

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

FUEL INJECTION (FUEL SYSTEMS)

FU(H4DOTC)

	Page
1. General Description	2
2. Throttle Body	12
3. Intake Manifold	13
4. Engine Coolant Temperature Sensor	23
5. Crankshaft Position Sensor	24
6. Camshaft Position Sensor	25
7. Knock Sensor	26
8. Throttle Position Sensor	27
9. Mass Air Flow and Intake Air Temperature Sensor	28
10. Manifold Absolute Pressure Sensor	29
11. Fuel Injector	30
12. Oil Flow Control Solenoid Valve	31
13. Wastegate Control Solenoid Valve	32
14. Front Oxygen (A/F) Sensor	33
15. Rear Oxygen Sensor	34
16. Engine Control Module (ECM)	35
17. Main Relay	36
18. Fuel Pump Relay	37
19. Electronic Throttle Control Relay	38
20. Fuel Pump Control Unit	39
21. Fuel	40
22. Fuel Tank	41
23. Fuel Filler Pipe	47
24. Fuel Pump	49
25. Fuel Level Sensor	51
26. Fuel Sub Level Sensor	52
27. Fuel Filter	54
28. Fuel Bypass Valve	55
29. Fuel Delivery, Return and Evaporation Lines	56
30. Fuel System Trouble in General	59

General Description

FUEL INJECTION (FUEL SYSTEMS)

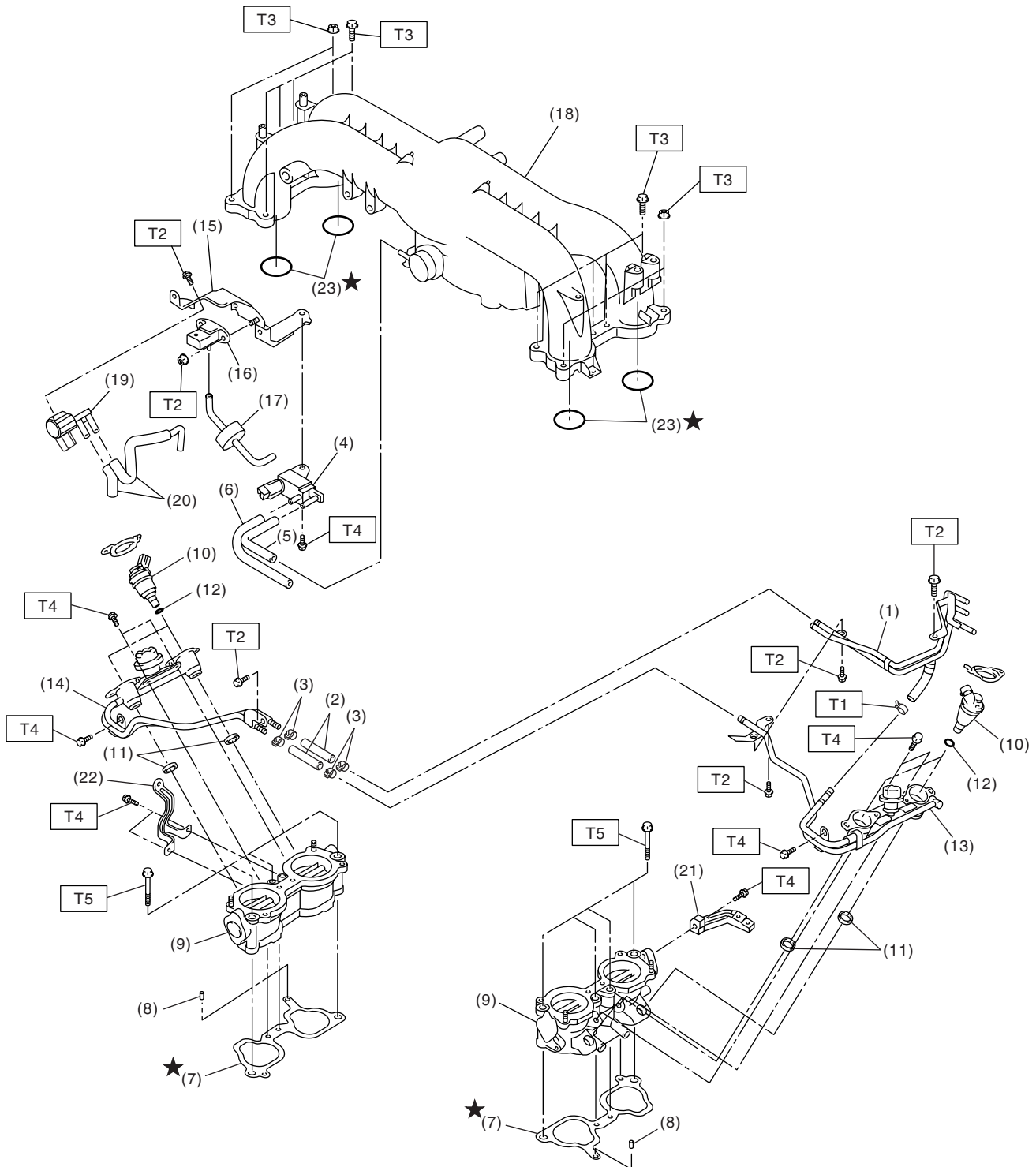
1. General Description

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 kg/cm ² , 79.8 — 123.3 psi)
	Discharge	155 ℓ (40.9 US gal, 34.1 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



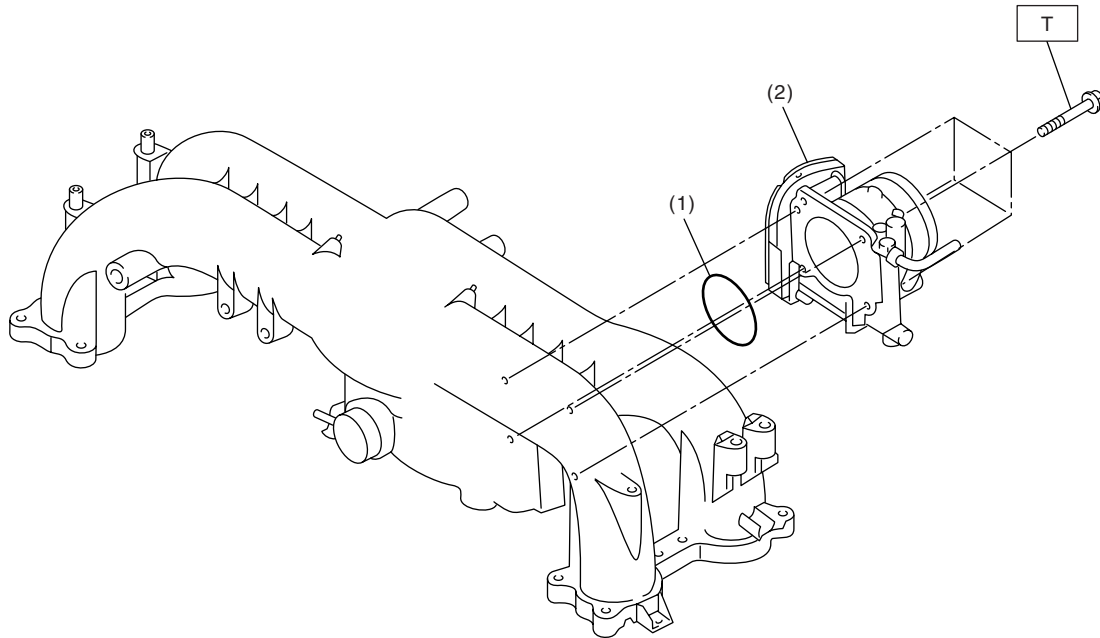
FU-01154

General Description

FUEL INJECTION (FUEL SYSTEMS)

(1) Fuel pipe ASSY	(12) O-ring	(22) Coolant filler tank stay
(2) Fuel hose	(13) Fuel injector pipe LH	(23) O-ring
(3) Clip	(14) Fuel injector pipe RH	
(4) Purge control solenoid valve	(15) Solenoid valve bracket	<i>Tightening torque: N·m (kgf-m, ft-lb)</i>
(5) Vacuum hose	(16) Manifold absolute pressure sensor	<i>T1: 1.5 (0.15, 1.1)</i>
(6) Vacuum control hose	(17) Filter	<i>T2: 6.5 (0.66, 4.8)</i>
(7) Intake manifold gasket	(18) Intake manifold	<i>T3: 8.3 (0.85, 6.1)</i>
(8) Guide pin	(19) Wastegate control solenoid valve ASSY	<i>T4: 19 (1.94, 13.7)</i>
(9) Intake manifold (lower)		<i>T5: 25 (2.5, 18.1)</i>
(10) Fuel injector	(20) Vacuum hose	
(11) Seal ring	(21) Ground stay	

2. AIR INTAKE SYSTEM



FU-01155

- (1) O-ring
- (2) Throttle body

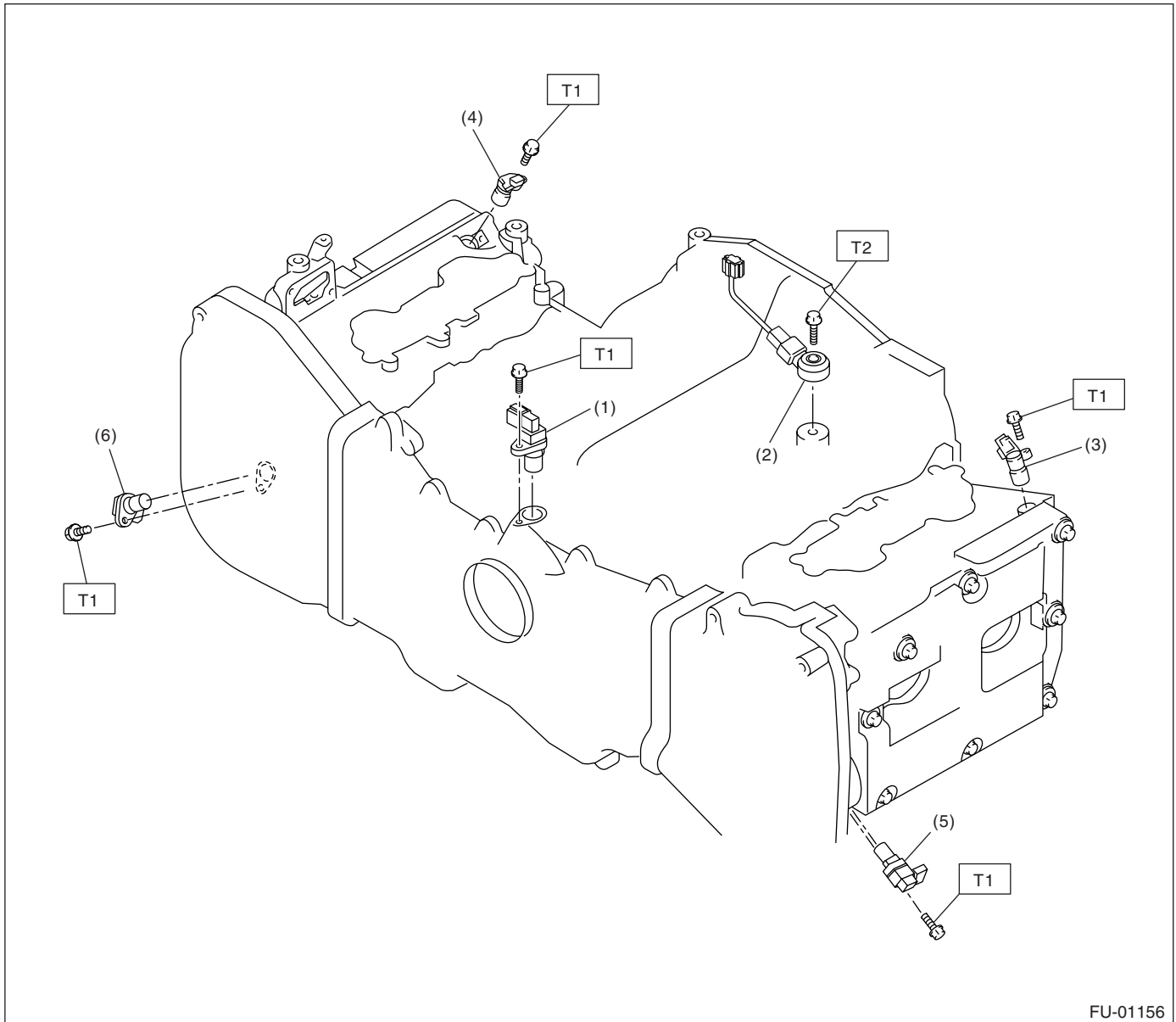
Tightening torque: N·m (kgf-m, ft-lb)

T: 8 (0.8, 5.9)

General Description

FUEL INJECTION (FUEL SYSTEMS)

3. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



- (1) Crankshaft position sensor
- (2) Knock sensor
- (3) Intake camshaft position sensor LH
- (4) Intake camshaft position sensor RH

- (5) Exhaust camshaft position sensor LH
- (6) Exhaust camshaft position sensor RH

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.65, 4.7)

T2: 24 (2.4, 17.4)

This exploded view diagram illustrates the assembly of a motorcycle engine and chassis. The central component is the engine (1), which is shown with its internal parts like the cylinder head (8) and piston (7). The engine is mounted on the frame (2) using bolts (T4) and brackets (20, 21). The frame is supported by the swingarm (3) and the rear subframe (24, 25). The swingarm is connected to the rear wheel (4) via the swingarm pivot (5) and the rear axle (6). The rear wheel is shown with its spokes (22) and tire. The front of the motorcycle is represented by the front fender (9) and the front wheel (10). The diagram also shows the front suspension components, including the front fork (11) and the front wheel hub (12). Various other components like the fuel tank (13), the seat (14), and the rear fender (15) are shown in their relative positions. The diagram uses numbered callouts (1-25) to identify the main components and lettered callouts (T1-T4) to identify the fasteners. Stars are used to indicate specific assembly points or torque specifications.

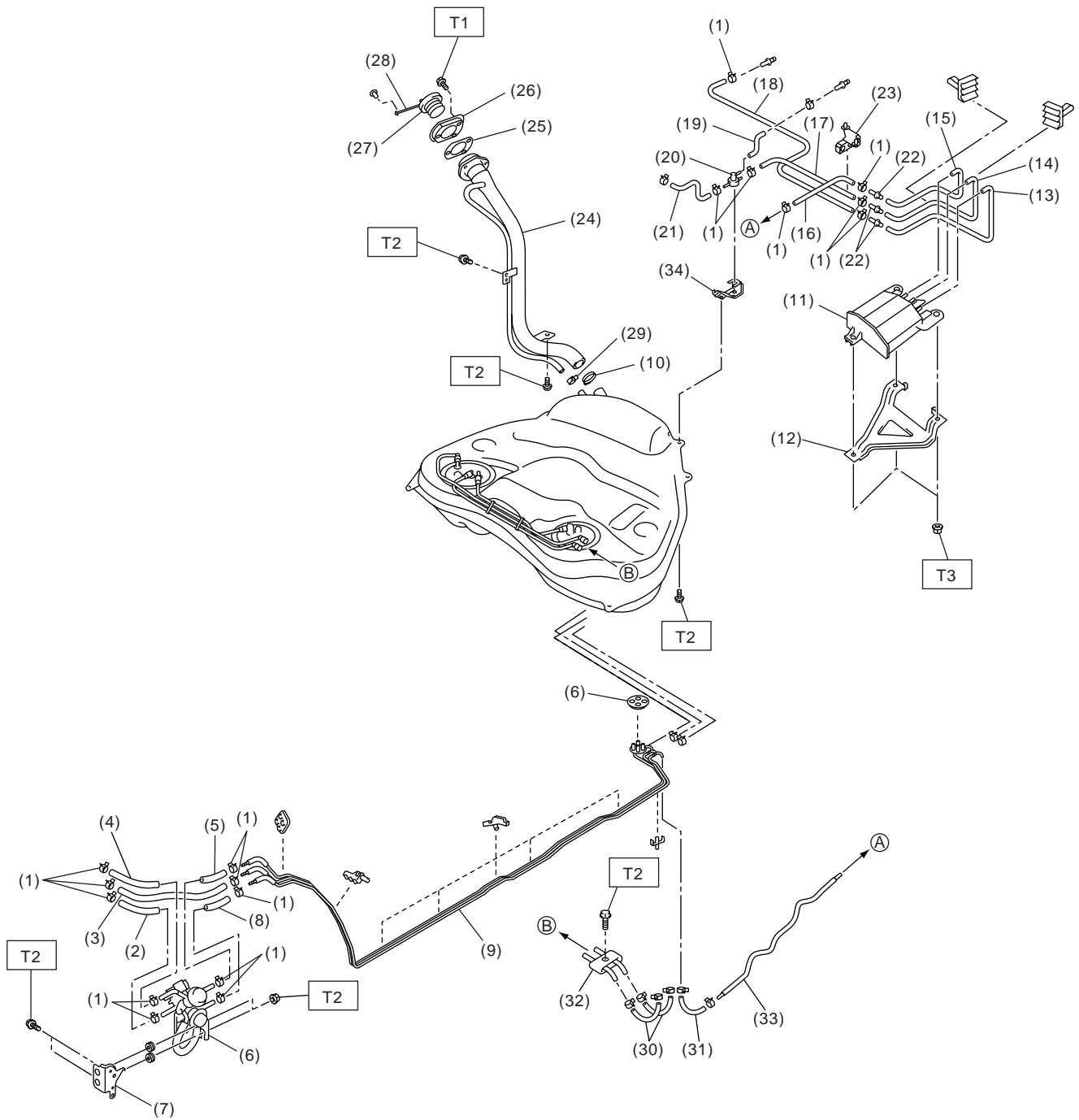
FU-01328

General Description

FUEL INJECTION (FUEL SYSTEMS)

(1) Fuel tank	(12) Fuel sub level sensor upper plate	(23) Heat shield cover
(2) Fuel tank band RH	(13) Fuel sub level sensor gasket	(24) Fuel tank protector RH (Front)
(3) Fuel tank band LH	(14) Fuel filler hose	(25) Fuel tank protector LH (Front)
(4) Delivery tube	(15) Clamp	
(5) Return tube	(16) Vent hose	<i>Tightening torque: N·m (kgf-m, ft-lb)</i>
(6) Jet pump tube	(17) Clip	<i>T1: 4.4 (0.45, 3.3)</i>
(7) Fuel pump ASSY	(18) Protector RH (Rear)	<i>T2: 9.0 (0.92, 6.6)</i>
(8) Fuel pump upper plate	(19) Protector LH (Rear)	<i>T3: 17.5 (1.78, 12.9)</i>
(9) Fuel pump gasket	(20) Stopper RH	<i>T4: 33 (3.4, 25)</i>
(10) Fuel level sensor	(21) Stopper LH	
(11) Fuel sub level sensor	(22) Retainer	

5. FUEL LINE



FU-01329

General Description

FUEL INJECTION (FUEL SYSTEMS)

(1) Clip	(14) Two-way valve hose A	(27) Filler cap
(2) Fuel return hose A	(15) Purge hose A	(28) Tether
(3) Evaporation hose	(16) Purge hose B	(29) Clip
(4) Fuel delivery hose A	(17) Two-way valve hose B	(30) Fuel hose
(5) Fuel delivery hose B	(18) Canister drain hose B	(31) Purge hose C
(6) Fuel bypass valve	(19) Two-way valve drain hose	(32) Fuel hose connector
(7) Fuel bypass valve bracket	(20) Two-way valve	(33) Purge pipe
(8) Fuel return hose B	(21) Two-way valve hose C	(34) Two-way valve bracket
(9) Fuel pipe ASSY	(22) Connector	
(10) Clamp	(23) Evaporation hose holder	
(11) Canister	(24) Fuel filler pipe ASSY	
(12) Canister protector (Sedan model)	(25) Filler pipe packing	
(13) Canister drain hose A	(26) Filler ring	

Tightening torque: N·m (kgf-m, ft-lb)

T1: 4.4 (0.45, 3.2)

T2: 7.5 (0.76, 5.53)

T3: 8.3 (0.85, 6.1)

General Description

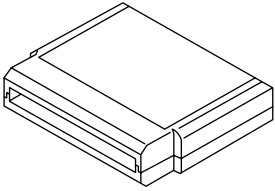
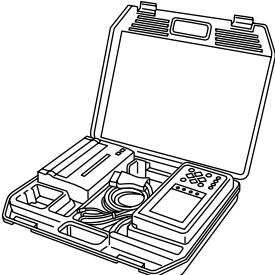
FUEL INJECTION (FUEL SYSTEMS)

C: CAUTION

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

- Be careful not to burn yourself, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Place "NO FIRE" signs near the working area.
- Be careful not to spill fuel on the floor.

D: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST24082AA230	24082AA230	CARTRIDGE	Troubleshooting for electrical system.
 ST22771AA030	22771AA030	SUBARU SELECT MONITOR KIT	Troubleshooting for electrical system. <ul style="list-style-type: none">• English: 22771AA030 (Without printer)• German: 22771AA070 (Without printer)• French: 22771AA080 (Without printer)• Spanish: 22771AA090 (Without printer)

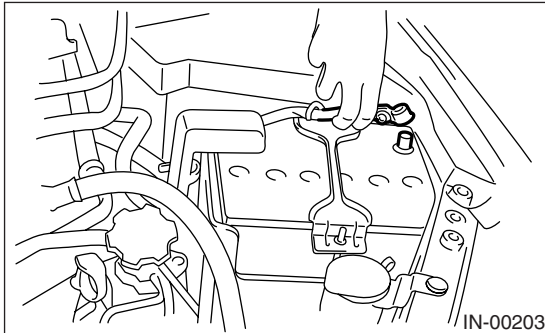
Throttle Body

FUEL INJECTION (FUEL SYSTEMS)

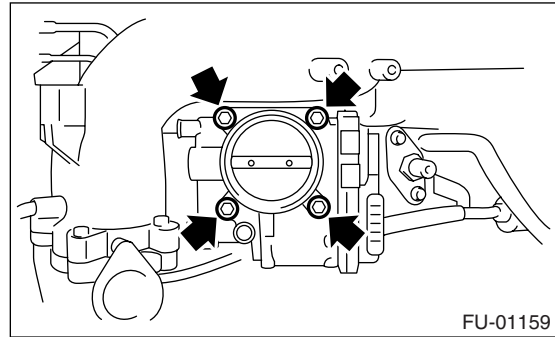
2. Throttle Body

A: REMOVAL

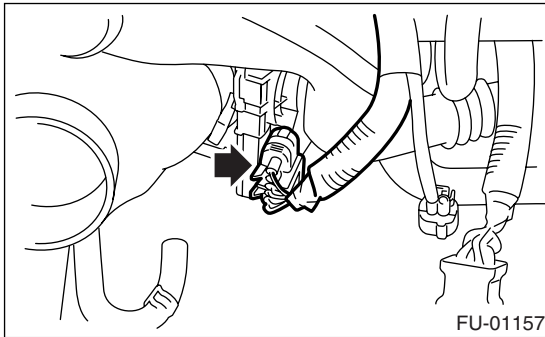
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



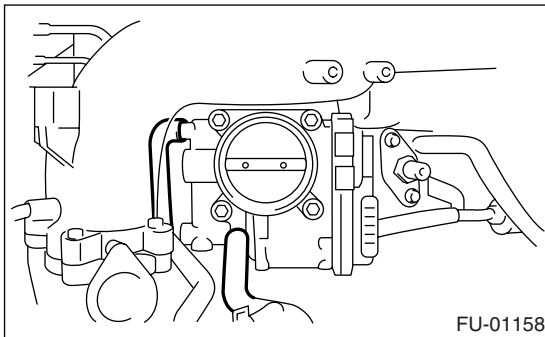
Tightening torque:
8 N·m (0.8 kgf-m, 5.9 ft-lb)



- 3) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 4) Disconnect the connectors from throttle position sensor.



- 5) Disconnect the engine coolant hose from throttle body.



- 6) Remove the bolts which secure throttle body to intake manifold.

B: INSTALLATION

Install in the reverse order of removal.

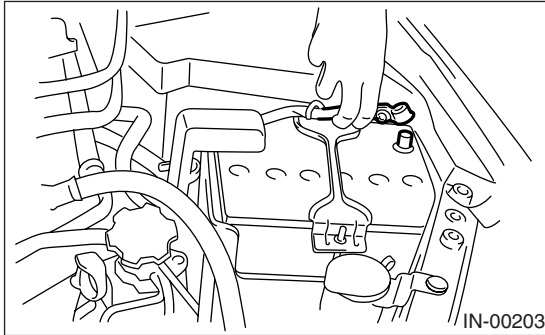
NOTE:

Always use new O-rings.

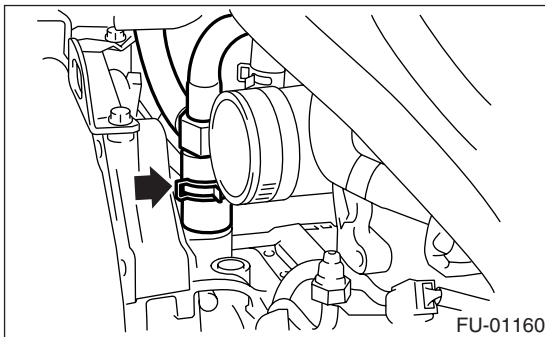
3. Intake Manifold

A: REMOVAL

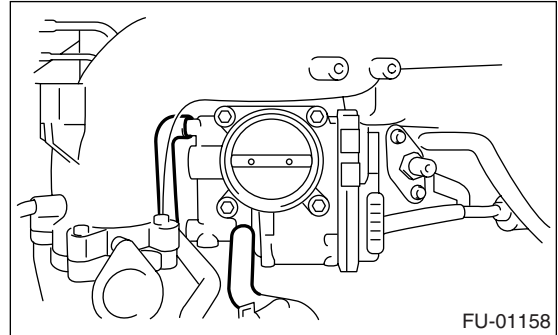
- 1) Release the fuel pressure.
<Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Open the fuel filler flap lid, and remove the fuel filler cap.
- 3) Remove the collector cover.
- 4) Disconnect the ground cable from battery.



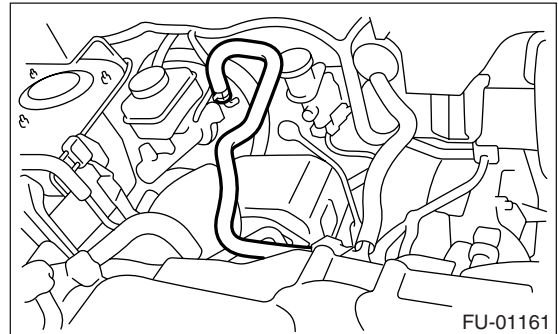
- 5) Lift-up the vehicle.
- 6) Remove the under cover.
- 7) Drain the coolant about 3.0 ℓ (3.2 US qt, 2.6 Imp qt).
- 8) Remove the intake duct from air cleaner case.
- 9) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 10) Remove the generator. <Ref. to SC(H4SO 2.0)-14, REMOVAL, Generator.>
- 11) Remove the coolant filler tank.
<Ref. to CO(H4DOTC)-31, REMOVAL, Coolant Filler Tank.>
- 12) Disconnect the PCV hose assembly from cylinder block.



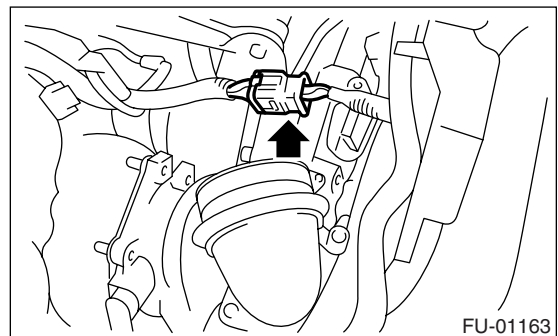
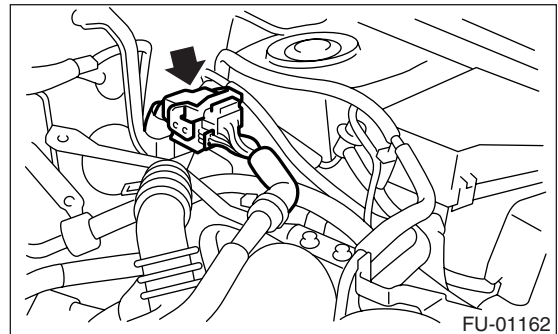
- 13) Disconnect the engine coolant hose from throttle body.



- 14) Disconnect the brake booster hose.



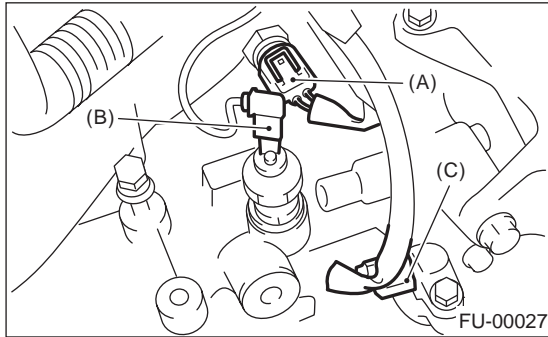
- 15) Disconnect the engine harness connectors from bulkhead harness connectors.



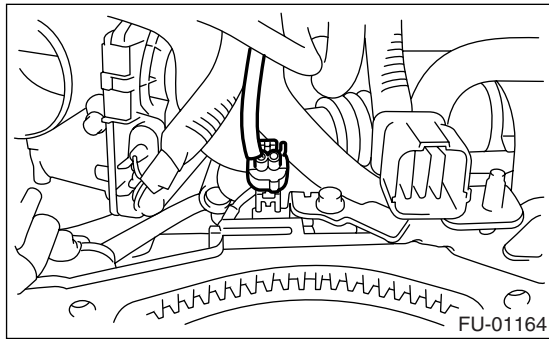
Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

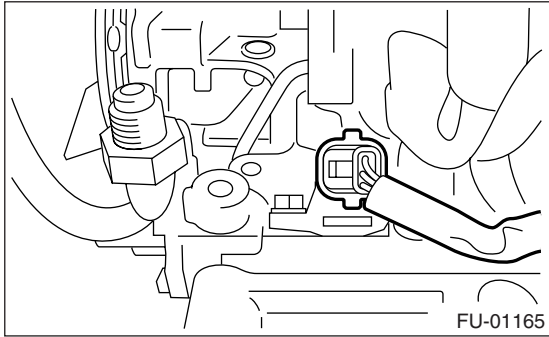
16) Disconnect the connectors from the engine coolant temperature sensor (A), oil pressure switch (B) and crankshaft position sensor (C).



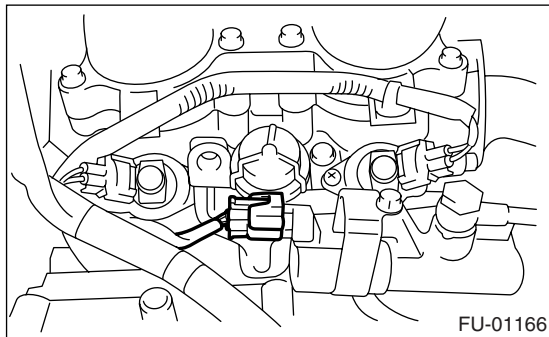
17) Disconnect the knock sensor connector.



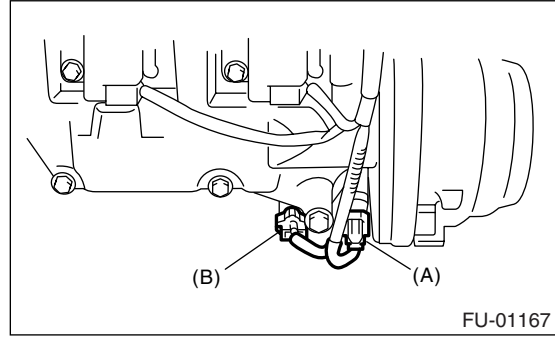
18) Disconnect the connector from intake camshaft position sensor.



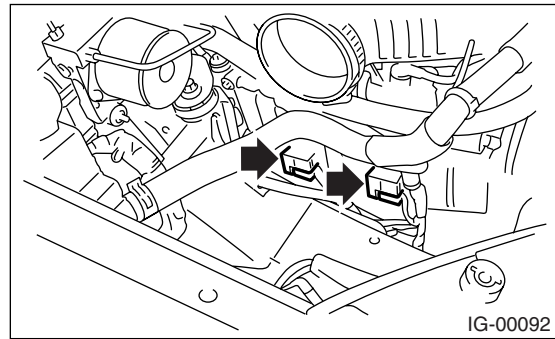
19) Disconnect the connector from the intake oil flow control solenoid valve.



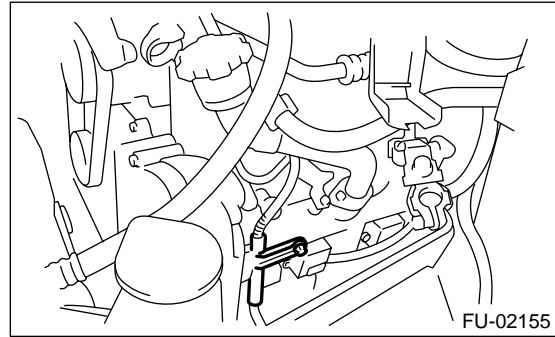
20) Disconnect the connector from the exhaust camshaft position sensor (A) and exhaust oil flow control solenoid valve (B).



21) Disconnect the connector from ignition coil.



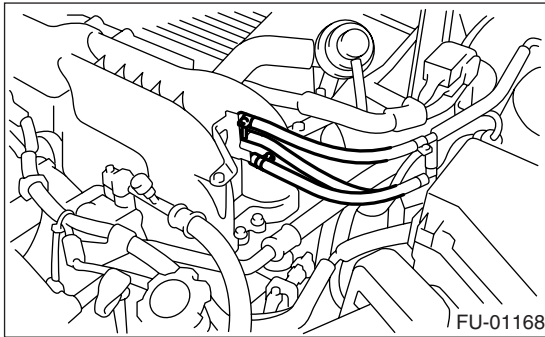
22) Remove the engine harness bracket from rocker cover.



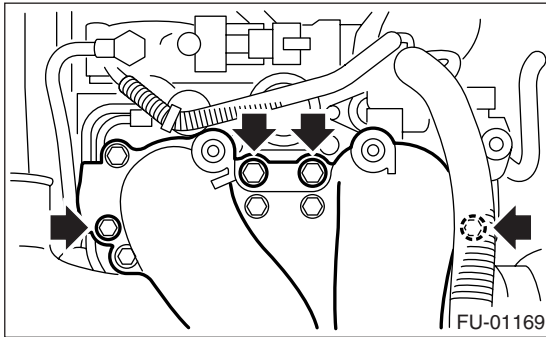
23) Disconnect the fuel delivery hose, return hose and evaporation hose.

CAUTION:

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



24) Remove the bolts which hold intake manifold onto the cylinder heads.



25) Remove the intake manifold.

B: INSTALLATION

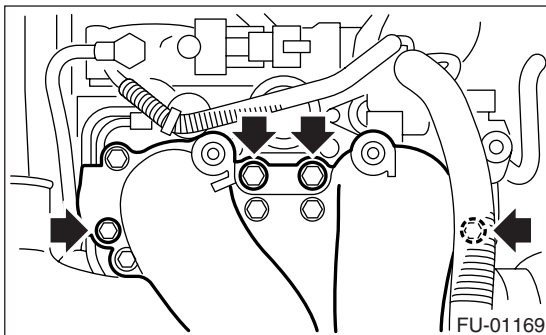
1) Install the intake manifold onto cylinder heads.

NOTE:

Use a new gasket.

Tightening torque:

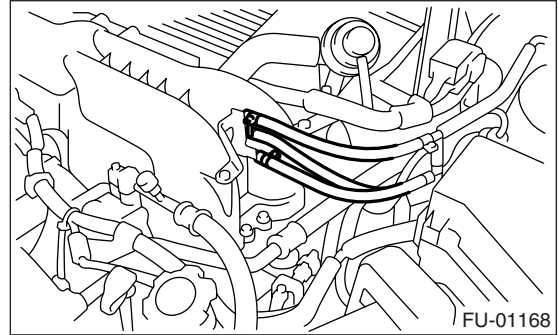
25 N·m (2.5 kgf-m, 18.1 ft-lb)



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

NOTE:

If fuel hoses or clamps are damaged, replace them with new ones.

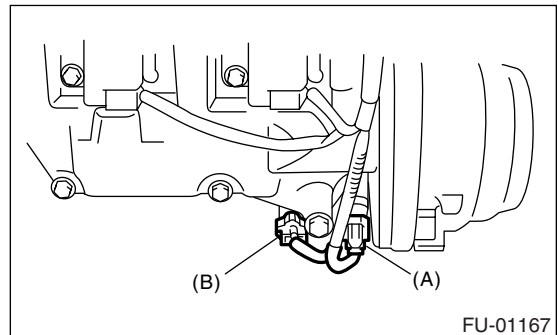


3) Tighten the hose clamp screws.

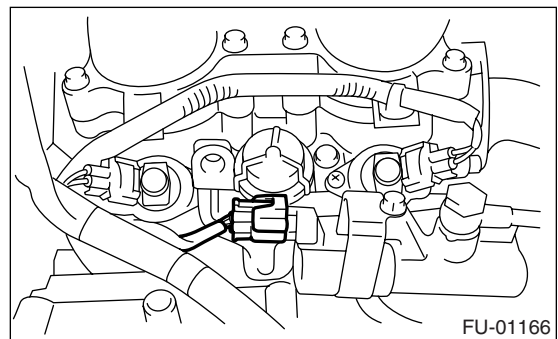
Tightening torque:

1.25 N·m (0.13 kgf-m, 0.94 ft-lb)

4) Connect the connector to the exhaust camshaft position sensor (A) and exhaust oil flow control solenoid valve (B).



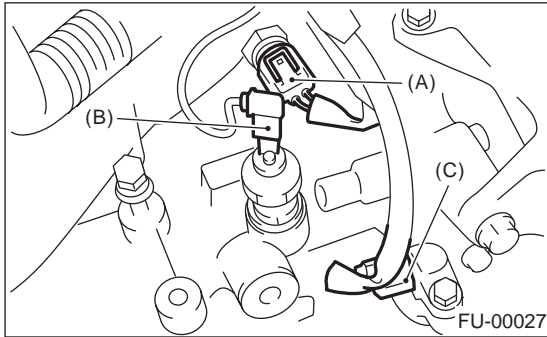
5) Connect the connector to intake oil flow control solenoid valve.



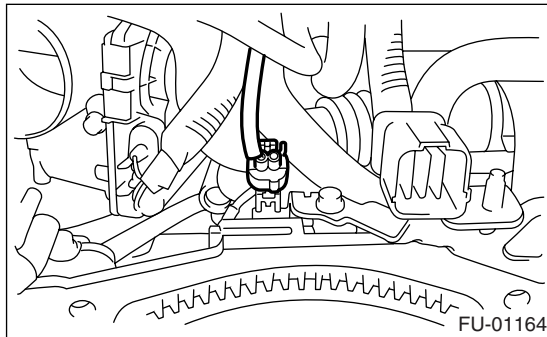
Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

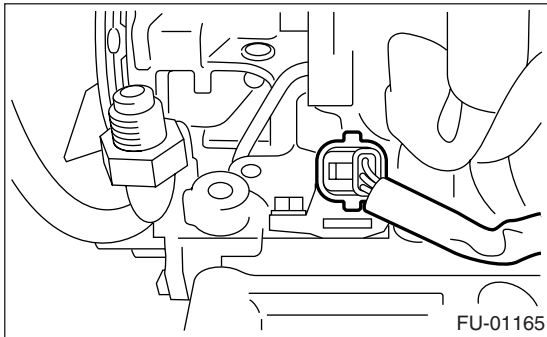
6) Connect the connector to the engine coolant temperature sensor (A), oil pressure switch (B) and crankshaft position sensor (C).



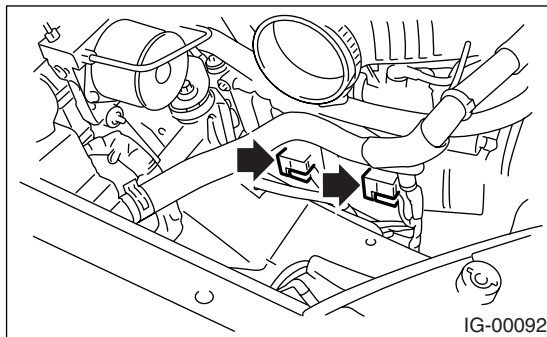
7) Connect the connector to knock sensor.



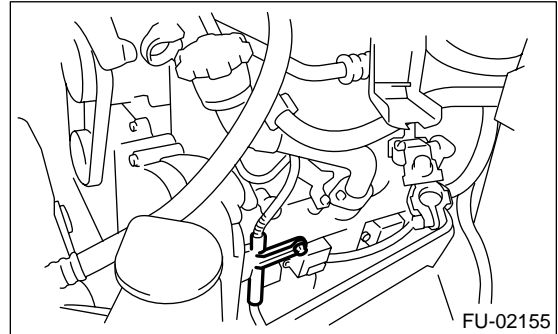
8) Connect the connector to intake camshaft position sensor.



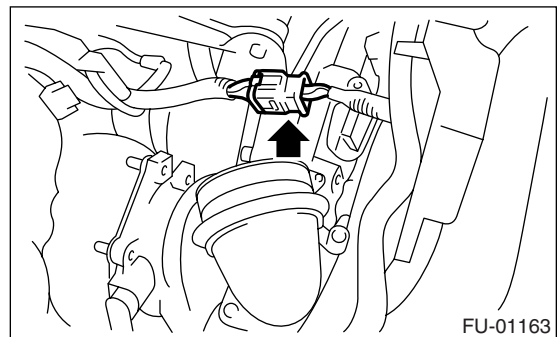
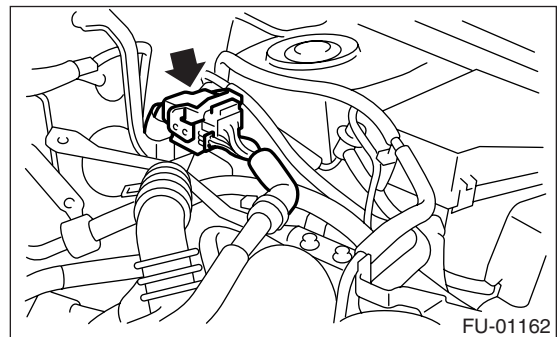
9) Connect the connector to ignition coil.



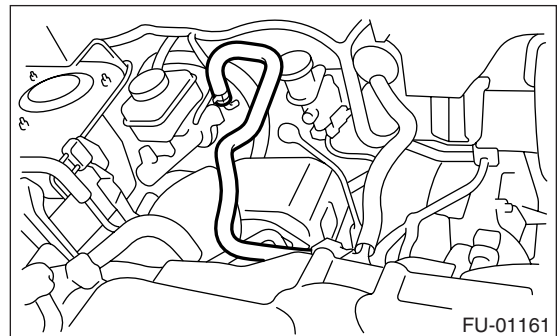
10) Install the engine harness bracket to rocker cover.



11) Connect the engine harness connector to bulk-head harness connector.



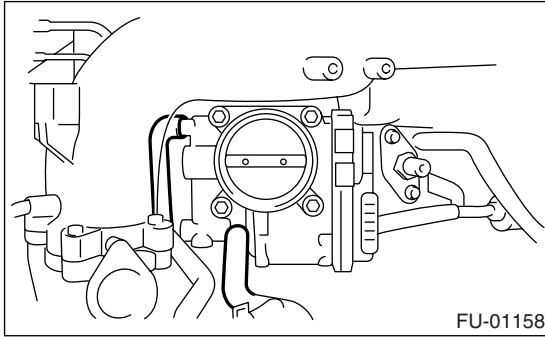
12) Connect the brake booster hose.



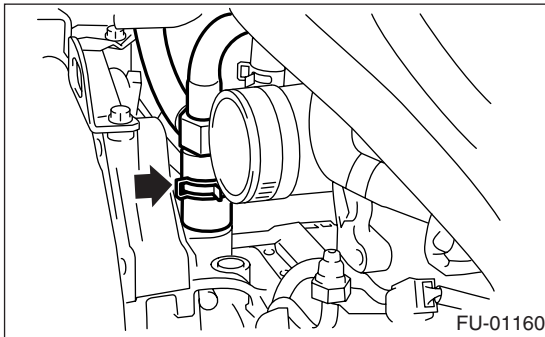
Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

- 13) Connect the engine coolant hose to throttle body.



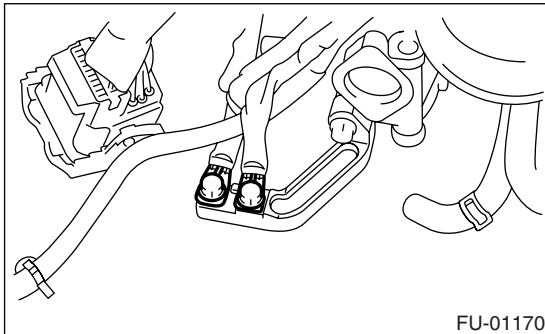
- 14) Connect the PCV hose assembly to cylinder block.



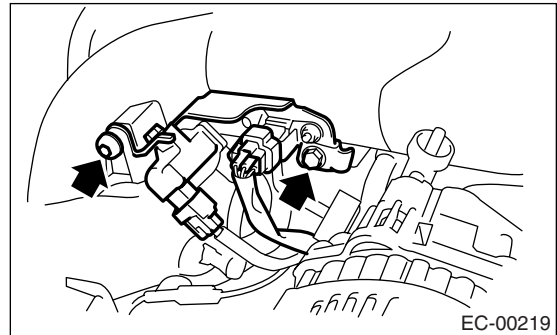
- 15) Install the coolant filler tank.
<Ref. to CO(H4DOTC)-31, INSTALLATION, Coolant Filler Tank.>
16) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
17) Install the intake duct to air cleaner case.
18) Install the fuse of fuel pump to main fuse box.
19) Connect the battery ground cable to battery.
20) Lift-up the vehicle.
21) Install the under cover.
22) Fill with engine coolant.
<Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
23) Install the collector cover.

C: DISASSEMBLY

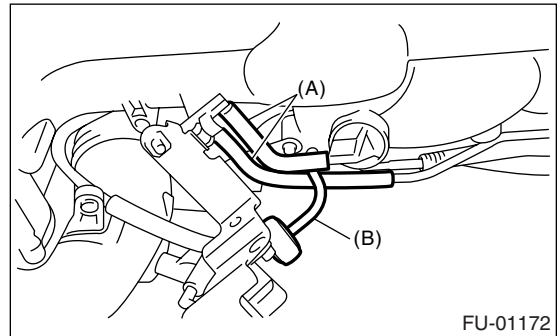
- 1) Disconnect the engine ground terminal from ground stay.



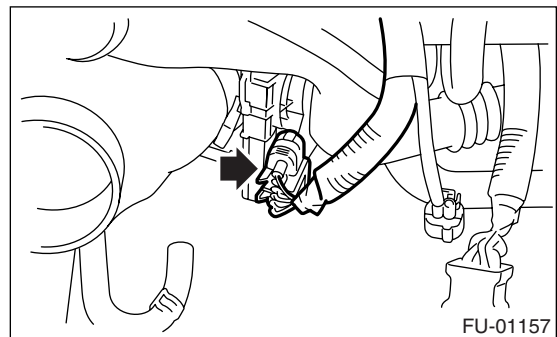
- 2) Remove the solenoid valve bracket assembly from intake manifold, and disconnect the connector from the wastegate control solenoid valve, manifold absolute pressure sensor and purge control solenoid valve.



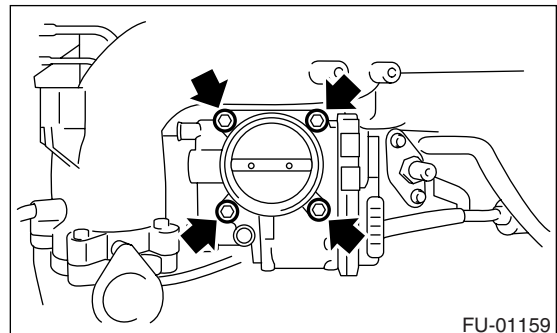
- 3) Disconnect the evaporation hoses (A) and filter assembly (B).



- 4) Disconnect the connectors from throttle position sensor.



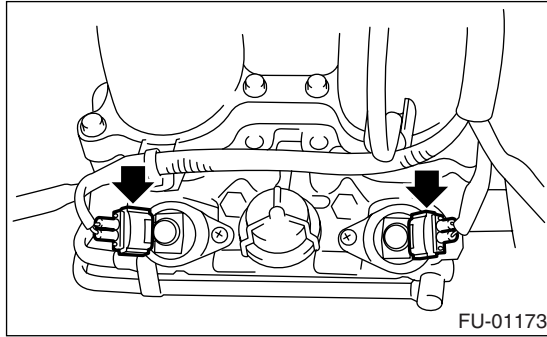
- 5) Remove the throttle body from intake manifold.



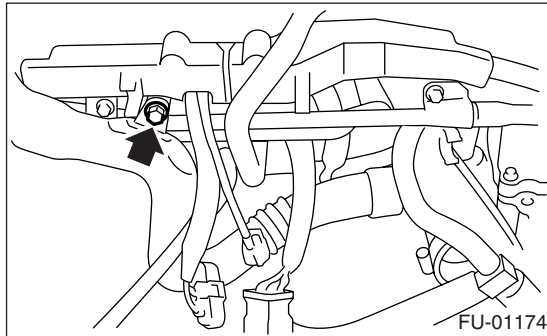
Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

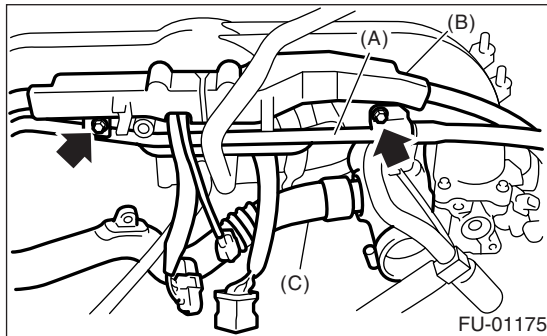
6) Disconnect the connectors from fuel injector.



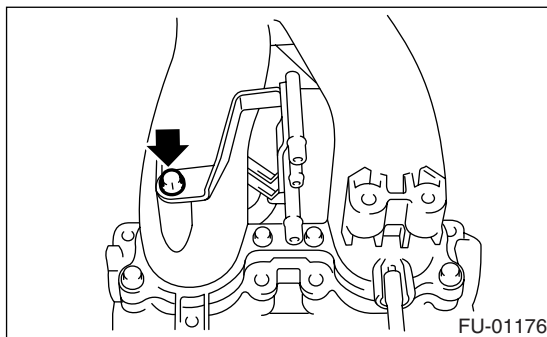
7) Remove the bolt which secures the air bypass pipe to intake manifold.



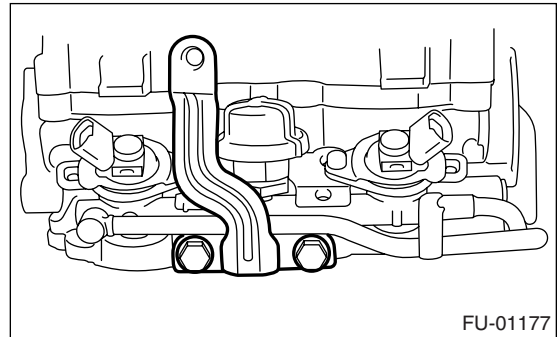
8) Disconnect the PCV pipe (A), harness assembly (B) and intake duct (C) from intake manifold.



9) Remove the bolt which holds fuel injector pipe LH onto the front side of intake manifold.

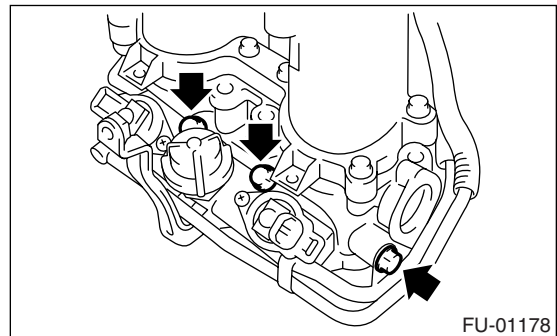


10) Remove the coolant filler tank stay from intake manifold.

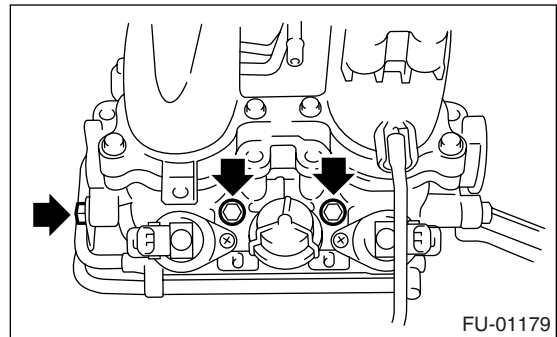


11) Remove the bolts which hold fuel injector pipe onto intake manifold.

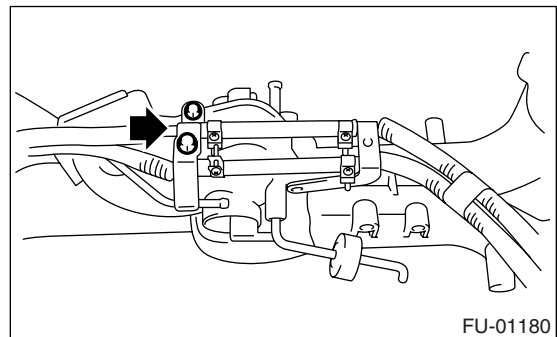
• RH side



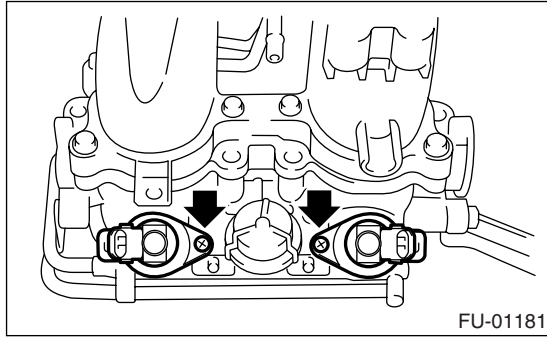
• LH side



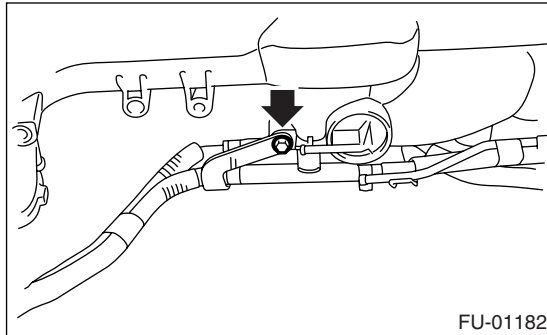
12) Remove the bolt which holds the fuel pipe to intake manifold.



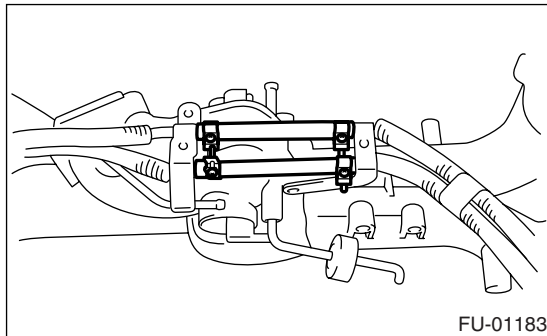
13) Remove the fuel injectors.



14) Remove the bolts which hold the fuel injector pipe RH onto the lower side of intake manifold.

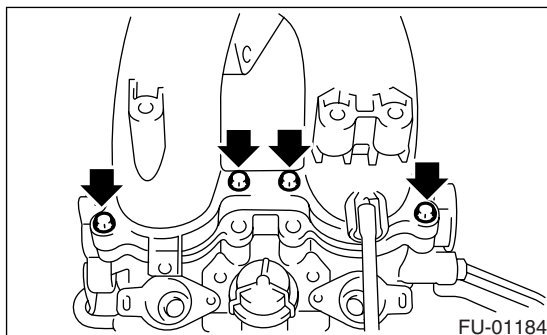


15) Loosen the clamp which holds fuel hose to injector pipe, and then disconnect the pipe from fuel hose.



16) Remove the fuel injector pipe.

17) Remove the intake manifold (upper) from intake manifold (lower).



D: ASSEMBLY

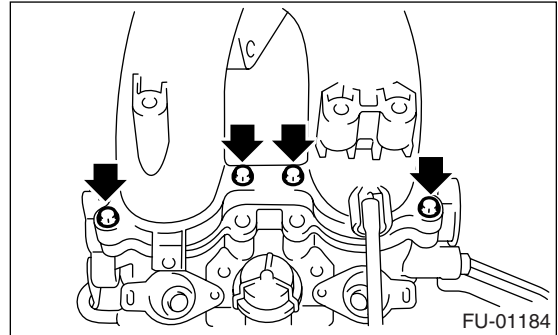
1) Install the intake manifold (lower) to intake manifold (upper).

NOTE:

Use new O-rings.

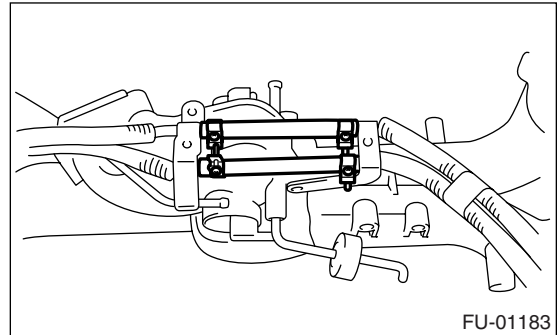
Tightening torque:

8.3 N·m (0.85 kgf-m, 6.1 ft-lb)



2) Install the fuel injector pipe.

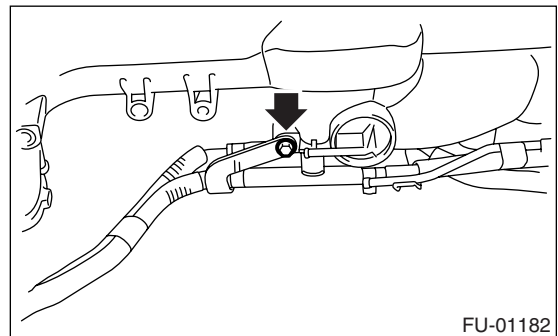
3) Connect the both fuel injector pipes with a fuel hose and secure them with clamps.



4) Tighten the bolt which secures the fuel injector pipe RH onto the lower side of intake manifold.

Tightening torque:

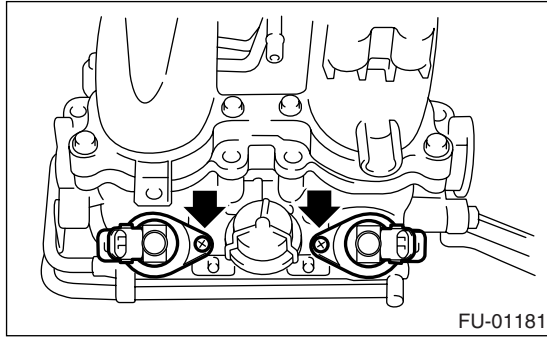
6.5 N·m (0.66 kgf-m, 4.8 ft-lb)



Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

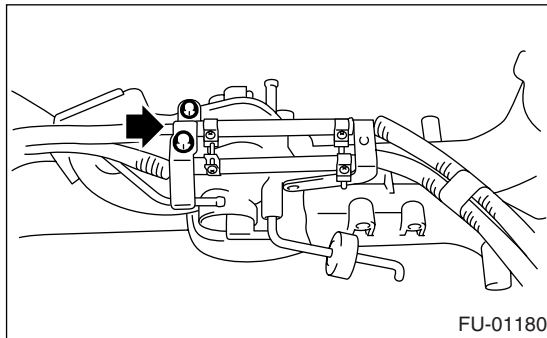
5) Install the fuel injectors.



6) Tighten the bolt which secures fuel pipe onto intake manifold.

Tightening torque:

6.5 N·m (0.66 kgf-m, 4.8 ft-lb)

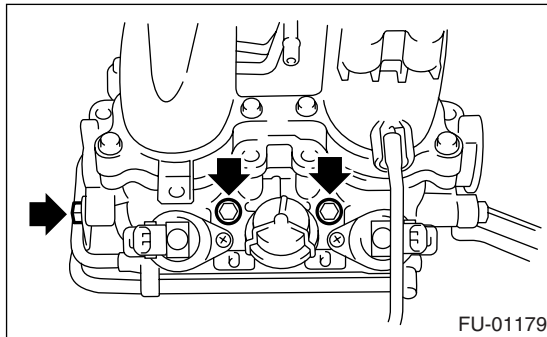


7) Tighten the bolts which secure fuel injector pipe onto intake manifold.

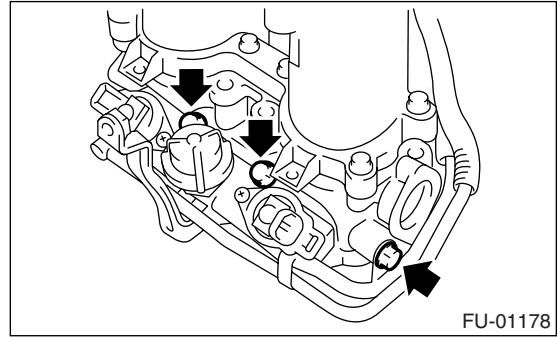
Tightening torque:

19 N·m (1.94 kgf-m, 13.7 ft-lb)

• LH side



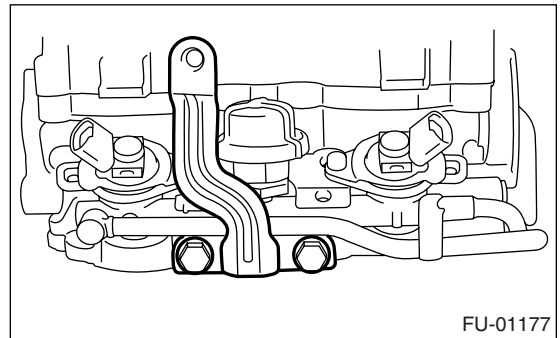
• RH side



8) Install the coolant filler tank stay to intake manifold.

Tightening torque:

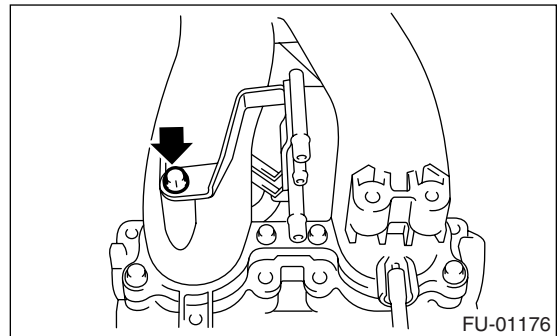
19 N·m (1.94 kgf-m, 13.7 ft-lb)



9) Tighten the bolt which installs fuel injector pipe LH on the front side of intake manifold.

Tightening torque:

6.5 N·m (0.66 kgf-m, 4.8 ft-lb)



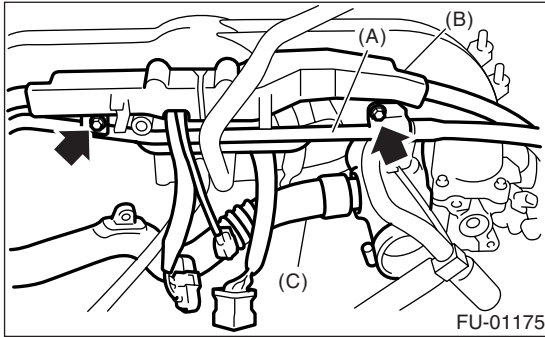
10) Install the PCV pipe (A), harness assembly (B) and intake duct (C) to intake manifold.

Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

Tightening torque:

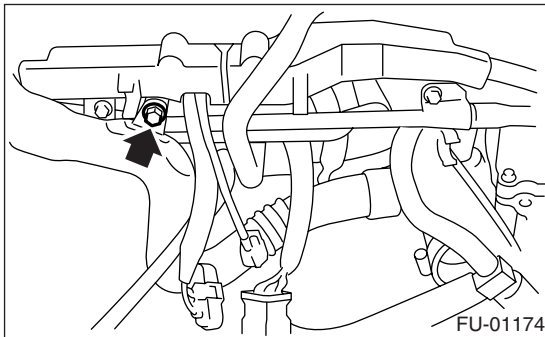
6.5 N·m (0.66 kgf-m, 4.8 ft-lb)



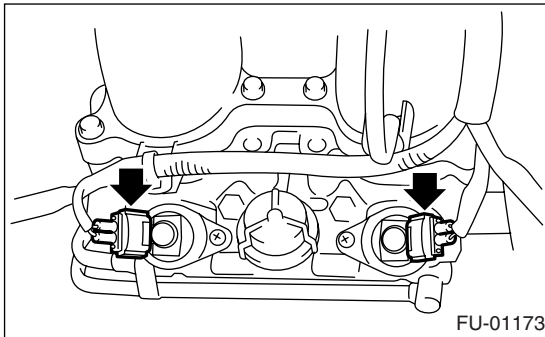
11) Tighten the bolt which secures air bypass pipe onto intake manifold.

Tightening torque:

6.5 N·m (0.66 kgf-m, 4.8 ft-lb)



12) Connect the connectors to fuel injector.



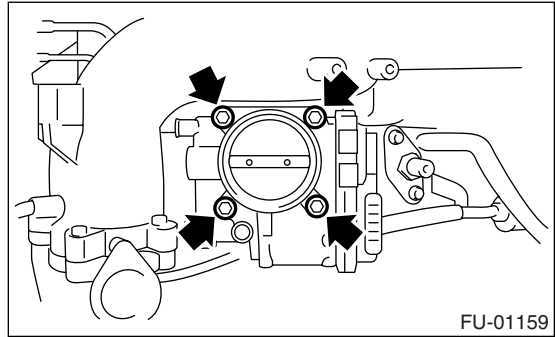
13) Install the throttle body to intake manifold.

NOTE:

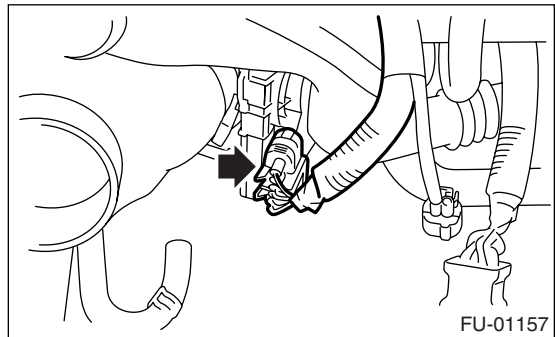
Use new O-rings.

Tightening torque:

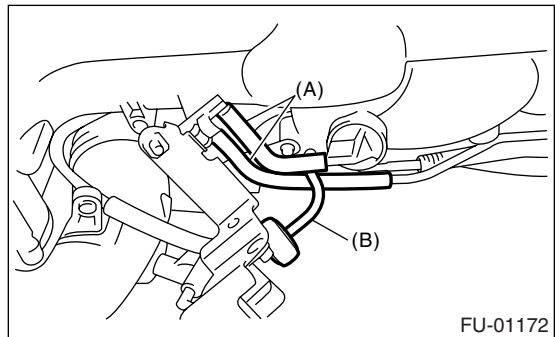
8 N·m (0.8 kgf-m, 5.9 ft-lb)



14) Connect the connector to throttle position sensor.



15) Connect the evaporation hoses (A) and filter assembly (B).

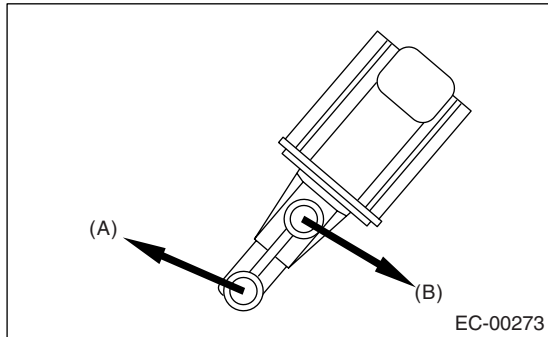


Intake Manifold

FUEL INJECTION (FUEL SYSTEMS)

NOTE:

Connect the evaporation hose as shown in the figure.



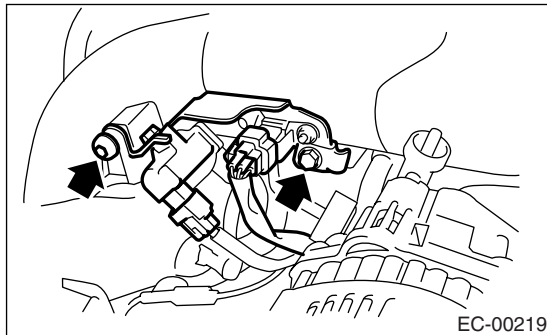
(A) To intake manifold

(B) To evaporation pipe

16) Connect the connector to the wastegate control solenoid valve, manifold absolute pressure sensor and purge control solenoid valve, and install the solenoid bracket assembly to intake manifold.

Tightening torque:

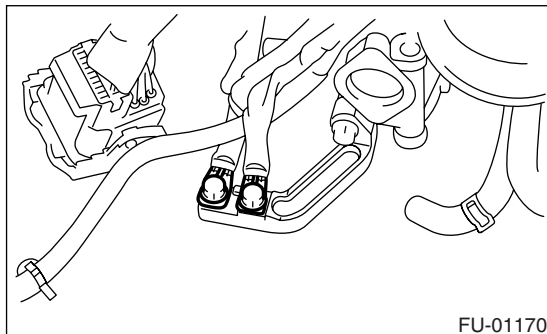
19 N·m (1.94 kgf-m, 13.7 ft-lb)



17) Install the engine ground terminal to ground stay.

Tightening torque:

19 N·m (1.94 kgf-m, 13.7 ft-lb)



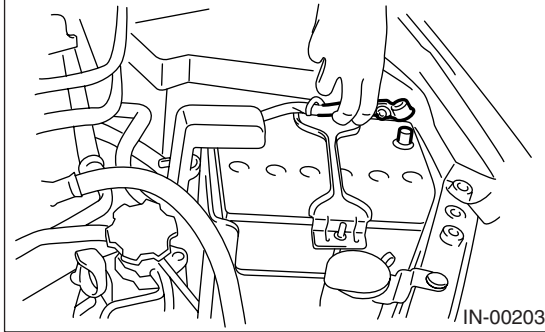
E: INSPECTION

Make sure that the fuel hoses and fuel pipes are not cracked and that connections are tight.

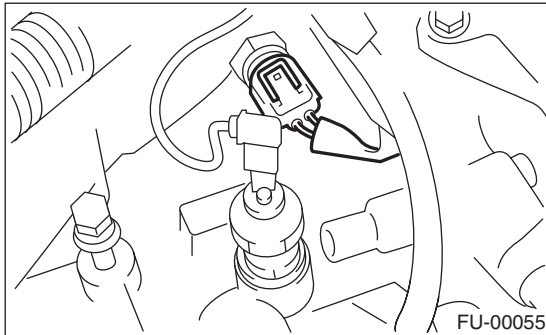
4. Engine Coolant Temperature Sensor

A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the generator. <Ref. to SC(H4SO 2.0)-14, REMOVAL, Generator.>
- 4) Drain coolant. <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 5) Disconnect the connectors from engine coolant temperature sensor.



- 6) Remove the engine coolant temperature sensor.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

18 N·m (1.8 kgf·m, 13.3 ft-lb)

Crankshaft Position Sensor

FUEL INJECTION (FUEL SYSTEMS)

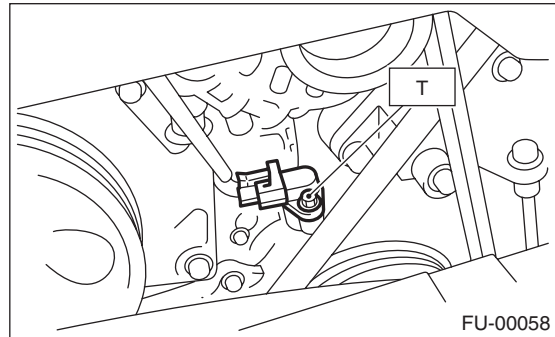
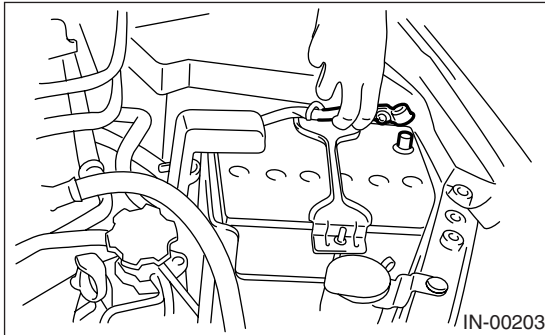
5. Crankshaft Position Sensor

Tightening torque:

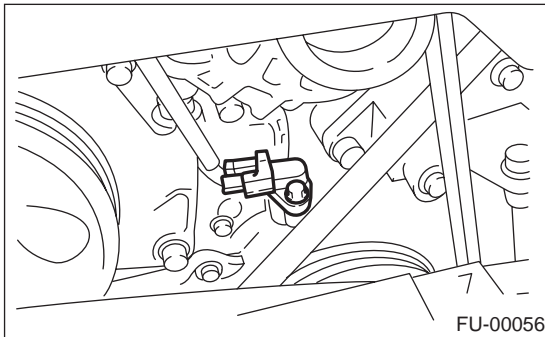
T: 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

A: REMOVAL

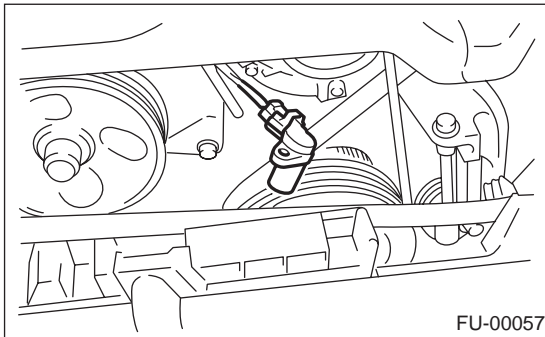
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the bolt which installs crankshaft position sensor to cylinder block.



- 4) Remove the crankshaft position sensor, and disconnect the connector from it.



B: INSTALLATION

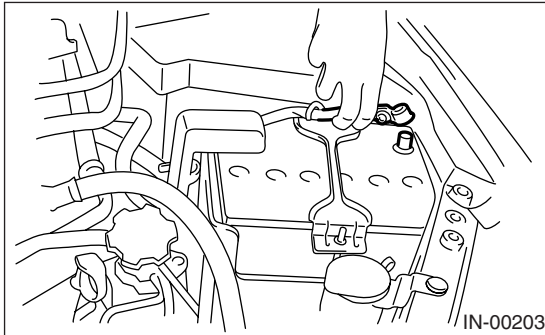
Install in the reverse order of removal.

6. Camshaft Position Sensor

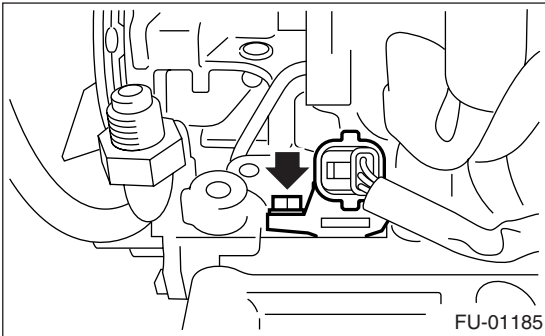
A: REMOVAL

1. INTAKE SIDE

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



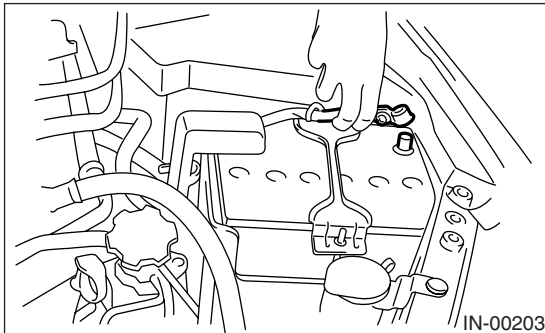
- 3) Disconnect the connector from camshaft position sensor RH.
- 4) Remove the camshaft position sensor RH from the rear side of cylinder head.



- 5) Remove the camshaft position sensor LH in the same procedure as RH.

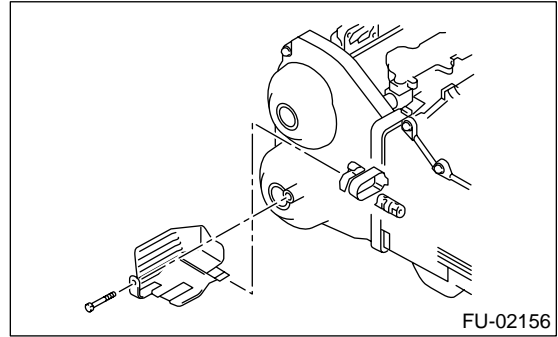
2. EXHAUST SIDE

- 1) Disconnect the ground cable from battery.

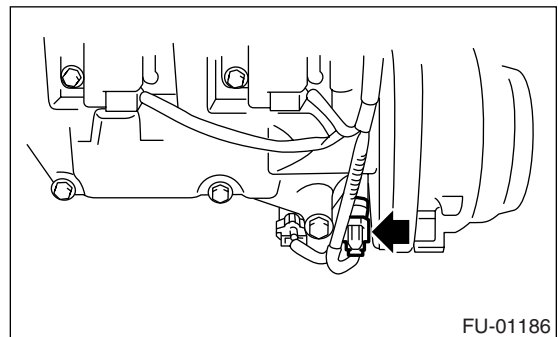


- 2) Lift-up the vehicle.
- 3) Remove the under cover.

- 4) Remove the sensor cover.



- 5) Disconnect the connector from camshaft position sensor RH.
- 6) Remove the camshaft position sensor RH from the lower side of cylinder head.



- 7) Remove the camshaft position sensor LH in the same procedure as RH.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

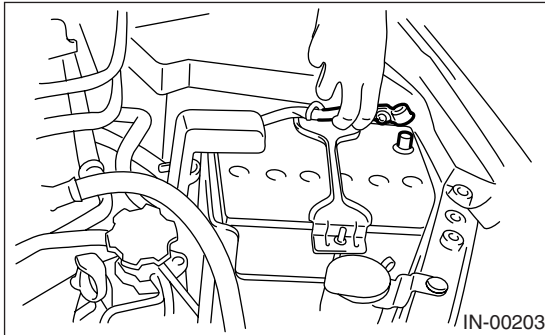
Knock Sensor

FUEL INJECTION (FUEL SYSTEMS)

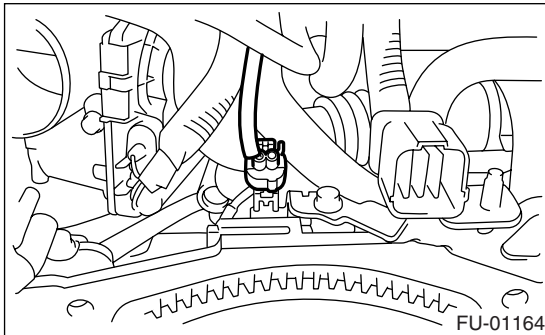
7. Knock Sensor

A: REMOVAL

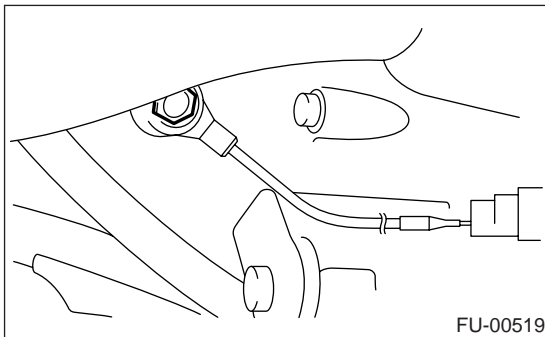
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 4) Disconnect the knock sensor connector.



- 5) Remove the knock sensor from cylinder block.



B: INSTALLATION

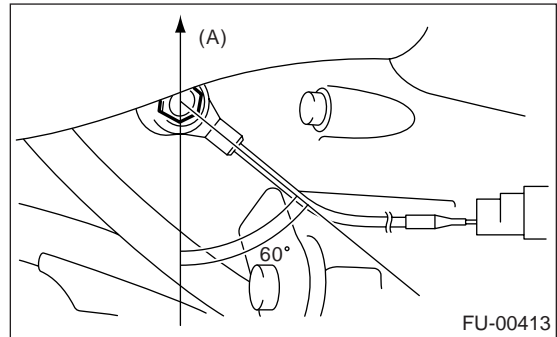
- 1) Install the knock sensor to cylinder block.

NOTE:

Extraction area of knock sensor cord must be positioned at a 60° angle relative to the engine rear.

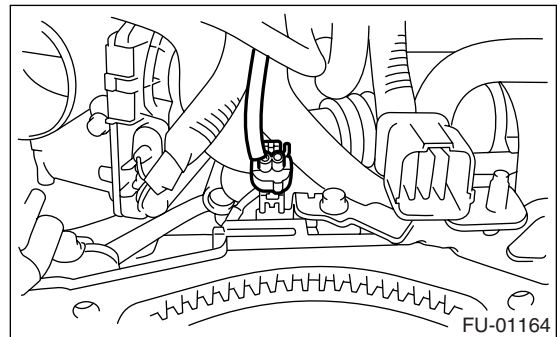
Tightening torque:

24 N·m (2.4 kgf-m, 17.4 ft-lb)

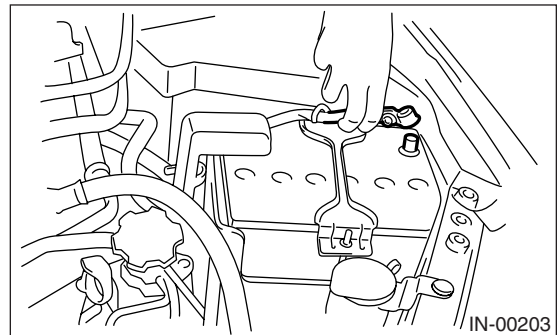


(A) Front side

- 2) Connect the knock sensor connector.



- 3) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 4) Connect the battery ground cable to battery.



- 5) Install the collector cover.

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. <Ref. to FU(H4DOTC)-12, REMOVAL, Throttle Body.> <Ref. to FU(H4DOTC)-12, INSTALLATION, Throttle Body.>

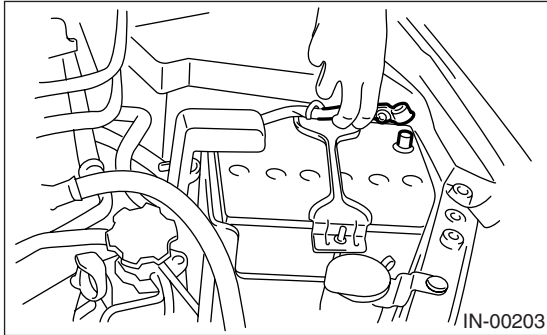
Mass Air Flow and Intake Air Temperature Sensor

FUEL INJECTION (FUEL SYSTEMS)

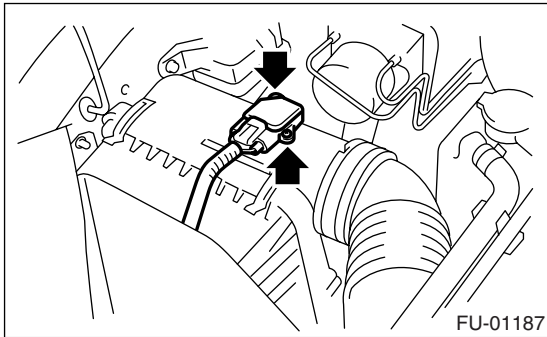
9. Mass Air Flow and Intake Air Temperature Sensor

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector from mass air flow and intake air temperature sensor.
- 3) Remove the mass air flow and intake air temperature sensor.



B: INSTALLATION

Install in the reverse order of removal.

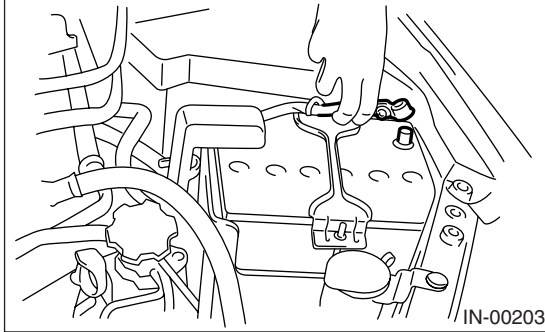
Tightening torque:

1.0 N·m (0.10 kgf-m, 0.74 ft-lb)

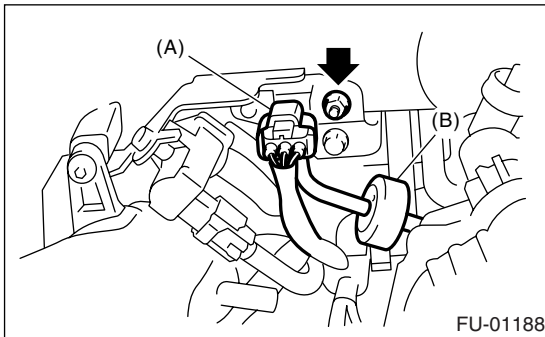
10. Manifold Absolute Pressure Sensor

A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Disconnect the connector from manifold absolute pressure sensor (A), and remove the filter assembly (B) from intake manifold.
- 4) Remove the manifold absolute pressure sensor from solenoid valve bracket.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

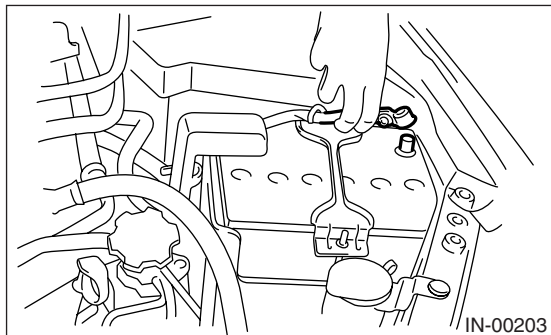
6.5 N·m (0.66 kgf-m, 4.8 ft-lb)

11. Fuel Injector

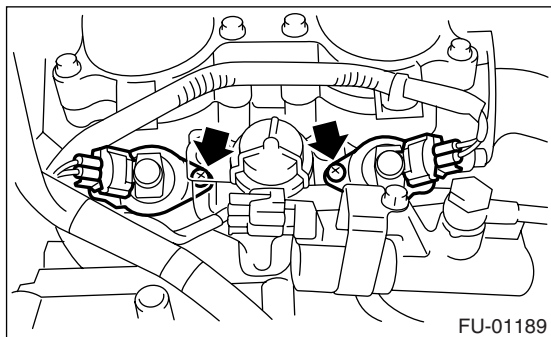
A: REMOVAL

1. RH SIDE

- 1) Release the fuel pressure.
<Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Open the fuel filler flap lid, and remove the fuel filler cap.
- 3) Remove the collector cover.
- 4) Disconnect the ground cable from battery.



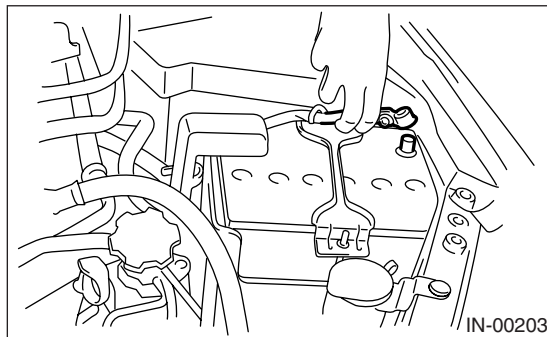
- 5) Remove the coolant filler tank.
<Ref. to CO(H4DOTC)-31, REMOVAL, Coolant Filler Tank.>
- 6) Disconnect the connector from fuel injector.
- 7) Remove the screw and remove the fuel injector.



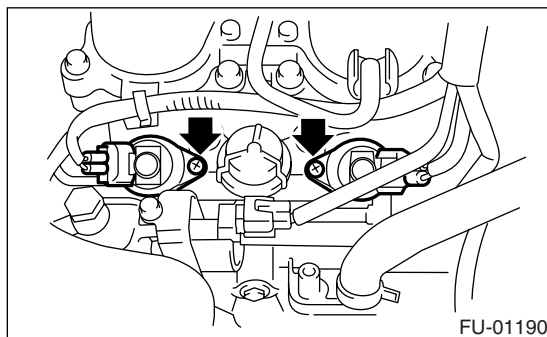
2. LH SIDE

- 1) Release the fuel pressure.
<Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Open the fuel filler flap lid, and remove the fuel filler cap.
- 3) Remove the collector cover.

- 4) Disconnect the ground cable from battery.



- 5) Disconnect the connector from fuel injector.
- 6) Remove the screw and remove the fuel injector.



B: INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

NOTE:
Use new O-rings.

Tightening torque:
3.5 N·m (0.36 kgf-m, 2.6 ft-lb)

2. LH SIDE

Install in the reverse order of removal.

NOTE:
Use new O-rings.

Tightening torque:
3.5 N·m (0.36 kgf-m, 2.6 ft-lb)

12.Oil Flow Control Solenoid Valve

A: REMOVAL

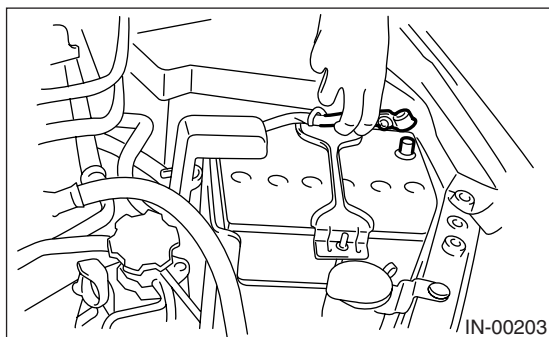
1. INTAKE SIDE

Oil flow control solenoid valve forms a unit with camshaft cap.

Refer to "Camshaft" for removal. <Ref. to ME(H4DOTC)-53, REMOVAL, Camshaft.>

2. EXHAUST SIDE

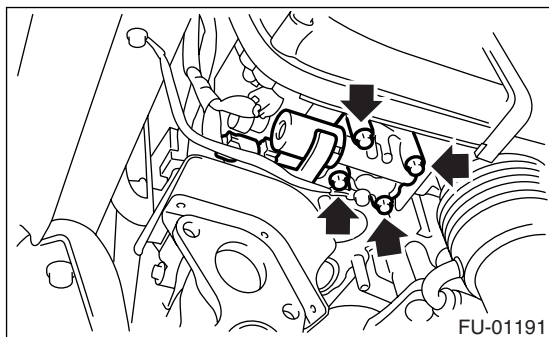
1) Disconnect the ground cable from battery.



2) Lift-up the vehicle.

3) Remove the under cover.

4) Remove the oil flow control solenoid valve from cylinder head.



B: INSTALLATION

1. INTAKE SIDE

Install in the reverse order of removal.

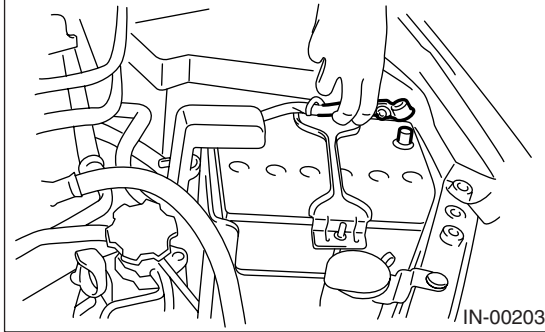
2. EXHAUST SIDE

Install in the reverse order of removal.

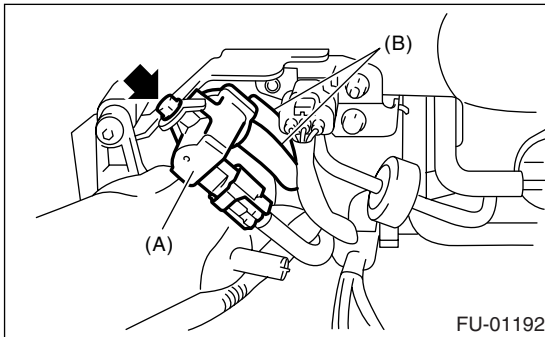
13. Wastegate Control Solenoid Valve

A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Disconnect the connector from wastegate control solenoid valve (A).
- 4) Disconnect the pressure hose (B) from wastegate control solenoid valve.
- 5) Remove the wastegate control solenoid valve from bracket.



B: INSTALLATION

Install in the reverse order of removal.

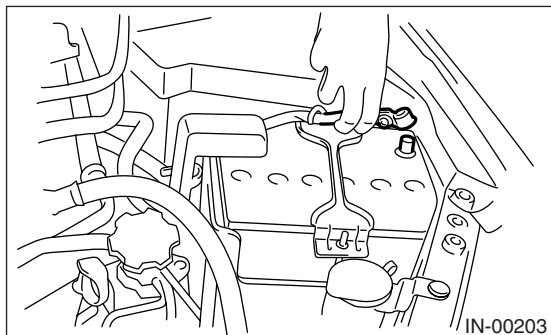
Tightening torque:

6.5 N·m (0.66 kgf-m, 4.8 ft-lb)

14. Front Oxygen (A/F) Sensor

A: REMOVAL

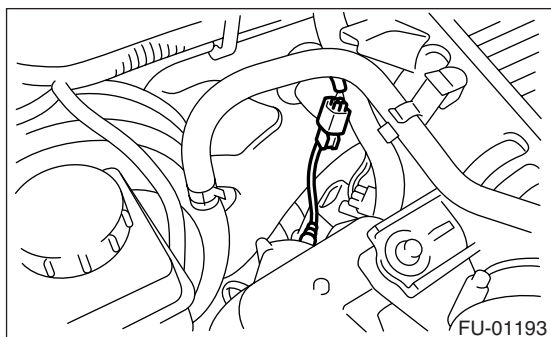
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Disconnect the connector from front oxygen (A/F) sensor.
- 4) Apply spray-type lubricant to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.
- 5) Remove the front oxygen (A/F) sensor.

CAUTION:

When removing the oxygen (A/F) sensor, wait until exhaust pipe cools, otherwise it will damage exhaust pipe.



B: INSTALLATION

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

Anti-seize compound:

SS-30 JET LUBE

CAUTION:

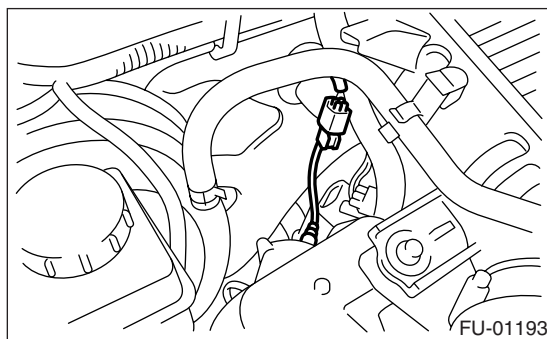
Never apply anti-seize compound to protector of front oxygen (A/F) sensor.

- 2) Install the front oxygen (A/F) sensor.

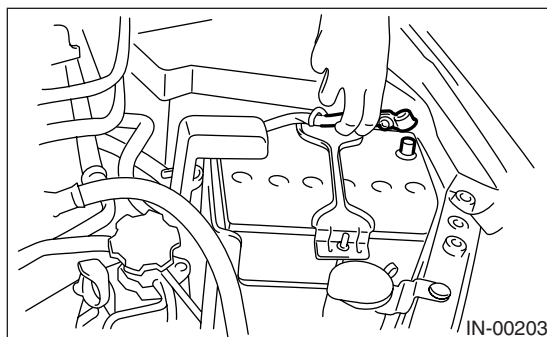
Tightening torque:

21 N·m (2.1 kgf-m, 15.2 ft-lb)

- 3) Connect the connector of front oxygen (A/F) sensor.



- 4) Connect the battery ground cable to battery.



- 5) Install the collector cover.

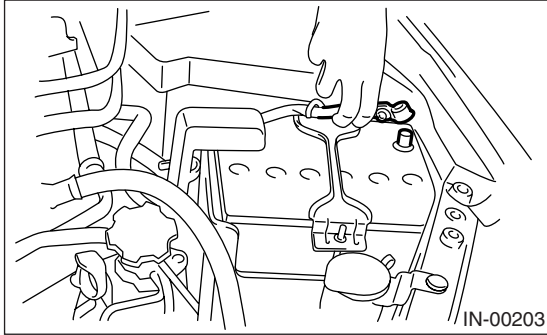
Rear Oxygen Sensor

FUEL INJECTION (FUEL SYSTEMS)

15.Rear Oxygen Sensor

A: REMOVAL

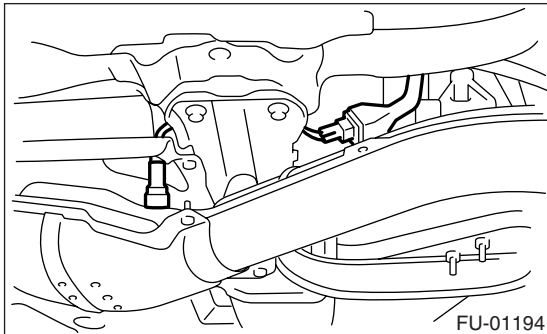
- 1) Disconnect the ground cable from battery.



- 2) Lift-up the vehicle.
- 3) Disconnect the connector from rear oxygen sensor.
- 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 exhaust pipe.



B: INSTALLATION

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

Anti-seize compound:
SS-30 JET LUBE

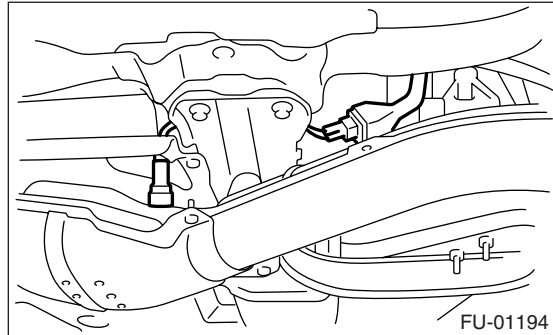
CAUTION:

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

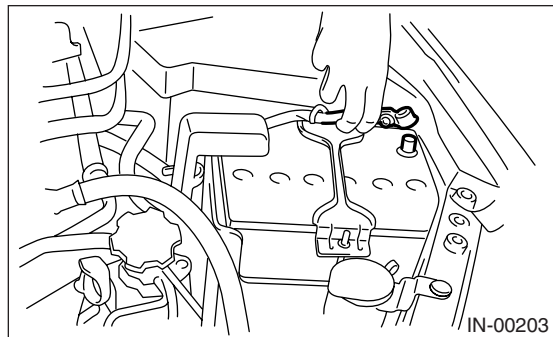
- 2) Install the rear oxygen sensor.

Tightening torque:

21 N·m (2.1 kgf-m, 15.2 ft-lb)



- 3) Connect the connector to rear oxygen sensor.
- 4) Lower the vehicle.
- 5) Connect the battery ground cable to battery.



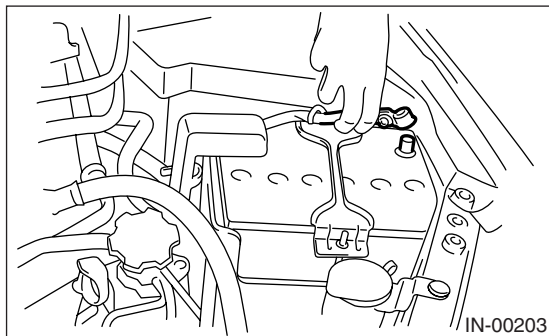
16.Engine Control Module (ECM)

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

A: REMOVAL

1) Disconnect the ground cable from battery.

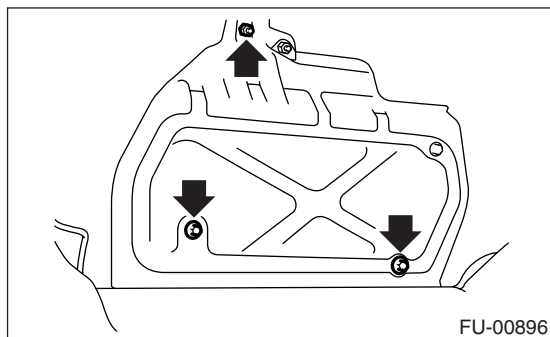


2) Remove the lower inner trim of passenger side.

<Ref. to EI-60, REMOVAL, Lower Inner Trim.>

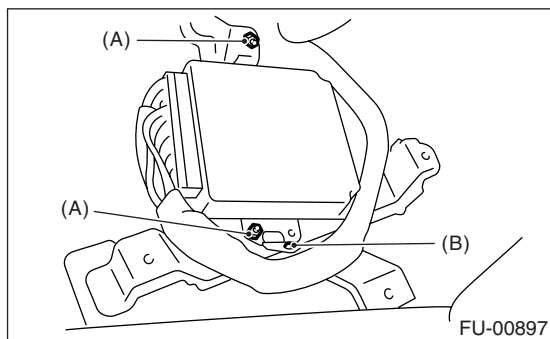
3) Detach the floor mat of front passenger's seat.

4) Remove the protect cover.



5) Remove the nuts (A) which hold the ECM to bracket.

6) Remove the clip (B) from bracket.



7) Disconnect the ECM connectors and take out the ECM.

B: INSTALLATION

Install in the reverse order of removal.

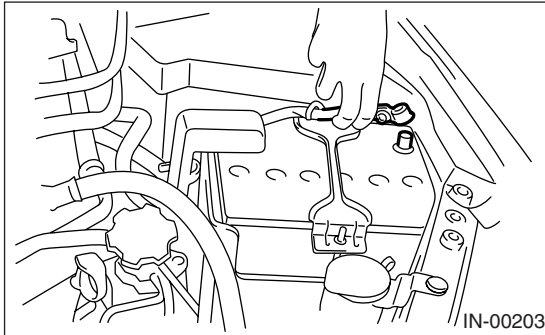
CAUTION:

- When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage to the fuel injection system.
- When replacing the ECM, be careful not to damage the harnesses and connectors.

17.Main Relay

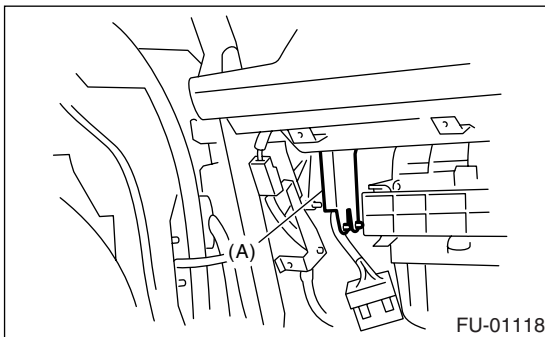
A: REMOVAL

1) Disconnect the ground cable from battery.

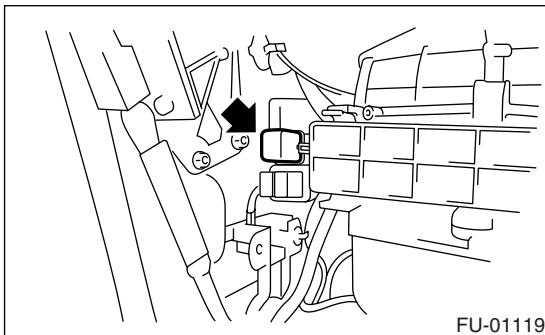


2) Remove the glove box. <Ref. to EI-51, REMOVAL, Glove Box.>

3) Remove the harness cover (A).



4) Disconnect the connector from main relay.



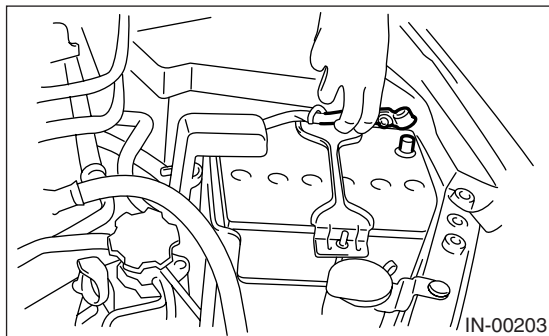
B: INSTALLATION

Install in the reverse order of removal.

18. Fuel Pump Relay

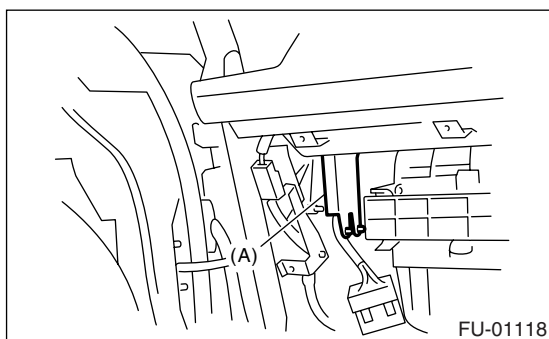
A: REMOVAL

1) Disconnect the ground cable from battery.

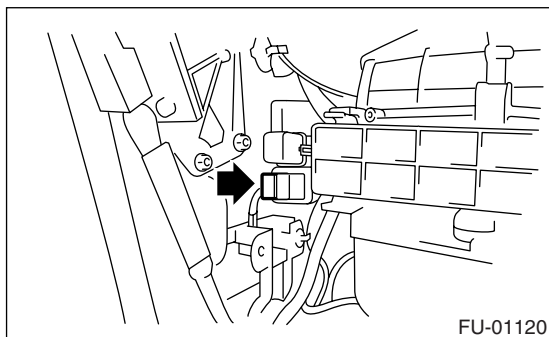


2) Remove the glove box. <Ref. to EI-51, REMOVAL, Glove Box.>

3) Remove the harness cover (A).



4) Disconnect the connector from fuel pump relay.



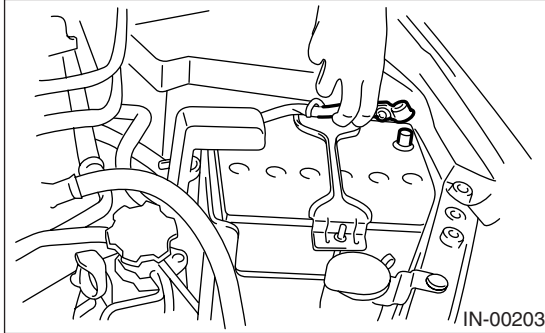
B: INSTALLATION

Install in the reverse order of removal.

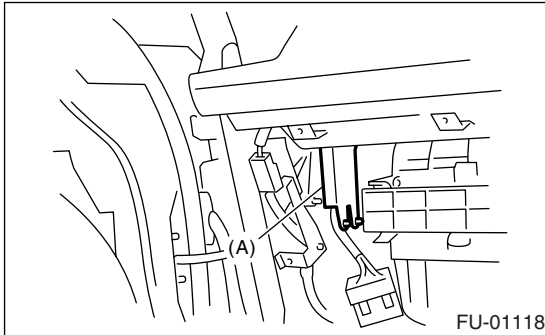
19. Electronic Throttle Control Relay

A: REMOVAL

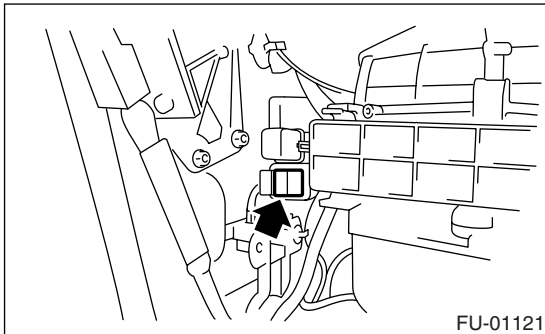
- 1) Disconnect the ground cable from battery.



- 2) Remove the glove box. <Ref. to EI-51, REMOVAL, Glove Box.>
- 3) Remove the harness cover (A).



- 4) Disconnect the connector from electronic throttle control relay.



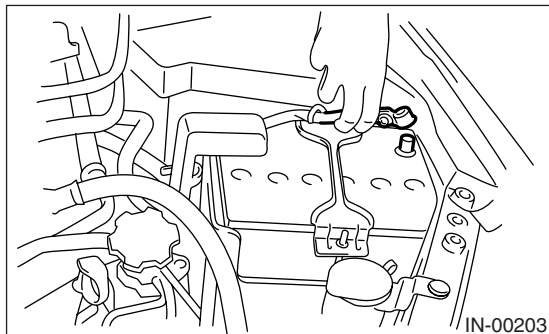
B: INSTALLATION

Install in the reverse order of removal.

20. Fuel Pump Control Unit

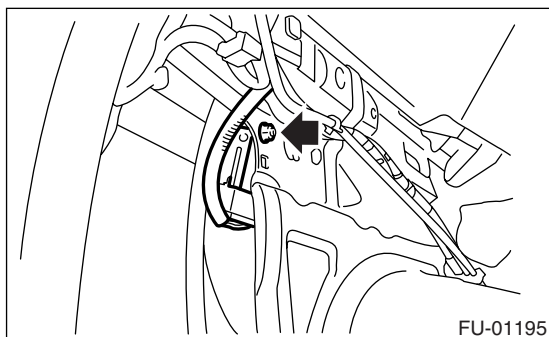
A: REMOVAL

1) Disconnect the ground cable from battery.



2) Remove the rear quarter trim. <Ref. to EI-63, REMOVAL, Rear Quarter Trim.>

3) Remove the fuel pump control unit.



4) Disconnect the connector from fuel pump control unit.

B: INSTALLATION

Install in the reverse order of removal.

21. Fuel

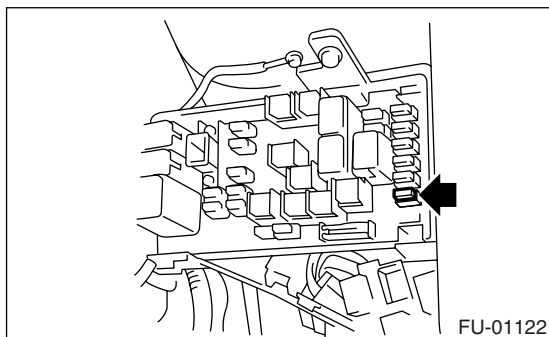
A: PROCEDURE

1. RELEASING OF FUEL PRESSURE

WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

1) Remove the fuse of fuel pump from main fuse box.



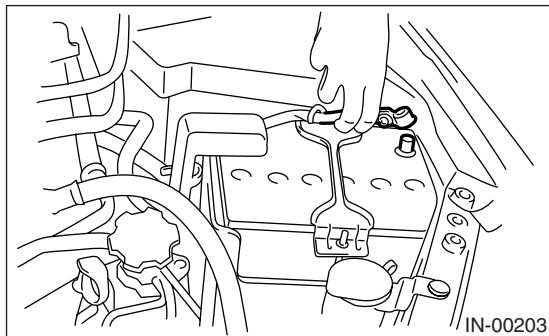
- 2) Start the engine and run it until it stalls.
- 3) After the engine stalls, crank it for five more seconds.
- 4) Turn the ignition switch to OFF.

2. DRAINING FUEL

WARNING:

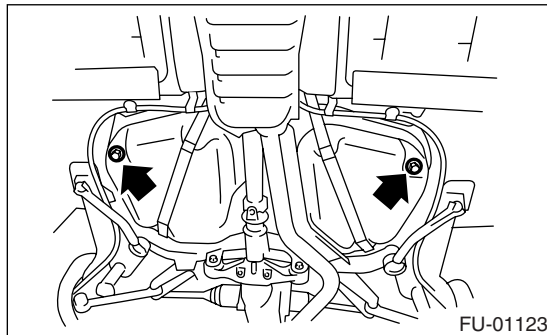
- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

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



- 3) Open the fuel filler flap lid and remove the fuel filler cap.
- 4) Lift-up the vehicle.
- 5) Remove the fuel tank protector.

6) Set a container under the vehicle and remove drain plug from fuel tank to drain fuel from the fuel tank.



7) Tighten the fuel drain plug.

NOTE:

Use a new gasket.

Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)

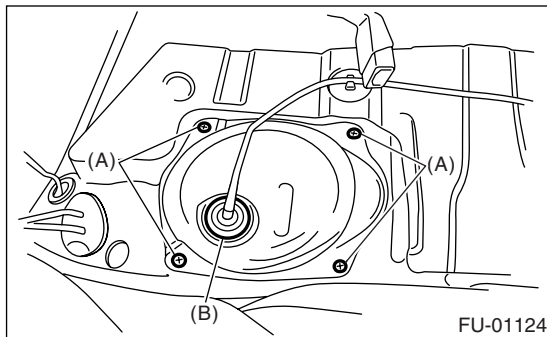
22.Fuel Tank

A: REMOVAL

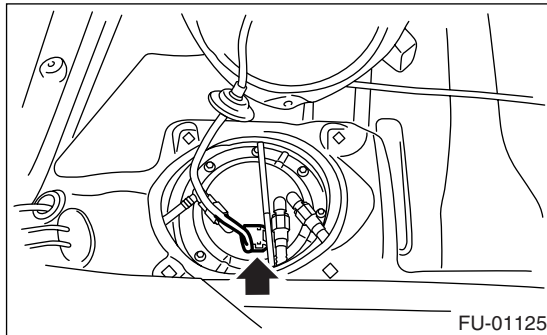
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure.
<Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Drain fuel from the fuel tank.
<Ref. to FU(H4DOTC)-40, DRAINING FUEL, PROCEDURE, Fuel.>
- 4) Remove the rear seat.
- 5) Remove the service hole cover from fuel pump.
 - (1) Remove the bolt (A).
 - (2) Push the grommet (B) down under the body and remove the service hole cover.

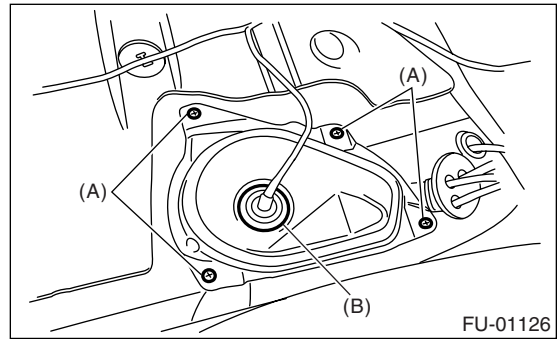


- 6) Disconnect the connector from fuel pump.

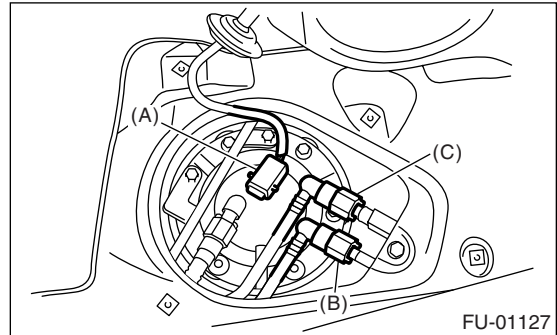


- 7) Remove the service hole cover from fuel sub level sensor.
 - (1) Remove the bolt (A).

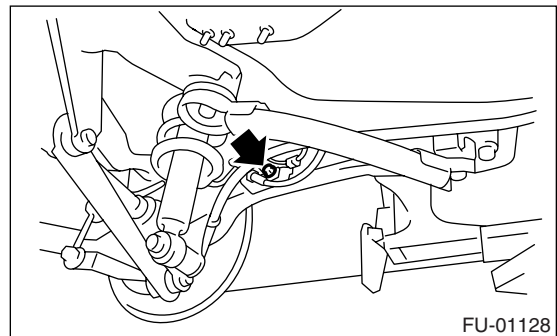
- (2) Push the grommet (B) down under the body and remove the service hole cover.



- 8) Disconnect the connector (A) from fuel sub level sensor.
- 9) Disconnect the quick connector from the fuel delivery (B) and return hose (C).
<Ref. to FU(H4DOTC)-56, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>



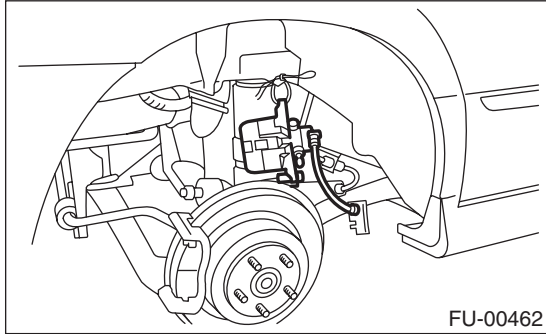
- 10) Remove the rear wheel.
- 11) Remove the bolts which secure rear brake hose installation bracket.



Fuel Tank

FUEL INJECTION (FUEL SYSTEMS)

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



13) Remove the parking brake cable from parking brake assembly. <Ref. to PB-7, REMOVAL, Parking Brake Assembly (Rear Disc Brake).>

14) Lift-up the vehicle.

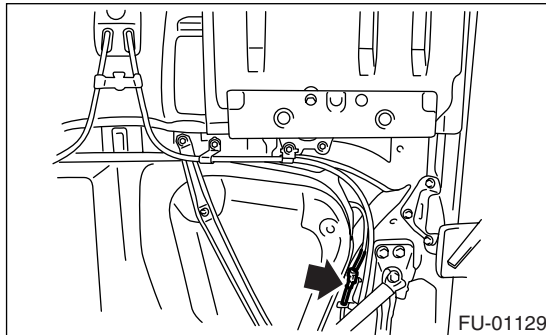
15) Remove the rear exhaust pipe.

<Ref. to EX(H4DOTC)-11, REMOVAL, Rear Exhaust Pipe.>

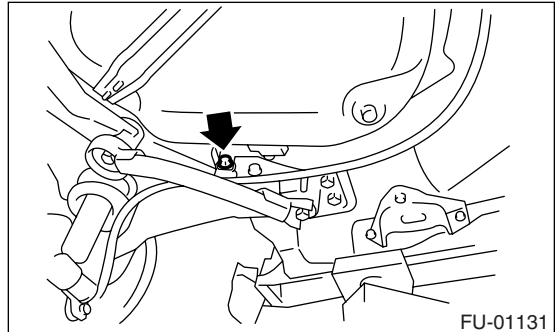
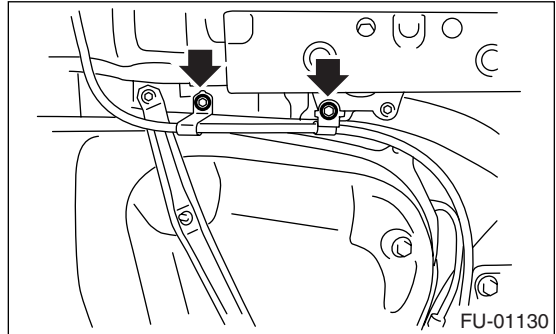
16) Remove the propeller shaft. <Ref. to DS-10, REMOVAL, Propeller Shaft.>

17) Remove the heat shield cover.

18) Disconnect the connector from rear ABS wheel speed sensor.



19) Remove the bolts which install parking brake cable clamp.



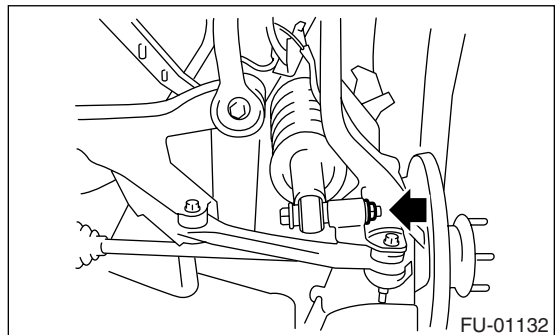
20) Remove the rear suspension assembly.

CAUTION:

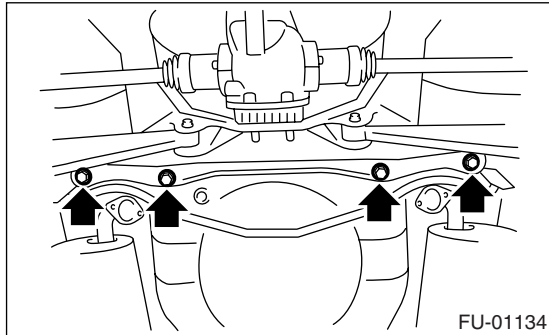
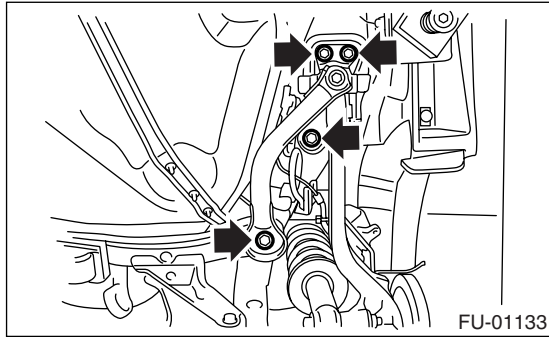
A helper is required to perform this work.

(1) Support the rear differential with transmission jack.

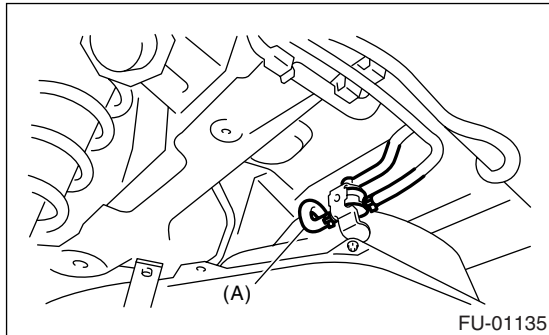
(2) Remove the bolt which installs the rear shock absorber to rear suspension arm.



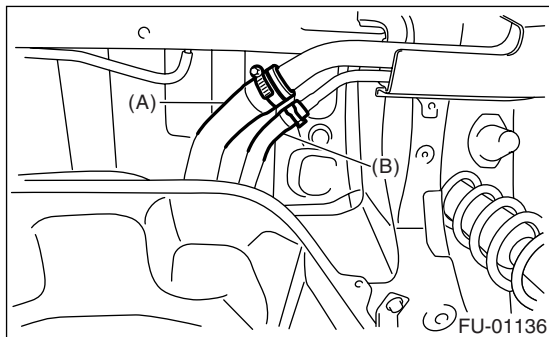
- (3) Remove the bolts which secure the rear suspension assembly to body.



- (4) Remove the rear suspension assembly.
21) Disconnect the two-way valve hose (A) from two-way valve, and then remove the two-way valve from bracket.

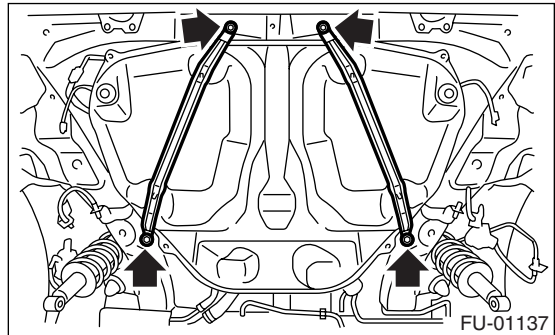


- 22) Loosen the clamp and disconnect the fuel filler hose (A) and vent hose (B) from fuel filler pipe.



- 23) Support the fuel tank with transmission jack, remove the bolts from fuel tank bands and dismount the fuel tank from vehicle.

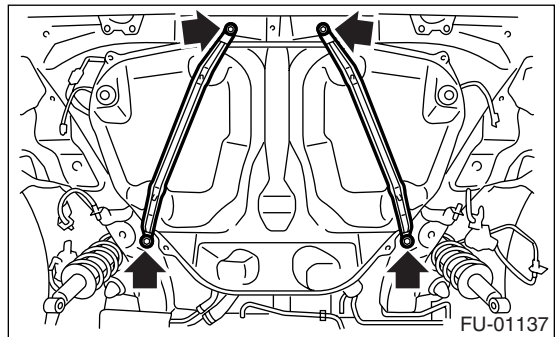
WARNING:
A helper is required to perform this work.



B: INSTALLATION

- 1) Support the fuel tank with transmission jack, set the fuel tank, and then temporarily tighten the bolts of fuel tank band.

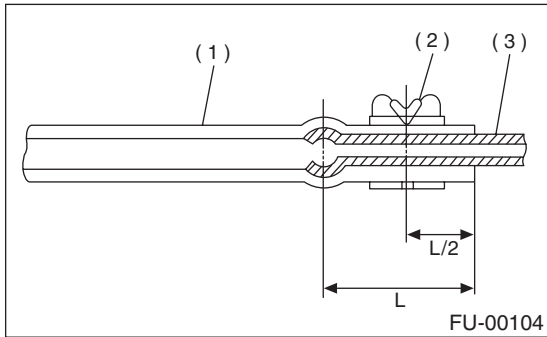
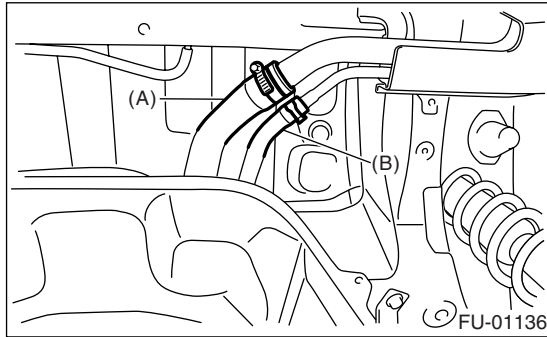
WARNING:
A helper is required to perform this work.



Fuel Tank

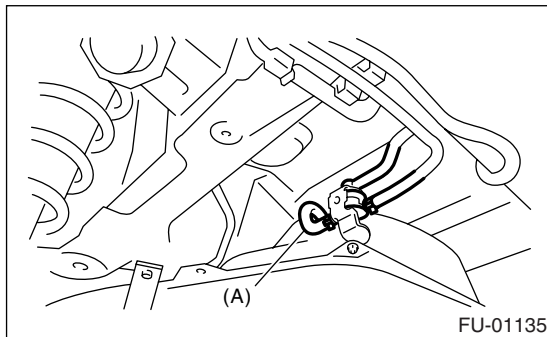
FUEL INJECTION (FUEL SYSTEMS)

2) Correctly insert the fuel filler hose (A) and vent hose (B) to specified position, and then tighten the clamp.



- (1) Hose
- (2) Clip or clamp
- (3) Pipes

3) Install the two-way valve to bracket, and connect the two-way valve hose (A) to two-way valve.



4) Tighten the bolt of fuel tank band.

Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)

5) Install the rear suspension assembly.

CAUTION:

A helper is required to perform this work.

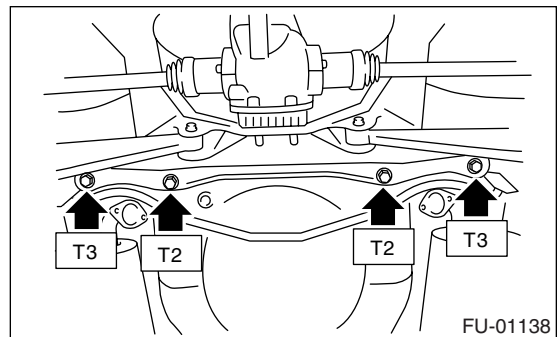
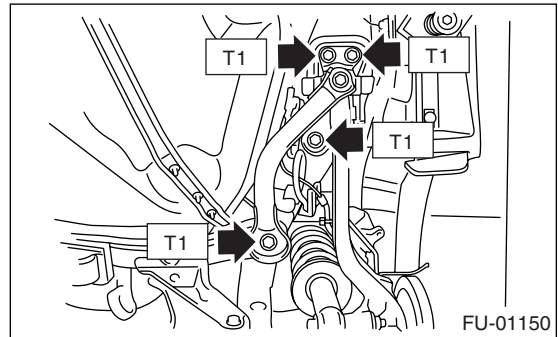
- (1) Support the rear differential with transmission jack.
- (2) Support the rear suspension assembly, and then tighten the bolts which secure the rear suspension assembly to body.

Tightening torque:

T1: 125 N·m (12.7 kgf-m, 92.2 ft-lb)

T2: 65 N·m (6.2 kgf-m, 48 ft-lb)

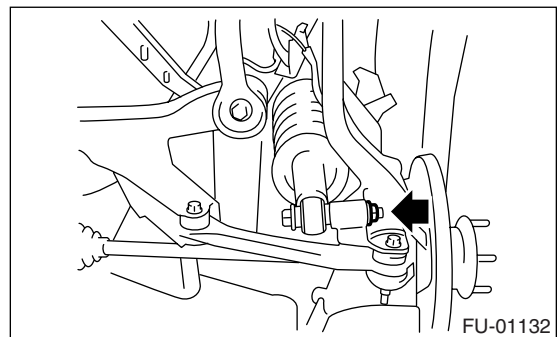
T3: 175 N·m (17.8 kgf-m, 129 ft-lb)



(3) Tighten the bolt which installs the rear shock absorber to rear suspension arm. <Ref. to RS-11, INSTALLATION, Rear Arm.>

Tightening torque:

62 N·m (6.3 kgf-m, 46 ft-lb)



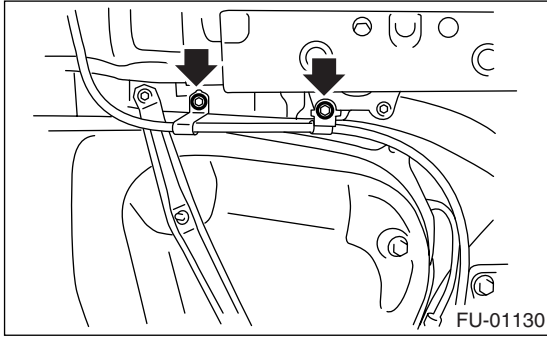
6) Tighten the bolts which install parking brake cable clamp.

Fuel Tank

FUEL INJECTION (FUEL SYSTEMS)

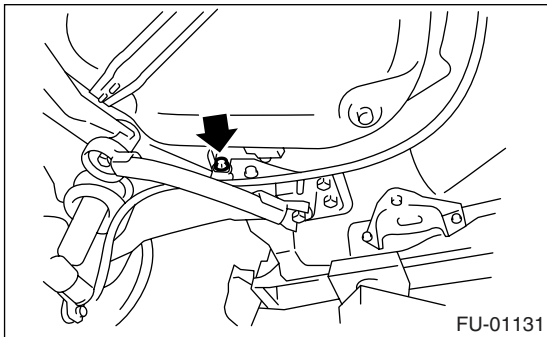
Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

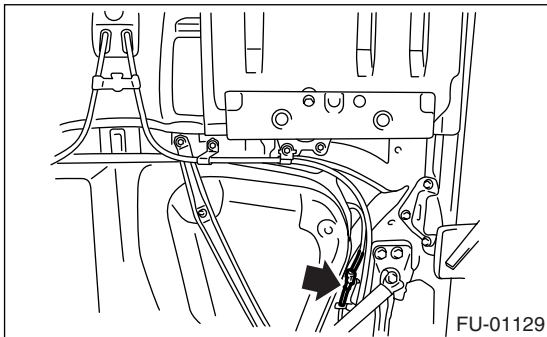


Tightening torque:

32 N·m (3.3 kgf-m, 23.9 ft-lb)



7) Connect the connector to ABS wheel speed sensor.



8) Install the heat shield cover.

Tightening torque:

17.5 N·m (1.78 kgf-m, 12.9 ft-lb)

9) Install the propeller shaft. <Ref. to DS-11, INSTALLATION, Propeller Shaft.>

10) Install the rear exhaust pipe.

<Ref. to EX(H4DOTC)-11, INSTALLATION, Rear Exhaust Pipe.>

11) Lower the vehicle.

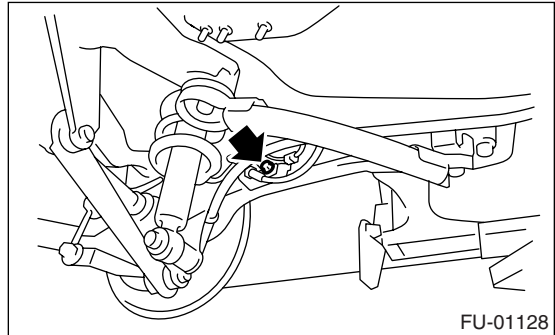
12) Connect the parking brake cable to parking brake assembly. <Ref. to PB-8, INSTALLATION, Parking Brake Assembly (Rear Disc Brake).>

13) Install the rear brake caliper.

14) Tighten the bolts which secure the rear brake hose installation bracket.

Tightening torque:

33 N·m (3.4 kgf-m, 25 ft-lb)



15) Install the rear wheel.

16) Lower the vehicle.

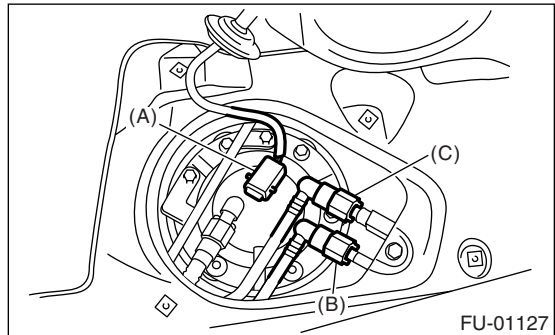
17) Connect the connector (A) to fuel sub level sensor.

18) Connect the quick connector to the fuel delivery (B) and return hose (C).

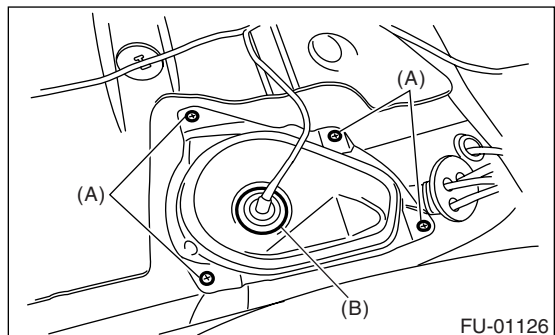
<Ref. to FU(H4DOTC)-57, INSTALLATION, Fuel Delivery, Return and Evaporation Lines.>

NOTE:

Be careful not to misconnect the delivery side and return side.



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



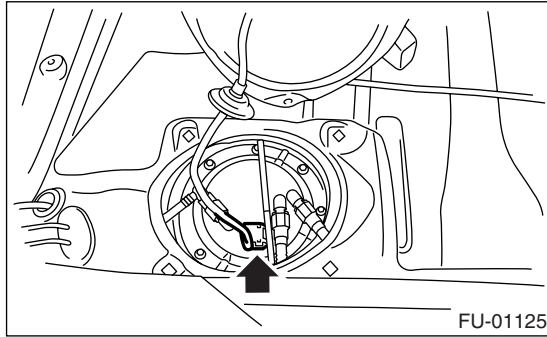
(A) Bolt

(B) Grommet

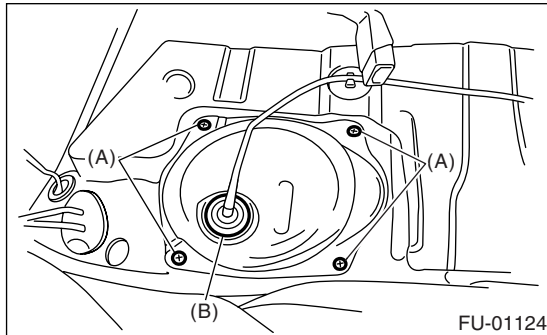
Fuel Tank

FUEL INJECTION (FUEL SYSTEMS)

20) Connect the connector to fuel pump.



21) Install the service hole cover of fuel pump.



(A) Bolt

(B) Grommet

22) Install the rear seat.

23) Install the fuse of fuel pump to main fuse box.

C: INSPECTION

1) Check that the fuel tank is not holed, cracked or otherwise damaged.

2) Make sure that the fuel hoses and fuel pipes are not cracked and that connections are tight.

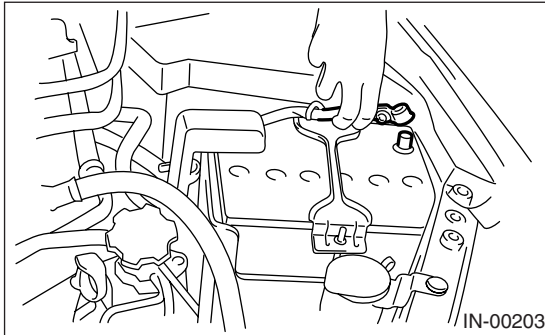
23. Fuel Filler Pipe

A: REMOVAL

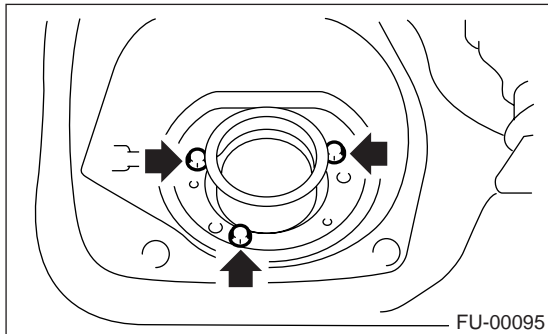
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

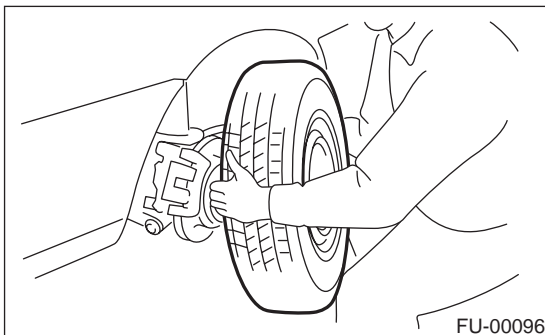
- 1) Release the fuel pressure.
<Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Open the fuel filler flap lid and remove the filler cap.
- 3) Disconnect the ground cable from battery.



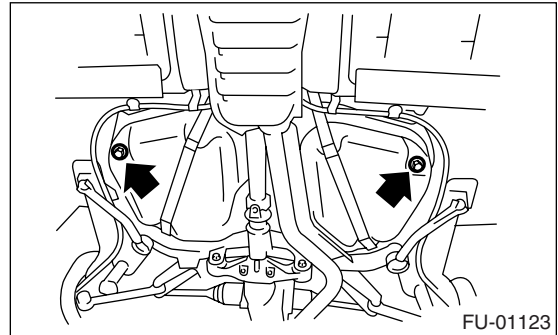
- 4) Remove the screws which secure packing.



- 5) Lift-up the vehicle.
- 6) Remove the rear wheel RH.



- 7) Set a container under the vehicle and remove drain plug from fuel tank to drain fuel from the fuel tank.



- 8) Tighten the fuel drain plug.

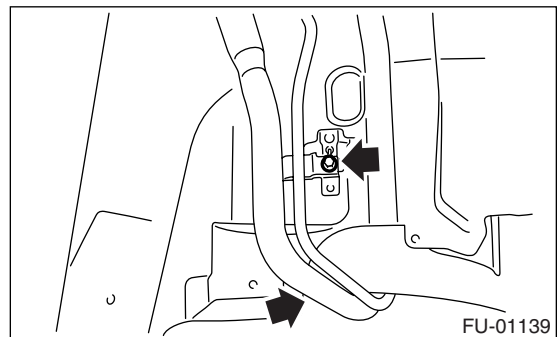
NOTE:

Use a new gasket.

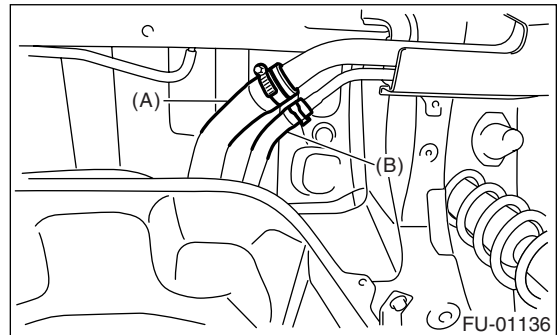
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)

- 9) Remove the mud guard. <Ref. to EI-29, REMOVAL, Mud Guard.>
- 10) Remove the rear sub frame. <Ref. to RS-23, REMOVAL, Rear Sub Frame.>
- 11) Remove the bolts which hold the fuel filler pipe bracket on the body.



- 12) Loosen the clamp, and disconnect the fuel filler hose (A) and vent hose (B) from fuel filler pipe.



- 13) Remove the fuel filler pipe to under side of the vehicle.

Fuel Filler Pipe

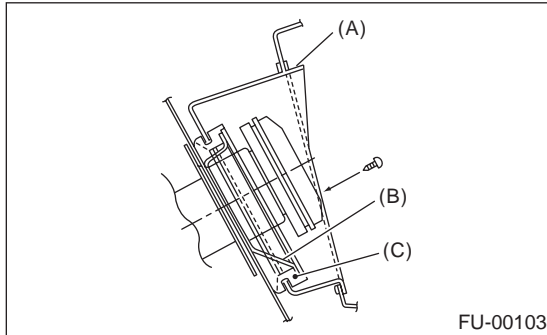
FUEL INJECTION (FUEL SYSTEMS)

B: INSTALLATION

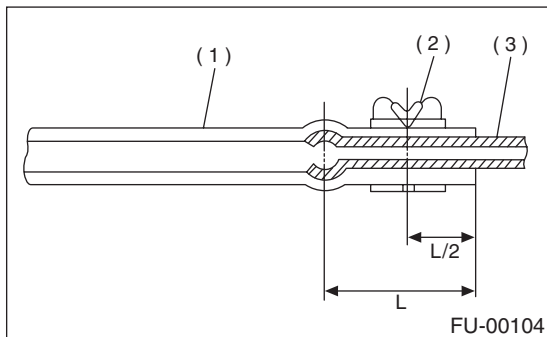
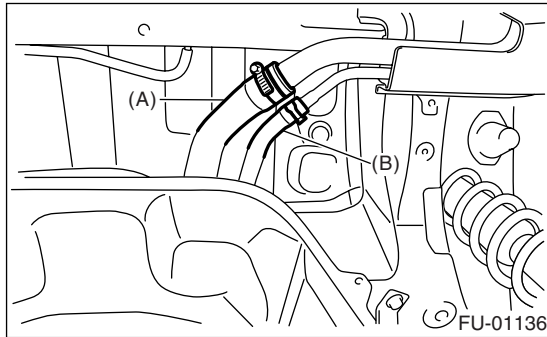
- 1) Open the fuel filler flap lid.
- 2) Set the fuel saucer (A) with rubber packing (C) and insert the fuel filler pipe into hole from the inner side of apron.
- 3) Align the holes in fuel filler pipe neck and set the cup (B), and tighten the screws.

NOTE:

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



- 4) Correctly insert the fuel filler hose (A) and vent pipe (B) to specified position, and then tighten the clamp.

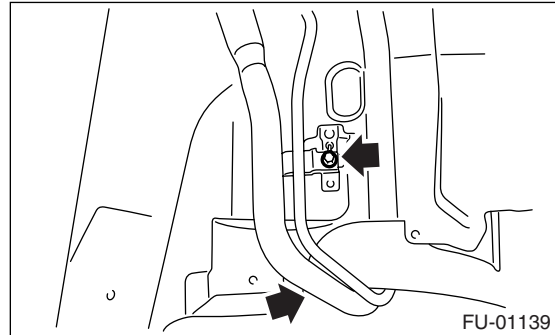


- (1) Hose
- (2) Clip or clamp
- (3) Pipes

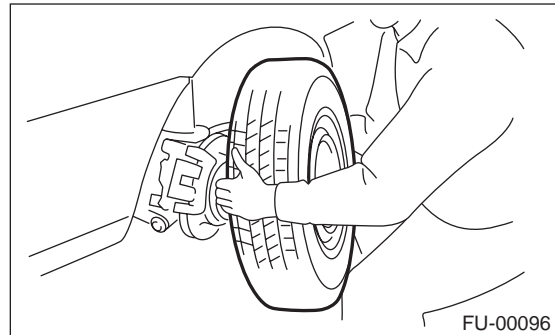
- 5) Tighten the bolts which hold the fuel filler pipe bracket on the body.

Tightening torque:

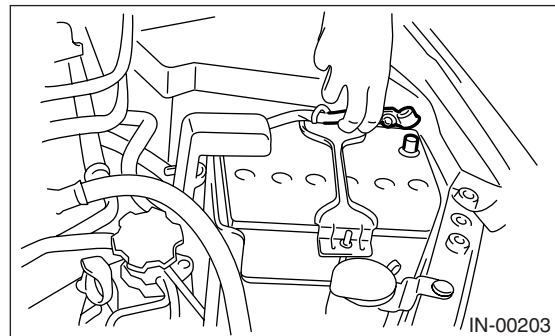
7.5 N·m (0.75 kgf-m, 5.4 ft-lb)



- 6) Install the rear sub frame. <Ref. to RS-23, INSTALLATION, Rear Sub Frame.>
- 7) Install the mud guard. <Ref. to EI-29, INSTALLATION, Mud Guard.>
- 8) Install the rear wheel RH.



- 9) Lower the vehicle.
- 10) Install the fuse of fuel pump to main fuse box.
- 11) Connect the battery ground cable to battery.



24.Fuel Pump

A: REMOVAL

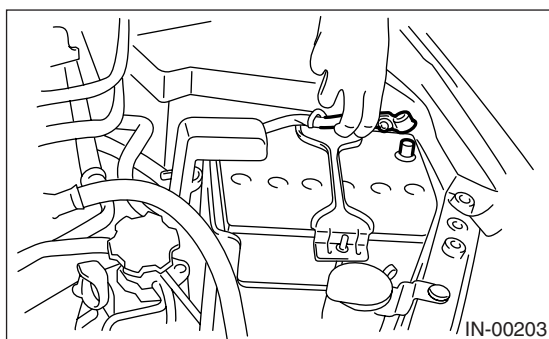
WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.
- Reduce the fuel in the fuel tank to less than 3/4 beforehand. Be careful that fuel may spill when the fuel is more than 3/4.

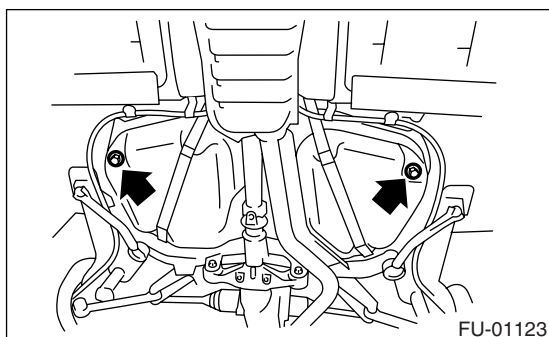
NOTE:

Fuel pump assembly consists of fuel pump and fuel level sensor.

- 1) Release the fuel pressure.
<Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Open the fuel filler flap lid and remove the fuel filler cap.
- 3) Disconnect the ground cable from battery.



- 4) Lift-up the vehicle.
- 5) Remove the fuel tank protector.
- 6) Set a container under the vehicle and remove the drain plug from fuel tank to drain fuel from the fuel tank.



- 7) Tighten the fuel drain plug.

NOTE:

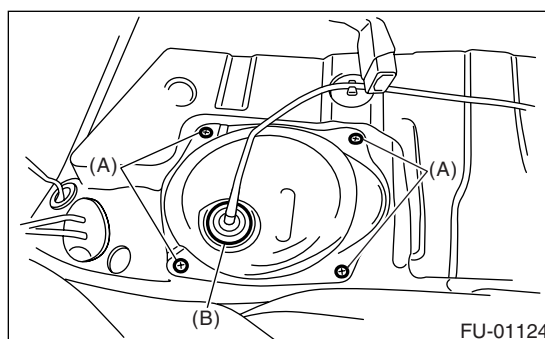
Use a new gasket.

Tightening torque:

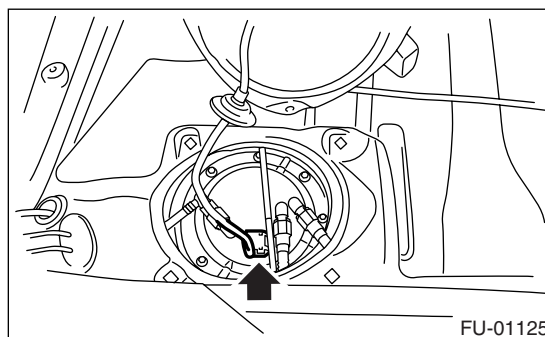
26 N·m (2.65 kgf-m, 19.2 ft-lb)

- 8) Remove the rear seat.
- 9) Remove the service hole cover.
 - (1) Remove the bolt (A).

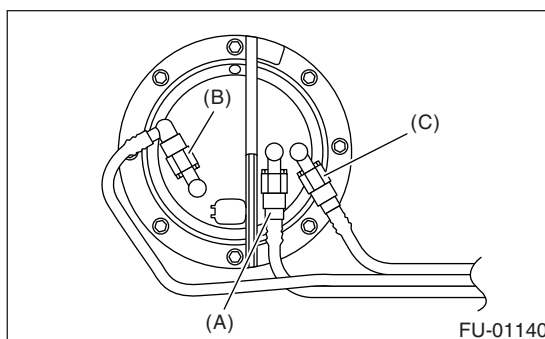
- (2) Push the grommet (B) down under the body and remove the service hole cover.



- 10) Disconnect the connector from fuel pump.



- 11) Disconnect the quick connector and then disconnect the fuel delivery hose, return hose and jet pump hose. <Ref. to FU(H4DOTC)-56, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>
- 12) Remove the nuts which install the fuel pump assembly onto fuel tank.



- (A) Delivery hose
- (B) Return hose
- (C) Jet pump hose

- 13) Take off the fuel pump assembly from fuel tank.

B: INSTALLATION

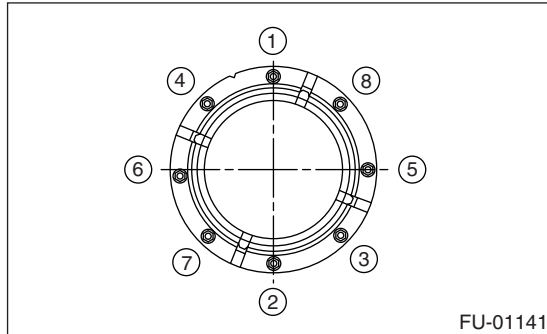
Install in the reverse order of removal.

NOTE:

- Use a new gasket.
- Ensure the sealing portion is free from fuel or foreign particles before installation.
- Tighten the nuts to specified torque in the order as shown in the figure.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)

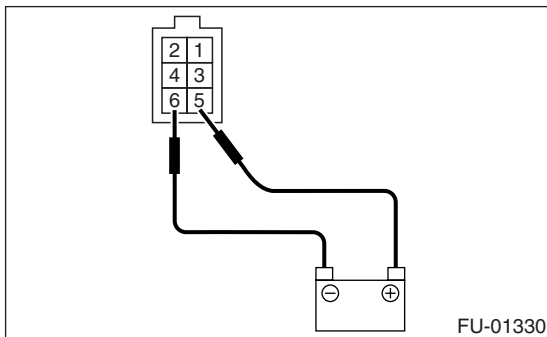


C: INSPECTION

Connect the lead harness to the connector terminal of fuel pump, and apply the battery power supply to check whether the pump operate.

WARNING:

- Wipe off the fuel completely.
- Keep battery as far apart from fuel pump as possible.
- Be sure to turn the battery supply to ON and OFF on the battery side.
- Do not run fuel pump for a long time under non-load condition.



25. Fuel Level Sensor

A: REMOVAL

WARNING:

- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.

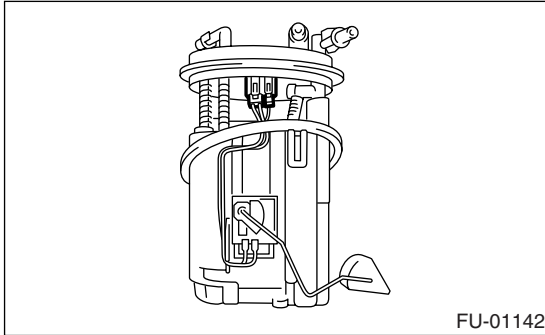
NOTE:

Fuel level sensor is built in fuel pump assembly.

1) Remove the fuel pump assembly.

<Ref. to FU(H4DOTC)-49, REMOVAL, Fuel Pump.>

2) Disconnect the connector from fuel pump bracket.



3) Remove the fuel level sensor.

B: INSTALLATION

Install in the reverse order of removal.

Fuel Sub Level Sensor

FUEL INJECTION (FUEL SYSTEMS)

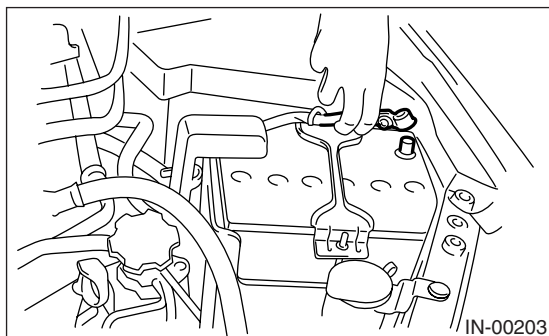
26. Fuel Sub Level Sensor

A: REMOVAL

WARNING:

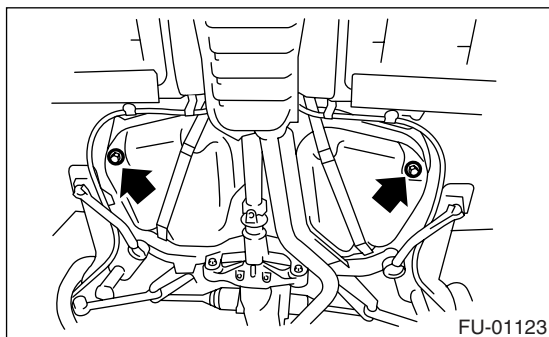
- Place “NO FIRE” signs near the working area.
- Be careful not to spill fuel on the floor.
- Reduce the fuel in the fuel tank to less than 3/4 beforehand. Be careful that fuel may spill when the fuel is more than 3/4.

1) Disconnect the ground cable from battery.



2) Lift-up the vehicle.

3) Set a container under the vehicle and remove the drain plug from fuel tank to drain the fuel from fuel tank.



4) Tighten the fuel drain plug.

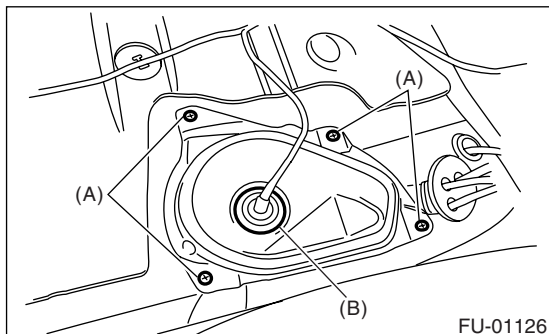
Tightening torque:

26 N·m (2.65 kgf-m, 19.2 ft-lb)

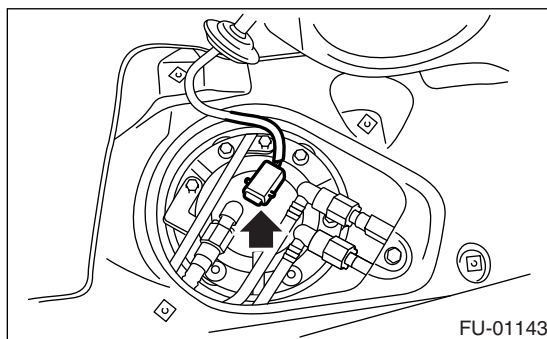
5) Remove the rear seat.

6) Remove the service hole cover.

- (1) Remove the bolt (A).
- (2) Push the grommet (B) down under the body and remove the service hole cover.

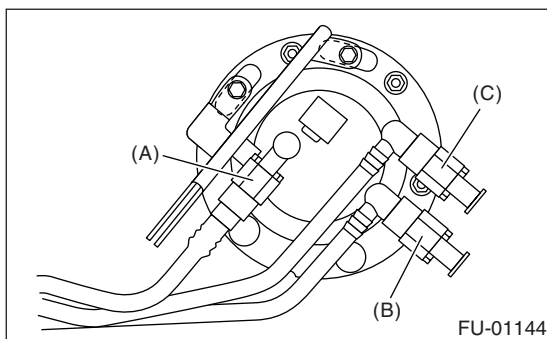


7) Disconnect the connector from fuel sub level sensor.



8) Disconnect the quick connector and then disconnect the fuel delivery hose, return hose and jet pump hose. <Ref. to FU(H4DOTC)-56, REMOVAL, Fuel Delivery, Return and Evaporation Lines.>

9) Remove the bolts which install the fuel sub level sensor on fuel tank.



- (A) Jet pump hose
(B) Delivery hose
(C) Return hose

10) Remove the fuel sub level sensor.

B: INSTALLATION

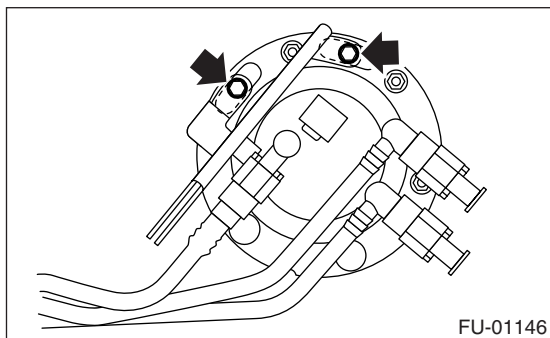
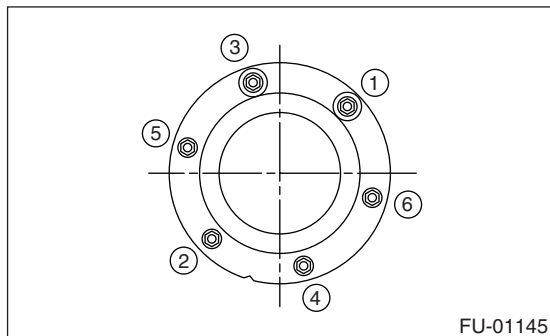
Install in the reverse order of removal.

NOTE:

- Use a new gasket.
- Ensure the sealing portion is free from fuel and foreign particles before installation.
- Tighten the nuts and bolts to specified torque in the order as shown in the figure.

Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



27.Fuel Filter

A: SPECIFICATION

Fuel filter forms a unit with fuel pump.

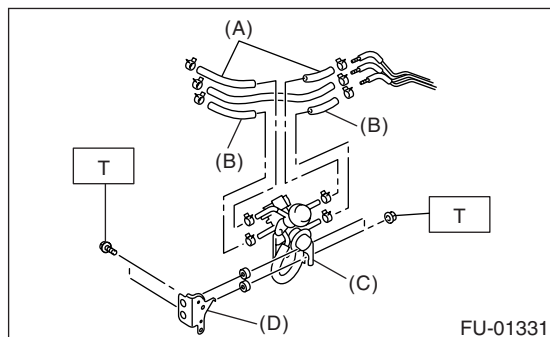
Refer to "Fuel Pump" for removal and installation.

<Ref. to FU(H4DOTC)-49, REMOVAL, Fuel Pump.> <Ref. to FU(H4DOTC)-50, INSTALLATION, Fuel Pump.>

28.Fuel Bypass Valve

A: REMOVAL

- 1) Release the fuel pressure.
<Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 2) Disconnect the fuel return line and delivery line from fuel bypass valve.
- 3) Remove the fuel bypass valve from vehicle.



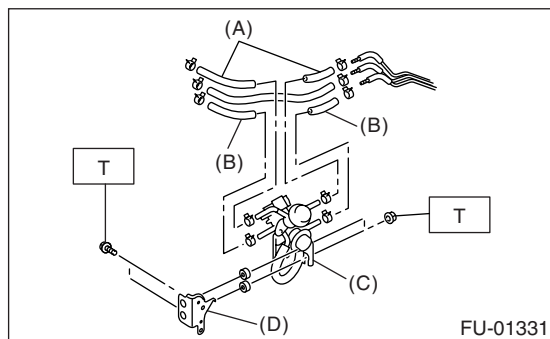
- (A) Fuel return line
- (B) Fuel delivery line
- (C) Fuel bypass valve
- (D) Fuel bypass valve bracket

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

7.5 N·m (0.76 kgf-m, 5.53 ft-lb)

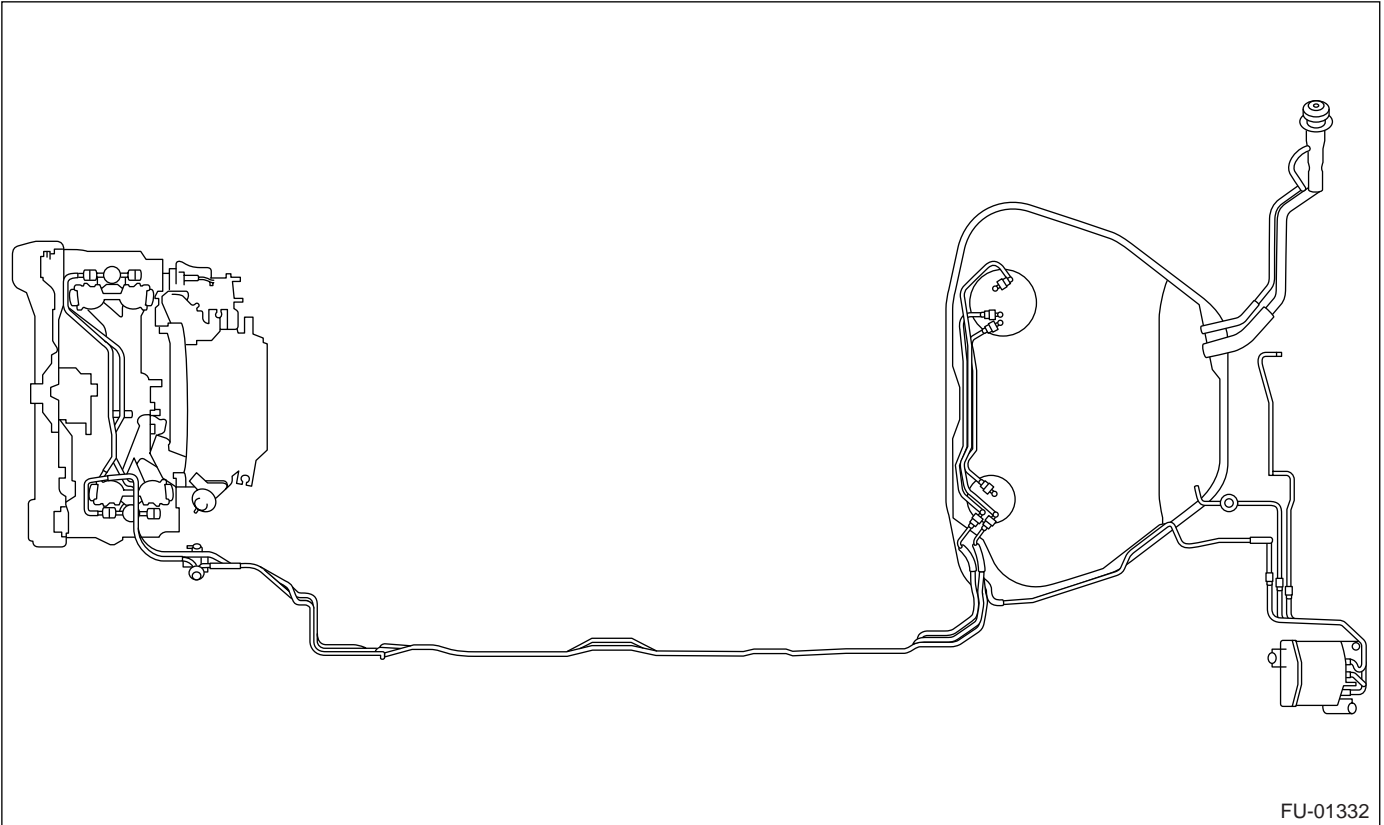


- (A) Fuel return line
- (B) Fuel delivery line
- (C) Fuel bypass valve
- (D) Fuel bypass valve bracket

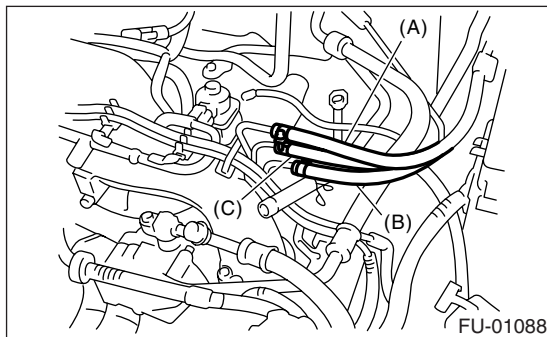
29. Fuel Delivery, Return and Evaporation Lines

A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Release the fuel pressure. <Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Open the fuel filler flap lid and remove the fuel filler cap.
- 4) Remove the floor mat. <Ref. to EI-73, REMOVAL, Floor Mat.>
- 5) Disconnect the fuel delivery pipes and hoses, and then disconnect the fuel return pipes and hoses, evaporation pipes and hoses.



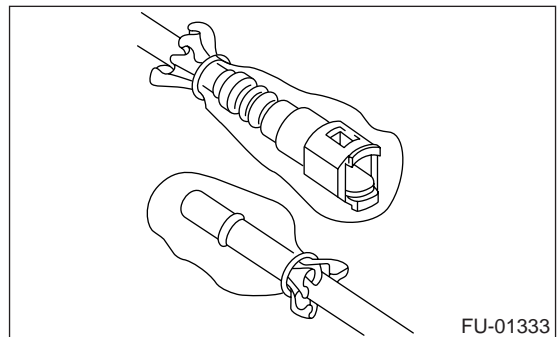
- 6) In the engine compartment, disconnect the fuel delivery hoses, return hoses and evaporation hose.



- (A) Fuel delivery hose
- (B) Return hose
- (C) Evaporation hose

- 7) Lift-up the vehicle.
- 8) Remove the fuel tank. <Ref. to FU(H4DOTC)-41, REMOVAL, Fuel Tank.>

- 9) Separate the quick connector of fuel line.
- (1) Clean the pipe and connector, if they are covered with dust.
 - (2) To prevent from damaging or entering foreign matter, wrap the pipes and connectors with plastic bag etc.



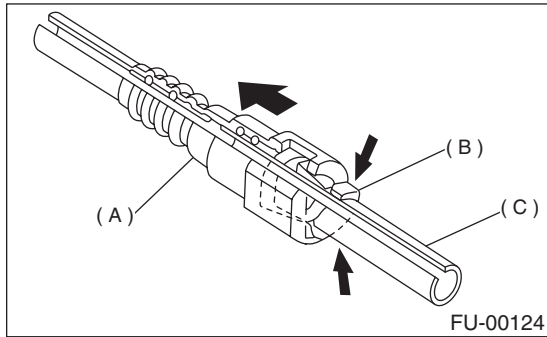
- (3) Hold the connector (A) and push retainer (B) down.
- (4) Pull out the connector (A) from retainer (B).

Fuel Delivery, Return and Evaporation Lines

FUEL INJECTION (FUEL SYSTEMS)

CAUTION:

Always use a new retainer.



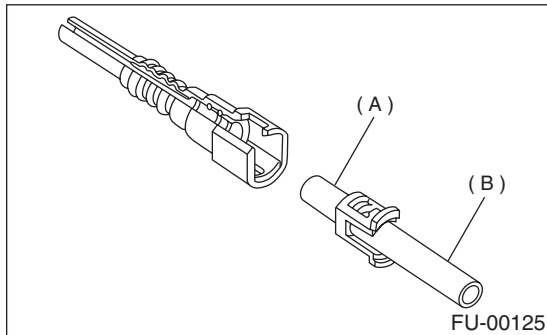
- (A) Connector
- (B) Retainer
- (C) Pipes

B: INSTALLATION

1) Connect the quick connector on fuel line.

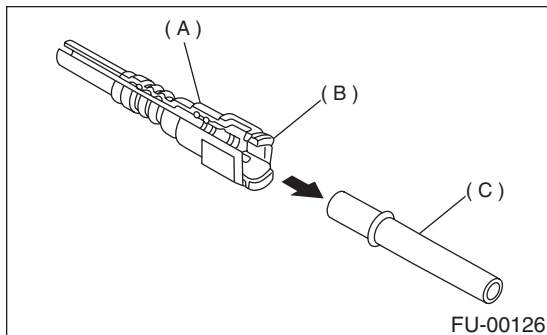
CAUTION:

- Always use a new retainer.
- Make sure that the connected portion is not damaged or has dust. If necessary, clean the seal surface of pipe.



- (A) Seal surface
- (B) Pipes

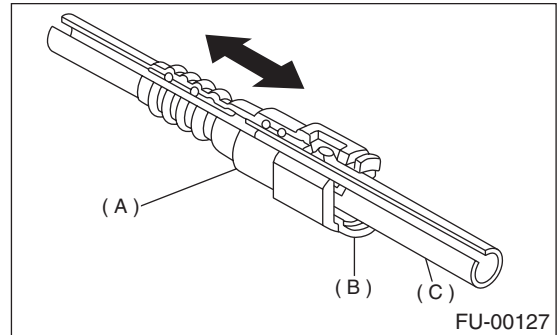
- (1) Set the new retainer (B) to connector (A).
- (2) Push the pipe into the connector completely.



- (A) Connector
- (B) Retainer
- (C) Pipes

CAUTION:

- Pull the connector to ensure it is connected securely.
- Ensure the two retainer pawls are engaged in their mating positions in the connector.
- Be sure to inspect hoses and their connections for fuel leakage.



- (A) Connector
- (B) Retainer
- (C) Pipes

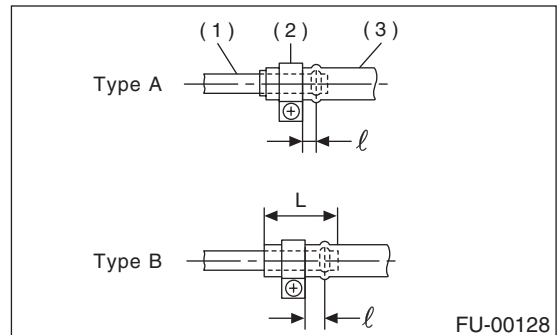
2) Connect the fuel delivery hose to the pipe with an overlap of 20 to 25 mm (0.79 to 0.98 in).

Type A: When the amount of inserting is specified.

Type B: When the amount of inserting is not specified.

$\phi : 2.5 \pm 1.5 \text{ mm } (0.098 \pm 0.059 \text{ in})$

$L : 22.5 \pm 2.5 \text{ mm } (0.886 \pm 0.098 \text{ in})$



- (1) Pipes
- (2) Clamp
- (3) Hose

3) Connect the return hose and evaporation hose to pipe by approx. 15 mm (0.59 in) from the hose end.

Fuel return hose:

$L = 22.5 \pm 2.5 \text{ mm } (0.885 \pm 0.098 \text{ in})$

Fuel evaporation hose:

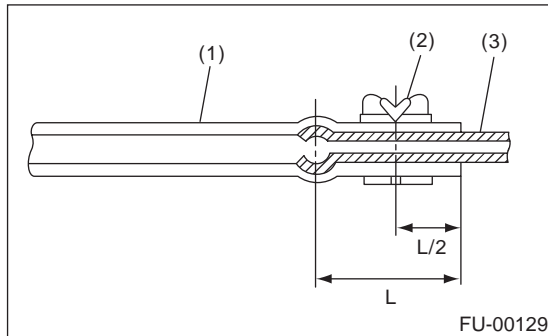
$L = 17.5 \pm 2.5 \text{ mm } (0.689 \pm 0.098 \text{ in})$

Fuel Delivery, Return and Evaporation Lines

FUEL INJECTION (FUEL SYSTEMS)

CAUTION:

Be sure to inspect hoses and their connections for fuel leakage.



- (1) Hose
- (2) Clip
- (3) Pipes

C: INSPECTION

- 1) Make sure that there are no cracks on the fuel pipes and fuel hoses.
- 2) Make sure that the fuel pipe and fuel hose connections are tightened firmly.

30. Fuel System Trouble in General

A: INSPECTION

Trouble and possible cause		Corrective action
1. Insufficient fuel supply to injector		
1)	Fuel pump does not operate.	
	○ Defective terminal contact.	Inspect contact, especially ground, and tighten it securely.
	○ Trouble in electromagnetic or electronic circuit parts.	Replace the faulty parts.
2)	Lowering of fuel pump function.	Replace the fuel pump.
3)	Clogged dust or water in the fuel filter.	Replace fuel filter, clean or replace fuel tank.
4)	Clogged or bent fuel pipe or hose.	Clean, correct or replace the fuel pipe or hose.
5)	Air is mixed in the fuel system.	Inspect or retighten each connection part.
6)	Clogged or bent air breather tube or pipe.	Clean, correct or replace air breather tube or pipe.
7)	Damaged diaphragm of pressure regulator.	Replace.
2. Leakage or blow out of fuel		
1)	Loosened joints of the fuel pipe.	Retightening.
2)	Cracked fuel pipe, hose and fuel tank.	Replace.
3)	Defective welding part on the fuel tank.	Replace.
4)	Defective drain packing of the fuel tank.	Replace.
5)	Clogged air breather tube or air vent tube.	Clean, correct or replace air breather tube or air vent tube.
3. Gasoline smell inside of compartment		
1)	Loose joints at air breather tube, air vent tube and fuel filler pipe.	Retightening.
2)	Defective packing air tightness on the fuel saucer.	Correct or replace the packing.
3)	Inoperative fuel pump modulator or circuit.	Replace.
4. Defective fuel meter indicator		
1)	Defective operation of fuel level sensor.	Replace.
2)	Defective operation of fuel meter.	Replace.
5. Noise		
1)	Large operation noise or vibration of fuel pump.	Replace.

NOTE:

- When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill fuel fully to prevent those problem. And also drain the water condensation from fuel filter.
- In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop below 0°C (32°F) throughout the winter season, use water removing agent in the fuel system to prevent freezing fuel system and accumulating water. Fill the water removing agent at the time when the fuel reduced at half to maintain the advantage.
- When water condensation is noticed in the fuel filter, drain the water from both the fuel filter and fuel tank or use water removing agent in the fuel tank.
- Before using a water removing agent, follow the cautions that noted on the bottle.

Fuel System Trouble in General

FUEL INJECTION (FUEL SYSTEMS)

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

ENGINE (DIAGNOSTICS)

EN(H4DOTC)(diag)

	Page
1. Basic Diagnostic Procedure	2
2. Check List for Interview	3
3. General Description	5
4. Electrical Component Location	8
5. Engine Control Module (ECM) I/O Signal	15
6. Engine Condition Data	19
7. Data Link Connector	20
8. Subaru Select Monitor	21
9. Read Diagnostic Trouble Code (DTC)	27
10. Inspection Mode	28
11. Clear Memory Mode	30
12. Compulsory Valve Operation Check Mode	31
13. Malfunction Indicator Light	33
14. Diagnostics for Engine Starting Failure	42
15. List of Diagnostic Trouble Code (DTC)	55
16. Diagnostic Procedure with Diagnostic Trouble Code (DTC)	60
17. General Diagnostic Table	202

Basic Diagnostic Procedure

ENGINE (DIAGNOSTICS)

1. Basic Diagnostic Procedure

A: PROCEDURE

1. ENGINE

Step	Check	Yes	No
1 CHECK ENGINE START FAILURE. 1) Ask the customer when and how the trouble occurred using the 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)-42, Diagnostics for Engine Starting Failure.>
2 CHECK ILLUMINATION OF MALFUNCTION INDICATOR LIGHT.	Does malfunction indicator light illuminate?	Go to step 3.	Inspection using "General Diagnostic Table". <Ref. to EN(H4DOTC)(diag)-202, General Diagnostic Table.>
3 CHECK INDICATION OF DTC ON SCREEN. 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to data link connector. 3) Turn the ignition switch to ON, and the Subaru Select Monitor switch to ON. 4) Read DTC on Subaru Select Monitor.	Is DTC displayed on the Subaru Select Monitor?	Record the DTC. Repair the trouble cause. <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).> Go to step 4.	Repair the related parts. NOTE: If DTC is not shown on display although the malfunction indicator light illuminates, perform the diagnostics for malfunction indicator light circuit or combination meter. <Ref. to EN(H4DOTC)(diag)-33, Malfunction Indicator Light.>
4 PERFORM THE DIAGNOSIS. 1) Perform clear memory mode. <Ref. to EN(H4DOTC)(diag)-30, Clear Memory Mode.> 2) Perform the inspection mode. <Ref. to EN(H4DOTC)(diag)-28, Inspection Mode.>	Is DTC displayed on the Subaru Select Monitor?	Check on "Diagnostic Chart with Diagnostic Trouble Code (DTC)" <Ref. to EN(H4DOTC)(diag)-60, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>	Finish the diagnosis.

Check List for Interview

ENGINE (DIAGNOSTICS)

2. Check List for Interview

A: CHECK

1. CHECK LIST No. 1

Check the following items when problem has occurred.

NOTE:

Use copies of this page for interviewing customers.

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

Check List for Interview

ENGINE (DIAGNOSTICS)

2. CHECK LIST No. 2

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

NOTE:

Use copies of this page for interviewing customers.

a) Other warning lights or indicators turn on. <input type="checkbox"/> Yes / <input type="checkbox"/> No
<input type="checkbox"/> Low fuel warning light <input type="checkbox"/> Charge indicator light <input type="checkbox"/> AT diagnostic indicator light <input type="checkbox"/> ABS warning light <input type="checkbox"/> Oil pressure indicator light
b) Fuel level
<ul style="list-style-type: none">• Lack of gasoline: <input type="checkbox"/> Yes / <input type="checkbox"/> No• Indicator position of fuel gauge:• Experienced running out of fuel: <input type="checkbox"/> Yes / <input type="checkbox"/> No
c) Intentional connecting or disconnecting of harness connectors or spark plug cords: <input type="checkbox"/> Yes / <input type="checkbox"/> No
<ul style="list-style-type: none">• What:
d) Intentional connecting or disconnecting of hoses: <input type="checkbox"/> Yes / <input type="checkbox"/> No
<ul style="list-style-type: none">• What:
e) Installing of other parts except genuine parts: <input type="checkbox"/> Yes / <input type="checkbox"/> No
<ul style="list-style-type: none">• What:• Where:
f) Occurrence of noise: <input type="checkbox"/> Yes / <input type="checkbox"/> No
<ul style="list-style-type: none">• From where:• What kind:
g) Occurrence of smell: <input type="checkbox"/> Yes / <input type="checkbox"/> No
<ul style="list-style-type: none">• From where:• What kind:
h) Intrusion of water into engine compartment or passenger compartment: <input type="checkbox"/> Yes / <input type="checkbox"/> No
i) Troubles occurred
<input type="checkbox"/> Engine does not start. <input type="checkbox"/> Engine stalls during idling. <input type="checkbox"/> Engine stalls while driving. <input type="checkbox"/> Engine speed decreases. <input type="checkbox"/> Engine speed does not decrease. <input type="checkbox"/> Rough idling <input type="checkbox"/> Poor acceleration <input type="checkbox"/> Back fire <input type="checkbox"/> After fire <input type="checkbox"/> Does not shift. <input type="checkbox"/> Excessive shift shock

3. General Description

A: CAUTION

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

CAUTION:

- All airbag system wiring harnesses and connectors are colored yellow. Do not use the electrical test equipment on these 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. The ECM will be destroyed instantly.

The fuel injector and other part will be damaged.

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

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

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

5) Poor contact has been identified as a primary cause of this problem. Measure the voltage or resistance of individual sensor or all electrical control modules using a tapered pin with a diameter of less than 0.64 mm (0.025 in). Do not insert the pin more than 5 mm (0.20 in) into the part.

6) Remove the ECM from the located position after disconnecting two cables on battery. Otherwise, the ECM may be damaged.

CAUTION:

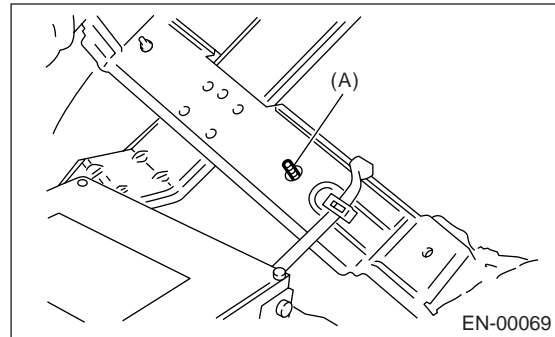
When replacing the ECM, be careful not to use the wrong spec. ECM to avoid any damage on the fuel injection system.

NOTE:

Immobilizer system must be registered when installing the ECM of the model with immobilizer. For doing so, all ignition keys and ID cards should be prepared. Refer to "REGISTRATION MANUAL FOR IMMOBILIZER".

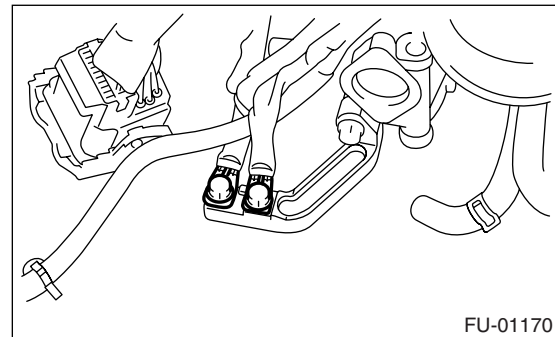
7) Connectors to each sensor in the engine compartment and the harness connectors on the engine side and body side are all designed to be waterproof. However, it is still necessary to take care not to allow water to get into the connectors when washing the vehicle, or when servicing the vehicle on a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

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



(A) Stud bolt

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



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

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

CAUTION:

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

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

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

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

B: INSPECTION

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

1. BATTERY

1) Measure battery voltage and specific gravity of electrolyte.

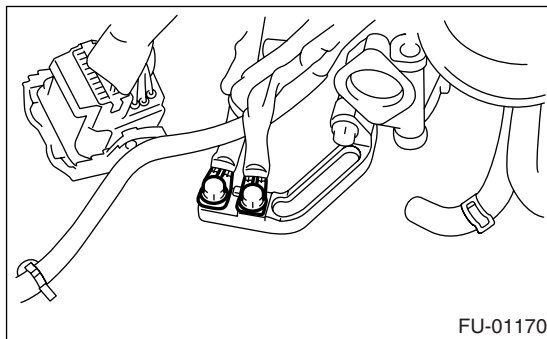
Standard voltage: 12 V

Specific gravity: Above 1.260

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

2. ENGINE GROUND

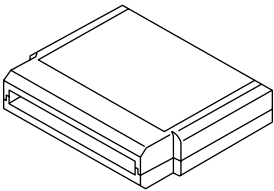

Make sure the engine grounding terminal is properly connected to the engine.



3. SELF-DIAGNOSIS FUNCTION

When detecting a malfunction by self-diagnosis function on ECM, malfunction indicator light illuminates and malfunction occurrence is displayed. Calling the self-diagnosis result is performed by Subaru Select Monitor.

C: PREPARATION TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST24082AA230</p>	24082AA230	CARTRIDGE	Troubleshooting for electrical system.
 <p>ST22771AA030</p>	22771AA030	SUBARU SELECT MONITOR KIT	Troubleshooting for electrical system. <ul style="list-style-type: none"> English: 22771AA030 (Without printer) German: 22771AA070 (Without printer) French: 22771AA080 (Without printer) Spanish: 22771AA090 (Without printer)

Electrical Component Location

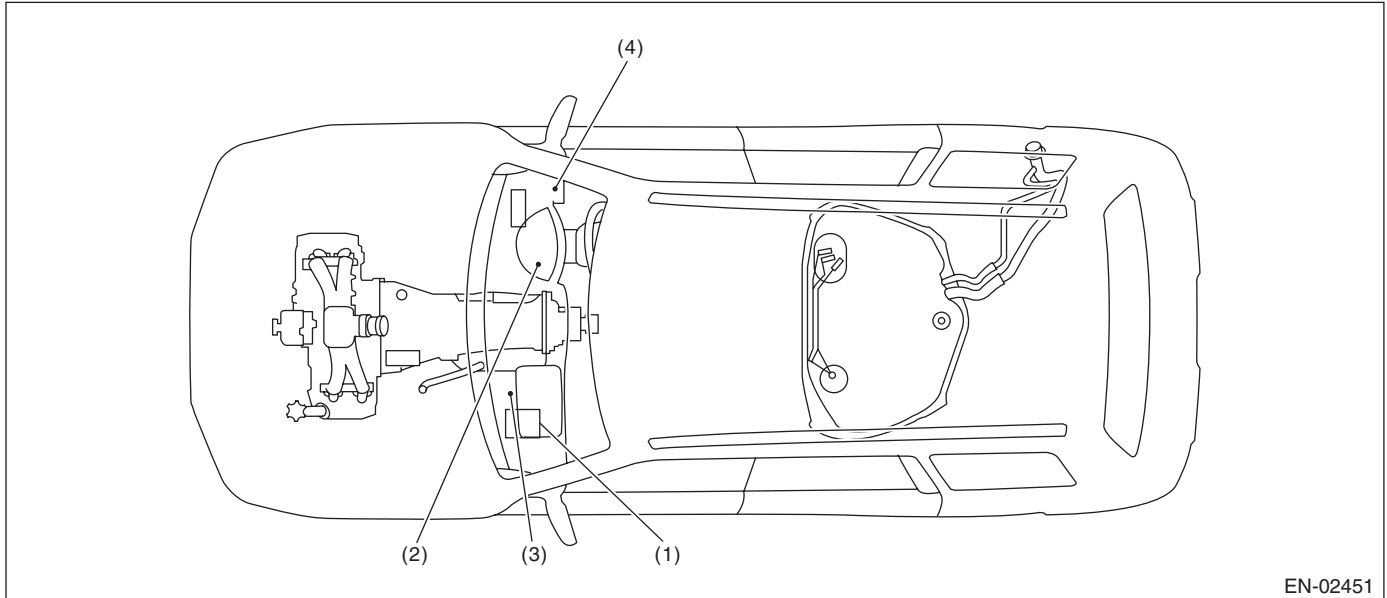
ENGINE (DIAGNOSTICS)

4. Electrical Component Location

A: LOCATION

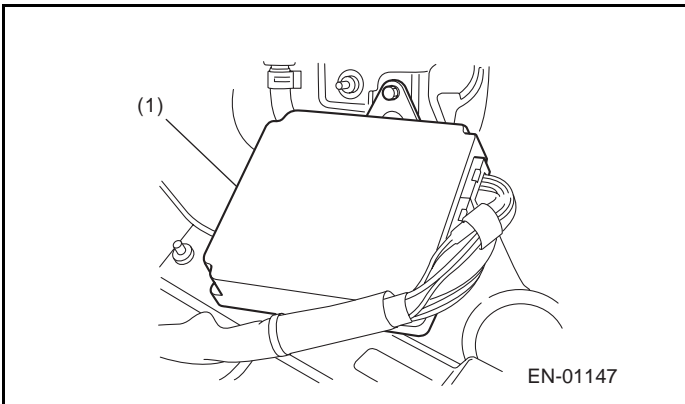
1. ENGINE

- Control module

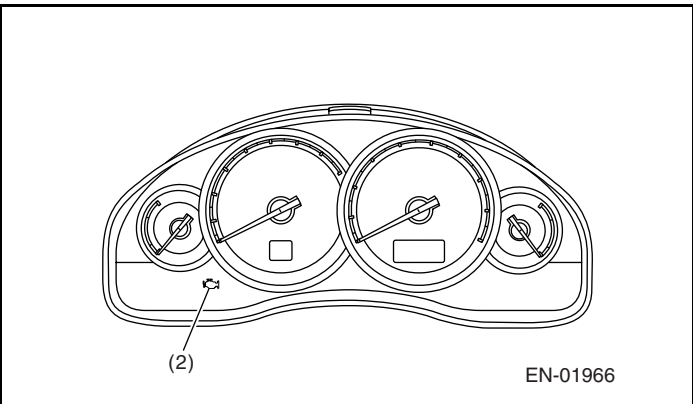


EN-02451

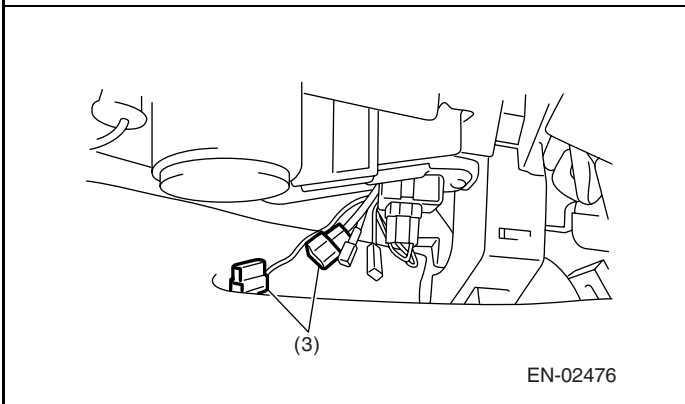
- (1) Engine control module (ECM) (3) Test mode connector (4) Data link connector
(2) Malfunction indicator light



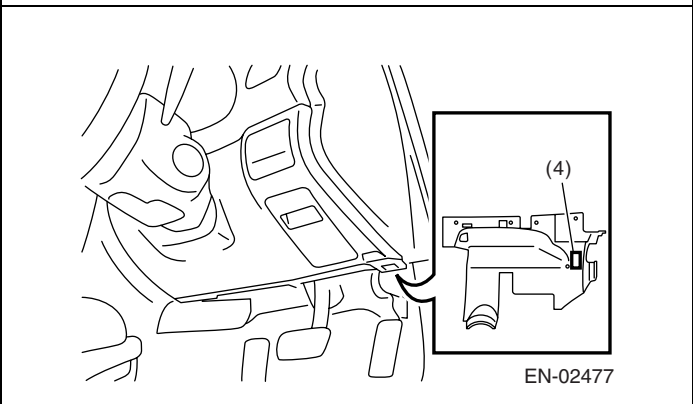
EN-01147



EN-01966

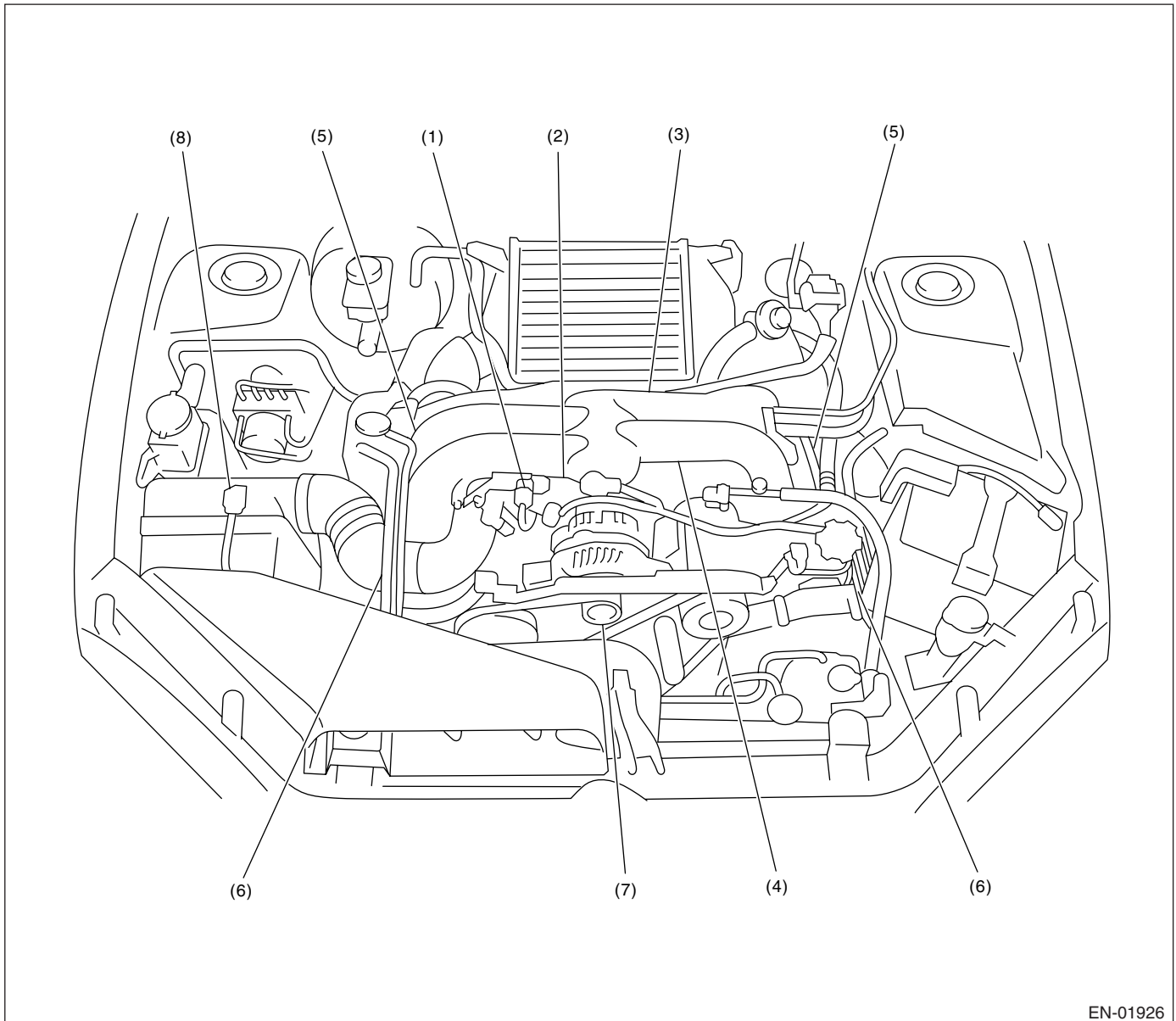


EN-02476



EN-02477

- Sensor

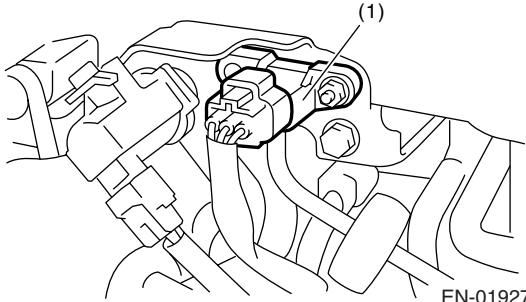
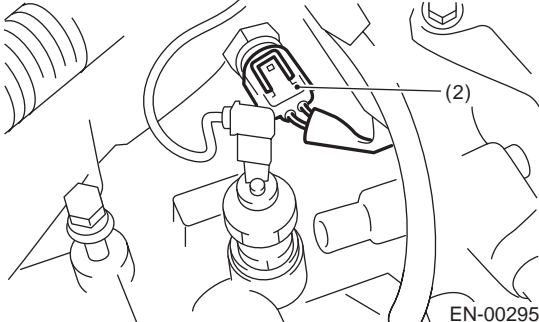
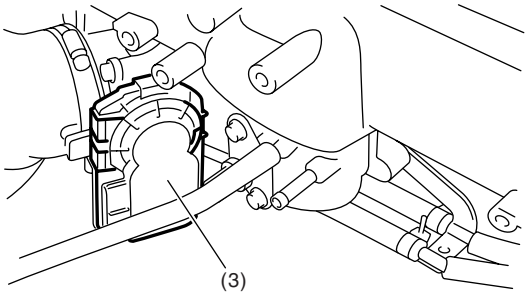
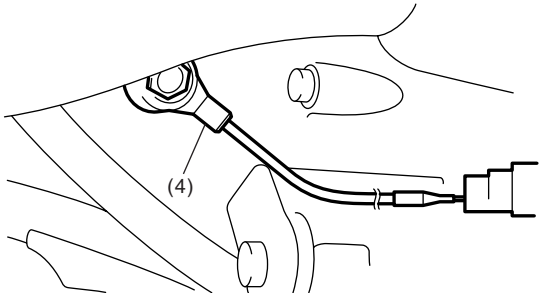
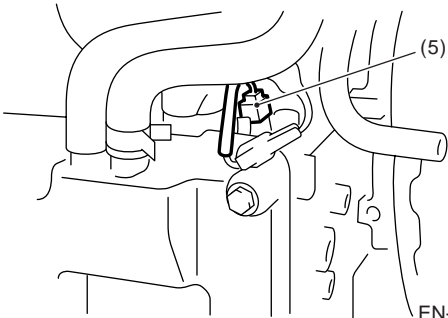
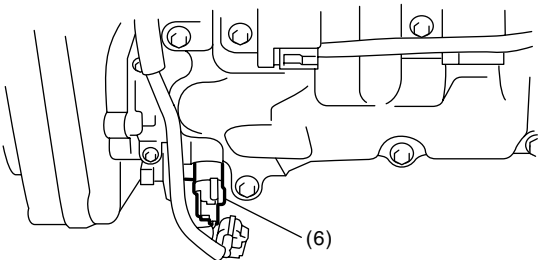
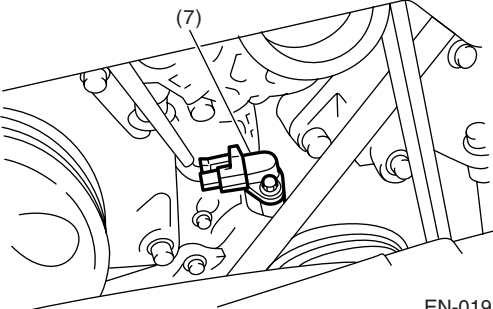
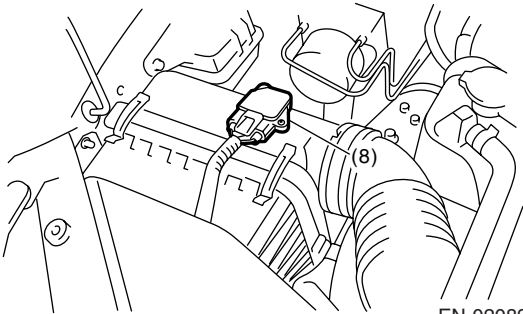


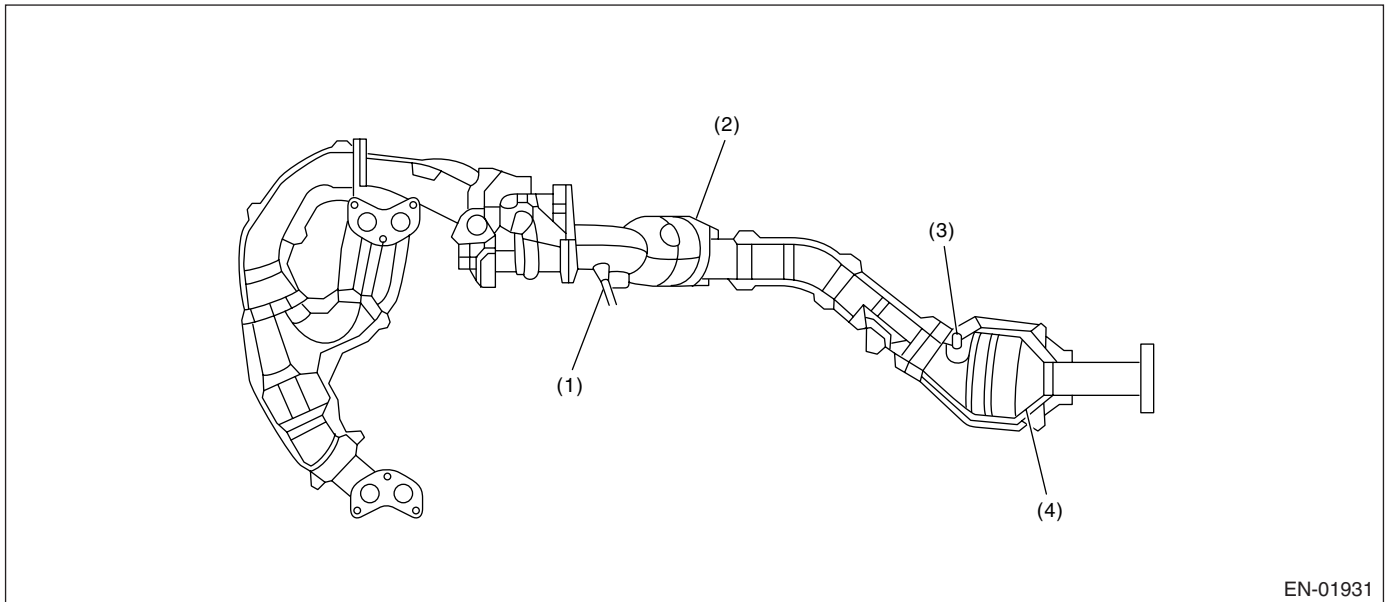
EN-01926

- | | | |
|---------------------------------------|--------------------------------------|-----------------------------------------------------|
| (1) Manifold absolute pressure sensor | (3) Electronic throttle control | (7) Crankshaft position sensor |
| (2) Engine coolant temperature sensor | (4) Knock sensor | (8) Mass air flow and intake air temperature sensor |
| (5) Intake camshaft position sensor | (6) Exhaust camshaft position sensor | |

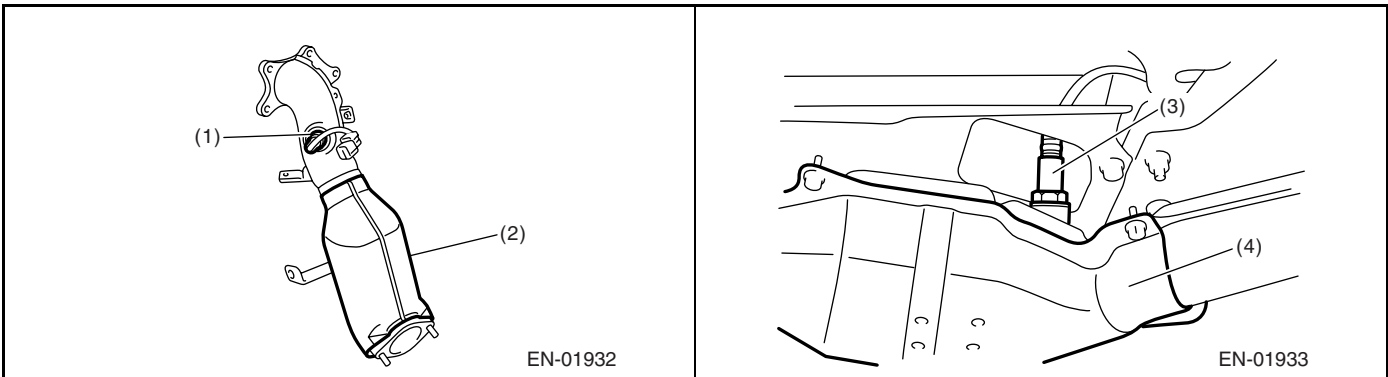
Electrical Component Location

ENGINE (DIAGNOSTICS)

 <p>EN-01927</p>	 <p>EN-00295</p>
 <p>EN-01928</p>	 <p>EN-02169</p>
 <p>EN-01798</p>	 <p>EN-01929</p>
 <p>EN-01930</p>	 <p>EN-02089</p>



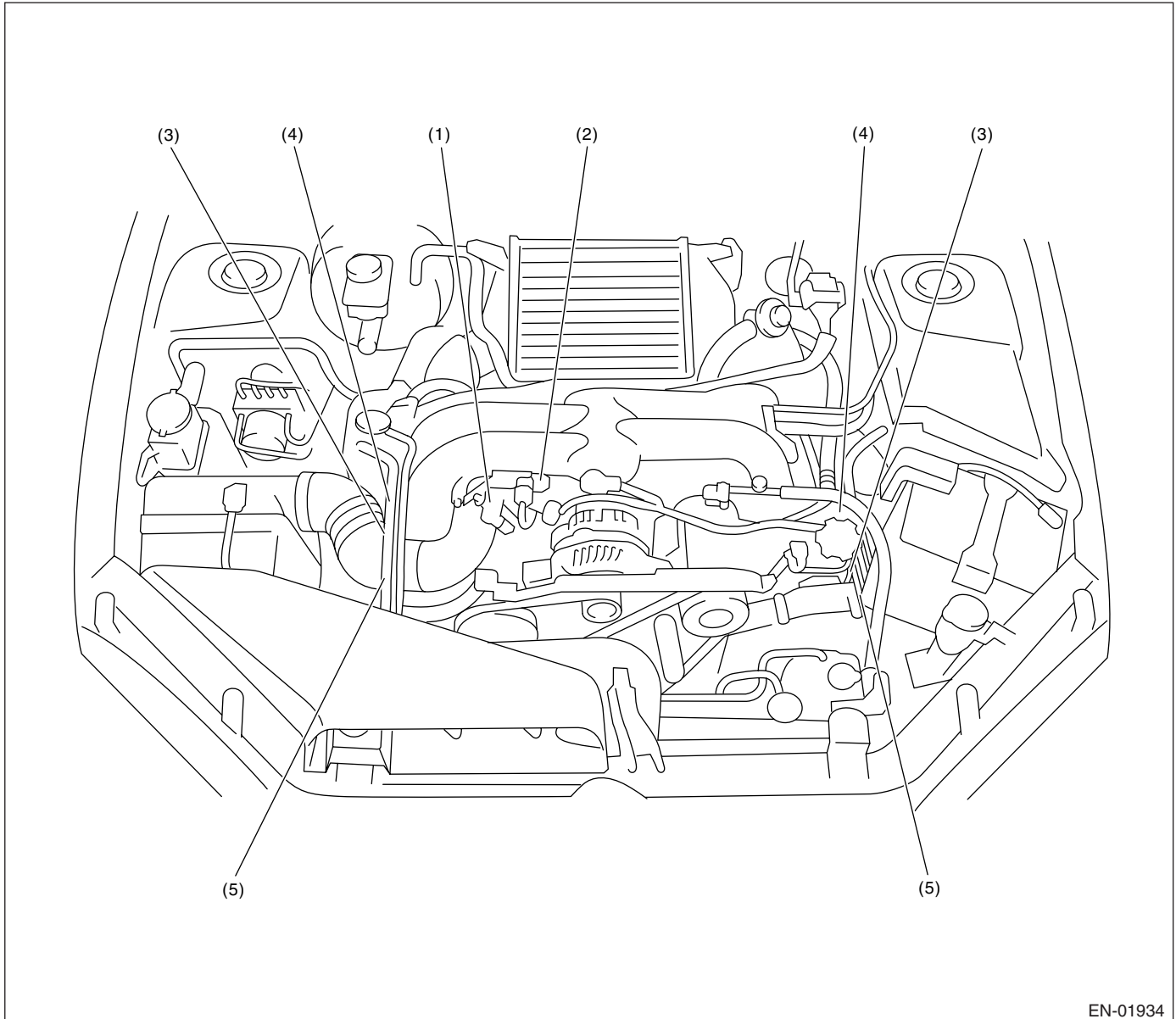
- (1) Front oxygen (A/F) sensor (3) Rear oxygen sensor (4) Rear catalytic converter
 (2) Front catalytic converter



Electrical Component Location

ENGINE (DIAGNOSTICS)

- Solenoid valve, actuator, emission control system parts and ignition system parts

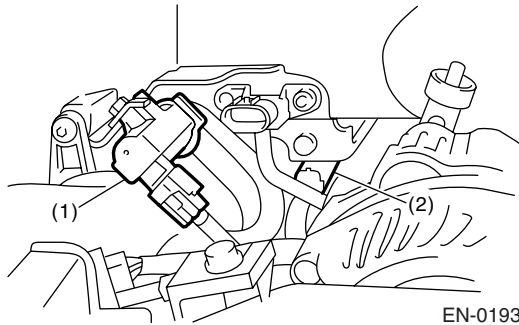


EN-01934

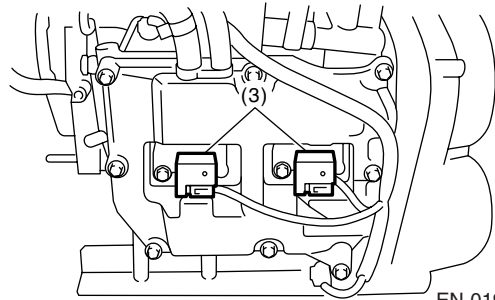
- | | | |
|--------------------------------------|--------------------------------------------|---------------------------------------------|
| (1) Wastegate control solenoid valve | (4) Intake oil flow control solenoid valve | (5) Exhaust oil flow control solenoid valve |
| (2) Purge control solenoid valve | | |
| (3) Ignition coil | | |

Electrical Component Location

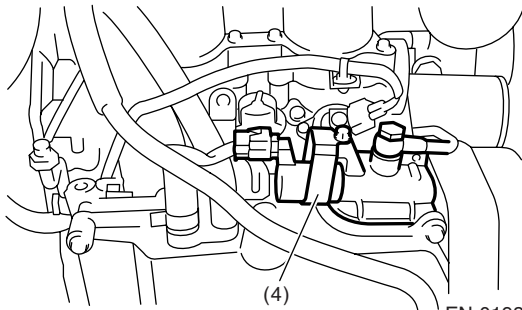
ENGINE (DIAGNOSTICS)



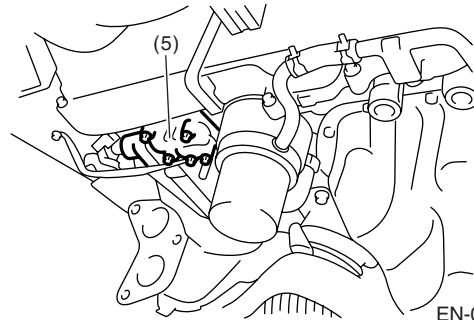
EN-01935



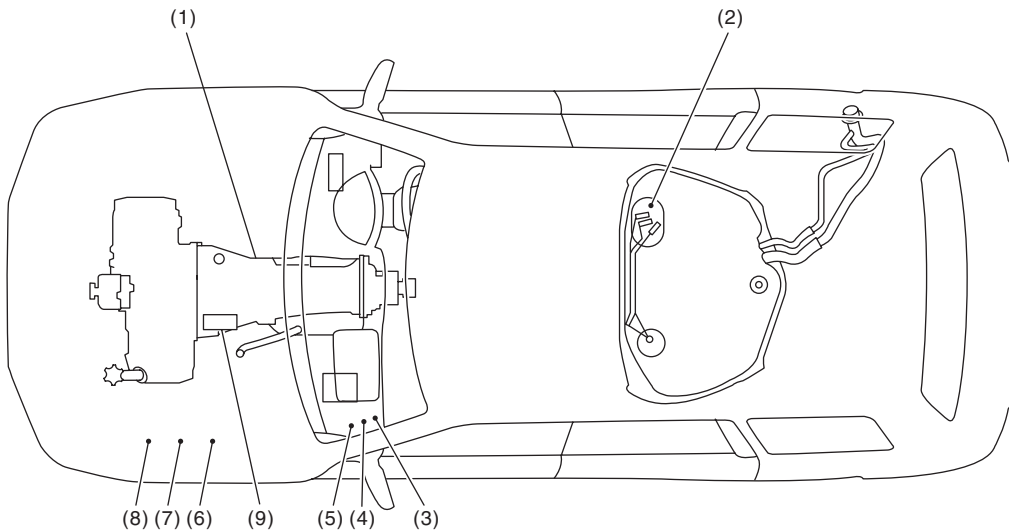
EN-01936



EN-01937



EN-01938

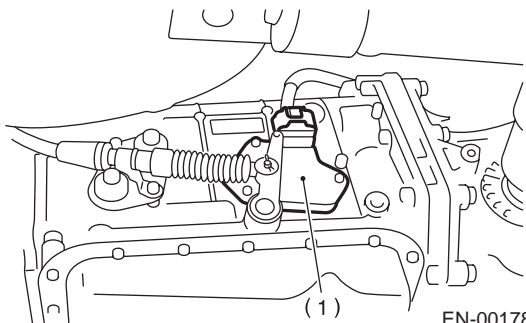
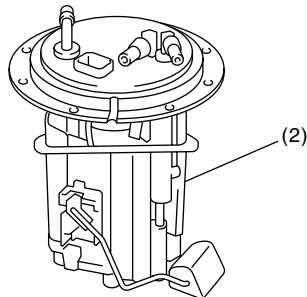
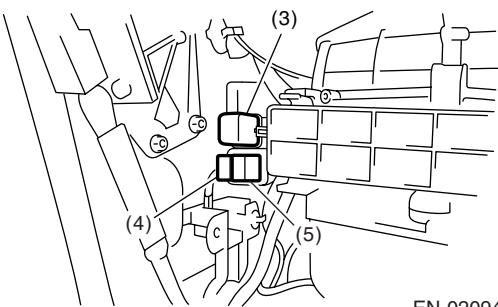
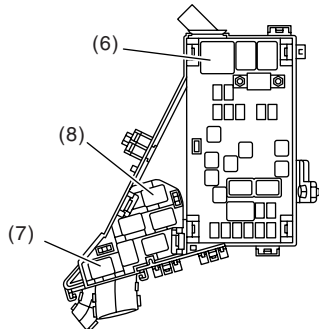
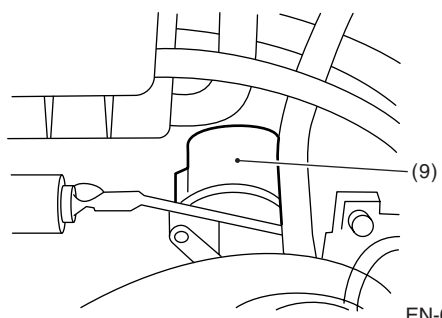


EN-01898

- | | | |
|----------------------|---------------------------------------|-------------------------------|
| (1) Inhibitor switch | (4) Fuel pump relay | (7) Radiator sub fan relay |
| (2) Fuel pump | (5) Electronic throttle control relay | (8) Radiator main fan relay 2 |
| (3) Main relay | (6) Radiator main fan relay 1 | (9) Starter |

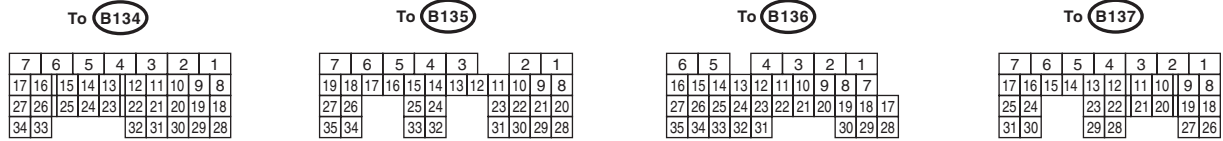
Electrical Component Location

ENGINE (DIAGNOSTICS)

 <p>EN-00178</p>	 <p>EN-02093</p>
 <p>EN-02094</p>	 <p>EN-02095</p>
 <p>EN-02096</p>	<p>SUBARU.</p>

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

A: ELECTRICAL SPECIFICATION



EN-01812

Description		Con- nector No.	Termi- nal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Crank- shaft posi- tion sensor	Signal (+)	B135	10	0	-7 — +7	Waveform
	Signal (-)	B135	22	0	0	—
	Shield	B135	31	0	0	—
Rear oxy- gen sen- sor	Signal	B137	25	0	0 — 0.9	—
	Shield	B137	31	0	0	—
	GND (sensor)	B136	35	0	0	—
Front oxy- gen (A/F) sensor heater	Signal 1	B134	3	—	—	Waveform
	Signal 2	B134	2	—	—	Waveform
Rear oxygen sensor heater signal		B135	2	0 — 13	—	Waveform
Engine coolant tempera- ture sen- sor	Signal	B136	14	1.0 — 1.4	1.0 — 1.4	After engine is warmed-up.
	GND (sensor)	B136	35	0	0	After engine is warmed-up.
Air flow sensor	Signal	B136	23	—	0.3 — 4.5	—
	Shield	B136	32	0	0	—
	GND	B136	31	0	0	—
Intake air temperature sensor signal		B136	13	0.3 — 4.6	0.3 — 4.6	—
Wastegate control sole- noid valve		B134	32	0 or 10 — 13	0 or 13 — 14	Waveform
Starter switch		B137	8	0	0	Cranking: 8 — 14
A/C switch		B137	17	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
Ignition switch		B137	14	10 — 13	13 — 14	—
Neutral position switch		B137	9	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—

Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Description		Con- nector No.	Termi- nal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Test mode connector		B137	15	10 — 13	13 — 14	When connected: 0
Knock sensor	Signal	B136	25	2.8	2.8	—
	Shield	B136	33	0	0	—
Back-up power supply		B135	19	10 — 13	13 — 14	Ignition switch "OFF": 10 — 13
Control module power supply		B135	5	10 — 13	13 — 14	—
		B135	6	10 — 13	13 — 14	—
Sensor power supply		B136	16	5	5	—
Ignition control	#1	B135	18	0	13 — 14	Waveform
	#2	B135	17	0	13 — 14	Waveform
	#3	B135	16	0	13 — 14	Waveform
	#4	B135	16	0	13 — 14	Waveform
Fuel injec- tor	#1	B136	6	10 — 13	1 — 14	Waveform
	#2	B136	5	10 — 13	1 — 14	Waveform
	#3	B136	4	10 — 13	1 — 14	Waveform
	#4	B136	3	10 — 13	1 — 14	Waveform
Fuel pump control unit	Signal 1	B137	28	10 — 13	13 — 14	—
	Signal 2	B135	27	0 or 5	0 or 5	Waveform
A/C relay control		B135	33	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	—
Radiator fan relay 1 control		B135	25	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	—
Radiator fan relay 2 control		B135	24	ON: 0.5 or less OFF: 10 — 13	ON: 0.5 or less OFF: 13 — 14	Model with A/C
Malfunction indicator light		B134	17	—	—	Light "ON": 1 or less Light "OFF": 10 — 14
Engine speed output		B134	23	—	0 — 13 or more	Waveform
Purge control solenoid valve		B134	14	ON: 1 or less OFF: 10 — 13	ON: 1 or less OFF: 13 — 14	Waveform
Manifold absolute pressure sensor	Signal	B136	22	1.7 — 2.4	1.1 — 1.6	—
	Power supply	B136	16	5	5	
	GND (sensor)	B136	35	0	0	
Blower fan switch		B137	13	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	With manual A/C model only
Power steering oil pres- sure switch		B137	10	10 — 13	ON: 0 OFF: 13 — 14	—
Front oxygen (A/F) sen- sor signal (+)		B134	33	2.8 — 3.2	2.8 — 3.2	—
Front oxygen (A/F) sen- sor signal (—)		B134	26	2.4 — 2.7	2.4 — 2.7	—
Front oxygen (A/F) sen- sor shield		B134	25	0	0	—
SSM communication line		B137	20	Less than 1←→ More than 4	Less than 1←→ More than 4	—
GND (injector)		B137	7	0	0	—
GND (sensor)		B136	35	0	0	—
GND (ignition system)		B135	12	0	0	—
GND (power supply)		B135	4	0	0	—
		B135	1	0	0	—
GND (control system)		B137	1	0	0	—
		B137	2	0	0	—

Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Description		Con- nector No.	Termi- nal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
GND (Front oxygen (A/F) sensor heater 1)		B134	7	0	0	—
GND (Front oxygen (A/F) sensor heater 2)		B134	6	0	0	—
Intake camshaft position sensor (LH)		B135	8	0 or 5	0 or 5	Waveform
Intake camshaft position sensor (RH)		B135	9	0 or 5	0 or 5	Waveform
Electronic throttle control	Main	B136	18	0.64 — 0.72 Fully open: 3.96	0.64 — 0.72 (After engine is warmed-up.)	Fully closed: 0.6 Fully open: 3.96
	Sub	B136	29	1.51 — 1.58 Fully open: 4.17	1.51 — 1.58 (After engine is warmed-up.)	Fully closed: 1.48 Fully open: 4.17
	Power supply	B136	16	5	5	—
	GND (sensor)	B136	35	0	0	—
Electronic throttle control motor (+)		B137	5	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor (–)		B137	4	Duty waveform	Duty waveform	Drive frequency: 500 Hz
Electronic throttle control motor power supply		B137	6	10 — 13	13 — 14	—
Electronic throttle control motor relay		B135	35	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	When ignition switch is turned to ON: ON
Intake AVCS solenoid (LH)	Signal (+)	B134	19	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
	Signal (–)	B134	29	0	0	—
Intake AVCS solenoid (RH)	Signal (+)	B134	18	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
	Signal (–)	B134	28	0	0	—
Exhaust AVCS solenoid (LH)	Signal (+)	B134	21	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
	Signal (–)	B134	31	0	0	—
Exhaust AVCS solenoid (RH)	Signal (+)	B134	20	ON: 10 — 13 OFF: 0	ON: 13 — 14 OFF: 0	—
	Signal (–)	B134	30	0	0	—
Exhaust camshaft position sensor (LH)	Signal (+)	B135	20	0	–7 — +7	Waveform
	Signal (–)	B135	28	0	0	—
	Shield	B135	30	0	0	—
Exhaust camshaft position sensor (RH)	Signal (+)	B135	21	0	–7 — +7	Waveform
	Signal (–)	B135	29	0	0	—
	Shield	B135	30	0	0	—

Engine Control Module (ECM) I/O Signal

ENGINE (DIAGNOSTICS)

Description		Con- nector No.	Termi- nal No.	Signal (V)		Note
				Ignition SW ON (engine OFF)	Engine ON (idling)	
Accelerator position sensor	Main	B136	17	Fully closed: 1 Fully open: 3.3	Fully closed: 1 Fully open: 3.3	—
	Power supply	B136	15	5	5	—
	GND (sensor)	B136	34	0	0	—
	Sub	B136	28	Fully closed: 1 Fully open: 3.3	Fully closed: 1 Fully open: 3.3	—
	Shield	B137	2	0	0	—
	Power supply	B136	16	5	5	—
	GND (sensor)	B136	35	0	0	—
Starter relay		B135	32	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	ON: Cranking
A/C middle pressure switch		B136	30	ON: 0 OFF: 10 — 13	ON: 0 OFF: 13 — 14	—
Clear memory switch		B137	24	5	5	When connected: 0
Clutch switch		B134	1	When clutch pedal is depressed: 0 When clutch pedal is released: 10 — 13	When clutch pedal is depressed: 0 When clutch pedal is released: 13 — 14	—
Brake switch 1		B136	9	When brake pedal is depressed: 0 When brake pedal is released: 10 — 13	When brake pedal is depressed: 0 When brake pedal is released: 13 — 14	—
Brake switch 2		B136	8	When brake pedal is depressed: 10 — 13 When brake pedal is released: 0	When brake pedal is depressed: 13 — 14 When brake pedal is released: 0	—
Cruise control command switch		B136	11	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	7	ON: 0 OFF: 5	ON: 0 OFF: 5	—

6. Engine Condition Data

A: ELECTRICAL SPECIFICATION

Remarks	Specification
Engine load	1.2 — 2.9 (%): Idling
	4.7 — 12.8 (%): 2,500 rpm racing

Measuring condition:

- After engine is warmed-up.
- Gear position is in neutral.
- A/C is turned off.
- Turn all accessory switches to OFF.

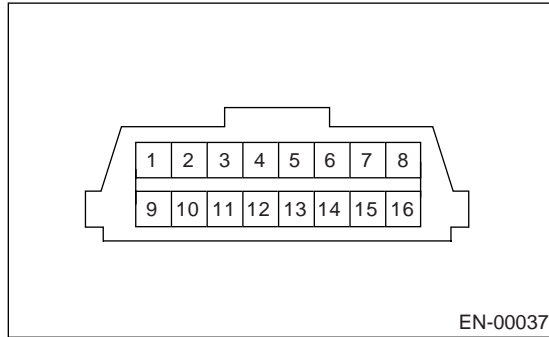
7. Data Link Connector

A: NOTE

This connector is used for Subaru Select Monitor.

CAUTION:

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



Terminal No.	Remarks	Terminal No.	Remarks
1	Power supply	9	Empty
2	Empty	10	Subaru Select Monitor signal
3	Empty	11	Empty
4	Empty	12	Ground
5	Empty	13	Ground
6	Line end check signal 1	14	Empty
7	Empty	15	Empty
8	Empty	16	Empty

8. Subaru Select Monitor

A: OPERATION

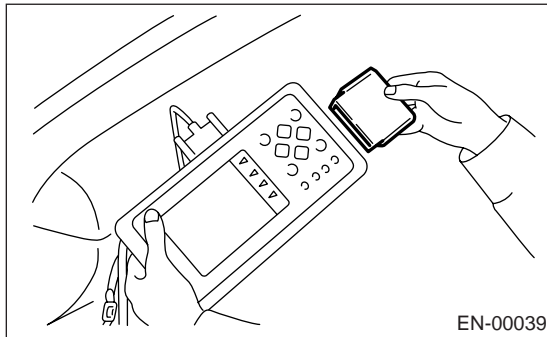
1. HOW TO USE SUBARU SELECT MONITOR

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



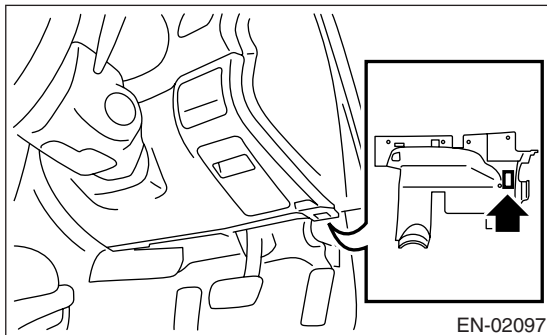
2) Connect the diagnosis cable to Subaru Select Monitor.

3) Insert the cartridge to Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>



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

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

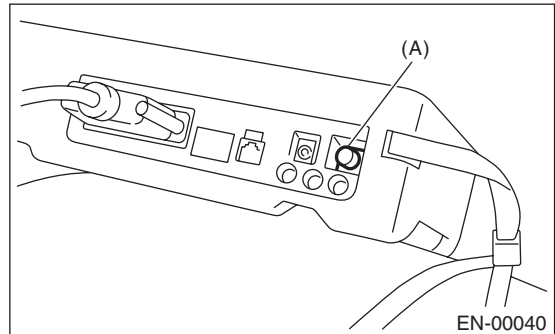


(2) Connect the diagnosis cable to data link connector.

CAUTION:

Do not connect the scan tools except for Subaru Select Monitor.

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



(A) Power switch

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

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

Refer to "Read Diagnostic Trouble Code (DTC)" for information about how to indicate DTC. <Ref. to EN(H4DOTC)(diag)-27, Read Diagnostic Trouble Code (DTC).>

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

Refer to "Read Diagnostic Trouble Code (DTC)" for information about how to indicate DTC. <Ref. to EN(H4DOTC)(diag)-27, Read Diagnostic Trouble Code (DTC).>

Subaru Select Monitor

ENGINE (DIAGNOSTICS)

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

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

Remarks	Display	Unit of measure	Note (at idling)
Engine coolant temperature signal	Coolant Temp.	°C	80 — 100°C
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	220 — 275 mmHg
Engine speed signal	Engine Speed	rpm	630 — 770 rpm (Agree with the tachometer indication)
Vehicle speed signal	Vehicle Speed	km/h	0 km/h (at parking)
Ignition timing signal	Ignition Timing	deg	10 — 15 deg
Intake air temperature signal	Intake Air Temp.	°C	20 — 50°C
Amount of intake air	Mass Air Flow	g/s	2.1 — 3.1 g/s
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
Knock sensor correction	Knock Correction	deg	0.0 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%
Generator duty ratio	ALT Duty	%	0 — 100%
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 RH (AVCS)	OCV Duty R	%	0 — 20%
Oil flow control solenoid valve duty LH (AVCS)	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	ohm	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%
Throttle motor duty	Throttle Motor Duty	%	-5%
Throttle power supply 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 accelerator sensor voltage	Main-accelerator Sensor	V	1.0 V
Atmospheric pressure signal	Atmospheric Pressure	mmHg	—
Intake manifold relative pressure	Mani. Relative Pressure	mmHg	Intake manifold absolute pressure – Atmospheric pressure

Subaru Select Monitor

ENGINE (DIAGNOSTICS)

Remarks	Display	Unit of measure	Note (at idling)
Memory vehicle speed	Memorized Cruise Speed	km/h	—
Estimated cumulative driving distance	Estimated Cumulative Driving Distance	km	—
Exhaust AVCS retard angle amount RH	Exh. VVT Retard Ang. R	deg	±5 deg
Exhaust AVCS retard angle amount LH	Exh. VVT Retard Ang. L	deg	±5 deg
Exhaust oil flow control solenoid valve duty ratio RH	Exh. OCV Duty R	%	0 — 20%
Exhaust oil flow control solenoid valve duty ratio LH	Exh. OCV Duty L	%	0 — 20%
Exhaust oil flow control solenoid valve current value RH	Exh. OCV Current R	mA	40 — 100 mA
Exhaust oil flow control solenoid valve current value LH	Exh. OCV Current L	mA	40 — 100 mA

NOTE:

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

Subaru Select Monitor

ENGINE (DIAGNOSTICS)

5. READ CURRENT DATA FOR ENGINE (OBD MODE)

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

Description	Display	Unit of measure
Number of diagnosis code	Number of Diag. Code:	—
Condition of malfunction indicator light	MI (MIL)	ON or OFF
Monitoring test of misfire	Misfire monitoring	no support
Monitoring test of fuel system	Fuel system monitoring	complete or incomplete
Monitoring test of comprehensive component	Component monitoring	complete or incomplete
Test of catalyst	Catalyst Diagnosis	no support
Test of heating-type catalyst	Heated catalyst	no support
Test of evaporative emission purge control system	Evaporative purge system	no support
Test of secondary air system	Secondary air system	no support
Test of air conditioning system refrigerant	A/C system refrigerant	no support
Test of oxygen sensor	Oxygen sensor	complete or incomplete
Test of oxygen sensor heater	O2 Heater Diagnosis	complete or incomplete
Test of EGR system	EGR system	no support

NOTE:

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

6. LED OPERATION MODE FOR ENGINE

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

Remarks	Display	Message	LED "ON" requirements
AT/MT identification signal	AT Vehicle ID Signal	ON or OFF	Illuminate (AT model)
Test mode signal	Test Mode Signal	ON or OFF	When test mode connector is connected.
Clear memory signal	Clear Memory Terminal	ON or OFF	When clear memory connector is connected.
Neutral position switch signal	Neutral Position Switch	ON or OFF	When neutral position signal is entered.
Idle switch signal	Idle Switch Signal	ON or OFF	When idle switch signal is entered.
Ignition switch signal	Ignition Switch	ON or OFF	When ignition switch is turned to ON.
Power steering switch signal	P/S Switch	ON or OFF	When power steering switch is entered.
Handle switch signal	Handle SW	LHD or RHD	When handle switch signal is input.
Starter switch signal	Starter Switch	ON or OFF	When starter switch is input.
Air conditioning switch signal	A/C Switch	ON or OFF	When air conditioning switch is input.
Rear oxygen sensor rich signal	Rear O2 Rich Signal	ON or OFF	When rear oxygen sensor mixture ratio is rich.
Knocking signal	Knocking Signal	ON or OFF	When knocking signal is input.
Crankshaft position sensor signal	Crankshaft Position Signal	ON or OFF	When crankshaft position sensor signal is input.
Camshaft position sensor signal	Camshaft Position Signal	ON or OFF	When camshaft position sensor signal is input.
Rear defogger switch signal	Rear Defogger Switch	ON or OFF	When rear defogger switch is turned to ON.
Blower fan switch signal	Blower Fan Switch	ON or OFF	When blower fan switch is turned to ON.
Small light switch signal	Light Switch	ON or OFF	When small light switch is turned to ON.
Windshield wiper switch signal	Wiper SW	ON or OFF	When windshield wiper switch is turned to ON.
A/C middle pressure switch signal	A/C Mid Pressure Switch	ON or OFF	When A/C middle pressure switch is turned to ON.
Air conditioning relay signal	A/C Compressor Signal	ON or OFF	When air conditioning relay is in function.
Radiator fan relay 1 signal	Radiator Fan Relay #1	ON or OFF	When radiator fan relay 1 is in function.
Radiator fan relay 2 signal	Radiator Fan Relay #2	ON or OFF	When radiator fan relay 2 is in function.
AT retard angle demand signal	Retard Signal	ON or OFF	When AT retard angle demand signal is input.
AT fuel cut signal	Fuel Cut	ON or OFF	When AT fuel cut signal is input.

Subaru Select Monitor

ENGINE (DIAGNOSTICS)

Remarks	Display	Message	LED "ON" requirements
Torque down output signal	Torque Down Output	ON or OFF	When torque down output signal is input.
Torque down demand signal	Request Torque Down	ON or OFF	When torque down demand signal is input.
AT coordinate permission signal	Torque Control Permission	ON or OFF	When AT coordinate permission signal is input.
Electronic throttle control motor relay signal	ETC Motor Relay	ON or OFF	When electronic throttle control motor relay is in function.
Clutch switch signal	Clutch Switch	ON or OFF	When clutch switch is turned to ON.
Stop light switch signal	Stop Light Switch	ON or OFF	When stop switch is turned to ON.
SET/COAST switch signal	SET/COAST Switch	ON or OFF	When SET/COAST switch is turned to ON.
RES/ACC switch signal	RESUME/ACCEL Switch	ON or OFF	When RES/ACC switch is turned to ON.
Brake switch signal	Brake Switch	ON or OFF	When brake switch is turned to ON.
Main switch signal	Main Switch	ON or OFF	When main switch is turned to ON.
Cancel switch signal	Cancel Switch	ON or OFF	When cancel switch is turned to ON.
Data reception signal	Body Int. Unit Data	ON or OFF	When data reception signal is entered.
Counter update signal	Body Int. Unit Count	ON or OFF	When counter update signal is entered.

NOTE:

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

9. Read Diagnostic Trouble Code (DTC)

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

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

NOTE:

- For detailed operation procedure, refer to the "SUBARU SELECT MONITOR OPERATION MANUAL".
- For details concerning DTCs, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>

2. SUBARU SELECT MONITOR (OBD MODE)

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

NOTE:

- For detailed operation procedure, refer to the "SUBARU SELECT MONITOR OPERATION MANUAL".
- For details concerning DTCs, refer to the List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>

10. Inspection Mode

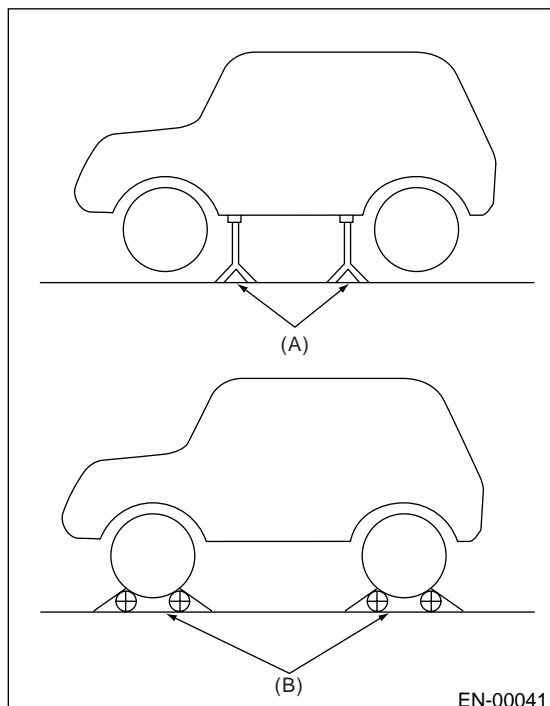
A: PROCEDURE

1. PREPARATION FOR THE INSPECTION MODE

- 1) Check battery voltage is more than 12 V and fuel remains half [20 to 40 ℓ (5.3 to 10.6 US gal, 4.4 to 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 brakes are 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.
- Do not abruptly depress/release clutch pedal or accelerator pedal during works even when the engine is operating at low speeds since this may cause vehicle to jump off free rollers.
- In order to prevent the vehicle from slipping due to vibration, do not place any wooden blocks or similar items between the rigid racks and the vehicle.
- Since the rear wheels will also rotate, do not place anything near them. Also, make sure that nobody goes in front of the vehicle.



EN-00041

- (A) Rigid rack
(B) Free rollers

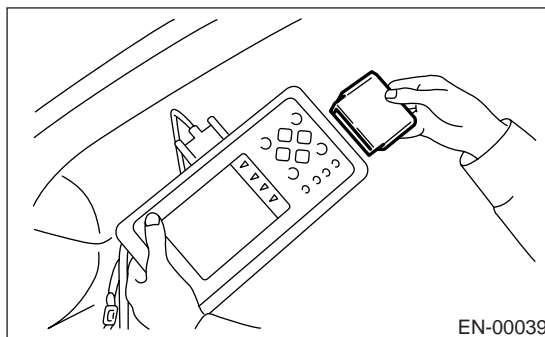
2. SUBARU SELECT MONITOR

- 1) After clearing the memory, check for any remaining unresolved trouble data. <Ref. to EN(H4DOTC)(diag)-30, Clear Memory Mode.>
- 2) Idle the engine.
- 3) Prepare the Subaru Select Monitor kit. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>



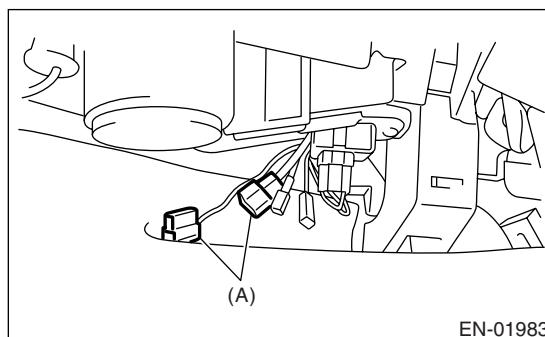
EN-00038

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



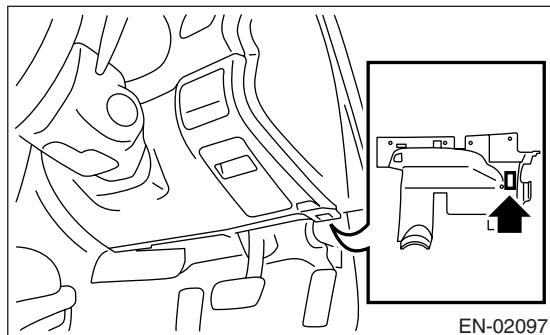
EN-00039

- 6) Connect the test mode connector (A) located at the lower portion of glove box.



EN-01983

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

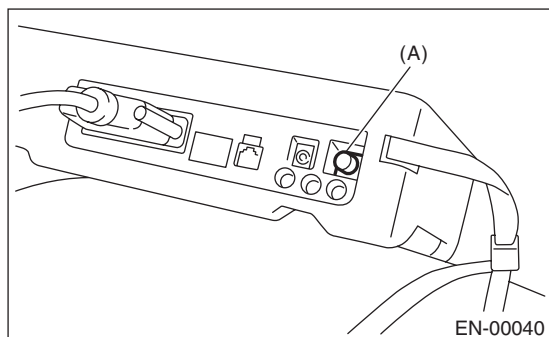


- Release the parking brake.
- The speed difference between front and rear wheels may light either the ABS warning light, but this indicates no malfunctions. When engine control diagnosis is finished, perform the ABS memory clearance procedure of self-diagnosis function.

CAUTION:

Do not connect the scan tools except for Subaru Select Monitor.

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



(A) Power switch

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

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

11) Press the [YES] key after the information of engine type was displayed.

12) On the «Engine Diagnosis» screen, select the {D Check} and press the [YES] key.

13) When the "Perform D Check?" is shown on the screen, press the [YES] key.

14) Perform subsequent procedures as instructed on the display screen.

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

NOTE:

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

- For details concerning DTCs, refer to the List of Diagnostic Trouble Code (DTC).

<Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>

11. Clear Memory Mode

A: OPERATION

1. SUBARU SELECT MONITOR (NORMAL MODE)

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

NOTE:

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

2. SUBARU SELECT MONITOR (OBD MODE)

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

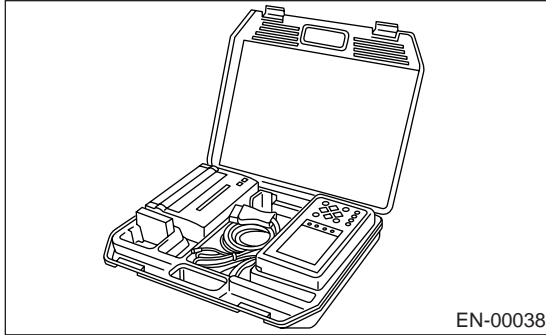
NOTE:

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

12. Compulsory Valve Operation Check Mode

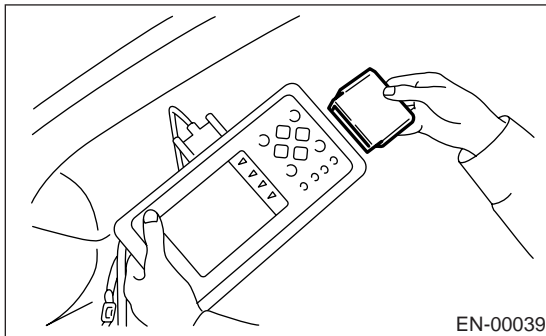
A: OPERATION

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

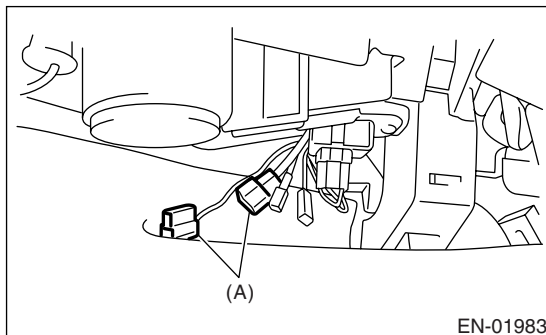


2) Connect the diagnosis cable to Subaru Select Monitor.

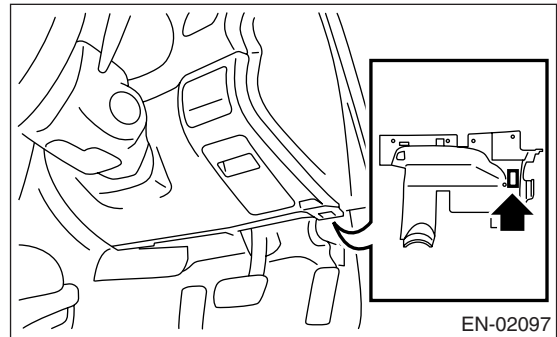
3) Insert the cartridge to Subaru Select Monitor. <Ref. to EN(H4DOTC)(diag)-7, PREPARATION TOOL, General Description.>



4) Connect the test mode connector (A) located at the lower portion of glove box.



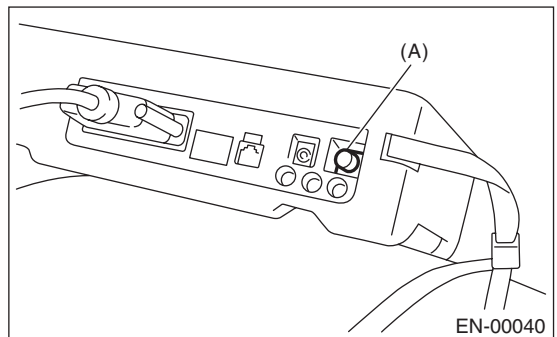
5) Connect the Subaru Select Monitor to data link connector located in the lower portion of the instrument panel (on the driver's side).



CAUTION:

Do not connect the scan tools except for Subaru Select Monitor.

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



(A) Power switch

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

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

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

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

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

12) On the «Actuator ON/OFF Operation» screen, select the desired compulsory actuator and press the [YES] key.

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

Compulsory Valve Operation Check Mode

ENGINE (DIAGNOSTICS)

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

Description	Display
Compulsory fuel pump relay operation check	Fuel Pump
Compulsory radiator fan relay operation check	Radiator Fan Relay
Compulsory air conditioning relay operation check	A/C Compressor Relay
Compulsory purge control solenoid valve operation check	CPC Solenoid
Compulsory wastegate control solenoid valve operation check	Wastegate control solenoid

NOTE:

- The following parts will be displayed but not functional.

Display
EGR Solenoid
ASV Solenoid
FICD Solenoid
Pressure Switching Solenoid
PCV Solenoid
AAI Solenoid
Vcut Solenoid
Fuel Tank Sensor Control Valve

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

13. Malfunction Indicator Light

A: PROCEDURE

1. Activation of malfunction indicator light. <Ref. to EN(H4DOTC)(diag)-34, ACTIVATION OF MALFUNCTION INDICATOR LIGHT, Malfunction Indicator Light.>
↓
2. Check that the malfunction indicator light does not come on. <Ref. to EN(H4DOTC)(diag)-35, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
↓
3. Check that the malfunction indicator light does not go off. <Ref. to EN(H4DOTC)(diag)-37, MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF., Malfunction Indicator Light.>
↓
4. Check that the malfunction indicator light does not blink. <Ref. to EN(H4DOTC)(diag)-38, MALFUNCTION INDICATOR LIGHT DOES NOT BLINK., Malfunction Indicator Light.>
↓
5. Check that the malfunction indicator light remains blinking. <Ref. to EN(H4DOTC)(diag)-40, MALFUNCTION INDICATOR LIGHT REMAINS BLINKING., Malfunction Indicator Light.>

Malfunction Indicator Light

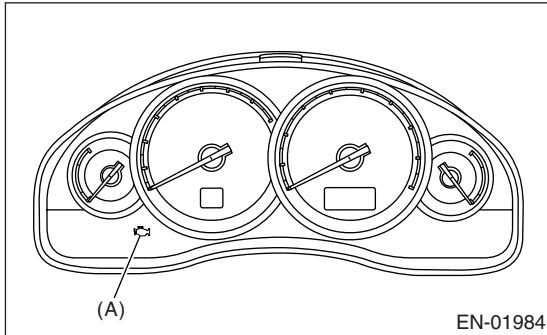
ENGINE (DIAGNOSTICS)

B: ACTIVATION OF MALFUNCTION INDICATOR LIGHT

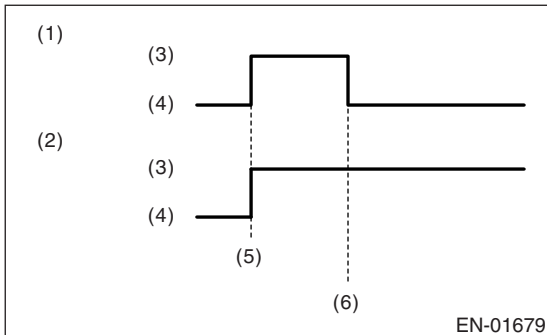
1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light (A) in the combination meter illuminates.

NOTE:

If the malfunction indicator light does not illuminate, perform the diagnosis of malfunction indicator light circuit or the combination meter circuit. <Ref. to EN(H4DOTC)(diag)-35, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>



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



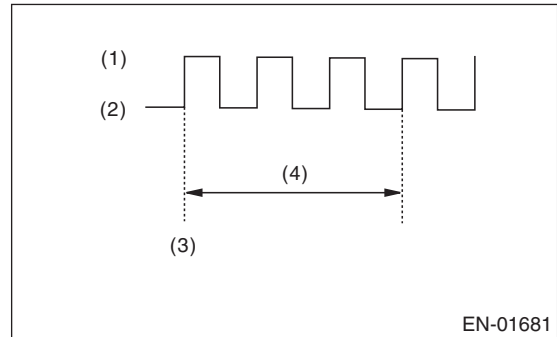
- (1) No trouble
- (2) Trouble occurs
- (3) ON
- (4) OFF
- (5) Ignition switch ON
- (6) Engine start

3) Turn the ignition switch to OFF and connect the test mode connector.

(1) When the ignition switch is turned to ON (engine OFF), the malfunction indicator light illuminates.

(2) Malfunction indicator light blinks at a cycle of 0.5 Hz after starting the engine. (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

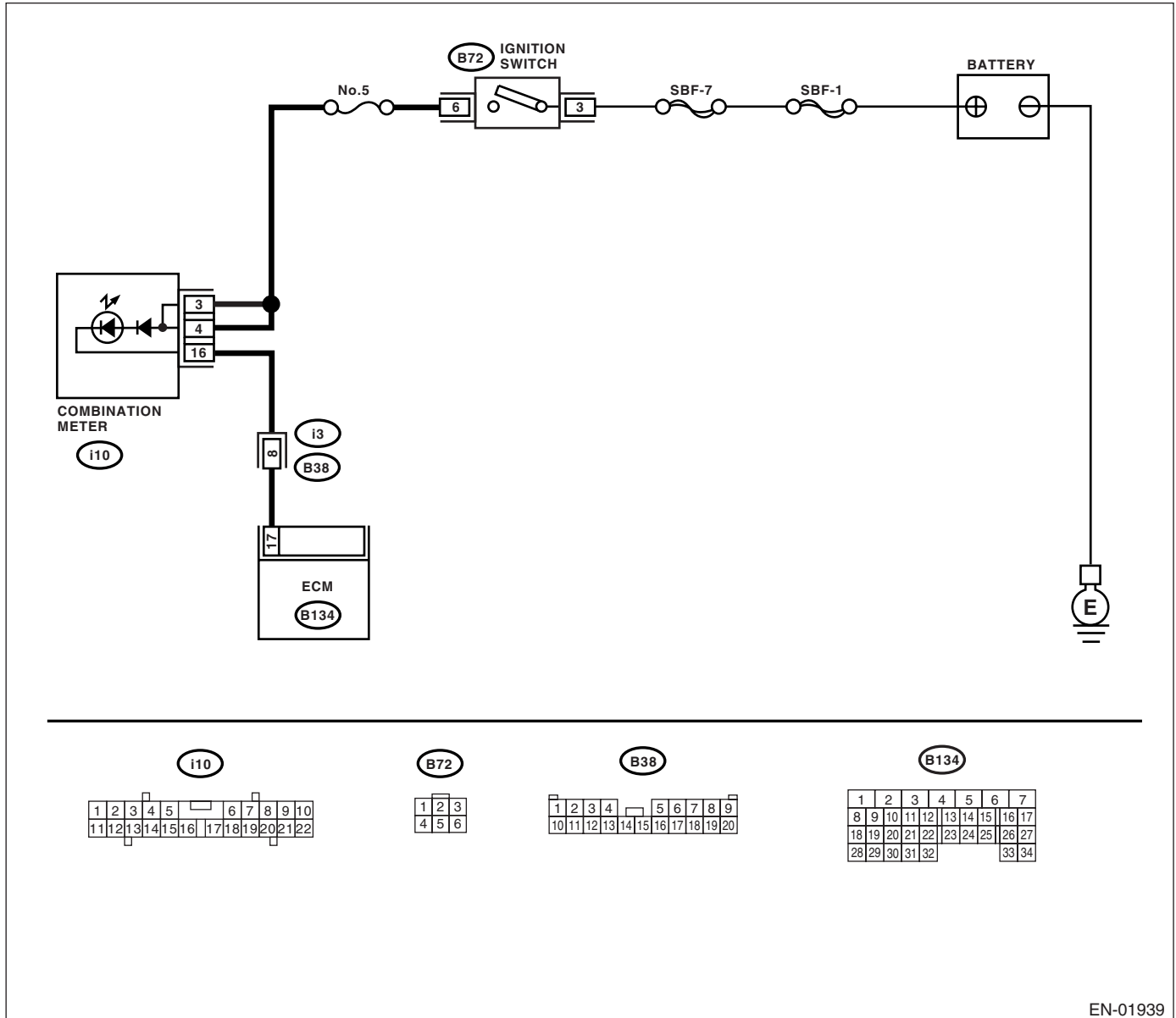
DIAGNOSIS:

The malfunction indicator light circuit is open or shorted.

TROUBLE SYMPTOM:

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

WIRING DIAGRAM:



EN-01939

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B134) No. 17 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 4.	Go to step 2.
2 CHECK POOR CONTACT. Check for poor connection when shaking or pulling ECM connector and harness.	Does malfunction indicator light illuminate?	Repair the poor contact in ECM connector.	Go to step 3.
3 CHECK ECM CONNECTOR. Check the connection of ECM connector.	Is the ECM connector correctly connected?	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Repair the connection of ECM connector.
4 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Remove the combination meter. <Ref. to IDI-16, Combination Meter Assembly.> 3) Disconnect the connector from ECM and combination meter. 4) Measure the resistance of harness between ECM and combination meter connector. Connector & terminal (B134) No. 17 — (i10) No. 16:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between ECM and combination meter connector • Poor contact in coupling connector
5 CHECK POOR CONTACT. Check poor contact in combination meter connector.	Is there poor contact in combination meter connector?	Repair the poor contact in combination meter connector.	Go to step 6.
6 CHECK HARNESS BETWEEN COMBINATION METER AND IGNITION SWITCH CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between combination meter connector and chassis ground. Connector & terminal (i10) No. 3 (+) — Chassis ground (-): (i10) No. 4 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Replace the board of combination meter. <Ref. to IDI-16, Combination Meter Assembly.>	Check the following and repair if necessary. NOTE: <ul style="list-style-type: none"> • Blown out fuse • Open or short circuit in harness between fuse and battery terminal • Poor contact in ignition switch connector

D: MALFUNCTION INDICATOR LIGHT DOES NOT GO OFF.

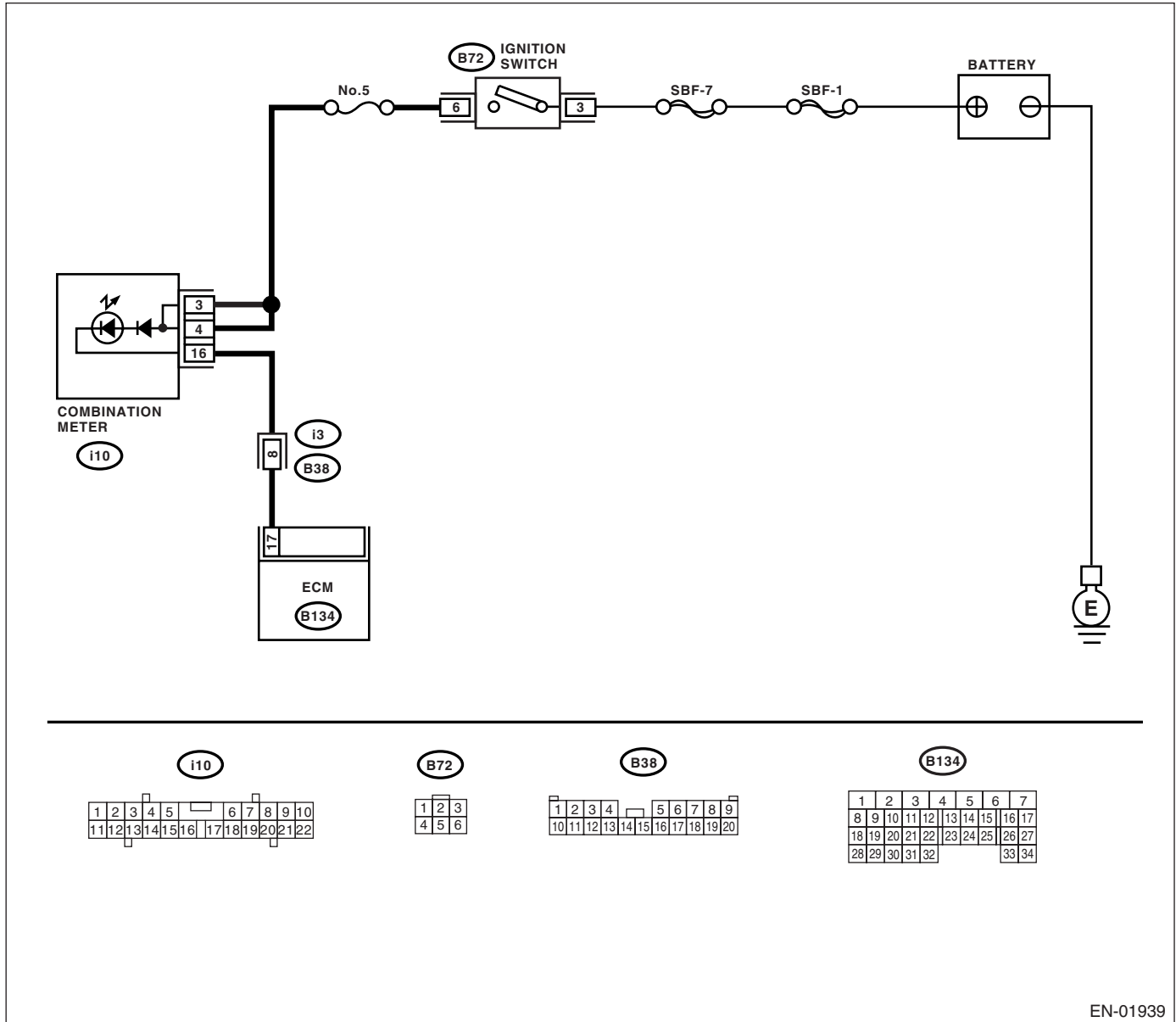
DIAGNOSIS:

The malfunction indicator light circuit is shorted.

TROUBLE SYMPTOM:

Although malfunction indicator light comes on when the engine runs, DTC is not shown on the Subaru Select Monitor display.

WIRING DIAGRAM:



EN-01939

Step	Check	Yes	No
1	CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Turn the ignition switch to ON.	Does malfunction indicator light illuminate? Repair the short circuit in harness between combination meter and ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

E: MALFUNCTION INDICATOR LIGHT DOES NOT BLINK.

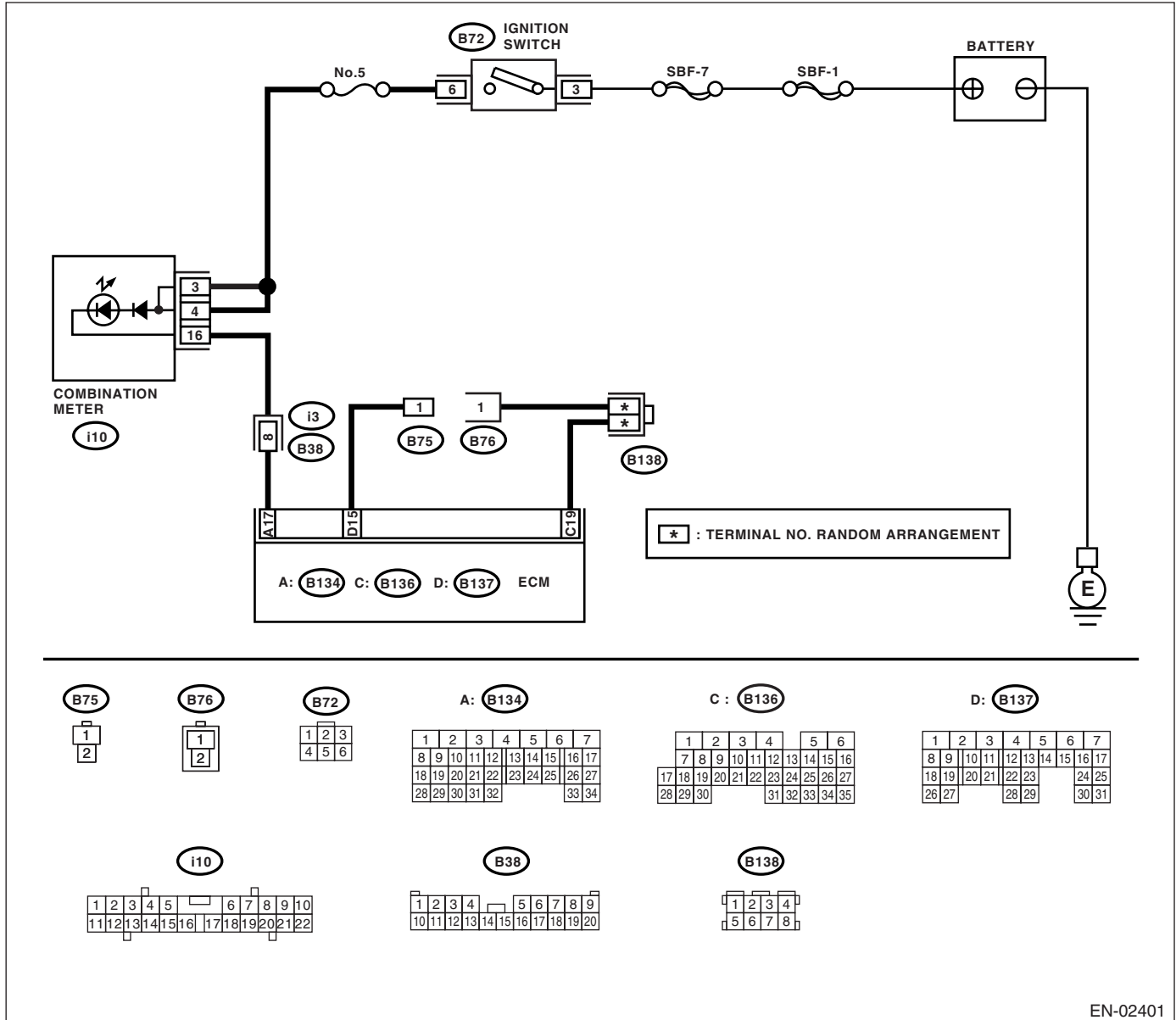
DIAGNOSIS:

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

TROUBLE SYMPTOM:

Malfunction indicator light does not blink during inspection mode.

WIRING DIAGRAM:



EN-02401

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK STATUS OF MALFUNCTION INDICATOR LIGHT. 1) Turn the ignition switch to OFF. 2) Disconnect the test mode connectors. 3) Turn the ignition switch to ON. (engine OFF)	Does malfunction indicator light illuminate?	Go to step 2.	Repair the malfunction indicator light circuit. <Ref. to EN(H4DOTC)(diag)-35, MALFUNCTION INDICATOR LIGHT DOES NOT COME ON, Malfunction Indicator Light.>
2 CHECK HARNESS BETWEEN COMBINATION METER AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Turn the ignition switch to ON.	Does malfunction indicator light illuminate?	Repair the ground short circuit in harness between combination meter and ECM connector.	Go to step 3.
3 CHECK HARNESS BETWEEN TEST MODE CONNECTOR AND ECU. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between test mode connector and ECM. Connector & terminal (B76) No. 1 — (B136) No. 19:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between test mode connector and ECM • Poor contact in joint connector
4 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is the poor contact in ECM connector?	Repair the poor contact in ECM connector.	Go to step 5.
5 CHECK HARNESS BETWEEN ECM AND TEST MODE CONNECTOR. Measure the resistance of harness between ECM and test mode connector. Connector & terminal (B137) No. 15 — (B75) No. 1:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the open circuit in harness between ECM and test mode connector.
6 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is the poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

F: MALFUNCTION INDICATOR LIGHT REMAINS BLINKING.

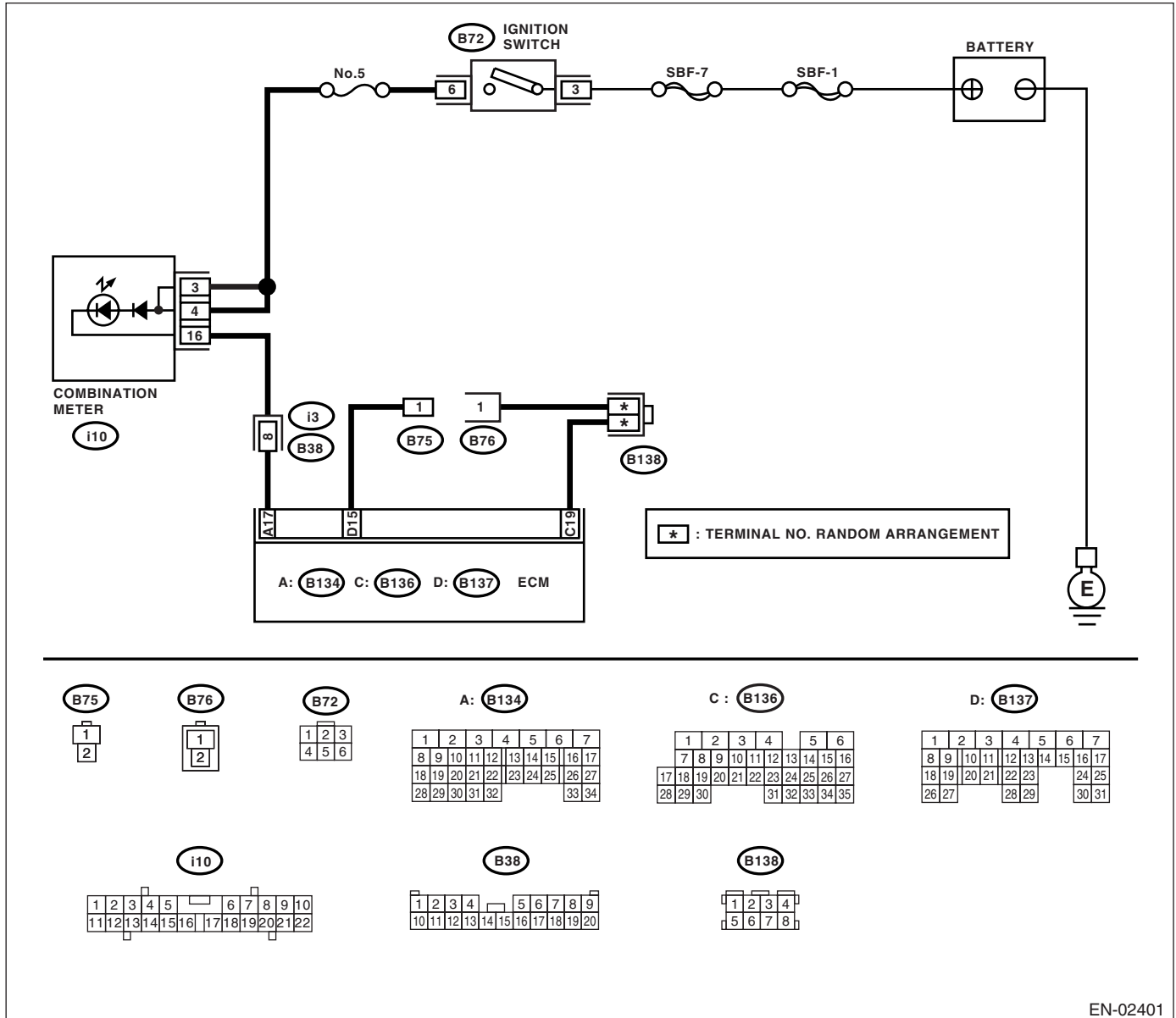
DIAGNOSIS:

Test mode connector circuit is shorted.

TROUBLE SYMPTOM:

Malfunction indicator light blinks when test mode connector is not connected.

WIRING DIAGRAM:



EN-02401

Malfunction Indicator Light

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK TEST MODE CONNECTOR. 1) Disconnect the test mode connectors 2) Turn the ignition switch to ON.	Does the malfunction indicator light blink?	Go to step 2.	System is in good order. NOTE: Malfunction indicator light blinks at a cycle of 3 Hz when test mode connector is connected.
2 CHECK HARNESS BETWEEN ECM CONNECTOR AND CHASSIS GROUNDING TERMINAL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B137) No. 15 — Chassis ground:	Is the resistance less than 5 Ω ?	Repair the short circuit in harness between ECM and test mode connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

14. Diagnostics for Engine Starting Failure

A: PROCEDURE

1. Check for fuel amount.
↓
2. Inspection of starter motor circuit. <Ref. to EN(H4DOTC)(diag)-43, STARTER MOTOR CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
3. Inspection of ECM power supply and ground line. <Ref. to EN(H4DOTC)(diag)-46, 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)-48, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>
↓
5. Inspection of fuel pump circuit. <Ref. to EN(H4DOTC)(diag)-51, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>
↓
6. Inspection of fuel injector circuit. <Ref. to EN(H4DOTC)(diag)-53, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1	CHECK OPERATION OF STARTER MOTOR.	Go to step 2.	Go to step 3.
2	CHECK DTC.	Inspect the relevant DTC using List of Diagnostic Trouble Code (DTC). <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>	Repair the poor contact in ECM connector.
3	CHECK INPUT SIGNAL FOR STARTER MOTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter motor. 3) Turn the ignition switch to START. 4) Measure the power supply voltage between starter motor connector terminal and engine ground. Connector & terminal (B14) No. 1 (+) — Engine ground (-): NOTE: Set the selector lever in the "P" or "N" range.	Is the voltage more than 10 V?	Go to step 5.
4	CHECK GROUND CIRCUIT OF STARTER MOTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the ground cable terminal from starter motor. 3) Measure the resistance of ground cable between ground cable terminal and engine ground.	Is the resistance less than 5 Ω?	Repair the open circuit of ground cable.
5	CHECK HARNESS BETWEEN BATTERY AND IGNITION SWITCH CONNECTOR. 1) Disconnect the connector from ignition switch. 2) Measure the power supply voltage between ignition switch connector and chassis ground. Connector & terminal (B72) No. 3 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Check the following and repair if necessary. • Blown out fuse • Open circuit in harness between ignition switch and battery
6	CHECK IGNITION SWITCH. 1) Disconnect the connector from ignition switch. 2) Measure the resistance between ignition switch terminals while turning the ignition switch to START position. Terminals No. 2 — No. 3:	Is the resistance less than 5 Ω?	Replace the ignition switch.

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK INPUT VOLTAGE OF STARTER RELAY. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from starter relay. 3) Connect the connector to ignition switch. 4) Measure the input voltage between starter relay connector and chassis ground while turning the ignition switch to START position. Connector & terminal (B225) No. 14 (+) — Chassis ground (-): (B225) No. 16 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 8.	Repair the open or ground short circuit in harness between starter relay and ignition switch.
8 CHECK STARTER RELAY. 1) Connect the battery to starter relay terminals No. 15 and No. 16. 2) Measure the resistance between starter relay terminals. Terminals No. 13 — No. 14:	Is the resistance less than 1 Ω ?	Go to step 9.	Replace the starter relay.
9 CHECK INPUT VOLTAGE FROM ECM. 1) Turn the ignition switch to OFF. 2) Connect the starter relay connector. 3) Disconnect the connectors from ECM. 4) Measure the resistance of harness between ECM and starter relay connector. Connector & terminal (B135) No. 32 — (B225) No. 15:	Is the resistance less than 1 Ω ?	Go to step 10.	Repair the open circuit in harness between ECM and starter relay.
10 CHECK INPUT VOLTAGE FOR STARTER MOTOR. 1) Turn the ignition switch to OFF. 2) Connect the connector to ECM. 3) Turn the ignition switch to START. 4) Measure the voltage between starter motor and engine ground. Connector & terminal (B14) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 11.	Repair the open or ground short circuit in harness between starter relay and starter.
11 CHECK HARNESS BETWEEN IGNITION SWITCH AND ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition switch and ECM. 3) Measure the resistance of harness between ignition switch and ECM connector. Connector & terminal (B137) No. 8 — (B72) No. 2:	Is the resistance less than 1 Ω ?	Check engine control module (ECM) power supply and ground line. <Ref. to EN(H4DOTC)(diag)-46, CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM), Diagnostics for Engine Starting Failure.>	Repair the open circuit between ignition switch and ECM.

Diagnostics for Engine Starting Failure

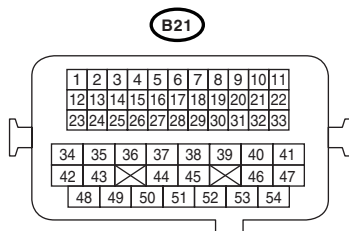
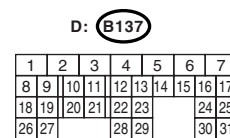
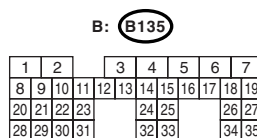
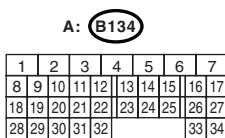
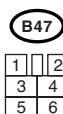
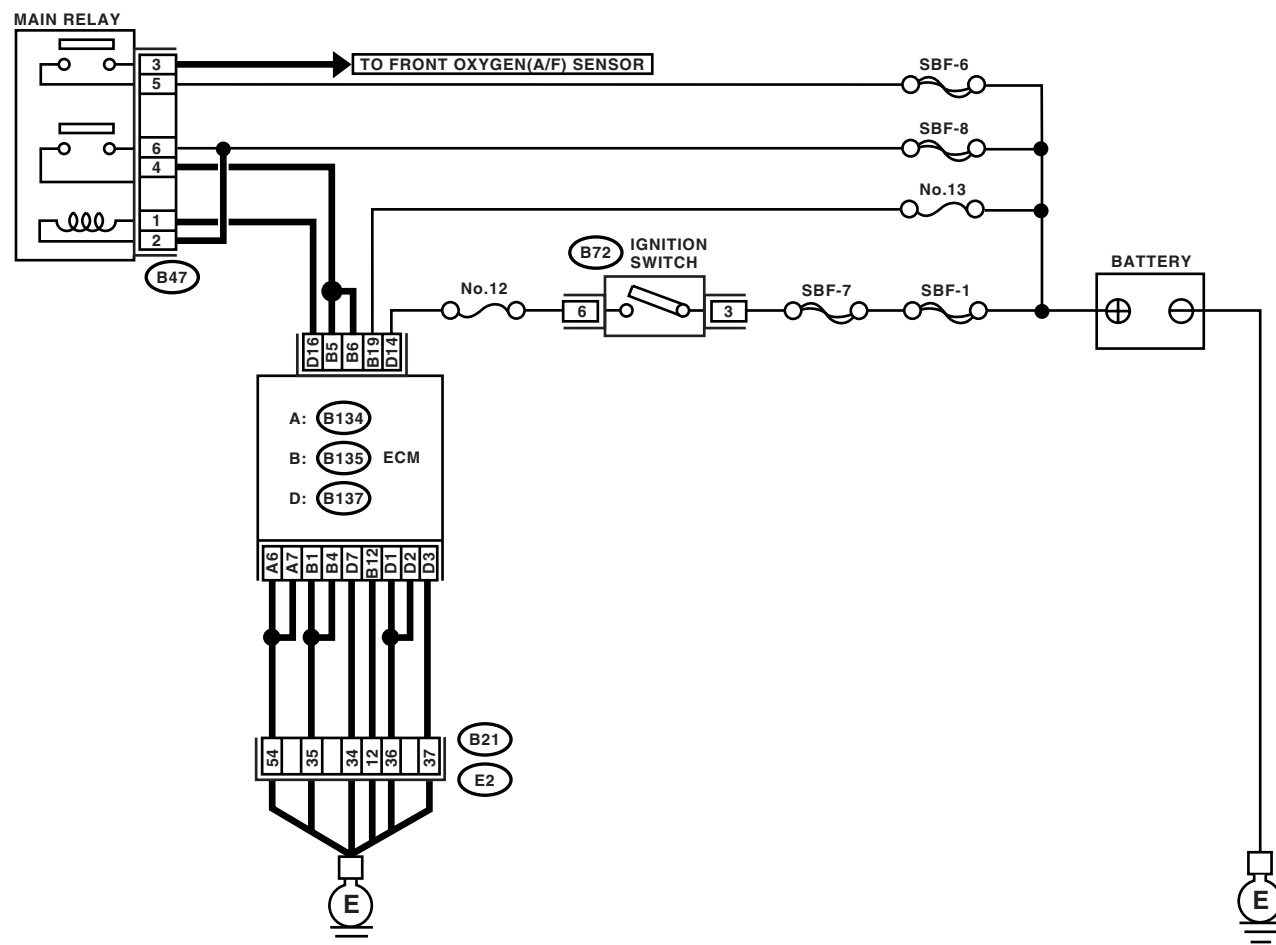
ENGINE (DIAGNOSTICS)

C: CHECK POWER SUPPLY AND GROUND LINE OF ENGINE CONTROL MODULE (ECM)

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-02403

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK MAIN RELAY. 1) Turn the ignition switch to OFF. 2) Remove the main relay. 3) Connect the battery to main relay terminals No. 1 and No. 2. 4) Measure the resistance between main relay terminals. Terminals No. 3 — No. 5: No. 4 — No. 6:	Is the resistance less than 10 Ω ?	Go to step 2.	Replace the main relay.
2 CHECK GROUND CIRCUIT FOR ECM. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B134) No. 6 — Chassis ground: (B134) No. 7 — Chassis ground: (B135) No. 1 — Chassis ground: (B135) No. 4 — Chassis ground: (B135) No. 12 — Chassis ground: (B137) No. 1 — Chassis ground: (B137) No. 2 — Chassis ground: (B137) No. 3 — Chassis ground: (B137) No. 7 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 3.	Repair the open circuit in harness between ECM connector and engine grounding terminal.
3 CHECK INPUT VOLTAGE OF ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 19 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 4.	Repair the open or ground short circuit of power supply circuit.
4 CHECK INPUT VOLTAGE OF ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B137) No. 14 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 5.	Repair the open or ground short circuit of power supply circuit.
5 CHECK INPUT VOLTAGE OF MAIN RELAY. Measure the voltage between main relay connector and chassis ground. Connector & terminal (B47) No. 2 (+) — Chassis ground (-): (B47) No. 5 (+) — Chassis ground (-): (B47) No. 6 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 6.	Repair the open or ground short circuit in harness of power supply circuit.
6 CHECK INPUT VOLTAGE OF ECM. 1) Connect the main relay connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 5 (+) — Chassis ground (-): (B135) No. 6 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Check ignition control system. <Ref. to EN(H4DOTC)(diag)-48, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>	Repair the open or ground short circuit in harness between ECM connector and main relay connector.

Diagnostics for Engine Starting Failure

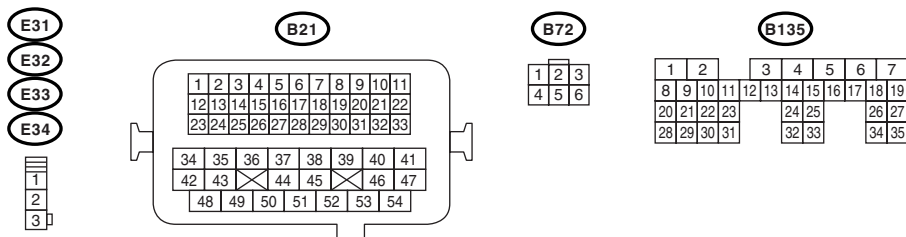
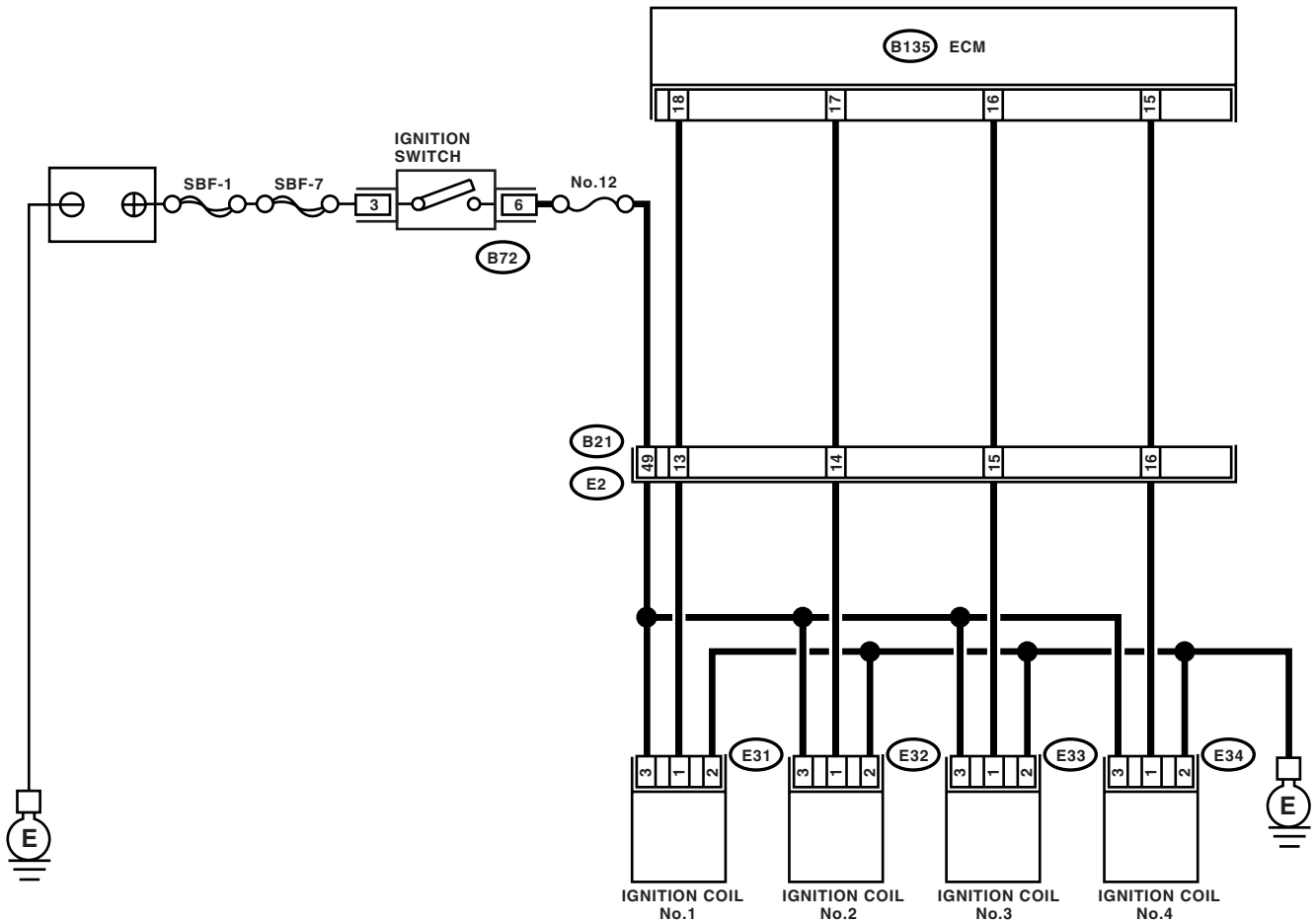
ENGINE (DIAGNOSTICS)

D: IGNITION CONTROL SYSTEM

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-02404

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SPARK PLUG CONDITION. 1) Remove the spark plug. <Ref. to IG(H4DOTC)-4, REMOVAL, Spark Plug.> 2) Check the spark plug condition. <Ref. to IG(H4DOTC)-5, INSPECTION, Spark Plug.>	Is the spark plug's status OK?	Go to step 2.	Replace the spark plug.
2 INSPECTION FOR SPARK OF IGNITION SYSTEM. 1) Connect the spark plug to ignition coil. 2) Release the fuel pressure. <Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.> 3) Contact the spark plug's thread portion on engine. 4) While the throttle valve is opening 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)-51, FUEL PUMP CIRCUIT, Diagnostics for Engine Starting Failure.>	Go to step 3.
3 CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL & IGNITOR ASSY. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition coil & ignitor ASSY. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between ignition coil & ignitor ASSY connector and engine ground. Connector & terminal (E31) No. 3 (+) — Engine ground (-): (E32) No. 3 (+) — Engine ground (-): (E33) No. 3 (+) — Engine ground (-): (E34) No. 3 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor ASSY, and ignition switch connector • Poor contact in coupling connector
4 CHECK HARNESS OF IGNITION COIL & IGNITOR ASSY GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance between ignition coil & ignitor ASSY connector and engine ground. Connector & terminal (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 5 Ω ?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor ASSY connector and engine grounding terminal
5 CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSY CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from ignition coil & ignitor ASSY. 4) Measure the resistance of harness between ECM and ignition coil & ignitor ASSY connector. Connector & terminal (B135) No. 15 — (E34) No. 1: (B135) No. 16 — (E33) No. 1: (B135) No. 17 — (E32) No. 1: (B135) No. 18 — (E31) No. 1:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and ignition coil & ignitor ASSY connector • Poor contact in coupling connector

Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

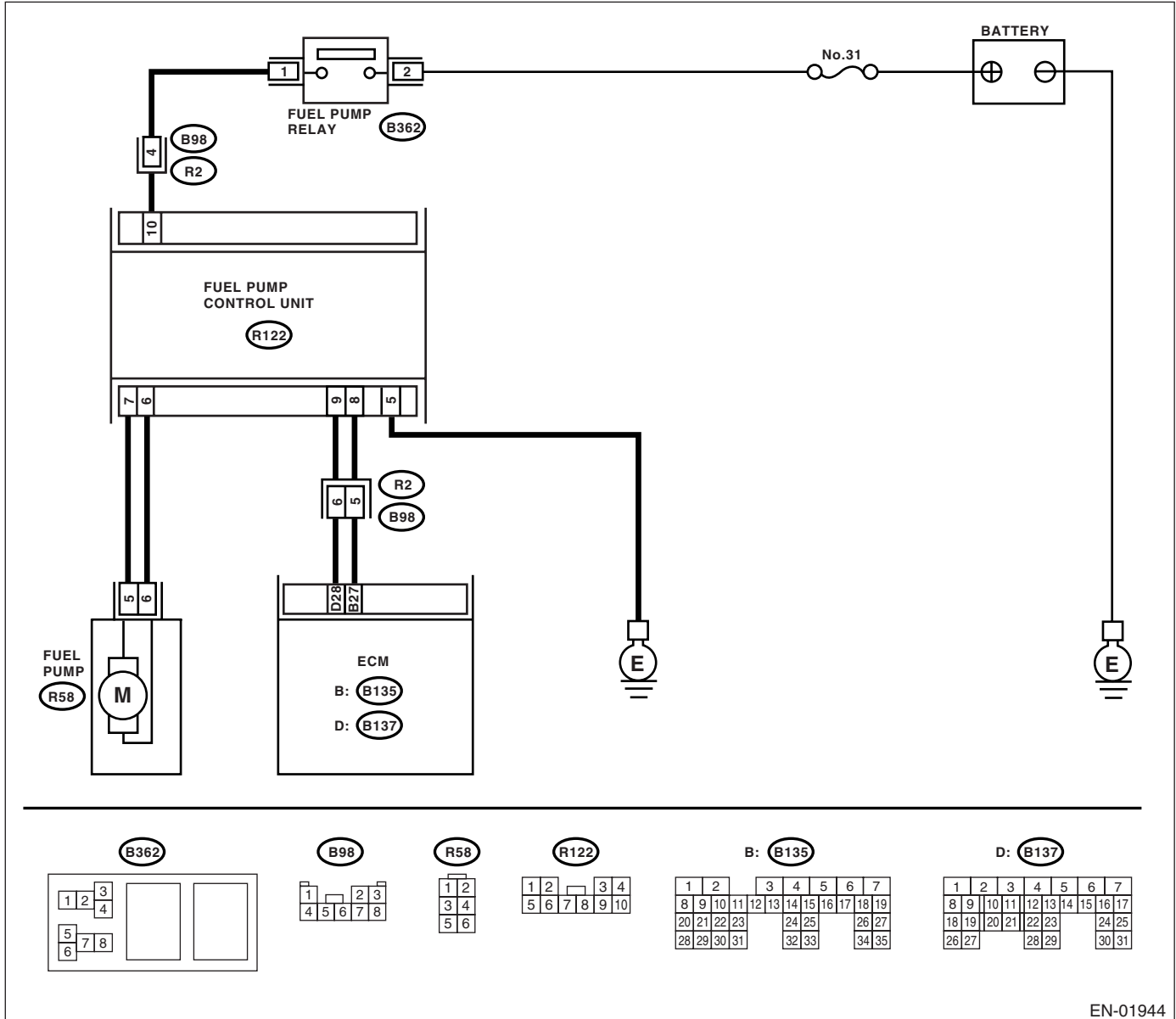
Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSY CONNECTOR. Measure the resistance of harness between ECM and engine ground. <i>Connector & terminal</i> <i>(B135) No. 15 — Engine ground:</i> <i>(B135) No. 16 — Engine ground:</i> <i>(B135) No. 17 — Engine ground:</i> <i>(B135)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

E: FUEL PUMP CIRCUIT

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01944

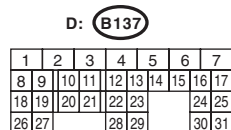
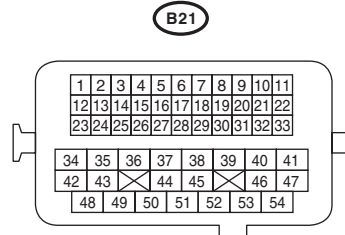
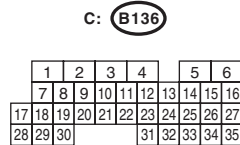
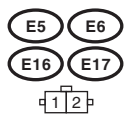
Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATING SOUND OF FUEL PUMP. Make sure that fuel pump is in operation for 2 seconds when turning the ignition switch to ON. NOTE: Fuel pump operation can also be executed using Subaru Select Monitor. Refer to "Compulsory Valve Operation Check Mode" for procedures. <Ref. to EN(H4DOTC)(diag)-31, Compulsory Valve Operation Check Mode.>	Does the fuel pump produce operating sound?	Check the fuel injector circuit. <Ref. to EN(H4DOTC)(diag)-53, FUEL INJECTOR CIRCUIT, Diagnostics for Engine Starting Failure.>	Display DTC. <Ref. to EN(H4DOTC)(diag)-27, OPERATION, Read Diagnostic Trouble Code (DTC).>

CAUTION:

- ### WIRING DIAGRAM:



Diagnostics for Engine Starting Failure

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OPERATION OF EACH FUEL INJECTOR. While cranking the engine, check that each fuel injector emits operating sound. Use a sound scope or attach a screwdriver to the injector for this check.	Does the fuel pump produce operating sound?	Check the fuel pressure. <Ref. to ME(H4DOTC)-26, 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 terminal and engine ground. Connector & terminal #1 (E5) No. 2 (+) — Engine ground (-): #2 (E16) No. 2 (+) — Engine ground (-): #3 (E6) No. 2 (+) — Engine ground (-): #4 (E17) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and fuel injector connector • Poor contact in main relay connector • Poor contact in coupling connector • Poor contact in fuel injector connector
3 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and fuel injector connector. Connector & terminal (B136) No. 6 — (E5) No. 1: (B136) No. 5 — (E16) No. 1: (B136) No. 4 — (E6) No. 1: (B136) No. 3 — (E17) No. 1:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel injector connector • Poor contact in coupling connector
4 CHECK HARNESS BETWEEN ECM AND FUEL INJECTOR CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B136) No. 6 — Chassis ground: (B136) No. 5 — Chassis ground: (B136) No. 4 — Chassis ground: (B136) No. 3 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair the ground short circuit in harness between ECM and fuel injector connector.
5 CHECK EACH FUEL INJECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between each fuel injector terminals. Terminals No. 1 — No. 2:	Is the resistance 5 — 20 Ω ?	Go to step 6.	Replace the faulty fuel injector.
6 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is the poor contact in ECM connector?	Repair the poor contact in ECM connector.	Inspection using "General Diagnostic Table" <Ref. to EN(H4DOTC)(diag)-202, INSPECTION, General Diagnostic Table.>

List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

15.List of Diagnostic Trouble Code (DTC)

A: LIST

DTC	Item	Note
P0031	HO2S Heater Control Circuit Low (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-60, 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)-62, 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)-64, 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)-67, DTC P0038 HO2S HEATER CONTROL CIRCUIT HIGH (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0102	Mass or Volume Air Flow Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-69, 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)-72, DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0107	Manifold Absolute Pressure/Barometric Pressure Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-74, DTC P0107 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0108	Intake Air Pressure Sensor Circuit High Input	<Ref. to EN(H4DOTC)(diag)-76, DTC P0108 MANIFOLD ABSOLUTE PRESSURE/BAROMETRIC PRESSURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0112	Intake Air Temperature Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-78, DTC P0112 INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0113	Intake Air Temperature Circuit High Input	<Ref. to EN(H4DOTC)(diag)-80, DTC P0113 INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0117	Engine Coolant Temperature Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-83, DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0118	Engine Coolant Temperature Circuit High Input	<Ref. to EN(H4DOTC)(diag)-85, DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0122	Throttle/Pedal Position Sensor/Switch "A" Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-88, DTC P0122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0123	Throttle/Pedal Position Sensor/Switch "A" Circuit High Input	<Ref. to EN(H4DOTC)(diag)-90, DTC P0123 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	<Ref. to EN(H4DOTC)(diag)-92, 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)-94, 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)-96, 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)-98, DTC P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Note
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	<Ref. to EN(H4DOTC)(diag)-101, DTC P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0171	System Too Lean (Bank 1)	<Ref. to EN(H4DOTC)(diag)-103, 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)-104, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0222	Throttle/Pedal Position Sensor/Switch "B" Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-107, DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0223	Throttle/Pedal Position Sensor/Switch "B" Circuit High Input	<Ref. to EN(H4DOTC)(diag)-109, DTC P0223 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0230	Fuel Pump Primary Circuit	<Ref. to EN(H4DOTC)(diag)-111, DTC P0230 FUEL PUMP PRIMARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0245	Turbo/Super Charger Wastegate Solenoid "A" Low	<Ref. to EN(H4DOTC)(diag)-114, 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)-116, DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0261	Cylinder 1 Injector Circuit Low	<Ref. to EN(H4DOTC)(diag)-118, DTC P0261 CYLINDER 1 INJECTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0264	Cylinder 2 Injector Circuit Low	<Ref. to EN(H4DOTC)(diag)-118, DTC P0264 CYLINDER 2 INJECTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0267	Cylinder 3 Injector Circuit Low	<Ref. to EN(H4DOTC)(diag)-118, DTC P0267 CYLINDER 3 INJECTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0270	Cylinder 4 Injector Circuit Low	<Ref. to EN(H4DOTC)(diag)-119, DTC P0270 CYLINDER 4 INJECTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	<Ref. to EN(H4DOTC)(diag)-122, DTC P0327 KNOCK SENSOR 1 CIRCUIT LOW INPUT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	<Ref. to EN(H4DOTC)(diag)-124, DTC P0328 KNOCK SENSOR 1 CIRCUIT HIGH INPUT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0335	Crankshaft Position Sensor "A" Circuit	<Ref. to EN(H4DOTC)(diag)-126, DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	<Ref. to EN(H4DOTC)(diag)-128, DTC P0340 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 1 OR SINGLE SENSOR), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0345	Camshaft Position Sensor "A" Circuit (Bank 2)	<Ref. to EN(H4DOTC)(diag)-130, DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0350	Ignition Coil Primary/Secondary Circuit	<Ref. to EN(H4DOTC)(diag)-132, DTC P0350 IGNITION COIL PRIMARY/SECONDARY CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0365	Camshaft Position Sensor "B" Circuit (Bank 1)	<Ref. to EN(H4DOTC)(diag)-135, DTC P0365 CAMSHAFT POSITION SENSOR "B" CIRCUIT (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0390	Camshaft Position Sensor "B" Circuit (Bank 2)	<Ref. to EN(H4DOTC)(diag)-137, DTC P0390 CAMSHAFT POSITION SENSOR "B" CIRCUIT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0458	Evaporative Emission Control System Purge Control Valve Circuit Low	<Ref. to EN(H4DOTC)(diag)-139, DTC P0458 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Note
P0459	Evaporative Emission Control System Purge Control Valve Circuit High	<Ref. to EN(H4DOTC)(diag)-141, DTC P0459 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0500	Vehicle Speed Sensor	<Ref. to EN(H4DOTC)(diag)-143, DTC P0500 VEHICLE SPEED SENSOR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0512	Starter Request Circuit	<Ref. to EN(H4DOTC)(diag)-144, DTC P0512 STARTER REQUEST CIRCUIT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0513	Incorrect Immobilizer Key	<Ref. to IM(diag)-17, DTC P0513 INCORRECT IMMOBILIZER KEY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0519	Idle Control System Malfunction (Fail-Safe)	<Ref. to EN(H4DOTC)(diag)-146, DTC P0519 IDLE CONTROL SYSTEM MALFUNCTION (FAIL-SAFE), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0562	System Voltage Low	<Ref. to EN(H4DOTC)(diag)-147, DTC P0562 SYSTEM VOLTAGE LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0563	System Voltage High	<Ref. to EN(H4DOTC)(diag)-149, DTC P0563 SYSTEM VOLTAGE HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0600	Serial Communication Link	<Ref. to EN(H4DOTC)(diag)-151, DTC P0600 SERIAL COMMUNICATION LINK, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0604	Internal Control Module Read Access Memory (RAM) Error	<Ref. to EN(H4DOTC)(diag)-151, DTC P0604 INTERNAL CONTROL MODULE READ 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)-151, DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0607	Control Module Performance	<Ref. to EN(H4DOTC)(diag)-152, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0638	Throttle Actuator Control Range/Performance (Bank 1)	<Ref. to EN(H4DOTC)(diag)-154, DTC P0638 THROTTLE ACTUATOR CONTROL RANGE/PERFORMANCE (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0700	Transmission Control System (MIL Request)	<Ref. to EN(H4DOTC)(diag)-154, DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0851	Neutral Switch Input Circuit Low	<Ref. to EN(H4DOTC)(diag)-154, DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P0852	Neutral Switch Input Circuit High	<Ref. to EN(H4DOTC)(diag)-154, DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1110	Atmospheric Pressure Sensor Circuit Malfunction (Low Input)	<Ref. to EN(H4DOTC)(diag)-155, DTC P1110 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (LOW INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1111	Atmospheric Pressure Sensor Circuit Malfunction (High Input)	<Ref. to EN(H4DOTC)(diag)-155, DTC P1111 ATMOSPHERIC PRESSURE SENSOR CIRCUIT MALFUNCTION (HIGH INPUT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1160	Return Spring Failure	<Ref. to EN(H4DOTC)(diag)-155, DTC P1160 RETURN SPRING FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1518	Starter Switch Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-156, DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1560	Back-Up Voltage Circuit Malfunction	<Ref. to EN(H4DOTC)(diag)-158, DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1570	Antenna	<Ref. to IM(diag)-18, DTC P1570 ANTENNA, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1571	Reference Code Incompatibility	<Ref. to IM(diag)-21, DTC P1571 REFERENCE CODE INCOMPATIBILITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1572	IMM Circuit Failure (Except Antenna Circuit)	<Ref. to IM(diag)-22, DTC P1572 IMM CIRCUIT FAILURE (EXCEPT ANTENNA CIRCUIT), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Note
P1574	Key Communication Failure	<Ref. to IM(diag)-25, DTC P1574 KEY COMMUNICATION FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1576	EGI Control Module EEPROM	<Ref. to IM(diag)-25, DTC P1576 EGI CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1577	IMM Control Module EEPROM	<Ref. to IM(diag)-25, DTC P1577 IMM CONTROL MODULE EEPROM, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P1578	Meter Failure	<Ref. to IM(diag)-26, DTC P1578 METER FAILURE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2088	OCV Solenoid Valve Signal A Circuit Open (Bank 1)	<Ref. to EN(H4DOTC)(diag)-160, DTC P2088 OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2089	OCV Solenoid Valve Signal A Circuit Short (Bank 1)	<Ref. to EN(H4DOTC)(diag)-162, DTC P2089 OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2090	OCV Solenoid Valve Signal B Circuit Open (Bank 1)	<Ref. to EN(H4DOTC)(diag)-164, DTC P2090 OCV SOLENOID VALVE SIGNAL B CIRCUIT OPEN (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2091	OCV Solenoid Valve Signal B Circuit Short (Bank 1)	<Ref. to EN(H4DOTC)(diag)-166, DTC P2091 OCV SOLENOID VALVE SIGNAL B CIRCUIT SHORT (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2092	OCV Solenoid Valve Signal A Circuit Open (Bank 2)	<Ref. to EN(H4DOTC)(diag)-168, DTC P2092 OCV SOLENOID VALVE SIGNAL A CIRCUIT OPEN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2093	OCV Solenoid Valve Signal A Circuit Short (Bank 2)	<Ref. to EN(H4DOTC)(diag)-170, DTC P2093 OCV SOLENOID VALVE SIGNAL A CIRCUIT SHORT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2094	OCV Solenoid Valve Signal B Circuit Open (Bank 2)	<Ref. to EN(H4DOTC)(diag)-172, DTC P2094 OCV SOLENOID VALVE SIGNAL B CIRCUIT OPEN (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2095	OCV Solenoid Valve Signal B Circuit Short (Bank 2)	<Ref. to EN(H4DOTC)(diag)-174, DTC P2095 OCV SOLENOID VALVE SIGNAL B CIRCUIT SHORT (BANK 2), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2101	Throttle Actuator Control Motor Circuit Range/Performance	<Ref. to EN(H4DOTC)(diag)-176, 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)-181, 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)-183, 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)-184, DTC P2109 THROTTLE ANGLE CLOSED POSITION ERROR, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2122	Throttle/Pedal Position Sensor/Switch "D" Circuit Low Input	<Ref. to EN(H4DOTC)(diag)-185, DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2123	Throttle/Pedal Position Sensor/Switch "D" Circuit High Input	<Ref. to EN(H4DOTC)(diag)-188, 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)-190, 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)-193, DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

List of Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

DTC	Item	Note
P2135	Throttle/Pedal Position Sensor/ Switch "A"/"B" Voltage Rationality	<Ref. to EN(H4DOTC)(diag)-195, DTC P2135 THROTTLE/PEDAL POSITION SENSOR/SWITCH "A" / "B" VOLTAGE RATIONALITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>
P2138	Throttle/Pedal Position Sensor/ Switch "D"/"E" Voltage Rationality	<Ref. to EN(H4DOTC)(diag)-198, DTC P2138 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" / "E" VOLTAGE RATIONALITY, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

16. Diagnostic Procedure with Diagnostic Trouble Code (DTC)

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

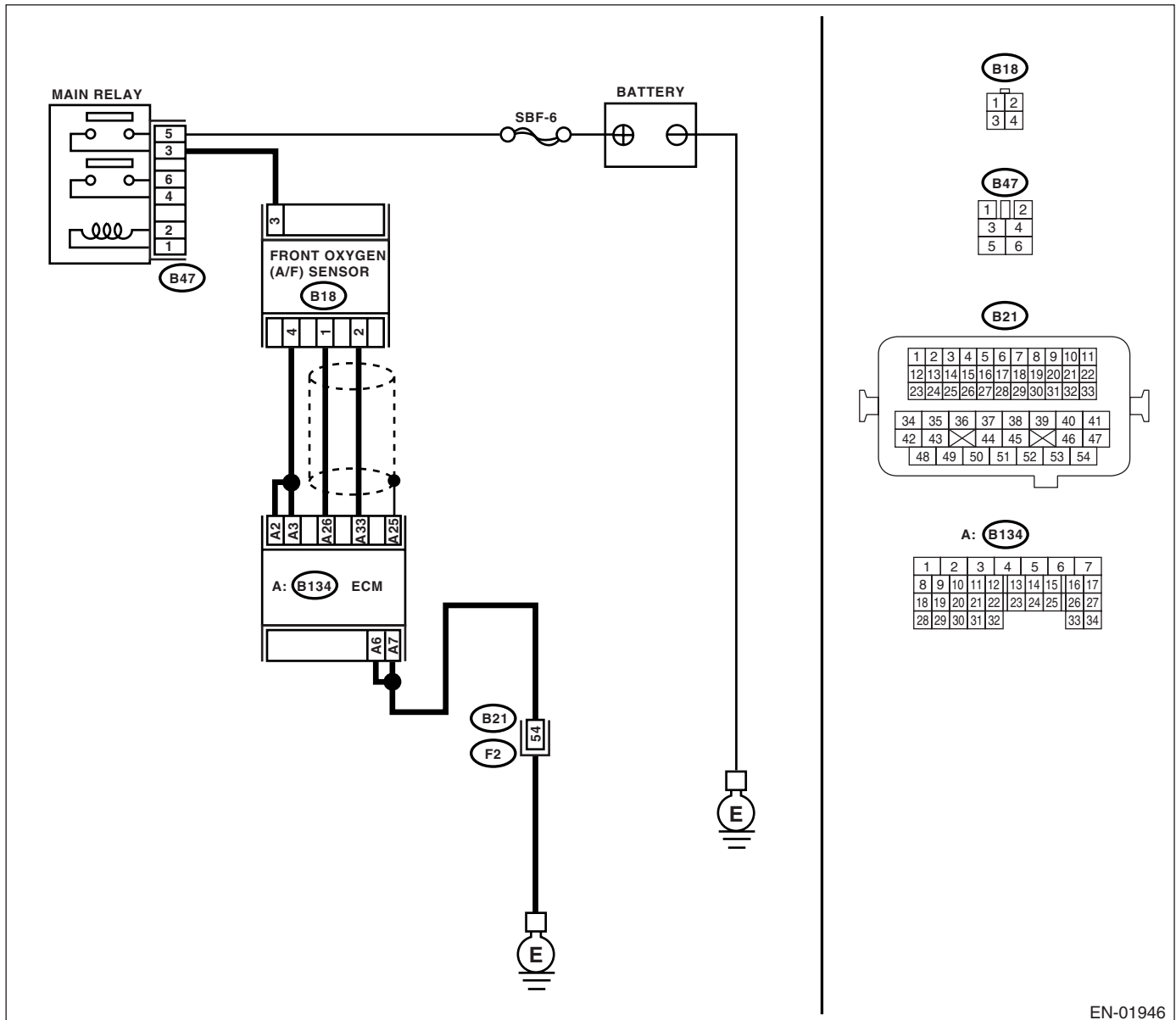
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01946

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK POWER SUPPLY TO FRONT OXYGEN (A/F) SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from front oxygen (A/F) sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between front oxygen (A/F) sensor connector and engine ground. Connector & terminal (B18) No. 3 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 2.	Repair the power supply line. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between main relay and front oxygen (A/F) sensor connector • Poor contact in front oxygen (A/F) sensor connector • Poor contact in main relay connector
2 CHECK HARNESS BETWEEN FRONT OXYGEN (A/F) SENSOR AND ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from ECM. 3) Measure the voltage between front oxygen (A/F) sensor connector and ECM. Connector & terminal (B18) No. 4 — (B134) No. 2: (B18) No. 4 — (B134) No. 3:	Is the resistance less than 1 Ω ?	Go to step 3.	Repair the open circuit in harness between ECM and front oxygen (A/F) sensor.
3 CHECK HARNESS BETWEEN FRONT OXYGEN (A/F) SENSOR AND ECM. Measure the resistance between ECM connector and chassis ground. Connector & terminal (B134) No. 2 — Chassis ground: (B134) No. 3 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 4.	Repair the ground short circuit in harness between ECM and front oxygen (A/F) sensor.
4 CHECK FRONT OXYGEN (A/F) SENSOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between front oxygen (A/F) sensor connector terminals. Terminals No. 3 — No. 4:	Is the resistance 2.4 Ω ?	Repair the poor contact in ECM connector.	Replace the front oxygen (A/F) sensor. <Ref. to FU(H4DOTC)-33, Front Oxygen (A/F) Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

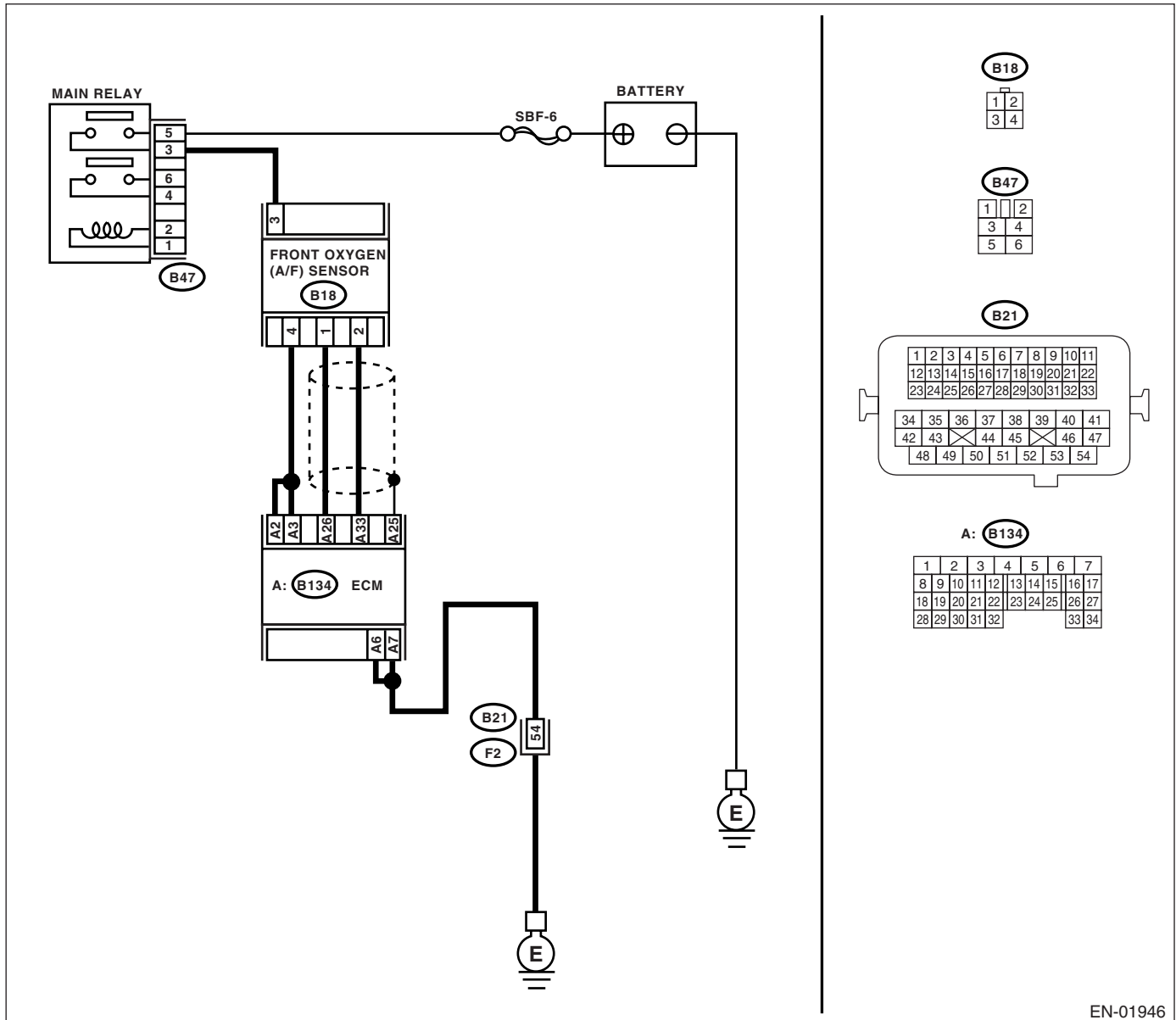
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01946

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK GROUND CIRCUIT FOR ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and chassis ground. Connector & terminal (B134) No. 6 — Chassis ground: (B136) No. 7 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 2.	Repair the open circuit in harness between ECM connector and chassis ground.
2 CHECK VOLTAGE BETWEEN ECM AND FRONT OXYGEN (A/F) SENSOR. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B137) No. 2 (+) — Chassis ground (-): (B137) No. 3 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit in harness between ECM and front oxygen (A/F) sensor connector.	Repair the poor contact in ECM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

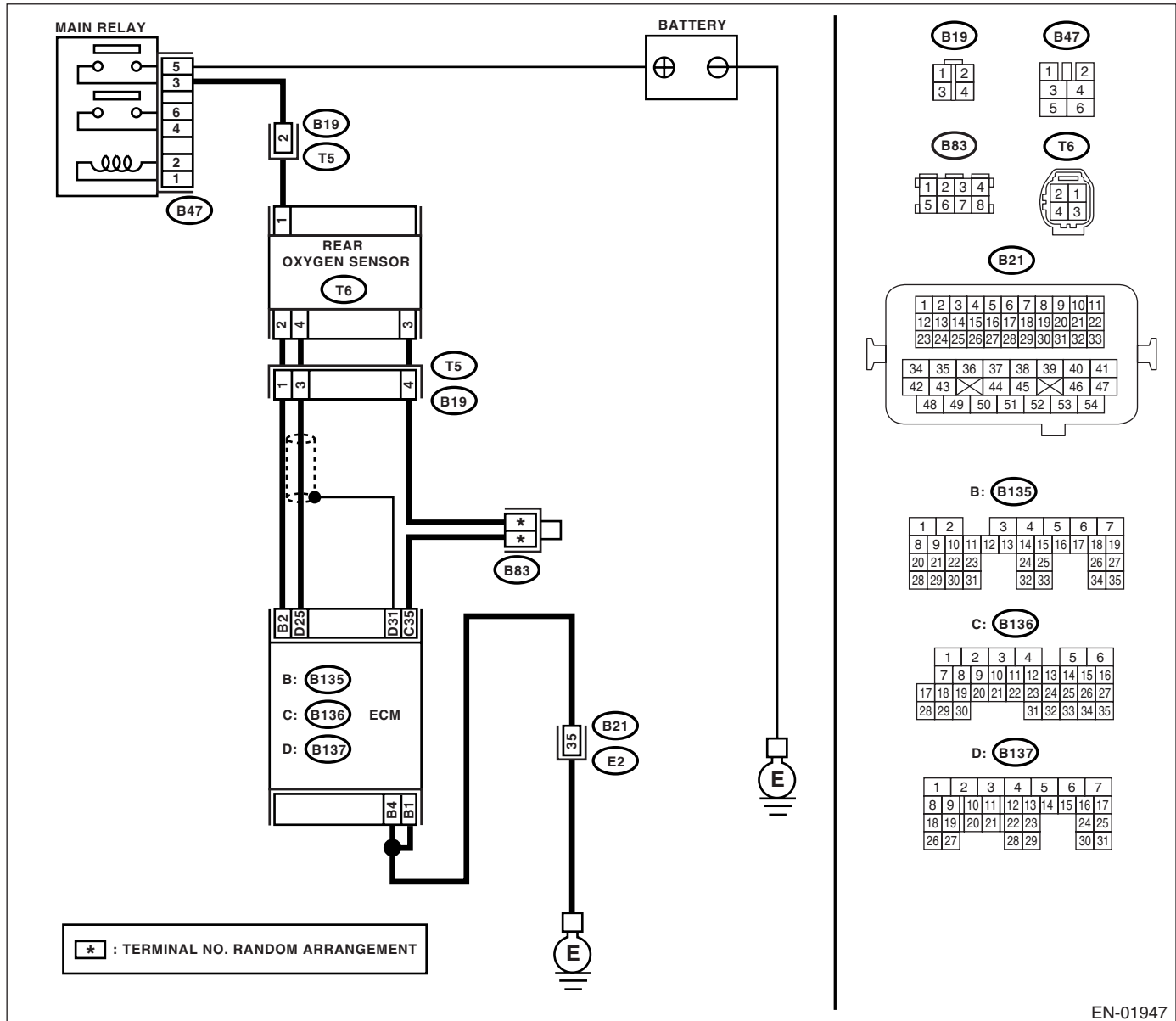
DTC DETECTING CONDITION:

Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01947

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK GROUND CIRCUIT FOR ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B135) No. 1 — Chassis ground: (B135) No. 4 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 2.	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between ECM and engine ground cable • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR. 1) Disconnect the connector from rear oxygen sensor. 2) Measure the resistance between ECM connector and chassis ground. Connector & terminal (B135) No. 2 — Chassis ground:	Is the voltage more than 1 M Ω ?	Go to step 3.	Repair the ground short circuit in harness between ECM and rear oxygen sensor connector.
3 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR. Measure the resistance between ECM connector and chassis ground. Connector & terminal (B135) No. 2 — Chassis ground:	Does the resistance change by shaking the ECM harness and connector?	Repair the poor contact in ECM connector.	Go to step 4.
4 CHECK POWER SUPPLY TO REAR OXYGEN SENSOR. 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. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 5.	Repair the power supply line. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between main relay and rear oxygen sensor connector • Poor contact in rear oxygen sensor connector • Poor contact in coupling connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK REAR OXYGEN SENSOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between rear oxygen sensor connector terminals. Terminals No. 1 — No. 2:	Is the resistance less than 30 Ω ?	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector • Poor contact in coupling connector 	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-34, Rear Oxygen Sensor.>

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

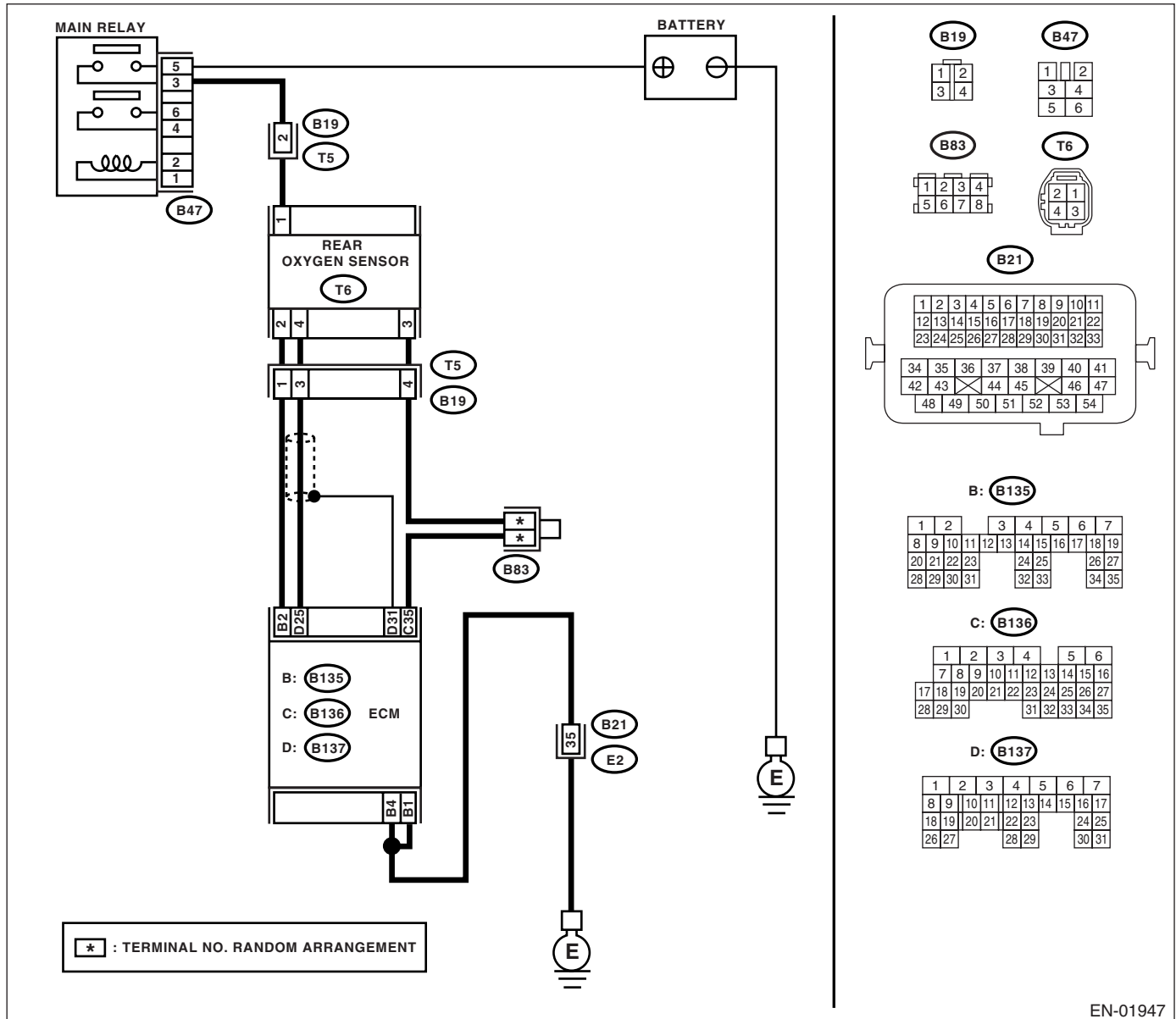
DTC DETECTING CONDITION:

Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01947

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK GROUND CIRCUIT FOR ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B135) No. 4 — Chassis ground: (B135) No. 1 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 2.	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between ECM and engine ground cable • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK HARNESS BETWEEN ECM AND REAR OXYGEN SENSOR. Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 2 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit in harness between ECM and rear oxygen sensor.	Repair the poor connection in ECM connector.

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

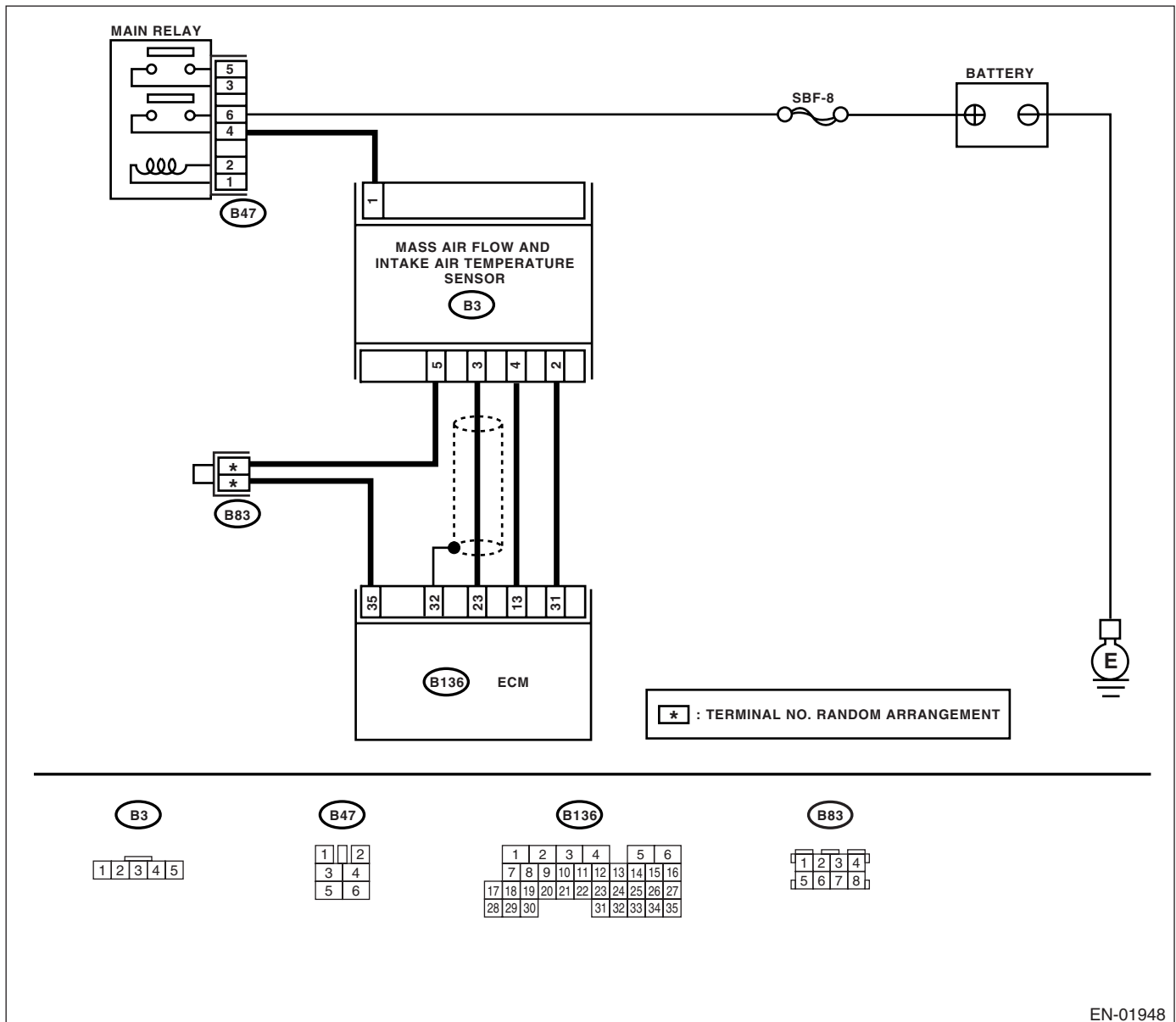
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01948

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 READ THE DATA CONNECTING SUBARU SELECT MONITOR. 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to data link connector. 3) Turn the ignition switch to ON, and the Subaru Select Monitor switch to ON. 4) Start and idle the engine. 5) Read the voltage of mass air flow sensor using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to the "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is the voltage 0.2 — 4.7 V?	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. A temporary poor contact of the connector or harness may be the cause. Repair harness or connector in the mass air flow sensor. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open or ground short circuit in harness between mass air flow sensor and ECM connector • Poor contact in mass air flow sensor or ECM connector 	Go to step 2.
2 CHECK INPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground while engine is idling. Connector & terminal (B136) No. 23 (+) — Chassis ground (-):	Is the voltage more than 0.2 V?	Go to step 4.	Go to step 3.
3 CHECK INPUT SIGNAL FOR ECM (USING SUBARU SELECT MONITOR). Measure the voltage between ECM connector and chassis ground while engine is idling.	Does the voltage change by shaking the harness and connector of ECM while monitoring the value with Subaru Select Monitor?	Repair the poor contact in ECM connector.	Replace and check it again because of ECM malfunction possibility.
4 CHECK POWER SUPPLY TO MASS AIR FLOW SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from mass air flow sensor. 3) Turn the ignition switch to ON. 4) Measure voltage between mass air flow sensor connector and chassis ground. Connector & terminal (B3) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 5.	Repair the open circuit between mass air flow sensor and main relay.
5 CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and mass air flow sensor connector. Connector & terminal (B136) No. 23 — (B3) No. 3: (B136) No. 31 — (B3) No. 2: (B136) No. 35 — (B3) No. 5:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the open circuit between ECM and mass air flow sensor connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW SENSOR CONNECTOR. Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B136) No. 23 — Chassis ground: (B136) No. 31 — Chassis ground: (B136) No. 35 — Chassis ground:	Is the resistance more than 1 MΩ?	Go to step 7.	Repair the ground short circuit between ECM and mass air flow sensor connector.
7 CHECK POOR CONTACT. Check poor contact in mass air flow sensor connector.	Is there poor contact in mass air flow sensor connector?	Repair the poor contact in mass air flow sensor connector.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-28, Mass Air Flow and Intake Air Temperature Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

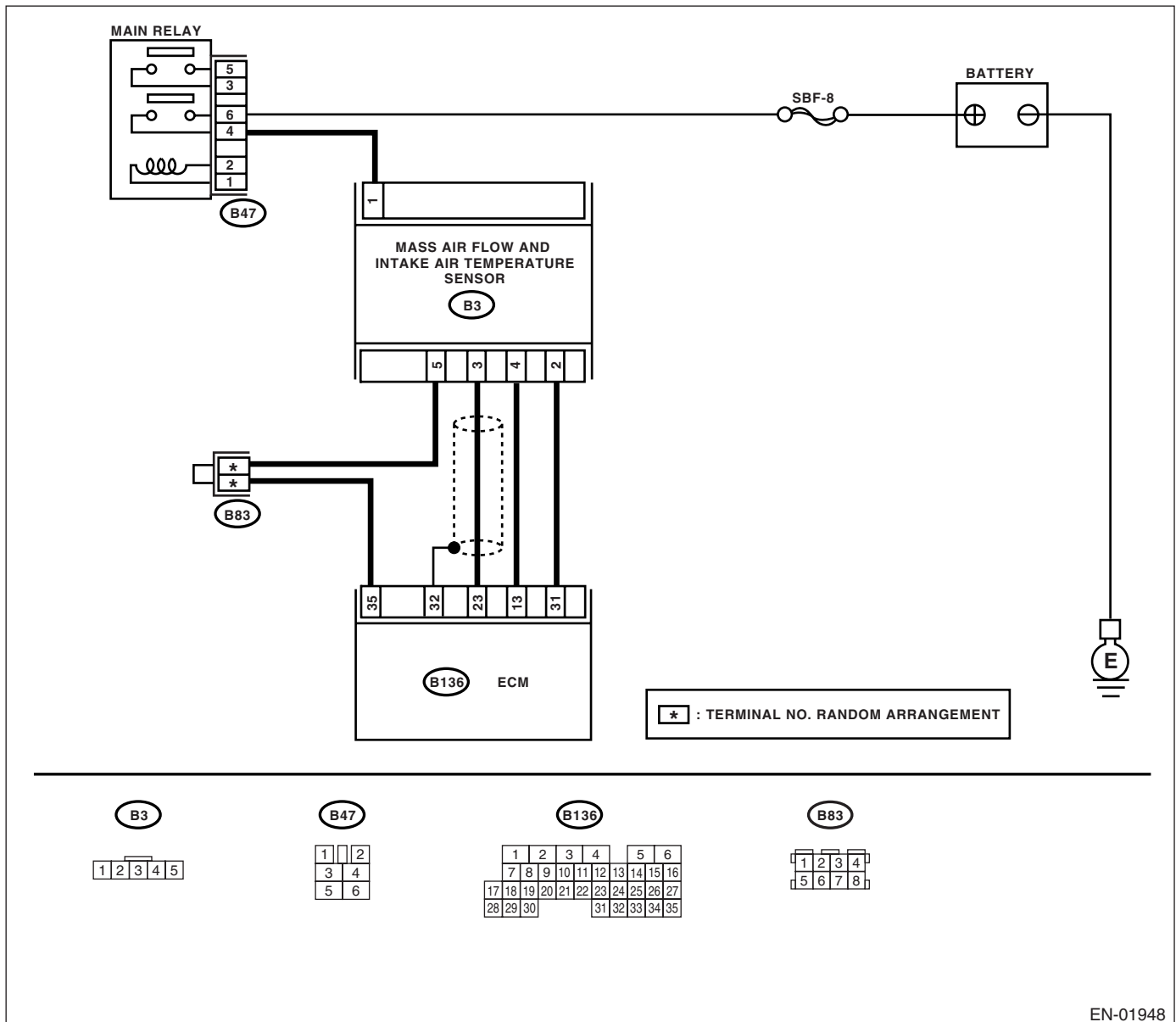
TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01948

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 READ THE DATA CONNECTING SUBARU SELECT MONITOR. 1) Turn the ignition switch to OFF. 2) Connect the Subaru Select Monitor to data link connector. 3) Turn the ignition switch to ON, and the Subaru Select Monitor switch to ON. 4) Start and idle the engine. 5) Read the voltage of mass air flow sensor using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is the voltage 0.2 — 4.7 V?	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time.	Go to step 2.
2 CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from mass air flow sensor. 3) Turn the ignition switch to ON. 4) Measure voltage between mass air flow sensor connector and chassis ground. Connector & terminal (B3) No. 3 (+) — Chassis ground (–):	Is the voltage more than 5 V?	Repair the battery short circuit in harness between mass air flow sensor connector and ECM connector.	Go to step 3.
3 CHECK HARNESS BETWEEN ECM AND MASS AIR FLOW SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM connector and mass air flow sensor connector. Connector & terminal (B3) No. 2 — (B136) No. 31:	Is the resistance less than 1 Ω ?	Replace the mass air flow sensor. <Ref. to FU(H4DOTC)-28, Mass Air Flow and Intake Air Temperature Sensor.>	Repair the open circuit in harness between mass air flow sensor connector and ECM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

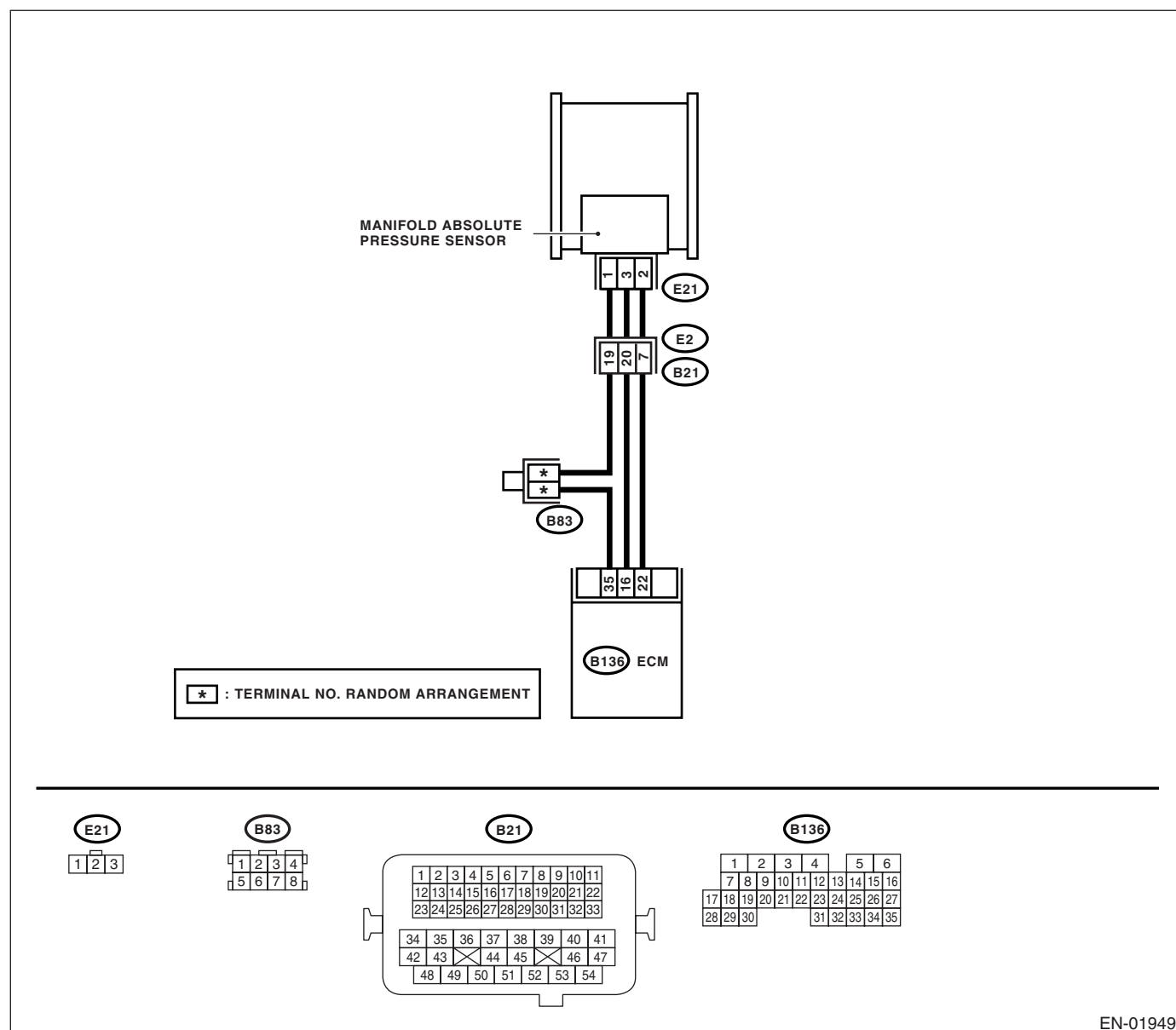
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01949

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 16 (+) — Chassis ground (—):	Is the voltage more than 4.5 V?	Go to step 3.	Go to step 2.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK INPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 16 (+) — Chassis ground (-):	Does the voltage change by shaking the harness and connector of ECM while monitoring the value with voltage meter?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
3 CHECK INPUT SIGNAL FROM ECM. Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 22 (+) — Chassis ground (-):	Is the voltage less than 0.7 V?	Go to step 4.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
4 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the manifold absolute pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between manifold absolute pressure sensor connector and engine ground. Connector & terminal (E21) No. 3 (+) — Engine ground (-):	Is the voltage more than 4.5 V?	Go to step 5.	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
5 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector. Connector & terminal (B136) No. 35 — (E21) No. 1:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
6 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR. Measure the resistance of harness between manifold absolute pressure sensor connector and engine ground. Connector & terminal (E21) No. 1 — Engine ground:	Is the resistance more than 1 $M\Omega$?	Go to step 7.	Repair the ground short circuit in harness between ECM and manifold absolute pressure sensor connector.
7 CHECK POOR CONTACT. Check poor contact in manifold absolute pressure sensor connector.	Is there poor contact in manifold absolute pressure sensor connector?	Repair the poor contact in manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DOTC)-28, Mass Air Flow and Intake Air Temperature Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

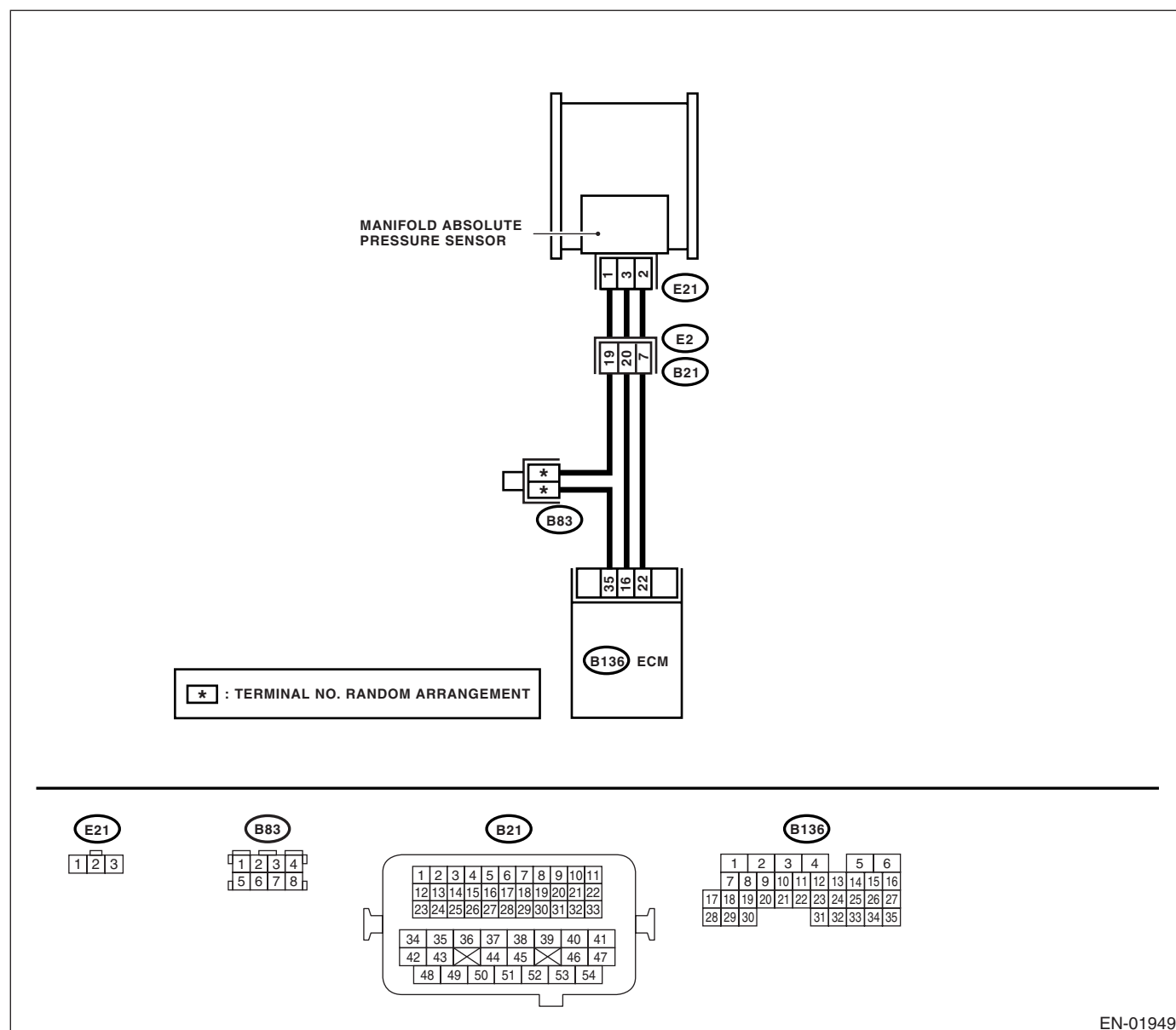
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01949

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 16 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 3.	Go to step 2.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
2 CHECK INPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 16 (+) — Chassis ground (-):	Does the voltage change by shaking the harness and connector of ECM while monitoring the value with voltage meter?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
3 CHECK INPUT SIGNAL FROM ECM. Measure the voltage between ECM connector and chassis ground. Connector & terminal (B136) No. 22 (+) — Chassis ground (-):	Is the voltage more than 4.5 V?	Go to step 4.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
4 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the manifold absolute pressure sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between manifold absolute pressure sensor connector and engine ground. Connector & terminal (E21) No. 3 (+) — Engine ground (-):	Is the voltage more than 4.5 V?	Go to step 5.	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
5 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance of harness between ECM and manifold absolute pressure sensor connector. Connector & terminal (B136) No. 22 — (E21) No. 2:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
6 CHECK HARNESS BETWEEN ECM AND MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR. Measure the resistance of harness between ECM and manifold absolute pressure sensor connector. Connector & terminal (B136) No. 35 — (E21) No. 1:	Is the resistance less than 1 Ω ?	Go to step 7.	Repair the open circuit in harness between ECM and manifold absolute pressure sensor connector.
7 CHECK POOR CONTACT. Check poor contact in manifold absolute pressure sensor connector.	Is there poor contact in manifold absolute pressure sensor connector?	Repair the poor contact in manifold absolute pressure sensor connector.	Replace the manifold absolute pressure sensor. <Ref. to FU(H4DOTC)-29, Manifold Absolute Pressure Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

I: DTC P0112 INTAKE AIR TEMPERATURE CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

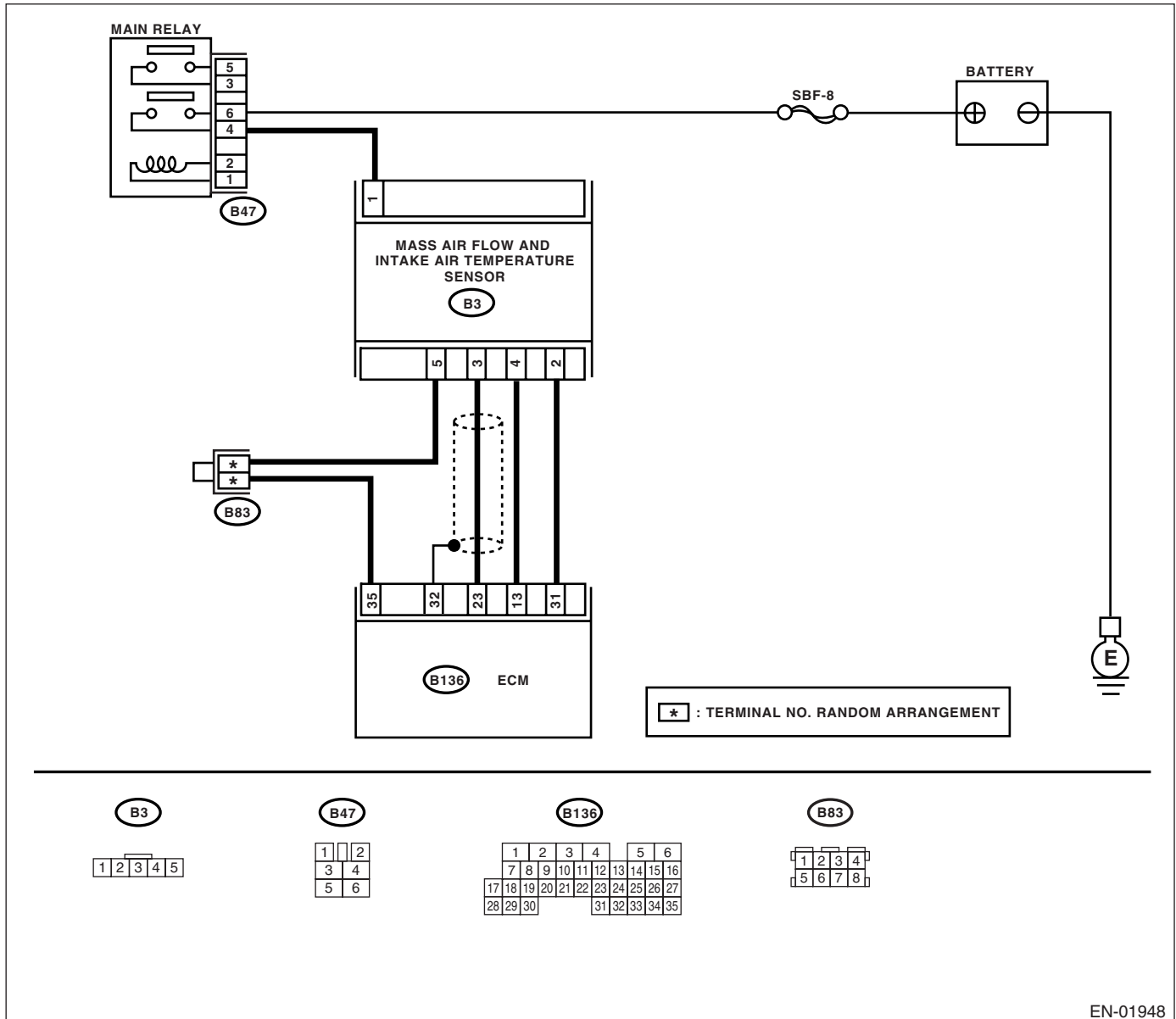
TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01948

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of intake air temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is engine coolant temperature more than 55°C (131°F)?	Go to step 2.	Repair the poor contact. NOTE: In this case, repair the following: • Poor contact in mass air flow and intake air temperature sensor • Poor contact in ECM • Poor contact in joint connector
2 CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector mass air flow and intake air temperature sensor. 3) Turn the ignition switch to ON. 4) Read the data of intake air temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is the value less than -36°C (-33°F)?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-28, Mass Air Flow and Intake Air Temperature Sensor.>	Repair the ground short circuit in harness between mass air flow and intake air temperature sensor and ECM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

J: DTC P0113 INTAKE AIR TEMPERATURE CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

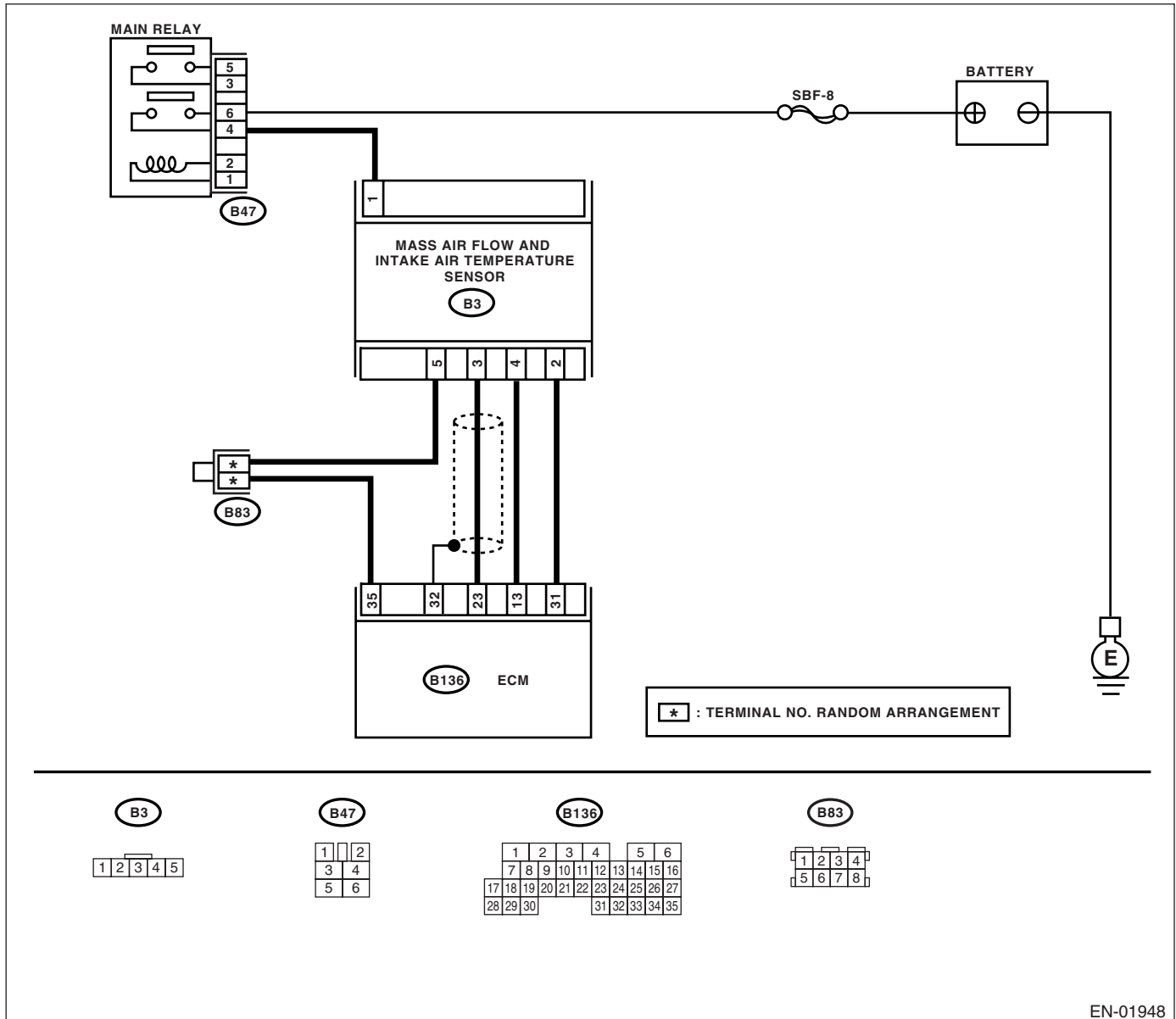
TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01948

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of intake air temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is the value less than -36°C (-33°F)?	Go to step 2.	Repair the poor contact. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Poor contact in mass air flow and intake air temperature sensor • Poor contact in ECM • Poor contact in joint connector
2 CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector mass air flow and intake air temperature sensor. 3) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground. Connector & terminal (B3) No. 4 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit in harness between mass air flow and intake air temperature sensor and ECM connector.	Go to step 3.
3 CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground. Connector & terminal (B3) No. 4 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit in harness between mass air flow and intake air temperature sensor and ECM connector.	Go to step 4.
4 CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. Measure the voltage between mass air flow and intake air temperature sensor connector and engine ground. Connector & terminal (B3) No. 4 (+) — Engine ground (-):	Is the voltage more than 4 V?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in mass air flow and intake air temperature sensor and ECM connector • Poor contact in mass air flow and intake air temperature sensor • Poor contact in ECM • Poor contact in joint connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between mass air flow and intake air temperature sensor and engine ground. Connector & terminal (B3) No. 5 — Engine ground:	Is the resistance less than 5 Ω ?	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-28, Mass Air Flow and Intake Air Temperature Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between mass air flow and intake air temperature sensor and ECM connector • Poor contact in mass air flow and intake air temperature sensor • Poor contact in ECM • Poor contact in joint connector

K: DTC P0117 ENGINE COOLANT TEMPERATURE CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

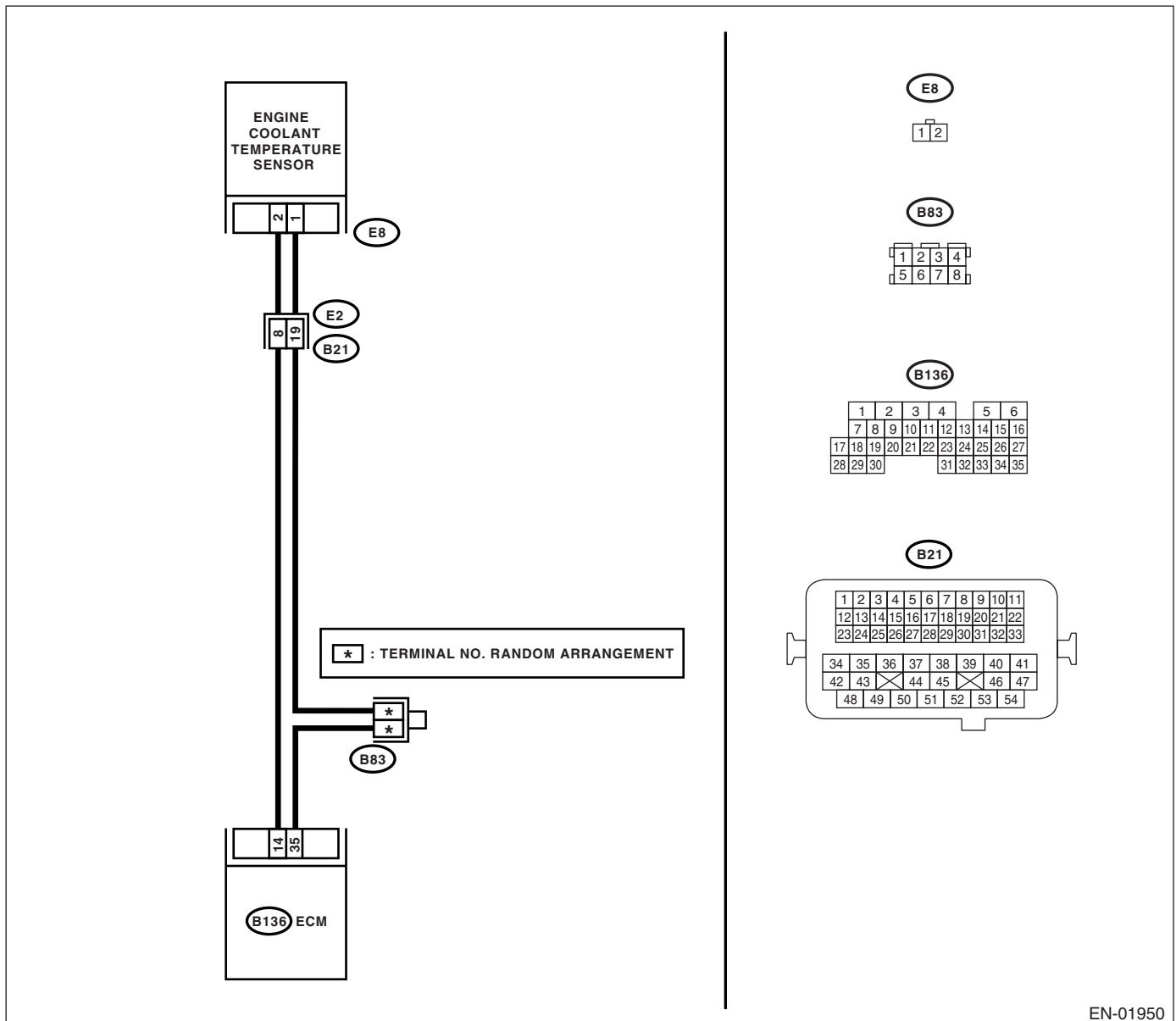
TROUBLE SYMPTOM:

- Hard to start
- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01950

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is engine coolant temperature more than 120°C (248°F)?	Go to step 2.	Repair the poor contact. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Poor contact in engine coolant temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the engine coolant temperature sensor. 3) Turn the ignition switch to ON. 4) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is engine coolant temperature more than -40°C (-40°F)?	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-23, Engine Coolant Temperature Sensor.>	Repair the ground short circuit in harness between engine coolant temperature sensor and ECM connector.

L: DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

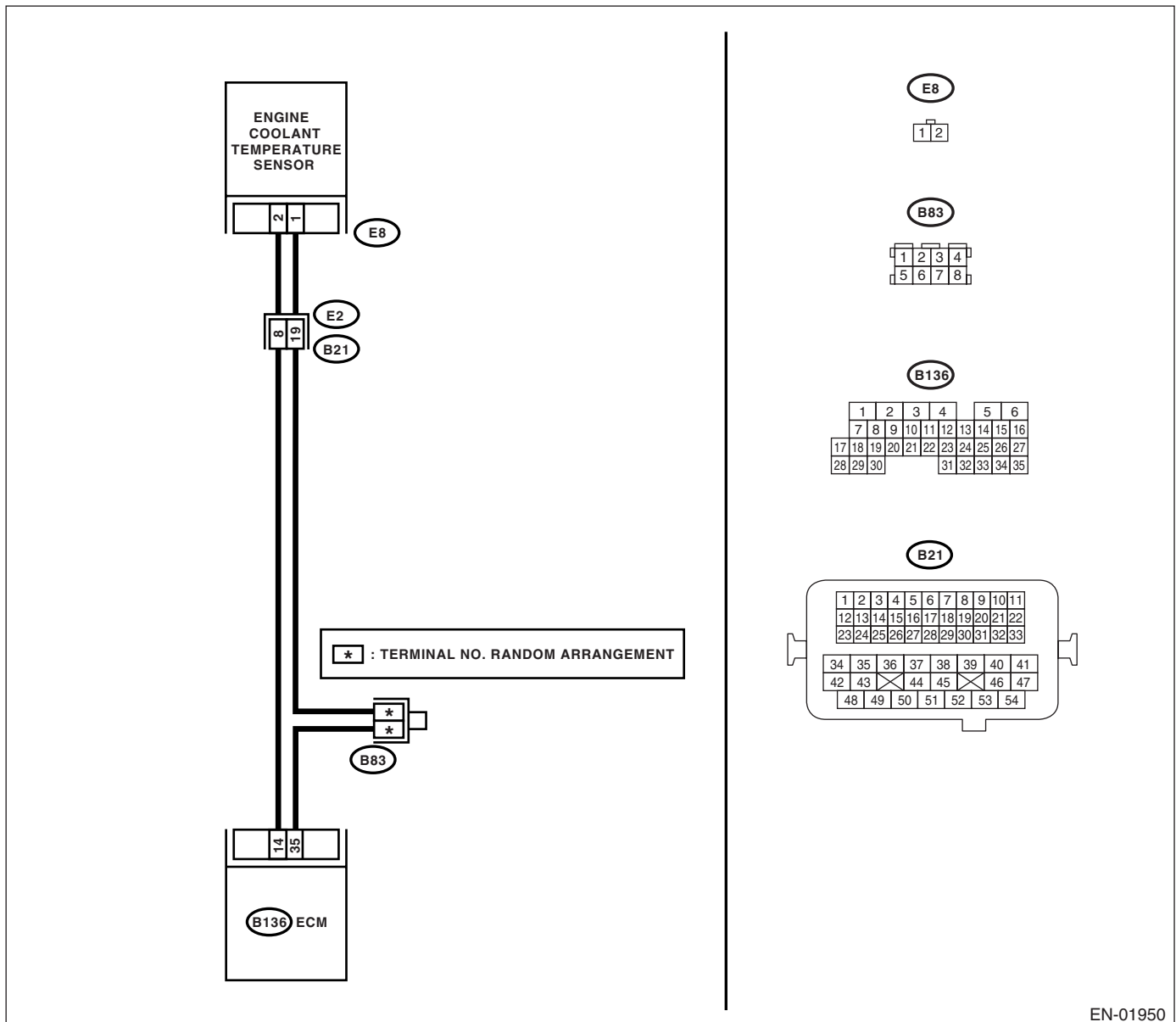
TROUBLE SYMPTOM:

- Hard to start
- Erroneous idling
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01950

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK CURRENT DATA. 1) Start the engine. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is engine coolant temperature less than -40°C (-40°F)?	Go to step 2.	Repair the poor contact. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Poor contact in engine coolant temperature sensor • Poor contact in ECM • Poor contact in coupling connector • Poor contact in joint connector
2 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from the engine coolant temperature sensor. 3) Measure the voltage between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit in harness between ECM and engine coolant temperature sensor connector.	Go to step 3.
3 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit in harness between ECM and engine coolant temperature sensor connector.	Go to step 4.
4 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. Measure the voltage between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 2 (+) — Engine ground (-):	Is the voltage more than 4 V?	Go to step 5.	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between ECM and engine coolant temperature sensor connector • Poor contact in engine coolant temperature sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN ENGINE COOLANT TEMPERATURE SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between engine coolant temperature sensor connector and engine ground. Connector & terminal (E8) No. 1 — Engine ground:	Is the resistance less than 5 Ω ?	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-23, Engine Coolant Temperature Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between ECM and engine coolant temperature sensor connector • Poor contact in engine coolant temperature sensor connector • Poor contact in ECM connector • Poor contact in coupling connector • Poor contact in joint connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

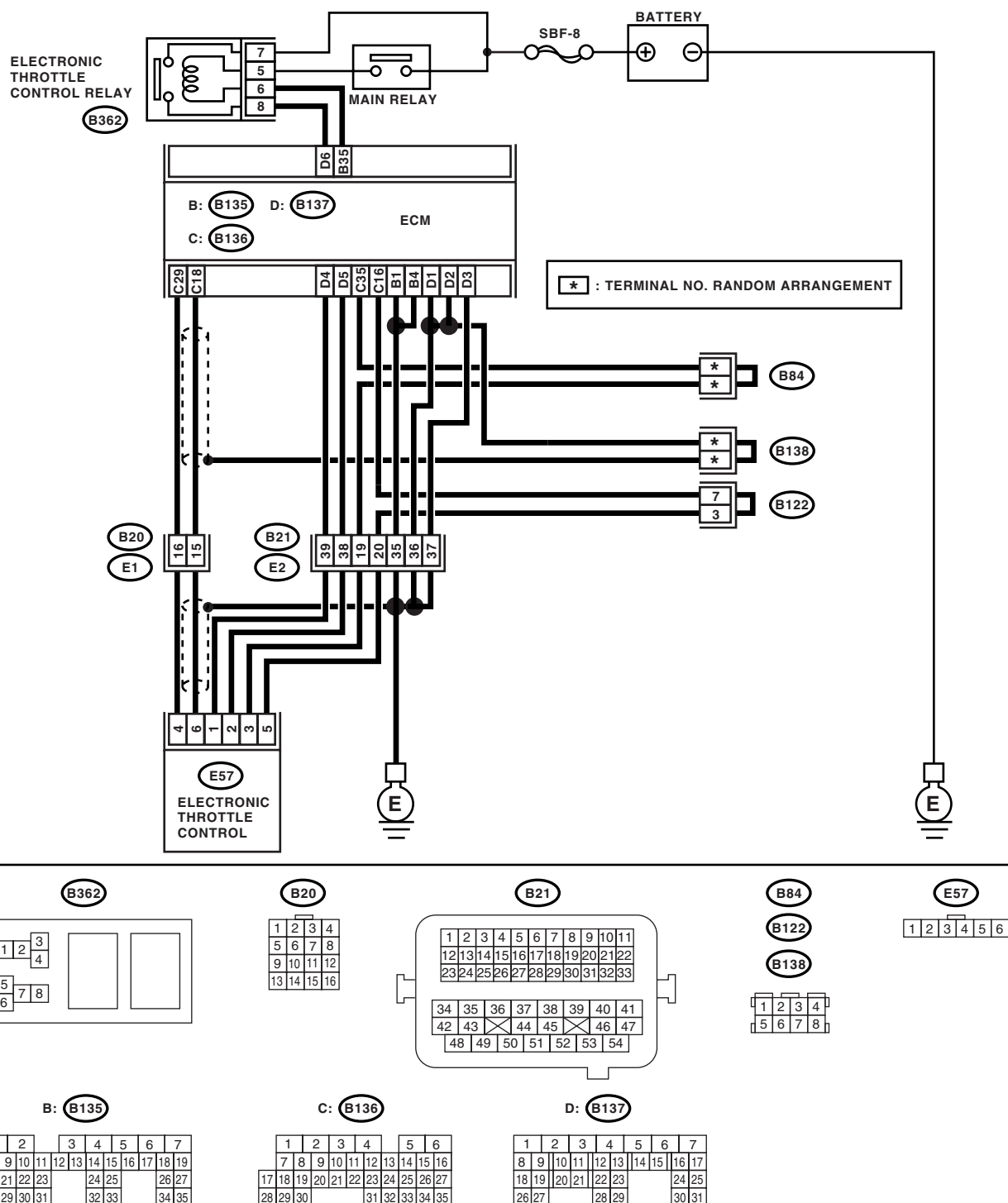
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

WIRING DIAGRAM:



EN-01951

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SENSOR OUTPUT. 1) Turn the ignition switch to ON. 2) Read the data of main throttle sensor signal using Subaru Select Monitor.	Is the voltage more than 0.4 V?	Go to step 2.	Go to step 3.
2 CHECK POOR CONTACT. Check the poor contact in connector between ECM and electronic throttle control.	Is there poor contact in connector between ECM and electronic throttle control?	Repair the poor contact.	Temporary poor contact occurred, but it is normal at present.
3 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from the electronic throttle control. 4) Measure the resistance between ECM connector and electronic throttle control connector. Connector & terminal (B136) No. 16 — (E57) No. 5: (B136) No. 18 — (E57) No. 6:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness connector.
4 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. Measure the resistance between ECM connector and chassis ground. Connector & terminal (B136) No. 18 — Chassis ground: (B136) No. 16 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair the chassis short circuit of harness.
5 CHECK POWER SUPPLY OF ELECTRONIC THROTTLE CONTROL. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. Connector & terminal (E57) No. 5 (+) — Engine ground (-):	Is the voltage 4.5 — 5.5 V?	Go to step 6.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
6 CHECK SHORT CIRCUIT INSIDE THE ECM. 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control connector and engine ground. Connector & terminal (E57) No. 6 — Engine ground:	Is the resistance more than 10 Ω ?	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

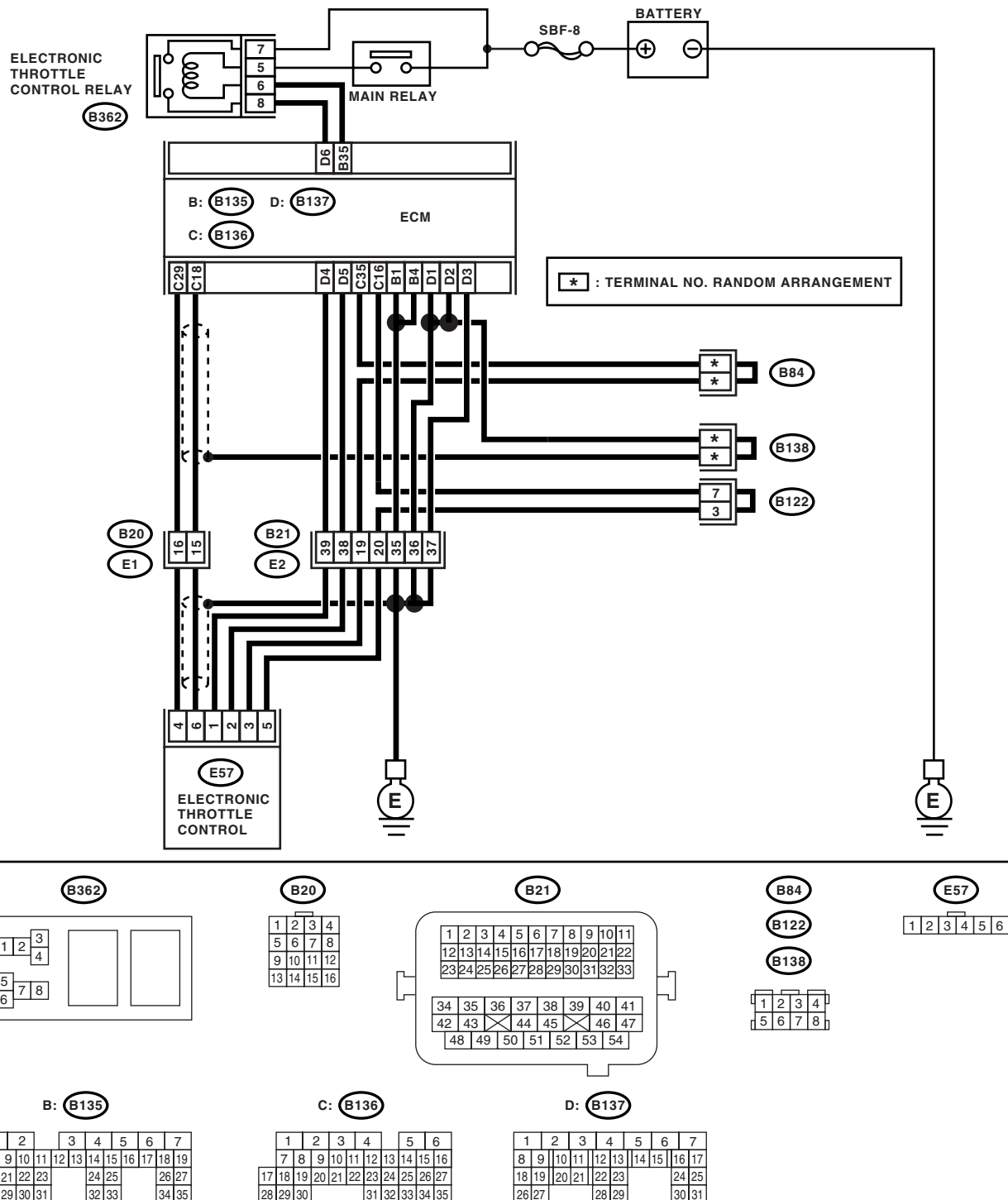
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

WIRING DIAGRAM:



EN-01951

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SENSOR OUTPUT. 1) Turn the ignition switch to ON. 2) Read the data of main throttle sensor signal using Subaru Select Monitor.	Is the voltage less than 4.63 V?	Go to step 2.	Go to step 3.
2 CHECK POOR CONTACT. Check the poor contact in connector between ECM and electronic throttle control.	Is there poor contact in connector between ECM and electronic throttle control?	Repair the poor contact.	Temporary poor contact occurred, but it is normal at present.
3 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from the electronic throttle control. 4) Measure the resistance between ECM connector and electronic throttle control connector. Connector & terminal (B136) No. 18 — (E57) No. 6: (B136) No. 35 — (E57) No. 3:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness connector.
4 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 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 (-): 3) Check the voltage change by shaking the harness and connector of ECM and engine harness connector while monitoring the value with voltage meter.	Is the voltage less than 10 V?	Go to step 5.	Repair the battery short circuit in harness between ECM connector and electronic throttle control connector.
5 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. Connector & terminal (B136) No. 18 — (B136) No. 16:	Is the resistance more than 1 M Ω ?	Repair the poor contact in harness. Repair the electronic throttle control.	Repair the short circuit to sensor power supply.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

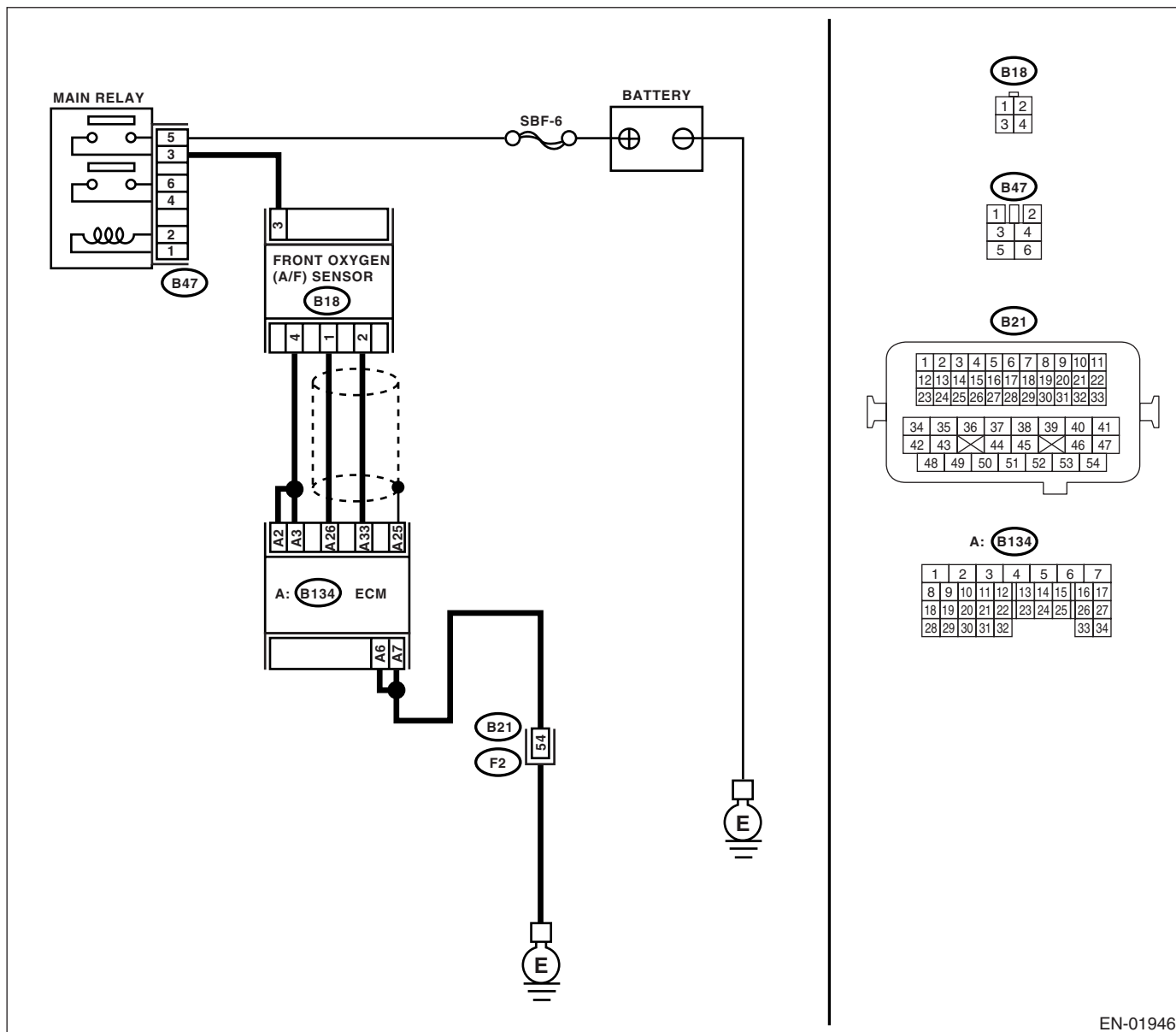
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01946

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

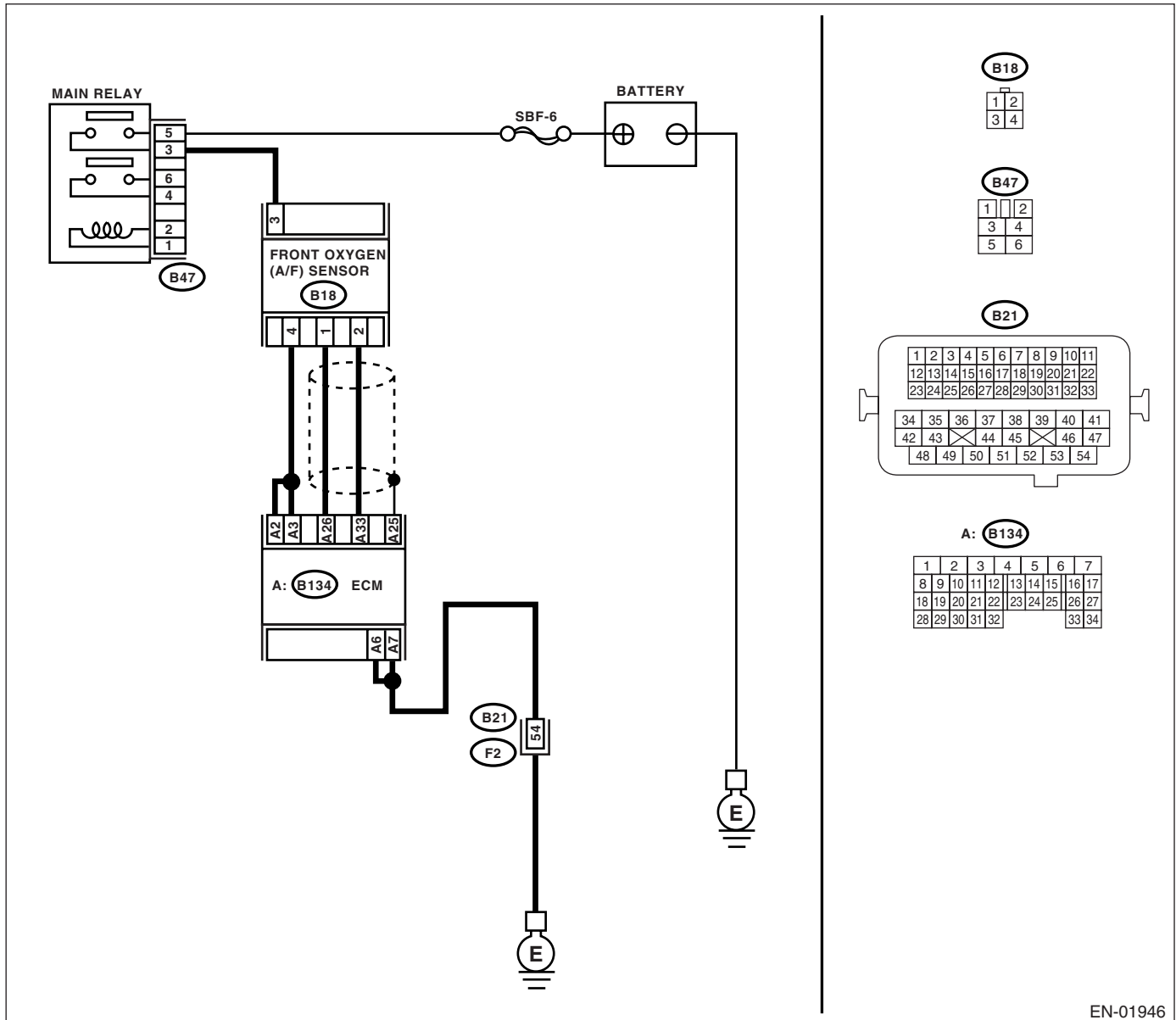
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01946

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

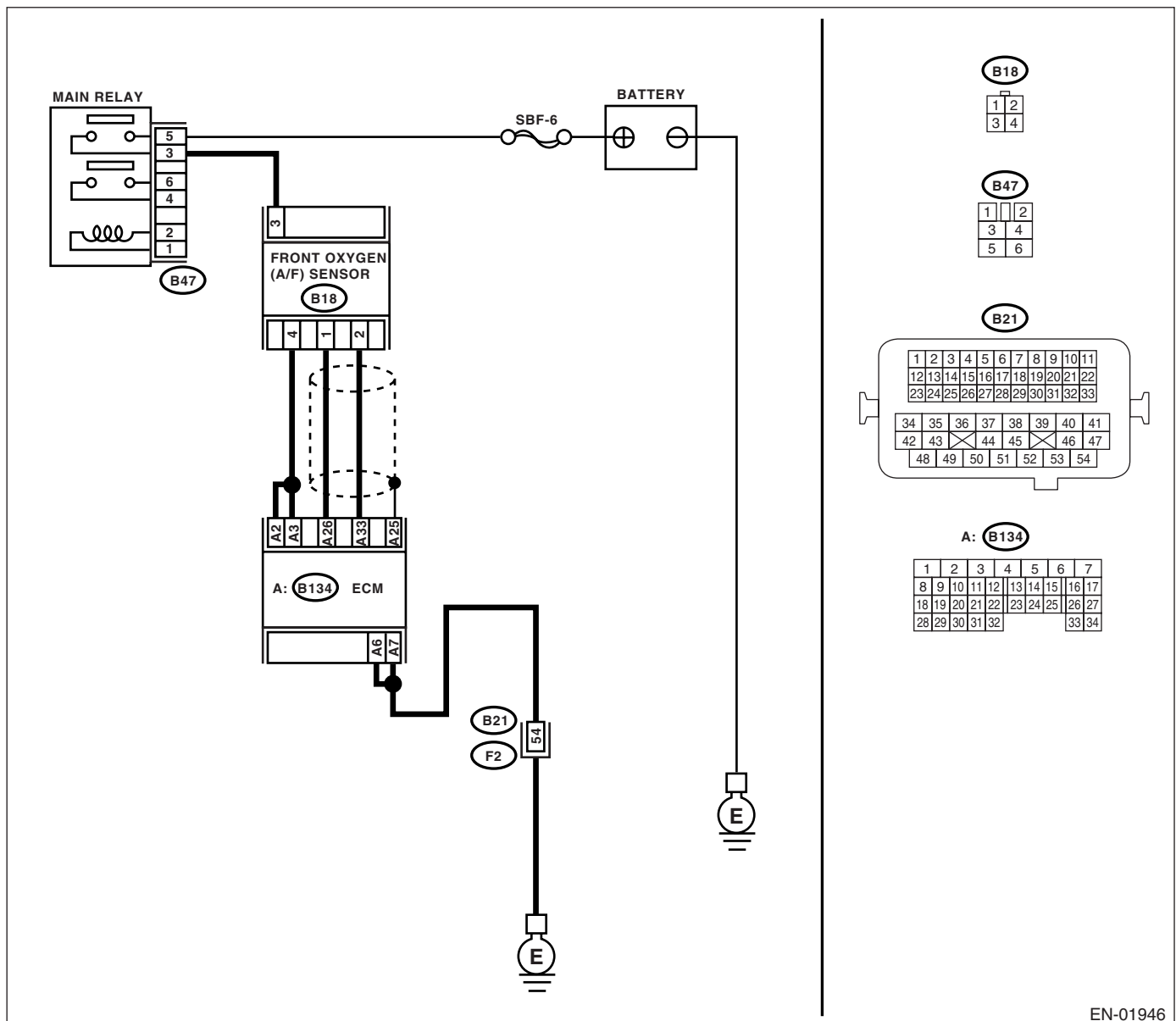
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01946

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

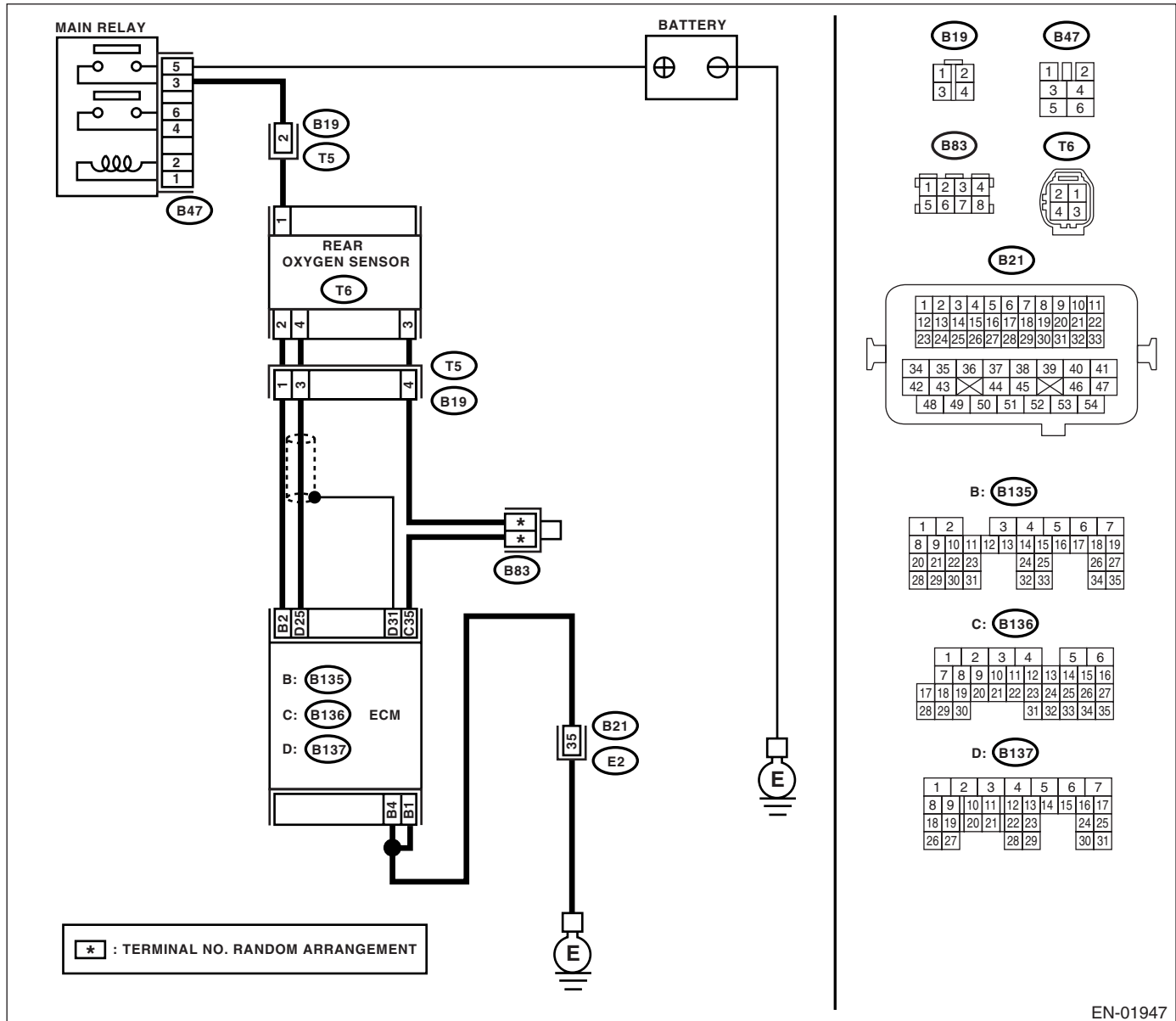
DTC DETECTING CONDITION:

Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01947

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK REAR OXYGEN SENSOR DATA. 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and keep the engine speed at 2,000 rpm to 3,000 rpm for 2 minutes. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Does the value fluctuate?	Go to step 6.	Go to step 3.
3 CHECK REAR OXYGEN SENSOR DATA. Read the data of rear oxygen sensor signal using Subaru Select Monitor.	Is the voltage 0.2 — 0.4 V?	Go to step 4.	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-34, Rear Oxygen Sensor.>
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 in harness between ECM and rear oxygen sensor connector. Connector & terminal (B137) No. 25 — (T6) No. 4:	Is the resistance more than 3 Ω?	Repair the open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 5.
5 CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor harness connector and chassis ground. Connector & terminal (T6) No. 4 (+) — Chassis ground (-):	Is the voltage more than 0.2 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-34, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK EXHAUST SYSTEM. Check exhaust system parts. NOTE: Check the following items: <ul style="list-style-type: none">• Loose part of exhaust system and incomplete installation• Damage (crack, hole etc.) of parts• Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	Is there a fault in exhaust system?	Repair or replace the faulty part.	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-34, Rear Oxygen Sensor.>

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

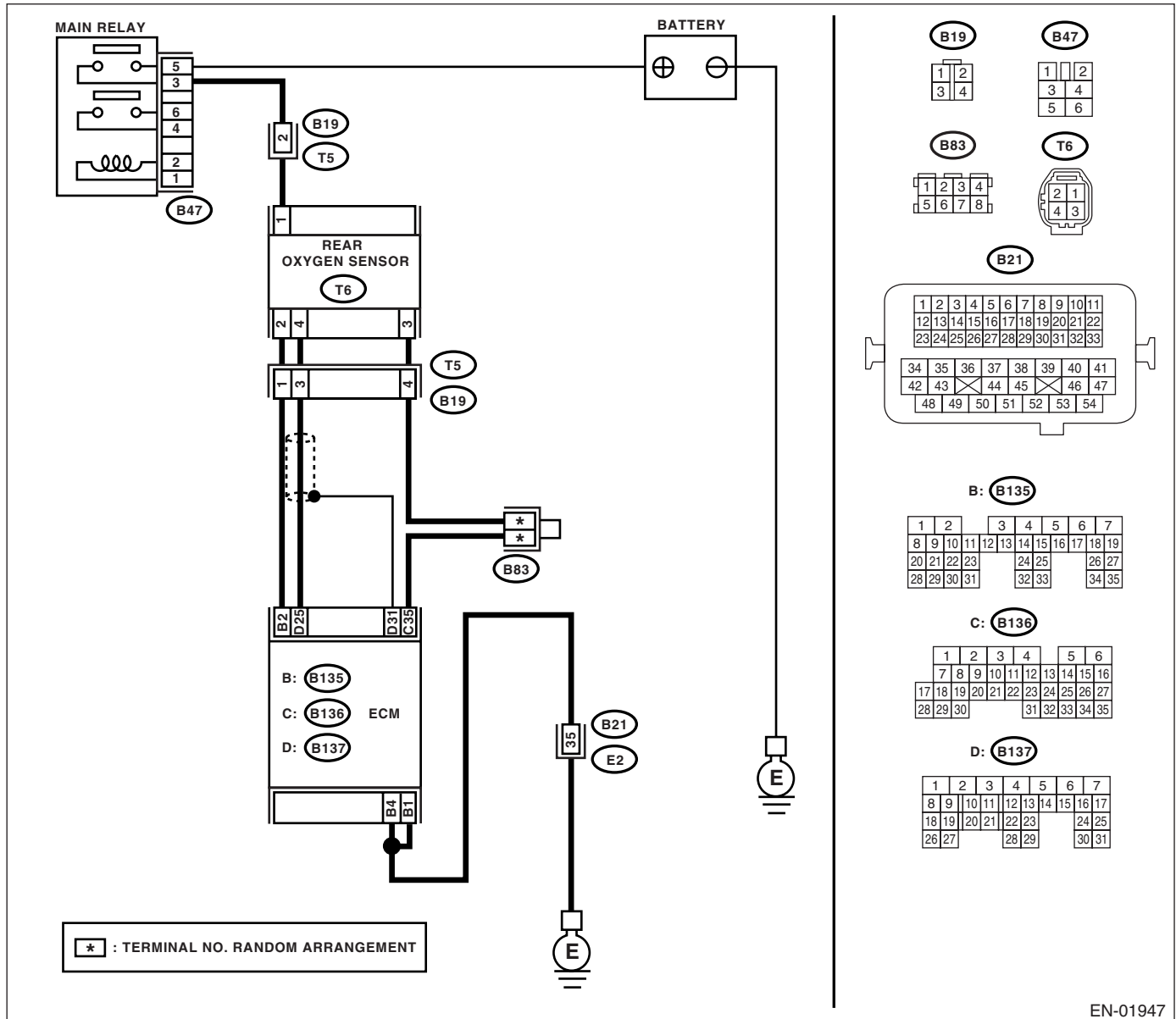
DTC DETECTING CONDITION:

Two consecutive driving cycles with fault

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01947

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK REAR OXYGEN SENSOR DATA. 1) Warm-up the engine until engine coolant temperature is above 70°C (158°F), and keep the engine speed at 2,000 rpm to 3,000 rpm for two minutes. 2) Read the data of rear oxygen sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Does the value fluctuate?	Go to step 6.	Go to step 3.
3 CHECK REAR OXYGEN SENSOR DATA. Read the data of rear oxygen sensor signal using Subaru Select Monitor.	Is the voltage 0.2 — 0.4 V?	Go to step 4.	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-34, Rear Oxygen Sensor.>
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 in harness between ECM and rear oxygen sensor connector. Connector & terminal (B137) No. 25 — (T6) No. 4:	Is the resistance more than 3 Ω?	Repair the open circuit in harness between ECM and rear oxygen sensor connector.	Go to step 5.
5 CHECK HARNESS BETWEEN REAR OXYGEN SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from rear oxygen sensor. 3) Turn the ignition switch to ON. 4) Measure the voltage between rear oxygen sensor harness connector and chassis ground. Connector & terminal (T6) No. 4 (+) — Chassis ground (-):	Is the voltage more than 0.2 V?	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-34, Rear Oxygen Sensor.>	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between rear oxygen sensor and ECM connector • Poor contact in rear oxygen sensor connector • Poor contact in ECM connector

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
6 CHECK EXHAUST SYSTEM. Check exhaust system parts. NOTE: Check the following items: <ul style="list-style-type: none">• Loose part of exhaust system and incomplete installation• Damage (crack, hole etc.) of parts• Looseness and ill fitting of parts between front oxygen (A/F) sensor and rear oxygen sensor	Is there a fault in exhaust system?	Repair or replace the faulty part.	Replace the rear oxygen sensor. <Ref. to FU(H4DOTC)-34, Rear Oxygen Sensor.>

T: DTC P0171 SYSTEM TOO LEAN (BANK 1)

NOTE:

For diagnostic procedure, refer to DTC P0172. <Ref. to EN(H4DOTC)(diag)-104, DTC P0172 SYSTEM TOO RICH (BANK 1), Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

U: DTC P0172 SYSTEM TOO RICH (BANK 1)

DTC DETECTING CONDITION:

Two consecutive driving cycles with fault

TROUBLE SYMPTOM:

- Erroneous idling
- Engine stalls.
- Poor driving performance

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK EXHAUST SYSTEM.	Are there holes or loose bolts on exhaust system?	Repair exhaust system.	Go to step 2.
2 CHECK AIR INTAKE SYSTEM.	Are there holes, loose bolts or disconnection of hoses on air intake system?	Repair air intake system.	Go to step 3.
3 CHECK FUEL PRESSURE. Warning: • Place “NO FIRE” signs near the working area. • Be careful not to spill fuel. 1) Release the fuel pressure. (1) Disconnect the connector from fuel pump relay. (2) Start the engine and run it until it stalls. (3) After the engine stalls, crank it for 5 more seconds. (4) Turn the ignition switch to OFF. 2) Connect the connector to fuel pump relay. 3) Disconnect the fuel delivery hose from fuel filter, and connect the fuel pressure gauge. 4) Install the fuel filler cap. 5) Start the engine and idle while gear position is neutral. 6) Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold. Warning: 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 fuel pressure 284 — 314 kPa (2.9 — 3.2 kg/cm ² , 41 — 46 psi)?	Go to step 4.	Repair the following items. 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

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
4 CHECK FUEL PRESSURE. After connecting the pressure regulator vacuum hose, measure fuel pressure. Warning: Release fuel pressure before removing the fuel pressure gauge. NOTE: <ul style="list-style-type: none"> If fuel pressure does not increase, squeeze fuel return hose 2 to 3 times, then measure fuel pressure again. If out of specification as measured at this step, check or replace pressure regulator and pressure regulator vacuum hose. 	Is measured value 206 — 235 kPa (2.1 — 2.4 kg/cm ² , 30 — 34 psi)?	Go to step 5.	Repair the following items. Fuel pressure is too high: <ul style="list-style-type: none"> Faulty pressure regulator Clogged fuel return line or bent hose Fuel pressure is too low: <ul style="list-style-type: none"> Faulty pressure regulator Improper fuel pump discharge Clogged fuel supply line
5 CHECK ENGINE COOLANT TEMPERATURE SENSOR. 1) Start the engine and warm-up completely. 2) Read the data of engine coolant temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is engine coolant temperature more than 60°C (140°F)?	Go to step 6.	Replace the engine coolant temperature sensor. <Ref. to FU(H4DOTC)-23, Engine Coolant Temperature Sensor.>
6 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR. 1) Start and warm-up the engine until engine coolant temperature is greater than 60°C (140°F). 2) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Is the measured value within the following? Ignition ON: 73.3 — 106.6 kPa (550 — 800 mmHg, 21.65 — 31.50 inHg) Idling: 24.0 — 41.3 kPa (180 — 310 mmHg, 7.09 — 12.20 inHg)	Go to step 7.	Replace the mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-28, Mass Air Flow and Intake Air Temperature Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
7 CHECK MASS AIR FLOW AND INTAKE AIR TEMPERATURE SENSOR. 1) Start and warm-up the engine until engine coolant temperature is greater than 60°C (140°F). 2) Place the shift lever in neutral position. 3) Turn the A/C switch to OFF. 4) Turn all accessory switches to OFF. 5) Open the hood. 6) Measure the ambient temperature. 7) Read the data of mass air flow and intake air temperature sensor signal using Subaru Select Monitor. NOTE: For detailed operation procedure, refer to "READ CURRENT DATA SHOWN ON DISPLAY FOR ENGINE". <Ref. to EN(H4DOTC)(diag)-21, Subaru Select Monitor.>	Subtract the ambient temperature from intake air temperature, and is the value from – 10°C (14°F) to 50°C (122°F)?	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Check mass air flow and intake air temperature sensor. <Ref. to FU(H4DOTC)-28, Mass Air Flow and Intake Air Temperature Sensor.>

V: DTC P0222 THROTTLE/PEDAL POSITION SENSOR/SWITCH "B" CIRCUIT LOW INPUT

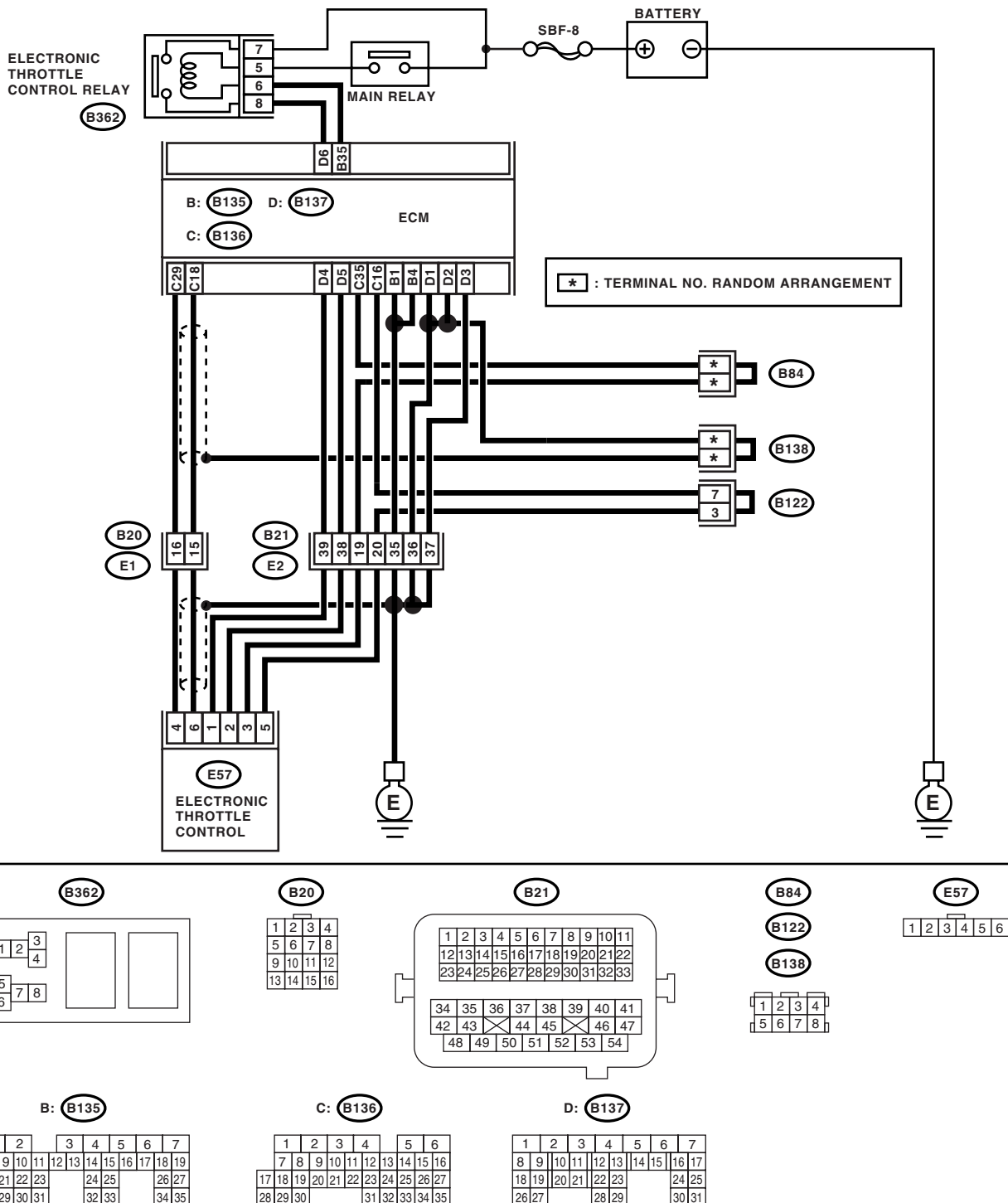
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance
- Engine stalls.

WIRING DIAGRAM:

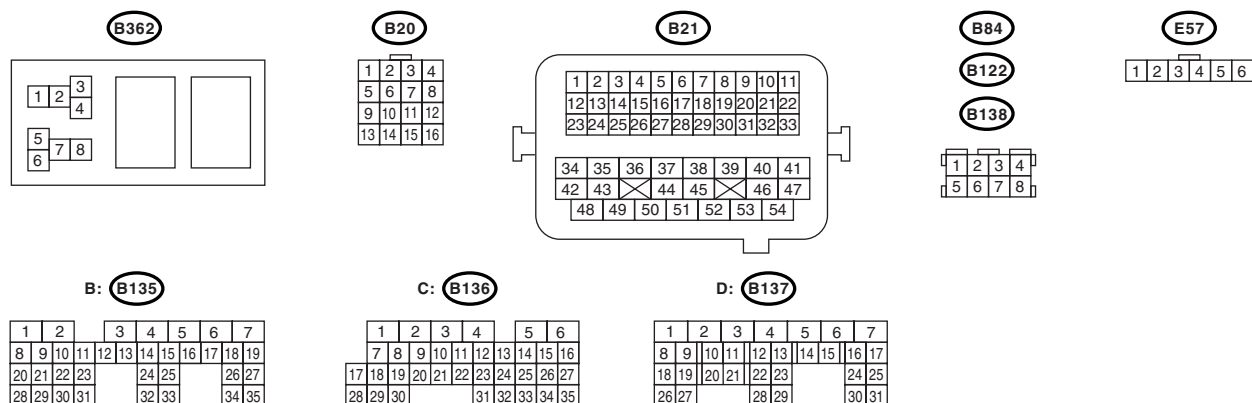
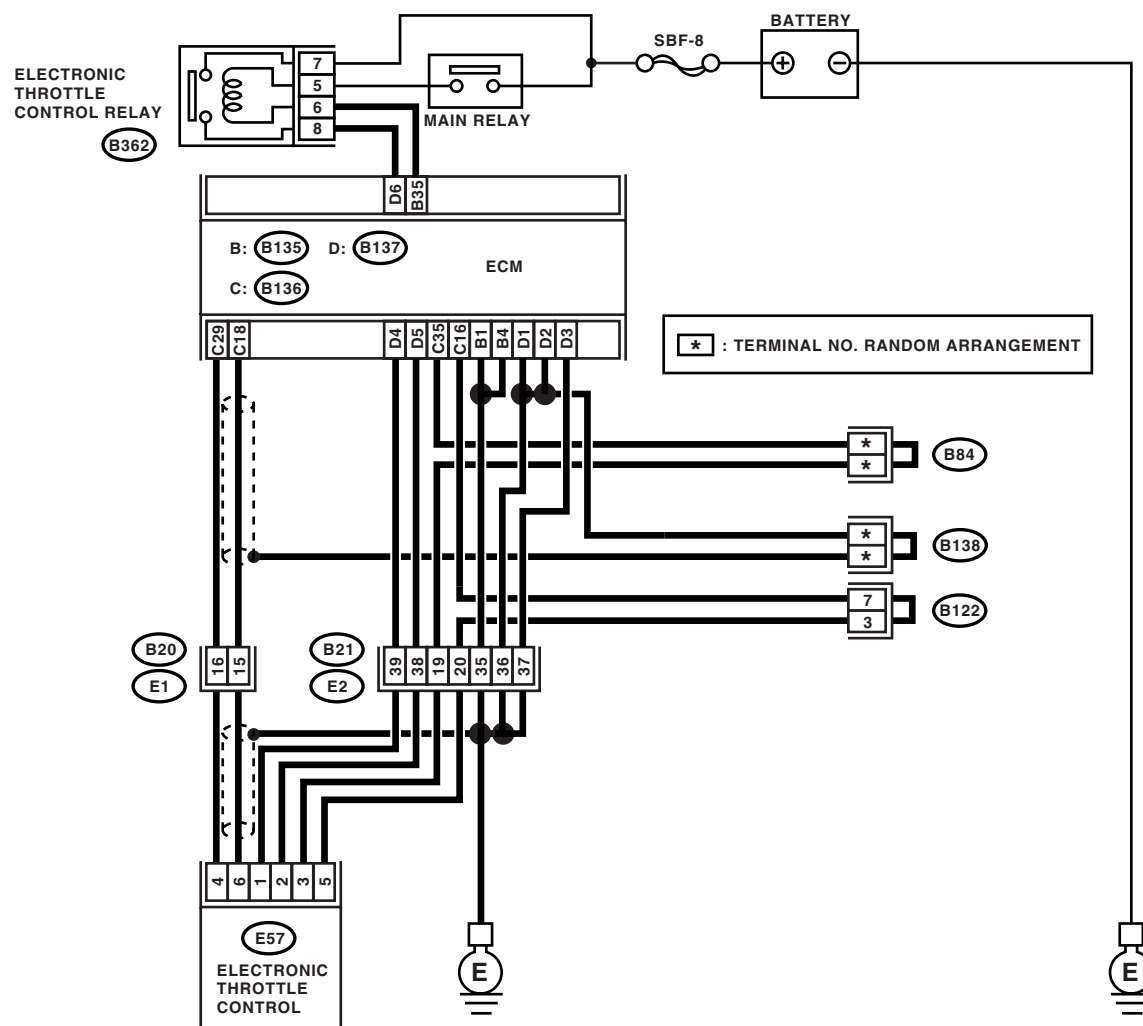


Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SENSOR OUTPUT. 1) Turn the ignition switch to ON. 2) Read the data of sub throttle sensor signal using Subaru Select Monitor.	Is the voltage more than 0.8 V?	Go to step 2.	Go to step 3.
2 CHECK POOR CONTACT. Check the poor contact in connector between ECM and electronic throttle control.	Is there poor contact?	Repair the poor contact.	Temporary poor contact occurred, but it is normal at present.
3 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from the electronic throttle control. 4) Measure the resistance between ECM connector and electronic throttle control connector. Connector & terminal (B136) No. 16 — (E57) No. 5: (B136) No. 29 — (E57) No. 4:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness connector.
4 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. Measure the resistance between ECM connector and chassis ground. Connector & terminal (B136) No. 29 — Chassis ground: (B136) No. 16 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair the chassis short circuit of harness.
5 CHECK SENSOR POWER SUPPLY. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. Connector & terminal (E57) No. 5 (+) — Engine ground (-):	Is the voltage 4.5 — 5.5 V?	Go to step 6.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
6 CHECK SHORT CIRCUIT INSIDE THE ECM. 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control connector and engine ground. Connector & terminal (E57) No. 4 — Engine ground:	Is the resistance more than 10 Ω ?	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SENSOR OUTPUT. 1) Turn the ignition switch to ON. 2) Read the data of sub throttle sensor signal using Subaru Select Monitor.	Is the voltage less than 4.73 V?	Go to step 2.	Go to step 3.
2 CHECK POOR CONTACT. Check the poor contact in connector between ECM and electronic throttle control.	Is there poor contact in connector between ECM and electronic throttle control?	Repair the poor contact.	Temporary poor contact occurred, but it is normal at present.
3 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from the electronic throttle control. 4) Measure the resistance between ECM connector and electronic throttle control connector. Connector & terminal (B136) No. 35 — (E57) No. 3: (B136) No. 29 — (E57) No. 4:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness connector.
4 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. Connector & terminal (E57) No. 4 (+) — Engine ground (-):	Is the voltage less than 10 V?	Go to step 5.	Repair the battery short circuit in harness between ECM connector and electronic throttle control connector.
5 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between connector terminals. Connector & terminal (B136) No. 29 — (B136) No. 16:	Is the resistance more than 1 M Ω ?	Repair the poor contact. Repair the electronic throttle control.	Sensor power supply circuit may be shorted.

X: DTC P0230 FUEL PUMP PRIMARY CIRCUIT

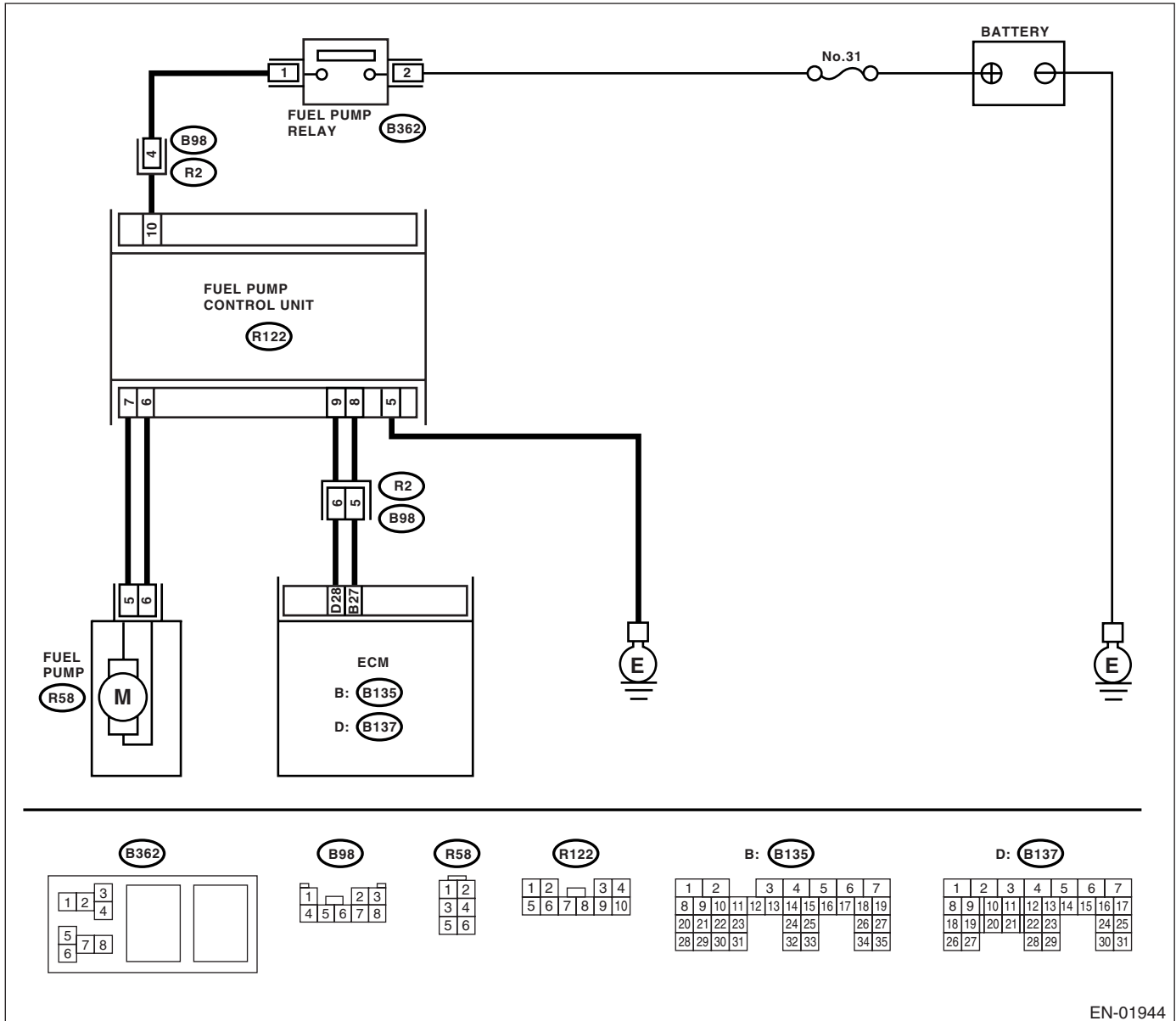
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01944

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK POWER SUPPLY CIRCUIT TO FUEL PUMP CONTROL UNIT. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from fuel pump control unit. 3) Turn the ignition switch to ON. 4) Measure the voltage between fuel pump control unit and chassis ground. Connector & terminal (R122) No. 10 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 2.	Repair the power supply circuit. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open or ground short circuit in harness between fuel pump relay and fuel pump control unit • Poor contact in fuel pump control unit connector • Poor contact in fuel pump relay connector
2 CHECK GROUND CIRCUIT OF FUEL PUMP CONTROL UNIT. 1) Turn the ignition switch to OFF. 2) Measure the resistance of harness between fuel pump control unit and chassis ground. Connector & terminal (R122) No. 5 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit between fuel pump control unit and chassis ground • Poor contact in fuel pump control unit connector
3 CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR. 1) Disconnect the connector from fuel pump. 2) Measure the resistance of harness between fuel pump control unit and fuel pump connector. Connector & terminal (R122) No. 7 — (R58) No. 5: (R122) No. 6 — (R58) No. 6:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit between fuel pump control unit and fuel pump.
4 CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND FUEL PUMP CONNECTOR. Measure the resistance of harness between fuel pump control unit and chassis ground. Connector & terminal (R122) No. 7 — Chassis ground: (R122) No. 6 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair the ground short circuit between fuel pump control unit and fuel pump.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
5 CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance in harness between fuel pump control unit and ECM connector. Connector & terminal (R122) No. 9 — (B137) No. 28: (R122) No. 8 — (B135) No. 27:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit between fuel pump control unit and ECM • Poor contact in fuel pump control unit and ECM connector
6 CHECK HARNESS BETWEEN FUEL PUMP CONTROL UNIT AND ECM CONNECTOR. Measure the resistance of harness between fuel pump control unit and chassis ground. Connector & terminal (R122) No. 9 — Chassis ground: (R122) No. 8 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 7.	Repair the ground short circuit between fuel pump control unit and ECM.
7 CHECK POOR CONTACT. Check poor contact in ECM and fuel pump control unit connector.	Is there poor contact in ECM and fuel pump control unit connector?	Repair the poor contact in ECM and fuel pump control unit.	Go to step 8.
8 CHECK EXPERIENCE OF RUNNING OUT OF FUEL.	Did the vehicle experience running out of fuel?	Finish the diagnosis. NOTE: DTC record may be conducted as a result of fuel pump idling while running out of fuel.	Replace the fuel pump control unit. <Ref. to FU(H4DOTC)-39, Fuel Pump Control Unit.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Y: DTC P0245 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" LOW

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

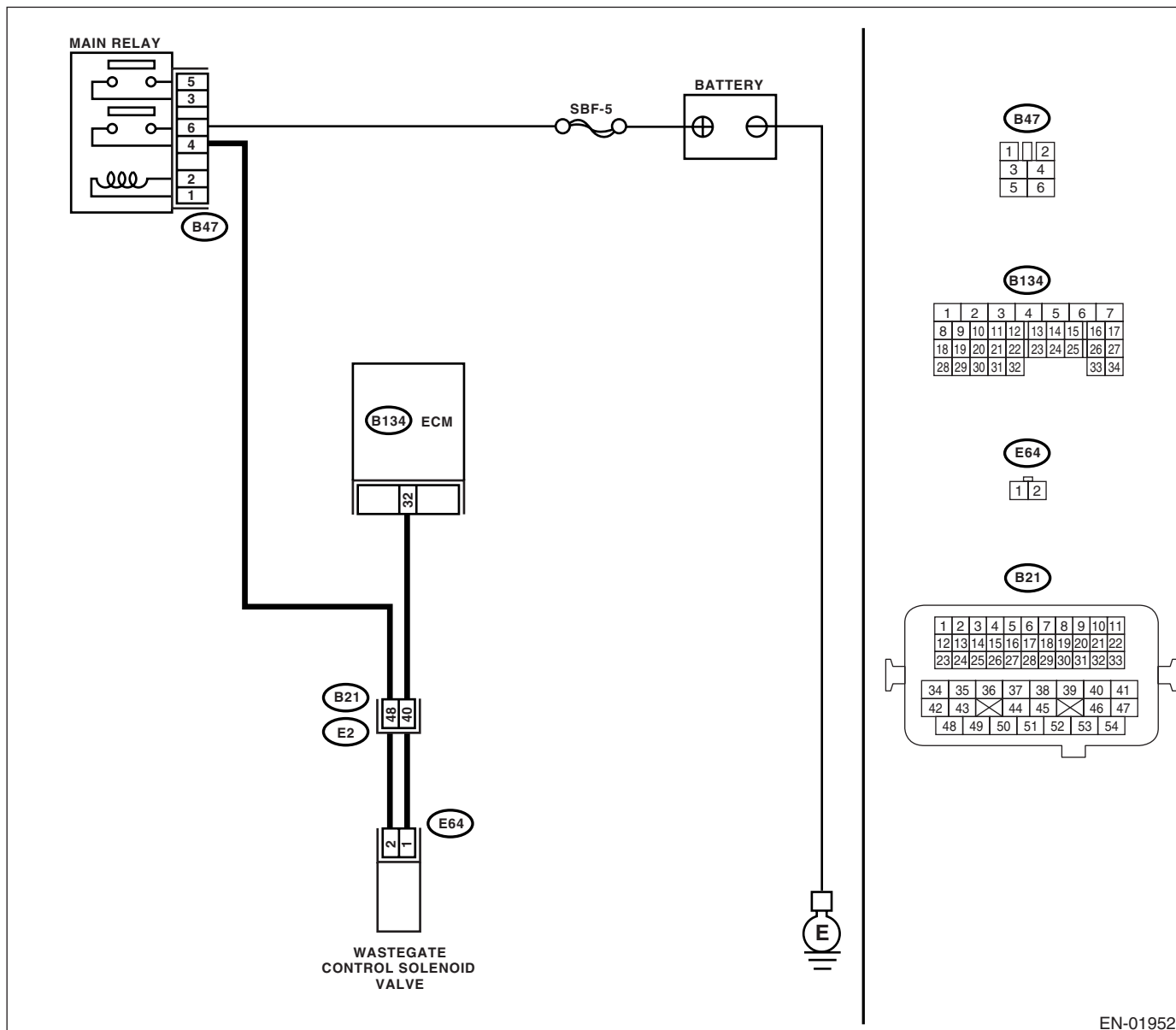
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 32 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time.	Go to step 2.
2 CHECK HARNESS BETWEEN WASTEGATE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from wastegate control solenoid valve and ECM. 3) Measure the resistance in harness between wastegate control solenoid valve connector and engine ground. Connector & terminal (E64) No. 1 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 3.	Repair the ground short circuit in harness between ECM and wastegate control solenoid valve connector.
3 CHECK HARNESS BETWEEN WASTEGATE CONTROL SOLENOID VALVE AND ECM CONNECTOR. Measure the resistance of harness between wastegate control solenoid valve of harness connector and ECM. Connector & terminal (B134) No. 32 — (E64) No. 1:	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit in harness between ECM and wastegate control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and wastegate control solenoid valve connector
4 CHECK WASTEGATE CONTROL SOLENOID VALVE. 1) Remove the wastegate control solenoid valve. 2) Measure the resistance between wastegate control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance 30 — 34 Ω?	Go to step 5.	Replace the wastegate control solenoid valve. <Ref. to FU(H4DOTC)-32, Wastegate Control Solenoid Valve.>
5 CHECK POWER SUPPLY TO WASTEGATE CONTROL SOLENOID VALVE. 1) Turn the ignition switch to ON. 2) Measure the voltage between wastegate control solenoid valve and engine ground. Connector & terminal (E64) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 6.	Repair the open circuit in harness between main relay and wastegate control solenoid valve connector.
6 CHECK POOR CONTACT. Check poor contact in wastegate control solenoid valve connector.	Is there poor contact in wastegate control solenoid valve connector?	Repair the poor contact in wastegate control solenoid valve connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Z: DTC P0246 TURBO/SUPER CHARGER WASTEGATE SOLENOID "A" HIGH DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

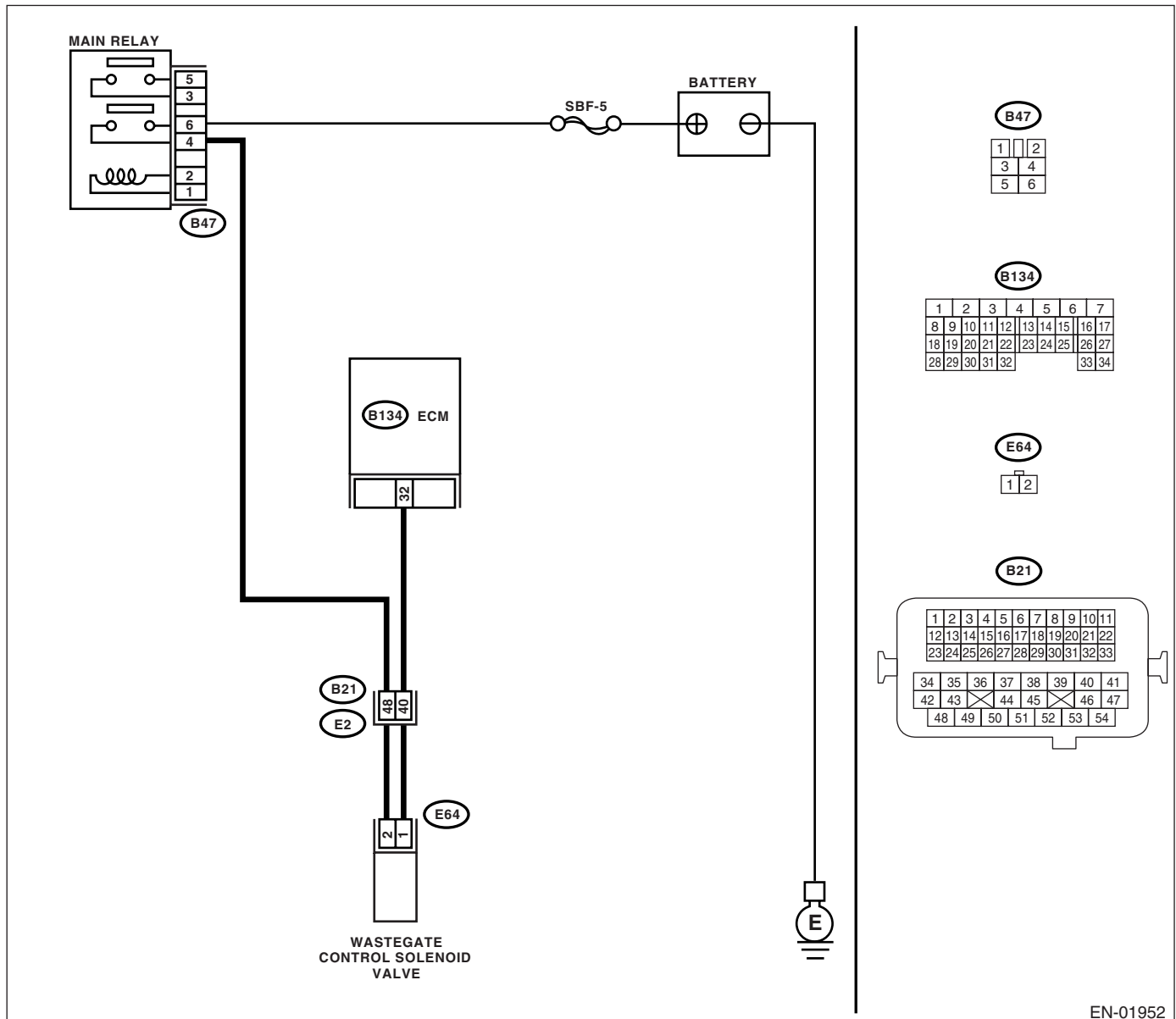
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 32 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 3.	Go to step 2.
2 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
3 CHECK HARNESS BETWEEN WASTEGATE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from wastegate control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 32 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit in harness between ECM and wastegate control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Go to step 4.
4 CHECK WASTEGATE CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Measure the resistance between wastegate control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance less than 1 Ω ?	Replace the wastegate control solenoid valve and ECM. <Ref. to FU(H4DOTC)-32, Wastegate Control Solenoid Valve.> <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Go to step 5.
5 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is the poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AA:DTC P0261 CYLINDER 1 INJECTOR CIRCUIT LOW

NOTE:

For the diagnostic procedure, refer to DTC P0270. <Ref. to EN(H4DOTC)(diag)-119, DTC P0270 CYLINDER 4 INJECTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AB:DTC P0264 CYLINDER 2 INJECTOR CIRCUIT LOW

NOTE:

For the diagnostic procedure, refer to DTC P0270. <Ref. to EN(H4DOTC)(diag)-119, DTC P0270 CYLINDER 4 INJECTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AC:DTC P0267 CYLINDER 3 INJECTOR CIRCUIT LOW

NOTE:

For the diagnostic procedure, refer to DTC P0270. <Ref. to EN(H4DOTC)(diag)-119, DTC P0270 CYLINDER 4 INJECTOR CIRCUIT LOW, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AD:DTC P0270 CYLINDER 4 INJECTOR CIRCUIT LOW

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Engine stalls.
- Erroneous idling
- Rough driving

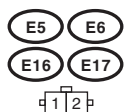
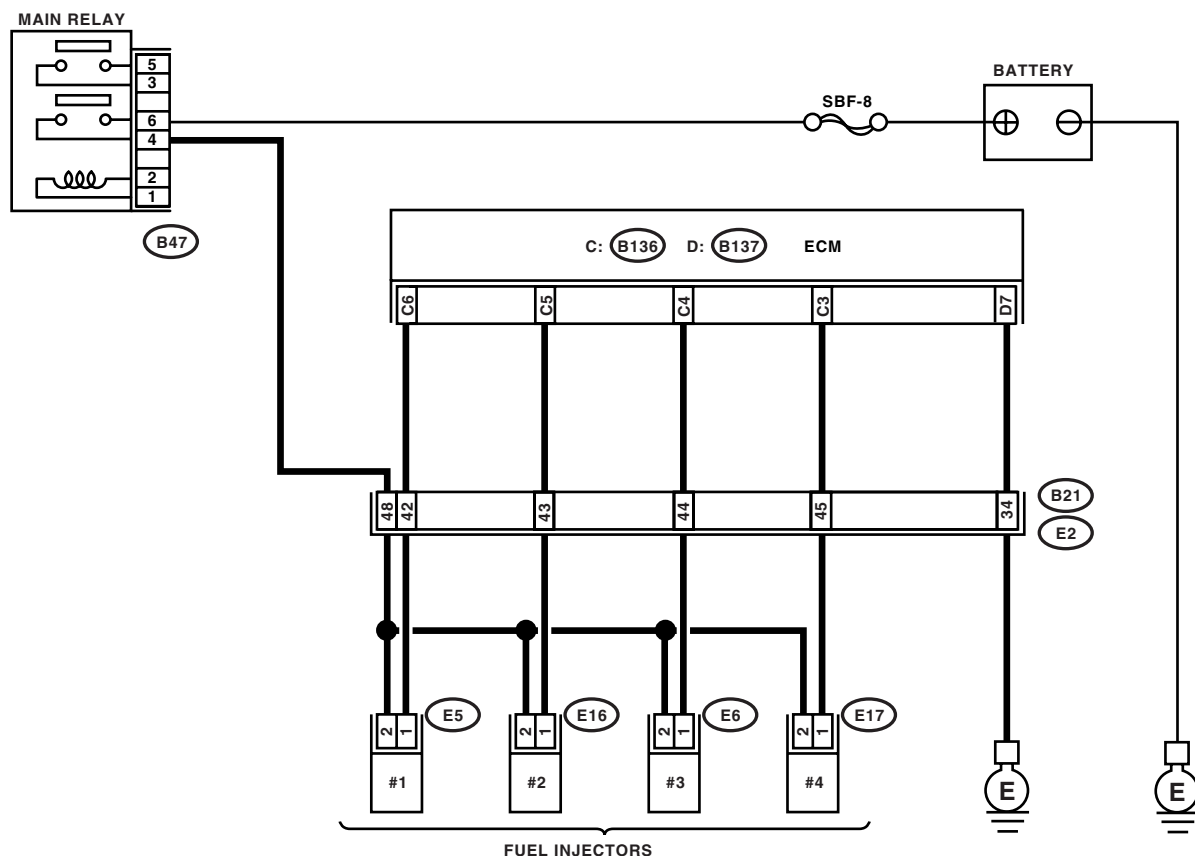
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



C: B136

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	

D: B137

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			

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	



EN-01945

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK POWER SUPPLY LINE. 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 and engine ground on faulty cylinders. Connector & terminal #1 (E5) No. 2 (+) — Engine ground (-): #2 (E16) No. 2 (+) — Engine ground (-): #3 (E6) No. 2 (+) — Engine ground (-): #4 (E17) No. 2 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 2.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between main relay and fuel injector connector on faulty cylinders • Poor contact in coupling connector • Poor contact in main relay connector • Poor contact in fuel injector connector on faulty cylinders
2 CHECK FUEL INJECTOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between fuel injector terminals on faulty cylinder. Terminals No. 1 — No. 2:	Is the resistance less than 11 — 12 Ω ?	Go to step 3.	Replace the faulty fuel injector and ECM. <Ref. to FU(H4DOTC)-30, Fuel Injector.>
3 CHECK OUTPUT SIGNAL FROM ECM. 1) Connect the connector to the fuel injector. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector and chassis ground on faulty cylinders. Connector & terminal #1 (B136) No. 6 (+) — Chassis ground (-): #2 (B136) No. 5 (+) — Chassis ground (-): #3 (B136) No. 4 (+) — Chassis ground (-): #4 (B136) No. 3 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 4.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and fuel injector connector • Poor contact in coupling connector
4 CHECK GROUND CIRCUIT FOR ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and chassis ground. Connector & terminal (B137) No. 7 — Chassis ground:	Is the resistance less than 5 Ω ?	Repair the poor contact in fuel injector and ECM connector.	Repair ground open circuit in ECM.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

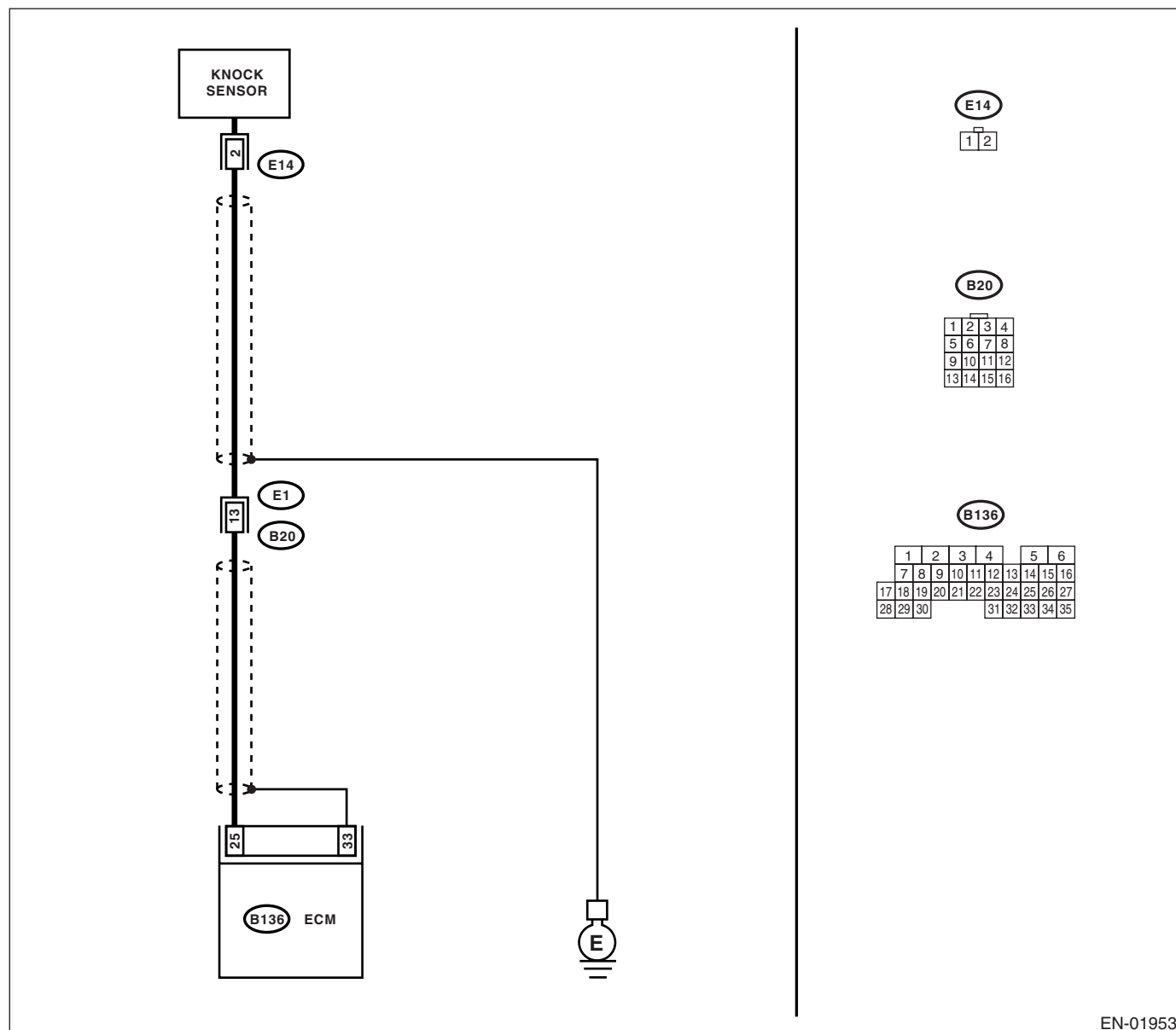
TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01953

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM harness connector and chassis ground. Connector & terminal (B136) No. 25 — Chassis ground:	Is the resistance more than 700 k Ω ?	Go to step 2.	Repair the harness and connector. NOTE: In this case, repair the following in this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between knock sensor and ECM connector • Poor contact in knock sensor connector • Poor contact in coupling connector
2 CHECK KNOCK SENSOR. 1) Disconnect the connector from knock sensor. 2) Measure the resistance between knock sensor connector terminal and engine ground. Terminals No. 2 — Engine ground:	Is the resistance more than 700 k Ω ?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following in this case, repair the following: <ul style="list-style-type: none"> • Poor contact in knock sensor connector • Poor contact in coupling connector
3 CHECK CONDITION OF KNOCK SENSOR INSTALLATION.	Is the knock sensor installation bolt tightened securely?	Replace the knock sensor. <Ref. to FU(H4DOTC)-26, Knock Sensor.>	Tighten knock sensor installation bolt securely.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

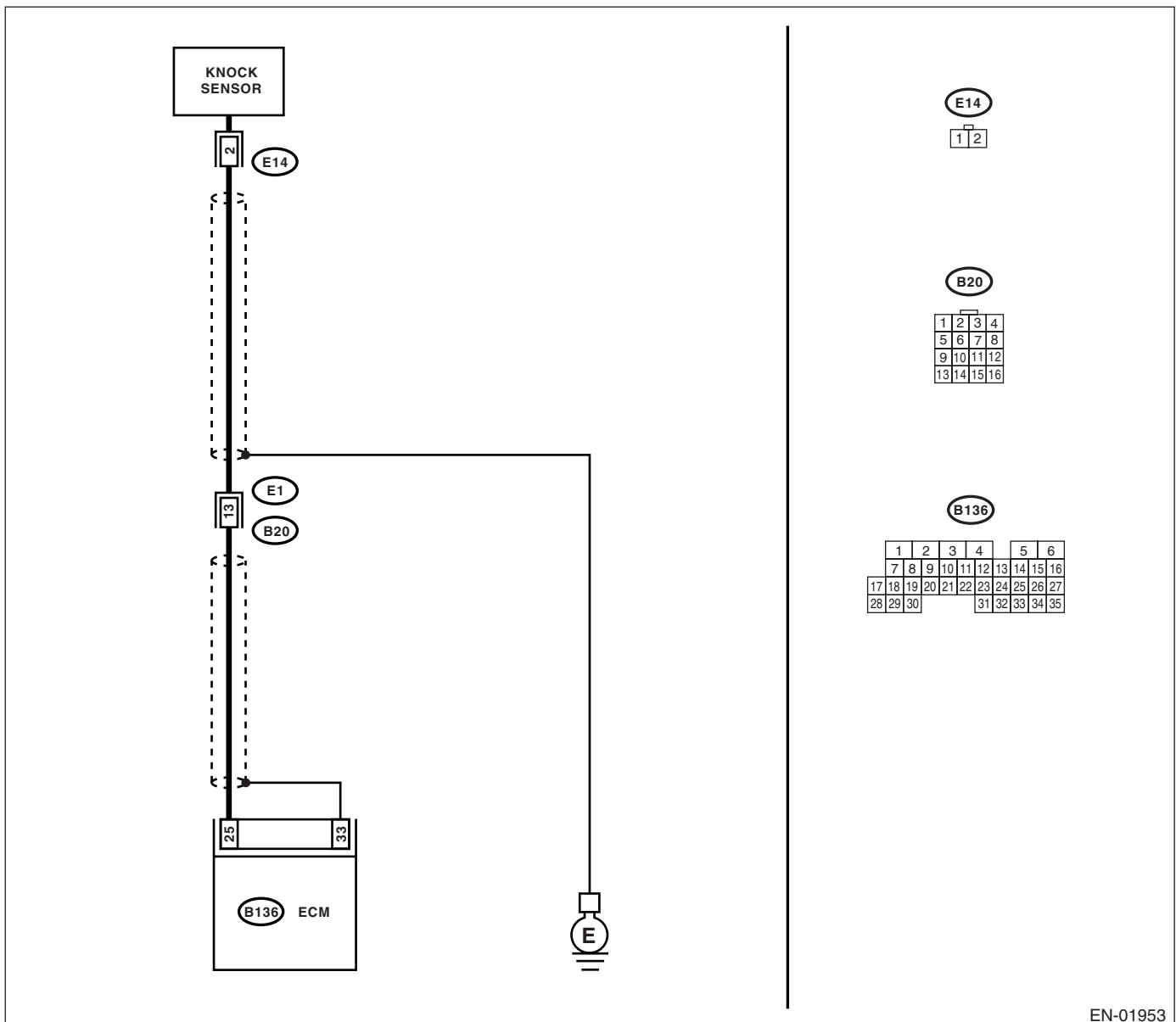
TROUBLE SYMPTOM:

- Poor driving performance
- Knocking occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01953

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN KNOCK SENSOR AND ECM CONNECTOR. Measure the resistance of harness between ECM connector and chassis ground. Connector & terminal (B136) No. 25 — Chassis ground:	Is the resistance less than 400 k Ω ?	Go to step 2.	Go to step 3.
2 CHECK KNOCK SENSOR. 1) Disconnect the connector from knock sensor. 2) Measure the resistance between knock sensor connector terminal and engine ground. Terminals No. 2 — Engine ground:	Is the resistance less than 400 k Ω ?	Replace the knock sensor. <Ref. to FU(H4DOTC)-26, Knock Sensor.>	Repair the ground short circuit in harness between knock sensor connector and ECM connector. NOTE: The harness between both connectors are shielded. Repair the short circuit in harness covered with shield.
3 CHECK INPUT SIGNAL FROM ECM. 1) Connect the connectors to ECM and knock sensor. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM and chassis ground. Connector & terminal (B136) No. 25 (+) — Chassis ground (-):	Is the voltage more than 2 V?	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. (However, the possibility of poor contact still remains.) NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Poor contact in knock sensor connector • Poor contact in ECM connector • Poor contact in coupling connector 	Repair the poor contact in ECM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AG:DTC P0335 CRANKSHAFT POSITION SENSOR "A" CIRCUIT

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

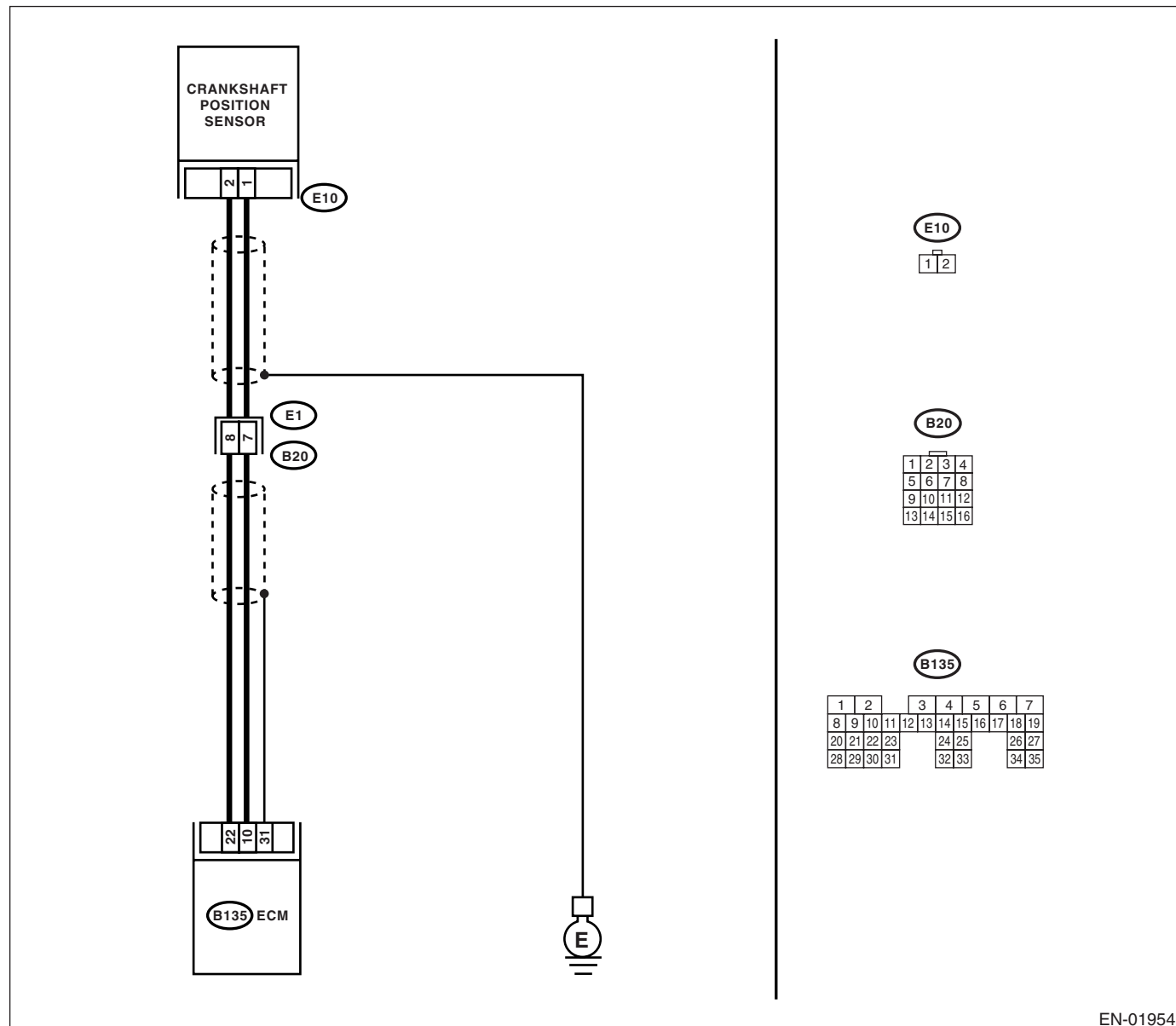
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from the crankshaft position sensor. 3) Measure the resistance of harness between crankshaft position sensor connector and engine ground. Connector & terminal (E10) No. 1 — (B135) No. 10: (E10) No. 2 — (B135) No. 22:	Is the resistance more than 100 kΩ?	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between crankshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector	Go to step 3.
3 CHECK HARNESS BETWEEN CRANKSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between crankshaft position sensor connector and engine ground. Connector & terminal (E10) No. 1 — Engine ground: (E10) No. 2 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 4.	Repair the ground short circuit in harness between crankshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair the ground short circuit in harness together with shield.
4 CHECK CONDITION OF CRANKSHAFT POSITION SENSOR.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 5.	Tighten the crankshaft position sensor installation bolt securely.
5 CHECK CRANKSHAFT POSITION SENSOR. 1) Remove the crankshaft position sensor. 2) Measure the resistance between connector terminals of crankshaft position sensor. Terminals No. 1 — No. 2:	Is the resistance 1 — 4 kΩ?	Repair the poor contact in crankshaft position sensor connector.	Replace the crankshaft position sensor. <Ref. to FU(H4DOTC)-24, Crankshaft Position Sensor.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

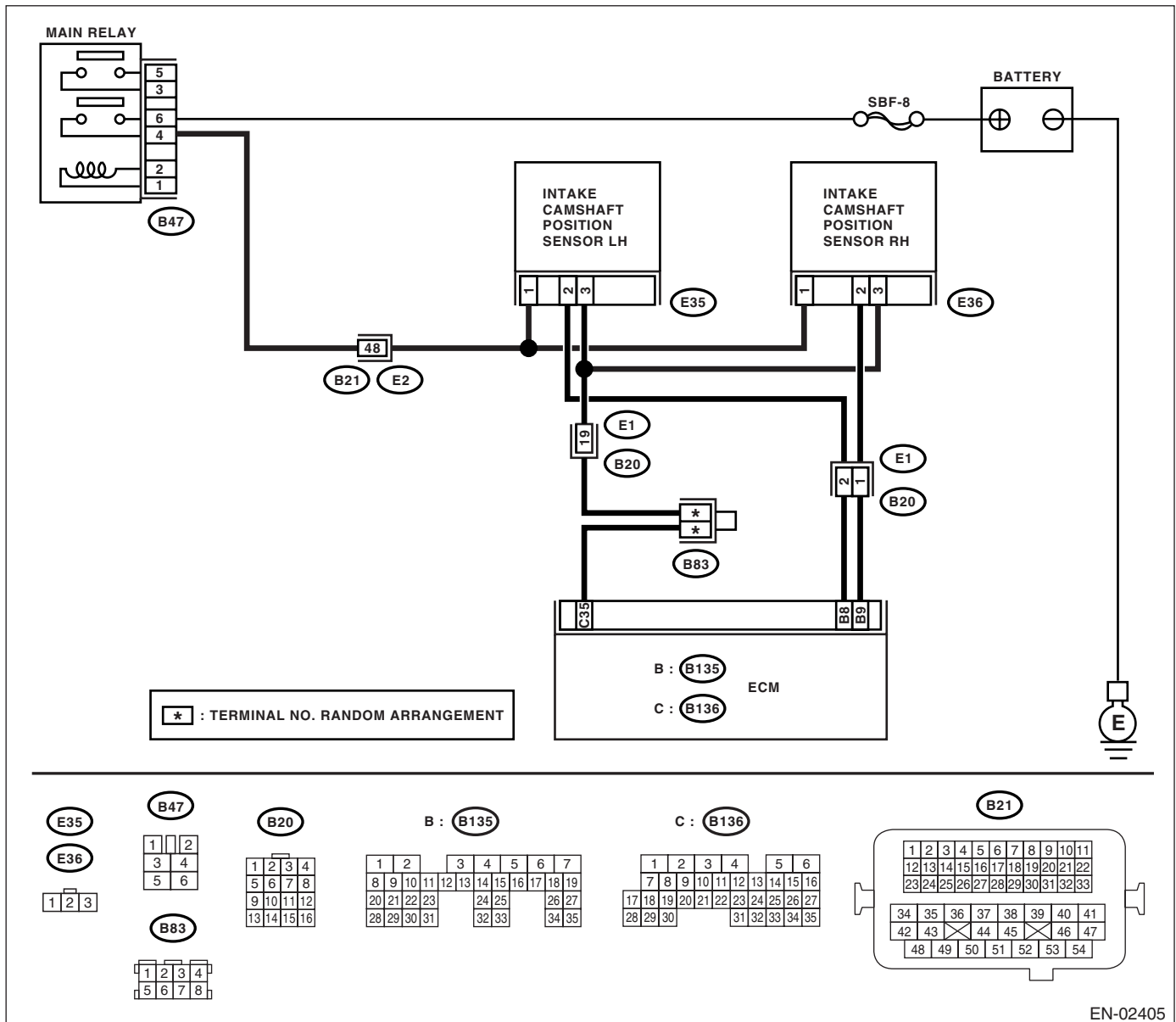
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-02405

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the voltage between camshaft position sensor connector and engine ground. Connector & terminal (E36) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit between main relay connector and camshaft position sensor connector.	Go to step 3.
3 CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between camshaft position sensor connector and engine ground. Connector & terminal (E36) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 4.	Repair the open or ground short circuit between main relay connector and camshaft position sensor connector.
4 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR CONNECTOR AND ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between camshaft position sensor connector and ECM. Connector & terminal (E36) No. 2 — (B135) No. 9: (E36) No. 3 — (B136) No. 35:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair the open circuit between camshaft position sensor and ECM.
5 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR CONNECTOR AND ECM. Measure the resistance between camshaft position sensor connector and engine ground. Connector & terminal (E36) No. 2 — Engine ground:	Is the resistance more than 1 M Ω ?	Go to step 6.	Repair the ground short circuit between camshaft position sensor and ECM.
6 CHECK CONDITION OF CAMSHAFT POSITION SENSOR.	Is the camshaft position sensor installation bolt tightened securely?	Go to step 7.	Tighten the camshaft position sensor installation bolt securely.
7 CHECK CAMSHAFT POSITION SENSOR. Check waveform of camshaft position sensor. <Ref. to EN(H4DOTC)(diag)-15, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DOTC)-24, Crankshaft Position Sensor.>	Go to step 8.
8 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AI: DTC P0345 CAMSHAFT POSITION SENSOR "A" CIRCUIT (BANK 2)

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

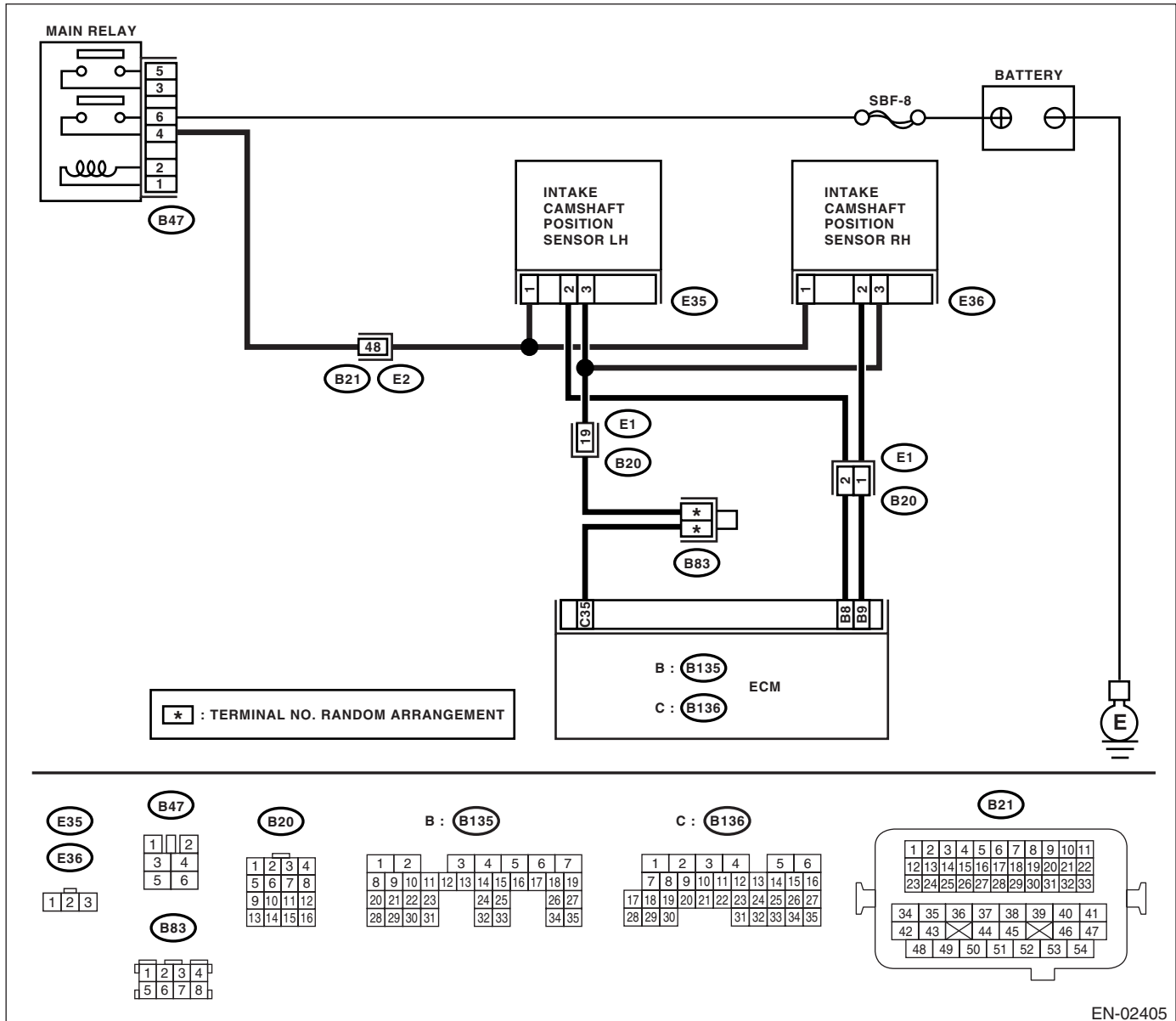
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-02405

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No	
1	CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the DTC using “List of Diagnostic Trouble Code (DTC)”. <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2	CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the voltage between camshaft position sensor connector and engine ground. Connector & terminal (E35) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit between main relay connector and camshaft position sensor connector.	Go to step 3.
3	CHECK POWER SUPPLY OF CAMSHAFT POSITION SENSOR. 1) Turn the ignition switch to ON. 2) Measure the voltage between camshaft position sensor connector and engine ground. Connector & terminal (E35) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 4.	Repair the open or ground short circuit between main relay connector and camshaft position sensor connector.
4	CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR CONNECTOR AND ECM. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between camshaft position sensor connector and ECM. Connector & terminal (E35) No. 2 — (B135) No. 8: (E35) No. 3 — (B136) No. 35:	Is the resistance less than 1 Ω?	Go to step 5.	Repair the open circuit between camshaft position sensor and ECM.
5	CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR CONNECTOR AND ECM. Measure the resistance between camshaft position sensor connector and engine ground. Connector & terminal (E35) No. 2 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 6.	Repair the ground short circuit between camshaft position sensor and ECM.
6	CHECK CONDITION OF CAMSHAFT POSITION SENSOR.	Is the camshaft position sensor installation bolt tightened securely?	Go to step 7.	Tighten the camshaft position sensor installation bolt securely.
7	CHECK CAMSHAFT POSITION SENSOR. Check waveform of camshaft position sensor. <Ref. to EN(H4DOTC)(diag)-15, Engine Control Module (ECM) I/O Signal.>	Is there any abnormality in waveform?	Replace the camshaft position sensor. <Ref. to FU(H4DOTC)-25, Camshaft Position Sensor.>	Go to step 8.
8	CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AJ:DTC P0350 IGNITION COIL PRIMARY/SECONDARY CIRCUIT

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

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

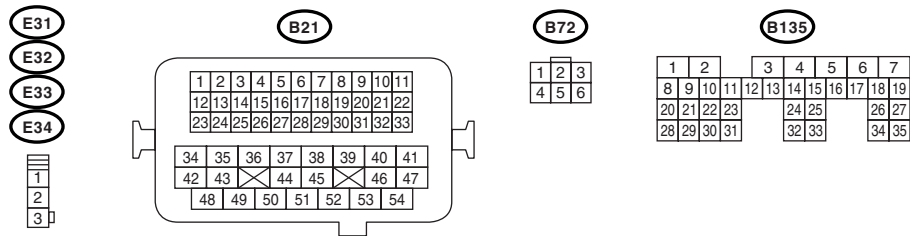
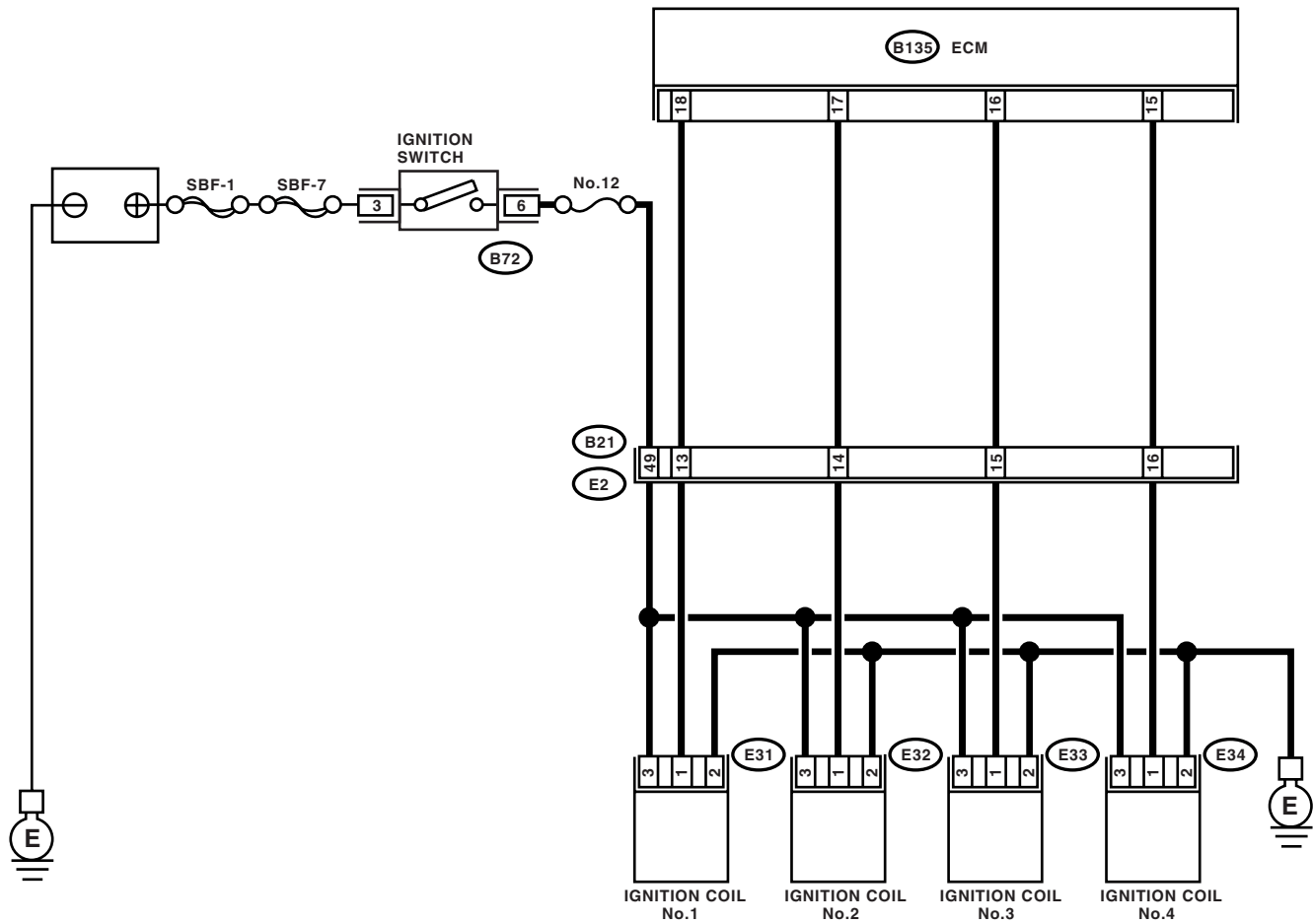
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-02404

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK POWER SUPPLY CIRCUIT FOR IGNITION COIL & IGNITOR ASSY. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ignition coil & ignitor ASSY. 3) Turn the ignition switch to ON. 4) Measure the power supply voltage between ignition coil & ignitor ASSY connector and engine ground. Connector & terminal (E31) No. 3 (+) — Engine ground (-): (E32) No. 3 (+) — Engine ground (-): (E33) No. 3 (+) — Engine ground (-): (E34) No. 3 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 2.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor ASSY and ignition switch connector • Poor contact in coupling connector
2 CHECK HARNESS OF ECM AND IGNITION COIL & IGNITOR ASSY GROUND CIRCUIT. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ignition coil & ignitor ASSY 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 5 Ω ?	Go to step 3.	Repair the harness and connector. NOTE: In this case, repair the following: • Open circuit in harness between ignition coil & ignitor ASSY connector and engine grounding terminal • Poor contact in coupling connector
3 CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSY CONNECTOR. 1) Disconnect the connector from ignition coil & ignitor ASSY. 2) Measure the resistance of harness between ECM and ignition coil & ignitor ASSY connector. Connector & terminal (B135) No. 18 — (E31) No. 1: (B135) No. 17 — (E32) No. 1: (B135) No. 16 — (E33) No. 1: (B135) No. 15 — (E34) 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: • Open circuit in harness between ECM and ignition coil & ignitor ASSY connector • Poor contact in coupling connector
4 CHECK HARNESS BETWEEN ECM AND IGNITION COIL & IGNITOR ASSY CONNECTOR. Measure the resistance of harness between ignition coil & ignitor ASSY connector and engine ground. Connector & terminal: (E31) No. 1 — Engine ground: (E32) No. 1 — Engine ground: (E32) No. 1 — Engine ground: (E34) No. 1 — Engine ground:	Is the resistance more than 1 M Ω ?	Repair the poor contact in terminal.	Repair the harness and connector. Repair the harness and connector.

AK:DTC P0365 CAMSHAFT POSITION SENSOR "B" CIRCUIT (BANK 1)

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

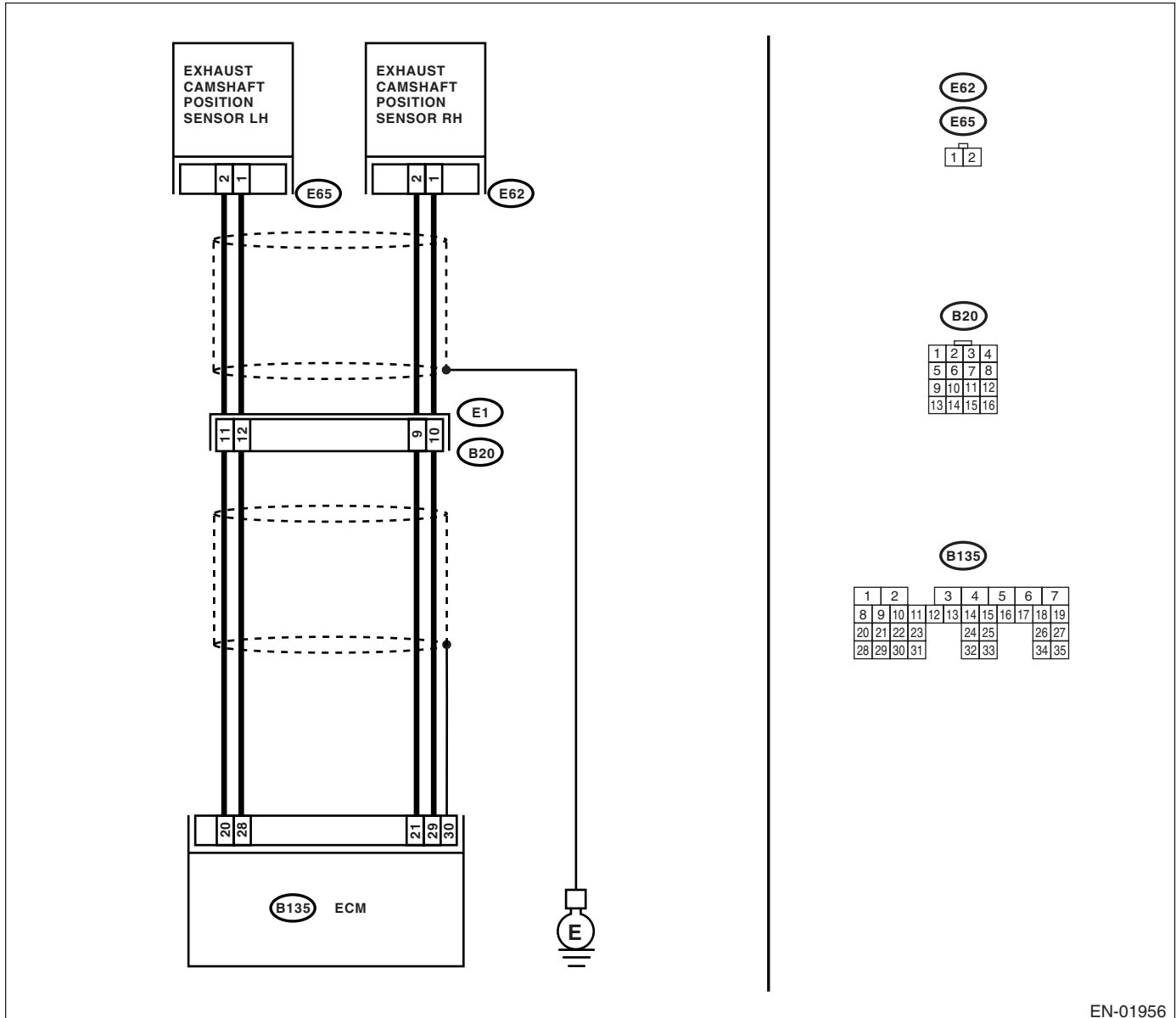
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01956

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the resistance of harness between camshaft position sensor connector and ECM. Connector & terminal (E62) No. 1 — (B135) No. 29: (E62) No. 2 — (B135) No. 21:	Is the resistance less than 1 Ω ?	Go to step 2.	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E62) No. 1 — Engine ground: (E62) No. 2 — Engine ground:	Is the resistance more than 1 M Ω ?	Go to step 3.	Repair the ground short circuit in harness between camshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair the ground short circuit in harness together with shield.
3 CHECK CONDITION OF CAMSHAFT POSITION SENSOR.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 4.	Tighten the crankshaft position sensor installation bolt securely.
4 CHECK CAMSHAFT POSITION SENSOR. 1) Remove the camshaft position sensor. 2) Measure the resistance between connector terminals of camshaft position sensor. Terminals No. 1 — No. 2:	Is the resistance 1 — 4 k Ω ?	Repair the poor contact in camshaft position sensor connector.	Replace the camshaft position sensor. <Ref. to FU(H4DOTC)-25, Camshaft Position Sensor.>

AL:DTC P0390 CAMSHAFT POSITION SENSOR "B" CIRCUIT (BANK 2)

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

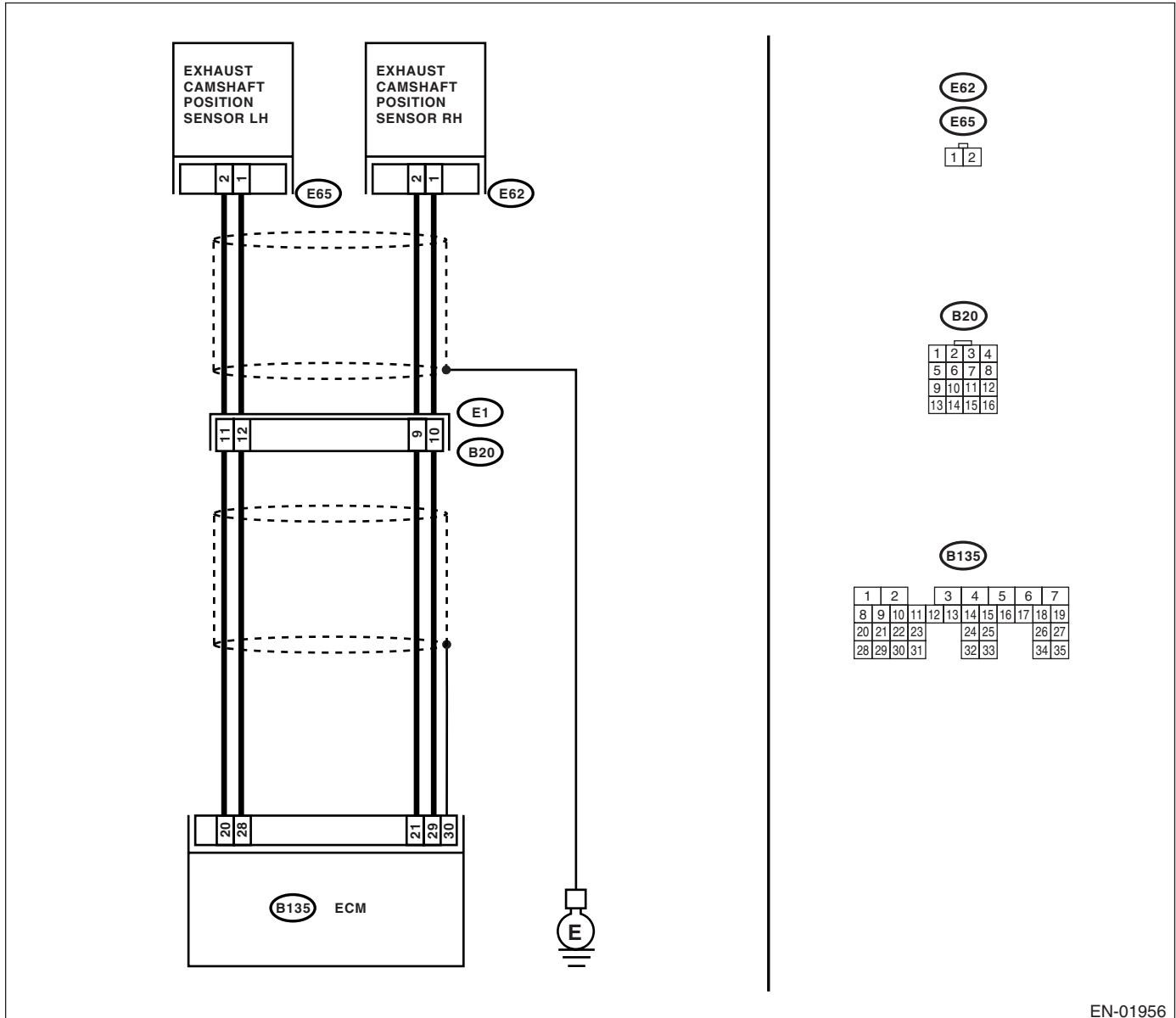
TROUBLE SYMPTOM:

- Engine stalls.
- Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01956

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from camshaft position sensor. 3) Measure the resistance of harness between camshaft position sensor connector and ECM. Connector & terminal (E65) No. 1 — (B135) No. 28: (E65) No. 2 — (B135) No. 20:	Is the resistance less than 1 Ω ?	Go to step 2.	Repair the harness and connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between camshaft position sensor and ECM connector • Poor contact in ECM connector • Poor contact in coupling connector
2 CHECK HARNESS BETWEEN CAMSHAFT POSITION SENSOR AND ECM CONNECTOR. Measure the resistance of harness between camshaft position sensor connector and engine ground. Connector & terminal (E65) No. 1 — Engine ground: (E65) No. 2 — Engine ground:	Is the resistance more than 1 M Ω ?	Go to step 3.	Repair the ground short circuit in harness between camshaft position sensor and ECM connector. NOTE: The harness between both connectors are shielded. Repair the ground short circuit in harness together with shield.
3 CHECK CONDITION OF CAMSHAFT POSITION SENSOR.	Is the crankshaft position sensor installation bolt tightened securely?	Go to step 4.	Tighten the crankshaft position sensor installation bolt securely.
4 CHECK CAMSHAFT POSITION SENSOR. 1) Remove the camshaft position sensor. 2) Measure the resistance between connector terminals of camshaft position sensor. Terminals No. 1 — No. 2:	Is the resistance 1 — 4 k Ω ?	Repair the poor contact in camshaft position sensor connector.	Replace the camshaft position sensor. <Ref. to FU(H4DOTC)-25, Camshaft Position Sensor.>

AM:DTC P0458 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT LOW**DTC DETECTING CONDITION:**

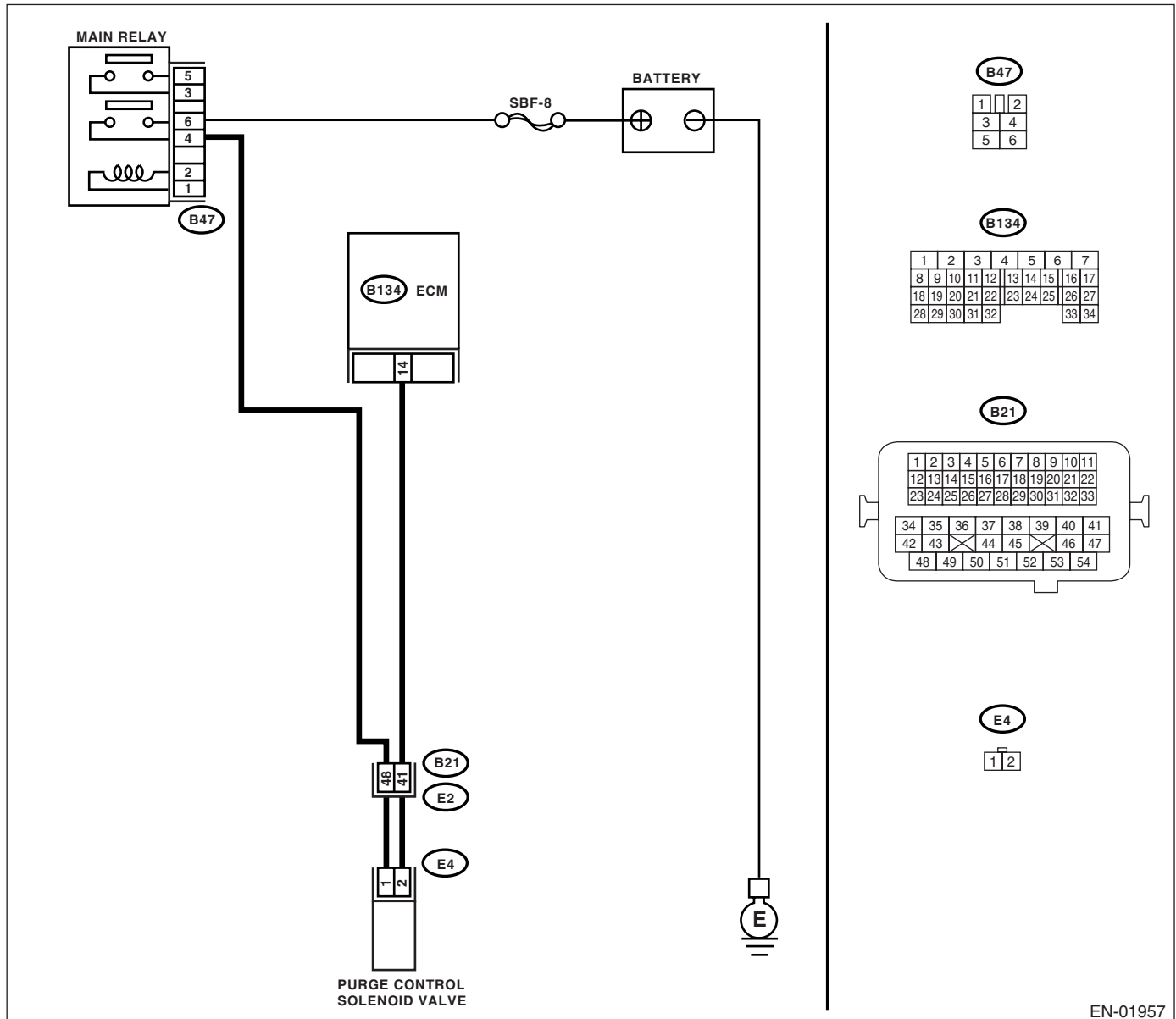
Two consecutive driving cycles with fault

TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 14 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time.	Go to step 2.
2 CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connectors from purge control solenoid valve and ECM. 3) Measure the resistance of harness between purge control solenoid valve connector and engine ground. Connector & terminal (E4) No. 2 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 3.	Repair the ground short circuit in harness between ECM and purge control solenoid valve connector.
3 CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. Measure the resistance of harness between ECM and purge control solenoid valve of harness connector. Connector & terminal (B134) No. 14 — (E4) No. 2:	Is the resistance less than 1 Ω?	Go to step 4.	Repair the open circuit in harness between ECM and purge control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and purge control solenoid valve connector • Poor contact in coupling connector
4 CHECK PURGE CONTROL SOLENOID VALVE. 1) Remove the purge control solenoid valve. 2) Measure the resistance between purge control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance 29 — 35 Ω?	Go to step 5.	Replace the purge control solenoid valve. <Ref. to EC(H4DOTC)-6, Purge Control Solenoid Valve.>
5 CHECK POWER SUPPLY TO PURGE CONTROL SOLENOID VALVE. 1) Turn the ignition switch to ON. 2) Measure the voltage between purge control solenoid valve and engine ground. Connector & terminal (E4) No. 1 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 6.	Repair the open circuit in harness between main relay and purge control solenoid valve connector.
6 CHECK POOR CONTACT. Check poor contact in purge control solenoid valve connector.	Is there poor contact in purge control solenoid valve connector?	Repair the poor contact in purge control solenoid valve connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

AN:DTC P0459 EVAPORATIVE EMISSION CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT HIGH**DTC DETECTING CONDITION:**

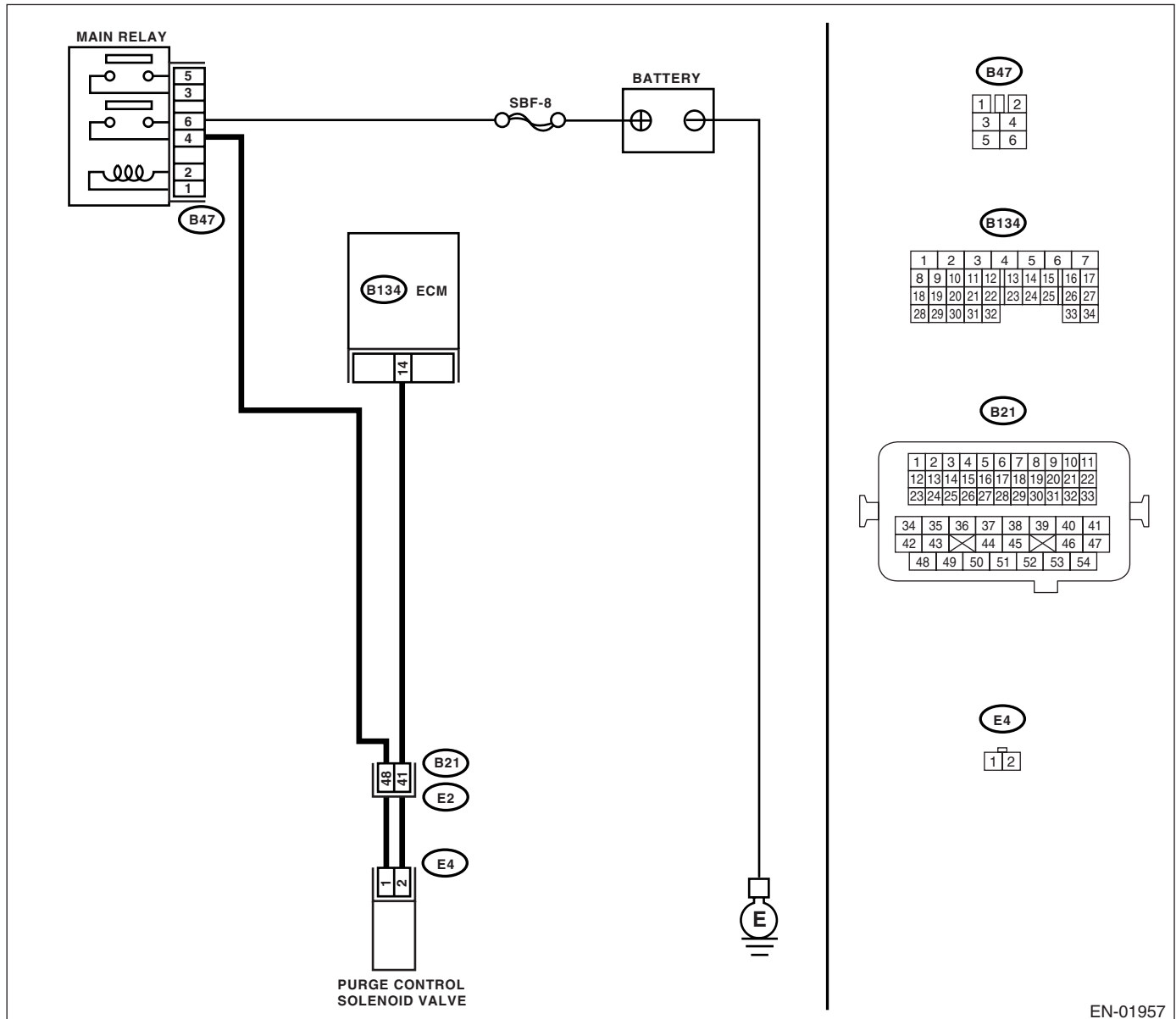
Two consecutive driving cycles with fault

TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

EN-01957

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK OUTPUT SIGNAL FROM ECM. 1) Turn the ignition switch to OFF. 2) Connect the test mode connector at the lower portion of instrument panel (on the driver's side). 3) Turn the ignition switch to ON.	Does the purge control solenoid valve operate?	Go to step 2.	Even if the malfunction indicator light illuminates, the circuit has returned to a normal condition at this time. In this case, repair the poor contact in ECM connector.
2 CHECK PURGE CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from purge control solenoid valve. 3) Measure the resistance between purge control solenoid valve terminals. Terminals No. 1 — No. 2:	Is the resistance less than 29 — 35 Ω ?	Go to step 3.	Replace the purge control solenoid valve. <Ref. to EC(H4DOTC)-6, Purge Control Solenoid Valve.>
3 CHECK HARNESS BETWEEN PURGE CONTROL SOLENOID VALVE AND ECM CONNECTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from purge control solenoid valve. 3) Turn the ignition switch to ON. 4) Measure the voltage between ECM and chassis ground. Connector & terminal (B134) No. 14 (+) — Chassis ground (-):	Is the voltage less than 1 V?	Go to step 4.	Repair the battery short circuit in harness between ECM and purge control solenoid valve connector. After repair, replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
4 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there poor contact in ECM connector?	Repair the poor contact in ECM connector.	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>

AO:DTC P0500 VEHICLE SPEED SENSOR

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

Step		Check	Yes	No
1	CHECK DTC OF ABS.	Is DTC of ABS displayed?	Perform the diagnosis according to the DTC. <Ref. to ABS(diag)-39, List of Diagnostic Trouble Code (DTC).>	Repair the poor contact in ECM.
	Check DTC of ABS.			

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AP:DTC P0512 STARTER REQUEST CIRCUIT

DTC DETECTING CONDITION:

Two consecutive driving cycles with fault

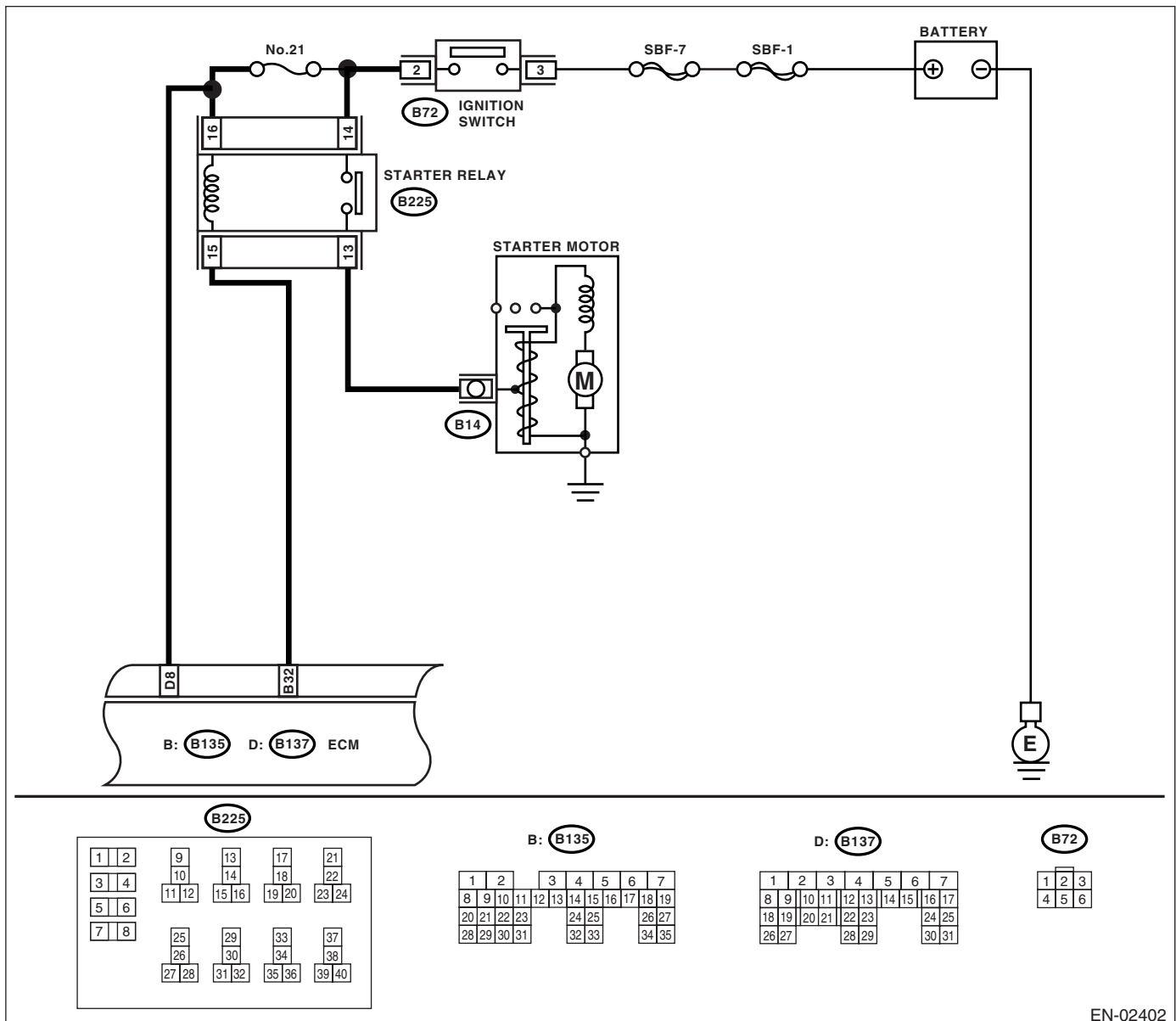
TROUBLE SYMPTOM:

Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-02402

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN IGNITION SWITCH AND ECM. 1) Disconnect the connectors from ECM. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B137) No. 32 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair the battery short circuit in harness between ignition switch and ECM.	Repair the poor contact in ECM.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Engine keeps running at higher revolution than specified idling revolution.
- Fuel is cut according to fail-safe function.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the relevant DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).> NOTE: In this case, it is not necessary to inspect DTC P0519.	Go to step 2.
2 CHECK AIR INTAKE SYSTEM. 1) Turn the ignition switch to ON. 2) Start and idle the engine. 3) Check the following items: <ul style="list-style-type: none">• Loose installation of intake manifold and throttle body• Cracks of intake manifold gasket and throttle body gasket• Disconnections 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. 3) Check the electronic throttle control.	Are foreign matters found inside the electronic throttle control?	Remove foreign matters from the electronic throttle control.	Perform the diagnosis of DTC P2101.

AR:DTC P0562 SYSTEM VOLTAGE LOW**DTC DETECTING CONDITION:**

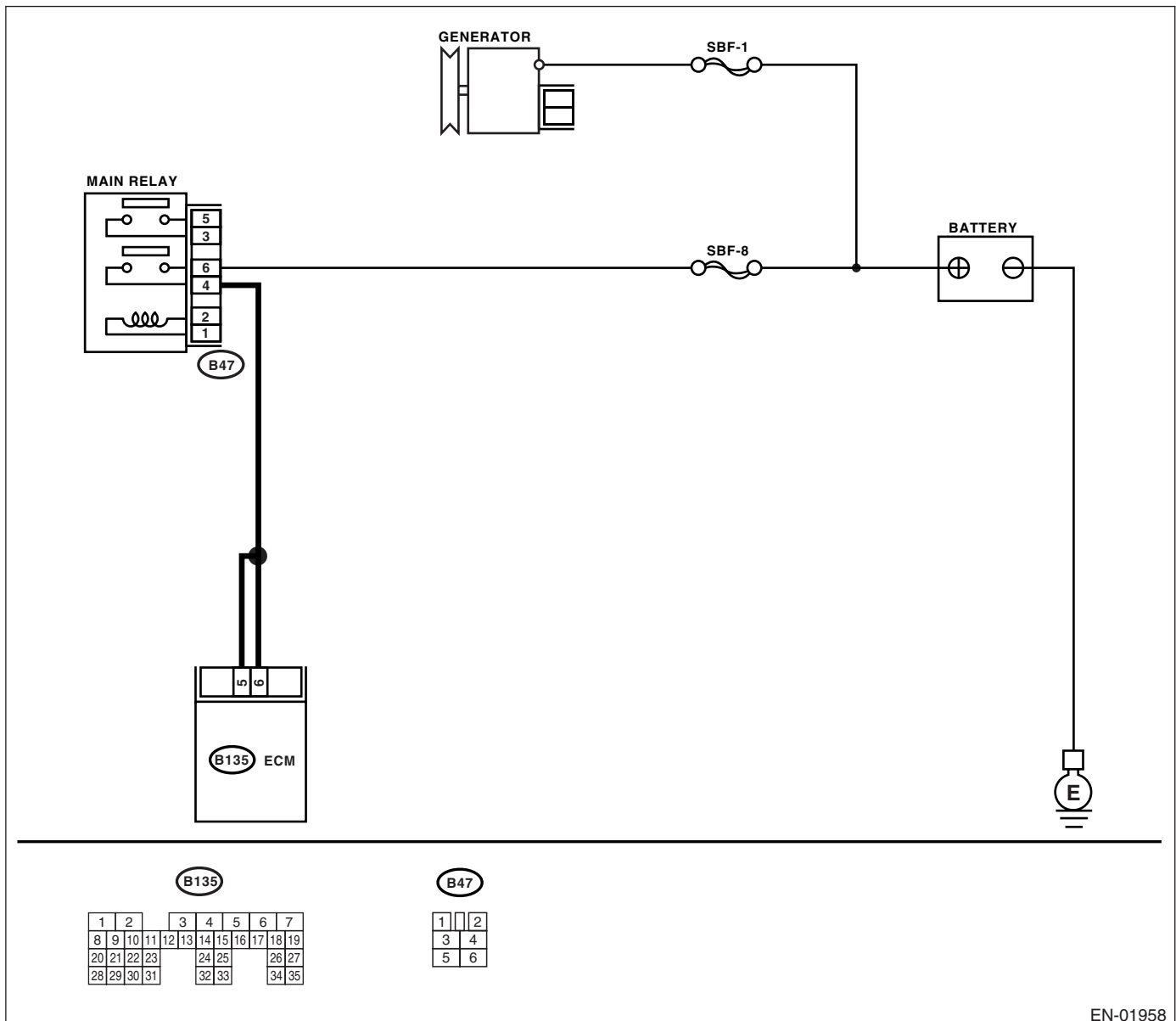
Detect in case of low power supply voltage of ECM.

TROUBLE SYMPTOM:

Charge indicator light illuminates.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:

EN-01958

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK BATTERY. 1) Turn the ignition switch to OFF. 2) Measure battery voltage and specific gravity of electrolyte.	Is the voltage more than 12 V and the gravity more than 1.26?	Go to step 2.	Charge or replace the battery.
2 CHECK GENERATOR. 1) Start the engine. 2) Run the engine at idle after warming up. 3) Measure the voltage between generator B terminal and chassis ground. Terminals Generator B terminal (+) — Chassis ground (-):	Is the voltage less than 10.8 V?	Go to step 3.	Repair the generator. <Ref. to SC(H4SO 2.0)-14, Generator.>
3 CHECK GENERATOR. 1) Run the engine at 5,000 rpm. 2) Measure the voltage between generator B terminal and chassis ground. Terminals Generator B terminal (+) — Chassis ground (-):	Is the voltage less than 10.8 V?	Go to step 4.	Repair the generator. <Ref. to SC(H4SO 2.0)-14, Generator.>
4 CHECK BATTERY TERMINAL. 1) Turn the ignition switch to OFF. 2) Check the installation of positive and negative terminals of battery.	Are the positive and negative battery terminals clamped tightly?	Go to step 5.	Tighten the clamp of terminal.
5 CHECK INPUT VOLTAGE OF ECM. 1) Run the engine at idle. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 5 (+) — Chassis ground (-): (B135) No. 6 (+) — Chassis ground (-):	Is the voltage less than 10.8 V?	Go to step 6.	Repair the harness connectors between battery, main relay and ECM.
6 CHECK POOR CONTACT IN CONNECTORS. Check the poor contact in connectors between generator, battery and ECM.	Is there poor contact in connectors between generator, battery and ECM?	Repair the poor contact.	Go to step 7.
7 CHECK ECM. 1) Connect all the connectors. 2) Erase the memory. <Ref. to EN(H4DOTC)(diag)-30, Clear Memory Mode.> 3) Perform the inspection mode. <Ref. to EN(H4DOTC)(diag)-28, Inspection Mode.> 4) Read the DTC. <Ref. to EN(H4DOTC)(diag)-27, Read Diagnostic Trouble Code (DTC).> Check if the same DTC is displayed.	Is the same DTC displayed?	Replace the generator.	Go to step 8.
8 CHECK ANY OTHER DTC IS DISPLAYED. Check if any other DTC is displayed.	Is any other DTC displayed?	Perform the diagnosis of DTC displayed.	Temporary poor contact occurs.

AS:DTC P0563 SYSTEM VOLTAGE HIGH

DTC DETECTING CONDITION:

Detect in case of high power supply voltage of ECM.

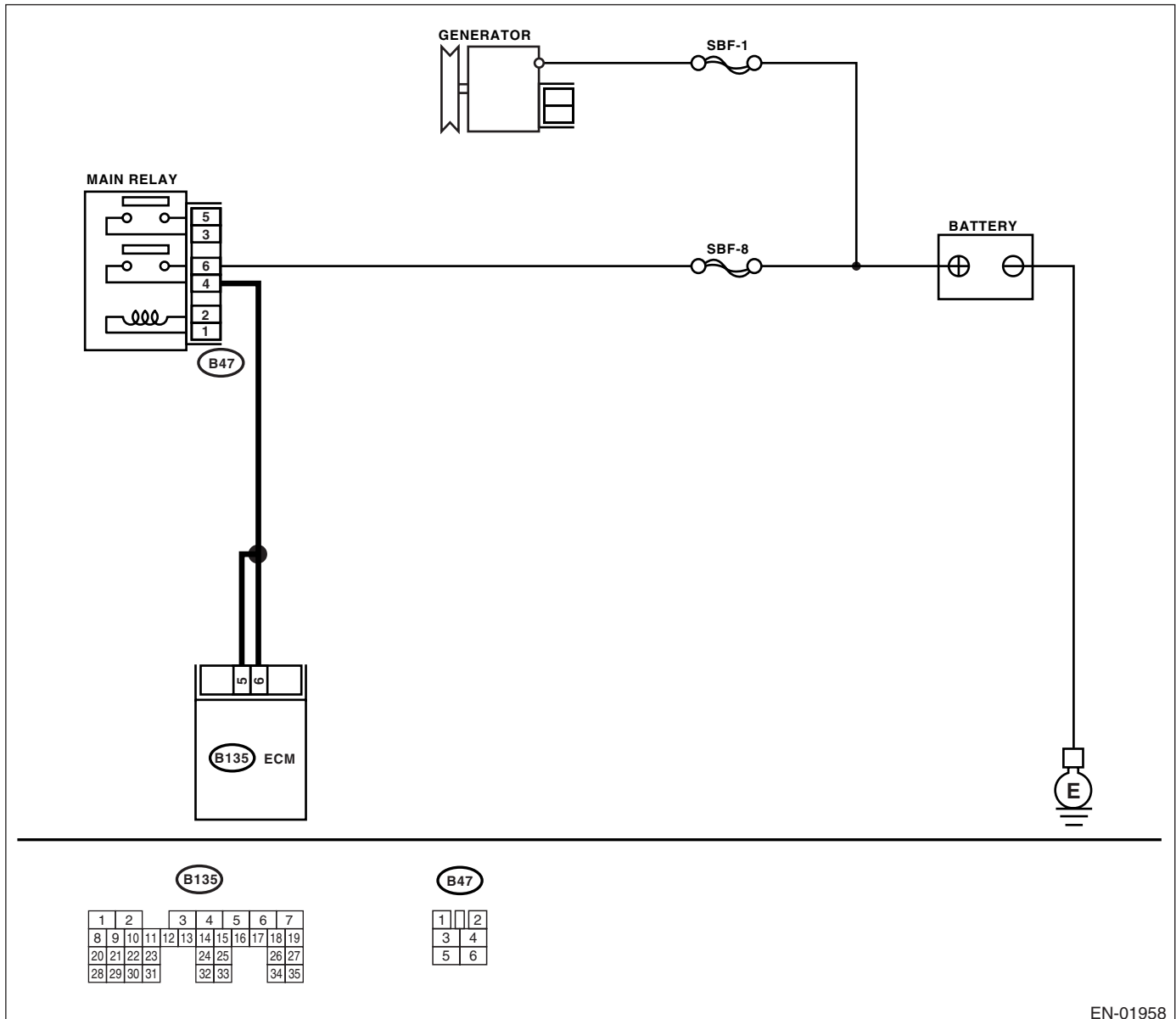
TROUBLE SYMPTOM:

Charge indicator light illuminates.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01958

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK BATTERY. 1) Turn the ignition switch to OFF. 2) Measure battery voltage and specific gravity of electrolyte.	Is the voltage more than 12 V and the gravity more than 1.26?	Go to step 2.	Replace the battery.
2 CHECK GENERATOR. 1) Start the engine. 2) Run the engine at idle after warming up. 3) Measure the voltage between generator B terminal and chassis ground. Terminals Generator B terminal (+) — Chassis ground (-):	Is the voltage more than 16.2 V?	Go to step 3.	Repair the generator. <Ref. to SC(H4SO 2.0)-14, Generator.>
3 CHECK GENERATOR. 1) Run the engine at 5,000 rpm. 2) Measure the voltage between generator B terminal and chassis ground. Terminals Generator B terminal (+) — Chassis ground (-):	Is the voltage more than 16.2 V?	Go to step 4.	Repair the generator. <Ref. to SC(H4SO 2.0)-14, Generator.>
4 CHECK BATTERY TERMINAL. 1) Turn the ignition switch to OFF. 2) Check the installation of positive and negative terminals of battery.	Are the positive and negative battery terminals clamped tightly?	Go to step 5.	Tighten the clamp of terminal.
5 CHECK INPUT VOLTAGE OF ECM. 1) Run the engine at idle. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal (B135) No. 5 (+) — Chassis ground (-): (B135) No. 6 (+) — Chassis ground (-):	Is the voltage more than 16.2 V?	Go to step 6.	Repair the harness connectors between battery, main relay and ECM.
6 CHECK POOR CONTACT IN CONNECTORS. Check the poor contact in connectors between generator, battery and ECM.	Is there poor contact in connectors between generator, battery and ECM?	Repair the poor contact.	Go to step 7.
7 CHECK ECM. 1) Connect all the connectors. 2) Erase the memory. <Ref. to EN(H4DOTC)(diag)-30, Clear Memory Mode.> 3) Perform the inspection mode. <Ref. to EN(H4DOTC)(diag)-28, Inspection Mode.> 4) Read the DTC. <Ref. to EN(H4DOTC)(diag)-27, Read Diagnostic Trouble Code (DTC).> Check if the same DTC is displayed.	Is the same DTC displayed?	Replace the generator.	Go to step 8.
8 CHECK ANY OTHER DTC IS DISPLAYED. Check if any other DTC is displayed.	Is any other DTC displayed?	Perform the diagnosis of DTC displayed.	Temporary poor contact occurs.

AT:DTC P0600 SERIAL COMMUNICATION LINK

NOTE:

For the diagnostic procedure, refer to LAN system.

AU:DTC P0604 INTERNAL CONTROL MODULE READ ACCESS MEMORY (RAM) ERROR

NOTE:

For the diagnostic procedure, refer to DTC P0607. <Ref. to EN(H4DOTC)(diag)-152, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

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

NOTE:

For the diagnostic procedure, refer to DTC P0607. <Ref. to EN(H4DOTC)(diag)-152, DTC P0607 CONTROL MODULE PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

AW:DTC P0607 CONTROL MODULE PERFORMANCE

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

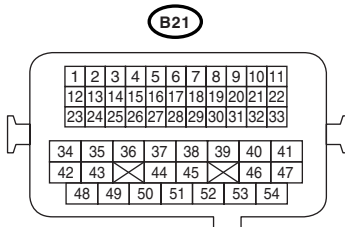
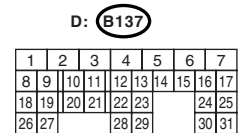
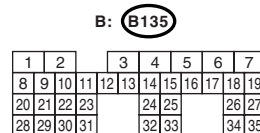
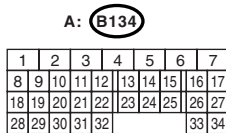
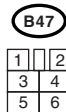
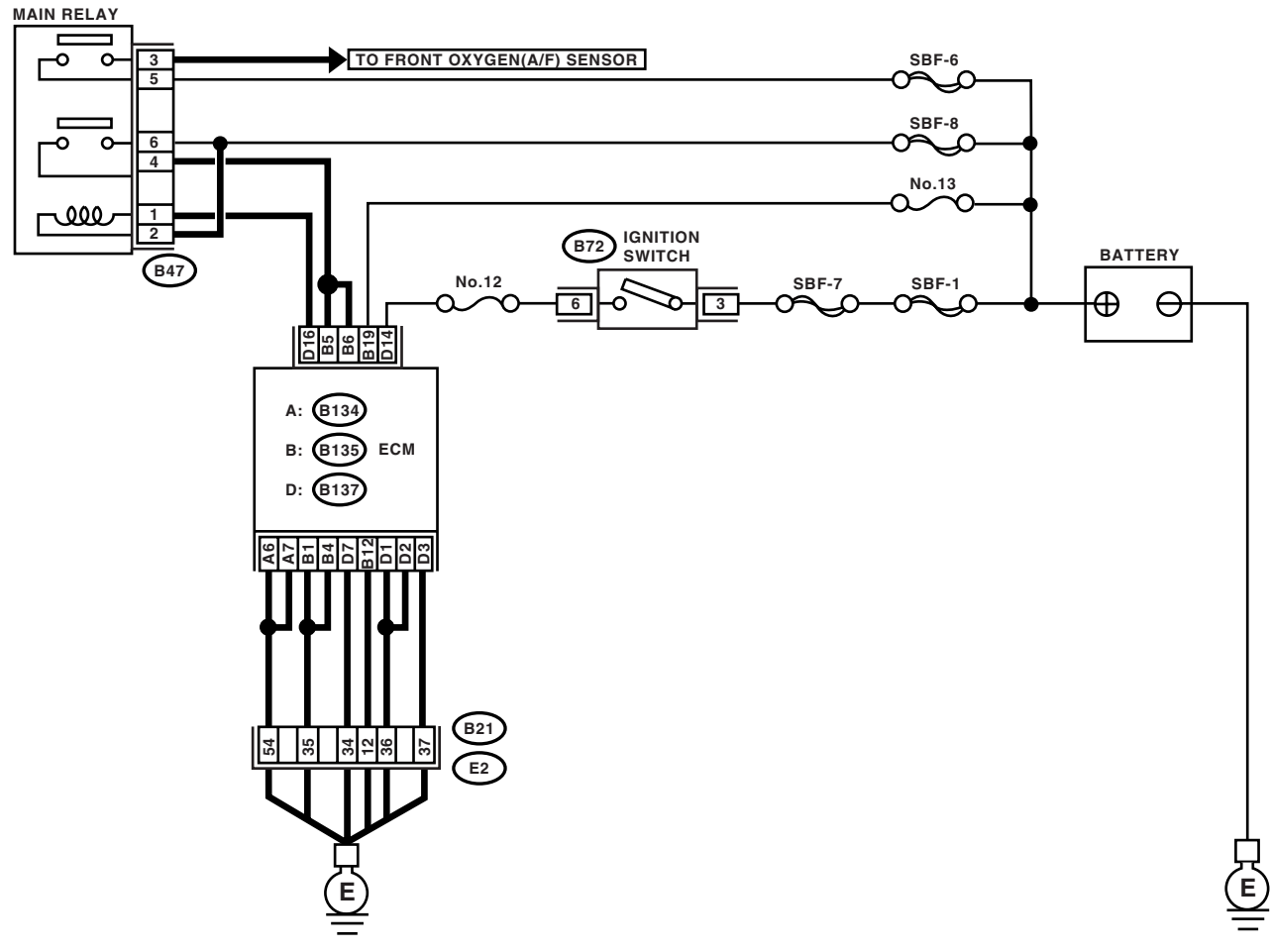
CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



EN-02403

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT VOLTAGE OF ECM. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector and chassis ground. Connector & terminal <i>(B135) No. 5 (+) — Chassis ground (-):</i> <i>(B135) No. 6 (+) — Chassis ground (-):</i>	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 connector and chassis ground. Connector & terminal <i>(B135) No. 5 (+) — Chassis ground (-):</i> <i>(B135) No. 6 (+) — Chassis ground (-):</i>	Is the voltage 13 — 15 V?	Go to step 3.	Repair the open or ground short circuit of power supply circuit.
3 CHECK ECM GROUND HARNESS. Measure the voltage between ECM connector and chassis ground. Connector & terminal <i>(B137) No. 1 (+) — Chassis ground (-):</i> <i>(B137) No. 2 (+) — Chassis ground (-):</i>	Is the voltage less than 1 V?	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Further tighten the engine ground terminal.

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

NOTE:

For diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)(diag)-176, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

AY:DTC P0700 TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

NOTE:

For the diagnostic procedure, refer to AT section. <Ref. to 5AT(diag)-2, Basic Diagnostics Procedure.>

AZ:DTC P0851 NEUTRAL SWITCH INPUT CIRCUIT LOW

NOTE:

For the diagnostic procedure, refer to AT section. <Ref. to 5AT(diag)-2, Basic Diagnostics Procedure.>

BA:DTC P0852 NEUTRAL SWITCH INPUT CIRCUIT HIGH

NOTE:

For the diagnostic procedure, refer to AT section. <Ref. to 5AT(diag)-2, Basic Diagnostics Procedure.>

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is DTC P1110 displayed on the Subaru Select Monitor?	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).> NOTE: Atmospheric pressure sensor is built in ECM.	Temporary poor contact occurs.

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is DTC P1111 displayed on the Subaru Select Monitor?	Replace the ECM. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).> NOTE: Atmospheric pressure sensor is built in ECM.	Temporary poor contact occurs.

BD:DTC P1160 RETURN SPRING FAILURE

NOTE:

For diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)(diag)-176, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BE:DTC P1518 STARTER SWITCH CIRCUIT LOW INPUT

DTC DETECTING CONDITION:

Two consecutive driving cycles with fault

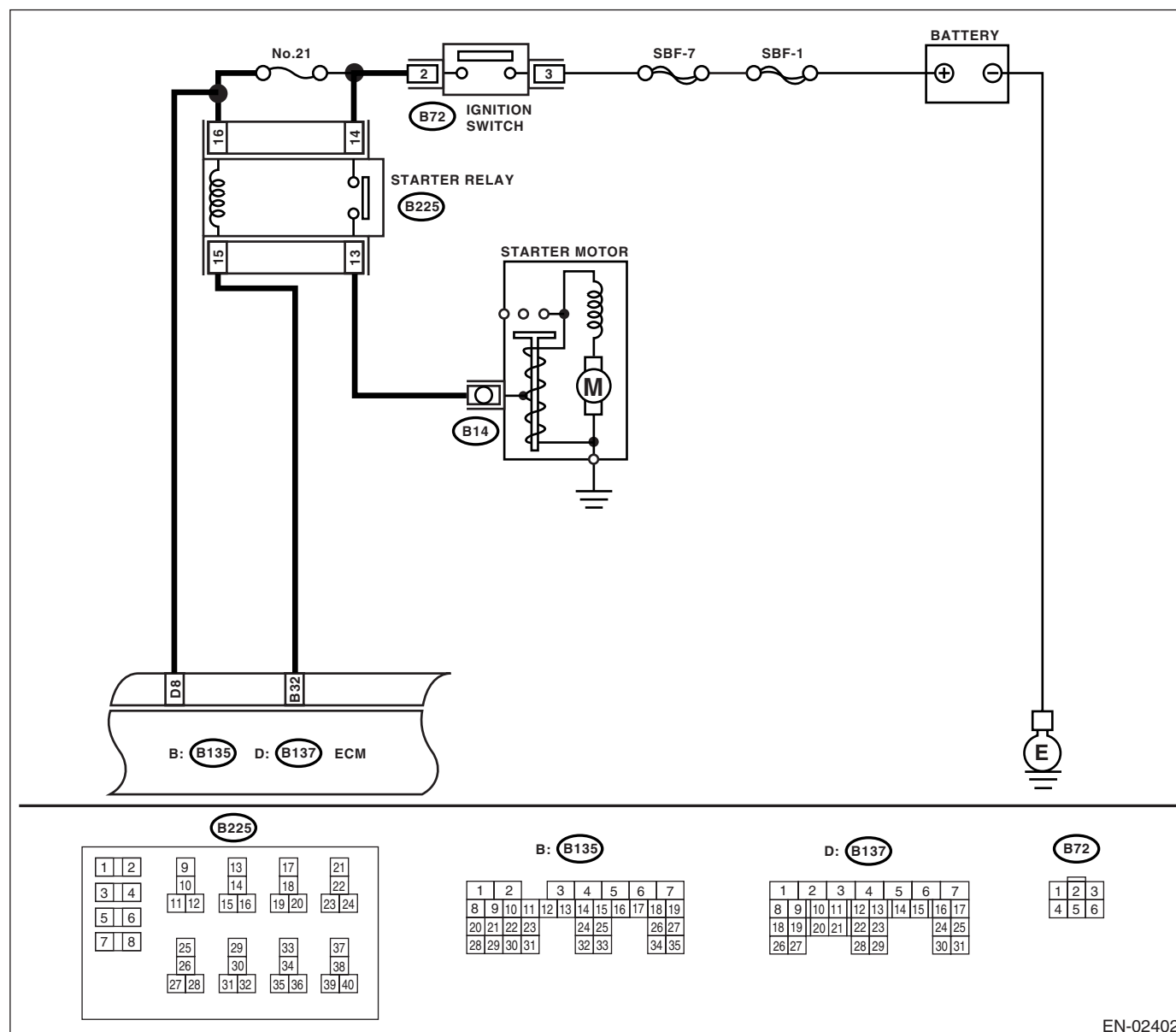
TROUBLE SYMPTOM:

Failure of engine to start

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-02402

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ANY OTHER DTC ON DISPLAY.	Is any other DTC displayed?	Inspect the DTC using "List of Diagnostic Trouble Code (DTC)". <Ref. to EN(H4DOTC)(diag)-55, List of Diagnostic Trouble Code (DTC).>	Go to step 2.
2 CHECK HARNESS BETWEEN STARTER RELAY AND ECM. 1) Disconnect the connectors from starter relay and ECM. 2) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B135) No. 32 — Chassis ground:	Is the resistance more than 1 MΩ?	Repair the ground short circuit between starter motor and ECM.	Repair the poor contact in ECM connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BF:DTC P1560 BACK-UP VOLTAGE CIRCUIT MALFUNCTION

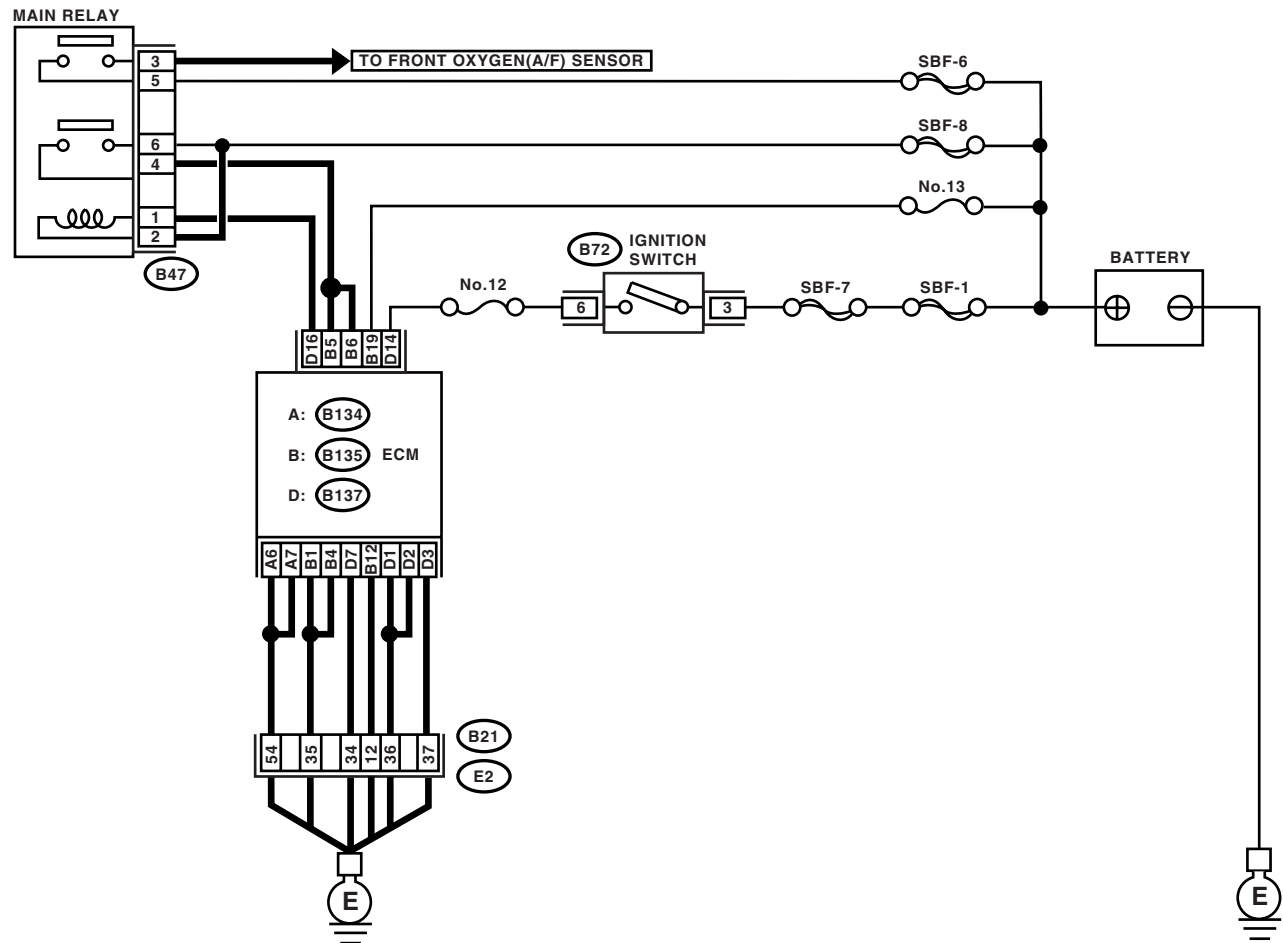
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



(B72)

1	2	3
4	5	6

(B47)

1	2
3	4
5	6

A: (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	

B: (B135)

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

D: (B137)

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				

(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				

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK INPUT SIGNAL FROM ECM. 1) Turn the ignition switch to OFF. 2) Measure the voltage between ECM and chassis ground. Connector & terminal (B135) No. 19 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Repair the poor contact in ECM connector.	Go to step 2.
2 CHECK HARNESS BETWEEN ECM AND MAIN FUSE BOX CONNECTOR. 1) Disconnect the connector from ECM. 2) Measure the resistance of harness between ECM and chassis ground. Connector & terminal (B135) No. 19 — Chassis ground:	Is the resistance less than 10 Ω ?	Repair the ground short circuit in harness between ECM connector and battery terminal.	Go to step 3.
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: <ul style="list-style-type: none"> • Open circuit in harness between ECM and battery • Poor contact in ECM connector • Poor contact in battery terminal

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

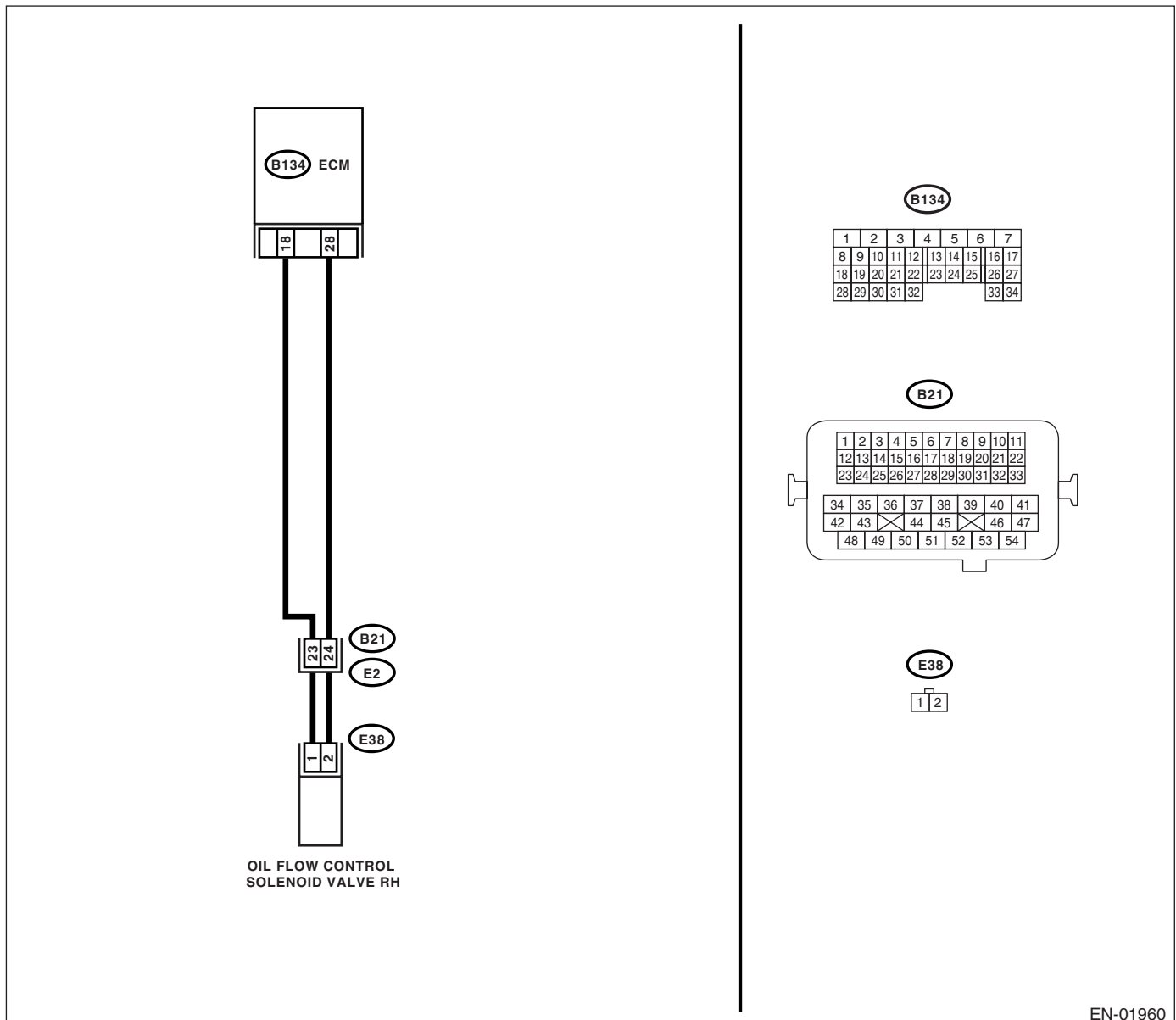
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01960

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. Connector & terminal (B134) No. 18 — (E38) No. 1: (B134) No. 28 — (E38) No. 2:	Is the resistance less than 1 Ω ?	Go to step 2.	Repair the open circuit in harness between ECM and oil flow control solenoid valve connector. NOTE: In this case, repair the following: • Open circuit in harness between ECM and oil flow control solenoid valve connector • Poor contact in coupling connector
2 CHECK OIL FLOW CONTROL SOLENOID VALVE. 1) Disconnect the oil flow control solenoid valve connector. 2) 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 in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

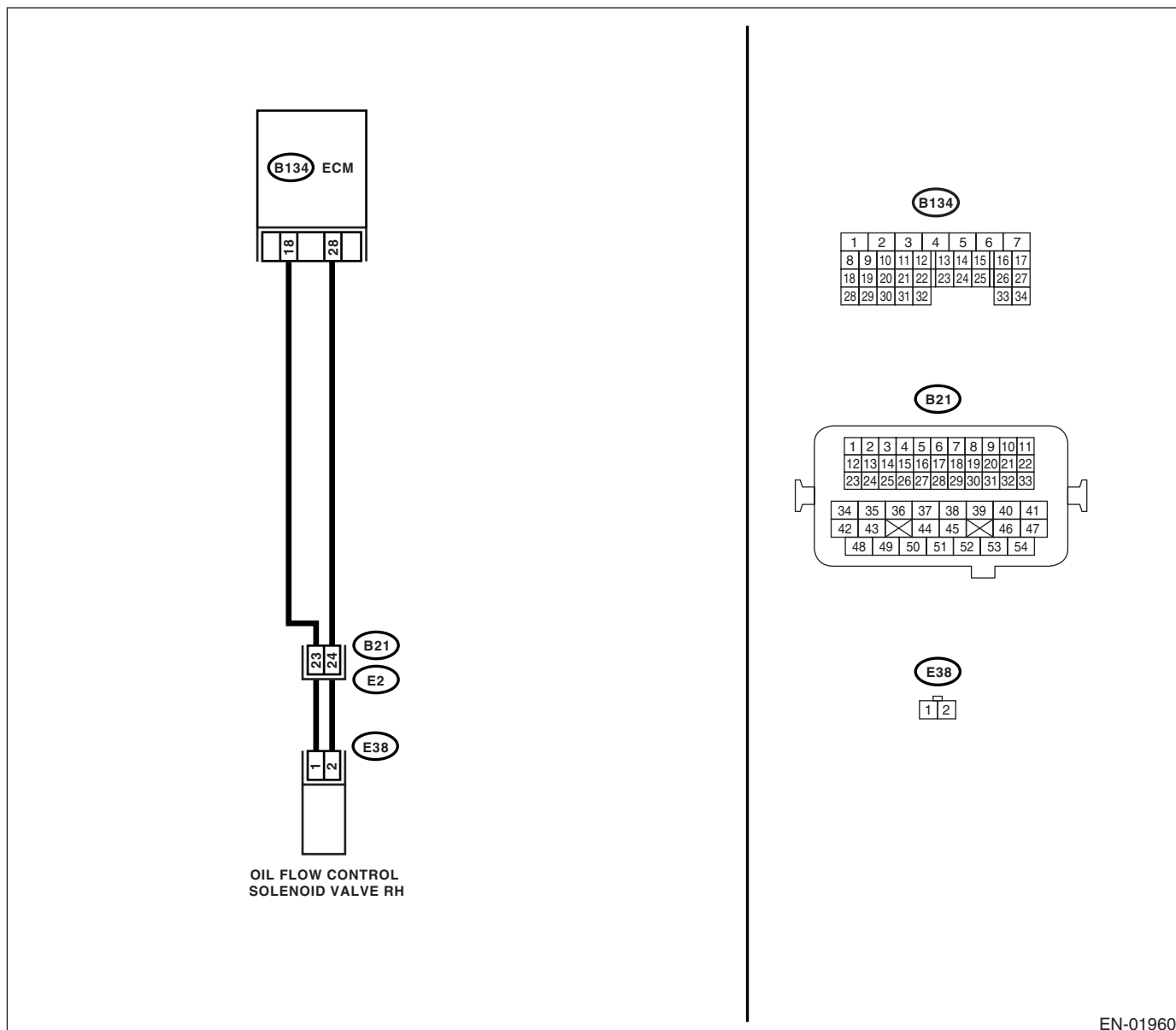
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01960

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between oil flow control solenoid valve and engine ground. Connector & terminal (E38) No. 1 — Engine ground: (E38) No. 2 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 2.	Repair the short circuit between ECM and oil flow control solenoid valve connector.
2 CHECK OIL FLOW CONTROL SOLENOID VALVE. 1) Disconnect the oil flow control solenoid valve connector. 2) 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 in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BI: DTC P2090 OCV SOLENOID VALVE SIGNAL B CIRCUIT OPEN (BANK 1)

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

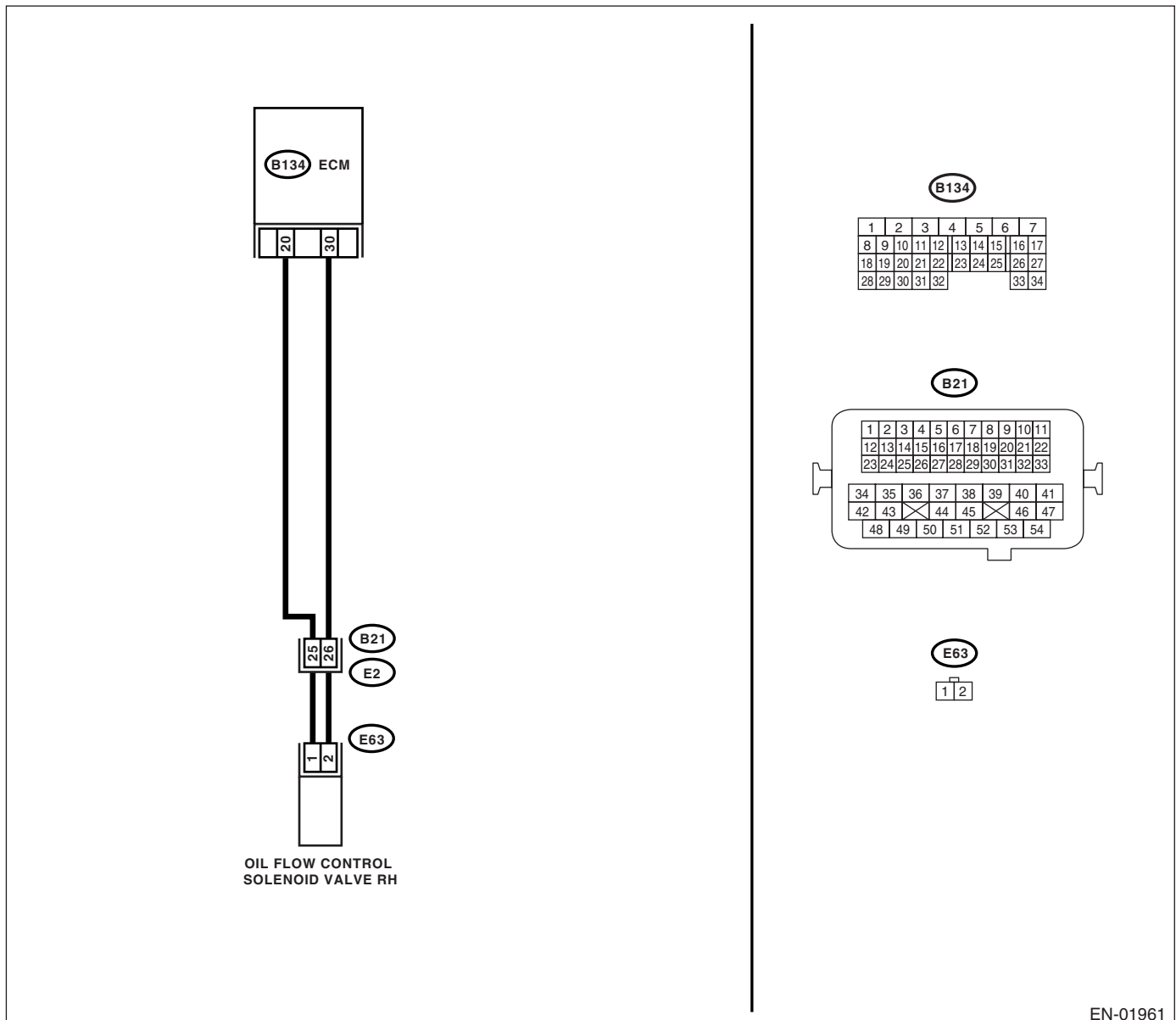
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01961

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. Connector & terminal (B134) No. 20 — (E63) No. 1: (B134) No. 30 — (E63) No. 2:	Is the resistance less than 1 Ω ?	Go to step 2.	Repair the open circuit in harness between ECM and oil flow control solenoid valve connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between ECM and oil flow control solenoid valve connector • Poor contact in coupling connector
2 CHECK OIL FLOW CONTROL SOLENOID VALVE. 1) Disconnect the oil flow control solenoid valve connector. 2) 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 in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BJ:DTC P2091 OCV SOLENOID VALVE SIGNAL B CIRCUIT SHORT (BANK 1)

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

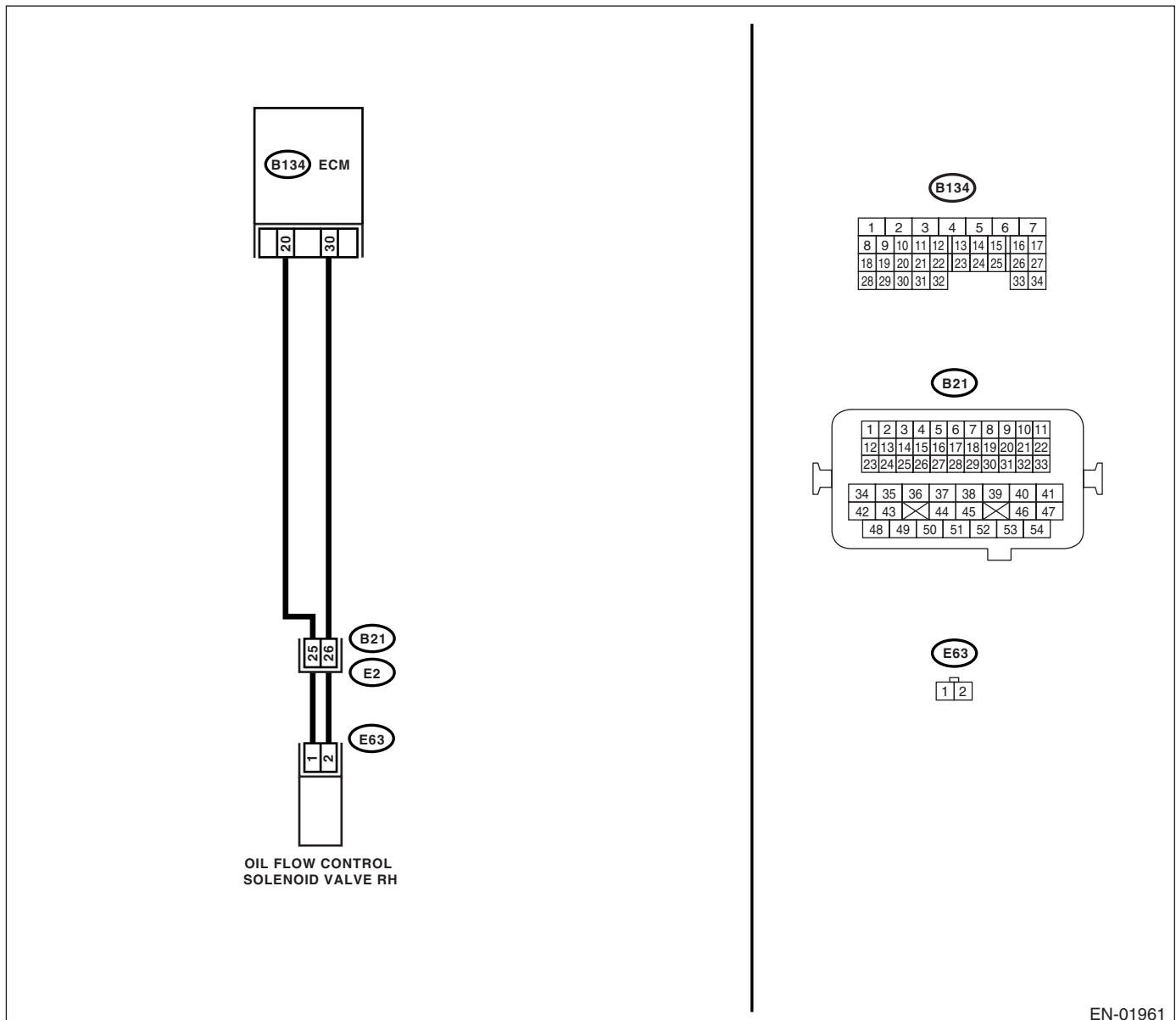
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01961

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between oil flow control solenoid valve and engine ground. Connector & terminal (E63) No. 1 — Engine ground: (E63) No. 2 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 2.	Repair the short circuit between ECM and oil flow control solenoid valve connector.
2 CHECK OIL FLOW CONTROL SOLENOID VALVE. 1) Disconnect the oil flow control solenoid valve connector. 2) 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 in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

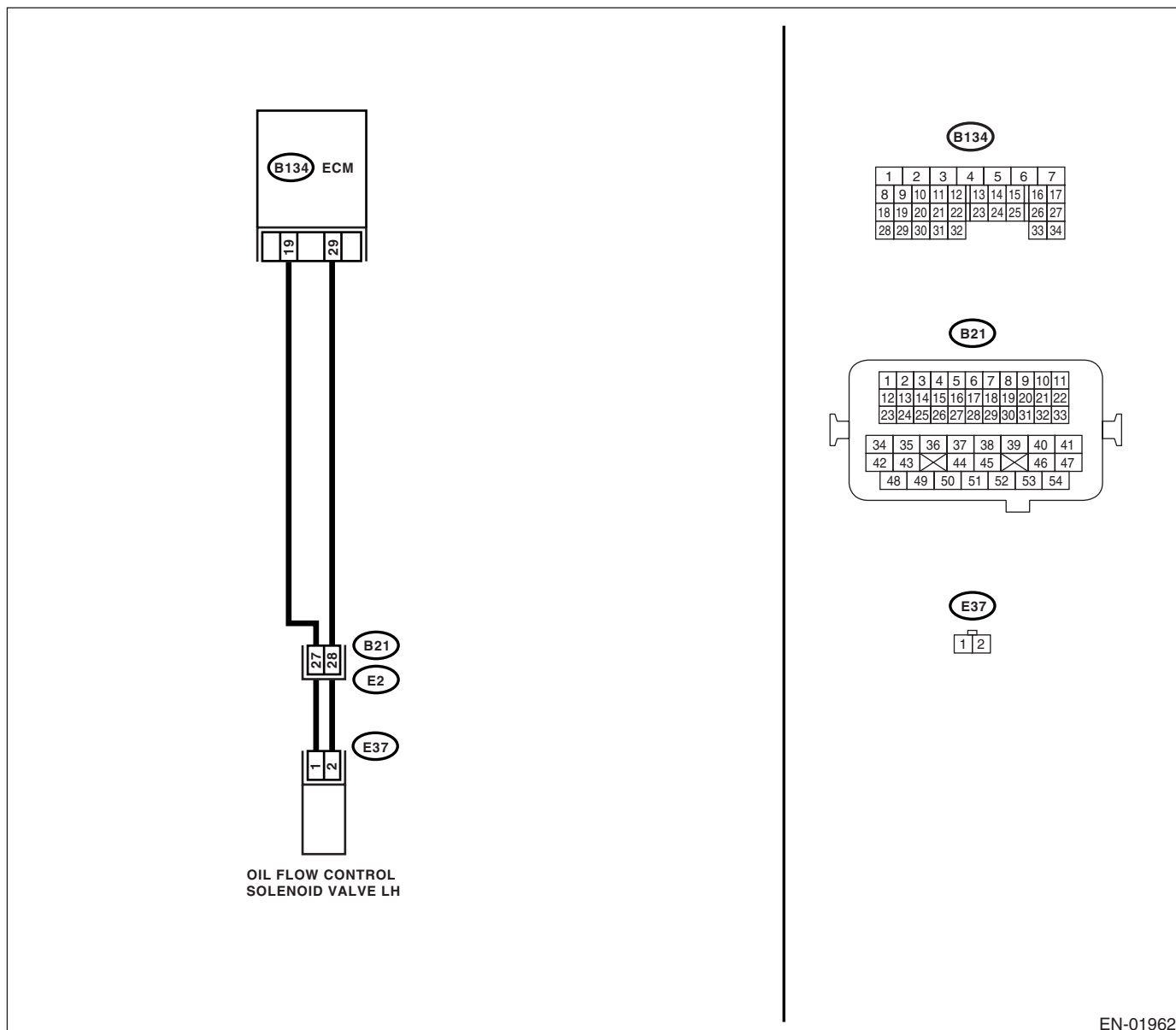
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01962

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. Connector & terminal (B134) No. 19 — (E37) No. 1: (B134) No. 29 — (E37) No. 2:	Is the resistance less than 1 Ω ?	Go to step 2.	Repair the open circuit in harness between ECM and oil flow control solenoid valve connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between ECM and oil flow control solenoid valve connector • Poor contact in coupling connector
2 CHECK OIL FLOW CONTROL SOLENOID VALVE. 1) Disconnect the oil flow control solenoid valve connector. 2) 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 in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

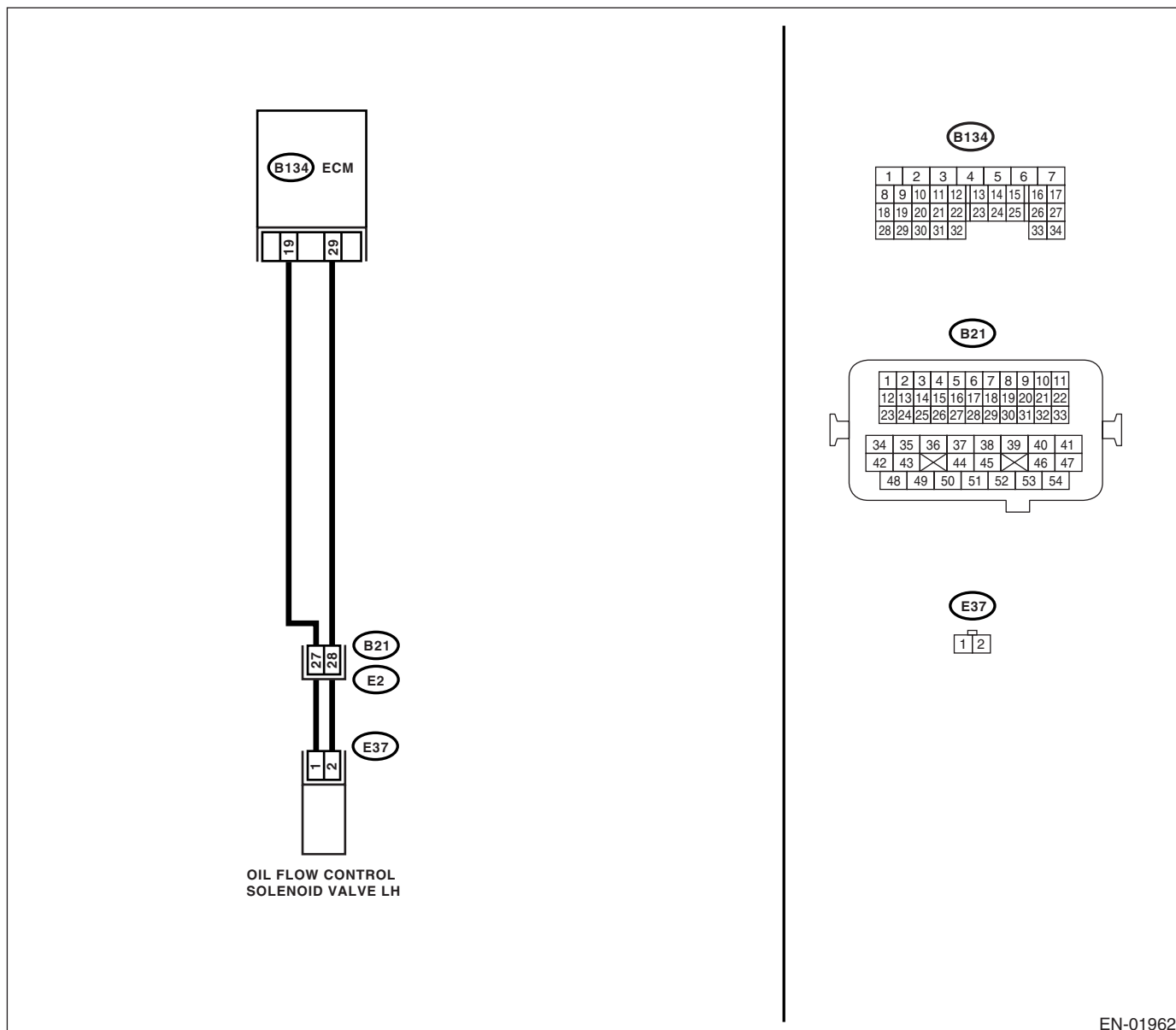
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01962

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between oil flow control solenoid valve and engine ground. Connector & terminal (E37) No. 1 — Engine ground: (E37) No. 2 — Engine ground:	Is the resistance more than 1 M Ω ?	Go to step 2.	Repair the short circuit between ECM and oil flow control solenoid valve connector.
2 CHECK OIL FLOW CONTROL SOLENOID VALVE. 1) Disconnect the oil flow control solenoid valve connector. 2) 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 in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BM:DTC P2094 OCV SOLENOID VALVE SIGNAL B CIRCUIT OPEN (BANK 2)

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

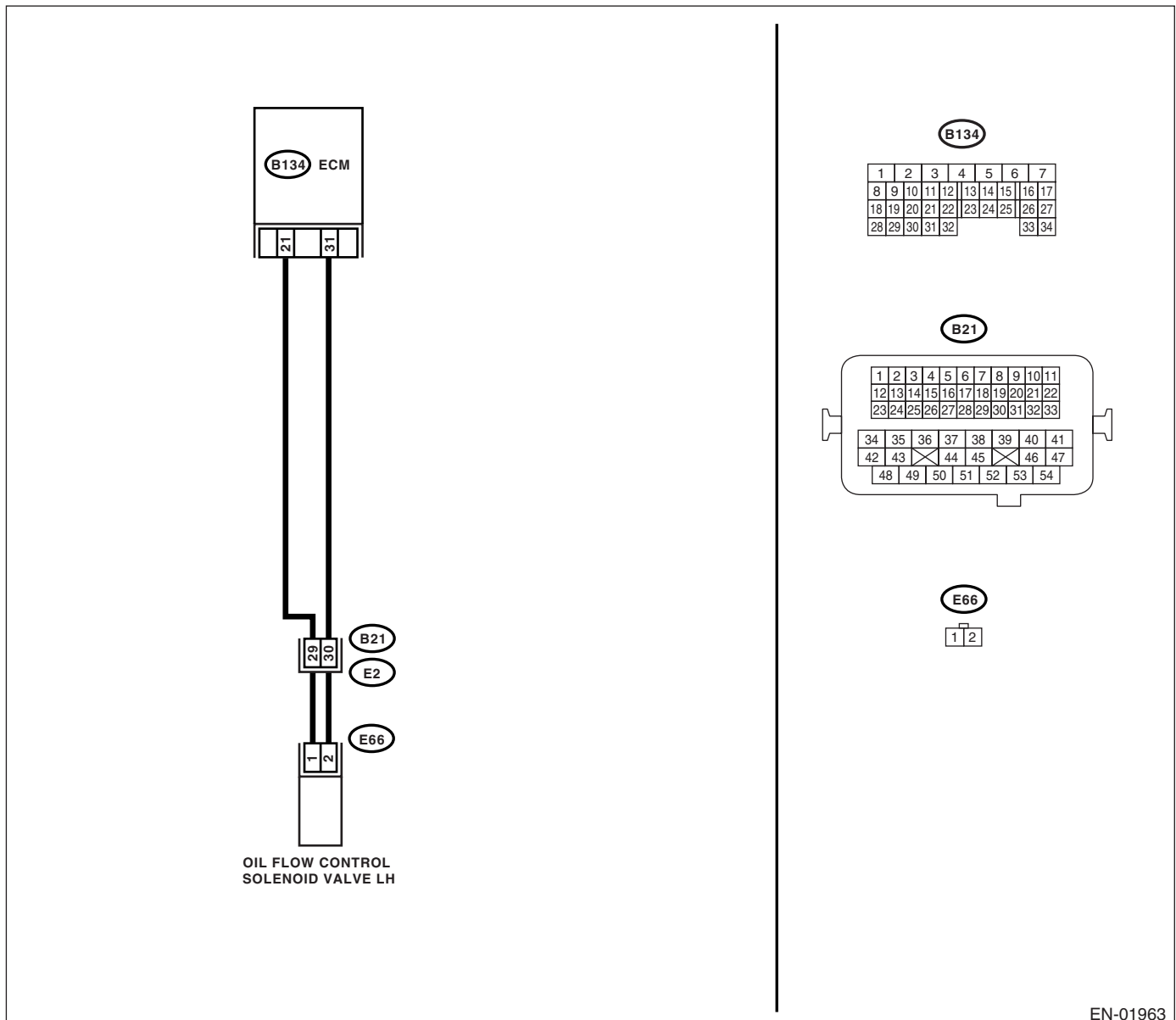
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between ECM and oil flow control solenoid valve. Connector & terminal (B134) No. 21 — (E66) No. 1: (B134) No. 31 — (E66) No. 2:	Is the resistance less than 1 Ω ?	Go to step 2.	Repair the open circuit in harness between ECM and oil flow control solenoid valve connector. NOTE: In this case, repair the following: <ul style="list-style-type: none"> • Open circuit in harness between ECM and oil flow control solenoid valve connector • Poor contact in coupling connector
2 CHECK OIL FLOW CONTROL SOLENOID VALVE. 1) Disconnect the oil flow control solenoid valve connector. 2) 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 in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BN:DTC P2095 OCV SOLENOID VALVE SIGNAL B CIRCUIT SHORT (BANK 2)

DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

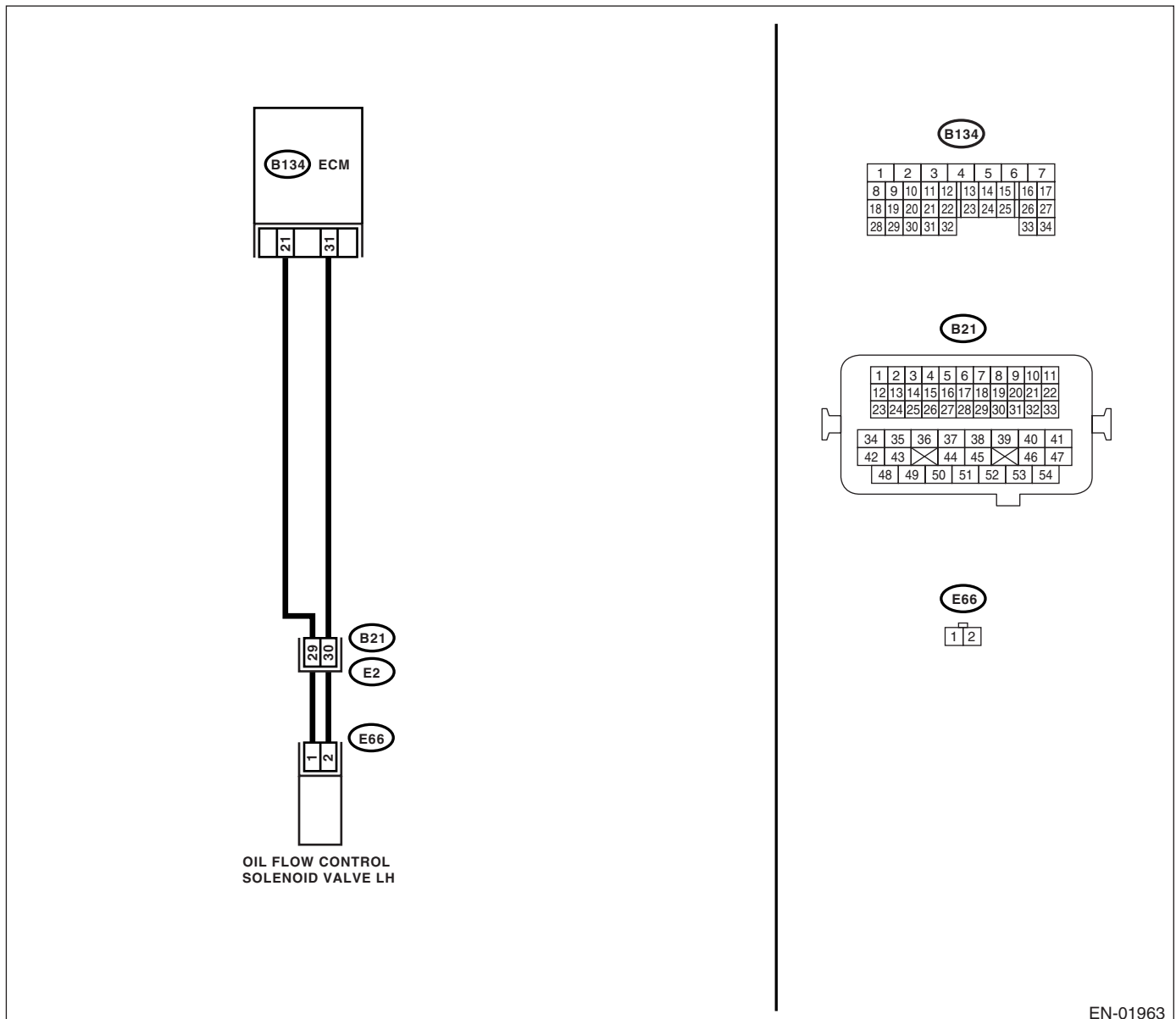
TROUBLE SYMPTOM:

Erroneous idling

CAUTION:

After repair or replacement of faulty parts, conduct Clear Memory Mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and Inspection Mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.>.

WIRING DIAGRAM:



EN-01963

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK HARNESS BETWEEN ECM AND OIL FLOW CONTROL SOLENOID VALVE. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM and oil flow control solenoid valve. 3) Measure the resistance between oil flow control solenoid valve and engine ground. Connector & terminal (E66) No. 1 — Engine ground: (E66) No. 2 — Engine ground:	Is the resistance more than 1 MΩ?	Go to step 2.	Repair the short circuit between ECM and oil flow control solenoid valve connector.
2 CHECK OIL FLOW CONTROL SOLENOID VALVE. 1) Disconnect the oil flow control solenoid valve connector. 2) 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 in ECM and oil flow control solenoid valve.	Replace the oil flow control solenoid valve. <Ref. to ME(H4DOTC)-53, Camshaft.>

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

BO:DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/ PERFORMANCE

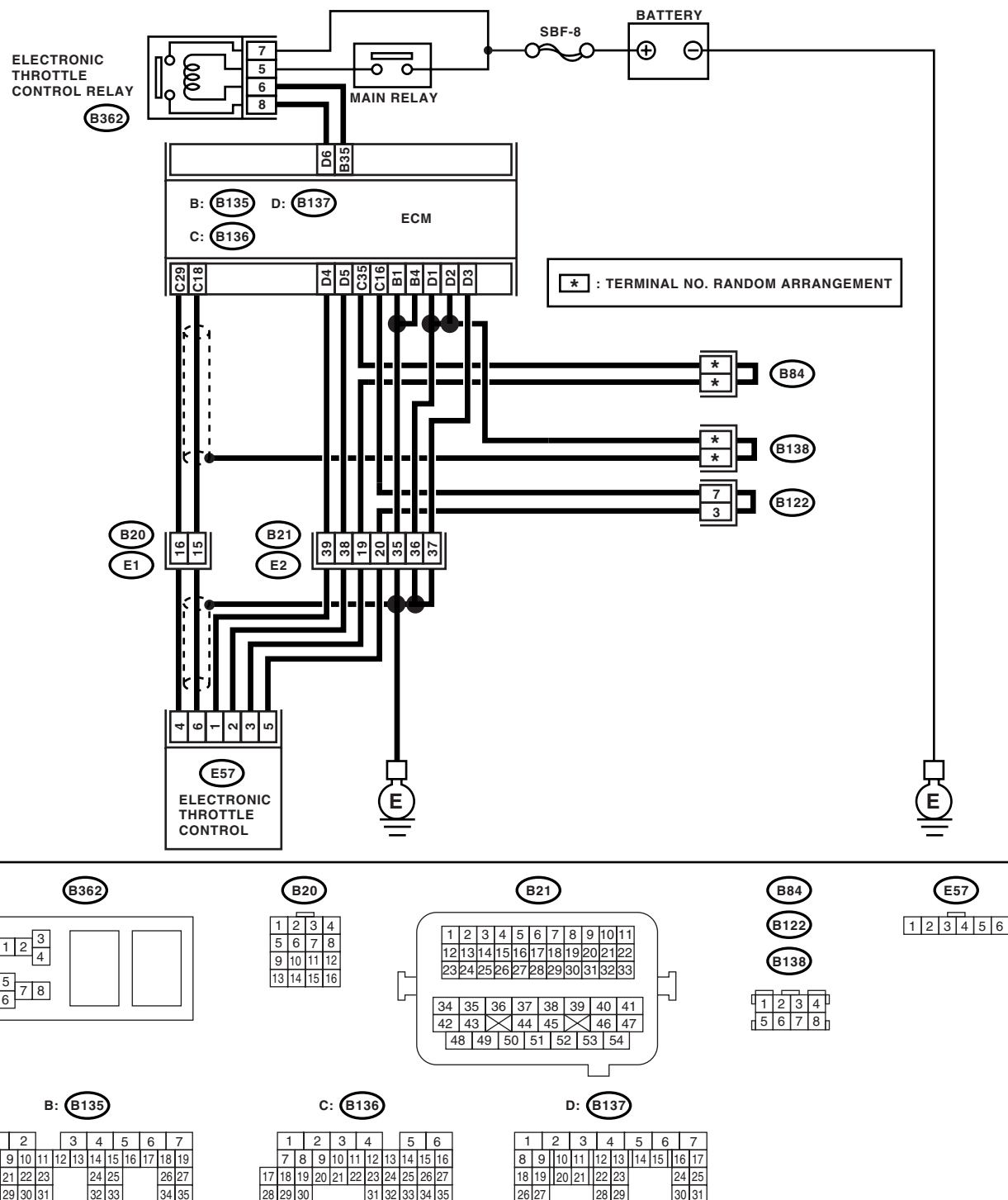
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance
- Engine stalls.

WIRING DIAGRAM:



EN-01951

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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. 5 and No. 6 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control relay terminals. Terminals No. 7 — No. 8:	Is the resistance less than 1 Ω ?	Go to step 2.	Replace the 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 (B362) No. 7 (+) — Chassis ground (-): (B362) No. 5 (+) — Chassis ground (-):	Is the voltage more than 5 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 RELAY. 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 (B362) No. 6 (+) — Chassis ground (-):	Is the voltage less than 5 V?	Go to step 4.	Repair power supply short circuit in harness between ECM and electronic throttle control.
4 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY. 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. Connector & terminal (B362) No. 6 — Chassis ground: (B362) No. 8 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair the ground short circuit in harness between ECM and electronic throttle control relay.
5 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY. Measure the resistance between ECM connector and electronic throttle control relay connector. Connector & terminal (B135) No. 35 — (B362) No. 6: (B137) No. 6 — (B362) No. 8:	Is the resistance less than 1 Ω ?	Go to step 6.	Repair the open circuit in harness between ECM and electronic throttle control relay.
6 CHECK SENSOR OUTPUT. 1) Connect all the connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector terminals. Connector & terminal (B136) No. 18 (+) — (B136) No. 35 (-):	Is the voltage more than 0.4 V?	Go to step 7.	Go to step 9.
7 CHECK SENSOR OUTPUT. 1) Connect all the connectors. 2) Turn the ignition switch to ON. 3) Measure the voltage between ECM connector terminals. Connector & terminal (B136) No. 29 (+) — (B136) No. 35 (-):	Is the voltage more than 0.8 V?	Go to step 8.	Go to step 9.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK POOR CONTACT. Check the poor contact in connector between ECM and electronic throttle control.	Is there poor contact?	Repair the poor contact.	Go to step 13 .
9 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from the electronic throttle control. 4) Measure the resistance between ECM connector and electronic throttle control connector. Connector & terminal (B136) No. 16 — (E57) No. 5:	Is the resistance less than 1 Ω ?	Go to step 10 .	Repair the open circuit of harness connector.
10 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. Measure the resistance between ECM connector and chassis ground. Connector & terminal (B136) No. 16 — Chassis ground: (B136) No. 18 — Chassis ground: (B136) No. 29 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 11 .	Repair the ground short circuit of harness.
11 CHECK SENSOR POWER SUPPLY. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. Connector & terminal (E57) No. 5 (+) — Engine ground (-):	Is the voltage 4.5 — 5.5 V?	Go to step 12 .	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
12 CHECK SHORT CIRCUIT IN ECM. 1) Turn the ignition switch to OFF. 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 more than 10 Ω ?	Go to step 13 .	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
13 CHECK SENSOR OUTPUT. 1) Connect all the connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal using Subaru Select Monitor.	Is the voltage 4.63 V?	Go to step 14 .	Go to step 16 .
14 CHECK SENSOR OUTPUT. Read the data of sub throttle sensor signal using Subaru Select Monitor.	Is the voltage 4.73 V?	Go to step 15 .	Go to step 16 .
15 CHECK POOR CONTACT. Check the poor contact in connector between ECM and electronic throttle control.	Is there poor contact?	Repair the poor contact.	Go to step 20 .

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
16 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from the electronic throttle control. 4) Measure the resistance between ECM connector and electronic throttle control connector. Connector & terminal (B136) No. 35 — (E57) No. 3: (B136) No. 18 — (E57) No. 6: (B136) No. 29 — (E57) No. 4:	Is the resistance less than 1 Ω ?	Go to step 17.	Repair the open circuit of harness connector.
17 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Connect the ECM connector. 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 18.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
18 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 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 less than 10 V?	Go to step 19.	Repair the short circuit in harness between ECM connector and electronic throttle control connector.
19 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Remove the ECM. 3) Measure the resistance between ECM connectors. Connector & terminal (B136) No. 18 — (B136) No. 35: (B136) No. 29 — (B136) No. 35:	Is the resistance more than 1 M Ω ?	Go to step 20.	Repair the short circuit to sensor power supply.
20 CHECK SENSOR OUTPUT. 1) Turn the ignition switch to OFF. 2) Connect the connectors except of the electric control throttle relay. 3) Turn the ignition switch to ON. 4) Read the data of main throttle sensor signal using Subaru Select Monitor.	Is the voltage 0.81 — 0.87 V?	Go to step 21.	Repair the poor contact of electronic throttle control connector. Replace the electronic throttle control if defective.
21 CHECK SENSOR OUTPUT. Read the data of sub throttle sensor signal using Subaru Select Monitor.	Is the voltage 1.64 — 1.70 V?	Go to step 22.	Repair the poor contact in ECM connector. Replace the electronic throttle control if defective.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
22 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL MOTOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from the electronic throttle control. 4) Measure the resistance between ECM connector and electronic throttle control connector. Connector & terminal (B137) No. 5 — (E57) No. 2: (B137) No. 4 — (E57) No. 1:	Is the resistance less than 1 Ω ?	Go to step 23.	Repair the open circuit of harness connector.
23 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 less than 5 V?	Go to step 24.	Repair power supply short circuit in harness between ECM and electronic throttle control.
24 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 more than 1 M Ω ?	Go to step 25.	Repair the short circuit of harness.
25 CHECK ELECTRONIC THROTTLE CONTROL MOTOR HARNESS. Measure the resistance between electronic throttle control connector terminals. Connector & terminal (E57) No. 2 — (E57) No. 1:	Is the resistance more than 1 M Ω ?	Go to step 26.	Repair the short circuit of harness.
26 CHECK ELECTRONIC THROTTLE CONTROL GROUND CIRCUIT. Measure the resistance between ECM connector and chassis ground. Connector & terminal (B137) No. 3 — Chassis ground:	Is the resistance less than 10 Ω ?	Go to step 27.	Repair the open circuit of harness.
27 CHECK ELECTRONIC THROTTLE CONTROL. Measure the resistance between electronic throttle control terminals. Terminals No. 1 — No. 2:	Is the resistance less than 5 Ω ?	Go to step 28.	Replace the electronic throttle control.
28 CHECK ELECTRONIC THROTTLE CONTROL. Move the throttle valve to the fully open and fully closed positions with fingers. Check 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 in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Replace the electronic throttle control.

BP:DTC P2102 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT LOW

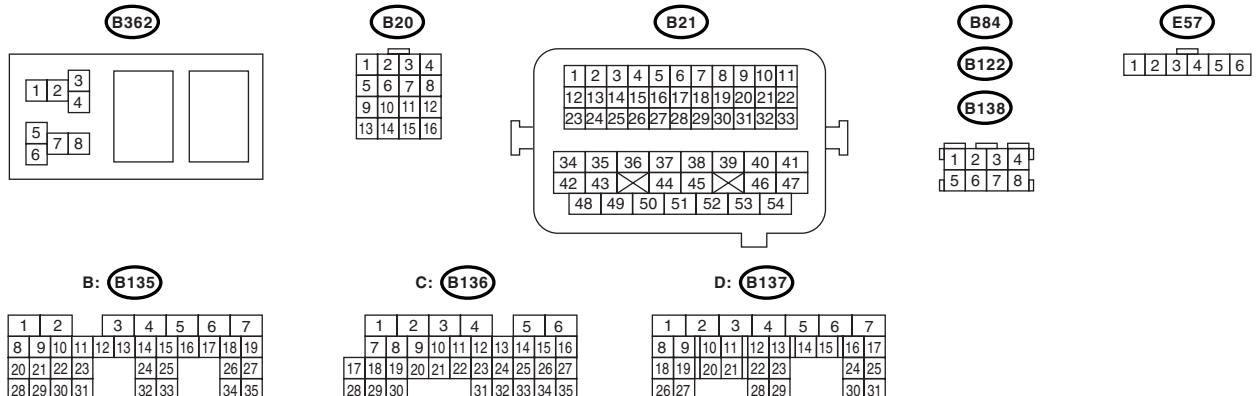
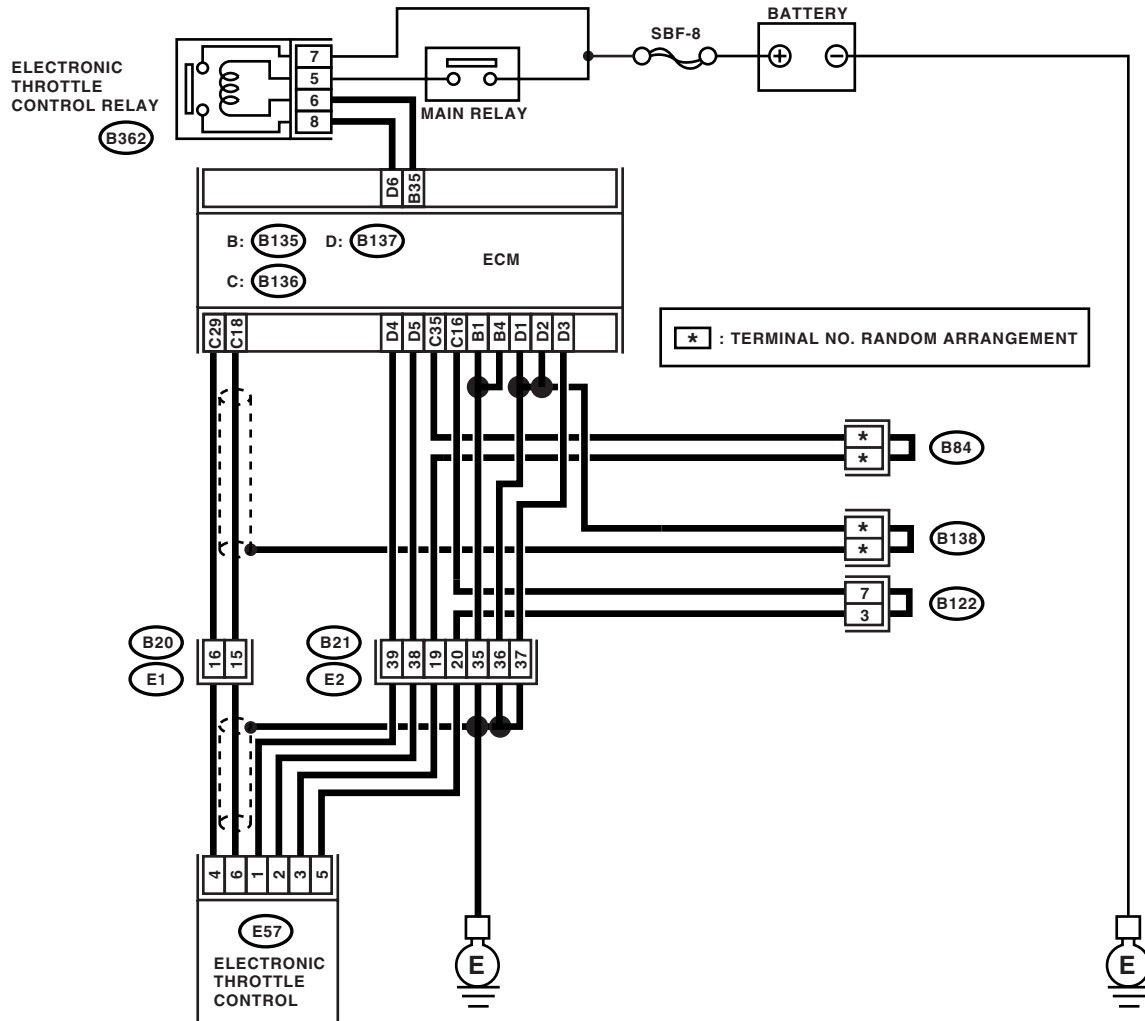
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance
- Engine stalls.

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

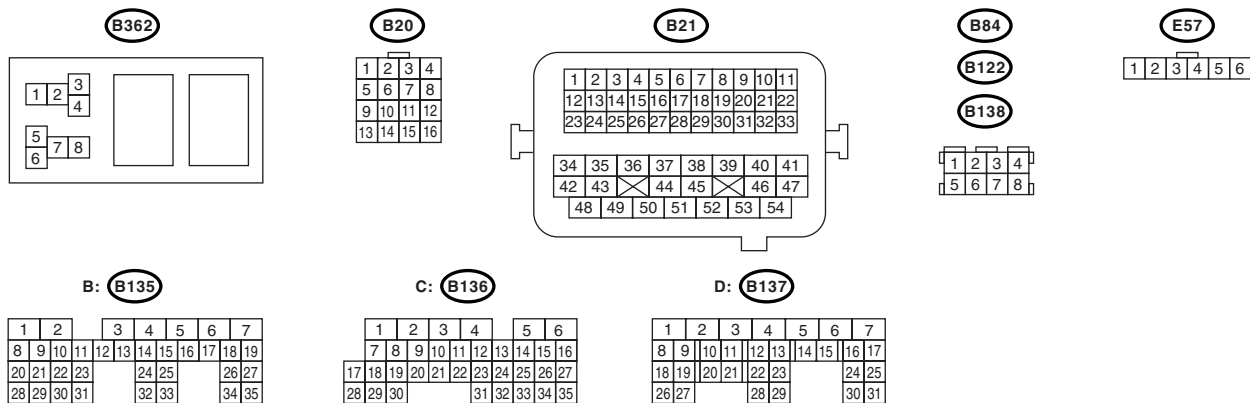
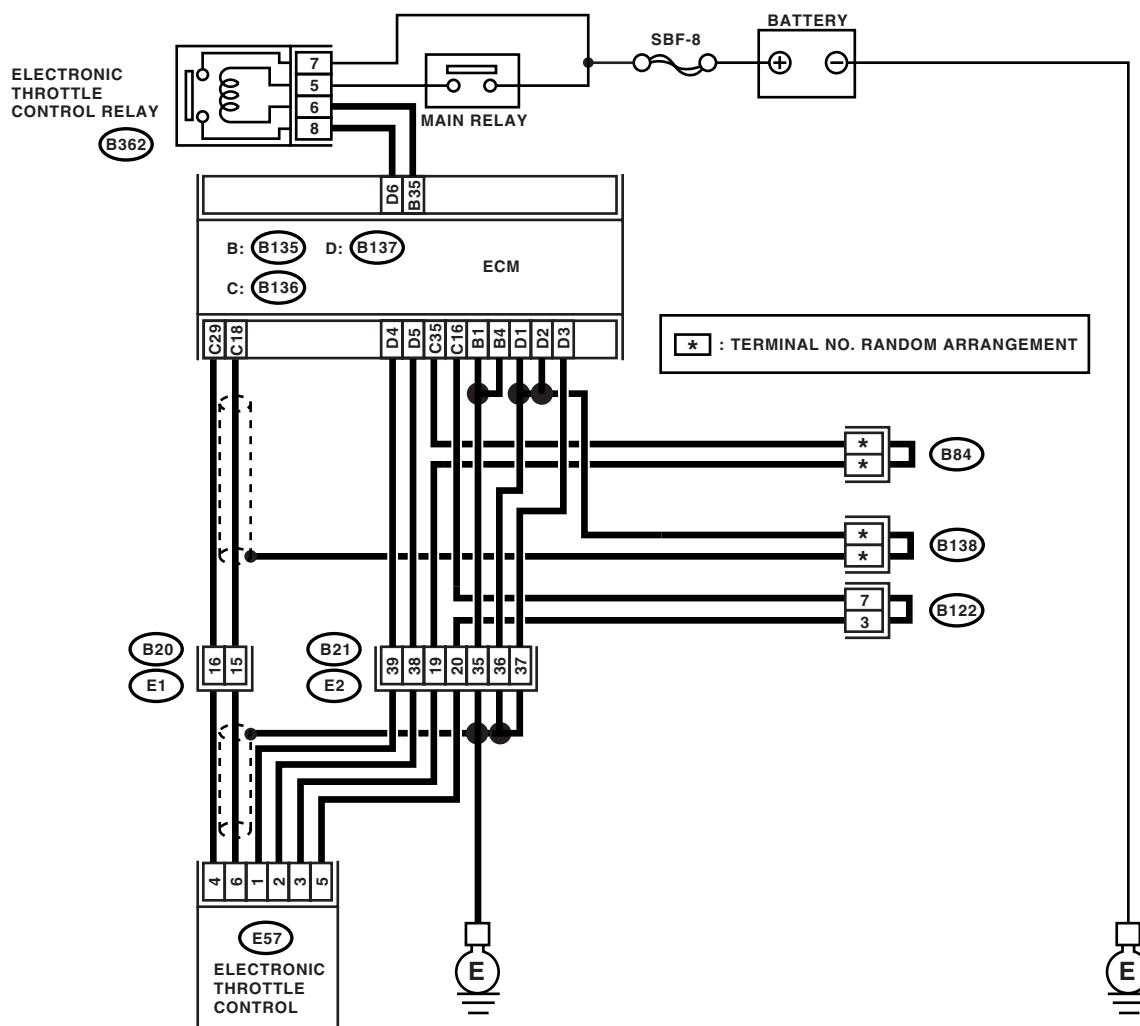
ENGINE (DIAGNOSTICS)

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. 5 and No. 6 of electronic throttle control relay. 4) Measure the resistance between electronic throttle control terminals. Terminals (B362) No. 7 — (B362) No. 8:	Is the resistance less than 1 Ω ?	Go to step 2.	Replace the 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 (B362) No. 7 (+) — Chassis ground (-): (B362) No. 5 (+) — Chassis ground (-):	Is the voltage more than 5 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 RELAY. 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 (B362) No. 6 (+) — Chassis ground (-):	Is the voltage less than 5 V?	Go to step 4.	Repair power supply short circuit in harness between ECM and electronic throttle control relay.
4 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY. 1) Turn the ignition switch to OFF. 2) Measure the resistance between electronic throttle control relay connector and chassis ground. Connector & terminal (B362) No. 6 — Chassis ground: (B362) No. 8 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair the ground short circuit in harness between ECM and electronic throttle control relay.
5 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY. Measure the resistance between ECM connector and electronic throttle control relay connector. Connector & terminal (B135) No. 35 — (B362) No. 6: (B137) No. 6 — (B362) No. 8:	Is the resistance less than 1 Ω ?	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Repair the open circuit in harness between ECM and electronic throttle control relay.

ENGINE (DIAGNOSTICS)

DTC DETECTING CONDITION:

WIRING DIAGRAM:



EN-01951

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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. <i>Terminals</i> <i>No. 7 — No. 8:</i>	Is the resistance more than 1 MΩ?	Go to step 2.	Replace the electronic throttle control relay.
2 CHECK POWER SUPPLY SHORT CIRCUIT OF ELECTRONIC THROTTLE CONTROL RELAY. 1) Turn the ignition switch to ON. 2) Measure the voltage between electronic throttle control relay connector and chassis ground. <i>Connector & terminal</i> <i>(B362) No. 8 (+) — Chassis ground (-):</i>	Is the voltage more than 5 V?	Go to step 3.	Repair power supply short circuit in harness between ECM and electronic throttle control relay.
3 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL RELAY. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector and chassis ground. <i>Connector & terminal</i> <i>(B135) No. 35 — Chassis ground:</i>	Is the resistance more than 1 MΩ?	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Repair the ground short circuit in harness between ECM and electronic throttle control relay.

BR:DTC P2109 THROTTLE ANGLE CLOSED POSITION ERROR

NOTE:

For diagnostic procedure, refer to DTC P2101. <Ref. to EN(H4DOTC)(diag)-176, DTC P2101 THROTTLE ACTUATOR CONTROL MOTOR CIRCUIT RANGE/PERFORMANCE, Diagnostic Procedure with Diagnostic Trouble Code (DTC).>

BS:DTC P2122 THROTTLE/PEDAL POSITION SENSOR/SWITCH "D" CIRCUIT LOW INPUT

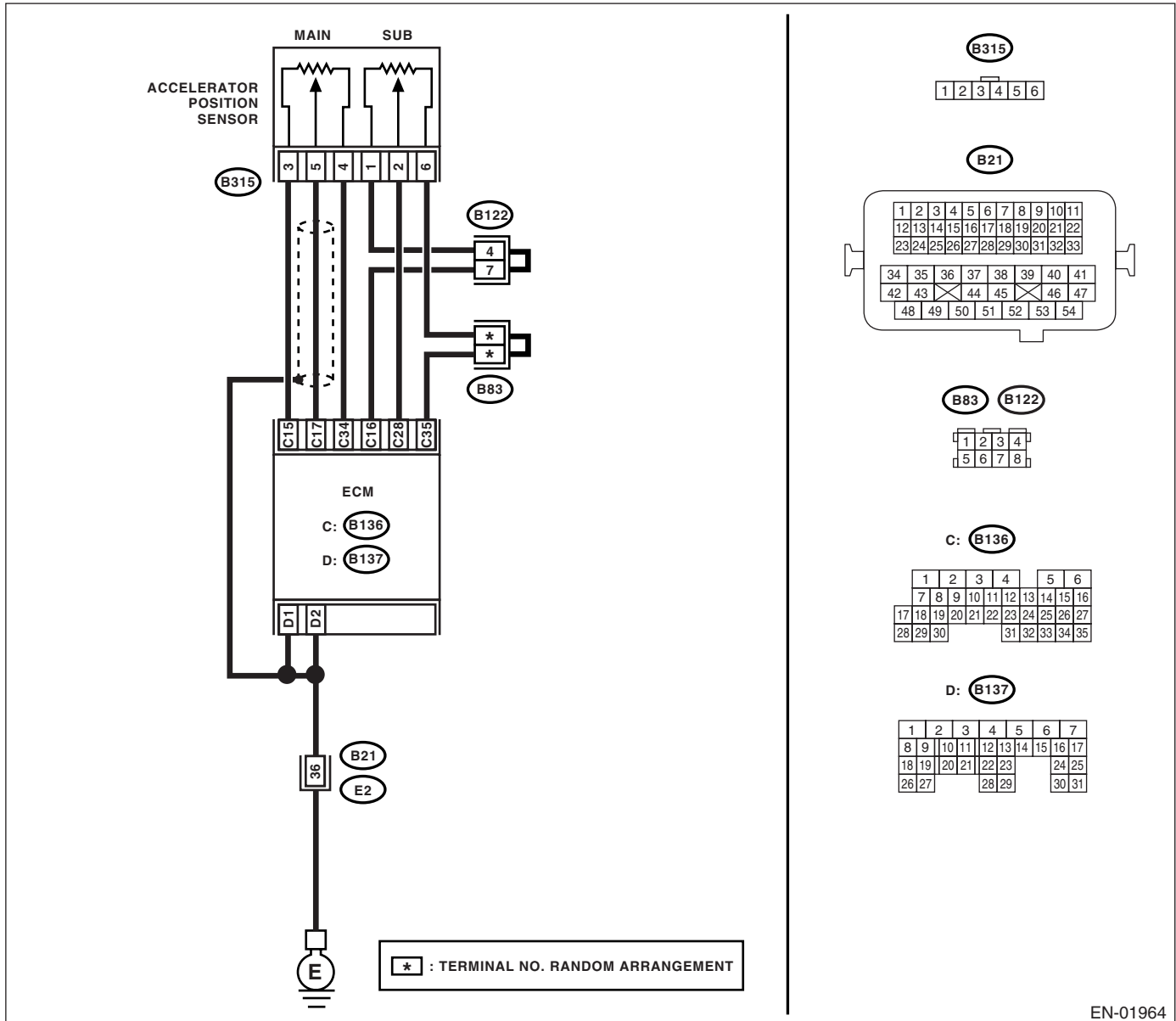
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

WIRING DIAGRAM:



EN-01964

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ACCELERATOR POSITION SENSOR OUTPUT. 1) Turn the ignition switch to ON. 2) Read the data of main accelerator position sensor signal using Subaru Select Monitor.	Is the voltage more than 0.4 V?	Go to step 2.	Go to step 3.
2 CHECK POOR CONTACT. Check poor contact in connector between ECM and accelerator position sensor.	Is there poor contact?	Repair the poor contact.	Temporary poor contact occurred, but it is normal at present.
3 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from the accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor connector. Connector & terminal (B136) No. 17 — (B315) No. 5: (B136) No. 15 — (B315) No. 3:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness connector.
4 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. Measure the resistance between ECM connector and chassis ground. Connector & terminal (B136) No. 17 — Chassis ground: (B136) No. 15 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair the chassis short circuit of harness.
5 CHECK POWER SUPPLY OF ACCELERATOR POSITION SENSOR. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and chassis ground. Connector & terminal (B315) No. 3 (+) — Chassis ground (-):	Is the voltage 4.5 — 5.5 V?	Go to step 6.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
6 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor. Terminals No. 3 — No. 4:	Is the resistance 1.2 — 4.8 k Ω ?	Go to step 7.	Replace the accelerator position sensor.
7 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor. Terminals No. 5 — No. 4: Check the measured value is within the specification without depressing the accelerator pedal.	Is the resistance 0.2 — 1.0 k Ω ?	Go to step 8.	Replace the accelerator position sensor.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor. Terminals No. 5 — No. 4: Check the measured value is within the specification with the accelerator pedal depressed.	Is the resistance 0.5 — 2.5 k Ω ?	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Replace the accelerator position sensor.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

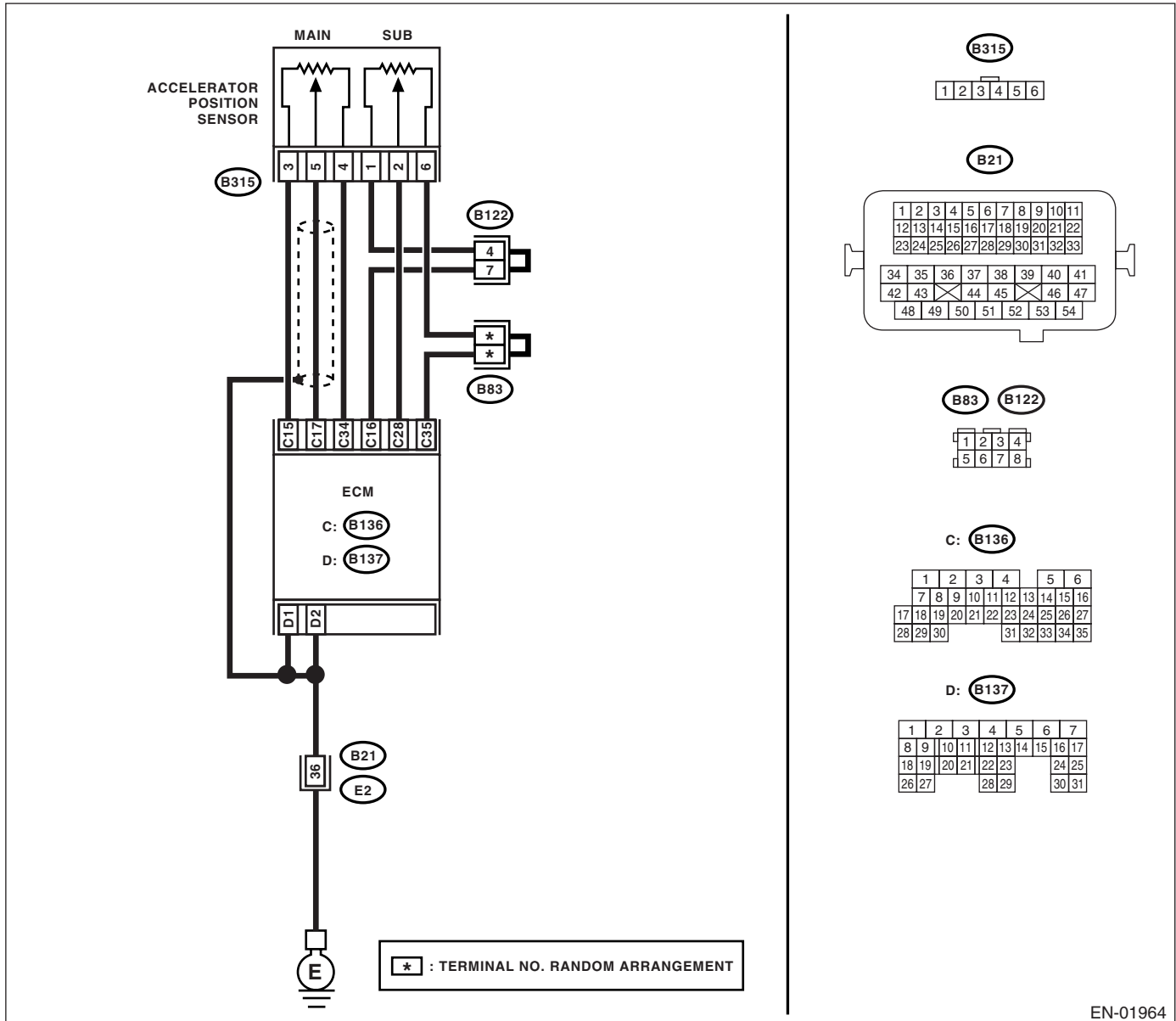
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

WIRING DIAGRAM:



EN-01964

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ACCELERATOR POSITION SENSOR OUTPUT. Turn the ignition switch to ON.	Is the voltage less than 4.8 V?	Go to step 2.	Go to step 3.
2 CHECK POOR CONTACT. Check poor contact in connector between ECM and accelerator position sensor.	Is there poor contact?	Repair the poor contact.	Temporary poor contact occurred, but it is normal at present.
3 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from the accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor connector. Connector & terminal (B136) No. 34 — (B315) No. 4:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness connector.
4 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Connect the ECM connector. 2) Measure the resistance between accelerator position sensor connector and chassis ground. Connector & terminal (B315) No. 4 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 5.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
5 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and chassis ground. Connector & terminal (B315) No. 5 (+) — Chassis ground (-):	Is the voltage less than 6 V?	Go to step 6.	Repair the battery short circuit in harness between ECM connector and accelerator position sensor connector.
6 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector terminals. Connector & terminal (B136) No. 17 — (B136) No. 15: (B136) No. 17 — (B136) No. 16:	Is the resistance more than 1 M Ω ?	Repair the poor contact in accelerator position sensor connector. Replace the accelerator position sensor if defective.	Repair the short circuit to sensor power supply.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

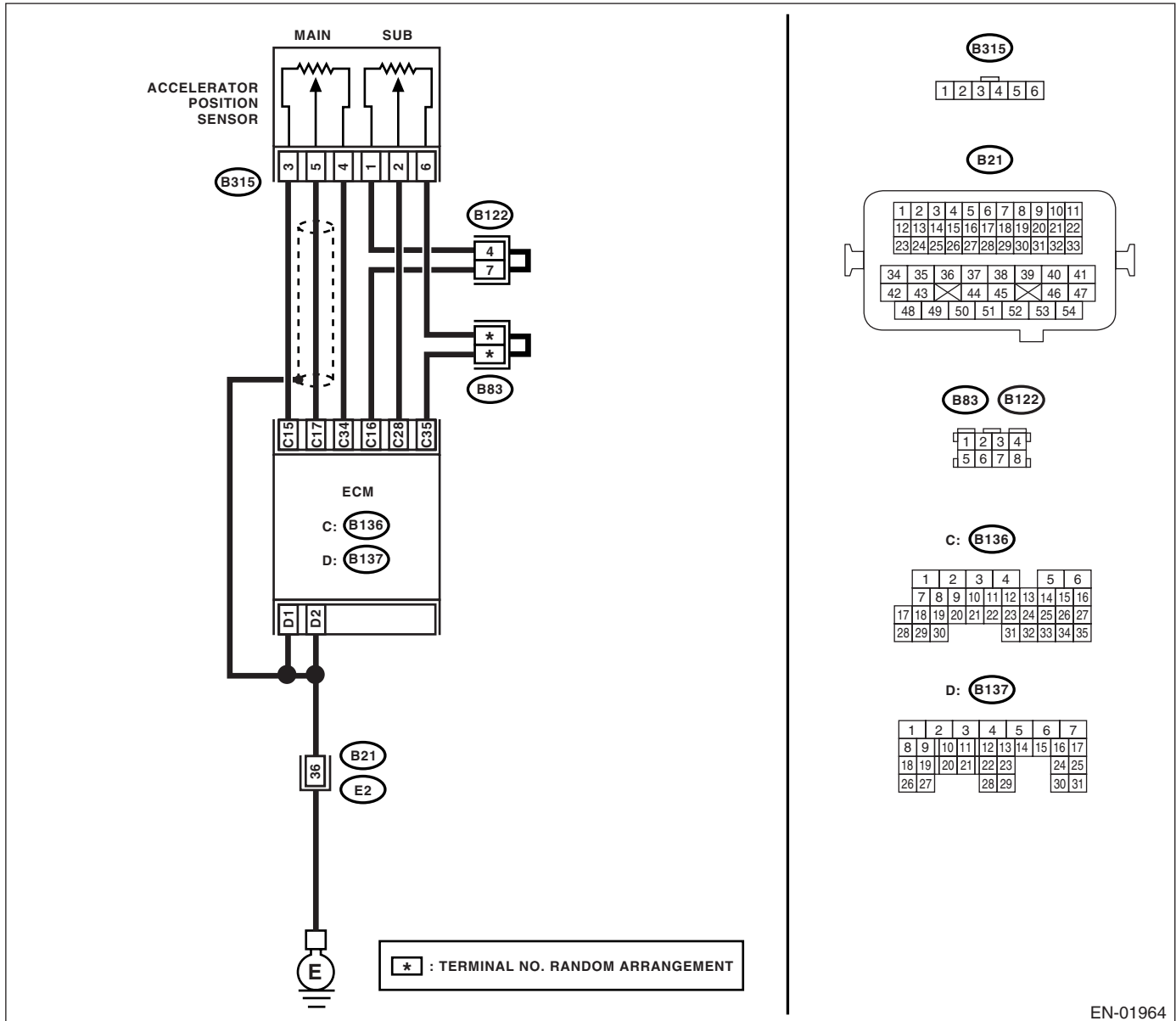
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

WIRING DIAGRAM:



EN-01964

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ACCELERATOR POSITION SENSOR OUTPUT. 1) Turn the ignition switch to ON. 2) Read the data of sub accelerator position sensor signal using Subaru Select Monitor.	Is the voltage more than 0.4 V?	Go to step 2.	Go to step 3.
2 CHECK POOR CONTACT. Check poor contact in connector between ECM and accelerator position sensor.	Is there poor contact?	Repair the poor contact.	Temporary poor contact occurred, but it is normal at present.
3 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from the accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor connector. <i>Connector & terminal</i> <i>(B136) No. 28 — (B315) No. 2:</i> <i>(B136) No. 16 — (B315) No. 1:</i>	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness connector.
4 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. Measure the resistance between ECM connector and chassis ground. <i>Connector & terminal</i> <i>(B136) No. 28 — Chassis ground:</i> <i>(B136) No. 16 — Chassis ground:</i>	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair the chassis short circuit of harness.
5 CHECK POWER SUPPLY OF ACCELERATOR POSITION SENSOR. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and chassis ground. <i>Connector & terminal</i> <i>(B315) No. 1 (+) — Chassis ground (-):</i>	Is the voltage 4.5 — 5.5 V?	Go to step 6.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
6 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor. <i>Terminals</i> <i>No. 1 — No. 6:</i>	Is the resistance 0.75 — 3.15 k Ω ?	Go to step 7.	Replace the accelerator position sensor.
7 CHECK ACCELERATOR POSITION SENSOR. 1) Measure the resistance of accelerator position sensor. <i>Terminals</i> <i>No. 2 — No. 6:</i> 2) Check the measured value is within the specification without depressing the accelerator pedal.	Is the resistance 0.15 — 0.63 k Ω ?	Go to step 8.	Replace the accelerator position sensor.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
8 CHECK ACCELERATOR POSITION SENSOR. 1) Measure the resistance of accelerator position sensor. Terminals No. 2 — No. 6: 2) Check the measured value is within the specification with the accelerator pedal depressed.	Is the resistance 0.28 — 1.68 k Ω ?	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Replace the accelerator position sensor.

BV:DTC P2128 THROTTLE/PEDAL POSITION SENSOR/SWITCH "E" CIRCUIT HIGH INPUT

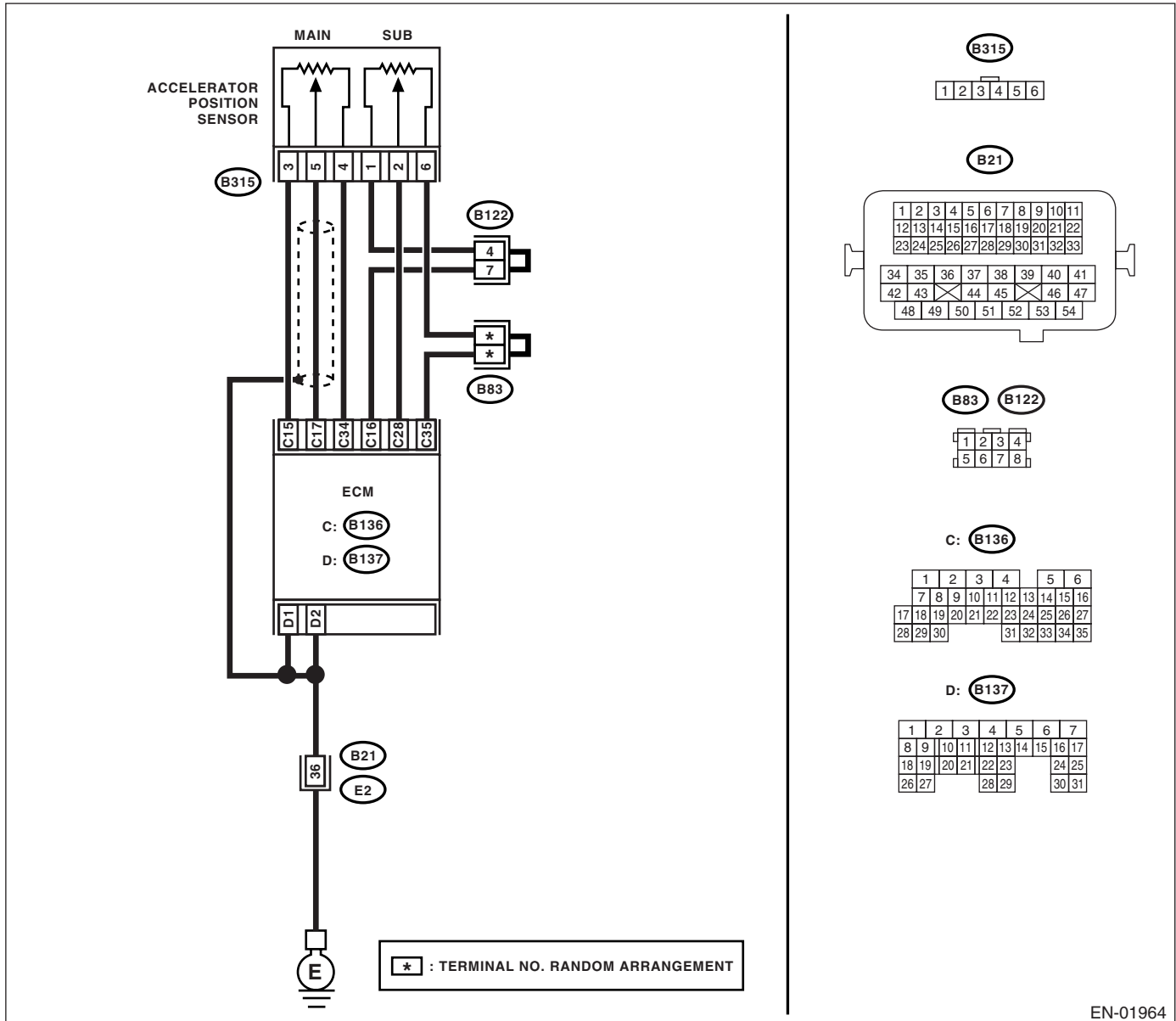
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

WIRING DIAGRAM:



EN-01964

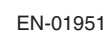
Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ACCELERATOR POSITION SENSOR OUTPUT. 1) Turn the ignition switch to ON. 2) Read the data of sub accelerator position sensor signal using Subaru Select Monitor.	Is the voltage less than 4.8 V?	Go to step 2.	Go to step 3.
2 CHECK POOR CONTACT. Check poor contact in connector between ECM and accelerator position sensor.	Is there poor contact?	Repair the poor contact.	Temporary poor contact occurred, but it is normal at present.
3 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from the accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor connector. Connector & terminal (B136) No. 35 — (B315) No. 6:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness connector.
4 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Connect the ECM connector. 2) Measure the resistance between accelerator position sensor connector and chassis ground. Connector & terminal (B315) No. 6 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 5.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
5 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and chassis ground. Connector & terminal (B315) No. 2 (+) — Chassis ground (-):	Is the voltage less than 6 V?	Go to step 6.	Repair the battery short circuit in harness between ECM connector and accelerator position sensor connector.
6 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Measure the resistance between ECM connector terminals. Connector & terminal (B137) No. 28 — (B137) No. 15: (B137) No. 28 — (B137) No. 16:	Is the resistance more than 1 M Ω ?	Repair the poor contact in accelerator position sensor connector. Replace the accelerator position sensor if defective.	Repair the short circuit to sensor power supply.

ENGINE (DIAGNOSTICS)

WIRING DIAGRAM:



Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK SENSOR OUTPUT. 1) Turn the ignition switch to ON. 2) Measure the voltage between ECM connector terminals. Connector & terminal (B136) No. 18 (+) — (B136) No. 35 (-):	Is the voltage more than 0.4 V?	Go to step 2.	Go to step 4.
2 CHECK SENSOR OUTPUT. Measure the voltage between ECM connector terminals. Connector & terminal (B136) No. 29 (+) — (B136) No. 35 (-):	Is the voltage more than 0.8 V?	Go to step 3.	Go to step 4.
3 CHECK POOR CONTACT. Check the poor contact in connector between ECM and electronic throttle control.	Is there poor contact?	Repair the poor contact.	Go to step 14.
4 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from the electronic throttle control. 4) Measure the resistance between ECM connector and electronic throttle control connector. Connector & terminal (B136) No. 16 — (E57) No. 5:	Is the resistance less than 1 Ω ?	Go to step 5.	Repair the open circuit of harness connector.
5 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. Measure the resistance between ECM connector and chassis ground. Connector & terminal (B136) No. 18 — Chassis ground: (B136) No. 29 — Chassis ground: (B136) No. 16 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 6.	Repair the ground short circuit of harness.
6 CHECK SENSOR POWER SUPPLY. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. Connector & terminal (E57) No. 5 (+) — Engine ground (-):	Is the voltage 4.5 — 5.5 V?	Go to step 7.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
7 CHECK SHORT CIRCUIT IN ECM. 1) Turn the ignition switch to OFF. 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 more than 10 Ω ?	Go to step 8.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
8 CHECK SENSOR OUTPUT. 1) Connect all the connectors. 2) Turn the ignition switch to ON. 3) Read the data of main throttle sensor signal using Subaru Select Monitor.	Is the voltage less than 4.63 V?	Go to step 9.	Go to step 11.
9 CHECK SENSOR OUTPUT. Read the data of sub throttle sensor signal using Subaru Select Monitor.	Is the voltage less than 4.73 V?	Go to step 10.	Go to step 11.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
10 CHECK POOR CONTACT. Check the poor contact in connector between ECM and electronic throttle control.	Is there poor contact?	Repair the poor contact.	Temporary poor contact occurred, but it is normal at present.
11 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connectors from the electronic throttle control. 4) Measure the resistance between ECM connector and electronic throttle control connector. Connector & terminal (B136) No. 35 — (E57) No. 3: (B136) No. 18 — (E57) No. 6: (B136) No. 29 — (E57) No. 4:	Is the resistance less than 1 Ω ?	Go to step 12.	Repair the open circuit of harness connector.
12 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Connect the ECM connector. 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 13.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
13 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between electronic throttle control connector and engine ground. Connector & terminal (E57) No. 5 (+) — Engine ground (-):	Is the voltage more than 10 V?	Go to step 14.	Repair the battery short circuit in harness between ECM connector and electronic throttle control connector.
14 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 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 less than 10 V?	Go to step 15.	Repair the short circuit in harness between ECM connector and electronic throttle control connector.
15 CHECK HARNESS BETWEEN ECM AND ELECTRONIC THROTTLE CONTROL. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connectors. Connector & terminal (B136) No. 18 — (B136) No. 35: (B136) No. 29 — (B136) No. 35:	Is the resistance more than 1 M Ω ?	Go to step 16.	Repair the short circuit to sensor power supply.
16 CHECK ELECTRONIC THROTTLE CONTROL HARNESS. 1) Disconnect the connector from ECM. 2) Disconnect the connectors from the electronic throttle control. 3) Measure the resistance between electronic throttle control connector terminals. Connector & terminal (E57) No. 6 — (E57) No. 4:	Is the resistance more than 1 M Ω ?	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Repair the short circuit of harness.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

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

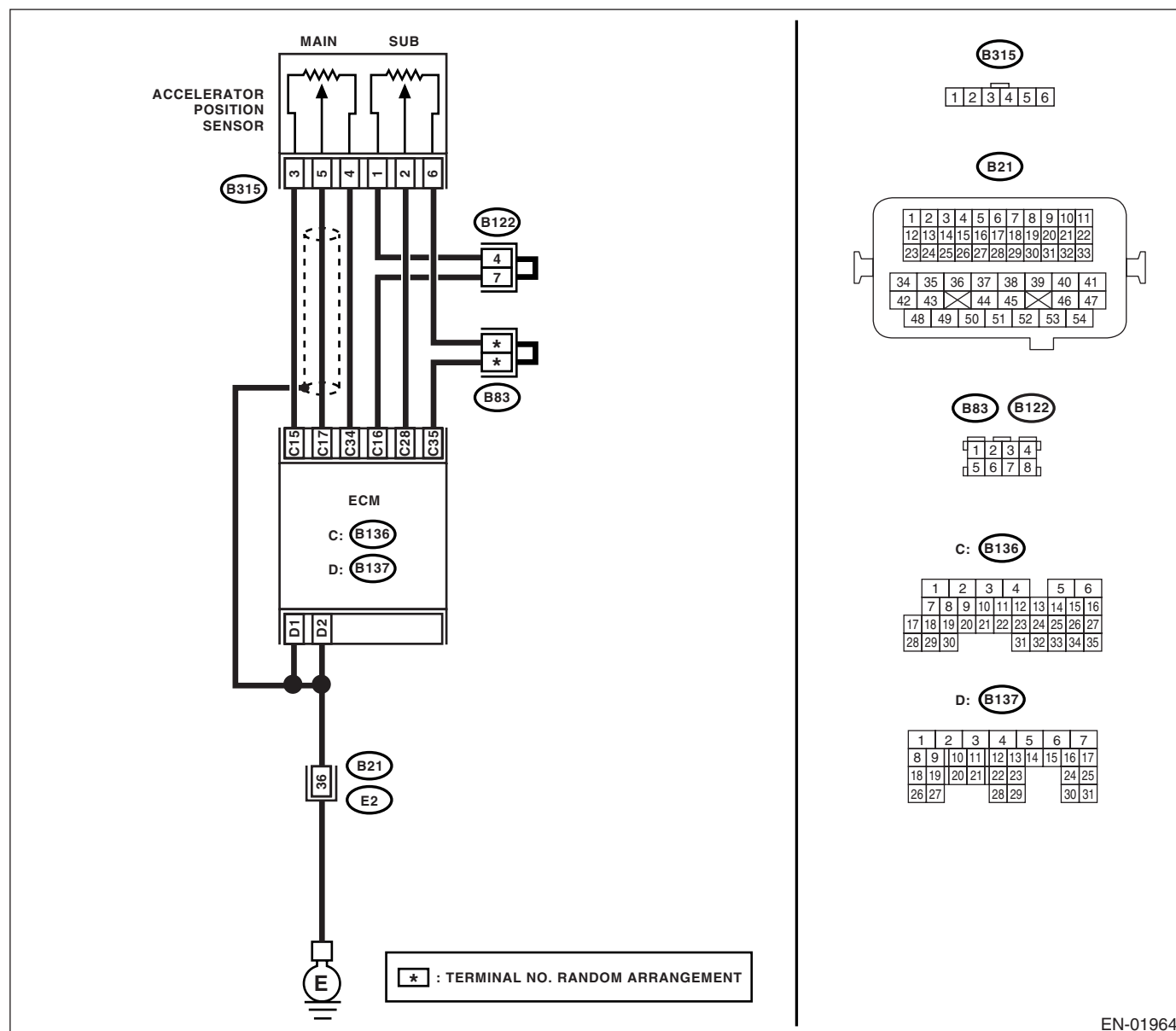
DTC DETECTING CONDITION:

Detect as soon as the malfunction occurs.

TROUBLE SYMPTOM:

- Erroneous idling
- Poor driving performance

WIRING DIAGRAM:



EN-01964

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
1 CHECK ACCELERATOR POSITION SENSOR OUTPUT. 1) Turn the ignition switch to ON. 2) Read the data of main accelerator position sensor signal and sub accelerator position sensor signal using Subaru Select Monitor.	Is the voltage more than 0.4 V?	Go to step 2.	Go to step 3.
2 CHECK POOR CONTACT. Check poor contact in connector between ECM and accelerator position sensor.	Is there poor contact?	Repair the poor contact.	Go to step 12.
3 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from the accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor connector. Connector & terminal (B136) No. 17 — (B315) No. 5: (B136) No. 15 — (B315) No. 3: (B136) No. 28 — (B315) No. 2: (B136) No. 16 — (B315) No. 1:	Is the resistance less than 1 Ω ?	Go to step 4.	Repair the open circuit of harness connector.
4 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. Measure the resistance between ECM connector and chassis ground. Connector & terminal (B136) No. 17 — Chassis ground: (B136) No. 15 — Chassis ground: (B136) No. 28 — Chassis ground: (B136) No. 16 — Chassis ground:	Is the resistance more than 1 M Ω ?	Go to step 5.	Repair the ground short circuit of harness.
5 CHECK POWER SUPPLY OF ACCELERATOR POSITION SENSOR. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and chassis ground. Connector & terminal (B315) No. 3 (+) — Chassis ground (-): (B315) No. 1 (+) — Chassis ground (-):	Is the voltage 4.5 — 5.5 V?	Go to step 6.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
6 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor. Terminals No. 3 — No. 4:	Is the resistance 1.2 — 4.8 k Ω ?	Go to step 7.	Replace the accelerator position sensor.
7 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor. Terminals No. 1 — No. 6:	Is the resistance 0.75 — 3.15 k Ω ?	Go to step 8.	Replace the accelerator position sensor.
8 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor without depressing the accelerator pedal. Terminals No. 5 — No. 4:	Is the resistance 0.2 — 0.8 k Ω ?	Go to step 9.	Replace the accelerator position sensor.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
9 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor without depressing the accelerator pedal. Terminals No. 2 — No. 6:	Is the resistance 0.15 — 0.63 kΩ?	Go to step 10.	Replace the accelerator position sensor.
10 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor with the accelerator pedal depressed. Terminals No. 5 — No. 4:	Is the resistance 0.5 — 2.5 kΩ?	Go to step 11.	Replace the accelerator position sensor.
11 CHECK ACCELERATOR POSITION SENSOR. Measure the resistance of accelerator position sensor with the accelerator pedal depressed. Terminals No. 2 — No. 6:	Is the resistance 0.28 — 1.68 kΩ?	Go to step 12.	Replace the accelerator position sensor.
12 CHECK ACCELERATOR POSITION SENSOR OUTPUT. 1) Turn the ignition switch to OFF. 2) Connect all the connectors. 3) Turn the ignition switch to ON. 4) Read the data of main throttle sensor signal and sub accelerator position sensor signal using Subaru Select Monitor.	Is the voltage less than 4.8 V?	Go to step 13.	Go to step 14.
13 CHECK POOR CONTACT. Check poor contact in connector between ECM and accelerator position sensor.	Is there poor contact?	Repair the poor contact.	Go to step 18.
14 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from the accelerator position sensor. 4) Measure the resistance between ECM connector and accelerator position sensor connector. Connector & terminal (B136) No. 34 — (B315) No. 4: (B136) No. 35 — (B315) No. 6:	Is the resistance less than 1 Ω?	Go to step 15.	Repair the open circuit of harness connector.
15 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Connect the ECM connector. 2) Measure the resistance between accelerator position sensor connector and chassis ground. Connector & terminal (B315) No. 4 — Chassis ground: (B315) No. 6 — Chassis ground:	Is the resistance less than 5 Ω?	Go to step 16.	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>
16 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Connect the ECM connector. 2) Turn the ignition switch to ON. 3) Measure the voltage between accelerator position sensor connector and chassis ground. Connector & terminal (B315) No. 5 (+) — Chassis ground (-): (B315) No. 2 (+) — Chassis ground (-):	Is the voltage less than 6 V?	Go to step 17.	Repair the battery short circuit in harness between ECM connector and accelerator position sensor connector.

Diagnostic Procedure with Diagnostic Trouble Code (DTC)

ENGINE (DIAGNOSTICS)

Step	Check	Yes	No
17 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Measure the resistance between ECM connector terminals. Connector & terminal (B136) No. 17 — (B136) No. 15: (B136) No. 17 — (B136) No. 16: (B136) No. 28 — (B136) No. 15: (B136) No. 28 — (B136) No. 16:	Is the resistance more than 1 MΩ?	Go to step 18.	Repair the short circuit to sensor power supply.
18 CHECK HARNESS BETWEEN ECM AND ACCELERATOR POSITION SENSOR. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from ECM. 3) Disconnect the connector from the accelerator position sensor. 4) Measure the resistance between connector terminals of accelerator position sensor. Connector & terminal (B315) No. 5 — (B315) No. 2:	Is the resistance more than 1 MΩ?	Repair the poor contact in ECM connector. Replace the ECM if defective. <Ref. to FU(H4DOTC)-35, Engine Control Module (ECM).>	Repair the short circuit in harness between ECM connector and accelerator position sensor connector.

General Diagnostic Table

ENGINE (DIAGNOSTICS)

17.General Diagnostic Table

A: INSPECTION

1. ENGINE

NOTE:

Malfunction of parts other than those listed is also possible. <Ref. to ME(H4DOTC)-90, Engine Trouble in General.>

Symptom	Problem 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 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 cut relay 10) Engine torque control signal circuit 11) Ignition parts (*1)
5. Engine stalls or engine sags or hesitates at acceleration.	1) Manifold absolute pressure sensor 2) Mass air flow and intake 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
6. Surge	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) Throttle position sensor 8) Fuel pump and fuel pump relay

General Diagnostic Table

ENGINE (DIAGNOSTICS)

Symptom	Problem parts
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 & ignitor ASSY and spark plug.

*2: Indicate the symptom occurring only in cold temperatures.

*3: Ensure the secure installation.

*4: Check fuel injector, fuel pressure regulator and fuel filter.

*5: Inspect air leak in air intake system.

General Diagnostic Table

ENGINE (DIAGNOSTICS)

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

STARTING/CHARGING SYSTEMS

SC(H4DOTC)

	Page
1. General Description	2

1. General Description

A: SPECIFICATION

Specifications for Turbo model is included in SC(H4SO 2.0) section. <Ref. to SC(H4SO 2.0)-2, General Description.>

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

IGNITION

IG(H4DOTC)

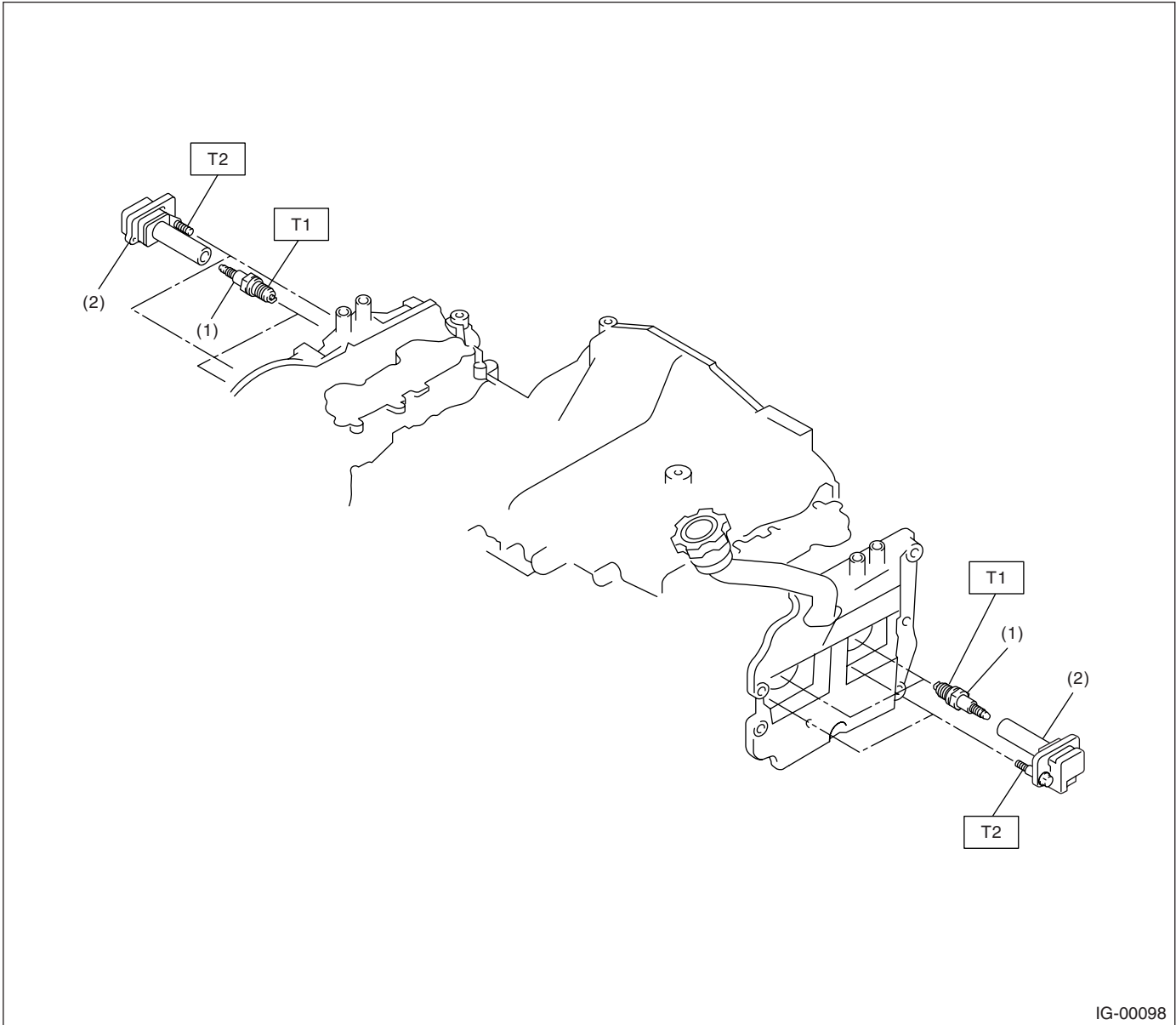
	Page
1. General Description	2
2. Spark Plug.....	4
3. Ignition Coil & Ignitor ASSY	7

1. General Description

A: SPECIFICATION

Item		Specification
Ignition coil & ignitor ASSY	Model	FK0186
	Ignition system	Independent ignition coil
	Manufacturer	Diamond Electric
Spark plug	Manufacturer and type	NGK: ILFR6B
	Thread size (diameter, pitch, length) mm	14, 1.25, 19
	Spark plug gap mm (in)	0.7 — 0.8 (0.028 — 0.031)
	Electrode	Iridium

B: COMPONENT



IG-00098

- (1) Spark plug
- (2) Ignition coil & ignitor ASSY

Tightening torque: N·m (kgf-m, ft-lb)
T1: 21 (2.1, 15.2)
T2: 16 (1.6, 11.7)

C: CAUTION

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

2. Spark Plug

A: REMOVAL

CAUTION:

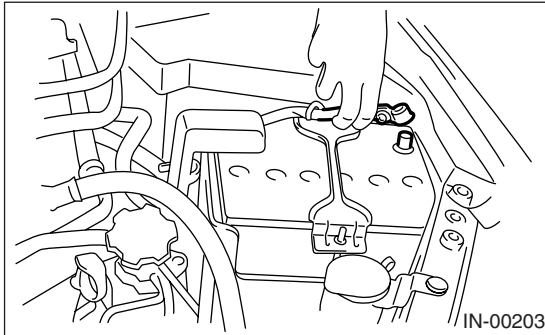
All spark plugs installed on an engine must be of the same heat range.

Spark plug:

<Ref. to IG(H4DOTC)-2, SPECIFICATION, General Description.>

1. RH SIDE

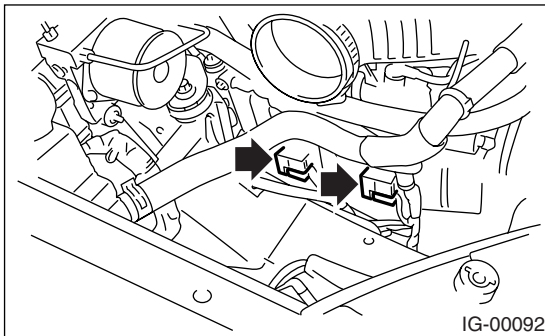
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the air cleaner case.
<Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>
- 4) Disconnect the connector from ignition coil.
- 5) Remove the ignition coil.

NOTE:

Turn the #3 ignition coil by 180° to remove it.



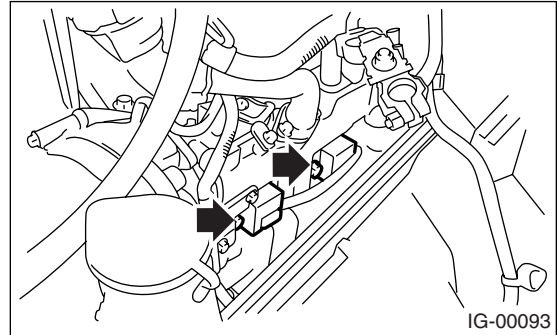
- 6) Remove the spark plug with a spark plug socket.

2. LH SIDE

- 1) Remove the collector cover.
- 2) Remove the battery and battery carrier.
- 3) Disconnect the connector from ignition coil.
- 4) Remove the ignition coil.

NOTE:

Turn the #4 ignition coil by 180° to remove it.



- 5) 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, 15.2 ft-lb)

Tightening torque (Ignition coil):

16 N·m (1.6 kgf-m, 11.7 ft-lb)

NOTE:

The above torque should only be applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approximately 1/3 of the specified torque in order to avoid over-stressing.

2. LH SIDE

Install in the reverse order of removal.

Tightening torque (Spark plug):

21 N·m (2.1 kgf-m, 15.2 ft-lb)

Tightening torque (Ignition coil):

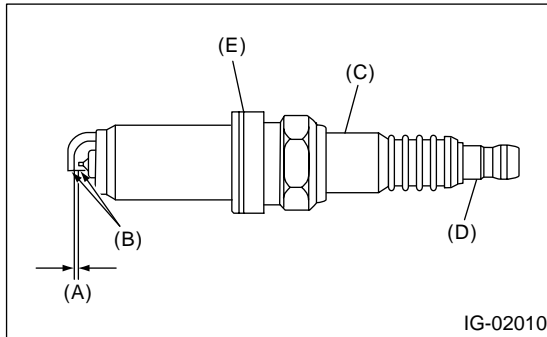
16 N·m (1.6 kgf-m, 11.7 ft-lb)

NOTE:

The above torque should only be applied to new spark plugs without oil on their threads. In case their threads are lubricated, the torque should be reduced by approx. 1/3 of the specified torque in order to avoid over-stressing.

C: INSPECTION

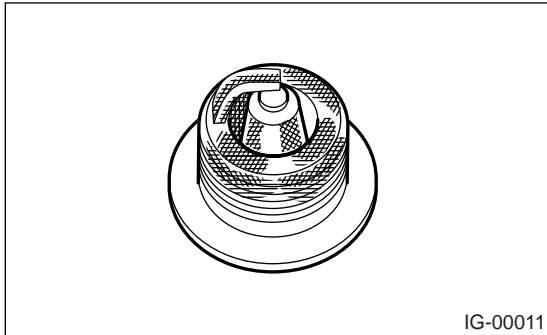
Check the electrodes and inner and outer ceramic insulator of plugs, noting the type of deposits and the degree of electrode erosion.



- (A) Spark plug gap
- (B) Carbon accumulation or wear
- (C) Crack
- (D) Damage
- (E) Damaged gasket

1) Normal:

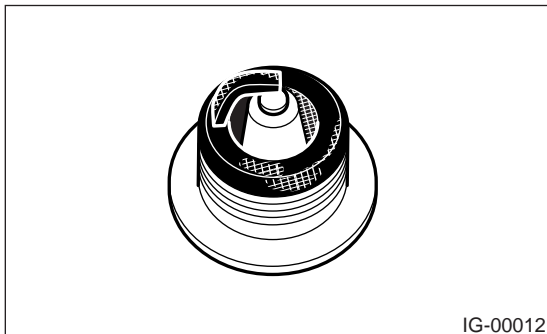
Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.



2) Carbon fouled:

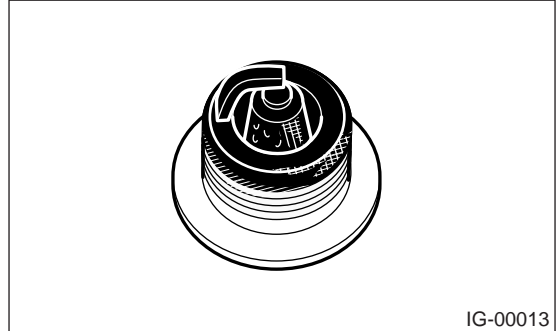
Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in the city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.

It is advisable to replace with plugs having hotter heat range.



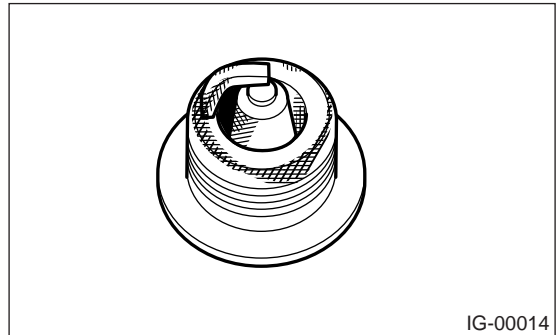
3) Oil fouled:

Wet black deposits show excessive oil entrance into combustion chamber through worn rings and pistons or excessive clearance between valve guides and stems. If the same condition remains after repair, use a hotter plug.



4) Overheating:

White or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, wrong selection of fuel, hotter range plug, etc. It is advisable to replace with plugs having colder heat range.



D: ADJUSTMENT

Clean the spark plugs using a wire brush.

Clean and remove the carbon or oxide deposits.

But do not wear away ceramic insulator.

If deposits are too stubborn, replace the plugs.

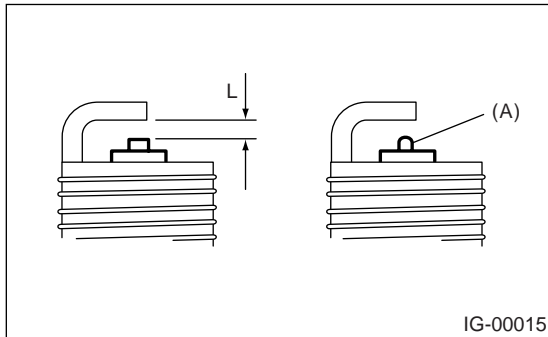
After cleaning the spark plugs, correct the spark plug gap using a gap gauge.

NOTE:

Do not use a plug cleaner because the spark plugs are applied with iridium tip.

Spark plug gap: L

0.7 — 0.8 mm (0.028 — 0.031 in)



NOTE:

Replace with a new spark plug if this area (A) is worn to “ball” shape.

3. Ignition Coil & Ignitor ASSY

A: REMOVAL

Direct ignition type has been adopted. Refer to "Spark Plug" for removal procedure. <Ref. to IG(H4DOTC)-4, REMOVAL, Spark Plug.>

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

16 N·m (1.6 kgf-m, 11.7 ft-lb)

C: INSPECTION

For inspection procedure, refer to "Diagnostics for Engine Starting Failure". <Ref. to EN(H4DOTC)(diag)-48, IGNITION CONTROL SYSTEM, Diagnostics for Engine Starting Failure.>

Ignition Coil & Ignitor ASSY

IGNITION

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES)** EC(H4DOTC)

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

SPEED CONTROL SYSTEMS

SP(H4DOTC)

	Page
1. General Description	2

1. General Description

A: SPECIFICATION

Specifications for Turbo model is included in SP(H4SO 2.0) section. <Ref. to SP(H4SO 2.0)-2, General Description.>

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

LUBRICATION

LU(H4DOTC)

	Page
1. General Description	2
2. Oil Pressure System	6
3. Engine Oil.....	8
4. Oil Pump	9
5. Oil Pan and Strainer	13
6. Oil Pressure Switch.....	16
7. Engine Oil Filter.....	17
8. Engine Lubrication System Trouble in General.....	18

General Description

LUBRICATION

1. General Description

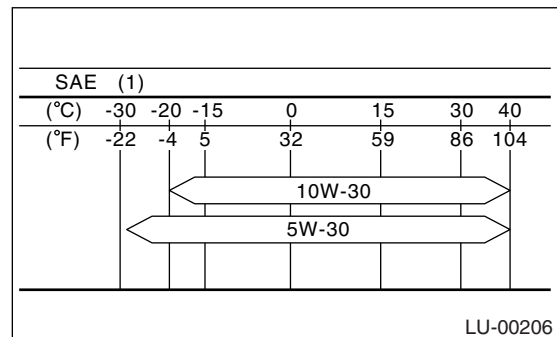
A: SPECIFICATION

Lubrication method				Forced lubrication	
Oil pump	Pump type			Trochoid type	
	Number of teeth	Inner rotor		9	
		Outer rotor		10	
	Outer rotor diameter × thickness			mm (in)	78 × 12 (3.07 × 0.47)
	Tip clearance between inner and outer rotors			mm (in)	0.04 — 0.14 (0.0016 — 0.0055)
	Side clearance between inner rotor and pump case			mm (in)	0.02 — 0.07 (0.0008 — 0.0028)
	Case clearance between outer rotor and pump case		Standard value	mm (in)	0.10 — 0.175 (0.0039 — 0.0069)
	Performance at 80°C (176°F)	600 rpm	Discharge pressure	kPa (kg/cm ² , psi)	98 (1.0, 14)
			Discharge	ℓ (US qt, Imp qt)/min.	6.5 (6.9, 5.7) or more
		6,000 rpm	Discharge pressure	kPa (kg/cm ² , psi)	588 (6.0, 85)
			Discharge	ℓ (US qt, Imp qt)/min.	59.0 (62.3, 51.9) 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)	800 (124)	
			Outer diameter 65 mm (2.56 in)	470 (72.9)	
	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)	68 × 65 (2.68 × 2.56)	
			Outer diameter 65 mm (2.56 in)	65 × 74.4 (2.56 × 2.93)	
	Installation screw specifications			M 20 × 1.5	
Oil pressure switch	Type			Immersed contact point type	
	Working voltage — wattage			12 V — 3.4 W or less	
	Warning light activation pressure			kPa (kg/cm ² , psi)	14.7 (0.15, 2.1)
	Proof pressure			kPa (kg/cm ² , psi)	981 (10, 142) or more
Oil capacity (at replacement)			ℓ (US qt, Imp qt)	4.0 (4.2, 3.5)	

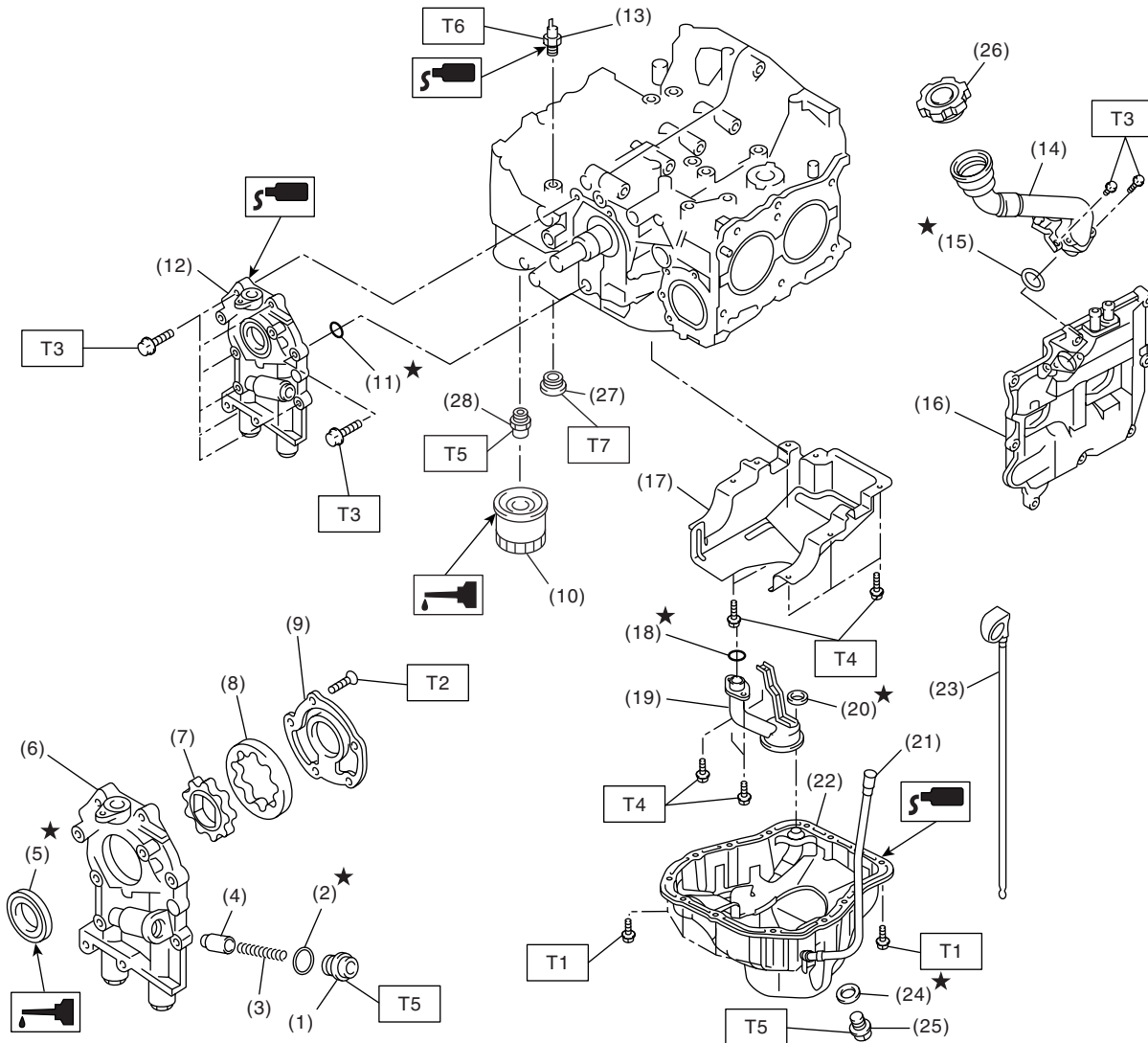
Recommended oil

API classification

SL or SJ or SH with the words “Energy Conserving or Energy conserving II”, CCMC specification G4 or G5, ACEA specification A1, A2 or A3, or New API mark displayed on the container (If it is impossible to get SL or SJ or SH grade, you may use SG grade.)



(1) SAE viscosity No. and applicable temperature



General Description

LUBRICATION

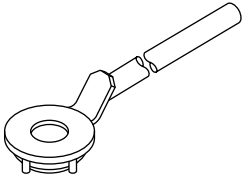
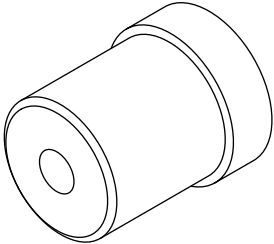
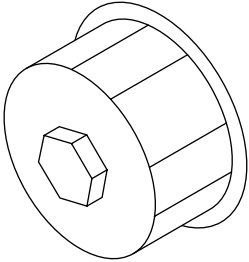
C: CAUTION

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

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

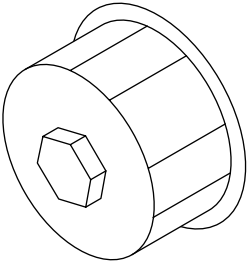
D: PREPARATION TOOL

1. SPECIAL TOOL

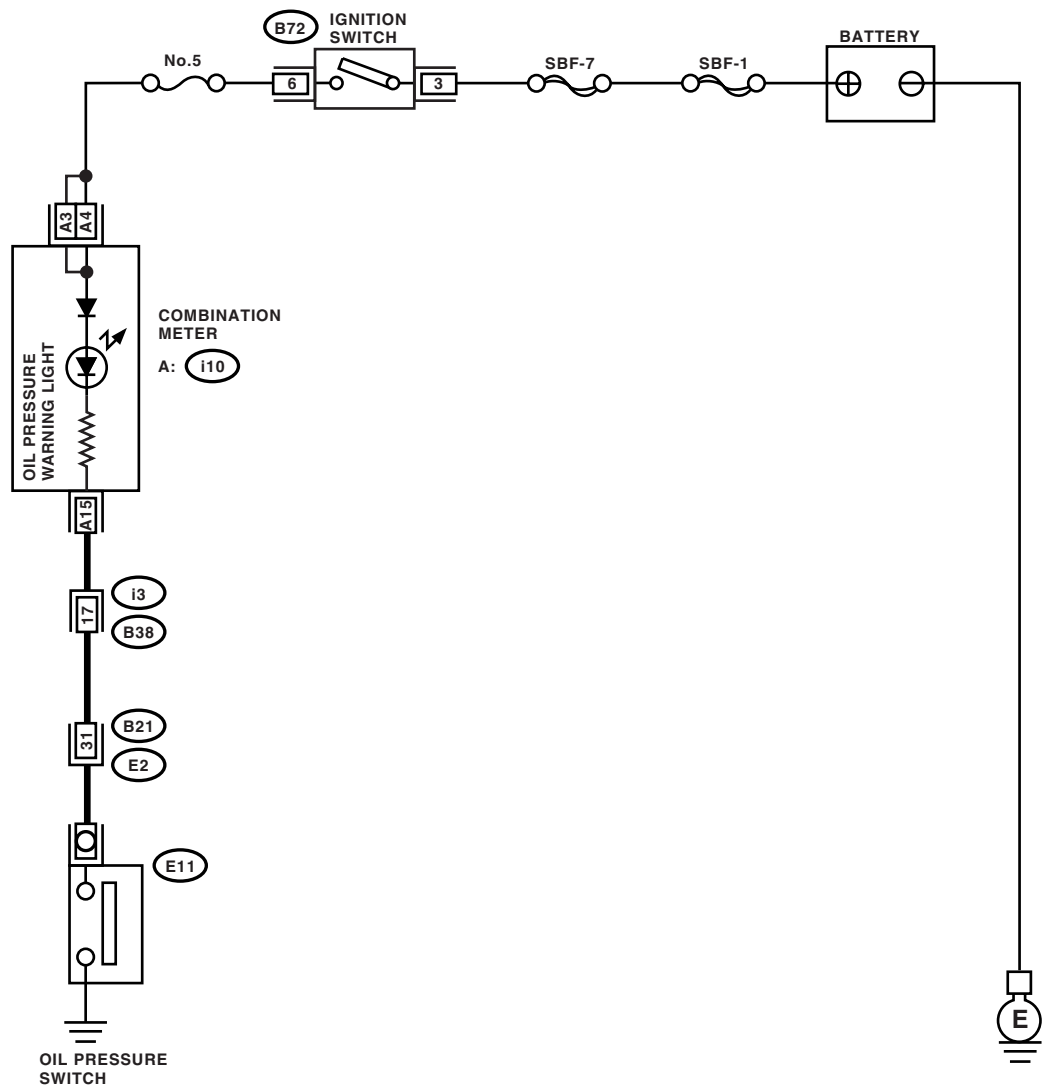
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499977400</p>	499977400	CRANK PULLEY WRENCH	Used for stopping rotation of crank pulley when removing and tightening crank pulley bolt.
 <p>ST-499587100</p>	499587100	OIL SEAL INSTALLER	Used for installing oil seal into oil pump.
 <p>ST18332AA000</p>	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 68 mm (2.68 in))

General Description

LUBRICATION

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST18332AA010	18332AA010	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 65 mm (2.56 in))

2. Oil Pressure System
A: WIRING DIAGRAM



B72

1	2	3
4	5	6

A: i10

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22								

B38

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20							

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				

LU-00241

B: INSPECTION

Step	Check	Yes	No
1 CHECK COMBINATION METER. 1) Turn the ignition switch to ON (engine OFF). 2) Check the warning light of combination meter.	Does the warning light illuminate?	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-3, INSPECTION, Combination Meter System.>
2 CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND OIL PRESSURE SWITCH. 1) Turn the ignition switch to OFF. 2) Disconnect the connector from oil pressure switch. 3) Turn the ignition switch to ON. 4) Measure the voltage of harness between combination meter connector and chassis ground. Connector & terminal (E11) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Replace the oil pressure switch.	Go to step 3.
3 CHECK COMBINATION METER. 1) Turn the ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of combination meter. Terminals No. 4 — No. 15: No. 3 — No. 15:	Is the resistance less than 10 Ω ?	Replace the harness connector between combination meter and oil pressure switch.	Repair or replace the combination meter. <Ref. to IDI-3, INSPECTION, Combination Meter System.>

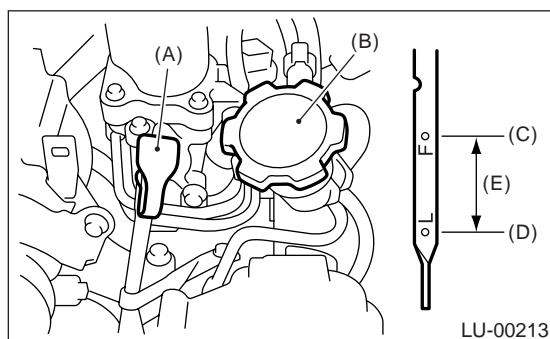
3. Engine Oil

A: INSPECTION

- 1) Park the vehicle on a level surface.
- 2) Remove the oil level gauge and wipe it clean.
- 3) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted and properly orientated.
- 4) Remove it again and check the engine oil level. If the engine oil level is below "L" line, add oil to bring the level up to "F" line.
- 5) After turning off the engine, wait a few minutes for the oil to return to the oil pan before checking the level.
- 6) Just after driving or while the engine is warm, engine oil level show in the range between "F" line and notch mark. This is caused by thermal expansion of the engine oil.

NOTE:

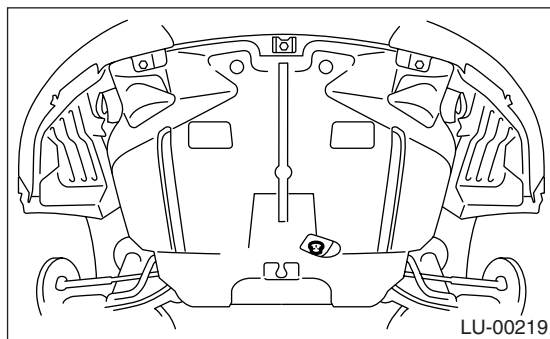
To prevent overfilling the engine oil, do not add oil above "F" line when the engine is cold.



- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ̶ (1.1 US qt, 0.9 Imp qt)

B: REPLACEMENT

- 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.



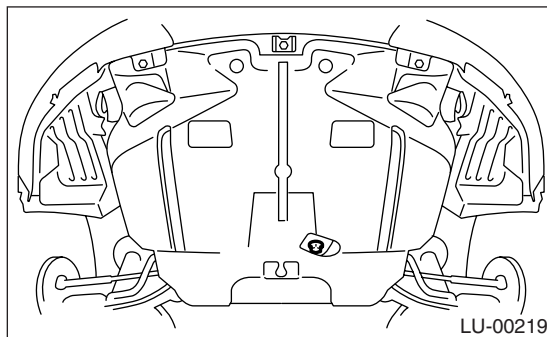
- 4) Tighten the engine oil drain plug after draining engine oil.

NOTE:

Use a new metal gasket.

Tightening torque:

44 N·m (4.5 kgf-m, 32.5 ft-lb)



- 5) Use the engine oil of proper quality and viscosity, fill engine oil through the oil filler duct to upper point on level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

Recommended oil:

<Ref. to LU(H4DOTC)-2, SPECIFICATION, General Description.>

Engine oil capacity:

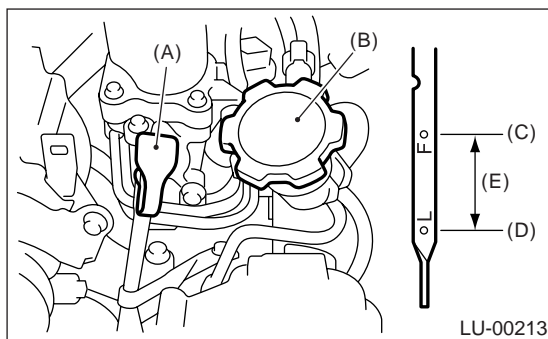
Upper level

4.0 ̶ (4.2 US qt, 3.5 Imp qt)

Lower level

3.0 ̶ (3.2 US qt, 2.6 Imp qt)

- 6) Close the engine oil filler cap.
- 7) Start the engine and warm it up for a time.
- 8) After the engine stops, recheck the oil level. If necessary, add engine oil up to the upper level on level gauge.

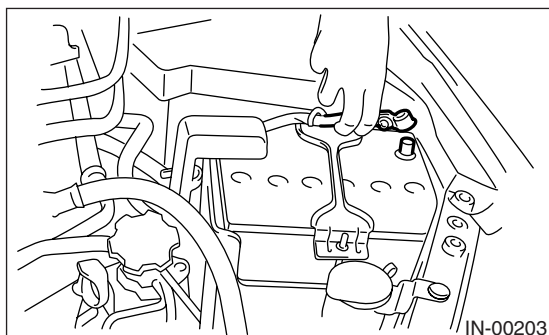


- (A) Oil level gauge
- (B) Engine oil filler cap
- (C) Upper level
- (D) Lower level
- (E) Approx. 1.0 ̶ (1.1 US qt, 0.9 Imp qt)

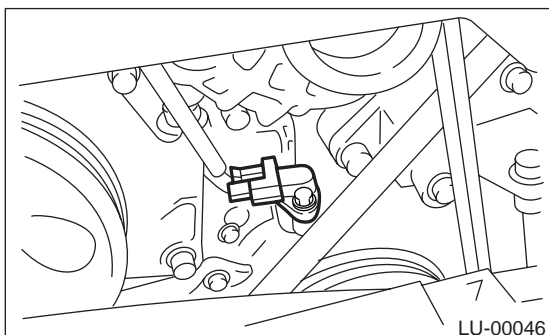
4. Oil Pump

A: REMOVAL

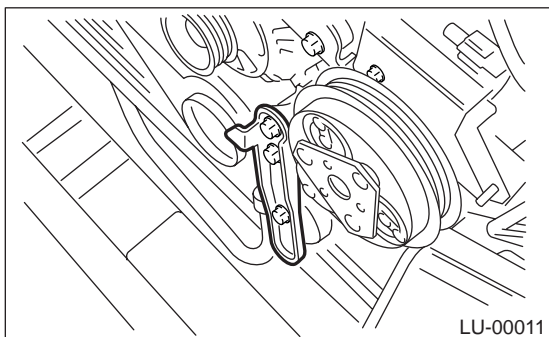
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



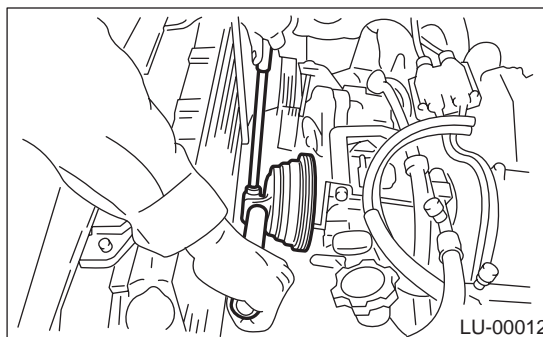
- 3) Lift-up the vehicle.
- 4) Remove the under cover.
- 5) Remove the radiator. <Ref. to CO(H4DOTC)-19, REMOVAL, Radiator.>
- 6) Remove the crankshaft position sensor.



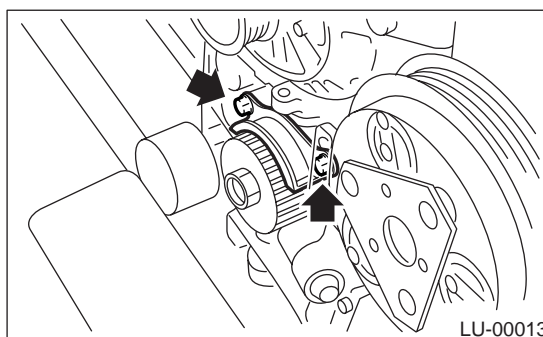
- 7) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
- 8) Remove the rear side V-belt tensioner.



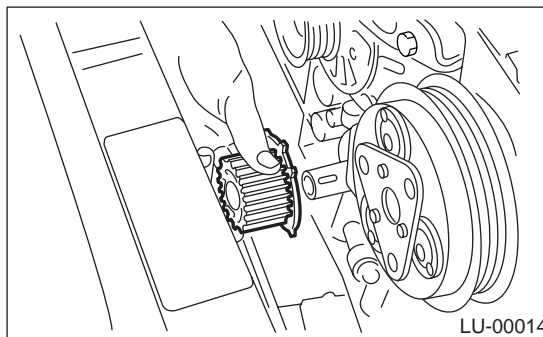
- 9) Remove the crank pulley by using ST. <Ref. to ME(H4DOTC)-41, REMOVAL, Crank Pulley.>



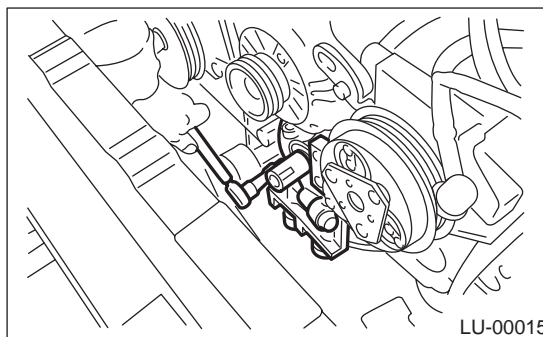
- 10) Remove the water pump. <Ref. to CO(H4DOTC)-15, REMOVAL, Water Pump.>
- 11) Remove the timing belt guide.



- 12) Remove the crank sprocket.



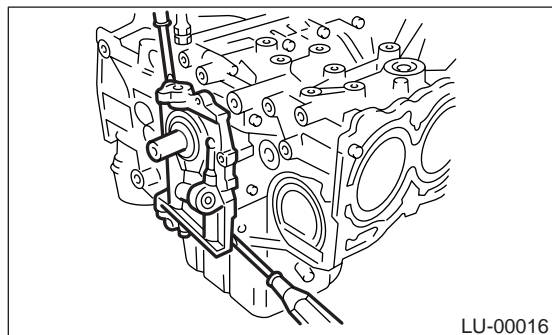
- 13) Remove the bolts which hold oil pump onto cylinder block.



- 14) Remove the oil pump by using flat bladed screwdriver.

CAUTION:

Be careful not to scratch mating surfaces of cylinder block and oil pump.

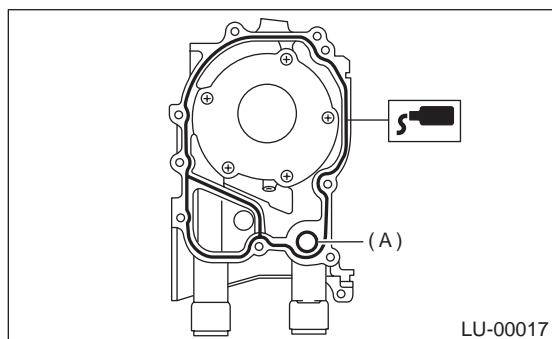
**B: INSTALLATION**

Install in the reverse order of removal.
Perform the following.

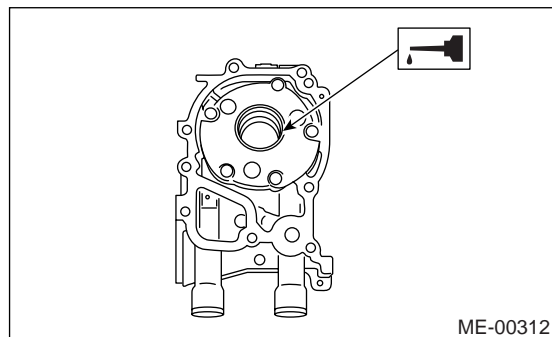
- 1) Apply liquid gasket to the matching surfaces of oil pump.

Liquid gasket:

THREE BOND 1215 (Part No. 004403007) or equivalent



- 2) Replace the O-ring (A) with a new one.
- 3) Apply a coat of engine oil to the inside of oil seal.



- 4) Position the oil pump, aligning the notched area with crankshaft, and push the oil pump straight.

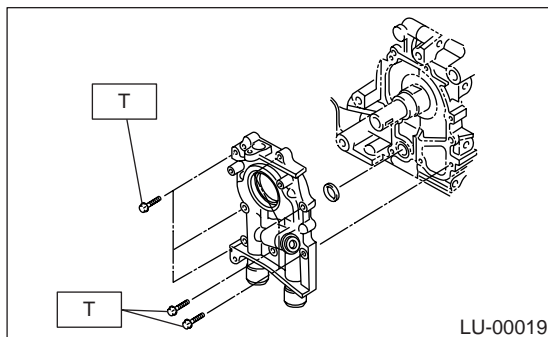
CAUTION:

- Make sure the oil seal lip is not folded.
- Be careful not to scratch oil seal when installing oil pump on cylinder block.

- 5) Install the oil pump.

Tightening torque:

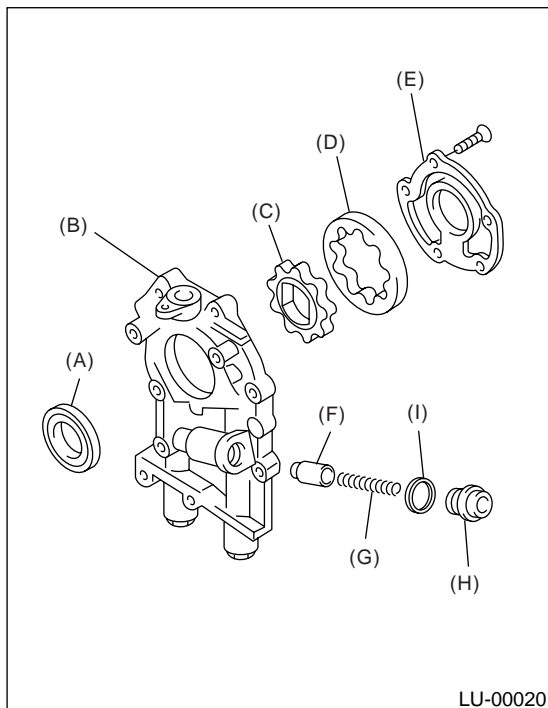
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

**C: DISASSEMBLY**

Remove the screws which secure oil pump cover and then disassemble oil pump. Inscribe alignment marks on the inner and outer rotors so that they can be replaced in their original positions during reassembly.

CAUTION:

Before disassembling the oil pump, remove the relief valve.



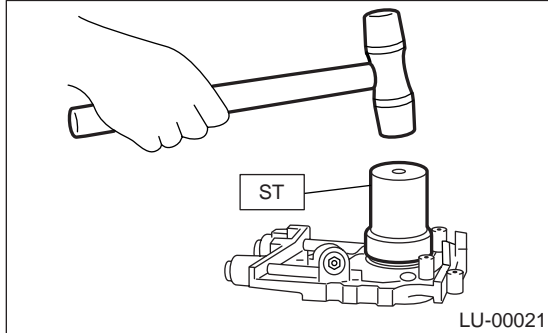
- (A) Oil seal
- (B) Pump case
- (C) Inner rotor
- (D) Outer rotor
- (E) Pump cover
- (F) Relief valve
- (G) Relief valve spring
- (H) Plug
- (I) Gasket

D: ASSEMBLY

- 1) Install the front oil seal by using ST.
ST 499587100 OIL SEAL INSTALLER

NOTE:

Use a new oil seal.



- 2) Apply a coat of engine oil to the inner and outer rotors.
- 3) Install the inner and outer rotors in their original positions.
- 4) Install the oil relief valve and relief valve spring and plug.

NOTE:

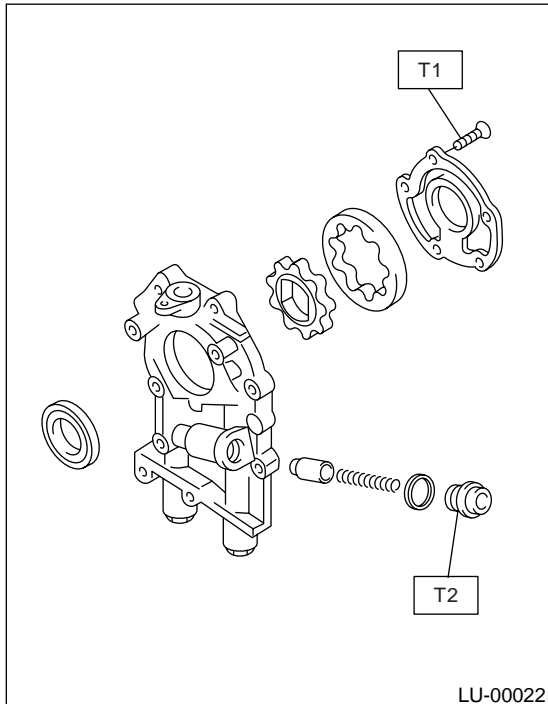
Use a new gasket.

- 5) Install the oil pump cover.

Tightening torque:

T1: 5.4 N·m (0.55 kgf-m, 4.0 ft-lb)

T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)



E: INSPECTION

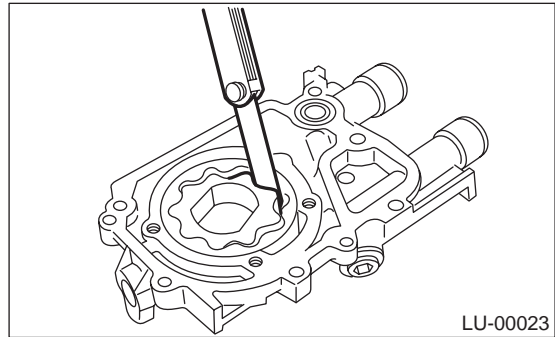
1. TIP CLEARANCE

Measure the tip clearance of rotors. If the clearance exceeds the standard value, replace the rotors as a matched set.

Tip clearance:

Standard value

0.04 — 0.14 mm (0.0016 — 0.0055 in)



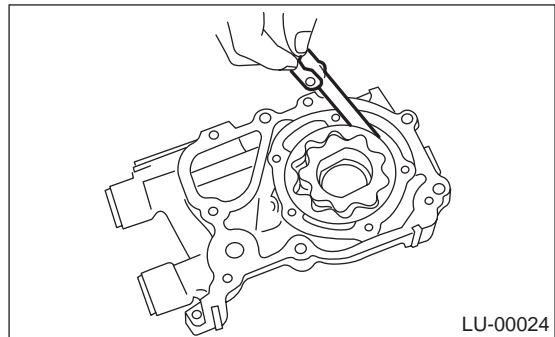
2. CASE CLEARANCE

Measure the clearance between outer rotor and oil pump rotor housing. If the clearance exceeds the standard value, replace the oil pump case.

Case clearance:

Standard value

0.10 — 0.175 mm (0.0039 — 0.0069 in)



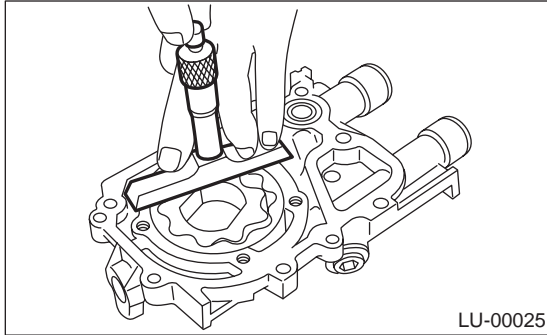
3. SIDE CLEARANCE

Measure the clearance between oil pump inner rotor and pump cover. If the clearance exceeds the standard value, replace the rotor or pump body.

Side clearance:

Standard value

0.02 — 0.07 mm (0.0008 — 0.0028 in)



4. OIL RELIEF VALVE

Check the valve for fitting condition and damage, and the relief valve spring for damage and deterioration. Replace the parts if defective.

Relief valve spring:

Free length

73.7 mm (2.902 in)

Installed length

54.7 mm (2.154 in)

Load when installed

93.1 N (9.49 kgf, 20.88 lb)

5. OIL PUMP CASE

Check the oil pump case for worn shaft hole, clogged oil passage, worn rotor chamber, cracks and other faults.

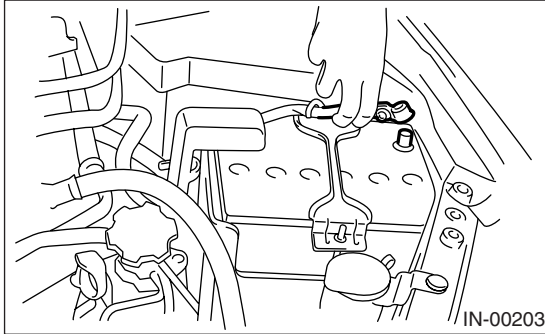
6. OIL SEAL

Check the oil seal lips for deformation, hardening, wear, etc. and replace if defective.

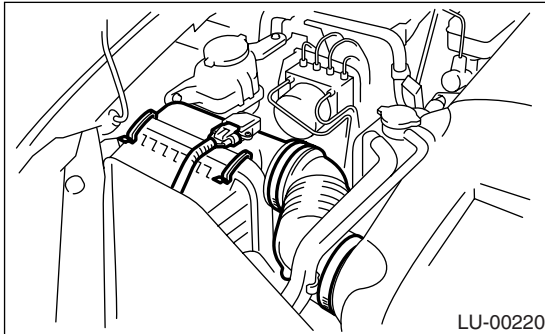
5. Oil Pan and Strainer

A: REMOVAL

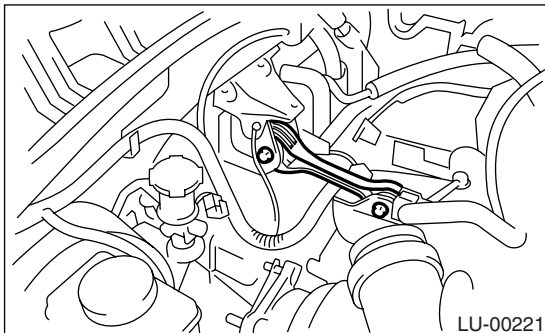
- 1) Set the vehicle on a lift.
- 2) Remove the front wheels.
- 3) Remove the collector cover.
- 4) Disconnect the ground cable from battery.



- 5) Disconnect the connector from mass airflow sensor.
- 6) Remove the air intake boot and air cleaner upper cover.

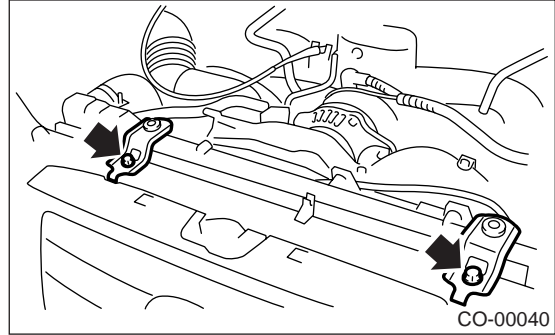


- 7) Remove the intercooler.
<Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 8) Remove the pitching stopper.

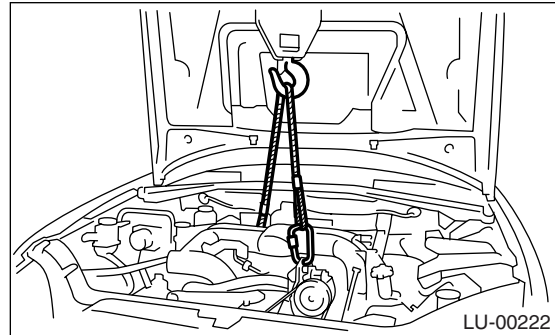


- 9) Remove the linear motion mounting.
<Ref. to ME(H4DOTC)-37, REMOVAL, Linear Motion Mounting.>

- 10) Remove the radiator upper brackets.



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

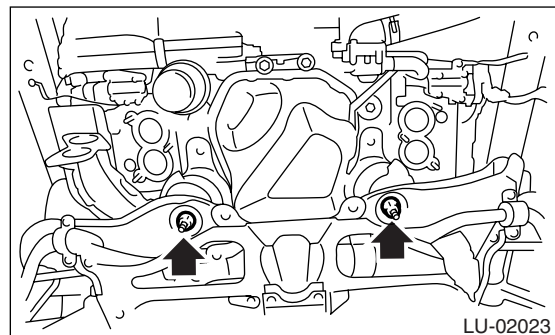


- 12) Lift-up the vehicle.

CAUTION:

When lifting up the vehicle, raise up wire ropes at the same time.

- 13) Remove the under cover.
- 14) Drain engine oil.
- 15) Remove the front exhaust pipe.
<Ref. to EX(H4DOTC)-5, REMOVAL, Front Exhaust Pipe.>
- 16) Remove the nuts which install front cushion rubber onto front crossmember.



- 17) Remove the bolts which install oil pan on cylinder block with the engine raised up.
- 18) Insert the oil pan cutter blade into the clearance between cylinder block and oil pan.

CAUTION:

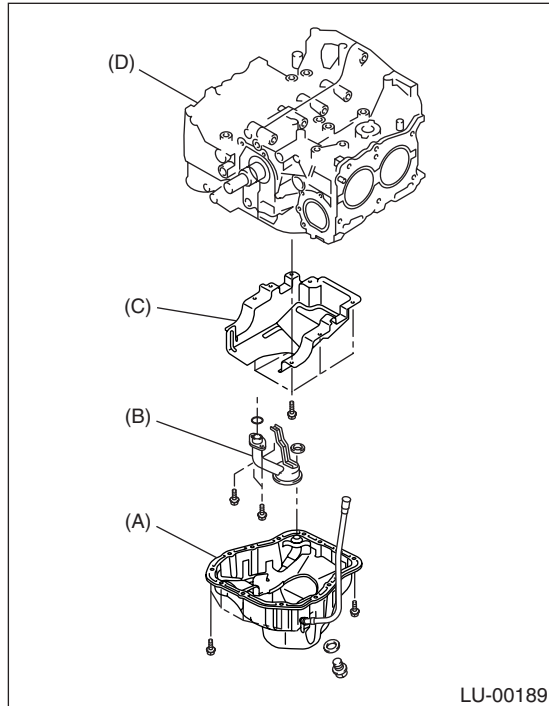
Do not use a screwdriver or similar tool in place of oil pan cutter.

- 19) Remove the oil strainer.

Oil Pan and Strainer

LUBRICATION

20) Remove the baffle plate.



- (A) Oil pan
- (B) Oil strainer
- (C) Baffle plate
- (D) Cylinder block

B: INSTALLATION

CAUTION:

Before installing the oil pan, wipe clean the oil pan and the mating face of engine block.

1) Install the baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

2) Install the oil strainer onto baffle plate.

NOTE:

Replace O-ring with new one.

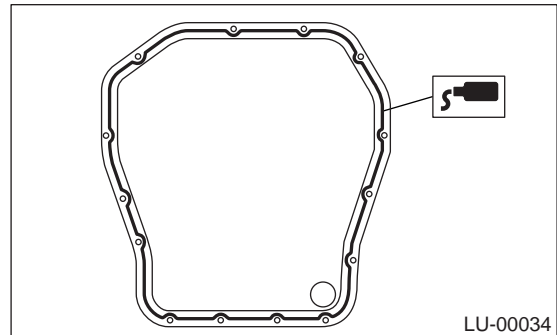
Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

3) Apply liquid gasket to the mating surfaces and install the oil pan.

Liquid gasket:

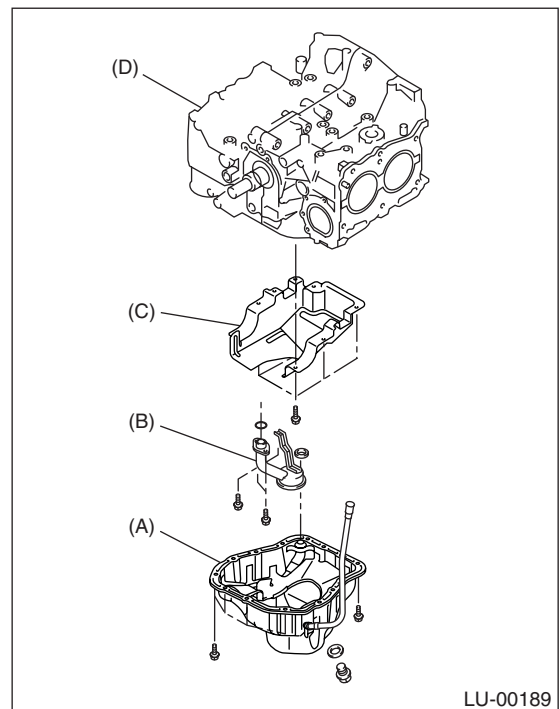
THREE BOND 1207C (Part No. 004403012) or equivalent



4) Tighten the bolts which install oil pan onto engine block.

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



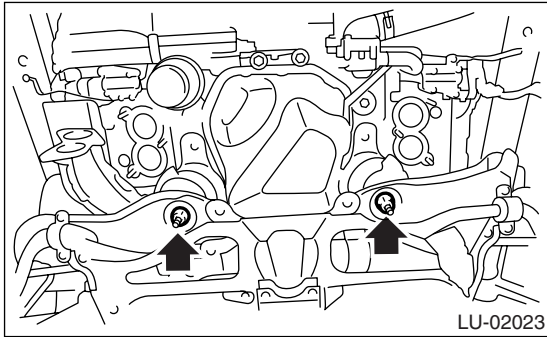
- (A) Oil pan
- (B) Oil strainer
- (C) Baffle plate
- (D) Cylinder block

5) Lower the engine onto front crossmember.

6) Tighten the nuts which hold front cushion rubber onto front crossmember.

Tightening torque:

83 N·m (8.5 kgf-m, 61 ft-lb)

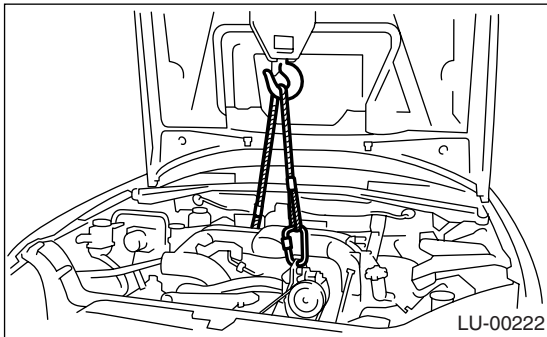


- 7) Install the front exhaust pipe.
<Ref. to EX(H4DOTC)-5, INSTALLATION, Front Exhaust Pipe.> <Ref. to EX(H4SO 2.0)-8, INSTALLATION, Front Exhaust Pipe.>
- 8) Install the under cover.
- 9) Lower the vehicle.

CAUTION:

When lowering the vehicle, lower the lift-up device and wire ropes at the same time.

- 10) Remove the lifting device and wire ropes.

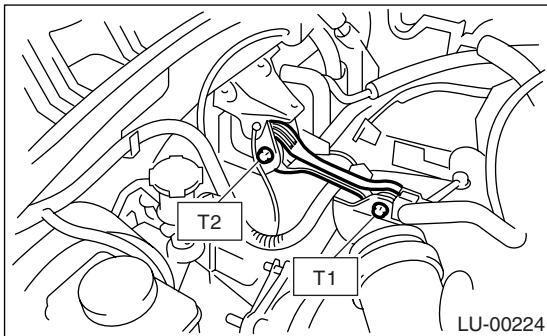


- 11) Install the pitching stopper.

Tightening torque:

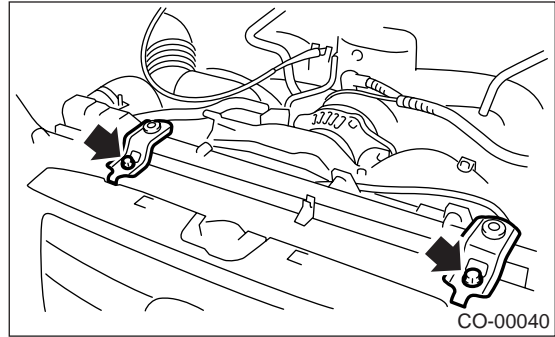
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)

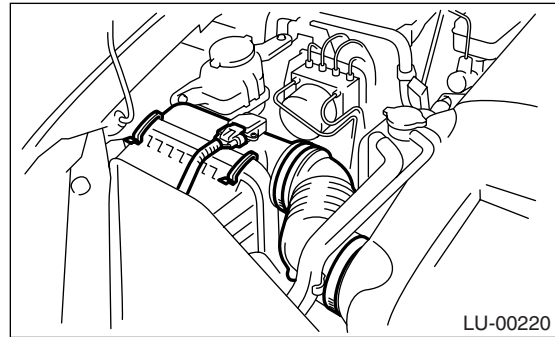


- 12) Install the linear motion mounting.
<Ref. to ME(H4DOTC)-37, INSTALLATION, Linear Motion Mounting.>

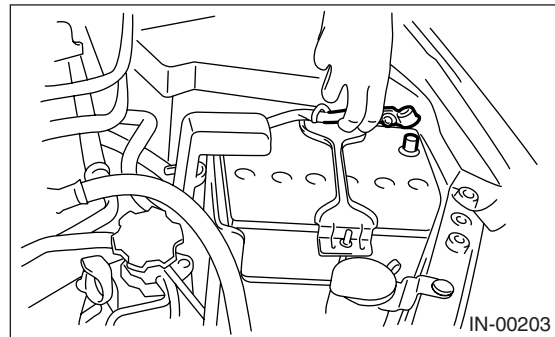
- 13) Install the radiator upper brackets.



- 14) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- 15) Install the air intake boot and air cleaner upper cover.
- 16) Connect the connector to mass air flow sensor.



- 17) Install the front wheels.
- 18) Install the collector cover.
- 19) Connect the battery ground cable to battery.



- 20) Fill engine oil. <Ref. to LU(H4DOTC)-8, INSPECTION, Engine Oil.>

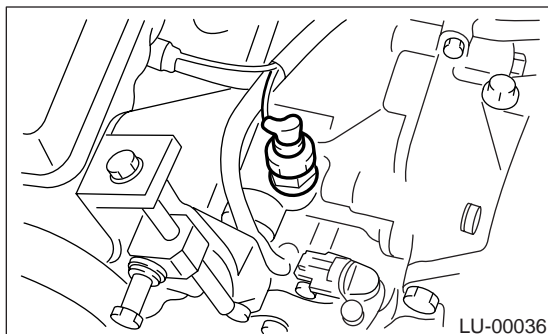
C: INSPECTION

Visually check that the oil pan, oil strainer, oil strainer stay and baffle plate are not damaged.

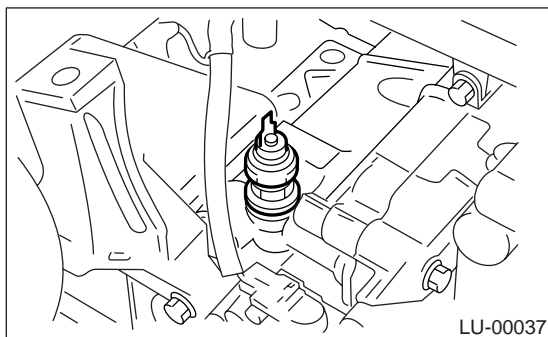
6. Oil Pressure Switch

A: REMOVAL

- 1) Remove the collector cover.
- 2) Remove the generator from bracket.
<Ref. to SC(H4SO 2.0)-14, REMOVAL, Generator.>
- 3) Disconnect the terminal from oil pressure switch.



- 4) Remove the oil pressure switch.

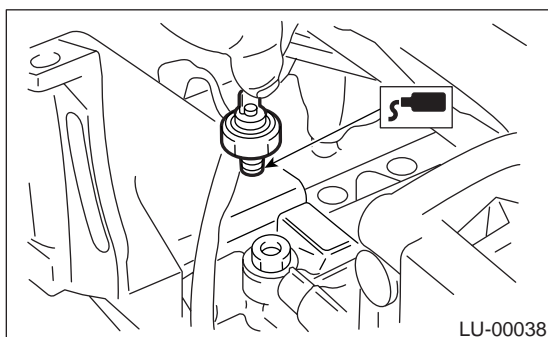


B: INSTALLATION

- 1) Apply liquid gasket to the oil pressure switch threads.

Liquid gasket:

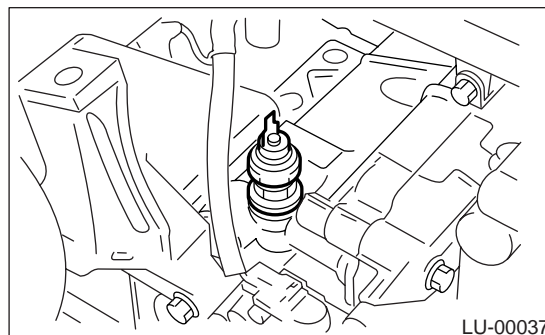
THREE BOND 1324 (Part No. 004403007) or equivalent



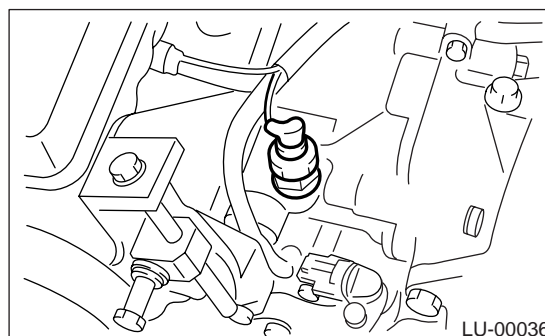
- 2) Install the oil pressure switch onto engine block.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 3) Connect the terminal to oil pressure switch.



- 4) Install the generator to bracket.
<Ref. to SC(H4SO 2.0)-14, INSTALLATION, Generator.>
- 5) Install the collector cover.

C: INSPECTION

Make sure oil does not leak or seep from where the oil pressure switch is installed.

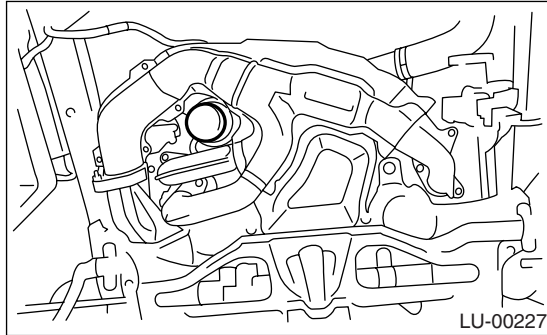
7. Engine Oil Filter

A: REMOVAL

- 1) Lift-up the vehicle.
- 2) Remove the under cover.
- 3) Remove the oil filter using STs.

ST 18332AA000 OIL FILTER WRENCH (Outer diameter: 68 mm (2.68 in))

ST 18332AA010 OIL FILTER WRENCH (Outer diameter: 65 mm (2.56 in))



B: INSTALLATION

- 1) 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 seal rubber.
- 3) Install the oil filter, turning it by hand, being careful not to damage seal rubber.
- 4) Tighten more after the seal rubber contacts oil cooler.

NOTE:

- In case of oil filter in diameter 68 mm (2.68 in), tighten by approx. one turn.
 - In case of oil filter in diameter 65 mm (2.56 in), tighten by approx. 2/3 to 3/4 turn.
 - Over-tightening may cause oil leak.
- 5) Install the under cover.
 - 6) Lower the vehicle.

C: INSPECTION

- 1) After installing the oil filter, run the engine and make sure that no oil is leaking around seal rubber.

NOTE:

The filter element and filter case are permanently jointed; therefore, interior cleaning is not necessary.

- 2) Check the engine oil level.

<Ref. to LU(H4DOTC)-8, INSPECTION, Engine Oil.>

Engine Lubrication System Trouble in General

LUBRICATION

8. Engine Lubrication System Trouble in General

A: INSPECTION

Before performing diagnosis, make sure that the engine oil level is correct and no oil leakage exists.

Symptom	Possible cause		Corrective action
1. Warning light remains on.	1) Oil pressure switch failure	Cracked diaphragm or oil leakage within switch	Replace.
		Broken spring or seized contacts	Replace.
	2) Low oil pressure	Clogging of oil filter	Replace.
		Malfunction of oil by-pass valve in oil filter	Clean or 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 and gear	Replace.
		Clogged oil strainer or broken pipe	Clean or replace.
	3) No oil pressure	Insufficient engine oil	Replenish.
		Broken pipe of oil strainer	Replace.
		Stuck oil pump rotor	Replace.
2. Warning light does not come on.	1) Malfunction of combination meter		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact at terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed in 1).— 2).

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

FUEL INJECTION (FUEL SYSTEMS)

FU(H4DOTC)

	Page
1. General Description	2
2. Throttle Body	12
3. Intake Manifold	13
4. Engine Coolant Temperature Sensor	23
5. Crankshaft Position Sensor	24
6. Camshaft Position Sensor	25
7. Knock Sensor	26
8. Throttle Position Sensor	27
9. Mass Air Flow and Intake Air Temperature Sensor	28
10. Manifold Absolute Pressure Sensor	29
11. Fuel Injector	30
12. Oil Flow Control Solenoid Valve	31
13. Wastegate Control Solenoid Valve	32
14. Front Oxygen (A/F) Sensor	33
15. Rear Oxygen Sensor	34
16. Engine Control Module (ECM)	35
17. Main Relay	36
18. Fuel Pump Relay	37
19. Electronic Throttle Control Relay	38
20. Fuel Pump Control Unit	39
21. Fuel	40
22. Fuel Tank	41
23. Fuel Filler Pipe	47
24. Fuel Pump	49
25. Fuel Level Sensor	51
26. Fuel Sub Level Sensor	52
27. Fuel Filter	54
28. Fuel Bypass Valve	55
29. Fuel Delivery, Return and Evaporation Lines	56
30. Fuel System Trouble in General	59

COOLING

CO(*H4DOTC*)

	Page
1. General Description	2
2. Radiator Fan System	8
3. Engine Coolant.....	13
4. Water Pump	15
5. Thermostat	17
6. Radiator.....	19
7. Radiator Cap	23
8. Radiator Main Fan and Fan Motor	24
9. Radiator Sub Fan and Fan Motor.....	27
10. Reservoir Tank.....	30
11. Coolant Filler Tank	31
12. Engine Cooling System Trouble in General	32

General Description

COOLING

1. General Description

A: SPECIFICATION

Cooling system				Electric fan + Forced engine coolant circulation system	
Total engine coolant capacity				ℓ (US qt, Imp qt)	
				Approx. 7.3 (7.7, 6.4)	
Water pump	Type			Centrifugal impeller type	
	Discharge performance I	Discharge amount		20 (5.3, 4.4)	
		ℓ (US gal, Imp gal)/min			
		Pump speed — Discharge pressure		760 rpm — 2.9 kPa (0.3 mAq)	
	Engine coolant temperature		85°C (185°F)		
	Discharge performance II	Discharge amount		100 (26.4, 22.0)	
		ℓ (US gal, Imp gal)/min			
		Pump speed — Discharge pressure		3,000 rpm — 49.0 kPa (5.0 mAq)	
	Engine coolant temperature		85°C (185°F)		
	Discharge performance III	Discharge amount		200 (52.8, 44.0)	
		ℓ (US gal, Imp gal)/min			
		Pump speed — Discharge pressure		6,000 rpm — 225.4 kPa (23.0 mAq)	
	Engine coolant temperature		85°C (185°F)		
	Impeller diameter			mm (in)	
				76 (2.99)	
Number of impeller vanes			8		
Pump pulley diameter			mm (in)		
			60 (2.36)		
Clearance between impeller and case		Standard	mm (in)		
			0.5 — 1.5 (0.020 — 0.059)		
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		
		Sub fan	W		
	Fan diameter / Blades	Main fan			
		Sub fan			
Radiator	Type			Down flow	
	Core dimensions	Width × Height × Thickness		687.4 × 340 × 16 (27.06 × 13.39 × 0.63)	
	Pressure range in which cap valve is open	Coolant filler tank side		Above: 108±15 (1.1±0.15, 16±2)	
		kPa (kg/cm ² , psi)		Below: -1.0 — -4.9 (-0.01 — -0.05, -0.1 — -0.7)	
	Radiator side	kPa (kg/cm ² , psi)		Above only: 137±14.7 (1.40±0.15, 20±2.1)	
Fins			Corrugated fin type		
Reservoir tank	Capacity			ℓ (US qt, Imp qt)	
				0.45 (0.48, 0.40)	

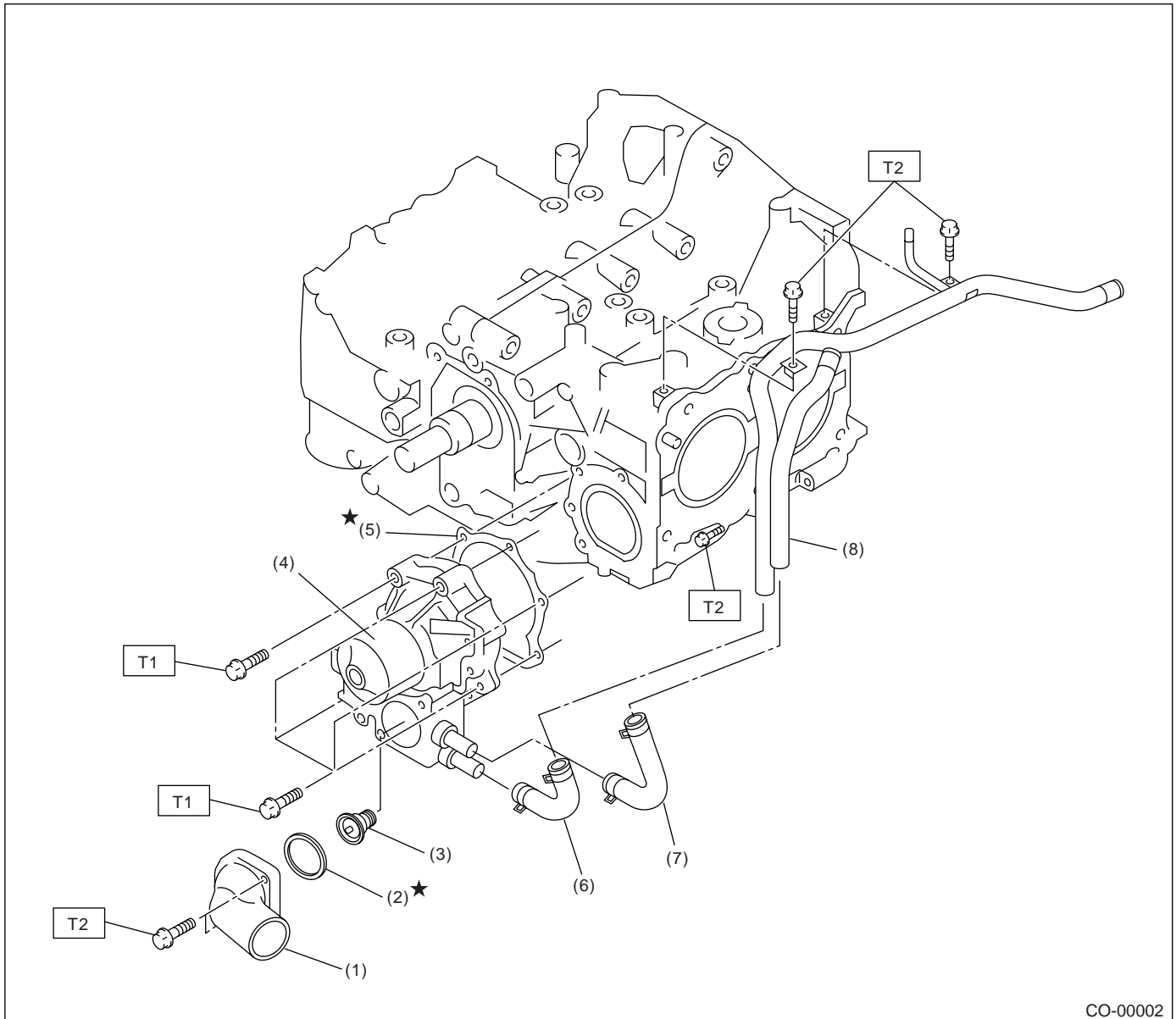
General Description

COOLING

Vehicle speed	A/C compressor load	Engine coolant temperature		
		95°C (203°F) or less	96 — 99°C (205 — 210°F)	100°C (212°F) or more
		Operation of radiator fan	Operation of radiator fan	Operation of radiator fan
19 km/h (12 MPH) or less	OFF	OFF	Low-Speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
20 — 69 km/h (12 — 43 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	High-Speed	High-Speed	High-Speed
	High	High-Speed	High-Speed	High-Speed
70 — 105 km/h (43 — 65 MPH)	OFF	OFF	Low-Speed	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	Low-Speed	High-Speed	High-Speed
106 km/h (66 MPH) or more	OFF	OFF	OFF	High-Speed
	Low	OFF	Low-Speed	High-Speed
	High	OFF	Low-Speed	High-Speed

B: COMPONENT

1. WATER PUMP



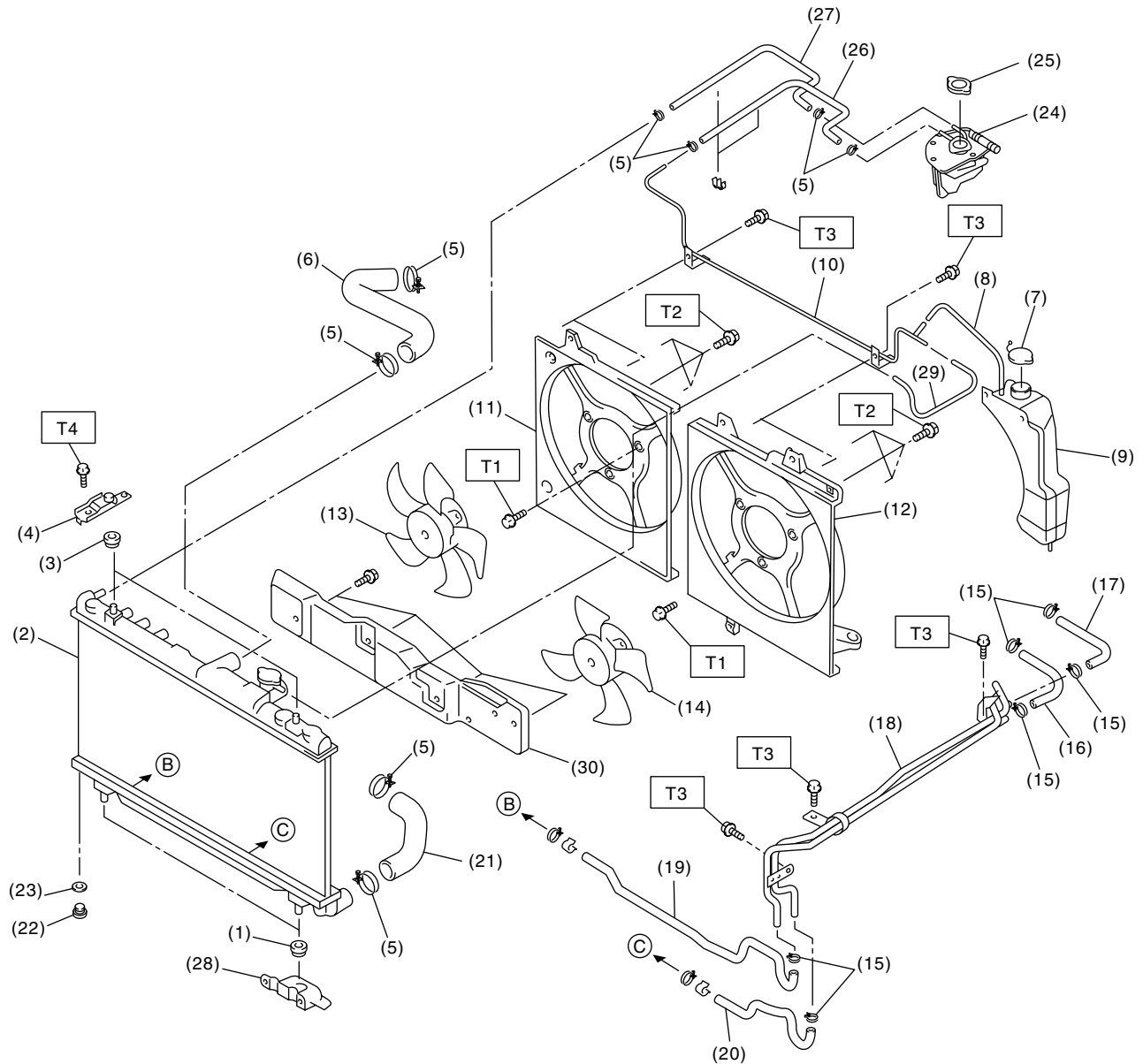
- | | |
|----------------------|---------------------------------|
| (1) Thermostat cover | (5) Gasket |
| (2) Gasket | (6) Heater by-pass hose |
| (3) Thermostat | (7) Coolant filler by-pass hose |
| (4) Water pump ASSY | (8) Water by-pass pipe |

Tightening torque: N·m (kgf-m, ft-lb)

**T1: First 12 (1.2, 8.7)
Second 12 (1.2, 8.7)**

T2: 12 (1.2, 8.7)

2. RADIATOR AND RADIATOR FAN



CO-02004

General Description

COOLING

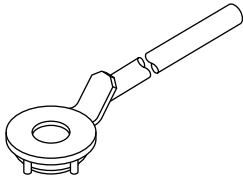
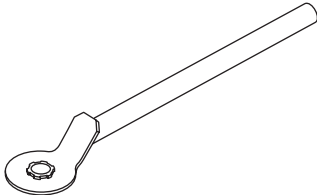
(1) Radiator lower cushion	(14) Radiator main fan ASSY	(26) Engine overflow hose
(2) Radiator	(15) ATF hose clamp	(27) Engine air breather hose
(3) Radiator upper cushion	(16) ATF inlet hose A	(28) Radiator lower bracket
(4) Radiator upper bracket	(17) ATF outlet hose A	(29) Overflow hose B
(5) Clamp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

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

C: CAUTION

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

D: PREPARATION TOOL

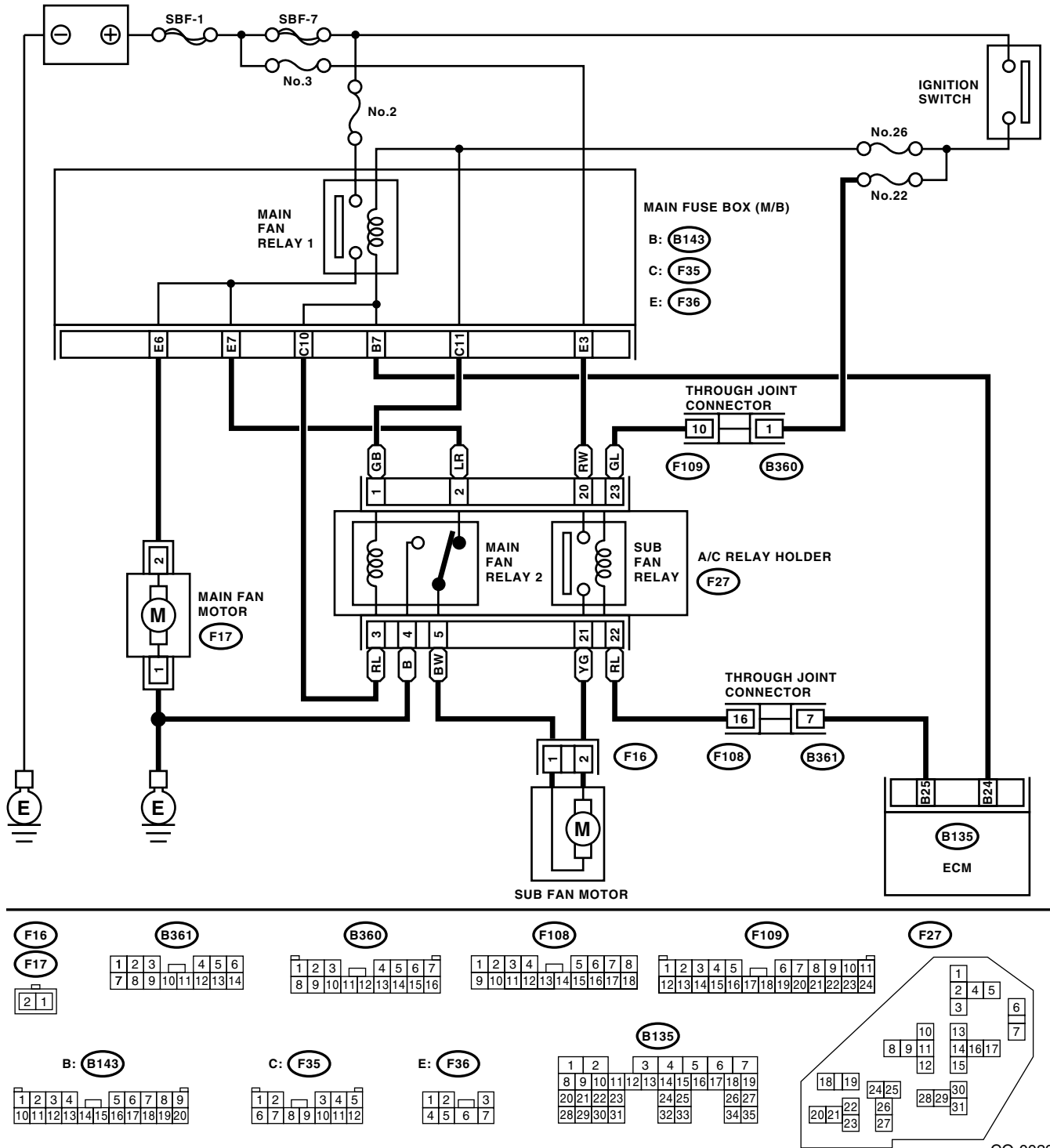
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977400	499977400	CRANK PULLEY WRENCH	Used for stopping crank pulley when loosening and tightening crank pulley bolts.
 ST-499977500	499977500	CAM SPROCKET WRENCH	Used for removing and installing the intake and exhaust camshaft sprocket.

Radiator Fan System

COOLING

2. Radiator Fan System

A: WIRING DIAGRAM



CO-00298

B: INSPECTION

DETECTING CONDITION:

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

TROUBLE SYMPTOMS:

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

Step	Check	Yes	No
1 CHECK OPERATION OF RADIATOR FAN. 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. NOTE: <ul style="list-style-type: none"> • When performing the compulsory operation check for the radiator fan relay using Subaru Select Monitor, the radiator main fan and sub fan will repeat such a operation as low speed revolution → high speed revolution → OFF in this order. • Refer to Compulsory Valve Operation Check Mode for more operation procedure. <Ref. to EN(H4DOTC)(diag)-31, Compulsory Valve Operation Check Mode.> 	Do the radiator main fan and sub fan rotate at low speed?	Go to step 2.	Go to step 3.
2 CHECK OPERATION OF RADIATOR FAN. 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. NOTE: <ul style="list-style-type: none"> • When performing the compulsory operation check for the radiator fan relay using Subaru Select Monitor, the radiator main fan and sub fan will repeat such a operation as low speed revolution → high speed revolution → OFF in this order. • Refer to Compulsory Valve Operation Check Mode for more operation procedure. <Ref. to EN(H4DOTC)(diag)-31, Compulsory Valve Operation Check Mode.> 	Do the radiator main fan and sub fan rotate at high speed?	Radiator 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 A/C relay holder. 3) Measure the voltage between sub fan relay terminal and chassis ground. Connector & terminal (F27) No. 20 (+) — Chassis ground (-):	Is the voltage more than 10 V?	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 terminal and chassis ground. Connector & terminal (F27) No. 23 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 7.	Go to step 6.

Radiator Fan System

COOLING

Step	Check	Yes	No
5 CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 3. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
6 CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 22. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Repair the power supply line.
7 CHECK SUB FAN RELAY. 1) Turn the ignition switch to OFF. 2) Measure the resistance between sub fan relay terminals. <i>Terminals</i> <i>No. 20 — No. 21:</i>	Is the resistance more than 1 MΩ?	Go to step 8.	Replace the sub fan relay.
8 CHECK SUB FAN RELAY. 1) Connect the terminals No. 22 and No. 23 of sub fan relay to battery. 2) Measure the resistance between sub fan relay terminals. <i>Terminals</i> <i>No. 20 — No. 21:</i>	Is the resistance less than 1 Ω?	Go to step 9.	Replace the sub fan relay.
9 CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR. 1) Disconnect the connector from sub fan motor. 2) Measure the resistance of harness between sub fan relay terminal and sub fan motor connector. <i>Connector & terminal</i> <i>(F16) No. 2 — (F27) No. 21:</i>	Is the resistance less than 1 Ω?	Go to step 10.	Repair the open circuit of harness between sub fan relay terminal and sub fan motor connector.
10 CHECK HARNESS BETWEEN SUB FAN MOTOR CONNECTOR AND MAIN FAN RELAY 2 CONNECTOR. 1) Remove the main fan relay 2 from A/C relay holder. 2) Measure the resistance of harness between sub fan motor connector and main fan relay 2 connector. <i>Connector & terminal</i> <i>(F16) No. 1 — (F27) No. 5:</i>	Is the resistance less than 1 Ω?	Go to step 11.	Repair the open harness between sub fan motor connector and main fan relay 2 connector.
11 CHECK POOR CONTACT. Check the poor contact in sub fan motor connector.	Is there poor contact in sub fan motor connector?	Repair the poor contact in sub fan motor connector.	Go to step 12.
12 CHECK SUB FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 2 of sub fan motor, and the ground (–) terminal to terminal No. 1.	Does the sub fan rotate?	Go to step 13.	Replace the sub fan motor.
13 CHECK MAIN FAN RELAY 2. Measure the resistance of main fan relay 2. <i>Terminals</i> <i>No. 2 — No. 5:</i>	Is the resistance less than 1 Ω?	Go to step 14.	Replace the main fan relay 2.

Radiator Fan System

COOLING

Step	Check	Yes	No
14 CHECK HARNESS BETWEEN MAIN FAN RELAY 2 TERMINAL AND MAIN FAN MOTOR CONNECTOR. 1) Disconnect the connector from main fan motor. 2) Measure the resistance of harness between main fan relay 2 terminal and main fan motor connector. Connector & terminal (F17) No. 2 — (F27) No. 2:	Is the resistance less than 1 Ω ?	Go to step 15.	Repair the open circuit of harness between main fan relay 2 terminal and main fan motor connector.
15 CHECK MAIN FAN MOTOR AND GROUND CIRCUIT. Measure the resistance between main fan motor connector and chassis ground. Connector & terminal (F17) No. 1 — Chassis ground:	Is the resistance less than 5 Ω ?	Go to step 16.	Repair the open circuit in harness between main fan motor connector and chassis ground.
16 CHECK POOR CONTACT. Check poor contact in main fan motor connector.	Is there poor contact in main fan motor connector?	Repair the poor contact in main fan motor connector.	Go to step 17.
17 CHECK MAIN FAN MOTOR. Connect the battery positive (+) terminal to terminal No. 2 of main fan motor, and the ground (–) terminal to terminal No. 1.	Does the main fan rotate?	Go to step 18.	Replace the main fan motor.
18 CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM. 1) Disconnect the connector from ECM. 2) Measure the resistance between sub fan relay terminal and ECM connector. Connector & terminal (B135) No. 25 — (F27) No. 22:	Is the resistance less than 1 Ω ?	Go to step 19.	Repair the open circuit in harness between sub fan relay terminal and ECM.
19 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there a poor contact in ECM connector?	Repair the poor contact in ECM connector.	Check the DTC. Repair the trouble cause. <Ref. to EN(H4DOTC)(diag)-27, Read Diagnostic Trouble Code (DTC).>
20 CHECK MAIN FAN RELAY 1. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay 1 from A/C relay holder. 3) Measure the resistance of terminal in main fan relay 1 switch.	Is the resistance more than 1 M Ω ?	Go to step 21.	Replace the main fan relay 1.
21 CHECK MAIN FAN RELAY 1. 1) Connect the terminal of main fan relay 1 coil side terminal to 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 TERMINAL AND MAIN FAN MOTOR CONNECTOR. 1) Disconnect the connector from main fan motor. 2) Measure the resistance of harness between main fan relay 1 terminal and main fan motor connector. Connector & terminal (F17) No. 2 — (F36) No. 6:	Is the resistance less than 1 Ω ?	Go to step 23.	Repair the open circuit of harness between main fan relay 1 terminal and main fan motor connector.

Radiator Fan System

COOLING

Step	Check	Yes	No
23 CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND ECM. 1) Disconnect the connector from ECM. 2) Measure the resistance between main fan relay 1 terminal and ECM connector. Connector & terminal (B135) No. 24 — (B143) No. 7:	Is the resistance less than 1 Ω ?	Go to step 24.	Repair the open circuit of harness between main fan relay 1 terminal and ECM.
24 CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM. Measure the resistance between main fan relay 2 terminal and ECM connector. Connector & terminal (B135) No. 24 — (F27) No. 3:	Is the resistance less than 1 Ω ?	Go to step 25.	Repair the open circuit of harness between main fan relay 2 terminal and ECM.
25 CHECK FUSE. 1) Turn the ignition switch to OFF. 2) Remove the fuse No. 2 and No. 26. 3) Check the condition of fuse.	Is the fuse blown out?	Replace the fuse.	Go to step 26.
26 CHECK POOR CONTACT. Check poor contact in ECM connector.	Is there a poor contact in ECM connector?	Repair the poor contact in ECM connector.	Repair the power supply circuit for main fuse box.
27 CHECK OPERATION OF RADIATOR FAN. Check the sub fan rotates when both fans do not rotate at high speed under the step 2.	Does the sub fan rotate?	Go to step 20.	Go to step 28.
28 CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2. 1) Remove the main fan relay 2 from A/C relay holder. 2) Measure the resistance between main fan relay 2 terminal and chassis ground. Connector & terminal (F27) No. 4 — Chassis ground:	Is the resistance less than 1 Ω ?	Go to step 29.	Repair the open circuit in harness between main fan relay 2 and chassis ground.
29 CHECK POWER SUPPLY TO MAIN FAN RELAY 2. 1) Turn the ignition switch to ON. 2) Measure the voltage between main fan relay 2 terminal and chassis ground. Connector & terminal (F27) No. 1 (+) — Chassis ground (-):	Is the voltage more than 10 V?	Go to step 30.	Repair the power supply line.
30 CHECK MAIN FAN RELAY 2. 1) Turn the ignition switch to OFF. 2) Remove the main fan relay 2. 3) Measure the resistance of main fan relay 2. Terminals (F27) No. 4 — (F27) No. 5:	Is the resistance more than 1 M Ω ?	Go to step 31.	Replace the main fan relay 2.
31 CHECK MAIN FAN RELAY 2. 1) Connect the battery to terminals No. 1 and No. 3 of main fan relay 2. 2) Measure the resistance of main fan relay 2. Terminals (F27) No. 4 — (F27) No. 5:	Is the resistance less than 1 Ω ?	Go to step 23.	Replace the main fan relay 2.

3. Engine Coolant

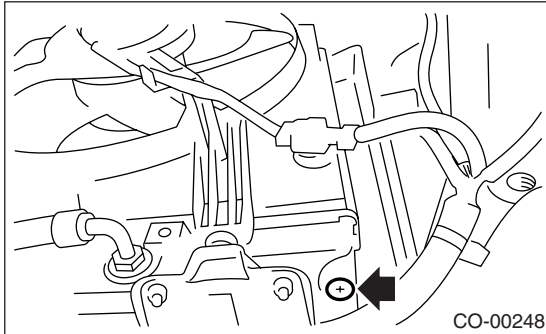
A: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

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

NOTE:

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



- 4) Install the drain plug.

2. FILLING OF ENGINE COOLANT

- 1) Remove the collector cover.
- 2) Fill engine coolant into coolant filler tank up to the filler neck position.

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

Approx. 7.3 ℓ (7.7 US qt, 6.4 Imp qt)

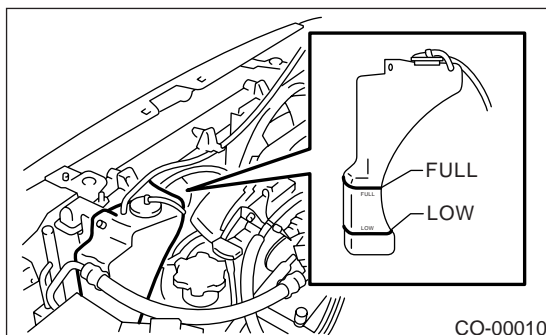
CAUTION:

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

- 3) Fill engine coolant into the reservoir tank up to "FULL" level.



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

- 5) If the engine coolant level drops in coolant filler tank, add engine coolant to filler neck position.

- 6) If the engine coolant level drops from "FULL" level of reservoir tank, add engine coolant to "FULL" level.

- 7) Attach the coolant filler tank cap and reservoir tank cap properly.

- 8) Install the collector cover.

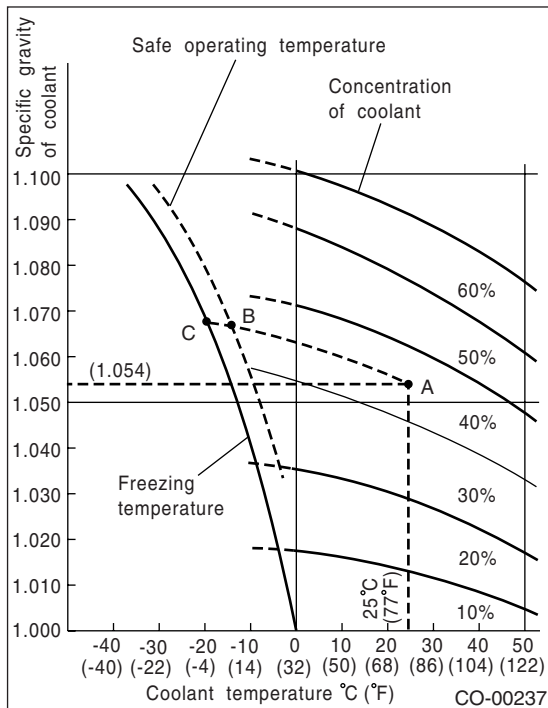
B: INSPECTION

1. RERATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

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

[Example]

If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 45% (point A), the safe operating temperature is -14°C (7°F) (point B), and the freezing temperature is -20°C (-4°F) (point C).



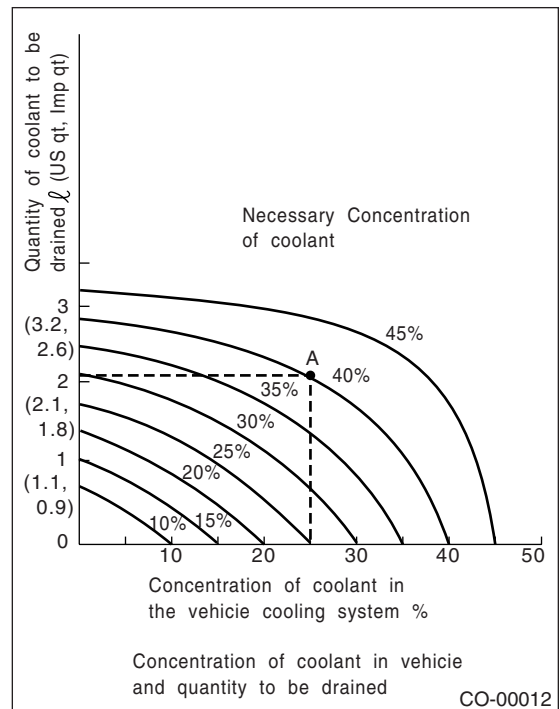
2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

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

[Example]

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

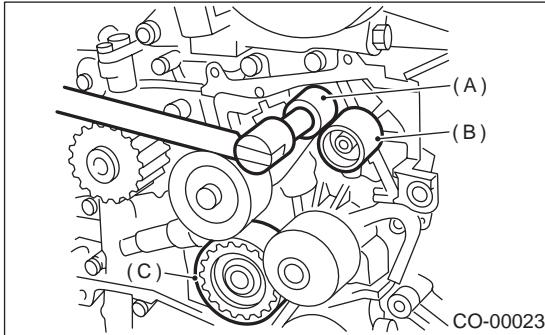
If a coolant concentration of 50% is needed, drain all the coolant and refill with the undiluted solution only.



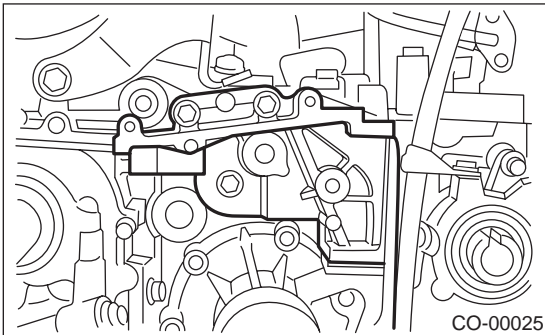
4. Water Pump

A: REMOVAL

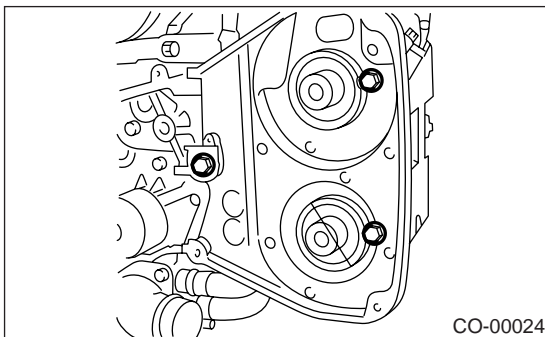
- 1) Remove the collector cover.
- 2) Remove the radiator. <Ref. to CO(H4DOTC)-19, REMOVAL, Radiator.>
- 3) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
- 4) Remove the timing belt. <Ref. to ME(H4DOTC)-43, REMOVAL, Timing Belt.>
- 5) Remove the automatic belt tension adjuster (A).
- 6) Remove the belt idler (B).
- 7) Remove the belt idler No. 2 (C).



- 8) Remove the camshaft position sensor. <Ref. to FU(H4DOTC)-25, REMOVAL, Camshaft Position Sensor.>
- 9) Remove the cam sprocket (LH) using ST. <Ref. to ME(H4DOTC)-51, REMOVAL, Cam Sprocket.>
- 10) Remove the tensioner bracket.

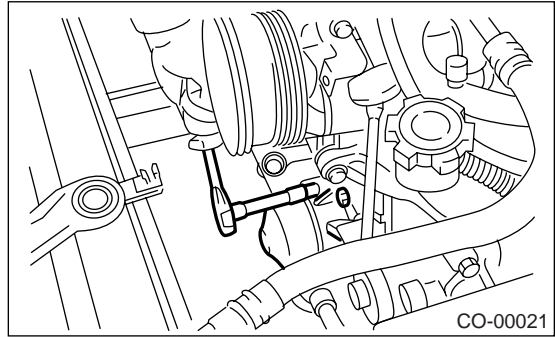


- 11) Remove the belt cover No. 2 (LH).



- 12) Disconnect the hose from water pump.

- 13) Remove the water pump.



B: INSTALLATION

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

NOTE:

- Always use new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in the figure.

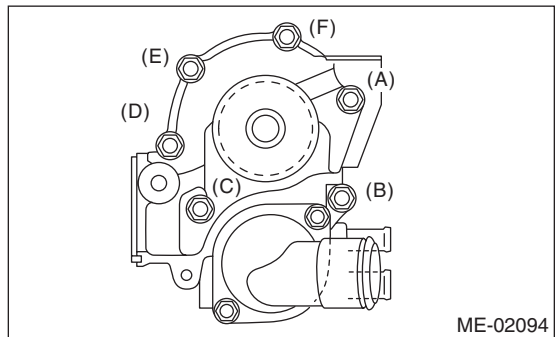
Tightening torque:

First:

12 N·m (1.2 kgf-m, 8.7 ft-lb)

Second:

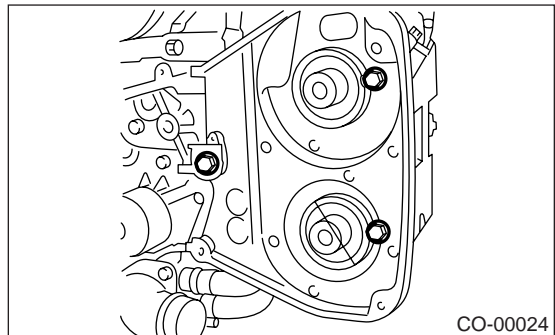
12 N·m (1.2 kgf-m, 8.7 ft-lb)



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

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



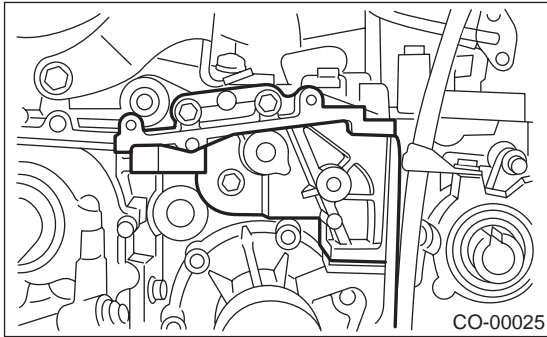
Water Pump

COOLING

4) Install the tensioner bracket.

Tightening torque:

25 N·m (2.5 kgf·m, 18.1 ft·lb)



5) Install the cam sprocket (LH) using ST. <Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>

6) Install the camshaft position sensor. <Ref. to FU(H4DOTC)-25, INSTALLATION, Camshaft Position Sensor.>

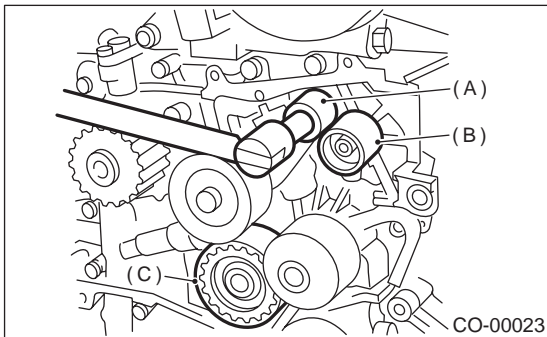
7) Install the belt idler No. 2 (C).

8) Install the belt idler (B).

9) Install the automatic belt tension adjuster (A) which has a tension rod held by a pin. <Ref. to ME(H4DOTC)-44, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

Tightening torque:

39 N·m (4.0 kgf·m, 28.9 ft·lb)



10) Install the timing belt. <Ref. to ME(H4DOTC)-45, TIMING BELT, INSTALLATION, Timing Belt.>

11) Install the V-belts. <Ref. to ME(H4DOTC)-39, INSTALLATION, V-belt.>

12) Install the radiator. <Ref. to CO(H4DOTC)-20, INSTALLATION, Radiator.>

13) Install the collector cover.

C: INSPECTION

1) Check the water pump bearing for smooth rotation.

2) Check the water pump pulley for abnormalities.

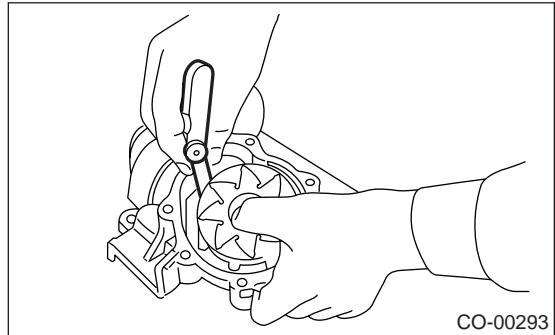
3) Make sure the impeller is not deformed or damaged.

4) Inspect the clearance between impeller and pump case.

Clearance between impeller and pump case:

Standard value

0.5 — 1.5 mm (0.020 — 0.059 in)

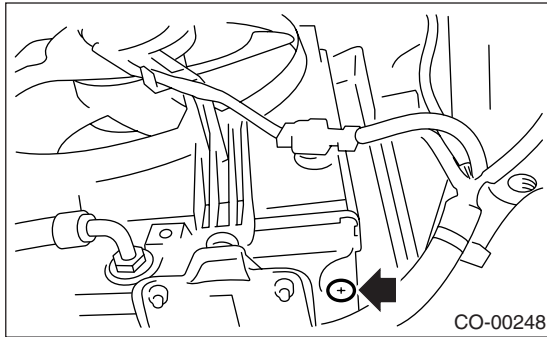


5) After water pump installation, check the pulley shaft for engine coolant leaks and noise. If leaks or noise are noted, replace the water pump assembly.

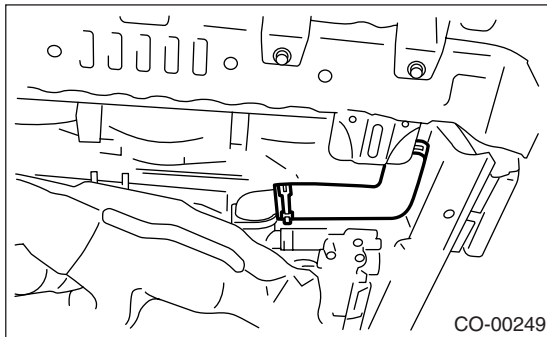
5. Thermostat

A: REMOVAL

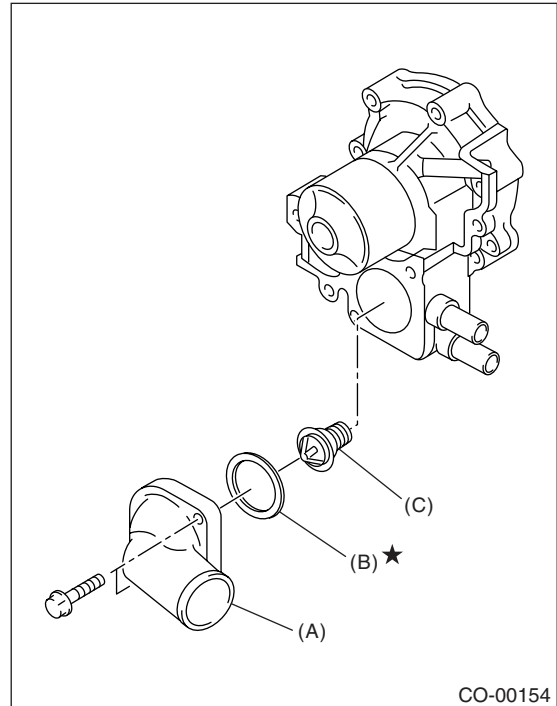
- 1) Set the vehicle on a lift.
- 2) Lift-up the vehicle.
- 3) Remove the under cover.
- 4) Drain engine coolant completely.
<Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



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



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



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

B: INSTALLATION

- 1) Install the gasket to thermostat, and install the thermostat and gasket to water pump as a unit. Then, install the thermostat cover.

NOTE:

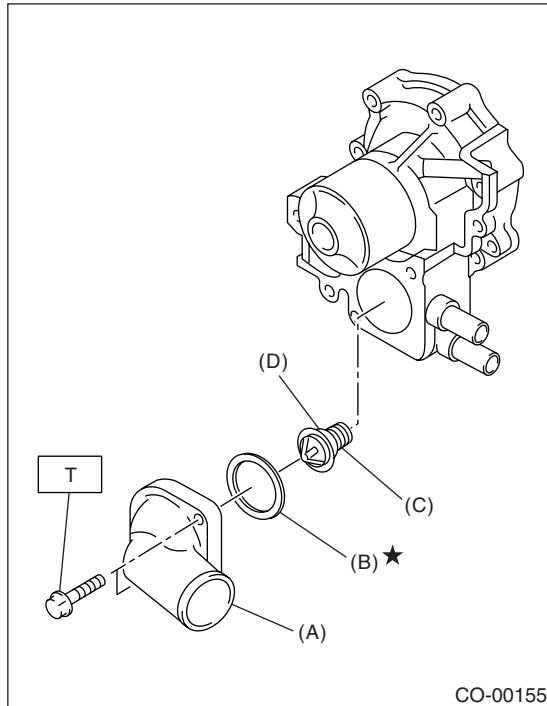
- When reinstalling the thermostat, use a new gasket.
- The thermostat must be installed with the jiggle pin facing upward.

Thermostat

COOLING

Tightening torque:

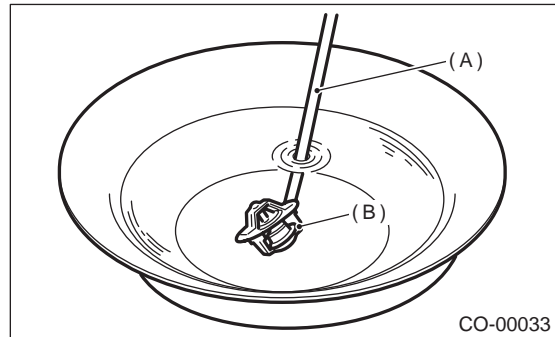
12 N·m (1.2 kgf-m, 8.7 ft-lb)



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

Valve lift:

9.0 mm (0.354 in) or more



- (A) Thermometer
- (B) Thermostat

2) Connect the radiator outlet hose to thermostat cover.

3) Install the under cover.

4) Lower the vehicle.

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

C: INSPECTION

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

• Inspection method

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

Starting temperature to open:

76 — 80°C (169 — 176°F)

Fully opens:

91°C (196°F)

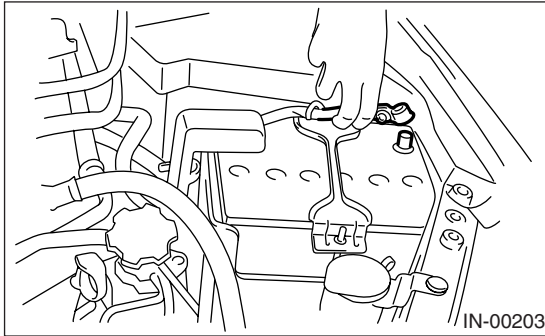
6. Radiator

A: REMOVAL

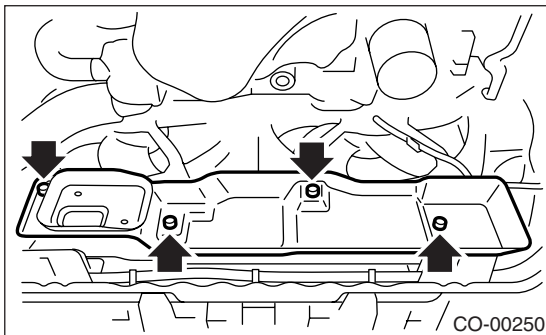
WARNING:

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

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

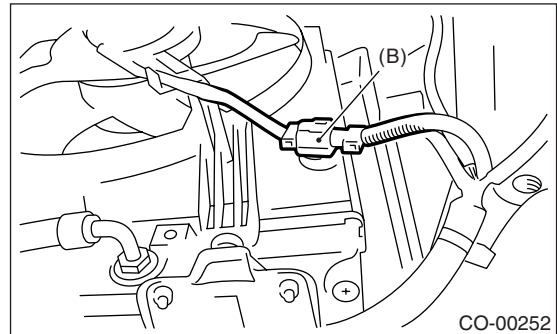
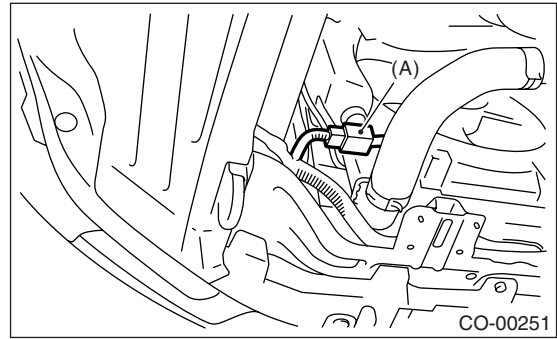


- 4) Lift-up the vehicle.
- 5) Remove the under cover.
- 6) Remove the heat shield cover from radiator.

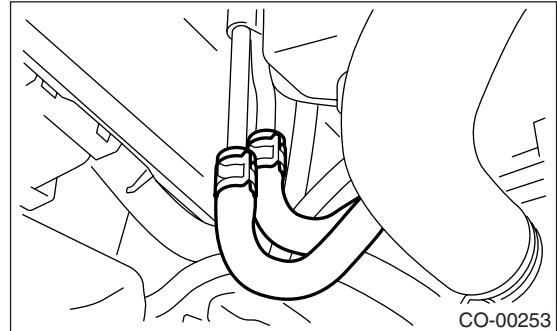


- 7) Drain engine coolant completely.
<Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

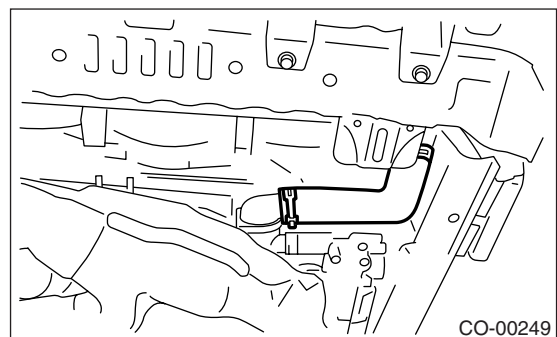
- 8) Disconnect the connectors of radiator main fan motor (A) and sub fan motor (B).



- 9) Disconnect the ATF cooler hoses from ATF pipes.
Plug the ATF pipe to prevent ATF leaks.



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

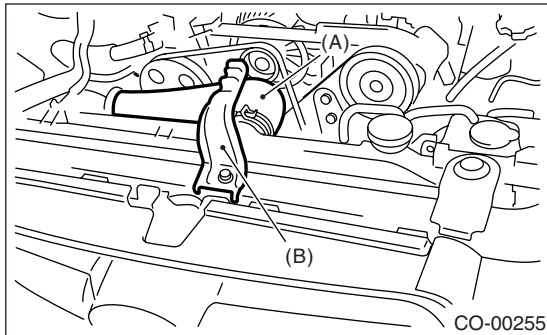


- 11) Lower the vehicle.
- 12) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>
- 13) Disconnect the over flow hose.

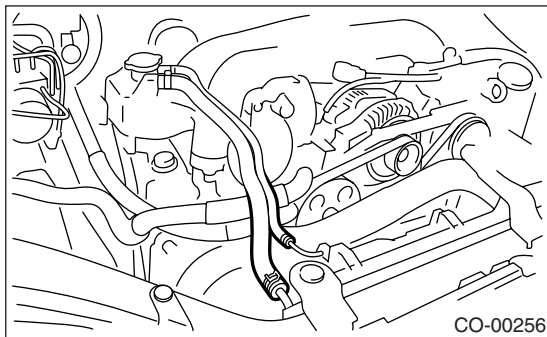
Radiator

COOLING

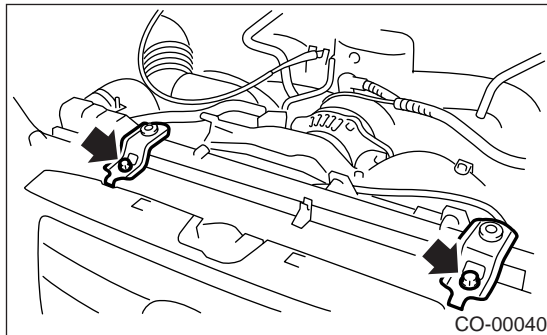
- 14) Remove the reservoir tank. <Ref. to CO(H4DOTC)-30, REMOVAL, Reservoir Tank.>
- 15) Disconnect the radiator inlet hose (A) from radiator.
- 16) Remove the hood stay holder (B).



- 17) Disconnect the two coolant filler tank hoses from radiator.



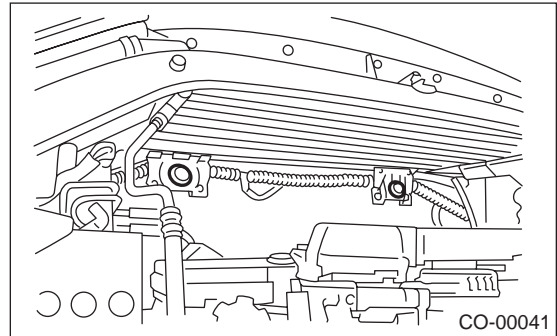
- 18) Remove the radiator upper brackets.



- 19) While lifting the radiator up, slide it to the left.
- 20) Lift the radiator up and away from vehicle.

B: INSTALLATION

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



- 2) Install the radiator to vehicle.

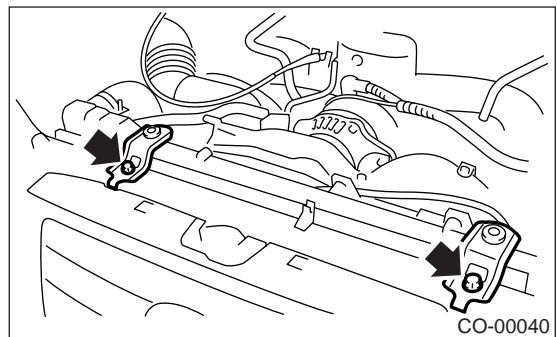
NOTE:

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

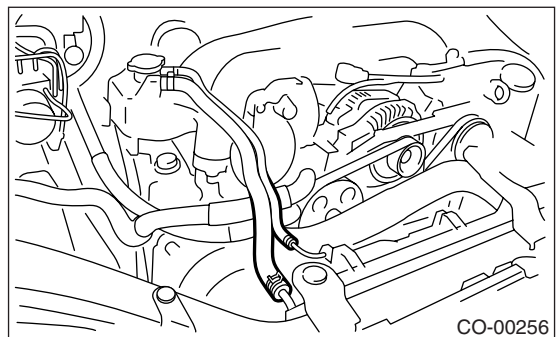
- 3) Install the radiator upper brackets and tighten the bolts.

Tightening torque:

18 N·m (1.8 kgf-m, 13.0 ft-lb)

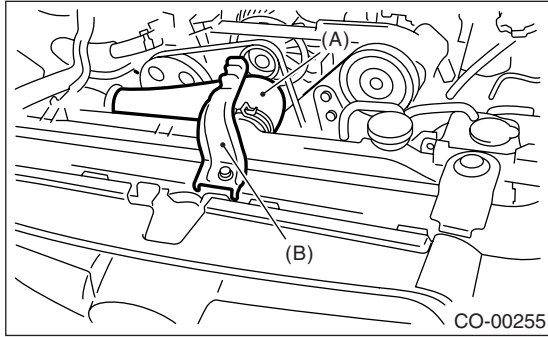


- 4) Connect the two coolant filler tank hoses to radiator.



- 5) Connect the radiator inlet hose (A).

6) Install the hood stay holder (B).



7) Install the reservoir tank. <Ref. to CO(H4DOTC)-30, INSTALLATION, Reservoir Tank.>

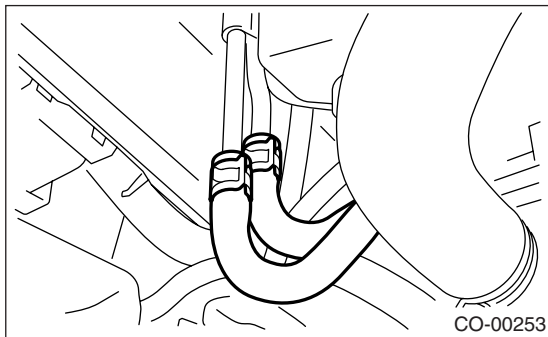
8) Connect the over flow hose.

9) Install the air intake duct.

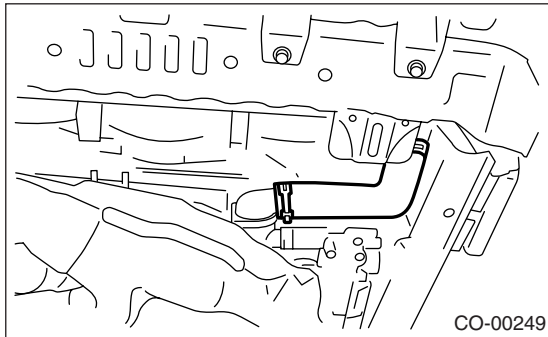
<Ref. to IN(H4DOTC)-9, INSTALLATION, Air Intake Duct.>

10) Lift-up the vehicle.

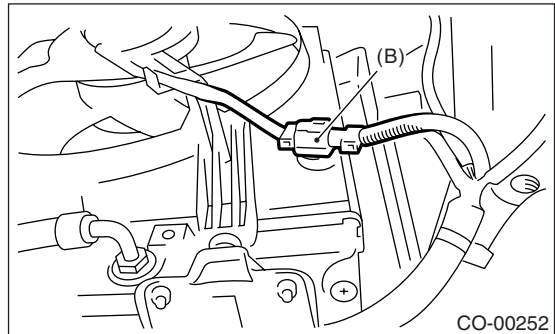
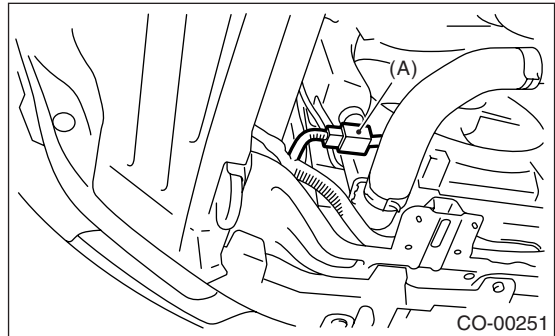
11) Connect the ATF cooler hoses.



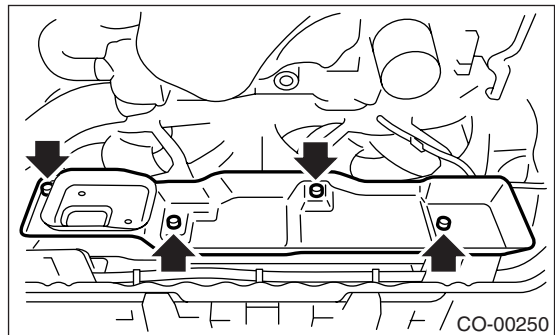
12) Connect the radiator outlet hose.



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



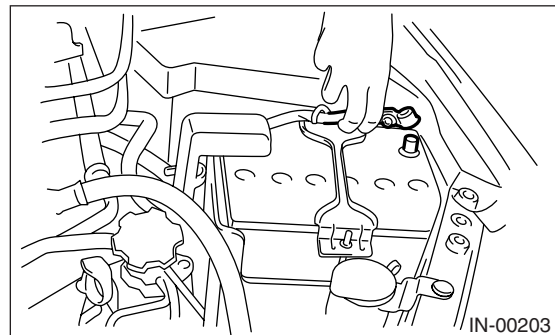
14) Install the heat shield cover.



15) Install the under cover.

16) Lower the vehicle.

17) Connect the battery ground cable to battery.



18) Fill engine coolant.

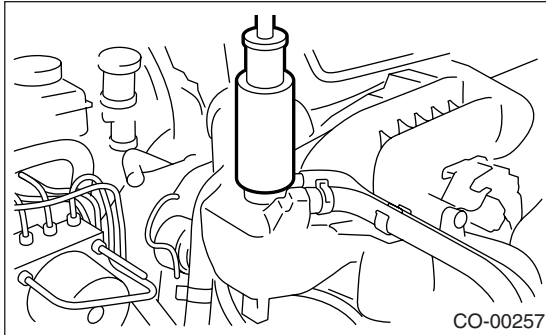
<Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

19) Check the ATF level. <Ref. to 5AT-27, INSPECTION, Automatic Transmission Fluid.>

20) Install the collector cover.

C: INSPECTION

1) Remove the coolant filler tank cap and fill engine coolant to coolant filler tank, then attach the tester to radiator in place of cap.



2) Apply a pressure of 122 kPa (1.2 kg/cm², 18 psi) to the radiator to check if:

- Engine coolant leaks at or around radiator.
- Engine coolant leaks at/around hoses or connections.

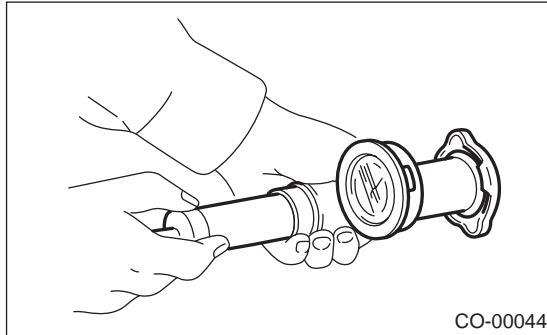
CAUTION:

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

7. Radiator Cap

A: INSPECTION

1) Attach the radiator cap to tester.



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

Coolant filler tank side

Standard pressure:

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

Service limit pressure:

83 kPa (0.85 kg/cm², 12 psi)

Radiator side

Standard pressure:

122 — 152 kPa (1.24 — 1.55 kg/cm², 18 — 22 psi)

Service limit pressure:

112 kPa (1.14 kg/cm², 16 psi)

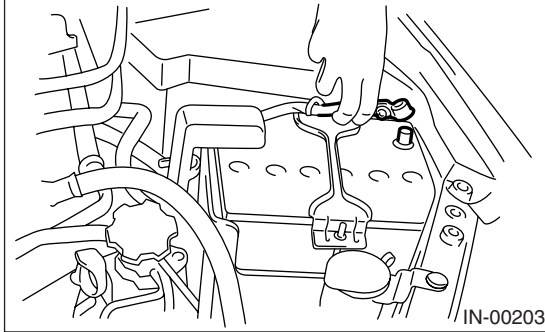
CAUTION:

- Be sure to remove foreign matter and rust from the cap in advance. Otherwise, results of pressure test will be incorrect.
- Not to confuse the cap of coolant filler tank and cap of radiator.

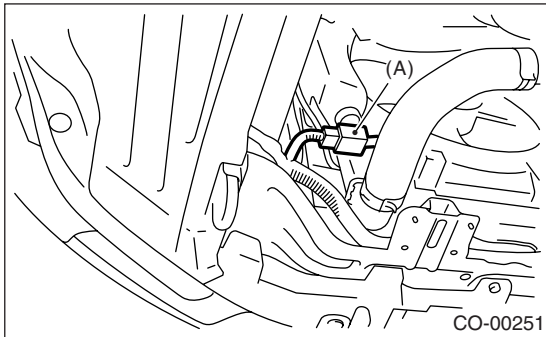
8. Radiator Main Fan and Fan Motor

A: REMOVAL

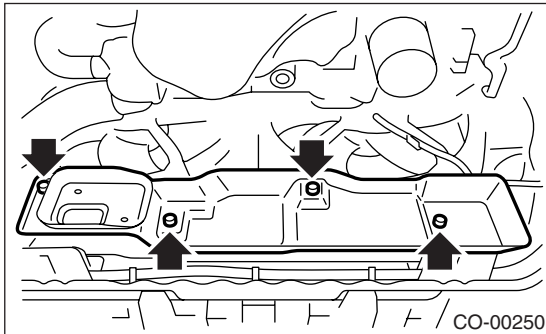
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



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

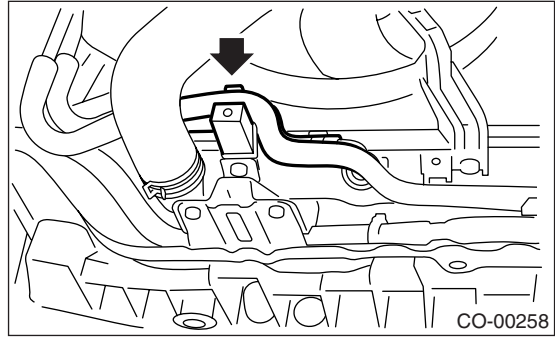


- 6) Remove the heat shield cover from radiator.

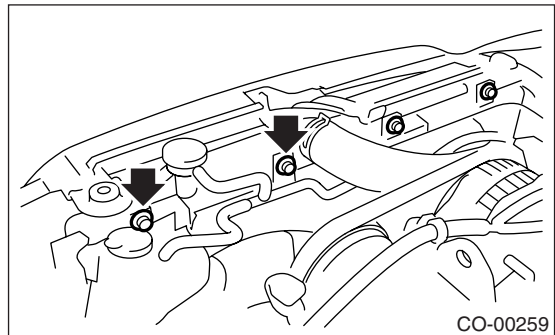


- 7) Drain the coolant about 1 ℓ (1.06 US qt, 0.88 Imp qt). <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

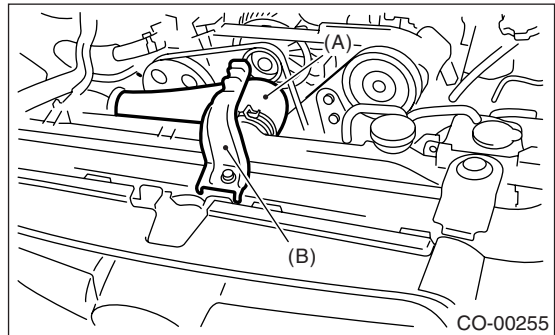
- 8) Remove the ATF hose from the clip of radiator main fan motor assembly.



- 9) Lower the vehicle.
- 10) Remove the air intake duct.
- 11) Disconnect the over flow hose.
- 12) Remove the over flow pipe.
- 13) Remove the reservoir tank. <Ref. to CO(H4DOTC)-30, REMOVAL, Reservoir Tank.>
- 14) Remove the mounting bolts from radiator main fan motor assembly.



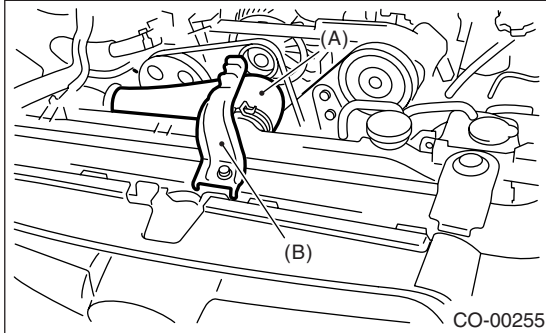
- 15) Disconnect the radiator inlet hose (A) from radiator.
- 16) Remove the hood stay holder (B).



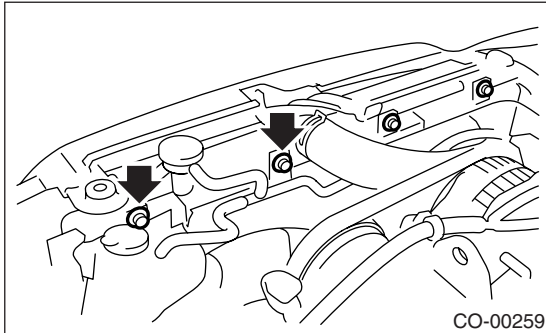
- 17) Remove the radiator main fan motor assembly from vehicle.

B: INSTALLATION

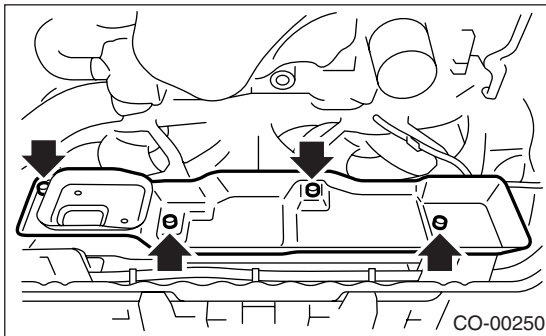
- 1) Install the radiator main fan motor assembly to vehicle.
- 2) Connect the radiator inlet hose (A) to radiator.
- 3) Install the hood stay holder (B).



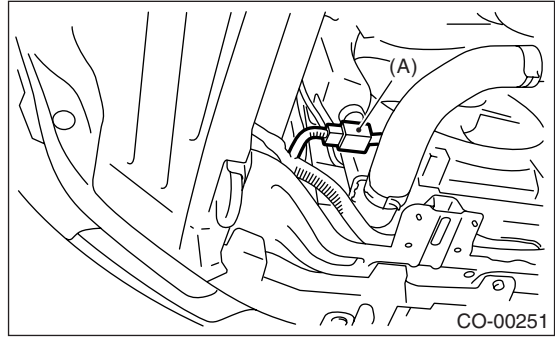
- 4) Install the mounting bolts of radiator main fan motor assembly.



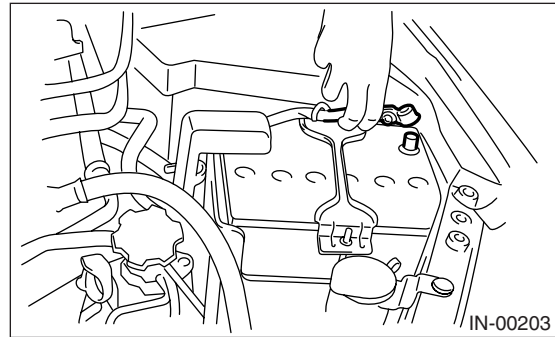
- 5) Install the reservoir tank. <Ref. to CO(H4DOTC)-30, INSTALLATION, Reservoir Tank.>
- 6) Install the over flow pipe.
- 7) Connect the over flow hose.
- 8) Install the air intake duct.
- 9) Lift-up the vehicle.
- 10) Attach the ATF hose to the clip of radiator main fan motor assembly.
- 11) Install the heat shield cover to radiator.



- 12) Connect the main fan motor connector (A).



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



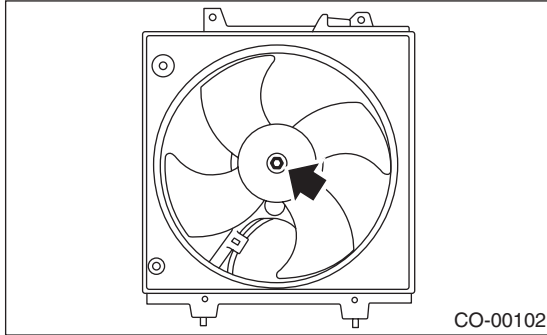
- 16) Fill engine coolant.
<Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 17) Install the collector cover.

Radiator Main Fan and Fan Motor

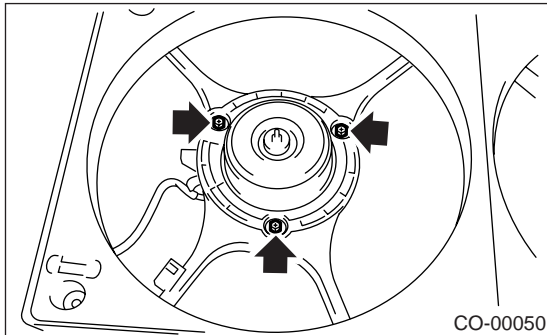
COOLING

C: DISASSEMBLY

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



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

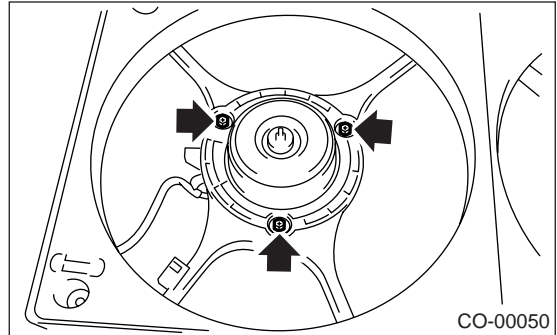


D: ASSEMBLY

Assemble in the reverse order of disassembly.

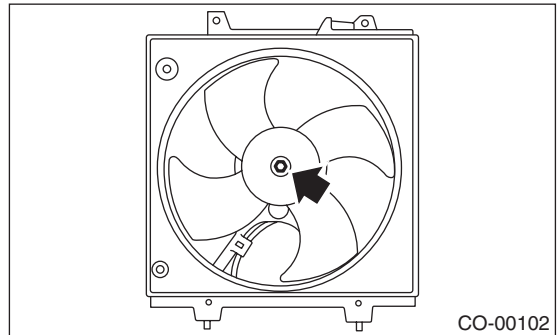
Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



Tightening torque:

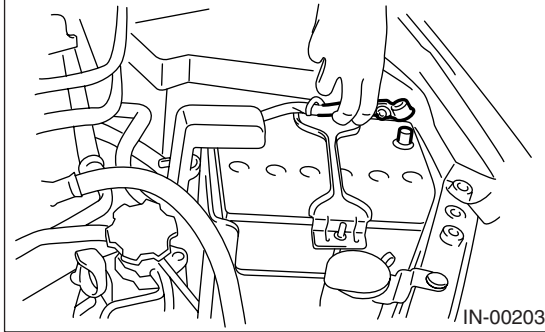
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



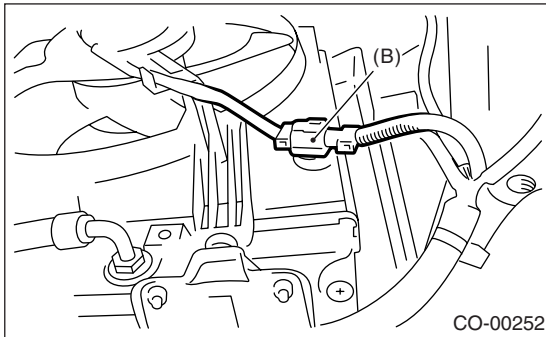
9. Radiator Sub Fan and Fan Motor

A: REMOVAL

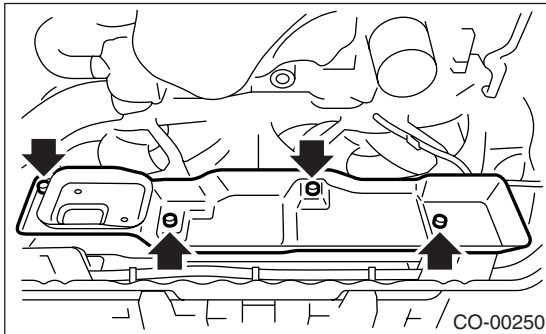
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



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

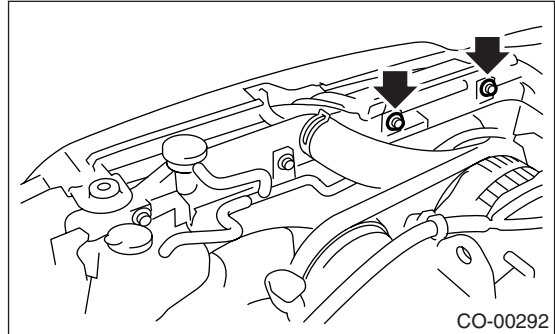


- 6) Remove the heat shield cover from radiator.

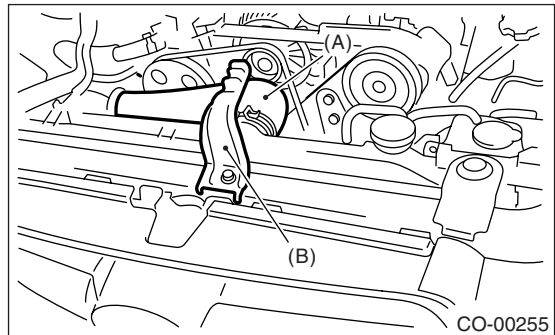


- 7) Drain the coolant about 1 ℓ (1.06 US qt, 0.88 Imp qt). <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 8) Remove the ATF hose from the clip of radiator sub fan motor assembly.
- 9) Lower the vehicle.
- 10) Remove the air intake duct.
- 11) Disconnect the over flow hose.
- 12) Remove the over flow pipe.
- 13) Remove the reservoir tank. <Ref. to CO(H4DOTC)-30, REMOVAL, Reservoir Tank.>

- 14) Remove the mounting bolts of radiator sub fan motor assembly.



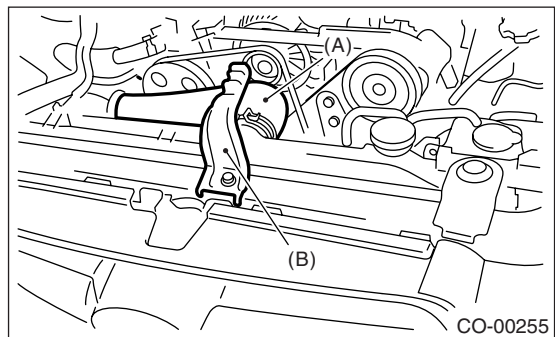
- 15) Disconnect the radiator inlet hose (A) from radiator.
- 16) Remove the hood stay holder (B).



- 17) Remove the radiator sub fan motor assembly from vehicle.

B: INSTALLATION

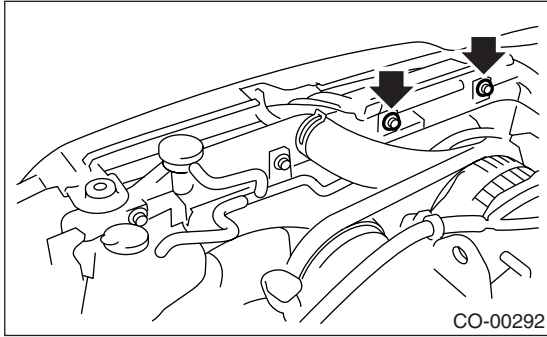
- 1) Install the radiator sub fan motor assembly to vehicle.
- 2) Connect the radiator inlet hose (A) to radiator.
- 3) Install the hood stay holder (B).



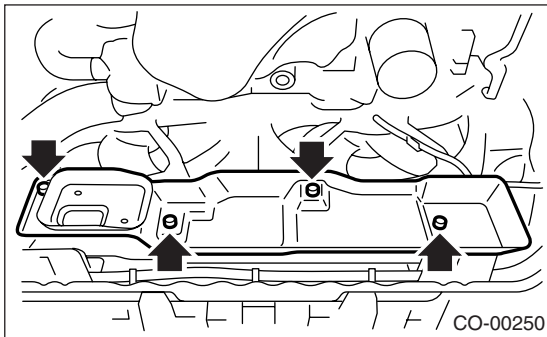
Radiator Sub Fan and Fan Motor

COOLING

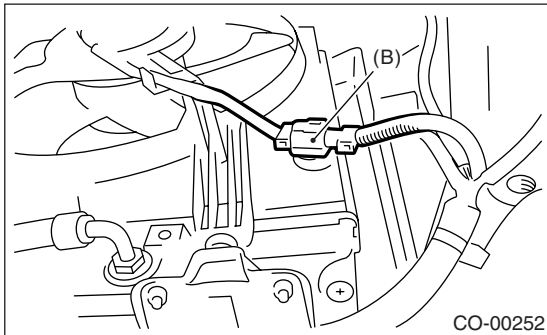
- 4) Install the mounting bolts of radiator sub fan motor assembly.



- 5) Install the reservoir tank. <Ref. to CO(H4DOTC)-30, INSTALLATION, Reservoir Tank.>
6) Install the over flow pipe.
7) Connect the over flow hose.
8) Install the air intake duct.
9) Lift-up the vehicle.
10) Attach the ATF hose to the clip of radiator sub fan motor assembly.
11) Install the heat shield cover to radiator.

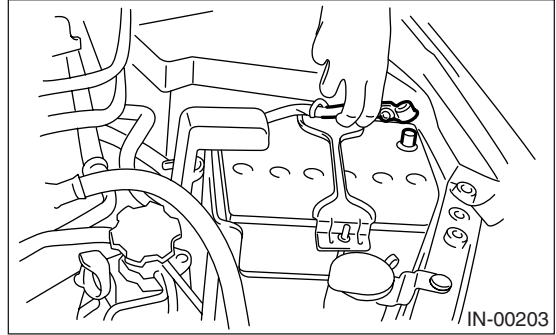


- 12) Connect the sub fan motor connector (B).



- 13) Install the under cover.
14) Lower the vehicle.

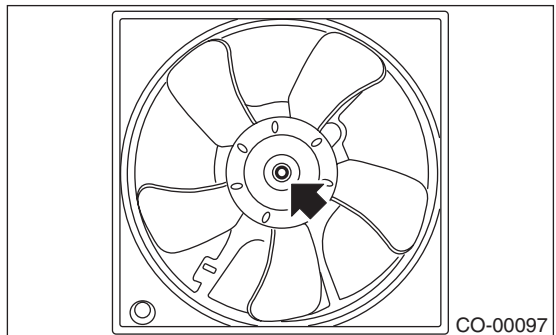
- 15) Connect the battery ground cable to battery.



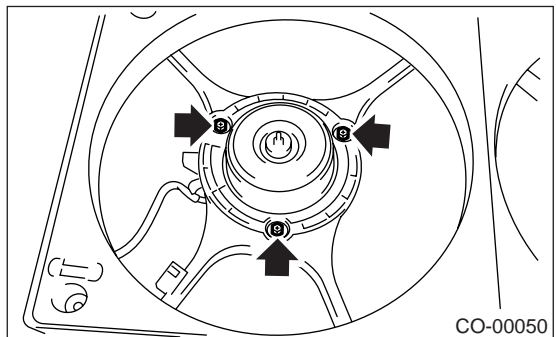
- 16) Fill engine coolant.
<Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
17) Install the collector cover.

C: DISASSEMBLY

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



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

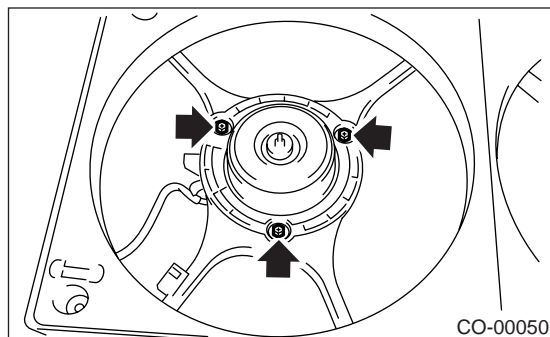


D: ASSEMBLY

Assemble in the reverse order of disassembly.

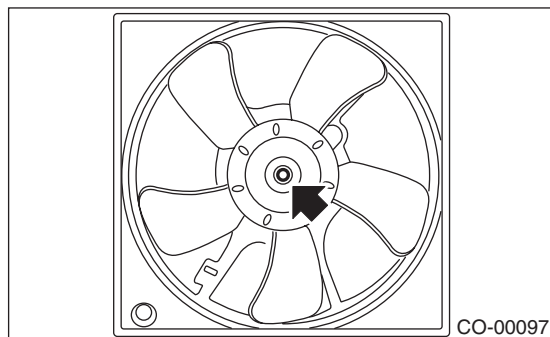
Tightening torque:

4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



Tightening torque:

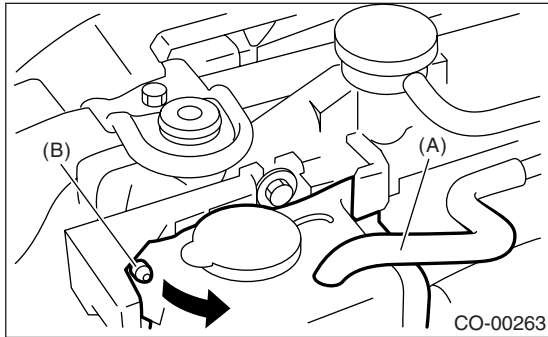
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



10. Reservoir Tank

A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the over flow hose (A).
- 3) 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

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

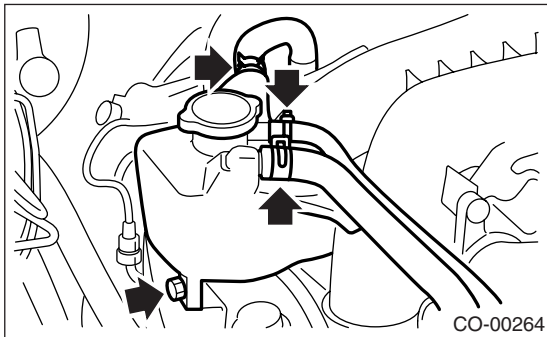
11. Coolant Filler Tank

A: REMOVAL

WARNING:

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

- 1) Remove the collector cover.
- 2) Drain the coolant about 3.0 ℓ (3.2 US qt, 2.6 Imp qt). <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 3) Disconnect the engine coolant hoses from coolant filler tank.
- 4) Remove the bolts which install the coolant filler tank.
- 5) Disconnect the engine coolant hose which connects the under side of coolant filler tank.
- 6) Remove the coolant filler tank.

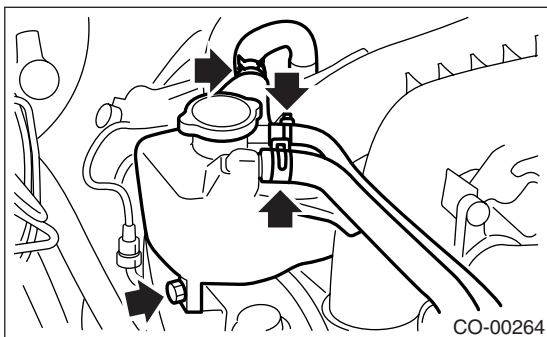


B: INSTALLATION

- 1) Install in the reverse order of removal.

Tightening torque:

16 N·m (1.6 kgf-m, 11.8 ft-lb)



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

Engine Cooling System Trouble in General

COOLING

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 drive belt	Replace.
	d. Malfunction of thermostat	Replace.
	e. Malfunction of water pump	Replace.
	f. Clogged engine coolant passage	Clean.
	g. Improper ignition timing	Inspect and repair the ignition control system. <Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean, repair or replace.
	i. Improper engine oil in engine coolant	Replace engine coolant.
	j. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	k. Excessive back pressure in exhaust system	Clean or replace.
	l. Insufficient clearance between piston and cylinder	Adjust or replace.
	m. Slipping clutch	Repair or replace.
Over-cooling	n. Dragging brake	Adjustment.
	o. Defective radiator fan	Inspect radiator fan relay, engine coolant temperature sensor or radiator motor and replace there.
Engine coolant leaks	a. Ambient temperature extremely low	Partly cover radiator front area.
	b. Defective thermostat	Replace.
	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 gasket.
	e. Damaged or cracked cylinder head and crankcase	Repair or replace.
Noise	f. Damaged or cracked thermostat case	Repair or replace.
	g. Leakage from radiator	Repair or replace.
	a. Defective drive belt	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

EXHAUST

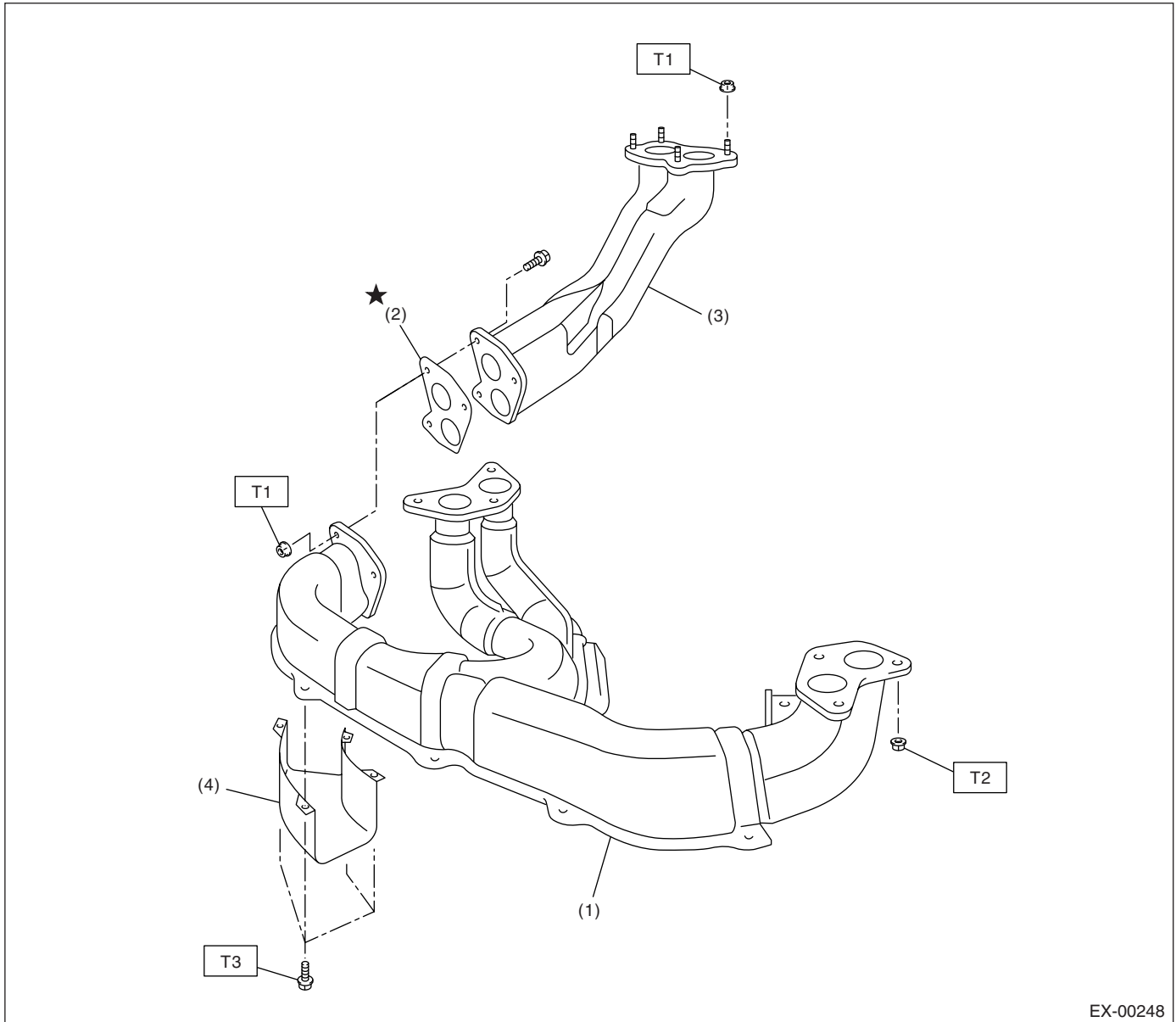
EX(H4DOTC)

	Page
1. General Description	2
2. Front Exhaust Pipe.....	5
3. Center Exhaust Pipe	6
4. Joint Pipe	10
5. Rear Exhaust Pipe	11
6. Muffler	12

1. General Description

A: COMPONENT

1. FRONT EXHAUST PIPE



EX-00248

- | | |
|-----------------------------|------------------------------|
| (1) Front exhaust pipe ASSY | (3) Turbocharger joint pipe |
| (2) Gasket | (4) Front exhaust pipe cover |

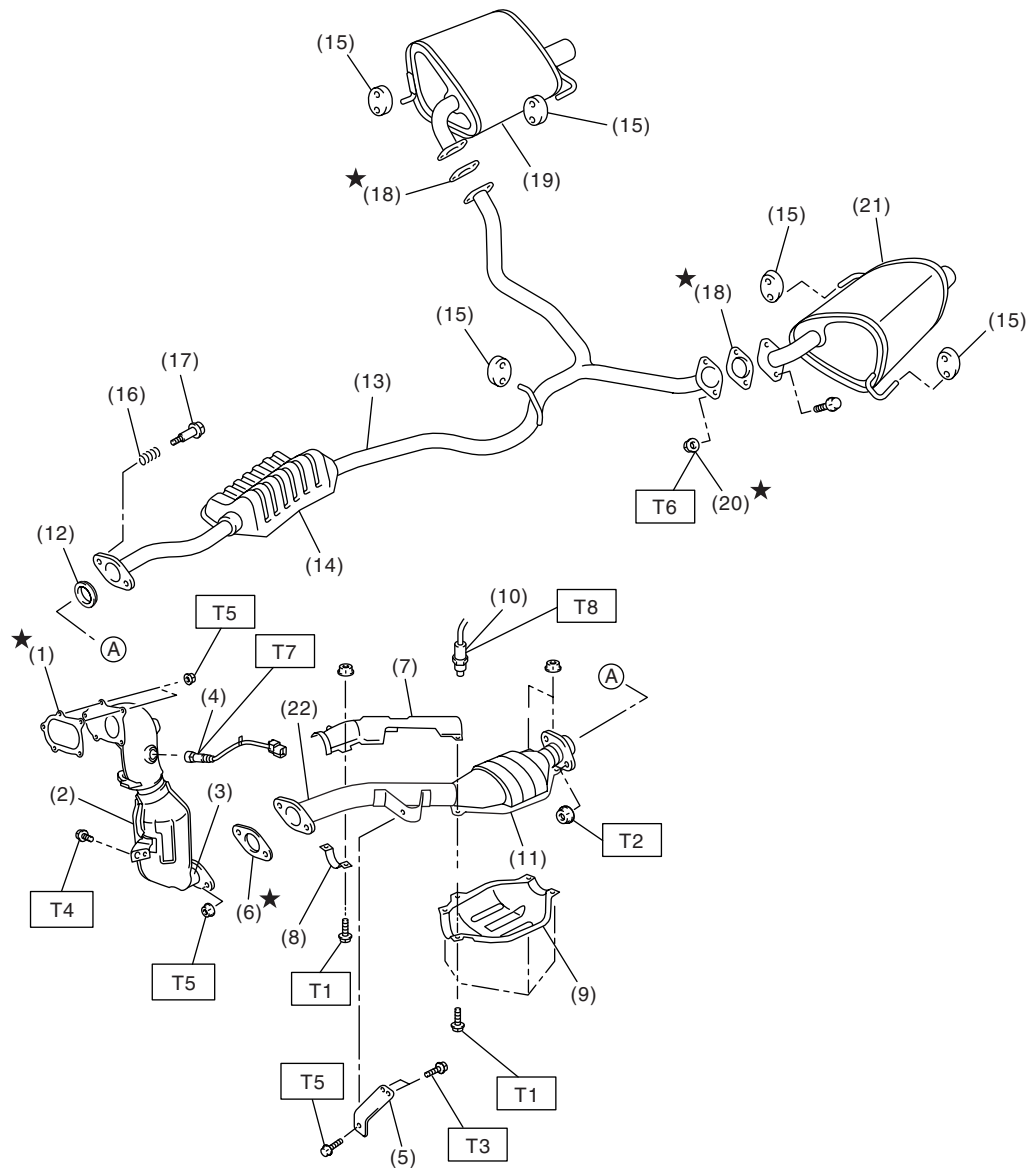
Tightening torque: N·m (kgf-m, ft-lb)

T1: 35 (3.6, 26.0)

T2: 30 (3.1, 22.1)

T3: 7.5 (0.76, 5.5)

2. CENTER AND REAR EXHAUST PIPE, AND MUFFLER



EX-02005

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

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, 26.0)

T6: 48 (4.9, 35.4)

T7: <Ref. to FU(H4DOTC)-33,
INSTALLATION, Front Oxygen
(A/F) Sensor.>

T8: <Ref. to FU(H4DOTC)-34,
INSTALLATION, Rear Oxygen
Sensor.>

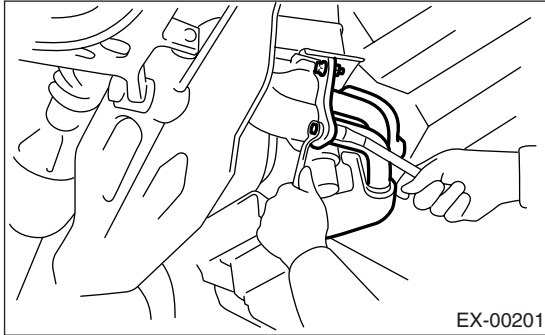
B: CAUTION

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

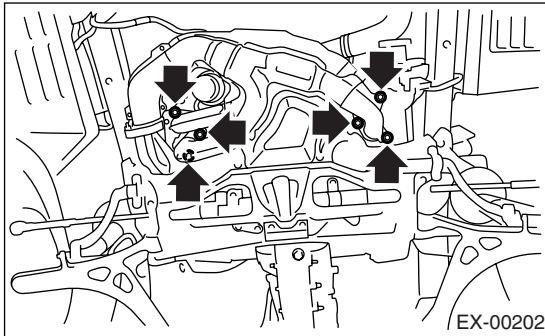
2. Front Exhaust Pipe

A: REMOVAL

- 1) Lift-up the vehicle.
- 2) Remove the under cover.
- 3) Remove the front exhaust pipe cover.
- 4) Remove the nuts which hold front exhaust pipe assembly onto turbocharger joint pipe.



- 5) While holding the front exhaust pipe assembly, remove the nuts which hold front exhaust pipe assembly to cylinder head exhaust port.



- 6) Remove the front exhaust pipe assembly.

B: INSTALLATION

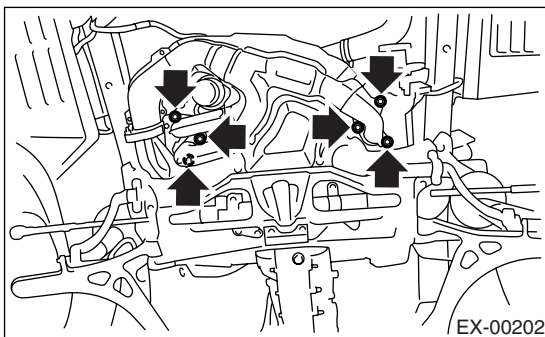
NOTE:

Use a new gasket.

- 1) Install the front exhaust pipe assembly.

Tightening torque:

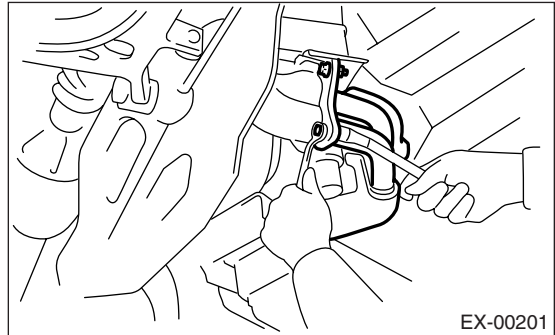
30 N·m (3.1 kgf-m, 22.1 ft-lb)



- 2) Install the front exhaust pipe assembly to turbocharger joint pipe.

Tightening torque:

35 N·m (3.6 kgf-m, 26.0 ft-lb)



- 3) Install the front exhaust pipe cover.
- 4) Install the under cover.
- 5) Lower the vehicle.

C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Check the rear exhaust pipe for holes or rust.

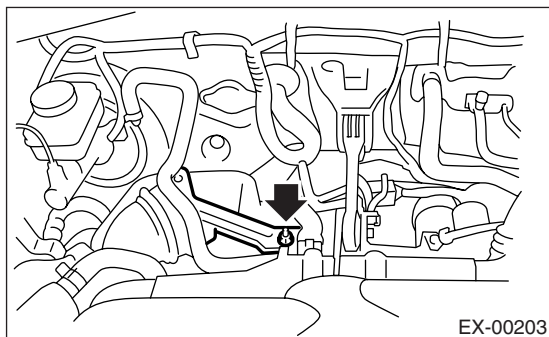
Center Exhaust Pipe

EXHAUST

3. Center Exhaust Pipe

A: REMOVAL

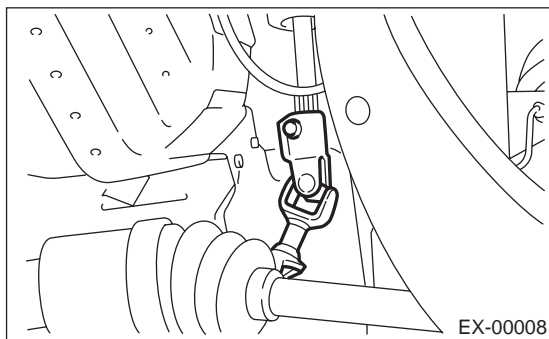
- 1) Set the vehicle on a lift.
- 2) Remove the collector cover.
- 3) Disconnect the ground cable from battery.
- 4) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 5) Remove the intercooler bracket.



- 6) Lift-up the vehicle.
- 7) Remove the under cover.
- 8) Remove the universal joint bolts and then remove the universal joint.

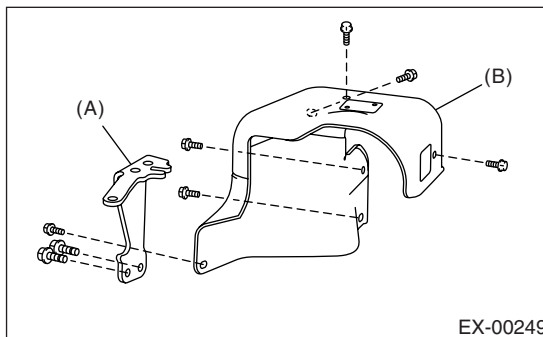
CAUTION:

Scribe alignment marks on the universal joint so that it can be reassembled at the original serration.



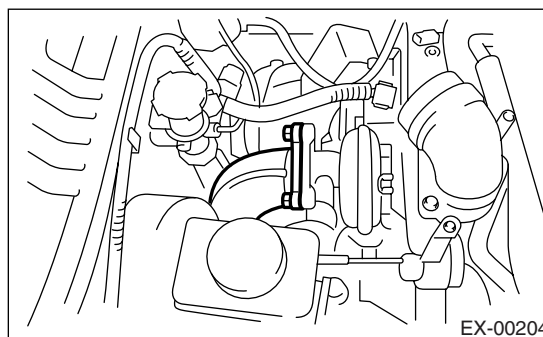
- 9) Lower the vehicle.
- 10) Remove the linear motion mounting. <Ref. to ME(H4DOTC)-37, REMOVAL, Linear Motion Mounting.>
- 11) Remove the linear motion mounting bracket.

- 12) Remove the turbocharger cover.

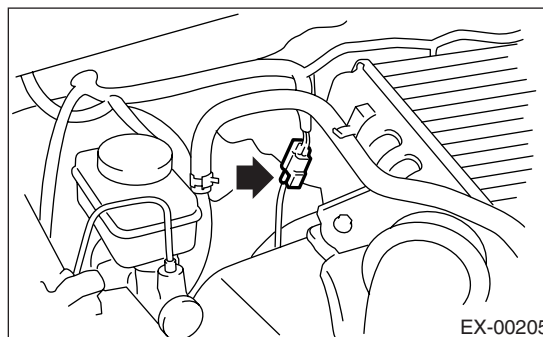


- (A) Linear motion mounting bracket
(B) Turbocharger cover

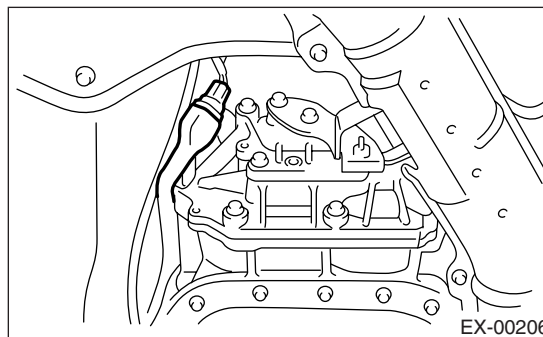
- 13) Separate the center exhaust pipe from turbocharger.



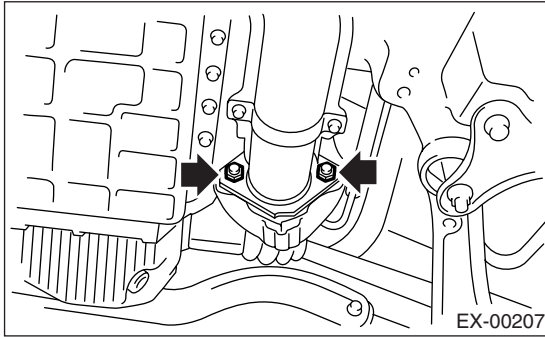
- 14) Disconnect the connector from front oxygen (A/F) sensor.



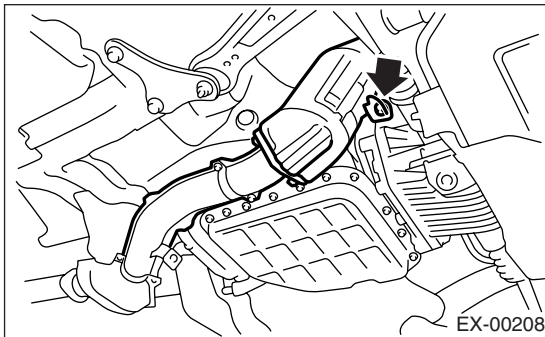
- 15) Lift-up the vehicle.
- 16) Disconnect the connector from rear oxygen sensor.



- 17) Separate the center exhaust pipe from rear exhaust pipe.

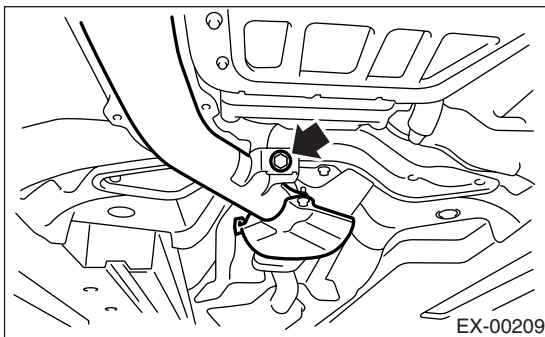


- 18) Remove the bolt which holds center exhaust pipe bracket to transmission.



- 19) Remove the intercooler bracket.
20) Remove the bolt which holds center exhaust pipe to hanger bracket.

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



- 21) Remove the center exhaust pipe.

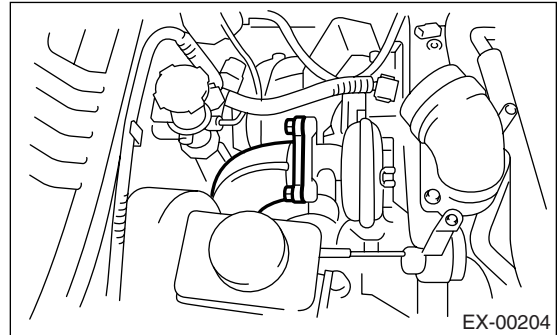
B: INSTALLATION

NOTE:
Use a new gasket.

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

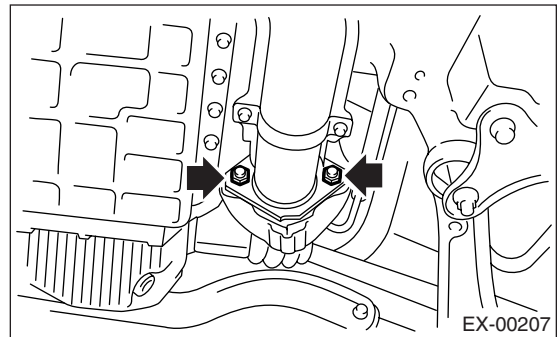
- 3) Connect the center exhaust pipe to turbocharger.

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

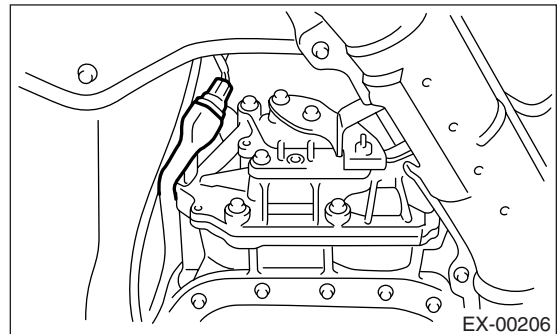


- 4) Install the center exhaust pipe to rear exhaust pipe.

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



- 5) Connect the connector to rear oxygen sensor.



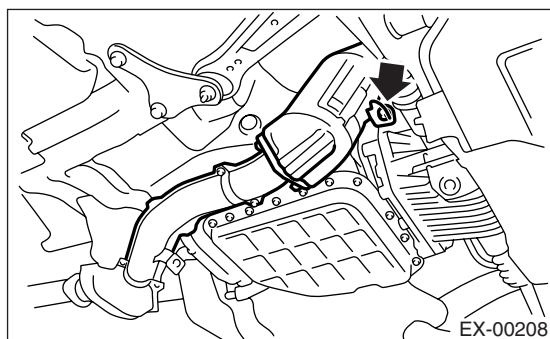
Center Exhaust Pipe

EXHAUST

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

Tightening torque:

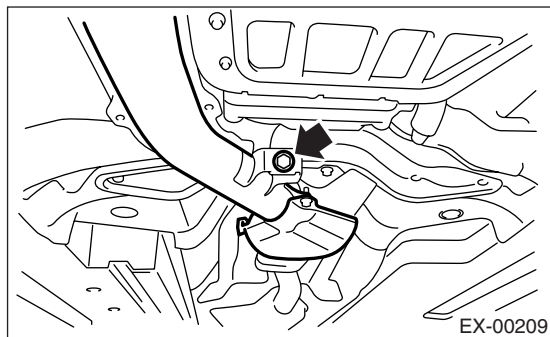
30 N·m (3.1 kgf-m, 22.1 ft-lb)



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

Tightening torque:

35 N·m (3.6 kgf-m, 26.0 ft-lb)



8) Lower the vehicle.

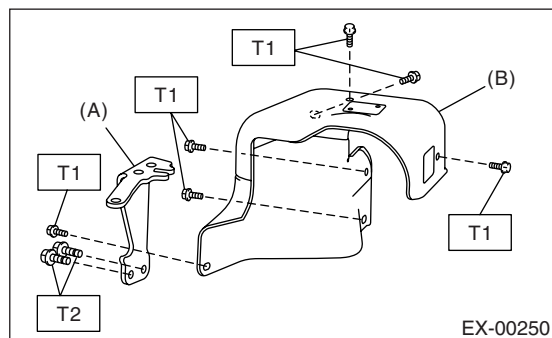
9) Install the turbocharger cover.

10) Install the linear motion mounting bracket.

Tightening torque:

T1: 7.4 N·m (0.75 kgf-m, 5.4 ft-lb)

T2: 40 N·m (4.1 kgf-m, 29.5 ft-lb)

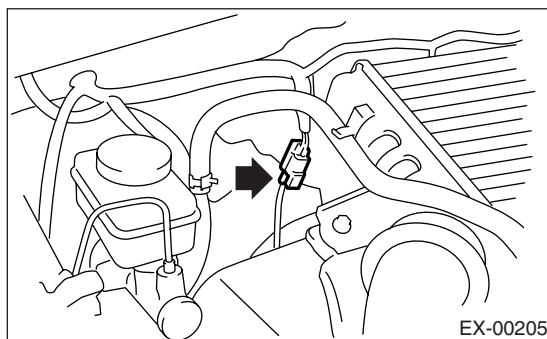


(A) Linear motion mounting bracket

(B) Turbocharger cover

11) Install the linear motion mounting. <Ref. to ME(H4DOTC)-37, INSTALLATION, Linear Motion Mounting.>

12) Connect the connector of front oxygen (A/F) sensor.



13) Lift-up the vehicle.

14) Install the universal joint.

(1) Align the bolt hole on the long yoke side of universal joint with the cutout at the serrated section of shaft end, and then insert the universal joint.

(2) Align the bolt hole on the short yoke side of universal joint with the cutout at the serrated section of gearbox assembly. Lower the universal joint completely.

(3) Temporarily tighten the bolt of short yoke side. Raise the universal joint to make sure the bolt is properly passing through the cutout at the serrated section.

(4) Tighten the long yoke side bolt, and also tighten the short yoke side bolt.

Tightening torque:

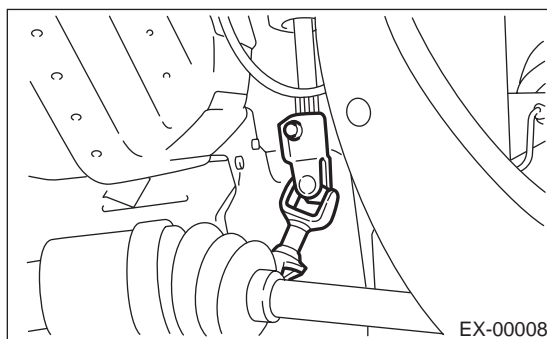
24 N·m (2.4 kgf-m, 17.4 ft-lb)

CAUTION:

- Make sure the universal joint bolts are tightened through the shaft serration notches.
- Excessively large tightening torque of universal joint bolts may lead to heavy steering wheel operation.

Standard clearance between gearbox and DOJ:

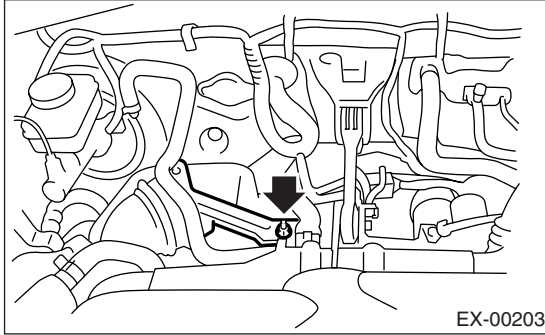
15 mm (0.59 in) or more



15) Install the under cover.

16) Lower the vehicle.

17) Install the intercooler bracket.



18) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

19) Install the collector cover.

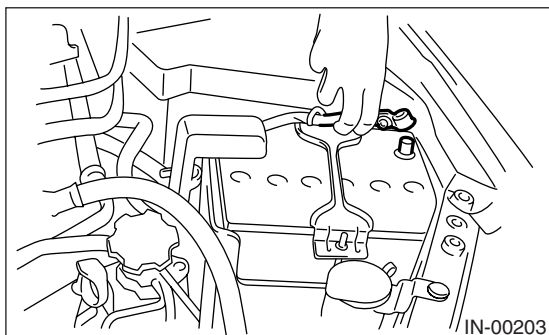
C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Check the rear exhaust pipe for holes or rust.

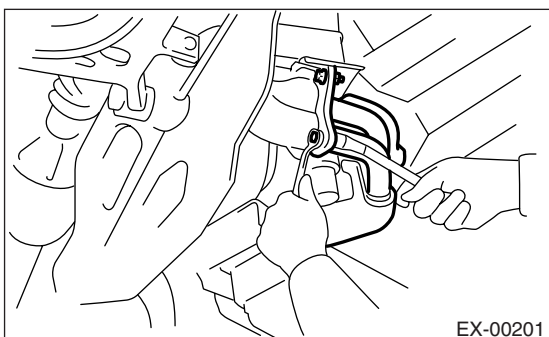
4. Joint Pipe

A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Lift-up the vehicle.
- 4) Remove the under cover.
- 5) Remove the front exhaust pipe cover.
- 6) Remove the nuts which hold front exhaust manifold to turbocharger joint pipe.



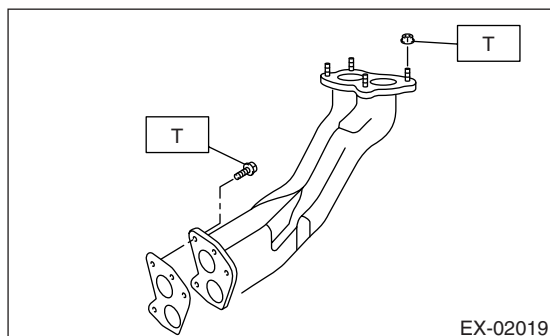
- 7) Remove the center exhaust pipe.
<Ref. to EX(H4DOTC)-6, REMOVAL, Center Exhaust Pipe.>
- 8) Remove the turbocharger. <Ref. to IN(H4DOTC)-14, REMOVAL, Turbocharger.>
- 9) Remove the joint pipe from the lower side of vehicle.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

T: 35 N·m (3.6 kgf-m, 26.0 ft-lb)



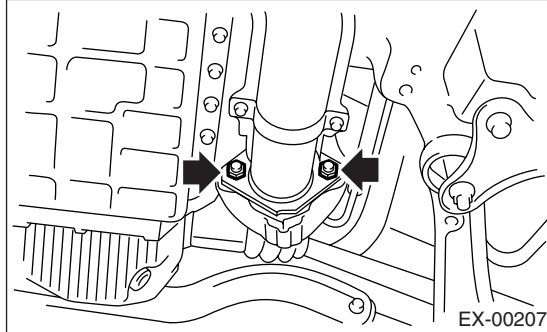
C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Check the rear exhaust pipe for holes or rust.

5. Rear Exhaust Pipe

A: REMOVAL

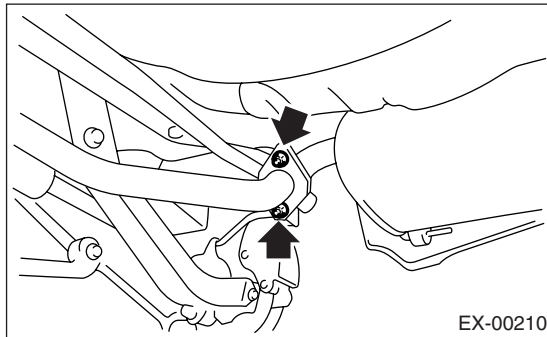
- 1) Lift-up the vehicle.
- 2) Separate the rear exhaust pipe from center exhaust pipe.



- 3) Separate the rear exhaust pipe from both mufflers.

CAUTION:

Be careful not to pull down the rear exhaust pipe.



- 4) Remove the rear exhaust pipe.

B: INSTALLATION

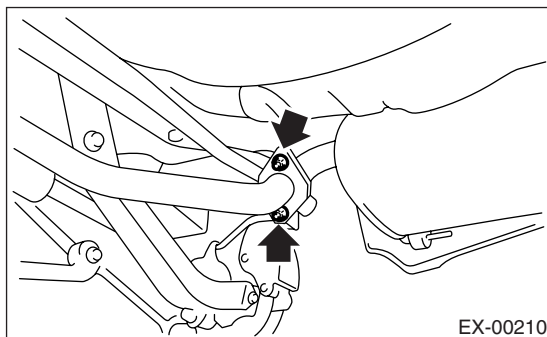
NOTE:

Use a new gasket.

- 1) Install the rear exhaust pipe to both mufflers.

Tightening torque:

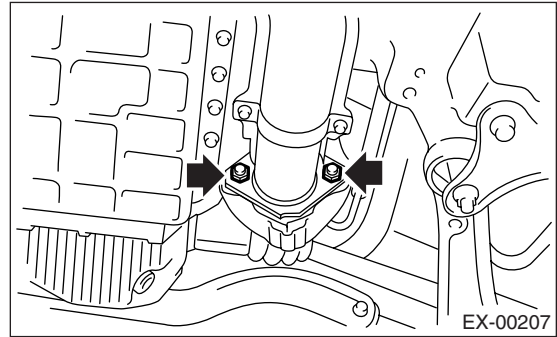
48 N·m (4.9 kgf-m, 35.4 ft-lb)



- 2) Install the rear exhaust pipe to center exhaust pipe.

Tightening torque:

35 N·m (3.6 kgf-m, 26.0 ft-lb)



- 3) Lower the vehicle.

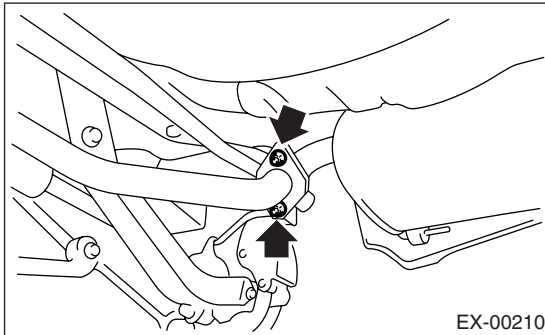
C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Check the rear exhaust pipe for holes or rust.
- 3) Check the cushion rubber for wear or crack.

6. Muffler

A: REMOVAL

- 1) Separate the muffler (RH) from rear exhaust pipe.



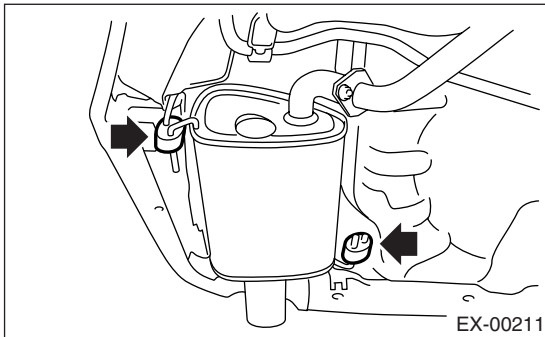
- 2) Remove the cushion rubbers, and detach the muffler.

CAUTION:

Be careful not to drop the muffler during removal.

NOTE:

To facilitate removal, apply a coat of spray type lubricant to the mating area of cushion rubbers in advance.



- 3) Perform the same procedure for muffler (LH).

B: INSTALLATION

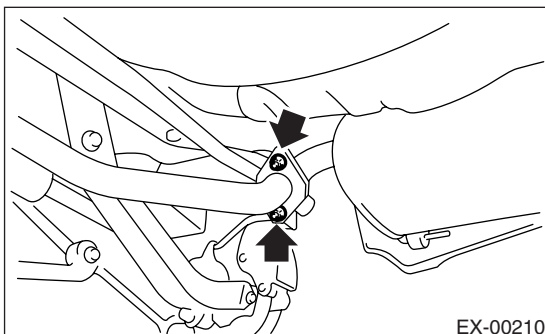
Install in the reverse order of removal.

NOTE:

Always use a new gasket and self-locking nuts.

Tightening torque:

48 N·m (4.9 kgf-m, 35.4 ft-lb)



C: INSPECTION

- 1) Check the connections and welds for exhaust leaks.
- 2) Check the mufflers for holes or rust.
- 3) Check the cushion rubber for wear or crack.

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

MECHANICAL

ME(H4DOTC)

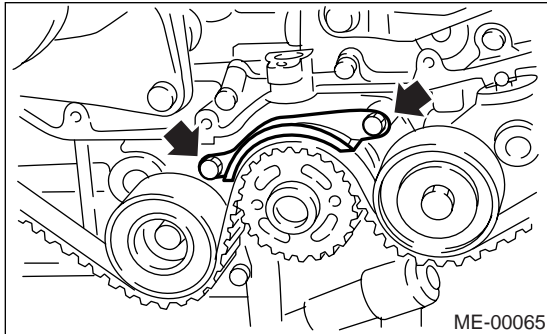
	Page
1. General Description	2
2. Compression	21
3. Idle Speed	22
4. Ignition Timing	23
5. Intake Manifold Vacuum.....	24
6. Engine Oil Pressure	25
7. Fuel Pressure	26
8. Valve Clearance	27
9. Engine Assembly	30
10. Engine Mounting	36
11. Linear Motion Mounting.....	37
12. Preparation for Overhaul.....	38
13. V-belt	39
14. Crank Pulley	41
15. Timing Belt Cover.....	42
16. Timing Belt	43
17. Cam Sprocket	51
18. Crank Sprocket	52
19. Camshaft.....	53
20. Cylinder Head	59
21. Cylinder Block	66
22. Intake and Exhaust Valve	86
23. Piston	87
24. Connecting Rod	88
25. Crankshaft.....	89
26. Engine Trouble in General	90
27. Engine Noise	96

16. Timing Belt

A: REMOVAL

1. TIMING BELT

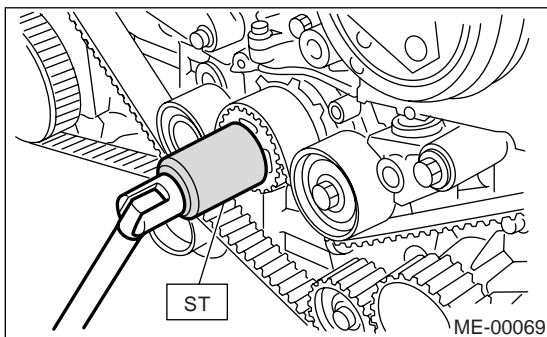
- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-41, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt guide.



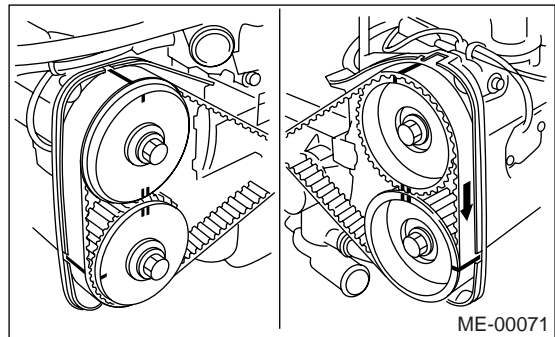
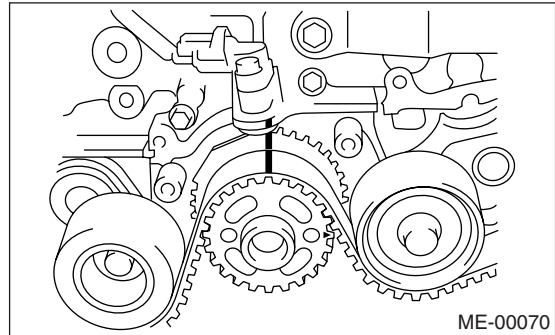
- 5) If the alignment mark or arrow mark (which indicates rotation direction) on timing belt fade away, put new marks before removing the timing belt as shown in procedures below.

- (1) Turn the crankshaft using ST, 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 notches of timing belt cover and cylinder block.

ST 499987500 CRANKSHAFT SOCKET



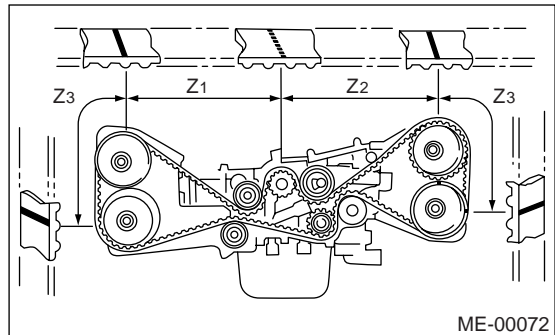
- (2) Using white paint, put alignment and/or arrow marks on the timing belts in relation to the cam sprockets.



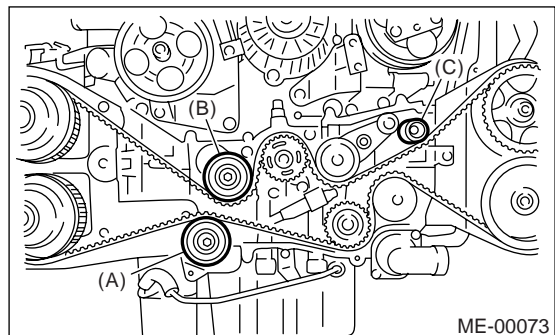
Z₁: 54.5 tooth length

Z₂: 51 tooth length

Z₃: 28 tooth length



- 6) Remove the belt idler (A).



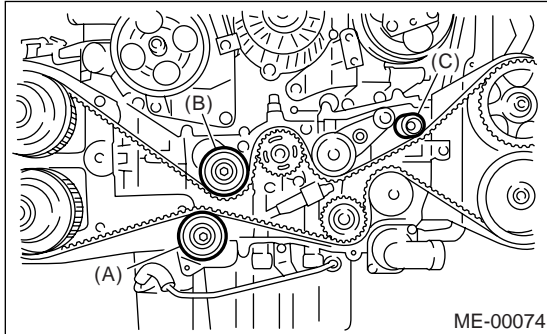
7) Remove the timing belt.

CAUTION:

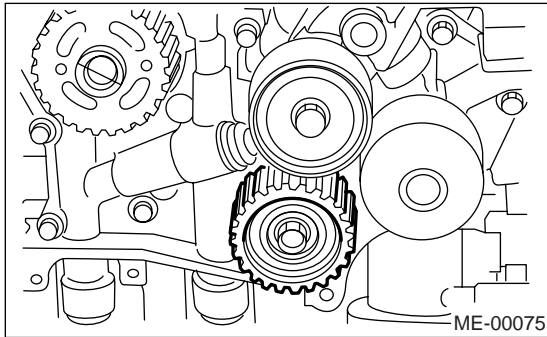
After the timing belt has been removed, never rotate the intake and exhaust cam sprocket. If the cam sprocket is rotated, the intake and exhaust valve heads strike together and valve stems are bent.

2. BELT IDLER AND AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY

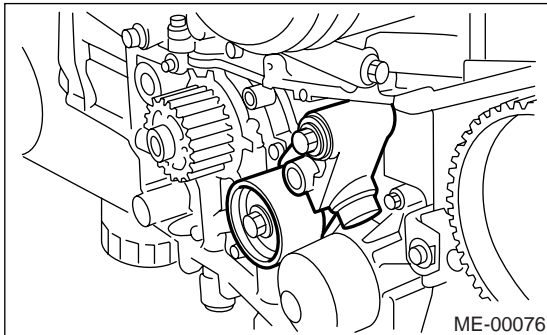
1) Remove the belt idler (B) and (C).



2) Remove the belt idler No. 2.



3) Remove the automatic belt tension adjuster assembly.



B: INSTALLATION

1. AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER

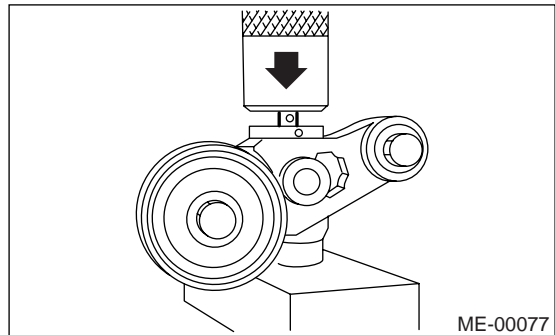
1) Preparation for installation of automatic belt tension adjuster assembly.

CAUTION:

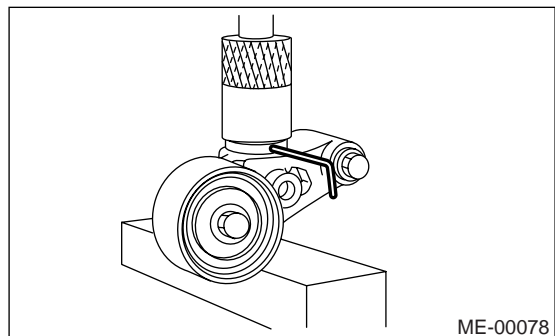
- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Be sure to move the adjuster rod down slowly applying a pressure of 294 N (30 kgf, 66 lb).
- Press-in the push adjuster rod gradually taking more than three minutes.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
- Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into cylinder. Doing so may damage the cylinder.
- Do not release the press pressure until stopper pin is completely inserted.

(1) Attach the automatic belt tension adjuster assembly to the vertical pressing tool.

(2) Slowly move the adjuster rod down with a pressure of 294 N (30 kgf, 66 lb) until the adjuster rod is aligned with the stopper pin hole in the cylinder.



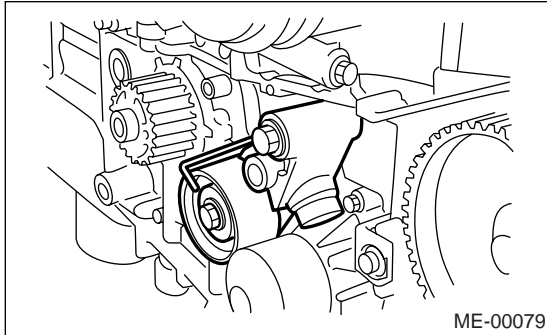
(3) With a 2 mm (0.08 in) dia. stopper pin or a 2 mm (0.08 in) (nominal) dia. hex wrench inserted into the stopper pin hole in cylinder, secure the adjuster rod.



2) Install the automatic belt tension adjuster assembly.

Tightening torque:

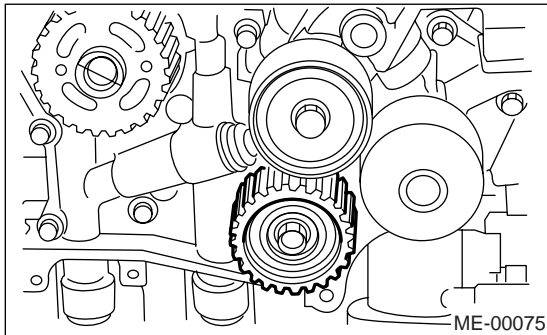
39 N·m (4.0 kgf-m, 28.9 ft-lb)



3) Install the belt idler No. 2.

Tightening torque:

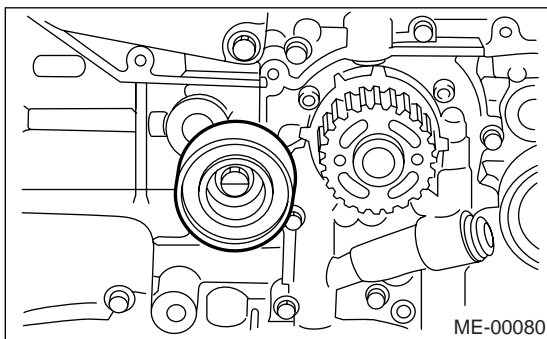
39 N·m (4.0 kgf-m, 28.9 ft-lb)



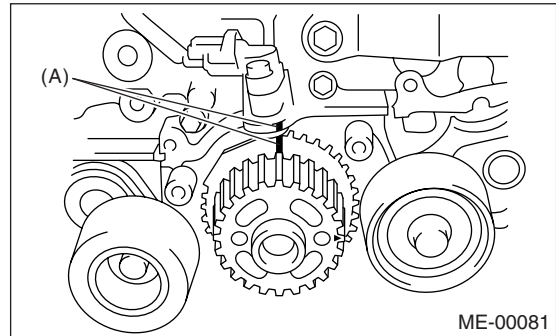
4) Install the belt idlers.

Tightening torque:

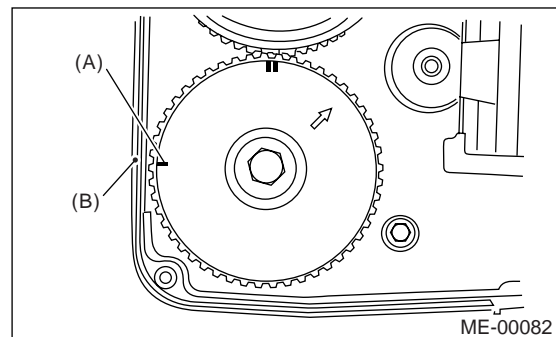
39 N·m (4.0 kgf-m, 28.9 ft-lb)



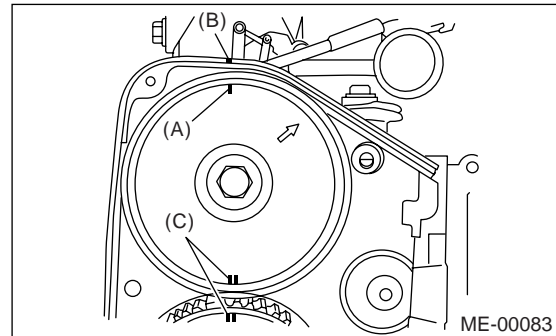
(1) Align the mark (A) on crank sprocket with the mark on oil pump cover at cylinder block.



(2) Align single line mark (A) on the exhaust cam sprocket (RH) with notch (B) on timing belt cover.



(3) Align single line mark (A) on the intake cam sprocket (RH) with notch (B) on timing belt cover. (Ensure double lines (C) on intake and exhaust cam sprockets are aligned.)



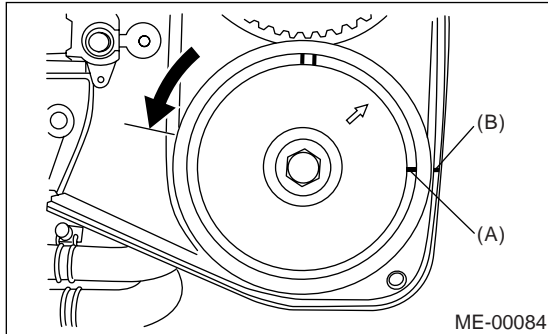
2. TIMING BELT

1) Preparation for installation of automatic belt tension adjuster assembly. <Ref. to ME(H4DOTC)-44, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt.>

2) Crankshaft and cam sprocket alignment

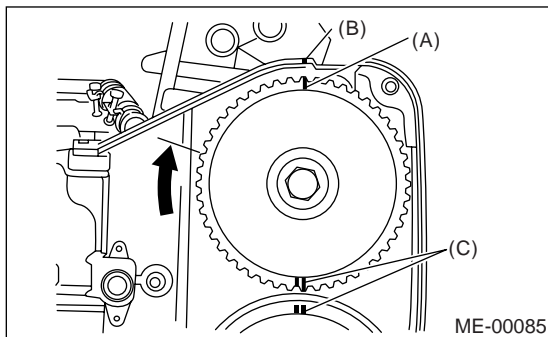
Timing Belt

(4) Align single line mark (A) on exhaust cam sprocket (LH) with notch (B) on timing belt cover by turning the sprocket counterclockwise (as viewed from front of engine).



(5) Align single line mark (A) on intake cam sprocket (LH) with notch (B) on timing belt cover by turning the sprocket clockwise (as viewed from front of engine).

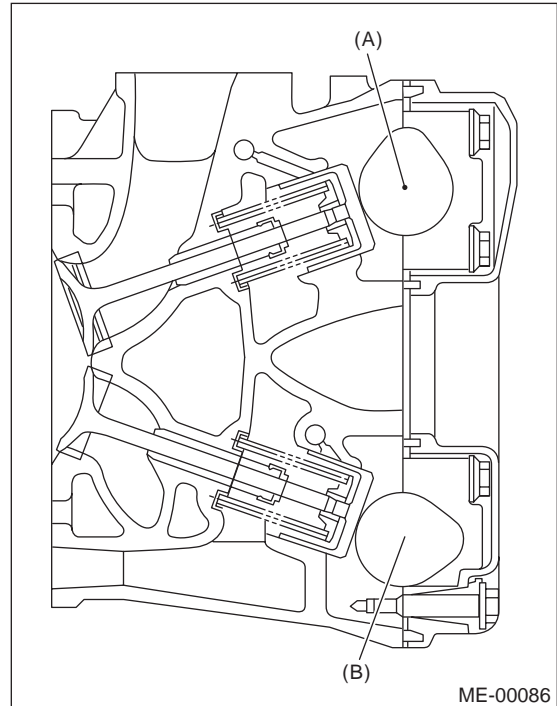
Ensure double lines (C) on intake and exhaust cam sprockets are aligned.



(6) Ensure 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, their heads will interfere with each other, resulting in bent valves.



(A) Intake camshaft

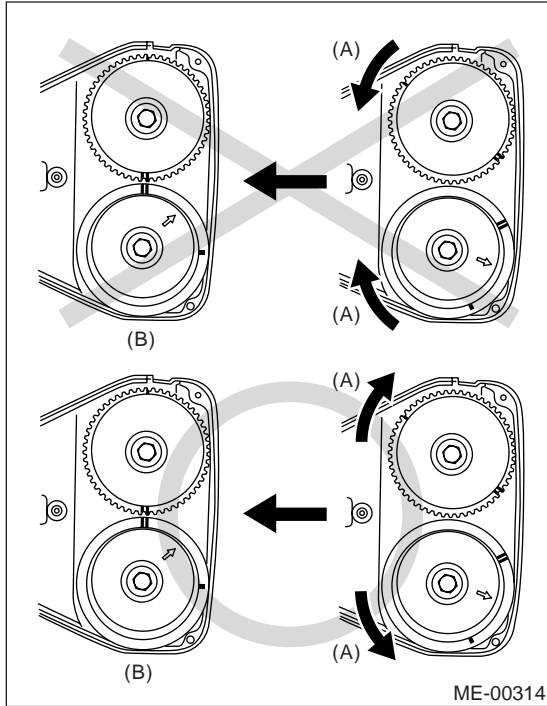
(B) Exhaust camshaft

- When the timing belts are not installed, four camshafts are held at the “zero-lift” position, where all cams on camshafts do not push the intake and exhaust valves down. (Under this condition, all valves remain unlifted.)

- When the camshafts are rotated to install the timing belts, #2 intake and #4 exhaust cam of camshafts (LH) are held to push their corresponding valves down. (Under this condition, these valves are held lifted.) Camshafts (RH) are held so that their cams do not push valves down.

- Camshafts (LH) must be rotated from the “zero-lift” position to the position where the timing belt is to be installed 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 figure as this causes both intake and exhaust valves to lift simultaneously, resulting in interference with their heads.



- (A) Revolving direction
(B) Timing belt installation position

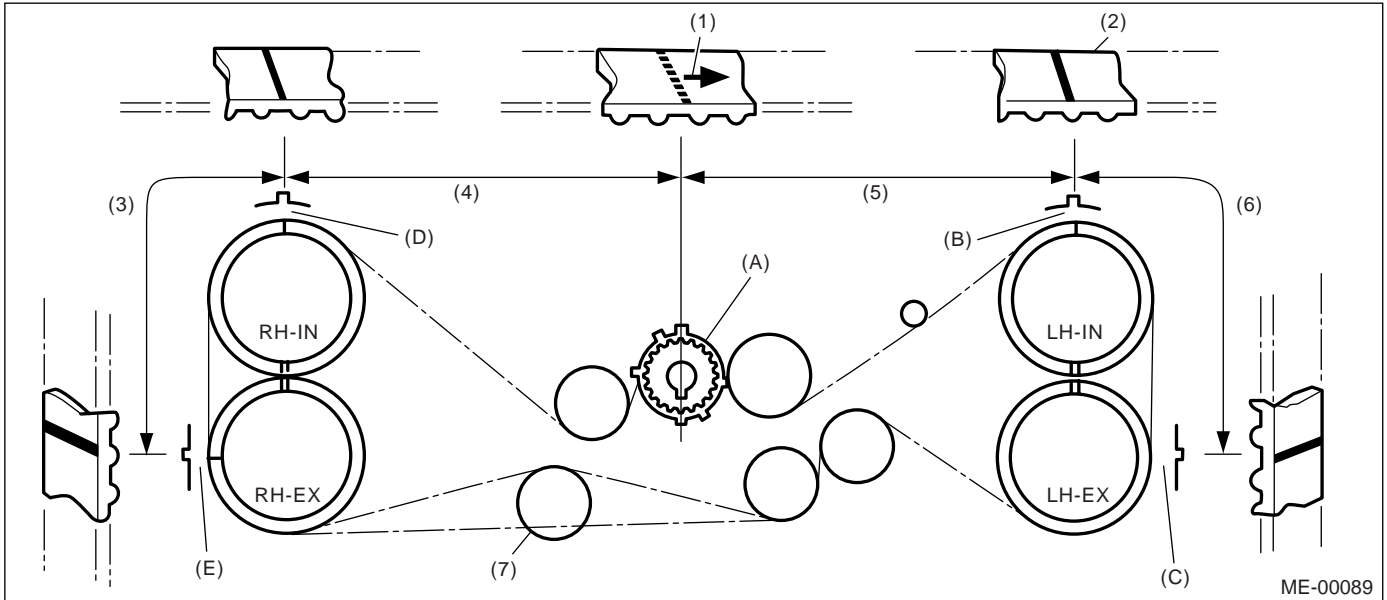
MECHANICAL

3) Installation of timing belt:

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.

CAUTION:

- Disengagement of more than one timing belt tooth may result in interference between valve and piston.
- Ensure the belt's rotating direction is correct.



- | | | |
|---------------------|-----------------------|---------------------------|
| (1) Arrow mark | (4) 54.5 tooth length | (7) Install it in the end |
| (2) Timing belt | (5) 51 tooth length | |
| (3) 28 tooth length | (6) 28 tooth length | |

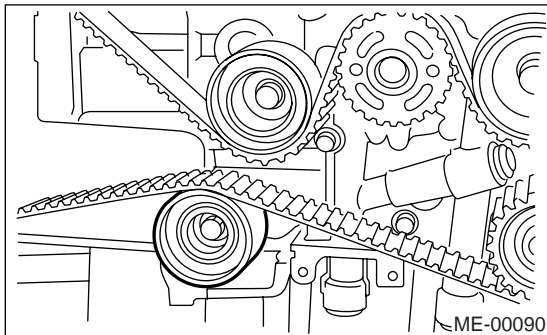
4) Install the belt idlers.

Tightening torque:

39 N·m (4.0 kgf-m, 28.9 ft-lb)

NOTE:

Make sure that the marks on the timing belt and sprockets are aligned.



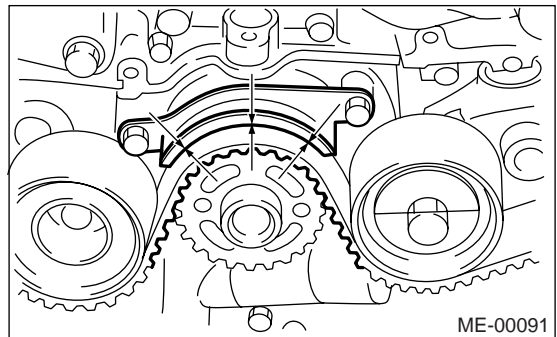
5) After ensuring that the marks on the timing belt and sprockets are aligned, remove the stopper pin from tensioner adjuster.

6) Install the timing belt guide.

- (1) Temporarily tighten the bolts.
- (2) Check and adjust the clearance between timing belt and timing belt guide.

Clearance:

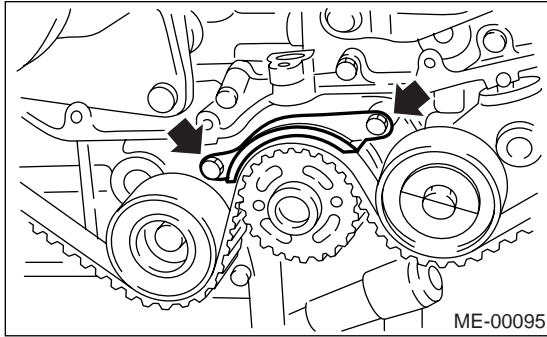
1.0±0.5 mm (0.039±0.020 in)



- (3) Tighten the bolt.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)



7) Install the timing belt cover.

<Ref. to ME(H4DOTC)-42, INSTALLATION, Timing Belt Cover.>

8) Install the crank pulley.

<Ref. to ME(H4DOTC)-41, INSTALLATION, Crank Pulley.>

9) Install the V-belts. <Ref. to ME(H4DOTC)-39, INSTALLATION, V-belt.>

C: INSPECTION

1. TIMING BELT

1) Check the timing belt teeth for breaks, cracks and wear. If any fault is found, replace the timing belt.

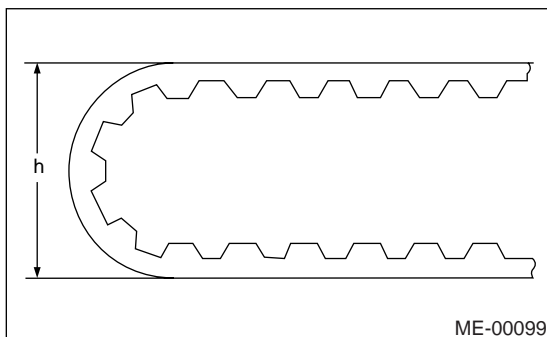
2) Check the condition of the backside of timing belt. If cracks are found, replace the timing belt.

CAUTION:

- Be careful not to let oil, grease or engine coolant contact the 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 ADJUST-ER

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 trace of oil at rod's oil seal does not indicate a problem.

2) Check that the adjuster rod does not move when a pressure of 294 N (30 kgf, 66 lb) is applied to it. This is to check adjuster rod stiffness.

3) If the adjuster rod is not stiff and moves freely when applying 294 N (30 kgf, 66 lb), check it using the following procedures:

(1) Slowly press the adjuster rod down to the end surface of the cylinder. Repeat this operation two to three times.

(2) With the adjuster rod moved all the way up, apply a pressure of 294 N (30 kgf, 66 lb) to it. Check the adjuster rod stiffness.

(3) If the adjuster rod is not stiff and moves down, replace the automatic belt tension adjuster assembly with a new one.

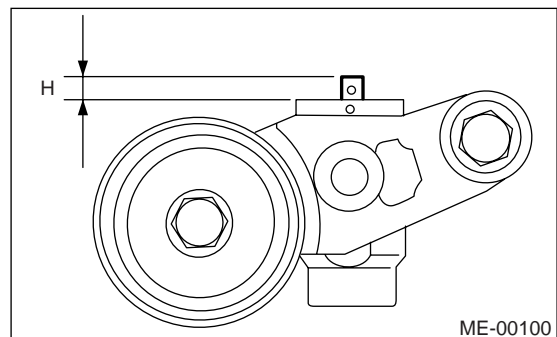
CAUTION:

- Always use a vertical type pressing tool to move the adjuster rod down.
- Do not use a lateral type vise.
- Push the adjuster rod vertically.
- Press-in the push adjuster rod gradually taking more than three minutes.
- Do not allow press pressure to exceed 9,807 N (1,000 kgf, 2,205 lb).
- Press the adjuster rod as far as the end surface of the cylinder. Do not press the adjuster rod into cylinder. Doing so may damage the cylinder.

4) Measure the amount of rod protrusion beyond the body. If it is not within specifications, replace with a new one.

Amount of rod protrusion H:

5.7±0.5 mm (0.224±0.020 in)



3. BELT TENSION PULLEY

1) Check the mating surfaces of timing belt and contact point of adjuster rod for abnormal wear or scratches. Replace the belt tension pulley if faulty.

2) Check the belt tension pulley for smooth rotation. Replace if noise or excessive play occurs.

3) Check the belt tension pulley for grease leakage.

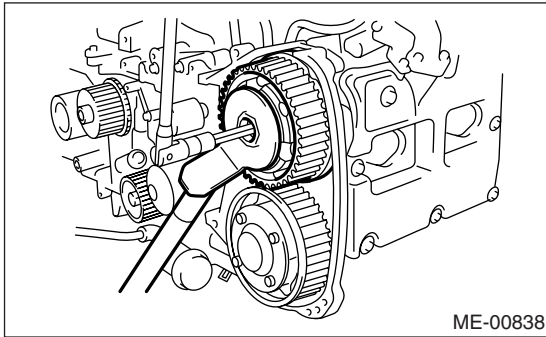
4. BELT IDLER

- 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.

17. Cam Sprocket

A: REMOVAL

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
 - 2) Remove the crank pulley.
<Ref. to ME(H4DOTC)-41, REMOVAL, Crank Pulley.>
 - 3) Remove the timing belt cover.
<Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt Cover.>
 - 4) Remove the timing belt.
<Ref. to ME(H4DOTC)-43, REMOVAL, Timing Belt.>
 - 5) Remove the cam sprocket. To lock the camshaft, use ST.
- ST 499977500 CAM SPROCKET WRENCH

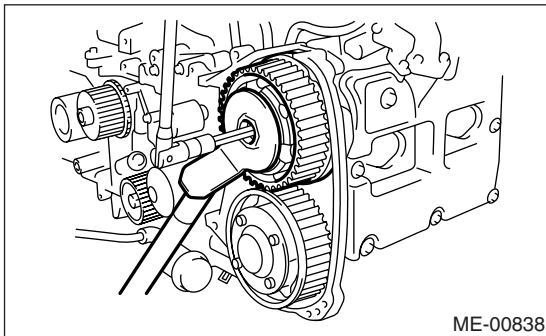


B: INSTALLATION

- 1) Install the cam sprocket. To lock the camshaft, use ST.

Tightening torque:

Tighten to 29.5 N·m (3.0 kgf-m, 21.8 ft-lb) of torque, and then tighten further by 45°



- 2) Install the timing belt. <Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>
- 3) Install the timing belt cover.
<Ref. to ME(H4DOTC)-42, INSTALLATION, Timing Belt Cover.>
- 4) Install the crank pulley.
<Ref. to ME(H4DOTC)-41, INSTALLATION, Crank Pulley.>
- 5) Install the V-belts. <Ref. to ME(H4DOTC)-39, INSTALLATION, V-belt.>

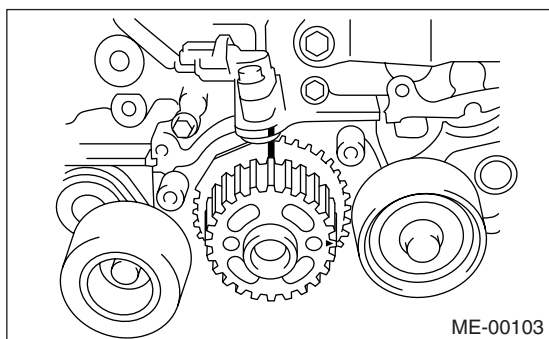
C: INSPECTION

- 1) Check the cam sprocket teeth for abnormal wear and scratches.
- 2) Make sure there is no free play between cam sprocket and key.
- 3) Check the cam sprocket protrusion used for sensor for damage and contamination of foreign matter.

18.Crank Sprocket

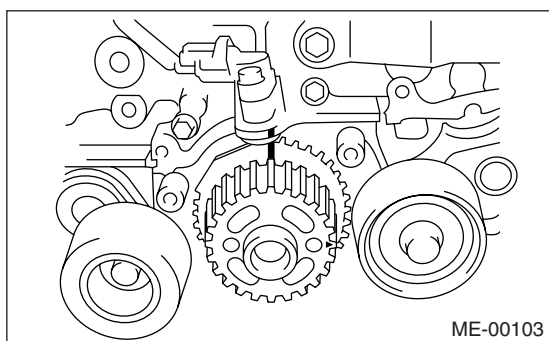
A: REMOVAL

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
- 2) Remove the crank pulley.
<Ref. to ME(H4DOTC)-41, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover.
<Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt.
<Ref. to ME(H4DOTC)-43, REMOVAL, Timing Belt.>
- 5) Remove the cam sprocket.
<Ref. to ME(H4DOTC)-51, REMOVAL, Cam Sprocket.>
- 6) Remove the crank sprocket.



B: INSTALLATION

- 1) Install the crank sprocket.



- 2) Install the cam sprocket.
<Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>
- 3) Install the timing belt.
<Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>
- 4) Install the timing belt cover.
<Ref. to ME(H4DOTC)-42, INSTALLATION, Timing Belt Cover.>
- 5) Install the crank pulley. <Ref. to ME(H4DOTC)-41, INSTALLATION, Crank Pulley.>
- 6) Install the V-belts. <Ref. to ME(H4DOTC)-39, INSTALLATION, V-belt.>

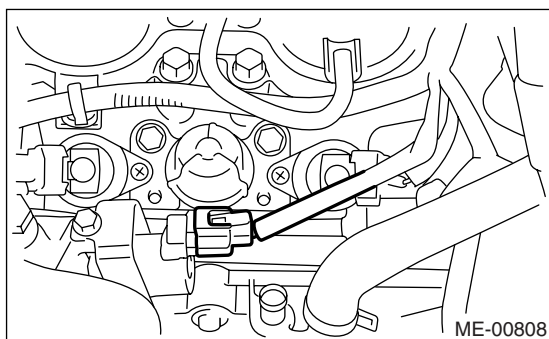
C: INSPECTION

- 1) Check the crank sprocket teeth for abnormal wear and scratches.
- 2) Make sure there is no free play between crank sprocket and key.
- 3) Check the crank sprocket protrusion used for sensor for damage and contamination of foreign matter.

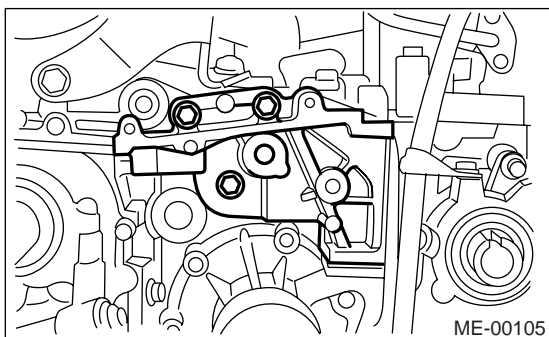
19. Camshaft

A: REMOVAL

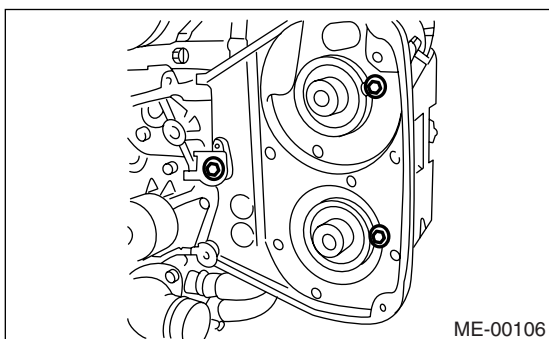
- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-41, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover. <Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt. <Ref. to ME(H4DOTC)-43, REMOVAL, Timing Belt.>
- 5) Remove the cam sprocket. <Ref. to ME(H4DOTC)-51, REMOVAL, Cam Sprocket.>
- 6) Remove the crank sprocket. <Ref. to ME(H4DOTC)-52, REMOVAL, Crank Sprocket.>
- 7) Disconnect the oil flow control solenoid valve assembly connector.



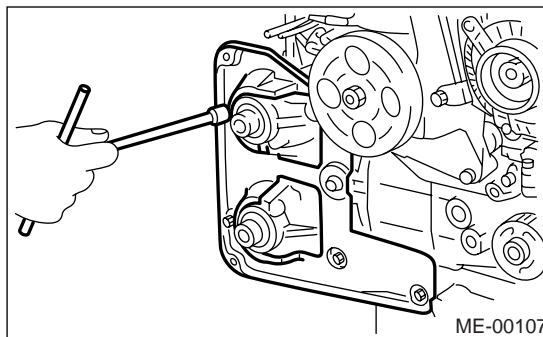
- 8) Remove the tensioner bracket.



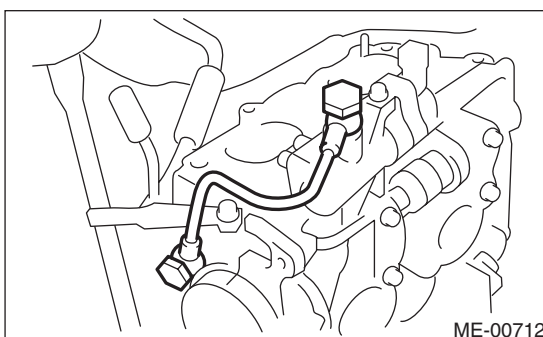
- 9) Remove the timing belt cover No. 2 (RH).



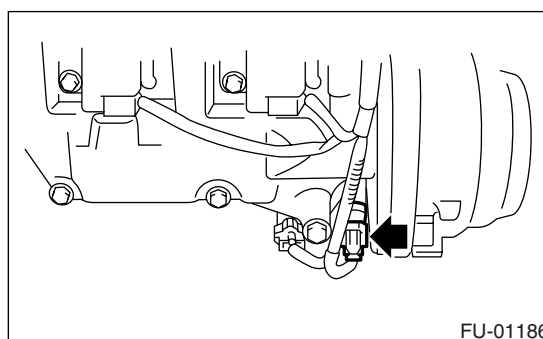
- 10) Remove the timing belt cover No. 2 (RH).



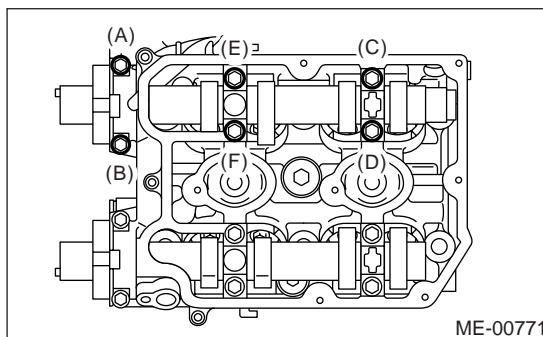
- 11) Remove the spark plug cords.
- 12) Remove the oil level gauge guide. (LH side)
- 13) Remove the rocker cover and gasket.
- 14) Remove the oil pipe.



- 15) Remove the camshaft position sensor on exhaust side.



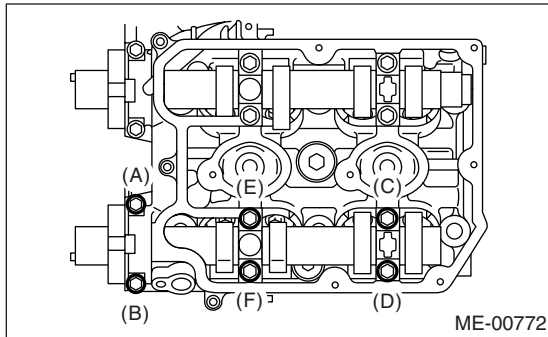
- 16) Loosen the oil flow control solenoid valve assembly and intake camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



Camshaft

MECHANICAL

17) Loosen the exhaust camshaft cap bolts equally, a little at a time in alphabetical sequence shown in the figure.



18) Remove the oil flow control solenoid valve assembly, intake camshaft cap and camshaft.

19) Remove the exhaust camshaft caps and camshaft.

NOTE:

Arrange camshaft caps in order so that they can be installed in their original positions.

20) Similarly, remove the camshafts (RH) and related parts.

B: INSTALLATION

1) Camshaft installation:

Apply engine oil to the cylinder head at camshaft bearing location before installing the camshaft. Install the camshaft so that each valve is close to or in contact with "base circle" of cam lobe.

NOTE:

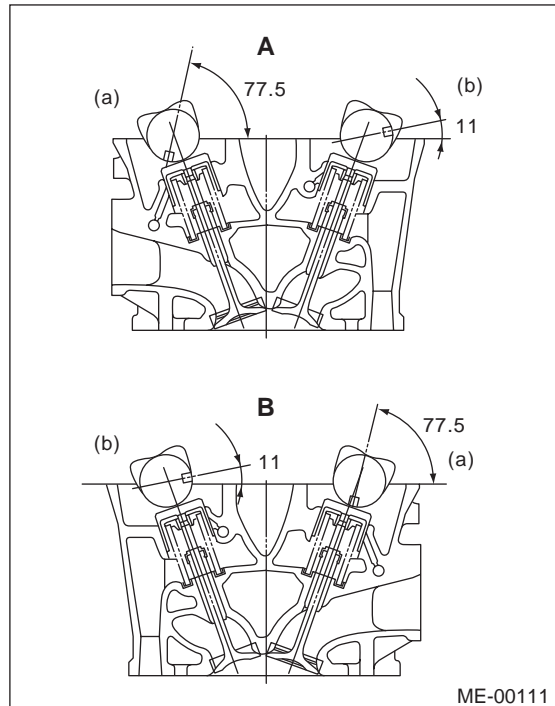
- When the camshafts are positioned as shown in the figure, camshafts need to be rotated at a minimum to align with the timing belt during installation.
- Camshaft (RH) need not be rotated when set at the position shown in the figure.

Intake camshaft (LH):

Rotate 80° clockwise.

Exhaust camshaft (LH):

Rotate 45° counterclockwise.



A Cylinder head (LH)

B Cylinder head (RH)

(a) Intake camshaft

(b) Exhaust camshaft

2) Camshaft cap and oil flow control solenoid valve assembly installation:

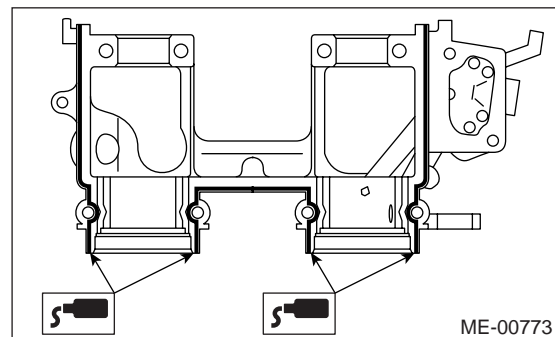
(1) Apply small amount of liquid gasket to the cap mating surface.

NOTE:

Do not apply liquid gasket excessively. Otherwise, the excessive liquid gasket may come out and flow toward oil seal, resulting in oil leaks.

Liquid gasket:

THREE BOND 1215 (Part No. 004403007) or equivalent



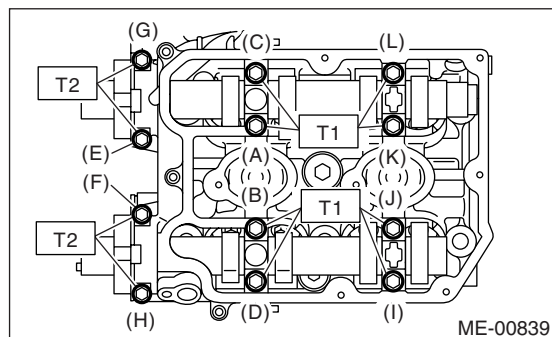
(2) Apply engine oil to the cap bearing surface, and install the cap on camshaft as shown by identification mark.

(3) Gradually tighten the camshaft cap and oil control valve assembly in at least two stages in alphabetical sequence shown in the figure, and then tighten to the specified torque.

Tightening torque:

T1: 10 N·m (1.0 kgf-m, 7.2 ft-lb)

T2: 20 N·m (2.0 kgf-m, 14.5 ft-lb)

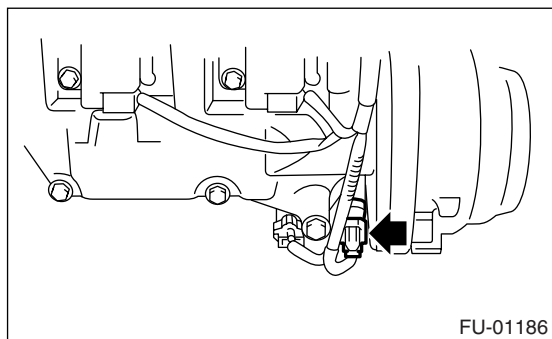


(4) After tightening the camshaft cap, ensure the camshaft rotates only slightly while holding it at "base circle".

3) Install the camshaft position sensor on exhaust side.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



4) Camshaft oil seal installation:

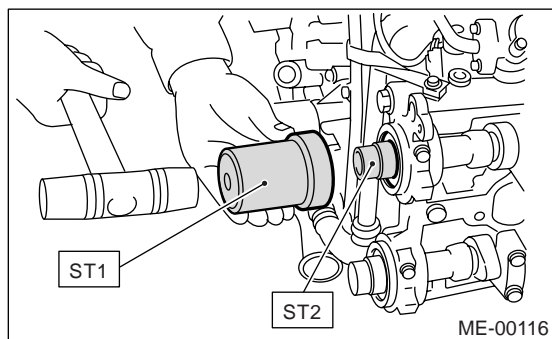
Apply grease to the new oil seal lips and press onto the front end of camshaft by using ST1 and ST2.

NOTE:

Use a new oil seal.

ST1 499587600 OIL SEAL INSTALLER

ST2 499597200 OIL SEAL GUIDE



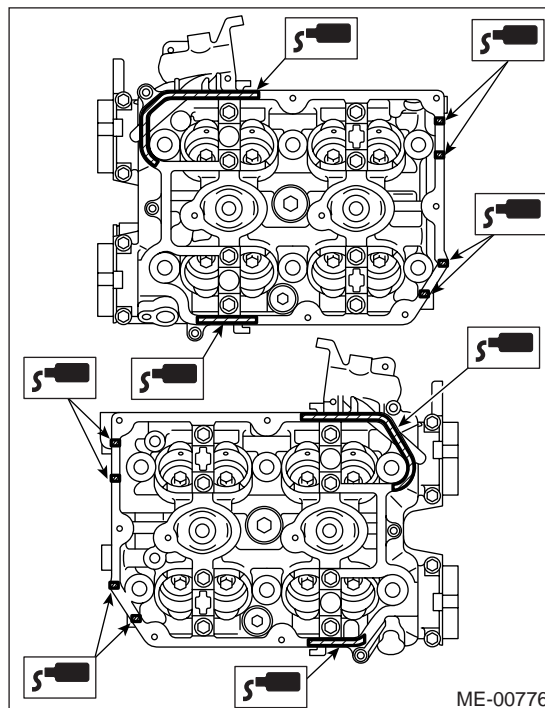
5) Rocker cover installation:

(1) Install the gasket on rocker cover. Install the peripheral gasket and ignition coil gasket.

(2) Apply liquid gasket to the designated point of cylinder head.

Liquid gasket:

THREE BOND 1215 (Part No. 004403007) or equivalent

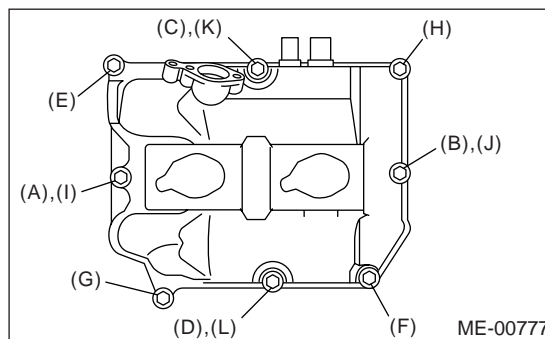


(3) Install the rocker cover on cylinder head. Ensure the gasket is properly positioned during installation.

(4) Tighten the rocker cover tightening bolt in alphabetical sequence shown in the figure, and then tighten to the specified torque.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



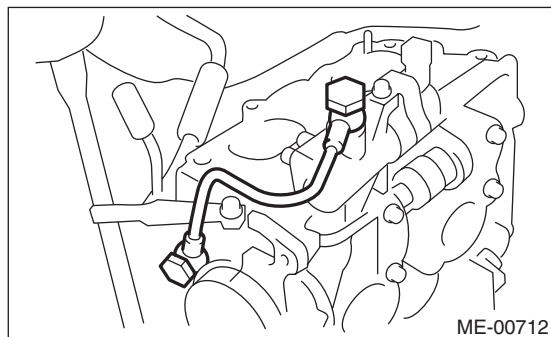
Camshaft

MECHANICAL

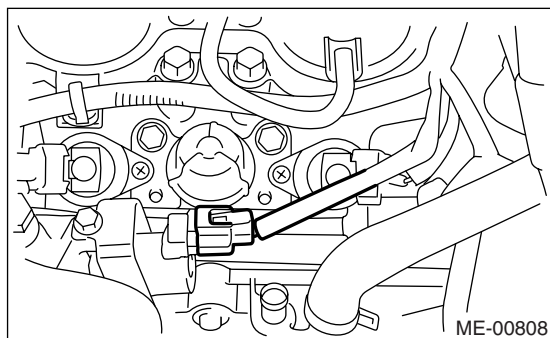
6) Install the oil pipe.

Tightening torque:

29 N·m (3.0 kgf-m, 21.4 ft-lb)



7) Connect the oil flow control solenoid valve connector.



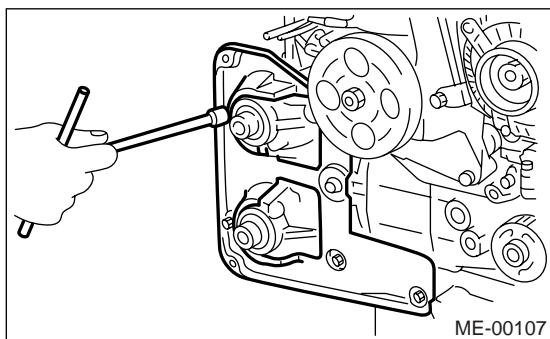
8) Install the spark plug cord.

9) Similarly, install the parts on right-hand side.

10) Install the timing belt cover No. 2 (RH).

Tightening torque:

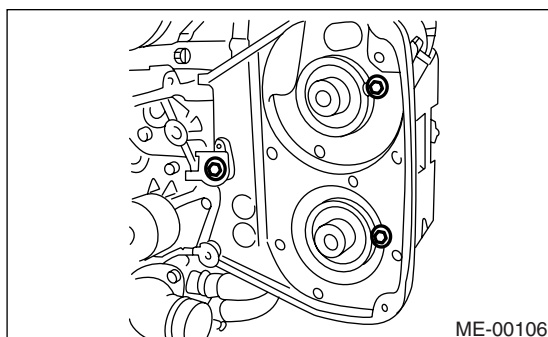
5 N·m (0.5 kgf-m, 3.6 ft-lb)



11) Install the timing belt cover No. 2 (LH).

Tightening torque:

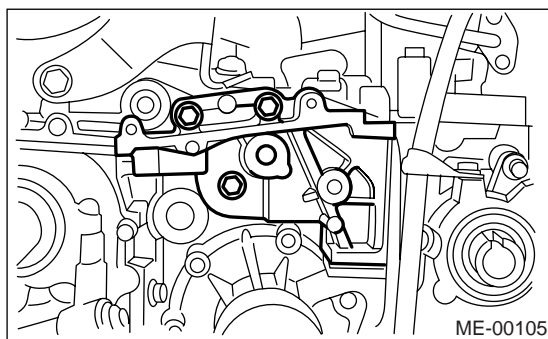
5 N·m (0.5 kgf-m, 3.6 ft-lb)



12) Install the tensioner bracket.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



13) Install the crank sprocket.

<Ref. to ME(H4DOTC)-52, INSTALLATION, Crank Sprocket.>

14) Install the cam sprocket.

<Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>

15) Install the timing belt. <Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>

16) Install the timing belt cover.

<Ref. to ME(H4DOTC)-42, INSTALLATION, Timing Belt Cover.>

17) Install the crank pulley.

<Ref. to ME(H4DOTC)-41, INSTALLATION, Crank Pulley.>

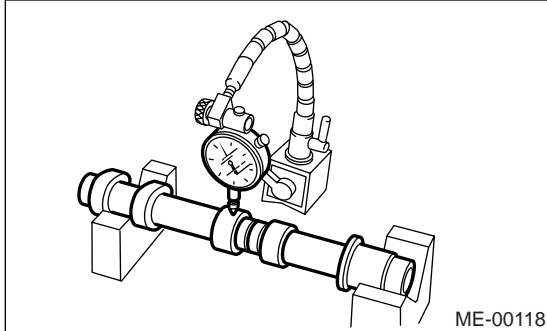
18) Install the V-belts. <Ref. to ME(H4DOTC)-39, INSTALLATION, V-belt.>

C: INSPECTION

1) Measure the bend, and repair or replace if necessary.

Standard value:

0.020 mm (0.0008 in) or less



2) Check the journal for damage and wear. Replace if faulty.

3) Measure the outside diameter of camshaft journal. If the journal diameter is not within specification, check the oil clearance.

	Camshaft journal	
	Front	Center, rear
Standard value	37.946 — 37.963	29.946 — 29.963
mm (in)	(1.4939 — 1.4946)	(1.1790 — 1.1796)

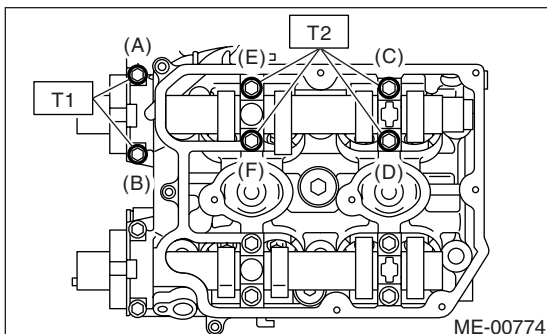
4) Measurement of the camshaft journal oil clearance:

- (1) Clean the bearing caps and camshaft journals.
- (2) Place the camshafts on cylinder head. (Without installing the valve rocker.)
- (3) Place a plastigauge across each of the camshaft journals.
- (4) Gradually tighten the cap in at least two stages in alphabetical sequence shown in the figure, and then tighten to the specified torque. Do not turn the camshaft.

Tightening torque:

T1: 10 N·m (1.0 kgf-m, 7.2 ft-lb)

T2: 20 N·m (2.0 kgf-m, 14.5 ft-lb)

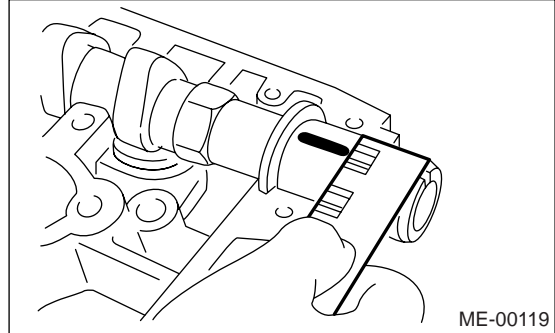


(5) Remove the bearing caps.

(6) Measure the widest point of the plastigauge on each journal. If oil clearance exceeds the limit, replace the camshaft. If necessary, replace the camshaft caps and cylinder head as a set.

Standard:

0.037 — 0.072 mm (0.0015 — 0.0028 in)



(7) Completely remove the plastigauge.

5) Check the cam face condition, and remove the minor faults by grinding with oil stone. Measure the cam height H. If it exceeds the limit or has partial wear, replace it.

Cam height H:

Standard

Intake

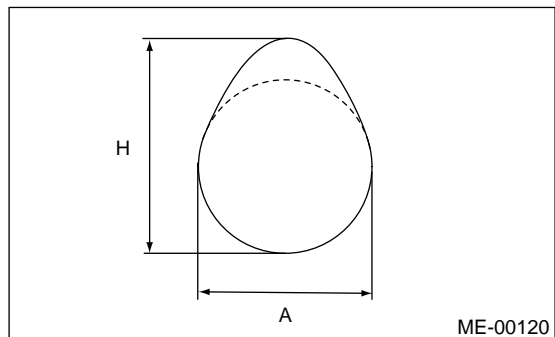
45.85 — 45.95 mm (1.805 — 1.809 in)

Exhaust

45.75 — 45.85 mm (1.801 — 1.805 in)

Cam base circle diameter A:

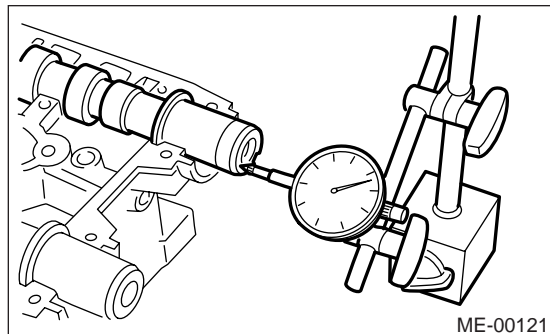
37.0 mm (1.457 in)



6) Measure the side clearance of camshaft with dial gauge. If the clearance exceeds the limit or has partial wear, replace the caps and cylinder head as a set. If necessary, replace the camshaft.

Standard:

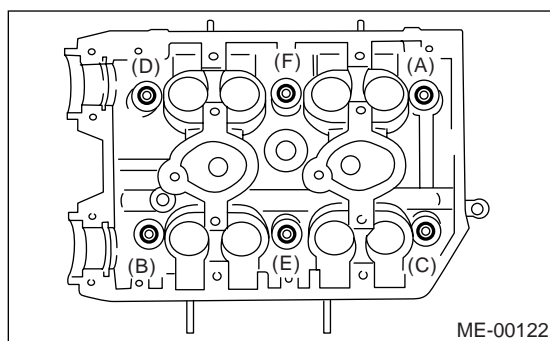
0.068 — 0.116 mm (0.0027 — 0.0047 in)



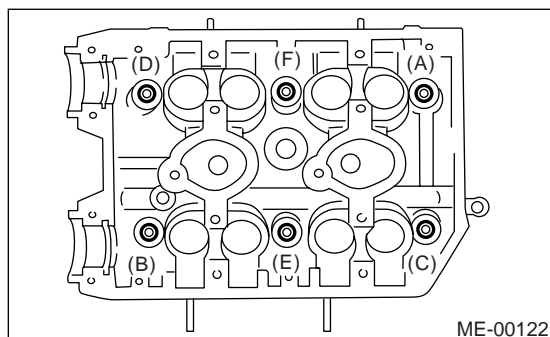
20. Cylinder Head

A: REMOVAL

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
- 2) Remove the crank pulley.
<Ref. to ME(H4DOTC)-41, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover.
<Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt Cover.>
- 4) Remove the timing belt.
<Ref. to ME(H4DOTC)-43, REMOVAL, Timing Belt.>
- 5) Remove the cam sprocket.
<Ref. to ME(H4DOTC)-51, REMOVAL, Cam Sprocket.>
- 6) Remove the intake manifold.
<Ref. to FU(H4DOTC)-13, REMOVAL, Intake Manifold.>
- 7) Remove the bolt which installs the A/C compressor bracket on cylinder head.
- 8) Remove the camshaft. <Ref. to ME(H4DOTC)-53, REMOVAL, Camshaft.>
- 9) Remove the cylinder head bolts in alphabetical sequence shown in the figure.
Leave the bolts (A) and (D) engaged by three or four threads to prevent the cylinder head from falling.



- 10) While tapping the cylinder head with a plastic hammer, separate it from cylinder block.
Remove the bolts (A) and (D) to remove cylinder head.



- 11) Remove the cylinder head gasket.

CAUTION:

Be careful not to scratch the mating surface of cylinder head and cylinder block.

- 12) Similarly, remove the cylinder head (RH).

B: INSTALLATION

- 1) Install the cylinder head and gaskets on cylinder block.

CAUTION:

- Use new cylinder head gaskets.
- Be careful not to scratch the mating surface of cylinder head and cylinder block.

- 2) Tighten the cylinder head bolts.
 - (1) Apply a coat of engine oil to washers and bolt threads.
 - (2) Tighten all bolts to 29 N·m (3.0 kgf-m, 21.4 ft-lb) in alphabetical sequence.
 - (3) Retighten all bolts to 69 N·m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence.
 - (4) Back off all bolts by 180° in the reverse order of installation, and back them off again by 180°.
 - (5) Tighten all bolts to 49 N·m (5.0 kgf-m, 36 ft-lb) in alphabetical sequence.
 - (6) Tighten all bolts by 80 — 90° in alphabetical sequence.
 - (7) Tighten all bolts by 40 — 45° in alphabetical sequence.

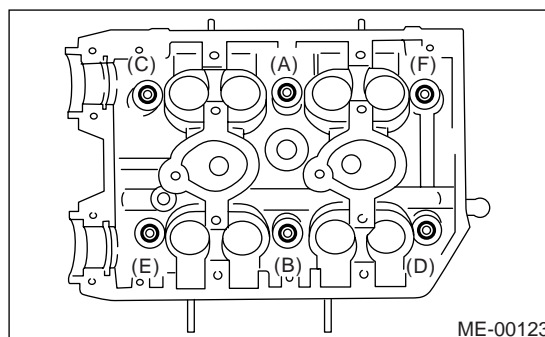
CAUTION:

Do not tighten the bolts more than 45°.

- (8) Further tighten the bolts (A) and (B) by 40 — 45°.

CAUTION:

Ensure the total “re-tightening angle” [in the former two steps], do not exceed 90°.



- 3) Install the camshaft. <Ref. to ME(H4DOTC)-54, INSTALLATION, Camshaft.>
- 4) Install the A/C compressor bracket on cylinder head.
- 5) Install the intake manifold.
<Ref. to FU(H4DOTC)-15, INSTALLATION, Intake Manifold.>

Cylinder Head

MECHANICAL

6) Install the cam sprocket.

<Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>

7) Install the timing belt.

<Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>

8) Install the timing belt cover.

<Ref. to ME(H4DOTC)-42, INSTALLATION, Timing Belt Cover.>

9) Install the crank pulley.

<Ref. to ME(H4DOTC)-41, INSTALLATION, Crank Pulley.>

10) Install the V-belts. <Ref. to ME(H4DOTC)-39, INSTALLATION, V-belt.>

C: DISASSEMBLY

1) Remove the valve lifter.

2) Compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.

ST1 498267600 CYLINDER HEAD TABLE

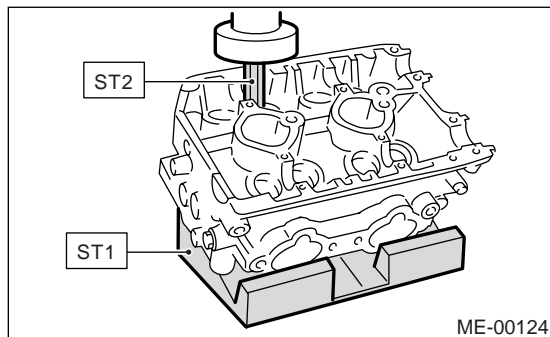
ST2 499718000 VALVE SPRING REMOVER

NOTE:

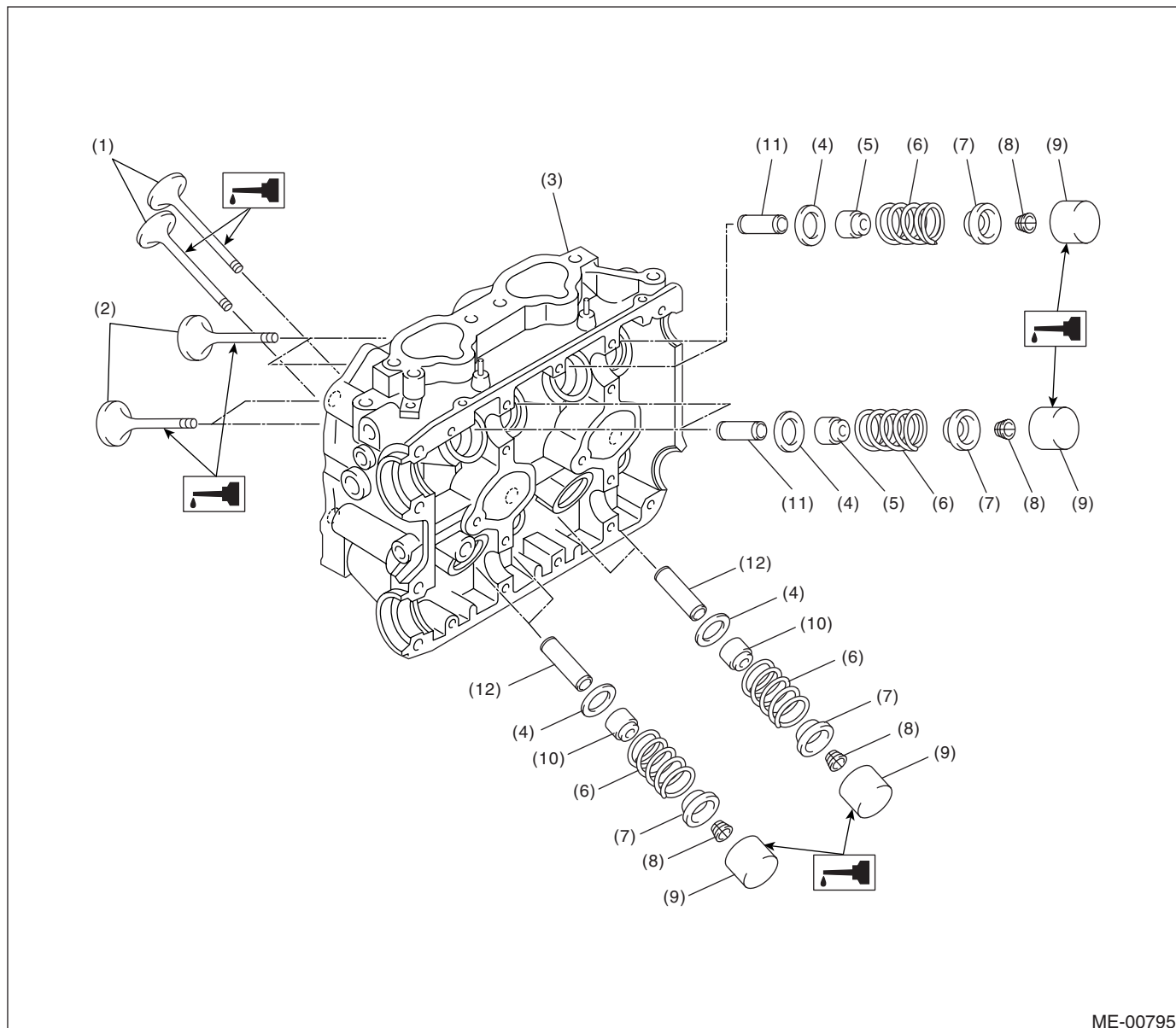
Keep all the removed parts in order for re-installing in their original positions.

CAUTION:

- Mark each valve to prevent confusion.
- Use extreme care not to damage the lips of the intake valve oil seals and exhaust valve oil seals.



D: ASSEMBLY



ME-00795

- | | | |
|-----------------------|---------------------------|-----------------------------|
| (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) Retainer | (11) Intake valve guide |
| (4) Valve spring seat | (8) Retainer key | (12) Exhaust valve guide |

Cylinder Head

MECHANICAL

- 1) Installation of valve spring and valve:
 - (1) Coat the stem of each valve with engine oil and insert the valve into valve guide.

NOTE:

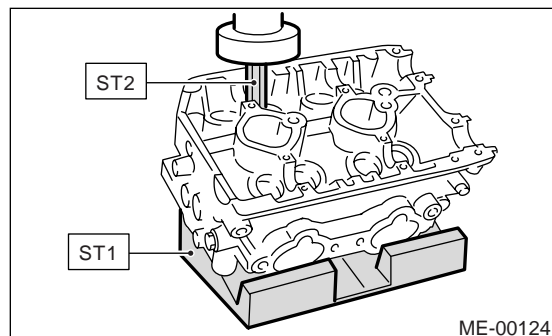
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

- (2) Set the cylinder head on ST1.
- (3) Install the valve spring and retainer using ST2.

ST1 498267600 CYLINDER HEAD TABLE
ST2 499718000 VALVE SPRING REMOVER

NOTE:

Be sure to install the valve spring with their close-coiled end facing the seat on the cylinder head.



- (4) Compress the valve spring and fit the valve spring retainer key.
 - (5) After installing, tap the valve spring retainers lightly with a wooden hammer for better seating.
- 2) Apply oil to the surfaces of the valve lifter.
 - 3) Install the valve lifter.

E: INSPECTION

1. CYLINDER HEAD

- 1) Make sure that cracks or other damages do not exist. In addition to visual inspection, inspect important areas by means of red lead check.
- 2) Measure the warping of the cylinder head surface that mates with crankcase using a straight edge (A) and thickness gauge (B). If the warping exceeds the limit, regrind the surface with a surface grinder.

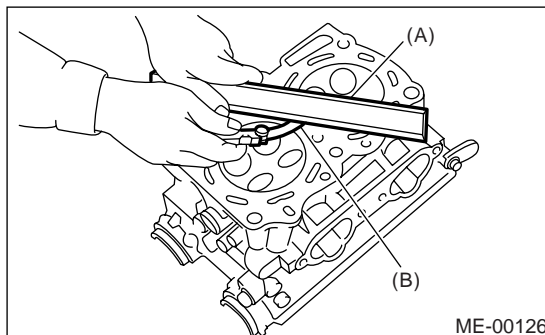
Warping limit:
0.035 mm (0.0014 in)

Grinding limit:
0.3 mm (0.012 in)

Standard height of cylinder head:
127.5 mm (5.02 in)

NOTE:

Uneven torque for the cylinder head nuts can cause warping. When 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.

Valve seat width W:

Intake

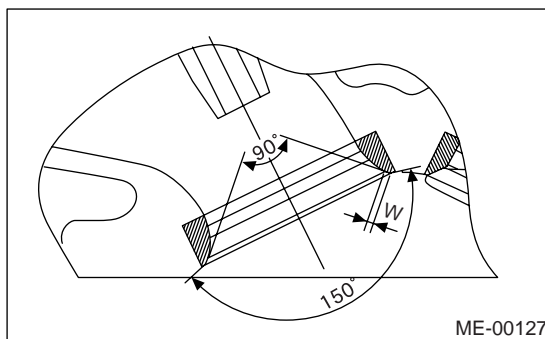
Standard

0.6 — 1.4 mm (0.024 — 0.055 in)

Exhaust

Standard

1.2 — 1.8 mm (0.047 — 0.071 in)



3. VALVE GUIDE

- 1) Check the clearance between valve guide and stem. The clearance can be checked by measuring the outer diameter of valve stem and inner diameter of valve guide respectively with a micrometer.

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 stem exceeds the standard value, replace the valve guide or valve itself whichever shows greater amount of wear or has abnormality such as scratch. 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)

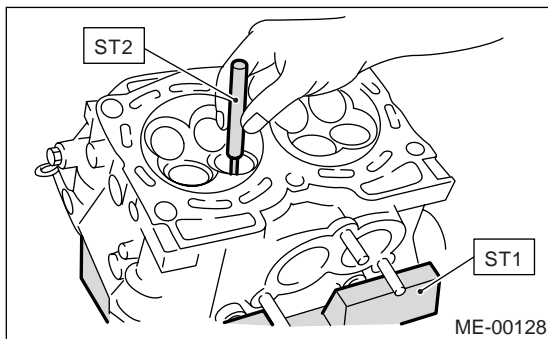
Exhaust

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.

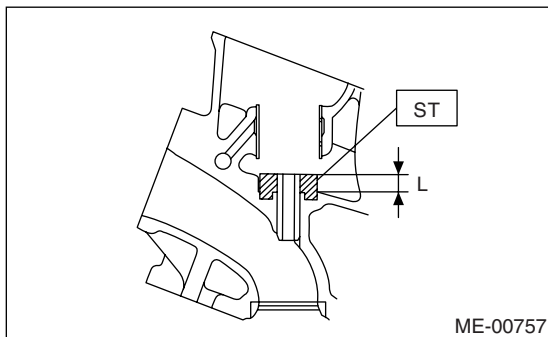
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

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.

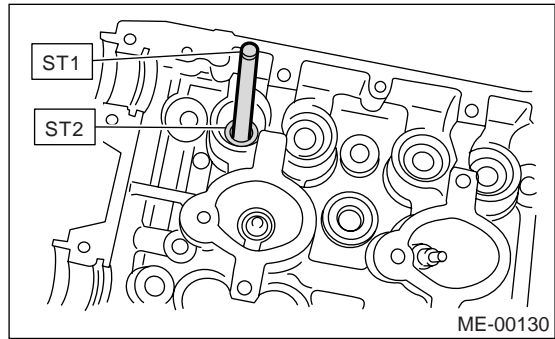
ST 18251AA020 VALVE GUIDE ADJUSTER



(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inside surface of the valve guide holes in cylinder head.

(5) Put a new valve guide, coated with sufficient oil, in cylinder, 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.

Valve guide protrusion L:

15.8 — 16.2 mm (0.622 — 0.638 in)

(7) Ream the inside of valve guide using ST. Put the reamer in valve guide, and rotate the reamer slowly clockwise pushing it lightly. Bring the reamer back while rotating it clockwise. After reaming, clean the valve guide to remove chips.

ST 499767400 VALVE GUIDE REAMER

NOTE:

- Apply engine oil to the reamer when reaming.
- If the inner surface of the valve guide is torn, the edge of the reamer should be slightly ground with an oil stone.
- If the inner surface of the valve guide becomes lustrous and the reamer does not chip, use a new reamer or remedy the reamer.

(8) Recheck the contact condition between valve and valve seat after replacing the valve guide.

4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace them if damaged, worn, deformed, or if "H" is exceed the standard value or if they have partial wear.

H:

Intake (A)

Standard

1.0 — 1.4 mm (0.039 — 0.055 in)

Exhaust (B)

Standard

1.3 — 1.7 mm (0.051 — 0.067 in)

Cylinder Head

MECHANICAL

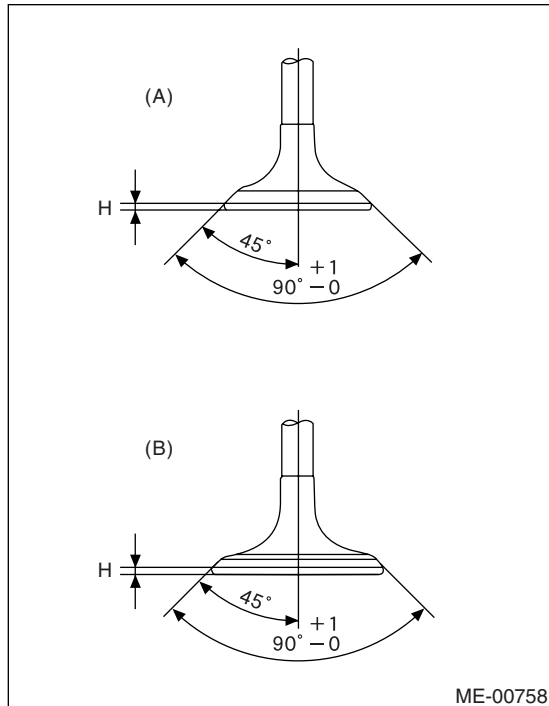
Valve overall length:

Intake (A)

104.4 mm (4.110 in)

Exhaust (B)

104.65 mm (4.1201 in)

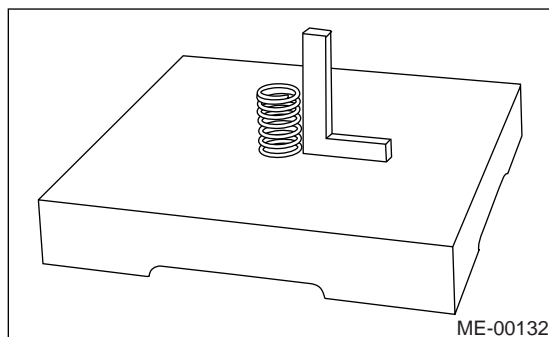


2) Put a small amount of grinding compound on the seat surface, and lap the valve and seat surface. Install a new intake valve oil seal after lapping.

5. VALVE SPRINGS

- 1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within the standard value presented in the table.
- 2) To measure the squareness of the valve spring, stand the spring on a surface plate and measure its deflection at the top of spring using a try square.

Free length	mm (in)	44.67 (1.759)
Tension/spring height N (kgf, lb)/mm (in)	Set	206 — 236 (21.0 — 24.1, 46.3 — 53.1)/36.0 (1.417)
	Lift	485 — 537 (21.0 — 24.1, 109 — 121) /26.0 (1.024)
Squareness		2.5°, 2.0 mm (0.079 in)



6. INTAKE AND EXHAUST VALVE OIL SEAL

Replace the oil seal with a new one, if the lip is damaged or spring is out of place, or when the surfaces of intake valve and valve seat are reconditioned or intake valve guide is replaced.

- 1) Place the cylinder head on ST1.
- 2) Press-fit the oil seal to the specified dimension indicated in the figure using ST2.

ST1 498267600 CYLINDER HEAD TABLE
ST2 498857100 VALVE OIL SEAL GUIDE

NOTE:

- Apply engine oil to oil seal before force-fitting.
- Differentiate between the intake valve oil seal and exhaust valve oil seal by noting their difference in color.

Color of rubber part:

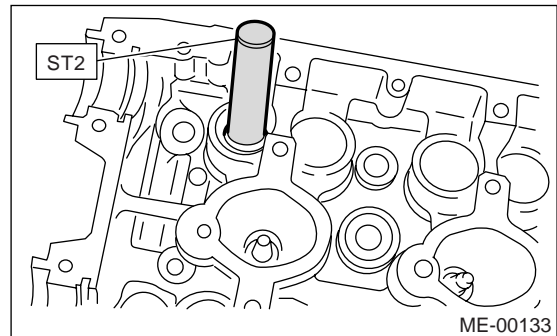
Intake [Black]

Exhaust [Brown]

Color of spring part:

Intake [Silver]

Exhaust [Silver]

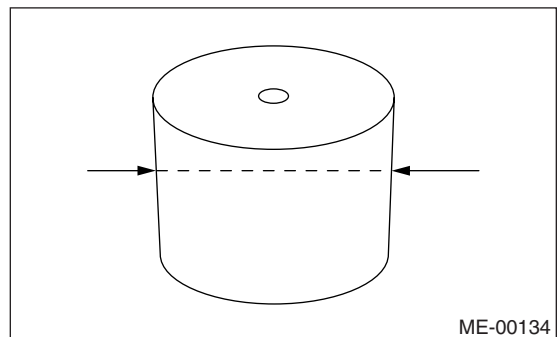


7. VALVE LIFTER

- 1) Check the valve lifter visually.
- 2) Measure the outer diameter of valve lifter.

Outer diameter:

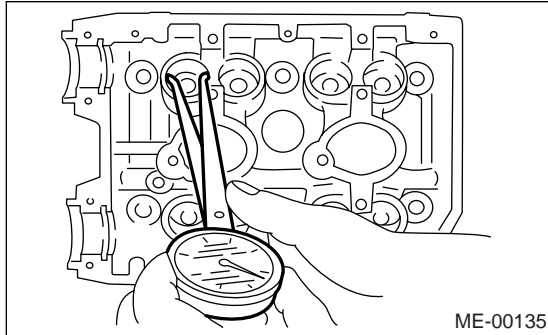
34.959 — 34.975 mm (1.3763 — 1.3770 in)



3) Measure the inner diameter of valve lifter mating part on cylinder head.

Inner diameter:

34.994 — 35.016 mm (1.3777 — 1.3786 in)



NOTE:

If difference between outer diameter of valve lifter and inner diameter of valve lifter mating part is over the standard or has partial wear in inner surface, replace the cylinder head.

Standard:

0.019 — 0.057 mm (0.0007 — 0.0022 in)

21. Cylinder Block

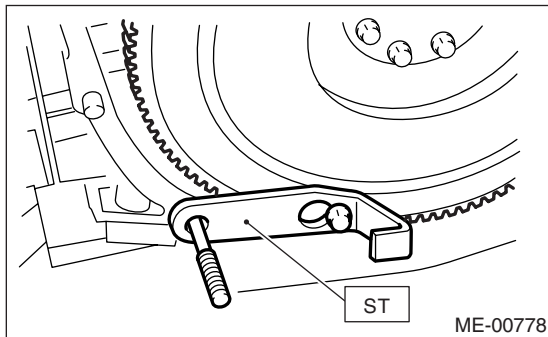
A: REMOVAL

NOTE:

Before conducting this procedure, drain engine oil completely.

- 1) Remove the intake manifold.
<Ref. to FU(H4DOTC)-13, REMOVAL, Intake Manifold.>
- 2) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
- 3) Remove the crank pulley.
<Ref. to ME(H4DOTC)-41, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover.
<Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt.
<Ref. to ME(H4DOTC)-43, REMOVAL, Timing Belt.>
- 6) Remove the cam sprocket.
<Ref. to ME(H4DOTC)-51, REMOVAL, Cam Sprocket.>
- 7) Remove the crank sprocket.
<Ref. to ME(H4DOTC)-52, REMOVAL, Crank Sprocket.>
- 8) Remove the generator and A/C compressor with their brackets.
- 9) Remove the cylinder head.
<Ref. to ME(H4DOTC)-59, REMOVAL, Cylinder Head.>

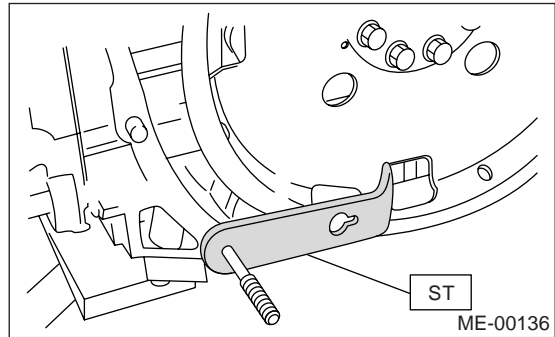
ST 498497100 CRANKSHAFT STOPPER



- 10) Remove the drive plate.

To lock crankshaft, use ST.

ST 498497100 CRANKSHAFT STOPPER

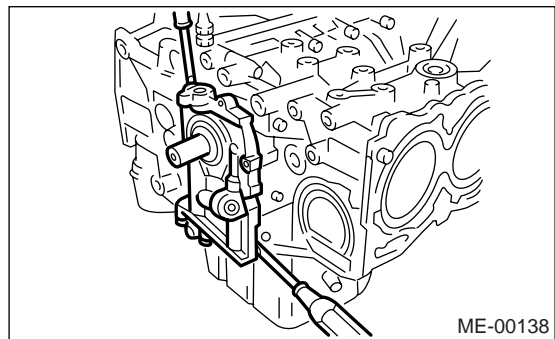


- 11) Remove the oil separator cover.

- 12) Remove the oil pump by using flat tip screwdriver.

CAUTION:

Be careful not to scratch the mating surface of cylinder block and oil pump.



- 13) Remove the water by-pass pipe for heater.

- 14) Remove the oil filter.

- 15) Removal of oil pan:

- (1) Place the cylinder block to face the #2 and #4 cylinder side upward.
- (2) Remove the bolts which secure oil pan to cylinder block.
- (3) Insert a oil pan cutter blade between cylinder block-to-oil pan clearance and remove the oil pan. Do not use a screwdriver or similar tools in place of oil pan cutter.

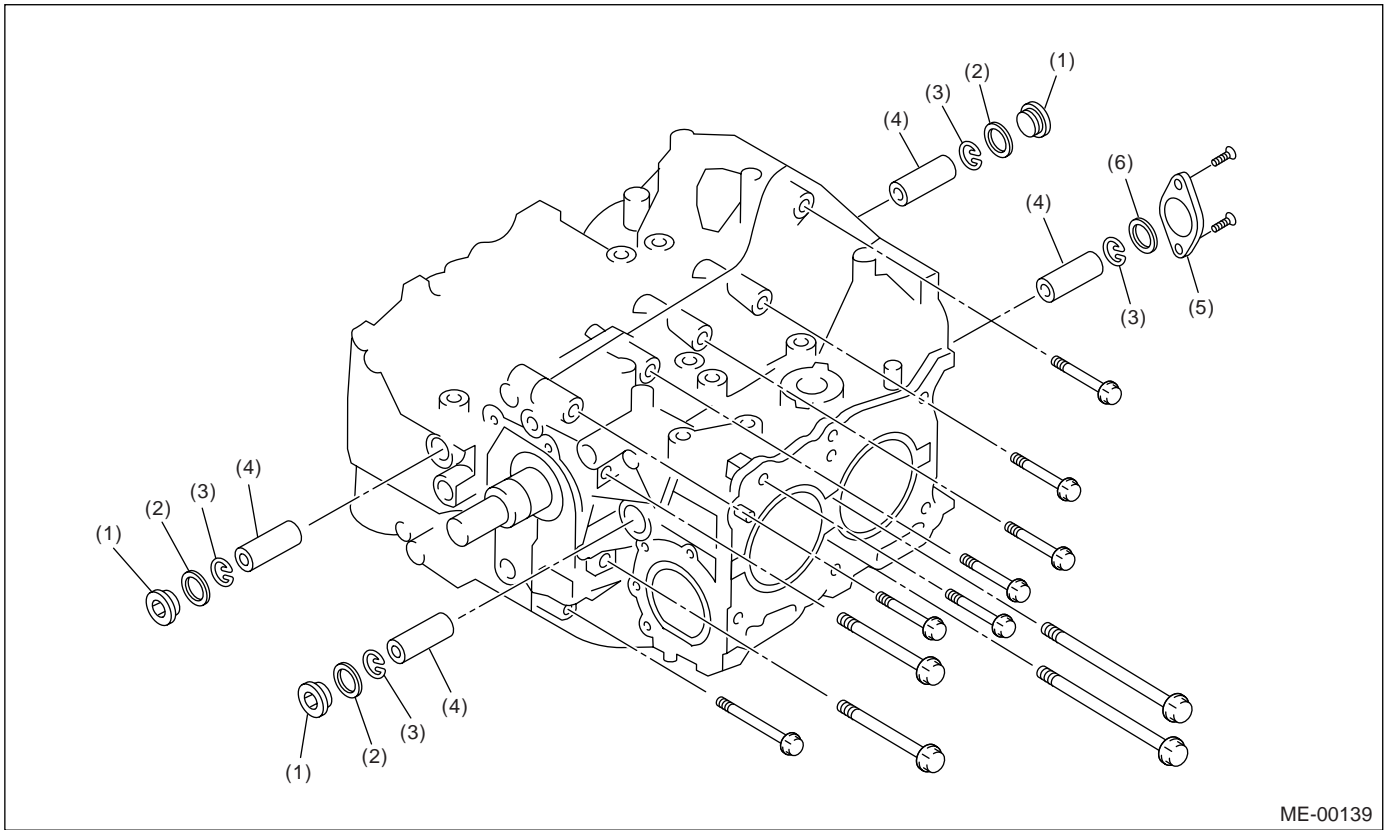
- 16) Remove the oil strainer stay.

- 17) Remove the oil strainer.

- 18) Remove the baffle plate.

- 19) Remove the water pipe.

- 20) Remove the water pump.



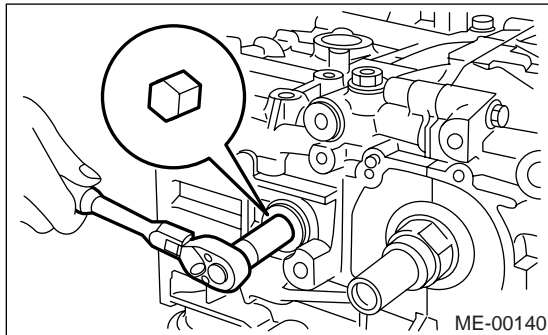
ME-00139

- (1) Service hole plug
- (2) Gasket

- (3) Snap ring
- (4) Piston pin

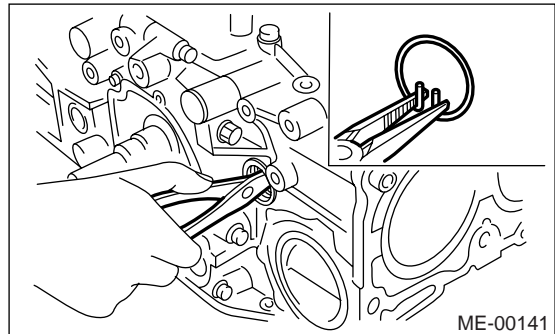
- (5) Service hole cover
- (6) O-ring

21) Remove the service hole cover and service hole plugs using a hexagon wrench [14 mm].



ME-00140

22) 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.



ME-00141

23) Draw out the piston pins from #1 and #2 pistons using ST.

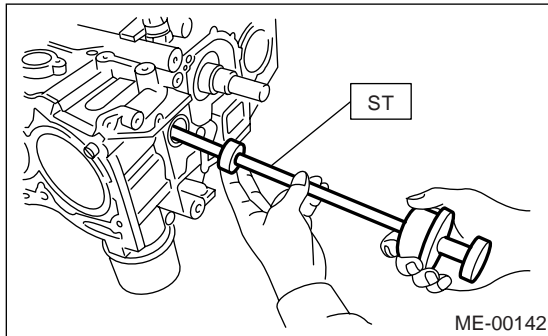
ST 499097700 PISTON PIN REMOVER

Cylinder Block

MECHANICAL

NOTE:

Be careful not to confuse the original combination of piston, piston pin and cylinder.



24) Similarly remove the piston pins from #3 and #4 pistons.

25) Remove the bolts which connect cylinder block on the side of #2 and #4 cylinders.

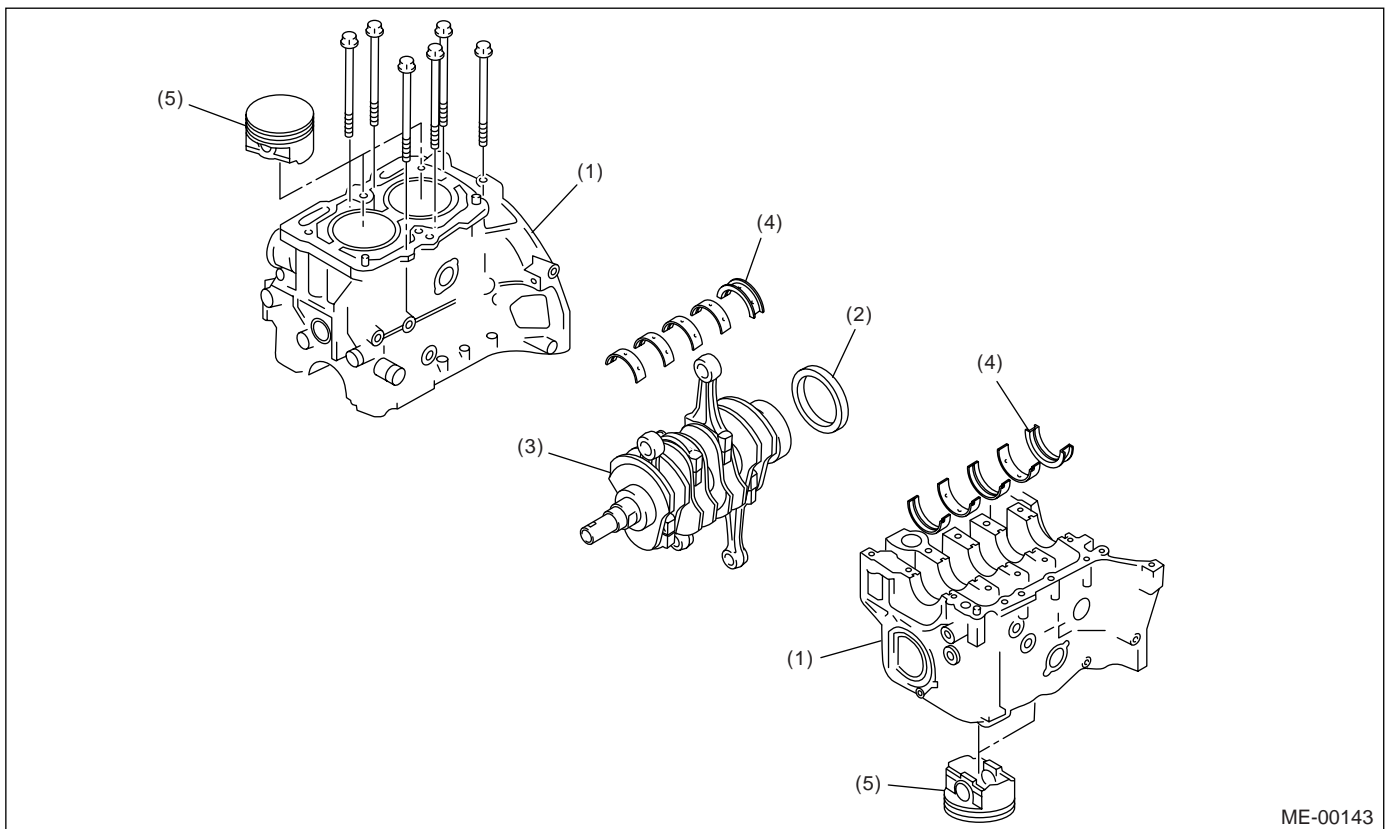
26) Back off the bolts which connect cylinder block on the side of #1 and #3 cylinders two or three turns.

27) Place the cylinder block to face the #1 and #3 cylinder side upward, and remove cylinder block connecting bolts.

28) Separate the cylinder block (LH) and (RH).

NOTE:

When separating the cylinder block, do not allow the connecting rod to fall and damage the cylinder block.



(1) Cylinder block

(2) Rear oil seal

(3) Crankshaft

(4) Crankshaft bearing

(5) Piston

29) Remove the rear oil seal.

30) Remove the crankshaft together with connecting rod.

31) Remove the crankshaft bearings from cylinder block using a hammer handle.

NOTE:

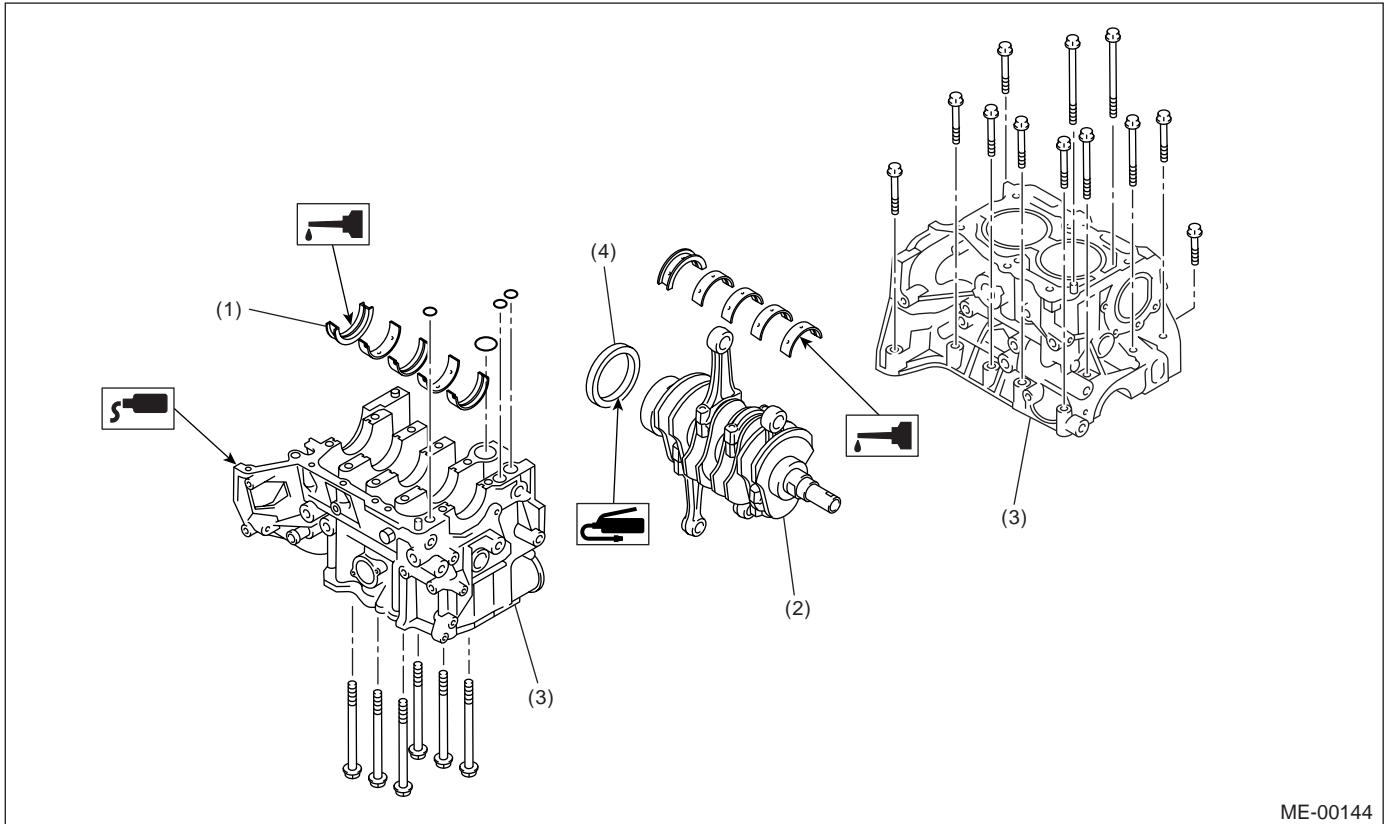
Do not confuse the combination of crankshaft bearings.

Press the bearing at the end opposite to locking lip.

32) Draw out each piston from cylinder block using a wooden bar or hammer handle.

NOTE:

Be careful not to confuse the original combination of piston and cylinder.

B: INSTALLATION

ME-00144

(1) Crankshaft bearing

(3) Cylinder block

(4) Rear oil seal

(2) Crankshaft

1) Remove oil on the mating surface of bearing and cylinder block before installation. Apply a coat of engine oil to crankshaft pins.

2) Position the crankshaft on the #2 and #4 cylinder block.

3) Apply liquid gasket to the mating surface of #1 and #3 cylinder block, and position it on #2 and #4 cylinder block.

Liquid gasket:

THREE BOND 1215 (Part No. 004403007) or equivalent

NOTE:

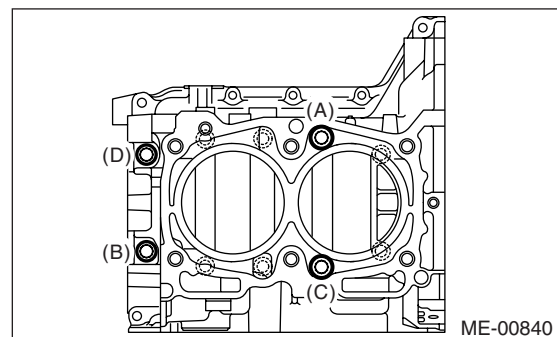
Do not allow liquid gasket to run over to O-ring grooves, oil passages, bearing grooves, etc.

4) Apply a coat of engine oil to washers and bolt threads.

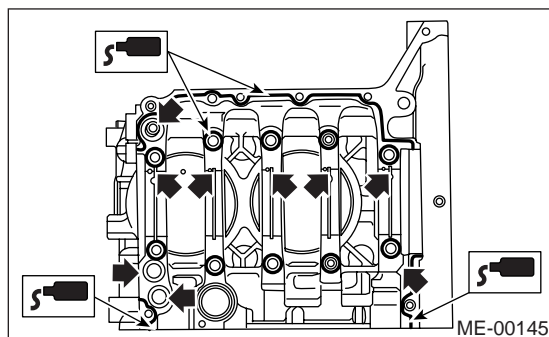
5) Tighten the 10 mm cylinder block connecting bolts on LH side (A — D) in alphabetical sequence.

Tightening torque:

10 N·m (1.0 kgf-m, 7.4 ft-lb)



ME-00840



ME-00145

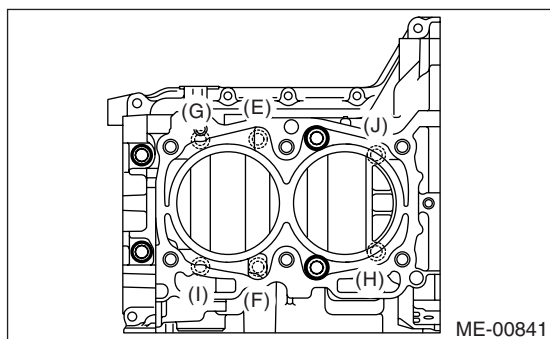
Cylinder Block

MECHANICAL

6) Tighten the 10 mm cylinder block connecting bolts on RH side (E — J) in alphabetical sequence.

Tightening torque:

10 N·m (1.0 kgf-m, 7.4 ft-lb)

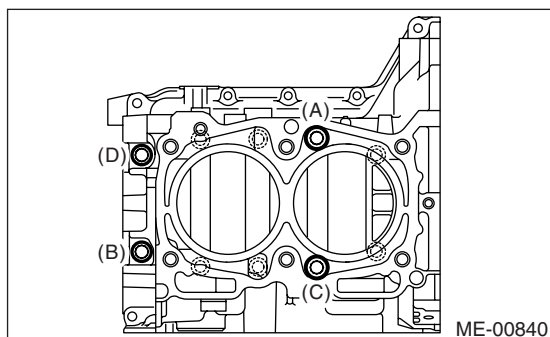


7) Further tighten the LH side bolts (A — D) in alphabetical sequence.

Tightening torque:

(A), (C): 20 N·m (2.0 kgf-m, 14.8 ft-lb)

(B), (D): 15 N·m (1.5 kgf-m, 10.8 ft-lb)

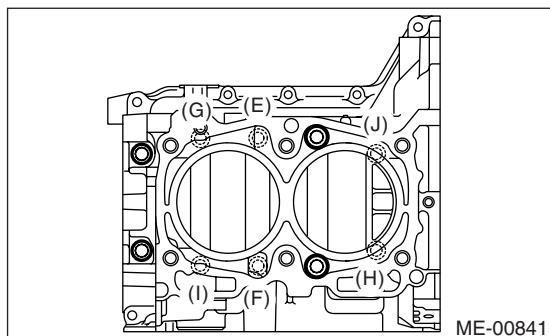


8) Further tighten the RH side bolts (E — J) in alphabetical sequence.

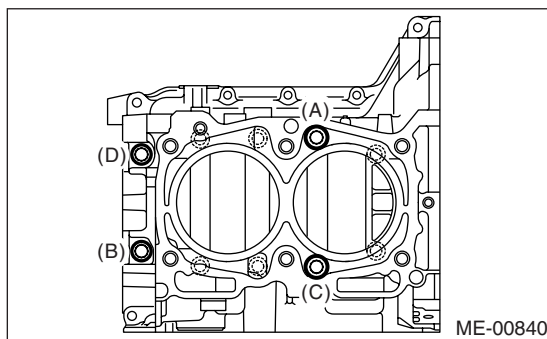
Tightening torque:

(E), (F), (G), (I): 20 N·m (2.0 kgf-m, 14.8 ft-lb)

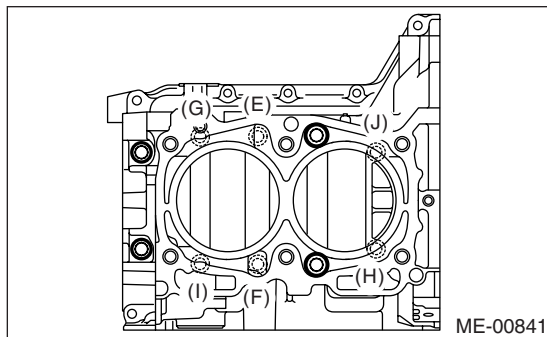
(H), (J): 18 N·m (1.8 kgf-m, 13.3 ft-lb)



9) Further tighten the LH side bolts (A — D) to 90° in alphabetical sequence.



10) Further tighten the RH side bolts (E — J) to 90° in alphabetical sequence.

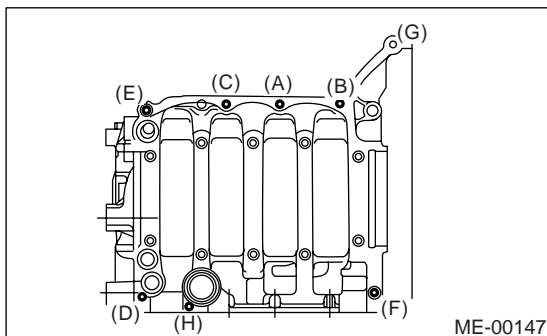


11) Tighten the 8 mm and 6 mm cylinder block connecting bolts on LH side (A — H) in alphabetical sequence.

Tightening torque:

(A) — (G): 25 N·m (2.5 kgf-m, 18.1 ft-lb)

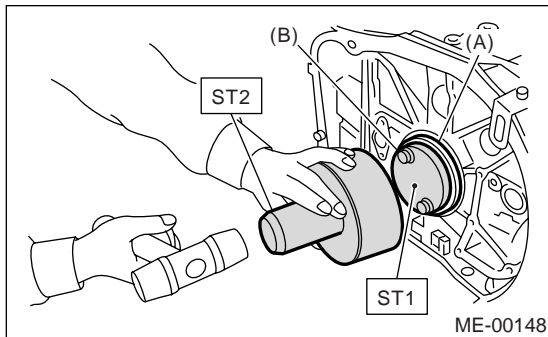
(H): 6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



12) Install the rear oil seal using ST1 and ST2.

ST1 499597100 CRANKSHAFT OIL SEAL
GUIDE

ST2 499587200 CRANKSHAFT OIL SEAL IN-
STALLER

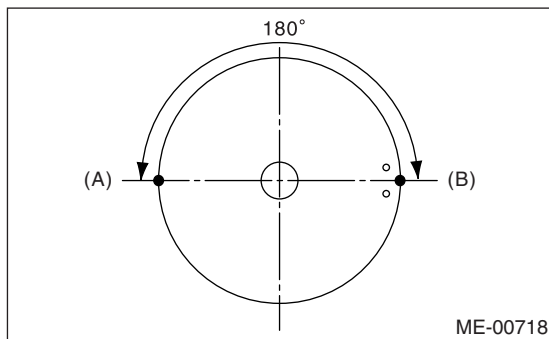


(A) Rear oil seal

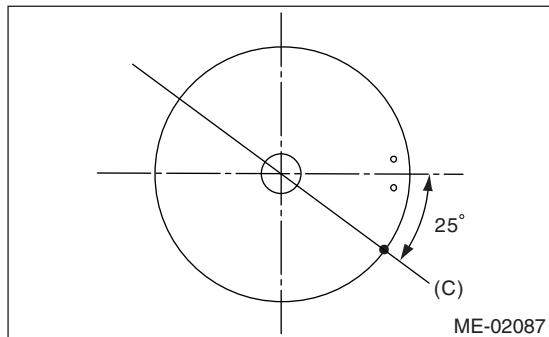
(B) Flywheel attaching bolt

13) Position the top ring gap at (A) or (B) in the figure.

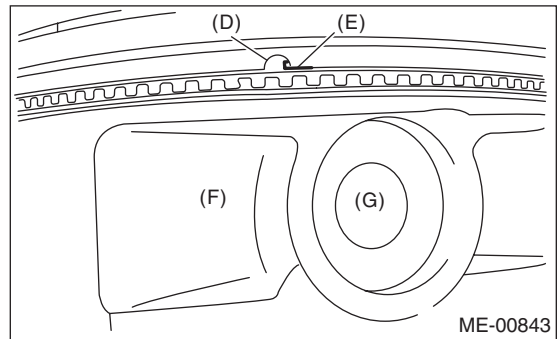
14) Position the second ring gap at 180° on the reverse side of the top ring gap.



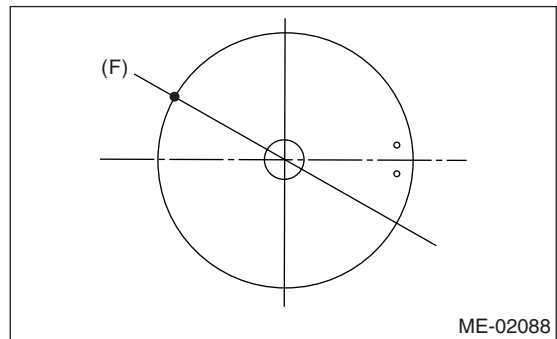
15) Position the upper rail gap at (C) in the figure.



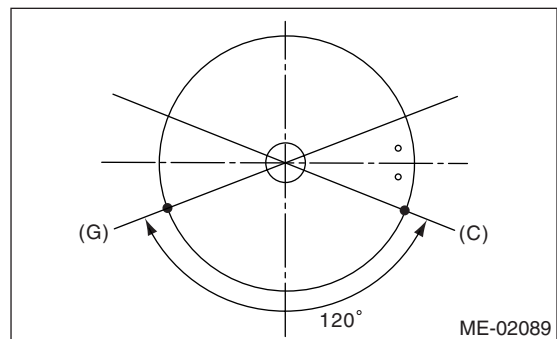
16) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



17) Position the expander gap at 180° on the reverse side of (C) that shown (F) in the figure.



18) Position the lower rail gap at 120° on counter-clockwise of (C) that shown (G) in the figure.



CAUTION:

- Ensure ring gaps do not face the same direction.
- Ensure ring gaps are not within the piston skirt area.

19) Install the snap ring.

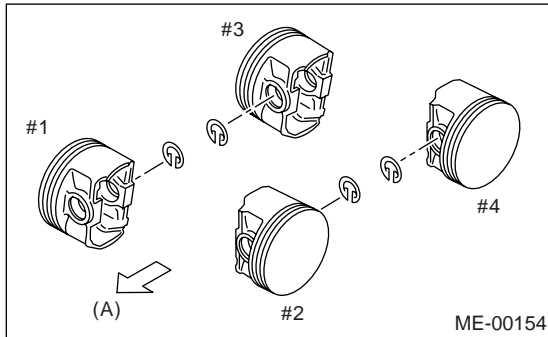
Install snap rings in the piston holes located opposite to the service holes in cylinder block, when positioning all pistons in the corresponding cylinders.

Cylinder Block

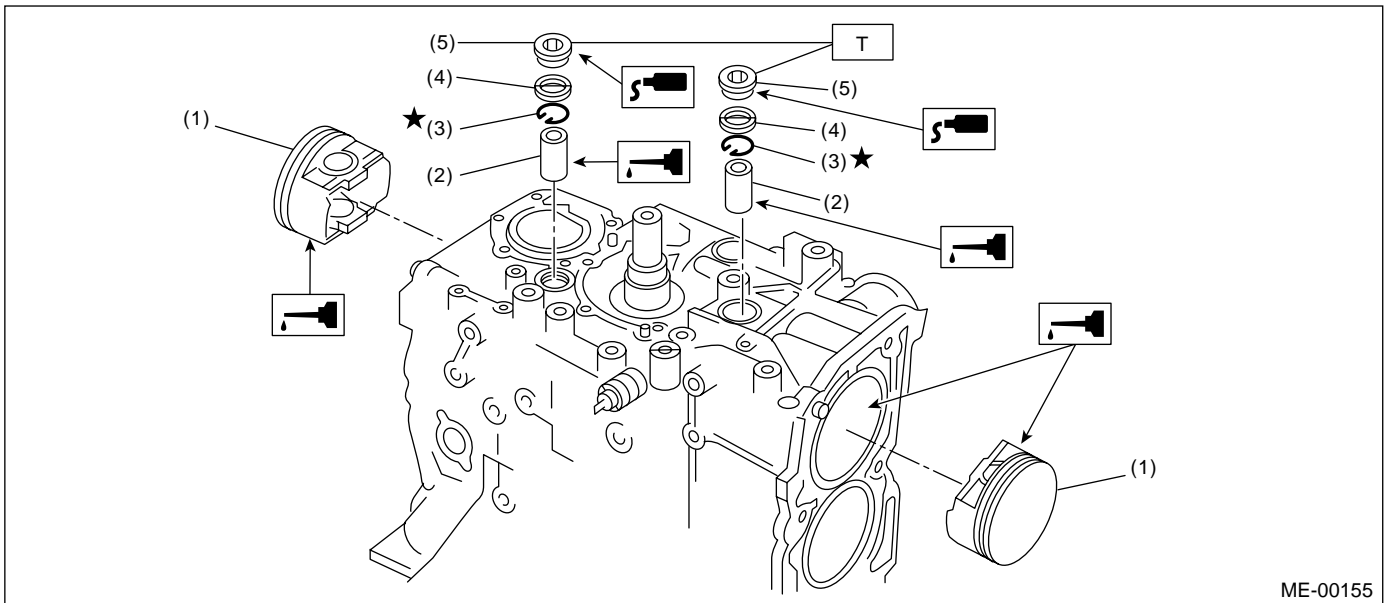
MECHANICAL

NOTE:

Use new snap rings.



(A) Front side



- | | |
|----------------|-----------------------|
| (1) Piston | (4) Gasket |
| (2) Piston pin | (5) Service hole plug |
| (3) Snap ring | |

Tightening torque: N·m (kgf-m, ft-lb)
T: 70 (7.1, 51.6)

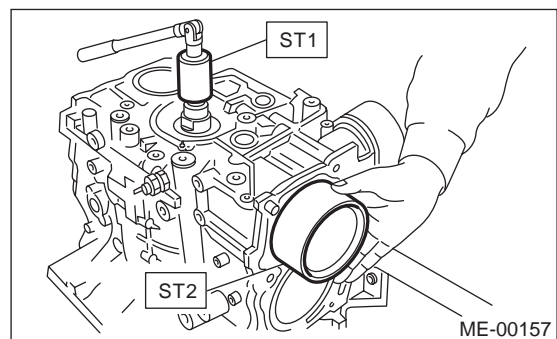
20) Installation of piston:

- (1) Place the cylinder block to face the #1 and #2 cylinder side upward.
- (2) Using the ST1, turn the crankshaft so that #1 and #2 connecting rods are set at bottom dead center.

ST1 499987500 CRANKSHAFT SOCKET

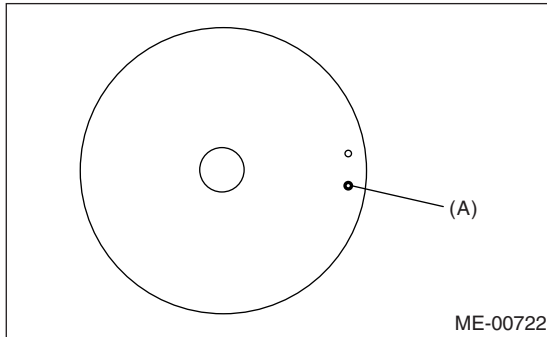
- (3) Apply a coat of engine oil to the pistons and cylinders and insert pistons in their cylinders using ST2.

ST2 398744300 PISTON GUIDE



NOTE:

Piston front mark faces towards the front of engine.

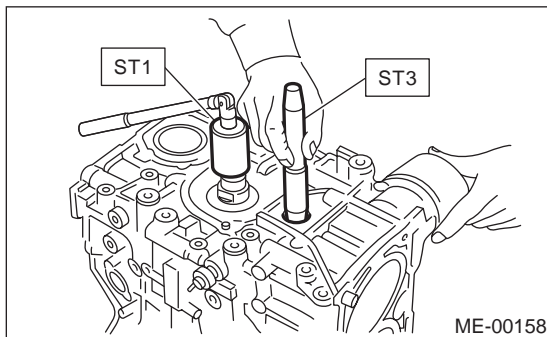


(A) Front mark

21) Installation of piston pin:

- (1) Apply a coat of engine oil to ST3 before insertion, and then insert it into the service hole to align piston pin hole with connecting rod small end.

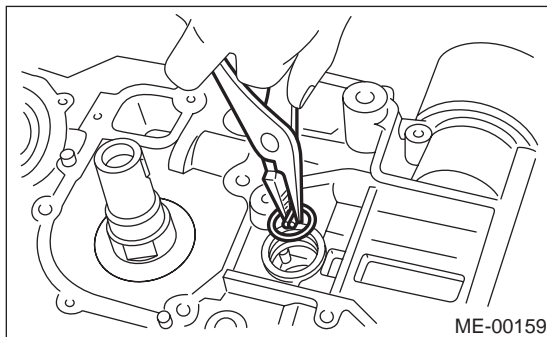
ST3 499017100 PISTON PIN GUIDE



- (2) Apply a coat of engine oil to piston pin, and insert the piston pin into piston and connecting rod through service hole.
- (3) Install the snap ring.

NOTE:

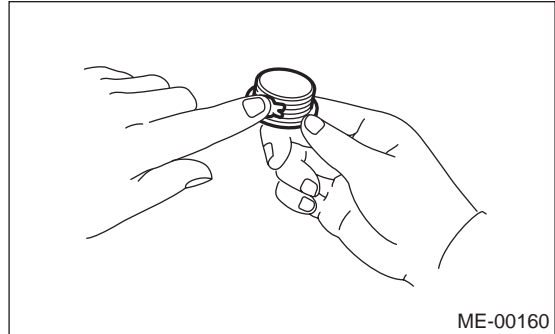
Use new snap rings.



- (4) Apply liquid gasket around the service hole plug.

Liquid gasket:

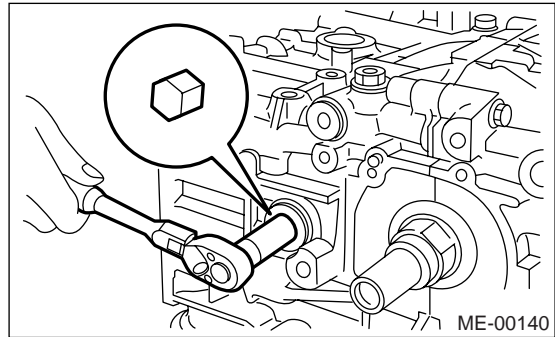
THREE BOND 1215 (Part No. 004403007) or equivalent



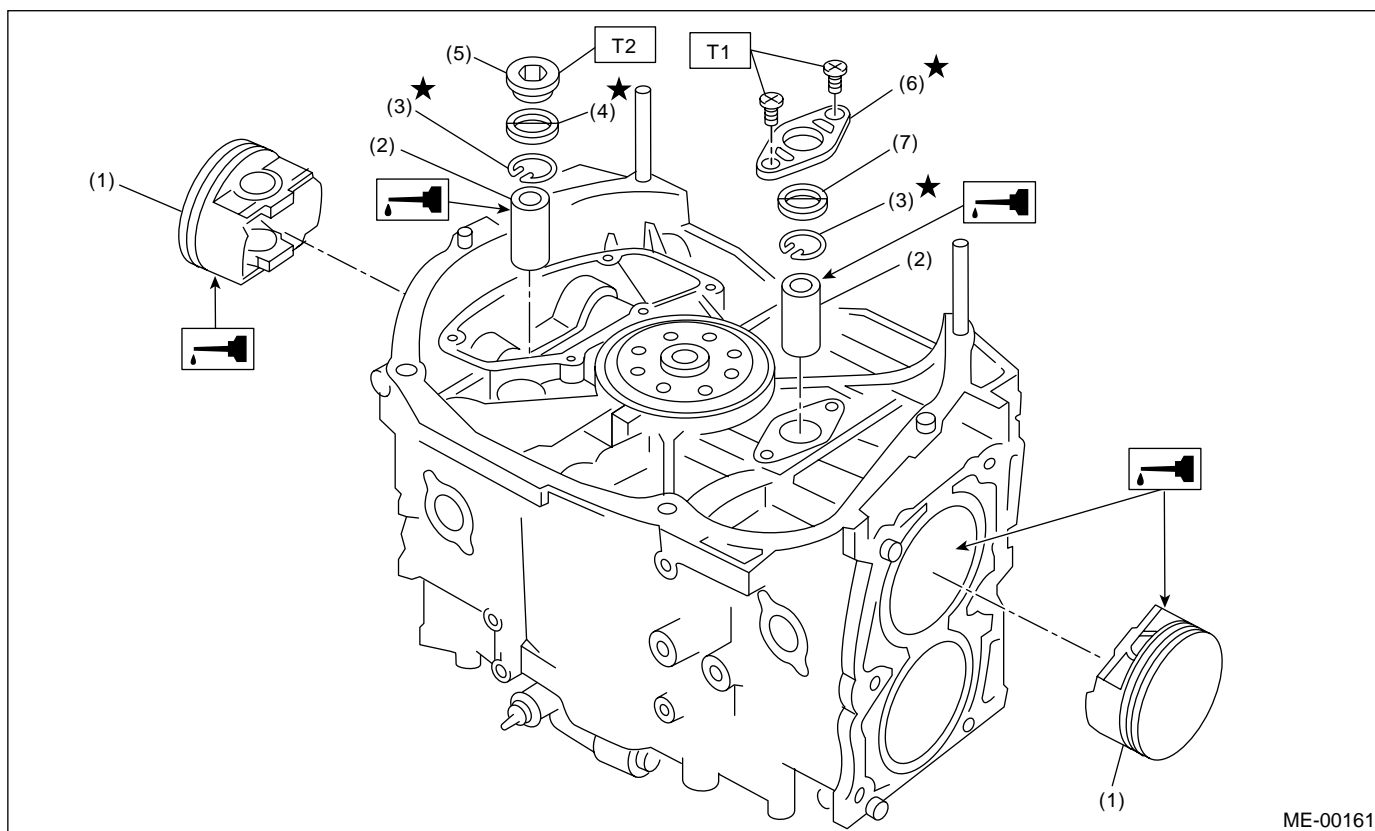
- (5) Install the service hole plug and gasket.

NOTE:

Use a new gasket.



Cylinder Block



ME-00161

- | | |
|----------------|------------------------|
| (1) Piston | (5) Service hole plug |
| (2) Piston pin | (6) Service hole cover |
| (3) Snap ring | (7) O-ring |
| (4) Gasket | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.65, 4.7)

T2: 70 (7.1, 51.6)

(6) Place the cylinder block to face the #3 and #4 cylinder side upward. Following the same procedures as used for #1 and #2 cylinders, install the pistons and piston pins.

22) Install the water pipe.

23) Install the baffle plate.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

24) Install the oil strainer and O-ring.

Tightening torque:

10 N·m (1.0 kgf-m, 7.2 ft-lb)

25) Install the oil strainer stay.

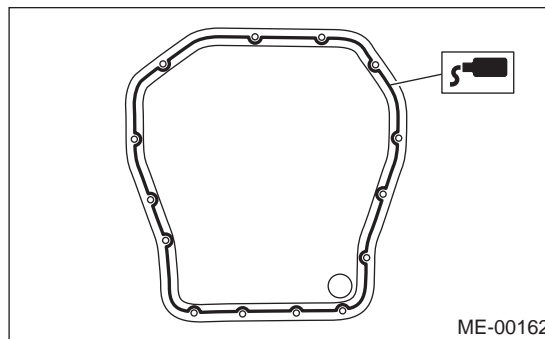
26) Apply liquid gasket to mating surfaces and install the oil pan.

Liquid gasket:

THREE BOND 1207C (Part No. 004403012) or equivalent

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



ME-00162

27) Apply liquid gasket to mating surfaces and install the oil separator cover.

NOTE:

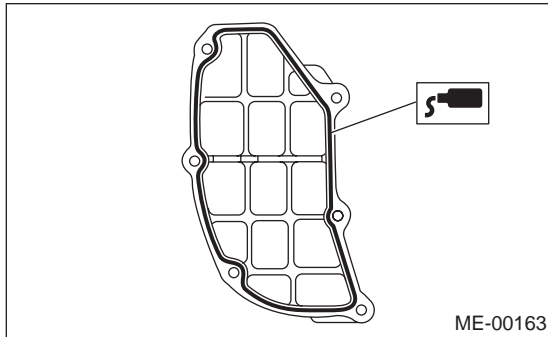
Install them within 20 min. from applying liquid gasket.

Liquid gasket:

THREE BOND 1207C (Part No. 004403012) or equivalent

Tightening torque:

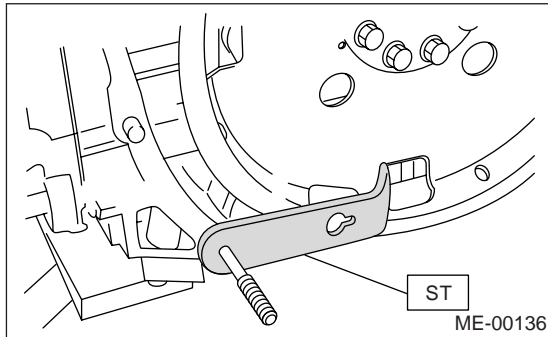
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



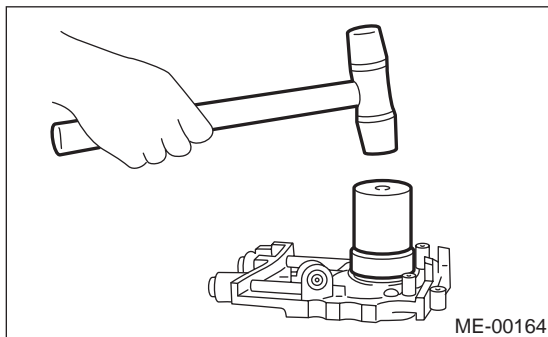
28) Install the drive plate.
To lock the crankshaft, use ST.
ST 498497100 CRANKSHAFT STOPPER

Tightening torque:

72 N·m (7.3 kgf-m, 53.1 ft-lb)



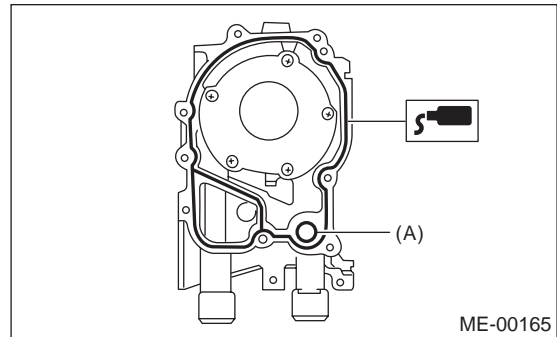
29) Installation of oil pump:
(1) Install the front oil seal by using ST.
ST 499587100 OIL SEAL INSTALLER
NOTE:
Use a new front oil seal.



(2) Apply liquid gasket to the matching surface of oil pump.

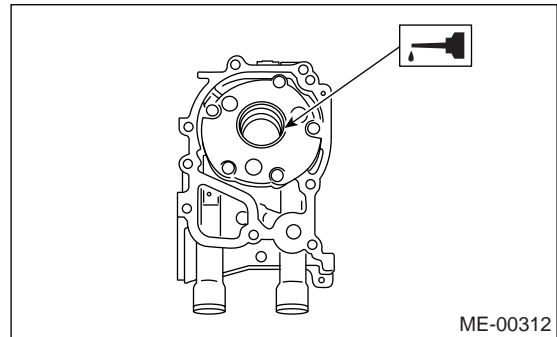
Liquid gasket:

THREE BOND 1215 (Part No. 004403007) or equivalent



(A) O-ring

(3) Apply a coat of engine oil to the inside of oil seal.



(4) Install the oil pump on cylinder block. Be careful not to damage the oil seal during installation.

Tightening torque:

6.4 N·m (0.65 kgf-m, 4.7 ft-lb)

CAUTION:

- Do not forget to install the O-ring and seal when installing the oil pump.
- Align the flat surface of oil pump's inner rotor with crankshaft before installation.

30) Install the water pump and gasket.

Tightening torque:

First: 12 N·m (1.2 kgf-m, 8.7 ft-lb)

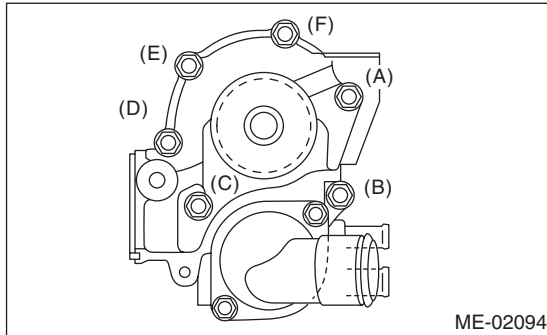
Second: 12 N·m (1.2 kgf-m, 8.7 ft-lb)

Cylinder Block

MECHANICAL

CAUTION:

- Be sure to use a new gasket.
- When installing the water pump, tighten the bolts in two stages in alphabetical sequence as shown in the figure.



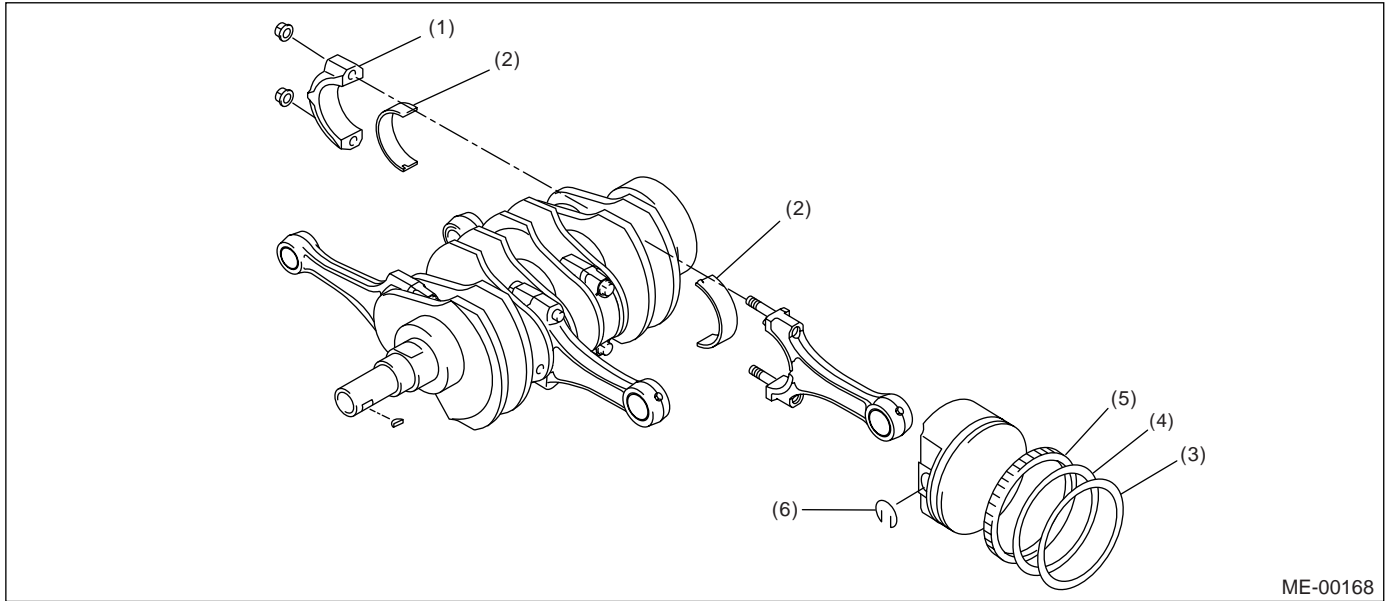
- 31) Install the water by-pass pipe for heater.
- 32) Install the oil filter.
- 33) Install the water by-pass pipe between oil cooler and water pump.
- 34) Install the water pipe.

NOTE:

Always use new O-rings.

- 35) Install the cylinder head.
<Ref. to ME(H4DOTC)-59, INSTALLATION, Cylinder Head.>
- 36) Install the oil level gauge guide. (LH side)
- 37) Install the rocker cover.
- 38) Install the crank sprocket.
<Ref. to ME(H4DOTC)-52, INSTALLATION, Crank Sprocket.>
- 39) Install the cam sprocket.
<Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>
- 40) Install the timing belt.
<Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>
- 41) Install the timing belt cover.
<Ref. to ME(H4DOTC)-42, INSTALLATION, Timing Belt Cover.>
- 42) Install the crank pulley.
<Ref. to ME(H4DOTC)-41, INSTALLATION, Crank Pulley.>
- 43) Install the generator and A/C compressor brackets on cylinder head.
- 44) Install the V-belts. <Ref. to ME(H4DOTC)-39, INSTALLATION, V-belt.>
- 45) Install the intake manifold.
<Ref. to FU(H4DOTC)-15, INSTALLATION, Intake Manifold.>

C: DISASSEMBLY



(1) Connecting rod cap

(3) Top ring

(5) Oil ring

(2) Connecting rod bearing

(4) Second ring

(6) Snap ring

1) Remove the connecting rod cap.

2) Remove the connecting rod bearing.

NOTE:

Arrange the removed connecting rod, connecting rod cap and bearing in order to prevent confusion.

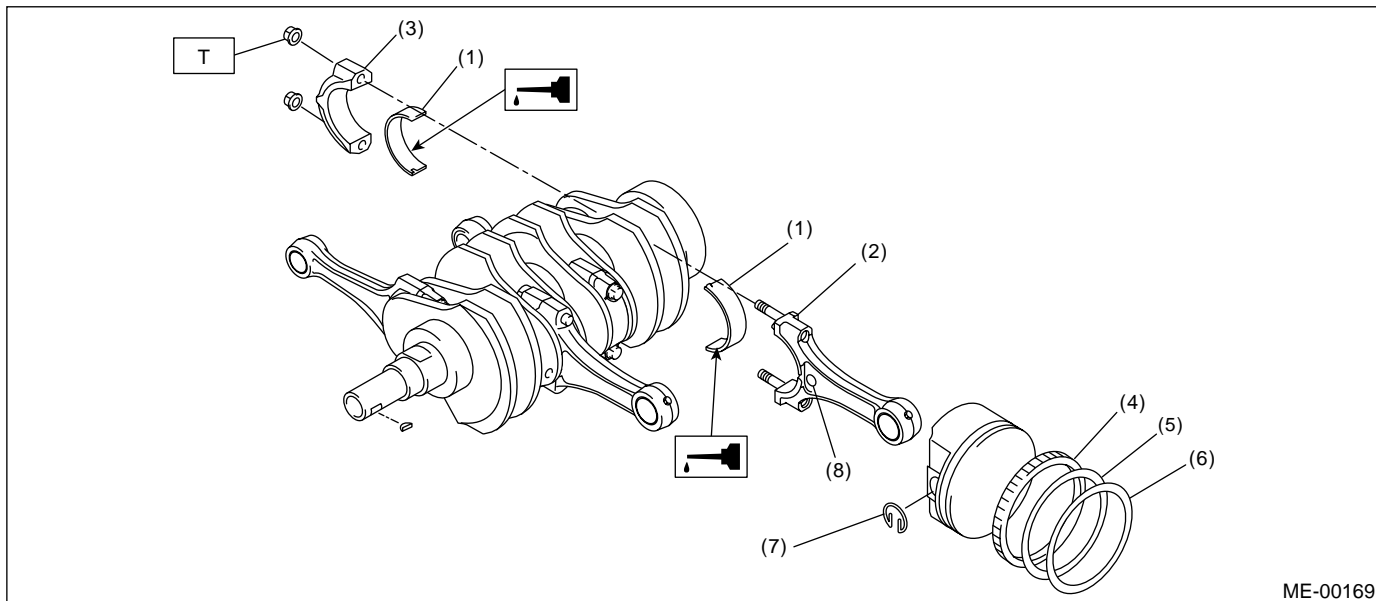
3) Remove the piston rings using a piston ring expander.

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

ME-00169

- | | |
|----------------------------|-----------------|
| (1) Connecting rod bearing | (5) Second ring |
| (2) Connecting rod | (6) Top ring |
| (3) Connecting rod cap | (7) Snap ring |
| (4) Oil ring | (8) Side mark |

Tightening torque: N·m (kgf-m, ft-lb)
T: 45 (4.6, 33)

1) Apply oil to the surfaces of the connecting rod bearings. Install the connecting rod bearings on connecting rods and connecting rod caps.

2) Install the connecting rod on crankshaft.

NOTE:

Position each connecting rod with the side marked facing forward.

3) Install the connecting rod cap.

Ensure the arrow mark on connecting rod cap facing front during installation.

CAUTION:

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching number.
- When tightening the connecting rod nuts, apply oil on the threads.

4) Install the oil ring spacer, upper rail and lower rail in this order by hand. Then install the second ring and top ring with a piston ring expander.

E: INSPECTION

1. CYLINDER BLOCK

- 1) Visually check for cracks and damage. Especially, inspect the important parts by means of red lead check.
- 2) Check the oil passages for clogging.
- 3) Inspect the crankcase surface that mates with cylinder head for warping by using a straight edge, and correct by grinding if necessary.

Warping limit:
0.025 mm (0.00098 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 cylinder block's front upper surface.

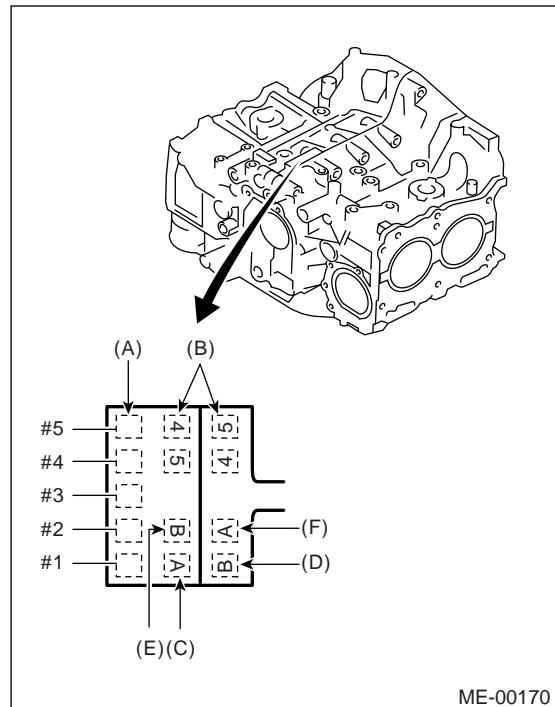
NOTE:

- 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: 92.005 — 92.015 mm (3.6222 — 3.6226 in)

B: 91.995 — 92.005 mm (3.6219 — 3.6222 in)



- (A) Main journal size mark
- (B) Cylinder block (RH) – (LH) combination mark
- (C) #1 cylinder bore size mark
- (D) #2 cylinder bore size mark
- (E) #3 cylinder bore size mark
- (F) #4 cylinder bore size mark

- 2) How to measure the inner diameter of each cylinder:

Measure the inner diameter of each cylinder in both the thrust and piston pin directions at the heights as shown in the figure, using a cylinder bore gauge.

NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

Taper:

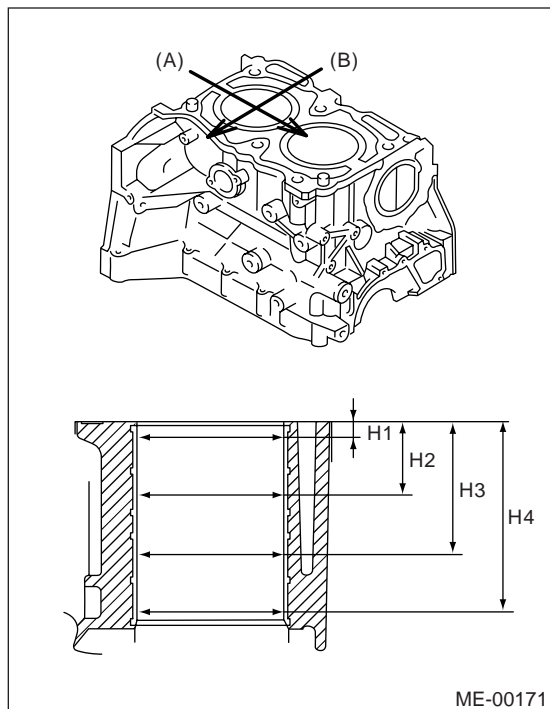
Standard
0.015 mm (0.0006 in)

Cylinder Block

Out-of-roundness:

Standard

0.010 mm (0.0004 in)



(A) Piston pin direction

(B) Thrust direction

H1: 10 mm (0.39 in)

H2: 45 mm (1.77 in)

H3: 80 mm (3.15 in)

H4: 115 mm (4.53 in)

3) When the piston is to be replaced due to general or cylinder wear, determine a suitable sized piston by measuring the piston clearance.

4) How to measure the outer diameter of each piston:

Measure the outer diameter of each piston at the height as shown in the figure. (Thrust direction)

NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

Piston grade point H:

40.0 mm (1.57 in)

Piston outer diameter:

Standard

A: 92.005 — 92.015 mm (3.6222 — 3.6226 in)

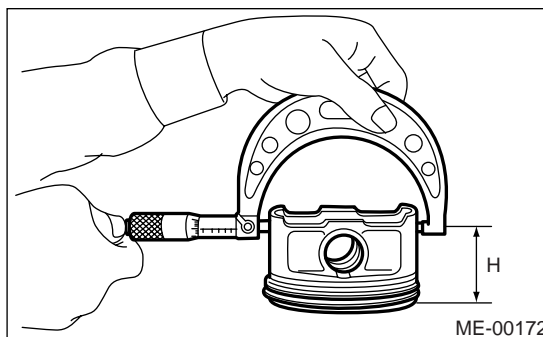
B: 91.995 — 92.005 mm (3.6219 — 3.6222 in)

0.25 mm (0.0098 in) oversize

92.245 — 92.265 mm (3.6317 — 3.6467 in)

0.50 mm (0.0197 in) oversize

92.495 — 92.515 mm (3.6415 — 3.6423 in)



5) Calculate the clearance between cylinder and piston.

NOTE:

Measurement should be performed at a temperature of 20°C (68°F).

Cylinder to piston clearance at 20°C (68°F):

Standard

-0.010 — 0.010 mm (-0.00039 — 0.00039 in)

6) Boring and honing:

(1) If one of the values of taper, out-of-roundness, or cylinder-to-piston clearance exceeds the specified limit or is out of standard, or if there is any damage on the cylinder wall, rebore it to use an oversize piston.

CAUTION:

When any of the cylinders needs reboring, all other cylinders must be bored at the same time, and use oversize pistons. Do not perform boring on one cylinder only. Nor use an oversize piston for one cylinder only.

(2) If the cylinder inner diameter exceeds 92.515 mm (3.6423 in) after boring and honing, replace the crankcase.

NOTE:

Immediately after reboring, the cylinder diameter may differ from its real diameter due to temperature rise. Thus, pay attention to this when measuring the cylinder diameter.

3. PISTON AND PISTON PIN

1) Check the pistons and piston pins for damage, cracks, and wear and the piston ring grooves for wear and damage. Replace if defective.

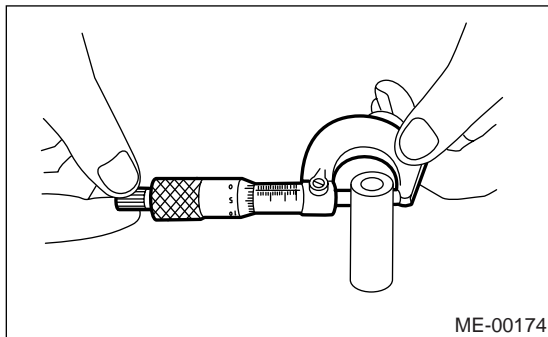
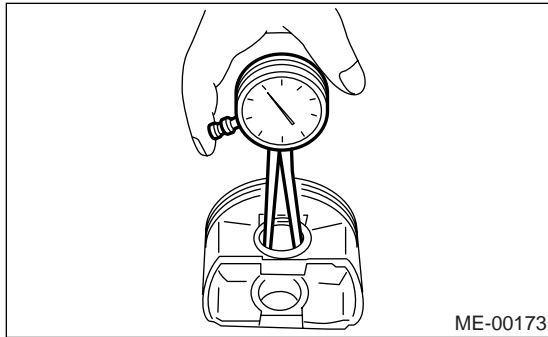
2) Measure the piston-to-cylinder clearance at each cylinder. <Ref. to ME(H4DOTC)-79, CYLINDER AND PISTON, INSPECTION, Cylinder Block.> If any of the clearances is out of specification, replace the piston or bore the cylinder to use an oversize piston.

3) Make sure that the piston pin can be inserted into the piston pin hole with your thumb at 20°C (68°F). Replace if defective.

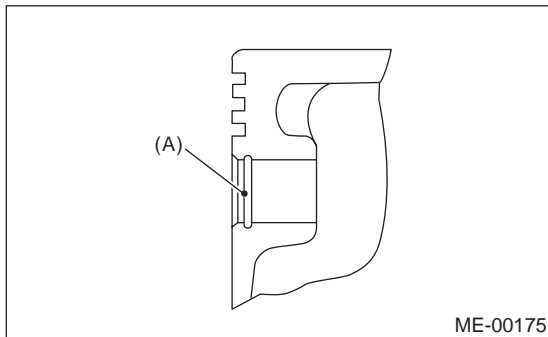
Standard clearance between piston pin and hole in piston:

Standard

0.004 — 0.008 mm (0.0002 — 0.0003 in)



4) Check the snap ring installation groove on the piston for burr (A). If necessary, remove burr from the groove so that the piston pin can lightly move.



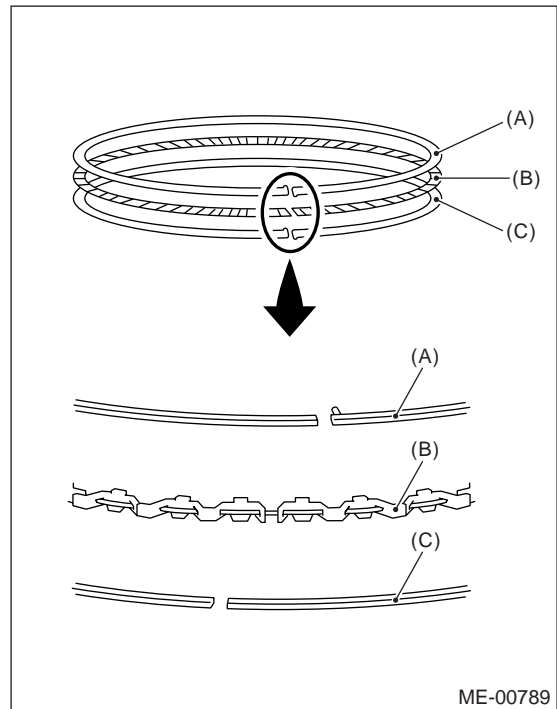
5) Check the piston pin snap ring for distortion, cracks and wear.

4. PISTON RING

1) If the piston ring is broken, damaged or worn, or if its tension is insufficient, or when the piston is replaced, replace the piston ring with a new one of the same size as the piston.

CAUTION:

- Marks are displayed on the end of top and second rings. When installing the rings to the piston, face those marks upward.
- Oil ring consists of the upper rail, expander and lower rail. When installing on piston, be careful of each rail's direction.



- (A) Upper rail
(B) Expander
(C) Lower rail

2) Squarely place the piston ring and oil ring in cylinder, and measure the piston ring gap with a thickness gauge.

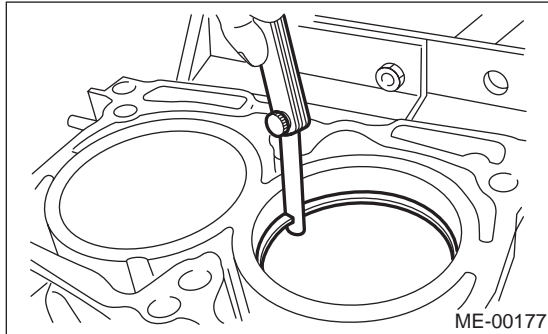
		Standard mm (in)
Piston ring gap	Top ring	Outer circle side: 0.20 — 0.25 (0.0079 — 0.0098) Inner circle side: 0.20 — 0.30 (0.0079 — 0.014)
	Second ring	0.40 — 0.50 (0.016 — 0.020)
	Oil ring rail	0.20 — 0.50 (0.0079 — 0.0197)

Cylinder Block

MECHANICAL

NOTE:

Difference between outer and inner perimeters of top ring should be within 0.05 mm (0.0020 in).

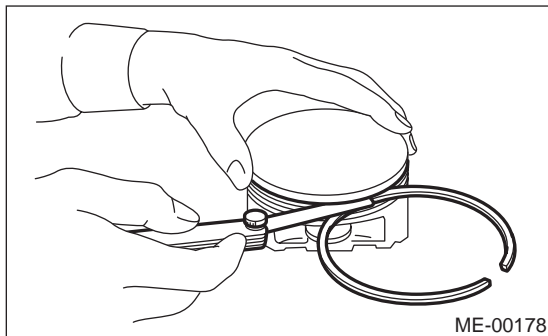


3) Measure the clearance between piston ring and piston ring groove with a thickness gauge.

NOTE:

Before measuring the clearance, clean the piston ring groove and piston ring.

		Standard mm (in)
Clearance between piston ring and piston ring groove	Top ring	0.030 — 0.070 (0.0012 — 0.0028)
	Second ring	0.030 — 0.070 (0.0012 — 0.0028)

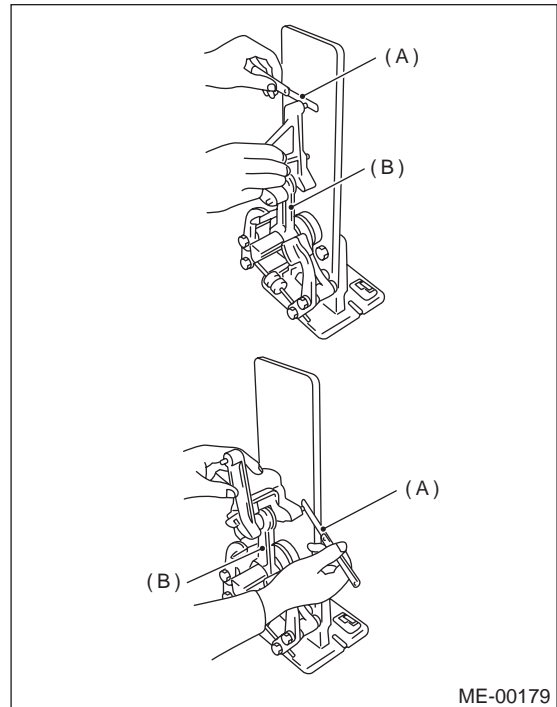


5. CONNECTING ROD

- 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

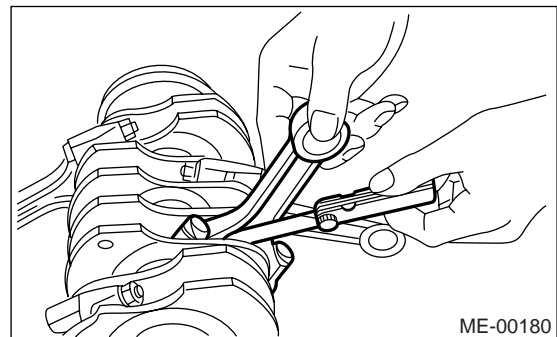
(B) Connecting rod

3) Install the connecting rod fitted with bearing to crankshaft and measure the side clearance (thrust clearance). If side clearance exceeds the limit or has partial wear, replace the connecting rod.

Connecting rod side 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 individual connecting rod bearings by means of plastigauge. If any oil clearance is not within the specification, replace the defective bearing with a new one of standard size or undersize as necessary. (See the table below.)

Connecting rod oil clearance:

Standard

0.026 — 0.052 mm (0.0010 — 0.0020 in)

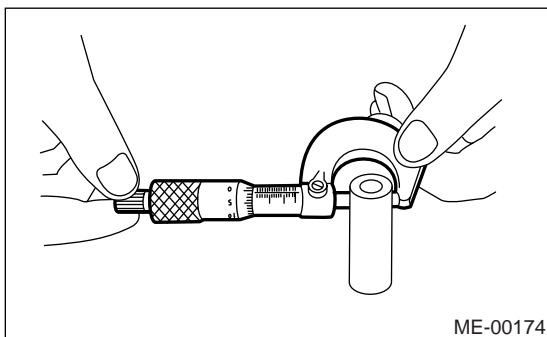
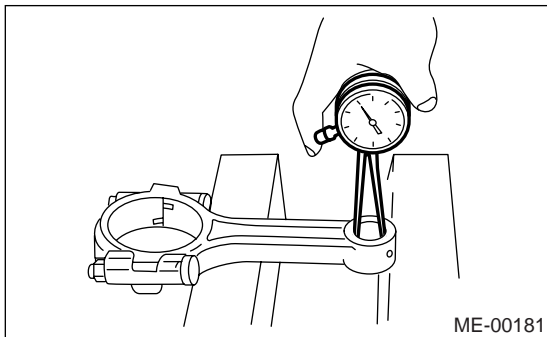
Unit: mm (in)		
Bearings	Bearing size (Thickness at center)	Outer diameter of crank pin
Standard	1.486 — 1.498 (0.0585 — 0.0590)	51.984 — 52.000 (2.0466 — 2.0472)
0.03 (0.0012) undersize	1.504 — 1.512 (0.0592 — 0.0595)	51.954 — 51.970 (2.0454 — 2.0461)
0.05 (0.0020) undersize	1.514 — 1.522 (0.0596 — 0.0599)	51.934 — 51.950 (2.0447 — 2.0453)
0.25 (0.0098) undersize	1.614 — 1.622 (0.0635 — 0.0639)	51.734 — 51.750 (2.0368 — 2.0374)

6) Inspect the bushing at connecting rod small end, and replace if worn or damaged. Also measure the piston pin clearance at the connecting rod small end.

Clearance between piston pin and bushing:

Standard

0 — 0.022 mm (0 — 0.0009 in)

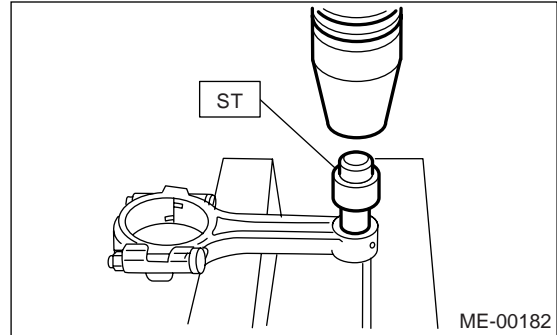


7) Replacement procedure is as follows.

- (1) Remove the bushing from connecting rod with ST and press.
- (2) Press the bushing with ST after applying oil on the periphery of bushing.

ST 499037100

CONNECTING ROD BUSHING REMOVER AND INSTALLER



- (3) Make two 3 mm (0.12 in) holes in bushing. Ream the inside of bushing.
- (4) After completion of reaming, clean the bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

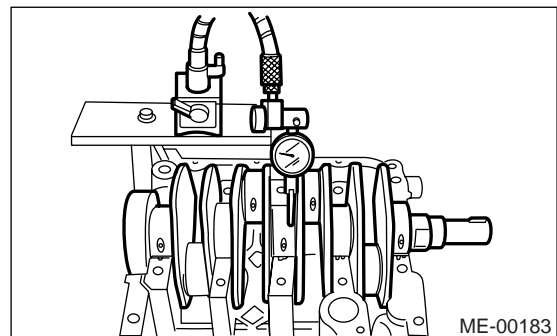
- 1) Clean the crankshaft completely, and check it for cracks using red lead. Replace if defective.
- 2) Measure the bend of crankshaft. If it exceeds the limit, repair or replace it.

NOTE:

If a suitable V-block is not available, install #1 and #5 crankshaft bearing on cylinder block, position the crankshaft on these bearings, and 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 specifications, replace the bearing with a suitable (undersize) one, and replace or recondition 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.

Cylinder Block

MECHANICAL

Crank pin and crank journal:

Out-of-roundness

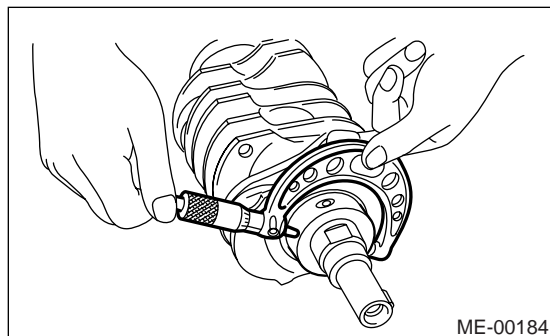
0.005 mm (0.0002 in) or less

Cylindricity

0.006 mm (0.0002 in)

Grinding limit (dia.)

51.750 mm (2.0374 in)



Unit: mm (in)				
		Crank journal diameter		Crank pin diameter
		#1, #3	#2, #4, #5	
Standard	Journal O.D.	59.992 — 60.008 (2.3619 — 2.3625)	59.992 — 60.008 (2.3619 — 2.3625)	51.984 — 52.000 (2.0466 — 2.0472)
	Bearing size (Thickness at center)	1.998 — 2.011 (0.0787 — 0.0792)	2.000 — 2.013 (0.0787 — 0.0793)	1.486 — 1.498 (0.0585 — 0.0590)
0.03 (0.0012) undersize	Journal O.D.	59.962 — 59.978 (2.3607 — 2.3613)	59.962 — 59.978 (2.3607 — 2.3613)	51.954 — 51.970 (2.0454 — 2.0461)
	Bearing size (Thickness at center)	2.017 — 2.020 (0.0794 — 0.0795)	2.019 — 2.022 (0.0795 — 0.0796)	1.504 — 1.512 (0.0592 — 0.0595)
0.05 (0.0020) undersize	Journal O.D.	59.942 — 59.958 (2.3599 — 2.3605)	59.942 — 59.958 (2.3599 — 2.3605)	51.934 — 51.950 (2.0447 — 2.0453)
	Bearing size (Thickness at center)	2.027 — 2.030 (0.0798 — 0.0799)	2.029 — 2.032 (0.0799 — 0.0800)	1.514 — 1.522 (0.0596 — 0.0599)
0.25 (0.0098) undersize	Journal O.D.	59.742 — 59.758 (2.3520 — 2.3527)	59.742 — 59.758 (2.3520 — 2.3527)	51.734 — 51.750 (2.0368 — 2.0374)
	Bearing size (Thickness at center)	2.127 — 2.130 (0.0837 — 0.0839)	2.129 — 2.132 (0.0838 — 0.0839)	1.614 — 1.622 (0.0635 — 0.0639)

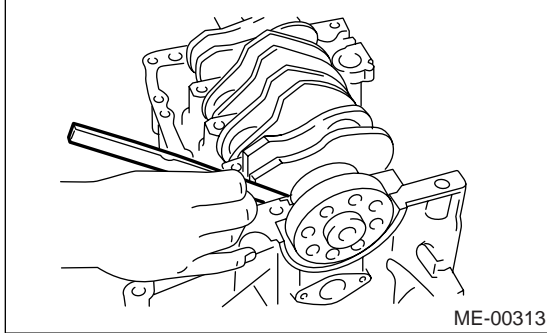
O.D. : Outer Diameter

4) Measure the thrust clearance of crankshaft at center bearing. If clearance exceeds the limit, replace the bearing.

Crankshaft side clearance:

Standard

0.030 — 0.115 mm (0.0012 — 0.0045 in)



5) Inspect individual crankshaft bearings for signs of flaking, seizure, melting, and wear.

6) Measure the oil clearance on each crankshaft bearing by means of plastigauge. If the measurement is not within the specification, replace the defective bearing with an undersize one, and replace or recondition the crankshaft as necessary.

Crankshaft oil clearance:

Standard

0.010 — 0.030 mm (0.00039 — 0.0012 in)

22.Intake and Exhaust Valve

A: SPECIFICATION

Refer to "Cylinder Head" for removal and installation procedures of intake and exhaust valves. <Ref. to ME(H4DOTC)-59, REMOVAL, Cylinder Head.>
<Ref. to ME(H4DOTC)-59, INSTALLATION, Cylinder Head.>

23.Piston

A: SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of pistons. <Ref. to ME(H4DOTC)-66, REMOVAL, Cylinder Block.> <Ref. to ME(H4DOTC)-69, INSTALLATION, Cylinder Block.>

24.Connecting Rod

A: SPECIFICATION

Refer to “Cylinder Block” for removal and installation procedures of connecting rod. <Ref. to ME(H4DOTC)-66, REMOVAL, Cylinder Block.>
<Ref. to ME(H4DOTC)-69, INSTALLATION, Cylinder Block.>

25.Crankshaft

A: SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of crankshaft. <Ref. to ME(H4DOTC)-66, REMOVAL, Cylinder Block.>
<Ref. to ME(H4DOTC)-69, INSTALLATION, Cylinder Block.>

Engine Trouble in General

MECHANICAL

26.Engine Trouble in General

A: INSPECTION

NOTE:

“RANK” shown in the chart refers to the possibility of the cause of trouble in order (“Very often” to “Rarely”)

A — Very often

B — Sometimes

C — Rarely

Symptom	Problem parts, etc.	Possible cause	RANK
1. Engine does not start.			
1) Starter does not turn.	Starter	Defective battery-to-starter harness	B
		Defective ignition starter switch	C
		Defective inhibitor switch or neutral switch	C
		Defective starter	B
	Battery	Poor terminal connection	A
		Run-down battery	A
		Defective charging system	B
	Friction	Seizure of crankshaft and connecting rod bearing	C
		Seized camshaft	C
		Seized or stuck piston and cylinder	C
	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
		Lack of or insufficient fuel	B
	Belt	Trouble	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective 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

Engine Trouble in General

MECHANICAL

Symptom	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 or insufficient fuel	B
	Belt	Trouble	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective 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 or insufficient fuel	B
	Belt	Trouble	B
		Defective timing	B
	Compression	Incorrect valve clearance	C
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective 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

Engine Trouble in General

MECHANICAL

Symptom	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 or insufficient fuel	B
	Belt	Defective timing	C
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective 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
	Other	Evaporative emission control system malfunction	A
		Stuck or damaged throttle valve	B

Engine Trouble in General

MECHANICAL

Symptom	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 or insufficient fuel	C
	Belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	B
		Loosened cylinder head bolt or defective 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
	Other	Evaporative emission control system malfunction	A
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 or insufficient fuel	C
	Belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective 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
	Other	Evaporative emission control system malfunction	C

Engine Trouble in General

MECHANICAL

Symptom	Problem parts, etc.	Possible cause	RANK
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
	Other	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
	Other	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
	Belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective 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
	Other	Evaporative emission control system malfunction	C
8. Knocking	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Loosened oil filler cap	B
	Belt	Defective timing	B
	Compression	Incorrect valve clearance	C
		Incorrect valve timing	B
	Cooling System	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 O-ring	B
		Defective crankshaft oil seal	B
		Defective rocker cover gasket	B
		Loosened oil drain plug or defective gasket	B
		Loosened oil pan fitting bolts or defective oil pan	B

Engine Trouble in General

MECHANICAL

Symptom	Problem parts, etc.	Possible cause	RANK
10. Excessive fuel consumption	Engine control system <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>		A
	Intake system	Dirty air cleaner element	A
	Belt	Defective timing	B
	Compression	Incorrect valve clearance	B
		Loosened spark plug or defective gasket	C
		Loosened cylinder head bolt or defective 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

27.Engine Noise

A: INSPECTION

Type of sound	Condition	Possible cause
Regular clicking sound	Sound increases as engine speed increases.	<ul style="list-style-type: none"> Valve mechanism is defective. Incorrect valve clearance Worn valve rocker Worn camshaft Broken valve spring
Heavy and dull clank	Oil pressure is low.	<ul style="list-style-type: none"> Worn crankshaft main bearing Worn connecting rod bearing (large end)
	Oil pressure is normal.	<ul style="list-style-type: none"> Loose flywheel mounting bolts Damaged engine mounting
High-pitched clank	Sound is noticeable when accelerating with an overload.	<ul style="list-style-type: none"> Ignition timing advanced Accumulation of carbon inside combustion chamber Wrong spark plug Improper gasoline
Clank when engine speed is 1,000 to 2,000 rpm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> Worn crankshaft main bearing Worn bearing at crankshaft end of connecting rod
Knocking sound when engine is operating under idling speed and engine is warm	Sound is reduced when fuel injector connector of noisy cylinder is disconnected. (NOTE*)	<ul style="list-style-type: none"> Worn cylinder liner and piston ring Broken or stuck piston ring Worn piston pin and hole at piston end of connecting rod
	Sound is not reduced if each fuel injector connector is disconnected in turn. (NOTE*)	<ul style="list-style-type: none"> Unusually worn valve lifter Worn cam gear Worn camshaft journal bore in crankcase
Squeaky sound	—	<ul style="list-style-type: none"> Insufficient generator lubrication
Rubbing sound	—	<ul style="list-style-type: none"> Defective generator brush and rotor contact
Gear scream when starting engine	—	<ul style="list-style-type: none"> Defective ignition starter switch Worn gear and starter pinion
Sound like polishing glass with a dry cloth	—	<ul style="list-style-type: none"> Loose drive belt Defective water pump shaft
Hissing sound	—	<ul style="list-style-type: none"> Loss of compression Air leakage in air intake system, hoses, connections or manifolds
Timing belt noise	—	<ul style="list-style-type: none"> Loose timing belt Belt contacting case/adjacent part
Valve tappet noise	—	<ul style="list-style-type: none"> Incorrect valve clearance

NOTE*:

When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory. Therefore, carry out the clear memory mode <Ref. to EN(H4DOTC)(diag)-30, OPERATION, Clear Memory Mode.> and inspection mode <Ref. to EN(H4DOTC)(diag)-28, PROCEDURE, Inspection Mode.> after connecting the fuel injector connector.

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

MECHANICAL

ME(H4DOTC)

	Page
1. General Description	2
2. Compression	21
3. Idle Speed	22
4. Ignition Timing	23
5. Intake Manifold Vacuum.....	24
6. Engine Oil Pressure	25
7. Fuel Pressure	26
8. Valve Clearance	27
9. Engine Assembly	30
10. Engine Mounting	36
11. Linear Motion Mounting.....	37
12. Preparation for Overhaul.....	38
13. V-belt	39
14. Crank Pulley	41
15. Timing Belt Cover.....	42
16. Timing Belt	43
17. Cam Sprocket	51
18. Crank Sprocket	52
19. Camshaft.....	53
20. Cylinder Head	59
21. Cylinder Block	66
22. Intake and Exhaust Valve	86
23. Piston	87
24. Connecting Rod	88
25. Crankshaft.....	89
26. Engine Trouble in General	90
27. Engine Noise	96

General Description

MECHANICAL

1. General Description

A: SPECIFICATION

Engine	Cylinder arrangement			Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine
	Valve system mechanism			Belt driven, double overhead camshaft, 4 valves/cylinder
	Bore × Stroke mm (in)			92 × 75 (3.62 × 2.95)
	Displacement cm ³ (cu in)			1,994 (121.67)
	Compression ratio			9.5
	Compression pressure (at 400 rpm) kPa (kg/cm ² , psi)			1,100 — 1,300 (11.2 — 13.3, 160 — 189)
	Number of piston rings			Pressure ring: 2, Oil ring: 1
	Intake valve timing	Open	Max.retard	ATDC 6°
			Min.advance	BTDC 37°
		Close	Max.retard	ABDC 62°
			Min.advance	ABDC 19°
	Exhaust valve timing	Open	Max.retard	BBDC 60°
			Min.advance	BBDC 30°
		Close	Max.retard	BTDC 2°
			Min.advance	ATDC 28°
	Valve clearance mm (in)	Intake		0.20 ^{+0.04} _{-0.06} (0.0079 ^{+0.0016} _{-0.0024})
		Exhaust		0.35±0.05 (0.0138±0.0020)
Idle speed ["P"/"N" range] rpm	No-load		650±50	
	A/C ON		825±50	
Ignition order			1 → 3 → 2 → 4	
Ignition timing BTDC/rpm			14°±3°/650	

NOTE:

OS: Oversize US: Undersize

Belt tension adjuster	Protrusion of adjuster rod			mm (in)	5.2 — 6.2 (0.205 — 0.244)	
Belt tensioner	Spacer O.D.			mm (in)	17.955 — 17.975 (0.7069 — 0.7077)	
	Tensioner bush I.D.			mm (in)	18.0 — 18.08 (0.7087 — 0.7118)	
	Clearance between spacer and bush	mm (in)	Standard		0.025 — 0.125 (0.0010 — 0.0049)	
	Side clearance of spacer	mm (in)	Standard		0.2 — 0.55 (0.0079 — 0.0217)	
Camshaft	Bend limit			mm (in)	0.020 (0.0079) or less	
	Side clearance			mm (in)	Standard	0.068 — 0.116 (0.0027 — 0.0047)
	Cam lobe height	mm (in)	Intake	Standard	45.85 — 45.95 (1.805 — 1.809)	
			Exhaust	Standard	45.75 — 45.85 (1.801 — 1.805)	
	Journal O.D.	mm (in)	Standard	Front	37.946 — 37.963 (1.4939 — 1.4946)	
				Center rear	29.946 — 29.963 (1.1790 — 1.1796)	
	Clearance at journal			mm (in)	Standard	0.037 — 0.072 (0.0015 — 0.0028)
Cylinder Head	Surface warpage limit			mm (in)	0.035 (0.0014)	
	Grinding limit			mm (in)	0.3 (0.012)	
	Standard height			mm (in)	127.5 (5.02)	
Valve seat	Refacing angle				90°	
	Contacting width	mm (in)	Intake	Standard	0.6 — 1.4 (0.024 — 0.055)	
			Exhaust	Standard	1.2 — 1.8 (0.047 — 0.071)	
Valve guide	Inside diameter			mm (in)	6.000 — 6.012 (0.2362 — 0.2367)	
	Protrusion above head			mm (in)	15.8 — 16.2 (0.622 — 0.638)	

General Description

MECHANICAL

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)	
	Stem outer diameters	mm (in)	Intake		5.955 — 5.970 (0.2344 — 0.2350)	
			Exhaust		5.945 — 5.960 (0.2341 — 0.2346)	
	Valve stem gap	mm (in)	Standard	Intake	0.030 — 0.057 (0.0012 — 0.0022)	
				Exhaust	0.040 — 0.067 (0.0016 — 0.0026)	
Overall length	mm (in)	Intake		104.4 (4.110)		
		Exhaust		104.65 (4.1201)		
Valve springs	Free length				mm (in) 44.67 (1.759)	
	Squareness				2.5°, 2.0 mm (0.079 in)	
	Tension/spring height			Set	206 — 236 (21.0 — 24.1, 46.3 — 53.1)/36.0 (1.417)	
					Lift	485 — 537 (49.5 — 54.8, 109 — 121)/26.00 (1.024)
Cylinder block	Surface warpage limit (mating with cylinder head)				mm (in) 0.025 (0.00098)	
	Grinding limit				mm (in) 0.1 (0.004)	
	Cylinder inner diameter	mm (in)	Standard	A	92.005 — 92.015 (3.6222 — 3.6226)	
				B	91.995 — 92.005 (3.6218 — 3.6222)	
	Taper			mm (in)	Standard 0.015 (0.0006)	
	Out-of-roundness			mm (in)	Standard 0.010 (0.0004)	
	Piston clearance			mm (in)	Standard −0.010 — 0.010 (−0.00039 — 0.00039)	
Boring limit				mm (in) 0.5 (0.020)		
Piston	Outer diameter	mm (in)	Standard	A	92.005 — 92.015 (3.6222 — 3.6226)	
				B	91.995 — 92.005 (3.6219 — 3.6222)	
			0.25 (0.0098) OS			92.245 — 92.265 (3.6317 — 3.6467)
			0.50 (0.0197) OS			92.495 — 92.515 (3.6415 — 3.6423)
Piston pin	Standard clearance between piston and piston pin			mm (in)	Standard 0.004 — 0.008 (0.0002 — 0.0003)	
	Degree of fit				Piston pin must be fitted into position with thumb at 20°C (68°F).	
Piston ring	Ring closed gap	mm (in)	Top ring	Standard	Outer circle side: 0.20 — 0.25 (0.0079 — 0.0098)	
					Inner circle side: 0.20 — 0.35 (0.0079 — 0.014)	
			Second ring	Standard	0.40 — 0.50 (0.016 — 0.020)	
			Oil ring	Standard	0.20 — 0.50 (0.0079 — 0.0197)	
	Ring groove gap	mm (in)	Top ring	Standard	0.030 — 0.070 (0.0012 — 0.0028)	
Second ring			Standard	0.030 — 0.070 (0.0012 — 0.0028)		
Connecting rod	Bend or twist per 100 mm (3.94 in) in length			mm (in)	Limit 0.10 (0.0039)	
	Side clearance of large end			mm (in)	Standard 0.070 — 0.330 (0.0028 — 0.0130)	
Bearing of large end	Oil clearance			mm (in)	Standard 0.026 — 0.052 (0.0010 — 0.0020)	
	Bearing size (Thickness at center)	mm (in)	Standard		1.486 — 1.498 (0.0585 — 0.0590)	
			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)	

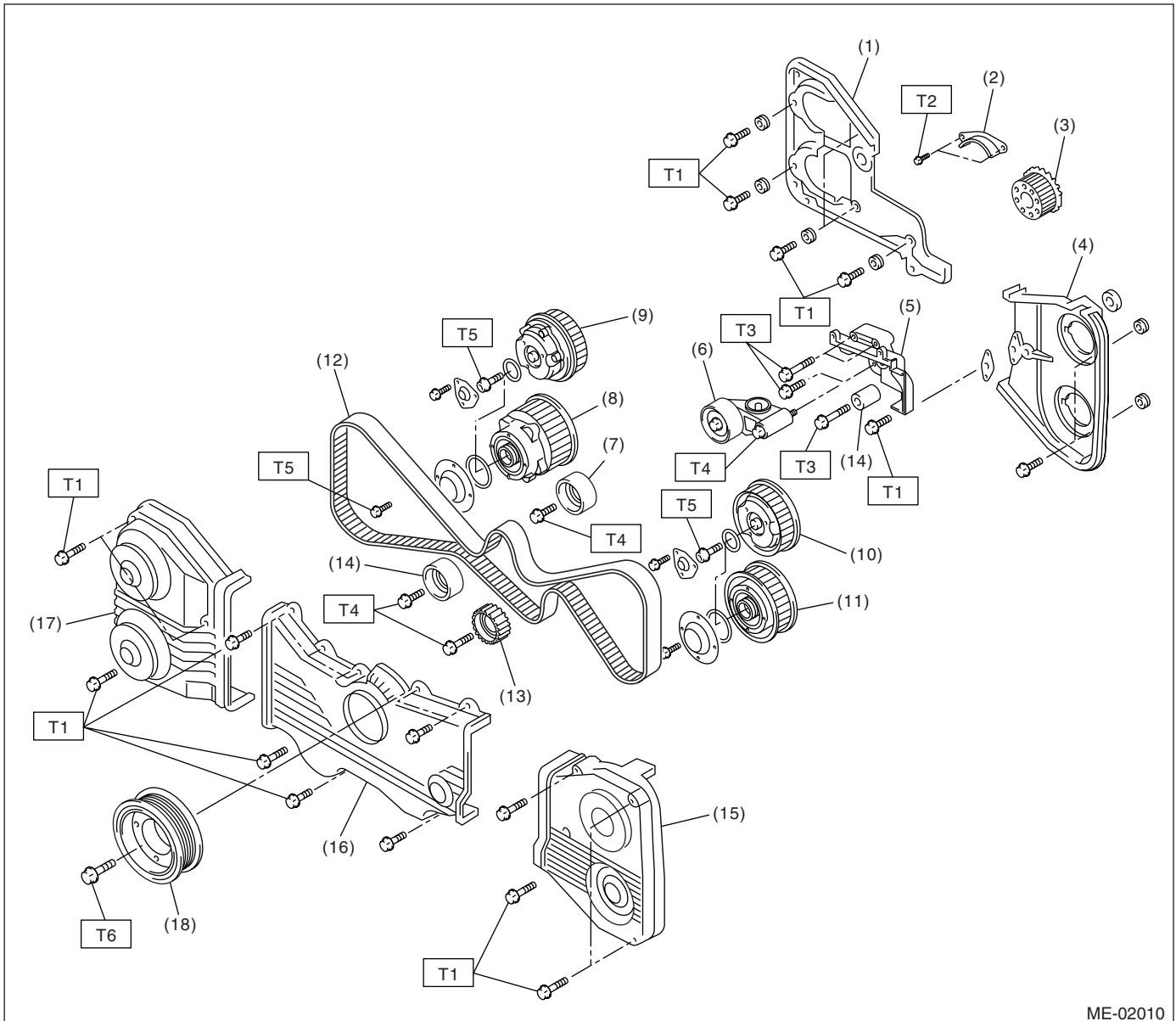
General Description

MECHANICAL

Crankshaft	Bend limit		mm (in)	0.035 (0.0014)	
	Crank pin and crank journal	Out-of-roundness		mm (in)	0.005 (0.0002) or less
		Grinding limit (dia.)		mm (in)	51.750 (2.0374)
	Crank pin outer diameter mm (in)		Standard	51.984 — 52.000 (2.0466 — 2.0472)	
			0.03 (0.0012) US	51.954 — 51.970 (2.0454 — 2.0461)	
			0.05 (0.0020) US	51.934 — 51.950 (2.0447 — 2.0453)	
			0.25 (0.0098) US	51.734 — 51.750 (2.0368 — 2.0374)	
	Crank journal outer diameter mm (in)		Standard	59.992 — 60.008 (2.3619 — 2.3625)	
			0.03 (0.0012) US	59.962 — 59.978 (2.3607 — 2.3613)	
			0.05 (0.0020) US	59.942 — 59.958 (2.3599 — 2.3605)	
0.25 (0.0098) US			59.742 — 59.758 (2.3520 — 2.3527)		
Side 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)
Main bearing	Bearing size (Thickness at center) mm (in)	#1, #3	Standard	1.998 — 2.011 (0.0787 — 0.0792)	
			0.03 (0.0012) US	2.017 — 2.020 (0.0794 — 0.0795)	
			0.05 (0.0020) US	2.027 — 2.030 (0.0798 — 0.0799)	
			0.25 (0.0098) US	2.127 — 2.130 (0.0837 — 0.0839)	
		#2, #4, #5	Standard	2.000 — 2.013 (0.0787 — 0.0793)	
			0.03 (0.0012) US	2.019 — 2.022 (0.0795 — 0.0796)	
			0.05 (0.0020) US	2.029 — 2.032 (0.0799 — 0.0800)	
			0.25 (0.0098) US	2.129 — 2.132 (0.0838 — 0.0839)	

B: COMPONENT

1. TIMING BELT



ME-02010

- | | |
|------------------------------------------|--------------------------------|
| (1) Timing belt cover No. 2 (RH) | (10) Intake cam sprocket (LH) |
| (2) Timing belt guide | (11) Exhaust cam sprocket (LH) |
| (3) Crank sprocket | (12) Timing Belt |
| (4) Timing belt cover No. 2 (LH) | (13) Belt idler No. 2 |
| (5) Tensioner bracket | (14) Belt idler |
| (6) Automatic belt tension adjuster ASSY | (15) Timing belt cover (LH) |
| (7) Belt idler | (16) Front belt cover |
| (8) Exhaust cam sprocket (RH) | (17) Timing belt cover (RH) |
| (9) Intake cam sprocket (RH) | (18) Crank pulley |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)

T2: 10 (1.0, 7.2)

T3: 25 (2.5, 18.1)

T4: 39 (4.0, 28.9)

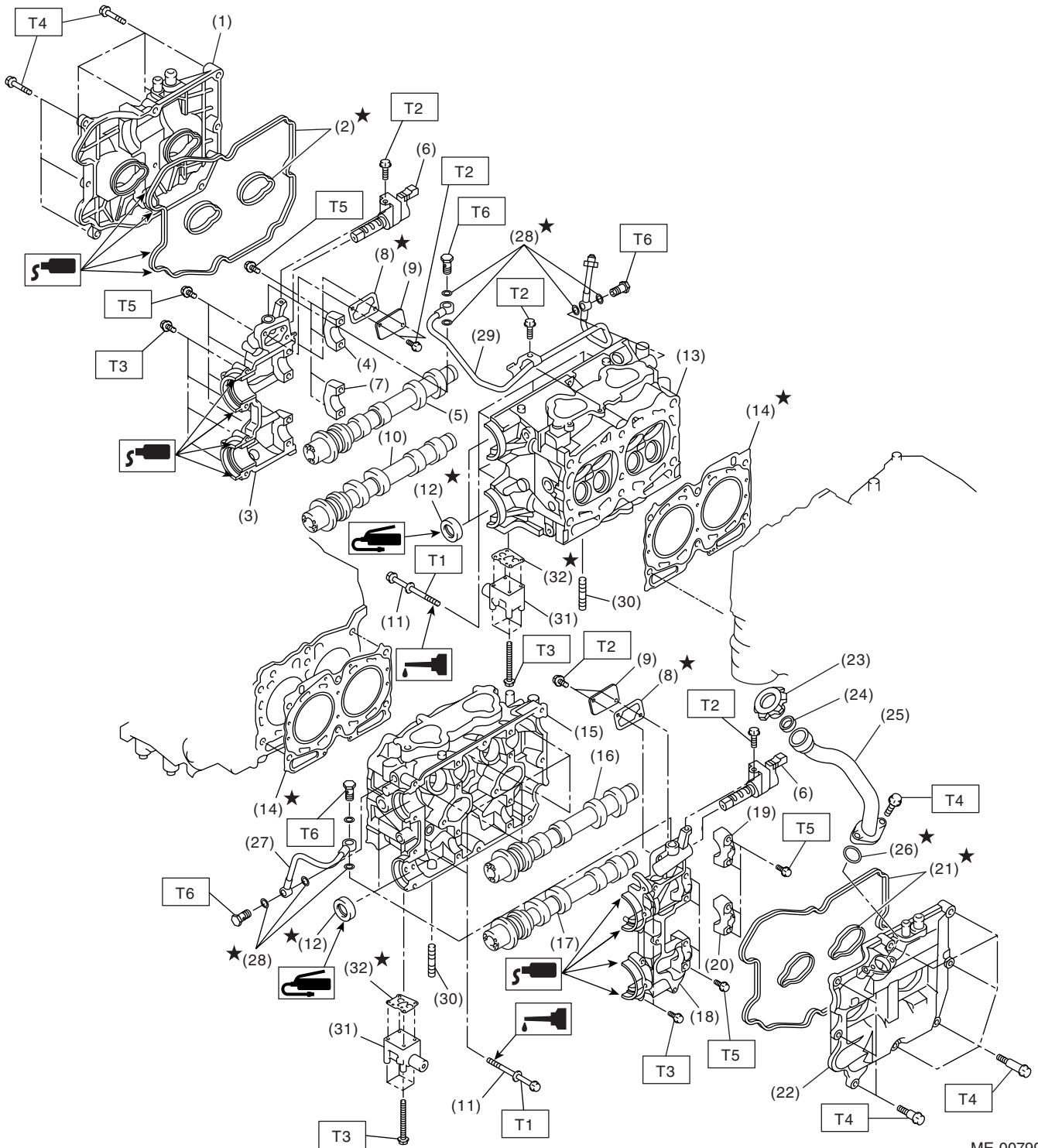
T5: <Ref. to ME(H4DOTC)-51, INSTALLATION, Cam Sprocket.>

T6: <Ref. to ME(H4DOTC)-41, INSTALLATION, Crank Pulley.>

General Description

MECHANICAL

2. CYLINDER HEAD AND CAMSHAFT



ME-00799

ME(H4DOTC)-6

General Description

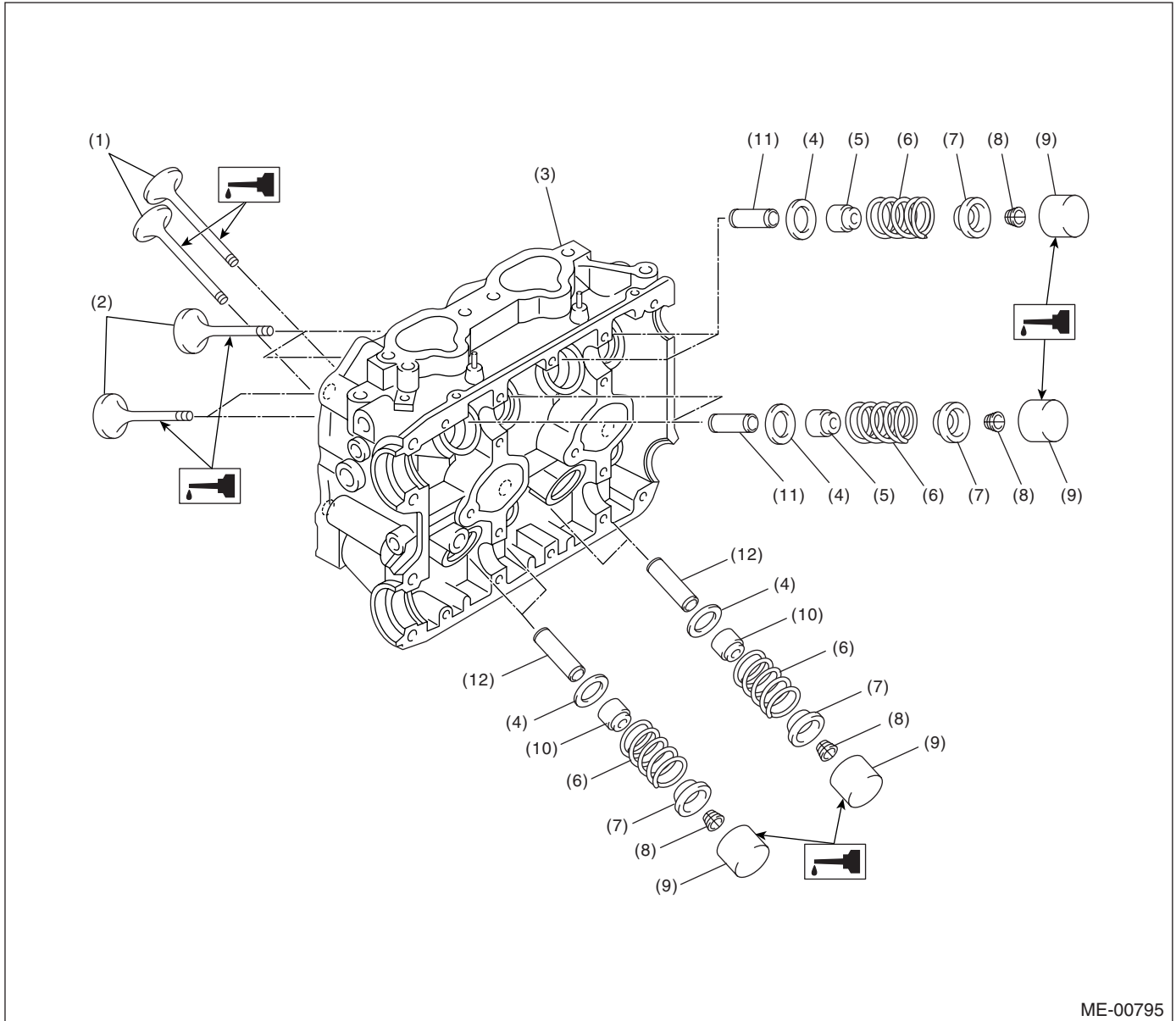
MECHANICAL

(1) Rocker cover (RH)	(15) Cylinder head (LH)	(30) Stud bolt
(2) Rocker cover gasket (RH)	(16) Intake camshaft (LH)	(31) Oil flow control solenoid valve (Exhaust)
(3) Camshaft cap (Front RH)	(17) Exhaust camshaft (LH)	(32) Gasket
(4) Intake camshaft cap (Rear RH)	(18) Camshaft cap (Front LH)	
(5) Intake camshaft (RH)	(19) Intake camshaft cap (Rear LH)	
(6) Oil flow control solenoid valve (Intake)	(20) Exhaust camshaft cap (Rear LH)	<hr/> Tightening torque: N·m (kgf-m, ft-lb)
(7) Exhaust camshaft cap (Rear RH)	(21) Rocker cover gasket (LH)	T1: <Ref. to ME(H4DOTC)-59, INSTALLATION, Cylinder Head.>
(8) Gasket	(22) Rocker cover (LH)	T2: 8 (0.8, 5.9)
(9) Oil return cover	(23) Oil filler cap	T3: 10 (1.0, 7.2)
(10) Exhaust camshaft (RH)	(24) Gasket	T4: 6.4 (0.65, 4.7)
(11) Cylinder head bolt	(25) Oil filler duct	T5: 20 (2.0, 14.5)
(12) Oil seal	(26) O-ring	T6: 29 (3.0, 21.4)
(13) Cylinder head (RH)	(27) Oil pipe (LH)	
(14) Cylinder head gasket	(28) Gasket	
	(29) Oil pipe (RH)	

General Description

MECHANICAL

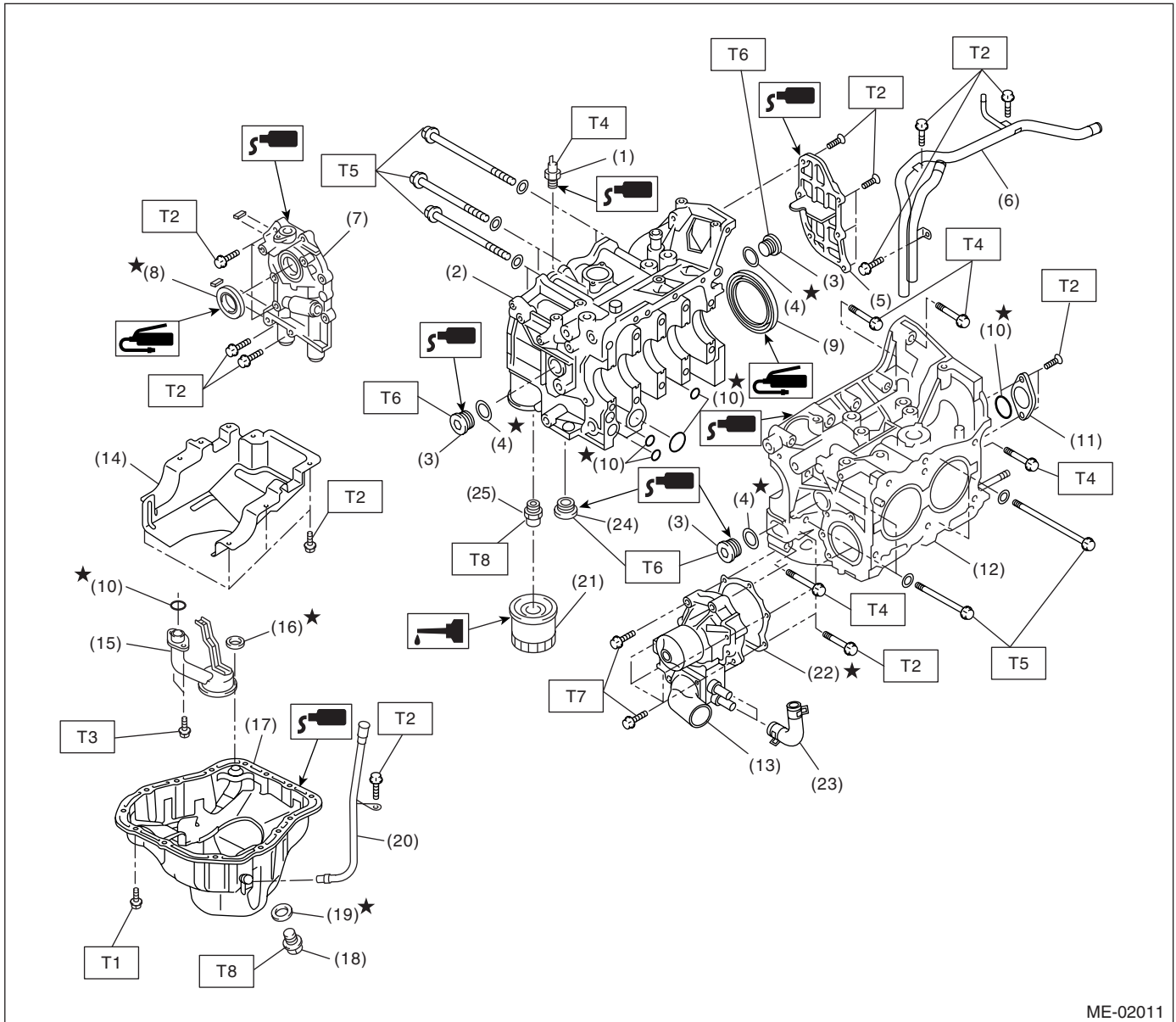
3. CYLINDER HEAD AND VALVE ASSEMBLY



ME-00795

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

4. CYLINDER BLOCK



ME-02011

- | | |
|--------------------------|----------------------------|
| (1) Oil pressure switch | (14) Baffle plate |
| (2) Cylinder block (RH) | (15) Oil strainer |
| (3) Service hole plug | (16) Gasket |
| (4) Gasket | (17) Oil pan |
| (5) Oil separator cover | (18) Drain plug |
| (6) Water by-pass pipe | (19) Metal gasket |
| (7) Oil pump | (20) Oil level gauge guide |
| (8) Front oil seal | (21) Oil filter |
| (9) Rear oil seal | (22) Gasket |
| (10) O-ring | (23) Water pump hose |
| (11) Service hole cover | (24) Plug |
| (12) Cylinder block (LH) | (25) Connector |
| (13) Water pump | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 5 (0.5, 3.6)

T2: 6.4 (0.65, 4.7)

T3: 10 (1.0, 7.2)

T4: 25 (2.5, 18.1)

**T5: <Ref. to ME(H4DOTC)-69,
INSTALLATION, Cylinder
Block.>**

T6: 70 (7.1, 51.6)

T7: First 12 (1.2, 8.7)

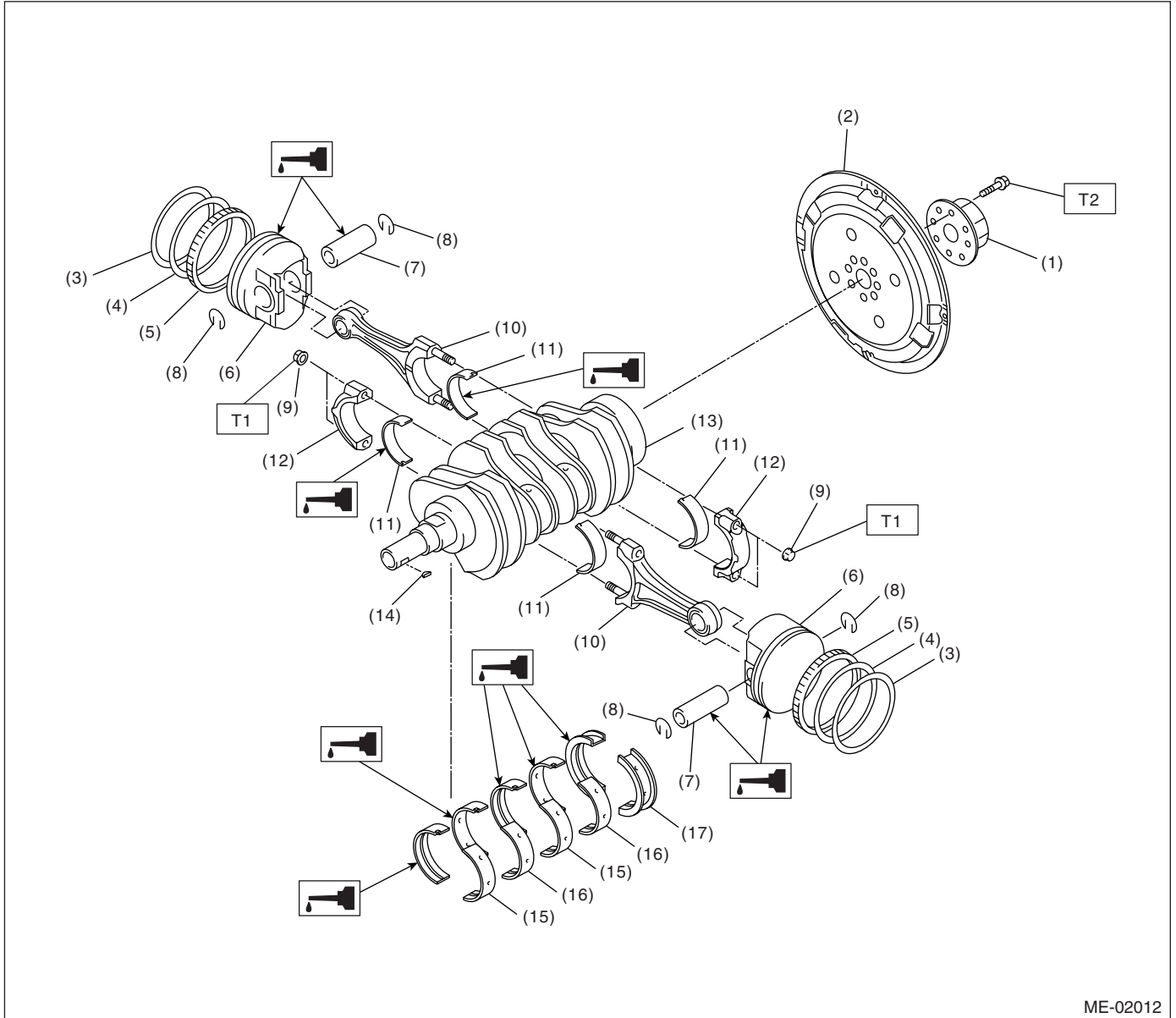
Second 12 (1.2, 8.7)

T8: 44 (4.5, 33)

General Description

MECHANICAL

5. CRANKSHAFT AND PISTON



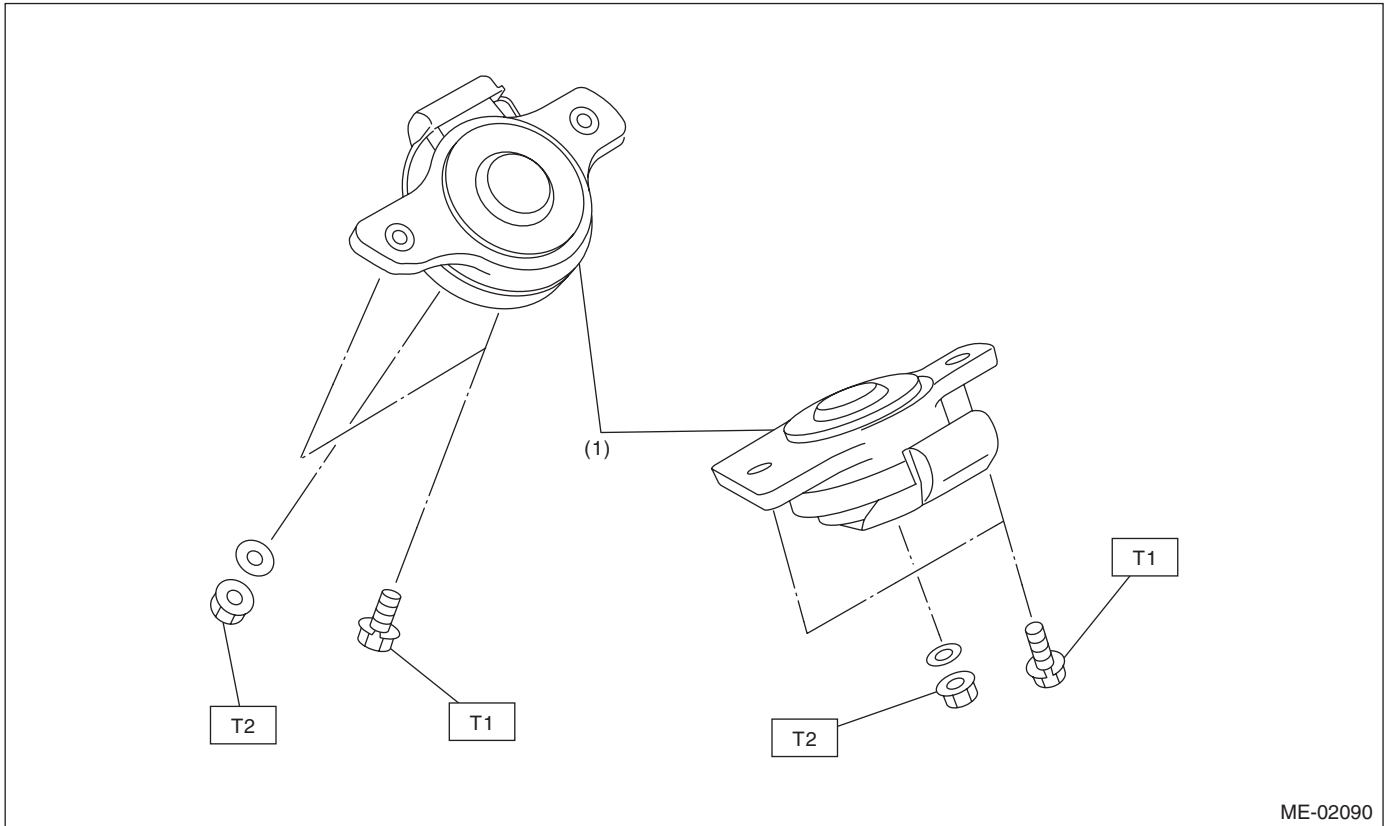
- | | | |
|-------------------|-----------------------------|--------------------------------|
| (1) Reinforcement | (8) Snap ring | (15) Crankshaft bearing #1, #3 |
| (2) Drive plate | (9) Connecting rod nut | (16) Crankshaft bearing #2, #4 |
| (3) Top ring | (10) Connecting rod | (17) Crankshaft bearing #5 |
| (4) Second ring | (11) Connecting rod bearing | |
| (5) Oil ring | (12) Connecting rod cap | |
| (6) Piston | (13) Crankshaft | |
| (7) Piston pin | (14) Woodruff key | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 52 (5.3, 38.4)

T2: 72 (7.3, 53.1)

6. ENGINE MOUNTING



(1) Front cushion rubber

Tightening torque: N·m (kgf-m, ft-lb)

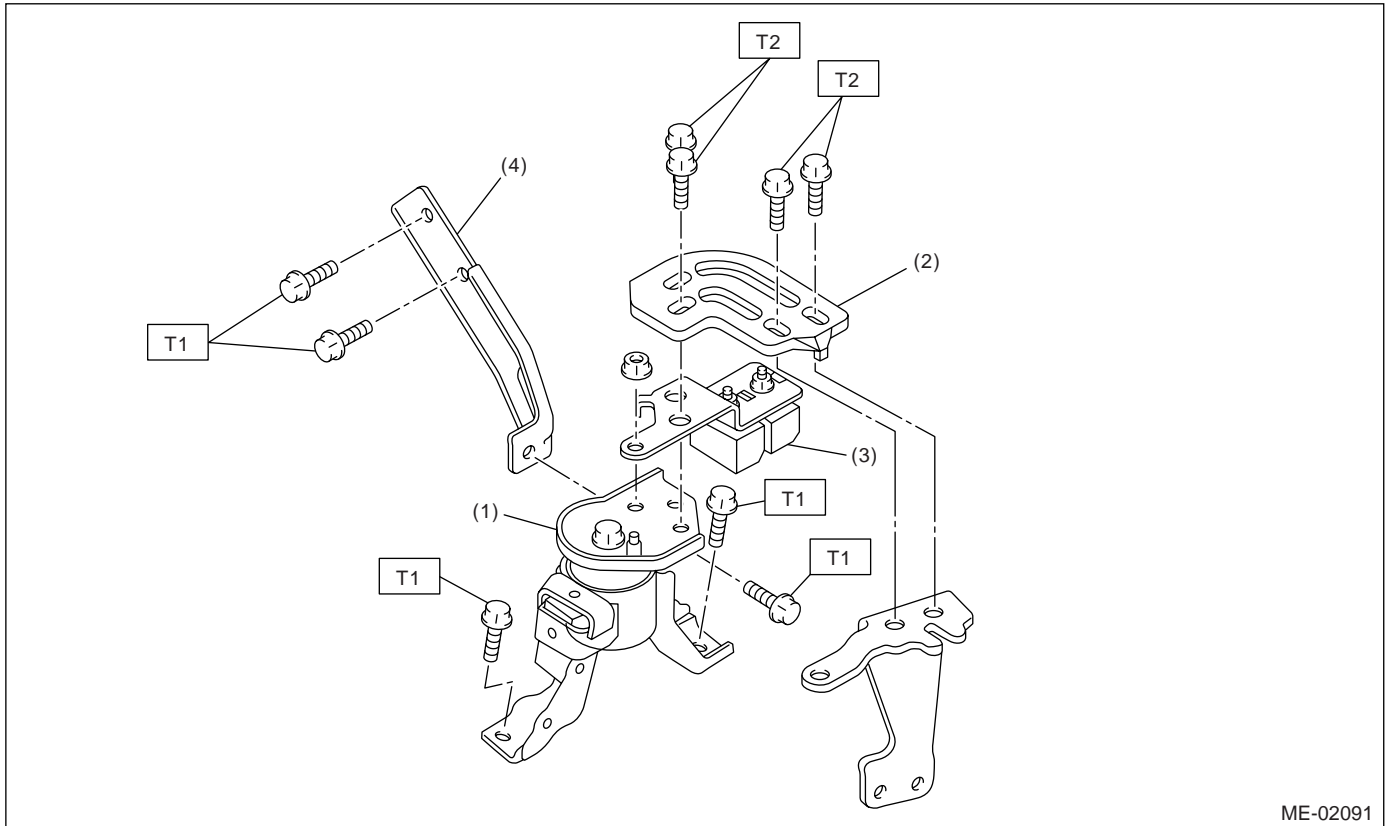
T1: 35 (3.6, 25.8)

T2: 85 (8.7, 62.7)

General Description

MECHANICAL

7. LINEAR MOTION MOUNTING



- (1) Linear motion mounting
- (2) Linear motion mounting bracket
- (3) Dynamic damper

- (4) Bracket

Tightening torque: N·m (kgf·m, ft·lb)

T1: 33 (3.4, 24.3)

T2: 30 (3.1, 22.1)

C: CAUTION

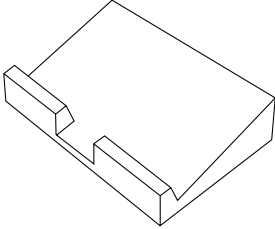
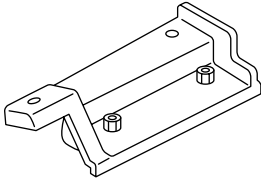
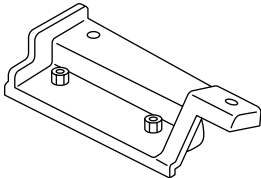
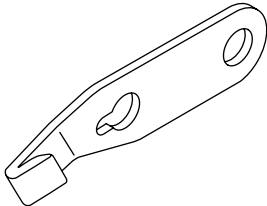
- Wear work clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Be careful not to burn yourself, because each part on the vehicle is hot after running.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting electrical connectors of sensors or units, be sure to disconnect the ground cable from battery.
- All parts should be thoroughly cleaned, paying special attention to the engine oil passages, pistons and bearings.
- Rotating parts and sliding parts such as piston, bearing and gear should be coated with oil prior to assembly.
- Be careful not to let oil, grease or coolant contact the timing belt, clutch disc and flywheel.
- All removed parts, if to be reused, should be reinstalled in the original positions and directions.
- Bolts, nuts and washers should be replaced with new ones as required.
- Even if necessary inspections have been made in advance, proceed with assembly work while making rechecks.
- Remove or install the engine in an area where chain hoists, lifting devices, etc. are available for ready use.
- Be sure not to damage coated surfaces of body panels with tools, or not to stain seats and windows with coolant or oil. Place a cover over fender, as required, for protection.
- Prior to starting work, prepare the following:
Service tools, clean cloth, containers to catch coolant and oil, wire ropes, chain hoist, transmission jacks, etc.
- Lift-up or lower the vehicle when necessary. Make sure to support the correct positions.

General Description

MECHANICAL

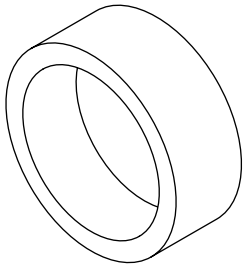
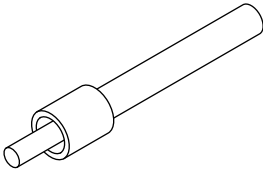
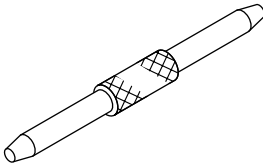
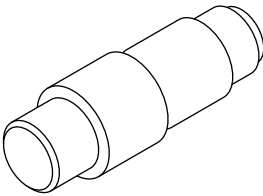
D: PREPARATION TOOL

1. SPECIAL TOOL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-498267600</p>	498267600	CYLINDER HEAD TABLE	<ul style="list-style-type: none"> Used for replacing valve guides. Used for removing and installing valve spring.
 <p>ST-498457000</p>	498457000	ENGINE STAND ADAPTER RH	Used with ENGINE STAND (499817000).
 <p>ST-498457100</p>	498457100	ENGINE STAND ADAPTER LH	Used with ENGINE STAND (499817000).
 <p>ST-498497100</p>	498497100	CRANKSHAFT STOPPER	Used for stopping rotation of drive plate when loosening/tightening crank pulley bolt.

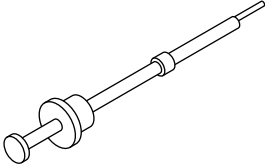
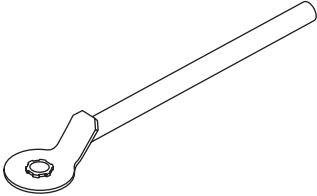
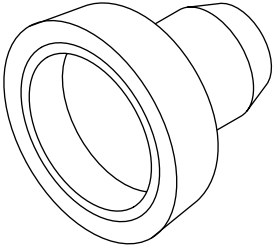
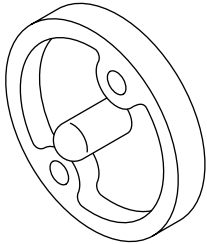
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-398744300</p>	398744300	PISTON GUIDE	Used for installing piston in cylinder.
 <p>ST-498857100</p>	498857100	VALVE OIL SEAL GUIDE	Used for press-fitting of intake and exhaust valve guide oil seals.
 <p>ST-499017100</p>	499017100	PISTON PIN GUIDE	Used for installing piston pin, piston and connecting rod.
 <p>ST-499037100</p>	499037100	CONNECTING ROD BUSHING REMOVER AND INSTALLER	Used for removing and installing connecting rod bushing.

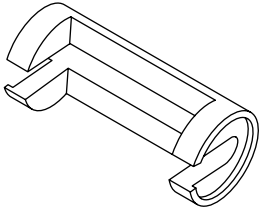
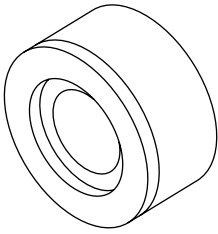
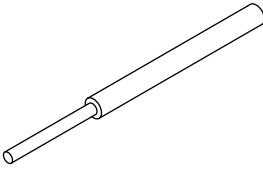
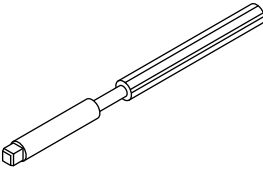
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499097700</p>	499097700	PISTON PIN REMOVER ASSY	Used for removing piston pin.
 <p>ST-499977500</p>	499977500	CAM SPROCKET WRENCH	Used for removing and installing the intake cam sprocket and exhaust cam sprocket.
 <p>ST-499587200</p>	499587200	CRANKSHAFT OIL SEAL INSTALLER	<ul style="list-style-type: none"> • Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL GUIDE (499597100).
 <p>ST-499597100</p>	499597100	CRANKSHAFT OIL SEAL GUIDE	<ul style="list-style-type: none"> • Used for installing crankshaft oil seal. • Used with CRANKSHAFT OIL SEAL INSTALLER (499587200).

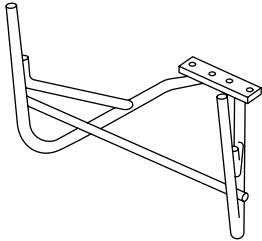
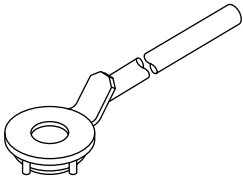
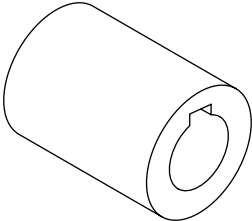
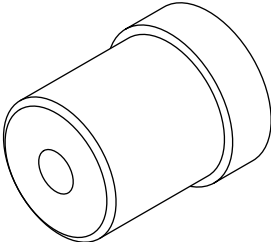
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499718000</p>	499718000	VALVE SPRING REMOVER	Used for removing and installing valve spring.
 <p>ST18251AA020</p>	18251AA020	VALVE GUIDE ADJUSTER	Used for installing intake and exhaust valve guides.
 <p>ST-499767200</p>	499767200	VALVE GUIDE REMOVER	Used for removing valve guides.
 <p>ST-499767400</p>	499767400	VALVE GUIDE REAMER	Used for reaming valve guides.

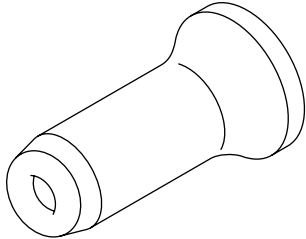
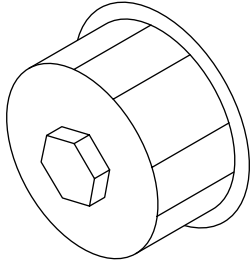
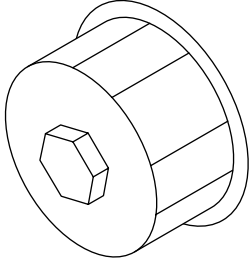
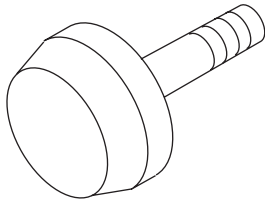
General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499817000</p>	499817000	ENGINE STAND	<ul style="list-style-type: none"> Stand used for engine disassembly and assembly. Used with ENGINE STAND ADAPTER RH (498457000) & LH (498457100).
 <p>ST-499977400</p>	499977400	CRANK PULLEY WRENCH	Used for stopping rotation of crank pulley when loosening/tightening crank pulley bolt.
 <p>ST-499987500</p>	499987500	CRANKSHAFT SOCKET	Used for rotating crankshaft.
 <p>ST-499587100</p>	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

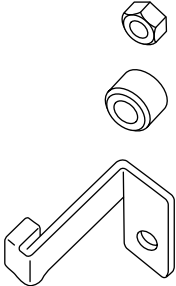
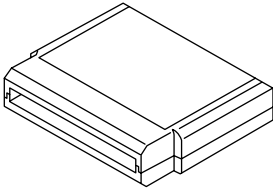

General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499587600</p>	499587600	OIL SEAL INSTALLER	Used for installing camshaft oil seal for DOHC engine.
 <p>ST18332AA000</p>	18332AA000	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 68 mm (2.68 in))
 <p>ST18332AA010</p>	18332AA010	OIL FILTER WRENCH	Used for removing and installing oil filter. (Outer diameter: 65 mm (2.56 in))
 <p>ST-499597200</p>	499597200	OIL SEAL GUIDE	<ul style="list-style-type: none"> Used for installing camshaft oil seal for DOHC engine. Used with OIL SEAL INSTALLER (499587600)

General Description

MECHANICAL

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p style="text-align: center;">ST-498277200</p>	498277200	STOPPER SET	Used for installing automatic transmission assembly to engine.
 <p style="text-align: center;">ST24082AA230</p>	24082AA230	CARTRIDGE	Troubleshooting for electrical system.
 <p style="text-align: center;">ST22771AA030</p>	22771AA030	SUBARU SELECT MONI- TOR KIT	Troubleshooting for electrical system. <ul style="list-style-type: none"> • English: 22771AA030 (Without printer) • German: 22771AA070 (Without printer) • French: 22771AA080 (Without printer) • Spanish: 22771AA090 (Without printer)

2. GENERAL TOOL

TOOL NAME	REMARKS
Compression gauge	Used for measuring compression.

E: PROCEDURE

It is possible to conduct the following service procedures with engine on the vehicle, however, the procedures described in this section are based on the condition that the engine is removed from vehicle.

- V-belt
- Timing belt
- Camshaft
- Cylinder head

2. Compression

A: INSPECTION

CAUTION:

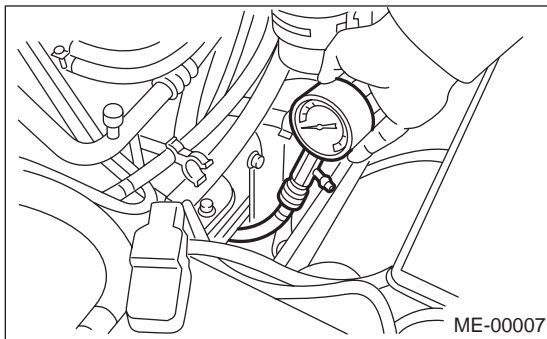
After warming-up, engine becomes very hot. Be careful not to burn yourself during measurement.

- 1) Remove the collector cover.
- 2) After warming-up the engine, turn the ignition switch to OFF.
- 3) Make sure that the battery is fully charged.
- 4) Release the fuel pressure. <Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 5) Remove all the spark plugs.
<Ref. to IG(H4DOTC)-4, REMOVAL, Spark Plug.>
- 6) Fully open the throttle valve.
- 7) Check the starter motor for satisfactory performance and operation.
- 8) Hold the compression gauge tight against the spark plug hole.

NOTE:

When using a screw-in type compression gauge, the screw (put into cylinder head spark plug hole) should be less than 18 mm (0.71 in) long.

- 9) Crank the engine by means of the starter motor, and read the maximum value on the gauge when the pointer is steady.



- 10) Perform at least two measurements per cylinder, and make sure that the values are correct.

Compression pressure (Throttle fully open):

Standard:

1,100 — 1,300 kPa (11.2 — 13.3 kg/cm², 160 — 189 psi)

Difference between cylinders:

49 kPa (0.5 kgf/cm², 7 psi) or less

3. Idle Speed

A: INSPECTION

1) Before checking the idle speed, check the following:

- (1) Ensure the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.
- (2) Ensure the malfunction indicator light does not illuminate.

2) Idle the engine.

3) Stop the engine, and turn the ignition switch to OFF.

4) Insert the cartridge to Subaru Select Monitor.

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

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

7) Select {Each System Check} in Main Menu.

8) Select {Engine} in Selection Menu.

9) Select {Current Data Display & Save} in Engine Control System Diagnosis.

10) Select {Data Display} in Data Display Menu.

11) Start the engine, and read the engine idle speed.

12) Check the idle speed when unloaded. (With headlights, heater fan, rear defroster, radiator fan, air conditioning, etc. OFF)

Idle speed [No load and gears in neutral]:

650±50 rpm

13) Check the idle speed when loaded. (Turn the air conditioning switch to “ON” and operate the compressor for at least one minute before measurement.)

Idle speed [A/C “ON”, and gears in neutral]:

825±50 rpm

NOTE:

Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted. If the idle speed is out of specifications, refer to General Diagnosis Table under “Engine Control System”.
<Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

4. Ignition Timing

A: INSPECTION

- 1) Before checking the ignition timing, check the following:
 - (1) Ensure the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
 - (2) Ensure the malfunction indicator light does not illuminate.
- 2) Idle the engine.
- 3) Stop the engine, and turn the ignition switch to OFF.
- 4) Insert the cartridge to Subaru Select Monitor.
- 5) Connect the Subaru Select Monitor to data link connector.
- 6) Turn the ignition switch to ON and Subaru Select Monitor switch to ON.
- 7) Select {Each System Check} in Main Menu.
- 8) Select {Engine} in Selection Menu.
- 9) Select {Current Data Display & Save} in Engine Control System Diagnosis.
- 10) Select {Data Display} in Data Display Menu.
- 11) Start the engine and check the ignition timing at idle speed.

Ignition timing [BTDC/rpm]:

14°±3°/650

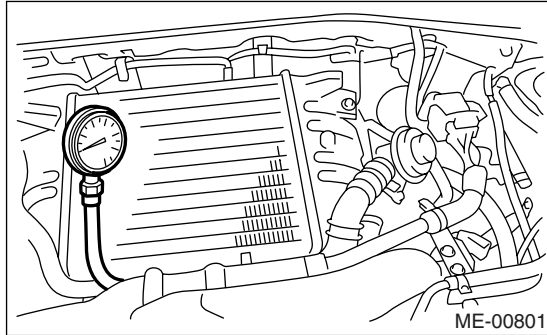
If the timing is not correct, check the ignition control system. Refer to "Engine Control System". <Ref. to EN(H4DOTC)(diag)-2, Basic Diagnostic Procedure.>

5. Intake Manifold Vacuum

A: INSPECTION

- 1) Remove the collector cover.
- 2) Idle the engine.
- 3) Disconnect the brake vacuum hose from intake manifold, and then install the vacuum gauge.
- 4) Keep the engine at idle speed and read the vacuum gauge indication.

By observing the gauge needle movement, internal condition of the engine can be diagnosed as described below.



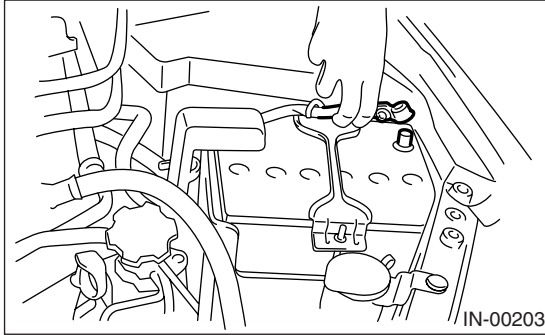
Vacuum pressure (at idling, A/C “OFF”):
–66.7 kPa (–500 mmHg, –19.70 inHg) or less

Diagnosis of engine condition by measurement of intake manifold vacuum	
Vacuum gauge indication	Possible engine condition
1. Needle motion is steady but lower than normal position. This tendency becomes more evident as engine temperature rises.	Leakage around intake manifold gasket, or disconnected or damaged vacuum hose
2. When engine speed is reduced slowly from higher speed, needle stops temporarily when it is lowering or becomes steady above normal position.	Back pressure too high, or exhaust system clogged
3. Needle intermittently drops to the lower position than normal.	Leakage around cylinder
4. Needle drops suddenly and intermittently from normal position.	Sticky valve
5. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases.	Weak or broken valve springs
6. Needle vibrates above and below normal position in narrow range.	Defective ignition system or throttle chamber idle adjustment

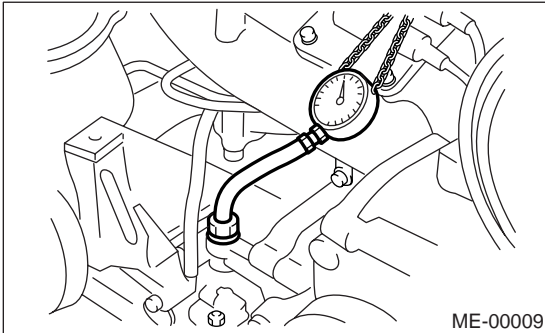
6. Engine Oil Pressure

A: INSPECTION

- 1) Remove the collector cover.
- 2) Remove the oil pressure switch from engine cylinder block. <Ref. to LU(H4DOTC)-16, REMOVAL, Oil Pressure Switch.>
- 3) Connect the oil pressure gauge hose to cylinder block.
- 4) Connect the battery ground cable to battery.



- 5) Start the engine, and measure the oil pressure.



Oil pressure:

Standard:

98 kPa (1.0 kgf/cm², 14 psi) or more (At 600 rpm)

588 kPa (6.0 kgf/cm², 85 psi) or more (At 6,000 rpm)

CAUTION:

- If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. <Ref. to LU(H4DOTC)-18, INSPECTION, Engine Lubrication System Trouble in General.>
- If the oil pressure warning light is turned to ON and oil pressure is within specification, replace the oil pressure switch. <Ref. to LU(H4DOTC)-18, INSPECTION, Engine Lubrication System Trouble in General.>

NOTE:

The specified value is based on an engine oil temperature of 80°C (176°F).

- 6) After measuring the oil pressure, install the oil pressure switch. <Ref. to LU(H4DOTC)-16, INSTALLATION, Oil Pressure Switch.>

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

7. Fuel Pressure

A: INSPECTION

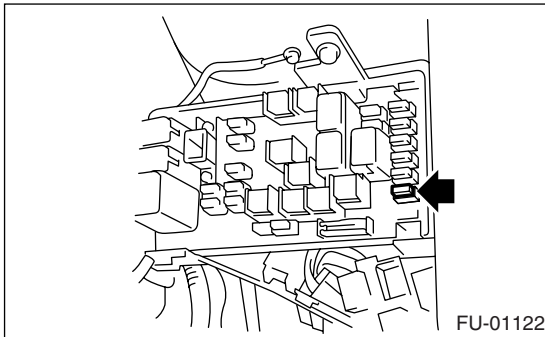
WARNING:

Before removing the fuel pressure gauge, release the fuel pressure.

NOTE:

When the fuel pressure is out of specification, check or replace the pressure regulator and pressure regulator vacuum hose.

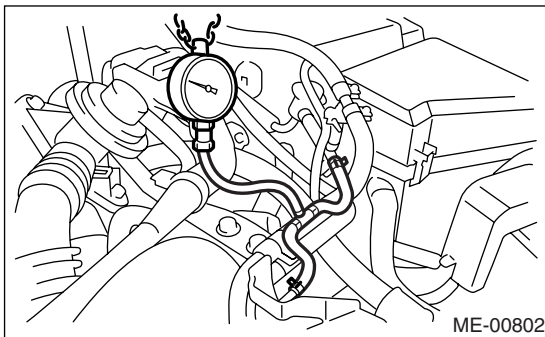
- 1) Remove the collector cover.
- 2) Release the fuel pressure. <Ref. to FU(H4DOTC)-40, RELEASING OF FUEL PRESSURE, PROCEDURE, Fuel.>
- 3) Open the fuel filler flap lid, and remove the fuel filler cap.
- 4) Disconnect the fuel delivery hose and connect fuel pressure gauge.
- 5) Remove the fuse of fuel pump from main fuse box.



- 6) Start the engine.
- 7) Measure the fuel pressure while disconnecting pressure regulator vacuum hose from intake manifold.

Fuel pressure:

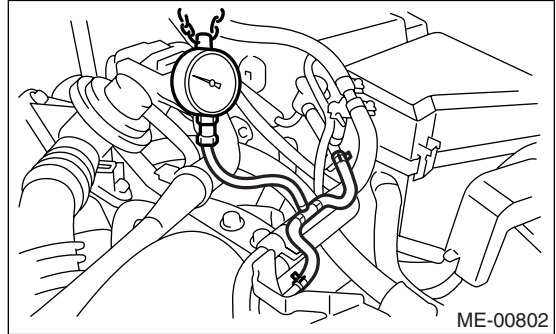
Standard: 284 — 314 kPa (2.9 — 3.2 kgf/cm², 41 — 46 psi)



- 8) After connecting the pressure regulator vacuum hose, measure the fuel pressure.

Fuel pressure:

Standard: 230 — 260 kPa (2.35 — 2.65 kgf/cm², 33 — 38 psi)



NOTE:

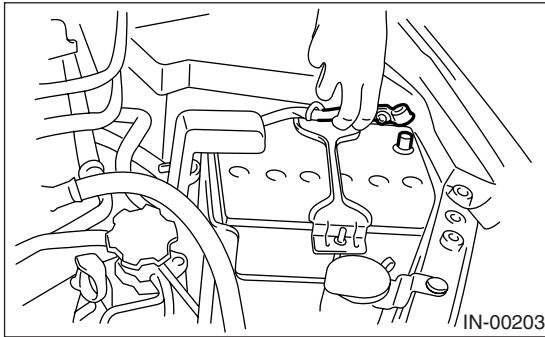
The fuel pressure gauge registers 10 to 20 kPa (0.1 to 0.2 kgf/cm², 1 to 3 psi) higher than standard values during high-altitude operations.

8. Valve Clearance

A: INSPECTION

Inspection and adjustment of valve clearance should be performed while engine is cold.

- 1) Lift-up the vehicle.
- 2) Remove the under cover.
- 3) Lower the vehicle.
- 4) Remove the collector cover.
- 5) Disconnect the ground cable from battery.



6) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>

7) Remove a bolt which secures timing belt cover (RH).

8) Loosen the remaining bolts which secure timing belt cover (RH), then remove the timing belt cover.

9) When inspecting #1 and #3 cylinders:

- (1) Remove the air cleaner case.
<Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>
- (2) Disconnect the connector from ignition coil.
- (3) Remove the ignition coil.
- (4) Place a suitable container under the vehicle.
- (5) Disconnect the PCV hose from rocker cover (RH).
- (6) Remove the bolts, then remove the rocker cover (RH).

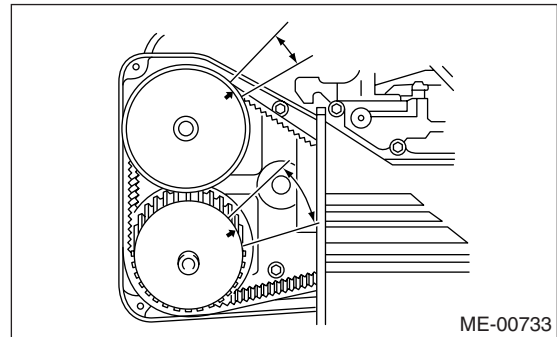
10) When inspecting #2 and #4 cylinders:

- (1) Disconnect the battery cable, and then remove the battery and battery carrier.
- (2) Disconnect the connector from ignition coil.
- (3) Remove the ignition coil.
- (4) Place a suitable container under the vehicle.
- (5) Disconnect the PCV hose from rocker cover (LH).
- (6) Remove the bolts, then remove the rocker cover (LH).

11) Turn the crank pulley clockwise until arrow mark on the cam sprocket is set to position shown in the figure.

NOTE:

Turn the crankshaft using a socket wrench.



12) Measure the #1 cylinder intake valve and #3 cylinder exhaust valve clearance by using thickness gauge (A).

NOTE:

- Insert the thickness gauge in as horizontal a direction as possible with respect to the valve lifter.
- Measure the exhaust valve clearances while lifting-up the vehicle.

Valve clearance

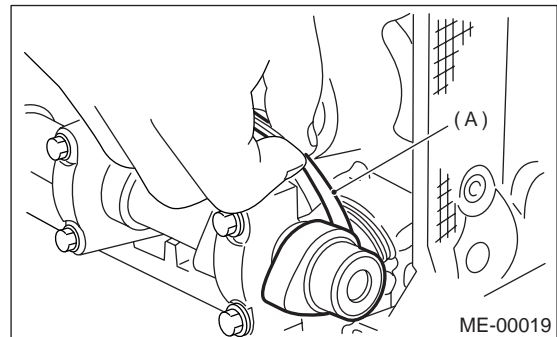
Intake:

$$0.20^{+0.04}_{-0.06} \text{ mm } (0.0079^{+0.0016}_{-0.0024} \text{ in})$$

Exhaust:

$$0.35 \pm 0.05 \text{ mm } (0.0138 \pm 0.0020 \text{ in})$$

- If the measured value is not within specification, take notes of the value in order to adjust the valve clearance later on.

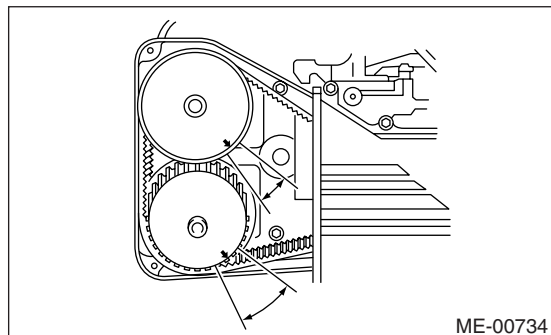


13) If necessary, adjust the valve clearance. <Ref. to ME(H4DOTC)-28, ADJUSTMENT, Valve Clearance.>

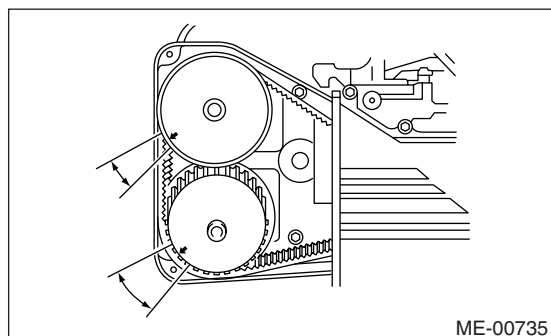
14) Further turn the crank pulley clockwise and then measure the valve clearances again.

Valve Clearance

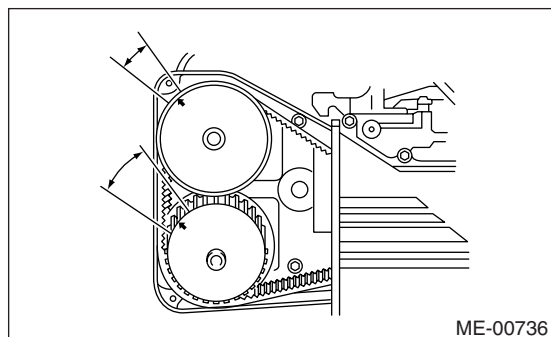
- (1) Set the arrow mark on cam sprocket to the position shown in the figure, and measure the #2 cylinder exhaust valve and #3 cylinder intake valve clearances.



- (2) Set the arrow mark on cam sprocket to the position shown in the figure, and measure the #2 cylinder intake valve and #4 cylinder exhaust valve clearances.



- (3) Set the arrow mark on cam sprocket to the position shown in the figure, and measure the #1 cylinder exhaust valve and #4 cylinder intake valve clearances.



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

B: ADJUSTMENT

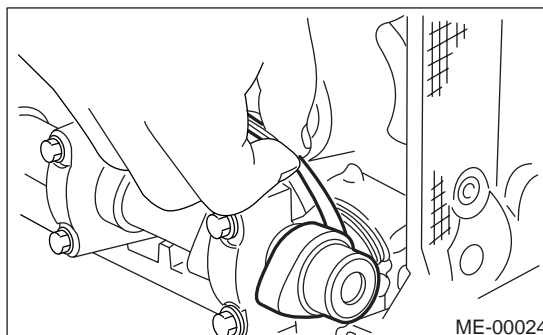
CAUTION:

Adjustment of valve clearance should be performed while engine is cold.

- 1) Measure all valve clearances. <Ref. to ME(H4DOTC)-27, INSPECTION, Valve Clearance.>

NOTE:

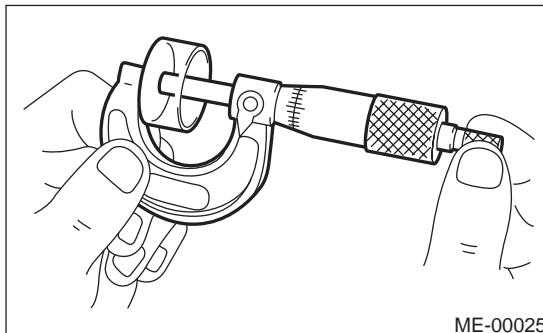
Record each valve clearance after it has been measured.



- 2) Remove the camshaft. <Ref. to ME(H4DOTC)-53, REMOVAL, Camshaft.>

- 3) Remove the valve lifter.

- 4) Measure the thickness of valve lifter with a micrometer.



- 5) Select a valve lifter of suitable thickness based on the measured valve clearance and valve lifter thickness, by referring to the following table.

Unit: (mm)	
Intake valve: $S = (V + T) - 0.20$	
Exhaust valve: $S = (V + T) - 0.35$	
S: Valve lifter thickness required	
V: Measured valve clearance	
T: Valve lifter thickness to be used	

Valve Clearance

MECHANICAL

Part number	Thickness mm (in)
13228 AB101	4.68 (0.1843)
13228 AB111	4.69 (0.1846)
13228 AB121	4.70 (0.1850)
13228 AB131	4.71 (0.1854)
13228 AB141	4.72 (0.1858)
13228 AB151	4.73 (0.1862)
13228 AB161	4.74 (0.1866)
13228 AB171	4.75 (0.1870)
13228 AB181	4.76 (0.1874)
13228 AB191	4.77 (0.1878)
13228 AB201	4.78 (0.1882)
13228 AB211	4.79 (0.1886)
13228 AB221	4.80 (0.1890)
13228 AB231	4.81 (0.1894)
13228 AB241	4.82 (0.1898)
13228 AB251	4.83 (0.1902)
13228 AB261	4.84 (0.1906)
13228 AB271	4.85 (0.1909)
13228 AB281	4.86 (0.1913)
13228 AB291	4.87 (0.1917)
13228 AB301	4.88 (0.1921)
13228 AB311	4.89 (0.1925)
13228 AB321	4.90 (0.1929)
13228 AB331	4.91 (0.1933)
13228 AB341	4.92 (0.1937)
13228 AB351	4.93 (0.1941)
13228 AB361	4.94 (0.1945)
13228 AB371	4.95 (0.1949)
13228 AB381	4.96 (0.1953)
13228 AB391	4.97 (0.1957)
13228 AB401	4.98 (0.1961)
13228 AB411	4.99 (0.1965)
13228 AB421	5.00 (0.1969)
13228 AB431	5.01 (0.1972)
13228 AB441	5.02 (0.1976)
13228 AB451	5.03 (0.1980)
13228 AB461	5.04 (0.1984)
13228 AB471	5.05 (0.1988)
13228 AB481	5.06 (0.1992)
13228 AB491	5.07 (0.1996)
13228 AB501	5.08 (0.2000)
13228 AB511	5.09 (0.2004)
13228 AB521	5.10 (0.2008)
13228 AB531	5.11 (0.2012)
13228 AB541	5.12 (0.2016)
13228 AB551	5.13 (0.2020)
13228 AB561	5.14 (0.2024)
13228 AB571	5.15 (0.2028)
13228 AB581	5.16 (0.2031)
13228 AB591	5.17 (0.2035)
13228 AB601	5.18 (0.2039)

Part number	Thickness mm (in)
13228 AB611	5.19 (0.2043)
13228 AB621	5.20 (0.2047)
13228 AB631	5.21 (0.2051)
13228 AB641	5.22 (0.2055)
13228 AB651	5.23 (0.2059)
13228 AB661	5.24 (0.2063)
13228 AB671	5.25 (0.2067)
13228 AB681	5.26 (0.2071)
13228 AB691	5.27 (0.2075)
13228 AB701	4.38 (0.1724)
13228 AB711	4.40 (0.1732)
13228 AB721	4.42 (0.1740)
13228 AB731	4.44 (0.1748)
13228 AB741	4.46 (0.1756)
13228 AB751	4.48 (0.1764)
13228 AB761	4.50 (0.1771)
13228 AB771	4.52 (0.1780)
13228 AB781	4.54 (0.1787)
13228 AB791	4.56 (0.1795)
13228 AB801	4.58 (0.1803)
13228 AB811	4.60 (0.1811)
13228 AB821	4.62 (0.1819)
13228 AB831	4.64 (0.1827)
13228 AB841	4.66 (0.1835)
13228 AB851	5.29 (0.2083)
13228 AB861	5.31 (0.2091)
13228 AB871	5.33 (0.2098)
13228 AB881	5.35 (0.2106)
13228 AB891	5.37 (0.2114)
13228 AB901	5.39 (0.2122)
13228 AB911	5.41 (0.2123)
13228 AB921	5.43 (0.2138)
13228 AB931	5.45 (0.2146)
13228 AB941	5.47 (0.2154)
13228 AB951	5.49 (0.2161)
13228 AB961	5.51 (0.2169)
13228 AB971	5.53 (0.2177)
13228 AB981	5.55 (0.2185)
13228 AB991	5.57 (0.2193)
13228 AC001	5.59 (0.2201)
13228 AC011	5.61 (0.2209)
13228 AC021	5.63 (0.2217)
13228 AC031	5.65 (0.2224)

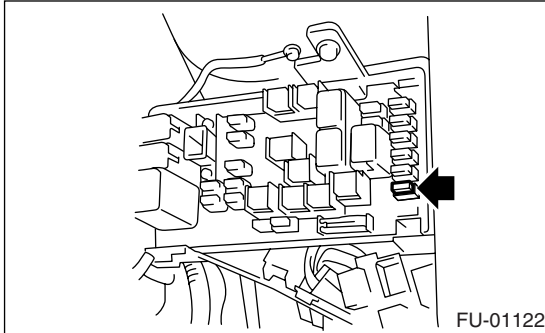
6) Inspect all valves for clearance again at this stage. If the valve clearance is not correct, repeat the procedure over again from the first step.

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

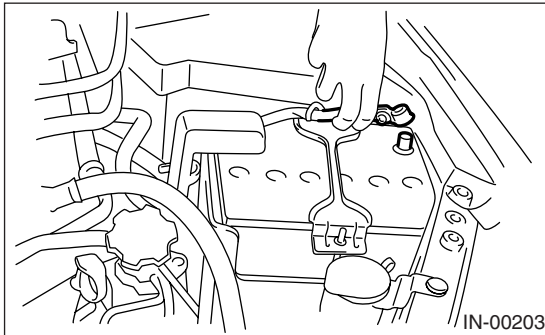
9. Engine Assembly

A: REMOVAL

- 1) Set the vehicle on a lift.
- 2) Open the front hood fully and support with a front food stay.
- 3) Collect the refrigerant from A/C system. <Ref. to AC-20, Refrigerant Recovery Procedure.>
- 4) Release the fuel pressure.
 - (1) Remove the fuse of fuel pump from main fuse box.

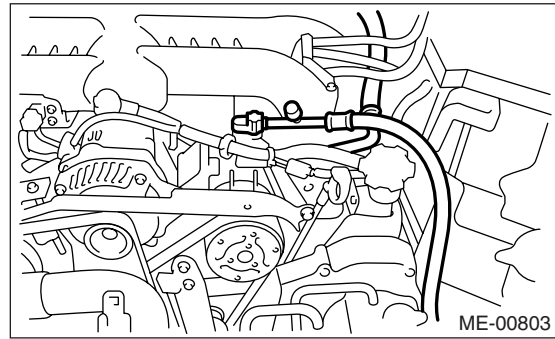


- (2) Start the engine, and run until stalls.
 - (3) After the engine stalls, crank it for 5 seconds more.
 - (4) Turn the ignition switch to OFF.
- 5) Remove the fuel filler cap.
- 6) Remove the collector cover.
- 7) Disconnect the ground cable from battery.



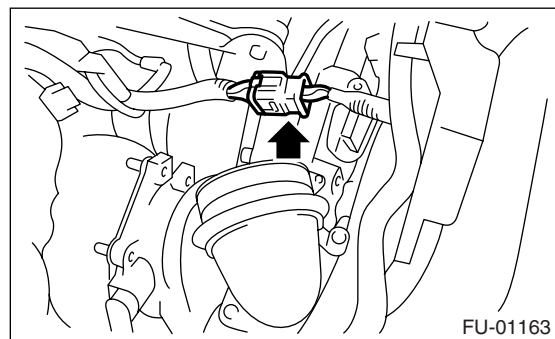
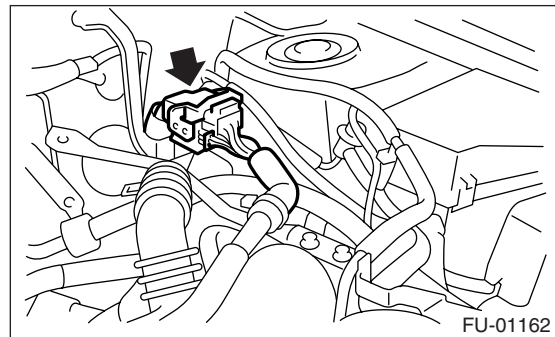
- 8) Remove the radiator from vehicle. <Ref. to CO(H4DOTC)-19, REMOVAL, Radiator.>
- 9) Remove the coolant filler tank. <Ref. to CO(H4DOTC)-31, REMOVAL, Coolant Filler Tank.>

- 10) Disconnect the A/C pressure hoses from A/C compressor.

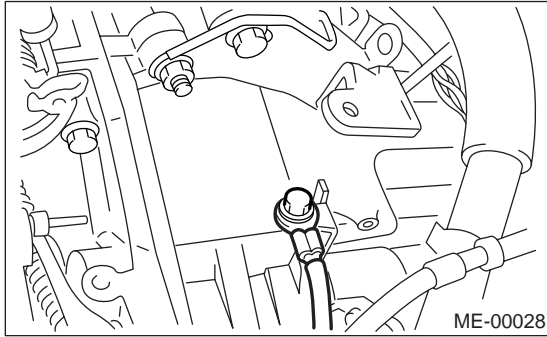


- 11) Repair the air intake system.
 - (1) Remove the intercooler. (DOHC turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
 - (2) Remove the air cleaner element and air cleaner case. <Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>
- 12) Disconnect the following connectors and cables.

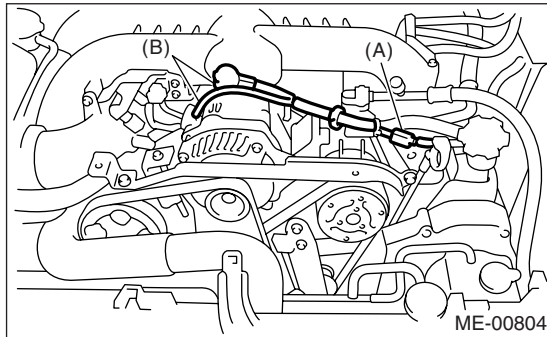
- (1) Engine harness connectors



(2) Engine ground terminals



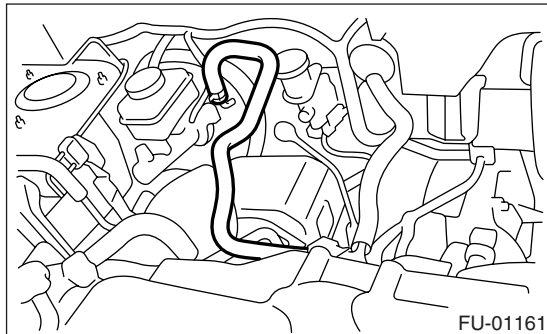
(3) Generator connector, terminal and A/C compressor connector



- (A) A/C compressor connector
- (B) Generator connector and terminal

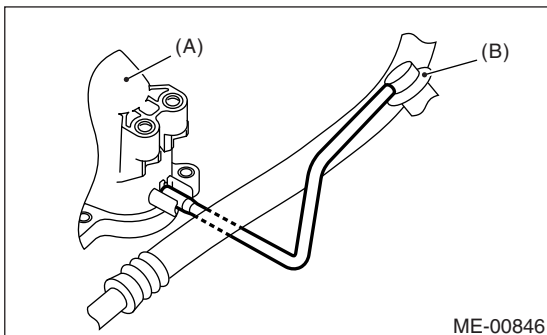
13) Disconnect the following hoses.

(1) Brake booster vacuum hose



(2) Heater inlet and outlet hoses

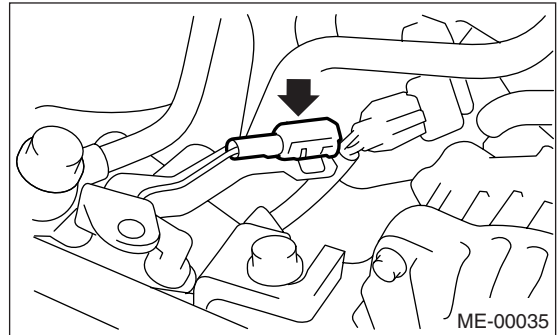
(3) Remove the hose between intake manifold (A) and pressure regulator (B).



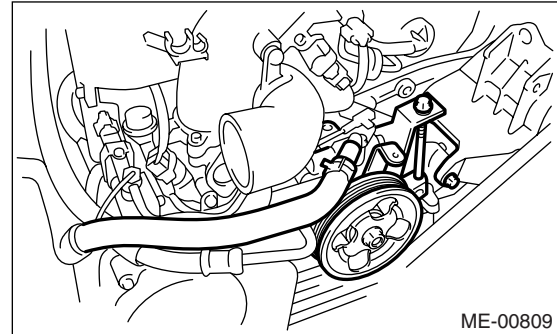
14) Remove the power steering pump from bracket.

(1) Loosen the lock bolt and slider bolt, and remove the front side belt. <Ref. to ME(H4DOTC)-39, FRONT SIDE BELT, REMOVAL, V-belt.>

(2) Disconnect the power steering switch connector.



(3) Remove the power steering pump from engine.



(4) Place the power steering pump on the right side wheel apron.

15) Remove the linear motion mounting. <Ref. to ME(H4DOTC)-37, REMOVAL, Linear Motion Mounting.>

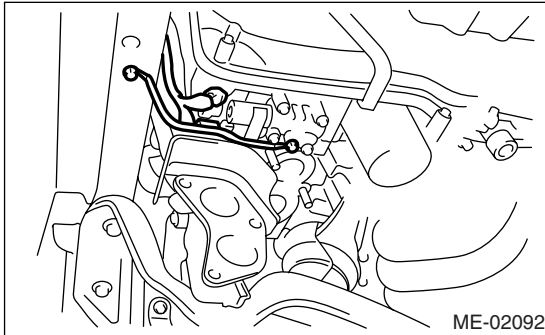
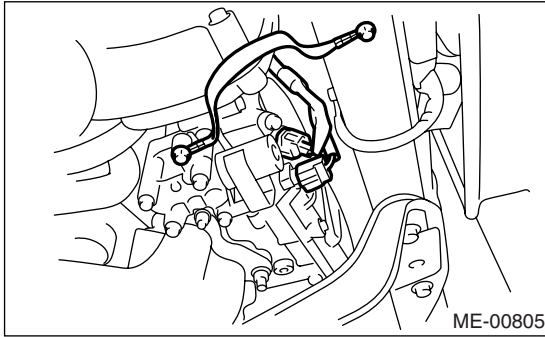
16) Lift-up the vehicle.

17) Remove the center exhaust pipe. <Ref. to EX(H4DOTC)-6, REMOVAL, Center Exhaust Pipe.>

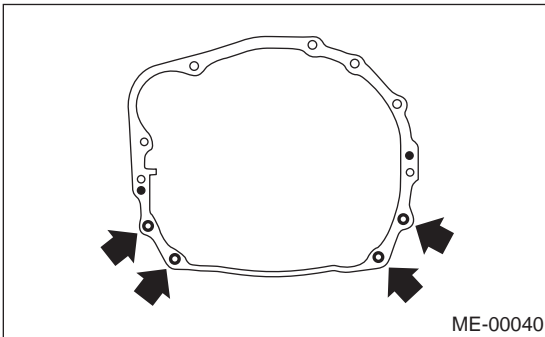
Engine Assembly

MECHANICAL

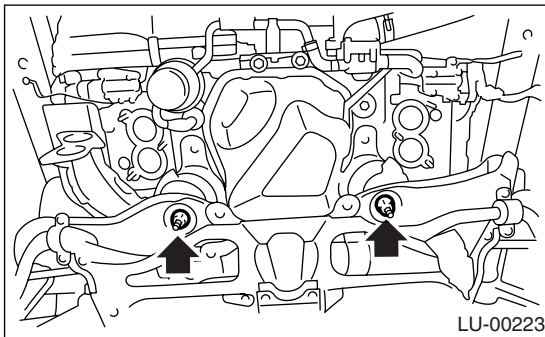
18) Disconnect the oil flow control solenoid valve connector and ground cable.



19) Remove the nuts which hold lower side of the transmission to engine.



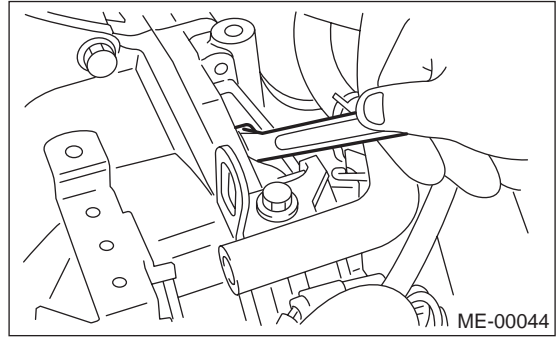
20) Remove the nuts which install front cushion rubber onto front crossmember.



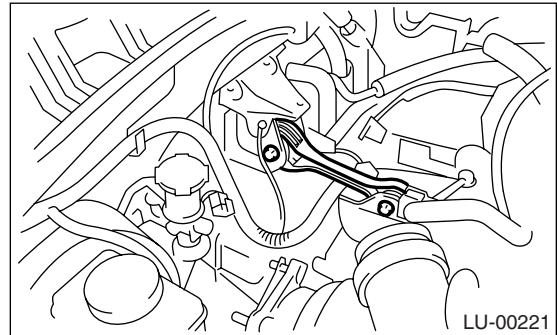
21) Separate the torque converter clutch from drive plate.

- (1) Lower the vehicle.
- (2) Remove the service hole plug.
- (3) Remove the bolts which hold torque converter clutch to drive plate.

(4) Remove other bolts while rotating the engine using a socket wrench.



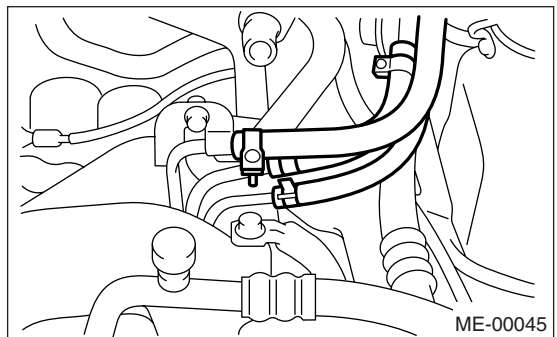
22) Remove the pitching stopper.



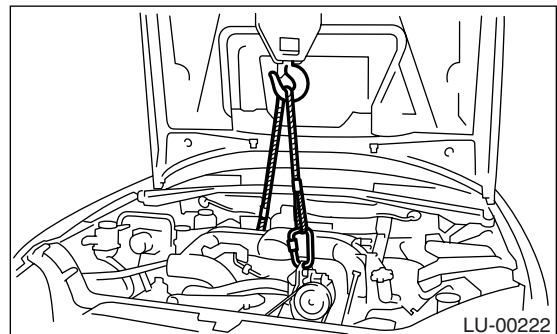
23) Disconnect the fuel delivery hose, return hose and evaporation hose.

CAUTION:

- Collect fuel from the hose into container.
- Disconnect the hose with its end wrapped with cloth to prevent fuel from splashing.



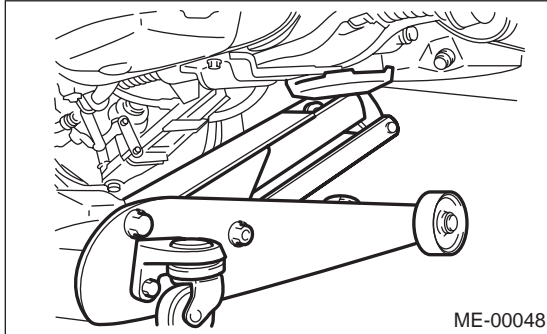
24) Support the engine with a lifting device and wire ropes.



25) Support the transmission with a garage jack.

CAUTION:

Doing this is very important because the transmission lowers for its own weight. This work is also of great importance for facilitating reinstallation.



CAUTION:

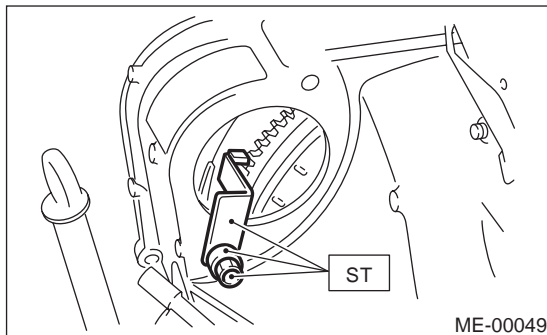
Before moving the engine away from transmission, check to be sure no work has been overlooked.

26) Separation of engine and transmission.

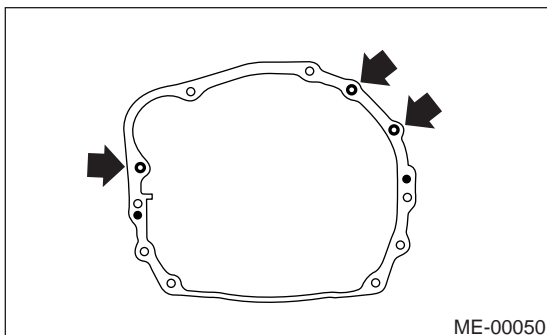
(1) Remove the starter. <Ref. to SC(H4SO 2.0)-6, REMOVAL, Starter.>

(2) Install the ST to converter case.

ST 498277200 STOPPER SET



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



27) Remove the engine from vehicle.

(1) Slightly raise the engine.

(2) Raise the transmission with garage jack.

(3) Move the engine horizontally until main shaft is withdrawn from clutch cover.

(4) Slowly move the engine away from engine compartment.

NOTE:

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

28) Remove the front cushion rubbers.

B: INSTALLATION

1) Install the front cushion rubbers to engine.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)

2) Install the engine onto transmission.

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

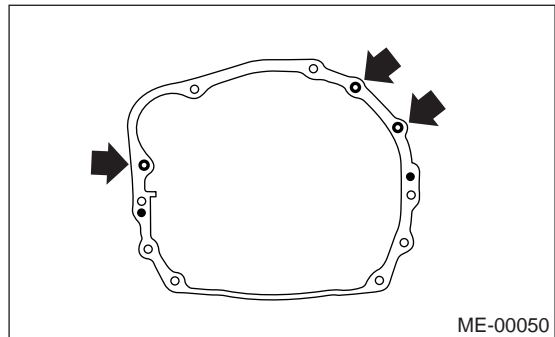
NOTE:

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

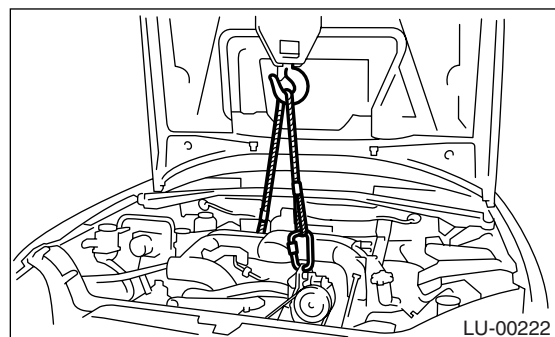
3) Tighten the bolts which hold upper side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



4) Remove the lifting device and wire ropes.



5) Remove the garage jack.

Engine Assembly

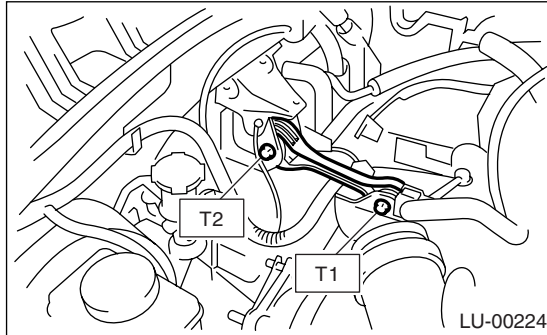
MECHANICAL

6) 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, 43 ft-lb)



7) Remove the ST from converter case.

NOTE:

Be careful not to drop the ST into the converter case when removing the ST.

ST 498277200 STOPPER SET

8) Install the starter. <Ref. to SC(H4SO 2.0)-6, INSTALLATION, Starter.>

9) Install the torque converter clutch to drive plate.

(1) Tighten the bolts which hold torque converter clutch to drive plate.

(2) Tighten other bolts while rotating the engine by using ST.

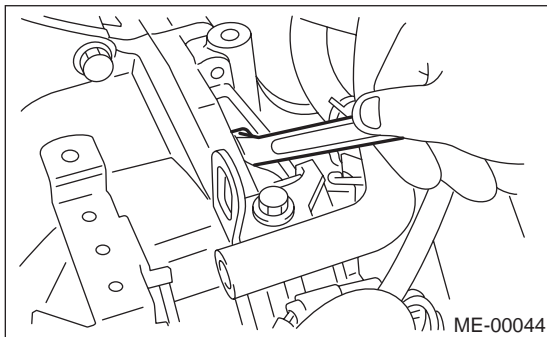
CAUTION:

Be careful not to drop bolts into the torque converter clutch housing.

ST 499977400 CRANK PULLEY WRENCH

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



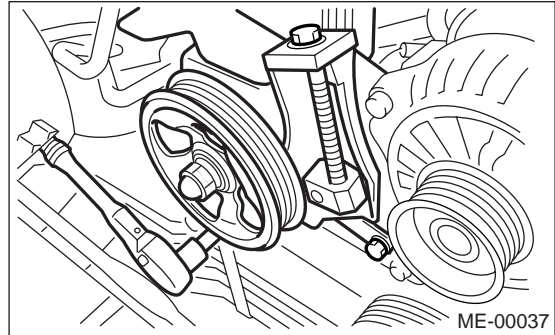
10) Install the linear motion mounting. <Ref. to ME(H4DOTC)-37, INSTALLATION, Linear Motion Mounting.>

11) Install the power steering pump on bracket.

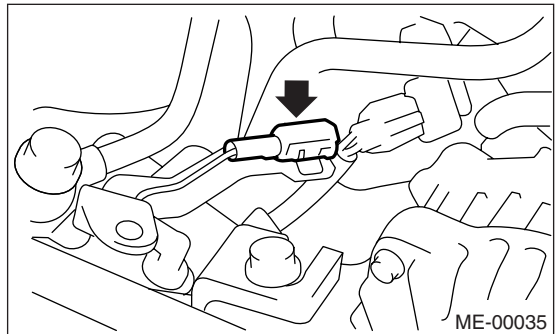
(1) Install the power steering pump.

Tightening torque:

20.1 N·m (2.05 kgf-m, 14.8 ft-lb)



(2) Connect the power steering switch connector.



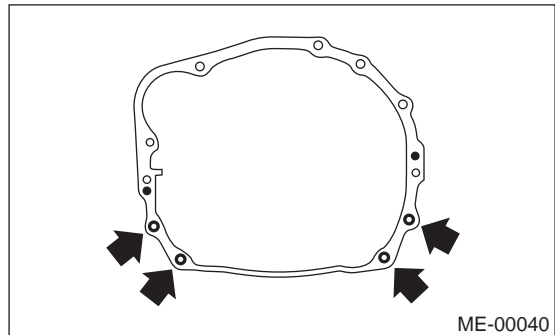
(3) Install the front side belt and adjust it. <Ref. to ME(H4DOTC)-39, FRONT SIDE BELT, INSTALLATION, V-belt.>

12) Lift-up the vehicle.

13) Tighten the nuts which hold lower side of the transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



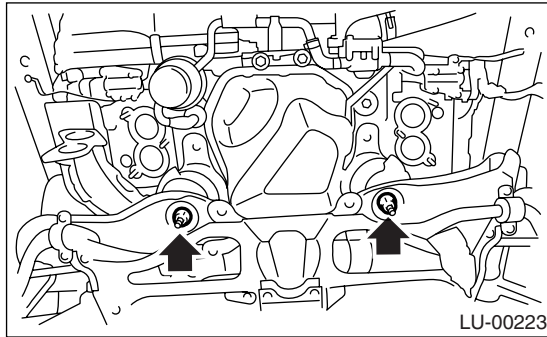
14) Tighten the nuts which install the front cushion rubber onto crossmember.

Tightening torque:

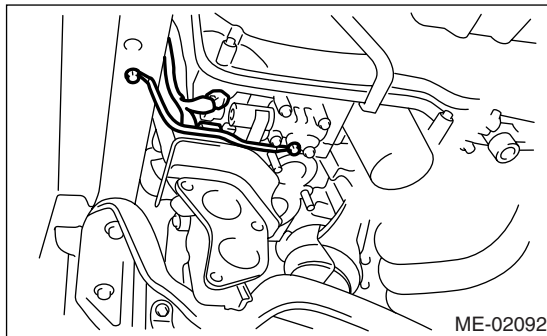
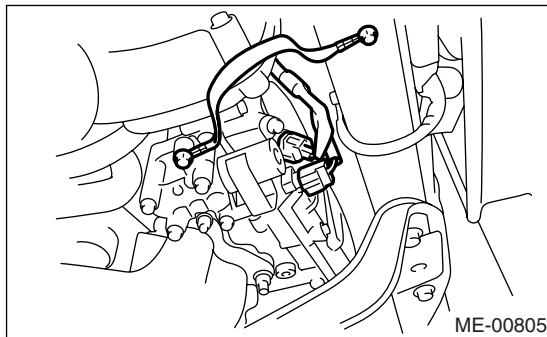
85 N·m (8.7 kgf-m, 62.7 ft-lb)

NOTE:

Make sure the front cushion rubber mounting bolts and locator are securely installed.



- 15) Install the center exhaust pipe.
<Ref. to EX(H4DOTC)-7, INSTALLATION, Center Exhaust Pipe.>
- 16) Connect the oil flow control solenoid valve connector and ground cable of exhaust side.



- 17) Lower the vehicle.
- 18) Connect the following hoses.
 - (1) Fuel delivery hose, return hose and evaporation hose
 - (2) Heater inlet and outlet hoses
 - (3) Brake booster vacuum hose
 - (4) Pressure regulator hose
- 19) Connect the following connectors and terminals.
 - (1) Engine ground terminals
 - (2) Engine harness connectors
 - (3) Generator connector and terminal
 - (4) A/C compressor connector
- 20) Install the air intake system.

- (1) Install the intercooler. (DOHC turbo model)
<Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>
- (2) Install the air cleaner element and air cleaner case. <Ref. to IN(H4DOTC)-8, INSTALLATION, Air Cleaner Case.>

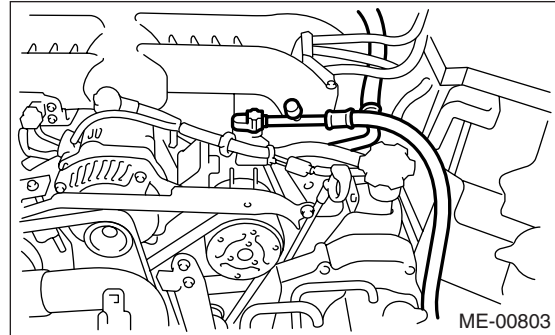
- 21) Install the A/C pressure hoses.

NOTE:

Use new O-rings.

Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)



- 22) Install the radiator. <Ref. to CO(H4DOTC)-20, INSTALLATION, Radiator.>
- 23) Install the coolant filler tank. (DOHC turbo model) <Ref. to CO(H4DOTC)-31, INSTALLATION, Coolant Filler Tank.>
- 24) Install the window washer tank.
- 25) Install the battery to vehicle, and connect the battery ground terminal.
- 26) Fill engine coolant.
<Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 27) Charge the A/C system with refrigerant.
<Ref. to AC-21, PROCEDURE, Refrigerant Charging Procedure.>
- 28) Install the collector cover.
- 29) Remove the front hood stay, and close the front hood.
- 30) Take off the vehicle from a lift.

C: INSPECTION

- 1) Check pipes and hoses are connected firmly.
- 2) Check the engine coolant and ATF are at specified levels.

10.Engine Mounting

A: REMOVAL

- 1) Remove the engine assembly. <Ref. to ME(H4DOTC)-30, REMOVAL, Engine Assembly.>
- 2) Remove the engine mounting from engine assembly.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

Engine mounting;

35 N·m (3.6 kgf-m, 25.8 ft-lb)

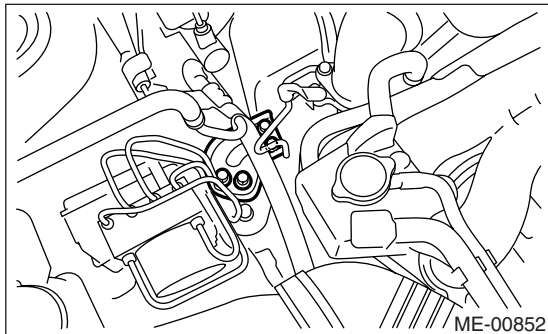
C: INSPECTION

Make sure that cracks or other damages do not exist.

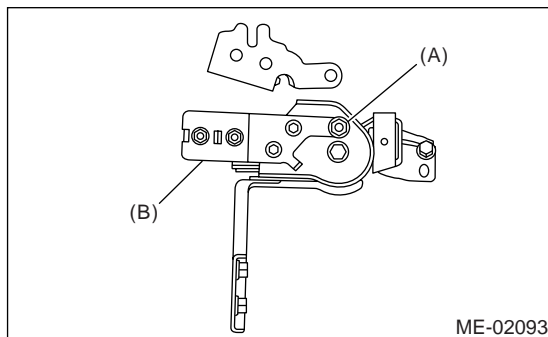
11.Linear Motion Mounting

A: REMOVAL

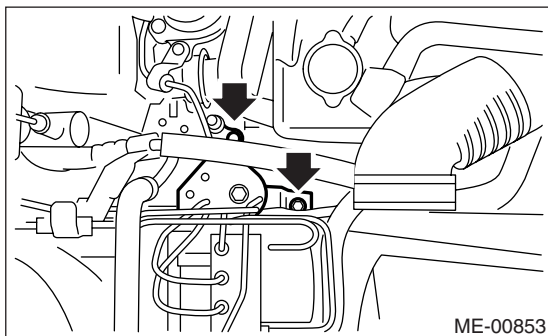
- 1) Remove the collector cover.
- 2) Remove the air cleaner case.
- 3) Remove the linear motion mounting bracket.



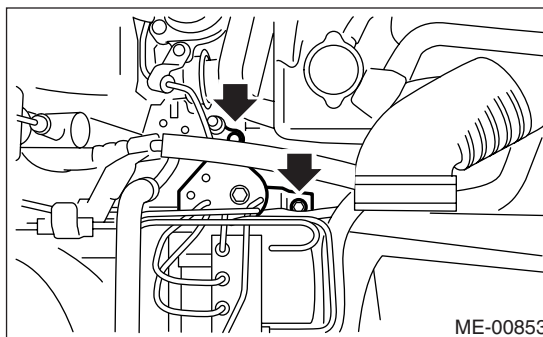
- 4) Remove the speed nut (A), and remove the dynamic damper (B).



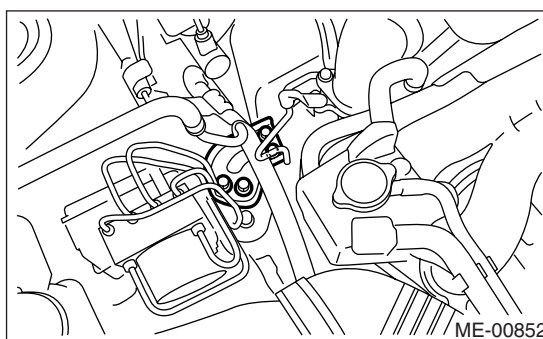
- 5) Remove the linear motion mounting.



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



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



B: INSTALLATION

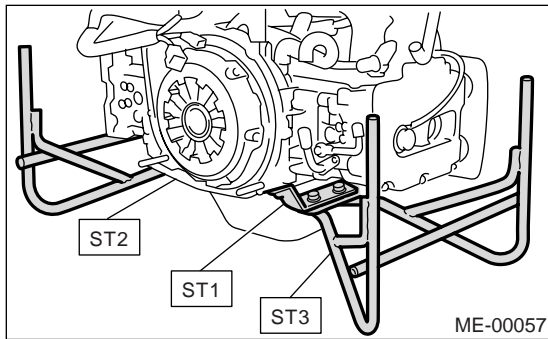
Install in the reverse order of removal.

12.Preparation for Overhaul

A: PROCEDURE

1) After removing the engine from body, secure it in the STs shown below.

ST1	498457000	ENGINE STAND ADAPTER RH
ST2	498457100	ENGINE STAND ADAPTER LH
ST3	499817000	ENGINE STAND



2) In this section the procedures described under each index are all connected and stated in order. It will be the complete procedure for overhauling of the engine itself when you go through all steps in the process.

Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

13.V-belt

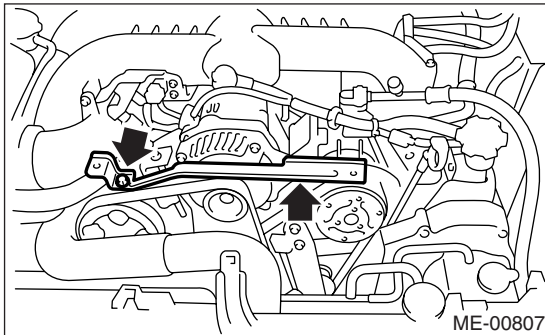
A: REMOVAL

NOTE:

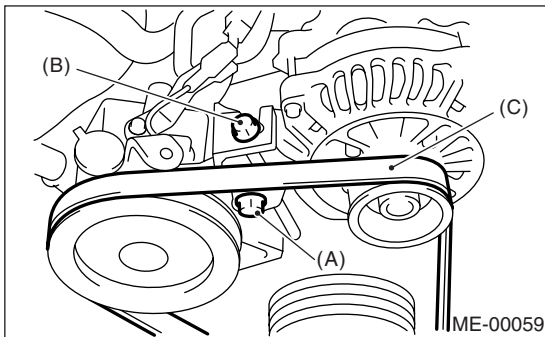
Perform the following procedures with the engine installed to the body.

1. FRONT SIDE BELT

- 1) Remove the collector cover.
- 2) Remove the V-belt covers.

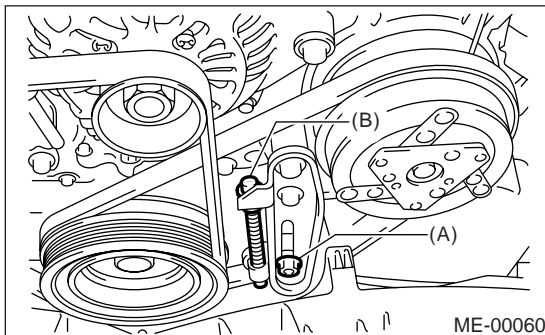


- 3) Loosen the lock bolt (A).
- 4) Loosen the slider bolt (B).
- 5) Remove the front side belt (C).



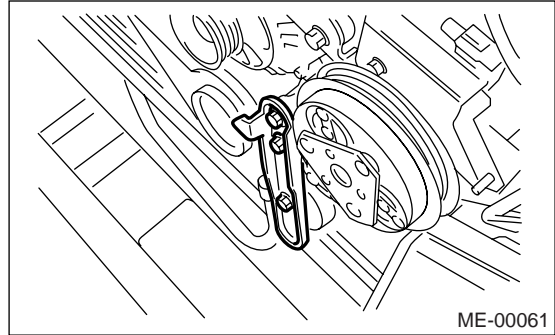
2. REAR SIDE BELT

- 1) Loosen the lock nut (A).
- 2) Loosen the slider bolt (B).



- 3) Remove the A/C belt.

- 4) Remove the A/C belt tensioner.



B: INSTALLATION

NOTE:

Wipe off any oil or water on the belt and pulley.

1. FRONT SIDE BELT

- 1) Install a V-belt (C), and tighten the slider bolt so as to obtain the specified belt tension. <Ref. to ME(H4DOTC)-40, INSPECTION, V-belt.>
- 2) Tighten the lock bolt (A).
- 3) Tighten the slider bolt (B).

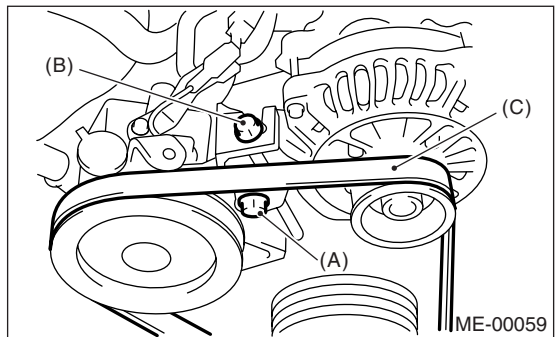
Tightening torque:

Lock bolt (A):

25 N·m (2.5 kgf-m, 18.1 ft-lb)

Slider bolt (B):

8 N·m (0.8 kgf-m, 5.9 ft-lb)



2. REAR SIDE BELT

- 1) Remove the A/C belt tensioner.
- 2) Install a V-belt, and tighten the slider bolt (B) so as to obtain the specified belt tension. <Ref. to ME(H4DOTC)-40, INSPECTION, V-belt.>

V-belt

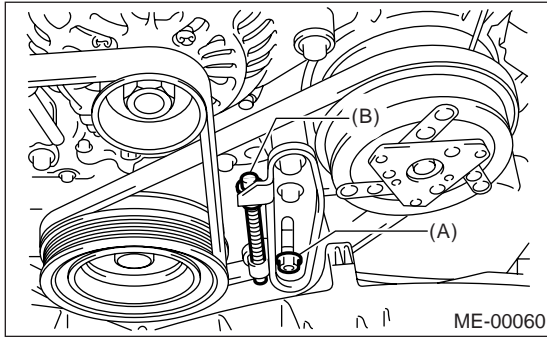
MECHANICAL

3) Tighten the lock nut (A).

Tightening torque:

Lock nut (A):

22.6 N·m (2.3 kgf-m, 16.6 ft-lb)



C: INSPECTION

1) Replace the belts, if crack, fraying or wear is found.

2) Check the V-belt tension and adjust it if necessary by changing the generator installing position and idler pulley installing position.

Belt tension (with belt tension gauge)

(A)

When installing new parts:

618 — 755 N (63 — 77 kgf, 139 — 170 lb)

At inspection:

490 — 640 N (50 — 65 kgf, 110 — 144 lb)

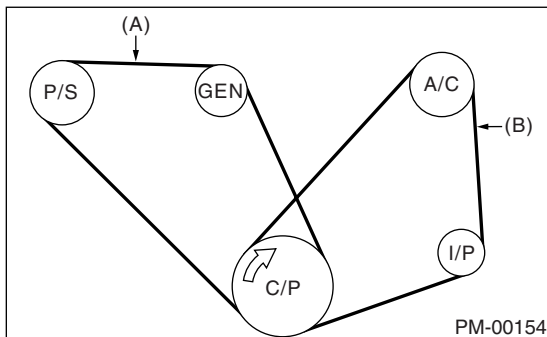
(B)

When installing new parts:

740 — 880 N (75 — 90 kgf, 166 — 198 lb)

At inspection:

350 — 450 N (36 — 46 kgf, 78 — 101 lb)



(A) Front side belt

(B) Rear side belt

C/P Crank pulley

GEN Generator

P/S Power steering oil pump pulley

A/C A/C compressor pulley

I/P Idler pulley

Belt tension (without belt tension gauge)

(A)

When installing new parts:

7 — 9 mm (0.276 — 0.354 in)

At inspection:

9 — 11 mm (0.354 — 0.433 in)

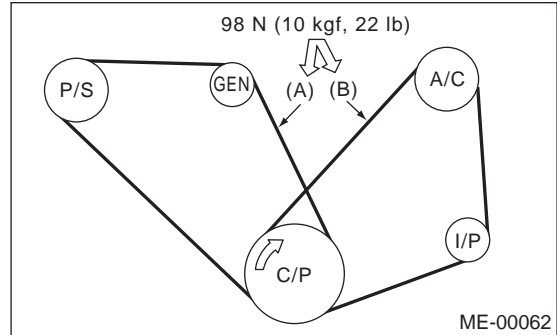
(B)

When installing new parts:

7.5 — 8.5 mm (0.295 — 0.335 in)

At inspection:

9.0 — 10.0 mm (0.354 — 0.394 in)



C/P Crank pulley

GEN Generator

P/S Power steering oil pump pulley

A/C A/C compressor pulley

I/P Idler pulley

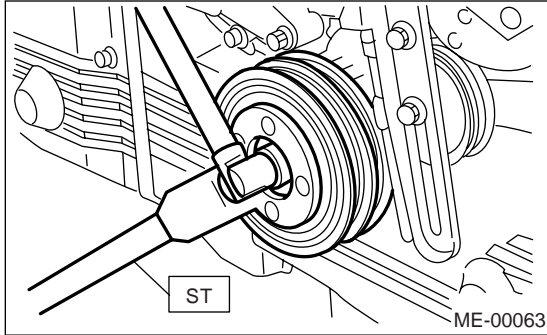
14. Crank Pulley

A: REMOVAL

1) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>

2) Remove the crank pulley bolt. To lock the crankshaft, use ST.

ST 499977400 CRANK PULLEY WRENCH



3) Remove the crank pulley.

B: INSTALLATION

1) Install the crank pulley.

2) Install the pulley bolt.

To lock the crankshaft, use ST.

ST 499977400 CRANK PULLEY WRENCH

(1) Clean the crank shaft thread using compressed air.

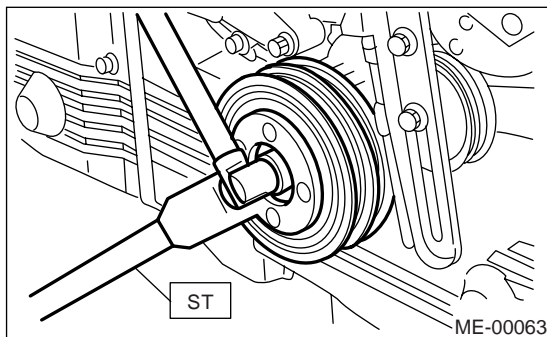
(2) Apply engine oil to the crank pulley bolt seat and thread.

(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).

(4) Tighten the crank pulley bolts.

Tightening torque:

130 N·m (13.3 kgf-m, 95.9 ft-lb)



3) Confirm that the tightening angle of the crank pulley bolt is 45° or more. Perform the following procedures when less than 45°.

CAUTION:

If the tightening angle of crank pulley bolt is less than 45°, the bolt should be damaged. In this case, the bolt must be replaced.

(1) Replace and clean the crank pulley bolts.

Crank pulley bolt:

Part No. 12369AA011

(2) Clean the crankshaft thread using compressed air.

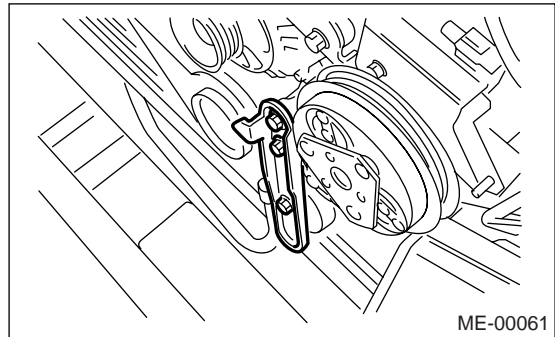
(3) Tighten the bolts temporarily with tightening torque of 44 N·m (4.5 kgf-m, 33 ft-lb).

(4) Tighten the crank pulley bolts keeping them in an angle 45° — 60°.

NOTE:

Conduct the tightening procedures by confirming the turning angle of the crank pulley bolt referring to the gauge indicated on the timing belt cover.

4) Install the A/C belt tensioner.



5) Install the V-belts. <Ref. to ME(H4DOTC)-39, INSTALLATION, V-belt.>

C: INSPECTION

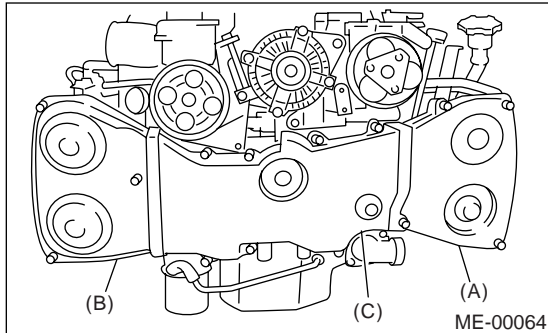
1) Check the V-belt is not worn or otherwise damaged.

2) Check the tension of the belt. <Ref. to ME(H4DOTC)-40, INSPECTION, V-belt.>

15. Timing Belt Cover

A: REMOVAL

- 1) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
- 2) Remove the crank pulley. <Ref. to ME(H4DOTC)-41, REMOVAL, Crank Pulley.>
- 3) Remove the timing belt cover (LH) (A).
- 4) Remove the timing belt cover (RH) (B).
- 5) Remove the front timing belt cover (C).



B: INSTALLATION

- 1) Install the front timing belt cover (C).

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

- 2) Install the timing belt cover (RH) (B).

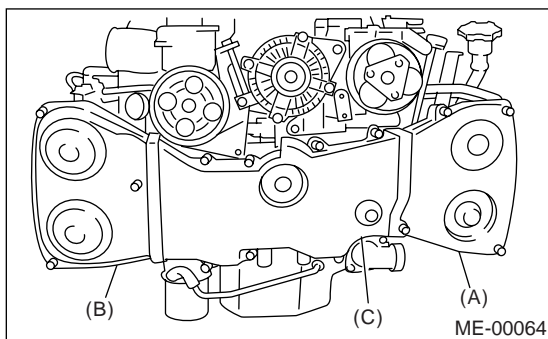
Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)

- 3) Install the timing belt cover (LH) (A).

Tightening torque:

5 N·m (0.5 kgf-m, 3.6 ft-lb)



- 4) Install the crank pulley. <Ref. to ME(H4DOTC)-41, INSTALLATION, Crank Pulley.>
- 5) Install the V-belts. <Ref. to ME(H4DOTC)-39, INSTALLATION, V-belt.>

C: INSPECTION

Check the cover for damage.

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

INTAKE (INDUCTION)

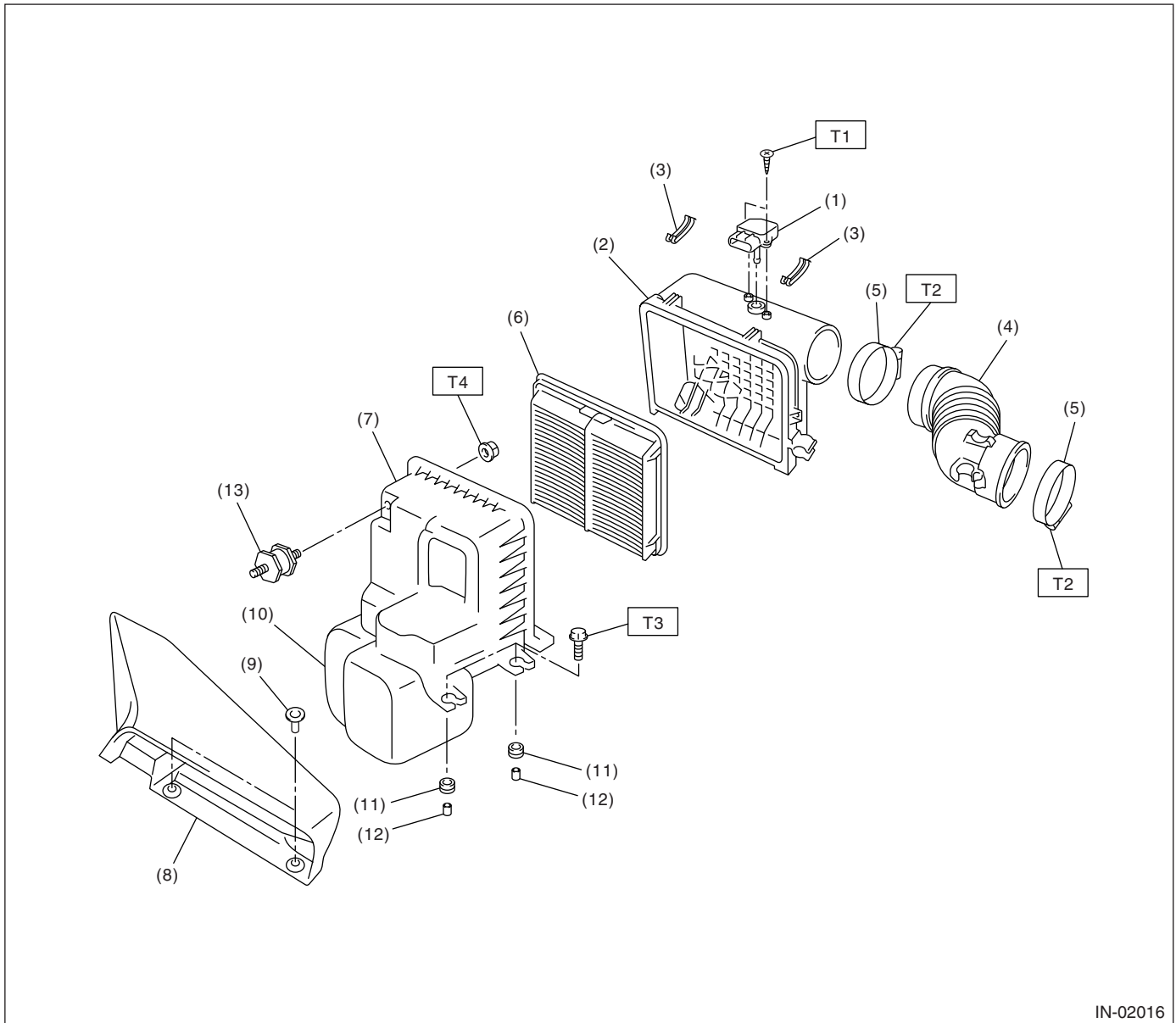
IN(H4DOTC)

	Page
1. General Description	2
2. Air Cleaner Element	7
3. Air Cleaner Case	8
4. Air Intake Duct	9
5. Resonator Chamber	10
6. Intake Duct	11
7. Intercooler	12
8. Turbocharger	14
9. Air By-pass Valve	16

1. General Description

A: COMPONENT

1. AIR CLEANER



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

Tightening torque: N·m (kgf-m, ft-lb)

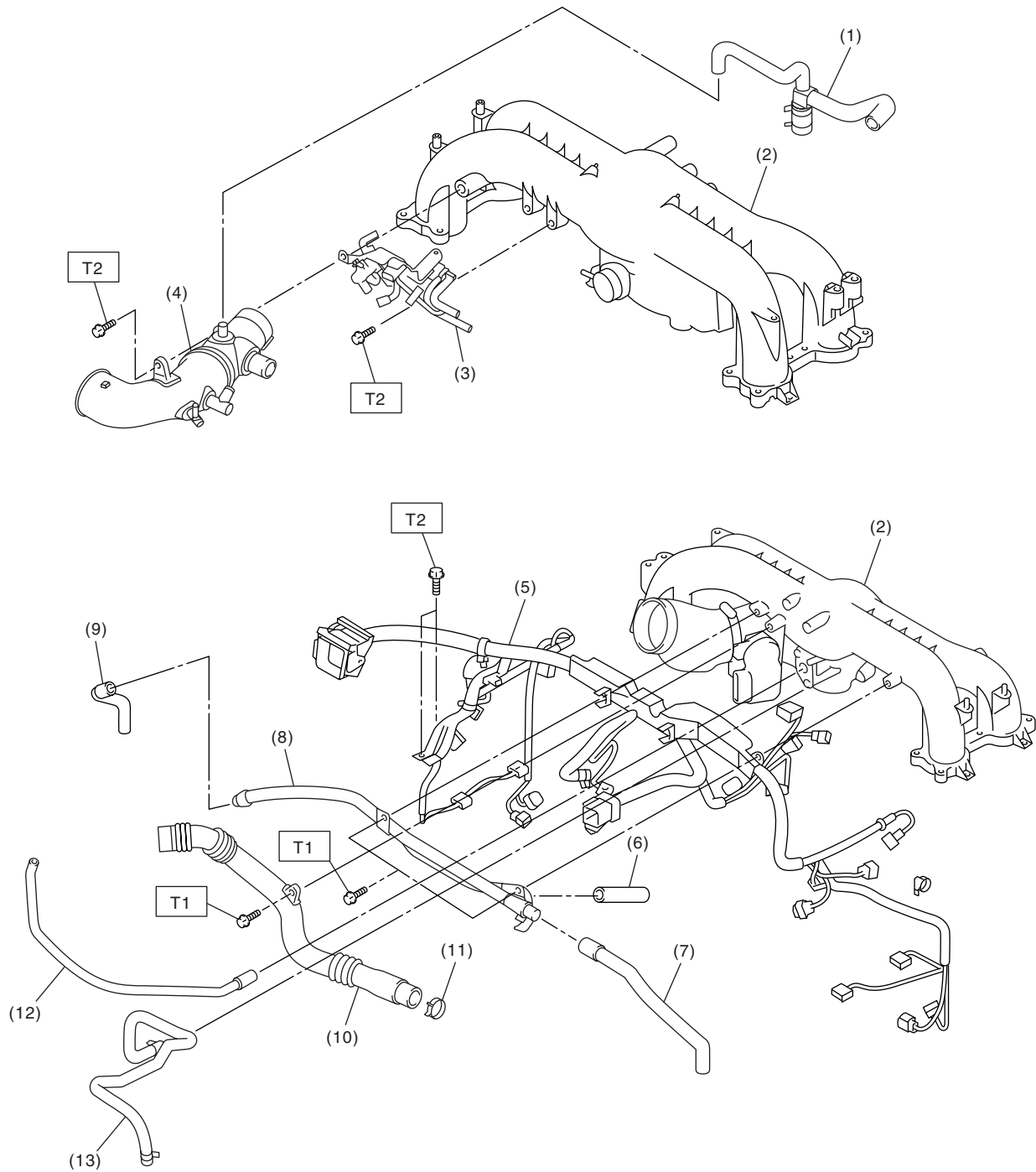
T1: 1.0 (0.10, 0.74)

T2: 2.5 (0.25, 1.8)

T3: 6.0 (0.61, 4.4)

T4: 7.5 (0.76, 5.5)

2. INTAKE DUCT



IN-00214

- (1) PCV hose ASSY
- (2) Intake manifold
- (3) Solenoid valve bracket ASSY
- (4) Intake duct
- (5) Engine harness ASSY
- (6) Vacuum hose

- (7) Vacuum hose
- (8) PCV pipe
- (9) Vacuum hose
- (10) Air by-pass pipe
- (11) Clamp
- (12) Vacuum hose

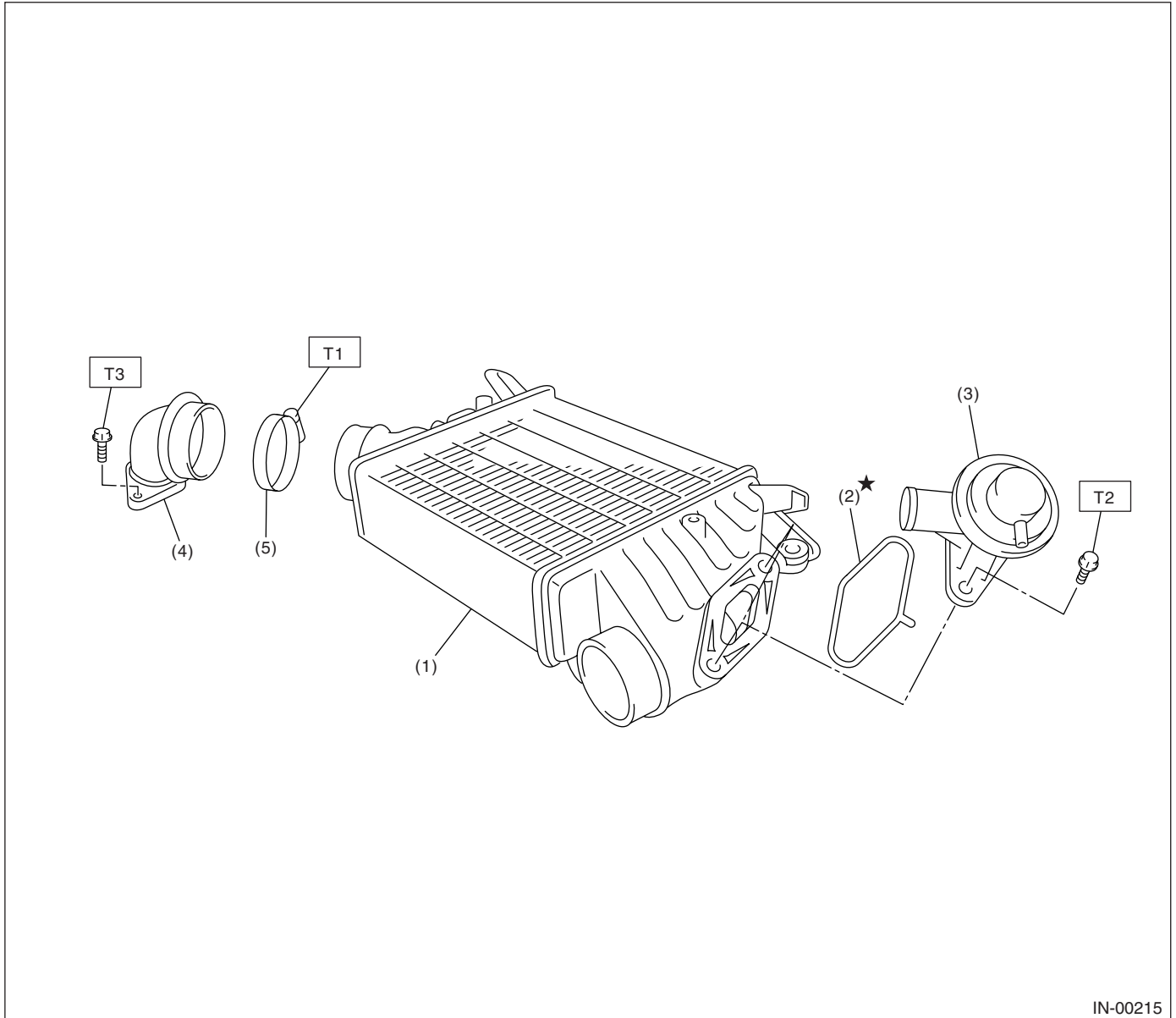
- (13) Brake booster hose

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.5 (0.66, 4.8)

T2: 19 (1.9, 13.7)

3. INTERCOOLER



- (1) Intercooler
- (2) Gasket
- (3) Air by-pass valve

- (4) Intake duct
- (5) Clamp

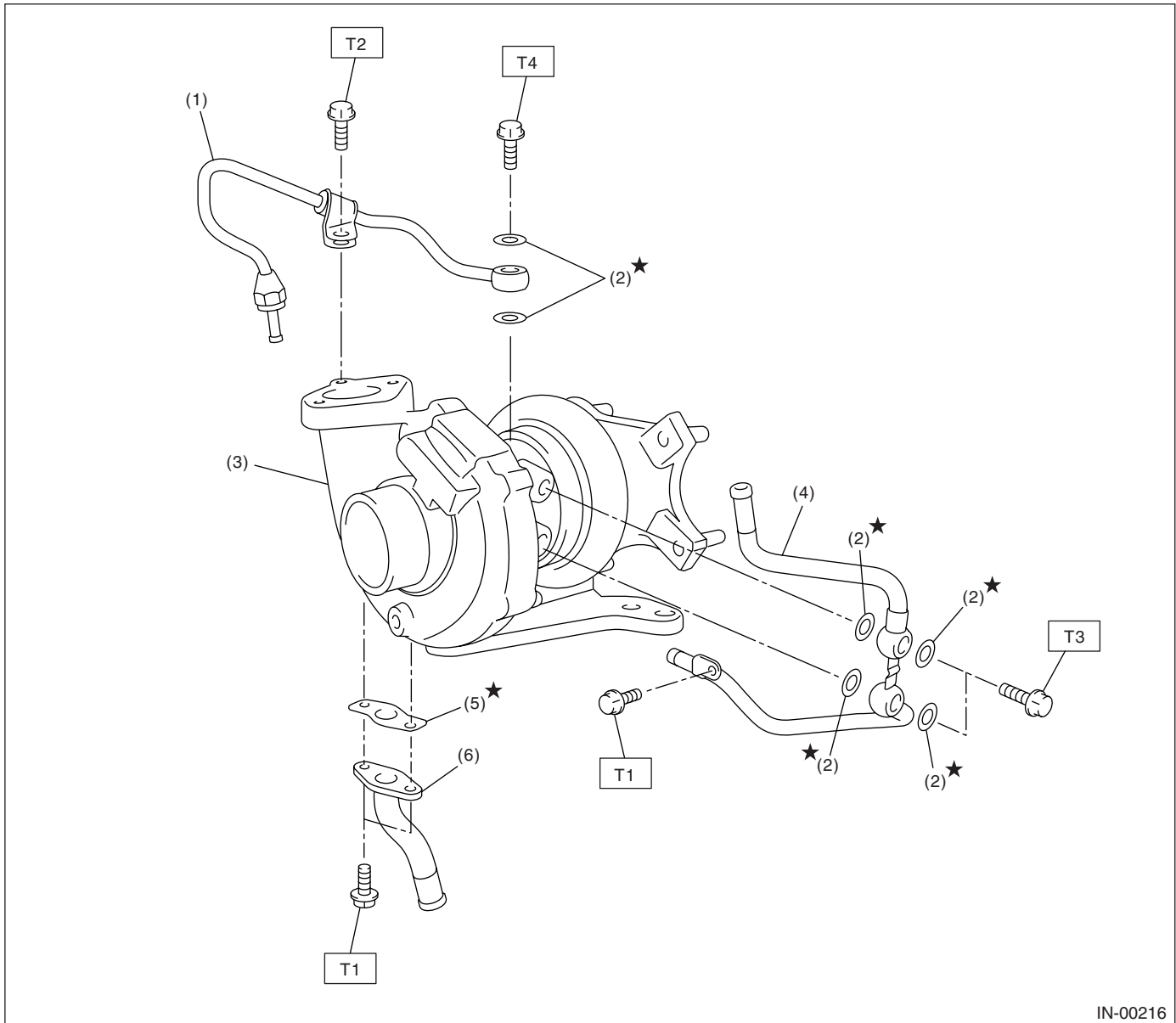
Tightening torque: N·m (kgf·m, ft·lb)

T1: 3.0 (0.3, 2.2)

T2: 6.5 (0.66, 4.8)

T3: 16 (1.6, 11.6)

4. TURBOCHARGER



- | | |
|--------------------|---------------------|
| (1) Oil inlet pipe | (4) Water pipe |
| (2) Metal gasket | (5) Gasket |
| (3) Turbocharger | (6) Oil outlet pipe |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 4.7 (0.48, 3.5)

T2: 5.0 (0.51, 3.7)

T3: 23 (2.3, 17.0)

T4: 16 (1.6, 11.8)

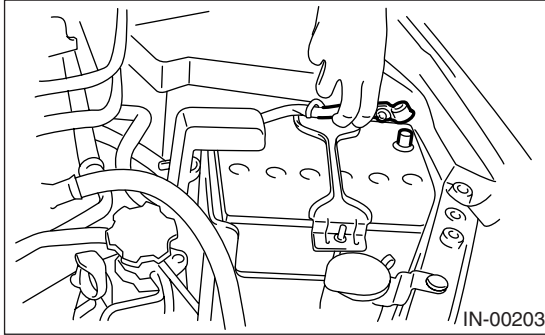
B: CAUTION

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

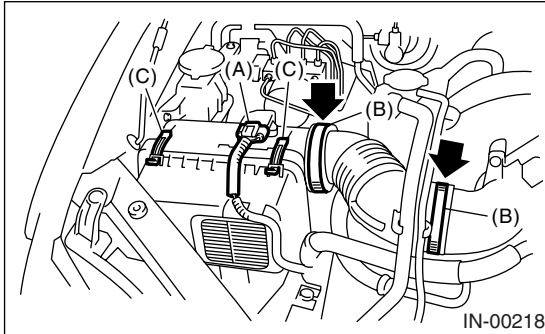
2. Air Cleaner Element

A: REMOVAL

- 1) Disconnect the ground cable from battery.



- 2) Disconnect the connector (A) from mass air flow sensor.
- 3) Loosen the clamps (B) which connect air intake boot to intake duct.
- 4) Remove the clips (C) from air cleaner case.



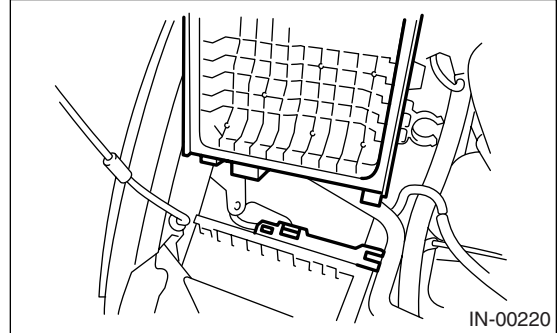
- 5) Remove the air cleaner case (rear) and air intake boot.
- 6) Remove the air cleaner element.

B: INSTALLATION

Install in the reverse order of removal.

NOTE:

When installing the air cleaner case (rear), align the protrusion part of air cleaner case (rear) to the hole of air cleaner case (front).



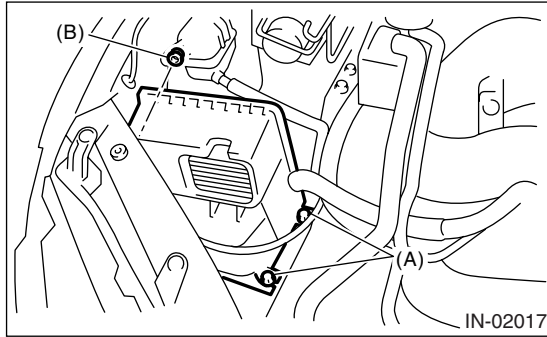
C: INSPECTION

Replace if excessively damaged or dirty.

3. Air Cleaner Case

A: REMOVAL

- 1) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>
- 2) Remove the air cleaner element.
<Ref. to IN(H4DOTC)-7, REMOVAL, Air Cleaner Element.>
- 3) Remove the bolts (A) and nut (B) which install air cleaner case (front) on the body.



- 4) Remove the air cleaner case (front).

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

Bolt: 6.0 N·m (0.61 kgf-m, 4.4 ft-lb)

Nut: 7.5 N·m (0.76 kgf-m, 5.5 ft-lb)

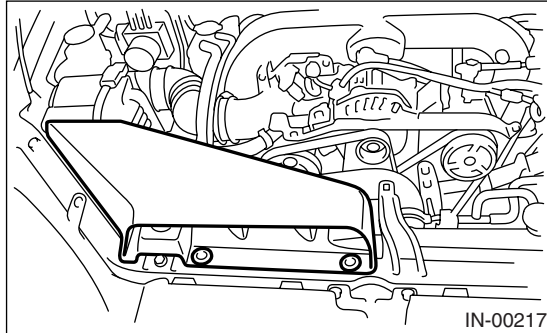
C: INSPECTION

Check for cracks or loose connections.

4. Air Intake Duct

A: REMOVAL

Remove the clips which install the air intake duct on the front side of body.



B: INSTALLATION

Install in the reverse order of removal.

C: INSPECTION

- 1) Check for cracks or loose connection.
- 2) Inspect that no foreign objects in the air intake duct.

5. Resonator Chamber

A: REMOVAL

Refer to "Air Cleaner Case" for removal procedure because the resonator chamber forms a single unit with air cleaner case. <Ref. to IN(H4DOTC)-8, REMOVAL, Air Cleaner Case.>

B: INSTALLATION

Refer to "Air Cleaner Case" for installation procedure because the resonator chamber forms a single unit with air cleaner case. <Ref. to IN(H4DOTC)-8, INSTALLATION, Air Cleaner Case.>

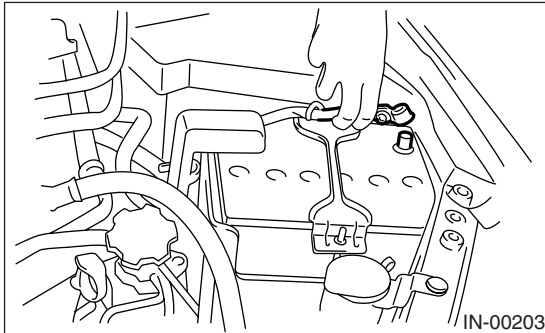
C: INSPECTION

Check for cracks or loose connections.

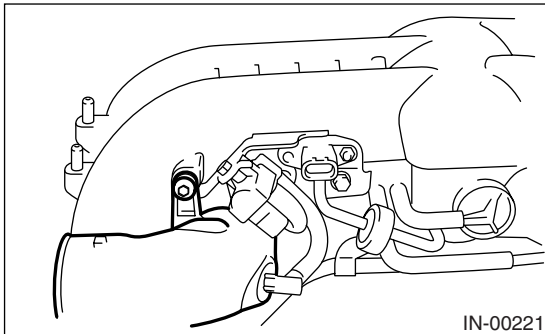
6. Intake Duct

A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the intake manifold.
<Ref. to FU(H4DOTC)-13, REMOVAL, Intake Manifold.>
- 4) Remove the sensor, engine harness and fuel pipe attached to the intake manifold. <Ref. to FU(H4DOTC)-17, DISASSEMBLY, Intake Manifold.>
- 5) Remove the intake duct from intake manifold.

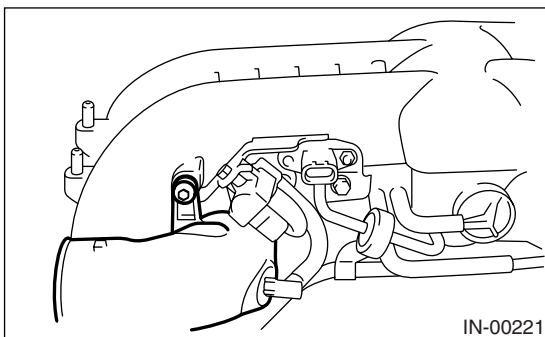


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

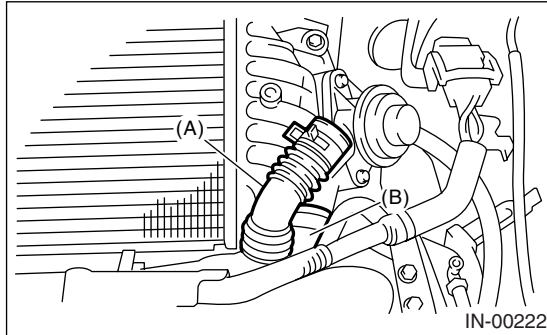
19 N·m (1.9 kgf-m, 13.7 ft-lb)



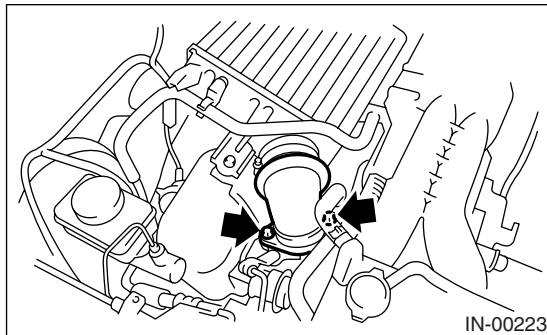
7. Intercooler

A: REMOVAL

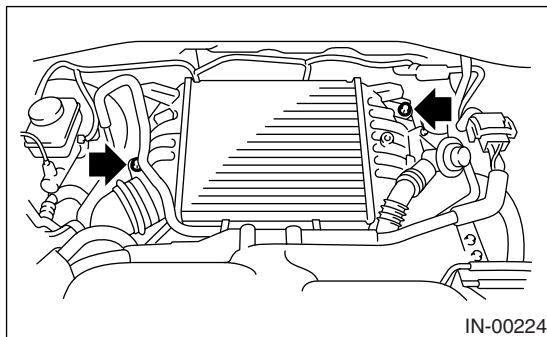
- 1) Remove the collector cover.
- 2) Loosen the clamp, and then remove the air by-pass pipe (A) from air by-pass valve.
- 3) Loosen the clamp, and then remove the intake duct (B) from intercooler.



- 4) Remove the bolts which secure intake duct to turbocharger.



- 5) Remove the bolts which secure intercooler to bracket, and then remove the intercooler.

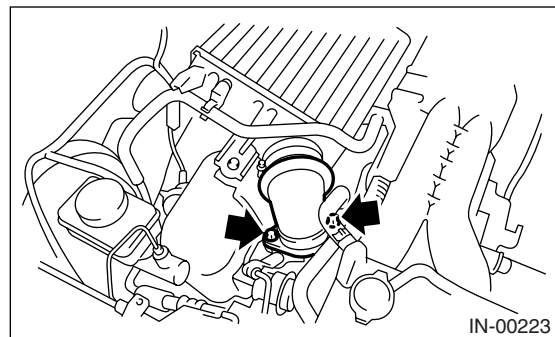
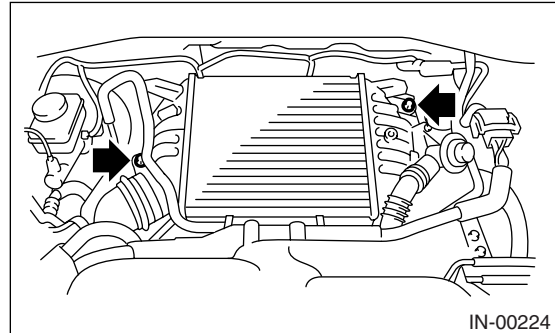


B: INSTALLATION

Install in the reverse order of removal.

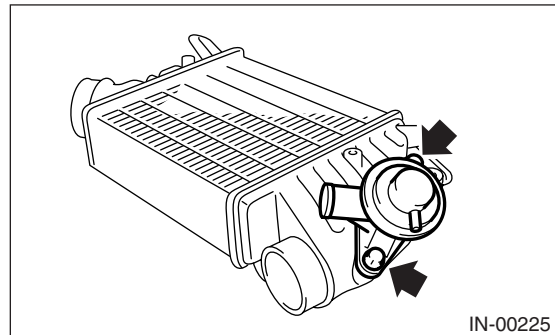
Tightening torque:

16 N·m (1.6 kgf-m, 11.6 ft-lb)



C: DISASSEMBLY

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

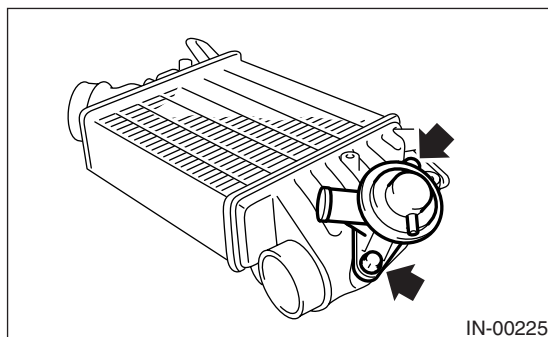


D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:

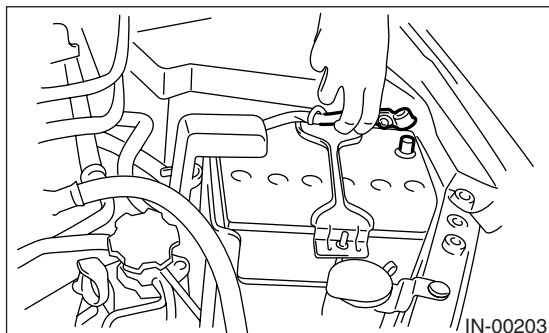
6.5 N·m (0.66 kgf-m, 4.8 ft-lb)



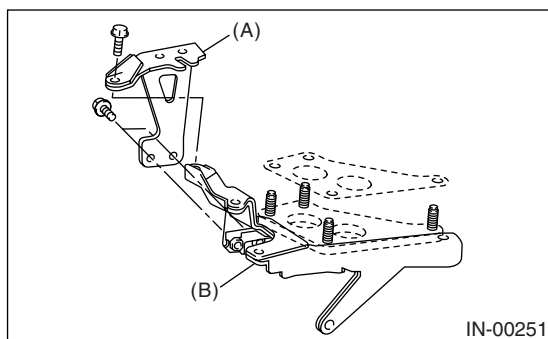
8. Turbocharger

A: REMOVAL

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

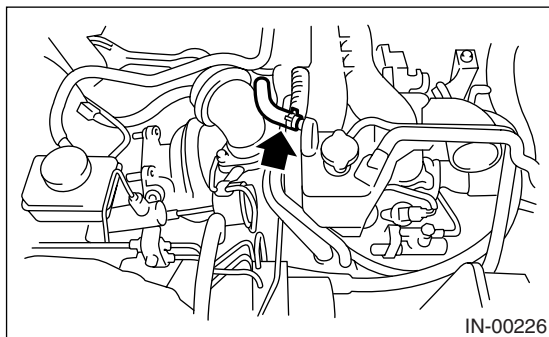


- 4) Remove the intercooler. <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>
- 5) Remove the intercooler bracket RH.
- 6) Remove the linear motion mounting.
<Ref. to ME(H4DOTC)-37, REMOVAL, Linear Motion Mounting.>
- 7) Remove the linear motion mounting bracket.

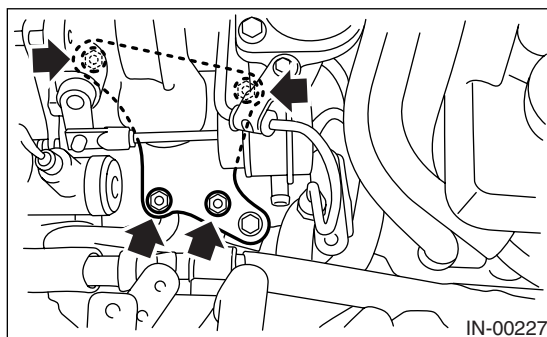


- (A) Linear motion mounting bracket
(B) Turbocharger bracket

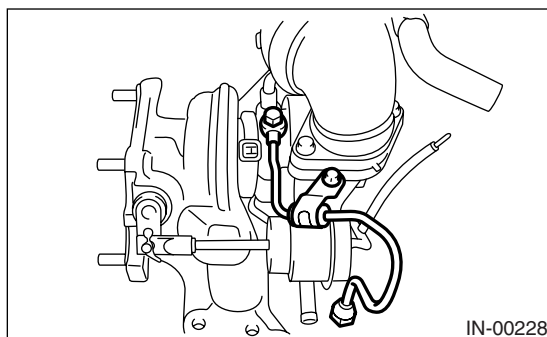
- 8) Remove the center exhaust pipe.
<Ref. to EX(H4DOTC)-6, REMOVAL, Center Exhaust Pipe.>
- 9) Lower the vehicle.
- 10) Disconnect the engine coolant hose which is connected to coolant filler tank.



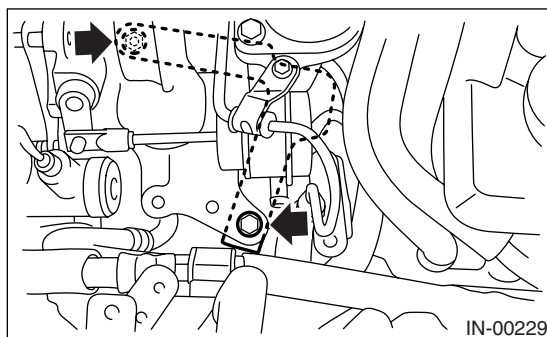
- 11) Separate the turbocharger joint pipe from turbocharger.



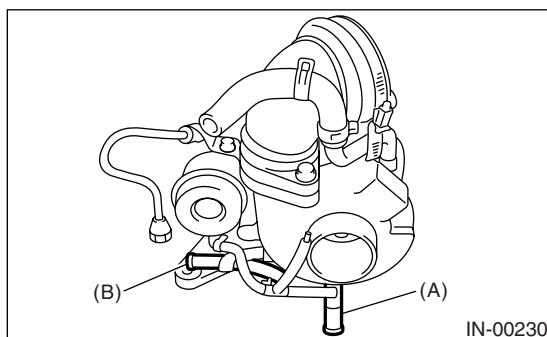
- 12) Remove the bolts which secure oil pipe bracket to turbocharger.
- 13) Remove the oil inlet pipe from turbocharger.



- 14) Remove the bolts which secure turbocharger to bracket.



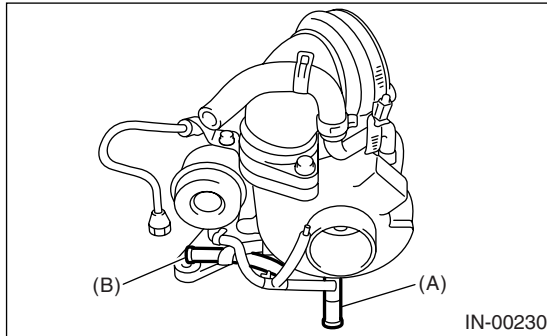
- 15) Disconnect the hoses from the oil outlet pipe (A) and coolant pipe (B) located under the turbocharger.



- 16) Take out the turbocharger from engine compartment.

B: INSTALLATION

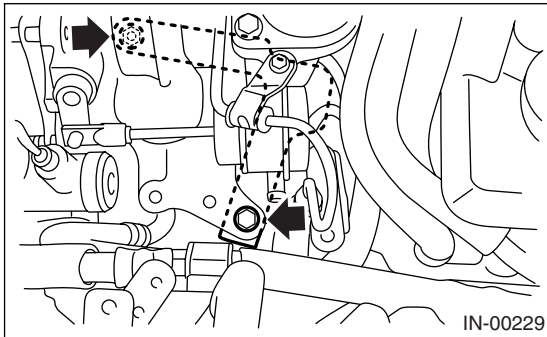
1) Connect the hoses to the oil outlet pipe (A) and coolant pipe (B) located under the turbocharger.



2) Install the turbocharger to bracket.

Tightening torque:

33 N·m (3.4 kgf-m, 24.6 ft-lb)

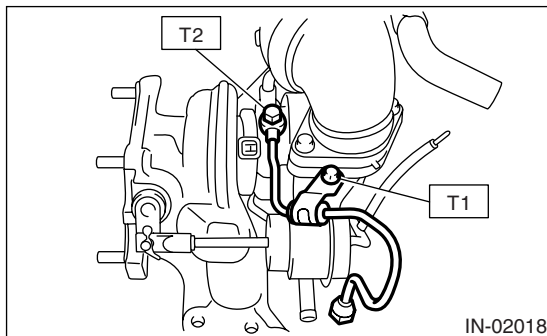


3) Install the oil inlet pipe to turbocharger.

Tightening torque:

T1: 5.0 N·m (0.51 kgf-m, 3.7 ft-lb)

T2: 16 N·m (1.6 kgf-m, 11.6 ft-lb)



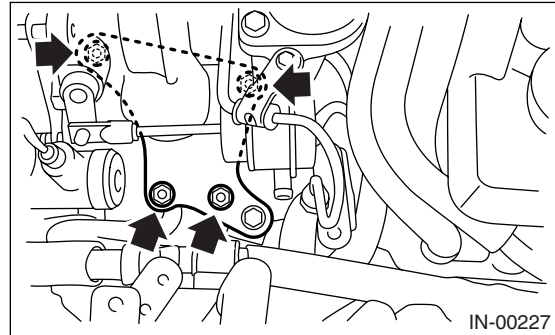
4) Install the joint pipe to turbocharger.

NOTE:

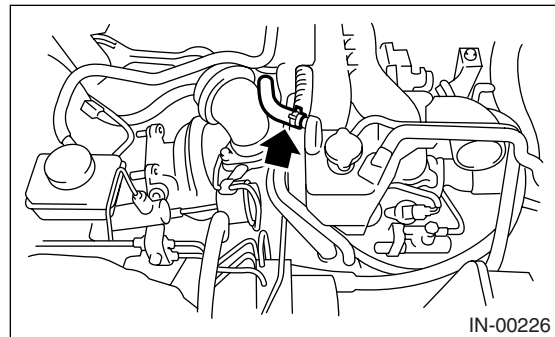
Use a new gasket.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)



5) Connect the engine coolant hose which is connected to the coolant filler tank.

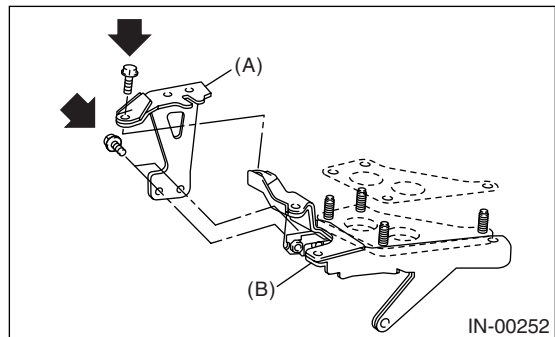


6) Lift-up the vehicle.

7) Install the center exhaust pipe.

<Ref. to EX(H4DOTC)-7, INSTALLATION, Center Exhaust Pipe.>

8) Install the linear motion mounting bracket.



(A) Linear motion mounting bracket

(B) Turbocharger bracket

Tightening torque:

40 N·m (4.1 kgf-m, 29.5 ft-lb)

9) Install the linear motion mounting.

<Ref. to ME(H4DOTC)-37, INSTALLATION, Linear Motion Mounting.>

10) Install the intercooler bracket RH.

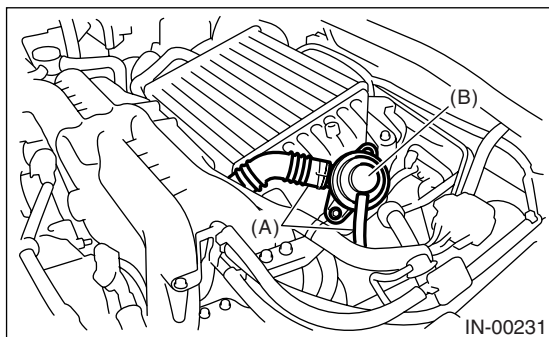
11) Install the intercooler. <Ref. to IN(H4DOTC)-12, INSTALLATION, Intercooler.>

12) Install the collector cover.

9. Air By-pass Valve

A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the air by-pass hose (A) from air by-pass valve.
- 3) Remove the air by-pass valve (B) from intercooler.

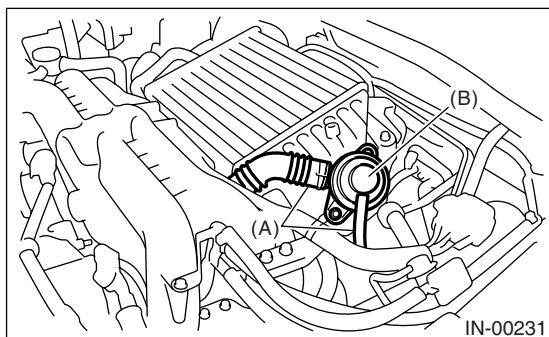


B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

6.5 N·m (0.66 kgf-m, 4.8 ft-lb)



- (A) Air by-pass hose
(B) Air by-pass valve

ENGINE SECTION 2

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4DOTC)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4DOTC)**

INTAKE (INDUCTION) IN(H4DOTC)

MECHANICAL ME(H4DOTC)

EXHAUST EX(H4DOTC)

COOLING CO(H4DOTC)

LUBRICATION LU(H4DOTC)

SPEED CONTROL SYSTEMS SP(H4DOTC)

IGNITION IG(H4DOTC)

STARTING/CHARGING SYSTEMS SC(H4DOTC)

ENGINE (DIAGNOSTICS) EN(H4DOTC)(diag)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES) *EC(H4DOTC)*

	Page
1. General Description	2
2. Front Catalytic Converter	3
3. Rear Catalytic Converter	4
4. Canister	5
5. Purge Control Solenoid Valve	6
6. Two-way Valve	7
7. PCV Valve	8

1. General Description

A: CAUTION

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

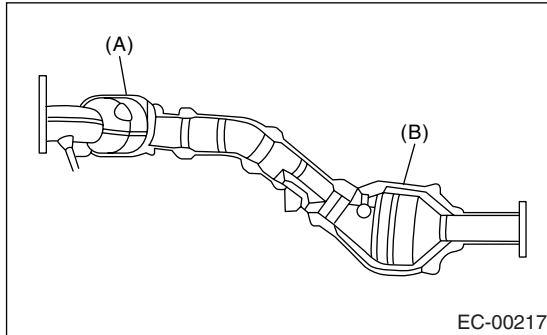
Front Catalytic Converter

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

2. Front Catalytic Converter

A: REMOVAL

- 1) Remove the center exhaust pipe.
<Ref. to EX(H4DOTC)-6, REMOVAL, Center Exhaust Pipe.>
- 2) Separate the front catalytic converter (A) from rear catalytic converter (B).



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Always use new gasket.

C: INSPECTION

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

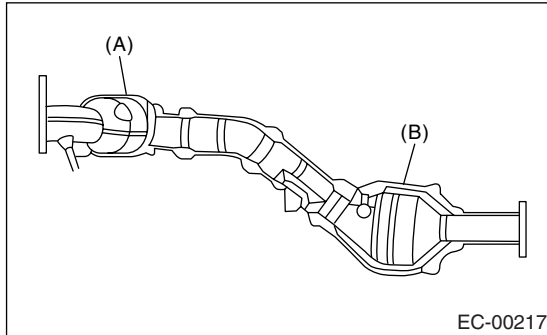
Rear Catalytic Converter

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

3. Rear Catalytic Converter

A: REMOVAL

- 1) Remove the center exhaust pipe.
<Ref. to EX(H4DOTC)-6, REMOVAL, Center Exhaust Pipe.>
- 2) Separate the rear catalytic converter (B) from front catalytic converter (A).



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Always use new gasket.

C: INSPECTION

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

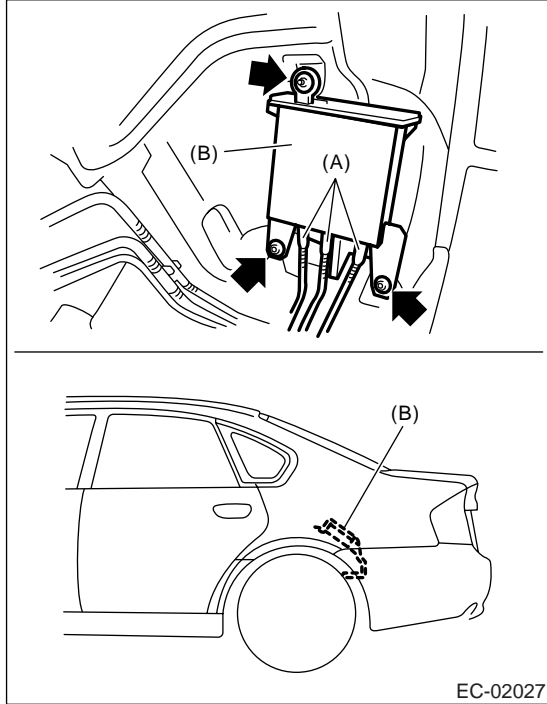
Canister

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

4. Canister

A: REMOVAL

- 1) Lift-up the vehicle.
- 2) Remove the rear wheel LH.
- 3) Remove the rear mud guard LH.
- 4) Remove the canister protector.
- 5) Disconnect the quick connector (A).
- 6) Remove the canister (B) from body.



B: INSTALLATION

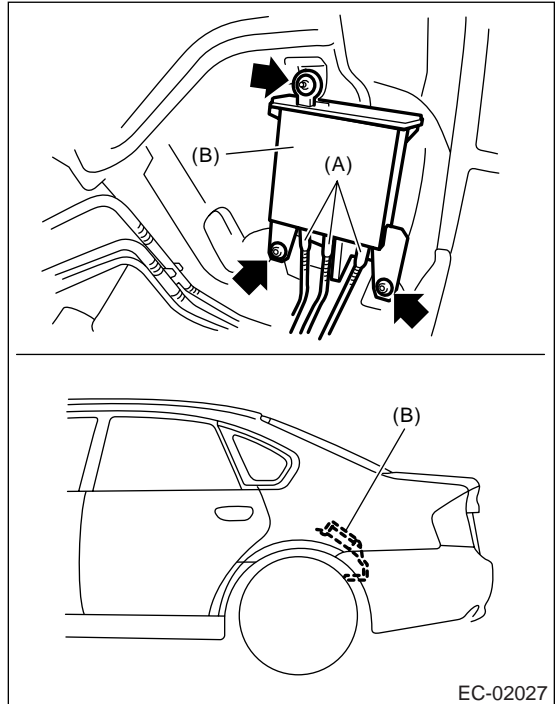
Install in the reverse order of removal.

NOTE:

Make sure there are no damage or dust on the connection of quick connector. If necessary, clean the seal surface of pipe.

Tightening torque:

8.3 N·m (0.85 kgf-m, 6.1 ft-lb)



C: INSPECTION

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

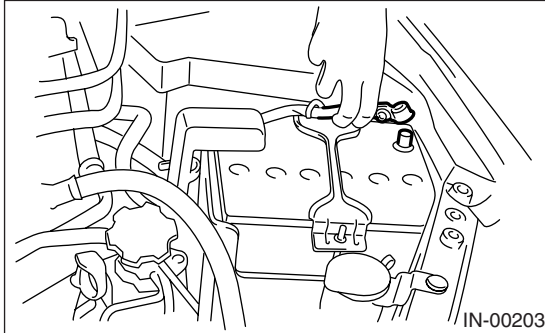
Purge Control Solenoid Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

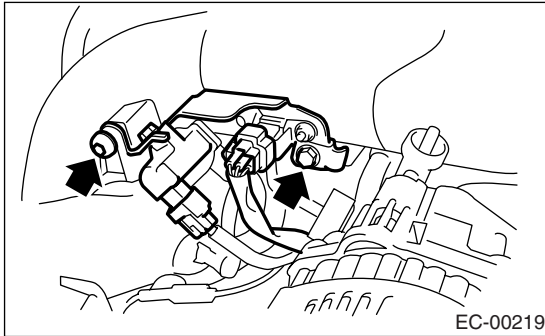
5. Purge Control Solenoid Valve

A: REMOVAL

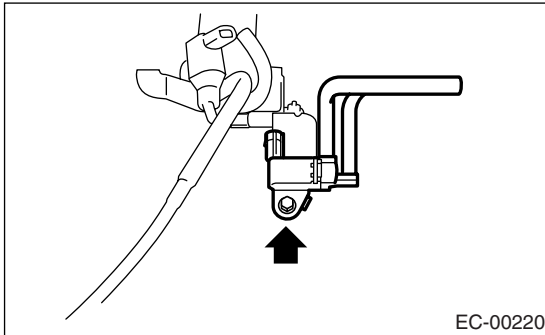
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



- 3) Remove the solenoid valve bracket assembly from intake manifold.



- 4) Disconnect the connector from purge control solenoid valve.
- 5) Disconnect the evaporation hose from the intake manifold and fuel pipe assembly.
- 6) Remove the purge control solenoid valve from solenoid valve bracket assembly.

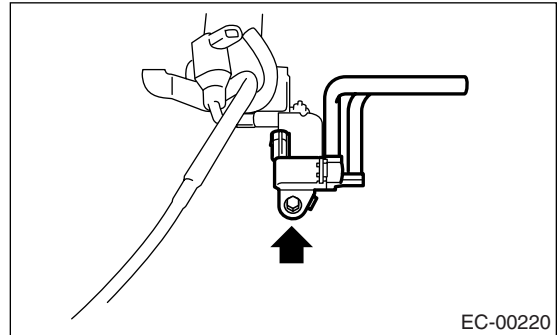


B: INSTALLATION

Install in the reverse order of removal.

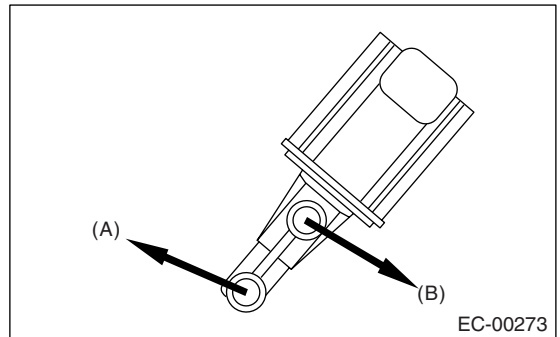
Tightening torque:

19 N·m (1.94 kgf-m, 13.7 ft-lb)



NOTE:

Connect the evaporation hose as shown in the figure.

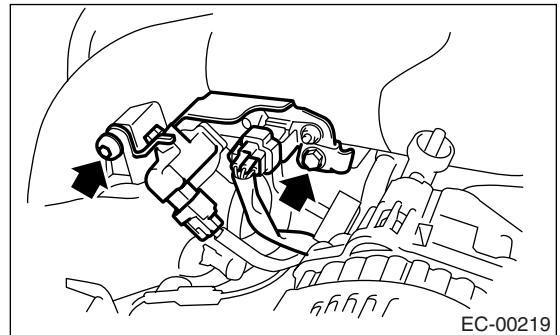


(A) To intake manifold

(B) To fuel pipe ASSY

Tightening torque:

19 N·m (1.94 kgf-m, 13.7 ft-lb)



C: INSPECTION

Make sure the hoses are not cracked or loose.

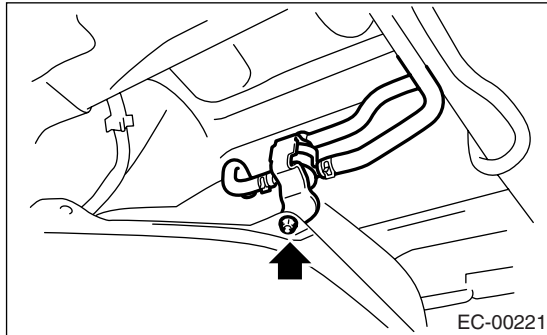
Two-way Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

6. Two-way Valve

A: REMOVAL

- 1) Lift-up the vehicle.
- 2) Disconnect the evaporation hoses from two-way valve.
- 3) Remove the two-way valve as a unit with bracket from body.



- 4) Remove the two-way valve from bracket.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

7.5 N·m (0.76 kgf-m, 5.5 ft-lb)

C: INSPECTION

Make sure the hoses are not cracked or loose.

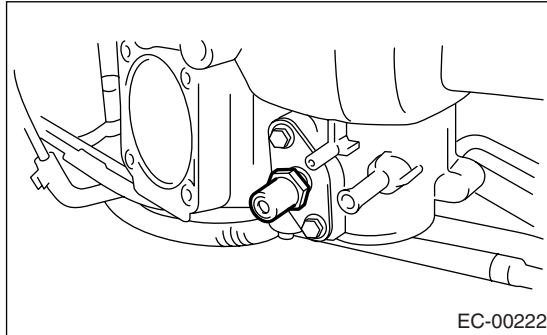
PCV Valve

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)

7. PCV Valve

A: REMOVAL

- 1) Remove the intake manifold.
<Ref. to FU(H4DOTC)-13, REMOVAL, Intake Manifold.>
- 2) Remove the PCV valve from intake manifold.



B: INSTALLATION

Install in the reverse order of removal.

NOTE:

Apply liquid gasket to the bolt threads of PCV valve.

Liquid gasket:

THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:

23 N·m (2.35 kgf-m, 17.0 ft-lb)

ENGINE SECTION 1

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.

FUEL INJECTION (FUEL SYSTEMS) FU(H4SO 2.0)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4SO 2.0)**

INTAKE (INDUCTION) IN(H4SO 2.0)

MECHANICAL ME(H4SO 2.0)

EXHAUST EX(H4SO 2.0)

COOLING CO(H4SO 2.0)

LUBRICATION LU(H4SO 2.0)

SPEED CONTROL SYSTEMS SP(H4SO 2.0)

IGNITION IG(H4SO 2.0)

STARTING/CHARGING SYSTEMS SC(H4SO 2.0)

**ENGINE (DIAGNOSTICS) EN(H4SO 2.0)
(diag)**

FUEL INJECTION (FUEL SYSTEMS) FU(H4SO 2.5)

**EMISSION CONTROL
(AUX. EMISSION CONTROL DEVICES) EC(H4SO 2.5)**

INTAKE (INDUCTION) IN(H4SO 2.5)

MECHANICAL ME(H4SO 2.5)

EXHAUST EX(H4SO 2.5)

COOLING CO(H4SO 2.5)

ENGINE SECTION 1**LUBRICATION****LU(H4SO 2.5)****SPEED CONTROL SYSTEMS****SP(H4SO 2.5)****IGNITION****IG(H4SO 2.5)****STARTING/CHARGING SYSTEMS****SC(H4SO 2.5)****ENGINE (DIAGNOSTICS)****EN(H4SO 2.5)
(diag)**

STARTING/CHARGING SYSTEMS

SC(H4SO 2.0)

	Page
1. General Description	2
2. Starter	6
3. Generator	14
4. Battery	20

General Description

STARTING/CHARGING SYSTEMS

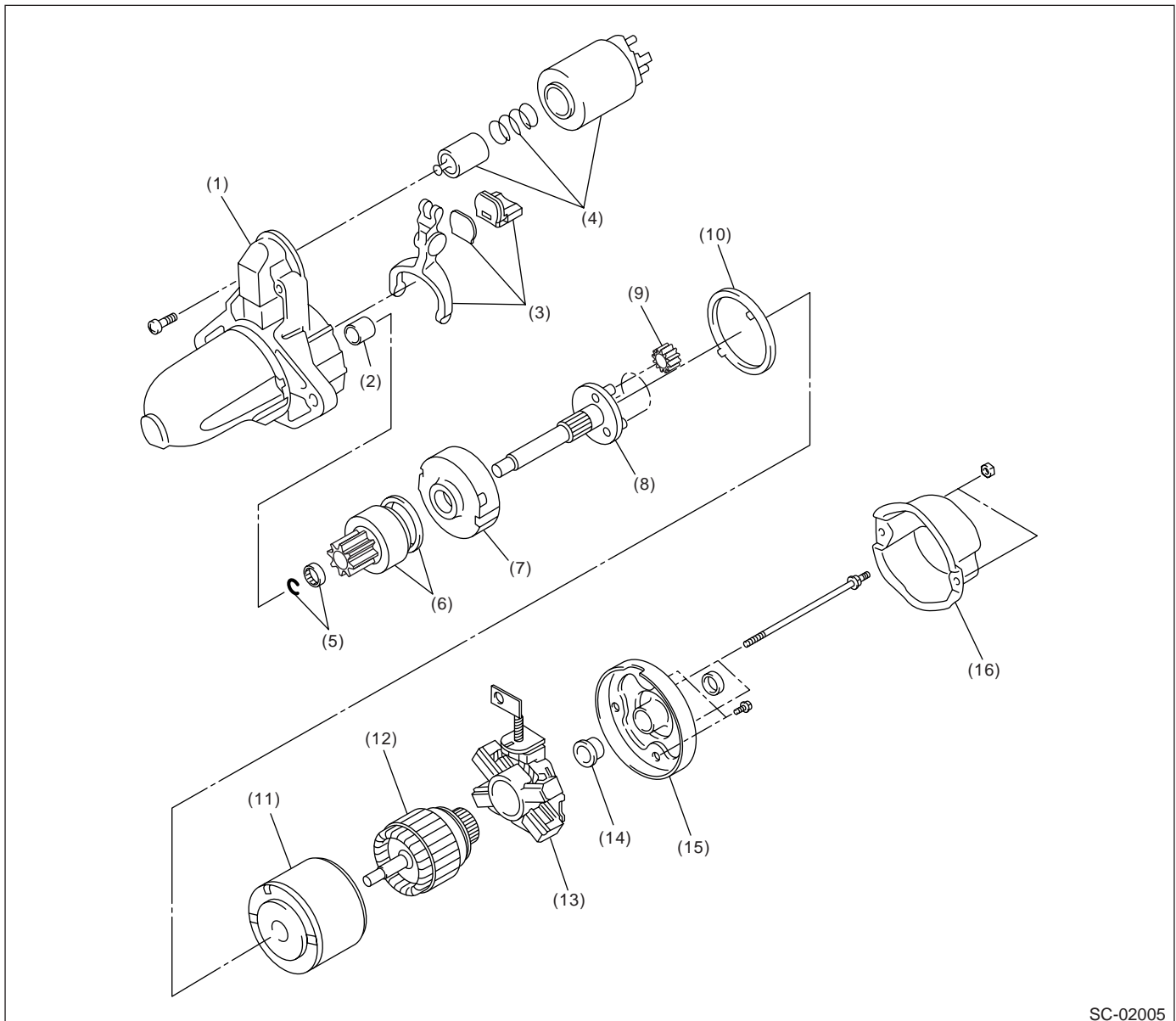
1. General Description

A: SPECIFICATION

Item			Specification	
Vehicle model			MT	AT
Starter	Type		Reduction type	
	Model		M000T30471	M000T20171
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 1.0 kW	12 V — 1.4 kW
	Revolving direction		Counterclockwise (when observed from pinion)	
	Number of pinion teeth		8	9
	No-load characteristics	Voltage	11 V	
		Current	95 A or less	90 A or less
		Rotating speed	2,500 rpm or more	2,000 rpm or more
	Load characteristics	Voltage	7.5 V	7.7 V
		Current	300 A	400 A
		Torque	8.84 N·m (0.90 kgf-m, 6.5 ft-lb) or more	16.7 N·m (1.70 kgf-m, 12.3 ft-lb) or more
		Rotating speed	870 rpm or more	710 rpm or more
	Lock characteristics	Voltage	4 V	3.5 V
		Current	680 A or less	960 A or less
		Torque	17 N·m (1.73 kgf-m, 12.5 ft-lb) or more	31 N·m (3.16 kgf-m, 22.9 ft-lb) or more
Generator	Model		Rotating-field three-phase type, voltage regulator built-in type, with load response control system	
	Model		A3TG0491	
	Manufacturer		Mitsubishi Electric	
	Voltage and output		12 V — 110 A	
	Polarity on ground side		Negative	
	Revolving direction		Clockwise (when observed from pulley side)	
	Armature connection		3-phase Y-type	
	Output current		1,500 rpm — 50 A or more 2,500 rpm — 91 A or more 5,000 rpm — 105 A or more	
	Regulated voltage		14.1 — 14.8 V [20°C (68°F)]	
Battery	Type and capacity	EC, EK, K4 model	12 V — 48 AH (55D23L)	12 V — 52 AH (65D23L) 12 V — 52 AH (75D23L)
		KS, KA model	12 V — 27 AH (34B19L) 12 V — 48 AH (55D23L)	

B: COMPONENT

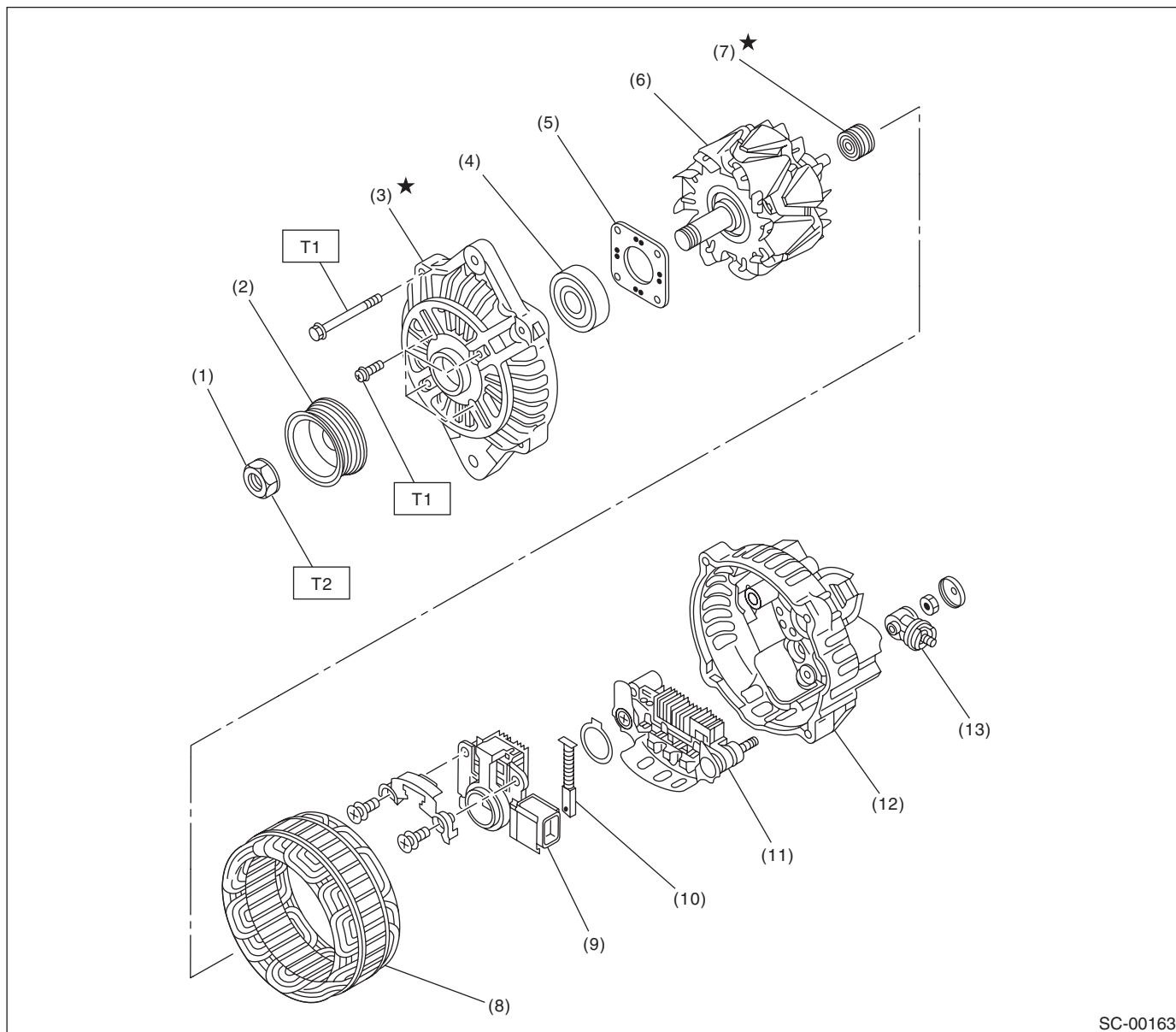
1. STARTER



SC-02005

- | | | |
|------------------------|------------------------|------------------------|
| (1) Front bracket | (7) Internal gear ASSY | (13) Brush holder ASSY |
| (2) Sleeve bearing | (8) Shaft ASSY | (14) Sleeve bearing |
| (3) Lever set | (9) Gear ASSY | (15) Rear cover |
| (4) Magnet switch ASSY | (10) Packing | (16) Rear cover set |
| (5) Stopper set | (11) Yoke ASSY | |
| (6) Overrunning clutch | (12) Armature | |
| | (13) Brush holder ASSY | |

2. GENERATOR



SC-00163

- | | |
|----------------------|-----------------------------|
| (1) Pulley nut | (7) Bearing |
| (2) Pulley | (8) Stator coil |
| (3) Front cover | (9) IC regulator with brush |
| (4) Ball bearing | (10) Brush |
| (5) Bearing retainer | (11) Rectifier |
| (6) Rotor | (12) Rear cover |

- (13) Terminal

Tightening torque: N·m (kgf·m, ft·lb)

T1: 4.7 (0.48, 3.5)

T2: 108 (11.0, 80)

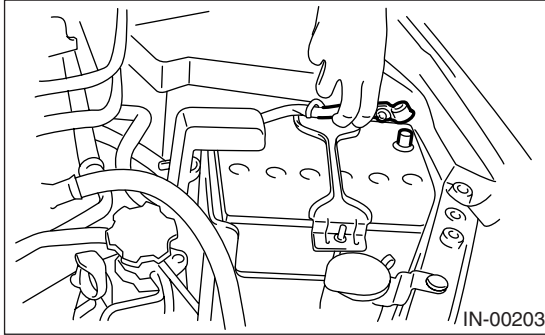
C: CAUTION

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

2. Starter

A: REMOVAL

1) Disconnect the ground cable from battery.

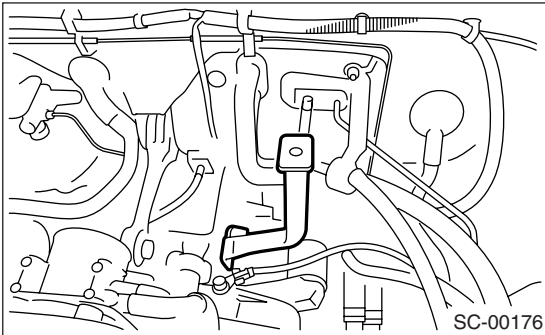


2) Remove the air intake chamber. (Non-turbo model) <Ref. to IN(H4SO 2.0)-8, REMOVAL, Air Intake Chamber.>

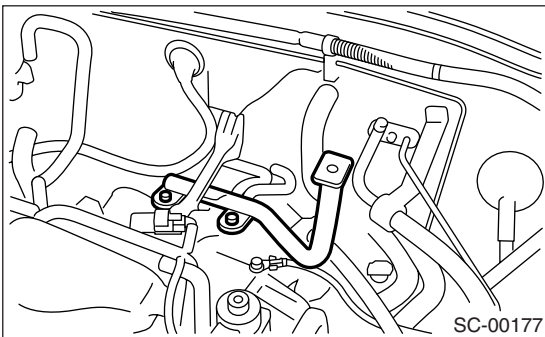
3) Remove the intercooler. (Turbo model) <Ref. to IN(H4DOTC)-12, REMOVAL, Intercooler.>

4) Remove the air intake chamber stay LH. (Non-turbo model).

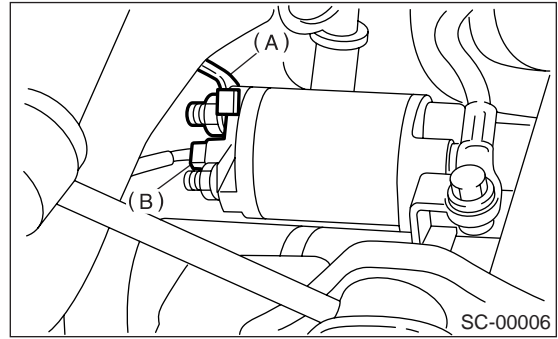
- MT model



- AT model



5) Disconnect the connector and terminal from starter.

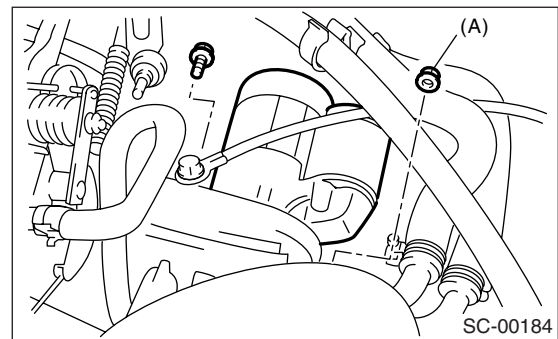


- (A) Terminals
- (B) Connector

6) Remove the starter from transmission.

NOTE:

In case of MT model, the bolt is used in place of nut (A) shown in the figure.



B: INSTALLATION

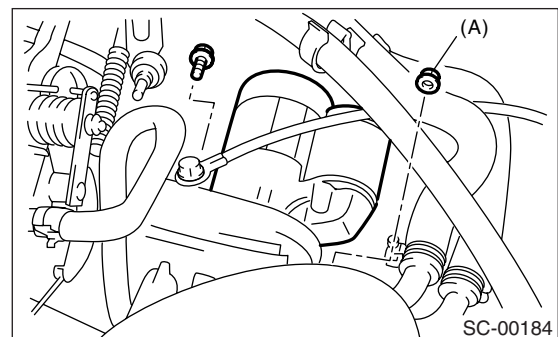
Install in the reverse order of removal.

NOTE:

In case of MT model, the bolt is used in place of nut (A) shown in the figure.

Tightening torque:

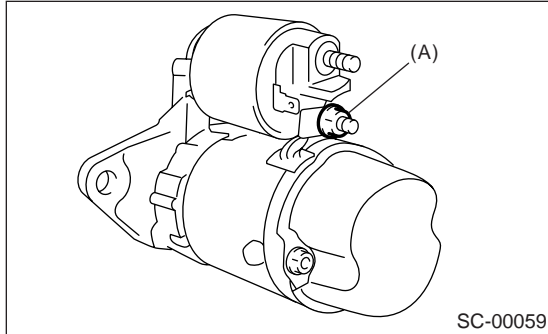
50 N·m (5.1 kgf-m, 37 ft-lb)



C: DISASSEMBLY

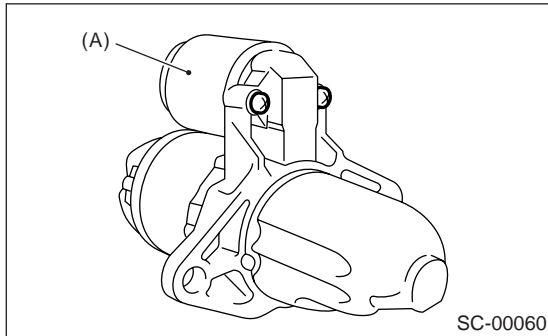
1. STARTER ASSEMBLY

1) Loosen the nut which holds terminal M of switch assembly, and then disconnect the connector.



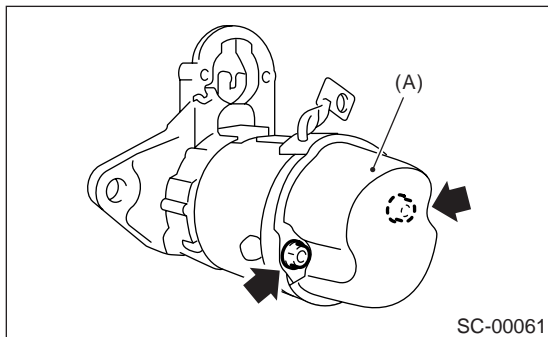
(A) Terminal M

2) Remove the bolts which hold switch assembly, and then remove the switch assembly, plunger and plunger spring from starter as a unit.



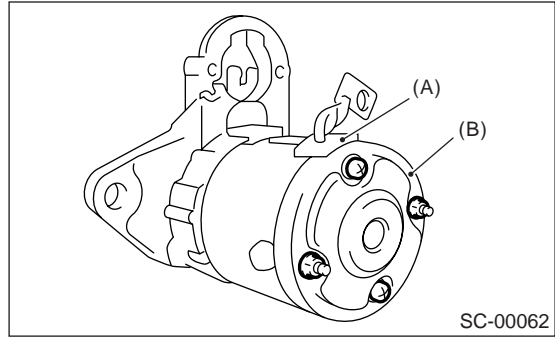
(A) Switch ASSY

3) Remove the nuts of both sides, and then remove rear cover set.



(A) Rear cover set

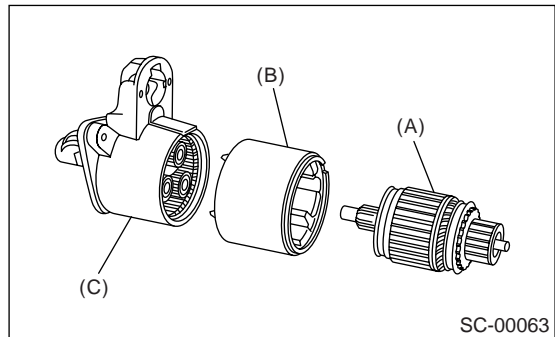
4) Remove the through-bolts and brush holder screws of both sides, and then detach the rear cover and brush holder assembly.



(A) Brush holder ASSY

(B) Rear cover

5) Remove the armature and yoke assembly from front bracket.

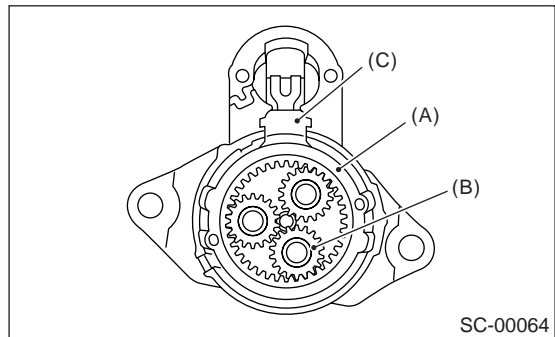


(A) Armature

(B) Yoke ASSY

(C) Front bracket

6) Remove the packing A, planetary gear and packing B.

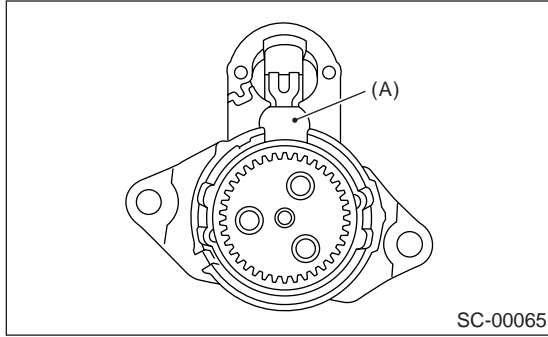


(A) Packing A

(B) Planetary gear

(C) Packing B

7) Remove the plate.



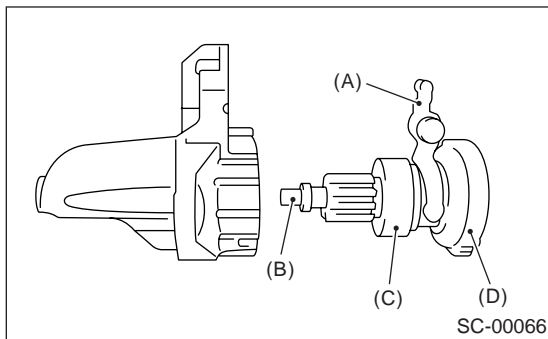
(A) Plate

8) Remove the shaft assembly and overrunning clutch from front bracket as a unit.

NOTE:

Check the following points before removal.

- Lever direction
- Position of internal gear assembly

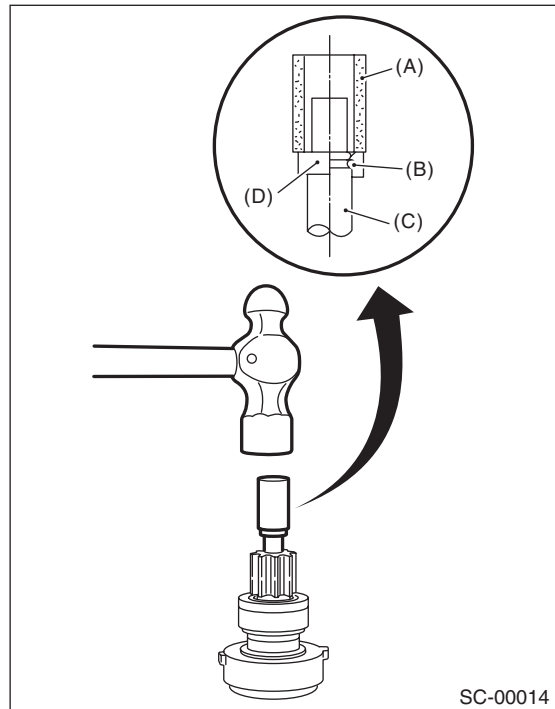


- (A) Lever
- (B) Shaft ASSY
- (C) Overrunning clutch
- (D) Internal gear ASSY

9) Remove the overrunning clutch from shaft assembly as follows:

(1) Remove the stopper from ring by lightly tapping the stopper with an appropriate tool (such as a fit socket wrench).

(2) Remove the ring, stopper and clutch from shaft.



- (A) Socket wrench
- (B) Ring
- (C) Shaft
- (D) Stopper

D: ASSEMBLY

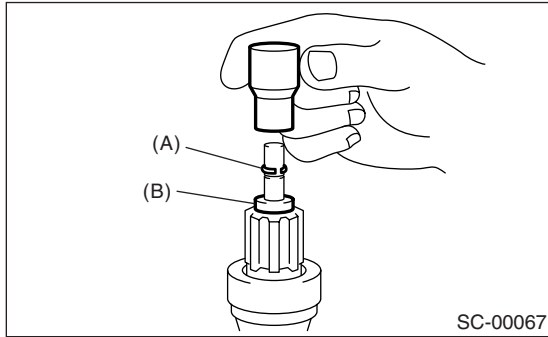
NOTE:

Apply grease to the following parts before assembly.

- Sleeve bearing
- Pinion shaft rotating part
- Shaft spline portion
- Inside of reduction system
- Lever fulcrum/Clutch rotating part

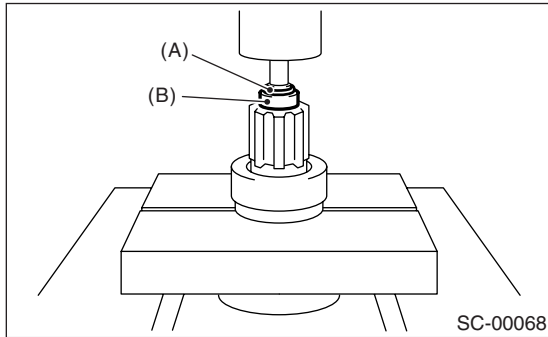
- 1) Install the overrunning clutch to shaft assembly.
- 2) Install the stopper to shaft assembly as follows.

(1) Insert the ring into the shaft groove by lightly tapping it with an appropriate tool (such as a fit socket wrench).



- (A) Ring
- (B) Stopper

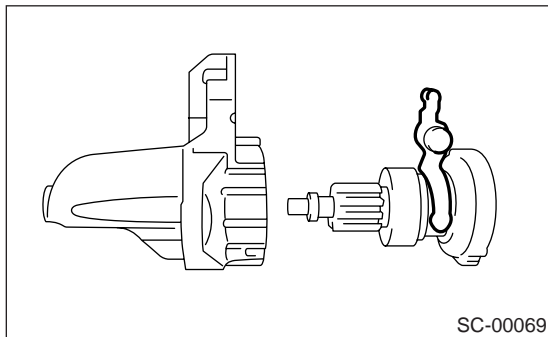
(2) Install the stopper to ring using a press.



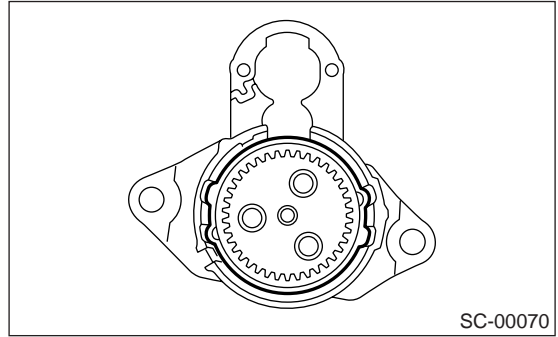
- (A) Ring
- (B) Stopper

3) Install the shaft assembly to front bracket while taking care of the following points.

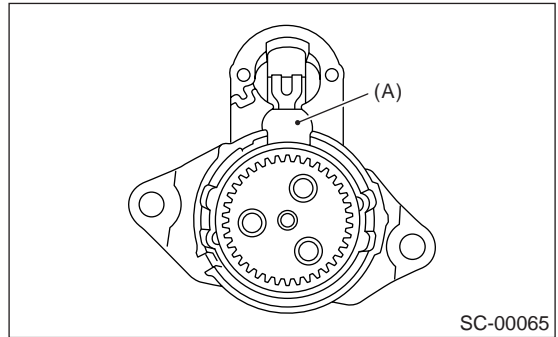
(1) Lever direction



(2) Internal gear position



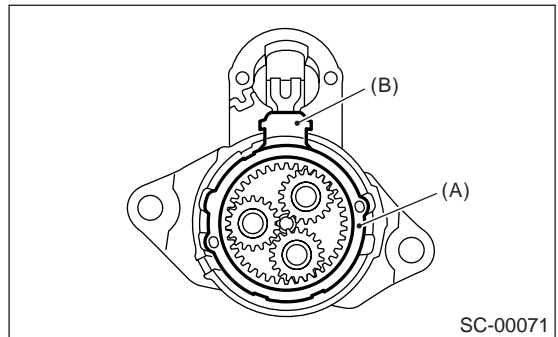
4) Install the plate.



- (A) Plate

5) Install the planetary gear.

6) Install the packing A and B while taking care of installing positions.



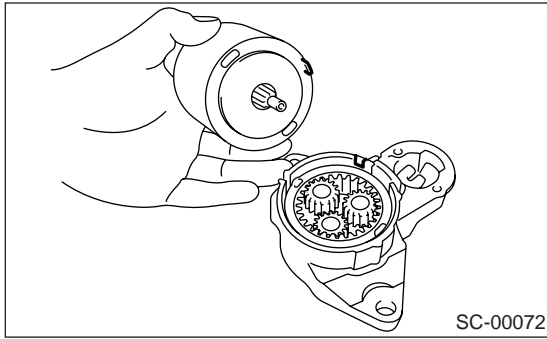
- (A) Packing A
- (B) Packing B

7) Install the armature to yoke assembly.

Starter

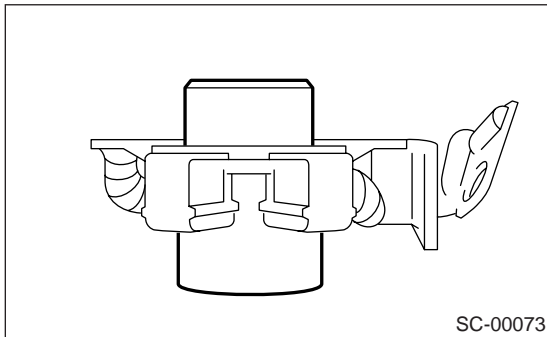
STARTING/CHARGING SYSTEMS

8) Install the yoke to front bracket matching front bracket to the groove of yoke assembly.

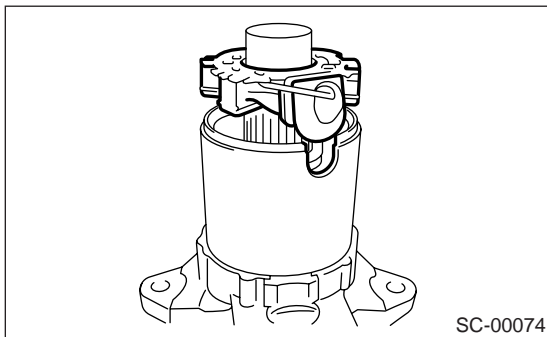


9) Install the brush holder to yoke assembly as follows.

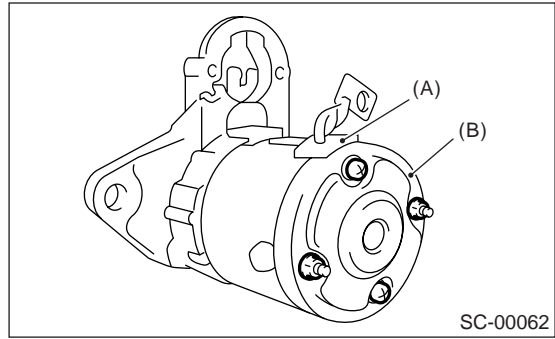
(1) Press the brush down into brush holder, and then fix the brush in that position using an appropriate tool (such as a fit socket wrench).



(2) Match the brush holder to groove of yoke, and then slide the brush holder into yoke assembly to install.



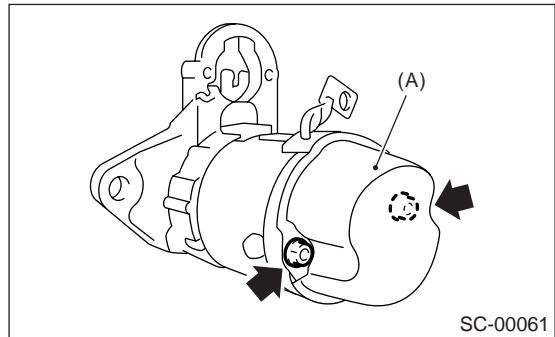
10) Install the rear cover matching its groove to brush holder assembly.



(A) Brush holder ASSY

(B) Rear cover

11) Install rear cover set.

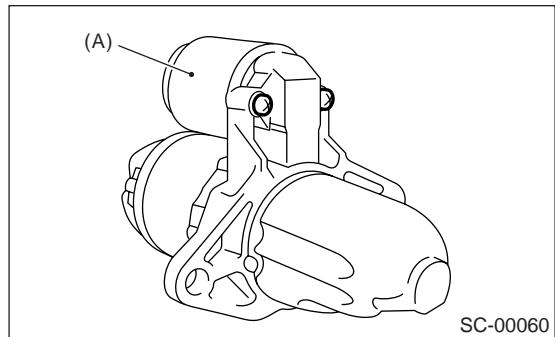


(A) Rear cover set

12) Install the switch assembly to front bracket as follows.

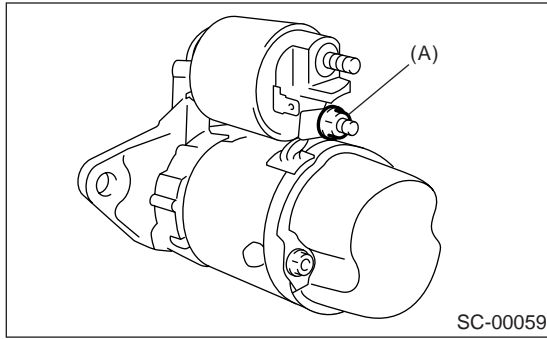
(1) Insert the plunger and plunger spring into switch assembly.

(2) Hook the plunger protrusion on lever edge to install plunger to front bracket.



(A) Switch ASSY

13) Connect the connector to terminal M of switch assembly.



(A) Terminal M

E: INSPECTION

1. ARMATURE

1) Check the commutator for any sign of burns or rough surfaces or stepped wear. If wear is of a minor nature, correct it by using sand paper.

2) Run-out test

Check the commutator for run-out, and then replace if it exceeds the limit.

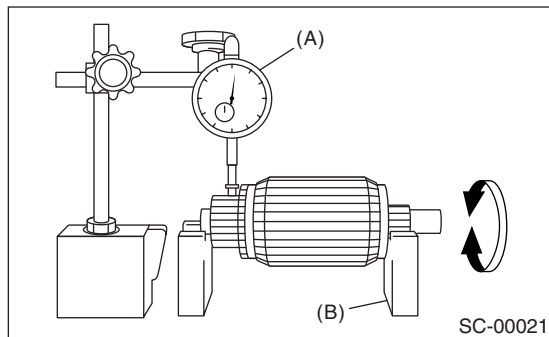
Commutator run-out:

Standard

0.05 mm (0.0020 in)

Service limit

Less than 0.10 mm (0.0039 in)

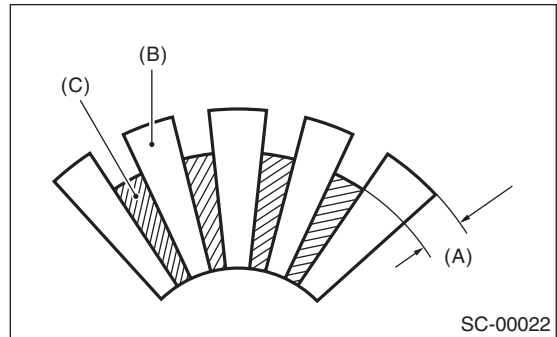


(A) Dial gauge

(B) V-block

3) Depth of segment mold
Check the depth of segment mold.

Depth of segment mold:
0.5 mm (0.020 in)



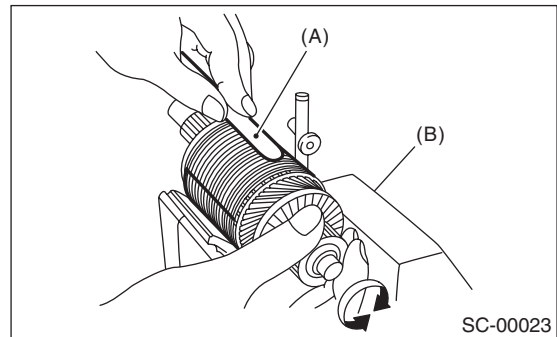
(A) Depth of mold

(B) Segment

(C) Mold

4) Armature short-circuit test

Check the armature for short-circuit by placing it on growler tester. Hold an iron sheet against the armature core while slowly rotating the armature. A short-circuited armature will cause the iron sheet to vibrate and to be attracted to core. If the iron sheet is attracted or vibrates, the armature, which is short-circuited, must be replaced or repaired.



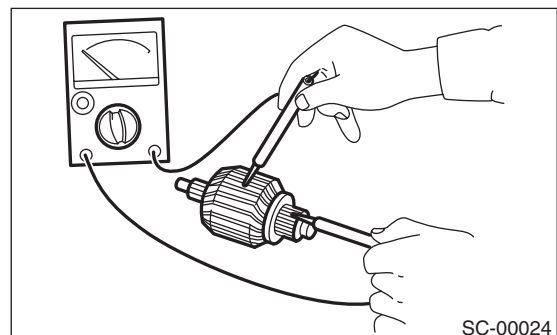
(A) Iron sheet

(B) Growler tester

5) Armature ground test

Using a circuit tester, touch one probe to the commutator segment and the other to shaft. There should be no continuity. If there is continuity, the armature is grounded.

Replace the armature if it is grounded.



2. YOKE

Make sure the pole is set in position.

3. OVERRUNNING CLUTCH

Inspect the teeth of pinion for wear and damage. Replace if it is damaged. Rotate the pinion in the right direction of rotation (counterclockwise). It should rotate smoothly. But in the opposite direction, it should be locked.

CAUTION:

Do not clean the overrunning clutch with oil to prevent grease from flowing out.

4. BRUSH AND BRUSH HOLDER

1) Brush length

Measure the brush length, and then replace if it exceeds the service limit.

Replace if abnormal wear or cracks are noticed.

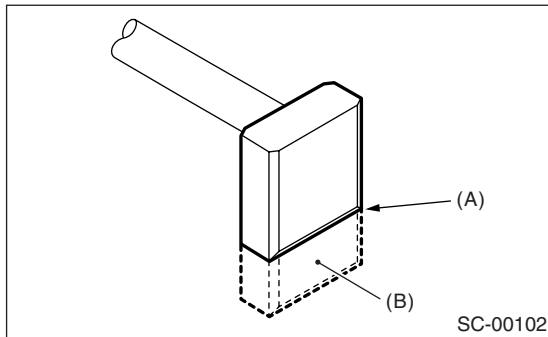
Brush length:

Standard

12.3 mm (0.484 in)

Service limit

7.0 mm (0.276 in)



(A) Service limit line

(B) Brush

2) Brush movement

Be sure the brush moves smoothly inside brush holder.

3) Brush spring force

Measure the brush spring force with a spring scale. If it is less than the service limit, replace the brush holder.

Brush spring force:

Standard

15.9 — 19.5 N (1.62 — 1.99 kgf, 3.57 — 4.38 lb) (when new)

Service limit

2.5 N (0.25 kgf, 0.56 lb)

5. SWITCH ASSEMBLY

Be sure there is continuity between the terminals S and M, and between terminal S and ground. Use a circuit tester (set in "ohm").

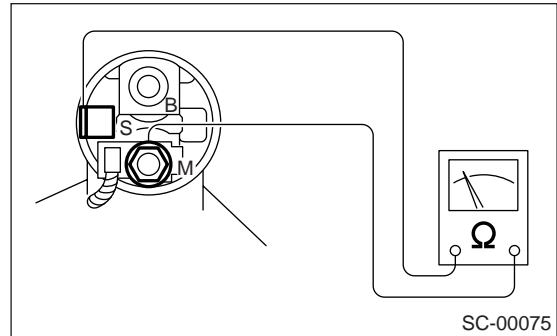
Also check to be sure there is no continuity between terminal M and B.

Terminal / Specified resistance:

S — M / Less than 1 Ω

S — Ground / Less than 1 Ω

M — B / More than 1 M Ω



SC-00075

6. SWITCH ASSEMBLY OPERATION

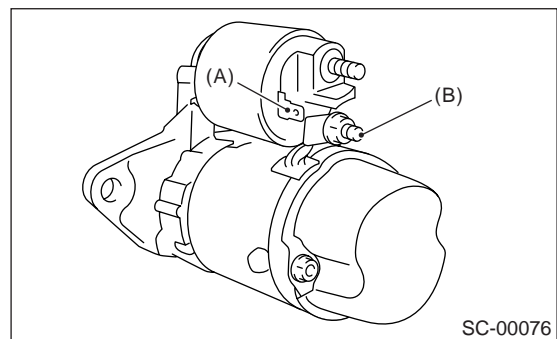
1) Using a lead wire, connect the terminal S of switch assembly to positive terminal of battery, and starter body to ground terminal of battery. The pinion should be forced endwise on shaft.

CAUTION:

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.



SC-00076

(A) Terminal S

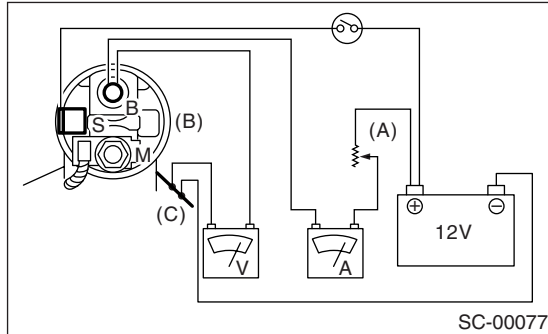
(B) Terminal M

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 the figure.



- (A) Variable resistance
- (B) Starter body
- (C) Magnetic switch

1) No-load test

With switch on, adjust the variable resistance for the voltage to obtain 11 V, read the ammeter and measure the starter speed. Compare these values with the specifications.

No-load test (Standard):

Voltage / Current

MT model

11 V / 95 A or less

AT model

11 V / 90 A or less

Rotating speed

MT model

2,500 rpm or more

AT model

2,000 rpm or more

2) Load test

Apply the specified braking torque to starter. The condition is satisfactory if the current draw and starter speed are within specifications.

Load test (Standard):

Voltage / Load

MT model

7.5 V / 8.84 N·m (0.90 kgf-m, 6.5 ft-lb)

AT model

7.7 V / 16.7 N·m (1.70 kgf-m, 12.3 ft-lb)

Current / Speed

MT model

300 A / 870 rpm or more

AT model

400 A / 710 rpm or more

3) Lock test

With the starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to the specified voltage.

Lock test (Standard):

Voltage / Current

MT model

4 V / 680 A or less

AT model

3.5 V / 960 A or less

Torque

MT model

17 N·m (1.73 kgf-m, 12.5 ft-lb)

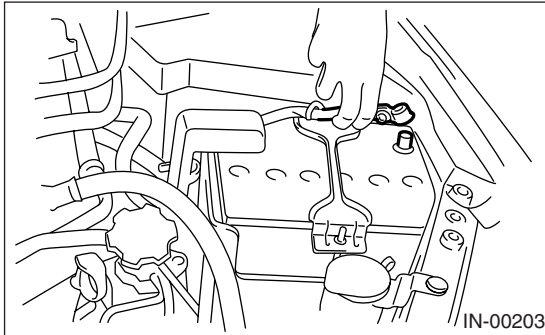
AT model

31 N·m (3.16 kgf-m, 22.9 ft-lb)

3. Generator

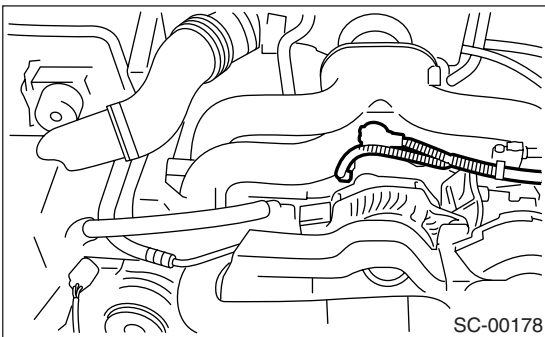
A: REMOVAL

1) Disconnect the ground cable from battery.

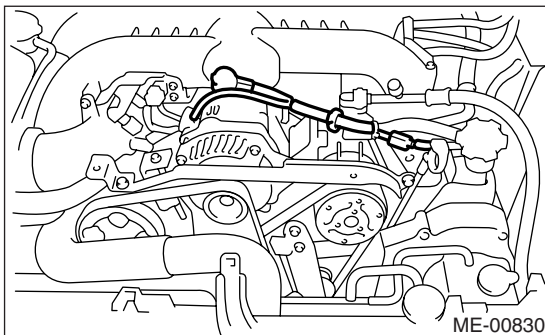


2) Disconnect the connector and terminal from generator.

- Non-turbo model



- Turbo model

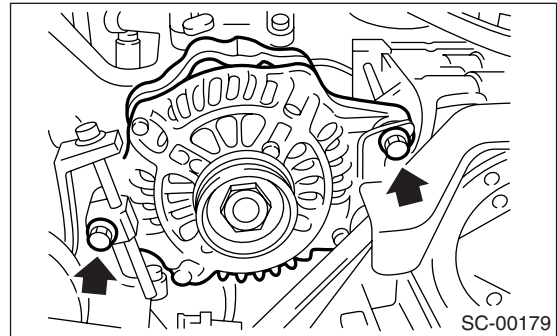


3) Remove the V-belt covers.

4) Remove the front side belts.

<Ref. to ME(H4SO 2.0)-38, FRONT SIDE BELT, REMOVAL, V-belt.> or <Ref. to ME(H4DOTC)-39, 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.

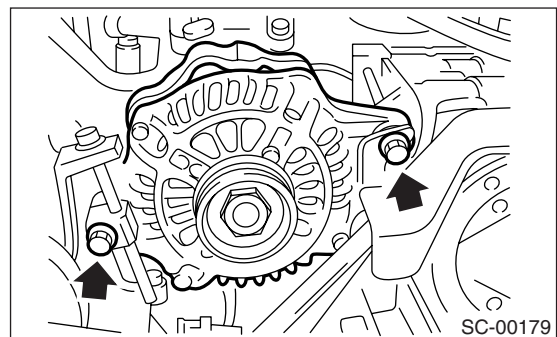
Tightening torque:

25 N·m (2.5 kgf-m, 18.1 ft-lb)

CAUTION:

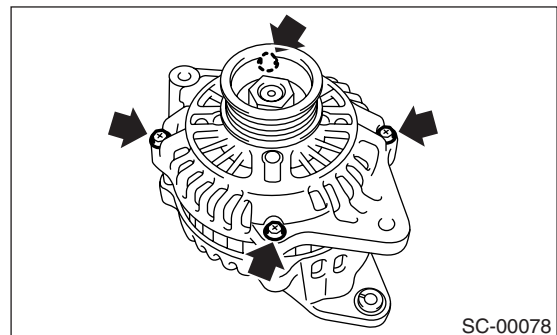
Check and adjust the V-belt tension.

<Ref. to ME(H4SO 2.0)-39, INSPECTION, V-belt.> or <Ref. to ME(H4DOTC)-40, INSPECTION, V-belt.>

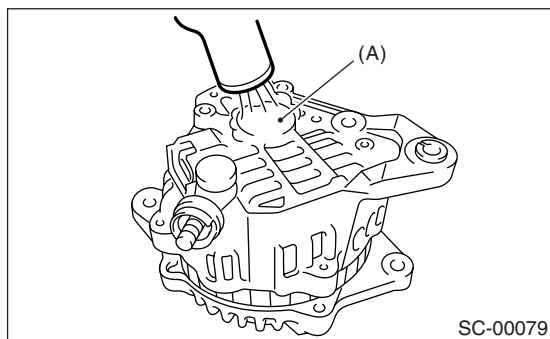


C: DISASSEMBLY

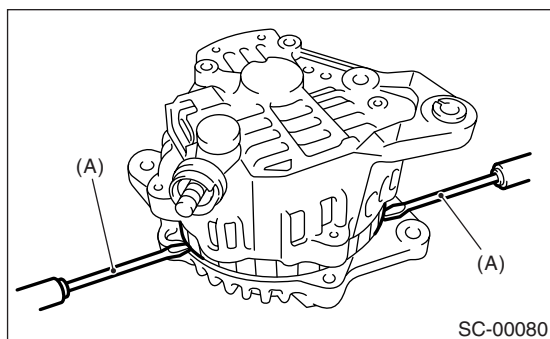
1) Remove the four through-bolts.



- 2) Heat portion (A) of rear cover to 50°C (122°F) with a heater drier.

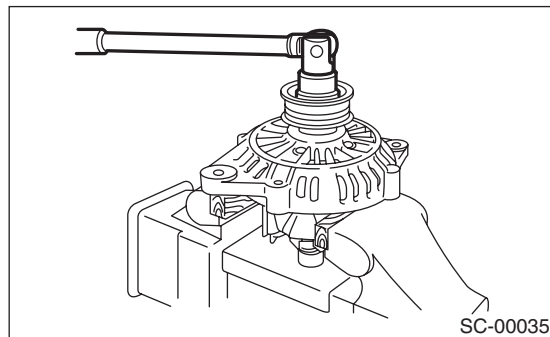


- 3) Then insert the tip of a flat tip screwdriver into the gap between stator core and front cover. Pry them apart to disassemble.



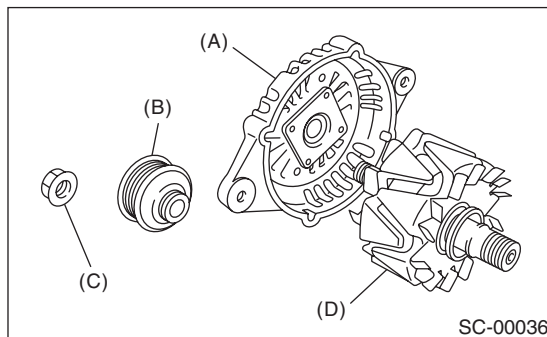
(A) Screwdriver

- 4) Hold the rotor with a vise and remove pulley nut.



CAUTION:

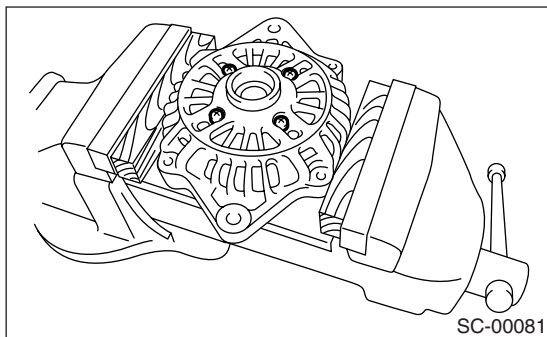
When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.



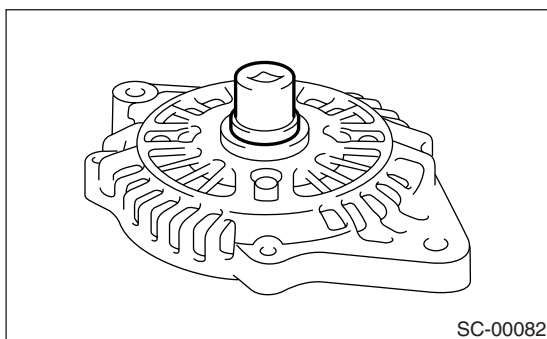
- (A) Front cover
- (B) Pulley
- (C) Nut
- (D) Rotor

- 5) Remove the ball bearing as follows.

- (1) Remove the bolt, and then remove the bearing retainer.



- (2) Firmly install an appropriate tool (such as a fit socket wrench) to bearing inner race.

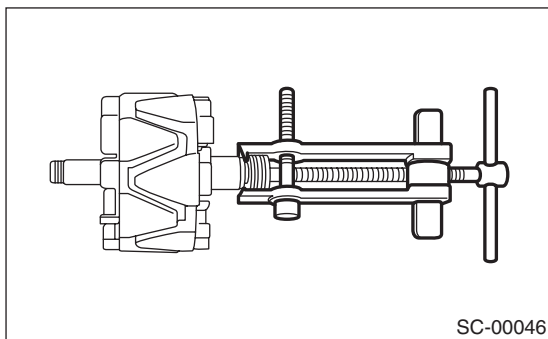


- (3) Push the ball bearing off the front cover using a press.

Generator

STARTING/CHARGING SYSTEMS

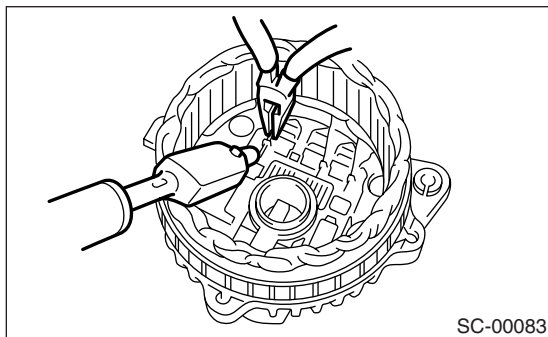
6) Remove the bearing from rotor using a bearing puller.



7) Unsolder connection between rectifier and stator coil to remove the stator coil.

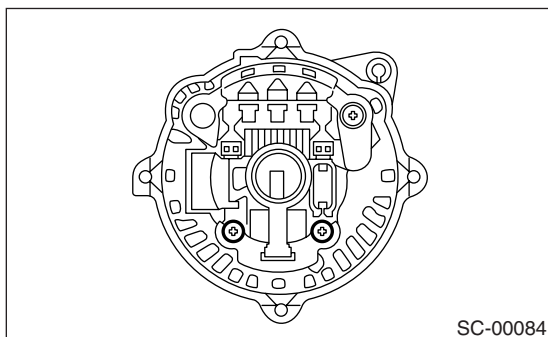
CAUTION:

Do not allow a 180 — 270 W soldering iron to contact the terminals for more than 5 seconds at once because the rectifier cannot withstand so much heat.

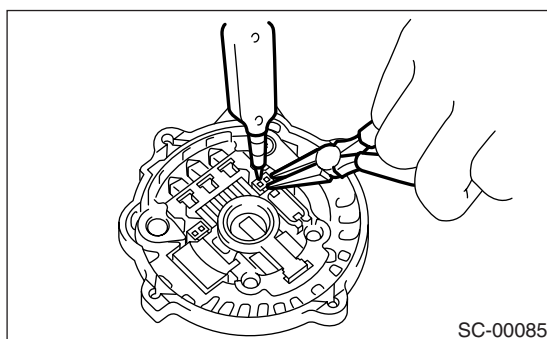


8) Remove the IC regulator as follows.

(1) Remove the screws which secure IC regulator to rear cover.

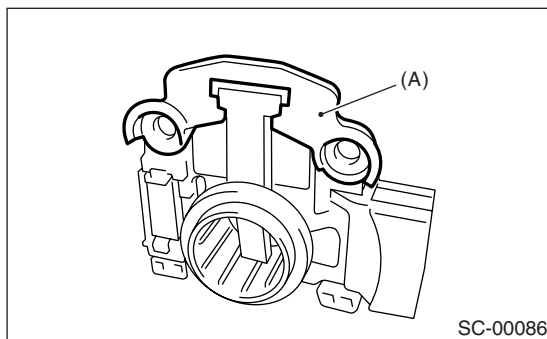


(2) Unsolder the connection between IC regulator and rectifier to remove the IC regulator.



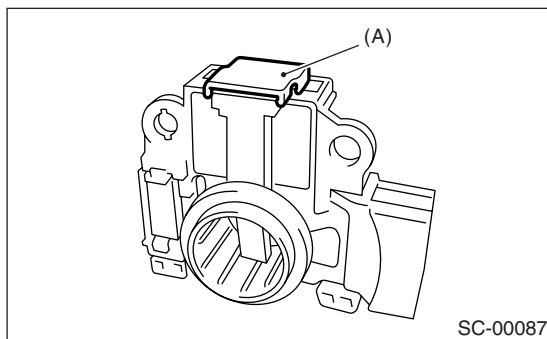
9) Remove the brush as follows.

(1) Remove cover A.



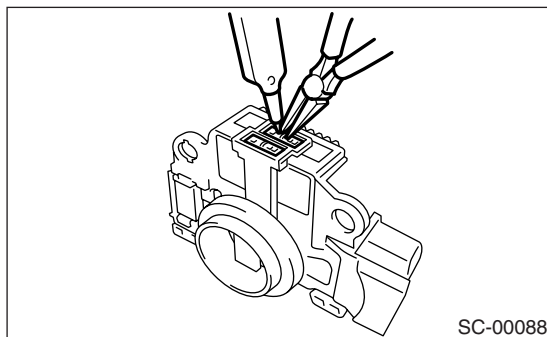
(A) Cover A

(2) Remove cover B.



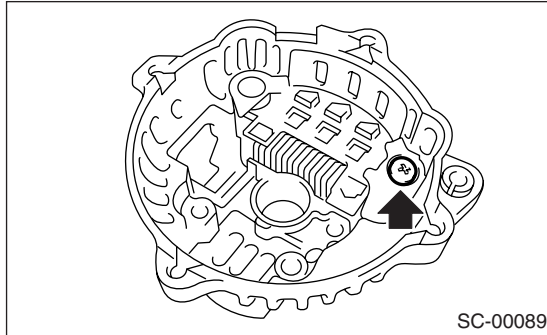
(A) Cover B

(3) Separate the brush from connection to remove.

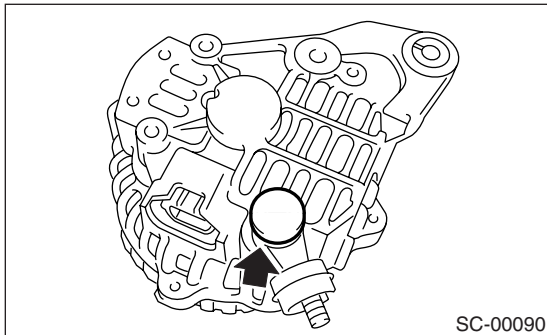


10) Remove the rectifier as follows.

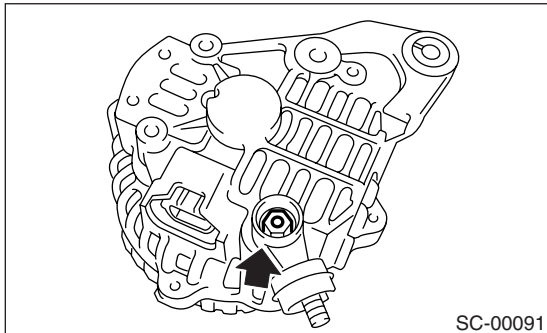
(1) Remove the bolt which secures the rectifier.



(2) Remove the cover of terminal B.

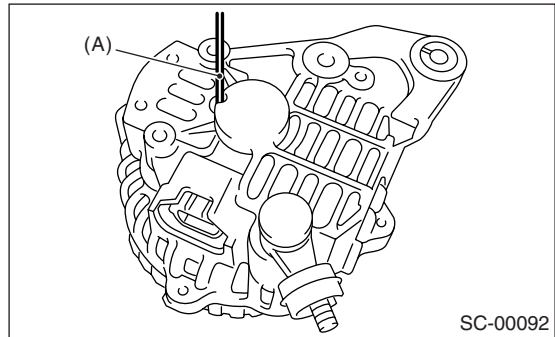


(3) Remove the nut of terminal B, and then remove the rectifier.



CAUTION:

Be sure to remove the wire after reassembly.



(A) Wire

2) Install the ball bearing.

(1) Set the ball bearing on the front cover, and then securely install an appropriate tool (such as a fit socket wrench) to the bearing outer race.

(2) Press the ball bearing into the specified position using a press.

(3) Install the bearing retainer.

3) Press the bearing (rear side) into the rotor shaft using a press to install.

4) Heat the bearing box in rear cover [50 to 60°C (122 to 140°F)], and then press the rear bearing into rear cover.

CAUTION:

Grease should not be applied to rear bearing. Remove the oil completely if it is found on bearing box.

5) After reassembly, turn the pulley by hand to check that rotor turns smoothly.

D: ASSEMBLY

Assemble in the reverse order of disassembly.

1) Pulling up brush

Before assembling, press the brush down into brush holder, and then fix them in that position by passing a [1 mm (0.08 in) dia. 40 to 50 mm (1.6 to 2.0 in) long] wire through the hole as shown in the figure.

E: INSPECTION

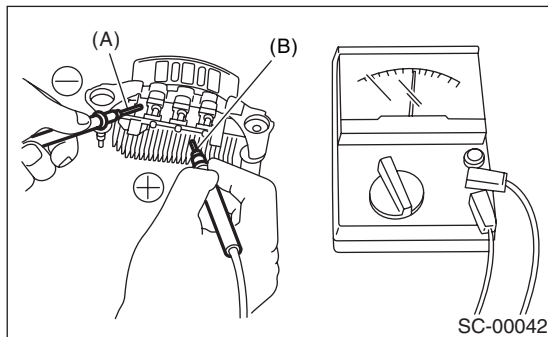
1. DIODE

CAUTION:

Never use a mega tester (designed for reading high voltage) or any other similar instrument for this test; otherwise, the diodes may be damaged.

1) Checking positive diode

Check for continuity between the diode lead and positive side heat sink. The positive diode is in good condition if resistance is $1\ \Omega$ or less only in the direction from the diode lead to heat sink.

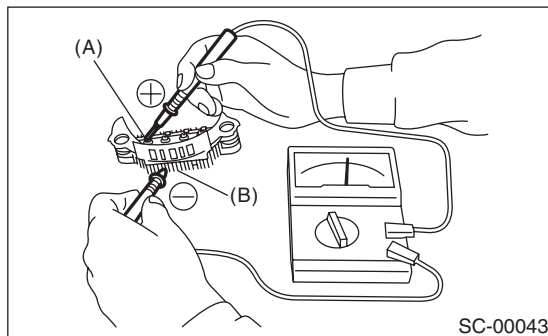


(A) Diode lead

(B) Heat sink (positive side)

2) Checking negative diode

Check for continuity between the negative side heat sink and diode lead. The negative diode is in good condition if resistance is $1\ \Omega$ or less only in the direction from the heat sink to diode lead.



(A) Diode lead

(B) Heat sink (negative side)

2. ROTOR

1) Slip ring surface

Inspect the slip rings for contamination or any roughness on the sliding surface. Repair the slip ring surface using a lathe or sand paper.

2) Slip ring outer diameter

Measure the slip ring outer diameter. If the slip ring is worn, replace the rotor assembly.

Slip ring outer diameter:

Standard

22.7 mm (0.894 in)

Limit

22.1 mm (0.870 in)

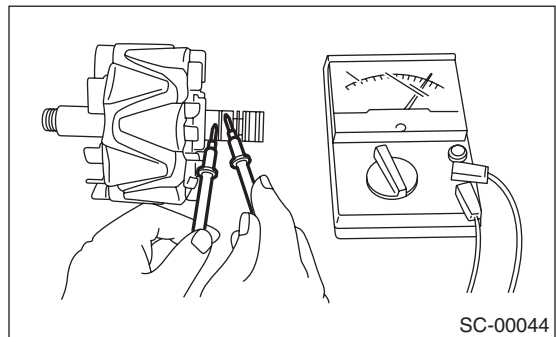
3) Continuity test

Check the resistance between slip rings using circuit tester.

If the resistance is not within the specified range, replace the rotor assembly.

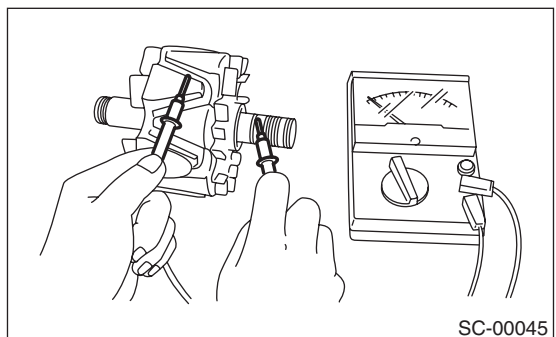
Specified resistance:

Approx. 1.8 — 2.2 Ω



4) Insulation test

Check the continuity between slip ring and rotor core or shaft. If resistance is $1\ \Omega$ or less, the rotor coil is grounded, and so replace the rotor assembly.



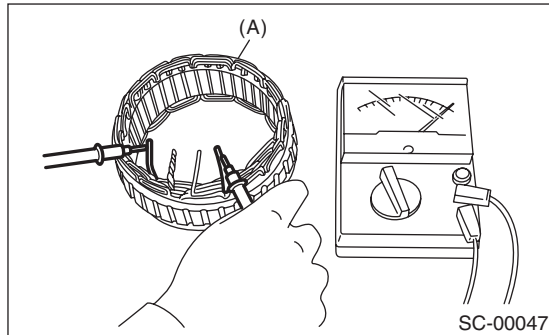
5) Ball bearing (rear side)

Check the rear ball bearing. Replace if it is noisy or if the rotor does not turn smoothly.

3. STATOR

1) Continuity test

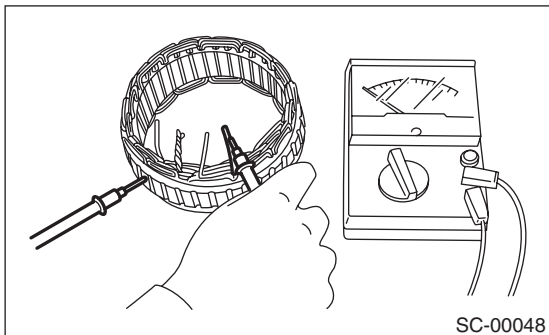
Inspect the stator coil for continuity between each end of the lead wires. If resistance is $1\text{ M}\Omega$ or more, the lead wire is broken, and so replace the stator assembly.



(A) Stator

2) Insulation test

Inspect the stator coil for continuity between stator core and each end of lead wire. If resistance is $1\ \Omega$ or less, the stator coil is grounded, and so replace the stator assembly.



4. BRUSH

1) Measure the length of each brush. If wear exceeds the service limit, replace the brush. Each brush has the service limit mark (A) on it.

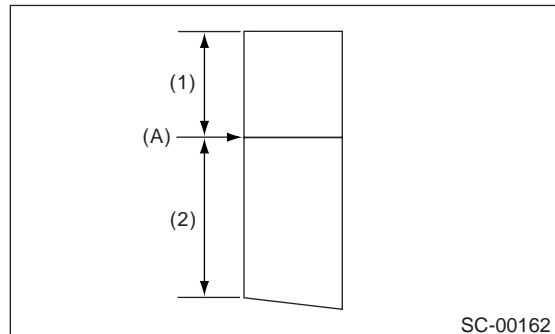
Brush length:

Service limit (1)

5.0 mm (0.197 in)

Standard (2)

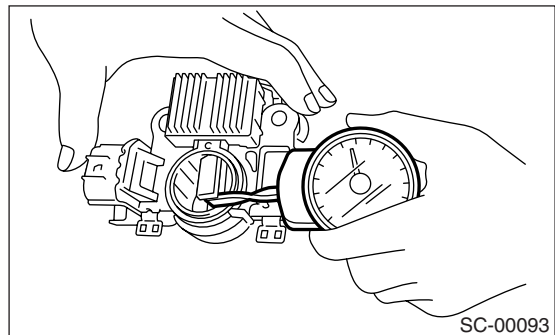
18.5 mm (0.728 in)



SC-00162

2) Checking brush spring for proper pressure

Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.08 in). Then measure the pressure of brush spring. If the pressure is less than 2.648 N (270 g, 9.52 oz), replace the brush spring with a new one. The new spring must have a pressure of 4.609 to 5.786 N (470 to 590 g, 16.58 to 20.810 oz).



SC-00093

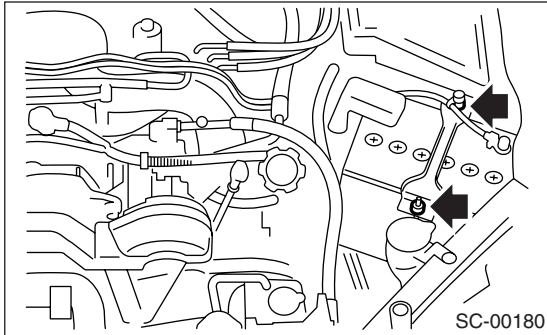
5. BEARING (FRONT SIDE)

Check the front ball bearing. If the resistance is felt while rotating, or if abnormal noise is heard, replace the ball bearing.

4. Battery

A: REMOVAL

- 1) Disconnect the positive (+) terminal after disconnecting the negative (–) terminal of battery.
- 2) Remove the flange nuts from battery rods and take off battery holder.



- 3) Remove the battery.

B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:

3.4 N·m (0.35 kgf-m, 2.5 ft-lb)

NOTE:

- Clean the battery cable terminals and apply grease to retard the formation of corrosion.
- Connect the positive (+) terminal, and then connect the negative (–) terminal of battery.
- Initial diagnosis of electronic control throttle is performed after battery installation. For this reason, start the engine after 10 seconds or more have elapsed since the ignition switch was turned to ON.

C: INSPECTION

WARNING:

- Electrolyte has toxicity; be careful handling the fluid.
- Avoid contact with skin, eyes or clothing. Especially at contact with eyes, flush with water for 15 minutes and get prompt medical attention.
- Batteries produce explosive gases. Keep sparks, flame, cigarettes away.
- Ventilate when charging or using in enclosed space.
- For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. Never lean over a battery.
- Do not let battery fluid contact eyes, skin, fabrics, or paint-work because battery fluid is corrosive acid.

- To lessen the risk of sparks, remove rings, metal watch-bands, and other metal jewelry. Never allow metal tools to contact the positive battery terminal and anything connected to it while you are at the same time in contact with any other metallic portion of the vehicle. This may cause short circuit.

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 equation:

$$S_{20} = St + 0.0007 \times (t - 20)$$

S_{20} : Specific gravity corrected at electrolyte temperature of 20°C (68°F)

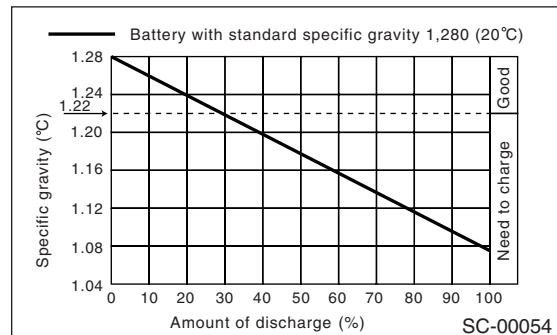
St : Measured specific gravity

t : Measured temperature (°C)

Determine whether or not battery must be charged, according to corrected specific gravity.

Standard specific gravity: 1.220 — 1.290 [20°C (68°F)]

- 2) Measuring the specific gravity of the electrolyte in the battery will disclose the state of charge of the battery. The relation between specific gravity and state of charge is as shown in the figure.



D: MEASUREMENT

WARNING:

Do not bring an open flame close to the battery at this time.

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 vehicle, disconnect the battery ground terminal to prevent damage of generator diodes or other electrical modules.

1. JUDGMENT OF BATTERY IN CHARGED CONDITION

1) Specific gravity of electrolyte should be held within the specific range from 1.250 to 1.290 for more than one hour.

2) Voltage per battery cell should be held at a specific value in a range from 2.5 to 2.8 V for more than one hour.

2. CHECK HYDROMETER FOR STATE OF CHARGE

Hydrometer indicator	Charge battery	Corrective action
Green	Above 65%	Load test
Dark	Below 65%	Charge battery
Clear	Low electrolyte	Replace battery* (If cranking is difficult)

* Check electrical system before replacement.

3. NORMAL CHARGING

Charge the battery at current value specified by manufacturer or at approx. 1/10 of battery's ampere-hour rating.

4. QUICK CHARGING

Quick charging is a method that the battery is charged in a short period of time with a relatively large current by using a quick charger.

Since a large current flow raises electrolyte temperature, the battery is subject to damage if the large current is used for prolonged time. For this reason, the quick charging must be carried out within a current range that will not increase the electrolyte temperature above 40°C (104°F).

Also the quick charging is a temporary means to bring battery voltage up to a fair value and, as a rule, a battery should be charged slowly with a low current.

CAUTION:

- Observe the items in 3. NORMAL CHARGING.
- Never use more than 10 A when charging the battery because it will shorten the battery life.

