal to the terminal No. 4. Check that air is discharged from (B), when supplying air to (A).



3. OTHER INSPECTIONS

1) Check that the secondary air pipe has no deformation, cracks or other damages.
2) Check that the air duct has no cracks, damage or loose part.

INTAKE (INDUCTION)

IN(w/o STI)

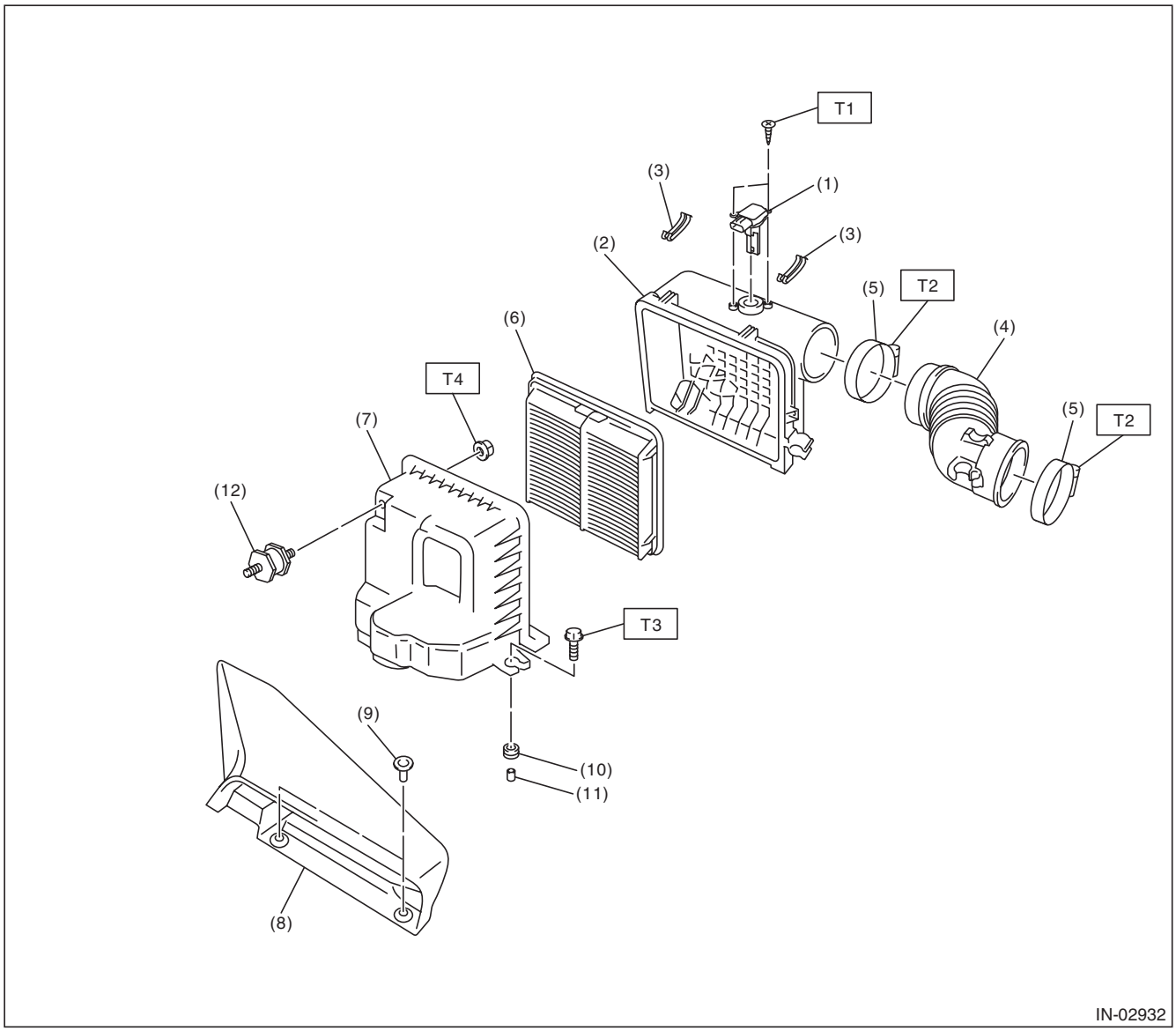
Page

1. General Description 2
2. Air Cleaner Element 7
3. Air Cleaner Case 8
4. Air Intake Duct 10
5. Intake Duct 11
6. Intercooler 12
7. Turbocharger 14
8. Air By-pass Valve 18

1. General Description

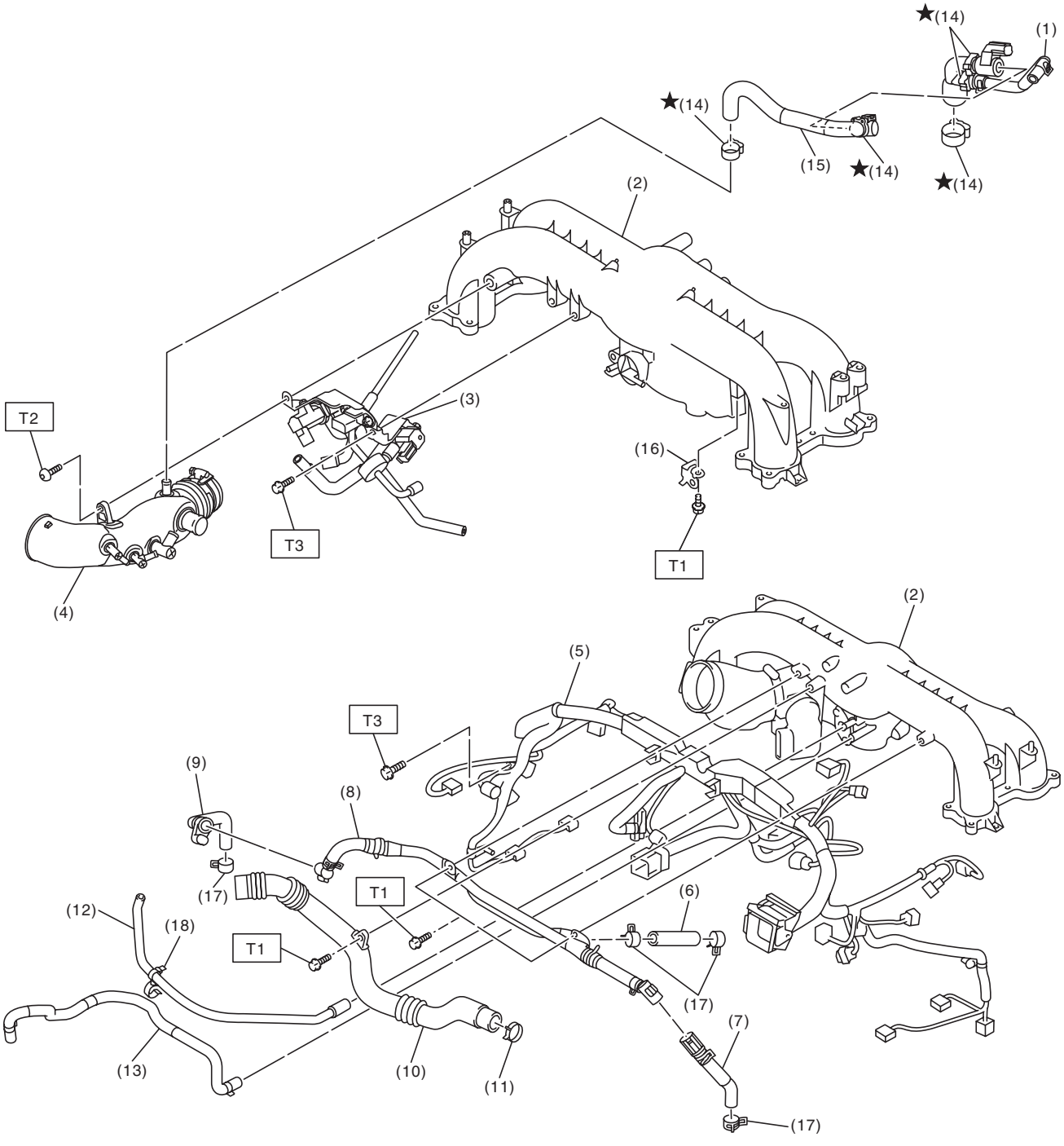
A: COMPONENT

1. AIR CLEANER



(1)	Mass air flow and intake air temperature sensor	(7)	Air cleaner case (front)	***Tightening torque: N·m (kgf-m, ft-lb)***
(2)	Air cleaner case (rear)	(8)	Air intake duct	***T1: 1 (0.1, 0.7)***
(3)	Clip	(9)	Clip	***T2: 2.5 (0.3, 1.8)***
(4)	Air intake boot	(10)	Cushion	***T3: 6 (0.6, 4.4)***
(5)	Clamp	(11)	Spacer	***T4: 7.5 (0.8, 5.5)***
(6)	Air cleaner element	(12)	Cushion	

2. INTAKE DUCT

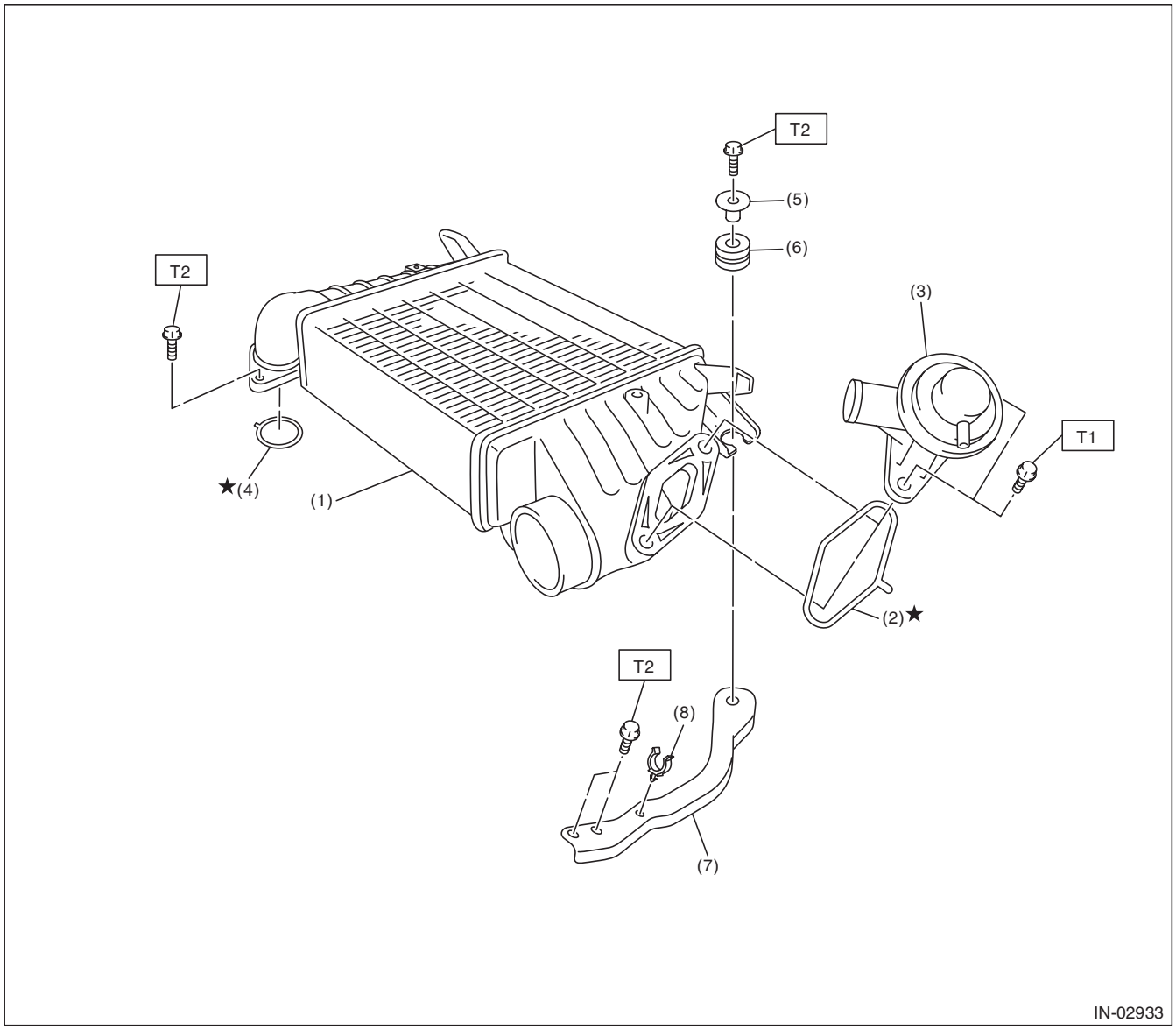


IN-03310

(1) PCV hose ASSY A
(2) Intake manifold
(3) Solenoid valve bracket ASSY
(4) Intake duct
(5) Engine harness ASSY
(6) Vacuum hose
(7) PCV hose ASSY B
(8) PCV pipe ASSY
(9) PCV hose ASSY C
(10) Air by-pass pipe
(11) Clip
(12) Vacuum hose
(13) Brake booster vacuum hose
(14) Clamp
(15) PCV hose ASSY D
(16) Solenoid valve bracket
(17) Clip
(18) Clip

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)

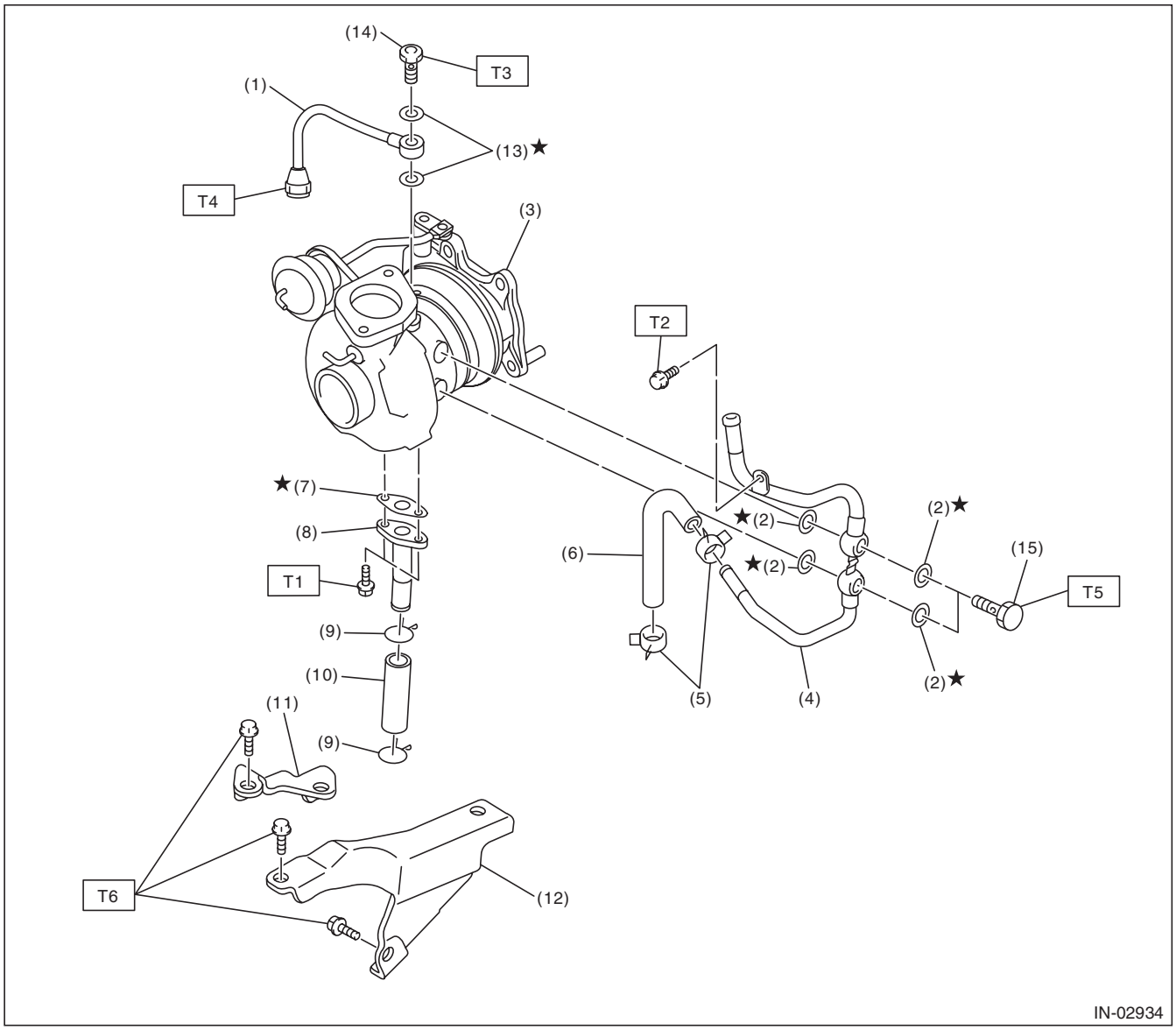
3. INTERCOOLER



(1)	Intercooler	(5)	Spacer
(2)	O-ring	(6)	Cushion
(3)	Air by-pass valve	(7)	Intercooler stay
(4)	O-ring	(8)	Clip

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.5 (0.7, 4.8)
T2: 16 (1.6, 11.8)

4. TURBOCHARGER



(1)	Oil inlet pipe	(9)	Clip
(2)	Gasket	(10)	Oil outlet hose
(3)	Turbocharger	(11)	Turbocharger stay RH
(4)	Water pipe	(12)	Turbocharger stay LH
(5)	Clip	(13)	Gasket
(6)	Engine coolant hose	(14)	Union bolt A
(7)	Gasket	(15)	Union bolt B
(8)	Oil outlet pipe		

Tightening torque: N·m (kgf-m, ft-lb)
T1: 4.9 (0.5, 3.6)
T2: 7.8 (0.8, 5.8)
T3: 16 (1.6, 11.8)
T4: 20 (2.0, 14.8)
T5: 23 (2.3, 17.0)
T6: 33 (3.4, 24.3)

B: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

C: PREPARATION TOOL

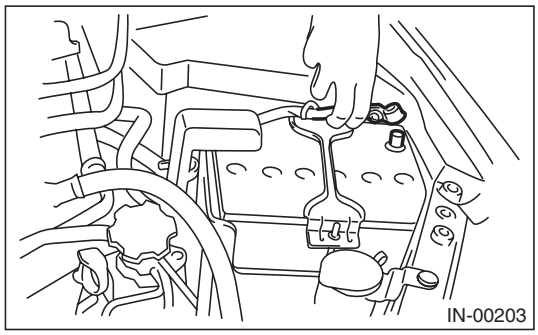
1. GENERAL TOOL

TOOL NAME	REMARKS
Mighty Vac	Used for checking waste gate actuator and air by-pass valve.

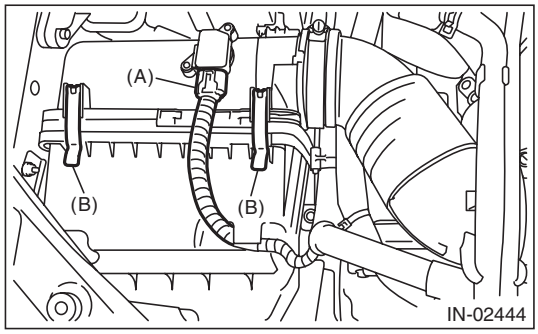
2. Air Cleaner Element

A: REMOVAL

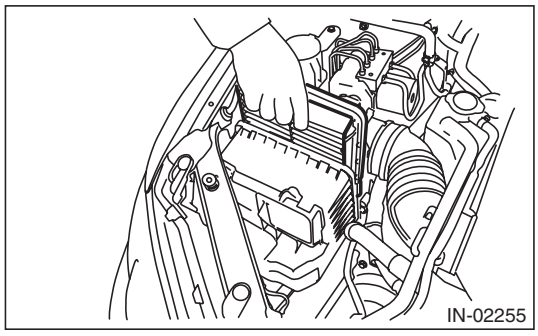
1) Disconnect the ground cable from battery.



2) Remove the air intake duct. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.>
3) Disconnect the connector (A) from air flow and intake air temperature sensor.
4) Remove the clips (B) from the air cleaner case (front).



5) Open the air cleaner case, and remove the air cleaner element.

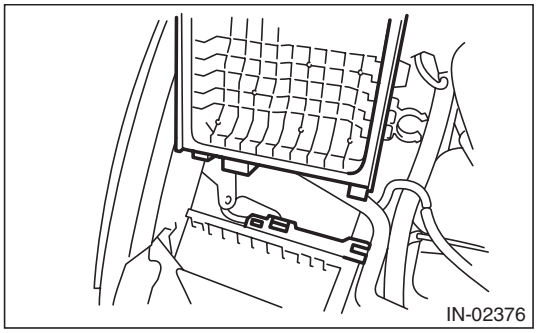


B: INSTALLATION

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.
• If the protrusion of the air cleaner case (rear) is removed when removing the air cleaner element, align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.



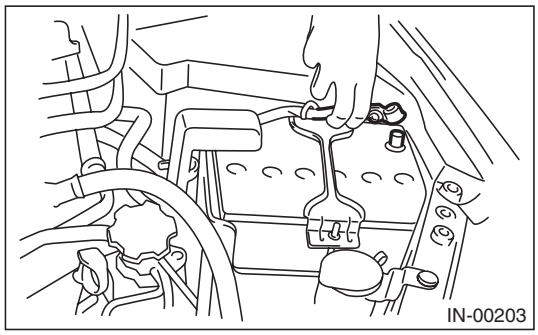
C: INSPECTION

1) Check that the air cleaner element has no deformation, cracks or other damages.
2) Check the air cleaner element for excessive dirt.

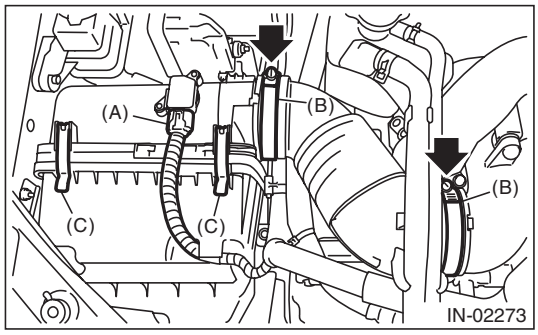
3. Air Cleaner Case

A: REMOVAL

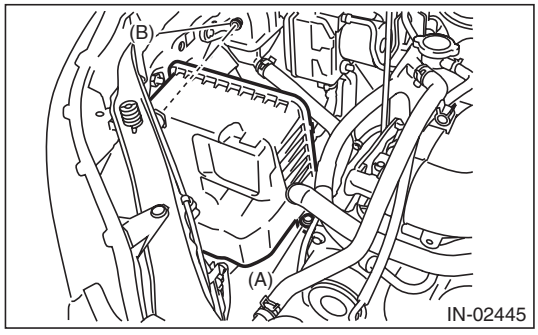
1) Disconnect the ground cable from battery.



2) Remove the air intake duct. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.>
3) Disconnect the connector (A) from air flow and intake air temperature sensor.
4) Loosen the clamp (B) which holds the air intake boot.
5) Remove the clip (C) from the air cleaner case (front).



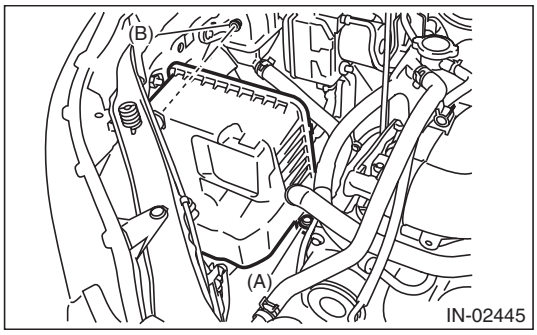
6) Remove the air cleaner case (rear) and air intake boot.
7) Remove the air cleaner element.
8) Remove bolts (A) and nuts (B) which secure the air cleaner case (front) to the body, and remove the air cleaner case (front).



B: INSTALLATION

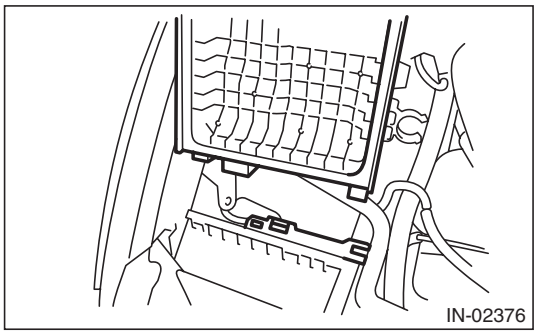
1) Install the bolt (A) and nut (B) which secure the air cleaner case (front) to the body.

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)

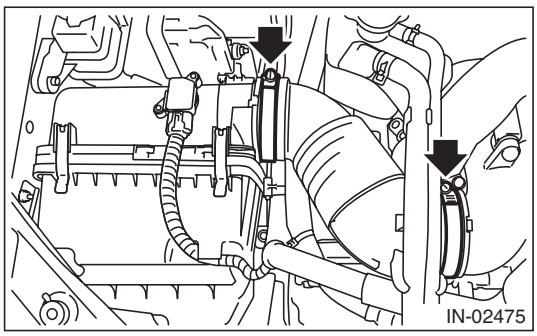


2) Install the air cleaner element.
3) Install the air cleaner case (rear) and air intake boot.

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.

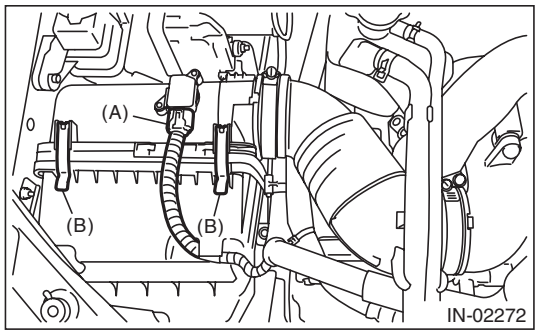


Tightening torque:
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

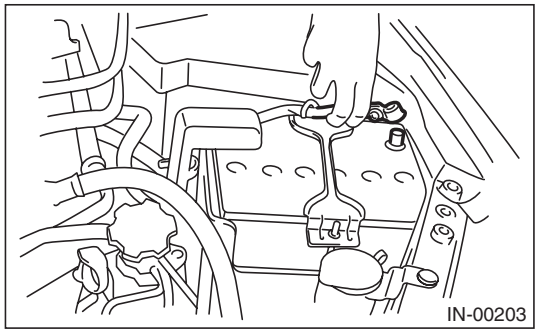


4) Install the clip (B) to the air cleaner case (front).

5) Connect the connector (A) to the mass air flow and intake air temperature sensor.



6) Install the air intake duct. <Ref. to IN(w/o STI)-10, INSTALLATION, Air Intake Duct.>
7) Connect the battery ground terminal.



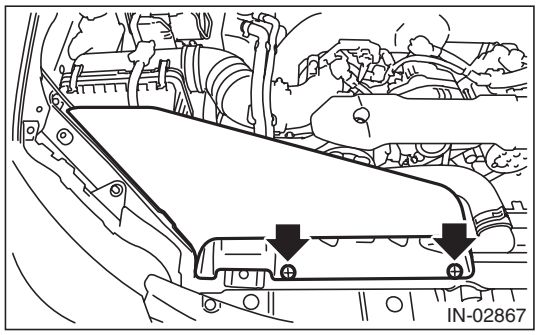
C: INSPECTION

1) Check that the air cleaner case has no deformation, cracks or other damages.
2) Check that the air intake boot has no cracks, damage or loose part.

4. 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.

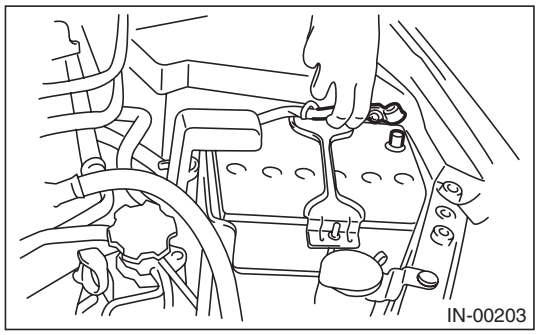
C: INSPECTION

1) Check that the air intake duct has no deformation, cracks or other damages.
2) Inspect that no foreign objects are mixed in the air intake duct.

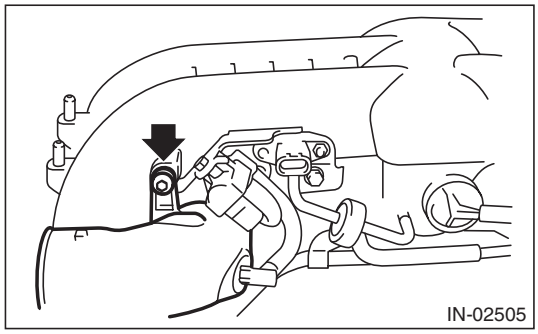
5. Intake Duct

A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
3) Remove the sensor, engine harness and fuel pipe from the intake manifold. <Ref. to FU(w/o STI)-26, DISASSEMBLY, Intake Manifold.>
4) Remove the intake duct from intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
17 N·m (1.7 kgf-m, 12.5 ft-lb)

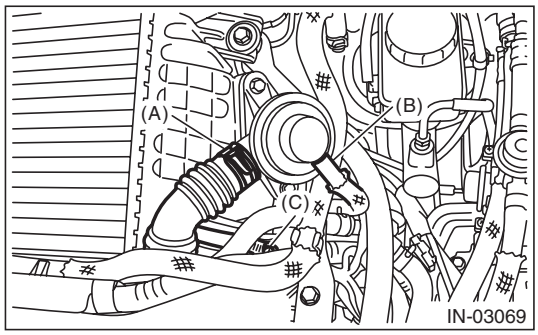
C: INSPECTION

Check that the intake duct has no deformation, cracks or other damages.

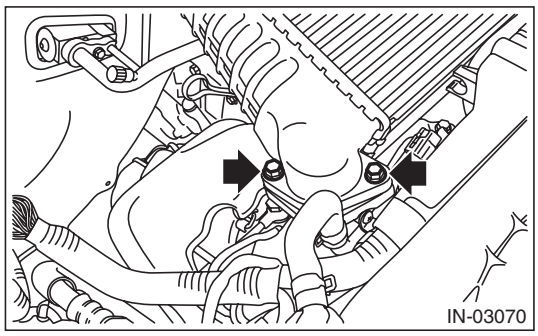
6. Intercooler

A: REMOVAL

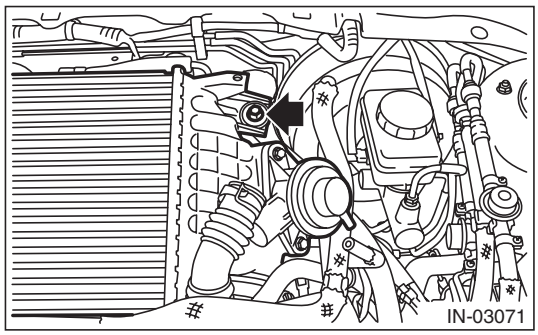
1) Disconnect the air by-pass pipe (A) and vacuum hose (B) from the air by-pass valve.
2) Loosen the clamp (C) which holds the intake duct to intercooler.



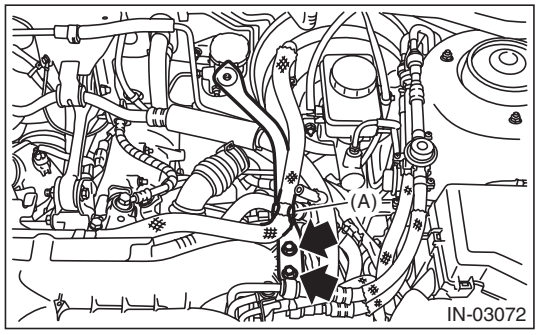
3) Remove the bolts which secure the intercooler to the turbocharger.



4) Remove the bolts which secure the intercooler to the intercooler stay, and remove the intercooler.



5) Remove the brake booster vacuum hose from the clip (A), and remove the intercooler stay.

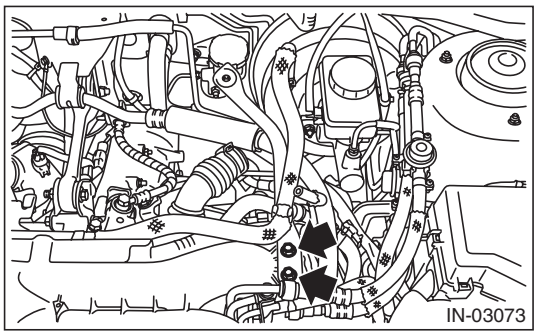


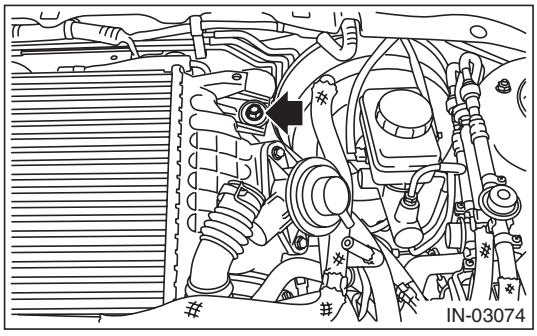
B: INSTALLATION

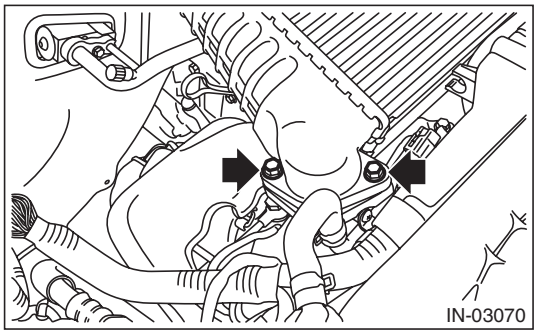
Install in the reverse order of removal.

NOTE:
- Use new O-rings.
- Be careful not to pinch the O-ring.

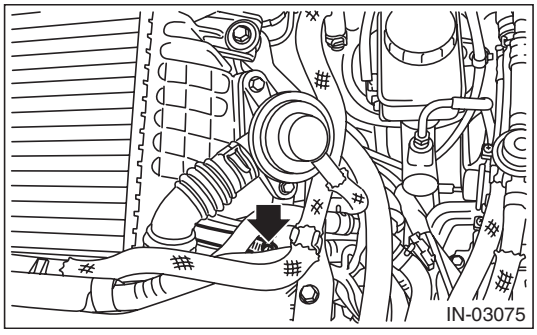
Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)





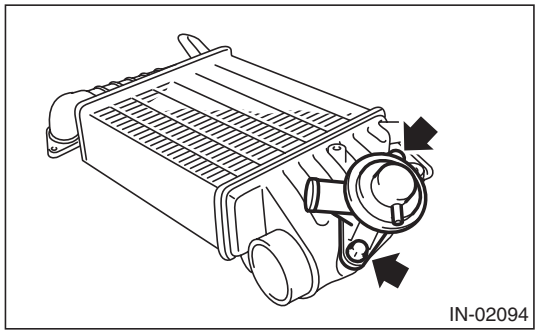


Tightening torque:
3 N·m (0.3 kgf-m, 2.2 ft-lb)



C: DISASSEMBLY

1) Remove the air by-pass valve from intercooler.



D: ASSEMBLY

Assemble in the reverse order of disassembly.

NOTE:
- Use new O-rings.
- Be careful not to pinch the O-ring.

Tightening torque:
6.5 N·m (0.7 kgf-m, 4.8 ft-lb)

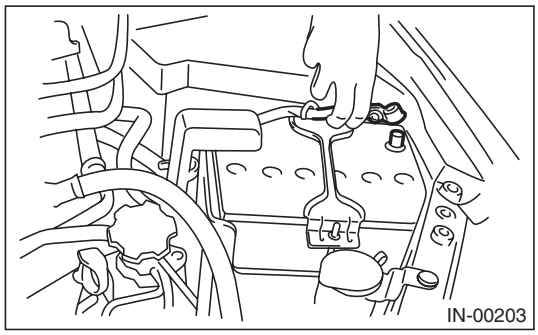
E: INSPECTION

1) Check that the intercooler has no deformation, cracks or other damages.
2) Check that the vacuum hose, air by-pass pipe and intake duct have no cracks, damage or loose part.

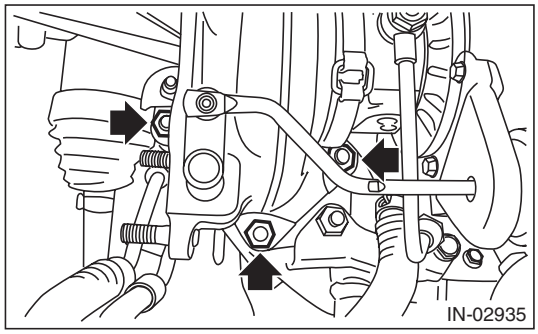
7. Turbocharger

A: REMOVAL

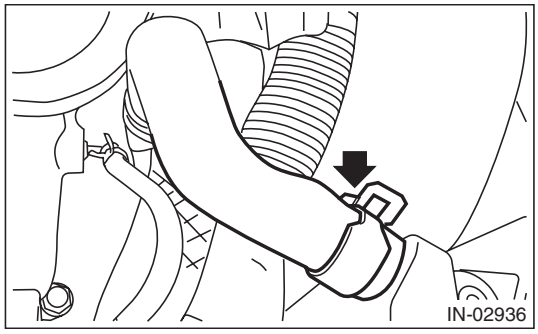
1) Disconnect the ground cable from battery.



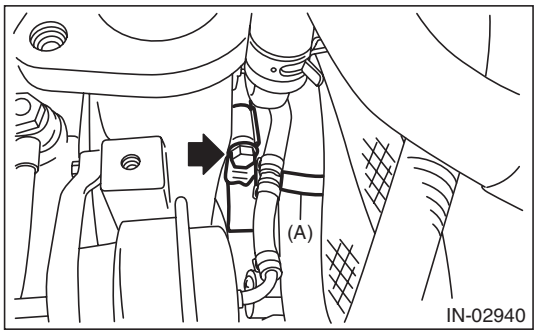
2) Lift up the vehicle.
3) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(w/o STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Lower the vehicle.
5) Remove the intercooler. <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
6) Remove the center exhaust pipe. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>
7) Lower the vehicle.
8) Remove the joint pipe from the turbocharger.



9) Disconnect the engine coolant hoses from coolant filler tank.

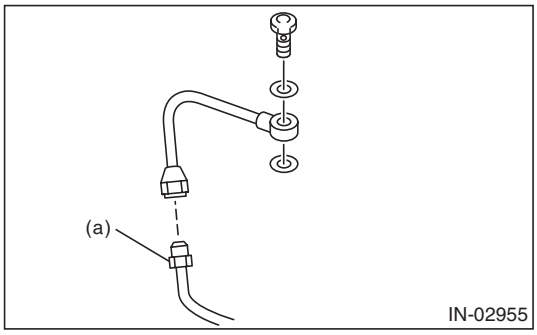


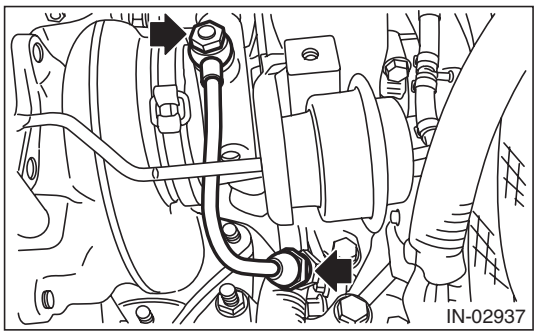
10) Disconnect the air control hose (A), and loosen the clamp holding the intake duct to the turbocharger.



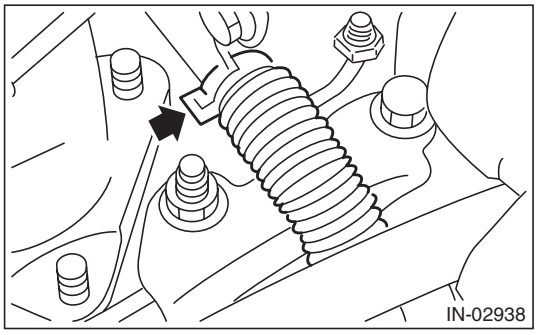
11) Remove the oil inlet pipe from the turbocharger.

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.

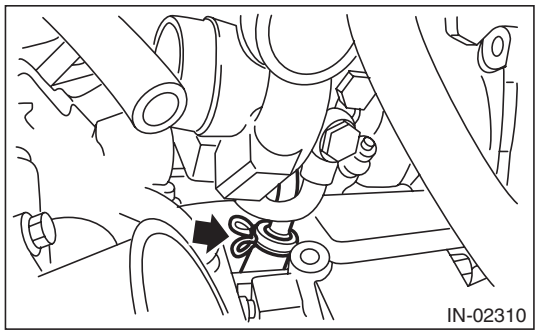




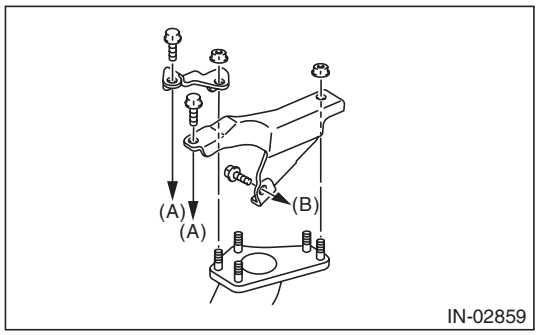
12) Disconnect the engine coolant hose from the water pipe.



13) Disconnect the oil outlet hose from the oil outlet pipe, and remove the turbocharger.



14) Remove the turbocharger stay.

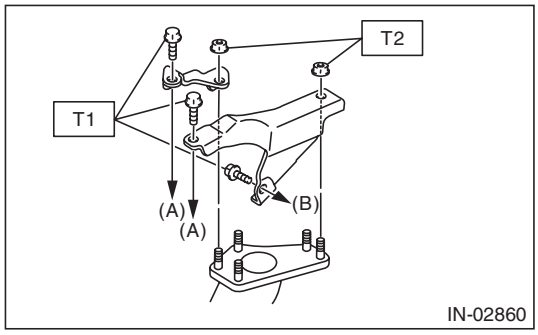


(A) To cylinder head RH
(B) To cylinder block RH

B: INSTALLATION

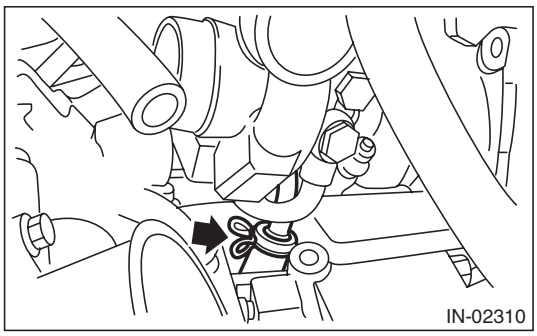
1) Install the turbocharger stay.

Tightening torque:
T1: 33 N·m (3.4 kgf-m, 24.3 ft-lb)
T2: 42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

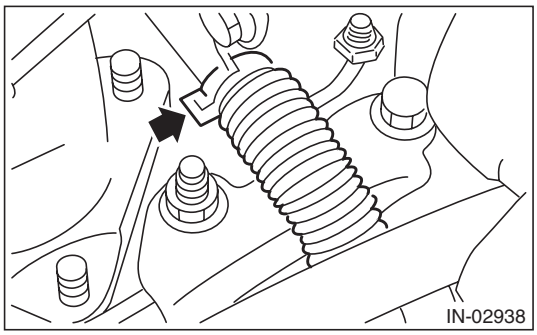


(A) To cylinder head RH
(B) To cylinder block RH

2) Connect the oil outlet hose to the oil outlet pipe.

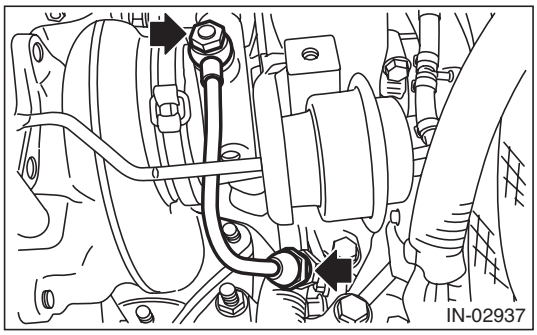


3) Connect the engine coolant hoses to the water pipe.



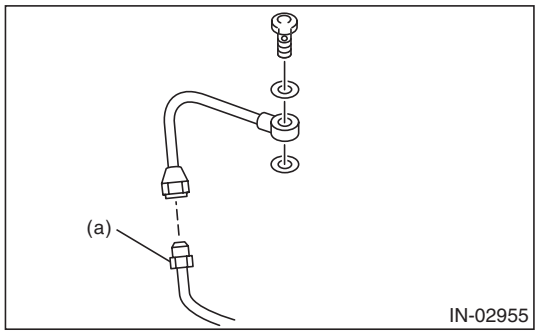
4) Temporarily tighten the union bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

NOTE:
Use a new gasket.

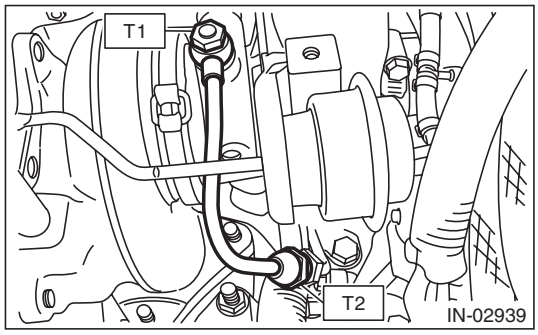


5) Tighten the union bolts and flare nuts which secure the oil inlet pipe to the turbocharger.

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.

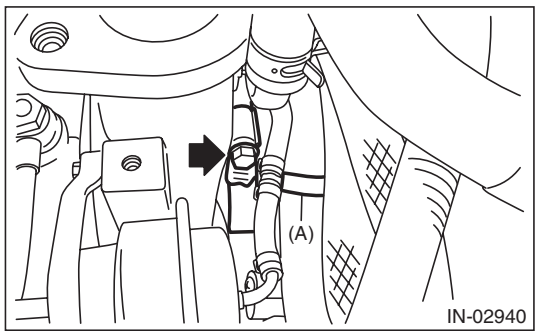


Tightening torque:
T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)

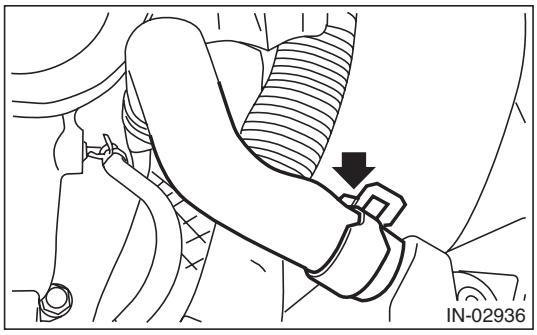


6) Connect the air control hose (A), and install the intake duct to the turbocharger.

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



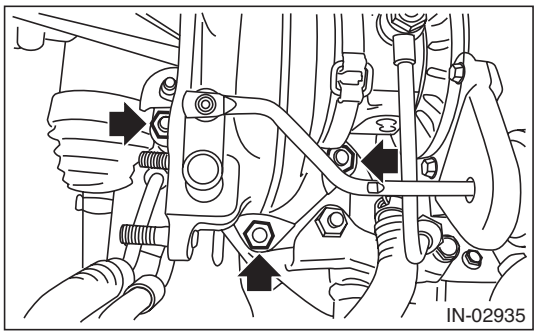
7) Connect the engine coolant hoses to the coolant filler tank.



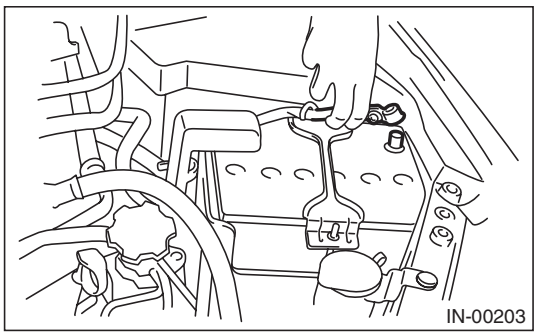
8) Install the joint pipe to turbocharger.

NOTE:
Replace the gasket with a new part.

Tightening torque:
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



9) Lift up the vehicle.
10) Install the center exhaust pipe. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>
11) Lower the vehicle.
12) Install the intercooler. <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>
13) Connect the battery ground terminal.

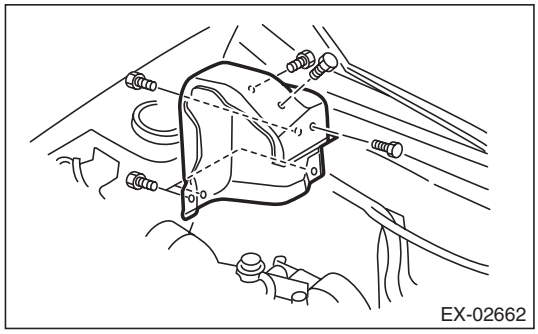


14) Fill engine coolant. <Ref. to CO(w/o STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

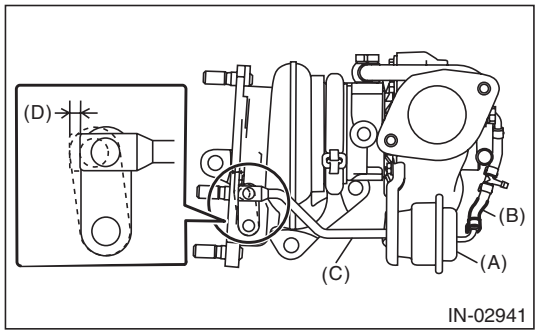
C: INSPECTION

1. WASTE GATE ACTUATOR

1) Remove the intercooler. <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
2) Remove the turbocharger upper cover.



3) Remove the boost hose (B) from the waste gate actuator (A) of the turbocharger, and connect the Mighty Vac to the waste gate actuator (A).



(A) Waste gate actuator
(B) Boost hose
(C) Control rod
(D) Control rod stroke

4) Pressurize slowly with the Mighty Vac, and measure the pressure when the control rod stroke (D) becomes 2 mm (0.08 in). If it is not within the standard, replace the turbocharger assembly.

CAUTION:
Do not pressurize over 89.9 kPa (0.92 kgf/cm^2, 13.0 psi) to prevent damaging the waste gate actuator.

Operating pressure (control rod stroke 2 mm (0.08 in)):
Standard
74.7 — 80.8 kPa (0.76 — 0.82 kgf/cm^2, 10.8 — 11.7 psi)

5) After inspection, install the related parts in the reverse order of removal.

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

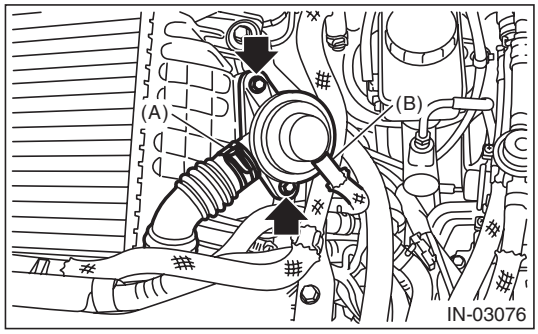
2. OTHER INSPECTIONS

1) Check that the turbocharger and pipe have no deformation, cracks or other damages.
2) Check that the hose and intake duct have no cracks, damage or loose part.
3) Check that there are no oil leakage or water leakage from the pipe attachment section.

8. Air By-pass Valve

A: REMOVAL

Disconnect the air by-pass pipe (A) and vacuum hose (B) from the air by-pass valve, and remove the air by-pass valve from the intercooler.



B: INSTALLATION

Install in the reverse order of removal.

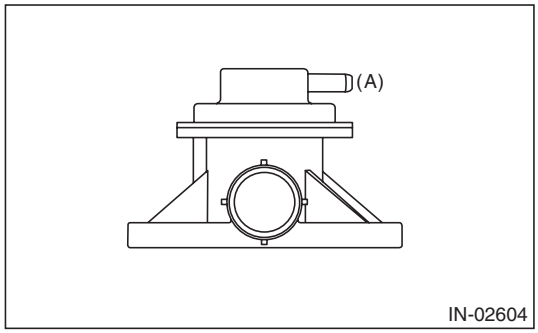
NOTE:
- Use new O-rings.
- Be careful not to pinch the O-ring.

Tightening torque:
6.5 N·m (0.7 kgf-m, 4.8 ft-lb)

C: INSPECTION

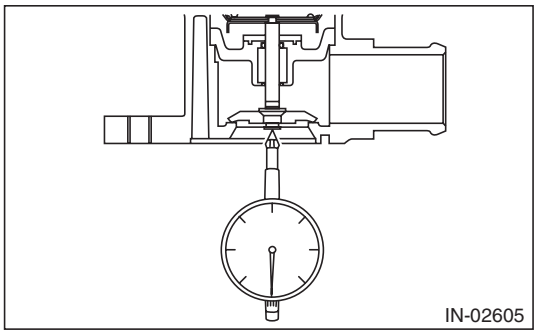
1. AIR BY-PASS VALVE

1) Check that the air by-pass valve has no deformation, cracks or other damages.
2) Connect the Mighty Vac to the nipple (A) of the air by-pass valve.



3) Using the Mighty Vac, generate the negative pressure to –93.3 kPa (–0.95 kgf/cm^2, –13.5 psi). Check that the Mighty Vac gauge needle holds 10 seconds without falling by –92.6 kPa (–0.94 kgf/cm^2, –13.4 psi).

4) Set a dial gauge to the end of valve rod of the air by-pass valve.



5) Using the Mighty Vac, generate the negative pressure, and check the pressure when dial gauge needle (valve stroke) shows 0.5 mm (0.02 in). If it is not within the standard, replace the air by-pass valve.

Opening pressure (valve stroke 0.5 mm (0.02 in)):
Standard
–53.3 — –61.3 kPa (–0.54 — –0.63 kgf/cm^2, –7.73 — –8.89 psi)

6) Generate the additional negative pressure from 5), and check the pressure when dial gauge needle (valve stroke) shows 7.5 mm (0.3 in). If it is not within the standard, replace the air by-pass valve.

Full open pressure (valve stroke 7.5 mm (0.3 in)):
Standard
–93.4 — –108 kPa (–0.95 — –1.10 kgf/cm^2, –13.5 — –15.7 psi)

2. OTHER INSPECTIONS

Check that the vacuum hose and air by-pass pipe have no cracks, damage or loose part.

MECHANICAL

ME(w/o STI)

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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, double 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				8.4
	Compression pressure (at 200 — 300 rpm) kPa (kg/cm^2, psi)			Standard	981 — 1,177 (10 — 12, 142 — 171)
	Number of piston rings				Pressure ring: 2, Oil ring: 1
	Intake valve timing		Open	Max. retard	ATDC 5°
				Min. advance	BTDC 35°
			Close	Max. retard	ABDC 65°
				Min. advance	ABDC 25°
	Exhaust valve timing		Open		BBDC 55°
			Close		ATDC 5°
	Valve clearance mm (in)	Inspection value	Intake		$0.20^{+0.04}_{-0.06}$ ($0.0079^{+0.0016}_{-0.0024}$)
			Exhaust		0.35±0.05 (0.0138±0.0020)
		Adjustment value	Intake		$0.20^{+0.01}_{-0.03}$ ($0.0079^{+0.0004}_{-0.0012}$)
			Exhaust		0.35±0.02 (0.0138±0.0008)
	Idle speed (Gear shift lever is in neutral) rpm		No load	Standard	700±100
			A/C ON	Standard	750±100
	Ignition order				1 → 3 → 2 → 4
	Ignition timing BTDC/rpm			Standard	12°±10°/700

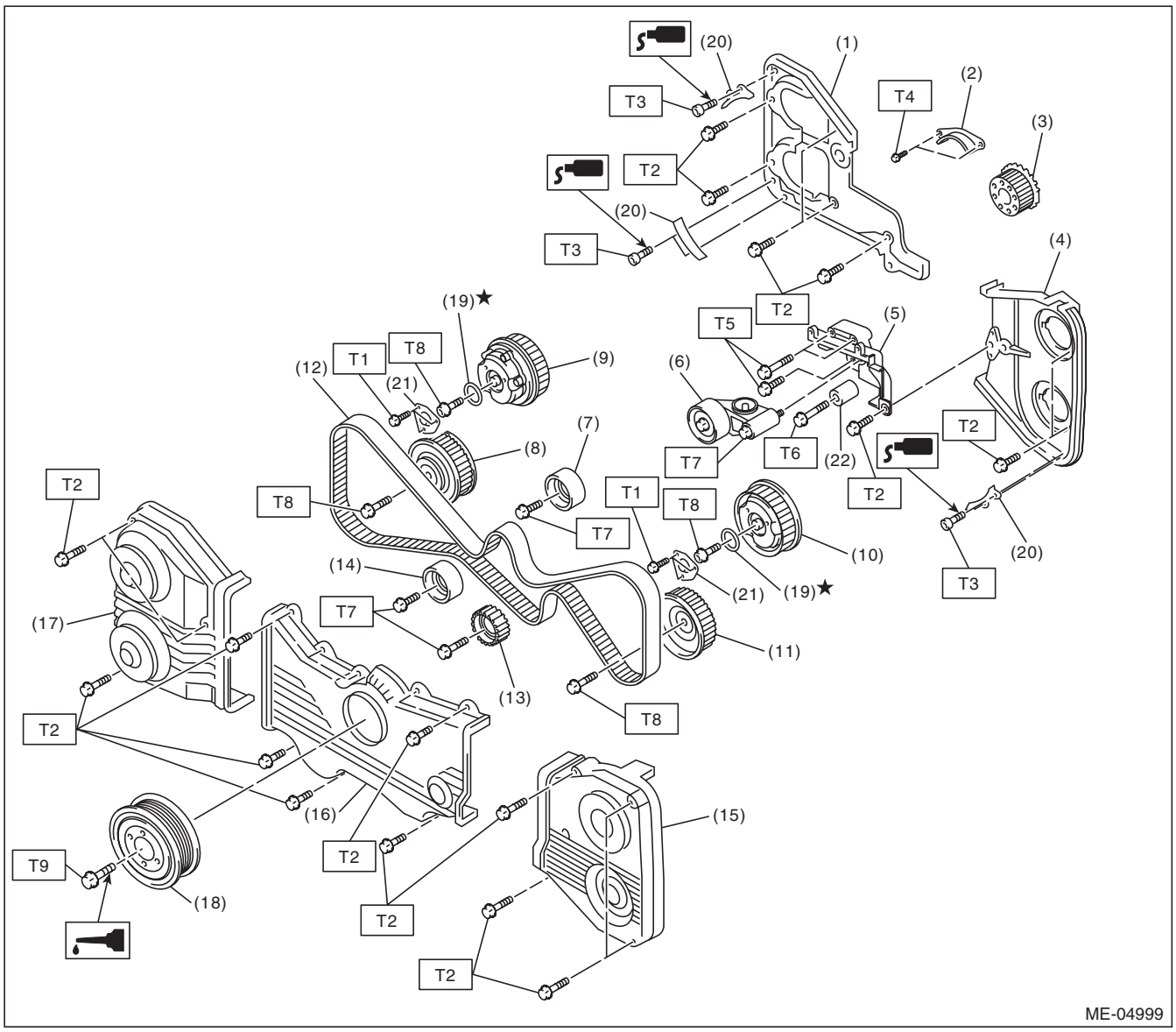
NOTE:
OS: Oversize US: Undersize

Belt tension adjuster	Adjuster rod protrusion amount		mm (in)	5.2 — 6.2 (0.205 — 0.244)
Camshaft	Bending limit		mm (in)	0.020 (0.00079)
	Cam lobe height mm (in)	Intake	Standard	46.55 — 46.65 (1.833 — 1.837)
		Exhaust	Standard	46.75 — 46.85 (1.841 — 1.844)
	Cam base circle diameter mm (in)		Standard	37.0 (1.457)
	Journal O.D. mm (in)	Front	Standard	37.946 — 37.963 (1.4939 — 1.4946)
		Center, rear	Standard	29.946 — 29.963 (1.1790 — 1.1796)
	Oil clearance mm (in)		Standard	0.037 — 0.072 (0.0015 — 0.0028)
	Thrust clearance mm (in)		Standard	0.068 — 0.116 (0.0027 — 0.0047)
Cylinder head	Warping limit (mating surface with cylinder block)		mm (in)	0.035 (0.0014)
	Grinding limit		mm (in)	0.3 (0.012)
	Standard height		mm (in)	127.5 (5.02)
Valve seat	Seating angle between valve and valve seat			90°
	Contacting width between valve and valve seat mm (in)	Intake	Standard	0.6 — 1.4 (0.024 — 0.055)
		Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)
Valve guide	Clearance between the valve guide and valve stem mm (in)	Intake	Standard	0.030 — 0.057 (0.0012 — 0.0022)
		Exhaust	Standard	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		5.955 — 5.970 (0.2344 — 0.2350)
		Exhaust		5.945 — 5.960 (0.2341 — 0.2346)
	Valve guide protrusion amount		mm (in)	15.8 — 16.2 (0.622 — 0.638)
Valve	Head edge thickness mm (in)	Intake	Standard	1.0 — 1.4 (0.039 — 0.055)
		Exhaust	Standard	1.3 — 1.7 (0.051 — 0.067)
	Overall length mm (in)	Intake		104.4 (4.110)
		Exhaust		104.65 (4.1201)
Valve spring	Free length		mm (in)	47.32 (1.863)
	Tension/spring height N (kgf, lb)/mm (in)		Set	205 — 235 (20.9 — 24.0, 46.1 — 52.8)/36.0 (1.417)
			Lift	426 — 490 (43.4 — 50.0, 95.8 — 110)/26.50 (1.043)
	Squareness			2.5°, 2.1 mm (0.083 in) or less
Valve lifter	Outer diameter mm (in)		Standard	34.959 — 34.975 (1.3763 — 1.3770)
	Valve lifter mating surface inner diameter mm (in)		Standard	34.994 — 35.016 (1.3777 — 1.3786)
	Valve lifter and valve lifter mating surface clearance mm (in)		Standard	0.019 — 0.057 (0.0007 — 0.0022)
Cylinder block	Warping limit (mating surface with cylinder head)		mm (in)	0.025 (0.0098)
	Grinding limit		mm (in)	0.1 (0.004)
	Standard height		mm (in)	201.0 (7.91)
	Cylindricality mm (in)		Limit	0.015 (0.0006)
	Out-of-roundness mm (in)		Limit	0.010 (0.0004)
	Clearance between cylinder and piston 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 (1.50)
	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 — 3.9278)
		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 pin 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 — 0.25 (0.0079 — 0.0098)
		Second ring		Standard	0.37 — 0.52 (0.015 — 0.0203)
		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)	Limit	0.10 (0.0039)
	Thrust clearance		mm (in)	Standard	0.070 — 0.330 (0.0028 — 0.0130)
	Oil clearance		mm (in)	Standard	0.017 — 0.045 (0.0007 — 0.0018)
	Bearing size (Thickness at center) mm (in)			Standard	1.490 — 1.506 (0.0587 — 0.0593)
				0.03 (0.0012) US	1.504 — 1.512 (0.0592 — 0.0595)
				0.05 (0.0020) US	1.514 — 1.522 (0.0596 — 0.0599)
				0.25 (0.0098) US	1.614 — 1.622 (0.0635 — 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	Cylindricality	mm (in)	Limit	0.006 (0.0002)
		Out-of-roundness	mm (in)	Limit	0.005 (0.0002)
		Grinding limit (dia.)		mm (in)	To 51.750 (2.0374)
	Crank journal	Cylindricality	mm (in)	Limit	0.006 (0.0002)
		Out-of-roundness	mm (in)	Limit	0.005 (0.0002)
		Grinding limit (dia.)		mm (in)	To 59.758 (2.3527)
	Crank pin outer diameter mm (in)			Standard	51.976 — 52.000 (2.0463 — 2.0472)
				0.03 (0.0012) US	51.954 — 51.970 (2.0454 — 2.0461)
				0.05 (0.0020) US	51.934 — 51.950 (2.0447 — 2.0453)
				0.25 (0.0098) US	51.734 — 51.750 (2.0368 — 2.0374)
	Crank journal outer diameter mm (in)			Standard	59.984 — 60.008 (2.3616 — 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 — 2.015 (0.0787 — 0.0793)
				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 — 2.017 (0.0787 — 0.0794)
				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

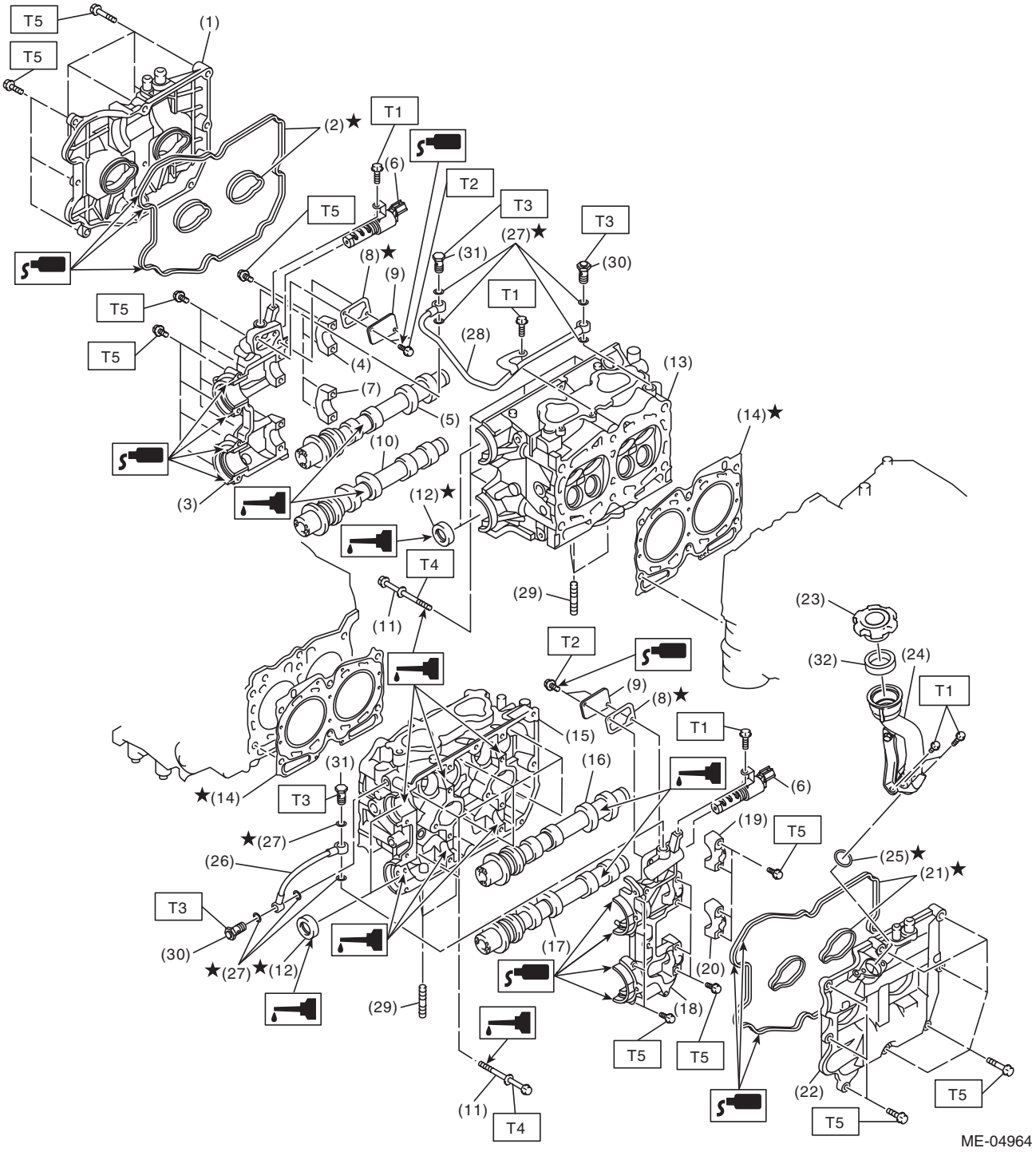


(1)	Timing belt cover No. 2 RH	(12)	Timing belt
(2)	Timing belt guide	(13)	Belt idler No. 2
(3)	Crank sprocket	(14)	Belt idler
(4)	Timing belt cover No. 2 LH	(15)	Timing belt cover LH
(5)	Tensioner bracket	(16)	Front belt cover
(6)	Automatic belt tension adjuster ASSY	(17)	Timing belt cover RH
(7)	Belt idler	(18)	Crank pulley
(8)	Exhaust cam sprocket RH	(19)	O-ring
(9)	Intake cam sprocket RH	(20)	Timing belt guide
(10)	Intake cam sprocket LH	(21)	Actuator cover
(11)	Exhaust cam sprocket LH	(22)	Belt idler

Tightening torque: N·m (kgf-m, ft-lb)

- ***T1: 3.4 (0.3, 2.5)***
- ***T2: 5 (0.5, 3.7)***
- ***T3: 6.4 (0.7, 4.7)***
- ***T4: 9.75 (1.0, 7.2)***
- ***T5: 24.5 (2.5, 18.1)***
- ***T6: 25 (2.5, 18.4)***
- ***T7: 39 (4.0, 28.8)***
- ***T8: <Ref. to ME(w/o STI)-57, INSTALLATION, Cam Sprocket.>***
- ***T9: <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>***

2. CYLINDER HEAD AND CAMSHAFT

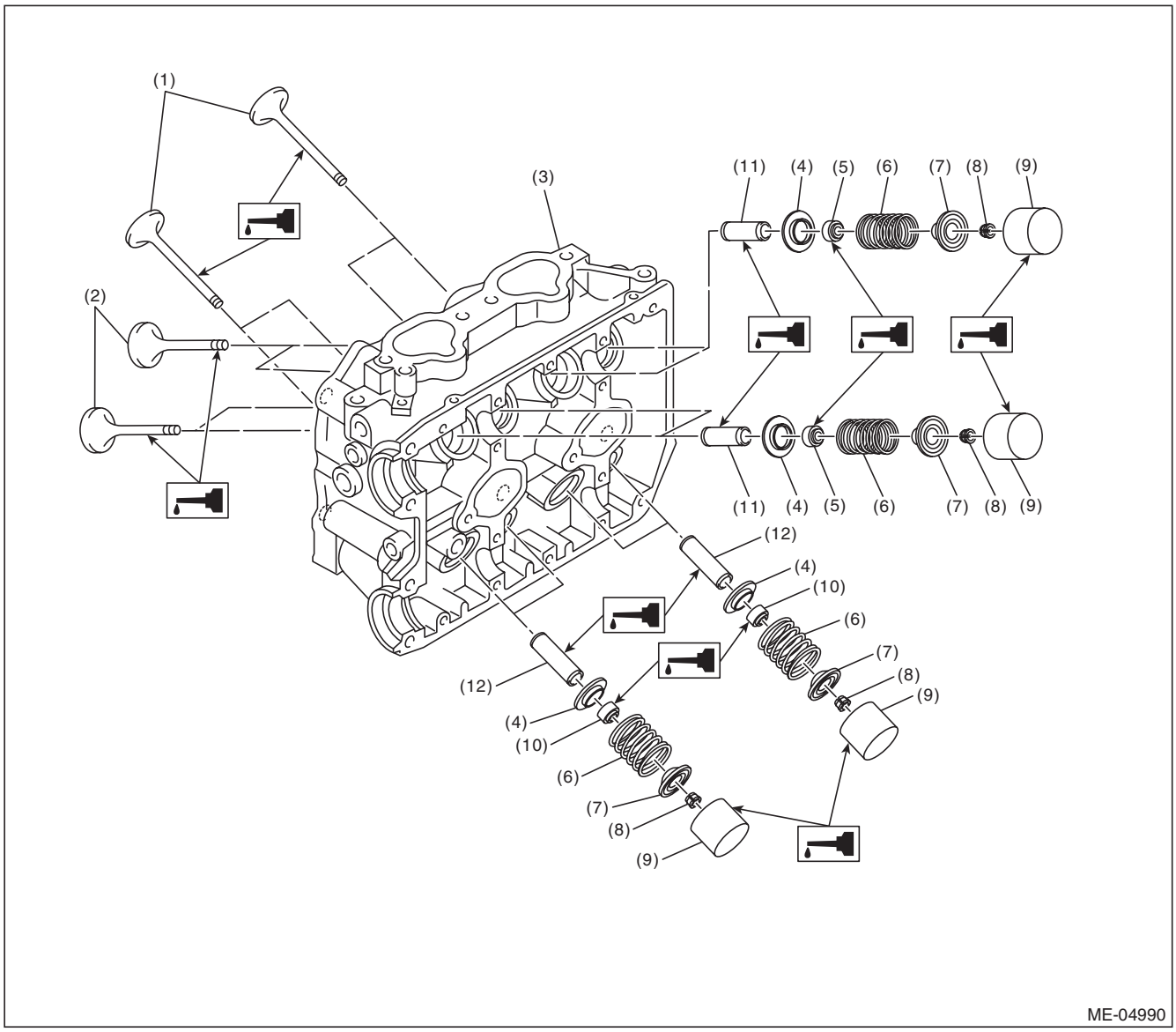


(1) Rocker cover RH
(2) Rocker cover gasket RH
(3) Front camshaft cap RH
(4) Intake camshaft cap RH
(5) Intake camshaft RH
(6) Oil flow control solenoid valve
(7) Exhaust camshaft cap RH
(8) Gasket
(9) Oil return cover
(10) Exhaust camshaft RH
(11) Cylinder head bolt
(12) Oil seal
(13) Cylinder head RH
(14) Cylinder head gasket
(15) Cylinder head LH
(16) Intake camshaft LH
(17) Exhaust camshaft LH
(18) Front camshaft cap LH
(19) Intake camshaft cap LH
(20) Exhaust camshaft cap LH
(21) Rocker cover gasket LH
(22) Rocker cover LH
(23) Oil filler cap
(24) Oil filler duct
(25) O-ring
(26) Oil pipe LH
(27) Gasket
(28) Oil pipe RH
(29) Stud bolt
(30) Union bolt with filter (with protrusion)
(31) Union bolt without filter (without protrusion)
(32) Gasket

Tightening torque: N·m (kgf-m, ft-lb)

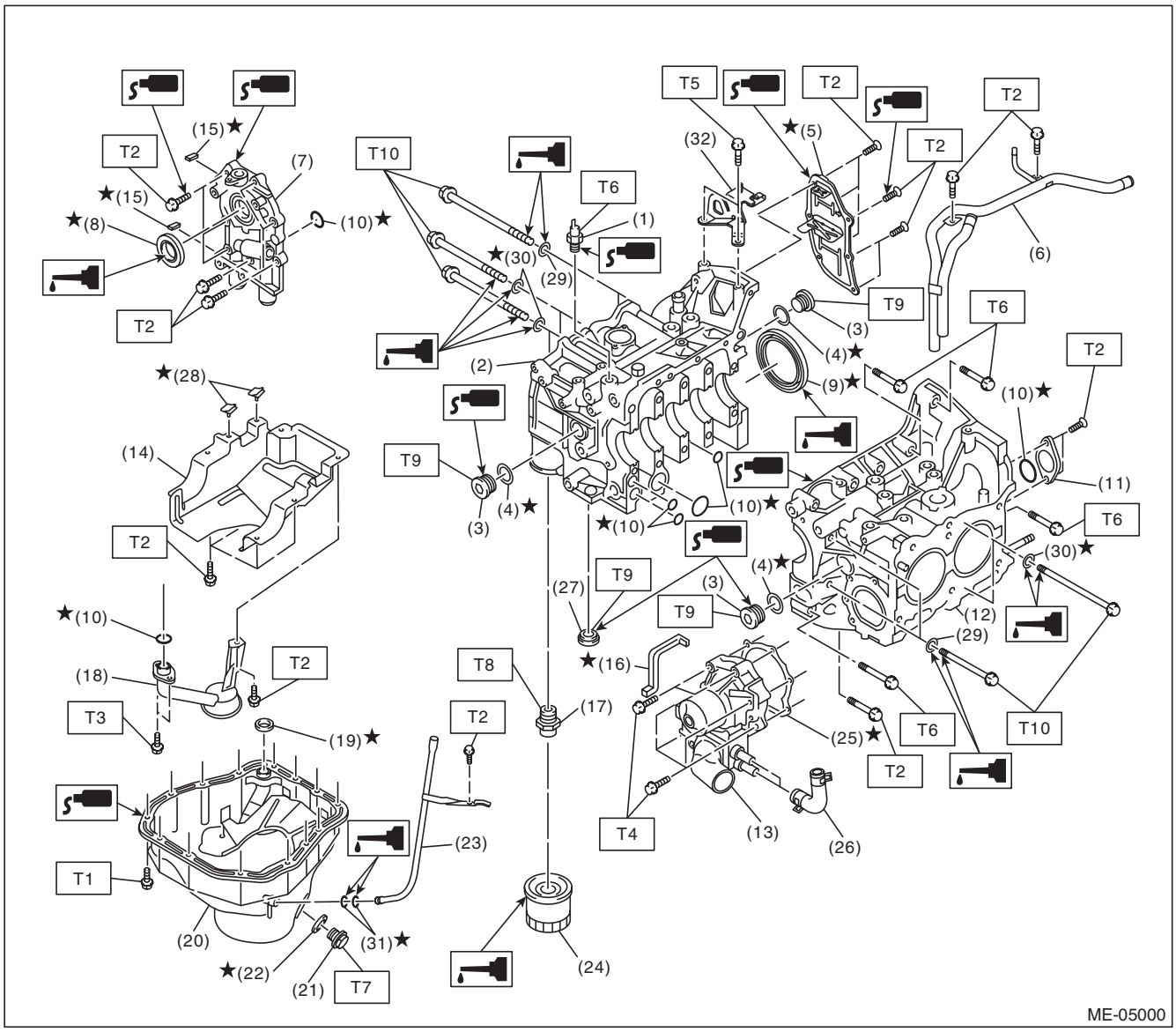
T1: 6.4 (0.7, 4.7)
T2: 9 (0.9, 6.6)
T3: 29 (3.0, 21.4)
T4: <Ref. to ME(w/o STI)-68, INSTALLATION, Cylinder Head.>
T5: <Ref. to ME(w/o STI)-61, INSTALLATION, Camshaft.>

3. CYLINDER HEAD AND VALVE ASSEMBLY



(1) Exhaust valve
(2) Intake valve
(3) Cylinder head
(4) Valve spring seat
(5) Intake valve oil seal
(6) Valve spring
(7) Valve spring retainer
(8) Valve spring retainer key
(9) Valve lifter
(10) Exhaust valve oil seal
(11) Intake valve guide
(12) Exhaust valve guide

4. CYLINDER BLOCK

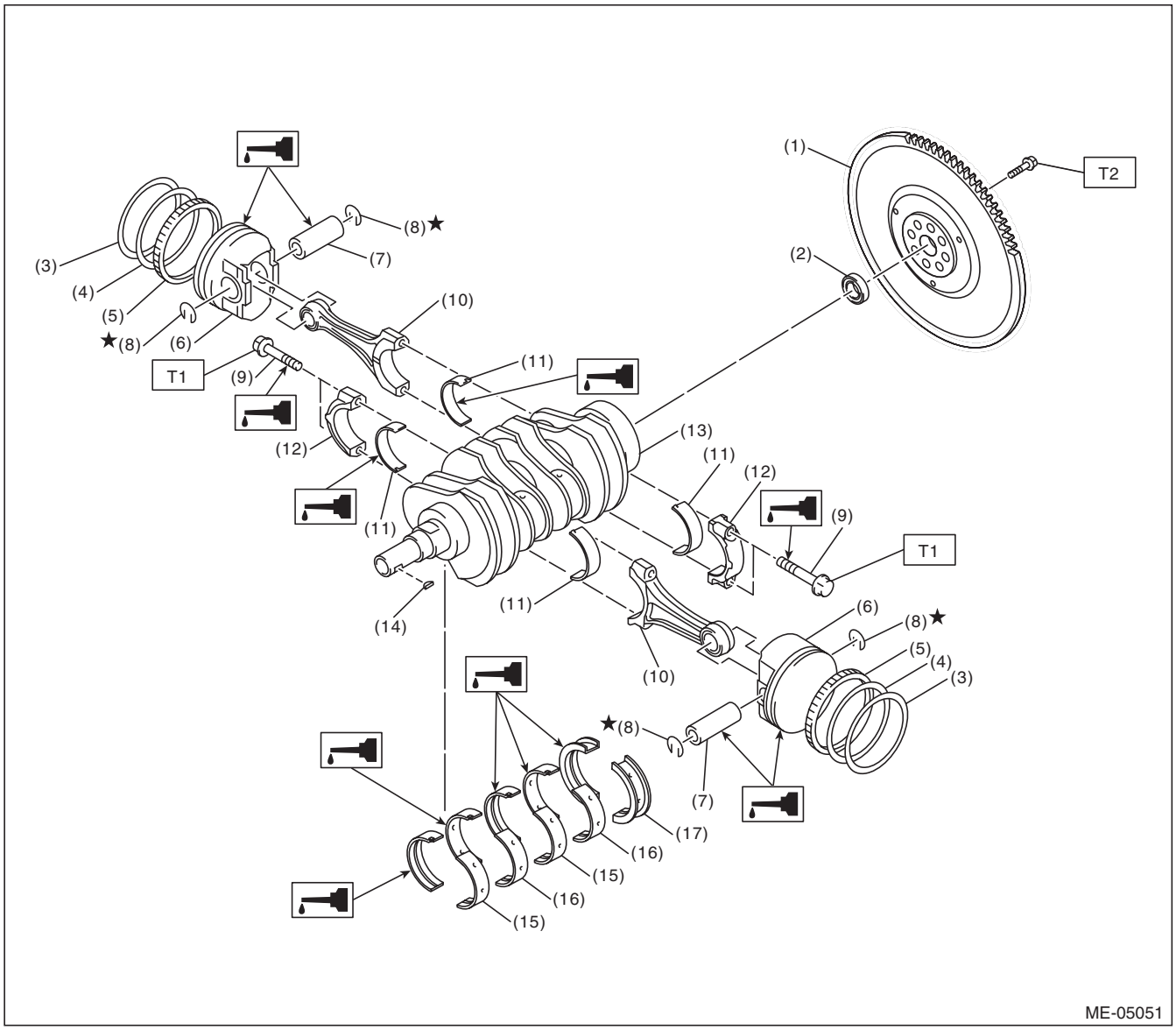


(1) Oil pressure switch
(2) Cylinder block RH
(3) Service hole plug
(4) Gasket
(5) Oil separator cover
(6) Water by-pass pipe
(7) Oil pump
(8) Front oil seal
(9) Rear oil seal
(10) O-ring
(11) Service hole cover
(12) Cylinder block LH
(13) Water pump
(14) Baffle plate
(15) Oil pump seal
(16) Water pump sealing
(17) Oil filter connector
(18) Oil strainer
(19) Gasket
(20) Oil pan
(21) Drain plug
(22) Drain plug gasket
(23) Oil level gauge guide
(24) Oil filter
(25) Gasket
(26) Water pump hose
(27) Plug
(28) Seal
(29) Washer
(30) Seal washer
(31) O-ring
(32) Engine rear hanger

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, 7.2)***
T4:	***First 12 (1.2, 8.9) Second 12 (1.2, 8.9)***
T5:	***16 (1.6, 11.8)***
T6:	***25 (2.5, 18.4)***
T7:	***44 (4.5, 32.5)***
T8:	***45 (4.6, 33.2)***
T9:	***70 (7.1, 51.6)***
T10:	***<Ref. to ME(w/o STI)-81, INSTALLATION, Cylinder Block.>***

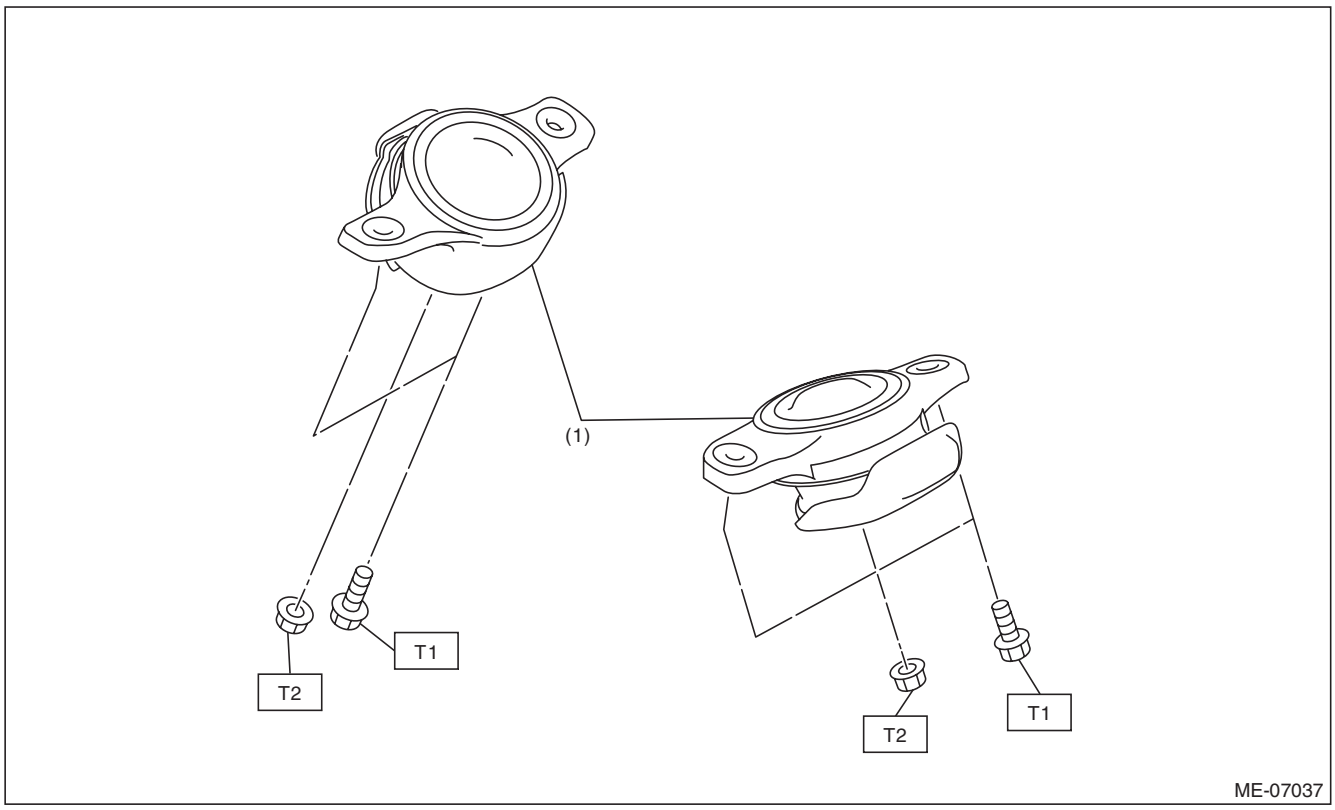
5. CRANKSHAFT AND PISTON



(1) Flywheel
(2) Ball bearing
(3) Top ring
(4) Second ring
(5) Oil ring
(6) Piston
(7) Piston pin
(8) Snap ring
(9) Connecting rod bolt
(10) Connecting rod
(11) Connecting rod bearing
(12) Connecting rod cap
(13) Crankshaft
(14) Woodruff key
(15) Crankshaft bearing #1, #3
(16) Crankshaft bearing #2, #4
(17) Crankshaft bearing #5

Tightening torque: N·m (kgf-m, ft-lb)
T1: 52 (5.3, 38.4)
T2: <Ref. to CL-14, INSTALLATION, Flywheel.>

6. ENGINE MOUNTING



(1) Front cushion rubber

Tightening torque: N·m (kgf-m, ft-lb)
T1: 35 (3.6, 25.8)
T2: 45 (4.6, 33.2)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use. When lifting up the vehicle, make sure to support the vehicle at the jack-up points.
- Be careful not to let any oil or grease contact the clutch disc or flywheel.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil when being assembled.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

D: PREPARATION TOOL

1. SPECIAL TOOL

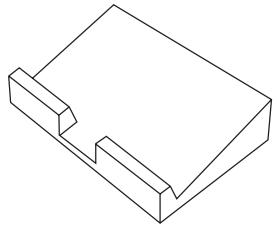
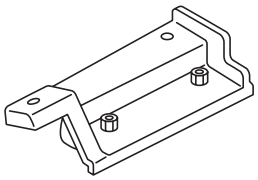
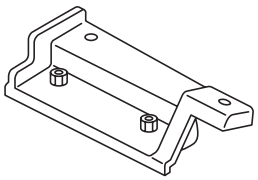
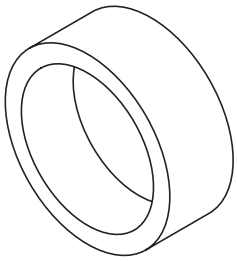
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498267600	498267600	CYLINDER HEAD TABLE	• Used for replacing valve guides. • Used for removing and installing valve spring.
 ST-498457000	498457000	ENGINE STAND ADAPTER RH	Used together with ENGINE STAND (499817100).
 ST-498457100	498457100	ENGINE STAND ADAPTER LH	Used together with ENGINE STAND (499817100).
 ST-498747300	498747300	PISTON GUIDE	Used for installing the piston into the cylinder.

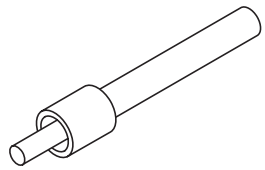
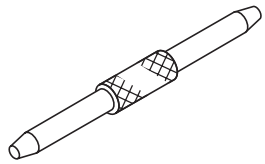
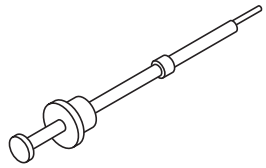
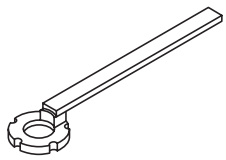
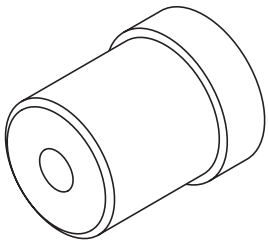
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-498857100	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake valve guide oil seals and exhaust valve guide oil seals.
 ST-499017100	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 ST-499097700	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 ST-499207400	499207400	CAM SPROCKET WRENCH	Used for removing and installing exhaust cam sprocket.
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

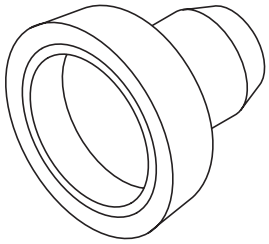
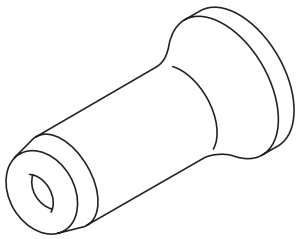
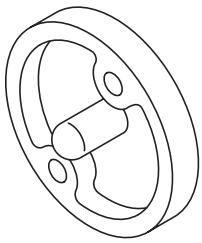
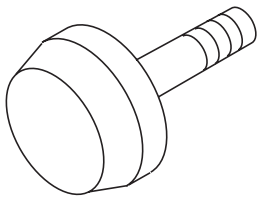
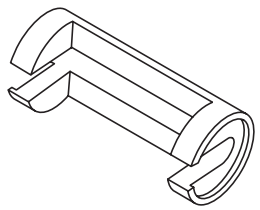
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587200	499587200	CRANKSHAFT OIL SEAL INSTALLER	• Used for installing crankshaft oil seal. • Used together with CRANKSHAFT OIL SEAL GUIDE (499597100).
 ST-499587600	499587600	OIL SEAL INSTALLER	Used for installing the camshaft oil seal.
 ST-499597100	499597100	CRANKSHAFT OIL SEAL GUIDE	• Used for installing crankshaft oil seal. • Used together with CRANKSHAFT OIL SEAL INSTALLER (499587200).
 ST-499597200	499597200	OIL SEAL GUIDE	• Used for installing the camshaft oil seal. • Used together with OIL SEAL INSTALLER (499587600).
 ST-499718000	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.

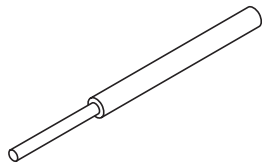
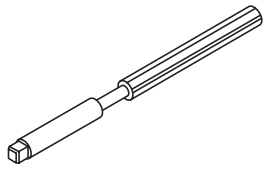
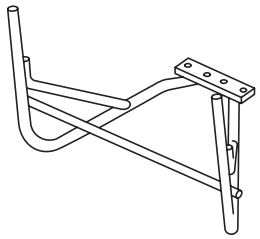
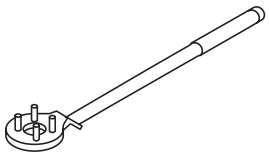
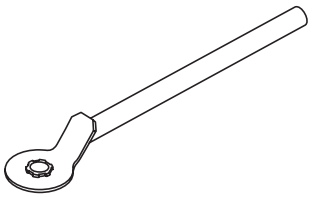
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499767200	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 ST-499767400	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.
 ST-499817100	499817100	ENGINE STAND	• Used for disassembling and assembling engine. • Used together with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for removing and installing the crank pulley.
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket.

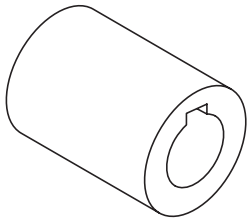
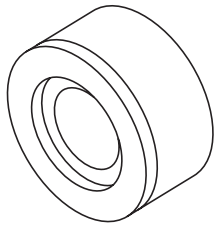
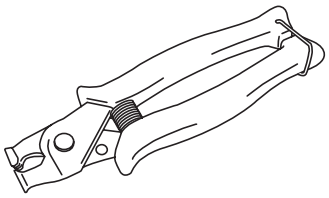
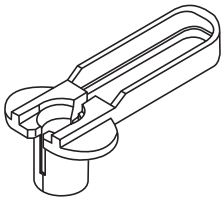
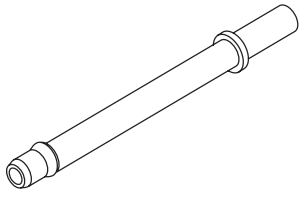
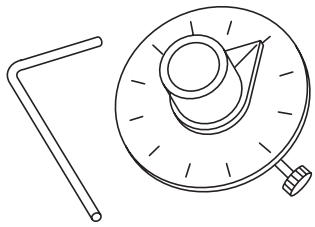
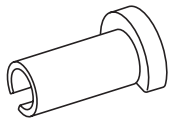
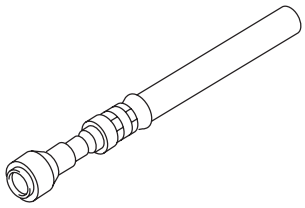
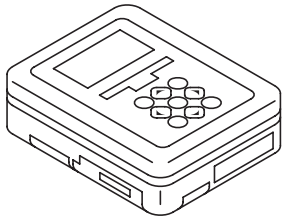
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 ST18251AA020	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake valve guides and exhaust valve guides.
 ST18353AA000	18353AA000	CLAMP PLIERS	• Used for removing and installing 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.
 ST18371AA000	18371AA000	CONNECTOR REMOVER	Used for disconnecting the quick connector on the fuel return hose side of the engine compartment (intake manifold).
 ST18471AA000	18471AA000	FUEL PIPE ADAPTER	Used for inspecting the fuel pressure.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18854AA000	18854AA000	ANGLE GAUGE	Used for installing the crank pulley.
 ST42099AE000	42099AE000	QUICK CONNECTOR RELEASE	Used for removing the quick connector.
 ST42075AG690	42075AG690	FUEL HOSE	Used for inspecting the fuel pressure. NOTE: This is the SUBARU genuine part.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for various inspections.

2. GENERAL TOOL

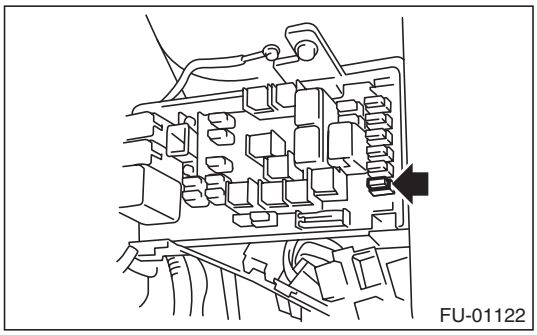
TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.
Timing light	Used for measuring ignition timing.
Vacuum gauge	Used for measuring intake manifold vacuum.
Oil pressure gauge	Used for measuring engine oil pressure.
Fuel pressure gauge	Used for measuring fuel pressure.

2. Compression

A: INSPECTION

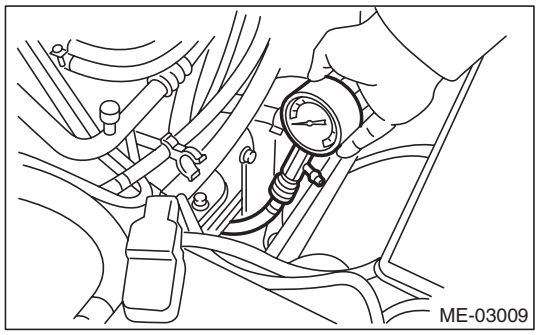
CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

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(w/o STI)-5, REMOVAL, Spark Plug.>
8) Fully open the throttle valve.
9) Check the starter motor for satisfactory performance and operation.
10) Install the compression gauge to 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 starter motor and read the value when the needle of the compression gauge becomes stable.

NOTE:
• Perform at least two measurements per cylinder, and make sure that the values are correct.
• If the compression pressure is out of standard, check or adjust the pistons, valves and cylinders.

Compression (fully open throttle):
Standard
981 — 1,177 kPa (10 — 12 kgf/cm^2, 142 — 171 psi)
Difference between cylinders
49 kPa (0.5 kgf/cm^2, 7 psi) or less

12) 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(H4DOTC)(diag)-40, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

NOTE:
• Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted.
• If idle speed is out of standard, refer to the General Diagnosis Table under “Engine Control System”. <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>
   (1) 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 gear shift lever in neutral position):
Standard
700±100 rpm
   (2) 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 gear shift lever in neutral position):
Standard
750±100 rpm

4. Ignition Timing

A: INSPECTION

CAUTION:
After warming-up, engine becomes very hot. Be careful not to burn yourself at measurement.

1. METHOD WITH SUBARU SELECT MONITOR

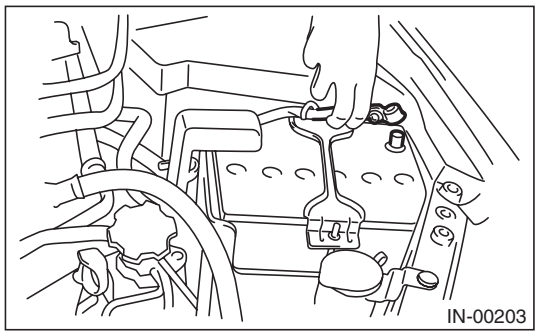
1) Before checking the ignition timing, check the following item:
   (1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
   (2) Check the malfunction indicator light does not illuminate.
2) Warm up the engine.
3) Read the ignition timing using Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-40, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>

NOTE:
If ignition timing is out of standard, check the ignition control system. Refer to "Engine Control System". <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

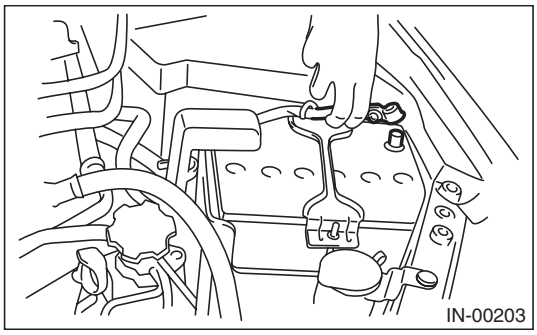
Ignition timing [BTDC/rpm]:
Standard
12°±10°/700

2. METHOD WITH TIMING LIGHT

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) Disconnect the ground cable from battery.



5) Remove the air intake duct. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.>
6) Remove the air cleaner case. <Ref. to IN(w/o STI)-8, REMOVAL, Air Cleaner Case.>
7) Connect the timing light to the power wire of #1 ignition coil.
8) Install the air cleaner case. <Ref. to IN(w/o STI)-8, INSTALLATION, Air Cleaner Case.>
9) Connect the battery ground terminal.



10) Start the engine, turn the timing light to the crank pulley, and check the ignition timing through the timing belt cover gauge.

NOTE:
If ignition timing is out of standard, check the ignition control system. Refer to "Engine Control System". <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

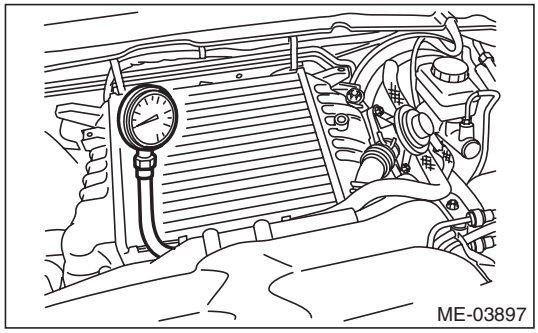
Ignition timing [BTDC/rpm]:
Standard
12°±10°/700

11) After inspection, install the related parts in the reverse order of removal.

5. Intake Manifold Vacuum

A: INSPECTION

1) Warm up the engine.
2) Remove the intercooler. <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
3) Disconnect the brake booster vacuum hose from the intake manifold, and attach the vacuum gauge.



4) Install the intercooler. <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>
5) Keep the engine at idle speed and read the vacuum gauge indication.

NOTE:
Condition of engine inside can be diagnosed by observing the behavior of the vacuum gauge needle as described in table below.

Intake manifold vacuum (at idling, A/C OFF):
Standard
–70.6 kPa (–530 mmHg, –20.85 inHg) or more

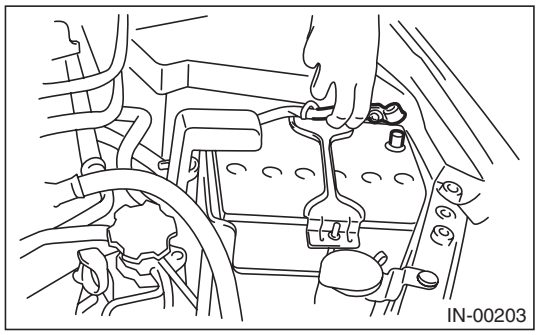
6) After inspection, install the related parts in the reverse order of removal.

Diagnosis of engine condition by inspection of intake manifold vacuum	
Vacuum gauge needle behavior	Possible engine condition
1. Needle is steady but lower than standard value. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket, disconnection or damage of vacuum hose
2. Needle intermittently drops to position lower than standard value.	Leakage around cylinder
3. Needle drops suddenly and intermittently from standard value.	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 standard value in narrow range.	Defective ignition system

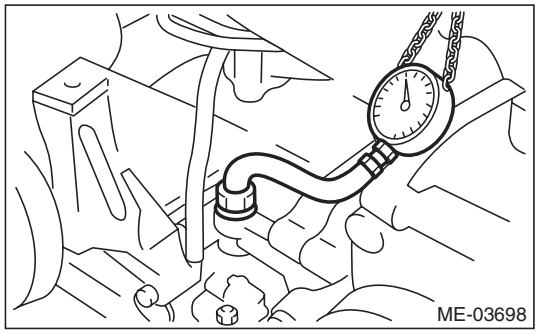
6. Engine Oil Pressure

A: INSPECTION

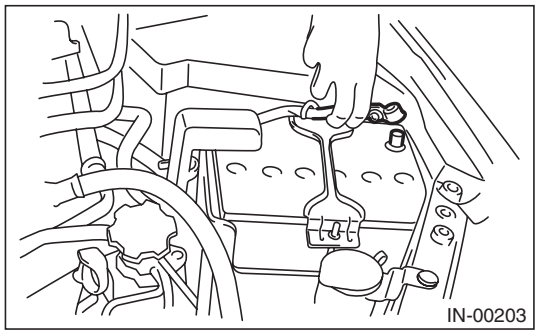
1) Disconnect the ground cable from battery.



2) Remove the oil pressure switch. <Ref. to LU(STI)-22, REMOVAL, Oil Pressure Switch.>
3) Install the oil pressure gauge to cylinder block.



4) Connect the battery ground terminal.



5) Start the engine, and check the oil pressure.

NOTE:
• Standard value is based on an engine oil temperature of 80°C (176°F).
• If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(STI)-32, 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(STI)-32, INSPECTION, Engine Lubrication System Trouble in General.>

Engine oil pressure:
Standard
98 kPa (1.0 kgf/cm^2, 14 psi) or more (at 600 rpm)
294 kPa (3.0 kgf/cm^2, 43 psi) or more (at 5,000 rpm)

6) After inspection, install the related parts in the reverse order of removal.

7. Fuel Pressure

A: INSPECTION

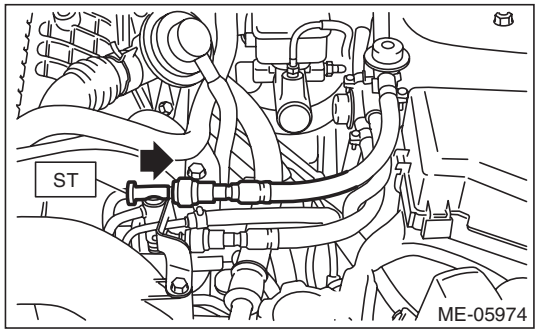
CAUTION:
• Before removing the fuel pressure gauge, release the fuel pressure.
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

1) Release the fuel pressure. <Ref. to FU(w/o STI)-65, 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 delivery pipe, and connect the fuel pressure gauge.

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

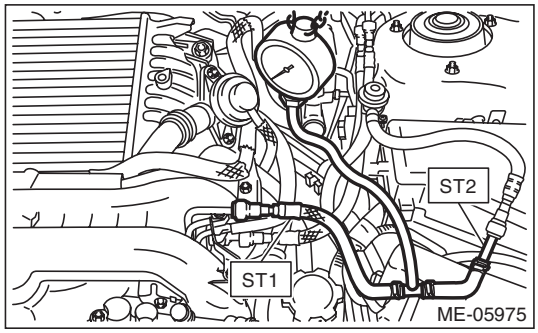
(1) Attach ST to the fuel delivery pipe and push ST in the direction of arrow mark to disconnect the quick connector of the fuel delivery hose.

ST 42099AE000 QUICK CONNECTOR RELEASE



(2) Connect the fuel pressure gauge with ST1 and ST2.

NOTE:
ST1 is a SUBARU genuine part.
ST1 42075AG690 FUEL HOSE
ST2 18471AA000 FUEL PIPE ADAPTER



4) Start the engine.
5) Check the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold.

NOTE:
• The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.
• If the fuel pressure is out of specification, check or replace the fuel pump, fuel line, pressure regulator and pressure regulator vacuum hose.

Fuel pressure:
Standard
284 — 314 kPa (2.9 — 3.2 kgf/cm^2, 41 — 46 psi)

6) After connecting the vacuum hose to the pressure regulator, check the fuel pressure again.

NOTE:
• The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm^2, 1 to 3 psi) higher than standard values during high-altitude operations.
• If the fuel pressure is out of specification, check or replace the fuel pump, fuel line, pressure regulator and pressure regulator vacuum hose.

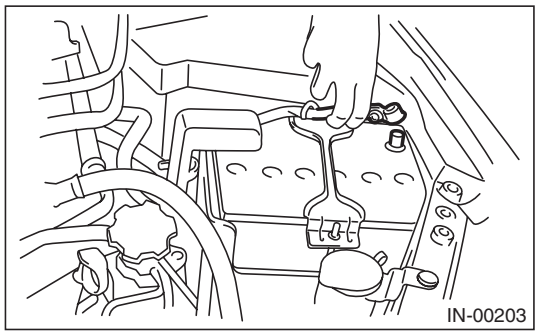
Fuel pressure:
Standard
230 — 260 kPa (2.4 — 2.7 kgf/cm^2, 33 — 38 psi)

7) After inspection, install the related parts in the reverse order of removal.

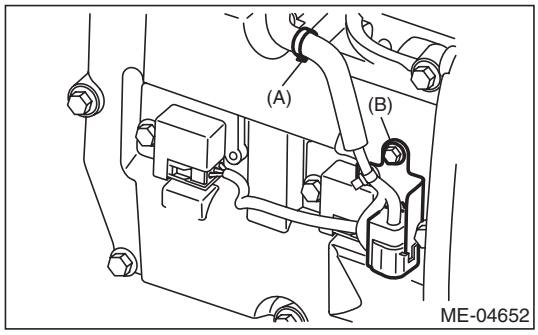
8. Valve Clearance

A: INSPECTION

1) Disconnect the ground cable from battery.

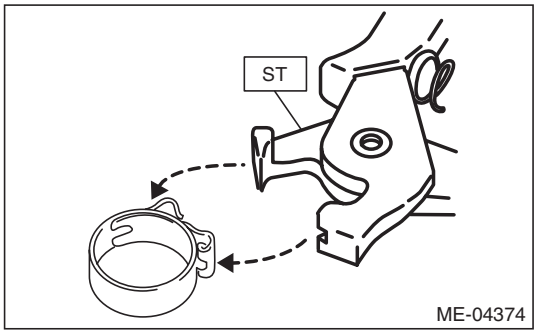


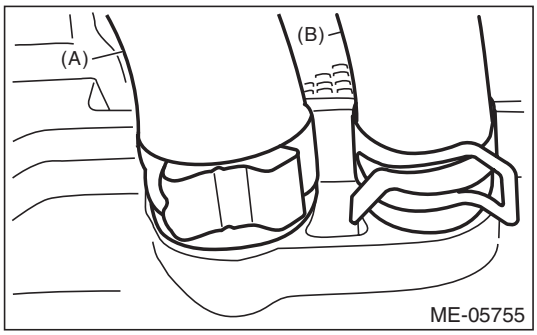
2) Remove the engine from vehicle. <Ref. to ME(w/o STI)-29, REMOVAL, Engine Assembly.>
3) Remove the timing belt cover RH. <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
4) When inspecting #1 and #3 cylinders
(1) Remove the clip (A) and the stay (B) which hold the engine harness to the rocker cover RH.



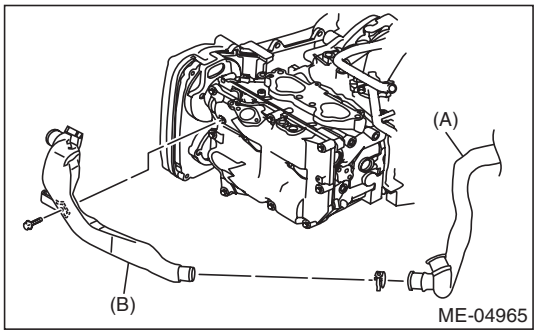
(2) Remove the ignition coil. <Ref. to IG(w/o STI)-8, REMOVAL, Ignition Coil.>
(3) Disconnect the PCV hose (A) and PCV hose assembly (B) from the rocker cover RH.

NOTE:
Pinch the clamp of the PCV hose (A) by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS





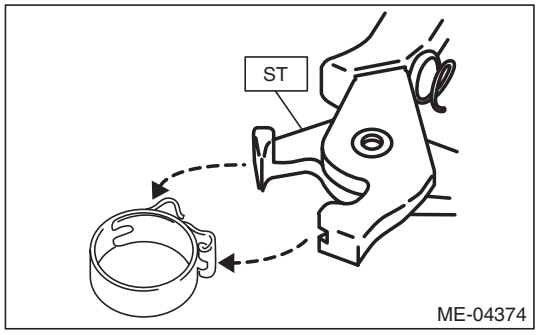
(4) Remove the rocker cover RH.
5) When inspecting #2 and #4 cylinders
(1) Remove the secondary air pump. <Ref. to EC(w/o STI)-29, REMOVAL, Secondary Air Pump.>
(2) Remove the air duct B (B) from the rocker cover LH and the air duct A (A).

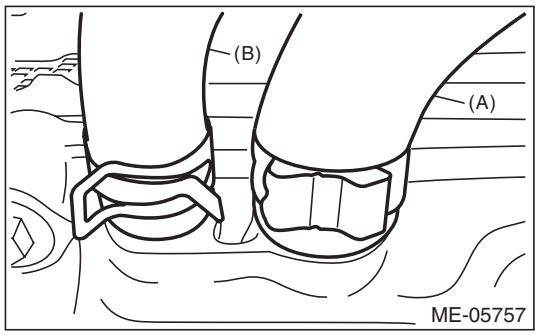


(3) Remove the ignition coil. <Ref. to IG(w/o STI)-8, REMOVAL, Ignition Coil.>

(4) Disconnect the PCV hose (A) and PCV hose assembly (B) from the rocker cover LH.

NOTE:
Pinch the clamp of the PCV hose (A) by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS



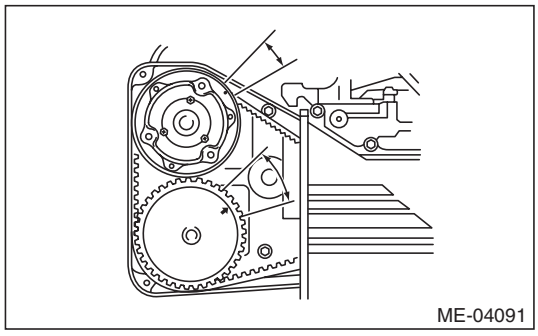


(5) Remove the rocker cover LH.

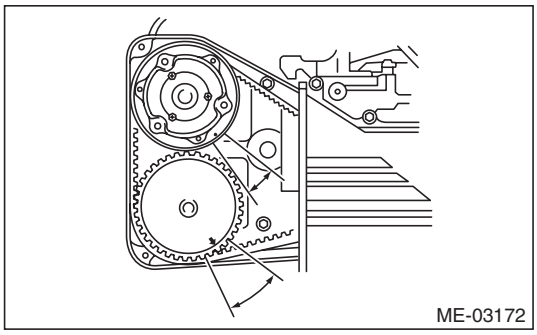
6) Turn the crank pulley clockwise until the round mark and arrow mark on the cam sprocket are set to position shown in the figure.

NOTE:
Turn the crank pulley using a socket wrench.

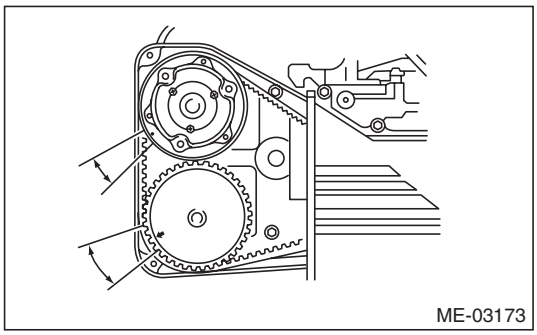
• Measurement of clearance of #1 cylinder intake valve and #3 cylinder exhaust valve



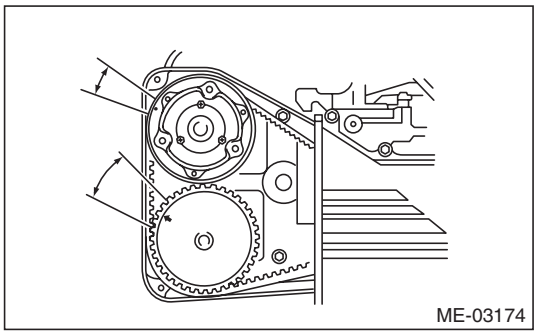
• Measurement of clearance of #2 cylinder exhaust valve and #3 cylinder intake valve



• Measurement of clearance of #2 cylinder intake valve and #4 cylinder exhaust valve



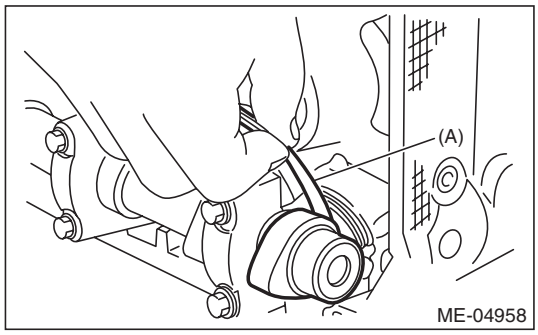
• Measurement of clearance of #1 cylinder exhaust valve and #4 cylinder intake valve



7) Measure the clearance of intake valve and exhaust valve using thickness gauge (A).

NOTE:
• Insert a thickness gauge in a direction as horizontal as possible with respect to the valve lifter.
• Lift up the vehicle, and then measure the exhaust valve clearances.
• If the measured value is not within the inspection value, take notes of the value in order to adjust the valve clearance later on.

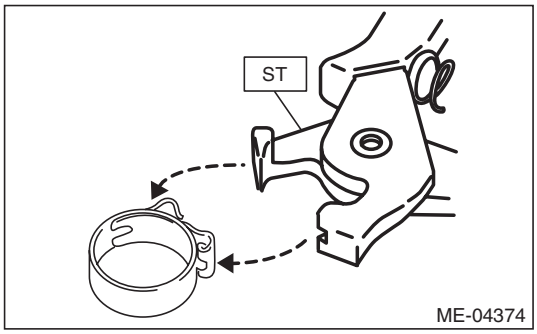
Valve clearance (inspection value):
Intake
$0.20^{+0.04}_{-0.06}$ mm ($0.0079^{+0.0016}_{-0.0024}$ in)
Exhaust
0.35±0.05 mm (0.0138±0.0020 in)

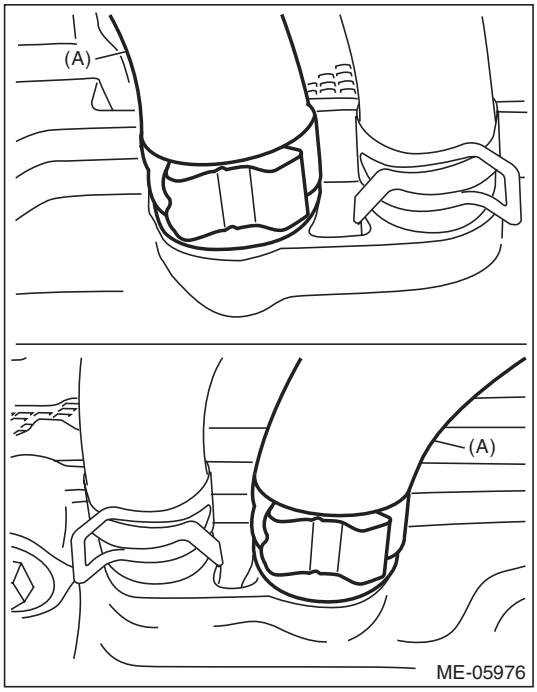


8) If necessary, adjust the valve clearance. <Ref. to ME(w/o STI)-28, ADJUSTMENT, Valve Clearance.>

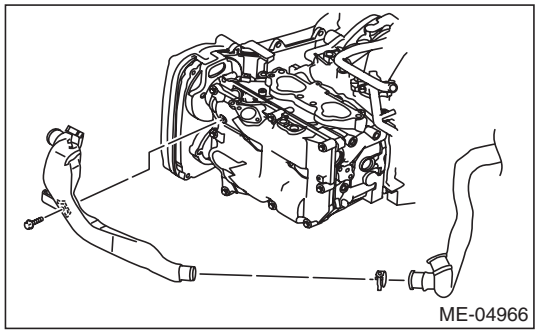
9) After inspection, install the related parts in the reverse order of removal.

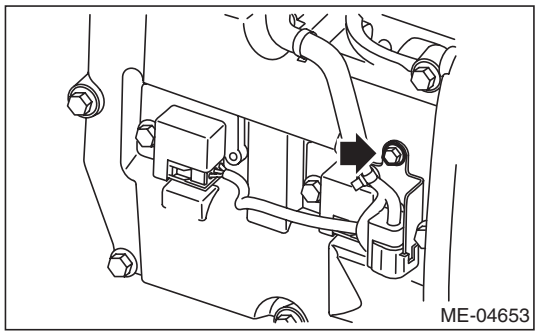
NOTE:
• Refer to “Camshaft” when installing the rocker cover. <Ref. to ME(w/o STI)-61, INSTALLATION, Camshaft.>
• Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS





Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

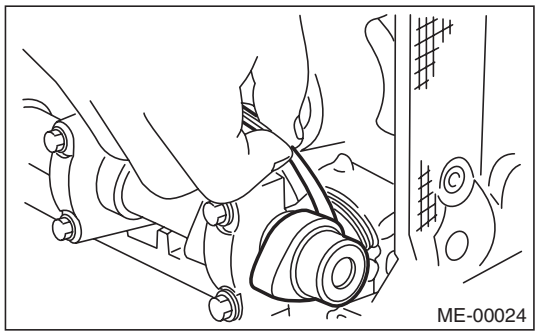

ME-04966


ME-04653

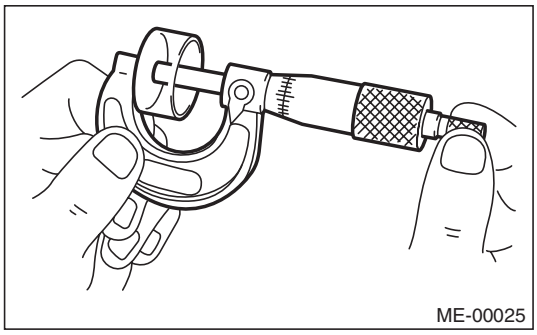
B: ADJUSTMENT

1) Measure all the valve clearances. <Ref. to ME(w/o STI)-25, INSPECTION, Valve Clearance.>

NOTE:
Record the measured value of each valve clearance.


ME-00024

2) Remove the camshaft. <Ref. to ME(w/o STI)-59, REMOVAL, Camshaft.>
3) Remove the valve lifter.
4) Measure the thickness of valve lifter using micrometer.


ME-00025

5) Select a valve lifter of suitable thickness using the measured valve clearance and valve lifter thickness, and install it.

NOTE:
Use a new valve lifter.

Unit: mm (in)
Intake valve: S = (V + T) – 0.19 (0.0075) Exhaust valve: S = (V + T) – 0.35 (0.0138)
S: Valve lifter thickness required V: Measured valve clearance T: Valve lifter thickness to be used

6) Install the camshaft. <Ref. to ME(w/o STI)-61, INSTALLATION, Camshaft.>
7) Install the cam sprocket. <Ref. to ME(w/o STI)-57, INSTALLATION, Cam Sprocket.>
8) Install the timing belt. <Ref. to ME(w/o STI)-51, TIMING BELT, INSTALLATION, Timing Belt.>
9) Measure all valves for valve clearance again at this time. If the valve clearance is not within the adjustment value, repeat the procedure over again from step 2).

Valve clearance (adjustment value):
Intake
$0.20^{+0.01}_{-0.03}$ mm ($0.0079^{+0.0004}_{-0.0012}$ in)
Exhaust
0.35 ± 0.02 mm (0.0138 ± 0.0008 in)

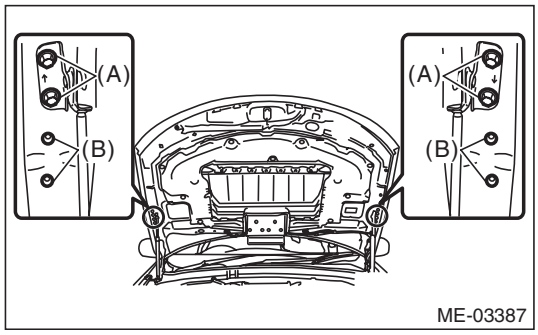
10) After adjustment, install the related parts in the reverse order of removal.

9. Engine Assembly

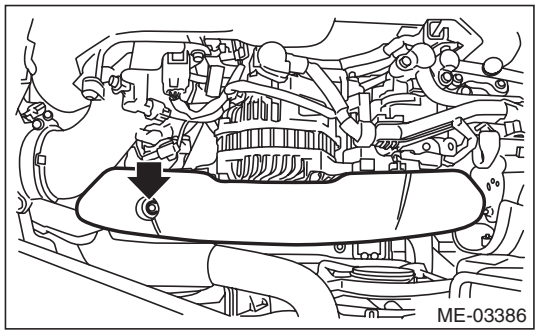
A: REMOVAL

1) Change the bolt installation position from (A) to (B), then open the front hood completely.

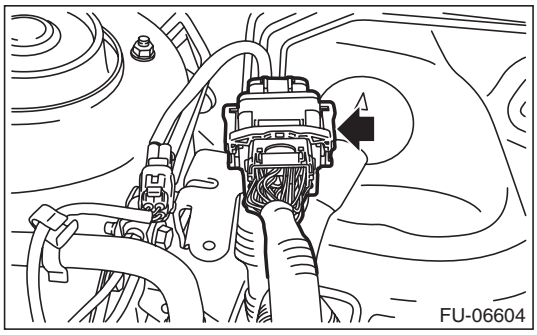
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



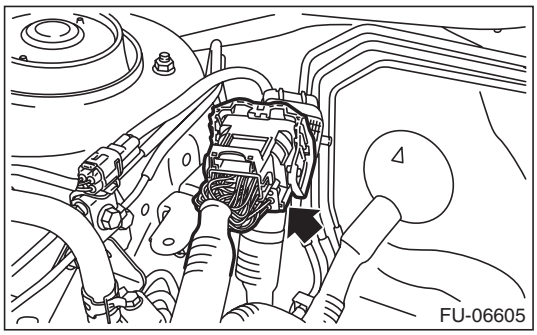
2) Remove the V-belt covers.



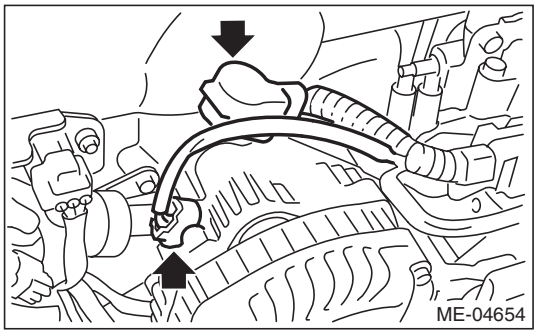
3) Collect the refrigerant from A/C system. <Ref. to AC-19, Refrigerant Recovery Procedure.>
4) Release the fuel pressure. <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
5) Remove the battery. <Ref. to SC(STI)-27, REMOVAL, Battery.>
6) Open the fuel filler lid and remove the fuel filler cap.
7) Remove the air intake duct and air cleaner case. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.> <Ref. to IN(w/o STI)-8, REMOVAL, Air Cleaner Case.>
8) Remove the intercooler. <Ref. to IN(w/o STI)-12, REMOVAL, Intercooler.>
9) Remove the radiator. <Ref. to CO(w/o STI)-19, REMOVAL, Radiator.>
10) Remove the coolant filler tank. <Ref. to CO(w/o STI)-28, REMOVAL, Coolant Filler Tank.>
11) Disconnect the bulkhead harness connectors from the engine harness connectors.



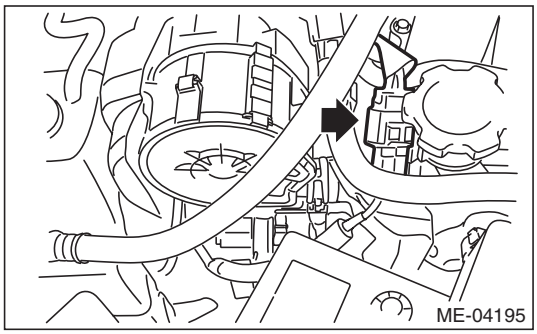
12) Remove the engine harness connector from the engine harness bracket.



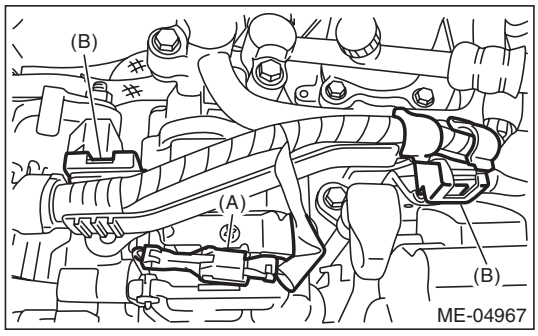
13) Disconnect the following connectors and terminals.
(1) Generator connector and terminal



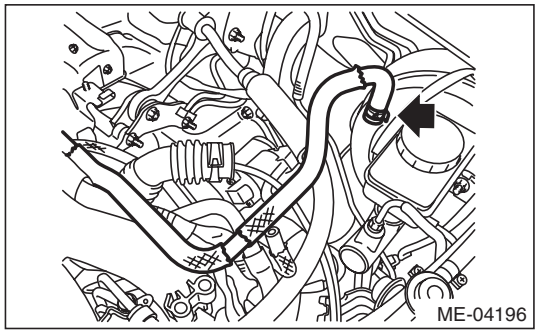
(2) Secondary air pump connector



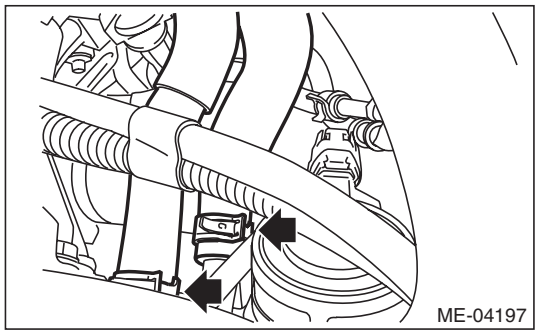
14) Disconnect the connector (A) from the A/C compressor, and remove the clip (B) securing the generator cord.



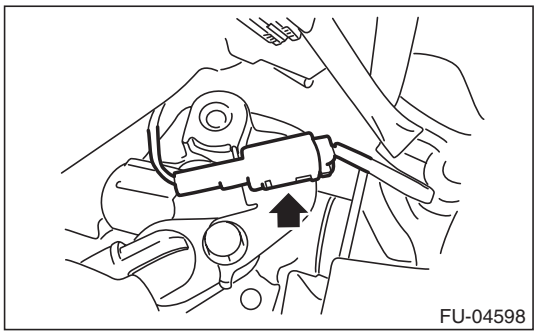
15) Disconnect the following hoses.
(1) A/C pressure hose <Ref. to AC-38, REMOVAL, Hose and Pipe.>
(2) Brake booster vacuum hose



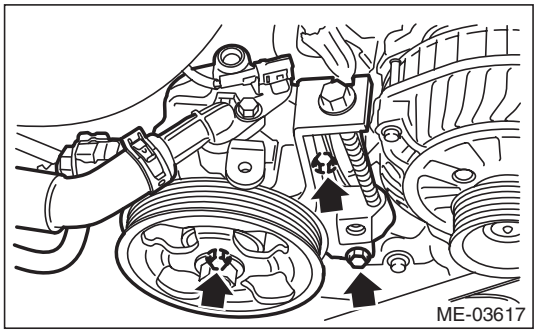
(3) Heater inlet hose and heater outlet hose



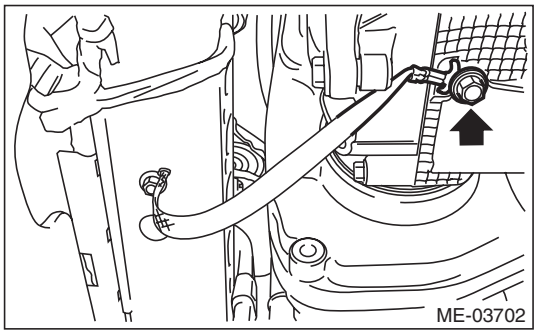
16) Remove the power steering pump.
(1) Remove the front side belts. <Ref. to ME(w/o STI)-38, FRONT SIDE BELT, REMOVAL, V-belt.>
(2) Disconnect the connector from power steering pump switch.



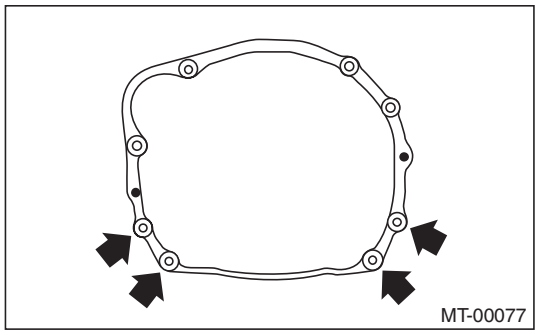
(3) Remove the power steering pump from the engine.



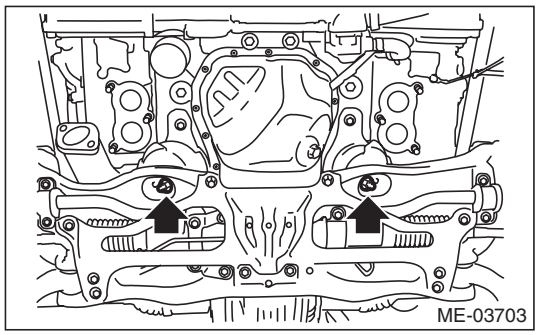
(4) Place the power steering pump on the right side wheel apron.
17) Remove the center exhaust pipe. <Ref. to EX(STI)-8, REMOVAL, Center Exhaust Pipe.>
18) Remove the turbocharger. <Ref. to IN(w/o STI)-14, REMOVAL, Turbocharger.>
19) Remove the joint pipe and front exhaust pipe. <Ref. to EX(STI)-12, REMOVAL, Joint Pipe.> <Ref. to EX(STI)-6, REMOVAL, Front Exhaust Pipe.>
20) Disconnect the ground cable on the engine side.



21) Remove the bolts and nuts which hold the lower side of transmission to the engine.

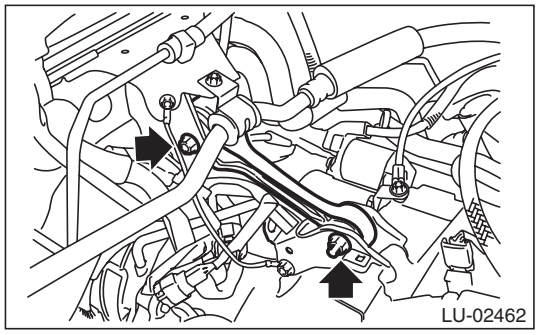


22) Remove the nuts which secure the engine mounting to the front crossmember.



23) Lower the vehicle.

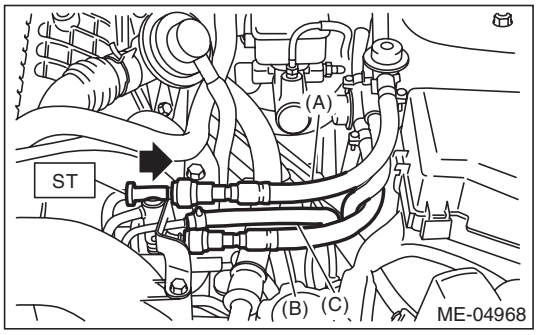
24) Remove the pitching stopper.



25) 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.



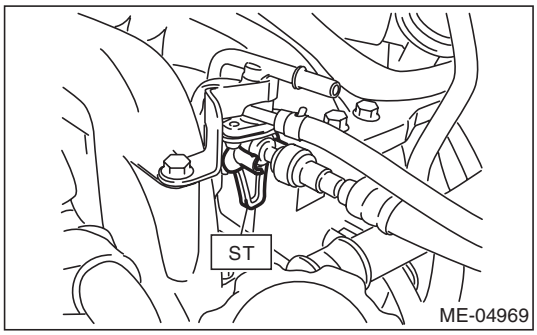
(A) Fuel delivery hose
(B) Fuel return hose
(C) Evaporation hose

26) Disconnect the fuel return hose using the ST.

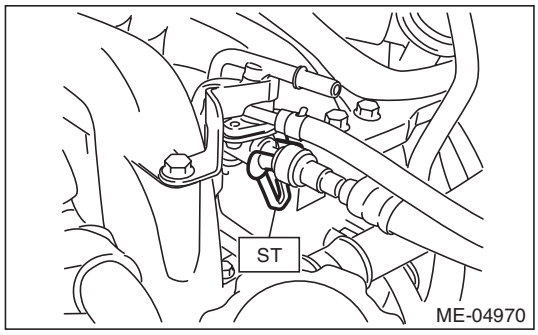
ST 18371AA000 CONNECTOR REMOVER

CAUTION:
• Be careful not to spill fuel.
• Catch the fuel from hoses using a container or cloth.

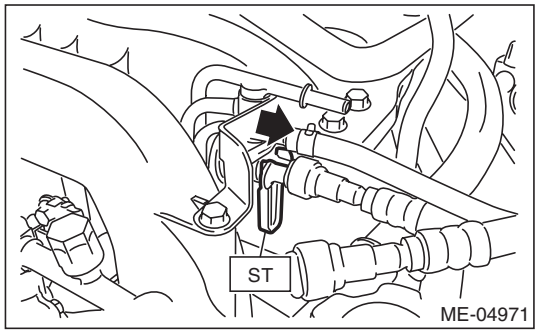
(1) Attach ST to the fuel return pipe as shown in the figure.



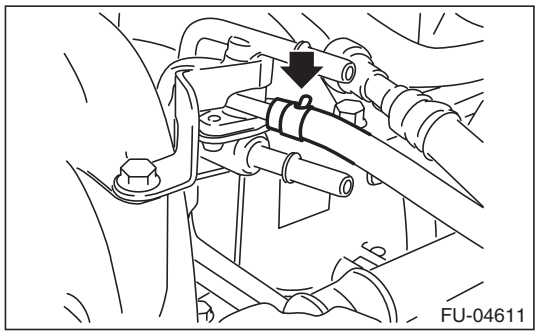
(2) Insert the front side of ST into the quick connector.



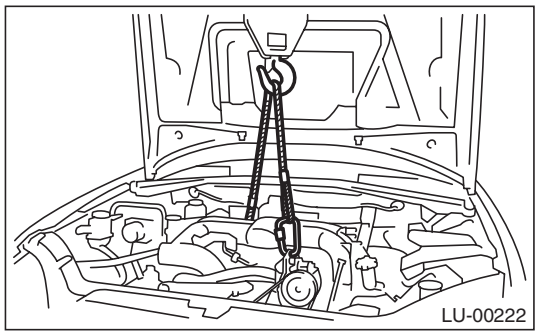
(3) Insert the back side of ST into the quick connector and push ST in the direction of arrow mark to disconnect the fuel return hose.



27) Remove the clip and disconnect the evaporation hose from the fuel pipe.

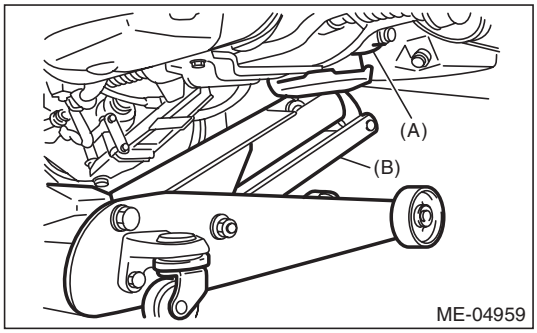


28) Support the engine with a lifting device and wire ropes.



29) Support the transmission with a garage jack.

CAUTION:
Be sure to perform this procedure to prevent the transmission from lowering by its own weight.

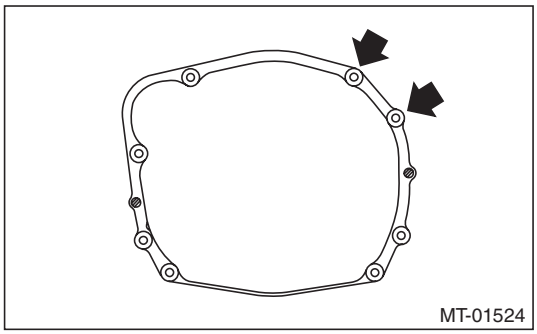


(A) Transmission
(B) Garage jack

30) 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(STI)-8, REMOVAL, Starter.>
(2) Remove the bolts which hold the upper side of the transmission to the engine.



31) Remove the engine from the vehicle.

NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

(1) Slightly raise the engine.
(2) Raise the transmission with garage jack.
(3) Move the engine horizontally until main shaft is withdrawn from clutch cover.
(4) Slowly move the engine away from engine compartment.

32) 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.

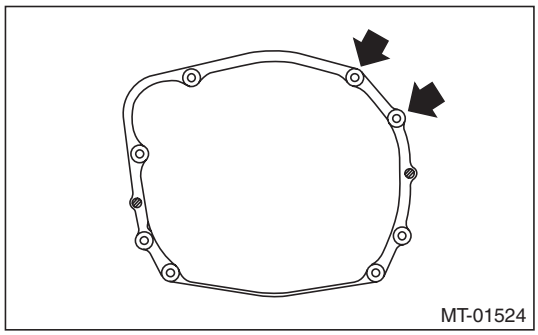
Grease:
NICHIMOLY N-130 or equivalent

3) Position the engine in engine compartment and align it with transmission.

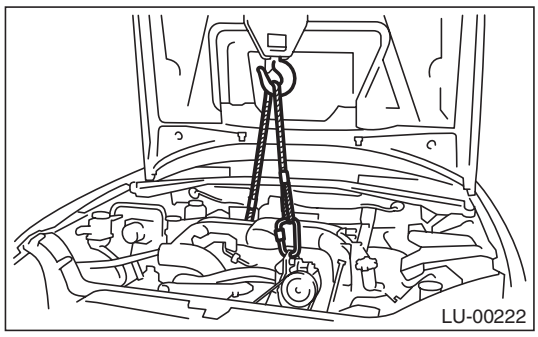
NOTE:
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

4) Install the bolts which hold upper side of transmission to engine.

Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



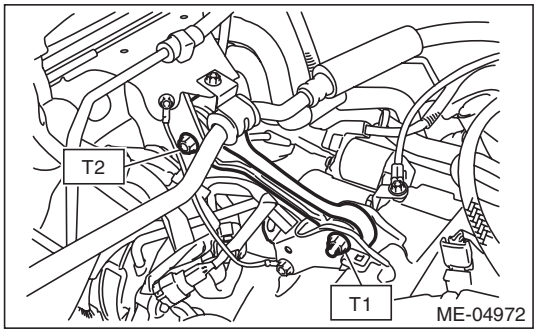
5) Remove the lifting device and wire ropes.



6) Remove the garage jack.

7) Install the pitching stopper.

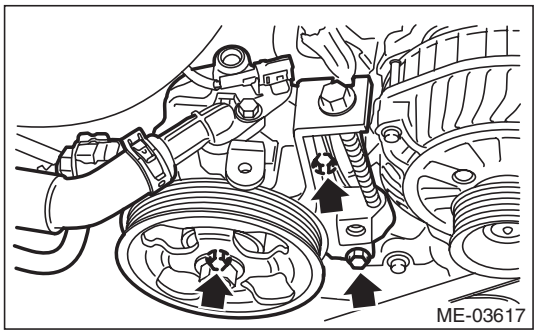
Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



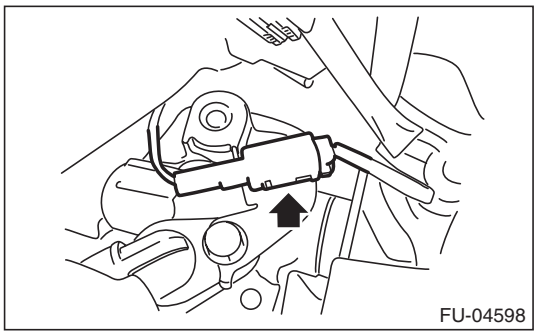
8) Install the starter. <Ref. to SC(STI)-8, INSTALLATION, Starter.>

9) Install the power steering pump.
(1) Install the power steering pump onto the engine.

Tightening torque:
Refer to "COMPONENT" of "Power Steering" for the tightening torque. <Ref. to PS-4, COMPONENT, General Description.>



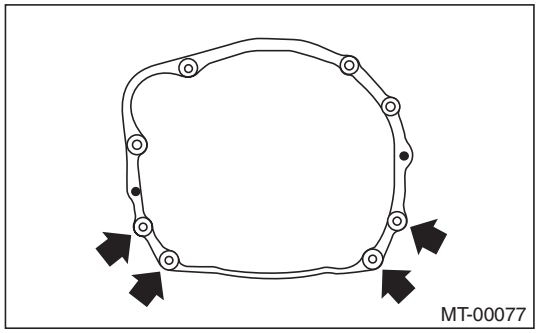
(2) Connect the connector to the power steering pump switch.



(3) Install the front side belt. <Ref. to ME(w/o STI)-38, FRONT SIDE BELT, INSTALLATION, V-belt.>

10) Lift up the vehicle.
11) Install the bolts and nuts which hold lower side of the transmission to engine.

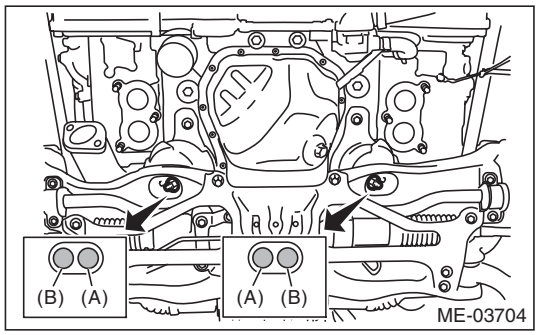
Tightening torque:
50 N·m (5.1 kgf-m, 36.9 ft-lb)



12) Install the nuts which hold the engine mounting to the crossmember.

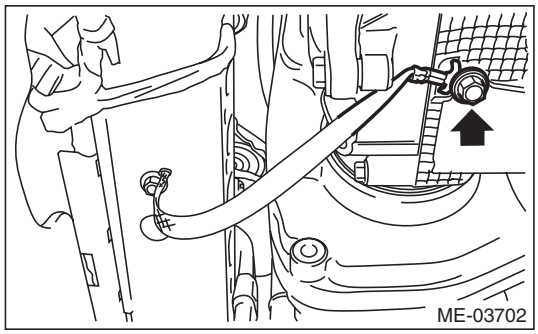
NOTE:
Make sure that the engine mounting nuts (A) and locator (B) are securely installed.

Tightening torque:
45 N·m (4.6 kgf-m, 33.2 ft-lb)

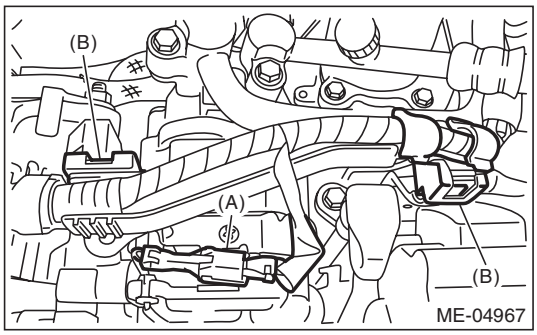


13) Connect the ground cable.

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

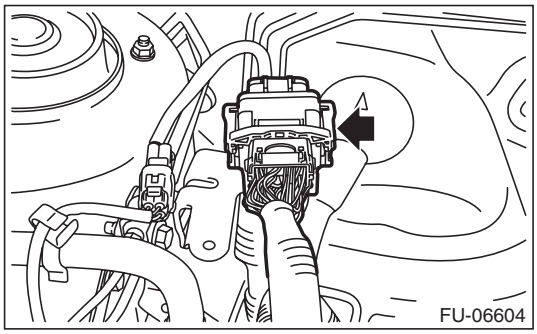


14) Install the joint pipe and front exhaust pipe. <Ref. to EX(STI)-6, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(STI)-12, INSTALLATION, Joint Pipe.>
15) Install the turbocharger. <Ref. to IN(w/o STI)-15, INSTALLATION, Turbocharger.>
16) Install the center exhaust pipe. <Ref. to EX(STI)-9, INSTALLATION, Center Exhaust Pipe.>
17) Connect the following hoses.
(1) Fuel delivery hose, fuel return hose and evaporation hose
(2) Heater inlet hose and heater outlet hose
(3) Brake booster vacuum hose
(4) A/C pressure hose <Ref. to AC-38, INSTALLATION, Hose and Pipe.>
18) Secure the generator cord using the clip (B) and connect the connector (A) to A/C compressor.



19) Connect the following connectors and terminals.
(1) Generator connector and terminal

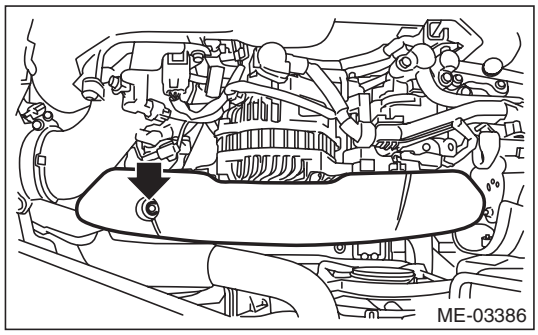
Tightening torque:
15 N·m (1.5 kgf-m, 11.1 ft-lb)
(2) Secondary air pump connector
20) Install the engine harness connector to engine harness bracket, then connect the bulkhead harness connector to the engine harness connector.



21) Install the intercooler. <Ref. to IN(w/o STI)-12, INSTALLATION, Intercooler.>
22) Install the radiator. <Ref. to CO(w/o STI)-20, INSTALLATION, Radiator.>
23) Install the coolant filler tank. <Ref. to CO(w/o STI)-28, INSTALLATION, Coolant Filler Tank.>
24) Install the air cleaner case and air intake duct. <Ref. to IN(w/o STI)-8, INSTALLATION, Air Cleaner Case.> <Ref. to IN(w/o STI)-10, INSTALLATION, Air Intake Duct.>
25) Install the battery. <Ref. to SC(STI)-27, INSTALLATION, Battery.>

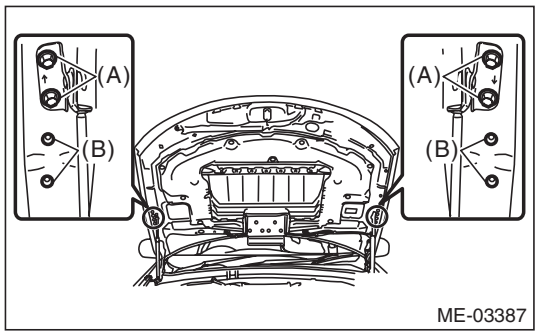
26) Fill engine coolant. <Ref. to CO(w/o STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
27) Charge the A/C system with refrigerant. <Ref. to AC-20, PROCEDURE, Refrigerant Charging Procedure.>
28) Install the V-belt cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



29) 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) 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 from the vehicle. <Ref. to ME(w/o STI)-29, REMOVAL, Engine Assembly.>
2) Remove the engine mounting from the engine.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
35 N·m (3.6 kgf-m, 25.8 ft-lb)

C: INSPECTION

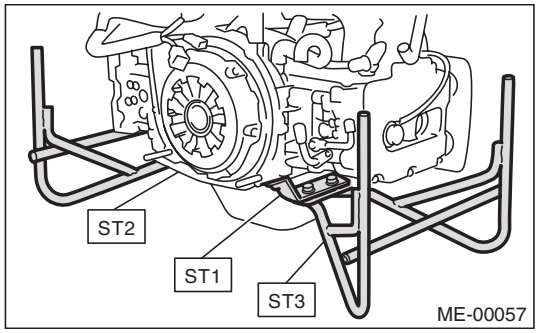
Make sure that there are no cracks or other damages.

11.Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from vehicle body, attach the ST to the engine as shown in the figure.

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.

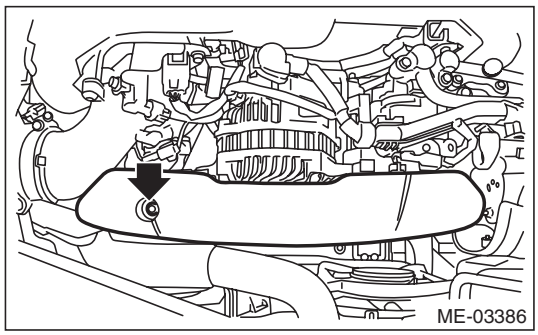
12.V-belt

A: REMOVAL

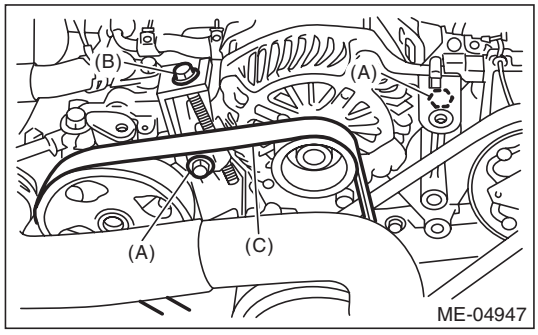
NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.

1. FRONT SIDE BELT

1) Remove the V-belt covers.

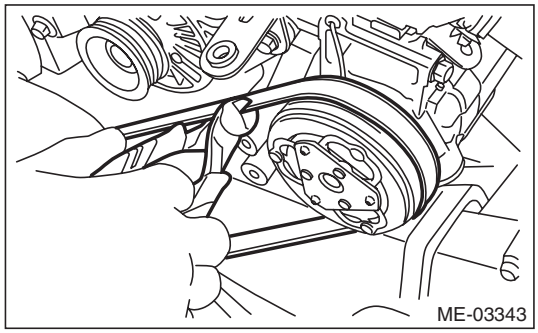


2) Remove the air intake duct. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.>
3) Loosen the bolt (A).
4) Loosen the slider bolt (B).
5) Remove the front side belt (C).



2. REAR SIDE BELT

1) Remove the front side belts. <Ref. to ME(w/o STI)-38, FRONT SIDE BELT, REMOVAL, V-belt.>
2) Cut the rear side belt with a wire cutter, etc., and discard.



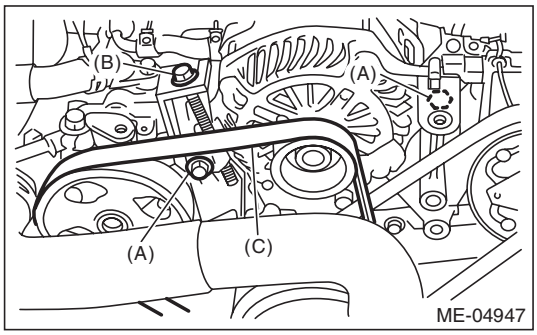
B: INSTALLATION

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.

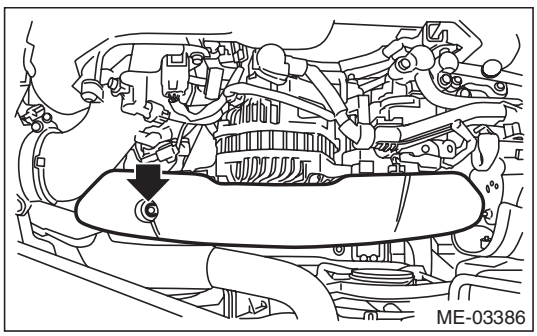
1) Wipe off any dust, oil and water on the groove of each pulley with cloth.
2) Install the front side belt (C), and adjust the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(w/o STI)-44, INSPECTION, V-belt.>
3) Tighten the bolt (A).
4) Tighten the slider bolt (B).

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)



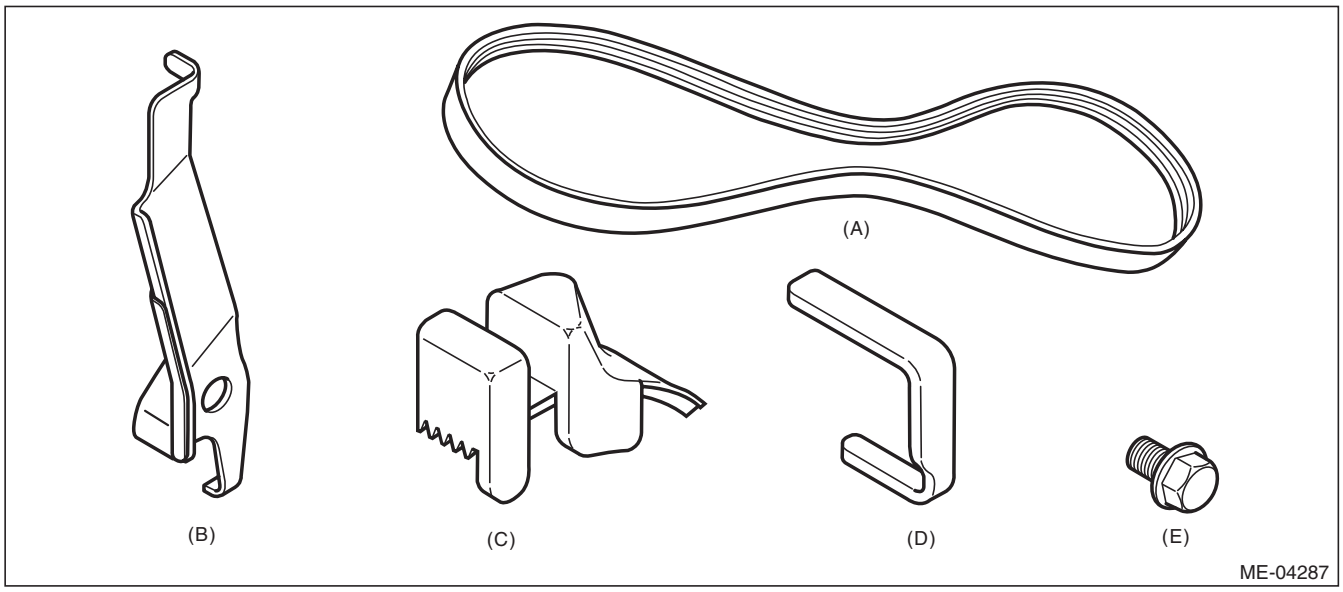
5) Install the air intake duct. <Ref. to IN(w/o STI)-10, INSTALLATION, Air Intake Duct.>
6) Install the V-belt cover.

Tightening torque:
13 N·m (1.3 kgf-m, 9.6 ft-lb)



2. REAR SIDE BELT

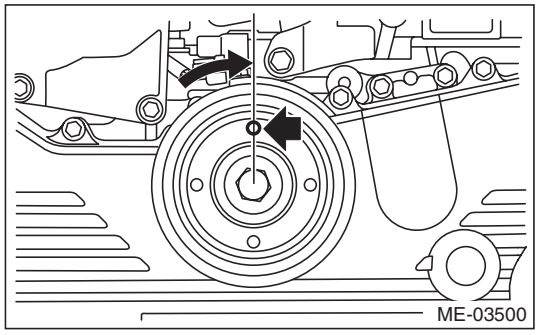
CAUTION:
- **Do not re-use the rear side belt.**
- **Be careful not to let oil, grease or coolant contact a new rear side belt.**
- **Be careful not to rub the belt end surface with bare hands; exposed core may cause injury.**
- **To install the rear side belt, always use the provided tools (belt stopper, belt guide, belt guide holder, and bolt).**



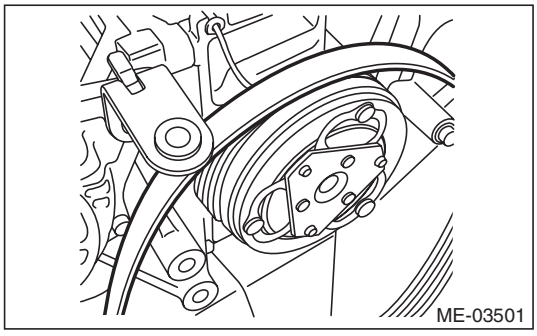
(A) Rear side belt
(B) Belt stopper
(C) Belt guide
(D) Belt guide holder
(E) Bolt

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.

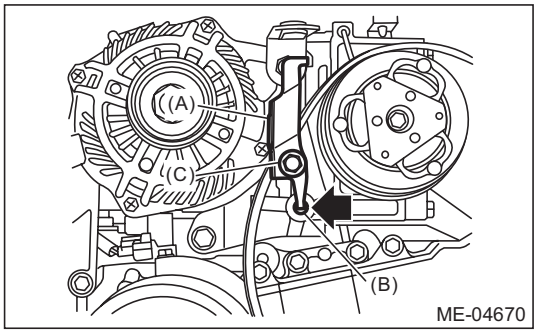
CAUTION:
Do not turn the crank pulley counterclockwise.



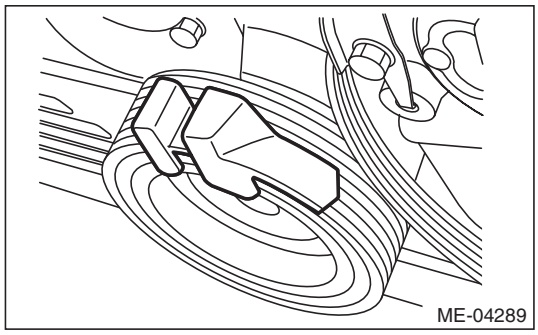
4) Hook a new rear side belt on the A/C compressor pulley.



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).

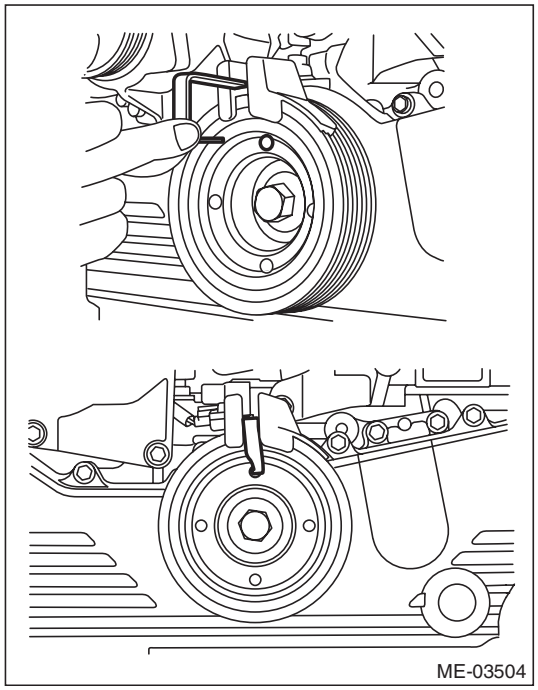


6) Place the belt guide while aligning it with the belt line of the crank pulley on the front side belt side.

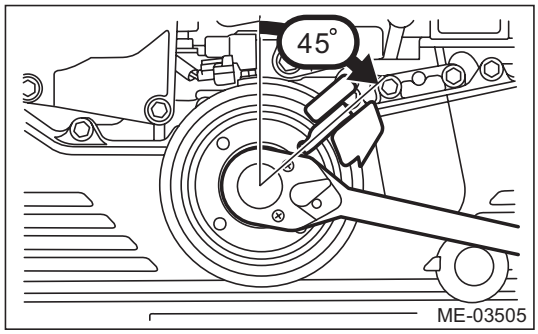


7) Insert the belt guide holder into the service hole of the crank pulley so that the belt guide comes in between.

NOTE:
Place the belt guide holder with the longer side up.

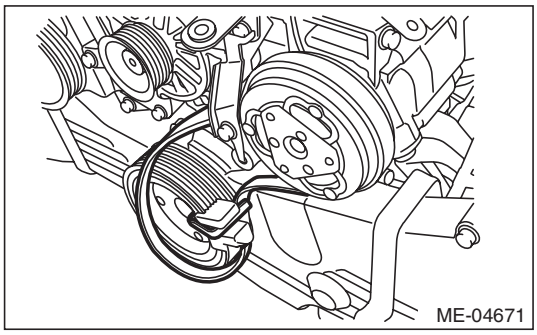


8) Slowly turn the crank pulley clockwise until the belt guide comes to approximately 45°.

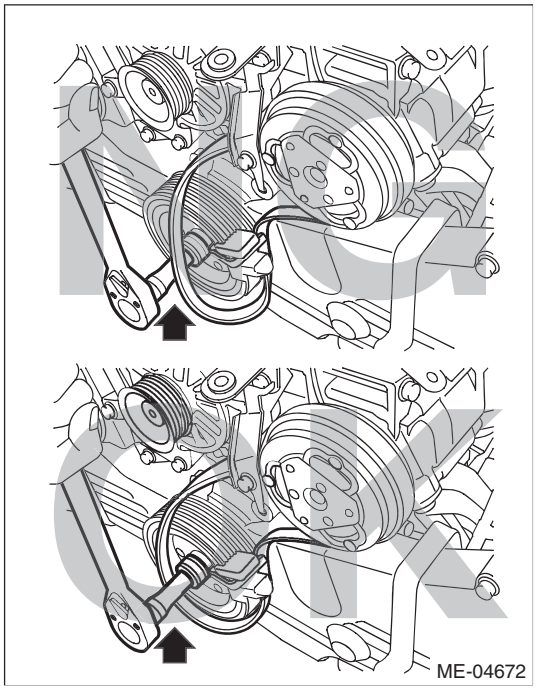


9) Place the rib surface of the rear side belt into the crank pulley groove, so that the rear side belt comes in between the belt guide holder.

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.

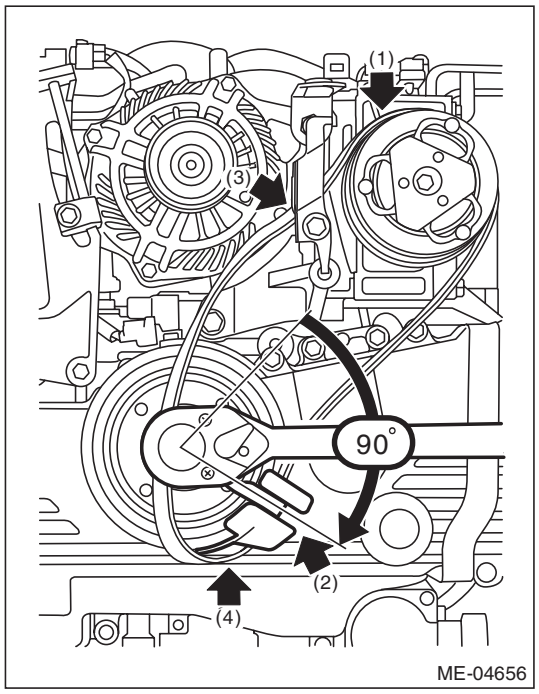


10) Place the tool through the loop of the rear side belt, and set on the crank pulley bolt.

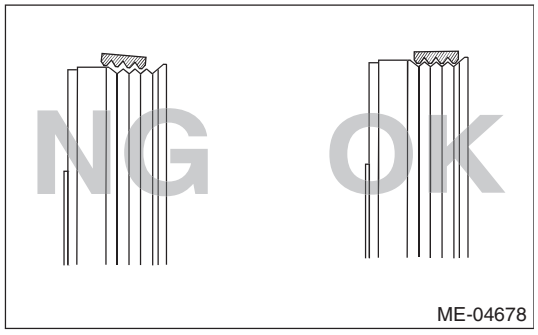


11) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.

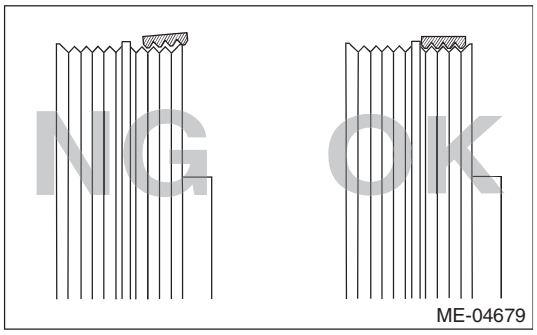
CAUTION:
When turning the crank pulley, always make sure that the belt guide is not off from the crank pulley groove.



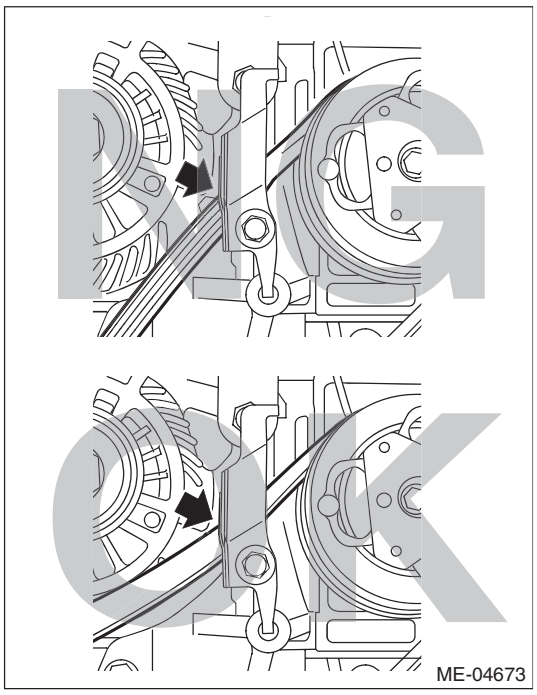
(1) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



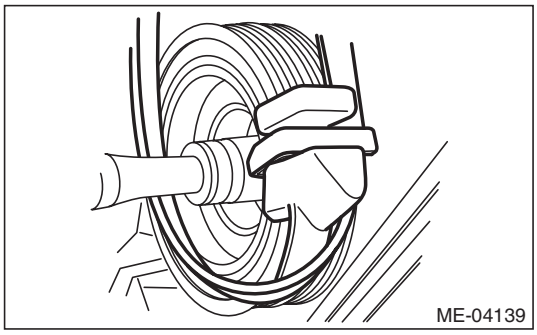
(2) The rib of the rear side belt is securely placed on the groove of the crank pulley.



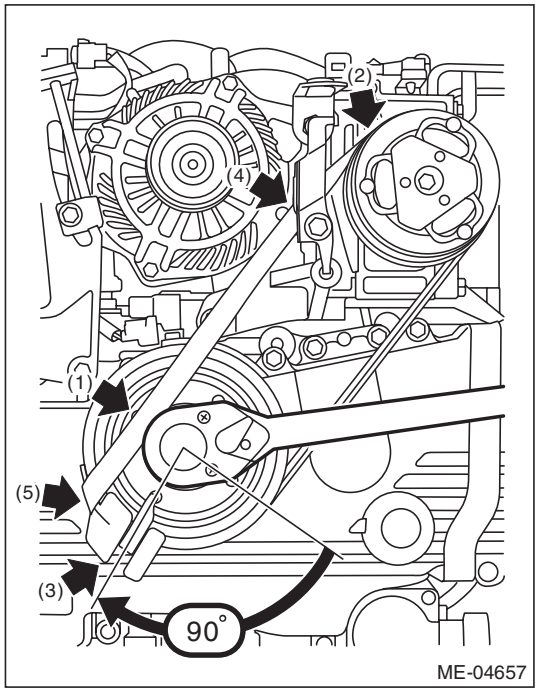
(3) The surface of the rear side belt is held by the belt stopper.



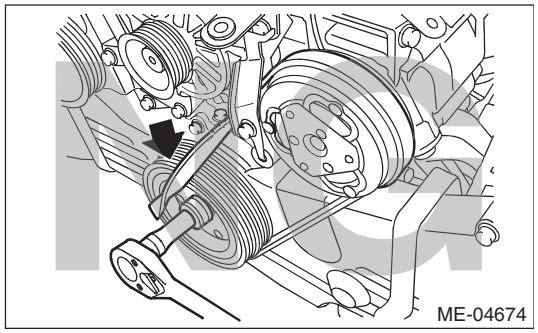
(4) The rear side belt is securely placed on the belt guide.



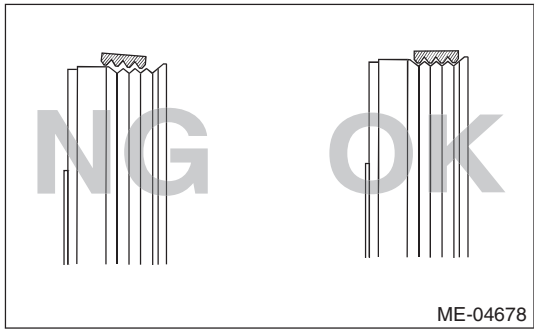
12) While checking the following, slowly turn the crank pulley approximately 90° clockwise so that the belt guide comes to the position shown in the figure.



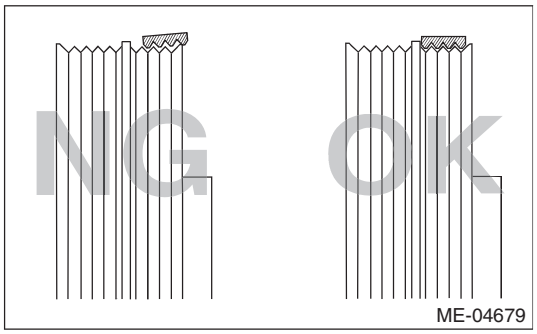
(1) The rear side belt is not twisted.



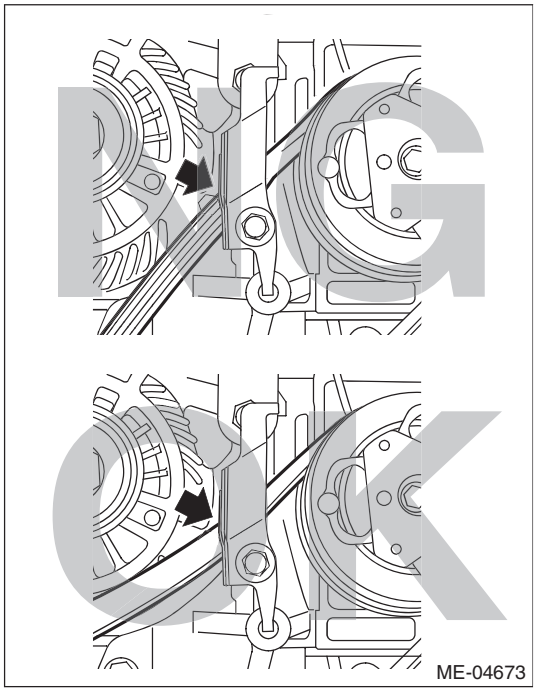
(2) The rib of the rear side belt is securely placed on the groove of the A/C compressor pulley.



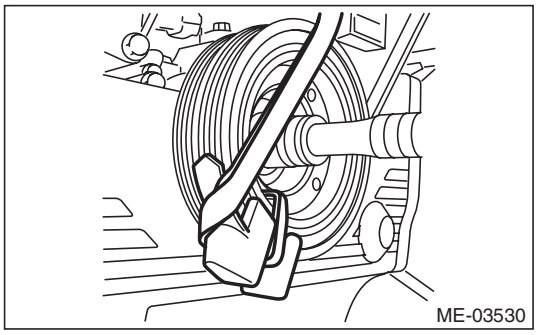
(3) The rib of the rear side belt is securely placed on the groove of the crank pulley.



(4) The surface of the rear side belt is held by the belt stopper.

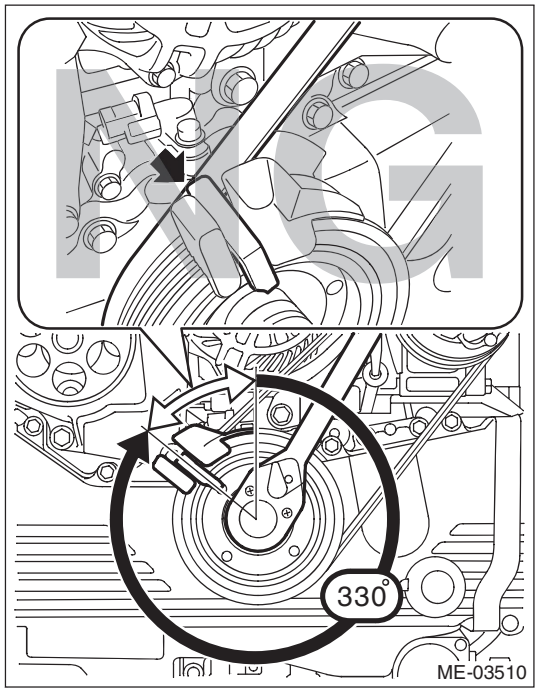


(5) The rear side belt is securely placed on the belt guide.

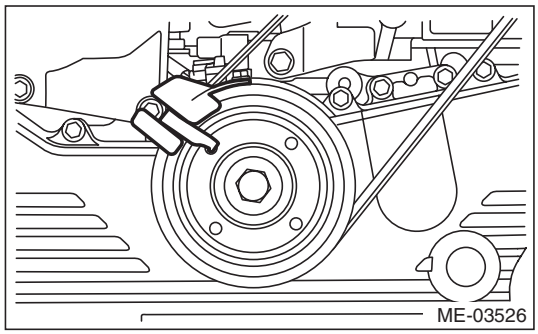


13) Slowly turn the crank pulley clockwise, and install the rear side belt.

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.

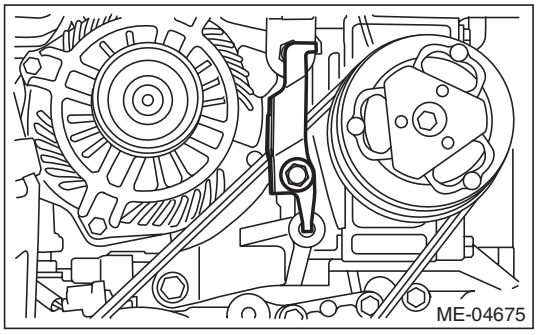


14) Remove the belt guide and belt guide holder from the crank pulley.

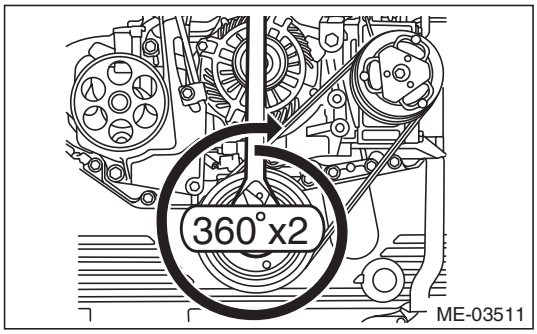


15) Remove the belt stopper from the compressor bracket.

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.



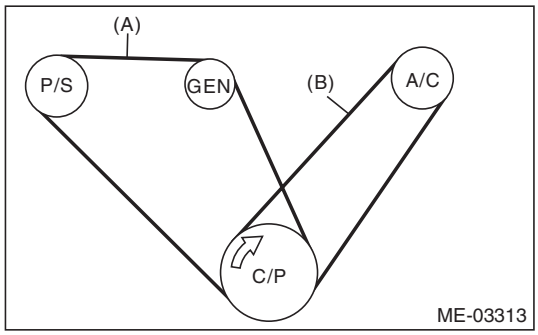
17) Discard the provided tools (belt stopper, belt guide, belt guide holder, and bolt) that are used.
18) Install the front side belt. <Ref. to ME(w/o STI)-38, FRONT SIDE BELT, INSTALLATION, V-belt.>

C: INSPECTION

1. FRONT SIDE BELT

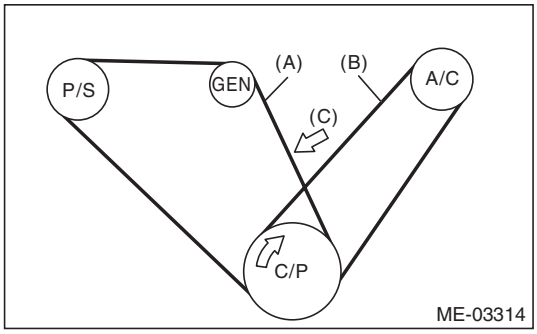
CAUTION:
Check and adjust the front side belt tension so that it is within the specified range. Using the belt with a tension out of the specified range may result in a fault such as the following:
• If the front side belt tension is higher, unexpected force is generated at the power steering oil pump, 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

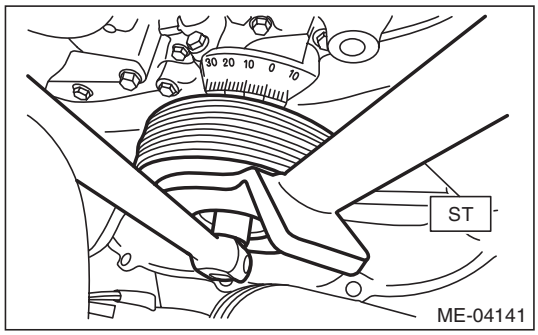
Replace the rear side belt, if crack, fraying or wear is found, or noise is emitted.

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:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the V-belts. <Ref. to ME(w/o STI)-38, REMOVAL, V-belt.>
2) Use the ST to lock the crank pulley, and remove the crank pulley bolt.
ST 499977100 CRANK PULLEY WRENCH



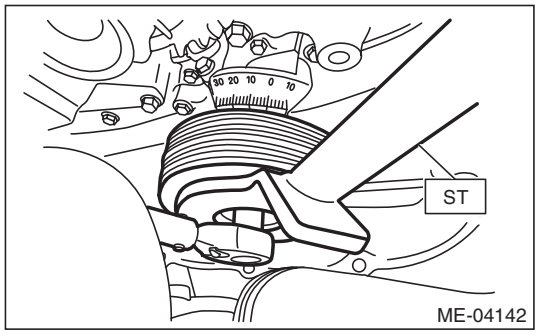
3) Remove the crank pulley.

B: INSTALLATION

1. METHOD WITHOUT ANGLE GAUGE

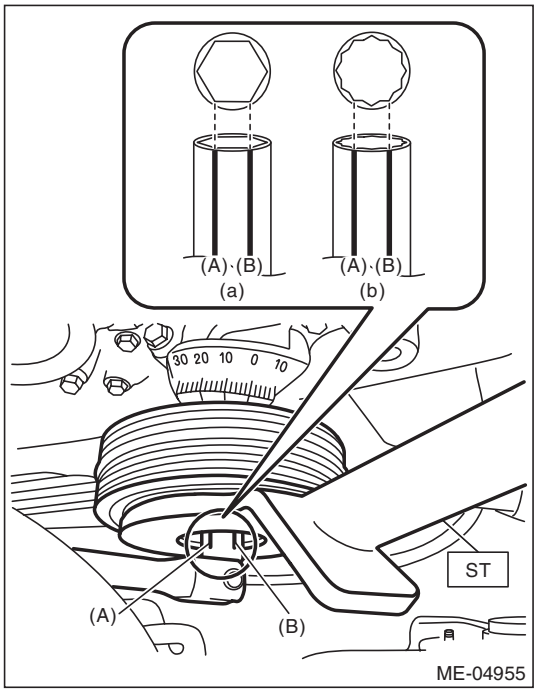
1) Clean the crankshaft thread using compressed air.
2) Install the crank pulley.
3) Apply engine oil to the crank pulley bolt seat and thread.
4) Tighten the crank pulley bolts.
(1) Use the ST to lock the crank pulley, and temporarily tighten the crank pulley bolt.
ST 499977100 CRANK PULLEY WRENCH

Tightening torque:
47 N·m (4.8 kgf-m, 34.7 ft-lb)



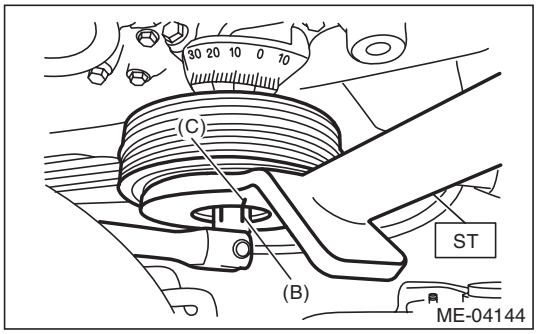
(2) Draw reference lines (A) and (B) using a marker to set the socket to the crank pulley bolt as shown in the figure.

NOTE:
Set the socket onto the crank pulley bolt so that reference lines (A) and (B) is visible.
ST 499977100 CRANK PULLEY WRENCH



(a) When using 6-point socket
(b) When using 12-point socket

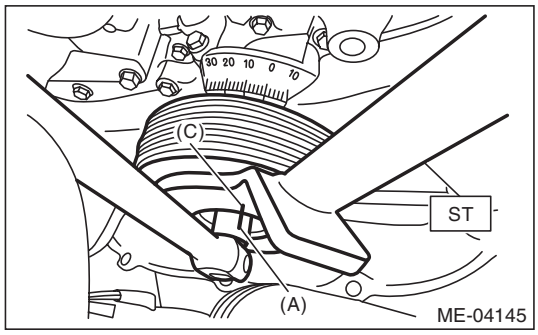
(3) Draw end line (C) on ST using a marker at the same position as reference line (B) drawn on the socket in step (2).
ST 499977100 CRANK PULLEY WRENCH



(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.

NOTE:
It should be approx. 60° when reference line (A) and end line (C) are aligned.
ST 499977100 CRANK PULLEY WRENCH

Tightening angle:
60°±5°

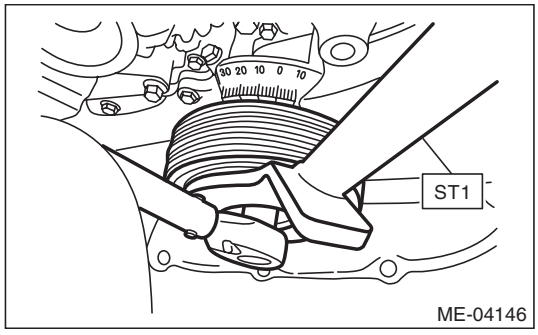


5) Install the V-belts. <Ref. to ME(w/o STI)-38, INSTALLATION, V-belt.>

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 fan motor assembly. <Ref. to CO(w/o STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(w/o STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.>
(2) Use the ST1 to lock the crank pulley, and temporarily tighten the crank pulley bolt.
ST1 499977100 CRANK PULLEY WRENCH

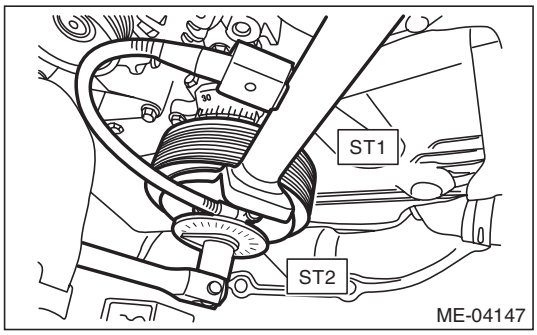
Tightening torque:
47 N·m (4.8 kgf-m, 34.7 ft-lb)



(3) Set the ST2, use the ST1 to lock the crank pulley, and tighten the crank pulley bolt to the specified angle.

NOTE:
Attach the magnet used for securing the ST2 (ANGLE GAUGE) to ST1.
ST1 499977100 CRANK PULLEY WRENCH
ST2 18854AA000 ANGLE GAUGE

Tightening angle:
60°±5°



(4) Install the radiator main fan motor assembly and radiator sub fan motor assembly. <Ref. to CO(w/o STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.> <Ref. to CO(w/o STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>

5) Install the V-belts. <Ref. to ME(w/o STI)-38, INSTALLATION, V-belt.>

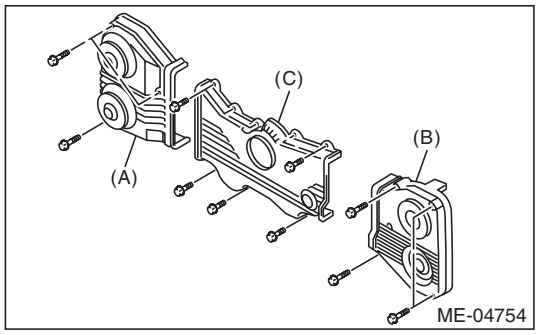
C: INSPECTION

1) Check that the crank pulley has no deformation, cracks or other damages.

14.Timing Belt Cover

A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the secondary air pump. <Ref. to EC(w/o STI)-29, REMOVAL, Secondary Air Pump.>
2) Remove the crank pulley. <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
3) Remove the timing belt cover RH (A).
4) Remove the timing belt cover LH (B).
5) Remove the front timing belt cover (C).



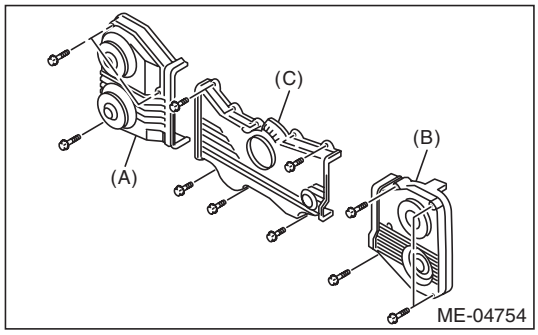
B: INSTALLATION

1) Install the front timing belt cover (C).

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)
2) Install the timing belt cover LH (B).

Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)
3) Install the timing belt cover RH (A).

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



4) Install the crank pulley. <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>
5) Install the secondary air pump. <Ref. to EC(w/o STI)-29, INSTALLATION, Secondary Air Pump.>

C: INSPECTION

Check the timing belt cover for damage.

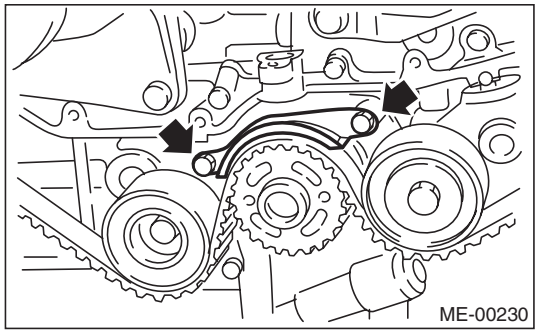
15.Timing Belt

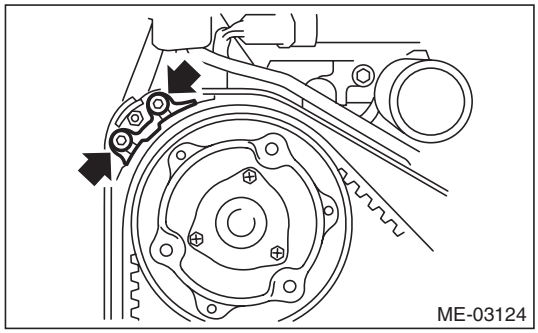
A: REMOVAL

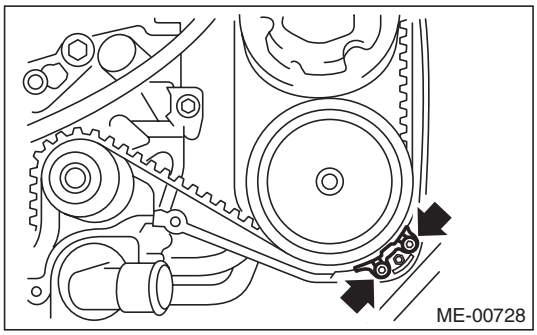
NOTE:
• When replacing a single part, perform the work with the engine assembly installed to body.
• When performing the work with the engine installed to body, the following parts must also be removed/installed.
  • Radiator main fan motor assembly <Ref. to CO(w/o STI)-23, REMOVAL, Radiator Main Fan and Fan Motor.> <Ref. to CO(w/o STI)-23, INSTALLATION, Radiator Main Fan and Fan Motor.>
  • Radiator sub fan motor assembly <Ref. to CO(w/o STI)-25, REMOVAL, Radiator Sub Fan and Fan Motor.> <Ref. to CO(w/o STI)-25, INSTALLATION, Radiator Sub Fan and Fan Motor.>
• When performing the work with the engine installed to body, protect the radiator with cardboards or blankets.

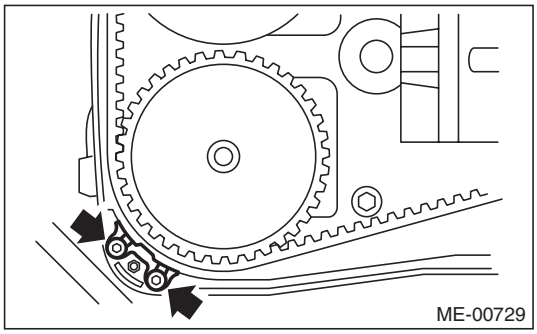
1. TIMING BELT

1) Remove the crank pulley. <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt guide.


ME-00230

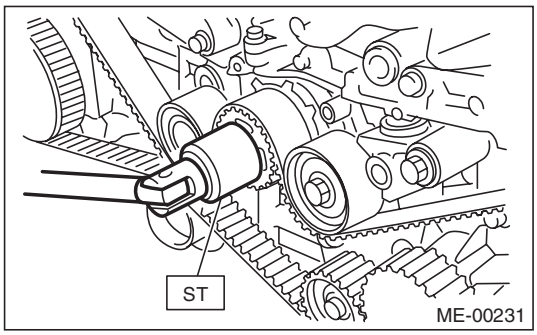

ME-03124


ME-00728


ME-00729

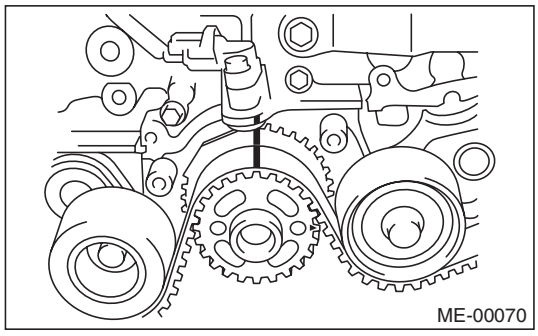
4) If the alignment mark or arrow mark (which indicates the direction of rotation) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.
  (1) Turn the crankshaft using ST, and align the alignment marks on crank sprocket, intake cam sprocket LH, exhaust cam sprocket LH, intake cam sprocket RH and exhaust cam sprocket RH with marks on oil pump and notches of timing belt cover.

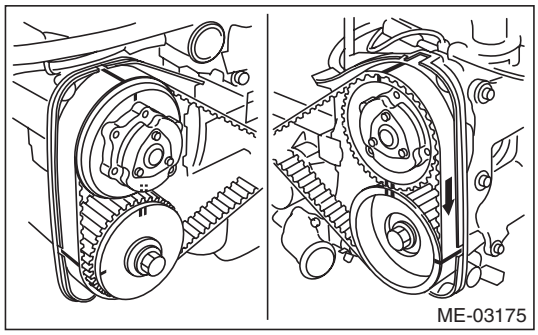
ST 499987500 CRANKSHAFT SOCKET



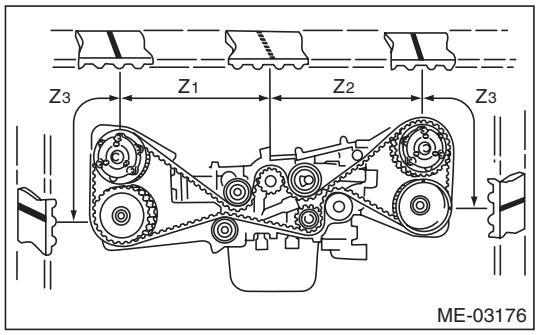
ME-00231

(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-00070

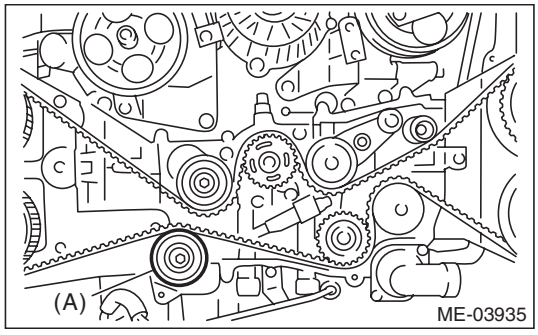

ME-03175

Z_1: 54.5 teeth
Z_2: 51 teeth
Z_3: 28 teeth



ME-03176

5) Remove the belt idler (A).



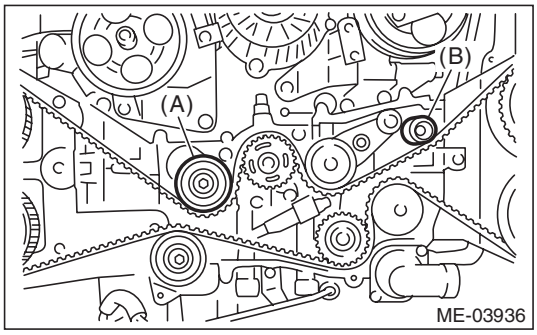
ME-03935

6) Remove the timing belt.

CAUTION:
After the timing belt has been removed, never rotate the intake and exhaust sprocket. If the cam sprocket is rotated, the intake and exhaust valve heads strike together and valve stems are bent.

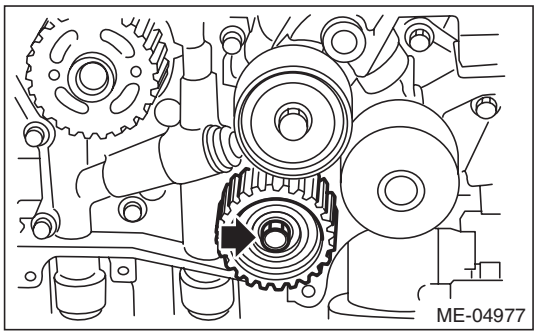
2. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

1) Remove the belt idler (A) and (B).

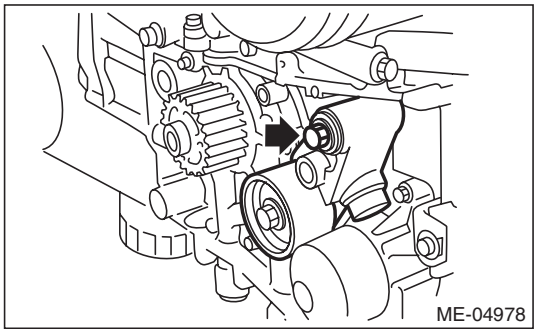


ME-03936

2) Remove the belt idler No. 2.


ME-04977

3) Remove the automatic belt tension adjuster assembly.


ME-04978

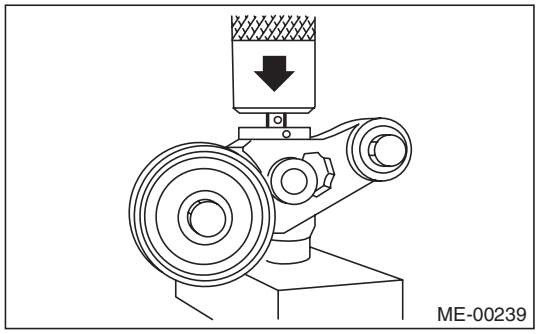
B: INSTALLATION

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

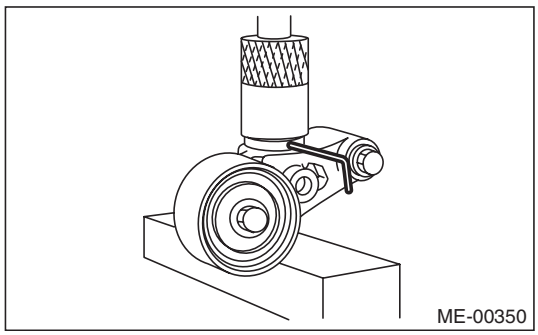
1) Prepare for installation of the automatic belt tension adjuster assembly.

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 press 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.

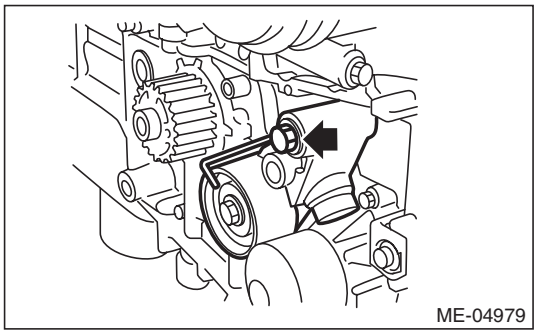

ME-00239

(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (nominal) dia. hex wrench inserted into the stopper pin hole in cylinder, secure the adjuster rod.


ME-00350

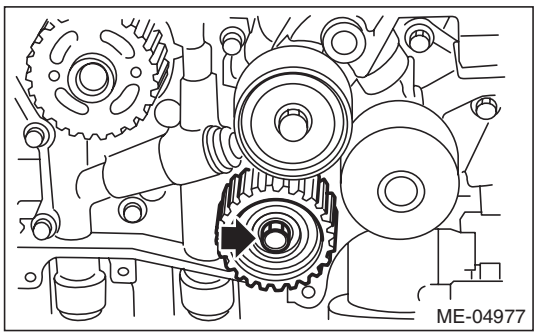
2) Install the automatic belt tension adjuster assembly.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)


ME-04979

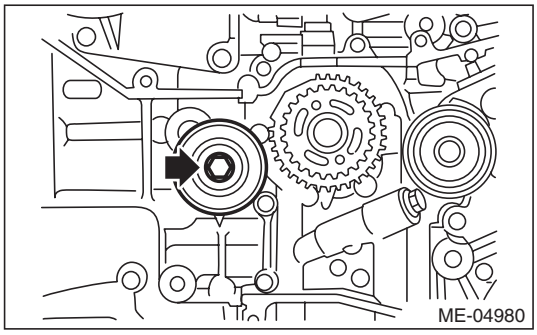
3) Install the belt idler No. 2.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)

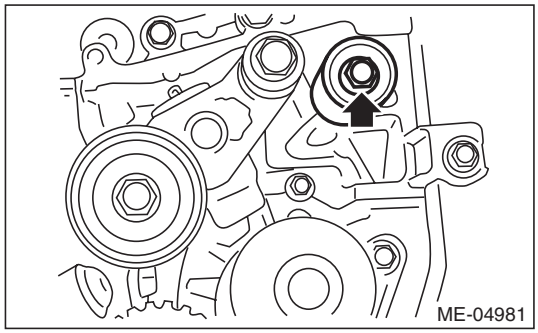

ME-04977

4) Install the belt idlers.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)

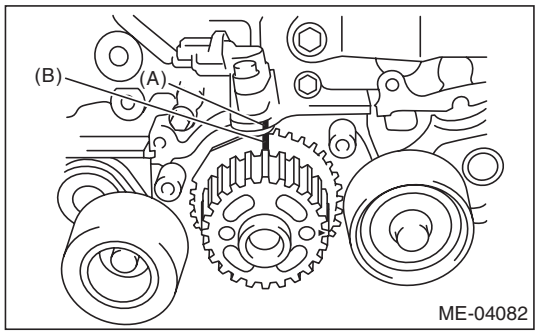

ME-04980

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)

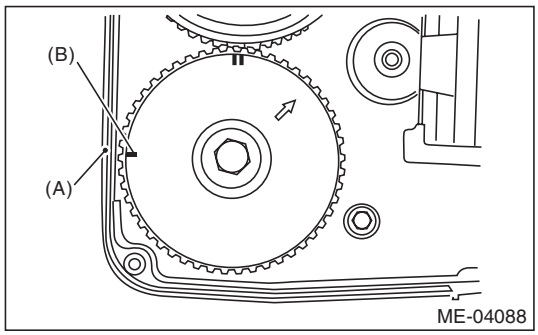


2. TIMING BELT

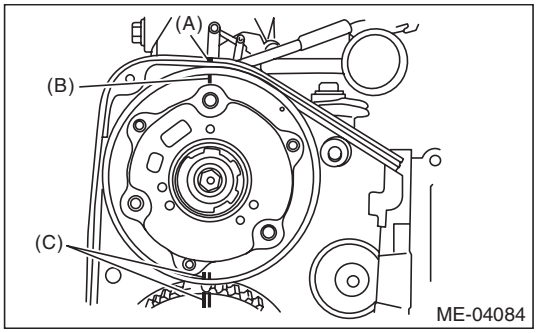
1) Prepare for installation of the automatic belt tension adjuster assembly. <Ref. to ME(w/o STI)-50, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>
2) Align the mark (B) on crank sprocket with the mark (A) on oil pump.



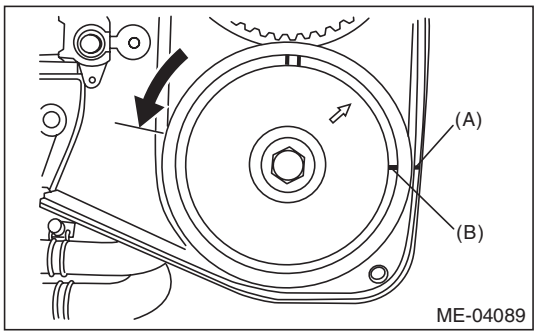
3) Align the single line mark (B) on the exhaust cam sprocket RH with notch (A) on the timing belt cover.



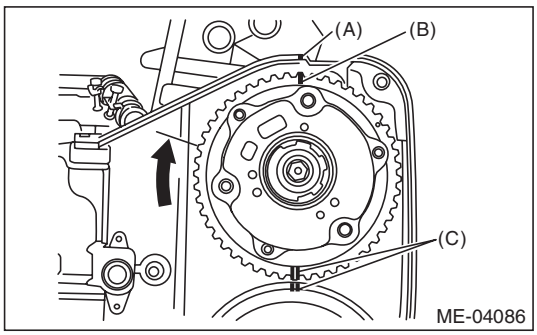
4) Align the single line mark (B) on the intake cam sprocket RH with notch (A) on the timing belt cover. Make sure that the double line marks (C) on intake cam sprocket and exhaust cam sprocket are aligned.



5) Align the single line mark (B) on exhaust cam sprocket LH with notch (A) on the timing belt cover by turning the sprocket counterclockwise (as viewed from front of engine).

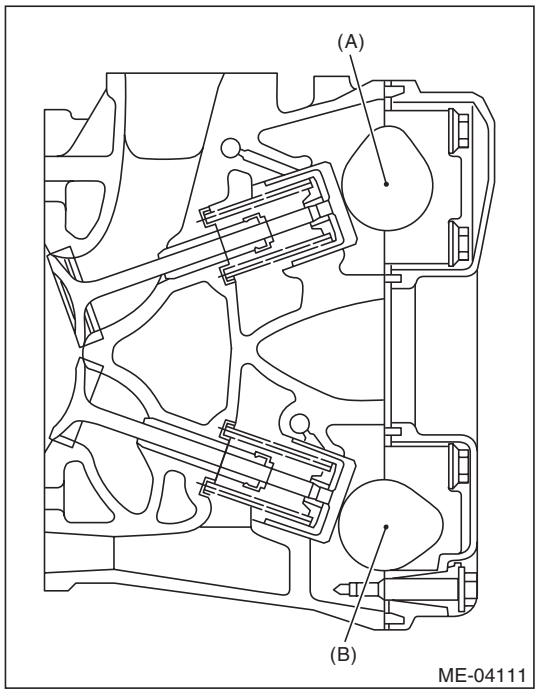


6) Align the single line mark (B) on intake cam sprocket LH with notch (A) on the timing belt cover by turning the sprocket clockwise (as viewed from front of engine). Make sure that the double line marks (C) on intake cam sprocket and exhaust cam sprocket are aligned.



7) Make sure that the cam and crank sprockets are positioned properly.

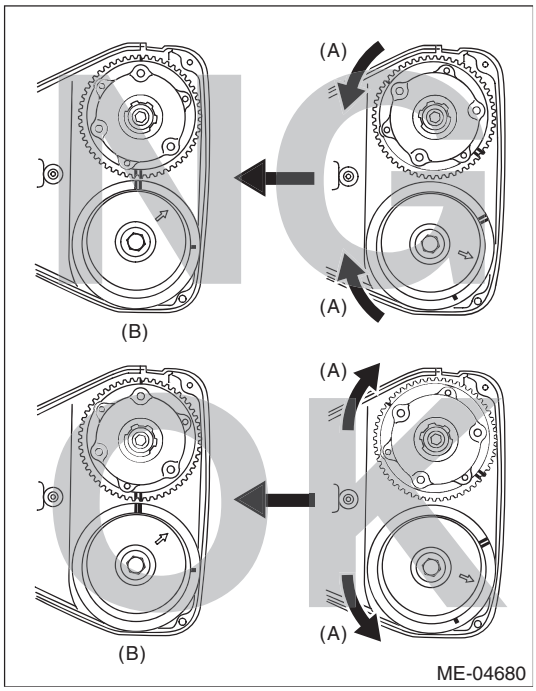
CAUTION:
• Intake and exhaust camshafts for this DOHC engine can be independently rotated with the timing belts removed. As can be seen from the figure, if the intake and exhaust valves are lifted simultaneously, heads will interfere with each other, resulting in bent valves.



(A) Intake camshaft
(B) Exhaust camshaft

• When the timing belts are not installed, four camshafts are held at the "zero-lift" position, where all cams on camshafts are not pushing down on the intake and exhaust valves. (Under this condition, all valves remain unlifted.)
• When the camshafts are rotated to install the timing belts, #2 intake and #4 exhaust cam of camshaft LH are held, pushing their corresponding valves down. (Under this condition, these valves are held lifted.) Camshaft RH are held so that their cams do not push the valves down.
• Camshafts LH must be rotated from the zero-lift position to the position where the timing belt is to be installed with the smallest possible angle, in order to prevent mutual interference of intake and exhaust valve heads.

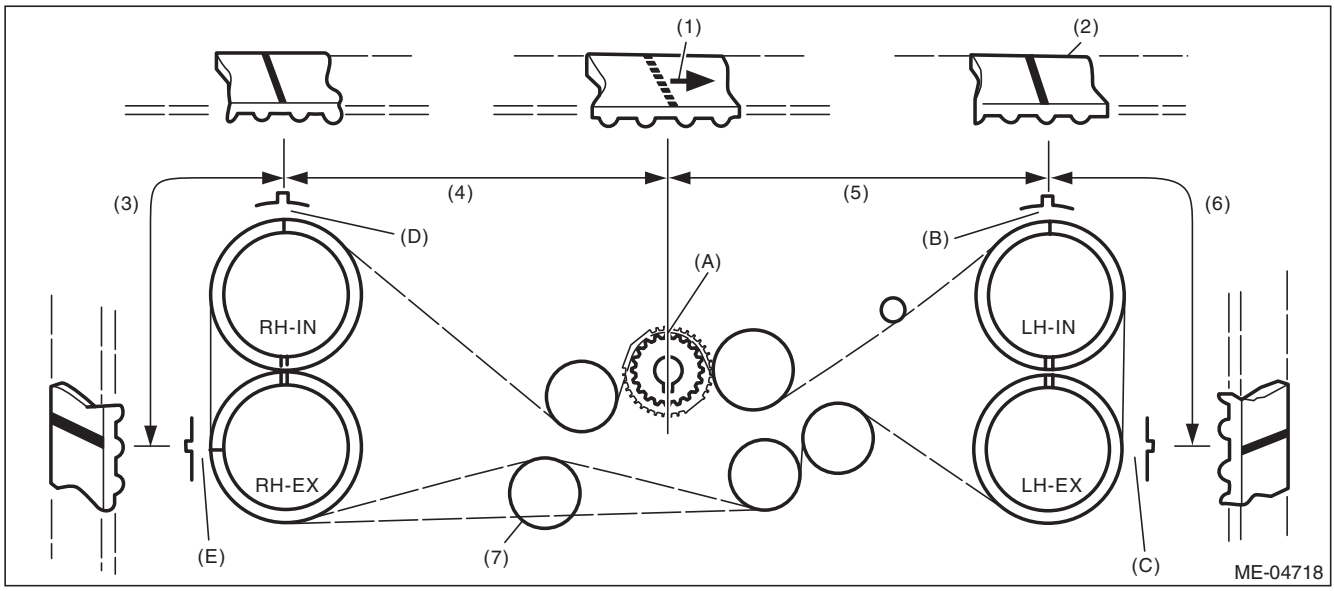
• Do not allow the camshafts to rotate in the direction shown in the upper figure. Doing this may cause both the intake and exhaust valves to lift simultaneously, resulting in mutual interference of valve heads.



(A) Direction of rotation
(B) Timing belt installation position

8) Align the alignment mark on the timing belt with marks on the sprockets in the alphabetical order shown in the figure. While aligning marks, position the timing belt properly, and install the timing belt.

CAUTION:
- **If the timing belt slips by 1 or more teeth, the valve and piston may hit each other.**
- **Make sure that the direction of belt rotation is correct.**

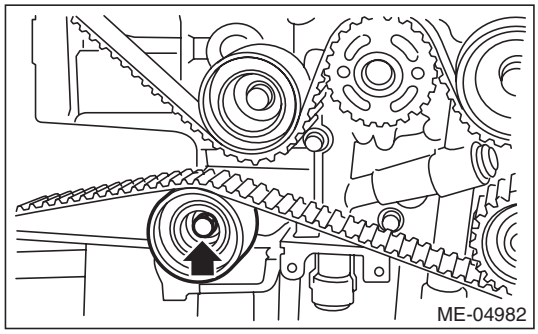


(1) Arrow mark
(2) Timing belt
(3) 28 teeth
(4) 54.5 teeth
(5) 51 teeth
(6) 28 teeth
(7) Install it in the end

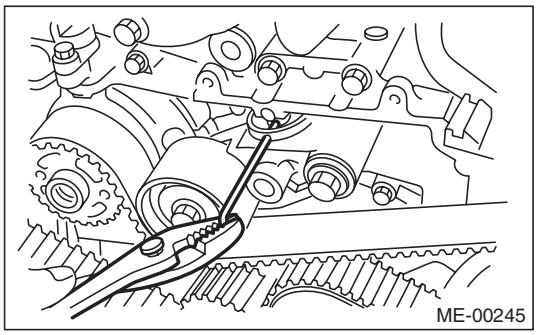
9) Install the belt idlers.

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)

NOTE:
Make sure that the marks on the timing belt and sprockets are aligned.



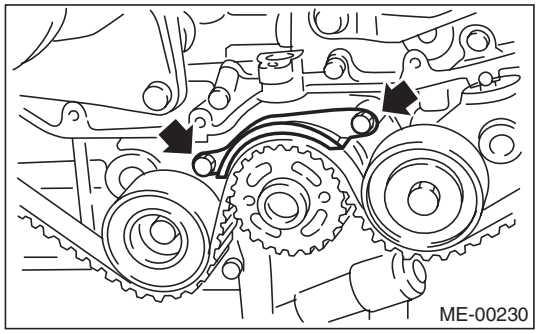
10) After ensuring that the marks on the timing belt and sprockets are aligned, remove the stopper pin from tensioner adjuster.

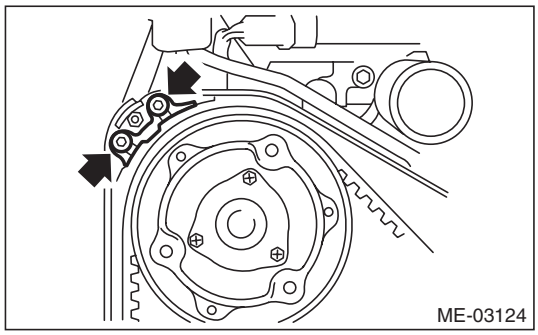


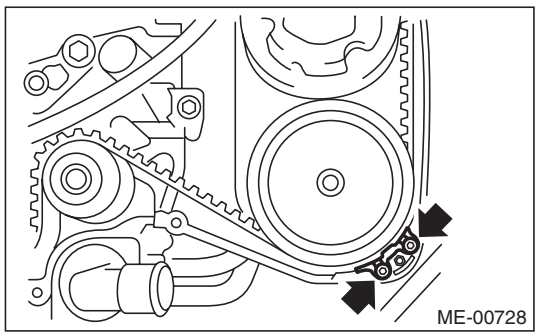
11) Install the timing belt guide.
(1) Temporarily tighten the bolts securing the timing belt guide.

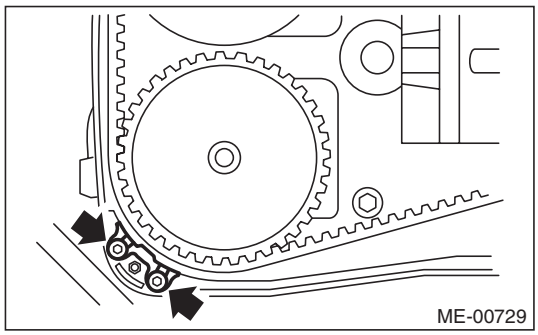
NOTE:
• Before installing the timing belt guide, clean the timing belt guide mounting bolt holes of the timing belt cover No. 2.
• Apply liquid gasket to the thread of the timing belt guide mounting bolt on the cam sprocket section. (when reusing bolts)

Liquid gasket:
THREE BOND 1324 (Part No. 004403042)


ME-00230

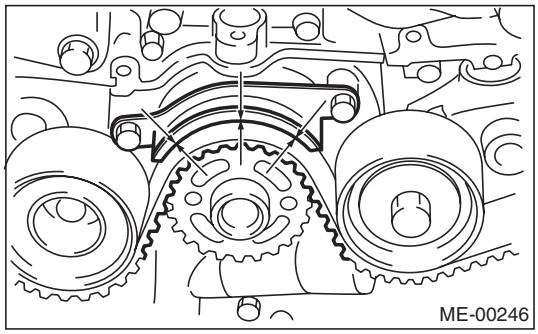

ME-03124

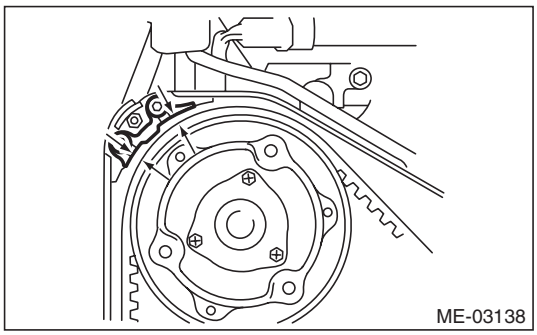

ME-00728

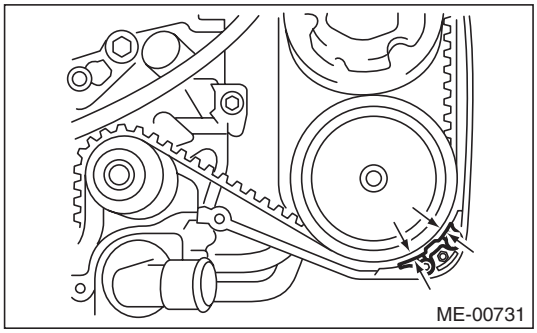

ME-00729

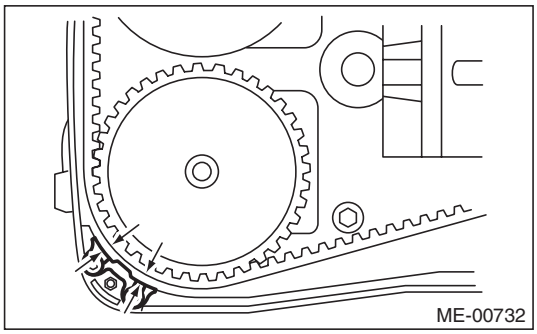
(2) Adjust the clearance between timing belt and timing belt guide using a thickness gauge and tighten.

Clearance:
1.0±0.5 mm (0.039±0.020 in)

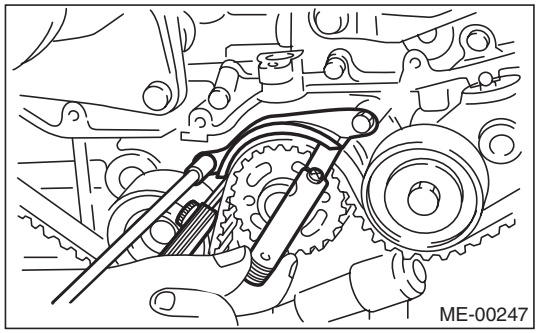

ME-00246


ME-03138

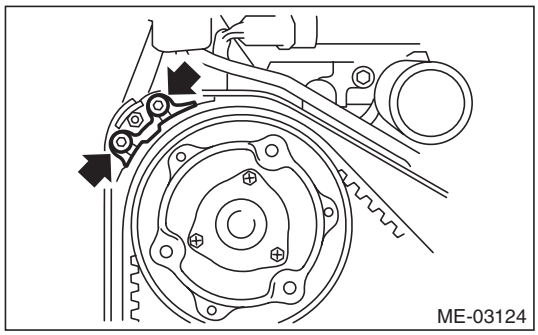

ME-00731

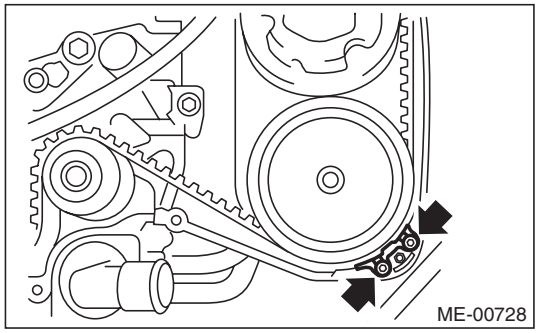

ME-00732

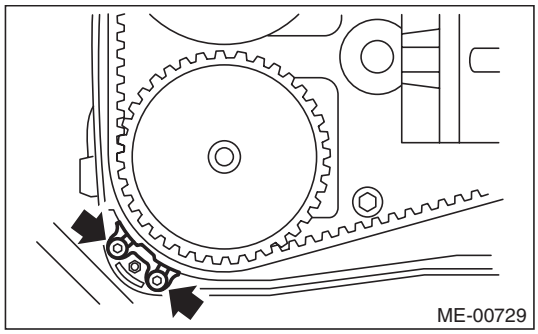
Tightening torque:
9.75 N·m (1.0 kgf-m, 7.2 ft-lb)



Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)







12) Install the timing belt cover. <Ref. to ME(w/o STI)-47, INSTALLATION, Timing Belt Cover.>
13) Install the crank pulley. <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>

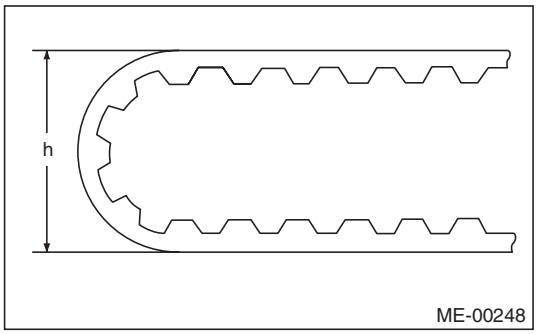
C: INSPECTION

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.

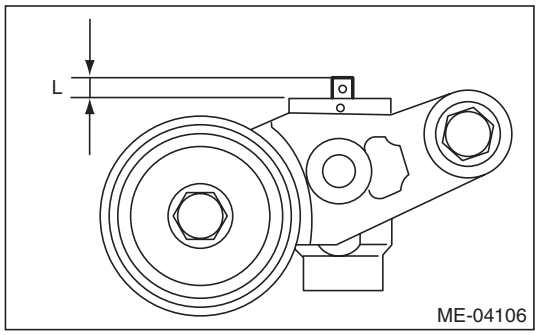
NOTE:
Slight traces of oil at the rod oil seal does not indicate a problem.
2) Check that the adjuster rod does not move when a pressure of 165 N (16.8 kgf, 37.1 lb) is applied to it. This is to check adjuster rod stiffness.
3) If the adjuster rod is not stiff and moves freely when applying 165 N (16.8 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-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 press the adjuster rod below the end face of the cylinder. Doing so may damage the cylinder.

4) Measure the amount of adjuster rod protrusion "L" from the end surface of the cylinder. If it is not within specifications, replace the automatic belt tension adjuster assembly with a new part.

Protrusion amount of adjuster rod L:
5.2 — 6.2 mm (0.205 — 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.

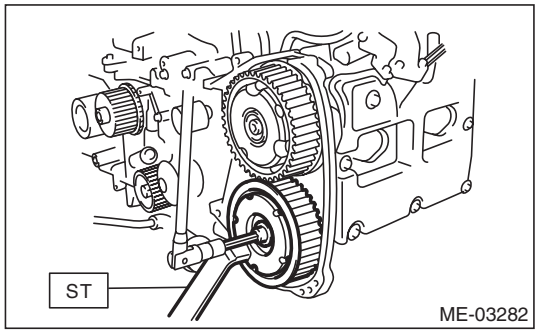
4. BELT IDLER

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.

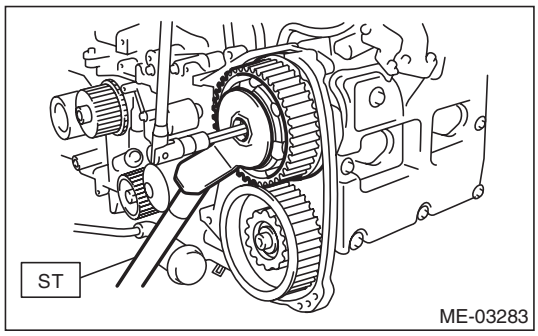
16.Cam Sprocket

A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the crank pulley. <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt. <Ref. to ME(w/o STI)-48, REMOVAL, Timing Belt.>
4) Remove the actuator cover from intake cam sprocket.
5) Use the ST to lock the cam sprocket, and remove the cam sprocket bolt.
ST 499207400 CAM SPROCKET WRENCH



ST 499977500 CAM SPROCKET WRENCH



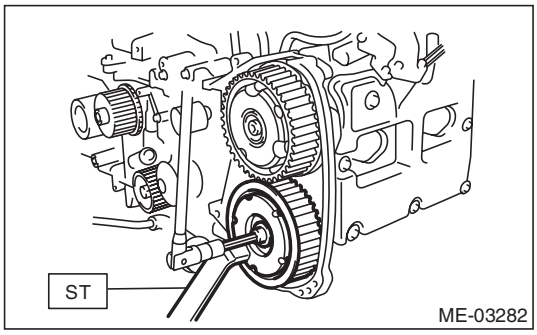
6) Remove the cam sprocket.

B: INSTALLATION

1) Install the cam sprocket.
2) Use the ST to lock the cam sprocket, and install the cam sprocket bolt.

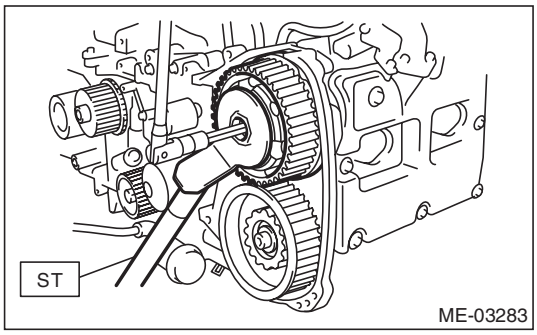
NOTE:
Do not confuse cam sprockets (LH) and (RH) during installation.
ST 499207400 CAM SPROCKET WRENCH

Tightening torque:
Tighten to 30 N·m (3.1 kgf-m, 22.1 ft-lb) of torque, and then tighten further by 45°.



ST 499977500 CAM SPROCKET WRENCH

Tightening torque:
Tighten to 30 N·m (3.1 kgf-m, 22.1 ft-lb) of torque, and then tighten further by 45°.



3) Install the actuator cover to intake cam sprocket.

NOTE:
Use new O-rings.

Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)
4) Install the timing belt. <Ref. to ME(w/o STI)-50, INSTALLATION, Timing Belt.>
5) Install the timing belt cover. <Ref. to ME(w/o STI)-47, INSTALLATION, Timing Belt Cover.>
6) Install the crank pulley. <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>

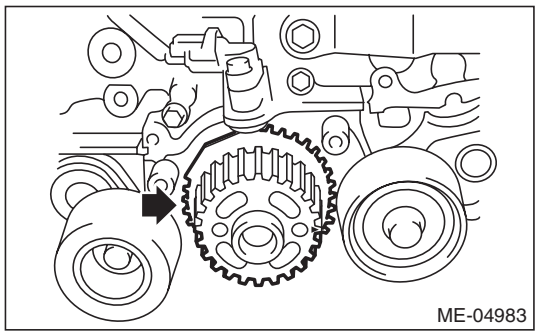
C: INSPECTION

1) Check the cam sprocket teeth for abnormal wear and scratches.
2) Make sure there is no free play between cam sprocket and key.

17.Crank Sprocket

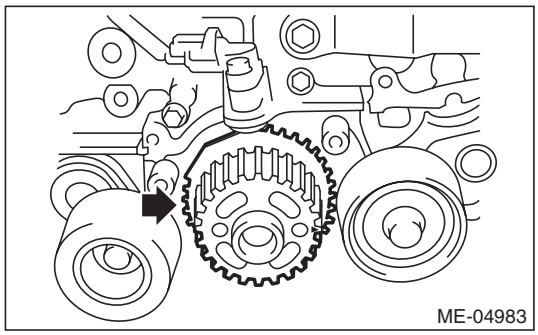
A: REMOVAL

NOTE:
When replacing a single part, perform the work with the engine assembly installed to body.
1) Remove the crank pulley. <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
2) Remove the timing belt cover. <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
3) Remove the timing belt. <Ref. to ME(w/o STI)-48, REMOVAL, Timing Belt.>
4) Remove the crank sprocket.



B: INSTALLATION

1) Install the crank sprocket.



2) Install the timing belt. <Ref. to ME(w/o STI)-50, INSTALLATION, Timing Belt.>
3) Install the timing belt cover. <Ref. to ME(w/o STI)-47, INSTALLATION, Timing Belt Cover.>
4) Install the crank pulley. <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>

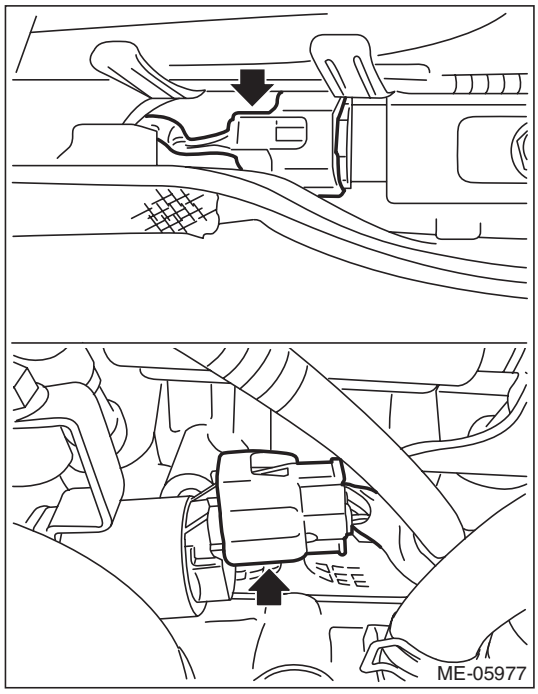
C: INSPECTION

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.Camshaft

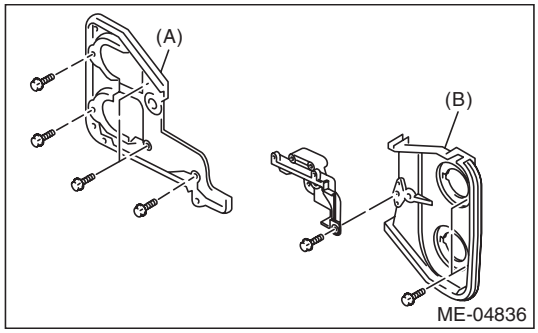
A: REMOVAL

1) Remove the engine from the vehicle. <Ref. to ME(w/o STI)-29, REMOVAL, Engine Assembly.>
2) Remove the rear side belt. <Ref. to ME(w/o STI)-38, REAR SIDE BELT, REMOVAL, V-belt.>
3) Remove the crank pulley. <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(w/o STI)-48, REMOVAL, Timing Belt.>
6) Remove the cam sprocket. <Ref. to ME(w/o STI)-57, REMOVAL, Cam Sprocket.>
7) Disconnect the connector from the oil flow control solenoid valve.

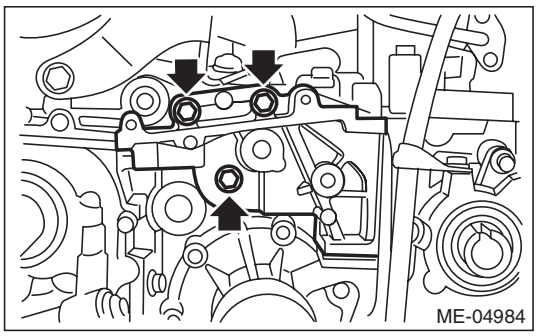


8) Remove the timing belt cover No. 2 RH (A) and timing belt cover No. 2 LH (B).

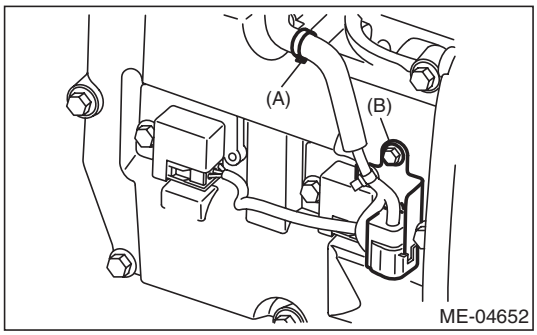
NOTE:
When removing the timing belt cover, be careful not to damage the seal rubber.



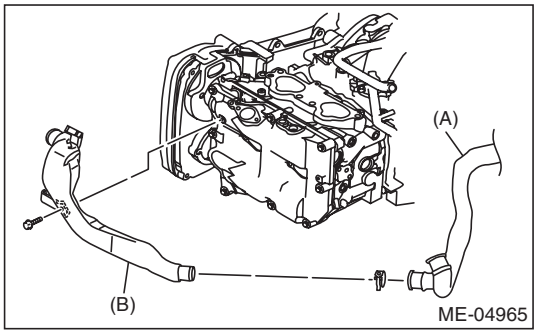
9) Remove the tensioner bracket.



10) Remove the clip (A) and the stay (B) which hold the engine harness to the rocker cover RH.



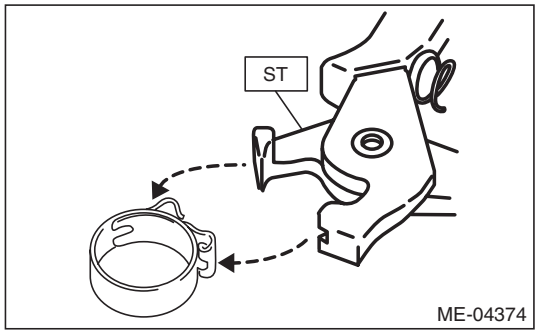
11) Remove the air duct B (B) from the rocker cover LH and the air duct A (A).

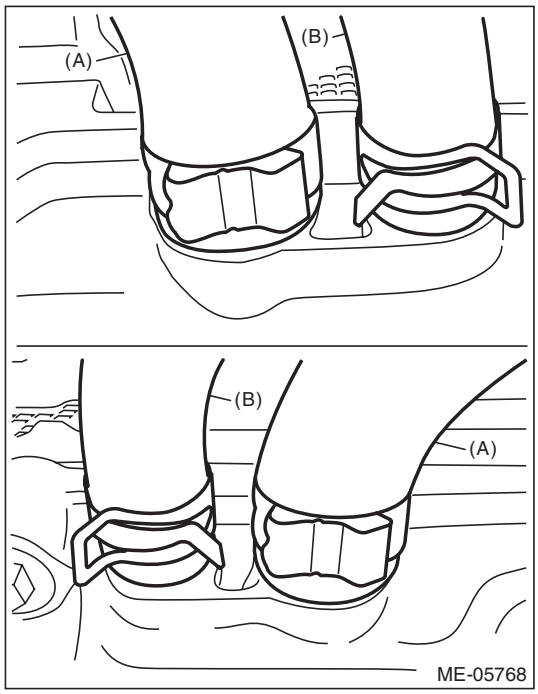


12) Remove the ignition coil. <Ref. to IG(w/o STI)-8, REMOVAL, Ignition Coil.>

13) Disconnect the PCV hose (A) and PCV hose assembly (B) from the rocker cover.

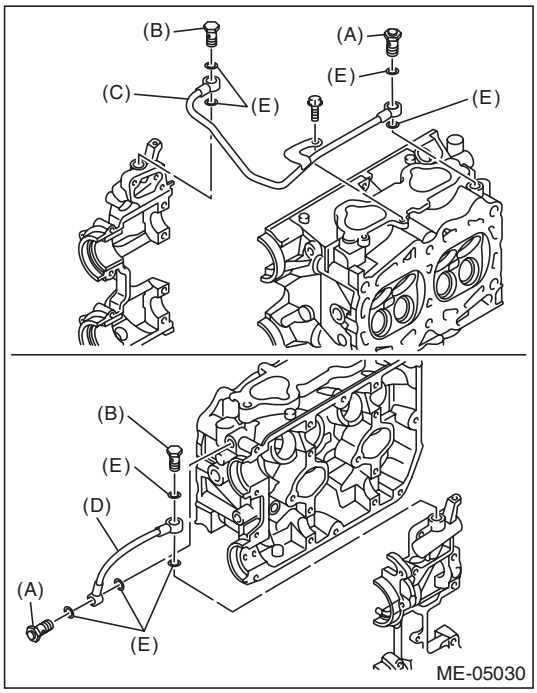
NOTE:
Pinch the clamp of the PCV hose (A) by fitting the cut out in the ST in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS





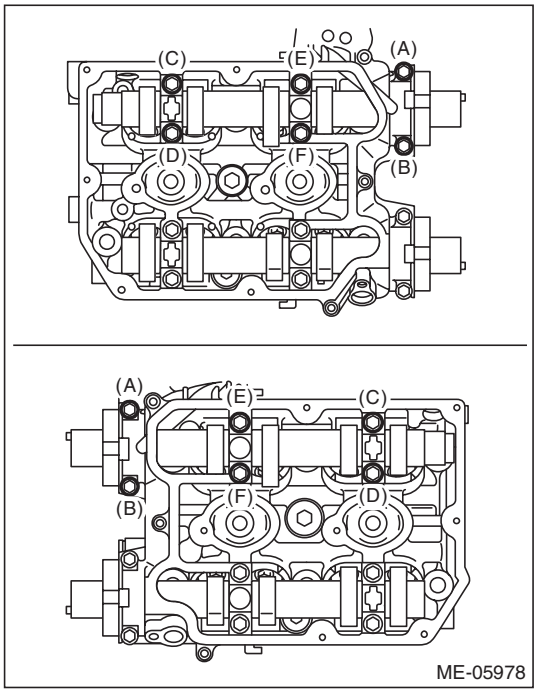
14) Remove the rocker cover.

15) Remove the union bolt without filter (without protrusion) which secures the oil pipe to the front camshaft cap.

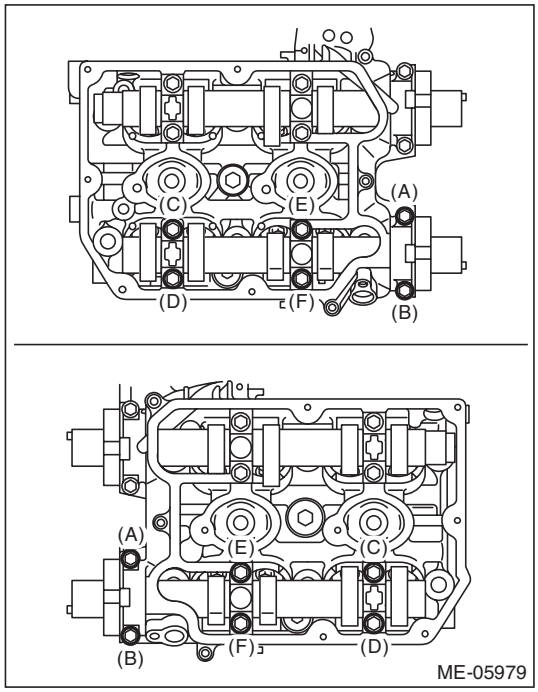


(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

16) Loosen the upper side of the front camshaft cap and the intake camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



17) Loosen the lower side of the front camshaft cap and the exhaust camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



18) Remove the front camshaft cap.
19) Remove the intake camshaft caps and intake camshaft.
20) Remove the exhaust camshaft caps and exhaust camshaft.

NOTE:
Arrange camshaft caps in order so that they can be installed in their original positions.
21) Remove the oil seal.

CAUTION:
Do not scratch the journal surface when removing the oil seal.

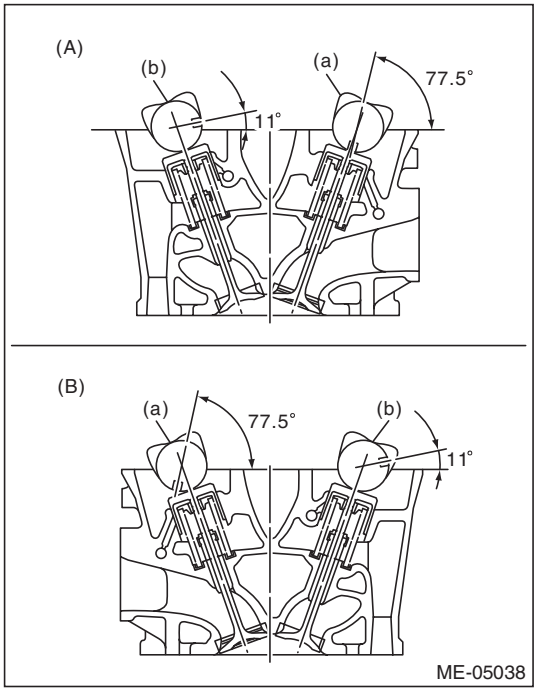
B: INSTALLATION

1) Install the camshaft.
Apply engine oil to the cylinder head at camshaft bearing installation location before installing the camshaft. Install the camshaft so that each valve is close to or in contact with base circle of the cam lobe.

NOTE:
• Set the camshaft to the position shown in the figure.
• When set at the position shown in the figure, it is not necessary to rotate the camshaft RH when installing the timing belt, but it is necessary to rotate the camshaft LH slightly.

Intake camshaft LH:
Rotate 80° clockwise.

Exhaust camshaft LH:
Rotate 45° counterclockwise.



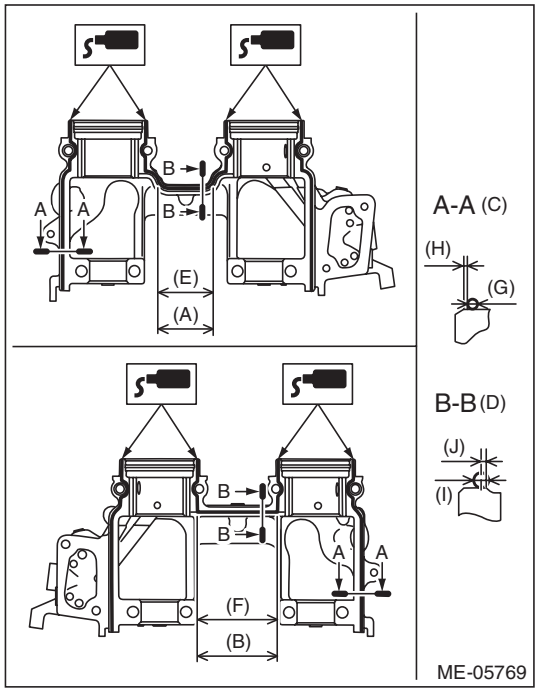
(A) Cylinder head RH
(B) Cylinder head LH
(a) Intake camshaft
(b) Exhaust camshaft

2) Install the camshaft cap.
(1) Apply small amount of liquid gasket to the mating surface of cap.

NOTE:
- Install within 5 min. after applying liquid gasket.
- Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to come out and flow toward oil seal, resulting in oil leak.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent

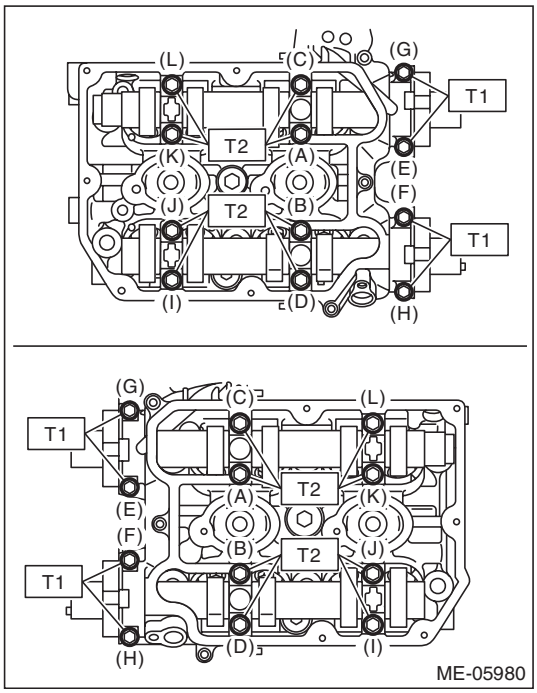
Liquid gasket applying diameter:
Mating surfaces other than ranges A and B
2±0.5 mm (0.0787±0.0197 in)
Mating surfaces of ranges A and B
3±1 mm (0.1181±0.0394 in)



(A) Range A
(B) Range B
(C) Liquid gasket applying position of mating surfaces of ranges other than A and B
(D) Liquid gasket applying position of mating surfaces of ranges A and B
(E) 44.8 mm (1.7638 in)
(F) 65 mm (2.5591 in)
(G) ϕ2±0.5 mm (0.0787±0.0197 in)
(H) 0.5±0.5 mm (0.0197±0.0197 in)
(I) ϕ3±1 mm (0.1181±0.0394 in)
(J) 1 mm (0.0394 in) or less

(2) Apply a thin coat of engine oil to the cap journal surface, and install the camshaft cap to the camshaft.
(3) Gradually tighten the camshaft cap in at least two steps, in alphabetical order shown in the figure, and then tighten to the specified torque.

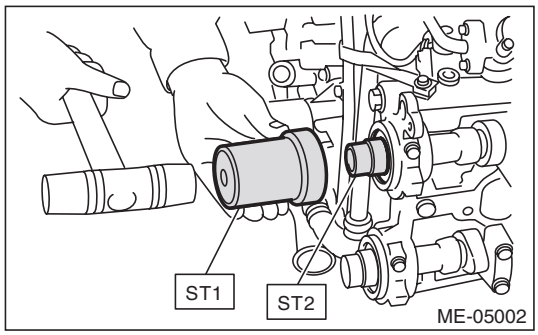
Tightening torque:
T1: 9.75 N·m (1.0 kgf-m, 7.2 ft-lb)
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)



(4) After tightening the camshaft cap, ensure the camshaft rotates only slightly while holding it at base circle.

3) Apply a thin coat of engine oil to the periphery of the camshaft oil seal and oil seal lip, and install the oil seal on the camshaft using ST1 and ST2.

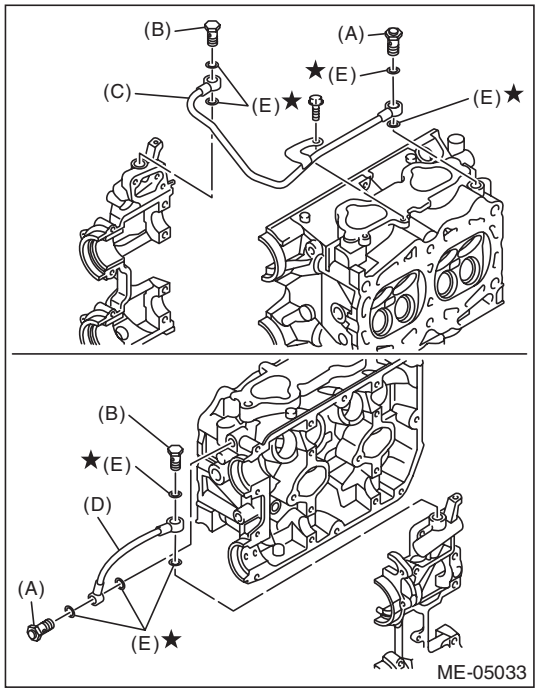
NOTE:
Use a new oil seal.
ST1 499587600 OIL SEAL INSTALLER
ST2 499597200 OIL SEAL GUIDE



4) Install the oil pipe to the front camshaft cap using the union bolt without filter (without protrusion).

NOTE:
Use a new gasket.

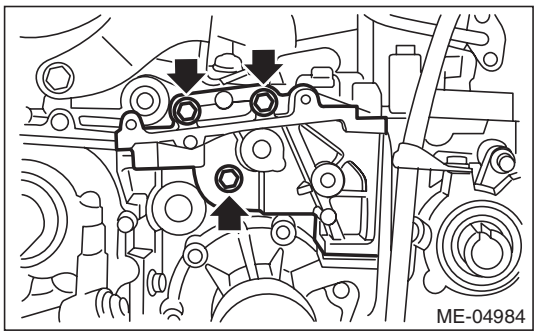
Tightening torque:
29 N·m (3.0 kgf-m, 21.4 ft-lb)



(A) Union bolt with filter (with protrusion)
(B) Union bolt without filter (without protrusion)
(C) Oil pipe RH
(D) Oil pipe LH
(E) Gasket

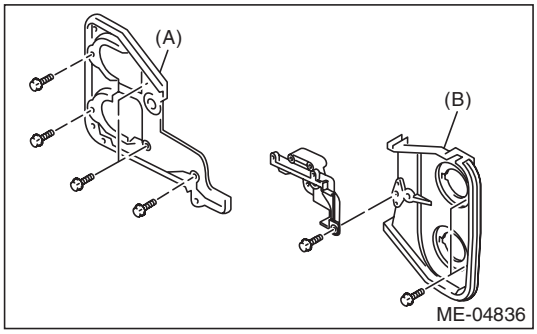
5) Install the tensioner bracket.

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



6) Install the timing belt cover No. 2 RH (A) and timing belt cover No. 2 LH (B).

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



7) Install the cam sprocket. <Ref. to ME(w/o STI)-57, INSTALLATION, Cam Sprocket.>
8) Install the timing belt. <Ref. to ME(w/o STI)-50, INSTALLATION, Timing Belt.>
9) Adjust the valve clearance. <Ref. to ME(w/o STI)-28, ADJUSTMENT, Valve Clearance.>

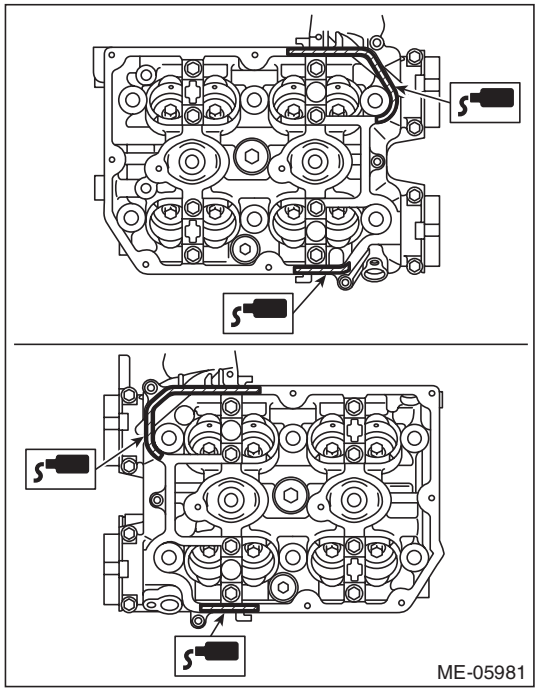
10) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:
Use a new rocker cover gasket.

(2) Apply liquid gasket to the specified point of the cylinder head.

NOTE:
Install within 5 min. after applying liquid gasket.

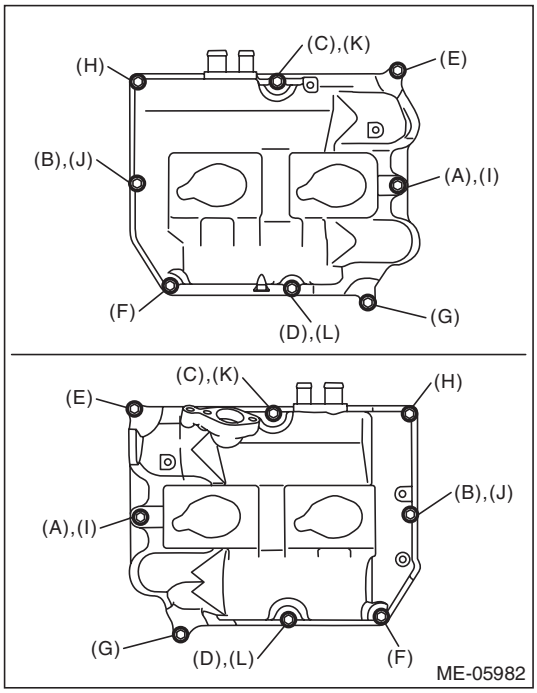
Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.

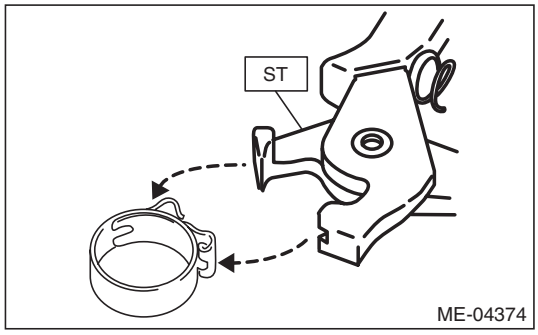
(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

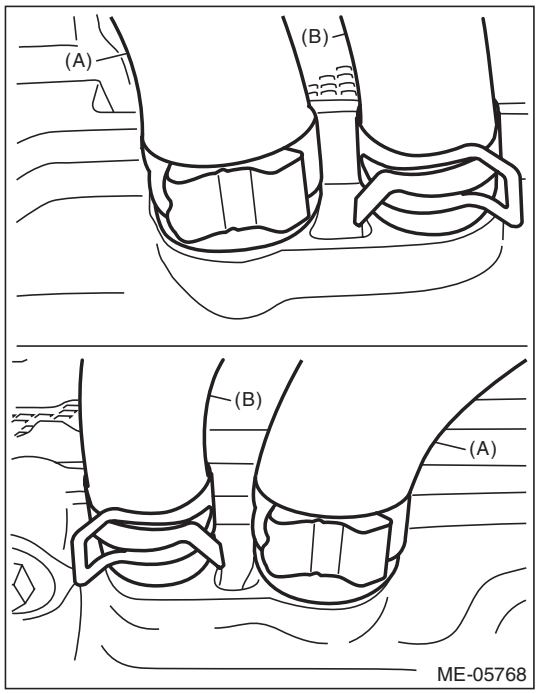
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



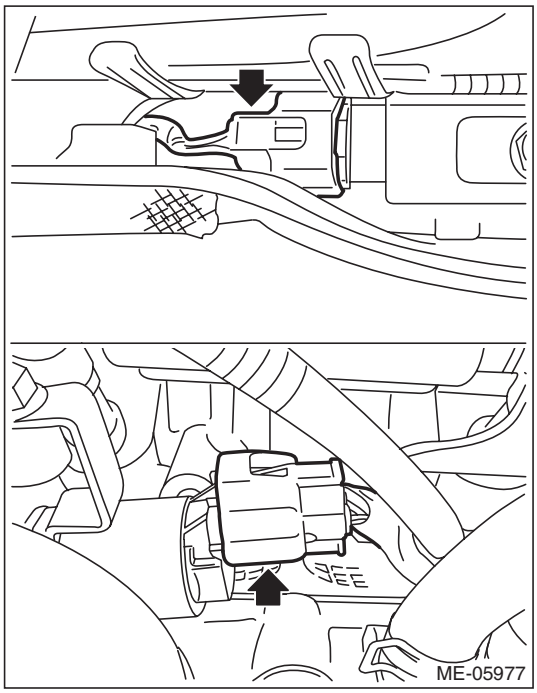
11) Connect the PCV hose (A) and PCV hose assembly (B) to the rocker cover.

NOTE:
Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS



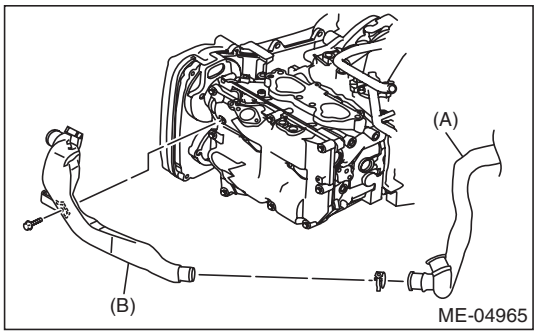


12) Connect the connector to oil flow control solenoid valve.



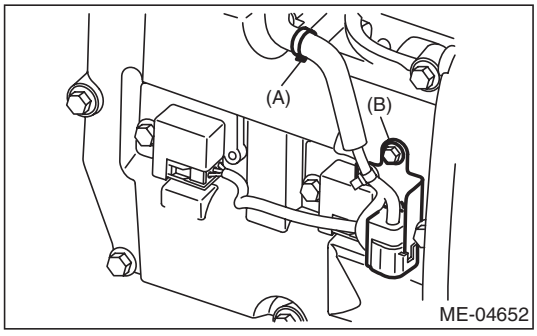
13) Install the ignition coil. <Ref. to IG(w/o STI)-8, INSTALLATION, Ignition Coil.>
14) Install the air duct B (B) to the rocker cover LH and the air duct A (A).

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



15) Securely install the engine harness with clip (A) and stay (B) to the rocker cover RH.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

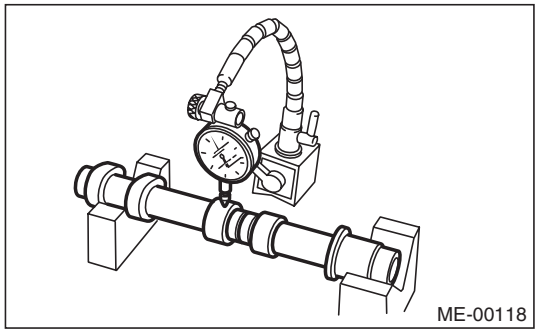


16) Install the timing belt cover. <Ref. to ME(w/o STI)-47, INSTALLATION, Timing Belt Cover.>
17) Install the crank pulley. <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>
18) Install the rear side belt. <Ref. to ME(w/o STI)-39, REAR SIDE BELT, INSTALLATION, V-belt.>
19) Install the engine to the vehicle. <Ref. to ME(w/o STI)-33, INSTALLATION, Engine Assembly.>

C: INSPECTION

1) Measure the bend, and repair or replace if necessary.

Camshaft bend limit:
0.020 mm (0.00079 in)

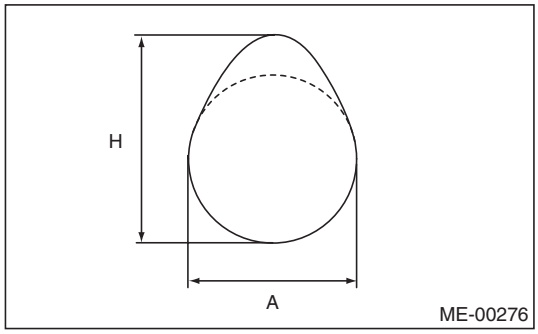


2) Check the journal for damage and wear. Replace if faulty.
3) Check the cutout portion used for camshaft sensor for damage. Replace if faulty.
4) Check the cam face condition, and remove the minor faults by grinding with oil stone. If offset wear occurs, replace it.
5) Measure the cam lobe height “H” and cam base circle diameter “A”. If it exceeds the standard or offset wear occurs, replace it.

Cam lobe height H:

Standard
Intake
46.55 — 46.65 mm (1.833 — 1.837 in)
Exhaust
46.75 — 46.85 mm (1.841 — 1.844 in)

Cam base circle diameter A:
Standard
37.0 mm (1.457 in)

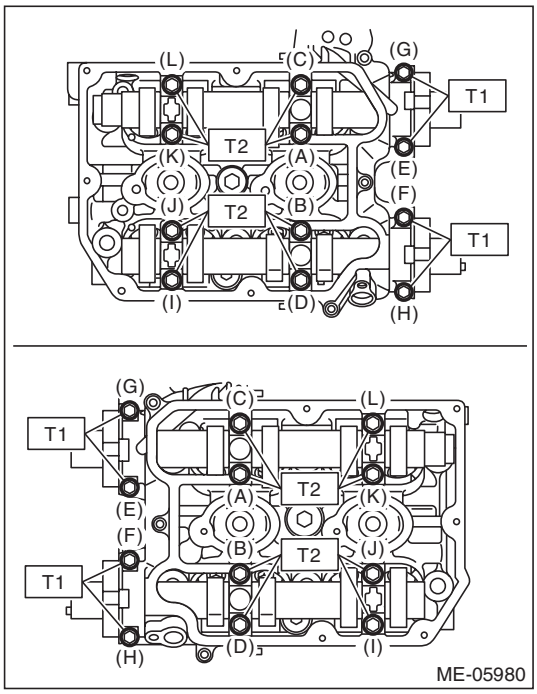


6) Measure the outside diameter of camshaft journal. If the journal diameter is not within specification, check the oil clearance.

	Camshaft journal	
	Front	Center, rear
Standard mm (in)	37.946 — 37.963 (1.4939 — 1.4946)	29.946 — 29.963 (1.1790 — 1.1796)

7) Measure the oil clearance of camshaft journal.
(1) Clean the camshaft cap and cylinder head camshaft journal.
(2) Place the camshaft on cylinder head. (Without installing the valve lifter)
(3) Place a plastigauge across each camshaft journals.
(4) Gradually tighten the camshaft cap in at least two steps, in alphabetical order shown in the figure, and then tighten to the specified torque. Do not turn the camshaft.

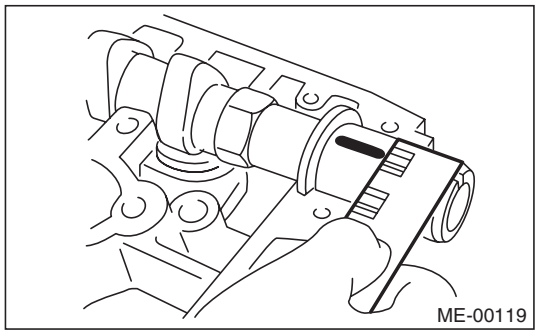
Tightening torque:
T1: 9.75 N·m (1.0 kgf-m, 7.2 ft-lb)
T2: 20 N·m (2.0 kgf-m, 7.2 ft-lb)



(5) Remove the camshaft cap.

(6) Measure the widest point of the plastigauge on each journal. If oil clearance exceeds the standard, replace the camshaft. If necessary, replace the camshaft caps and cylinder head as a set.

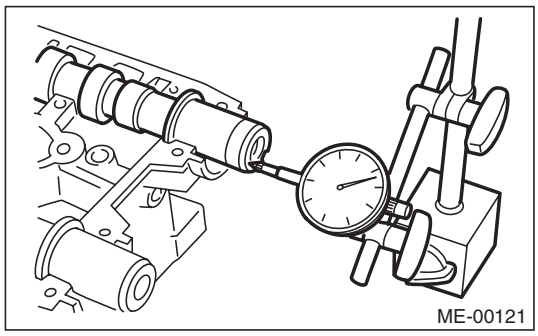
Camshaft oil clearance:
Standard
0.037 — 0.072 mm (0.0015 — 0.0028 in)



(7) Completely remove the plastigauge.

8) 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 off-set wear, replace the camshaft caps and cylinder head as a set. If necessary replace the camshaft.

Camshaft thrust clearance:
Standard
0.068 — 0.116 mm (0.0027 — 0.0047 in)

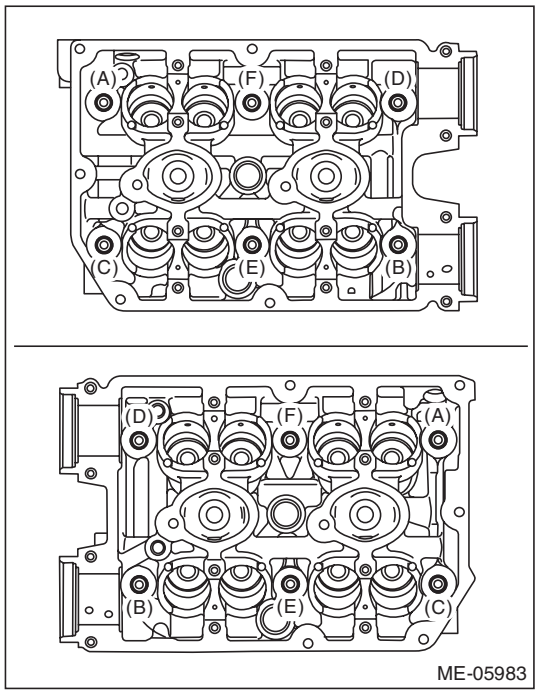


19.Cylinder Head

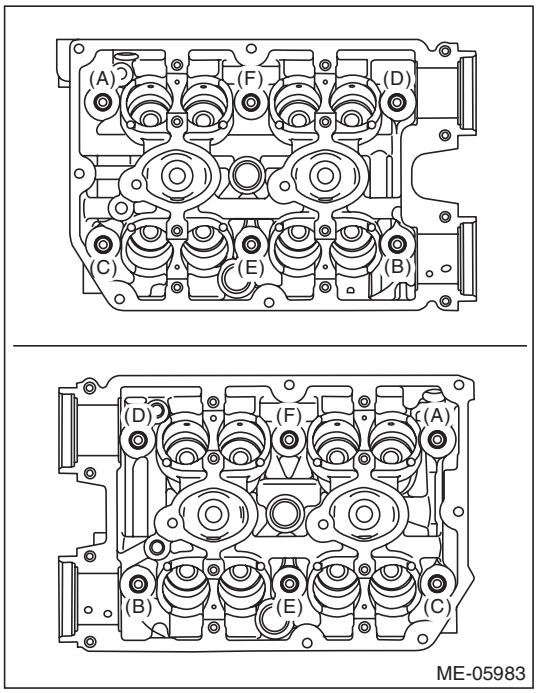
A: REMOVAL

1) Remove the engine from the vehicle. <Ref. to ME(w/o STI)-29, REMOVAL, Engine Assembly.>
2) Remove the rear side belt. <Ref. to ME(w/o STI)-38, REAR SIDE BELT, REMOVAL, V-belt.>
3) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
4) Remove the crank pulley. <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
5) Remove the timing belt cover. <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
6) Remove the timing belt. <Ref. to ME(w/o STI)-48, REMOVAL, Timing Belt.>
7) Remove the cam sprocket. <Ref. to ME(w/o STI)-57, REMOVAL, Cam Sprocket.>
8) Remove the secondary air combination valve. <Ref. to EC(w/o STI)-30, REMOVAL, Secondary Air Combination Valve.>
9) Remove the bolts which secure A/C compressor bracket to cylinder head.
10) Remove the oil pipe. <Ref. to LU(STI)-25, REMOVAL, Oil Pipe.>
11) Remove the camshaft. <Ref. to ME(w/o STI)-59, REMOVAL, Camshaft.>
12) Remove the oil level gauge guide. (LH side only)
13) Remove the cylinder head bolts in alphabetical order shown in the figure.

NOTE:
Leave the bolts (A) and (D) engaged by three or four threads to prevent the cylinder head from falling.



14) While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (A) and (D) to remove cylinder head.



15) Remove the cylinder head gasket.

CAUTION:
Be careful not to scratch the mating surface of cylinder head and cylinder block.

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.

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.

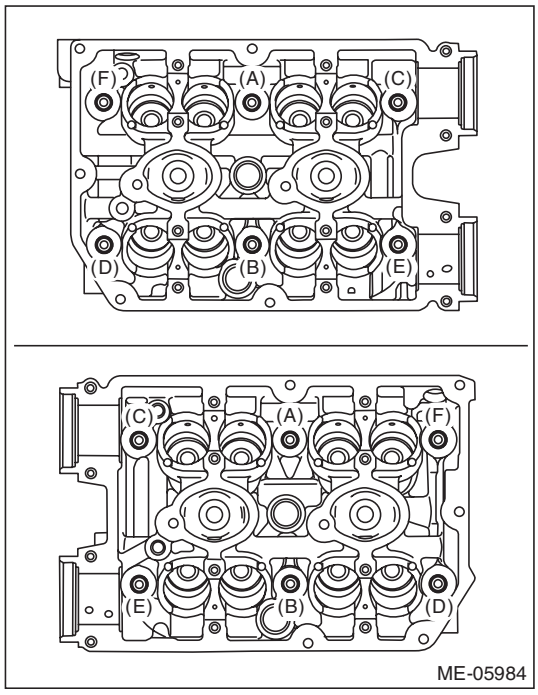
CAUTION:
If the bolt makes stick-slip sound during tightening, repeat the procedure from step (1). In this case, the cylinder head gasket can be reused.

(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 70 N·m (7.1 kgf-m, 51.6 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 only)

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

3) Install the camshaft. <Ref. to ME(w/o STI)-61, INSTALLATION, Camshaft.>
4) Install the oil pipe. <Ref. to LU(STI)-27, INSTALLATION, Oil Pipe.>
5) Install the A/C compressor bracket on cylinder head.

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)

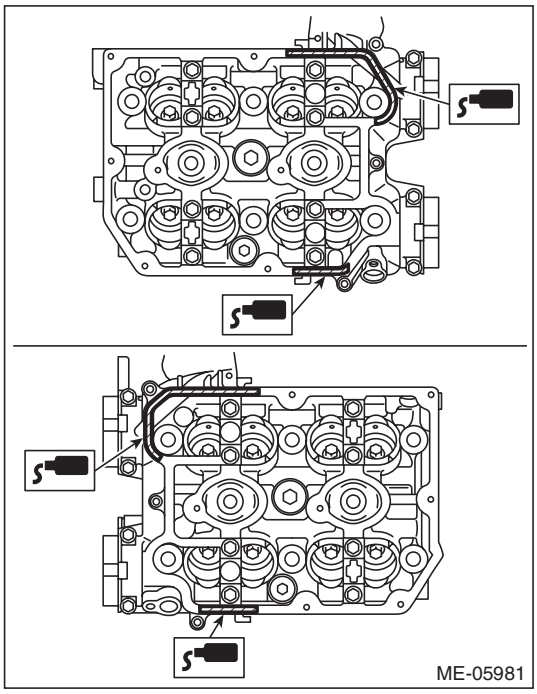
6) Install the secondary air combination valve. <Ref. to EC(w/o STI)-31, INSTALLATION, Secondary Air Combination Valve.>
7) Install the cam sprocket. <Ref. to ME(w/o STI)-57, INSTALLATION, Cam Sprocket.>
8) Install the timing belt. <Ref. to ME(w/o STI)-50, INSTALLATION, Timing Belt.>
9) Adjust the valve clearance. <Ref. to ME(w/o STI)-28, ADJUSTMENT, Valve Clearance.>
10) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:
Use a new rocker cover gasket.

(2) Apply liquid gasket to the specified point of the cylinder head.

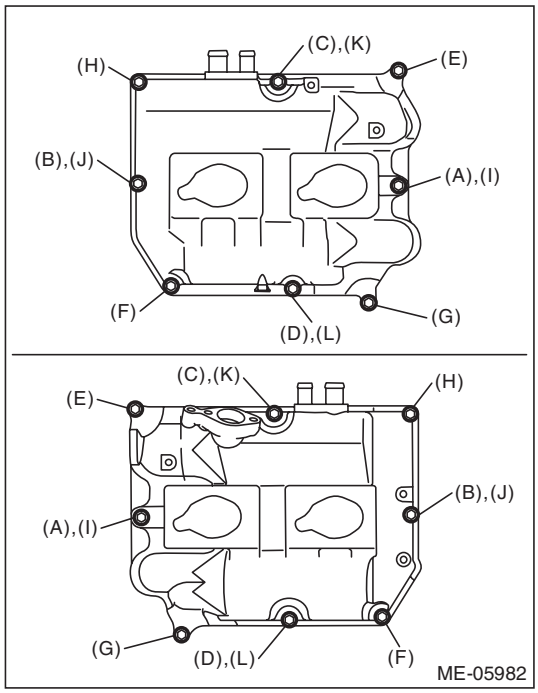
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



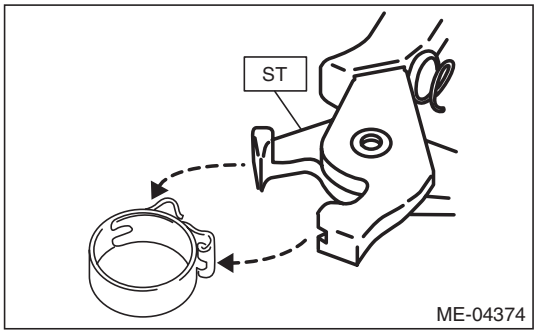
(3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.
(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

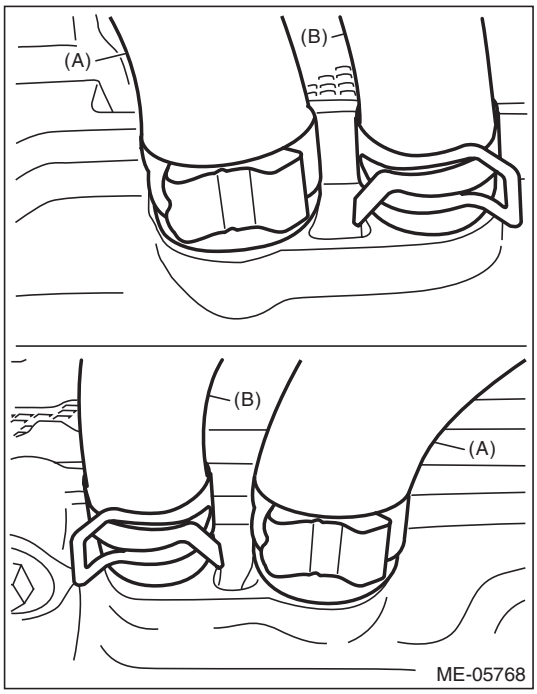
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



11) Connect the PCV hose (A) and PCV hose assembly (B) to the rocker cover.

NOTE:
Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS



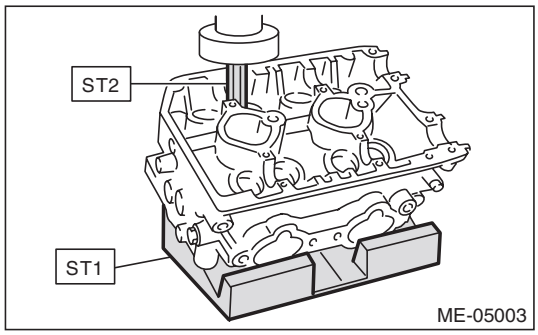


12) Install the timing belt cover. <Ref. to ME(w/o STI)-47, INSTALLATION, Timing Belt Cover.>
13) Install the crank pulley. <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>
14) Install the intake manifold. <Ref. to FU(w/o STI)-22, INSTALLATION, Intake Manifold.>
15) Install the rear side belt. <Ref. to ME(w/o STI)-39, REAR SIDE BELT, INSTALLATION, V-belt.>
16) Install the engine to the vehicle. <Ref. to ME(w/o STI)-33, INSTALLATION, Engine Assembly.>

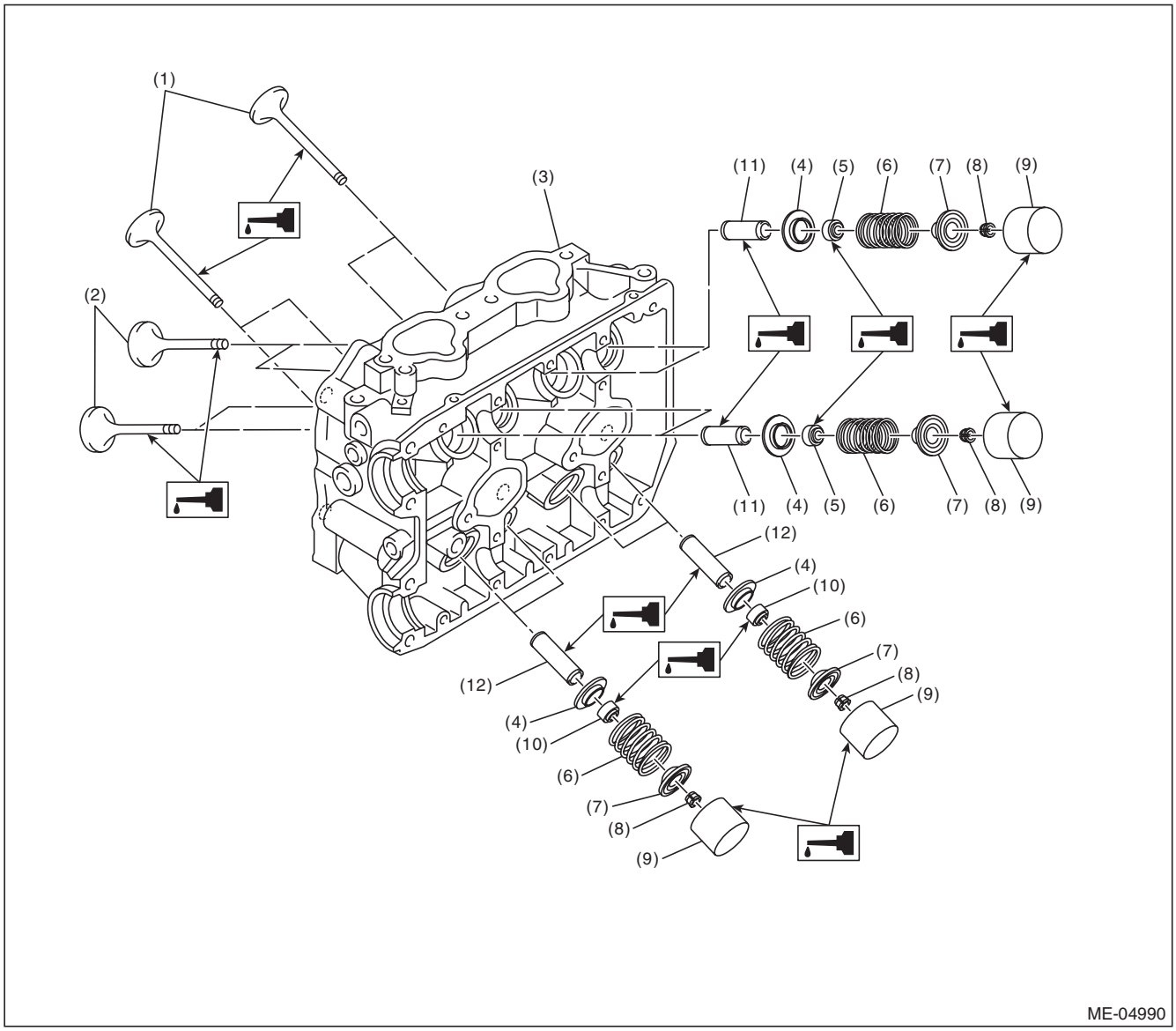
C: DISASSEMBLY

1) Remove the valve lifter.
2) Place the cylinder head on ST1.
ST1 498267600 CYLINDER HEAD TABLE
3) Using ST2, compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.
ST2 499718000 VALVE SPRING REMOVER

NOTE:
- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.
- Keep all the removed parts in order for re-installing in their original positions.
- For removal and installation procedures of the valve guide, intake valve oil seal and exhaust valve oil seal, refer to “INSPECTION”. <Ref. to ME(w/o STI)-73, VALVE GUIDE, INSPECTION, Cylinder Head.> <Ref. to ME(w/o STI)-75, INTAKE AND EXHAUST VALVE OIL SEAL, INSPECTION, Cylinder Head.>



D: ASSEMBLY



(1)	Exhaust valve	(5)	Intake valve oil seal	(9)	Valve lifter
(2)	Intake valve	(6)	Valve spring	(10)	Exhaust valve oil seal
(3)	Cylinder head	(7)	Valve spring retainer	(11)	Intake valve guide
(4)	Valve spring seat	(8)	Valve spring retainer key	(12)	Exhaust valve guide

1) Install the valve spring and valve.
   (1) Coat the valve stem of each valve with engine oil and insert the valve into valve guide.

NOTE:
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

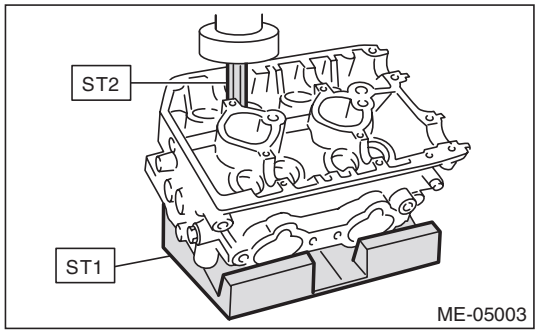
   (2) Set the cylinder head on ST1.

ST1 498267600 CYLINDER HEAD TABLE

   (3) Install the valve spring and valve spring retainer.

NOTE:
Be sure to install the valve spring with its close-coiled end facing the cylinder head side.

(4) Set the ST2 on valve spring.
ST2 499718000 VALVE SPRING REMOVER



(5) Compress the valve spring and fit the valve spring retainer key.
(6) After installing, tap the valve spring retainers lightly with a plastic hammer for better seating.

2) Apply oil to the surface of valve lifter.
3) Install the valve lifter.

E: INSPECTION

1. CYLINDER HEAD

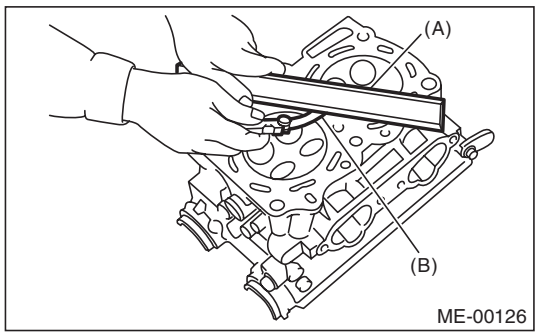
1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.
2) Measure the warping of the cylinder head surface that mates with cylinder block using a straight edge (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:
0.3 mm (0.012 in)

Standard height of cylinder head:
127.5 mm (5.02 in)

NOTE:
Uneven torque for the cylinder head bolts can cause warpage. When reinstalling, pay special attention to the torque so as to tighten evenly.

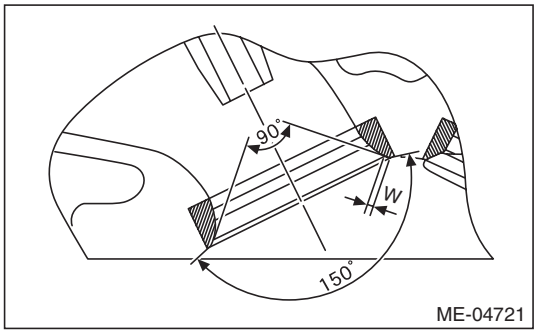


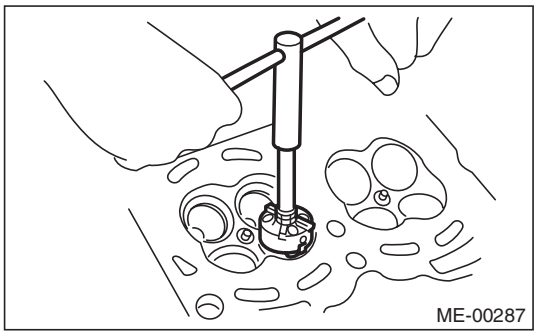
2. VALVE SEAT

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
0.6 — 1.4 mm (0.024 — 0.055 in)
Exhaust
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
0.030 — 0.057 mm (0.0012 — 0.0022 in)
Exhaust
0.040 — 0.067 mm (0.0016 — 0.0026 in)

2) If the clearance between valve guide and valve stem exceeds the standard, replace the valve guide or valve itself, whichever shows the greater amount of wear or damage. See the following procedure for valve guide replacement.

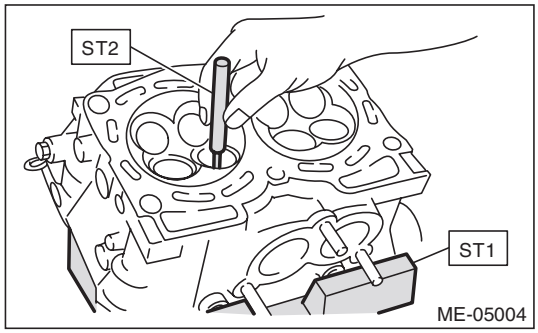
Valve guide inner diameter:
6.000 — 6.012 mm (0.2362 — 0.2367 in)

Valve stem outer diameters:
Intake
5.955 — 5.970 mm (0.2344 — 0.2350 in)
Exhaust
5.945 — 5.960 mm (0.2341 — 0.2346 in)

(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides fit the holes in ST1.

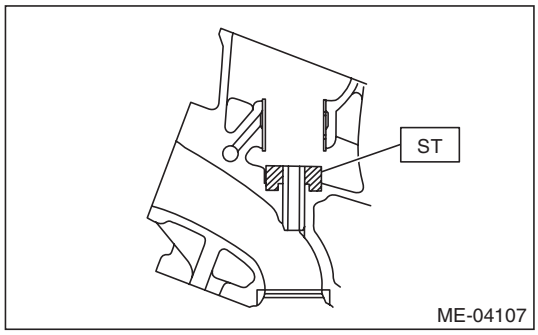
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267600 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



(3) Turn the cylinder head upside down and place the ST as shown in the figure.

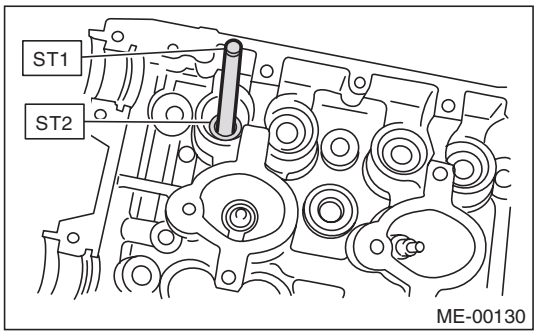
ST 18251AA020 VALVE GUIDE ADJUSTER



(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.

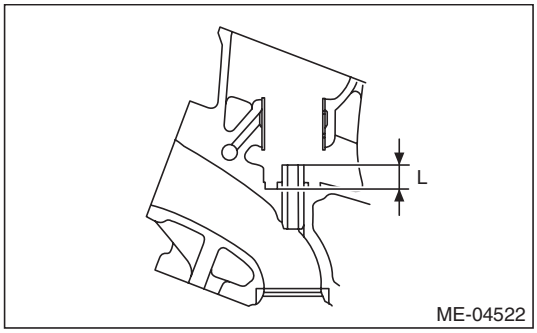
(5) Put a new valve guide, coated with sufficient oil, in the cylinder head, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499767200 VALVE GUIDE REMOVER
ST2 18251AA020 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion amount "L".

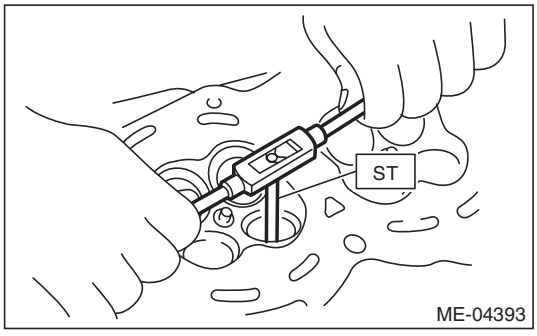
Valve guide protrusion amount L:
15.8 — 16.2 mm (0.622 — 0.638 in)



(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



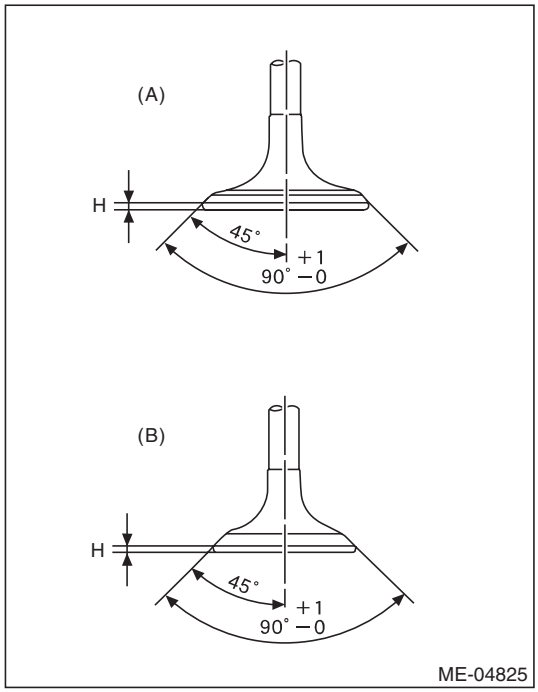
(8) After reaming, clean the valve guide to remove chips.
(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

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:

Standard
Intake (A)
1.0 — 1.4 mm (0.039 — 0.055 in)
Exhaust (B)
1.3 — 1.7 mm (0.051 — 0.067 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.

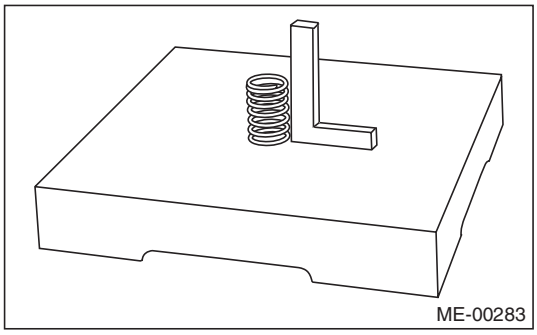
NOTE:
It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

Valve overall length:
Intake
104.4 mm (4.110 in)
Exhaust
104.65 mm (4.1201 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)	47.32 (1.863)
Tension/spring height N (kgf, lb)/mm (in)	Set	205 — 235 (20.9 — 24.0, 46.1 — 52.8)/36.0 (1.417)
	Lift	426 — 490 (43.4 — 50.0, 95.8 — 110)/26.50 (1.041)
Squareness		2.5°, 2.1 mm (0.083 in) or less



6. INTAKE AND EXHAUST VALVE OIL SEAL

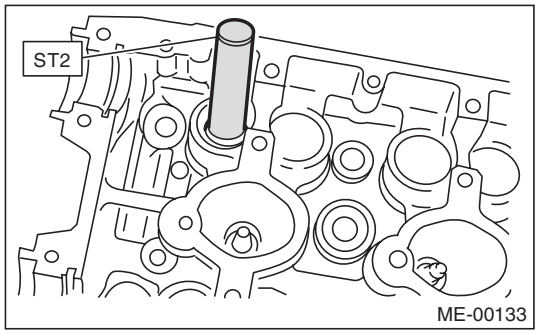
1) For the following, replace the oil seal with a new part. See the procedure 2) and subsequent for replacement procedures.
- When the lip is damaged.
- When the spring is out of the specified position.
- When readjusting the surfaces of valve and valve seat.
- When replacing the valve guide.

2) Place the cylinder head on ST1, and use ST2 to press-fit the oil seal.

ST1	498267600	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.

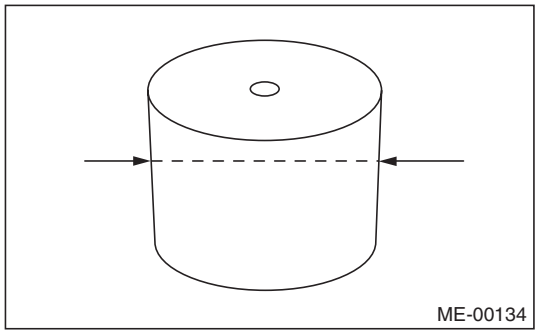
Color of rubber part:
Intake [Gray]
Exhaust [Green]



7. VALVE LIFTER

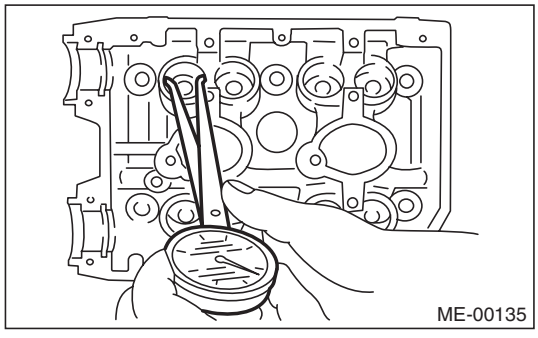
1) Check the valve lifter visually.
2) Measure the outer diameter of valve lifter.

Outer diameter of valve lifter:
Standard
34.959 — 34.975 mm (1.3763 — 1.3770 in)



3) Measure the inner diameter of valve lifter mating surface on cylinder head.

Valve lifter mating surface inner diameter:
Standard
34.994 — 35.016 mm (1.3777 — 1.3786 in)



4) Check the clearance between valve lifter and valve lifter mating surface. The clearance can be checked by measuring the outer diameter of valve lifter and the inner diameter of valve lifter. If it exceeds the standard or offset wear occurs, replace the cylinder head.

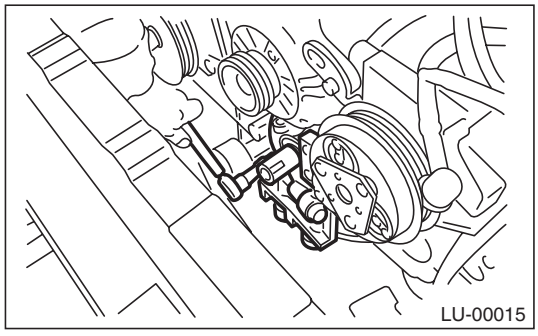
Valve lifter and valve lifter mating surface clearance:
Standard
0.019 — 0.057 mm (0.0007 — 0.0022 in)

20.Cylinder Block

A: REMOVAL

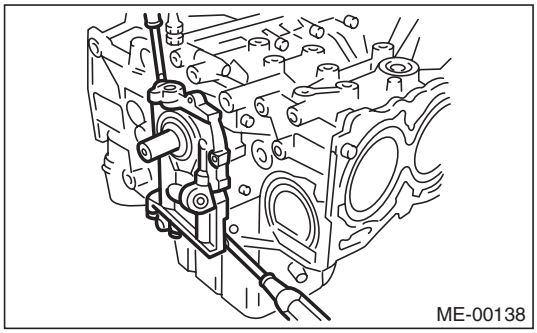
NOTE:
Before conducting this procedure, drain the engine oil completely.
1) Remove the engine from the vehicle. <Ref. to ME(w/o STI)-29, REMOVAL, Engine Assembly.>
2) Remove the rear side belt. <Ref. to ME(w/o STI)-38, REAR SIDE BELT, REMOVAL, V-belt.>
3) Remove the intake manifold. <Ref. to FU(w/o STI)-18, REMOVAL, Intake Manifold.>
4) Remove the crank pulley. <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
5) Remove the timing belt cover. <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
6) Remove the timing belt. <Ref. to ME(w/o STI)-48, REMOVAL, Timing Belt.>
7) Remove the cam sprocket. <Ref. to ME(w/o STI)-57, REMOVAL, Cam Sprocket.>
8) Remove the crank sprocket. <Ref. to ME(w/o STI)-58, REMOVAL, Crank Sprocket.>
9) Remove the generator and A/C compressor with their brackets.
10) Remove the camshaft. <Ref. to ME(w/o STI)-59, REMOVAL, Camshaft.>
11) Remove the cylinder head. <Ref. to ME(w/o STI)-68, REMOVAL, Cylinder Head.>
12) Remove the clutch disc and cover. <Ref. to CL-11, REMOVAL, Clutch Disc and Cover.>
13) Remove the flywheel. <Ref. to CL-14, REMOVAL, Flywheel.>
14) Remove the oil separator cover.
15) Remove the water by-pass pipe for heater.
16) Remove the oil filter. <Ref. to LU(STI)-31, REMOVAL, Engine Oil Filter.>
17) Remove the water pump. <Ref. to CO(w/o STI)-15, REMOVAL, Water Pump.>
18) 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.


LU-00015

19) Remove the oil pump from cylinder block using a flat tip screwdriver.

CAUTION:
Be careful not to scratch the mating surface of the cylinder block and oil pump.

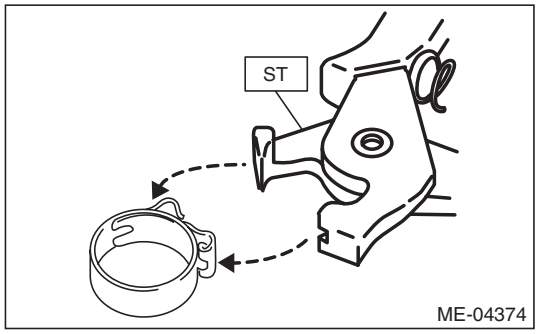

ME-00138

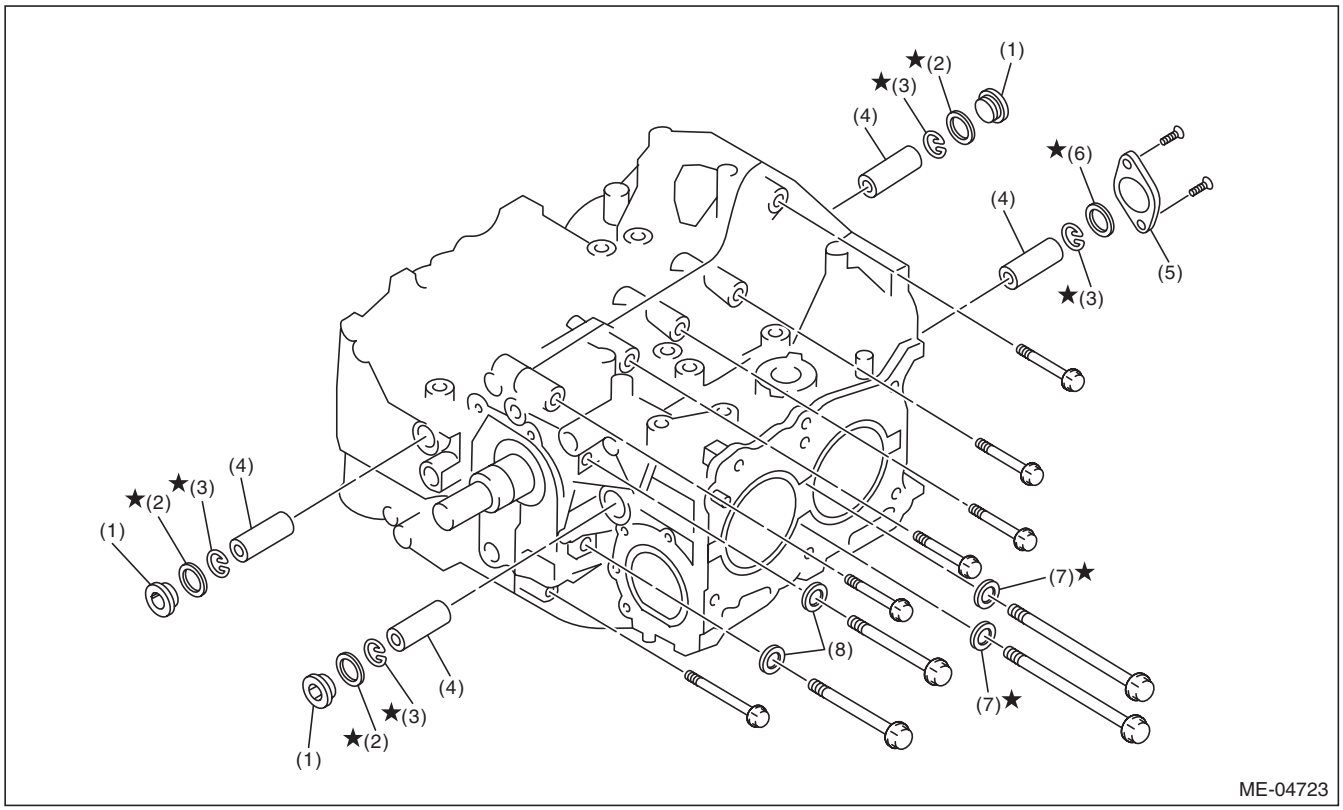
20) Remove the front oil seal from the oil pump.
21) Remove the oil pan.
(1) Set the part so that the cylinder block LH is on the upper side.
(2) Remove the bolts which secure oil pan to cylinder block.
(3) Insert an oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan.

CAUTION:
Do not use a screwdriver or similar tools in place of oil pan cutter.
22) Remove the oil strainer.
23) Remove the baffle plate.

24) Remove the water tank pipe assembly from the cylinder block RH.

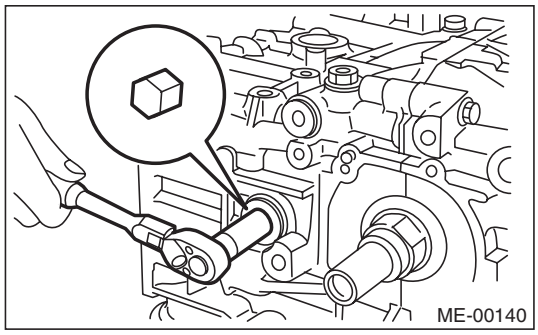
NOTE:
Pinch the clamp of the water tank pipe assembly by fitting the cut out in the ST with the protrusion on the clamp as shown in the figure, and unlock the clamp.
ST 18353AA000 CLAMP PLIERS



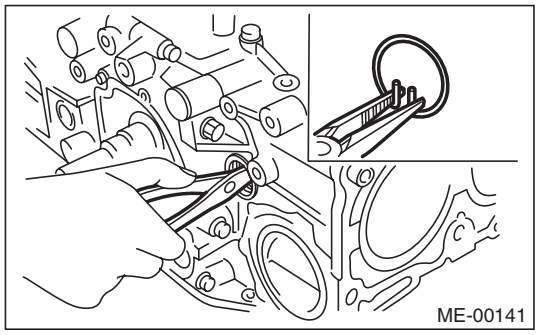


(1) Service hole plug
(2) Gasket
(3) Snap ring
(4) Piston pin
(5) Service hole cover
(6) O-ring
(7) Seal washer
(8) Washer

25) Remove the service hole plugs using a hexagon wrench [14 mm].



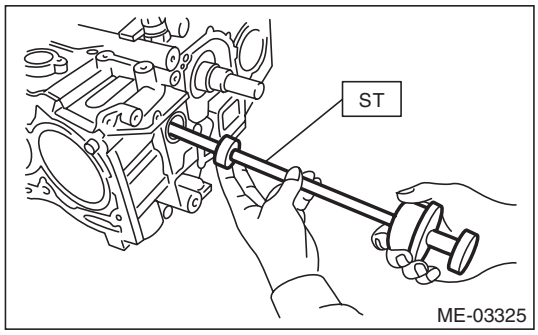
26) Remove the service hole cover.
27) Rotate the crankshaft to bring #1 and #2 pistons to bottom dead center position, then remove the piston snap ring through service hole of #1 and #2 cylinders.



28) Draw out the piston pin from #1 and #2 pistons using ST.

ST	499097700	PISTON PIN REMOVER ASSY

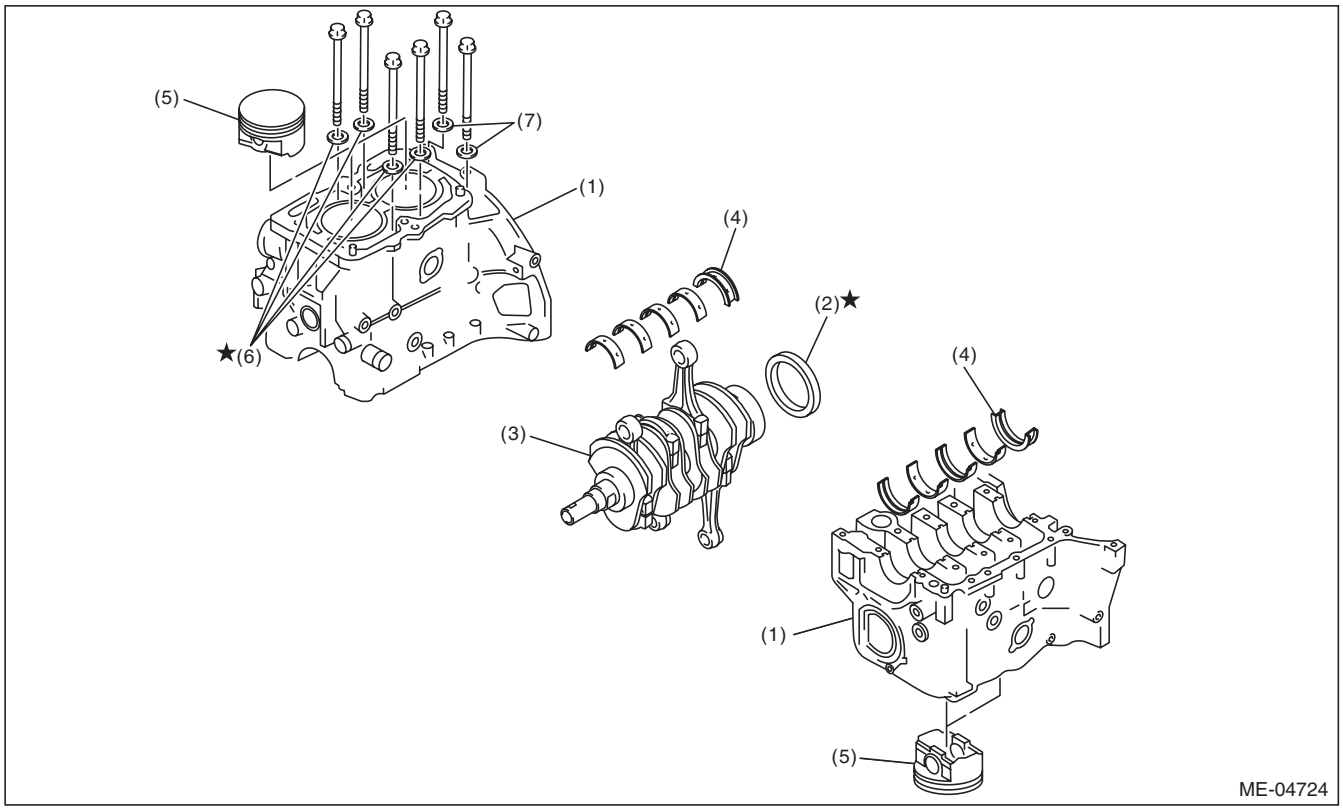
NOTE:
Be careful not to confuse the original combination of piston, piston pin and cylinder.



29) Similarly draw out the piston pins from #3 and #4 pistons.
30) Remove the cylinder block connecting bolt on the RH side.
31) Loosen the cylinder block connecting bolt on the LH side by 2 to 3 turns.
32) Set the part so that the cylinder block LH is on the upper side, and remove the cylinder block connecting bolt.

33) 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

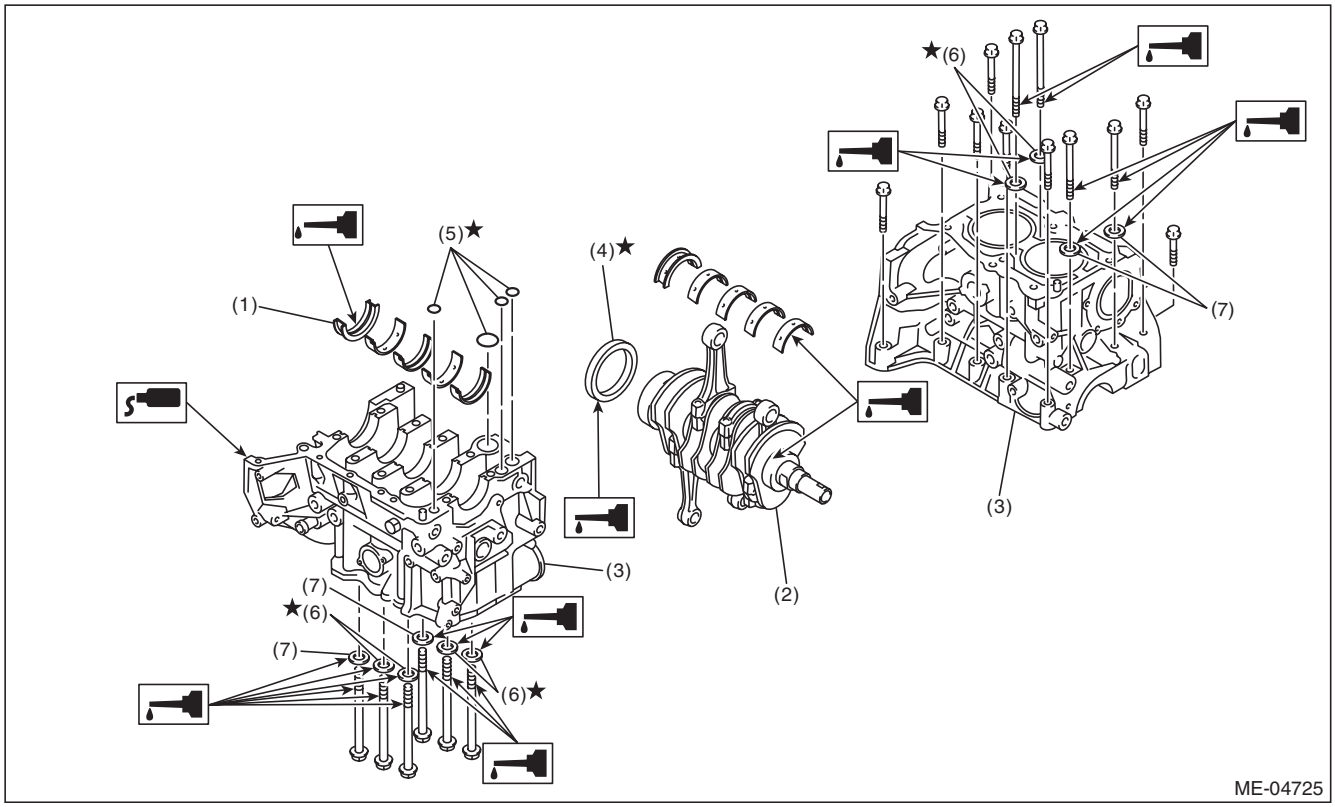
34) Remove the rear oil seal.
35) Remove the crankshaft together with connecting rod.
36) Remove the crankshaft bearings from cylinder block using a hammer handle.

NOTE:
• Press the crankshaft bearing at the end opposite to locking lip to remove.
• Be careful not to confuse the crankshaft bearing combination.

37) 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

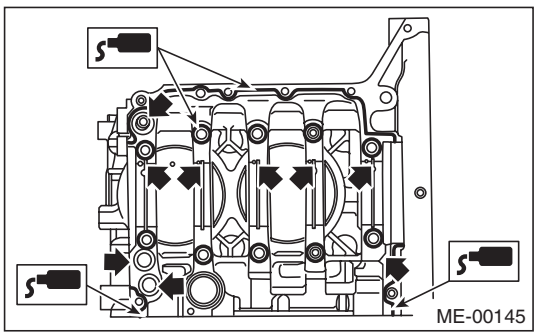
1) Remove oil on the mating surface of cylinder block before installation. Apply a coat of engine oil to the bearing and crankshaft journal.
2) Position the crankshaft and O-ring on cylinder block RH.

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

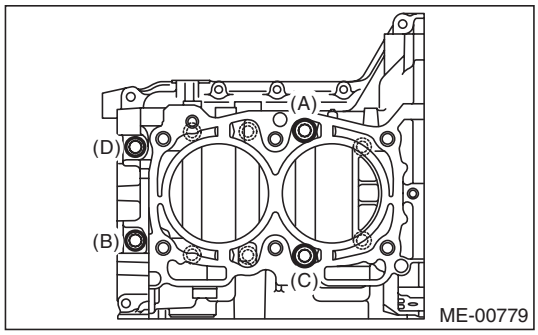


4) Apply a coat of engine oil to the washer and bolt thread.

NOTE:
Use a new seal washer.

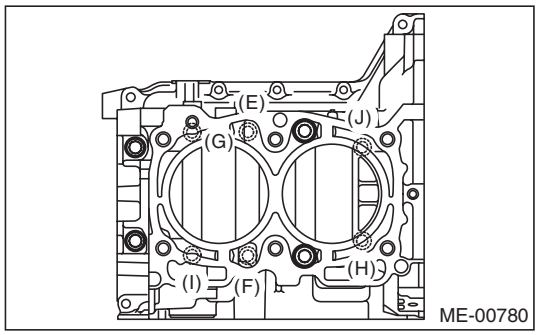
5) Tighten the 10 mm cylinder block connecting bolts on the LH side (A — D) in alphabetical order.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



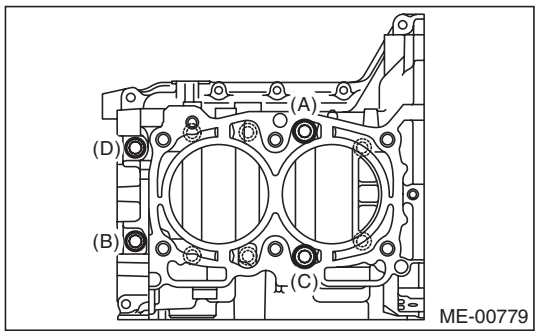
6) Tighten the 10 mm cylinder block connecting bolts on the RH side (E — J) in alphabetical order.

Tightening torque:
10 N·m (1.0 kgf-m, 7.4 ft-lb)



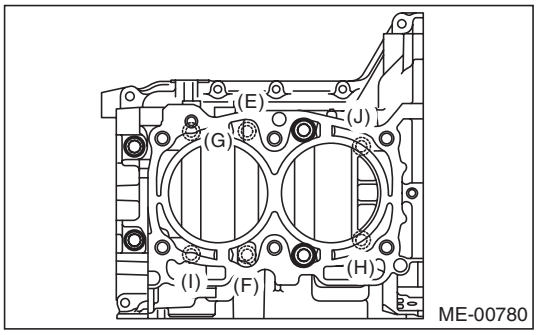
7) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

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)



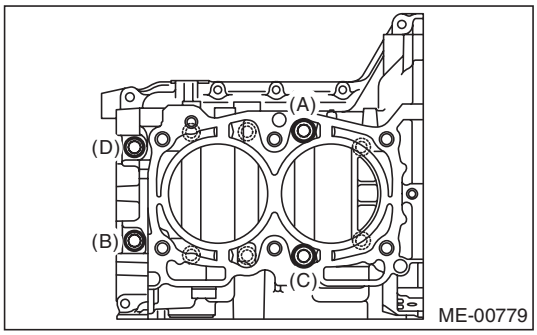
9) Tighten the LH side cylinder block connecting bolts (A — D) further in alphabetical order.

- (A), (C): Angle tightening

Tightening angle:
90°

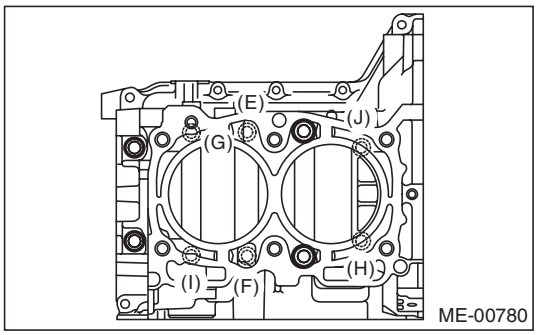
- (B), (D): Torque tightening

Tightening torque:
40 N·m (4.1 kgf-m, 29.5 ft-lb)



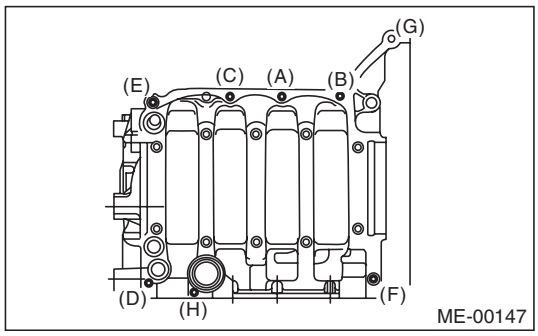
10) Tighten the RH side cylinder block connecting bolts (E — J) further in alphabetical order.

Tightening angle:
90°



11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on the LH side (A — H) in alphabetical order.

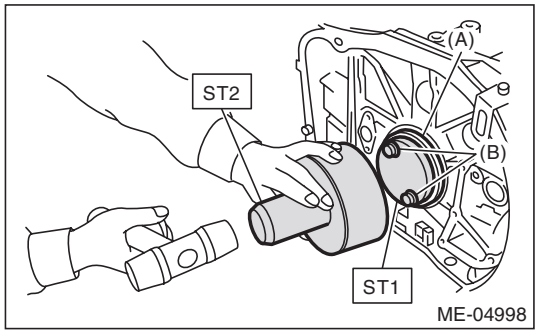
Tightening torque:
(A) — (G): 25 N·m (2.5 kgf-m, 18.4 ft-lb)
(H): 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



12) Apply a coat of engine oil to the oil seal inner periphery and outer periphery, and install the rear oil seal using ST1 and ST2.

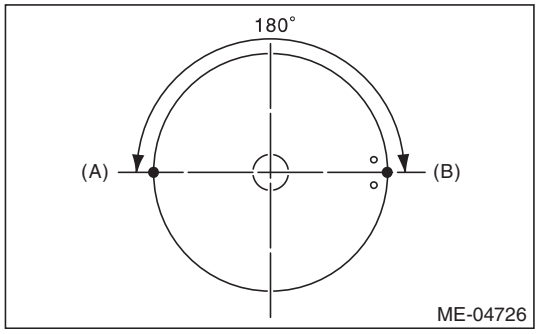
NOTE:
Use a new rear oil seal.

ST1	499597100	CRANKSHAFT OIL SEAL GUIDE
ST2	499587200	CRANKSHAFT OIL SEAL INSTALLER

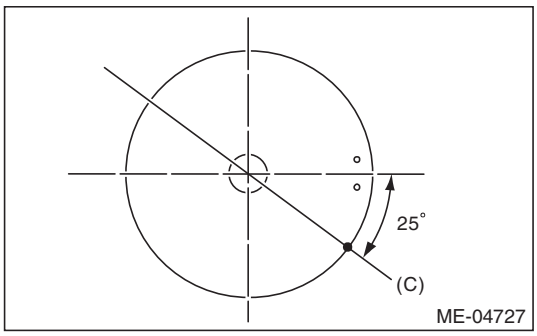


(A) Rear oil seal
(B) Flywheel attachment bolt

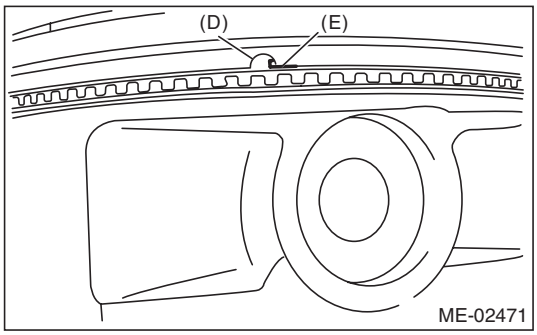
13) Position the top ring gap at (A) or (B) in the figure.
14) Position the second ring gap at 180° on the reverse side the top ring gap.



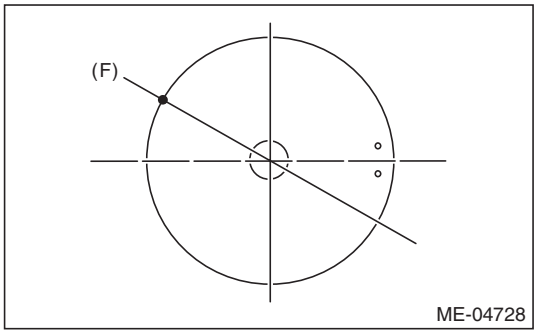
15) Position the upper rail gap at (C) in the figure.



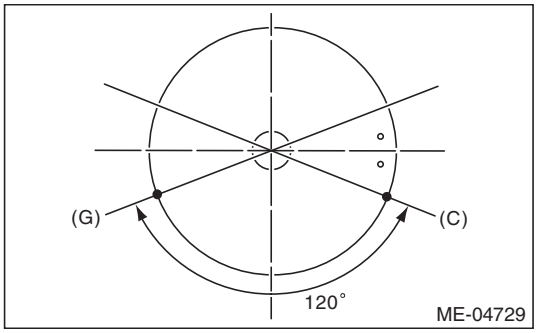
16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



17) Position the expander gap at (F) in the figure on the 180° opposite direction of (C).



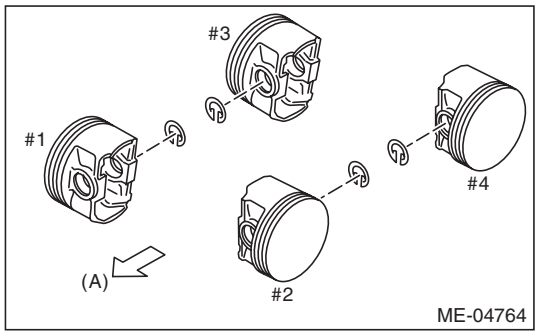
18) Set the lower rail gap at position (G), located 120° clockwise from (C) in the figure.



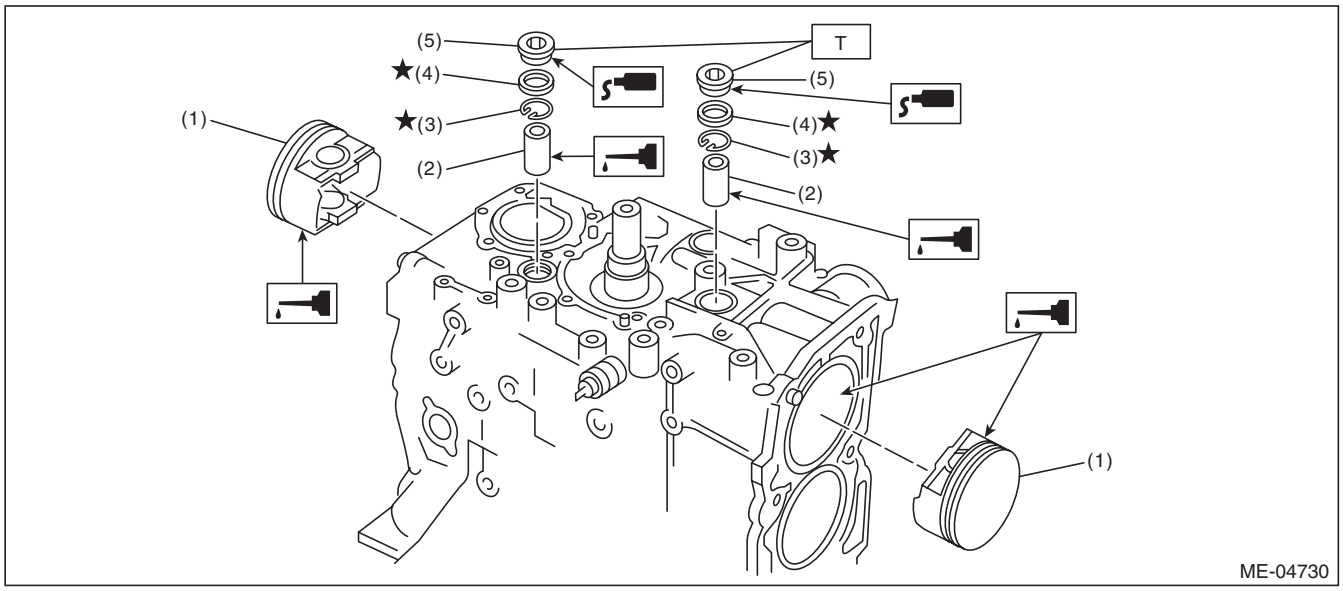
NOTE:
• Make sure ring gaps do not face the same direction.
• Make sure ring gaps are not within the piston skirt area.

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

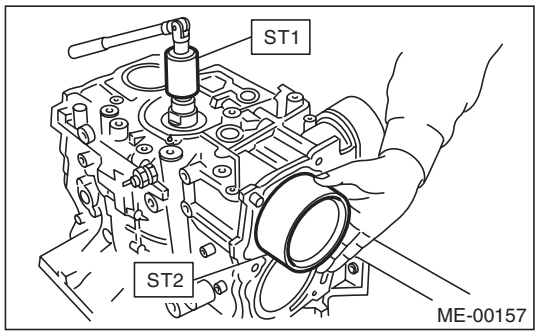
Tightening torque: N·m (kgf-m, ft-lb)
T: 70 (7.1, 51.6)

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.

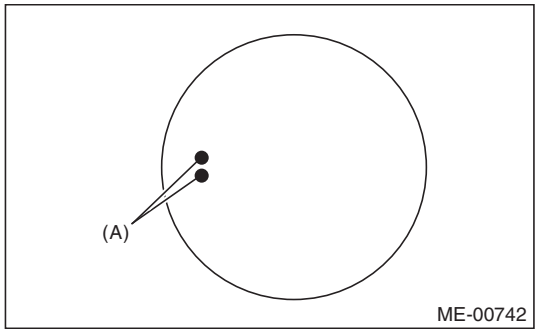
ST1 499987500 CRANKSHAFT SOCKET

(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.



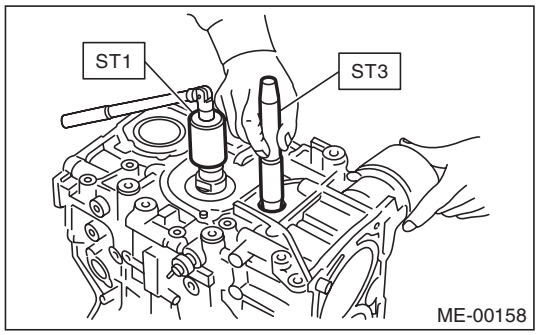
(A) Front mark

21) Install the piston pin.

(1) Apply a coat of engine oil to ST3.

(2) Insert ST3 into the service hole to align the piston pin hole and the connecting rod small end.

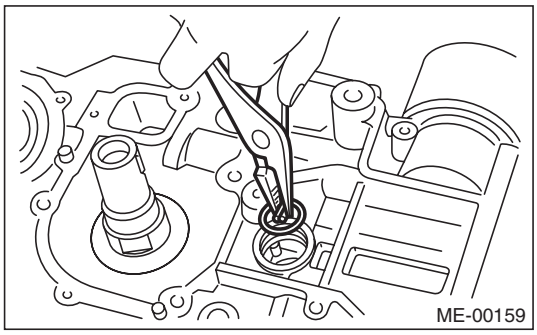
ST3 499017100 PISTON PIN GUIDE



(3) Apply a thin coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.

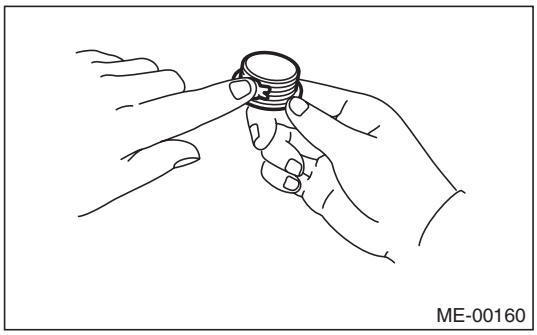
(4) Install the snap ring.

NOTE:
Use new snap rings.



(5) Apply liquid gasket to the threaded portion of the service hole plug.

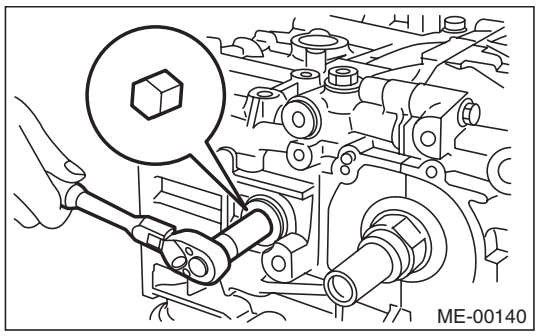
Liquid gasket:
THREE BOND 1105 (Part No. 004403010) or equivalent

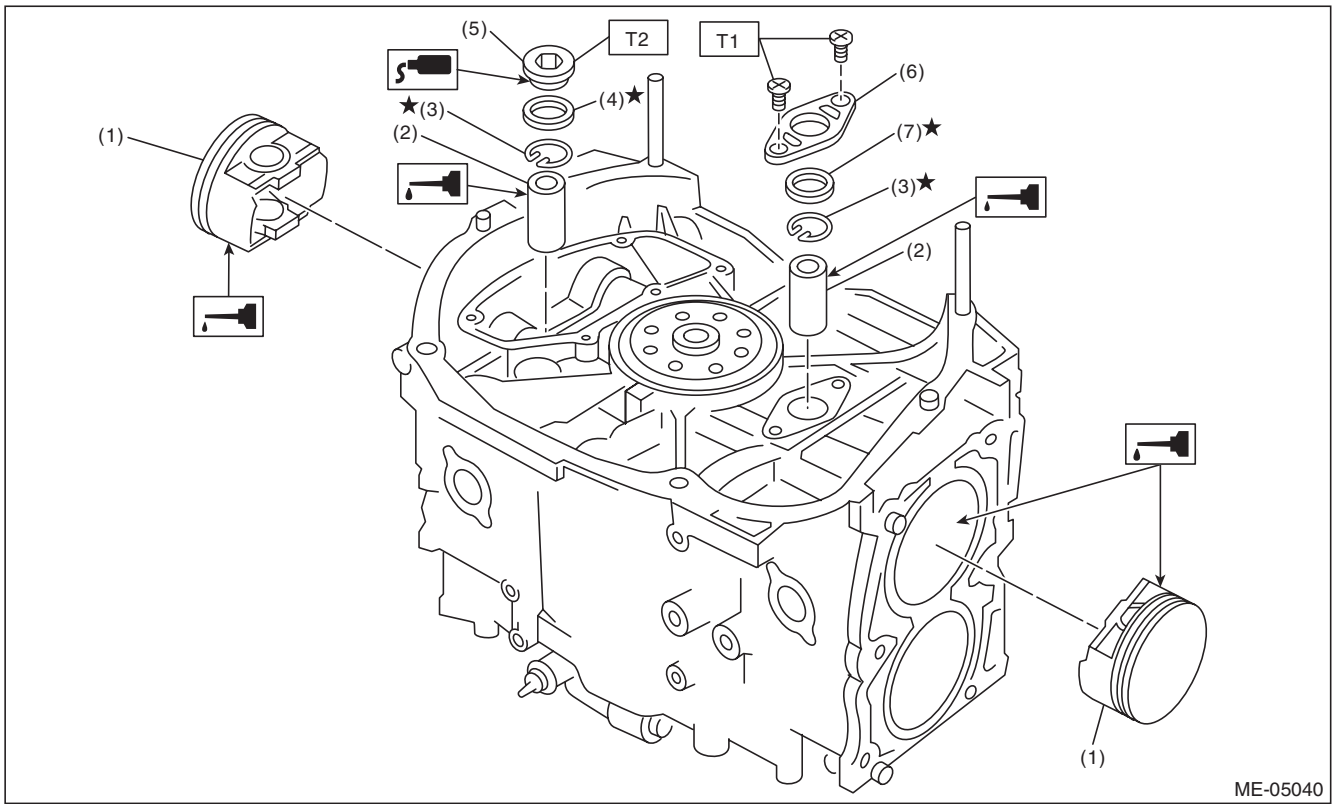


(6) Install the service hole plug and gasket.

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.

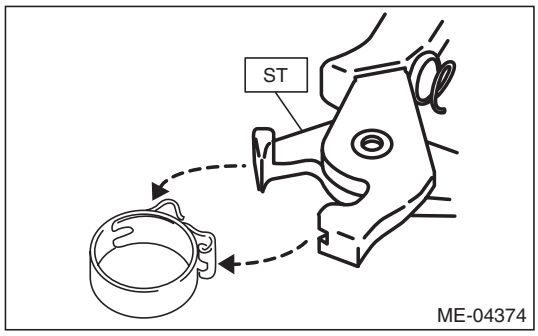
(8) Install the service hole cover.

NOTE:
Use new O-rings.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

22) Install the water tank pipe assembly onto the cylinder block RH.

NOTE:
Use a new clamp for the water tank pipe assembly clamp, fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS



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, 7.2 ft-lb)

25) Tighten the oil strainer stay together with the baffle plate.

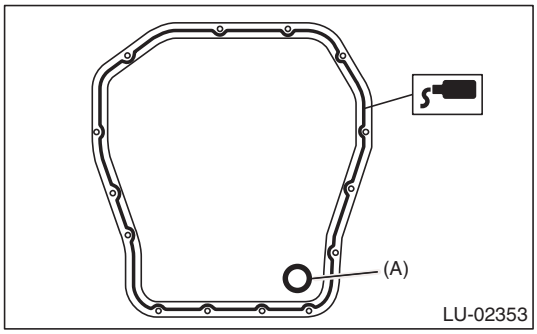
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

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)



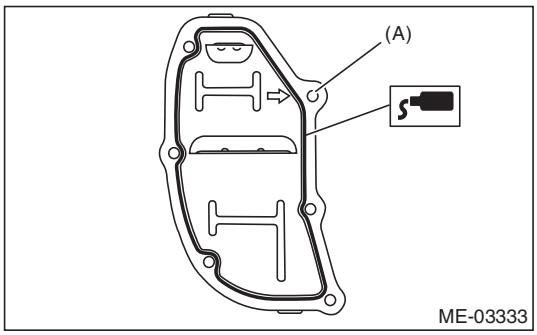
(A) Gasket

27) Apply liquid gasket to the mating surface of 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.

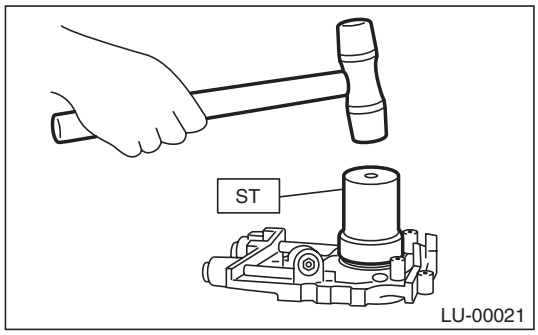
Liquid gasket:
Mating surface
THREE BOND 1217G (Part No. K0877Y0100) or equivalent
Bolt thread (A) (when reusing the bolt)
THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



28) Install the flywheel. <Ref. to CL-14, INSTALLATION, Flywheel.>
29) Install the clutch disc and cover. <Ref. to CL-11, INSTALLATION, Clutch Disc and Cover.>
30) Install the oil pump.
(1) Using the ST, install the front oil seal.
ST 499587100 OIL SEAL INSTALLER

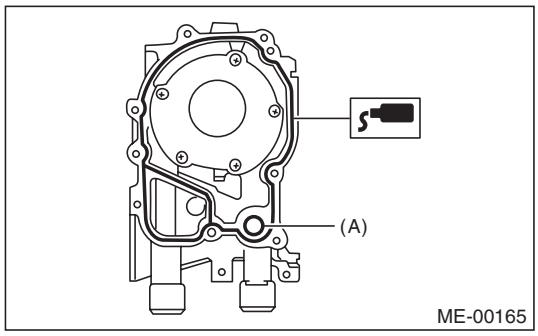
NOTE:
Use a new front oil seal.



(2) Apply liquid gasket to the mating surfaces of oil pump.

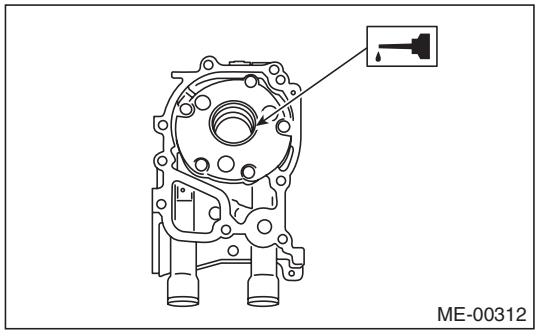
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



(A) O-ring

(3) Apply a thin coat of engine oil to the inside of front oil seal.



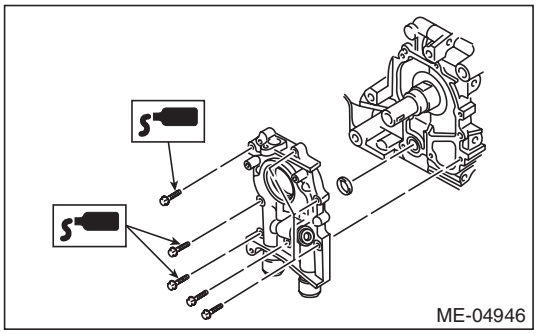
(4) Install the oil pump to cylinder block.

CAUTION:
• Be careful not to damage the front oil seal during installation.
• Make sure the front oil seal lip is not folded.

NOTE:
• Align the flat surface of oil pump's inner rotor with that of 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

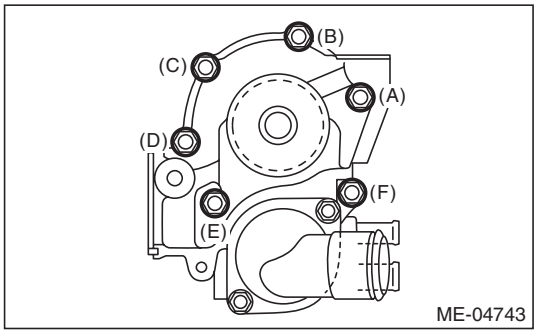
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



31) 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)



32) Install the water by-pass pipe for heater.

Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

33) Install the oil filter. <Ref. to LU(STI)-31, INSTALLATION, Engine Oil Filter.>
34) Install the cylinder head. <Ref. to ME(w/o STI)-68, INSTALLATION, Cylinder Head.>
35) Install the camshaft. <Ref. to ME(w/o STI)-61, INSTALLATION, Camshaft.>
36) Install the generator and A/C compressor with their brackets.

Tightening torque:
36 N·m (3.7 kgf-m, 26.6 ft-lb)

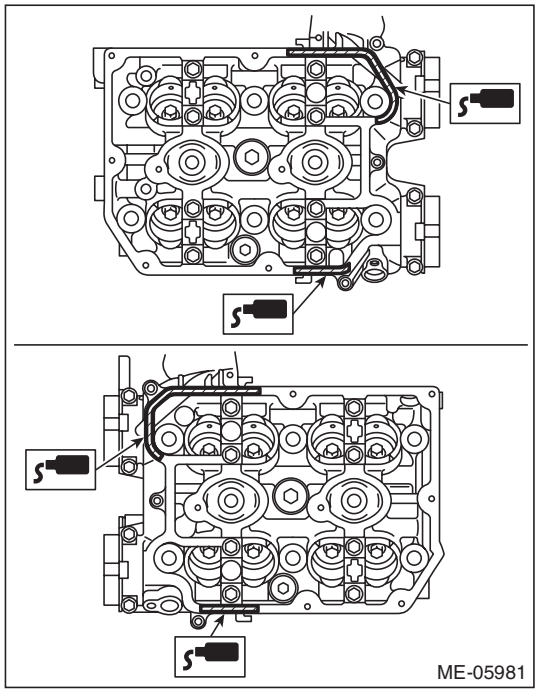
37) Install the crank sprocket. <Ref. to ME(w/o STI)-58, INSTALLATION, Crank Sprocket.>
38) Install the cam sprocket. <Ref. to ME(w/o STI)-57, INSTALLATION, Cam Sprocket.>
39) Install the timing belt. <Ref. to ME(w/o STI)-50, INSTALLATION, Timing Belt.>
40) Adjust the valve clearance. <Ref. to ME(w/o STI)-28, ADJUSTMENT, Valve Clearance.>
41) Install the rocker cover.
(1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:
Use a new rocker cover gasket.

(2) Apply liquid gasket to the specified point of the cylinder head.

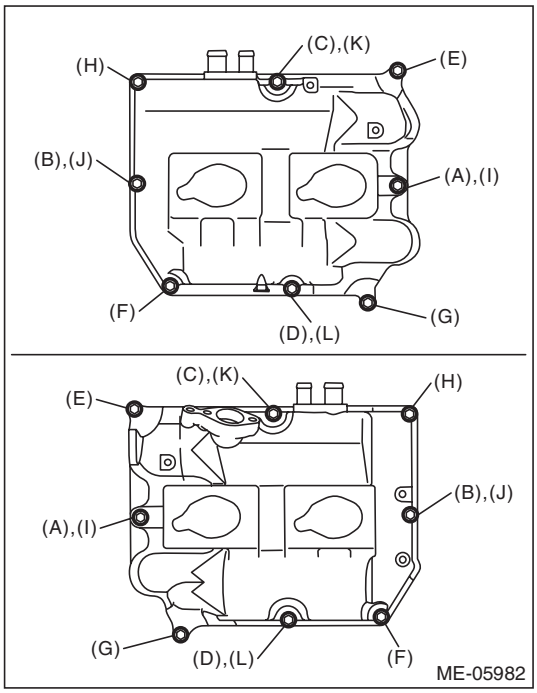
NOTE:
Install within 5 min. after applying liquid gasket.

Liquid gasket:
THREE BOND 1217G (Part No. K0877Y0100) or equivalent



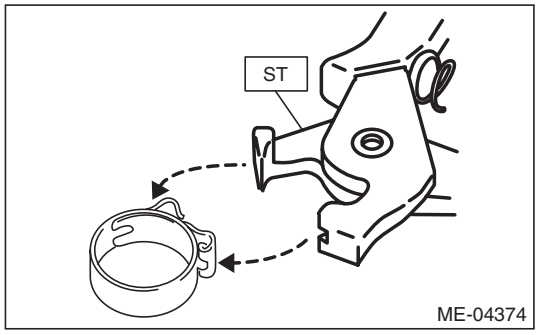
(3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.
(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

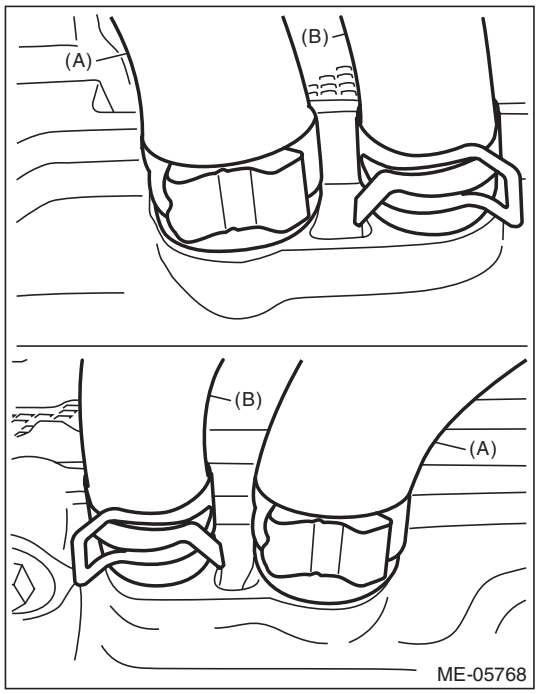
Tightening torque:
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



42) Connect the PCV hose (A) and PCV hose assembly (B) to the rocker cover.

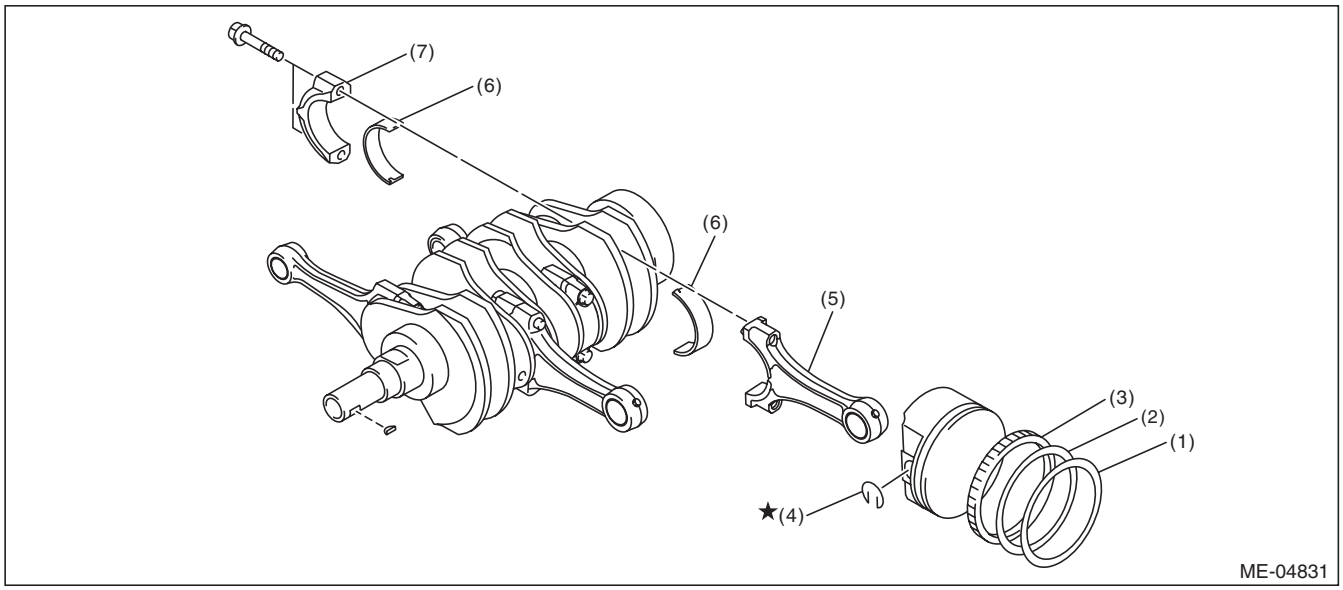
NOTE:
Use a new clamp for the PCV hose (A), fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.
ST 18353AA000 CLAMP PLIERS





43) Install the timing belt cover. <Ref. to ME(w/o STI)-47, INSTALLATION, Timing Belt Cover.>
44) Install the crank pulley. <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>
45) Install the intake manifold. <Ref. to FU(w/o STI)-22, INSTALLATION, Intake Manifold.>
46) Install the rear side belt. <Ref. to ME(w/o STI)-39, REAR SIDE BELT, INSTALLATION, V-belt.>
47) Install the engine to the vehicle. <Ref. to ME(w/o STI)-33, INSTALLATION, Engine Assembly.>

C: DISASSEMBLY



(1) Top ring
(2) Second ring
(3) Oil ring
(4) Snap ring
(5) Connecting rod
(6) Connecting rod bearing
(7) Connecting rod cap

1) Remove the connecting rod cap.
2) Remove the connecting rod bearing.

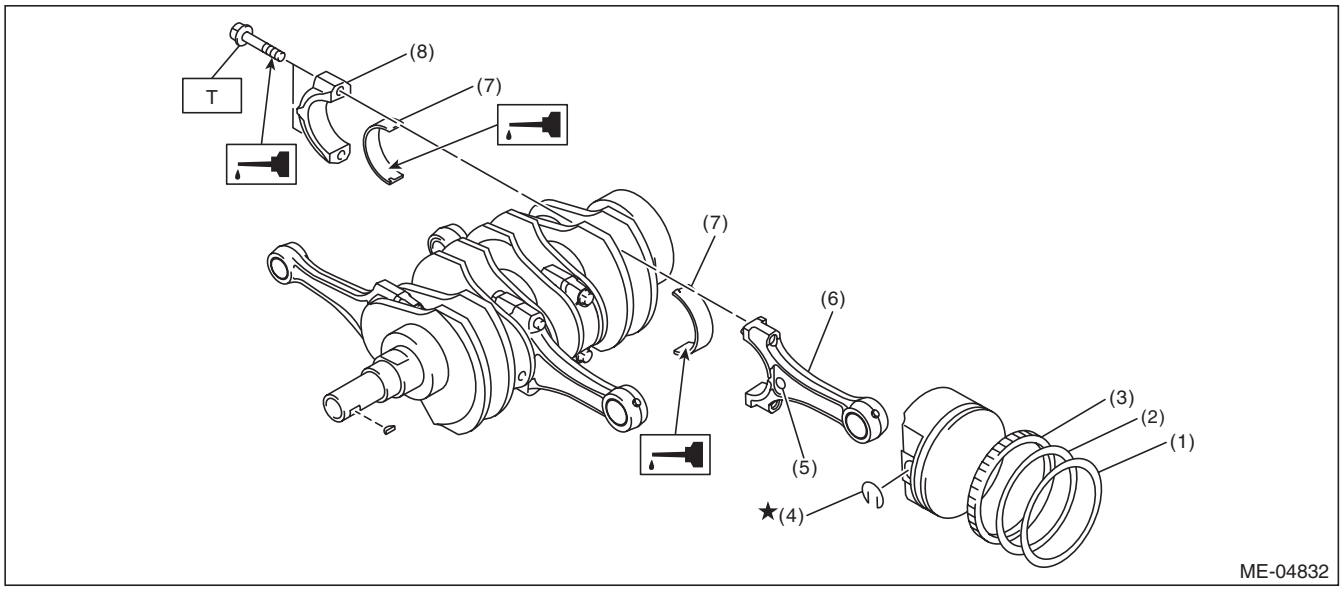
NOTE:
Keep the removed connecting rods, connecting rod caps and bearings in order so that they are kept in their original combinations/groups, and not mixed together.

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) Top ring
(2) Second ring
(3) Oil ring
(4) Snap ring
(5) Side mark
(6) Connecting rod
(7) Connecting rod bearing
(8) Connecting rod cap

Tightening torque: N·m (kgf-m, ft-lb)
T: 52 (5.3, 38.4)

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 it with connecting rod bolt. 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 bolts, apply oil on the threads.

Tightening torque:
52 N·m (5.3 kgf-m, 38.4 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)

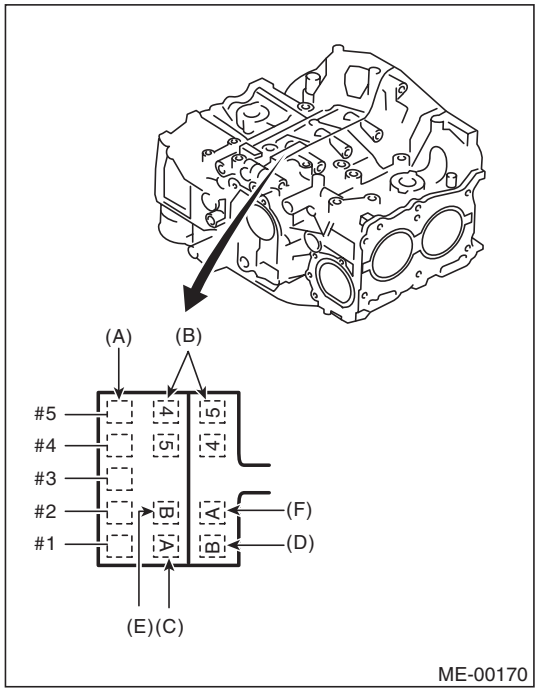
Standard height of cylinder block:
201.0 mm (7.91 in)

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)



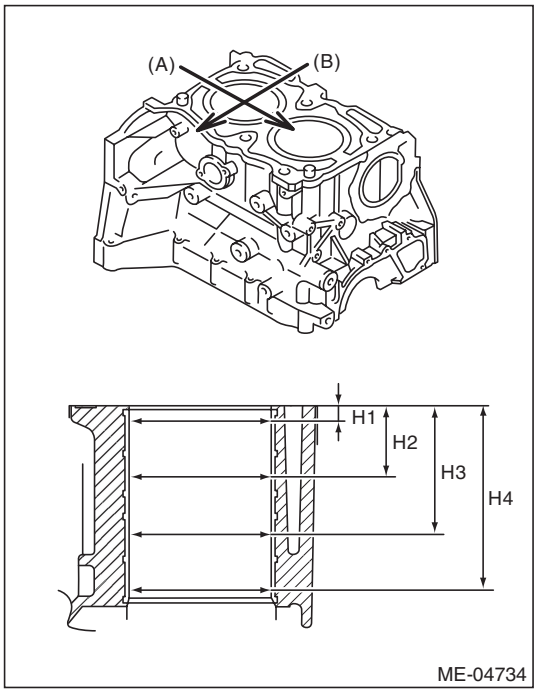
(A) Main journal size mark
(B) Cylinder block (RH) – (LH) combination mark
(C) #1 cylinder bore size mark
(D) #2 cylinder bore size mark
(E) #3 cylinder bore size mark
(F) #4 cylinder bore size mark

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).

Cylindricality:
Limit
0.015 mm (0.0006 in)

Out-of-roundness:
Limit
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)

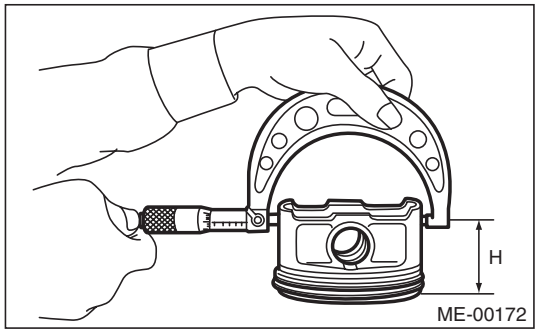
3) When the piston is to be replaced due to general or cylinder wear, select a suitable sized piston by measuring the piston clearance.
4) Measure outer diameter of each piston.
Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

Piston grade point H:
38.2 mm (1.50 in)

Piston outer diameter:

Standard
A: 99.505 — 99.515 mm (3.9175 — 3.9179 in)
B: 99.495 — 99.505 mm (3.9171 — 3.9175 in)
0.25 mm (0.0098 in) oversize
99.745 — 99.765 mm (3.9270 — 3.9278 in)
0.50 mm (0.0197 in) oversize
99.995 — 100.015 mm (3.9368 — 3.9376 in)



5) Calculate the clearance between cylinder and piston.

NOTE:
Measurement should be performed at a temperature of 20°C (68°F).

Clearance between cylinder and piston 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 cylindricality, 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.

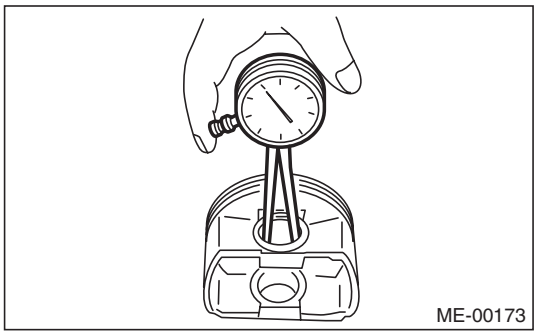
NOTE:
Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, when measuring the cylinder diameter, wait until it has cooled to room temperature.

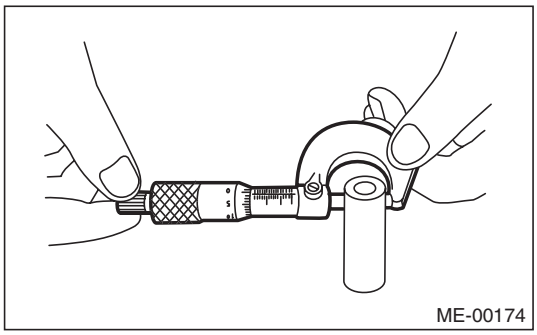
Cylinder inner diameter boring limit (diameter):
To 100.005 mm (3.9372 in)

3. PISTON AND PISTON PIN

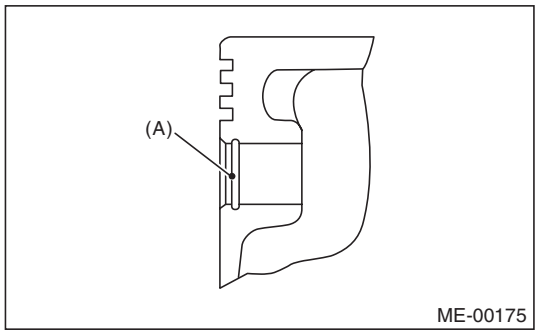
1) Check the piston and piston pin for damage, cracks or wear. Replace if faulty.
2) Check the piston ring groove for wear or damage. Replace if faulty.
3) Make sure that the piston pin can be inserted into the piston pin hole with a thumb at 20°C (68°F). Replace if faulty.

Clearance between piston pin 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.

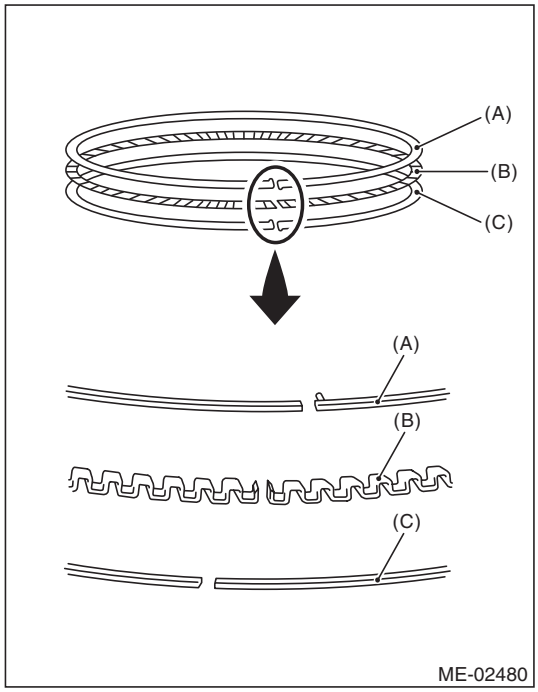


5) Check the snap ring for distortion, cracks and wear.

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.

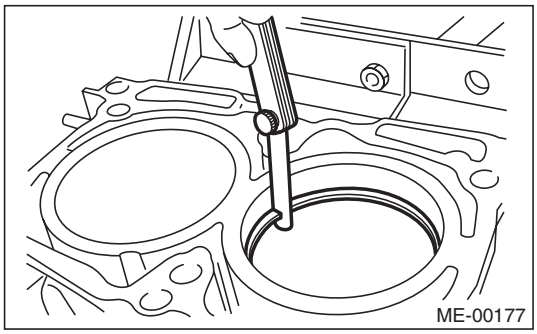
NOTE:
• The top ring and second ring have the mark to determine the direction for installing. When installing the ring to piston, face marks to the top side.
• Oil ring consists of the upper rail, expander and lower rail. When installing oil ring on piston, be careful of the direction of each rail.



(A) Upper rail
(B) Expander
(C) Lower rail

2) Using the piston, insert the piston ring and oil ring into the cylinder block so that they are perpendicular to the cylinder wall, and measure the piston ring gap using a thickness gauge.

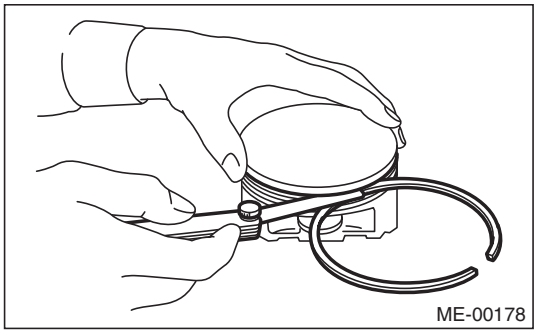
		Standard mm (in)
Piston ring gap	Top ring	0.20 — 0.25 (0.0079 — 0.0098)
	Second ring	0.37 — 0.52 (0.015 — 0.020)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)



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.

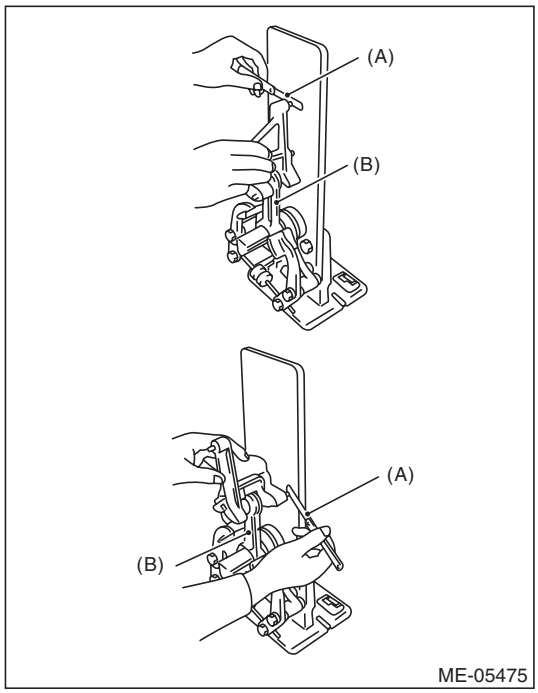
		Standard mm (in)
Clearance between piston ring and piston ring groove	Top ring	0.040 — 0.080 (0.0016 — 0.0031)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)



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.

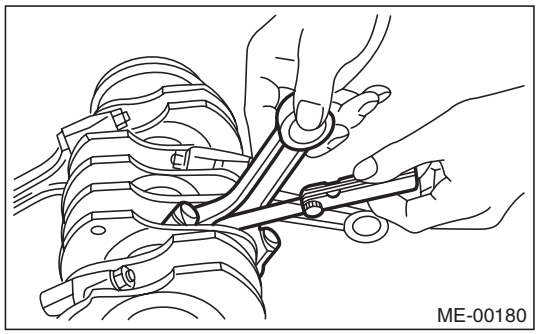
Limit of bend or twist per 100 mm (3.94 in) in length:
0.10 mm (0.0039 in)



(A) Thickness gauge
(B) Connecting rod

3) Install the connecting rod with bearings attached to the crankshaft, and using a thickness gauge, measure the thrust clearance. 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.

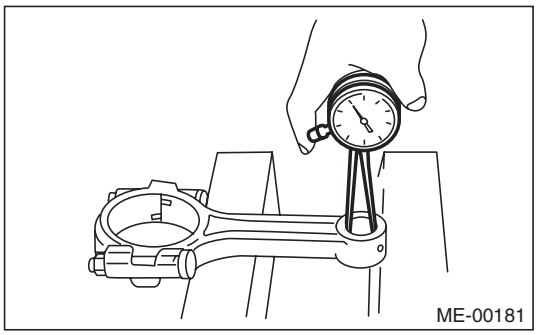
Connecting rod oil clearance:
Standard
0.017 — 0.045 mm (0.0007 — 0.0018 in)

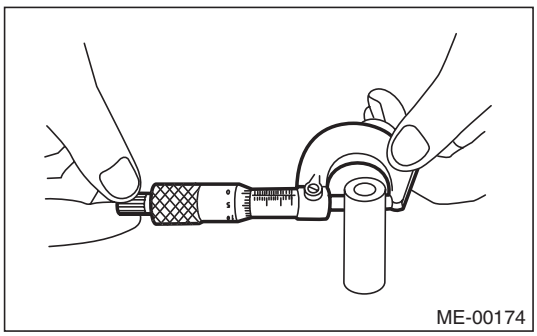
Unit: mm (in)

Bearing	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.490 — 1.506 (0.0587 — 0.0593)	51.976 — 52.000 (2.0463 — 2.0472)
0.03 (0.0012) Undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) Undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0447 — 2.0453)
0.25 (0.0098) Undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

6) Inspect the bushing at connecting rod small end, and replace the connecting rod if it is worn or damaged.
7) Measure the piston pin clearance at connecting rod small end. If the measured value is not within the standard, replace the connecting rod and piston pin as a set.

Clearance between piston pin and bushing:
Standard
0 — 0.022 mm (0 — 0.0009 in)



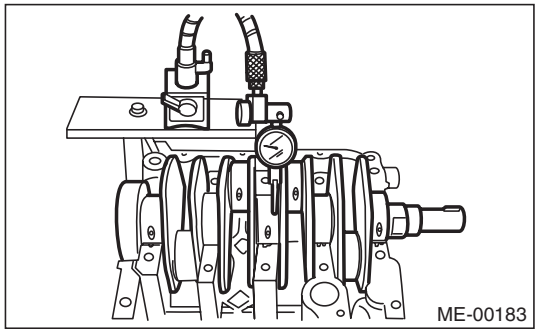


6. CRANKSHAFT AND CRANKSHAFT BEARING

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.

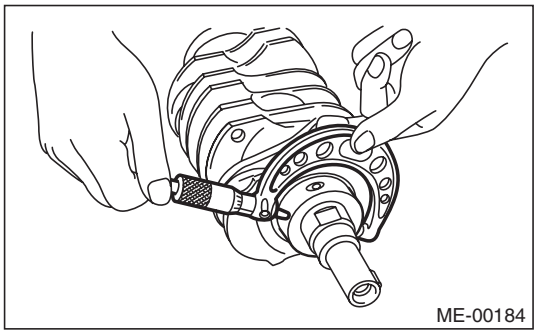
Crankshaft bend limit:
0.035 mm (0.0014 in)



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:
Cylindricality
Limit
0.006 mm (0.0002 in)
Out-of-roundness
Limit
0.005 mm (0.0002 in)
Grinding limit (dia.)
To 51.750 mm (2.0374 in)

Crank journal:
Cylindricality
Limit
0.006 mm (0.0002 in)
Out-of-roundness
Limit
0.005 mm (0.0002 in)
Grinding limit (dia.)
To 59.758 mm (2.3527 in)

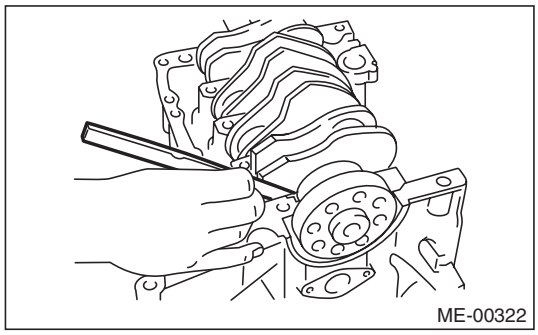


Unit: mm (in)

		Crank journal diameter		Crank pin outer diameter
		#1, #3	#2, #4, #5	
Standard	Journal O.D.	59.984 — 60.008 (2.3616 — 2.3625)	59.984 — 60.008 (2.3616 — 2.3625)	51.976 — 52.000 (2.0463 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.015 (0.0787 — 0.0793)	2.000 — 2.017 (0.0787 — 0.0794)	1.490 — 1.506 (0.0587 — 0.0593)
0.03 (0.0012) Undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) Undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0447 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) Undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

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)

21.Intake and Exhaust Valve

A: SPECIFICATION

Refer to “Cylinder Head” for removal and installation procedures of the intake and exhaust valves. <Ref. to ME(w/o STI)-68, REMOVAL, Cylinder Head.> <Ref. to ME(w/o STI)-68, INSTALLATION, Cylinder Head.>

22.Piston

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of pistons. <Ref. to ME(w/o STI)-77, REMOVAL, Cylinder Block.> <Ref. to ME(w/o STI)-81, INSTALLATION, Cylinder Block.>

23.Connecting Rod

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of connecting rod.
<Ref. to ME(w/o STI)-77, REMOVAL, Cylinder Block.> <Ref. to ME(w/o STI)-81, INSTALLATION, Cylinder Block.>

24.Crankshaft

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of the crankshaft. <Ref. to ME(w/o STI)-77, REMOVAL, Cylinder Block.> <Ref. to ME(w/o STI)-81, INSTALLATION, Cylinder Block.>

25.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 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
	Immobilizer system <Ref. to IM(diag)-2, Basic Diagnostic Procedure.>		A
2) Initial combustion does not occur.	Starter	Defective starter	C
	Engine control system <Ref. to EN(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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(H4DOTC)(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

26.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	• Valve mechanism is defective. • Incorrect valve clearance • Worn camshaft • Broken valve spring
Heavy and dull clank	Oil pressure is low.	• Worn crankshaft main bearing • Worn connecting rod bearing (large end)
	Oil pressure is normal.	• Loosened flywheel mounting bolt • Damaged engine mounting
High-pitched clank	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 between 1,000 and 2,000 rpms.	Sound is reduced when the fuel injector connector of the noisy cylinder is disconnected.*	• 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 the fuel injector connector of the noisy cylinder is disconnected.*	• 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.*	• Unusually worn valve lifter • 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

* 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

EXHAUST

EX(w/o STI)

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1. General Description

A: SPECIFICATION

Specifications for models other than STI model are included in the EX (STI) section. <Ref. to EX(STI)-2, General Description.>

COOLING

CO(w/o STI)

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1. General Description

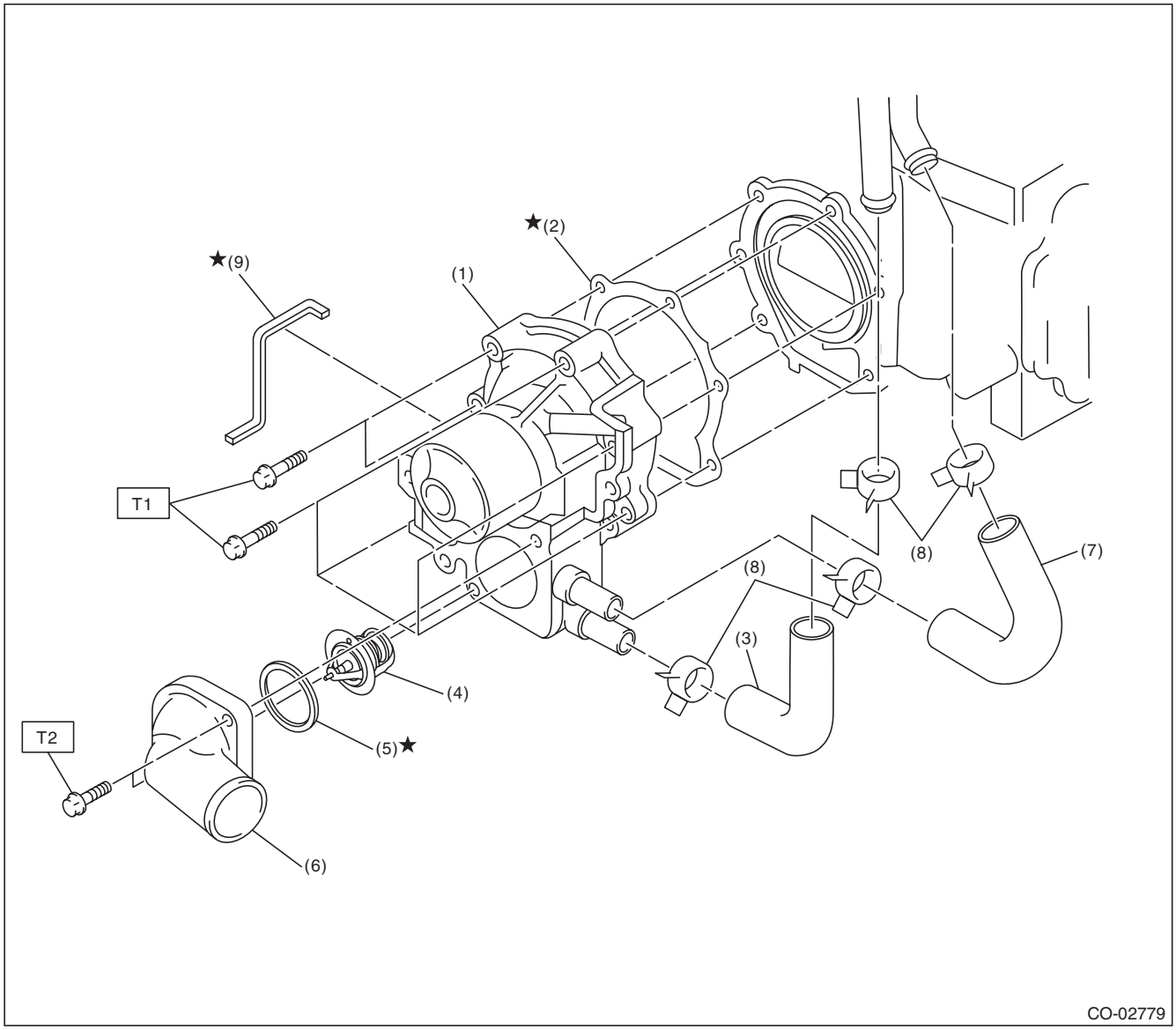
A: SPECIFICATION

Cooling system					Electric fan + Forced engine coolant circulation system
Total engine coolant capacity			L (US qt, Imp qt)		Approx. 7.4 (7.8, 6.5)
Water pump	Type				Centrifugal impeller type
	Discharge performance	Discharge rate	L (US gal, Imp gal)/min.		200 (52.8, 44.0)
		Pump speed — Discharge pressure			6,000 rpm — 225.4 kPa (23.0 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 pump case		mm (in)	Standard	0.5 — 1.5 (0.020 — 0.059)
Thermostat	Type				Wax pellet type
	Starting temperature to open				76 — 80°C (169 — 176°F)
	Fully opens				91°C (196°F)
	Valve lift		mm (in)		9.0 (0.354) or more
	Valve bore		mm (in)		35 (1.38)
Radiator fan	Motor input	Main fan	W		120
		Sub fan	W		120
	Fan diameter / Blade	Main fan			318.5 mm (12.54 in)/9
		Sub fan			318.5 mm (12.54 in)/11
Radiator	Type				Down flow
	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	Coolant filler tank side	kPa (kg/cm^2, psi)	Positive pressure side / Standard	93 — 123 (0.95 — 1.25, 14 — 18)
				Positive pressure side / Limit	83 (0.85, 12)
				Negative pressure side / Standard	–1.0 — –4.9 (–0.01 — –0.05, –0.1 — –0.7)
		Radiator side	kPa (kg/cm^2, psi)	Positive pressure side only / Standard	122 — 152 (1.24 — 1.55, 18 — 22)
				Positive pressure side only / Limit	112 (1.14, 16)
	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	(6)	Thermostat cover
(2)	Gasket	(7)	Coolant filler by-pass hose
(3)	Heater by-pass hose	(8)	Clip
(4)	Thermostat	(9)	Water pump sealing
(5)	Gasket		

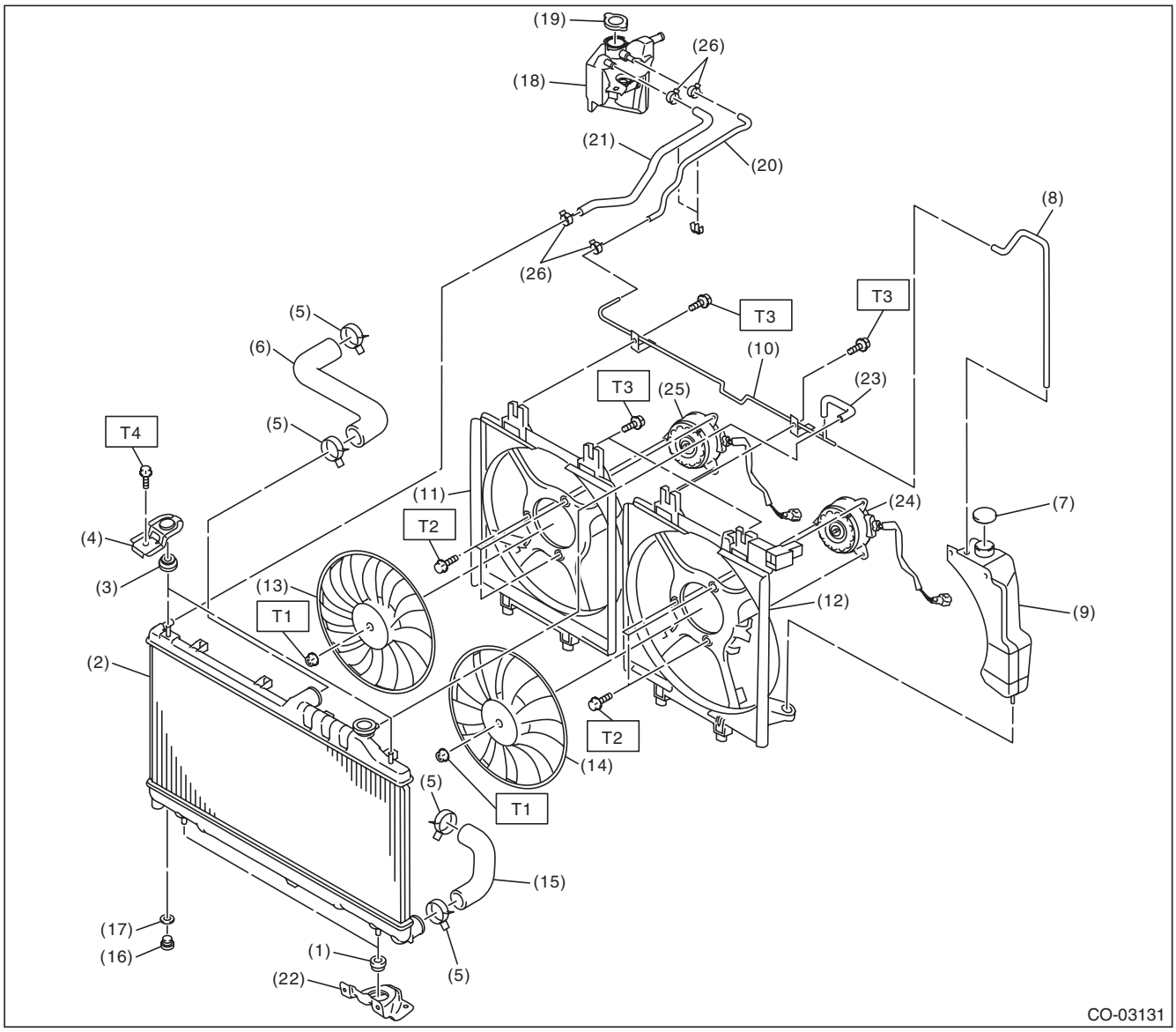
Tightening torque: N·m (kgf-m, ft-lb)

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
(2) Radiator
(3) Radiator upper cushion
(4) Radiator upper bracket
(5) Clip
(6) Radiator inlet hose
(7) Engine coolant reservoir tank cap
(8) Over flow hose A
(9) Engine coolant reservoir tank
(10) Over flow pipe
(11) Radiator sub fan shroud
(12) Radiator main fan shroud
(13) Radiator sub fan
(14) Radiator main fan
(15) Radiator outlet hose
(16) Radiator drain plug
(17) O-ring
(18) Coolant filler tank
(19) Radiator cap (Coolant filler tank cap)
(20) Engine coolant hose A
(21) Engine coolant hose B
(22) Radiator lower bracket
(23) Over flow hose B
(24) Main fan motor
(25) Sub fan motor
(26) Clip

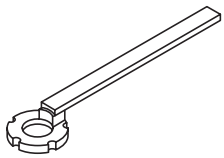
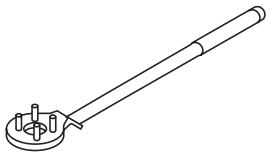
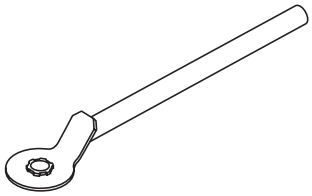
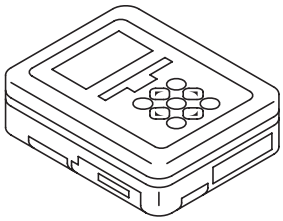
Tightening torque: N·m (kgf-m, ft-lb)	
T1:	*3.4 (0.3, 2.5)*
T2:	*4.41 (0.45, 3.25)*
T3:	*7.5 (0.8, 5.5)*
T4:	*12 (1.2, 8.9)*

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- 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.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- 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-499207400	499207400	CAM SPROCKET WRENCH	Used for removing and installing exhaust cam sprocket.
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used for removing and installing the crank pulley.
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing intake cam sprocket.
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.

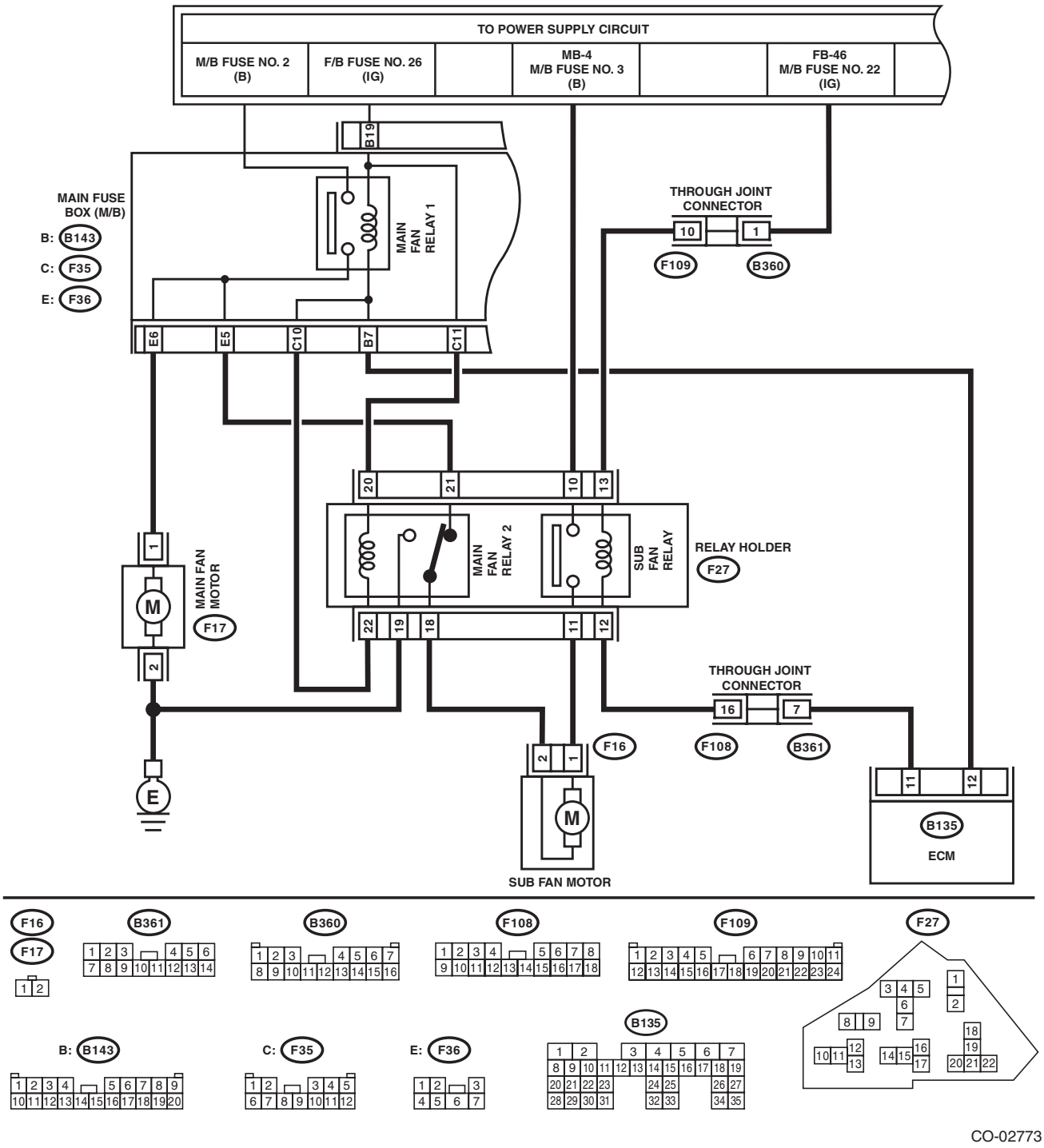
2. GENERAL TOOL

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

Radiator Fan System <Ref. to WI-64, WIRING DIAGRAM, Radiator Fan System.>



CO-02773

B: INSPECTION

OPERATING CONDITION:

Vehicle speed	A/C compressor load	Engine coolant temperature		
		Increase: 94°C (201°F) or less Decrease: 91°C (196°F) or less	Increase: 95 — 96°C (203 — 205°F) Decrease: 92 — 94°C (198 — 201°F)	Increase: 97°C (207°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 — 105 km/h (43 — 65 MPH) During deceleration: 65 — 103 km/h (40 — 64 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
During acceleration: 106 km/h (66 MPH) or more During deceleration: 104 km/h (65 MPH) or more	OFF	OFF	High-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-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) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. 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(H4DOTC)(diag)-63, 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**.
2	**CHECK OPERATION OF RADIATOR FAN.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. 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(H4DOTC)(diag)-63, 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 sub fan relay connector 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 sub fan relay connector 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.

	Step	Check	Yes	No
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.
8	**CHECK SUB FAN RELAY.** 1) Connect the battery to terminals No. 12 and No. 13 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.
9	**CHECK HARNESS BETWEEN SUB FAN RELAY CONNECTOR AND SUB FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the sub fan motor. 2) Measure the resistance of harness between sub fan relay connector and sub fan motor connector. ***Connector & terminal*** ***(F16) No. 1 — (F27) No. 11:***	Is the resistance less than 1 Ω?	Go to step **10**.	Repair the open circuit of harness between sub fan relay connector and sub fan motor connector.
10	**CHECK HARNESS BETWEEN SUB FAN MOTOR 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 connector and main fan relay 2 connector. ***Connector & terminal*** ***(F16) No. 2 — (F27) No. 18:***	Is the resistance less than 1 Ω?	Go to step **11**.	Repair the open circuit of the harness between sub fan motor connector and main fan relay 2 connector.
11	**CHECK FOR POOR CONTACT.** Check poor contact of sub fan motor connector.	Is there poor contact of the sub fan motor connector?	Repair the poor contact of sub fan motor connector.	Go to step **12**.
12	**CHECK SUB FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 of the sub fan motor, and the ground (–) terminal to terminal No. 2.	Does the radiator sub fan rotate?	Go to step **13**.	Replace the sub fan motor.
13	**CHECK MAIN FAN RELAY 2.** Measure the resistance between main fan relay 2 terminals. ***Terminals*** ***No. 21 — No. 18:***	Is the resistance less than 1 Ω?	Go to step **14**.	Replace the main fan relay 2.
14	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 CONNECTOR AND MAIN FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 2 connector and main fan motor connector. ***Connector & terminal*** ***(F17) No. 1 — (F27) No. 21:***	Is the resistance less than 1 Ω?	Go to step **15**.	Repair the open circuit of the harness between main fan relay 2 connector and main fan motor connector.

	Step	Check	Yes	No
15	**CHECK MAIN FAN MOTOR AND GROUND CIRCUIT.** Measure the resistance between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 2 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **16**.	Repair the open circuit of the harness between main fan motor connector and chassis ground.
16	**CHECK FOR POOR CONTACT.** Check poor contact of main fan motor connector.	Is there poor contact of the main fan motor connector?	Repair the poor contact of main fan motor connector.	Go to step **17**.
17	**CHECK MAIN FAN MOTOR.** Connect the battery positive (+) terminal to terminal No. 1 of the main fan motor, and the ground (–) terminal to terminal No. 2.	Does the radiator main fan rotate?	Go to step **18**.	Replace the main fan motor.
18	**CHECK HARNESS BETWEEN SUB FAN RELAY CONNECTOR AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between the sub fan relay connector and ECM connector. ***Connector & terminal*** ***(B135) No. 11 — (F27) No. 12:***	Is the resistance less than 1 Ω?	Go to step **19**.	Repair the open circuit of harness between sub fan relay connector and ECM.
19	**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.	Check the DTC. Repair the trouble cause. <Ref. to EN(H4DOTC)(diag)-47, 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 between terminals of main fan relay 1 switch.	Is the resistance 1 MΩ or more?	Go to step **21**.	Replace the main fan relay 1.
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 of main fan relay 1 switch.	Is the resistance less than 1 Ω?	Go to step **22**.	Replace the main fan relay 1.
22	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 CONNECTOR AND MAIN FAN MOTOR CONNECTOR.** 1) Disconnect the connector from the main fan motor. 2) Measure the resistance of the harness between main fan relay 1 connector and main fan motor connector. ***Connector & terminal*** ***(F17) No. 1 — (F36) No. 6:***	Is the resistance less than 1 Ω?	Go to step **23**.	Repair the open circuit of the harness between main fan relay 1 connector and main fan motor connector.
23	**CHECK HARNESS BETWEEN MAIN FAN RELAY 1 CONNECTOR AND ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between the main fan relay 1 connector and ECM connector. ***Connector & terminal*** ***(B135) No. 12 — (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 connector and ECM.

	Step	Check	Yes	No
24	**CHECK HARNESS BETWEEN MAIN FAN RELAY 2 CONNECTOR AND ECM.** Measure the resistance between the main fan relay 2 connector and ECM connector. ***Connector & terminal*** ***(B135) No. 12 — (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 connector and ECM.
25	**CHECK FUSE.** 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 2 and No. 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step **26**.
26	**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.	Repair the power supply circuit to the main fuse box.
27	**CHECK OPERATION OF RADIATOR FAN.** If the both 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 main fan relay 2 from the relay holder. 2) Measure the resistance between main fan relay 2 connector 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 connector 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 connector 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 between main fan relay 2 terminals. ***Terminals*** ***No. 18 — No. 19:***	Is the resistance 1 MΩ or more?	Go to step **31**.	Replace the main fan relay 2.
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 between main fan relay 2 terminals. ***Terminals*** ***No. 18 — No. 19:***	Is the resistance less than 1 Ω?	Go to step **23**.	Replace the main fan relay 2.

3. Engine Coolant

A: INSPECTION

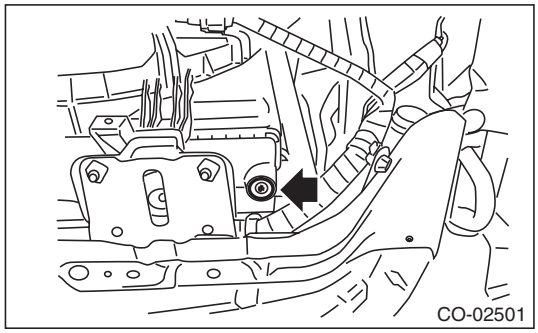
NOTE:
When adding the engine coolant, always use SUBARU Super Coolant.
1) Park the vehicle on a level surface.
2) Check the engine coolant amount, and if the coolant level is low, check for the coolant leakage, and then add the engine coolant.
(1) Make sure the engine coolant level in the reservoir tank is between "FULL" and "LOW" with the engine in a cold condition.
(2) Open the cap of coolant filler tank, and check that the engine coolant is filled up to the filler neck position.

B: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Remove the drain plug to drain engine coolant into container.

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



4) Install the drain plug.
5) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>

2. FILLING OF ENGINE COOLANT

1) Pour cooling system conditioner through the filler neck of coolant filler tank.

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

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

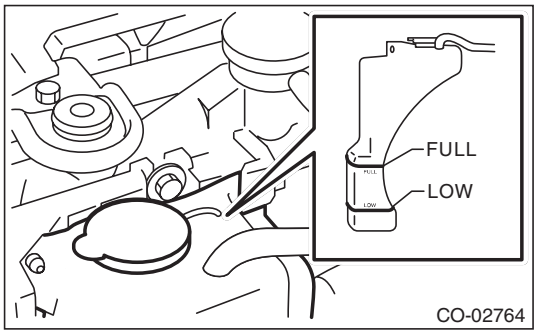
Recommended engine coolant:
Refer to "SPECIFICATION" for recommended engine coolant. <Ref. to CO(w/o STI)-2, SPECIFICATION, General Description.>

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

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

CAUTION:
Do not confuse the cap of coolant filler tank and cap of radiator.

NOTE:
• When pouring the engine coolant, the radiator side cap must not be removed.
• The SUBARU Super Coolant contains anti-freeze and anti-rust agents, and is especially made for Subaru engines with an aluminum cylinder block. Be sure to 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 coolant filler tank 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, then open the coolant filler tank cap. If the engine coolant level drops, add engine coolant into coolant filler tank up to the filler neck position.
6) Perform the procedures 4) and 5) again.
7) Install the coolant filler tank 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 to prevent overheating.

10) Stop the engine and wait until the engine coolant temperature lowers to 30°C (86°F) or less.
11) Open the coolant filler tank cap. If the engine coolant level drops, add engine coolant into the coolant filler tank up to the filler neck position and the reservoir tank to “FULL” level.
12) Install the coolant filler tank cap and reservoir tank cap properly.
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 the heater core, repeat the procedures from step 9).

C: 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.

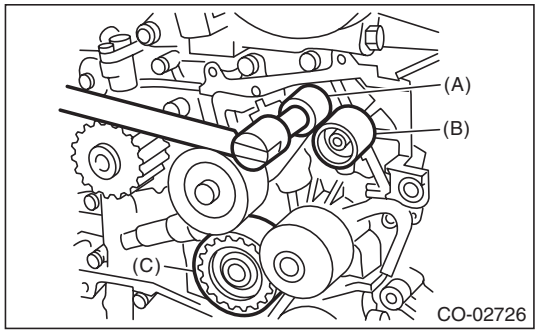
Relationship of SUBARU Super Coolant concentration and freezing temperature			
SUBARU Super Coolant concentration	50%	55%	60%
Freezing temperature	–36°C (–33°F)	–41°C (–42°F)	–50°C (–58°F)

Engine coolant and diluting water:
Refer to “SPECIFICATION” for recommended engine coolant and diluting water. <Ref. to CO(w/o STI)-2, SPECIFICATION, General Description.>

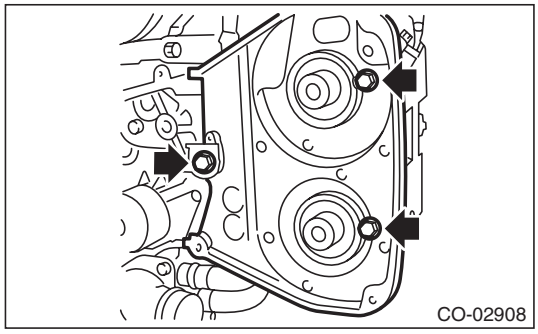
4. Water Pump

A: REMOVAL

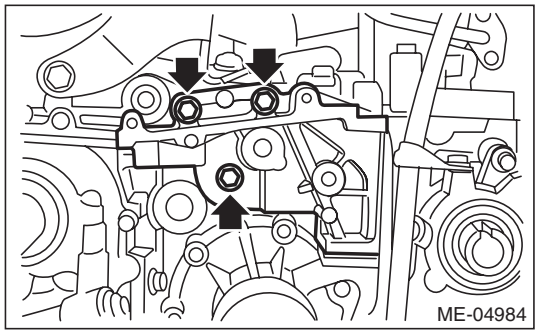
1) Remove the radiator. <Ref. to CO(w/o STI)-19, REMOVAL, Radiator.>
2) Remove the V-belts. <Ref. to ME(w/o STI)-38, REMOVAL, V-belt.>
3) Remove the crank pulley. <Ref. to ME(w/o STI)-45, REMOVAL, Crank Pulley.>
4) Remove the timing belt cover. <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>
5) Remove the timing belt. <Ref. to ME(w/o STI)-48, REMOVAL, Timing Belt.>
6) Remove the automatic belt tension adjuster (A).
7) Remove the belt idler (B).
8) Remove the belt idler No. 2 (C).



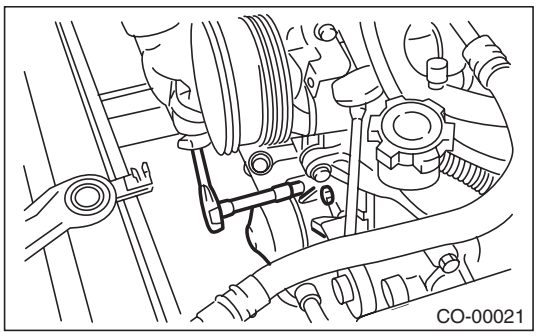
9) Remove the cam sprocket LH. <Ref. to ME(w/o STI)-57, REMOVAL, Cam Sprocket.>
10) Remove the belt cover No. 2 LH.



11) Remove the tensioner bracket.



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

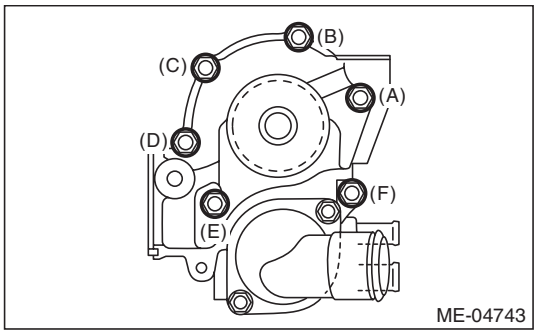


B: INSTALLATION

1) Install the water pump onto cylinder block LH.

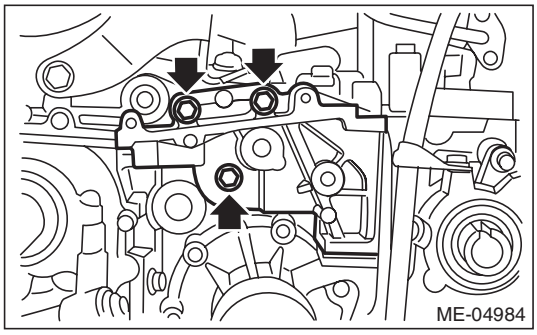
NOTE:
- Use a new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in figure.

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)



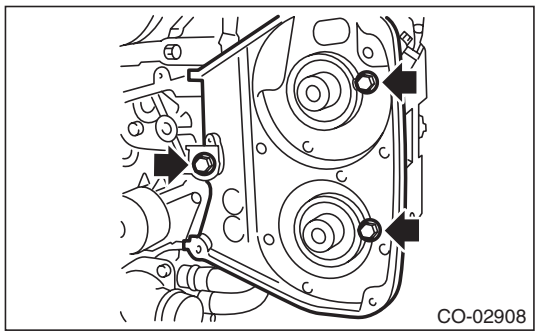
2) Install the hose to water pump.
3) Install the tensioner bracket.

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



4) Install the belt cover No. 2 LH.

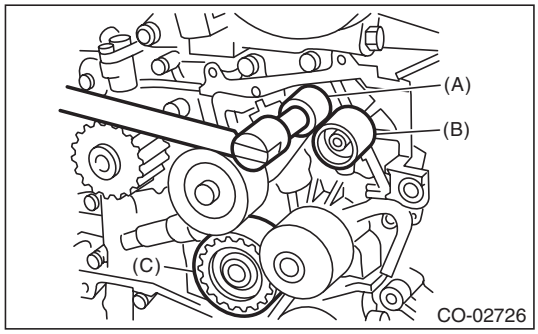
Tightening torque:
5 N·m (0.5 kgf-m, 3.7 ft-lb)



5) Install the cam sprocket LH. <Ref. to ME(w/o STI)-57, INSTALLATION, Cam Sprocket.>
6) Install the belt idler No. 2 (C).

Tightening torque:
39 N·m (4.0 kgf-m, 28.8 ft-lb)
7) Install the belt idler (B).

Tightening torque:
25 N·m (2.5 kgf-m, 18.4 ft-lb)
8) Install the automatic belt tension adjuster (A) with the tension rod held by a pin. <Ref. to ME(w/o STI)-50, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

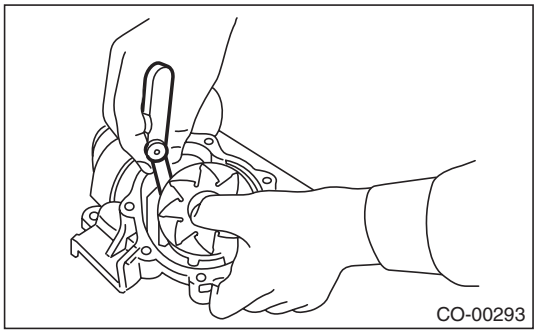


9) Install the timing belt. <Ref. to ME(w/o STI)-51, TIMING BELT, INSTALLATION, Timing Belt.>
10) Install the timing belt cover. <Ref. to ME(w/o STI)-47, INSTALLATION, Timing Belt Cover.>
11) Install the crank pulley. <Ref. to ME(w/o STI)-45, INSTALLATION, Crank Pulley.>
12) Install the V-belts. <Ref. to ME(w/o STI)-38, INSTALLATION, V-belt.>
13) Install the radiator. <Ref. to CO(w/o STI)-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 abnormally 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 — 0.059 in)

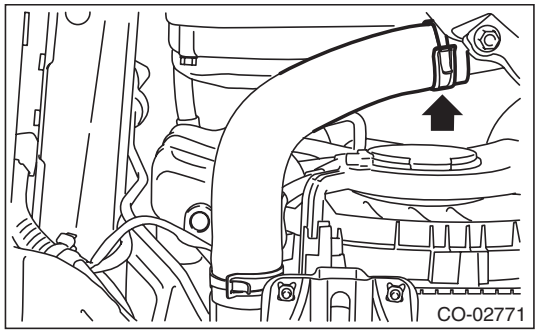


5) After water pump installation, check pulley shaft for engine coolant leaks or noise. If leaks or noise are noted, replace the water pump assembly.

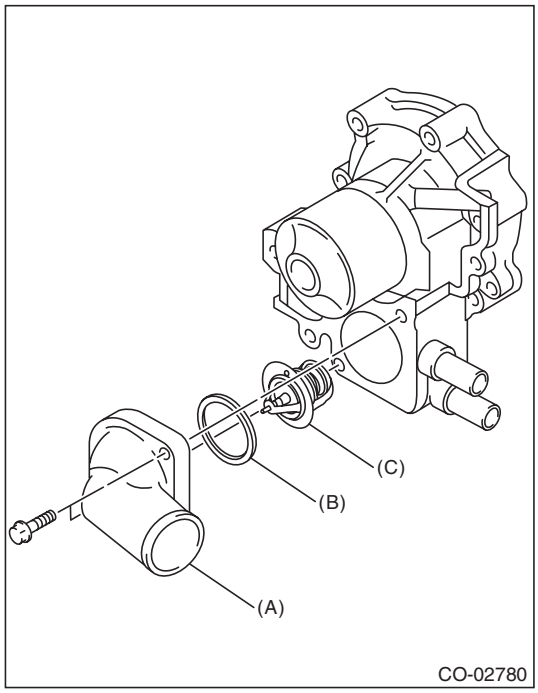
5. Thermostat

A: REMOVAL

1) Lift up the vehicle.
2) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
3) Drain engine coolant. <Ref. to CO(w/o STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect the radiator outlet hose from thermostat cover.



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



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

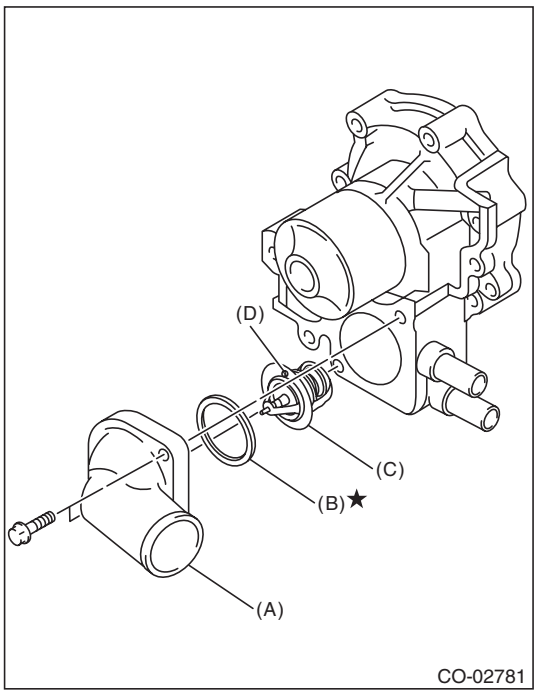
B: INSTALLATION

1) Install a gasket to thermostat.

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

NOTE:
Install the parts 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 under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
5) Lower the vehicle.
6) Fill engine coolant. <Ref. to CO(w/o STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

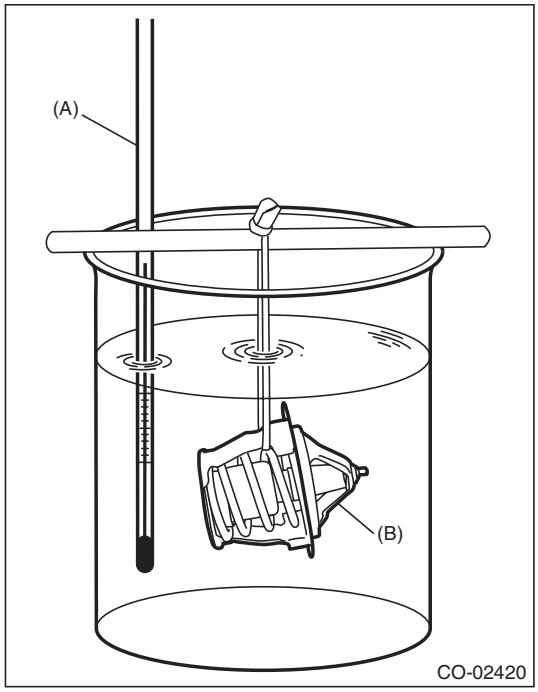
1) Check that the thermostat does not have deformation, cracks or damage.
2) Check that the thermostat valve closes completely at an ambient temperature.
3) Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and check the temperature and valve lift when the valve begins to open and when the valve is fully opened. Replace the thermostat if faulty.

NOTE:
• During the test, agitate the water for even temperature distribution.
• Leave the thermostat in the boiling water for five minutes or more before measuring the valve lift.
• Hold the thermostat with a wire or the like to avoid contacting the container.

Starting temperature to open:
76 — 80°C (169 — 176°F)

Full open temperature:
91°C (196°F)

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



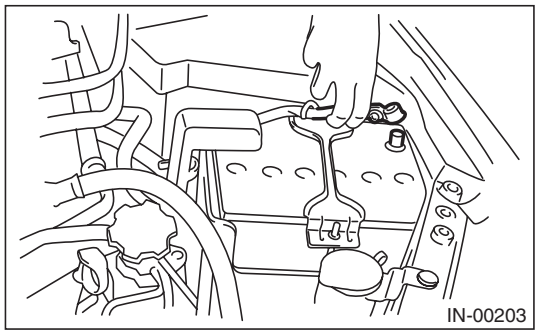
(A) Thermometer
(B) Thermostat

6. Radiator

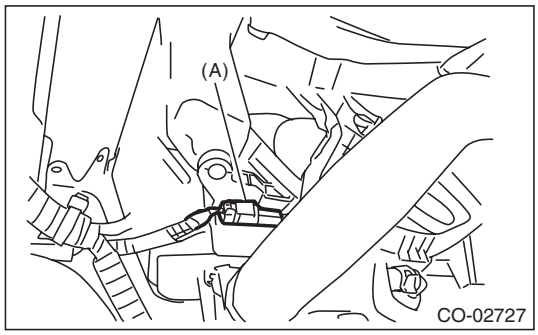
A: REMOVAL

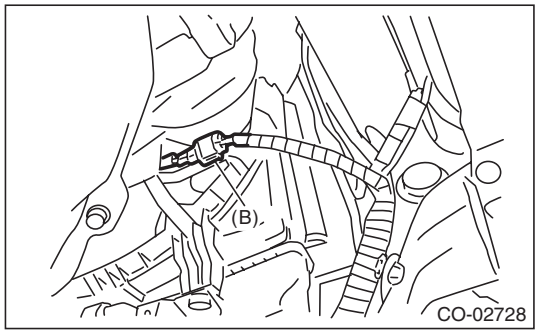
CAUTION:
The radiator is pressurized when the engine and radiator are hot. Wait until engine and radiator cool down before working on the radiator.

1) Disconnect the ground cable from battery.

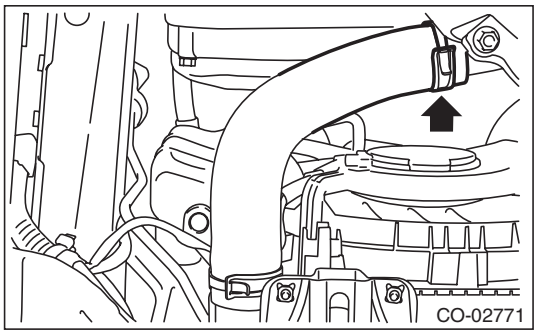


2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Drain engine coolant. <Ref. to CO(w/o STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Disconnect the connector (A) from the main fan motor and the connector (B) from the sub fan motor.

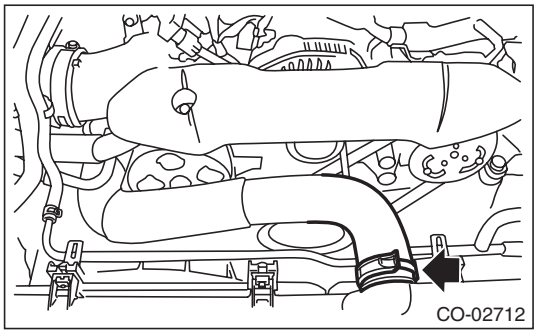




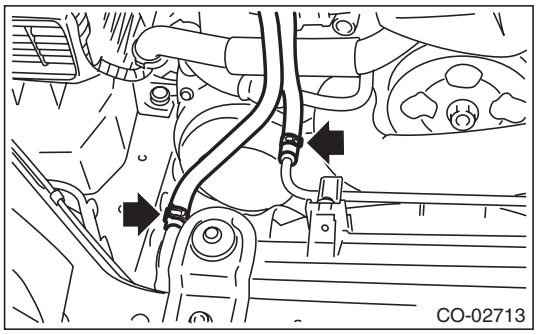
6) Disconnect the radiator outlet hose from thermostat cover.



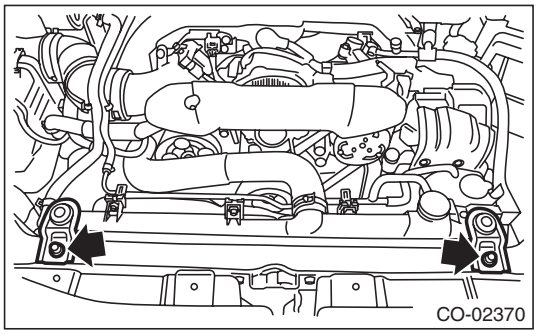
7) Lower the vehicle.
8) Remove the air intake duct. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.>
9) Remove the reservoir tank. <Ref. to CO(w/o STI)-27, REMOVAL, Reservoir Tank.>
10) Disconnect the radiator inlet hose from the radiator.



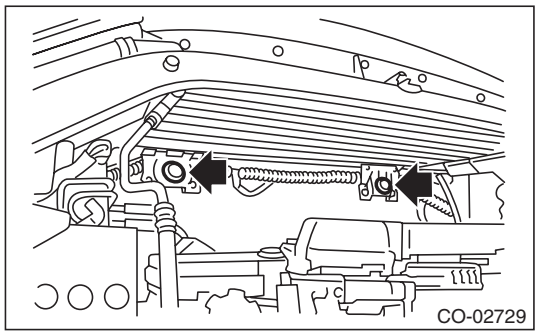
11) Disconnect the two engine coolant hoses from the radiator and over flow pipe.



12) Remove the radiator upper brackets.

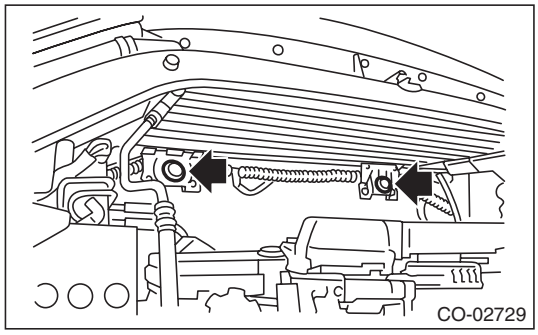


13) Move the radiator to the left while lifting it upward.
14) Lift the radiator up and remove the radiator from vehicle.
15) Remove the radiator lower cushion from the radiator lower bracket.



B: INSTALLATION

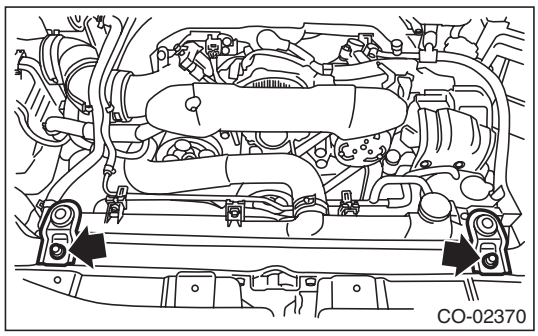
1) Attach the radiator lower cushion to the radiator lower bracket.



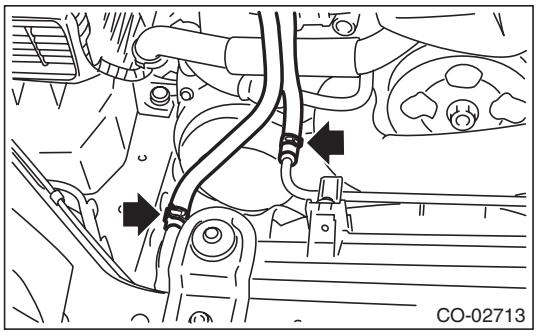
2) Install the radiator to vehicle.

NOTE:
Make pins on the lower side of radiator be fitted into the radiator lower cushions.
3) Install the radiator upper brackets.

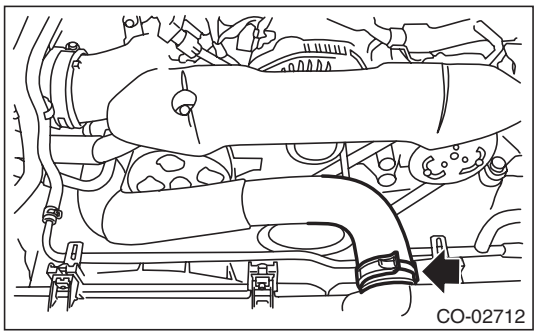
Tightening torque:
12 N·m (1.2 kgf-m, 8.9 ft-lb)



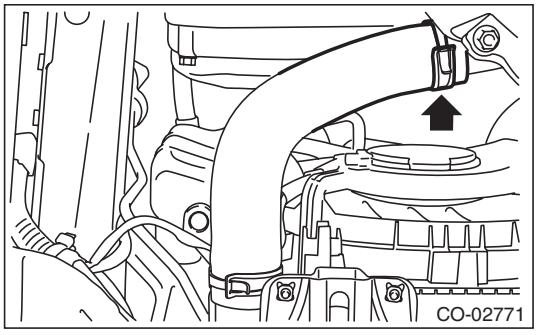
4) Connect the two engine coolant hoses to the radiator and over flow pipe.



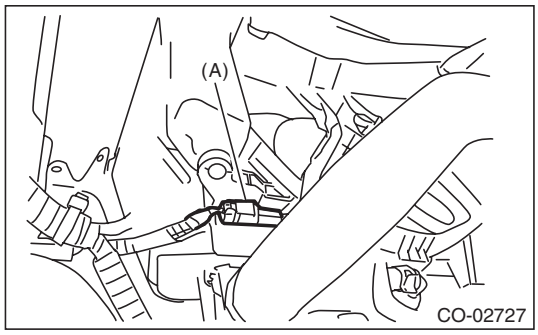
5) Connect the radiator inlet hose.

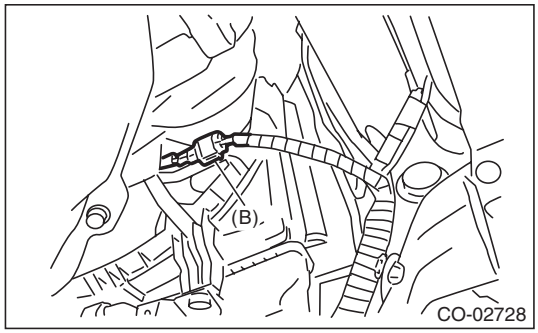


6) Install the reservoir tank. <Ref. to CO(w/o STI)-27, INSTALLATION, Reservoir Tank.>
7) Install the air intake duct. <Ref. to IN(w/o STI)-10, INSTALLATION, Air Intake Duct.>
8) Lift up the vehicle.
9) Connect the radiator outlet hose.

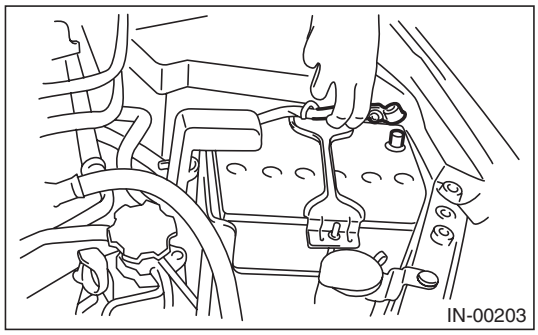


10) Connect the connector (A) to the main fan motor and the connector (B) to the sub fan motor.





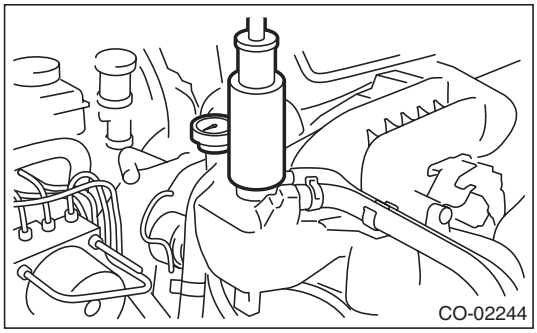
11) Install the under cover. <Ref. to EI-28, INSTALLATION, Front Under Cover.>
12) Lower the vehicle.
13) Connect the battery ground terminal.



14) Fill engine coolant. <Ref. to CO(w/o STI)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

1) Check that the radiator does not have deformation, cracks or damage.
2) Check that the hose has no cracks, damage or loose part.
3) Remove the coolant filler tank cap, fill the coolant filler tank with engine coolant, then install the radiator cap tester to the filler neck of coolant filler tank.



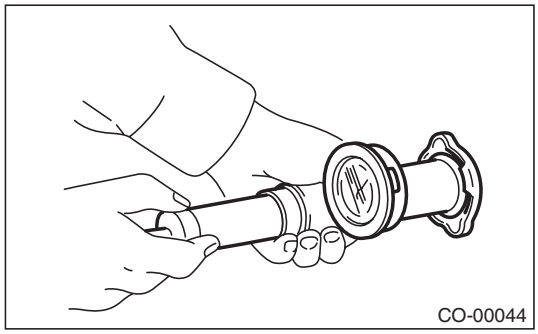
4) Apply a pressure of 122 kPa (1.2 kg/cm^2, 18 psi) to the radiator and check the following points:
- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

CAUTION:
• Inspection must be carried out at the side of coolant filler tank, not at the side of radiator.
• Engine should be turned off.
• Wipe engine coolant from check points in advance.
• Be careful not to deform the filler neck of the coolant filler tank when installing and removing the radiator cap tester.
• Be careful of engine coolant from spurting out when removing the radiator cap tester.

7. Radiator Cap

A: INSPECTION

1) Check that the radiator cap does not have deformation, cracks or damage.
2) Attach the radiator cap tester to radiator cap.



3) Increase pressure until the radiator cap tester gauge needle stops. Radiator cap is functioning properly if it holds the service limit pressure for 5 — 6 seconds. Replace the radiator cap if its valve opens at less than the service limit.

Coolant filler tank side:
Standard
93 — 123 kPa (0.95 — 1.25 kg/cm^2, 14 — 18 psi)
Limit
83 kPa (0.85 kg/cm^2, 12 psi)

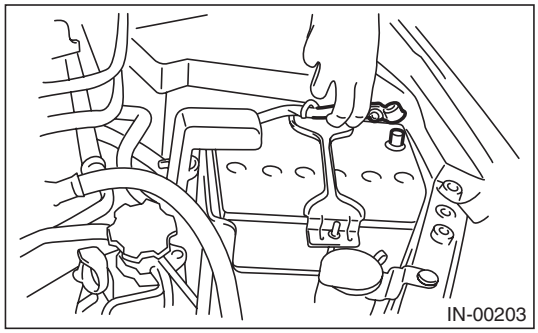
Radiator side:
Standard
122 — 152 kPa (1.24 — 1.55 kg/cm^2, 18 — 22 psi)
Limit
112 kPa (1.14 kg/cm^2, 16 psi)

CAUTION:
• Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.
• Do not confuse the cap of coolant filler tank and cap of radiator.

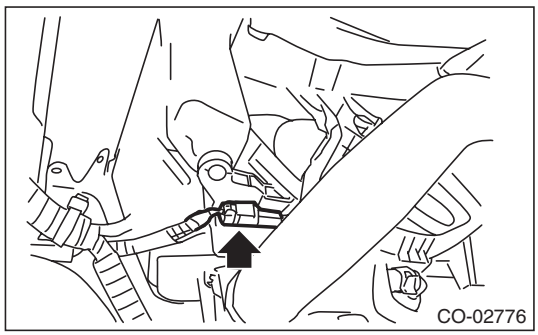
8. Radiator Main Fan and Fan Motor

A: REMOVAL

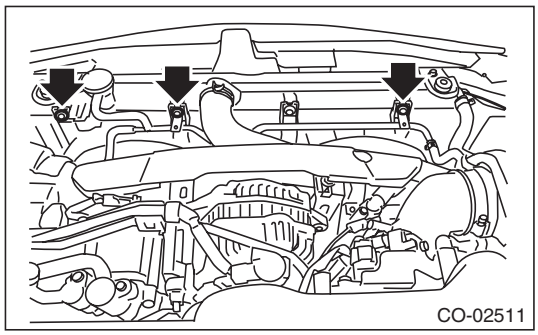
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Disconnect the connector from the main fan motor.



5) Lower the vehicle.
6) Remove the air intake duct. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.>
7) Remove the reservoir tank. <Ref. to CO(w/o STI)-27, REMOVAL, Reservoir Tank.>
8) Remove the bolts which secure the radiator main fan motor assembly and the over flow pipe.



9) Remove the radiator main fan motor assembly from the upper side of the vehicle.

B: INSTALLATION

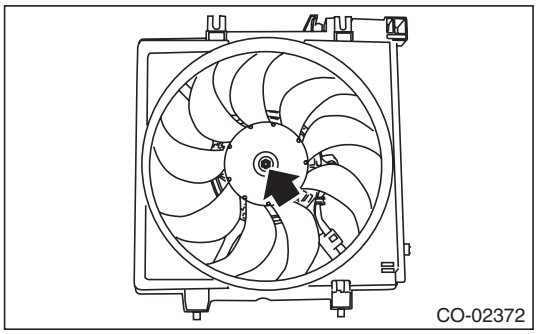
Install in the reverse order of removal.

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

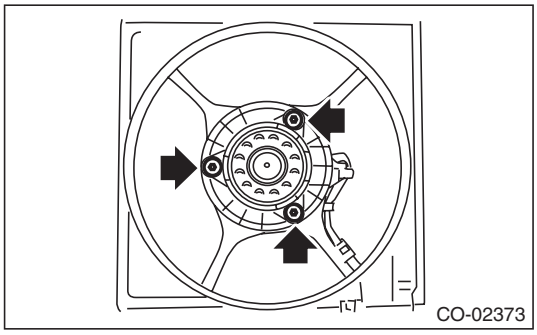
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the clip which holds the main fan motor connector onto the radiator main fan shroud.
2) Disconnect the radiator main fan from the main fan motor.



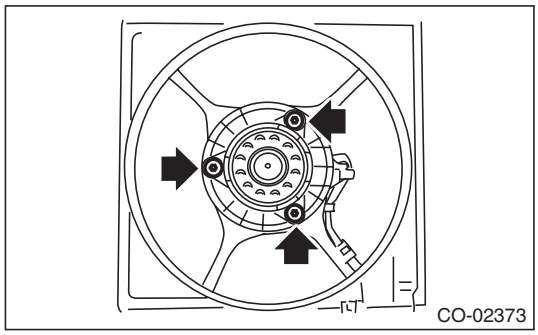
3) Disconnect the main fan motor from the radiator main fan shroud.



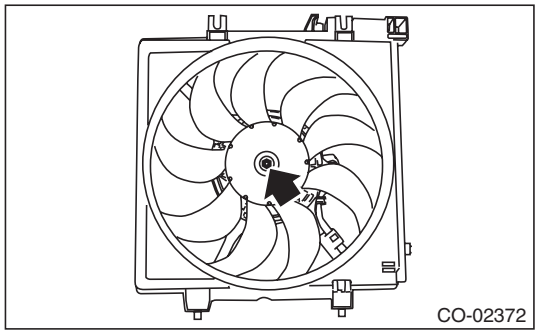
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



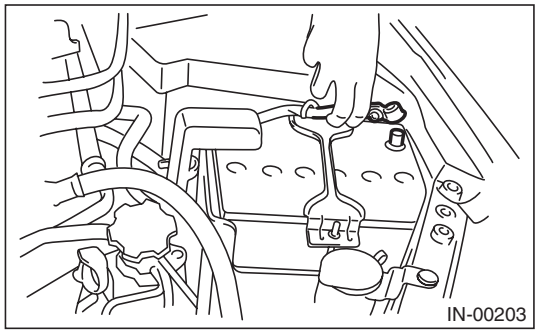
E: INSPECTION

Check that the radiator main fan, radiator main fan shroud and main fan motor do not have deformation, cracks or damage.

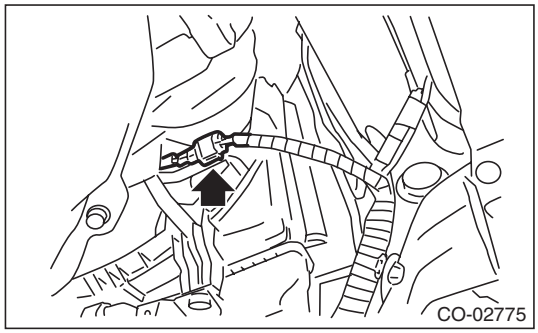
9. Radiator Sub Fan and Fan Motor

A: REMOVAL

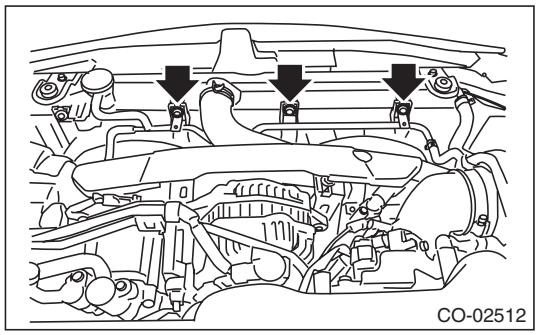
1) Disconnect the ground cable from battery.



2) Lift up the vehicle.
3) Remove the under cover. <Ref. to EI-28, REMOVAL, Front Under Cover.>
4) Disconnect the connector from the sub fan motor.



5) Lower the vehicle.
6) Remove the air intake duct. <Ref. to IN(w/o STI)-10, REMOVAL, Air Intake Duct.>
7) Remove the bolts which secure the radiator sub fan motor assembly and the over flow pipe.



8) Raise the radiator sub fan motor assembly slightly, remove the pin at the lower part of the radiator sub fan motor assembly from the radiator hole, and remove the radiator sub fan motor assembly from the lower side of the vehicle.

B: INSTALLATION

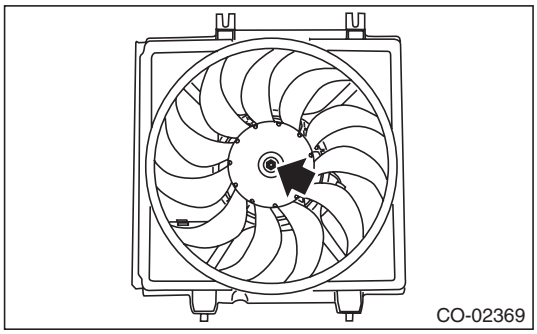
Install in the reverse order of removal.

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

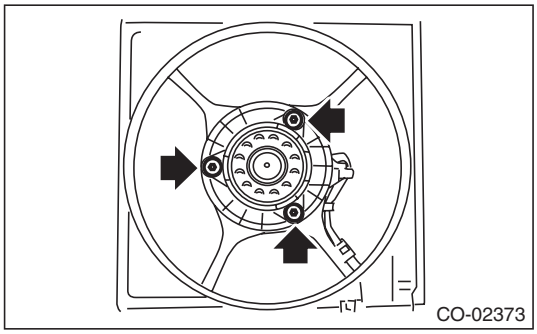
Tightening torque:
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

C: DISASSEMBLY

1) Remove the clip which holds the sub fan motor connector onto the radiator sub fan shroud.
2) Disconnect the radiator sub fan from the sub fan motor.



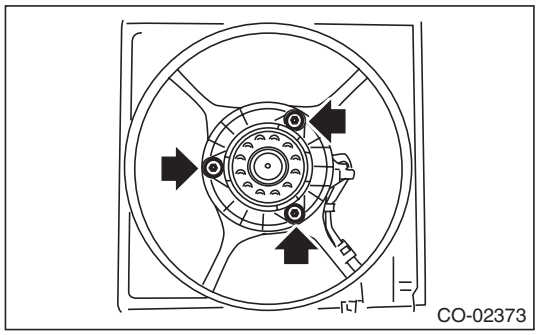
3) Disconnect the sub fan motor from the radiator sub fan shroud.



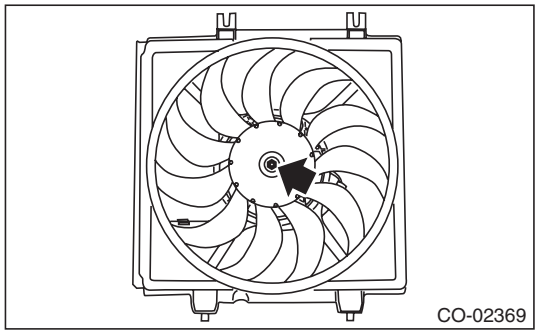
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



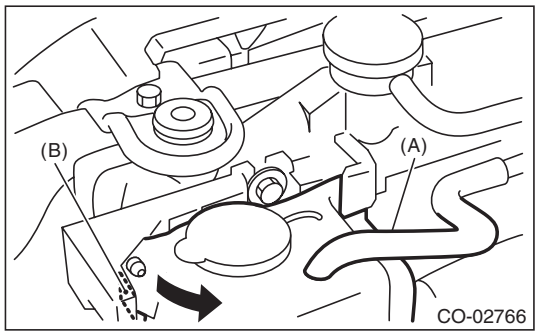
E: INSPECTION

Check that the radiator sub fan, radiator sub fan shroud and sub fan motor do not have deformation, cracks or damage.

10.Reservoir Tank

A: REMOVAL

1) Pull out the over flow hose (A).
2) Pull out the reservoir tank to the arrow direction while pushing the claw (B).



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

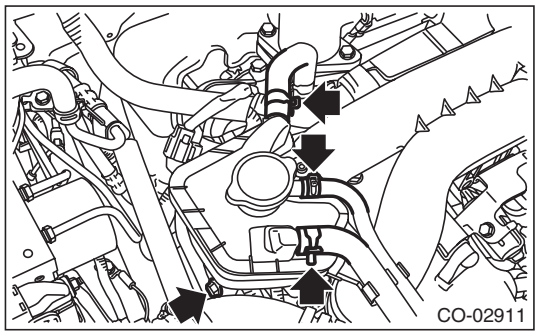
1) Check that the reservoir tank does not have deformation, cracks or damage.
2) Check the over flow hose for cracks or damage.
3) Make sure the engine coolant level is between “FULL” and “LOW”.

11.Coolant Filler Tank

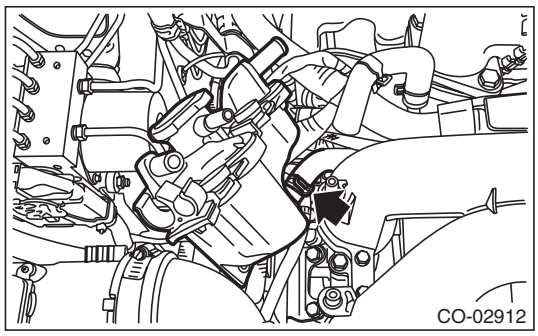
A: REMOVAL

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

1) Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. <Ref. to CO(w/o STI)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
2) Disconnect the engine coolant hoses from coolant filler tank.
3) Remove the bolts which secure the coolant filler tank.



4) Disconnect the engine coolant hose which connects the under side of coolant filler tank, and remove the coolant filler tank.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

C: INSPECTION

1) Check that the coolant filler tank does not have deformation, cracks or damage.
2) Check that the engine coolant hose has no cracks, damage or loose part.

12.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(H4DOTC)(diag)-2, PROCEDURE, 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(H4DOTC)(diag)-2, PROCEDURE, 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 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(w/o STI)

Page
1. General Description 2

1. General Description

A: SPECIFICATION

Specifications for models other than STI are included in the LU (STI) section. <Ref. to LU(STI)-2, General Description.>

SPEED CONTROL SYSTEMS

SP(w/o STI)

Page

1. General Description 2

1. General Description

A: SPECIFICATION

Specifications for models other than STI are the same as those for STI model. <Ref. to SP(STI)-2, General Description.>

IGNITION

IG(w/o STI)

Page

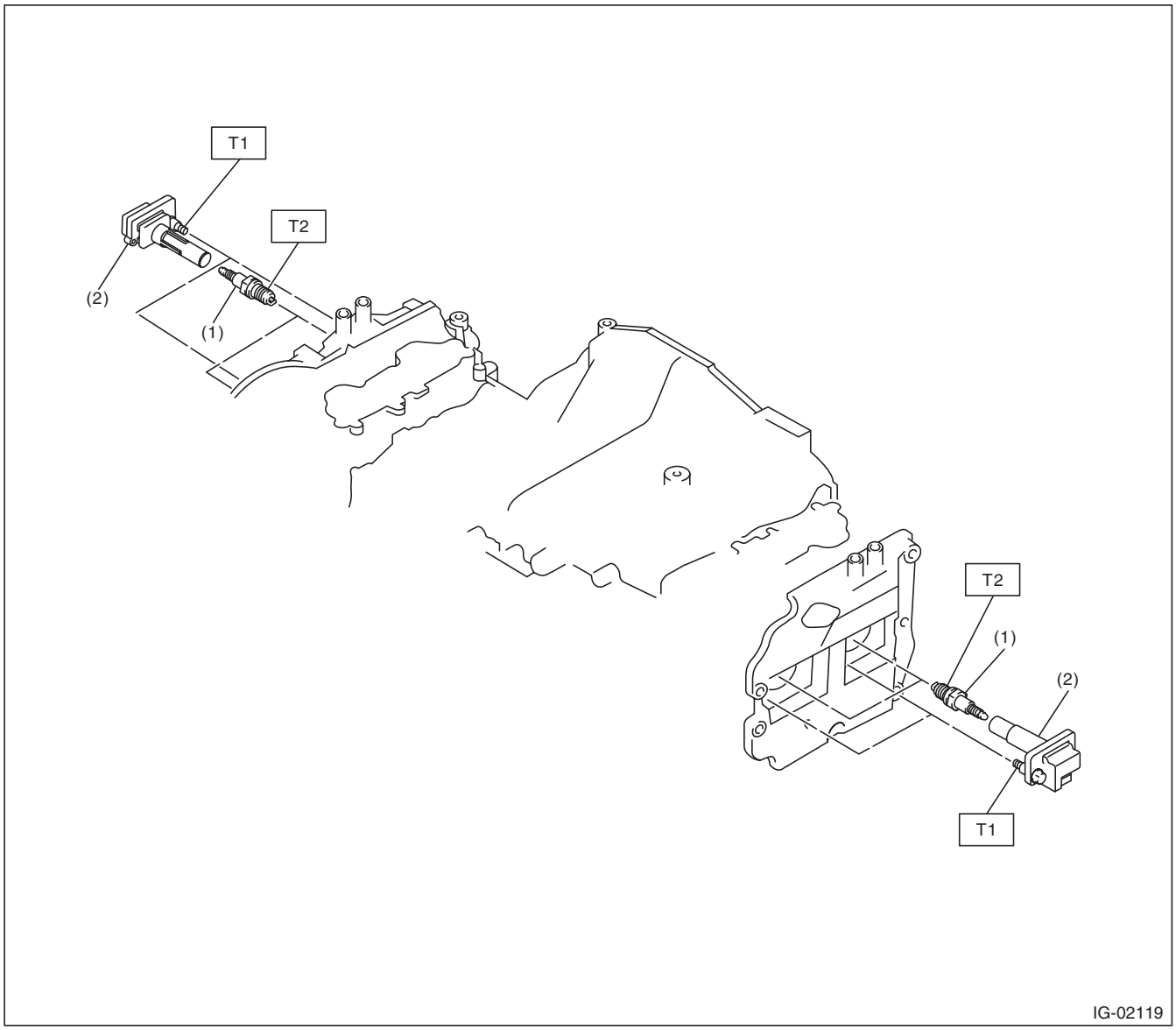
1. General Description 2
2. Spark Plug 5
3. Ignition Coil 8

1. General Description

A: SPECIFICATION

Item			Specifications
Ignition coil	Type		FK0368
	Ignition system		Independent ignition coil
	Manufacturer		Diamond Electric
Spark plug	Manufacturer and type		NGK: SILFR6A
	Thread size (diameter, pitch, length) mm		14, 1.25, 26.5
	Spark plug gap mm (in)	Standard	0.7 — 0.8 (0.028 — 0.031)
	Electrode		Iridium

B: COMPONENT



(1) Spark plug
(2) Ignition coil

Tightening torque: N·m (kgf-m, ft-lb)
T1: 16 (1.6, 11.8)
T2: 21 (2.1, 15.5)

C: CAUTION

- Prior to starting work, pay special attention to the following:
  1. Always wear work clothes, a safety cap, protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
  2. Protect the vehicle using a seat cover, fender cover, etc.
  3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.

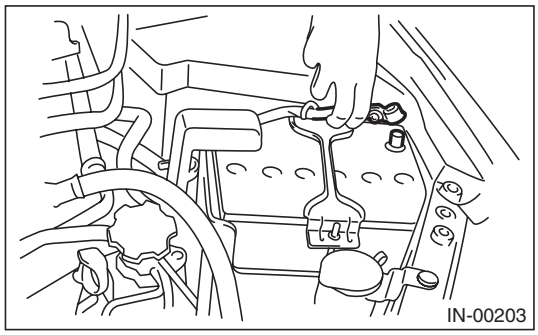
2. Spark Plug

A: REMOVAL

Spark plug:
Refer to "SPECIFICATION" for spark plug. <Ref. to IG(w/o STI)-2, SPECIFICATION, General Description.>

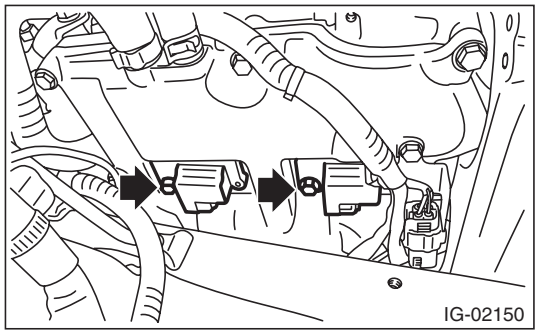
1. RH SIDE

1) Disconnect the ground cable from battery.



2) Remove the air cleaner case. <Ref. to IN(w/o STI)-8, REMOVAL, Air Cleaner Case.>
3) Disconnect the connector from ignition coil.
4) Remove the ignition coil.

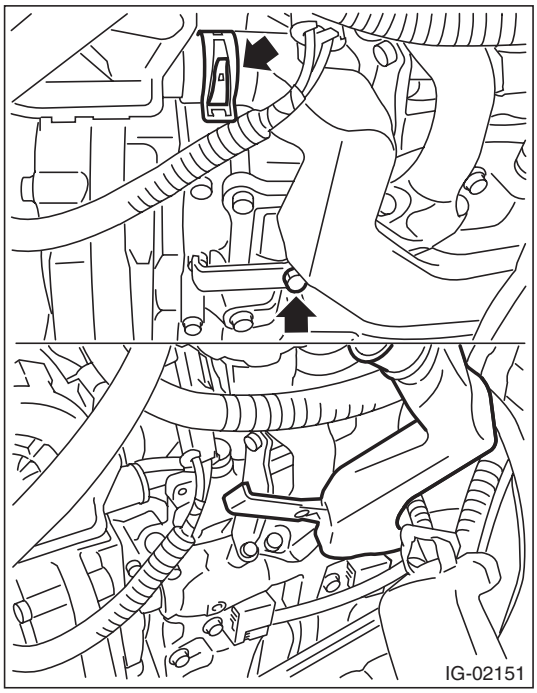
NOTE:
Turn #3 ignition coil by 180° to remove it.



5) Remove the spark plug with a spark plug socket.

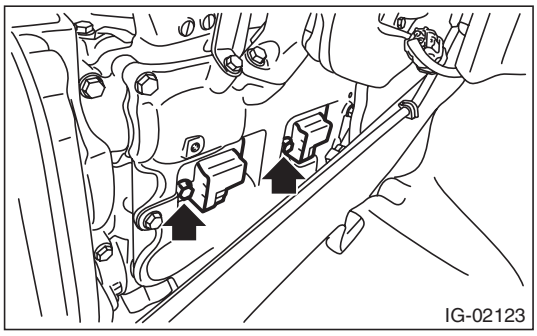
2. LH SIDE

1) Remove the battery. <Ref. to SC(STI)-27, REMOVAL, Battery.>
2) Disconnect the air duct from the secondary air pump.
3) Remove the bolts that secure the air duct to the rocker cover LH, and lift the air duct.



4) Disconnect the connector from ignition coil.
5) Remove the ignition coil.

NOTE:
Turn #4 ignition coil by 180° to remove it.



6) Remove the spark plug with a spark plug socket.

B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.5 ft-lb)

Tightening torque (Ignition coil):
16 N·m (1.6 kgf-m, 11.8 ft-lb)

2. LH SIDE

Install in the reverse order of removal.

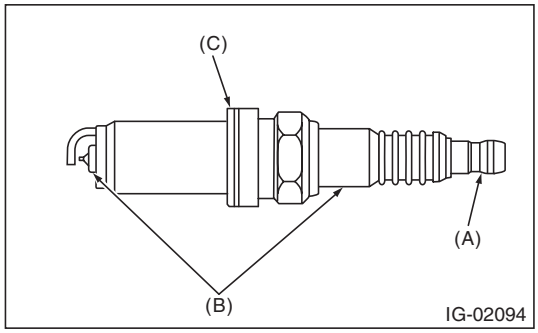
Tightening torque (Spark plug):
21 N·m (2.1 kgf-m, 15.5 ft-lb)

Tightening torque (Ignition coil):
16 N·m (1.6 kgf-m, 11.8 ft-lb)

Tightening torque (Air duct):
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

C: INSPECTION

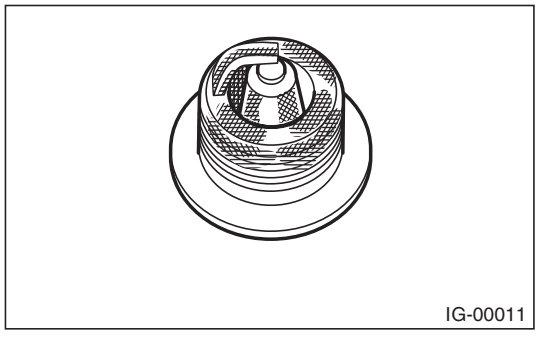
1) Check the spark plug for abnormalities. If defective, replace the spark plug.



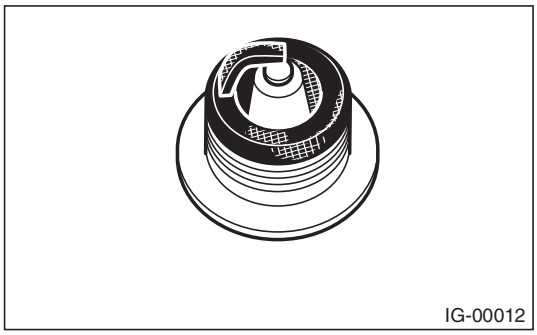
(A) Terminal damage
(B) Crack or damage in insulator
(C) Damaged gasket

2) Check the spark plug electrode and condition of the insulator. If abnormal, check and repair the cause and replace the spark plug.

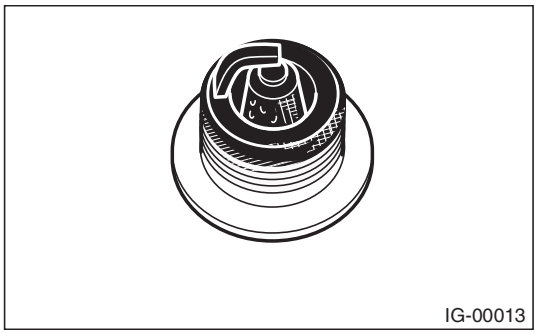
(1) Normal:
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



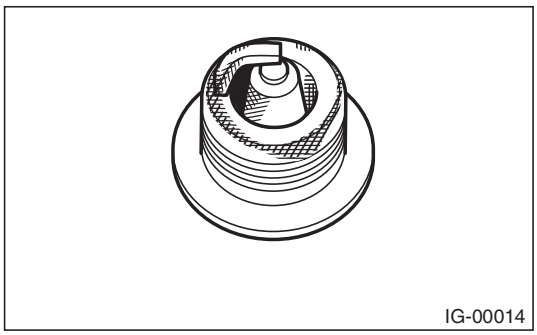
(2) Carbon fouled:
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in the city, weak ignition, too rich fuel mixture, etc.



(3) Oil fouled:
Wet black deposits show oil entrance into combustion chamber through worn piston rings or increased clearance between valve guides and valve stems.



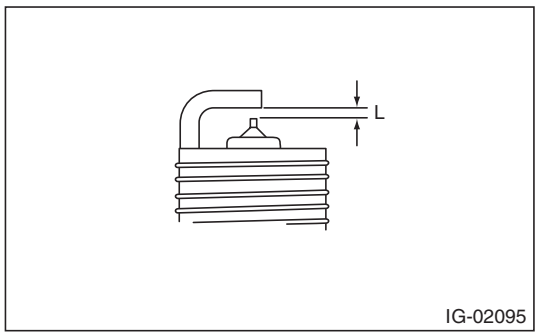
(4) Overheating:
A white or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, wrong selection of fuel, or loose spark plugs.



3) Using a nylon brush, etc., clean and remove the carbon or oxide deposits from the spark plug. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, check the spark plug gap “L” using a gap gauge. If it is not within the standard, replace the spark plug.

NOTE:
- Never use a plug cleaner.
- Do not use a metal brush as it may damage the electrode area.

Spark plug gap L:
Standard
0.7 — 0.8 mm (0.028 — 0.031 in)



3. Ignition Coil

A: REMOVAL

Direct ignition type is adopted. Refer to “Spark Plug” for removal procedure. <Ref. to IG(w/o STI)-5, REMOVAL, Spark Plug.>

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
16 N·m (1.6 kgf-m, 11.8 ft-lb)

C: INSPECTION

For inspection procedure, refer to “Diagnostics for Engine Starting Failure”. <Ref. to EN(H4DOTC)(diag)-79, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>

STARTING/CHARGING SYSTEMS
SC(w/o STI)

Page
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1. General Description

A: SPECIFICATION

Specifications for models other than STI are included in the SC (STI) section. <Ref. to SC(STI)-2, General Description.>

ENGINE 3 SECTION

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.

ENGINE (DIAGNOSTICS)

EN(H4DOTC)(diag)

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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(H4DOTC)(diag)-3, CHECK, Check List for Interview.> 2) Start the engine.	Does the engine start?	Go to step **2**.	Inspection using "Diagnostics for Engine Starting Failure". <Ref. to EN(H4DOTC)(diag)-73, 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(H4DOTC)(diag)-468, 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(H4DOTC)(diag)-39, 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 "Diagnostic Procedure for Subaru Select Monitor Communication". <Ref. to EN(H4DOTC)(diag)-85, 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 (DTC)" for detailed operation procedure. <Ref. to EN(H4DOTC)(diag)-47, 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 DTC and freeze frame data, then repair the trouble cause. <Ref. to EN(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).> After repair, go to the next step. 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(H4DOTC)(diag)-66, Malfunction Indicator Light.>
5	**PERFORM DIAGNOSIS.** 1) Perform the Clear Memory Mode. <Ref. to EN(H4DOTC)(diag)-62, Clear Memory Mode.> 2) Perform the Inspection Mode or Drive Cycle. <Ref. to EN(H4DOTC)(diag)-48, Inspection Mode.> <Ref. to EN(H4DOTC)(diag)-54, 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(H4DOTC)(diag)-97, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

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	Rear entertainment system	❑ ON/❑ OFF
Radiator fan	❑ ON/❑ OFF	Car phone	❑ ON/❑ OFF
Front wiper	❑ ON/❑ OFF	Wireless device	❑ ON/❑ OFF
Rear wiper	❑ ON/❑ OFF		

Check List for Interview

2. CHECK LIST NO. 2

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

NOTE:
Use copies of this page for interviewing customers.

a) Other warning lights or indicators illuminate: ❑ Yes / ❑ No
❑ Fuel level 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 ❑ Electronic parking brake warning light ❑ Glow indicator light ❑ Sedimenter 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 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

3. General Description

A: CAUTION

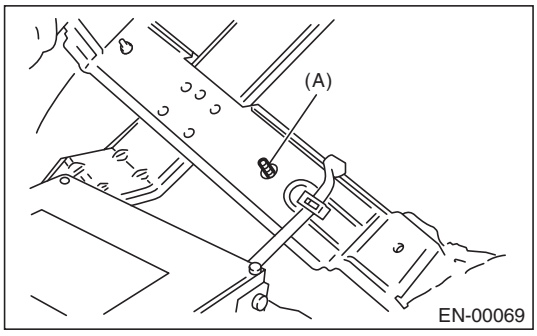
1) Airbag system wiring harness is routed near the ECM, main relay and fuel pump relay.

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) When disconnecting the connectors of the electrical components, always be sure to turn the ignition switch to OFF. Perform the Clear Memory Mode after connecting the connectors. <Ref. to EN(H4DOTC)(diag)-62, 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.

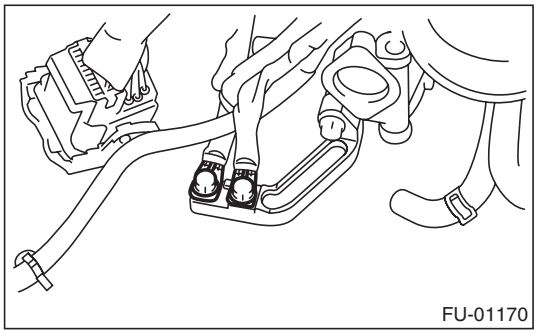
CAUTION:
When replacing the ECM, be careful not to use the ECM of wrong specification to avoid any damage on the fuel injection system.

NOTE:
When replacing the ECM of the models with immobilizer, immobilizer system must be registered. For detailed procedures, refer to “REGISTRATION MANUAL FOR IMMOBILIZER”.
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 for the 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 when measuring the voltage and resistance in engine compartment.



9) All parts related to the engine control system are precision parts. Do not drop or otherwise apply impact. Do not reuse the parts that are dropped accidentally.
10) Observe the following cautions when installing a radio in vehicle.

CAUTION:
• The antenna must be kept as far apart as possible from the ECM. <Ref. to EN(H4DOTC)(diag)-8, CONTROL MODULE, LOCATION, Electrical Component Location.>
• 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, be sure to release the fuel pressure beforehand. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.> <Ref. to FU(w/o STI)-65, 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 rotating 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)-27, 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.

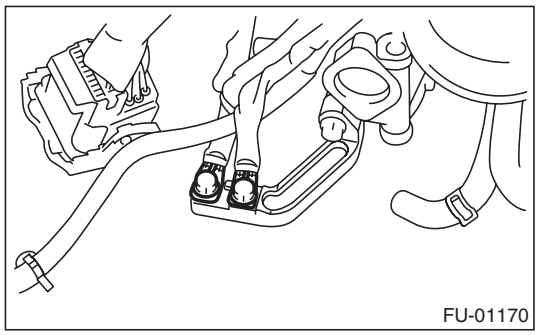
Standard voltage: 12 V

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

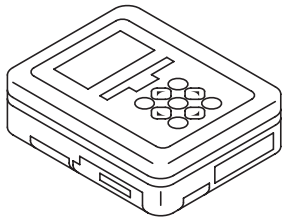
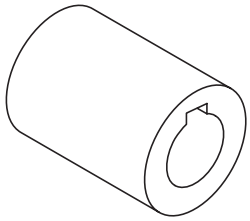
Make sure that the engine ground terminal is properly connected to the engine.



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.
*: One driving cycle means the period between the ignition switch ON and the ignition switch OFF after driving.
• When performing diagnosis, connect the Subaru Select Monitor or general scan tool to the vehicle.

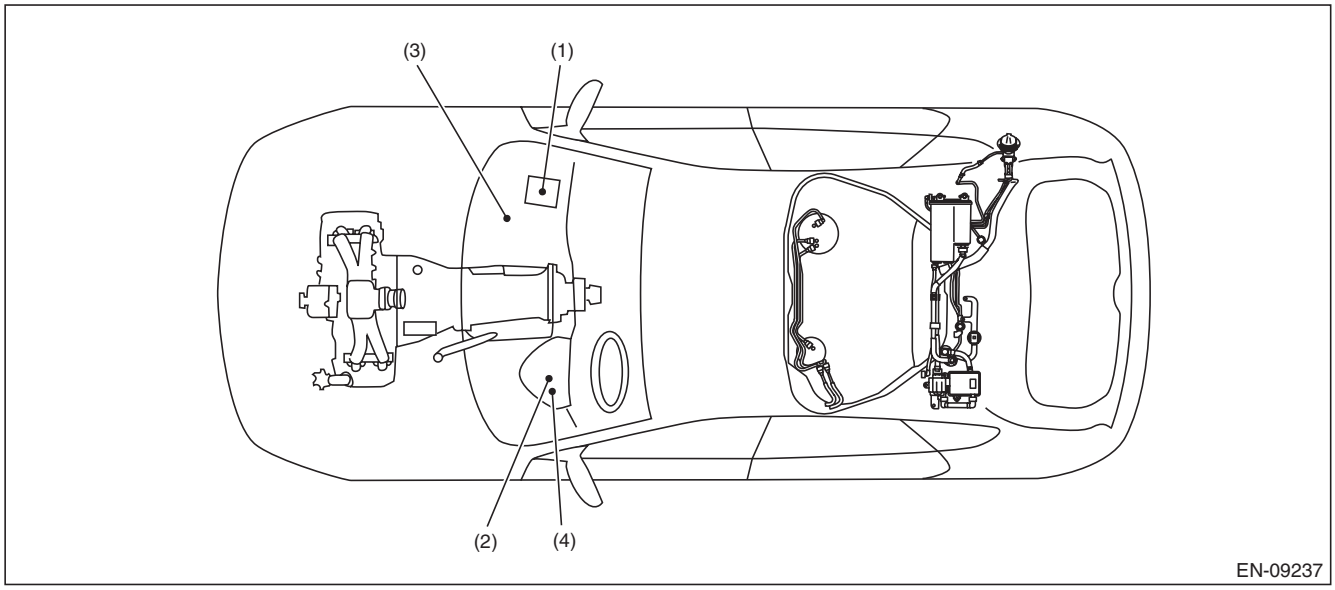
D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST1B022XU0	1B022XU0	SUBARU SELECT MONITOR III KIT	Used for troubleshooting the electrical system.
 ST-499987500	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.

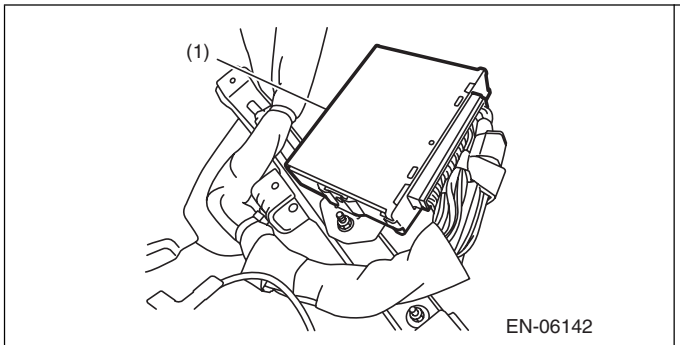
4. Electrical Component Location

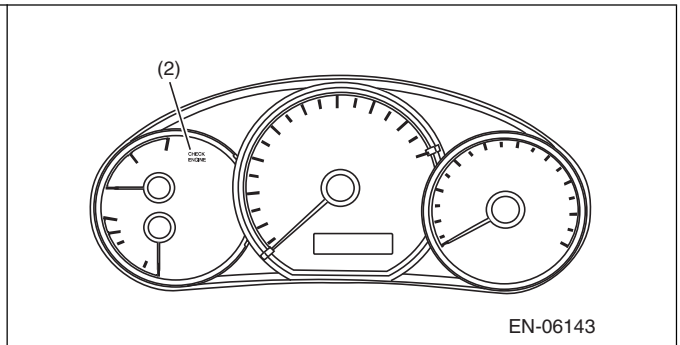
A: LOCATION

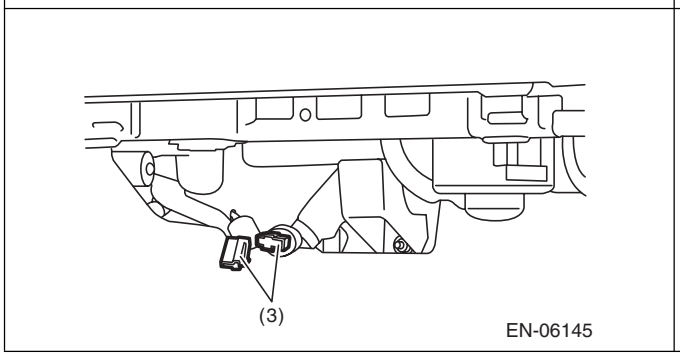
1. CONTROL MODULE

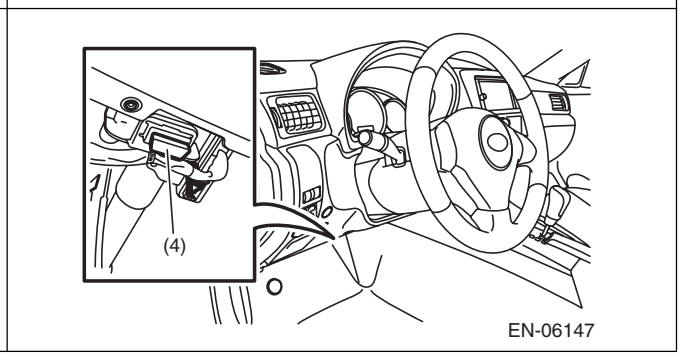


(1) Engine control module (ECM)
(2) Malfunction indicator light
(3) Delivery (test) mode connector
(4) Data link connector



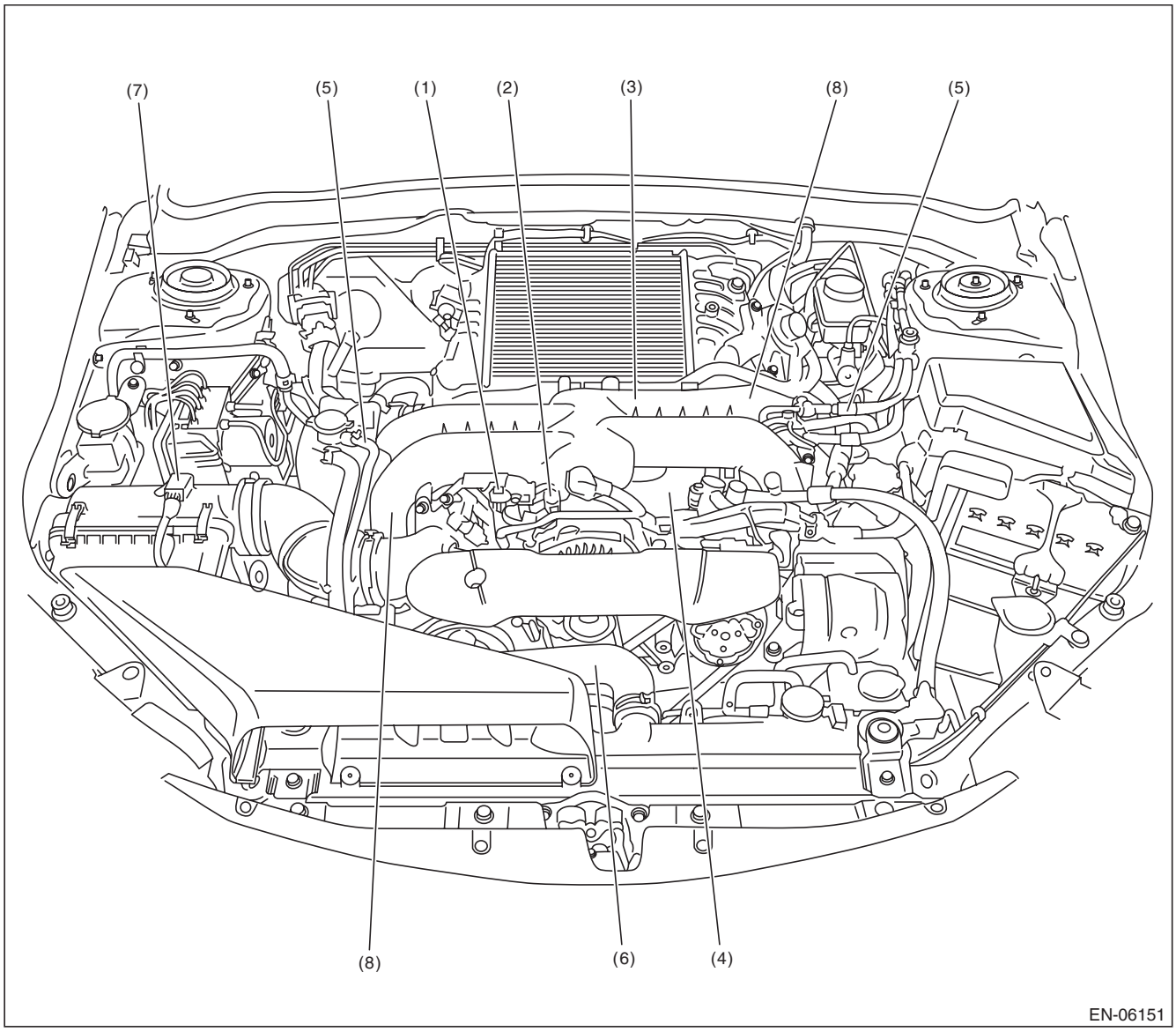






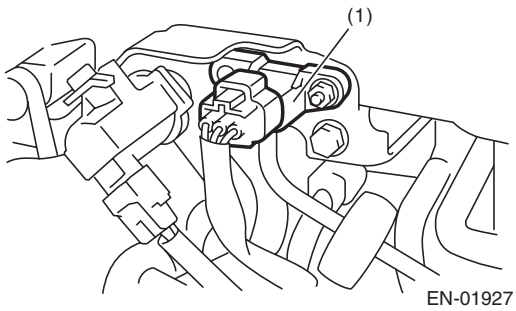
2. SENSOR

- Models without SI-DRIVE

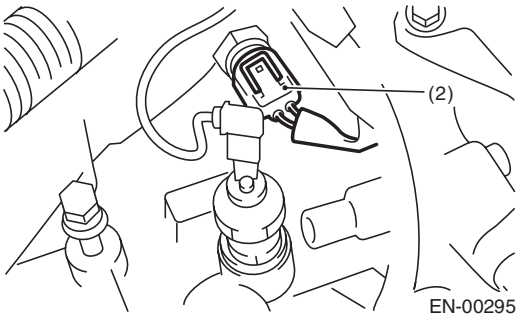


(1) Manifold absolute pressure sensor
(2) Engine coolant temperature sensor
(3) Electronic throttle control
(4) Knock sensor
(5) Intake camshaft position sensor
(6) Crankshaft position sensor
(7) Mass air flow and intake air temperature sensor
(8) Tumble generator valve ASSY

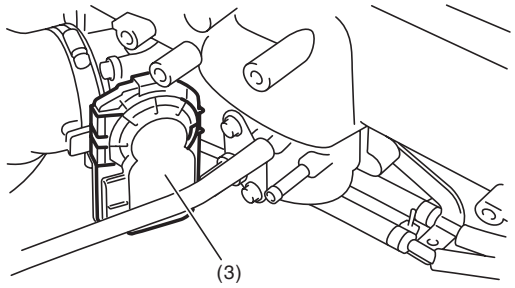
Electrical Component Location



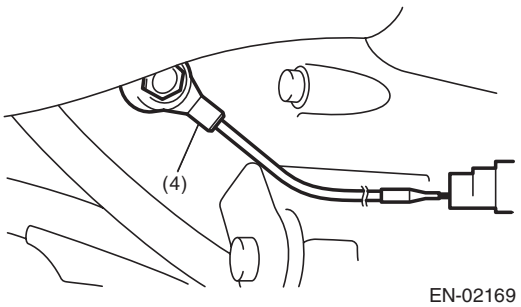
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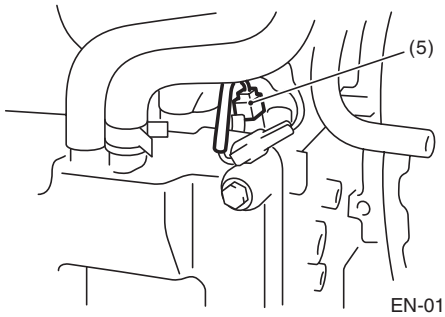
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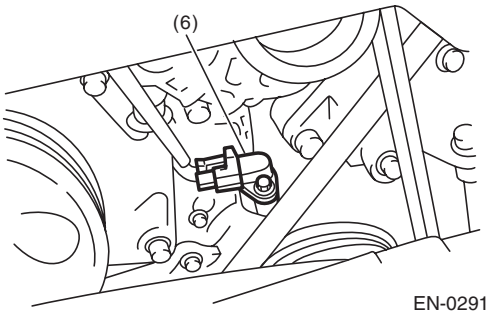
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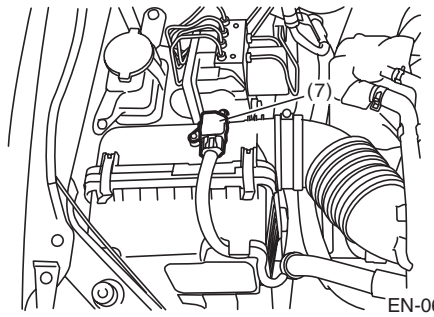
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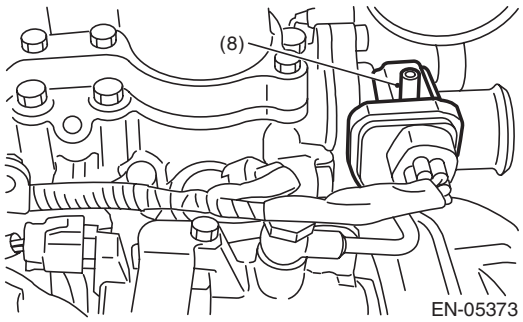
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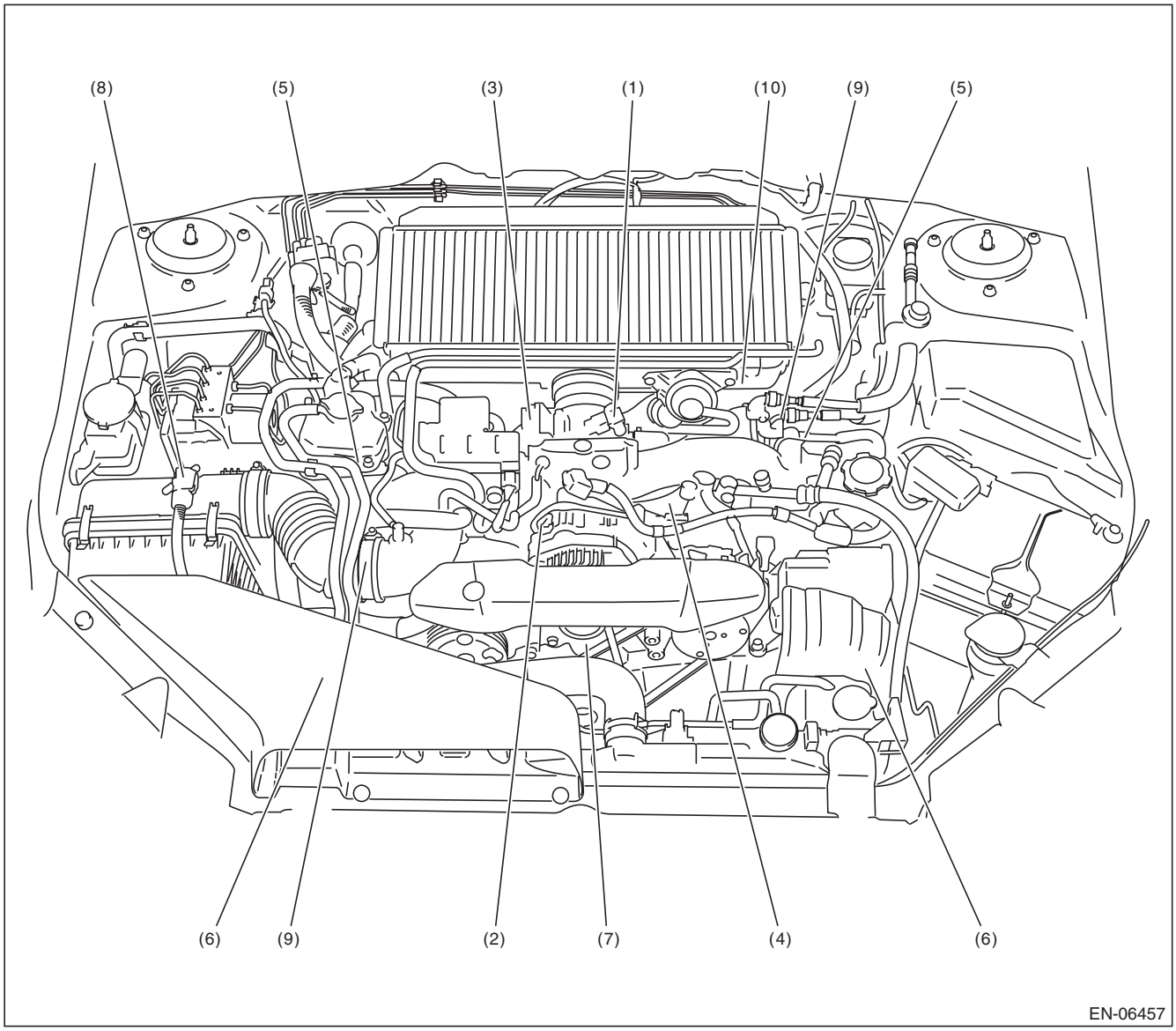


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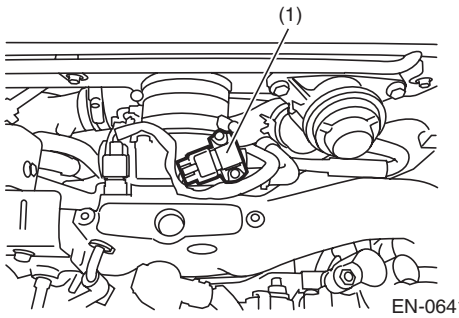
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- Models with SI-DRIVE

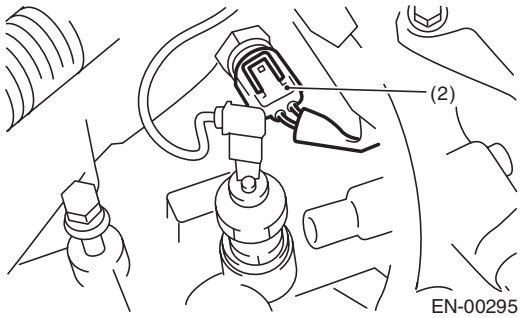


(1) Manifold absolute pressure sensor
(2) Engine coolant temperature sensor
(3) Electronic throttle control
(4) Knock sensor
(5) Intake camshaft position sensor
(6) Exhaust camshaft position sensor
(7) Crankshaft position sensor
(8) Mass air flow and intake air temperature sensor
(9) Tumble generator valve ASSY
(10) Secondary air pipe pressure sensor

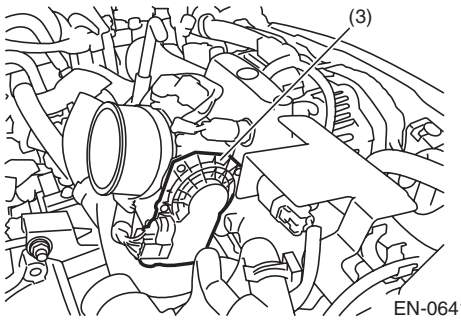
Electrical Component Location



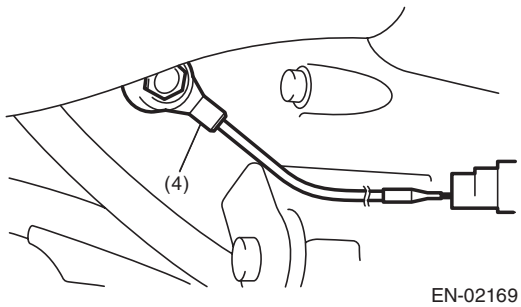
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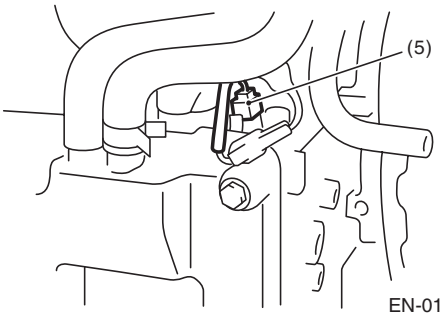
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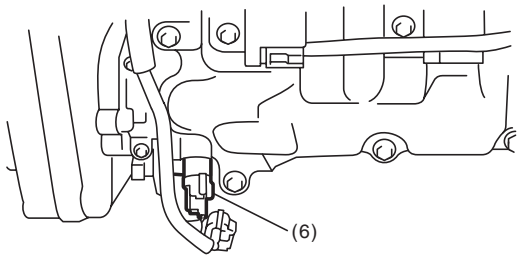
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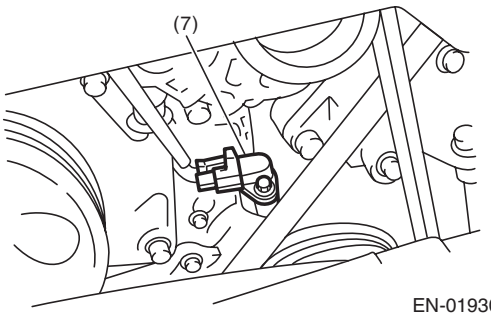
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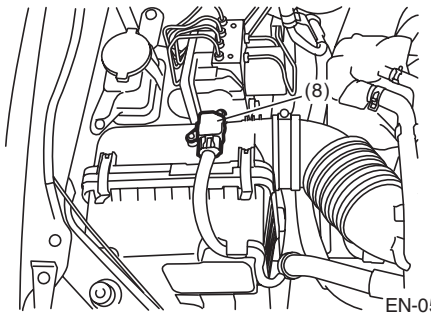
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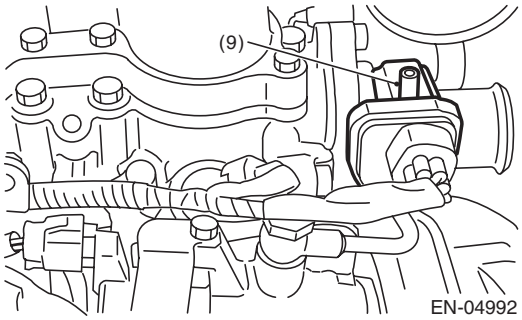
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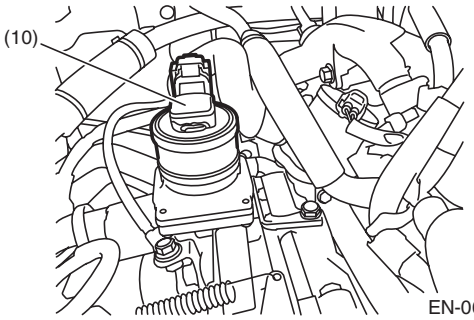
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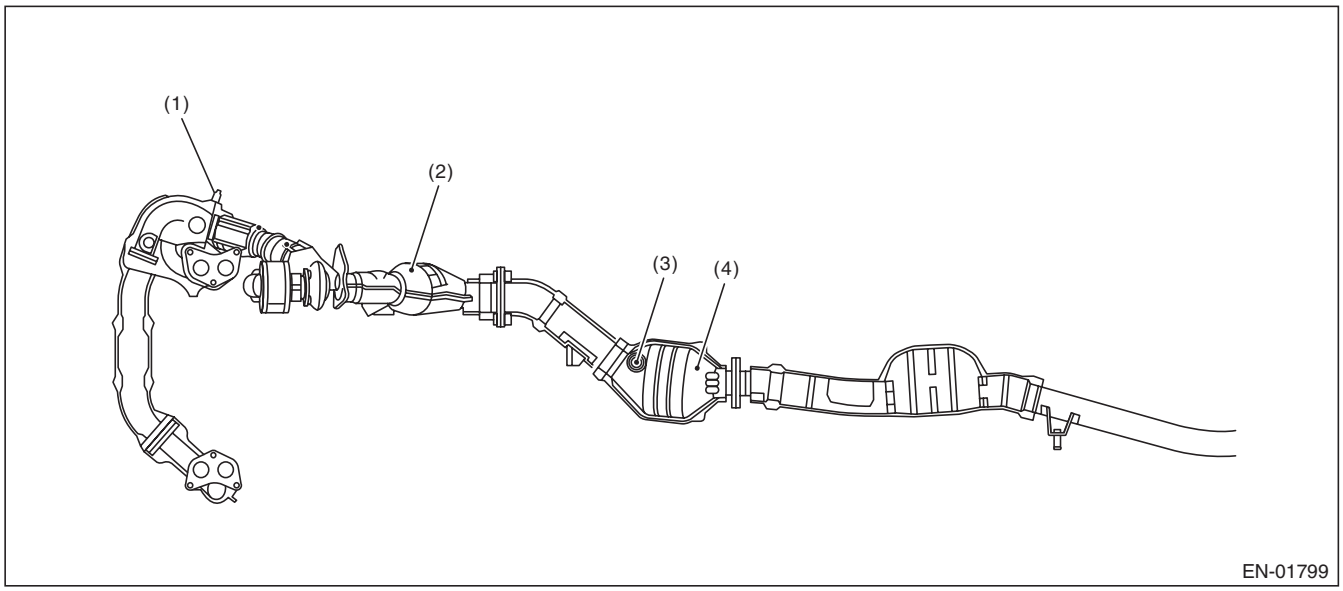
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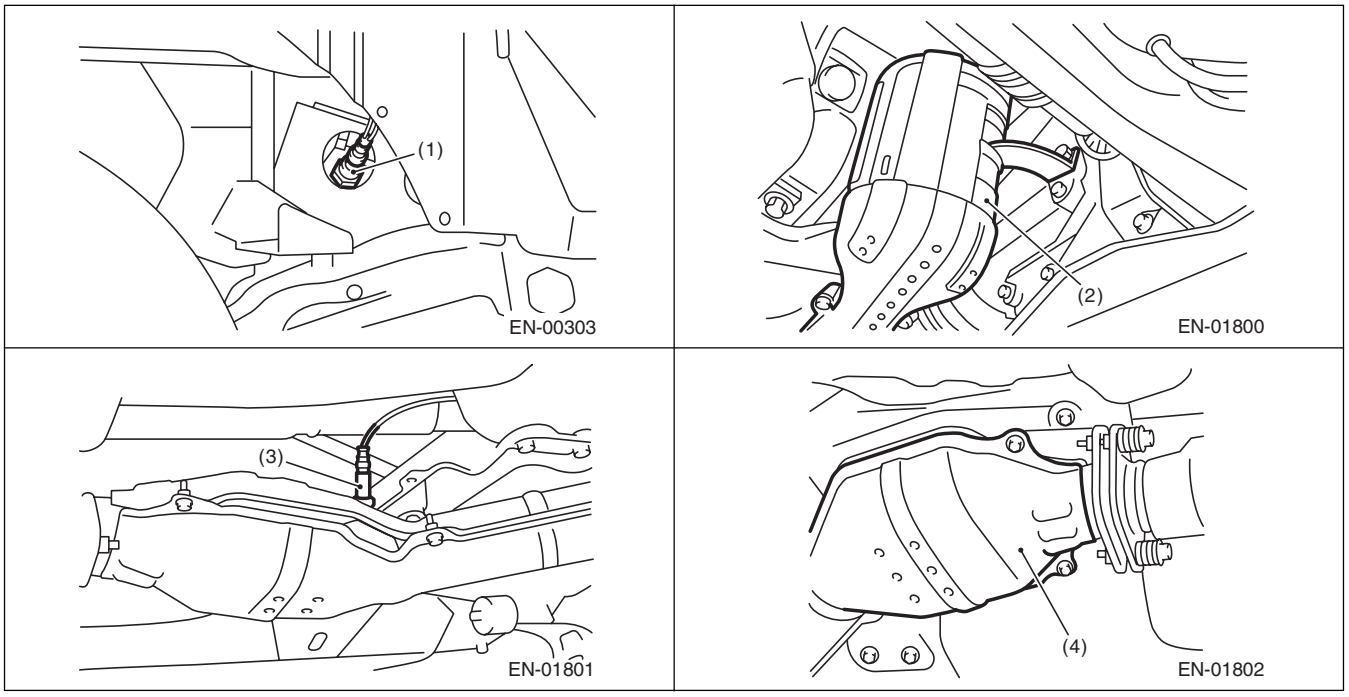
EN-04992



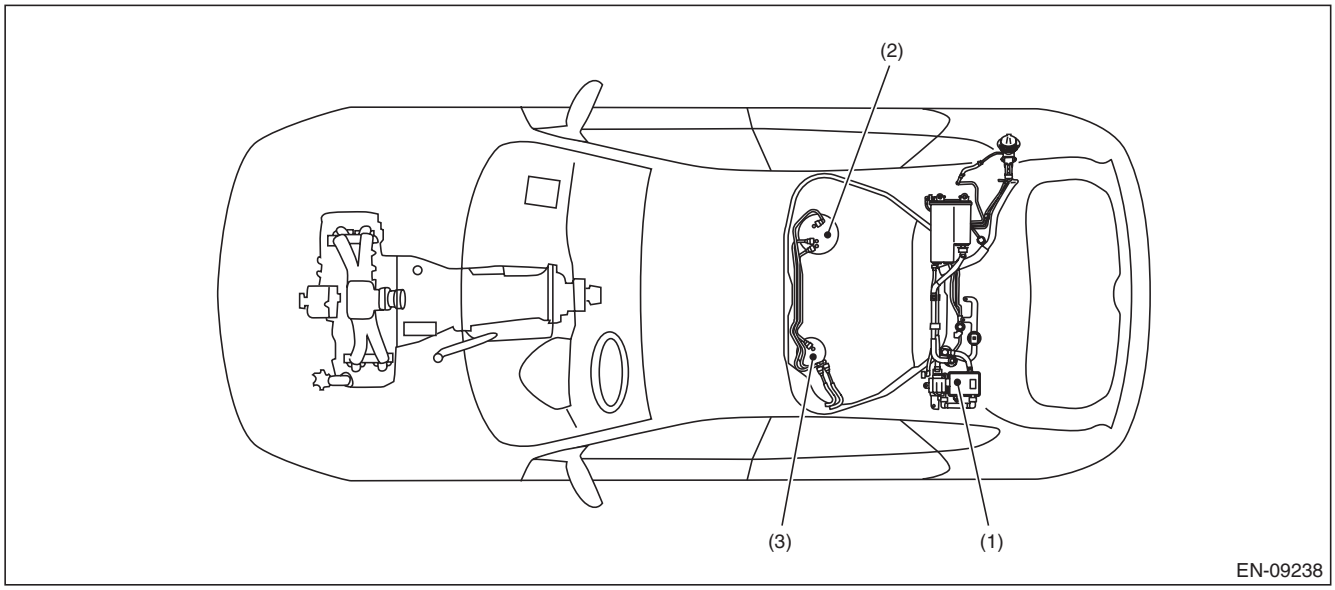
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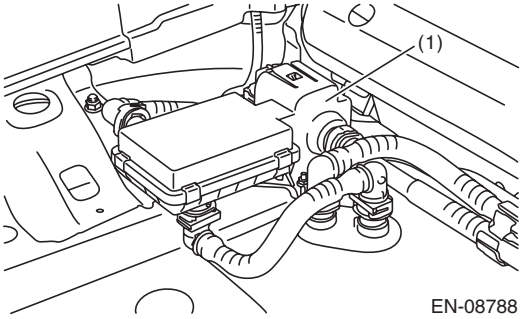
(1) Front oxygen (A/F) sensor
(2) Front catalytic converter
(3) Rear oxygen sensor
(4) Rear catalytic converter

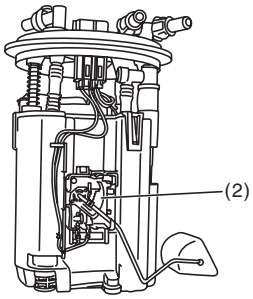


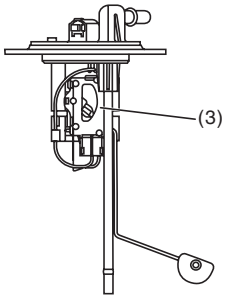
Electrical Component Location



(1) Leak check valve ASSY (with built-in pressure sensor)
(2) Fuel level sensor
(3) Fuel sub level sensor

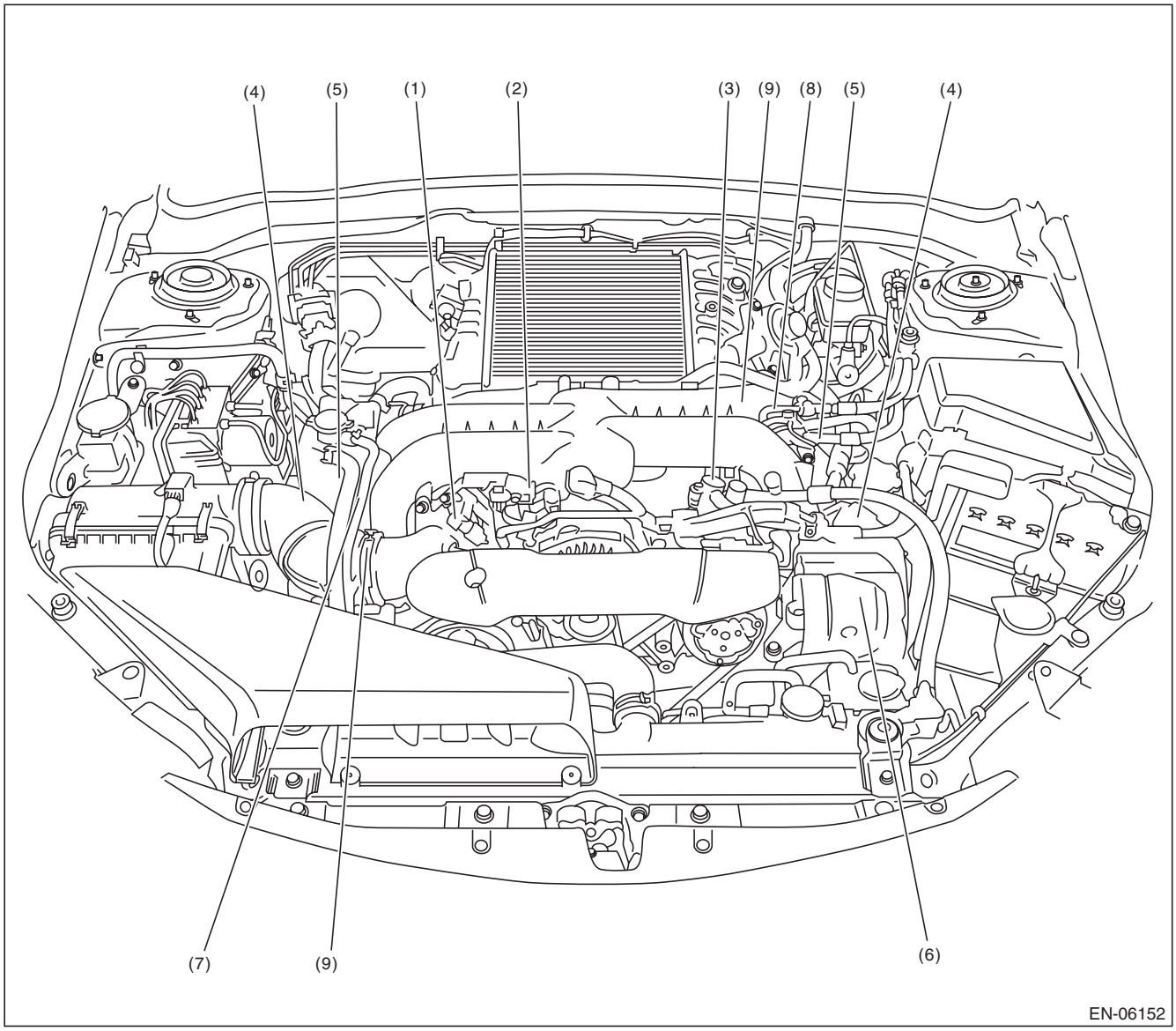






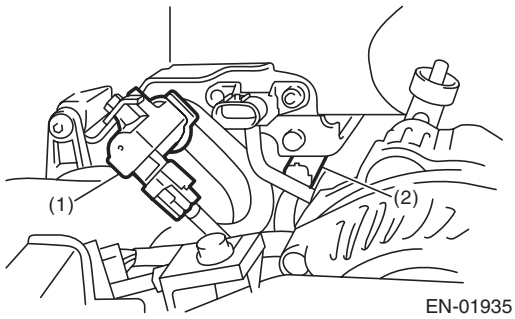
3. SOLENOID VALVE, ACTUATOR, EMISSION CONTROL SYSTEM PARTS AND IGNITION SYSTEM PARTS

- Models without SI-DRIVE

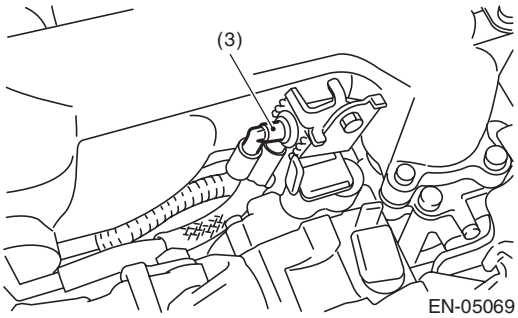


(1)	Wastegate control solenoid valve	(4)	Ignition coil	(7)	Secondary air combination valve RH
(2)	Purge control solenoid valve 2	(5)	Intake oil flow control solenoid valve	(8)	Secondary air combination valve LH
(3)	Purge control solenoid valve 1	(6)	Secondary air pump	(9)	Tumble generator valve ASSY

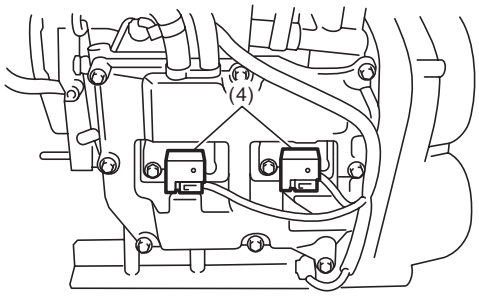
Electrical Component Location



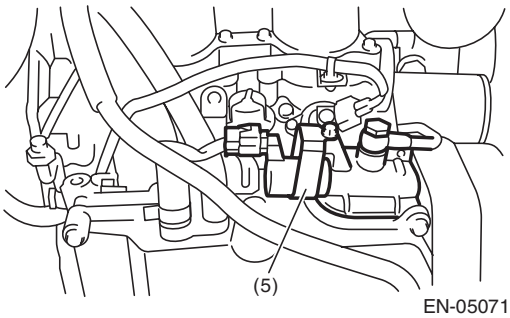
EN-01935



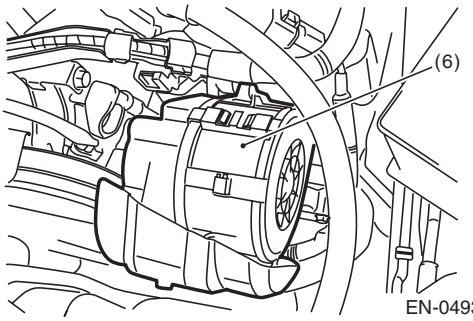
EN-05069



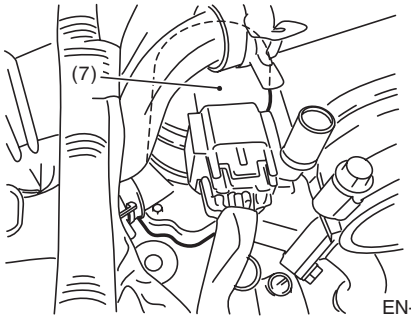
EN-05070



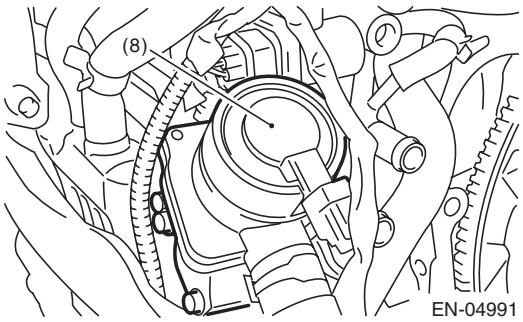
EN-05071



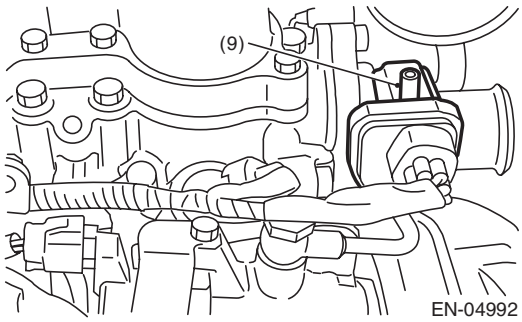
EN-04936



EN-04990

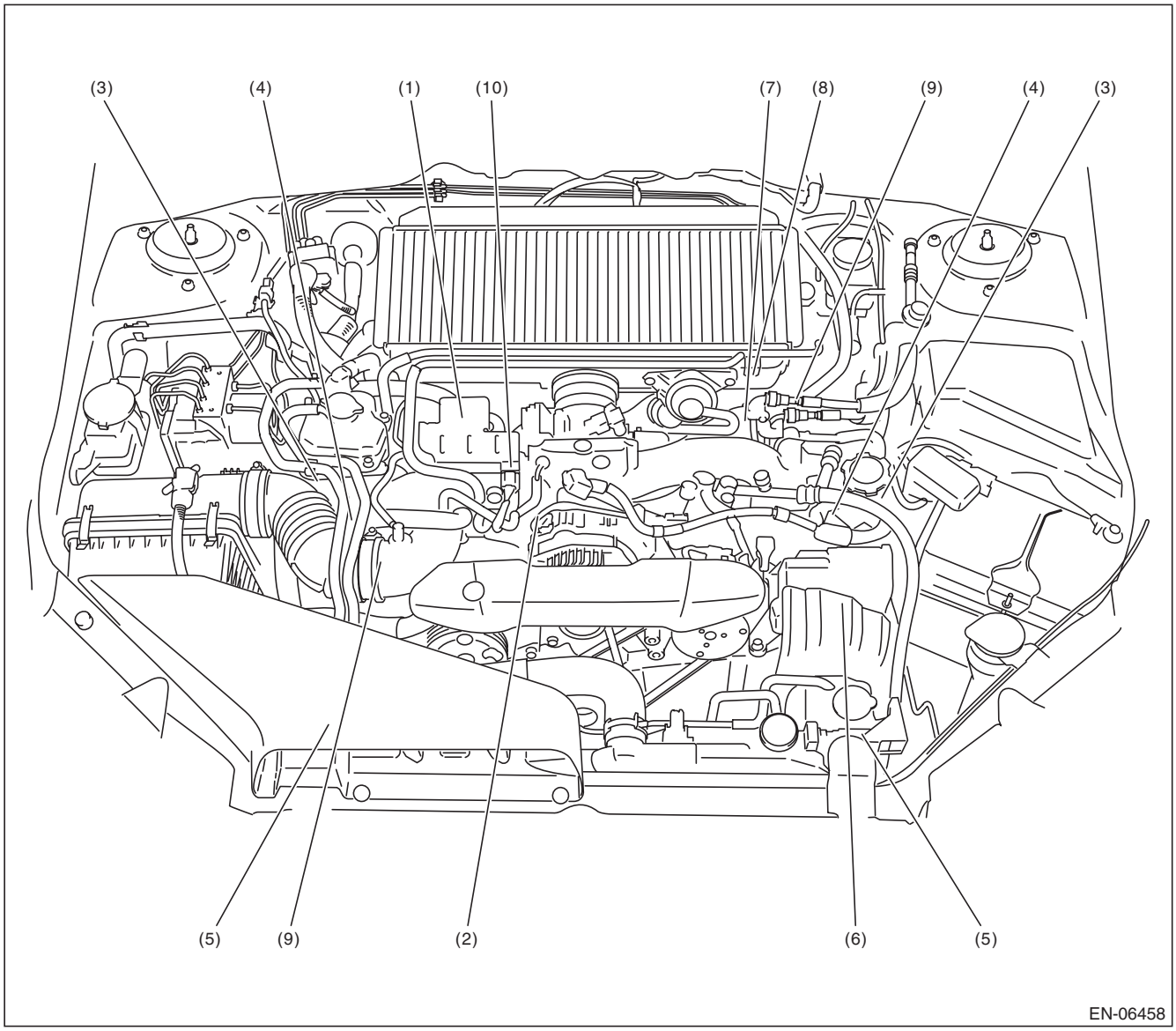


EN-04991



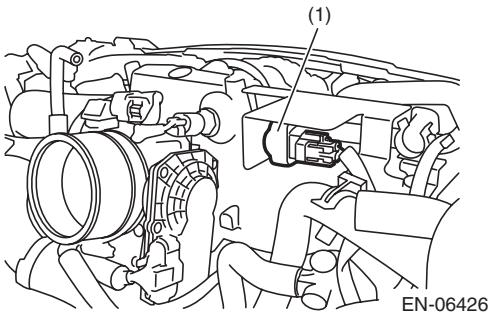
EN-04992

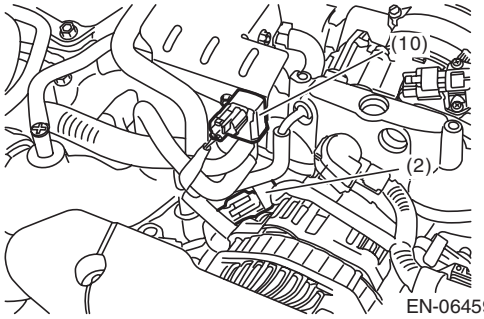
- Models with SI-DRIVE

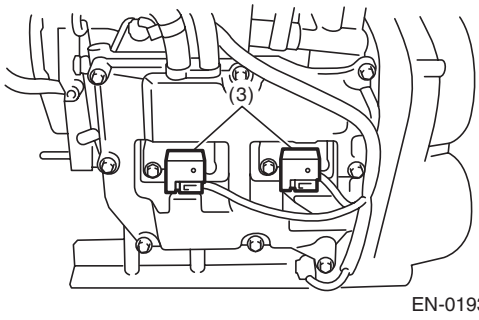


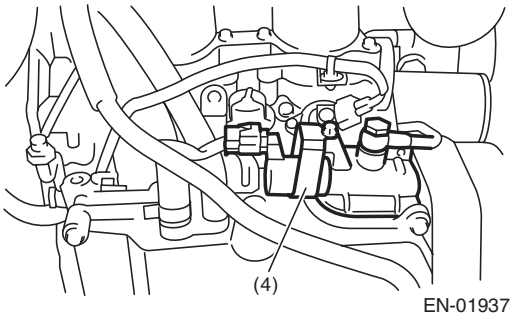
(1) Wastegate control solenoid valve
(2) Purge control solenoid valve 1
(3) Ignition coil
(4) Intake oil flow control solenoid valve
(5) Exhaust oil flow control solenoid valve
(6) Secondary air pump
(7) Secondary air combination valve RH
(8) Secondary air combination valve LH
(9) Tumble generator valve ASSY
(10) Purge control solenoid valve 2

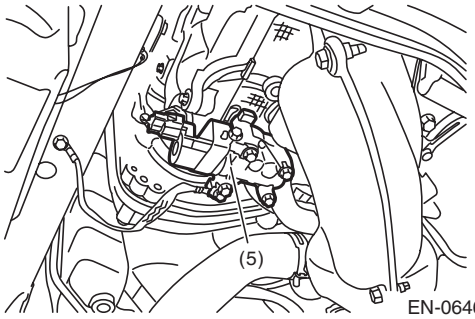
Electrical Component Location

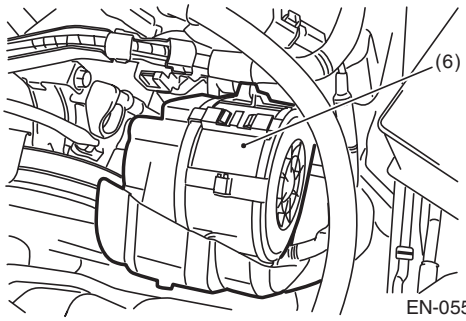


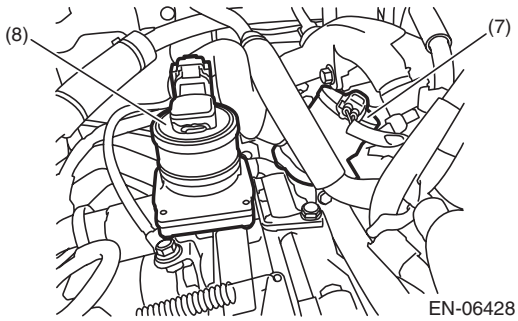


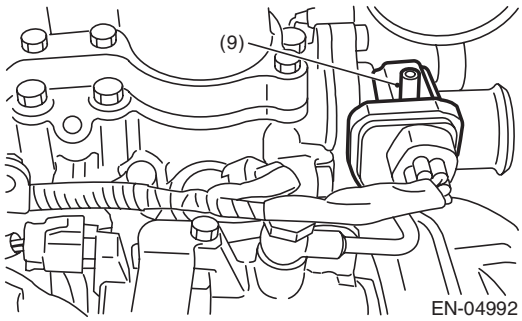


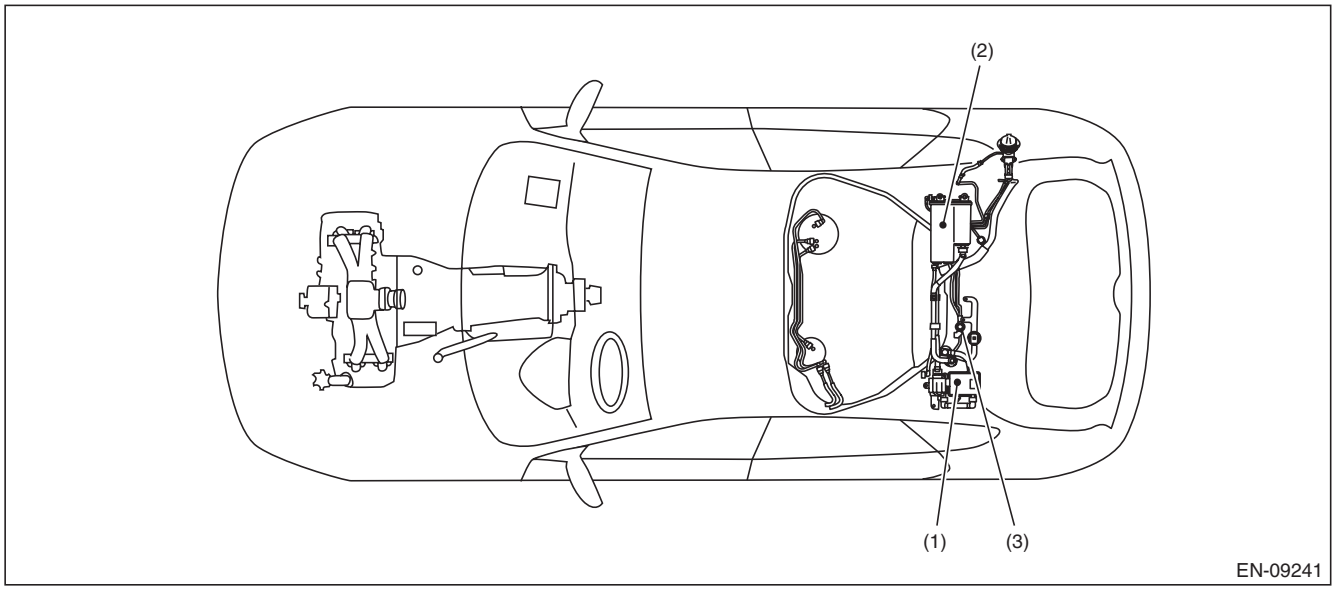




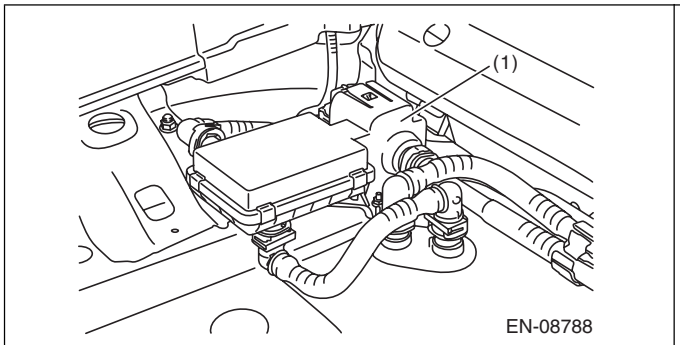


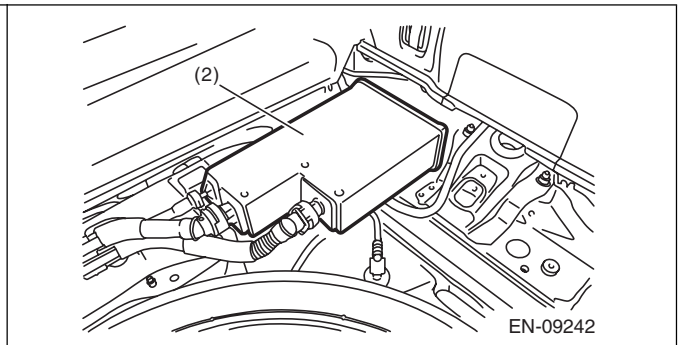


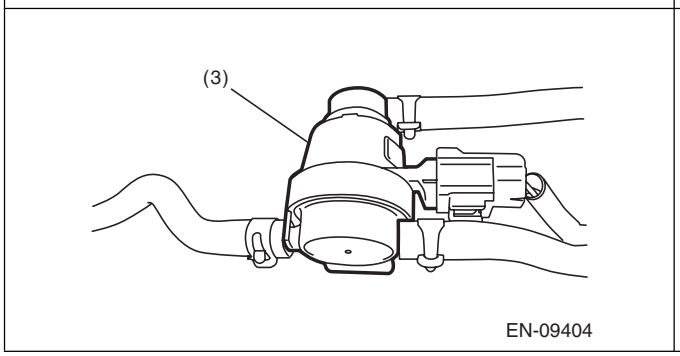




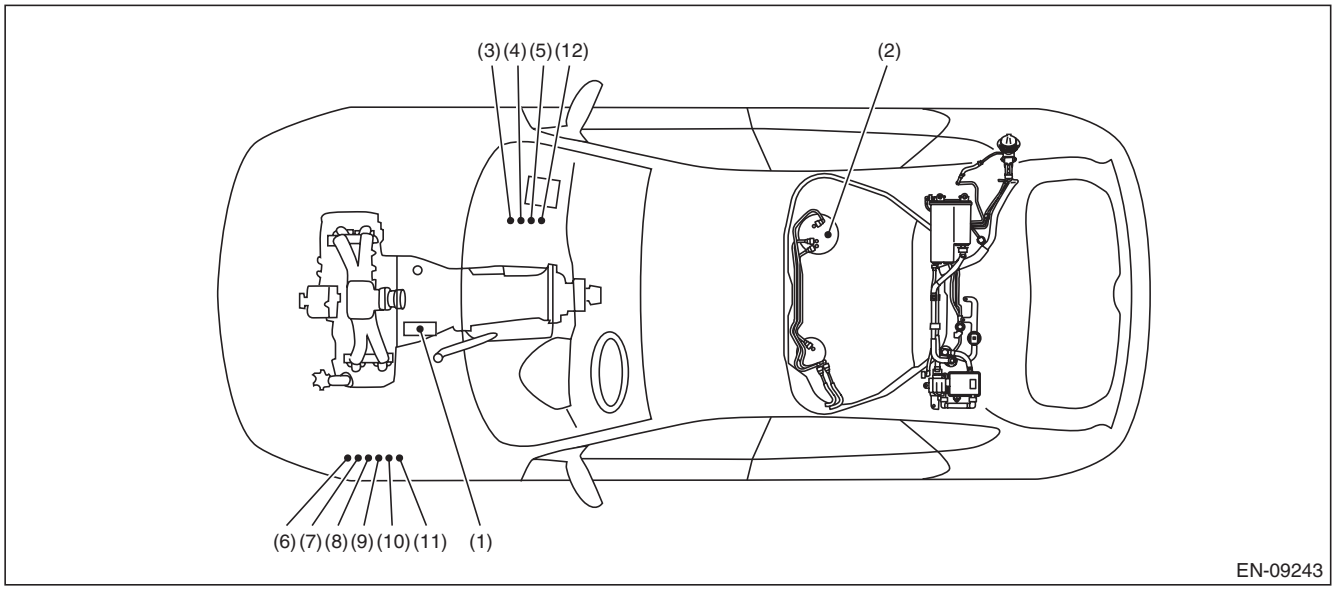
(1) Leak check valve ASSY
(2) Canister
(3) Pressure control solenoid valve ASSY



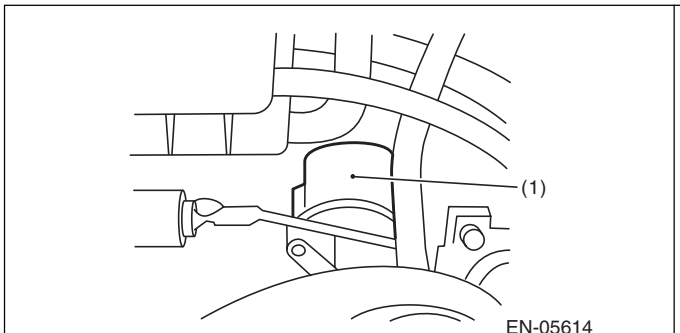


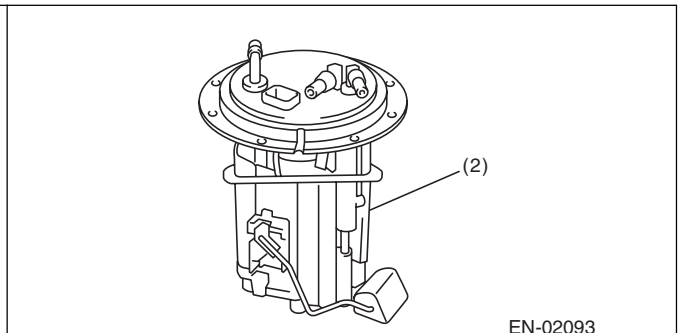


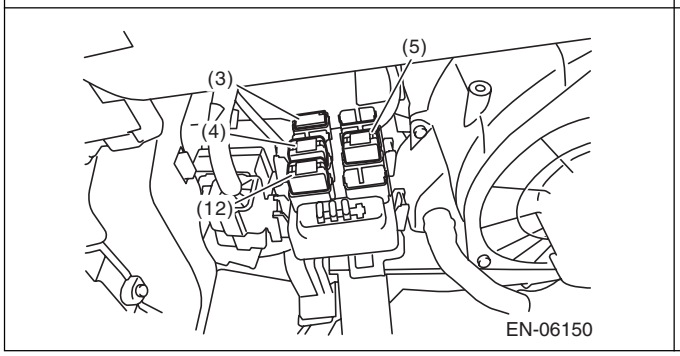
Electrical Component Location

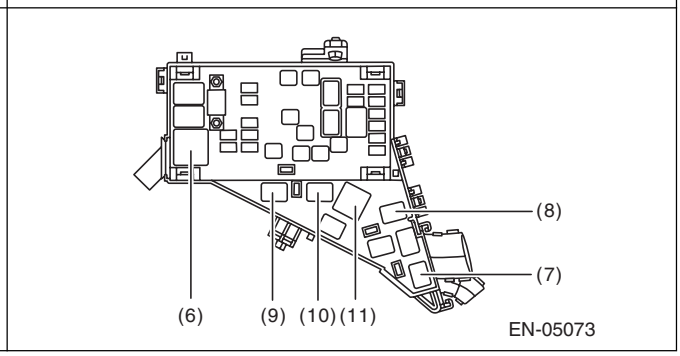


(1)	Starter	(5)	Electronic throttle control relay	(9)	Secondary air combination valve relay 1
(2)	Fuel pump	(6)	Radiator main fan relay 1	(10)	Secondary air combination valve relay 2
(3)	Main relay	(7)	Radiator sub fan relay	(11)	Secondary air pump relay
(4)	Fuel pump relay	(8)	Radiator main fan relay 2	(12)	A/F, oxygen sensor relay

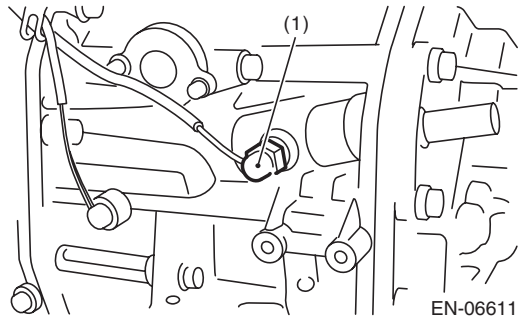
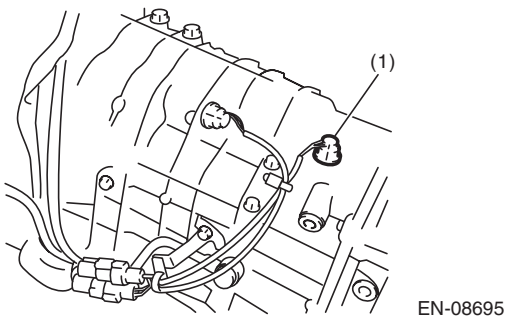








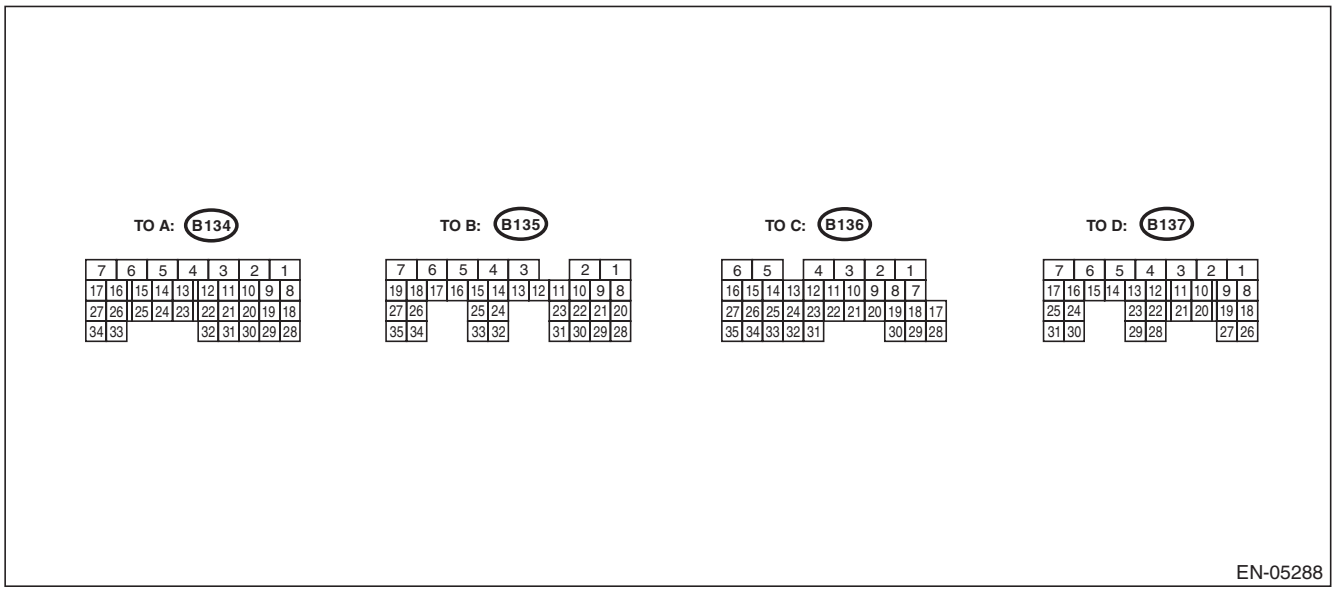
4. TRANSMISSION

• 5MT model	• 6MT model
	

(1) Neutral position switch

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 (+)	B137	17	0	–7 — +7	Waveform
	Signal (–)	B137	25	0	0	—
	Shield	B137	31	0	0	—
Front oxygen (A/F) sensor	Signal (+)	B136	19	2.8 — 3.2	2.8 — 3.2	—
	Signal (–)	B136	18	2.4 — 2.7	2.4 — 2.7	—
	Shield	B136	9	0	0	—
Rear oxygen sensor	Signal	B136	20	0	0 — 0.9	—
	Shield	B136	9	0	0	—
	Ground (sensor)	B135	30	0	0	—
Front oxygen (A/F) sensor heater	Signal 1	B136	6	—	—	Waveform
	Signal 2	B136	5	—	—	Waveform
Rear oxygen sensor heater signal		B135	6	0 — 13	12 — 14	Waveform
Engine coolant temperature sensor	Signal	B137	22	1.0 — 1.4	1.0 — 1.4	After engine is warmed up.
	Ground (sensor)	B134	29	0	0	After engine is warmed up.
Air flow sensor	Signal	B136	22	—	0.3 — 4.5	—
	Shield	B136	10	0	0	—
	Ground	B136	11	0	0	—
Intake air temperature sensor signal		B136	31	0.3 — 4.6	0.3 — 4.6	—
Wastegate control solenoid valve		B134	33	0 or 10 — 13	0 or 12 — 14	Waveform
Starter switch		B136	16	0	0	Cranking: 8 — 14
A/C switch		B136	29	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	—

Engine Control Module (ECM) I/O Signal

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Ignition switch		B136	30	10 — 13	12 — 14	—
Neutral position switch		B136	35	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Delivery (test) mode connector		B136	34	10 — 13	13 — 14	When connected: 0
Knock sensor	Signal	B137	2	2.45 — 2.55	2.45 — 2.55	—
	Shield	B137	8	0	0	—
Back-up power supply		B136	2	10 — 13	12 — 14	Ignition switch “OFF”: 10 — 13
Control module power supply		B136	1	10 — 13	12 — 14	—
		B137	7	10 — 13	12 — 14	—
Sensor power supply		B134	19	5	5	—
Ignition control	#1	B134	21	0	0 or 5	Waveform
	#2	B134	22	0	0 or 5	Waveform
	#3	B134	31	0	0 or 5	Waveform
	#4	B134	32	0	0 or 5	Waveform
Fuel injector	#1	B134	10	10 — 13	1 — 14	Waveform
	#2	B134	11	10 — 13	1 — 14	Waveform
	#3	B134	12	10 — 13	1 — 14	Waveform
	#4	B134	13	10 — 13	1 — 14	Waveform
Fuel pump control unit	Control	B136	33	0 or 5	0 or 5	Waveform
	Diagnostic signal	B135	10	10 — 13	12 — 14	—
A/C relay control		B135	35	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
Main fan relay control		B135	12	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
Sub fan relay control		B135	11	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 12 — 14	—
Engine speed output		B135	15	—	0 — 13 or more	Waveform
Purge control solenoid valve 1		B137	6	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	Waveform
Purge control solenoid valve 2		B137	15	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	Waveform
Manifold absolute pressure sensor	Signal	B137	20	1.7 — 2.4	1.1 — 1.6	—
	Power supply	B134	19	5	5	
	Ground (sensor)	B134	29	0	0	
Power steering oil pressure switch		B137	28	10 — 13	ON: 0 OFF: 12 — 14	—
SSM/GST communication line		B135	14	1 or less ←→ 4 or more	1 or less ←→ 4 or more	—
Intake camshaft position sensor (LH)		B137	16	0 or 5	0 or 5	Waveform
Intake camshaft position sensor (RH)		B137	24	0 or 5	0 or 5	Waveform
Exhaust camshaft position sensor (LH)		B137	29	0	–7 — +7	Models with SI-DRIVE Waveform
Exhaust camshaft position sensor (RH)		B137	23	0	–7 — +7	Models with SI-DRIVE Waveform

Engine Control Module (ECM) I/O Signal

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Camshaft position sensor ground		B137	30	0	0	—
Electronic Throttle	Main	B134	18	Approx. 0.9 (After engine is warmed up.)	Approx. 0.6 — 0.7 (After engine is warmed up.)	Fully closed: Approx. 0.6 Fully open: Approx. 4.0
	Sub	B134	28	Approx. 1.7 (After engine is warmed up.)	Approx. 1.5 — 1.6 (After engine is warmed up.)	Fully closed: Approx. 1.5 Fully open: Approx. 4.2
	Power supply	B134	19	5	5	—
	Ground (sensor)	B134	29	0	0	—
Electronic throttle control motor (+)		B134	2	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor (–)		B134	1	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor power supply		B135	7	10 — 13	12 — 14	—
Electronic throttle control motor relay		B135	17	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	When ignition switch is turned to ON: ON
Intake oil flow control solenoid valve (LH)	Signal (+)	B134	17	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	—
	Signal (–)	B134	16	0	0	—
Intake oil flow control solenoid valve (RH)	Signal (+)	B134	34	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	—
	Signal (–)	B134	27	0	0	—
Exhaust oil flow control solenoid valve (LH)	Signal (+)	B134	5	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	Models with SI-DRIVE
	Signal (–)	B134	14	0	0	Models with SI-DRIVE
Exhaust oil flow control solenoid valve (RH)	Signal (+)	B134	7	ON: 10 — 13 OFF: 0	ON: 12 — 14 OFF: 0	Models with SI-DRIVE
	Signal (–)	B134	15	0	0	Models with SI-DRIVE
Accelerator pedal position sensor	Main sensor signal	B135	23	Fully closed: 0.4 — 1.0 Fully opened: 2.4 — 3.7	Fully closed: 0.4 — 1.0 Fully opened: 2.4 — 3.7	—
	Main power supply	B135	21	5	5	—
	Ground (main sensor)	B135	29	0	0	—
	Shield	B136	4	0	0	—
	Sub sensor signal	B135	31	Fully closed: 0.3 — 1.1 Fully opened: 2.3 — 3.8	Fully closed: 0.3 — 1.1 Fully opened: 2.3 — 3.8	—
	Sub power supply	B135	22	5	5	—
	Ground (sub sensor)	B135	30	0	0	—
Starter relay		B135	26	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	ON: cranking

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
A/C middle pressure switch		B136	7	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Blower fan switch		B135	19	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	Manual A/C model
Clutch switch		B135	9	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 (brake switch)		B136	15	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 (stop light switch)		B136	3	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 command switch		B136	12	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	—
Cruise control main switch		B136	13	ON: 0 OFF: 5	ON: 0 OFF: 5	—
Fuel tank pressure sensor		B136	21	2.3 — 2.7	2.3 — 2.7	—
Pressure control solenoid valve assembly		B135	3	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 12 — 14	—
Immobilizer	Signal 1	B135	25	—	—	—
	Signal 2	B135	24	—	—	—
CAN communication (Hi)		B136	17	—	—	—
CAN communication (Lo)		B136	28	—	—	—
Blow-by leak diagnosis		B137	12	0	0	At the time of open circuit (fault): 5
Tumble generator valve position sensor signal (RH)		B137	11	Fully closed: 0.4 — 1.2 Fully opened: 2.8 — 4.6	Fully closed: 0.4 — 1.2 Fully opened: 2.8 — 4.6	—
Tumble generator valve position sensor signal (LH)		B137	10	Fully closed: 0.4 — 1.2 Fully opened: 2.8 — 4.6	Fully closed: 0.4 — 1.2 Fully opened: 2.8 — 4.6	—
Tumble generator valve (RH closed)		B134	26	0 or 10 — 13	0 or 12 — 14	—
Tumble generator valve (LH closed)		B134	24	0 or 10 — 13	0 or 12 — 14	—
Tumble generator valve (RH open)		B134	25	0 or 10 — 13	0 or 12 — 14	—
Tumble generator valve (LH open)		B134	23	0 or 10 — 13	0 or 12 — 14	—
Secondary air pipe pressure sensor	Signal	B137	9	2.2 — 2.8	2.2 — 2.8	When secondary air is inducted: 3.2 — 4.9
	Power supply	B134	19	5.12	5.12	—
	Ground (sensor)	B134	29	0	0	—

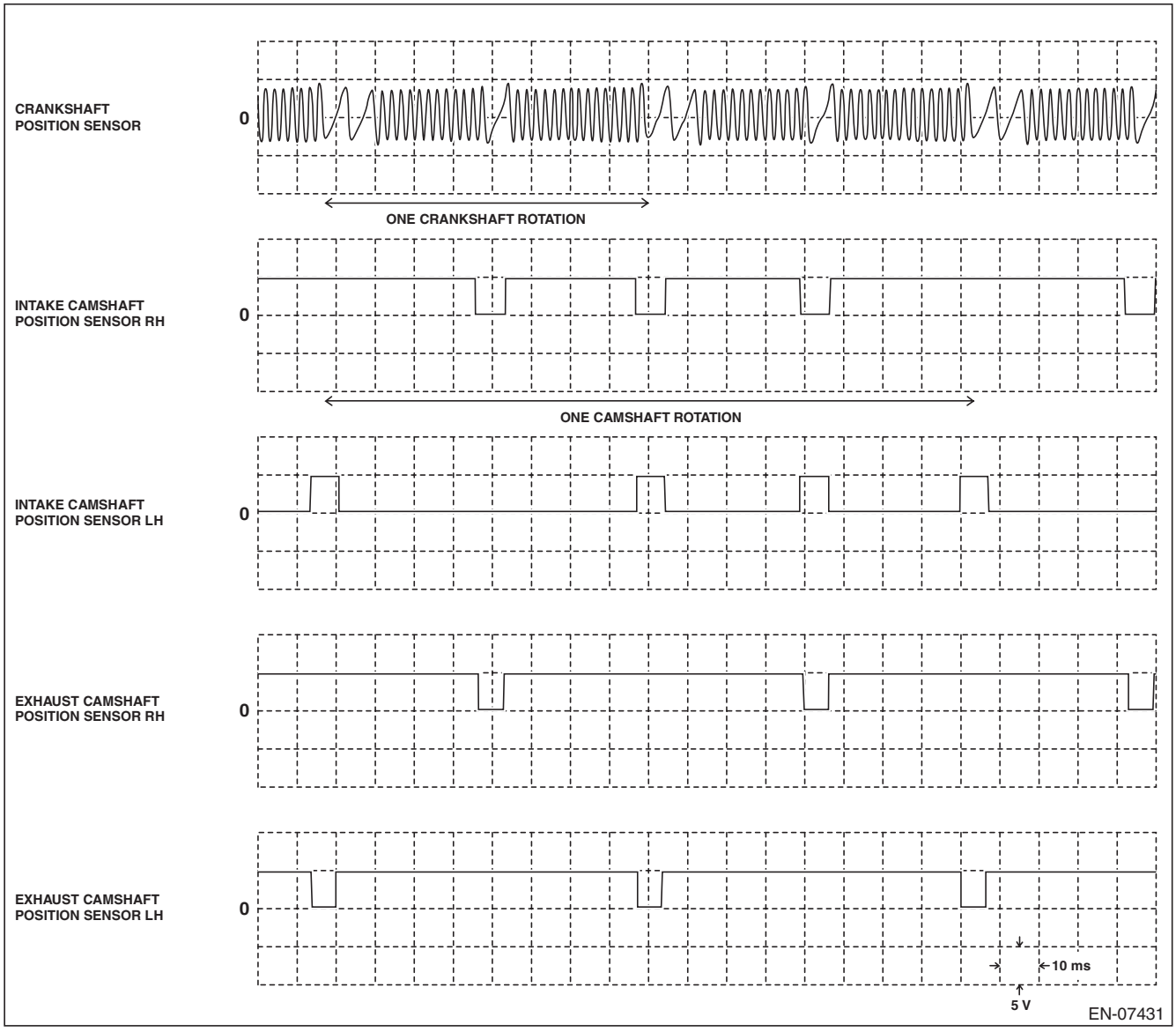
Engine Control Module (ECM) I/O Signal

Contents		Connector No.	Terminal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Secondary air combination valve relay 1		B135	8	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Secondary air combination valve relay 2		B135	20	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Secondary air pump relay		B135	27	ON: 0 OFF: 10 — 13	ON: 0 OFF: 12 — 14	—
Self-shutoff control		B135	13	10 — 13	12 — 14	—
ELCM	Switching valve	B135	4	10 — 13	12 — 14	Operating: 0
	Pressure sensor	B136	21	1 — 4	1 — 4	When ignition switch is turned to ON: atmospheric pressure
	Vacuum pump	B137	27	10 — 13	12 — 14	Operating: 0
Ground (engine 1)		B134	6	0	0	—
Ground (engine 2)		B134	4	0	0	—
Ground (engine 3)		B134	3	0	0	—
Ground (engine 4)		B137	1	0	0	—
Ground (engine 5)		B137	3	0	0	—
Ground (body)		B136	4	0	0	—

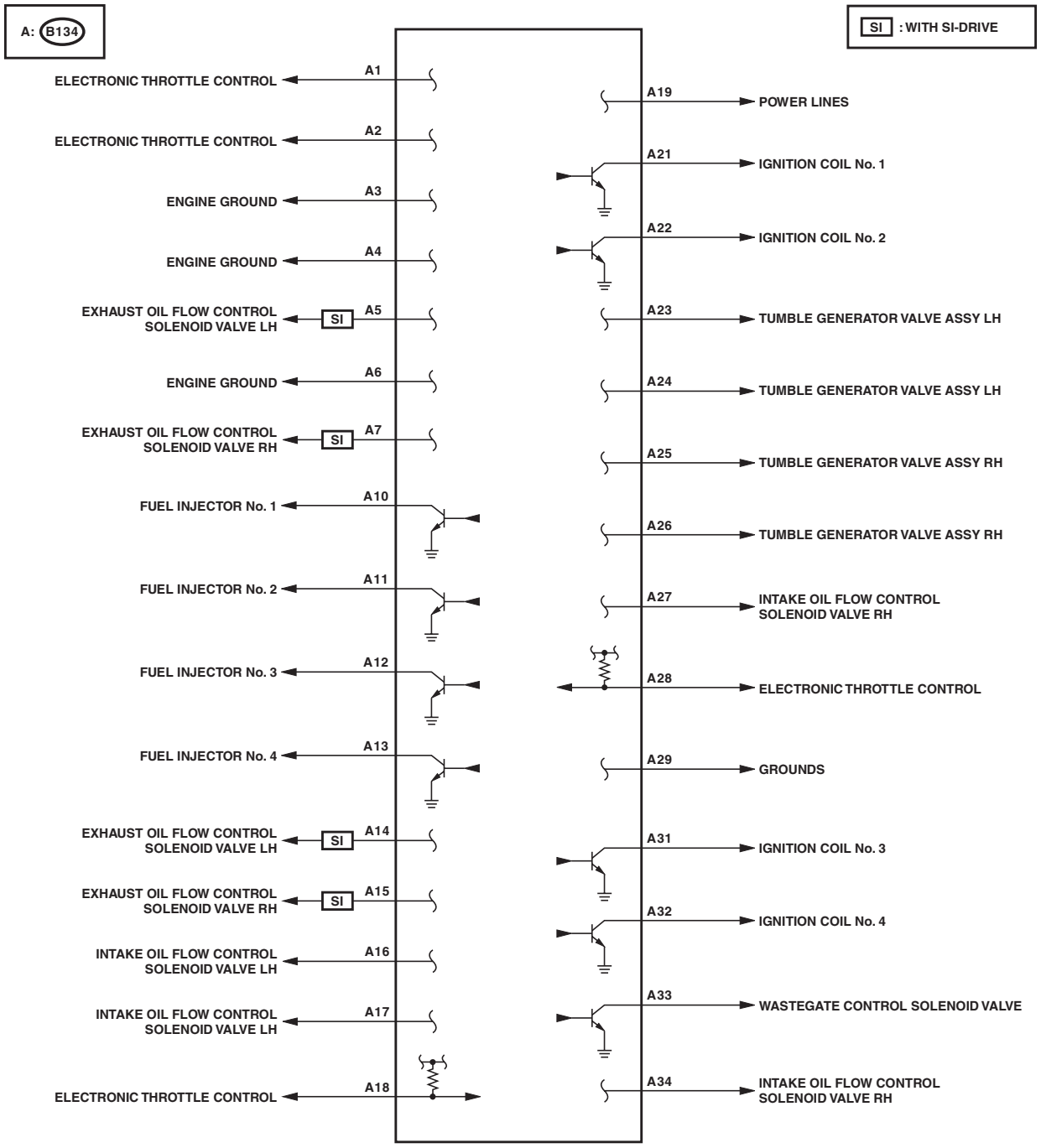
Engine Control Module (ECM) I/O Signal

Input/output name:
- Crankshaft position sensor
- Intake camshaft position sensor RH
- Intake camshaft position sensor LH
- Exhaust camshaft position sensor RH (models with SI-DRIVE)
- Exhaust camshaft position sensor LH (models with SI-DRIVE)

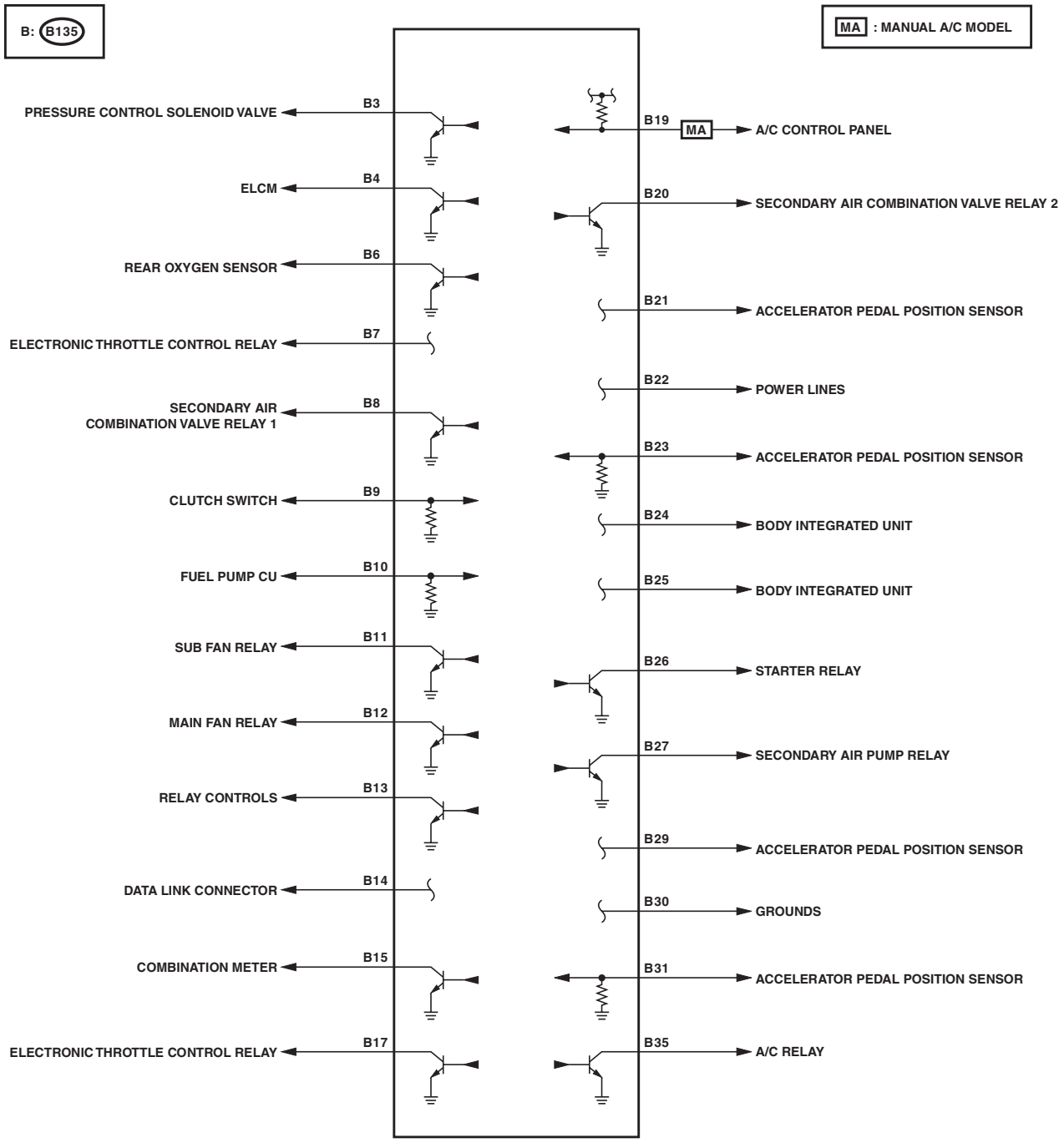
Measuring condition:
- After warming-up
- At idling



Engine Control Module (ECM) I/O Signal

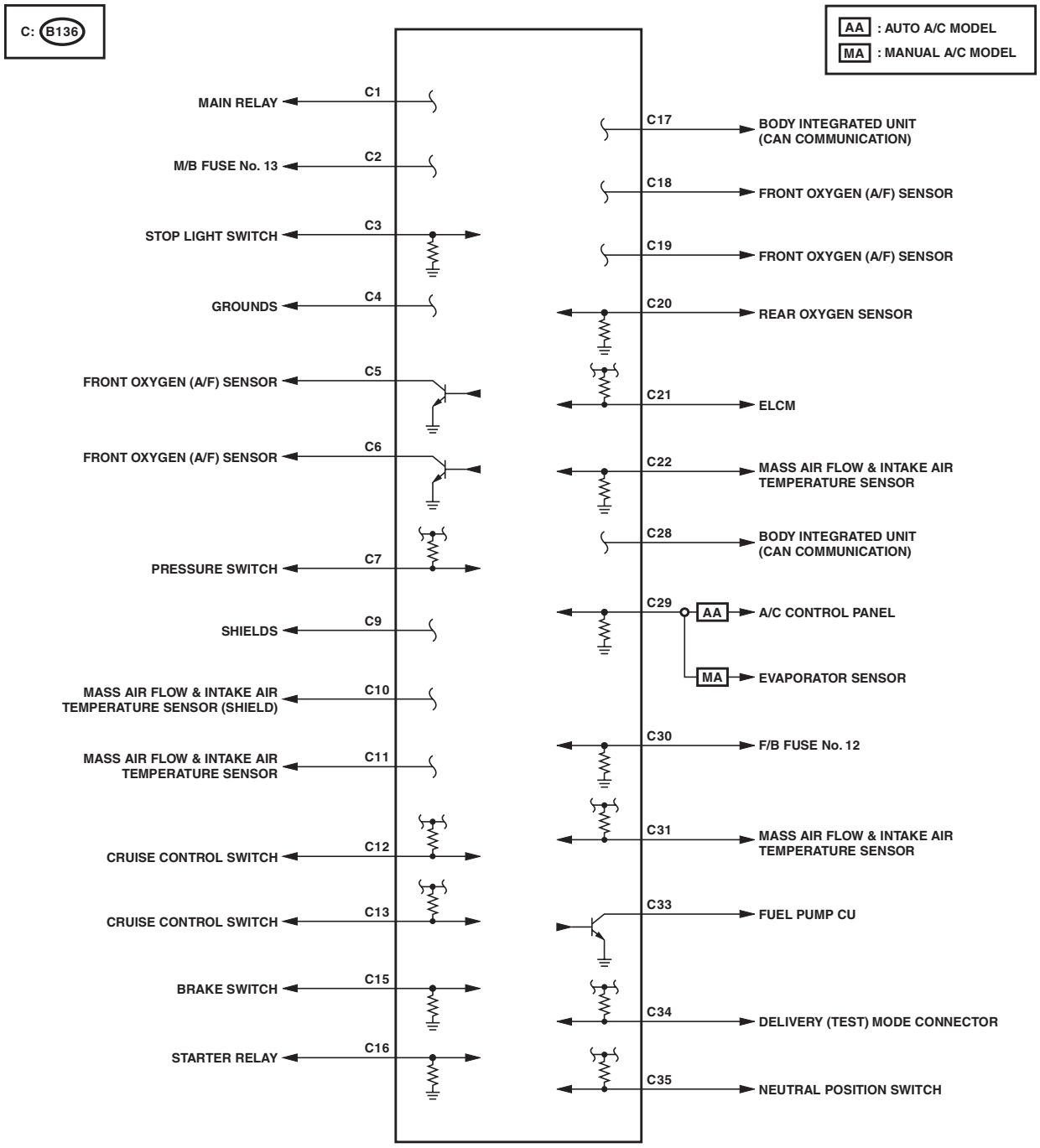


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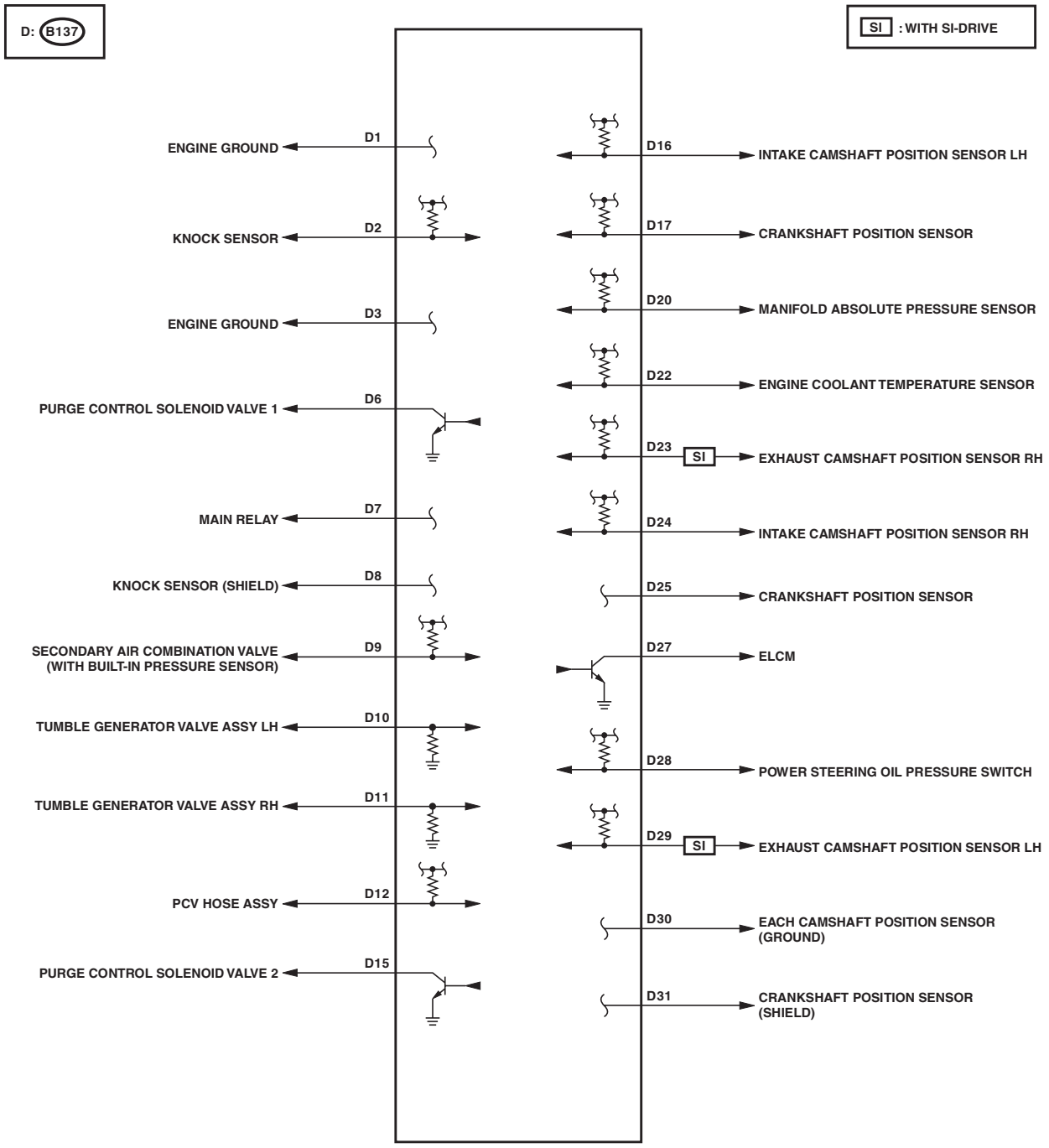

B: B135
MA : MANUAL A/C MODEL
PRESSURE CONTROL SOLENOID VALVE
B3
ELCM
B4
REAR OXYGEN SENSOR
B6
ELECTRONIC THROTTLE CONTROL RELAY
B7
SECONDARY AIR COMBINATION VALVE RELAY 1
B8
CLUTCH SWITCH
B9
FUEL PUMP CU
B10
SUB FAN RELAY
B11
MAIN FAN RELAY
B12
RELAY CONTROLS
B13
DATA LINK CONNECTOR
B14
COMBINATION METER
B15
ELECTRONIC THROTTLE CONTROL RELAY
B17
B19
MA
A/C CONTROL PANEL
B20
SECONDARY AIR COMBINATION VALVE RELAY 2
B21
ACCELERATOR PEDAL POSITION SENSOR
B22
POWER LINES
B23
ACCELERATOR PEDAL POSITION SENSOR
B24
BODY INTEGRATED UNIT
B25
BODY INTEGRATED UNIT
B26
STARTER RELAY
B27
SECONDARY AIR PUMP RELAY
B29
ACCELERATOR PEDAL POSITION SENSOR
B30
GROUNDS
B31
ACCELERATOR PEDAL POSITION SENSOR
B35
A/C RELAY

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Engine Control Module (ECM) I/O Signal



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D: B137
SI : WITH SI-DRIVE
ENGINE GROUND
D1
KNOCK SENSOR
D2
ENGINE GROUND
D3
PURGE CONTROL SOLENOID VALVE 1
D6
MAIN RELAY
D7
KNOCK SENSOR (SHIELD)
D8
SECONDARY AIR COMBINATION VALVE (WITH BUILT-IN PRESSURE SENSOR)
D9
TUMBLE GENERATOR VALVE ASSY LH
D10
TUMBLE GENERATOR VALVE ASSY RH
D11
PCV HOSE ASSY
D12
PURGE CONTROL SOLENOID VALVE 2
D15
D16
INTAKE CAMSHAFT POSITION SENSOR LH
D17
CRANKSHAFT POSITION SENSOR
D20
MANIFOLD ABSOLUTE PRESSURE SENSOR
D22
ENGINE COOLANT TEMPERATURE SENSOR
D23
SI
EXHAUST CAMSHAFT POSITION SENSOR RH
D24
INTAKE CAMSHAFT POSITION SENSOR RH
D25
CRANKSHAFT POSITION SENSOR
D27
ELCM
D28
POWER STEERING OIL PRESSURE SWITCH
D29
SI
EXHAUST CAMSHAFT POSITION SENSOR LH
D30
EACH CAMSHAFT POSITION SENSOR (GROUND)
D31
CRANKSHAFT POSITION SENSOR (SHIELD)

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6. Engine Condition Data

A: ELECTRICAL SPECIFICATION

Content	Specifications
Engine load	17.6 — 35.64 (%): Idling
	13.2 — 26.73 (%): 2,500 rpm racing

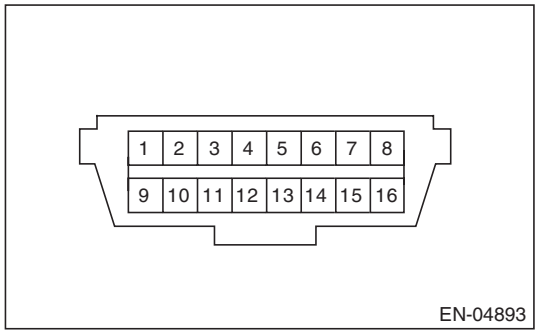
Measuring condition:
- After engine is warmed up.
- Place the shift lever in neutral position.
- Turn the A/C to OFF.
- Turn all the accessory switches to OFF.

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.



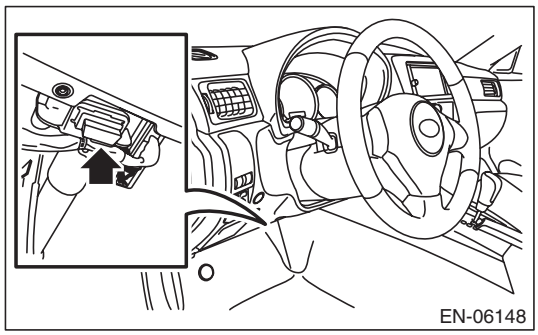
Terminal No.	Content	Terminal No.	Content
1	Blank	9	Blank
2	Blank	10	Blank
3	Blank	11	Blank
4	Ground	12	Blank
5	Ground	13	Blank
6	CAN communication (Hi)	14	CAN communication (Lo)
7	Subaru Select Monitor signal	15	Blank
8	Blank	16	Power supply

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 $08: Request control for on-board system, test, and component
   (8) MODE $09: Request vehicle information
4) Read out the data according to repair procedures. (For detailed operation procedure, refer to the general scan tool operation manual.)

NOTE:
For details concerning DTC, refer to "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-87, 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 temperature	°C
$10	Intake air amount	g/s
$11	Throttle valve absolute opening angle	%
$12	Secondary air control status	—
$13	Check whether oxygen sensor is installed.	—
$15	Oxygen sensor output voltage and short term fuel trim associated with oxygen sensor	V and %
$1C	Supporting OBD system	—
$1F	Elapsed time after starting the engine	sec
$21	Running distance after MIL turns on	miles
$24	A/F value and A/F sensor output voltage	— and V
$2E	Evaporative purge	%
$2F	Fuel level	%
$30	Number of warm ups after DTC clear	—
$31	Travel distance after DTC clear	miles
$33	Barometric pressure	kPa
$34	A/F sensor λ value, current	— and mA
$3C	Catalyst temperature	°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 operation time during MIL on	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 operation manual to access current powertrain diagnostic data (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 freeze frame data to be stored	—
$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 temperature	°C
$10	Intake air amount	g/s
$11	Throttle valve absolute opening angle	%
$12	Secondary air control status	—
$13	Air fuel ratio sensor	—
$15	Rear oxygen sensor voltage, compensation value	V and %
$1C	Supporting OBD system	—
$1F	Elapsed time after starting the engine	sec
$2E	Evaporative purge	%
$2F	Fuel level	%
$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 operation 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(H4DOTC)(diag)-87, 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.

NOTE:
Refer to the manufacturer's operation manual for the general scan tool to clear the emission-related diagnostic information (MODE $04).

6. MODE $06

Refer to diagnostic 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.

NOTE:
Some items are not displayed according to the specifications.

OBDMID	TID	SID	Diagnostic item
$01	$84	$1E	A/F sensor range failure (Bank 1 Sensor 1)
	$85	$1E	
	$86	$20	A/F sensor response failure (Bank 1 Sensor 1)
	$91	$20	
	$92	$10	
	$A3	$20	
	$A4	$10	
	$AC	$10	
	$AD	$10	
	$AE	$10	
	$AF	$10	
	$CD	$20	
	$CF	$20	
	$DF	$10	
$02	$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	
	$BD	$10	
	$D1	$10	Oxygen sensor delay failure (Bank 1 Sensor 2)
	$D2	$01	
$21	$89	$20	Catalyst deterioration diagnosis (Bank 1)
$35	$8B	$9D	VVT monitor (Bank 1)
	$8C	$9D	
	$8D	$9D	
	$8E	$9D	
	$D3	$9D	
	$D4	$9D	
	$D5	$9D	
	$D6	$9D	
$36	$8B	$9D	VVT monitor (Bank 2)
	$8C	$9D	
	$8D	$9D	
	$8E	$9D	
	$D3	$9D	
	$D4	$9D	
	$D5	$9D	
	$D6	$9D	

OBDMID	TID	SID	Diagnostic item
$3C	$96	$FE	Evaporative emission control system (0.02 inch leak)
	$C1	$FE	
	$C2	$FE	
	$C3	$FE	
	$C4	$FE	
	$C5	$FE	
	$C6	$35	
	$C7	$FE	
	$C8	$FE	
	$C9	$FE	
	$CA	$FE	
$3D	$98	$FE	Evaporative emission control system (Purge flow)
	$CB	$35	ELCM purge flow
	$CC	$FE	
$41	$9B	$14	A/F sensor heater characteristics failure (Bank 1 Sensor 1)
$42	$A2	$24	Oxygen sensor heater characteristics failure (Bank 1 Sensor 2)
$71	$9E	$17	Secondary air system (all systems)
	$9F	$0B	
	$A1	$0B	
	$B0	$17	Secondary air system (relay 2 — combination valve 2)
	$B3	$0B	
	$B5	$0B	
	$B4	$0B	
	$B6	$0B	
	$B8	$0B	
	$B9	$31	
	$BA	$31	
$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 $08 (REQUEST CONTROL FOR ON-BOARD SYSTEM, TEST, AND COMPONENT)

Perform “Active Test” of the on-board system.

9. MODE $09

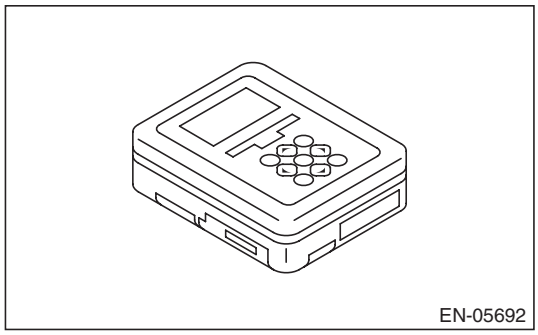
Refer to the data of the vehicle specification.

9. Subaru Select Monitor

A: OPERATION

1. HOW TO USE SUBARU SELECT MONITOR

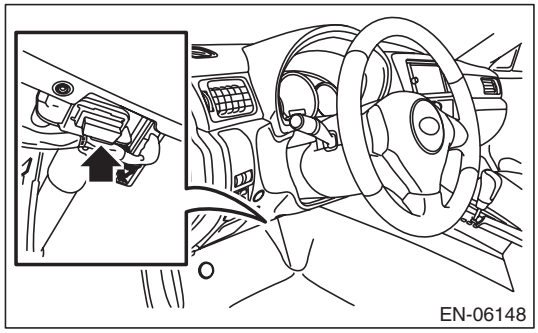
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>


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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.


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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	80 — 100°C or 176 — 212°F
A/F correction #1	A/F Correction #1	%	–10 — +10%
A/F learning #1	A/F Learning #1	%	–15 — +15%
Intake manifold absolute pressure	Mani. Absolute Pressure	mmHg, kPa, inHg or psig	220 — 275 mmHg, 29.5 — 37 kPa, 8.7 — 10 inHg or 4.2 — 5.3 psig
Engine speed signal	Engine Speed	rpm	630 — 770 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	10 — 15 deg
Intake air temperature signal	Intake Air Temp.	°C or °F	20 — 50°C or 68 — 122°F
Intake air amount	Mass Air Flow	g/s or lb/m	2.1 — 3.1 g/s or 0.35 — 0.40 lb/m
Throttle opening angle signal	Throttle Opening Angle	%	2.0 — 2.4%
Rear oxygen sensor voltage	Rear O2 Sensor	V	0 — 1.0 V
Battery voltage	Battery Voltage	V	12 — 15 V
Mass air flow voltage	Air Flow Sensor Voltage	V	1.0 — 1.7 V
Injection 1 pulse width	Fuel Injection #1 Pulse	ms	1.2 — 2.2 ms
Atmospheric pressure	Atmosphere Pressure	mmHg, kPa, inHg or psig	—
Intake manifold relative pressure	Mani. Relative Pressure	mmHg, kPa, inHg or psig	Air intake absolute pressure — Atmospheric pressure
Learned ignition timing	Learned Ignition Timing	deg	0 deg
Acceleration opening angle signal	Accel. Opening Angle	%	0.0%
Primary supercharged pressure control signal	Primary Control	%	0.0%
Purge control solenoid duty ratio	CPC Valve Duty Ratio	%	0 — 25%
Tumble generator valve RH opening signal	TGV Position Sensor R	V	0.81 V
Tumble generator valve LH opening signal	TGV Position Sensor L	V	0.81 V
Fuel pump duty ratio	Fuel Pump Duty	%	30 — 40%
AVCS advance angle amount RH	VVT Adv. Ang. Amount R	deg	±5 deg
AVCS advance angle amount LH	VVT Adv. Ang. Amount L	deg	±5 deg
Oil flow control solenoid valve duty ratio RH	OCV Duty R	%	0 — 20%
Oil flow control solenoid valve duty ratio LH	OCV Duty L	%	0 — 20%
Oil flow control solenoid valve current RH	OCV Current R	mA	40 — 100 mA
Oil flow control solenoid valve current LH	OCV Current L	mA	40 — 100 mA
A/F sensor current value 1	A/F Sensor #1 Current	mA	–20 — 20 mA
A/F sensor resistance value 1	A/F Sensor #1 Resistance	Ω	27 — 35 mA
A/F sensor output lambda 1	A/F Sensor #1	—	1.0
A/F correction #3	A/F Correction #3	%	0.00%
A/F learning #3	A/F Learning #3	%	0.00%

Content	Display	Unit of measure	Note (at idling)
SI drive mode (model with SI-DRIVE)	SI Drive mode	—	I, S or S#
Throttle motor duty	Throttle Motor Duty	%	–5%
Throttle motor voltage	Throttle Motor Voltage	V	12 — 15 V
Sub throttle sensor voltage	Sub-Throttle Sensor	V	1.5 V
Main throttle sensor voltage	Main-Throttle Sensor	V	0.6 V
Sub accelerator sensor voltage	Sub-Accelerator Sensor	V	1.1 V
Main acceleration sensor voltage	Main-Accelerator Sensor	V	1.0 V
Secondary air supply piping pressure signal	Sec. Air Piping Pressure	mmHg, kPa, inHg or psig	765 mmHg, 102 kPa, 30.1 inHg or 14.8 psig
Secondary airflow signal	Sec. Air Flow	g/s or lb/m	0.00 g/s or 0.00 lb/m
Memory vehicle speed	Memorized Cruise Speed	km/h or MPH	—
Fuel level sensor resistance	Fuel level resistance	Ω	4 — 96 Ω
Odometer	Odometer	km	—
Exhaust AVCS retard angle amount RH (model with SI-DRIVE)	Exh. VVT Retard Ang. R	deg	±5 deg
Exhaust AVCS retard angle amount LH (model with SI-DRIVE)	Exh. VVT Retard Ang. L	deg	±5 deg
Exhaust oil flow control solenoid valve duty ratio RH (model with SI-DRIVE)	Exh. OCV Duty R	%	0 — 20%
Exhaust oil flow control solenoid valve duty ratio LH (model with SI-DRIVE)	Exh. OCV Duty L	%	0 — 20%
Exhaust oil flow control solenoid valve current value RH (model with SI-DRIVE)	Exh. OCV Current R	mA	40 — 100 mA
Exhaust oil flow control solenoid valve current value LH (model with SI-DRIVE)	Exh. OCV Current L	mA	40 — 100 mA
#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 correction	Knocking Correction	deg	0.0 deg
AT vehicle ID signal	AT Vehicle ID Signal	—	OFF
D-check require Flag	D-check Require Flag	—	OFF
Delivery (test) mode terminal	Delivery Mode Connector (Test Mode Connector)	—	OFF
Neutral position switch signal	Neutral Position Switch	—	ON
Soft idle switch signal	Idle Switch Signal	—	ON
Ignition switch signal	Ignition Switch	—	ON
Power steering switch signal	P/S Switch	—	OFF (when OFF)
Air conditioning switch signal	A/C Switch	—	OFF (when OFF)
Starter switch signal	Starter Switch	—	OFF
Rear oxygen monitor	Rear O2 Rich Signal	—	ON/OFF
Knocking signal	Knocking Signal	—	OFF
Crankshaft position sensor signal	Crankshaft Position Sig.	—	ON
Camshaft position sensor signal	Camshaft Position Sig.	—	ON
Rear defogger switch signal	Rear Defogger SW	—	OFF (when OFF)
Blower fan switch signal	Blower Fan SW	—	OFF (when OFF)
Light switch signal	Light Switch	—	OFF (when OFF)
A/C middle pressure switch signal	A/C Mid Pressure Switch	—	OFF (when OFF)
Air conditioner compressor relay output signal	A/C Compressor Signal	—	OFF (when OFF)
Radiator fan relay 1 signal	Radiator Fan Relay #1	—	OFF (when OFF)

Content	Display	Unit of measure	Note (at idling)
Radiator fan relay 2 signal	Radiator Fan Relay #2	—	OFF (when OFF)
PCV hose assembly diagnosis signal	Blow-by leak Connector	—	ON
Pressure control solenoid valve assembly signal	PCV Solenoid Valve	—	OFF (when OFF)
Tumble generator valve output signal	TGV Output	—	OFF
Tumble generator valve driving signal	TGV Drive	—	Close
Purge control solenoid valve 2 signal	CPC Solenoid 2	—	OFF (when OFF)
Vehicle dynamics control (VDC) torque down prohibition output	Ban of Torque Down	—	ON
Vehicle dynamics control (VDC) torque down demand	Request Torque Down VDC	—	OFF
ETC 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 (when OFF)
Main switch signal	Main Switch	—	OFF (when OFF)
Secondary air combination valve relay 2 signal	Sec. Air Combi V Relay 2	—	OFF (when OFF)
Secondary air pump relay signal	Sec. Air Pump Relay	—	OFF (when OFF)
Secondary air combination valve relay 1 signal	Sec. Air Combi V Relay 1	—	OFF (when OFF)
Cruise control cancel switch signal	CC Cancel SW	—	OFF (when OFF)
Malfunction indicator light signal	MIL On Flag	—	OFF (when unlit)
ELCM switching valve drive signal	ELCM switching valve	—	Open
ELCM vacuum pump drive signal	ELCM pump	—	OFF

NOTE:
- For detailed operation procedures, refer to “PC application help for Subaru Select Monitor”.
- *: For models without cruise control, the brake switch signal does not change.

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 DTCs	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)	YES	—
Secondary air system test	Secondary air system(Rdy)	NO	—
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)	YES	—
Test of EGR system	EGR system(Supp)	NO	—
Test of EGR system	EGR system(Rdy)	N/A	—
Air fuel ratio control system for bank 1	Fuel system for Bank 1	Cl_normal	—
Engine load data	Calculated load value	19.2	%
Engine coolant temperature signal	Coolant Temp.	96	°C
Short term fuel trim by front oxygen (A/F) sensor (Bank 1)	Short term fuel trim B1	17.2	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 1)	Long term fuel trim B1	5.5	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	248	mmHg
Engine speed signal	Engine Speed	846	rpm
Vehicle speed signal	Vehicle Speed	0	km/h
#1 Cylinder ignition timing	Ignition timing adv. #1	13.5	°
Intake air temperature signal	Intake Air Temp.	44	°C
Intake air amount	Mass Air Flow	3.6	g/s
Throttle position signal	Throttle Opening Angle	13	%
Secondary air control status	Secondary air system	Stop	—
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	0.1 — 0.7	V
A/F correction (Bank 1 Sensor 2)	Short term fuel trim #12	0.0	%

Content	Display	Note (at idling)	Unit of measure
On-board diagnostic system	OBD System	OBD/OBD2	—
Front oxygen (A/F) sensor (Bank 1 Sensor 1)	Oxygen sensor #11	Supported	—
Oxygen sensor (Bank 1 Sensor 2)	Oxygen sensor #12	Supported	—
Elapsed time 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	0.951	—
A/F sensor output signal (Bank 1 Sensor 1)	A/F Sensor #11	2.468	V
Evaporative purge	Evap Purge	0	%
Fuel level signal	Fuel Level	—	%
Number of warm ups after DTC clear	Number of warm-ups	—	—
Travel distance after DTC clear	Meter since DTC cleared	—	km
Atmospheric pressure signal	Atmosphere Pressure	Atmospheric pressure	mmHg
A/F lambda signal (Bank 1 Sensor 1)	A/F Sensor #11	0.957	—
A/F sensor output signal (Bank 1 Sensor 1)	A/F Sensor #11	–0.18	mA
Catalyst temperature #1	Catalyst Temperature #11	—	°C
Monitoring test of misfire	Misfire monitoring(Enable)	YES	—
Monitoring test of misfire	Misfire monitoring(Comp)	YES	—
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)	NO	—
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)	YES	—
Secondary air system test	Secondary air system(Comp)	NO	—
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)	YES	—
Test of EGR system	EGR system(Enable)	N/A	—
Test of EGR system	EGR system(Comp)	N/A	—
ECM power supply voltage	Control module voltage	13.848	V
Absolute load	Absolute Load Value	21	%
A/F target lambda	Target Equivalence Ratio	0.993	—
Relative throttle opening angle	Relative Throttle Pos.	2	%
Ambient temperature	Ambient Temperature	Ambient temperature	°C
Absolute throttle opening angle 2	Absolute Throttle Pos.#2	31	%
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 Throttle Opening Angle	0	%
Engine operating time while malfunction indicator light lit	Time while MIL lighted	—	min
Elapsed time after DTC clear	Time since DTC cleared	—	min

Content	Display	Note (at idling)	Unit of measure
Type of fuel	Type of fuel	GAS	—
Relative acceleration opening angle	Relative Accelera. Pos.	0	%
Neutral condition	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.

Content	Display	Unit of measure
DTC of freeze frame data	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 (Bank 1)	Short term fuel trim B1	%
Long term fuel trim by front oxygen (A/F) sensor (Bank 1)	Long term fuel trim B1	%
Intake manifold absolute pressure signal	Mani. Absolute Pressure	mmHg, kPa, inHg or psi
Engine speed signal	Engine Speed	rpm
Vehicle speed signal	Vehicle Speed	km/h or MPH
Ignition timing adv. #1	Ignition timing adv. #1	°
Intake air temperature	Intake Air Temp.	°C
Amount of intake air	Mass Air Flow	g/s
Throttle valve angle	Throttle Opening Angle	%
Secondary air control status	Secondary air system	—
Oxygen sensor #12	Oxygen sensor #12	V
A/F correction #12	Short term fuel trim #12	%
OBD system	OBD System	—
Oxygen sensor #11	Oxygen sensor #11	—
Oxygen sensor #12	Oxygen sensor #12	—
Elapsed time after starting engine	Time Since Engine Start	sec
Evaporative purge	Evap Purge	%
Fuel level	Fuel Level	%
Atmospheric pressure	Atmosphere Pressure	mmHg, kPa, inHg or psig
ECM power supply voltage	Control module voltage	V
Absolute load	Absolute Load Value	%
A/F 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 Throttle Opening Angle	%
Neutral condition	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 the «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(H4DOTC)(diag)-87, 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(H4DOTC)(diag)-87, 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(H4DOTC)(diag)-87, 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(H4DOTC)(diag)-54, Drive Cycle.>

DTC	Item	Condition
P0011	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	—
P0014	Exhaust AVCS System 1 (Range/Performance)	—
P0016	Crankshaft Position - Camshaft Position Correlation (Bank1)	—
P0017	Crank and Cam Timing B System Failure (Bank 1)	—
P0018	Crankshaft Position - Camshaft Position Correlation (Bank2)	—
P0019	Crank and Cam Timing B System Failure (Bank 2)	—
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	—
P0024	Exhaust AVCS System 2 (Range/Performance)	—
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	—
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	—
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	—
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	—
P0102	Mass or Volume Air Flow Circuit Low Input	—
P0103	Mass or Volume Air Flow Circuit High Input	—
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	—
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	—
P0112	Intake Air Temperature 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 1)	—
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	—
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 (Bank1 Sensor2)	—
P0201	Injector #1	—
P0202	Injector #2	—
P0203	Injector #3	—
P0204	Injector #4	—
P0222	Throttle/Pedal Position Sensor/Switch “B” Circuit Low	—
P0223	Throttle/Pedal Position Sensor/Switch “B” Circuit High	—
P0230	Fuel Pump Primary Circuit	—
P0245	Turbo/Super Charger Wastegate Solenoid “A” Low	—
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)	—
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	—
P0346	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 2)	—
P0351	Ignition Coil A Primary/Secondary Circuit	—

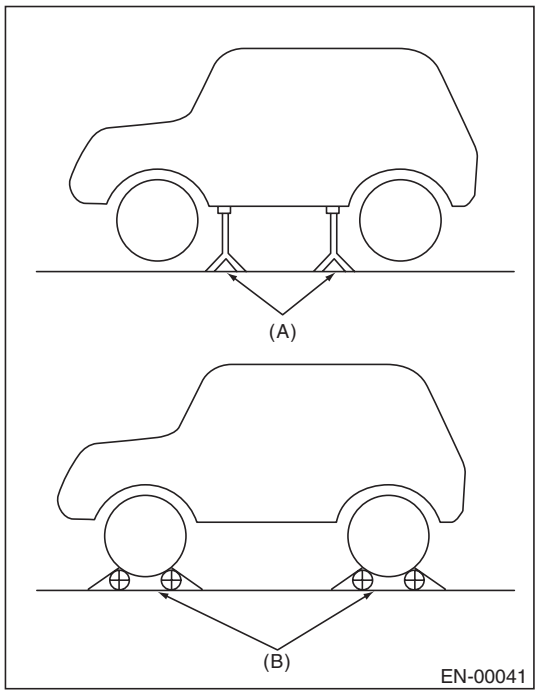
DTC	Item	Condition
P0352	Ignition Coil B Primary/Secondary Circuit	—
P0353	Ignition Coil C Primary/Secondary Circuit	—
P0354	Ignition Coil D Primary/Secondary Circuit	—
P0365	Camshaft Position Sensor “B” Circuit (Bank 1)	—
P0366	Camshaft Position Sensor B Circuit Range/Performance (Bank 1)	—
P0390	Camshaft Position Sensor “B” Circuit (Bank 2)	—
P0391	Camshaft Position Sensor B Circuit Range/Performance (Bank 2)	—
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	—
P0416	Secondary Air Injection System Switching Valve “B” Circuit Open	—
P0451	Evaporative Emission System Pressure Sensor/Switch Range/Performance	—
P0452	Evaporative Emission System Pressure Sensor/Switch Low	—
P0453	Evaporative Emission System Pressure Sensor/Switch High	—
P0458	Evaporative Emission System Purge Control Valve Circuit Low	—
P0462	Fuel Level Sensor “A” Circuit Low	—
P0463	Fuel Level Sensor “A” Circuit High	—
P04AC	Evap System Purge Control Valve "B" Circuit Low	—
P04AD	Evap System Purge Control Valve "B" Circuit High	—
P04DB	Crankcase Ventilation System Disconnected	—
P0500	Vehicle Speed Sensor “A”	—
P0513	Incorrect Immobilizer Key	—
P0560	System Voltage	—
P0604	Internal Control Module Random Access Memory (RAM) Error	—
P0605	Internal Control Module Read Only Memory (ROM) Error	—
P0606	Control Module Processor	—
P060A	Internal Control Module Monitoring Processor Performance	—
P060B	Internal Control Module A/D Processing Performance	—
P0616	Starter Relay Circuit Low	—
P0617	Starter Relay Circuit High	—
P062F	Internal Control Module EEPROM Error	—
P0851	Park/Neutral Switch Input Circuit Low	—
P0852	Park/Neutral Switch Input Circuit High	—
P1160	Return Spring Failure	—
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	—
P1410	Secondary Air Injection System Switching Valve Stuck Open	—
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	—
P1570	Antenna	—
P1571	Reference Code Incompatibility	—
P1572	IMM Circuit Failure (Except Antenna Circuit)	—
P1574	Key Communication Failure	—
P1576	EGI Control Module EEPROM	—
P1577	IMM Control Module EEPROM	—
P1578	Meter Failure	—
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	—
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	—
P2008	Intake Manifold Runner Control Circuit / Open (Bank 1)	—
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	—
P2011	Intake Manifold Runner Control Circuit / Open (Bank 2)	—
P2012	Intake Manifold Runner Control Circuit Low (Bank 2)	—
P2016	Tumble Generated Valve Position Sensor 1 Circuit Low	—
P2017	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 1)	—

DTC	Item	Condition
P2021	Tumble Generated Valve Position Sensor 2 Circuit Low	—
P2022	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 2)	—
P2088	Intake Camshaft Position Actuator Control Circuit Low (Bank 1)	—
P2089	Intake Camshaft Position Actuator Control Circuit High (Bank 1)	—
P2090	Exhaust Camshaft Position Actuator Control Circuit Low (Bank 1)	—
P2091	Exhaust Camshaft Position Actuator Control Circuit High (Bank 1)	—
P2092	Intake Camshaft Position Actuator Control Circuit Low (Bank 2)	—
P2093	Intake Camshaft Position Actuator Control Circuit High (Bank 2)	—
P2094	Exhaust Camshaft Position Actuator Control Circuit Low (Bank 2)	—
P2095	Exhaust Camshaft Position Actuator Control Circuit High (Bank 2)	—
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	—
P2119	Throttle Actuator Control Throttle Body Range/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	—
P2195	O2 Sensor Signal Biased/Stuck Lean (Bank 1 Sensor 1)	—
P2196	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 1)	—
P2257	Air System Control "A" Circuit Low	—
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	—
P2419	Evaporative Emission System Switching Valve Control Circuit Low	—
P2431	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Range/Performance	—
P2432	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Low	—
P2433	Secondary Air Injection System Air Flow /Pressure Sensor Circuit High	—
P2444	Secondary Air Injection System Pump Stuck On	—
U0073	CAN Failure, Bus ‘Off’ Detection	—
U0122	CAN (VDC) Data Not Loaded	—
U0140	CAN (BCU) Data Not Loaded	—
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.

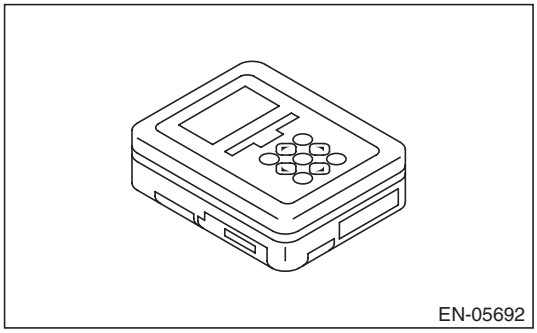
WARNING:
• Before lifting up the vehicle, ensure parking brake is applied.
• Do not use a pantograph jack in place of a rigid rack.
• Secure a rope or wire to the front or rear towing hooks to prevent the lateral runout of front wheels.
• Before rotating the wheels, make sure that there is no one in 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 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

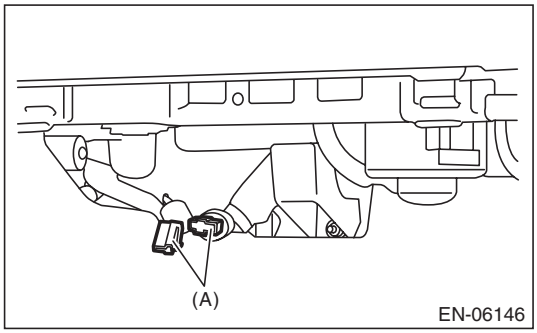
2. SUBARU SELECT MONITOR

1) Check that no DTC remains after clearing memory. <Ref. to EN(H4DOTC)(diag)-62, Clear Memory Mode.>
2) Warm up the engine.
3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>



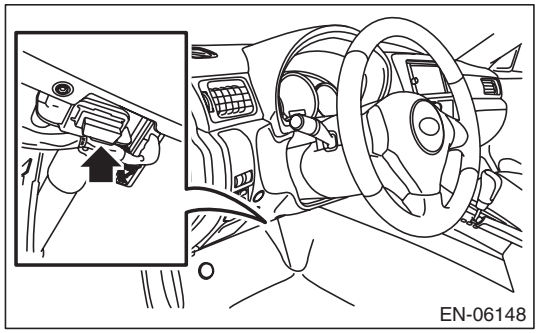
4) Prepare PC with Subaru Select Monitor installed.
5) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

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.

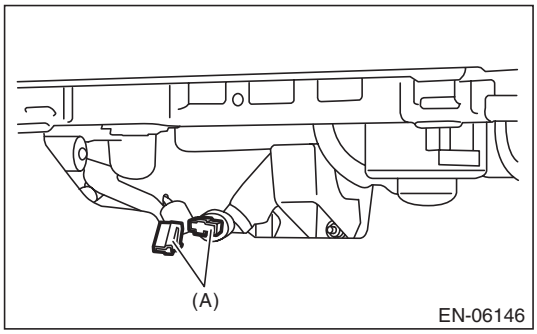


9) Start the PC.
10) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
11) On «Main Menu» display, select {Each System Check}.
12) On «System Selection Menu» display, select {Engine Control System}.
13) Click the [OK] button after the information of engine 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>
• Release the parking brake.
• The rotating speed difference between front and rear wheels may illuminate 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)-27, Clear Memory Mode.>

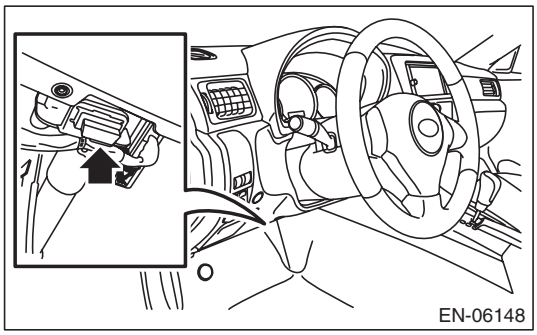
3. GENERAL SCAN TOOL

1) Check that no DTC remains after clearing memory. <Ref. to EN(H4DOTC)(diag)-62, 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:
Depress the clutch pedal when starting engine.
6) Turn the neutral position switch to ON by operating shift lever.
7) Keep the engine speed in 2,500 — 3,000 rpm range for 40 seconds.
8) Place the shift lever in 1st gear and drive the vehicle at 5 to 10 km/h (3 to 6 MPH).

NOTE:
• For AWD model, release the parking brake.
• The rotating speed difference between front and rear wheels may illuminate 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)-27, Clear Memory Mode.>

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

NOTE:
• For detailed operation procedures, refer to the general scan tool operation manual.
• For details concerning DTC, refer to “List of Diagnostic Trouble Code (DTC)”.
<Ref. to EN(H4DOTC)(diag)-87, 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(H4DOTC)(diag)-62, 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
*P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	—
*P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	«Coolant Temp.» at engine start: Less than 20°C (68°F)
*P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	—
*P014C	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 1)	—
*P014D	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 1)	—
*P015A	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 1)	—
*P015B	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 1)	—
*P0141	O2 Sensor Heater Circuit (Bank1 Sensor2)	—
*P0171	System Too Lean (Bank 1)	Complete diagnosis with drive cycle B or C as well.
*P0172	System Too Rich (Bank 1)	Complete diagnosis with drive cycle B or C as well.
*P0300	Random/Multiple Cylinder Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0301	Cylinder 1 Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0302	Cylinder 2 Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0303	Cylinder 3 Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0304	Cylinder 4 Misfire Detected	Complete diagnosis with drive cycle B or C as well.
*P0420	Catalyst System Efficiency Below Threshold (Bank 1)	—
*P0459	Evaporative Emission System Purge Control Valve Circuit High	—
*P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Complete diagnosis with drive cycle B or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Complete diagnosis with drive cycle B or C as well.

Diagnostic procedure:
1) Drive for 20 minutes or more at a constant speed of 80 km/h (50 MPH) or more.
2) Stop the vehicle and idle for one minute.

3. DRIVE CYCLE B

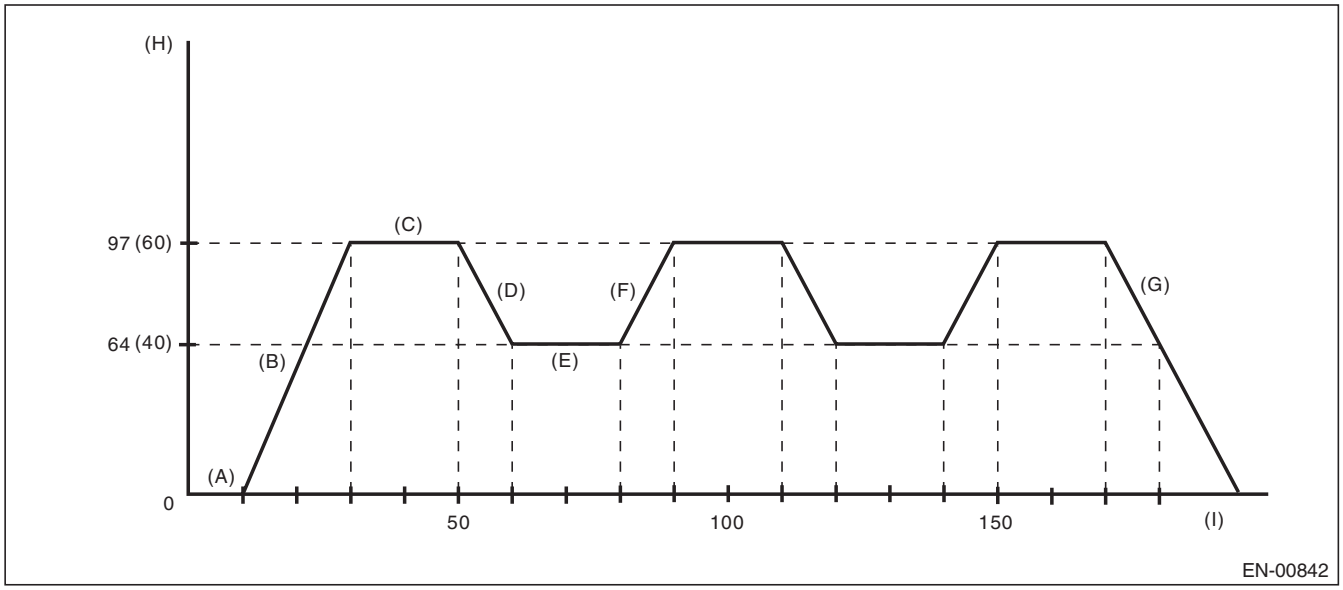
DTC	Item	Condition
*P0171	System Too Lean (Bank 1)	Complete diagnosis with drive cycle A or C as well.
*P0172	System Too Rich (Bank 1)	Complete diagnosis with drive cycle A or C as well.
*P0300	Random/Multiple Cylinder Misfire Detected	Complete diagnosis with drive cycle A or C as well.
*P0301	Cylinder 1 Misfire Detected	Complete diagnosis with drive cycle A or C as well.
*P0302	Cylinder 2 Misfire Detected	Complete diagnosis with drive cycle A or C as well.
*P0303	Cylinder 3 Misfire Detected	Complete diagnosis with drive cycle A or C as well.
*P0304	Cylinder 4 Misfire Detected	Complete diagnosis with drive cycle A or C as well.
*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)	Complete diagnosis with drive cycle A or C as well.
*P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Complete diagnosis with drive cycle A or C as well.
*P219A	Bank 1 Air-Fuel Ratio Imbalance	Complete diagnosis with drive cycle 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
*P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	—
*P0068	MAP/MAF - Throttle Position Correlation	—
*P0101	Mass or Volume Air Flow Circuit Range/Performance	—
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	—
*P013A	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 2)	—
*P013B	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 2)	—
*P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)	—
*P013F	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 2)	—
*P0171	System Too Lean (Bank 1)	Complete diagnosis with drive cycle A or B as well.
*P0172	System Too Rich (Bank 1)	Complete diagnosis with drive cycle A or B as well.
P0244	Turbo/Super Charger Wastegate Solenoid “A” Range/Performance	—
P0246	Turbo/Super Charger Wastegate Solenoid “A” High	—
*P0300	Random/Multiple Cylinder Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0301	Cylinder 1 Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0302	Cylinder 2 Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0303	Cylinder 3 Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0304	Cylinder 4 Misfire Detected	Complete diagnosis with drive cycle A or B as well.
*P0441	Evaporative Emission Cont. Sys. Incorrect Purge Flow	—
*P1449	Evaporative Emission Cont. Sys. Air Filter Clog	—
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	—
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	—
*P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Complete diagnosis with drive cycle A or B as well.
*P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Complete diagnosis with drive cycle A or B as well.
*P219A	Bank 1 Air-Fuel Ratio Imbalance	Complete diagnosis with drive cycle 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) or less.	(G)	Stop the vehicle with throttle fully closed.
(B)	Accelerate to 97 km/h (60 MPH) or more within 20 seconds.	(E)	Drive for 20 seconds or more at 64 km/h (40 MPH) or less.	(H)	Vehicle speed km/h (MPH)
(C)	Drive for 20 seconds or more at 97 km/h (60 MPH) or more.	(F)	Accelerate to 97 km/h (60 MPH) or more within 10 seconds.	(I)	Sec.

5. DRIVE CYCLE E

DTC	Item	Condition
*P0461	Fuel Level Sensor “A” Circuit Range/Performance	—

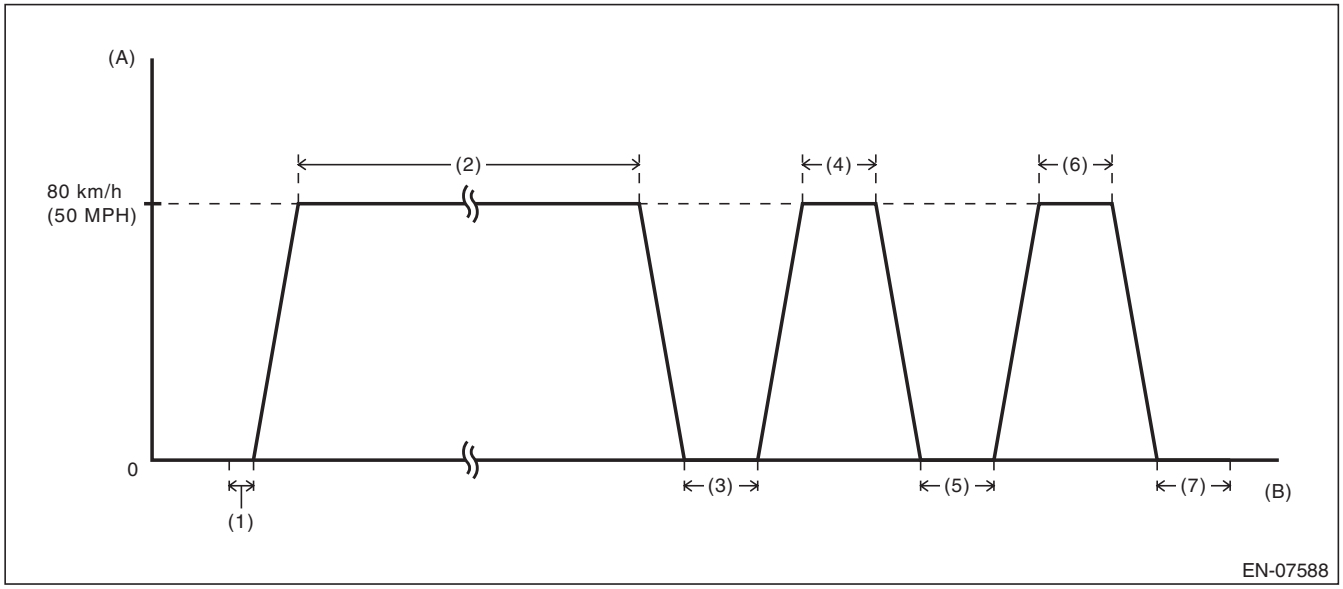
Diagnostic procedure:
1) Make sure that the battery voltage is 10.9 V or more.
2) Perform the Clear Memory Mode. <Ref. to EN(H4DOTC)(diag)-62, Clear Memory Mode.>
3) Drive for approximately 30 L (7.9 US gal, 6.6 Imp gal) of fuel.

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.)

6. 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 or more after engine start.
(2) Drive for 8 minutes or more at a constant speed of 80 km/h (50 MPH) or more.
(3) Stop the vehicle and idle for 30 seconds or more.
(4) Drive for 30 seconds or more at a constant speed of 80 km/h (50 MPH) or more.
(5) Stop the vehicle and idle for 30 seconds or more.
(6) Drive for 30 seconds or more at a constant speed of 80 km/h (50 MPH) or more.
(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).

7. DRIVE CYCLE G

DTC	Item	Condition
*P0410	Secondary Air Injection System	—
*P0411	Secondary Air Injection System Incorrect Flow Detected	—
P0414	Secondary Air Injection System Switching Valve “A” Circuit Shorted	—
P0417	Secondary Air Injection System Switching Valve “B” Circuit Shorted	—
P2258	Air System Control "A" Circuit High	—
*P2440	Secondary Air Injection System Switching Valve Stuck Open (Bank1)	—
*P2441	Secondary Air Injection System Switching Valve Stuck Closed (Bank1)	—
*P2442	Secondary Air Injection System Switching Valve Stuck Open (Bank2)	—
*P2443	Secondary Air Injection System Switching Valve Stuck Closed (Bank2)	—

Diagnostic procedure:
1) Disconnect the battery negative terminal, and reconnect after at least 10 seconds have passed.
2) Idle the engine until engine coolant temperature is 80°C (176°F) more.
3) Stop the engine to decrease the engine coolant temperature down to 40°C (104°F) or less.

NOTE:
Do not let engine coolant temperature drop to 5°C (41°F) or less.
4) Idle the engine until engine coolant temperature is 80°C (176°F) more.
5) Stop the engine to decrease the engine coolant temperature down to 40°C (104°F) or less.

NOTE:
Do not let engine coolant temperature drop to 5°C (41°F) or less.
6) Idle the engine.

8. DRIVE CYCLE H

DTC	Item	Condition
*P050A	Cold Start Idle Air Control System Performance	—
*P050B	Cold Start Ignition Timing Performance	—

Diagnostic procedure:
1) Perform the Clear Memory Mode. <Ref. to EN(H4DOTC)(diag)-62, Clear Memory Mode.>
2) With the ignition switch ON (engine stopped), read the value in «Coolant Temp.» and «Mass Air Flow». <Ref. to EN(H4DOTC)(diag)-40, READ CURRENT DATA FOR ENGINE (NORMAL MODE), OPERATION, Subaru Select Monitor.>
3) If the values from step 2) satisfy the following conditions, idle the engine for one minute.

Condition:
|Engine coolant temperature — Intake air temperature| ≤ 5°C (9°F)

NOTE:
- If the conditions are not satisfied, turn the ignition switch to OFF and wait until the parameters are satisfied.
- Do not move the shift lever from neutral position during idling.

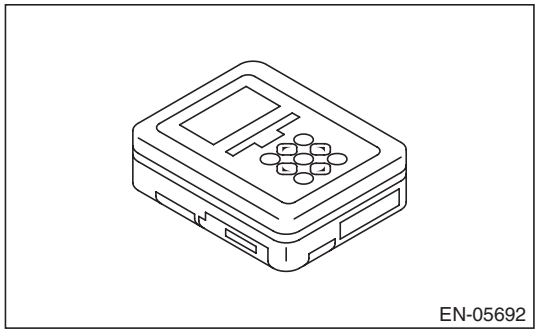
9. DRIVE CYCLE I

DTC	Item	Condition
*P0455	Evaporative Emission System Leak Detected (Large Leak)	«Coolant Temp.»: 5 — 45°C (41 — 113°F) «Intake Air Temp.»: 5 — 50°C (41 — 122°F)
*P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	
*P1451	Evaporative Emission Cont. Sys.	
*P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	
*P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/ Performance	
*P2420	Evaporative Emission System Switching Valve Control Circuit High	

CAUTION:
Be careful of the state of the battery when performing the DRIVE CYCLE I consecutively. Performing the DRIVE CYCLE I consecutively without the engine running may cause a low battery voltage and battery discharge.

NOTE:
- If it is necessary to perform DRIVE CYCLE I consecutively, drive the vehicle under the following conditions to release accumulated evaporating gas. Performing the DRIVE CYCLE I consecutively without starting the engine causes a large amount of evaporating gas to accumulate in the canister, which hinders an accurate diagnosis.
  - After engine is warmed up
  - Drive for 10 minutes or more at a speed of 48 km/h (30 MPH) or more (duration of drive can be an accumulation)
- To obtain an accurate diagnostic result, perform the procedures according to the following points.
  - Do not refuel gas immediately before performing DRIVE CYCLE I. There will be a large amount of evaporating gas immediately after refuel, which may cause a less accurate diagnostic performance.
  - Do not shake the vehicle while performing DRIVE CYCLE I. Shaking the vehicle causes evaporating gas to increase inside the fuel tank, which may cause a less accurate diagnostic performance.
  - Do not perform any service operation including installation or removal of parts or connectors while performing DRIVE CYCLE I. Performing service operation could affect on the functions of related parts, which may cause a less accurate diagnostic performance.

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

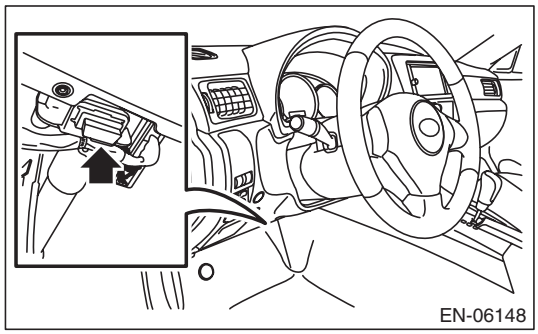

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2) Prepare PC with Subaru Select Monitor installed.
3) Connect the USB cable to SDI (Subaru Diagnosis Interface) and USB port on the personal computer (dedicated port for the Subaru Select Monitor).

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.



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 {OBD System}.
12) On «OBD Menu» display, select {Evaporative System Leak Test}.
13) On «Evaporative System Leak Test» display, select {Evaporative System Leak Test}.
14) On «Evaporative System Leak Test is running. Press Cancel to exit this function.» display, click the [OK] button to perform evaporative system leak test.
15) When «Conditions have been enabled to control this function. Turn the ignition switch off to terminate the test.» display appears, wait for 30 minutes without clicking the [OK] button.

CAUTION:
Do not leave the vehicle for an extended period of time after the test is complete. This may cause early deterioration of the battery or discharged battery.

NOTE:
• Clicking the [OK] button bring the «Evaporative System Leak Test» display back, although the test is continuing.
• The Subaru Select Monitor screen does not change after the evaporative system leak test is complete or when the test is aborted by turning off the ignition switch.
• If «Test conditions are not correct» display appears, check that the values in «Coolant Temp.» and «Intake Air Temp.» are within the specified range using Subaru Select Monitor. If the conditions are satisfied, make the necessary preparation for the drive cycle again. <Ref. to EN(H4DOTC)(diag)-54, PREPARATION FOR DRIVE CYCLE, PROCEDURE, Drive Cycle.>
16) After 30 minutes passed from the start of step 14), click the [OK] button to return to the «Evaporative System Leak Test» display.
17) Click buttons until the «OBD Menu» display appears, then select {Result of on-board monitor test}.
18) In the {Result of on-board monitor test}, check TID $C1 — $CA of MID $3C.

Result of on-board monitor test

Display	Details	Remarks
$0000 is stored in all Val.	During the evaporative system leak test, the test conditions were not met and the test was canceled.	Once the test conditions are met, perform the test again.
All Val. are stored with values and OK is set to all the results.	Evaporative system leak test is completed correctly.	While the ignition switch is ON, read temporary codes using the Subaru Select Monitor.
Some results were no good.	The evaporative system leak test completed successfully but the results were faulty.	While the ignition switch is ON, read temporary codes using the Subaru Select Monitor.

19) When the evaporative system leak test is completed correctly, read the temporary codes with the ignition switch turned to ON position. If the DTC is recorded, check the appropriate DTC. <Ref. to EN(H4DOTC)(diag)-47, OPERATION, Read Diagnostic Trouble Code (DTC).>

NOTE:
The temporary code will be cleared by turning ignition switch to OFF.

10.DRIVE CYCLE J

DTC	Item	Condition
P2610	ECM/PCM Internal Engine Off Timer Performance	—

1) Idle the engine for 15 minutes or more.
2) Turn the ignition switch to OFF.
3) After 10 hours passed from the start of step 2), read the temporary code using the Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-47, OPERATION, Read Diagnostic Trouble Code (DTC).>

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 {Clear 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

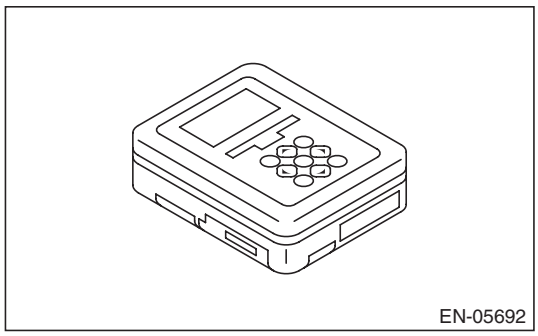
For procedures clearing memory using the general scan tool, refer to the general scan tool operation manual.

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

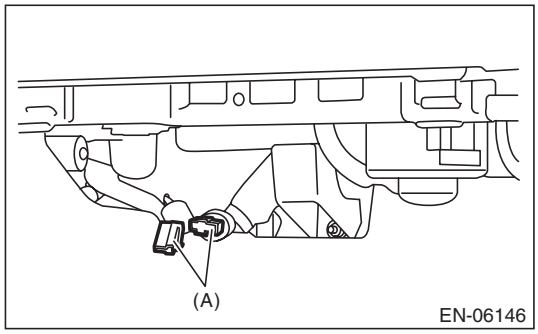
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>


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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.

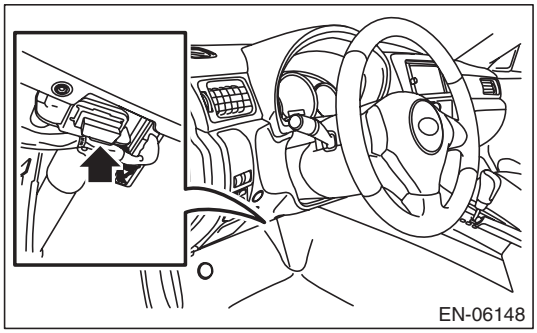
4) Connect the diagnosis cable to SDI.
5) Connect the delivery (test) mode connector (A) located under the glove box.



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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.


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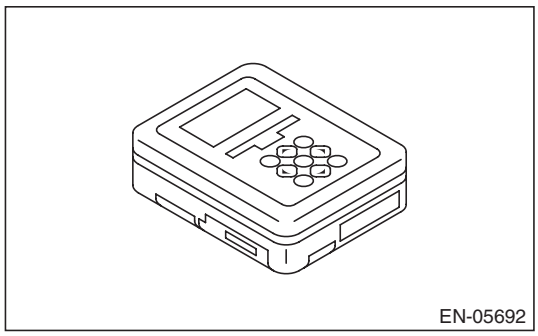
7) Start the PC.
8) Turn the ignition switch to ON (engine OFF) and run the "PC application for Subaru Select Monitor".
9) On «Main Menu» display, select {Each System Check}.
10) On «System Selection Menu» display, select {Engine Control System}.
11) Click the [OK] button after the information of engine 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 screen 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

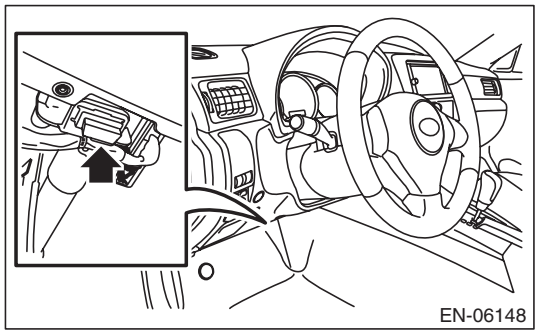
1) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>


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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
Fixed Idle Ignition Timing
Idle Speed Control
Injector Control

1. FUEL PUMP CONTROL (OFF DRIVE)

CAUTION:
After executing the system operation check mode, execute the Clear Memory Mode. <Ref. to EN(H4DOTC)(diag)-62, 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(H4DOTC)(diag)-62, 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(H4DOTC)(diag)-62, 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 idle 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(H4DOTC)(diag)-62, 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(H4DOTC)(diag)-62, 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 the «Injection Stop Mode» display screen.
8) On the «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(H4DOTC)(diag)-62, 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”.

16.Malfunction Indicator Light

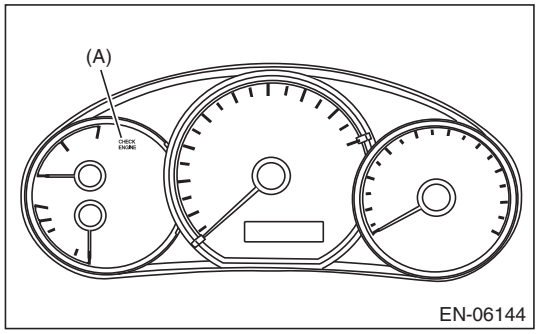
A: PROCEDURE

1. Activation of malfunction indicator light. <Ref. to EN(H4DOTC)(diag)-66, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.>
↓
2. Malfunction indicator light does not come on. <Ref. to EN(H4DOTC)(diag)-68, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
↓
3. Malfunction indicator light does not go off <Ref. to EN(H4DOTC)(diag)-68, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF, Malfunction Indicator Light.>
↓
4. Malfunction indicator light does not blink <Ref. to EN(H4DOTC)(diag)-69, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK, Malfunction Indicator Light.>
↓
5. Malfunction indicator light remains blinking <Ref. to EN(H4DOTC)(diag)-71, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING, Malfunction Indicator Light.>

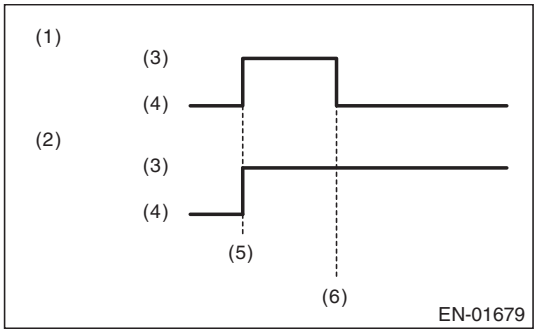
B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

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(H4DOTC)(diag)-68, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>

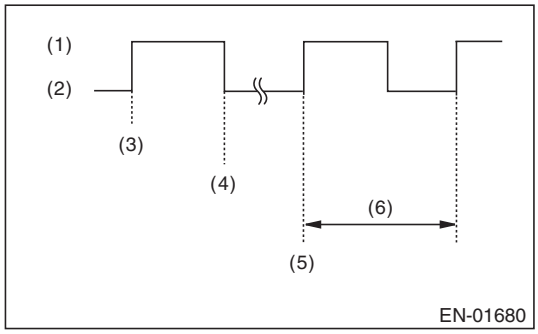


2) After starting the engine, the malfunction indicator light goes out. If it does not go off, any of the engine and emission control system has malfunction.



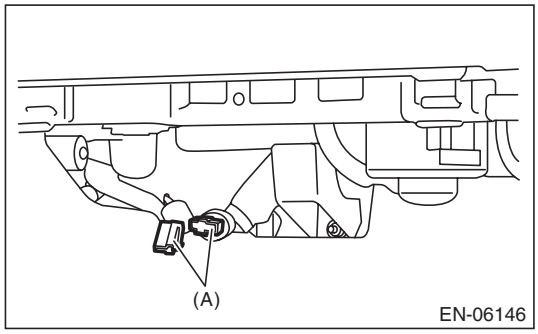
(1) No DTC
(2) Trouble occurs
(3) ON
(4) OFF
(5) Ignition switch ON
(6) Engine start

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.



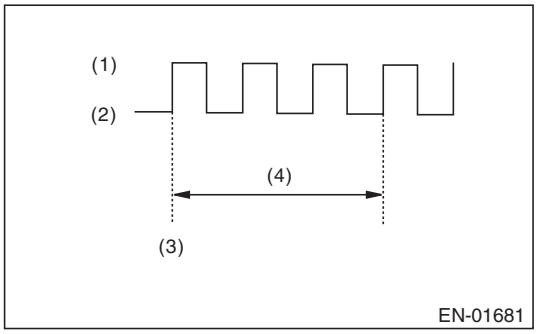
(1) ON
(2) OFF
(3) Ignition switch ON
(4) Engine start
(5) Misfire start
(6) 1 second

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 second

C: MALFUNCTION INDICATOR LIGHT DOES NOT COME ON

TROUBLE SYMPTOM:
When the ignition switch is turned to ON (engine OFF), malfunction indicator light does not illuminate.

Step		Check	Yes	No
1	**CHECK DTC.**	Is DTC of LAN system displayed? <Ref. to LAN(diag)-28, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to LAN(diag)-32, List of Diagnostic Trouble Code (DTC).>	Replace the meter case assembly of combination meter. <Ref. to IDI-18, Combination Meter.>

D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF

TROUBLE SYMPTOM:
Although malfunction indicator light comes on when the engine runs, DTC is not shown on the Subaru Select Monitor or general scan tool display.

Step		Check	Yes	No
1	**CHECK DTC.**	Is DTC of engine or LAN system displayed? <Ref. to EN(H4DOTC)(diag)-47, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).> <Ref. to LAN(diag)-32, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK COMBINATION METER.** Perform the self-diagnosis for combination meter system. <Ref. to IDI-5, SELF-DIAGNOSIS, INSPECTION, Combination Meter System.>	Does the malfunction indicator light illuminate and go off normally?	Replace the ECM. <Ref. to FU(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>	Replace the meter case assembly of combination meter. <Ref. to IDI-18, Combination Meter.>

E: MALFUNCTION INDICATOR LIGHT DOES NOT BLINK

DIAGNOSIS:

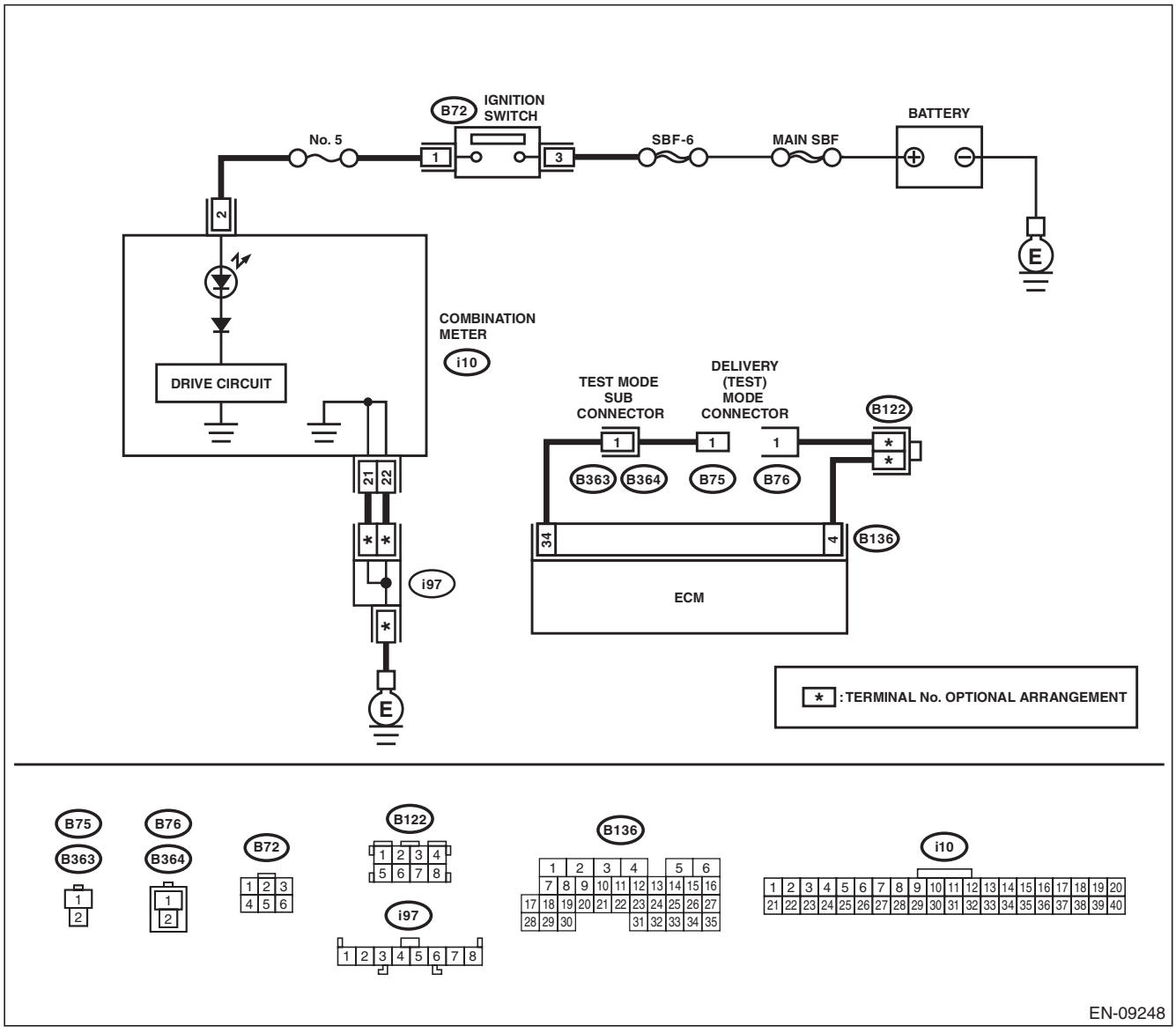
- The malfunction indicator light circuit is open or shorted.
- The delivery (test) mode connector circuit is open.

TROUBLE SYMPTOM:

Malfunction indicator light does not blink during Inspection Mode.

WIRING DIAGRAM:

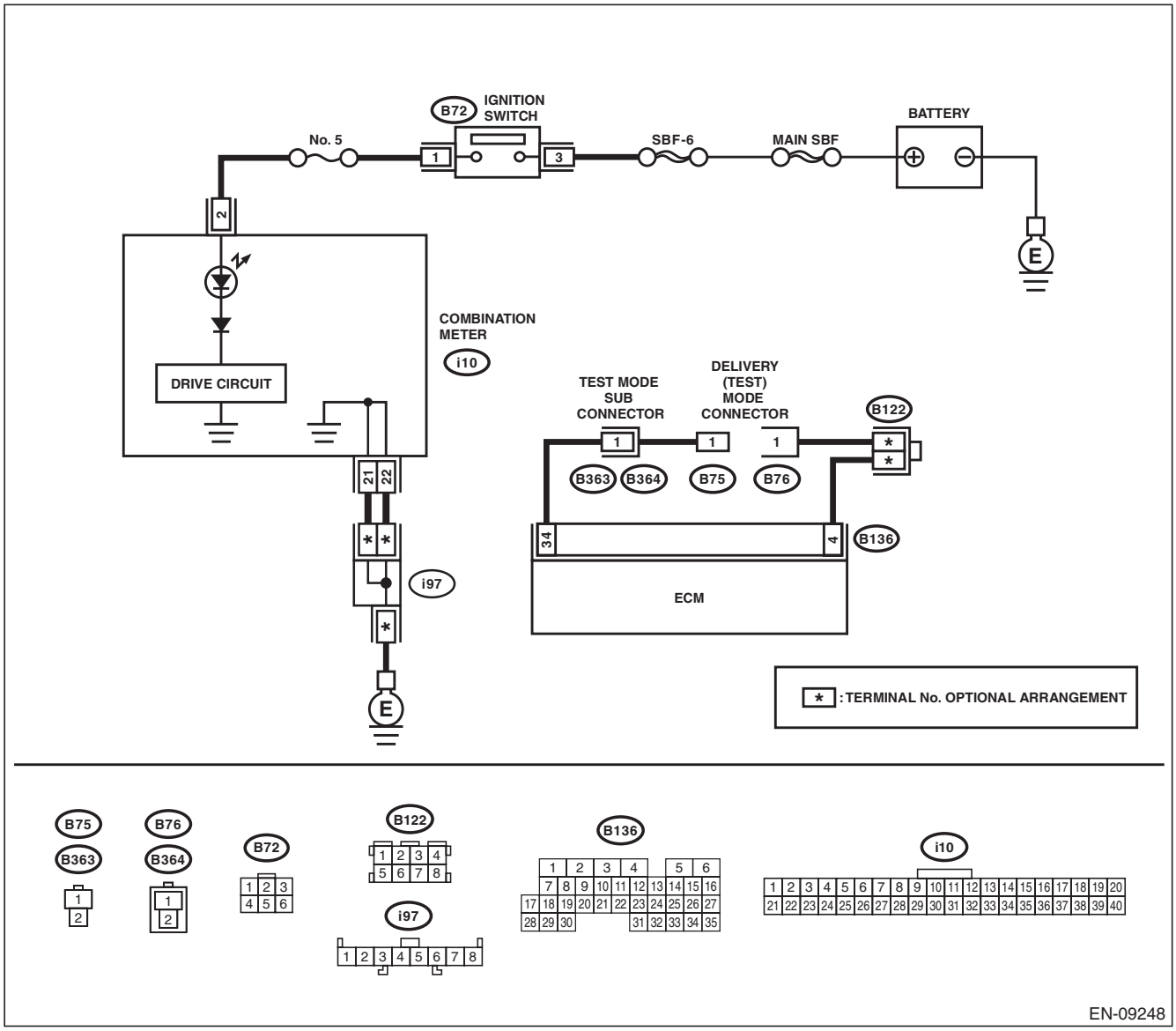
- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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(H4DOTC)(diag)-68, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
2	**CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Connect the delivery (test) mode connector. 4) Measure the resistance of harness between ECM connectors. ***Connector & terminal*** ***(B136) No. 34 — (B136) 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 connector • Poor contact of each connector between ECM connector
3	**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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>

F: MALFUNCTION INDICATOR LIGHT REMAINS BLINKING

DIAGNOSIS:
The delivery (test) mode connector circuit is short-circuited to ground.
TROUBLE SYMPTOM:
Malfunction indicator light blinks when delivery (test) mode connector is not connected.
WIRING DIAGRAM:
• Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
• Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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 at a cycle of 3 Hz when delivery (test) mode connector is connected.
2	**CHECK HARNESS BETWEEN ECM AND DELIVERY (TEST) MODE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 34 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the ECM. <Ref. to FU(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>	Repair the short circuit to ground in harness between ECM and delivery (test) mode connector.

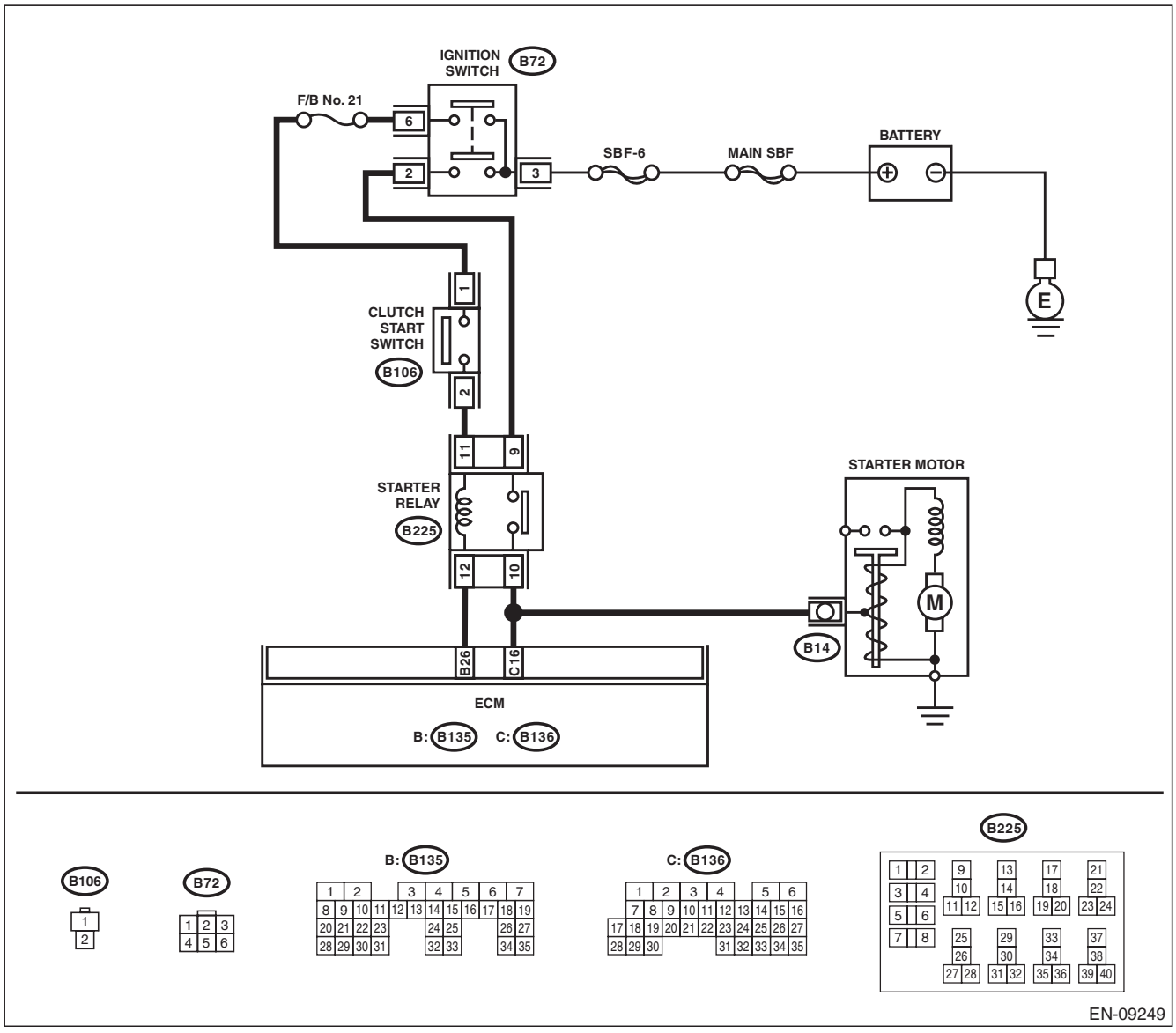
17.Diagnostics for Engine Starting Failure

A: PROCEDURE

1. Check of the fuel amount
↓
2. Inspection of starter motor circuit <Ref. to EN(H4DOTC)(diag)-74, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ECM power supply and ground line <Ref. to EN(H4DOTC)(diag)-77, 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(H4DOTC)(diag)-79, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel pump circuit <Ref. to EN(H4DOTC)(diag)-82, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
6. Inspection of fuel injector circuit <Ref. to EN(H4DOTC)(diag)-83, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.
WIRING DIAGRAM:
• Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
• Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



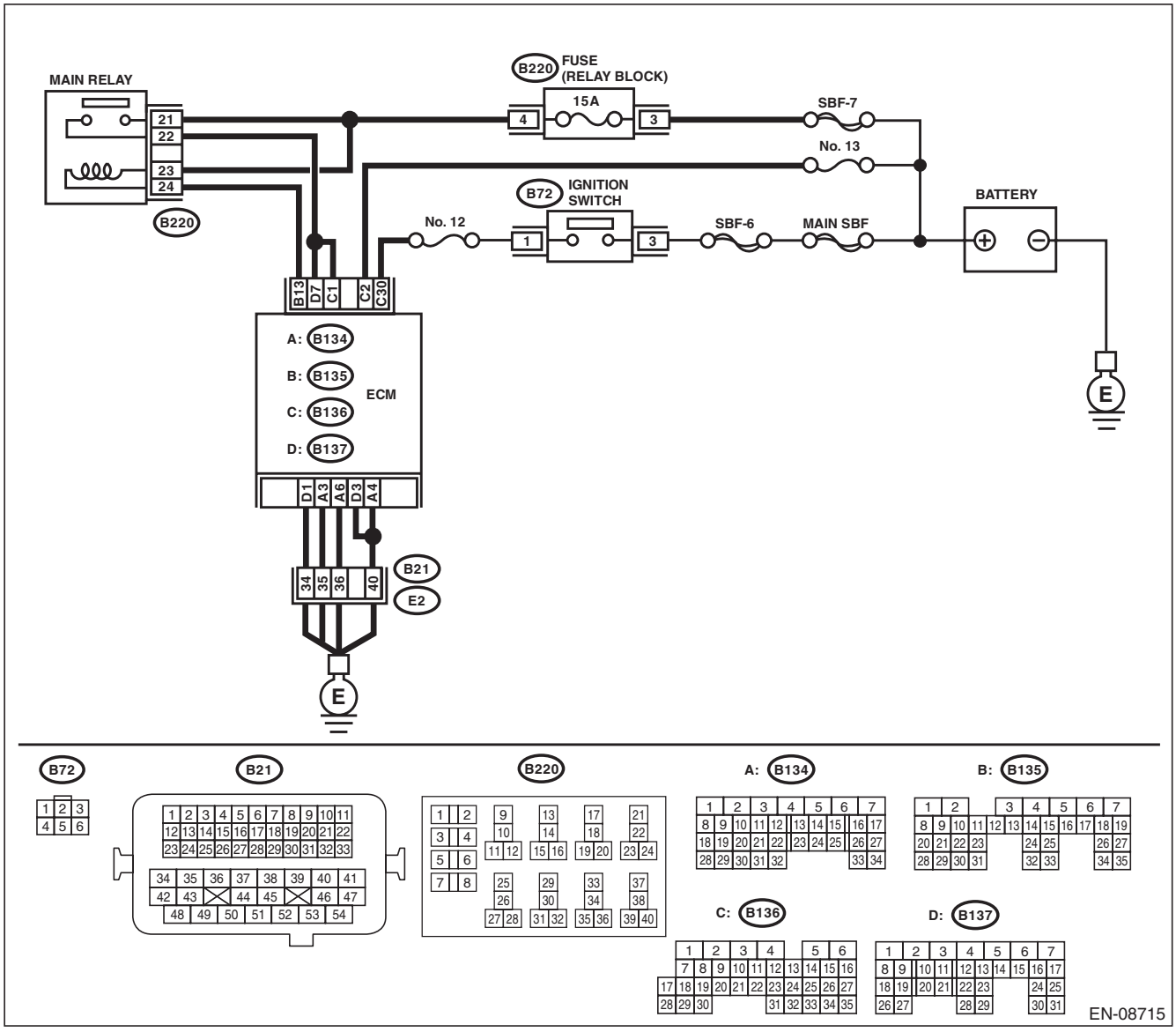
Step		Check	Yes	No
1	**CHECK BATTERY.** Check the battery. <Ref. to SC(STI)-27, Battery.>	Is the battery OK?	Go to step **2**.	Charge or replace the battery. <Ref. to SC(STI)-27, Battery.>
2	**CHECK OPERATION OF STARTER MOTOR.**	Does the starter motor operate?	Go to step **3**.	Go to step **4**.

	Step	Check	Yes	No
3	**CHECK DTC.**	Is DTC displayed? <Ref. to EN(H4DOTC)(diag)-47, OPERATION, Read Diagnostic Trouble Code (DTC).>	Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Check ignition control system. <Ref. to EN(H4DOTC)(diag)-79, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
4	**CHECK INPUT SIGNAL FOR STARTER MOTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter motor. 3) Depress the clutch pedal. 4) Turn the ignition switch to START. 5) Measure the voltage between the starter motor connector and the engine ground. ***Connector & terminal*** ***(B14) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Check the starter motor. <Ref. to SC(STI)-8, Starter.>	Go to step **5**.
5	**CHECK INPUT SIGNAL FOR STARTER MOTOR.** 1) Depress the clutch pedal. 2) Turn the ignition switch to START. 3) Measure the voltage between starter relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 10 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the open circuit of the harness between starter relay connector and starter motor.	Go to step **6**.
6	**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 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 **7**.	Repair the power supply circuit.
7	**CHECK IGNITION SWITCH.** Measure the resistance between ignition switch terminals after turning the ignition switch to START position. ***Terminals*** ***No. 2 — No. 3:*** ***No. 6 — No. 3:***	Is the resistance less than 1 Ω?	Go to step **8**.	Replace the ignition switch. <Ref. to SL-42, REPLACEMENT, Ignition Key Lock.>
8	**CHECK INPUT VOLTAGE OF CLUTCH START SWITCH.** 1) Turn the ignition switch to OFF. 2) Disconnect the clutch start switch connector. 3) Connect the connector to ignition switch. 4) Turn the ignition switch to START. 5) 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 **9**.	Check the following item and repair if necessary. • Blown out of fuse (F/B No. 21) • Open or short circuit to ground in harness between ignition switch connector and clutch start switch connector

	Step	Check	Yes	No
9	**CHECK HARNESS BETWEEN STARTER RELAY CONNECTOR AND CLUTCH START SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the starter relay. 3) Measure the resistance of harness between starter relay connector and clutch start switch connector. ***Connector & terminal*** ***(B225) No. 11 — (B106) No. 2:***	Is the resistance less than 1 Ω?	Go to step **10**.	Repair the open circuit in harness between starter relay connector and clutch start switch connector.
10	**CHECK INPUT VOLTAGE OF STARTER RELAY.** 1) Connect the connector to the clutch start switch. 2) Depress the clutch pedal. 3) Turn the ignition switch to START. 4) Measure the voltage between starter relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 11 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **11**.	Replace the clutch start switch. <Ref. to CL-33, Clutch Switch.>
11	**CHECK INPUT VOLTAGE OF STARTER RELAY.** 1) Turn the ignition switch to START. 2) Measure the voltage between starter relay connector and chassis ground. ***Connector & terminal*** ***(B225) No. 9 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **12**.	Repair the open circuit of harness between starter relay connector and ignition switch connector.
12	**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 **13**.	Replace the starter relay.
13	**CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and starter relay connector. ***Connector & terminal*** ***(B136) No. 16 — (B225) No. 10:***	Is the resistance less than 1 Ω?	Go to step **14**.	Repair the open circuit of harness between ECM and starter relay connector.
14	**CHECK ECM INPUT VOLTAGE.** 1) Install the starter relay. 2) Depress the clutch pedal. 3) Turn the ignition switch to START. 4) Measure the voltage between ECM connector and chassis ground. ***Connector & terminal*** ***(B135) No. 26 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Check the ECM power supply and ground line. <Ref. to EN(H4DOTC)(diag)-77, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Repair the open circuit of harness between ECM and starter relay connector.

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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.
WIRING DIAGRAM:
• Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
• Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>

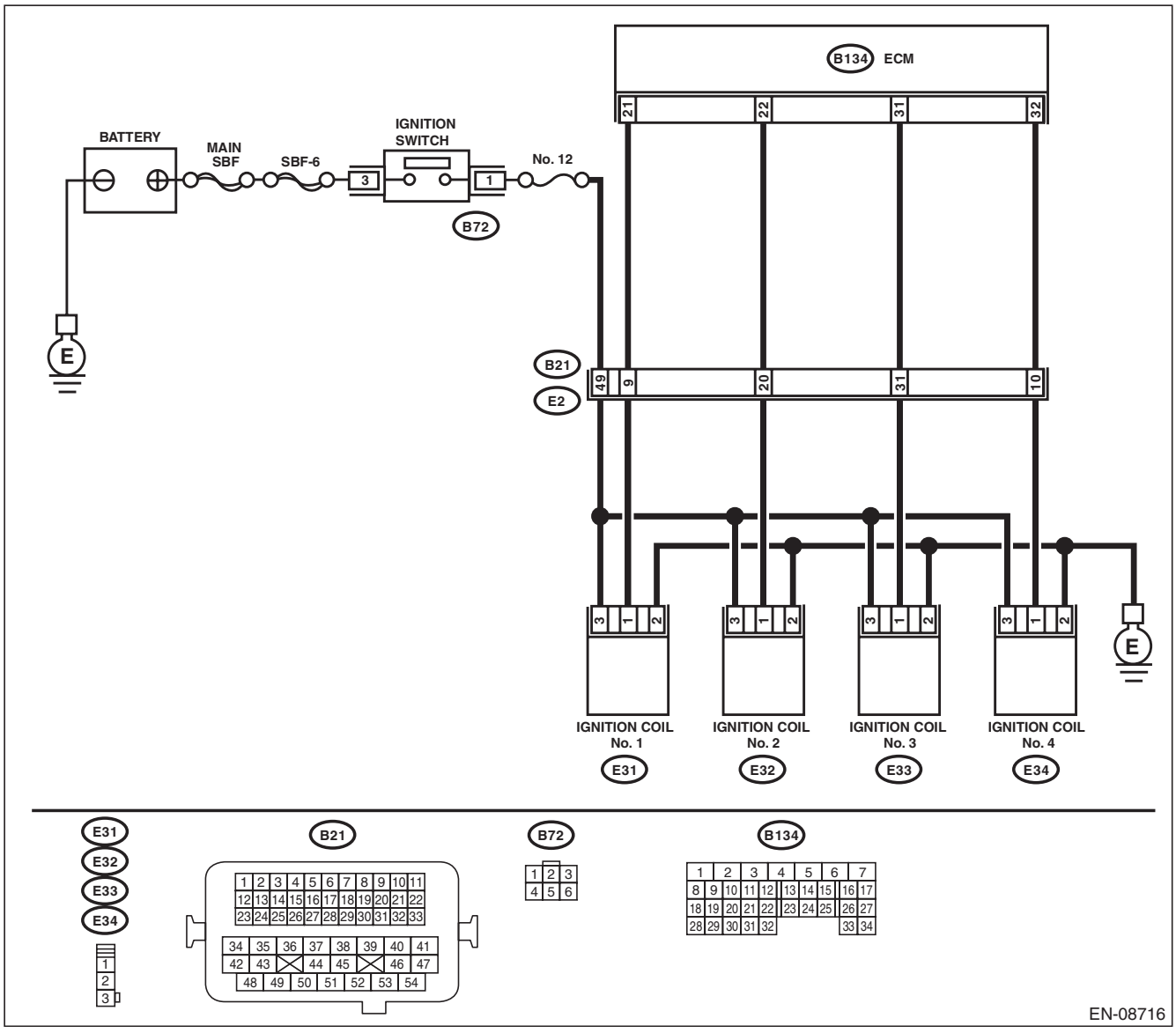


Diagnostics for Engine Starting Failure

	Step	Check	Yes	No
1	**CHECK MAIN RELAY.** 1) Turn the ignition switch to OFF. 2) Remove the main relay. 3) Connect the battery to main relay terminals No. 23 and No. 24. 4) Measure the resistance between main relay terminals. ***Terminals*** ***No. 21 — No. 22:***	Is the resistance less than 1 Ω?	Go to step **2**.	Replace the main relay. <Ref. to FU(STI)-60, Main Relay.> <Ref. to FU(w/o STI)-58, Main Relay.>
2	**CHECK GROUND CIRCUIT FOR ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B134) No. 6 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 3 — 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 • 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*** ***(B136) No. 2 (+) — Chassis ground (–):*** ***(B136) No. 30 (+) — 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. 21 (+) — Chassis ground (–):*** ***(B220) No. 23 (+) — 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*** ***(B135) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **6**.	Repair the open or ground short circuit of 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*** ***(B136) No. 1 (+) — Chassis ground (–):*** ***(B137) No. 7 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Check ignition control system. <Ref. to EN(H4DOTC)(diag)-79, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.
WIRING DIAGRAM:
• Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
• Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Diagnostics for Engine Starting Failure

	Step	Check	Yes	No
1	**CHECK SPARK PLUG CONDITION.** 1) Remove the spark plug. <Ref. to IG(STI)-4, REMOVAL, Spark Plug.> <Ref. to IG(w/o STI)-5, REMOVAL, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG(STI)-5, INSPECTION, Spark Plug.> <Ref. to IG(w/o STI)-6, INSPECTION, Spark Plug.>	Is the spark plug condition normal?	Go to step **2**.	Replace the spark plug. <Ref. to IG(STI)-4, Spark Plug.> <Ref. to IG(w/o STI)-5, Spark Plug.>
2	**CHECK IGNITION SYSTEM FOR SPARKS.** 1) Connect the spark plug to ignition coil. 2) Release the fuel pressure. <Ref. to FU(STI)-67, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.> <Ref. to FU(w/o STI)-65, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.> 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(H4DOTC)(diag)-82, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step **3**.
3	**CHECK IGNITION COIL POWER SUPPLY CIRCUIT.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition coil. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between ignition coil connector and engine ground. ***Connector & terminal*** ***(E31) No. 3 (+) — Engine ground (–):*** ***(E32) No. 3 (+) — Engine ground (–):*** ***(E33) No. 3 (+) — Engine ground (–):*** ***(E34) No. 3 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit or short circuit to ground in power supply circuit • Poor contact of coupling connector • Blown out of fuse
4	**CHECK HARNESS OF IGNITION COIL GROUND CIRCUIT.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between ignition coil connector and engine ground. ***Connector & terminal*** ***(E31) No. 2 — Engine ground:*** ***(E32) No. 2 — Engine ground:*** ***(E33) No. 2 — Engine ground:*** ***(E34) No. 2 — Engine ground:***	Is the resistance less than 1 Ω?	Go to step **5**.	Repair the open circuit in harness between ignition coil connector and engine ground.
5	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and ignition coil. 3) Measure the resistance of harness between ECM and ignition coil connector. ***Connector & terminal*** ***(B134) No. 21 — (E31) No. 1:*** ***(B134) No. 22 — (E32) No. 1:*** ***(B134) No. 31 — (E33) No. 1:*** ***(B134) No. 32 — (E34) 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 of harness between ECM and ignition coil connector • Poor contact of coupling connector

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.** Measure the resistance of harness between ECM and engine ground. ***Connector & terminal*** ***(B134) No. 21 — Engine ground:*** ***(B134) No. 22 — Engine ground:*** ***(B134) No. 31 — Engine ground:*** ***(B134) No. 32 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **7**.	Repair the ground short circuit of harness between ECM and ignition coil connector.
7	**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 ignition coil. <Ref. to IG(STI)-7, Ignition Coil.> <Ref. to IG(w/o STI)-8, Ignition Coil.>

E: FUEL PUMP CIRCUIT

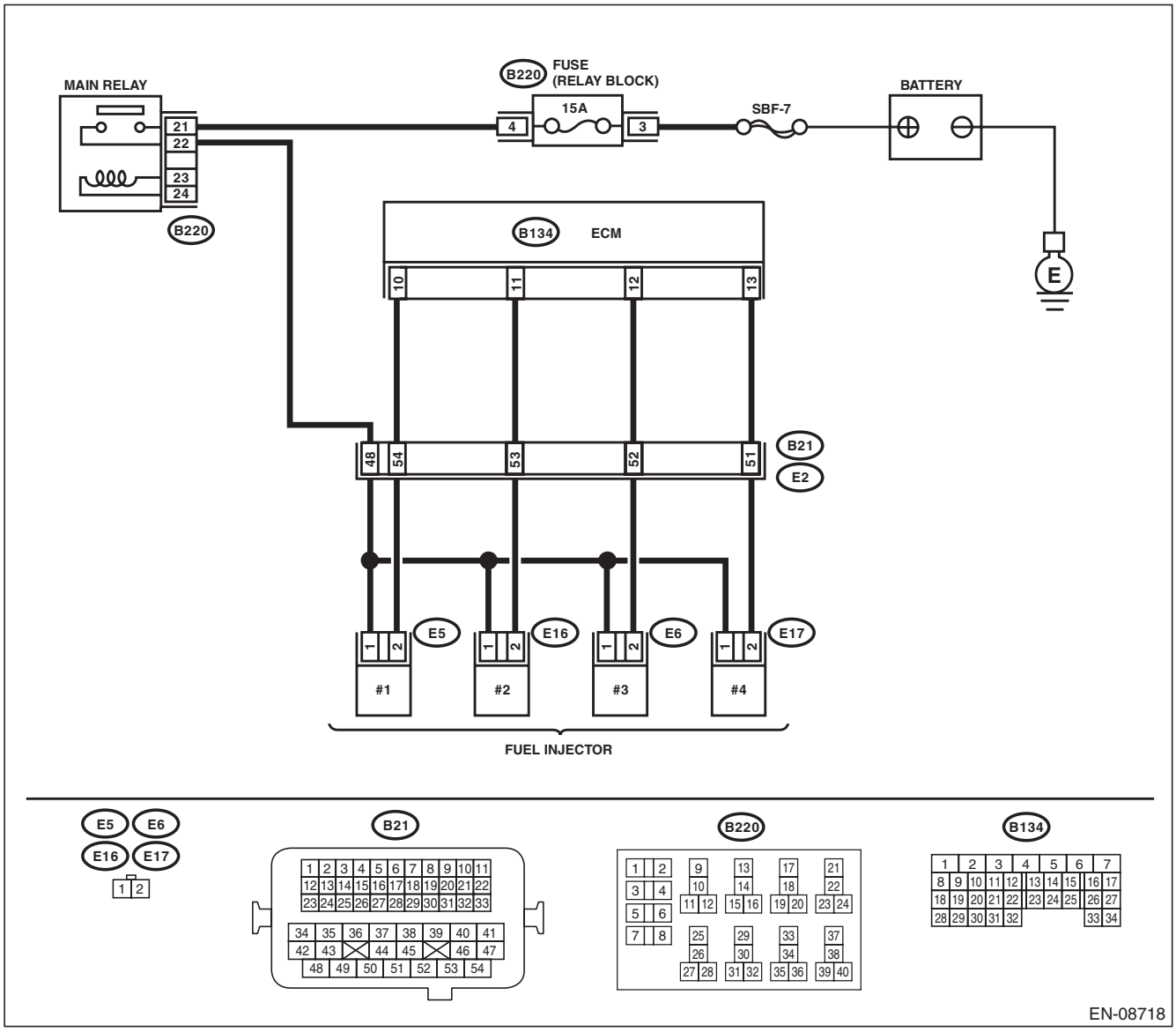
CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK OPERATING SOUND OF FUEL PUMP.** Make sure that 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(H4DOTC)(diag)-63, Compulsory Valve Operation Check Mode.>	Does the fuel pump emit operating sound?	Check the fuel injector circuit. <Ref. to EN(H4DOTC)(diag)-83, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>	Display the DTC. <Ref. to EN(H4DOTC)(diag)-47, OPERATION, Read Diagnostic Trouble Code (DTC).>

F: FUEL INJECTOR CIRCUIT

CAUTION:
- **Check or repair only faulty parts.**
- **After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.**

WIRING DIAGRAM:
- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



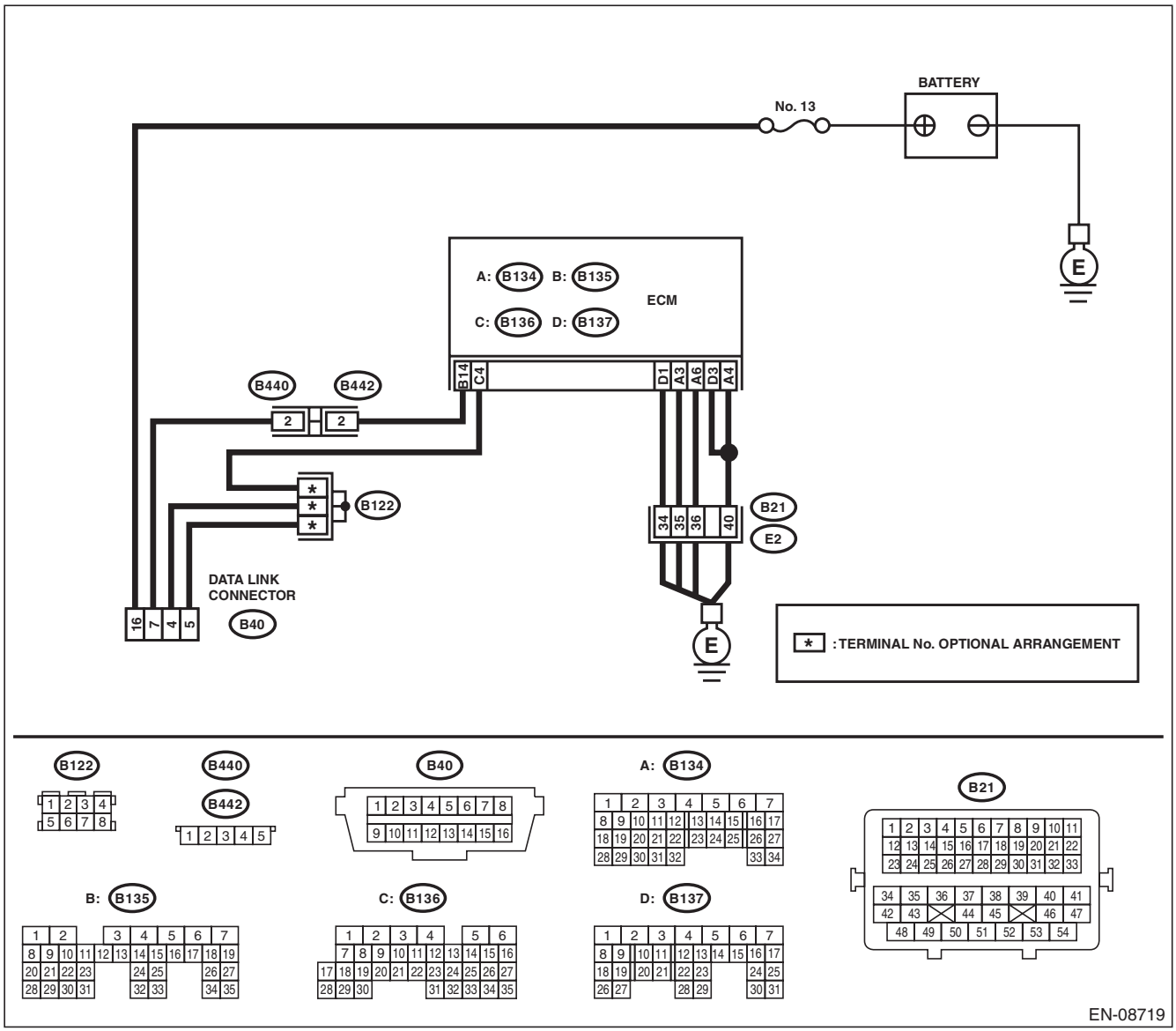
Diagnostics for Engine Starting Failure

	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 for this check.	Does the fuel injector emit operating sound?	Check the fuel pressure. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.>	Go to step **2**.
2	**CHECK POWER SUPPLY TO EACH FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel injector. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between fuel injector connector and the engine ground. ***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 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 connector from ECM. 3) Measure the resistance of harness between ECM and fuel injector connector. ***Connector & terminal*** ***#1 (B134) No. 10 — (E5) No. 2:*** ***#2 (B134) No. 11 — (E16) No. 2:*** ***#3 (B134) No. 12 — (E6) No. 2:*** ***#4 (B134) No. 13 — (E17) 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 fuel injector connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***#1 (B134) No. 10 — Chassis ground:*** ***#2 (B134) No. 11 — Chassis ground:*** ***#3 (B134) No. 12 — Chassis ground:*** ***#4 (B134) No. 13 — 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(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, 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(H4DOTC)(diag)-468, 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:
• Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
• Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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**.
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 coupling connector
4	**CHECK HARNESS BETWEEN ECM AND DATA LINK CONNECTOR.** 1) Disconnect the connectors from ECM, DCCD CM (6MT model only), VDC CM, airbag CM, impact sensor, TPMS & keyless entry CM, and body integrated unit. **CAUTION:** **When disconnecting the connector from airbag CM, 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*** ***(B135) No. 14 — (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 coupling 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
P0011	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	<Ref. to EN(H4DOTC)(diag)-97, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0014	Exhaust AVCS System 1 (Range/ Performance)	<Ref. to EN(H4DOTC)(diag)-98, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0016	Crankshaft Position - Camshaft Position Correlation (Bank1)	<Ref. to EN(H4DOTC)(diag)-99, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0017	Crank and Cam Timing B System Failure (Bank 1)	<Ref. to EN(H4DOTC)(diag)-100, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0018	Crankshaft Position - Camshaft Position Correlation (Bank2)	<Ref. to EN(H4DOTC)(diag)-101, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0019	Crank and Cam Timing B System Failure (Bank 2)	<Ref. to EN(H4DOTC)(diag)-102, DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	<Ref. to EN(H4DOTC)(diag)-103, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0024	Exhaust AVCS System 2 (Range/ Performance)	<Ref. to EN(H4DOTC)(diag)-104, DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-105, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-108, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-111, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-114, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-117, 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(H4DOTC)(diag)-120, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-121, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-122, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to EN(H4DOTC)(diag)-125, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Note
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-127, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to EN(H4DOTC)(diag)-130, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0111	Intake Air Temperature Sensor Range/Performance Problem	<Ref. to EN(H4DOTC)(diag)-132, DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to EN(H4DOTC)(diag)-133, 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(H4DOTC)(diag)-135, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-137, DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to EN(H4DOTC)(diag)-138, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine Coolant Temperature Circuit High	<Ref. to EN(H4DOTC)(diag)-140, 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(H4DOTC)(diag)-142, 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(H4DOTC)(diag)-145, 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(H4DOTC)(diag)-148, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to EN(H4DOTC)(diag)-149, 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 1)	<Ref. to EN(H4DOTC)(diag)-150, 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 1)	<Ref. to EN(H4DOTC)(diag)-153, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (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(H4DOTC)(diag)-155, 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(H4DOTC)(diag)-158, 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(H4DOTC)(diag)-161, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P013A	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-164, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P013B	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-166, DTC P013B O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-166, DTC P013E O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P013F	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-166, DTC P013F O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0140	O2 Sensor Circuit No Activity Detected (Bank1 Sensor2)	<Ref. to EN(H4DOTC)(diag)-167, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0141	O2 Sensor Heater Circuit (Bank1 Sensor2)	<Ref. to EN(H4DOTC)(diag)-169, DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P014C	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-170, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P014D	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-170, DTC P014D O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P015A	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-170, DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P015B	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-170, DTC P015B O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System Too Lean (Bank 1)	<Ref. to EN(H4DOTC)(diag)-170, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0172	System Too Rich (Bank 1)	<Ref. to EN(H4DOTC)(diag)-171, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0201	Injector #1	<Ref. to EN(H4DOTC)(diag)-173, DTC P0201 INJECTOR #1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0202	Injector #2	<Ref. to EN(H4DOTC)(diag)-175, DTC P0202 INJECTOR #2, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0203	Injector #3	<Ref. to EN(H4DOTC)(diag)-175, DTC P0203 INJECTOR #3, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0204	Injector #4	<Ref. to EN(H4DOTC)(diag)-175, DTC P0204 INJECTOR #4, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0222	Throttle/Pedal Position Sensor/ Switch “B” Circuit Low	<Ref. to EN(H4DOTC)(diag)-176, 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(H4DOTC)(diag)-179, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0230	Fuel Pump Primary Circuit	<Ref. to EN(H4DOTC)(diag)-182, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0244	Turbo/Super Charger Wastegate Solenoid “A” Range/Performance	<Ref. to EN(H4DOTC)(diag)-185, DTC P0244 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0245	Turbo/Super Charger Wastegate Solenoid “A” Low	<Ref. to EN(H4DOTC)(diag)-186, DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0246	Turbo/Super Charger Wastegate Solenoid “A” High	<Ref. to EN(H4DOTC)(diag)-189, DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Note
P0300	Random/Multiple Cylinder Misfire Detected	<Ref. to EN(H4DOTC)(diag)-191, DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0301	Cylinder 1 Misfire Detected	<Ref. to EN(H4DOTC)(diag)-195, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0302	Cylinder 2 Misfire Detected	<Ref. to EN(H4DOTC)(diag)-195, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0303	Cylinder 3 Misfire Detected	<Ref. to EN(H4DOTC)(diag)-195, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0304	Cylinder 4 Misfire Detected	<Ref. to EN(H4DOTC)(diag)-196, 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(H4DOTC)(diag)-202, 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(H4DOTC)(diag)-204, 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(H4DOTC)(diag)-206, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-208, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	<Ref. to EN(H4DOTC)(diag)-209, 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(H4DOTC)(diag)-211, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	<Ref. to EN(H4DOTC)(diag)-212, DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0346	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 2)	<Ref. to EN(H4DOTC)(diag)-214, DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0351	Ignition Coil A Primary/Secondary Circuit	<Ref. to EN(H4DOTC)(diag)-215, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0352	Ignition Coil B Primary/Secondary Circuit	<Ref. to EN(H4DOTC)(diag)-217, DTC P0352 IGNITION COIL B PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0353	Ignition Coil C Primary/Secondary Circuit	<Ref. to EN(H4DOTC)(diag)-217, DTC P0353 IGNITION COIL C PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0354	Ignition Coil D Primary/Secondary Circuit	<Ref. to EN(H4DOTC)(diag)-217, DTC P0354 IGNITION COIL D PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0365	Camshaft Position Sensor “B” Circuit (Bank 1)	<Ref. to EN(H4DOTC)(diag)-218, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0366	Camshaft Position Sensor B Circuit Range/Performance (Bank 1)	<Ref. to EN(H4DOTC)(diag)-220, DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0390	Camshaft Position Sensor “B” Circuit (Bank 2)	<Ref. to EN(H4DOTC)(diag)-221, DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P0391	Camshaft Position Sensor B Circuit Range/Performance (Bank 2)	<Ref. to EN(H4DOTC)(diag)-223, DTC P0391 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0410	Secondary Air Injection System	<Ref. to EN(H4DOTC)(diag)-224, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0411	Secondary Air Injection System Incorrect Flow Detected	<Ref. to EN(H4DOTC)(diag)-230, DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	<Ref. to EN(H4DOTC)(diag)-231, DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0414	Secondary Air Injection System Switching Valve “A” Circuit Shorted	<Ref. to EN(H4DOTC)(diag)-235, DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0416	Secondary Air Injection System Switching Valve “B” Circuit Open	<Ref. to EN(H4DOTC)(diag)-239, DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “B” CIRCUIT OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0417	Secondary Air Injection System Switching Valve “B” Circuit Shorted	<Ref. to EN(H4DOTC)(diag)-243, DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “B” CIRCUIT SHORTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to EN(H4DOTC)(diag)-247, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0441	Evaporative Emission Cont. Sys. Incorrect Purge Flow	<Ref. to EN(H4DOTC)(diag)-253, DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0451	Evaporative Emission System Pressure Sensor/Switch Range/ Performance	<Ref. to EN(H4DOTC)(diag)-254, DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0452	Evaporative Emission System Pressure Sensor/Switch Low	<Ref. to EN(H4DOTC)(diag)-255, DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0453	Evaporative Emission System Pressure Sensor/Switch High	<Ref. to EN(H4DOTC)(diag)-257, DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0455	Evaporative Emission System Leak Detected (Large Leak)	<Ref. to EN(H4DOTC)(diag)-259, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to EN(H4DOTC)(diag)-260, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to EN(H4DOTC)(diag)-261, 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(H4DOTC)(diag)-264, 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(H4DOTC)(diag)-266, 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(H4DOTC)(diag)-266, 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(H4DOTC)(diag)-267, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Note
P04AC	Evap System Purge Control Valve "B" Circuit Low	<Ref. to EN(H4DOTC)(diag)-268, DTC P04AC EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P04AD	Evap System Purge Control Valve "B" Circuit High	<Ref. to EN(H4DOTC)(diag)-271, DTC P04AD EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P04DB	Crankcase Ventilation System Disconnected	<Ref. to EN(H4DOTC)(diag)-273, DTC P04DB CRANKCASE VENTILATION SYSTEM DISCONNECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0500	Vehicle Speed Sensor “A”	<Ref. to EN(H4DOTC)(diag)-275, 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(H4DOTC)(diag)-276, 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(H4DOTC)(diag)-277, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P050A	Cold Start Idle Air Control System Performance	<Ref. to EN(H4DOTC)(diag)-278, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P050B	Cold Start Ignition Timing Performance	<Ref. to EN(H4DOTC)(diag)-287, DTC P050B COLD START IGNITION TIMING PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0513	Incorrect Immobilizer Key	<Ref. to IM(diag)-15, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0560	System Voltage	<Ref. to EN(H4DOTC)(diag)-288, DTC P0560 SYSTEM VOLTAGE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to EN(H4DOTC)(diag)-290, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to EN(H4DOTC)(diag)-290, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0606	Control Module Processor	<Ref. to EN(H4DOTC)(diag)-291, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P060A	Internal Control Module Monitoring Processor Performance	<Ref. to EN(H4DOTC)(diag)-292, DTC P060A INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P060B	Internal Control Module A/D Processing Performance	<Ref. to EN(H4DOTC)(diag)-292, DTC P060B INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0616	Starter Relay Circuit Low	<Ref. to EN(H4DOTC)(diag)-293, DTC P0616 STARTER RELAY CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0617	Starter Relay Circuit High	<Ref. to EN(H4DOTC)(diag)-295, DTC P0617 STARTER RELAY CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P062F	Internal Control Module EEPROM Error	<Ref. to EN(H4DOTC)(diag)-296, DTC P062F INTERNAL CONTROL MODULE EEPROM ERROR , Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Neutral Switch Input Circuit Low (MT Model)	<Ref. to EN(H4DOTC)(diag)-297, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to EN(H4DOTC)(diag)-299, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1160	Return Spring Failure	<Ref. to EN(H4DOTC)(diag)-300, DTC P1160 RETURN SPRING FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to EN(H4DOTC)(diag)-301, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1410	Secondary Air Injection System Switching Valve Stuck Open	<Ref. to EN(H4DOTC)(diag)-304, DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to EN(H4DOTC)(diag)-305, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1449	Evaporative Emission Cont. Sys. Air Filter Clog	<Ref. to EN(H4DOTC)(diag)-307, DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1451	Evaporative Emission Cont. Sys.	<Ref. to EN(H4DOTC)(diag)-308, DTC P1451 EVAPORATIVE EMISSION CONT. SYS., Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1570	Antenna	<Ref. to IM(diag)-16, DTC P1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1571	Reference Code Incompatibility	<Ref. to IM(diag)-18, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to IM(diag)-19, 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).>
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	<Ref. to EN(H4DOTC)(diag)-309, DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	<Ref. to EN(H4DOTC)(diag)-310, DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	<Ref. to EN(H4DOTC)(diag)-311, DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	<Ref. to EN(H4DOTC)(diag)-312, DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2008	Intake Manifold Runner Control Circuit / Open (Bank 1)	<Ref. to EN(H4DOTC)(diag)-313, DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	<Ref. to EN(H4DOTC)(diag)-315, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2011	Intake Manifold Runner Control Circuit / Open (Bank 2)	<Ref. to EN(H4DOTC)(diag)-317, DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2012	Intake Manifold Runner Control Circuit Low (Bank 2)	<Ref. to EN(H4DOTC)(diag)-319, DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2016	Tumble Generated Valve Position Sensor 1 Circuit Low	<Ref. to EN(H4DOTC)(diag)-321, DTC P2016 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Note
P2017	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 1)	<Ref. to EN(H4DOTC)(diag)-325, DTC P2017 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2021	Tumble Generated Valve Position Sensor 2 Circuit Low	<Ref. to EN(H4DOTC)(diag)-328, DTC P2021 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2022	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 2)	<Ref. to EN(H4DOTC)(diag)-332, DTC P2022 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2088	Intake Camshaft Position Actuator Control Circuit Low (Bank 1)	<Ref. to EN(H4DOTC)(diag)-335, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2089	Intake Camshaft Position Actuator Control Circuit High (Bank 1)	<Ref. to EN(H4DOTC)(diag)-337, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2090	Exhaust Camshaft Position Actuator Control Circuit Low (Bank 1)	<Ref. to EN(H4DOTC)(diag)-339, DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2091	Exhaust Camshaft Position Actuator Control Circuit High (Bank 1)	<Ref. to EN(H4DOTC)(diag)-341, DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2092	Intake Camshaft Position Actuator Control Circuit Low (Bank 2)	<Ref. to EN(H4DOTC)(diag)-343, DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2093	Intake Camshaft Position Actuator Control Circuit High (Bank 2)	<Ref. to EN(H4DOTC)(diag)-345, DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2094	Exhaust Camshaft Position Actuator Control Circuit Low (Bank 2)	<Ref. to EN(H4DOTC)(diag)-347, DTC P2094 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2095	Exhaust Camshaft Position Actuator Control Circuit High (Bank 2)	<Ref. to EN(H4DOTC)(diag)-349, DTC P2095 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	<Ref. to EN(H4DOTC)(diag)-351, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	<Ref. to EN(H4DOTC)(diag)-360, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-369, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to EN(H4DOTC)(diag)-375, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to EN(H4DOTC)(diag)-377, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2109	Throttle/Pedal Position Sensor “A” Minimum Stop Performance	<Ref. to EN(H4DOTC)(diag)-378, DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2119	Throttle Actuator Control Throttle Body Range/Performance	<Ref. to EN(H4DOTC)(diag)-378, DTC P2119 THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2122	Throttle/Pedal Position Sensor/ Switch “D” Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-379, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DTC	Item	Note
P2123	Throttle/Pedal Position Sensor/ Switch “D” Circuit High Input	<Ref. to EN(H4DOTC)(diag)-381, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2127	Throttle/Pedal Position Sensor/ Switch “E” Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-383, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2128	Throttle/Pedal Position Sensor/ Switch “E” Circuit High Input	<Ref. to EN(H4DOTC)(diag)-385, 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(H4DOTC)(diag)-387, 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(H4DOTC)(diag)-390, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2195	O2 Sensor Signal Biased/Stuck Lean (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-392, DTC P2195 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2196	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-395, DTC P2196 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P219A	Bank 1 Air-Fuel Ratio Imbalance	<Ref. to EN(H4DOTC)(diag)-398, DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2257	Air System Control "A" Circuit Low	<Ref. to EN(H4DOTC)(diag)-412, DTC P2257 AIR SYSTEM CONTROL "A" CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2258	Air System Control "A" Circuit High	<Ref. to EN(H4DOTC)(diag)-416, DTC P2258 AIR SYSTEM CONTROL "A" CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	<Ref. to EN(H4DOTC)(diag)-420, DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	<Ref. to EN(H4DOTC)(diag)-423, DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-425, DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2419	Evaporative Emission System Switching Valve Control Circuit Low	<Ref. to EN(H4DOTC)(diag)-429, DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2420	Evaporative Emission System Switching Valve Control Circuit High	<Ref. to EN(H4DOTC)(diag)-432, DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2431	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-434, DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2432	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Low	<Ref. to EN(H4DOTC)(diag)-435, DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2433	Secondary Air Injection System Air Flow /Pressure Sensor Circuit High	<Ref. to EN(H4DOTC)(diag)-440, DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2440	Secondary Air Injection System Switching Valve Stuck Open (Bank1)	<Ref. to EN(H4DOTC)(diag)-444, DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Note
P2441	Secondary Air Injection System Switching Valve Stuck Closed (Bank1)	<Ref. to EN(H4DOTC)(diag)-450, DTC P2441 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2442	Secondary Air Injection System Switching Valve Stuck Open (Bank2)	<Ref. to EN(H4DOTC)(diag)-451, DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2443	Secondary Air Injection System Switching Valve Stuck Closed (Bank2)	<Ref. to EN(H4DOTC)(diag)-457, DTC P2443 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2444	Secondary Air Injection System Pump Stuck On	<Ref. to EN(H4DOTC)(diag)-458, DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2610	ECM/PCM Internal Engine Off Timer Performance	<Ref. to EN(H4DOTC)(diag)-462, DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0073	CAN Failure, Bus 'Off' Detection	<Ref. to EN(H4DOTC)(diag)-462, DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0122	CAN (VDC) Data Not Loaded	<Ref. to EN(H4DOTC)(diag)-462, DTC U0122 CAN (VDC) DATA NOT LOADED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0140	CAN (BCU) Data Not Loaded	<Ref. to EN(H4DOTC)(diag)-462, DTC U0140 CAN (BCU) DATA NOT LOADED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0416	CAN (VDC) Data Abnormal	<Ref. to EN(H4DOTC)(diag)-462, DTC U0416 CAN (VDC) DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
U0422	CAN (BCU) Data Abnormal	<Ref. to EN(H4DOTC)(diag)-462, DTC U0422 CAN (BCU) DATA ABNORMAL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

20. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

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

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-11, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the value of «VVT Adv. Ang. Amount R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «VVT Adv. Ang. Amount R» approx. 0 deg?	Go to step **2**.	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)
2	**CHECK CURRENT DATA.** 1) Drive with acceleration and deceleration at 80 km/h (50 MPH) or less. NOTE: Drive to an extent that the duty output of oil flow control solenoid valve increases. 2) Read the values of «OCV Duty R» and «VVT Adv. Ang. Amount R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	When the value of «OCV Duty R» increases more than 10%, is the value of «VVT Adv. Ang. Amount R» approx. 0 deg?	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.> <Ref. to LU(STI)-31, Engine Oil Filter.>

B: DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-13, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the value of «Exh. VVT Retard Ang. R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Exh. VVT Retard Ang. R» approx. 0 deg?	Go to step **2**.	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft)
2	**CHECK CURRENT DATA.** 1) Drive with acceleration and deceleration at 80 km/h (50 MPH) or less. NOTE: Drive to an extent that the duty output of oil flow control solenoid valve increases. 2) Read the values of «Exh. OCV Duty R» and «Exh. VVT Retard Ang. R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	When the value of «Exh. OCV Duty R» increases more than 10%, is the value of «Exh. VVT Retard Ang. R» approx. 0 deg?	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft)	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.> <Ref. to LU(STI)-31, Engine Oil Filter.>

C: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-15, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the values of «VVT Adv. Ang. Amount R» and «OCV Duty R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «VVT Adv. Ang. Amount R» approx. 0 deg, and the value of «OCV Duty R» approx. 10%?	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.> <Ref. to LU(STI)-31, Engine Oil Filter.>	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft) • Timing belt (matching of timing mark)

D: DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-17, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the values of «Exh. VVT Retard Ang. R» and «Exh. OCV Duty R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Exh. VVT Retard Ang. R» approx. 0 deg, and the value of «Exh. OCV Duty R» approx. 10%?	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.> <Ref. to LU(STI)-31, Engine Oil Filter.>	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft) • Timing belt (matching of timing mark)

E: DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-18, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the values of «VVT Adv. Ang. Amount L» and «OCV Duty L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «VVT Adv. Ang. Amount L» approx. 0 deg, and the value of «OCV Duty L» approx. 10%?	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.> <Ref. to LU(STI)-31, Engine Oil Filter.>	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft) • Timing belt (matching of timing mark)

F: DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-18, DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the values of «Exh. VVT Retard Ang. L» and «Exh. OCV Duty L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Exh. VVT Retard Ang. L» approx. 0 deg, and the value of «Exh. OCV Duty L» approx. 10%?	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.> <Ref. to LU(STI)-31, Engine Oil Filter.>	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft) • Timing belt (matching of timing mark)

G: DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-18, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the value of «VVT Adv. Ang. Amount L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «VVT Adv. Ang. Amount L» approx. 0 deg?	Go to step **2**.	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)
2	**CHECK CURRENT DATA.** 1) Drive with acceleration and deceleration at 80 km/h (50 MPH) or less. NOTE: Drive to an extent that the duty output of oil flow control solenoid valve increases. 2) Read the values of «OCV Duty L» and «VVT Adv. Ang. Amount L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	When the value of «OCV Duty L» increases more than 10%, is the value of «VVT Adv. Ang. Amount L» approx. 0 deg?	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Intake camshaft (dirt, damage of camshaft)	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.> <Ref. to LU(STI)-31, Engine Oil Filter.>

H: DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-19, DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

- Engine stalls.
- Improper idling

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine and let it idle. 2) Read the value of «Exh. VVT Retard Ang. L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Exh. VVT Retard Ang. L» approx. 0 deg?	Go to step **2**.	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft)
2	**CHECK CURRENT DATA.** 1) Drive with acceleration and deceleration at 80 km/h (50 MPH) or less. NOTE: Drive to an extent that the duty output of oil flow control solenoid valve increases. 2) Read the values of «Exh. OCV Duty L» and «Exh. VVT Retard Ang. L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	When the value of «Exh. OCV Duty L» increases more than 10%, is the value of «Exh. VVT Retard Ang. L» approx. 0 deg?	Check the following item and repair or replace if necessary. • Oil pipe (clog) • Oil flow control solenoid valve (clog or dirt of oil routing, setting of spring) • Exhaust camshaft (dirt, damage of camshaft)	Perform the following procedures, and clean the oil routing. Replace the engine oil and idle the engine for 5 minutes, and then replace the oil filter and engine oil. <Ref. to LU(STI)-11, REPLACEMENT, Engine Oil.> <Ref. to LU(STI)-31, Engine Oil Filter.>

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

DTC DETECTING CONDITION:

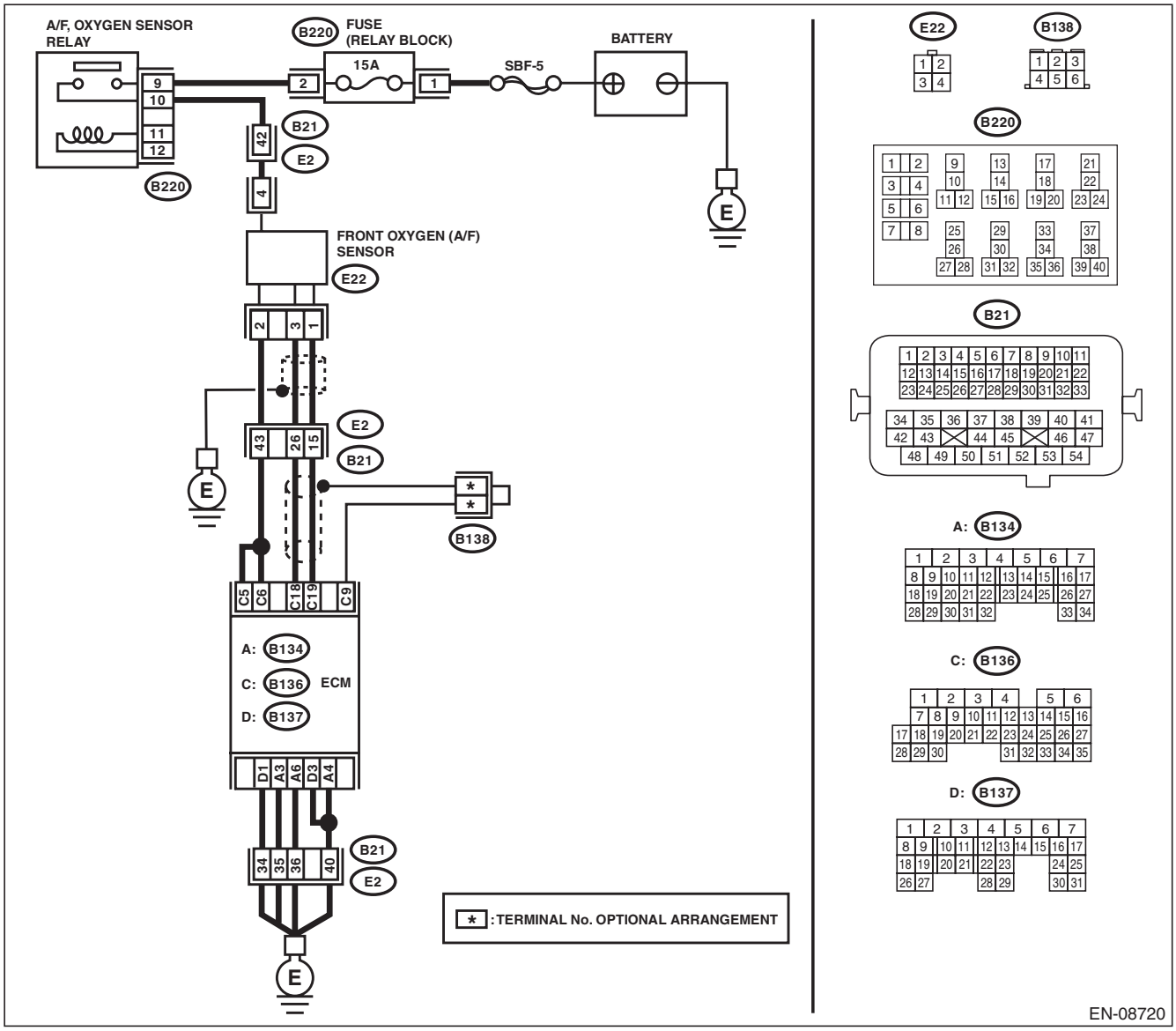
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-19, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

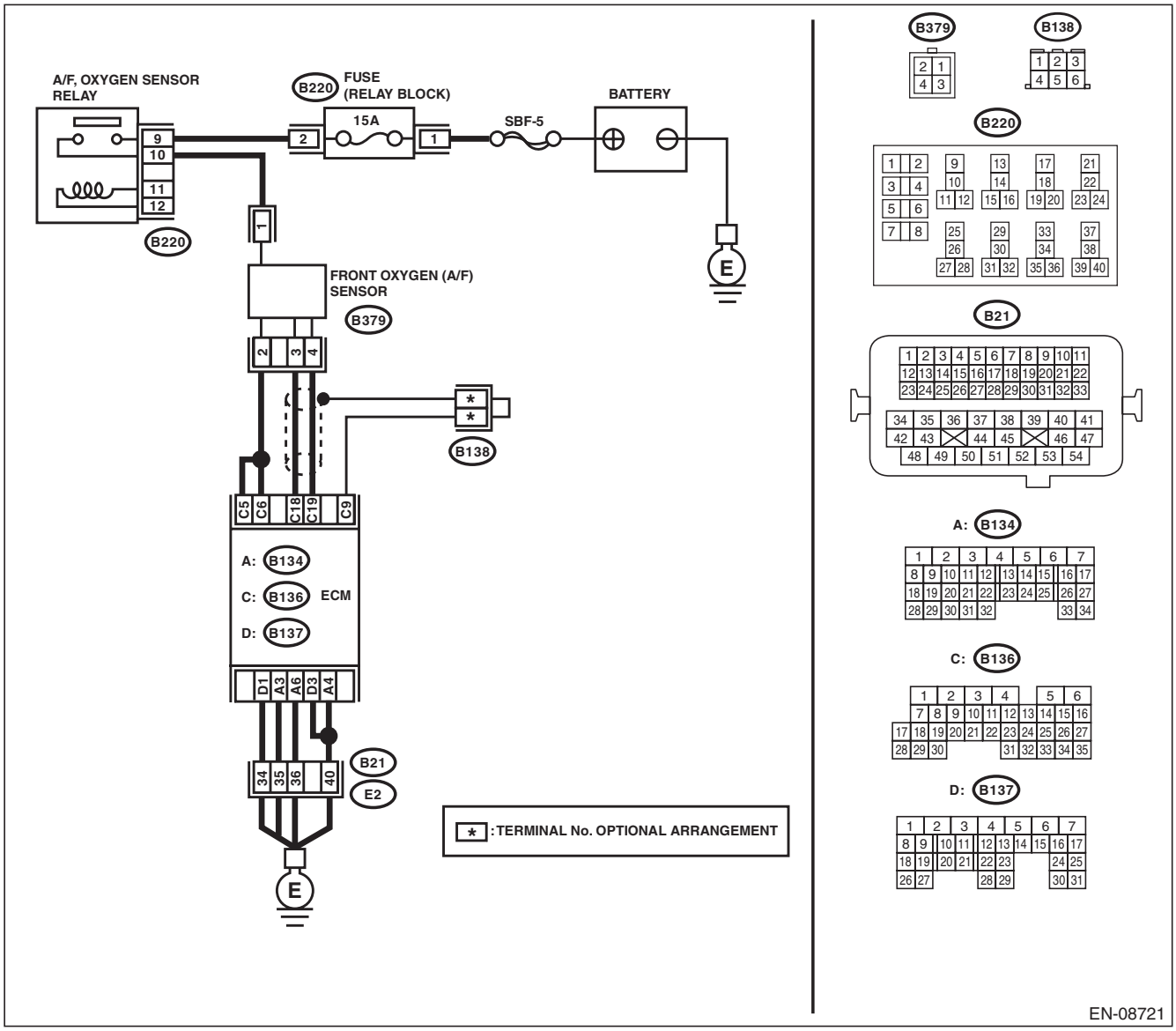
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***Models without SI-DRIVE*** ***(B136) No. 6 — (E22) No. 2:*** ***(B136) No. 5 — (E22) No. 2:*** ***(B136) No. 19 — (E22) No. 1:*** ***(B136) No. 18 — (E22) No. 3:*** ***Models with SI-DRIVE*** ***(B136) No. 6 — (B379) No. 2:*** ***(B136) No. 5 — (B379) No. 2:*** ***(B136) No. 19 — (B379) No. 4:*** ***(B136) No. 18 — (B379) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
2	**CHECK FRONT OXYGEN (A/F) SENSOR.** Measure the resistance between front oxygen (A/F) sensor terminals. ***Terminals*** ***Models without SI-DRIVE*** ***No. 4 — No. 2:*** ***Models with SI-DRIVE*** ***No. 2 — No. 1:***	Is the resistance less than 2 — 3 Ω?	Go to step **3**.	Replace the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, 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(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>

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

DTC DETECTING CONDITION:

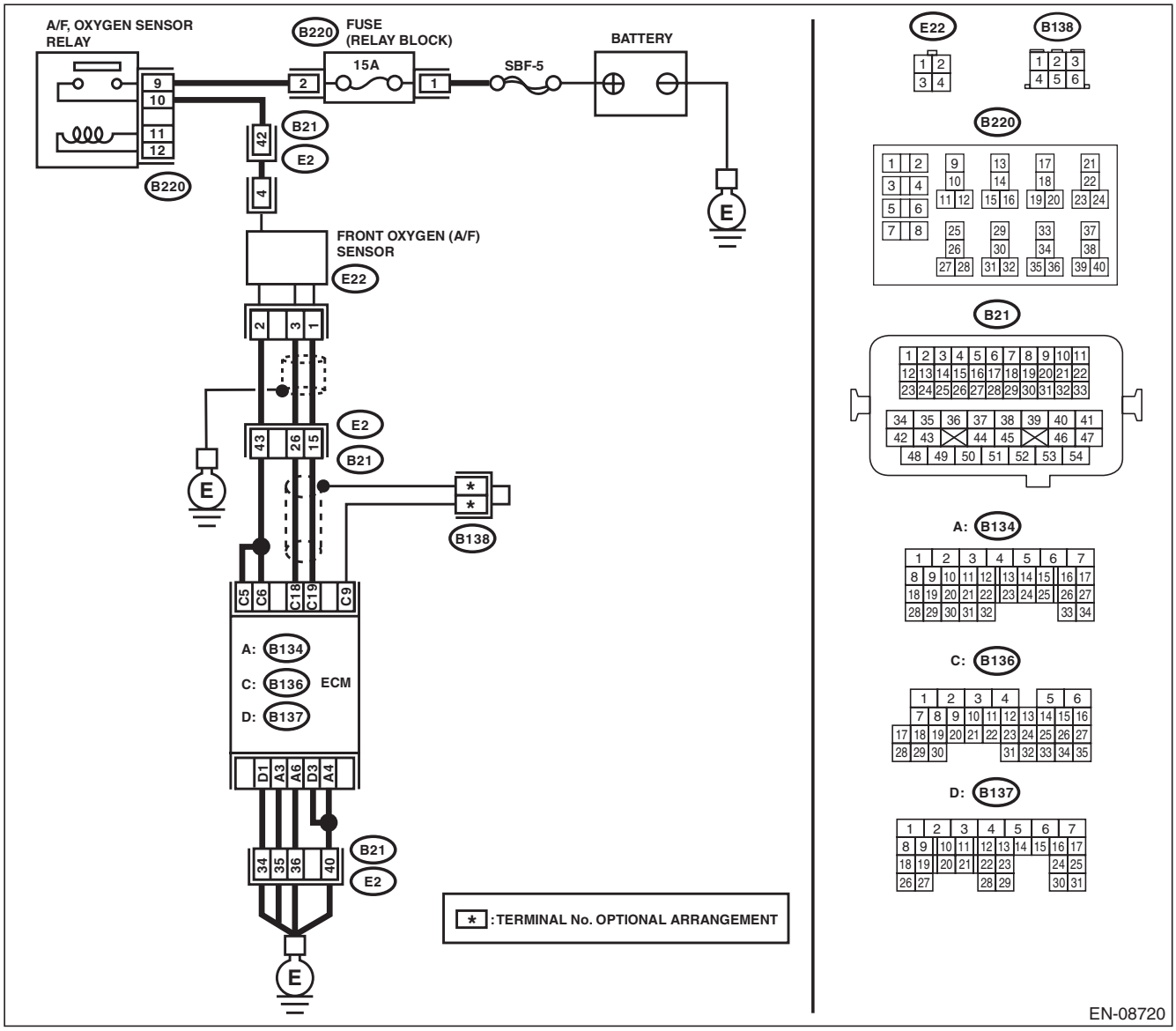
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-21, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

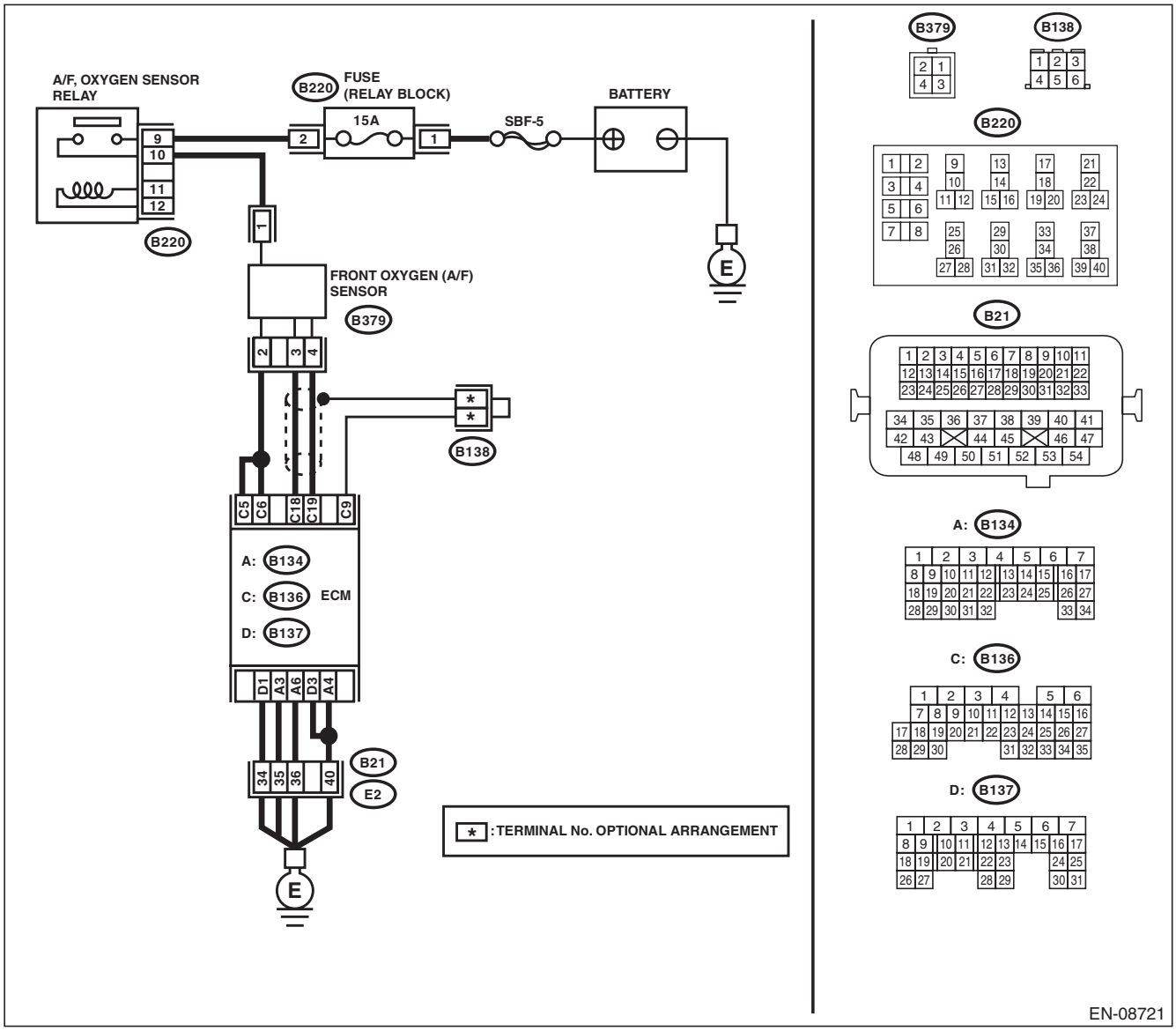
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***Models without SI-DRIVE*** ***(E22) No. 4 (+) — Engine ground (–):*** ***Models with SI-DRIVE*** ***(B379) No. 1 (+) — 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 and front oxygen (A/F) sensor connector • Poor contact of A/F, oxygen sensor relay 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 connector from ECM. 3) Measure the resistance between ECM and front oxygen (A/F) sensor connector. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(B136) No. 6 — (E22) No. 2:*** ***(B136) No. 5 — (E22) No. 2:*** ***Models with SI-DRIVE*** ***(B136) No. 6 — (B379) No. 2:*** ***(B136) No. 5 — (B379) No. 2:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
3	**CHECK GROUND CIRCUIT FOR ECM.** Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B134) No. 6 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 3 — 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*** ***Models without SI-DRIVE*** ***No. 4 — No. 2:*** ***Models with SI-DRIVE*** ***No. 2 — No. 1:***	Is the resistance 2 — 3 Ω?	Repair the poor contact of ECM connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>

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

DTC DETECTING CONDITION:

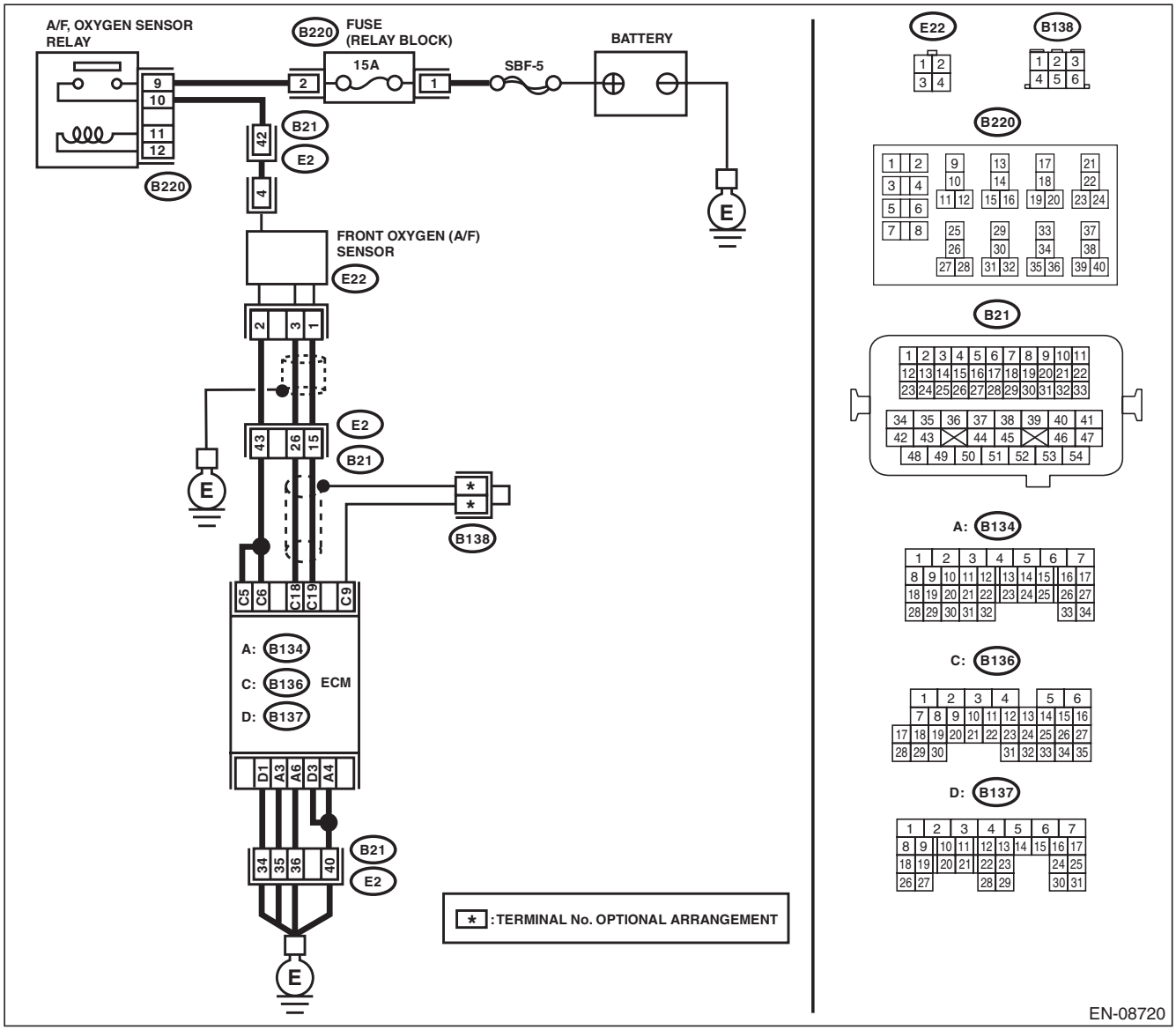
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-23, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

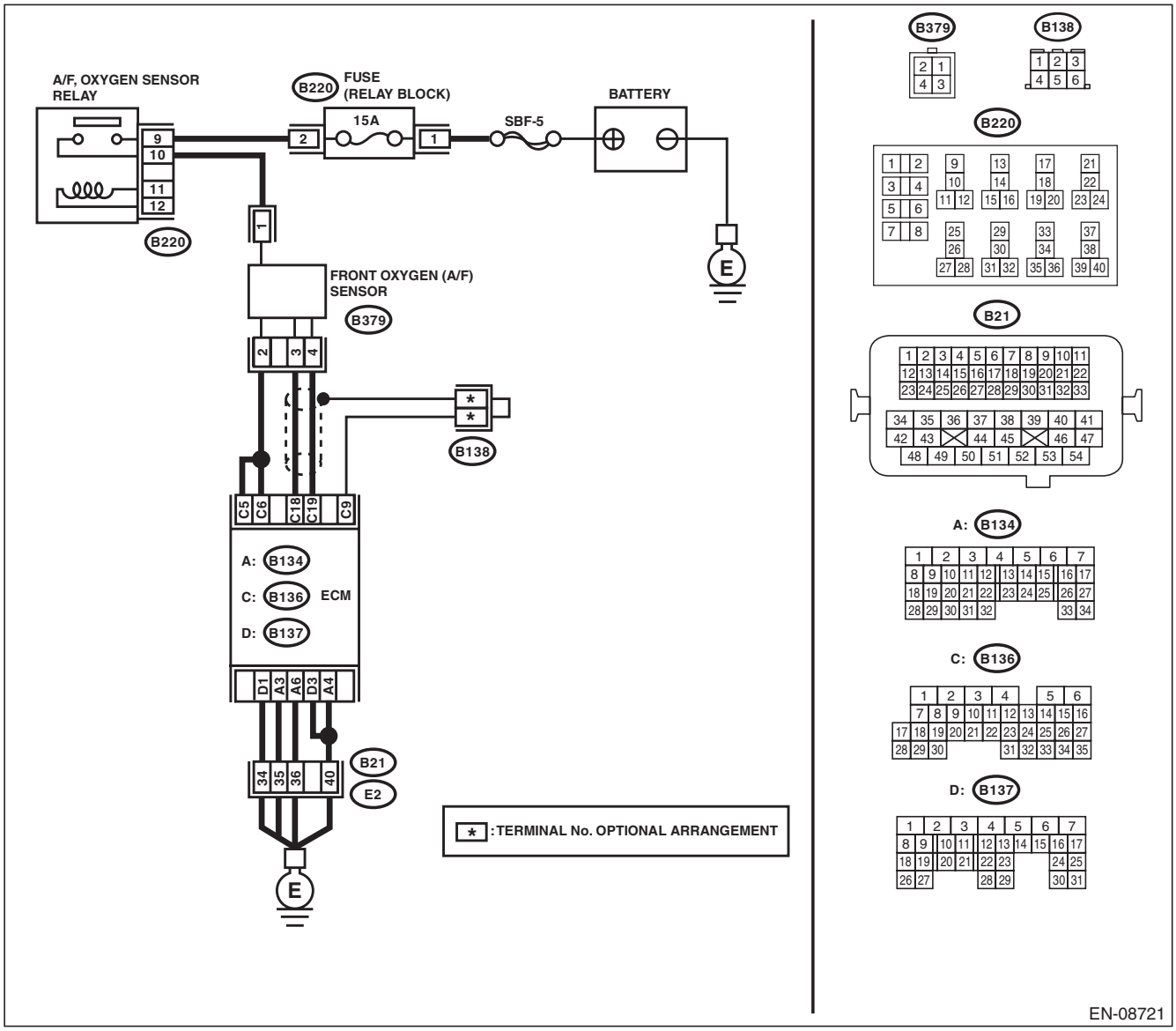
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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. 6 (+) — Chassis ground (–):*** ***(B136) No. 5 (+) — 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 connector from ECM. 2) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B134) No. 6 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 3 — 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

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

DTC DETECTING CONDITION:

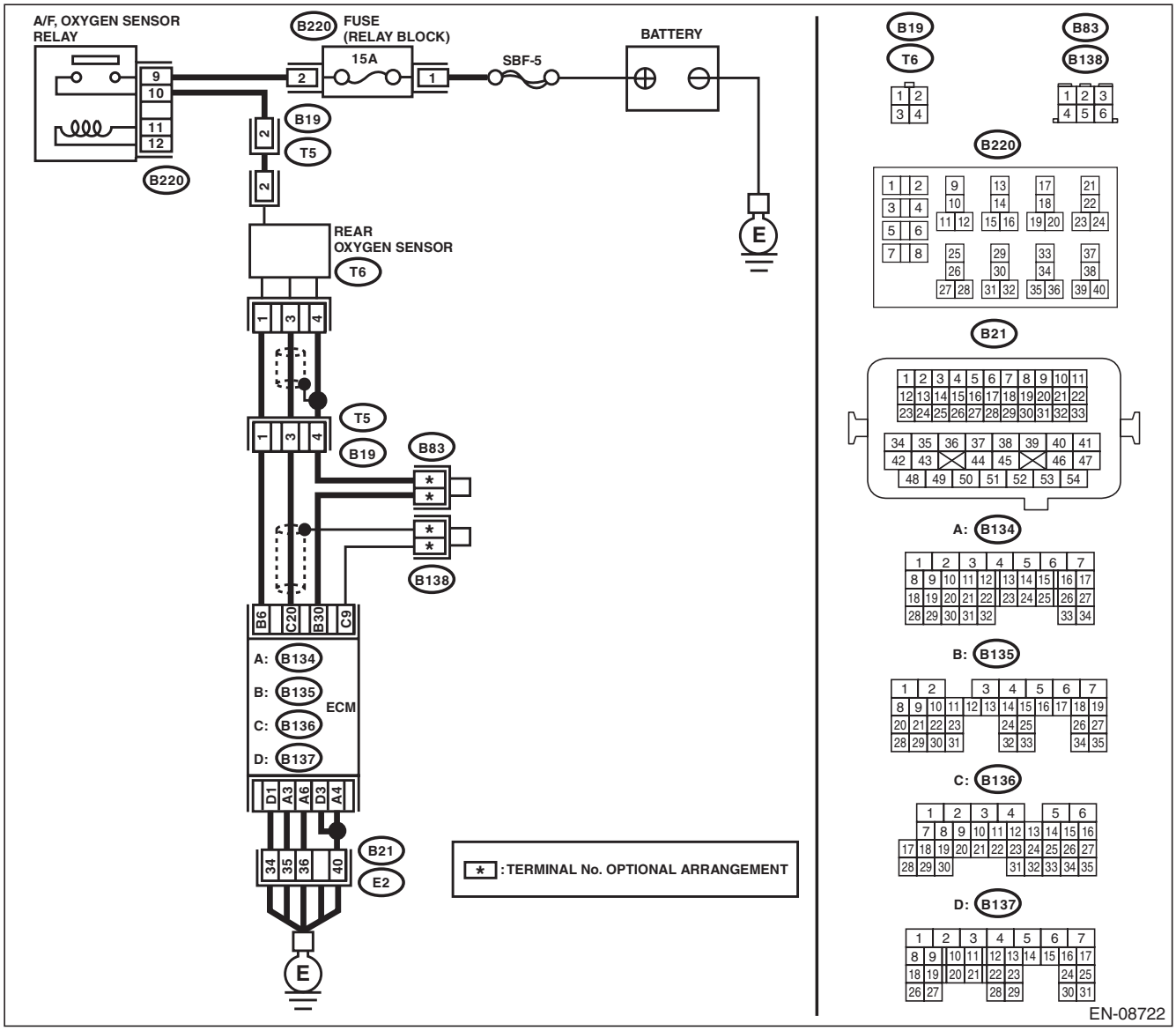
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-25, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

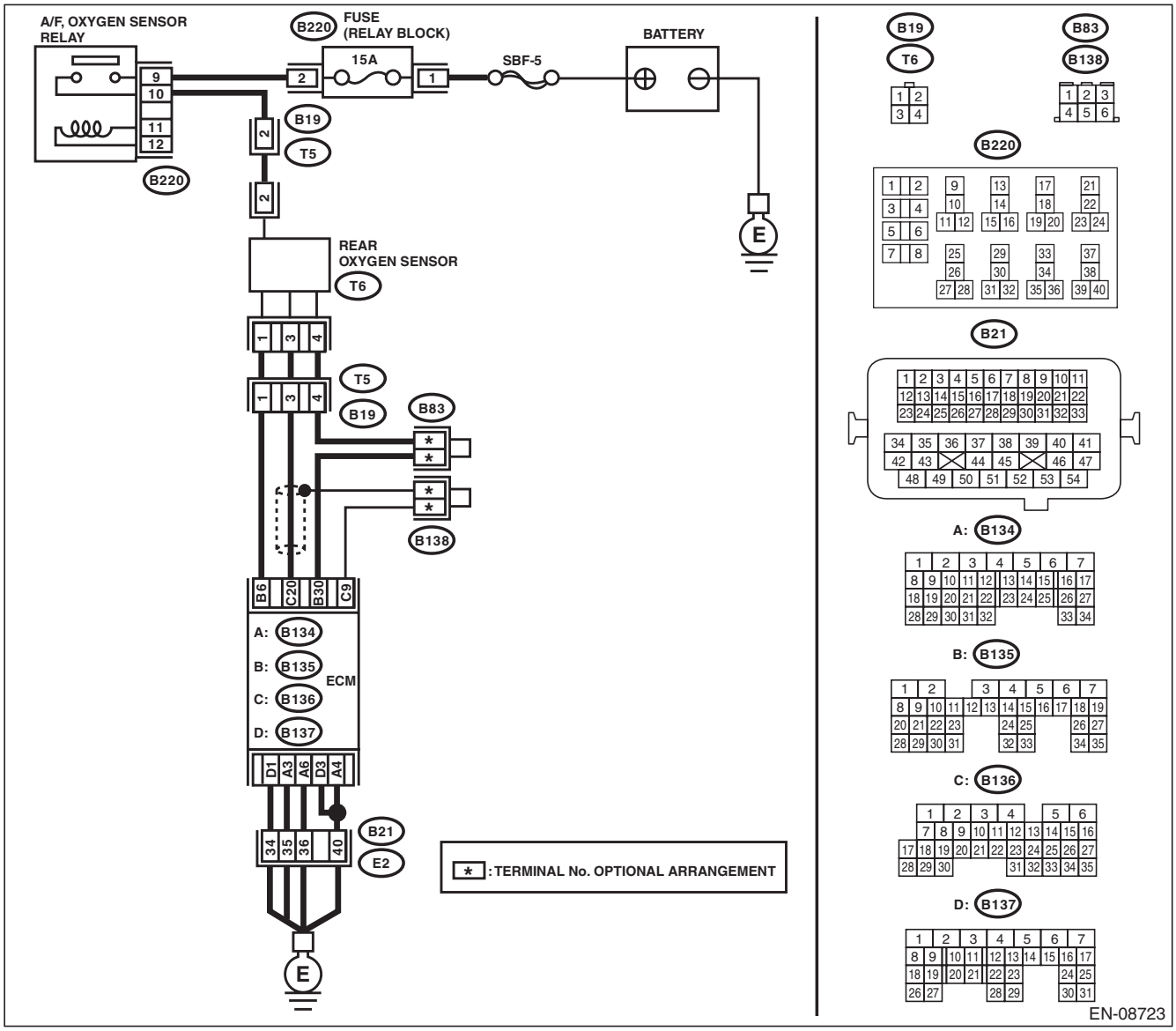
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***(T6) No. 2 (+) — 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 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 connector from ECM. 3) Measure the resistance between the ECM and rear oxygen sensor connector. ***Connector & terminal*** ***(B135) No. 6 — (T6) 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. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B134) No. 6 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 3 — 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 ECM connector • Poor contact of coupling connector
4	**CHECK REAR OXYGEN SENSOR.** Measure the resistance between rear oxygen sensor terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 7 Ω?	Repair the poor contact of ECM connector.	Replace the rear oxygen sensor. <Ref. to FU(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, Rear Oxygen Sensor.>

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

DTC DETECTING CONDITION:

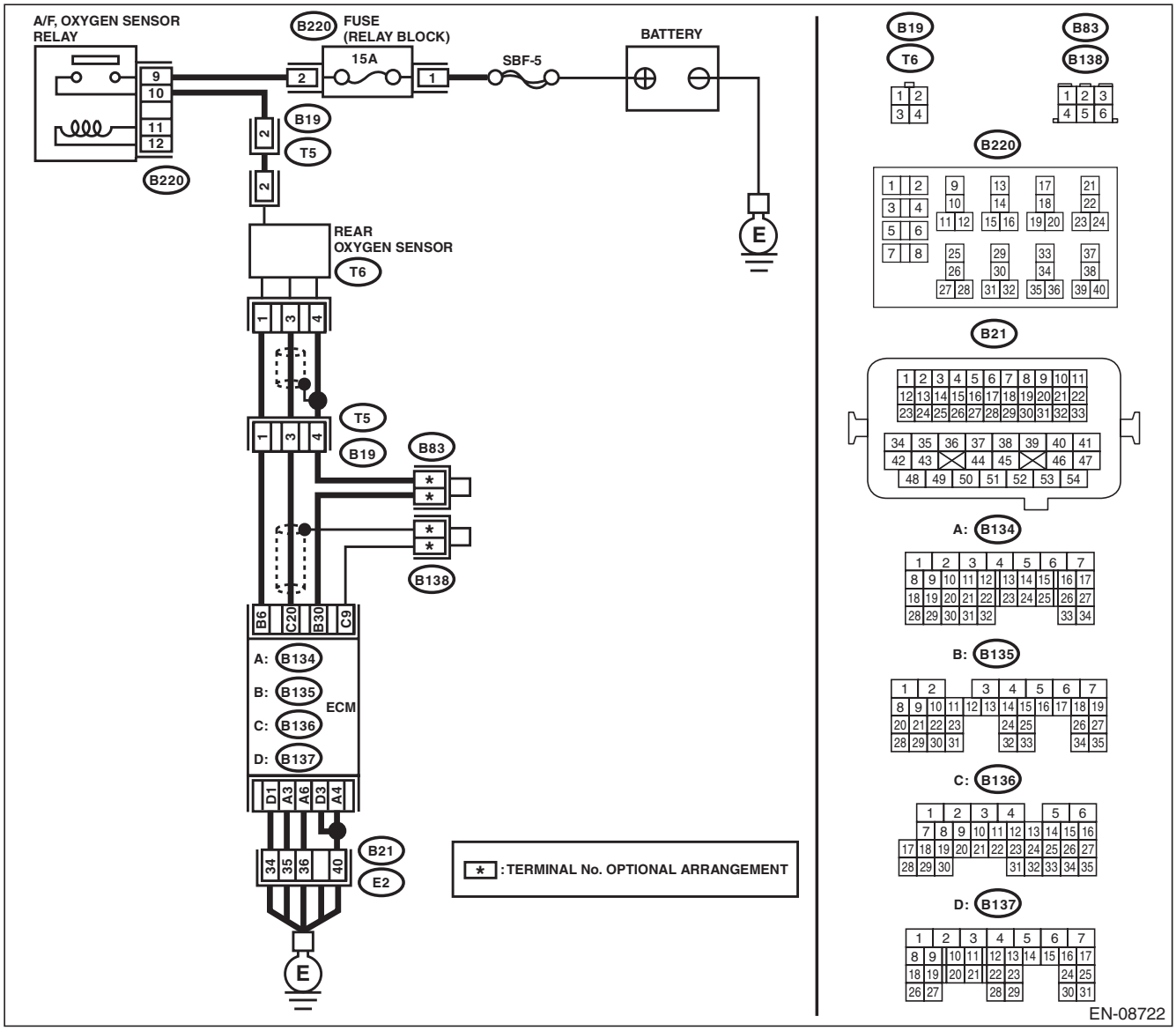
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-27, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

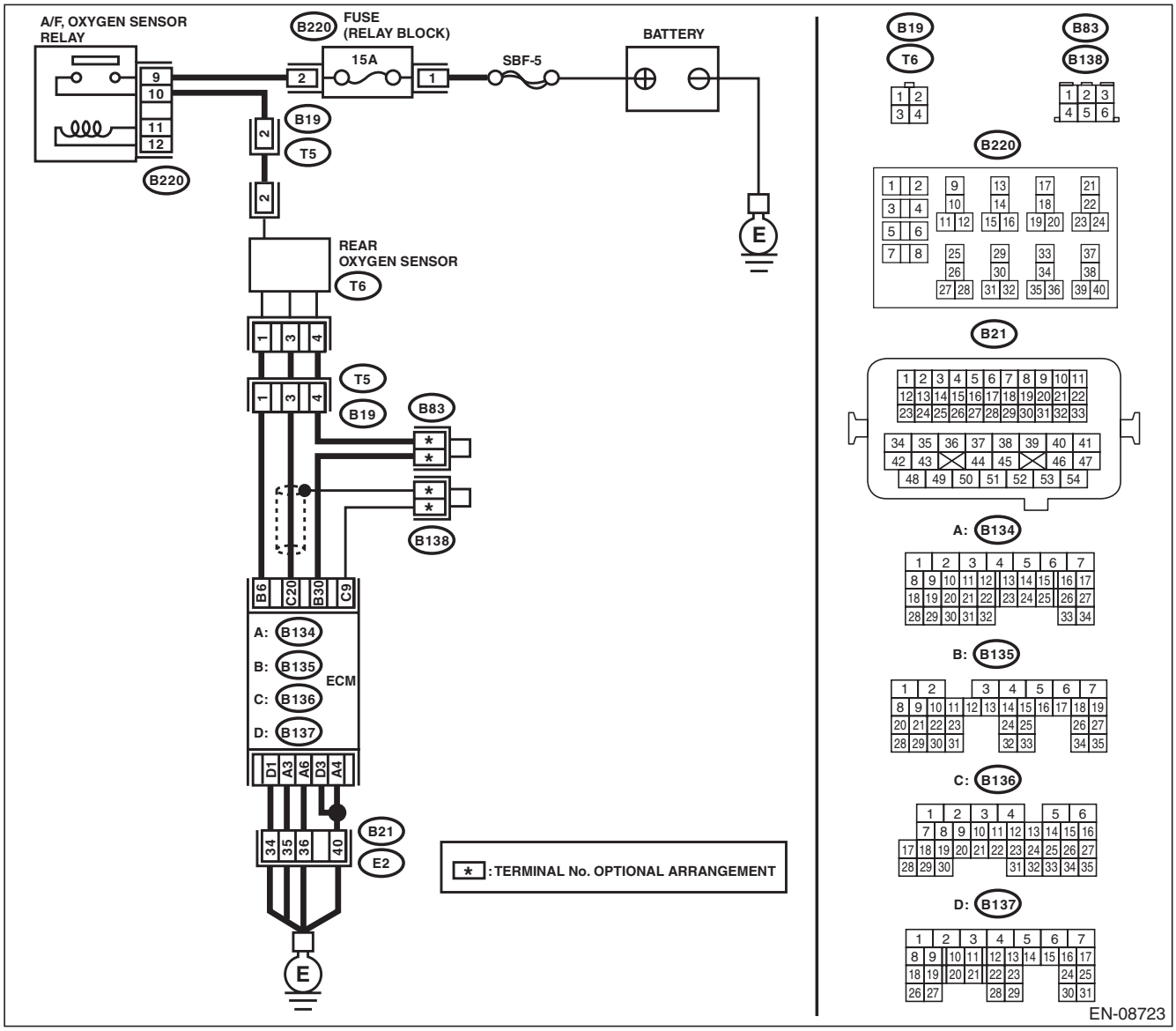
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***(B135) No. 6 (+) — 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**.
2	**CHECK GROUND CIRCUIT FOR ECM.** 1) Disconnect the connector from ECM. 2) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B134) No. 6 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 3 — 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

N: DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-29, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	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**.
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) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mani. Absolute Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the value in «Mani. Absolute Pressure» 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(STI)-43, Manifold Absolute Pressure Sensor.> <Ref. to FU(w/o STI)-43, Manifold Absolute Pressure Sensor.>
3	**CHECK THROTTLE OPENING ANGLE.** Using the Subaru Select Monitor or a general scan tool, read the value in «Throttle Opening Angle». NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the "General Scan Tool Instruction Manual".	Is the value in «Throttle Opening Angle» with the throttle fully closed less than 5%?	Go to step **4**.	Replace the electronic throttle control. <Ref. to FU(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>
4	**CHECK THROTTLE OPENING ANGLE.**	Is the value in «Throttle Opening Angle» with the throttle fully open 85% or more?	Replace the manifold absolute pressure sensor. <Ref. to FU(STI)-43, Manifold Absolute Pressure Sensor.> <Ref. to FU(w/o STI)-43, Manifold Absolute Pressure Sensor.>	Replace the electronic throttle control. <Ref. to FU(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>

O: 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(H4DOTC)-31, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-33, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

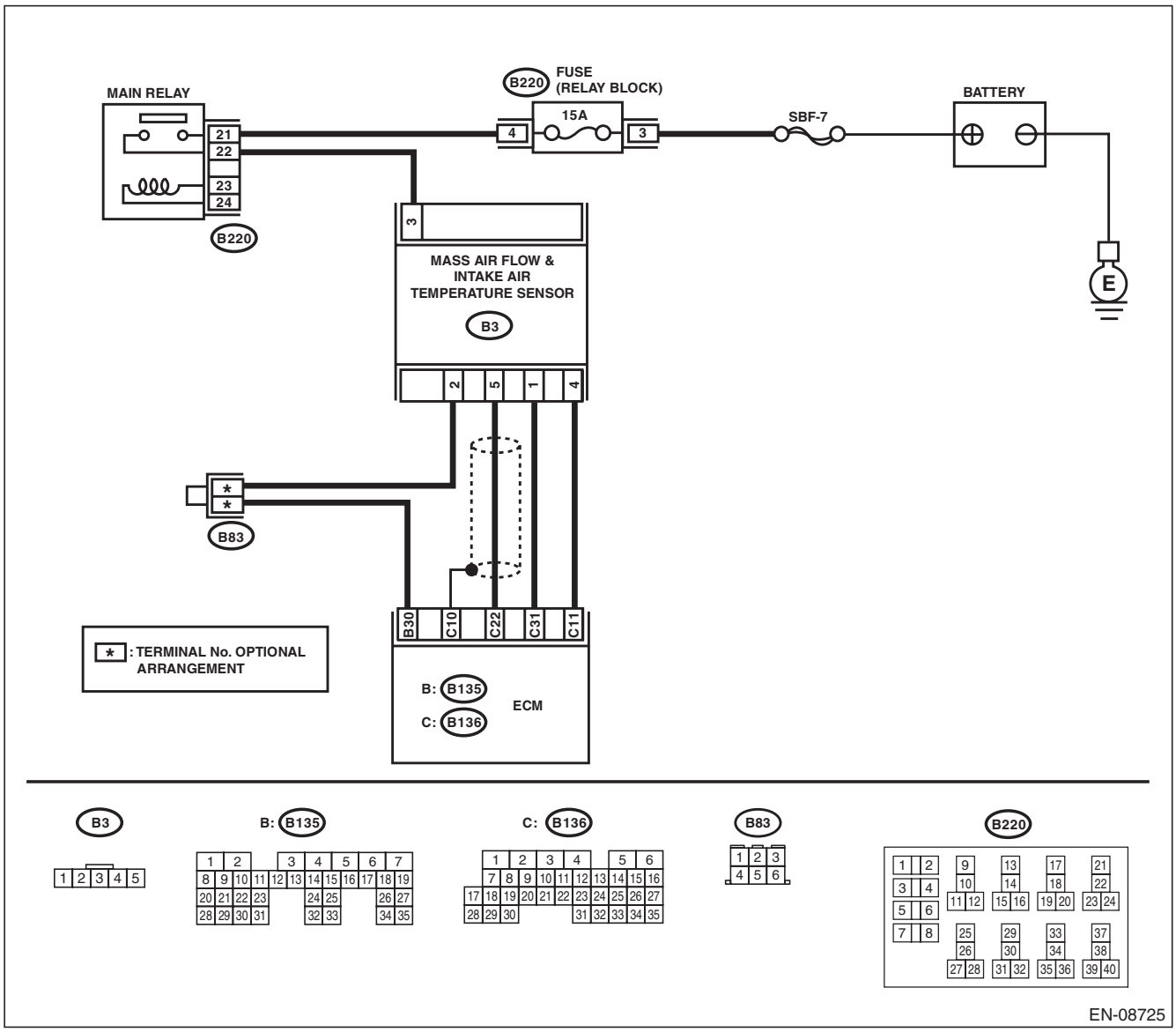
TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Air Flow Sensor Voltage» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Air Flow Sensor 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 connector 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 connector from ECM. 3) Measure the resistance of harness between ECM and the mass air flow and intake air temperature sensor connector. ***Connector & terminal*** ***(B136) No. 22 — (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*** ***(B136) No. 22 — 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.

	Step	Check	Yes	No
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(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-35, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

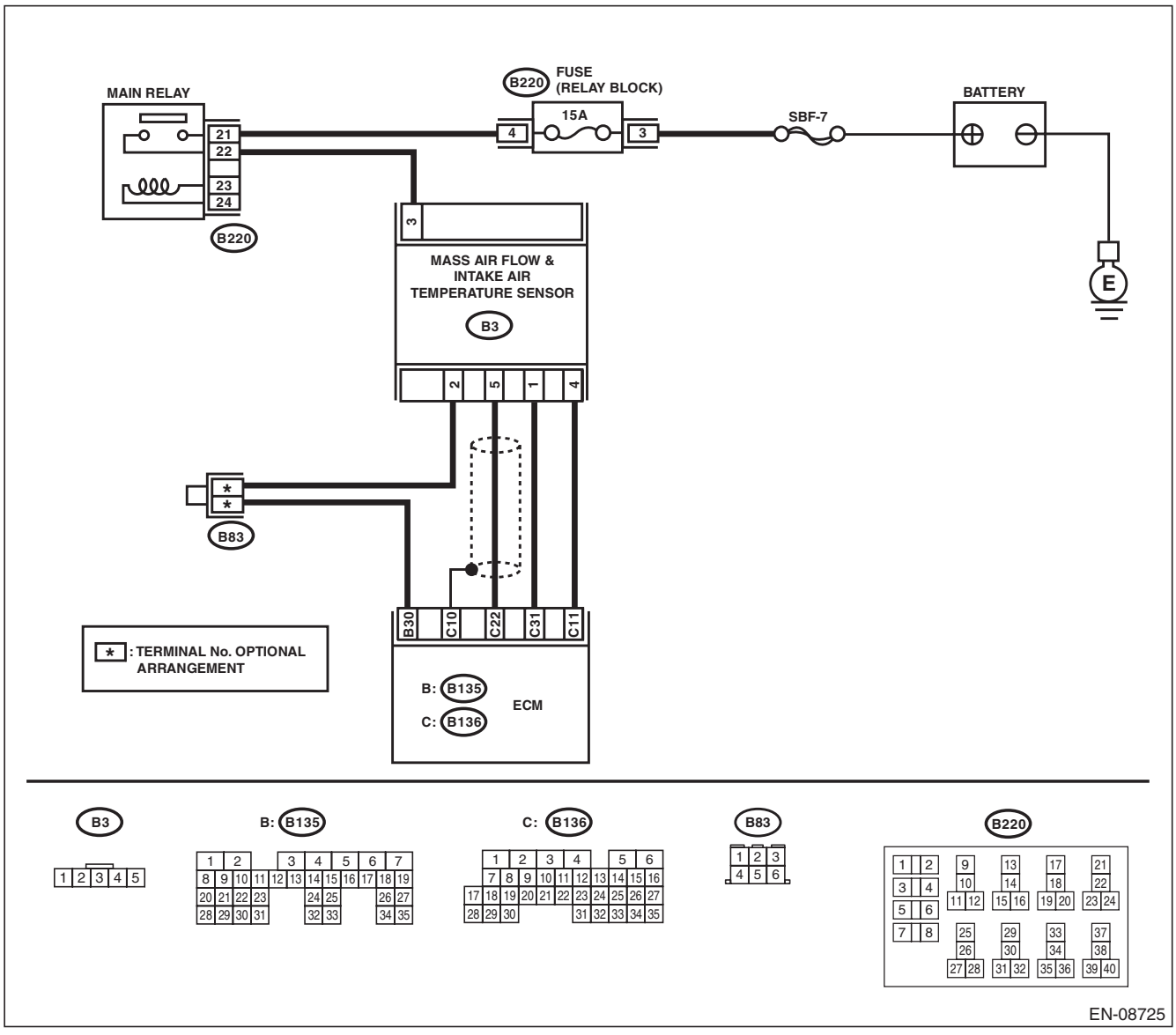
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08725

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Air Flow Sensor Voltage» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Air Flow Sensor 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 value of «Air Flow Sensor Voltage» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Air Flow Sensor 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(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>

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

DTC DETECTING CONDITION:

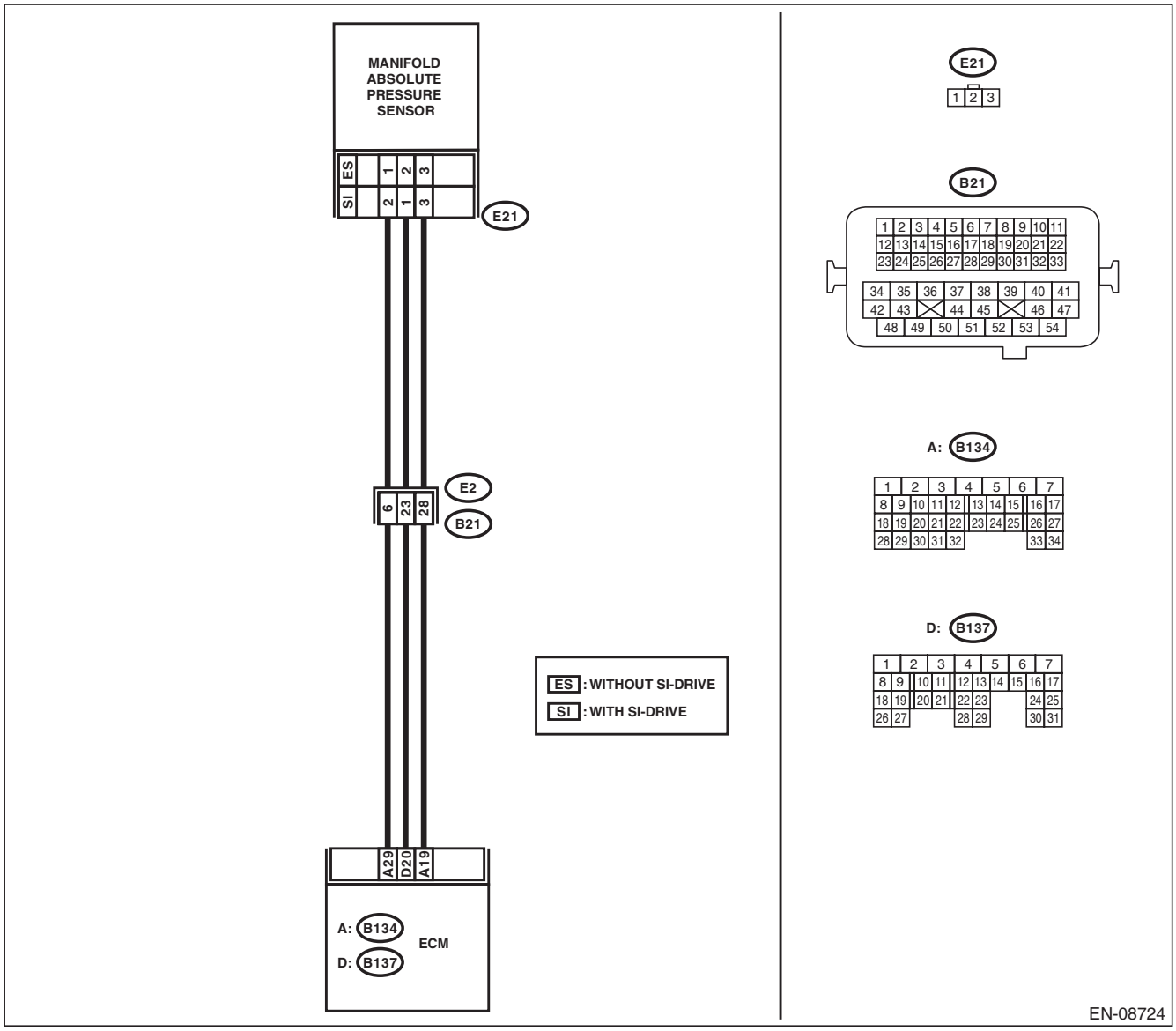
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-37, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/ BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Mani. Absolute Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mani. Absolute Pressure» 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 connector from ECM. 3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(B137) No. 20 — (E21) No. 2:*** ***Models with SI-DRIVE*** ***(B137) No. 20 — (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*** ***(B137) No. 20 — 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.

	Step	Check	Yes	No
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(STI)-43, Manifold Absolute Pressure Sensor.> <Ref. to FU(w/o STI)-43, Manifold Absolute Pressure Sensor.>

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

DTC DETECTING CONDITION:

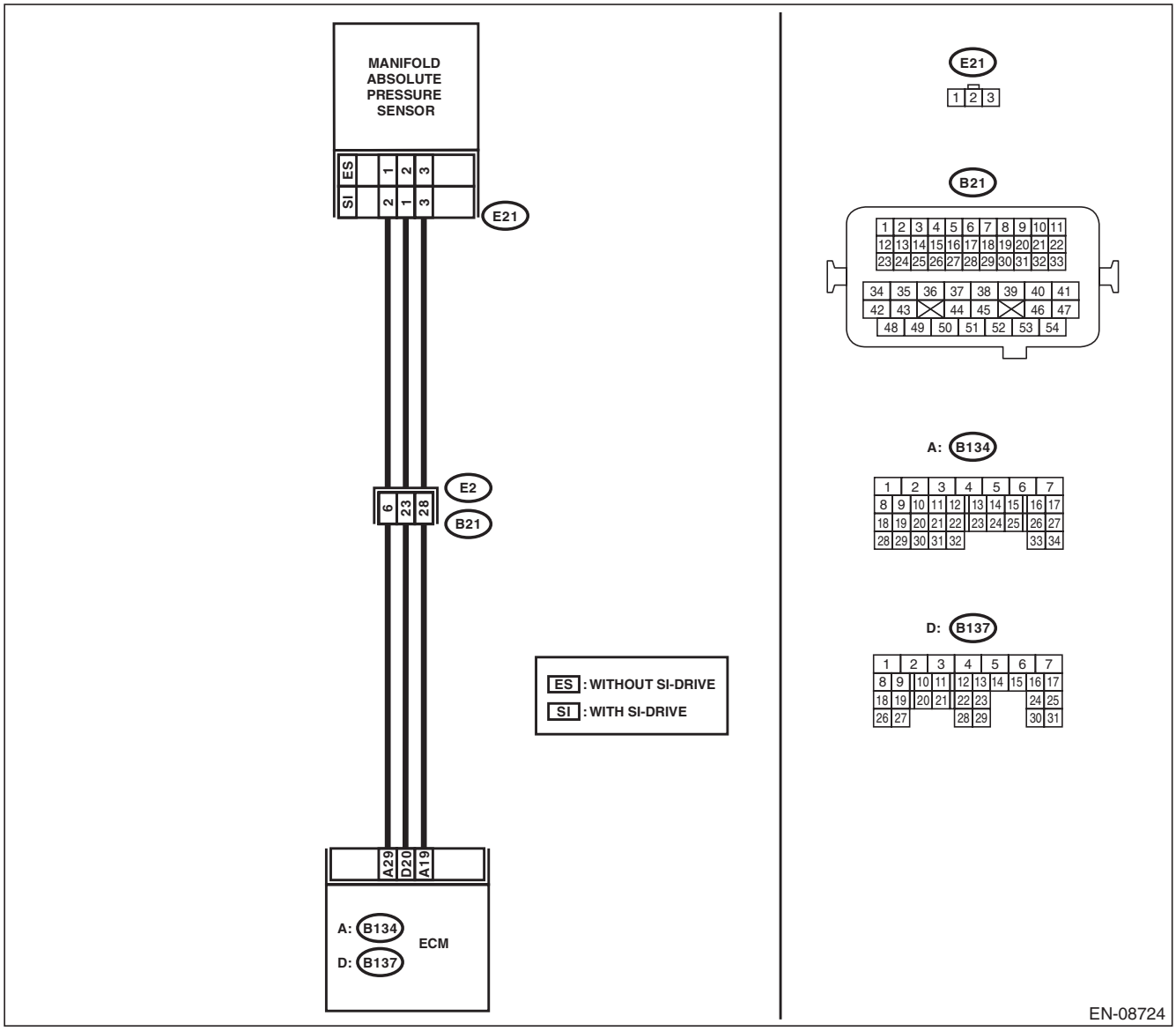
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-39, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/ BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Mani. Absolute Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mani. Absolute Pressure» 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 value of «Mani. Absolute Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mani. Absolute Pressure» 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*** ***Models without SI-DRIVE*** ***(E21) No. 1 — Engine ground:*** ***Models with SI-DRIVE*** ***(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(STI)-43, Manifold Absolute Pressure Sensor.> <Ref. to FU(w/o STI)-43, Manifold Absolute Pressure Sensor.>

T: DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-41, DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK ENGINE COOLANT TEMPERATURE.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>	Check for DTC P0125. <Ref. to EN(H4DOTC)(diag)-148, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

U: DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-44, DTC P0112 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

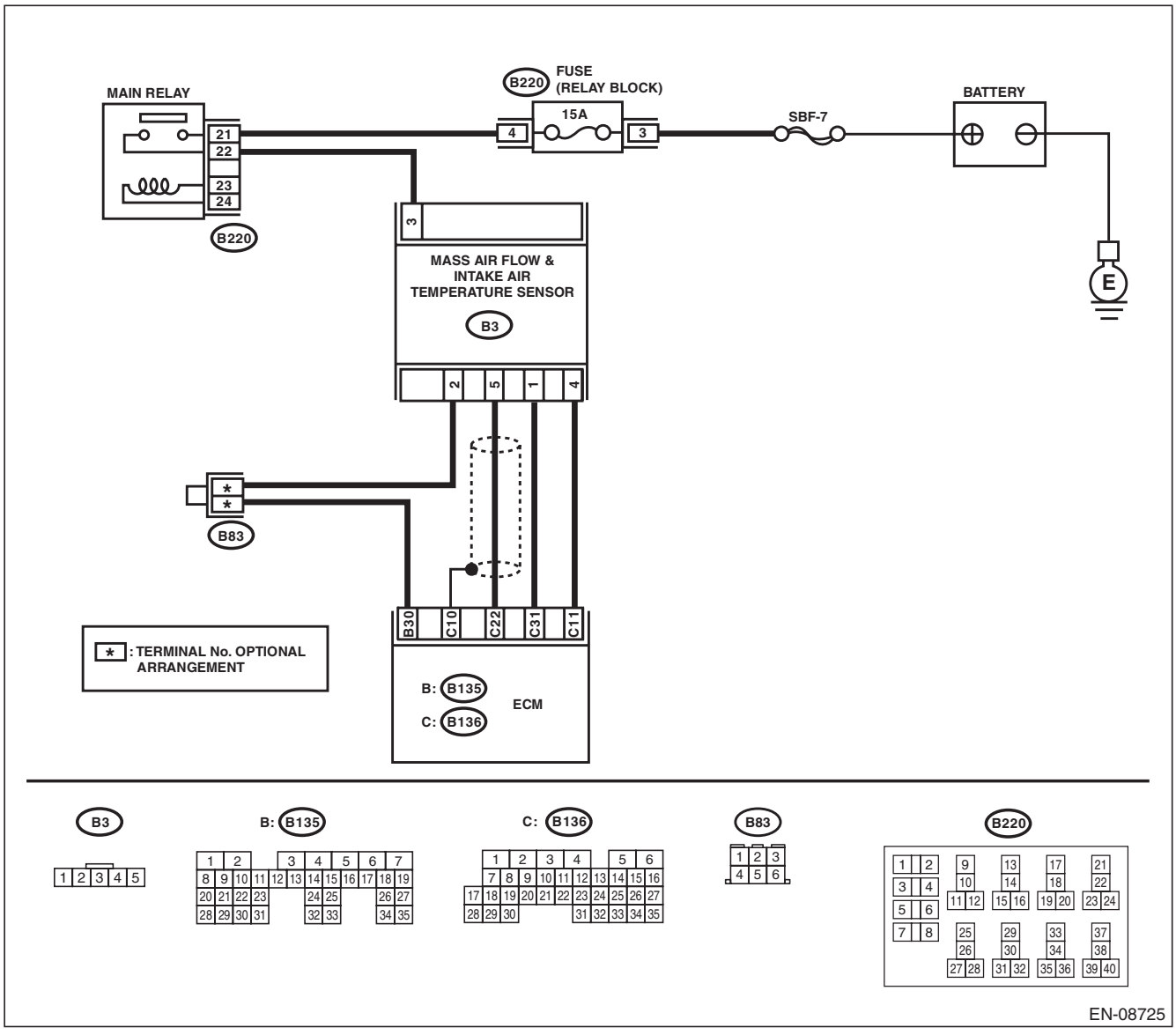
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Intake Air Temp.» 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*** ***(B136) No. 31 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, 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.

V: DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-46, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

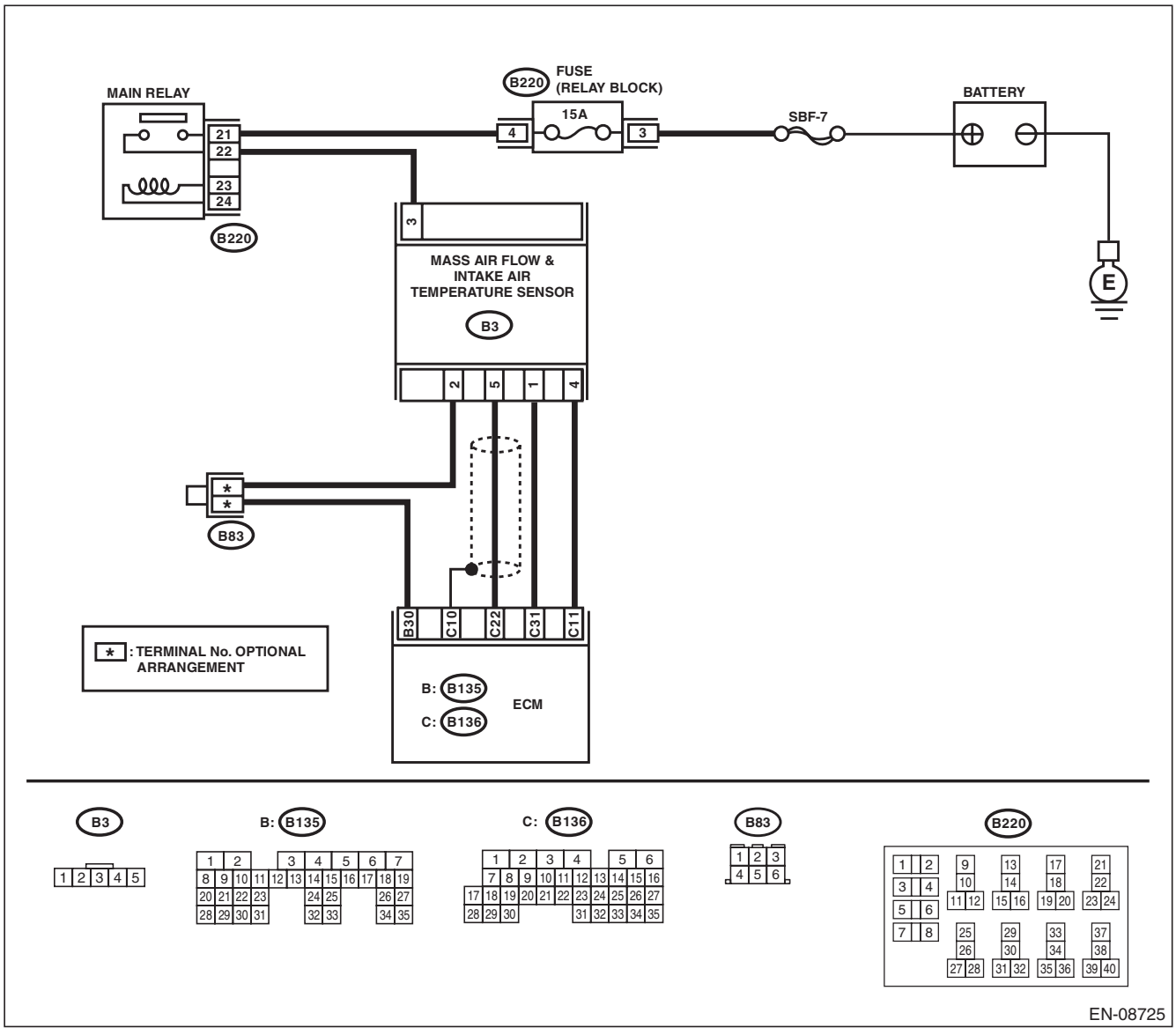
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08725

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Intake Air Temp.» 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*** ***(B136) No. 31 — (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*** ***(B136) No. 31 (+) — 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(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>

W: DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-48, DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Disconnect the connectors from the engine coolant temperature sensor. 2) 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(STI)-34, Engine Coolant Temperature Sensor.> <Ref. to FU(w/o STI)-34, Engine Coolant Temperature Sensor.>

X: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-50, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

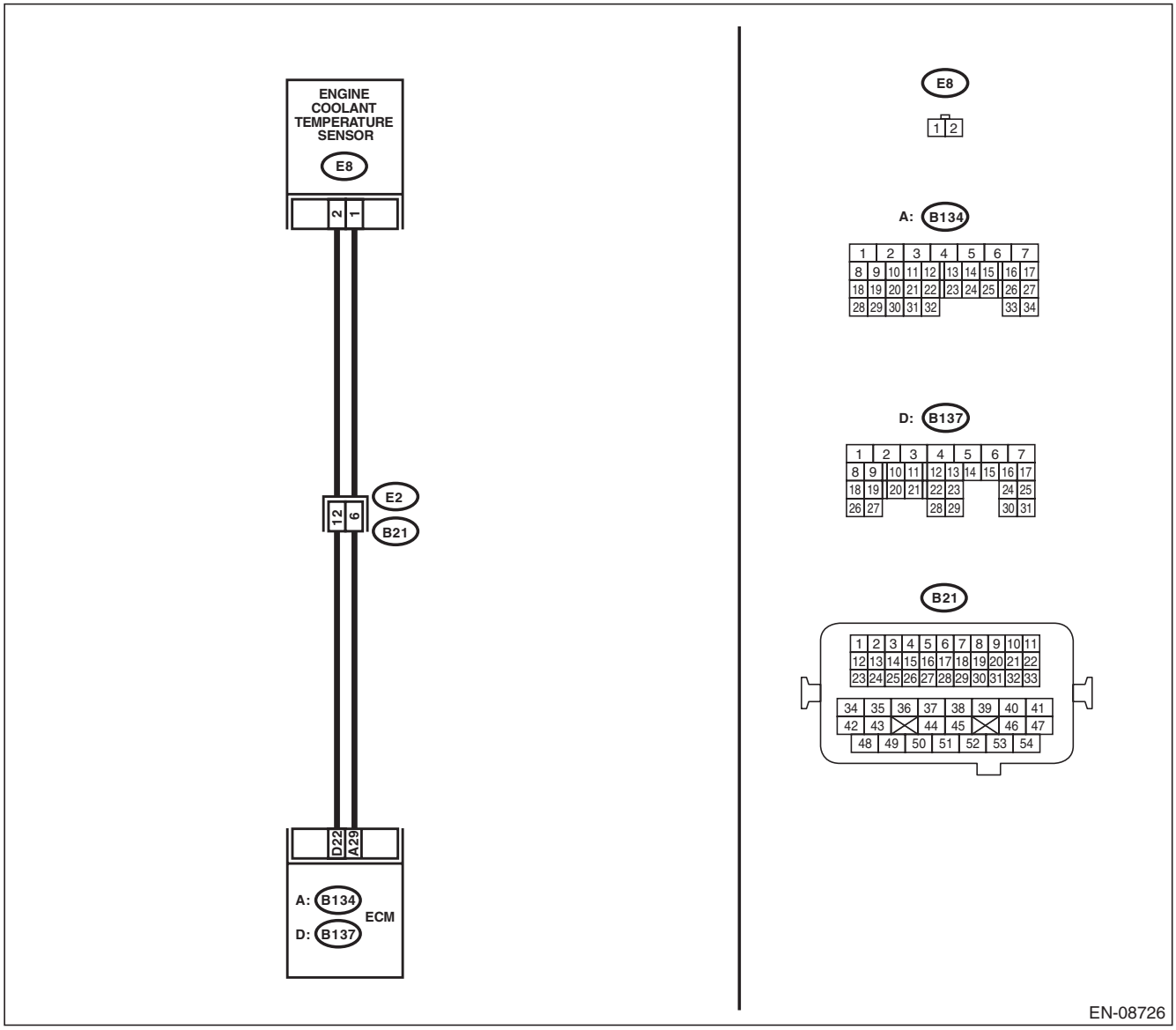
TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 150°C (302°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 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*** ***(B137) No. 22 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the engine coolant temperature sensor. <Ref. to FU(STI)-34, Engine Coolant Temperature Sensor.> <Ref. to FU(w/o STI)-34, Engine Coolant Temperature Sensor.>	Repair short circuit in harness to ground between ECM and engine coolant temperature sensor connector.

Y: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-52, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

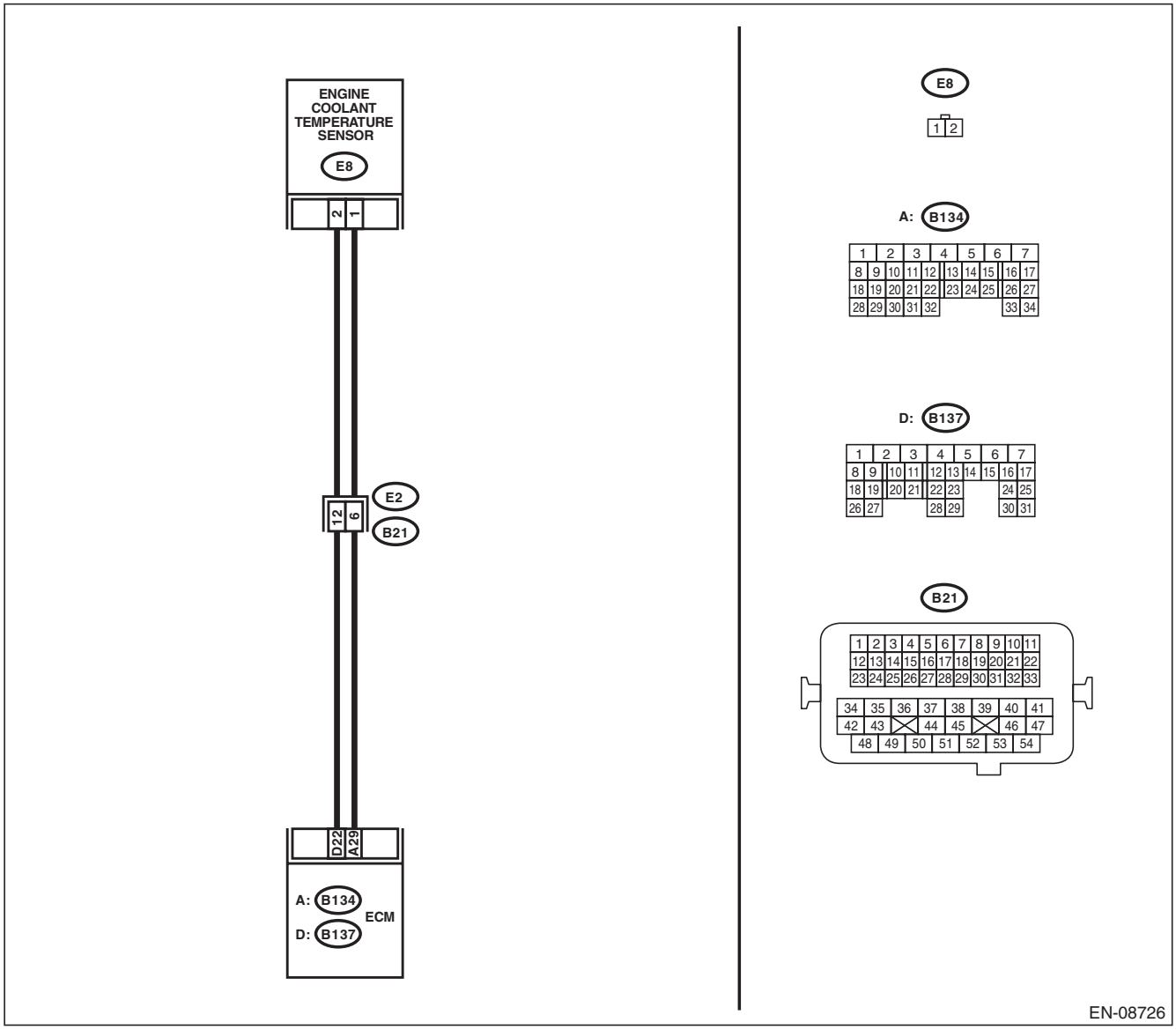
TROUBLE SYMPTOM:

- Hard to start
- Improper idling
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 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*** ***(B137) No. 22 — (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*** ***(B137) No. 22 (+) — 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(STI)-34, Engine Coolant Temperature Sensor.> <Ref. to FU(w/o STI)-34, Engine Coolant Temperature Sensor.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-54, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

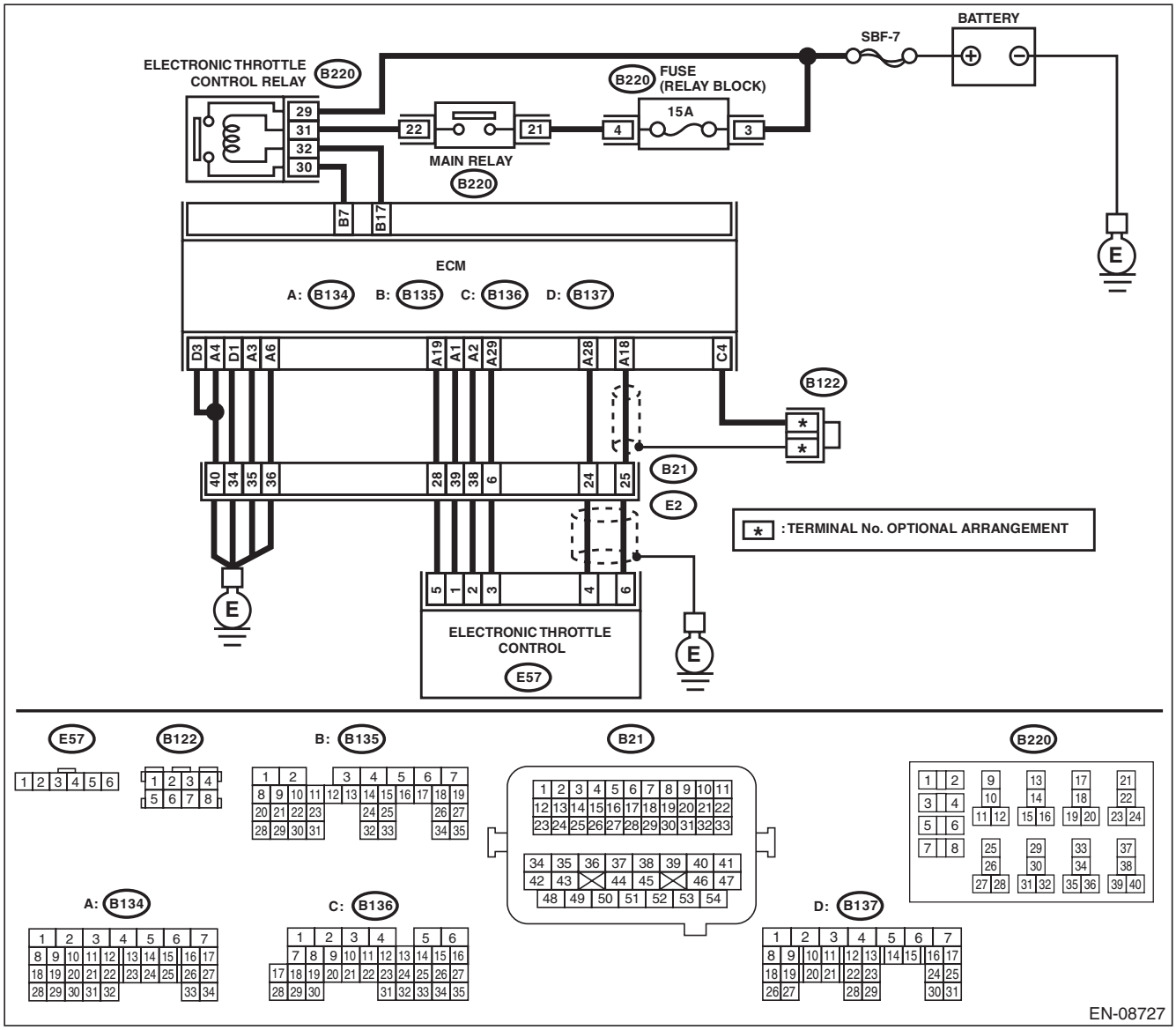
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

• Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>

• Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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. 4:***	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:***	Is the resistance 1 MΩ or more?	Replace the electronic throttle control. <Ref. to FU(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, 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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>

AA:DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-56, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

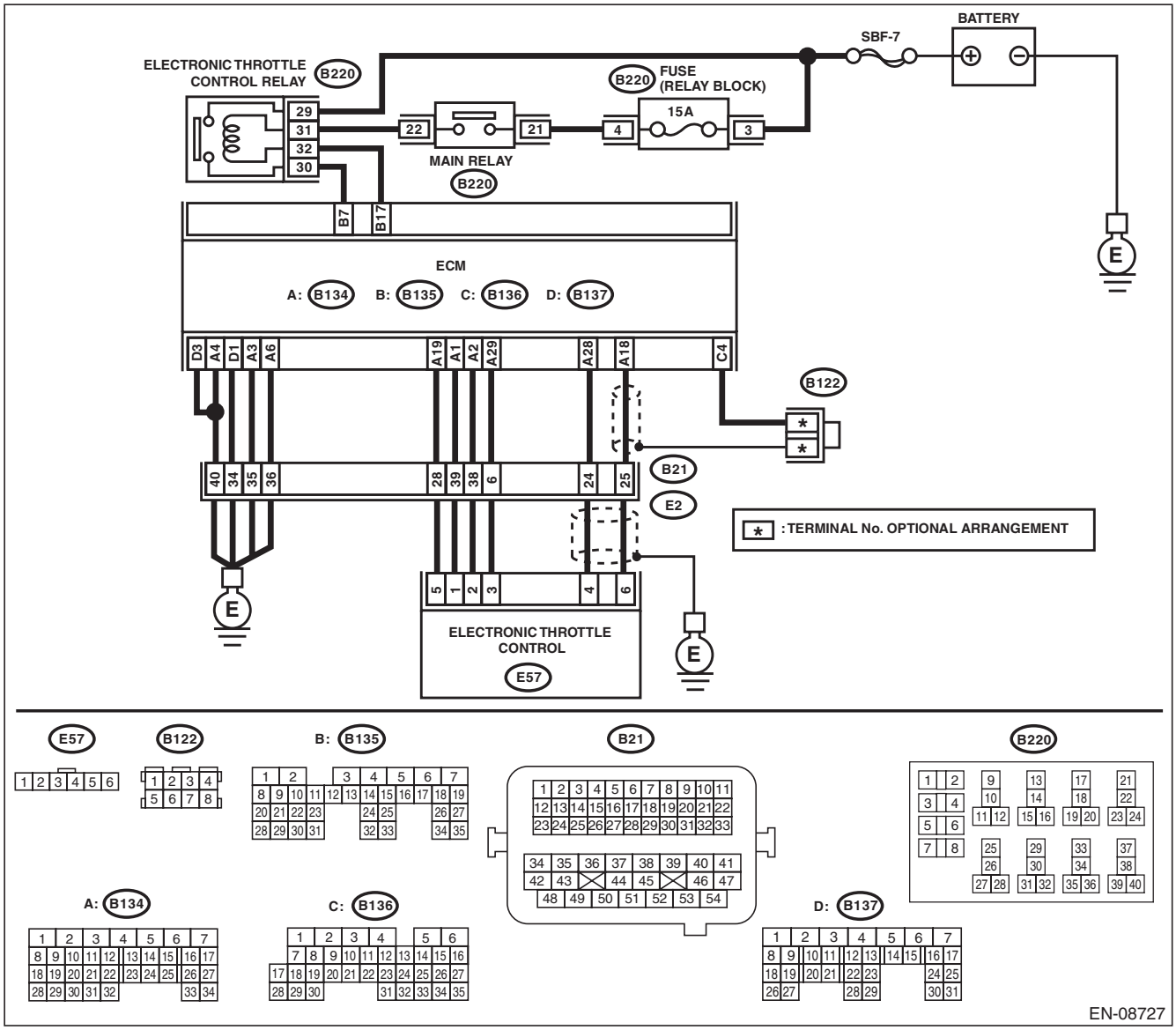
TROUBLE SYMPTOM:

- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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 connector 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(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>	Repair the short circuit to power in harness between ECM and electronic throttle control connector.

AB: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(H4DOTC)-58, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(STI)-13, Engine Coolant.> <Ref. to CO(w/o STI)-13, Engine Coolant.>
3	**CHECK THERMOSTAT.**	Does the thermostat remain opened?	Replace the thermostat. <Ref. to CO(STI)-17, Thermostat.> <Ref. to CO(w/o STI)-17, Thermostat.>	Replace the engine coolant temperature sensor. <Ref. to FU(STI)-34, Engine Coolant Temperature Sensor.> <Ref. to FU(w/o STI)-34, Engine Coolant Temperature Sensor.>

AC: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(H4DOTC)-60, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK ENGINE COOLANT.**	Is the engine coolant amount normal?	Go to step **3**.	Refill the engine coolant. <Ref. to CO(STI)-13, Engine Coolant.> <Ref. to CO(w/o STI)-13, Engine Coolant.>
3	**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(STI)-23, Radiator Main Fan and Fan Motor.> <Ref. to CO(w/o STI)-23, Radiator Main Fan and Fan Motor.> <Ref. to CO(STI)-25, Radiator Sub Fan and Fan Motor.> <Ref. to CO(w/o STI)-25, Radiator Sub Fan and Fan Motor.>	Replace the thermostat. <Ref. to CO(STI)-17, Thermostat.> <Ref. to CO(w/o STI)-17, Thermostat.>

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

DTC DETECTING CONDITION:

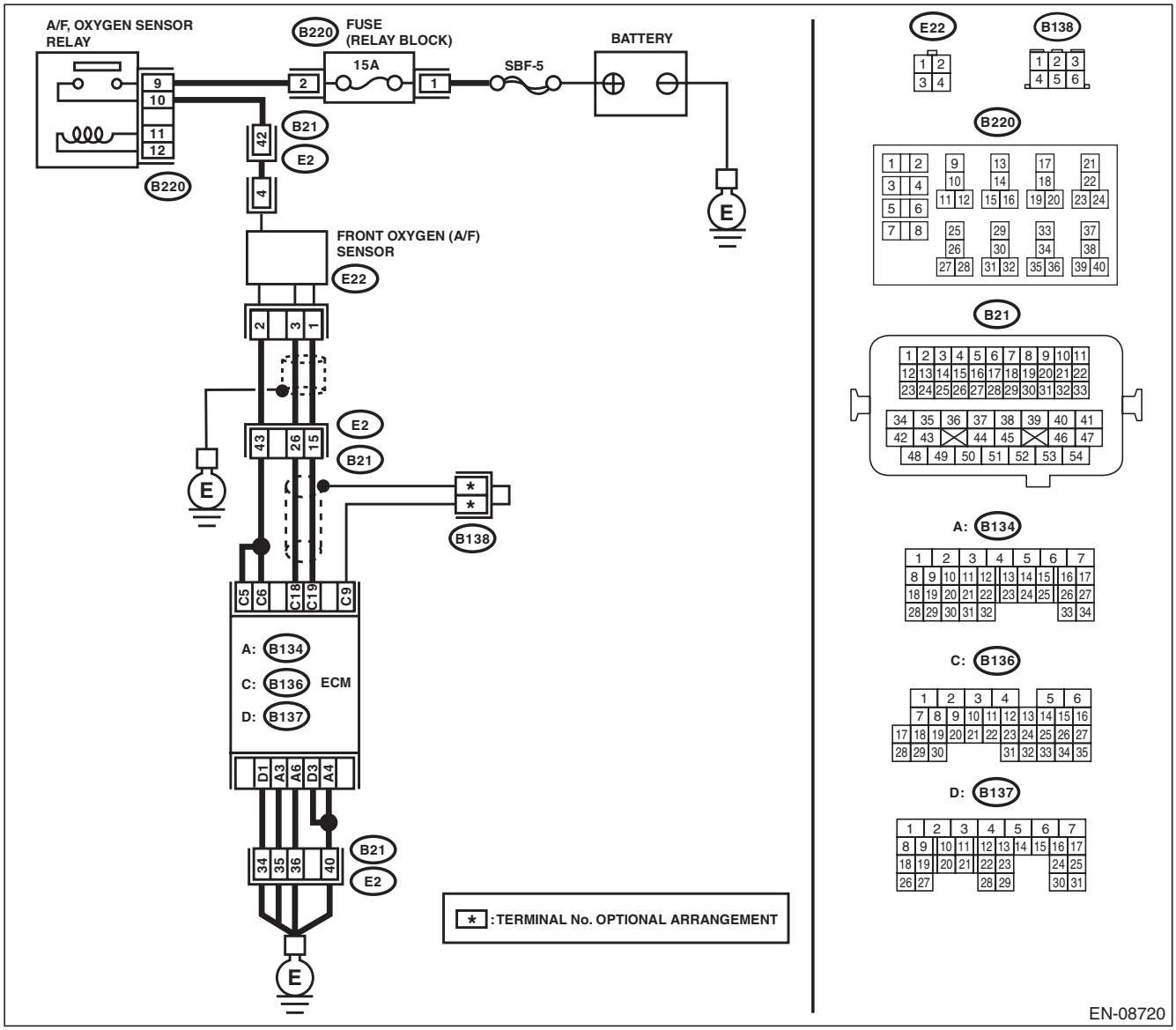
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-64, DTC P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

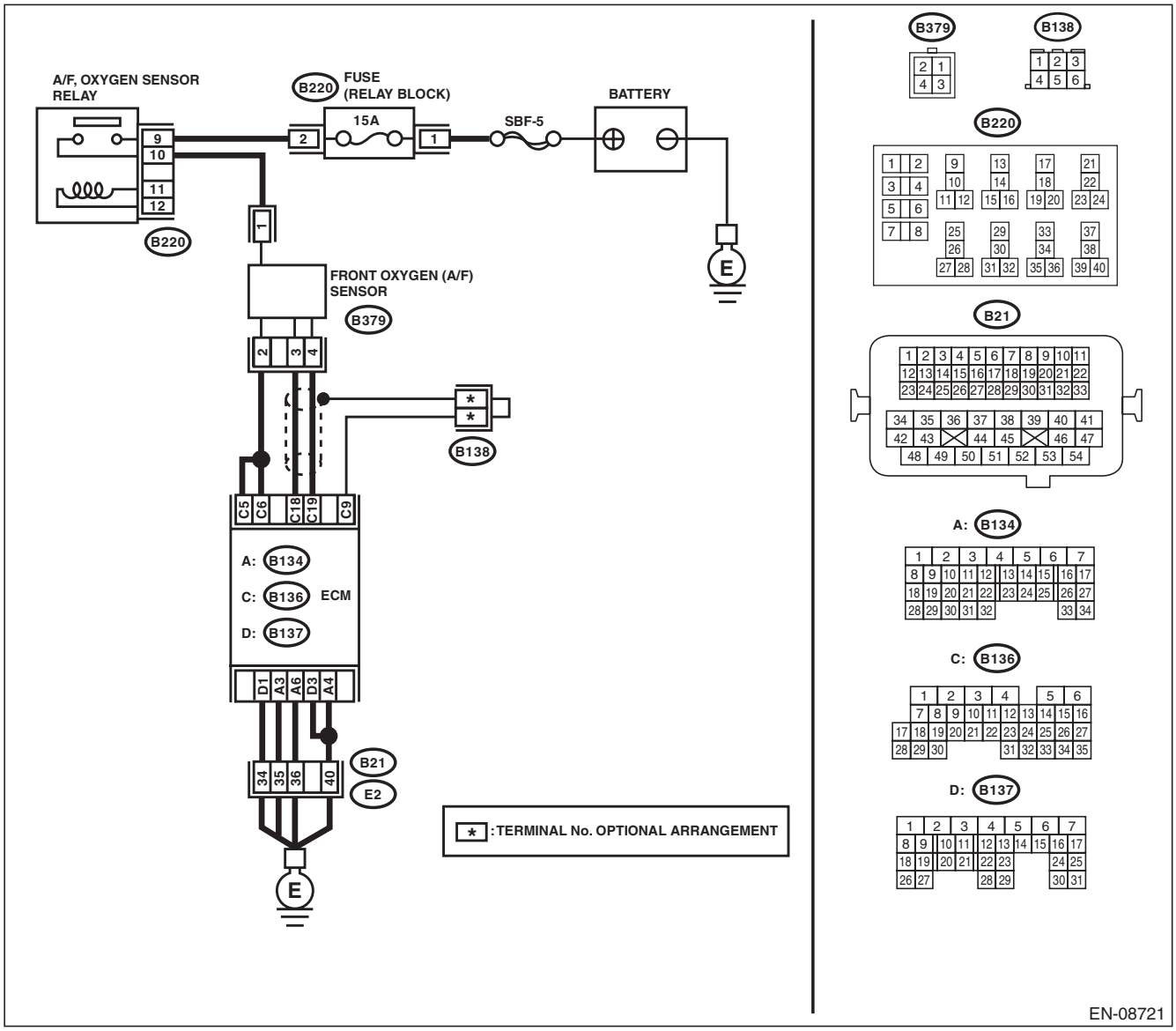
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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**.
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*** ***(B136) No. 19 — Chassis ground:*** ***(B136) No. 18 — 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.

	Step	Check	Yes	No
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(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>

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

DTC DETECTING CONDITION:

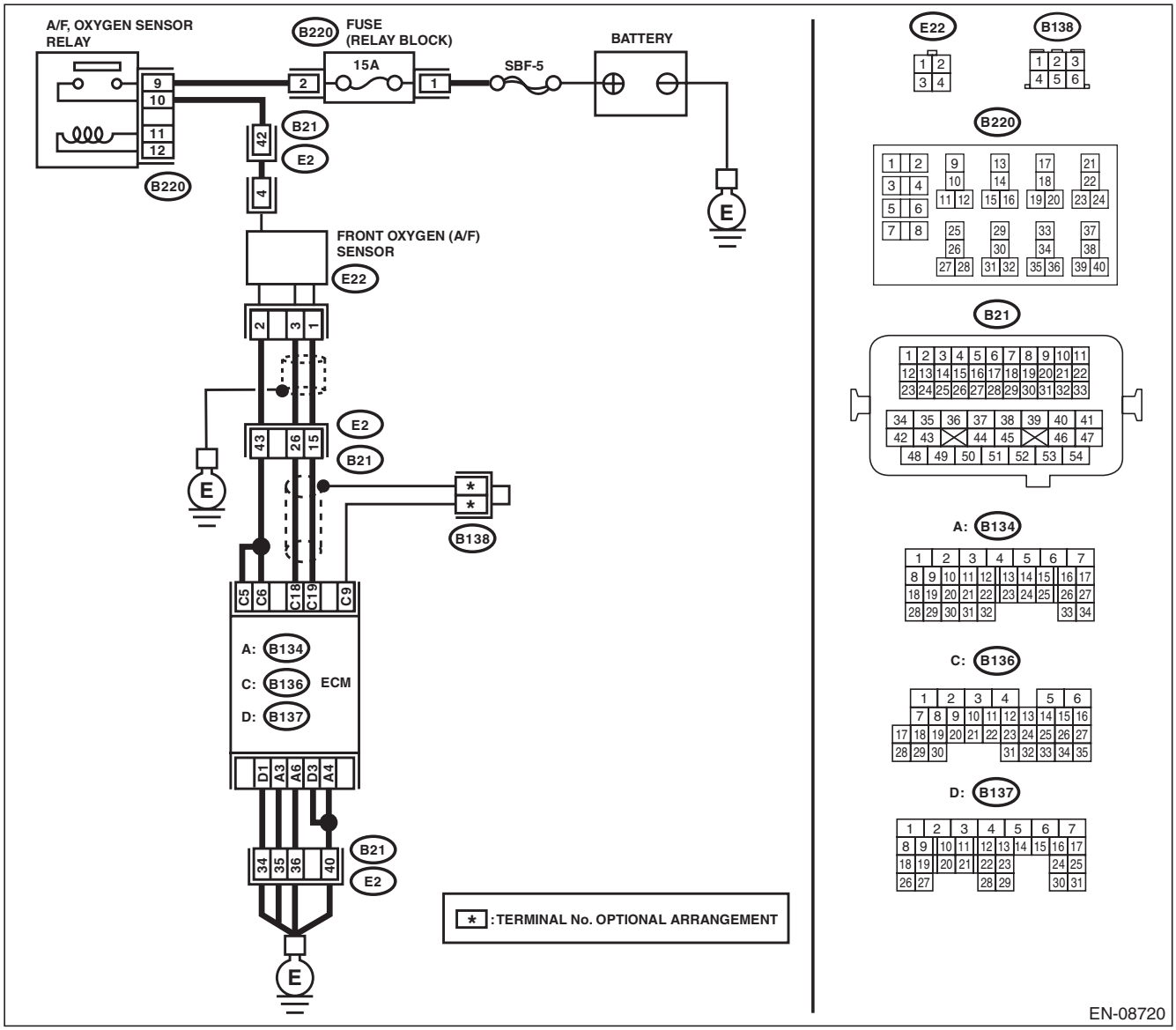
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-66, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

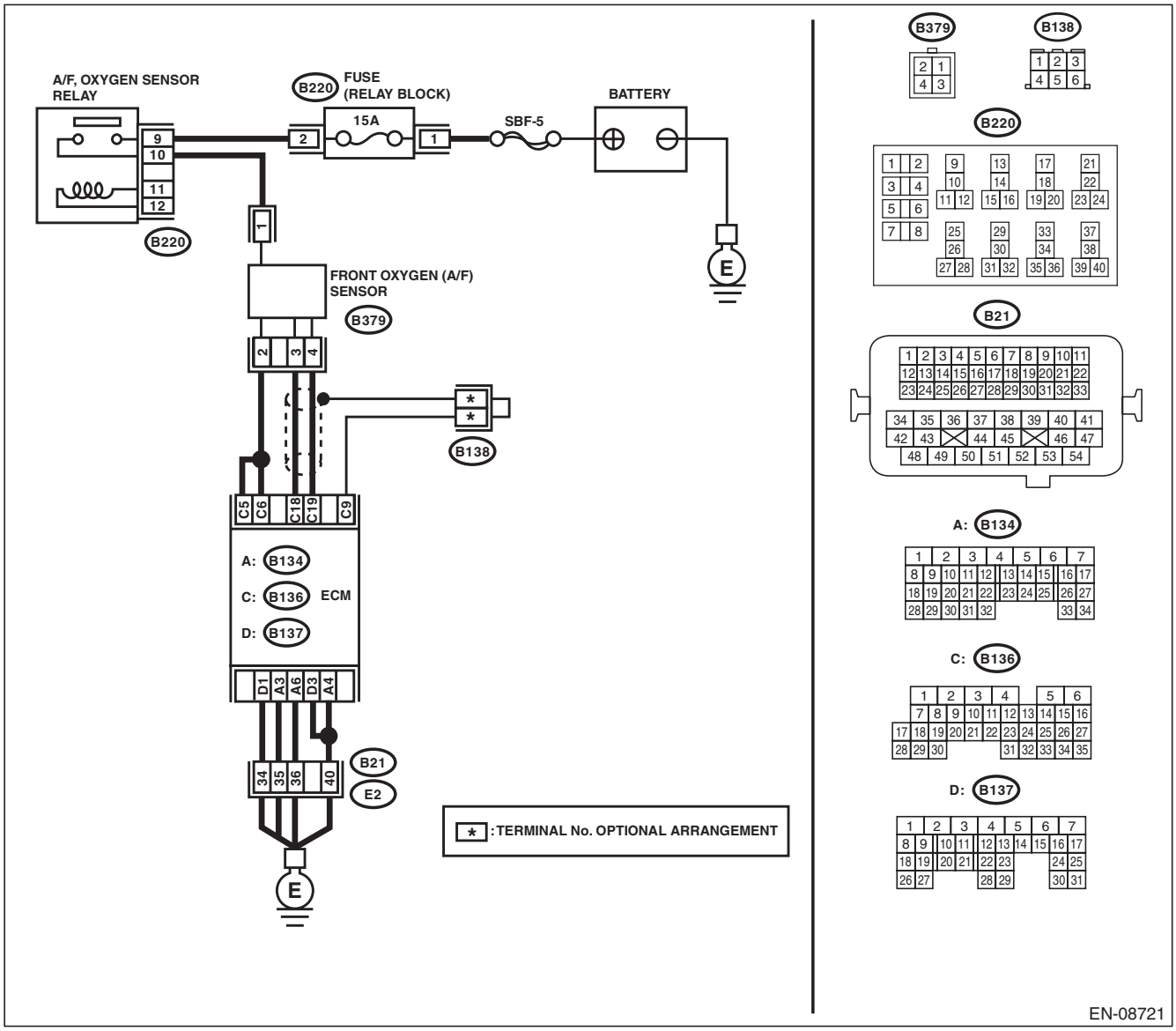
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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**.
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*** ***(B136) No. 19 (+) — Chassis ground (–):*** ***(B136) No. 18 (+) — 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(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>

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

DTC DETECTING CONDITION:

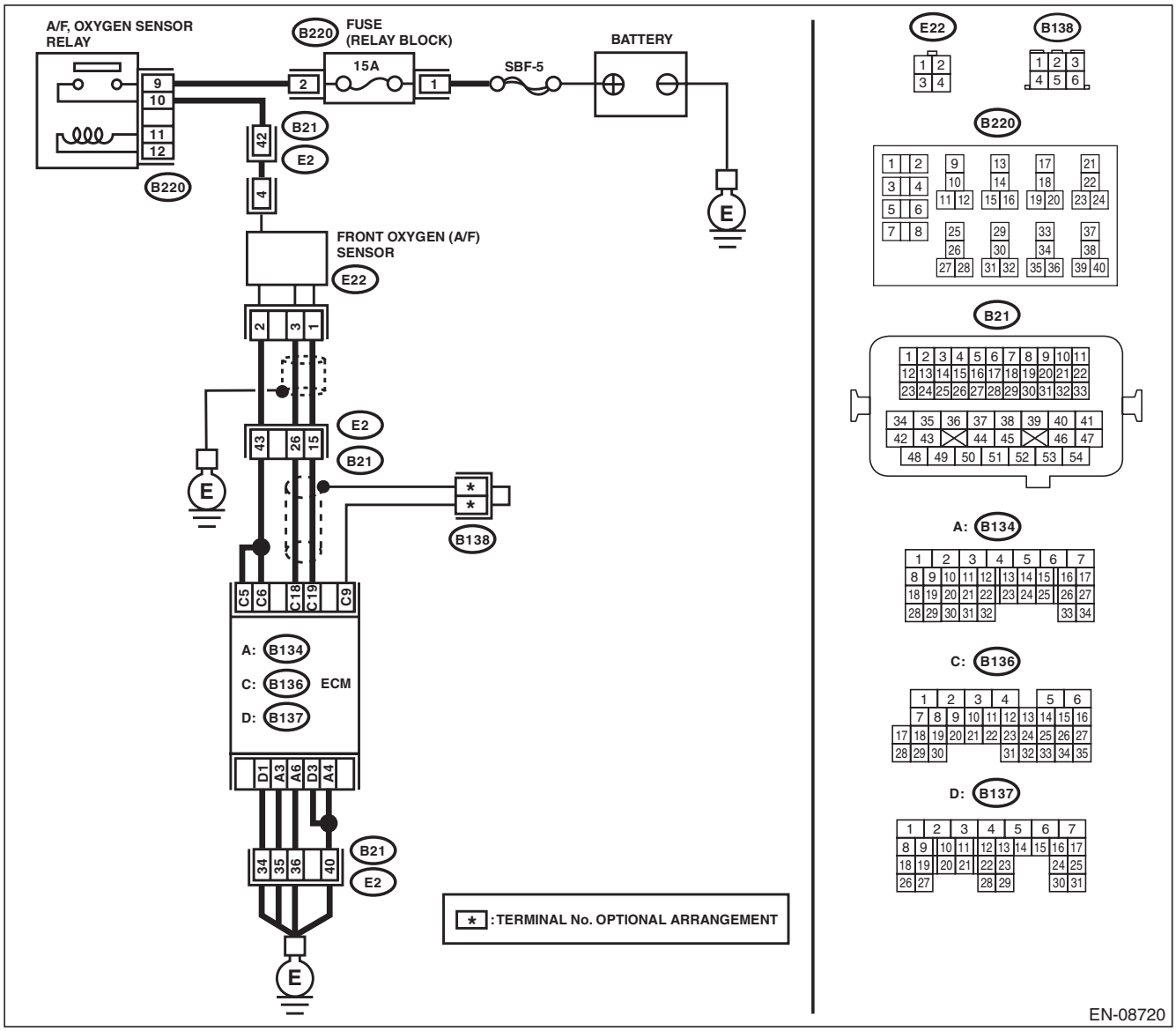
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-68, DTC P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

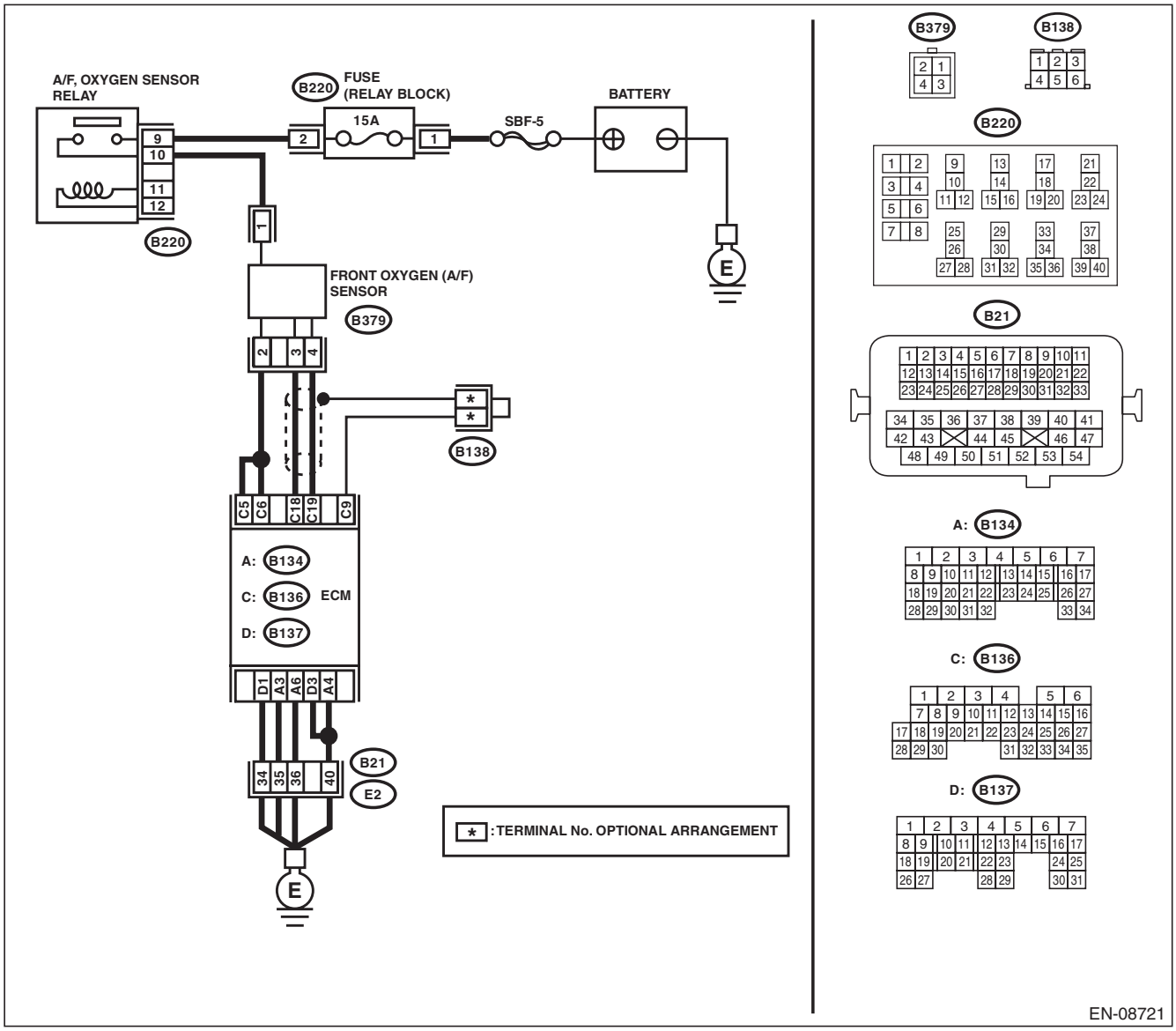
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***Models without SI-DRIVE*** ***(B136) No. 19 — (E22) No. 1:*** ***(B136) No. 18 — (E22) No. 3:*** ***Models with SI-DRIVE*** ***(B136) No. 19 — (B379) No. 4:*** ***(B136) No. 18 — (B379) No. 3:***	Is the resistance less than 1 Ω?	Go to step **2**.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor 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(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>

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

DTC DETECTING CONDITION:

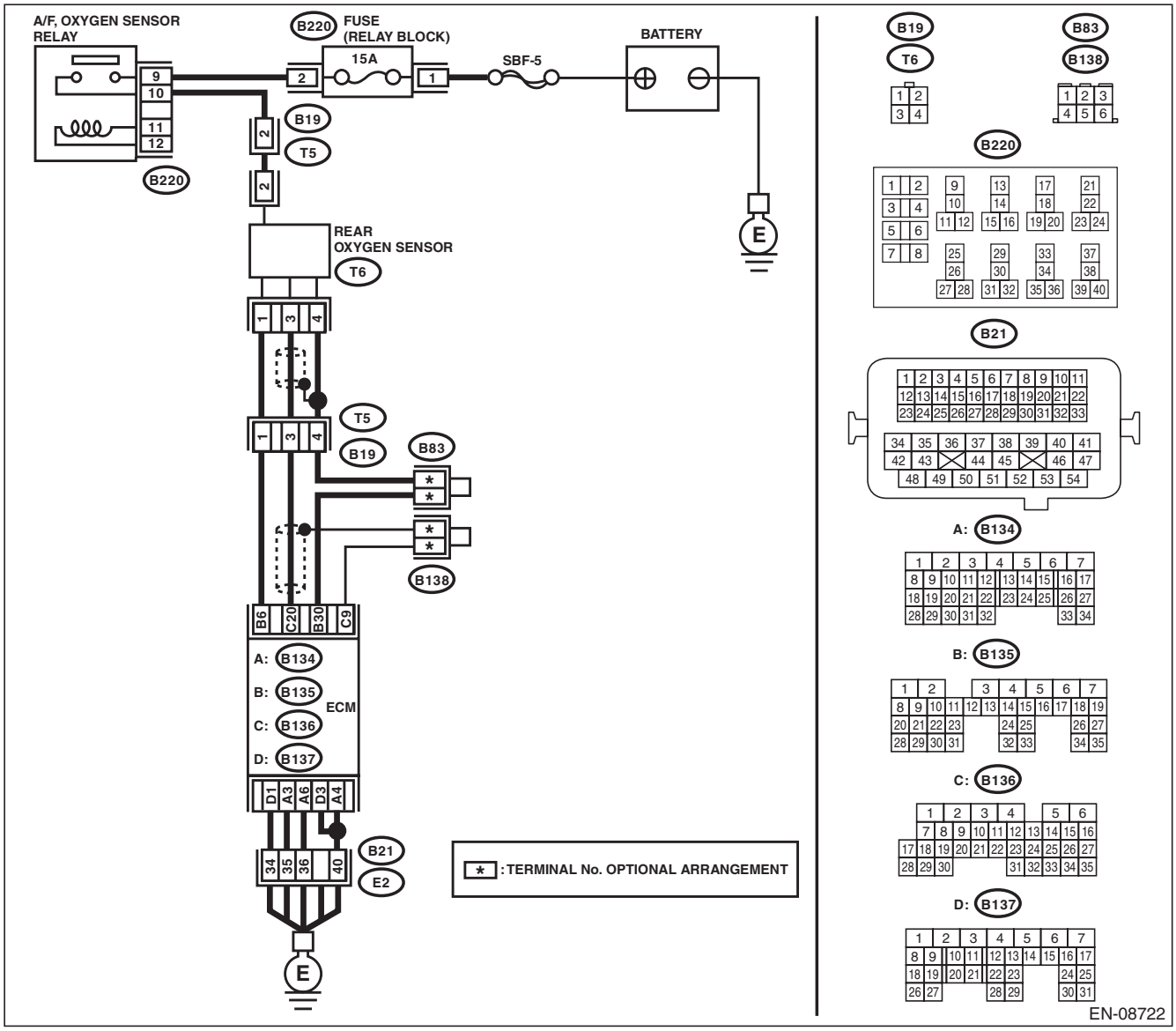
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-70, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

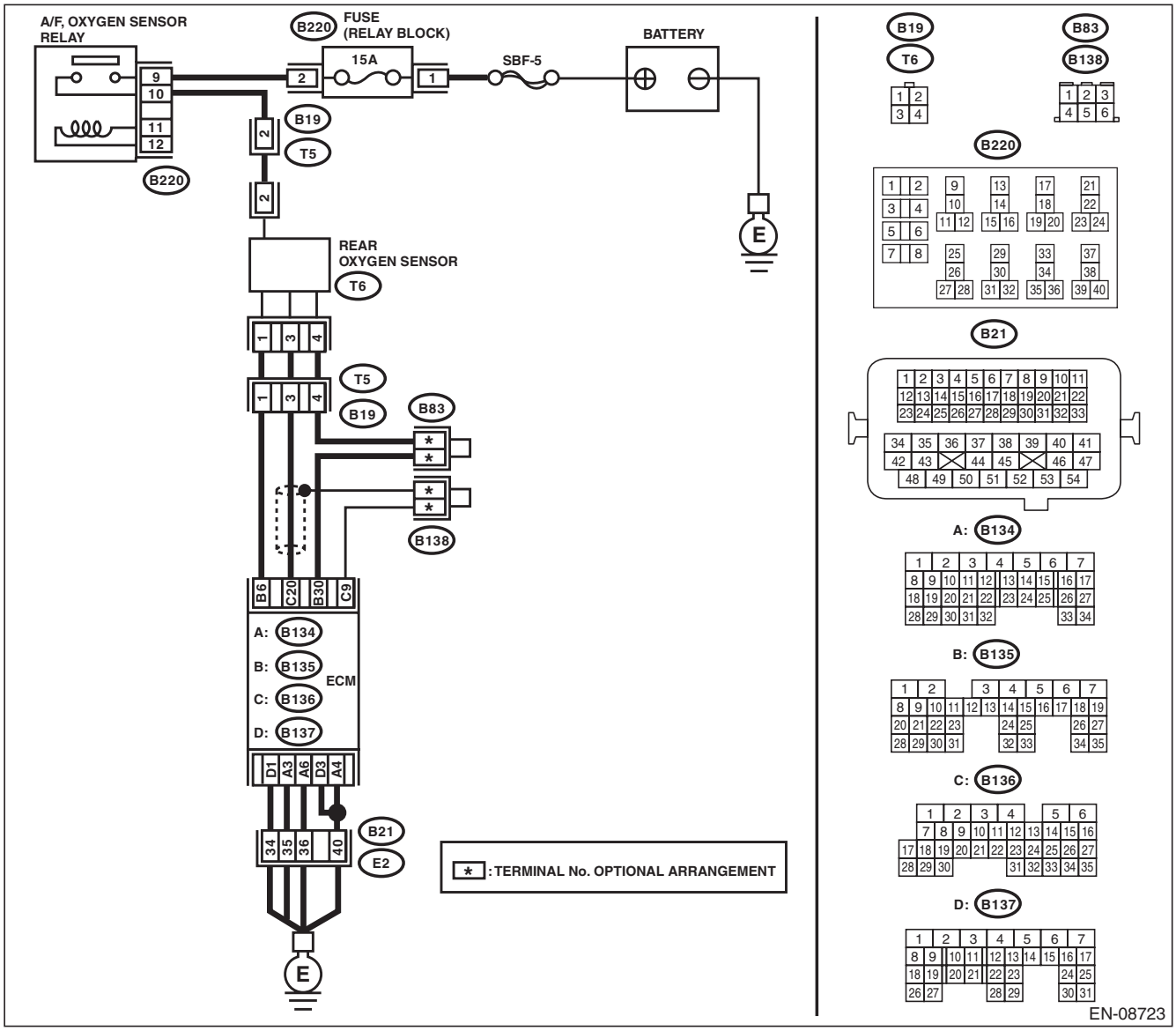
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.490 V 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*** ***(B136) No. 20 — (T6) No. 3:*** ***(B135) No. 30 — (T6) 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*** ***(T6) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, 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
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(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, Rear Oxygen Sensor.>

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

DTC DETECTING CONDITION:

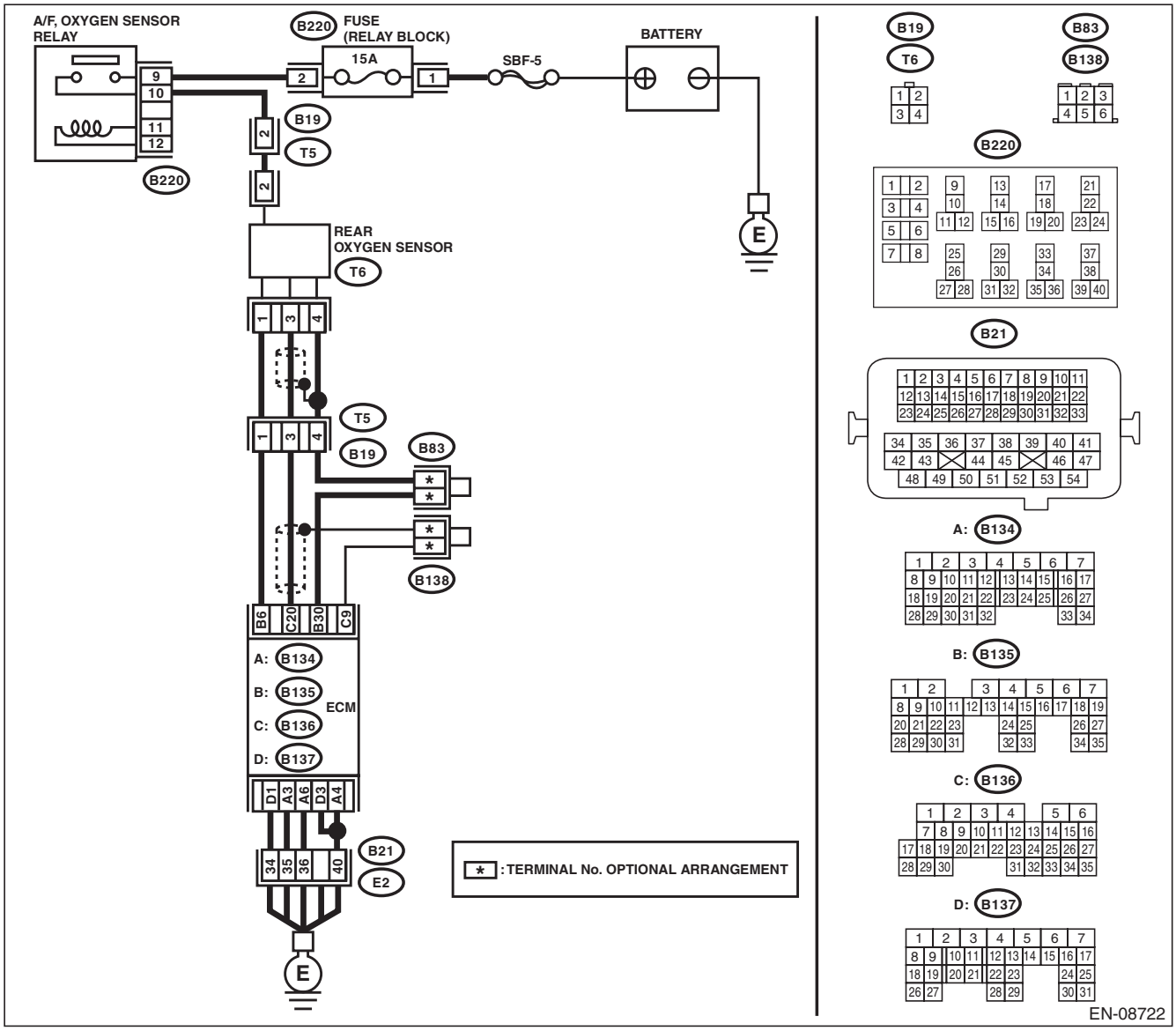
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-72, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

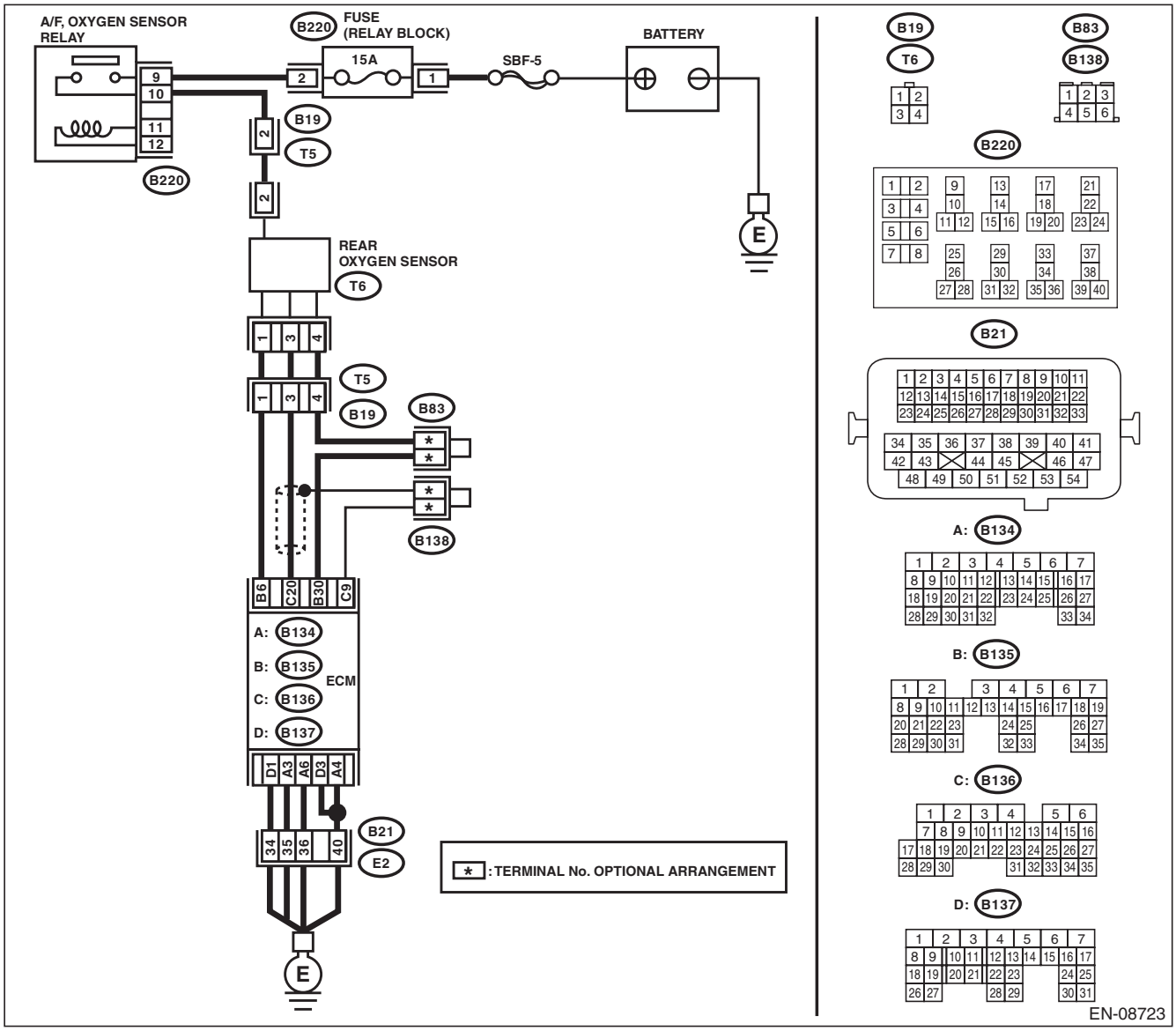
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.250 V 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*** ***(B136) No. 20 — (T6) No. 3:*** ***(B135) No. 30 — (T6) 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*** ***(T6) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, 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
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(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, Rear Oxygen Sensor.>

AI: DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

DTC DETECTING CONDITION:

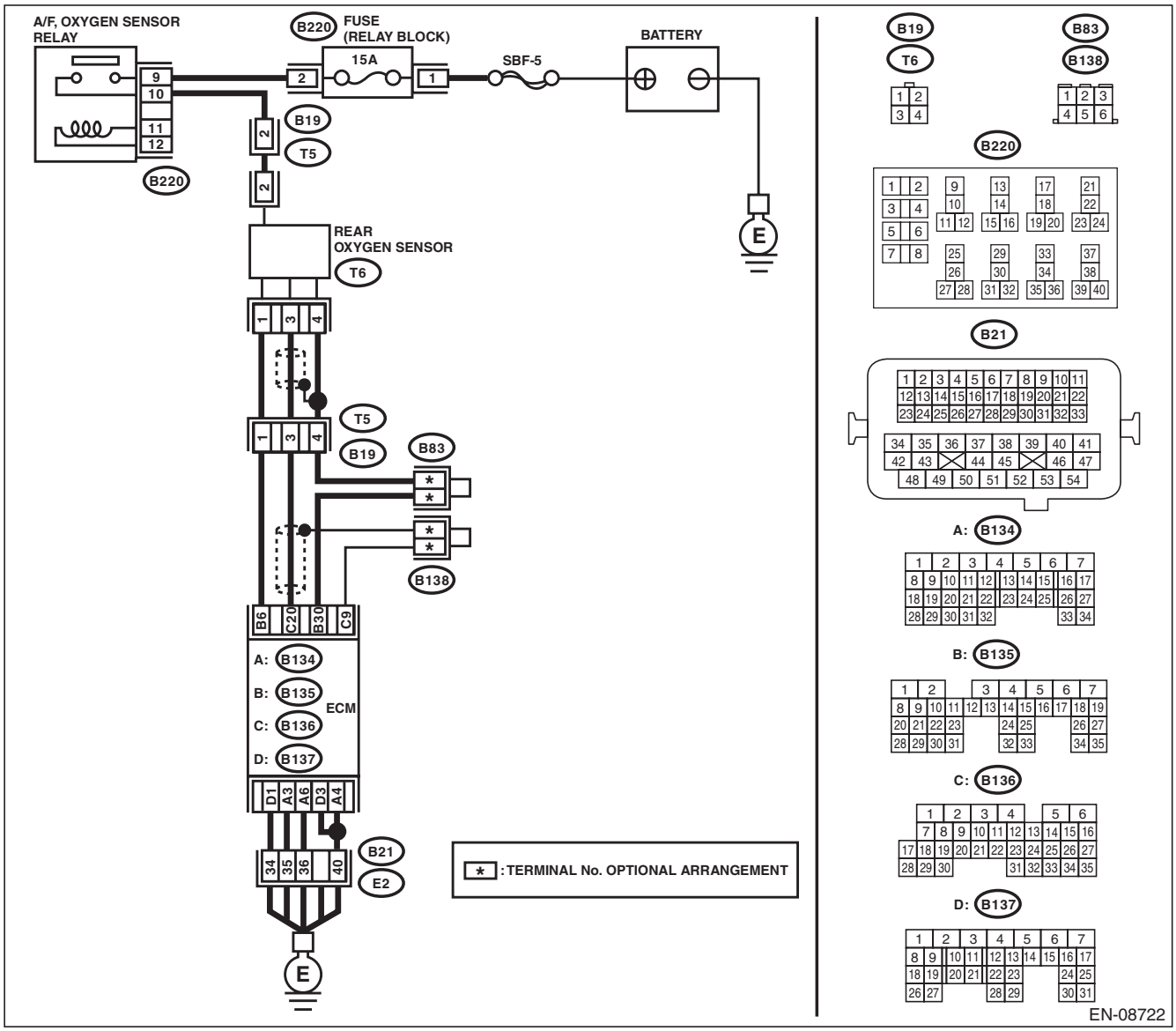
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-73, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

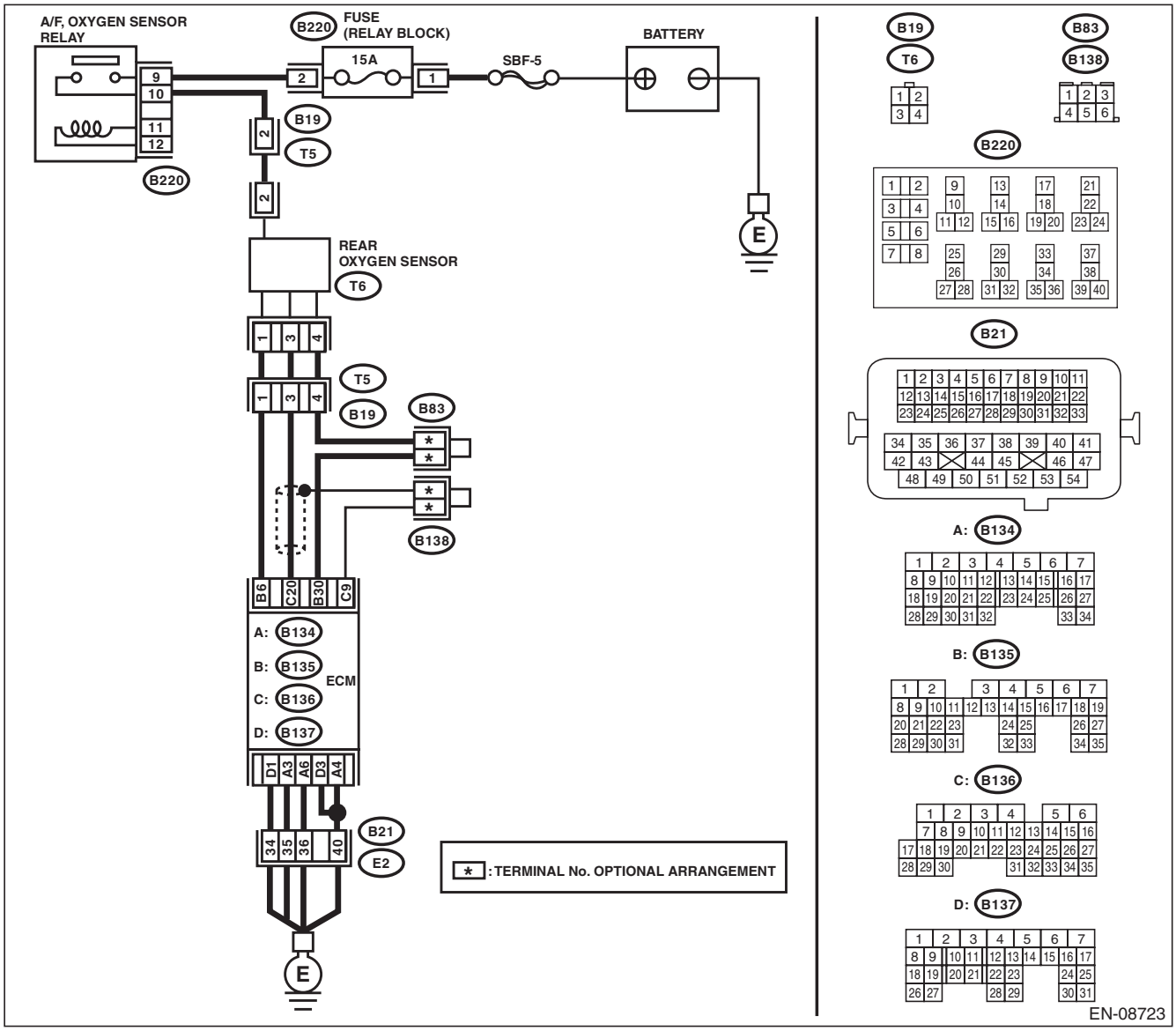
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***(B136) No. 20 — (T6) 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*** ***(T6) 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(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, 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.

AJ:DTC P013B O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

NOTE:
For the diagnostic procedure, refer to DTC P013A. <Ref. to EN(H4DOTC)(diag)-164, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AK:DTC P013E O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

NOTE:
For the diagnostic procedure, refer to DTC P013A. <Ref. to EN(H4DOTC)(diag)-164, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AL:DTC P013F O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

NOTE:
For the diagnostic procedure, refer to DTC P013A. <Ref. to EN(H4DOTC)(diag)-164, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

DTC DETECTING CONDITION:

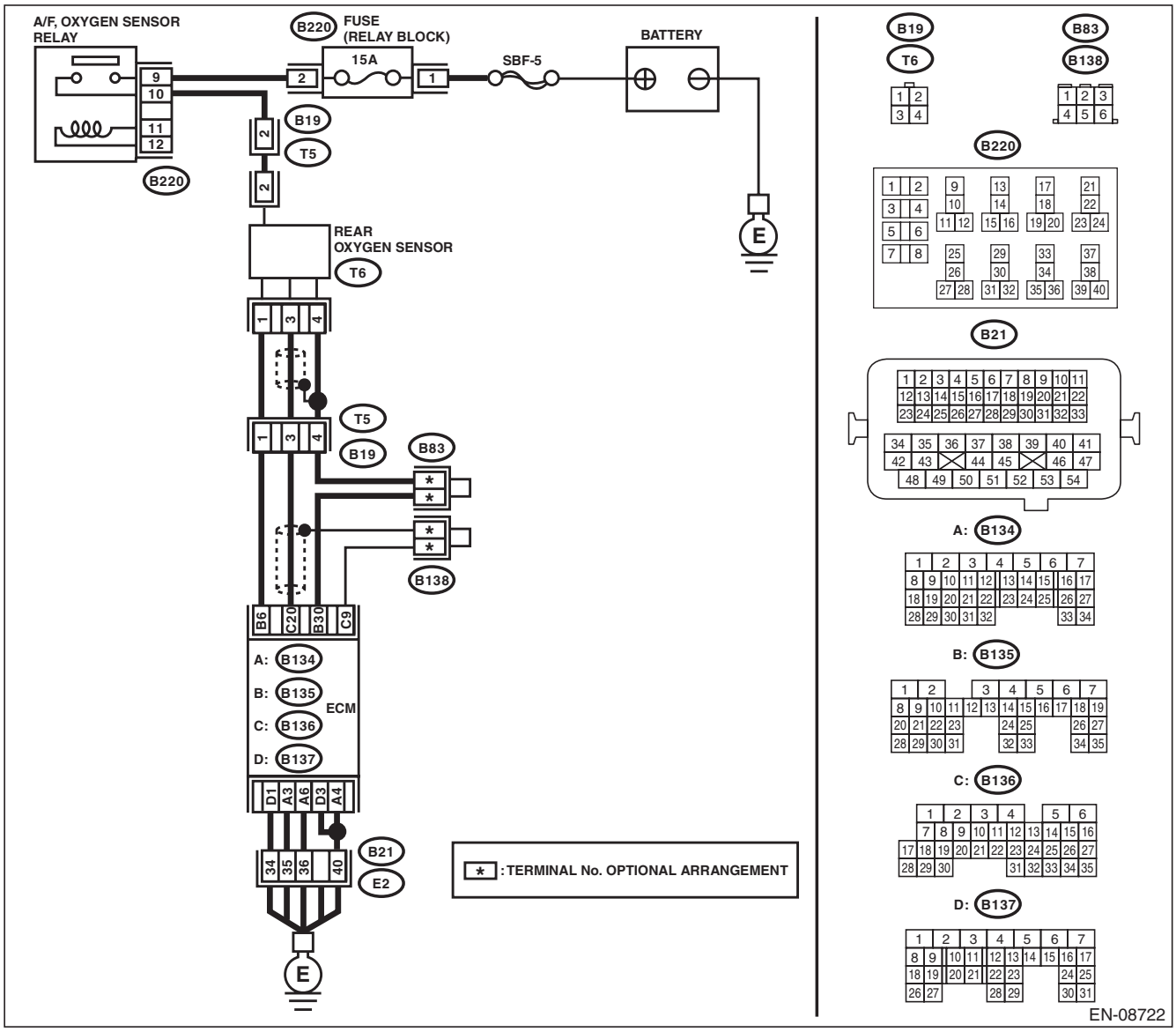
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-81, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

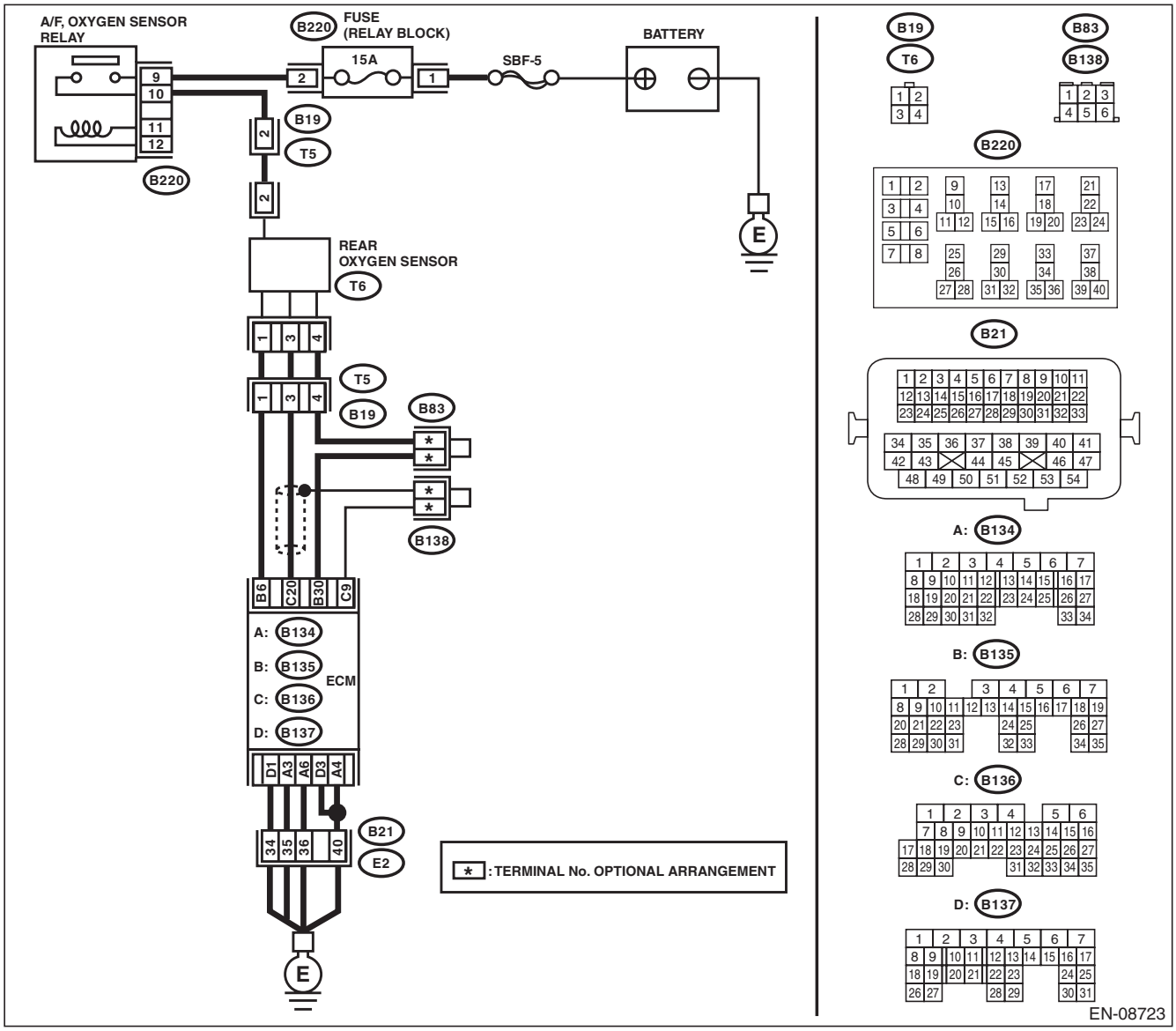
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.490 V or more?	Go to step **6**.	Go to step **2**.

	Step	Check	Yes	No
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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.250 V 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*** ***(B136) No. 20 — (T6) No. 3:*** ***(B135) No. 30 — (T6) 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
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*** ***(T6) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, 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
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(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, Rear Oxygen Sensor.>

AN:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)

For the diagnostic procedure, refer to DTC P0037. <Ref. to EN(H4DOTC)(diag)-114, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AO:DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-85, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	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(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>

AP:DTC P014D O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

NOTE:
For the diagnostic procedure, refer to DTC P014C. <Ref. to EN(H4DOTC)(diag)-170, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AQ:DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

NOTE:
For the diagnostic procedure, refer to DTC P014C. <Ref. to EN(H4DOTC)(diag)-170, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AR:DTC P015B O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

NOTE:
For the diagnostic procedure, refer to DTC P014C. <Ref. to EN(H4DOTC)(diag)-170, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AS:DTC P0171 SYSTEM TOO LEAN (BANK 1)

For the diagnostic procedure, refer to DTC P0172. <Ref. to EN(H4DOTC)(diag)-171, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AT:DTC P0172 SYSTEM TOO RICH (BANK 1)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-97, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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 while disconnecting pressure regulator vacuum hose from intake manifold. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: If fuel pressure does not increase, squeeze the fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value 284 — 314 kPa (2.9 — 3.2 kg/cm^2, 41 — 46 psi)?	Go to step **4**.	Repair the following item. Fuel pressure is too high: • Clogged fuel return line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel supply line
4	**CHECK FUEL PRESSURE.** After connecting the pressure regulator vacuum hose, measure fuel pressure. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: • If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. • If the measured value at this step is out of specification, check or replace pressure regulator and pressure regulator vacuum hose.	Is the measured value 230 — 260 kPa (2.35 — 2.65 kg/cm^2, 33 — 38 psi)?	Go to step **5**.	Repair the following item. Fuel pressure is too high: • Faulty pressure regulator • Clogged fuel return line or bent hose Fuel pressure is too low: • Faulty pressure regulator • Improper fuel pump discharge • Clogged fuel supply line

	Step	Check	Yes	No
5	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **6**.	Replace the engine coolant temperature sensor. <Ref. to FU(STI)-34, Engine Coolant Temperature Sensor.> <Ref. to FU(w/o STI)-34, Engine Coolant 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) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **7**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air 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) Place the shift lever in 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 value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». 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(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>

AU:DTC P0201 INJECTOR #1

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-99, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

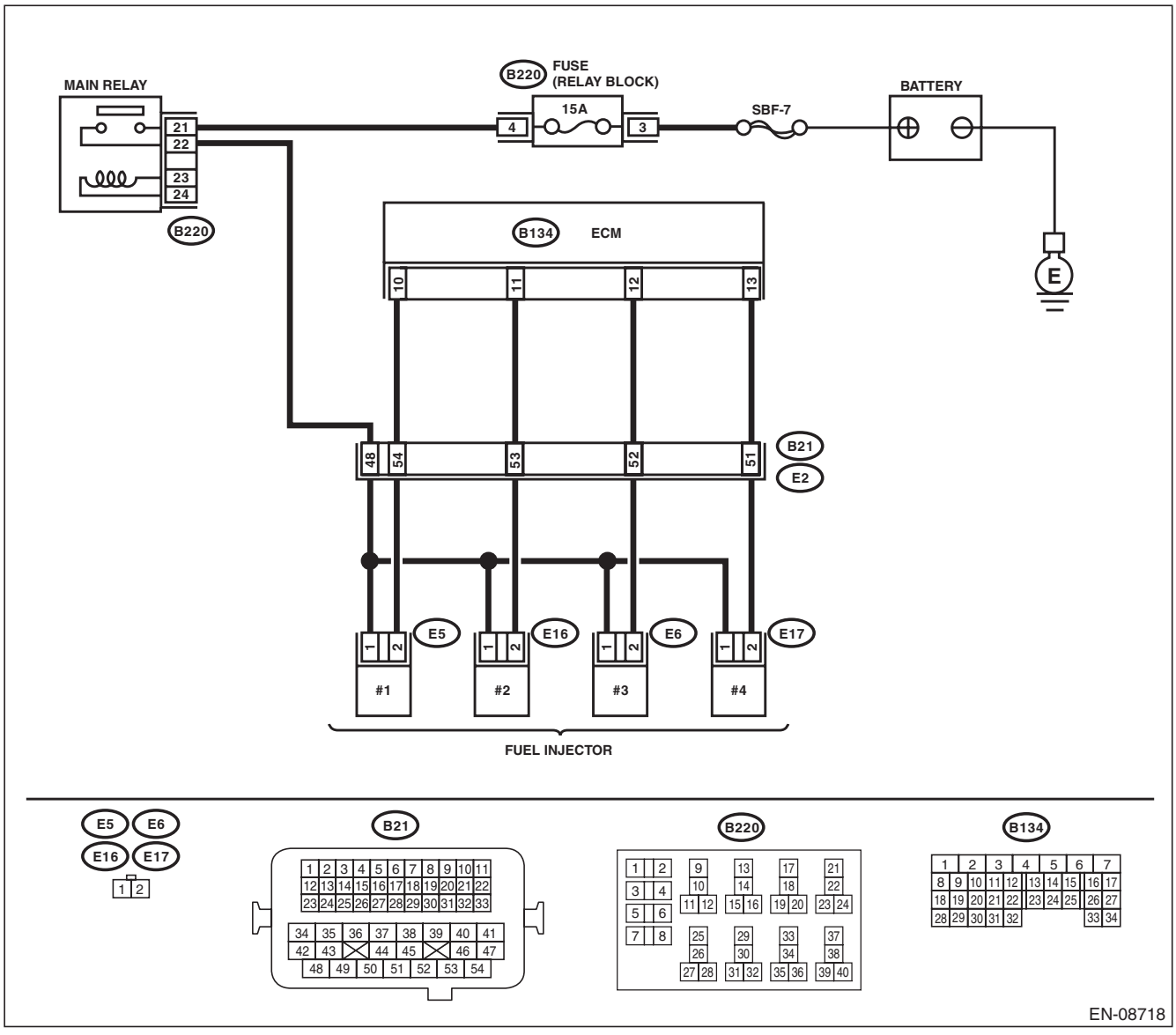
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO 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 voltage between fuel injector connector and the engine ground. ***Connector & terminal*** ***DTC P0201; (E5) No. 1 (+) — Engine ground (–):*** ***DTC P0202; (E16) No. 1 (+) — Engine ground (–):*** ***DTC P0203; (E6) No. 1 (+) — Engine ground (–):*** ***DTC P0204; (E17) No. 1 (+) — 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 main relay and fuel injector connector • Poor contact of main relay connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between fuel injector connector and engine ground. ***Connector & terminal*** ***DTC P0201; (E5) No. 2 — Engine ground:*** ***DTC P0202; (E16) No. 2 — Engine ground:*** ***DTC P0203; (E6) No. 2 — Engine ground:*** ***DTC P0204; (E17) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM connector and fuel injector connector.
3	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** Measure the resistance of harness between ECM connector and fuel injector connector. ***Connector & terminal*** ***DTC P0201; (B134) No. 10 — (E5) No. 2:*** ***DTC P0202; (B134) No. 11 — (E16) No. 2:*** ***DTC P0203; (B134) No. 12 — (E6) No. 2:*** ***DTC P0204; (B134) No. 13 — (E17) 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 connector and fuel injector connector • Poor contact of coupling connector
4	**CHECK FUEL INJECTOR.** Measure the resistance between fuel injector terminals on the corresponding cylinder. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **5**.	Replace the fuel injector. <Ref. to FU(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, Fuel Injector.>
5	**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 **6**.

	Step	Check	Yes	No
6	**CHECK FUEL INJECTOR OPERATION.** 1) Connect all connectors. 2) Start the engine. 3) Check if the corresponding fuel injector emits operating sound. NOTE: Use a sound scope to check the operating sound.	Does the fuel injector emit operating sound?	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 fuel injector connector.

AV:DTC P0202 INJECTOR #2

NOTE:
For the diagnostic procedure, refer to DTC P0201. <Ref. to EN(H4DOTC)(diag)-173, DTC P0201 INJECTOR #1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AW:DTC P0203 INJECTOR #3

NOTE:
For the diagnostic procedure, refer to DTC P0201. <Ref. to EN(H4DOTC)(diag)-173, DTC P0201 INJECTOR #1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AX:DTC P0204 INJECTOR #4

NOTE:
For the diagnostic procedure, refer to DTC P0201. <Ref. to EN(H4DOTC)(diag)-173, DTC P0201 INJECTOR #1, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-101, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

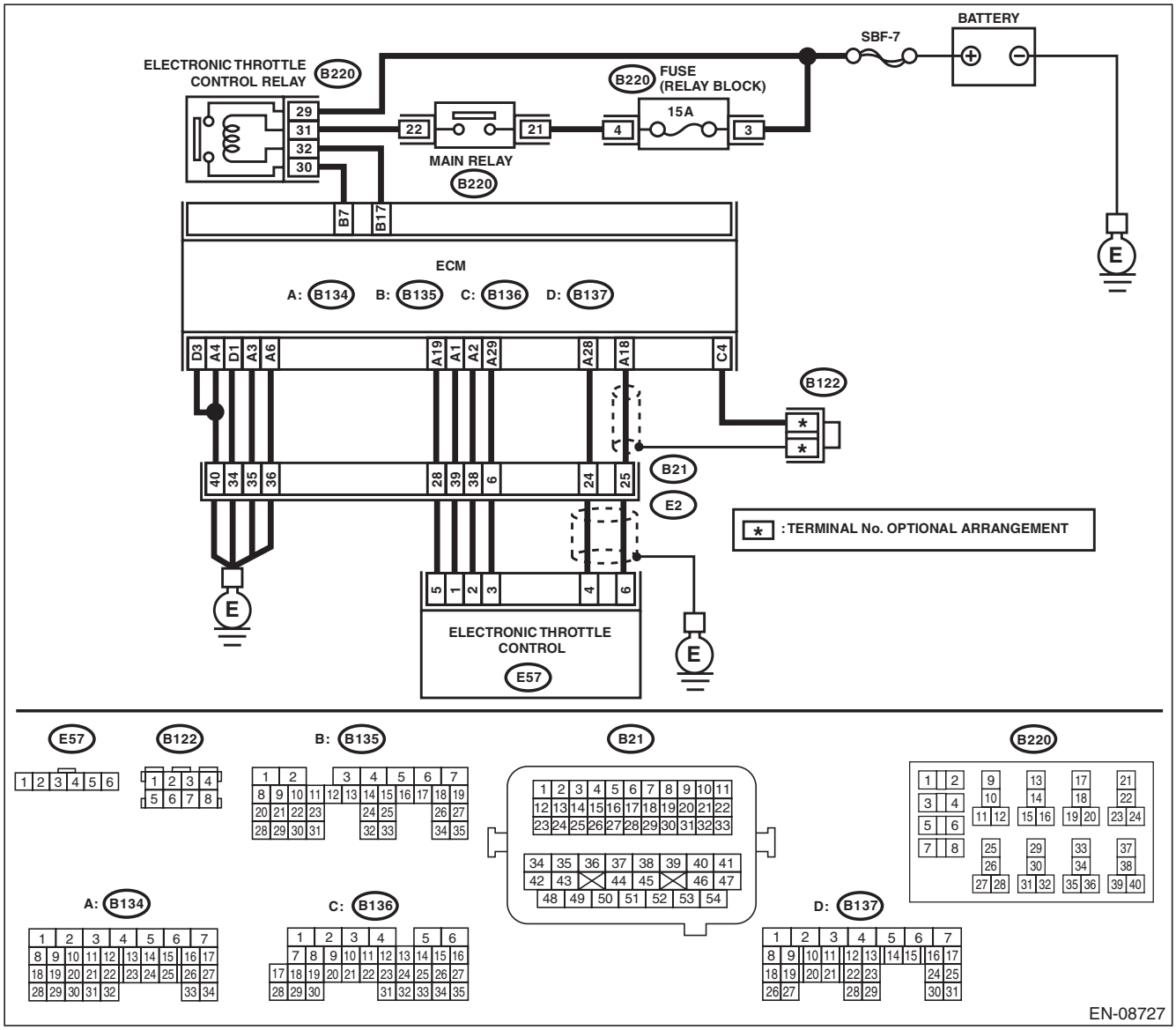
- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

• Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>

• Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, 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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-103, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

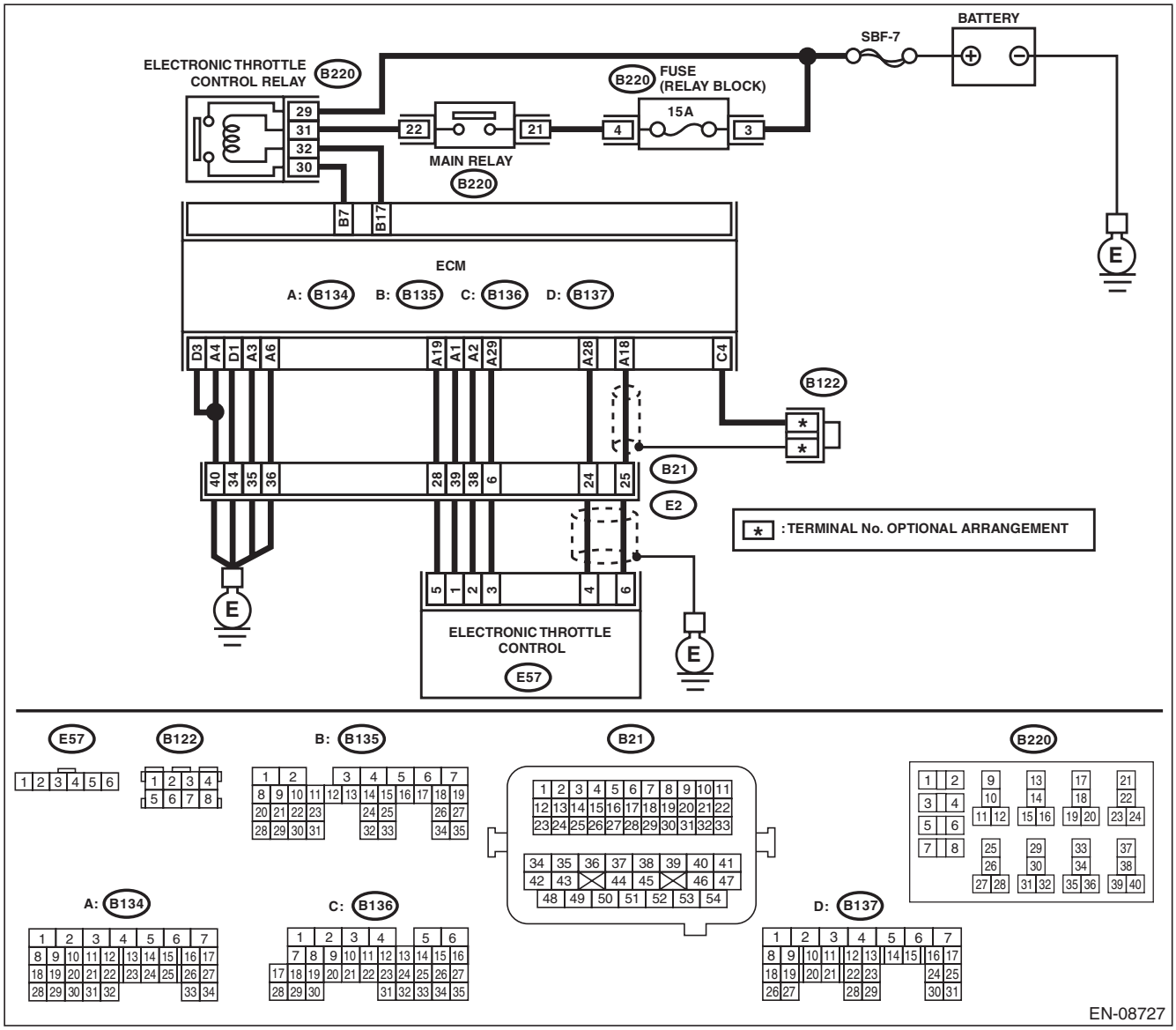
- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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 connector 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(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>	Repair the short circuit to power in harness between ECM and electronic throttle control connector.

BA:DTC P0230 FUEL PUMP PRIMARY CIRCUIT

DTC DETECTING CONDITION:

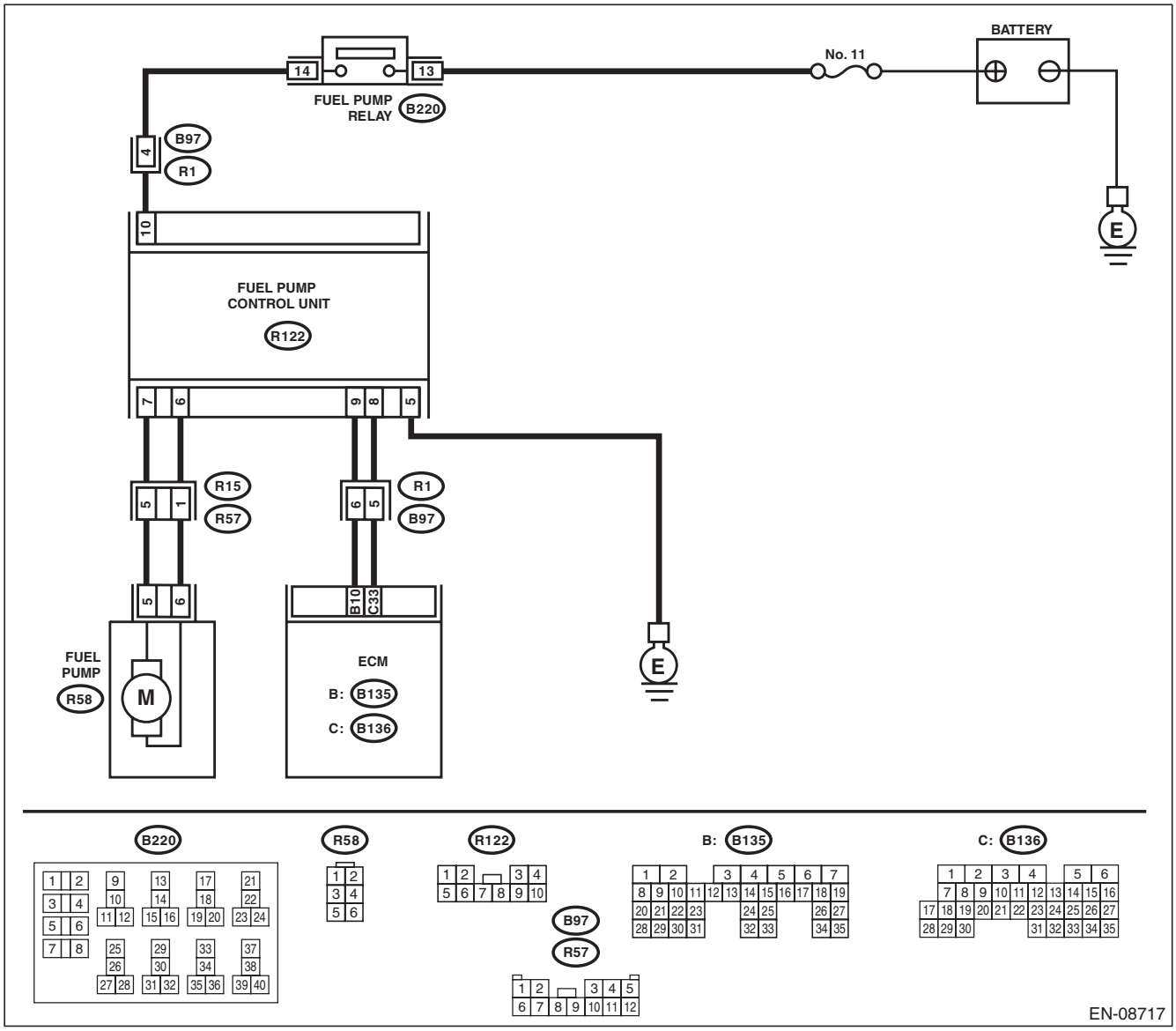
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-105, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY CIRCUIT TO FUEL PUMP CONTROL UNIT.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel pump control unit. 3) Turn the ignition switch to ON. 4) Measure the voltage between fuel pump control unit connector and chassis ground. ***Connector & terminal*** ***(R122) No. 10 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **2**.	Repair the power supply circuit. NOTE: In this case, repair the following item: • Open circuit or short circuit to ground in harness between fuel pump relay connector and fuel pump control unit connector • Poor contact of fuel pump relay connector • Poor contact of coupling connector
2	**CHECK GROUND CIRCUIT OF FUEL PUMP CONTROL UNIT.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between fuel pump control unit connector and chassis ground. ***Connector & terminal*** ***(R122) No. 5 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the open circuit in harness between fuel pump control unit connector and chassis ground.
3	**CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR.** 1) Disconnect the connector from fuel pump. 2) Measure the resistance of harness between fuel pump control unit and fuel pump connector. ***Connector & terminal*** ***(R122) No. 7 — (R58) No. 5:*** ***(R122) No. 6 — (R58) 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 fuel pump control unit connector and fuel pump connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR.** Measure the resistance between fuel pump control unit connector and chassis ground. ***Connector & terminal*** ***(R122) No. 7 — Chassis ground:*** ***(R122) No. 6 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between fuel pump control unit connector and fuel pump connector.
5	**CHECK HARNESS BETWEEN ECM AND FUEL PUMP CONTROL UNIT CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and fuel pump control unit connector. ***Connector & terminal*** ***(B135) No. 10 — (R122) No. 9:*** ***(B136) No. 33 — (R122) No. 8:***	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 fuel pump control unit connector • Poor contact of coupling connector

	Step	Check	Yes	No
6	**CHECK HARNESS BETWEEN ECM AND FUEL PUMP CONTROL UNIT CONNECTOR.** Measure the resistance between fuel pump control unit connector and chassis ground. ***Connector & terminal*** ***(R122) No. 9 — Chassis ground:*** ***(R122) No. 8 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **7**.	Repair the short circuit to ground in harness between ECM and fuel pump control unit connector.
7	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and fuel pump control unit connector.	Is there poor contact of ECM or fuel pump control unit connector?	Repair the poor contact of ECM or fuel pump control unit connector.	Go to step **8**.
8	**CHECK EXPERIENCE OF RUNNING OUT OF FUEL.**	Has the vehicle experienced running out of fuel?	Finish the diagnosis. NOTE: DTC may be recorded as a result of fuel pump idling while running out of fuel.	Replace the fuel pump control unit. <Ref. to FU(STI)-66, Fuel Pump Control Unit.> <Ref. to FU(w/o STI)-64, Fuel Pump Control Unit.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-107, DTC P0244 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK WASTEGATE ACTUATOR PIPING AND WASTEGATE CONTROL SOLENOID VALVE PIPING.**	Are there any damage or disconnection of hose in wastegate actuator piping or wastegate control solenoid valve piping?	Connect the wastegate actuator pipe or wastegate control solenoid valve pipe properly. If defective, replace the hose.	Replace the wastegate control solenoid valve. <Ref. to FU(STI)-52, Wastegate Control Solenoid Valve.> <Ref. to FU(w/o STI)-51, Wastegate Control Solenoid Valve.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-109, DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

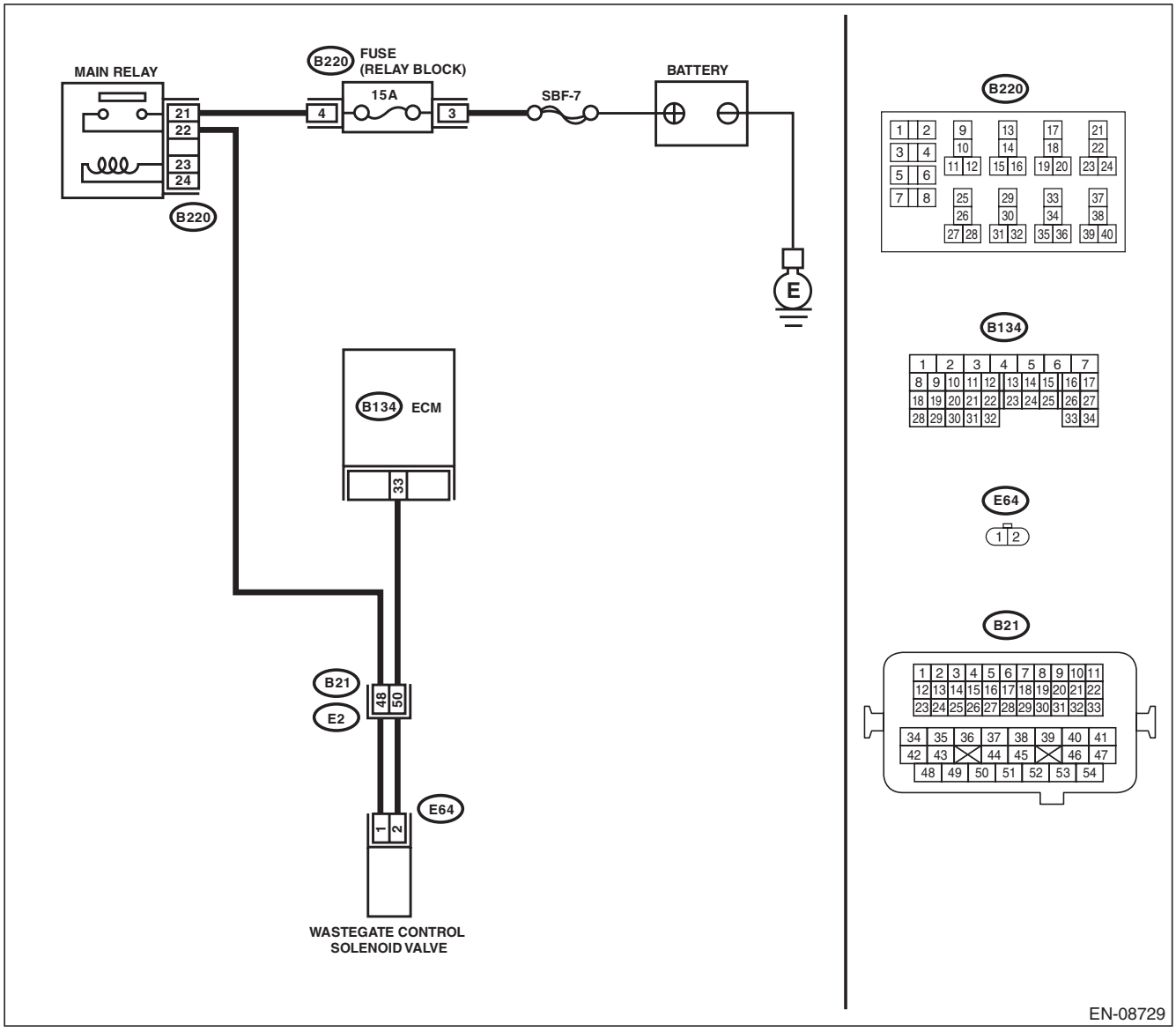
Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***(B134) No. 33 (+) — 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 WASTEGATE CONTROL SOLENOID VALVE.** Measure the voltage between wastegate control solenoid valve connector and engine ground. ***Connector & terminal*** ***(E64) No. 1 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND WASTEGATE CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and wastegate control solenoid valve. 3) Measure the resistance between wastegate control solenoid valve connector and engine ground. ***Connector & terminal*** ***(E64) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair ground short circuit of harness between ECM and wastegate control solenoid valve connector.
5	**CHECK HARNESS BETWEEN ECM AND WASTEGATE CONTROL SOLENOID VALVE CONNECTOR.** Measure the resistance of harness between ECM and wastegate control solenoid valve connector. ***Connector & terminal*** ***(B134) No. 33 — (E64) 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 wastegate control solenoid valve connector • Poor contact of coupling connector

	Step	Check	Yes	No
6	**CHECK WASTEGATE CONTROL SOLENOID VALVE.** 1) Remove the wastegate control solenoid valve. 2) Measure the resistance between wastegate control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 10 — 100 Ω?	Repair poor contact of wastegate control solenoid valve connector.	Replace the wastegate control solenoid valve. <Ref. to FU(STI)-52, Wastegate Control Solenoid Valve.> <Ref. to FU(w/o STI)-51, Wastegate Control Solenoid Valve.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-111, DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

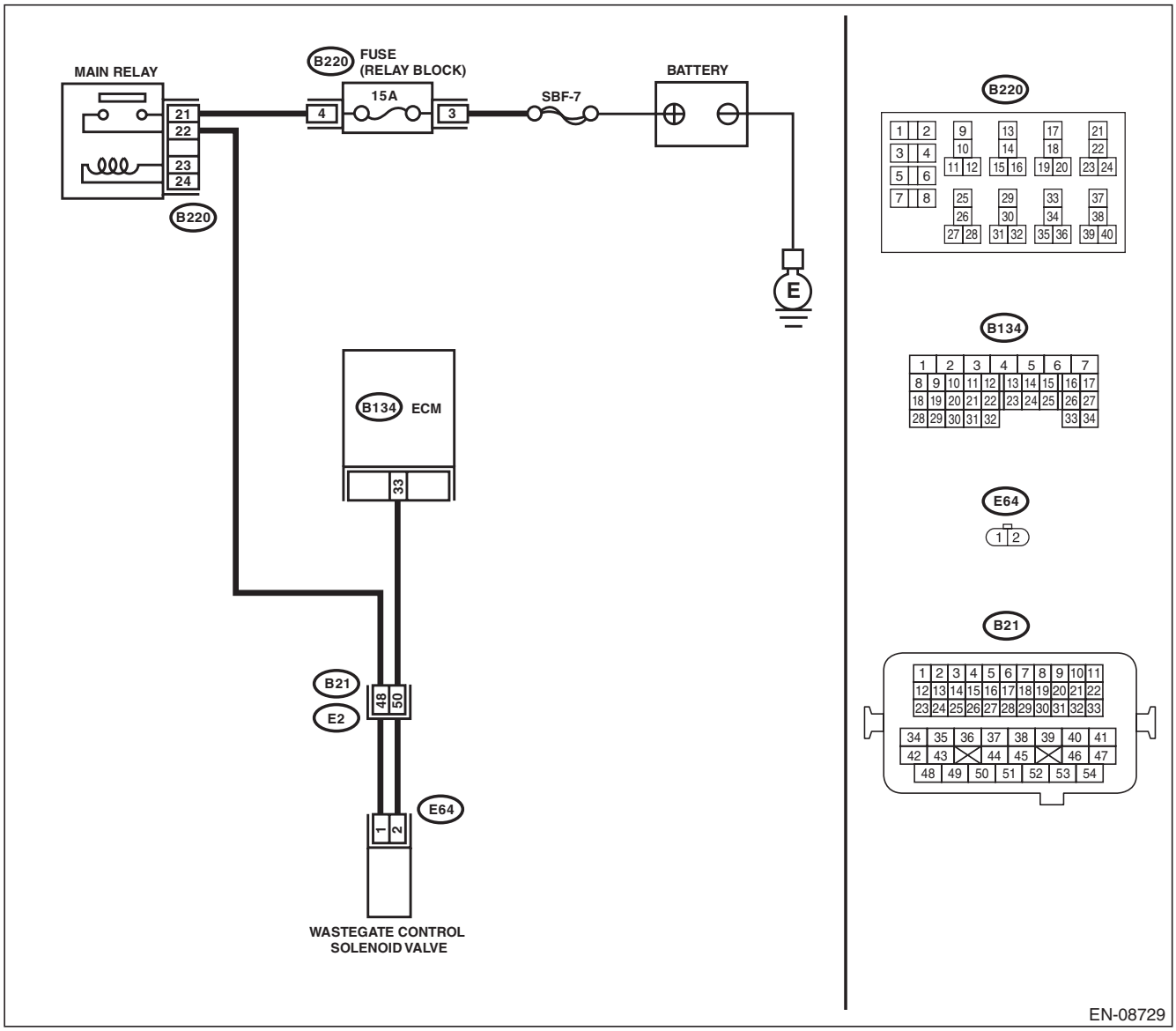
Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND WASTEGATE CONTROL SOLENOID VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and wastegate control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 33 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair short circuit to power in the harness between ECM and wastegate control solenoid valve connector.	Go to step **2**.
2	**CHECK WASTEGATE CONTROL SOLENOID VALVE.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between wastegate control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Replace the wastegate control solenoid valve. <Ref. to FU(STI)-52, Wastegate Control Solenoid Valve.> <Ref. to FU(w/o STI)-51, Wastegate Control Solenoid Valve.>	Repair the poor contact of ECM connector.

BE:DTC P0300 RANDOM/MULTIPLE CYLINDER 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(H4DOTC)-112, DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

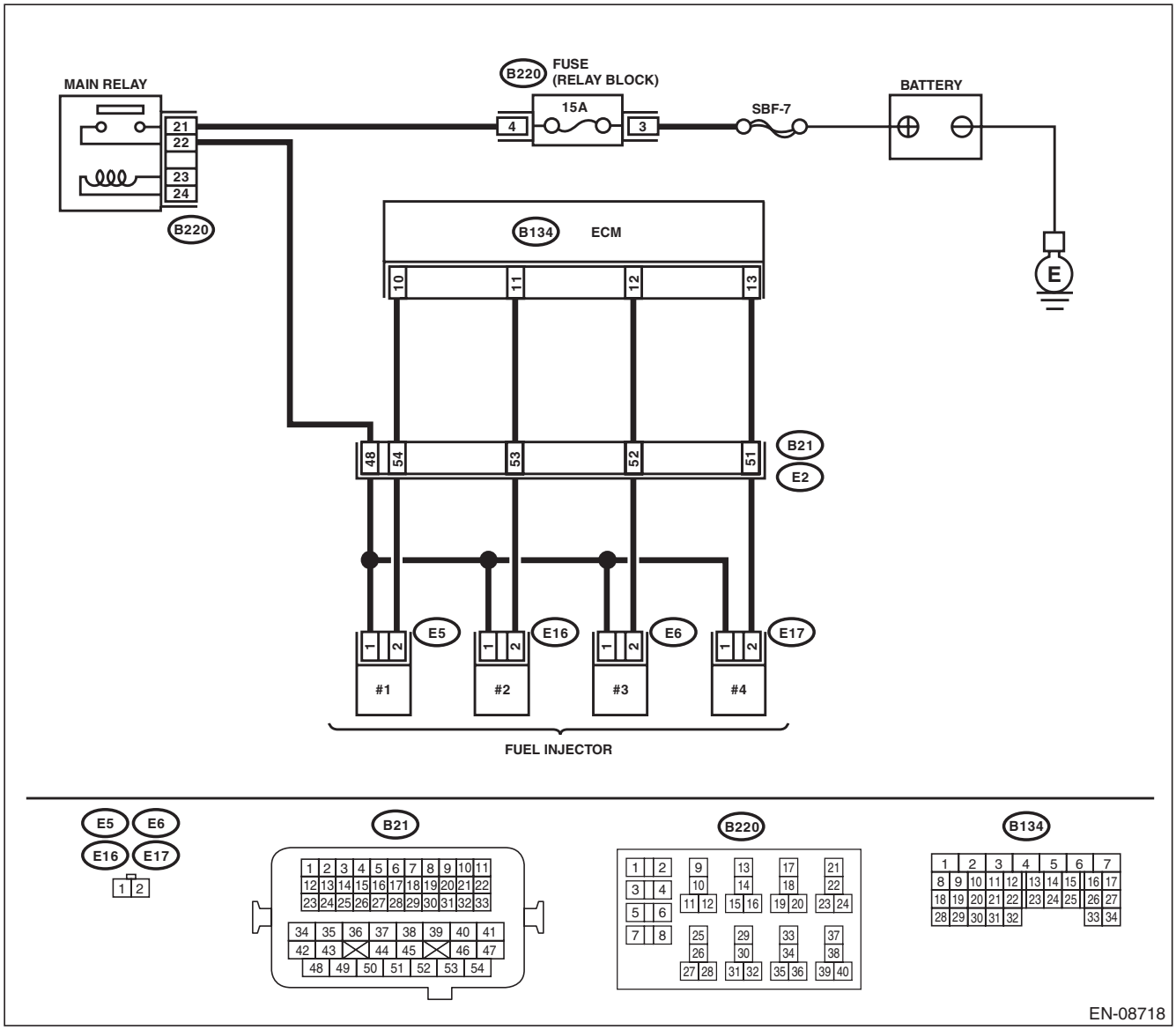
- Engine stalls.
- Improper idling
- Rough driving

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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 all 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**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from all fuel injectors. 3) Measure the resistance between all fuel injector connectors and engine ground. ***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 connector on all 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 all fuel injector terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **5**.	Replace the faulty fuel injector. <Ref. to FU(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, Fuel Injector.>
5	**CHECK POWER SUPPLY LINE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between all fuel injector connectors and the 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?	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
6	**CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from all fuel injectors. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground on all 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**.

	Step	Check	Yes	No
7	**CHECK FUEL INJECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between all fuel injector terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 5 — 20 Ω?	Go to step **8**.	Replace the faulty fuel injector. <Ref. to FU(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, Fuel Injector.>
8	**CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.**	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(STI)-37, Camshaft Position Sensor.> <Ref. to FU(STI)-35, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-37, Camshaft Position Sensor.> <Ref. to FU(w/o STI)-35, Crankshaft Position Sensor.>	Go to step **9**.
9	**CHECK CRANK SPROCKET.** Remove the timing belt cover.	Is the crank sprocket rusted or does it have broken teeth?	Replace the crank sprocket. <Ref. to ME(STI)-59, Crank Sprocket.> <Ref. to ME(w/o STI)-58, Crank Sprocket.>	Go to step **10**.
10	**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(STI)-49, Timing Belt.> <Ref. to ME(w/o STI)-48, Timing Belt.>	Go to step **11**.
11	**CHECK FUEL LEVEL.**	Is the fuel meter indication higher than the “Lower” level?	Go to step **12**.	Refill the fuel so that the fuel meter indication is higher than the “Lower” level, and proceed to the next step. 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(H4DOTC)(diag)-62, 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 ALL CYLINDERS.	Is there a fault in any cylinder?	Repair or replace the faulty part of the faulty cylinder. NOTE: Check the following items. • Spark plug • Fuel injector • Ignition coil • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-170, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BF:DTC P0301 CYLINDER 1 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DOTC)(diag)-196, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BG:DTC P0302 CYLINDER 2 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DOTC)(diag)-196, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BH:DTC P0303 CYLINDER 3 MISFIRE DETECTED

NOTE:
For the diagnostic procedure, refer to DTC P0304. <Ref. to EN(H4DOTC)(diag)-196, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BI: 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(H4DOTC)-122, DTC P0304 CYLINDER 4 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

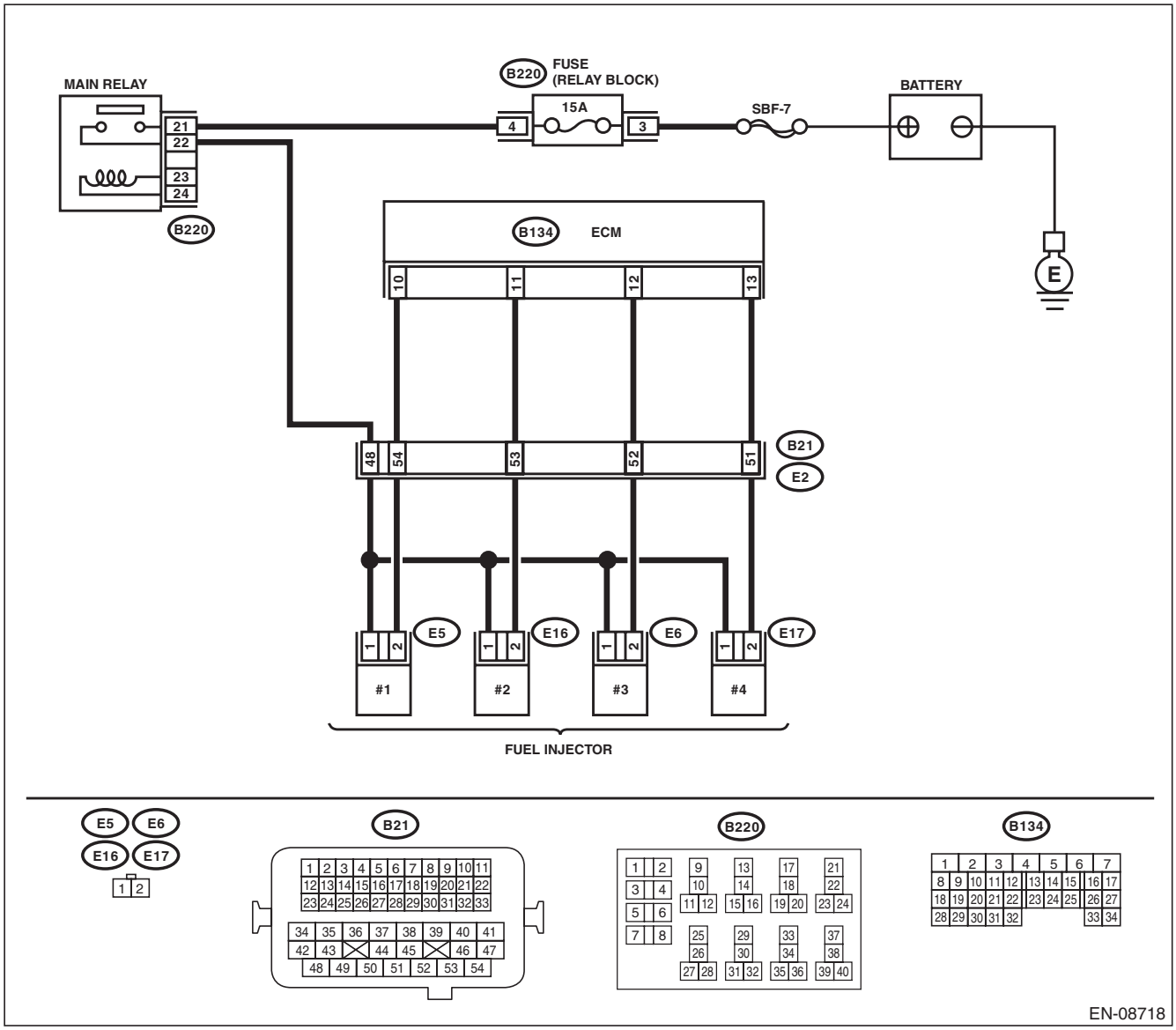
- Engine stalls.
- Improper idling
- Rough driving

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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 (B134) No. 10 (+) — Chassis ground (–):*** ***#2 (B134) No. 11 (+) — Chassis ground (–):*** ***#3 (B134) No. 12 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — 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. 2 — Engine ground:*** ***#2 (E16) No. 2 — Engine ground:*** ***#3 (E6) No. 2 — Engine ground:*** ***#4 (E17) No. 2 — 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 connector on faulty cylinders. ***Connector & terminal*** ***#1 (B134) No. 10 — (E5) No. 2:*** ***#2 (B134) No. 11 — (E16) No. 2:*** ***#3 (B134) No. 12 — (E6) No. 2:*** ***#4 (B134) No. 13 — (E17) 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 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(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, Fuel Injector.>
5	**CHECK POWER SUPPLY LINE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector connector of faulty cylinders and engine ground. ***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 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 (B134) No. 10 (+) — Chassis ground (–):*** ***#2 (B134) No. 11 (+) — Chassis ground (–):*** ***#3 (B134) No. 12 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — 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?	Go to step **8**.	Replace the faulty fuel injector. <Ref. to FU(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, Fuel Injector.>
8	**CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.**	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(STI)-37, Camshaft Position Sensor.> <Ref. to FU(STI)-35, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-37, Camshaft Position Sensor.> <Ref. to FU(w/o STI)-35, Crankshaft Position Sensor.>	Go to step **9**.
9	**CHECK CRANK SPROCKET.** Remove the timing belt cover.	Is the crank sprocket rusted or does it have broken teeth?	Replace the crank sprocket. <Ref. to ME(STI)-59, Crank Sprocket.> <Ref. to ME(w/o STI)-58, Crank Sprocket.>	Go to step **10**.
10	**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(STI)-49, Timing Belt.> <Ref. to ME(w/o STI)-48, Timing Belt.>	Go to step **11**.
11	**CHECK FUEL LEVEL.**	Is the fuel meter indication higher than the “Lower” level?	Go to step **12**.	Refill the fuel so that the fuel meter indication is higher than the “Lower” level, and proceed to the next step. Go to step **12**.

	Step	Check	Yes	No
12	**CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DOTC)(diag)-62, 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**.
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) Check for DTC. <Ref. to EN(H4DOTC)(diag)-47, Read Diagnostic Trouble Code (DTC).>	Does the Subaru Select Monitor or general scan tool indicate only one DTC?	Go to step **18**.	Go to step **16**.
16	**CHECK DTC.**	Is DTC P0301 and P0303 displayed on the Subaru Select Monitor or general scan tool?	Go to step **19**.	Go to step **17**.
17	**CHECK DTC.**	Is DTC P0302 and P0304 displayed on the Subaru Select Monitor or general scan tool?	Go to step **20**.	Go to step **21**.
18	**ONLY ONE CYLINDER.**	Is there any fault in the cylinder?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Ignition coil • Fuel injector • Compression ratio	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-170, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

	Step	Check	Yes	No
19	**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 • Ignition coil • Fuel injector • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-170, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
20	**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 • Ignition coil • Fuel injector • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-170, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
21	**CYLINDER AT RANDOM.**	Is the engine idle rough?	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-170, 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 • Ignition coil • Fuel injector • Compression ratio

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-123, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

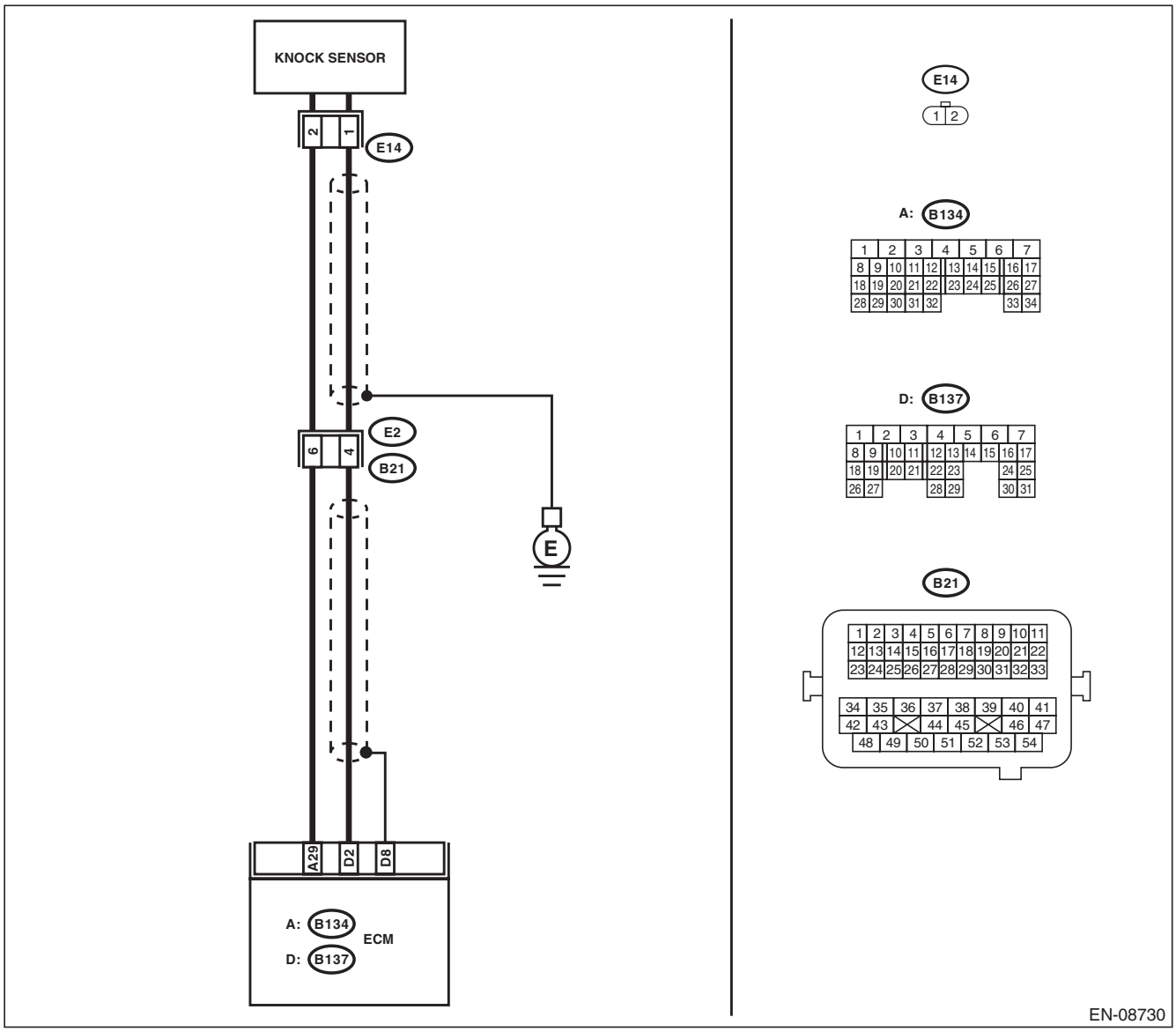
TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B137) No. 2 — (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 the 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(STI)-40, Knock Sensor.> <Ref. to FU(w/o STI)-39, 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

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-125, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

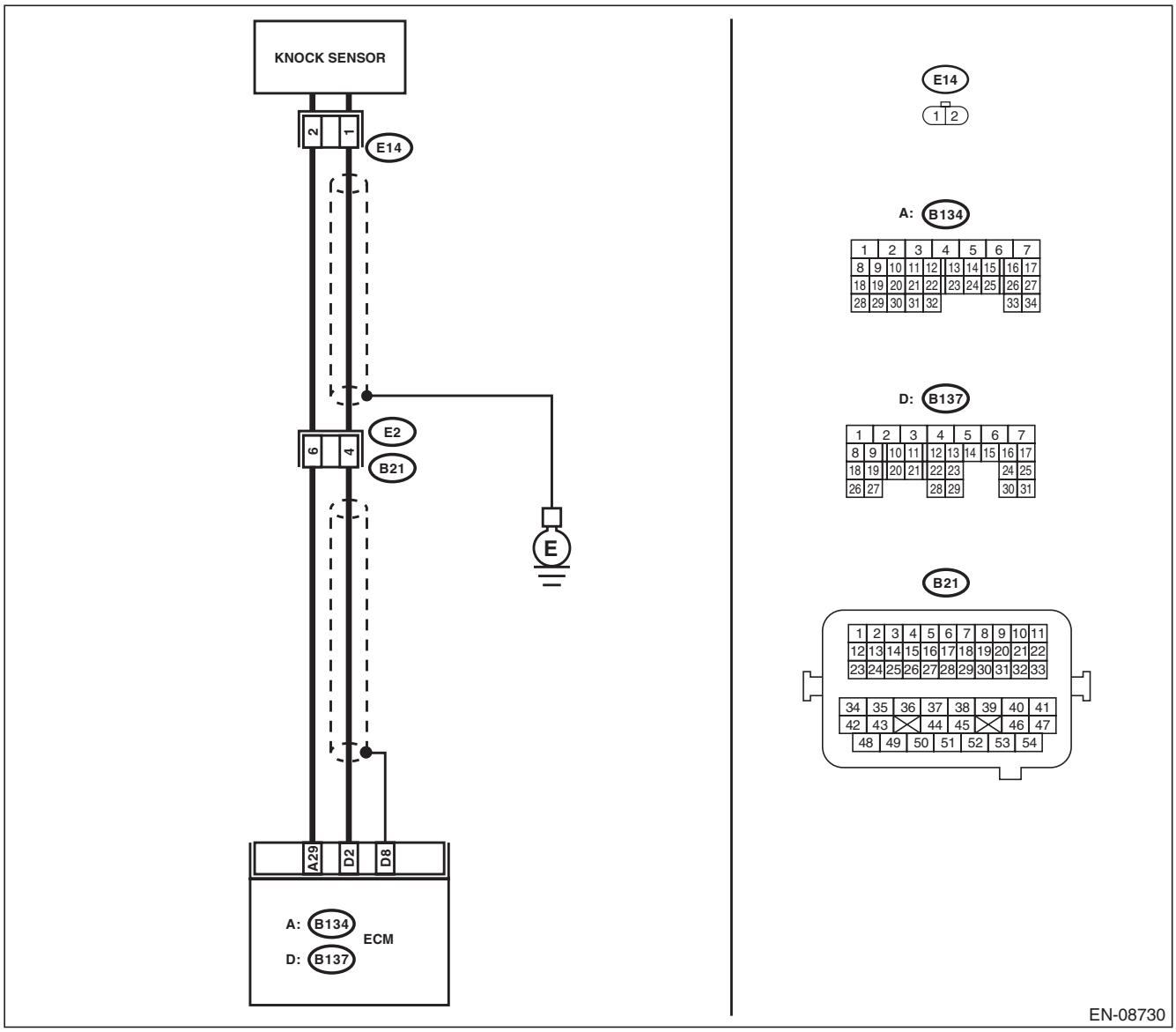
TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND KNOCK SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. ***Connector & terminal*** ***(B137) No. 2 — (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 the knock sensor. 2) Measure the resistance between knock sensor connectors. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 500 kΩ?	Replace the knock sensor. <Ref. to FU(STI)-40, Knock Sensor.> <Ref. to FU(w/o STI)-39, 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*** ***(B137) No. 2 (+) — 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.

BL:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-127, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

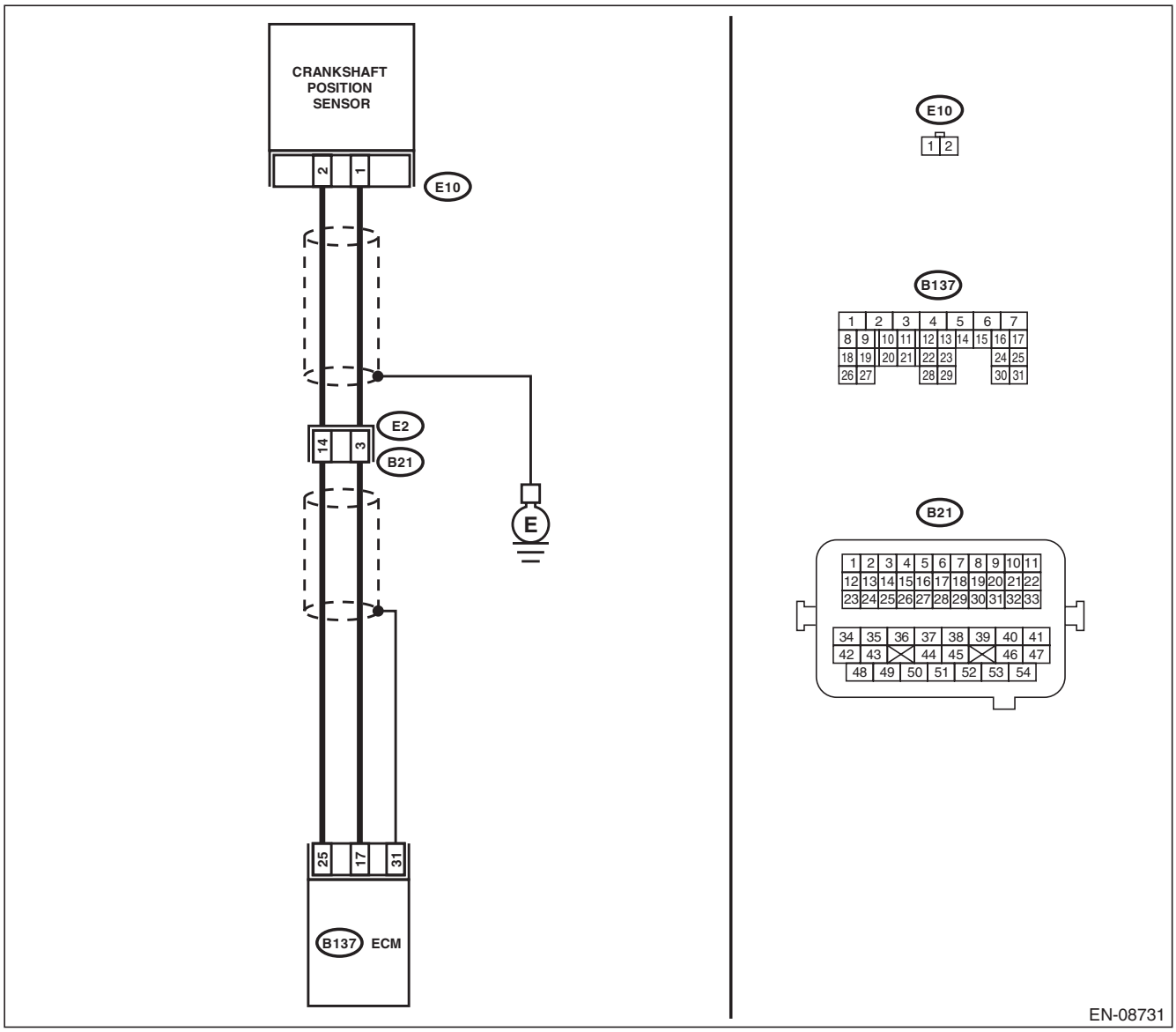
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK 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(STI)-35, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-35, 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(STI)-35, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-35, Crankshaft Position Sensor.>
3	**CHECK HARNESS BETWEEN ECM AND CRANKSHAFT POSITION SENSOR CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and crankshaft position sensor connector. ***Connector & terminal*** ***(B137) No. 17 — (E10) No. 1:*** ***(B137) No. 25 — (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

BM: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(H4DOTC)-129, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	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(STI)-35, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-35, 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(STI)-59, Crank Sprocket.> <Ref. to ME(w/o STI)-58, 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(STI)-49, Timing Belt.> <Ref. to ME(w/o STI)-48, Timing Belt.>	Replace the crankshaft position sensor. <Ref. to FU(STI)-35, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-35, Crankshaft Position Sensor.>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-131, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

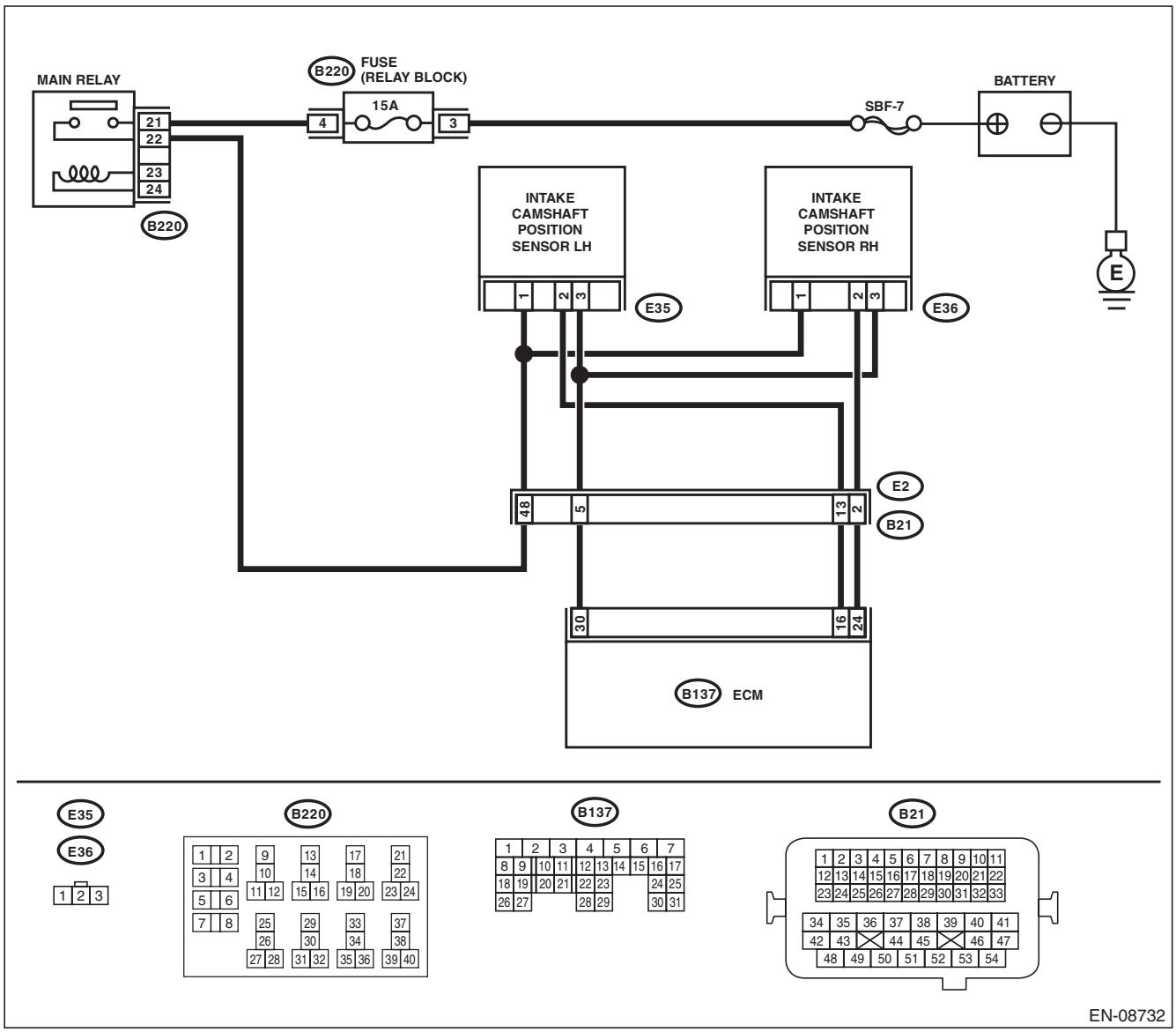
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E36) No. 1 (+) — 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 or short circuit to ground in harness between main relay connector and camshaft position sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM and camshaft position sensor connector. ***Connector & terminal*** ***(B137) No. 24 — (E36) No. 2:*** ***(B137) No. 30 — (E36) 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 camshaft position sensor connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E36) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair short circuit to ground in harness between ECM and camshaft position sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E36) No. 2 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM and camshaft position sensor connector.	Go to step **5**.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6**.	Tighten the camshaft position sensor installation bolt securely. <Ref. to FU(STI)-37, Camshaft Position Sensor.> <Ref. to FU(w/o STI)-37, Camshaft Position Sensor.>
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the waveform of the camshaft position sensor. <Ref. to EN(H4DOTC)(diag)-22, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(STI)-37, Camshaft Position Sensor.> <Ref. to FU(w/o STI)-37, Camshaft Position Sensor.>	Repair the following item. • Poor contact of ECM connector • Poor contact of camshaft position sensor connector • Poor contact of coupling connector

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

NOTE:
For the diagnostic procedure, refer to DTC P0340. <Ref. to EN(H4DOTC)(diag)-209, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-134, DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

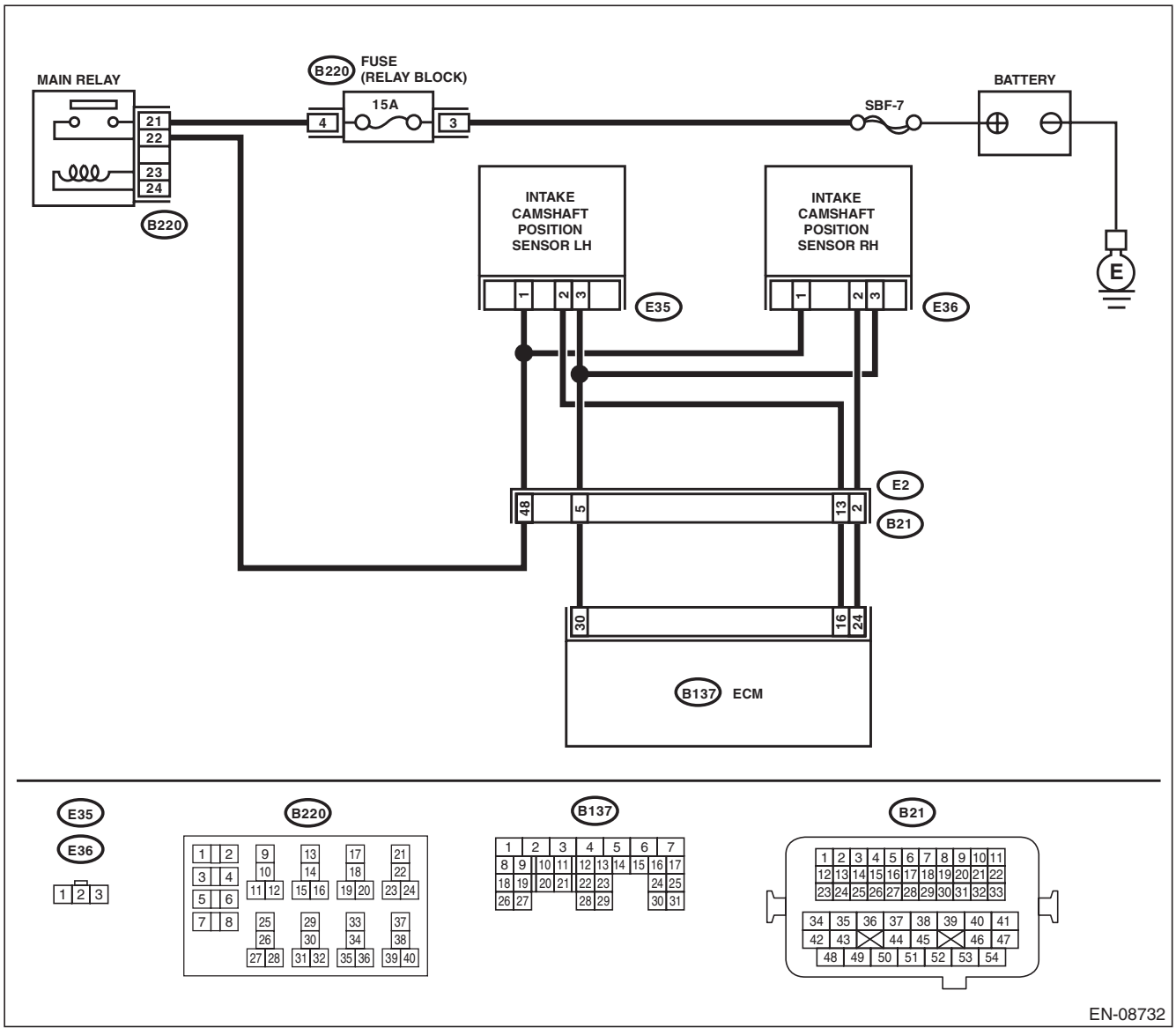
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E35) No. 1 (+) — 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 or short circuit to ground in harness between main relay connector and camshaft position sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM and camshaft position sensor connector. ***Connector & terminal*** ***(B137) No. 16 — (E35) No. 2:*** ***(B137) No. 22 — (E35) 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 connector and camshaft position sensor connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E35) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair short circuit to ground in harness between ECM and camshaft position sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E35) No. 2 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM and camshaft position sensor connector.	Go to step **5**.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6**.	Tighten the camshaft position sensor installation bolt securely. <Ref. to FU(STI)-37, Camshaft Position Sensor.> <Ref. to FU(w/o STI)-37, Camshaft Position Sensor.>
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the waveform of the camshaft position sensor. <Ref. to EN(H4DOTC)(diag)-22, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(STI)-37, Camshaft Position Sensor.> <Ref. to FU(w/o STI)-37, Camshaft Position Sensor.>	Repair the following item. • Poor contact of ECM connector • Poor contact of camshaft position sensor connector • Poor contact of coupling connector

BQ:DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2)

NOTE:
For the diagnostic procedure, refer to DTC P0345. <Ref. to EN(H4DOTC)(diag)-212, DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BR:DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-135, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

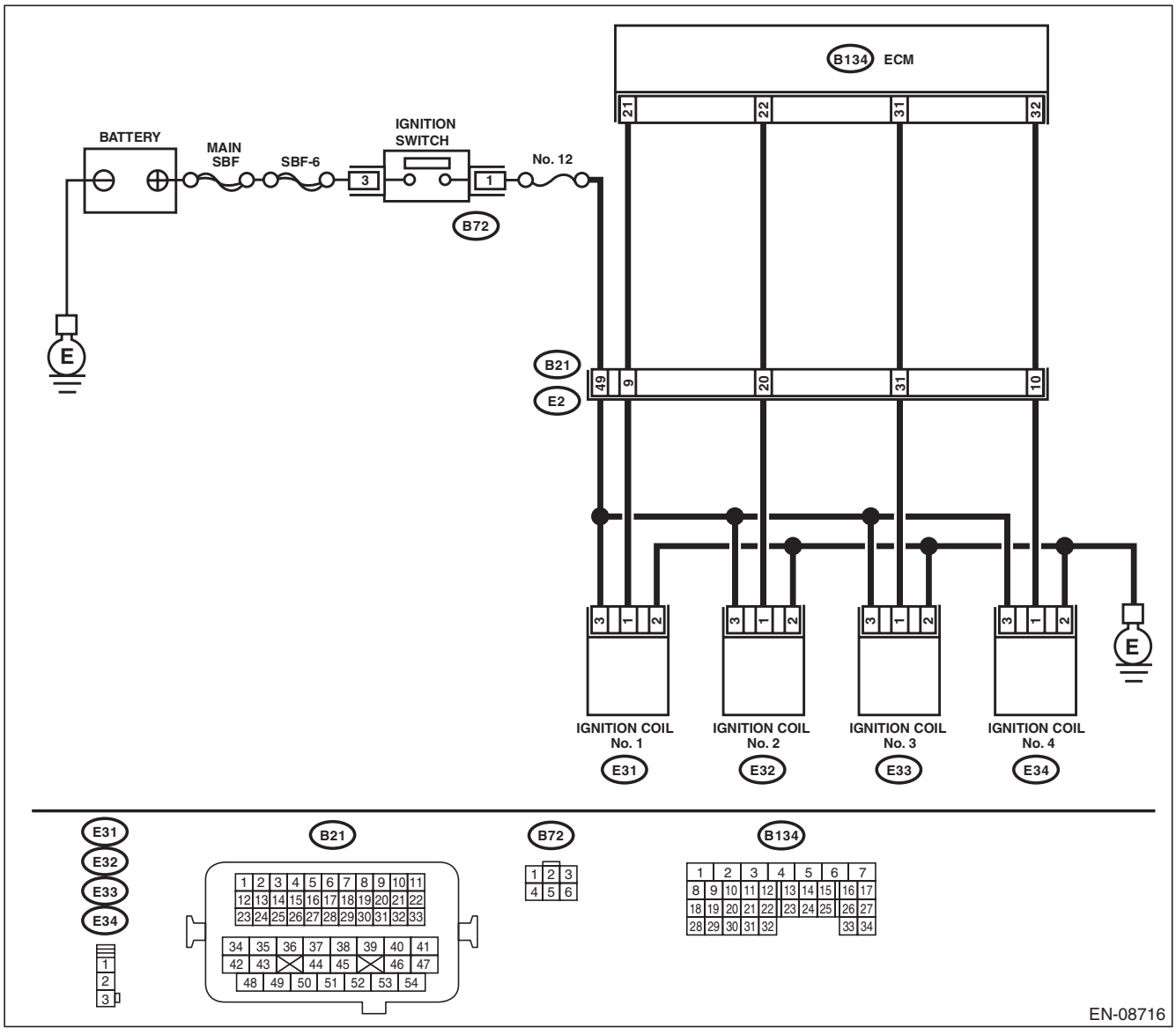
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK IGNITION COIL POWER SUPPLY CIRCUIT.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition coil. 3) Turn the ignition switch to ON. 4) Measure the voltage between ignition coil connector and engine ground. ***Connector & terminal*** ***DTC P0351; (E31) No. 3 (+) — Engine ground (–):*** ***DTC P0352; (E32) No. 3 (+) — Engine ground (–):*** ***DTC P0353; (E33) No. 3 (+) — Engine ground (–):*** ***DTC P0354; (E34) No. 3 (+) — 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 or short circuit to ground in harness of power supply circuit • Blown out of fuse • Poor contact of coupling connector
2	**CHECK HARNESS OF IGNITION COIL GROUND CIRCUIT.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between ignition coil connector and engine ground. ***Connector & terminal*** ***DTC P0351; (E31) No. 2 — Engine ground:*** ***DTC P0352; (E32) No. 2 — Engine ground:*** ***DTC P0353; (E33) No. 2 — Engine ground:*** ***DTC P0354; (E34) No. 2 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **3**.	Repair the open circuit in harness between ignition coil connector and engine grounding terminal.
3	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance between ignition coil connector and engine ground. ***Connector & terminal*** ***DTC P0351; (E31) No. 1 — Engine ground:*** ***DTC P0352; (E32) No. 1 — Engine ground:*** ***DTC P0353; (E33) No. 1 — Engine ground:*** ***DTC P0354; (E34) No. 1 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the ground short circuit of harness between ECM connector and ignition coil connector.
4	**CHECK HARNESS BETWEEN ECM AND IGNITION COIL CONNECTOR.** Measure the resistance of harness between ECM connector and ignition coil connector. ***Connector & terminal*** ***DTC P0351; (B134) No. 21 — (E31) No. 1:*** ***DTC P0352; (B134) No. 22 — (E32) No. 1:*** ***DTC P0353; (B134) No. 31 — (E33) No. 1:*** ***DTC P0354; (B134) No. 32 — (E34) No. 1:***	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 connector and the ignition coil connector • Poor contact of coupling connector
5	**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 **6**.
6	**CHECK SPARK PLUG CONDITION.** 1) Remove the spark plug of the corresponding cylinder. <Ref. to IG(STI)-4, REMOVAL, Spark Plug.> <Ref. to IG(w/o STI)-5, REMOVAL, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG(STI)-5, INSPECTION, Spark Plug.> <Ref. to IG(w/o STI)-6, INSPECTION, Spark Plug.>	Is the spark plug condition normal?	Replace the ignition coil. <Ref. to IG(STI)-7, Ignition Coil.> <Ref. to IG(w/o STI)-8, Ignition Coil.>	Replace the spark plug. <Ref. to IG(STI)-4, Spark Plug.> <Ref. to IG(w/o STI)-5, Spark Plug.>

BS:DTC P0352 IGNITION COIL B PRIMARY/SECONDARY CIRCUIT

NOTE:
For the diagnostic procedure, refer to DTC P0351. <Ref. to EN(H4DOTC)(diag)-215, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BT:DTC P0353 IGNITION COIL C PRIMARY/SECONDARY CIRCUIT

NOTE:
For the diagnostic procedure, refer to DTC P0351. <Ref. to EN(H4DOTC)(diag)-215, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BU:DTC P0354 IGNITION COIL D PRIMARY/SECONDARY CIRCUIT

NOTE:
For the diagnostic procedure, refer to DTC P0351. <Ref. to EN(H4DOTC)(diag)-215, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BV:DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-136, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

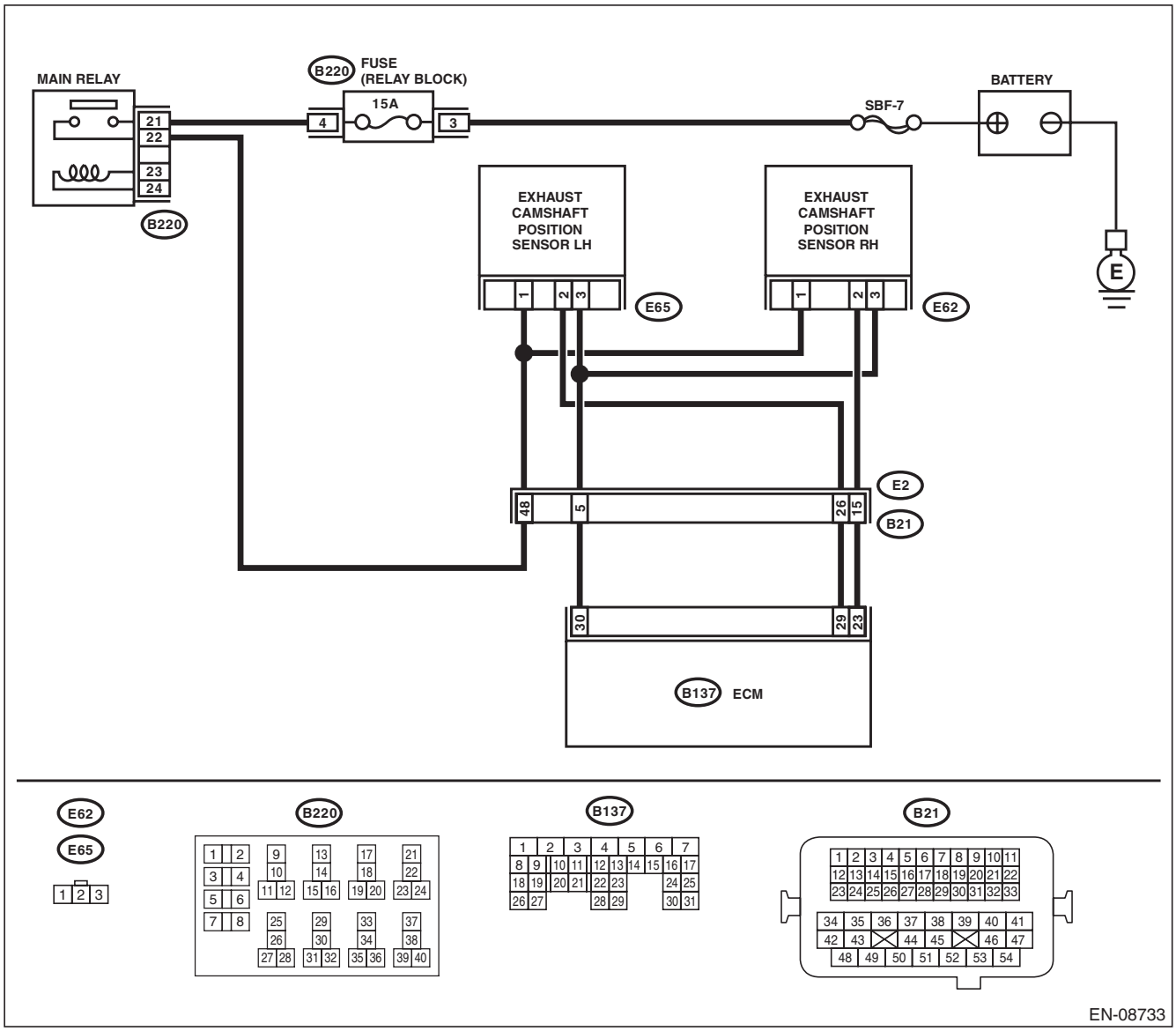
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E62) No. 1 (+) — 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 or short circuit to ground in harness between main relay connector and camshaft position sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM and camshaft position sensor connector. ***Connector & terminal*** ***(B137) No. 23 — (E62) No. 2:*** ***(B137) No. 30 — (E62) 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 camshaft position sensor connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E62) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair short circuit to ground in harness between ECM and camshaft position sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E62) No. 2 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM and camshaft position sensor connector.	Go to step **5**.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6**.	Tighten the camshaft position sensor installation bolt securely. <Ref. to FU(STI)-37, Camshaft Position Sensor.>
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the waveform of the camshaft position sensor. <Ref. to EN(H4DOTC)(diag)-22, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(STI)-37, Camshaft Position Sensor.>	Repair the following item. • Poor contact of ECM connector • Poor contact of camshaft position sensor connector • Poor contact of coupling connector

BW:DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1)

NOTE:
For the diagnostic procedure, refer to DTC P0365. <Ref. to EN(H4DOTC)(diag)-218, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BX:DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-137, DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

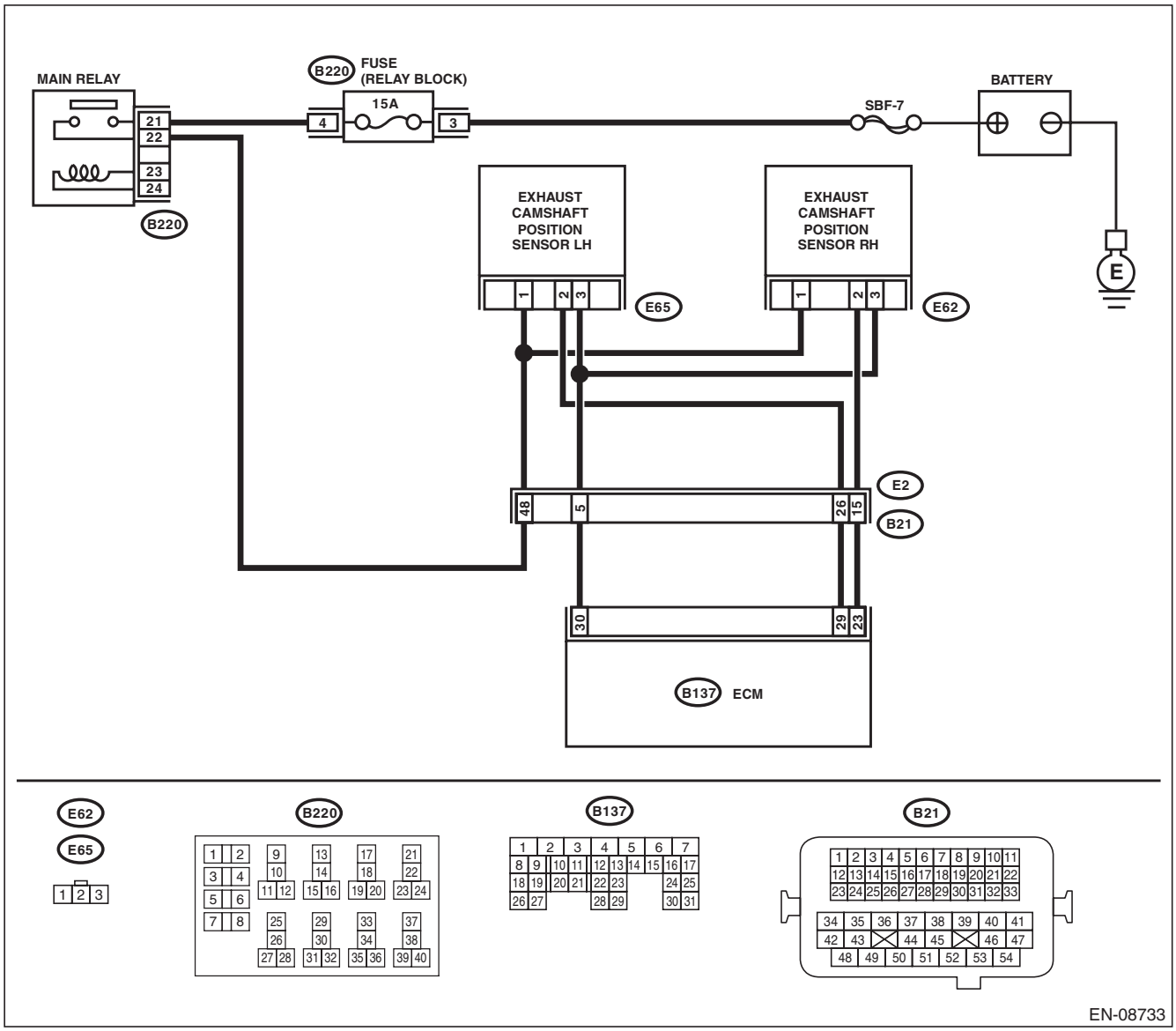
- Engine stalls.
- Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E65) No. 1 (+) — 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 or short circuit to ground in harness between main relay connector and camshaft position sensor connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM and camshaft position sensor connector. ***Connector & terminal*** ***(B137) No. 29 — (E65) No. 2:*** ***(B137) No. 30 — (E65) 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 camshaft position sensor connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the resistance between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E65) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair short circuit to ground in harness between ECM and camshaft position sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND CAMSHAFT POSITION SENSOR CONNECTOR.** Measure the voltage between camshaft position sensor connector and engine ground. ***Connector & terminal*** ***(E65) No. 2 (+) — Engine ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in the harness between ECM and camshaft position sensor connector.	Go to step **5**.
5	**CHECK CONDITION OF CAMSHAFT POSITION SENSOR.**	Is the camshaft position sensor installation bolt tightened securely?	Go to step **6**.	Tighten the camshaft position sensor installation bolt securely. <Ref. to FU(STI)-37, Camshaft Position Sensor.>
6	**CHECK CAMSHAFT POSITION SENSOR.** Check the waveform of the camshaft position sensor. <Ref. to EN(H4DOTC)(diag)-22, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(STI)-37, Camshaft Position Sensor.>	Repair the following item. • Poor contact of ECM connector • Poor contact of camshaft position sensor connector • Poor contact of coupling connector

BY:DTC P0391 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 2)

NOTE:
For the diagnostic procedure, refer to DTC P0390. <Ref. to EN(H4DOTC)(diag)-221, DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BZ:DTC P0410 SECONDARY AIR INJECTION SYSTEM

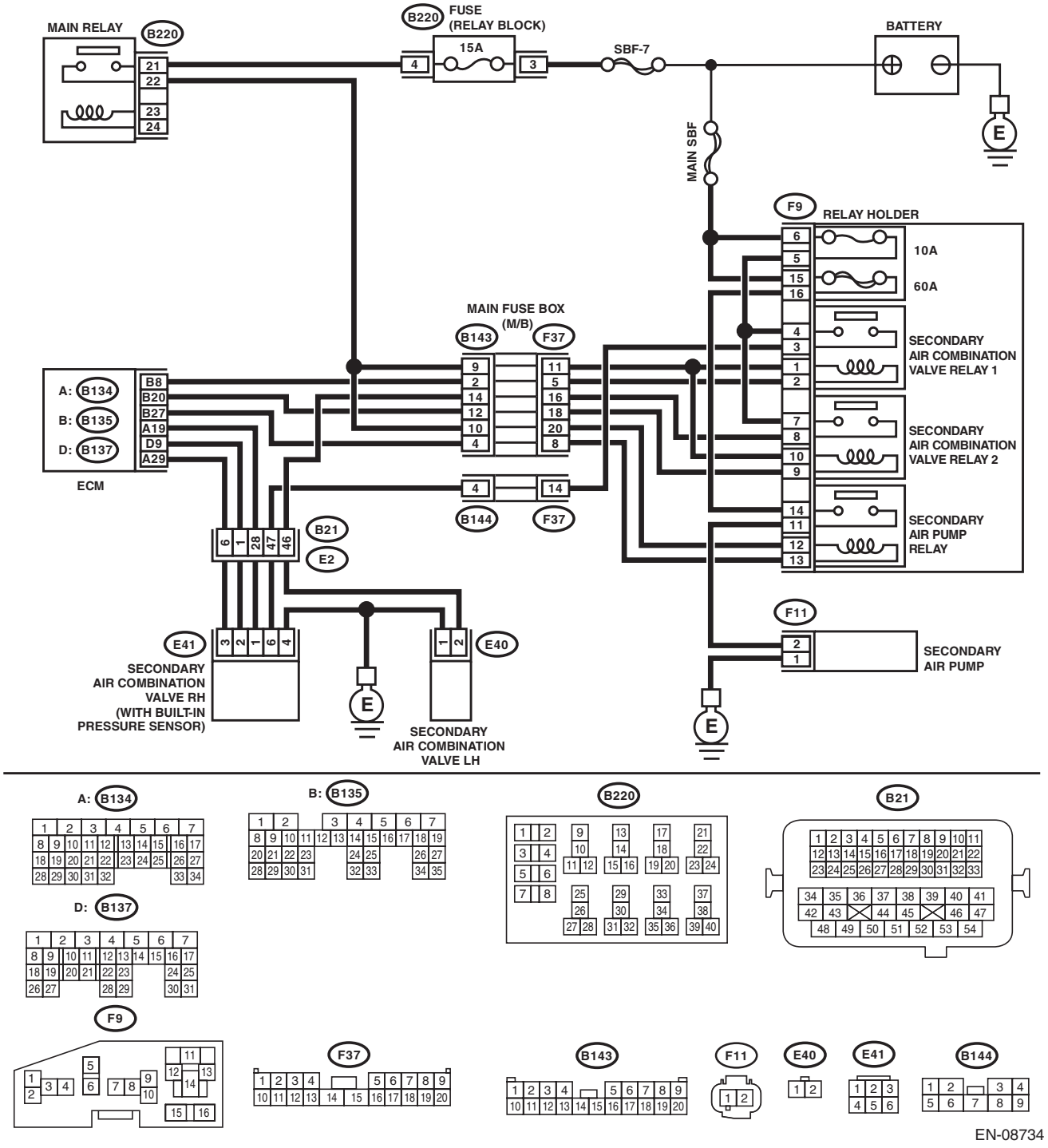
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-138, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

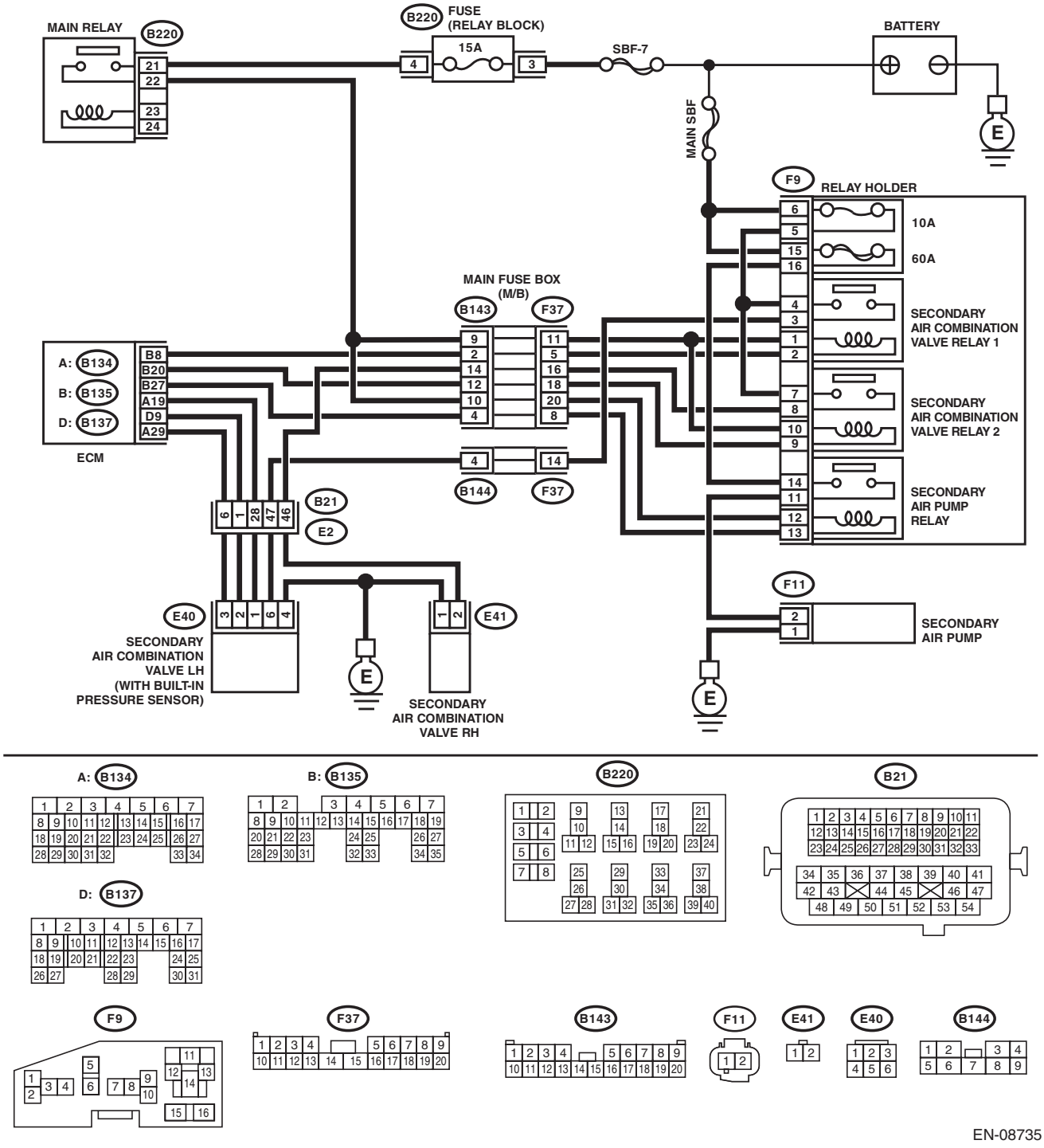
• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08735

	Step	Check	Yes	No
1	**CHECK SECONDARY AIR PUMP FUSE.** Check if the secondary air pump fuse (60 A) is blown out.	Is the fuse blown out?	Go to step **2**.	Go to step **3**.
2	**CHECK HARNESS BETWEEN FUSE BOX AND SECONDARY AIR PUMP CONNECTOR.** 1) Remove the secondary air pump fuse from the fuse box. 2) Disconnect the secondary air pump connector. 3) Measure the resistance between the secondary air pump fuse and secondary air pump connector, and chassis ground. ***Connector & terminal*** ***(F9) No. 16 — Chassis ground:*** ***(F11) No. 2 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the fuse with a new part, and connect the secondary air pump connector. Go to step **3**.	Repair ground short of the harness between the fuse box and the secondary air pump connector.
3	**CHECK SECONDARY AIR PUMP OPERATION.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform the Clear Memory Mode. 4) Perform operation check for the secondary air pump using the Subaru Select Monitor. NOTE: • Subaru Select Monitor For detailed operation procedure, refer to “Clear Memory Mode” <Ref. to EN(H4DOTC)(diag)-62, Clear Memory Mode.> and “Compulsory Valve Operation Check Mode” <Ref. to EN(H4DOTC)(diag)-63, Compulsory Valve Operation Check Mode.>. • The compulsory operation using the Subaru Select Monitor is performed only for 5 seconds in order to protect the secondary air pump. When operating again, perform the Clear Memory Mode.	Does the secondary air pump operate?	Go to step **4**.	Go to step **5**.
4	**CHECK DUCT BETWEEN SECONDARY AIR PUMP AND COMBINATION VALVE.** Check the duct between secondary air pump and combination valve.	Is there damage, clog or disconnection of the duct?	Replace, clean or connect the duct.	Replace the secondary air combination valve LH (models with SI-DRIVE) or RH (models without SI-DRIVE). <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>

	Step	Check	Yes	No
5	**CHECK POWER SUPPLY TO SECONDARY AIR PUMP.** 1) Perform the Clear Memory Mode. 2) Turn the ignition switch to OFF. 3) Disconnect the secondary air pump connector. 4) In the condition of step 3, measure the voltage between the secondary air pump connector and the chassis ground. NOTE: For detailed procedures, refer to "Clear Memory Mode". <Ref. to EN(H4DOTC)(diag)-62, Clear Memory Mode.> ***Connector & terminal*** ***(F11) No. 2 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Replace the secondary air pump. <Ref. to EC(STI)-27, Secondary Air Pump.> <Ref. to EC(w/o STI)-29, Secondary Air Pump.>	Go to step **6**.
6	**CHECK HARNESS BETWEEN SECONDARY AIR PUMP RELAY AND SECONDARY AIR PUMP CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the secondary air pump relay. 3) Measure the resistance of harness between secondary air pump relay connector and secondary air pump connector. ***Connector & terminal*** ***(F9) No. 11 — (F11) No. 2:***	Is the resistance less than 1 Ω?	Go to step **7**.	Repair the open circuit in harness between secondary air pump relay connector and secondary air pump connector.
7	**CHECK HARNESS BETWEEN SECONDARY AIR PUMP CONNECTOR AND CHASSIS GROUND.** Measure the resistance of the harness between secondary air pump connector and chassis ground. ***Connector & terminal*** ***(F11) No. 1 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **8**.	Repair the open circuit of the harness between secondary air pump connector and chassis ground.
8	**CHECK SECONDARY AIR PUMP RELAY.** 1) Connect the battery to terminals No. 12 and No. 13 of the secondary air pump relay. 2) Measure the resistance between secondary air pump relay terminals. ***Terminals*** ***No. 14 — No. 11:***	Is the resistance less than 1 Ω?	Go to step **9**.	Replace the secondary air pump relay. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
9	**CHECK SECONDARY AIR PUMP RELAY POWER SUPPLY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between the secondary air pump relay connector and chassis ground. ***Connector & terminal*** ***(F9) No. 14 (+) — Chassis ground (–):*** ***(F9) No. 12 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **10**.	Repair the open or ground short circuit of power supply circuit.

	Step	Check	Yes	No
10	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the ECM connector. 3) Measure the resistance of harness between ECM and secondary air pump relay connector. ***Connector & terminal*** ***(B135) No. 27 — (F9) No. 13:***	Is the resistance less than 1 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 connector and secondary air pump relay connector • Poor contact of coupling connector

CA:DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-145, DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK SECONDARY AIR COMBINATION VALVE.** Check the pipe between the secondary air combination valve and cylinder head.	Is there damage or disconnection of the pipe?	Replace the pipe between secondary air combination valve and cylinder head. <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>	Go to step **2**.
2	**CHECK SECONDARY AIR COMBINATION VALVE.** Race the engine at 2,000 rpm to check whether or not the exhaust leak is heard.	Is there any exhaust leak?	Replace the pipe between secondary air combination valve and cylinder head. <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>	Repair the poor contact of ECM connector.

CB:DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT OPEN

DTC DETECTING CONDITION:

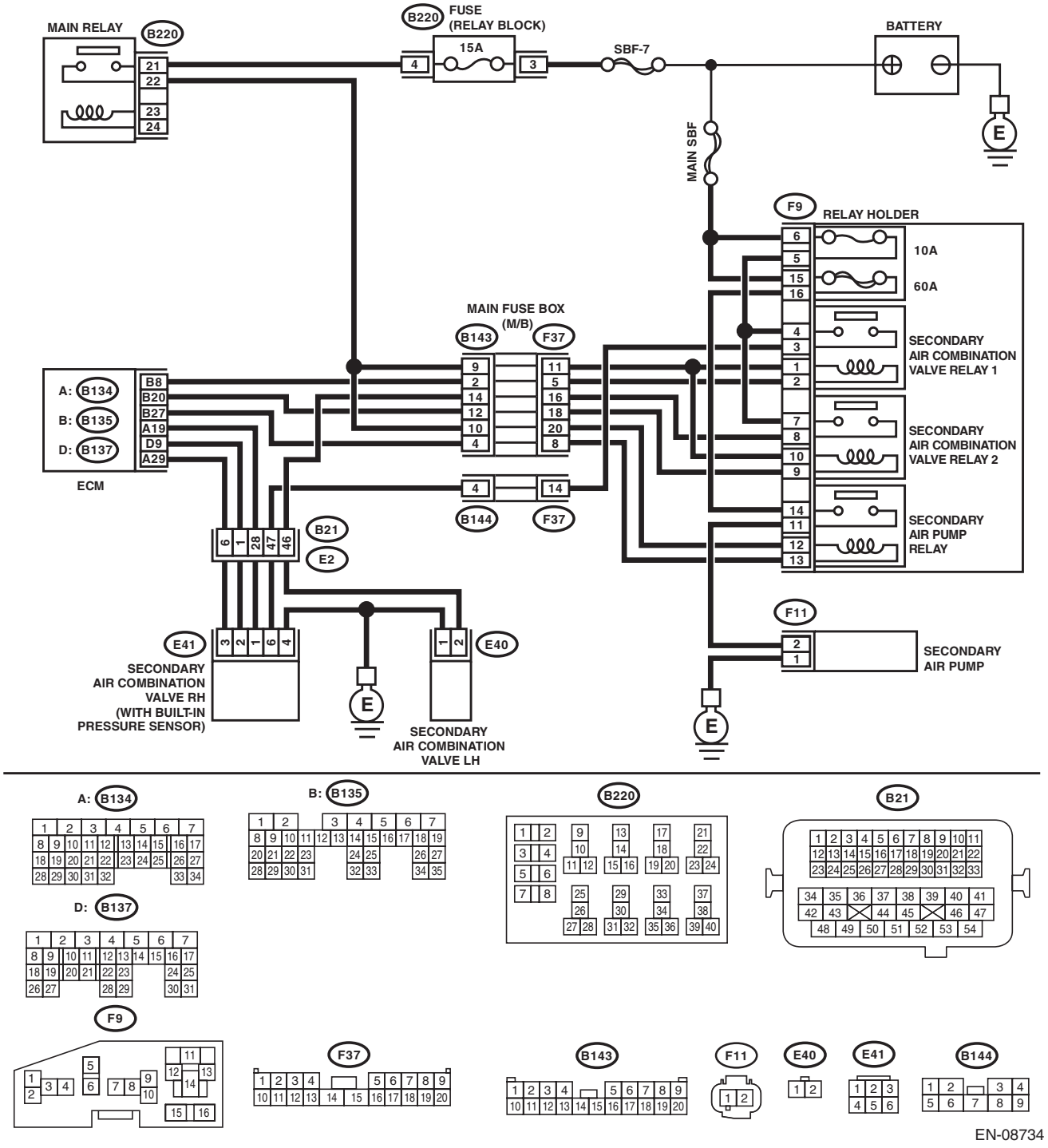
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-146, DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

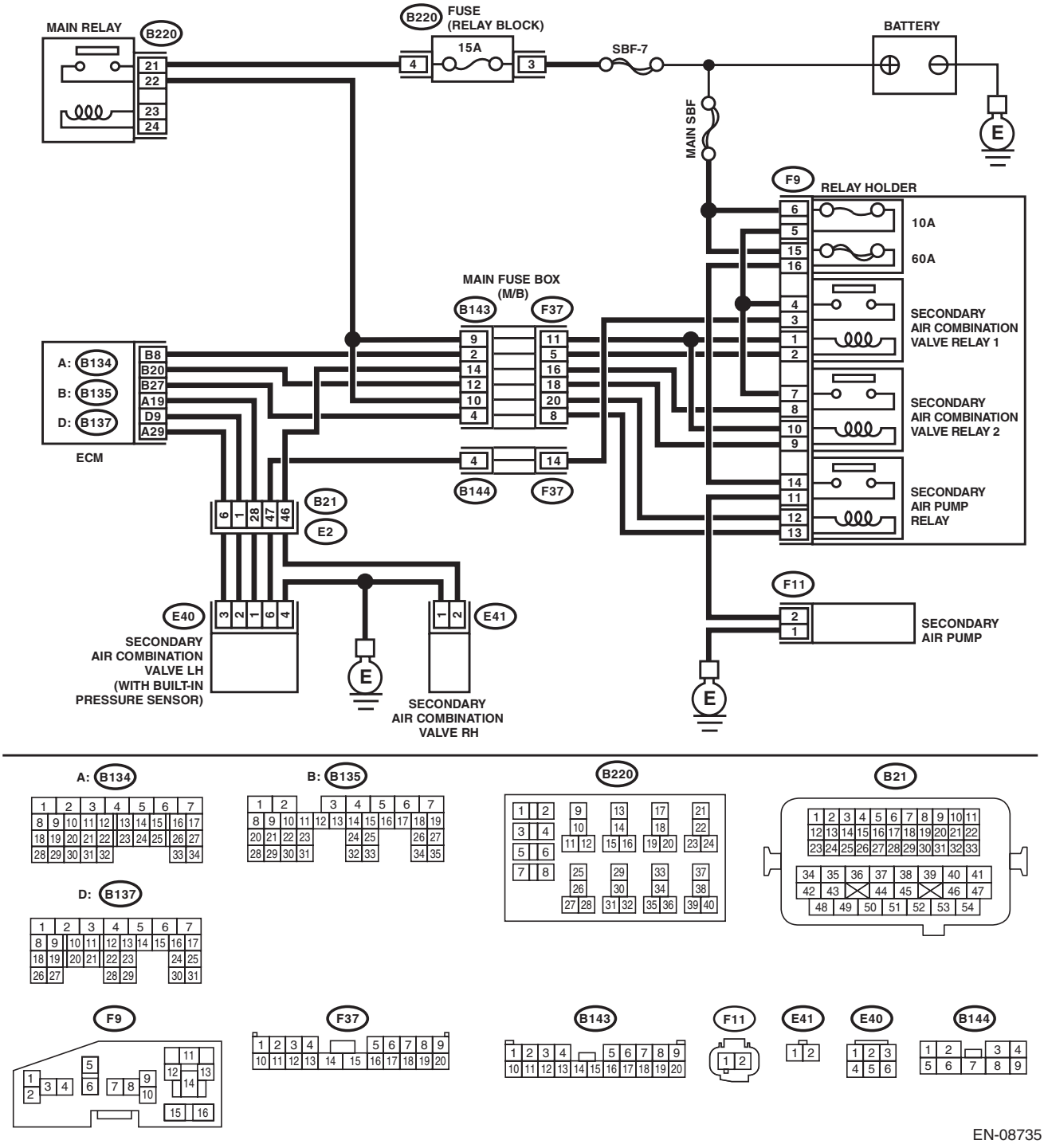
WIRING DIAGRAM:

• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08735

Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Remove the secondary air combination valve relay 1. 4) Measure the resistance of harness between ECM and secondary air combination valve relay 1 connector. ***Connector & terminal*** ***(B135) No. 8 — (F9) 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 secondary air combination valve relay 1 connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1 CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 8 — Chassis ground:***	Is the resistance 1 MΩ 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 short circuit to ground in harness between ECM and secondary air combination valve relay 1 connector.

CC:DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT SHORTED

DTC DETECTING CONDITION:

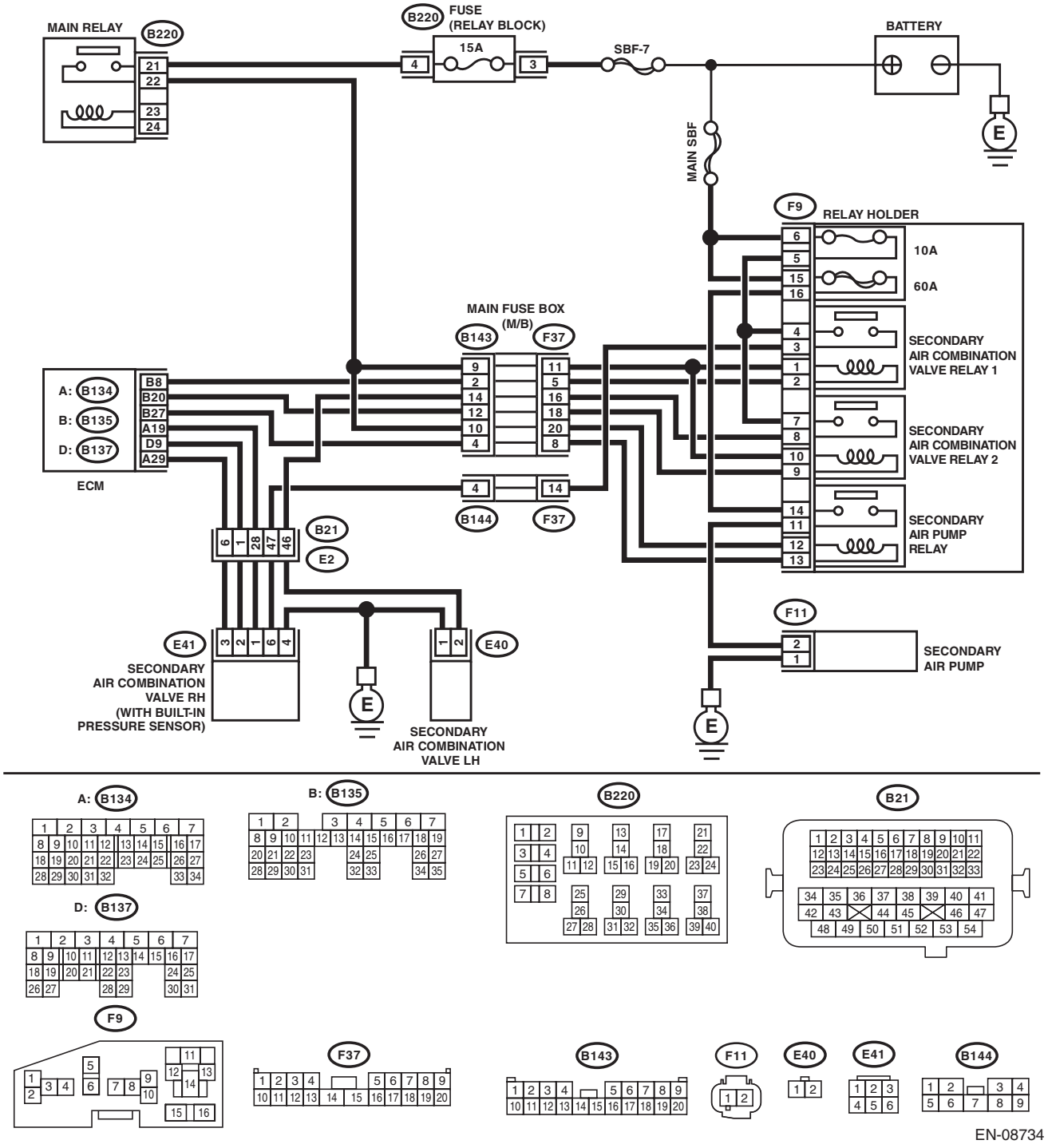
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-147, DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

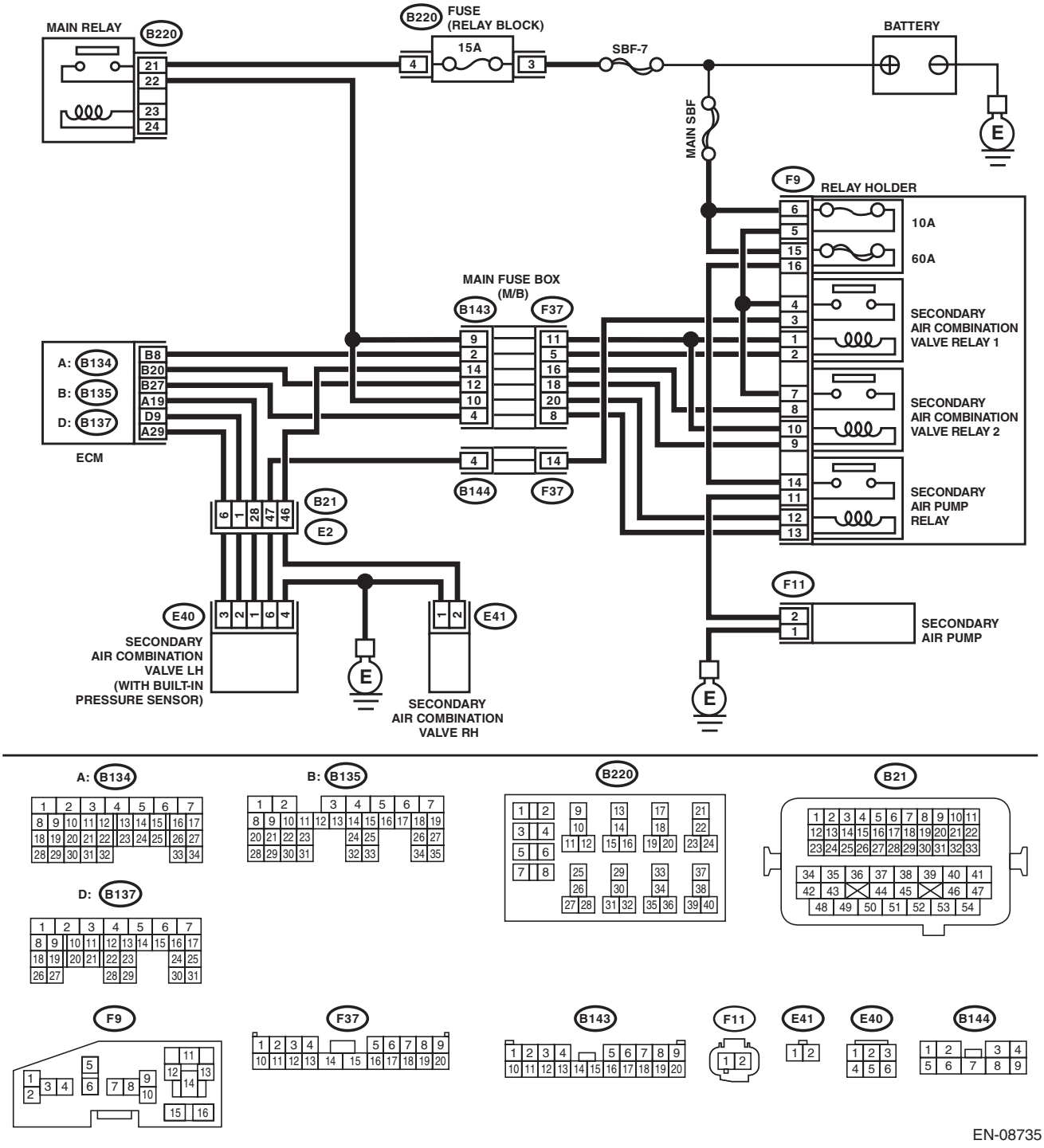
WIRING DIAGRAM:

• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Remove the secondary air combination valve relay 1. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 8 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM and secondary air combination valve relay 1 connector.	Repair the poor contact of ECM connector.

CD:DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “B” CIRCUIT OPEN

DTC DETECTING CONDITION:

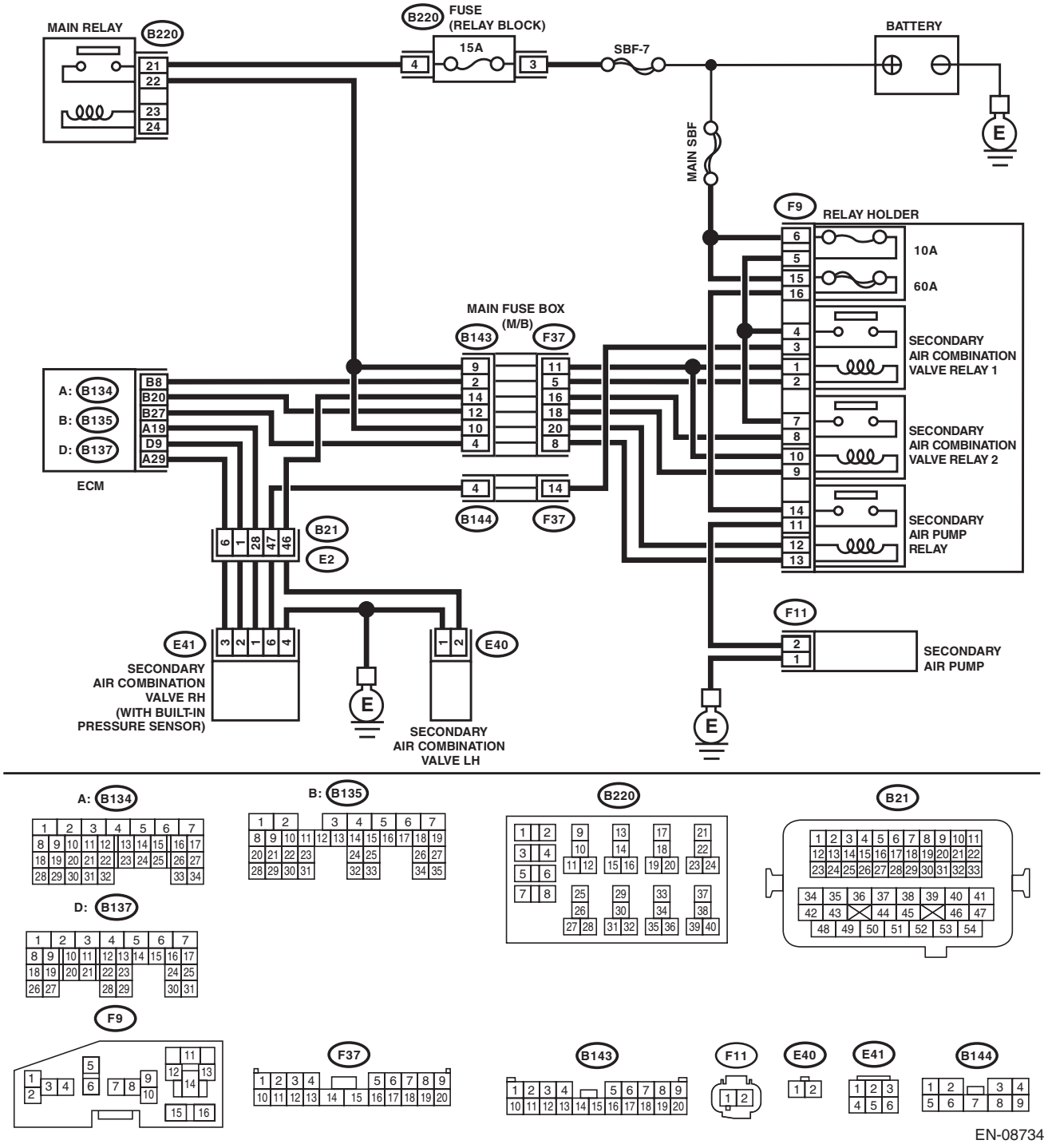
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-147, DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “B” CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

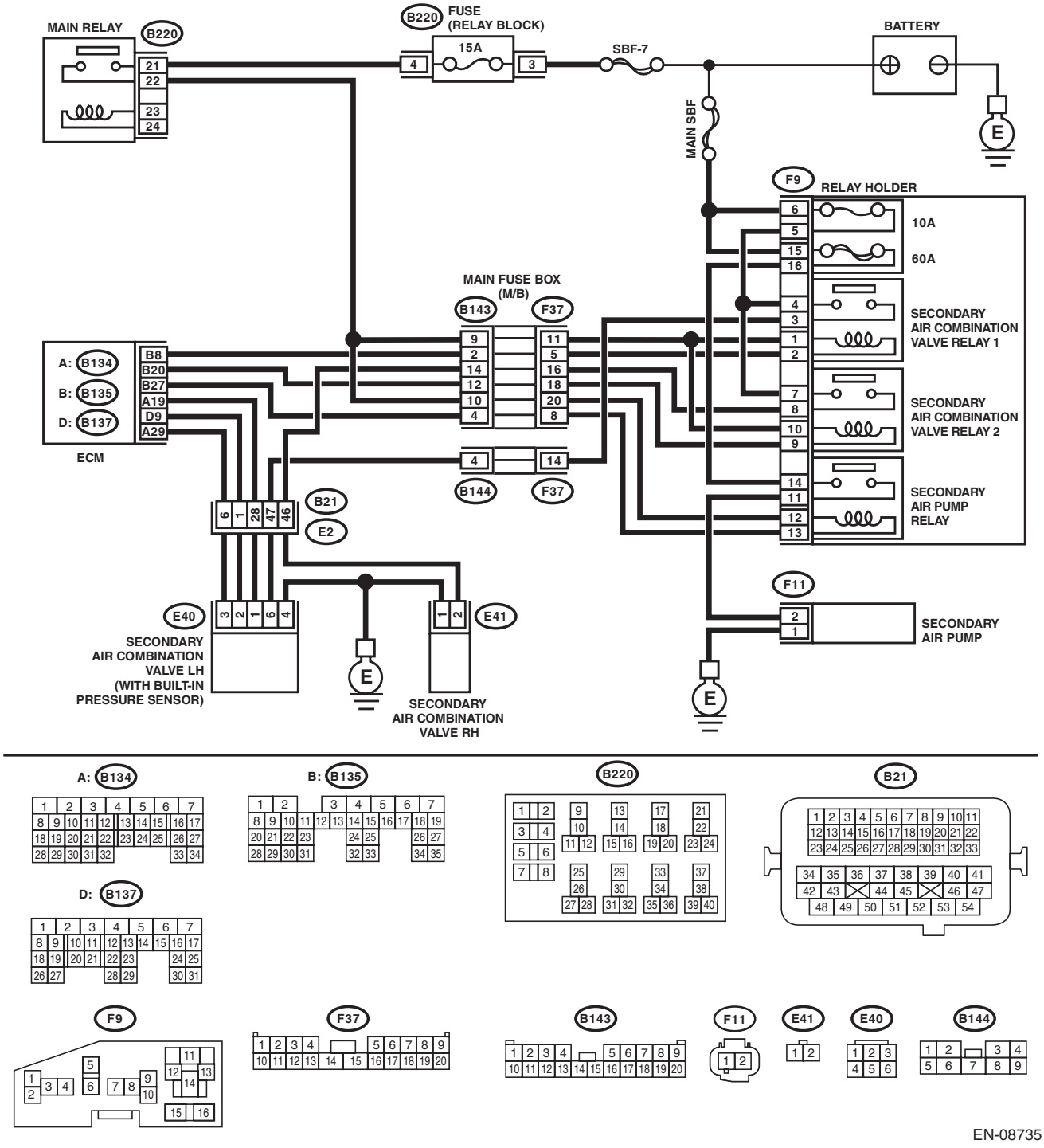
WIRING DIAGRAM:

• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08735

	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Remove the secondary air combination valve relay 2. 4) Measure the resistance of harness between ECM and secondary air combination valve relay 2 connector. ***Connector & terminal*** ***(B135) No. 20 — (F9) No. 9:***	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 secondary air combination valve relay 2 connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2 CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 20 — Chassis ground:***	Is the resistance 1 MΩ 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 short circuit to ground in harness between ECM and secondary air combination valve relay 2 connector.

CE:DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “B” CIRCUIT SHORTED

DTC DETECTING CONDITION:

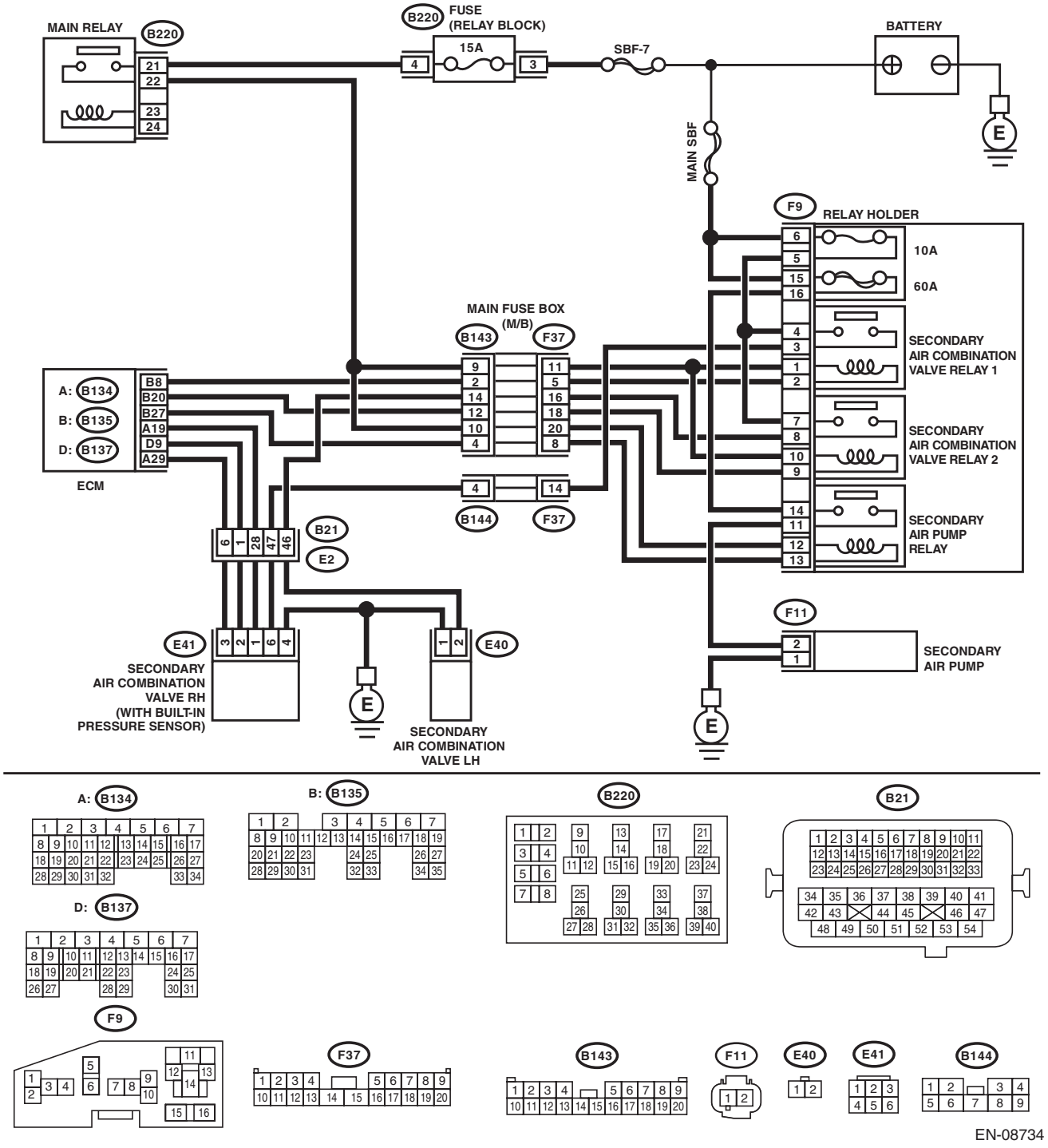
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-147, DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “B” CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

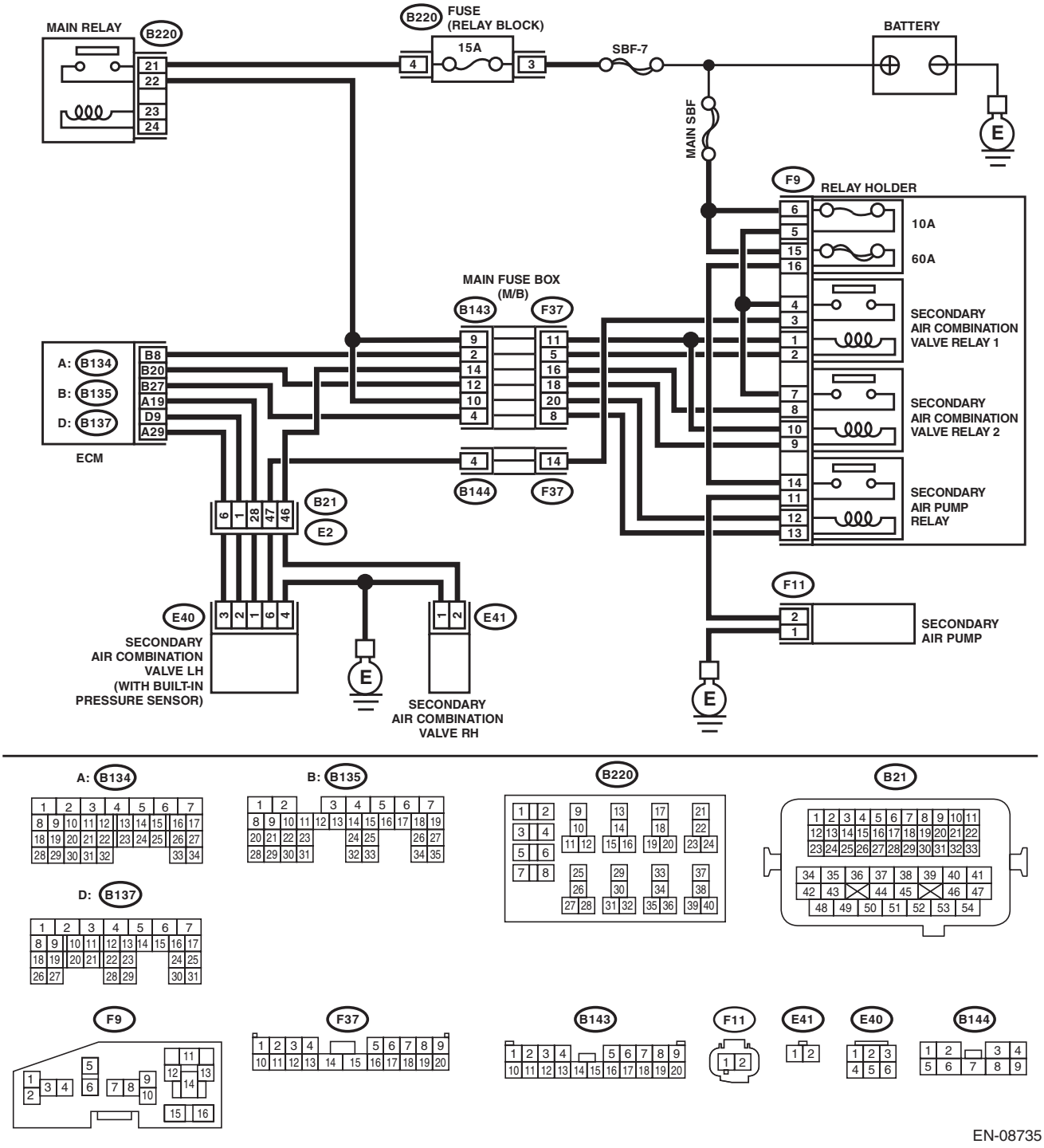
WIRING DIAGRAM:

• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08735

Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Remove the secondary air combination valve relay 2. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 20 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM and secondary air combination valve relay 2 connector.	Repair the poor contact of ECM connector.

CF: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(H4DOTC)-148, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

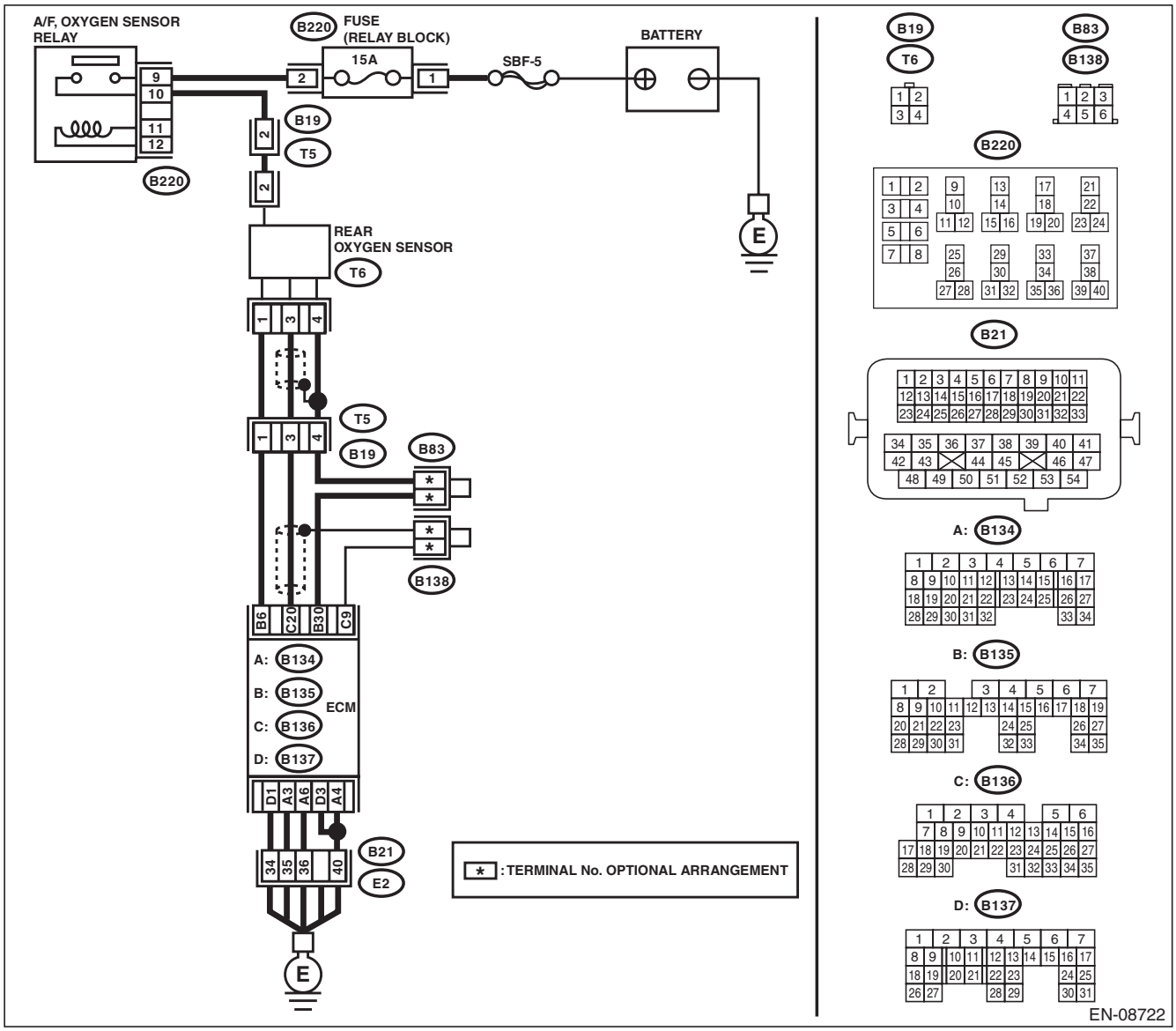
- Engine stalls.
- Idle mixture is out of specifications.

CAUTION:

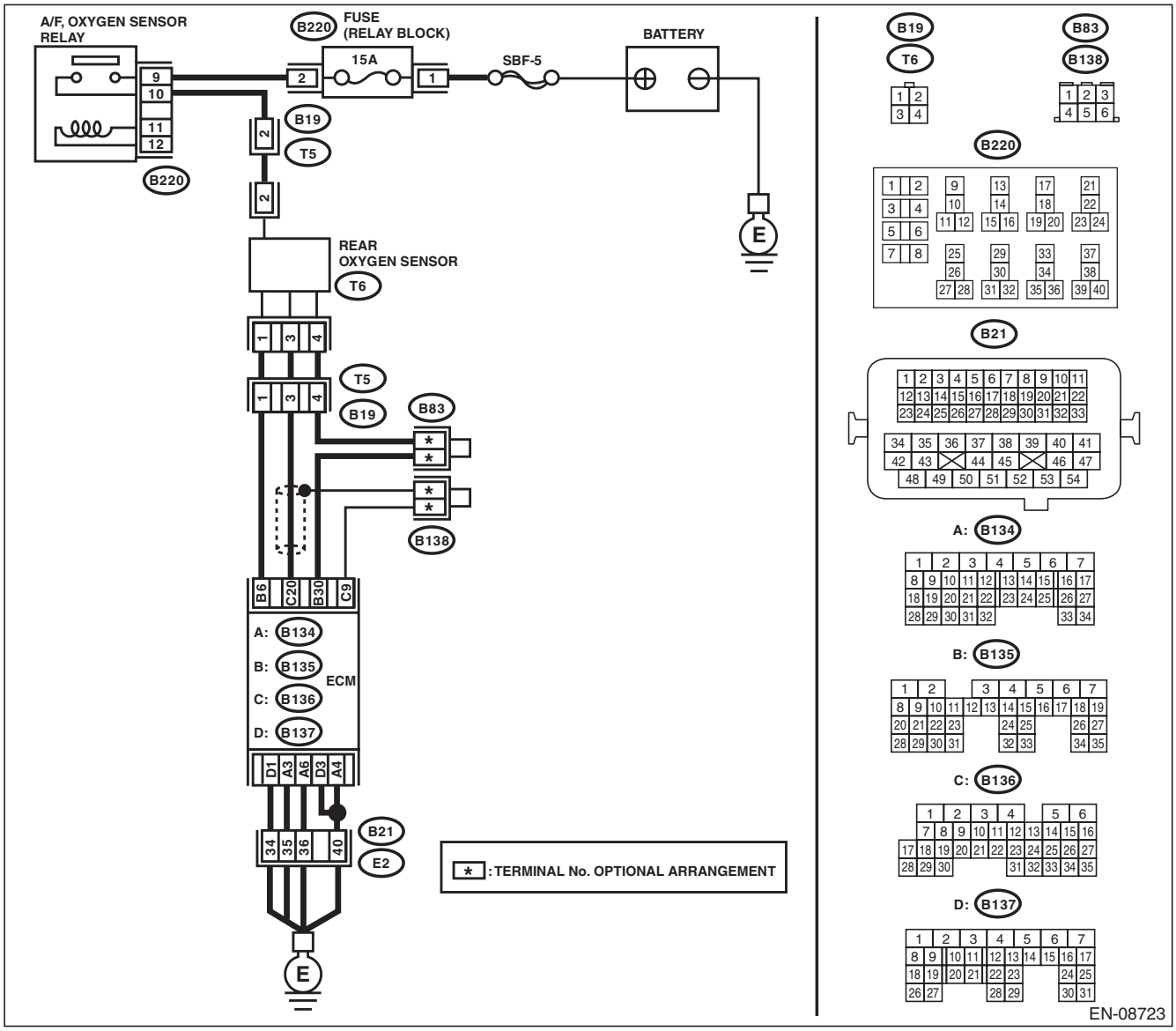
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

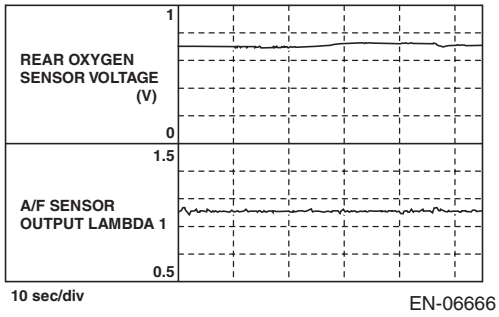
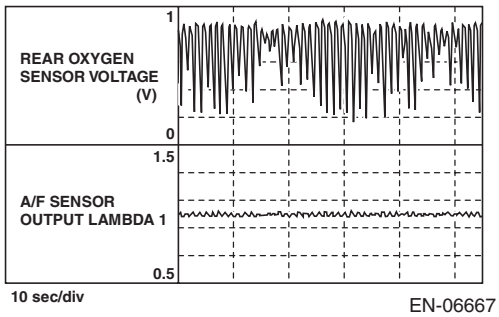
WIRING DIAGRAM:

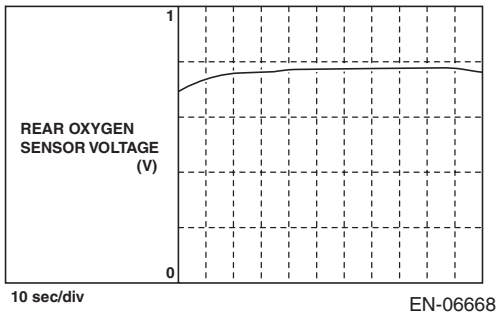
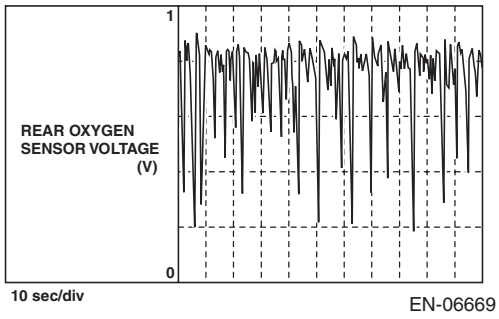
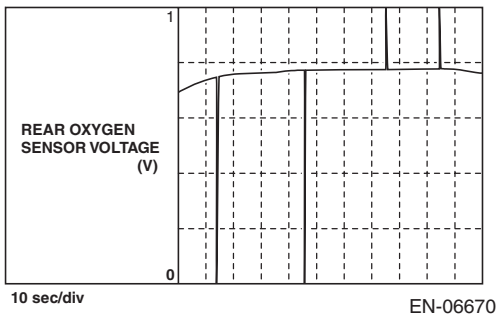
- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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(STI)-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(STI)-5, Front Catalytic Converter.> <Ref. to EC(w/o STI)-5, 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*** ***(B136) No. 20 — (T6) No. 3:*** ***(B135) No. 30 — (T6) 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 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?	Go to step **8**.	Repair the open circuit of rear oxygen sensor harness.
8	**CHECK ENGINE OIL AMOUNT AND EXHAUST GAS.** 1) Check the engine oil amount. <Ref. to LU(STI)-11, INSPECTION, Engine Oil.> 2) Check exhaust gas during idling.	Does the engine oil amount drop or white smoke emit from the muffler?	Check the engine, and repair the defective part. <Ref. to ME(STI)-105, INSPECTION, Engine Trouble in General.> <Ref. to ME(w/o STI)-103, INSPECTION, Engine Trouble in General.> After repairing the engine, replace the catalytic converter. <Ref. to EX(STI)-8, Center Exhaust Pipe.> After the catalytic converter is replaced, perform step 2 to check the normal waveform is displayed, and then exit the procedure.	Go to step **9**.
9	**CHECK IGNITION SYSTEM.** 1) Check the spark plug. <Ref. to IG(STI)-5, INSPECTION, Spark Plug.> <Ref. to IG(w/o STI)-6, INSPECTION, Spark Plug.> 2) Check the status of the ignition coil connector and the spark plug terminal.	Is there any fault in the ignition system?	After repairing the ignition system, replace the catalytic converter. <Ref. to EX(STI)-8, Center Exhaust Pipe.> After the catalytic converter is replaced, perform step 2 to check the normal waveform is displayed, and then exit the procedure.	Go to step **10**.

	Step	Check	Yes	No
10	**CHECK FUEL SYSTEM.** 1) Refer to and check the items in “Insufficient fuel supply to fuel injector (except for “a. Fuel pump does not operate.”)” and “Leakage or blow out of fuel”. <Ref. to FU(STI)-98, INSPECTION, Fuel System Trouble in General.> <Ref. to FU(w/o STI)-94, INSPECTION, Fuel System Trouble in General.> 2) Check throttle body. <Ref. to FU(STI)-15, INSPECTION, Throttle Body.> <Ref. to FU(w/o STI)-16, INSPECTION, Throttle Body.> 3) Check intake manifold. <Ref. to FU(STI)-33, INSPECTION, Intake Manifold.> <Ref. to FU(w/o STI)-33, INSPECTION, Intake Manifold.>	Is there any fault in the fuel system?	After repairing the fuel system, replace the catalytic converter. <Ref. to EX(STI)-8, Center Exhaust Pipe.> After the catalytic converter is replaced, perform step 2 to check the normal waveform is displayed, and then exit the procedure.	Go to step **11**.
11	**CHECK DTC.**	Is any other DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).> After checking the DTC, replace the catalytic converter. <Ref. to EX(STI)-8, Center Exhaust Pipe.> After the catalytic converter is replaced, perform step 2 to check the normal waveform is displayed, and then exit the procedure.	Replace the rear oxygen sensor. <Ref. to FU(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, Rear Oxygen Sensor.>

CG:DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-151, DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK PURGE CONTROL SOLENOID VALVE.** Operate the purge control solenoid valve using the Subaru Select Monitor. NOTE: Refer to "Compulsory Valve Operation Check Mode" for more operation procedures. <Ref. to EN(H4DOTC)(diag)-63, Compulsory Valve Operation Check Mode.>	Does the purge control solenoid valve operate?	Go to step **3**.	Replace the purge control solenoid valve. <Ref. to EC(STI)-11, Purge Control Solenoid Valve.> <Ref. to EC(w/o STI)-11, Purge Control Solenoid Valve.>
3	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.** 1) Turn the ignition switch to OFF. 2) Check the delivery (test) mode connector is disconnected.	Are there holes, cracks, clogging, or disconnection, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of ECM connector.

CH:DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-154, DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON (engine OFF). 2) Using the Subaru Select Monitor or general scan tool, read the value in «Atmosphere Pressure» and «Mani. Absolute Pressure», and compare them with the actual atmospheric pressure. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual. • To read the actual atmospheric pressure, connect the Subaru Select Monitor or general scan tool to the other known good vehicle.	Is the difference with the actual atmospheric pressure 27 kPa (200 mmHg, 7.9 inHg) or more?	Replace the parts that showed deviations from the actual atmospheric pressure. • If deviations are found in value for «Atmosphere Pressure»: Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.> • If deviations are found in value for «Mani. Absolute Pressure»: Replace the manifold pressure sensor. <Ref. to FU(STI)-43, Manifold Absolute Pressure Sensor.> <Ref. to FU(w/o STI)-43, Manifold Absolute Pressure 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.

CI: DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH LOW

DTC DETECTING CONDITION:

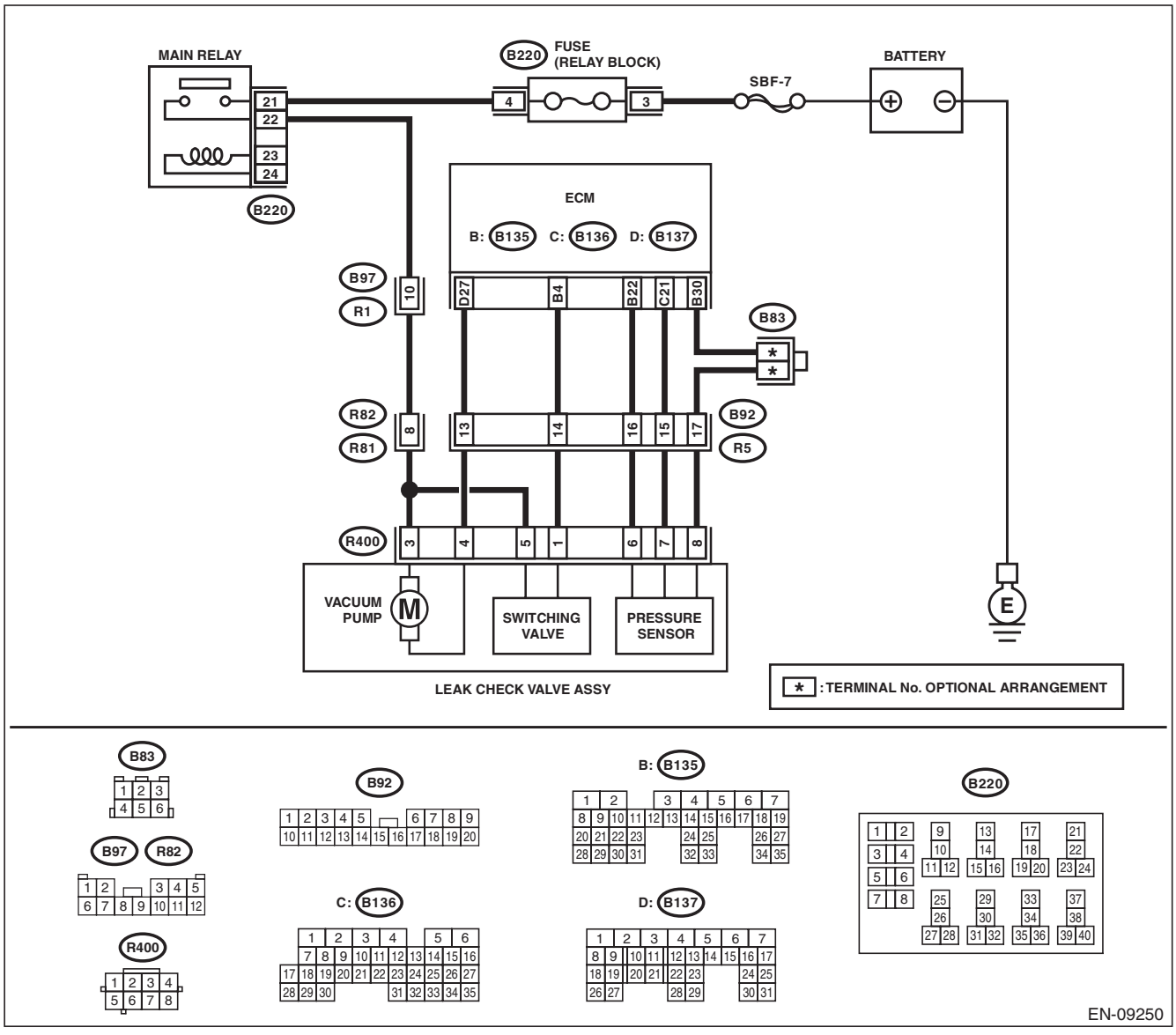
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-156, DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON. 2) Read the value of «Atmosphere Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Atmosphere Pressure» 34 kPa (255 mmHg, 10 inHg) or less?	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 LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between the leak check valve assembly connector and chassis ground. ***Connector & terminal*** ***(R400) No. 6 (+) — 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 in harness between ECM and the leak check valve assembly connector • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector 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?	Go to step **4**.	Repair the short circuit to ground in harness between ECM and leak check valve assembly connector.
4	**CHECK FOR POOR CONTACT.** Check for poor contact of leak check valve assembly connector.	Is there poor contact in the leak check valve assembly connector?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>

CJ:DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH HIGH

DTC DETECTING CONDITION:

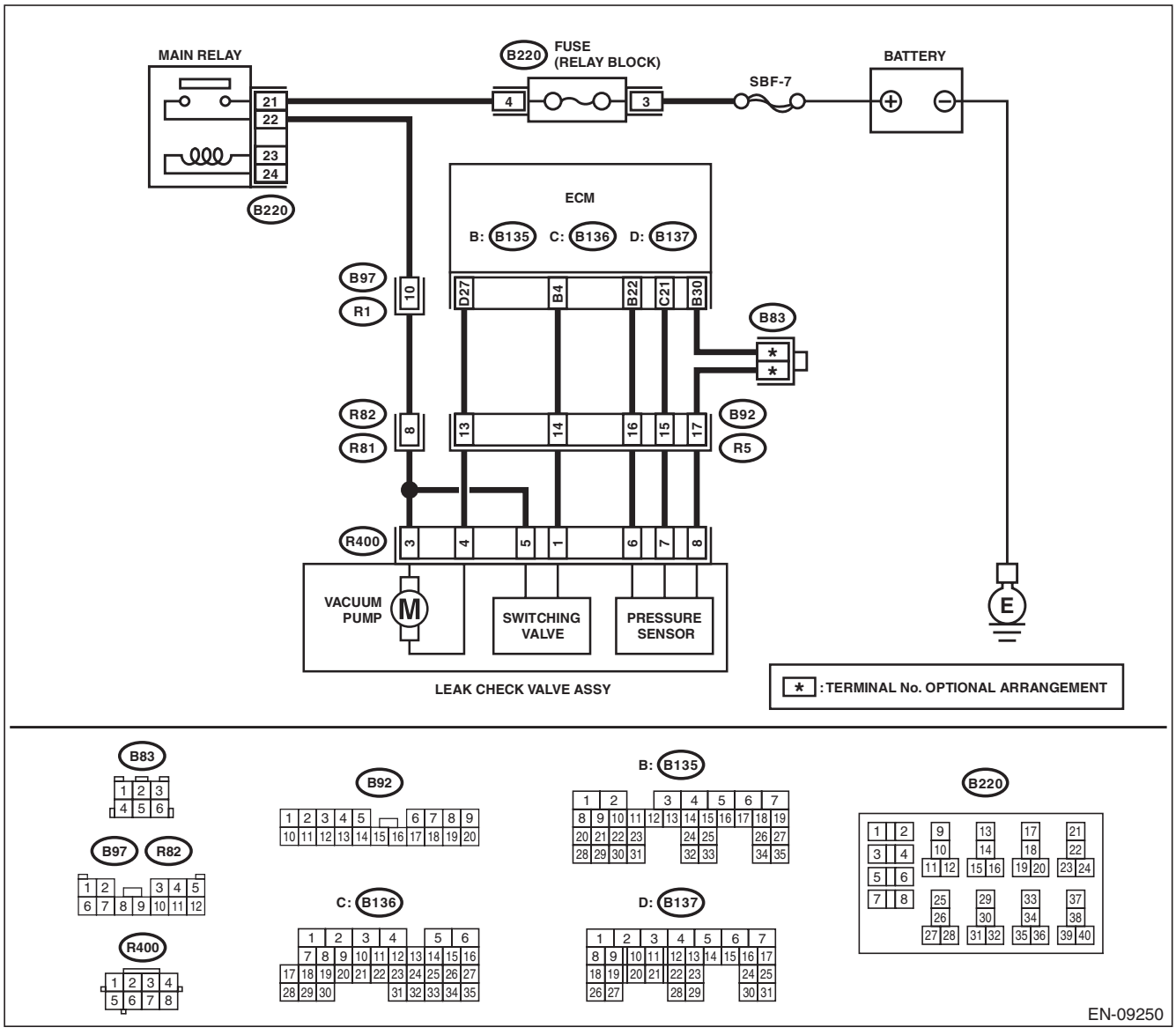
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-158, DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON. 2) Read the value of «Atmosphere Pressure» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Atmosphere Pressure» 125 kPa (938 mmHg, 36.9 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 LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the leak check valve assembly. 3) Measure the resistance of harness between ECM and the leak check valve assembly connector. ***Connector & terminal*** ***(B136) No. 21 — (R400) No. 7:*** ***(B135) No. 30 — (R400) No. 8:***	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 the leak check valve assembly connector • Poor contact of coupling connector • Poor contact of joint connector
3	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and the leak check valve assembly connector.	Is there poor contact in ECM and the leak check valve assembly connector?	Repair the poor contact of ECM and the leak check valve assembly connector.	Go to step **4**.
4	**CHECK LEAK CHECK VALVE ASSEMBLY.** Check the pressure sensor of the leak check valve assembly. <Ref. to EC(STI)-21, CHECK PRESSURE SENSOR, INSPECTION, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-22, CHECK PRESSURE SENSOR, INSPECTION, Leak Check Valve Assembly.>	Is the pressure sensor of the leak check valve assembly OK?	Repair the short circuit to power in harness between ECM and leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>

CK:DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK)

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-160, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE 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.
- Fuel filler cap loose or lost

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	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(STI)-77, Fuel Filler Pipe.> <Ref. to FU(w/o STI)-75, Fuel Filler Pipe.>	Go to step **4**.
4	**CHECK PURGE CONTROL SOLENOID VALVE.** Check air-tightness of the purge control solenoid valve. <Ref. to EC(STI)-12, INSPECTION, Purge Control Solenoid Valve.> <Ref. to EC(w/o STI)-13, INSPECTION, Purge Control Solenoid Valve.>	Is the purge control solenoid valve OK?	Go to step **5**.	Replace the purge control solenoid valve. <Ref. to EC(STI)-11, Purge Control Solenoid Valve.> <Ref. to EC(w/o STI)-11, Purge Control Solenoid Valve.>
5	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM LINE.**	Are there holes on the evaporation line?	Repair or replace the evaporation line. <Ref. to FU(STI)-93, Fuel Delivery, Return and Evaporation Lines.> <Ref. to FU(w/o STI)-89, Fuel Delivery, Return and Evaporation Lines.>	Go to step **6**.

	Step	Check	Yes	No
6	**CHECK CANISTER.**	Are there holes on the canister?	Replace the canister. <Ref. to EC(STI)-7, Canister.> <Ref. to EC(w/o STI)-7, Canister.>	Go to step **7**.
7	**CHECK LEAK CHECK VALVE ASSEMBLY.**	Are there damage or holes on the leak check valve assembly?	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>	Go to step **8**.
8	**CHECK FUEL TANK.** Remove the fuel tank. <Ref. to FU(STI)-70, Fuel Tank.> <Ref. to FU(w/o STI)-68, Fuel Tank.>	Are there damage or holes on the fuel tank?	Repair or replace the fuel tank. <Ref. to FU(STI)-70, Fuel Tank.> <Ref. to FU(w/o STI)-68, Fuel Tank.>	Go to step **9**.
9	**CHECK ANY OTHER MECHANICAL TROUBLE IN EVAPORATIVE EMISSION CONTROL SYSTEM.**	Are there holes, cracks, clogging, or disconnection, misconnection of hoses or pipes in evaporative emission control system?	Repair or replace the hoses or pipes.	Repair the poor contact of ECM connector.

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

NOTE:
For the diagnostic procedure, refer to DTC P0455. <Ref. to EN(H4DOTC)(diag)-259, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CM: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(H4DOTC)-166, DTC P0458 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

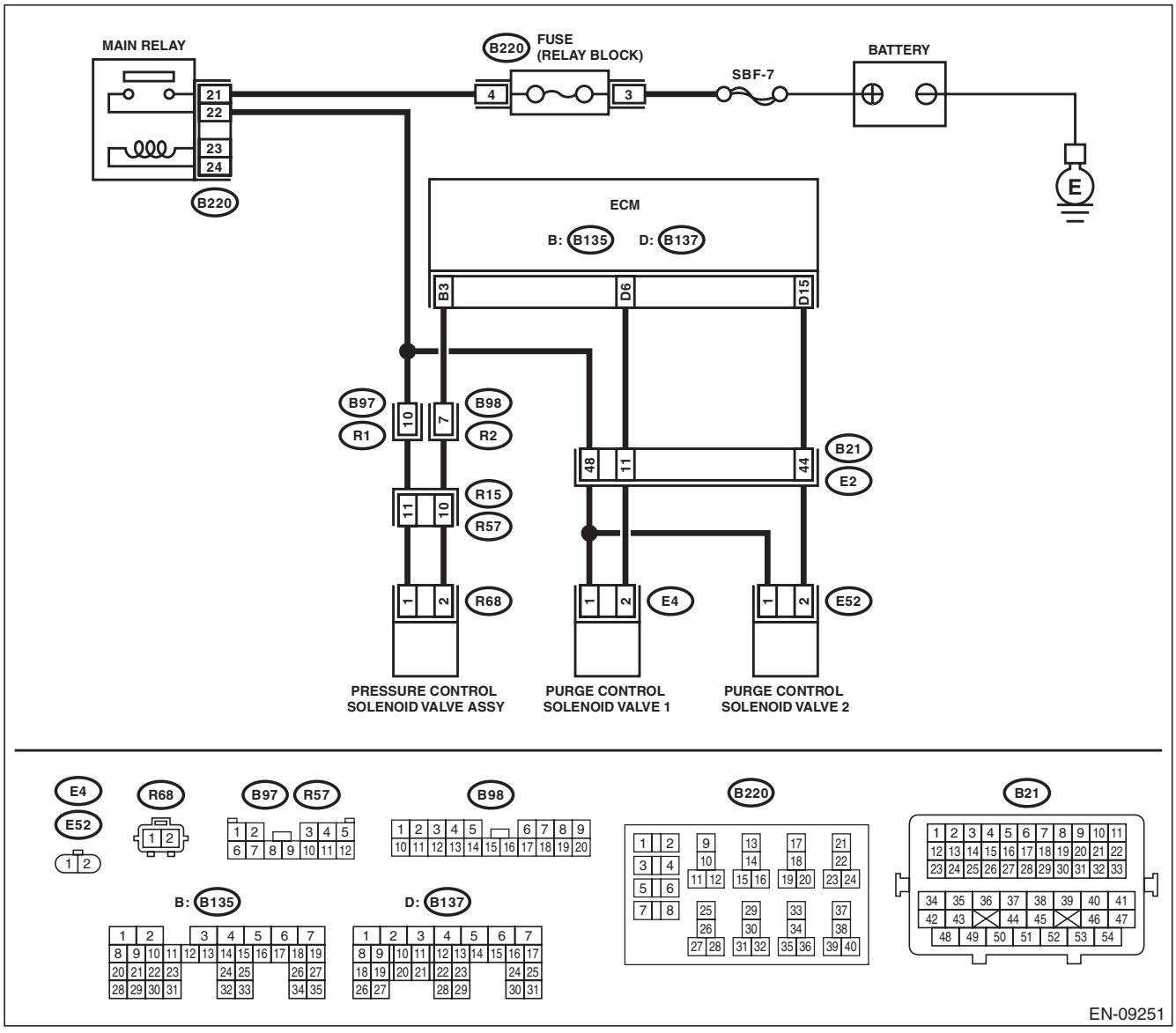
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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. 6 (+) — 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 CONNECTOR.** Measure the voltage between purge control solenoid valve connector and engine ground. ***Connector & terminal*** ***(E4) No. 1 (+) — 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. 2 — 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. ***Connector & terminal*** ***(B137) No. 6 — (E4) 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 purge control solenoid valve connector • Poor contact of coupling connector

	Step	Check	Yes	No
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(STI)-11, Purge Control Solenoid Valve.> <Ref. to EC(w/o STI)-11, Purge Control Solenoid Valve.>

CN: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(H4DOTC)-168, DTC P0459 EVAPORATIVE EMISSION SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

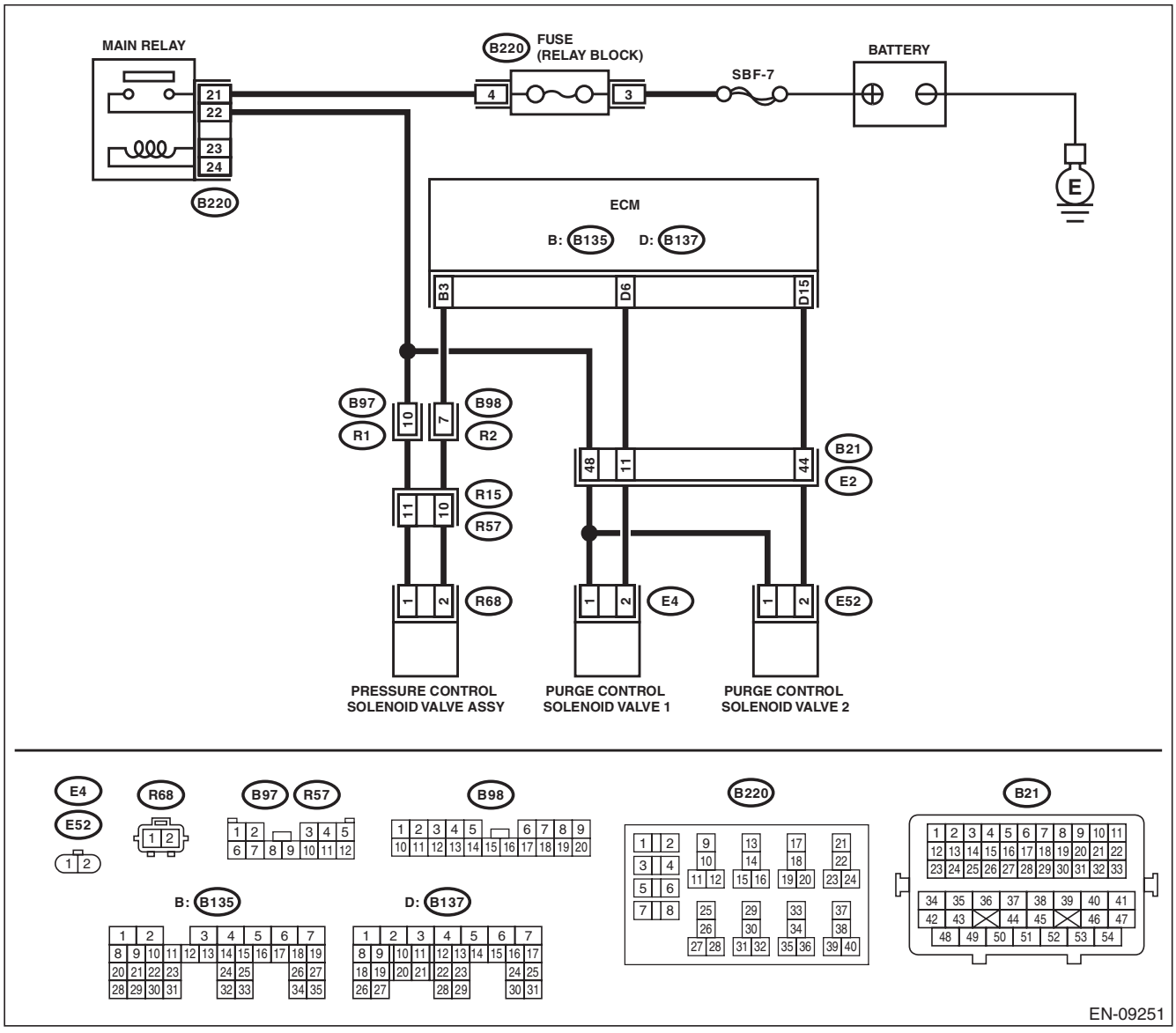
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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. 6 (+) — 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(STI)-11, Purge Control Solenoid Valve.> <Ref. to EC(w/o STI)-11, Purge Control Solenoid Valve.>	Repair the poor contact of ECM connector.

CO: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(H4DOTC)-170, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Replace the fuel level sensor and fuel sub level sensor. <Ref. to FU(STI)-82, Fuel Level Sensor.> <Ref. to FU(STI)-83, Fuel Sub Level Sensor.> <Ref. to FU(w/o STI)-80, Fuel Level Sensor.> <Ref. to FU(w/o STI)-81, Fuel Sub Level Sensor.>

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

NOTE:
For the diagnostic procedure, refer to DTC P0463. <Ref. to EN(H4DOTC)(diag)-267, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CQ: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(H4DOTC)-174, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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-9, 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.

CR:DTC P04AC EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT LOW

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-176, DTC P04AC EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

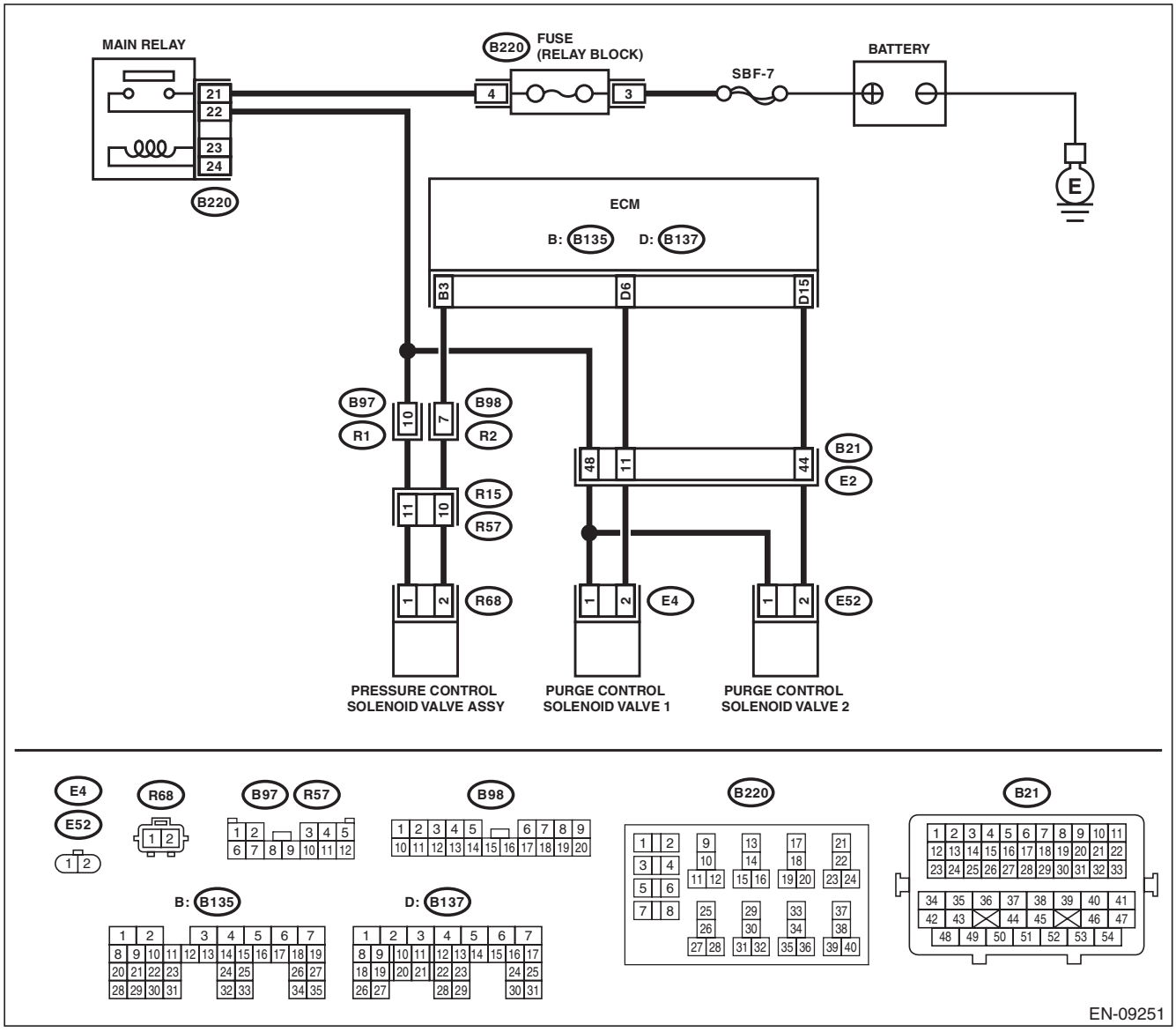
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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. 15 (+) — 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 2 CONNECTOR.** Measure the voltage between purge control solenoid valve 2 connector and engine ground. ***Connector & terminal*** ***(E52) No. 1 (+) — 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 2 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve 2. 3) Measure the resistance between the purge control solenoid valve 2 connector and engine ground. ***Connector & terminal*** ***(E52) No. 2 — 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 2 connector.
5	**CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE 2 CONNECTOR.** Measure the resistance of harness between ECM and purge control solenoid valve 2 connector. ***Connector & terminal*** ***(B137) No. 15 — (E52) 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 purge control solenoid valve 2 connector • Poor contact of coupling connector

Step		Check	Yes	No
6	**CHECK PURGE CONTROL SOLENOID VALVE 2.** 1) Remove the purge control solenoid valve 2. 2) Measure the resistance between purge control solenoid valve 2 terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 10 — 100 Ω?	Repair the poor contact of the purge control solenoid valve 2 connector.	Replace the purge control solenoid valve 2. <Ref. to EC(STI)-11, Purge Control Solenoid Valve.> <Ref. to EC(w/o STI)-11, Purge Control Solenoid Valve.>

CS:DTC P04AD EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT HIGH

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-177, DTC P04AD EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

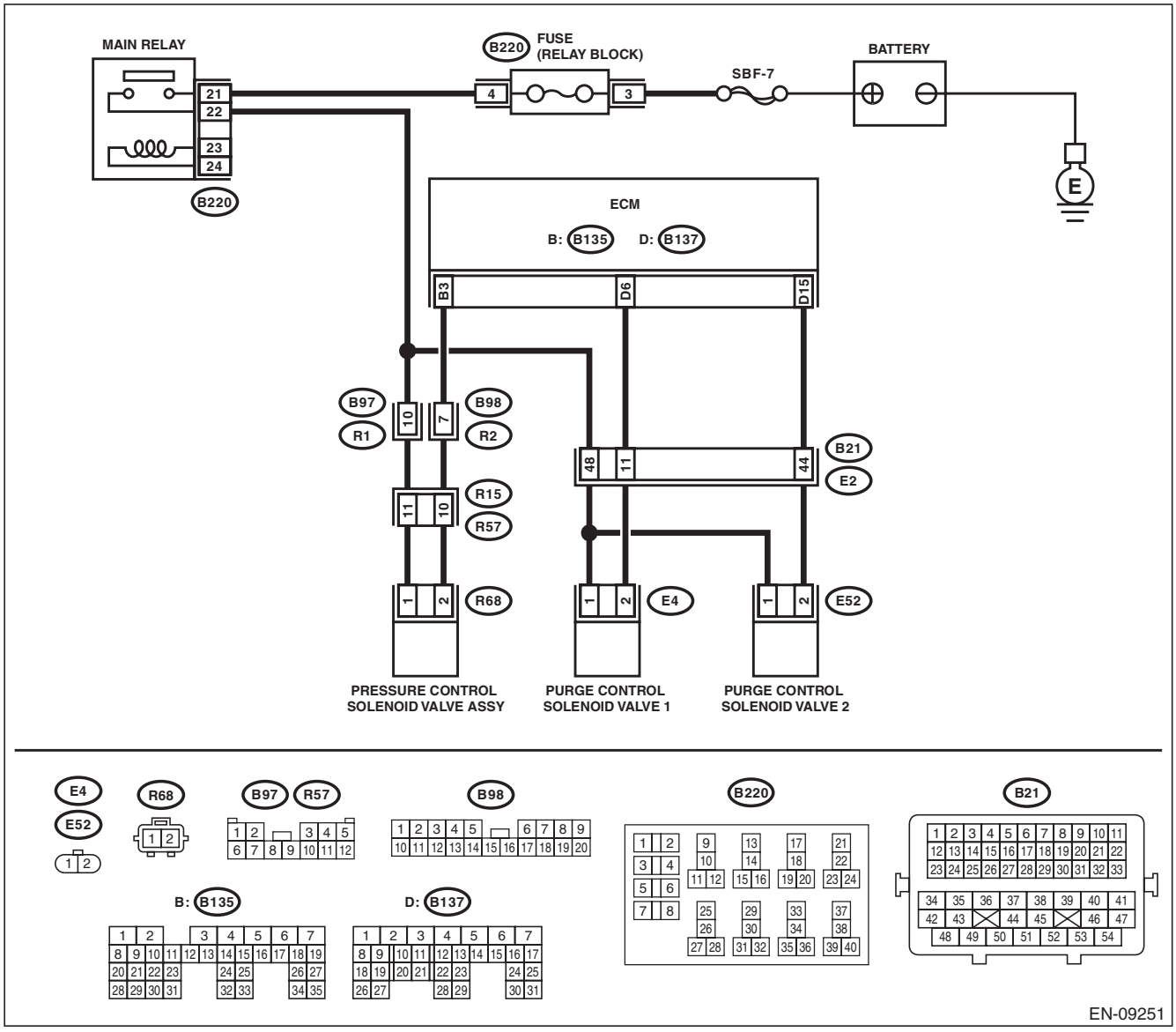
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND PURGE CONTROL SOLENOID VALVE 2 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and purge control solenoid valve 2. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 15 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short to power in the harness between ECM and purge control solenoid valve 2 connector.	Go to step **2**.
2	**CHECK PURGE CONTROL SOLENOID VALVE 2.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between purge control solenoid valve 2 terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Replace the purge control solenoid valve 2. <Ref. to EC(STI)-11, Purge Control Solenoid Valve.> <Ref. to EC(w/o STI)-11, Purge Control Solenoid Valve.>	Repair the poor contact of ECM connector.

CT:DTC P04DB CRANKCASE VENTILATION SYSTEM DISCONNECTED

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-178, DTC P04DB CRANKCASE VENTILATION SYSTEM DISCONNECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

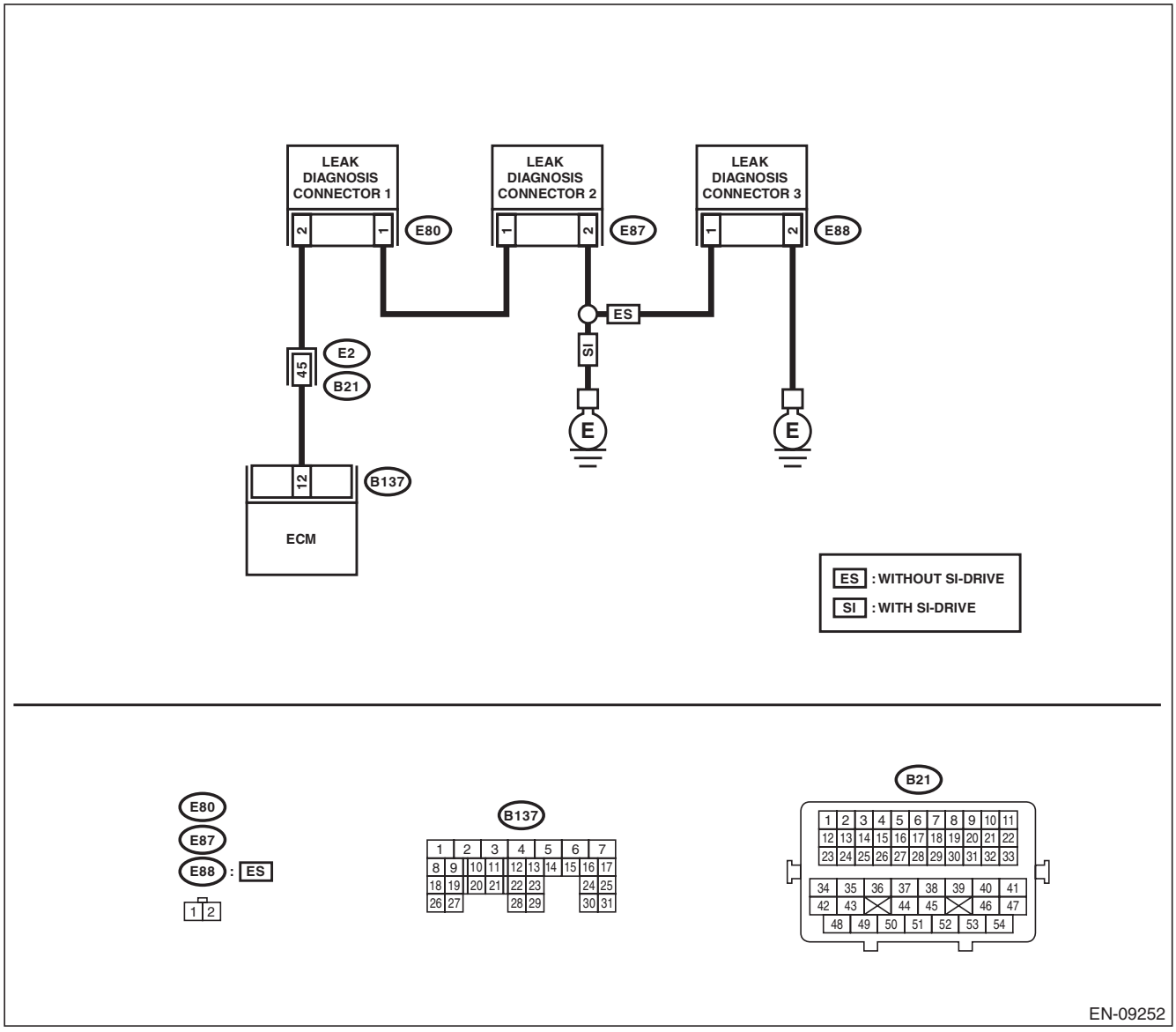
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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?	Install or replace the blow-by hose.	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND PCV HOSE ASSEMBLY CONNECTOR.** 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*** ***(B137) No. 12 — (E80) 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 CONNECTOR.** Measure the resistance between PCV hose assembly connector and chassis ground. ***Connector & terminal*** ***(B137) No. 12 — 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 HARNESS BETWEEN LEAK DIAGNOSIS CONNECTORS.** Measure the resistance of harness between leak diagnosis connectors. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(B80) No. 1 — (B87) No. 1:*** ***(B87) No. 2 — (B88) No. 1:*** ***Models with SI-DRIVE*** ***(B80) No. 1 — (B87) No. 1:***	Is the resistance less than 1 Ω?	Go to step **5**.	Repair the open circuit in the wiring harness between leak diagnosis connectors.
5	**CHECK GROUND CIRCUIT OF PCV HOSE ASSEMBLY.** Measure the resistance of harness between PCV hose assembly connector and engine ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(B88) No. 2 — Engine ground:*** ***Models with SI-DRIVE*** ***(B87) No. 2 — Engine ground:***	Is the resistance less than 5 Ω?	Go to step **6**.	Repair the open circuit in harness between PCV hose assembly connector and engine ground.
6	**CHECK PCV HOSE ASSEMBLY.** Measure the resistance between terminals of each leak diagnosis connector. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω at all measurement?	Repair the poor contact of ECM and PCV hose assembly connector.	Replace the PCV hose assembly. <Ref. to EC(STI)-24, PCV Hose Assembly.> <Ref. to EC(w/o STI)-25, PCV Hose Assembly.>

CU:DTC P0500 VEHICLE SPEED SENSOR “A”

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-180, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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)-48, List of Diagnostic Trouble Code (DTC).>	Repair the poor contact of ECM connector.

CV: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(H4DOTC)-181, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, 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(STI)-7, Air Cleaner Element.> <Ref. to IN(w/o STI)-7, Air Cleaner Element.>	Go to step **3**.
3	**CHECK ELECTRONIC THROTTLE CONTROL.** 1) Remove the electronic throttle control. <Ref. to FU(STI)-15, REMOVAL, Throttle Body.> <Ref. to FU(w/o STI)-15, 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(H4DOTC)(diag)-369, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CW: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(H4DOTC)-182, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, 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(STI)-15, REMOVAL, Throttle Body.> <Ref. to FU(w/o STI)-15, 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(H4DOTC)(diag)-369, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CX:DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-183, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

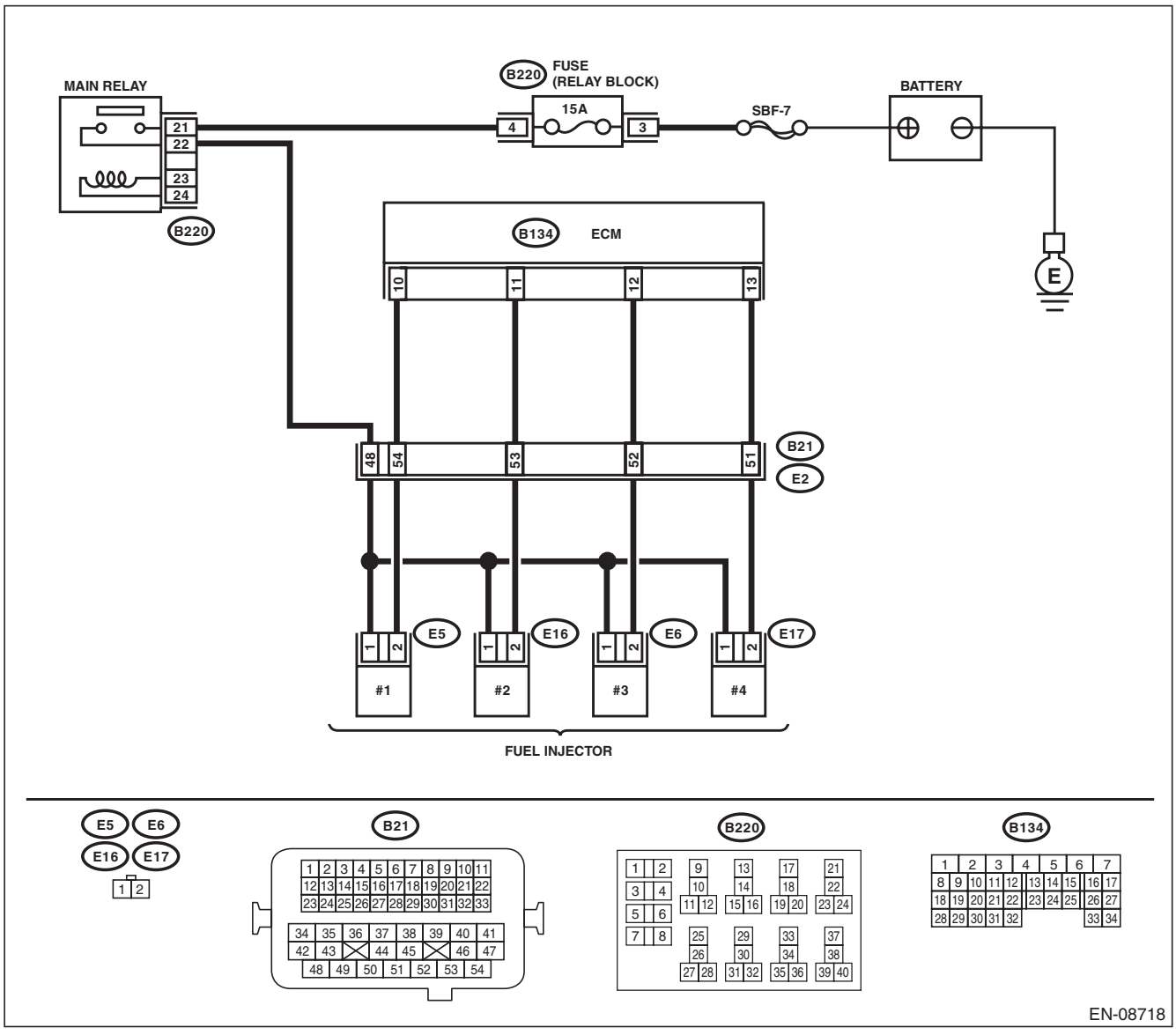
- Engine keeps running at higher speed than specified idle speed.
- Engine keeps running at a lower speed than the specified idle speed.
- Engine stalls.

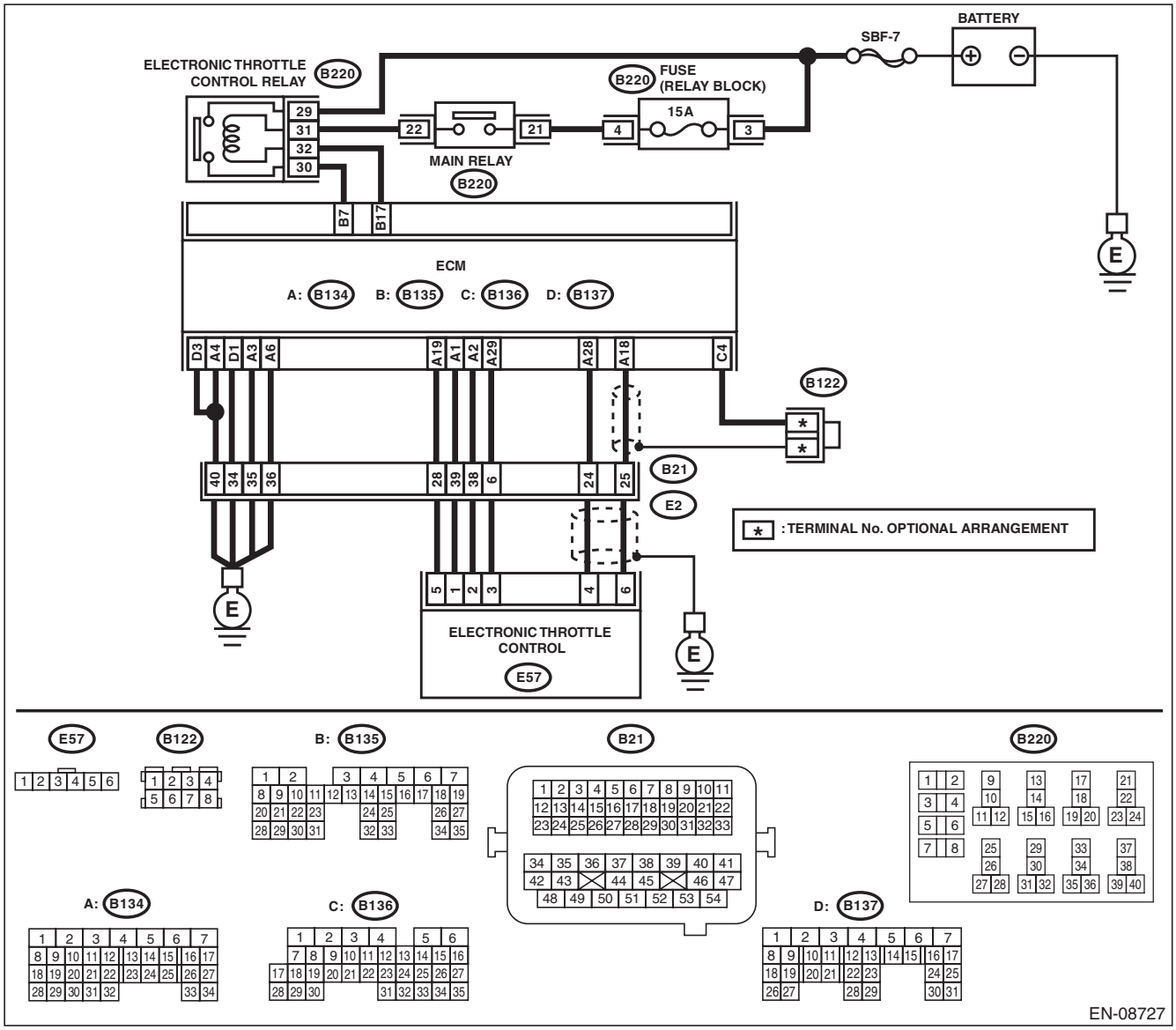
CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>





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(H4DOTC)(diag)-87, 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(STI)-11, 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 while disconnecting pressure regulator vacuum hose from intake manifold. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: If fuel pressure does not increase, squeeze the fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value 284 — 314 kPa (2.9 — 3.2 kg/cm^2, 41 — 46 psi)?	Go to step **6**.	Repair the following item. Fuel pressure is too high: • Clogged fuel return line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel supply line
6	**CHECK FUEL PRESSURE.** After connecting the pressure regulator vacuum hose, measure fuel pressure. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: • If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. • If the measured value at this step is out of specification, check or replace pressure regulator and pressure regulator vacuum hose.	Is the measured value 230 — 260 kPa (2.35 — 2.65 kg/cm^2, 33 — 38 psi)?	Go to step **7**.	Repair the following item. Fuel pressure is too high: • Faulty pressure regulator • Clogged fuel return line or bent hose Fuel pressure is too low: • Faulty pressure regulator • Improper fuel pump discharge • Clogged fuel supply line
7	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **8**.	Replace the engine coolant temperature sensor. <Ref. to FU(STI)-34, Engine Coolant Temperature Sensor.> <Ref. to FU(w/o STI)-34, Engine Coolant 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) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **9**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>
9	**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) Place the shift lever in 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 value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **10**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>
10	**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 (B134) No. 10 (+) — Chassis ground (–):*** ***#2 (B134) No. 11 (+) — Chassis ground (–):*** ***#3 (B134) No. 12 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **15**.	Go to step **11**.

	Step	Check	Yes	No
11	**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. 2 — Engine ground:*** ***#2 (E16) No. 2 — Engine ground:*** ***#3 (E6) No. 2 — Engine ground:*** ***#4 (E17) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **12**.	Repair the short circuit to ground in harness between ECM and fuel injector connector.
12	**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 (B134) No. 10 — (E5) No. 2:*** ***#2 (B134) No. 11 — (E16) No. 2:*** ***#3 (B134) No. 12 — (E6) No. 2:*** ***#4 (B134) No. 13 — (E17) No. 2:***	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 ECM and fuel injector connector • Poor contact of coupling connector
13	**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 **14**.	Replace the faulty fuel injector. <Ref. to FU(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, Fuel Injector.>
14	**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. 1 (+) — Engine ground (–):*** ***#2 (E16) No. 1 (+) — Engine ground (–):*** ***#3 (E6) No. 1 (+) — Engine ground (–):*** ***#4 (E17) No. 1 (+) — 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
15	**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 (B134) No. 10 (+) — Chassis ground (–):*** ***#2 (B134) No. 11 (+) — Chassis ground (–):*** ***#3 (B134) No. 12 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — 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 **16**.

	Step	Check	Yes	No
16	**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?	Go to step **17**.	Replace the faulty fuel injector. <Ref. to FU(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, Fuel Injector.>
17	**CHECK INSTALLATION OF CAMSHAFT POSITION SENSOR/CRANKSHAFT POSITION SENSOR.**	Is the camshaft position sensor or crankshaft position sensor loosely installed?	Tighten the camshaft position sensor or crankshaft position sensor. <Ref. to FU(STI)-37, Camshaft Position Sensor.> <Ref. to FU(STI)-35, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-37, Camshaft Position Sensor.> <Ref. to FU(w/o STI)-35, Crankshaft Position Sensor.>	Go to step **18**.
18	**CHECK CRANK SPROCKET.** Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.> <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>	Is the crank sprocket rusted or does it have broken teeth?	Replace the crank sprocket. <Ref. to ME(STI)-59, Crank Sprocket.> <Ref. to ME(w/o STI)-58, Crank Sprocket.>	Go to step **19**.
19	**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(STI)-49, Timing Belt.> <Ref. to ME(w/o STI)-48, Timing Belt.>	Go to step **20**.
20	**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 **21**.	Replace the electronic throttle control relay. <Ref. to FU(STI)-64, Electronic Throttle Control Relay.> <Ref. to FU(w/o STI)-62, Electronic Throttle Control Relay.>
21	**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 **22**.	Repair the open or ground short circuit of power supply circuit.

	Step	Check	Yes	No
22	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** 1) Disconnect the connector 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 **23**.
23	**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 **24**.	Repair the short circuit in harness to ground between ECM and electronic throttle control relay connector.
24	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY CONNECTOR.** Measure the resistance between ECM and electronic throttle control relay connector. ***Connector & terminal*** ***(B135) No. 17 — (B220) No. 32:*** ***(B135) No. 7 — (B220) No. 30:***	Is the resistance less than 1 Ω?	Go to step **25**.	Repair the open circuit in harness between ECM and electronic throttle control relay connector.
25	**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. 4:*** ***(B134) No. 28 — Chassis 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.
26	**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*** ***(B57) No. 6 — Engine ground:*** ***(B57) No. 4 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **27**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector. Replace the ECM if defective. <Ref. to FU(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>

	Step	Check	Yes	No
27	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Disconnect the connector 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 **28**.	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
28	**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 **29**.	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
29	**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 **30**.
30	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector 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 **31**.	Repair the short circuit to power in harness between ECM and electronic throttle control connector.
31	**CHECK SENSOR OUTPUT.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Read the value of «Main-Throttle Sensor» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to “READ CURRENT DATA FOR ENGINE”. <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Main-Throttle Sensor» 0.81 — 0.87 V?	Go to step **32**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>

	Step	Check	Yes	No
32	**CHECK SENSOR OUTPUT.** Read the value of «Sub-Throttle Sensor» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Sub-Throttle Sensor» 1.64 — 1.70 V?	Go to step **33**.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective. <Ref. to FU(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>
33	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.** 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*** ***(B134) No. 2 — (E57) No. 2:*** ***(B134) No. 1 — (E57) No. 1:***	Is the resistance less than 1 Ω?	Go to step **34**.	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
34	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.** 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 **35**.
35	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector 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 **36**.	Repair the short circuit to ground in harness between ECM and electronic throttle control connector.
36	**CHECK ELECTRONIC THROTTLE CONTROL MOTOR 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 **37**.	Repair the short circuit of harness between ECM and electronic throttle control connector.

	Step	Check	Yes	No
37	**CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B134) No. 6 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 3 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **38**.	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
38	**CHECK ELECTRONIC THROTTLE CONTROL.** Measure the resistance between electronic throttle control terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 50 Ω or less?	Go to step **39**.	Replace the electronic throttle control. <Ref. to FU(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>
39	**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(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>

CY:DTC P050B COLD START IGNITION TIMING PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P050A. <Ref. to EN(H4DOTC)(diag)-278, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

CZ:DTC P0560 SYSTEM VOLTAGE

DTC DETECTING CONDITION:

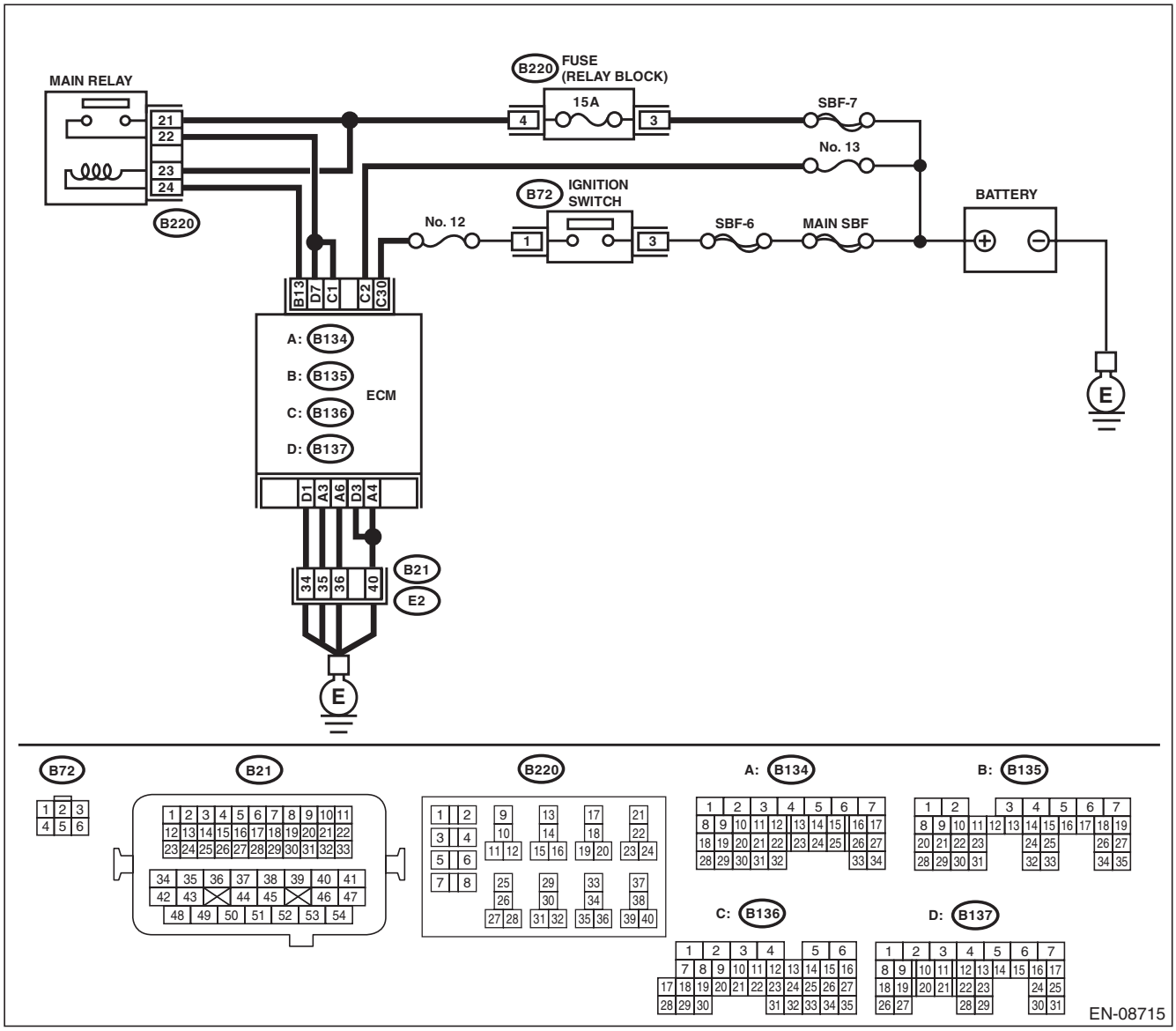
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-188, DTC P0560 SYSTEM VOLTAGE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***(B136) No. 2 (+) — 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 MAIN FUSE BOX CONNECTOR.** 1) Disconnect the connector from ECM. 2) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 2 — 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.**	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

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-189, 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(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, 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.

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

NOTE:
For the diagnostic procedure, refer to DTC P0606. <Ref. to EN(H4DOTC)(diag)-291, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DC:DTC P0606 CONTROL MODULE PROCESSOR

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-191, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

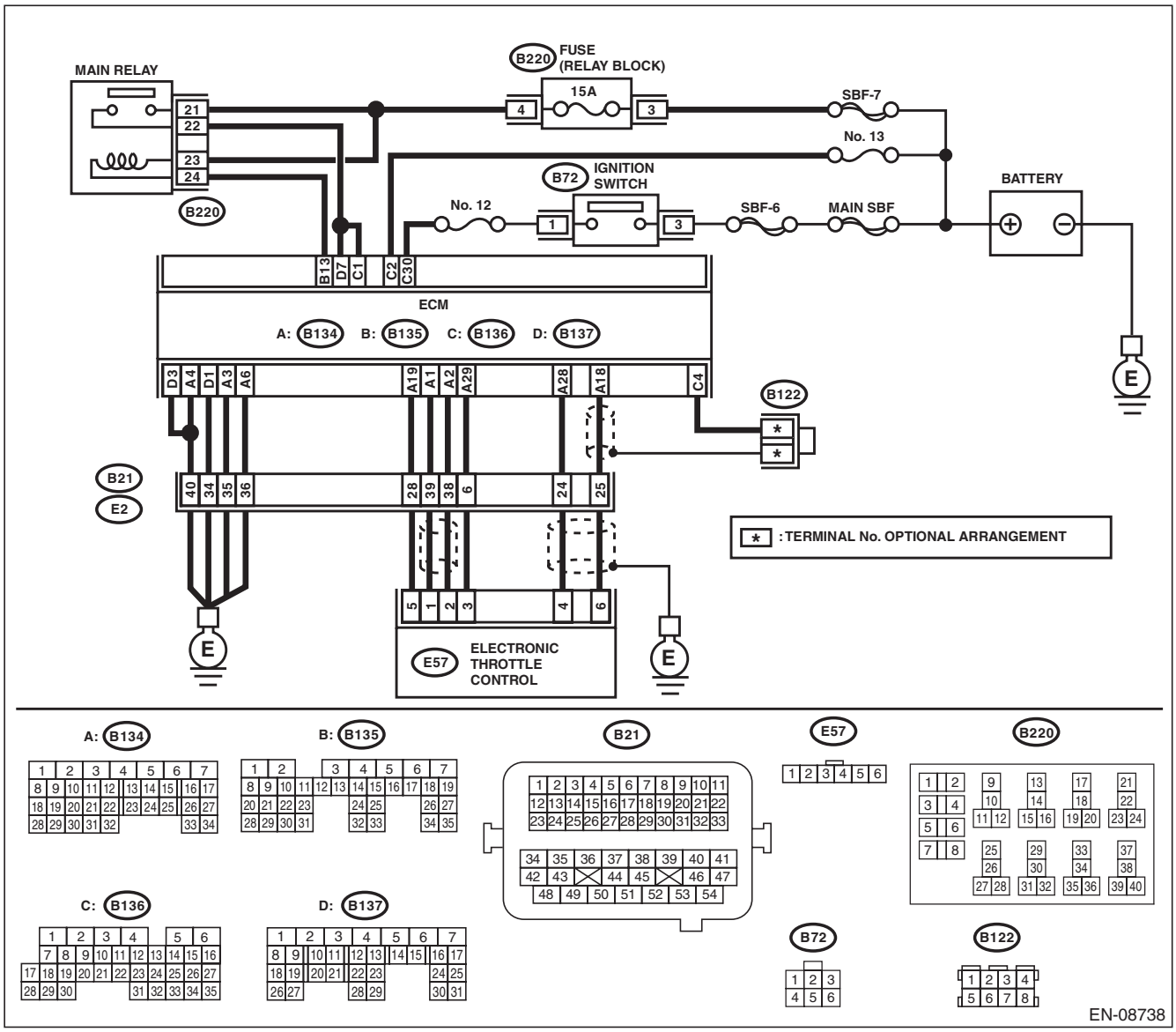
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***(B136) No. 1 (+) — Chassis ground (–):*** ***(B137) No. 7 (+) — 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*** ***(B136) No. 1 (+) — Chassis ground (–):*** ***(B137) No. 7 (+) — 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.** 1) Connect all connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B134) No. 6 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 3 — 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 ECM connector • Poor contact of coupling connector

DD:DTC P060A INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P0606. <Ref. to EN(H4DOTC)(diag)-291, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DE:DTC P060B INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P0606. <Ref. to EN(H4DOTC)(diag)-291, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DF:DTC P0616 STARTER RELAY CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-197, DTC P0616 STARTER RELAY CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

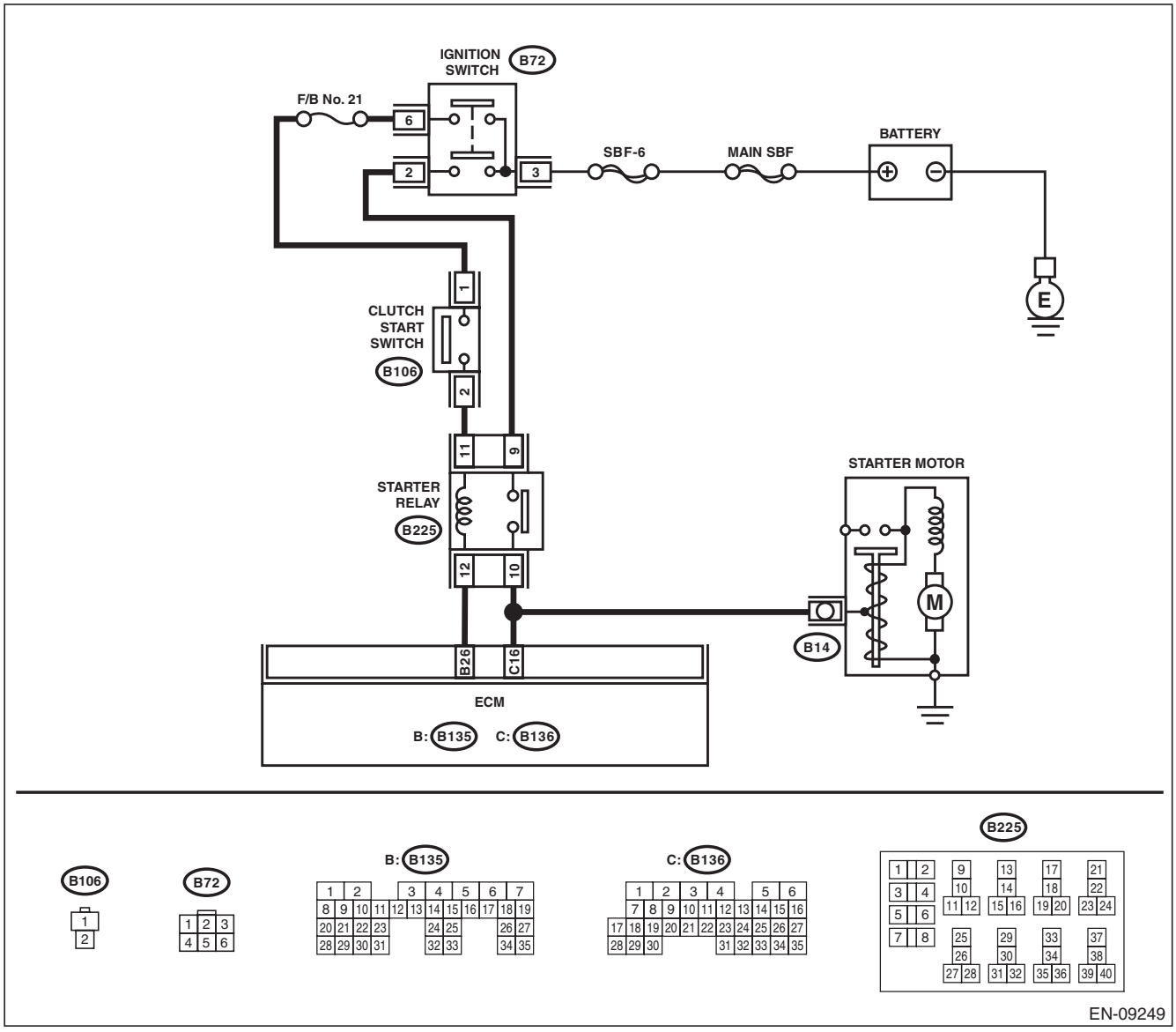
Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and starter motor. 3) Remove the starter relay. 4) Measure the resistance of harness between ECM and starter relay connector. ***Connector & terminal*** ***(B136) No. 16 — (B225) No. 10:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the open circuit of harness between ECM and starter relay connector.
3	**CHECK HARNESS BETWEEN ECM AND STARTER RELAY CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 16 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the short circuit to ground in harness between ECM and starter relay connector.

DG:DTC P0617 STARTER RELAY CIRCUIT HIGH

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-198, DTC P0617 STARTER RELAY CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

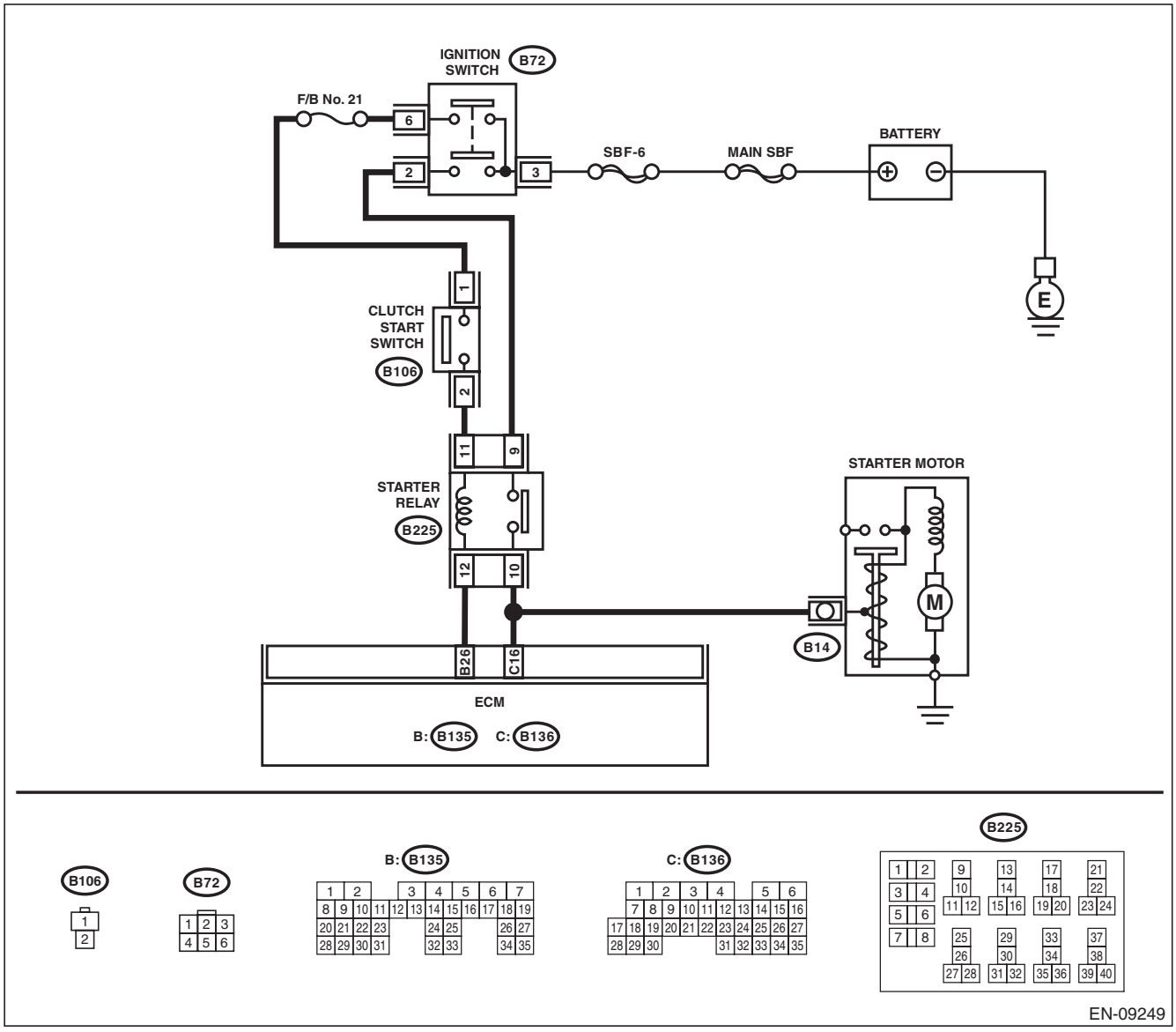
Failure of engine to start

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK HARNESS BETWEEN ECM AND IGNITION SWITCH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 16 (+) — Chassis ground (–):***	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.

DH:DTC P062F INTERNAL CONTROL MODULE EEPROM ERROR

NOTE:
For the diagnostic procedure, refer to DTC P0606. <Ref. to EN(H4DOTC)(diag)-291, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DI: 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(H4DOTC)-200, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

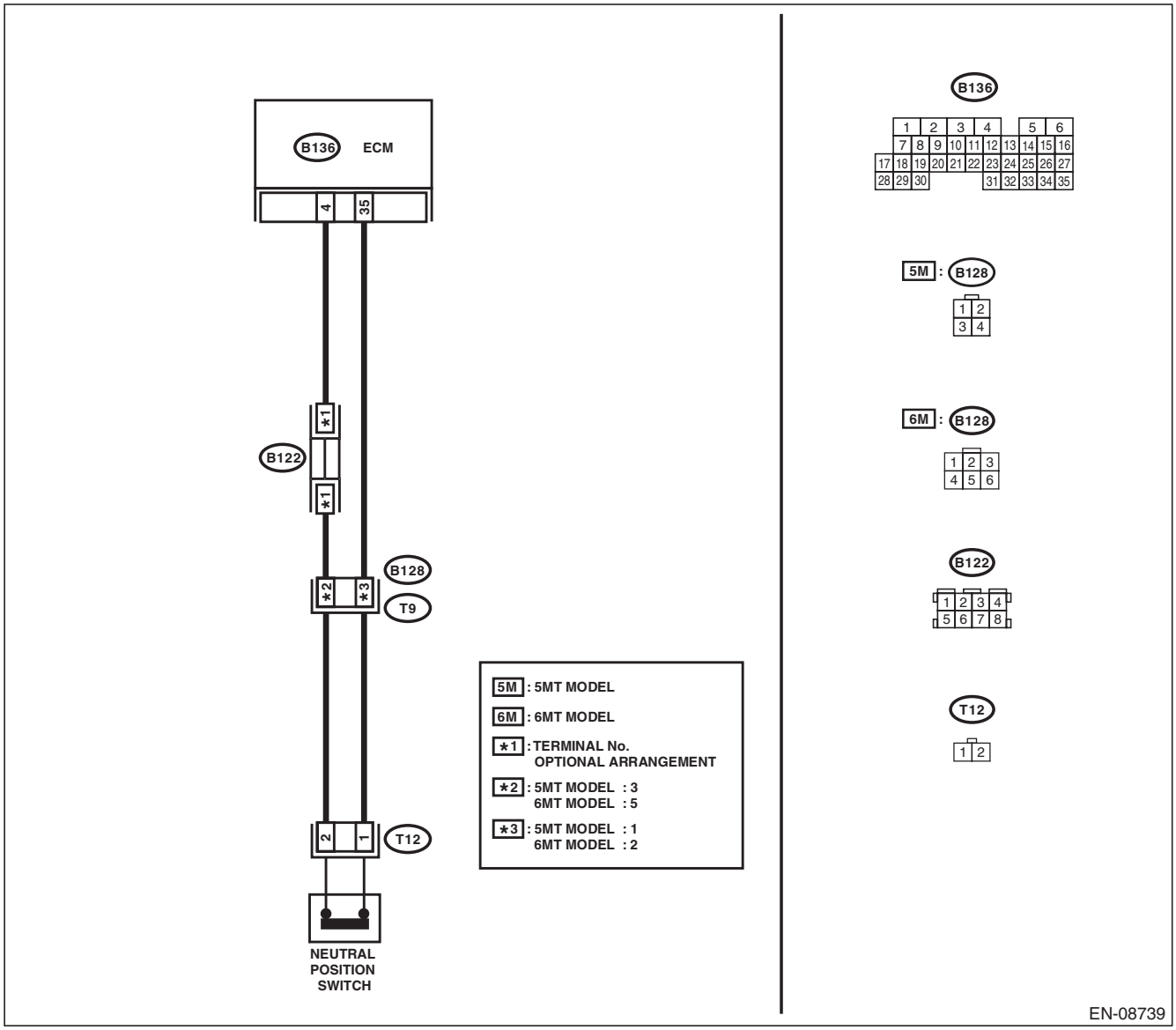
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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. 35 (+) — 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. 35 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the neutral position switch. <Ref. to 5MT-32, Switches and Harness.> <Ref. to 6MT-41, Neutral Position Switch.>	Repair the short circuit to ground harness between ECM and neutral position switch connector.

DJ: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(H4DOTC)-201, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

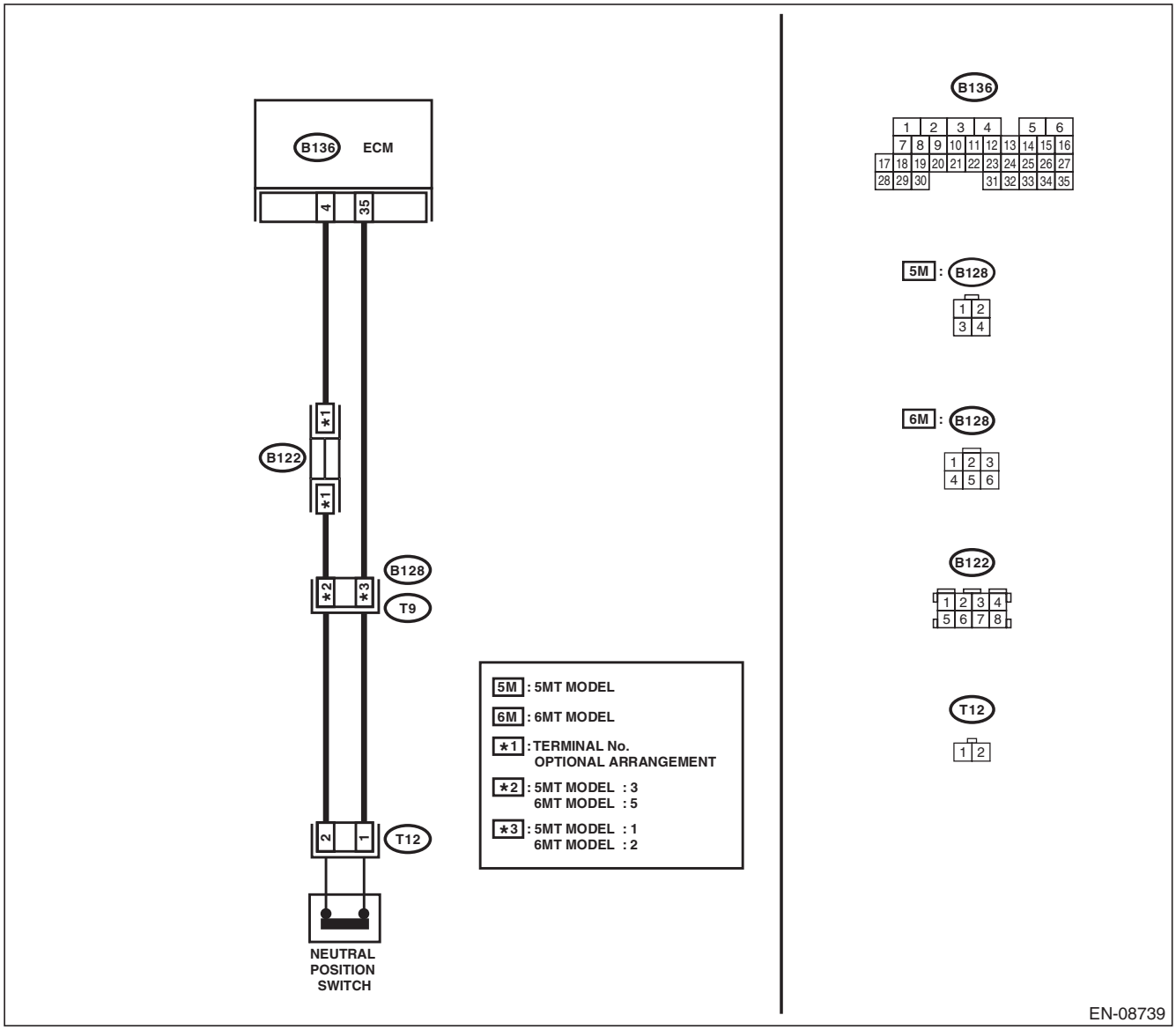
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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. 35 (+) — Chassis ground (–):***	Is the voltage less than 1 V?	Repair the poor contact of ECM connector. Replace the ECM if defective. <Ref. to FU(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>	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 transmission harness connector (T9). 3) Measure the resistance of harness between ECM and transmission harness connector. ***Connector & terminal*** ***5MT model*** ***(B136) No. 35 — (B128) No. 1:*** ***6MT model*** ***(B136) No. 35 — (B128) No. 2:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the open circuit in harness between ECM and transmission harness connector.
3	**CHECK HARNESS BETWEEN ECM AND NEUTRAL POSITION SWITCH CONNECTOR.** Measure the resistance of harness between ECM and transmission harness connector. ***Connector & terminal*** ***5MT model*** ***(B128) No. 3 — (B136) No. 4:*** ***6MT model*** ***(B128) No. 5 — (B136) No. 4:***	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 transmission harness connector • Poor contact of coupling connector
4	**CHECK NEUTRAL POSITION SWITCH.** 1) Place the shift lever in neutral. 2) Measure the resistance between transmission harness connector terminals. ***Connector & terminal*** ***5MT model*** ***(T9) No. 1 — No. 3:*** ***6MT model*** ***(T9) No. 2 — No. 5:***	Is the resistance less than 1 Ω?	Repair the poor contact of transmission harness connector.	Repair the open circuit of transmission harness, or replace the neutral position switch. <Ref. to 5MT-32, Switches and Harness.> <Ref. to 6MT-41, Neutral Position Switch.>

DK:DTC P1160 RETURN SPRING FAILURE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)(diag)-369, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DL:DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW

DTC DETECTING CONDITION:

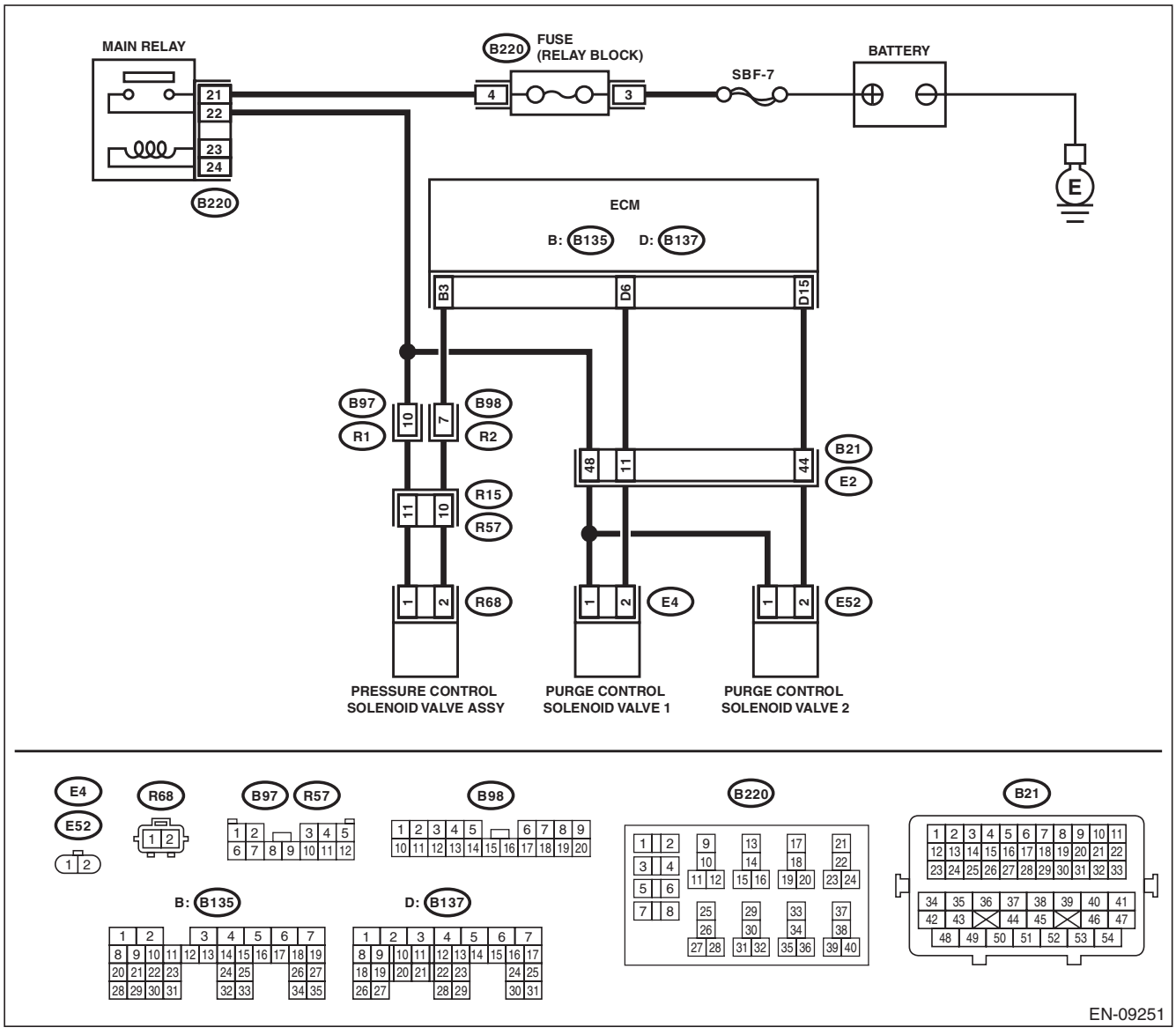
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-204, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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*** ***(B135) No. 3 (+) — 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 PRESSURE CONTROL SOLENOID VALVE ASSEMBLY.** Measure the voltage between the pressure control solenoid valve assembly 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 ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and pressure control solenoid valve assembly. 3) Measure the resistance between the pressure control solenoid valve assembly connector and chassis ground. ***Connector & terminal*** ***(R68) No. 2 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the harness between ECM and pressure control solenoid valve assembly connector for short-circuit to ground.
5	**CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE ASSEMBLY CONNECTOR.** Measure the resistance of harness between ECM and pressure control solenoid valve assembly connector. ***Connector & terminal*** ***(B135) No. 3 — (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 the wiring harness between ECM and pressure control solenoid valve assembly connector • Poor contact of coupling connector

	Step	Check	Yes	No
6	**CHECK PRESSURE CONTROL SOLENOID VALVE ASSEMBLY.** Measure the resistance between terminals of pressure control solenoid valve assembly. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 10 — 100 Ω?	Repair the pressure control solenoid valve assembly connector for poor contact.	Replace the pressure control solenoid valve assembly. <Ref. to EC(STI)-16, Pressure Control Solenoid Valve Assembly.> <Ref. to EC(w/o STI)-17, Pressure Control Solenoid Valve Assembly.>

DM:DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-206, DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK SECONDARY AIR COMBINATION VALVE.** 1) Remove the secondary air combination valve. <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.> 2) Blow in air from the secondary air combination valve air inlet, and check whether there are leaks at the pipe connections.	Are there air leaks from the pipe connections?	Replace the secondary air combination valve on the side with the air leak. <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>	Perform the diagnostic procedure of DTC P2440. <Ref. to EN(H4DOTC)(diag)-444, DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

DN:DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH

DTC DETECTING CONDITION:

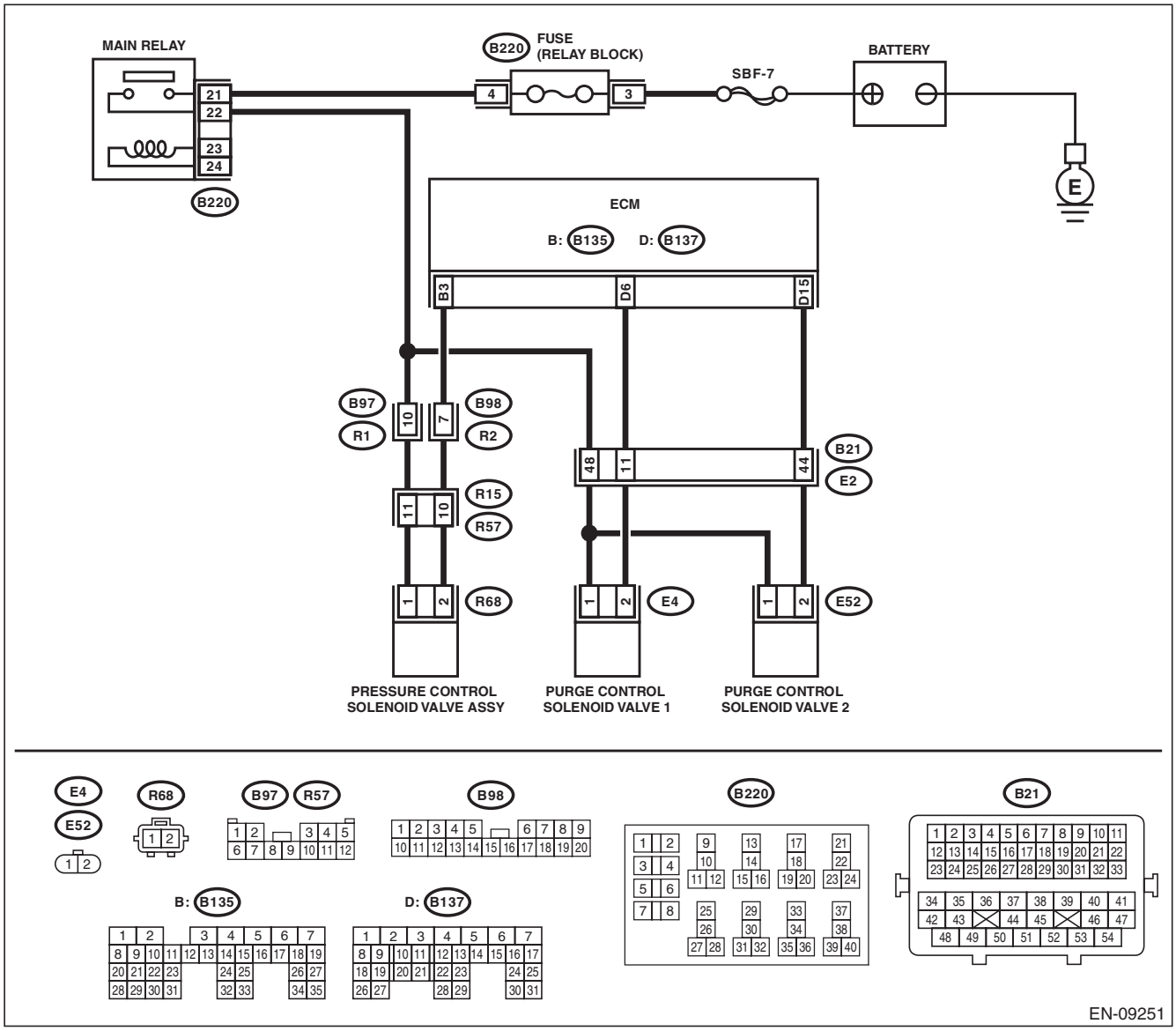
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-208, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND PRESSURE CONTROL SOLENOID VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and pressure control solenoid valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 3 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the harness between ECM and pressure control solenoid valve assembly connector for short-circuit to power supply.	Go to step **2**.
2	**CHECK PRESSURE CONTROL SOLENOID VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Measure the resistance between terminals of pressure control solenoid valve assembly. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance less than 1 Ω?	Replace the pressure control solenoid valve assembly. <Ref. to EC(STI)-16, Pressure Control Solenoid Valve Assembly.> <Ref. to EC(w/o STI)-17, Pressure Control Solenoid Valve Assembly.>	Repair the poor contact of ECM connector.

DO:DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-210, DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK DRAIN TUBE OF LEAK CHECK VALVE ASSEMBLY.**	Is the drain tube of leak check valve assembly clogged?	Replace the drain tube of leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>	Go to step **3**.
3	**CHECK HOSES BETWEEN LEAK CHECK VALVE ASSEMBLY AND DRAIN SEPARATOR.**	Are the hoses between the leak check valve assembly and drain separator clogged?	Replace the leak check valve assembly and drain separator. <Ref. to EC(STI)-7, Canister.> <Ref. to EC(w/o STI)-7, Canister.> <Ref. to EC(STI)-23, Drain Separator.> <Ref. to EC(w/o STI)-24, Drain Separator.>	Go to step **4**.
4	**CHECK DRAIN SEPARATOR.**	Is the drain separator clogged?	Replace the drain separator. <Ref. to EC(STI)-23, Drain Separator.> <Ref. to EC(w/o STI)-24, Drain Separator.>	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>

DP:DTC P1451 EVAPORATIVE EMISSION CONT. SYS.

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-213, DTC P1451 EVAPORATIVE EMISSION CONT. SYS., Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

	Step	Check	Yes	No
1	**CHECK DRAIN TUBE BETWEEN CANISTER AND LEAK CHECK VALVE ASSEMBLY.**	Is the drain tube between canister and leak check valve assembly clogged?	Replace the drain tube between the canister and leak check valve assembly. <Ref. to EC(STI)-7, Canister.> <Ref. to EC(w/o STI)-7, Canister.>	Go to step **2**.
2	**CHECK HOSES BETWEEN CANISTER AND FUEL TANK.**	Are the hoses between the canister and fuel tank clogged?	Replace the hoses between the canister and fuel tank. <Ref. to EC(STI)-7, Canister.> <Ref. to EC(w/o STI)-7, Canister.> <Ref. to FU(STI)-70, Fuel Tank.> <Ref. to FU(w/o STI)-68, Fuel Tank.>	Replace the canister. <Ref. to EC(STI)-7, Canister.> <Ref. to EC(w/o STI)-7, Canister.> After the operation is complete, go to the next step. Go to step **3**.
3	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM.** Perform drive cycle I. <Ref. to EN(H4DOTC)(diag)-58, DRIVE CYCLE H, PROCEDURE, Drive Cycle.>	Is DTC P1451 displayed on the display?	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>	End.

DQ:DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-214, DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK TUMBLE GENERATOR VALVE RH.** 1) Remove the tumble generator valve assembly RH. 2) Check the tumble generator valve body.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve assembly RH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

DR:DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-215, DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK TUMBLE GENERATOR VALVE LH.** 1) Remove the tumble generator valve assembly LH. 2) Check the tumble generator valve body.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve assembly LH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

DS:DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-216, DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK TUMBLE GENERATOR VALVE RH.** 1) Remove the tumble generator valve assembly RH. 2) Check the tumble generator valve body.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve assembly RH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

DT:DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-217, DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK TUMBLE GENERATOR VALVE LH.** 1) Remove the tumble generator valve assembly LH. 2) Check the tumble generator valve body.	Is there any dirt or clogging with foreign objects in the tumble generator valve?	Clean the tumble generator valve.	Replace the tumble generator valve assembly LH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

DU:DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1)

DTC DETECTING CONDITION:

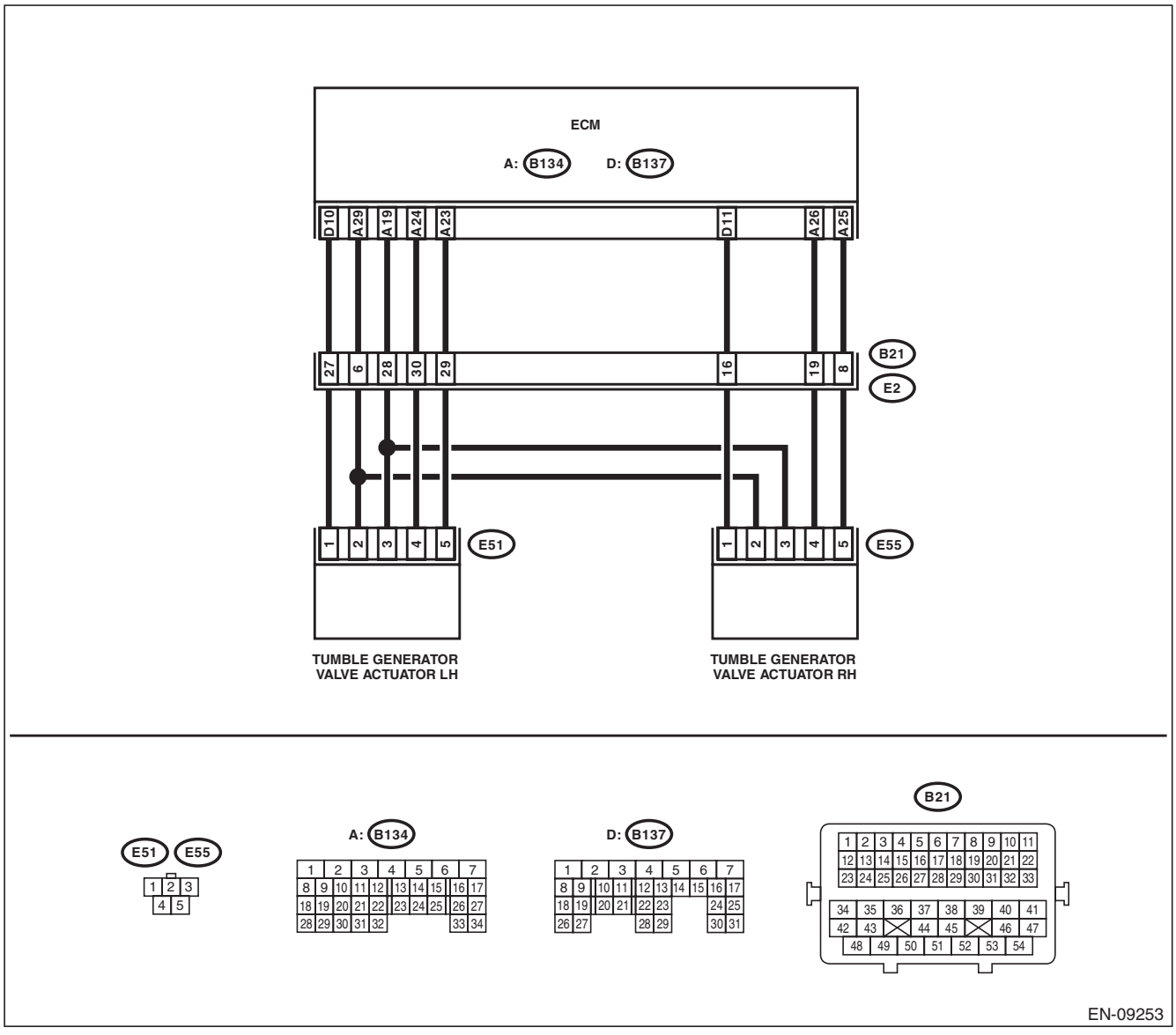
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-218, DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the ECM and tumble generator valve assembly RH. 3) Measure the resistance of harness between ECM and tumble generator valve assembly RH. ***Connector & terminal*** ***(B134) No. 25 — (E55) No. 5:*** ***(B134) No. 26 — (E55) No. 4:***	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 tumble generator valve assembly RH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY RH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 25 — Chassis ground:*** ***(B134) No. 26 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **3**.	Repair the short circuit to ground in harness between ECM and tumble generator valve assembly RH connector.
3	**CHECK FOR POOR CONTACT.** Check for poor contact of tumble generator valve assembly RH connector.	Is there poor contact of the tumble generator valve assembly RH connector?	Repair the poor contact of tumble generator valve assembly RH connector.	Replace the tumble generator valve assembly RH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

DV:DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1)

DTC DETECTING CONDITION:

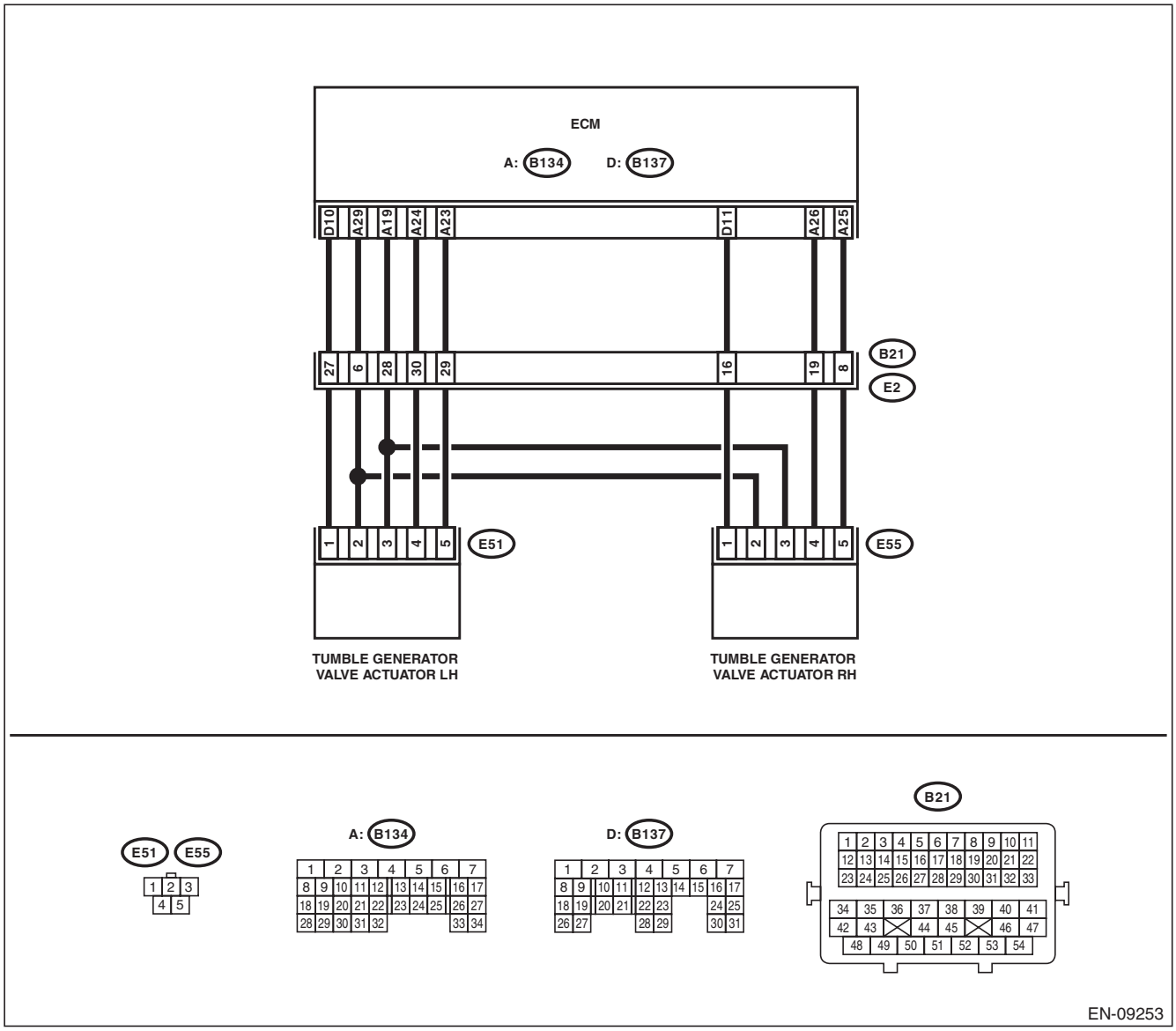
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-220, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 25 (+) — Chassis ground (–):*** ***(B134) No. 26 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and tumble generator valve assembly RH connector.	Replace the tumble generator valve assembly RH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

DW:DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2)

DTC DETECTING CONDITION:

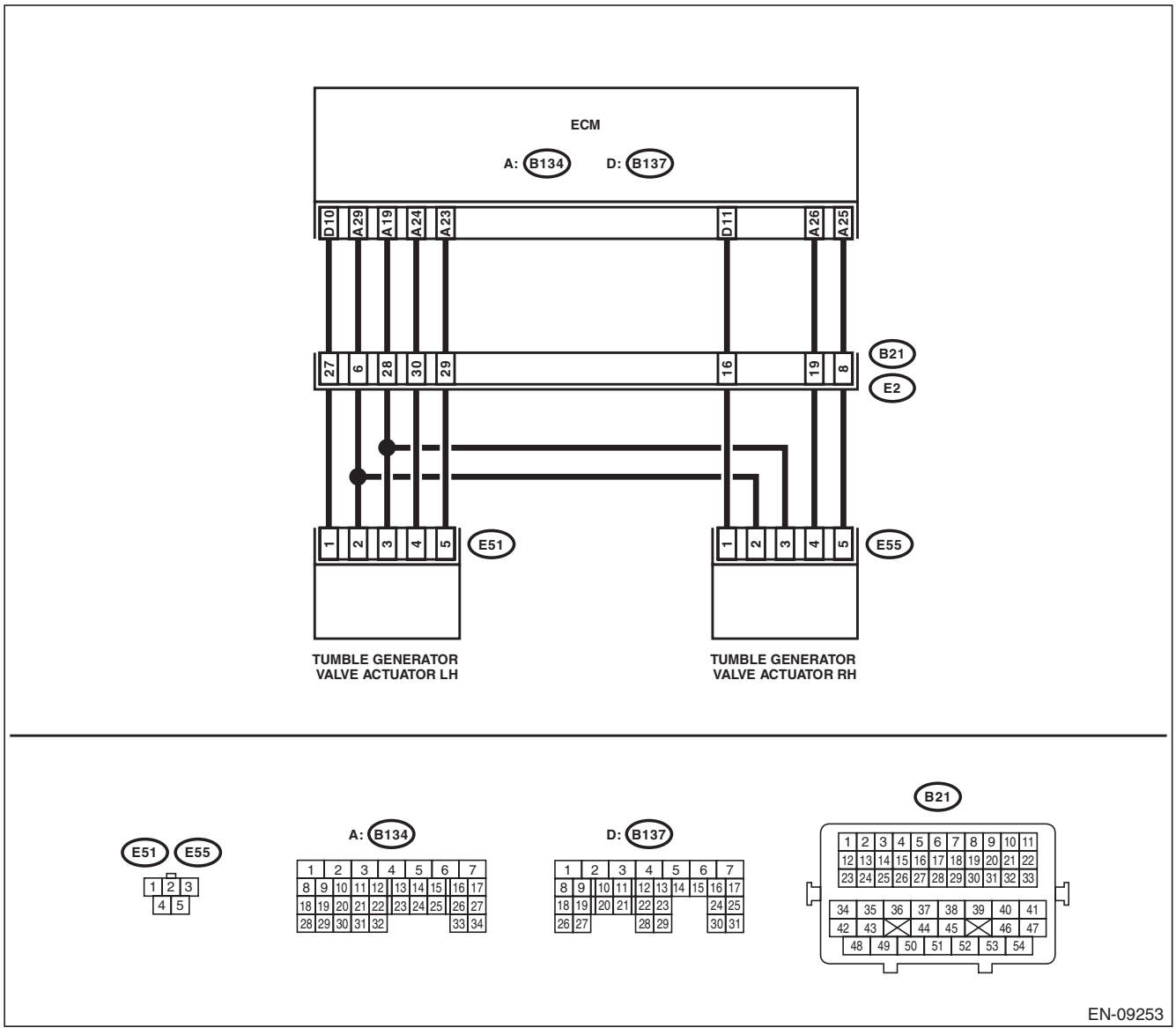
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-221, DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and tumble generator valve assembly LH. 3) Measure the resistance of harness between ECM and tumble generator valve assembly LH. ***Connector & terminal*** ***(B134) No. 23 — (E51) No. 5:*** ***(B134) No. 24 — (E51) No. 4:***	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 tumble generator valve assembly LH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY LH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 23 — Chassis ground:*** ***(B134) 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 tumble generator valve assembly LH connector.
3	**CHECK FOR POOR CONTACT.** Check for poor contact of tumble generator valve assembly LH connector.	Is there poor contact of the tumble generator valve assembly LH connector?	Repair the poor contact of tumble generator valve assembly LH connector.	Replace the tumble generator valve assembly LH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

DX:DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2)

DTC DETECTING CONDITION:

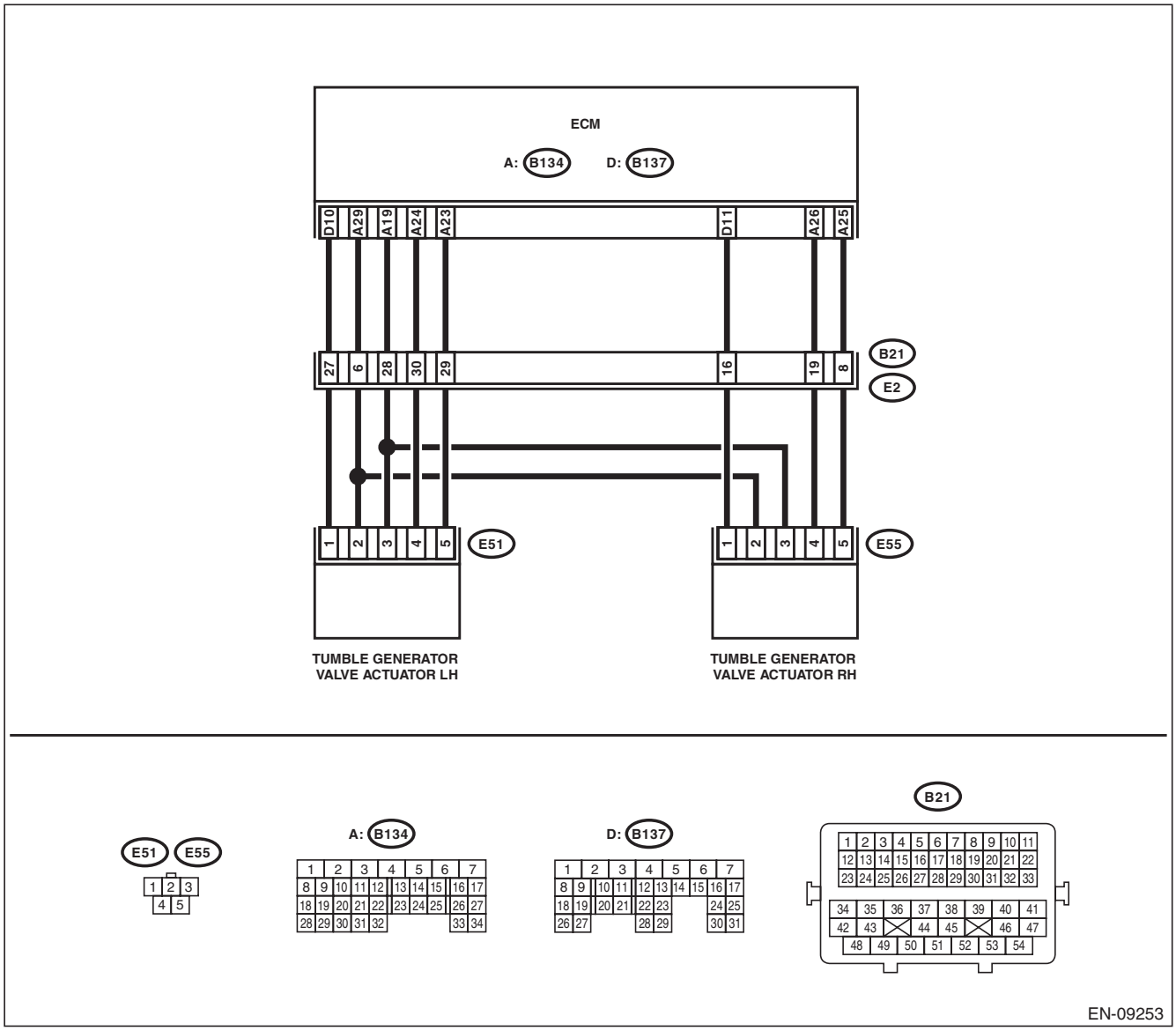
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-223, DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 23 (+) — Chassis ground (–):*** ***(B134) No. 24 (+) — Chassis ground (–):***	Is the voltage 5 V or more?	Repair the short circuit to power in harness between ECM and tumble generator valve assembly LH connector.	Replace the tumble generator valve assembly LH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

DY:DTC P2016 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-224, DTC P2016 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

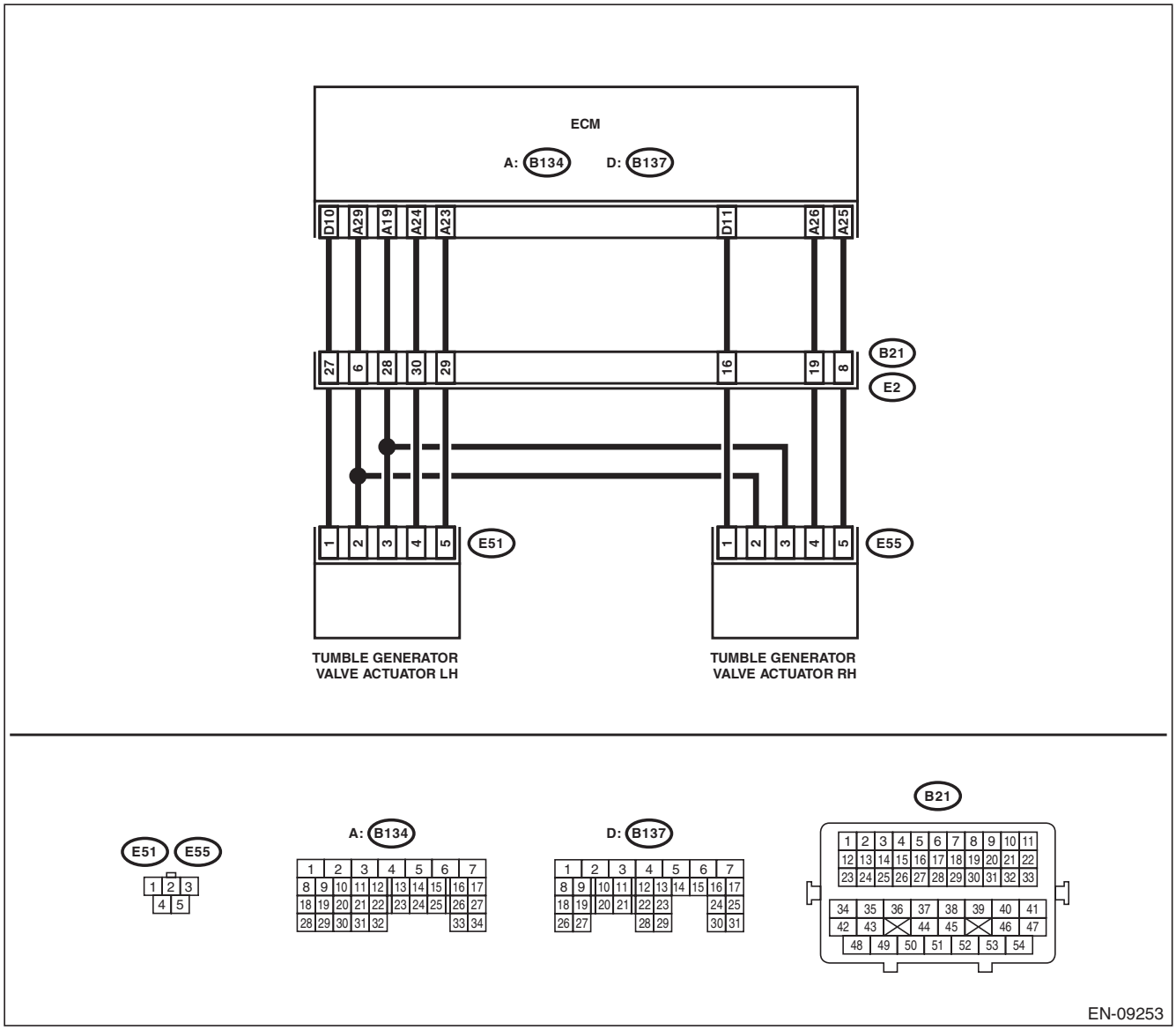
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «TGV Position Sensor R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «TGV Position Sensor R» 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 TUMBLE GENERATOR VALVE ASSEMBLY RH.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve assembly RH. 3) Turn the ignition switch to ON. 4) Measure the voltage between tumble generator valve assembly RH connector and engine ground. ***Connector & terminal*** ***(E55) 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 in harness between ECM and tumble generator valve assembly RH connector • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and tumble generator valve assembly RH. ***Connector & terminal*** ***(B137) No. 11 — (E55) 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 tumble generator valve assembly RH connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY RH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(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 tumble generator valve assembly RH connector.

Step		Check	Yes	No
5	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and tumble generator valve assembly RH connector.	Is there poor contact of ECM or the tumble generator valve assembly RH connector?	Repair the poor contact of ECM or tumble generator valve assembly RH connector.	Replace the tumble generator valve assembly RH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

DZ:DTC P2017 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-226, DTC P2017 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

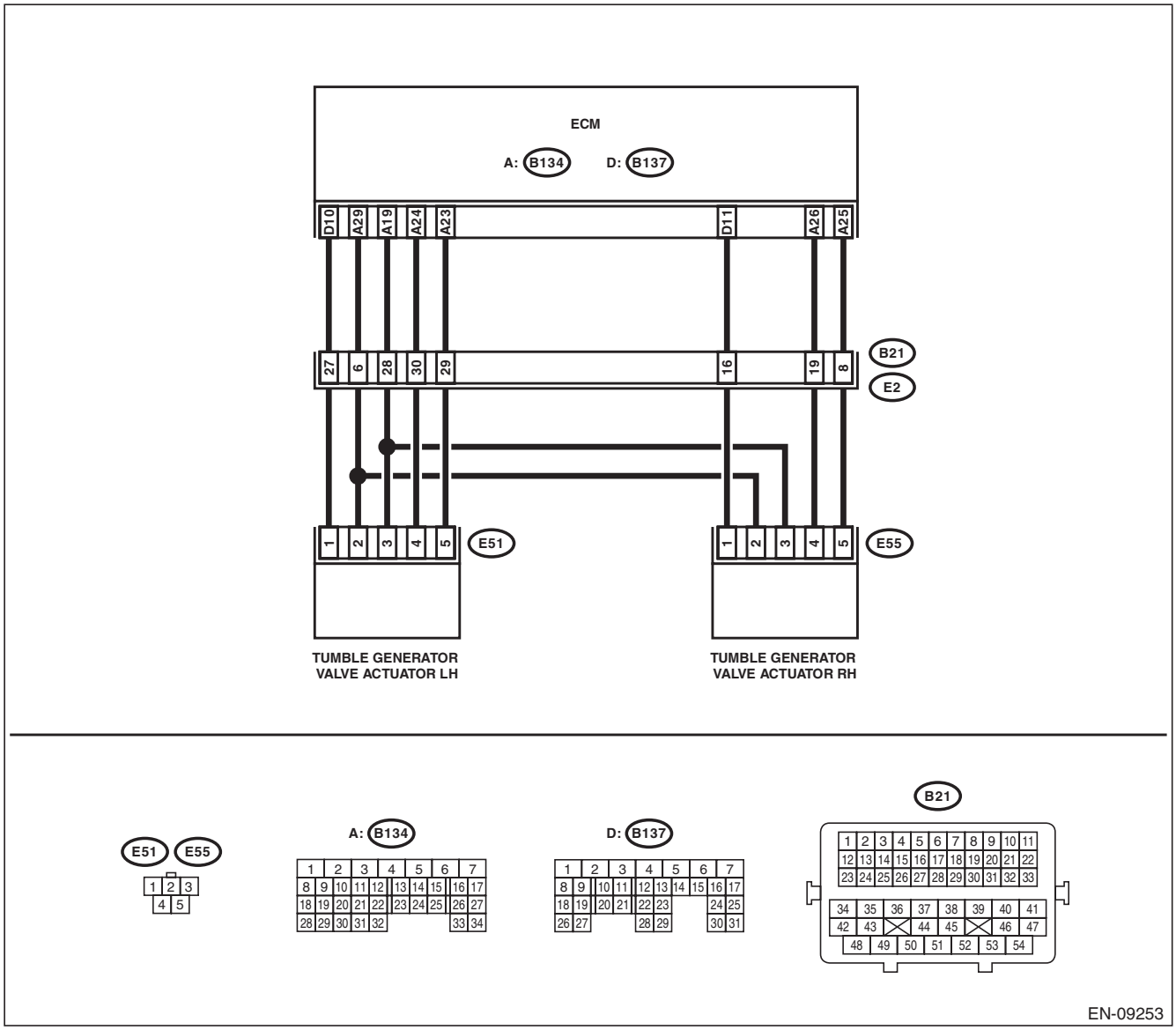
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «TGV Position Sensor R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «TGV Position Sensor R» 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 TUMBLE GENERATOR VALVE ASSEMBLY RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve assembly RH. 3) Start the engine. 4) Read the value of «TGV Position Sensor R» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «TGV Position Sensor R» 5 V or more?	Repair the short circuit to power in harness between ECM and tumble generator valve assembly RH connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between tumble generator valve assembly RH connector and engine ground. ***Connector & terminal*** ***(E55) 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 in harness between ECM and tumble generator valve assembly RH connector • Poor contact of ECM connector • Poor contact of coupling connector
4	**CHECK FOR POOR CONTACT.** Check for poor contact of tumble generator valve assembly RH connector.	Is there poor contact of the tumble generator valve assembly RH connector?	Repair the poor contact of tumble generator valve assembly RH connector.	Replace the tumble generator valve assembly RH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

EA:DTC P2021 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-228, DTC P2021 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

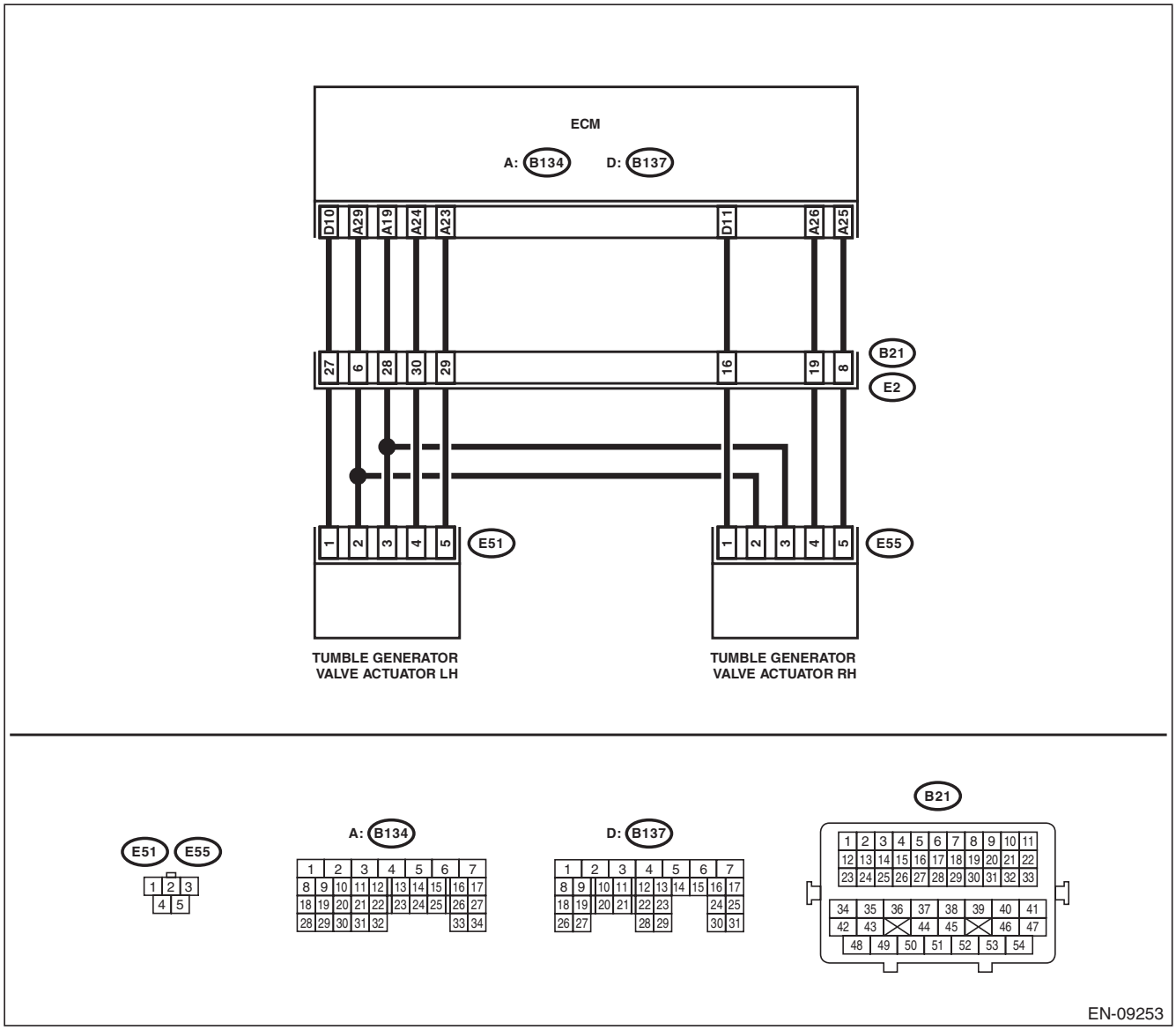
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «TGV Position Sensor L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «TGV Position Sensor L» 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 TUMBLE GENERATOR VALVE ASSEMBLY LH.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve assembly LH. 3) Turn the ignition switch to ON. 4) Measure the voltage between tumble generator valve assembly LH connector and engine ground. ***Connector & terminal*** ***(E51) 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 in harness between ECM and tumble generator valve assembly LH connector • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and tumble generator valve assembly LH. ***Connector & terminal*** ***(B137) No. 10 — (E51) 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 tumble generator valve assembly LH connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY LH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 10 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM and tumble generator valve assembly LH connector.

	Step	Check	Yes	No
5	**CHECK FOR POOR CONTACT.** Check for poor contact of ECM and tumble generator valve assembly LH connector.	Is there poor contact of ECM or the tumble generator valve assembly LH connector?	Repair the poor contact of ECM or tumble generator valve assembly LH connector.	Replace the tumble generator valve assembly LH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

EB:DTC P2022 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-230, DTC P2022 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

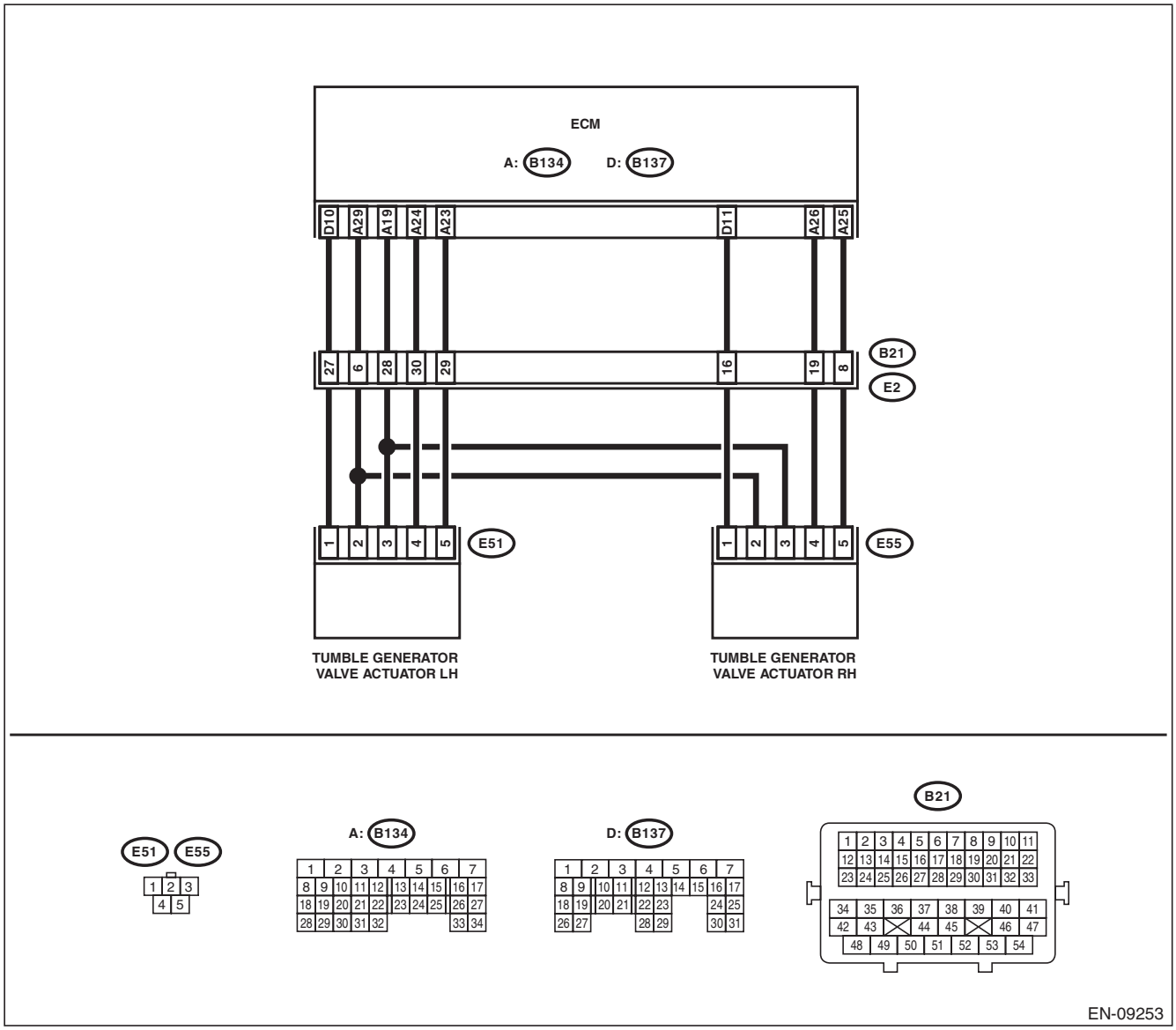
- Improper idling
- Engine stalls.
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Start the engine. 2) Read the value of «TGV Position Sensor L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «TGV Position Sensor L» 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 TUMBLE GENERATOR VALVE ASSEMBLY LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from tumble generator valve assembly LH. 3) Start the engine. 4) Read the value of «TGV Position Sensor L» using the Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «TGV Position Sensor L» 5 V or more?	Repair the short circuit to power in harness between ECM and tumble generator valve assembly LH connector.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND TUMBLE GENERATOR VALVE ASSEMBLY LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between tumble generator valve assembly LH connector and engine ground. ***Connector & terminal*** ***(E51) 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 in harness between ECM and tumble generator valve assembly LH connector • Poor contact of ECM connector • Poor contact of coupling connector
4	**CHECK FOR POOR CONTACT.** Check for poor contact of tumble generator valve assembly LH connector.	Is there poor contact of the tumble generator valve assembly LH connector?	Repair the poor contact of tumble generator valve assembly LH connector.	Replace the tumble generator valve assembly LH. <Ref. to FU(STI)-48, Tumble Generator Valve Assembly.> <Ref. to FU(w/o STI)-48, Tumble Generator Valve Assembly.>

EC:DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-232, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

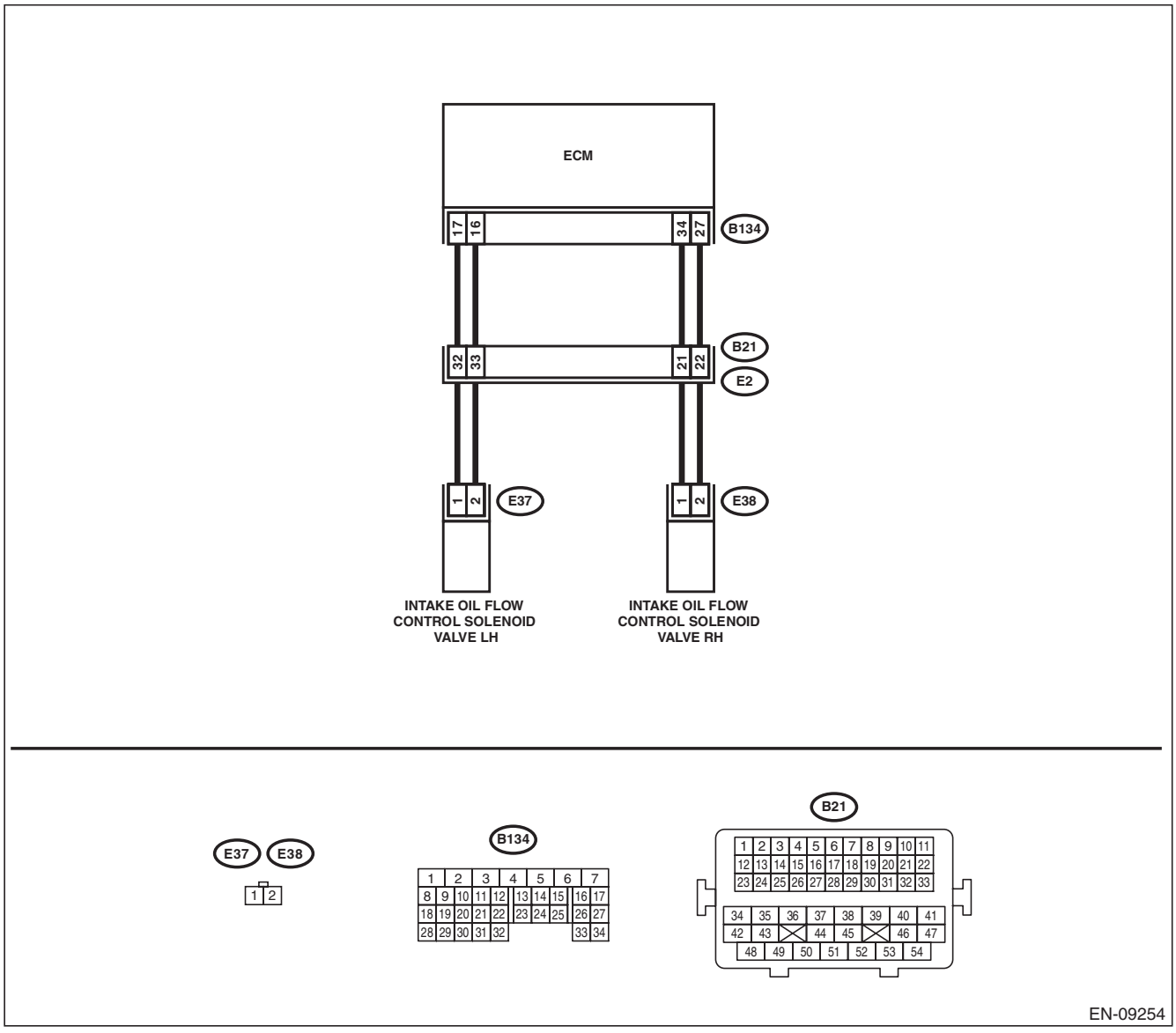
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve RH. 3) Measure the resistance of harness between ECM and oil flow control solenoid valve RH connector. ***Connector & terminal*** ***(B134) No. 34 — (E38) No. 1:*** ***(B134) No. 27 — (E38) 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 flow control solenoid valve RH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE RH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 34 — Chassis ground:*** ***(B134) No. 27 — 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 flow control solenoid valve RH connector.
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between oil flow control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil flow control solenoid valve RH connector.	Replace the oil flow control solenoid valve RH. <Ref. to ME(STI)-60, Camshaft.> <Ref. to ME(w/o STI)-59, Camshaft.>

ED:DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-233, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

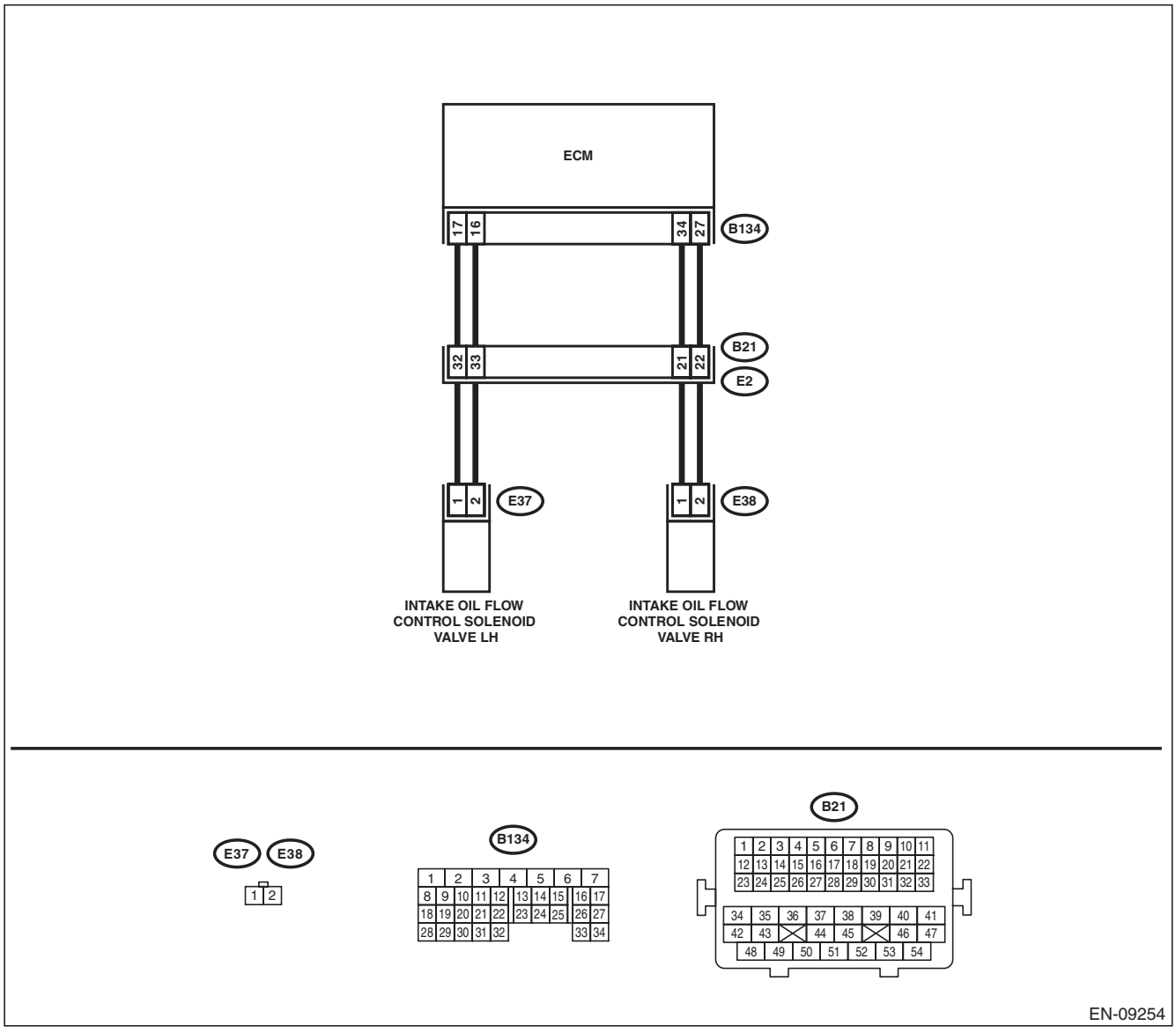
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve RH. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 34 (+) — Chassis ground (–):*** ***(B134) No. 27 (+) — 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 flow control solenoid valve RH connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE RH CONNECTOR.** Measure the resistance of harness between ECM and oil flow control solenoid valve RH connector. ***Connector & terminal*** ***(B134) No. 34 — (E38) No. 1:*** ***(B134) No. 27 — (E38) 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 flow control solenoid valve RH connector • Poor contact of coupling connector
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between oil flow control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil flow control solenoid valve RH connector.	Replace the oil flow control solenoid valve RH. <Ref. to ME(STI)-60, Camshaft.> <Ref. to ME(w/o STI)-59, Camshaft.>

EE:DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-234, DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

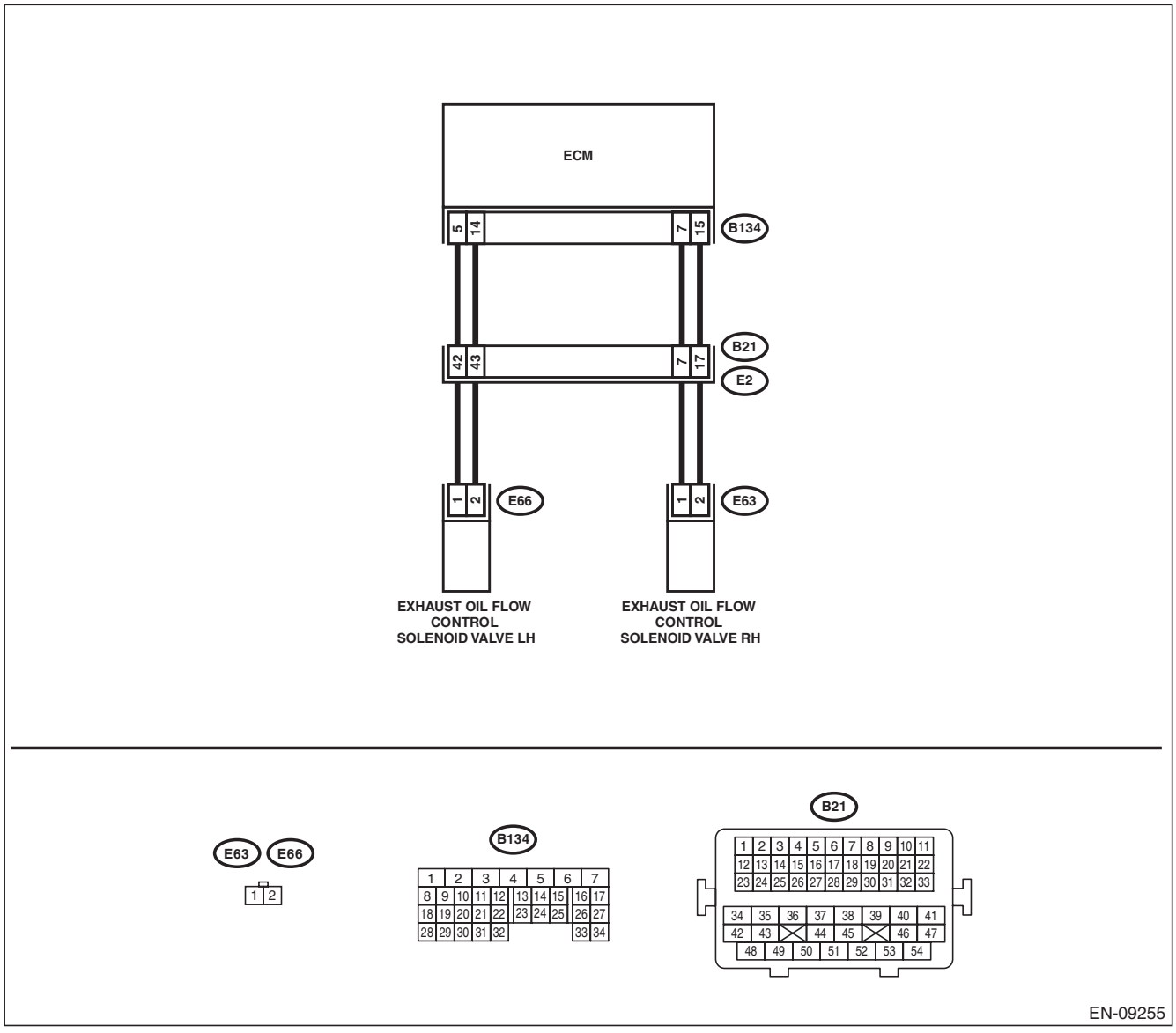
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve RH. 3) Measure the resistance of harness between ECM and oil flow control solenoid valve RH connector. ***Connector & terminal*** ***(B134) No. 7 — (E63) No. 1:*** ***(B134) No. 15 — (E63) 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 flow control solenoid valve RH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE RH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 7 — Chassis ground:*** ***(B134) No. 15 — 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 flow control solenoid valve RH connector.
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between oil flow control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil flow control solenoid valve RH connector.	Replace the oil flow control solenoid valve RH. <Ref. to FU(STI)-50, Oil Flow Control Solenoid Valve.>

EF:DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-235, DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

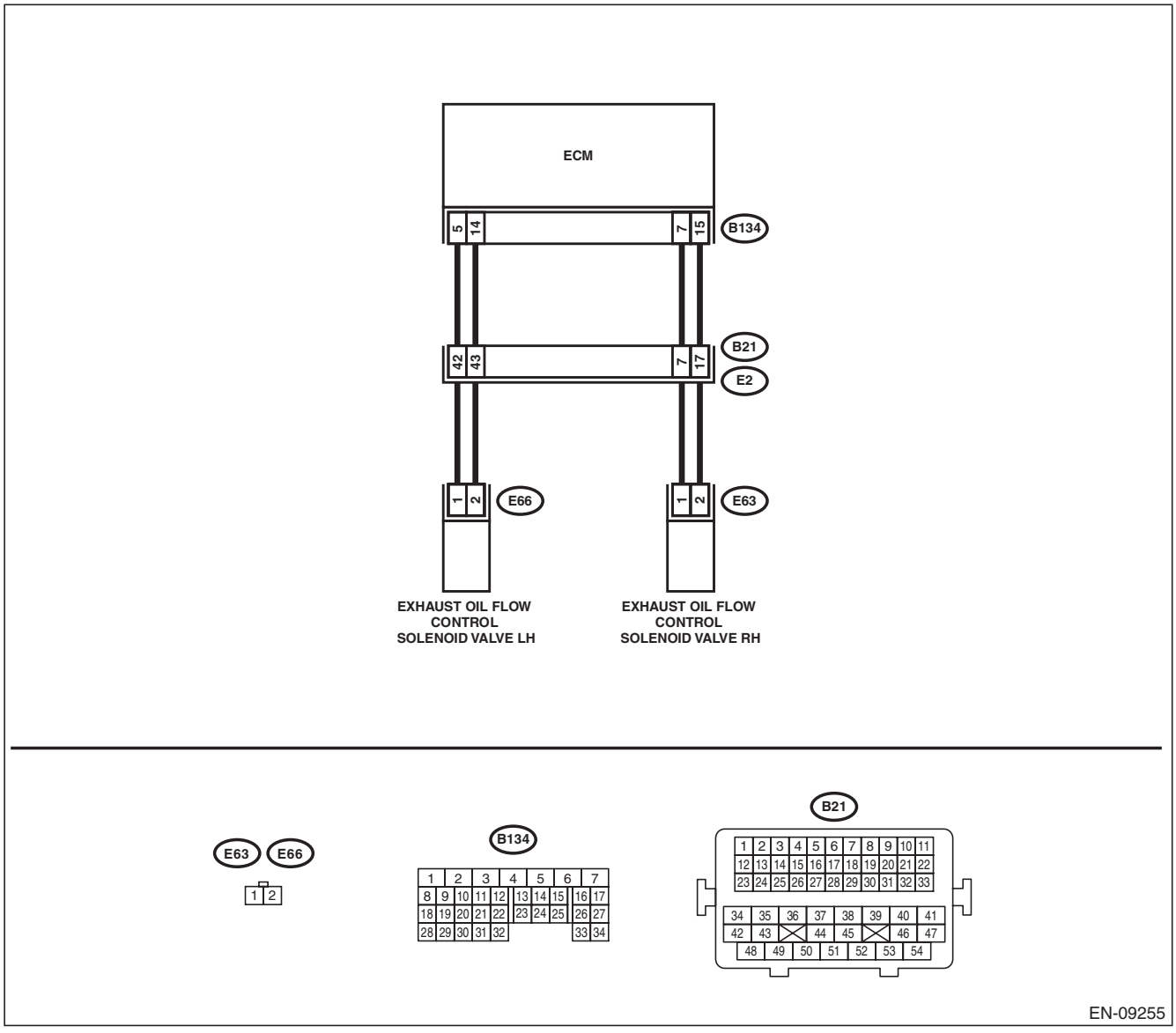
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve RH. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 7 (+) — Chassis ground (–):*** ***(B134) No. 15 (+) — 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 flow control solenoid valve RH connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE RH CONNECTOR.** Measure the resistance of harness between ECM and oil flow control solenoid valve RH connector. ***Connector & terminal*** ***(B134) No. 7 — (E63) No. 1:*** ***(B134) No. 15 — (E63) 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 flow control solenoid valve RH connector • Poor contact of coupling connector
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between oil flow control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil flow control solenoid valve RH connector.	Replace the oil flow control solenoid valve RH. <Ref. to FU(STI)-50, Oil Flow Control Solenoid Valve.>

EG:DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-236, DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

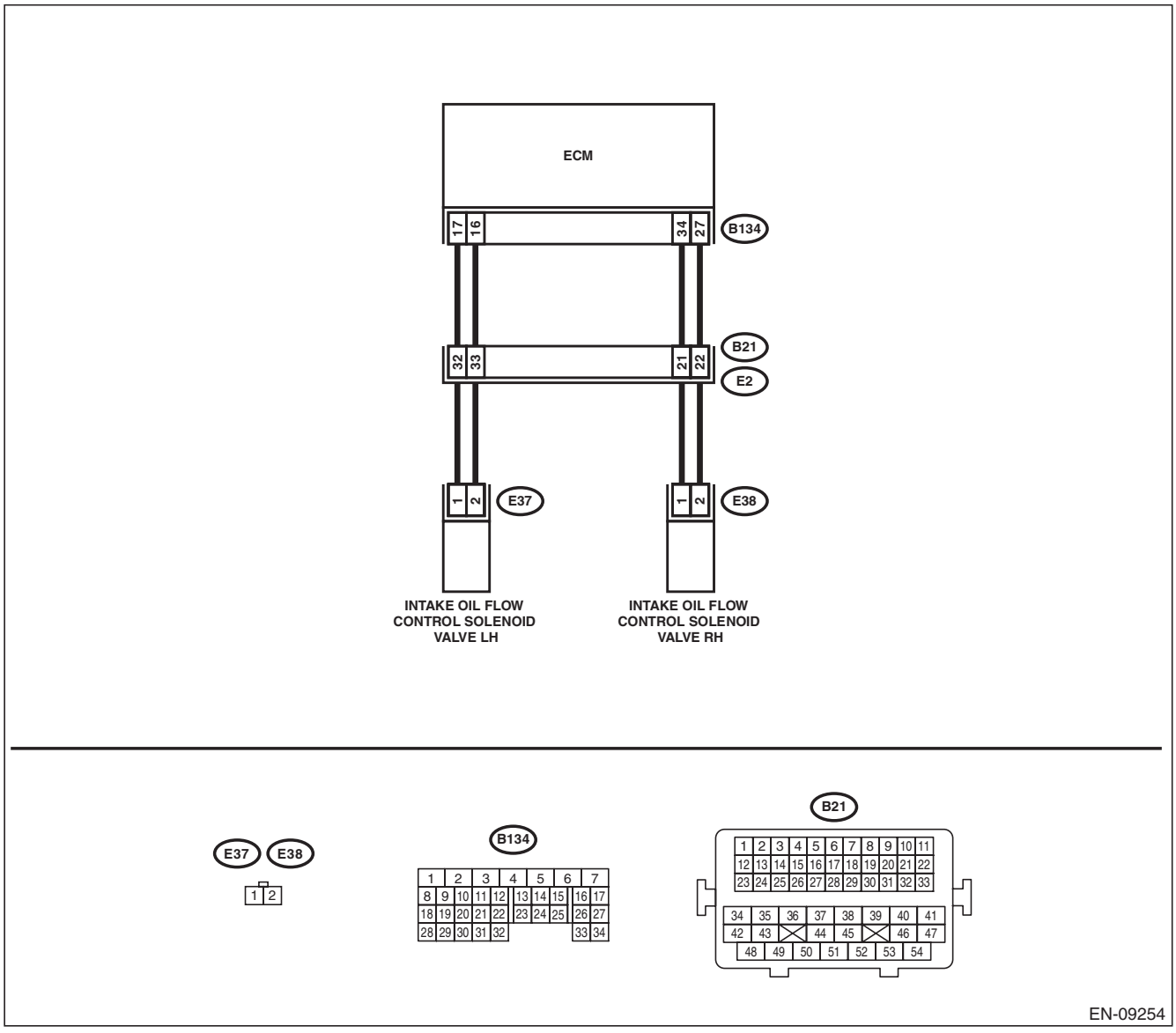
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve LH. 3) Measure the resistance of harness between ECM and oil flow control solenoid valve LH connector. ***Connector & terminal*** ***(B134) No. 17 — (E37) No. 1:*** ***(B134) No. 16 — (E37) 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 flow control solenoid valve LH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE LH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 17 — Chassis ground:*** ***(B134) No. 16 — 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 flow control solenoid valve LH connector.
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between oil flow control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil flow control solenoid valve LH connector.	Replace the oil flow control solenoid valve LH. <Ref. to ME(STI)-60, Camshaft.> <Ref. to ME(w/o STI)-59, Camshaft.>

EH:DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-236, DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

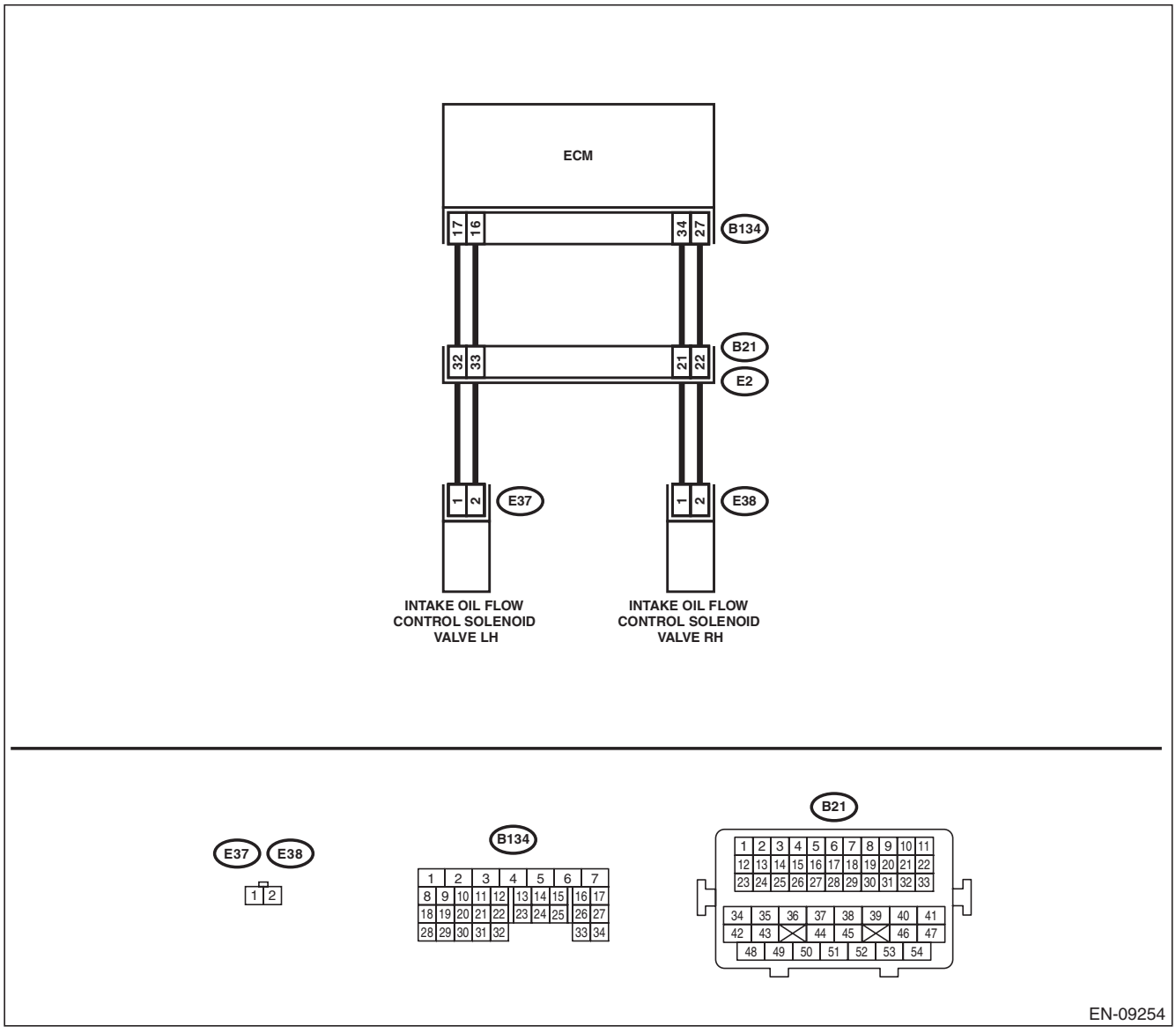
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve LH. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 17 (+) — Chassis ground (–):*** ***(B134) No. 16 (+) — 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 flow control solenoid valve LH connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE LH CONNECTOR.** Measure the resistance of harness between ECM and oil flow control solenoid valve LH connector. ***Connector & terminal*** ***(B134) No. 17 — (E37) No. 1:*** ***(B134) No. 16 — (E37) 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 flow control solenoid valve LH connector • Poor contact of coupling connector
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between oil flow control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil flow control solenoid valve LH connector.	Replace the oil flow control solenoid valve LH. <Ref. to ME(STI)-60, Camshaft.> <Ref. to ME(w/o STI)-59, Camshaft.>

EI: DTC P2094 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-236, DTC P2094 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

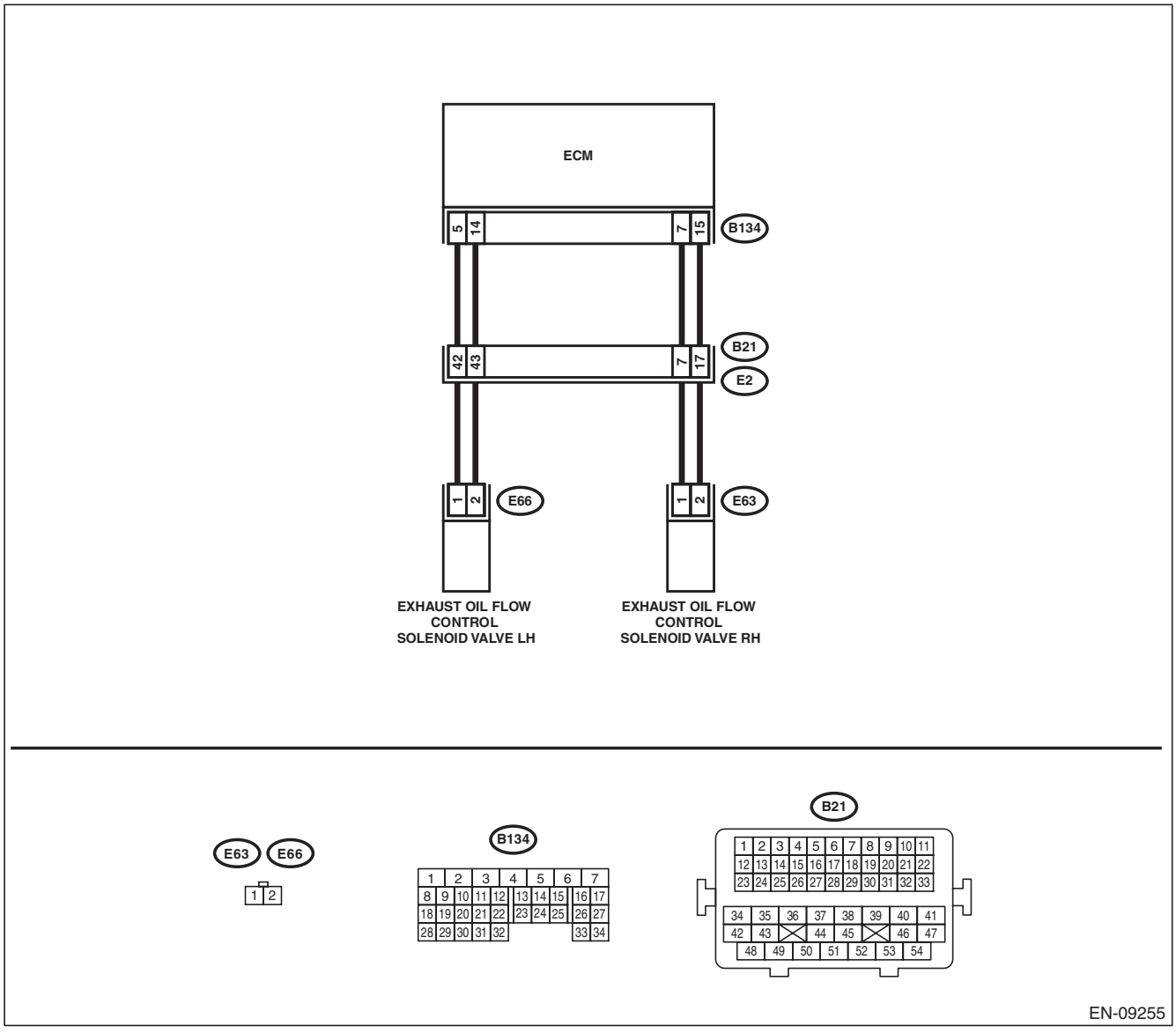
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve LH. 3) Measure the resistance of harness between ECM and oil flow control solenoid valve LH connector. ***Connector & terminal*** ***(B134) No. 5 — (E66) No. 1:*** ***(B134) No. 14 — (E66) 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 flow control solenoid valve LH connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE LH CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 — Chassis ground:*** ***(B134) No. 14 — 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 flow control solenoid valve LH connector.
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between oil flow control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil flow control solenoid valve LH connector.	Replace the oil flow control solenoid valve LH. <Ref. to FU(STI)-50, Oil Flow Control Solenoid Valve.>

EJ: DTC P2095 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-236, DTC P2095 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

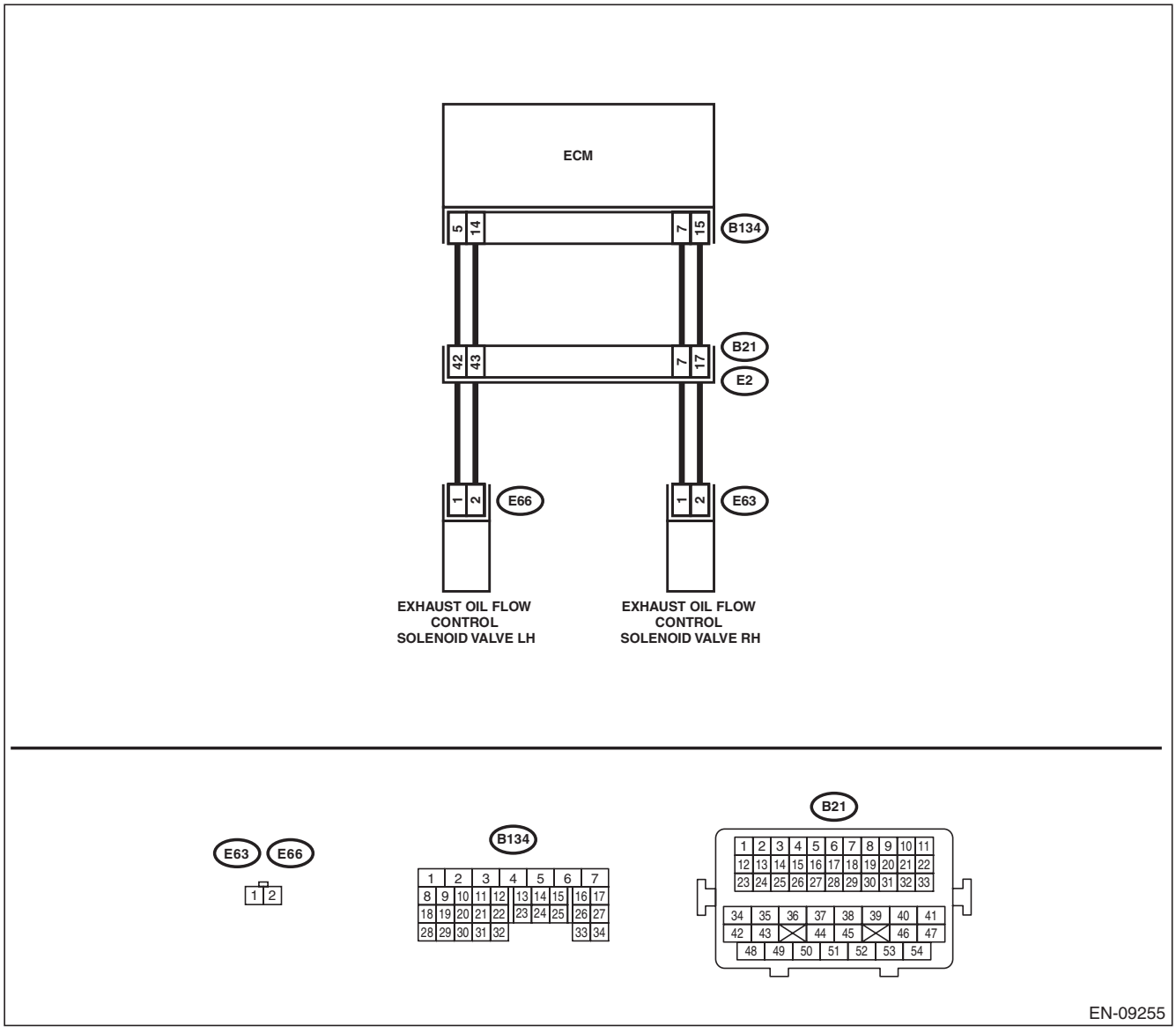
Improper idling

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM and oil flow control solenoid valve LH. 3) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 5 (+) — Chassis ground (–):*** ***(B134) No. 14 (+) — 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 flow control solenoid valve LH connector.
2	**CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE LH CONNECTOR.** Measure the resistance of harness between ECM and oil flow control solenoid valve LH connector. ***Connector & terminal*** ***(B134) No. 5 — (E66) No. 1:*** ***(B134) No. 14 — (E66) 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 flow control solenoid valve LH connector • Poor contact of coupling connector
3	**CHECK OIL FLOW CONTROL SOLENOID VALVE.** Measure the resistance between oil flow control solenoid valve terminals. ***Terminals*** ***No. 1 — No. 2:***	Is the resistance 6 — 12 Ω?	Repair the poor contact of ECM and oil flow control solenoid valve LH connector.	Replace the oil flow control solenoid valve LH. <Ref. to FU(STI)-50, Oil Flow Control Solenoid Valve.>

EK:DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1)

DTC DETECTING CONDITION:

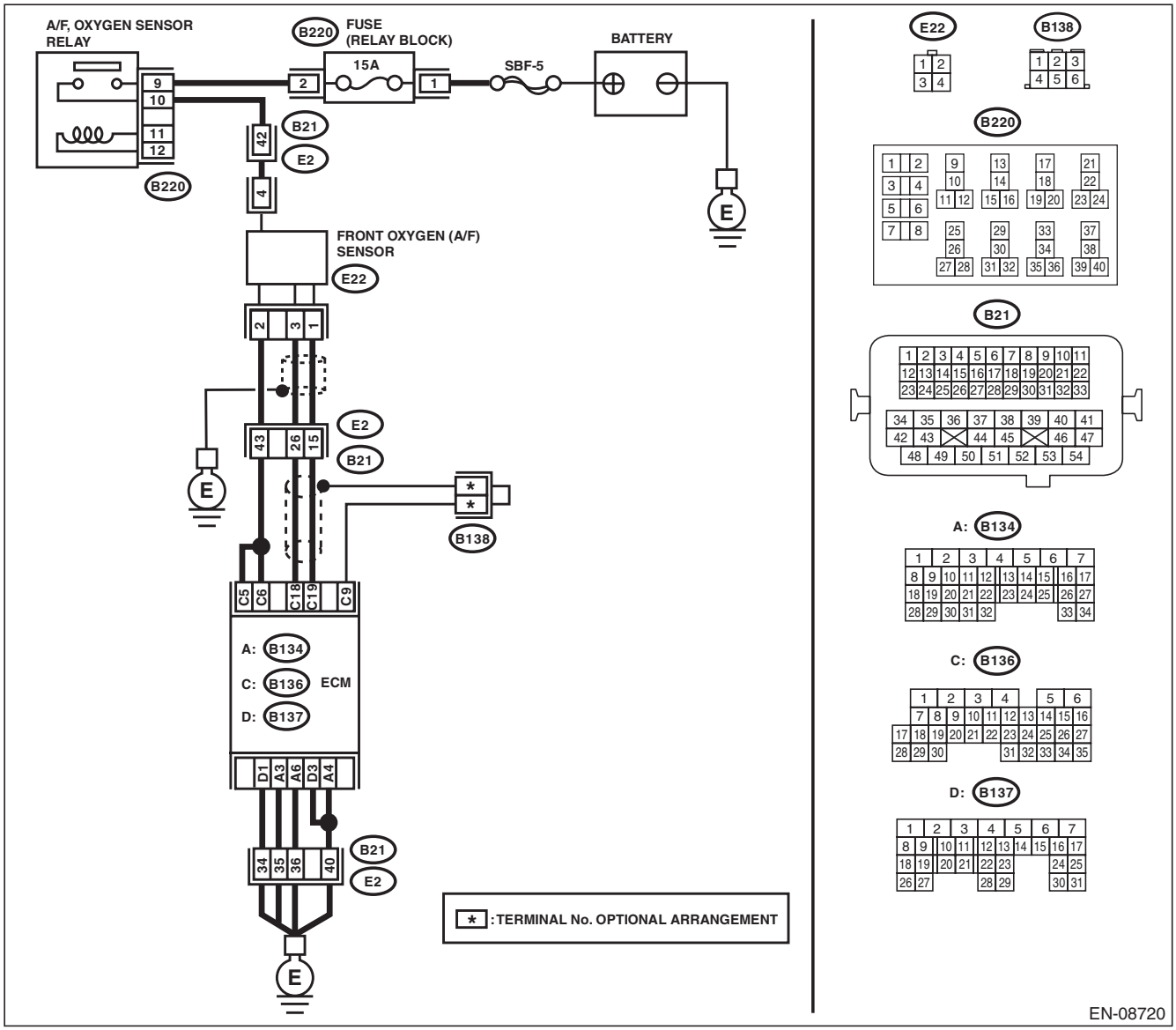
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-237, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

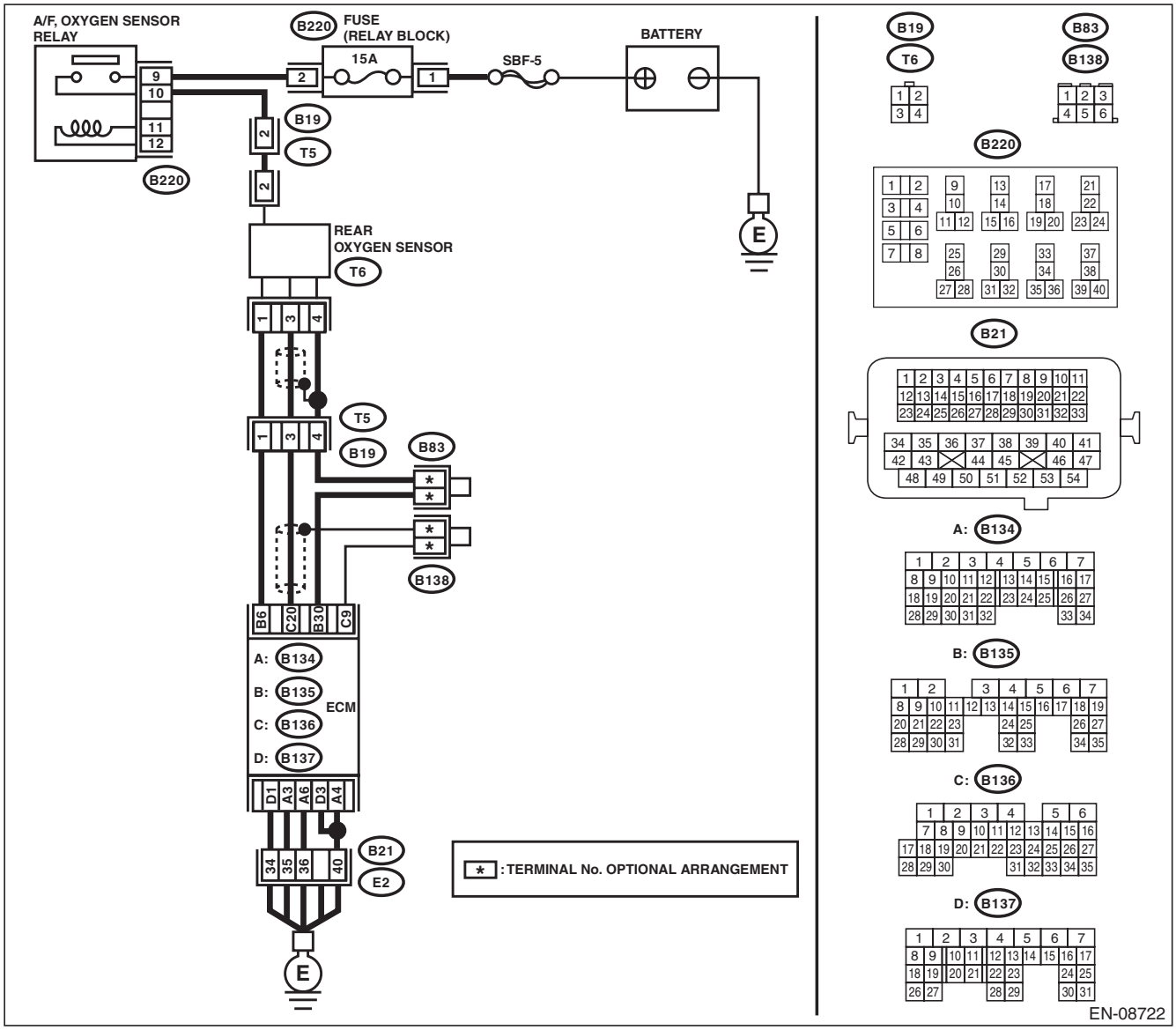
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

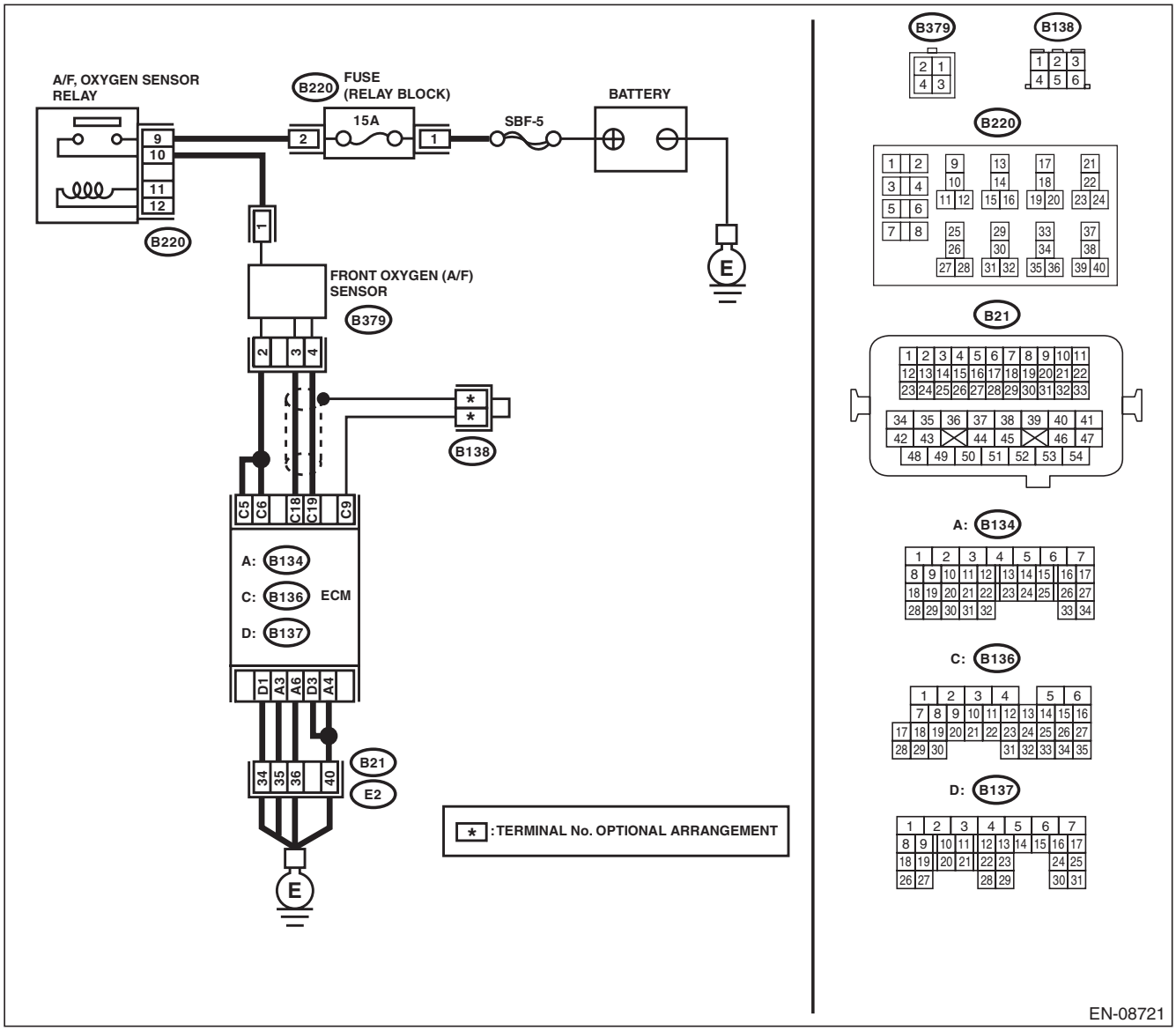
- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



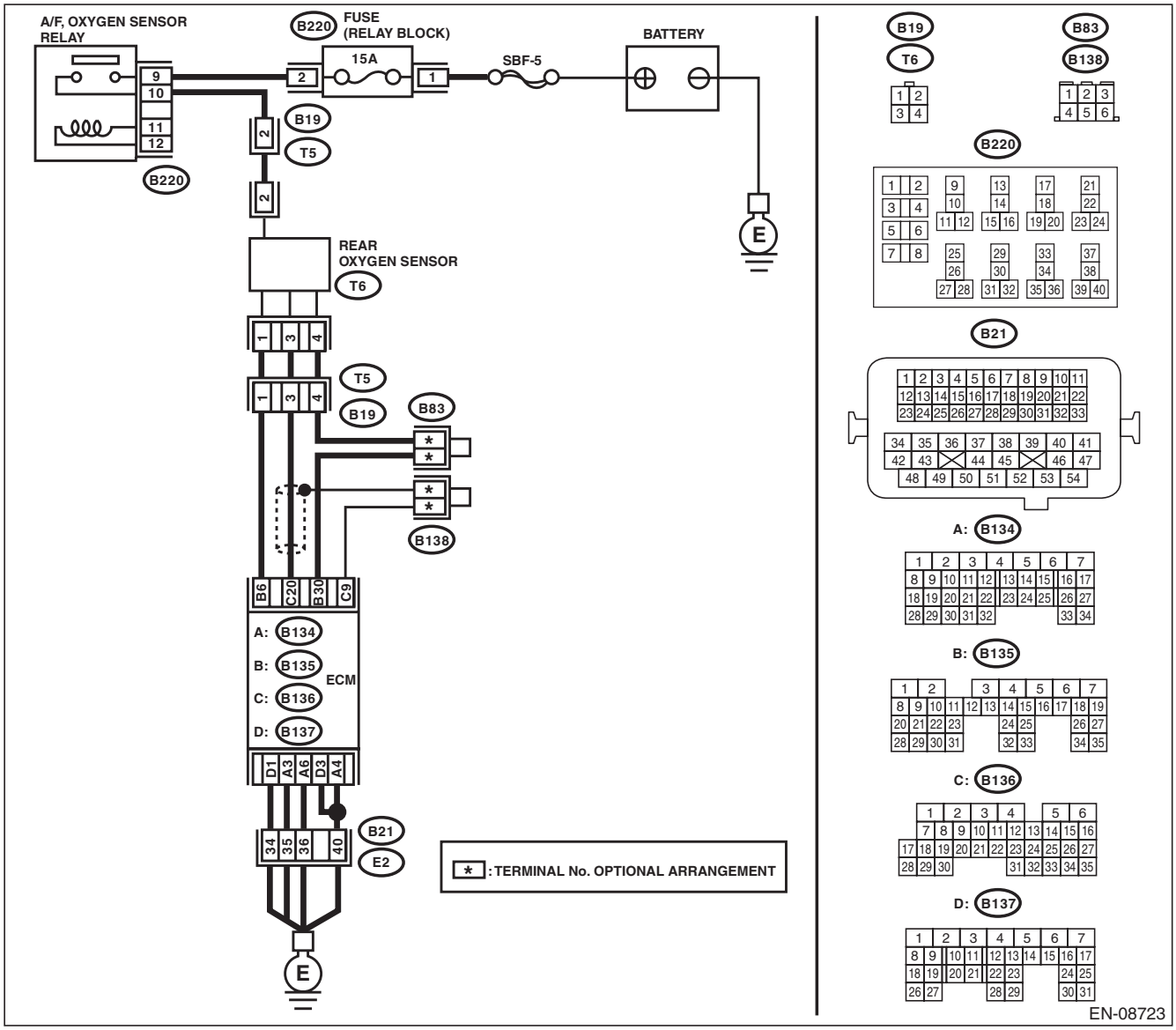
Diagnostic Procedure with Diagnostic Trouble Code (DTC)



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Diagnostic Procedure with Diagnostic Trouble Code (DTC)



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(H4DOTC)(diag)-87, 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*** ***Models without SI-DRIVE*** ***(B136) No. 19 — (E22) No. 1:*** ***(B136) No. 18 — (E22) No. 3:*** ***Models with SI-DRIVE*** ***(B136) No. 19 — (B379) No. 4:*** ***(B136) No. 18 — (B379) 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 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*** ***(B136) No. 19 — Chassis ground:*** ***(B136) No. 18 — 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*** ***Models without SI-DRIVE*** ***(E22) No. 1 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(B379) No. 4 (+) — 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*** ***Models without SI-DRIVE*** ***(E22) No. 3 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(B379) 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*** ***Models without SI-DRIVE*** ***(E22) No. 3 (+) — Chassis ground (–):*** ***(E22) No. 1 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(B379) No. 3 (+) — Chassis ground (–):*** ***(B379) No. 4 (+) — 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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, 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**.

	Step	Check	Yes	No
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**.
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 while disconnecting pressure regulator vacuum hose from intake manifold. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: If fuel pressure does not increase, squeeze the fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value 284 — 314 kPa (2.9 — 3.2 kgf/cm^2, 41 — 46 psi)?	Go to step **11**.	Repair the following item. Fuel pressure is too high: • Clogged fuel return line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel supply line
11	**CHECK FUEL PRESSURE.** After connecting the pressure regulator vacuum hose, measure fuel pressure. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: • If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. • If the measured value at this step is out of specification, check or replace pressure regulator and pressure regulator vacuum hose.	Is the measured value 230 — 260 kPa (2.35 — 2.65 kgf/cm^2, 33 — 38 psi)?	Go to step **12**.	Repair the following item. Fuel pressure is too high: • Faulty pressure regulator • Clogged fuel return line or bent hose Fuel pressure is too low: • Faulty pressure regulator • Improper fuel pump discharge • Clogged fuel supply line
12	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **13**.	Replace the engine coolant temperature sensor. <Ref. to FU(STI)-34, Engine Coolant Temperature Sensor.> <Ref. to FU(w/o STI)-34, Engine Coolant 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) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **14**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>
14	**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) Place the shift lever in 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 value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **15**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>
15	**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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.490 V or more?	Go to step **16**.	Go to step **17**.

	Step	Check	Yes	No
16	**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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.250 V or less?	Go to step **18**.	Go to step **17**.
17	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **19**.
18	**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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Rear O2 Sensor» kept at 0.250 V or less for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>	Go to step **19**.
19	**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*** ***(B136) No. 20 — (T6) No. 3:*** ***(B135) No. 30 — (T6) No. 4:***	Is the resistance less than 1 Ω?	Go to step **20**.	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
20	**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*** ***(T6) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, 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

EL:DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1)

DTC DETECTING CONDITION:

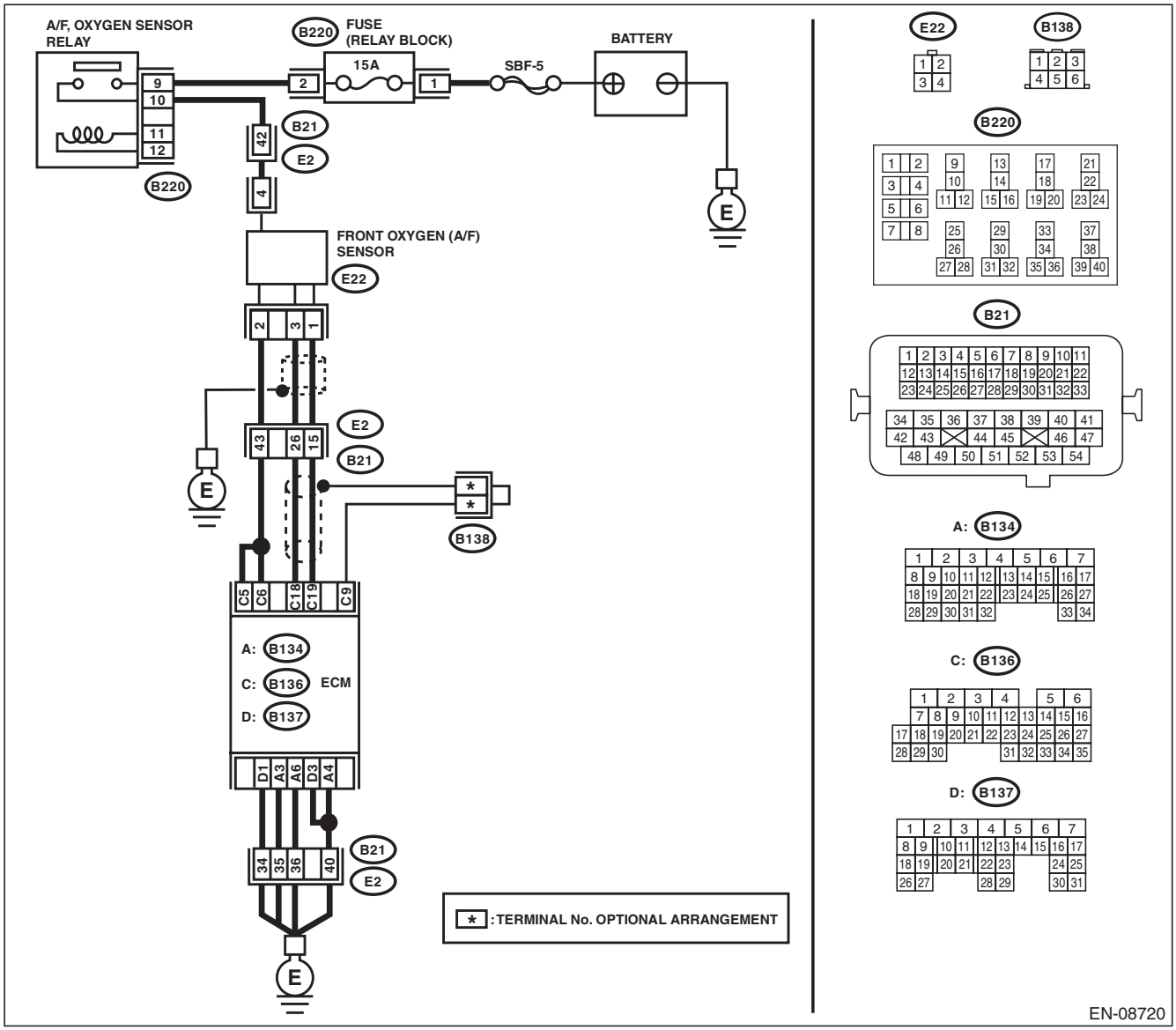
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-239, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

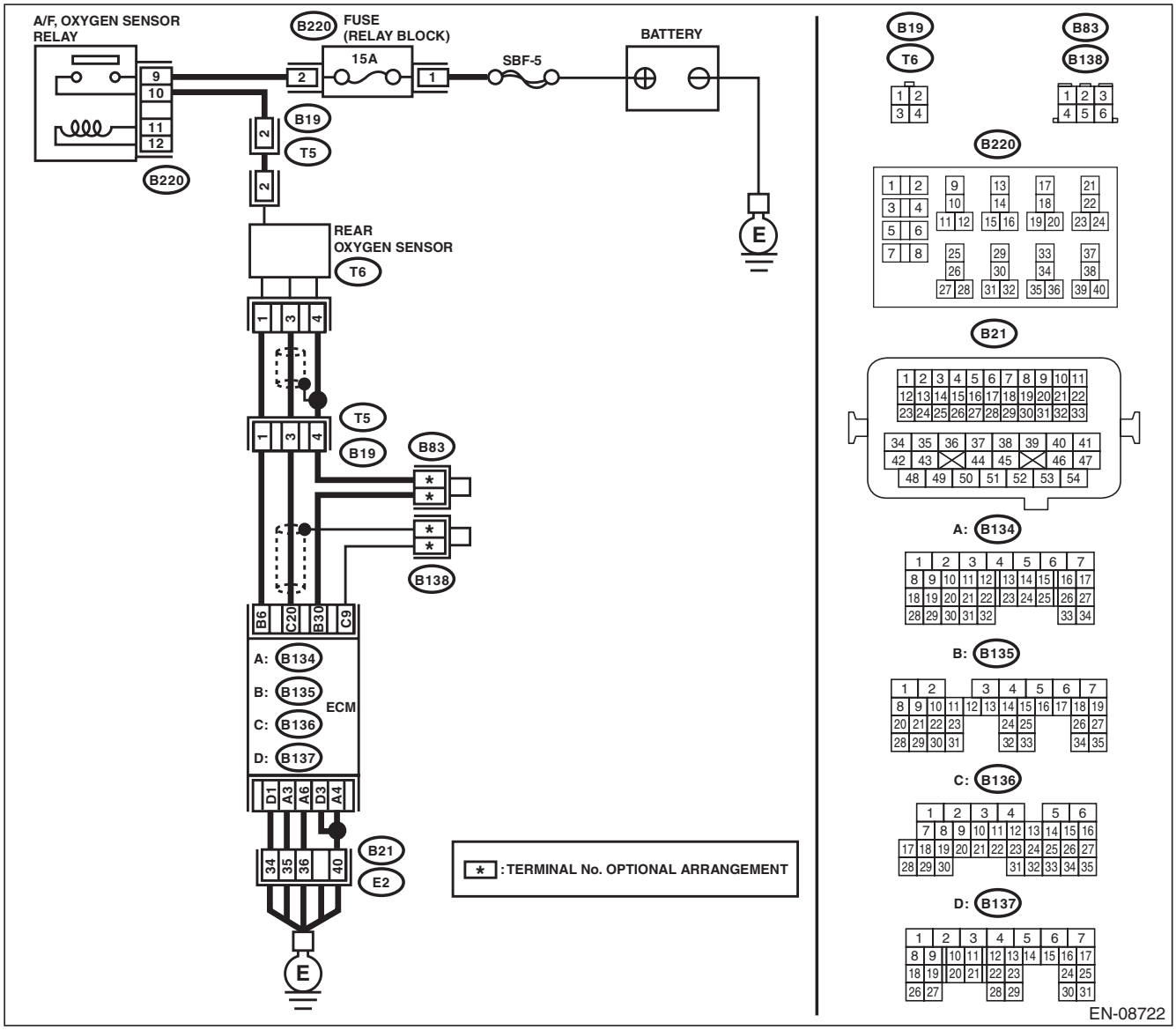
CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

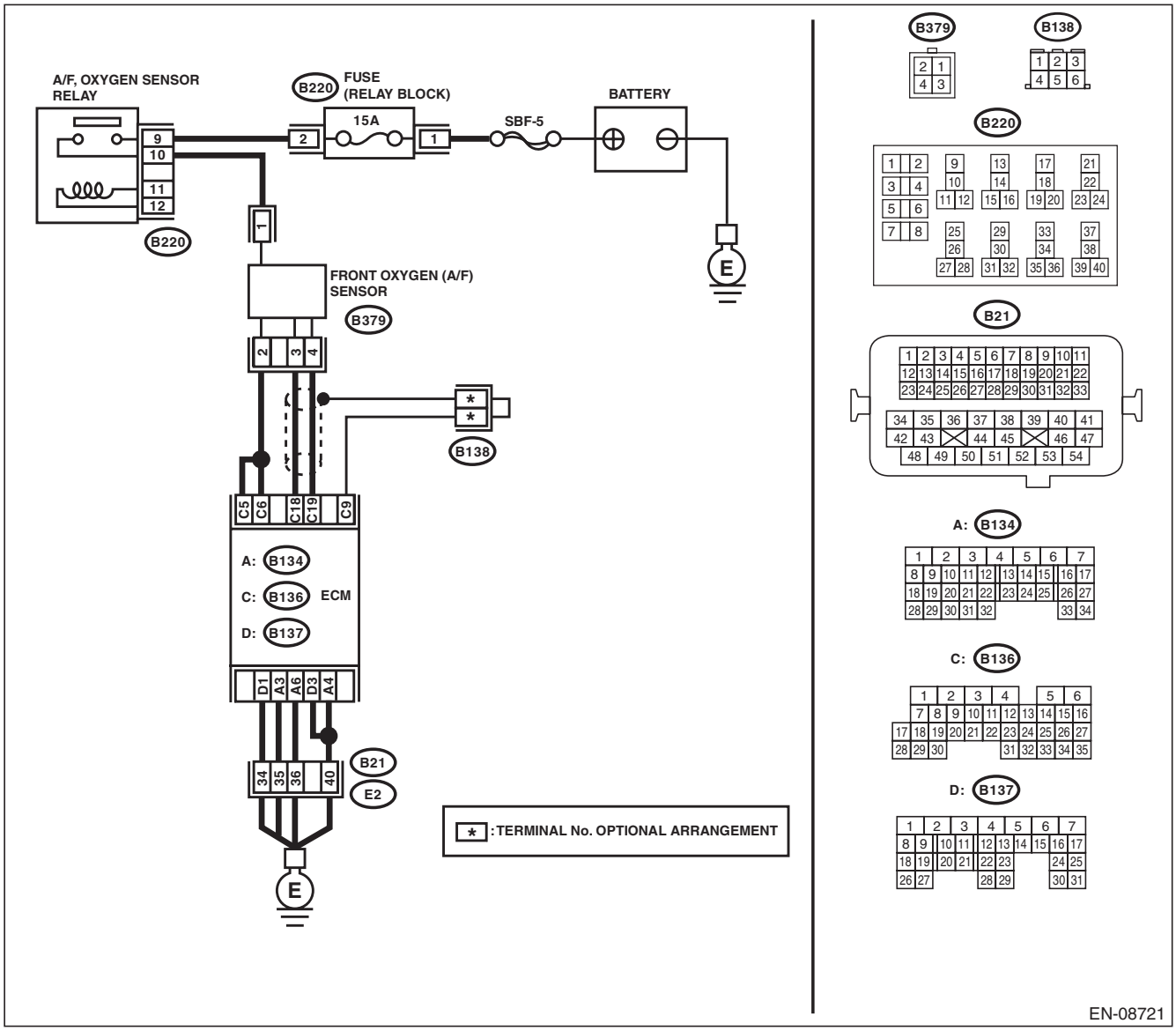
WIRING DIAGRAM:

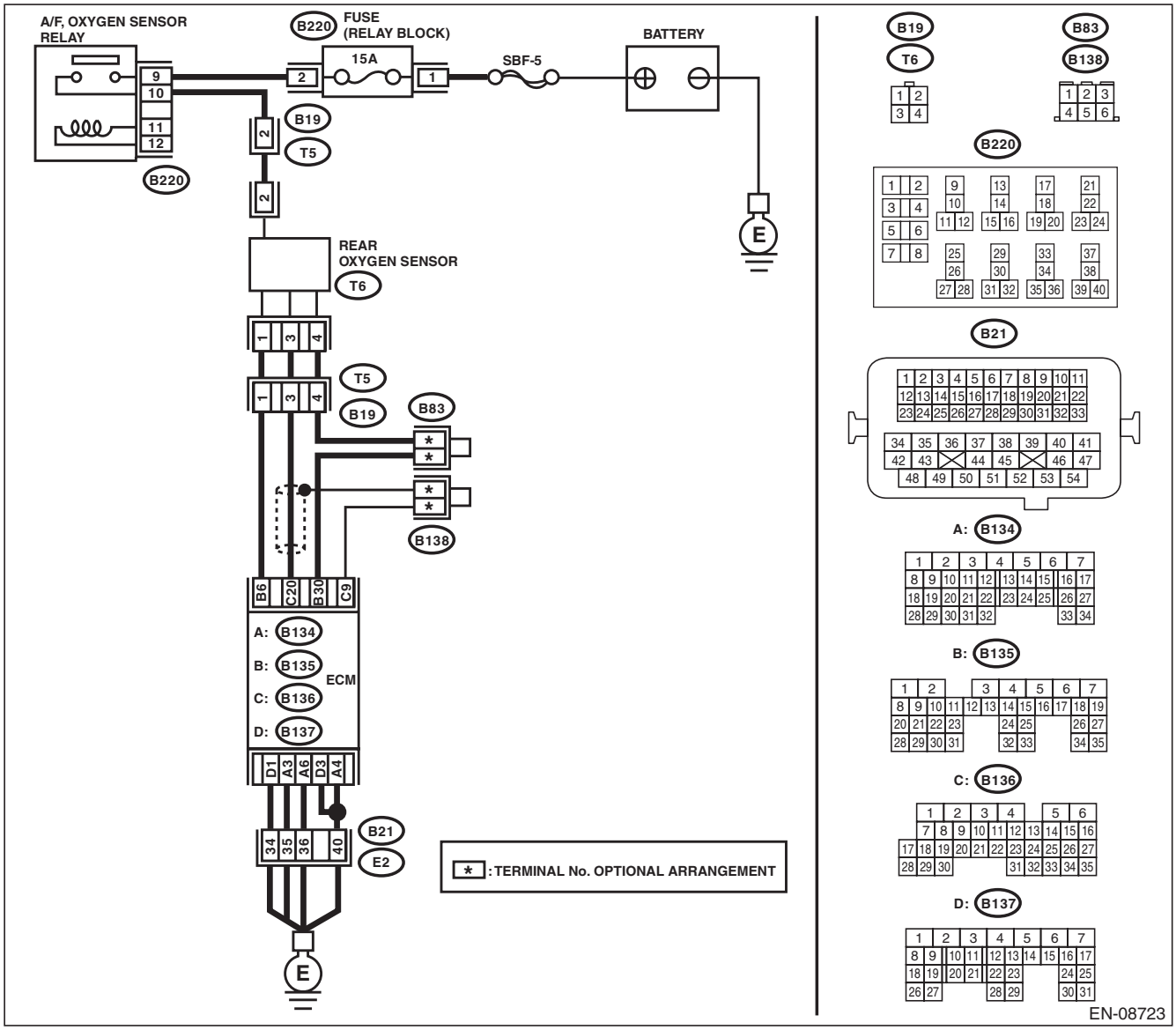
- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>




A/F, OXYGEN SENSOR RELAY
B220
FUSE (RELAY BLOCK)
15A
SBF-5
BATTERY
B19
T5
REAR OXYGEN SENSOR
T6
T5
B19
B83
B138
B6
C20
B30
C9
A: B134
B: B135
C: B136
D: B137
ECM
D1
A3
A6
D3
A4
34
35
36
40
B21
E2
E
: TERMINAL No. OPTIONAL ARRANGEMENT
B19
T6
B83
B138
B220
B21
A: B134
B: B135
C: B136
D: B137
EN-08722

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>





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(H4DOTC)(diag)-87, 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*** ***Models without SI-DRIVE*** ***(B136) No. 19 — (E22) No. 1:*** ***(B136) No. 18 — (E22) No. 3:*** ***Models with SI-DRIVE*** ***(B136) No. 19 — (B379) No. 4:*** ***(B136) No. 18 — (B379) No. 3:***	Is the resistance less than 1 Ω?	Go to step **4**.	Repair the open circuit of harness between ECM and front oxygen (A/F) sensor connector.
4	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 19 — Chassis ground:*** ***(B136) No. 18 — 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*** ***Models without SI-DRIVE*** ***(E22) No. 1 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(B379) No. 4 (+) — 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*** ***Models without SI-DRIVE*** ***(E22) No. 3 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(B379) 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*** ***Models without SI-DRIVE*** ***(E22) No. 3 (+) — Chassis ground (–):*** ***(E22) No. 1 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(B379) No. 3 (+) — Chassis ground (–):*** ***(B379) No. 4 (+) — 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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, 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**.

	Step	Check	Yes	No
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**.
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 while disconnecting pressure regulator vacuum hose from intake manifold. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: If fuel pressure does not increase, squeeze the fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value 284 — 314 kPa (2.9 — 3.2 kgf/cm^2, 41 — 46 psi)?	Go to step **11**.	Repair the following item. Fuel pressure is too high: • Clogged fuel return line or bent hose Fuel pressure is too low: • Improper fuel pump discharge • Clogged fuel supply line
11	**CHECK FUEL PRESSURE.** After connecting the pressure regulator vacuum hose, measure fuel pressure. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: • If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. • If the measured value at this step is out of specification, check or replace pressure regulator and pressure regulator vacuum hose.	Is the measured value 230 — 260 kPa (2.35 — 2.65 kgf/cm^2, 33 — 38 psi)?	Go to step **12**.	Repair the following item. Fuel pressure is too high: • Faulty pressure regulator • Clogged fuel return line or bent hose Fuel pressure is too low: • Faulty pressure regulator • Improper fuel pump discharge • Clogged fuel supply line
12	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **13**.	Replace the engine coolant temperature sensor. <Ref. to FU(STI)-34, Engine Coolant Temperature Sensor.> <Ref. to FU(w/o STI)-34, Engine Coolant 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) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 2.0 — 5.0 g/s (0.26 — 0.66 lb/m)?	Go to step **14**.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>
14	**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) Place the shift lever in 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 value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». Is the obtained value –10 — 50°C (–18 — 90°F)?	Go to step **15**.	Check the mass air flow and intake air temperature sensor. <Ref. to FU(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>
15	**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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.490 V or more?	Go to step **16**.	Go to step **17**.

	Step	Check	Yes	No
16	**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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.250 V or less?	Go to step **18**.	Go to step **17**.
17	**CHECK REAR OXYGEN SENSOR CONNECTOR AND COUPLING CONNECTOR.**	Has water entered the connector?	Completely remove any water inside.	Go to step **19**.
18	**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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Rear O2 Sensor» kept at 0.8 V or more for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>	Go to step **19**.
19	**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*** ***(B136) No. 20 — (T6) No. 3:*** ***(B135) No. 30 — (T6) No. 4:***	Is the resistance less than 1 Ω?	Go to step **20**.	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
20	**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*** ***(T6) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, 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

EM:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-241, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

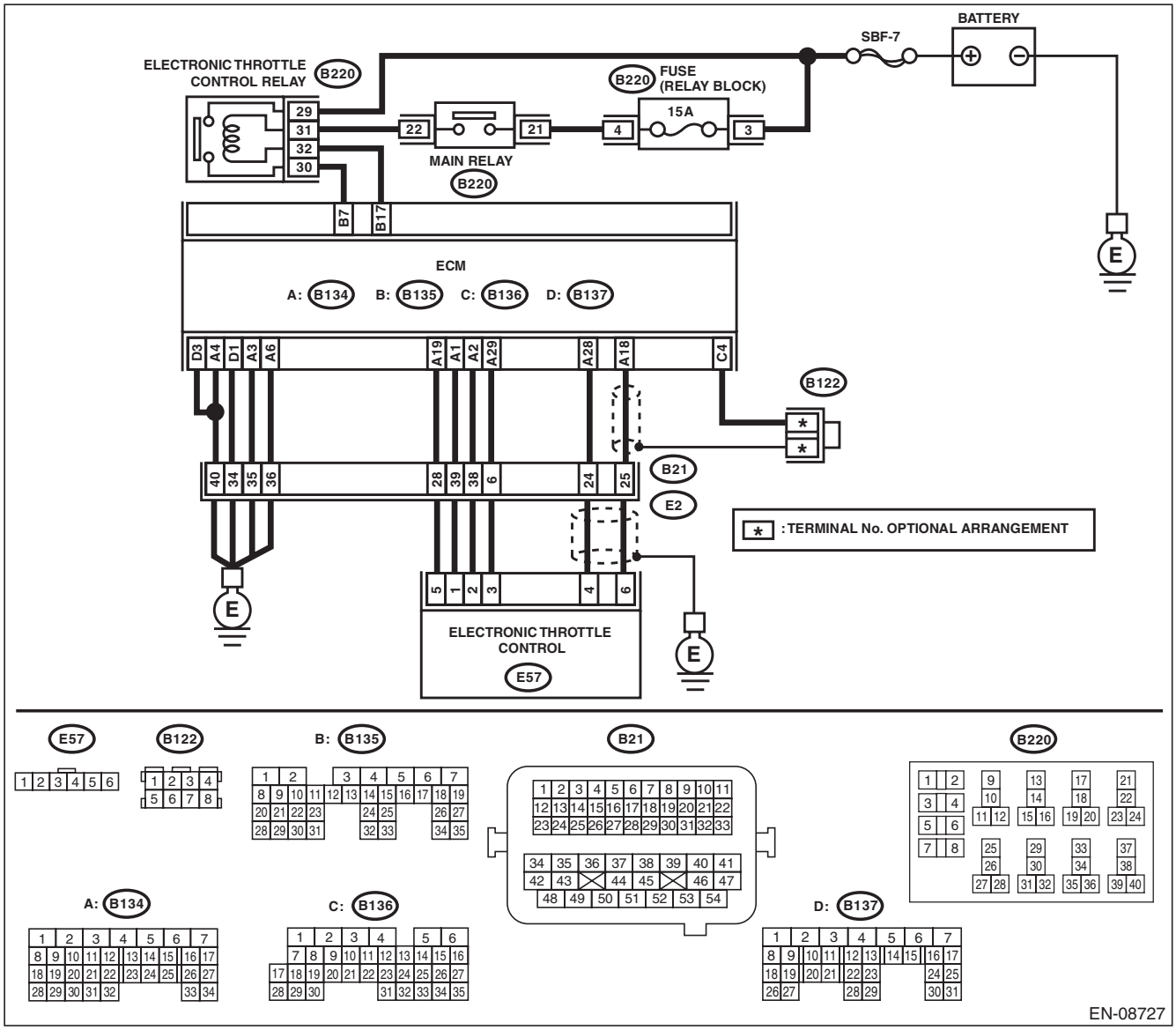
- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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(STI)-64, Electronic Throttle Control Relay.> <Ref. to FU(w/o STI)-62, 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 connector 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*** ***(B135) No. 17 — (B220) No. 32:*** ***(B135) No. 7 — (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. 4:*** ***(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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>
8	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Disconnect the connector 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 connector 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) Start the engine and warm up completely. 3) Stop the engine, and then turn the ignition switch to ON (engine OFF). 4) Read the value of «Main-Throttle Sensor» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Main-Throttle Sensor» 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(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>
13	**CHECK SENSOR OUTPUT.** Read the value of «Sub-Throttle Sensor» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Sub-Throttle Sensor» 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(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>
14	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR.** 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*** ***(B134) No. 2 — (E57) No. 2:*** ***(B134) No. 1 — (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 MOTOR.** 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 MOTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector 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.

	Step	Check	Yes	No
17	**CHECK ELECTRONIC THROTTLE CONTROL MOTOR 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.
18	**CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B134) No. 3 — Chassis ground:*** ***(B134) No. 4 — Chassis ground:*** ***(B134) No. 6 — Chassis ground:*** ***(B137) No. 1 — Chassis ground:*** ***(B137) No. 3 — 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(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, 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(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>

EN:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-243, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

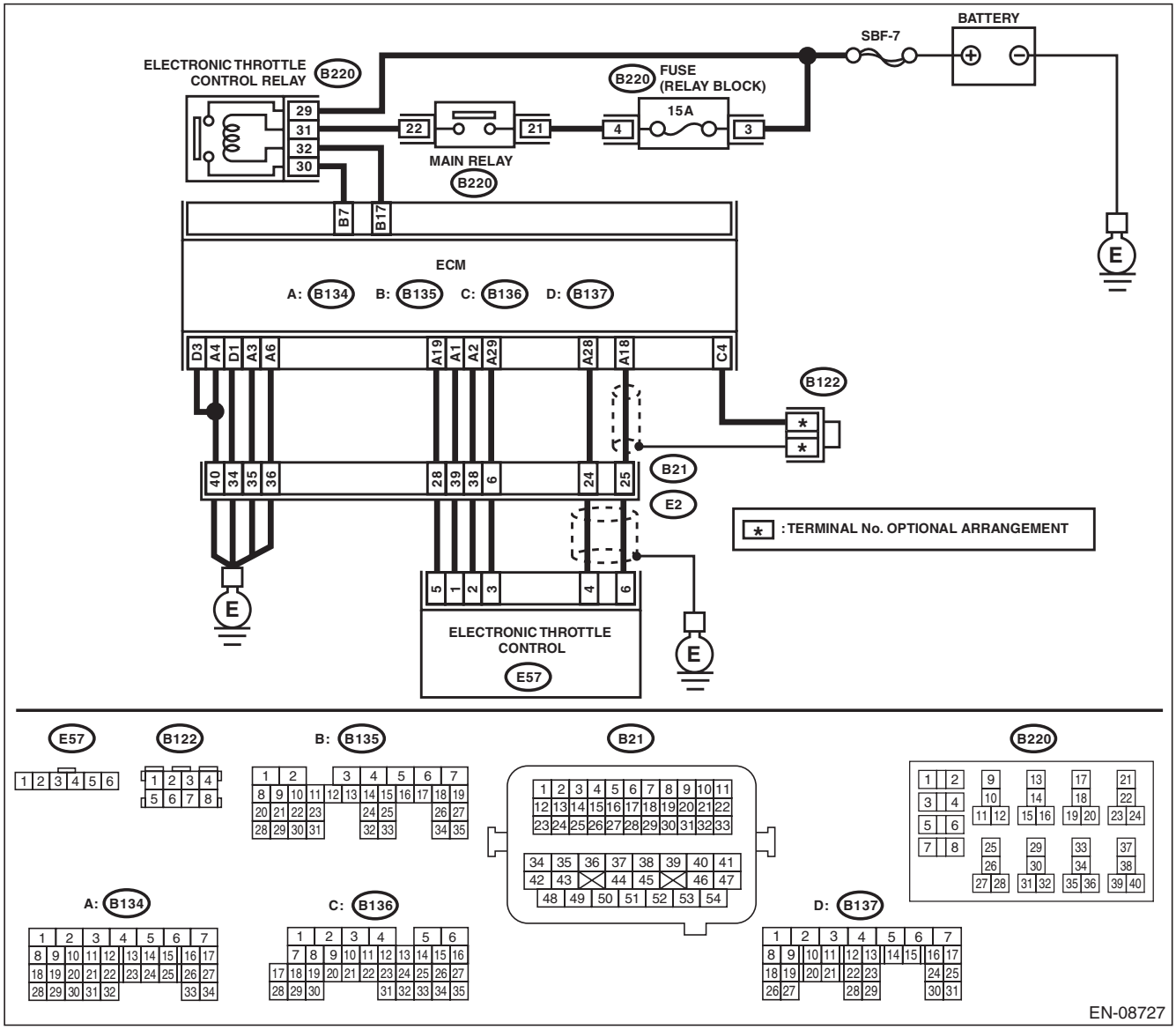
- Improper idling
- Poor driving performance
- Engine stalls.

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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(STI)-64, Electronic Throttle Control Relay.> <Ref. to FU(w/o STI)-62, 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 connector 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*** ***(B135) No. 17 — (B220) No. 32:*** ***(B135) No. 7 — (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.

EO:DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH

DTC DETECTING CONDITION:

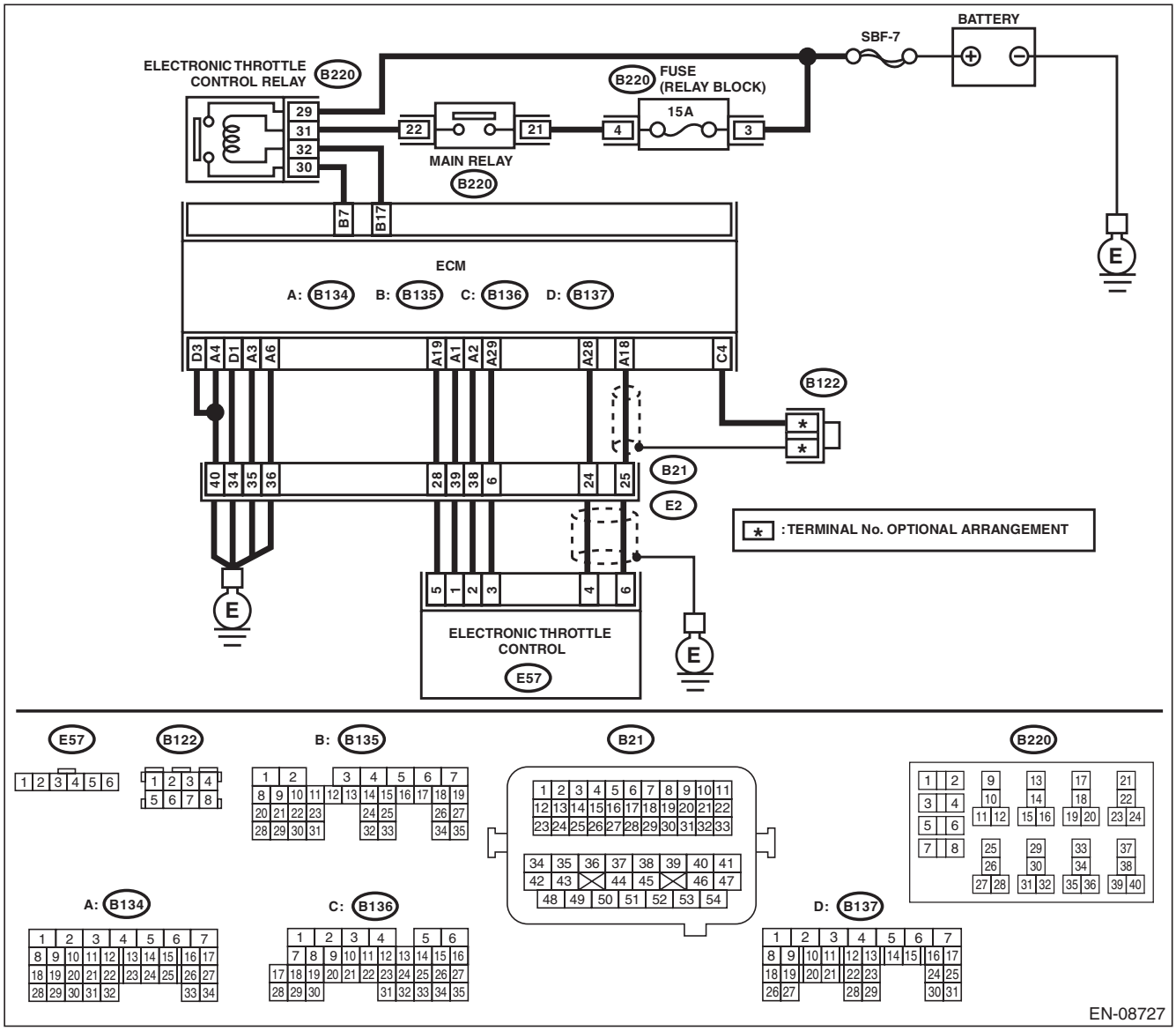
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-245, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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(STI)-64, Electronic Throttle Control Relay.> <Ref. to FU(w/o STI)-62, 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 connector from ECM. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 17 — 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.

EP:DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)(diag)-369, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

EQ:DTC P2119 THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/PERFORMANCE

NOTE:
For the diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)(diag)-369, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-252, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

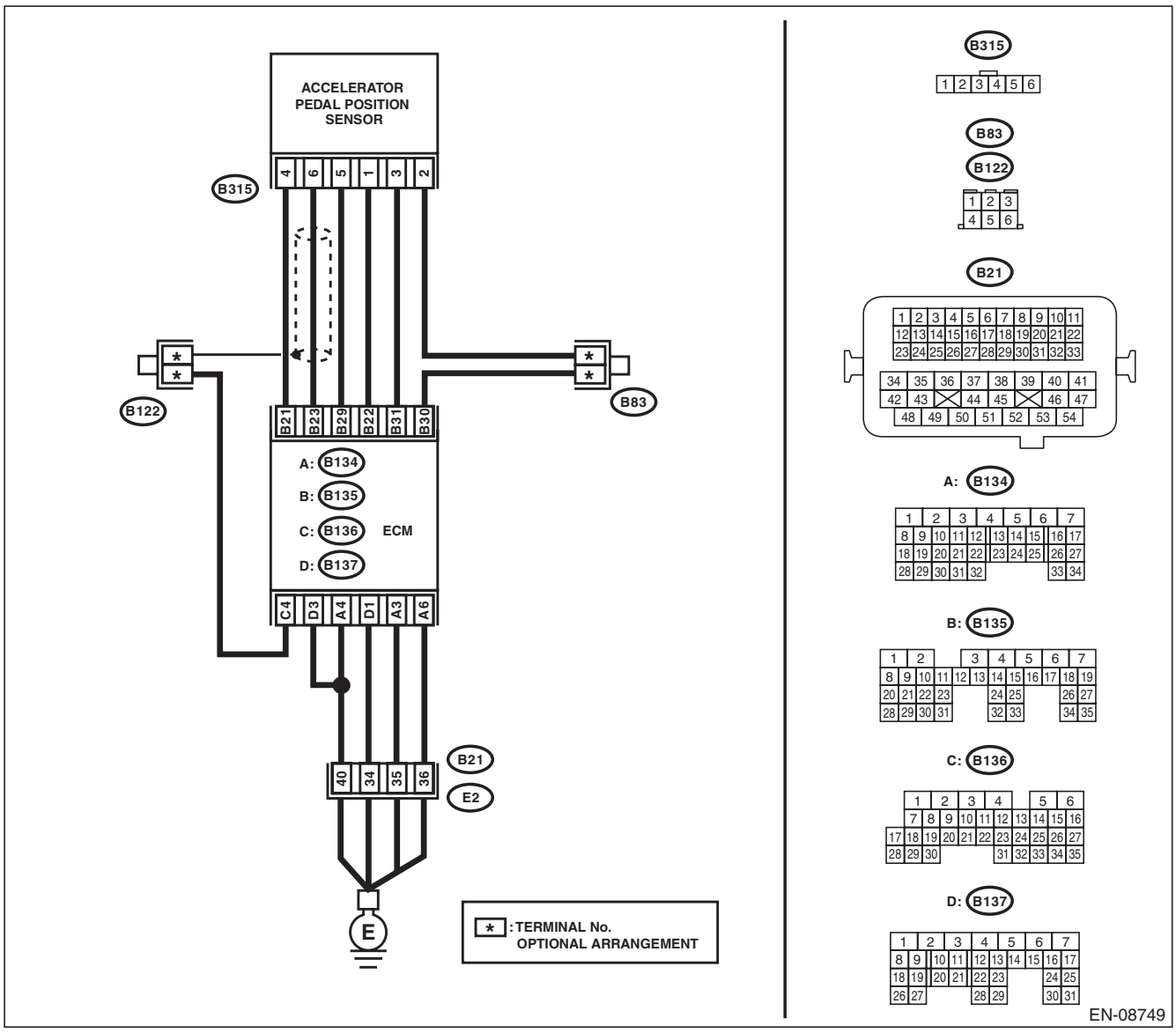
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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 — (B136) No. 4:***	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(STI)-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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-254, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

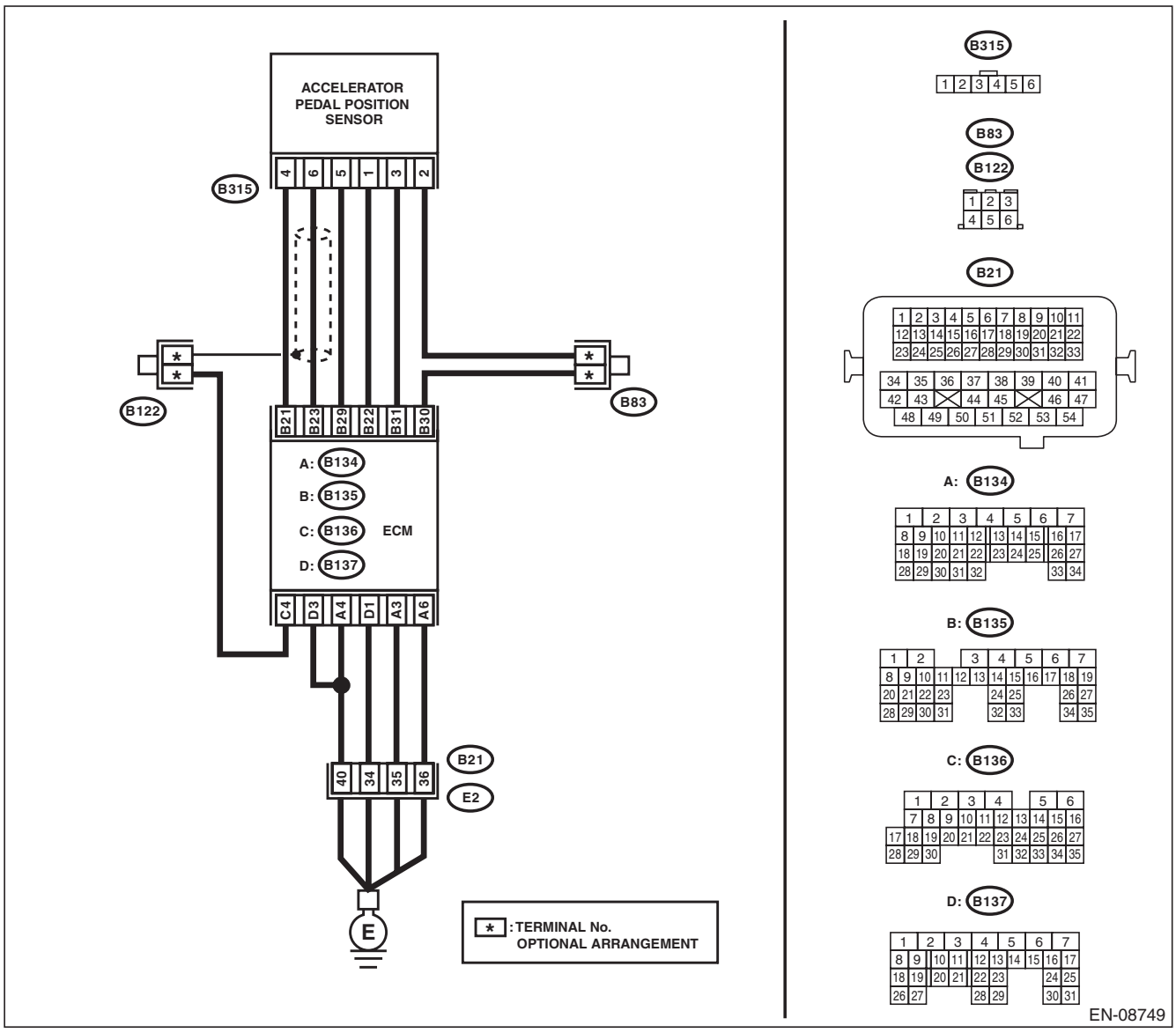
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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 connector 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(STI)-4, Accelerator Pedal.>	Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector.

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

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-256, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

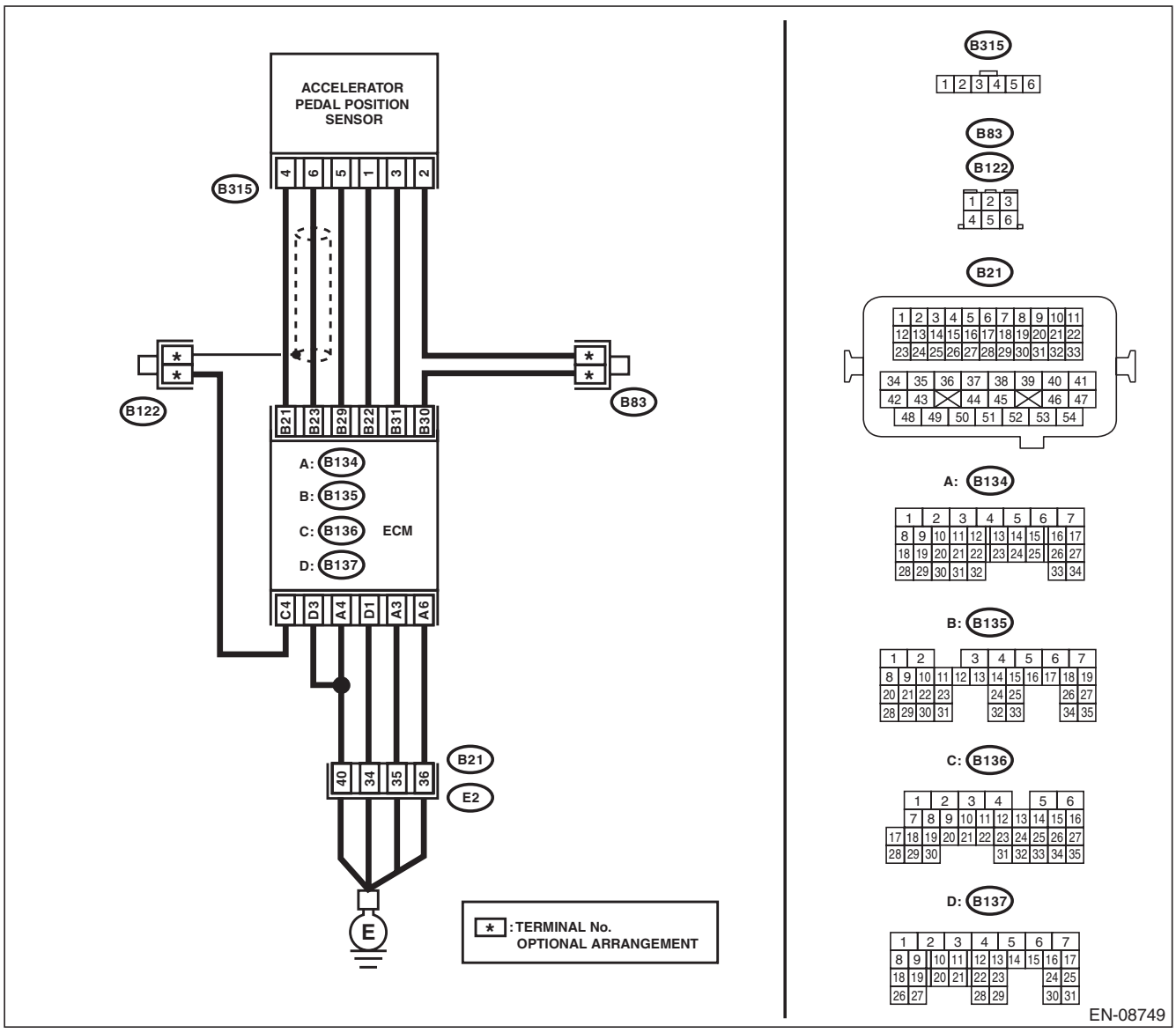
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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(STI)-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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>

EU:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-258, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

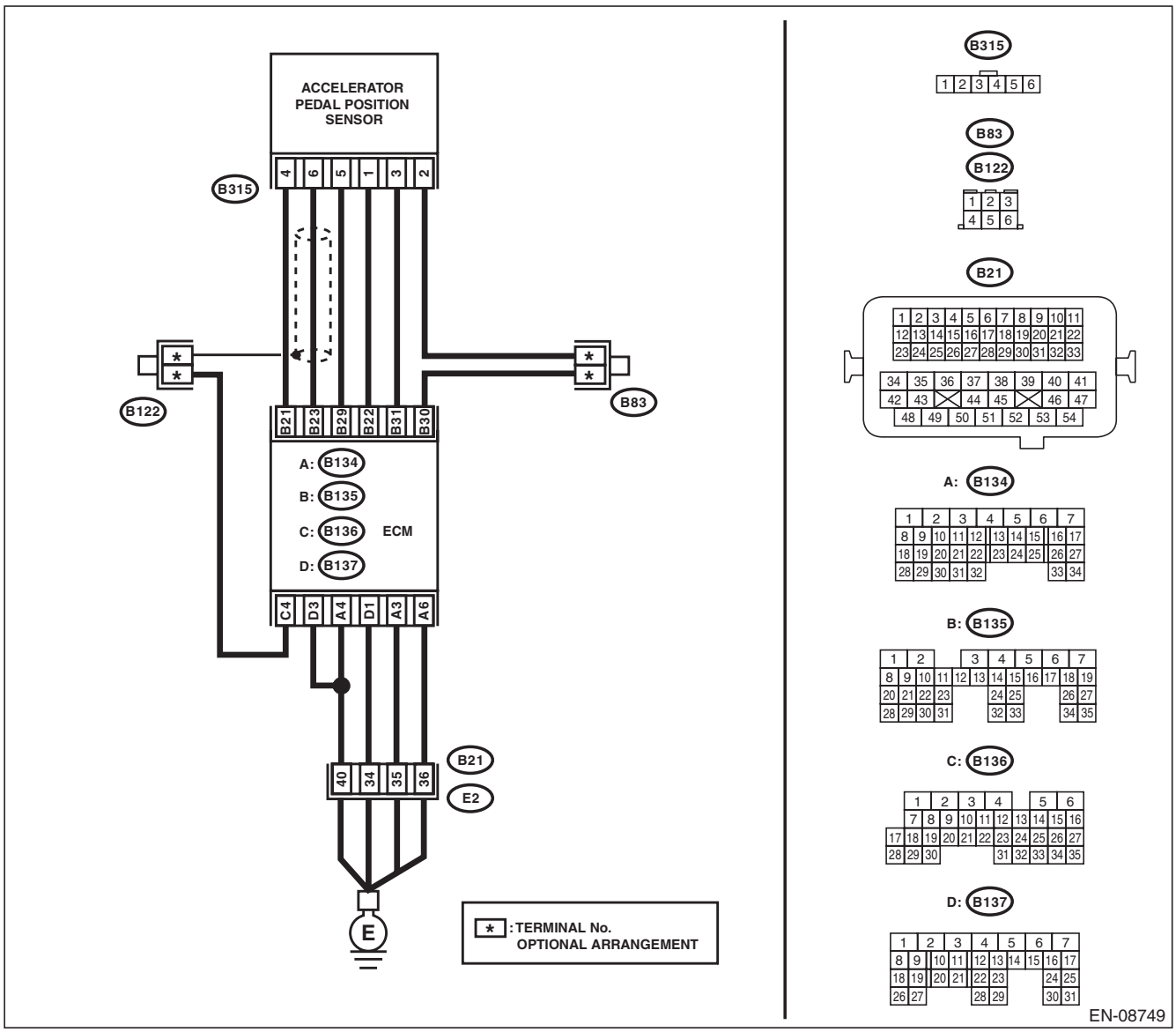
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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 connector 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(STI)-4, Accelerator Pedal.>	Repair the short circuit to power supply in the harness between the ECM and accelerator pedal position sensor connector.

EV:DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-260, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH “A”/“B” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

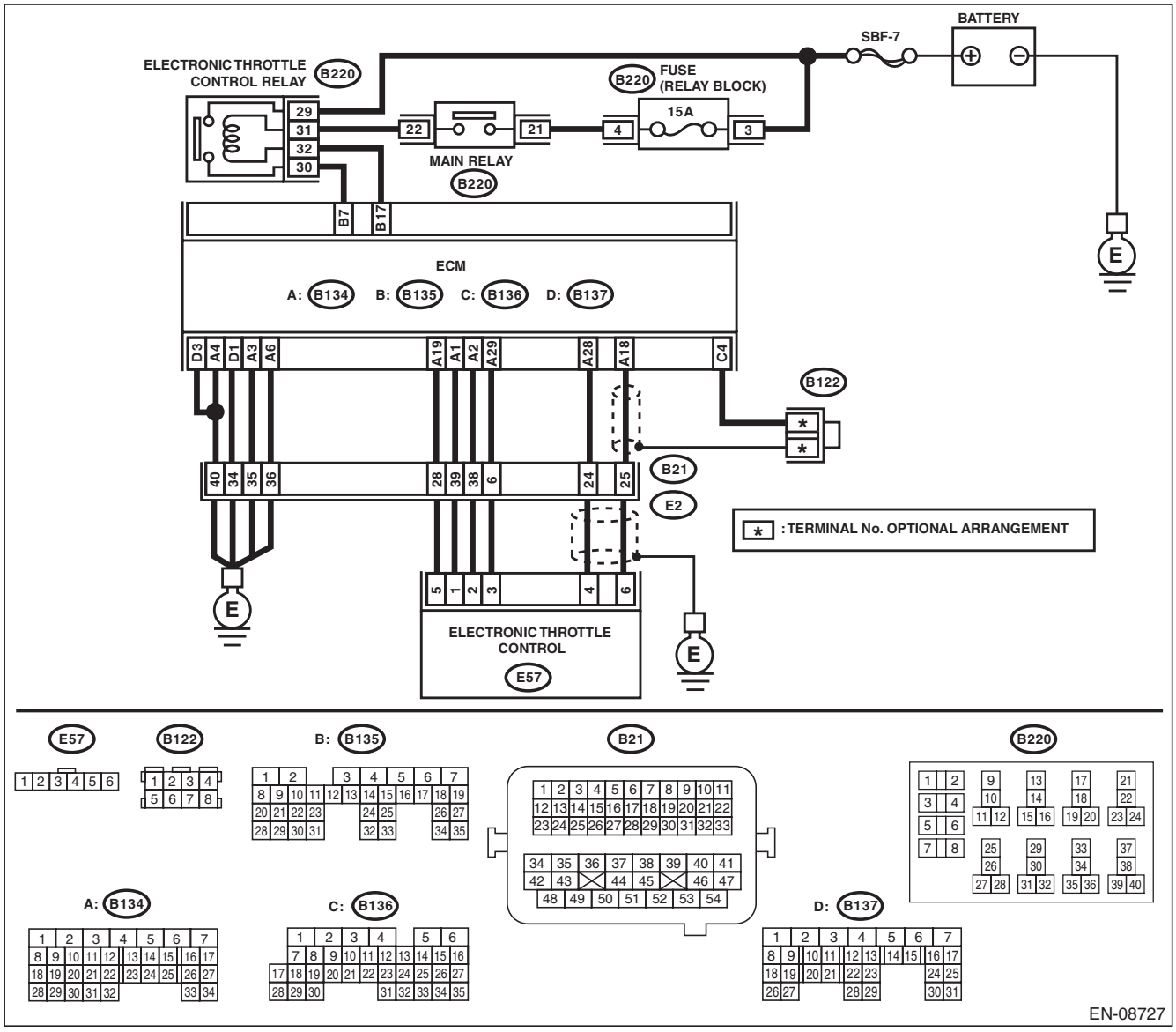
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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. 4:*** ***(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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>
3	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Disconnect the connector 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

	Step	Check	Yes	No
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**.
6	**CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector 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(STI)-15, Throttle Body.> <Ref. to FU(w/o STI)-15, Throttle Body.>	Repair the short circuit to power in harness between ECM and electronic throttle control connector.

EW:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-262, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

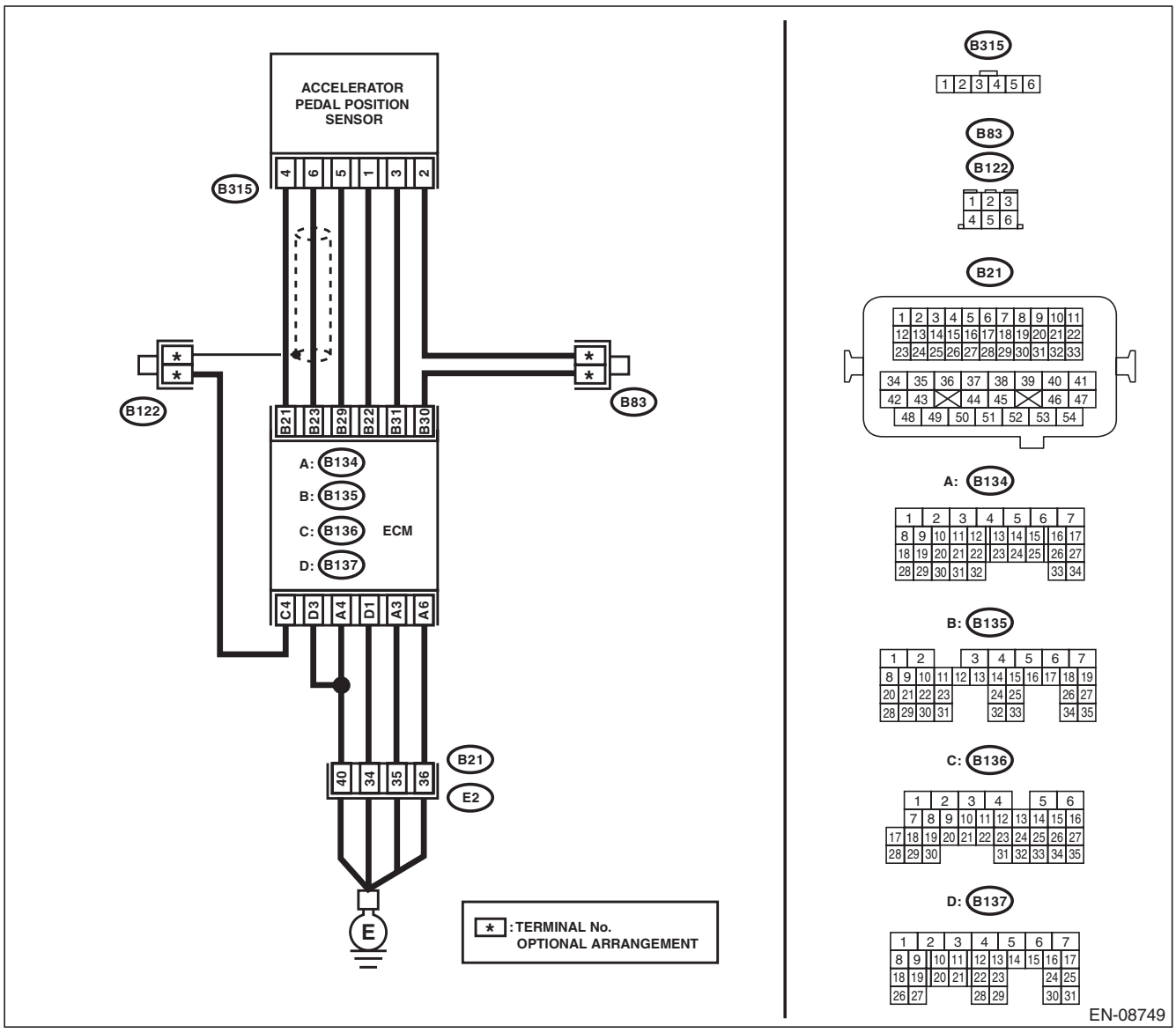
- Improper idling
- Poor driving performance

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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(STI)-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 coupling connector

EX:DTC P2195 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

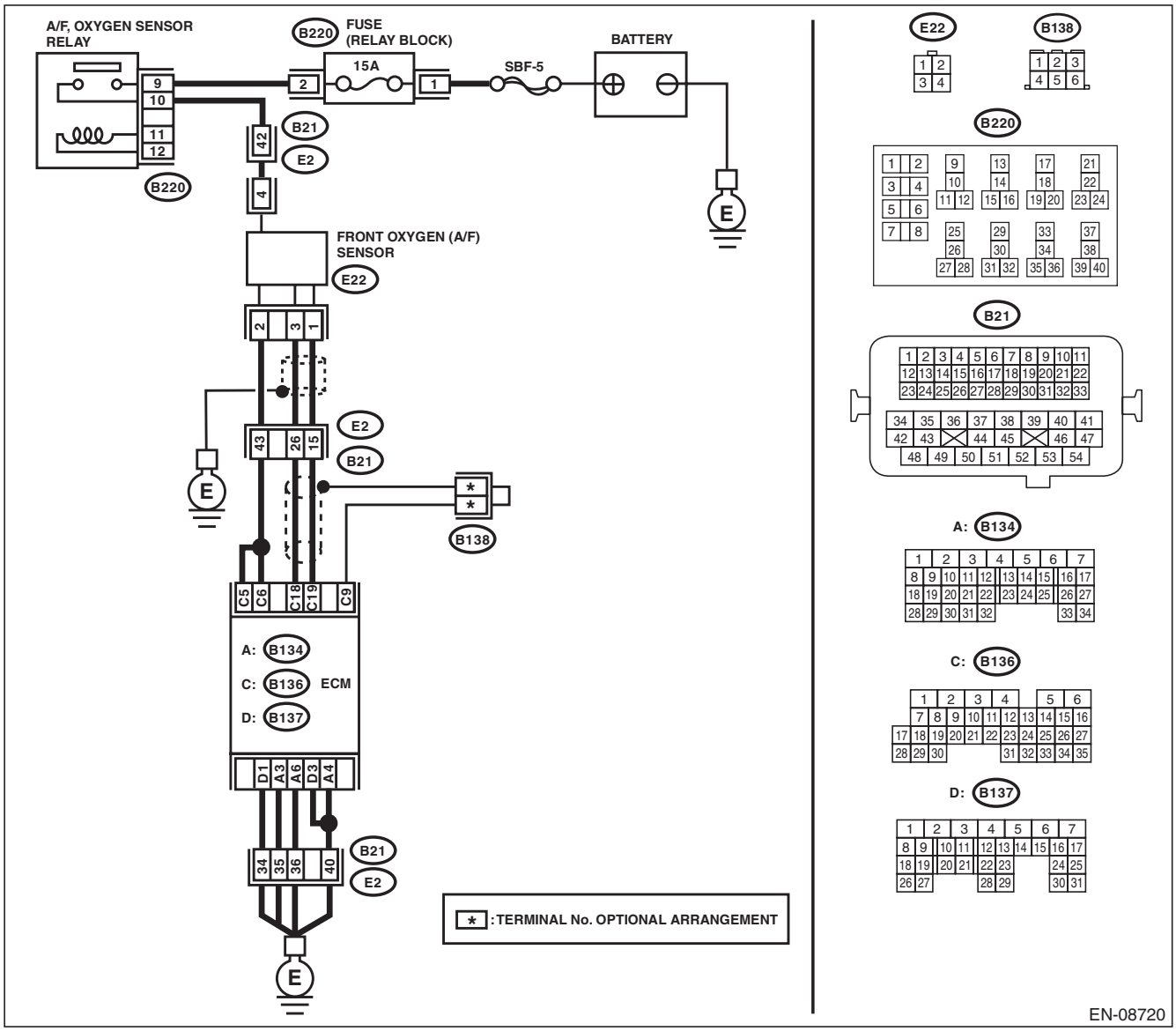
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-264, DTC P2195 O2 SENSOR SIGNAL BIASED/ STUCK LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

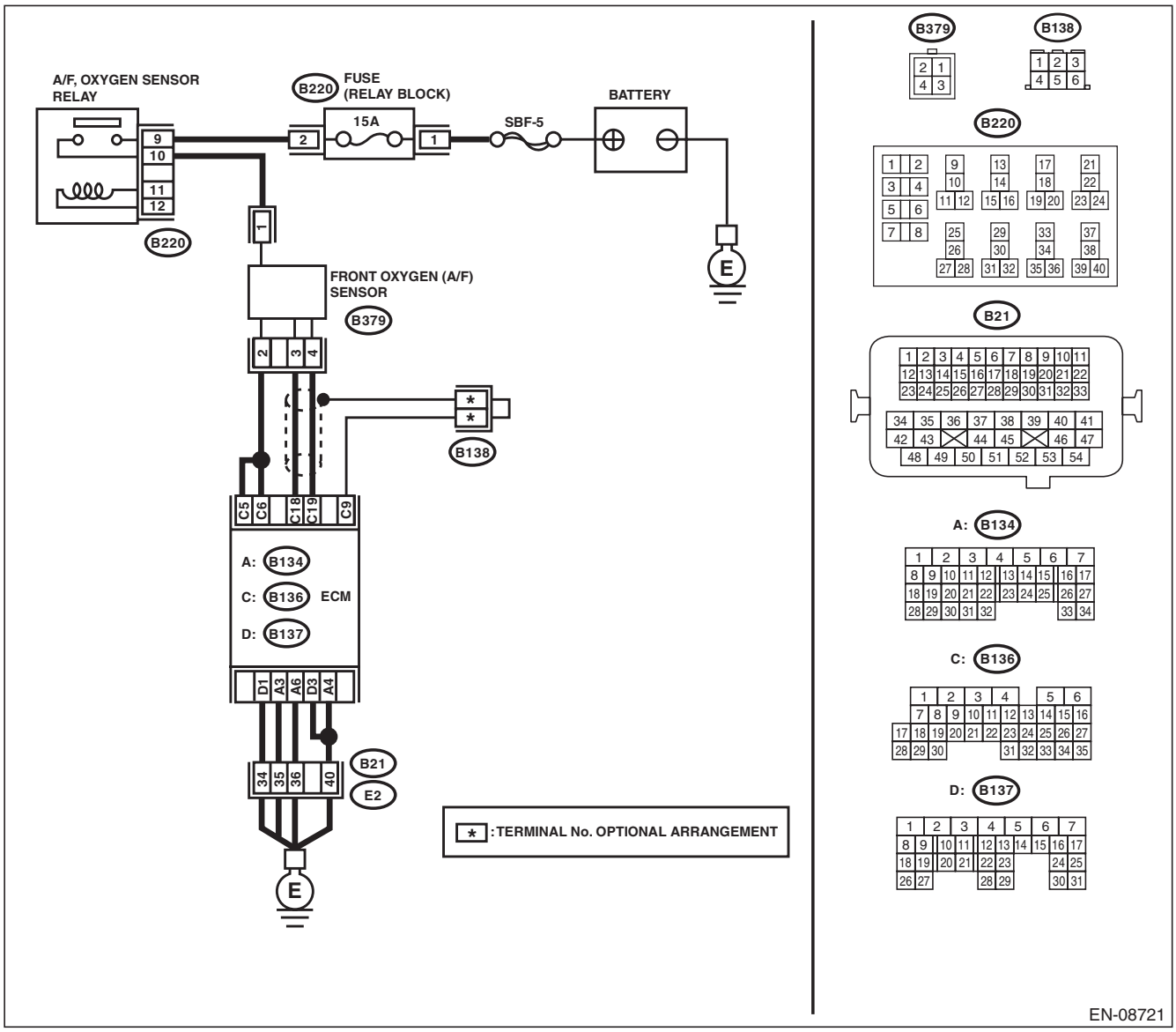
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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**.
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*** ***Models without SI-DRIVE*** ***(B136) No. 19 — (E22) No. 1:*** ***(B136) No. 18 — (E22) No. 3:*** ***Models with SI-DRIVE*** ***(B136) No. 19 — (B379) No. 4:*** ***(B136) No. 18 — (B379) No. 3:***	Is the resistance less than 1 Ω?	Go to step **3**.	Repair the open 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(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>

EY:DTC P2196 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 1)

DTC DETECTING CONDITION:

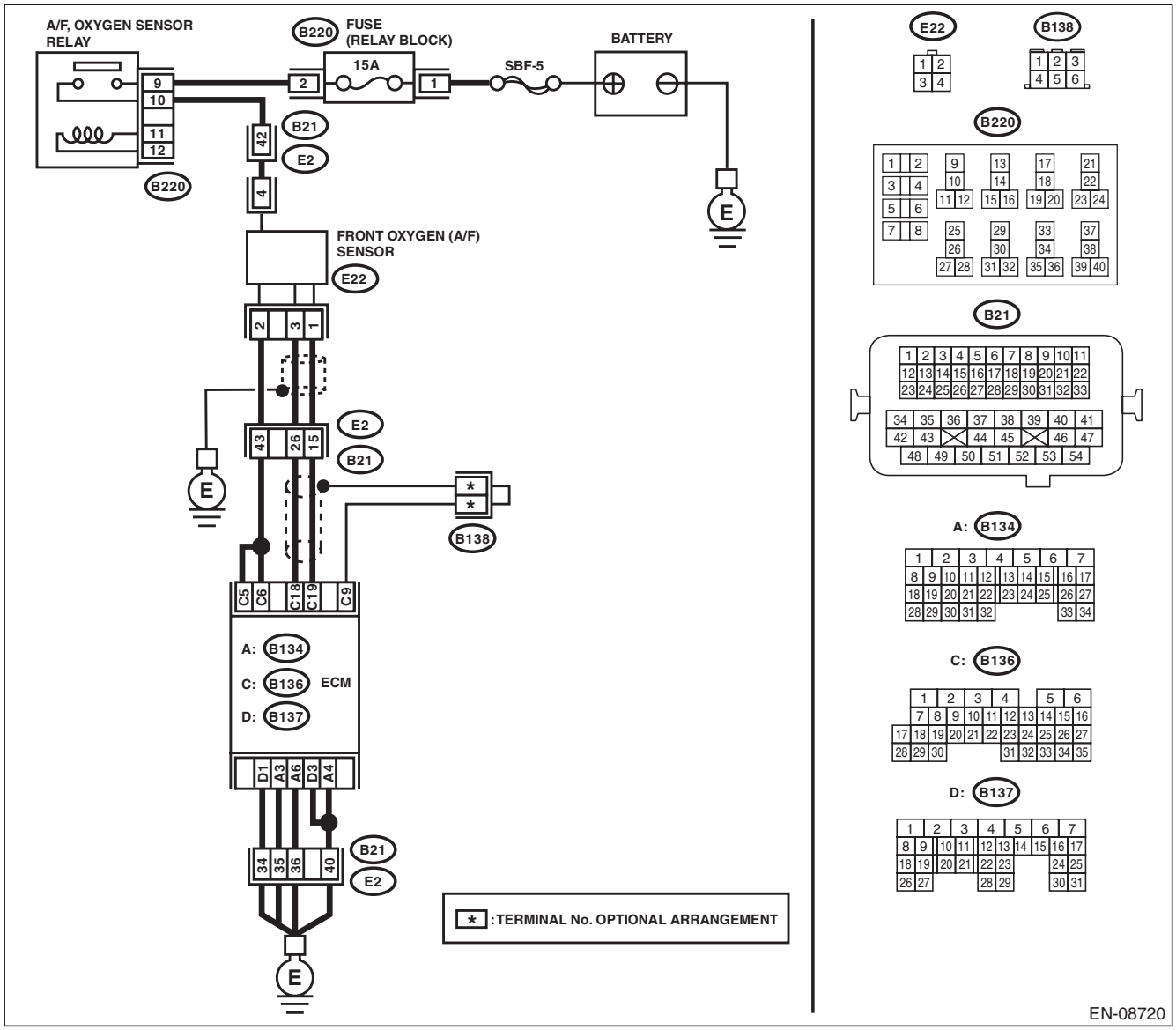
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-266, DTC P2196 O2 SENSOR SIGNAL BIASED/ STUCK RICH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

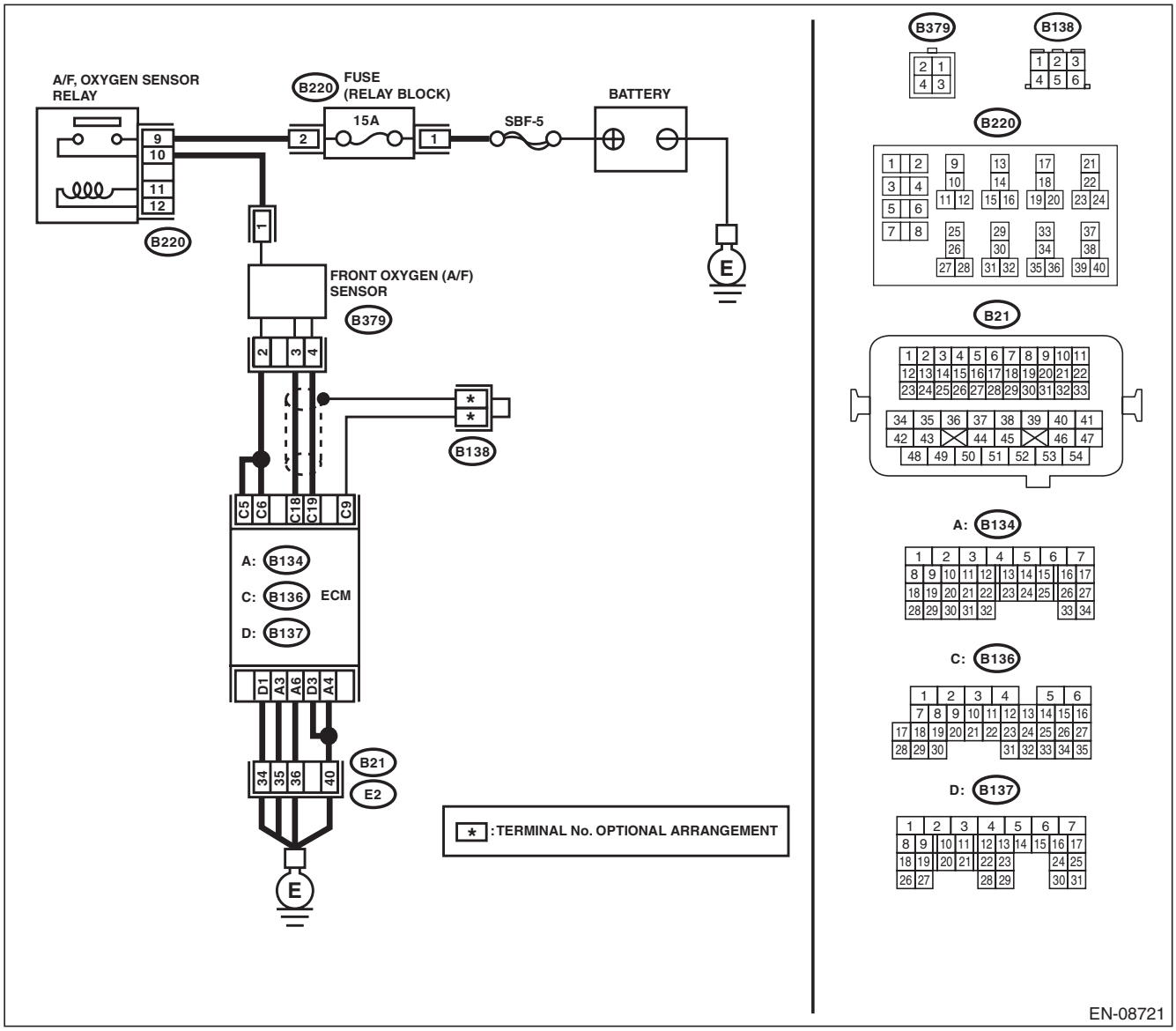
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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**.
2	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 19 — Chassis ground:*** ***(B136) No. 18 — 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.

	Step	Check	Yes	No
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*** ***(B136) No. 19 (+) — 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*** ***(B136) No. 18 (+) — Chassis ground (–):***	Is the voltage 4.95 V or more?	Go to step **5**.	Replace the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, Front Oxygen (A/F) Sensor.>
5	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 19 (+) — Chassis ground (–):*** ***(B136) No. 18 (+) — 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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>	Repair the poor contact of ECM connector.

EZ:DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-268, DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TROUBLE SYMPTOM:

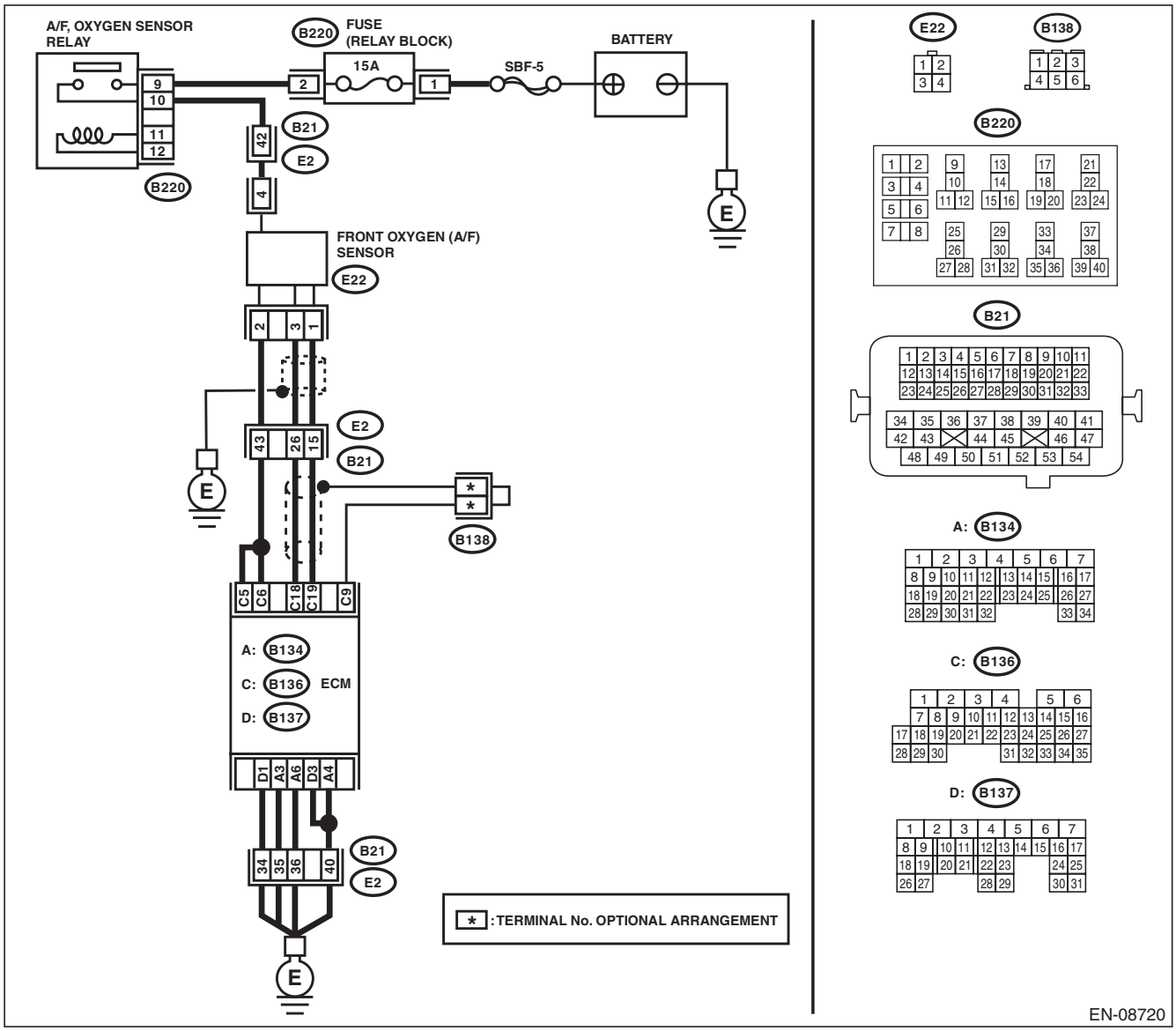
- Engine stalls.
- Improper idling

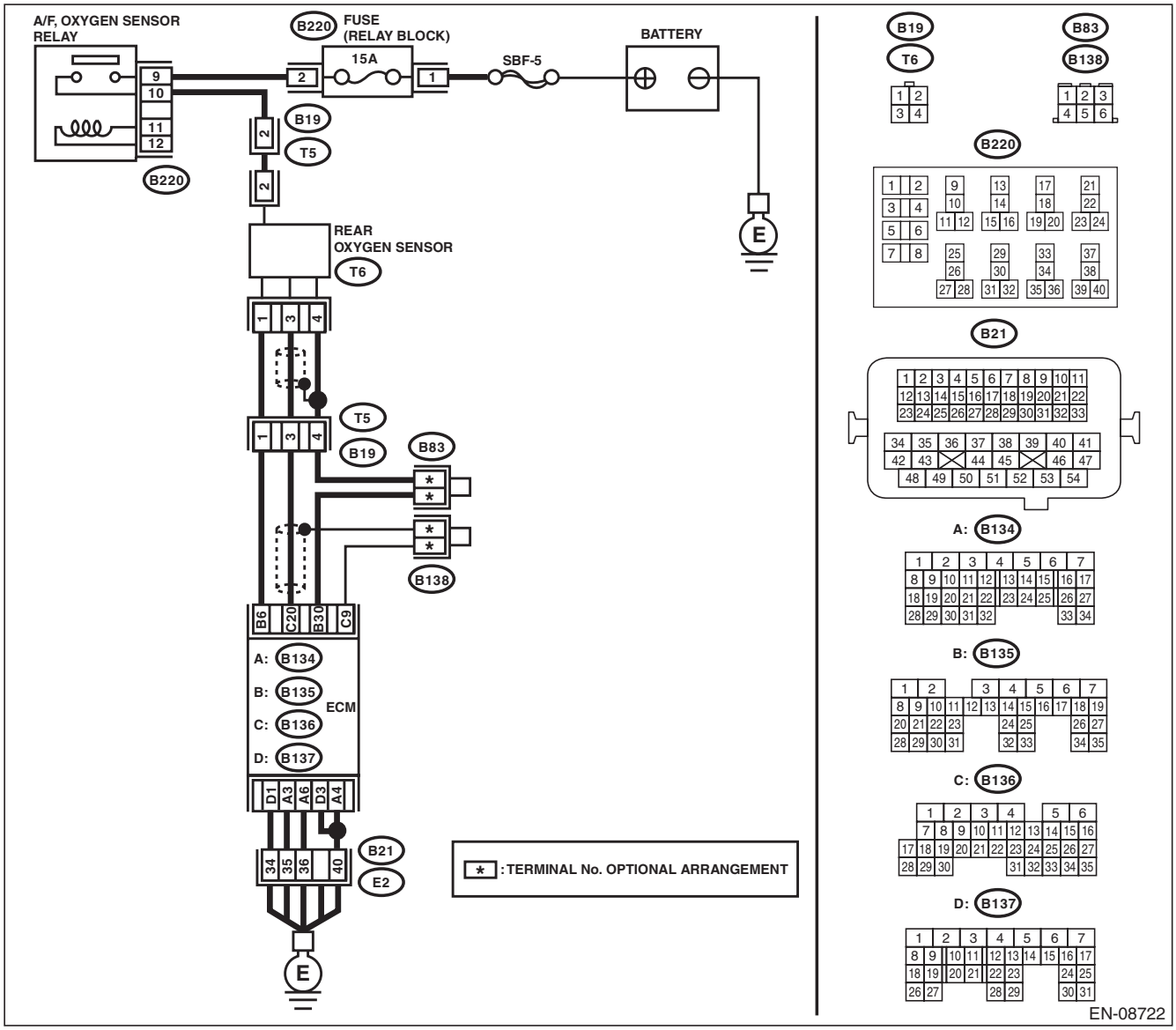
CAUTION:

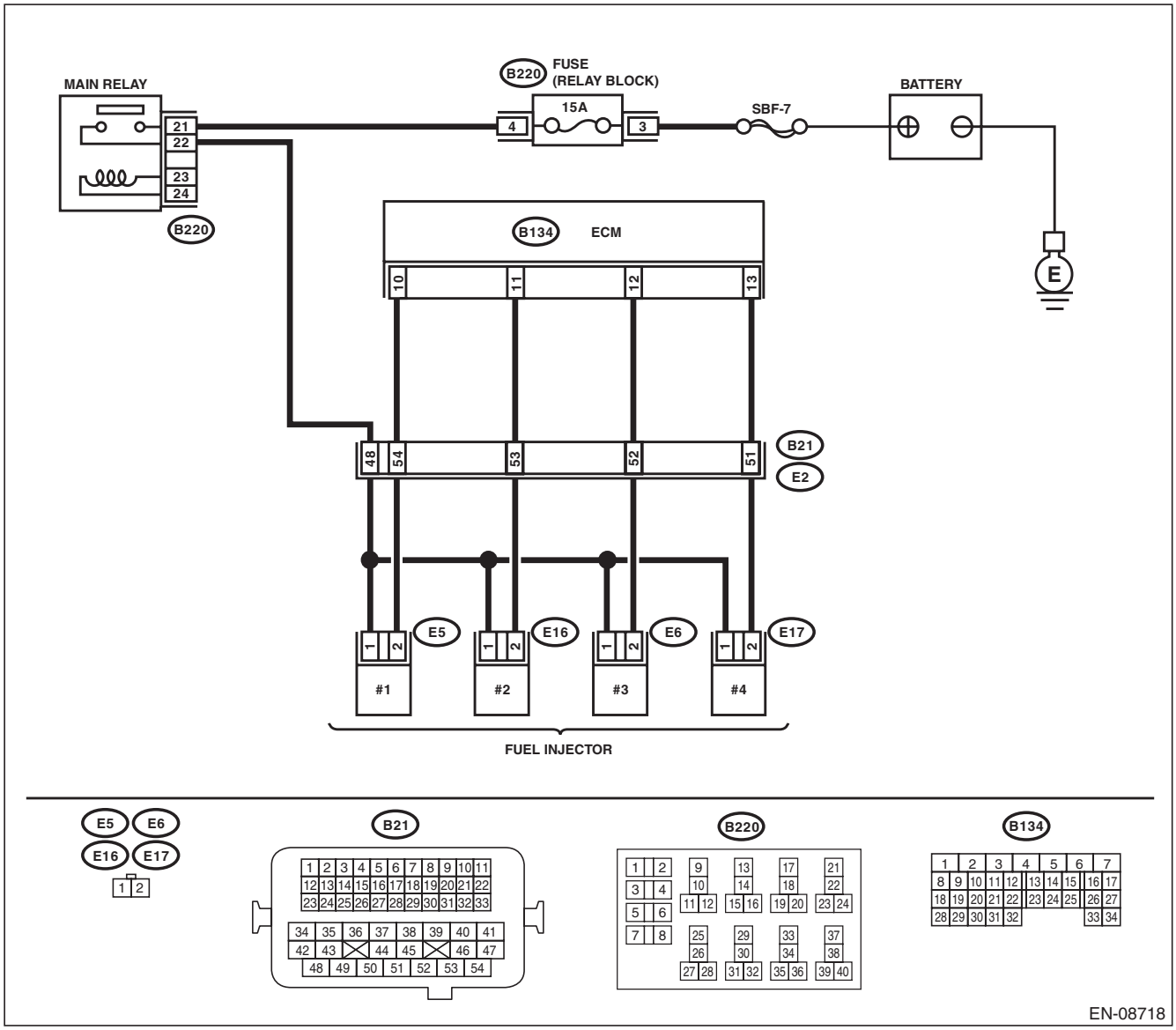
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

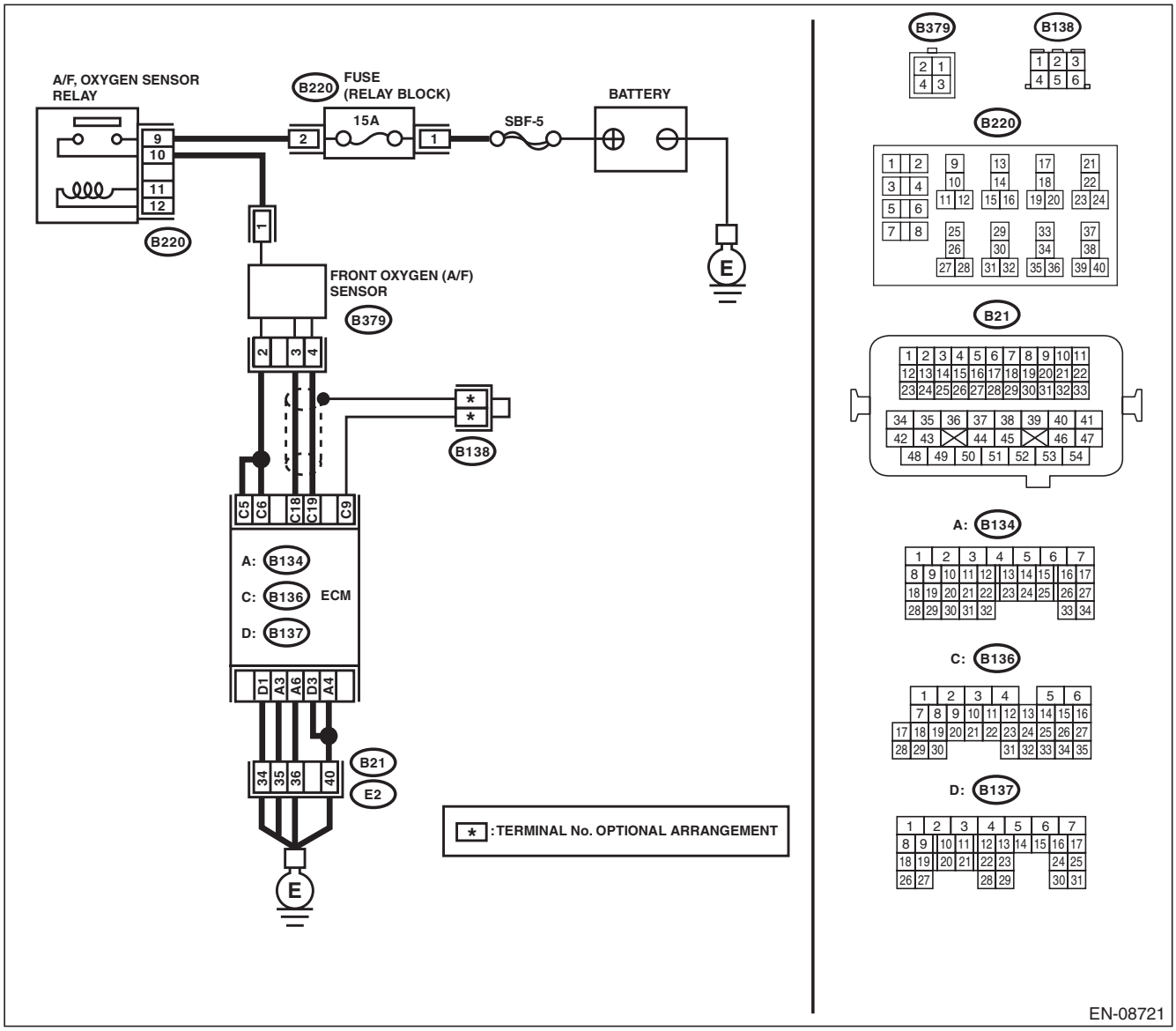
- Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>

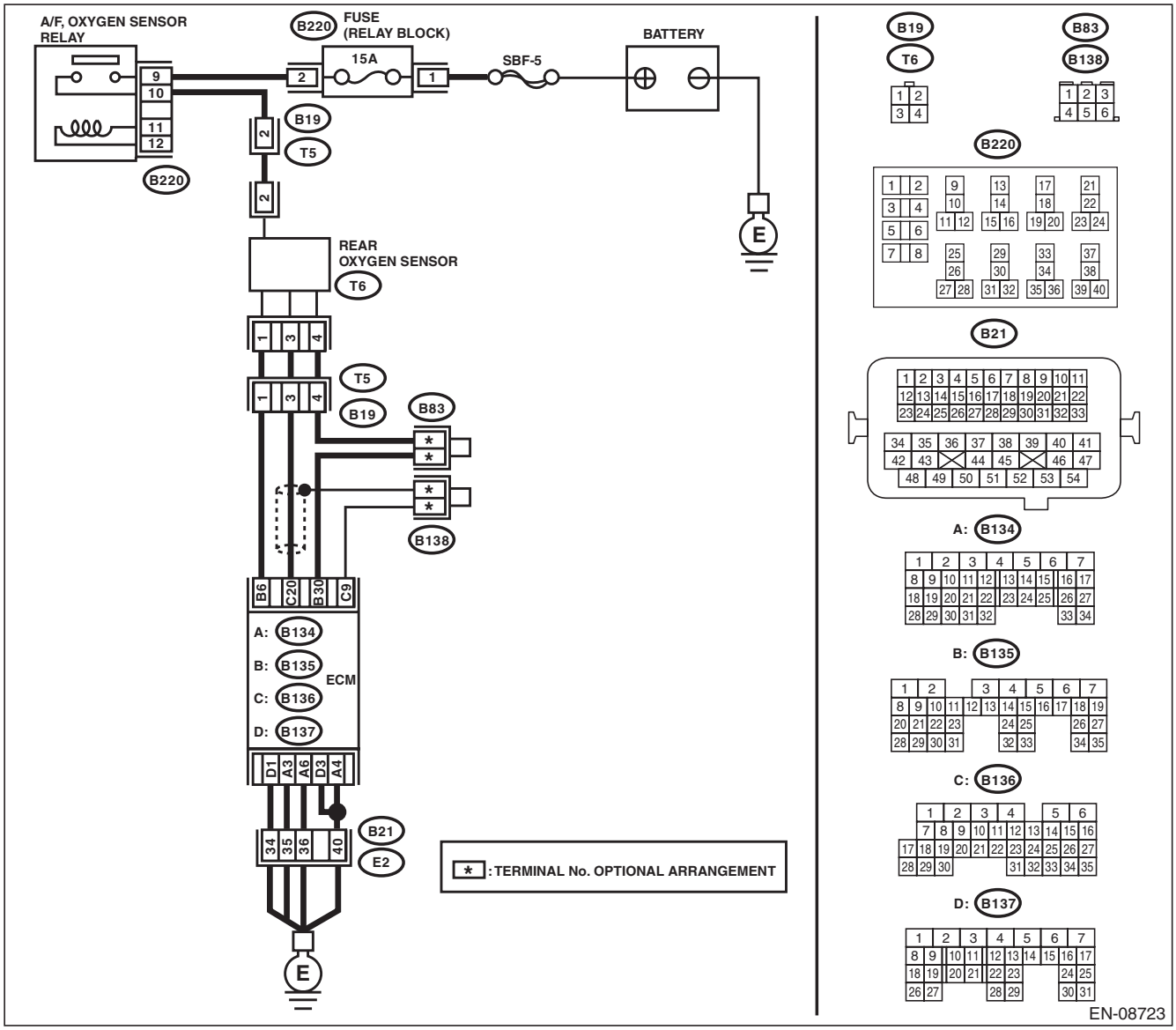


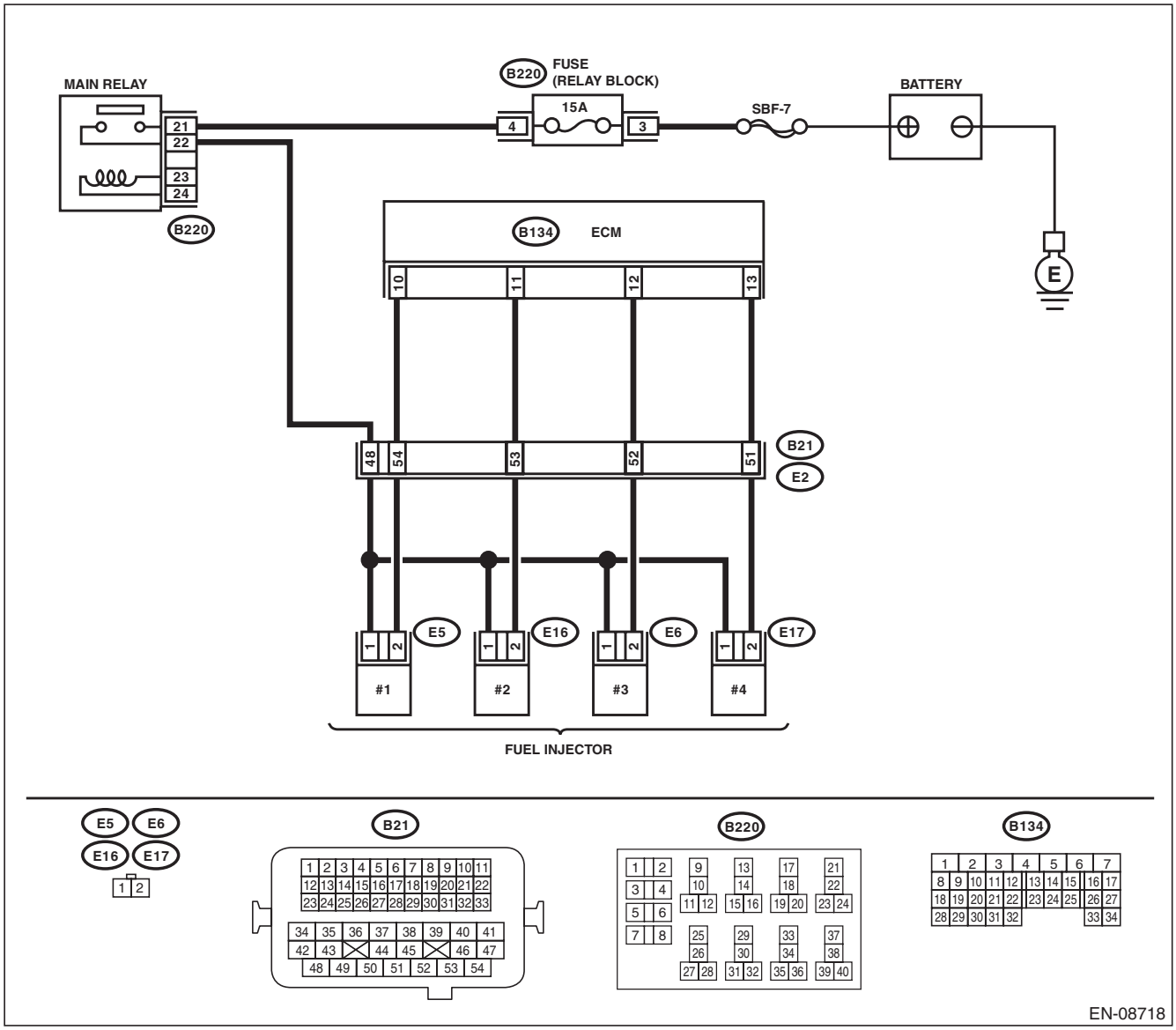

A/F, OXYGEN SENSOR RELAY
B220
FUSE (RELAY BLOCK)
15A
SBF-5
BATTERY
B19
T5
REAR OXYGEN SENSOR
T6
T5
B19
B83
B138
B6
C20
B30
C9
A: B134
B: B135
C: B136
D: B137
ECM
D1
A3
A6
D3
A4
34
35
36
40
B21
E2
E
: TERMINAL No. OPTIONAL ARRANGEMENT
B19
T6
B83
B138
B220
B21
A: B134
B: B135
C: B136
D: B137
EN-08722


MAIN RELAY
21
22
23
24
B220
B220
FUSE
(RELAY BLOCK)
15A
4
3
SBF-7
BATTERY
E
B134
ECM
10
11
12
13
48
54
53
52
51
B21
E2
E5
E16
E6
E17
1
2
#1
#2
#3
#4
FUEL INJECTOR
E5
E6
E16
E17
1 2
B21
1 2 3 4 5 6 7 8 9 10 11
12 13 14 15 16 17 18 19 20 21 22
23 24 25 26 27 28 29 30 31 32 33
34 35 36 37 38 39 40 41
42 43 44 45 46 47
48 49 50 51 52 53 54
B220
1 2
3 4
5 6
7 8
9 10
11 12
13 14
15 16
17 18
19 20
21 22
23 24
25 26
27 28
29 30
31 32
33 34
35 36
37 38
39 40
B134
1 2 3 4 5 6 7
8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34
EN-08718

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>




A/F, OXYGEN SENSOR RELAY
B220
FUSE (RELAY BLOCK)
15A
SBF-5
BATTERY
B19
T5
REAR OXYGEN SENSOR
T6
B83
B138
B6
C20
B30
C9
A: B134
B: B135
C: B136
D: B137
ECM
D1
A3
A6
D3
A4
B21
E2
E
: TERMINAL No. OPTIONAL ARRANGEMENT
EN-08723



	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**.
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*** ***Models without SI-DRIVE*** ***(B136) No. 19 — (E22) No. 1:*** ***(B136) No. 18 — (E22) No. 3:*** ***Models with SI-DRIVE*** ***(B136) No. 19 — (B379) No. 4:*** ***(B136) No. 18 — (B379) 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

	Step	Check	Yes	No
3	**CHECK HARNESS BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B136) No. 19 — Chassis ground:*** ***(B136) No. 18 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the ground short circuit of harness between ECM and front oxygen (A/F) sensor connector.
4	**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*** ***Models without SI-DRIVE*** ***(E22) No. 1 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(B379) No. 4 (+) — Chassis ground (–):***	Is the voltage 4.5 V or more?	Go to step **6**.	Go to step **5**.
5	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(E22) No. 3 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(B379) No. 3 (+) — Chassis ground (–):***	Is the voltage 4.95 V or more?	Go to step **6**.	Go to step **7**.
6	**CHECK OUTPUT SIGNAL FOR ECM.** Measure the voltage between front oxygen (A/F) sensor connector and chassis ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(E22) No. 3 (+) — Chassis ground (–):*** ***(E22) No. 1 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(B379) No. 3 (+) — Chassis ground (–):*** ***(B379) No. 4 (+) — 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(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).>	Repair the poor contact of ECM connector.
7	**CHECK EXHAUST SYSTEM.**	Are there holes or loose bolts on exhaust system?	Repair the exhaust system.	Go to step **8**.
8	**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 **9**.

	Step	Check	Yes	No
9	**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 while disconnecting pressure regulator vacuum hose from intake manifold. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: If fuel pressure does not increase, squeeze the fuel return hose 2 to 3 times, then measure fuel pressure again.	Is the measured value 284 — 314 kPa (2.9 — 3.2 kg/cm^2, 41 — 46 psi)?	Go to step **10**.	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 supply line
10	**CHECK FUEL PRESSURE.** After connecting the pressure regulator vacuum hose, measure fuel pressure. <Ref. to ME(STI)-24, INSPECTION, Fuel Pressure.> <Ref. to ME(w/o STI)-24, INSPECTION, Fuel Pressure.> **CAUTION:** **Release fuel pressure before removing the fuel pressure gauge.** NOTE: • If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. • If the measured value at this step is out of specification, check or replace pressure regulator vacuum hose.	Is the measured value 230 — 260 kPa (2.35 — 2.65 kg/cm^2, 33 — 38 psi)?	Go to step **11**.	Repair the following item. Fuel pressure is too high: • Faulty pressure regulator • Clogged fuel return line or bent hose Fuel pressure is too low: • Faulty pressure regulator • Improper fuel pump discharge • Clogged fuel supply line
11	**CHECK ENGINE COOLANT TEMPERATURE SENSOR.** 1) Start the engine and warm up completely. 2) Read the value of «Coolant Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Coolant Temp.» 75°C (167°F) or more?	Go to step **12**.	Replace the engine coolant temperature sensor. <Ref. to FU(STI)-34, Engine Coolant Temperature Sensor.> <Ref. to FU(w/o STI)-34, Engine Coolant Temperature Sensor.>

	Step	Check	Yes	No
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) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all the accessory switches to OFF. 5) Read the value of «Mass Air Flow» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Mass Air Flow» 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(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, Mass Air Flow and Intake Air Temperature Sensor.>
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) Place the shift lever in 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 value of «Intake Air Temp.» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Subtract ambient temperature from «Intake Air Temp.». 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(STI)-42, Mass Air Flow and Intake Air Temperature Sensor.> <Ref. to FU(w/o STI)-42, 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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.490 V or more?	Go to step **15**.	Go to step **16**.

	Step	Check	Yes	No
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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Depress the clutch pedal. • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value of «Rear O2 Sensor» 0.250 V or less?	Go to step **17**.	Go to step **16**.
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 value of «Rear O2 Sensor» using the Subaru Select Monitor or a general scan tool. NOTE: • Subaru Select Monitor For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.> • General scan tool For detailed operation procedures, refer to the general scan tool operation manual.	Is the value in «Rear O2 Sensor» kept at 0.250 V or less for 5 minutes or more?	Replace the front oxygen (A/F) sensor. <Ref. to FU(STI)-54, Front Oxygen (A/F) Sensor.> <Ref. to FU(w/o STI)-53, 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*** ***(B136) No. 20 — (T6) No. 3:*** ***(B135) No. 30 — (T6) 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*** ***(T6) No. 3 (+) — Chassis ground (–):***	Is the voltage 0.2 — 0.5 V?	Replace the rear oxygen sensor. <Ref. to FU(STI)-56, Rear Oxygen Sensor.> <Ref. to FU(w/o STI)-55, Rear Oxygen Sensor.>	Go to step **20**.

	Step	Check	Yes	No
20	**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 (B134) No. 10 (+) — Chassis ground (–):*** ***#2 (B134) No. 11 (+) — Chassis ground (–):*** ***#3 (B134) No. 12 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **25**.	Go to step **21**.
21	**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. 2 — Engine ground:*** ***#2 (E16) No. 2 — Engine ground:*** ***#3 (E6) No. 2 — Engine ground:*** ***#4 (E17) No. 2 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **22**.	Repair the short circuit to ground in harness between ECM and fuel injector connector.
22	**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 (B134) No. 10 — (E5) No. 2:*** ***#2 (B134) No. 11 — (E16) No. 2:*** ***#3 (B134) No. 12 — (E6) No. 2:*** ***#4 (B134) No. 13 — (E17) No. 2:***	Is the resistance less than 1 Ω?	Go to step **23**.	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
23	**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 **24**.	Replace the faulty fuel injector. <Ref. to FU(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, Fuel Injector.>
24	**CHECK POWER SUPPLY LINE.** 1) Turn the ignition switch to ON. 2) Measure the voltage between fuel injector connector of faulty cylinders and engine ground. ***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 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 and fuel injector connector on faulty cylinders • Poor contact of coupling connector • Poor contact of main relay connector

	Step	Check	Yes	No
25	**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 (B134) No. 10 (+) — Chassis ground (–):*** ***#2 (B134) No. 11 (+) — Chassis ground (–):*** ***#3 (B134) No. 12 (+) — Chassis ground (–):*** ***#4 (B134) No. 13 (+) — 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 **26**.
26	**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?	Go to step **27**.	Replace the faulty fuel injector. <Ref. to FU(STI)-45, Fuel Injector.> <Ref. to FU(w/o STI)-45, Fuel Injector.>
27	**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(STI)-37, Camshaft Position Sensor.> <Ref. to FU(STI)-35, Crankshaft Position Sensor.> <Ref. to FU(w/o STI)-37, Camshaft Position Sensor.> <Ref. to FU(w/o STI)-35, Crankshaft Position Sensor.>	Go to step **28**.
28	**CHECK CRANK SPROCKET.** Remove the timing belt cover. <Ref. to ME(STI)-48, REMOVAL, Timing Belt Cover.> <Ref. to ME(w/o STI)-47, REMOVAL, Timing Belt Cover.>	Is the crank sprocket rusted or does it have broken teeth?	Replace the crank sprocket. <Ref. to ME(STI)-59, Crank Sprocket.> <Ref. to ME(w/o STI)-58, Crank Sprocket.>	Go to step **29**.
29	**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(STI)-49, Timing Belt.> <Ref. to ME(w/o STI)-48, Timing Belt.>	Go to step **30**.
30	**CHECK FUEL LEVEL.**	Is the fuel meter indication higher than the “Lower” level?	Go to step **31**.	Refill the fuel so that the fuel meter indication is higher than the “Lower” level, and proceed to the next step. Go to step **31**.

	Step	Check	Yes	No
31	**CHECK STATUS OF MALFUNCTION INDICATOR LIGHT.** 1) Clear the memory using the Subaru Select Monitor or general scan tool. <Ref. to EN(H4DOTC)(diag)-62, 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 **33**.	Go to step **32**.
32	**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
33	**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 **34**.
34	**CHECK MISFIRE SYMPTOM.** 1) Turn the ignition switch to ON. 2) Check for DTC. <Ref. to EN(H4DOTC)(diag)-47, Read Diagnostic Trouble Code (DTC).>	Does the Subaru Select Monitor or general scan tool indicate only one DTC?	Go to step **37**.	Go to step **35**.
35	**CHECK DTC.**	Is DTC P0301 and P0303 displayed on the Subaru Select Monitor or general scan tool?	Go to step **38**.	Go to step **36**.
36	**CHECK DTC.**	Is DTC P0302 and P0304 displayed on the Subaru Select Monitor or general scan tool?	Go to step **39**.	Go to step **40**.
37	**ONLY ONE CYLINDER.**	Is there any fault in the cylinder?	Repair or replace faulty parts. NOTE: Check the following items. • Spark plug • Ignition coil • Fuel injector • Compression ratio	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-170, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

	Step	Check	Yes	No
38	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 • Ignition coil • Fuel injector • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-170, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
39	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 • Ignition coil • Fuel injector • Compression ratio • Skipping timing belt teeth	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-170, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
40	CYLINDER AT RANDOM.	Is the engine idle rough?	Go to DTC P0171. <Ref. to EN(H4DOTC)(diag)-170, 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 • Ignition coil • Fuel injector • Compression ratio

FA:DTC P2257 AIR SYSTEM CONTROL "A" CIRCUIT LOW

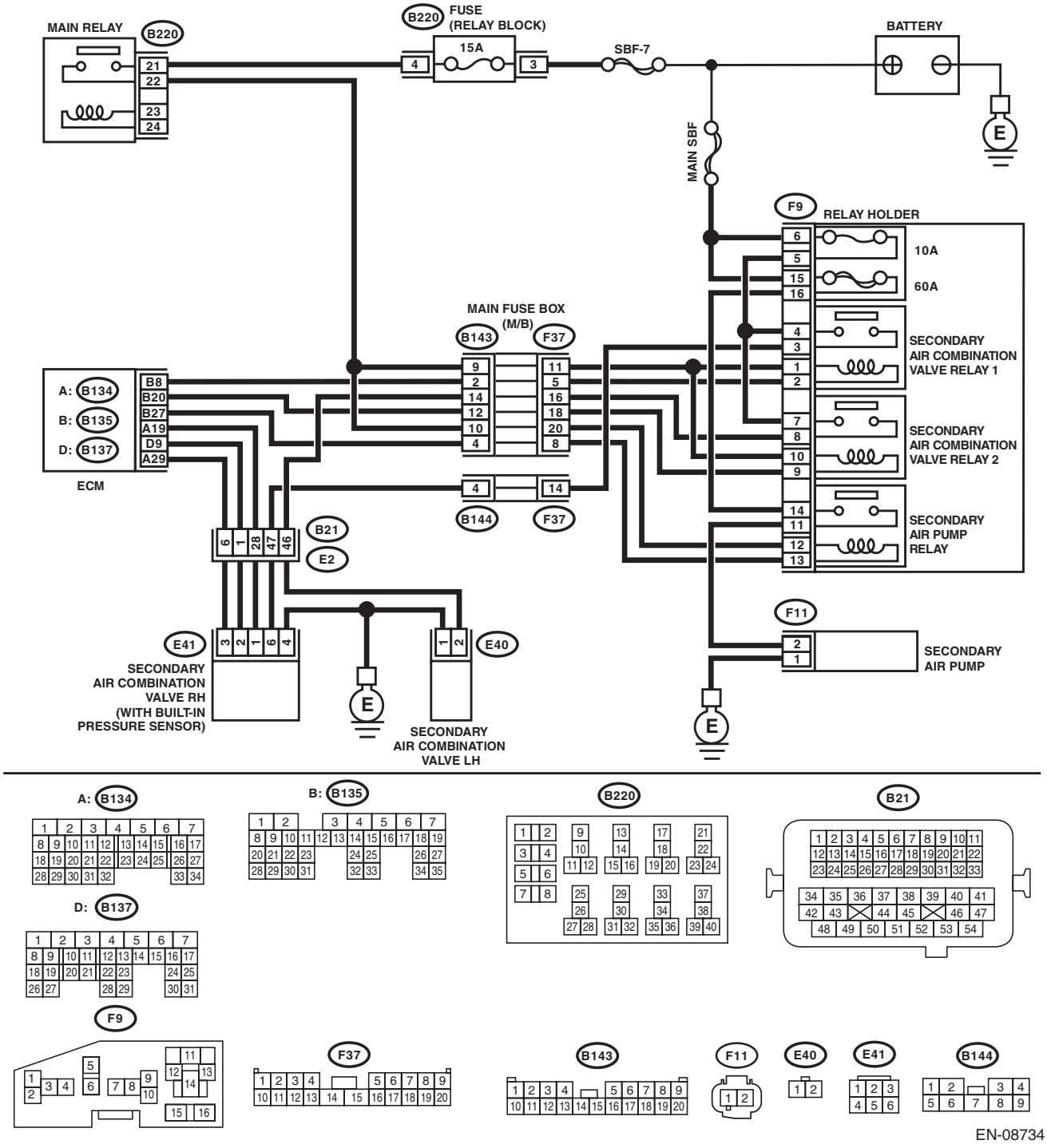
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-271, DTC P2257 AIR SYSTEM CONTROL "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

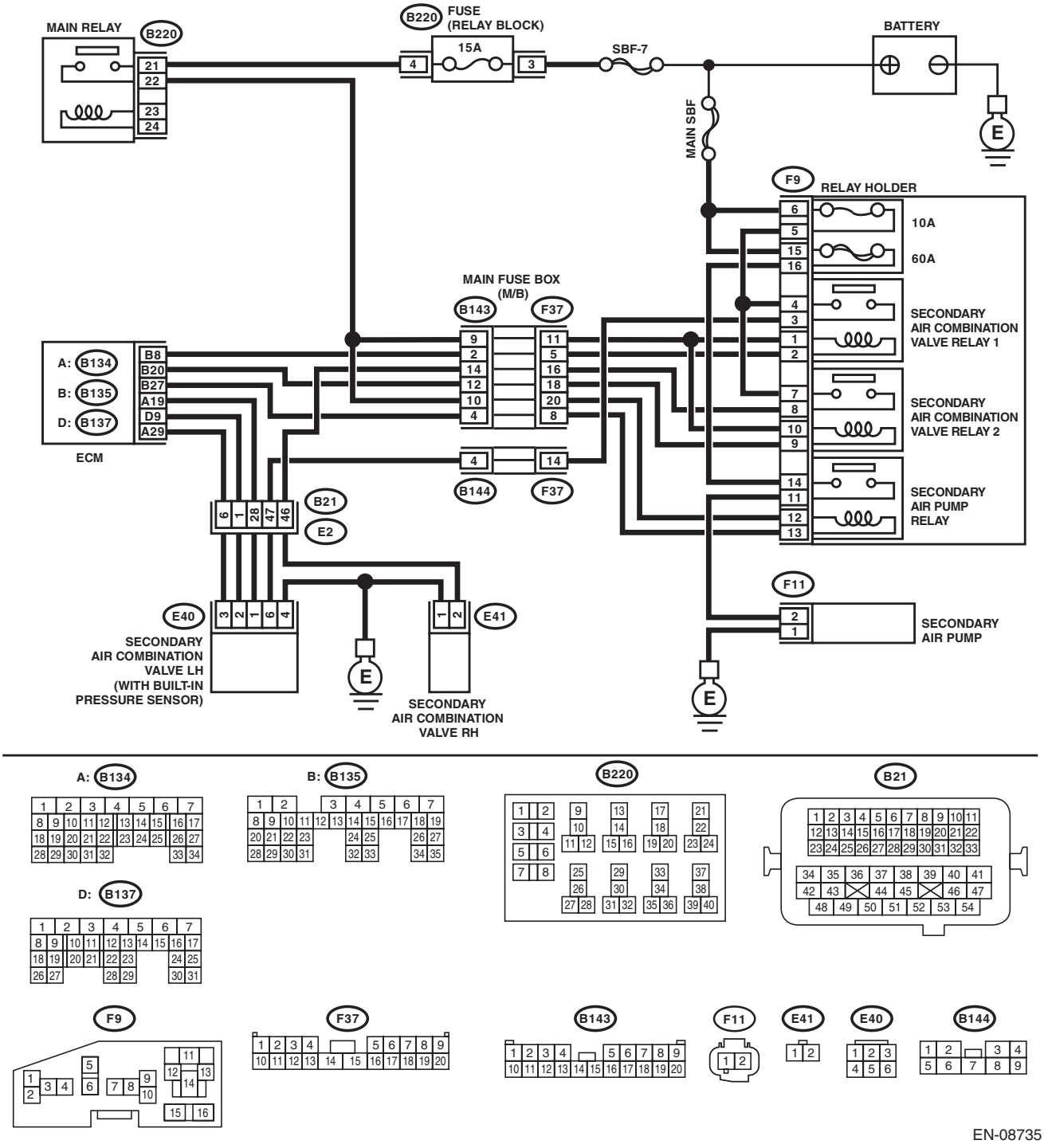
CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08735

	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Remove the secondary air pump relay. 4) Measure the resistance of harness between ECM and secondary air pump relay connector. ***Connector & terminal*** ***(B135) No. 27 — (F9) No. 13:***	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 secondary air pump relay connector • Poor contact of coupling connector
2	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 27 — Chassis ground:***	Is the resistance 1 MΩ 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 short circuit to ground in harness between ECM and secondary air pump relay connector.

FB:DTC P2258 AIR SYSTEM CONTROL "A" CIRCUIT HIGH

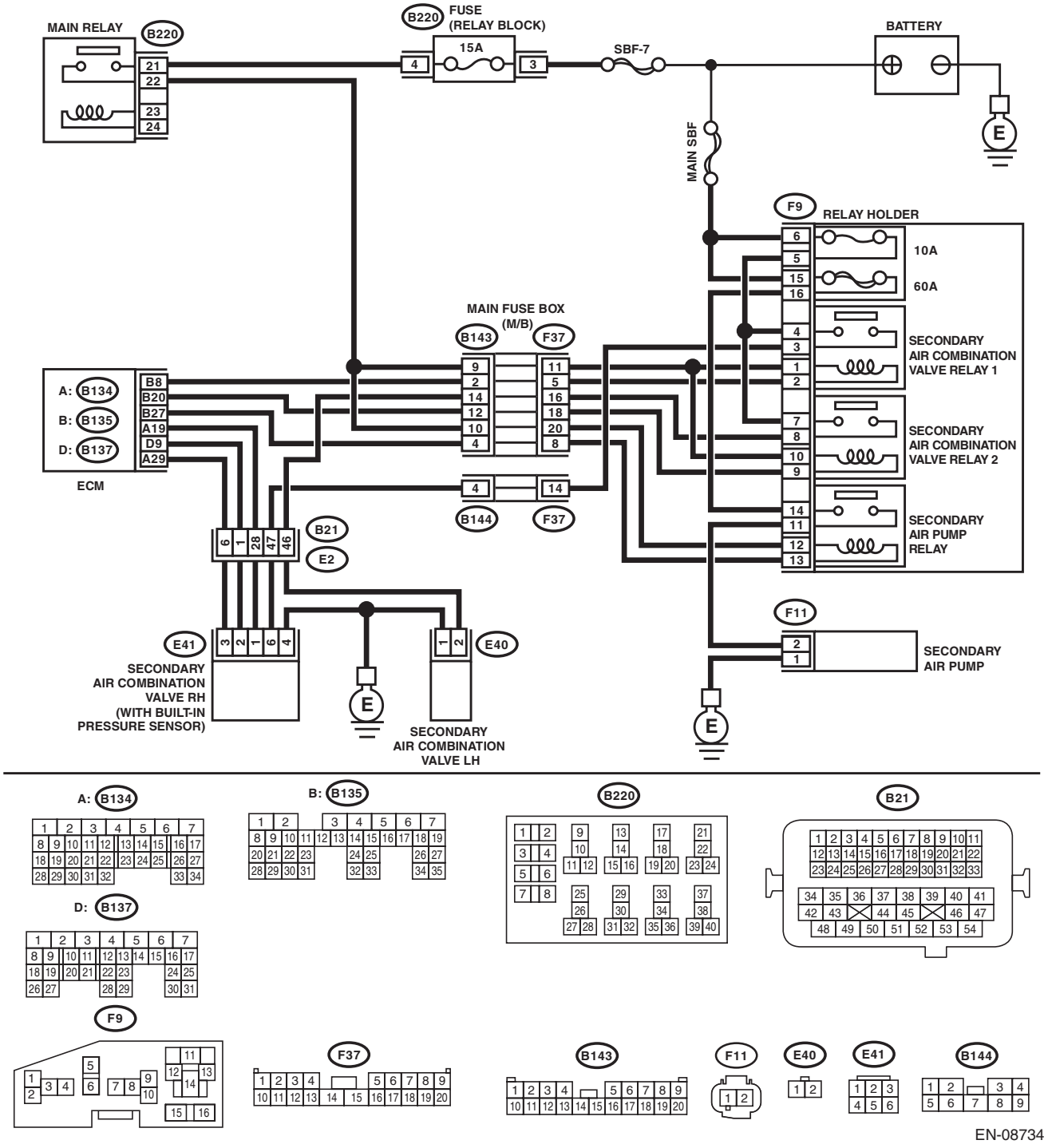
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-272, DTC P2258 AIR SYSTEM CONTROL "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

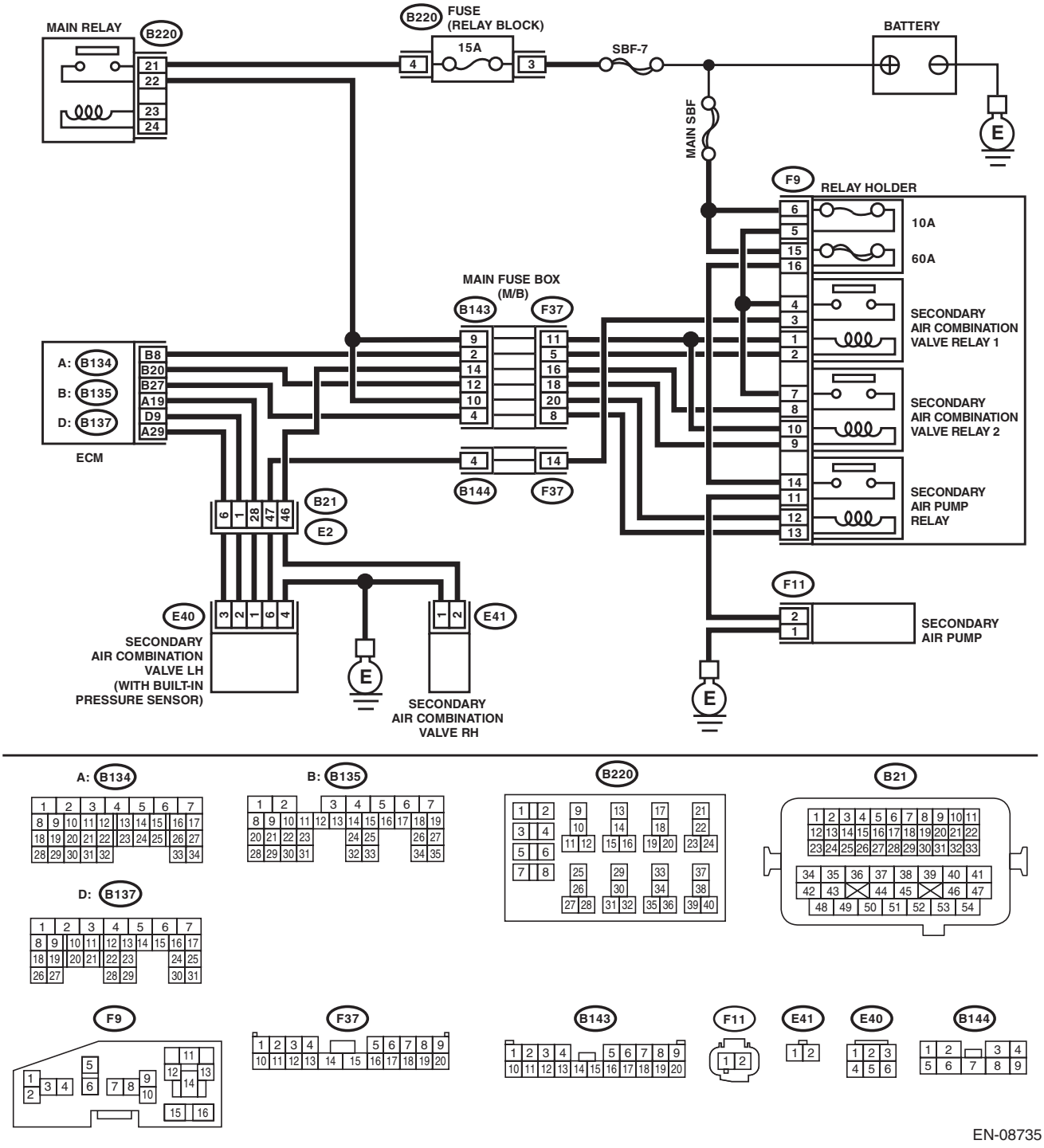
WIRING DIAGRAM:

• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Remove the secondary air pump relay. 4) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 27 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in the harness between ECM and secondary air pump relay 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 poor contact of connector, temporary open or short circuit of harness may be the cause.

FC:DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW

DTC DETECTING CONDITION:

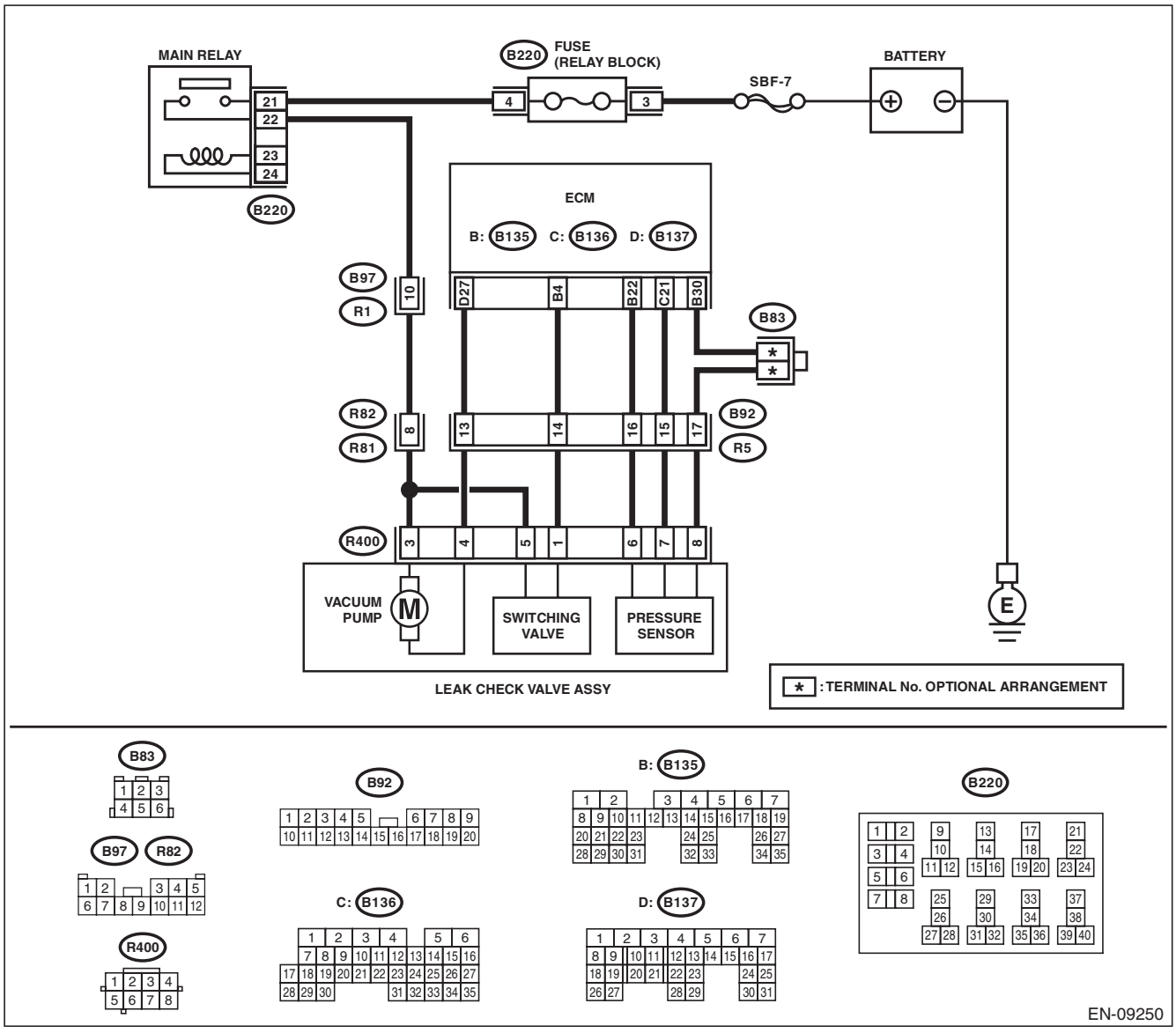
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-273, DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 27 (+) — 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 LEAK CHECK VALVE ASSEMBLY.** Measure the voltage between the leak check valve assembly connector and engine ground. ***Connector & terminal*** ***(R400) No. 3 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the leak check valve assembly. 3) Measure the resistance between leak check valve assembly and chassis ground. ***Connector & terminal*** ***(R400) No. 4 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM and leak check valve assembly connector.
5	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** Measure the resistance of harness between ECM and the leak check valve assembly connector. ***Connector & terminal*** ***(B137) No. 27 — (R400) No. 4:***	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 the leak check valve assembly connector • Poor contact of coupling connector

	Step	Check	Yes	No
6	**CHECK LEAK CHECK VALVE ASSEMBLY.** Check the vacuum pump of the leak check valve assembly. <Ref. to EC(STI)-21, CHECK VACUUM PUMP, INSPECTION, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-22, CHECK VACUUM PUMP, INSPECTION, Leak Check Valve Assembly.>	Is the vacuum pump of the leak check valve assembly OK?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>

FD:DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH

DTC DETECTING CONDITION:

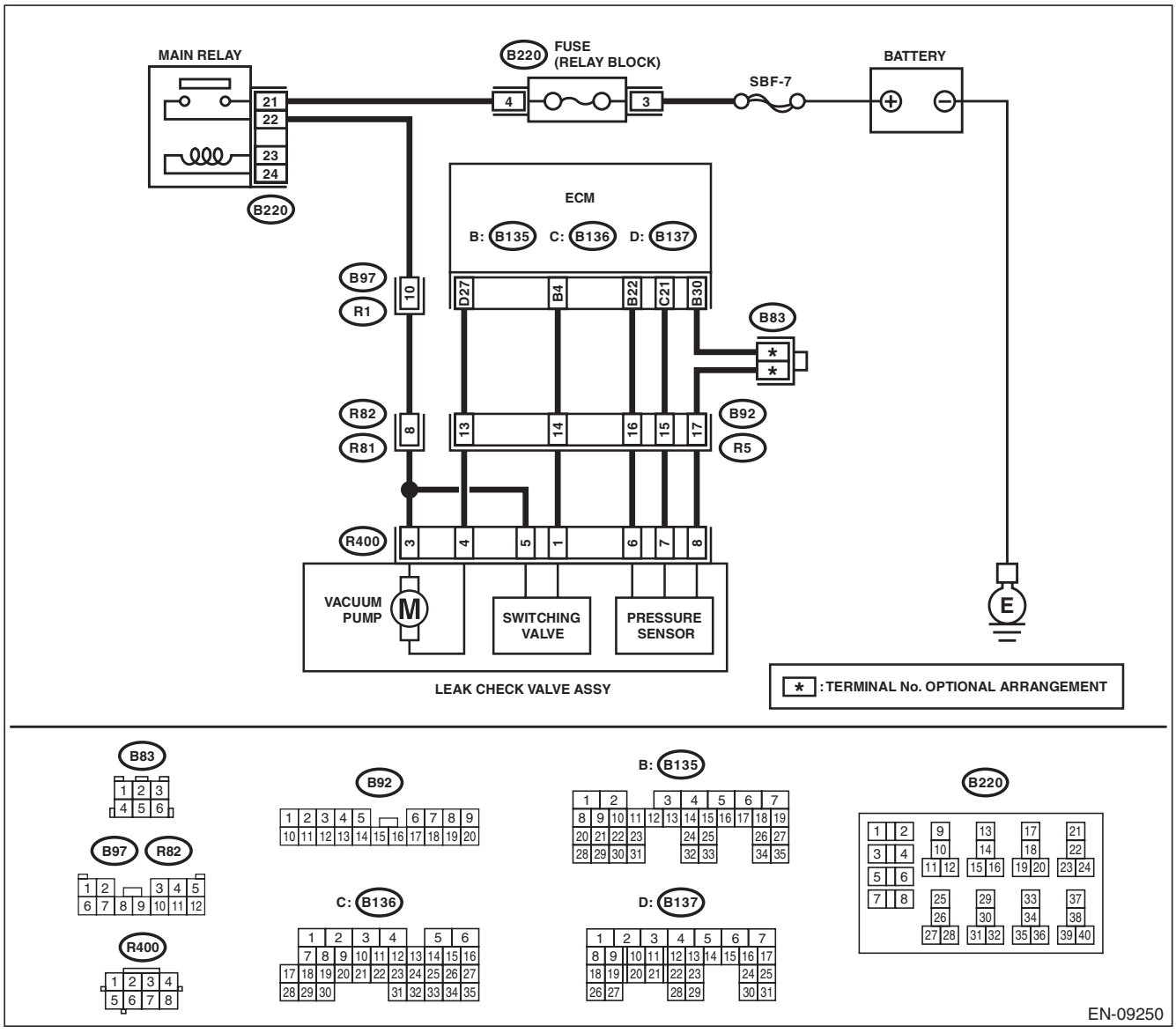
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-275, DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



Step		Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between leak check valve assembly and chassis ground. ***Connector & terminal*** ***(R400) No. 4 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM and leak check valve assembly connector.	Go to step **2**.
2	**CHECK LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Check the vacuum pump of the leak check valve assembly. <Ref. to EC(STI)-21, CHECK VACUUM PUMP, INSPECTION, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-22, CHECK VACUUM PUMP, INSPECTION, Leak Check Valve Assembly.>	Is the vacuum pump of the leak check valve assembly OK?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>

FE:DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE

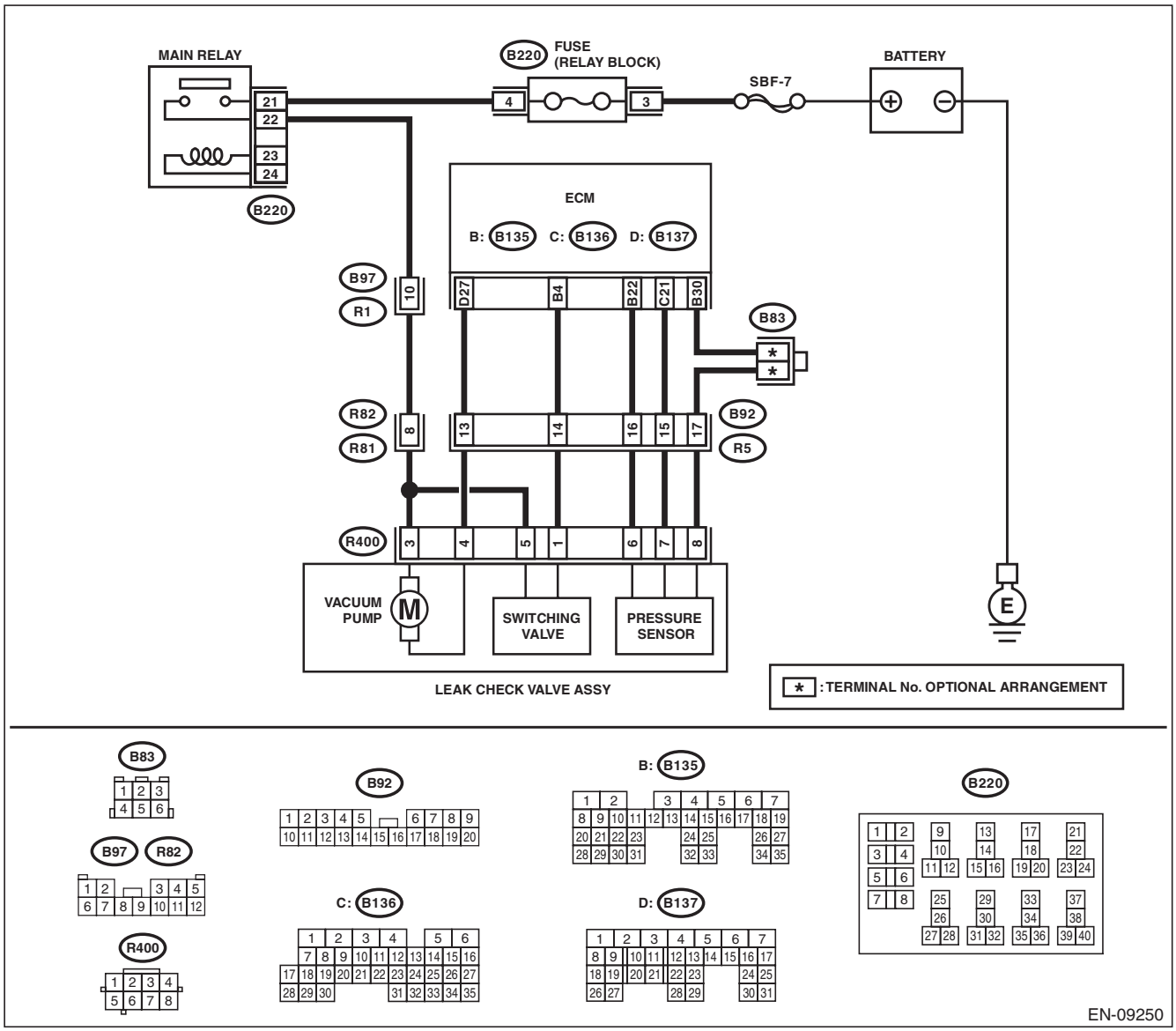
DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-276, DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK ELCM PUMP.** Operate the ELCM pump using the Subaru Select Monitor. NOTE: Refer to "Compulsory Valve Operation Check Mode" for more operation procedures. <Ref. to EN(H4DOTC)(diag)-63, Compulsory Valve Operation Check Mode.>	Does the ELCM pump operate?	Go to step **6**.	Go to step **3**.
3	**CHECK POWER SUPPLY OF LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between the leak check valve assembly connector and chassis ground. ***Connector & terminal*** ***(R400) No. 3 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay and the leak check valve assembly connector • Poor contact of main relay connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and the leak check valve assembly connector. ***Connector & terminal*** ***(B137) No. 27 — (R400) 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 the leak check valve assembly connector • Poor contact of coupling connector
5	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 27 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>	Repair the short circuit to ground in harness between ECM and leak check valve assembly connector.

	Step	Check	Yes	No
6	**CHECK ELCM SWITCHING VALVE.** Operate the ELCM switching valve using the Subaru Select Monitor. NOTE: Refer to "Compulsory Valve Operation Check Mode" for more operation procedures. <Ref. to EN(H4DOTC)(diag)-63, Compulsory Valve Operation Check Mode.>	Does the ELCM switching valve operate?	Go to step **10**.	Go to step **7**.
7	**CHECK POWER SUPPLY OF LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between the leak check valve assembly connector and chassis ground. ***Connector & terminal*** ***(R400) No. 5 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **8**.	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit in harness between the main relay and the leak check valve assembly connector • Poor contact of main relay connector • Poor contact of coupling connector
8	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and the leak check valve assembly connector. ***Connector & terminal*** ***(B135) No. 4 — (R400) No. 1:***	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 the leak check valve assembly connector • Poor contact of coupling connector
9	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Measure the resistance of harness between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 4 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>	Repair the short circuit to ground in harness between ECM and leak check valve assembly connector.

	Step	Check	Yes	No
10	**CHECK EVAPORATIVE EMISSION CONTROL SYSTEM.** Perform drive cycle I. <Ref. to EN(H4DOTC)(diag)-58, DRIVE CYCLE H, PROCEDURE, Drive Cycle.>	Is DTC P2404 displayed on the display?	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>	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.

FF: DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW

DTC DETECTING CONDITION:

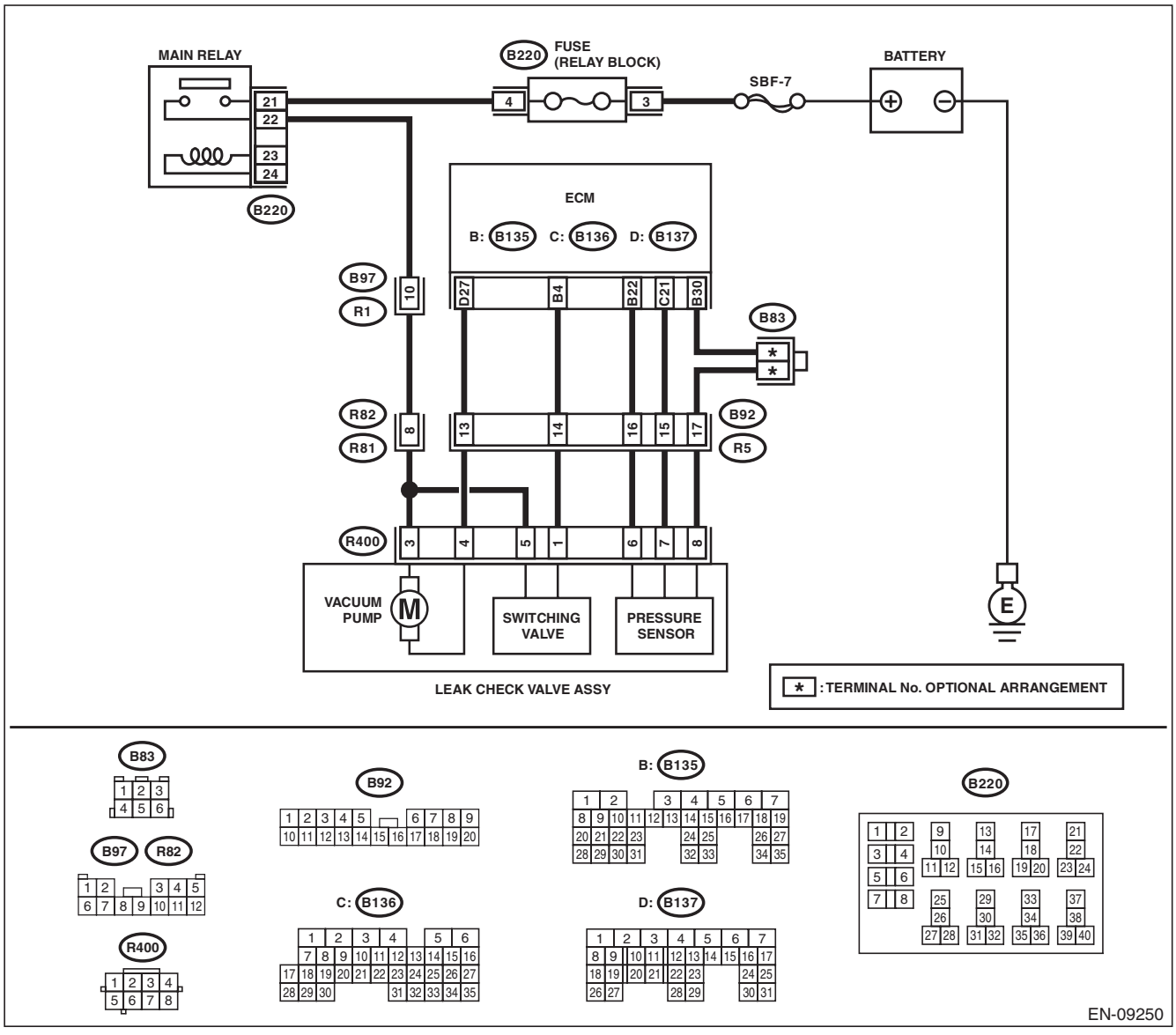
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-277, DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. ***Connector & terminal*** ***(B135) No. 4 (+) — 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 LEAK CHECK VALVE ASSEMBLY.** Measure the voltage between the leak check valve assembly connector and engine ground. ***Connector & terminal*** ***(R400) No. 5 (+) — Engine ground (–):***	Is the voltage 10 V or more?	Go to step **4**.	Repair the power supply circuit.
4	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and the leak check valve assembly. 3) Measure the resistance between leak check valve assembly and chassis ground. ***Connector & terminal*** ***(R400) No. 1 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the short circuit to ground in harness between ECM and leak check valve assembly connector.
5	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** Measure the resistance of harness between ECM and the leak check valve assembly connector. ***Connector & terminal*** ***(B135) No. 4 — (R400) 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 the leak check valve assembly connector • Poor contact of coupling connector

	Step	Check	Yes	No
6	**CHECK LEAK CHECK VALVE ASSEMBLY.** Check the switching valve of the leak check valve assembly. <Ref. to EC(STI)-20, CHECK SWITCHING VALVE, INSPECTION, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-21, CHECK SWITCHING VALVE, INSPECTION, Leak Check Valve Assembly.>	Is the switching valve of the leak check valve assembly OK?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>

FG:DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH

DTC DETECTING CONDITION:

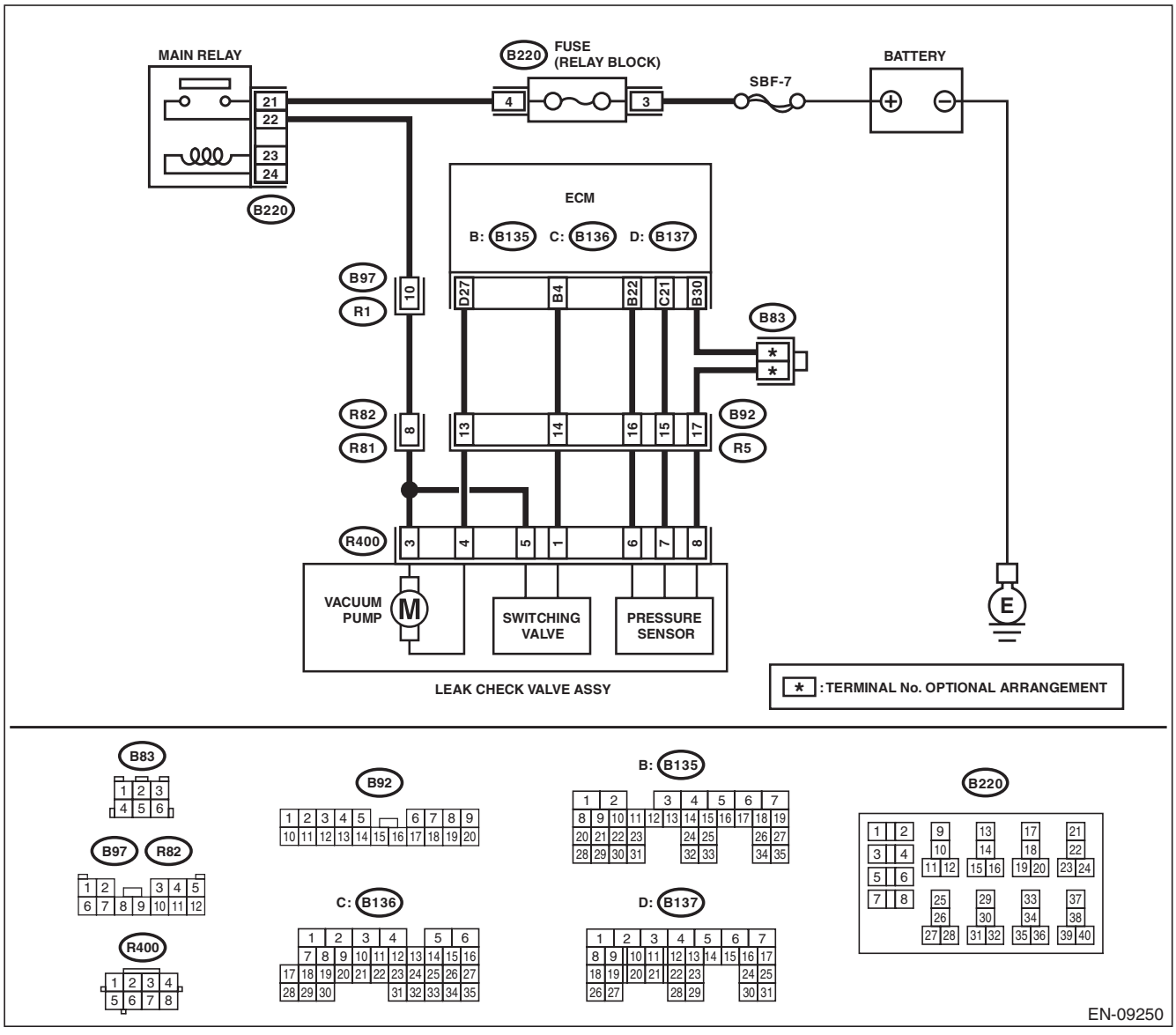
- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-279, DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK HARNESS BETWEEN ECM AND LEAK CHECK VALVE ASSEMBLY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the leak check valve assembly. 3) Turn the ignition switch to ON. 4) Measure the voltage between leak check valve assembly and chassis ground. ***Connector & terminal*** ***(R400) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Repair the short circuit to power in harness between ECM and leak check valve assembly connector.	Go to step **2**.
2	**CHECK LEAK CHECK VALVE ASSEMBLY.** 1) Turn the ignition switch to OFF. 2) Check the switching valve of the leak check valve assembly. <Ref. to EC(STI)-20, CHECK SWITCHING VALVE, INSPECTION, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-21, CHECK SWITCHING VALVE, INSPECTION, Leak Check Valve Assembly.>	Is the switching valve of the leak check valve assembly OK?	Repair the poor contact in the leak check valve assembly connector.	Replace the leak check valve assembly. <Ref. to EC(STI)-19, Leak Check Valve Assembly.> <Ref. to EC(w/o STI)-20, Leak Check Valve Assembly.>

FH:DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-281, DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON (engine OFF). 2) Using the Subaru Select Monitor, read the values in «Sec. Air Piping Pressure», «Mani. Absolute Pressure» and «Atmosphere Pressure», and compare them with actual atmospheric pressure. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Does the displayed value differ from the actual atmospheric pressure by 200 mmHg (27 kPa, 8 inHg, 3.9 psig) or more?	Replace the secondary air combination valve (with built-in pressure sensor). <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>	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.

FI: DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW

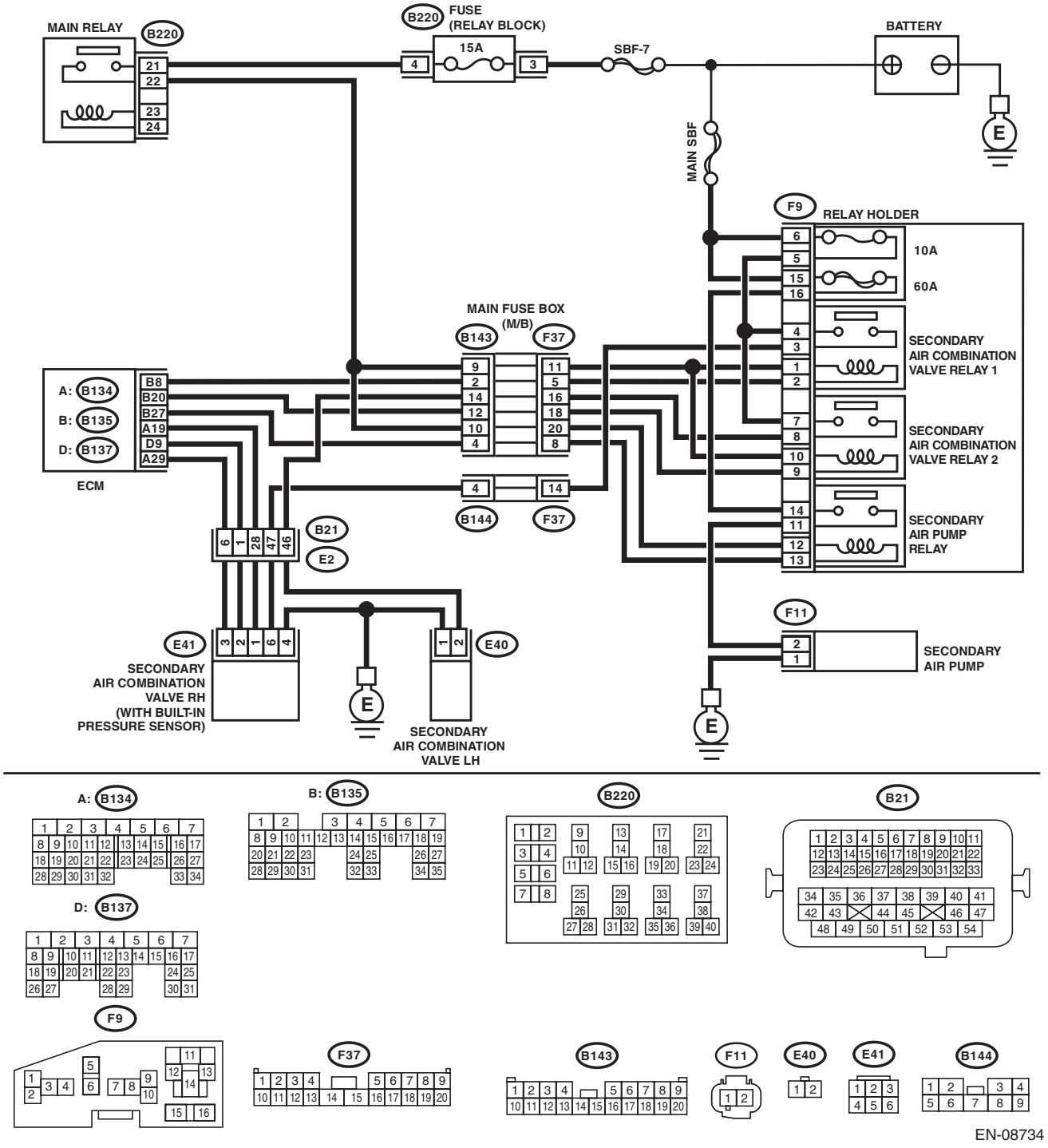
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-282, DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

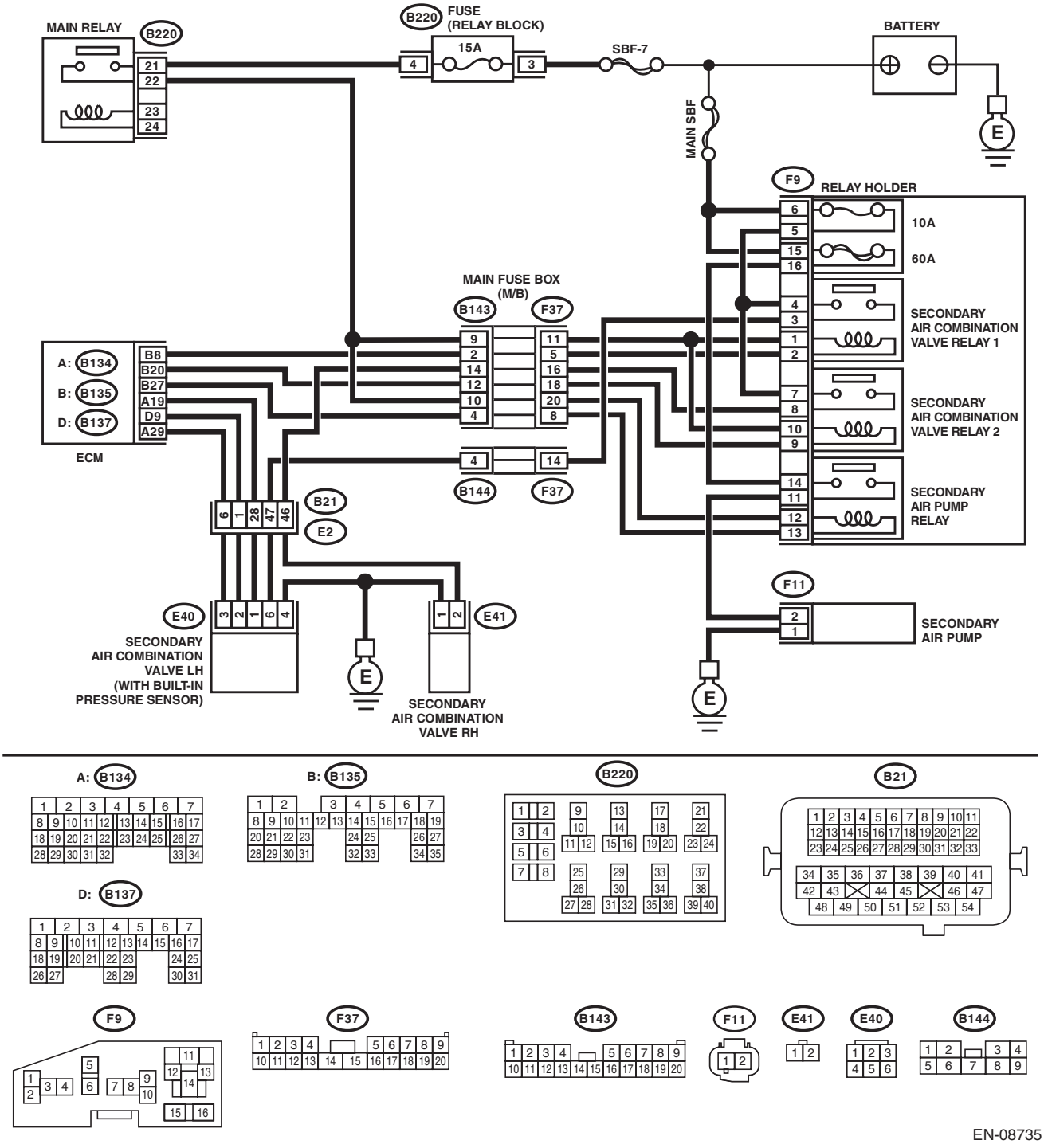
WIRING DIAGRAM:

• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



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- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON. 2) Read the value of «Sec. Air Piping Pressure» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Sec. Air Piping Pressure» less than 53.3 kPa (400 mmHg, 15.8 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 SECONDARY AIR COMBINATION VALVE.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from secondary air combination valve RH (models without SI-DRIVE) or LH (models with SI-DRIVE). 3) Turn the ignition switch to ON. 4) Measure the voltage between the secondary air combination valve RH or LH connector and chassis ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(E41) No. 1 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(E40) No. 1 (+) — 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 in harness between ECM and secondary air combination valve RH or LH connector • Poor contact of ECM connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of the harness between ECM and secondary air combination valve RH or LH connector. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(B137) No. 9 — (E41) No. 2:*** ***Models with SI-DRIVE*** ***(B137) No. 9 — (E40) 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 secondary air combination valve RH or LH connector • Poor contact of coupling connector
4	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE CONNECTOR.** Measure the resistance between ECM and chassis ground. ***Connector & terminal*** ***(B137) No. 9 — Chassis ground:***	Is the resistance 1 MΩ or more?	Go to step **5**.	Repair the ground short circuit in harness between ECM and secondary air combination valve RH or LH connector.

	Step	Check	Yes	No
5	**CHECK FOR POOR CONTACT.** Check for poor contact of the ECM and secondary air combination valve RH or LH connector.	Is there poor contact of ECM or secondary air combination valve RH or LH connector?	Repair the poor contact of the ECM or secondary air combination valve RH or LH connector.	Replace the secondary air combination valve RH or LH. <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>

FJ: DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH

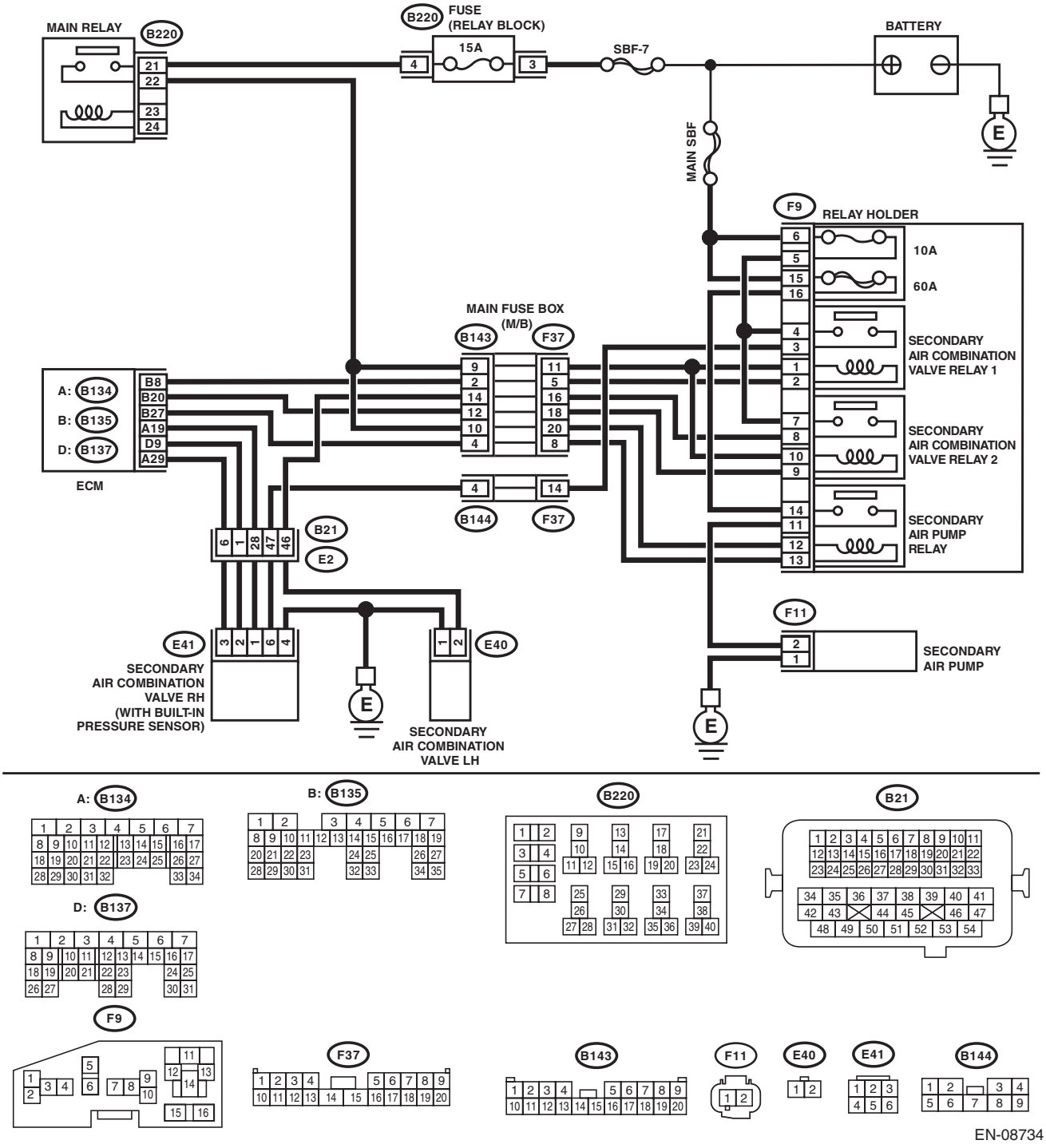
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-283, DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

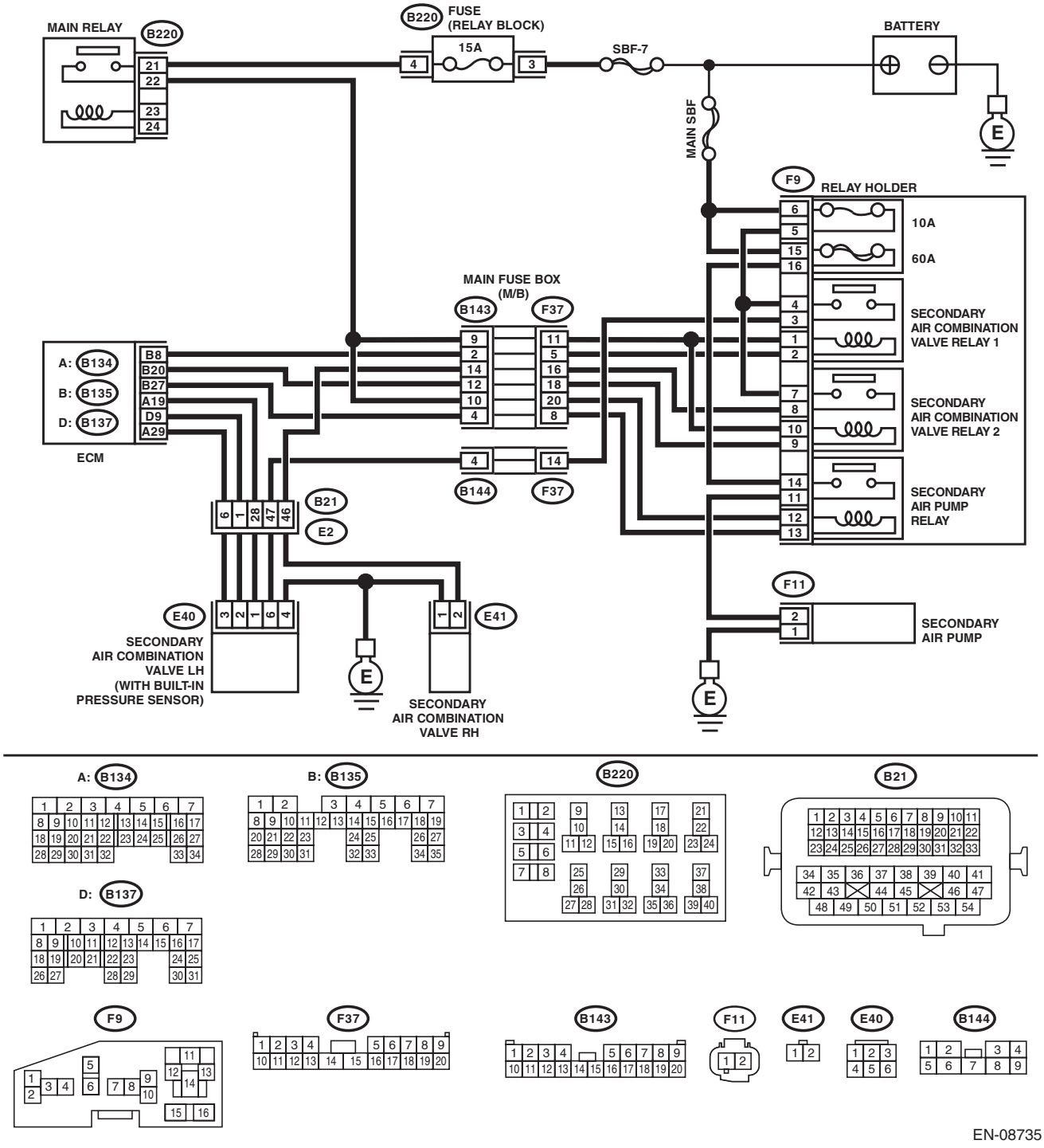
• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08735

	Step	Check	Yes	No
1	**CHECK CURRENT DATA.** 1) Turn the ignition switch to ON. 2) Read the value of «Sec. Air Piping Pressure» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Sec. Air Piping Pressure» 133.3 kPa (1,000 mmHg, 39.4 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 SECONDARY AIR COMBINATION VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from secondary air combination valve RH (models without SI-DRIVE) or LH (models with SI-DRIVE). 3) Turn the ignition switch to ON. 4) Read the value of «Sec. Air Piping Pressure» using Subaru Select Monitor. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the value of «Sec. Air Piping Pressure» 133.3 kPa (1,000 mmHg, 39.4 inHg) or more?	Repair the short circuit to power supply in the harness between ECM and secondary air combination valve RH or LH connectors.	Go to step **3**.
3	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Measure the resistance of the harness between secondary air combination valve RH or LH connector and engine ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(E41) No. 3 — Engine ground:*** ***Models with SI-DRIVE*** ***(E40) No. 3 — 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 secondary air combination valve RH or LH connector • Poor contact of ECM connector • Poor contact of coupling connector
4	**CHECK FOR POOR CONTACT.** Check for poor contact of the secondary air combination valve RH or LH connector.	Is there poor contact of the secondary air combination valve RH or LH connector?	Repair the poor contact of secondary air combination valve RH or LH connector.	Replace the secondary air combination valve RH or LH. <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>

FK:DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK1)

DTC DETECTING CONDITION:

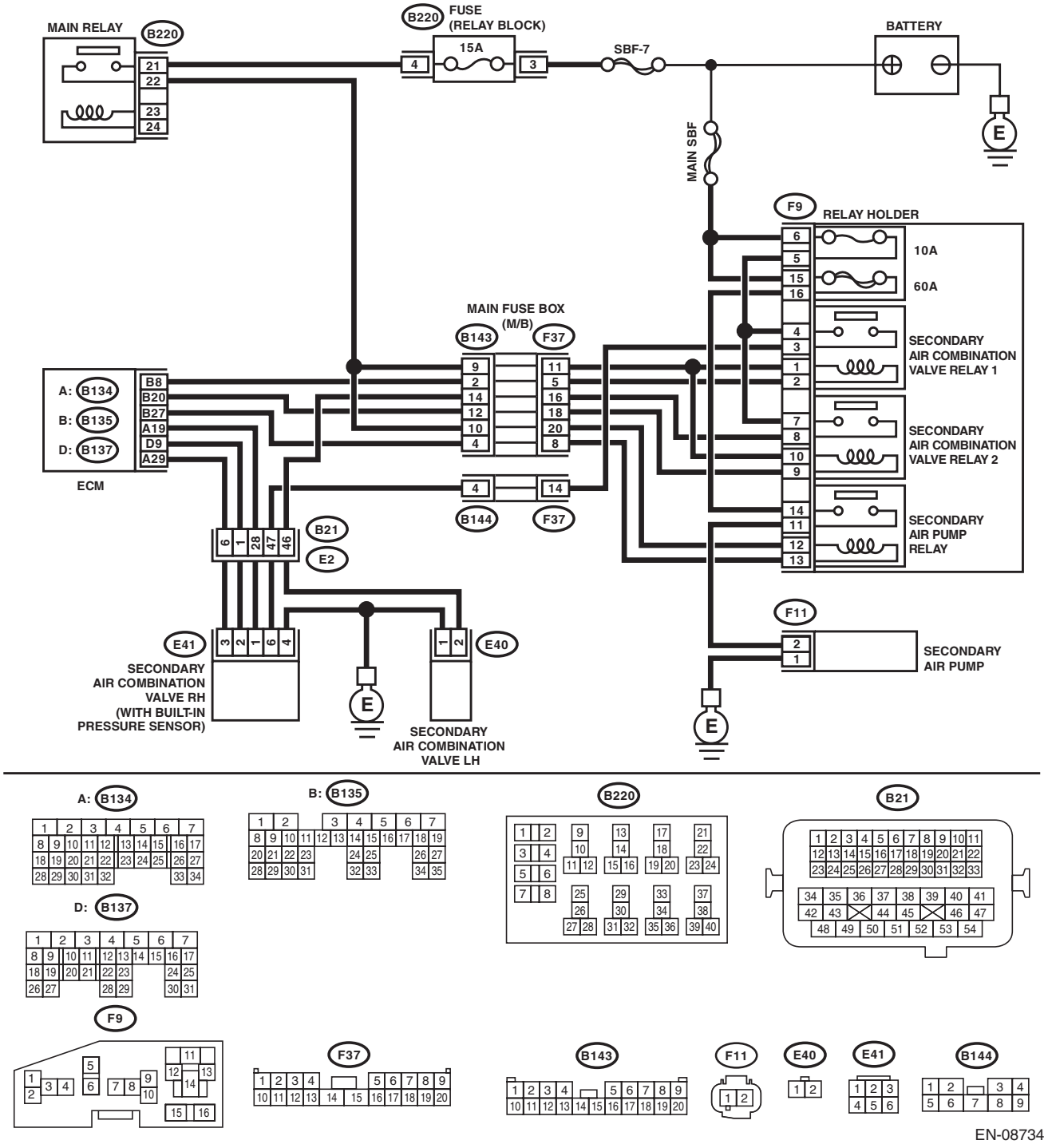
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-284, DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

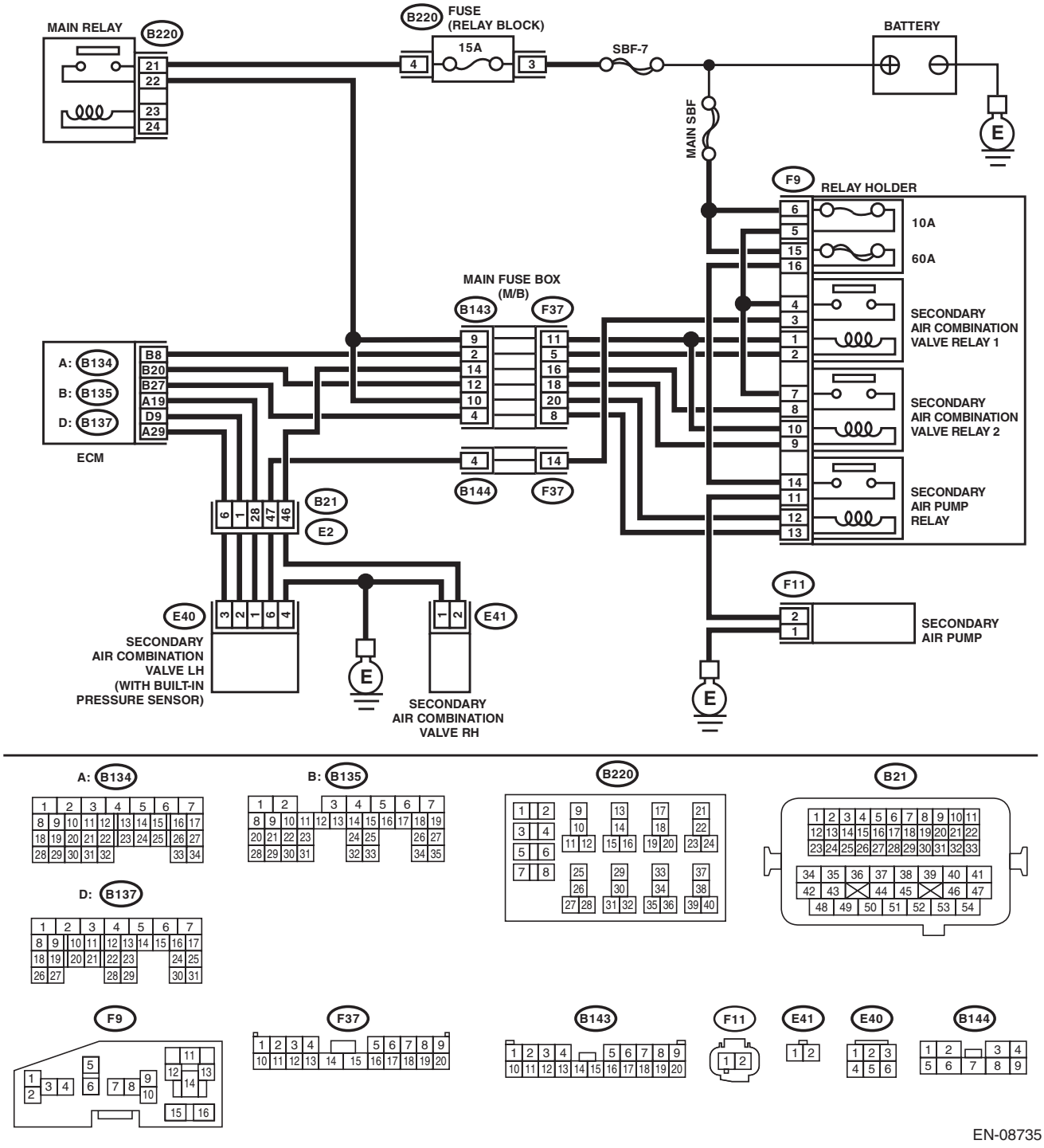
• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08735

Step		Check	Yes	No
1	**CHECK SECONDARY AIR COMBINATION VALVE FUSE.** Check if the secondary air combination valve fuse (10 A) is blown out.	Is the fuse blown out?	Go to step **2**.	Go to step **3**.

	Step	Check	Yes	No
2	**CHECK HARNESS BETWEEN FUSE BOX AND SECONDARY AIR COMBINATION VALVE RH CONNECTOR.** 1) Remove the secondary air combination valve fuse (10 A) from the fuse box. 2) Disconnect the connector from the secondary air combination valve RH. 3) Measure the resistance between the secondary air combination valve fuse and secondary air combination valve RH connector, and chassis ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(F9) No. 5 — Chassis ground:*** ***(E41) No. 6 — Chassis ground:*** ***Models with SI-DRIVE*** ***(F9) No. 5 — Chassis ground:*** ***(E41) No. 2 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the fuse with a new part, and connect the secondary air combination valve RH connector. Go to step **3**.	Repair the short circuit to ground in harness between the fuse box and the secondary air combination valve RH connector.
3	**CHECK SECONDARY AIR COMBINATION VALVE RH OPERATION.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform operation check for the secondary air combination valve RH using the Subaru Select Monitor. NOTE: Refer to “Compulsory Valve Operation Check Mode” for more operation procedures. <Ref. to EN(H4DOTC)(diag)-63, Compulsory Valve Operation Check Mode.>	Does the secondary air combination valve RH repeatedly switch to ON and OFF?	Go to step **4**.	Go to step **6**.
4	**CHECK DUCT BETWEEN SECONDARY AIR PUMP AND SECONDARY AIR COMBINATION VALVE RH.** Check the duct between the secondary air pump and secondary air combination valve RH.	Is there damage, clog or disconnection of the duct?	Replace, clean or connect the duct.	Go to step **5**.
5	**CHECK PIPE BETWEEN SECONDARY AIR COMBINATION VALVE RH AND CYLINDER HEAD.** Check the pipe between the secondary air combination valve RH and cylinder head.	Is there damage, clog or disconnection of the pipe?	Replace, clean or connect the pipe.	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.

	Step	Check	Yes	No
6	**CHECK POWER SUPPLY TO SECONDARY AIR COMBINATION VALVE RH.** 1) Disconnect the connector from the secondary air combination valve RH. 2) In the condition of step 3, measure the voltage between secondary air combination valve RH connector and chassis ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(E41) No. 6 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(E41) No. 2 (+) — Chassis ground (–):***	Does the voltage repeatedly change between 10 V and 0 V?	Replace the secondary air combination valve RH. <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>	Go to step **7**.
7	**CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE RH AND CHASSIS GROUND.** Measure the resistance between the secondary air combination valve RH connector and chassis ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(E41) No. 4 — Chassis ground:*** ***Models with SI-DRIVE*** ***(E41) No. 1 — Chassis ground:***	Is the resistance less than 5 Ω?	• Models without SI-DRIVE: Go to step **8**. • Models with SI-DRIVE: Go to step **14**.	Repair the open circuit in harness between secondary air combination valve RH connector and chassis ground.
8	**CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE RELAY 1 AND SECONDARY AIR COMBINATION VALVE RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the secondary air combination valve relay 1 from the relay box. 3) Measure the resistance of the harness between secondary air combination valve relay 1 connector and secondary air combination valve RH connector. ***Connector & terminal*** ***(F9) No. 3 — (E41) No. 6:***	Is the resistance less than 1 Ω?	Go to step **9**.	Repair the open circuit in harness between secondary air combination valve relay 1 and secondary air combination valve RH connector.
9	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 1.** 1) Connect the battery to terminals No. 1 and No. 2 of the secondary air combination valve relay 1. 2) Measure the resistance between the secondary air combination valve relay 1 terminals. ***Terminals*** ***No. 3 — No. 4:***	Is the resistance less than 1 Ω?	Go to step **10**.	Replace the secondary air combination valve relay 1. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
10	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 1.** Measure the resistance between the secondary air combination valve relay 1 terminals with the battery disconnected. ***Terminals*** ***No. 3 — No. 4:***	Is the resistance 1 MΩ or more?	Go to step **11**.	Replace the secondary air combination valve relay 1. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>

	Step	Check	Yes	No
11	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 1 POWER SUPPLY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between the secondary air combination valve relay 1 connector and chassis ground. ***Connector & terminal*** ***(F9) No. 4 (+) — Chassis ground (–):*** ***(F9) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **12**.	Repair the open or ground short circuit of power supply circuit.
12	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the ECM connector. 3) Measure the resistance of harness between ECM and secondary air combination valve relay 1 connector. ***Connector & terminal*** ***(B135) No. 8 — (F9) No. 2:***	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 ECM and secondary air combination valve relay 1 connector • Poor contact of coupling connector
13	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1 CONNECTOR.** Measure the resistance between the secondary air combination valve relay 1 connector and chassis ground. ***Connector & terminal*** ***(F9) No. 2 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the short circuit to ground in harness between ECM and secondary air combination valve relay 1 connector.
14	**CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE RELAY 2 AND SECONDARY AIR COMBINATION VALVE RH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the secondary air combination valve relay 2 from the relay box. 3) Measure the resistance of the harness between secondary air combination valve relay 2 connector and secondary air combination valve RH connector. ***Connector & terminal*** ***(F9) No. 8 — (E41) No. 2:***	Is the resistance less than 1 Ω?	Go to step **15**.	Repair the open circuit in harness between secondary air combination valve relay 2 and secondary air combination valve RH connector.
15	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 2.** 1) Connect the battery to terminals No. 9 and No. 10 of the secondary air combination valve relay 2. 2) Measure the resistance between the secondary air combination valve relay 2 terminals. ***Terminals*** ***No. 7 — No. 8:***	Is the resistance less than 1 Ω?	Go to step **16**.	Replace the secondary air combination valve relay 2. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
16	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 2.** Measure the resistance between the secondary air combination valve relay 2 terminals with the battery disconnected. ***Terminals*** ***No. 7 — No. 8:***	Is the resistance 1 MΩ or more?	Go to step **17**.	Replace the secondary air combination valve relay 2. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>

	Step	Check	Yes	No
17	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 2 POWER SUPPLY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between the secondary air combination valve relay 2 connector and chassis ground. ***Connector & terminal*** ***(F9) No. 7 (+) — Chassis ground (–):*** ***(F9) No. 10 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **18**.	Repair the open or ground short circuit of power supply circuit.
18	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the ECM connector. 3) Measure the resistance of harness between ECM and secondary air combination valve relay 2 connector. ***Connector & terminal*** ***(B135) No. 20 — (F9) No. 9:***	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 secondary air combination valve relay 2 connector • Poor contact of coupling connector
19	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2 CONNECTOR.** Measure the resistance between the secondary air combination valve relay 2 connector and chassis ground. ***Connector & terminal*** ***(F9) No. 9 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the short circuit to ground in harness between ECM and secondary air combination valve relay 2 connector.

FL: DTC P2441 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK1)

NOTE:
For the diagnostic procedure, refer to DTC P2440. <Ref. to EN(H4DOTC)(diag)-444, DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

FM:DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2)

DTC DETECTING CONDITION:

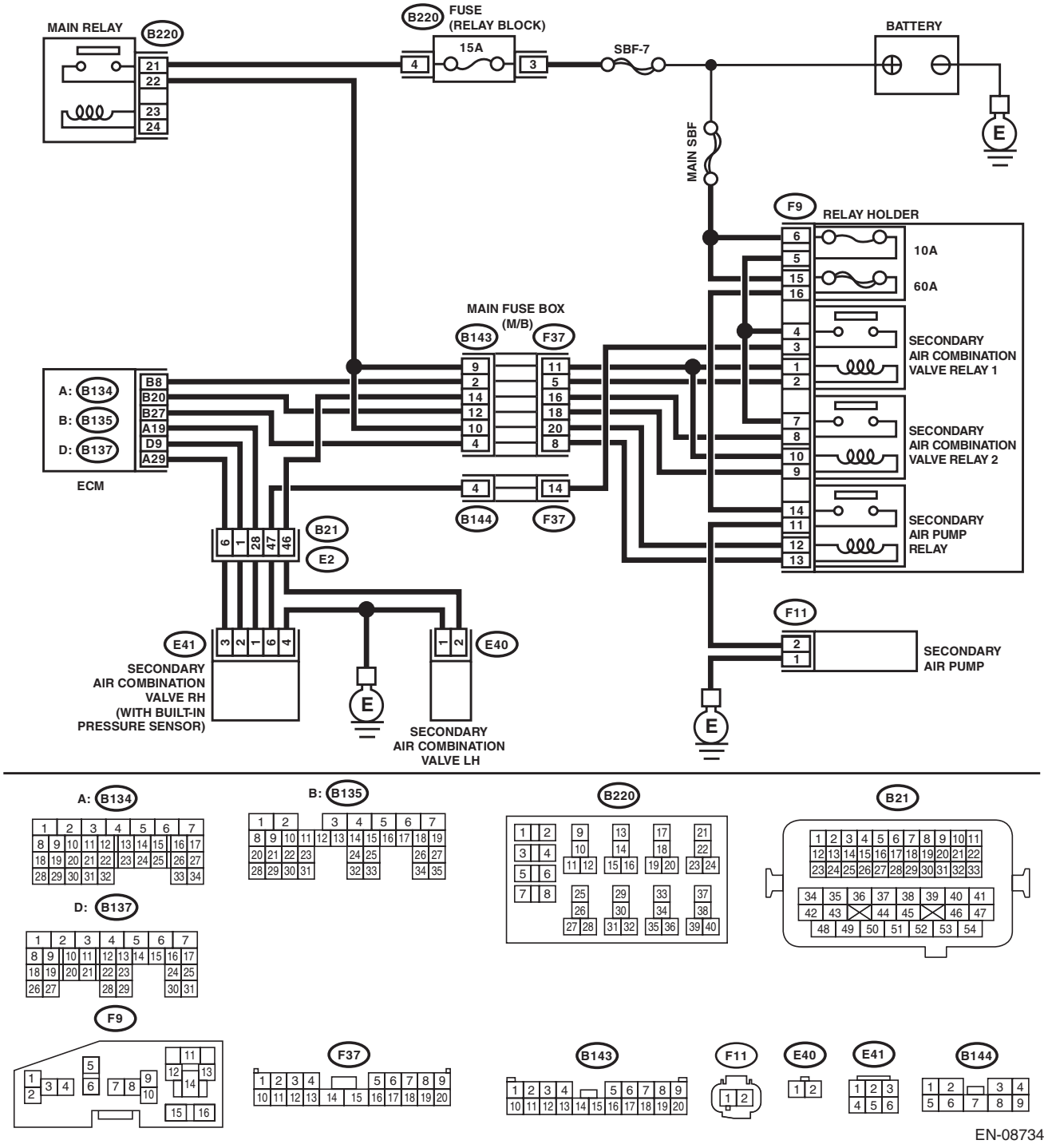
- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-284, DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:

After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

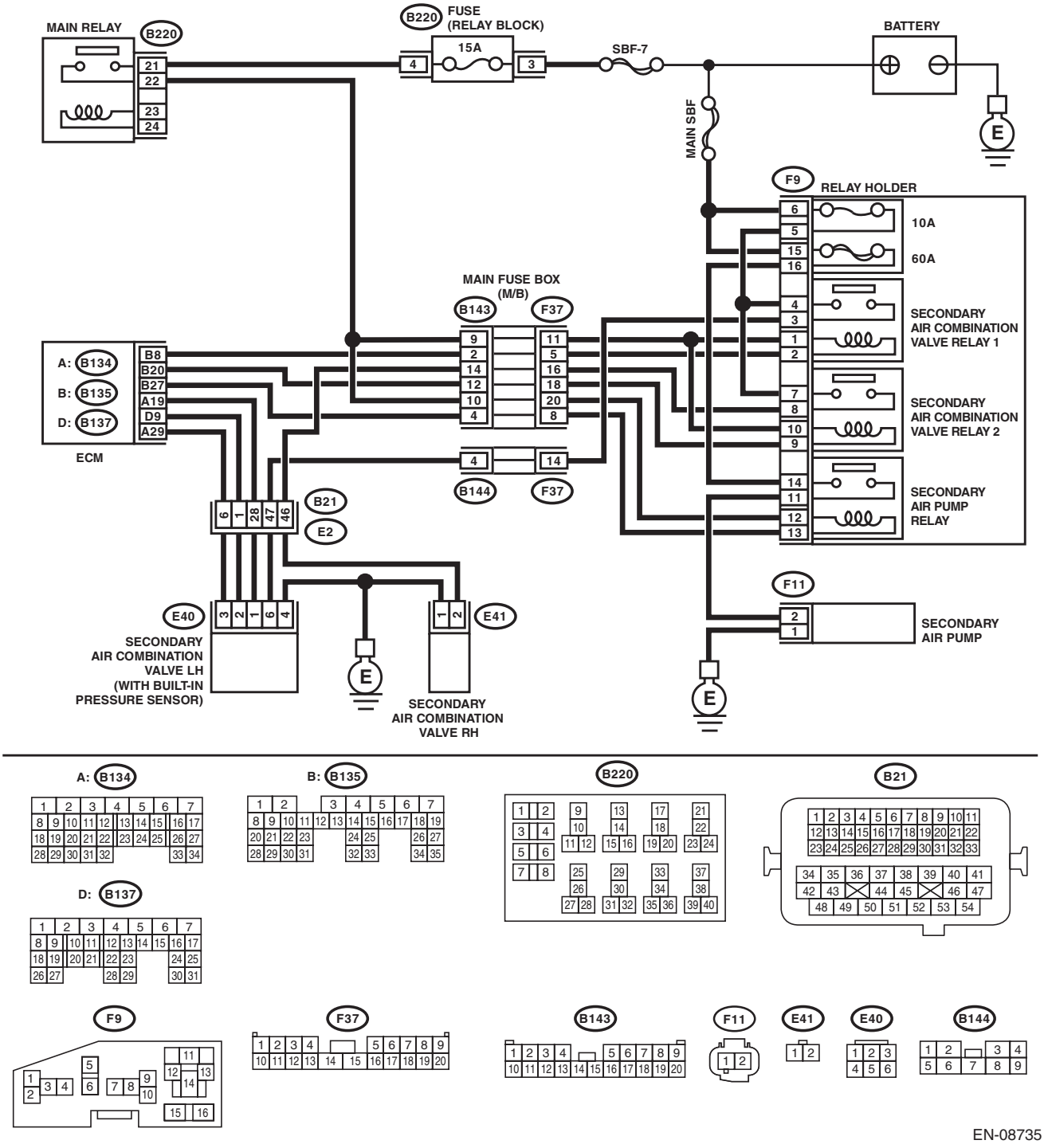
WIRING DIAGRAM:

• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08735

	Step	Check	Yes	No
1	**CHECK SECONDARY AIR COMBINATION VALVE FUSE.** Check if the secondary air combination valve fuse (10 A) is blown out.	Is the fuse blown out?	Go to step **2**.	Go to step **3**.
2	**CHECK HARNESS BETWEEN FUSE BOX AND SECONDARY AIR COMBINATION VALVE LH CONNECTOR.** 1) Remove the secondary air combination valve fuse (10 A) from the fuse box. 2) Disconnect the connector from the secondary air combination valve LH. 3) Measure the resistance between the secondary air combination valve fuse and secondary air combination valve LH connector, and chassis ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(F9) No. 5 — Chassis ground:*** ***(E40) No. 2 — Chassis ground:*** ***Models with SI-DRIVE*** ***(F9) No. 5 — Chassis ground:*** ***(E40) No. 6 — Chassis ground:***	Is the resistance 1 MΩ or more?	Replace the fuse with a new part, and connect the secondary air combination valve LH connector. Go to step **3**.	Repair the ground short circuit of harness between the fuse box and the secondary air combination valve LH connector.
3	**CHECK SECONDARY AIR COMBINATION VALVE LH OPERATION.** 1) Connect the delivery (test) mode connector. 2) Turn the ignition switch to ON. 3) Perform operation check for the secondary air combination valve LH using the Subaru Select Monitor. NOTE: Refer to “Compulsory Valve Operation Check Mode” for more operation procedures. <Ref. to EN(H4DOTC)(diag)-63, Compulsory Valve Operation Check Mode.>	Does the secondary air combination valve LH repeatedly switch to ON and OFF?	Go to step **4**.	Go to step **6**.
4	**CHECK DUCT BETWEEN SECONDARY AIR PUMP AND SECONDARY AIR COMBINATION VALVE LH.** Check the duct between the secondary air pump and secondary air combination valve LH.	Is there damage, clog or disconnection of the duct?	Replace, clean or connect the duct.	Go to step **5**.
5	**CHECK PIPE BETWEEN SECONDARY AIR COMBINATION VALVE LH AND CYLINDER HEAD.** Check the pipe between the secondary air combination valve LH and cylinder head.	Is there damage, clog or disconnection of the pipe?	Replace, clean or connect the pipe.	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.

	Step	Check	Yes	No
6	**CHECK POWER SUPPLY TO SECONDARY AIR COMBINATION VALVE LH.** 1) Disconnect the connector from the secondary air combination valve LH. 2) In the condition of step 3, measure the voltage between secondary air combination valve LH connector and chassis ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(E40) No. 2 (+) — Chassis ground (–):*** ***Models with SI-DRIVE*** ***(E40) No. 6 (+) — Chassis ground (–):***	Does the voltage repeatedly change between 10 V and 0 V?	Replace the secondary air combination valve LH. <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>	Go to step **7**.
7	**CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE LH AND CHASSIS GROUND.** Measure the resistance between the secondary air combination valve LH connector and chassis ground. ***Connector & terminal*** ***Models without SI-DRIVE*** ***(E40) No. 1 — Chassis ground:*** ***Models with SI-DRIVE*** ***(E40) No. 4 — Chassis ground:***	Is the resistance less than 5 Ω?	• Models without SI-DRIVE: Go to step **8**. • Models with SI-DRIVE: Go to step **14**.	Repair the open circuit in harness between secondary air combination valve LH connector and chassis ground.
8	**CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE RELAY 2 AND SECONDARY AIR COMBINATION VALVE LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the secondary air combination valve relay 2 from the relay box. 3) Measure the resistance of the harness between the secondary air combination valve relay 2 and secondary air combination valve LH connector. ***Connector & terminal*** ***(F9) No. 8 — (E40) No. 2:***	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 secondary air combination valve relay 2 connector and secondary air combination valve LH connector • Poor contact of coupling connector
9	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 2.** 1) Connect the battery to terminals No. 10 and No. 9 of the secondary air combination valve relay 2. 2) Measure the resistance between the secondary air combination valve relay 2 terminals. ***Terminals*** ***No. 7 — No. 8:***	Is the resistance less than 1 Ω?	Go to step **10**.	Replace the secondary air combination valve relay 2. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
10	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 2.** Measure the resistance between the secondary air combination valve relay 2 terminals with the battery disconnected. ***Terminals*** ***No. 7 — No. 8:***	Is the resistance 1 MΩ or more?	Go to step **11**.	Replace the secondary air combination valve relay 2. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>

	Step	Check	Yes	No
11	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 2 POWER SUPPLY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between the secondary air combination valve relay 2 connector and chassis ground. ***Connector & terminal*** ***(F9) No. 7 (+) — Chassis ground (–):*** ***(F9) No. 10 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **12**.	Repair the open or ground short circuit of power supply circuit.
12	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the ECM connector. 3) Measure the resistance of harness between ECM and secondary air combination valve relay 2 connector. ***Connector & terminal*** ***(B135) No. 20 — (F9) No. 9:***	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 ECM and secondary air combination valve relay 2 connector • Poor contact of coupling connector
13	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 2 CONNECTOR.** Measure the resistance between the secondary air combination valve relay 2 connector and chassis ground. ***Connector & terminal*** ***(F9) No. 9 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the short circuit to ground in harness between ECM and secondary air combination valve relay 2 connector.
14	**CHECK HARNESS BETWEEN SECONDARY AIR COMBINATION VALVE RELAY 1 AND SECONDARY AIR COMBINATION VALVE LH CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the secondary air combination valve relay 1 from the relay box. 3) Measure the resistance of the harness between the secondary air combination valve relay 1 and secondary air combination valve LH connector. ***Connector & terminal*** ***(F9) No. 3 — (E40) No. 6:***	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 secondary air combination valve relay 1 connector and secondary air combination valve LH connector • Poor contact of coupling connector
15	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 1.** 1) Connect the battery to terminals No. 1 and No. 2 of the secondary air combination valve relay 1. 2) Measure the resistance between the secondary air combination valve relay 1 terminals. ***Terminals*** ***No. 3 — No. 4:***	Is the resistance less than 1 Ω?	Go to step **16**.	Replace the secondary air combination valve relay 1. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>

	Step	Check	Yes	No
16	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 1.** Measure the resistance between the secondary air combination valve relay 1 terminals with the battery disconnected. ***Terminals*** ***No. 3 — No. 4:***	Is the resistance 1 MΩ or more?	Go to step **17**.	Replace the secondary air combination valve relay 1. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>
17	**CHECK SECONDARY AIR COMBINATION VALVE RELAY 1 POWER SUPPLY.** 1) Turn the ignition switch to ON. 2) Measure the voltage between the secondary air combination valve relay 1 connector and chassis ground. ***Connector & terminal*** ***(F9) No. 4 (+) — Chassis ground (–):*** ***(F9) No. 1 (+) — Chassis ground (–):***	Is the voltage 10 V or more?	Go to step **18**.	Repair the open or ground short circuit of power supply circuit.
18	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1 CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the ECM connector. 3) Measure the resistance of harness between ECM and secondary air combination valve relay 1 connector. ***Connector & terminal*** ***(B135) No. 8 — (F9) No. 2:***	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 secondary air combination valve relay 1 connector • Poor contact of coupling connector
19	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR COMBINATION VALVE RELAY 1 CONNECTOR.** Measure the resistance between the secondary air combination valve relay 1 connector and chassis ground. ***Connector & terminal*** ***(F9) No. 2 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of ECM connector.	Repair the short circuit to ground in harness between ECM and secondary air combination valve relay 1 connector.

FN:DTC P2443 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK2)

NOTE:
For the diagnostic procedure, refer to DTC P2442. <Ref. to EN(H4DOTC)(diag)-451, DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

FO:DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON

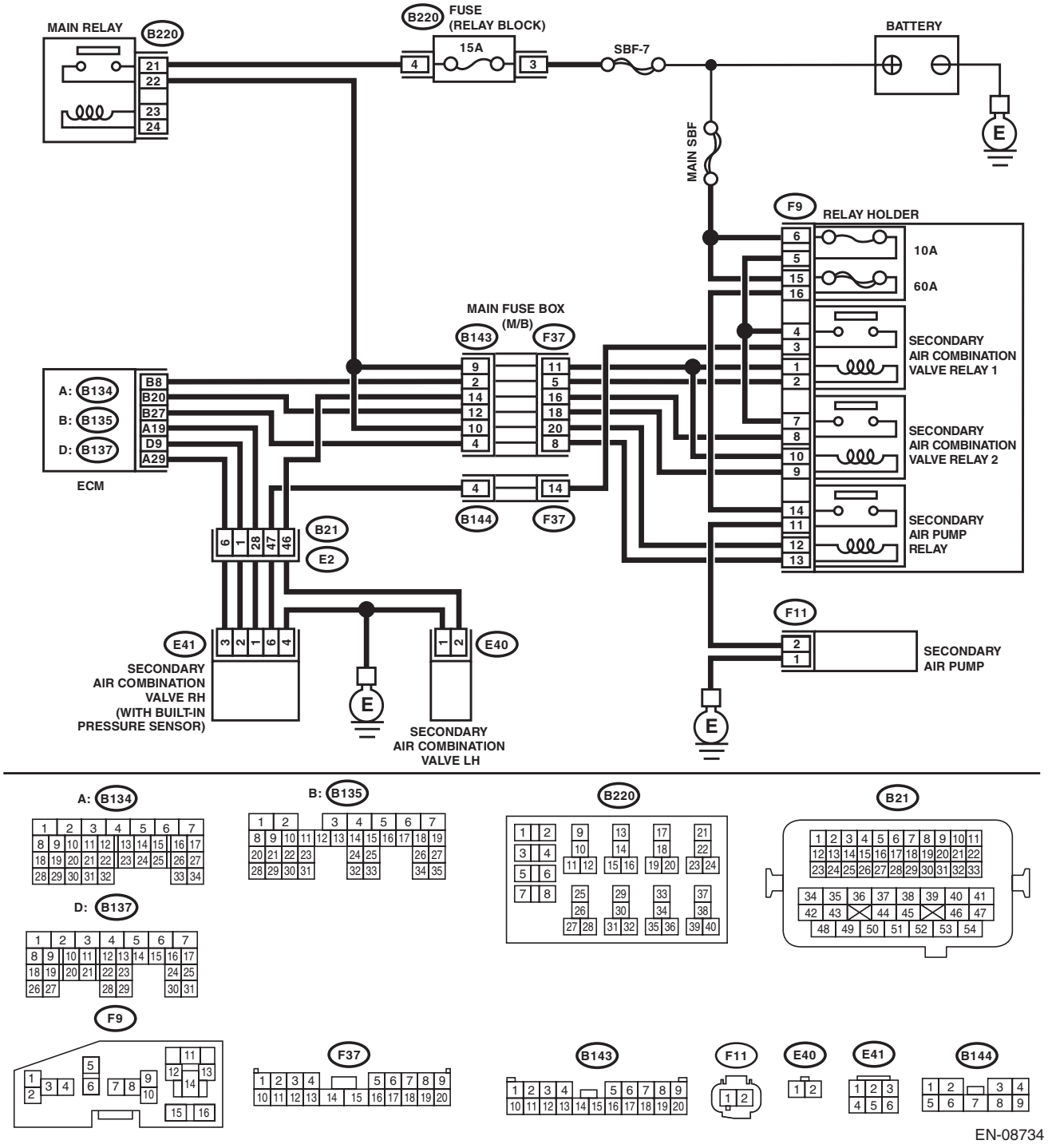
DTC DETECTING CONDITION:

- Immediately at fault recognition
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-285, DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, PROCEDURE, Inspection Mode.>.

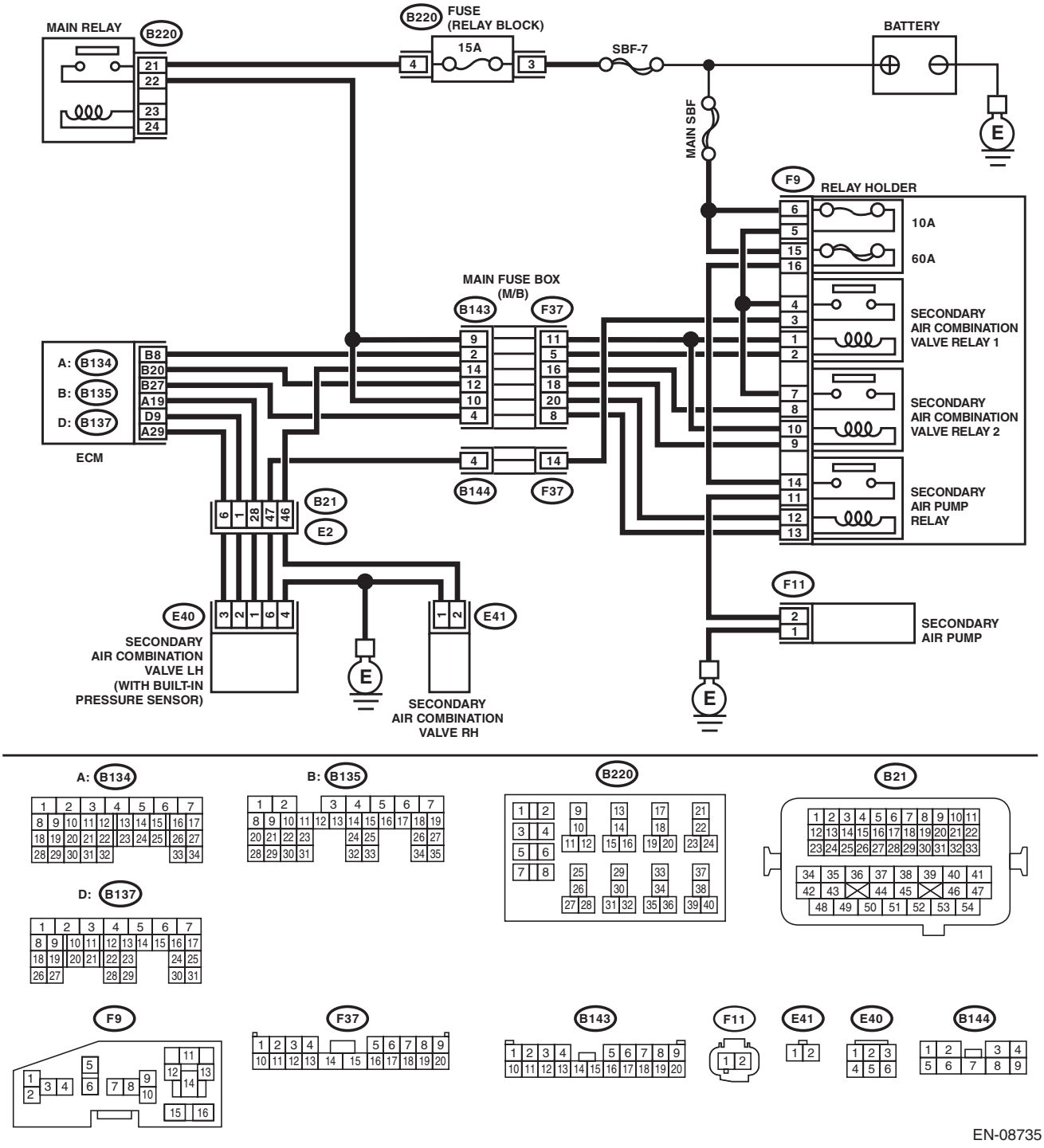
WIRING DIAGRAM:

• Models without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08734

- Models with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



EN-08735

	Step	Check	Yes	No
1	**CHECK SECONDARY AIR PIPING PRESSURE.** 1) Turn the ignition switch to ON. 2) Using the Subaru Select Monitor, read the value of «Sec. Air Piping Pressure», and compare with the actual atmospheric pressure. NOTE: For detailed operation procedures, refer to "READ CURRENT DATA FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-39, Subaru Select Monitor.>	Is the difference between «Sec. Air Piping Pressure» and atmospheric pressure 50 mmHg (6.7 kPa, 2.0 inHg, 0.97 psig) 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 SECONDARY AIR PUMP.** 1) Start the engine and warm up engine until coolant temperature is higher than 75°C (167°F). 2) Check whether the secondary air pump is operating.	Is the secondary air pump operating?	Go to step **3**.	Replace the secondary air combination valve RH (models without SI-DRIVE) or LH (models with SI-DRIVE). <Ref. to EC(STI)-29, Secondary Air Combination Valve.> <Ref. to EC(w/o STI)-30, Secondary Air Combination Valve.>
3	**CHECK HARNESS BETWEEN ECM AND SECONDARY AIR PUMP RELAY CONNECTOR.** 1) Turn the ignition switch to OFF. 2) Remove the secondary air pump relay from the relay box. 3) Measure the resistance between the secondary air pump relay connector and engine ground terminals. ***Connector & terminal*** ***(F9) No. 13 — Engine ground:***	Is the resistance 1 MΩ or more?	Go to step **4**.	Repair the short circuit to ground in harness between ECM and secondary air pump relay connector.
4	**CHECK SECONDARY AIR PUMP RELAY.** Measure the resistance between the secondary air pump relay terminals. ***Terminals*** ***No. 14 — No. 11:***	Is the resistance 1 MΩ or more?	Repair the short circuit to power in the harness between secondary air pump relay and secondary air pump connector.	Replace the secondary air pump relay. <Ref. to EN(H4DOTC)(diag)-8, Electrical Component Location.>

FP:DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE

DTC DETECTING CONDITION:

- Detected when two consecutive driving cycles with fault occur.
- GENERAL DESCRIPTION <Ref. to GD(H4DOTC)-286, DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CAUTION:
After servicing or replacing faulty parts, perform Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-62, OPERATION, Clear Memory Mode.>, and Inspection Mode <Ref. to EN(H4DOTC)(diag)-48, 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(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Replace the ECM. <Ref. to FU(STI)-59, Engine Control Module (ECM).> <Ref. to FU(w/o STI)-57, Engine Control Module (ECM).> NOTE: The soak timer IC is built into the ECM.

FQ:DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

FR:DTC U0122 CAN (VDC) DATA NOT LOADED

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

FS:DTC U0140 CAN (BCU) DATA NOT LOADED

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

FT:DTC U0416 CAN (VDC) DATA ABNORMAL

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

FU:DTC U0422 CAN (BCU) DATA ABNORMAL

NOTE:
For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>

21.Diagnostic Procedure without Diagnostic Trouble Code (DTC)

A: CHECK SI-DRIVE (SUBARU INTELLIGENT DRIVE) SYSTEM

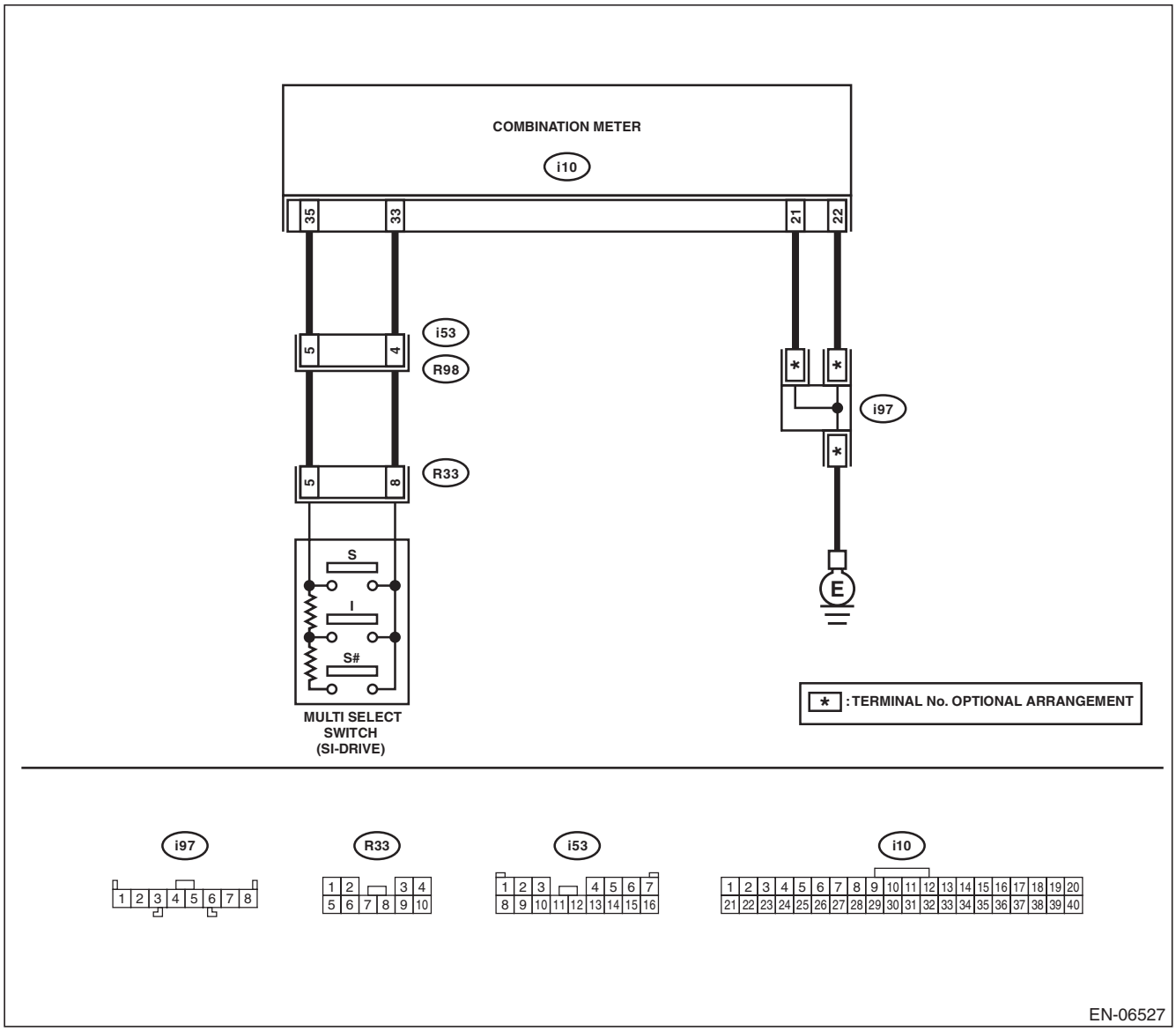
DIAGNOSIS:
SI-DRIVE mode does not switch.

CAUTION:
Note that SI-DRIVE system operates the following controls when it switches the modes.
1. Switches to S (SPORT) when turning the engine ON after turning the engine OFF in S# (SPORT sharp) mode.
2. Returns to the mode last selected when turning the engine ON after turning the engine OFF in S (SPORT) or I (Intelligent) mode.
3. Switches to S (SPORT) when the malfunction indicator light illuminates while the engine is running. In this case, Cannot switch to S# (SPORT sharp) or I (Intelligent) mode.
4. Cannot switch to S# (SPORT sharp), when engine coolant temperature tells that overheating may occur. Switches to S (SPORT) while driving in S# (SPORT sharp) mode.

1. SI-DRIVE MODE INDICATION DOES NOT CHANGE AND MODES DO NOT SWITCH AFTER SWITCHING SI-DRIVE MODES

WIRING DIAGRAM:

- Engine electrical system, without SI-DRIVE <Ref. to WI-32, WITHOUT SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>
- Engine electrical system, with SI-DRIVE <Ref. to WI-48, WITH SI-DRIVE, WIRING DIAGRAM, Engine Electrical System.>



	Step	Check	Yes	No
1	**CHECK SI-DRIVE SELECTOR.** 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the combination meter. 3) Measure the resistance between connectors when the SI-DRIVE selector is operated. ***Connector & terminal*** ***(i10) No. 33 — (i10) No. 35:***	Does the resistance change as below? S#: 3.48 — 3.85 kΩ I: 0.95 — 1.05 kΩ S: less than 1 Ω	Go to step **4**.	Go to step **2**.
2	**CHECK HARNESS BETWEEN COMBINATION METER AND MULTI-SELECT SWITCH CONNECTOR.** 1) Disconnect the connector from multi-select switch. 2) Measure the resistance of harness between combination meter and multi-select switch connector. ***Connector & terminal*** ***(i10) No. 33 — (R33) No. 8:*** ***(i10) No. 35 — (R33) No. 5:***	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 combination meter and multi-select switch connector • Poor contact of coupling connector
3	**CHECK HARNESS BETWEEN COMBINATION METER AND MULTI-SELECT SWITCH CONNECTOR.** Measure the resistance between multi-select switch connector and chassis ground. ***Connector & terminal*** ***(R33) No. 8 — Chassis ground:*** ***(R33) No. 5 — Chassis ground:***	Is the resistance 1 MΩ or more?	Repair the poor contact of multi-select switch connector. Replace the multi-select switch if defective. <Ref. to FU(STI)-58, SI-DRIVE (SUBARU Intelligent Drive) Selector.>	Repair the ground short circuit in harness between combination meter and multi-select switch connector.
4	**CHECK HARNESS BETWEEN COMBINATION METER AND CHASSIS GROUND.** Measure the resistance of harness between combination meter and chassis ground. ***Connector & terminal*** ***(i10) No. 21 — Chassis ground:*** ***(i10) No. 22 — Chassis 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 in harness between combination meter and chassis ground • Poor contact of coupling connector
5	**RECHECK FAULT.** 1) Connect all connectors. 2) Switch SI-DRIVE modes.	Is there any fault?	Repair the poor contact of combination meter connector. Replace the combination meter if defective. <Ref. to IDI-18, Combination Meter.>	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. “S” BLINKS ON SI-DRIVE MODE DISPLAY IN THE COMBINATION METER APPROX. 5 SECONDS AFTER SWITCHING SI-DRIVE MODES

	Step	Check	Yes	No
1	**CHECK DTC.**	Is DTC displayed?	Check the appropriate DTC using the “List of Diagnostic Trouble Code (DTC)” concerning the respective units.	Go to step **2**.
2	**CHECK COMBINATION METER AND CLOCK DISPLAY.** Check for abnormal indication other than “S” blinking. Examples: • Malfunction indicator light illuminates. • “Err” is displayed on fuel efficiency display part. • Engine coolant temperature gauge does not move.	Is there any abnormal indication other than “S” blinking?	For the diagnostic procedure, refer to LAN section. <Ref. to LAN(diag)-2, Basic Diagnostic Procedure.>	Go to step **3**.
3	**CHECK COMBINATION METER, ECM AND BODY INTEGRATED UNIT.**	Are the part numbers of combination meter, ECM and body integrated unit correct?	Replace the combination meter. <Ref. to IDI-18, Combination Meter.>	Replace the combination meter, ECM or body integrated unit with parts of proper part number. <Ref. to IDI-18, Combination Meter.> <Ref. to FU(STI)-59, Engine Control Module (ECM).> or <Ref. to SL-48, Body Integrated Unit.>

3. "S#", "I" OR "S" BLINKS ON SI-DRIVE MODE DISPLAY IN THE COMBINATION METER AFTER SWITCHING SI-DRIVE MODES

NOTE:
In this case, there is a fault other than in SI-DRIVE system.

	Step	Check	Yes	No
1	**CHECK MALFUNCTION INDICATOR LIGHT.** 1) Start the engine. 2) Check if malfunction indicator light illuminates.	Does the malfunction indicator light illuminate?	Read the DTC using Subaru Select Monitor and check the indicated DTC. <Ref. to EN(H4DOTC)(diag)-87, List of Diagnostic Trouble Code (DTC).>	Go to step **2**.
2	**CHECK ENGINE COOLANT TEMPERATURE GAUGE.** 1) Turn the ignition switch to ON. 2) Check the engine coolant temperature gauge.	Does it indicate overheating?	Inspect for the cause of overheating and repair.	Go to step **3**.
3	**CHECK COMBINATION METER INDICATION.** 1) Turn the ignition switch to ON. 2) Switch SI-DRIVE modes. 3) Check the SI-DRIVE mode display in the combination meter.	Does "S#", "I" or "S" of the SI-DRIVE mode blink in combination meter?	Replace the combination meter. <Ref. to IDI-18, Combination Meter.>	Perform test driving to check the malfunction indicator light and engine coolant temperature gauge. Complete the diagnosis if they are normal.

22.General Diagnostic Table

A: INSPECTION

1. ENGINE

NOTE:
Malfunction of parts other than those listed is also possible. <Ref. to ME(STI)-105, Engine Trouble in General.> <Ref. to ME(w/o STI)-103, Engine Trouble in General.>

Symptoms	Faulty parts
1. Engine stalls during idling.	1) Electronic throttle control 2) Manifold absolute pressure sensor 3) Mass air flow and intake air temperature sensor 4) Ignition parts (*1) 5) Engine coolant temperature sensor (*2) 6) Crankshaft position sensor (*3) 7) Camshaft position sensor (*3) 8) Fuel injection parts (*4)
2. Rough idling	1) Electronic throttle control 2) Manifold absolute pressure sensor 3) Mass air flow and intake air temperature sensor 4) Engine coolant temperature sensor (*2) 5) Ignition parts (*1) 6) Air intake system (*5) 7) Fuel injection parts (*4) 8) Crankshaft position sensor (*3) 9) Camshaft position sensor (*3) 10) Oxygen sensor 11) Fuel pump and fuel pump relay
3. Engine does not return to idle.	1) Electronic throttle control 2) Engine coolant temperature sensor 3) Manifold absolute pressure sensor 4) Mass air flow and intake air temperature sensor 5) Accelerator pedal position 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) Accelerator pedal position sensor
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) Fuel pump and fuel pump relay 9) Electronic throttle control

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

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

GENERAL DESCRIPTION

GD(H4DOTC)

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1. List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Index
P0011	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 1)	<Ref. to GD(H4DOTC)-11, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0014	Exhaust AVCS System 1 (Range/ Performance)	<Ref. to GD(H4DOTC)-13, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0016	Crankshaft Position - Camshaft Position Correlation (Bank1)	<Ref. to GD(H4DOTC)-15, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0017	Crank and Cam Timing B System Failure (Bank 1)	<Ref. to GD(H4DOTC)-17, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0018	Crankshaft Position - Camshaft Position Correlation (Bank2)	<Ref. to GD(H4DOTC)-18, DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0019	Crank and Cam Timing B System Failure (Bank 2)	<Ref. to GD(H4DOTC)-18, DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0021	Intake Camshaft Position - Timing Over-Advanced or System Performance (Bank 2)	<Ref. to GD(H4DOTC)-18, DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0024	Exhaust AVCS System 2 (Range/ Performance)	<Ref. to GD(H4DOTC)-19, DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0030	HO2S Heater Control Circuit (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-19, DTC P0030 HO2S HEATER CONTROL CIRCUIT (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-21, DTC P0031 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0032	HO2S Heater Control Circuit High (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-23, DTC P0032 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0037	HO2S Heater Control Circuit Low (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-25, DTC P0037 HO2S HEATER CONTROL CIRCUIT LOW (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0038	HO2S Heater Control Circuit High (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-27, 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(H4DOTC)-29, DTC P0068 MAP/MAF - THROTTLE POSITION CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0101	Mass or Volume Air Flow Circuit Range/Performance	<Ref. to GD(H4DOTC)-31, DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to GD(H4DOTC)-33, DTC P0102 MASS OR VOLUME AIR FLOW CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0103	Mass or Volume Air Flow Circuit High Input	<Ref. to GD(H4DOTC)-35, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to GD(H4DOTC)-37, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0108	Manifold Absolute Pressure/Barometric Pressure Circuit High Input	<Ref. to GD(H4DOTC)-39, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P0111	Intake Air Temperature Sensor Range/Performance Problem	<Ref. to GD(H4DOTC)-41, DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0112	Intake Air Temperature Sensor 1 Circuit Low	<Ref. to GD(H4DOTC)-44, 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(H4DOTC)-46, DTC P0113 INTAKE AIR TEMPERATURE SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0116	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	<Ref. to GD(H4DOTC)-48, DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0117	Engine Coolant Temperature Circuit Low	<Ref. to GD(H4DOTC)-50, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0118	Engine Coolant Temperature Circuit High	<Ref. to GD(H4DOTC)-52, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0122	Throttle/Pedal Position Sensor/ Switch “A” Circuit Low	<Ref. to GD(H4DOTC)-54, 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(H4DOTC)-56, 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(H4DOTC)-58, DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0128	Coolant Thermostat (Engine Coolant Temperature Below Thermostat Regulating Temperature)	<Ref. to GD(H4DOTC)-60, 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(H4DOTC)-64, 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(H4DOTC)-66, DTC P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-68, 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(H4DOTC)-70, 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(H4DOTC)-72, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P013A	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-73, DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P013B	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-75, DTC P013B O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-77, DTC P013E O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P013F	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 2)	<Ref. to GD(H4DOTC)-79, DTC P013F O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0140	O2 Sensor Circuit No Activity Detected (Bank1 Sensor2)	<Ref. to GD(H4DOTC)-81, DTC P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

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P0141	O2 Sensor Heater Circuit (Bank1 Sensor2)	<Ref. to GD(H4DOTC)-83, DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P014C	O2 Sensor Slow Response - Rich to Lean (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-85, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P014D	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-87, DTC P014D O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P015A	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-88, DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P015B	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-94, DTC P015B O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0171	System Too Lean (Bank 1)	<Ref. to GD(H4DOTC)-95, DTC P0171 SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0172	System Too Rich (Bank 1)	<Ref. to GD(H4DOTC)-97, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0201	Injector #1	<Ref. to GD(H4DOTC)-99, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0202	Injector #2	<Ref. to GD(H4DOTC)-100, DTC P0202 INJECTOR #2, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0203	Injector #3	<Ref. to GD(H4DOTC)-100, DTC P0203 INJECTOR #3, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0204	Injector #4	<Ref. to GD(H4DOTC)-100, DTC P0204 INJECTOR #4, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0222	Throttle/Pedal Position Sensor/ Switch “B” Circuit Low	<Ref. to GD(H4DOTC)-101, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0223	Throttle/Pedal Position Sensor/ Switch “B” Circuit High	<Ref. to GD(H4DOTC)-103, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH “B” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0230	Fuel Pump Primary Circuit	<Ref. to GD(H4DOTC)-105, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0244	Turbo/Super Charger Wastegate Solenoid “A” Range/Performance	<Ref. to GD(H4DOTC)-107, DTC P0244 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0245	Turbo/Super Charger Wastegate Solenoid “A” Low	<Ref. to GD(H4DOTC)-109, DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0246	Turbo/Super Charger Wastegate Solenoid “A” High	<Ref. to GD(H4DOTC)-111, DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID “A” HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0300	Random/Multiple Cylinder Misfire Detected	<Ref. to GD(H4DOTC)-112, DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0301	Cylinder 1 Misfire Detected	<Ref. to GD(H4DOTC)-113, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0302	Cylinder 2 Misfire Detected	<Ref. to GD(H4DOTC)-122, DTC P0302 CYLINDER 2 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0303	Cylinder 3 Misfire Detected	<Ref. to GD(H4DOTC)-122, DTC P0303 CYLINDER 3 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0304	Cylinder 4 Misfire Detected	<Ref. to GD(H4DOTC)-122, 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(H4DOTC)-123, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

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P0328	Knock Sensor 1 Circuit High (Bank 1 or Single Sensor)	<Ref. to GD(H4DOTC)-125, 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(H4DOTC)-127, DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0336	Crankshaft Position Sensor “A” Circuit Range/Performance	<Ref. to GD(H4DOTC)-129, DTC P0336 CRANKSHAFT POSITION SENSOR “A” CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0340	Camshaft Position Sensor “A” Circuit (Bank 1 or Single Sensor)	<Ref. to GD(H4DOTC)-131, 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(H4DOTC)-133, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0345	Camshaft Position Sensor “A” Circuit (Bank 2)	<Ref. to GD(H4DOTC)-134, DTC P0345 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0346	Camshaft Position Sensor "A" Circuit Range/Performance (Bank 2)	<Ref. to GD(H4DOTC)-134, DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0351	Ignition Coil A Primary/Secondary Circuit	<Ref. to GD(H4DOTC)-135, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0352	Ignition Coil B Primary/Secondary Circuit	<Ref. to GD(H4DOTC)-135, DTC P0352 IGNITION COIL B PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0353	Ignition Coil C Primary/Secondary Circuit	<Ref. to GD(H4DOTC)-135, DTC P0353 IGNITION COIL C PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0354	Ignition Coil D Primary/Secondary Circuit	<Ref. to GD(H4DOTC)-135, DTC P0354 IGNITION COIL D PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0365	Camshaft Position Sensor “B” Circuit (Bank 1)	<Ref. to GD(H4DOTC)-136, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0366	Camshaft Position Sensor B Circuit Range/Performance (Bank 1)	<Ref. to GD(H4DOTC)-137, DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0390	Camshaft Position Sensor “B” Circuit (Bank 2)	<Ref. to GD(H4DOTC)-137, DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0391	Camshaft Position Sensor B Circuit Range/Performance (Bank 2)	<Ref. to GD(H4DOTC)-137, DTC P0391 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0410	Secondary Air Injection System	<Ref. to GD(H4DOTC)-138, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0411	Secondary Air Injection System Incorrect Flow Detected	<Ref. to GD(H4DOTC)-145, DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0413	Secondary Air Injection System Switching Valve “A” Circuit Open	<Ref. to GD(H4DOTC)-146, DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0414	Secondary Air Injection System Switching Valve “A” Circuit Shorted	<Ref. to GD(H4DOTC)-147, DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “A” CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0416	Secondary Air Injection System Switching Valve “B” Circuit Open	<Ref. to GD(H4DOTC)-147, DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “B” CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0417	Secondary Air Injection System Switching Valve “B” Circuit Shorted	<Ref. to GD(H4DOTC)-147, DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE “B” CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Index
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	<Ref. to GD(H4DOTC)-148, DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0441	Evaporative Emission Cont. Sys. Incorrect Purge Flow	<Ref. to GD(H4DOTC)-151, DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0451	Evaporative Emission System Pressure Sensor/Switch Range/ Performance	<Ref. to GD(H4DOTC)-154, DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0452	Evaporative Emission System Pressure Sensor/Switch Low	<Ref. to GD(H4DOTC)-156, DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0453	Evaporative Emission System Pressure Sensor/Switch High	<Ref. to GD(H4DOTC)-158, DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/SWITCH HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0455	Evaporative Emission System Leak Detected (Large Leak)	<Ref. to GD(H4DOTC)-160, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	<Ref. to GD(H4DOTC)-165, DTC P0456 EVAPORATIVE EMISSION CONTROL SYSTEM LEAK DETECTED (VERY SMALL LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0458	Evaporative Emission System Purge Control Valve Circuit Low	<Ref. to GD(H4DOTC)-166, 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(H4DOTC)-168, 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(H4DOTC)-170, 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(H4DOTC)-172, DTC P0462 FUEL LEVEL SENSOR “A” CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0463	Fuel Level Sensor “A” Circuit High	<Ref. to GD(H4DOTC)-174, DTC P0463 FUEL LEVEL SENSOR “A” CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P04AC	Evap System Purge Control Valve "B" Circuit Low	<Ref. to GD(H4DOTC)-176, DTC P04AC EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P04AD	Evap System Purge Control Valve "B" Circuit High	<Ref. to GD(H4DOTC)-177, DTC P04AD EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P04DB	Crankcase Ventilation System Disconnected	<Ref. to GD(H4DOTC)-178, DTC P04DB CRANKCASE VENTILATION SYSTEM DISCONNECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0500	Vehicle Speed Sensor “A”	<Ref. to GD(H4DOTC)-180, DTC P0500 VEHICLE SPEED SENSOR “A”, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0506	Idle Air Control System RPM Lower Than Expected	<Ref. to GD(H4DOTC)-181, 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(H4DOTC)-182, DTC P0507 IDLE AIR CONTROL SYSTEM RPM HIGHER THAN EXPECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P050A	Cold Start Idle Air Control System Performance	<Ref. to GD(H4DOTC)-183, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P050B	Cold Start Ignition Timing Performance	<Ref. to GD(H4DOTC)-186, DTC P050B COLD START IGNITION TIMING PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Index
P0513	Incorrect Immobilizer Key	<Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0560	System Voltage	<Ref. to GD(H4DOTC)-188, DTC P0560 SYSTEM VOLTAGE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0604	Internal Control Module Random Access Memory (RAM) Error	<Ref. to GD(H4DOTC)-189, DTC P0604 INTERNAL CONTROL MODULE RANDOM ACCESS MEMORY (RAM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0605	Internal Control Module Read Only Memory (ROM) Error	<Ref. to GD(H4DOTC)-190, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0606	Control Module Processor	<Ref. to GD(H4DOTC)-191, DTC P0606 CONTROL MODULE PROCESSOR, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P060A	Internal Control Module Monitoring Processor Performance	<Ref. to GD(H4DOTC)-193, DTC P060A INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P060B	Internal Control Module A/D Processing Performance	<Ref. to GD(H4DOTC)-195, DTC P060B INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0616	Starter Relay Circuit Low	<Ref. to GD(H4DOTC)-197, DTC P0616 STARTER RELAY CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0617	Starter Relay Circuit High	<Ref. to GD(H4DOTC)-198, DTC P0617 STARTER RELAY CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P062F	Internal Control Module EEPROM Error	<Ref. to GD(H4DOTC)-199, DTC P062F INTERNAL CONTROL MODULE EEPROM ERROR , Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0851	Neutral Switch Input Circuit Low (MT Model)	<Ref. to GD(H4DOTC)-200, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P0852	Neutral Switch Input Circuit High (MT Model)	<Ref. to GD(H4DOTC)-201, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH (MT MODEL), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1160	Return Spring Failure	<Ref. to GD(H4DOTC)-202, DTC P1160 RETURN SPRING FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1400	Fuel Tank Pressure Control Solenoid Valve Circuit Low	<Ref. to GD(H4DOTC)-204, DTC P1400 FUEL TANK PRESSURE CONTROL SOLENOID VALVE CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1410	Secondary Air Injection System Switching Valve Stuck Open	<Ref. to GD(H4DOTC)-206, DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1420	Fuel Tank Pressure Control Sol. Valve Circuit High	<Ref. to GD(H4DOTC)-208, DTC P1420 FUEL TANK PRESSURE CONTROL SOL. VALVE CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1449	Evaporative Emission Cont. Sys. Air Filter Clog	<Ref. to GD(H4DOTC)-210, DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1451	Evaporative Emission Cont. Sys.	<Ref. to GD(H4DOTC)-213, DTC P1451 EVAPORATIVE EMISSION CONT. SYS., Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1570	Antenna	<Ref. to GD(H4DOTC)-213, DTC P1570 ANTENNA, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1571	Reference Code Incompatibility	<Ref. to GD(H4DOTC)-213, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to GD(H4DOTC)-213, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1574	Key Communication Failure	<Ref. to GD(H4DOTC)-213, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1576	EGI Control Module EEPROM	<Ref. to GD(H4DOTC)-213, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

DTC	Item	Index
P1577	IMM Control Module EEPROM	<Ref. to GD(H4DOTC)-213, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P1578	Meter Failure	<Ref. to GD(H4DOTC)-213, DTC P1578 METER FAILURE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2004	Intake Manifold Runner Control Stuck Open (Bank 1)	<Ref. to GD(H4DOTC)-214, DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2005	Intake Manifold Runner Control Stuck Open (Bank 2)	<Ref. to GD(H4DOTC)-215, DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2006	Intake Manifold Runner Control Stuck Closed (Bank 1)	<Ref. to GD(H4DOTC)-216, DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2007	Intake Manifold Runner Control Stuck Closed (Bank 2)	<Ref. to GD(H4DOTC)-217, DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2008	Intake Manifold Runner Control Circuit / Open (Bank 1)	<Ref. to GD(H4DOTC)-218, DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2009	Intake Manifold Runner Control Circuit Low (Bank 1)	<Ref. to GD(H4DOTC)-220, DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2011	Intake Manifold Runner Control Circuit / Open (Bank 2)	<Ref. to GD(H4DOTC)-221, DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2012	Intake Manifold Runner Control Circuit Low (Bank 2)	<Ref. to GD(H4DOTC)-223, DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2016	Tumble Generated Valve Position Sensor 1 Circuit Low	<Ref. to GD(H4DOTC)-224, DTC P2016 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2017	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 1)	<Ref. to GD(H4DOTC)-226, DTC P2017 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2021	Tumble Generated Valve Position Sensor 2 Circuit Low	<Ref. to GD(H4DOTC)-228, DTC P2021 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2022	Intake Manifold Runner Position Sensor / Switch Circuit High (Bank 2)	<Ref. to GD(H4DOTC)-230, DTC P2022 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2088	Intake Camshaft Position Actuator Control Circuit Low (Bank 1)	<Ref. to GD(H4DOTC)-232, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2089	Intake Camshaft Position Actuator Control Circuit High (Bank 1)	<Ref. to GD(H4DOTC)-233, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2090	Exhaust Camshaft Position Actuator Control Circuit Low (Bank 1)	<Ref. to GD(H4DOTC)-234, DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2091	Exhaust Camshaft Position Actuator Control Circuit High (Bank 1)	<Ref. to GD(H4DOTC)-235, DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2092	Intake Camshaft Position Actuator Control Circuit Low (Bank 2)	<Ref. to GD(H4DOTC)-236, DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DTC	Item	Index
P2093	Intake Camshaft Position Actuator Control Circuit High (Bank 2)	<Ref. to GD(H4DOTC)-236, DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2094	Exhaust Camshaft Position Actuator Control Circuit Low (Bank 2)	<Ref. to GD(H4DOTC)-236, DTC P2094 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2095	Exhaust Camshaft Position Actuator Control Circuit High (Bank 2)	<Ref. to GD(H4DOTC)-236, DTC P2095 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	<Ref. to GD(H4DOTC)-237, DTC P2096 POST CATALYST FUEL TRIM SYSTEM TOO LEAN (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	<Ref. to GD(H4DOTC)-239, DTC P2097 POST CATALYST FUEL TRIM SYSTEM TOO RICH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to GD(H4DOTC)-241, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2102	Throttle Actuator Control Motor Circuit Low	<Ref. to GD(H4DOTC)-243, DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2103	Throttle Actuator Control Motor Circuit High	<Ref. to GD(H4DOTC)-245, DTC P2103 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2109	Throttle/Pedal Position Sensor “A” Minimum Stop Performance	<Ref. to GD(H4DOTC)-247, DTC P2109 THROTTLE/PEDAL POSITION SENSOR “A” MINIMUM STOP PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2119	Throttle Actuator Control Throttle Body Range/Performance	<Ref. to GD(H4DOTC)-249, DTC P2119 THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2122	Throttle/Pedal Position Sensor/ Switch “D” Circuit Low Input	<Ref. to GD(H4DOTC)-252, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2123	Throttle/Pedal Position Sensor/ Switch “D” Circuit High Input	<Ref. to GD(H4DOTC)-254, DTC P2123 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D” CIRCUIT HIGH INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2127	Throttle/Pedal Position Sensor/ Switch “E” Circuit Low Input	<Ref. to GD(H4DOTC)-256, DTC P2127 THROTTLE/PEDAL POSITION SENSOR/SWITCH “E” CIRCUIT LOW INPUT, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2128	Throttle/Pedal Position Sensor/ Switch “E” Circuit High Input	<Ref. to GD(H4DOTC)-258, 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(H4DOTC)-260, 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(H4DOTC)-262, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2195	O2 Sensor Signal Biased/Stuck Lean (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-264, DTC P2195 O2 SENSOR SIGNAL BIASED/ STUCK LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2196	O2 Sensor Signal Biased/Stuck Rich (Bank 1 Sensor 1)	<Ref. to GD(H4DOTC)-266, DTC P2196 O2 SENSOR SIGNAL BIASED/ STUCK RICH (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P219A	Bank 1 Air-Fuel Ratio Imbalance	<Ref. to GD(H4DOTC)-268, DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

List of Diagnostic Trouble Code (DTC)

GENERAL DESCRIPTION

DTC	Item	Index
P2257	Air System Control "A" Circuit Low	<Ref. to GD(H4DOTC)-271, DTC P2257 AIR SYSTEM CONTROL "A" CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2258	Air System Control "A" Circuit High	<Ref. to GD(H4DOTC)-272, DTC P2258 AIR SYSTEM CONTROL "A" CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	<Ref. to GD(H4DOTC)-273, DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	<Ref. to GD(H4DOTC)-275, DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance	<Ref. to GD(H4DOTC)-276, DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2419	Evaporative Emission System Switching Valve Control Circuit Low	<Ref. to GD(H4DOTC)-277, DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2420	Evaporative Emission System Switching Valve Control Circuit High	<Ref. to GD(H4DOTC)-279, DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2431	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Range/Performance	<Ref. to GD(H4DOTC)-281, DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2432	Secondary Air Injection System Air Flow /Pressure Sensor Circuit Low	<Ref. to GD(H4DOTC)-282, DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2433	Secondary Air Injection System Air Flow /Pressure Sensor Circuit High	<Ref. to GD(H4DOTC)-283, DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2440	Secondary Air Injection System Switching Valve Stuck Open (Bank1)	<Ref. to GD(H4DOTC)-284, DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2441	Secondary Air Injection System Switching Valve Stuck Closed (Bank1)	<Ref. to GD(H4DOTC)-284, DTC P2441 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2442	Secondary Air Injection System Switching Valve Stuck Open (Bank2)	<Ref. to GD(H4DOTC)-284, DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2443	Secondary Air Injection System Switching Valve Stuck Closed (Bank2)	<Ref. to GD(H4DOTC)-284, DTC P2443 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK2), Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2444	Secondary Air Injection System Pump Stuck On	<Ref. to GD(H4DOTC)-285, DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON, Diagnostic Trouble Code (DTC) Detecting Criteria.>
P2610	ECM/PCM Internal Engine Off Timer Performance	<Ref. to GD(H4DOTC)-286, DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0073	CAN Failure, Bus ‘Off’ Detection	<Ref. to GD(H4DOTC)-294, DTC U0073 CAN FAILURE, BUS ‘OFF’ DETECTION, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0122	CAN (VDC) Data Not Loaded	<Ref. to GD(H4DOTC)-295, DTC U0122 CAN (VDC) DATA NOT LOADED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0140	CAN (BCU) Data Not Loaded	<Ref. to GD(H4DOTC)-295, DTC U0140 CAN (BCU) DATA NOT LOADED, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0416	CAN (VDC) Data Abnormal	<Ref. to GD(H4DOTC)-296, DTC U0416 CAN (VDC) DATA ABNORMAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>
U0422	CAN (BCU) Data Abnormal	<Ref. to GD(H4DOTC)-296, DTC U0422 CAN (BCU) DATA ABNORMAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

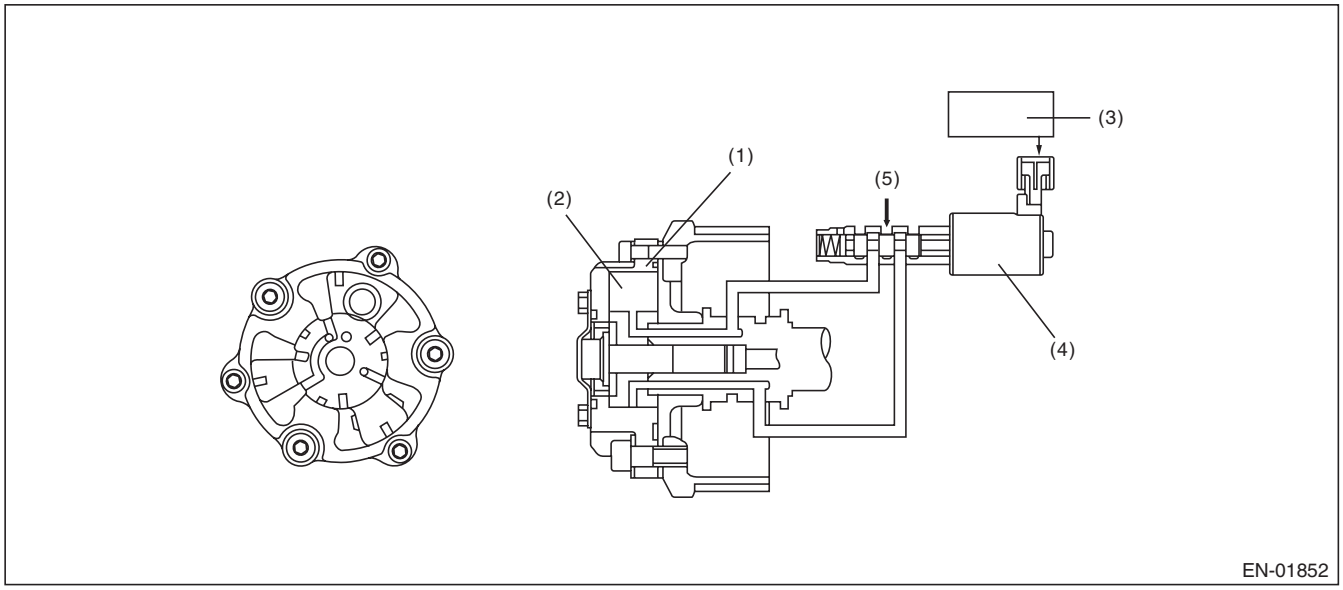
2. Diagnostic Trouble Code (DTC) Detecting Criteria

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

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.
Judge NG when the amount of AVCS actual timing advance does not approach to the amount of AVCS target timing advance.

2. COMPONENT DESCRIPTION



(1) AVCS timing controller
(2) Vane
(3) Engine control module (ECM)
(4) Oil flow control solenoid valve
(5) Oil pressure

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 3000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 1300 rpm (models without SI-DRIVE) ≥ 1500 rpm (models with SI-DRIVE)
Engine coolant temperature	≥ 60 °C (140 °F)
AVCS control	Operation
Target timing advance change amount (per 64 ms)	< 1.07 °CA

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after warming up when the engine speed increases and AVCS operates.

5. DIAGNOSTIC METHOD

1) When the conditions during which the differences of AVCS target timing advance amount and AVCS actual timing advance amount is large continues for certain amount of time.
2) When the differences of target timing advance amount and actual timing advance amount is calculated during AVCS control, and the difference per predetermined time is the specified value or larger.

• Abnormality Judgment

Judge as NG when the following conditions are established within the predetermined time.
Judgment Value
Models without SI-DRIVE

Malfunction Criteria	Threshold Value
Σ(Target position – Actual position)	> 5300 °CA (Bank 1) > 5300 °CA (Bank 2)
or	
Σ(Target position – Actual position)	< –5300 °CA (Bank 1) < –5300 °CA (Bank 2)

Time Needed for Diagnosis: 20000 ms
Models with SI-DRIVE

Malfunction Criteria	Threshold Value
Σ(Target position – Actual position)	> 8000 °CA (Bank 1) > 8000 °CA (Bank 2)
or	
Σ(Target position – Actual position)	< –8000 °CA (Bank 1) < –8000 °CA (Bank 2)

Time Needed for Diagnosis: 30000 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 within the predetermined time.
Judgment Value
Models without SI-DRIVE

Malfunction Criteria	Threshold Value
Σ(Target position – Actual position)	≤ 5300 °CA (Bank 1) ≤ 5300 °CA (Bank 2) and ≥ –5300 °CA (Bank 1) ≥ –5300 °CA (Bank 2)

Time Needed for Diagnosis: 20000 ms
Models with SI-DRIVE

Malfunction Criteria	Threshold Value
Σ(Target position – Actual position)	≤ 8000 °CA (Bank 1) ≤ 8000 °CA (Bank 2) and ≥ –8000 °CA (Bank 1) ≥ –8000 °CA (Bank 2)

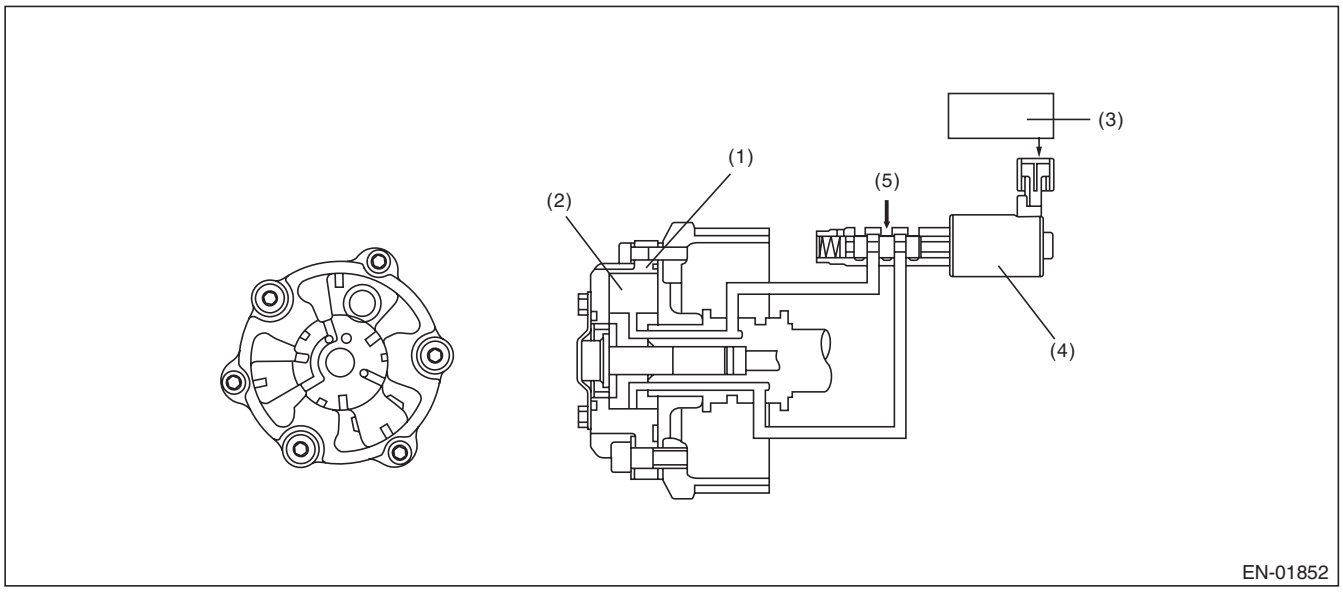
Time Needed for Diagnosis: 30000 ms

B: DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.
Judge NG when the amount of exhaust AVCS actual timing advance does not approach the amount of exhaust AVCS target timing advance.

2. COMPONENT DESCRIPTION



(1) Exhaust AVCS timing controller
(2) Vane
(3) Engine control module (ECM)
(4) Oil flow control solenoid valve
(5) Oil pressure

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Time of establishing all secondary parameter conditions	≥ 3000 ms
Battery voltage	≥ 10.9 V
Engine speed	≥ 1500 rpm
Engine coolant temperature	≥ 60 °C (140 °F)
Exhaust AVCS control	Operation
Target timing advance change amount (per 64 ms)	< 1.07 °CA

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after warming up when the engine speed increases and exhaust AVCS operates.

5. DIAGNOSTIC METHOD

1) When the conditions during which the differences of exhaust AVCS target timing advance amount and exhaust AVCS actual timing advance amount is large continues for certain amount of time.
2) When the differences of target timing advance amount and actual timing advance amount is calculated during exhaust AVCS control, and the difference per predetermined time is the specified value or larger.

- **Abnormality Judgment**

Judge as NG when the following conditions are established within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Σ(Target position – Actual position)	> 8000 °CA (Bank 1) > 8000 °CA (Bank 2)
or	
Σ(Target position – Actual position)	< –8000 °CA (Bank 1) < –8000 °CA (Bank 2)

Time Needed for Diagnosis:
30000 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 within the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
Σ(Target position – Actual position)	≤ 8000 °CA (Bank 1) ≤ 8000 °CA (Bank 2) and ≥ –8000 °CA (Bank 1) ≥ –8000 °CA (Bank 2)

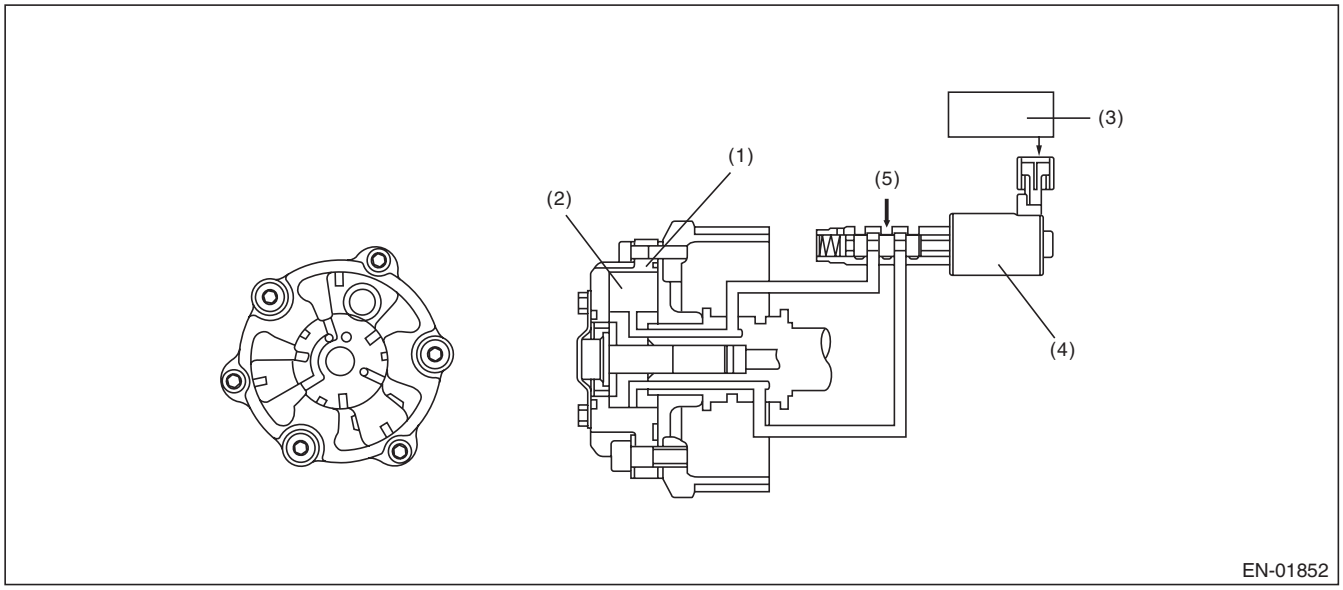
Time Needed for Diagnosis: 30000 ms

C: DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1)

1. OUTLINE OF DIAGNOSIS

Detect the AVCS system malfunction.
Judge as NG when standard timing advance amount is far from learning angle.

2. COMPONENT DESCRIPTION



(1) AVCS timing controller
(2) Vane
(3) Engine control module (ECM)
(4) Oil flow control solenoid valve
(5) Oil pressure

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed (models without SI-DRIVE)	≥ 600 rpm and < 1000 rpm
Engine speed (models with SI-DRIVE)	≥ 600 rpm and < 975 rpm
Engine coolant temperature	≥ 70 °C (158 °F)
AVCS control	Not in operation
Target timing advance	0°CA

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after starting engine and while AVCS is not operating.

5. DIAGNOSTIC METHOD

Judge as NG when the absolute value of the difference between cam signal input position and learning value is out of specification.

• 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
|Crankshaft position when camshaft position sensor signal is input – Learning value|	> 8.5 °CA

Time Needed for Diagnosis: 20000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

NOTE:
Initial standard learning value is the value of crank angle initially input at the production plant. And then it will be updated every time normal judgment has been completed. Learning value will not be updated if NG judgment occurs because timing belt or chain derails suddenly in process or because wrong assembly occurs during servicing.

• 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 when camshaft position sensor signal is input – Learning value|	≤ 8.5 °CA

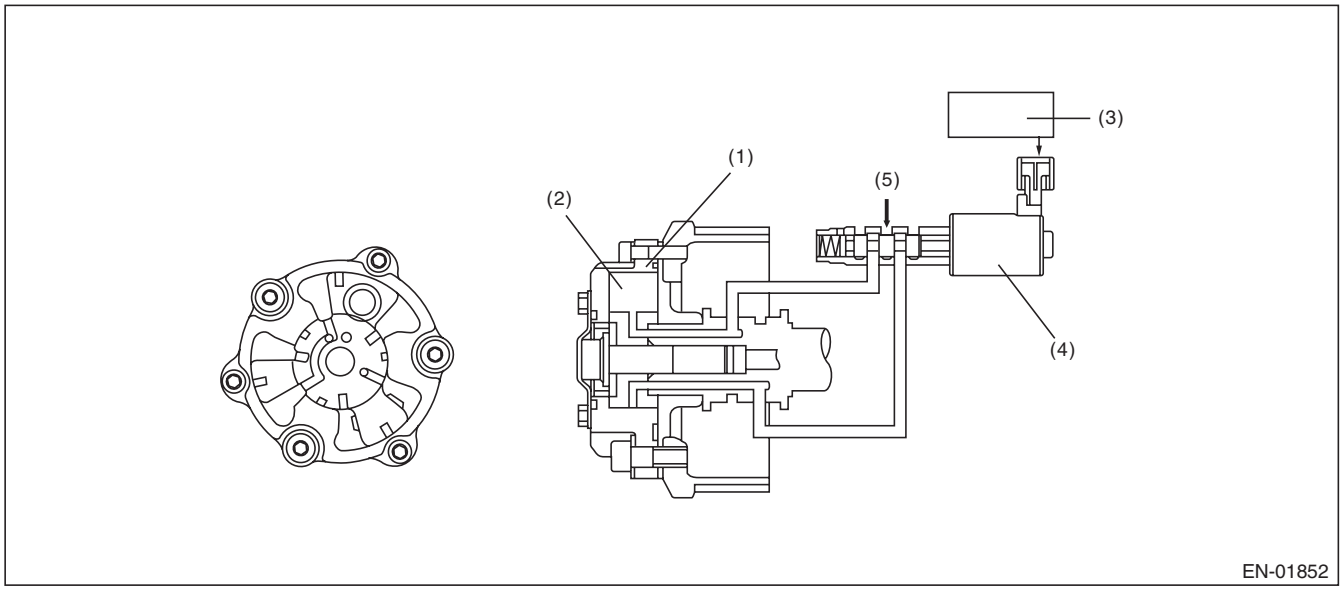
Time Needed for Diagnosis: Less than 1 second

D: DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the exhaust AVCS system malfunction.
Judge as NG when standard timing advance amount is far from learning angle.

2. COMPONENT DESCRIPTION



(1) Exhaust AVCS timing controller
(2) Vane
(3) Engine control module (ECM)
(4) Oil flow control solenoid valve
(5) Oil pressure

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine speed	≥ 600 rpm and < 975 rpm
Engine coolant temperature	≥ 70 °C (158 °F)
Exhaust AVCS control	Not in operation
Target timing advance	0°CA

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously while the exhaust AVCS is not operating after warming up.

5. DIAGNOSTIC METHOD

Judge as NG when the absolute value of the difference between cam signal input position and learning value is out of specification.

• 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
|Crankshaft position when camshaft position sensor signal is input – Learning value|	> 8.5 °CA

Time Needed for Diagnosis: 20000 ms
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

NOTE:
Initial standard learning value is the value of crank angle initially input at the production plant. And then it will be updated every time normal judgment has been completed. Learning value will not be updated if NG judgment occurs because timing belt or chain derails suddenly in process or because wrong assembly occurs during servicing.

• 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 when camshaft position sensor signal is input – Learning value|	≤ 8.5 °CA

Time Needed for Diagnosis: Less than 1 second

E: DTC P0018 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0016. <Ref. to GD(H4DOTC)-15, DTC P0016 CRANKSHAFT POSITION - CAMSHAFT POSITION CORRELATION (BANK1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

F: DTC P0019 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0017. <Ref. to GD(H4DOTC)-17, DTC P0017 CRANK AND CAM TIMING B SYSTEM FAILURE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

G: DTC P0021 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0011. <Ref. to GD(H4DOTC)-11, DTC P0011 INTAKE CAMSHAFT POSITION - TIMING OVER-ADVANCED OR SYSTEM PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

H: DTC P0024 EXHAUST AVCS SYSTEM 2 (RANGE/PERFORMANCE)

1. OUTLINE OF DIAGNOSIS

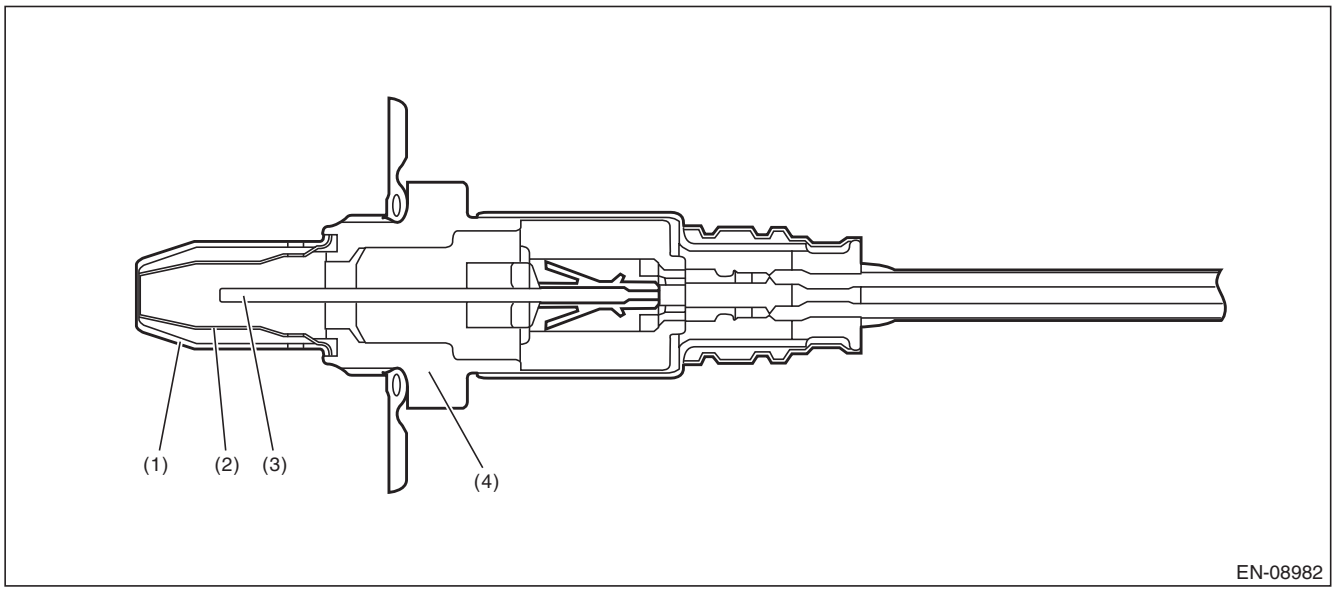
NOTE:
For the detection standard, refer to DTC P0014. <Ref. to GD(H4DOTC)-13, DTC P0014 EXHAUST AVCS SYSTEM 1 (RANGE/PERFORMANCE), Diagnostic Trouble Code (DTC) Detecting Criteria.>

I: 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) Sensor housing

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Condition established time	≥ 42000 ms
Battery voltage	≥ 10.9 V
Heater current	Permitted
A/F sensor heater final control	Main energization status
After fuel cut	≥ 20000 ms

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 42000 ms 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

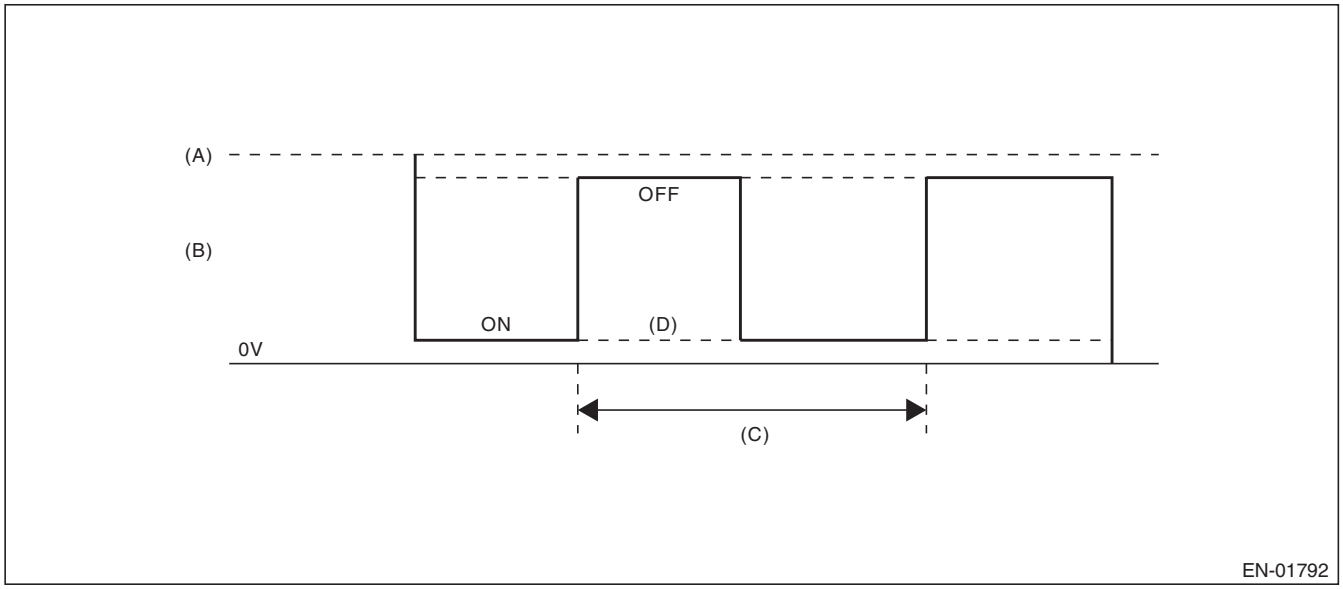
Time Needed for Diagnosis: 10000 ms

J: 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	Low
Front oxygen (A/F) sensor heater control duty	< 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

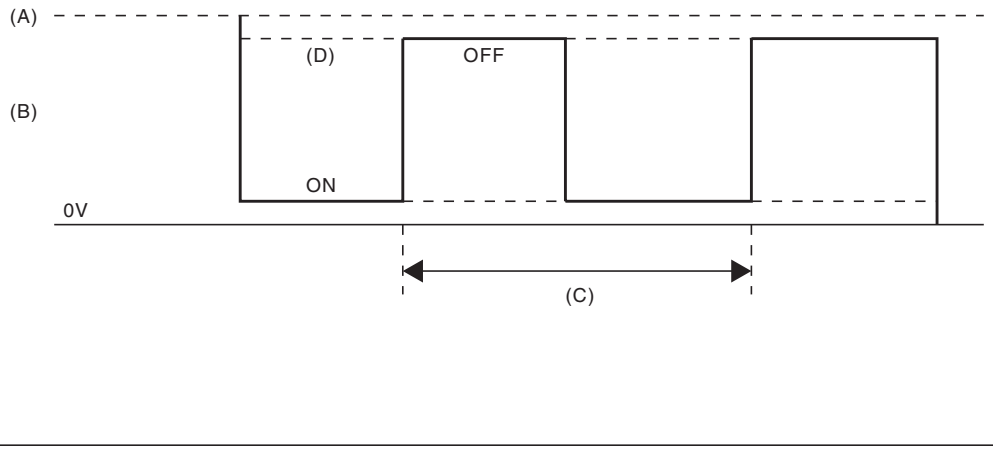
Time Needed for Diagnosis: Less than 1 second

K: 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	High
Front oxygen (A/F) sensor heater control duty	≥ 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

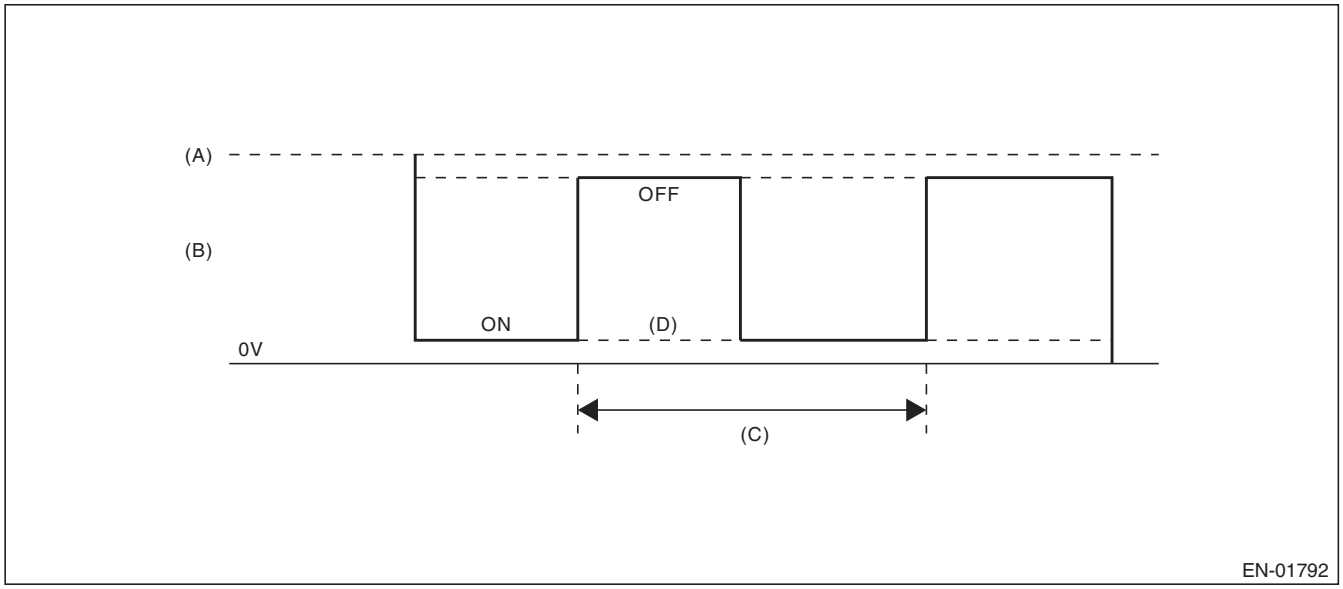
Time Needed for Diagnosis: Less than 1 second

L: 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

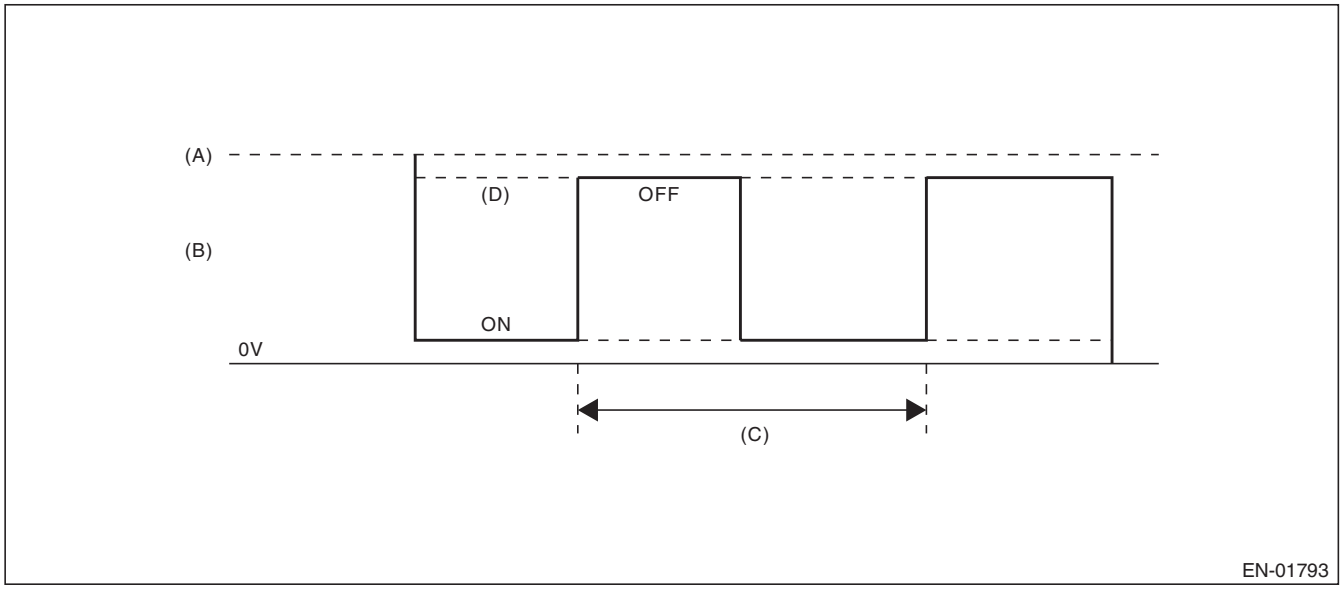
Time Needed for Diagnosis: Less than 1 second

M: 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	≥ 25 %

Time Needed for Diagnosis: 8 ms × 320 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

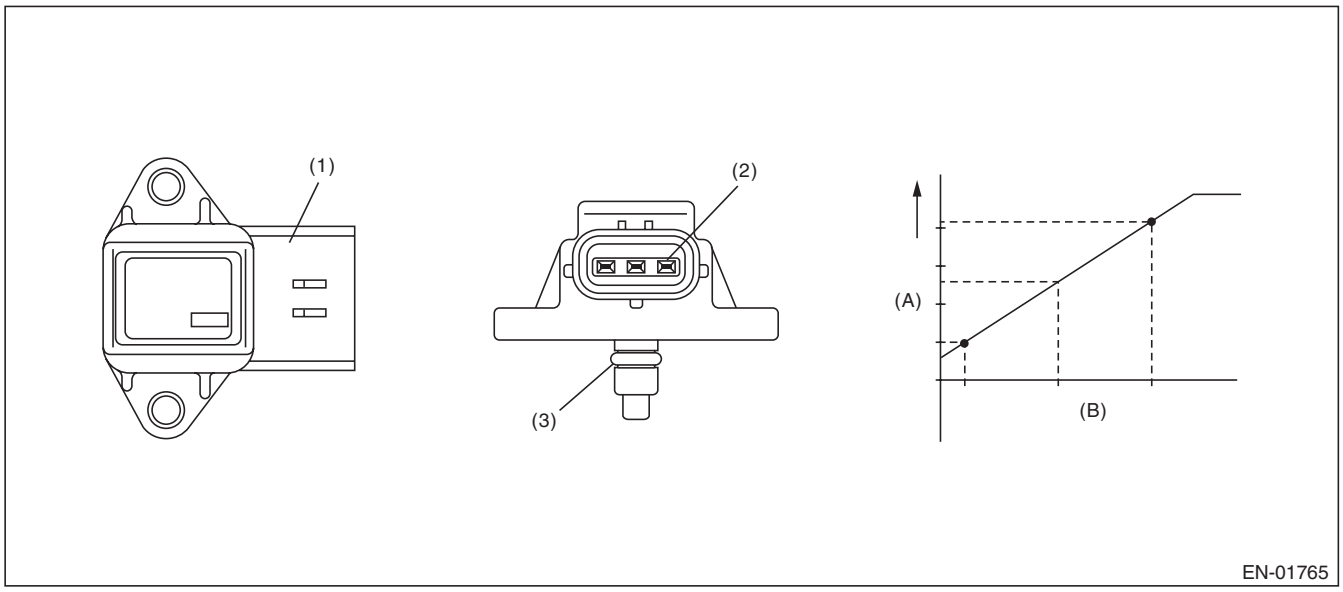
Time Needed for Diagnosis: Less than 1 second

N: 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	≥ 70 °C (158 °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	≥ 10 °
Output voltage	< 1 V (Models without SI-DRIVE) < 0.764 V (Models with SI-DRIVE)
Engine load	> 1.356 g/rev (0.05 oz/rev)
High	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.75 °
Output voltage	≥ 2.36 V (Models without SI-DRIVE) ≥ 2.126 V (Models with SI-DRIVE)
Engine load	< 0.4 g/rev (0.01 oz/rev)

Time Needed for Diagnosis:
Low side: 5000 ms
High side: 5000 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	≥ 10 °
Output voltage	≥ 1 V (Models without SI-DRIVE) ≥ 0.764 V (Models with SI-DRIVE)
Engine load	> 1.356 g/rev (0.05 oz/rev)
High	
Engine speed	600 rpm — 900 rpm
Throttle position	< 2.75 °
Output voltage	< 2.36 V (Models without SI-DRIVE) < 2.126 V (Models with SI-DRIVE)
Engine load	< 0.4 g/rev (0.01 oz/rev)

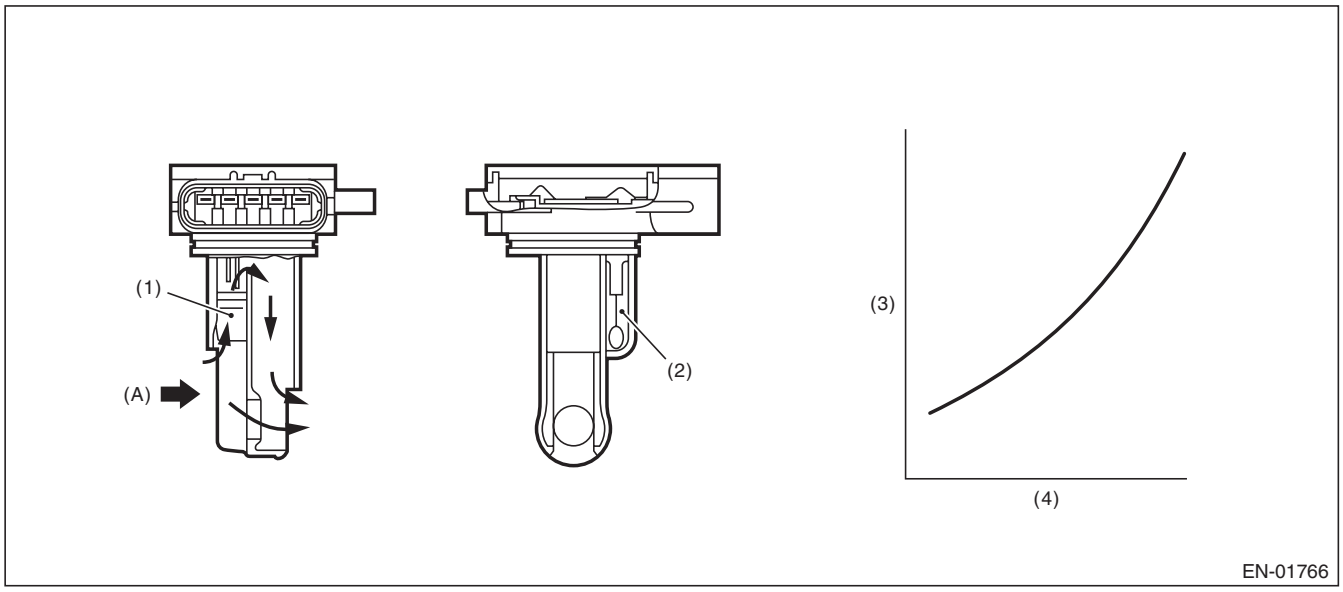
Time Needed for Diagnosis:
Low side: Less than 1 second
High side: Less than 1 second

O: 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	≥ 70 °C (158 °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	< 1.5 V
Engine speed	≥ 2500 rpm
Throttle opening angle	≥ 15 °
Intake manifold pressure	≥ 53.3 kPa (400 mmHg, 15.7 inHg)
High (1)	
Output voltage	≥ 1.95 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 4.1 °
Intake manifold pressure	< 52.7 kPa (395 mmHg, 15.6 inHg)
High (2)	
Output voltage	≥ 1.70 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 4.1 °
Intake manifold pressure	< 52.7 kPa (395 mmHg, 15.6 inHg)
Fuel system diagnosis	Rich side malfunction

Time Needed for Diagnosis:
Low: 5000 ms
High: 5000 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	≥ 1.5 V
Engine speed	≥ 2500 rpm
Throttle opening angle	≥ 15 °
Intake manifold pressure	≥ 53.3 kPa (400 mmHg, 15.7 inHg)
High	
Output voltage	< 1.95 V
Engine speed	600 rpm — 900 rpm
Throttle opening angle	< 4.1 °
Intake manifold pressure	< 52.7 kPa (395 mmHg, 15.6 inHg)
Fuel system diagnosis	Rich side normal

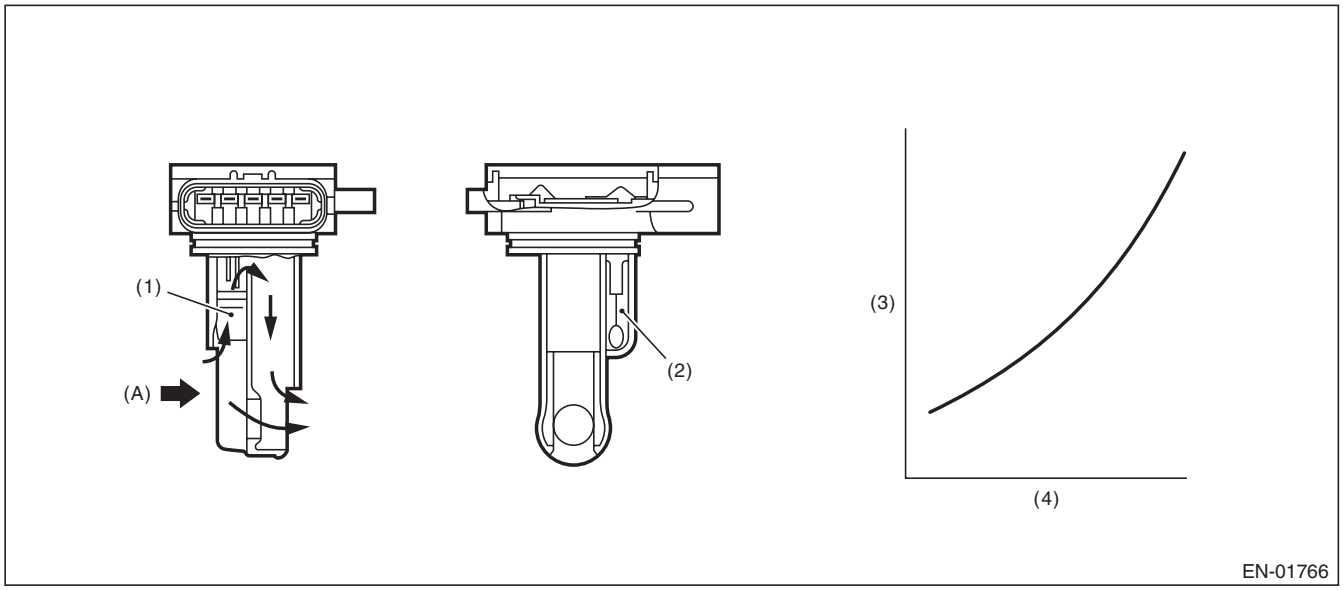
Time Needed for Diagnosis:
Low: Less than 1 second
High: Less than 1 second

P: 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

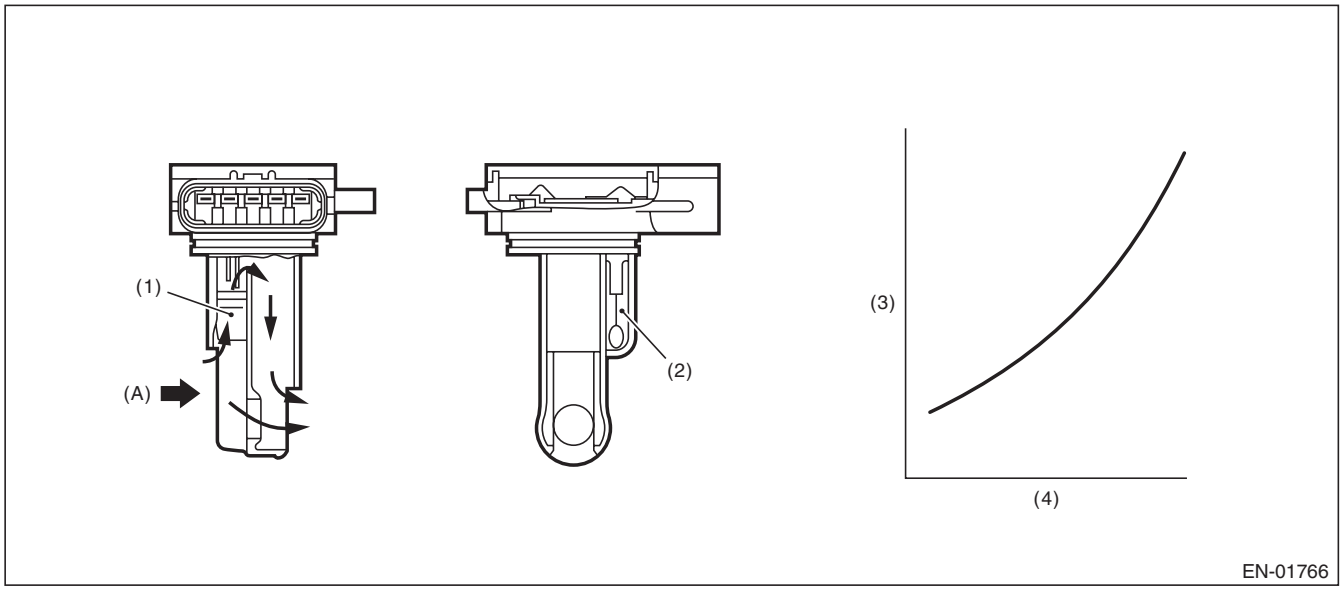
Time Needed for Diagnosis: Less than 1 second

Q: 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	≥ 4.952 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	< 4.952 V

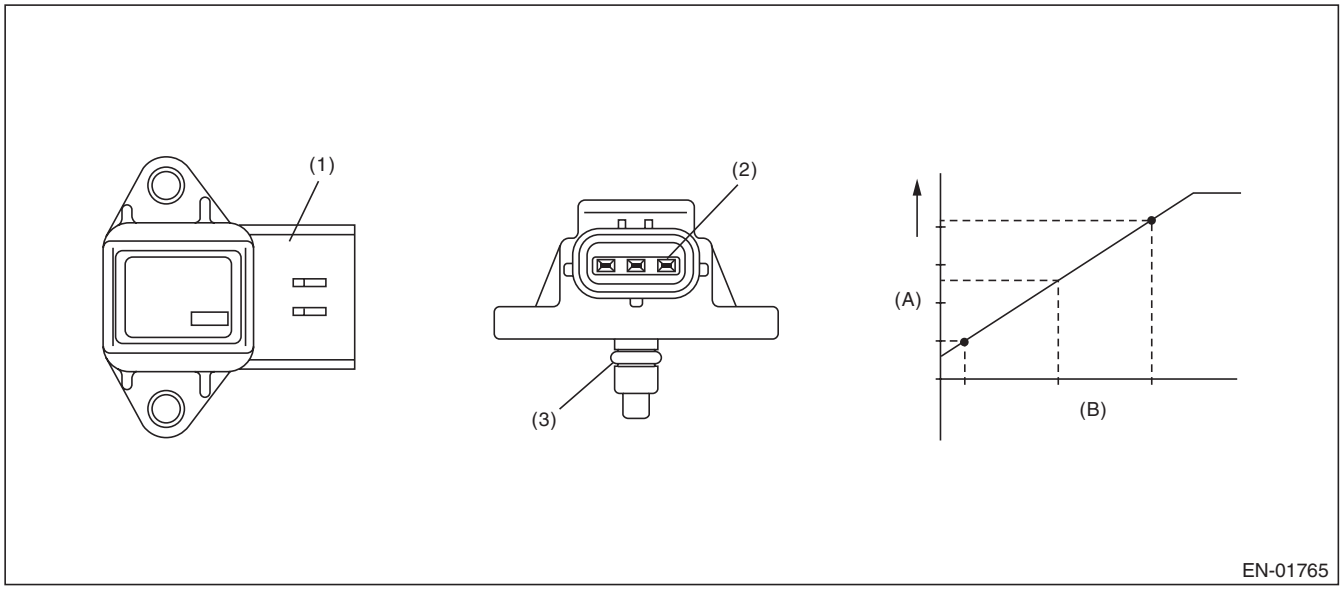
Time Needed for Diagnosis: Less than 1 second

R: 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	≤ 0.822 V (Models without SI-DRIVE) ≤ 0.581 V (Models with SI-DRIVE)

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
Output voltage	> 0.822 V (Models without SI-DRIVE) > 0.581 V (Models with SI-DRIVE)

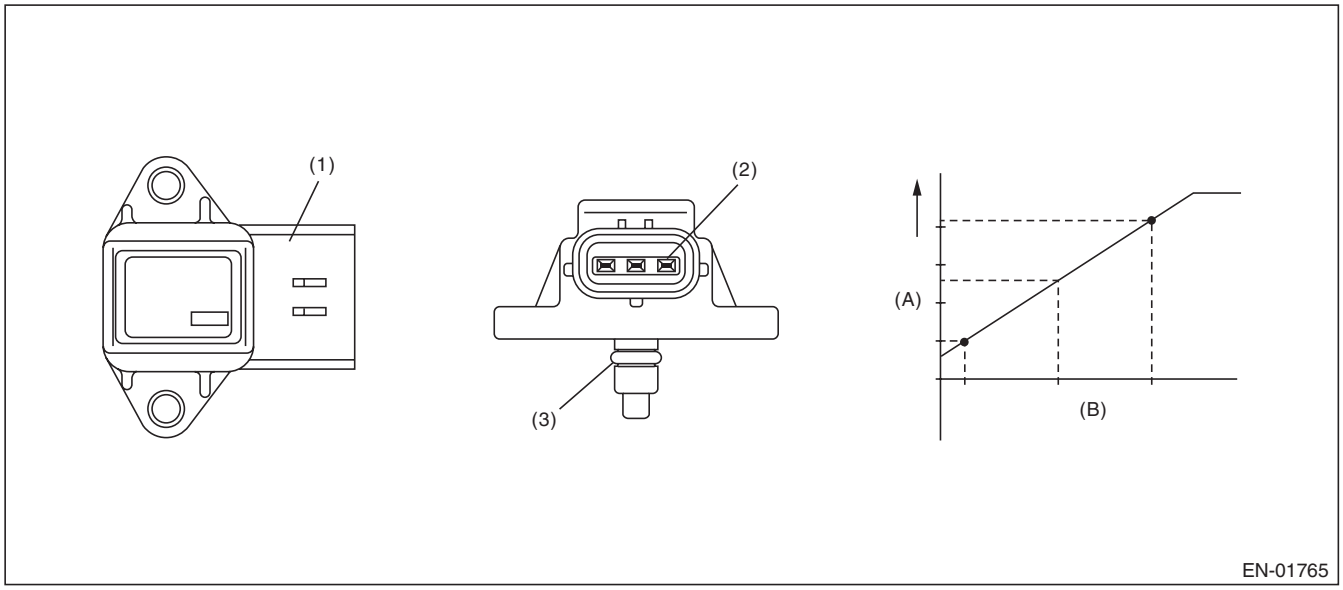
Time Needed for Diagnosis: Less than 1 second

S: 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	≥ 4.474 V (models without SI-DRIVE) ≥ 4.681 V (models with SI-DRIVE)

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
Output voltage	< 4.474 V (models without SI-DRIVE) < 4.681 V (models with SI-DRIVE)

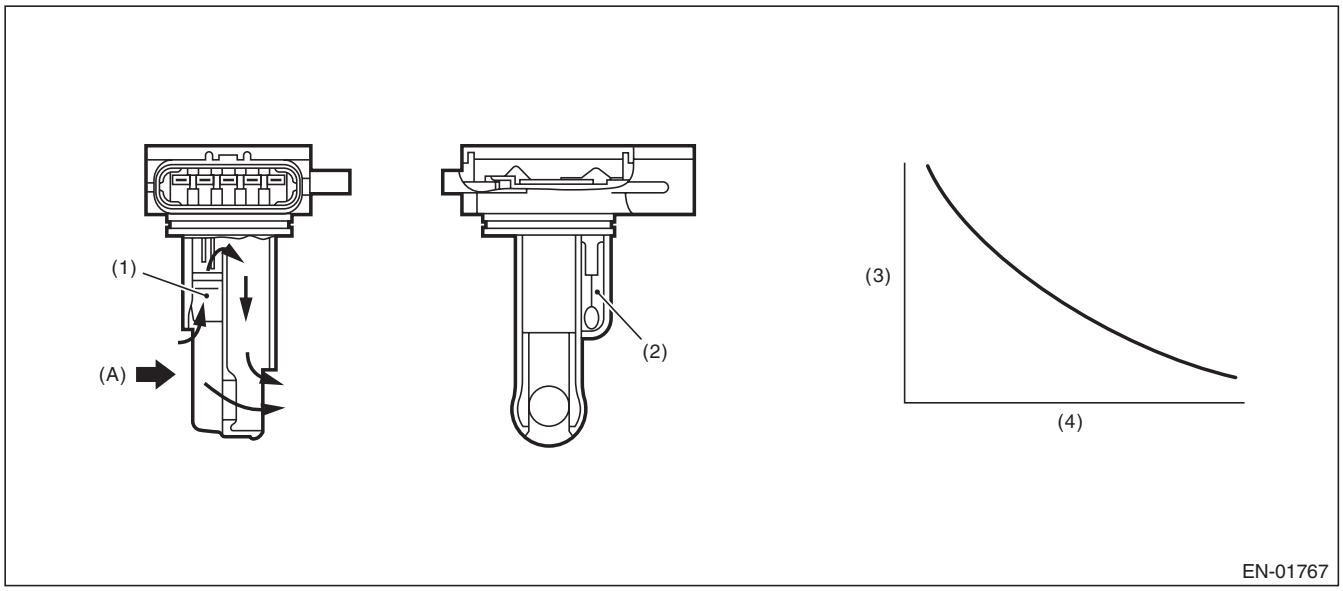
Time Needed for Diagnosis: Less than 1 second

T: DTC P0111 INTAKE AIR TEMPERATURE SENSOR RANGE/PERFORMANCE PROBLEM

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	< 200 °C (392 °F)
Battery voltage	≥ 10.9 V
Continuous time when the vehicle speed is less than 200 km/h (124.3 MPH)	≥ 1 s
Engine coolant temperature	≥ 70 °C (158 °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 from Map 2
• Continuous time when vehicle speed is 40 km/h (24.9 MPH) or more and	≥ 15 s
Establishing time of 1, 2	≥ 15 s
1. Intake air amount	≥ 15 g/s (0.53 oz/s)
2. Vehicle speed	≥ 4 km/h (2.5 MPH)

Map 1 (Models without SI-DRIVE)

Engine coolant temperature °C (°F)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)
Intake air amount sum value (g (oz))	76000 (2680.52)	10192 (359.47)	9028 (318.42)	7864 (277.36)	5800 (204.57)

Map 1 (Models with SI-DRIVE)

Engine coolant temperature °C (°F)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)
Intake air amount sum value (g (oz))	76000 (2680.52)	10192 (359.47)	9028 (318.42)	7864 (277.36)	6320 (222.91)

Map 2

Engine coolant temperature °C (°F)	–20 (–4)	–10 (14)	5 (41)	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

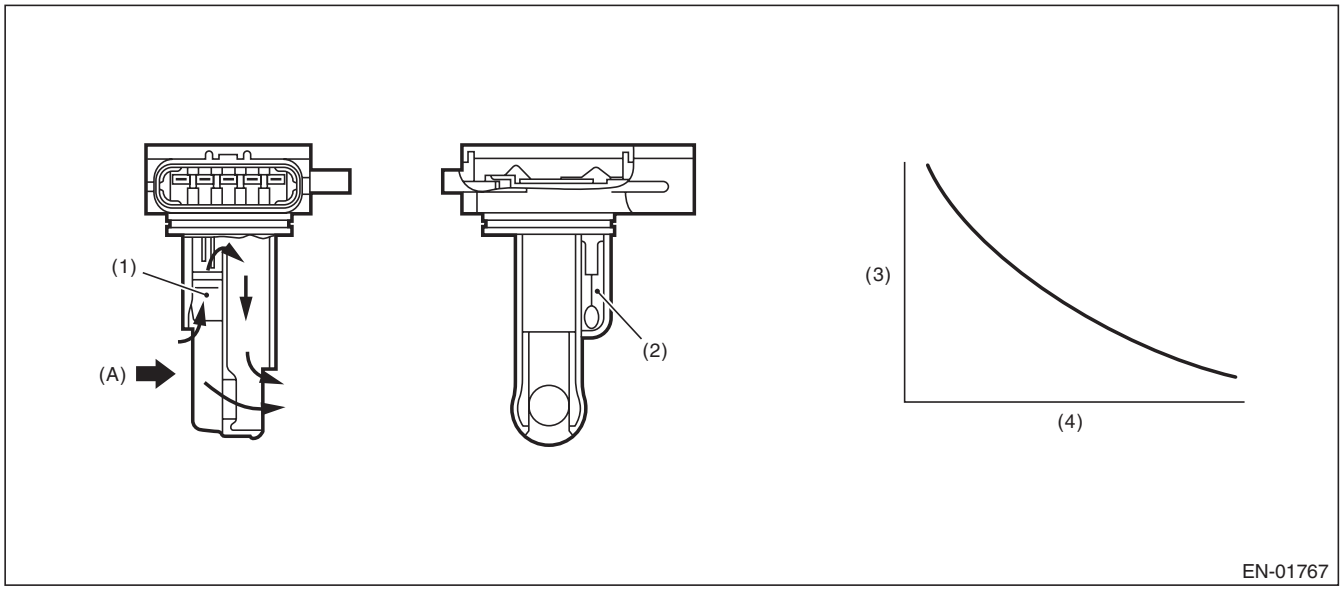
Time Needed for Diagnosis: Less than 1 second

U: 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	< 0.395 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	≥ 0.395 V

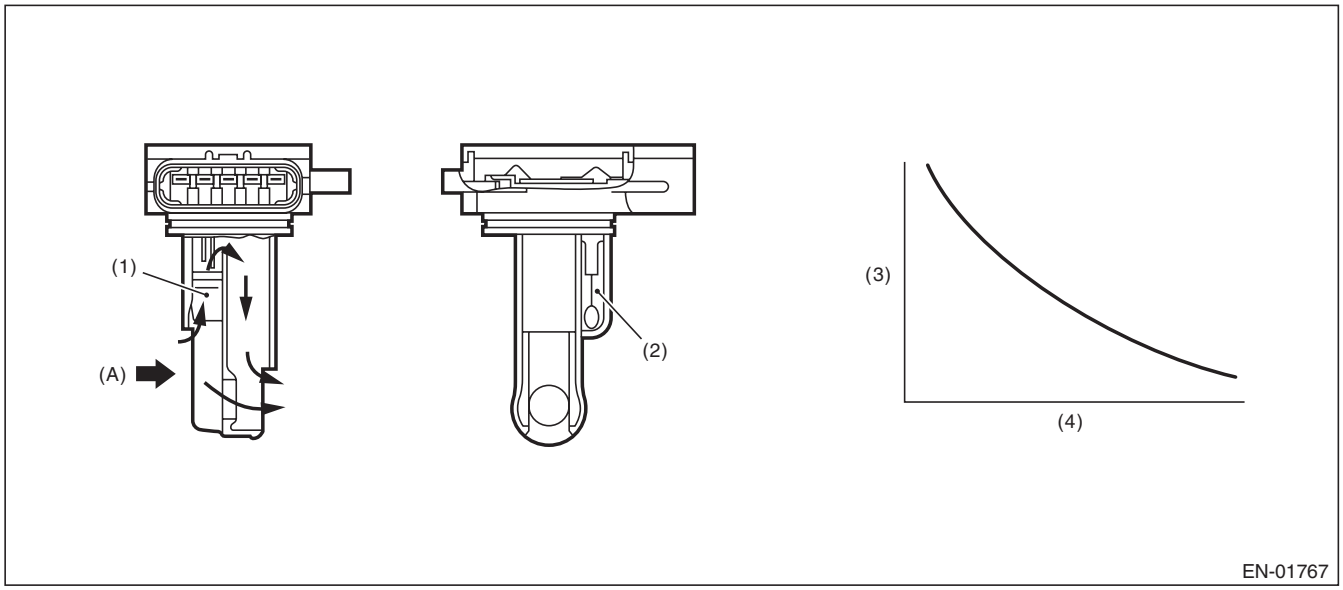
Time Needed for Diagnosis: Less than 1 second

V: 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	≥ 4.712 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	< 4.712 V

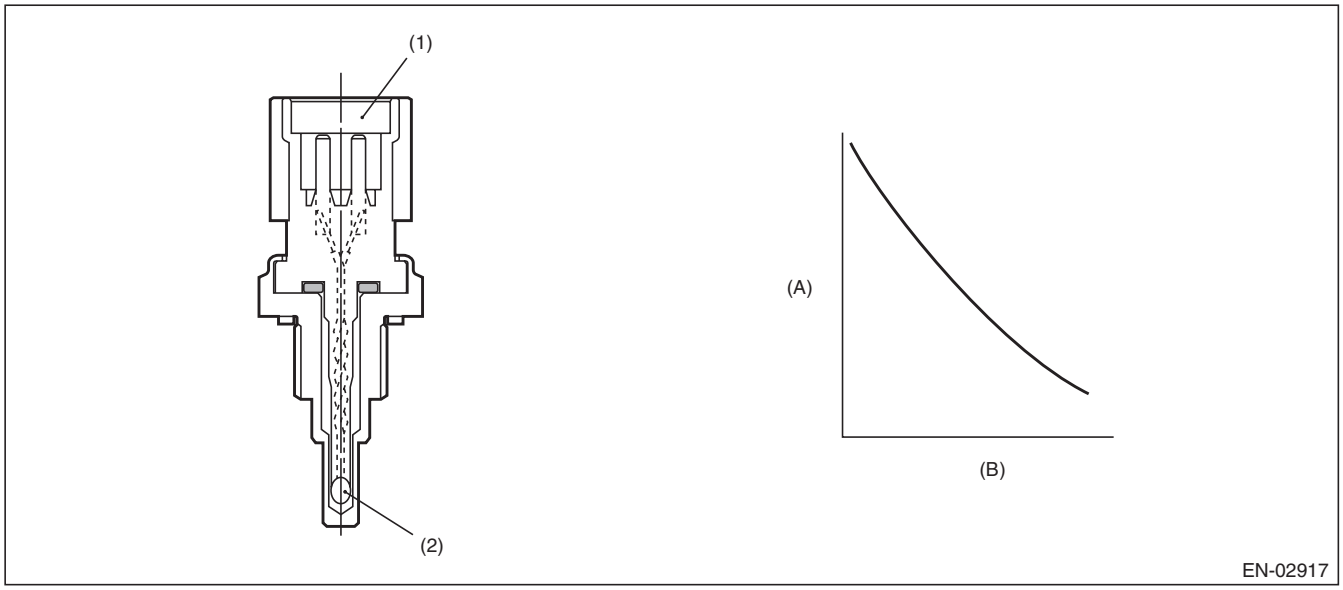
Time Needed for Diagnosis: Less than 1 second

W: DTC P0116 ENGINE COOLANT TEMPERATURE SENSOR 1 CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of the engine coolant temperature sensor characteristics.
When the ignition is ON after the specified period of soaking time has elapsed, compare the engine coolant temperature with intake air temperature. Judge as NG if the difference between two temperatures is larger than the predetermined value and the engine coolant temperature becomes the specified value or more.

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
Soaking time	≥ 21600 s
Engine coolant temperature at the last engine stop	≥ Value from Map

Map (Models without SI-DRIVE)

Estimate ambient temperature °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Engine coolant temperature at the last engine stop °C (°F)	75 (167)	75 (167)	75 (167)	75 (167)

Map (Models with SI-DRIVE)

Estimate ambient temperature °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Engine coolant temperature at the last engine stop °C (°F)	77.5 (171.5)	77.5 (171.5)	77.5 (171.5)	77.5 (171.5)

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
All of the following conditions are established.	
Engine coolant temperature – intake air temperature	> 15°C (27°F)
Engine coolant temperature	> 45 °C (113 °F)

Time Needed for Diagnosis: 512 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
When any one of the followings is established.	
Engine coolant temperature – intake air temperature	≤ 15°C (27°F)
Engine coolant temperature	≤ 45 °C (113 °F)

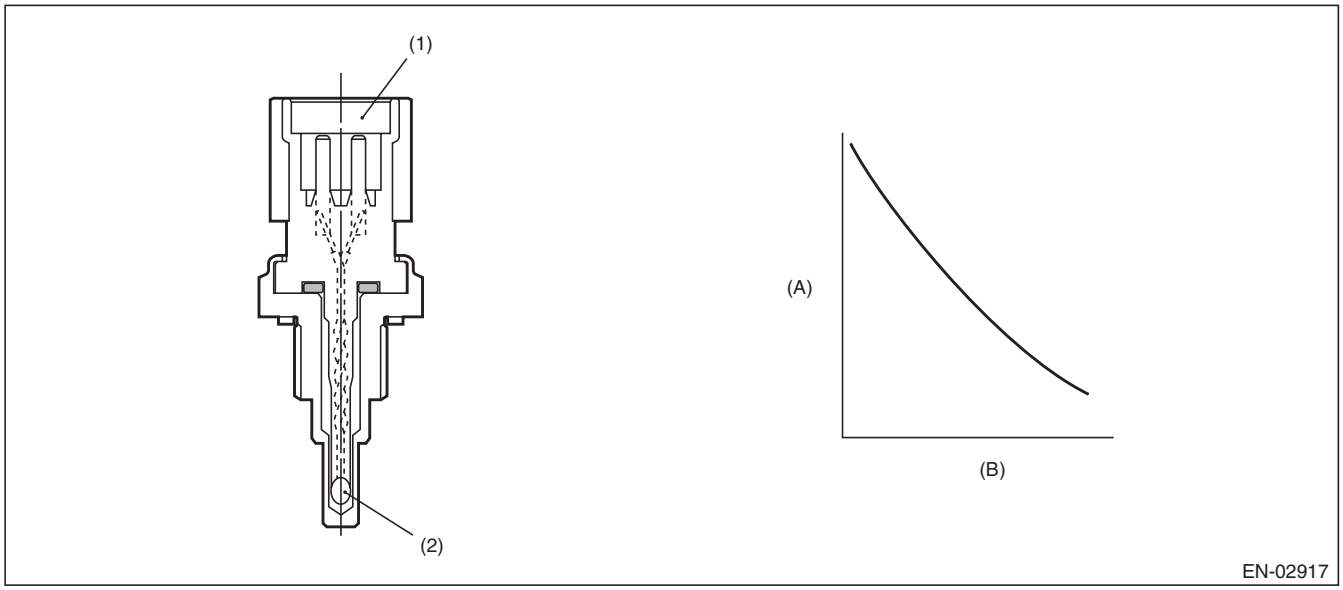
Time Needed for Diagnosis: Less than 1 second

X: 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	< 0.464 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	≥ 0.464 V

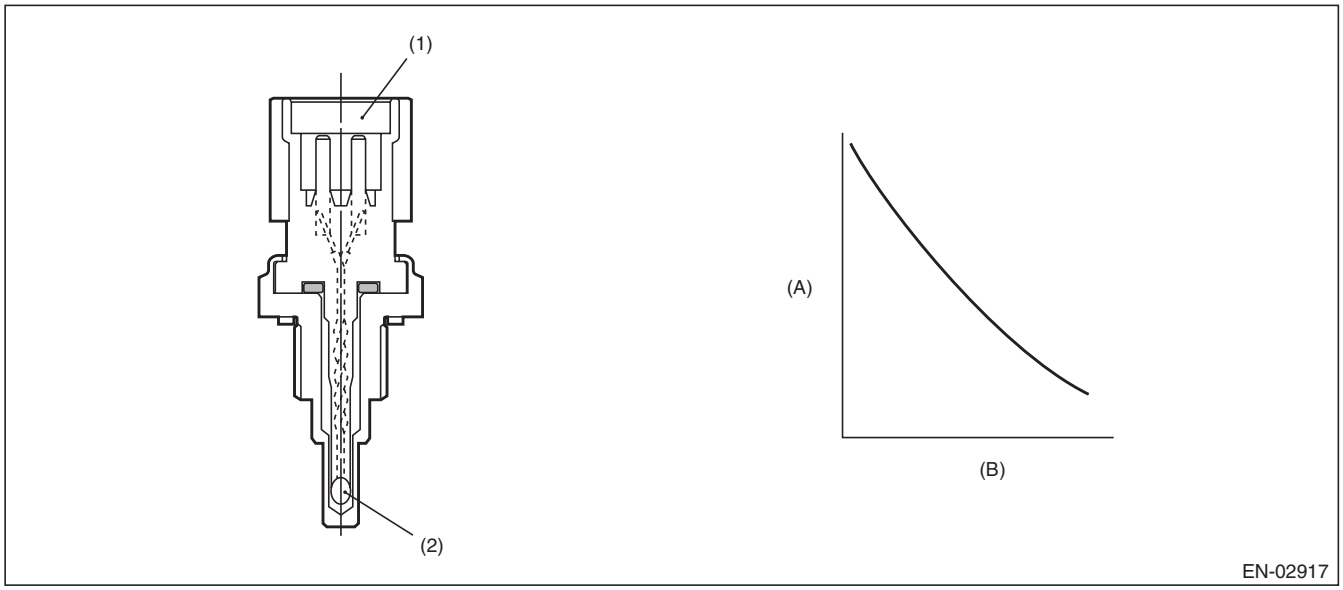
Time Needed for Diagnosis: Less than 1 second

Y: 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	≥ 4.702 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	< 4.702 V

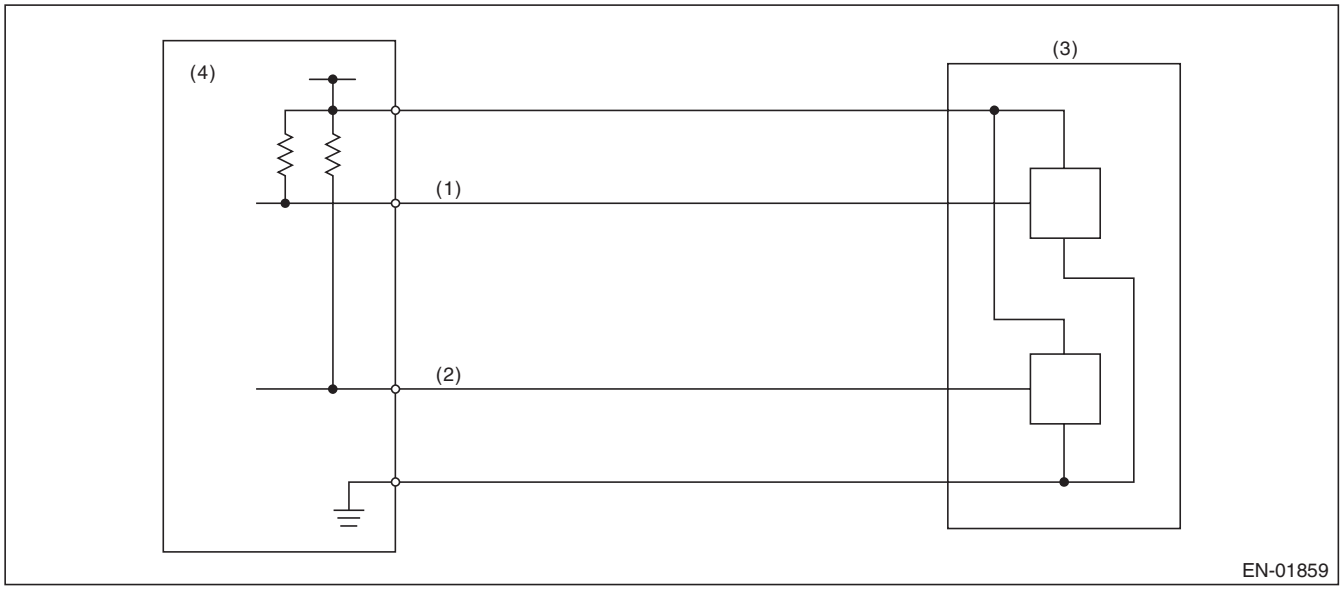
Time Needed for Diagnosis: Less than 1 second

Z: 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	≤ 0.27 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	> 0.27 V

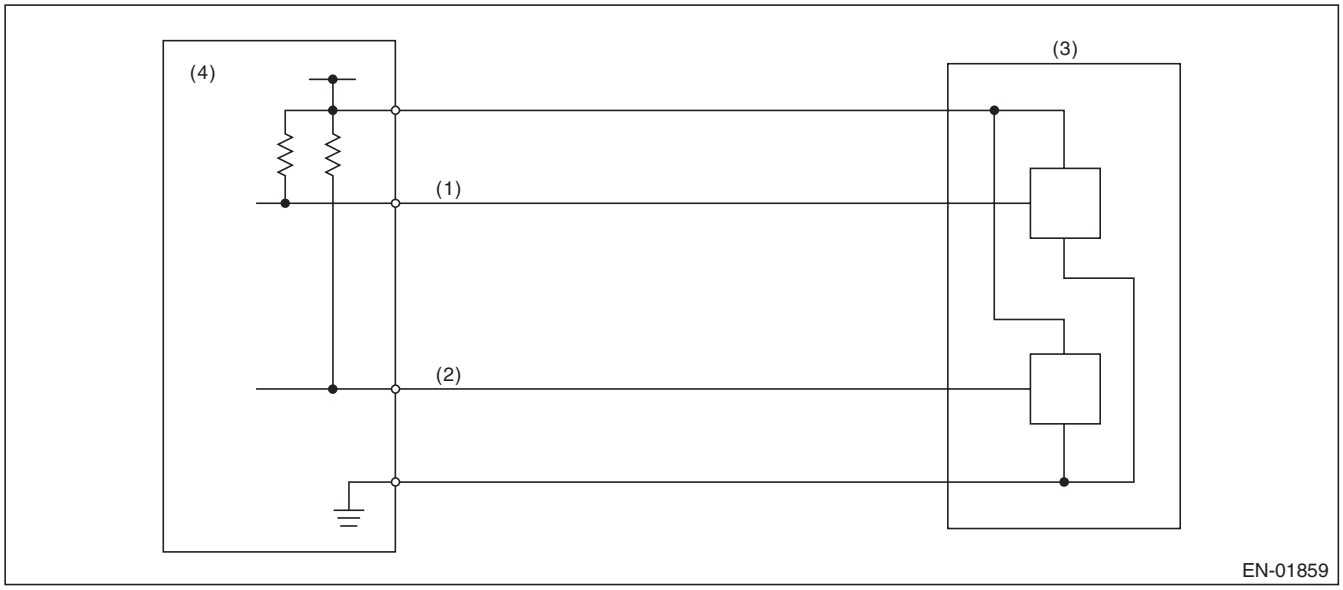
Time Needed for Diagnosis: 24 ms

AA: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

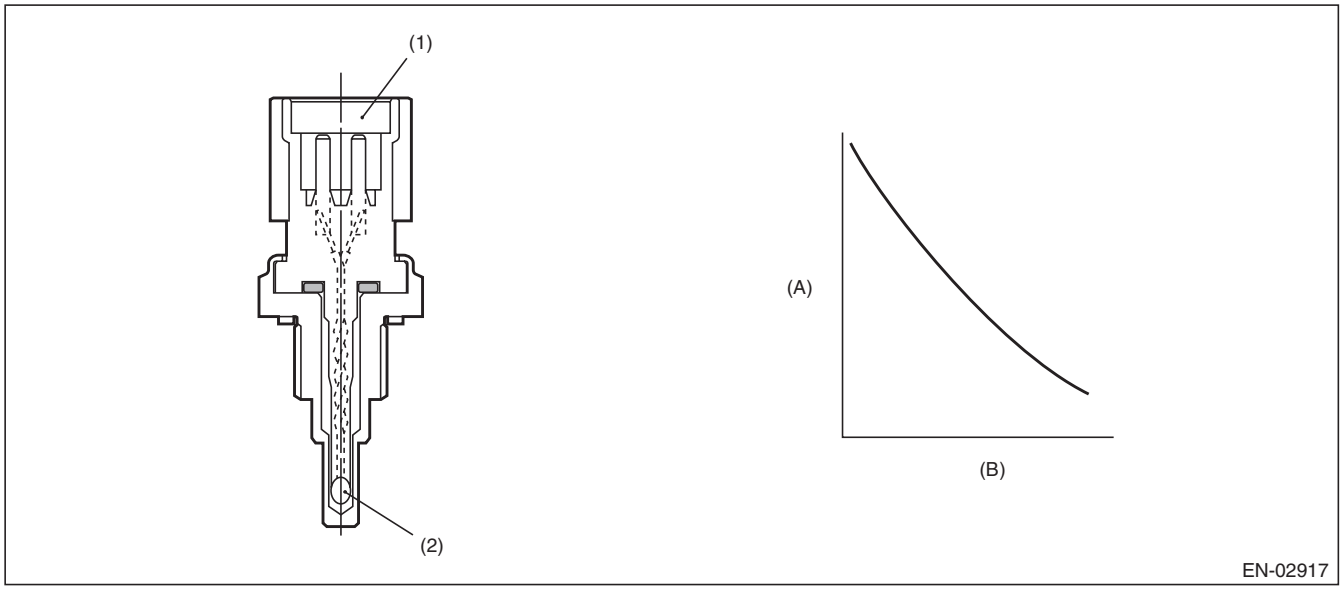
Time Needed for Diagnosis: 24 ms

AB: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 (when 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	37.136 ms	74.272 ms	111.41 ms	126.66 ms	141.91 ms	163.59 ms	185.26 ms
	–10 (14)	0 ms	27.391 ms	54.782 ms	82.173 ms	99.65 ms	117.13 ms	135.96 ms	154.8 ms
	0 (32)	0 ms	17.646 ms	35.292 ms	52.938 ms	72.64 ms	92.341 ms	108.34 ms	124.33 ms
	10 (50)	0 ms	7.9012 ms	15.802 ms	23.704 ms	45.63 ms	67.556 ms	80.711 ms	93.867 ms
	20 (68)	0 ms	7.9012 ms	15.802 ms	23.704 ms	45.63 ms	67.556 ms	80.711 ms	93.867 ms

Judgment value of timer after engine starting
t = 451056 ms – 25870 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

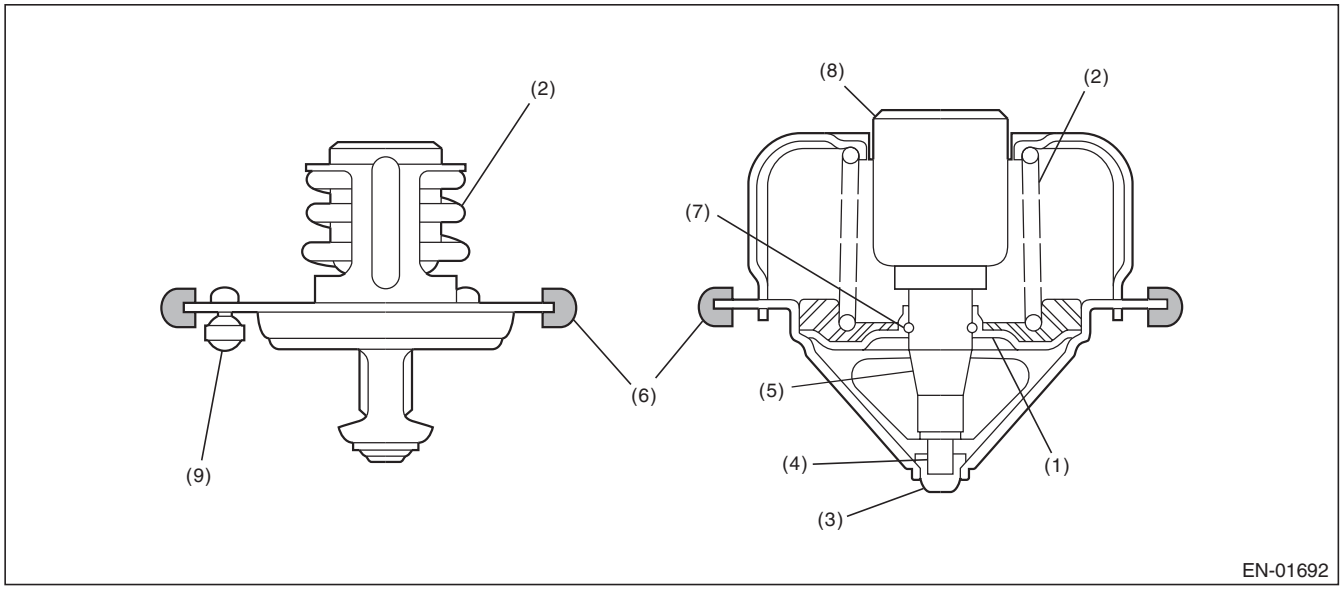
AC:DTC P0128 COOLANT THERMOSTAT (ENGINE COOLANT TEMPERATURE BELOW THERMOSTAT REGULATING TEMPERATURE)

1. OUTLINE OF DIAGNOSIS

Detect malfunctions of the thermostat function.
Judge as NG when any one of the following conditions is established.

- When the actual engine coolant temperature does not reach the maximum temperature necessary to perform other OBDII diagnosis and Σ (Estimated engine coolant temperature – actual engine coolant temperature) exceeded the predetermined value. (Judgment 1)
- When the actual engine coolant temperature does not reach the range within –11°C (–19.8°F) from the regulated temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature) exceeded the predetermined value. (Judgment 2)
- When the difference between the estimated coolant temperature and the actual engine coolant temperature exceeds the predetermined value, and Σ (Estimated engine coolant temperature – actual engine coolant temperature) exceeded the predetermined value. (Judgment 3)

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
<Judgment 1>	
Battery voltage	≥ 10.9 V
Estimate ambient temperature	≥ –7 °C (19.4 °F)
Vehicle speed	≥ 30 km/h (18.6 MPH)
Estimated coolant temperature	≥ Value of Map 1
<Judgment 2>	
Battery voltage	≥ 10.9 V
Estimate ambient temperature	≥ –7 °C (19.4 °F)
Vehicle speed	≥ 30 km/h (18.6 MPH)
Estimated coolant temperature	≥ Value from Map 2
<Judgment 3>	
Battery voltage	≥ 10.9 V
Estimate ambient temperature	≥ –7 °C (19.4 °F)
Vehicle speed	≥ 30 km/h (18.6 MPH)
Estimated coolant temperature	≥ Value from Map 3

Map 1

Engine coolant temperature at engine starting °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Estimated coolant temperature °C (°F)	70 (158)	70 (158)	70 (158)	70 (158)

Map 2 (Models without SI-DRIVE)

Engine coolant temperature at engine starting °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Estimated coolant temperature °C (°F)	75 (167)	75 (167)	75 (167)	75 (167)

Map 2 (Models with SI-DRIVE)

Engine coolant temperature at engine starting °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Estimated coolant temperature °C (°F)	77.5 (171.5)	77.5 (171.5)	77.5 (171.5)	77.5 (171.5)

Map 3 (Models without SI-DRIVE)

Engine coolant temperature at engine starting °C (°F)	–7 (19.4)	10 (50)	25 (77)	27 (80.6)
Estimated coolant temperature °C (°F)	58.1 (136.6)	66.6 (151.9)	74.2 (165.6)	75 (167)

Map 3 (Models with SI-DRIVE)

Engine coolant temperature at engine starting °C (°F)	–7 (19.4)	10 (50)	25 (77)	46 (114.8)
Estimated coolant temperature °C (°F)	59.8 (139.6)	65.5 (149.9)	70.5 (158.9)	77.5 (171.5)

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
When any one of the followings is established.	
<Judgment 1>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	< Value of Map 4 > Value of Map 5
<Judgment 2>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	< Regulated temperature – Value of Map 6 > Value of Map 7
<Judgment 3>	
Estimated engine coolant temperature – actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	> Value of Map 8 > Value of Map 9

Map 4

Estimate ambient temperature °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	70 (158)	70 (158)	70 (158)	70 (158)

Map 5

Engine coolant temperature at engine starting °C (°F)	–7 (19.4)	0 (32)	8 (46.4)	10 (50)	25 (77)	35 (95)
Threshold Value °C (°F)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1000 (1800)

Map 6

Estimate ambient temperature °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	11.1 (20)	11.1 (20)	11.1 (20)	11.1 (20)

Map 7

Engine coolant temperature at engine starting °C (°F)	–7 (19.4)	0 (32)	8 (46.4)	10 (50)	25 (77)	30 (86)	35 (95)
Threshold Value °C (°F)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1200 (2160)

Map 8

Estimate ambient temperature °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	11.1 (20)	11.1 (20)	11.1 (20)	11.1 (20)

Map 9

Engine coolant temperature at engine starting °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)	1731.6 (3116.9)

Time Needed for Diagnosis: 300 — 700 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 more than the predetermined time.

Judgment Value

Malfunction Criteria	Threshold Value
All of the following conditions are established.	
<Judgment 1>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	≥ Value of Map 4 ≤ Value of Map 5
<Judgment 2>	
Actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature)	≥ Regulated temperature – Value of Map 6 ≤ Value of Map 7
<Judgment 3>	
Estimated engine coolant temperature – actual engine coolant temperature and Σ (Estimated engine coolant temperature – actual engine coolant temperature) and Actual engine coolant temperature	≤ Value of Map 8 ≤ Value of Map 9 ≥ Regulated temperature – Value of Map 10

Map 10

Estimate ambient temperature °C (°F)	–7 (19.4)	8 (46.4)	10 (50)	25 (77)
Threshold Value °C (°F)	11.1 (20)	11.1 (20)	11.1 (20)	11.1 (20)

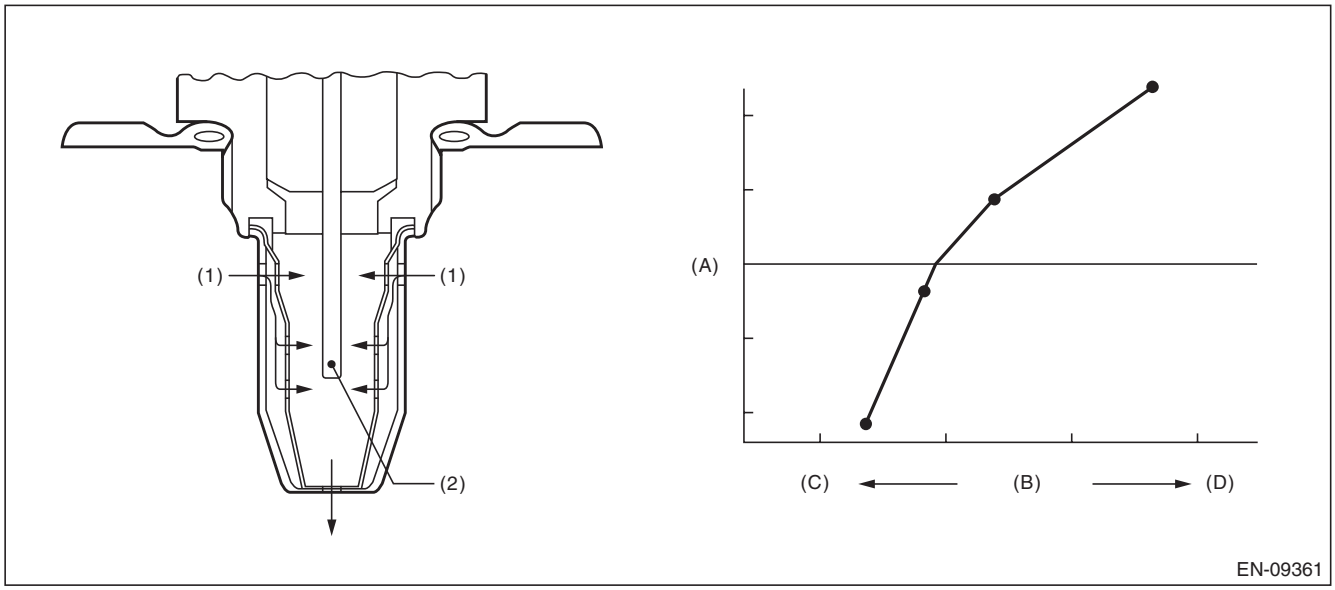
Time Needed for Diagnosis: 300 — 700 seconds

AD: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) Exhaust gas (2) ZrO_2

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 (+) or Input voltage (–) or |Input voltage (+) – Input voltage (–)|	< 1.128 V < 0.23 V < 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

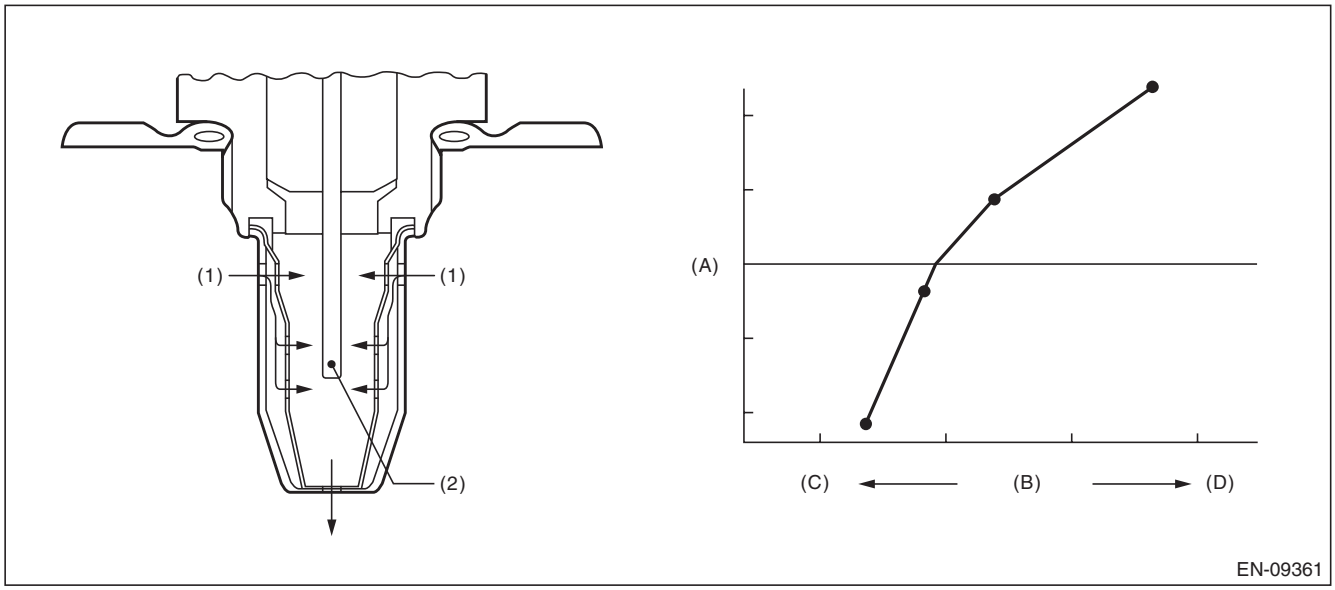
Time Needed for Diagnosis: Less than 1 second

AE: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) Exhaust gas (2) ZrO_2

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 (+) or Input voltage (–)	> 3.589 V > 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

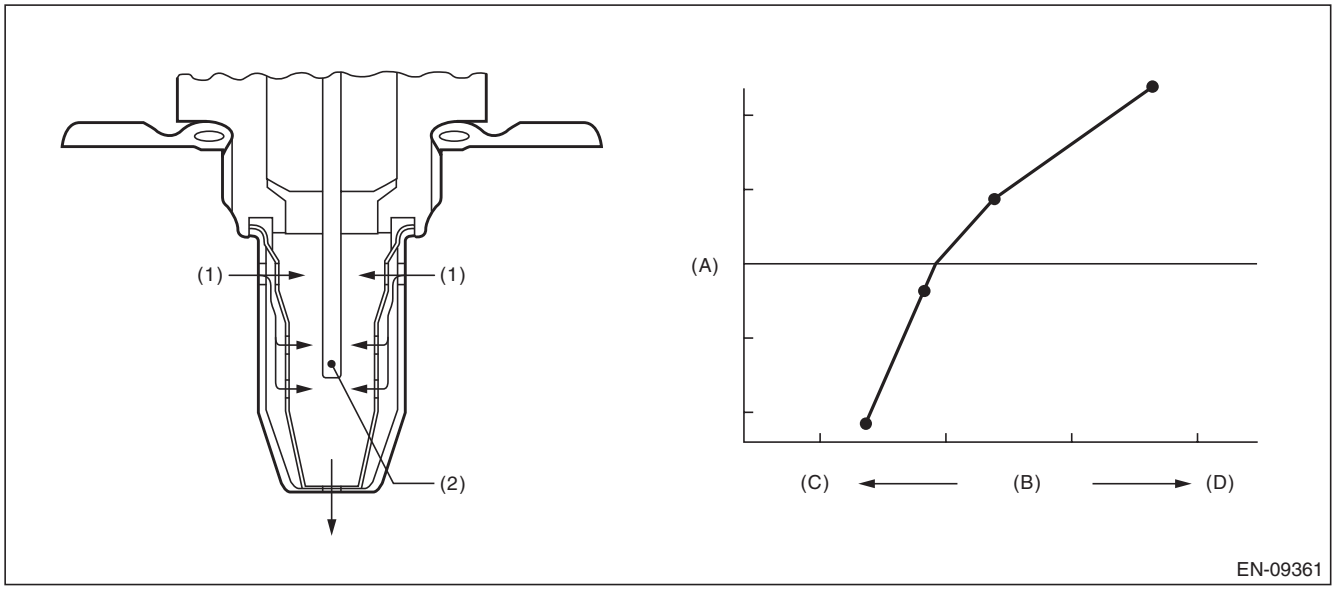
Time Needed for Diagnosis: Less than 1 second

AF: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) Exhaust gas (2) ZrO_2

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

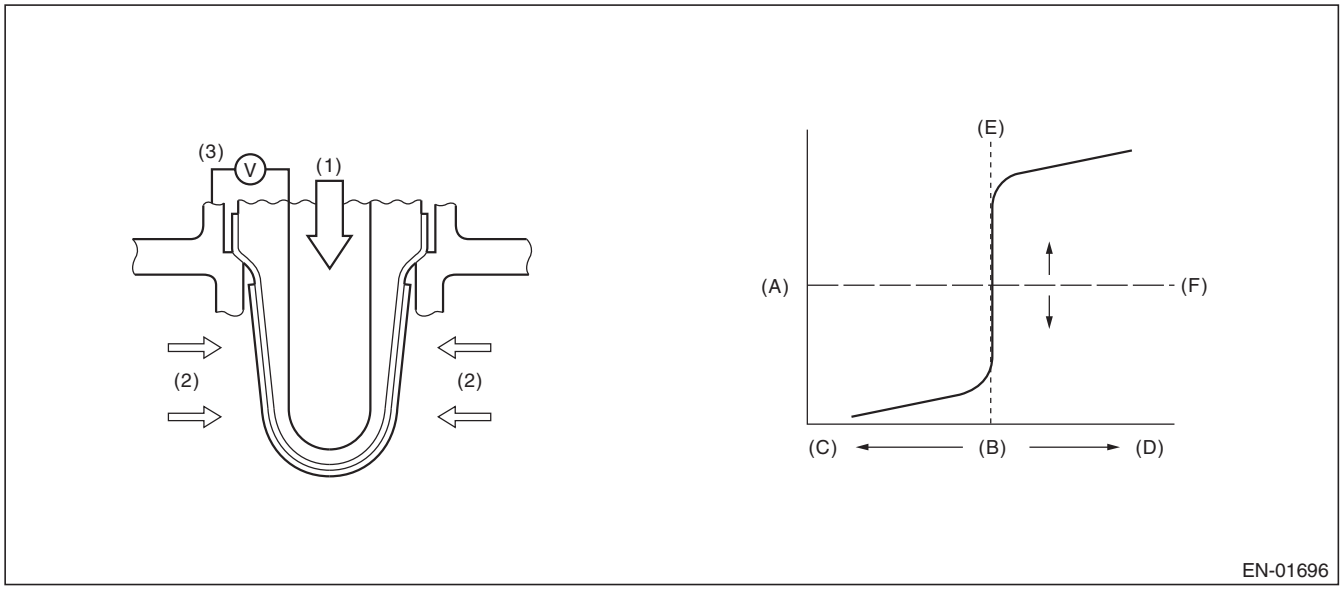
Time Needed for Diagnosis: Less than 1 second

AG: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	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 70 °C (158 °F)
Low (1)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 70 °C (158 °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	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 70 °C (158 °F)
Amount of intake air	< 10 g/s (0.35 oz/s)
Current continuation time of the rear oxygen sensor heater	≥ 25000 ms
Low (3)	
Secondary air system	Not in operation
Closed loop control at the oxygen sensor	In operation
Misfire detection every 200 rotations	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 70 °C (158 °F)
Amount of intake air	< 10 g/s (0.35 oz/s)
Current continuation time of the rear oxygen sensor heater	≥ 25000 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	< 65535 time(s)
Front oxygen (A/F) sensor compensation coefficient	Not in limit value
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ 70 °C (158 °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): 150000 ms
Low (3): Value from Map

Map

Fuel cut time (s)	0	2000	10000
Time Needed for Diagnosis (s)	150000	150000	150000

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

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

1. OUTLINE OF DIAGNOSIS

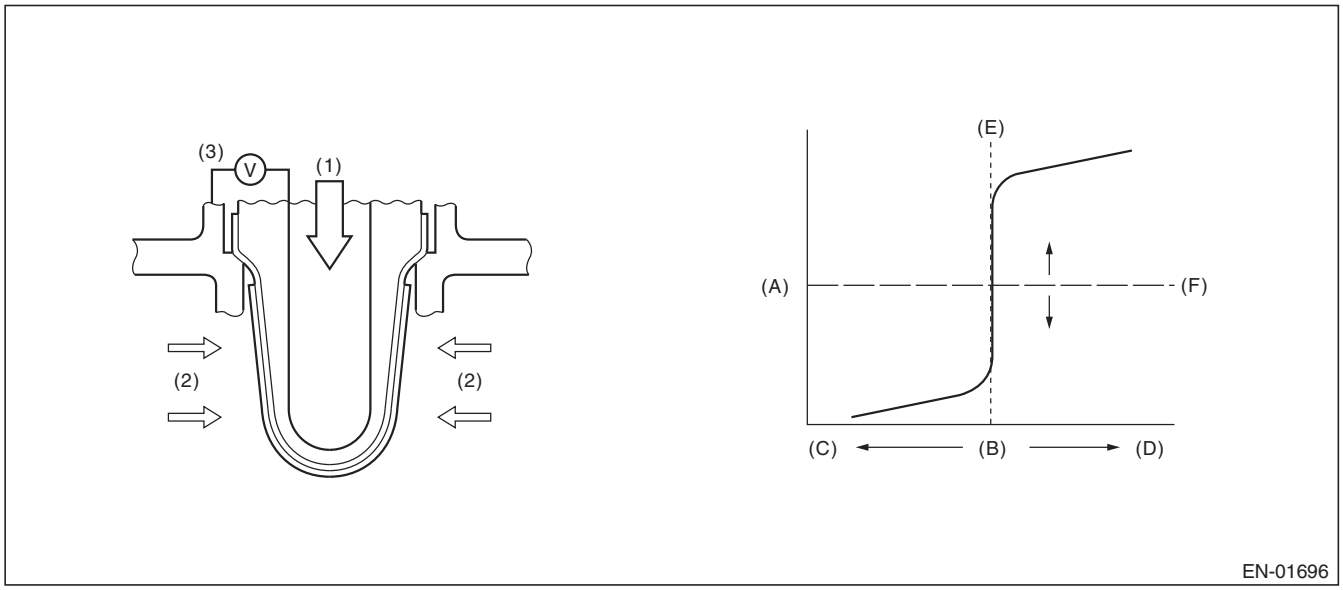
NOTE:
For the detection standard, refer to DTC P0137. <Ref. to GD(H4DOTC)-70, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AI: DTC P013A O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of rich → lean for rear oxygen sensor output.
When the deceleration fuel cut has occurred, detect the trouble by calculating the time when the rear oxygen sensor output passes through the predetermined range of voltages.
Judge as NG when the 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

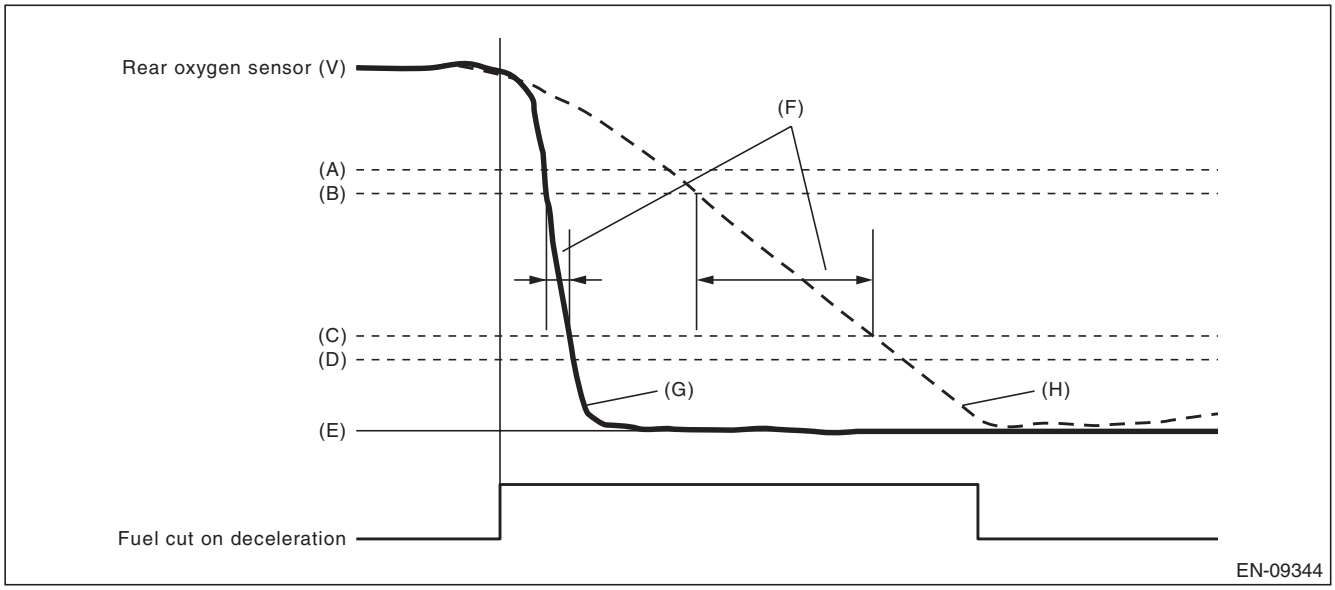
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Rear oxygen sensor closed loop control	Operation
Current calculation time of the rear oxygen sensor heater after starting	≥ 180000 ms
Engine speed when fuel cut starts	≥ 1600 rpm (Models without SI-DRIVE) ≥ 1700 rpm (Models with SI-DRIVE)
Rear oxygen sensor voltage when fuel cut starts	≥ 0.55 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut starts	≥ 70 °C (158 °F)
Estimated temperature of rear oxygen sensor element when fuel cut starts	≥ 450 °C (842 °F)

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.

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the response time of the rear oxygen sensor during fuel cut.



(A) 0.55 V
(B) 0.50 V
(C) 0.20 V
(D) 0.15 V
(E) 0 V
(F) Diagnostic parameter
(G) Normal
(H) Malfunction

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Time when rear oxygen sensor voltage changed from 0.5 V to 0.2 V.	> 837 ms

Time Needed for Diagnosis: 10 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
Time when rear oxygen sensor voltage changed from 0.5 V to 0.2 V.	≤ 837 ms

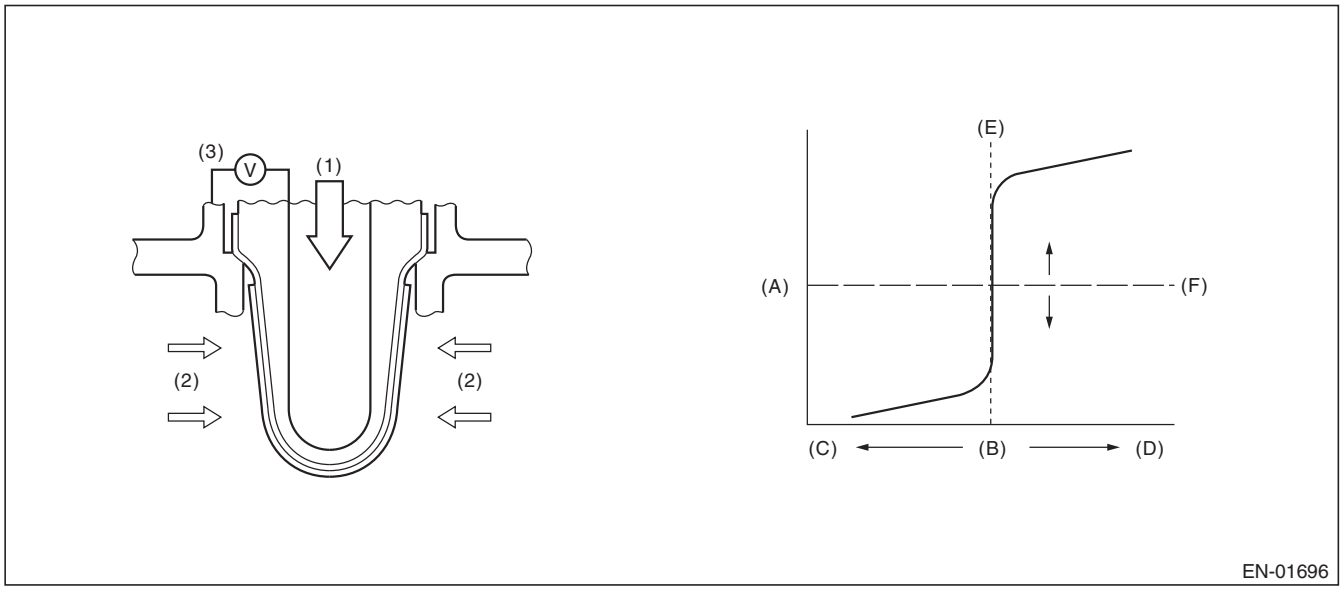
Time Needed for Diagnosis: 10 seconds

AJ:DTC P013B O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of lean → rich for rear oxygen sensor output.
After the deceleration fuel cut has occurred, detect the trouble by calculating the time when the rear oxygen sensor output passes through the predetermined range of voltages.
Judge as NG when the 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

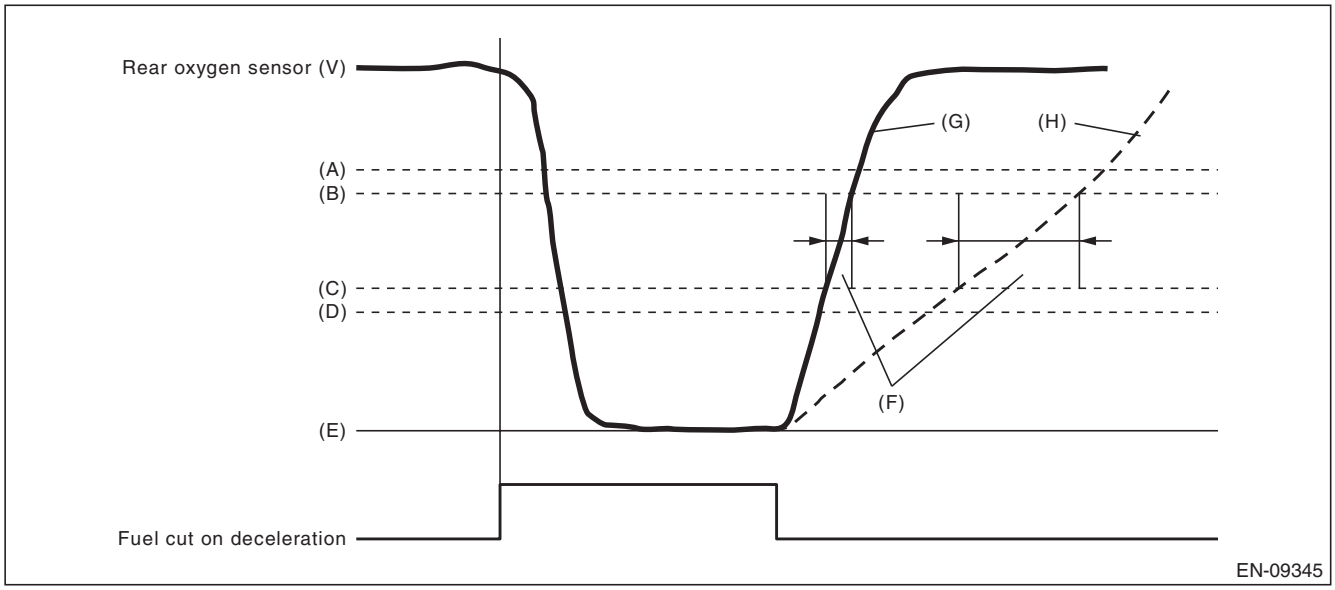
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Rear oxygen sensor closed loop control	Operation
Fuel cut time	≥ 5000 ms

4. GENERAL DRIVING CYCLE

Perform diagnosis only once after recovering from a deceleration fuel cut continued for more than predetermined time.

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the response time of the rear oxygen sensor after fuel cut.



(A) 0.55 V
(B) 0.50 V
(C) 0.30 V
(D) 0.25 V
(E) 0 V
(F) Diagnostic parameter
(G) Normal
(H) Malfunction

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Time when rear oxygen sensor voltage changed from 0.3 V to 0.5 V.	> 4000 ms

Time Needed for Diagnosis: 10 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
Time when rear oxygen sensor voltage changed from 0.3 V to 0.5 V.	≤ 4000 ms

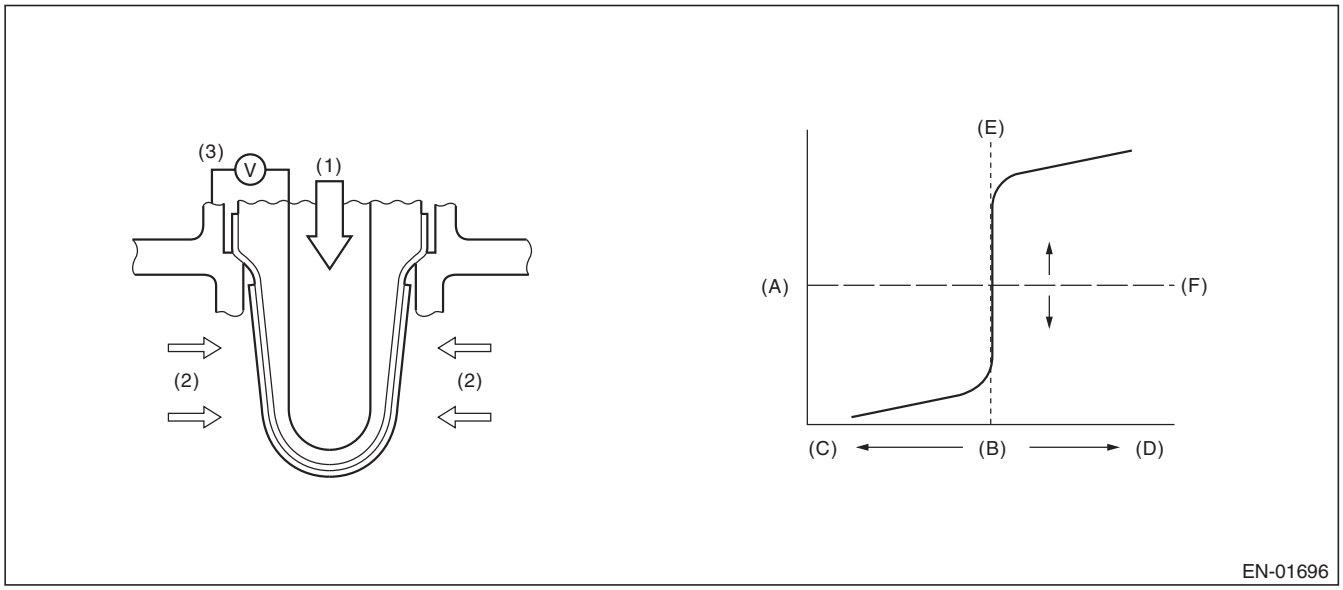
Time Needed for Diagnosis: 10 seconds

AK:DTC P013E O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the delayed response of rear oxygen sensor output for rich → lean.
After the deceleration fuel cut has started, detect the trouble by calculating the time when the rear oxygen sensor output decreases to the predetermined voltages.
Judge as NG when the 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

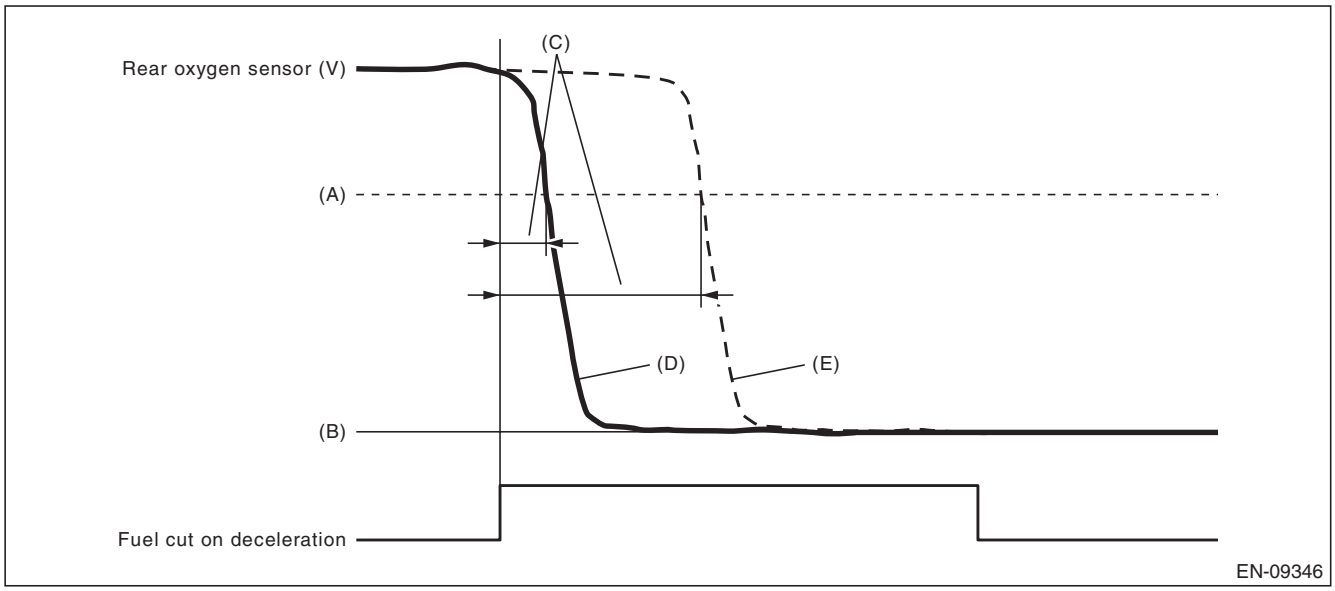
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Rear oxygen sensor closed loop control	Operation
Engine speed when fuel cut starts	≥ 1600 rpm (Models without SI-DRIVE) ≥ 1700 rpm (Models with SI-DRIVE)
Rear oxygen sensor voltage when fuel cut starts	≥ 0.55 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut starts	≥ 70 °C (158 °F)
Estimated temperature of rear oxygen sensor element when fuel cut starts	≥ 450 °C (842 °F)

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.

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the time from the beginning of the fuel cut to the beginning of the rear oxygen sensor voltage starting to drop.



(A) 0.5 V
(B) 0 V
(C) Diagnostic parameter
(D) Normal
(E) Malfunction

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Time when rear oxygen sensor voltage changed to 0.5 V after the fuel cut started.	> 4000 ms

Time Needed for Diagnosis: 10 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
Time when rear oxygen sensor voltage changed to 0.5 V after the fuel cut started.	≤ 4000 ms

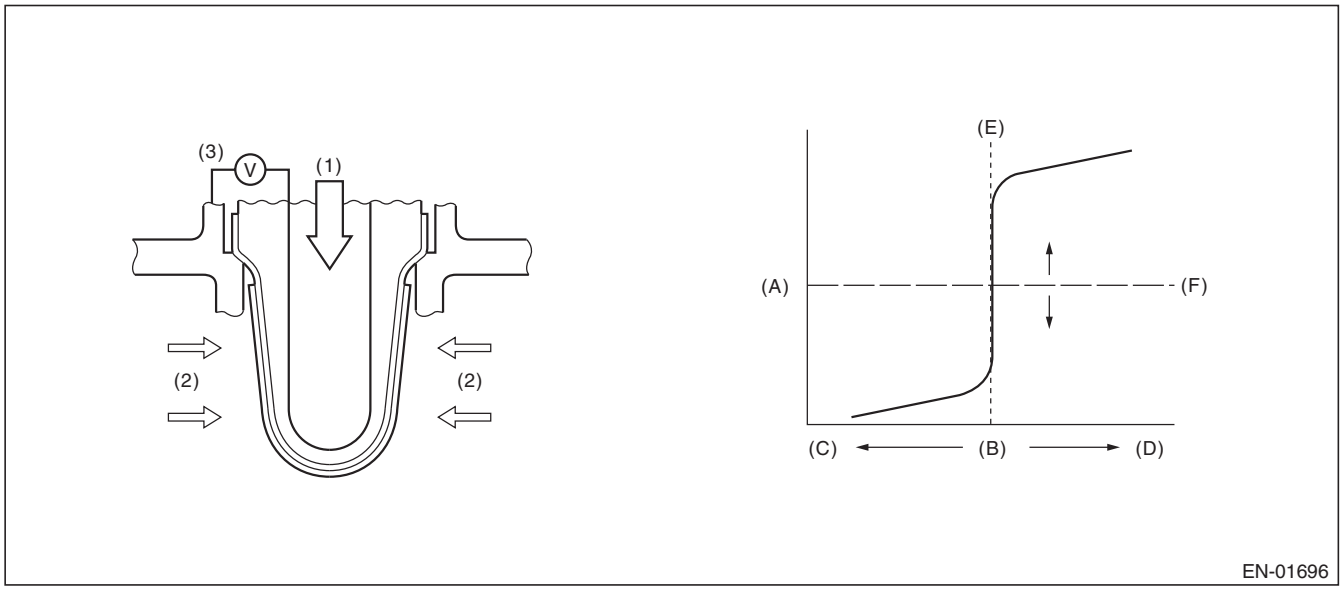
Time Needed for Diagnosis: 10 seconds

AL:DTC P013F O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 2)

1. OUTLINE OF DIAGNOSIS

Detect the delayed response of rear oxygen sensor output for lean → rich.
After the deceleration fuel cut has completed, detect the trouble by calculating the time when the rear oxygen sensor output increases to the predetermined voltages.
Judge as NG when the 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

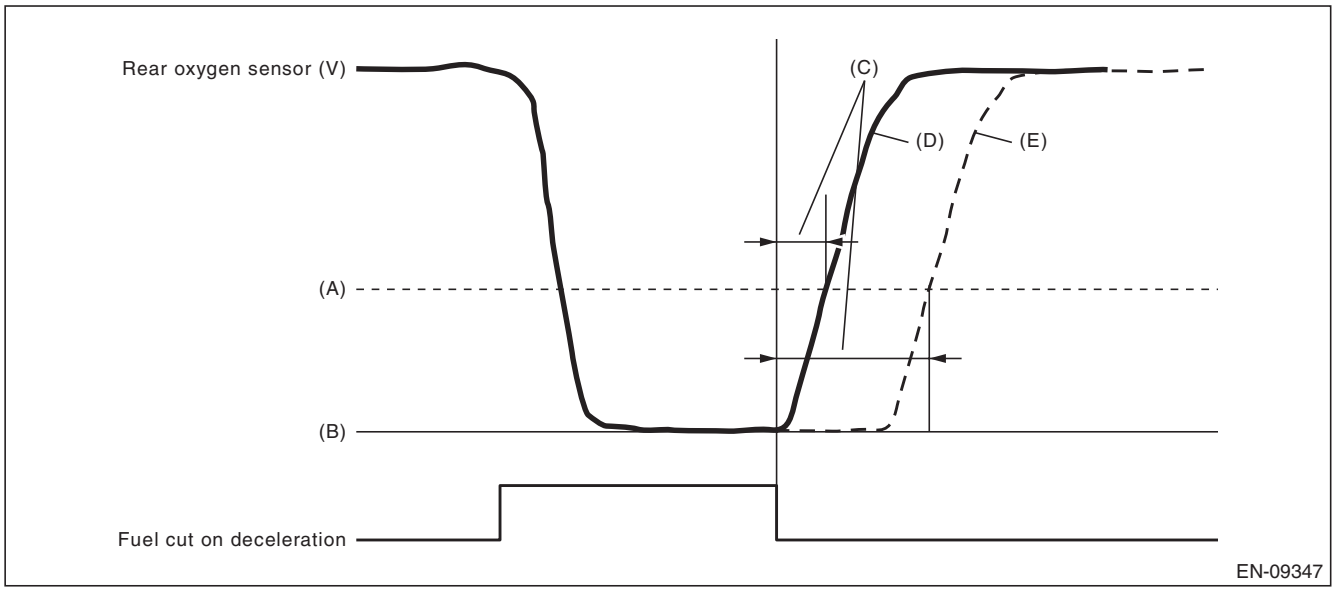
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Rear oxygen sensor closed loop control	Operation
Engine speed	≥ 500 rpm
Rear oxygen sensor voltage when fuel cut has completed	< 0.15 V
Fuel cut time	≥ 5000 ms
Engine coolant temperature when fuel cut has completed	≥ 70 °C (158 °F)
Estimated element temperature of rear oxygen sensor when fuel cut has completed	≥ 450 °C (842 °F)

4. GENERAL DRIVING CYCLE

Perform diagnosis only once when recovering from the deceleration fuel cut continued for more than predetermined time with the rear oxygen sensor warmed up sufficiently.

5. DIAGNOSTIC METHOD

Detect the trouble by calculating the time from the completion of the fuel cut to the beginning of the rear oxygen sensor voltage starting to rise.



(A) 0.3 V
(B) 0 V
(C) Diagnostic parameter
(D) Normal
(E) Malfunction

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
The number of times that the rear oxygen sensor voltage changed to 0.3 V after the fuel cut has completed (time counter)	> 3750 time(s)

Time Needed for Diagnosis: 10 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
The number of times that the rear oxygen sensor voltage changed to 0.3 V after the fuel cut has completed (time counter)	≤ 3750 time(s)

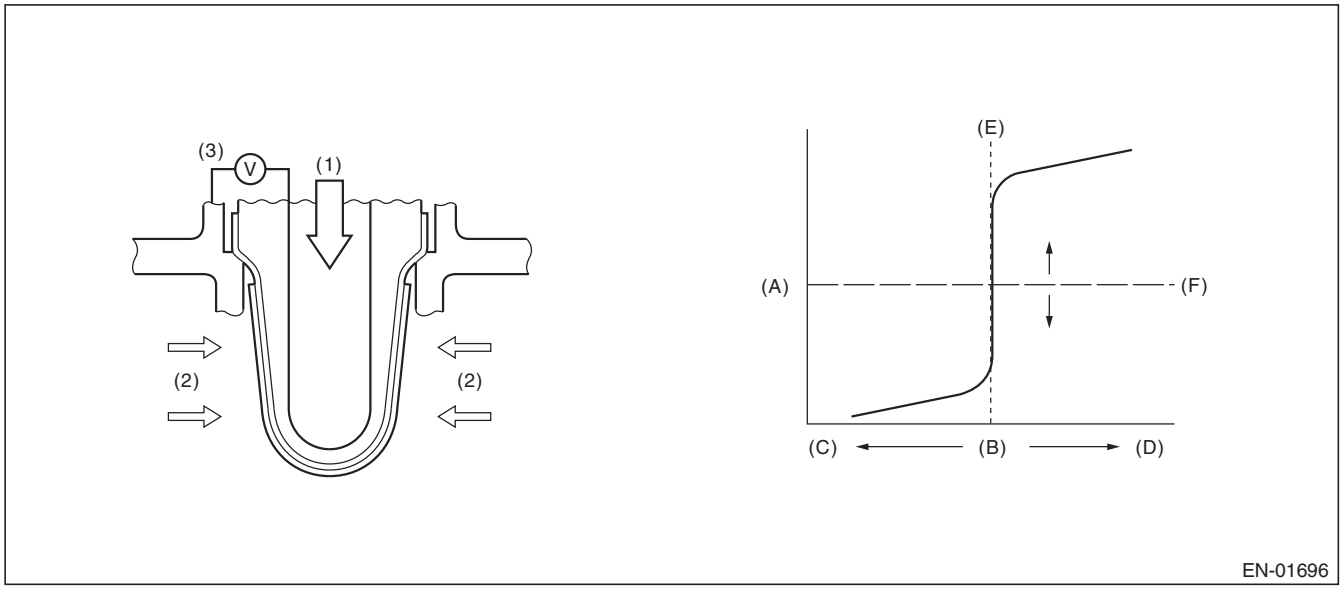
Time Needed for Diagnosis: 10 seconds

AM: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	≥ 70 °C (158 °F)
Misfire detection every 200 rotations	< 65535 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

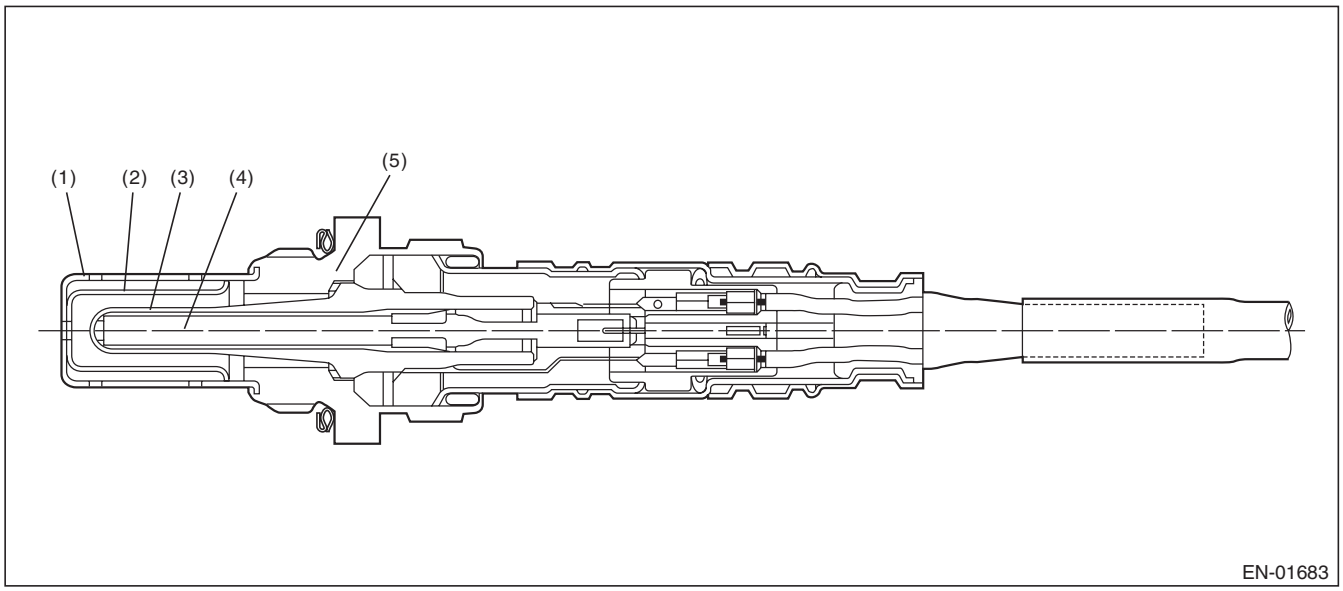
Time Needed for Diagnosis: Less than 1 second

AN:DTC P0141 O2 SENSOR HEATER CIRCUIT (BANK1 SENSOR2)

1. OUTLINE OF DIAGNOSIS

Detect malfunction of the rear oxygen sensor heater.
Judge as NG if it is determined that the rear oxygen sensor impedance is large by observing the engine conditions.

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
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 1000 ms
Engine coolant temperature	≥ 70 °C (158 °F)
A/F sensor element impedance	≤ 50 Ω
A/F sensor heater control duty	≤ 75 %
Rear oxygen sensor heater control duty	< 30 %

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously after 1000 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
Output terminal for heater characteristics failure detection	Low

Time Needed for Diagnosis: 4 ms × 2500 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 terminal for heater characteristics failure detection	High

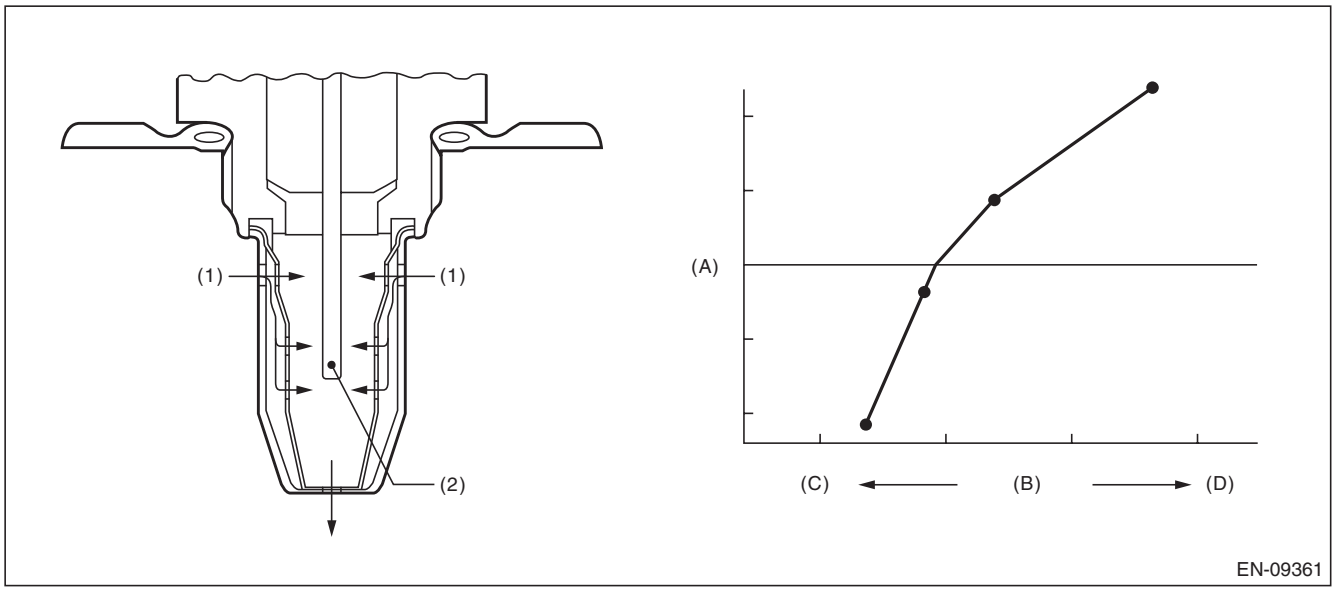
Time Needed for Diagnosis: 4 ms × 2500 time(s)

AO:DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.
For diagnosis, detect the trouble by processing the λ waveform in normal driving without forcibly changing the target air fuel ratio.

2. COMPONENT DESCRIPTION



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

(1) Exhaust gas
(2) ZrO_2

3. ENABLE CONDITIONS

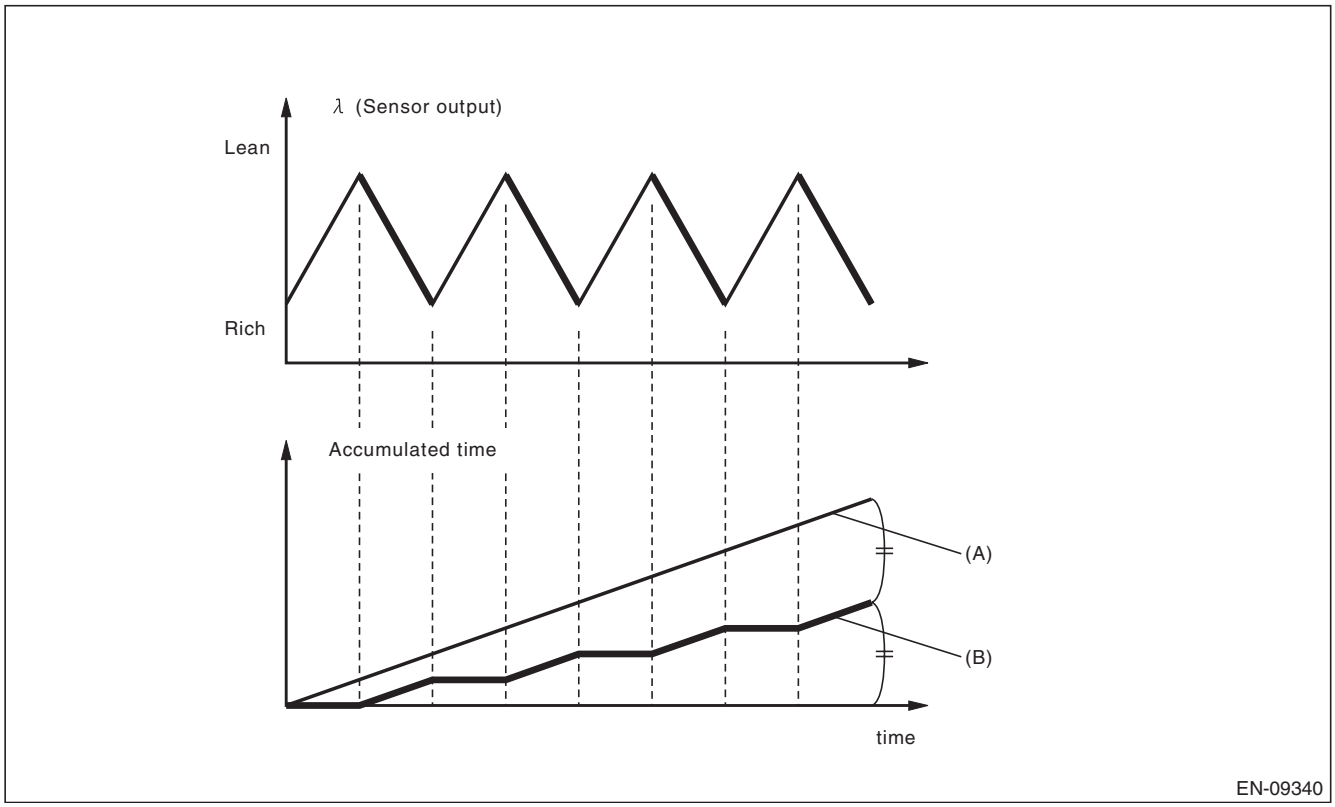
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	≥ 0 Ω and < 50 Ω
Elapsed time after starting the engine	≥ 40000 ms
Engine coolant temperature	≥ 0 °C (32 °F)
Engine speed	≥ 1000 rpm
Amount of intake air	≥ 10 g/s (0.35 oz/s)
After fuel cut	≥ 3000 ms
Idle switch	OFF

4. GENERAL DRIVING CYCLE

Perform diagnosis only once in a city driving including normal acceleration and deceleration.

5. DIAGNOSTIC METHOD 1

Detect the malfunction by checking “Cumulative value of time when λ changes from lean → rich” in comparison to “Time during which diagnosis is in progress”.



(A) Time during which diagnosis is in progress

(B) Cumulative value of time when λ changes from lean → rich

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
(Cumulative value of time when λ changes from lean → rich) / (Time during which diagnosis is in progress)	< 0.39	P014C
	> 0.63	P014D

Time Needed for Diagnosis: 90 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.

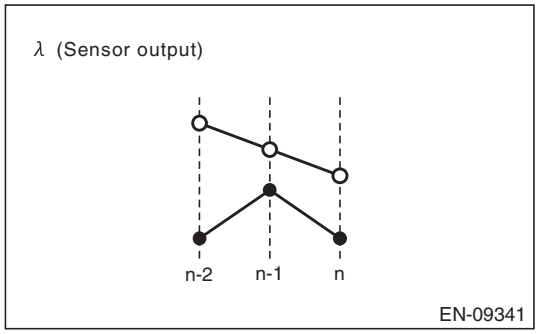
Judgment Value

Malfunction Criteria	Threshold Value	DTC
(Cumulative value of time when λ changes from lean → rich) / (Time during which diagnosis is in progress)	≥ 0.39	P014C
	≤ 0.63	P014D

Time Needed for Diagnosis: 90 seconds

6. DIAGNOSTIC METHOD 2

Detect the malfunction by the cumulative value obtained from the amount of variation in λ change.



- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Cumulative value obtained from the amount of variation in λ change Σ |(lambda(n) – lambda(n-1)) – (lambda(n-1) – lambda(n-2))|	< Value from Map	P014C and P014D

Map (Models without SI-DRIVE)

Cumulative value obtained from the amount of variation in λ Σ |lambda(n) – lambda(n-1)|	0.00	4.00
Cumulative value obtained from the amount of variation in λ change	0.00	4.00

Map (Models with SI-DRIVE)

Cumulative value obtained from the amount of variation in λ Σ |lambda(n) – lambda(n-1)|	0.00	6.00
Cumulative value obtained from the amount of variation in λ change	0.00	6.50

Time Needed for Diagnosis: 90 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	DTC
Cumulative value obtained from the amount of variation in λ change Σ |(lambda(n) – lambda(n-1)) – (lambda(n-1) – lambda(n-2))|	≥ Value from Map	P014C and P014D

Time Needed for Diagnosis: 90 seconds

AP:DTC P014D O2 SENSOR SLOW RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

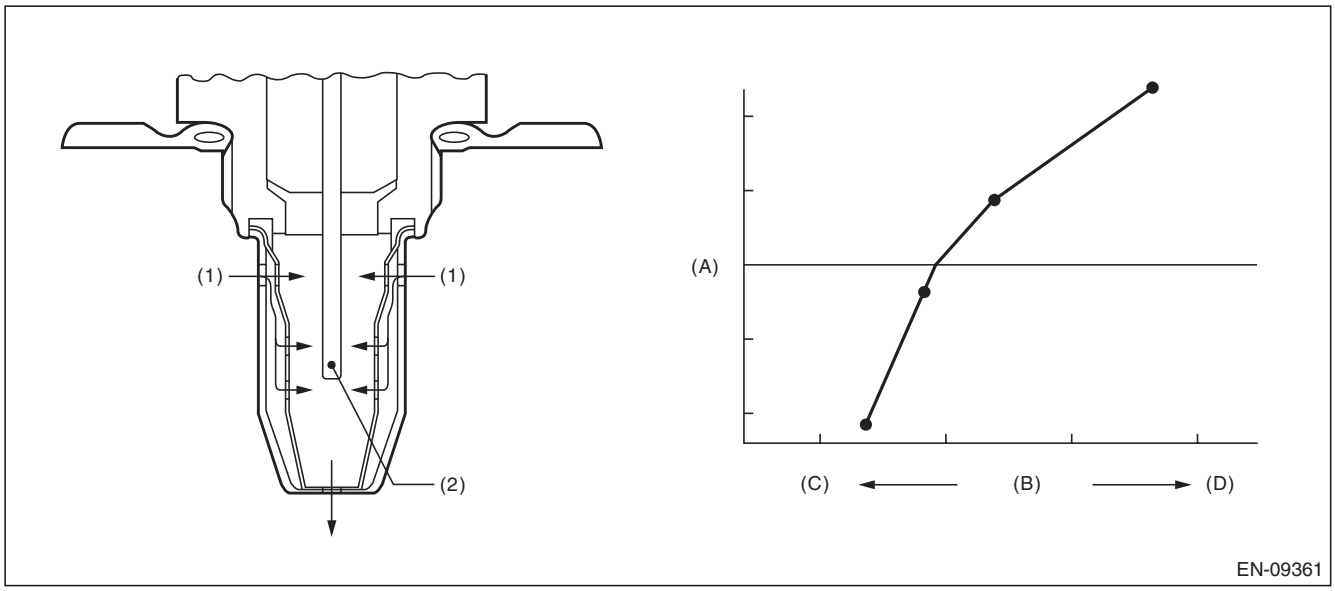
NOTE:
For the detection standard, refer to DTC P014C. <Ref. to GD(H4DOTC)-85, DTC P014C O2 SENSOR SLOW RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AQ:DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

Detect the slow response of front oxygen (A/F) sensor.
For diagnosis, detect the trouble by processing the λ waveform in normal driving without forcibly changing the target air fuel ratio.

2. COMPONENT DESCRIPTION



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

(1) Exhaust gas
(2) ZrO_2

3. ENABLE CONDITIONS

Diagnostic method 1

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	≥ 0 Ω and < 50 Ω
Elapsed time after starting the engine	≥ 40000 ms
Engine coolant temperature	≥ 0 °C (32 °F)
Engine speed	≥ 1000 rpm
Amount of intake air	≥ 10 g/s (0.35 oz/s)
After fuel cut	≥ 3000 ms
Idle switch	OFF

Diagnostic method 2

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	≥ 0 Ω and < 50 Ω
Elapsed time after starting the engine	≥ 40000 ms
Engine coolant temperature	≥ 0 °C (32 °F)
Engine speed	≥ 1000 rpm
Amount of intake air	≥ 10 g/s (0.35 oz/s)
After fuel cut	≥ 3000 ms
Learning value of EVAP conc. during purge	< 0.2
Total time of operating canister purge	≥ 20 s
Engine load change	< 0.02 g/rev (0 oz/rev)
Idle switch	OFF

Diagnostic method 3

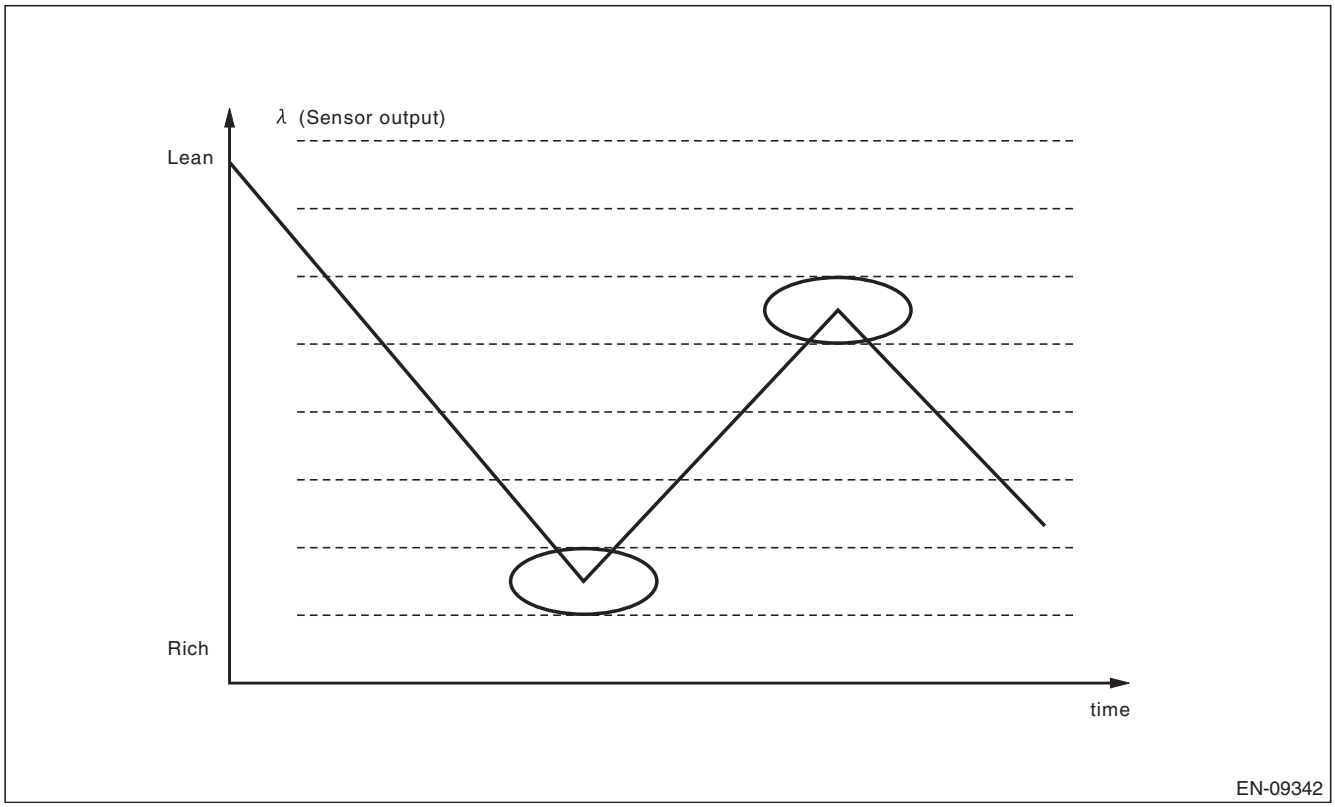
Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Closed loop control with main feedback	Operation
Front oxygen (A/F) sensor impedance	≥ 0 Ω and < 50 Ω
Elapsed time after starting the engine	≥ 40000 ms
Engine coolant temperature	≥ 70 °C (158 °F)
Vehicle speed	≥ 40 km/h (24.9 MPH)
Engine speed	≥ 1000 rpm and < 4000 rpm
Amount of intake air	≥ 10 g/s (0.35 oz/s) and < 40 g/s (1.41 oz/s)
Learning value of EVAP conc. during purge	< 0.2
Catalyst depletion diagnosis	Not under diagnosis

4. GENERAL DRIVING CYCLE

Perform diagnosis only once in a city driving including normal acceleration and deceleration.

5. DIAGNOSTIC METHOD 1

Detect the malfunction depending on the average value of time necessary for λ to inverse the air fuel ratio from “Lean → Rich → Lean” to “Rich → Lean → Rich”.



• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value of time necessary for λ to inverse the air fuel ratio to Lean → Rich → Lean.	> 200 ms (Models without SI-DRIVE) > 100 ms (Models with SI-DRIVE)	P015A
Average value of time necessary for λ to inverse the air fuel ratio to Rich → Lean → Rich.	> 150 ms (Models without SI-DRIVE) > 200 ms (Models with SI-DRIVE)	P015B

Time Needed for Diagnosis: 50 times of inversion
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.

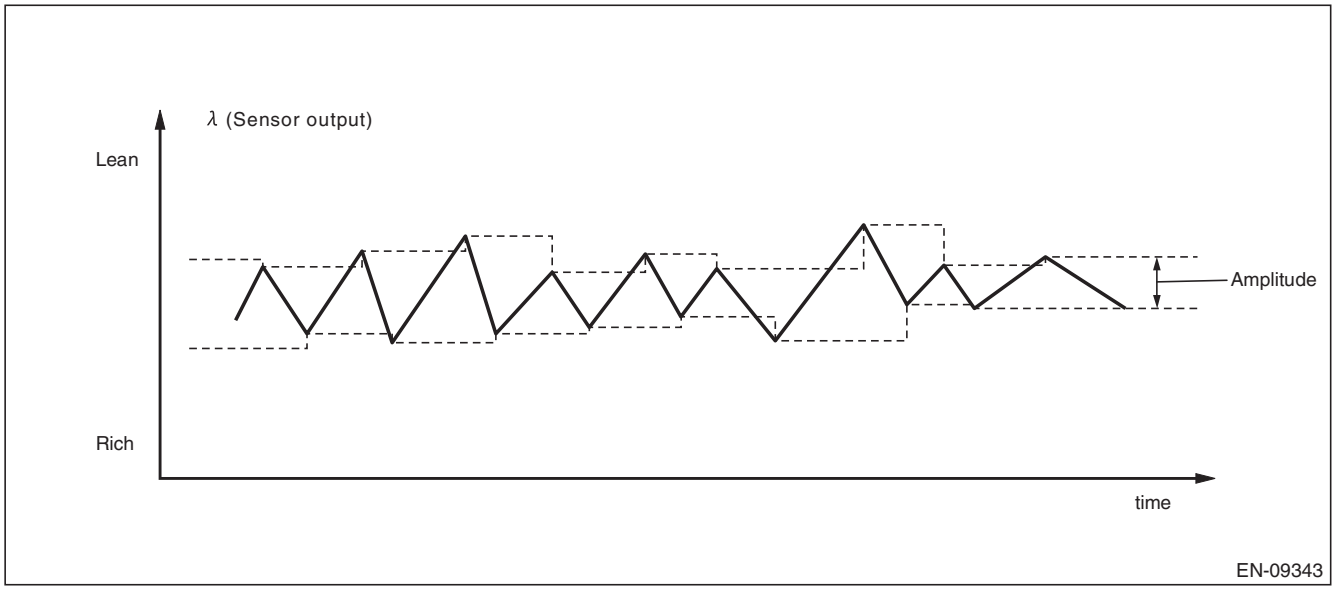
Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value of time necessary for λ to inverse the air fuel ratio to Lean → Rich → Lean.	≤ 200 ms (Models without SI-DRIVE) ≤ 100 ms (Models with SI-DRIVE)	P015A
Average value of time necessary for λ to inverse the air fuel ratio to Rich → Lean → Rich.	≤ 150 ms (Models without SI-DRIVE) ≤ 200 ms (Models with SI-DRIVE)	P015B

Time Needed for Diagnosis: 50 times of inversion

6. DIAGNOSTIC METHOD 2

Detect the malfunction by calculating the average amplitude of λ.



- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value for λ amplitude	> 0.1	P015A and P015B

Time Needed for Diagnosis: 11250 time(s) × 8 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.

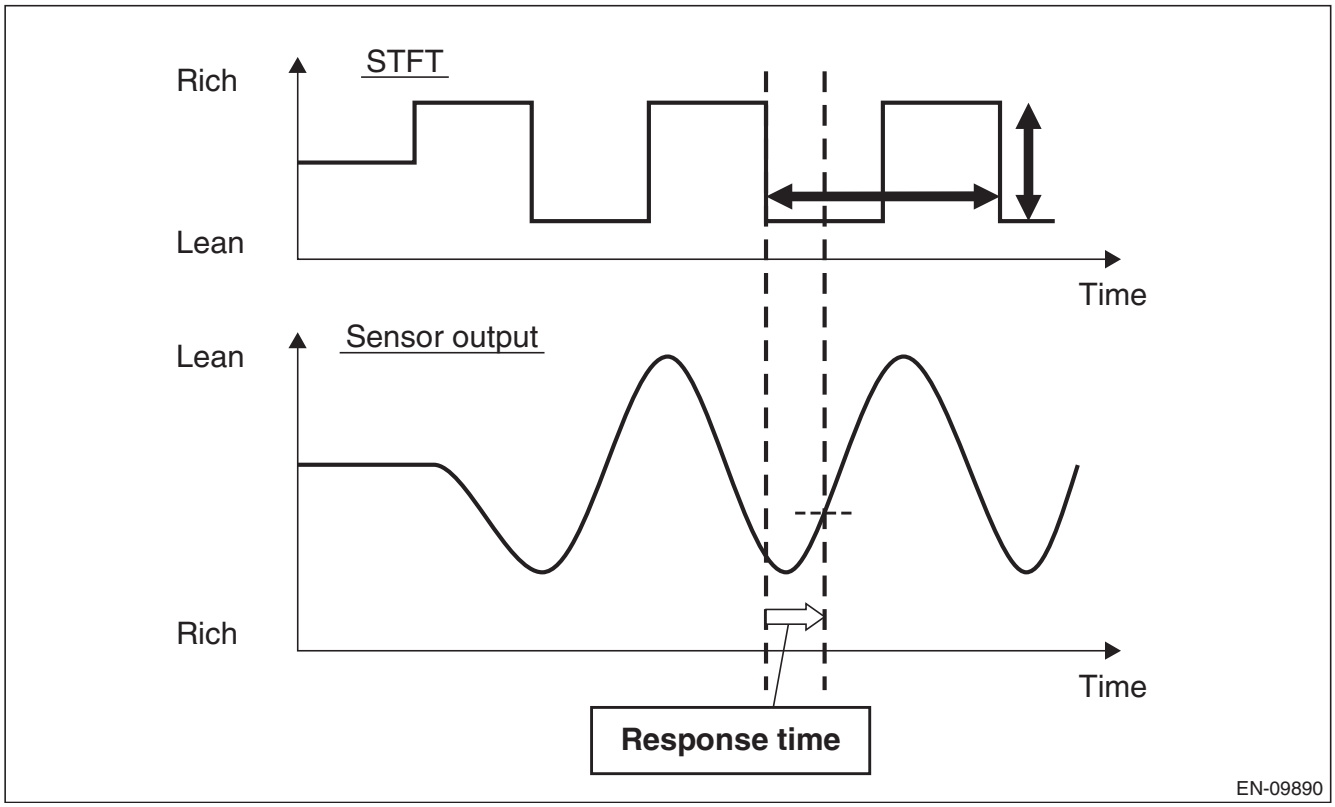
Judgment Value

Malfunction Criteria	Threshold Value	DTC
Average value for λ amplitude	≤ 0.1	P015A and P015B

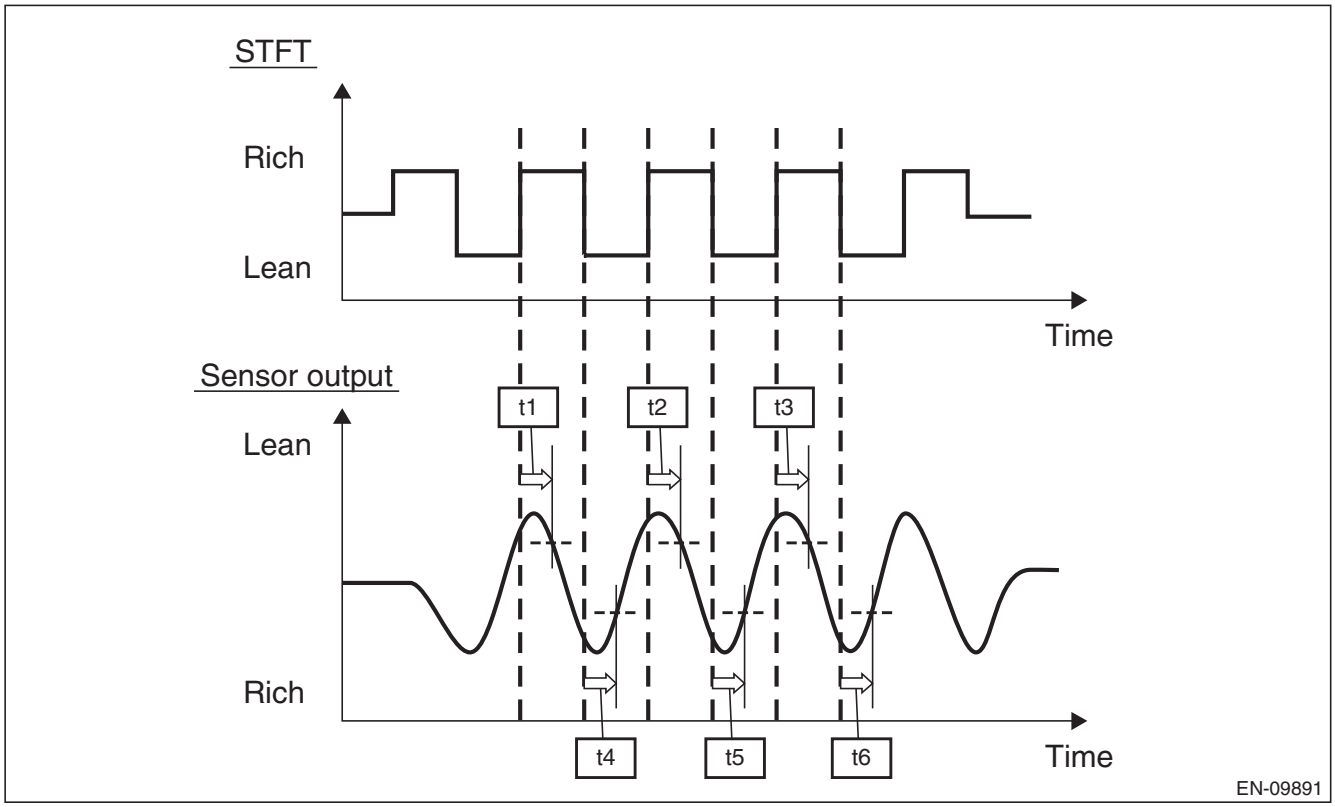
Time Needed for Diagnosis: 11250 time(s) × 8 ms

7. DIAGNOSTIC METHOD 3

Change STFT (A/F compensation value) by interruption, and measure the reaction time of λ value. When A/F sensor malfunctions, the reaction time takes longer than at normal condition. In this case, judge as abnormal.



Measure reaction time (t1, t2, t3) and reaction time (t4, t5, t6). Use the average value of the reaction time to obtain the diagnostic value.



- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
(t1 + t2 + t3)/3 and (t4 + t5 + t6)/3	> 420 ms (Models without SI-DRIVE) > 380 ms (Models with SI-DRIVE) > 420 ms (Models without SI-DRIVE) > 380 ms (Models with SI-DRIVE)	P015A and P015B

Time Needed for Diagnosis: 1000 ms × [1 time(s)/2] + 1000 ms × 3 time(s) + 500 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	DTC
(t1 + t2 + t3)/3 or (t4 + t5 + t6)/3	≤ 420 ms (Models without SI-DRIVE) ≤ 380 ms (Models with SI-DRIVE) ≤ 420 ms (Models without SI-DRIVE) ≤ 380 ms (Models with SI-DRIVE)	P015A and P015B

Time Needed for Diagnosis: 1000 ms × [1 time(s)/2] + 1000 ms × 3 time(s) + 500 ms

AR:DTC P015B O2 SENSOR DELAYED RESPONSE - LEAN TO RICH (BANK 1 SENSOR 1)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P015A. <Ref. to GD(H4DOTC)-88, DTC P015A O2 SENSOR DELAYED RESPONSE - RICH TO LEAN (BANK 1 SENSOR 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

AS: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	≥ 70 °C (158 °F)
Engine load change	< 0.02 g/rev (0 oz/rev)
Engine load	≥ Value of Map 1

Map1 (models without SI-DRIVE)

Engine speed (rpm)	Idling	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g (oz)/rev)	na	0.228 (0.01)	0.22 (0.01)	0.22 (0.01)	0.22 (0.01)	0.228 (0.01)	0.23 (0.01)	0.234 (0.01)	0.242 (0.01)	0.25 (0.01)	0.25 (0.01)

Map1 (models with SI-DRIVE)

Engine speed (rpm)	Idling	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g (oz)/rev)	na	0.225 (0.01)	0.245 (0.01)	0.239 (0.01)	0.224 (0.01)	0.233 (0.01)	0.259 (0.01)	0.257 (0.01)	0.254 (0.01)	0.256 (0.01)	0.274 (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 diagnostic 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 milliseconds) flaf = main feedback learning compensation coefficient	≥ Value from Map 2

Map 2

Amount of air (g (oz)/s)	0 (0)	2.34375 (0.08)	4.6875 (0.17)	7.03125 (0.25)	9.375 (0.33)	11.71875 (0.41)	14.0625 (0.5)
fsobdL1 (%)	1.4	1.4	1.368623	1.319185	1.26975	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	< 1.15

Time Needed for Diagnosis: 10 s

AT: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	≥ 70 °C (158 °F)
Engine load change	≤ 0.02 g/rev (0 oz/rev)
Learning value of EVAP conc.	< 0.2
Cumulative time of canister purge after engine start	≥ 20 s
Continuous period after canister purge starting	≥ 5000 ms
Engine load	≥ Value of Map 1

Map1 (models without SI-DRIVE)

Engine speed (rpm)	Idling	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g (oz)/rev)	na	0.228 (0.01)	0.22 (0.01)	0.22 (0.01)	0.22 (0.01)	0.228 (0.01)	0.23 (0.01)	0.234 (0.01)	0.242 (0.01)	0.25 (0.01)	0.25 (0.01)

Map1 (models with SI-DRIVE)

Engine speed (rpm)	Idling	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g (oz)/rev)	na	0.225 (0.01)	0.245 (0.01)	0.239 (0.01)	0.224 (0.01)	0.233 (0.01)	0.259 (0.01)	0.257 (0.01)	0.254 (0.01)	0.256 (0.01)	0.274 (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 diagnostic 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 milliseconds) flaf = main feedback learning compensation coefficient	< Value of Map 2

Map 2

Amount of air (g (oz)/s)	0 (0)	2.34375 (0.08)	4.6875 (0.17)	7.03125 (0.25)	9.375 (0.33)	11.7187 5 (0.41)	14.0625 (0.5)
fsobdL1 (%)	0.6	0.6	0.63137	0.68082	0.71025	0.72525	0.73025

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 if the status that the criteria below are met continues for 10 seconds.

Judgment Value

Malfunction Criteria	Threshold Value
fsobd = (sglmd – tglmda) + faf + flaf	≥ 0.85

Time Needed for Diagnosis: 10 s

AU:DTC P0201 INJECTOR #1

1. OUTLINE OF DIAGNOSIS

Based on the self-diagnostic result of the injector driving IC, judge the injector driving circuit as normal or abnormal.
Injector driving IC detects the status of “fuel remains injected” or “fuel is not injected” as a malfunction.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1 s
Engine speed	> 500 rpm
Injection time	≥ 1000 μs and < 120000000/engine speed – 1000 μs
Injection status	Not during fuel cut and Not during asynchronous injection controlled by crankshaft position sensor

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Injector driving IC information	Malfunction

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 following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Injector driving IC information	Normal

Time Needed for Diagnosis: Less than 1 second

AV:DTC P0202 INJECTOR #2

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0201. <Ref. to GD(H4DOTC)-99, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AW:DTC P0203 INJECTOR #3

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0201. <Ref. to GD(H4DOTC)-99, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AX:DTC P0204 INJECTOR #4

1. OUTLINE OF DIAGNOSIS

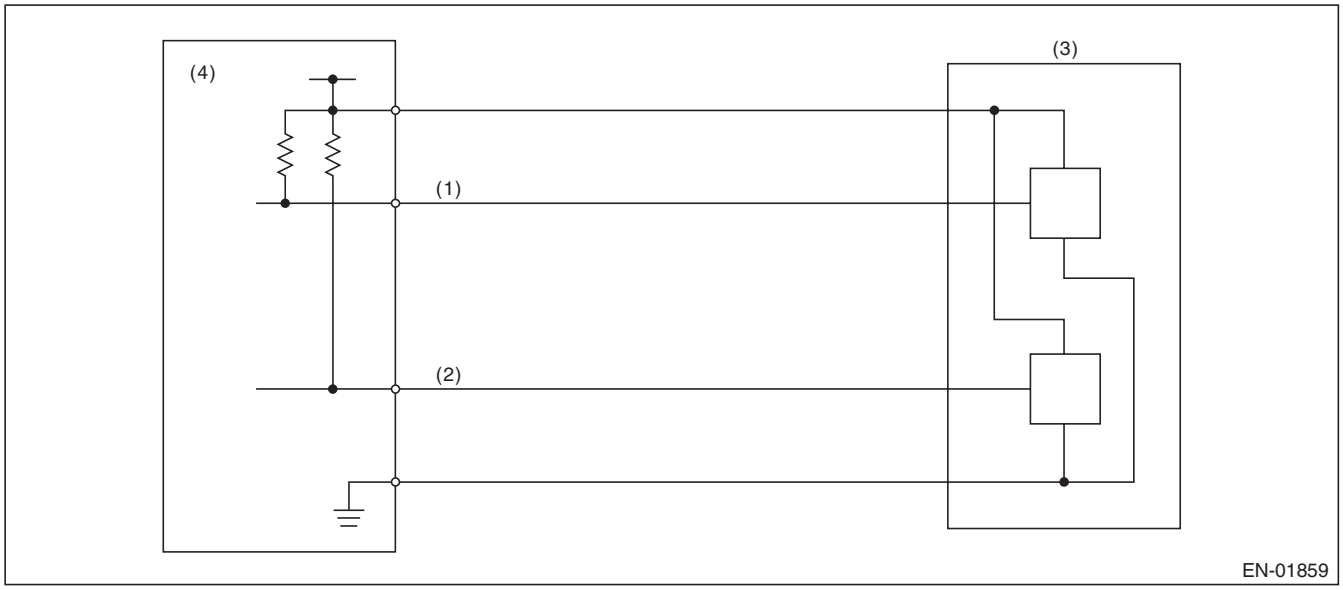
NOTE:
For the detection standard, refer to DTC P0201. <Ref. to GD(H4DOTC)-99, DTC P0201 INJECTOR #1, Diagnostic Trouble Code (DTC) Detecting Criteria.>

AY: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	≤ 1.15 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	> 1.15 V

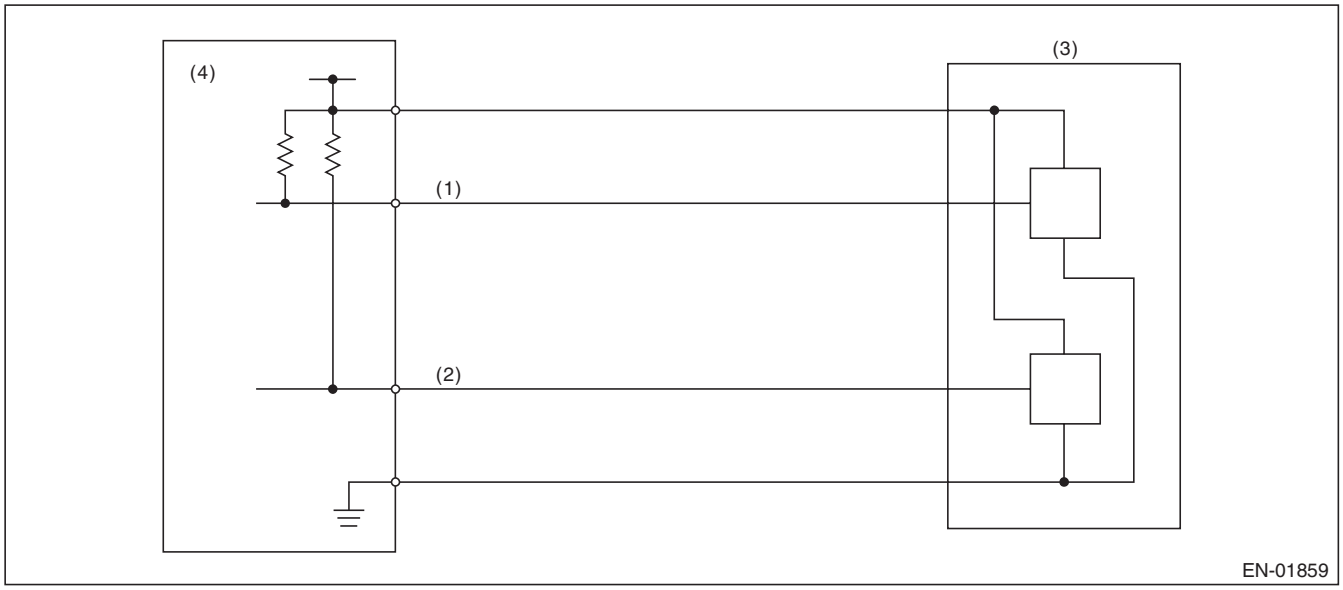
Time Needed for Diagnosis: 24 ms

AZ: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

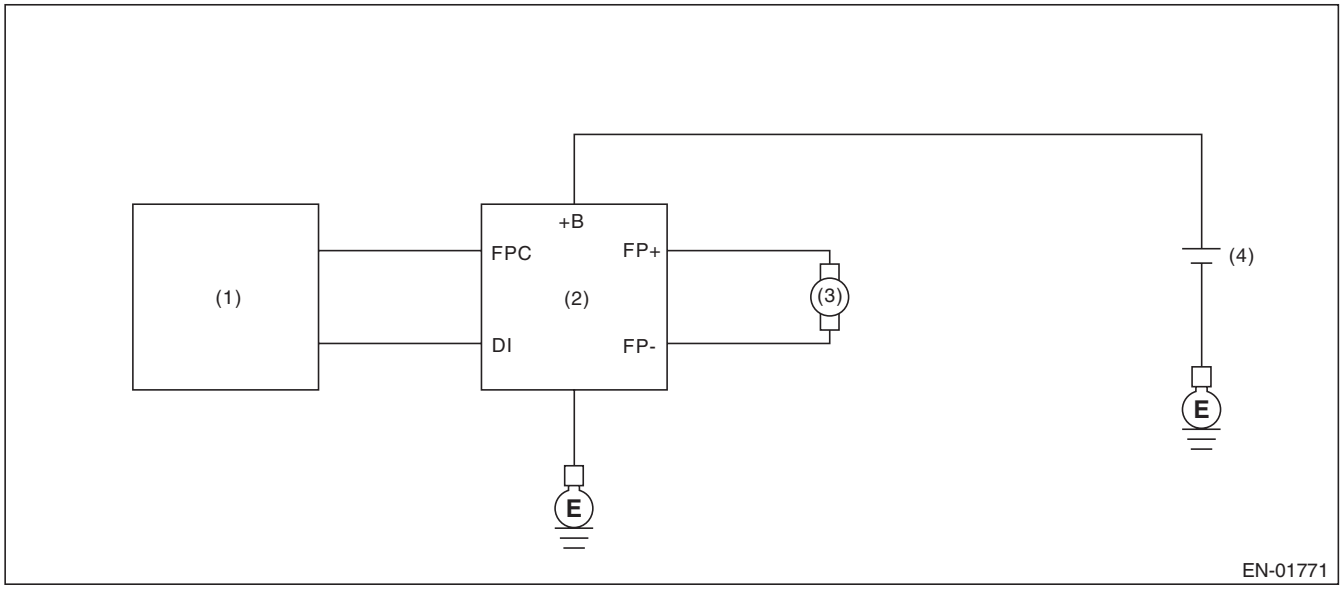
Time Needed for Diagnosis: 24 ms

BA:DTC P0230 FUEL PUMP PRIMARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of fuel pump control unit.
Judge as NG when the NG signal is sent through a diagnostic line coming from the fuel pump control unit.
Fuel pump control unit detects the open or short circuit malfunction for each line, and then sends NG signals if one of them is found NG.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM)
(2) Fuel pump control unit
(3) Fuel pump
(4) Battery

3. ENABLE 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
Elapsed time after starting the engine	≥ 180000 ms
Fuel pump control	ON
Fuel pump control unit output diagnosis signal	Low
Fuel level	≥ 10 ℓ (2.64 US gal, 2.2 Imp gal)

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	≥ 8 V
Elapsed time after starting the engine	≥ 180000 ms
Fuel pump control	ON
Fuel pump control unit output diagnosis signal	High
Fuel level	≥ 10 ℓ (2.64 US gal, 2.2 Imp gal)

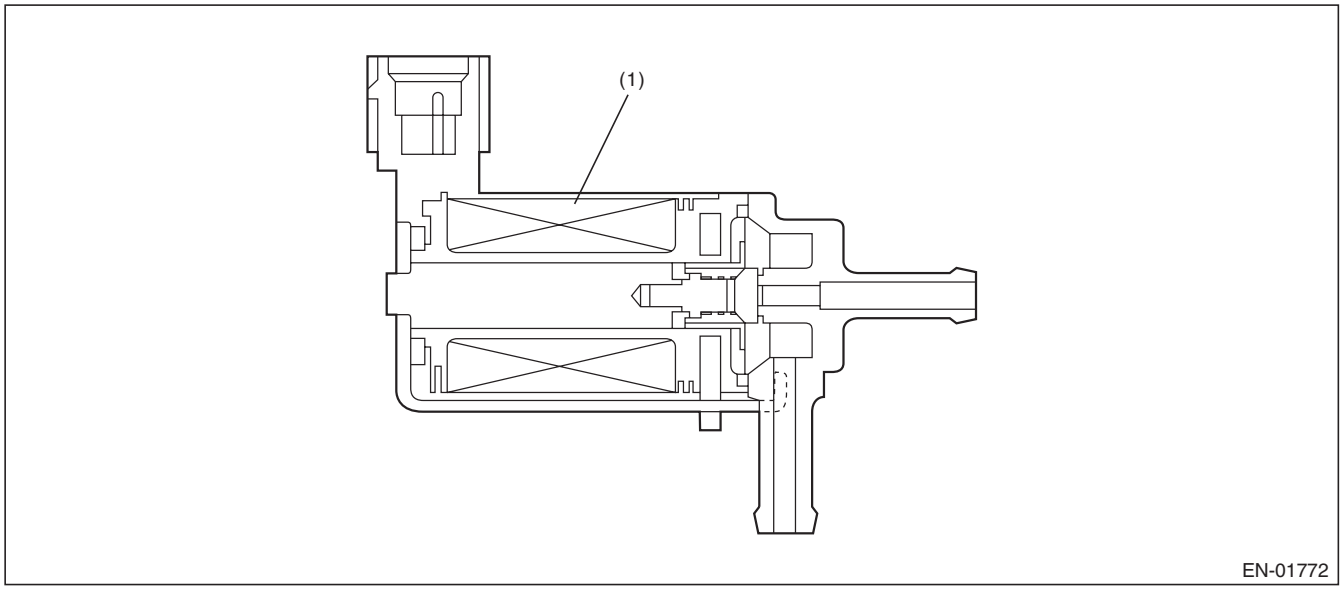
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of wastegate control solenoid valve function.
Judge as NG when becoming high wastegate pressure.

2. COMPONENT DESCRIPTION



(1) Coil

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
Intake manifold pressure	≥ Value from Map

Map (models without SI-DRIVE)

		Barometric pressure (kPa (mmHg, inHg))					
		58.7 (440, 17.3)	77.3 (580, 22.8)	89.3 (670, 26.4)	96 (720, 28.3)	98.6 (740, 29.1)	101.3 (760, 29.9)
Engine speed (rpm)	1000	109.5 (822, 32.3)	127.4 (956, 37.6)	138.6 (1040 , 40.9)	138.6 (1040 , 40.9)	138.6 (1040 , 40.9)	138.6 (1040 , 40.9)
	2000	139.1 (1044, 41.1)	163.4 (1226, 48.3)	178.6 (1340 , 52.8)	178.6 (1340 , 52.8)	178.6 (1340 , 52.8)	178.6 (1340 , 52.8)
	2400	169.7 (1273, 50.1)	200.6 (1505, 59.3)	219.9 (1650 , 65)	219.9 (1650 , 65)	219.9 (1650 , 65)	219.9 (1650 , 65)
	4000	169.7 (1273, 50.1)	200.6 (1505, 59.3)	219.9 (1650 , 65)	219.9 (1650 , 65)	219.9 (1650 , 65)	219.9 (1650 , 65)
	5000	144.1 (1081, 42.6)	173 (1298, 51.1)	193.9 (1454 , 57.3)	200.7 (1506 , 59.3)	217.9 (1635 , 64.4)	217.9 (1635 , 64.4)
	6000	138.6 (1040, 40.9)	166.6 (1250, 49.2)	187.2 (1404 , 55.3)	194.6 (1460 , 57.5)	213.3 (1600 , 63)	213.3 (1600 , 63)
kPa (mmHg, inHg)							

Map (models with SI-DRIVE)

		Barometric pressure (kPa (mmHg, inHg))					
		59.3 (445, 17.5)	68.6 (515, 20.3)	78 (585, 23)	92 (690, 27.2)	96 (720, 28.3)	98.6 (740, 29.1)
Engine speed (rpm)	1000	124.4 (934, 36.8)	135.3 (1015, 40)	135.3 (1015, 40)	135.3 (1015, 40)	135.3 (1015, 40)	135.3 (1015 , 40)
	2000	169.4 (1271, 50)	185.3 (1390, 54.7)	185.3 (1390, 54.7)	185.3 (1390, 54.7)	185.3 (1390, 54.7)	185.3 (1390 , 54.7)
	3000	158.2 (1187, 46.7)	214.6 (1610, 63.4)	214.6 (1610, 63.4)	214.6 (1610, 63.4)	214.6 (1610, 63.4)	214.6 (1610 , 63.4)
	4000	155.8 (1169, 46)	195.5 (1467, 57.7)	205.4 (1541, 60.7)	225.3 (1690, 66.5)	225.3 (1690, 66.5)	225.3 (1690 , 66.5)
	5000	145.8 (1094, 43.1)	169.7 (1273, 50.1)	185.6 (1392, 54.8)	215.3 (1616, 63.6)	225.3 (1690, 66.5)	225.3 (1690 , 66.5)
	6000	117.8 (884, 34.8)	156.3 (1173, 46.2)	168.5 (1264, 49.8)	205 (1538, 60.5)	215.1 (1614, 63.5)	229.3 (1720 , 67.7)
kPa (mmHg, inHg)							

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
Intake manifold pressure	<Map Value of Map – 22.4 kPa (168 mmHg, 6.6 inHg) (models without SI-DRIVE) <Map Value of Map – 20 kPa (150 mmHg, 5.9 inHg) (models with SI-DRIVE)

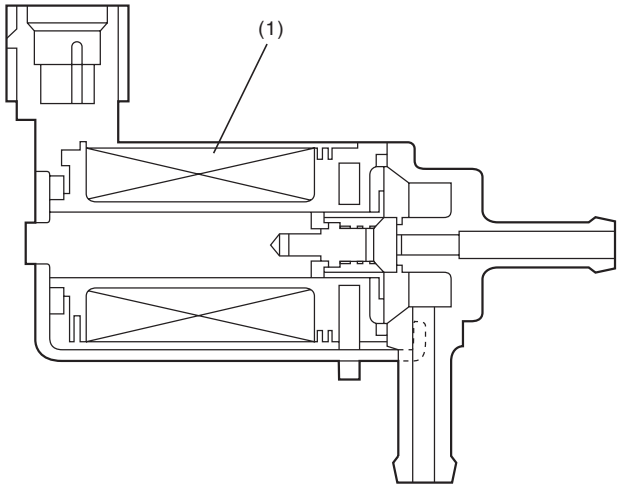
Time Needed for Diagnosis: Less than 1 second

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

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the wastegate control solenoid valve.
Judge as NG when the terminal output voltage remains Low during outputting the duty signal.

2. COMPONENT DESCRIPTION



EN-01772

(1) Coil

3. ENABLE CONDITIONS

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

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously 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
Terminal output voltage	Low
Duty ratio of wastegate control	< 75%

Time Needed for Diagnosis: 640 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 output voltage	High

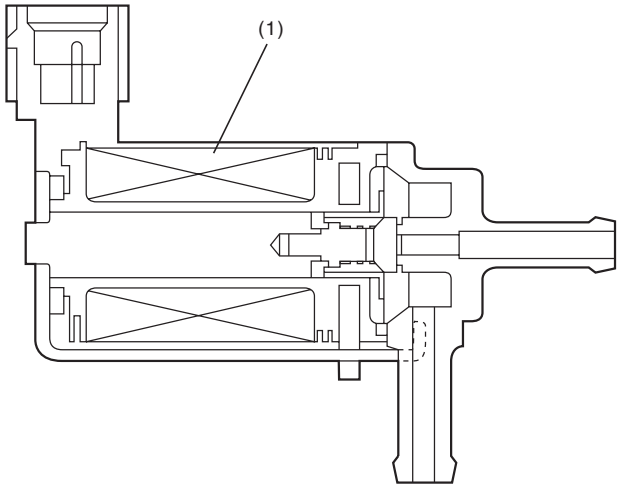
Time Needed for Diagnosis: Less than 1 second

BD:DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the wastegate control solenoid valve.
Judge as NG when the terminal output voltage remains Low or High during outputting the duty signal.

2. COMPONENT DESCRIPTION



EN-01772

(1) Coil

3. ENABLE CONDITIONS

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

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously 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
Terminal output voltage	High
Duty ratio of wastegate control	≥ 25%

Time Needed for Diagnosis: 640 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 output voltage	Low

Time Needed for Diagnosis: Less than 1 second

BE:DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-113, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BF: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
- 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	< 14 °
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	7000 rpm — 7100 rpm
Intake manifold pressure	≥ Value from Map 2
Battery voltage	≥ 8 V
Fuel parameter determination	Not extremely low volatility
Elapsed time after starting the engine	≥ 0 ms
Engine speed change during 32 milliseconds	< 1000 rpm

Map 1 (Models without SI-DRIVE)

rpm	750	1000	1500	2000	2500	3000	3500	4000
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)

rpm	4500	5000	5500	6000	6500	6700
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)

Map 1 (Models with SI-DRIVE)

rpm	700	1000	1500	2000	2500	3000	3500	4000
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)

rpm	4500	5000	5500	6000	6500	6700
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)

Map 2 (Models without SI-DRIVE)

- Normal ignition

		Barometric pressure (kPa (mmHg, inHg))						
		66.7 (500.0 , 19.7)	76.6 (575.0 , 22.6)	80 (600.0 , 23.6)	84 (630.0 , 24.8)	86.6 (650.0 , 25.6)	92 (690.0 , 27.2)	100.2 (752.0 , 29.6)
Engine speed (rpm)	700	23 (172.4 , 6.8)	23 (172.4 , 6.8)	23.7 (177.5 , 7)	25.4 (190.2 , 7.5)	26.7 (200.2 , 7.9)	26.5 (198.6 , 7.8)	27.9 (208.9 , 8.2)
	1000	20.4 (152.8 , 6)	20.4 (152.8 , 6)	20.8 (156.0 , 6.1)	22.7 (170.1 , 6.7)	23.2 (174.4 , 6.9)	23.9 (179.4 , 7.1)	25.1 (188.4 , 7.4)
	1500	20.7 (155.4 , 6.1)	20.7 (155.4 , 6.1)	21.5 (161.1 , 6.3)	22.6 (169.4 , 6.7)	23.3 (175.0 , 6.9)	24.4 (183.2 , 7.2)	25.8 (193.7 , 7.6)
	2000	20.1 (150.9 , 5.9)	20.1 (150.9 , 5.9)	20.9 (156.7 , 6.2)	22 (165.3 , 6.5)	22.8 (170.8 , 6.7)	23.6 (177.2 , 7)	24.8 (186.1 , 7.3)
	2500	20.2 (151.3 , 6)	20.2 (151.3 , 6)	20.9 (156.5 , 6.2)	21.9 (164.4 , 6.5)	22.5 (168.8 , 6.6)	23.2 (174.3 , 6.9)	24.4 (183.1 , 7.2)
	3000	21.4 (160.9 , 6.3)	21.4 (160.9 , 6.3)	20.7 (155.6 , 6.1)	21.9 (164.1 , 6.5)	22.6 (169.2 , 6.7)	23.6 (177.3 , 7)	24.3 (182.2 , 7.2)
	3500	25.1 (188.3 , 7.4)	25.1 (188.3 , 7.4)	25.8 (193.4 , 7.6)	27.1 (203.5 , 8)	27.8 (208.4 , 8.2)	29.2 (218.8 , 8.6)	29.3 (220.2 , 8.7)
	4000	25.7 (192.8 , 7.6)	25.7 (192.8 , 7.6)	26.5 (199.0 , 7.8)	28 (210.2 , 8.3)	28.9 (216.7 , 8.5)	29.4 (220.6 , 8.7)	29.5 (221.2 , 8.7)
	4500	25.8 (193.3 , 7.6)	25.8 (193.3 , 7.6)	26.3 (197.1 , 7.8)	27.5 (206.2 , 8.1)	28.7 (215.3 , 8.5)	29.1 (218.3 , 8.6)	29.2 (219.3 , 8.6)
	5000	30 (225.3 , 8.9)	30 (225.3 , 8.9)	30.6 (229.6 , 9)	31.3 (234.5 , 9.2)	32.1 (240.7 , 9.5)	33 (247.4 , 9.7)	33.2 (248.8 , 9.8)
	5500	33.8 (253.2 , 10)	33.8 (253.2 , 10)	34.2 (256.8 , 10.1)	35.5 (266.4 , 10.5)	36.2 (271.9 , 10.7)	37.2 (279.1 , 11)	37.2 (278.9 , 11)
	6000	37.9 (284.4 , 11.2)	37.9 (284.4 , 11.2)	38.2 (286.8 , 11.3)	39.3 (294.5 , 11.6)	40.2 (301.3 , 11.9)	40.8 (306.3 , 12.1)	41.6 (312.0 , 12.3)
	6500	42.6 (319.8 , 12.6)	42.6 (319.8 , 12.6)	43.4 (325.4 , 12.8)	44.5 (333.6 , 13.1)	45.5 (341.2 , 13.4)	47 (352.8 , 13.9)	47.2 (354.0 , 13.9)
	6700	43.4 (325.2 , 12.8)	43.4 (325.2 , 12.8)	44.1 (330.8 , 13)	45.2 (339.0 , 13.3)	46.2 (346.6 , 13.6)	47.7 (358.2 , 14.1)	47.9 (359.4 , 14.1)
kPa (mmHg, inHg)								

- Idling ignition

		Barometric pressure (kPa (mmHg, inHg))						
		66.7 (500.0 , 19.7)	76.6 (575.0 , 22.6)	80 (600.0 , 23.6)	84 (630.0 , 24.8)	86.6 (650.0 , 25.6)	92 (690.0 , 27.2)	100.2 (752.0 , 29.6)
Engine speed (rpm)	700	23 (172.4 , 6.8)	23 (172.4 , 6.8)	23.7 (177.5 , 7)	25.4 (190.2 , 7.5)	26.7 (200.2 , 7.9)	26.5 (198.6 , 7.8)	27.9 (208.9 , 8.2)
	1000	22.3 (167.3 , 6.6)	22.3 (167.3 , 6.6)	23 (172.6 , 6.8)	24.5 (184.2 , 7.3)	25.7 (192.8 , 7.6)	26.8 (201.0 , 7.9)	27 (202.3 , 8)
	1500	22.3 (167.6 , 6.6)	22.3 (167.6 , 6.6)	24.2 (181.9 , 7.2)	24.8 (185.7 , 7.3)	26.2 (196.7 , 7.7)	26.7 (200.0 , 7.9)	28.2 (211.8 , 8.3)
	2000	22 (164.8 , 6.5)	22 (164.8 , 6.5)	22.8 (170.9 , 6.7)	23.7 (177.8 , 7)	24.6 (184.7 , 7.3)	25.5 (191.6 , 7.5)	26.5 (198.4 , 7.8)
	2500	21.2 (158.9 , 6.3)	21.2 (158.9 , 6.3)	21.9 (164.3 , 6.5)	22.9 (171.7 , 6.8)	23.6 (177.2 , 7)	25.5 (191.6 , 7.5)	25.4 (190.3 , 7.5)
	3000	20.9 (156.4 , 6.2)	20.9 (156.4 , 6.2)	26.3 (197.6 , 7.8)	22.6 (169.7 , 6.7)	27.5 (206.2 , 8.1)	24.4 (183.1 , 7.2)	25.3 (189.5 , 7.5)
	3500	30 (225.3 , 8.9)	30 (225.3 , 8.9)	30.9 (231.8 , 9.1)	32 (240.4 , 9.5)	32.8 (246.0 , 9.7)	33.7 (252.5 , 9.9)	33.8 (253.7 , 10)
	4000	30.7 (230.0 , 9.1)	30.7 (230.0 , 9.1)	31.1 (233.6 , 9.2)	32.3 (242.7 , 9.6)	33.9 (254.5 , 10)	34.7 (260.6 , 10.3)	33.9 (254.4 , 10)
	4500	28.4 (213.4 , 8.4)	28.4 (213.4 , 8.4)	29 (217.2 , 8.6)	29.7 (222.9 , 8.8)	31.7 (237.5 , 9.3)	32.2 (241.8 , 9.5)	31.2 (234.1 , 9.2)
	5000	34.4 (257.9 , 10.2)	34.4 (257.9 , 10.2)	34.4 (257.7 , 10.1)	34.9 (261.8 , 10.3)	35.7 (268.1 , 10.6)	36.4 (272.8 , 10.7)	37 (277.6 , 10.9)
	5500	38.2 (286.5 , 11.3)	38.2 (286.5 , 11.3)	38.6 (289.8 , 11.4)	39.8 (298.3 , 11.7)	40.7 (305.1 , 12)	41.4 (310.8 , 12.2)	41.1 (308.3 , 12.1)
	6000	40.7 (305.0 , 12)	40.7 (305.0 , 12)	41.1 (308.6 , 12.2)	42.2 (316.8 , 12.5)	44.2 (331.3 , 13)	44.3 (332.3 , 13.1)	44.2 (331.3 , 13)
	6500	46.3 (347.3 , 13.7)	46.3 (347.3 , 13.7)	46.6 (349.9 , 13.8)	47.8 (358.4 , 14.1)	48.9 (366.5 , 14.4)	49.7 (372.9 , 14.7)	50.4 (377.9 , 14.9)
	6700	47 (352.7 , 13.9)	47 (352.7 , 13.9)	47.4 (355.3 , 14)	48.5 (363.8 , 14.3)	49.6 (371.9 , 14.6)	50.4 (378.3 , 14.9)	51.1 (383.3 , 15.1)
kPa (mmHg, inHg)								

Map 2 (Models with SI-DRIVE)

- Normal ignition

		Barometric pressure (kPa (mmHg, inHg))						
		66.7 (500, 19.7)	76.6 (575, 22.6)	80 (600, 23.6)	84 (630, 24.8)	86.6 (650, 25.6)	92 (690, 27.2)	100.2 (752, 29.6)
Engine speed (rpm)	700	26.7 (200.0 , 7.9)	26.7 (200.0 , 7.9)	27.3 (205.0 , 8.1)	28.4 (213.0 , 8.4)	29.3 (220.0 , 8.7)	29.9 (224.0 , 8.8)	28.8 (216.0 , 8.5)
	1000	23.9 (179.0 , 7)	23.9 (179.0 , 7)	24.9 (187.0 , 7.4)	25.5 (191.0 , 7.5)	25.9 (194.0 , 7.6)	27.5 (206.0 , 8.1)	28.6 (214.7 , 8.5)
	1500	22.4 (168.0 , 6.6)	22.4 (168.0 , 6.6)	23.3 (175.0 , 6.9)	24.1 (181.0 , 7.1)	24.7 (185.0 , 7.3)	24.8 (186.0 , 7.3)	24.9 (186.9 , 7.4)
	2000	23.2 (174.0 , 6.9)	23.2 (174.0 , 6.9)	24 (180.0 , 7.1)	25.5 (191.0 , 7.5)	26.1 (196.0 , 7.7)	25.6 (192.0 , 7.6)	25.3 (189.5 , 7.5)
	2500	23.9 (179.0 , 7)	23.9 (179.0 , 7)	24.5 (184.0 , 7.2)	25.5 (191.0 , 7.5)	26 (195.0 , 7.7)	25.5 (191.0 , 7.5)	25.1 (188.6 , 7.4)
	3000	24.7 (185.0 , 7.3)	24.7 (185.0 , 7.3)	25.3 (190.0 , 7.5)	25.6 (192.0 , 7.6)	26.1 (196.0 , 7.7)	25.9 (194.0 , 7.6)	25.8 (193.3 , 7.6)
	3500	29.1 (218.5 , 8.6)	29.1 (218.5 , 8.6)	29.8 (223.5 , 8.8)	29.9 (224.5 , 8.8)	31.3 (234.5 , 9.2)	31.5 (236.0 , 9.3)	29.5 (221.5 , 8.7)
	4000	29.2 (219.0 , 8.6)	29.2 (219.0 , 8.6)	29.9 (224.0 , 8.8)	30.5 (229.0 , 9)	30.8 (231.0 , 9.1)	31.7 (238.0 , 9.4)	32.3 (242.2 , 9.5)
	4500	29.3 (219.5 , 8.6)	29.3 (219.5 , 8.6)	30.3 (227.5 , 9)	30.9 (231.5 , 9.1)	31.4 (235.5 , 9.3)	32.1 (241.0 , 9.5)	32.6 (244.2 , 9.6)
	5000	30.4 (228.1 , 9)	30.4 (228.1 , 9)	30.7 (230.1 , 9.1)	31.7 (238.1 , 9.4)	32.1 (241.1 , 9.5)	32.7 (245.0 , 9.6)	33.1 (248.0 , 9.8)
	5500	33.4 (250.6 , 9.9)	33.4 (250.6 , 9.9)	34.2 (256.6 , 10.1)	34.9 (261.6 , 10.3)	35.1 (263.6 , 10.4)	35.7 (268.0 , 10.6)	36.1 (271.0 , 10.7)
	6000	37.5 (281.1 , 11.1)	37.5 (281.1 , 11.1)	38 (285.1 , 11.2)	38.8 (291.1 , 11.5)	39.1 (293.1 , 11.5)	40.3 (302.0 , 11.9)	40.9 (306.9 , 12.1)
	6500	42.6 (319.6 , 12.6)	42.6 (319.6 , 12.6)	43.3 (324.6 , 12.8)	43.9 (329.6 , 13)	43.8 (328.6 , 12.9)	44.9 (337.0 , 13.3)	45.6 (341.7 , 13.5)
	6700	43.3 (325, 12.8)	43.3 (325, 12.8)	44 (330, 13)	44.7 (335, 13.2)	44.5 (334, 13.1)	45.6 (342, 13.5)	46.3 (347.1442749, 13.7)
kPa (mmHg, inHg)								

• Idling ignition

		Barometric pressure (kPa (mmHg, inHg))						
		66.7 (500, 19.7)	76.6 (575 , 22.6)	80 (600 , 23.6)	84 (630 , 24.8)	86.6 (650 , 25.6)	92 (690 , 27.2)	100.2 (752 , 29.6)
Engine speed (rpm)	700	26.7 (200.0 , 7.9)	26.7 (200.0 , 7.9)	27.3 (205.0 , 8.1)	28.4 (213.0 , 8.4)	29.3 (220.0 , 8.7)	29.9 (224.0 , 8.8)	28.8 (216.0 , 8.5)
	1000	25.1 (188.0 , 7.4)	25.1 (188.0 , 7.4)	26 (195.0 , 7.7)	26.9 (202.0 , 8)	28 (210.0 , 8.3)	28.7 (215.0 , 8.5)	30.4 (228.1 , 9)
	1500	22.9 (172.0 , 6.8)	22.9 (172.0 , 6.8)	23.3 (175.0 , 6.9)	23.9 (179.0 , 7)	24.7 (185.0 , 7.3)	24.9 (187.0 , 7.4)	26.7 (200.6 , 7.9)
	2000	23.2 (174.0 , 6.9)	23.2 (174.0 , 6.9)	23.7 (178.0 , 7)	24.4 (183.0 , 7.2)	25.1 (188.0 , 7.4)	25.3 (190.0 , 7.5)	27.8 (208.5 , 8.2)
	2500	23.2 (174.0 , 6.9)	23.2 (174.0 , 6.9)	23.7 (178.0 , 7)	24.5 (184.0 , 7.2)	24.8 (186.0 , 7.3)	25.3 (190.0 , 7.5)	26.6 (199.7 , 7.9)
	3000	24.3 (182.0 , 7.2)	24.3 (182.0 , 7.2)	24.9 (187.0 , 7.4)	25.9 (194.0 , 7.6)	25.9 (194.0 , 7.6)	26.1 (196.0 , 7.7)	26.6 (199.7 , 7.9)
	3500	31.7 (237.5 , 9.4)	31.7 (237.5 , 9.4)	31.4 (235.5 , 9.3)	32.6 (244.5 , 9.6)	33.1 (248.5 , 9.8)	34.6 (259.5 , 10.2)	35.2 (264.0 , 10.4)
	4000	32.1 (241.0 , 9.5)	32.1 (241.0 , 9.5)	32.3 (242.0 , 9.5)	33.2 (249.0 , 9.8)	33.7 (253.0 , 10)	34.9 (262.0 , 10.3)	36 (270.0 , 10.6)
	4500	32.1 (240.5 , 9.5)	32.1 (240.5 , 9.5)	32.1 (240.5 , 9.5)	33 (247.5 , 9.7)	33.9 (254.5 , 10)	35.5 (266.5 , 10.5)	35.3 (265.1 , 10.4)
	5000	35.5 (266.1 , 10.5)	35.5 (266.1 , 10.5)	34.4 (258.1 , 10.2)	35.3 (265.1 , 10.4)	35.7 (268.1 , 10.6)	37.3 (280.1 , 11)	37.2 (279.2 , 11)
	5500	38.1 (285.6 , 11.2)	38.1 (285.6 , 11.2)	37.5 (281.6 , 11.1)	38.5 (288.6 , 11.4)	39.5 (296.6 , 11.7)	40.3 (302.6 , 11.9)	40.7 (305.2 , 12)
	6000	41.6 (312.1 , 12.3)	41.6 (312.1 , 12.3)	41.5 (311.1 , 12.2)	42.8 (321.1 , 12.6)	43.5 (326.1 , 12.8)	45.6 (342.1 , 13.5)	45.4 (340.3 , 13.4)
	6500	48.6 (364.6 , 14.4)	48.6 (364.6 , 14.4)	49.3 (369.6 , 14.6)	48.6 (364.6 , 14.4)	49.4 (370.6 , 14.6)	49.4 (370.6 , 14.6)	53.4 (400.7 , 15.8)
	6700	49.3 (370, 14.6)	49.3 (370, 14.6)	50 (375, 14.8)	49.3 (370, 14.6)	50.1 (376, 14.8)	50.1 (376, 14.8)	54.1 (406.1514536, 16)
kPa (mmHg, inHg)								

3. GENERAL DRIVING CYCLE

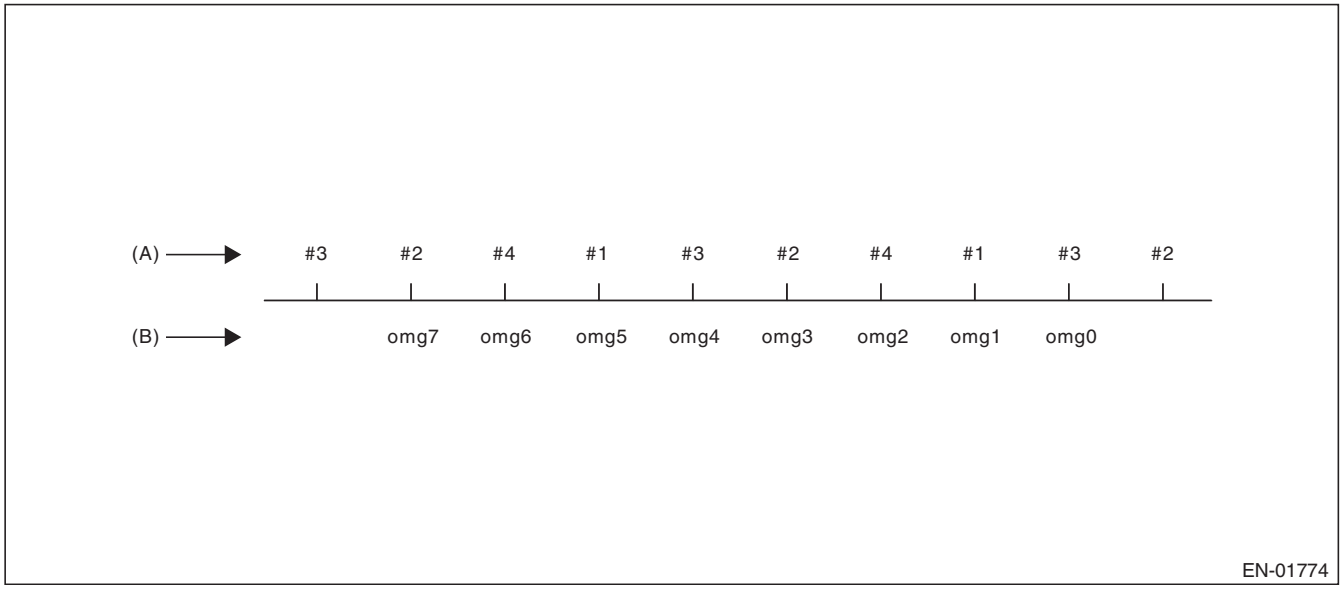
• If conditions are met, it is possible to detect the misfires from idling to high engine speed. However, in case any engine load or breakage occurs, perform with the engine at idle.
• Perform the diagnosis continuously.

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 value)
	• 180° Interval Difference Method • 360° Interval Difference Method • 720° Interval Difference Method	• FTP 1.5 times misfire NG judgment • Catalyst damage misfire NG judgment

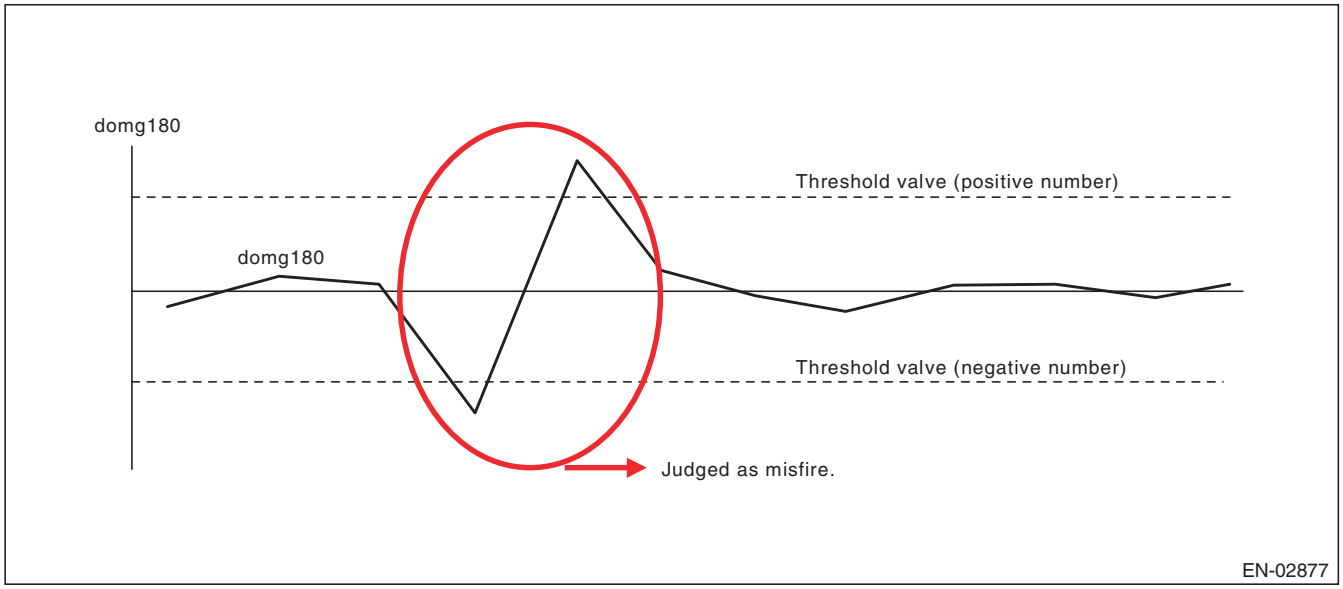
As shown in the following figure, pick a cylinder as the standard and name it omg 0. And the former crankshaft position speed is named omg 1, the second former crankshaft position speed is named omg 2, the third is named omg 3, etc.



(A) Ignition order (B) Crankshaft position speed

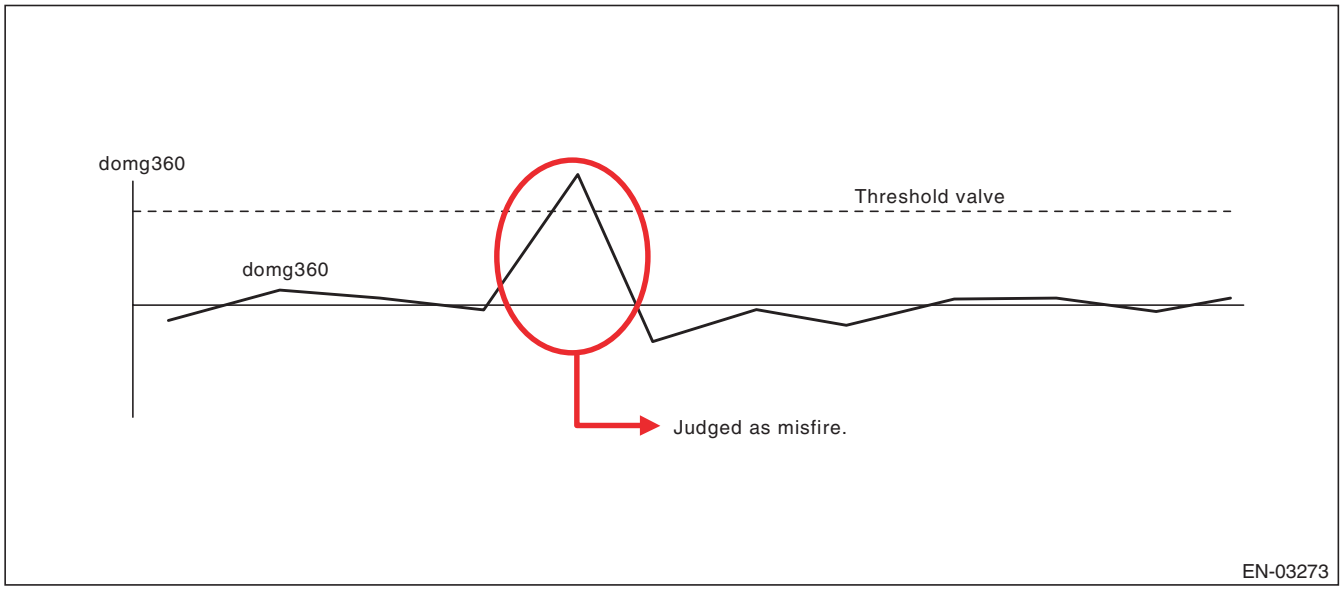
180° Interval Difference Method

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 (Diagnostic value before 180° CA)	



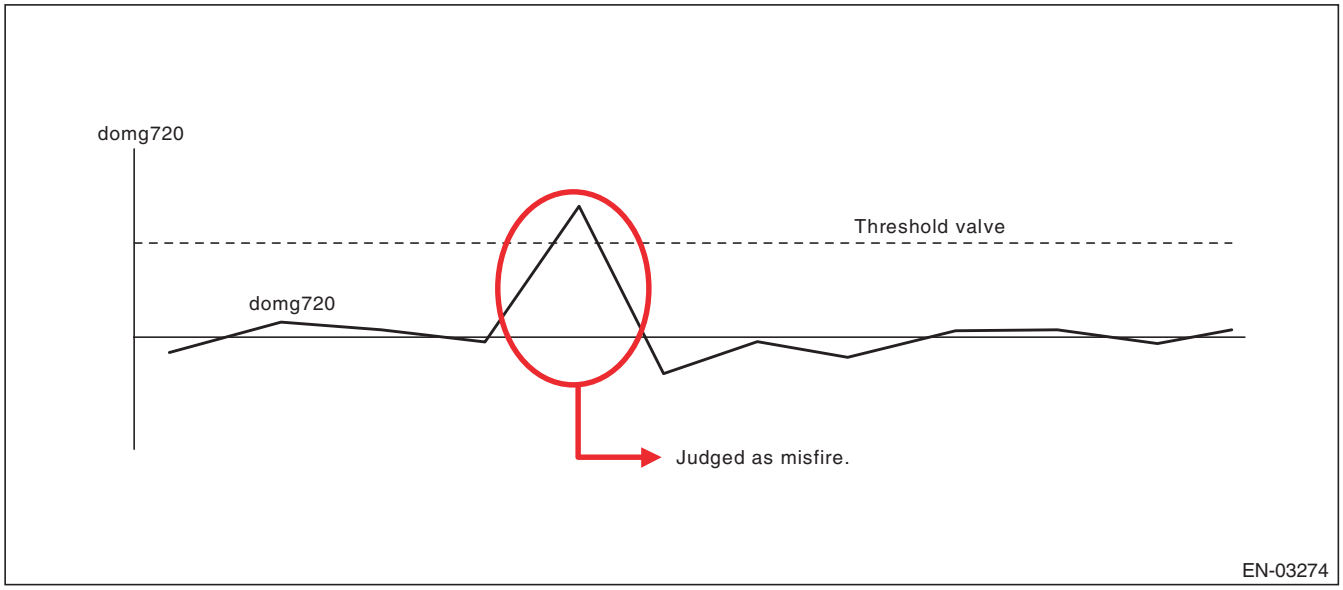
360° Interval Difference Method

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 diagnostic value	≥ 17 × 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 diagnostic value	< 17 × 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 diagnostic value	≥ Value from Map 3

Map 3 (Models without SI-DRIVE)

		Intake air (g(oz)/rev)									
		0.2 (0.01)	0.4 (0.01)	0.6 (0.02)	0.8 (0.03)	1 (0.04)	1.2 (0.04)	1.4 (0.05)	1.6 (0.06)	1.8 (0.06)	2 (0.07)
Engine speed (rpm)	700	100	100	100	100	100	90	90	90	90	90
	1000	100	100	100	100	92	85	85	85	85	85
	1500	100	100	100	90	85	85	85	72	72	72
	2000	100	90	90	73	58	43	40	36	32	20
	2500	100	87	57	45	39	36	34	32	30	20
	3000	100	87	58	39	36	36	32	30	28	20
	3500	98	74	43	27	23	22	20	20	20	20
	4000	69	61	40	27	22	20	20	20	20	20
	4500	60	55	34	25	20	20	20	20	20	20
	5000	55	55	34	23	20	20	20	20	20	20
	5500	54	54	33	22	20	20	20	20	20	20
	6000	52	52	32	21	20	20	20	20	20	20
	6500	50	50	30	20	20	20	20	20	20	20
	6700	50	50	30	20	20	20	20	20	20	20

Map 3 (Models with SI-DRIVE)

		Intake air (g(oz)/rev)									
		0.2 (0.01)	0.4 (0.01)	0.6 (0.02)	0.8 (0.03)	1 (0.04)	1.2 (0.04)	1.4 (0.05)	1.6 (0.06)	1.8 (0.06)	2 (0.07)
Engine speed (rpm)	700	148	128	116	106	100	90	90	90	90	90
	1000	148	128	114	104	92	85	85	85	85	85
	1500	140	118	102	90	85	85	85	72	72	72
	2000	128	90	90	73	58	43	40	36	32	20
	2500	116	87	57	45	39	36	34	32	30	20
	3000	108	87	58	39	36	36	32	30	28	20
	3500	74	74	43	27	23	22	20	20	20	20
	4000	61	61	40	27	22	20	20	20	20	20
	4500	55	55	34	25	20	20	20	20	20	20
	5000	55	55	34	23	20	20	20	20	20	20
	5500	54	54	33	22	20	20	20	20	20	20
	6000	52	52	32	21	20	20	20	20	20	20
	6500	50	50	30	20	20	20	20	20	20	20
	6700	50	50	30	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 diagnostic value	< Value of Map 3

Time Needed for Diagnosis: 200 engine revs.

BG:DTC P0302 CYLINDER 2 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-113, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BH:DTC P0303 CYLINDER 3 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-113, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BI: DTC P0304 CYLINDER 4 MISFIRE DETECTED

1. OUTLINE OF DIAGNOSIS

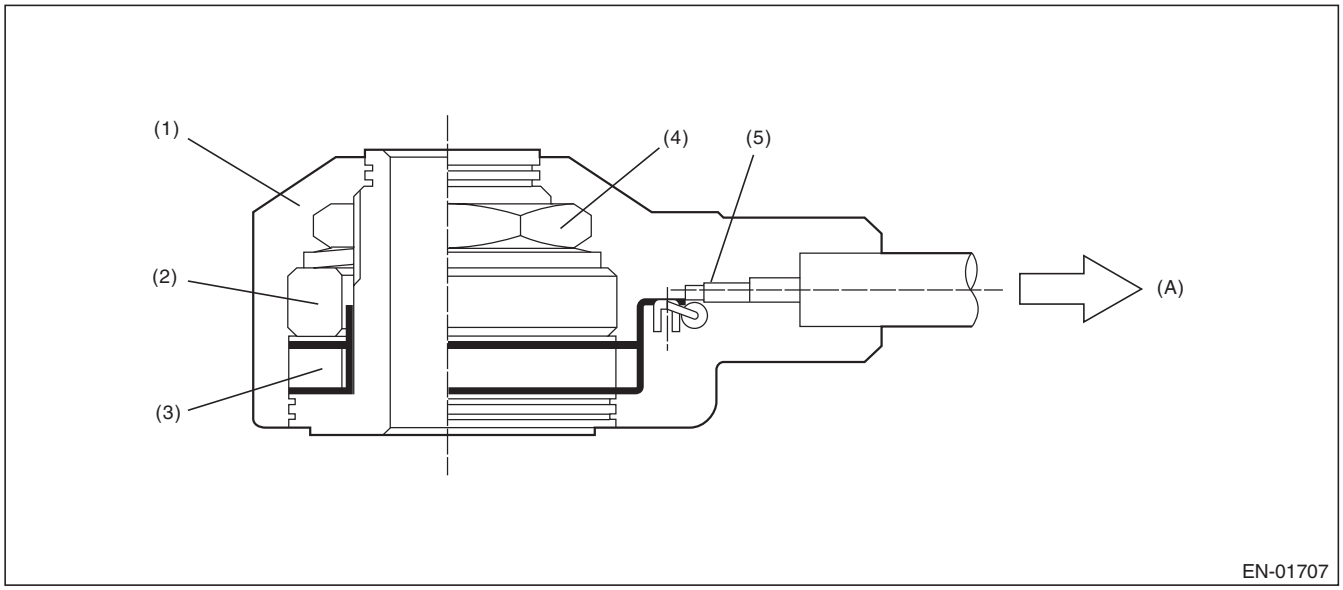
NOTE:
For the detection standard, refer to DTC P0301. <Ref. to GD(H4DOTC)-113, DTC P0301 CYLINDER 1 MISFIRE DETECTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BJ: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

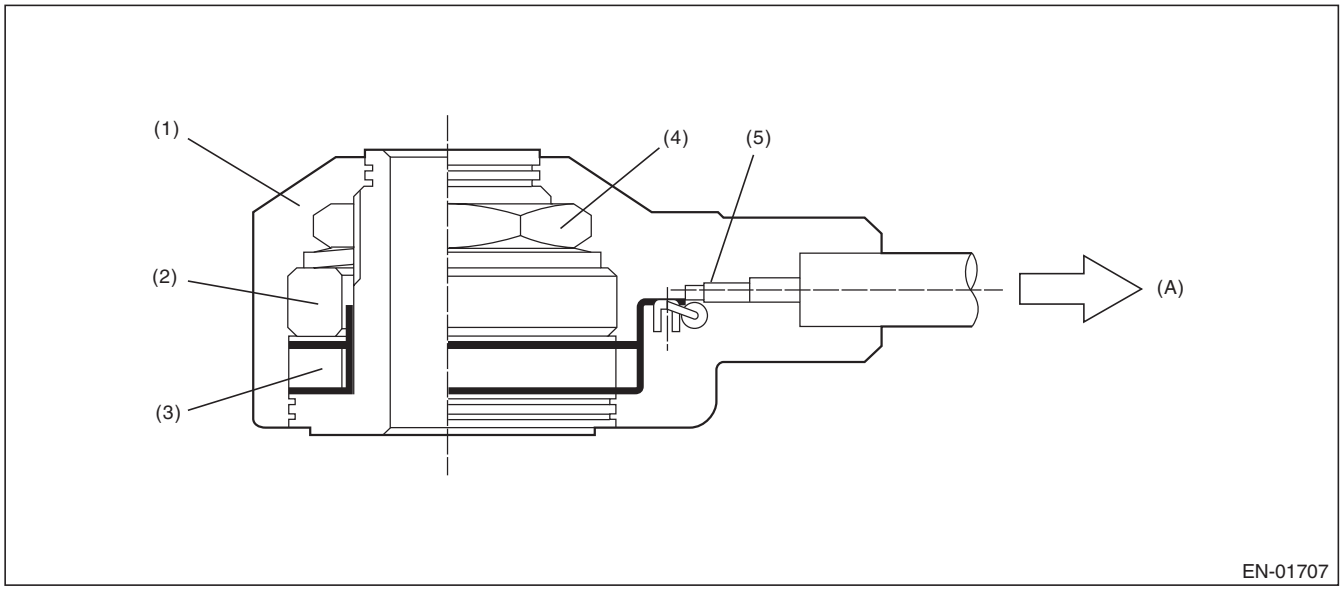
Time Needed for Diagnosis: Less than 1 second

BK: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

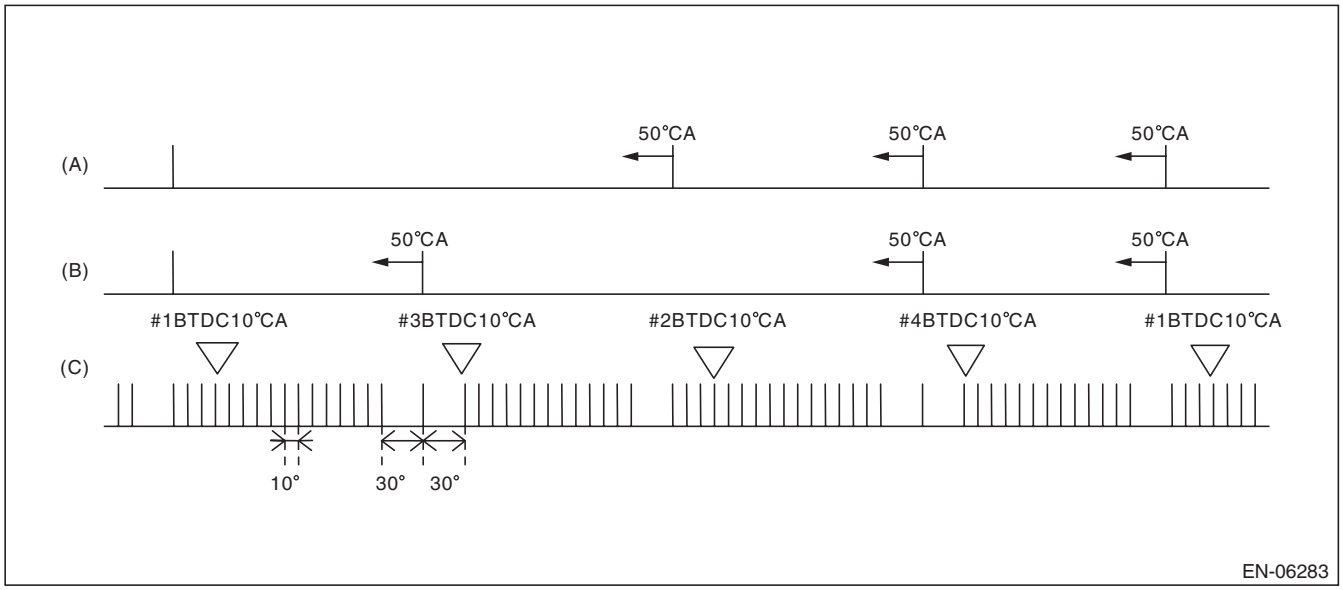
Time Needed for Diagnosis: Less than 1 second

BL:DTC P0335 CRANKSHAFT POSITION SENSOR “A” CIRCUIT

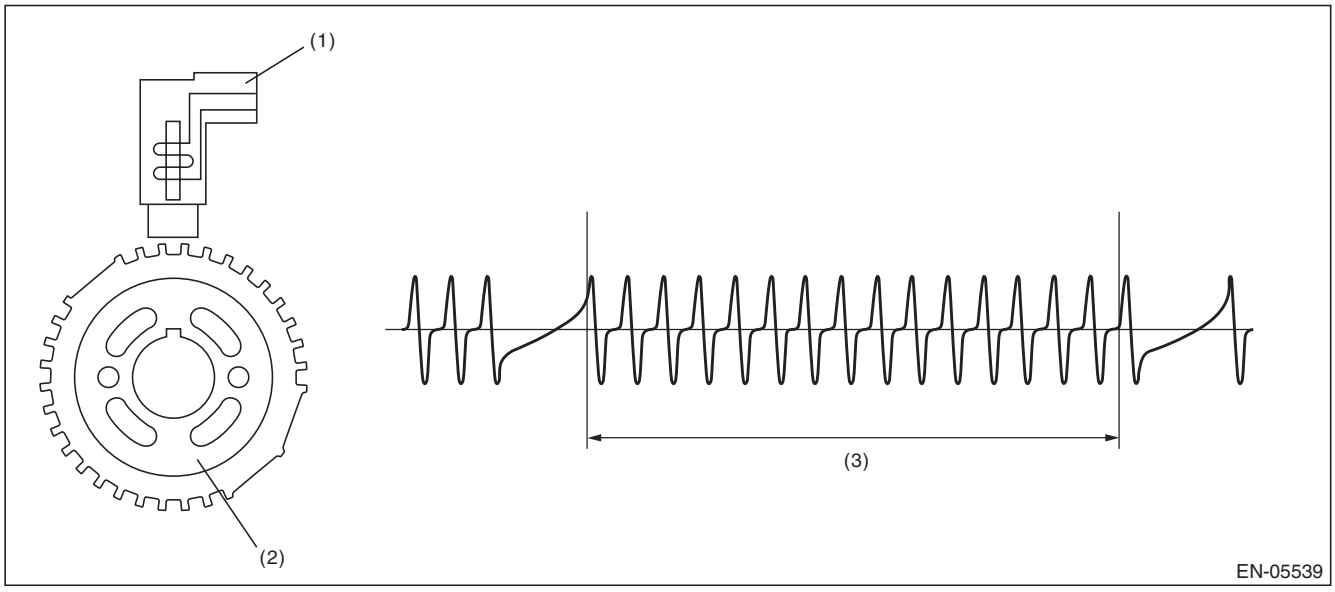
1. OUTLINE OF DIAGNOSIS

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) Camshaft signal (RH) (B) Camshaft signal (LH) (C) 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

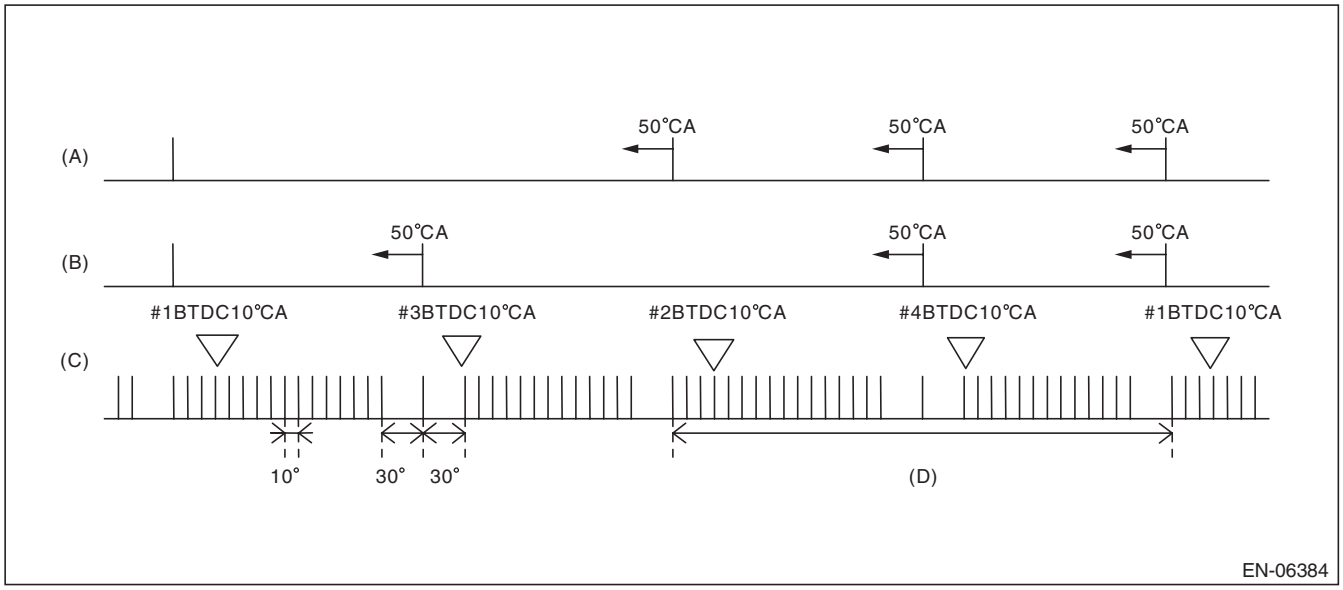
Time Needed for Diagnosis: Less than 1 second

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

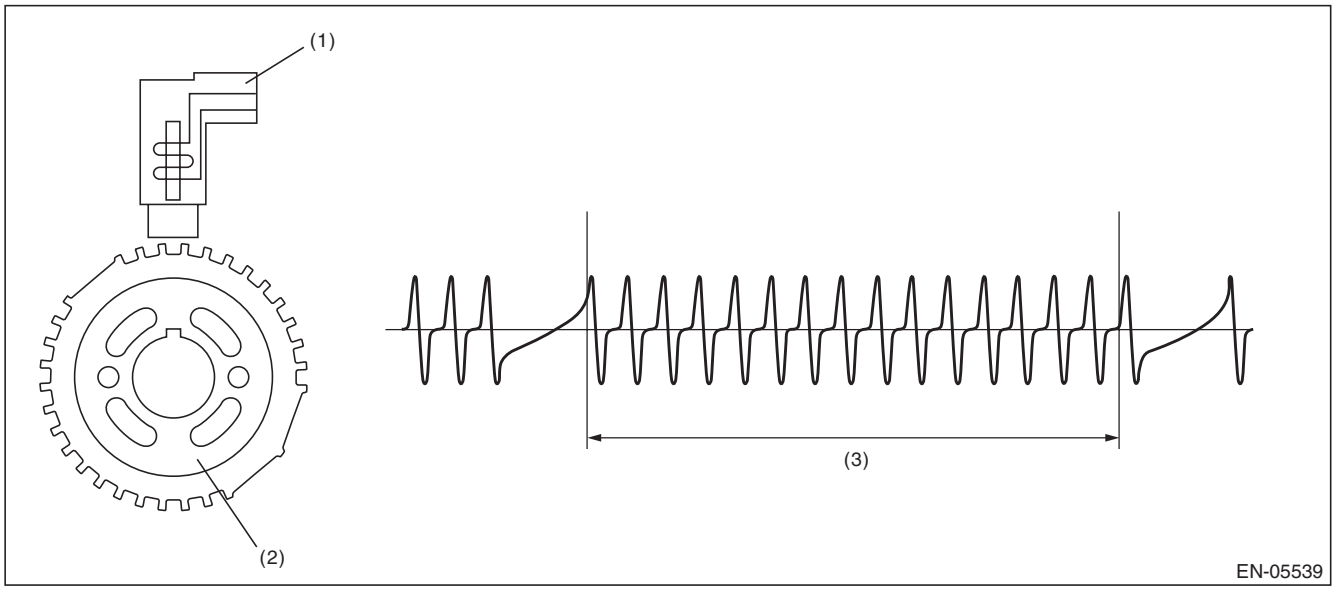
1. OUTLINE OF DIAGNOSIS

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) Camshaft signal (RH)
(B) Camshaft signal (LH)
(C) Crankshaft signal
(D) Number of crankshaft signals = 30 is normal



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

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Engine speed	< 3000 rpm

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously under 3000 rpm engine speed.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge 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

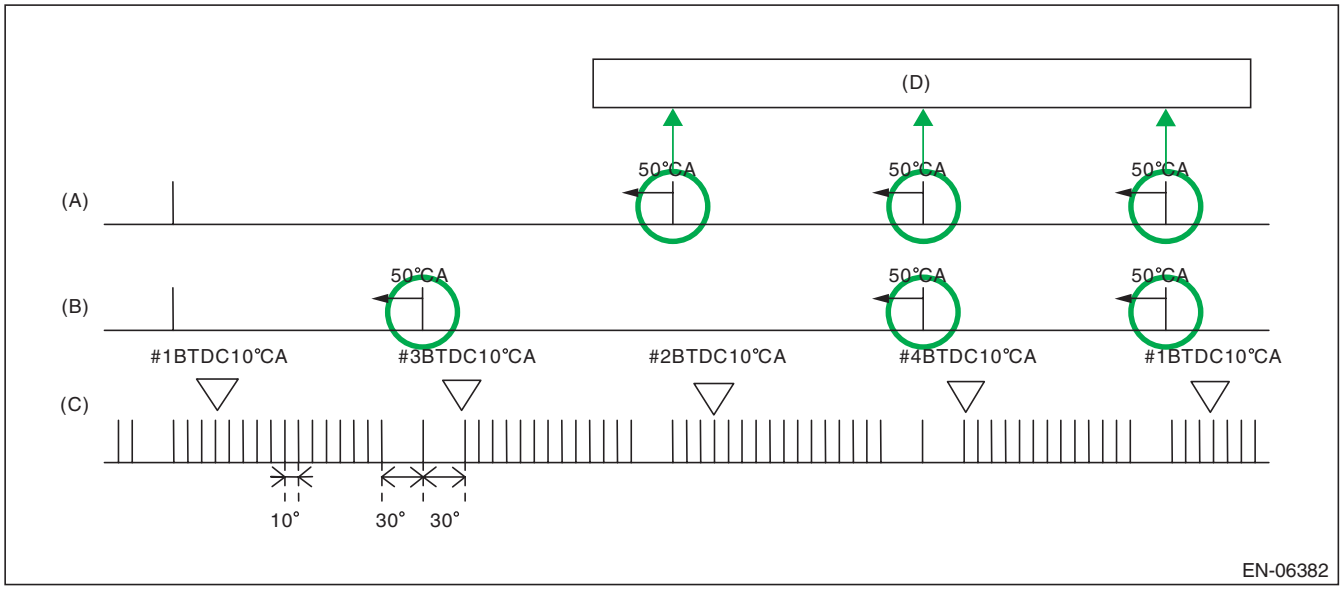
Time Needed for Diagnosis: Less than 1 second

BN: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.
When there is no camshaft position signal input continuously, judge as NG.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)
(B) Camshaft signal (LH)
(C) Crankshaft signal
(D) Camshaft position signal: When normal, there will be 3 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITIONS

Diagnosis 1

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 200 ms

Diagnosis 2

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Starter	ON

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Diagnosis 1

Judge as NG when no input of camshaft position sensor signal in TDC remains for 14 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
No camshaft position sensor signal input in TDC	≥ 14 time(s)

Time Needed for Diagnosis: TDC × 14 time(s)

Diagnosis 2

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
Camshaft position sensor signal	No input

Time Needed for Diagnosis: 3000 ms

Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Diagnosis 1

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

Judgment Value

Malfunction Criteria	Threshold Value
No camshaft position sensor signal input in TDC	= 0 time(s)

Time Needed for Diagnosis: TDC × 14 time(s)

Diagnosis 2

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
Camshaft position sensor signal	Input exists

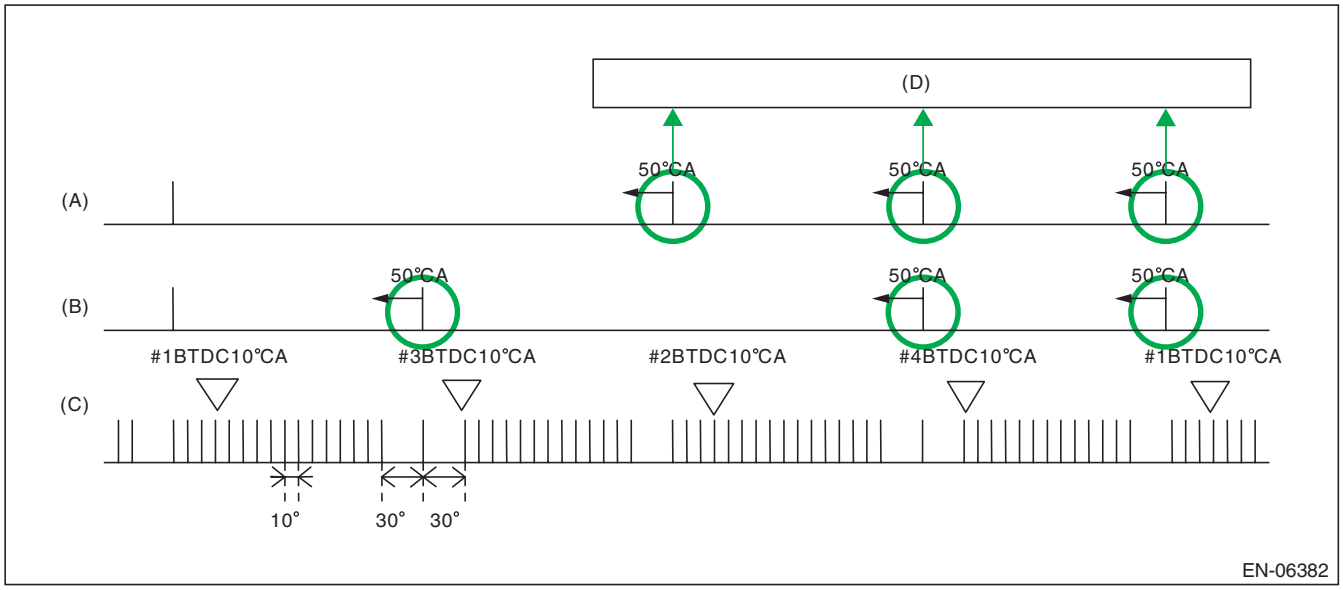
Time Needed for Diagnosis: 32 ms

BO: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 property.
Judge as NG when the number of camshaft signals remains abnormal.

2. COMPONENT DESCRIPTION



(A) Camshaft signal (RH)
(B) Camshaft signal (LH)
(C) Crankshaft signal
(D) Camshaft position signal: When normal, there will be 3 camshaft position signals for every 2 crankshaft revolutions.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 200 ms

4. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

5. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the status where the number of camshaft position sensor signal in two crankshaft revolutions is other than 3 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs of crankshaft.	≠ 3 time(s)

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 when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	= 3 time(s)

Time Needed for Diagnosis: Two engine revs.

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

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0340. <Ref. to GD(H4DOTC)-131, DTC P0340 CAMSHAFT POSITION SENSOR “A” CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BQ:DTC P0346 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0341. <Ref. to GD(H4DOTC)-133, DTC P0341 CAMSHAFT POSITION SENSOR "A" CIRCUIT RANGE/PERFORMANCE (BANK 1 OR SINGLE SENSOR), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BR:DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

Based on the self-diagnostic result of the ignition coil driving IC, judge the ignition coil driving circuit as normal or abnormal.
The ignition coil driving IC detects “no ignition” status as a malfunction.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	> 1 s
Engine speed	> 500 rpm
Ignition energization time	> 2000 μs
Ignition status	Not during ignition cut

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Ignition driving IC information	Malfunction

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 following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Ignition driving IC information	Normal

Time Needed for Diagnosis: Less than 1 second

BS:DTC P0352 IGNITION COIL B PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0351. <Ref. to GD(H4DOTC)-135, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BT:DTC P0353 IGNITION COIL C PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0351. <Ref. to GD(H4DOTC)-135, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BU:DTC P0354 IGNITION COIL D PRIMARY/SECONDARY CIRCUIT

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0351. <Ref. to GD(H4DOTC)-135, DTC P0351 IGNITION COIL A PRIMARY/SECONDARY CIRCUIT, Diagnostic Trouble Code (DTC) Detecting Criteria.>

BV:DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the camshaft position sensor.
When there is no camshaft position signal input continuously, judge as NG.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 200 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as NG when no input of camshaft position sensor signal in TDC remains for 15 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
No camshaft position sensor signal input in TDC	≥ 15 time(s)

Time Needed for Diagnosis: TDC × 15 time(s)
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
No camshaft position sensor signal input in TDC	= 0 time(s)

Time Needed for Diagnosis: Two engine revs.

BW:DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of camshaft position sensor property.
Judge as NG when the number of camshaft signals remains abnormal.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 8 V
Elapsed time after starting the engine	≥ 200 ms

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the status where the number of camshaft position sensor signal in two crankshaft revolutions is other than 2 time(s).

Judgment Value

Malfunction Criteria	Threshold Value
Amount of camshaft sensor signal during 2 revs of crankshaft.	≠ 2 time(s)

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 when the malfunction criteria below are met.

Judgment Value

Malfunction Criteria	Threshold Value
Camshaft position sensor signal	= 2 time(s)

Time Needed for Diagnosis: Two engine revs.

BX:DTC P0390 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0365. <Ref. to GD(H4DOTC)-136, DTC P0365 CAMSHAFT POSITION SENSOR “B” CIRCUIT (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BY:DTC P0391 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0366. <Ref. to GD(H4DOTC)-137, DTC P0366 CAMSHAFT POSITION SENSOR B CIRCUIT RANGE/PERFORMANCE (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

BZ:DTC P0410 SECONDARY AIR INJECTION SYSTEM

1. OUTLINE OF DIAGNOSIS

Detect NG judging from secondary air delivery pipe pressure, pulse of secondary air delivery pipe pressure and secondary air pipe airflow amount.

2. ENABLE CONDITIONS

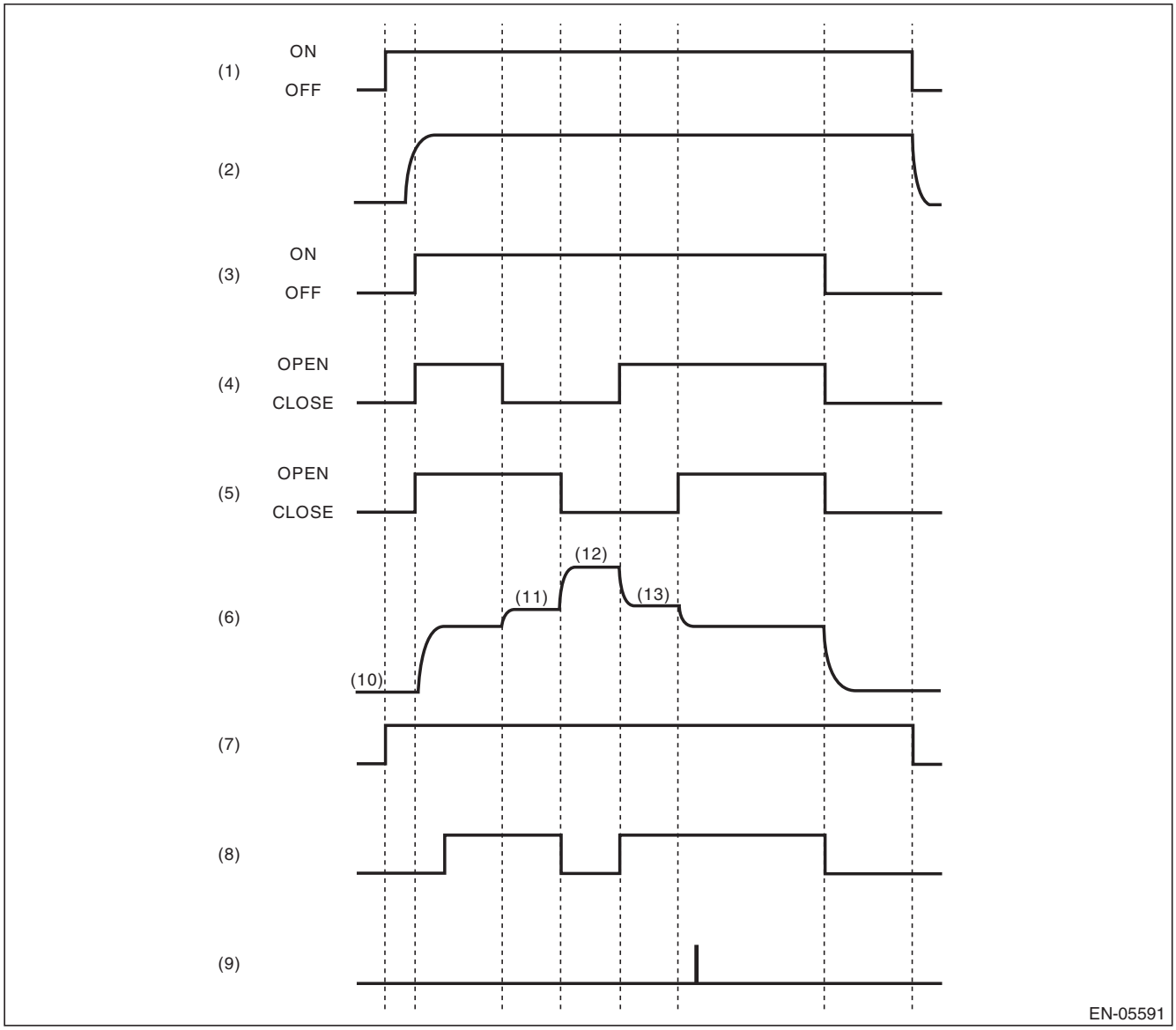
Secondary Parameters	Enable Conditions
Pump supply pressure check	
Estimate ambient temperature	≥ 4.4 °C
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Engine	In operation
Amount of intake air	≥ 2 g/s (0.07 oz/s)
Secondary air pump	Operating
Combination valve	Bank open (Except with both banks closed)
Combination valve both closed pulse diagnosis	
Estimate ambient temperature	≥ 4.4 °C
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Engine	In operation
Engine load	≥ 0.2 g/rev (0.01 oz/rev)
After fuel cut	≥ 1000 ms
Combination valve changeover pressure diagnosis	
Estimate ambient temperature	≥ 4.4 °C
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Engine	In operation
Amount of intake air	> 2 g/s (0.07 oz/s) and < 25 g/s (0.88 oz/s)
Engine speed	< 4000 rpm
After fuel cut	≥ 1000 ms
Overflow diagnosis	
Estimate ambient temperature	≥ 4.4 °C
Battery voltage	≥ 10.9 V
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Engine	In operation

3. GENERAL DRIVING CYCLE

Perform diagnosis during secondary air pump operation

4. DIAGNOSTIC METHOD

Measure secondary air delivery pipe pressure, pulse of secondary air delivery pipe pressure and secondary air pipe airflow amount.



(1) IG
(2) Ne
(3) Secondary air pump operating status
(4) E-COMB valve (right hand) status
(5) E-COMB valve (left hand) status
(6) Secondary air delivery pipe pressure (psi)
(7) Diagnosis enable condition
(8) Pump supply pressure check (judgment)
(9) Flow amount check (judgment)
(10) Barometric pressure (Pas) measurement before secondary air control
(11) Right bank all closed pressure (P0R) measurement
(12) Both banks all closed pressure (P0RL) measurement
(13) Left bank all closed pressure (P0L) measurement

Pump supply pressure check

Perform the system function diagnosis with how much the pressure rises when the secondary air pump is turned from OFF to ON.
Judge as NG if delivery pipe pressure does not rise though it should when the secondary air pump turns OFF → ON.

- **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
Secondary air supply pipe pressure (after barometric pressure compensation)	< 0.9 kPa (7 mmHg, 0.3 inHg)	P0410

Time Needed for Diagnosis: 2000 ms + 2800 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	DTC
Secondary air supply pipe pressure (after barometric pressure compensation)	≥ 0.9 kPa (7 mmHg, 0.3 inHg)	P0410

Time Needed for Diagnosis: 2000 ms + 2800 ms

Combination valve both closed pulse diagnosis

Perform open stuck diagnosis of both combination valves using delivery pipe pressure pulse when both combination valves are closed. Determine which side of valves is stuck open by comparing secondary air flow amount when RH combination valve is closed with that when LH combination valve is closed.
Calculate voltage pulse of the pump delivery pipe pressure when both combination valves are closed. The calculation should be small because there is no pulse from supply pipe pressure with both combination valves closed. When the calculation is large, determine that either of the combination valves is stuck open.
Determine which side of valves is stuck open by comparing secondary air flow amount when the RH combination valve is closed with that when the LH combination valve is closed. Air flow amount is larger on the open stuck valve.

- **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
Pulse calculation value when both combination valves are closed	> Value of Map 3	P2440
Air flow amount when the right bank is closed (value from Map 4)	≥ Air flow amount when the left bank is closed (value from Map 5)	
Pulse calculation value when both combination valves are closed	> Value of Map 3	P2442
Air flow amount when the left bank is closed (value from Map 5)	> Air flow amount when the right bank is closed (value from Map 4)	

Time Needed for Diagnosis: 4000 ms + 992 ms + 992 ms + 992 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	DTC
Pulse calculation value when both combination valves are closed	≤ Value of Map 3	P2440, P2442

Time Needed for Diagnosis: 4000 ms + 992 ms + 992 ms + 992 ms

Combination valve changeover pressure diagnosis

Perform the RH combination valve stuck closed diagnosis with the variation of delivery pipe pressure when the RH combination valve turns closed → open.
Delivery pipe pressure should vary when the RH combination valve turns closed → open. When the variation is small, determine that the RH combination valve is stuck closed.

- **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
Pressure variation value when the RH combination valve is switched	< Value of Map 6	P2441

Time Needed for Diagnosis: 4000 ms + 992 ms + 992 ms + 992 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	DTC
Pressure variation value when the RH combination valve is switched	≥ Value of Map 6	P2441

Time Needed for Diagnosis: 4000 ms + 992 ms + 992 ms + 992 ms
Perform the LH combination valve stuck closed diagnosis with the variation of delivery pipe pressure when the LH combination valve turns open → closed.
Delivery pipe pressure should vary when the LH combination valve turns open → closed. When the variation is small, determine that the LH combination valve is stuck closed.

- **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
Pressure variation value when the LH combination valve is switched	< Value of Map 7	P2443

Time Needed for Diagnosis: 4000 ms + 992 ms + 992 ms + 992 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	DTC
Pressure variation value when the LH combination valve is switched	≥ Value of Map 7	P2443

Time Needed for Diagnosis: 4000 ms + 992 ms + 992 ms + 992 ms

Overflow diagnosis

Perform secondary air system flow abnormality diagnosis using both sides of combination valves secondary air amount when both are closed.
Judge as secondary air system flow abnormality either if there is excessive secondary air flow amount with the RH combination valve closed, or if there is excessive secondary air flow amount with the LH combination valve closed.

- **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
Air flow amount when the right bank is closed (value from Map 4)	> Value of Map 8	P0411
or		
Air flow amount when the left bank is closed (value from Map 5)	> Value of Map 9	
Voltage at P0RL measurement – Voltage at P0R measurement	≤ 4 V	
Voltage at P0RL measurement – Voltage at P0L measurement	≤ 4 V	

P0RL: Both banks all closed pressure
P0R: Right bank all closed pressure
P0L: Left bank all closed pressure

Time Needed for Diagnosis: 4000 ms + 992 ms + 992 ms + 992 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	DTC
Air flow amount when the right bank is closed (value from Map 4)	≤ Value of Map 8	P0411
or		
Air flow amount when the left bank is closed (value from Map 5)	≤ Value of Map 9	
Voltage at P0RL measurement – Voltage at P0R measurement	≤ 4 V	
Voltage at P0RL measurement – Voltage at P0L measurement	≤ 4 V	

P0RL: Both banks all closed pressure
P0R: Right bank all closed pressure
P0L: Left bank all closed pressure

Time Needed for Diagnosis: 4000 ms + 992 ms + 992 ms + 992 ms

Map 3 (Models without SI-DRIVE)

Intake air (g (oz)/rev)	0.1 (0)	0.25 (0.01)	0.3 (0.01)	1 (0.04)
Threshold value (V)	13	13	3.25	3.25

Map 3 (Models with SI-DRIVE)

Intake air (g (oz)/rev)	0.1 (0)	0.25 (0.01)	0.3 (0.01)	1 (0.04)
Threshold value (V)	100	100	4.5	4.5

Map 4

Secondary air pressure in the pipe when both comb. valve is closing kPa (mmHg, inHg) Secondary air pressure in the pipe when LH comb. valve is closing kPa (mmHg, inHg)	69.3 (520, 20.5)	74.6 (560, 22)	80 (600, 23.6)	85.3 (640, 25.2)	90.6 (680, 26.8)	96 (720, 28.3)	101.3 (760, 29.9)	106.6 (800, 31.5)	112 (840, 33.1)	117.3 (880, 34.6)	122.6 (920, 36.2)	128 (960, 37.8)	133.3 (1000, 39.4)	138.6 (1040, 40.9)	144 (1080, 42.5)	149.3 (1120, 44.1)
69.3 (520, 20.5)	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400	2400	2400
74.6 (560, 22)	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400	2400
80 (600, 23.6)	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400
85.3 (640, 25.2)	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400
90.6 (680, 26.8)	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200
96 (720, 28.3)	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000
101.3 (760, 29.9)	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800
106.6 (800, 31.5)	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600
112 (840, 33.1)	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400
117.3 (880, 34.6)	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200
122.6 (920, 36.2)	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000
128 (960, 37.8)	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800
133.3 (1000, 39.4)	–2400	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600
138.6 (1040, 40.9)	–2400	–2400	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400
144 (1080, 42.5)	–2400	–2400	–2400	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200
149.3 (1120, 44.1)	–2400	–2400	–2400	–2400	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0
																(L/min)

Map 5

Secondary air pressure in the pipe when both comb. valve is closing kPa (mmHg, inHg) Secondary air pressure in the pipe when RH comb. valve is closing kPa (mmHg, inHg)	69.3 (520, 20.5)	74.6 (560, 22)	80 (600, 23.6)	85.3 (640, 25.2)	90.6 (680, 26.8)	96 (720, 28.3)	101.3 (760, 29.9)	106.6 (800, 31.5)	112 (840, 33.1)	117.3 (880, 34.6)	122.6 (920, 36.2)	128 (960, 37.8)	133.3 (1000, 39.4)	138.6 (1040, 40.9)	144 (1080, 42.5)	149.3 (1120, 44.1)
69.3 (520, 20.5)	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400	2400	2400
74.6 (560, 22)	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400	2400
80 (600, 23.6)	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2400
85.3 (640, 25.2)	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400
90.6 (680, 26.8)	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2200
96 (720, 28.3)	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800	2000
101.3 (760, 29.9)	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600	1800
106.6 (800, 31.5)	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400	1600
112 (840, 33.1)	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200	1400
117.3 (880, 34.6)	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000	1200
122.6 (920, 36.2)	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800	1000
128 (960, 37.8)	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600	800
133.3 (1000, 39.4)	–2400	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400	600
138.6 (1040, 40.9)	–2400	–2400	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200	400
144 (1080, 42.5)	–2400	–2400	–2400	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0	200
149.3 (1120, 44.1)	–2400	–2400	–2400	–2400	–2200	–2000	–1800	–1600	–1400	–1200	–1000	–800	–600	–400	–200	0
																(L/min)

Map 6

Amount of intake air when RH comb. valve switches (g (oz)/s) Battery voltage when RH comb. valve switches (V)	10 (0.35)	15 (0.53)	20 (0.71)	25 (0.88)	26 (0.92)
11	0.025	0.025	0.025	0.005	0
12	0.035	0.035	0.035	0.015	0
13	0.05	0.05	0.05	0.025	0
14	0.05	0.05	0.05	0.025	0
					(V)

Map 7

Amount of intake air when LH comb. valve switches (g (oz)/s) Battery voltage when LH comb. valve switches (V)	10 (0.35)	15 (0.53)	20 (0.71)	25 (0.88)	26 (0.92)
11	0.025	0.025	0.025	0.005	0
12	0.035	0.035	0.035	0.015	0
13	0.05	0.05	0.05	0.025	0
14	0.05	0.05	0.05	0.025	0
					(V)

Map 8

Amount of intake air when P0R is measuring (g (oz)/s) Battery voltage when P0R measuring (V)	2 (0.07)	25 (0.88)
11.5	345	345
12.5	345	345
13.5	345	345
14.5	390	390
15.5	420	420
		(L/min)

Map 9

Amount of intake air when P0L is measuring (g (oz)/s) Battery voltage when P0L measuring (V)	2 (0.07)	25 (0.88)
11.5	345	345
12.5	345	345
13.5	345	345
14.5	390	390
15.5	420	420
		(L/min)

CA:DTC P0411 SECONDARY AIR INJECTION SYSTEM INCORRECT FLOW DETECTED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-138, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CB:DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT OPEN

1. OUTLINE OF DIAGNOSIS

Judge as NG when the ECM output level differs from the actual terminal level.

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
Ignition	ON
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
Ignition	ON
Terminal output voltage when ECM outputs OFF signal	HIGH

Time Needed for Diagnosis: Less than 1 second

CC:DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT SHORTED

1. OUTLINE OF DIAGNOSIS

Judge as NG when the ECM output level differs from the actual terminal level.

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
Ignition	ON
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
Ignition	ON
Terminal output voltage when ECM outputs ON signal	LOW

Time Needed for Diagnosis: Less than 1 second

CD:DTC P0416 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT OPEN

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0413. <Ref. to GD(H4DOTC)-146, DTC P0413 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT OPEN, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CE:DTC P0417 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "B" CIRCUIT SHORTED

1. OUTLINE OF DIAGNOSIS

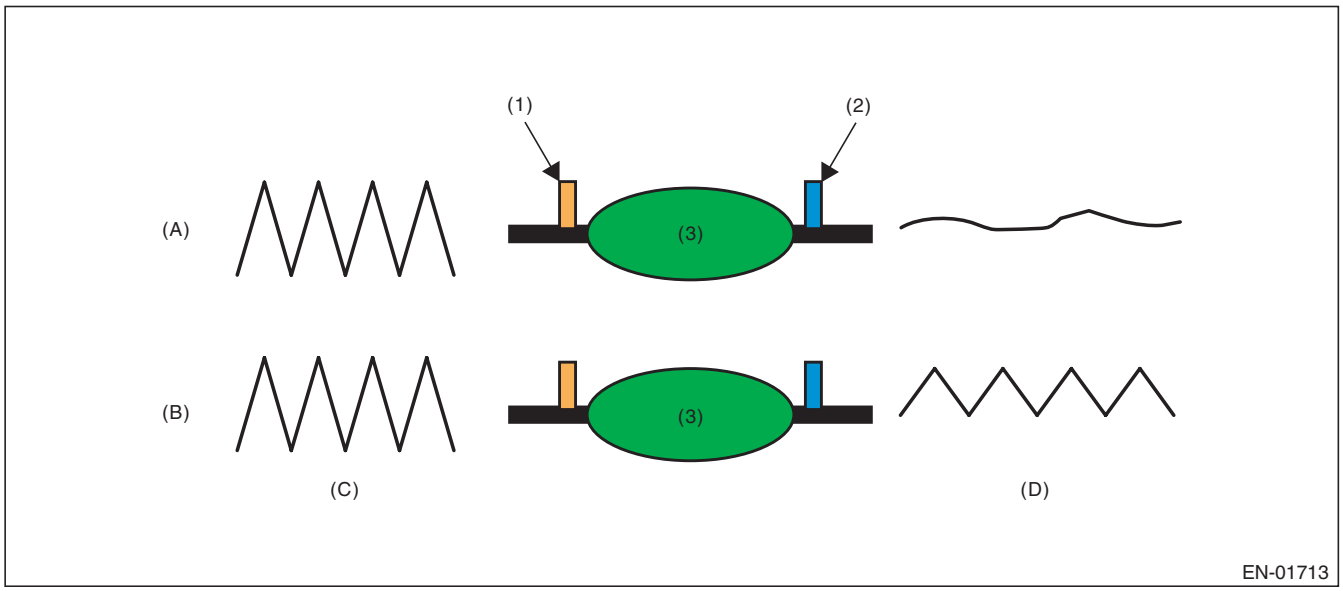
NOTE:
For the detection standard, refer to DTC P0414. <Ref. to GD(H4DOTC)-147, DTC P0414 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE "A" CIRCUIT SHORTED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CF: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	≥ 68.5 °C (155.3 °F) (models without SI-DRIVE) ≥ 70 °C (158 °F) (models with SI-DRIVE)
Estimated catalyst temperature	≥ 460 °C (860 °F) (models without SI-DRIVE) ≥ 490 °C (914 °F) (models with SI-DRIVE)
Misfire detection every 200 rotations	< 65535 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	> 60 km/h (37.3 MPH)
Amount of intake air	≥ 10 g/s (0.35 oz/s) and < 50 g/s (1.76 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	≥ Value from Map
Purge execution calculated time	≥ 5 s

Map (models without SI-DRIVE)

Engine coolant temperature °C (°F)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)
Elapsed time after starting the engine s	470	430	390	350	310	213

Map (models with SI-DRIVE)

Engine coolant temperature °C (°F)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)
Elapsed time after starting the engine s	470	430	390	350	310	230

4. GENERAL DRIVING CYCLE

Perform the diagnosis only once at a constant speed of 60 km/h (37.3 MPH) or higher.

5. DIAGNOSTIC METHOD

After the enable conditions have been established, calculate the front oxygen (A/F) sensor lambda value deviation sum value (Σ |(sglmd$_n$ – sglmd$_{n-1}$)|), and rear oxygen sensor output voltage deviation sum value (Σ |(ro2sad$_n$ – ro2sad$_{n-1}$)|) in every 32 ms × 4 times. If the front oxygen (A/F) sensor lambda value deviation sum value (Σ |(sglmd$_n$ – sglmd$_{n-1}$)|) is 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$_{n-1}$)|	> 7.94 (Models without SI-DRIVE) > 8 (Models with SI-DRIVE)

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$_{n-1}$)|	≤ 7.94 (Models without SI-DRIVE) ≤ 8 (Models with SI-DRIVE)

Time Needed for Diagnosis: 30 — 55 seconds

CG:DTC P0441 EVAPORATIVE EMISSION CONT. SYS. INCORRECT PURGE FLOW

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of purge flow by the change of ELCM pressure sensor output value before/after purge introduction.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
<Common conditions>	
Battery voltage	≥ 10.9 V
Atmospheric pressure	> 75 kPa (563 mmHg, 22.2 inHg)
<First diagnosis>	
Learning value of EVAP conc. during purge	< 0.2
Total time of canister purge operation	≥ 120 s
<Second diagnosis>	
Time after cancel of second diagnosis	≥ 60000 ms
Total time of canister purge operation	≥ 120 s
Intake manifold pressure (absolute pressure)	> 13.3 kPa (100 mmHg, 3.9 inHg)
Engine speed	≥ 1050 rpm
Intake manifold pressure (relative pressure)	< 13.3 kPa (100 mmHg, 3.9 inHg)
Vehicle speed	≥ 30 km/h (18.6 MPH)
Closed air/fuel ratio control	In operation
Air fuel ratio	> 0.76 and < 1.25
Main feedback compensation coefficient	> 0.9
Learning value of EVAP conc. during purge	< 0.2

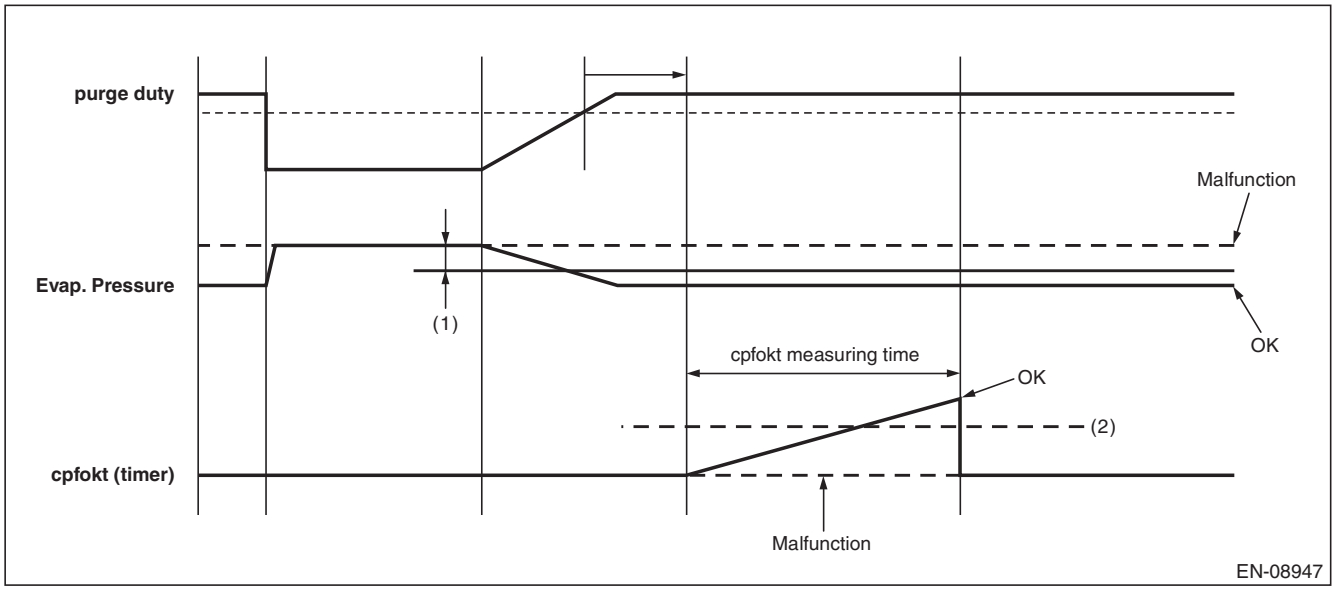
3. GENERAL DRIVING CYCLE

Perform the diagnosis only once after engine start.

4. DIAGNOSTIC METHOD

First diagnosis

Pressure decreases when the purge is introduced compared with when the purge is not performed. By using this, judge if the purge is correctly performed. If there is no pressure decrease, go to the second diagnosis.



(1) 0.0045 V (2) 2000 ms

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure sensor output voltage when purge is not performed – ELCM pressure sensor output voltage when purge is performed	> 0.0045 V
The accumulated time while the above conditions are met: cpfokt	< 2000 ms

Time Needed for Diagnosis: 26 seconds

- **Normality Judgment**

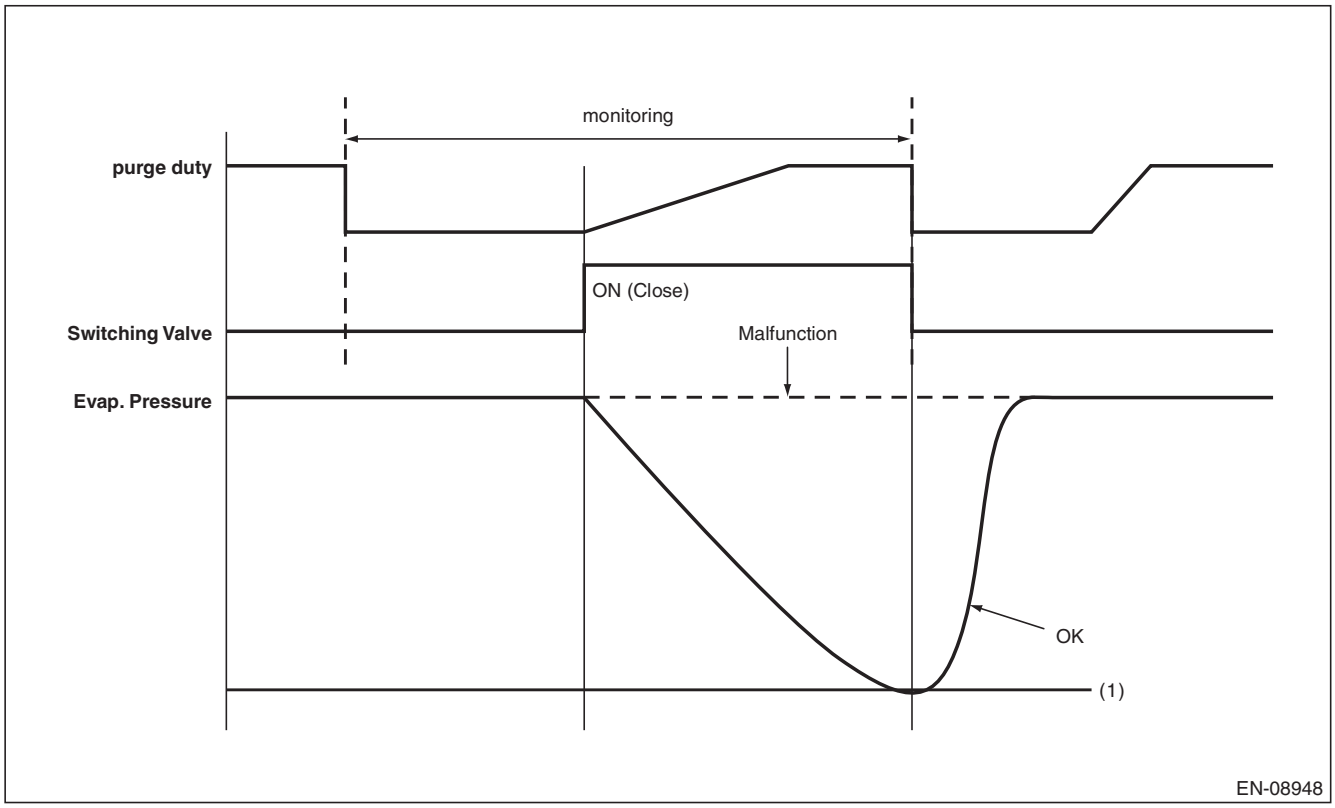
Judge as OK and clear the NG if the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure sensor output voltage when purge is not performed – ELCM pressure sensor output voltage when purge is performed	> 0.0045 V
The accumulated time while the above conditions are met: cpfokt	≥ 2000 ms

Time Needed for Diagnosis: 26 seconds

Second diagnosis
Close the ELCM switching valve, and close the fuel tank completely, and perform the forced purging. If pressure change amount is 0.7 kPa (5 mmHg, 0.2 inHg) or less, judge as malfunction of purge flow.



(1) 0.7 kPa (5 mmHg, 0.2 inHg)

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
ELCM pressure sensor output voltage when purge is not performed – ELCM pressure sensor output voltage when purge is performed	< 0.7 kPa (5 mmHg, 0.2 inHg)
Time of negative pressure introduction	≥ 30000 ms

Time Needed for Diagnosis: 21 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
ELCM pressure sensor output voltage when purge is not performed – ELCM pressure sensor output voltage when purge is performed	≥ 0.7 kPa (5 mmHg, 0.2 inHg)

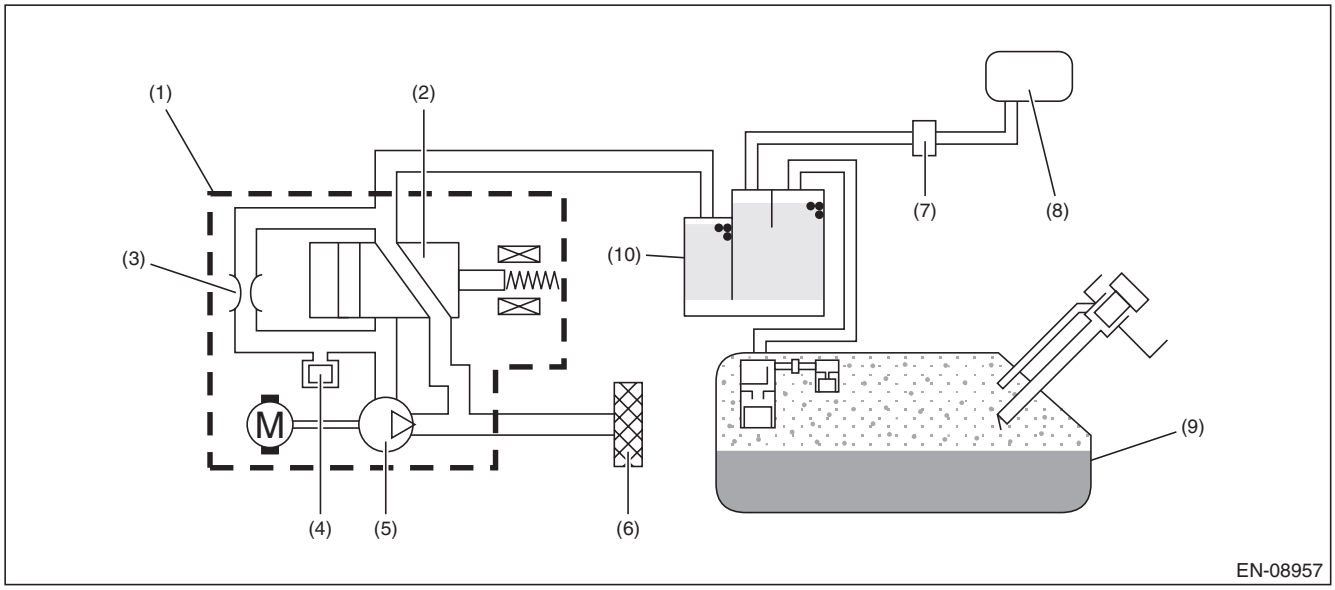
Time Needed for Diagnosis: Less than 21 second

CH:DTC P0451 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of ELCM pressure sensor output properties.
Judge as NG when the ELCM pressure sensor output value is largely different from the intake manifold pressure when the ignition switch is ON.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Ignition switch	ON
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.621 MPH)
Soaking time	≥ 60 s
Variation value of intake manifold pressure (absolute pressure) since ignition switch is turned to ON	< 1.332 kPa (9.99 mmHg, 0.39 inHg)
ELCM vacuum pump	Not in operation
ELCM switching valve	Open
Purge control	Not in operation

4. GENERAL DRIVING CYCLE

Perform the diagnosis once at ignition 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
|ELCM pressure sensor output value – intake manifold pressure (absolute pressure) when ignition switch is ON|	> 4.226 kPa (31.7 mmHg, 1.25 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
|ELCM pressure sensor output value – intake manifold pressure (absolute pressure) when ignition switch is ON|	≤ 4.226 kPa (31.7 mmHg, 1.25 inHg)

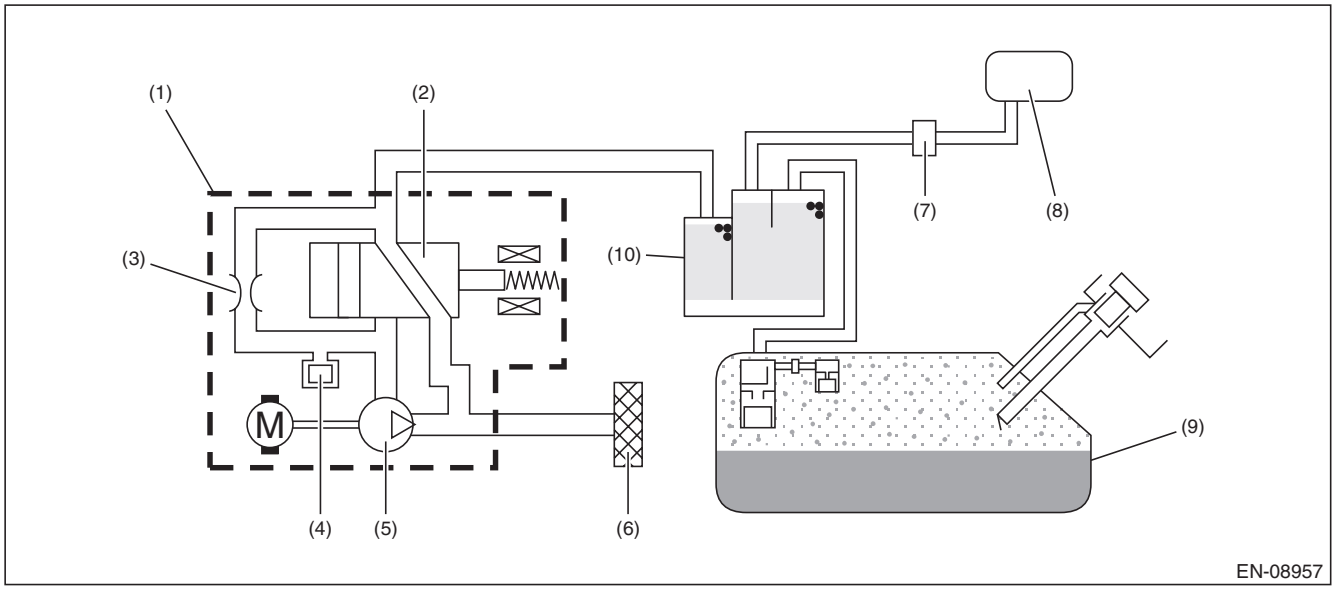
Time Needed for Diagnosis: 262 ms

CI: DTC P0452 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH LOW

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

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	< 0.973 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	≥ 0.973 V

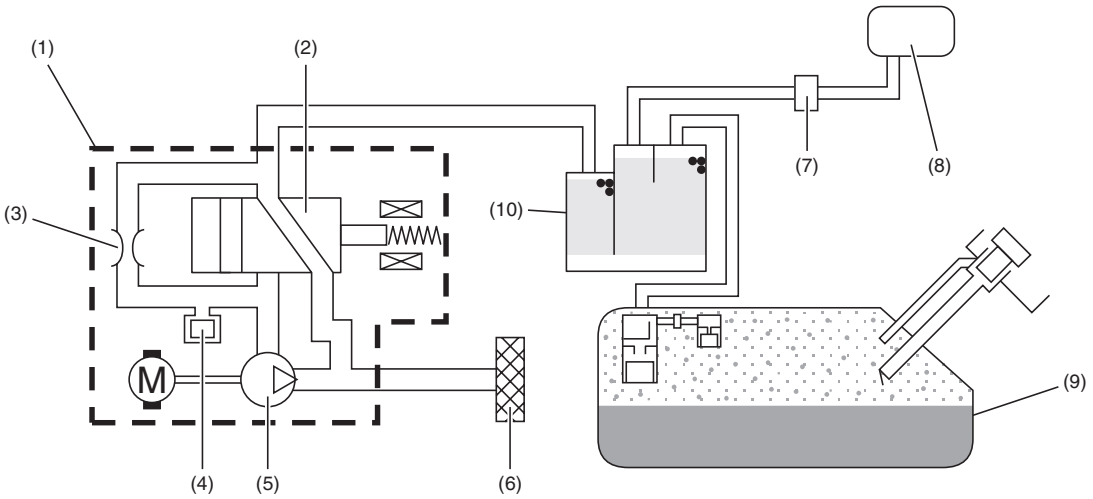
Time Needed for Diagnosis: Less than 1 second

CJ:DTC P0453 EVAPORATIVE EMISSION SYSTEM PRESSURE SENSOR/ SWITCH HIGH

1. OUTLINE OF DIAGNOSIS

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

2. COMPONENT DESCRIPTION



(1)	ELCM	(5)	Vacuum pump	(9)	Fuel tank
(2)	Switching valve	(6)	Drain filter	(10)	Canister
(3)	Reference orifice (0.02 inch orifice)	(7)	Purge control solenoid valve		
(4)	Pressure sensor	(8)	Intake manifold		

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	≥ 4.095 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	< 4.095 V

Time Needed for Diagnosis: Less than 1 second

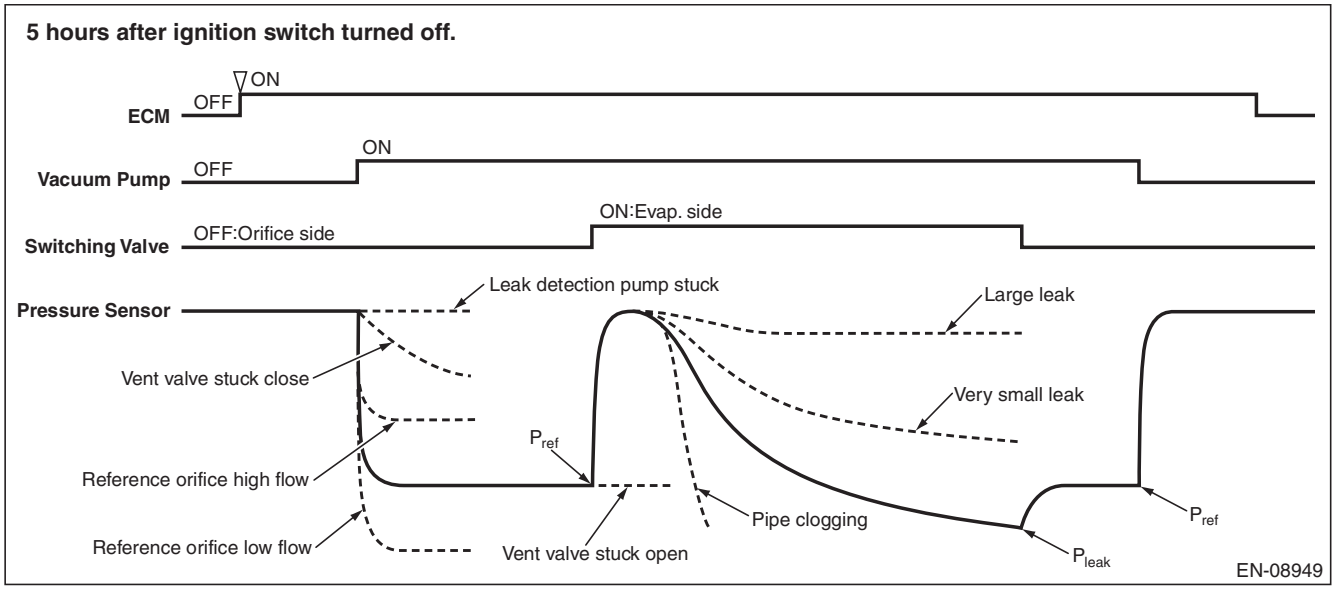
CK:DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK)

1. OUTLINE OF DIAGNOSIS

This diagnosis judges whether the ELCM operation is normal or not, and whether the evaporative emission system has leak and clogging or not.
To purge the canister, after driving, perform the five hours soaking after ignition switch OFF in order to stabilize the evaporative gas status. * After 5, 7 or 9.5 hours passed, ECM is activated by soaking timer, and the leak check is started.
Judges whether the ELCM operation is normal or not, by measuring the reference pressure status via reference orifice (0.02 inch orifice). Judge as malfunction if the reference pressure is out of specified range. Then, judge whether there is a leak or not, by comparing the pressure (leak pressure) when the reference pressure and the evaporative emission system are in negative pressure condition. Judge as system leak in the evaporative emission system if the leak pressure is higher than reference pressure. Judge as clogging of pipe if the leak pressure becomes lower than the reference pressure within the specified amount of time.
0.02 inch leak and 0.04 inch leak can be distinguished by measuring the leak pressure.
The diagnosis results are stored inside ECM until the engine is started again.
*: When the test conditions are not met in 5 hours, perform diagnosis at elapsed time of 7 hours. When the test conditions are not met in 7 hours, perform diagnosis at elapsed time of 9.5 hours.

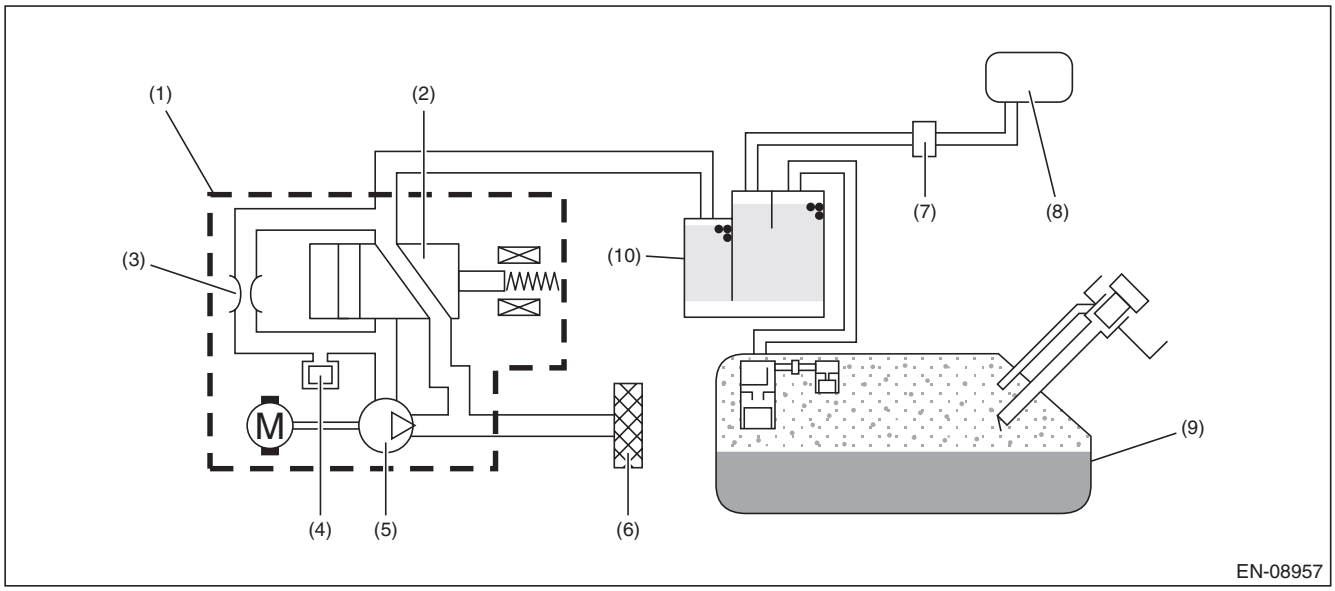
Diagnostic item	
ELCM system (ELCM body)	Vacuum pump stuck Switching valve stuck to open Switching valve stuck to close Reference orifice flow large Reference orifice flow small
Leak check	Large leak • 0.04 inch leak • Fuel cap loose • Fuel cap off • System malfunction
	Very small leak • 0.02 inch leak
Clogging of pipe	—

OUTLINE OF DIAGNOSIS



2. COMPONENT DESCRIPTION

ELCM consists of the pressure sensor, the reference orifice (diameter of 0.02 inch), the vacuum pump which introduces the negative pressure into evaporative emission system, and the switching valve which switches the passage to introduce the negative pressure.



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Activation of soaking timer	Completed
Battery voltage	≥ 10.9 V
Ignition switch	OFF
Engine coolant temperature	≥ 4.4 °C (39.9 °F) and < 45 °C (113 °F)
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg) and < 110 kPa (825 mmHg, 32.5 inHg)
EVAP conc. learning during previous driving cycle	Done
Learning value of EVAP conc. during previous driving cycle	≤ 0.2
Accumulated purge amount during previous driving cycle	≥ Value of Map 1

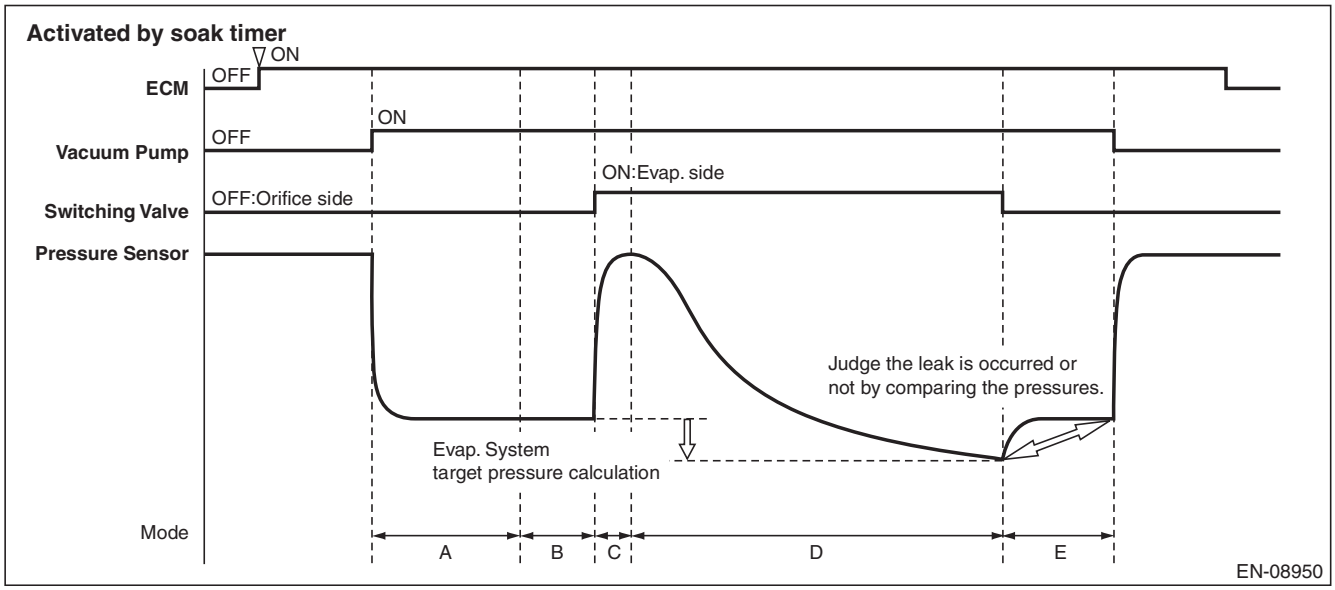
Map 1

Engine coolant temperature °C (°F)	0 (32)	30 (86)	45 (113)
Accumulated purge amount during previous driving cycle g (oz)	3000 (105.81)	3000 (105.81)	10000 (352.7)

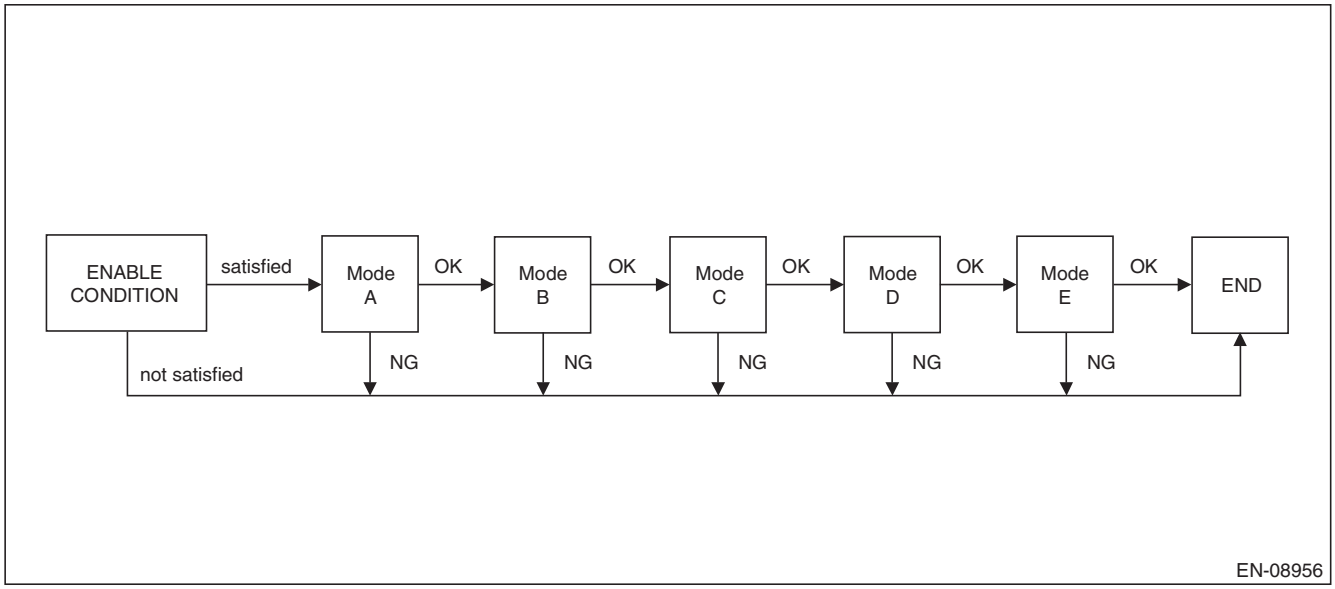
4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when 5, 7 or 9.5 hours has passed after ignition switch is OFF. For more detail, refer to “OUTLINE OF DIAGNOSIS”. <Ref. to GD(H4DOTC)-160, OUTLINE OF DIAGNOSIS, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

5. DIAGNOSTIC METHOD



Mode	Explanation of Mode	Diagnosis Period
A	Vacuum pump operation confirmation and characteristics stability	7 s or less & 300 s
B	Measurement of reference pressure for setting the target negative pressure	40 s or less
C	Switching valve operation confirmation	12 s or less
D	Clogging of pipe diagnosis and leak pressure measurement	900 s or less
E	Reference pressure measurement for judgment	40 s or less



Mode A (Vacuum pump operation confirmation and characteristics stability)

Purpose: Detect the vacuum pump operation trouble.
Judge as NG when the following conditions are established.
Judge as OK if the following conditions are not established, and warm up for five minutes to stabilize the vacuum pump characteristics.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure sensor output value	> –0.2 kPa (–1.68 mmHg, –0.1 inHg)	P2404

Mode B (Measurement of reference pressure for setting the target negative pressure)

1. Purpose: Judge the reference pressure stability.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
|Pressure sensor maximum output value – Pressure sensor minimum output value|	> 0.3 kPa (2.355 mmHg, 0.1 inHg)	P2404

2. Purpose: Judge whether the reference pressure is within the normal range, and detect the vacuum pump and orifice malfunctions.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Reference pressure for setting the target negative pressure	< Value of Map 2 or > Value of Map 3	P2404

Map 2

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for setting the target negative pressure kPa (mmHg, inHg)	–4 (–29.79, –1.2)	–4.1 (–30.593, –1.2)	–4.2 (–31.395, –1.2)	–4.3 (–32.19, –1.3)

Map 3

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for setting the target negative pressure kPa (mmHg, inHg)	–0.9 (–7.065, –0.3)	–1 (–7.86, –0.3)	–1.2 (–8.663, –0.3)	–1.3 (–9.465, –0.4)

Mode C (Switching valve operation confirmation)

Purpose: Measure the pressure increase when switching valve is changed from open to close, and detect the stuck to open/close malfunctions of the switching valve.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Pressure sensor output value – Reference pressure for setting the target negative pressure	< 0.2 kPa (1.68 mmHg, 0.1 inHg)	P2404

Mode D (Clogging of pipe diagnosis and leak pressure measurement)

1. **Clogging of pipe**
   Purpose: Measure the time required for the evaporative emission system to reach the target negative pressure by the vacuum pump, and detect the clogging of pipe trouble.
   Judge as clogging of pipe malfunction if the evaporative emission system reaches to the target negative pressure within the specified time.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Time required to reach to the target negative pressure For target vacuum, use one of the followings. •Reference pressure for target vacuum setting – value of Map 4 •–5 kPa (–37.298 mmHg, –1.5 inHg)	≤ 30000 ms	P1451

Map 4

Time of negative pressure introduction ms	0	100000	200000	300000	400000	500000	600000	700000	800000	900000	1000000	1100000	1200000
Reference pressure for setting the target negative pressure – Pressure sensor output value kPa (mmHg, inHg)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)	0.9 (7.058, 0.3)

2. **Leak pressure measurement**
   Purpose: Measure the pressure (leak pressure) when the evaporative emission system becomes the negative pressure by the vacuum pump.
   Store the pressure as a leak pressure while the following conditions are met.

Judgment Value

Conditions for storing the leak pressure	Threshold Value
When any one of the followings is established.	
• Reference pressure for setting the target negative pressure – Pressure sensor output value	≥ Value of Map 4
• Pressure sensor output value	< –5 kPa (–37.298 mmHg, –1.5 inHg)
• Time of negative pressure introduction	≥ 900000 ms

Mode E (Measurement of reference pressure for judgment)

1. Purpose: Judge the reference pressure stability.

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
|Pressure sensor maximum output value – Pressure sensor minimum output value|	> 0.3 kPa (2.355 mmHg, 0.1 inHg)	P2404

2. Purpose: Judge whether the reference pressure is within the normal range, and detect the vacuum pump and orifice malfunctions. Judge the vacuum pump performance stability.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
Reference pressure for judgment	< Value of Map 5 or > Value of Map 6	P2404

Map 5

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for judgment kPa (mmHg, inHg)	–4.5 (–34.02, –1.3)	–4.6 (–34.815, –1.4)	–4.7 (–35.618, –1.4)	–4.9 (–36.42, –1.4)

Map 6

Atmospheric pressure kPa (mmHg, inHg)	70 (525, 20.7)	80 (600, 23.6)	90 (675, 26.6)	100 (750, 29.5)
Reference pressure for judgment kPa (mmHg, inHg)	–0.8 (–6.18, –0.2)	–0.9 (–6.983, –0.3)	–1 (–7.785, –0.3)	–1.1 (–8.58, –0.3)

3. Purpose: Judge the presence of evaporative emission system leak.
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
<Large leak (0.04 inch)> Leak pressure lleakjdg = (Reference pressure for judgment) × 0.377 – (–45.5 Pa)	≥ lleakjdg (Pa)	P0455
<Very small leak (0.02 inch)> Leak pressure	< lleakjdg (Pa)	P0456

Time Needed for Diagnosis: Approx. 23 min

• Abnormality Judgment

At next engine start, confirm whether the enable conditions are satisfied even though refueling has been done during soaking, and determine the malfunction.
Malfunction Indicator Light Illumination: Illuminates when malfunction occurs in 2 continuous driving cycles.

• Normality Judgment

At next engine start, confirm whether the enable conditions are satisfied even though refueling has been done during soaking, then, if the following conditions are established, judge as OK and clear the NG.

Judgment Value

Malfunction Criteria	Threshold Value	DTC
NG flag	Not set	P0455 P0456 P1451 P2404

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

1. OUTLINE OF DIAGNOSIS

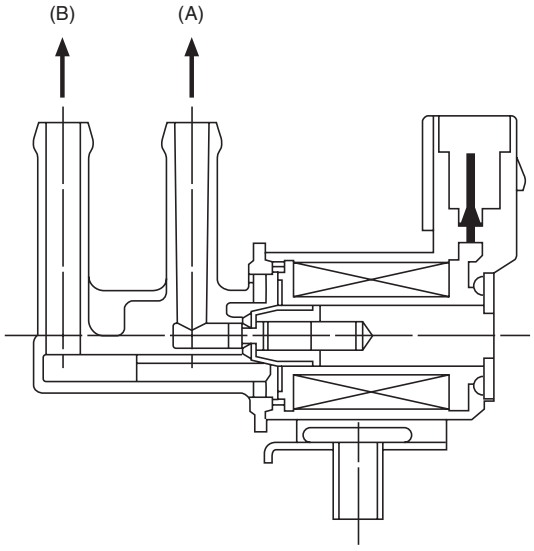
NOTE:
For the detection standard, refer to DTC P0455. <Ref. to GD(H4DOTC)-160, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

CM: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-02197

(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

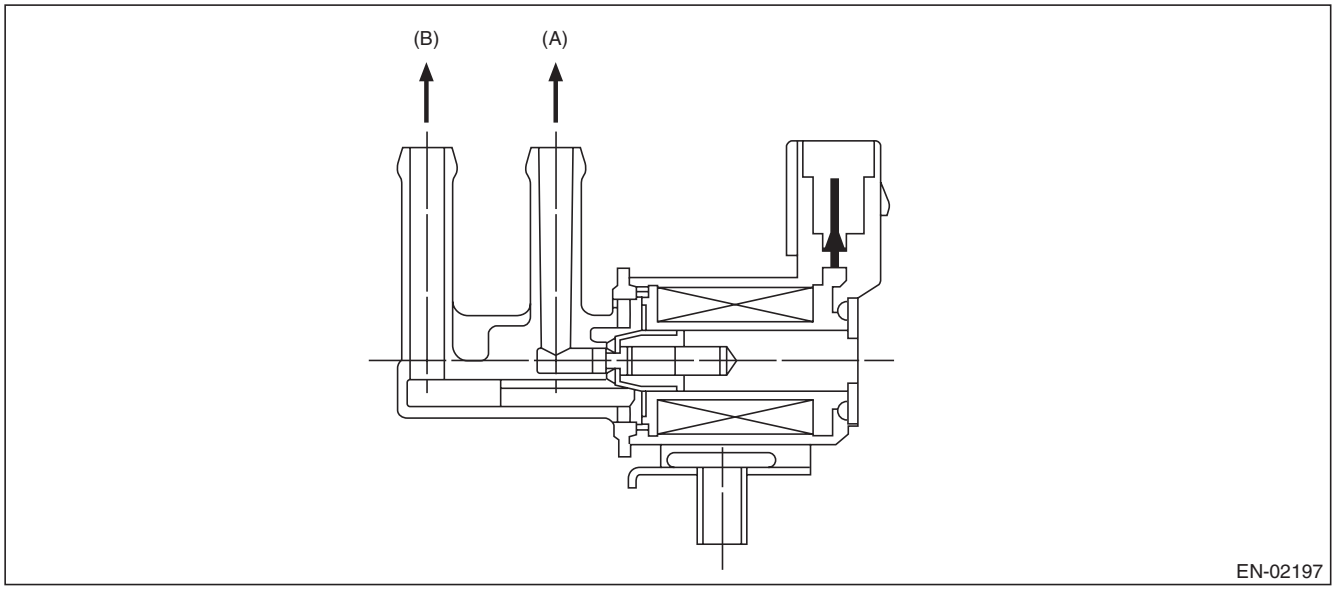
Time Needed for Diagnosis: Less than 1 second

CN: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



(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

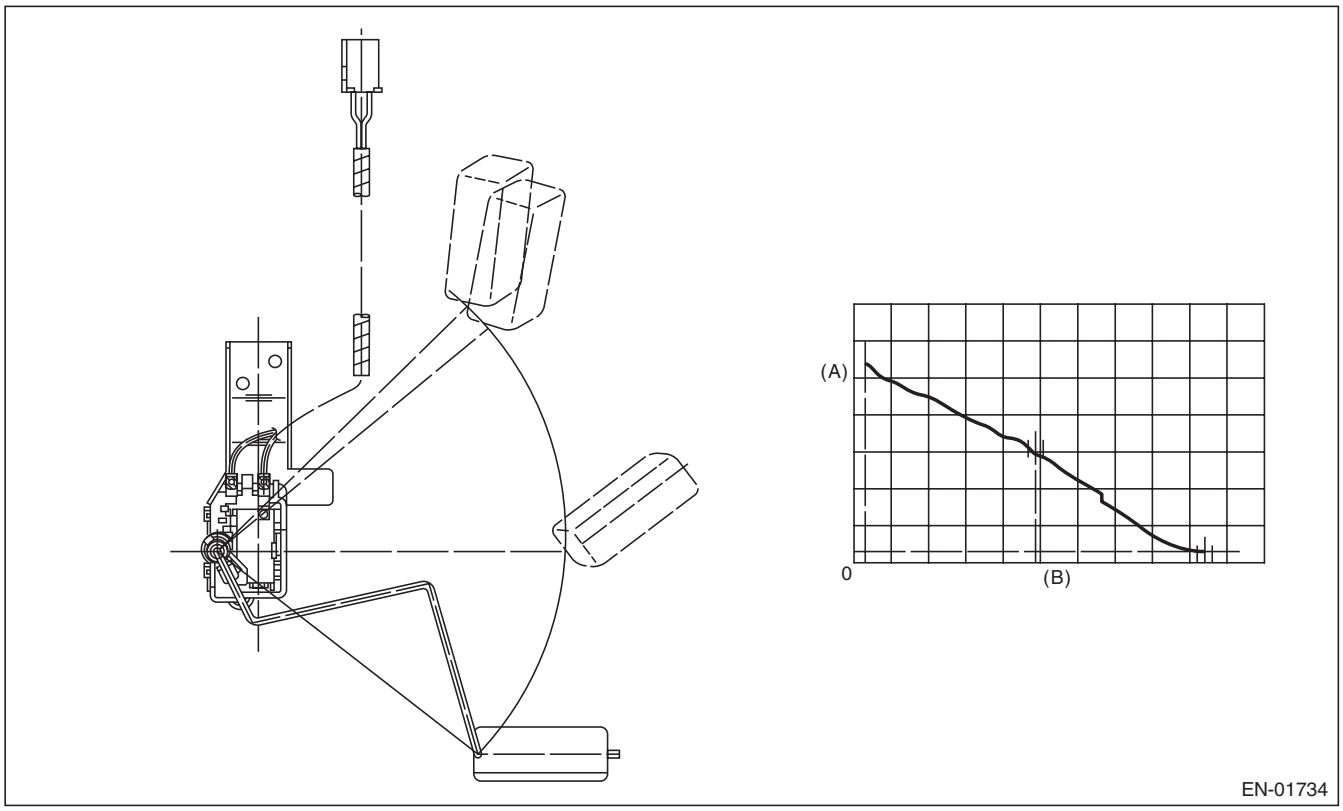
Time Needed for Diagnosis: Less than 1 second

CO: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	≥ 165375 g (5832.78 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	< 10000 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	≥ 165375 g (5832.78 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	< 10000 rpm
Elapsed time after starting the engine	≥ 5000 ms

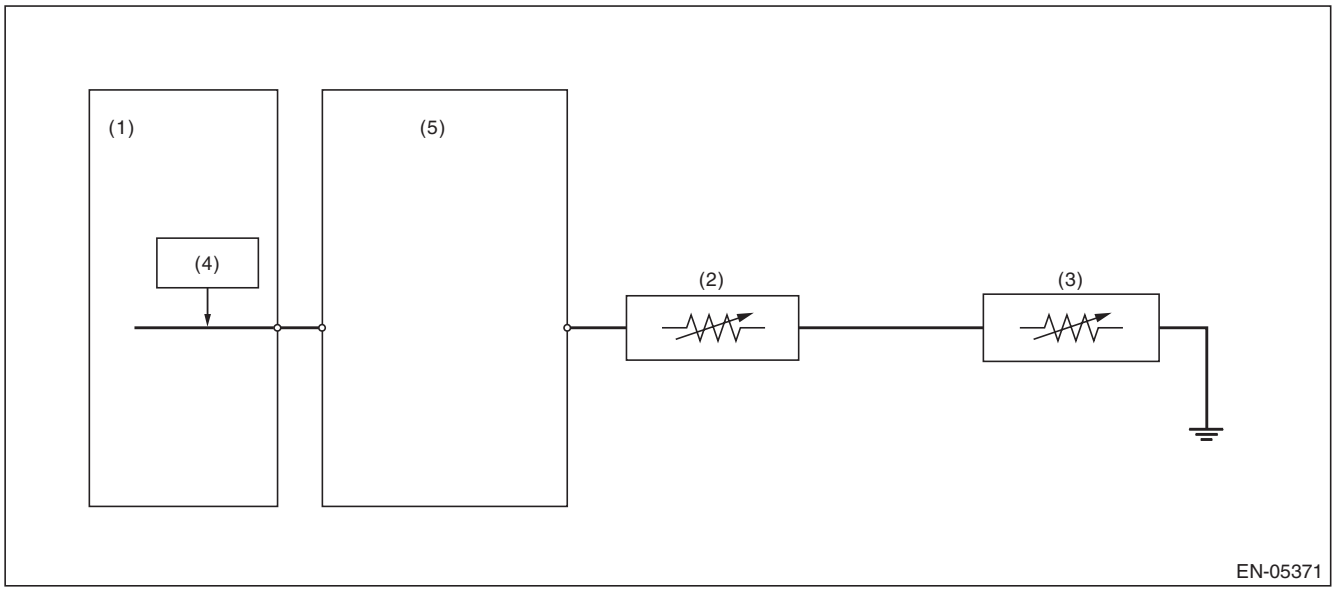
Time Needed for Diagnosis: Less than 1 second

CP: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

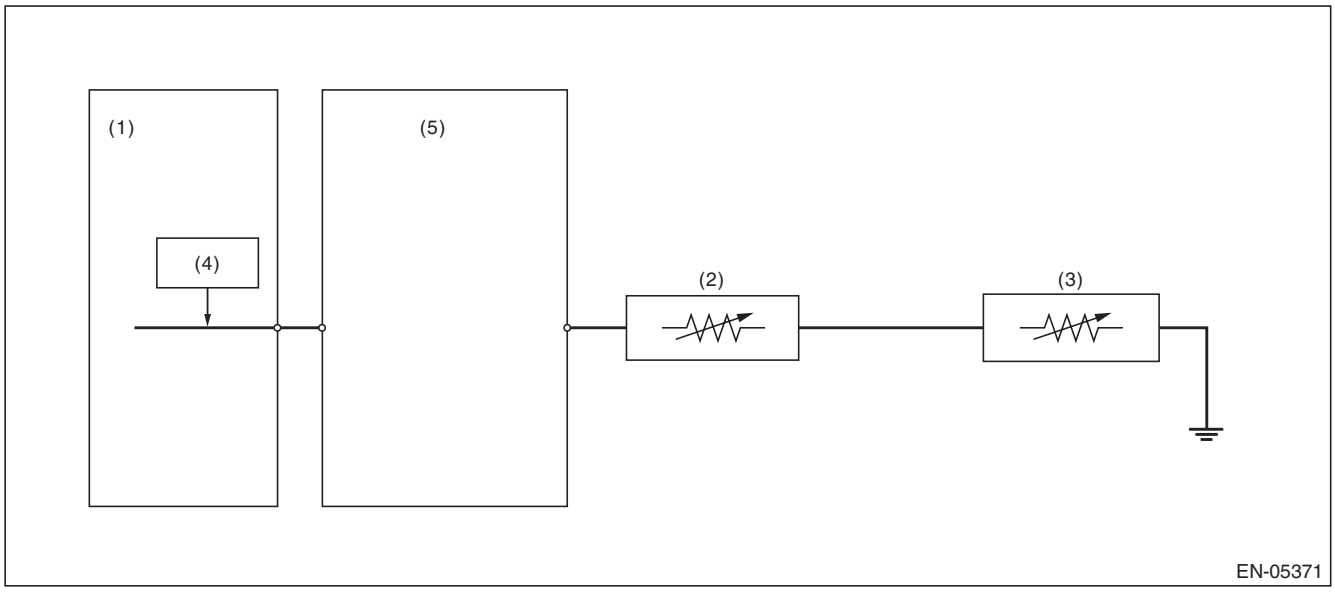
Time Needed for Diagnosis: Less than 1 second

CQ: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

CR:DTC P04AC EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve 2.
Judge as NG when the ECM output level differs from the actual terminal level.

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
Elapsed time after starting the engine	≥ 1 s
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 s
Terminal output voltage when ECM outputs OFF signal	High

Time Needed for Diagnosis: Less than 1 second

CS:DTC P04AD EVAP SYSTEM PURGE CONTROL VALVE "B" CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the purge control solenoid valve 2.
Judge as NG when the ECM output level differs from the actual terminal level.

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
Elapsed time after starting the engine	≥ 1 s
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 s
Terminal output voltage when ECM outputs ON signal	Low

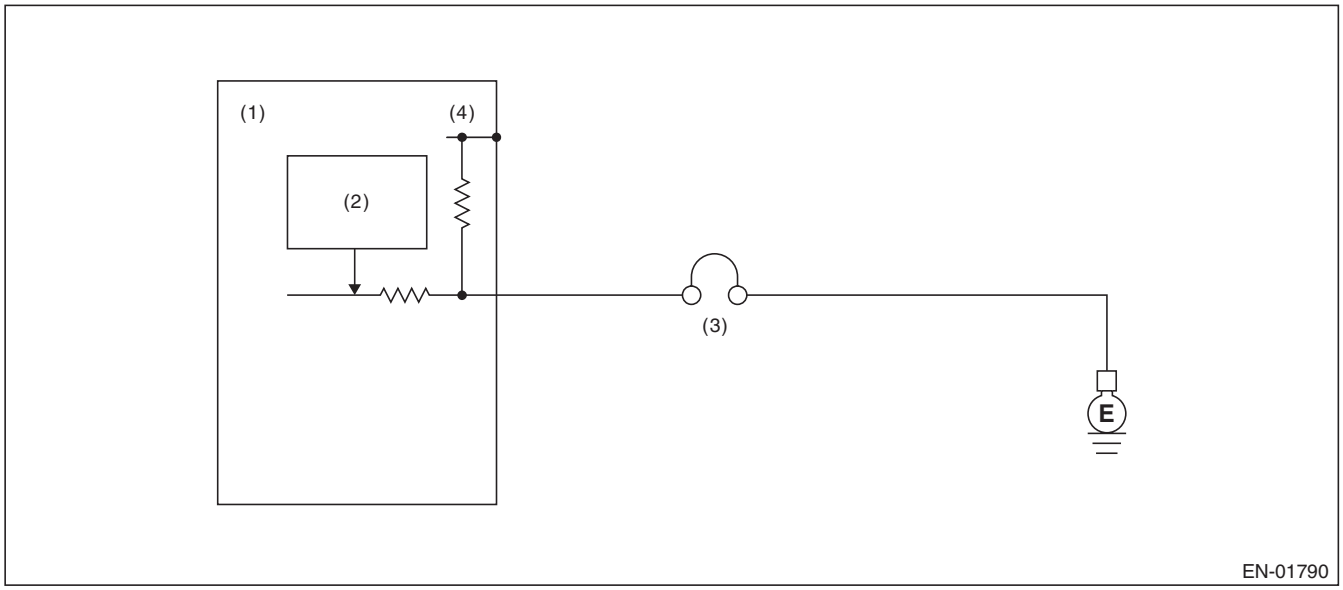
Time Needed for Diagnosis: Less than 1 second

CT:DTC P04DB CRANKCASE VENTILATION SYSTEM DISCONNECTED

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)
(2) Detecting circuit
(3) PCV diagnosis connector
(4) 5 V

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

CU: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: 512 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: 512 ms

CV: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	≥ 70 °C (158 °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)	≥ 0.9 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 compensation 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

CW: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	≥ 70 °C (158 °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)	≥ 0.9 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	≥ 200 rpm
Feedback compensation 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 engine speed – Targeted engine speed	< 200 rpm

Time Needed for Diagnosis: 10 s

CX:DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE

1. OUTLINE OF DIAGNOSIS

• When cold, the abnormality in the control of target engine speed increase is detected. (P050A)

Judge as NG if the exhaust gas temperature diagnosis or idle speed diagnosis 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 at cold start.

• Detect malfunctions of the catalyst advanced idling retard angle control. (P050B)

Judge as NG when ECM is not controlling the angle properly during catalyst advanced idling 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
<Exhaust gas temperature diagnosis>	
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Battery voltage	> 10.9 V
Engine condition	In operation
Vehicle speed	≤ 2 km/h (1.2 MPH)
Elapsed time after gear position change (P ←→ D or N ←→ D)	≥ 3000 ms
ISC feedback	In operation
Throttle opening angle	< 0.37 °
Fuel property	Not extremely low volatility
Target retard amount	≥ 5 °CA
<Idle speed diagnosis>	
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Battery voltage	> 10.9 V
Engine condition	In operation
Vehicle speed	≤ 2 km/h (1.2 MPH)
Engine coolant temperature	≤ 60 °C (140 °F)
Intake air amount sum value	≤ Value of Map 1
Elapsed time after gear position change (P ←→ D or N ←→ D)	≥ 3000 ms
Throttle opening angle	< 0.37 °
Fuel property	Not extremely low volatility
Elapsed time after starting the engine	≥ 2000 ms
<Final ignition timing diagnosis>	
Atmospheric pressure	≥ 75 kPa (563 mmHg, 22.2 inHg)
Battery voltage	> 10.9 V
Engine condition	In operation
Vehicle speed	≤ 2 km/h (1.2 MPH)
Engine coolant temperature	≤ 60 °C (140 °F)
Intake air amount sum value	≤ Value of Map 2
Elapsed time after gear position change (P ←→ D or N ←→ D)	≥ 3000 ms
Throttle opening angle	< 0.37 °
Fuel property	Not extremely low volatility
Target retard amount	≥ Value from Map 3

Map 1 (Models without SI-DRIVE)

Engine coolant temperature at engine starting °C (°F)	–40 (–40)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Intake air amount sum value g (oz)	1240 (43.73)	1170 (41.27)	1100 (38.8)	1040 (36.68)	980 (34.56)	570 (20.1)	280 (9.88)	265 (9.35)

Engine coolant temperature at engine starting °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Intake air amount sum value g (oz)	250 (8.82)	210 (7.41)	210 (7.41)	210 (7.41)	210 (7.41)	210 (7.41)	210 (7.41)	210 (7.41)

Map 1 (Models with SI-DRIVE)

Engine coolant temperature at engine starting °C (°F)	–40 (–40)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Intake air amount sum value g (oz)	950 (33.51)	925 (32.62)	900 (31.74)	870 (30.68)	840 (29.63)	620 (21.87)	420 (14.81)	310 (10.93)

Engine coolant temperature at engine starting °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Intake air amount sum value g (oz)	260 (9.17)	210 (7.41)	170 (6)	170 (6)	170 (6)	170 (6)	170 (6)	170 (6)

Map 2 (Models without SI-DRIVE)

Engine coolant temperature at engine starting °C (°F)	–40 (–40)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Intake air amount sum value g (oz)	1240 (43.73)	1170 (41.27)	1100 (38.8)	1040 (36.68)	980 (34.56)	570 (20.1)	280 (9.88)	265 (9.35)

Engine coolant temperature at engine starting °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Intake air amount sum value g (oz)	250 (8.82)	210 (7.41)	210 (7.41)	210 (7.41)	210 (7.41)	210 (7.41)	210 (7.41)	210 (7.41)

Map 2 (Models with SI-DRIVE)

Engine coolant temperature at engine starting °C (°F)	–40 (–40)	–30 (–22)	–20 (–4)	–10 (14)	0 (32)	10 (50)	20 (68)	30 (86)
Intake air amount sum value g (oz)	950 (33.51)	925 (32.62)	900 (31.74)	870 (30.68)	840 (29.63)	620 (21.87)	420 (14.81)	310 (10.93)

Engine coolant temperature at engine starting °C (°F)	40 (104)	50 (122)	60 (140)	70 (158)	80 (176)	90 (194)	100 (212)	110 (230)
Intake air amount sum value g (oz)	260 (9.17)	210 (7.41)	170 (6)	170 (6)	170 (6)	170 (6)	170 (6)	170 (6)

Map 3

Engine coolant temperature	–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)	60 °C (140 °F)
Target retard amount	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA

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.

Judgment Value

Malfunction Criteria	Threshold Value
Estimated exhaust gas temperature	< Value of Map 4

Map 4 (Models without SI-DRIVE)

Engine coolant temperature at engine starting	–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)	45 °C (113 °F)
Threshold Value	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	80 °C (176 °F)	83 °C (181.4 °F)	81 °C (177.8 °F)	75 °C (167 °F)	74 °C (165.2 °F)	71 °C (159.8 °F)

Map 4 (Models with SI-DRIVE)

Engine coolant temperature at engine starting	–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)	45 °C (113 °F)
Threshold Value	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	200 °C (392 °F)	80 °C (176 °F)	78 °C (172.4 °F)	79 °C (174.2 °F)	82 °C (179.6 °F)	79 °C (174.2 °F)	75 °C (167 °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 of Map 4

Time Needed for Diagnosis: Less than 1 second

• Idle speed diagnosis

Abnormality Judgment
Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Actual engine speed – Target engine speed	< – 125 rpm

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
Actual engine speed – Target engine speed	≥ – 125 rpm

Time Needed for Diagnosis: 5000 ms

- **Final ignition timing diagnosis**

Abnormality Judgment
Judge as NG when the following conditions are established.
Judgment Value

Malfunction Criteria	Threshold Value
Final ignition timing – ignition timing during CSERS* *: Ignition timing during CSERS (Cold Start Emission Reduction Strategy) = Base ignition timing – retard amount	> Value of Map 5

Map 5

Engine coolant temperature	–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)	60 °C (140 °F)
Threshold Value	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA	6 °CA

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
Final ignition timing – ignition timing during CSERS* *: Ignition timing during CSERS (Cold Start Emission Reduction Strategy) = Base ignition timing – retard amount	≤ Value of Map 5

Time Needed for Diagnosis: 5000 ms

CY:DTC P050B COLD START IGNITION TIMING PERFORMANCE

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P050A. <Ref. to GD(H4DOTC)-183, DTC P050A COLD START IDLE AIR CONTROL SYSTEM PERFORMANCE, Diagnostic Trouble Code (DTC) Detecting Criteria.>

CZ: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.

DA:DTC P0560 SYSTEM VOLTAGE

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

DB: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 when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Write the specified value into the RAM.	The written value cannot be read.

Time Needed for Diagnosis: Less than 1 second
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
Write the specified value into the RAM.	The written value can be read.

Time Needed for Diagnosis: Less than 1 second

DC: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

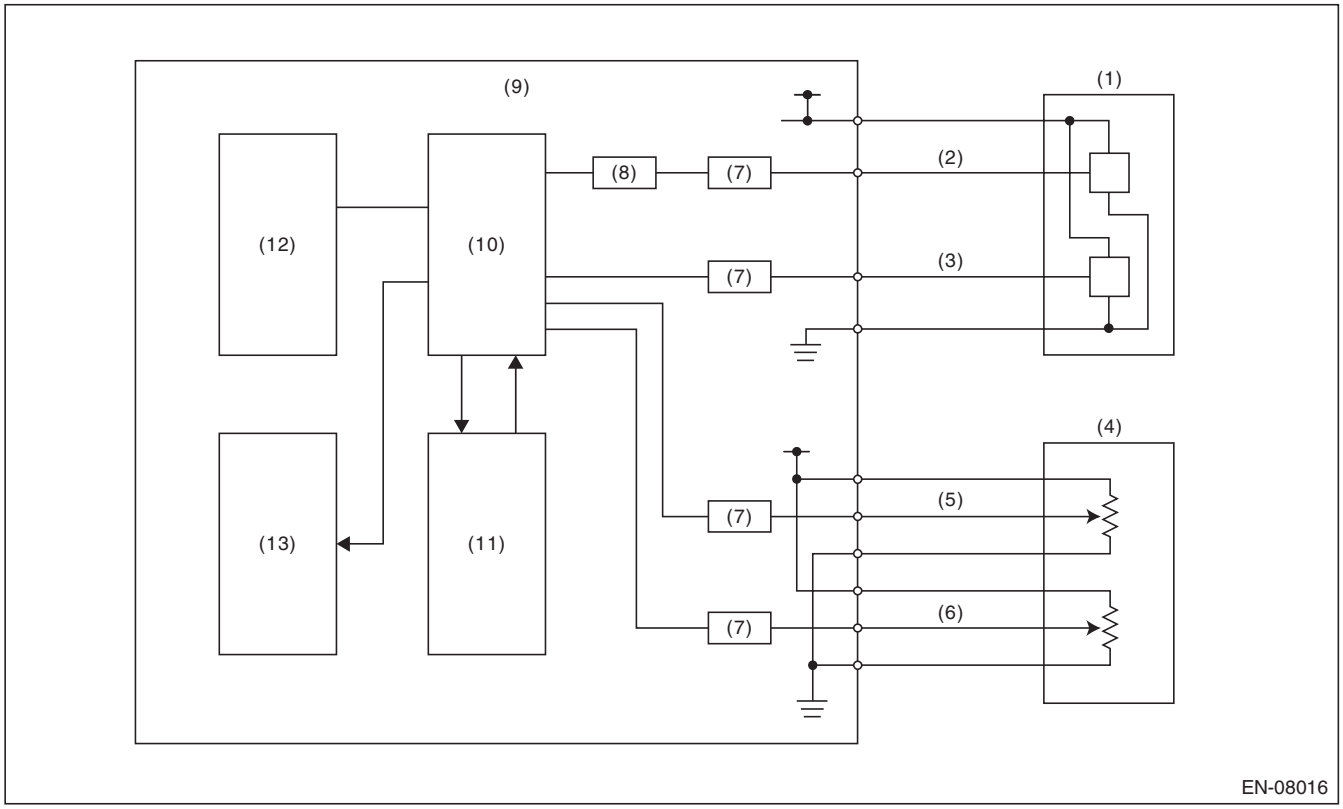
Time Needed for Diagnosis: Undetermined
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DD:DTC P0606 CONTROL MODULE PROCESSOR

1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.
(1) If the CPU operation is abnormal (instruction/flow check).
(2) If the output IC operation is abnormal (output driver malfunction).

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) Ignition switch	ON
(1) ETC control	Permission
(2) Ignition switch	ON
(2) 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) Main CPU calculation result	The result and expected value match.
(2) Communication between output ICs	Possible to communicate

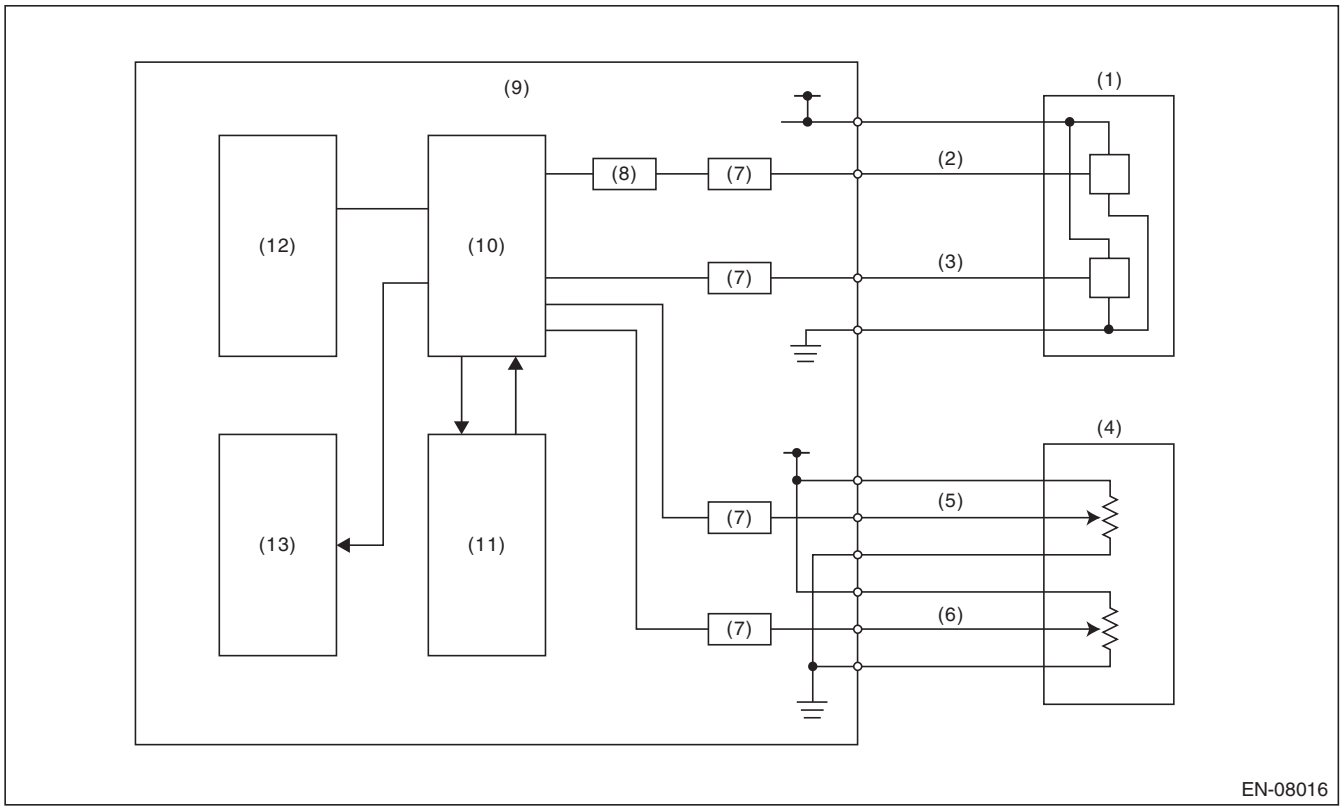
Time Needed for Diagnosis:
(1): 192 ms
(2): 2500 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DE:DTC P060A INTERNAL CONTROL MODULE MONITORING PROCESSOR PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when the monitoring IC operation is abnormal. (Monitoring IC malfunction)

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
Battery voltage	≥ 6 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
Monitoring IC operation	The result and expected value match.

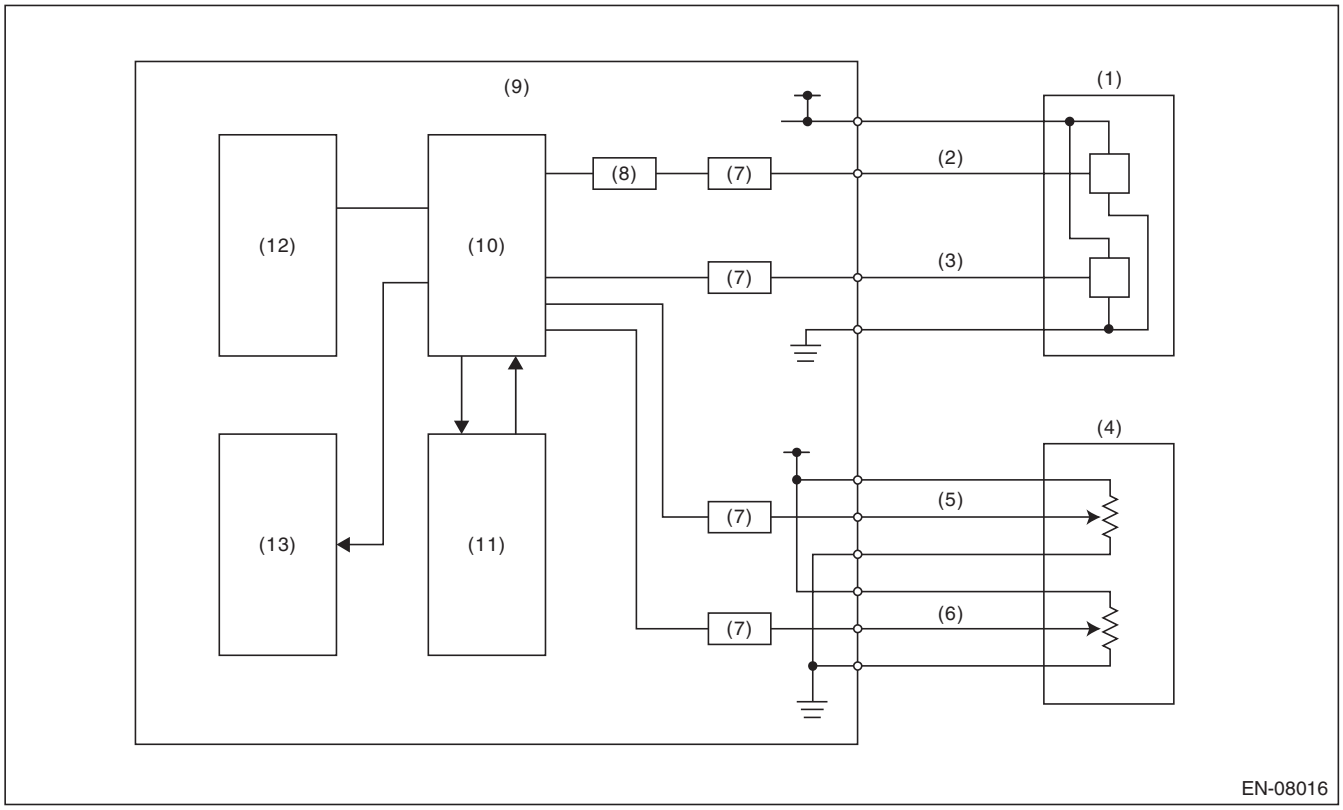
Time Needed for Diagnosis: 200 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DF:DTC P060B INTERNAL CONTROL MODULE A/D PROCESSING PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Judge as NG when any one of the followings is established.
(1) If the input amplifier circuit of throttle position sensor 1 is abnormal (quadruple amplification problem).
(2) If the A/D converter operation is abnormal (ADC malfunction).

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
Ignition switch	ON
Battery voltage	≥ 6 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) |Throttle position sensor 1 opening angle – (Throttle position sensor 1 opening angle after passing amplifier/4)|	< 3 °
(2) |Standard voltage – Readings of voltage value|	< 0.078125 V

Time Needed for Diagnosis:
(1): 24 ms
(2): 200 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

DG:DTC P0616 STARTER RELAY CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect abnormal continuity in the starter SW.
Judge as OFF NG when the starter SW signal remains OFF.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
None	

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

- **Abnormality Judgment**

Judge as OFF NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 8 V
Vehicle speed	< 1 km/h (0.6 MPH)
Engine condition	Change from pre-start to post-start
Starter SW signal	No ON experience

Time Needed for Diagnosis: Less than 1 second
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

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

Judgment Value

Malfunction Criteria	Threshold Value
Battery voltage	≥ 8 V
Vehicle speed	< 1 km/h (0.6 MPH)
Engine condition	Change from pre-start to post-start
Starter SW signal	ON Experience exists

Time Needed for Diagnosis: Less than 1 second

DH:DTC P0617 STARTER RELAY CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect abnormal continuity in the 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
Battery voltage	≥ 8 V
Engine condition	After engine starting
Starter SW signal	ON

Time Needed for Diagnosis: 30000 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	≥ 8 V
Starter SW signal	OFF

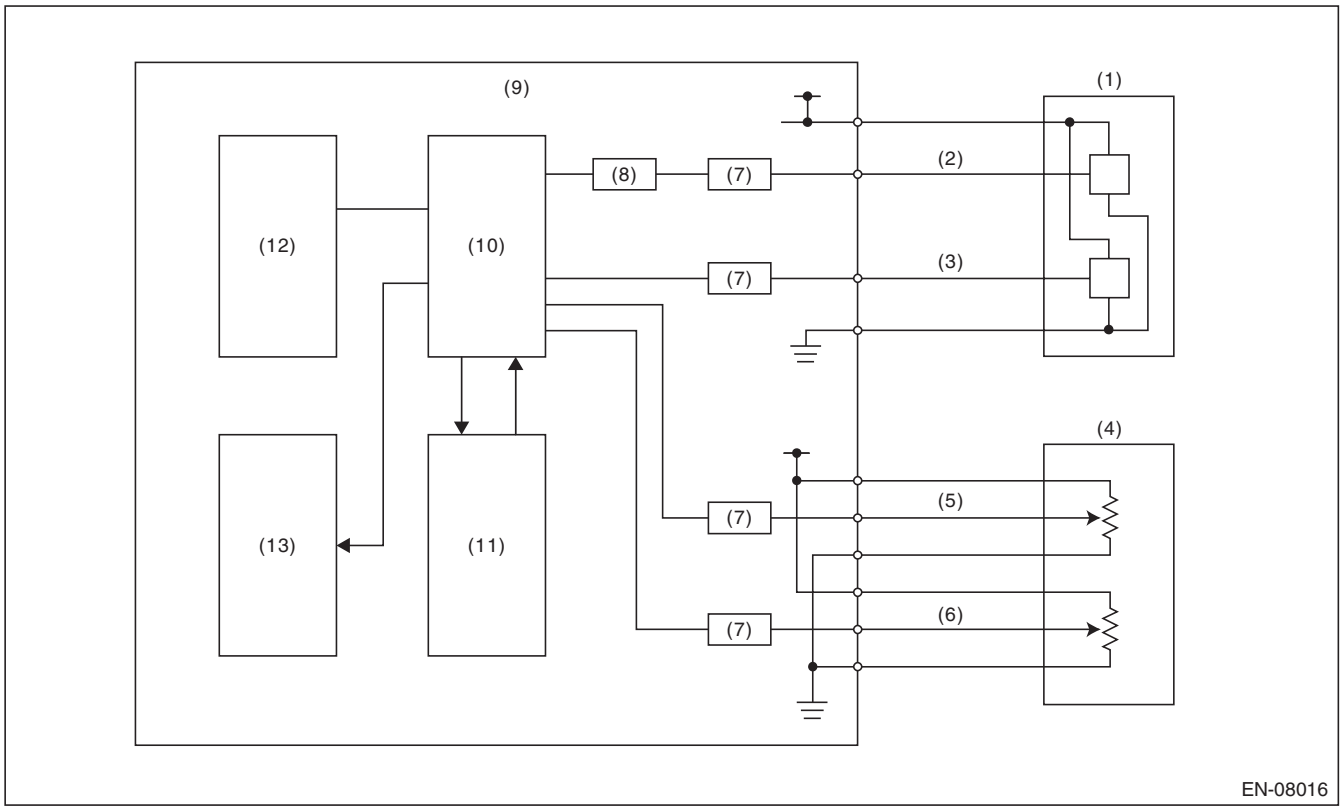
Time Needed for Diagnosis: Less than 1 second

DI: DTC P062F INTERNAL CONTROL MODULE EEPROM ERROR

1. OUTLINE OF DIAGNOSIS

Judge as NG when the EEPROM operation is abnormal. (EEPROM malfunction)

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
Starter switch	OFF
Battery voltage	> 6 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
EEPROM writing	Writing completed

Time Needed for Diagnosis: 48 ms
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of 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

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

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of 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)	

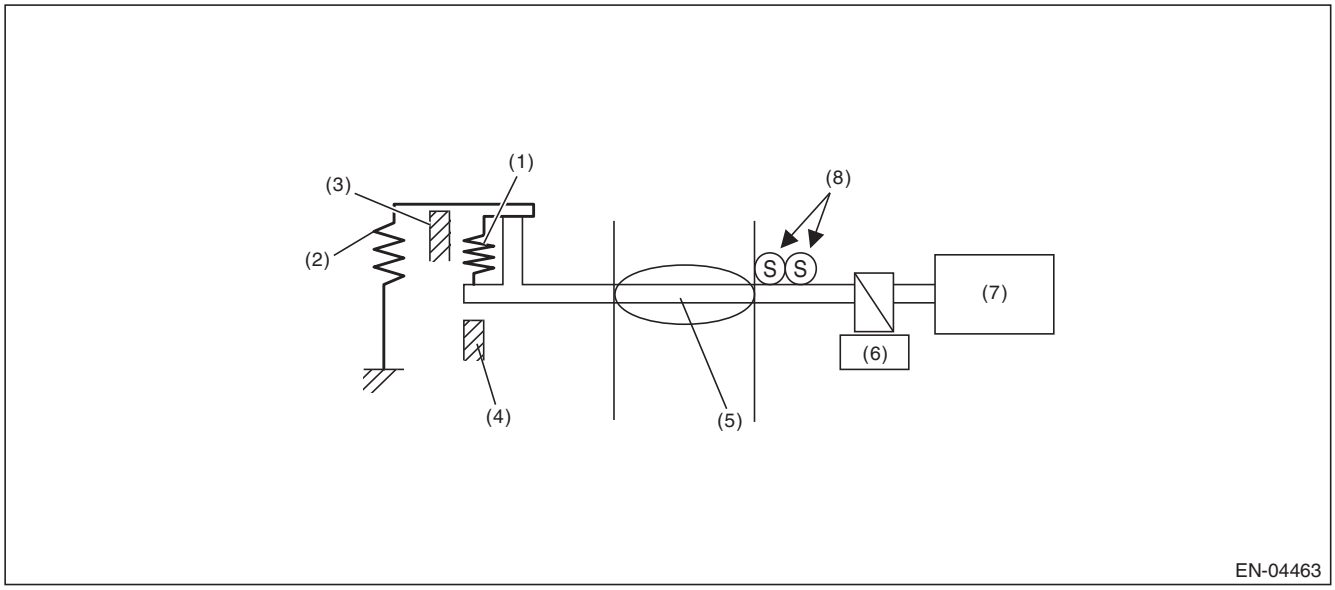
Time Needed for Diagnosis: Less than 1 second

DL: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 °

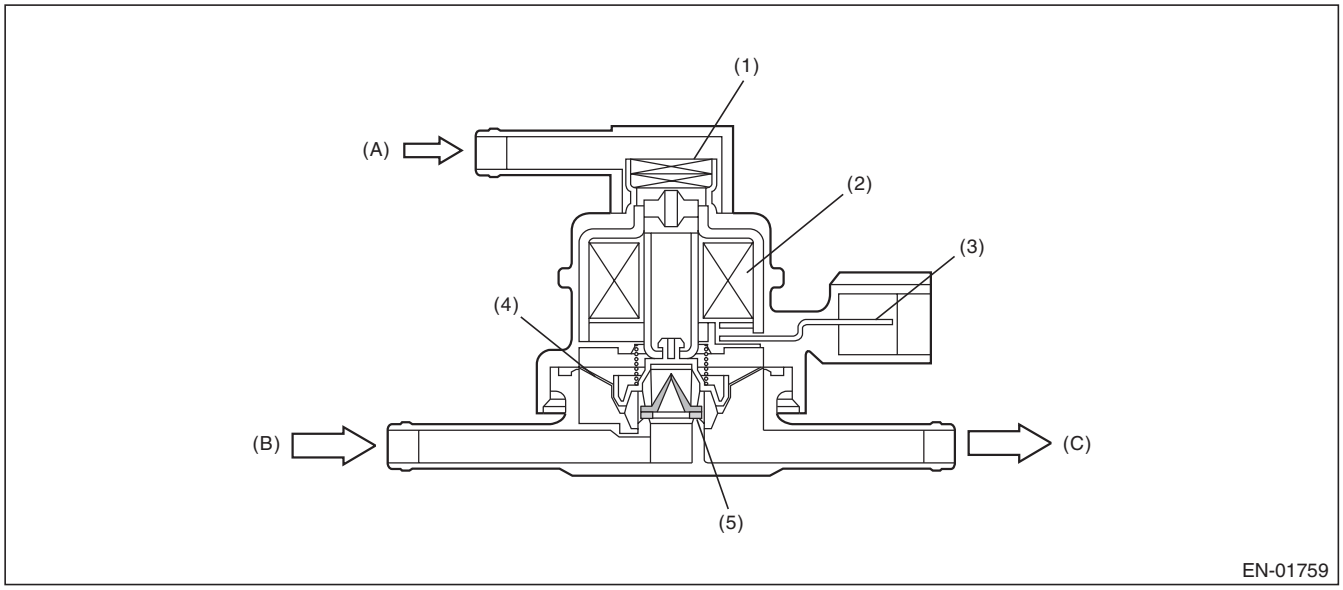
Time Needed for Diagnosis: 3400 ms

DM: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 s
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 s
Terminal output voltage when ECM outputs OFF signal	High

Time Needed for Diagnosis: Less than 1 second

DN:DTC P1410 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN

1. OUTLINE OF DIAGNOSIS

Always detect abnormality that both combination valve electromagnetic valve and the reed valve are open failure.
Calculate the integrated value of Max./Min. value and output voltage deviation of the secondary air delivery pipe pressure sensor output voltage in a given time after engine start. Judge as NG if the integrated value and the difference between Max. and Min. values are large.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine speed	≥ 500 rpm and < 10000 rpm
Elapsed time after starting the engine	≥ 9000 ms
After secondary air system stops	≥ 9000 ms
Amount of intake air	≥ 2 g/s (0.07 oz/s) and < 400 g/s (14.11 oz/s)
Battery voltage	≥ 10.9 V
Engine load	> 0 g/rev
After fuel cut	≥ 1000 ms

3. GENERAL DRIVING CYCLE

Perform continuous diagnosis when air flow amount is large during the secondary air pump stop after engine start.

4. DIAGNOSTIC METHOD

When both combination valve electromagnetic valve and the reed valve are open failure, the failure appears as pulses in the secondary air delivery pipe pressure sensor output. Detect abnormality by capturing these pulses using the following method.

- **Abnormality Judgment**

Calculate Max./Min. value of the secondary air delivery pipe pressure sensor output voltage and the sum of the output voltage deviation for the given time. Compare the difference between Max. and Min. values with threshold value and also compare the sum value with the threshold value. If both values exceed the threshold value, count up NG counter and then judge as NG if the counter reaches the given times.

Judgment Value

Malfunction Criteria	Threshold Value
Pipe inner pressure difference between Max. and Min.	> 0.05 V
Sum of the pipe inner pressure variation value every 4 milliseconds	> 5 V
Barometric pressure variation value	< 26.7 kPa (200 mmHg, 7.9 inHg)

Time Needed for Diagnosis: 2000 ms × 20 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear NG if neither exceeds the threshold value, or if either of the two exceeds the threshold value.

Judgment Value

Malfunction Criteria	Threshold Value
Pipe inner pressure difference between Max. and Min.	≤ 0.05 V
Sum of the pipe inner pressure variation value every 4 milliseconds	≤ 5 V

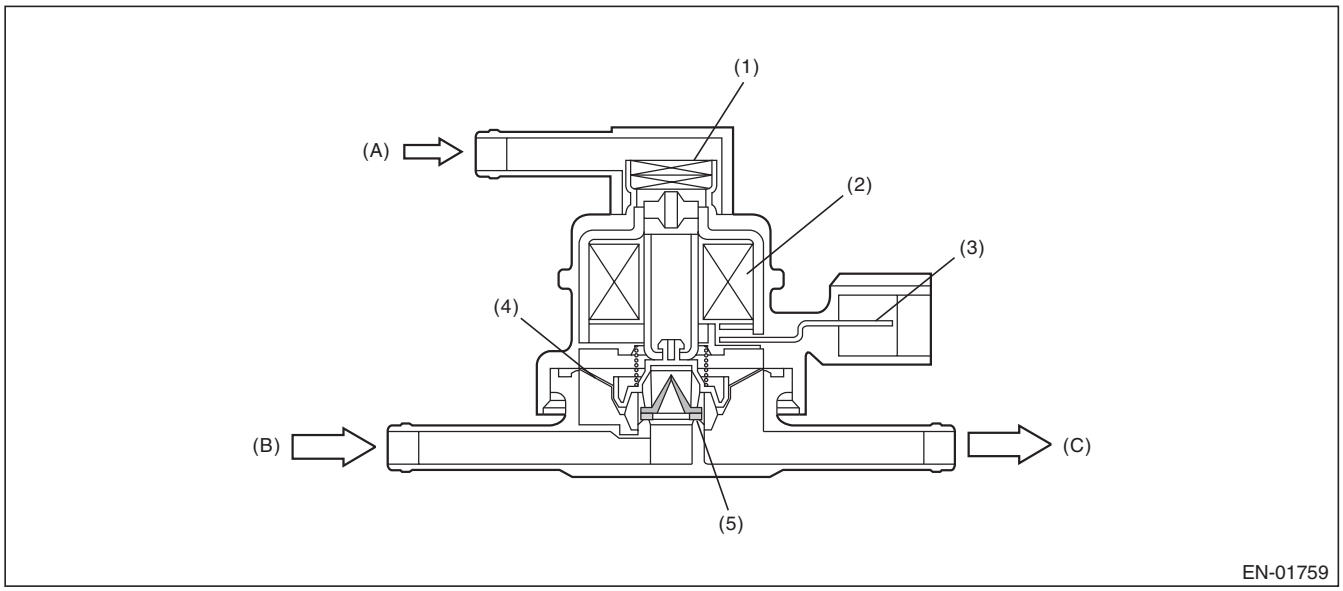
Time Needed for Diagnosis: 2000 ms

DO: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 s
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 s
Terminal output voltage when ECM outputs ON signal	Low

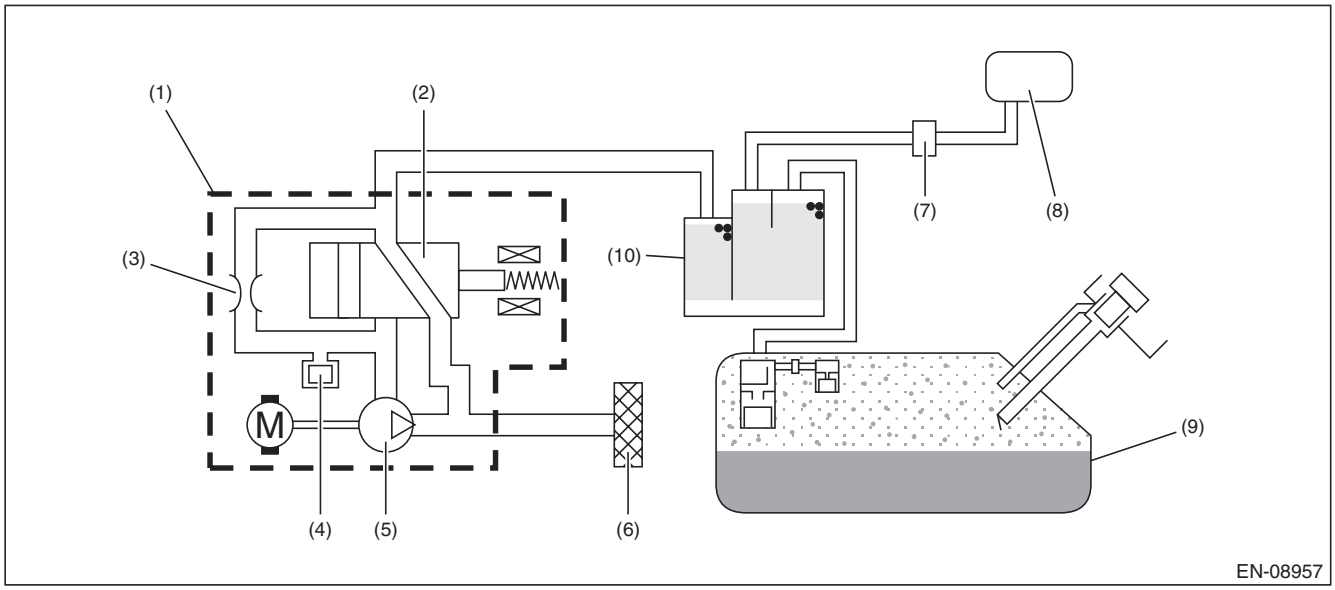
Time Needed for Diagnosis: Less than 1 second

DP:DTC P1449 EVAPORATIVE EMISSION CONT. SYS. AIR FILTER CLOG

1. OUTLINE OF DIAGNOSIS

Detect the drain filter clogging by the pressure change during purge introduction.
Judge as drain filter clogging malfunction if the pressure in the evaporative emission system piping suddenly decreases by the purging.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

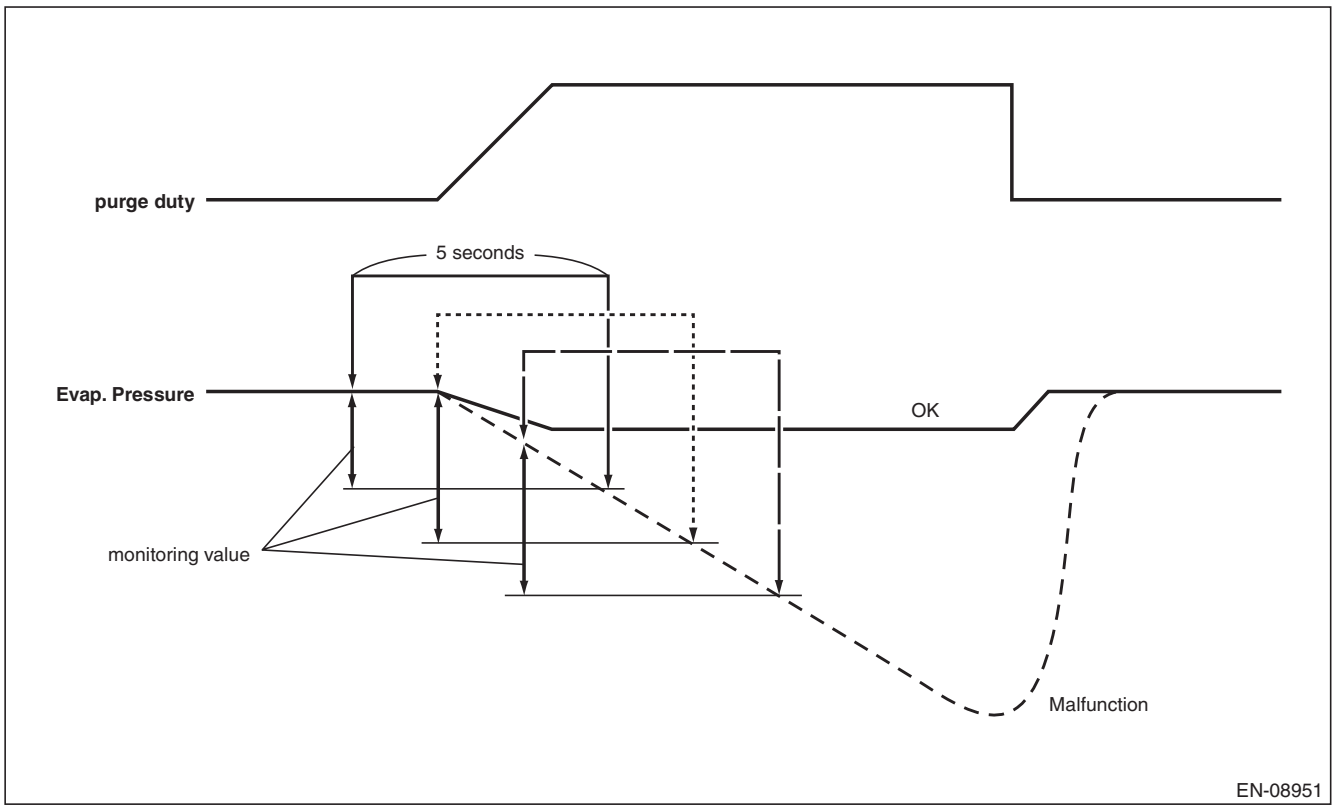
3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Elapsed time after starting the engine	≥ 20000 ms
Continuous time of |Pressure sensor output value – Pressure sensor output value 64 ms ago| ≤ 0.7 kPa (5 mmHg, 0.2 inHg)	≥ 5120 ms + 13000 ms
Establishing time for following conditions	≥ 10000 ms
• ELCM vacuum pump	Not in operation
• ELCM switching valve	Open

4. GENERAL DRIVING CYCLE

Perform the diagnosis continuously when purging is performed after 20000 ms have passed since the engine started.

5. DIAGNOSTIC METHOD



Calculate the difference between the ELCM pressure sensor output value as of 5 seconds ago and the current one, and if the value is greater than judgment value, detect and judge as filter clogging trouble.

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
|Pressure sensor output value as of 5 seconds ago – Current pressure sensor output value|	> Value from Map
Number of above conditions established	> 2 time(s)

Map

Vehicle speed km/h (MPH)	0 (0)	20 (12.4)	40 (24.9)	60 (37.3)	80 (49.7)	100 (62.1)	120 (74.6)	300 (186.4)
|Pressure sensor output value as of 5 seconds ago – Current pressure sensor output value| kPa (mmHg, inHg)	0.8 (5.864 , 0.2)	0.8 (5.864 , 0.2)	0.9 (6.757 , 0.3)	1 (7.649 , 0.3)	1 (7.649 , 0.3)	1 (7.649 , 0.3)	1 (7.649 , 0.3)	1.6 (11.647 , 0.5)

Time Needed for Diagnosis: Approx. 5 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
|Pressure sensor output value as of 5 seconds ago – Current pressure sensor output value|	≤ Value from Map

DQ:DTC P1451 EVAPORATIVE EMISSION CONT. SYS.

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0455. <Ref. to GD(H4DOTC)-160, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

DR:DTC P1570 ANTENNA

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DS:DTC P1571 REFERENCE CODE INCOMPATIBILITY

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DT:DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DU:DTC P1574 KEY COMMUNICATION FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DV:DTC P1576 EGI CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DW:DTC P1577 IMM CONTROL MODULE EEPROM

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DX:DTC P1578 METER FAILURE

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0513. <Ref. to GD(H4DOTC)-187, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Trouble Code (DTC) Detecting Criteria.>

DY:DTC P2004 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.
Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ –30 °C (–22 °F)
Ambient air temperature	≥ –30 °C (–22 °F)

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
Tumble generator valve opening	≥ 64.3 °
Tumble generator valve “close” signal output	≥ 3200 ms

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
Tumble generator valve opening	< 64.3 °
Tumble generator valve “close” signal output	≥ 3200 ms

Time Needed for Diagnosis: Less than 1 second

DZ:DTC P2005 INTAKE MANIFOLD RUNNER CONTROL STUCK OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.
Judge open fixing malfunction when the opening degree is large even after finishing the tumble generator valve closing driving.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ –30 °C (–22 °F)
Ambient air temperature	≥ –30 °C (–22 °F)

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
Tumble generator valve opening	≥ 64.3 °
Tumble generator valve “close” signal output	≥ 3200 ms

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
Tumble generator valve opening	< 64.3 °
Tumble generator valve “close” signal output	≥ 3200 ms

Time Needed for Diagnosis: Less than 1 second

EA:DTC P2006 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.
Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ –30 °C (–22 °F)
Ambient air temperature	≥ –30 °C (–22 °F)

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
Tumble generator valve opening	< 64.3 °
Tumble generator valve “open” signal output	≥ 4600 ms

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
Tumble generator valve opening	≥ 64.3 °
Tumble generator valve “open” signal output	≥ 4600 ms

Time Needed for Diagnosis: Less than 1 second

EB:DTC P2007 INTAKE MANIFOLD RUNNER CONTROL STUCK CLOSED (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of tumble generator valve motor function.
Judge close fixing malfunction when the opening degree is small even after finishing the tumble generator valve open driving.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 10.9 V
Engine coolant temperature	≥ –30 °C (–22 °F)
Ambient air temperature	≥ –30 °C (–22 °F)

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
Tumble generator valve opening	< 64.3 °
Tumble generator valve “open” signal output	≥ 4600 ms

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
Tumble generator valve opening	≥ 64.3 °
Tumble generator valve “open” signal output	≥ 4600 ms

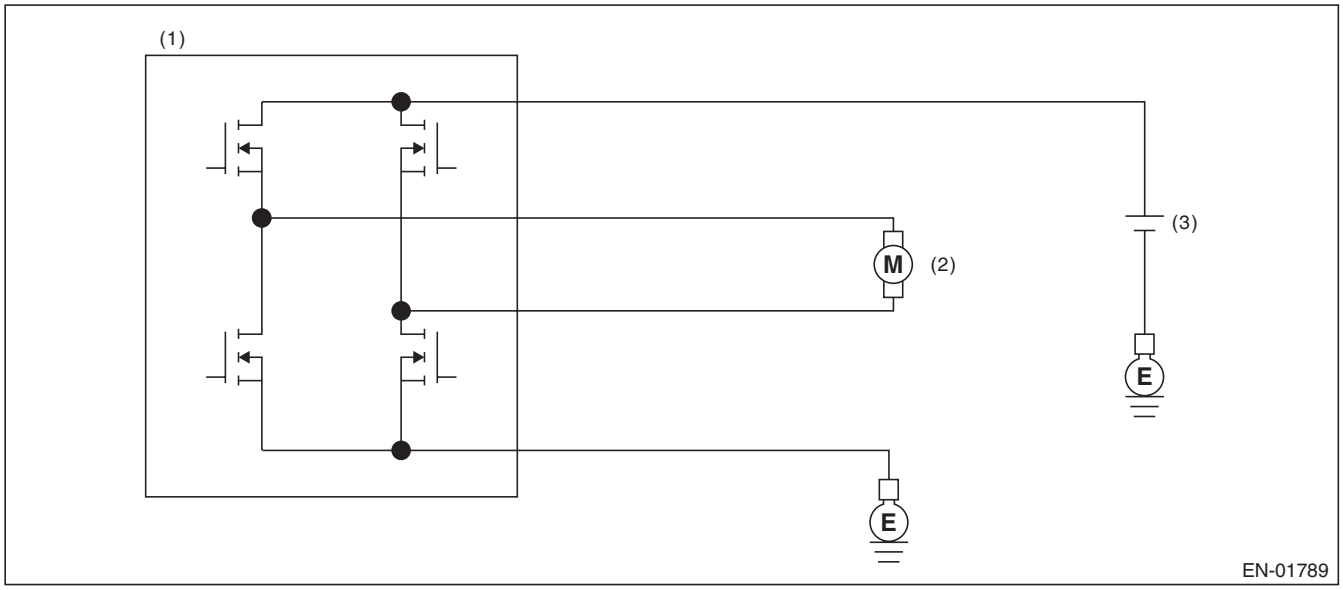
Time Needed for Diagnosis: Less than 1 second

EC:DTC P2008 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.
Judge as NG when the open signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generator valve (3) Battery

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

At the main IC, check the sent signal at each timing which occurs immediately after the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent 96 ms × 20 time(s) in a row.

Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	Low

Time Needed for Diagnosis: 96 ms × 20 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG when the OK signal is sent.

Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High

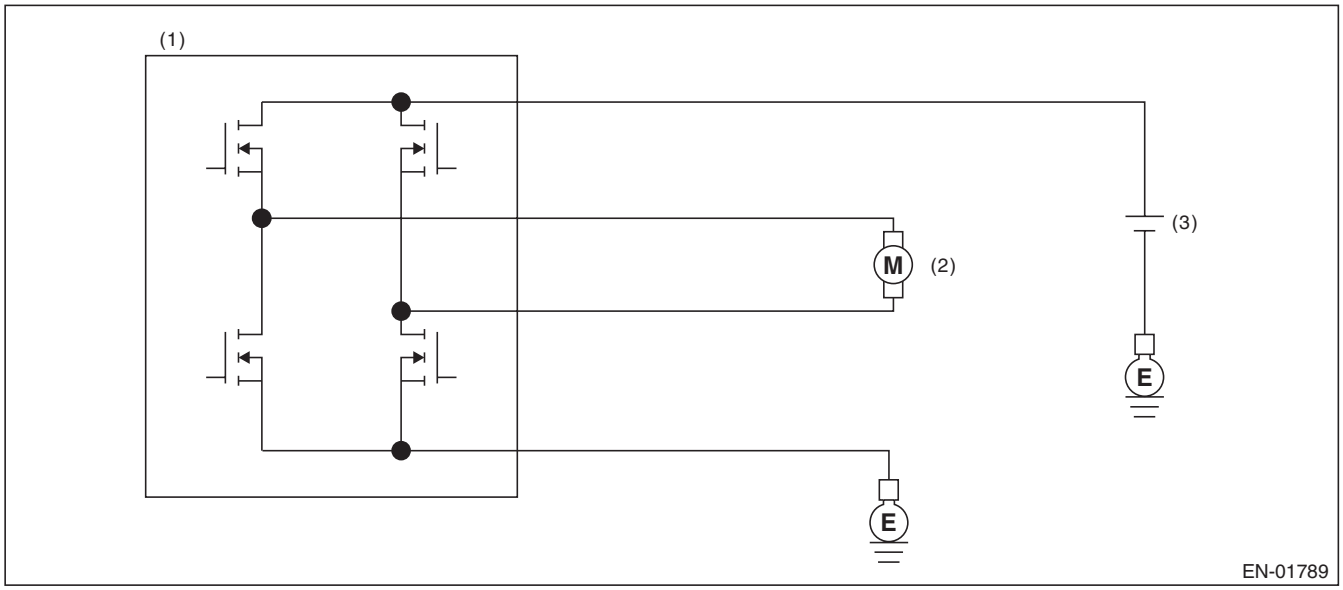
Time Needed for Diagnosis: Less than 1 second

ED:DTC P2009 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.
Judge as NG when the overcurrent signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generator valve (3) Battery

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

At the main IC, check the sent signal at each timing which occurs just before the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent 96 ms × 10 time(s) in a row.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent NG signal input	Low

Time Needed for Diagnosis: 96 ms × 10 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG when the OK signal is sent.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent NG signal input	High

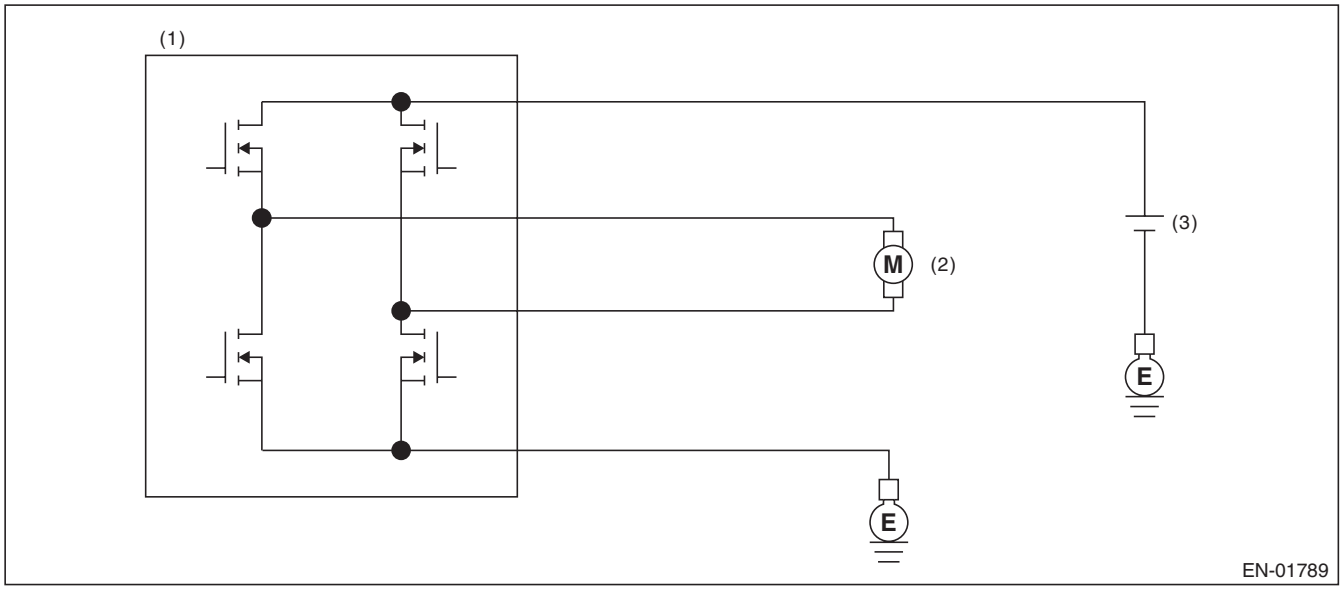
Time Needed for Diagnosis: Less than 1 second

EE:DTC P2011 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT / OPEN (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.
Judge as NG when the open signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generator valve (3) Battery

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

At the main IC, check the sent signal at each timing which occurs immediately after the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent 96 ms × 20 time(s) in a row.

Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	Low

Time Needed for Diagnosis: 96 ms × 20 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

- **Normality Judgment**

Judge as OK and clear the NG when the OK signal is sent.

Judgment Value

Malfunction Criteria	Threshold Value
Open NG signal input	High

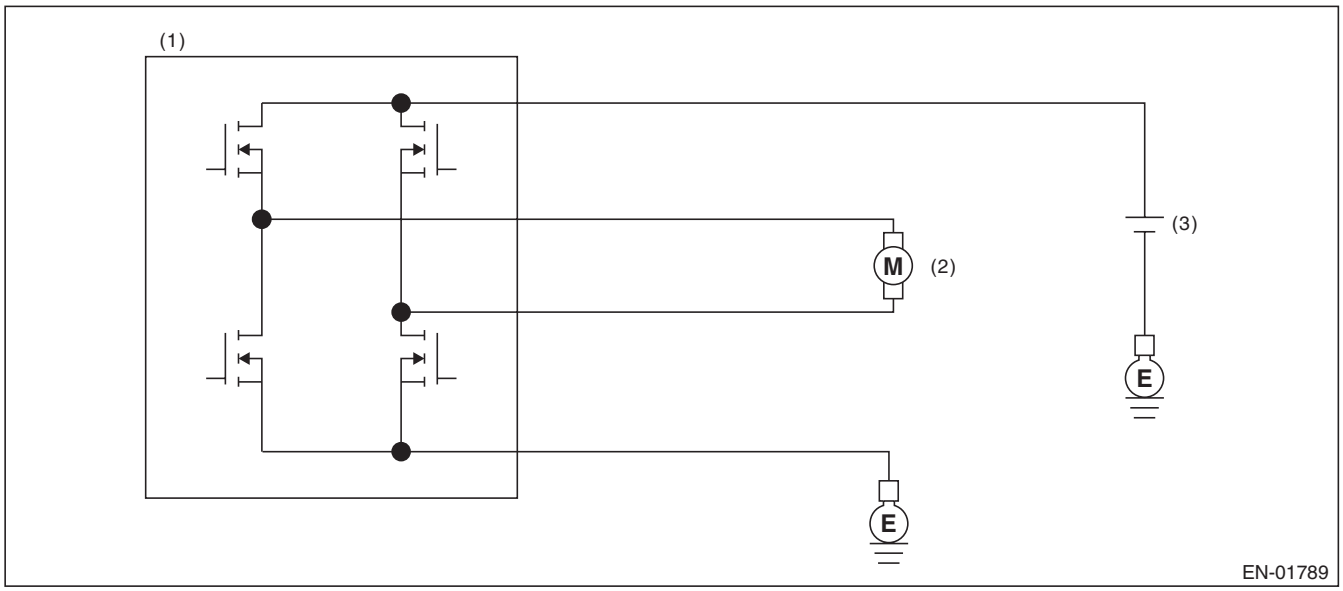
Time Needed for Diagnosis: Less than 1 second

EF:DTC P2012 INTAKE MANIFOLD RUNNER CONTROL CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of tumble generator valve motor.
Judge as NG when the overcurrent signal is sent from IC after tumble generator valve driving IC diagnosis.

2. COMPONENT DESCRIPTION



(1) Engine control module (ECM) (2) Tumble generator valve (3) Battery

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

At the main IC, check the sent signal at each timing which occurs just before the tumble generator valve output is set to ON → OFF, and judge open NG when the open NG signal is sent 96 ms × 10 time(s) in a row.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent NG signal input	Low

Time Needed for Diagnosis: 96 ms × 10 time(s)
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

• Normality Judgment

Judge as OK and clear the NG when the OK signal is sent.

Judgment Value

Malfunction Criteria	Threshold Value
Overcurrent NG signal input	High

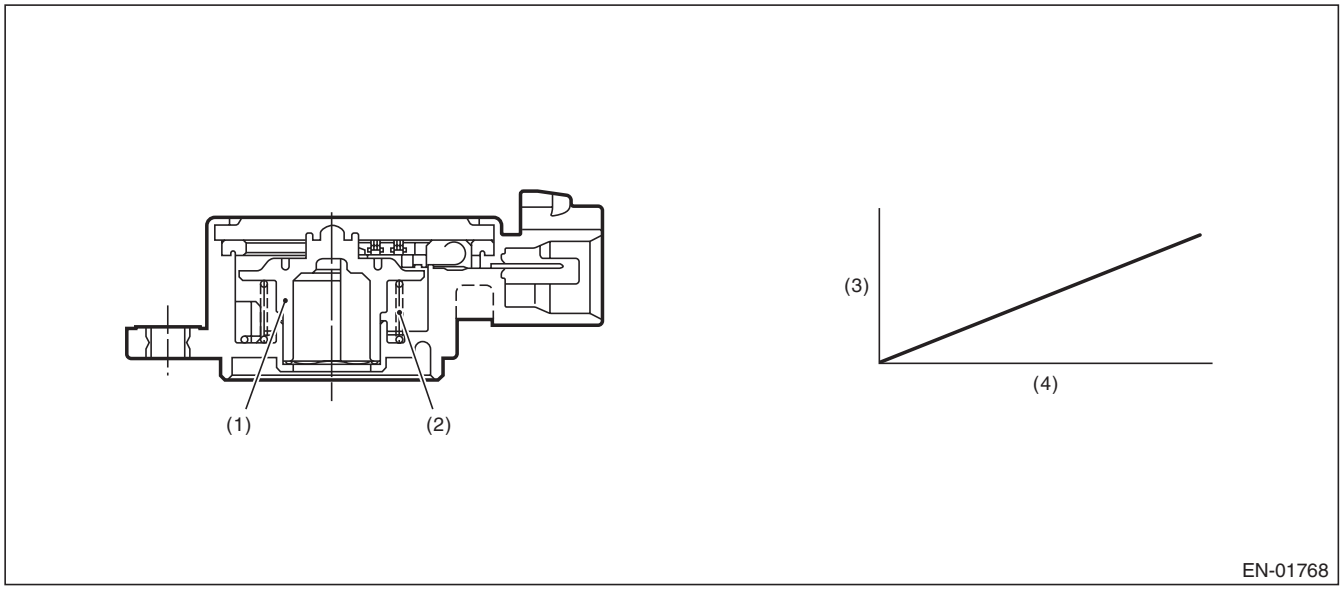
Time Needed for Diagnosis: Less than 1 second

EG:DTC P2016 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Rotor
(2) Return spring
(3) Voltage (V)
(4) Tumble generator valve opening (°)

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	< 0.264 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	≥ 0.264 V

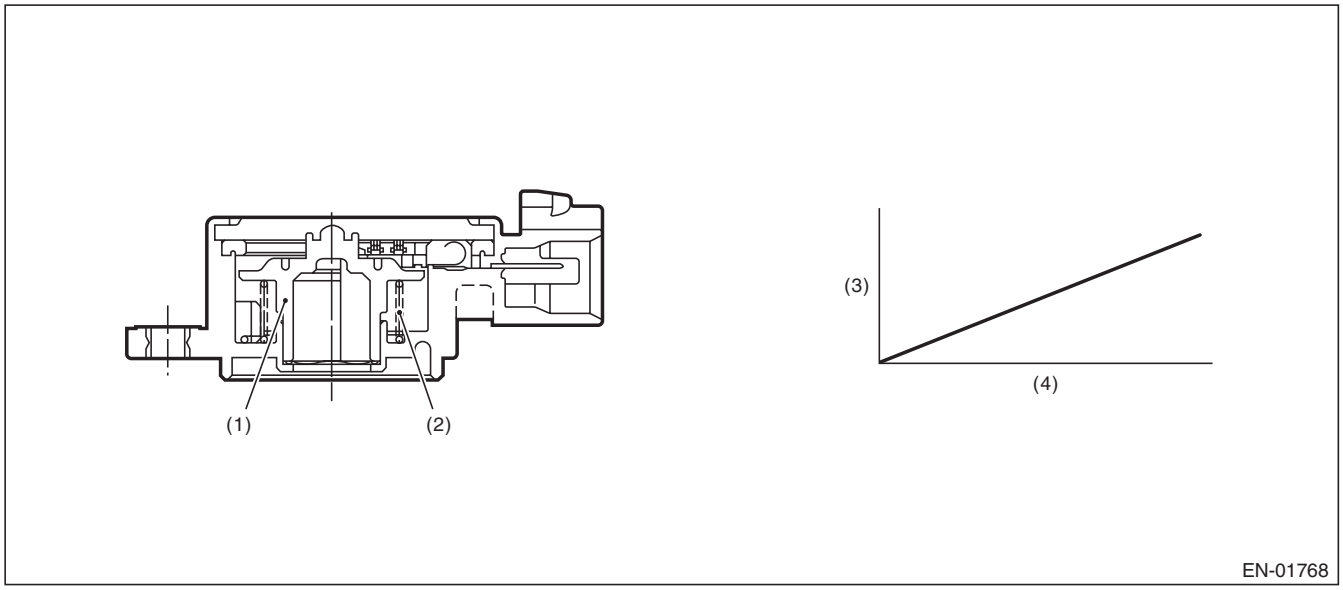
Time Needed for Diagnosis: Less than 1 second

EH:DTC P2017 TUMBLE GENERATED VALVE POSITION SENSOR 1 CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Rotor
(2) Return spring
(3) Voltage (V)
(4) Tumble generator valve opening (°)

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	≥ 4.783 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	< 4.783 V

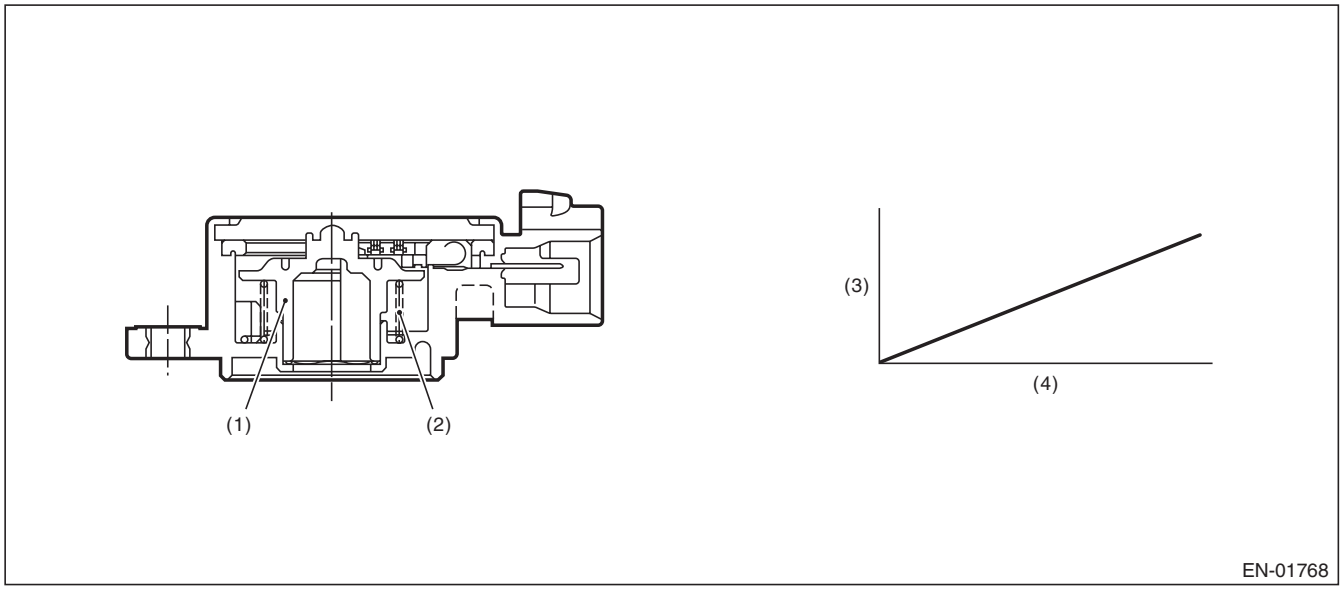
Time Needed for Diagnosis: Less than 1 second

EI: DTC P2021 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Rotor
(2) Return spring
(3) Voltage (V)
(4) Tumble generator valve opening (°)

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	< 0.264 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	≥ 0.264 V

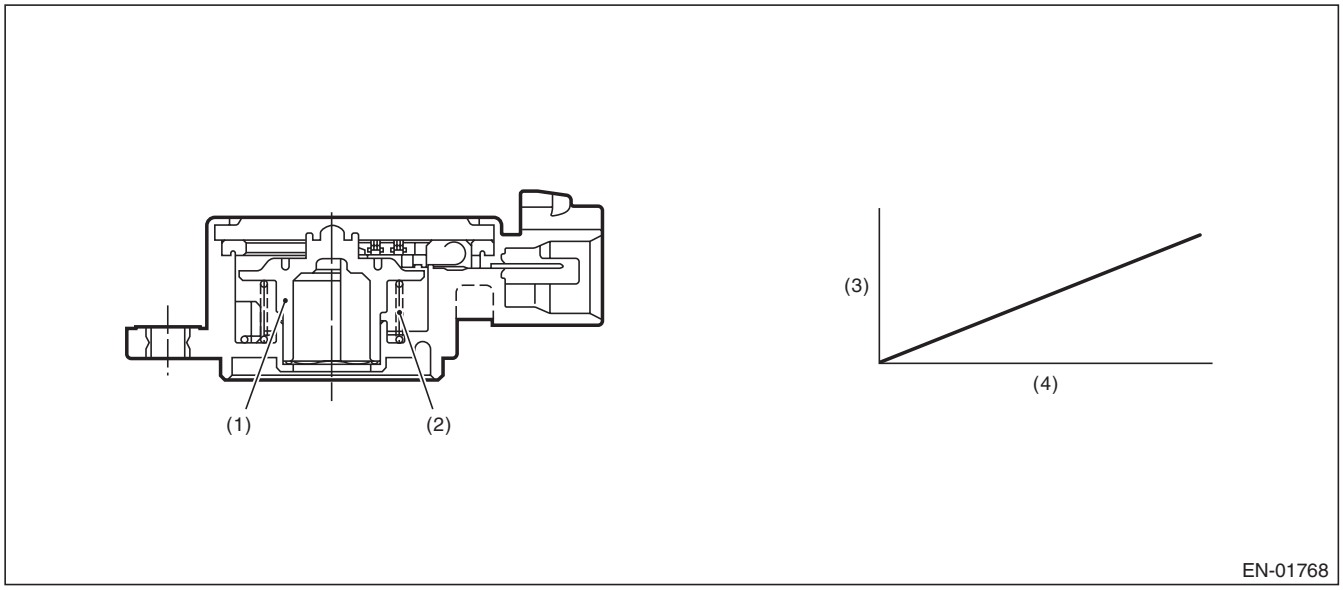
Time Needed for Diagnosis: Less than 1 second

EJ: DTC P2022 TUMBLE GENERATED VALVE POSITION SENSOR 2 CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of tumble generator valve position sensor.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) Rotor
(2) Return spring
(3) Voltage (V)
(4) Tumble generator valve opening (°)

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	≥ 4.783 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	< 4.783 V

Time Needed for Diagnosis: Less than 1 second

EK:DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the oil flow control solenoid valve.
Judge as NG when the current is small even though the duty signal is large.

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
Oil flow control solenoid valve control duty	≥ 99.61 %
Oil control solenoid valve control present current	< 0.306 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
Battery voltage	≥ 10.9 V
Target current value of the oil flow control solenoid valve	≥ 0.14 A
|Target current value of the oil flow control solenoid valve – oil flow control solenoid valve control current value|	< 0.08 A

Time Needed for Diagnosis: 2000 ms

EL:DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil flow control solenoid valve.
Judge as NG when the current is large even though the duty signal is small.

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
Oil flow control solenoid valve control duty	< 0.39 %
Oil control solenoid valve control present current	≥ 0.306 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
Battery voltage	≥ 10.9 V
|Target current value of the oil flow control solenoid valve – oil flow control solenoid valve control current value|	< 0.08 A

Time Needed for Diagnosis: 2000 ms

EM:DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of the oil flow control solenoid valve.
Judge as NG when the current is small even though the duty signal is large.

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
Oil flow control solenoid valve control duty	≥ 99.61 %
Oil control solenoid valve control present current	< 0.306 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
Battery voltage	≥ 10.9 V
Target current value of the oil flow control solenoid valve	≥ 0.14 A
|Target current value of the oil flow control solenoid valve – oil flow control solenoid valve control current value|	< 0.08 A

Time Needed for Diagnosis: 2000 ms

EN:DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1)

1. OUTLINE OF DIAGNOSIS

Detect open or short circuit of oil flow control solenoid valve.
Judge as NG when the current is large even though the duty signal is small.

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
Oil flow control solenoid valve control duty	< 0.39 %
Oil control solenoid valve control present current	≥ 0.306 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
Battery voltage	≥ 10.9 V
|Target current value of the oil flow control solenoid valve – oil flow control solenoid valve control current value|	< 0.08 A

Time Needed for Diagnosis: 2000 ms

EO:DTC P2092 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P2088. <Ref. to GD(H4DOTC)-232, DTC P2088 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EP:DTC P2093 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P2089. <Ref. to GD(H4DOTC)-233, DTC P2089 INTAKE CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

EQ:DTC P2094 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P2090. <Ref. to GD(H4DOTC)-234, DTC P2090 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT LOW (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

ER:DTC P2095 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 2)

1. OUTLINE OF DIAGNOSIS

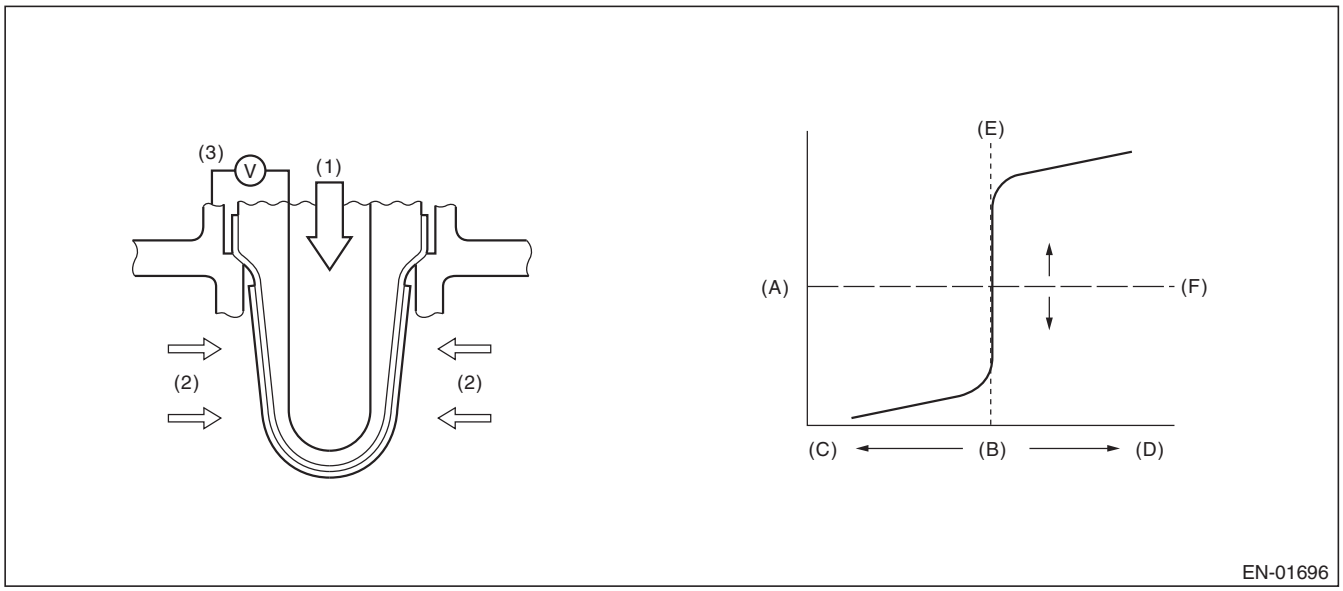
NOTE:
For the detection standard, refer to DTC P2091. <Ref. to GD(H4DOTC)-235, DTC P2091 EXHAUST CAMSHAFT POSITION ACTUATOR CONTROL CIRCUIT HIGH (BANK 1), Diagnostic Trouble Code (DTC) Detecting Criteria.>

ES: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	< –0.024 (Models without SI-DRIVE) < –0.037 (Models with SI-DRIVE)

Time Needed for Diagnosis: 1 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	≥ –0.024 + 0.004 (Models without SI-DRIVE) ≥ –0.037 + 0 (Models with SI-DRIVE)

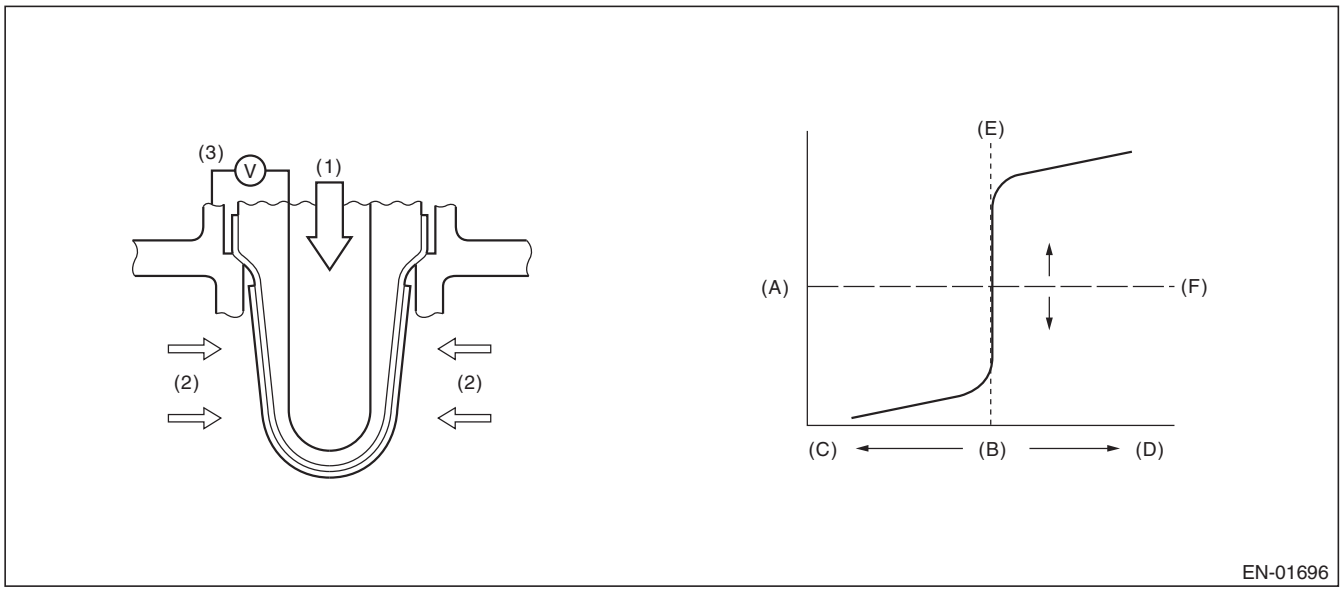
Time Needed for Diagnosis: 1 s

ET: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	≥ 0.028 (Models without SI-DRIVE) ≥ 0.023 (Models with SI-DRIVE)

Time Needed for Diagnosis: 1 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	< 0.028 + –0.01 (Models without SI-DRIVE) < 0.023 + 0 (Models with SI-DRIVE)

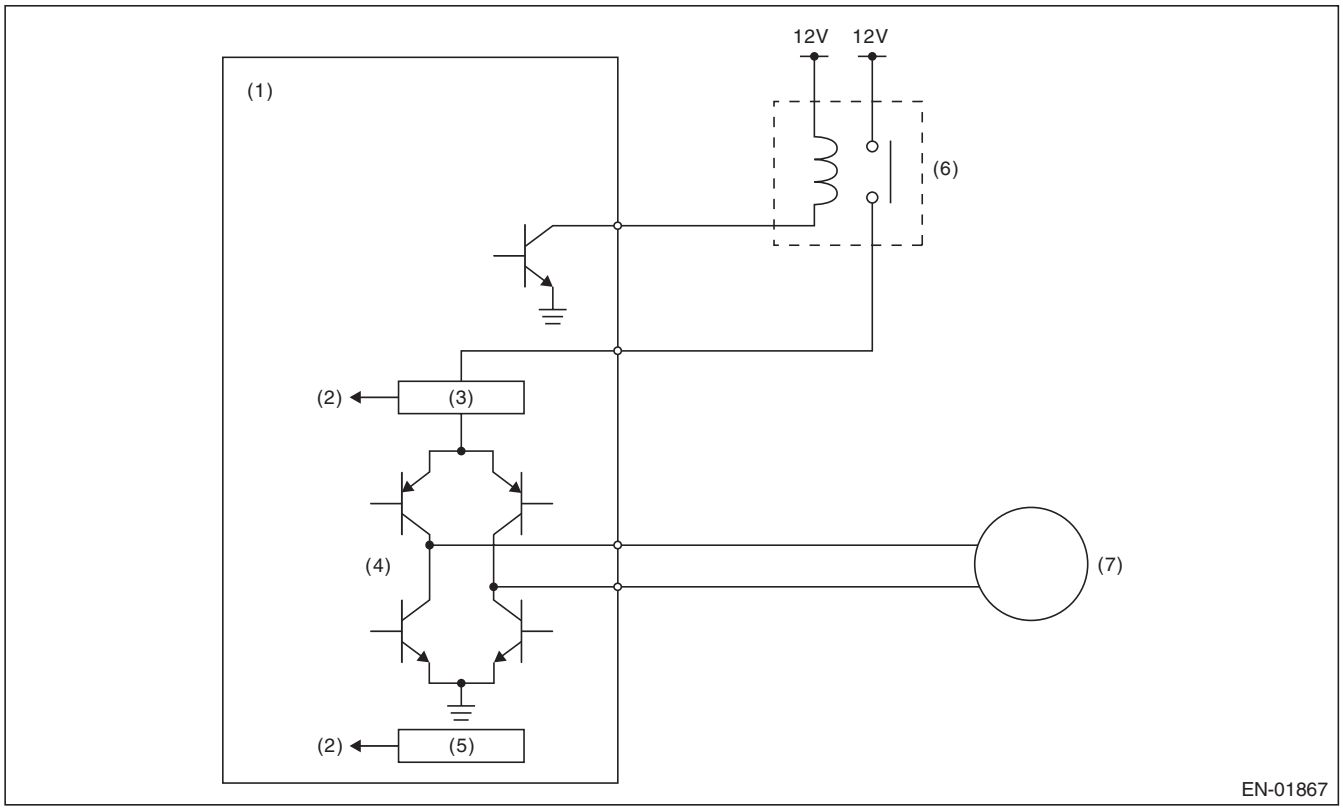
Time Needed for Diagnosis: 1 s

EU: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
CPU communication line sub → main normal judgment	Normal

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
Motor current	> 8 A
or	
Drive circuit inner temperature	> 175°C (347°F)

Time Needed for Diagnosis: 512 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
Motor current	≤ 8 A
Drive circuit inner temperature	≤ 175°C (347°F)

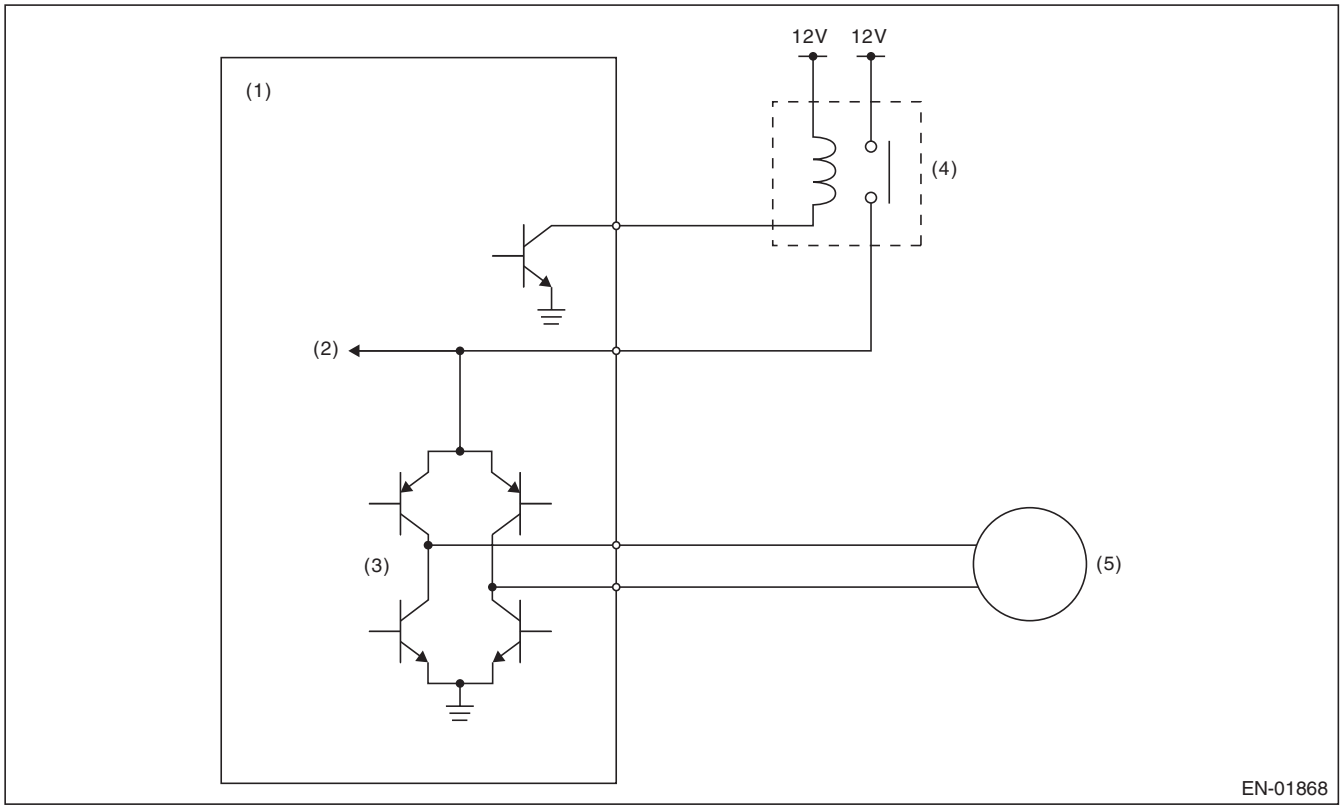
Time Needed for Diagnosis: 2000 ms

EV: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
Battery voltage	≥ 11 V
Electronic throttle control relay output	ON

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
Motor power voltage	≤ 5 V

Time Needed for Diagnosis: 352 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
Motor power voltage	> 5 V

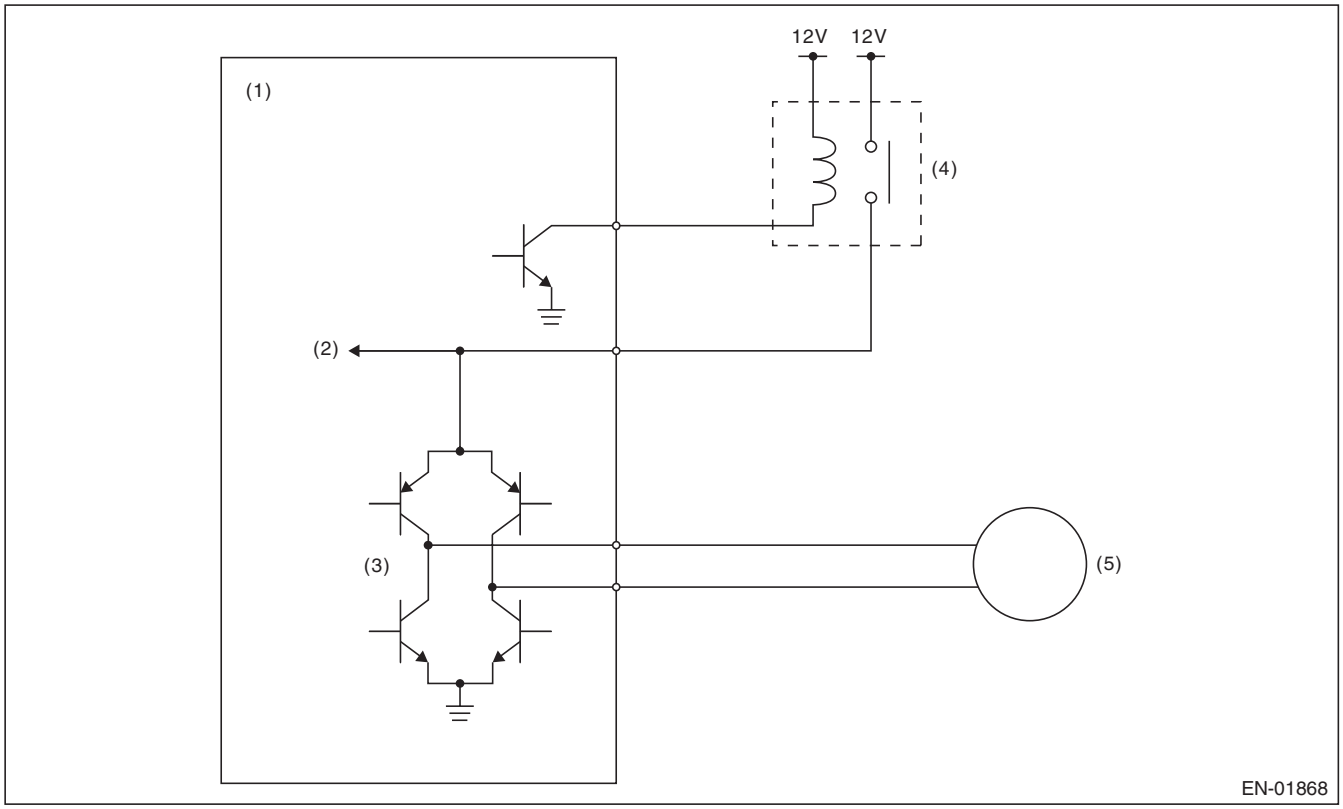
Time Needed for Diagnosis: 2000 ms

EW: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
Battery voltage	≥ 6 V
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

• 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
Motor power voltage	≥ 5 V

Time Needed for Diagnosis: 600 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
Motor power voltage	< 5 V

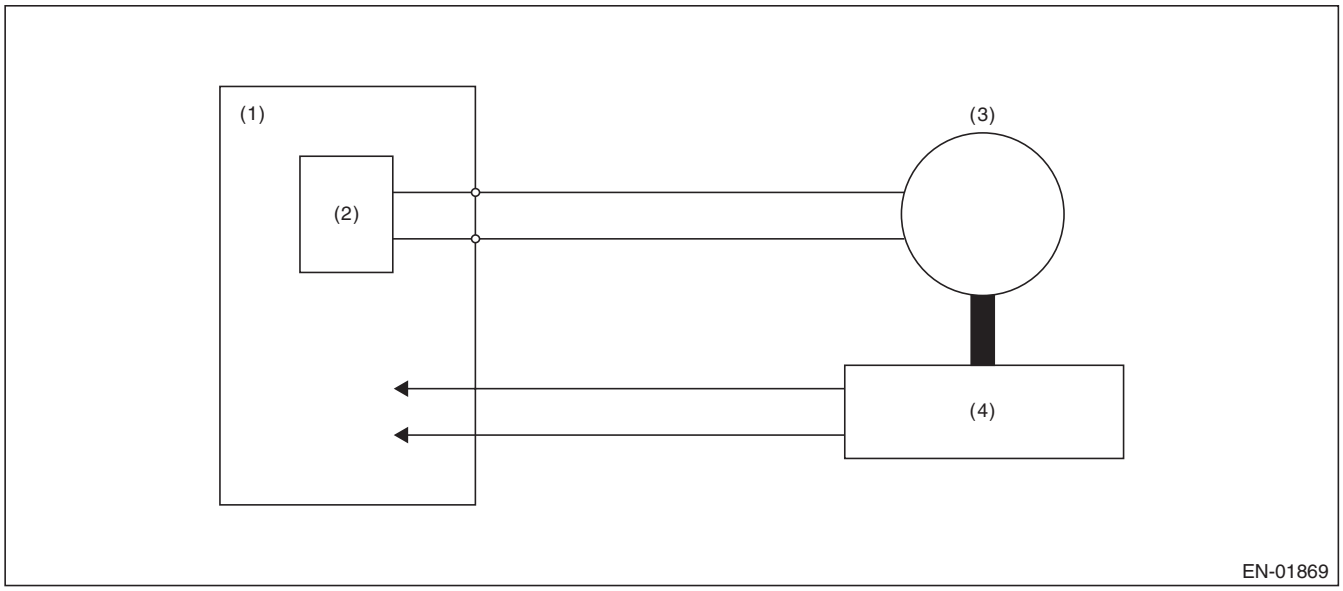
Time Needed for Diagnosis: 400 ms

EX: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

• 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
Throttle sensor opening angle at full close point learning or	< 9.884 ° or > 20.116 °
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	< 0.887 ° (models without SI-DRIVE) < 1.637 ° (models with SI-DRIVE)

Time Needed for Diagnosis: 8 ms — 80 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
Throttle sensor opening angle at full close point learning	≥ 9.884 ° and ≤ 20.116 °
Throttle opening angle when the ignition switch is ON – Throttle minimum stop position	≥ 0.887 ° (models without SI-DRIVE) ≥ 1.637 ° (models with SI-DRIVE)

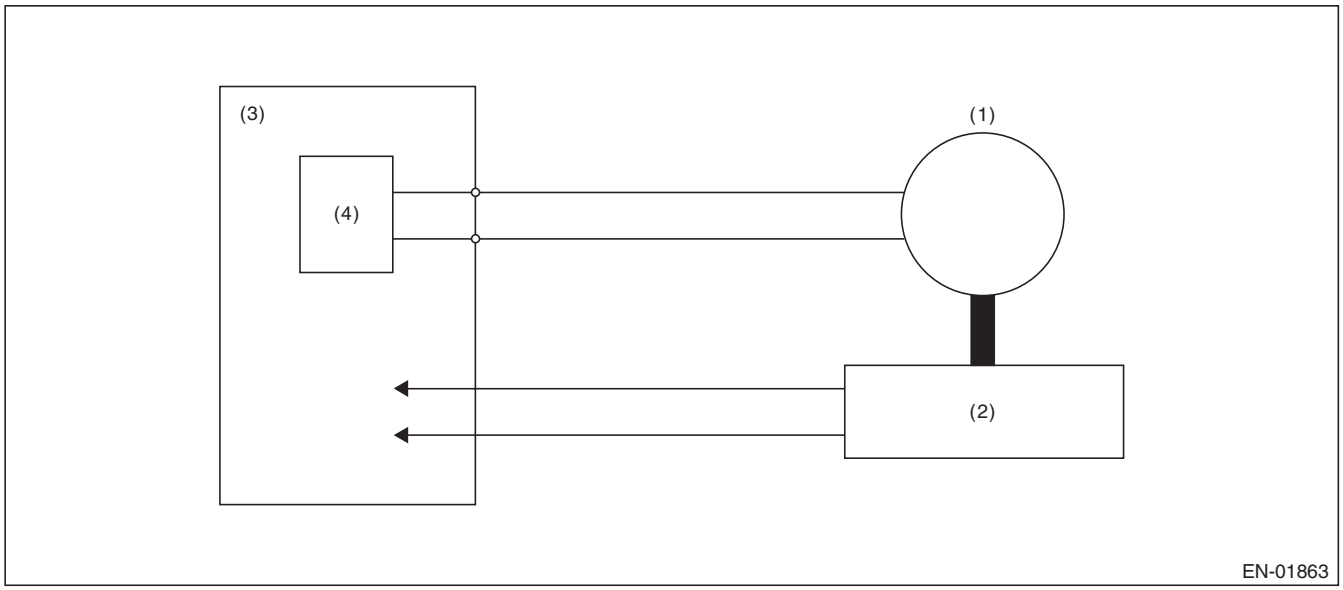
Time Needed for Diagnosis: 8 ms

EY:DTC P2119 THROTTLE ACTUATOR CONTROL THROTTLE BODY RANGE/ PERFORMANCE

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.

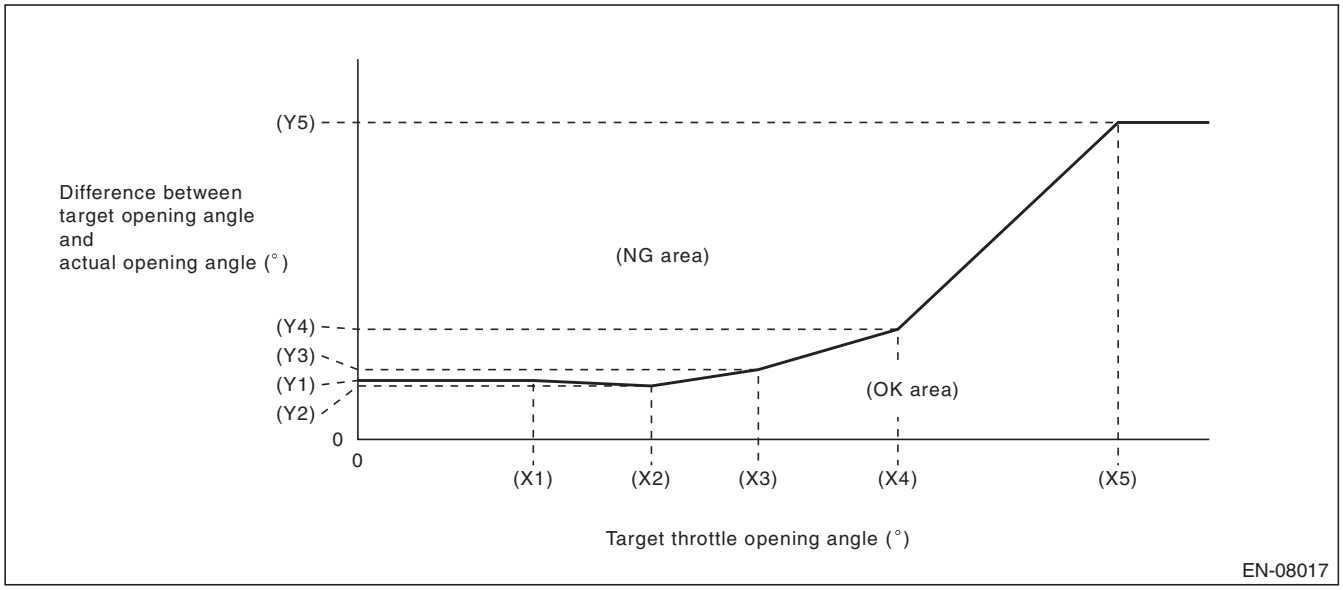
Judgment Value

Malfunction Criteria	Threshold Value
Difference between target opening angle and actual opening angle	Within OK range 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: See **Details of Judgment time**
  - OK judgment: 2000 ms
- Output duty to drive circuit: 2000 ms

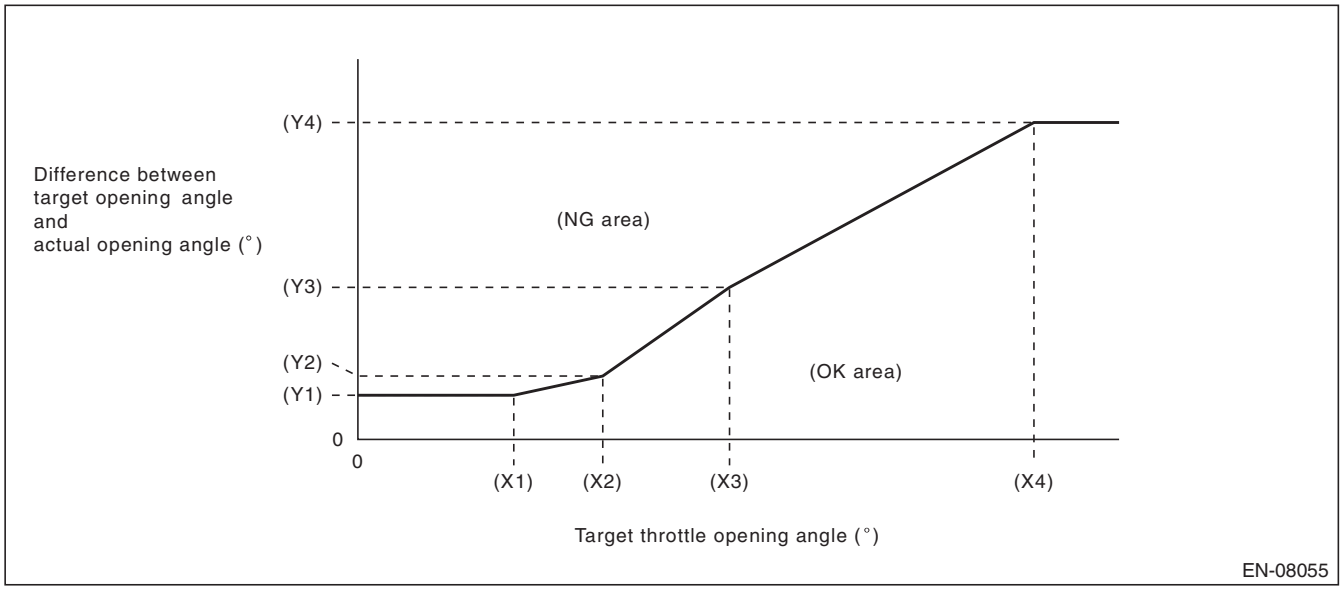
Details of Judgment Value
Models without SI-DRIVE



(X1) 6.915 °
(X2) 11.565 °
(X3) 15.785 °
(X4) 21.285 °
(X5) 29.965 °

(Y1) 4.65 °
(Y2) 4.22 °
(Y3) 5.5 °
(Y4) 8.68 °
(Y5) 25 °

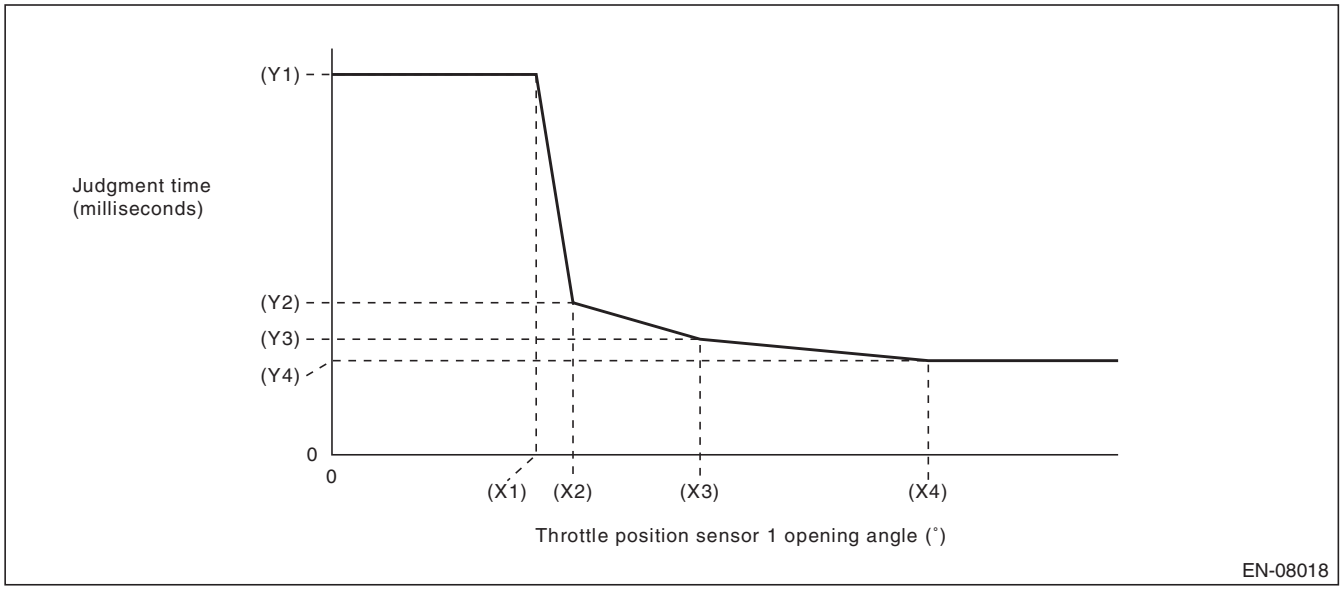
Models with SI-DRIVE



(X1) 6.15 °
(X2) 9.65 °
(X3) 14.65 °
(X4) 26.65 °

(Y1) 3.5 °
(Y2) 5 °
(Y3) 12 °
(Y4) 25 °

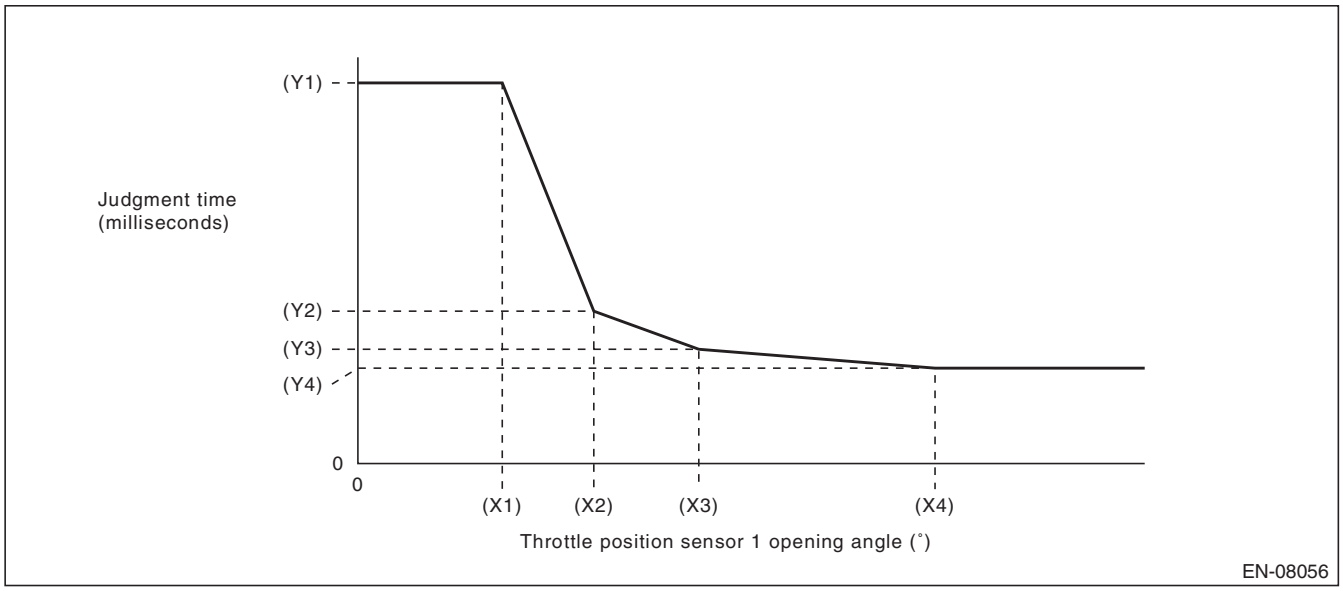
Details of Judgment time
Models without SI-DRIVE



(X1) 8.049999237 °
(X2) 9.5 °
(X3) 14.5 °
(X4) 23.5 °

(Y1) 1000 ms
(Y2) 400 ms
(Y3) 304 ms
(Y4) 248 ms

Models with SI-DRIVE



(X1) 5.5 °
(X2) 9 °
(X3) 13 °
(X4) 22 °

(Y1) 1000 ms
(Y2) 400 ms
(Y3) 300 ms
(Y4) 250 ms

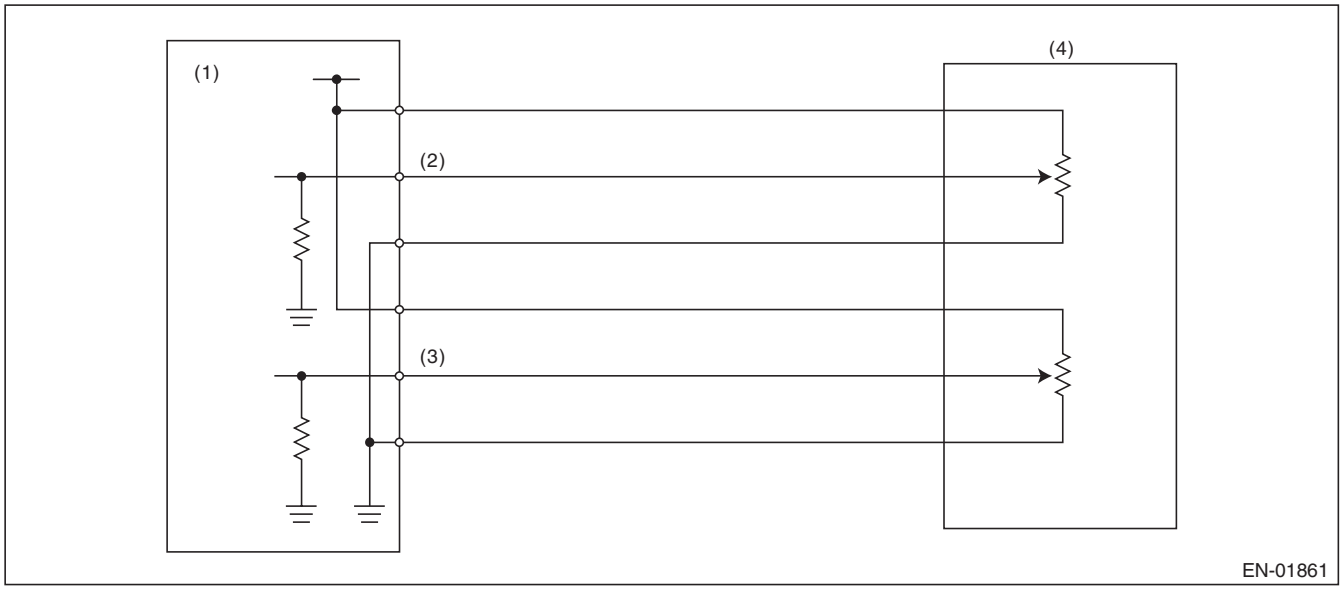
NOTE:
Judgment time when actual opening angle ≤ target opening angle is always 1000 milliseconds.
Malfunction Indicator Light Illumination: Illuminates as soon as a malfunction occurs.

EZ: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	< 0.301 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	≥ 0.301 V

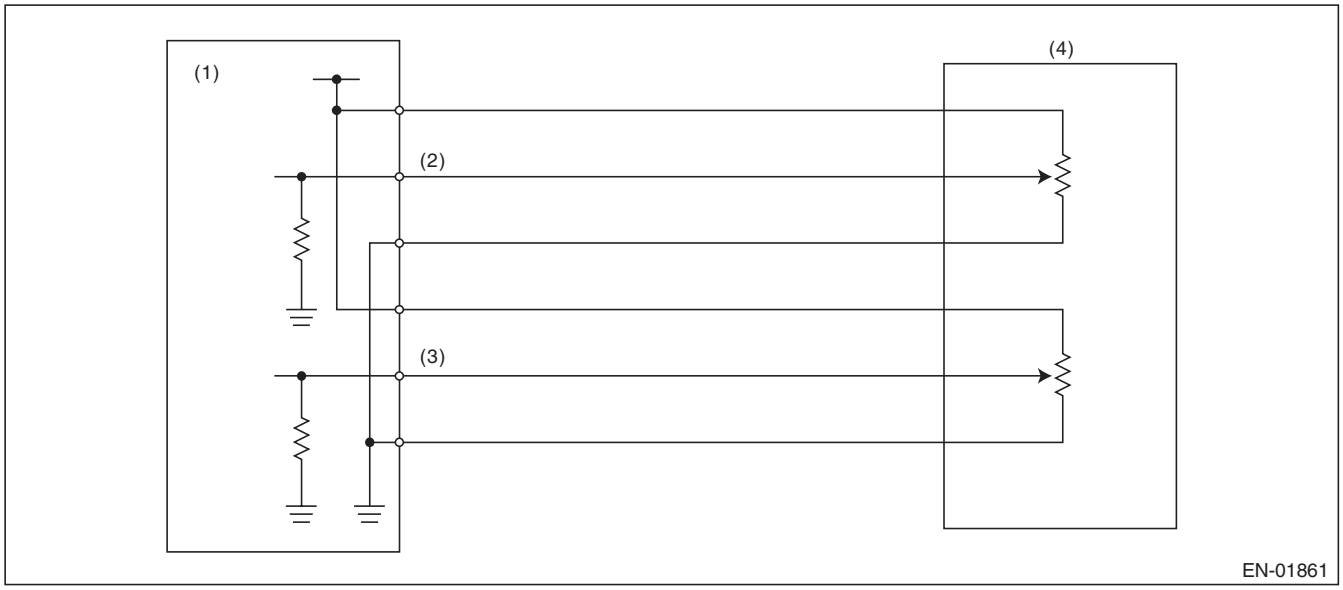
Time Needed for Diagnosis: 100 ms

FA: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

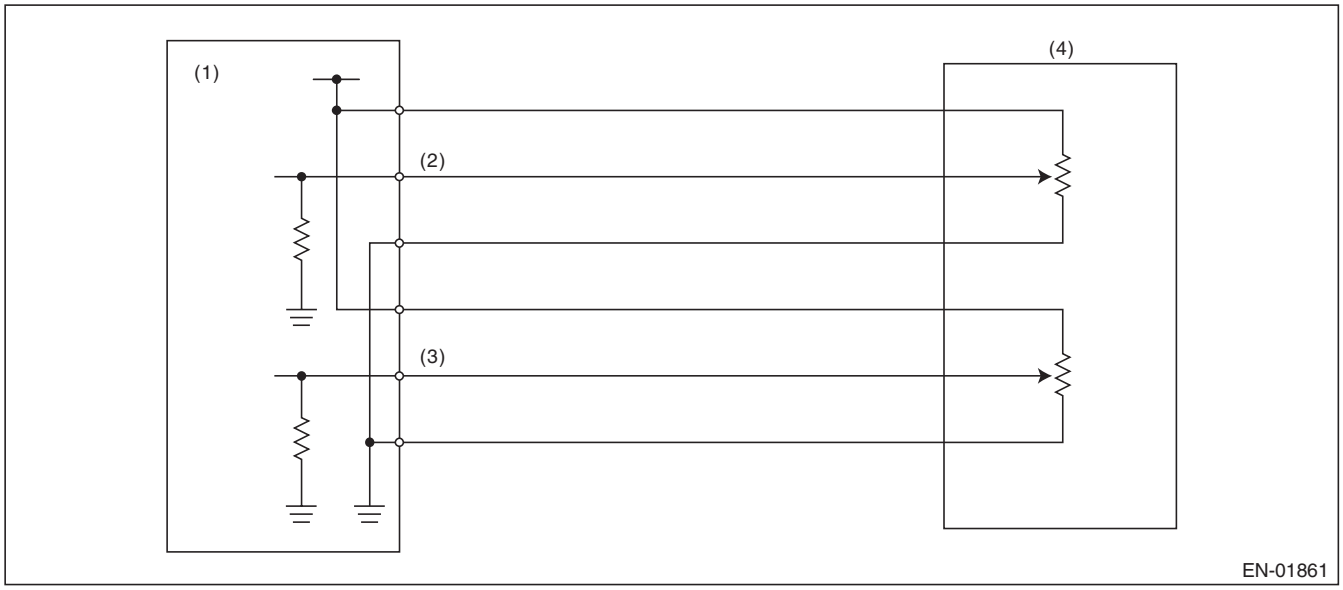
Time Needed for Diagnosis: 32 ms

FB: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	< 0.301 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	≥ 0.301 V

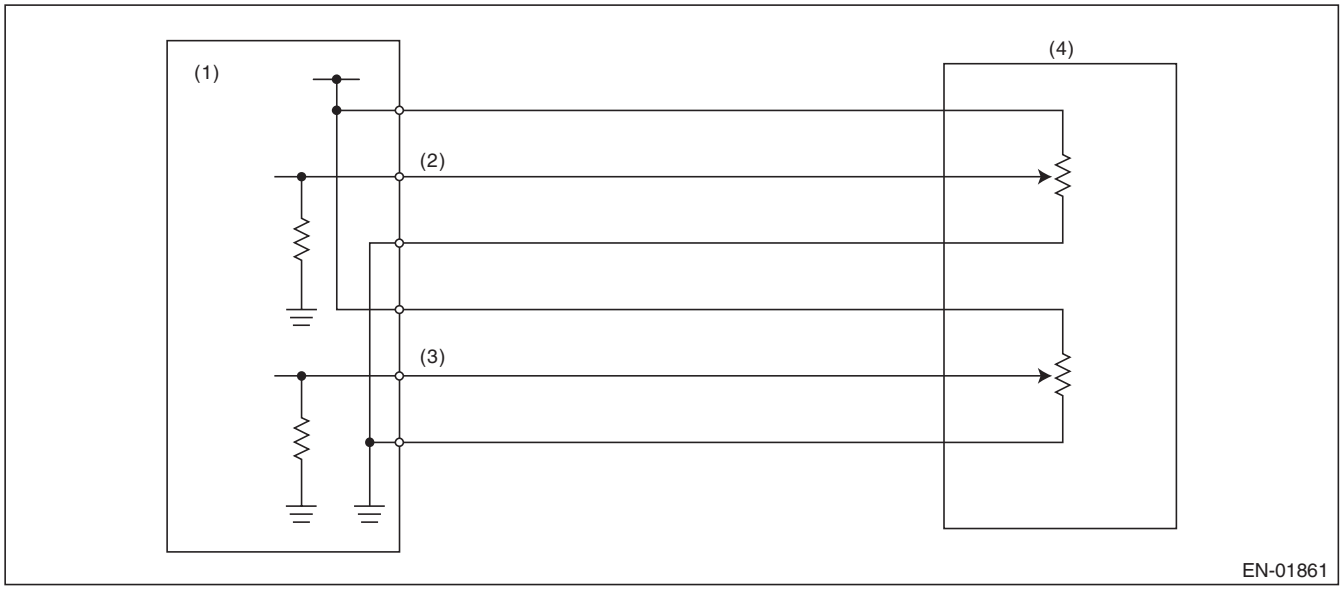
Time Needed for Diagnosis: 100 ms

FC: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

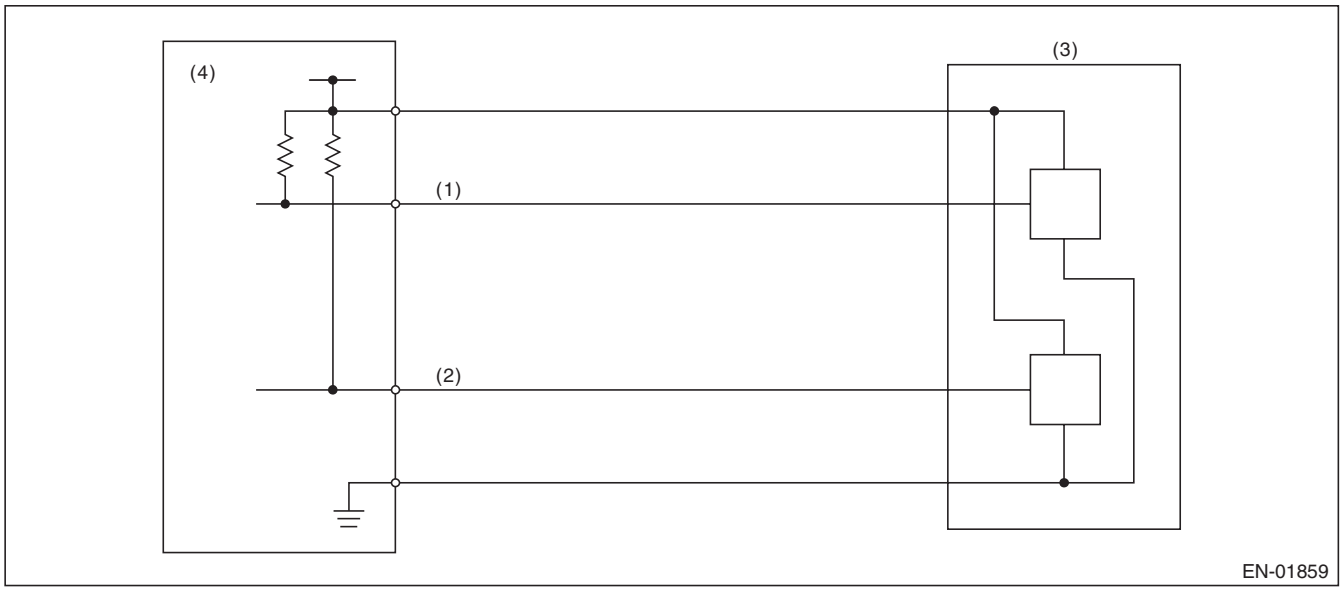
Time Needed for Diagnosis: 100 ms

FD: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

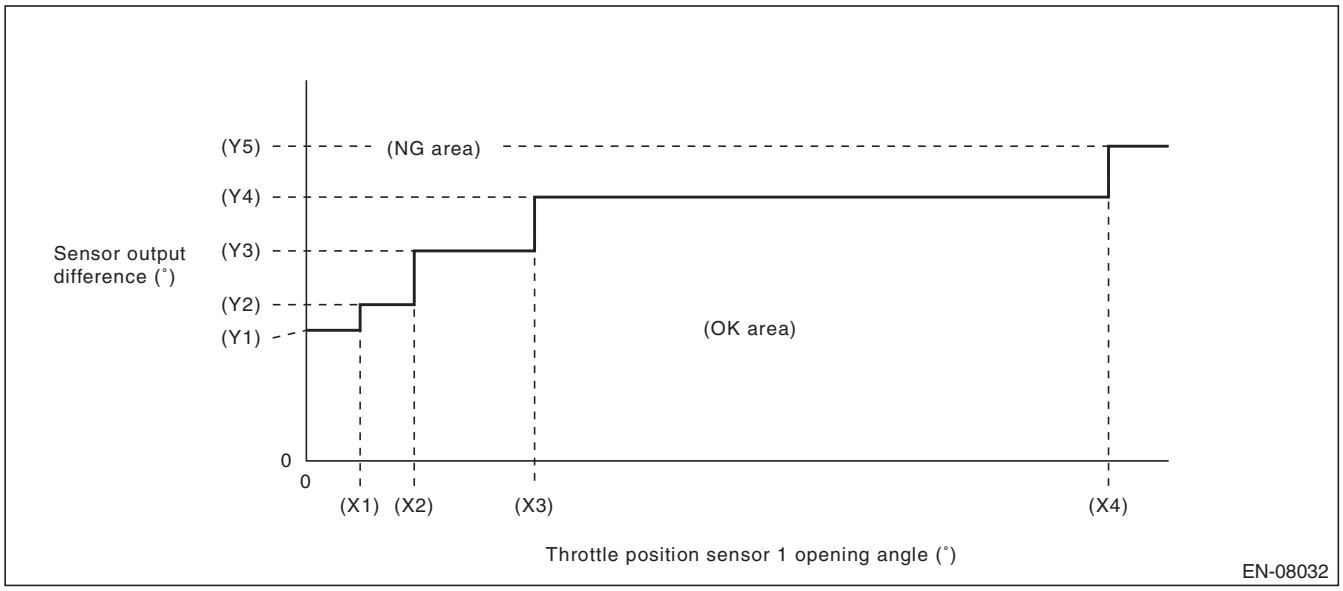
• Abnormality Judgment

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 range 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 range of **Details of Judgment value**

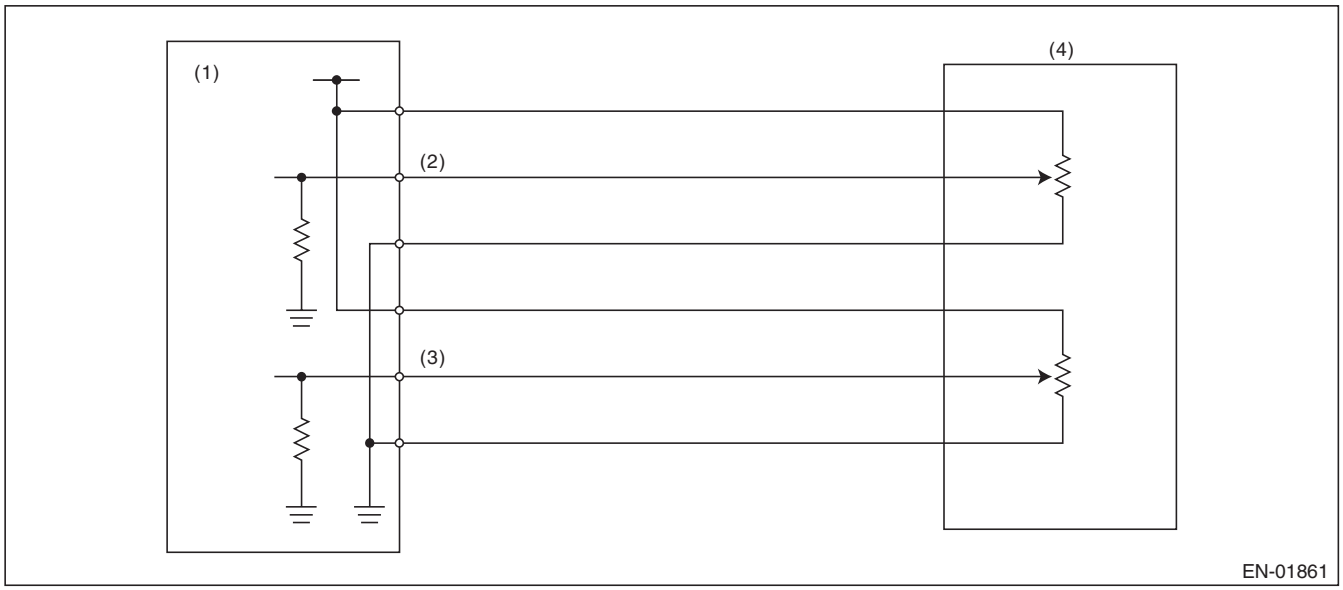
Time Needed for Diagnosis: 24 ms

FE:DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH “D”/“E” VOLTAGE CORRELATION

1. OUTLINE OF DIAGNOSIS

Judge as NG when the signal level of accelerator pedal position sensor 1 is different from the accelerator pedal 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

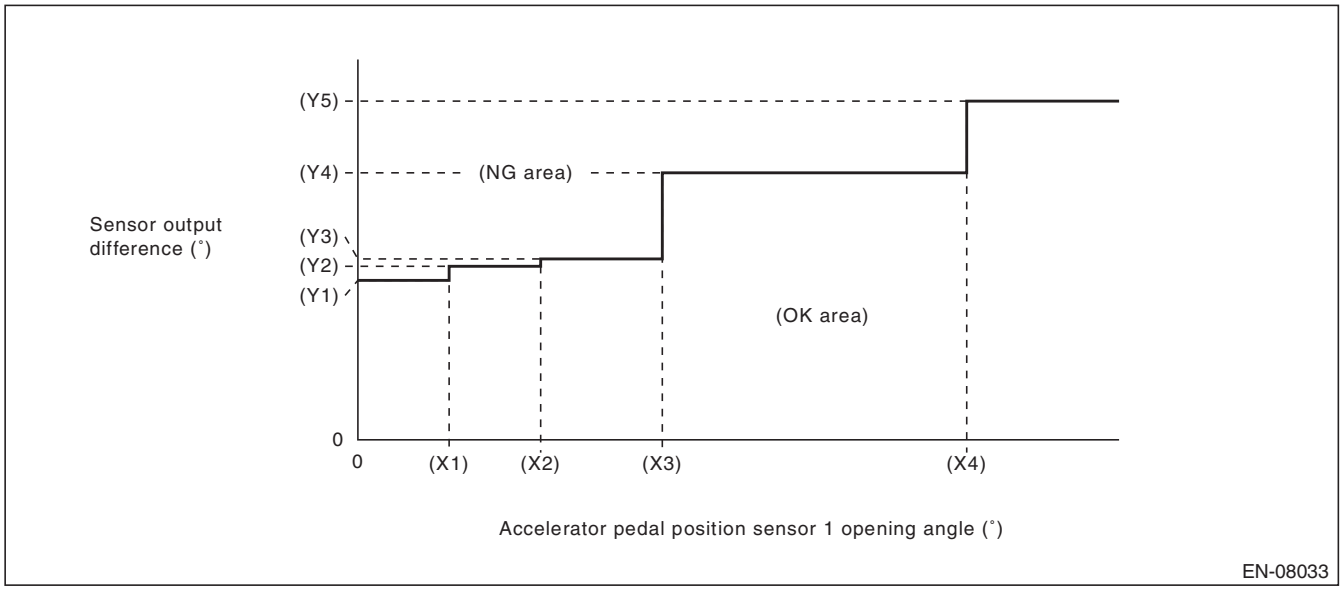
• Abnormality Judgment

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 range 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 range of **Details of Judgment value**

Time Needed for Diagnosis: 116 ms

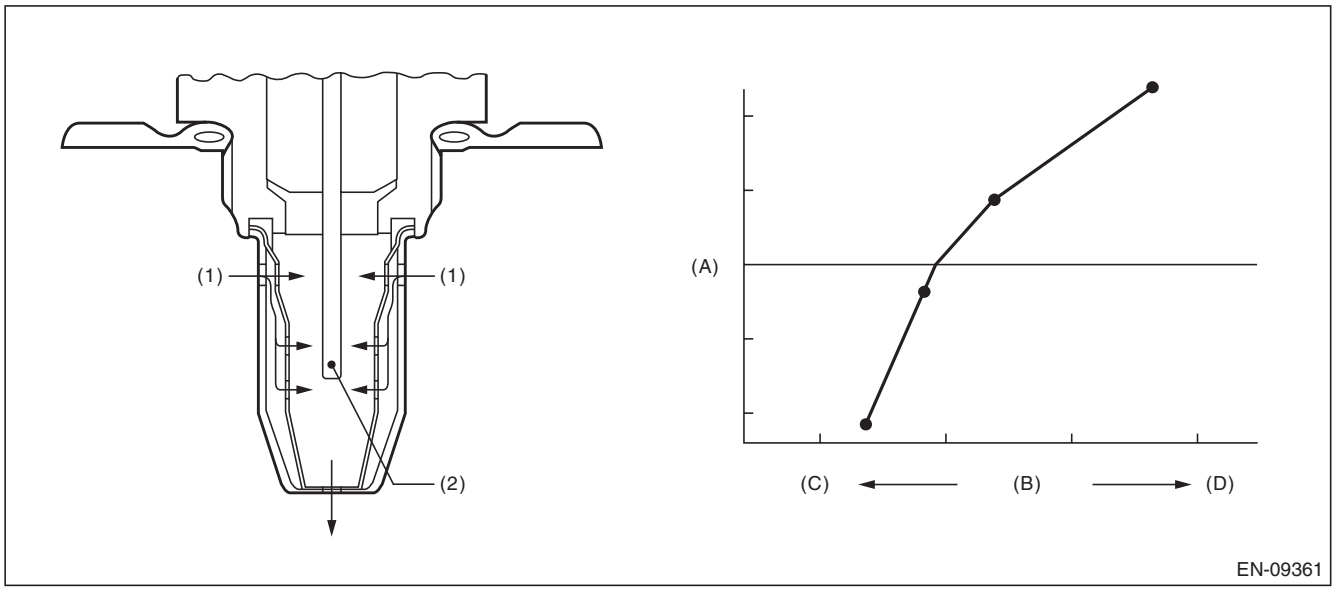
FF: DTC P2195 O2 SENSOR SIGNAL BIASED/STUCK LEAN (BANK 1 SENSOR 1)

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) Exhaust gas (2) ZrO_2

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	≥ 70 °C (158 °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	–1 — 1

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

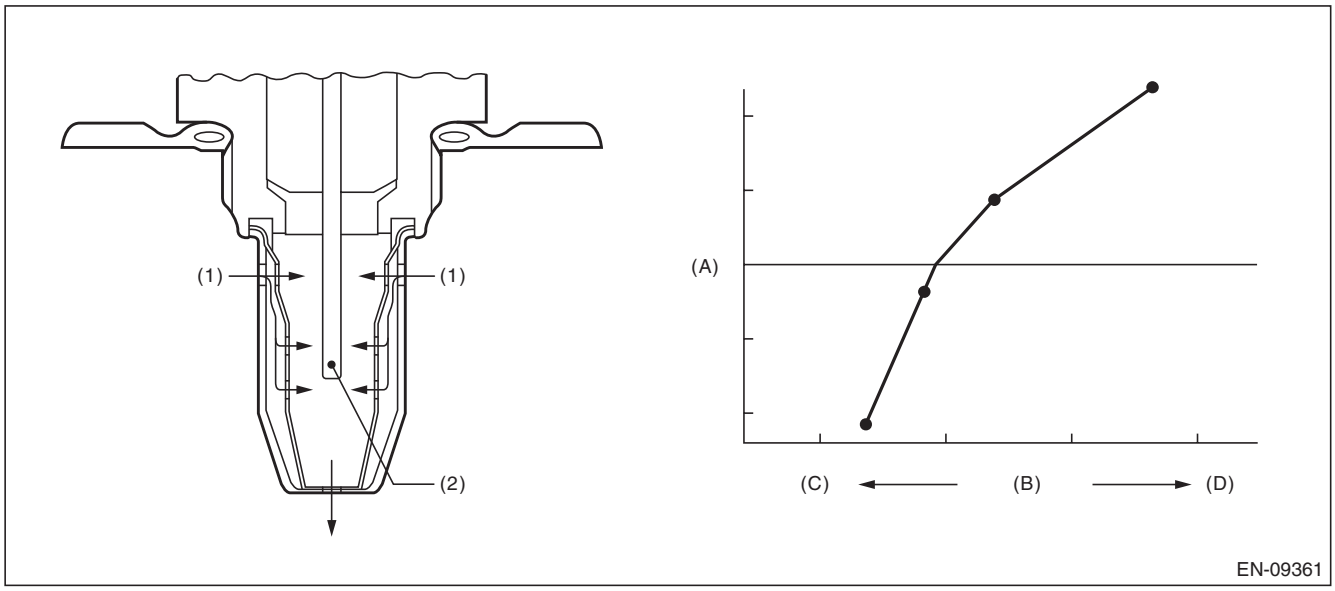
FG:DTC P2196 O2 SENSOR SIGNAL BIASED/STUCK RICH (BANK 1 SENSOR 1)

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) Exhaust gas (2) ZrO_2

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	≥ 70 °C (158 °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	–1 — 1

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

FH:DTC P219A BANK 1 AIR-FUEL RATIO IMBALANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of air fuel ratio deviation between cylinders from main feedback learning value, sub feedback learning value and engine speed variation.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	> 10.9 V
Atmospheric pressure	> 75 kPa (563 mmHg, 22.2 inHg)
A/F main learning system	In operation
Engine speed	> 550 rpm
Engine coolant temperature	> 70 °C (158 °F)
Intake air temperature	< 70 °C (158 °F)
Engine load	> Value of Map 1
Engine load change	< 0.02 g/rev (0 oz/rev)
Evaporative system leak check	Not in operation
Cumulative time of canister purge after engine start	≥ 20 s
Learning value of EVAP conc.	< 0.2
Vehicle dynamic control or AT torque control	Not in operation
Intake manifold pressure change at 180°CA	< Value of Map 2
Throttle position change during 16 milliseconds	< 14 °
Fuel shut-off function	Not in operation

Map 1 (Models without SI-DRIVE)

Engine speed (rpm)	Idling	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g (oz)/rev)	na	0.228 (0.01)	0.22 (0.01)	0.22 (0.01)	0.22 (0.01)	0.228 (0.01)	0.23 (0.01)	0.234 (0.01)	0.242 (0.01)	0.25 (0.01)	0.25 (0.01)

Map 1 (Models with SI-DRIVE)

Engine speed (rpm)	Idling	800	1200	1600	2000	2400	2800	3200	3600	4000	4400
Measured value (g (oz)/rev)	na	0.225 (0.01)	0.245 (0.01)	0.239 (0.01)	0.224 (0.01)	0.233 (0.01)	0.259 (0.01)	0.257 (0.01)	0.254 (0.01)	0.256 (0.01)	0.274 (0.01)

Map 2 (Models without SI-DRIVE)

rpm	750	1000	1500	2000	2500	3000	3500	4000
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)

rpm	4500	5000	5500	6000	6500	6700
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)

Map 2 (Models with SI-DRIVE)

rpm	700	1000	1500	2000	2500	3000	3500	4000
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)

rpm	4500	5000	5500	6000	6500	6700
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)

3. GENERAL DRIVING CYCLE

Always perform the diagnosis continuously.

4. DIAGNOSTIC METHOD

• Abnormality Judgment

Judge as NG when the following conditions are established.

Judgment Value

Models without SI-DRIVE

Malfunction Criteria	Threshold Value
Rich	
Main feedback learning value	< –0.16
Sub feedback learning value	< –0.0124
When any one of the followings is established.	
• Any one of the rich side misfire counters for each cylinder when in idling	> 8 time(s)
• Total of the rich side misfire counters for each cylinder when in idling	> 8 time(s)
• Any one of the rich side misfire counters for each cylinder when not in idling	> 18 time(s)
• Total of the rich side misfire counters for each cylinder when not in idling	> 18 time(s)
Lean	
Main feedback learning value	> 0.075
Sub feedback learning value	< 0
When any one of the followings is established.	
• Any one of the lean side misfire counters for each cylinder when in idling	> 113 time(s)
• Total of the lean side misfire counters for each cylinder when in idling	> 65535 time(s)
• Any one of the lean side misfire counters for each cylinder when not in idling	> 127 time(s)
• Total of the lean side misfire counters for each cylinder when not in idling	> 65535 time(s)

Models with SI-DRIVE

Malfunction Criteria	Threshold Value
Rich	
Main feedback learning value	< –0.14
Sub feedback learning value	< –0.017
When any one of the followings is established.	
• Any one of the rich side misfire counters for each cylinder when in idling	> 9 time(s)
• Total of the rich side misfire counters for each cylinder when in idling	> 9 time(s)
• Any one of the rich side misfire counters for each cylinder when not in idling	> 20 time(s)
• Total of the rich side misfire counters for each cylinder when not in idling	> 20 time(s)
Lean	
Main feedback learning value	> 0
Sub feedback learning value	< 100
When any one of the followings is established.	
• Any one of the lean side misfire counters for each cylinder when in idling	> 177 time(s)
• Total of the lean side misfire counters for each cylinder when in idling	> 65535 time(s)
• Any one of the lean side misfire counters for each cylinder when not in idling	> 192 time(s)
• Total of the lean side misfire counters for each cylinder when not in idling	> 65535 time(s)

Time Needed for Diagnosis: 1000 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 following conditions are established.

Judgment Value

Models without SI-DRIVE

Malfunction Criteria	Threshold Value
Rich	
Main feedback learning value	≥ –0.16
or	
Sub feedback learning value	≥ –0.0124
or	
All of the following conditions are established.	
• Any one of the rich side misfire counters for each cylinder when in idling	≤ 8 time(s)
• Total of the rich side misfire counters for each cylinder when in idling	≤ 8 time(s)
• Any one of the rich side misfire counters for each cylinder when not in idling	≤ 18 time(s)
• Total of the rich side misfire counters for each cylinder when not in idling	≤ 18 time(s)
Lean	
Main feedback learning value	≤ 0.075
or	
Sub feedback learning value	≥ 0
or	
All of the following conditions are established.	
• Any one of the lean side misfire counters for each cylinder when in idling	≤ 113 time(s)
• Total of the lean side misfire counters for each cylinder when in idling	≤ 65535 time(s)
• Any one of the lean side misfire counters for each cylinder when not in idling	≤ 127 time(s)
• Total of the lean side misfire counters for each cylinder when not in idling	≤ 65535 time(s)

Models with SI-DRIVE

Malfunction Criteria	Threshold Value
Rich	
Main feedback learning value	≥ –0.14
or	
Sub feedback learning value	≥ –0.017
or	
All of the following conditions are established.	
• Any one of the rich side misfire counters for each cylinder when in idling	≤ 9 time(s)
• Total of the rich side misfire counters for each cylinder when in idling	≤ 9 time(s)
• Any one of the rich side misfire counters for each cylinder when not in idling	≤ 20 time(s)
• Total of the rich side misfire counters for each cylinder when not in idling	≤ 20 time(s)
Lean	
Main feedback learning value	≤ 0
or	
Sub feedback learning value	≥ 100
or	
All of the following conditions are established.	
• Any one of the lean side misfire counters for each cylinder when in idling	≤ 177 time(s)
• Total of the lean side misfire counters for each cylinder when in idling	≤ 65535 time(s)
• Any one of the lean side misfire counters for each cylinder when not in idling	≤ 192 time(s)
• Total of the lean side misfire counters for each cylinder when not in idling	≤ 65535 time(s)

Time Needed for Diagnosis: 1000 engine revs.

FI: DTC P2257 AIR SYSTEM CONTROL "A" CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Judge as NG when the ECM output level differs from the actual terminal level.

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
Ignition	ON
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
Ignition	ON
Terminal output voltage when ECM outputs OFF signal	HIGH

Time Needed for Diagnosis: Less than 1 second

FJ: DTC P2258 AIR SYSTEM CONTROL "A" CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Judge as NG when the ECM output level differs from the actual terminal level.

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
Ignition	ON
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
Ignition	ON
Terminal output voltage when ECM outputs ON signal	LOW

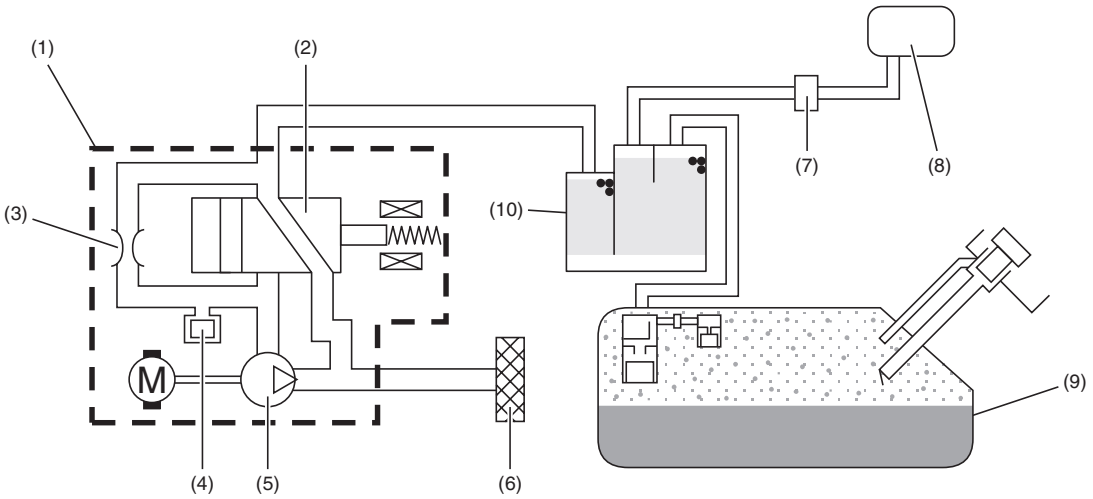
Time Needed for Diagnosis: Less than 1 second

FK:DTC P2401 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM vacuum pump.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

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
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
Terminal output voltage when ECM outputs OFF signal	High

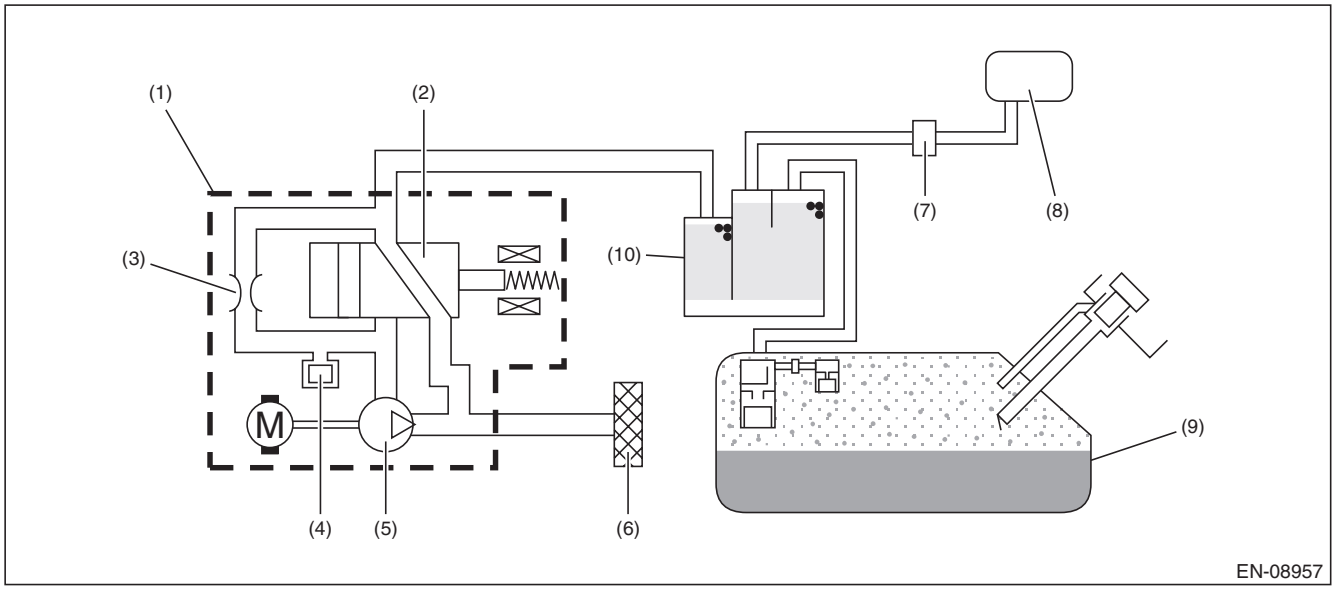
Time Needed for Diagnosis: Less than 1 second

FL: DTC P2402 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP CONTROL CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM vacuum pump.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1) ELCM
(2) Switching valve
(3) Reference orifice (0.02 inch orifice)
(4) Pressure sensor
(5) Vacuum pump
(6) Drain filter
(7) Purge control solenoid valve
(8) Intake manifold
(9) Fuel tank
(10) Canister

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
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
Terminal output voltage when ECM outputs ON signal	Low

Time Needed for Diagnosis: Less than 1 second

FM:DTC P2404 EVAPORATIVE EMISSION SYSTEM LEAK DETECTION PUMP SENSE CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

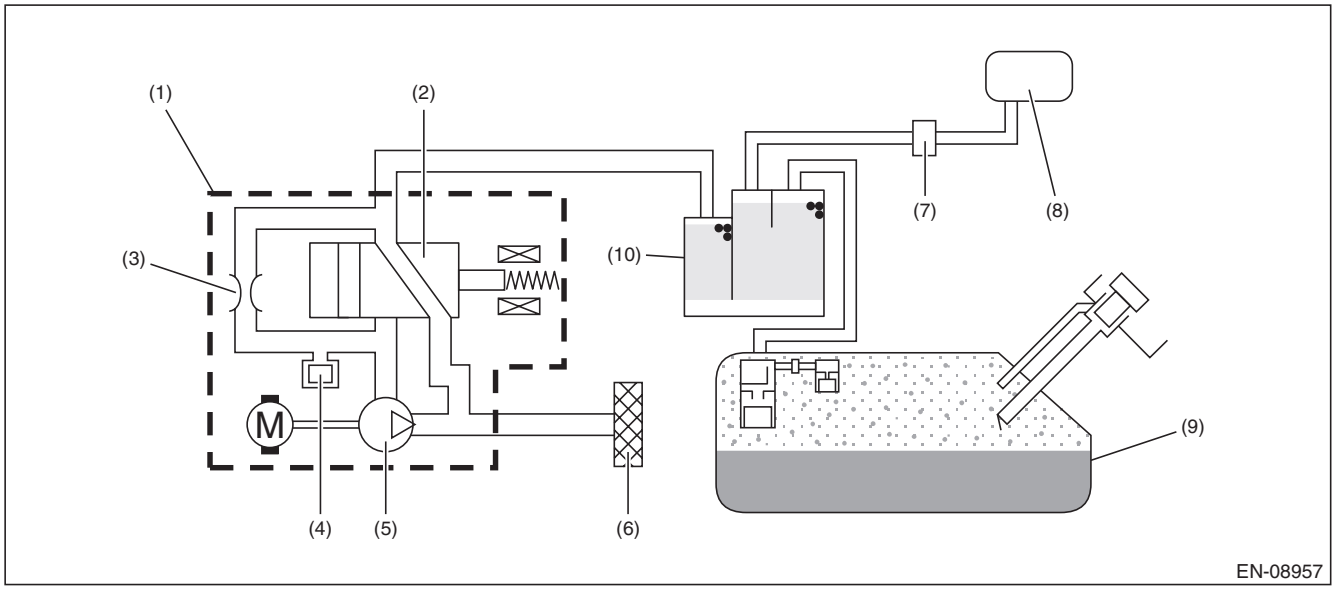
NOTE:
For the detection standard, refer to DTC P0455. <Ref. to GD(H4DOTC)-160, DTC P0455 EVAPORATIVE EMISSION SYSTEM LEAK DETECTED (LARGE LEAK), Diagnostic Trouble Code (DTC) Detecting Criteria.>

FN:DTC P2419 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM switching valve.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1)	ELCM	(5)	Vacuum pump	(9)	Fuel tank
(2)	Switching valve	(6)	Drain filter	(10)	Canister
(3)	Reference orifice (0.02 inch orifice)	(7)	Purge control solenoid valve		
(4)	Pressure sensor	(8)	Intake manifold		

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
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
Terminal output voltage when ECM outputs OFF signal	High

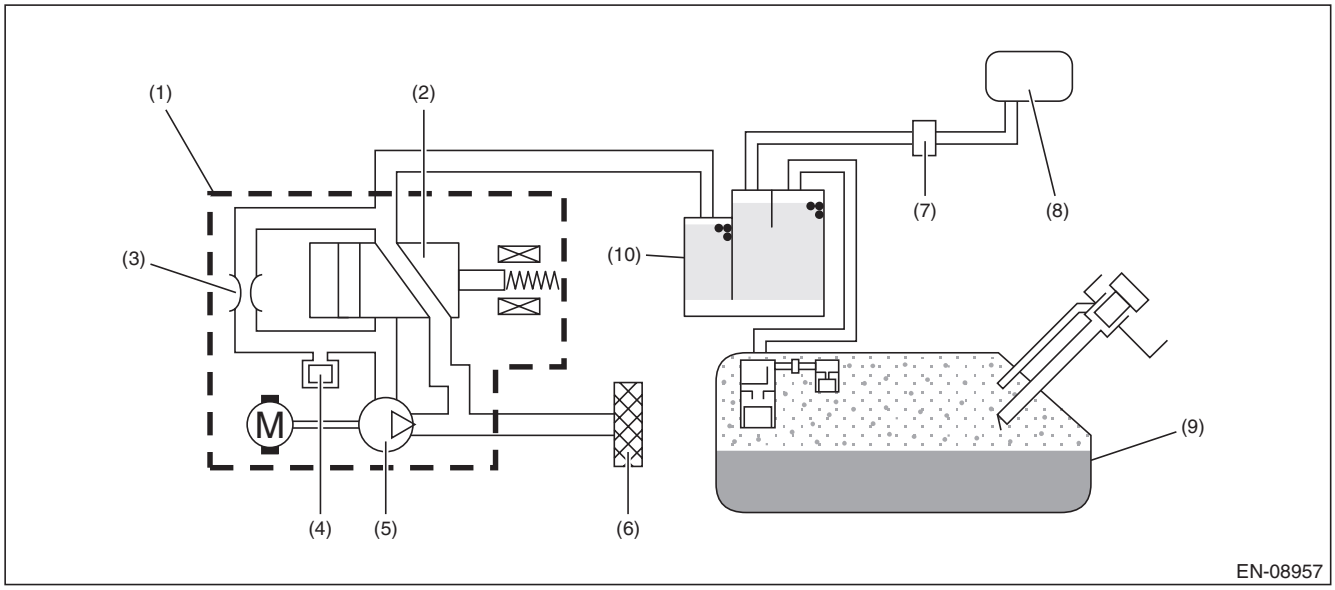
Time Needed for Diagnosis: Less than 1 second

FO:DTC P2420 EVAPORATIVE EMISSION SYSTEM SWITCHING VALVE CONTROL CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Detect the open or short circuit of the ELCM switching valve.
Judge as NG if out of specification.

2. COMPONENT DESCRIPTION



(1)	ELCM	(5)	Vacuum pump	(9)	Fuel tank
(2)	Switching valve	(6)	Drain filter	(10)	Canister
(3)	Reference orifice (0.02 inch orifice)	(7)	Purge control solenoid valve		
(4)	Pressure sensor	(8)	Intake manifold		

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
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
Terminal output voltage when ECM outputs ON signal	Low

Time Needed for Diagnosis: Less than 1 second

FP:DTC P2431 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT RANGE/PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect the malfunction of secondary air pressure sensor output property.
Judge as NG when the secondary air pressure sensor output is largely different from the intake manifold pressure at engine start.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Engine speed	< 300 rpm
Vehicle speed	< 1 km/h (0.6 MPH)
After secondary air system stops	≥ 2976 ms

3. GENERAL DRIVING CYCLE

Perform the diagnosis with ignition switch ON.

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
|Secondary air pipe 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
|Secondary air pipe pressure – Intake manifold pressure|	< 26.7 kPa (200 mmHg, 7.9 inHg)

Time Needed for Diagnosis: 262 ms

FQ:DTC P2432 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT LOW

1. OUTLINE OF DIAGNOSIS

Judge as NG if out of specification.

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
Ignition switch	ON
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
Ignition switch	ON
Output voltage	≥ 0.573 V

Time Needed for Diagnosis: Less than 1 second

FR:DTC P2433 SECONDARY AIR INJECTION SYSTEM AIR FLOW /PRESSURE SENSOR CIRCUIT HIGH

1. OUTLINE OF DIAGNOSIS

Judge as NG if out of specification.

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
Ignition switch	ON
Output voltage	> 4.916 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
Ignition switch	ON
Output voltage	≤ 4.916 V

Time Needed for Diagnosis: Less than 1 second

FS: DTC P2440 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK1)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-138, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FT: DTC P2441 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK1)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-138, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FU: DTC P2442 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK OPEN (BANK2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-138, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FV: DTC P2443 SECONDARY AIR INJECTION SYSTEM SWITCHING VALVE STUCK CLOSED (BANK2)

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC P0410. <Ref. to GD(H4DOTC)-138, DTC P0410 SECONDARY AIR INJECTION SYSTEM, Diagnostic Trouble Code (DTC) Detecting Criteria.>

FW:DTC P2444 SECONDARY AIR INJECTION SYSTEM PUMP STUCK ON

1. OUTLINE OF DIAGNOSIS

Detect the secondary air pump malfunction (always ON).
After the secondary air pump turns to OFF, judge as NG if the secondary air pipe pressure is higher than that before the secondary air pump operation.

2. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
Battery voltage	≥ 7 V
Engine	In operation

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
Time since secondary air control completion	≥ 3000 ms and ≤ 8000 ms
Secondary air pipe pressure – Secondary air pipe pressure before operation	> 6.7 kPa (50 mmHg, 2 inHg)

Time Needed for Diagnosis: 8000 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
Time since secondary air control completion	≥ 3000 ms and ≤ 8000 ms
Secondary air pipe pressure – Secondary air pipe pressure before operation	≤ 6.7 kPa (50 mmHg, 2 inHg)

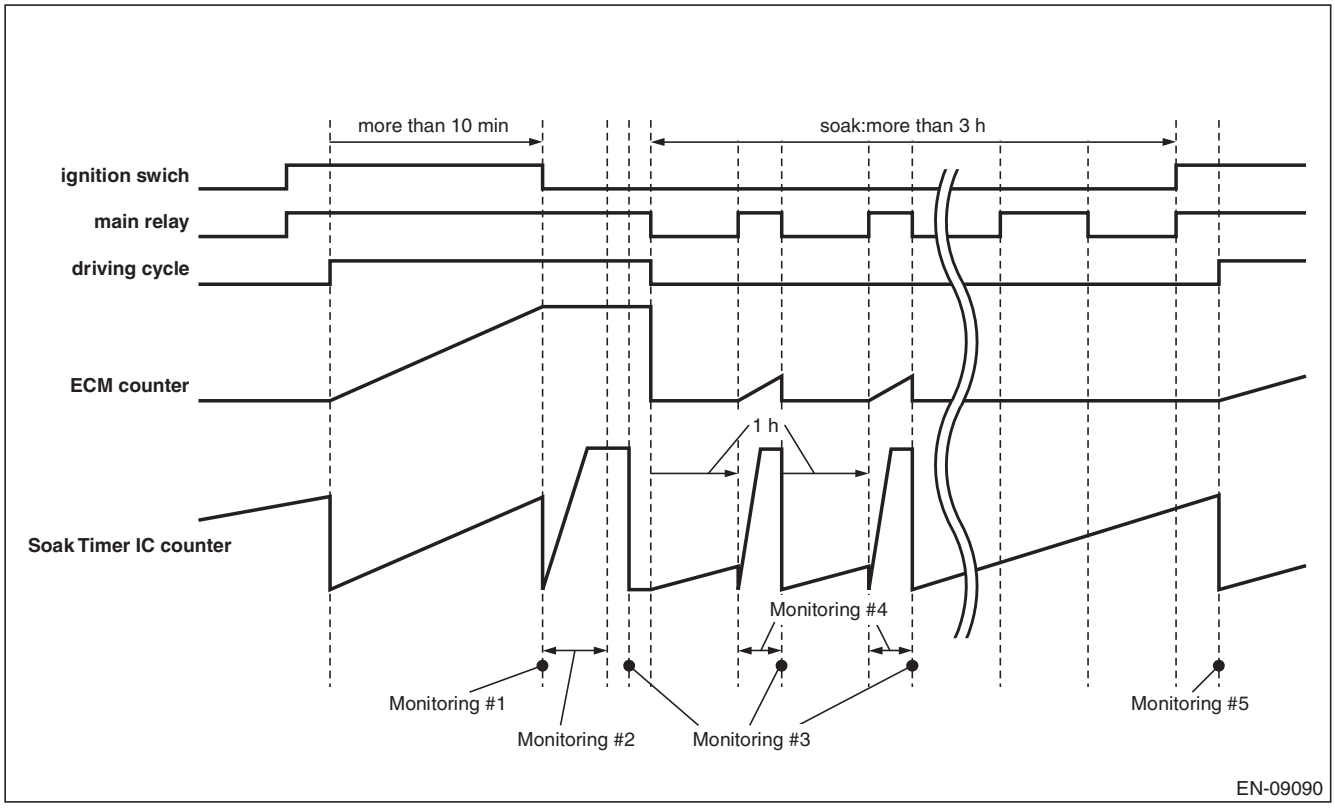
Time Needed for Diagnosis: 8000 ms

FX:DTC P2610 ECM/PCM INTERNAL ENGINE OFF TIMER PERFORMANCE

1. OUTLINE OF DIAGNOSIS

Detect malfunction of soaking timer IC by the five diagnoses below.

Monitor Number	Explanation	Time required for diagnosis
Monitor #1 <Timer diagnosis>	Perform diagnosis of the soaking timer IC accuracy	196 ms
Monitor #2 <Full count diagnosis>	Perform diagnosis of the soaking timer IC counter function	4000 ms
Monitor #3 <Soaking timer IC setting diagnosis>	Perform diagnosis of communication between ECM and soaking timer IC	196 ms
Monitor #4 <Timer diagnosis (during soaking)>	Perform diagnosis of the soaking timer IC accuracy during soaking	3000 ms
Monitor #5 <Wake-up diagnosis>	Perform diagnosis of wake-up function	64 ms



2. COMPONENT DESCRIPTION

The soaking timer IC is built into the ECM.

3. ENABLE CONDITIONS

Secondary Parameters	Enable Conditions
<Timer diagnosis>	
Battery voltage	≥ 10.9 V
Ignition switch	OFF
Elapsed time after starting the engine	> 600 s
< Full count diagnosis & soaking timer IC setting diagnosis>	
Battery voltage	≥ 10.9 V
Ignition switch	OFF
<Timer diagnosis (during soaking)>	
Battery voltage	≥ 10.9 V
Ignition switch	OFF
Number of wake-up	= 1, 2, 3, 4, 6, 8 time(s)
<Wake-up diagnosis>	
Ignition switch	ON
Wake-up activation time setting	Completed
Time in the soaking timer IC	> 3600 s

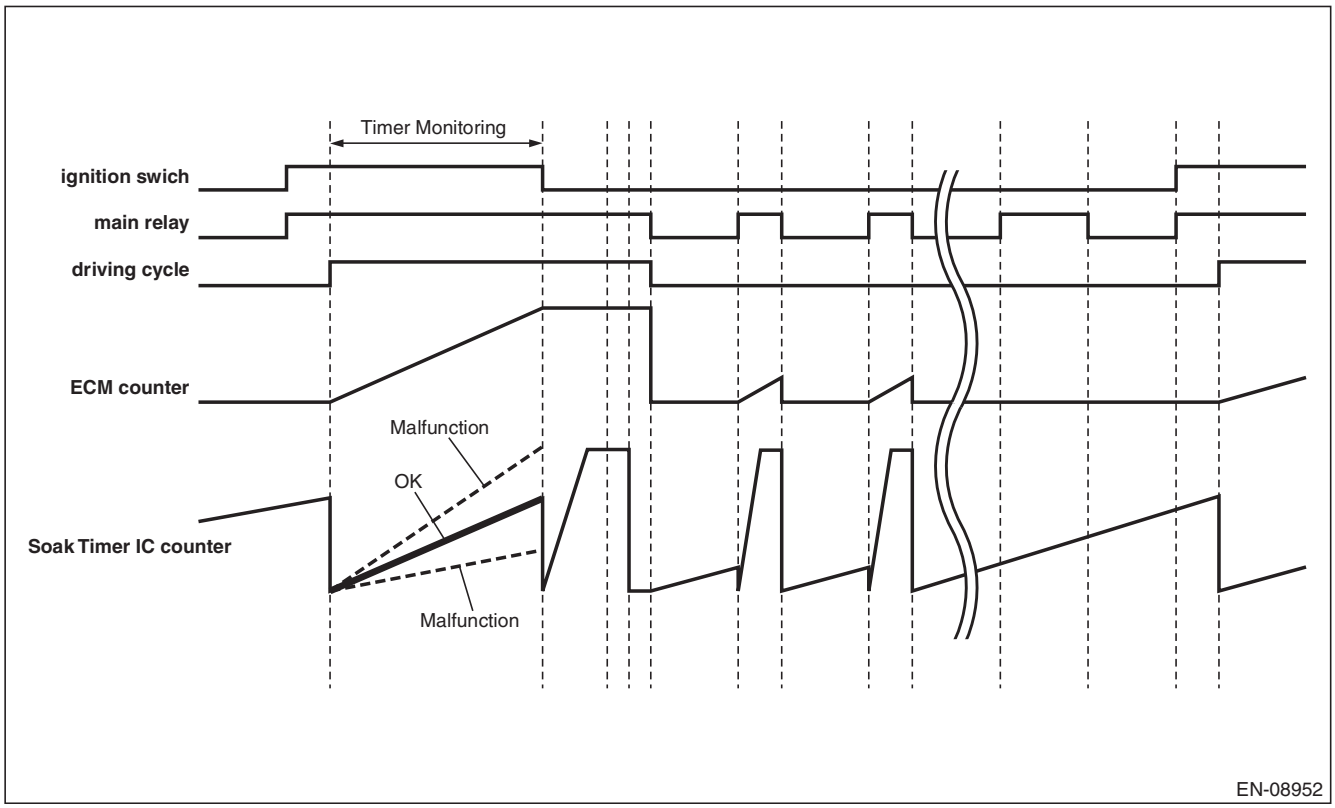
4. GENERAL DRIVING CYCLE

Perform the diagnosis only once when the ignition switch is OFF and when the ignition switch is ON after the soaking of one hour or more.

5. DIAGNOSTIC METHOD

<Timer diagnosis>

Start the count up operation of counters in ECM and in soaking timer IC when the engine is started.
Judge as timer malfunction if the difference between the counter in ECM and counter in soaking timer IC exceeds the allowable limit when the ignition switch is OFF.



- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
|osoaktimcpu – osoaktimic| / osoaktimcpu osoaktimcpu = Counter in ECM osoaktimic = Counter in soaking timer IC	> 0.24

- **Normality Judgment**

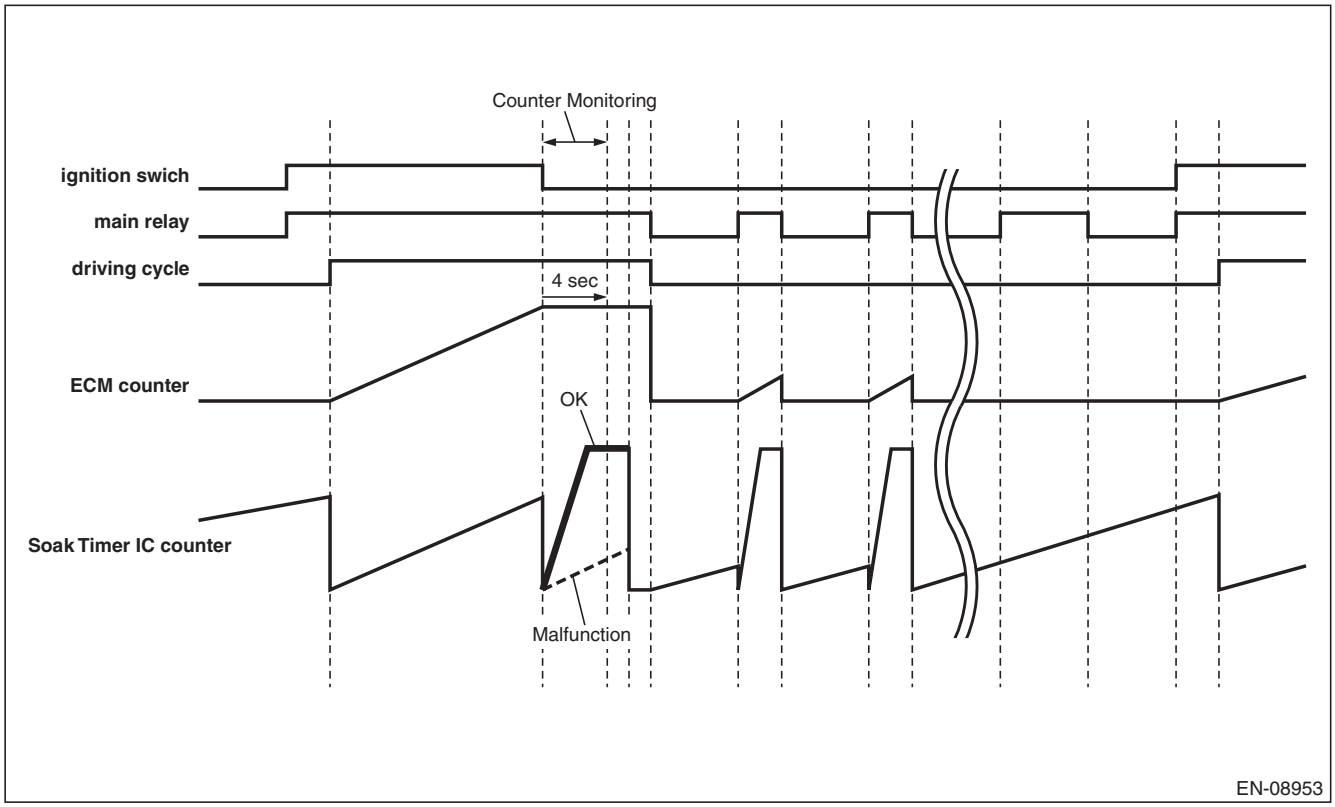
Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
|osoaktimcpu – osoaktimic| / osoaktimcpu	≤ 0.24

<Full count diagnosis>

Reset the counter in soaking timer IC and start the count up operation.
Judge as full count diagnosis malfunction if counter in soaking timer IC is not $3FF (1023 count) after 4 seconds.



- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
osoakfcntic osoakfcntic = Counter in soaking timer IC	≠ $3FF (1023 count)

- **Normality Judgment**

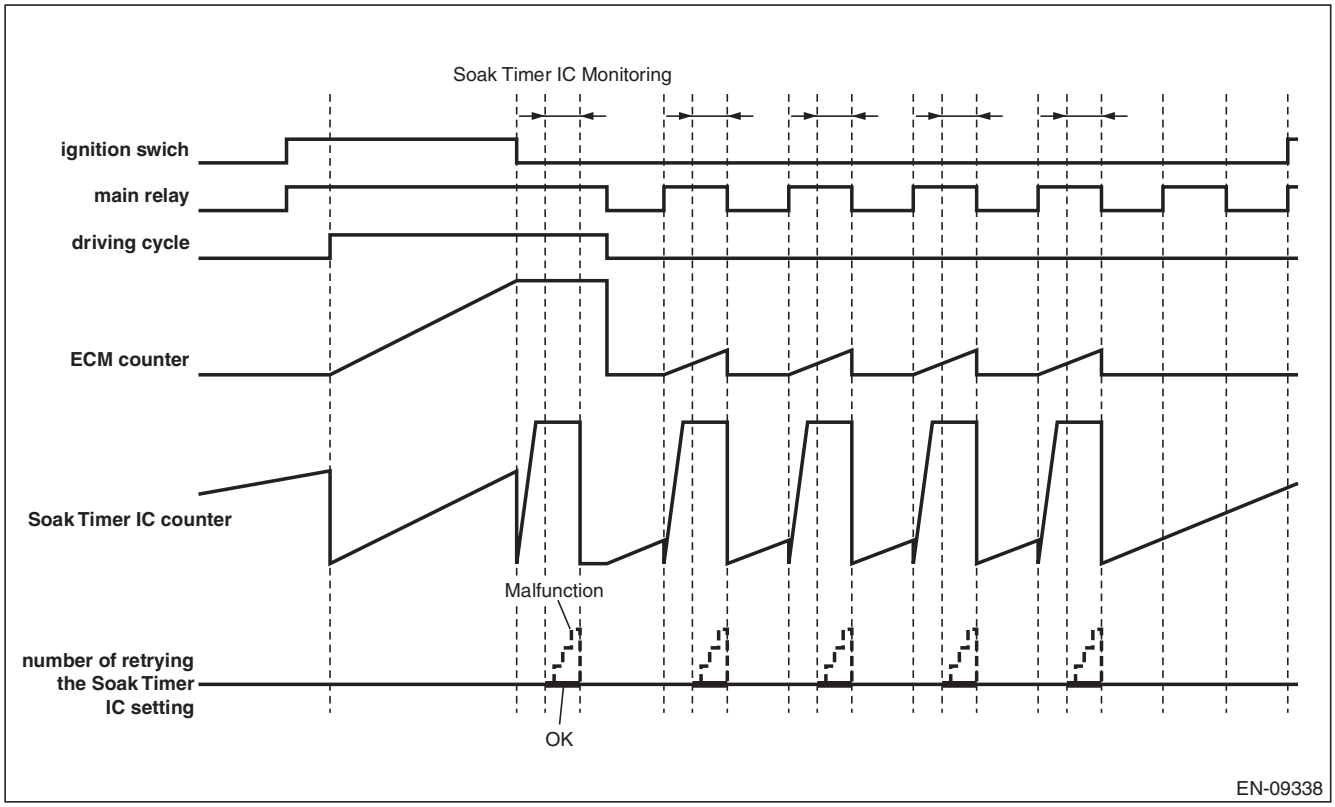
Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
osoakfcntic	= $3FF (1023 count)

<Soaking timer IC setting diagnosis>

When setting the activation setting time to soaking timer IC, compare the writing value to soaking timer IC with read out value. Judge as malfunction if the values do not match 3 times in a row.



- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Writing value and read out value when setting the soaking timer	Unmatch
Number of retrying the soaking timer setting	≥ 3 times

- **Normality Judgment**

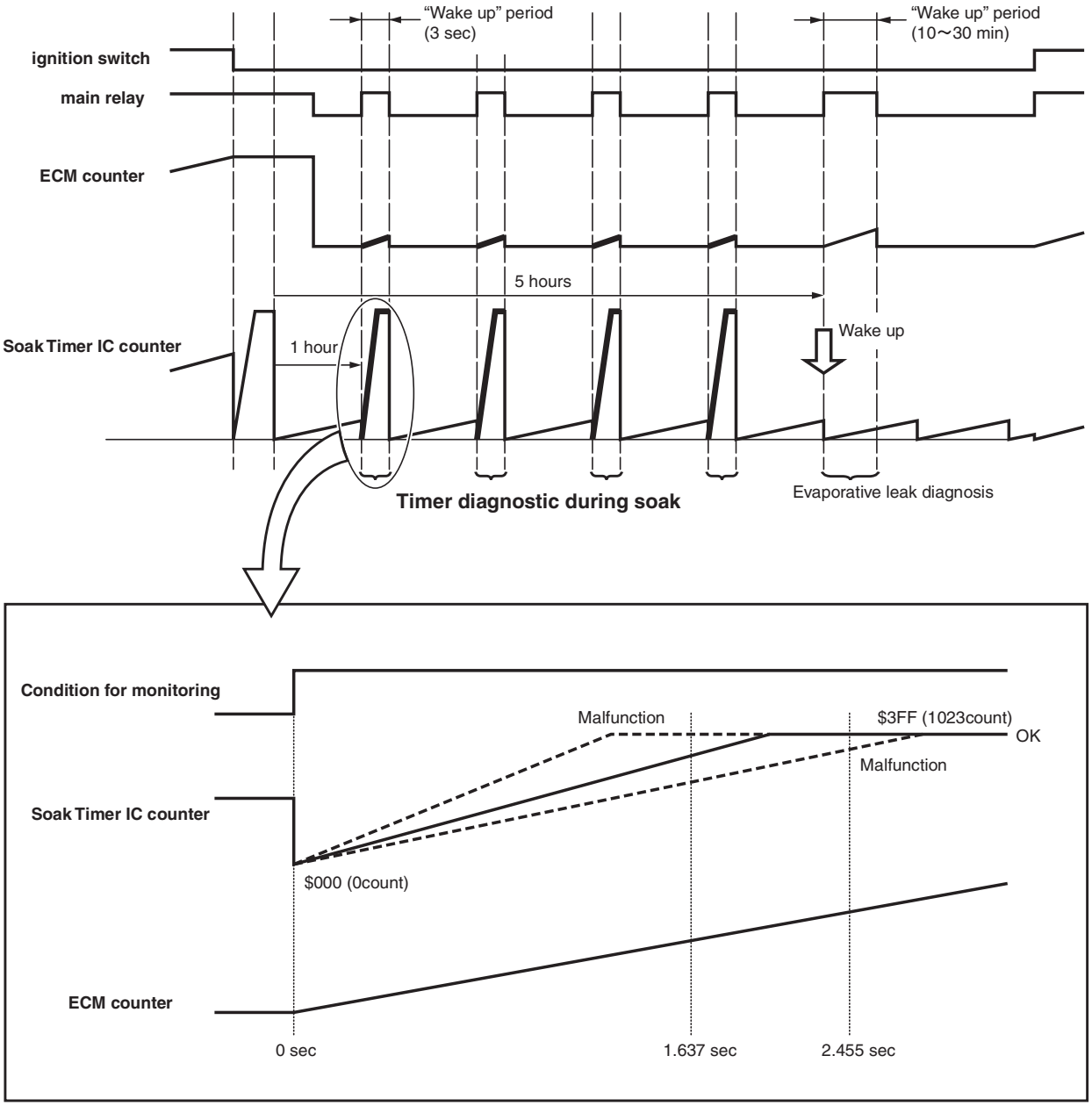
Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Writing value and read out value when setting the soaking timer	Match

<Timer diagnosis (during soaking)>

Wake-up at the predetermined interval until 5, 7 or 9.5 hours have passed after the ignition switch is OFF, and compare the counter in soaking timer IC with the counter in ECM.
Judge as malfunction if the counter in soaking timer IC is counted up to maximum value (1023 count) when the counter in ECM is 1637 ms, or if the counter in soaking timer IC is not counted up to maximum value (1023 count) when the counter in ECM is 2455 ms.



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- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
When any one of the followings is established.	
• All of the following conditions are established.	
Counter in ECM	≤ 1637 ms
Counter in soaking timer IC	= $3FF (1023 count)
• All of the following conditions are established.	
Counter in ECM	≥ 2455 ms
Counter in soaking timer IC	≠ $3FF (1023 count)

- **Normality Judgment**

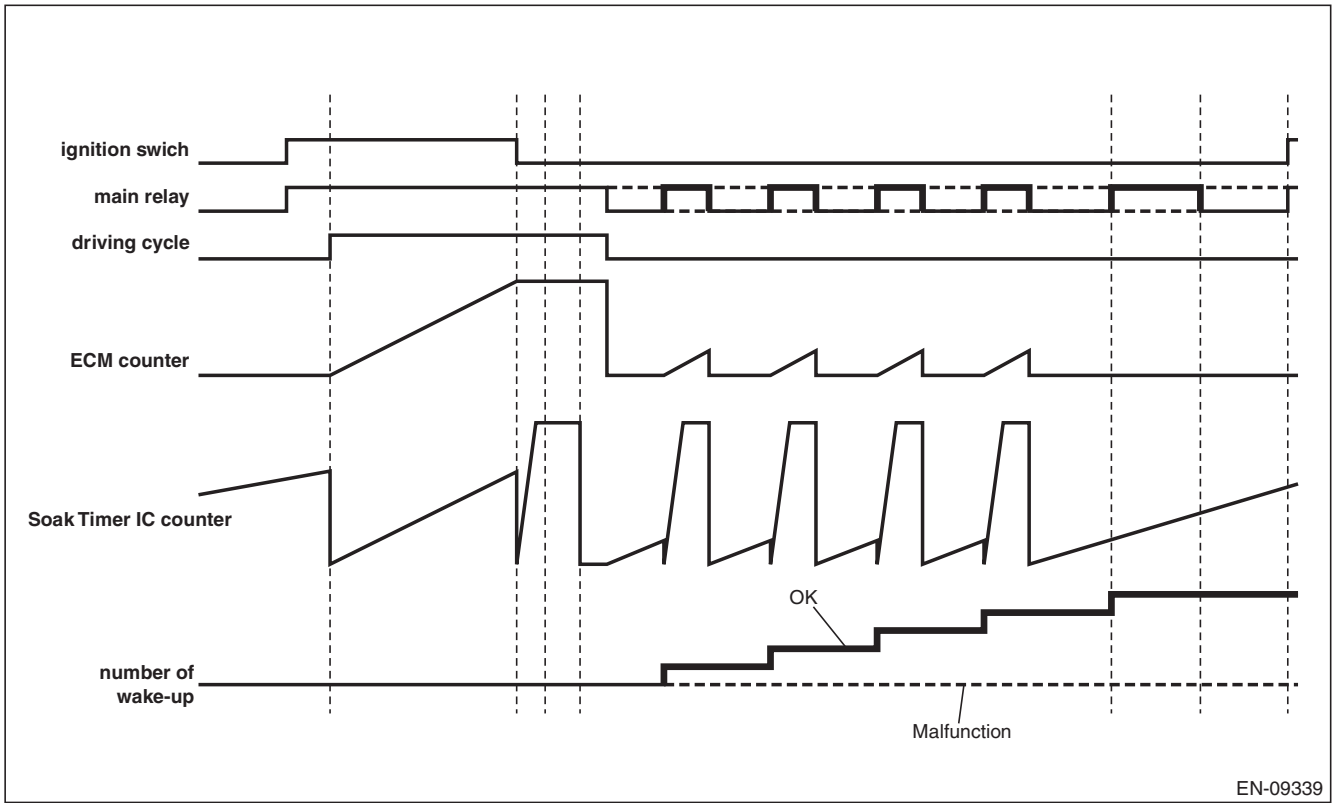
Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Following conditions are established.	
• All of the following conditions are established.	
Counter in ECM	≤ 1637 ms
Counter in soaking timer IC	≠ $3FF (1023 count)
• All of the following conditions are established.	
Counter in ECM	≥ 2455 ms
Counter in soaking timer IC	= $3FF (1023 count)

<Wake-up diagnosis>

Store the number of wake-up activation when the ECM wakes up by the soaking timer IC.
Next time when the ignition switch is ON, if the number of wake-up activation does not reach the predetermined value even though the counter in soaking timer IC operates 1 hour or more, judge as wake-up malfunction.



- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Number of wake-up	< Wake-up indication count

- **Normality Judgment**

Judge as OK when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Number of wake-up	≥ Wake-up indication count

- **Abnormality Judgment**

Judge as NG when the following conditions are established.

Judgment Value

Malfunction Criteria	Threshold Value
Ignition switch	ON
Driving cycle	Completed
When any one of the followings is established.	
• Timer diagnosis	NG
• Full count diagnosis	NG
• Soaking timer IC setting diagnosis	NG
• Timer diagnosis (during soaking)	NG
• Wake-up diagnosis	NG

Time Needed for Diagnosis: Approx. 5 — 9.5 hours
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
Ignition switch	ON
Driving cycle	Completed
All of the following conditions are established.	
• Timer diagnosis	OK
• Full count diagnosis	OK
• Soaking timer IC setting diagnosis	OK
• Timer diagnosis (during soaking)	OK
• Wake-up diagnosis	OK

Time Needed for Diagnosis: Approx. 5 — 9.5 hours

FY:DTC U0073 CAN FAILURE, BUS 'OFF' DETECTION

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when CAN communication failure has occurred.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
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)

Time Needed for Diagnosis: 436 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
Engine	run
bus off flag or error warning flag	clear (No error)

Time Needed for Diagnosis: 1000 ms

FZ:DTC U0122 CAN (VDC) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when CAN communication failure has occurred between VDC CM and body integrated unit.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
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
ID received from control module connected to CAN	None during 500 milliseconds

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
Engine	run
ID received from control module connected to CAN	Yes

Time Needed for Diagnosis: 1000 ms

GA:DTC U0140 CAN (BCU) DATA NOT LOADED

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0122. <Ref. to GD(H4DOTC)-295, DTC U0122 CAN (VDC) DATA NOT LOADED, Diagnostic Trouble Code (DTC) Detecting Criteria.>

GB:DTC U0416 CAN (VDC) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

Detect malfunction of CAN communication.
Judge as NG when data received from VDC CM and body integrated unit is not normal.

2. COMPONENT DESCRIPTION

(Common Specifications)
CAN Protocol 2.0 B (Active)
Frame Format: 11 Bit ID Frame (Standard Frame)
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
Data updated from control module connected to 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
Engine	run
Data updated from control module connected to CAN	Yes

Time Needed for Diagnosis: 1000 ms

GC:DTC U0422 CAN (BCU) DATA ABNORMAL

1. OUTLINE OF DIAGNOSIS

NOTE:
For the detection standard, refer to DTC U0416. <Ref. to GD(H4DOTC)-296, DTC U0416 CAN (VDC) DATA ABNORMAL, Diagnostic Trouble Code (DTC) Detecting Criteria.>

TRANSMISSION SECTION

CONTROL SYSTEMS	CS
MANUAL TRANSMISSION AND DIFFERENTIAL	5MT
MANUAL TRANSMISSION AND DIFFERENTIAL	6MT
MANUAL TRANSMISSION AND DIFFERENTIAL (DIAGNOSTICS)	6MT(diag)
CLUTCH SYSTEM	CL

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.

G1150BE5

CONTROL SYSTEMS

CS

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