

ADJUSTMENT

1. PROCEDURE TO ADJUST THE SUBARU SUPER COOLANT CONCENTRATION


Caution:

Use the SUBARU Super Coolant with a 50 – 60% concentration in order to obtain maximum anti-freeze and anti-rust performance.

To adjust the concentration of SUBARU Super Coolant according to temperature, find the proper SUBARU Super Coolant concentration in the table, and add dilution water to the SUBARU Super Coolant (concentrated type) until it reaches the proper dilution.

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

Engine coolant and diluting water:

Refer to "SPECIFICATION" for recommended engine coolant and diluting water.  [Ref. to COOLING\(H4DO\)>General Description>SPECIFICATION.](#)

COOLING(H4DO) > Engine Coolant

INSPECTION


Note:

When adding the engine coolant, always use SUBARU Super Coolant.

- 1.** Park the vehicle on a level surface.
- 2.** Check the engine coolant amount, and if the coolant level is low, check for the coolant leakage, and then add the engine coolant.
 - (1) Make sure the engine coolant level in the reservoir tank is between "FULL" and "LOW" with the engine in a cold condition.
 - (2) Open the radiator cap and make sure that the radiator is filled with the engine coolant up to its filler neck position.

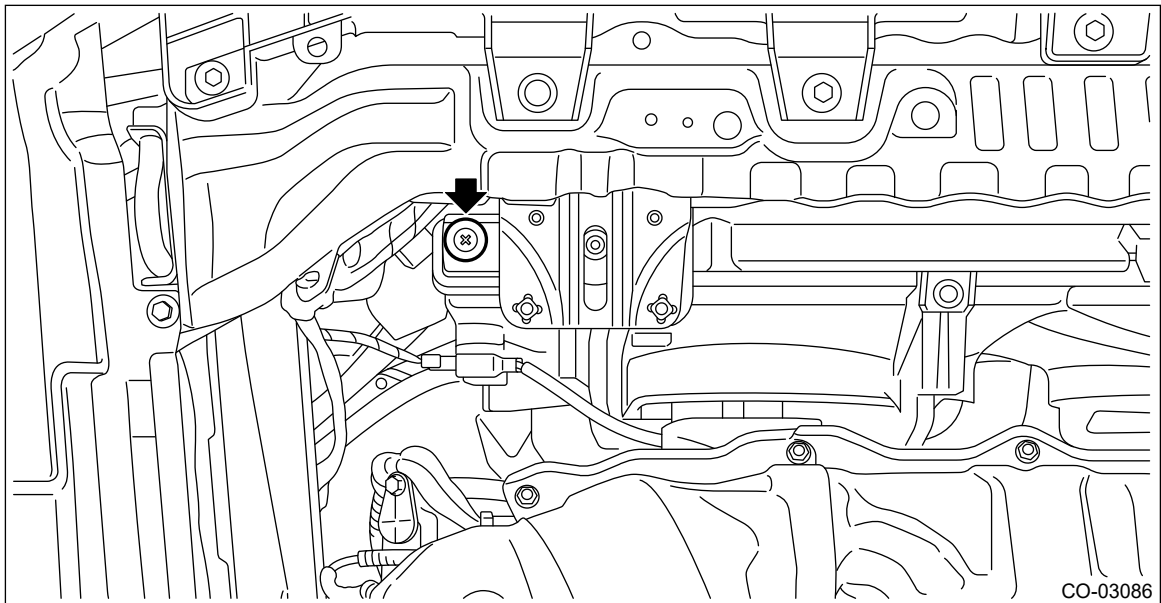
REPLACEMENT

1. DRAINING OF ENGINE COOLANT

1. Lift up the vehicle.
2. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
3. Remove the drain plug to drain engine coolant into container.

Note:

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



4. Install the drain plug.

Note:

Use new O-rings.

5. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)


2. FILLING OF ENGINE COOLANT

Caution:

For CVT models, set the select lever to "P" or "N" range (for MT models, the shift lever in neutral) during work, and do not shift the lever.

1. Pour cooling system conditioner through the filler neck.

Cooling system protective agent:


Refer to "SPECIFICATION" for cooling system protective agent.  [Ref. to COOLING\(H4DO\)>General Description>SPECIFICATION.](#)

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

Recommended engine coolant:

Refer to "SPECIFICATION" for recommended engine coolant.  [Ref. to COOLING\(H4DO\)>General Description>SPECIFICATION.](#)

Engine coolant level:

Refer to "SPECIFICATION" for engine coolant level.  [Ref. to COOLING\(H4DO\)>General Description>SPECIFICATION.](#)

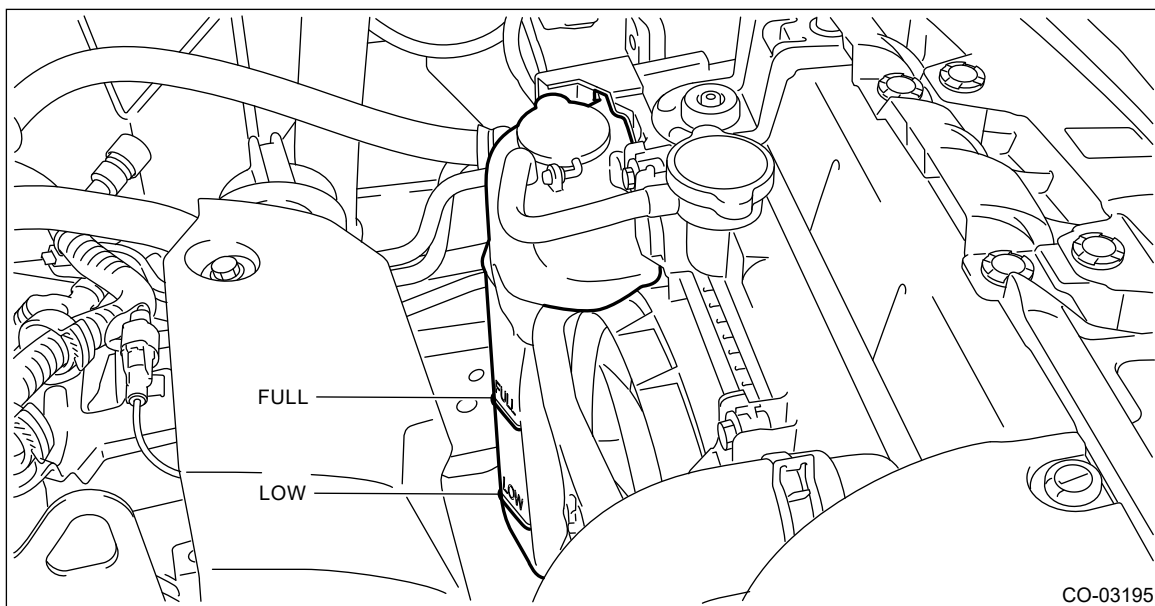
Engine coolant concentration:

Refer to "ADJUSTMENT" for the recommended engine coolant concentration.  [Ref. to COOLING\(H4DO\)>Engine Coolant>ADJUSTMENT.](#)

Note:

The SUBARU Super Coolant contains anti-freeze and anti-rust agents, and is especially made for Subaru engines with an aluminum cylinder block. Be sure to use SUBARU Super Coolant, since other coolant may cause corrosion.

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



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

Note:



Be careful with the engine coolant temperature to prevent overheating.

10. Stop the engine and wait until the engine coolant temperature lowers to 30°C (86°F) or less.
11. Open the radiator cap. If the engine coolant level drops, add engine coolant into the radiator up to the filler neck position and the reservoir tank to "FULL" level.
12. Attach the radiator cap and reservoir tank cap properly.
13. Set the heater setting to maximum hot position and the blower speed setting to "LO" and start the engine. Perform racing at 3,000 r/min or less. If the flowing sound is heard from

heater core at this time, perform the procedures from 9) again.

COOLING(H4DO) > Engine Cooling System Trouble in General

INSPECTION

| Trouble | Possible cause | Corrective action |
|----------------------|--|--|
| Over-heating | a. Insufficient engine coolant | Replenish engine coolant, inspect for leakage, and repair it if necessary. |
| | b. Defective thermostat | Replace. |
| | c. Malfunction of water pump | Replace. |
| | d. Clogged engine coolant passage | Clean. |
| | e. Improper ignition timing | Inspect and repair ignition control system.  Ref. to ENGINE (DIAGNOSTICS)(H4DO)>Basic Diagnostic Procedure. |
| | f. Clogged or leaking radiator | Clean, repair or replace. |
| | g. Defective radiator cap | Replace. |
| | h. Improper engine oil in engine coolant | Replace the engine coolant. If ineffective, check, repair or replace engine components. |
| | i. Air/fuel mixture ratio too lean | Inspect and repair the fuel injection system.  Ref. to ENGINE (DIAGNOSTICS)(H4DO)>Basic Diagnostic Procedure. |
| | j. Excessive back pressure in exhaust system | Clean or replace. |
| | k. Insufficient clearance between piston and cylinder | Adjust or replace. |
| | l. Slipping clutch | Repair or replace. |
| | m. Dragging brake | Adjust. |
| | n. Malfunction of radiator fan | Inspect the radiator fan relay, engine coolant temperature sensor or fan motor and replace them. |
| Over-cooling | a. Ambient temperature extremely low | Partly cover radiator front area. |
| | b. Defective thermostat | Replace. |
| Engine coolant leaks | a. Loosened or damaged connecting units on hoses | Repair or replace. |
| | b. Leakage from water pump | Replace. |
| | c. Leakage from water pipe | Repair or replace. |
| | d. Leakage around cylinder head gasket | Retighten cylinder head bolts or replace cylinder head gasket. |
| | e. Damaged or cracked cylinder head and cylinder block | Repair or replace. |
| | f. Damaged or cracked thermostat cover | Repair or replace. |
| | g. Leakage from radiator | Repair or replace. |

| | | |
|-------|---|---------------------|
| Noise | a. Defective radiator fan | Replace. |
| | b. Defective water pump bearing | Replace water pump. |
| | c. Defective water pump mechanical seal | Replace water pump. |

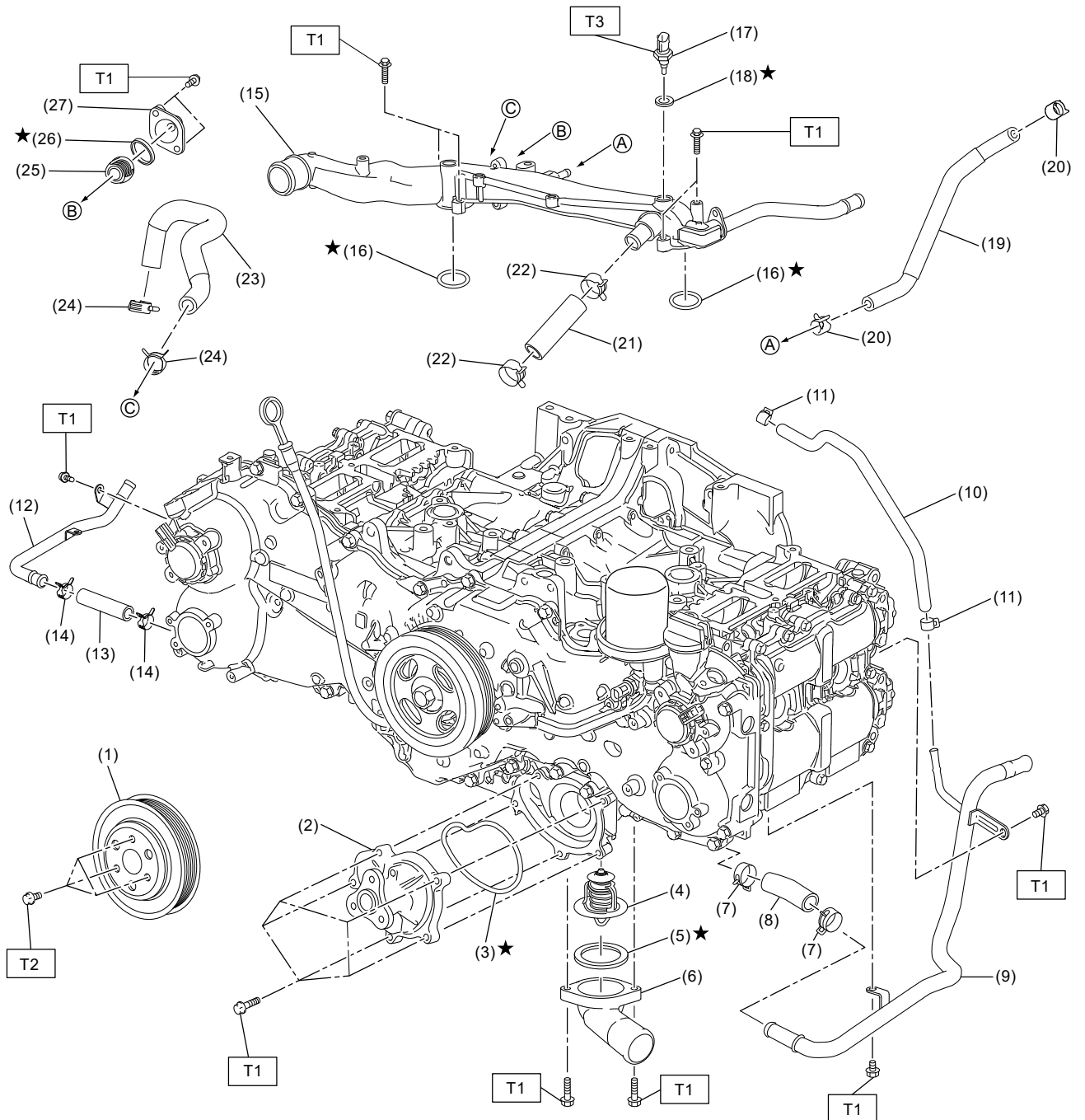
COOLING(H4DO) > General Description

CAUTION

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

COMPONENT

1. WATER PUMP

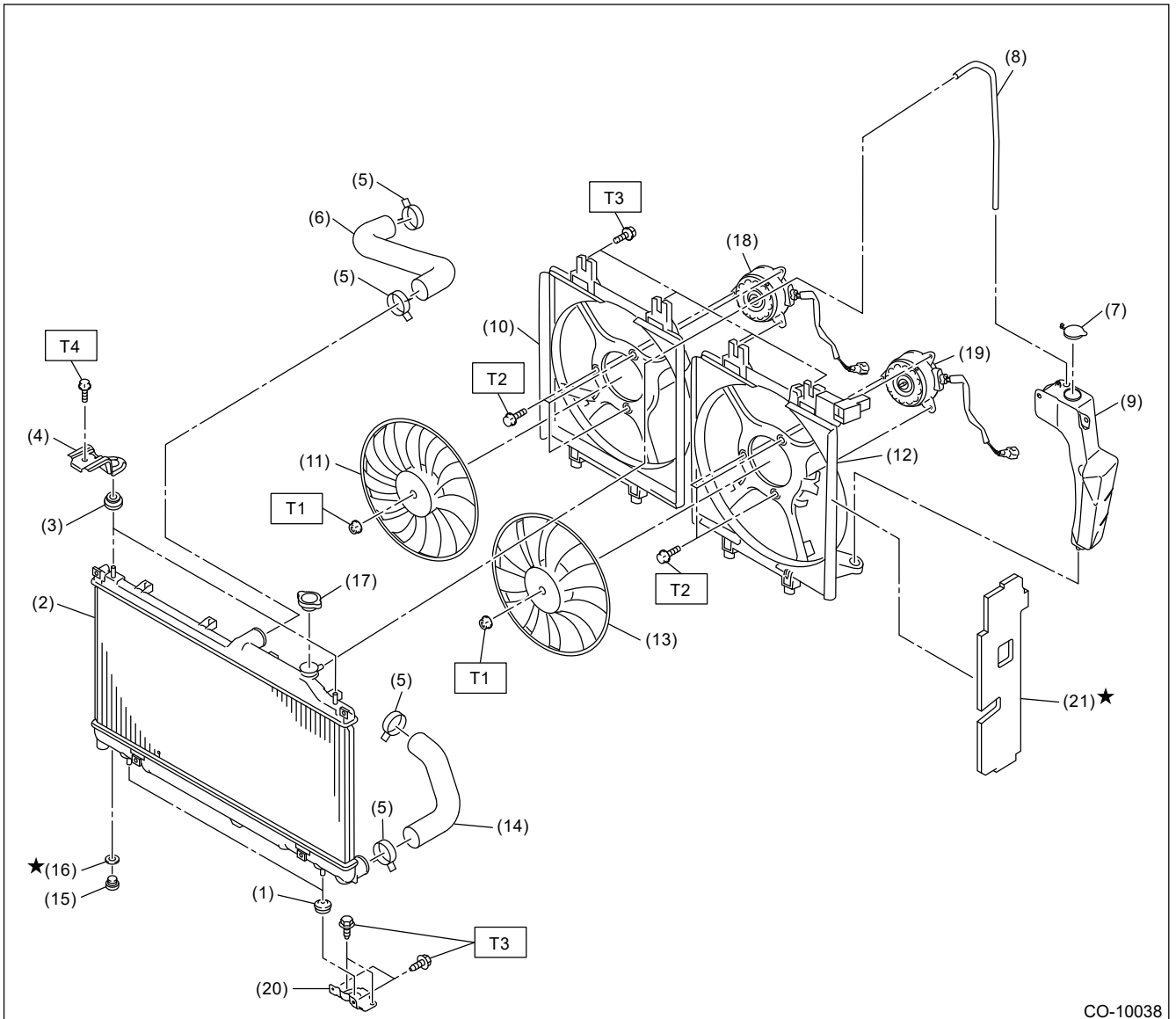


CO-10060

- | | | |
|-----------------------|-------------------------|----------------------------------|
| (1) Water pump pulley | (12) Water pipe RH | (23) Engine coolant hose |
| (2) Water pump ASSY | (13) Water pipe hose RH | (24) Clip |
| (3) Gasket | (14) Clip | (25) Thermostat (CVT model CVTF) |

- | | | |
|------------------------------------|--|--|
| (4) Thermostat (engine side) | (15) Water pipe ASSY | cooler (with warmer feature) side) |
| (5) Gasket (engine side) | (16) O-ring | (26) Gasket (CVT model CVTF cooler (with warmer feature) side) |
| (6) Thermostat cover (engine side) | (17) Engine coolant temperature sensor | (27) Thermostat cover (CVT model CVTF cooler (with warmer feature) side) |
| (7) Clip | (18) Gasket | |
| (8) Water pipe hose LH | (19) Preheater hose | Tightening torque: N·m (kgf-m, ft-lb) |
| (9) Water pipe LH | (20) Clip | T1: 6.4 (0.7, 4.7) |
| (10) Preheater hose | (21) Preheater hose | T2: 14 (1.4, 10.3) |
| (11) Clip | (22) Clip | T3: 18 (1.8, 13.3) |

2. RADIATOR & RADIATOR FAN



CO-10038

- | | | |
|---------------------------------------|-------------------------------|-----------------------------|
| (1) Radiator lower cushion | (10) Radiator sub fan shroud | (19) Main fan motor |
| (2) Radiator | (11) Radiator sub fan | (20) Radiator lower bracket |
| (3) Radiator upper cushion | (12) Radiator main fan shroud | (21) Radiator side gasket |
| (4) Radiator upper bracket | (13) Radiator main fan | |
| (5) Clip | (14) Radiator outlet hose | |
| (6) Radiator inlet hose | (15) Radiator drain plug | |
| (7) Engine coolant reservoir tank cap | (16) O-ring | |
| (8) Over flow hose | (17) Radiator cap | |
| (9) Engine coolant reservoir tank | (18) Sub fan motor | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 3.4 (0.3, 2.5)

T2: 4.41 (0.45, 3.25)

T3: 7.5 (0.8, 5.5)

T4: 12 (1.2, 8.9)

PREPARATION TOOL

1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---------------------|---------------------------|-------------------------|--|
| <p>ST18355AA000</p> | 18355AA000 | PULLEY WRENCH | <ul style="list-style-type: none"> Used for removing and installing water pump pulley. Used together with PULLEY WRENCH PIN SET (18334AA030). |
| <p>ST18334AA030</p> | 18334AA030 | PULLEY WRENCH PIN SET | <ul style="list-style-type: none"> Used for removing and installing water pump pulley. Used together with PULLEY WRENCH (18355AA000). |
| <p>ST73099SG000</p> | 73099SG000 | SPECIAL TOOL CONDENSER | Used for installing the radiator. |
| <p>STSSM4</p> | — (Newly adopted tool) | SUBARU SELECT MONITOR 4 | Used for setting of each function and troubleshooting for electrical system. Note: For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help". |

2. GENERAL TOOL

| | |
|--|--|
| | |
|--|--|

| TOOL NAME | REMARKS |
|---------------------|---|
| Circuit tester | Used for measuring resistance, voltage and current. |
| Radiator cap tester | Used for checking radiator and radiator cap. |
| DST-i | Used together with Subaru Select Monitor 4. |

COOLING(H4DO) > General Description

SPECIFICATION

| | | | | |
|-------------------------------|---|--|--|---|
| Cooling system | | | | Electric fan + Forced engine coolant circulation system |
| Total engine coolant capacity | L (US qt, Imp qt) | | CVT model | Approx. 7.7 (8.1, 6.8) |
| | | | MT model | Approx. 7.4 (7.8, 6.5) |
| Water pump | Type | | | Centrifugal impeller type |
| | Discharge performance | Discharge rate | L (US gal, Imp gal)/min | 230 (60.8, 50.6) |
| | | Pump speed — Discharge pressure | | 6,600 r/min — 88 kPa (9.2 mAq) |
| | | Engine coolant temperature | | 80°C (176°F) |
| | Impeller diameter | | mm (in) | 60 (2.36) |
| | Number of impeller vanes | | | 7 |
| | Pump pulley diameter | | mm (in) | 130 (5.12) |
| Thermostat | Type | | | Wax pellet type |
| | Starting temperature to open | Engine side | | 86 — 90°C (187 — 194°F) |
| | | CVTF cooler (with warmer feature) side | | 48 — 52°C (118 — 126°F) |
| | Fully opens | Engine side | | 95°C (203°F) |
| | | CVTF cooler (with warmer feature) side | | 63°C (145°F) |
| | Valve lift | m | Engine side | 8.0 (0.315) or more |
| | | m (in) | CVTF cooler (with warmer feature) side | 6.0 (0.236) or more |
| | Valve opening size | m | Engine side | 32 (1.26) |
| m (in) | | CVTF cooler (with warmer feature) side | 22 (0.87) | |
| Radiator fan | Motor input | Main fan | W | 120 |
| | | Sub fan | W | 120 |
| | Fan diameter / Blade | Main fan | | 320 mm (12.6 in) /9 |
| | | Sub fan | | 320 mm (12.6 in) /11 |
| Radiator | Type | | | Down flow, pressure type |
| | Core dimensions | Width × Height × Thickness | | mm (in) 687.4 × 340 × 16 (27.06 × 13.39 × 0.63) |
| | Pressure range in which cap valve is open | kPa (kg/cm ² , psi) | Positive pressure side | Standard 93 — 123 (0.95 — 1.25, 14 — 18) |
| | | | | Limit 83 (0.85, 12) |

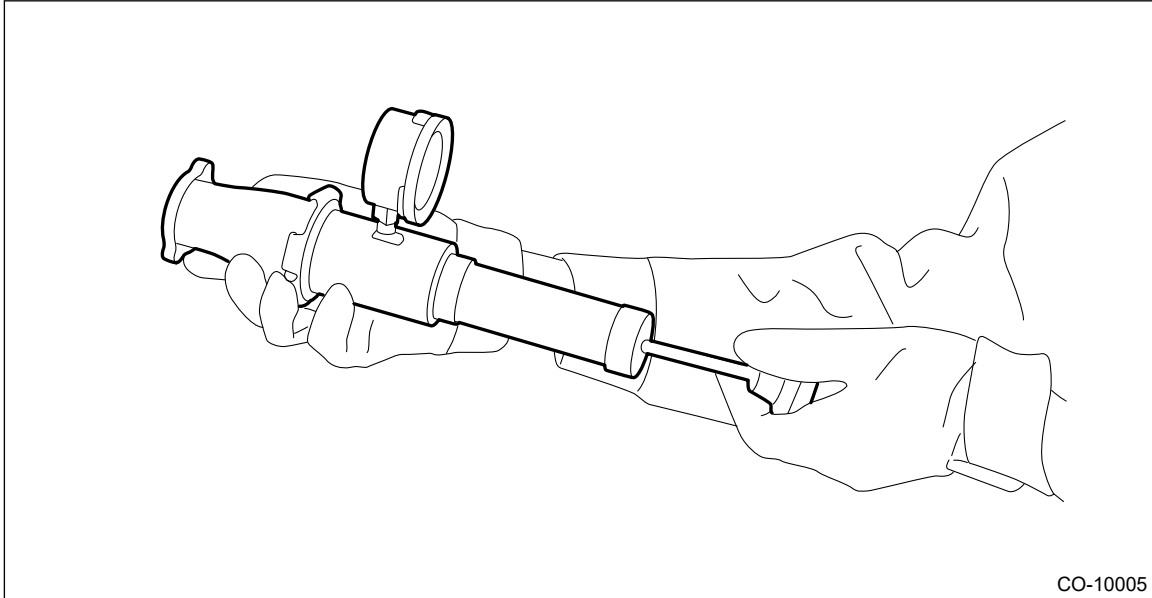
| | | | | | |
|----------------|----------|--|------------------------|----------|---|
| | | | Negative pressure side | Standard | -1.0 — -4.9 or less (-0.01 — -0.05, -0.1 — -0.7) |
| | Fins | | | | Corrugated fin type |
| Reservoir tank | Capacity | | L (US qt, Imp qt) | | 0.45 (0.48, 0.40) |

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

COOLING(H4DO) > Radiator Cap

INSPECTION

1. Check that the radiator cap does not have deformation, cracks or damage.
2. Attach the radiator cap tester to radiator cap.



3. Increase pressure until the radiator cap tester gauge needle stops. Radiator cap is functioning properly if it holds the service limit pressure for 5 – 6 seconds. Replace the radiator cap if its valve opens at less than the service limit.

Caution:

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

Standard:

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

Service limit:

83 kPa (0.85 kg/cm², 12 psi)

COOLING(H4DO) > Radiator Fan System

INSPECTION

Operating condition:

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

Diagnosis:

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

1. CHECK OPERATION OF RADIATOR FAN.

1. Install the delivery mode fuse.
2. Turn the ignition switch to ON.
3. Using the Subaru Select Monitor, perform the active test for the radiator fan relay.

Note:


- **When performing the active test for the radiator fan relay using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order.**
- **For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".**

Do the radiator main fans and radiator sub fans rotate at low speed?

Yes

 [Go to 2.](#)

No

 [Go to 3.](#)

2. CHECK OPERATION OF RADIATOR FAN.

Using the Subaru Select Monitor, perform the active test for the radiator fan relay.

Note:


- **When performing the active test for the radiator fan relay using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order.**
- **For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".**

Do the radiator main fans and radiator sub fans rotate at high speed?

Yes

Radiator main fan system is normal.

No

 [Go to 27.](#)

3. CHECK POWER SUPPLY TO SUB FAN RELAY.

1. Turn the ignition switch to OFF.
2. Remove the sub fan relay.


3. Measure the voltage between the sub fan relay terminal and chassis ground.

Connector & terminal


(F27) No. 17 (+) – Chassis ground (–):

Is the voltage 10 V or more?

Yes

 [Go to 4.](#)

No

 [Go to 5.](#)

4. CHECK POWER SUPPLY TO SUB FAN RELAY.

1. Turn the ignition switch to ON.

2. Measure the voltage between the sub fan relay terminal and chassis ground.

Connector & terminal


(F27) No. 20 (+) – Chassis ground (–):

Is the voltage 10 V or more?

Yes

 [Go to 7.](#)

No

 [Go to 6.](#)

5. CHECK FUSE.

1. Remove the fuse No. 3.

2. Check the condition of fuse.

Is the fuse blown out?

Yes

Replace the fuse.

No

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?

Yes

Replace the fuse.

No

Repair the power supply line.

7. CHECK SUB FAN RELAY.


Measure the resistance between sub fan relay switch terminals.

Is the resistance 1 M Ω or more?

Yes

 [Go to 8.](#)

No

Replace the sub fan relay.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

8. CHECK SUB FAN RELAY.


1. Connect the battery to the terminal on the sub fan relay coil side.
2. Measure the resistance between sub fan relay switch terminals.

Is the resistance less than 1 Ω ?

Yes

 [Go to 9.](#)

No

Replace the sub fan relay.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

9. CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.


1. Turn the ignition switch to OFF.
2. Disconnect the connector from the sub fan motor.
3. Measure the resistance of harness between the sub fan relay terminal and sub fan motor connector.

Connector & terminal

(F16) No. 1 — (F27) No. 18:

Is the resistance less than 1 Ω ?

Yes

 [Go to 10.](#)

No

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.
2. Measure the resistance of harness between sub fan motor connector and main fan relay 2 connector.

Connector & terminal

(F16) No. 2 – (F27) No. 12:

Is the resistance less than 1 Ω ?

Yes

 [Go to 11.](#)

No

Repair the open circuit of the harness between sub fan motor connector and main fan relay 2 connector.

11. CHECK FOR POOR CONTACT.


Check poor contact of sub fan motor connector.

Is there poor contact of the sub fan motor connector?

Yes

Repair the poor contact of sub fan motor connector.

No

 [Go to 12.](#)

12. CHECK SUB FAN MOTOR.


Connect the battery positive (+) terminal to terminal No. 1 of the sub fan motor, and the ground (–) terminal to terminal No. 2.

Does the radiator sub fan rotate?

Yes

 [Go to 13.](#)

No


Replace the sub fan motor.  [Ref. to COOLING\(H4DO\)>Radiator Sub Fan and Fan Motor.](#)

13. CHECK MAIN FAN RELAY 2.


Measure the resistance between terminals of main fan relay 2 switch (always ON side).

Is the resistance less than 1 Ω ?

Yes

 [Go to 14.](#)

No

Replace the main fan relay 2.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

14. CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND MAIN FAN MOTOR CONNECTOR.

1. Disconnect the connector from the main fan motor.
2. Measure the resistance of the harness between main fan relay 2 terminal and main fan motor connector.

Connector & terminal

(F17) No. 1 — (F27) No. 14:

Is the resistance less than 1 Ω ?

Yes

 [Go to 15.](#)

No

Repair the open circuit of the harness between main fan relay 2 terminal and main fan motor connector.

15. CHECK GROUND CIRCUIT OF MAIN FAN MOTOR.


Measure the resistance between main fan motor connector and chassis ground.

Connector & terminal

(F17) No. 2 — Chassis ground:

Is the resistance less than 5 Ω ?

Yes

 [Go to 16.](#)

No

Repair the open circuit of the harness between main fan motor connector and

chassis ground.

16. CHECK FOR POOR CONTACT.


Check poor contact of main fan motor connector.

Is there poor contact of the main fan motor connector?

Yes

Repair the poor contact of main fan motor connector.

No


 [Go to 17.](#)

17. CHECK MAIN FAN MOTOR.


Connect the battery positive (+) terminal to terminal No. 1 of the main fan motor, and the ground (–) terminal to terminal No. 2.

Does the radiator main fan rotate?

Yes

 [Go to 18.](#)

No

Replace the main fan motor.  [Ref. to COOLING\(H4DO\)>Radiator Main Fan and Fan Motor.](#)

18. CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.


1. Disconnect the connector from ECM.
2. Measure the resistance between the sub fan relay terminal and ECM connector.

Connector & terminal

(B134) No. 37 – (F27) No. 19:

Is the resistance less than 1 Ω ?

Yes

 [Go to 19.](#)

No

Repair the open circuit of harness between sub fan relay terminal and ECM.

19. CHECK FOR POOR CONTACT.


Check for poor contact of ECM connector.

Is there poor contact of ECM connector?

Yes

Repair the poor contact of ECM connector.

No


Check the DTC. Repair the trouble cause.  [Ref. to ENGINE \(DIAGNOSTICS\) \(H4DO\)>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.
3. Measure the resistance between terminals of main fan relay 1 switch.

Is the resistance 1 M Ω or more?

Yes

 [Go to 21.](#)

No


Replace the main fan relay 1.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

21. CHECK MAIN FAN RELAY 1.

1. Connect the main fan relay 1 coil side terminal to the battery.
2. Measure the resistance between terminals of main fan relay 1 switch.

Is the resistance less than 1 Ω ?

Yes

 [Go to 22.](#)

No

Replace the main fan relay 1.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

22. CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND MAIN FAN MOTOR CONNECTOR.


1. Disconnect the connector from the main fan motor.
2. Measure the resistance of the harness between main fan relay 1 terminal and main fan motor connector.

Connector & terminal

(F17) No. 1 — (F36) No. 6:

Is the resistance less than 1 Ω ?

Yes

 [Go to 23.](#)

No

Repair the open circuit of the harness between main fan relay 1 terminal and main fan motor connector.

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

(B134) No. 51 — (B143) No. 7:

Is the resistance less than 1 Ω ?

Yes

 [Go to 24.](#)

No

Repair the open circuit of the harness between main fan relay 1 terminal and ECM.

24. CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM.

Measure the resistance between main fan relay 2 terminal and ECM connector.

Connector & terminal

(B134) No. 51 — (F27) No. 15:

Is the resistance less than 1 Ω ?

Yes

 [Go to 25.](#)

No

Repair the open circuit of the harness between main fan relay 2 terminal and ECM.

25. CHECK FUSE.


1. Remove the fuses No. 2 and No. 19.
2. Check the condition of fuse.

Is the fuse blown out?

Yes

Replace the fuse.

No

 [Go to 26.](#)

26. CHECK FOR POOR CONTACT.

Check for poor contact of ECM connector.

Is there poor contact of ECM connector?

Yes

Repair the poor contact of ECM connector.

No


Repair the power supply circuit to the main fuse box.

27. CHECK OPERATION OF RADIATOR FAN.

If the both fans do not rotate at high speed in the condition of step 2, check whether the radiator sub fan is rotating.

Does the radiator sub fan rotate?

Yes

 [Go to 20.](#)

No

 [Go to 28.](#)

28. CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2.


1. Turn the ignition switch to OFF.
2. Remove the main fan relay 2.
3. Measure the resistance between main fan relay 2 terminal and chassis ground.

Connector & terminal

(F27) No. 13 — Chassis ground:

Is the resistance less than 1 Ω ?

Yes

 [Go to 29.](#)

No

Repair the open circuit of harness between main fan relay 2 and chassis ground.

29. CHECK POWER SUPPLY TO MAIN FAN RELAY 2.




1. Turn the ignition switch to ON.
2. Measure the voltage between main fan relay 2 terminal and chassis ground.

Connector & terminal

(F27) No. 16 (+) – Chassis ground (-):

Is the voltage 10 V or more?

Yes

 [Go to 30.](#)

No

Repair the power supply line.


30. CHECK MAIN FAN RELAY 2.




Measure the resistance between terminals of main fan relay 2 switch.

Is the resistance 1 M Ω or more?

Yes

 [Go to 31.](#)

No

Replace the main fan relay 2.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)


31. CHECK MAIN FAN RELAY 2.



1. Connect the main fan relay 2 coil side terminal to the battery.
2. Measure the resistance between terminals of main fan relay 2 switch (always OFF side).

Is the resistance less than 1 Ω ?

Yes

 [Go to 23.](#)

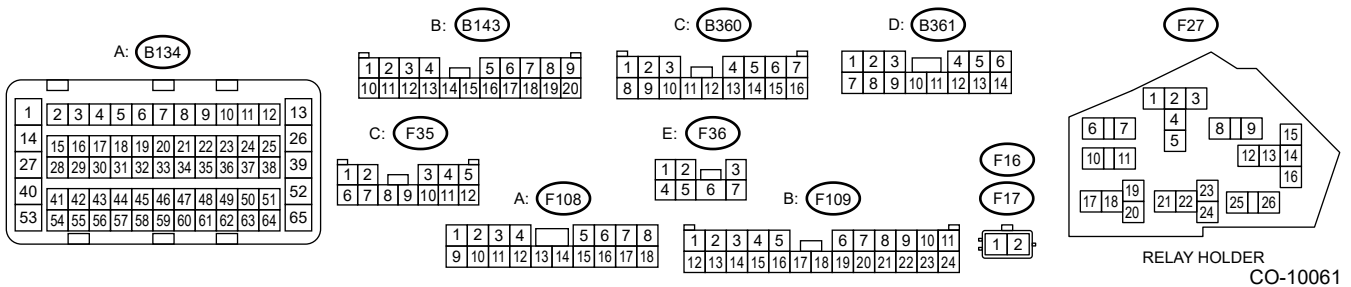
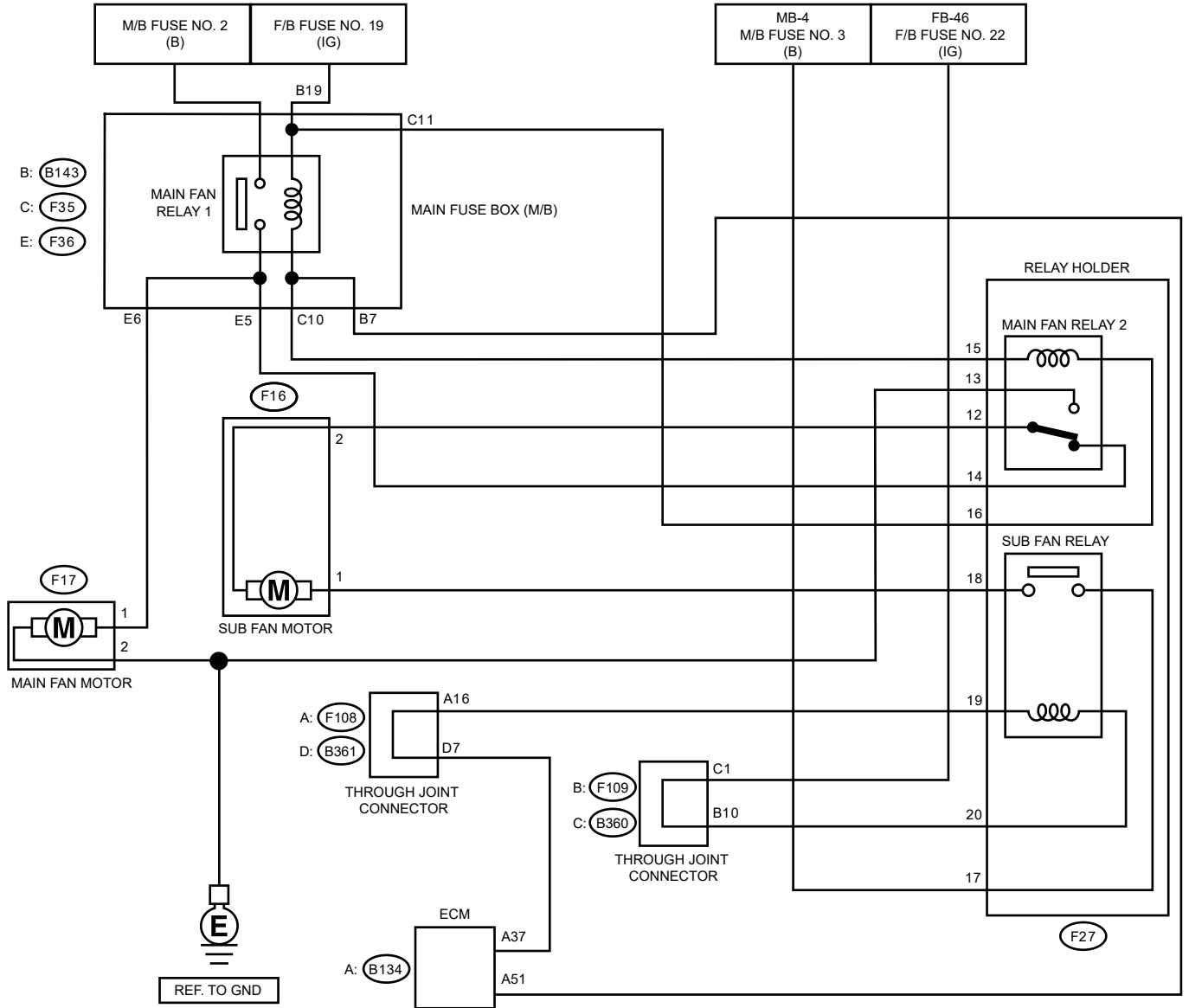
No

Replace the main fan relay 2.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

COOLING(H4DO) > Radiator Fan System

WIRING DIAGRAM

Radiator fan system  Ref. to WIRING SYSTEM>Radiator Fan System>WIRING DIAGRAM.



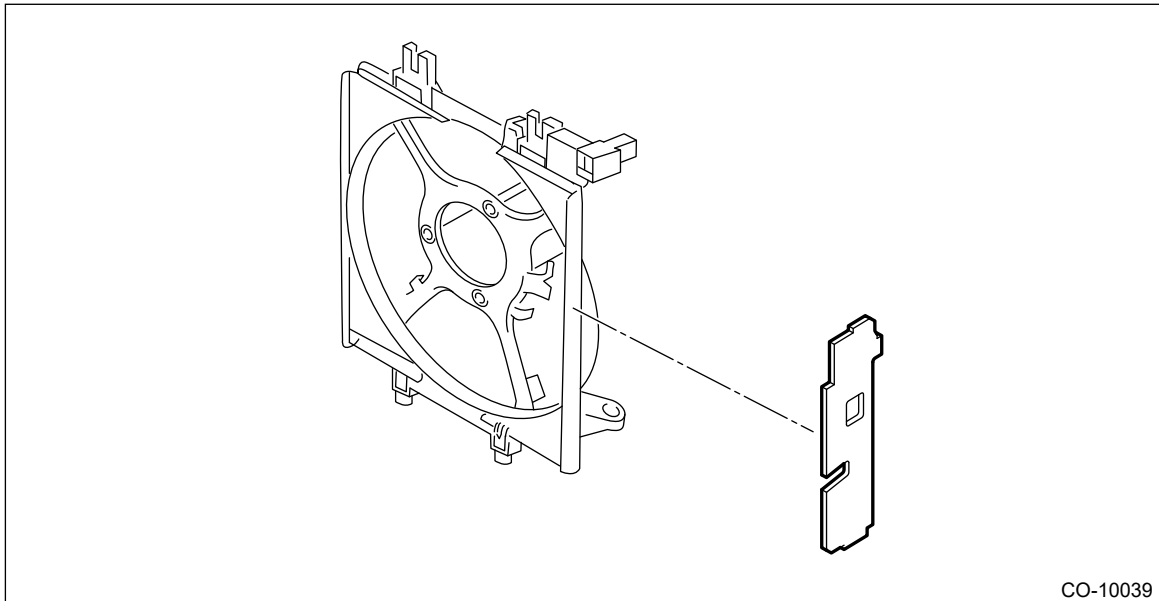
COOLING(H4DO) > Radiator Main Fan and Fan Motor

ASSEMBLY

Assemble in the reverse order of disassembly.

Note:

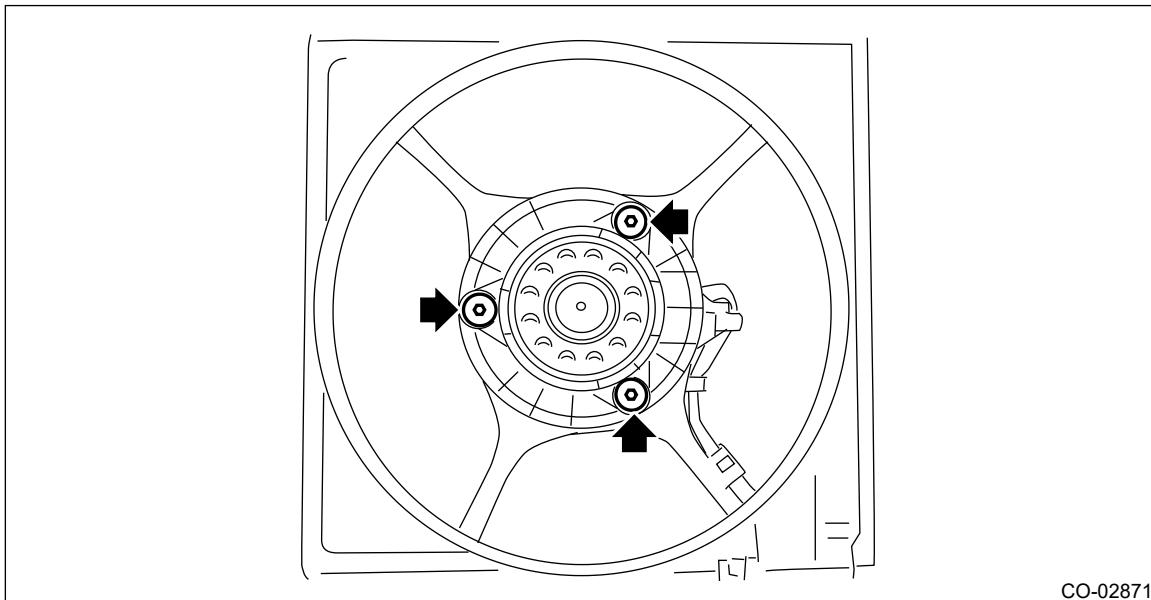
- Use a new radiator side gasket.
- Install the radiator side gasket at the position shown in the figure.



CO-10039

Tightening torque:

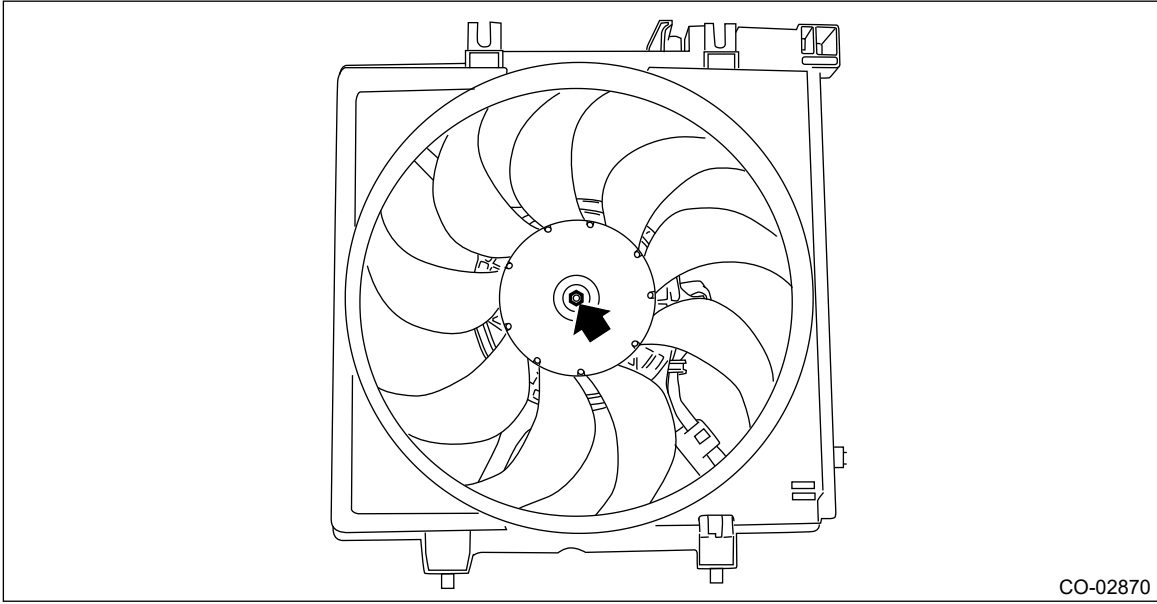
4.41 N•m (0.45 kgf-m, 3.25 ft-lb)



CO-02871

Tightening torque:

3.4 N•m (0.3 kgf-m, 2.5 ft-lb)



CO-02870

COOLING(H4DO) > Radiator Main Fan and Fan Motor

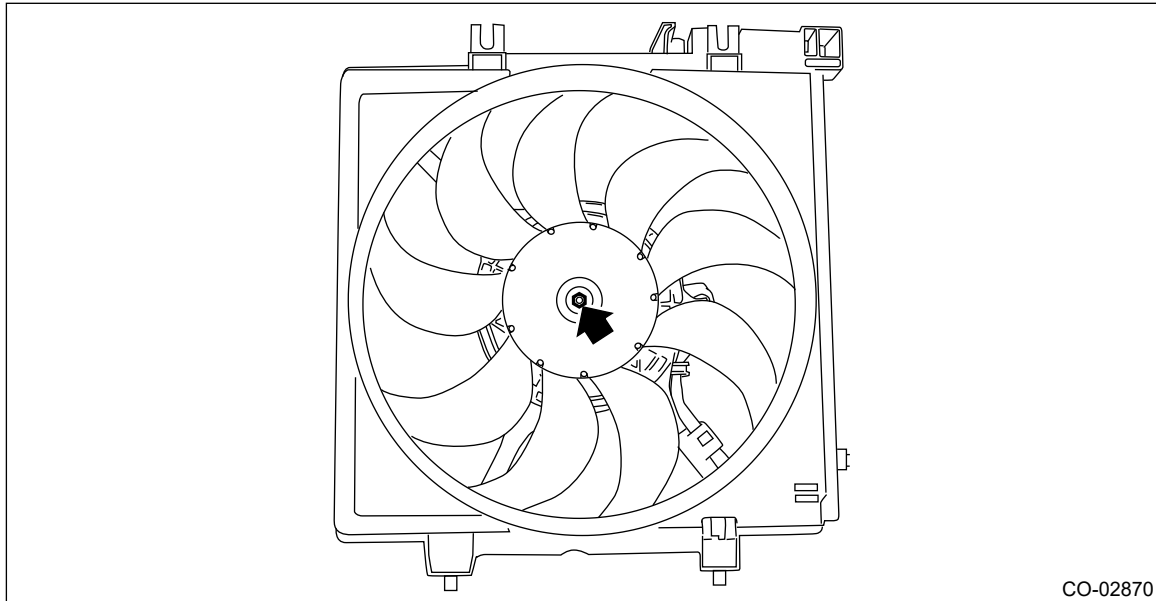
DISASSEMBLY

1. Remove the radiator side gasket from the radiator main fan shroud.

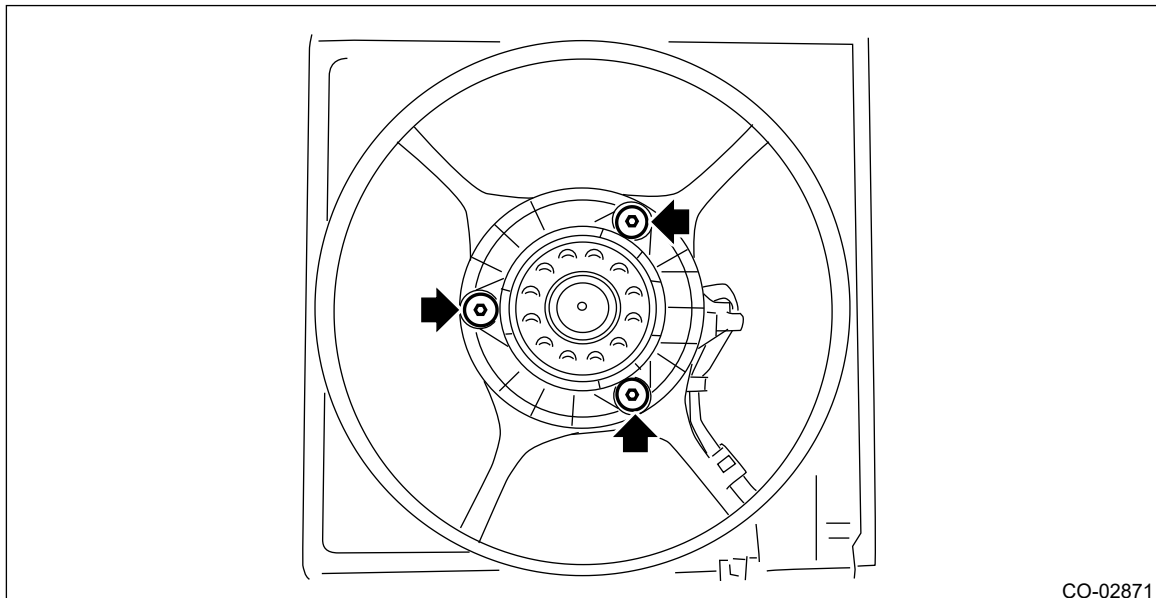
Note:

This operation is required only when replacing the radiator side gasket.

2. Remove the clip which holds the main fan motor connector onto the radiator main fan shroud.
3. Disconnect the radiator main fan from the main fan motor.



4. Disconnect the main fan motor from the radiator main fan shroud.



COOLING(H4DO) > Radiator Main Fan and Fan Motor

INSPECTION

Check that the radiator main fan, radiator main fan shroud and main fan motor assembly do not have deformation, cracks or damage.

COOLING(H4DO) > Radiator Main Fan and Fan Motor

INSTALLATION

Install in the reverse order of removal.

Caution:



Confirm that the radiator hose is securely connected.

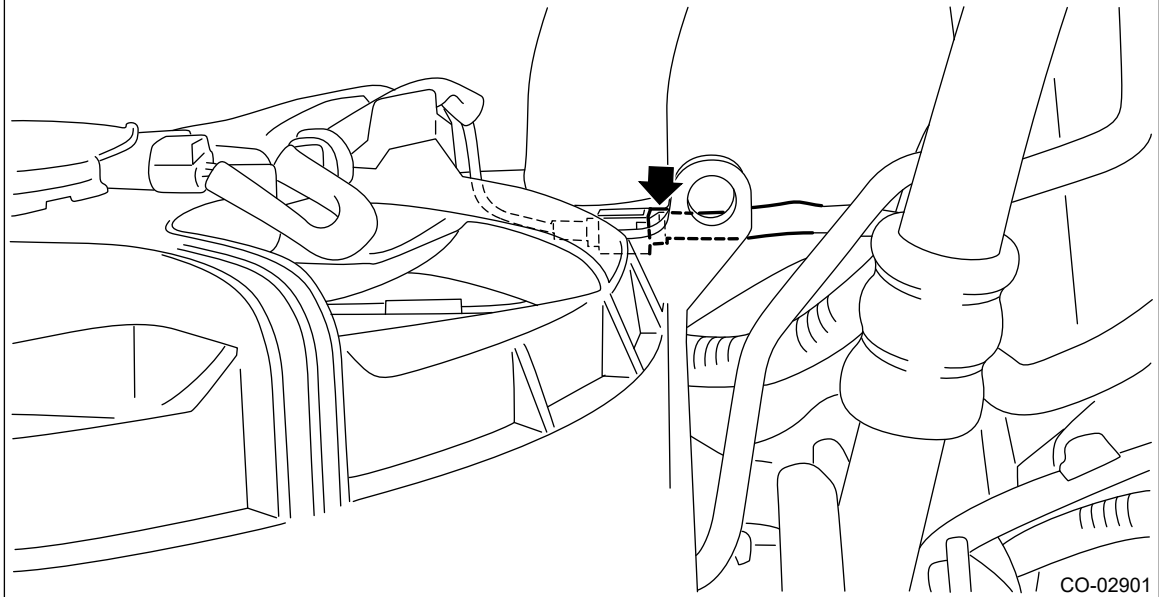
Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

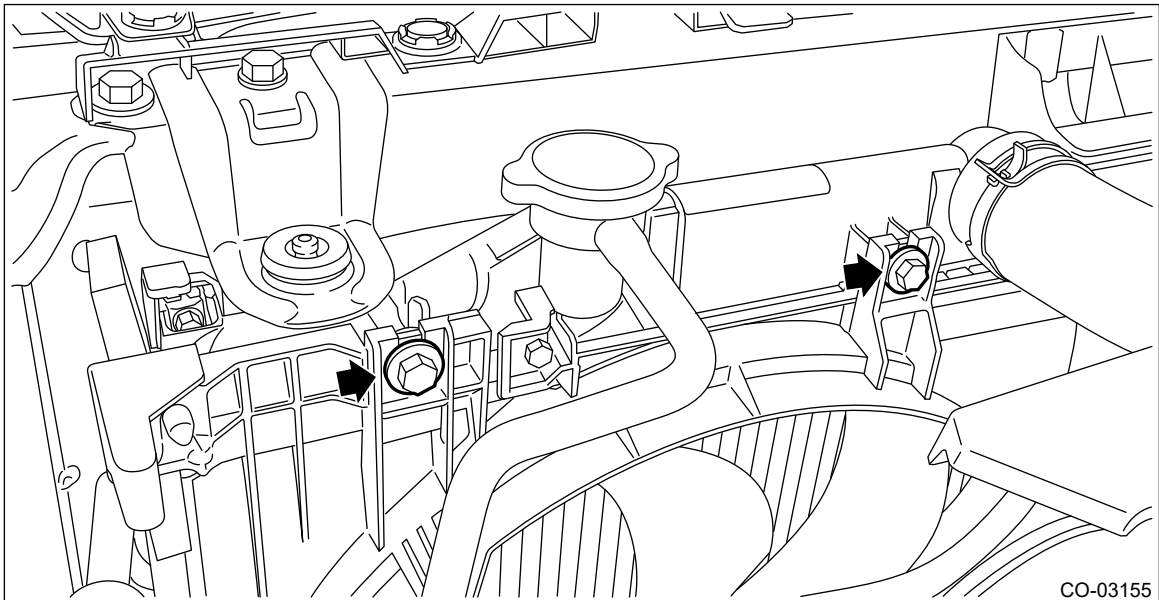
COOLING(H4DO) > Radiator Main Fan and Fan Motor

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the reservoir tank.  [Ref. to COOLING\(H4DO\)>Reservoir Tank>REMOVAL.](#)
3. Disconnect the connector from the main fan motor assembly.



4. Remove the bolts which hold the radiator main fan shroud onto the radiator.



5. Remove the radiator main fan and fan motor from the vehicle.

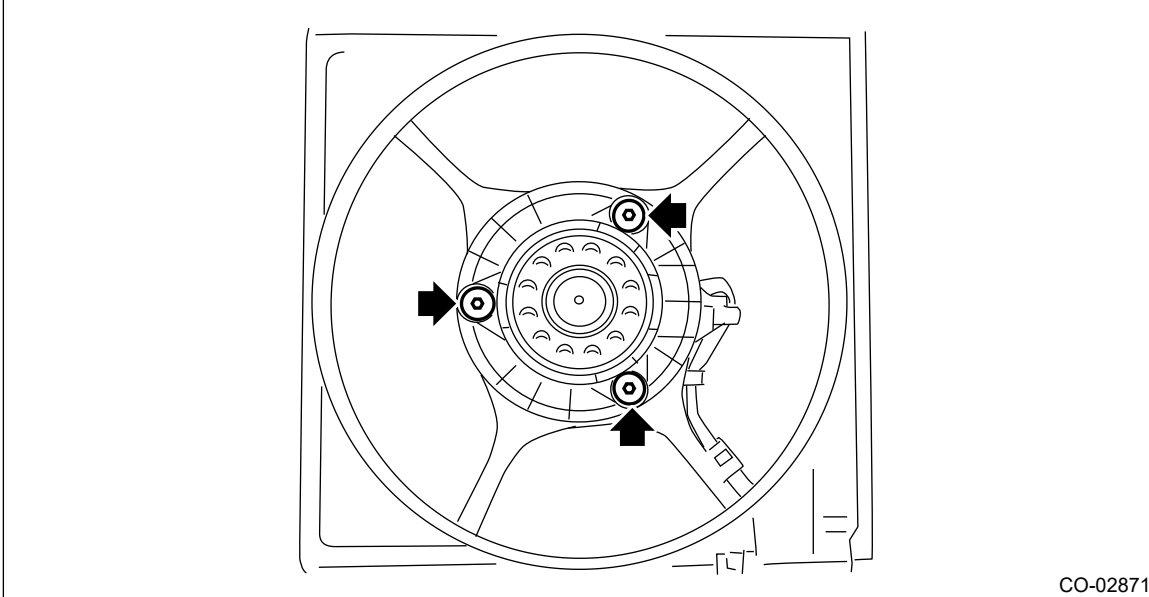
COOLING(H4DO) > Radiator Sub Fan and Fan Motor

ASSEMBLY

Assemble in the reverse order of disassembly.

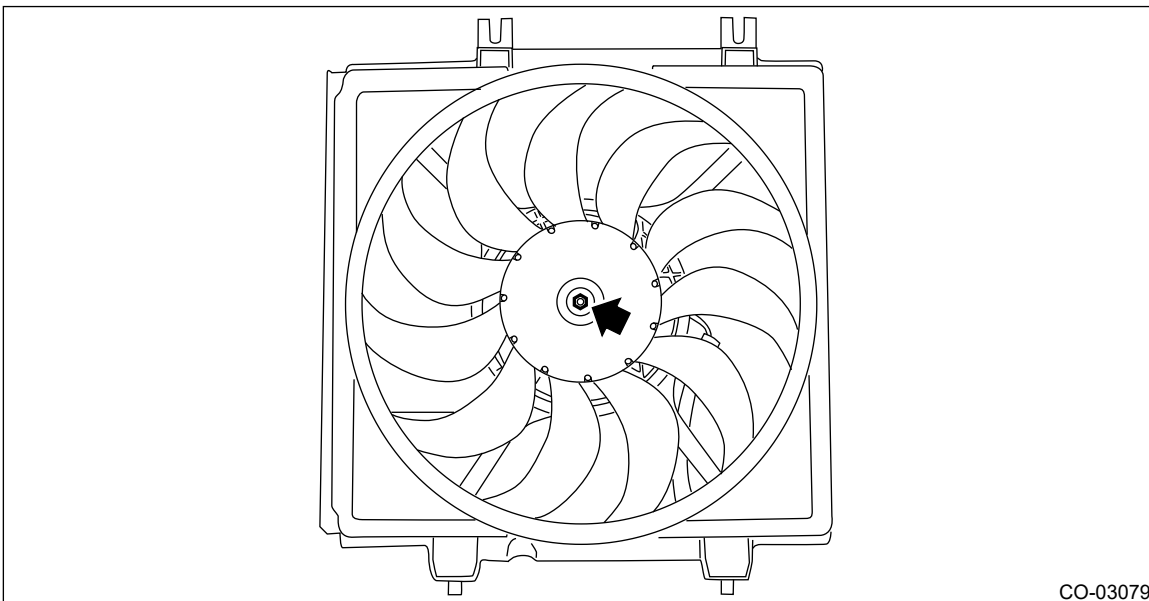
Tightening torque:

4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:

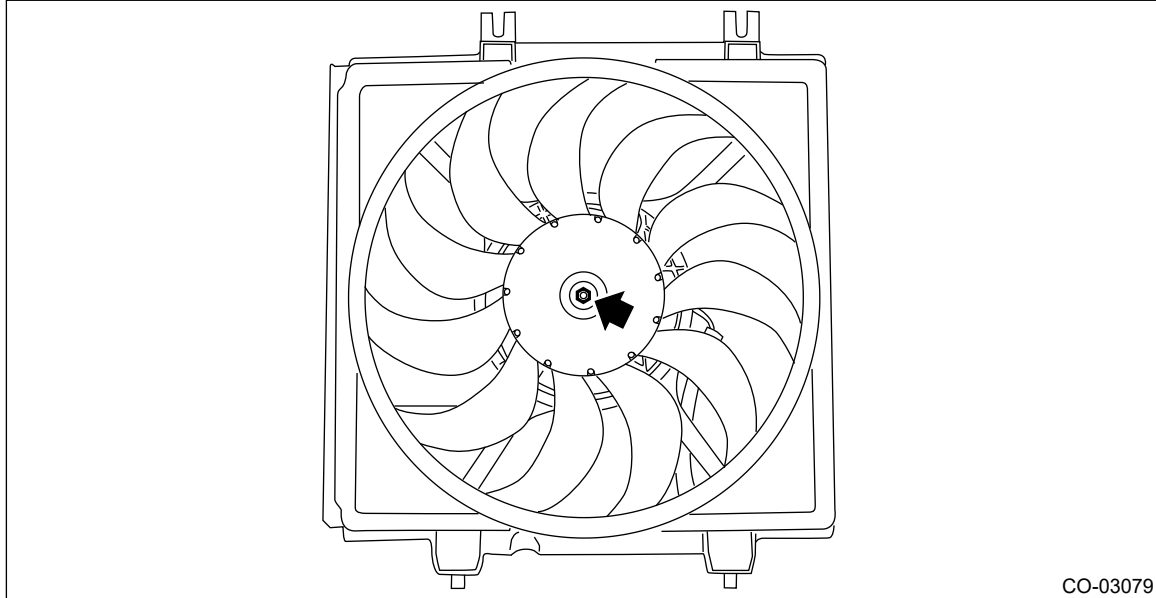
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



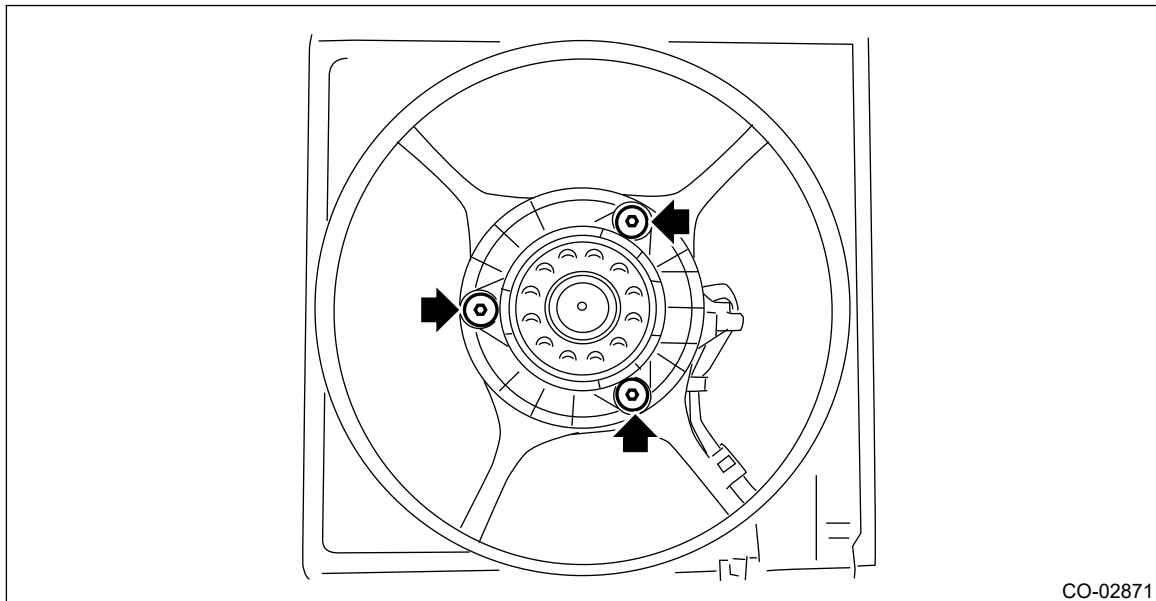
COOLING(H4DO) > Radiator Sub Fan and Fan Motor

DISASSEMBLY

1. Remove the clip which holds the sub fan motor connector onto the radiator sub fan shroud.
2. Disconnect the radiator sub fan from the sub fan motor.



3. Disconnect the sub fan motor from the radiator sub fan shroud.



COOLING(H4DO) > Radiator Sub Fan and Fan Motor

INSPECTION

Check that the radiator sub fan, radiator sub fan shroud and sub fan motor assembly do not have deformation, cracks or damage.

COOLING(H4DO) > Radiator Sub Fan and Fan Motor

INSTALLATION

Install in the reverse order of removal.

Caution:



Confirm that the radiator hose is securely connected.

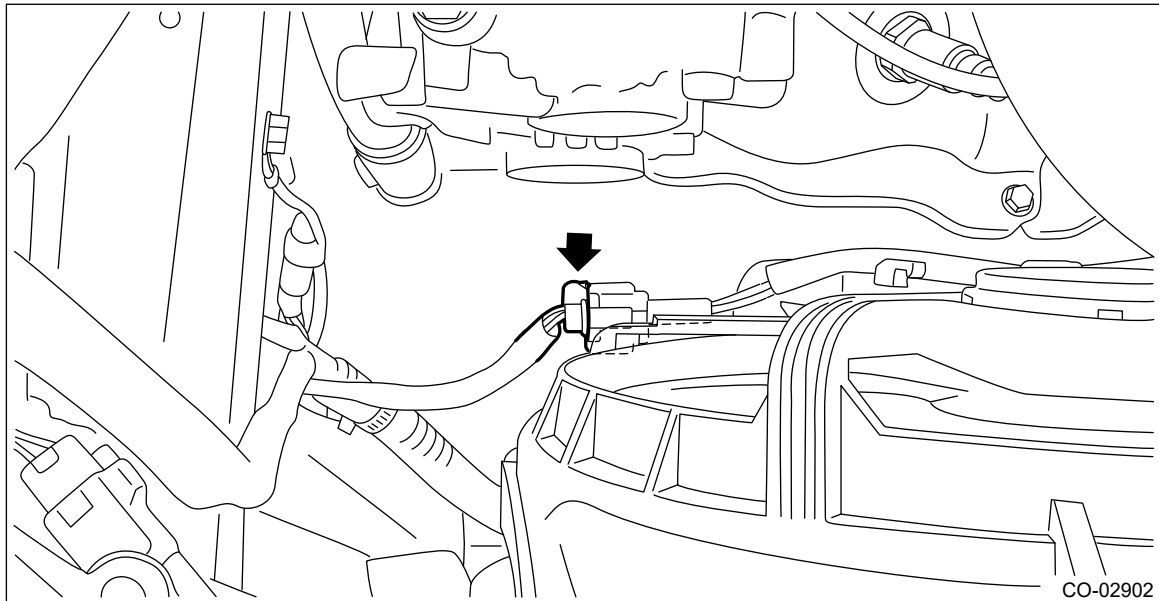
Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

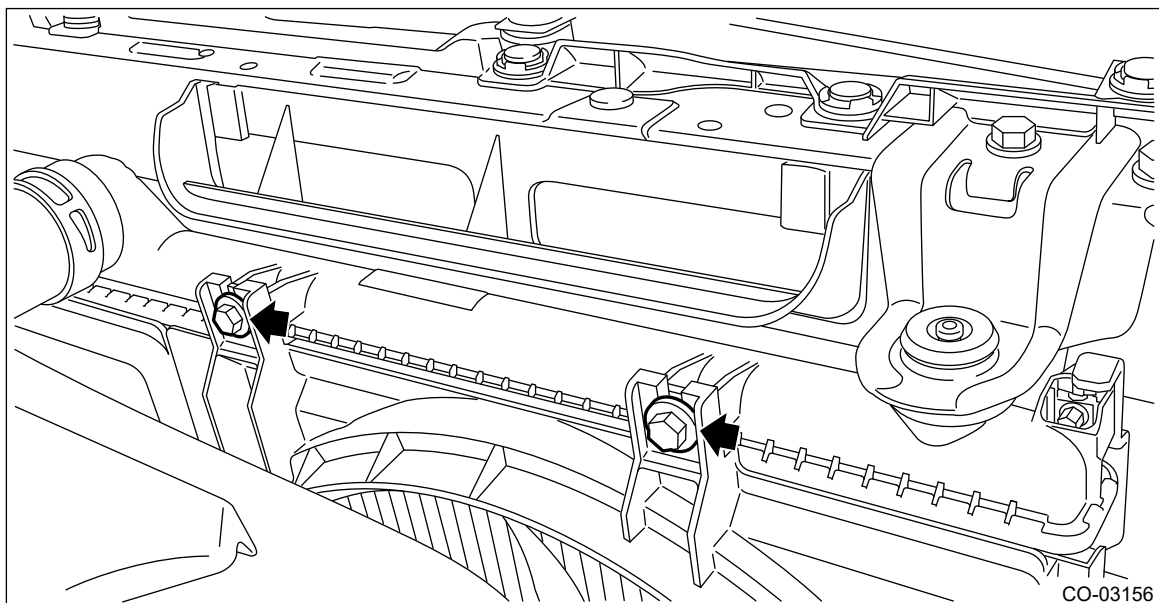
COOLING(H4DO) > Radiator Sub Fan and Fan Motor

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
3. Disconnect the connector from the sub fan motor assembly.



4. Remove the bolts which hold the radiator sub fan shroud onto the radiator.

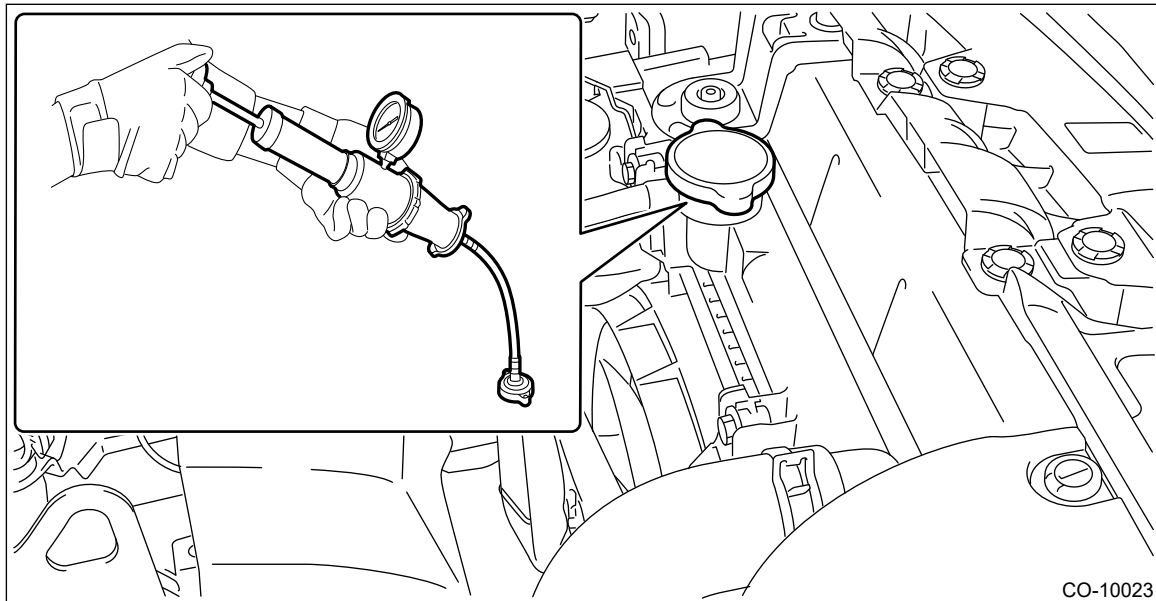


5. Remove the radiator sub fan and fan motor from vehicle.

COOLING(H4DO) > Radiator

INSPECTION

1. Check that the radiator does not have deformation, cracks or damage.
2. Check that the hose has no cracks, damage or loose part.
3. Remove the radiator cap, fill the radiator with engine coolant, and then install the radiator cap tester to the filler neck of radiator.



4. Apply a pressure of 157 kPa (1.6 kg/cm², 23 psi) to the radiator and check the following points:
 - Leakage from the radiator or its vicinity
 - Leakage from the hose or its connections

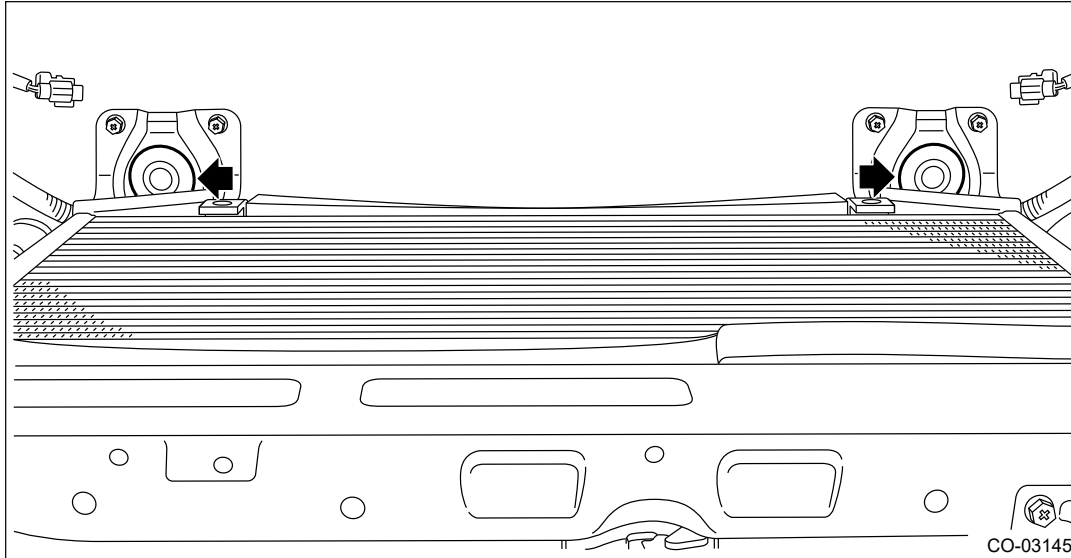
Caution:

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

COOLING(H4DO) > Radiator

INSTALLATION

1. Attach the radiator lower cushion to the radiator lower bracket.

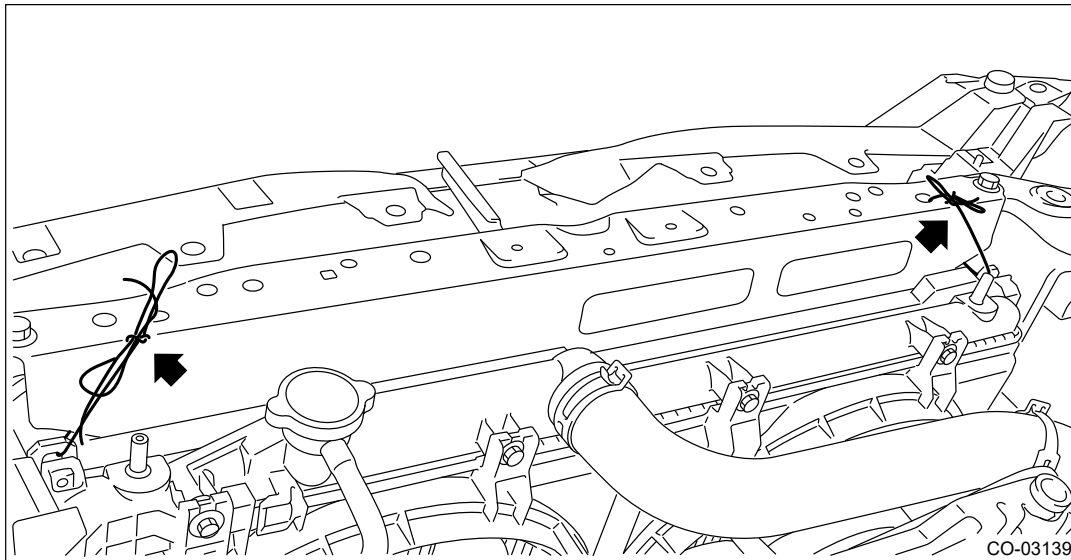


2. Install the radiator to vehicle.

Note:

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

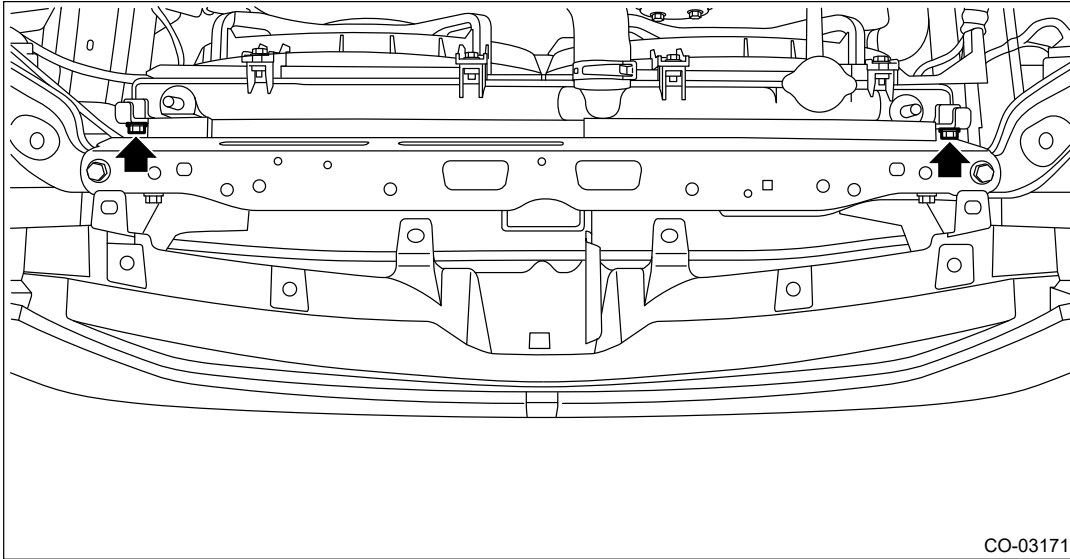
3. Remove the ropes or other means used to secure the condenser to the vehicle.



4. Install the bolts at the top of the condenser.

Tightening torque:

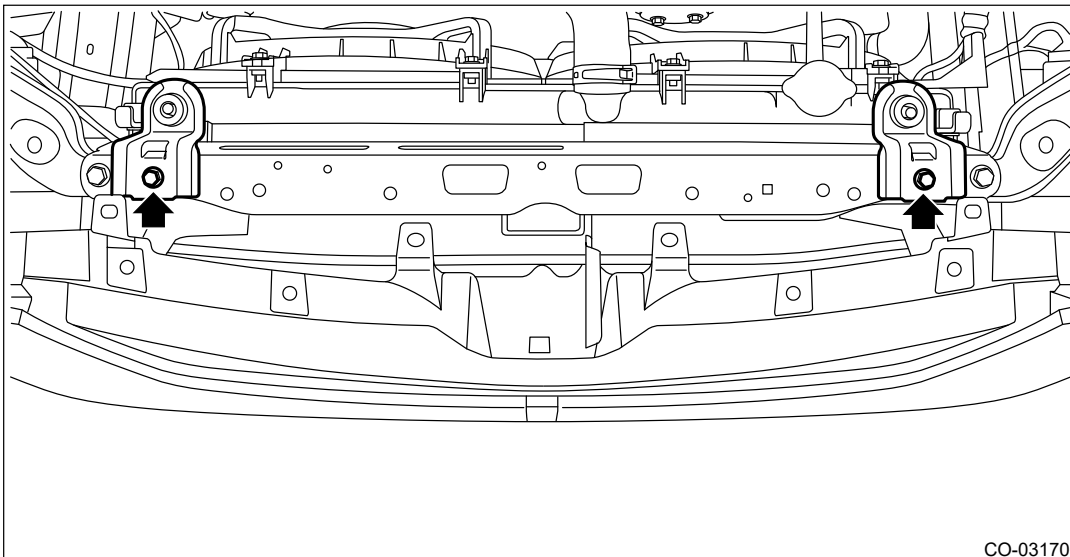
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



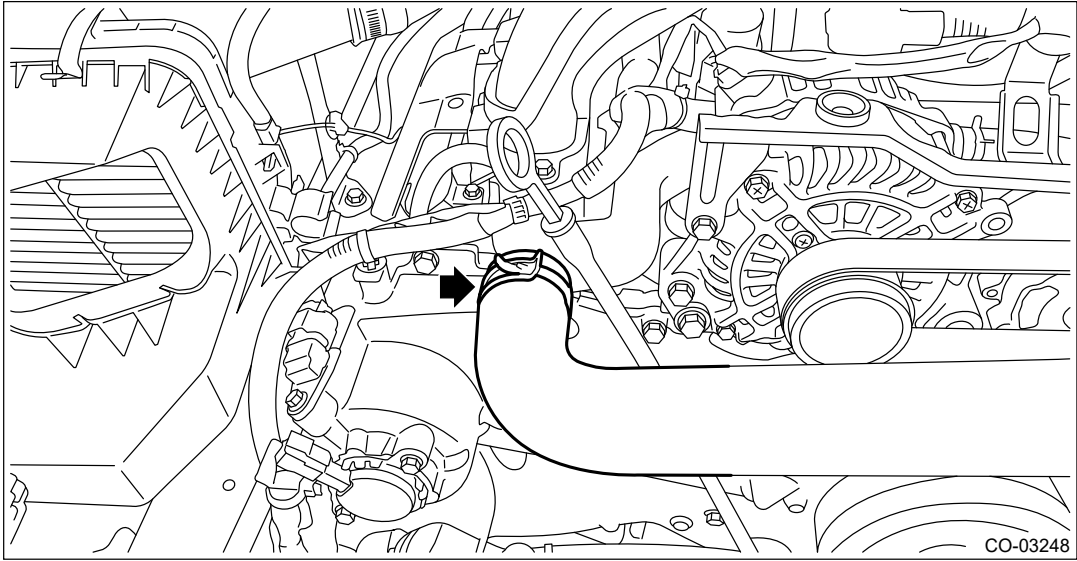
- 5.** Install the radiator upper brackets.

Tightening torque:

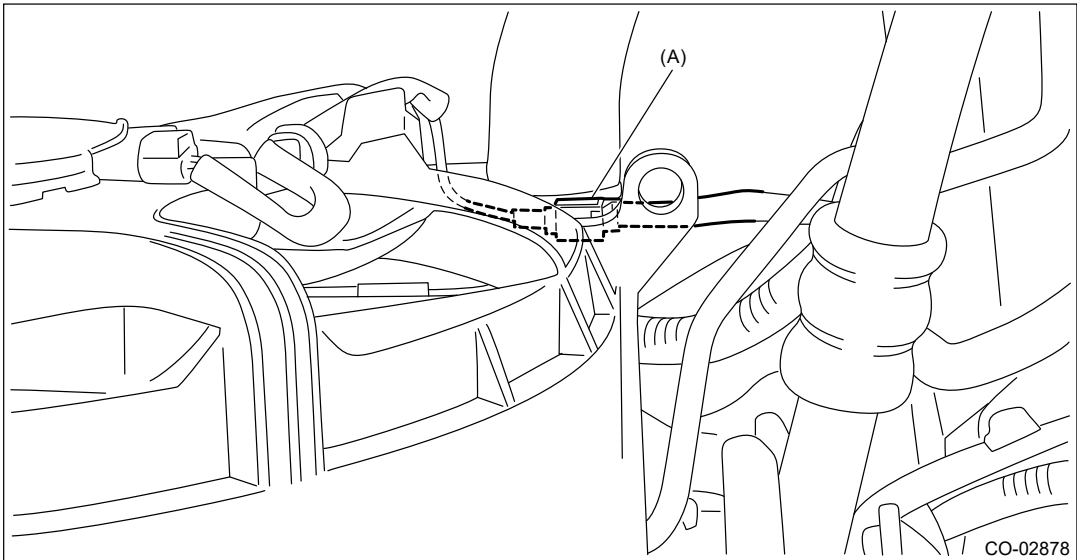
12 N·m (1.2 kgf-m, 8.9 ft-lb)

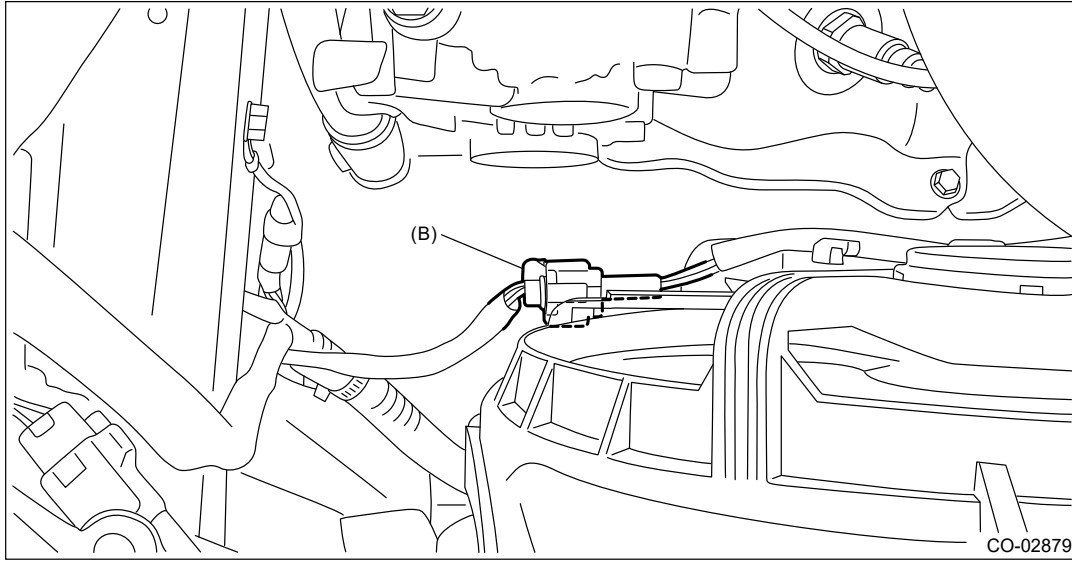


- 6.** Connect the radiator inlet hose to the water pipe assembly.

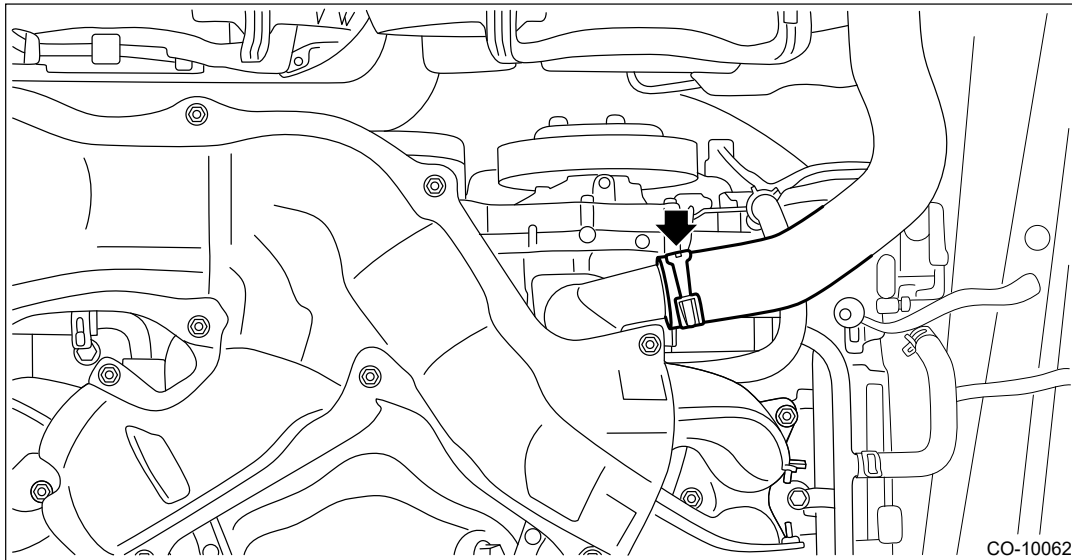


- 7.** Connect the connector (A) to the main fan motor assembly and the connector (B) to the sub fan motor assembly.

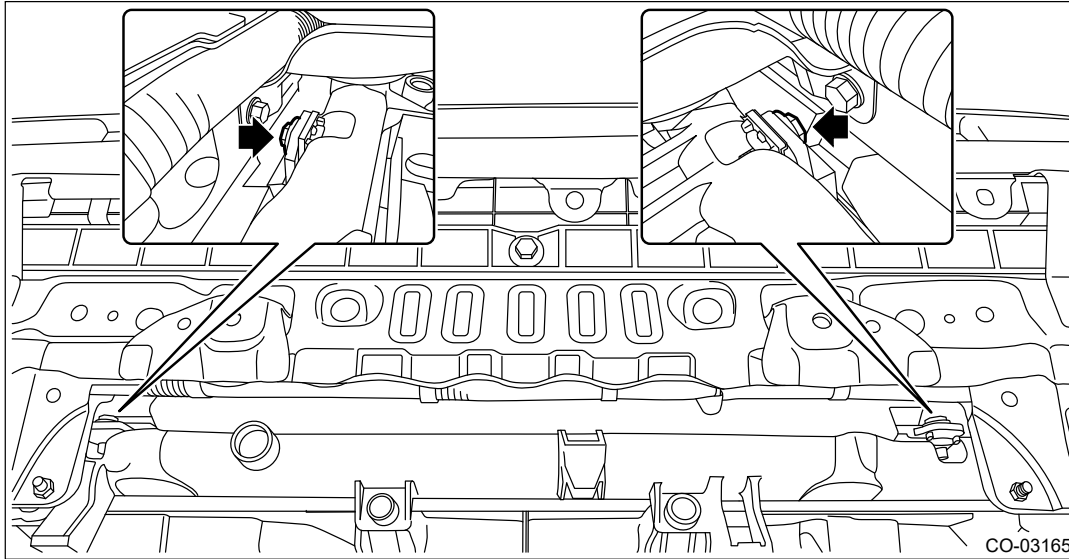





- 8.** Lift up the vehicle.
- 9.** Connect the radiator outlet hose to thermostat cover.



- 10.** Temporarily tighten the bolts at the bottom of the condenser.



11. Install the under cover.  Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.
12. Lower the vehicle.
13. Tighten the bolts at the bottom of the condenser using the ST.

ST 73099SG000 SPECIAL TOOL CONDENSER

Tightening torque:

Calculation formula

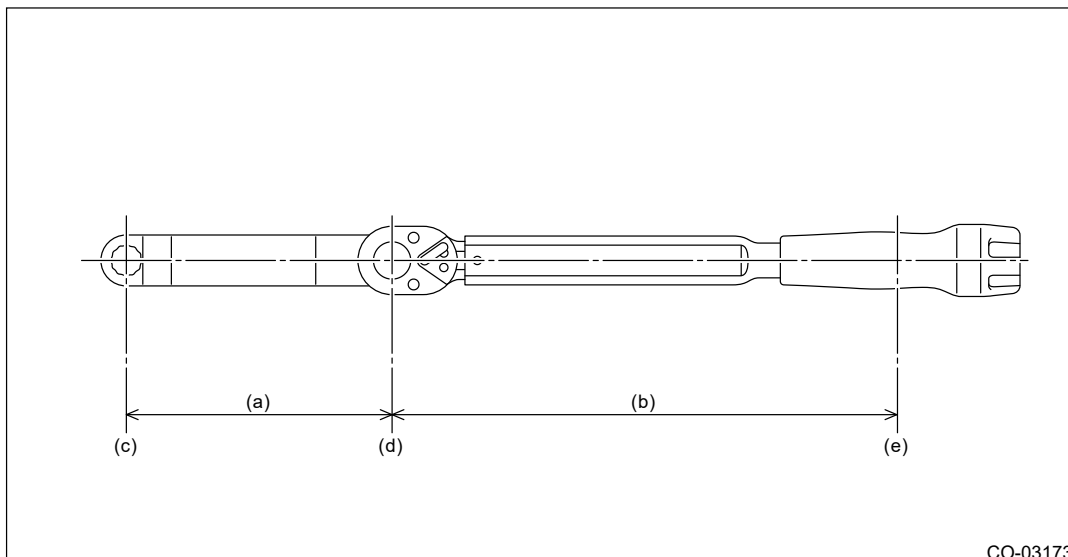
$$T = L / (100 \text{ mm (3.94 in)} + L) \times 7.5 \text{ N}\cdot\text{m (0.8 kgf}\cdot\text{m, 5.5 ft}\cdot\text{lb)}$$

T: Tightening torque

L: Effective length of torque wrench

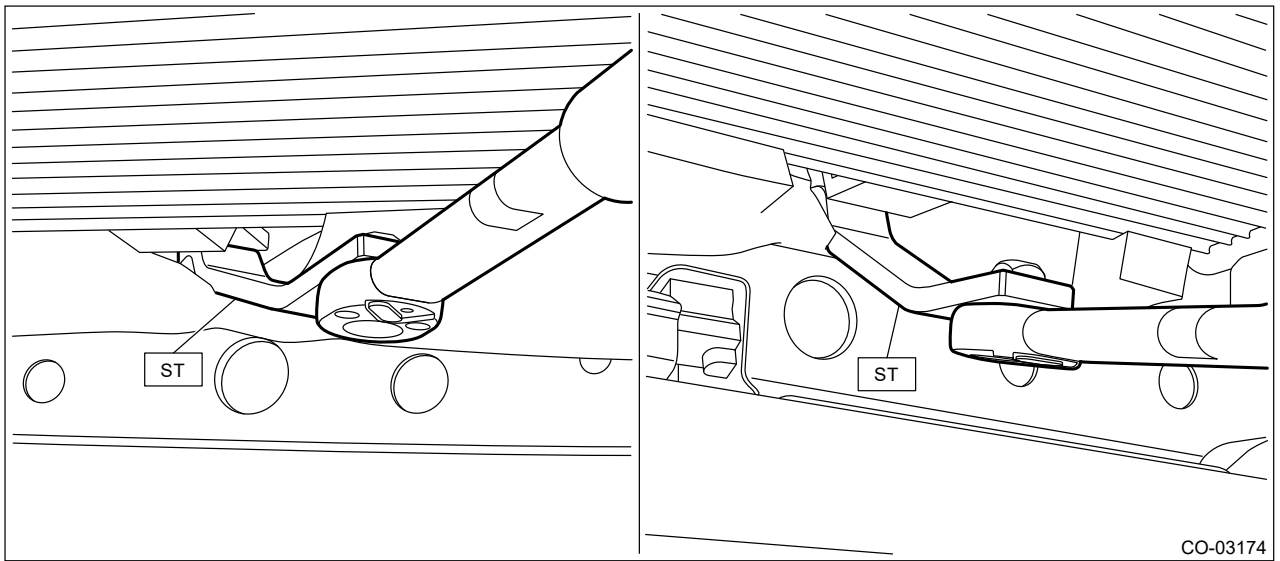
Note:

If the effective length of the torque wrench used is unknown, consult the manufacturer of the torque wrench.

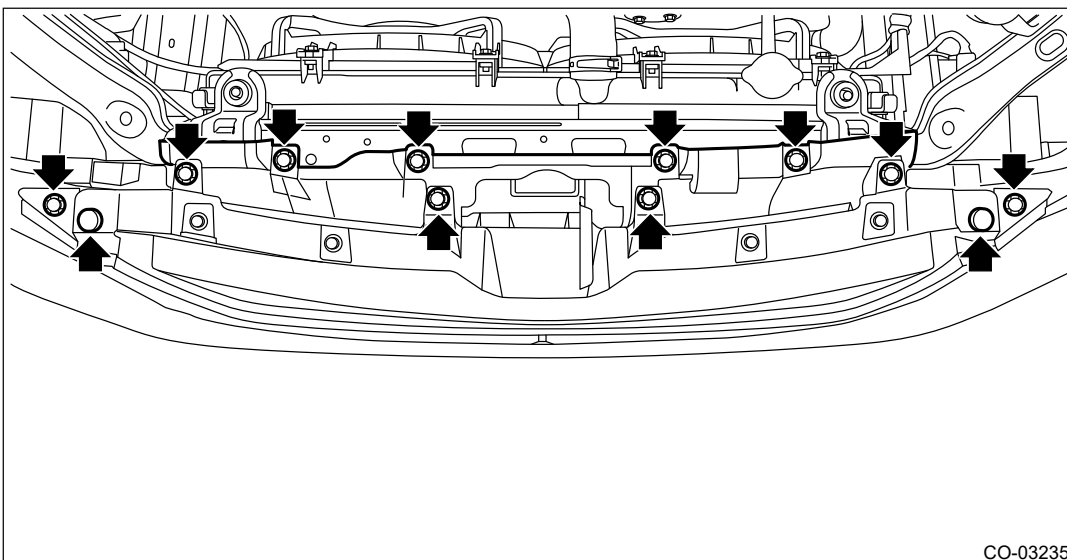


- (a) Effective length of the ST
- (b) Effective length of the torque wrench
- (c) Center of drive angle of the ST
- (d) Center of drive angle of the torque wrench

(e) Center of the position where a force is applied by hand



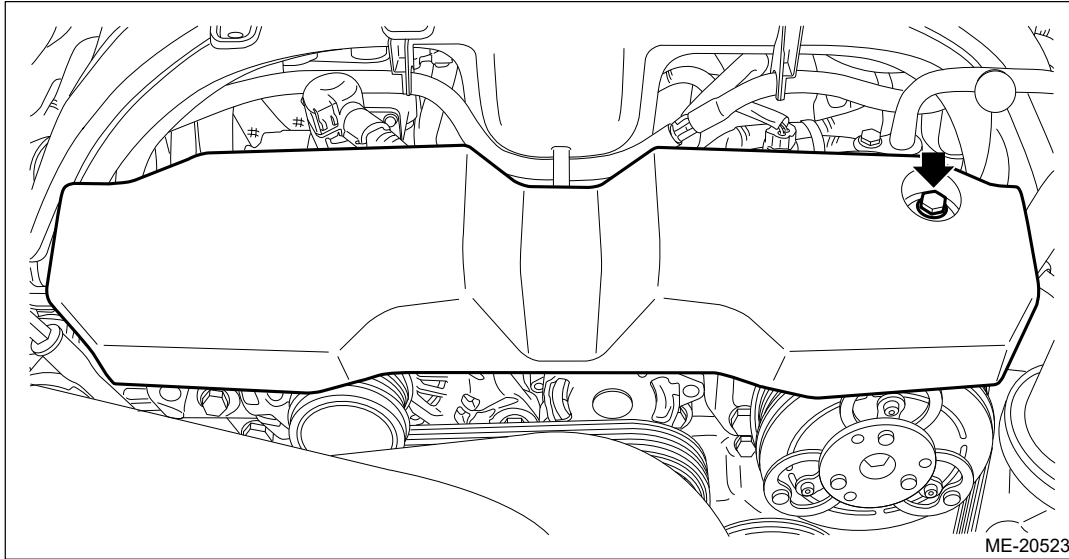
- 14.** Install the clips to the grille bracket and front bumper and install the grille bracket.



- 15.** Install the reservoir tank. [🔗 Ref. to COOLING\(H4DO\)>Reservoir Tank>INSTALLATION.](#)
- 16.** Install the air intake duct. [🔗 Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>INSTALLATION.](#)
- 17.** Install the V-belt cover.

Tightening torque:

7 N·m (0.7 kgf-m, 5.2 ft-lb)




- 18.** Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 19.** Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

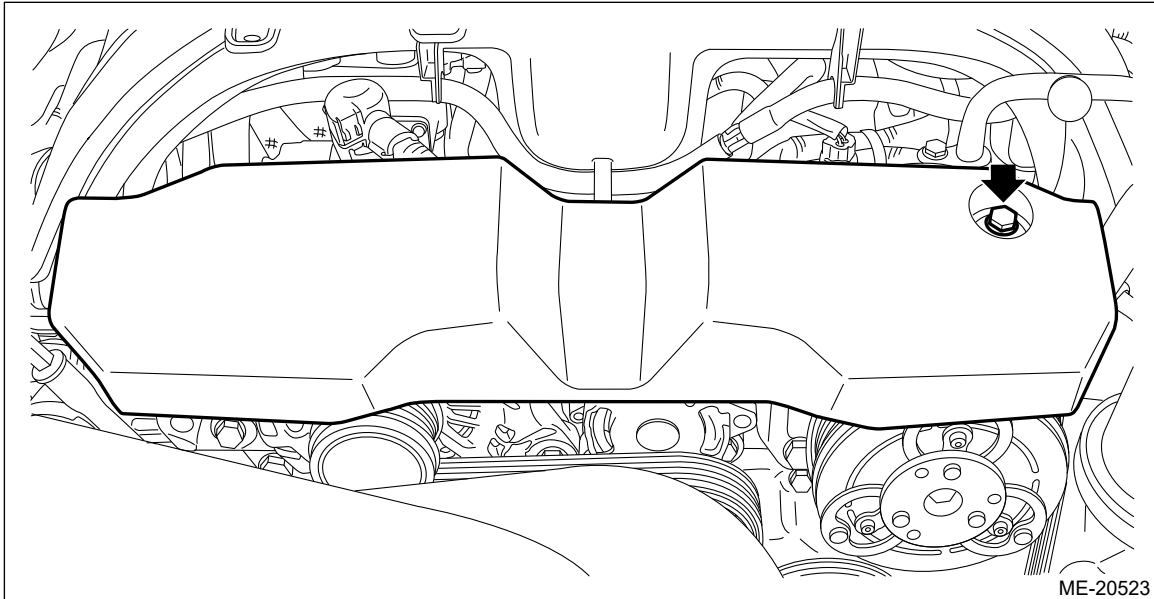
COOLING(H4DO) > Radiator



REMOVAL

Caution:

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

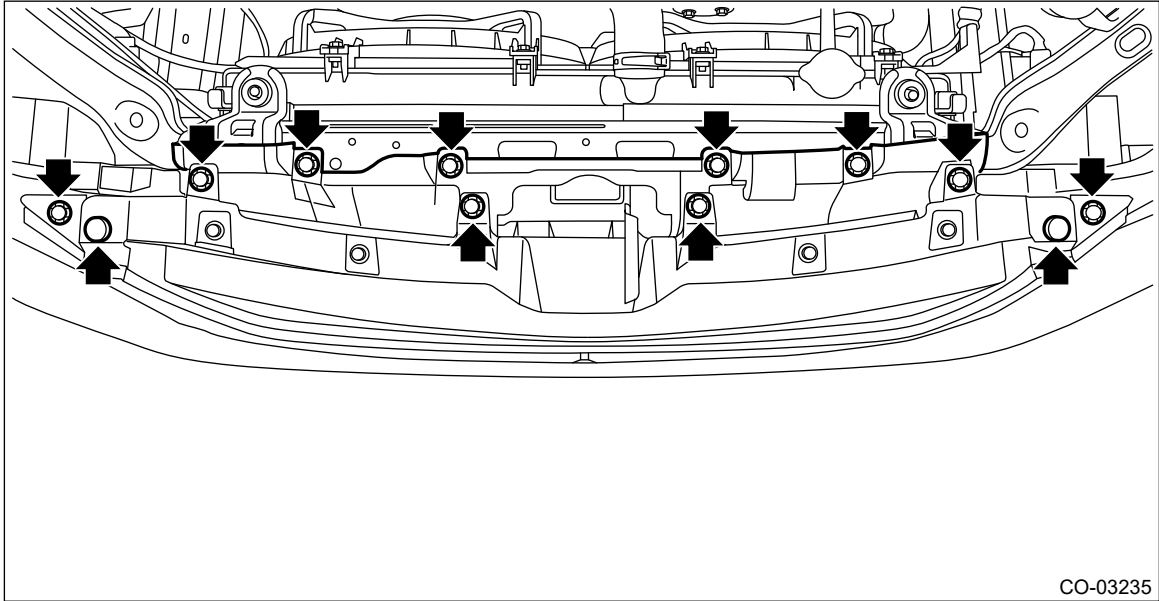
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the V-belt covers.



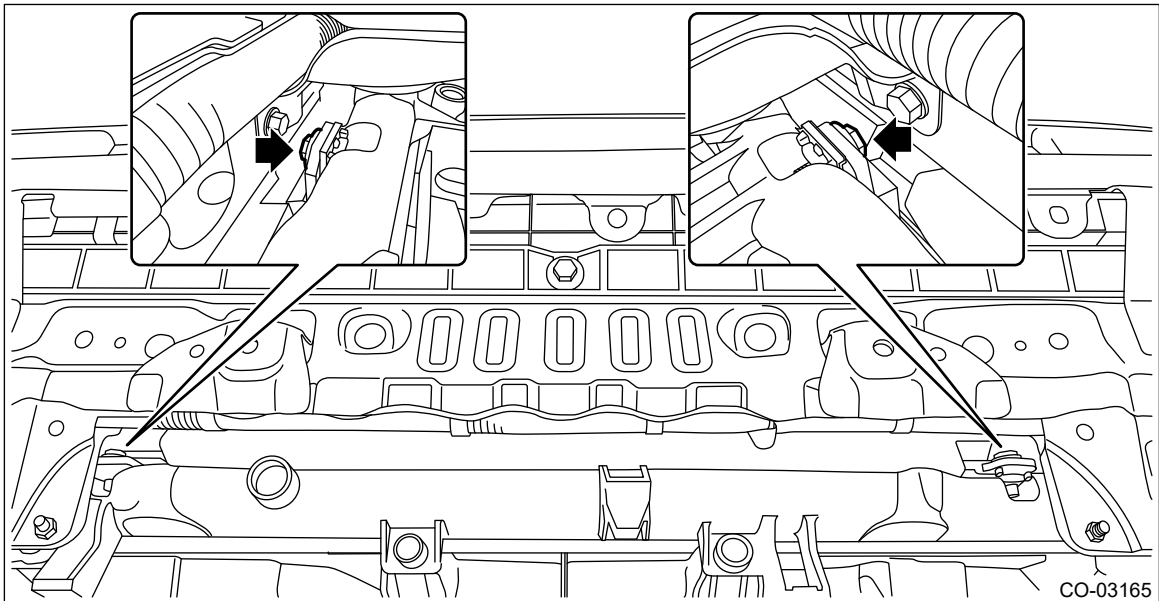
3. Remove the air intake duct.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
4. Remove the reservoir tank.  [Ref. to COOLING\(H4DO\)>Reservoir Tank>REMOVAL.](#)
5. Remove the clips from the grille bracket and front bumper to remove the grille bracket.

Note:

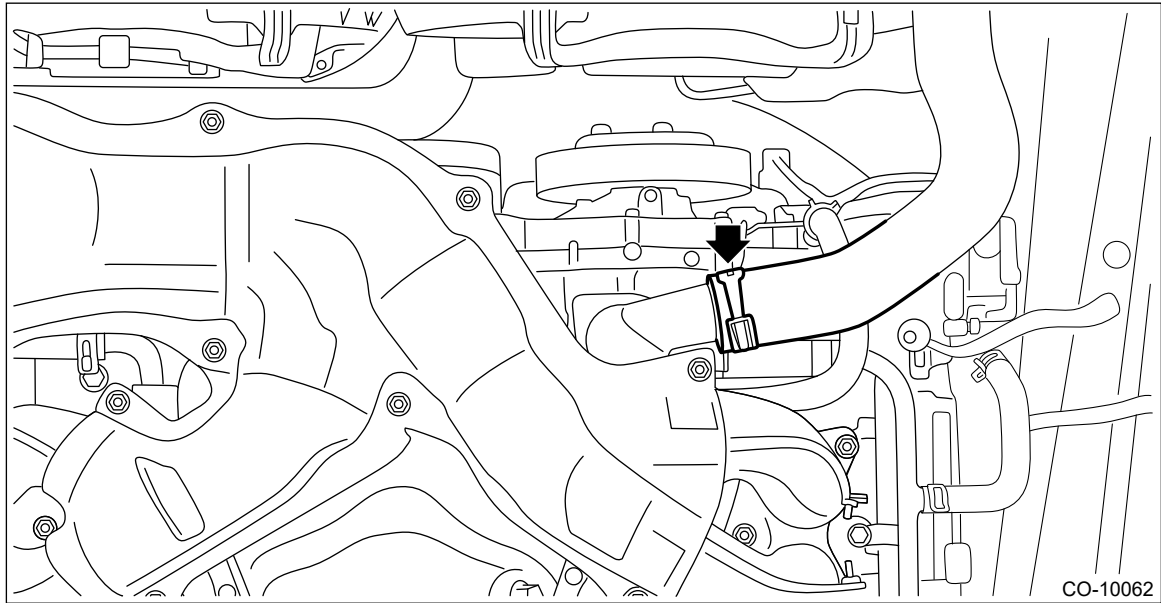
Remove the twelve clips.



6. Drain engine coolant. [🔧 Ref. to COOLING\(H4D0\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
7. Remove the bolts at the bottom of the condenser.

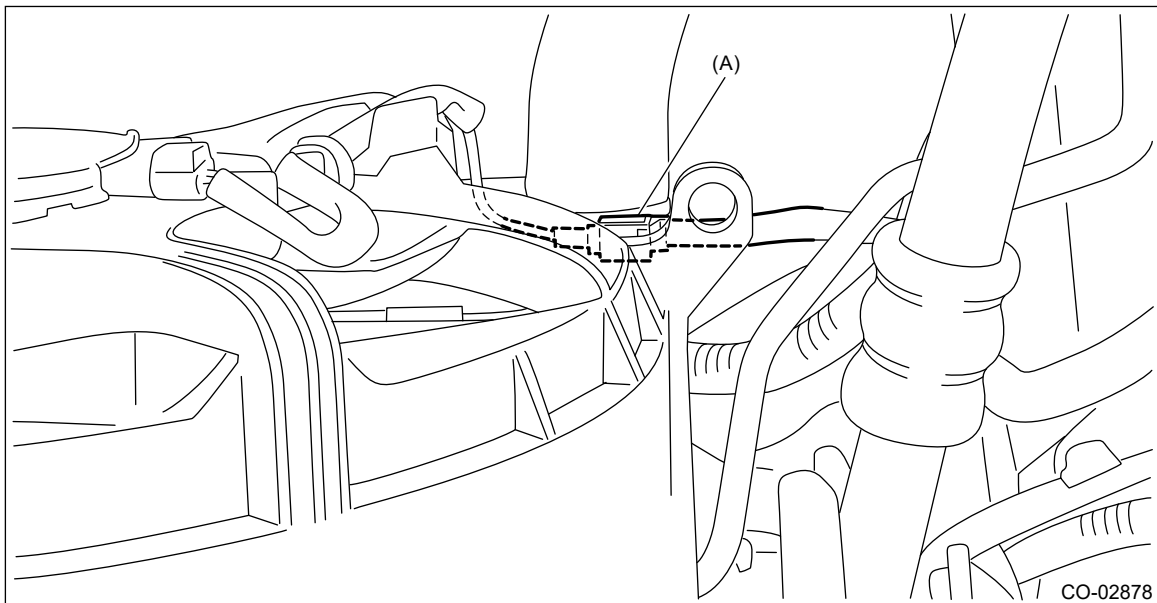


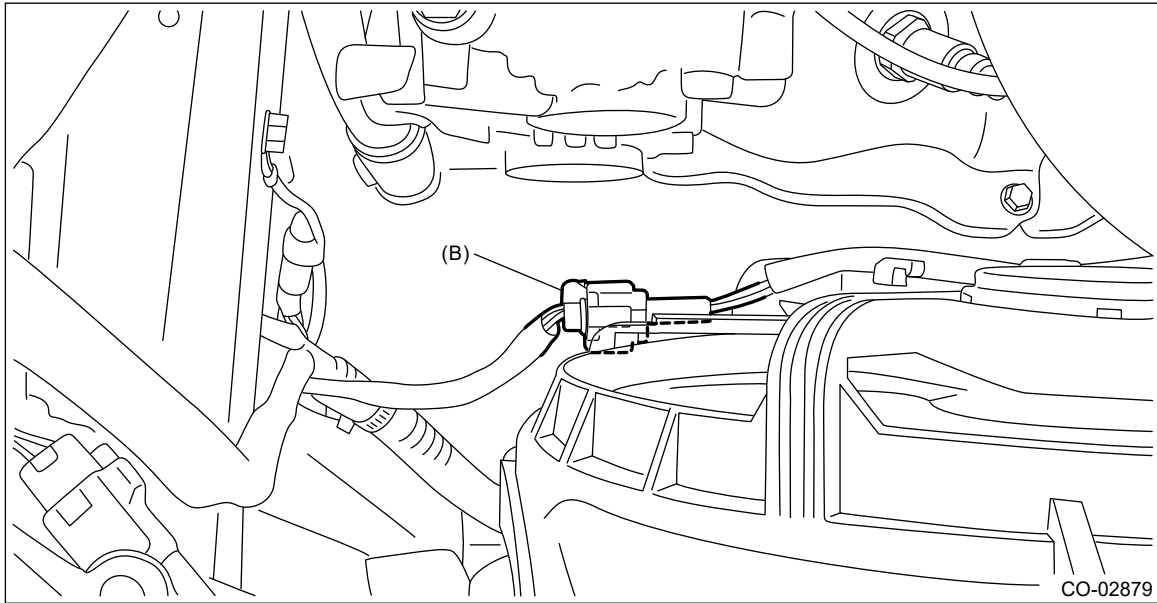
8. Disconnect the radiator outlet hose from thermostat cover.



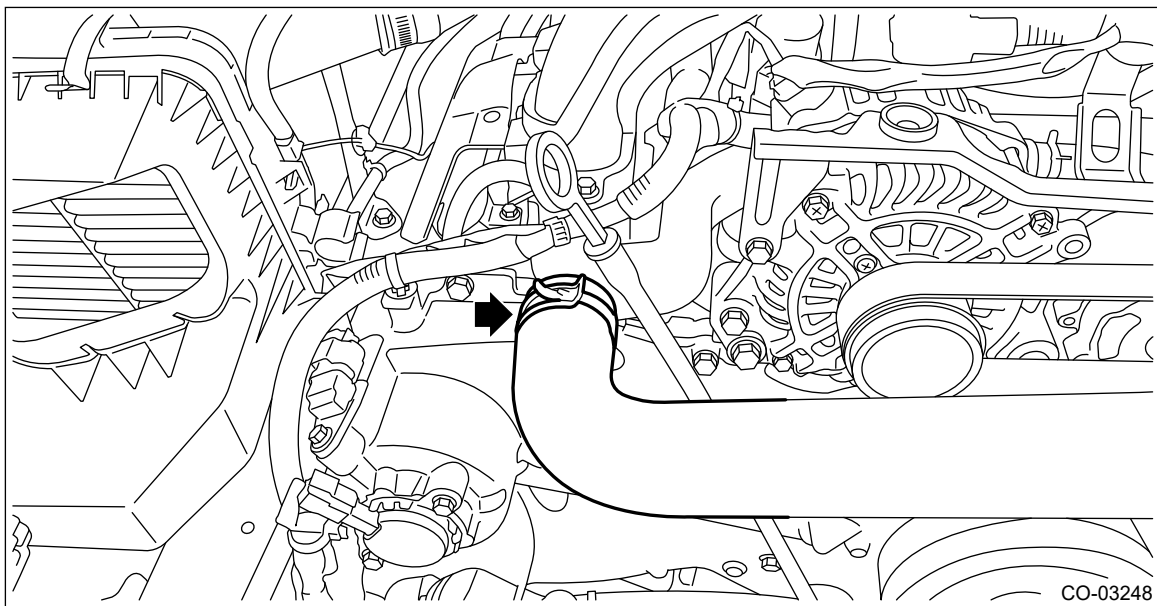
9. Lower the vehicle.

10. Disconnect the connector (A) from the main fan motor assembly and the connector (B) from the sub fan motor assembly.

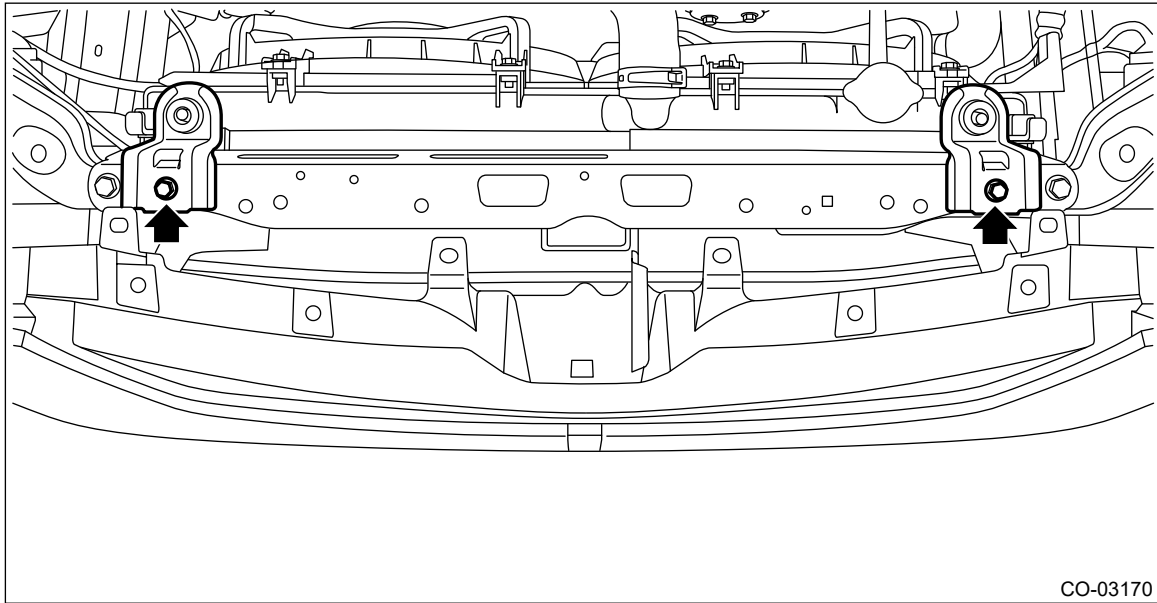




11. Disconnect the radiator inlet hose from the water pipe assembly.



12. Remove the radiator upper brackets.

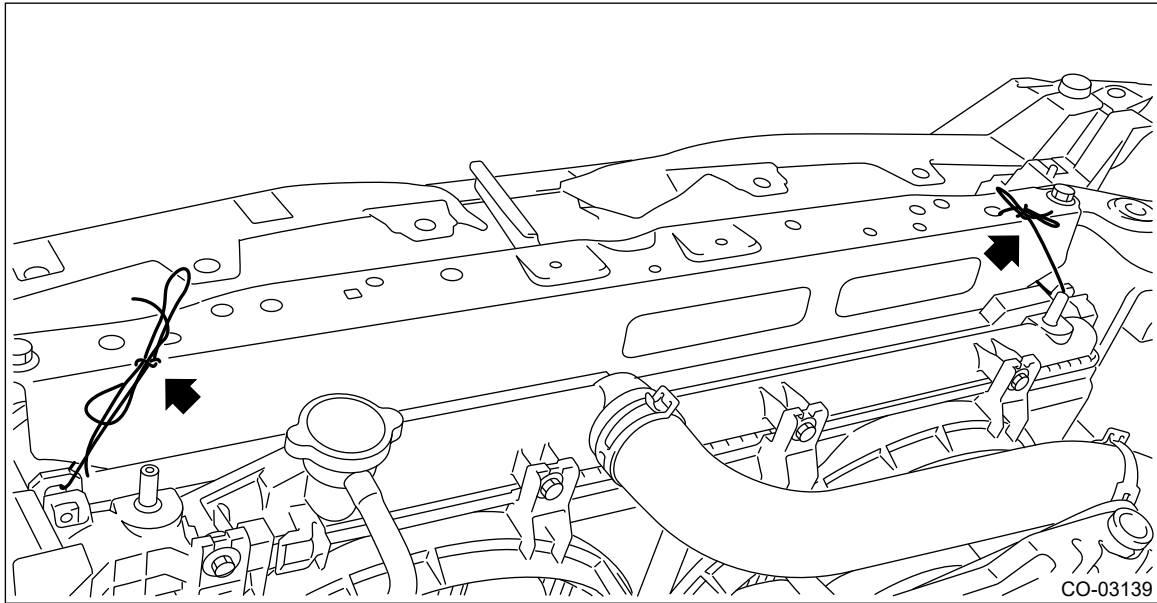


13. Remove the bolts at the top of the condenser.

14. Secure the condenser to the vehicle using ropes or other means.

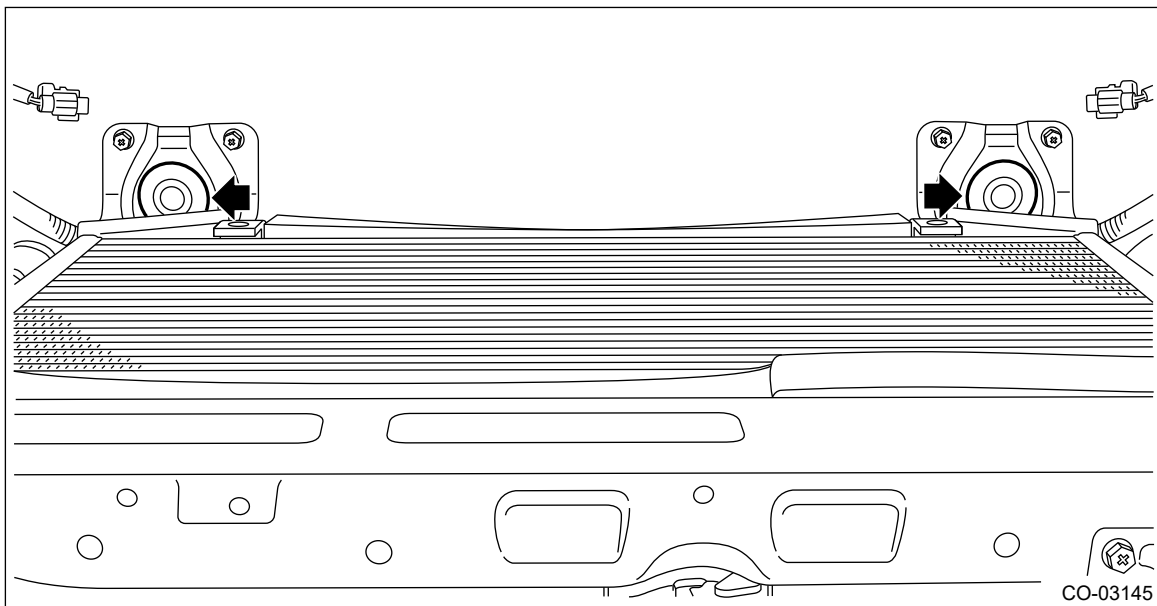
Note:

This procedure is required to prevent the condenser from dropping off and also damage to the air conditioner pipes.



CO-03139

- 15.** Remove the radiator from vehicle.
- 16.** Remove the radiator lower cushion from the radiator lower bracket.

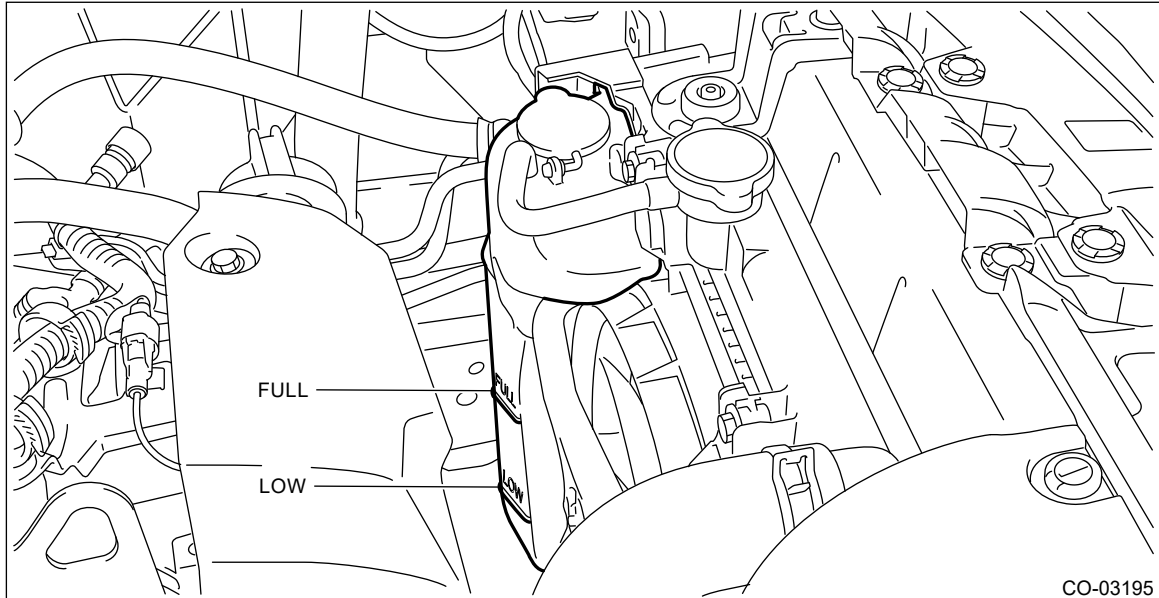


CO-03145

COOLING(H4DO) > Reservoir Tank

INSPECTION

1. Check that the reservoir tank does not have deformation, cracks or damage.
2. Make sure the over flow hoses are not cracked, damaged or loose.
3. Make sure the engine coolant level is between "FULL" and "LOW".



COOLING(H4DO) > Reservoir Tank

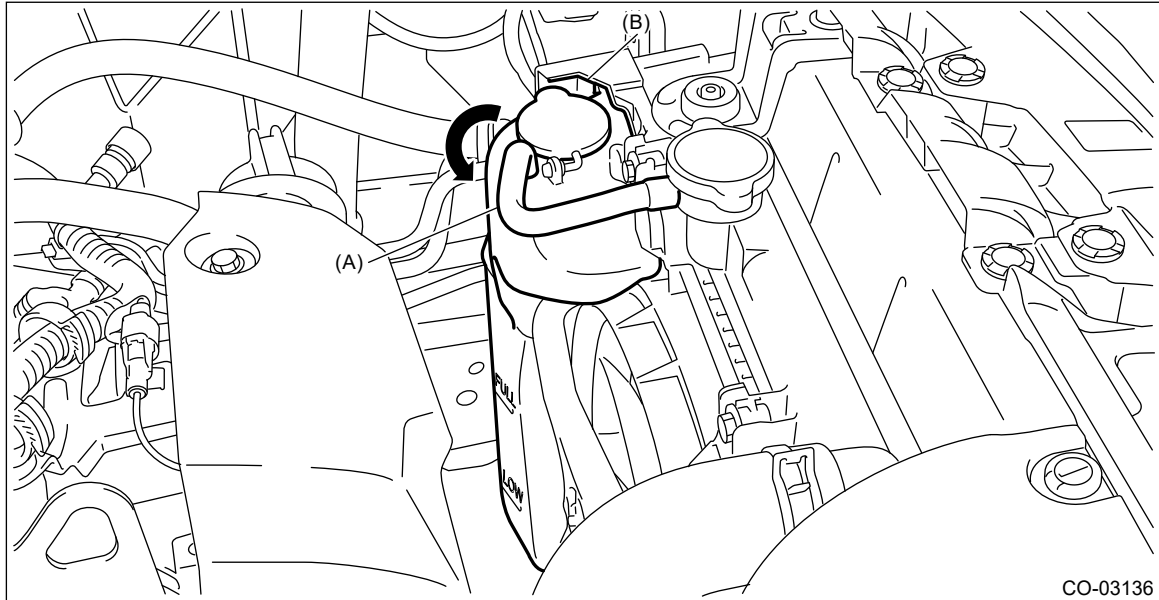
INSTALLATION

Install in the reverse order of removal.

COOLING(H4DO) > Reservoir Tank

REMOVAL

1. Disconnect the over flow hose (A) connected to the radiator filler neck from the reservoir tank.
2. Pull out the reservoir tank to the arrow direction while pushing the claw (B).



CO-03136

COOLING(H4DO) > Thermostat

INSPECTION

1. Check that the thermostat does not have deformation, cracks or damage.
2. Check that the thermostat valve closes completely at an ambient temperature.
3. Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and check the temperature and valve lift when the valve begins to open and when the valve is fully opened.
Replace the thermostat if faulty.

Note:

- During the test, agitate the water for even temperature distribution.
- Leave the thermostat in the boiling water for five minutes or more before measuring the valve lift.
- Hold the thermostat with a wire or the like to avoid contacting with container bottom.

Starting temperature to open:

Engine side

86 – 90°C (187 – 194°F)

CVTF cooler (with warmer feature) side

48 – 52°C (118 – 126°F)

Full open temperature:

Engine side

95°C (203°F)

CVTF cooler (with warmer feature) side

63°C (145°F)

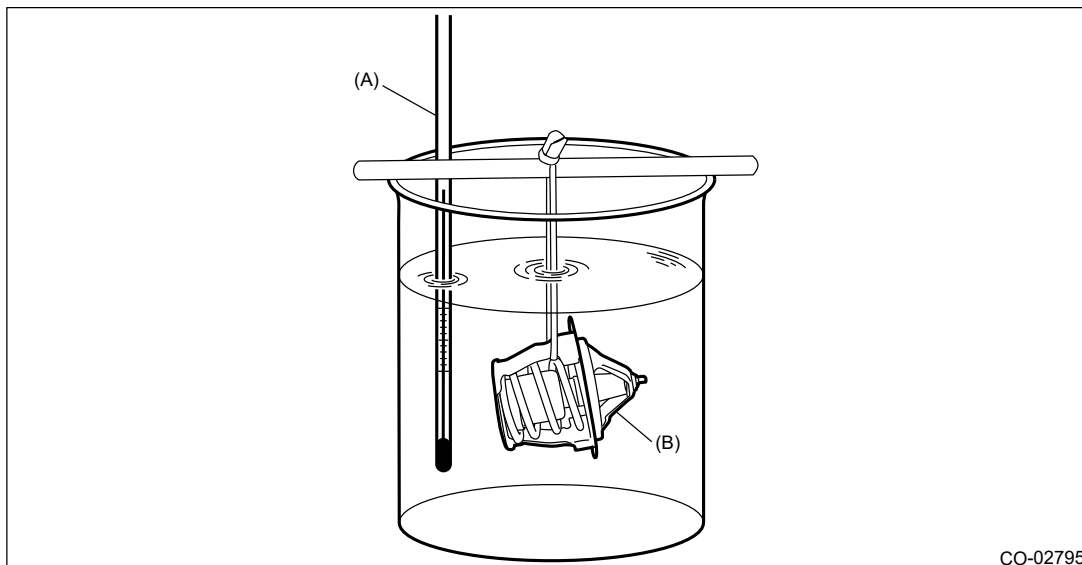
Total valve lift:

Engine side

8.0 mm (0.315 in) or more

CVTF cooler (with warmer feature) side

6.0 mm (0.236 in) or more



CO-02795

(A) Thermometer

(B) Thermostat

COOLING(H4DO) > Thermostat

INSTALLATION

1. ENGINE SIDE

1. Install a gasket to thermostat.

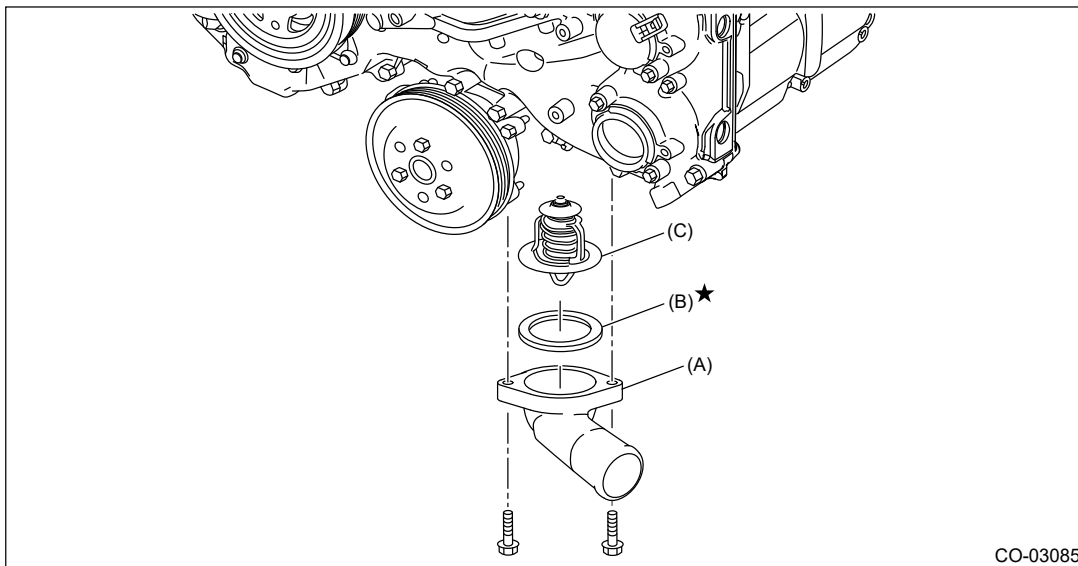
Note:

Use a new gasket.

2. Install the thermostat and thermostat cover.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

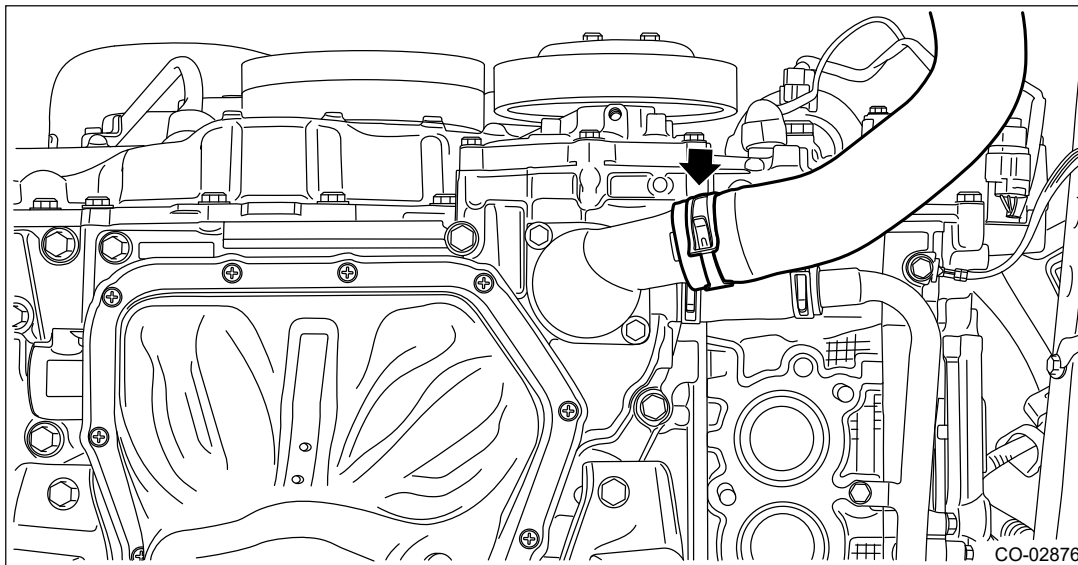




(A) Thermostat cover


(B) Gasket

(C) Thermostat

3. Connect the radiator outlet hose to thermostat cover.



4. Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>INSTALLATION.](#)
5. Lower the vehicle.
6. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

7. Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

2. CVTF COOLER (WITH WARMER FEATURE) SIDE

1. Install a gasket to thermostat.

Note:

Use a new gasket.

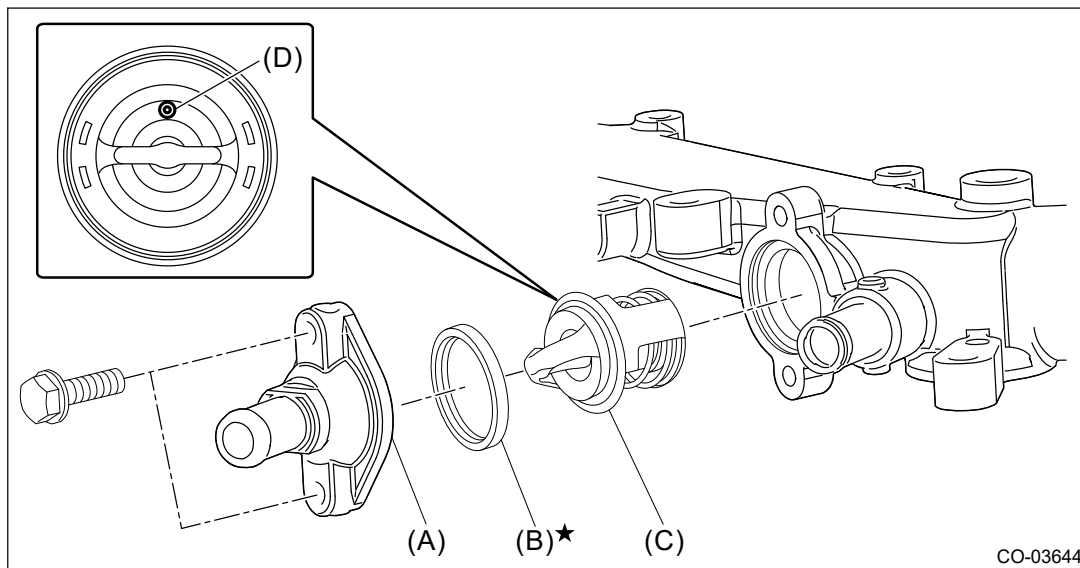
2. Install the thermostat and thermostat cover.

Note:

Install the parts with the air vent hole facing upward.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



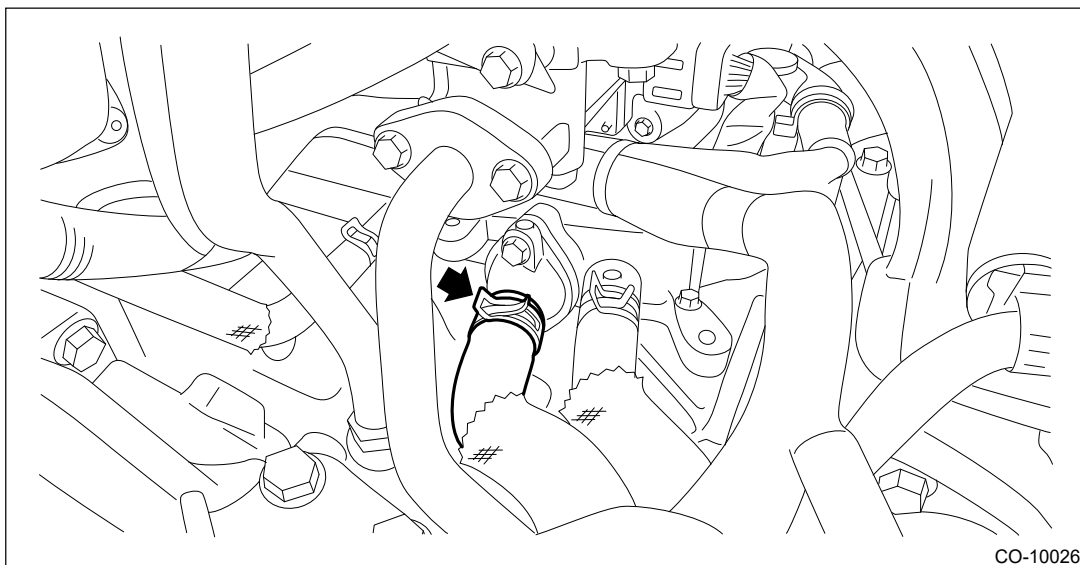
(A) Thermostat cover

(B) Gasket



(C) Thermostat

(D) Air vent hole

3. Connect the engine coolant hose to the thermostat cover.






4. Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)

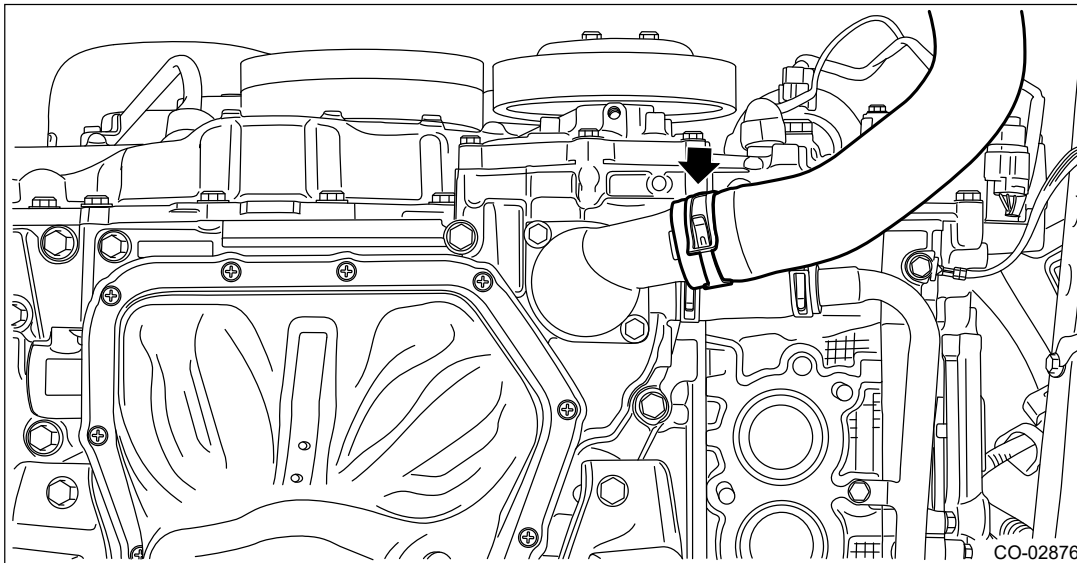
5. Lift up the vehicle.
6. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
7. Lower the vehicle.
8. Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

COOLING(H4DO) > Thermostat

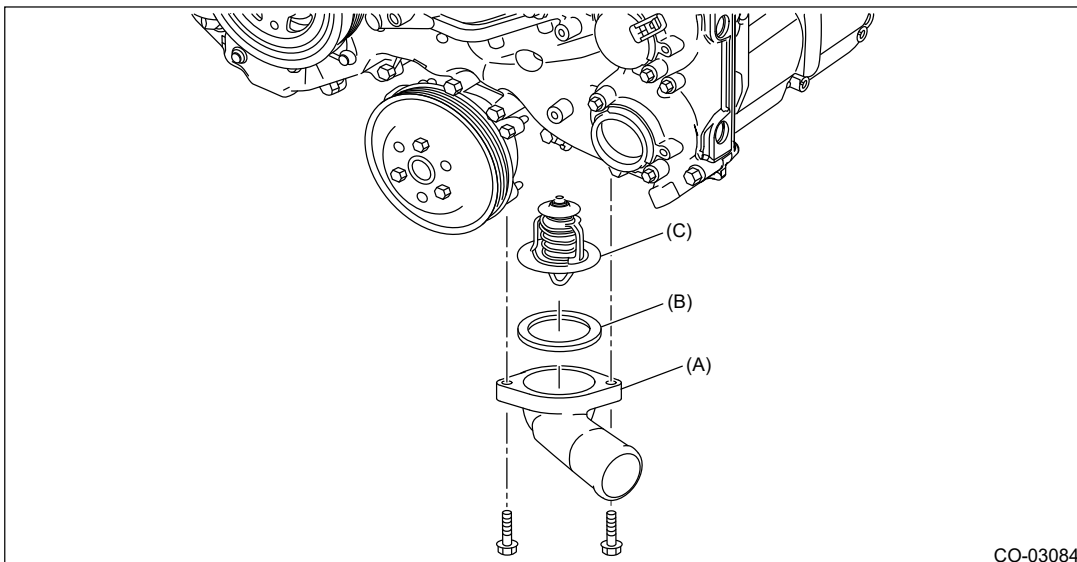
REMOVAL

1. ENGINE SIDE

1. Disconnect the ground terminal from battery sensor.  Ref. to [NOTE>NOTE > BATTERY](#).
2. Drain engine coolant.  Ref. to [COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT](#).
3. Remove the front exhaust pipe.  Ref. to [EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL](#).
4. Disconnect the radiator outlet hose from thermostat cover.



5. Remove the thermostat cover, and then remove the thermostat.




(A) Thermostat cover

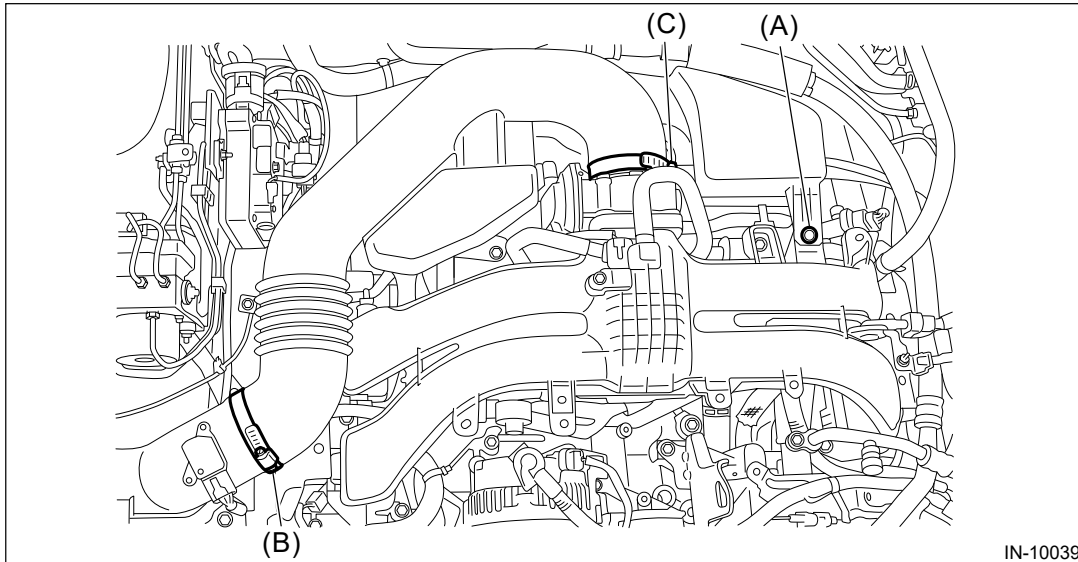
(B) Gasket

(C) Thermostat

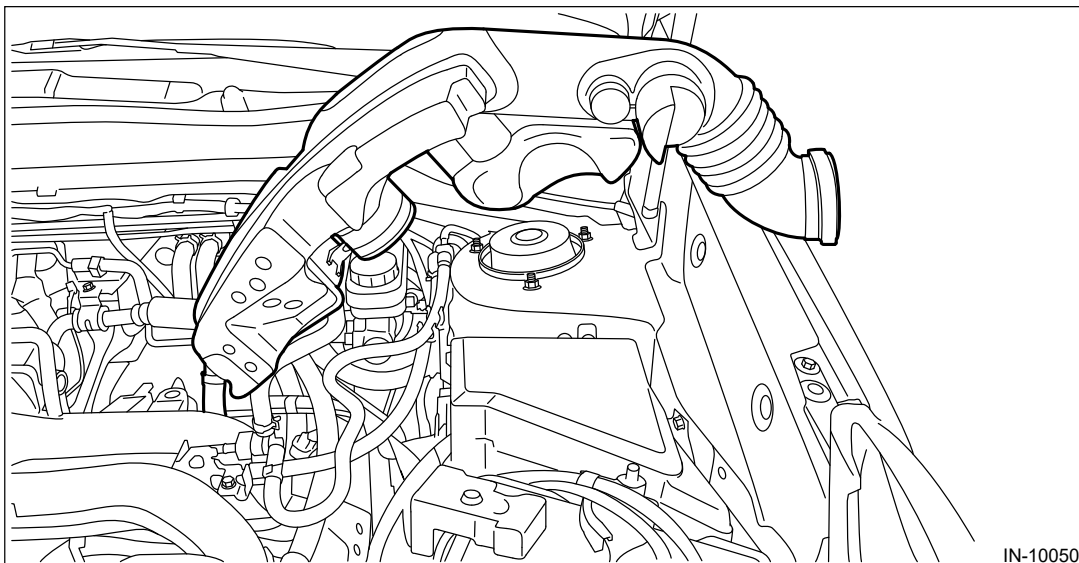
6. Remove the gasket from thermostat.

2. CVTF COOLER (WITH WARMER FEATURE) SIDE

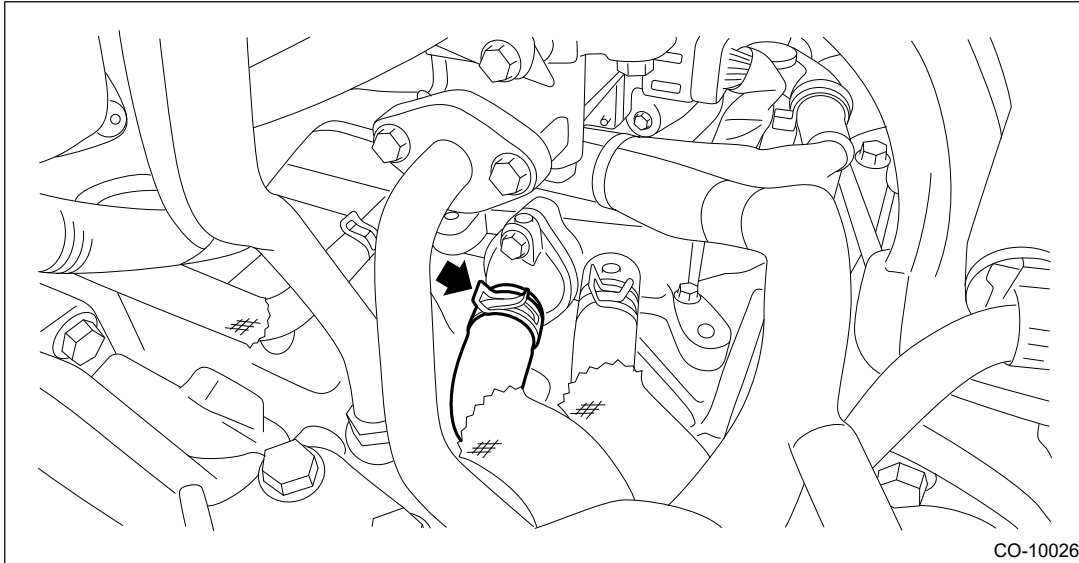
1. Drain engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
2. Lower the vehicle.
3. Remove the clip (A) from the air intake boot.
4. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
5. Loosen the clamp (C) which secures the throttle body to the air intake boot.



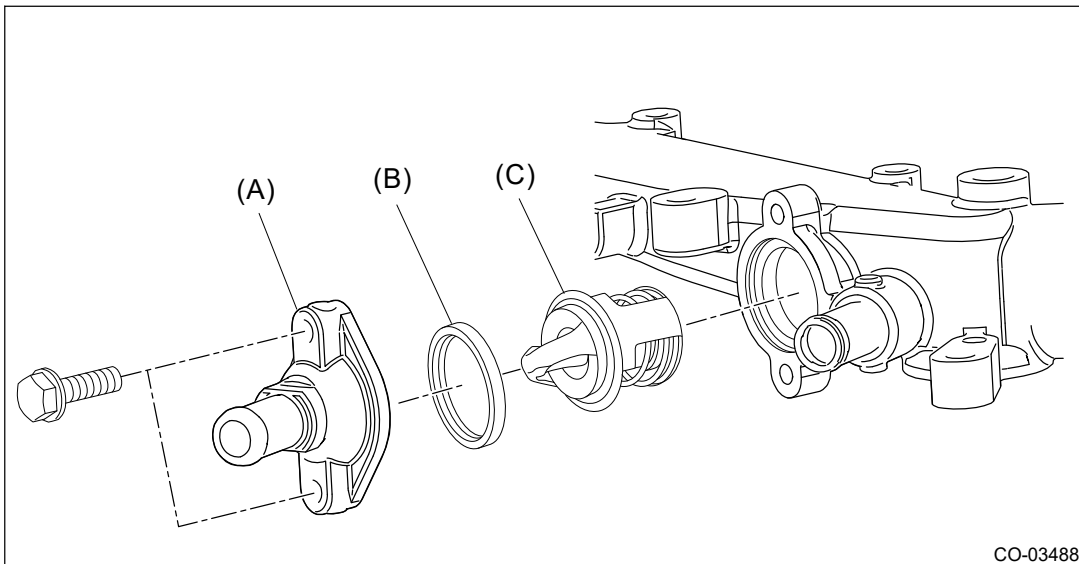
6. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.



7. Disconnect the engine coolant hose from the thermostat cover.



8. Remove the thermostat cover, and then remove the gasket and thermostat.



(A) Thermostat cover

(B) Gasket

(C) Thermostat

COOLING(H4DO) > Water Pipe Assembly

INSPECTION

- 1.** Check that the water pipe assembly has no deformation, cracks or other damages.
- 2.** Check that the hose has no cracks, damage or loose part.

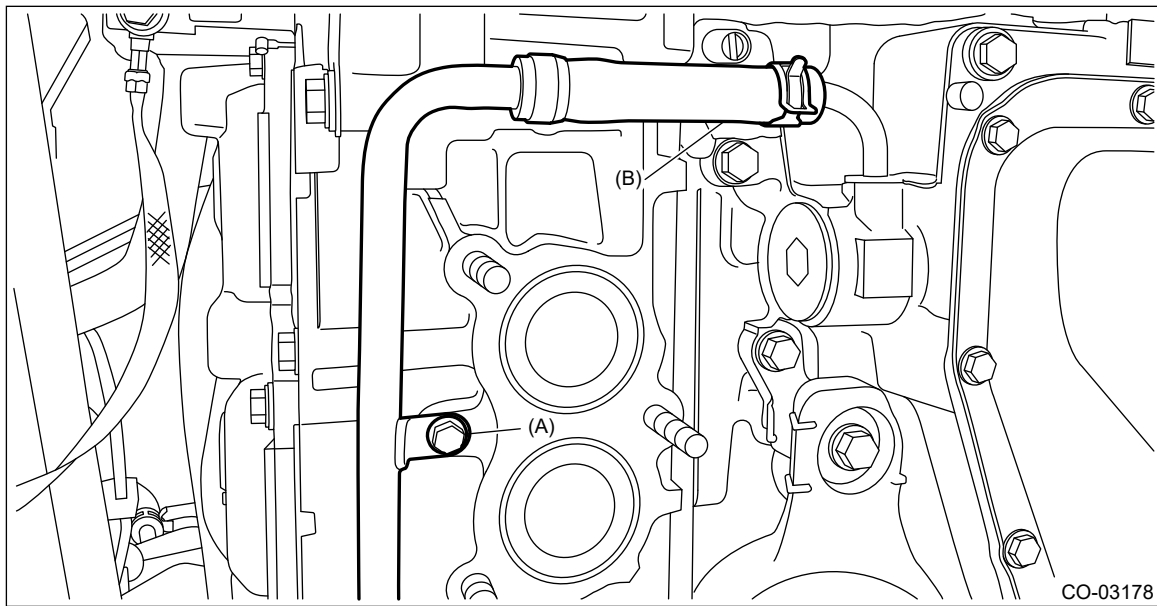
INSTALLATION

1. WATER PIPE ASSEMBLY RH

1. Set the water pipe assembly RH on the engine, and connect the water pipe hose RH (B) to the oil pan upper.
2. Secure the water pipe assembly RH to the cylinder head RH with bolt (A).

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

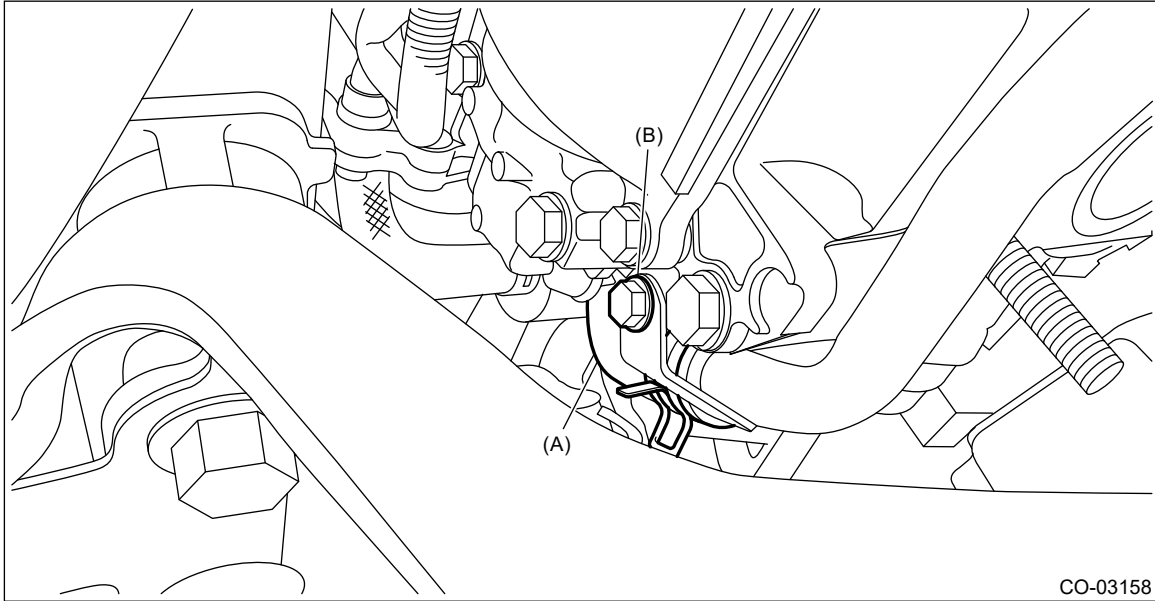


3. Install the bolt (B) which secures the water pipe assembly RH to the cam carrier RH.




Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

4. Connect the water hose (A) to the water pipe assembly RH.



CO-03158

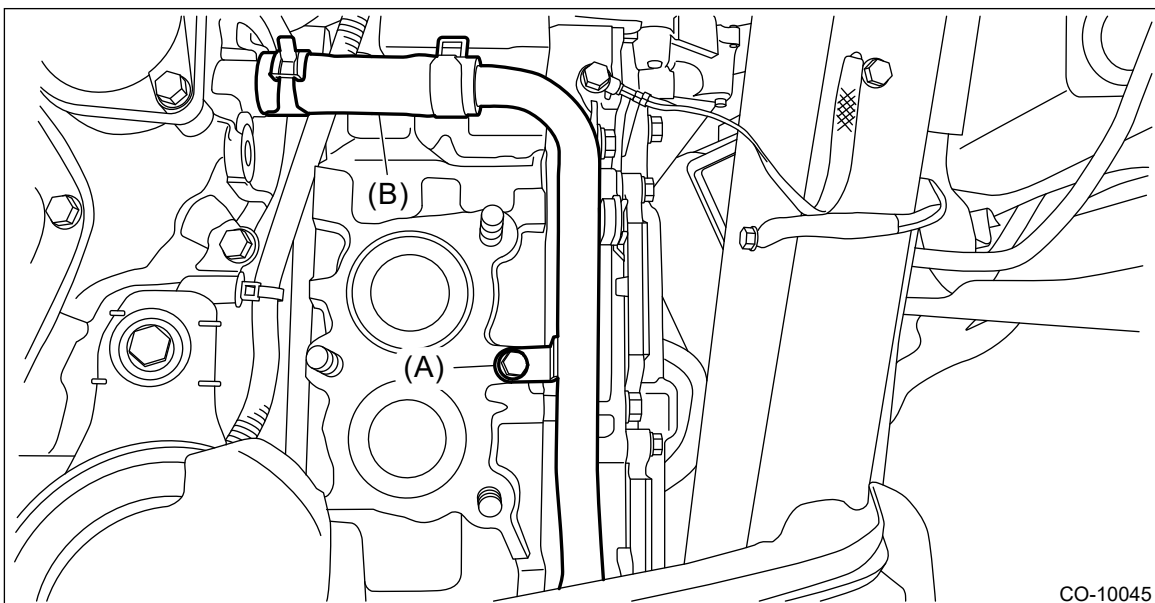
5. Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>INSTALLATION.](#)
6. Lower the vehicle.
7. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
8. Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

2. WATER PIPE ASSEMBLY LH

1. Set the water pipe assembly LH on the engine, and connect the water pipe hose LH (B) to the oil pan upper.
2. Secure the water pipe assembly LH to the cylinder head LH with bolt (A).

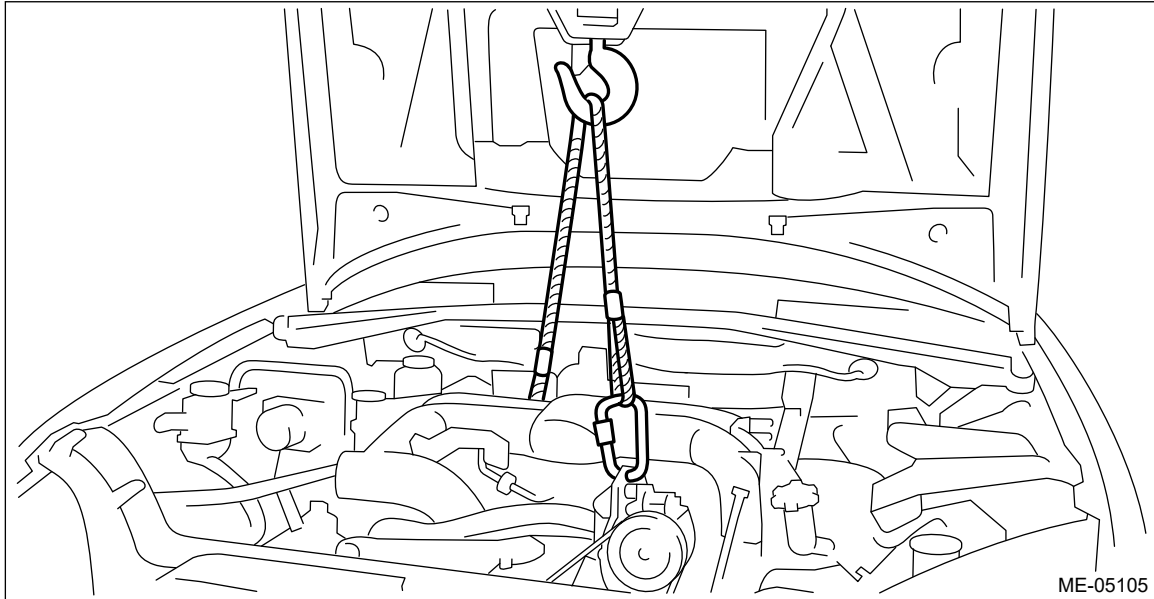
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



CO-10045

3. Lower the engine and remove the lifting device and wire ropes.

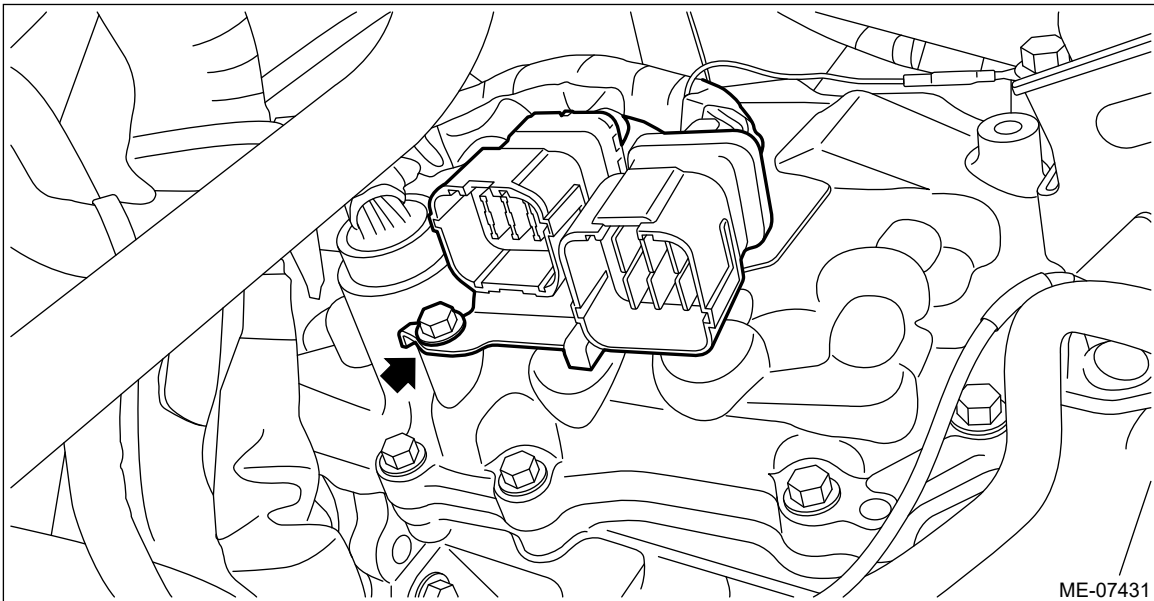


ME-05105

4. Install the transmission harness stay. (CVT model)

Tightening torque:

7 N·m (0.7 kgf-m, 5.2 ft-lb)

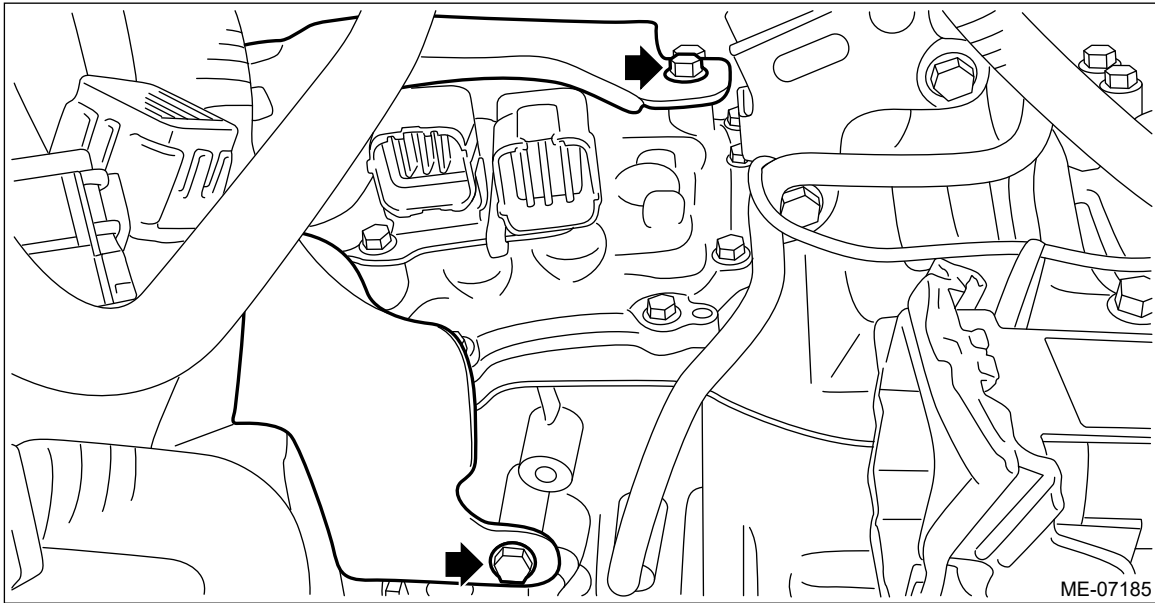


ME-07431

5. Install the transmission case cover. (CVT model)

Tightening torque:

8 N·m (0.8 kgf-m, 5.9 ft-lb)

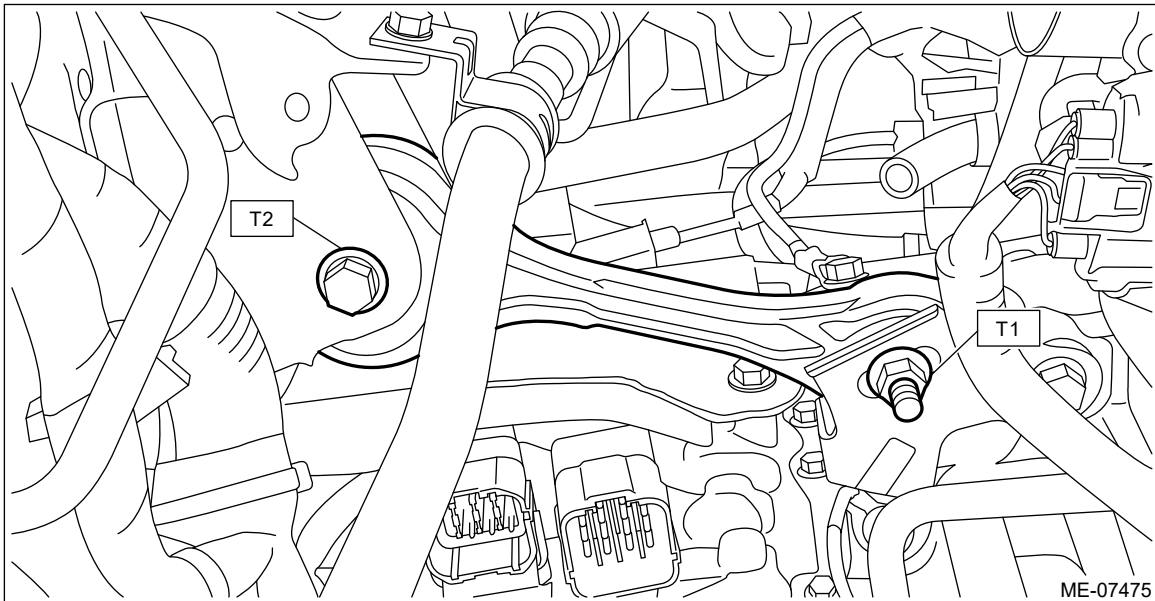


6. Install the pitching stopper.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

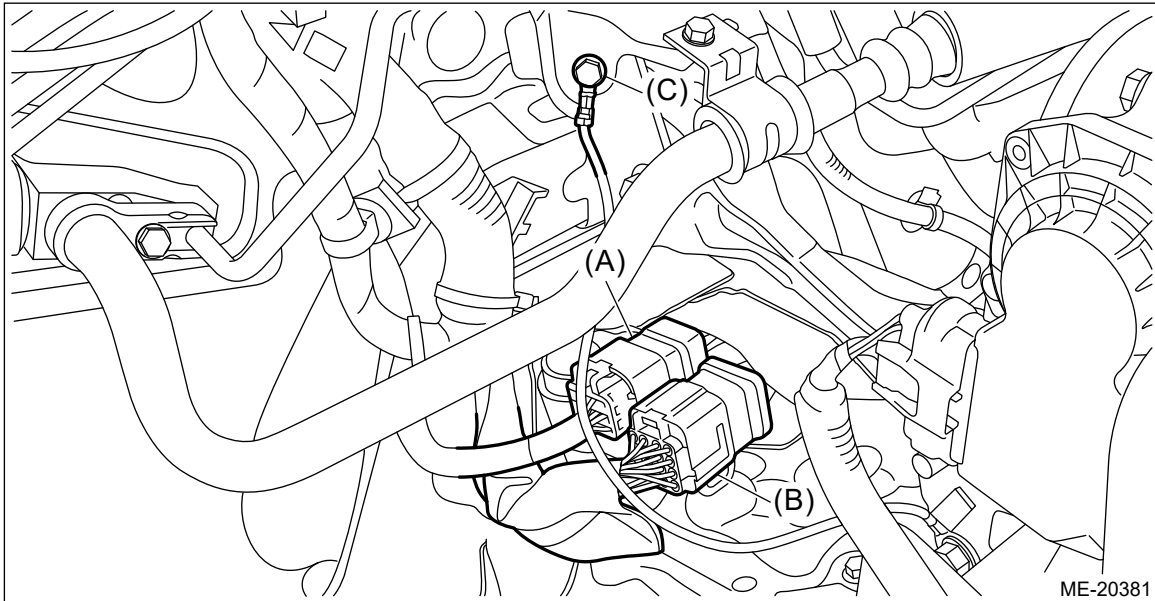
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



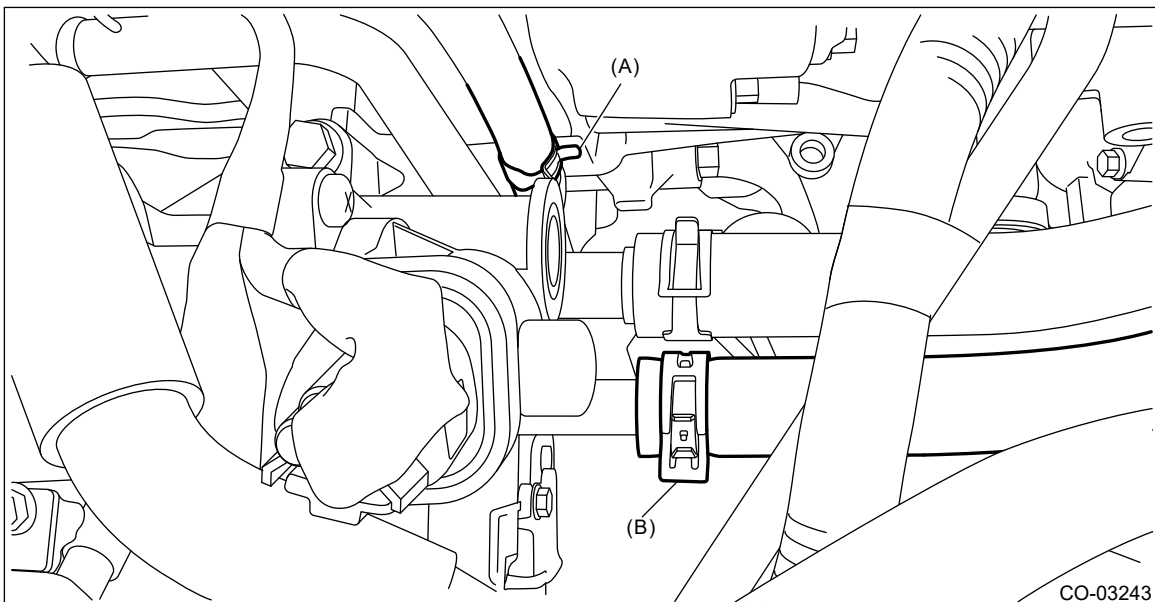
7. Connect the bulkhead harness connector to the transmission harness connector (A) and the inhibitor harness connector (B), and connect the transmission radio ground terminal (C) to the vehicle body. (CVT model)

Tightening torque:

13 N·m (1.3 kgf-m, 9.6 ft-lb)



- 8.** Connect the preheater hose (A) and the heater outlet hose (B) to the water pipe assembly LH.



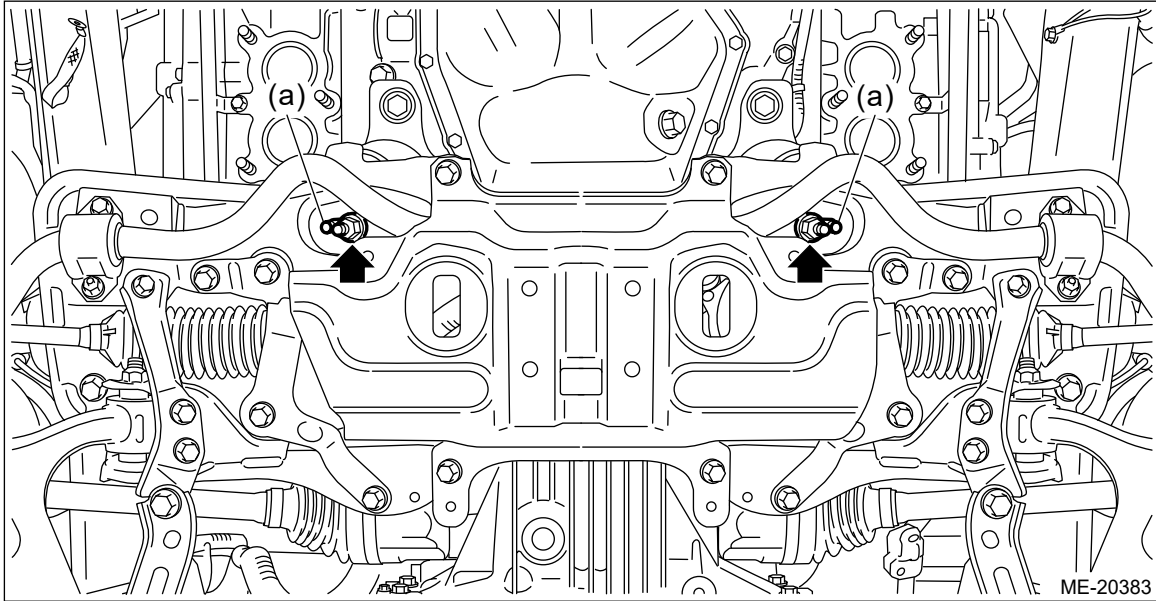
- 9.** Lift up the vehicle.
10. Install the nuts which hold the engine mounting to the front crossmember. (Hydraulic engine mounting model)

Note:

- **Make sure that locators (a) of the engine mounting are securely inserted.**
- **Use a new nut.**

Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)



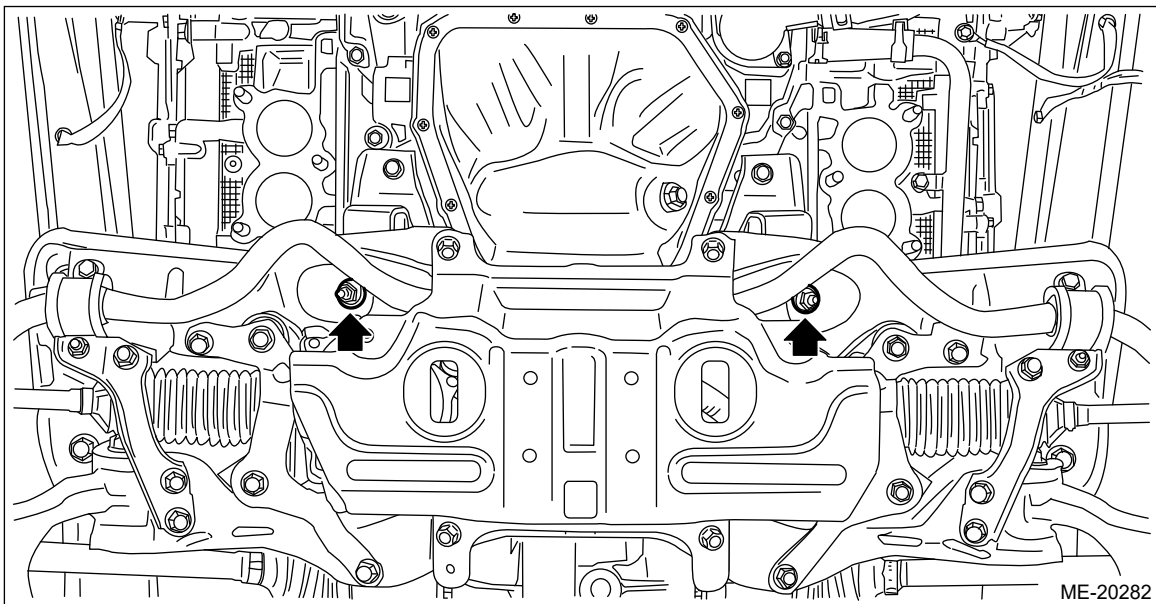
- 11.** Install the nuts which hold the engine mounting to the front crossmember. (Solid engine mounting model)

Note:

Use a new nut.

Tightening torque:

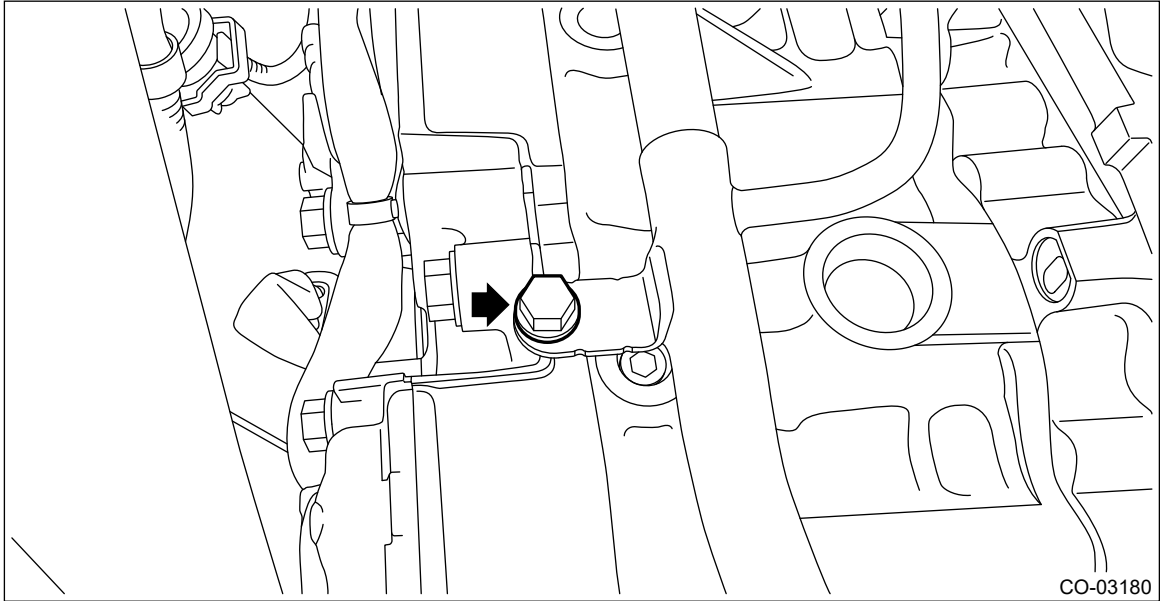
60 N·m (6.1 kgf-m, 44.3 ft-lb)








- 12.** Install the bolt which secures the water pipe assembly LH to the cylinder head LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

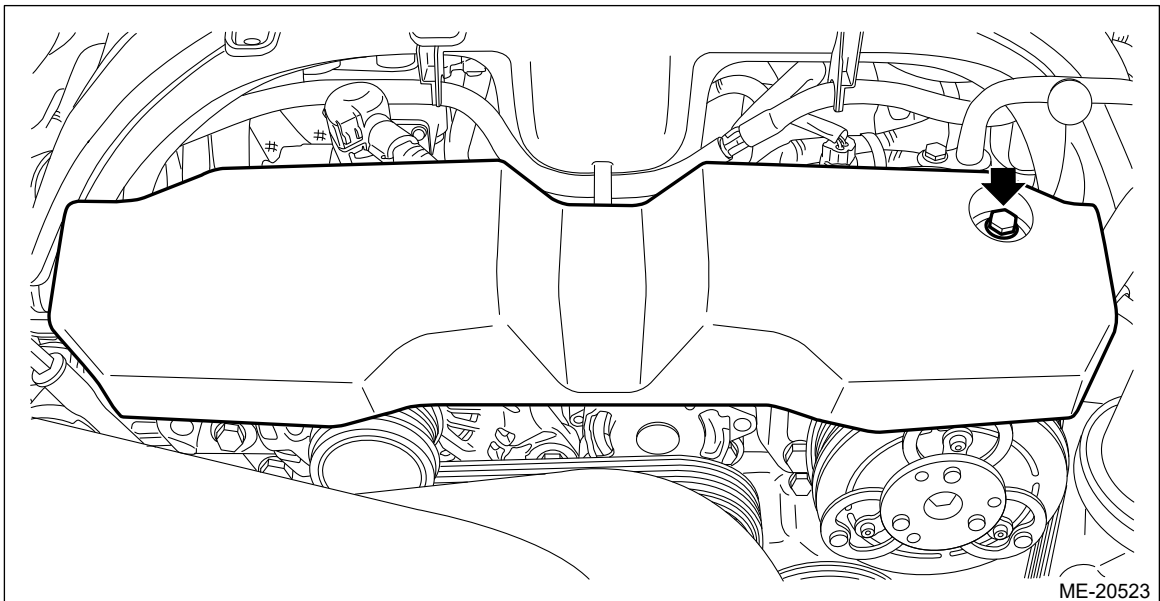


CO-03180

- 13.** Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)
- 14.** Lower the vehicle.
- 15.** Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)
- 16.** Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>INSTALLATION.](#)
- 17.** Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 18.** Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
- 19.** Install the V-belt cover.

Tightening torque:

7N·m (0.7 kgf-m, 5.2 ft-lb)

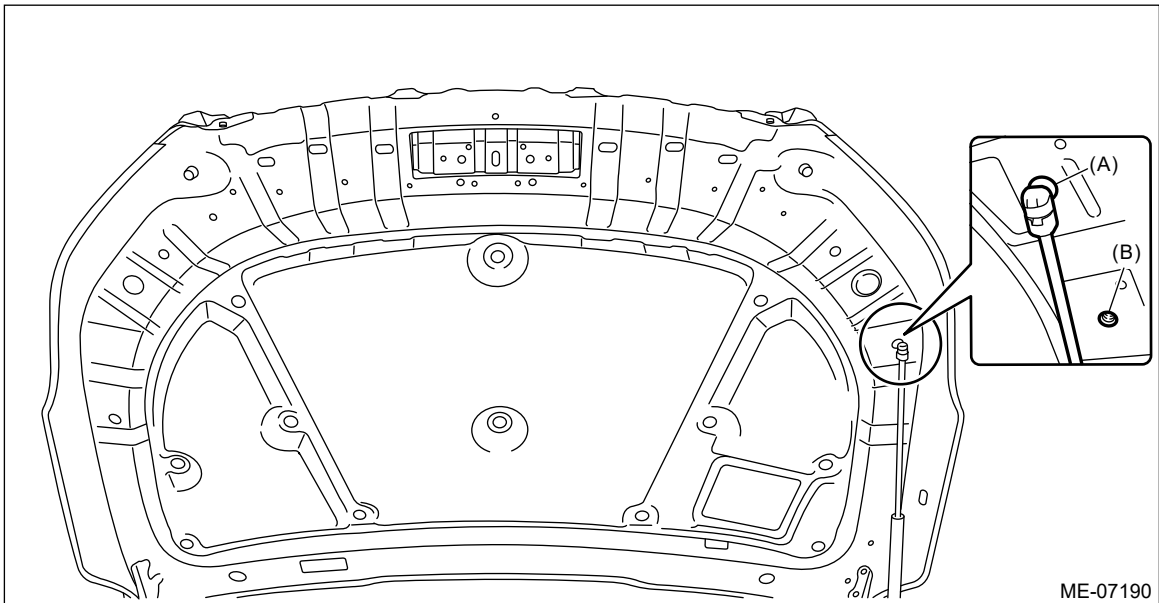


ME-20523

- 20.** Change the installation position of the front hood damper from (B) to (A).

Tightening torque:

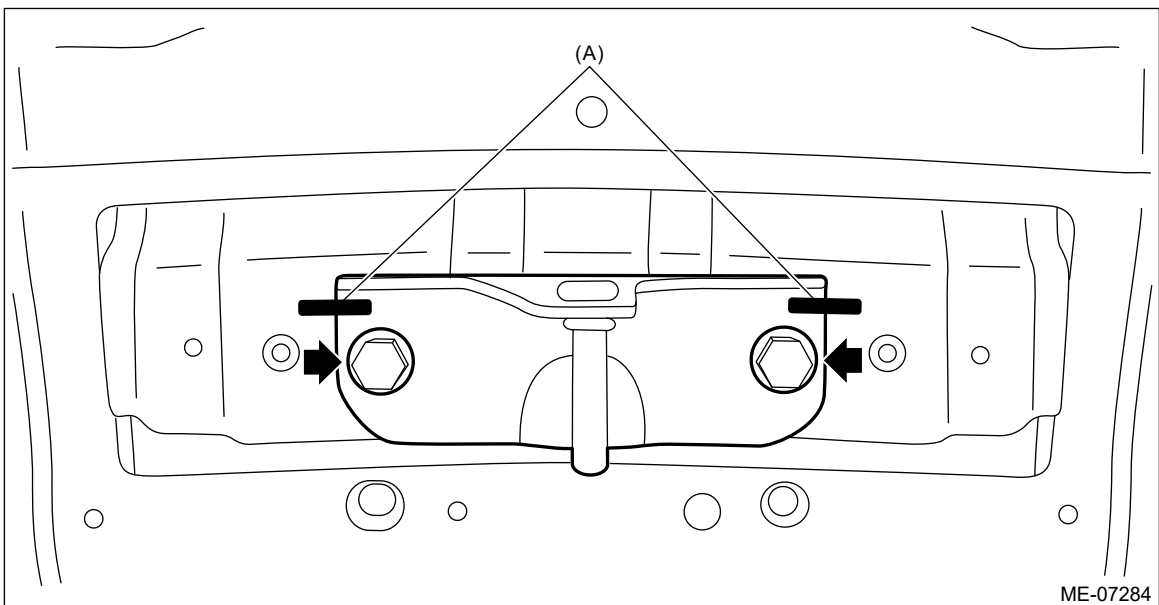
20 N·m (2.0 kgf-m, 14.8 ft-lb)




- 21.** Align the alignment marks (A), and install the front hood striker to the front hood.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)






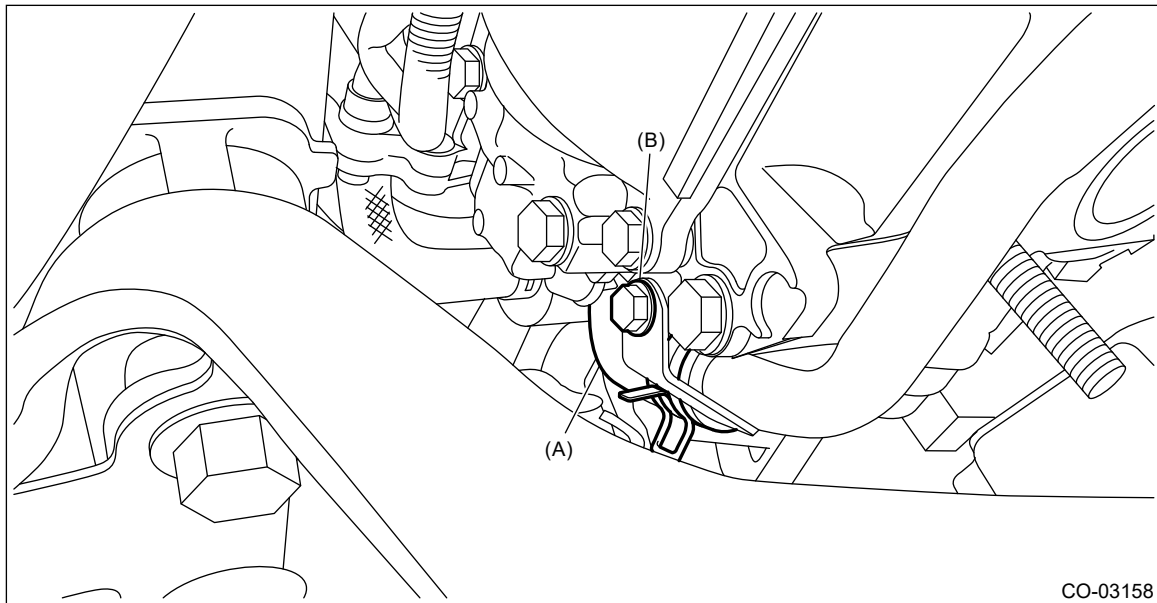
- 22.** Install the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>INSTALLATION.](#)

COOLING(H4DO) > Water Pipe Assembly

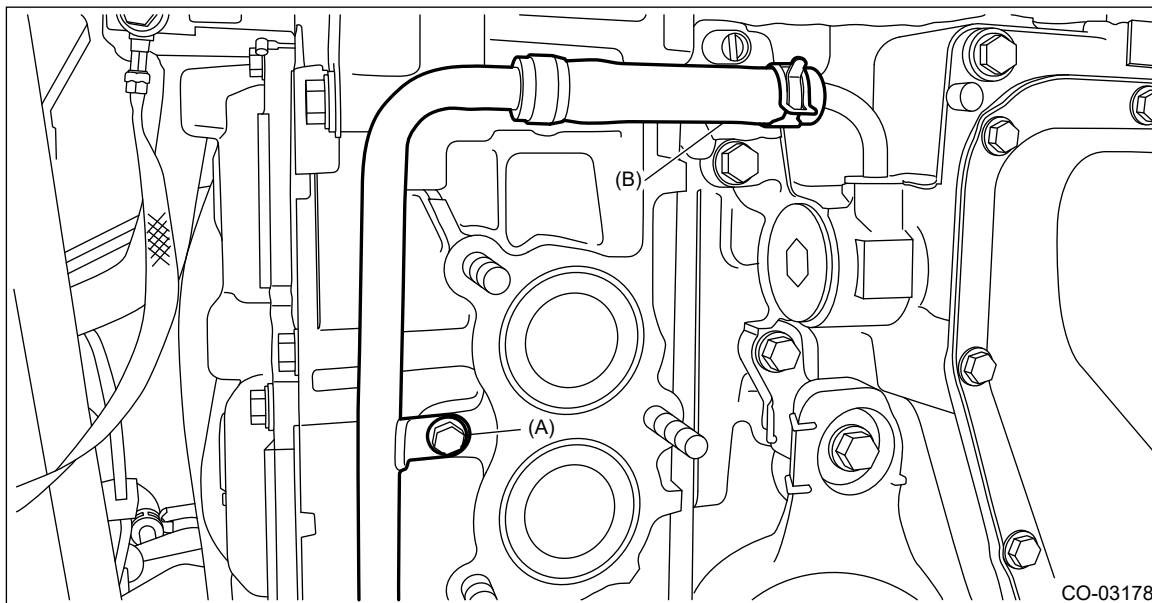
REMOVAL

1. WATER PIPE ASSEMBLY RH

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Drain engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
3. Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)
4. Disconnect the water hose (A) from the water pipe assembly RH, and remove the bolt (B) securing the water pipe assembly RH to the cam carrier RH.




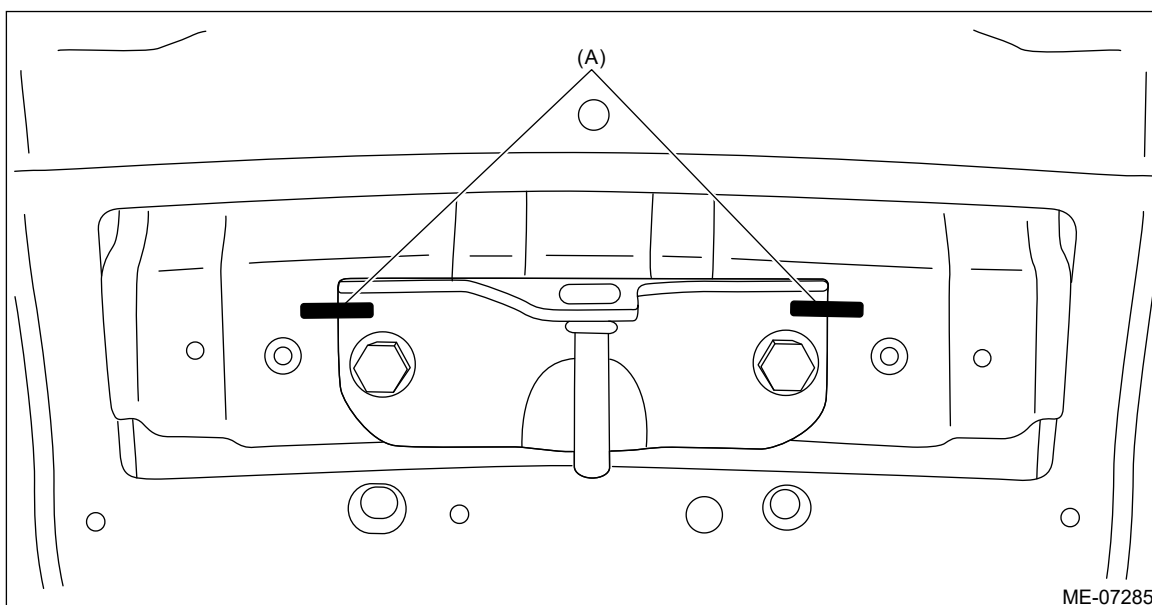
5. Remove the bolt (A) which secures the water pipe assembly RH to the cylinder head RH.
6. Disconnect the water pipe hose RH (B) from oil pan upper, and remove the water pipe assembly RH.



CO-03178

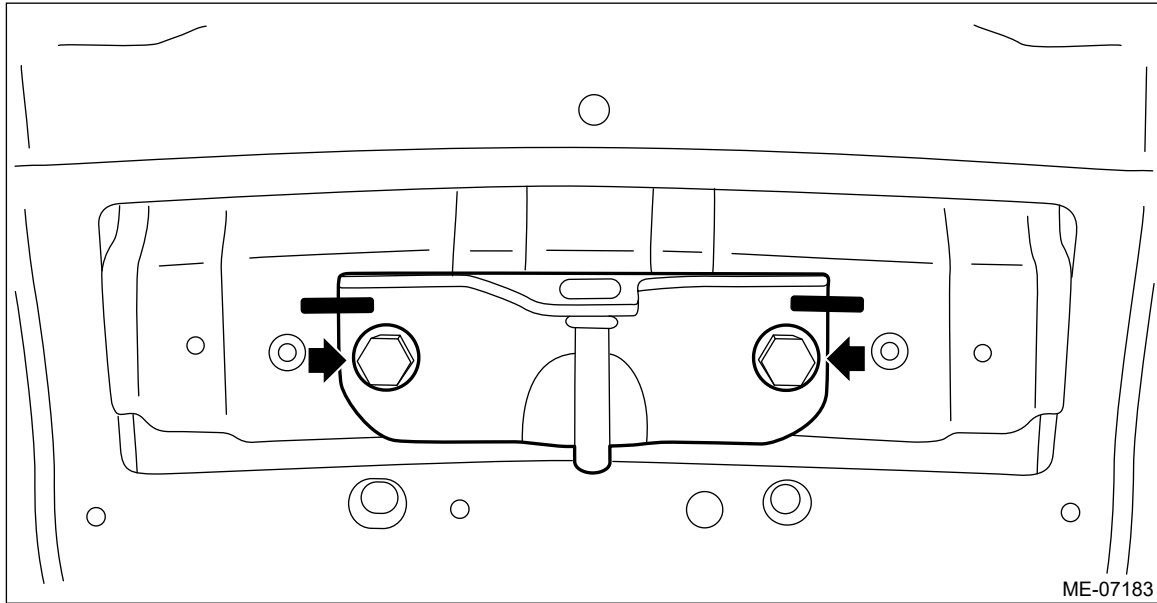
2. WATER PIPE ASSEMBLY LH

1. Remove the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>REMOVAL > FRONT GRILLE UPPER.](#)
2. Using a marker pen, make alignment marks (A) on both the front hood striker and the front hood.



ME-07285

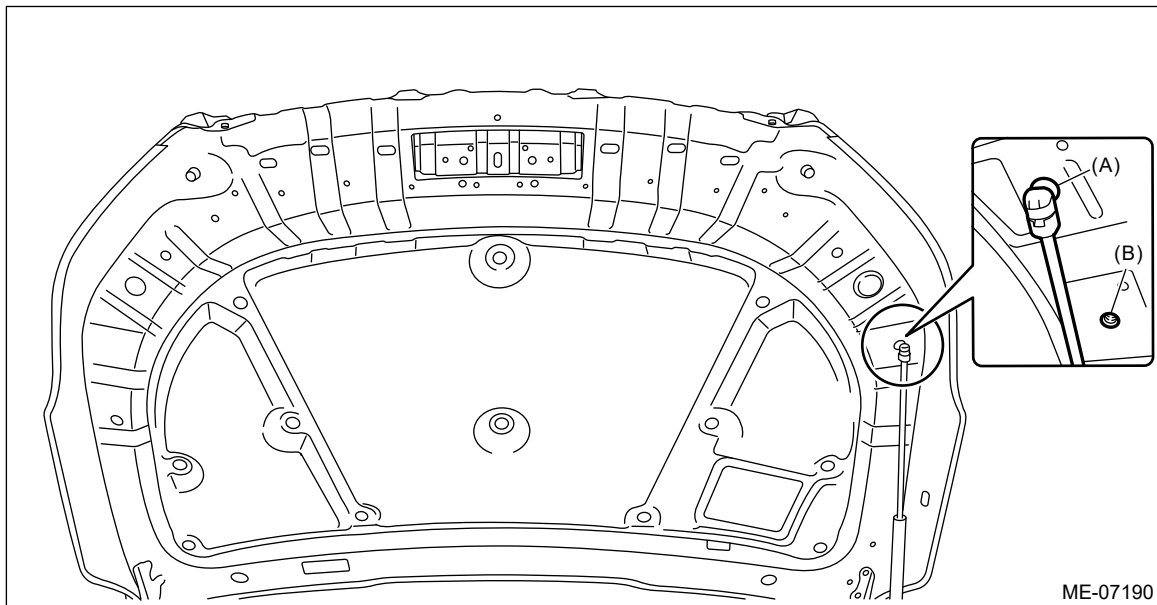
3. Remove the front hood striker from the front hood.



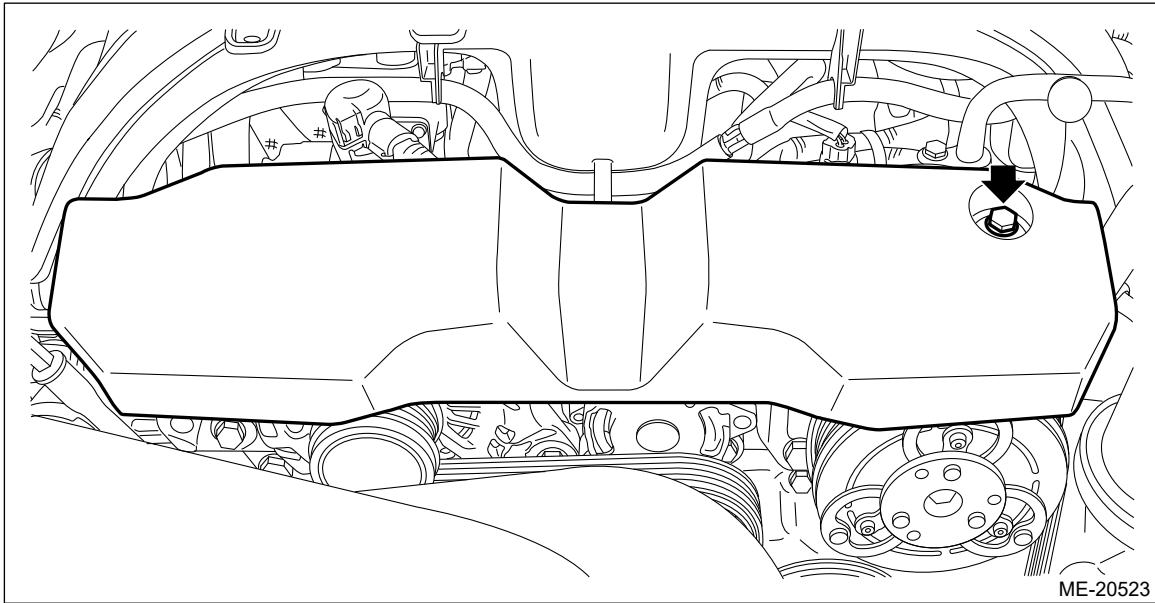
4. Change the front hood damper mounting position from (A) to (B), and completely open the front hood.



Tightening torque:

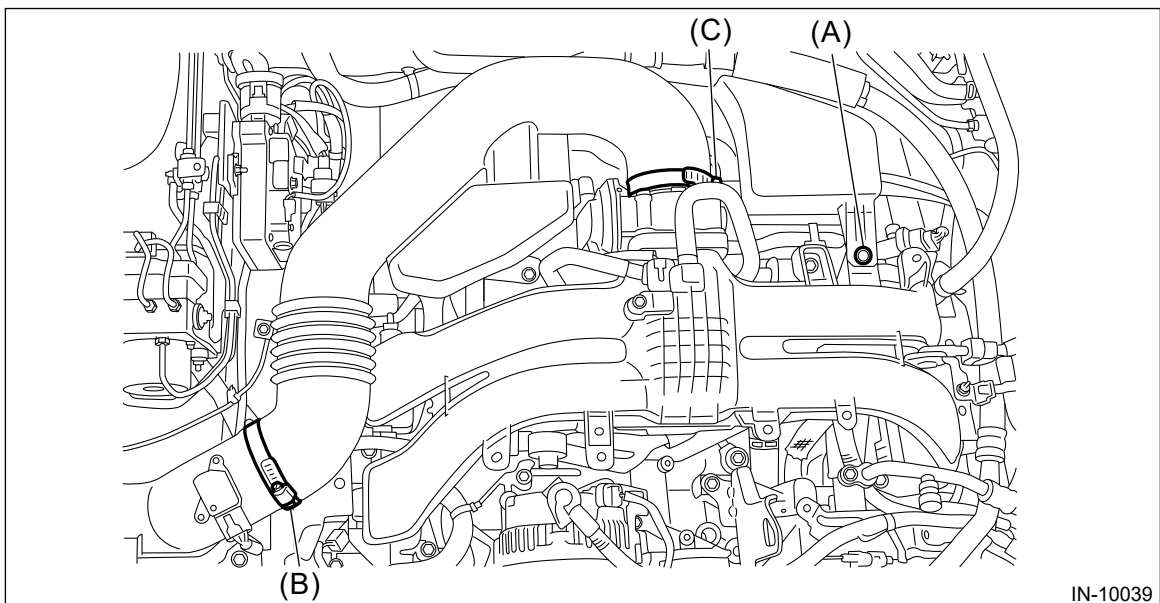
20 N•m (2.0 kgf-m, 14.8 ft-lb)



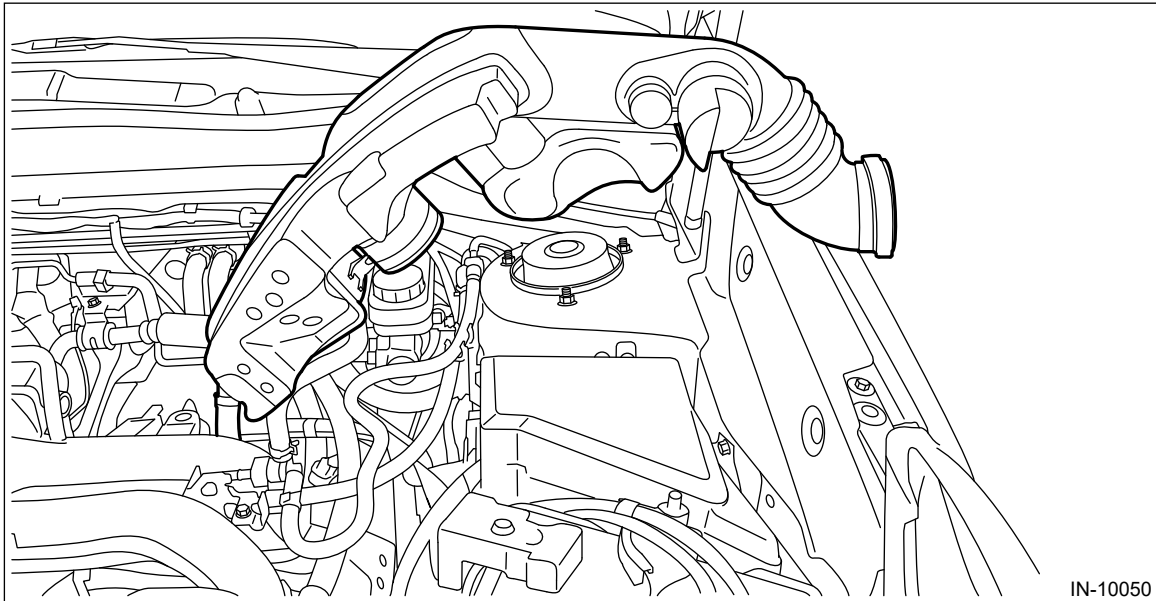
5. Remove the V-belt covers.





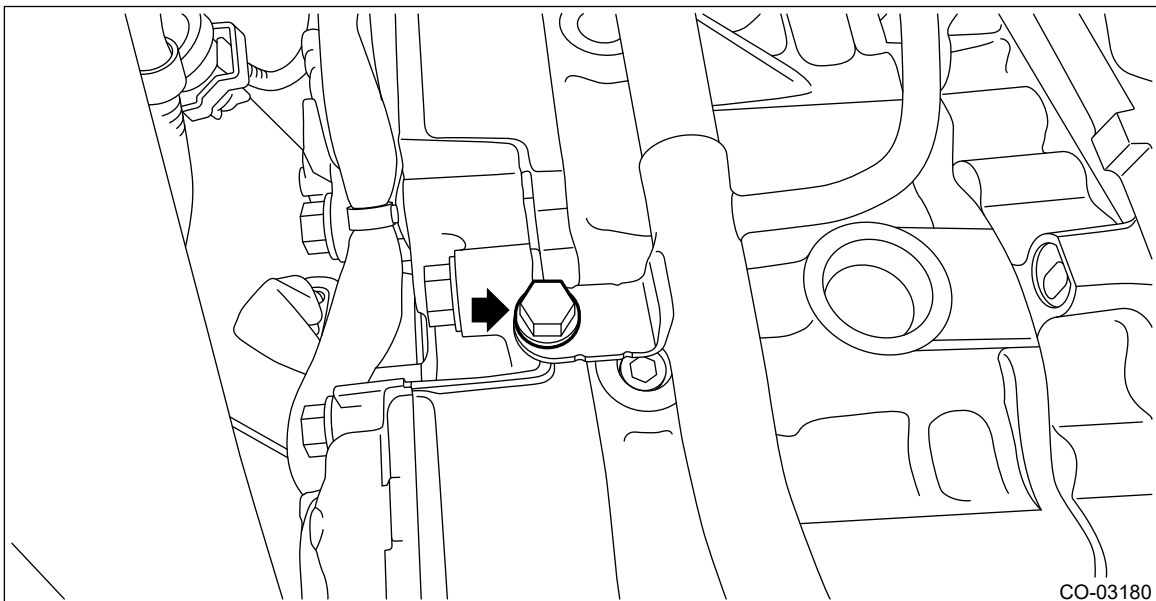
- 6.** Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 7.** Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
- 8.** Remove the clip (A) from the air intake boot.
- 9.** Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
- 10.** Loosen the clamp (C) which secures the throttle body to the air intake boot.



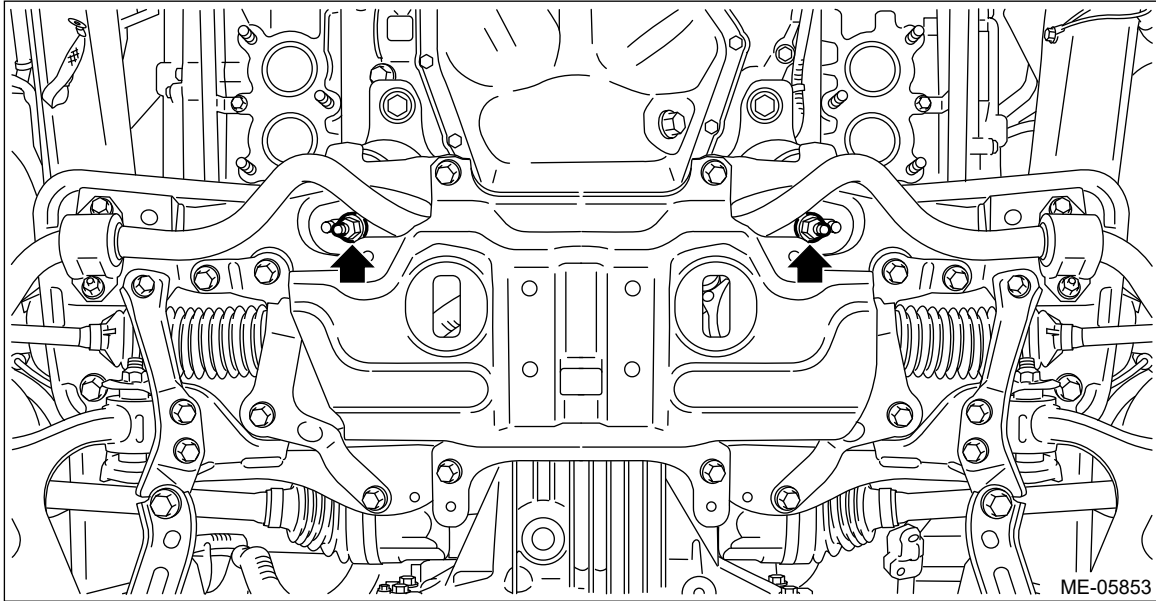
- 11.** Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.



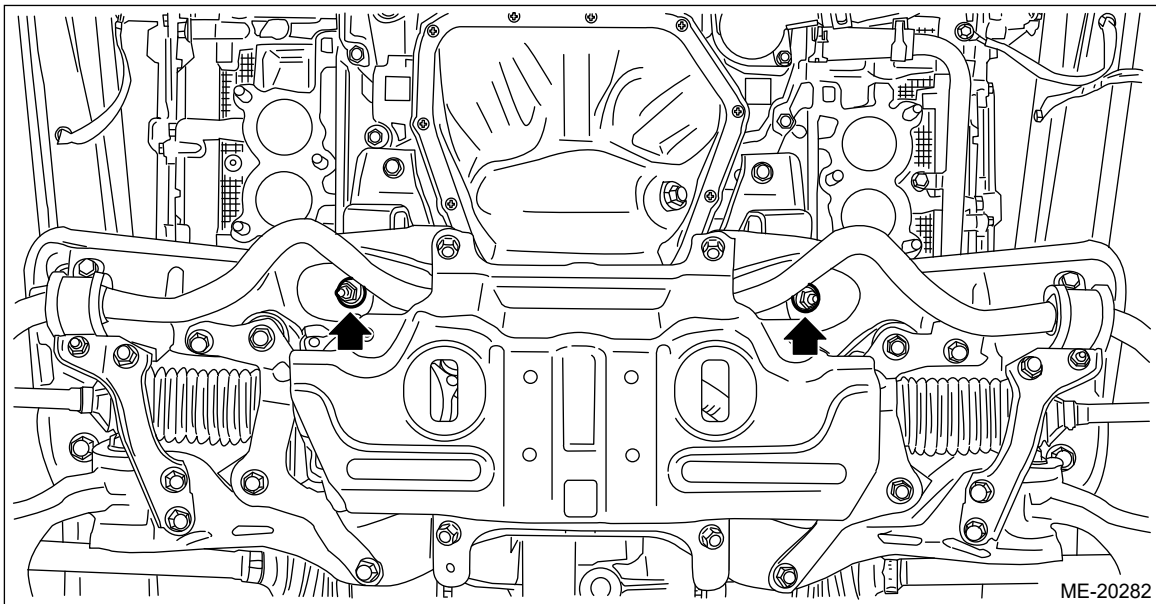
- 12.** Drain engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
- 13.** Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)
- 14.** Remove the bolt which holds the water pipe assembly LH to the cylinder head LH.



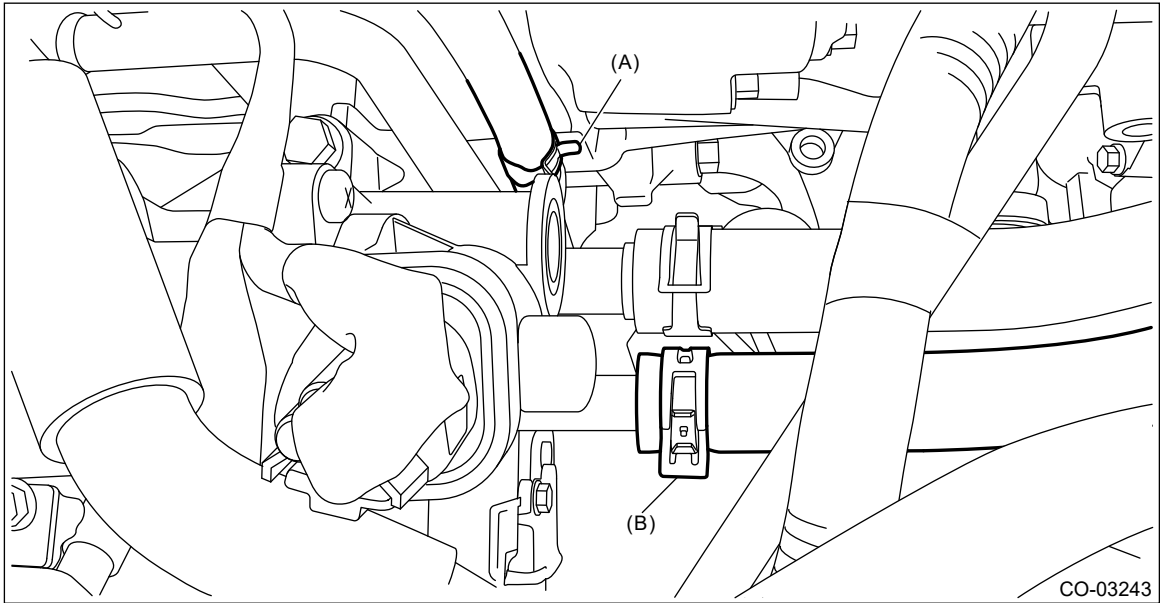
- 15.** Remove the nuts which secure the engine mounting to the front crossmember. (Hydraulic engine mounting model)



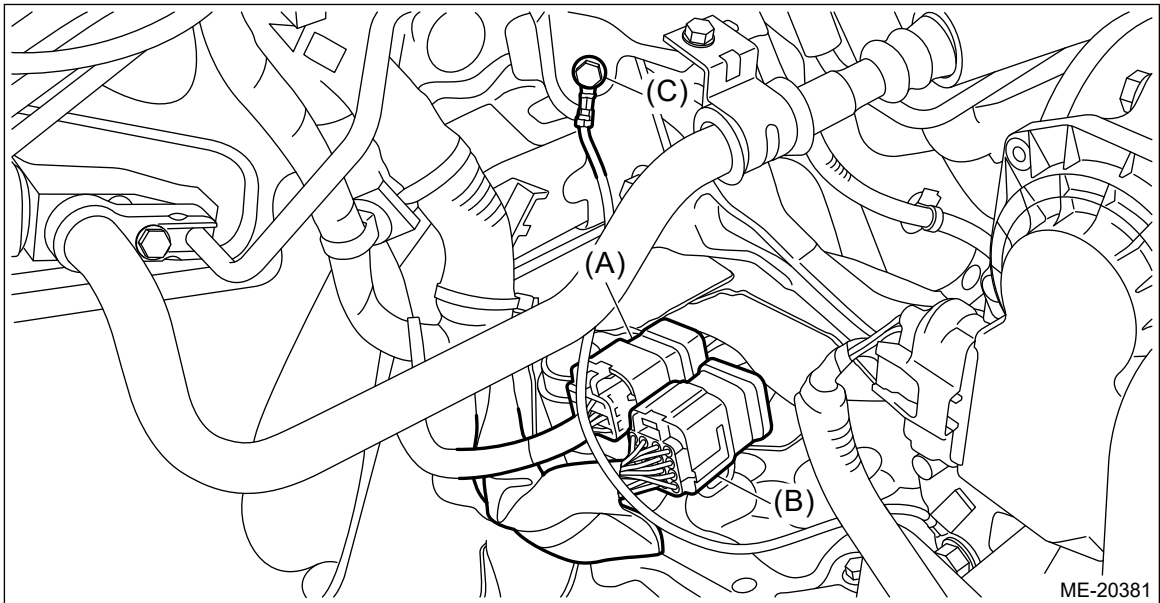
- 16.** Remove the nuts which secure the engine mounting to the front crossmember. (Solid engine mounting model)



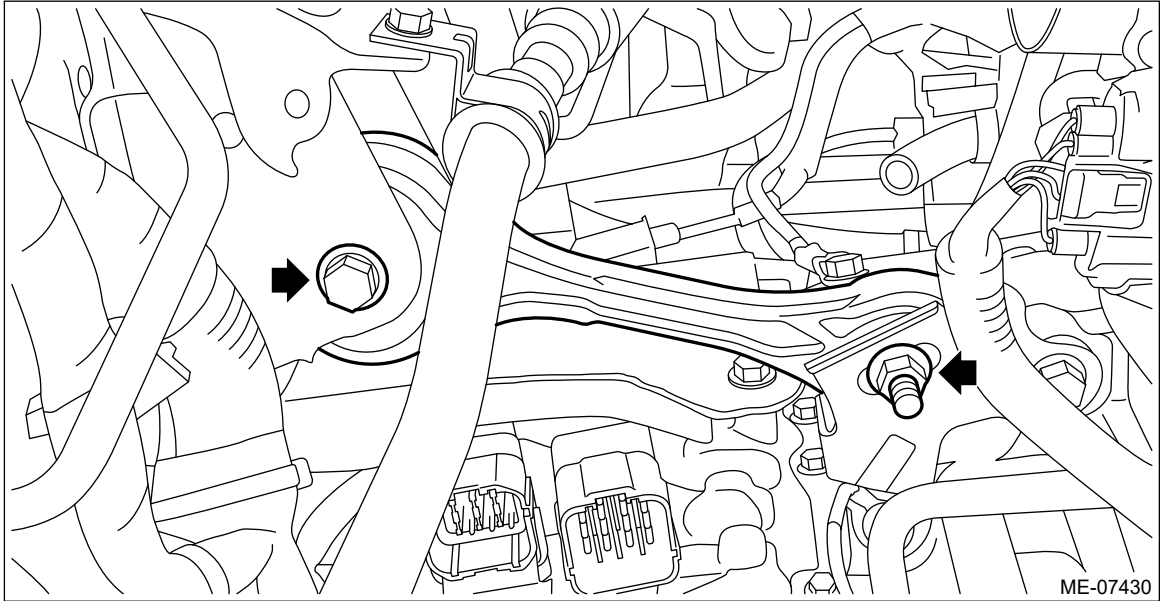
- 17.** Lower the vehicle.
- 18.** Disconnect the preheater hose (A) and the heater outlet hose (B) from the water pipe assembly LH.



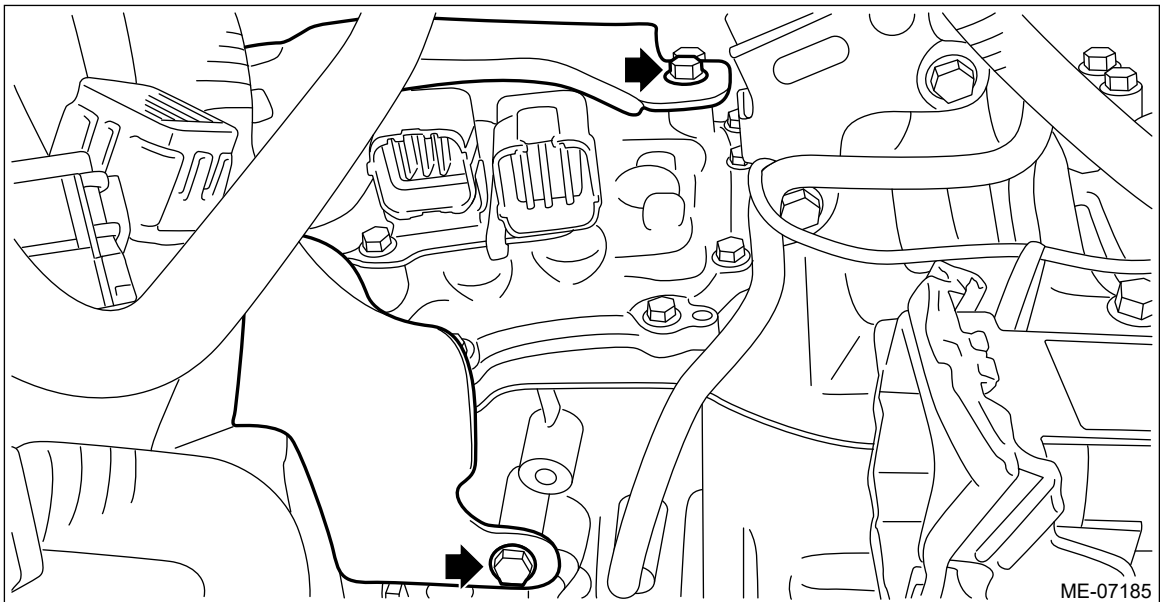
- 19.** Disconnect the bulkhead harness connector from the transmission harness connector (A) and the inhibitor harness connector (B), and disconnect the transmission radio ground terminal (C) from the vehicle body. (CVT model)



- 20.** Remove the pitching stopper.



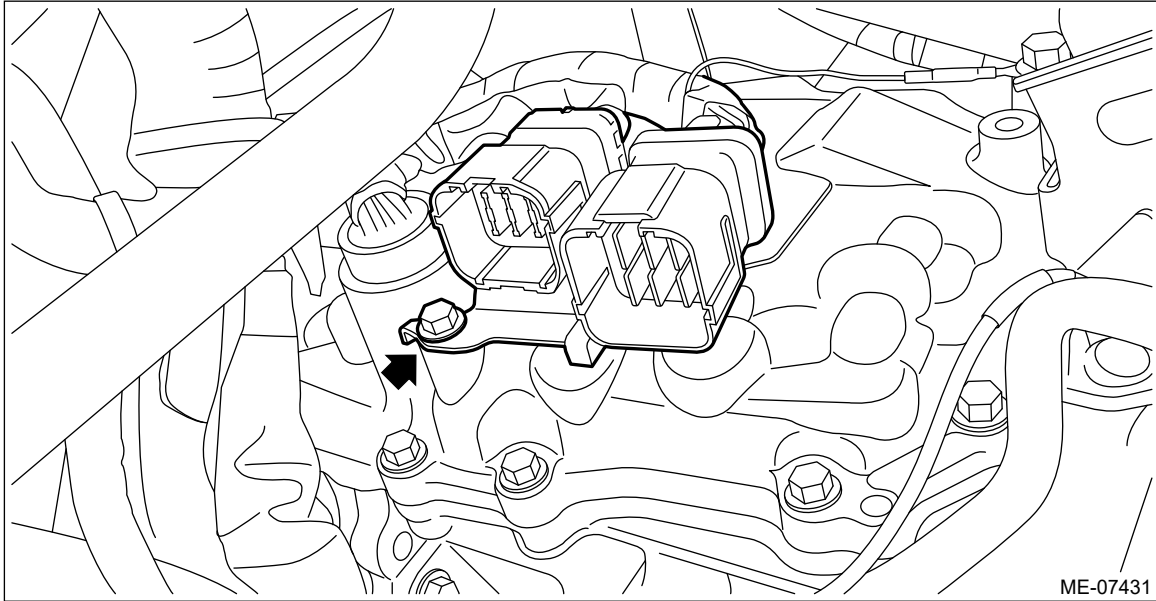
21. Remove the transmission case cover. (CVT model)



22. Remove the transmission harness stay and move to the engine side. (CVT model)

Note:

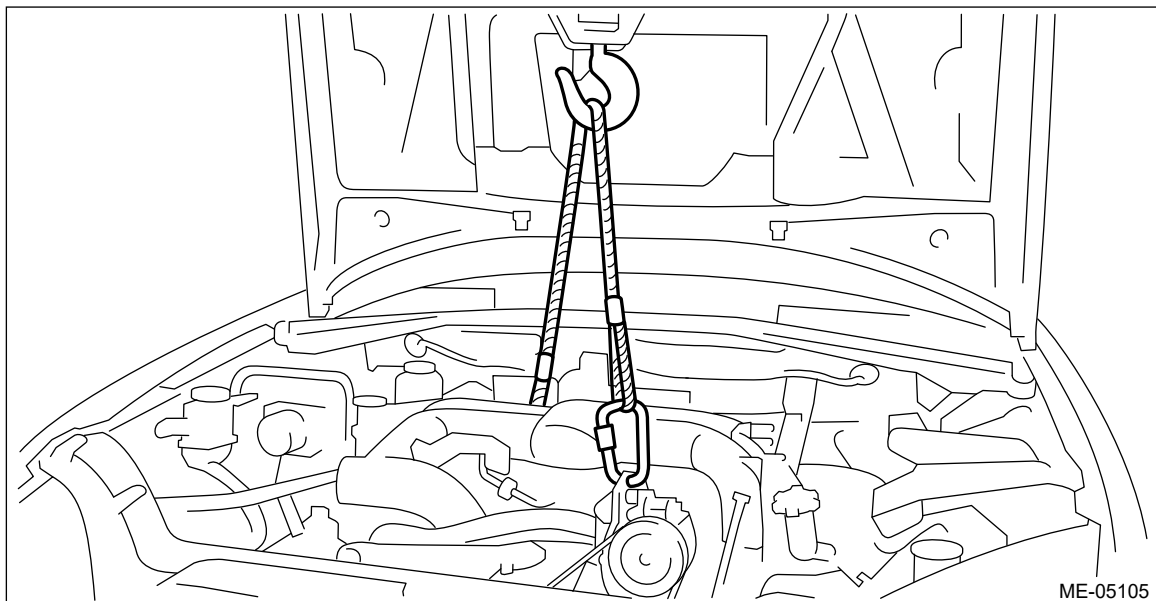
This procedure is required to prevent the transmission connector from touching the A/C pressure hose during engine lift-up.



23. Lift up the engine with a lifting device and wire ropes.

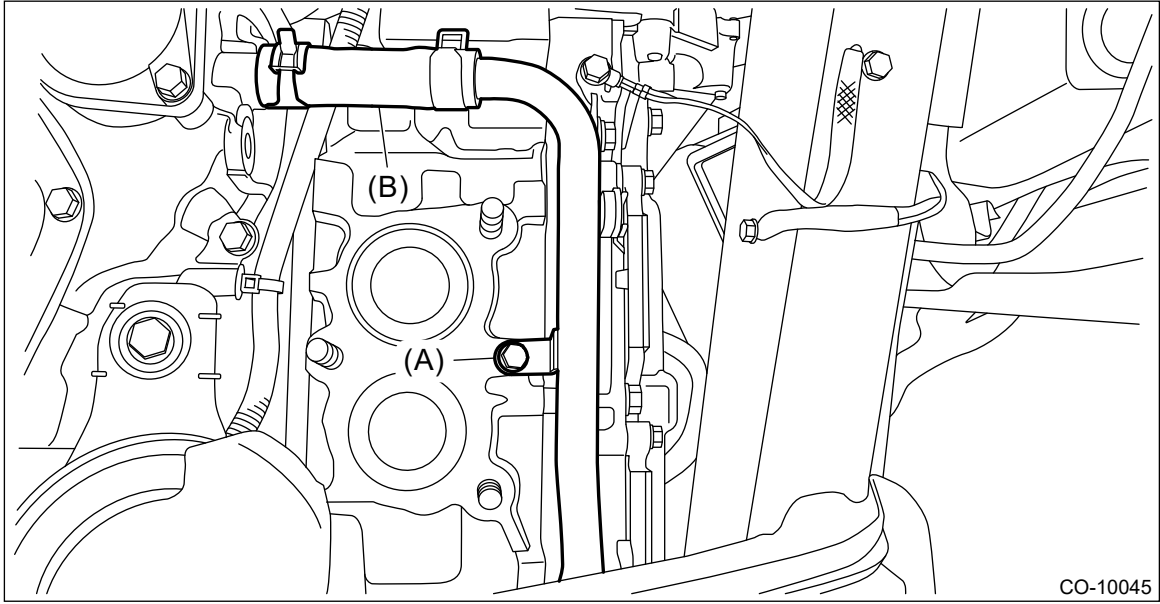
Caution:

When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.



24. Remove the bolt (A) which secures the water pipe assembly LH to the cylinder head LH.

25. Disconnect the water pipe hose LH (B) from oil pan upper, and remove the water pipe assembly LH.



CO-10045

COOLING(H4DO) > Water Pump

INSPECTION

- 1.** Check the water pump bearing for smooth rotation.
- 2.** Check the water pump pulley for abnormalities.
- 3.** Make sure the impeller is not abnormally deformed or damaged.

COOLING(H4DO) > Water Pump

INSTALLATION

1. WATER PUMP PULLEY

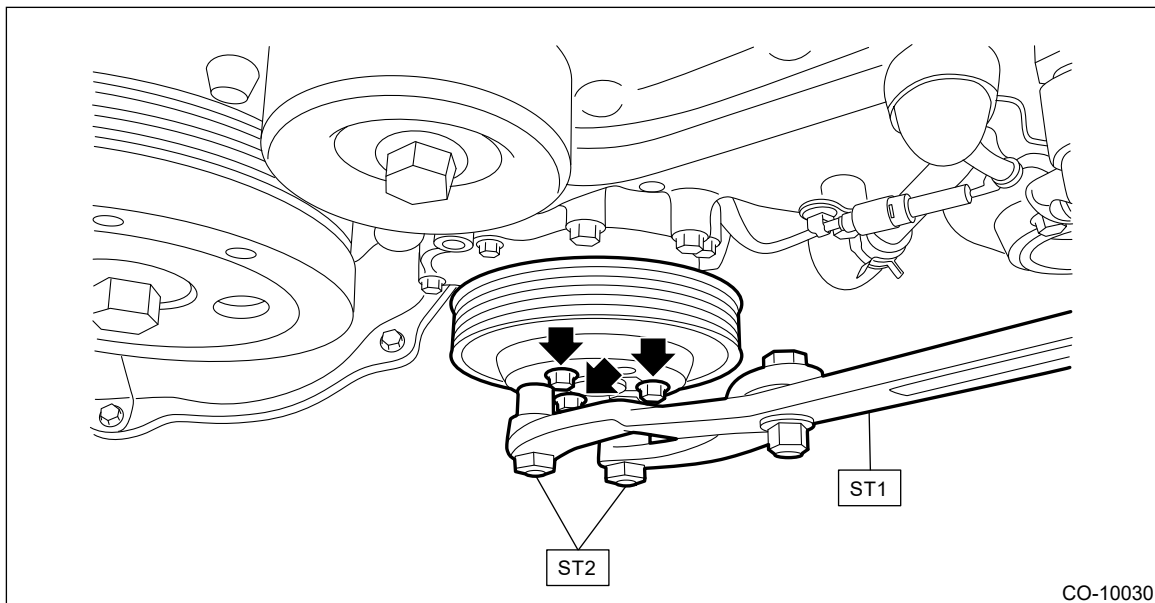
1. Using the ST, install the water pump pulley.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA030 PULLEY WRENCH PIN SET

Tightening torque:

14 N•m (1.4 kgf-m, 10.3 ft-lb)



2. Install the V-belts. [🔗 Ref. to MECHANICAL\(H4DO\)>V-belt>INSTALLATION.](#)

2. WATER PUMP

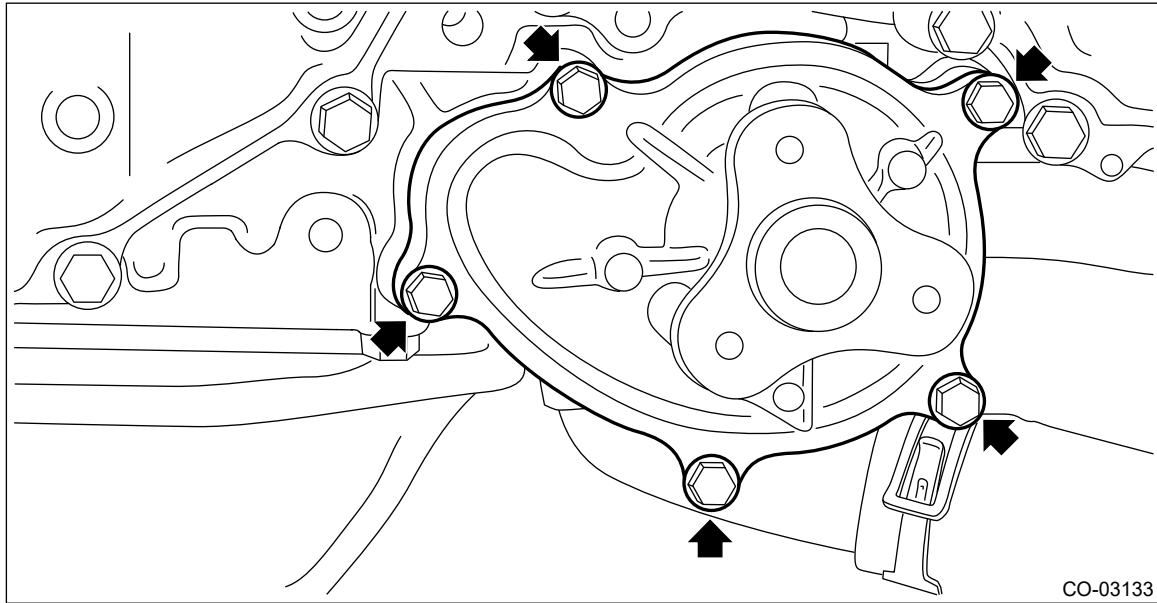
1. Install the water pump to oil pan upper.





Note:

Use a new gasket.

Tightening torque:

6.4 N•m (0.7 kgf-m, 4.7 ft-lb)




2. Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>INSTALLATION.](#)
3. Lower the vehicle.
4. Install the water pump pulley.  [Ref. to COOLING\(H4DO\)>Water Pump>INSTALLATION > WATER PUMP PULLEY.](#)
5. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
6. Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

COOLING(H4DO) > Water Pump

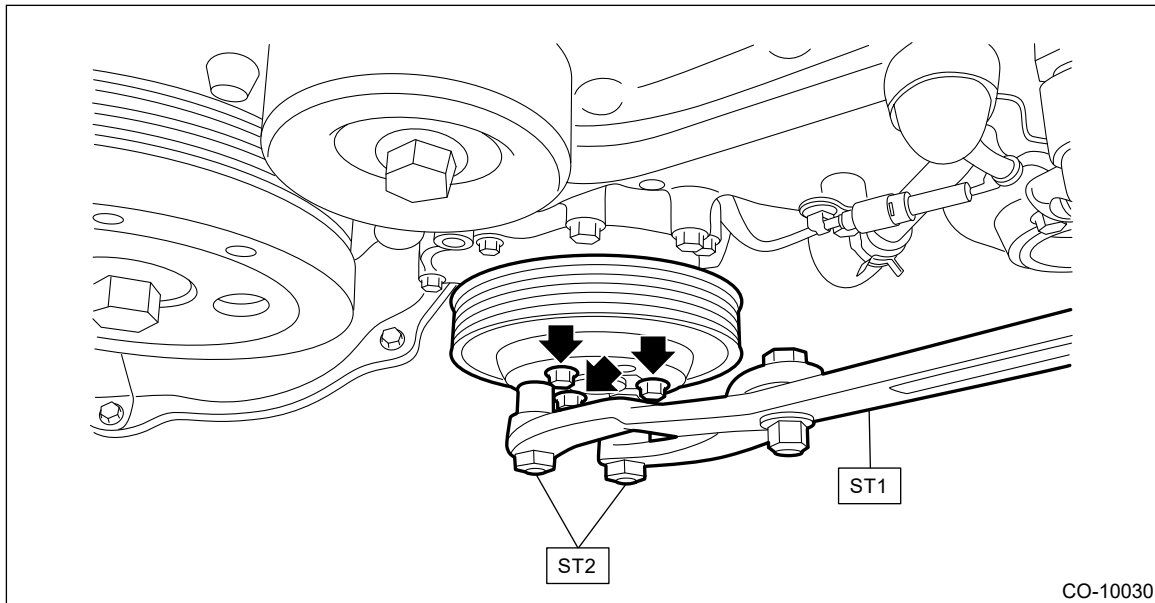
REMOVAL

1. WATER PUMP PULLEY





1. Remove the V-belts.  [Ref. to MECHANICAL\(H4DO\)>V-belt>REMOVAL.](#)
2. Remove the water pump pulley using the ST.

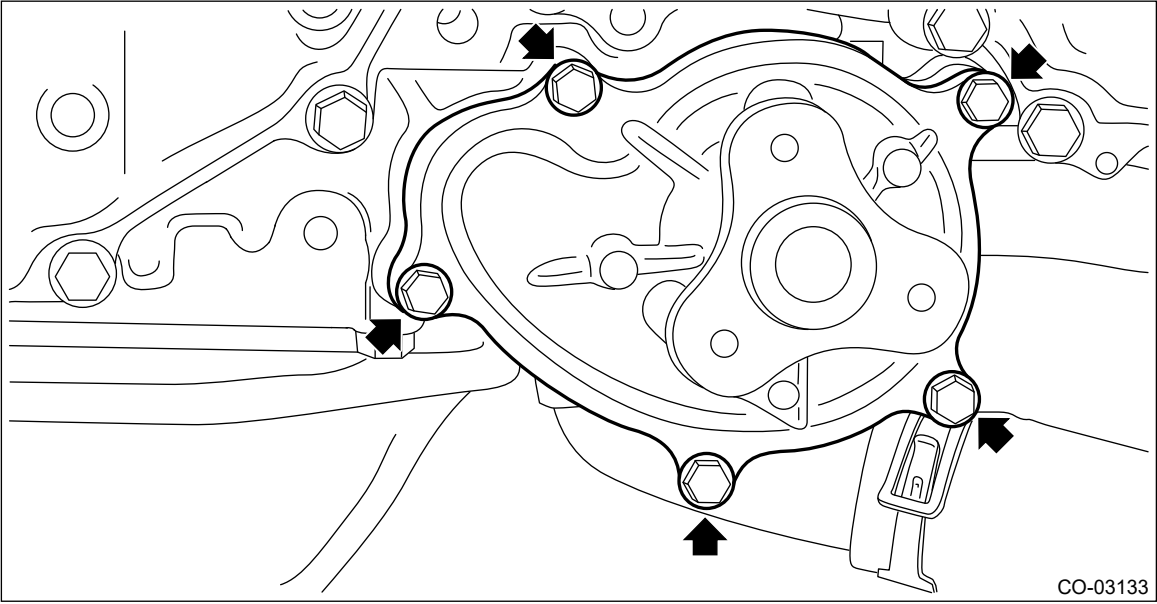
ST1 18355AA000 PULLEY WRENCH

ST2 18334AA030 PULLEY WRENCH PIN SET



2. WATER PUMP

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the water pump pulley.  [Ref. to COOLING\(H4DO\)>Water Pump>REMOVAL > WATER PUMP PULLEY.](#)
3. Drain engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
4. Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)
5. Remove the water pump from the oil pan upper.



CO-03133

ADJUSTMENT

1. PROCEDURE TO ADJUST THE SUBARU SUPER COOLANT CONCENTRATION


Caution:

Use the SUBARU Super Coolant with a 50 – 60% concentration in order to obtain maximum anti-freeze and anti-rust performance.

To adjust the concentration of SUBARU Super Coolant according to temperature, find the proper SUBARU Super Coolant concentration in the table, and add dilution water to the SUBARU Super Coolant (concentrated type) until it reaches the proper dilution.

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

Engine coolant and diluting water:

Refer to "SPECIFICATION" for recommended engine coolant and diluting water.  [Ref. to COOLING\(H4DOTC\)>General Description>SPECIFICATION.](#)

COOLING(H4DOTC) > Engine Coolant

INSPECTION


Note:

When adding the engine coolant, always use SUBARU Super Coolant.

- 1.** Park the vehicle on a level surface.
- 2.** Check the engine coolant amount, and if the coolant level is low, check for the coolant leakage, and then add the engine coolant.
 - (1) Make sure the engine coolant level in the reservoir tank is between "FULL" and "LOW" with the engine in a cold condition.
 - (2) Open the radiator cap and make sure that the radiator is filled with the engine coolant up to its filler neck position.

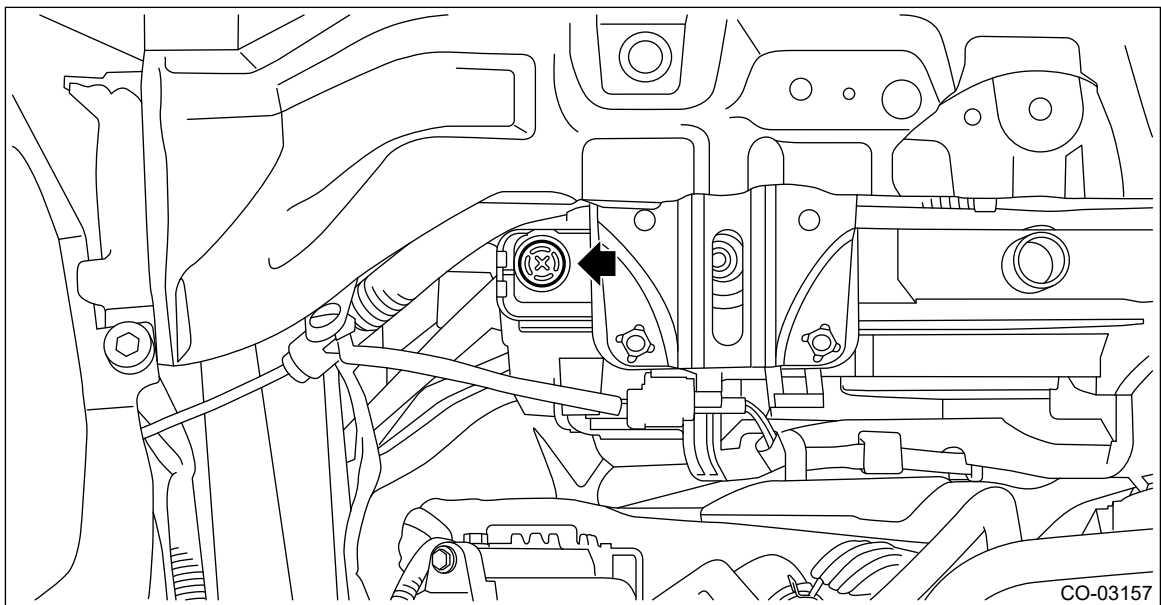
REPLACEMENT

1. DRAINING OF ENGINE COOLANT

1. Lift up the vehicle.
2. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
3. Remove the drain plug to drain engine coolant into container.

Note:

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



4. Install the drain plug.

Note:

Use new O-rings.

5. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)


2. FILLING OF ENGINE COOLANT

Caution:

During work, set the select lever to "P" or "N" range and do not shift the lever.


1. Pour cooling system conditioner through the filler neck.

Cooling system protective agent:


Refer to "SPECIFICATION" for cooling system protective agent.  [Ref. to COOLING\(H4DOTC\)>General Description>SPECIFICATION.](#)

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

Recommended engine coolant:

Refer to "SPECIFICATION" for recommended engine coolant.  [Ref. to COOLING\(H4DOTC\)>General Description>SPECIFICATION.](#)

Engine coolant level:

Refer to "SPECIFICATION" for engine coolant level.  [Ref. to COOLING\(H4DOTC\)>General Description>SPECIFICATION.](#)

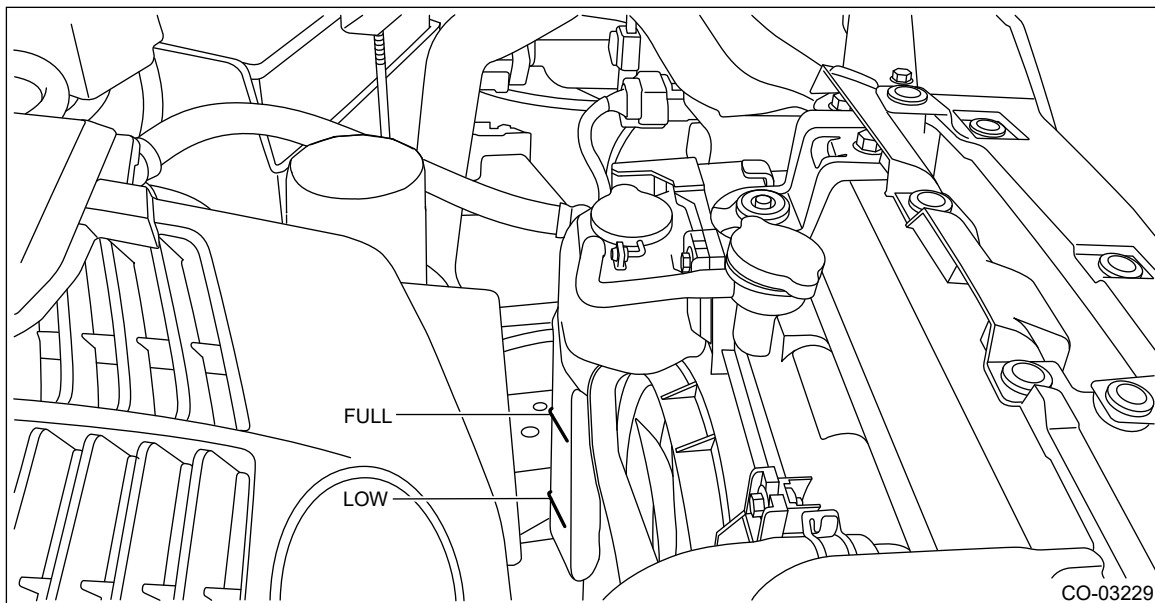
Engine coolant concentration:

Refer to "ADJUSTMENT" for the recommended engine coolant concentration.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>ADJUSTMENT.](#)

Note:

The SUBARU Super Coolant contains anti-freeze and anti-rust agents, and is especially made for Subaru engines with an aluminum cylinder block. Be sure to use SUBARU Super Coolant, since other coolant may cause corrosion.

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



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



Note:

Be careful with the engine coolant temperature to prevent overheating.

10. Stop the engine and wait until the engine coolant temperature lowers to 30°C (86°F) or less.
11. Open the radiator cap. If the engine coolant level drops, add engine coolant into the radiator up to the filler neck position and the reservoir tank to "FULL" level.
12. Attach the radiator cap and reservoir tank cap properly.
13. Set the heater setting to maximum hot position and the blower speed setting to "LO" and start the engine. Perform racing at 3,000 r/min or less. If the flowing sound is heard from the heater core, repeat the procedures from step 9).

COOLING(H4DOTC) > Engine Cooling System Trouble in General

INSPECTION

| [Trouble] | Possible cause | Corrective action |
|----------------------|--|---|
| Over-heating | a. Insufficient engine coolant | Replenish engine coolant, inspect for leakage, and repair it if necessary. |
| | b. Defective thermostat | Replace. |
| | c. Malfunction of water pump | Replace. |
| | d. Clogged engine coolant passage | Clean. |
| | e. Improper ignition timing | Inspect and repair ignition control system.  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. |
| | f. Clogged or leaking radiator | Clean, repair or replace. |
| | g. Defective radiator cap | Replace. |
| | h. Improper engine oil in engine coolant | Replace the engine coolant. If ineffective, check, repair or replace engine components. |
| | i. Air/fuel mixture ratio too lean | Inspect and repair the fuel injection system.  Ref. to ENGINE (DIAGNOSTICS)(H4DOTC)>Basic Diagnostic Procedure. |
| | j. Excessive back pressure in exhaust system | Clean or replace. |
| | k. Insufficient clearance between piston and cylinder | Adjust or replace. |
| | l. Dragging brake | Adjust. |
| | m. Defective radiator fan | Inspect the radiator fan relay, engine coolant temperature sensor or fan motor and replace them. |
| Over-cooling | a. Ambient temperature extremely low | Partly cover radiator front area. |
| | b. Defective thermostat | Replace. |
| Engine coolant leaks | a. Loosened or damaged connecting units on hoses | Repair or replace. |
| | b. Leakage from water pump | Replace. |
| | c. Leakage from water pipe | Repair or replace. |
| | d. Leakage around cylinder head gasket | Retighten cylinder head bolts or replace cylinder head gasket. |
| | e. Damaged or cracked cylinder head and cylinder block | Repair or replace. |
| | f. Damaged or cracked thermostat cover | Repair or replace. |
| | g. Leakage from radiator | Repair or replace. |
| Noise | a. Defective radiator fan | Replace. |

| | |
|---|---------------------|
| b. Defective water pump bearing | Replace water pump. |
| c. Defective water pump mechanical seal | Replace water pump. |

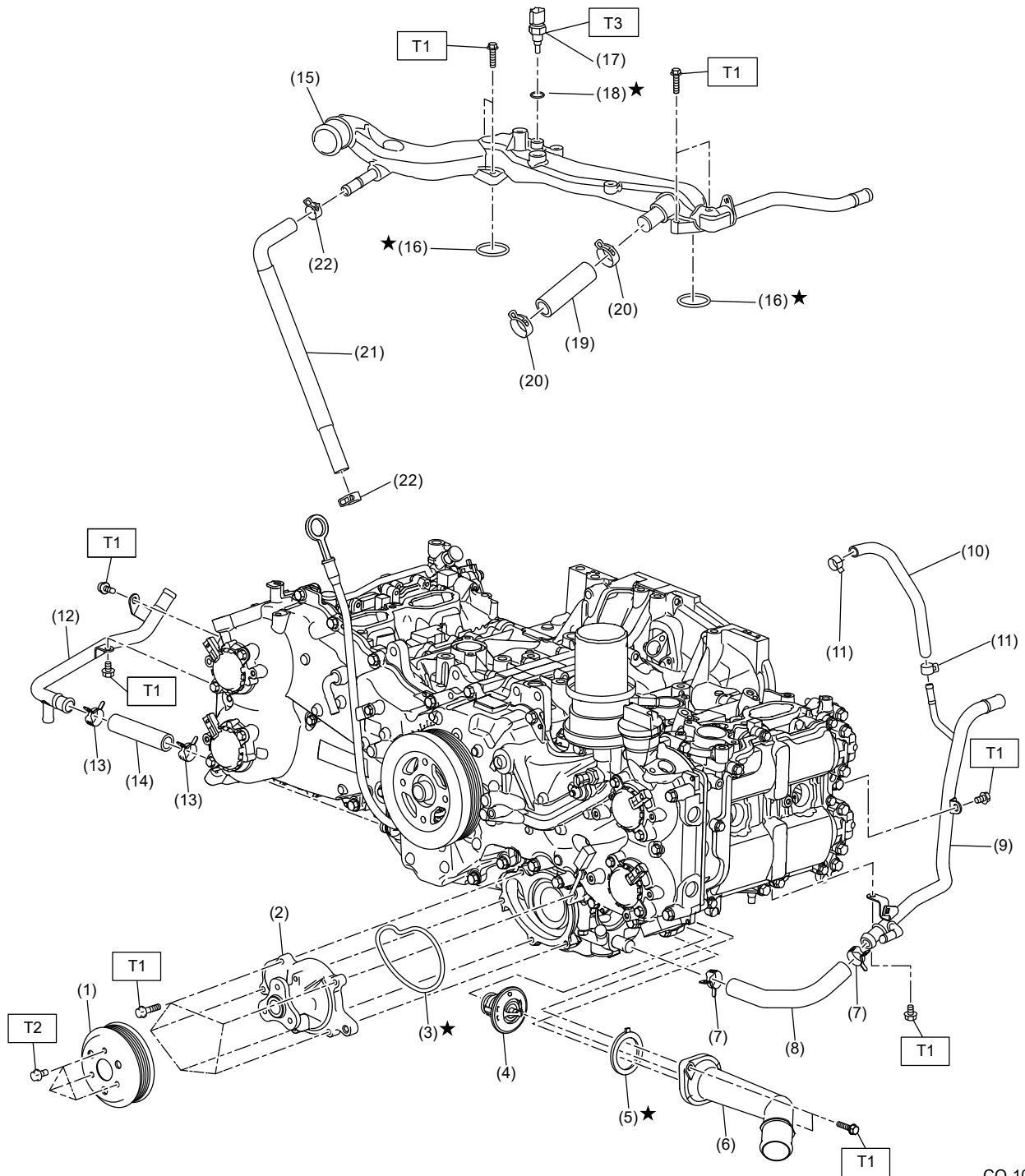
COOLING(H4DOTC) > General Description

CAUTION

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

COMPONENT

1. WATER PUMP



CO-10024

- | | | |
|-----------------------|---------------------|--------------------------|
| (1) Water pump pulley | (10) Preheater hose | (19) Preheater hose |
| (2) Water pump ASSY | (11) Clip | (20) Clip |
| (3) Gasket | (12) Water pipe RH | (21) Engine coolant hose |

- (4) Thermostat
- (5) Gasket
- (6) Thermostat cover
- (7) Clip
- (8) Water pipe hose LH
- (9) Water pipe LH

- (13) Clip
- (14) Water pipe hose RH
- (15) Water pipe ASSY
- (16) O-ring
- (17) Engine coolant temperature sensor
- (18) Gasket

- (22) Clip

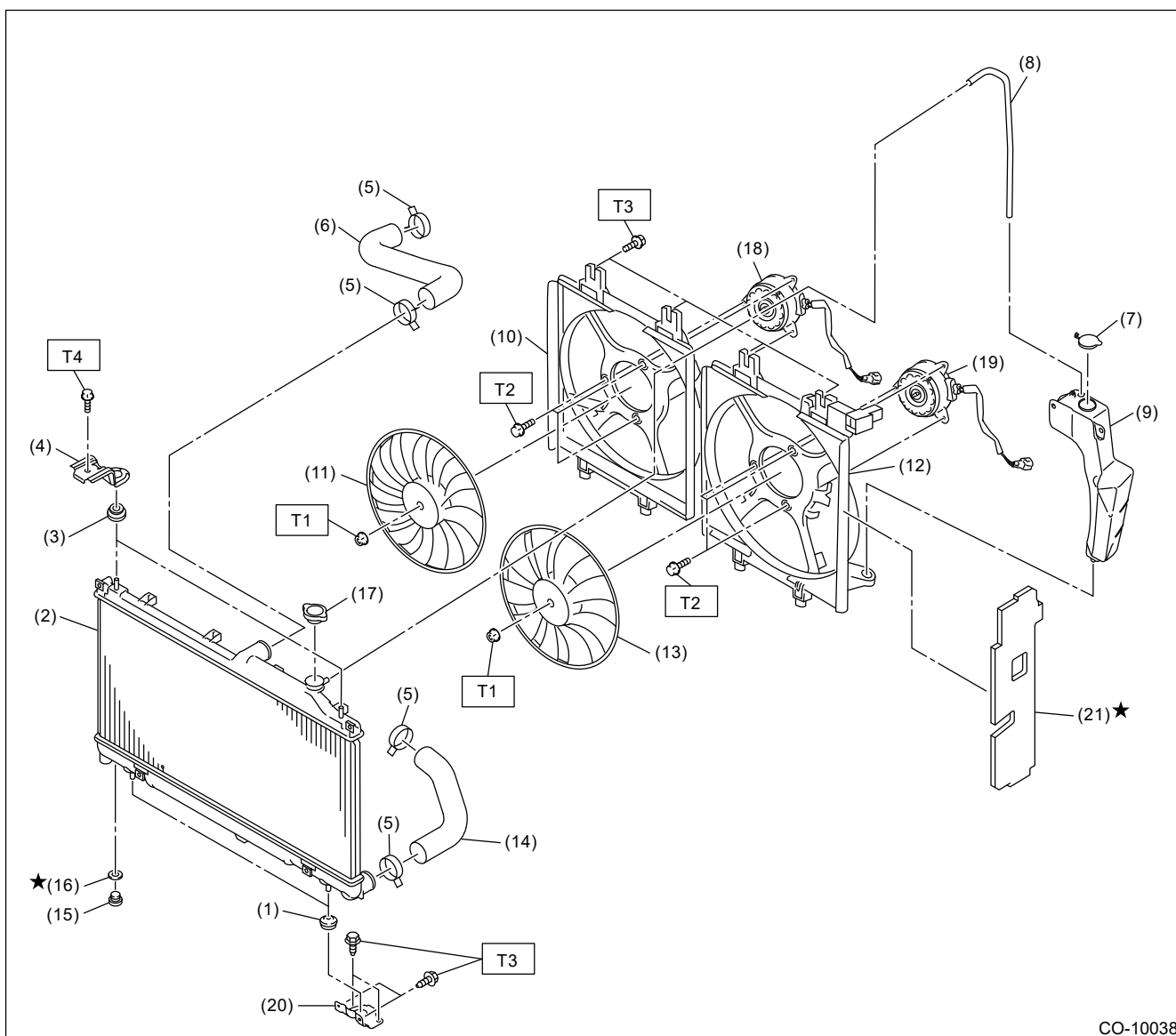
Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.7, 4.7)

T2: 14 (1.4, 10.3)

T3: 18 (1.8, 13.3)

2. RADIATOR & RADIATOR FAN



CO-10038

- (1) Radiator lower cushion
- (2) Radiator
- (3) Radiator upper cushion
- (4) Radiator upper bracket
- (5) Clip

- (10) Radiator sub fan shroud
- (11) Radiator sub fan
- (12) Radiator main fan shroud
- (13) Radiator main fan
- (14) Radiator outlet hose

- (19) Main fan motor
- (20) Radiator lower bracket
- (21) Radiator side gasket

Tightening torque: N·m (kgf-m, ft-lb)

- | | |
|---------------------------------------|--------------------------|
| (6) Radiator inlet hose | (15) Radiator drain plug |
| (7) Engine coolant reservoir tank cap | (16) O-ring |
| (8) Over flow hose | (17) Radiator cap |
| (9) Engine coolant reservoir tank | (18) Sub fan motor |

ft-lb)

T1: 3.4 (0.3, 2.5)

T2: 4.41 (0.45, 3.25)

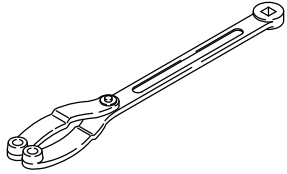
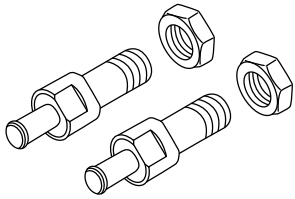
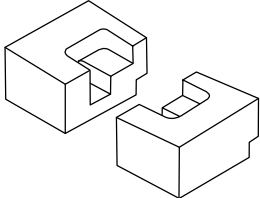
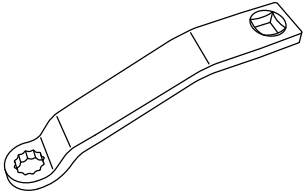
T3: 7.5 (0.8, 5.5)

T4: 12 (1.2, 8.9)

COOLING(H4DOTC) > General Description

PREPARATION TOOL

1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---------------------------|-------------------------|---|
|  <p>ST18355AA000</p> | 18355AA000 | PULLEY WRENCH | <ul style="list-style-type: none"> • Used for removing and installing water pump pulley. • Used together with PULLEY WRENCH PIN SET (18334AA030). |
|  <p>ST18334AA030</p> | 18334AA030 | PULLEY WRENCH PIN SET | <ul style="list-style-type: none"> • Used for removing and installing water pump pulley. • Used together with PULLEY WRENCH (18355AA000). |
|  <p>ST18632AA020</p> | 18632AA020 | STAND ASSY | Used for removing and installing the water pipe assembly. |
|  <p>ST73099SG000</p> | 73099SG000 | SPECIAL TOOL CONDENSER | Used for installing the radiator. |
| | — (Newly adopted tool) | SUBARU SELECT MONITOR 4 | Used for setting of each function and troubleshooting for electrical system. Note: |



STSSM4

For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".

2. GENERAL TOOL

| TOOL NAME | REMARKS |
|---------------------|---|
| Circuit tester | Used for measuring resistance, voltage and current. |
| Radiator cap tester | Used for checking radiator and radiator cap. |
| DST-i | Used together with Subaru Select Monitor 4. |

COOLING(H4DOTC) > General Description

SPECIFICATION

| | | | | | | |
|-------------------------------|---|---------------------------------|-------------------------|---|--|--|
| Cooling system | | | | Electric fan + Forced engine coolant circulation system | | |
| Total engine coolant capacity | L (US qt, Imp qt) | | | Approx. 9.0 (9.5, 7.9) | | |
| Water pump | Type | | | Centrifugal impeller type | | |
| | Discharge performance | Discharge rate | L (US gal, Imp gal)/min | | 248 (65.5, 54.6) | |
| | | Pump speed — Discharge pressure | | 8,580r/min — 88 kPa (9.2 mAq) | | |
| | | Engine coolant temperature | | 80°C (176°F) | | |
| | Impeller diameter | | mm (in) | | 56 (2.2) | |
| | Number of impeller vanes | | | 7 | | |
| | Pump pulley diameter | | mm (in) | | 100 (3.9) | |
| Thermostat | Type | | | Wax pellet type | | |
| | Starting temperature to open | | | 86 — 90°C (187 — 194°F) | | |
| | Fully opens | | | 95°C (203°F) | | |
| | Valve lift | mm (in) | | 8.0 (0.315) or more | | |
| | Valve opening size | mm (in) | | 32 (1.26) | | |
| Radiator fan | Motor input | Main fan | W | 120 | | |
| | | Sub fan | W | 120 | | |
| | Fan diameter / Blade | Main fan | 320 mm (12.6 in) /9 | | | |
| | | Sub fan | 320 mm (12.6 in) /11 | | | |
| Radiator | Type | | | Down flow, pressure type | | |
| | Core dimensions | Width × Height × Thickness | | mm (in) | 691.3× 340 × 27 (27.06×13.39×0.63) | |
| | Pressure range in which cap valve is open | kPa (kg/cm ² , psi) | Positive pressure side | Standard | 93 — 123 (0.95—1.25, 14 — 18) | |
| | | | Negative pressure side | Limit | 83 (0.85, 12) | |
| | | | | Standard | -1.0—-4.9 or less (-0.01—-0.05, -0.1—-0.7) | |
| Fins | | | Corrugated fin type | | | |
| Reservoir tank | Capacity | | L (US qt, Imp qt) | | 0.45 (0.48, 0.40) | |

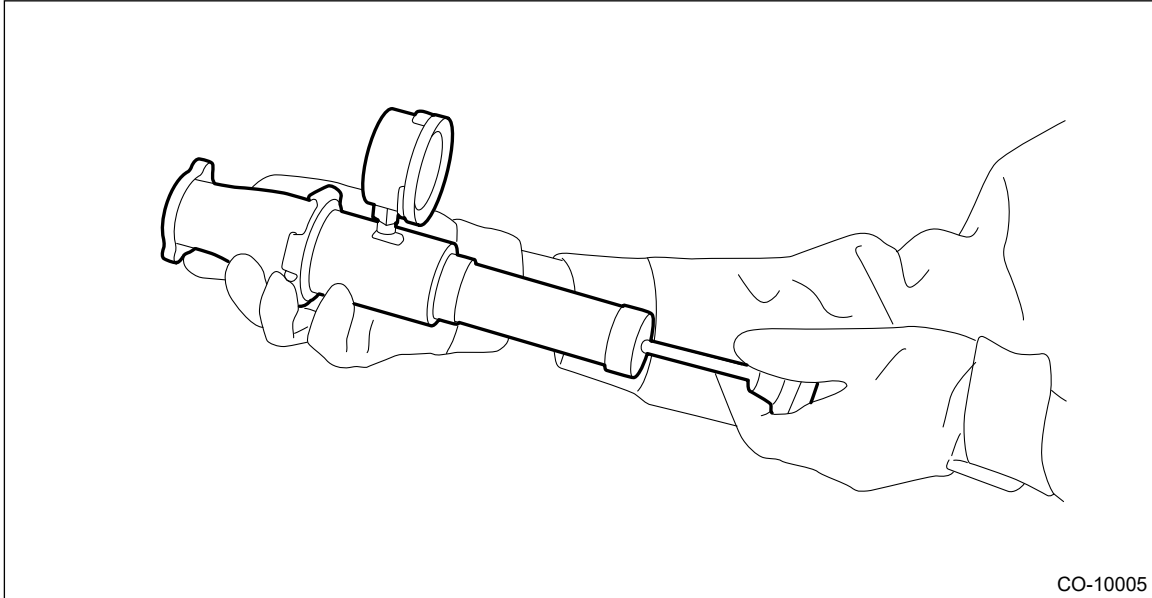
| | | | |
|--|--------------------|--------------------|--------------------|
| | Recommended | Item number | Alternative |
|--|--------------------|--------------------|--------------------|

| | materials | | |
|---------------------------------|--|------------|-------------------------|
| Coolant | SUBARU SUPER COOLANT (concentrated type) | — | — |
| | SUBARU SUPER COOLANT (diluted type) | K0670Y0001 | |
| Water for dilution | Distilled water | — | Soft water or tap water |
| Cooling system protective agent | Cooling system conditioner | SOA345001 | — |

COOLING(H4DOTC) > Radiator Cap

INSPECTION

1. Check that the radiator cap does not have deformation, cracks or damage.
2. Attach the radiator cap tester to radiator cap.



3. Increase pressure until the radiator cap tester gauge needle stops. Radiator cap is functioning properly if it holds the service limit pressure for 5 – 6 seconds. Replace the radiator cap if its valve opens at less than the service limit.

Caution:

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

Standard:

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

Service limit:

83 kPa (0.85 kg/cm², 12 psi)

COOLING(H4DOTC) > Radiator Fan System

INSPECTION

Operating condition:

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

*The fan may run at High-Speed when ambient temperature is high.

Diagnosis:

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

1. CHECK OPERATION OF RADIATOR FAN.


1. Install the delivery mode fuse.
2. Turn the ignition switch to ON.
3. Using the Subaru Select Monitor, perform the active test for the radiator fan relay.

Note:


- When performing the active test for the radiator fan relay using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order.
- For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".

Do the radiator main fans and radiator sub fans rotate at low speed?

Yes

 [Go to 2.](#)

No

 [Go to 3.](#)

2. CHECK OPERATION OF RADIATOR FAN.

Using the Subaru Select Monitor, perform the active test for the radiator fan relay.

Note:

- When performing the active test for the radiator fan relay using the Subaru Select Monitor, the radiator main fan and radiator sub fan will repeat low speed revolution → high speed revolution → OFF in this order.
- For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".

Do the radiator main fans and radiator sub fans rotate at high speed?

Yes

Radiator main fan system is normal.

No

 [Go to 27.](#)

3. CHECK POWER SUPPLY TO SUB FAN RELAY.

1. Turn the ignition switch to OFF.


2. Remove the sub fan relay.
3. Measure the voltage between the sub fan relay terminal and chassis ground.

Connector & terminal


(F27) No. 17 (+) – Chassis ground (–):

Is the voltage 10 V or more?

Yes

 [Go to 4.](#)

No

 [Go to 5.](#)

4. CHECK POWER SUPPLY TO SUB FAN RELAY.

1. Turn the ignition switch to ON.
2. Measure the voltage between the sub fan relay terminal and chassis ground.

Connector & terminal

(F27) No. 20 (+) – Chassis ground (–):

Is the voltage 10 V or more?

Yes

 [Go to 7.](#)

No

 [Go to 6.](#)

5. CHECK FUSE.

1. Remove the fuse No. 3.
2. Check the condition of fuse.

Is the fuse blown out?

Yes

Replace the fuse.

No

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?

Yes

Replace the fuse.

No

Repair the power supply line.


7. CHECK SUB FAN RELAY.




Measure the resistance between sub fan relay switch terminals.

Is the resistance 1 MΩ or more?

Yes

 [Go to 8.](#)

No

Replace the sub fan relay.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)


8. CHECK SUB FAN RELAY.




1. Connect the battery to the terminal on the sub fan relay coil side.
2. Measure the resistance between sub fan relay switch terminals.

Is the resistance less than 1 Ω?

Yes

 [Go to 9.](#)

No

Replace the sub fan relay.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

9. CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.




1. Turn the ignition switch to OFF.
2. Disconnect the connector from the sub fan motor.
3. Measure the resistance of harness between the sub fan relay terminal and sub fan motor connector.

Connector & terminal

(F16) No. 1 — (F27) No. 18:

Is the resistance less than 1 Ω ?

Yes

 [Go to 10.](#)

No

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.
2. Measure the resistance of harness between sub fan motor connector and main fan relay 2 connector.

Connector & terminal

(F16) No. 2 – (F27) No. 12:

Is the resistance less than 1 Ω ?

Yes

 [Go to 11.](#)

No

Repair the open circuit of the harness between sub fan motor connector and main fan relay 2 connector.

11. CHECK FOR POOR CONTACT.


Check poor contact of sub fan motor connector.

Is there poor contact of the sub fan motor connector?

Yes

Repair the poor contact of sub fan motor connector.

No


 [Go to 12.](#)

12. CHECK SUB FAN MOTOR.


Connect the battery positive (+) terminal to terminal No. 1 of the sub fan motor, and the ground (–) terminal to terminal No. 2.

Does the radiator sub fan rotate?

Yes

 [Go to 13.](#)

No


Replace the sub fan motor.  [Ref. to COOLING\(H4DOTC\)>Radiator Sub Fan and Fan Motor.](#)

13. CHECK MAIN FAN RELAY 2.


Measure the resistance between terminals of main fan relay 2 switch (always ON side).

Is the resistance less than 1 Ω ?

Yes

 [Go to 14.](#)

No

Replace the main fan relay 2.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

14. CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND MAIN FAN MOTOR CONNECTOR.


1. Disconnect the connector from the main fan motor.
2. Measure the resistance of the harness between main fan relay 2 terminal and main fan motor connector.

Connector & terminal

(F17) No. 1 – (F27) No. 14:

Is the resistance less than 1 Ω ?

Yes

 [Go to 15.](#)

No

Repair the open circuit of the harness between main fan relay 2 terminal and main fan motor connector.

15. CHECK GROUND CIRCUIT OF MAIN FAN MOTOR.


Measure the resistance between main fan motor connector and chassis ground.

Connector & terminal

(F17) No. 2 – Chassis ground:

Is the resistance less than 5 Ω ?

Yes

 [Go to 16.](#)

No

Repair the open circuit of the harness between main fan motor connector and chassis ground.

16. CHECK FOR POOR CONTACT.




Check poor contact of main fan motor connector.

Is there poor contact of the main fan motor connector?

Yes

Repair the poor contact of main fan motor connector.

No

 [Go to 17.](#)


17. CHECK MAIN FAN MOTOR.




Connect the battery positive (+) terminal to terminal No. 1 of the main fan motor, and the ground (-) terminal to terminal No. 2.

Does the radiator main fan rotate?

Yes

 [Go to 18.](#)

No

Replace the main fan motor.  [Ref. to COOLING\(H4DOTC\)>Radiator Main Fan and Fan Motor.](#)

18. CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.




1. Disconnect the connector from ECM.
2. Measure the resistance between the sub fan relay terminal and ECM connector.

Connector & terminal

(B134) No. 25 — (F27) No. 19:

Is the resistance less than 1 Ω ?

Yes

 [Go to 19.](#)

No

Repair the open circuit of harness between sub fan relay terminal and ECM.

19. CHECK FOR POOR CONTACT.

Check for poor contact of ECM connector.

Is there poor contact of ECM connector?

Yes

Repair the poor contact of ECM connector.

No

Check the DTC. Repair the trouble cause. [🔗 Ref. to ENGINE \(DIAGNOSTICS\) \(H4DOTC\)>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.
3. Measure the resistance between terminals of main fan relay 1 switch.

Is the resistance 1 MΩ or more?

Yes

[🔗 Go to 21.](#)

No

Replace the main fan relay 1. [🔗 Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

21. CHECK MAIN FAN RELAY 1.

1. Connect the main fan relay 1 coil side terminal to the battery.
2. Measure the resistance between terminals of main fan relay 1 switch.

Is the resistance less than 1 Ω?

Yes

[🔗 Go to 22.](#)

No

Replace the main fan relay 1. [🔗 Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

22. CHECK HARNESS BETWEEN MAIN FAN RELAY 1 AND MAIN FAN MOTOR CONNECTOR.

1. Disconnect the connector from the main fan motor.


2. Measure the resistance of the harness between main fan relay 1 terminal and main fan motor connector.

Connector & terminal

(F17) No. 1 — (F36) No. 6:

Is the resistance less than 1 Ω ?

Yes

 [Go to 23.](#)

No

Repair the open circuit of the harness between main fan relay 1 terminal and main fan motor connector.

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

(B134) No. 37 — (B143) No. 7:

Is the resistance less than 1 Ω ?

Yes

 [Go to 24.](#)

No

Repair the open circuit of the harness between main fan relay 1 terminal and ECM.

24. CHECK HARNESS BETWEEN MAIN FAN RELAY 2 AND ECM.


Measure the resistance between main fan relay 2 terminal and ECM connector.

Connector & terminal

(B134) No. 37 — (F27) No. 15:

Is the resistance less than 1 Ω ?

Yes

 [Go to 25.](#)

No

Repair the open circuit of the harness between main fan relay 2 terminal and ECM.

25. CHECK FUSE.


1. Remove the fuses No. 2 and No. 19.
2. Check the condition of fuse.

Is the fuse blown out?

Yes

Replace the fuse.

No

 [Go to 26.](#)

26. CHECK FOR POOR CONTACT.



Check for poor contact of ECM connector.

Is there poor contact of ECM connector?

Yes

Repair the poor contact of ECM connector.

No

Repair the power supply circuit to the main fuse box.


27. CHECK OPERATION OF RADIATOR FAN.




If the both fans do not rotate at high speed in the condition of step 2, check whether the radiator sub fan is rotating.

Does the radiator sub fan rotate?

Yes

 [Go to 20.](#)

No

 [Go to 28.](#)

28. CHECK GROUND CIRCUIT OF MAIN FAN RELAY 2.



1. Turn the ignition switch to OFF.
2. Remove the main fan relay 2.
3. Measure the resistance between main fan relay 2 terminal and chassis ground.


Connector & terminal

(F27) No. 13 — Chassis ground:

Is the resistance less than 1 Ω ?



Yes

 [Go to 29.](#)

No

Repair the open circuit of harness between main fan relay 2 and chassis ground.

29. CHECK POWER SUPPLY TO MAIN FAN RELAY 2.


1. Turn the ignition switch to ON.
2. Measure the voltage between main fan relay 2 terminal and chassis ground.

Connector & terminal

(F27) No. 16 (+) — Chassis ground (-):

Is the voltage 10 V or more?

Yes

 [Go to 30.](#)

No

Repair the power supply line.

30. CHECK MAIN FAN RELAY 2.

Measure the resistance between terminals of main fan relay 2 switch.

Is the resistance 1 M Ω or more?

Yes

 [Go to 31.](#)

No


Replace the main fan relay 2.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)

31. CHECK MAIN FAN RELAY 2.

1. Connect the main fan relay 2 coil side terminal to the battery.
2. Measure the resistance between terminals of main fan relay 2 switch (always OFF side).

Is the resistance less than 1 Ω ?

Yes

 [Go to 23.](#)

No

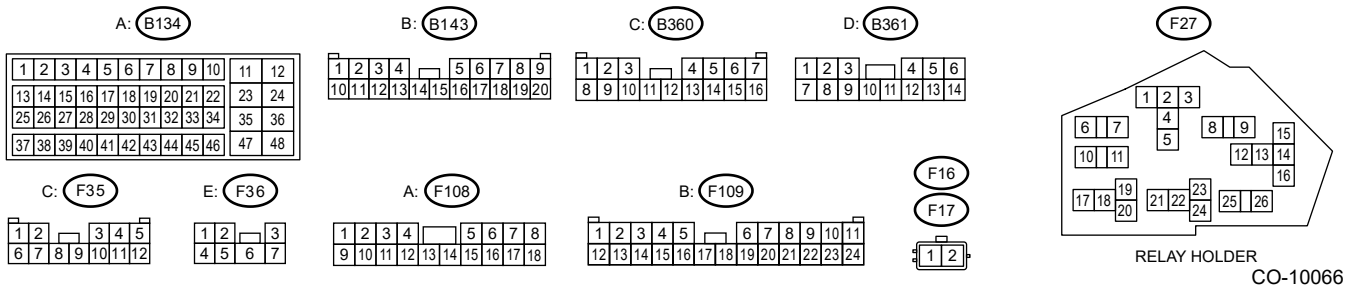
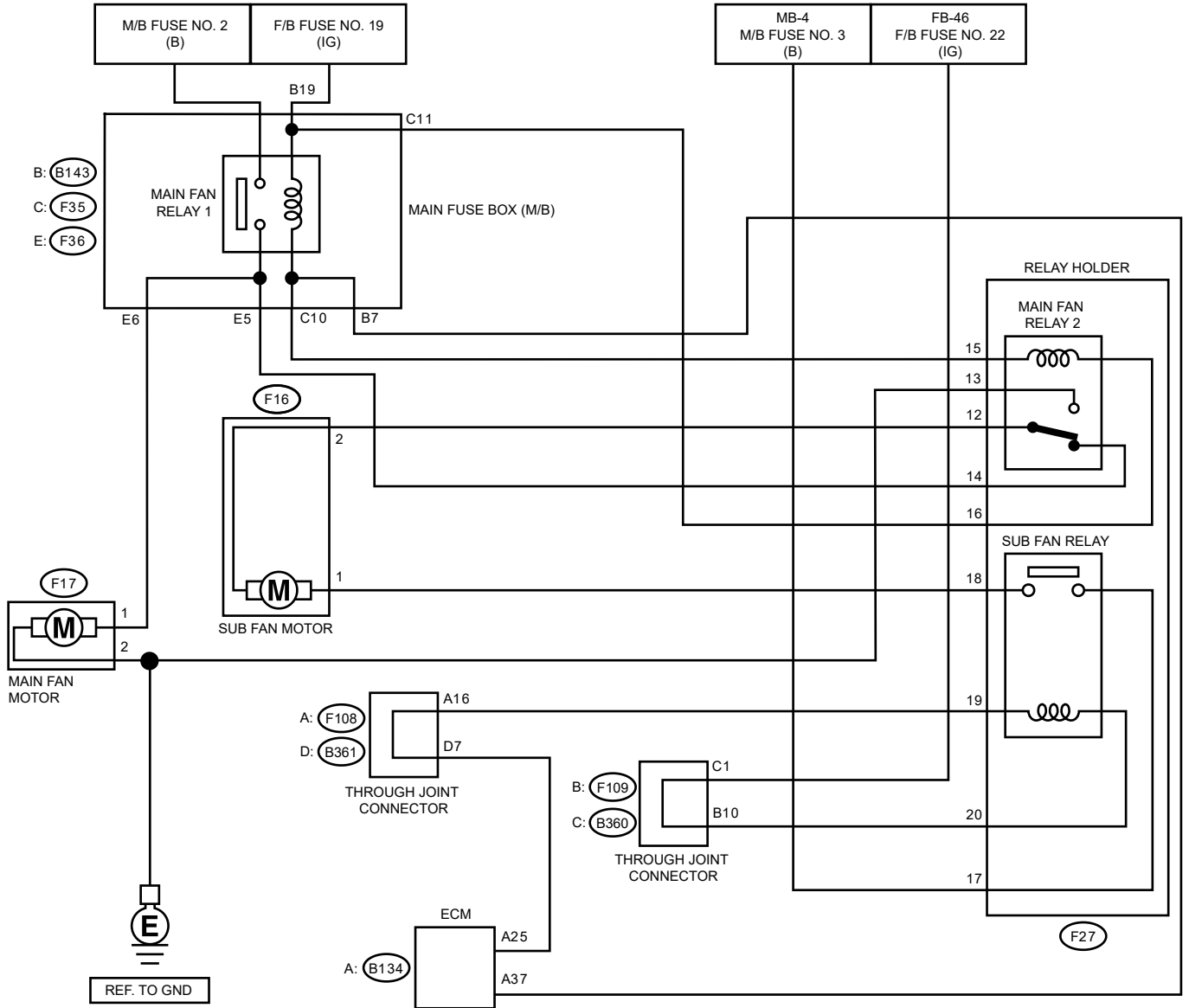
Replace the main fan relay 2.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Relay and Fuse.](#)



COOLING(H4DOTC) > Radiator Fan System

WIRING DIAGRAM

Radiator fan system  Ref. to WIRING SYSTEM>Radiator Fan System>WIRING DIAGRAM.



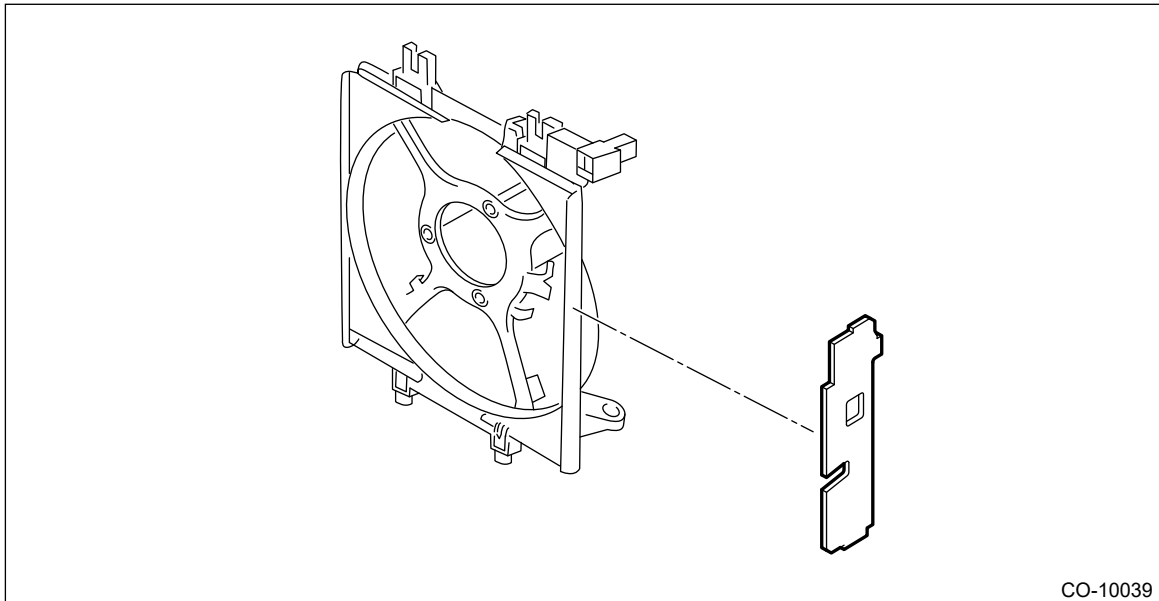
COOLING(H4DOTC) > Radiator Main Fan and Fan Motor

ASSEMBLY

Assemble in the reverse order of disassembly.

Note:

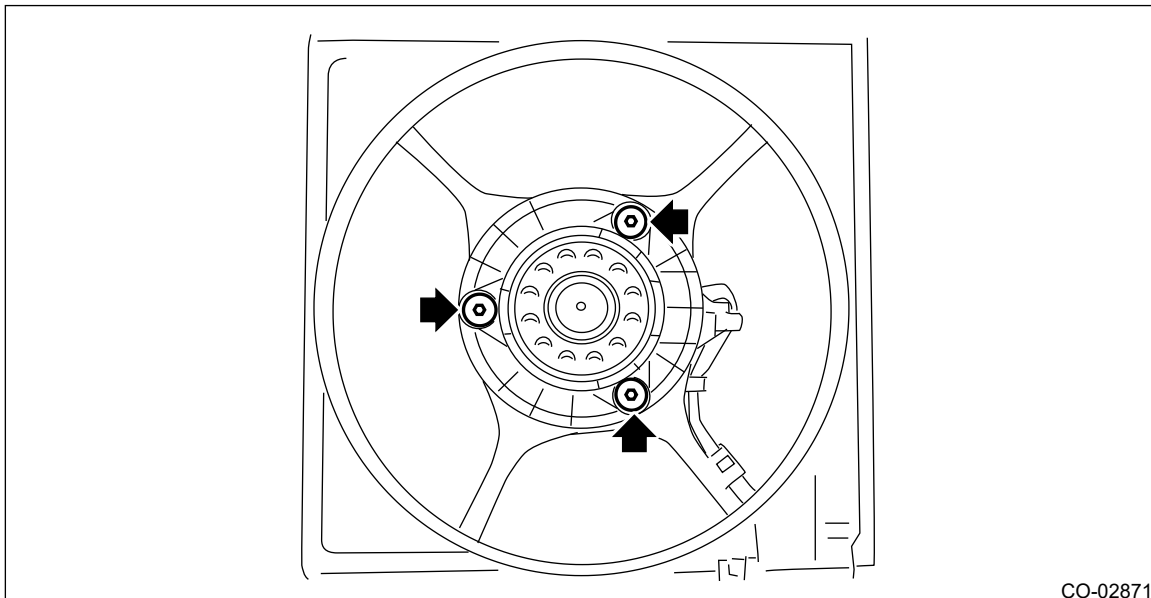
- Use a new radiator side gasket.
- Install the radiator side gasket at the position shown in the figure.



CO-10039

Tightening torque:

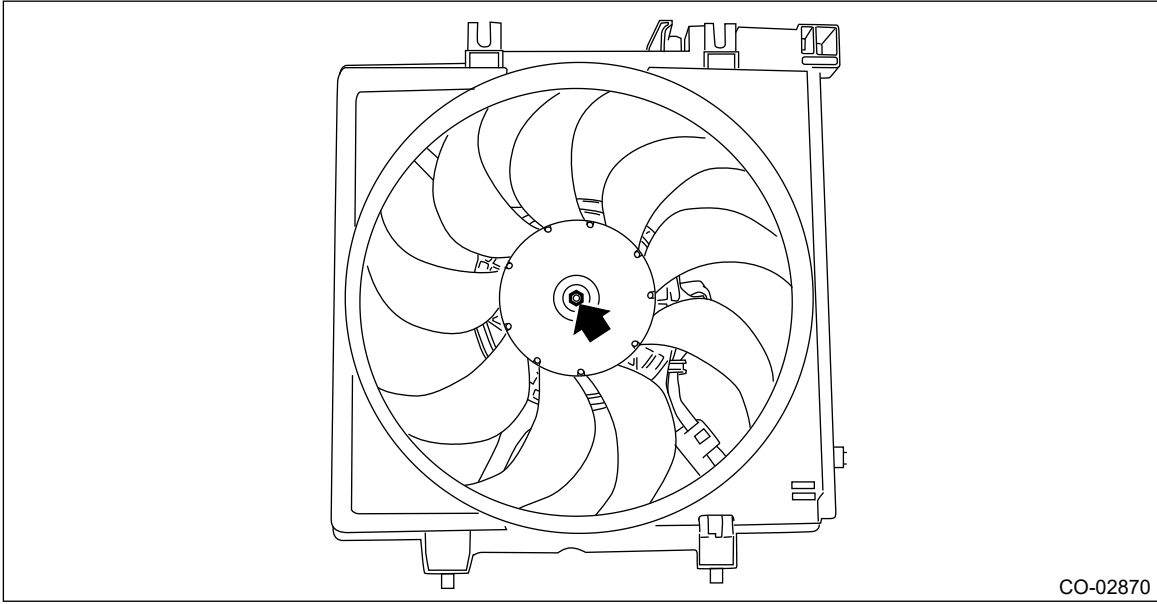
4.41 N•m (0.45 kgf-m, 3.25 ft-lb)



CO-02871

Tightening torque:

3.4 N•m (0.3 kgf-m, 2.5 ft-lb)



CO-02870

COOLING(H4DOTC) > Radiator Main Fan and Fan Motor

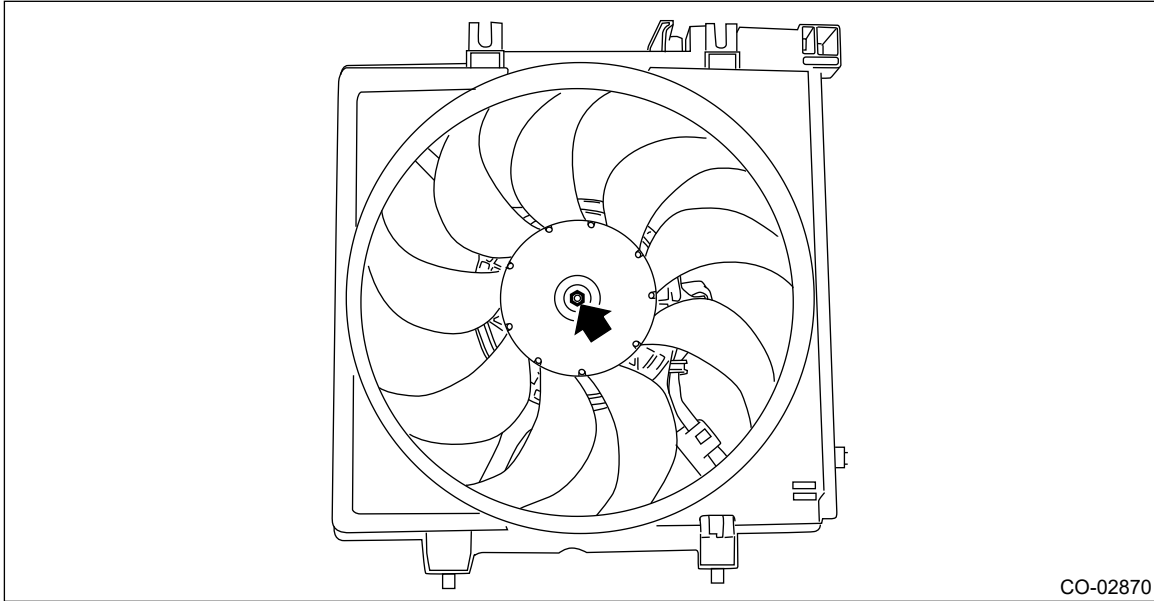
DISASSEMBLY

1. Remove the radiator side gasket from the radiator main fan shroud.

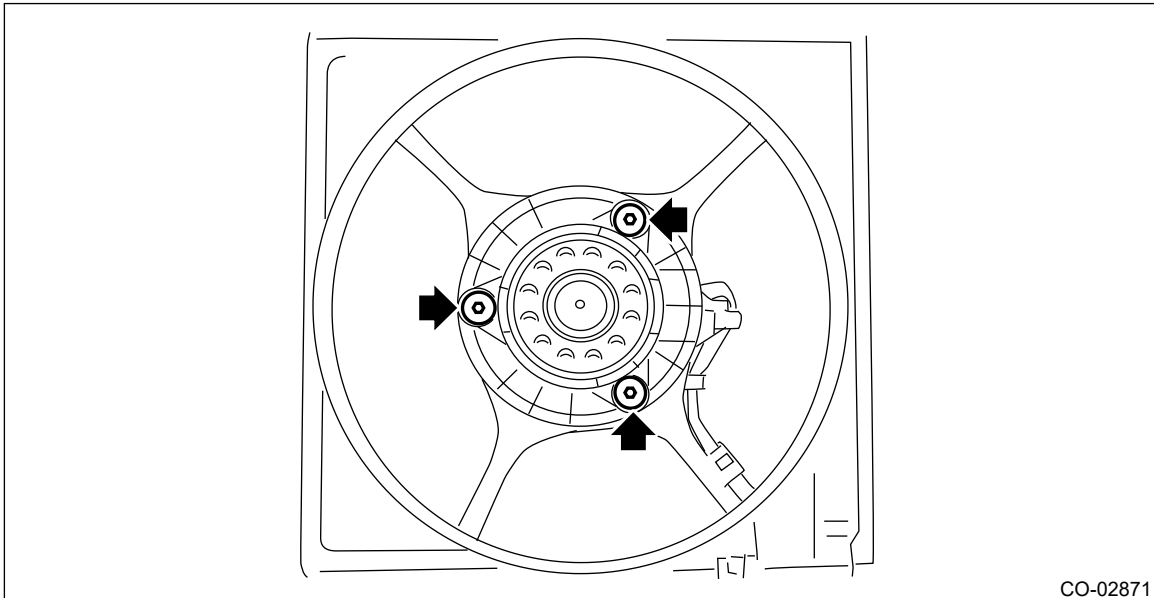
Note:

This operation is required only when replacing the radiator side gasket.

2. Remove the clip which holds the main fan motor connector onto the radiator main fan shroud.
3. Disconnect the radiator main fan from the main fan motor.



4. Disconnect the main fan motor from the radiator main fan shroud.



COOLING(H4DOTC) > Radiator Main Fan and Fan Motor

INSPECTION

Check that the radiator main fan, radiator main fan shroud and main fan motor do not have deformation, cracks or damage.

COOLING(H4DOTC) > Radiator Main Fan and Fan Motor

INSTALLATION

Install in the reverse order of removal.

Caution:

Confirm that the radiator hose is securely connected.

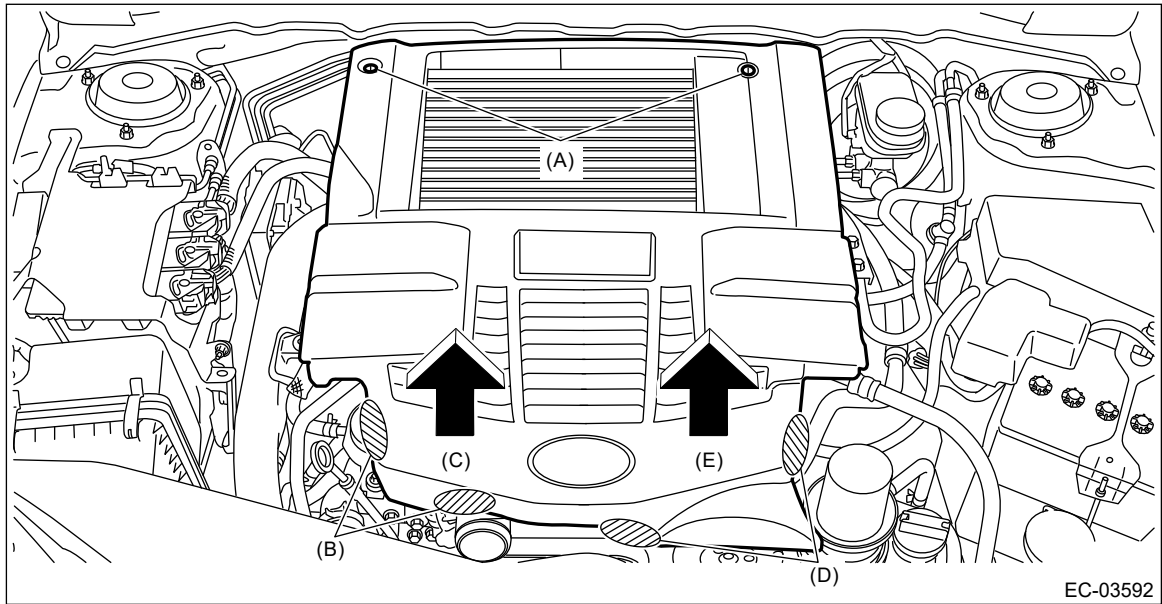
Tightening torque:



7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

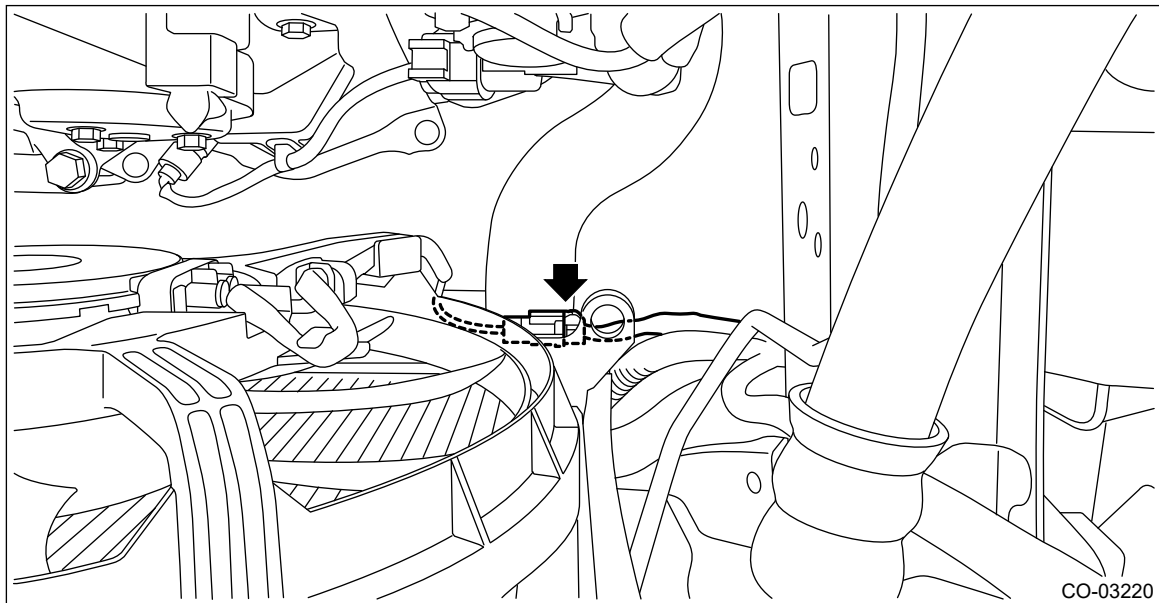
COOLING(H4DOTC) > Radiator Main Fan and Fan Motor

REMOVAL

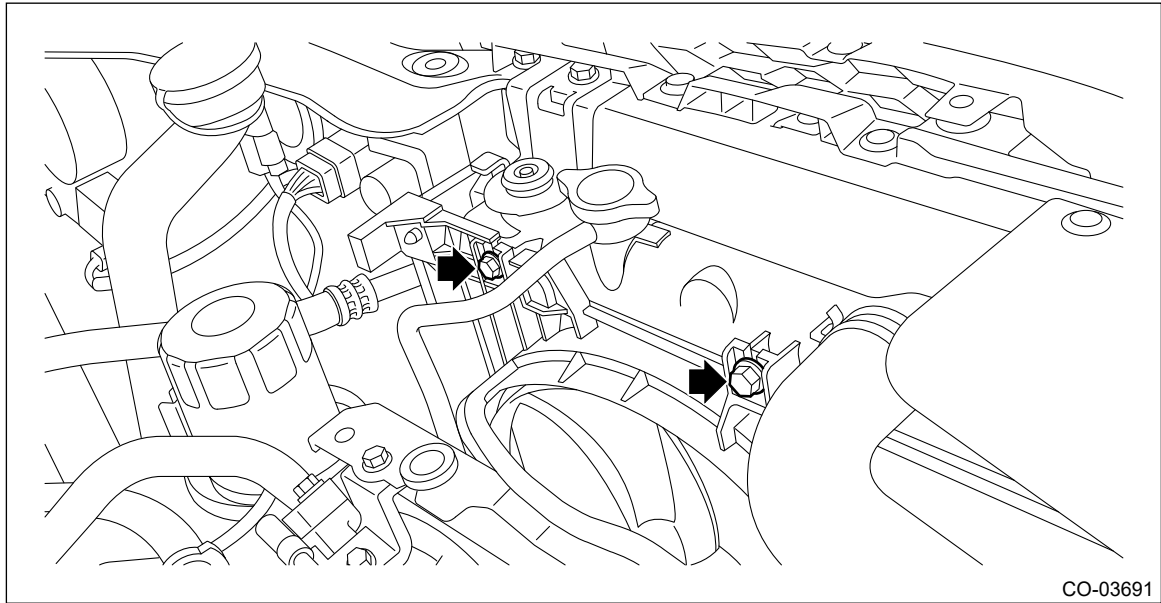
1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Remove the reservoir tank.  [Ref. to COOLING\(H4DOTC\)>Reservoir Tank>REMOVAL.](#)
4. Disconnect the connector from the main fan motor.



5. Remove the bolts which secure the radiator main fan motor assembly onto the radiator.



CO-03691

6. Remove the radiator main fan motor assembly from the vehicle.

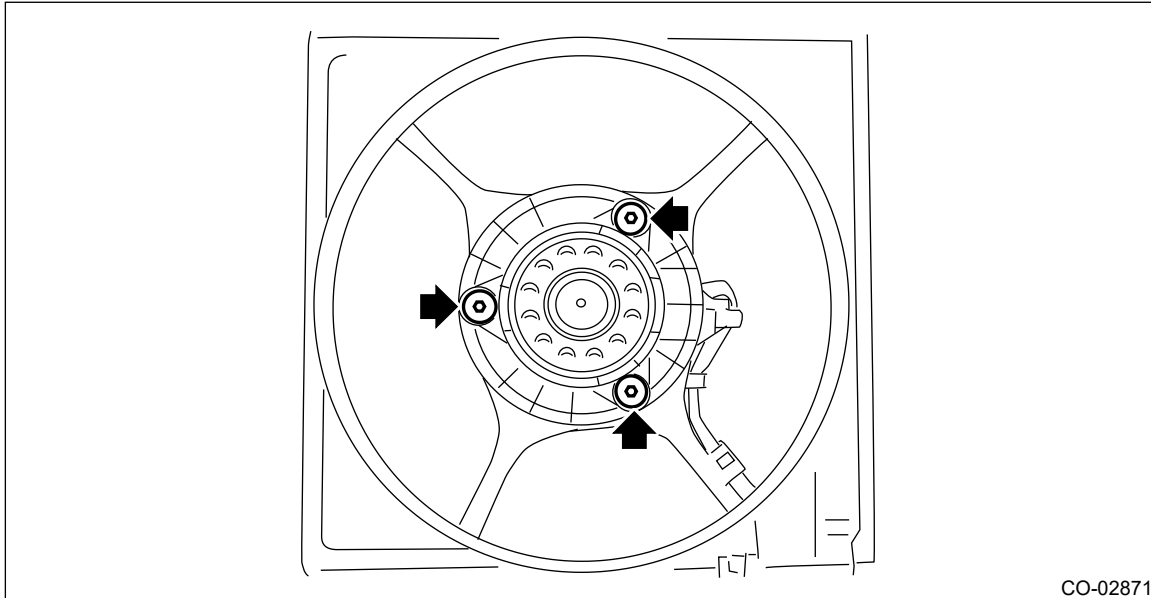
COOLING(H4DOTC) > Radiator Sub Fan and Fan Motor

ASSEMBLY

Assemble in the reverse order of disassembly.

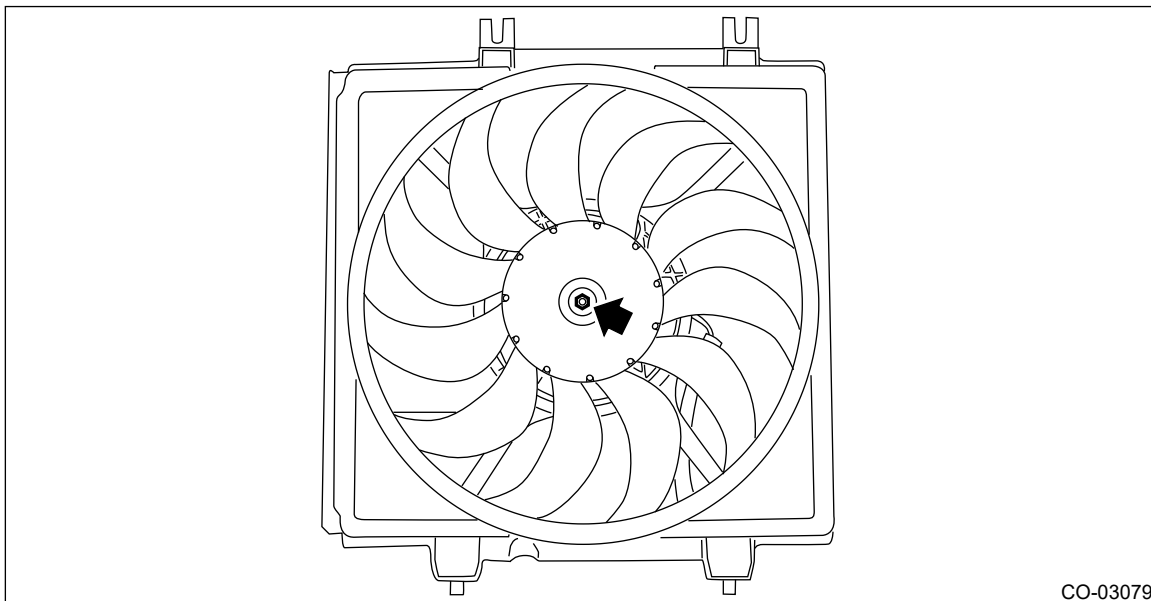
Tightening torque:

4.41 N·m (0.45 kgf-m, 3.25 ft-lb)



Tightening torque:

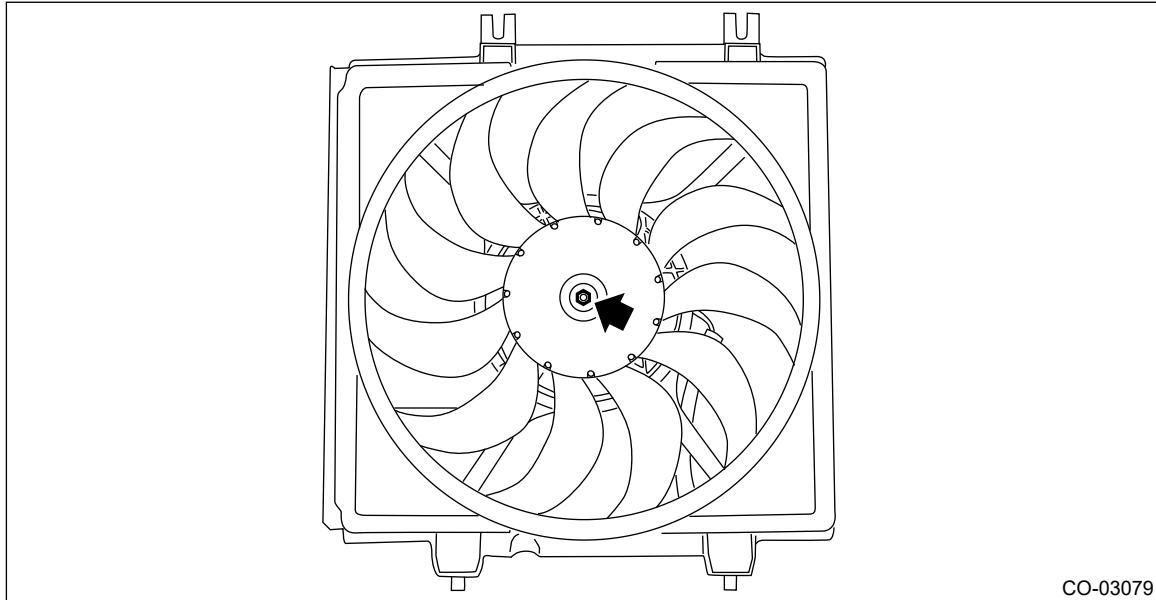
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)



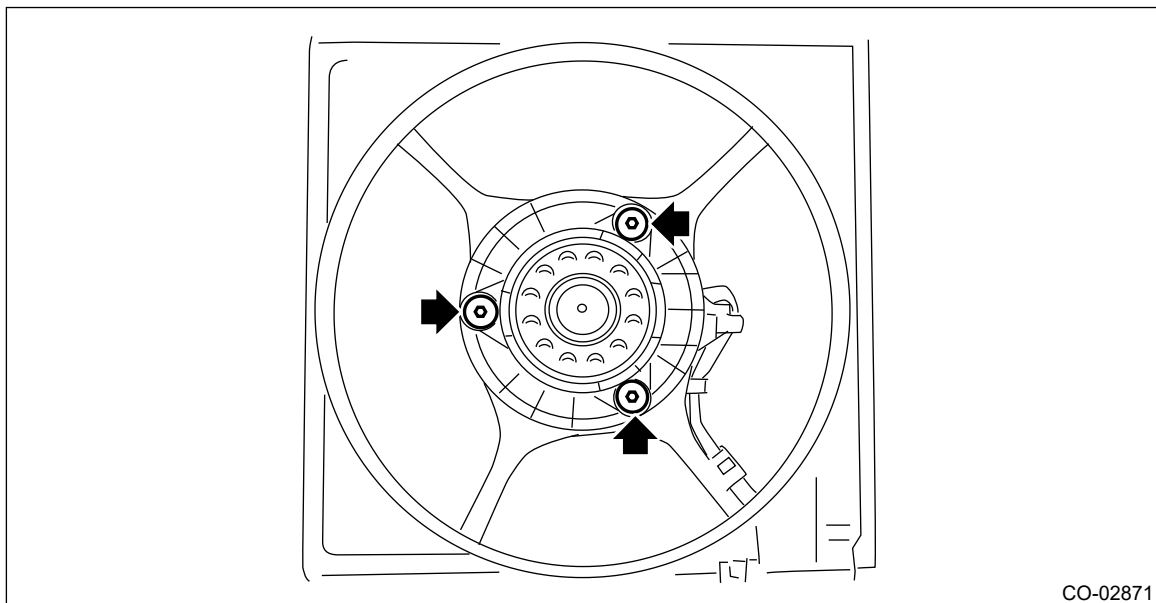
COOLING(H4DOTC) > Radiator Sub Fan and Fan Motor

DISASSEMBLY

1. Remove the clip which holds the sub fan motor connector onto the radiator sub fan shroud.
2. Disconnect the radiator sub fan from the sub fan motor.



3. Disconnect the sub fan motor from the radiator sub fan shroud.



COOLING(H4DOTC) > Radiator Sub Fan and Fan Motor

INSPECTION

Check that the radiator sub fan, radiator sub fan shroud and sub fan motor do not have deformation, cracks or damage.

COOLING(H4DOTC) > Radiator Sub Fan and Fan Motor

INSTALLATION

Install in the reverse order of removal.

Caution:



Confirm that the radiator hose is securely connected.

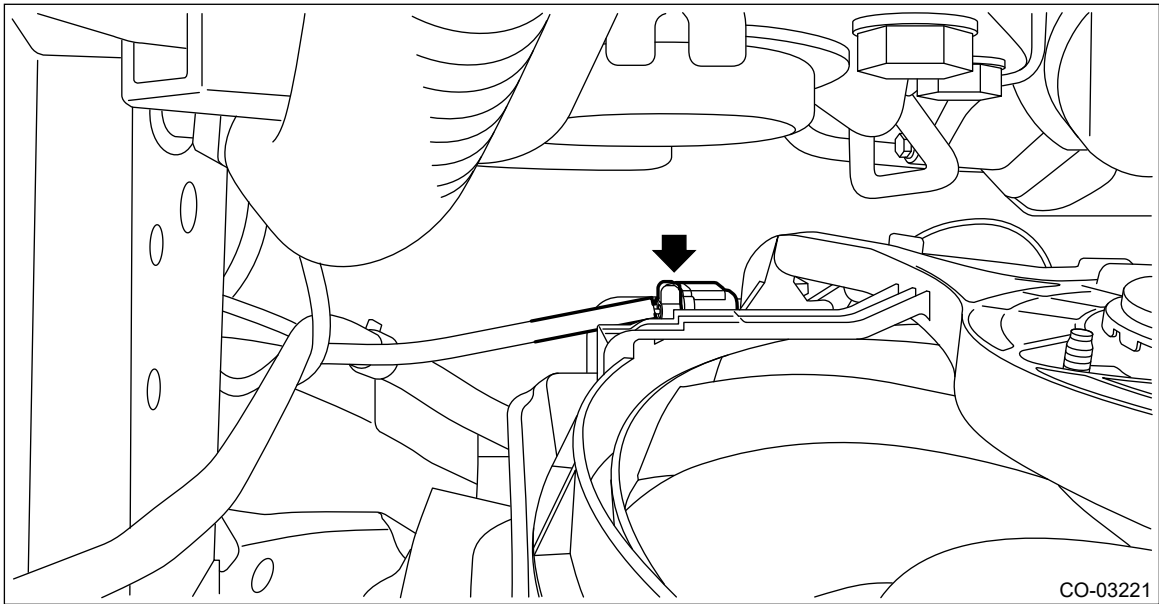
Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

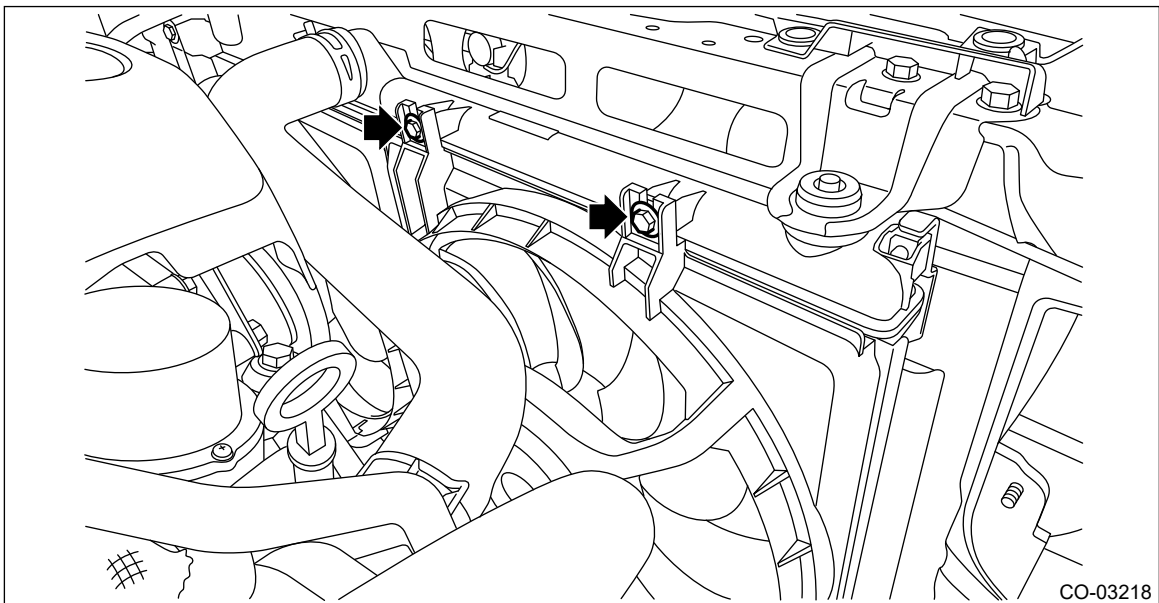
COOLING(H4DOTC) > Radiator Sub Fan and Fan Motor

REMOVAL

1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
3. Disconnect the connector from the sub fan motor.



4. Remove the bolts which secure the radiator sub fan motor assembly onto the radiator.

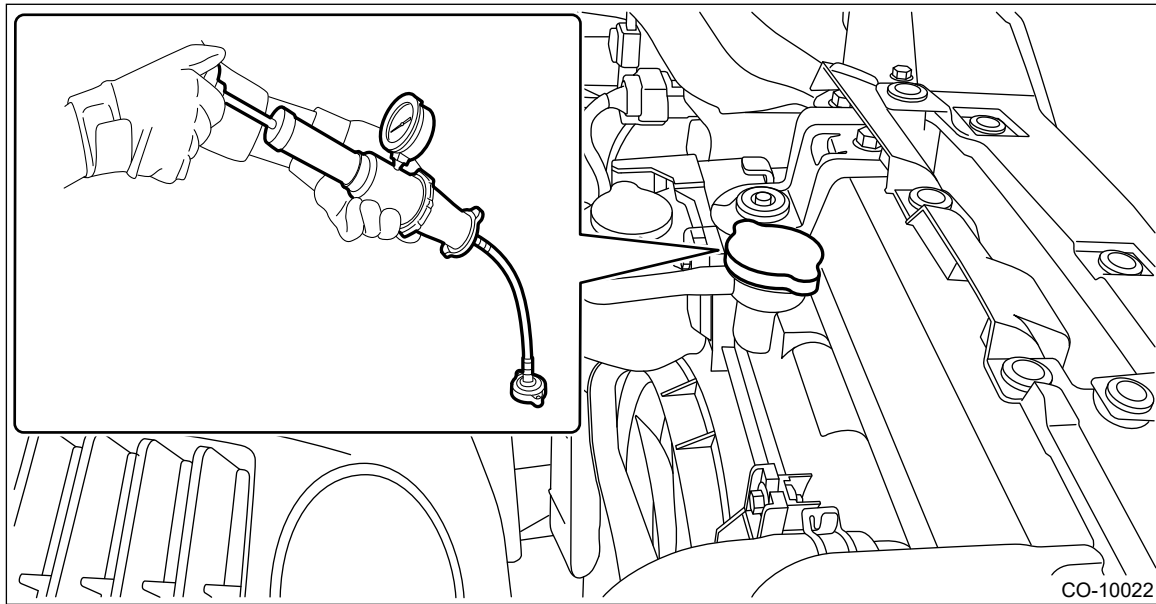


5. Remove the radiator sub fan motor assembly from the vehicle.

COOLING(H4DOTC) > Radiator

INSPECTION

1. Check that the radiator does not have deformation, cracks or damage.
2. Check that the hose has no cracks, damage or loose part.
3. Remove the radiator cap, fill the radiator with engine coolant, and then install the radiator cap tester to the filler neck of radiator.



4. Apply a pressure of 157 kPa (1.6 kg/cm², 23 psi) to the radiator and check the following points:

- Leakage from the radiator or its vicinity
- Leakage from the hose or its connections

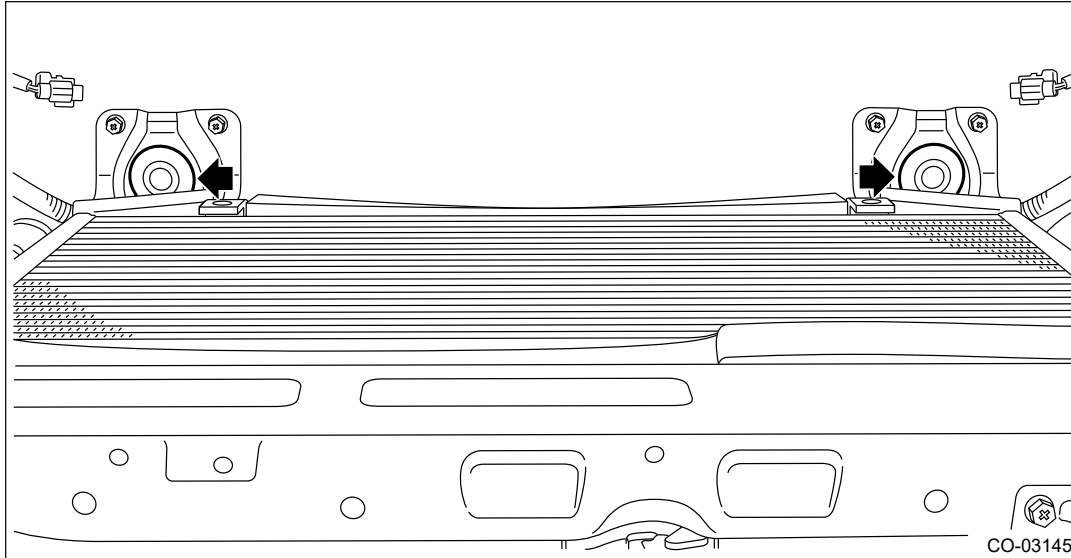
Caution:

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

COOLING(H4DOTC) > Radiator

INSTALLATION

1. Attach the radiator lower cushion to the radiator lower bracket.

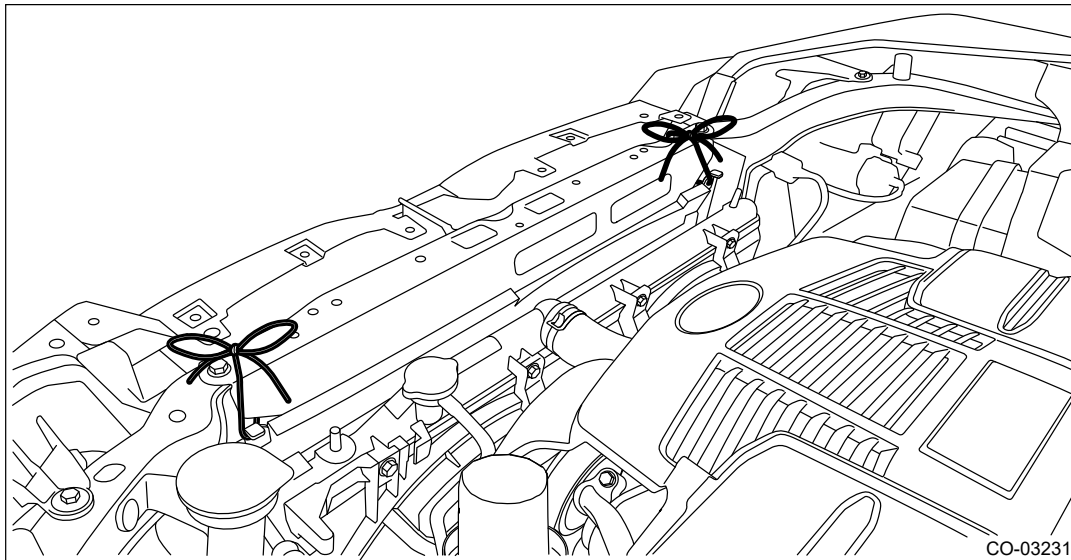


2. Install the radiator to vehicle.

Note:

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

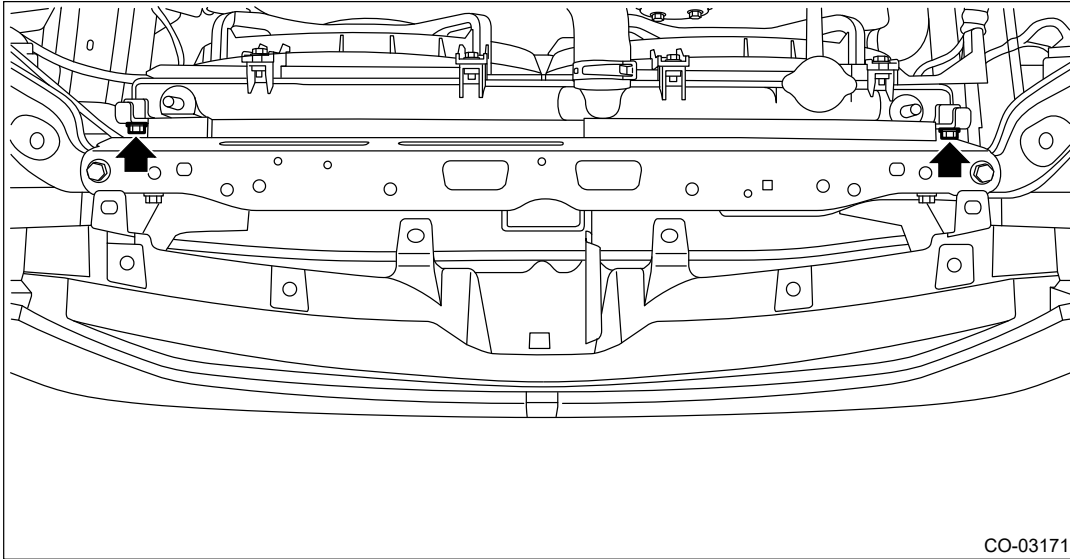
3. Remove the ropes or other means used to secure the condenser to the vehicle.



4. Install the bolts at the top of the condenser.

Tightening torque:

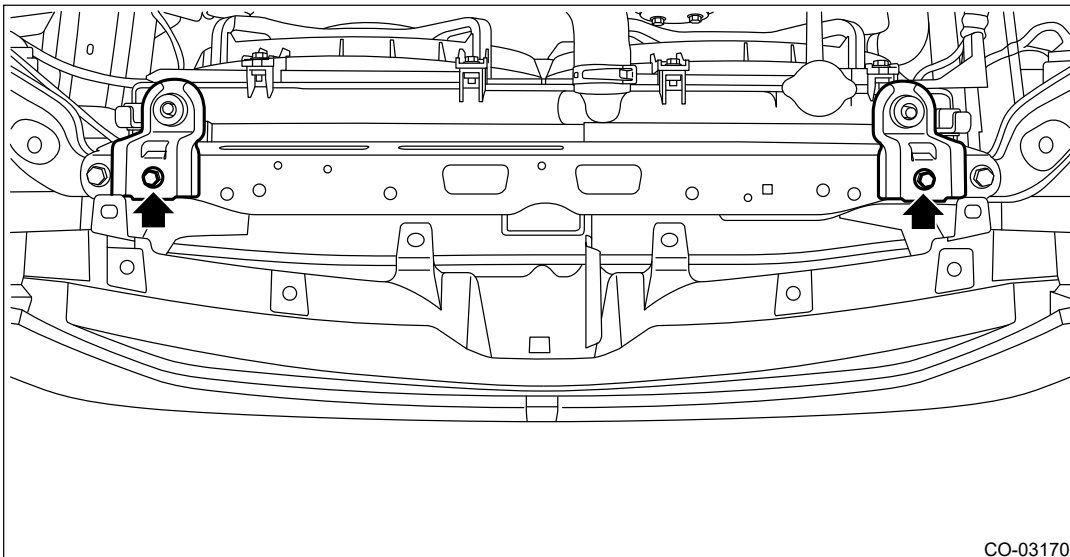
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



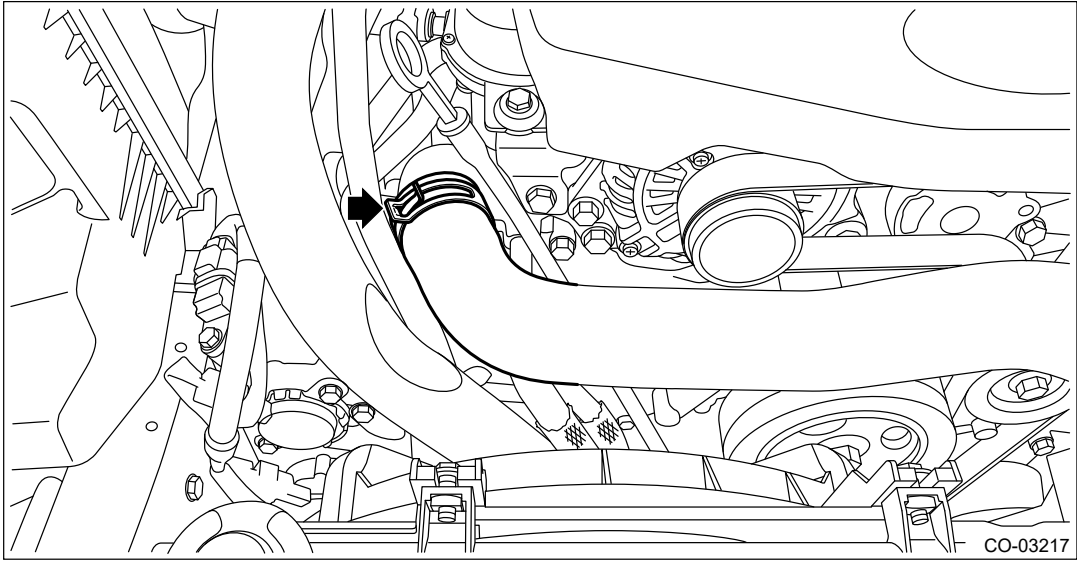
- 5.** Install the radiator upper brackets.

Tightening torque:

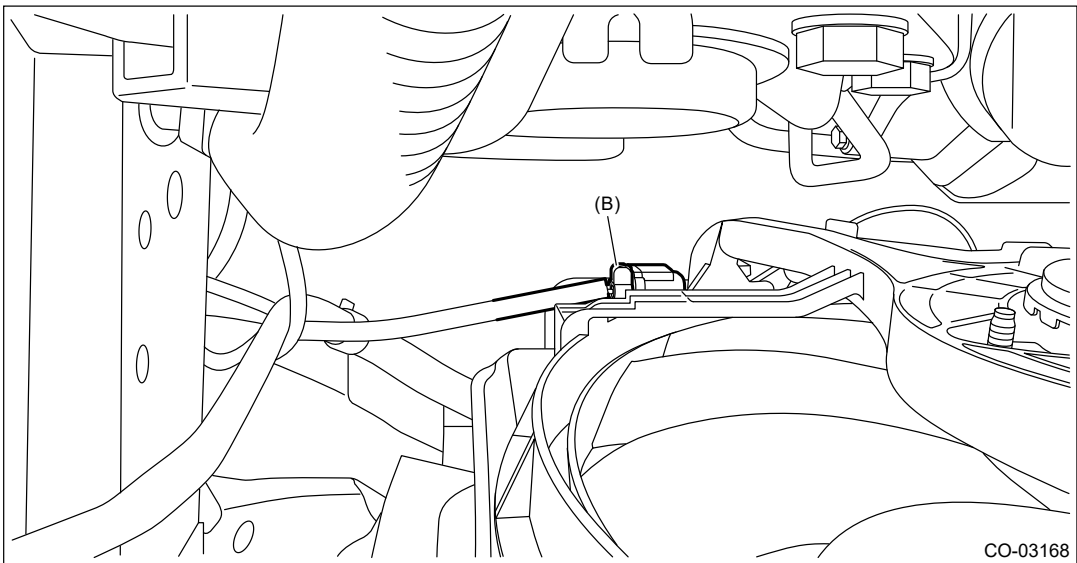
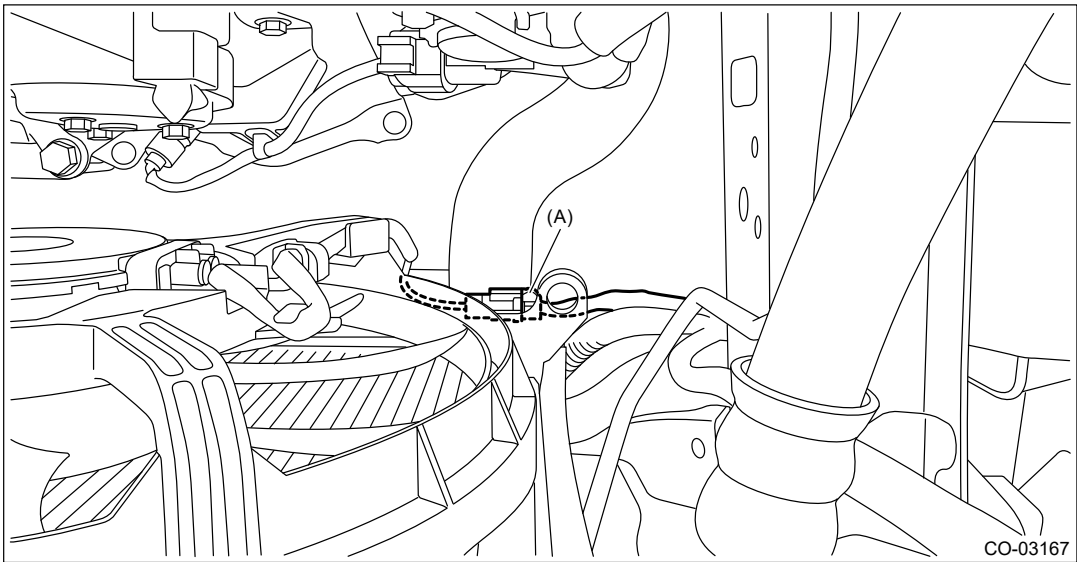
12 N·m (1.2 kgf-m, 8.9 ft-lb)



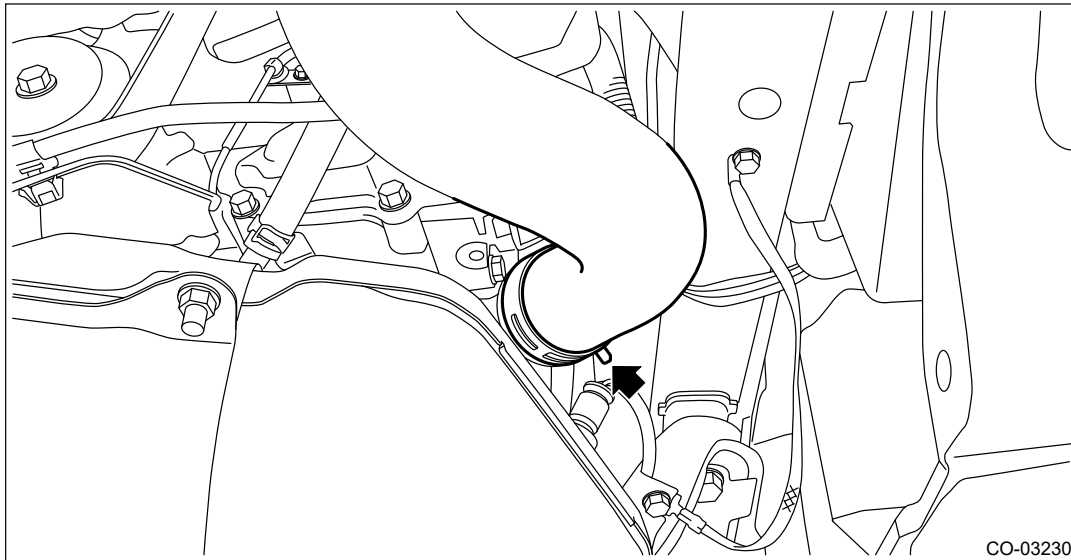
- 6.** Connect the radiator inlet hose to the water pipe assembly.



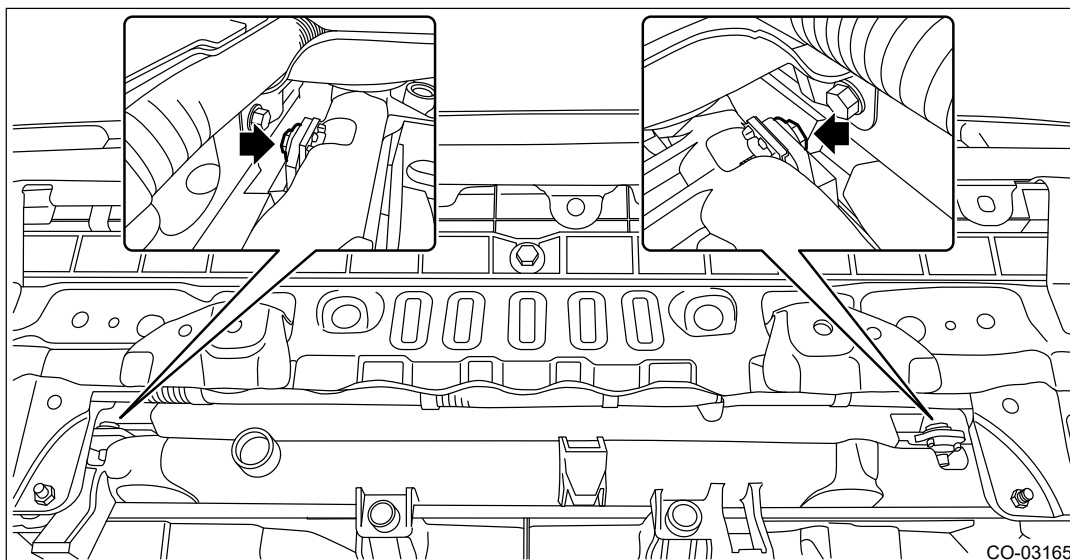
7. Connect the connector (A) to the main fan motor and the connector (B) to the sub fan motor.




8. Lift up the vehicle.
9. Connect the radiator outlet hose to thermostat cover.



10. Temporarily tighten the bolts at the bottom of the condenser.



11. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
12. Lower the vehicle.
13. Tighten the bolts at the bottom of the condenser using the ST.

ST 73099SG00 SPECIAL TOOL CONDENSER

Tightening torque:

Calculation formula

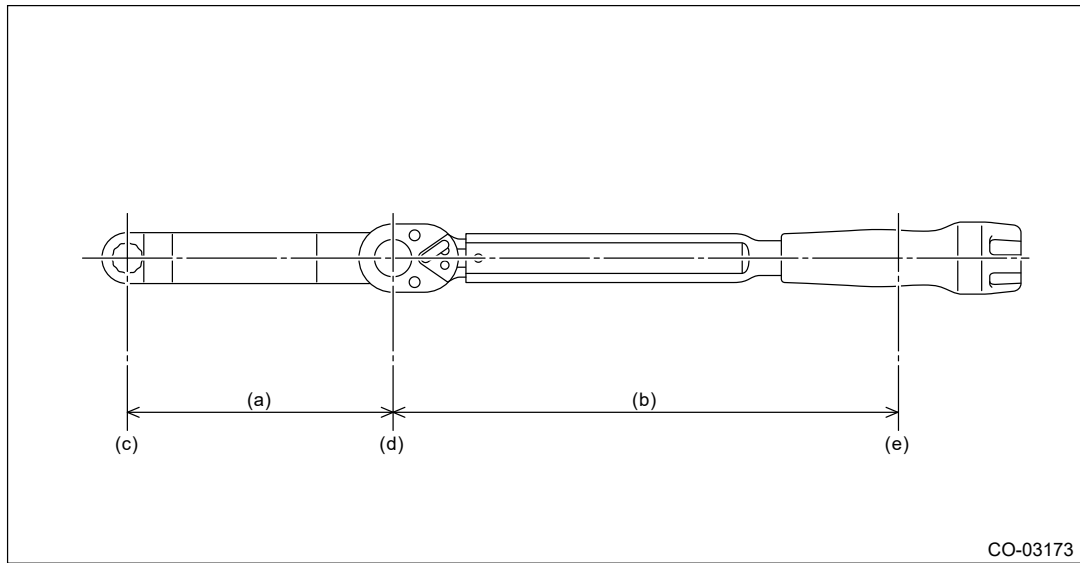
$$T = L / (100 \text{ mm (3.94 in)} + L) \times 7.5 \text{ N}\cdot\text{m (0.8 kgf}\cdot\text{m, 5.5 ft}\cdot\text{lb)}$$

T: Tightening torque

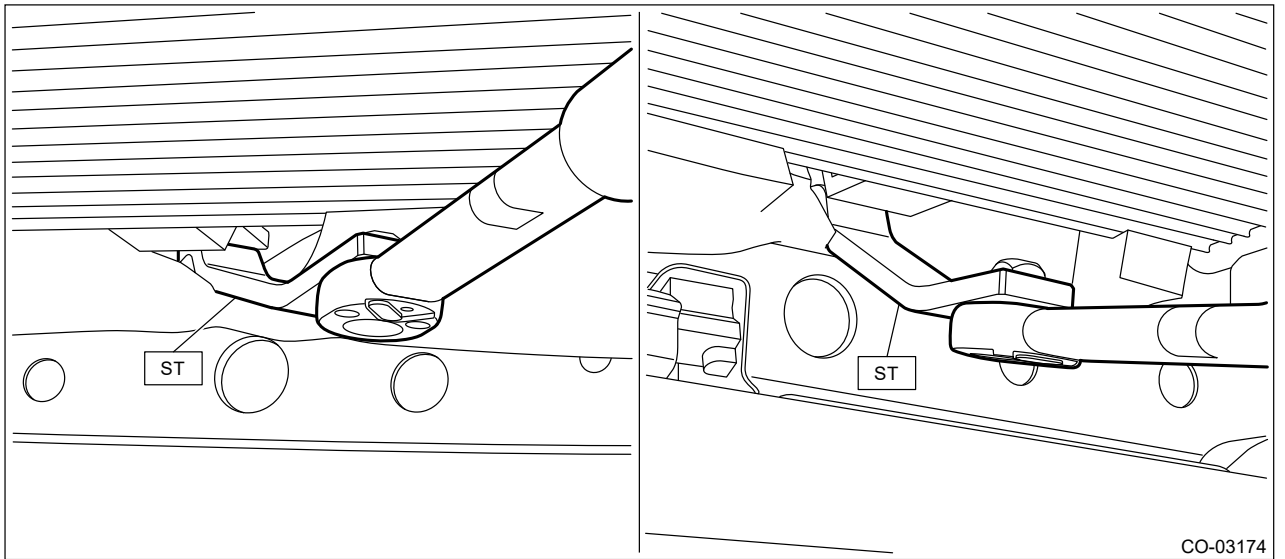
L: Effective length of torque wrench

Note:

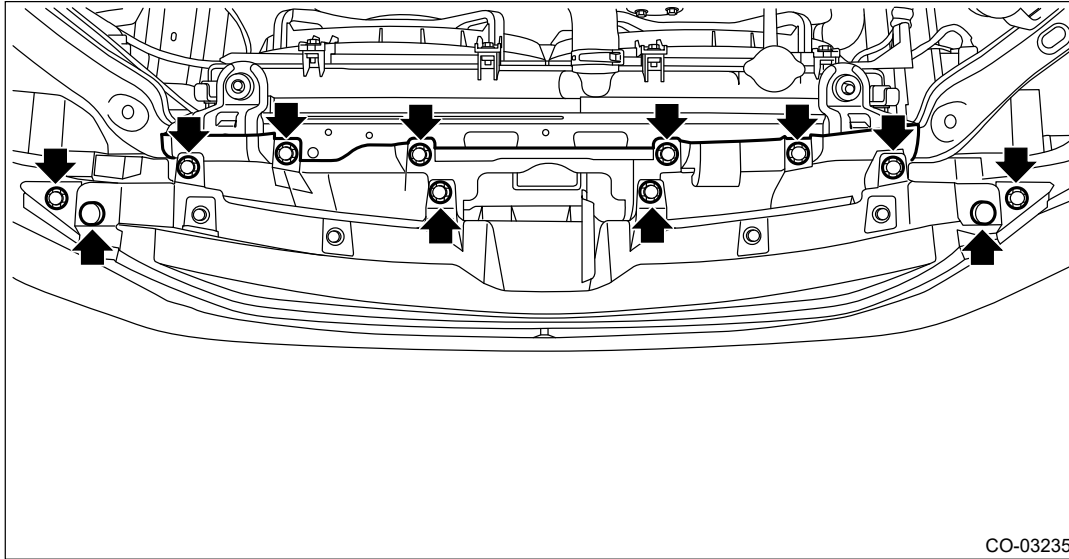
If the effective length of the torque wrench used is unknown, consult the manufacturer of the torque wrench.







- (a) Effective length of the ST
- (b) Effective length of the torque wrench
- (c) Center of drive angle of the ST
- (d) Center of drive angle of the torque wrench
- (e) Center of the position where a force is applied by hand



14. Install the clips to the grille bracket and front bumper and install the grille bracket.






- 15.** Install the reservoir tank.  [Ref. to COOLING\(H4DOTC\)>Reservoir Tank>INSTALLATION.](#)
- 16.** Install the air intake duct.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
- 17.** Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 18.** Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

COOLING(H4DOTC) > Radiator

REMOVAL

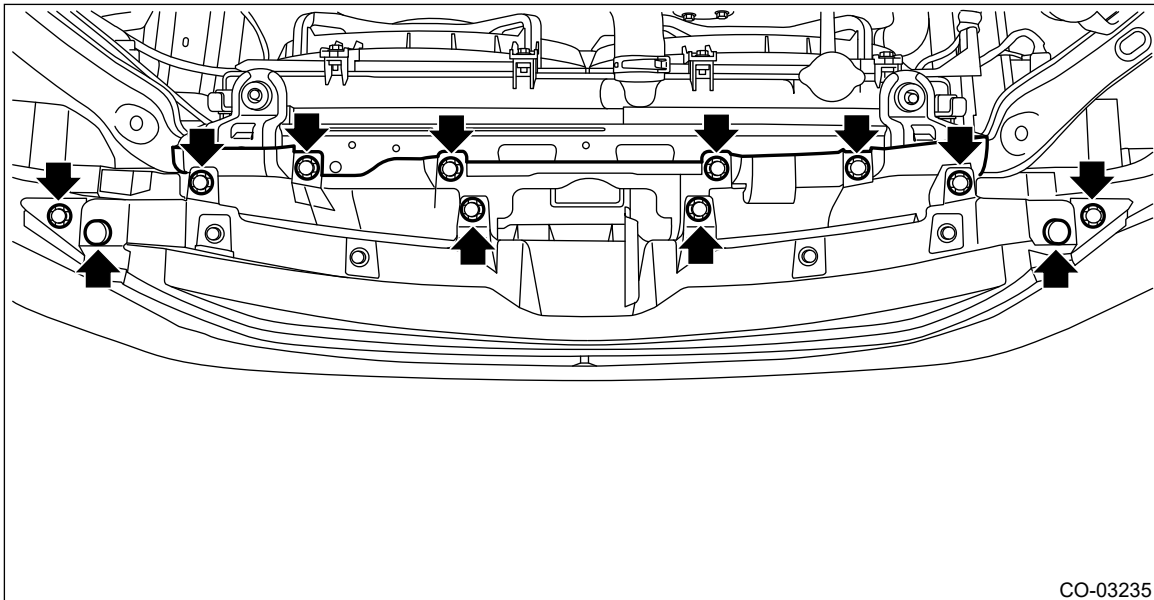
Caution:


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

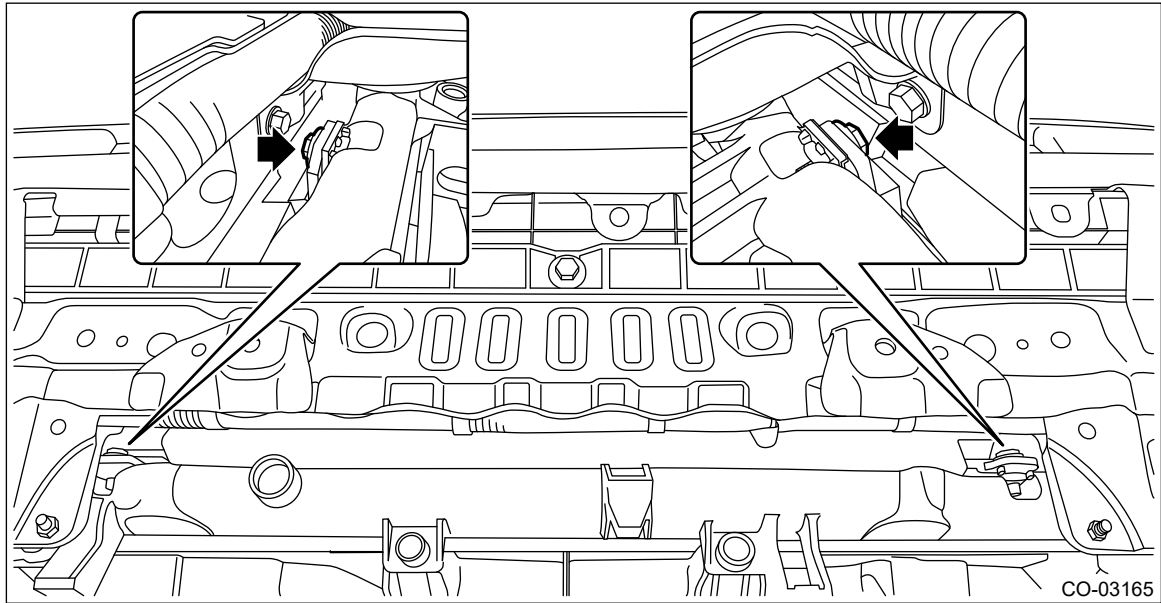
1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
3. Remove the reservoir tank.  [Ref. to COOLING\(H4DOTC\)>Reservoir Tank>REMOVAL.](#)
4. Remove the clips from the grille bracket and front bumper to remove the grille bracket.

Note:

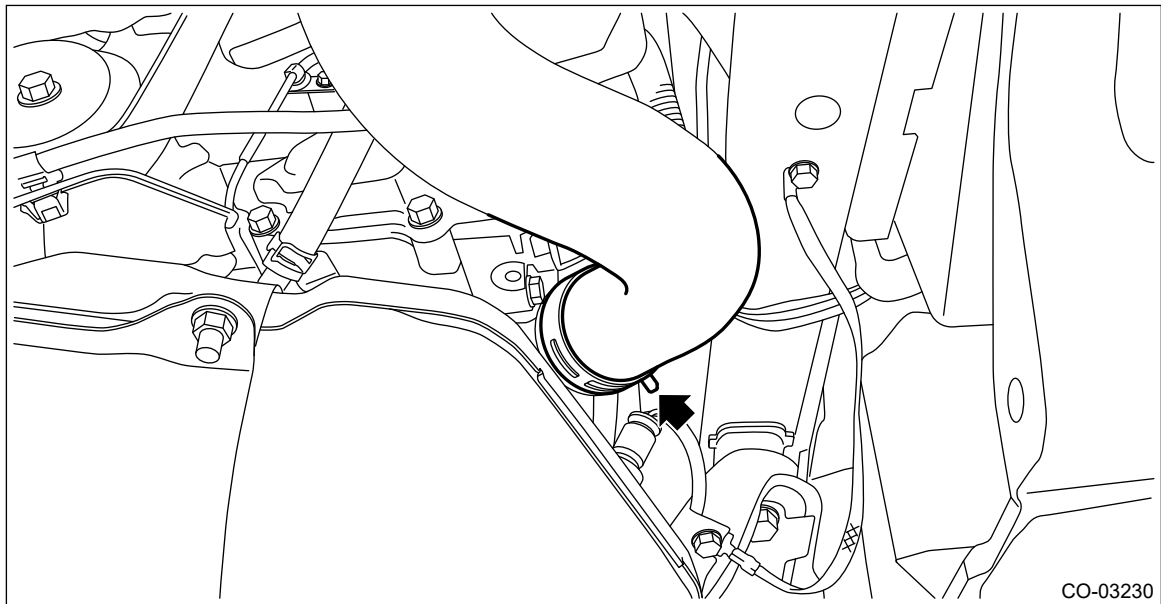
Remove the twelve clips.



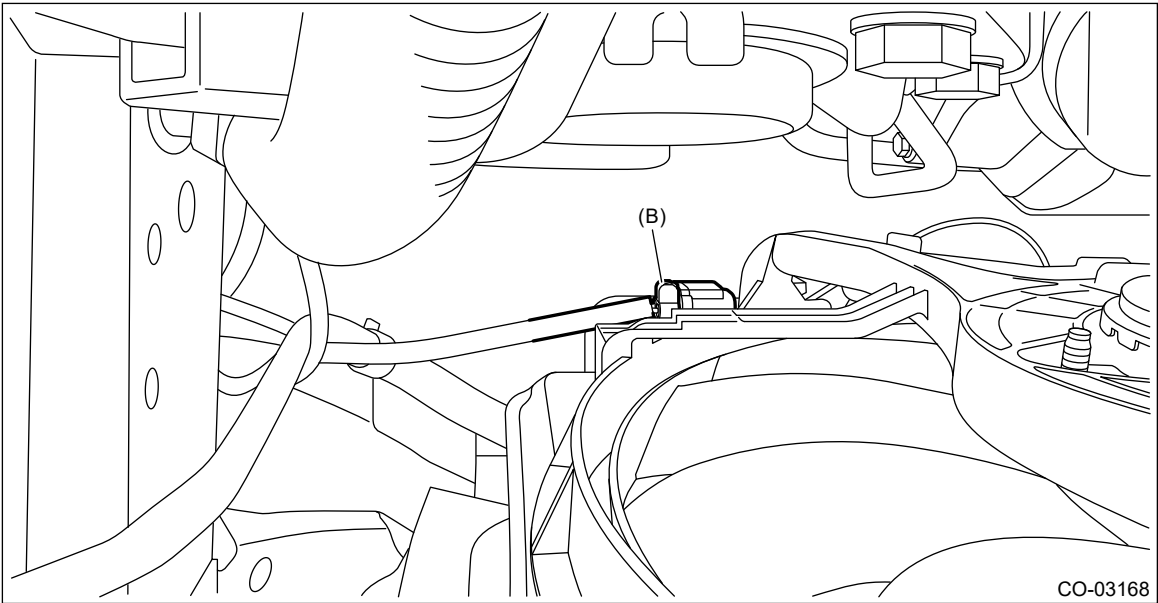
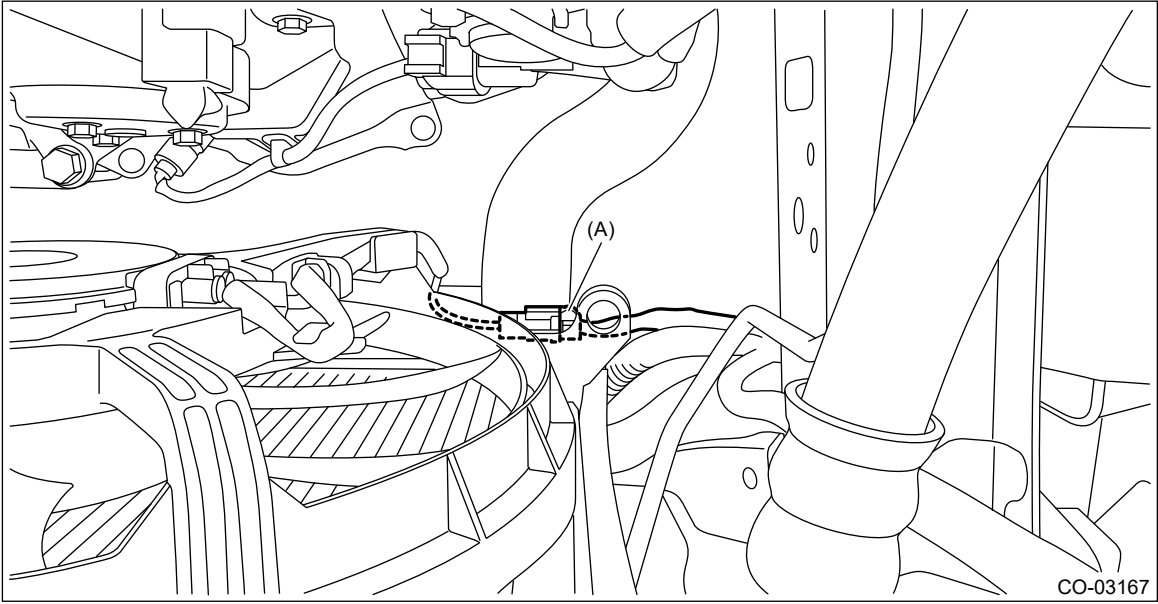
5. Drain engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
6. Remove the bolts at the bottom of the condenser.



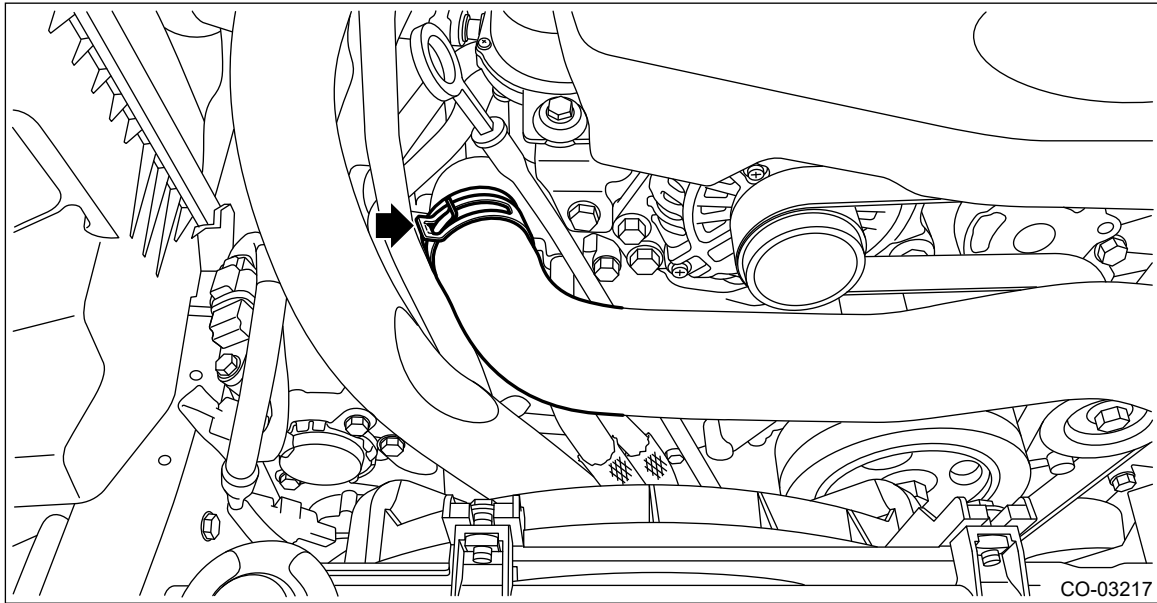
7. Disconnect the radiator outlet hose from thermostat cover.



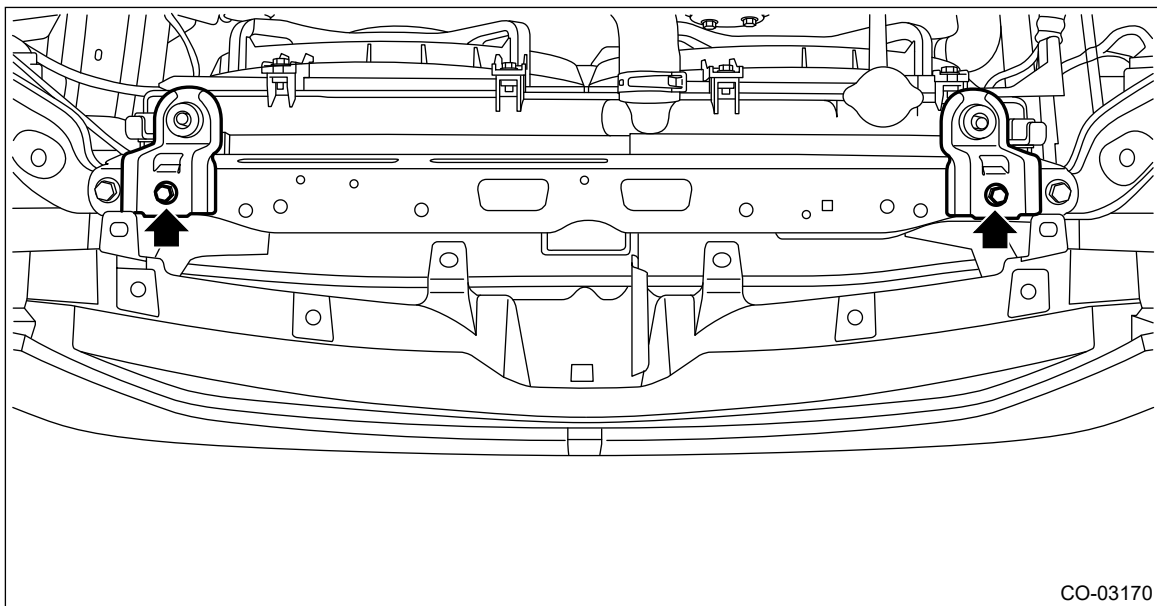
8. Lower the vehicle.
9. Disconnect the connector (A) from the main fan motor and the connector (B) from the sub fan motor.



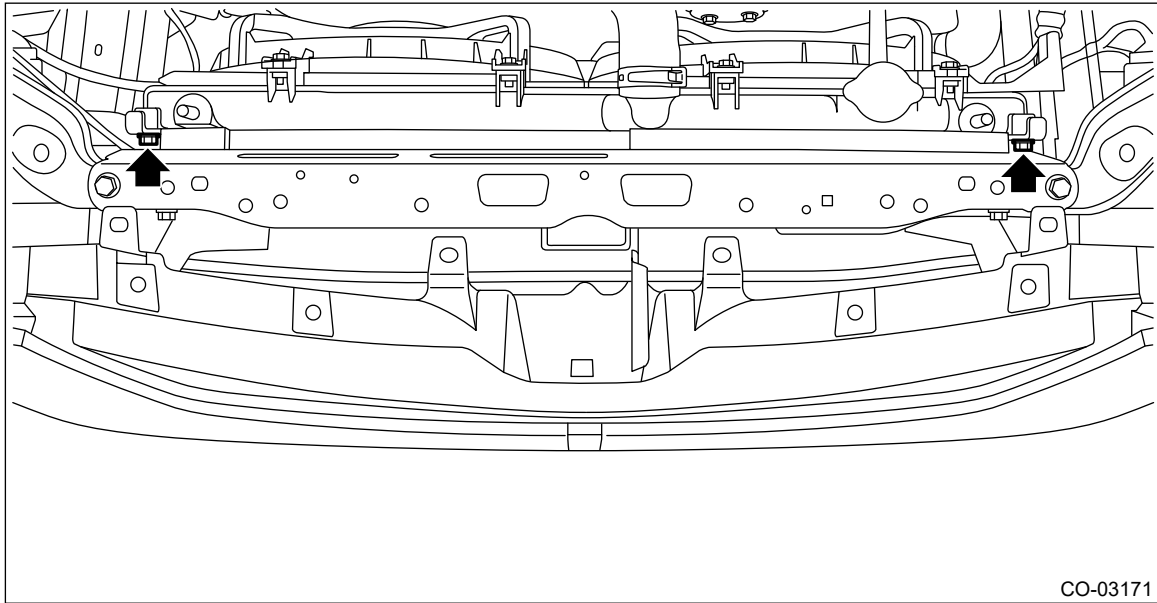
10. Disconnect the radiator inlet hose from the water pipe assembly.



11. Remove the radiator upper brackets.



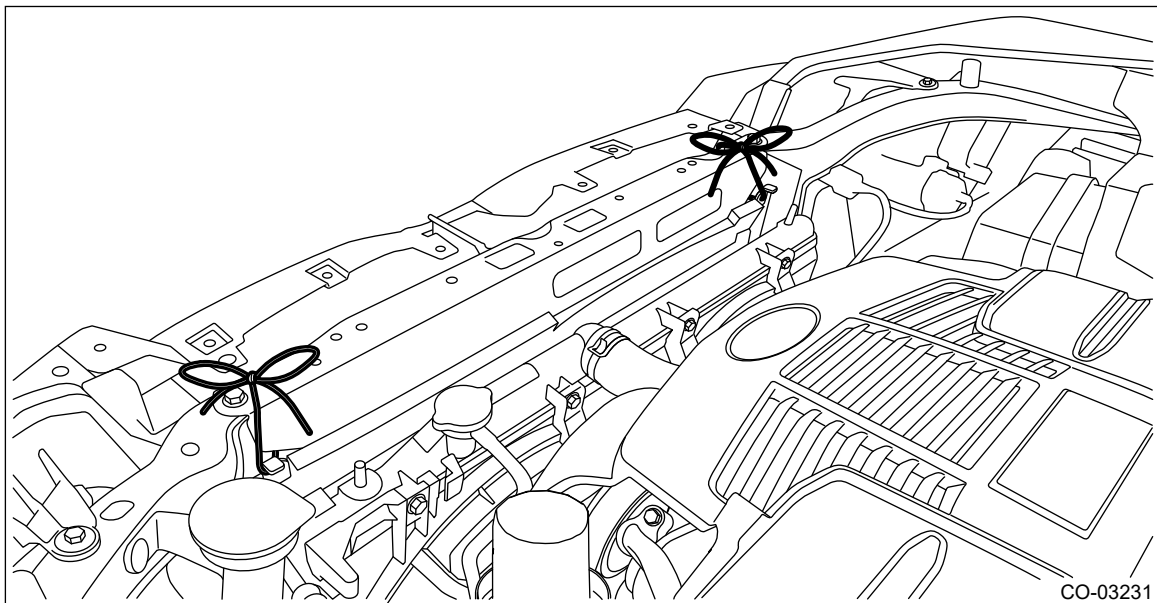
12. Remove the bolts at the top of the condenser.



13. Secure the condenser to the vehicle using ropes or other means.

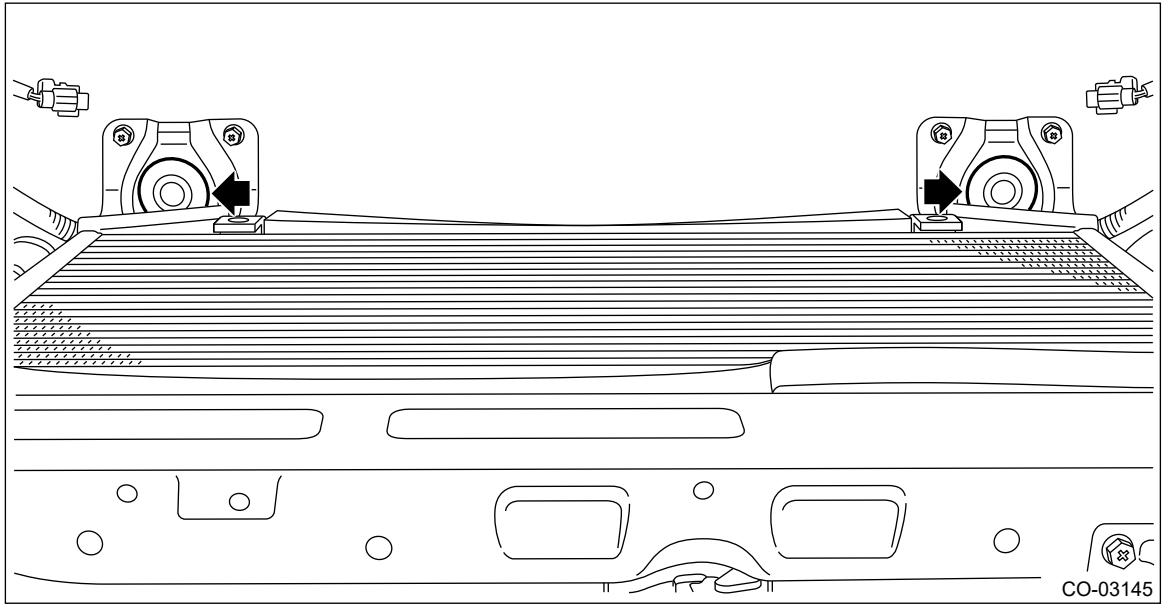
Note:

This procedure is required to prevent the condenser from dropping off and also damage to the air conditioner pipes.



14. Remove the radiator from vehicle.

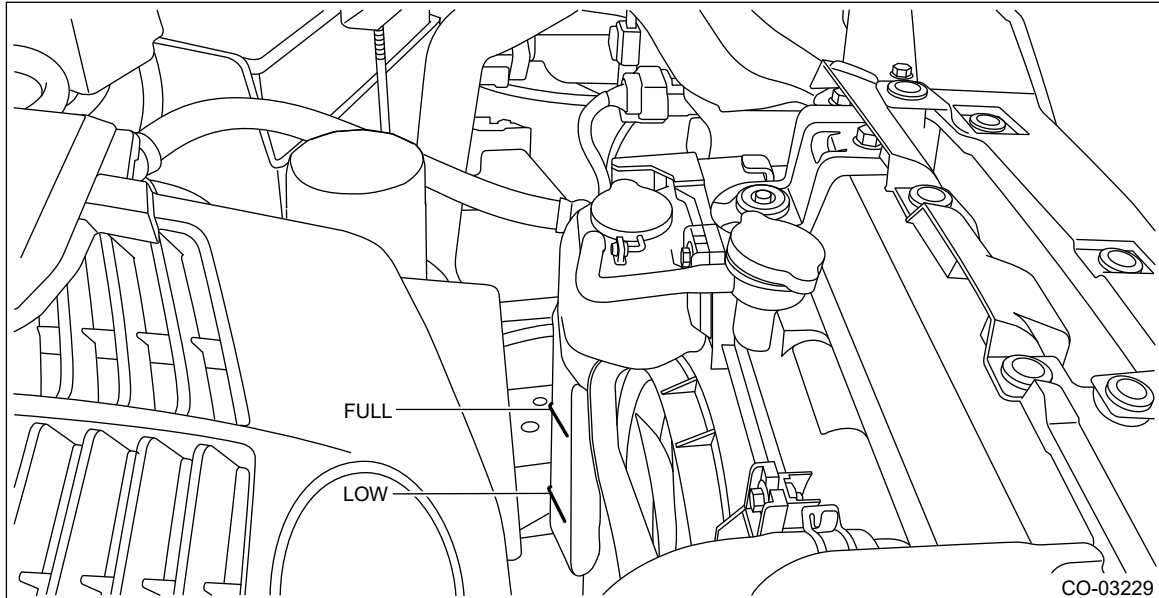
15. Remove the radiator lower cushion from the radiator lower bracket.



COOLING(H4DOTC) > Reservoir Tank

INSPECTION

1. Check that the reservoir tank does not have deformation, cracks or damage.
2. Make sure the over flow hoses are not cracked, damaged or loose.
3. Make sure the engine coolant level is between "FULL" and "LOW".



COOLING(H4DOTC) > Reservoir Tank

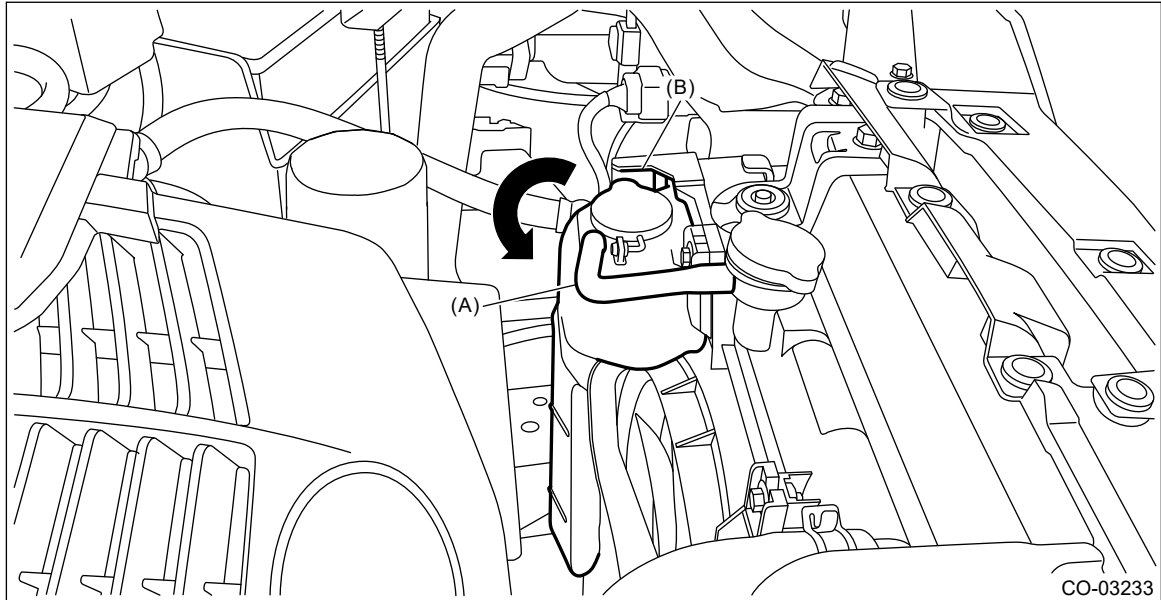
INSTALLATION

Install in the reverse order of removal.

COOLING(H4DOTC) > Reservoir Tank

REMOVAL

1. Disconnect the over flow hose (A) connected to the radiator filler neck from the reservoir tank.
2. Pull out the reservoir tank to the arrow direction while pushing the claw (B).



COOLING(H4DOTC) > Thermostat

INSPECTION

1. Check that the thermostat does not have deformation, cracks or damage.
2. Check that the thermostat valve closes completely at an ambient temperature.
3. Immerse the thermostat and a thermometer in water. Raise water temperature gradually, and check the temperature and valve lift when the valve begins to open and when the valve is fully opened. Replace the thermostat if faulty.

Note:

- During the test, agitate the water for even temperature distribution.
- Leave the thermostat in the boiling water for five minutes or more before measuring the valve lift.
- Hold the thermostat with a wire or the like to avoid contacting with container bottom.

Starting temperature to open:

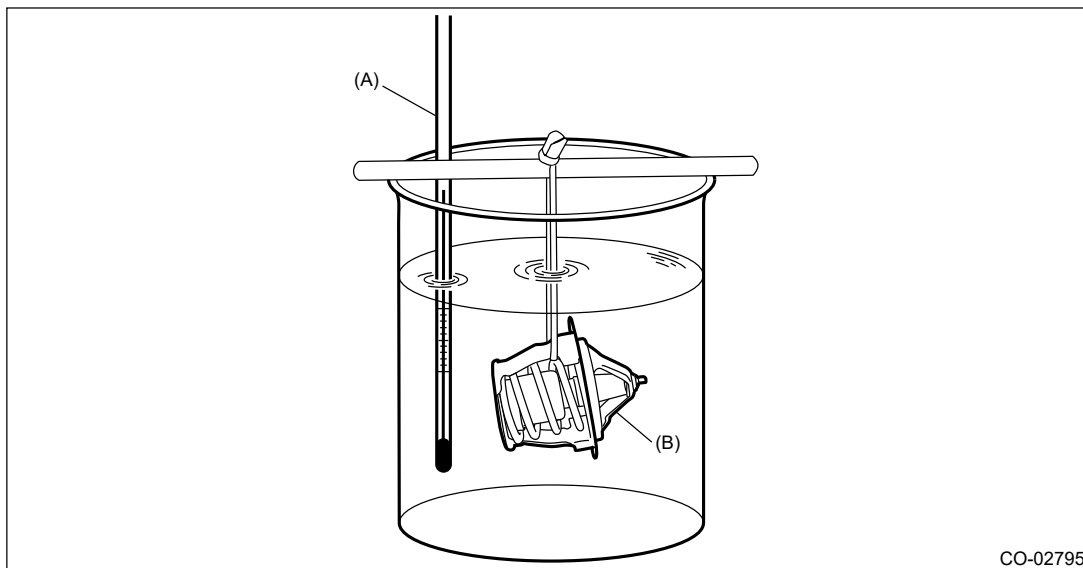
86 – 90°C (187 – 194°F)

Full open temperature:

95°C (203°F)

Total valve lift:

8.0 mm (0.315 in) or more



(A) Thermometer

(B) Thermostat

CO-02795

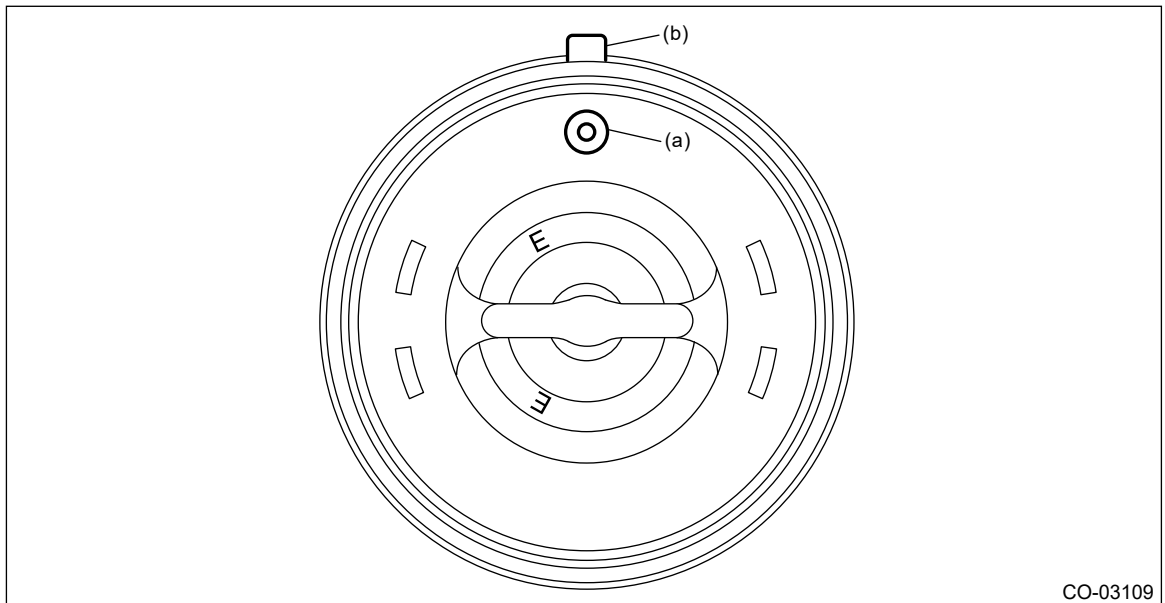
COOLING(H4DOTC) > Thermostat

INSTALLATION

1. Install a gasket to thermostat.

Note:

- Use a new gasket.
- Align the positions of the jig pin (a) and gasket ribs (b).

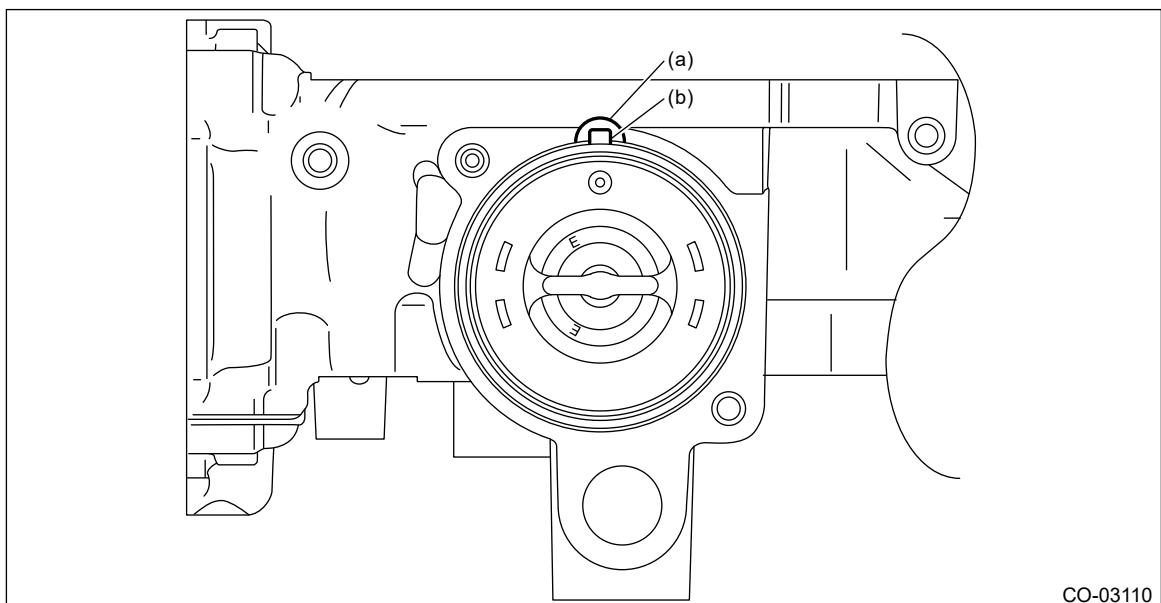


CO-03109

2. Install the thermostat and thermostat cover.

Note:

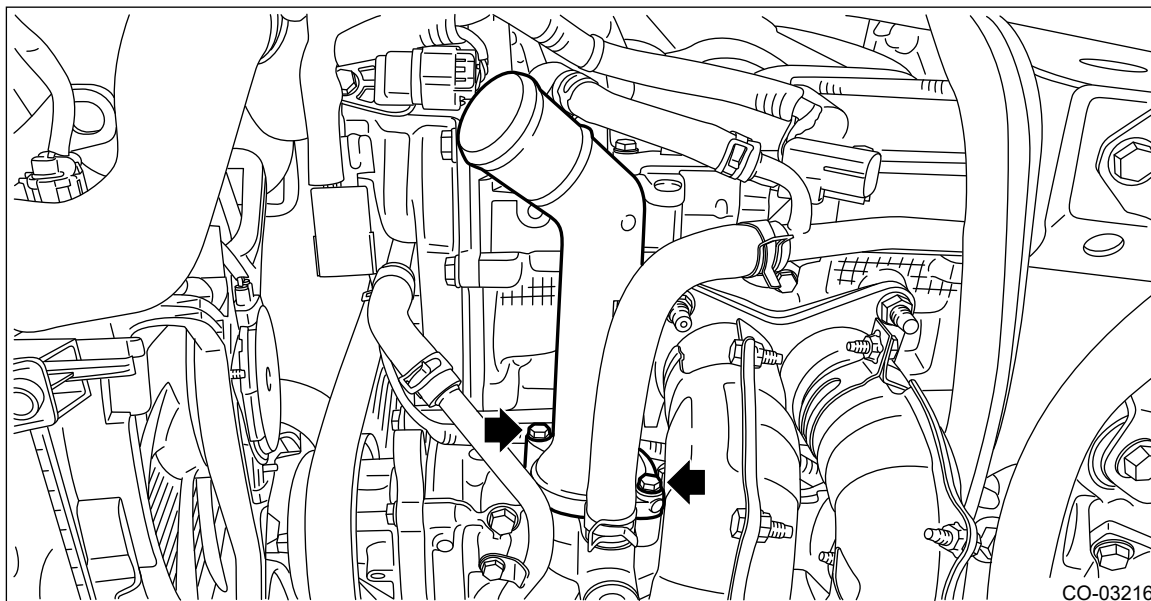
Align the oil pan upper cutout (a) with the position of the thermostat rib (b).



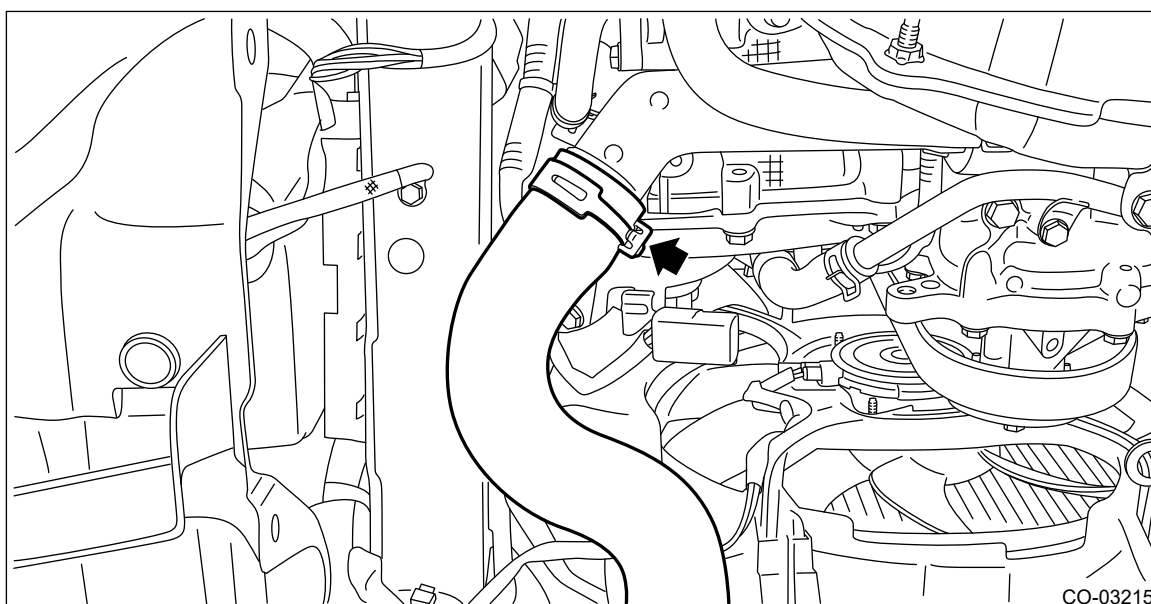
CO-03110





Tightening torque:

6.4 N•m (0.7 kgf-m, 4.7 ft-lb)






3. Connect the radiator outlet hose to thermostat cover.

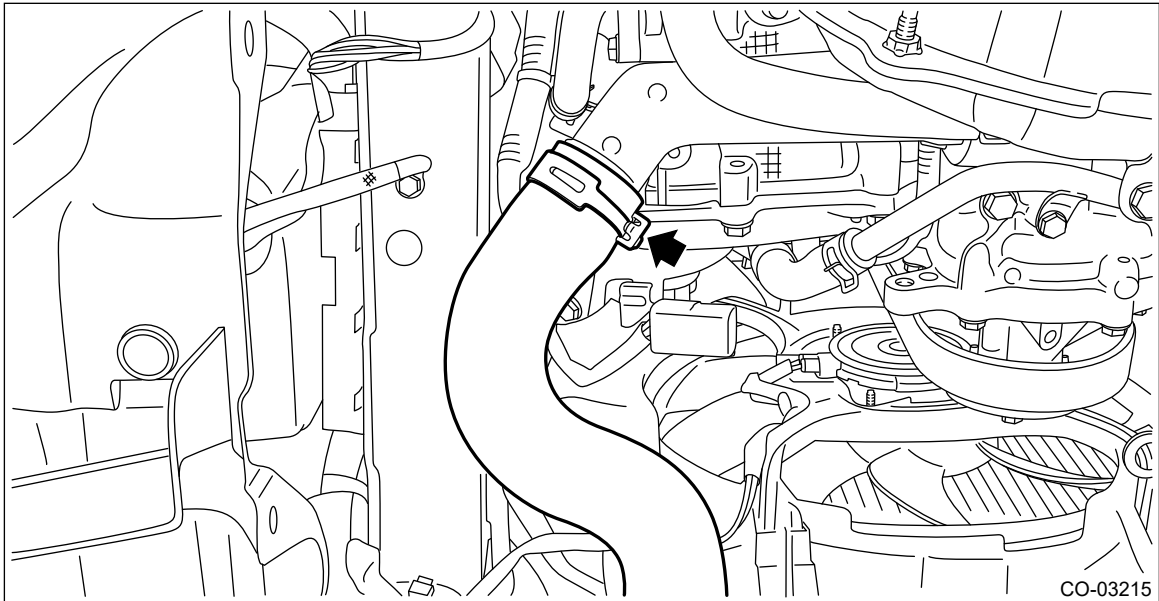


4. Install the center exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Center Exhaust Pipe>INSTALLATION.](#)
5. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
6. Lower the vehicle.
7. Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
8. Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

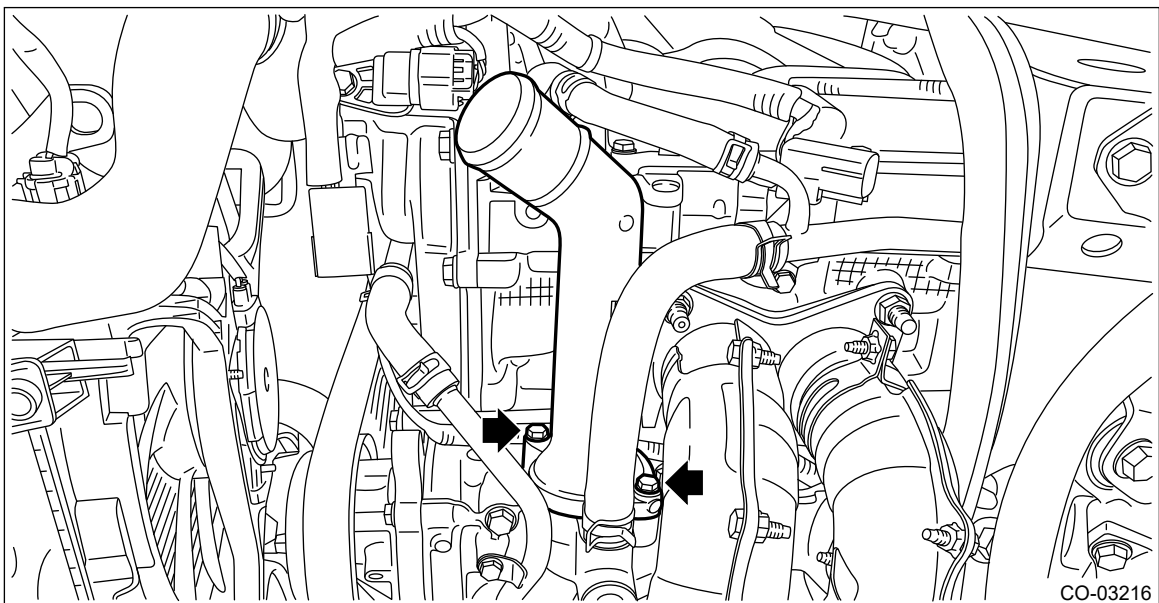
COOLING(H4DOTC) > Thermostat

REMOVAL

1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Drain engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
3. Remove the center exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Center Exhaust Pipe>REMOVAL.](#)
4. Disconnect the radiator outlet hose from thermostat cover.



5. Remove the thermostat cover, and then remove the thermostat.



6. Remove the gasket from thermostat.

COOLING(H4DOTC) > Water Pipe Assembly

INSPECTION

- 1.** Check that the water pipe assembly has no deformation, cracks or other damages.
- 2.** Check that the hose has no cracks, damage or loose part.

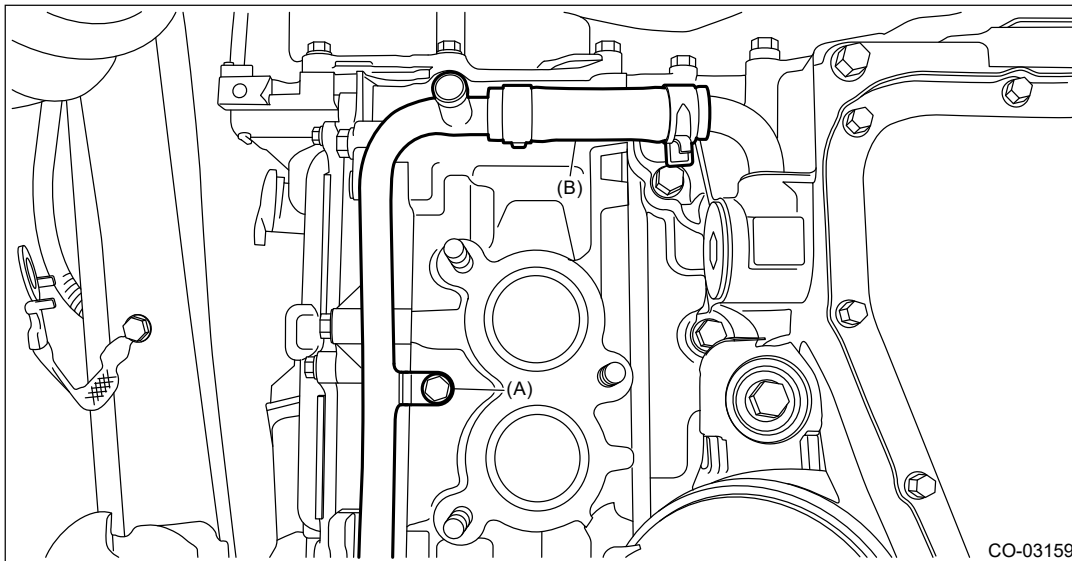
INSTALLATION

1. WATER PIPE ASSEMBLY RH

1. Set the water pipe assembly RH on the engine, and connect the water pipe hose RH (B) to the oil pan upper.
2. Install the bolt (A) which secures the water pipe assembly RH to the cylinder head RH.

Tightening torque:

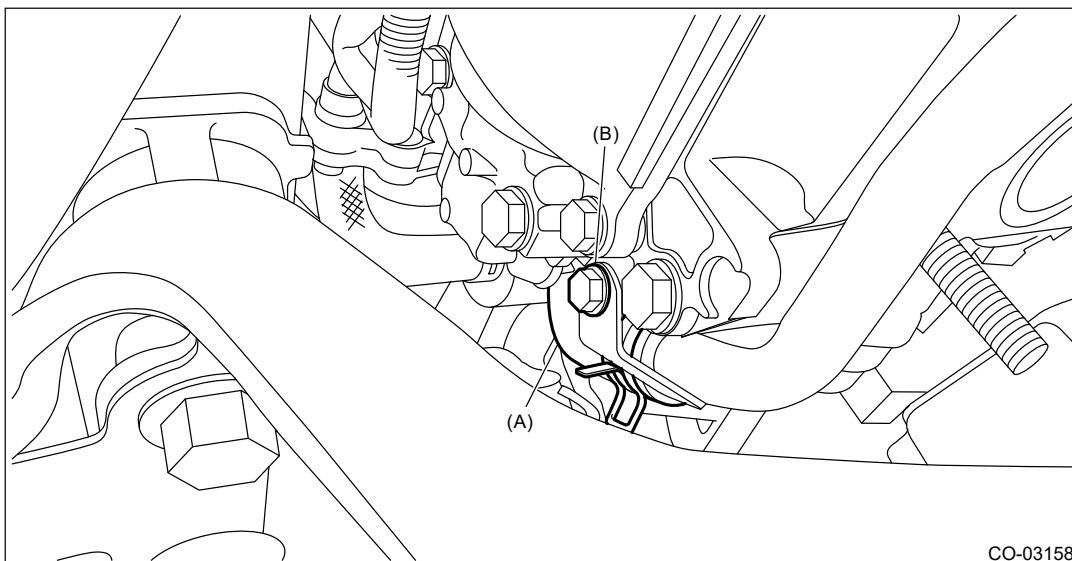
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)







3. Connect the water hose (A) to the water pipe assembly RH, and install the bolt (B) which secures the water pipe assembly RH to the cam carrier RH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



4. Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)
5. Install the oil pipe assembly.  [Ref. to LUBRICATION\(H4DO\)>Oil Pipe>INSTALLATION > OIL PIPE ASSEMBLY.](#)

6. Connect the battery ground terminal.  Ref. to [NOTE>NOTE > BATTERY](#).
7. Fill engine coolant.  Ref. to [COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT](#).

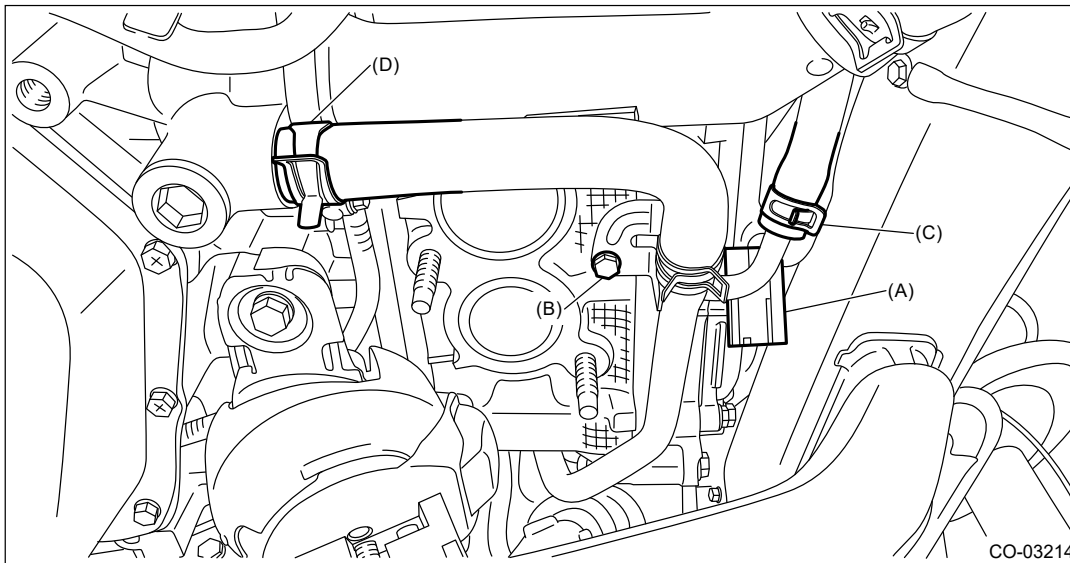
2. WATER PIPE ASSEMBLY LH

1. Set the water pipe assembly LH on the engine, and connect the water pipe hose LH (D) to the oil pan upper.
2. Connect the side engine oil cooler hose B (C) to the water pipe assembly LH.
3. Install the bolt (B) which secures the water pipe assembly LH to the cylinder head LH.

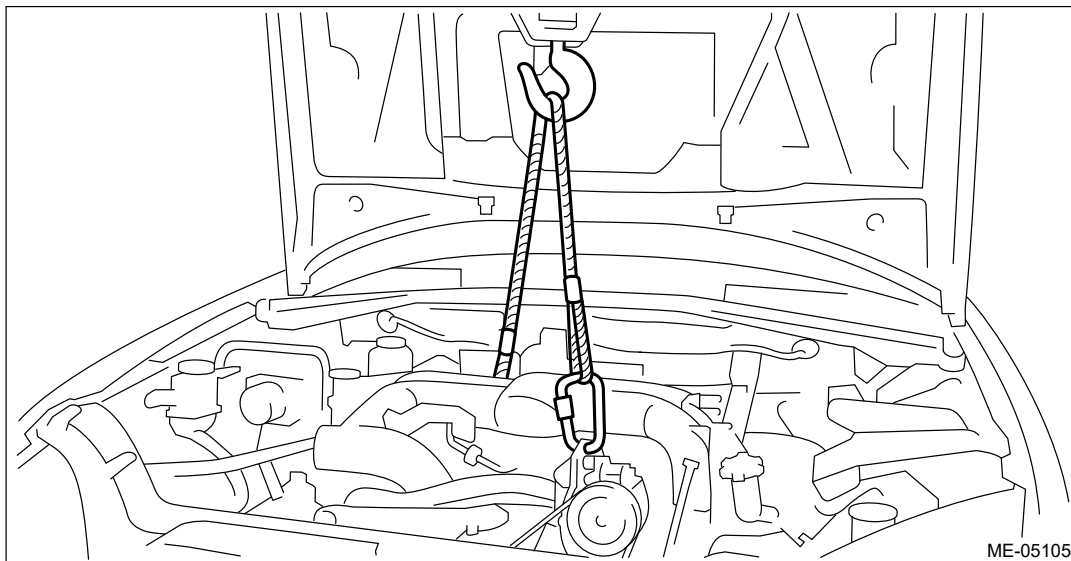
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

4. Install the rear oxygen sensor connector (A) to the water pipe assembly LH.



5. Lower the vehicle.
6. Support the engine with a lifting device and wire ropes.

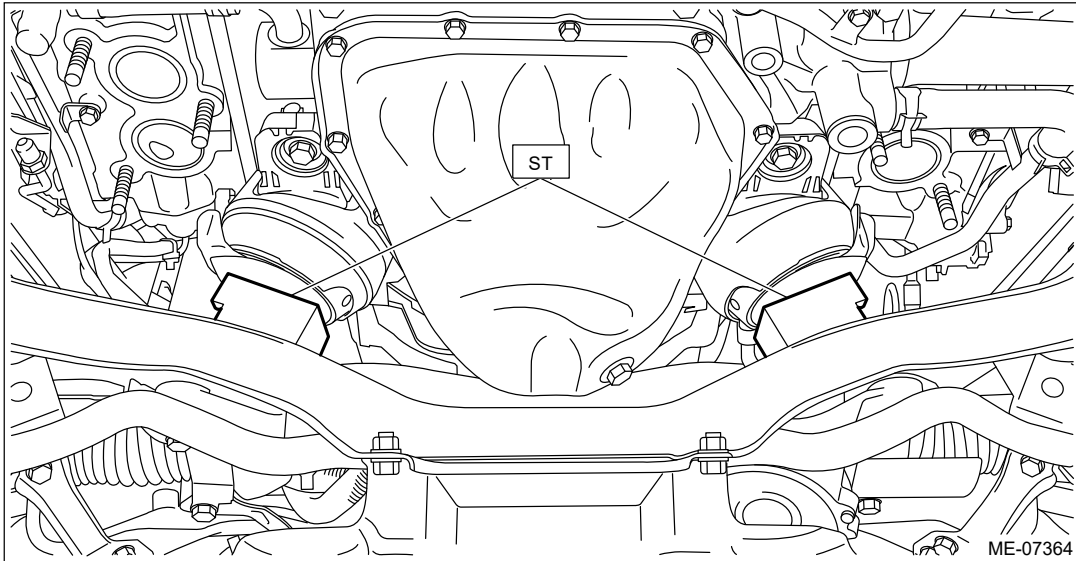


7. Lift the engine, and remove the ST.

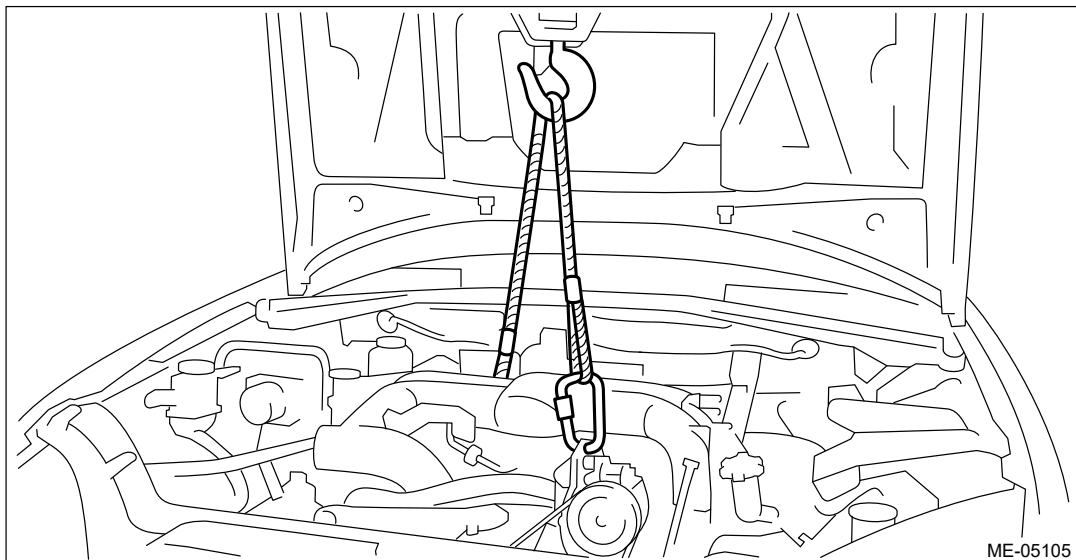
Caution:

When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.

ST 18632AA020 STAND ASSY



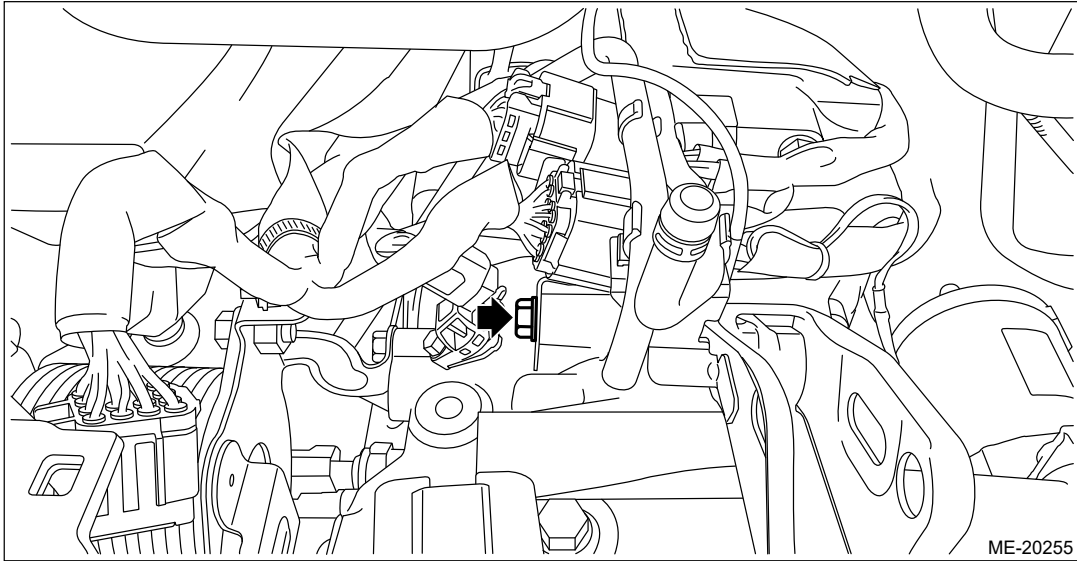
- 8.** Lower the engine and remove the lifting device and wire ropes.



- 9.** Install the bolt which secures the transmission harness stay to the CVT.

Tightening torque:

16 N·m (1.6 kgf-m, 11.8 ft-lb)

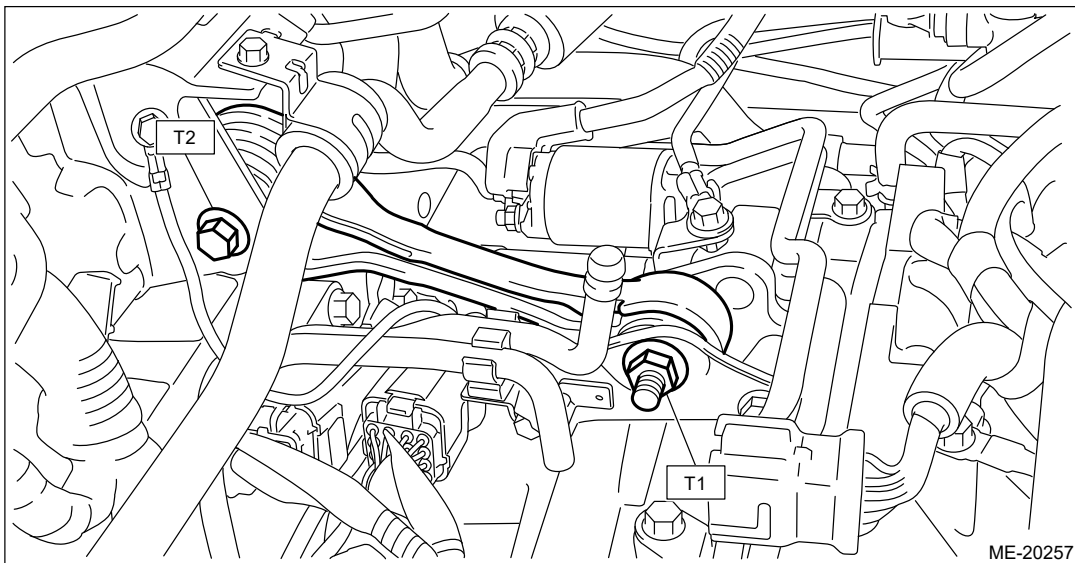


10. Install the pitching stopper.

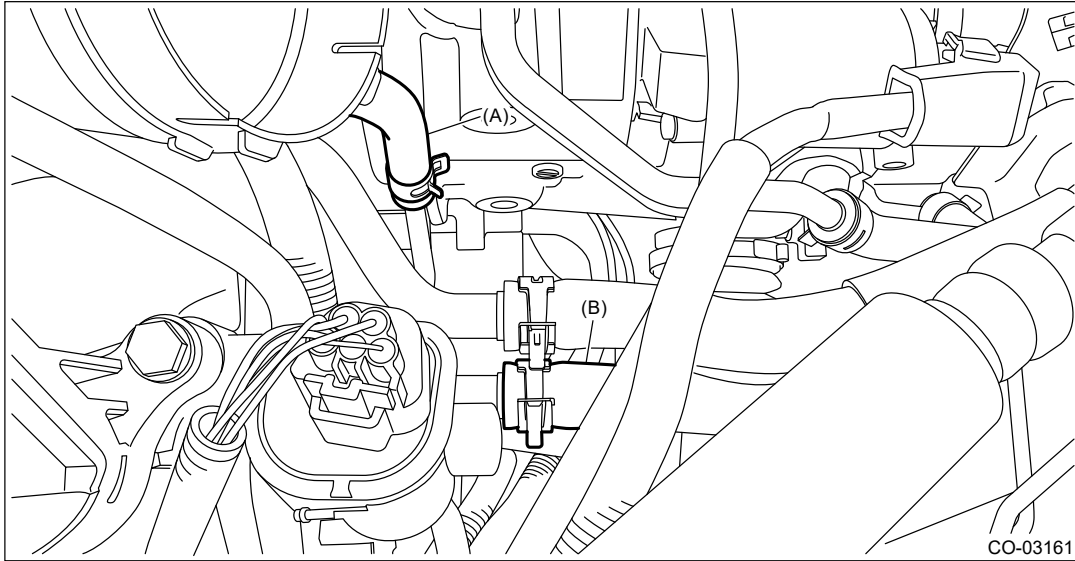
Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



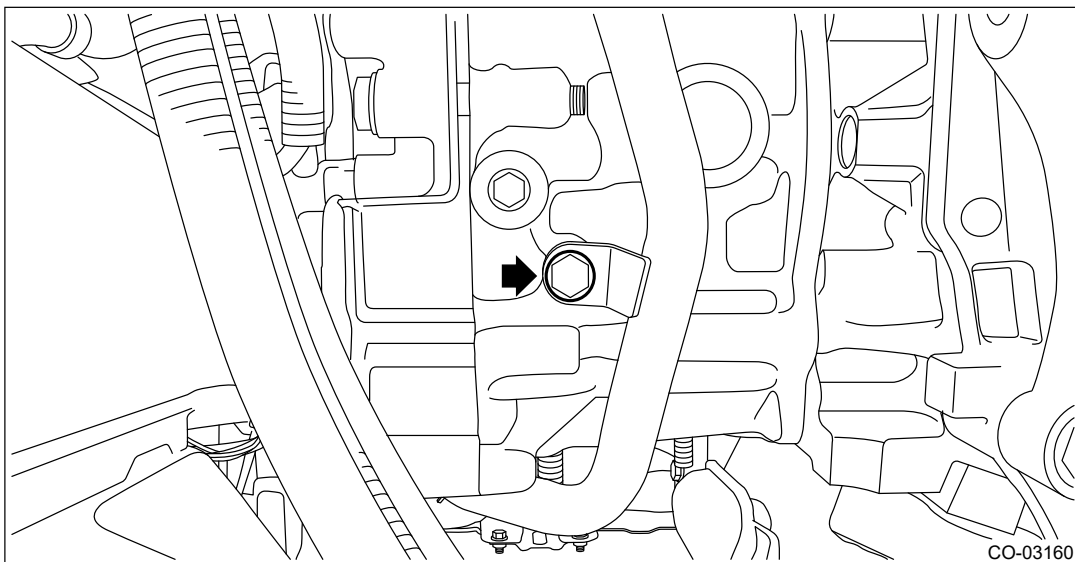
11. Connect the preheater hose (A) and the heater outlet hose (B) to the water pipe assembly LH.



- 12.** Install the bolt which secures the water pipe assembly LH to the cylinder head LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



- 13.** Install the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>INSTALLATION.](#)

- 14.** Lift up the vehicle.

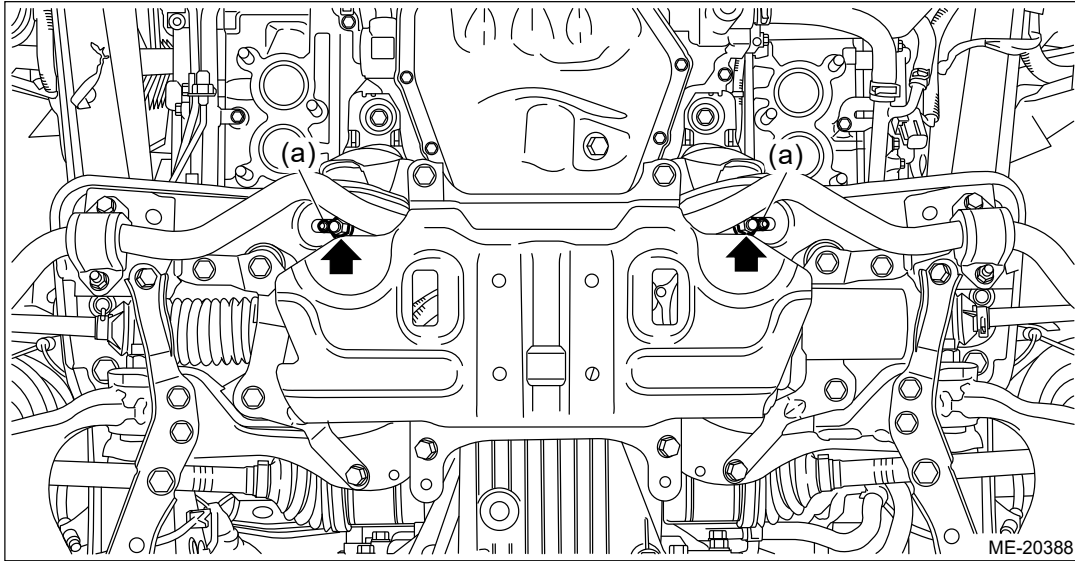
- 15.** Install the nuts which hold the engine mounting to the front crossmember.

Note:

- **Make sure that locators (a) of the engine mounting are securely inserted.**
- **Use a new nut.**

Tightening torque:

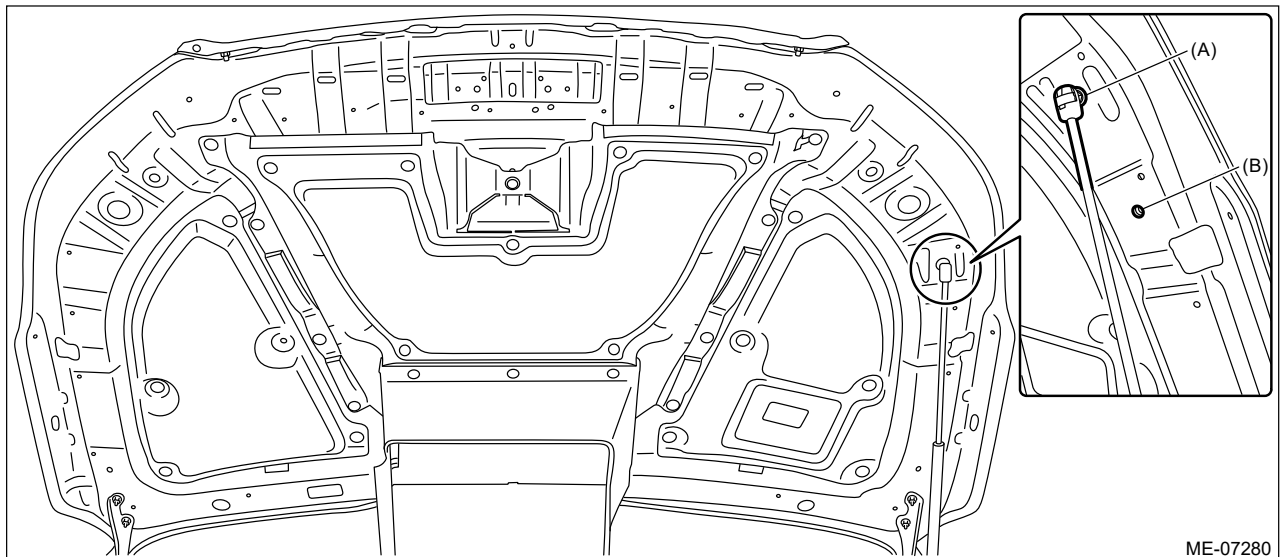
60 N·m (6.1 kgf-m, 44.3 ft-lb)



16. Install the front exhaust pipe. [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)
17. Install the air intake duct (rear). [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
18. Connect the battery ground terminal. [Ref. to NOTE>NOTE > BATTERY.](#)
19. Fill engine coolant. [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
20. Install the collector cover.
21. Change the installation position of the front hood damper from (B) to (A).

Tightening torque:

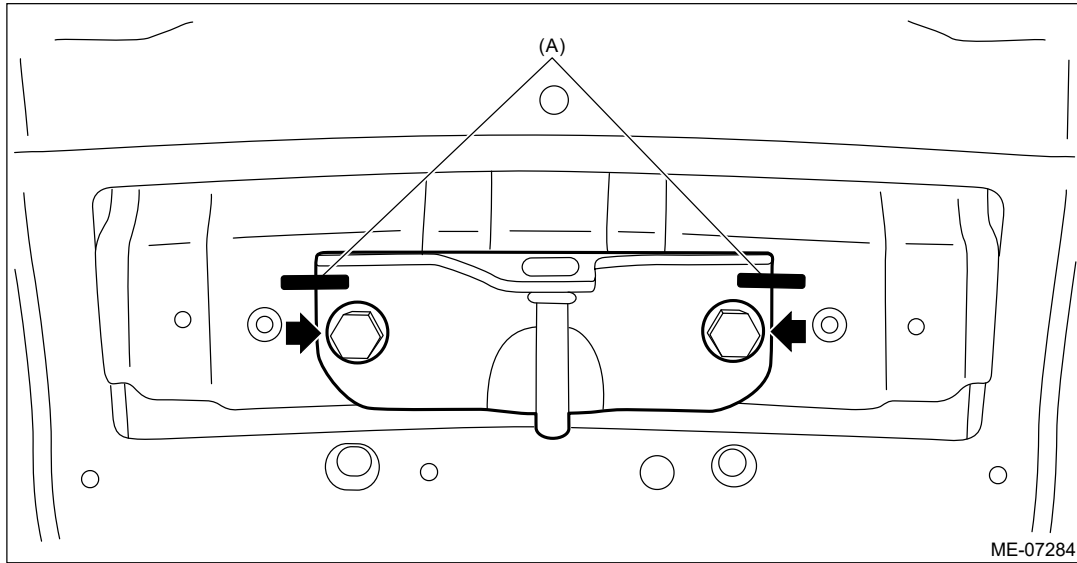
20 N·m (2.0 kgf-m, 14.8 ft-lb)




22. Align the alignment marks (A), and install the front hood striker to the front hood.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)







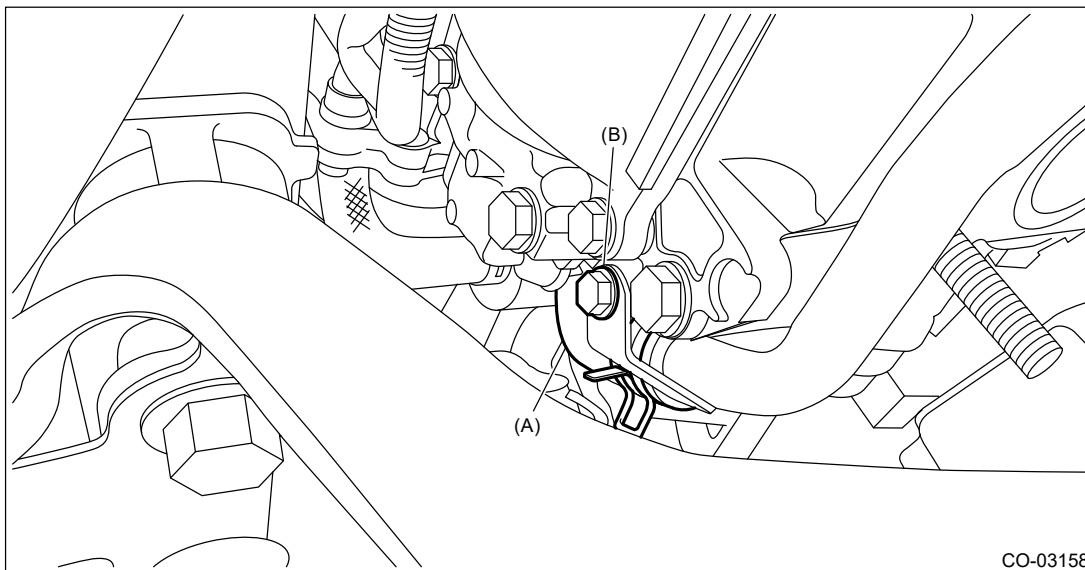
23. Install the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>INSTALLATION.](#)

COOLING(H4DOTC) > Water Pipe Assembly

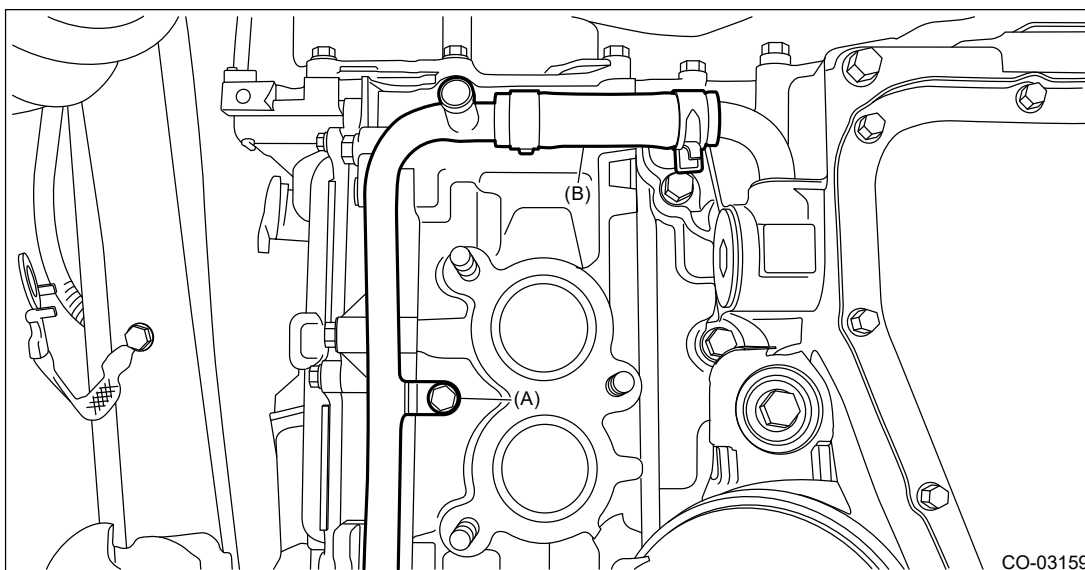
REMOVAL

1. WATER PIPE ASSEMBLY RH


1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Drain engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
3. Remove the oil pipe assembly.  [Ref. to LUBRICATION\(H4DO\)>Oil Pipe>REMOVAL > OIL PIPE ASSEMBLY.](#)
4. Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>REMOVAL.](#)
5. Disconnect the water hose (A) from the water pipe assembly RH, and remove the bolt (B) securing the water pipe assembly RH to the cam carrier RH.

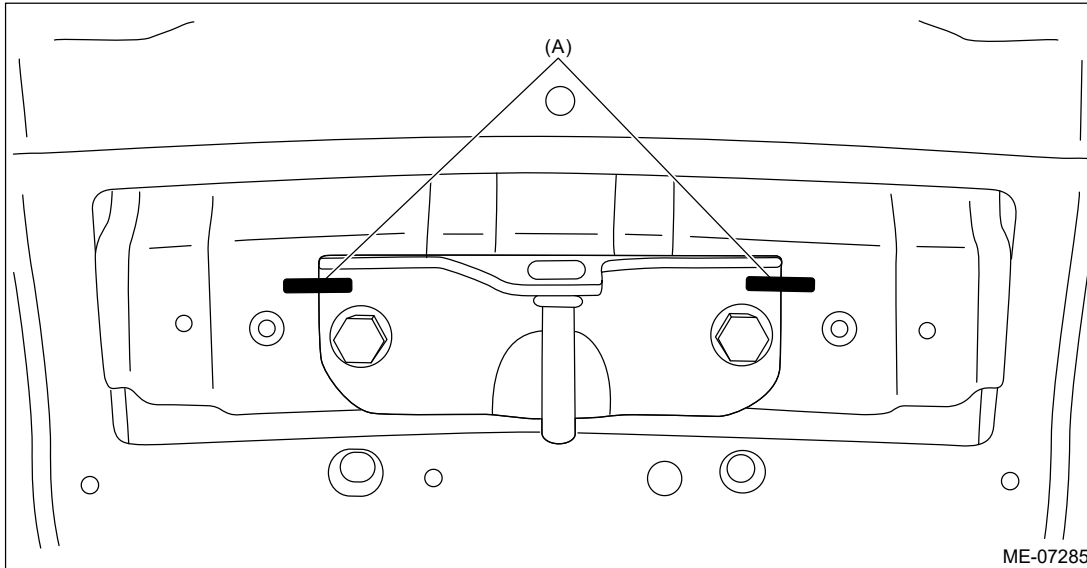


6. Remove the bolt (A) which secures the water pipe assembly RH to the cylinder head RH.
7. Disconnect the water pipe hose RH (B) from oil pan upper, and remove the water pipe assembly RH.

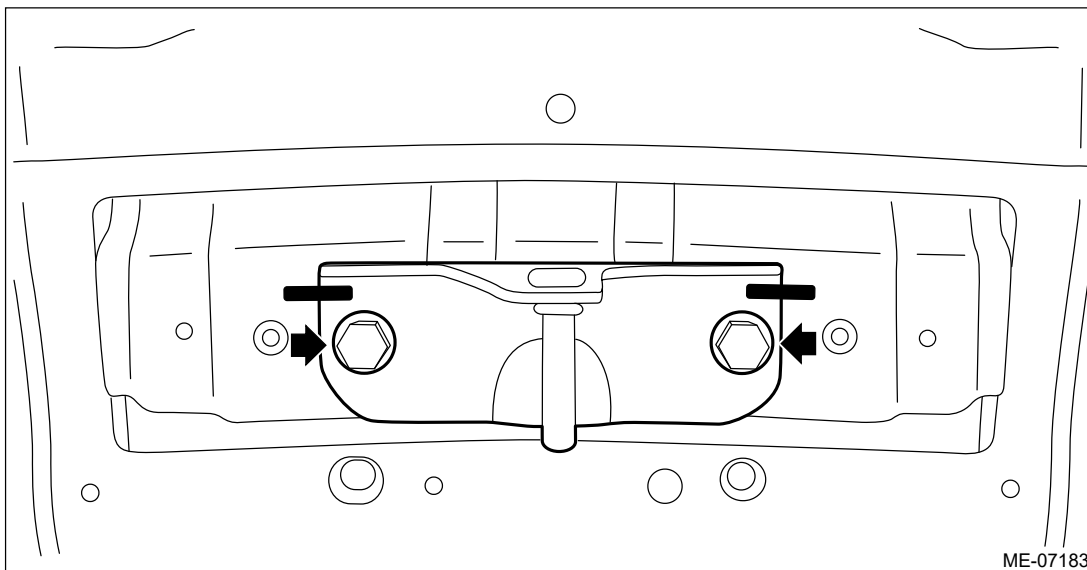


2. WATER PIPE ASSEMBLY LH

1. Remove the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>REMOVAL > FRONT GRILLE UPPER.](#)
2. Using a marker pen, make alignment marks (A) on both the front hood and the front hood striker.



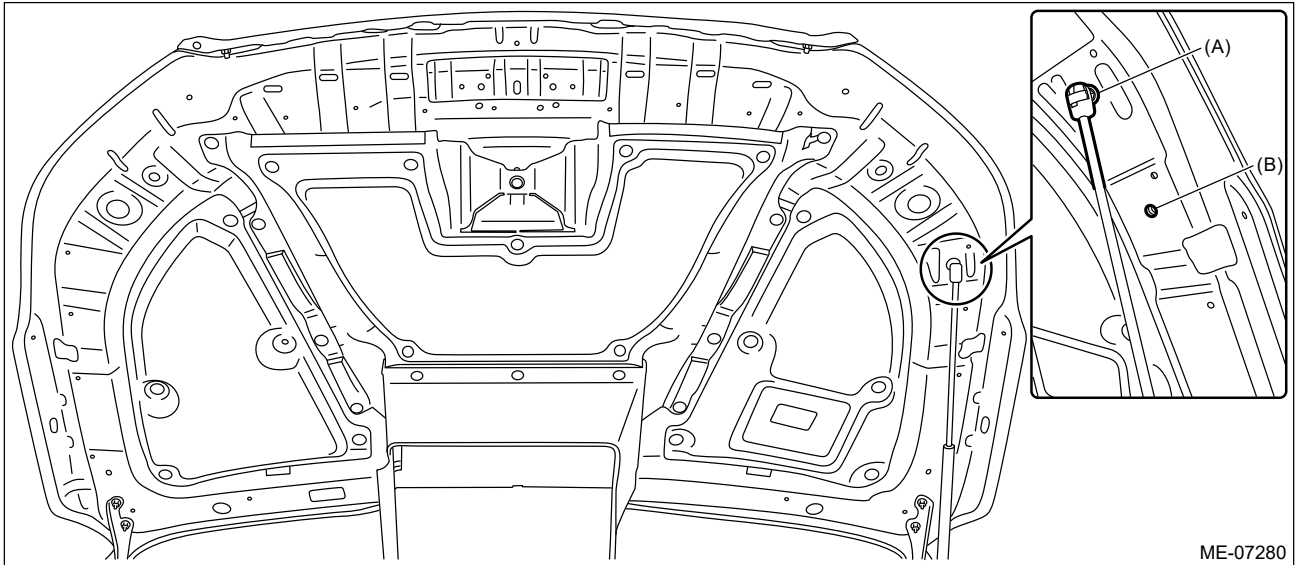
3. Remove the front hood striker from the front hood.



4. Change the front hood damper mounting position from (A) to (B), and completely open the front hood.

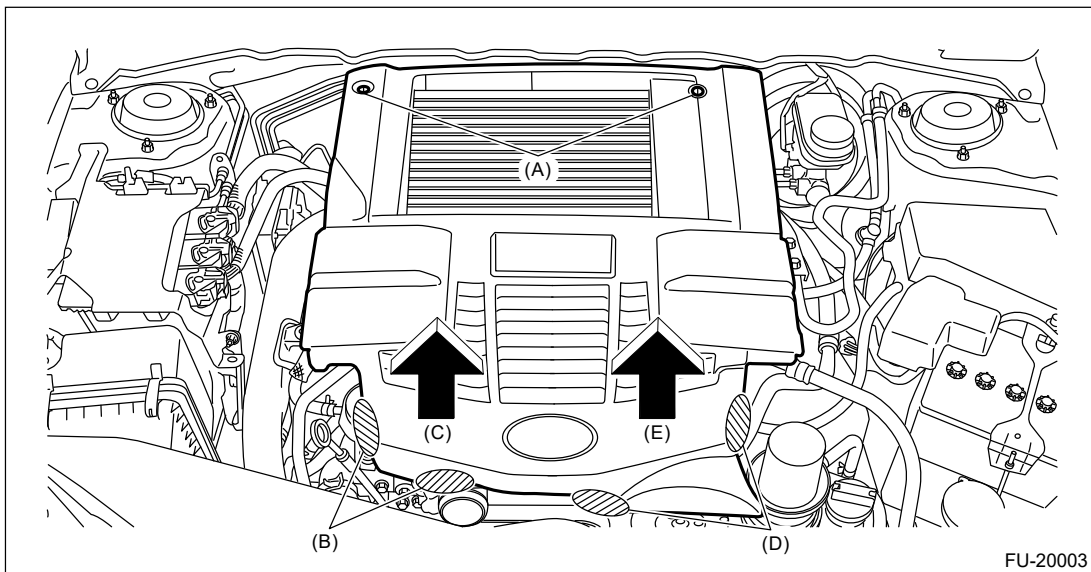
Tightening torque:





20 N·m (2.0 kgf-m, 14.8 ft-lb)

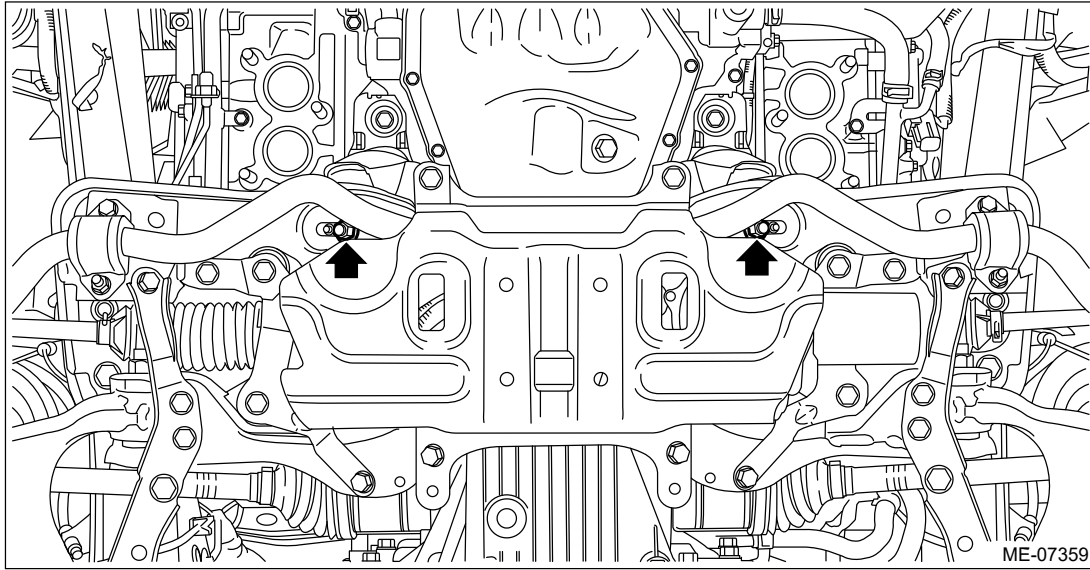



5. Remove the collector cover.

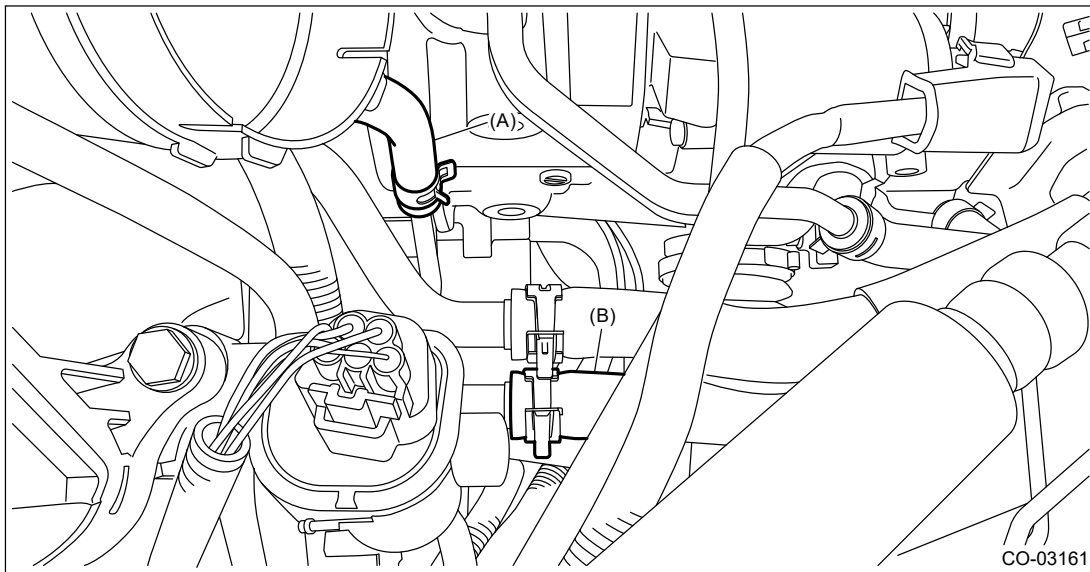
- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



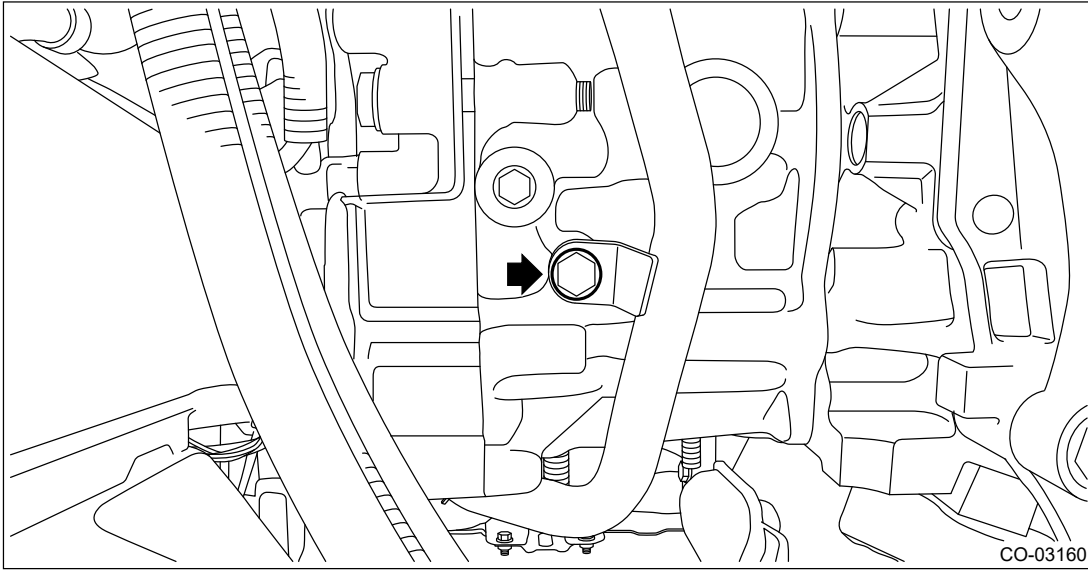
- 6.** Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 7.** Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
- 8.** Drain engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
- 9.** Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>REMOVAL.](#)
- 10.** Remove the nuts which secure the engine mounting to the front crossmember.



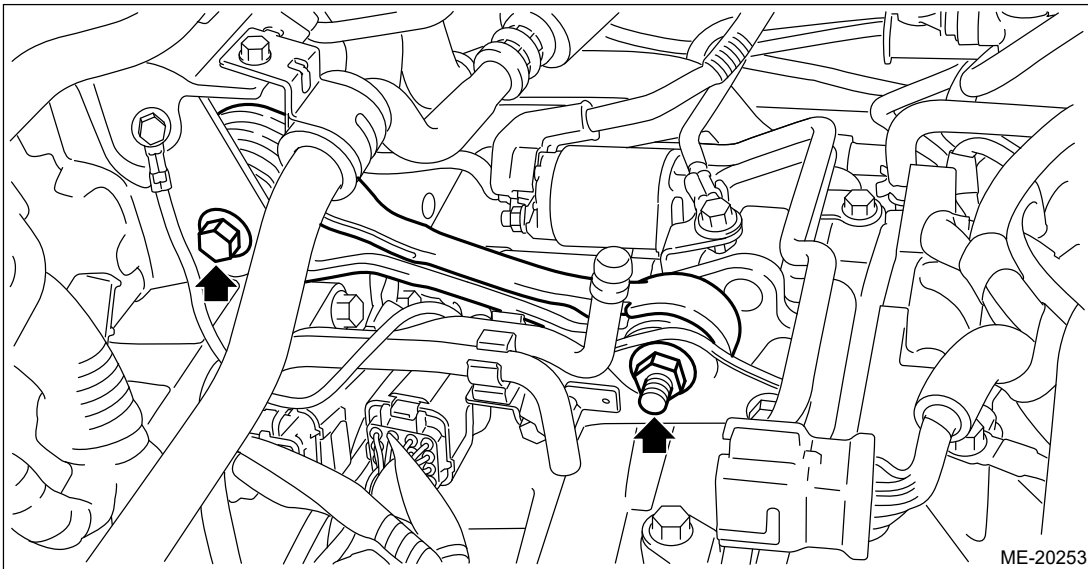
- 11.** Lower the vehicle.
- 12.** Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
- 13.** Disconnect the preheater hose (A) and the heater outlet hose (B) from the water pipe assembly LH.



- 14.** Remove the bolt which holds the water pipe assembly LH from the cylinder head LH.



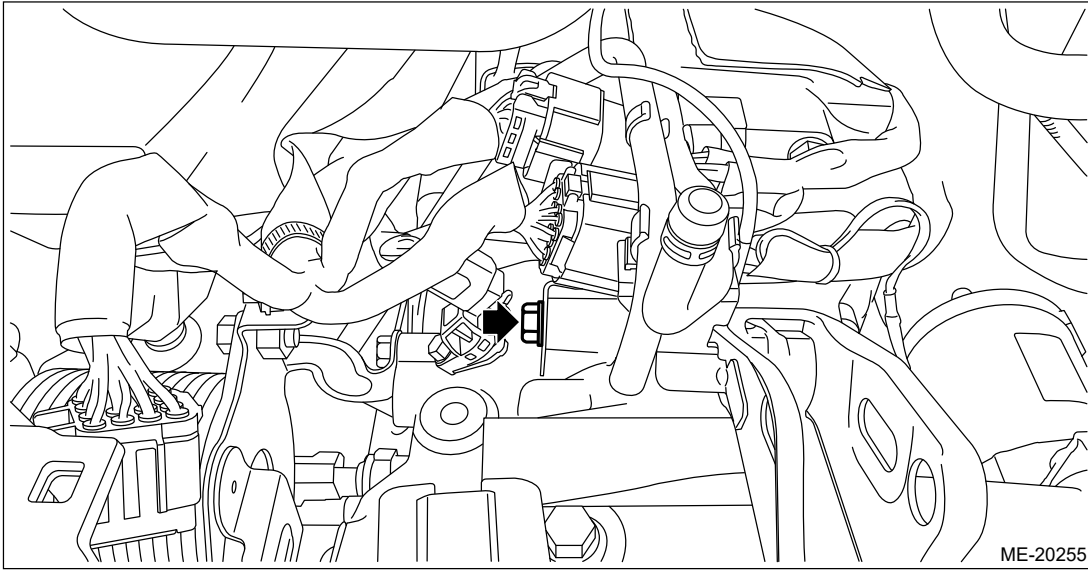
15. Remove the pitching stopper.



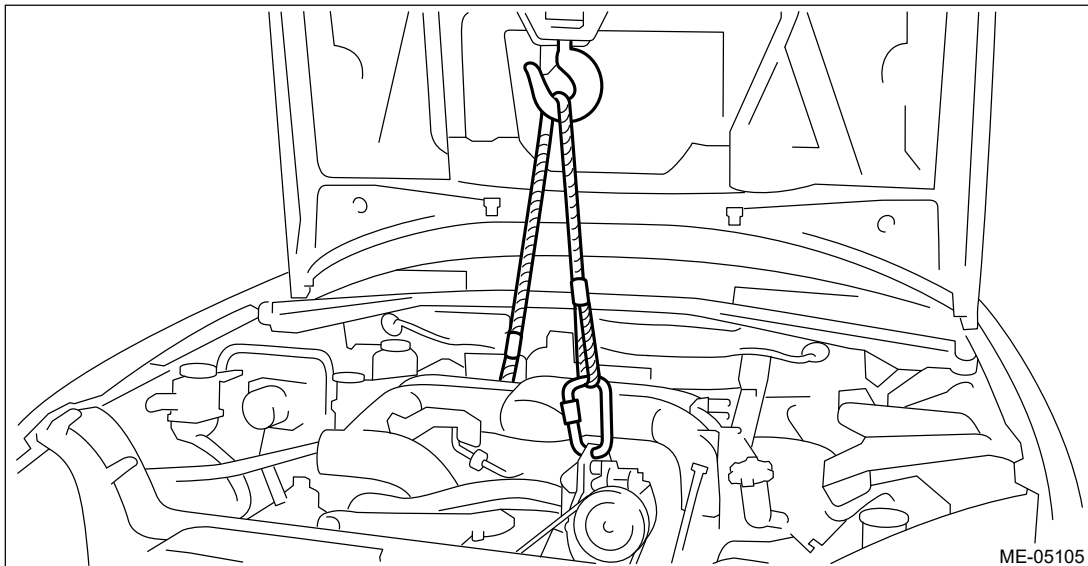
16. Remove the bolt securing the transmission harness stay to the CVT.

Note:

This procedure is required to prevent the transmission connector from touching the A/C pressure hose during engine lift-up.



- 17.** Support the engine with a lifting device and wire ropes.



- 18.** Lift the engine high enough until the stud bolt of the engine mount is drawn out of the front crossmember.

Caution:

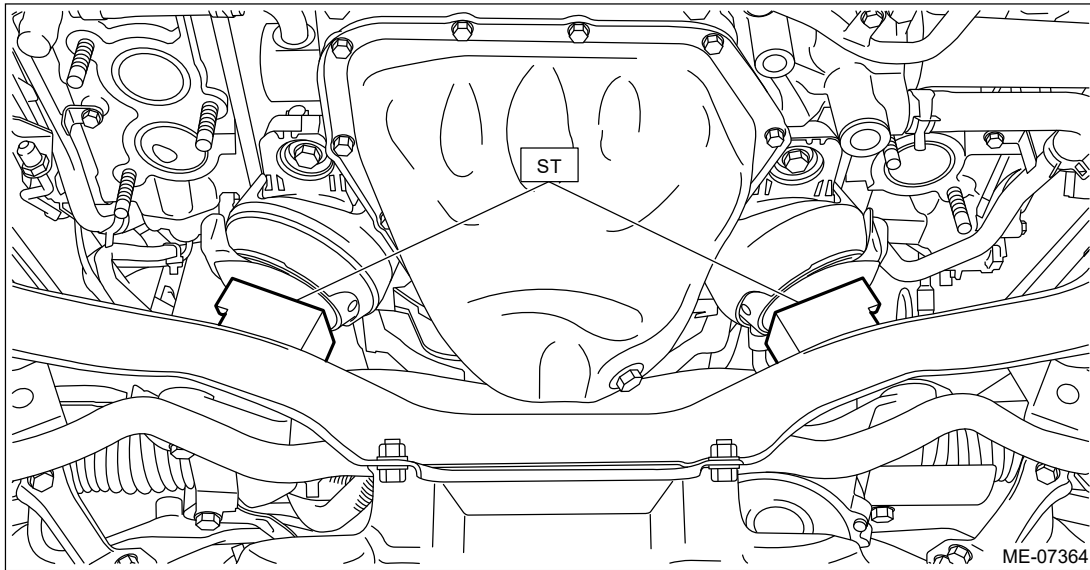
When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.

- 19.** Set the ST between the engine mount and front crossmember, and slowly lower the engine.

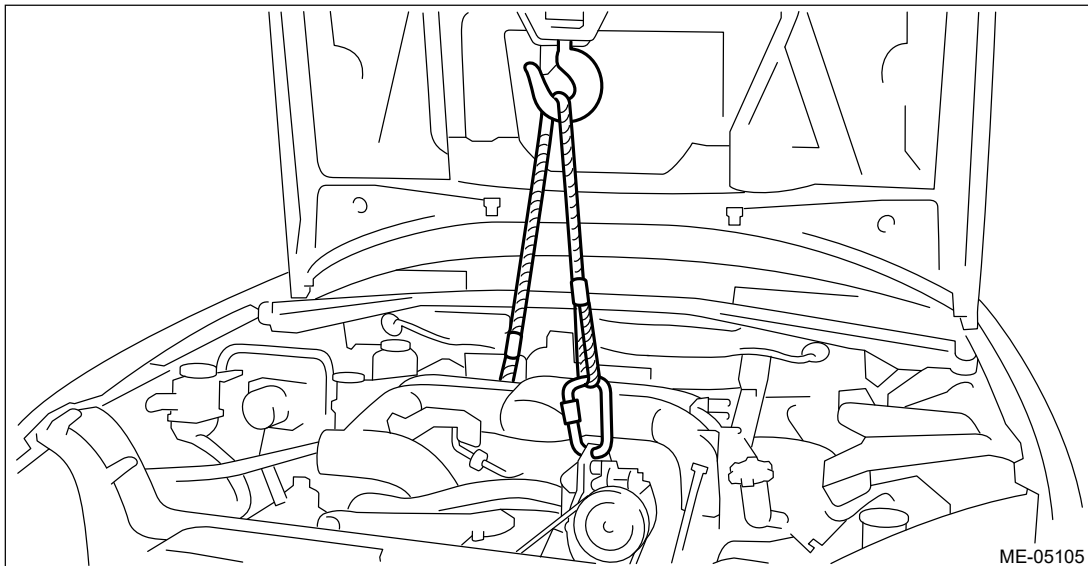
Caution:

After the engine is lowered, rock the engine to make sure that the ST is securely installed.

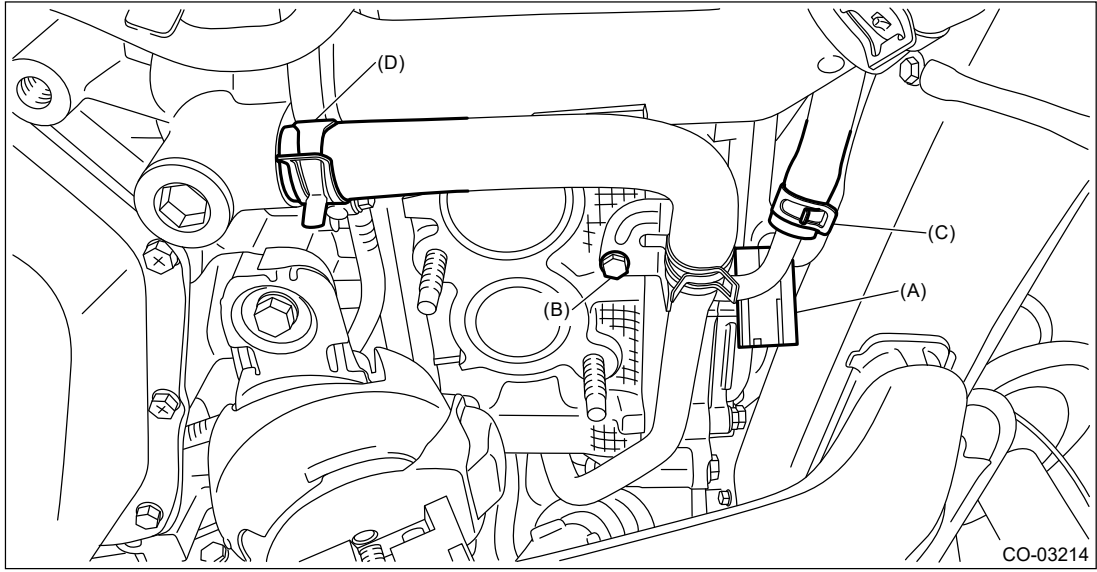
ST 18632AA020 STAND ASSY



20. Remove the lifting device and wire ropes.



- 21.** Lift up the vehicle.
- 22.** Remove the rear oxygen sensor connector (A) from the water pipe assembly LH.
- 23.** Remove the bolt (B) which secures the water pipe assembly LH to the cylinder head LH.
- 24.** Disconnect the side engine oil cooler hose B (C) from the water pipe assembly LH.
- 25.** Disconnect the water pipe hose LH (D) from oil pan upper, and remove the water pipe assembly LH.



CO-03214

COOLING(H4DOTC) > Water Pump

INSPECTION

- 1.** Check that the water pump pulley does not have deformation, cracks and any other damage.
- 2.** Check the water pump bearing for smooth rotation.
- 3.** Make sure the impeller is not abnormally deformed or damaged.

COOLING(H4DOTC) > Water Pump

INSTALLATION

1. WATER PUMP PULLEY

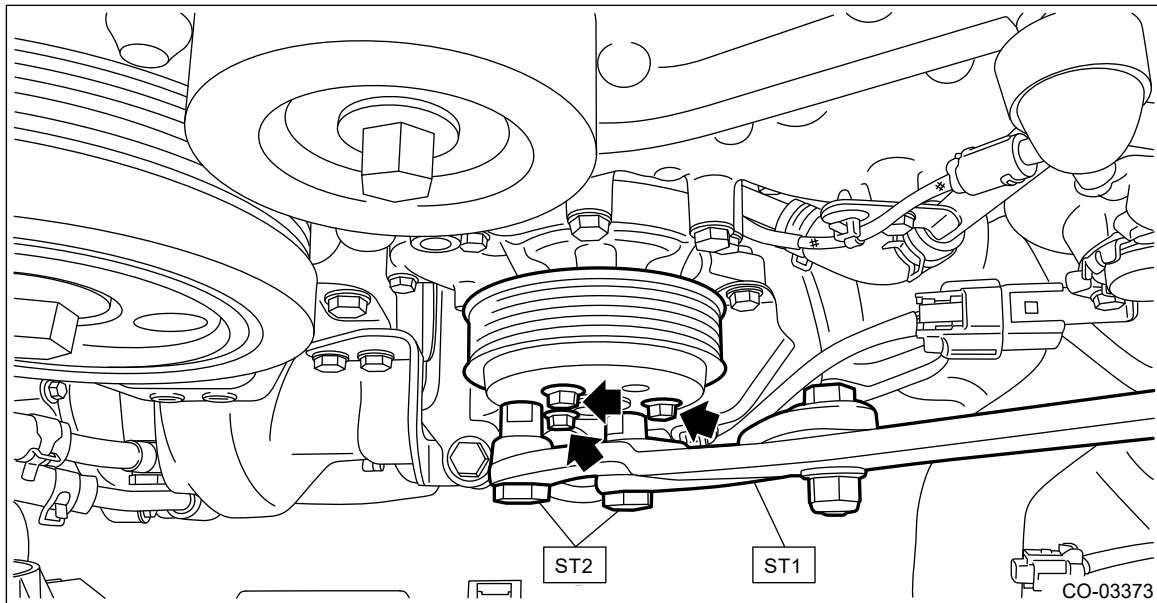
1. Using the ST, install the water pump pulley.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA030 PULLEY WRENCH PIN SET

Tightening torque:

14 N•m (1.4 kgf-m, 10.3 ft-lb)



2. Install the V-belts.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>INSTALLATION.](#)

2. WATER PUMP

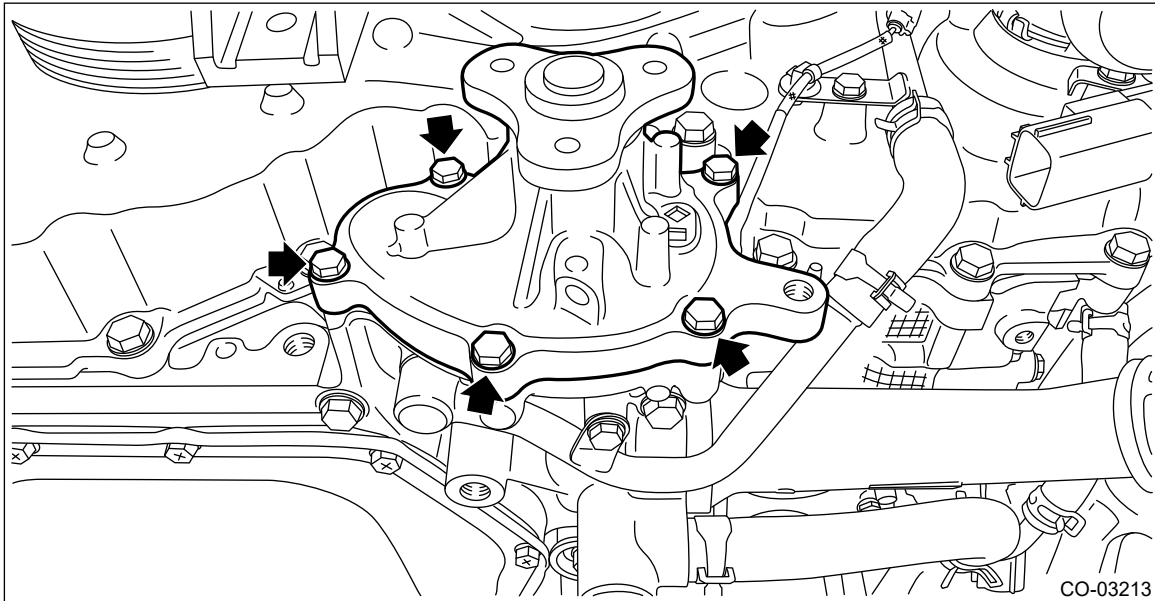
1. Install the water pump to oil pan upper.





Note:

Use a new gasket.

Tightening torque:

6.4 N•m (0.7 kgf-m, 4.7 ft-lb)




2. Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)
3. Install the water pump pulley.  [Ref. to COOLING\(H4DOTC\)>Water Pump>INSTALLATION > WATER PUMP PULLEY.](#)
4. Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
5. Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

COOLING(H4DOTC) > Water Pump

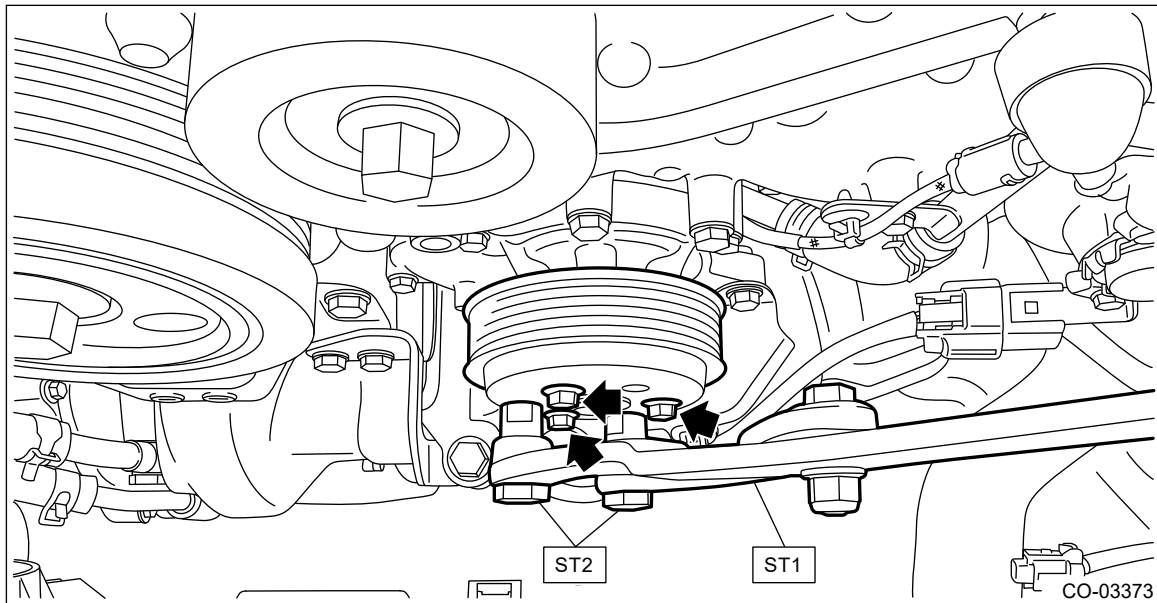
REMOVAL

1. WATER PUMP PULLEY





1. Remove the V-belts.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>REMOVAL.](#)
2. Remove the water pump pulley using the ST.

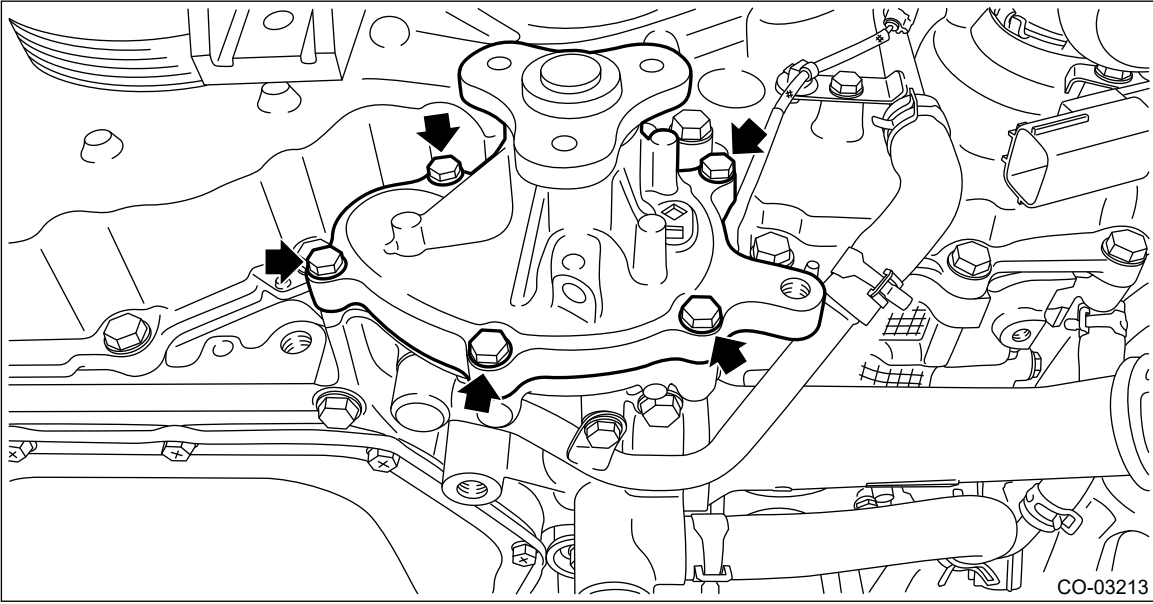
ST1 18355AA000 PULLEY WRENCH

ST2 18334AA030 PULLEY WRENCH PIN SET



2. WATER PUMP

1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the water pump pulley.  [Ref. to COOLING\(H4DOTC\)>Water Pump>REMOVAL > WATER PUMP PULLEY.](#)
3. Drain engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
4. Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>REMOVAL.](#)
5. Remove the water pump from the oil pan upper.



CO-03213

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Canister

INSPECTION

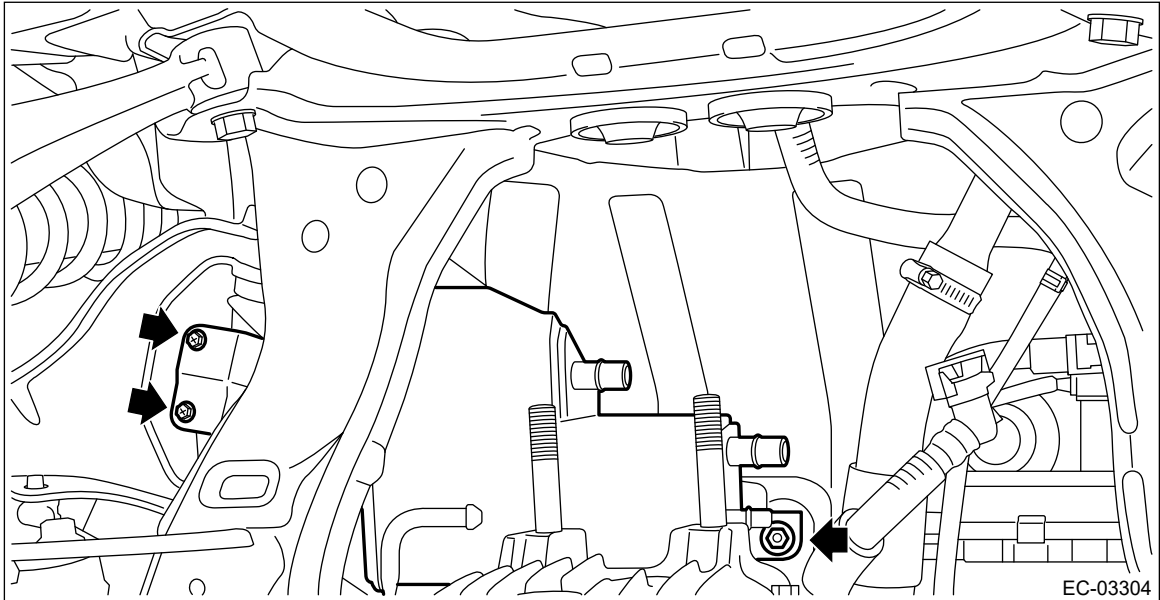
- 1.** Check that the canister has no deformation, cracks or other damages.
- 2.** Check that the tube has no cracks, damage or loose part.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Canister INSTALLATION

1. Install the canister to the vehicle.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



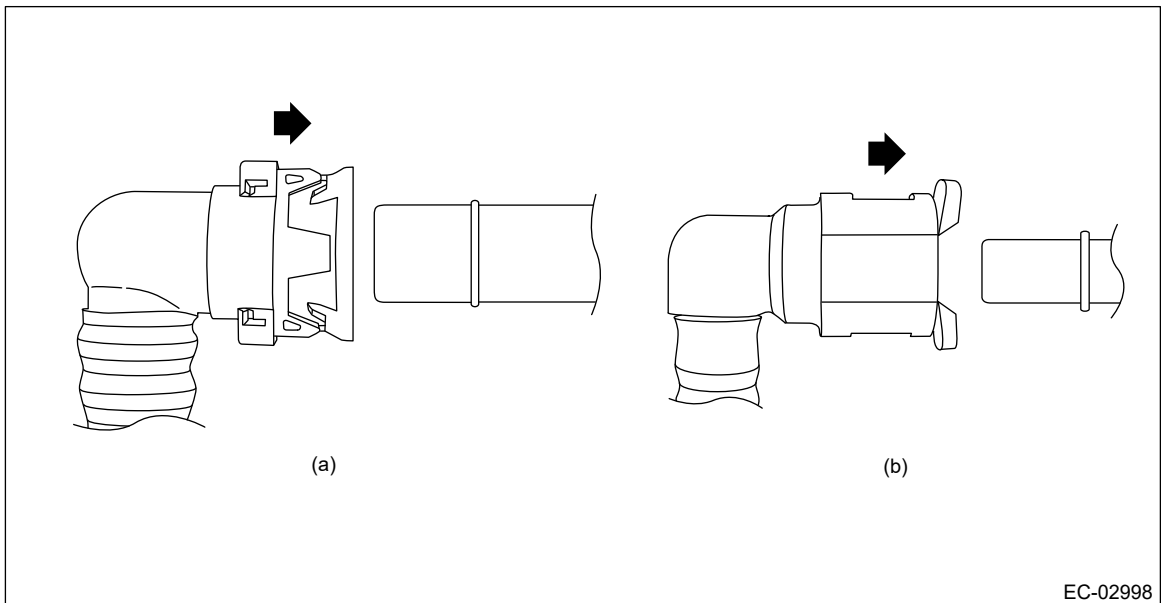
2. Install the drain tube (A), vent tube (B) and purge tube (C) to the canister.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

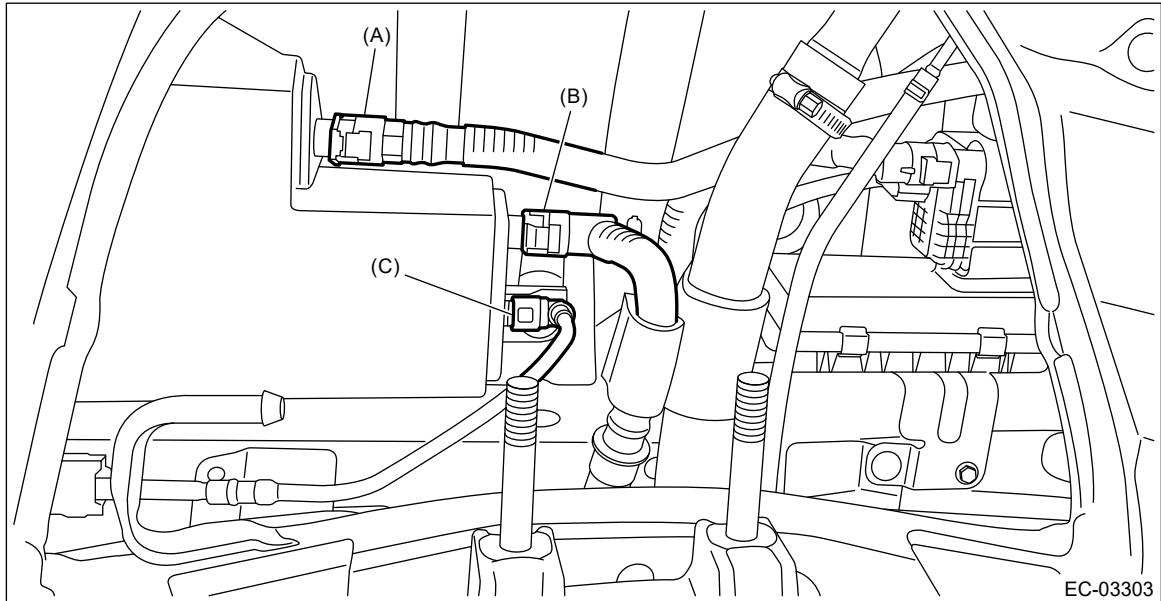
Note:

Install the quick connector as shown in the figure.



(a) Drain tube and vent tube

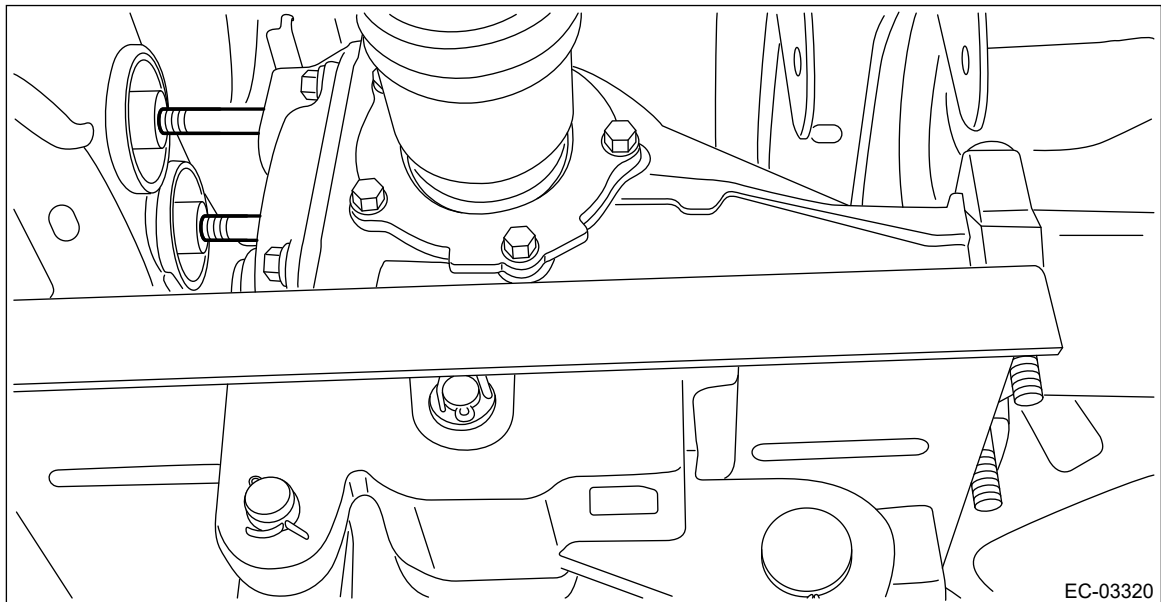
(b) Purge tube



3. Lift up the transmission jack gradually, and set the rear differential to the rear sub frame assembly.

Note:

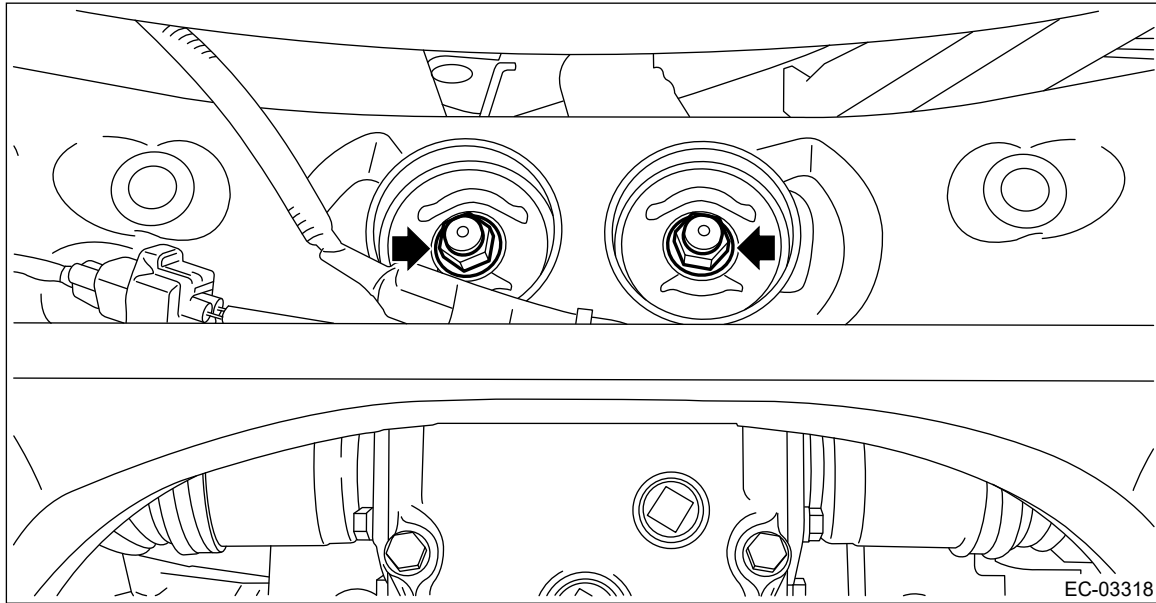
When inserting the stud bolt into the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.



4. Temporarily tighten the self-locking nuts which hold the rear differential to the rear sub frame assembly.

Note:

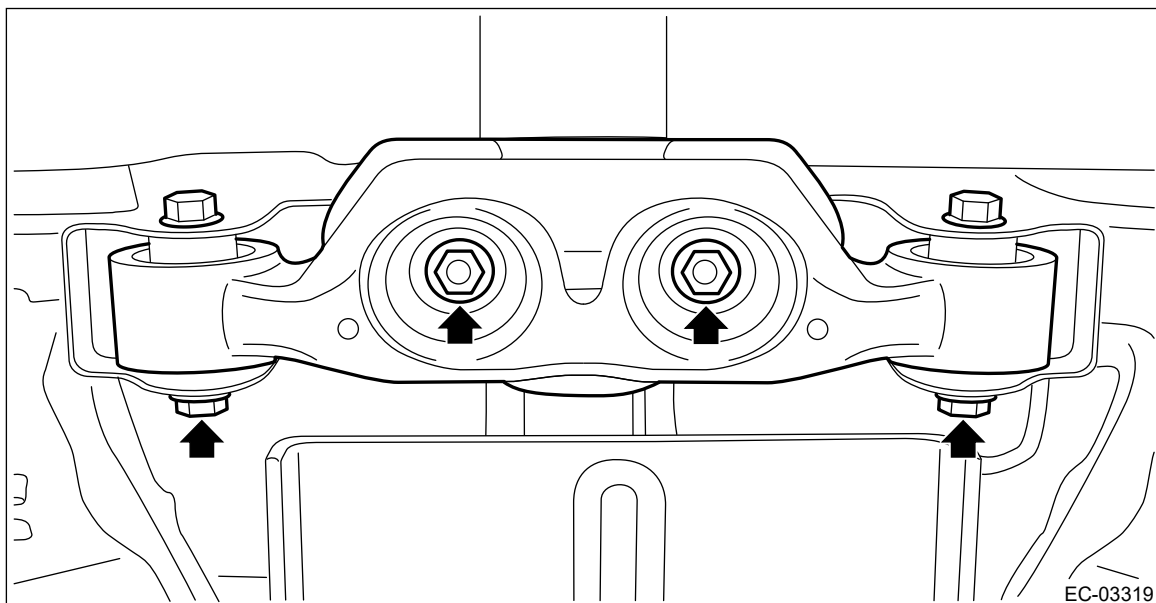
Use a new self-locking nut.



5. Set the rear differential member to the rear sub frame assembly and rear differential, and temporarily tighten the self-lock nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Note:

Use a new self-locking nut.

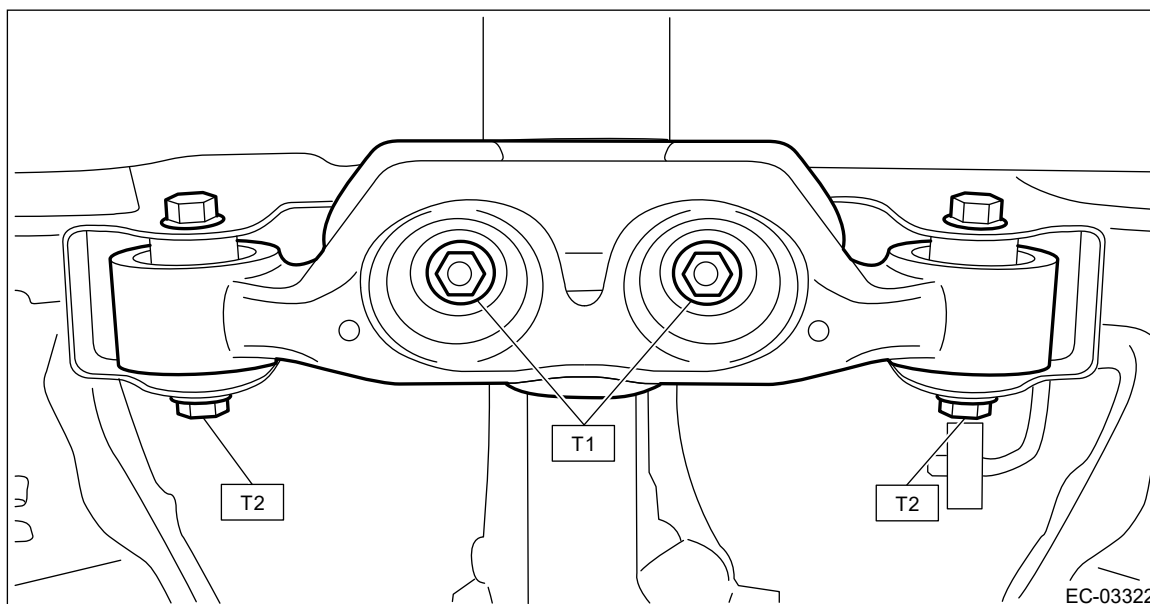


6. Remove the transmission jack from the rear differential.
7. Tighten the self-locking nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

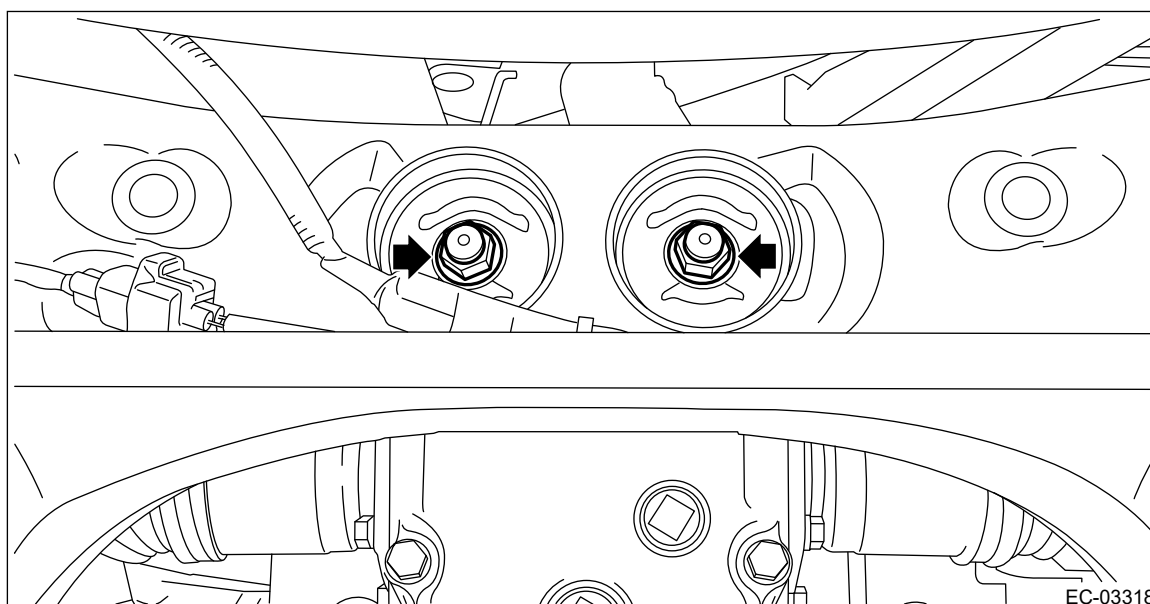
T2: 110 N·m (11.2 kgf-m, 81.1 ft-lb)





- 8.** Tighten the self-locking nuts which secure the rear differential to the rear sub frame assembly.

Tightening torque:

70 N·m (7.1 kgf-m, 51.6 ft-lb)

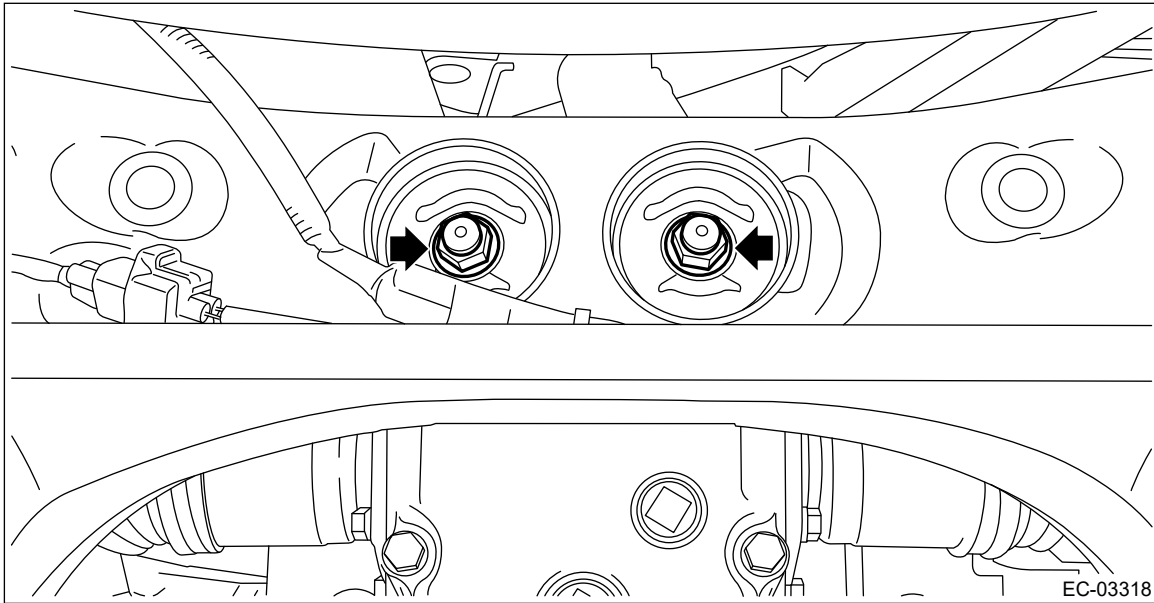


- 9.** Install the propeller shaft.  [Ref. to DRIVE SHAFT SYSTEM>Propeller Shaft>INSTALLATION.](#)
- 10.** Install the rear exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Rear Exhaust Pipe>INSTALLATION.](#)
- 11.** Lower the vehicle.

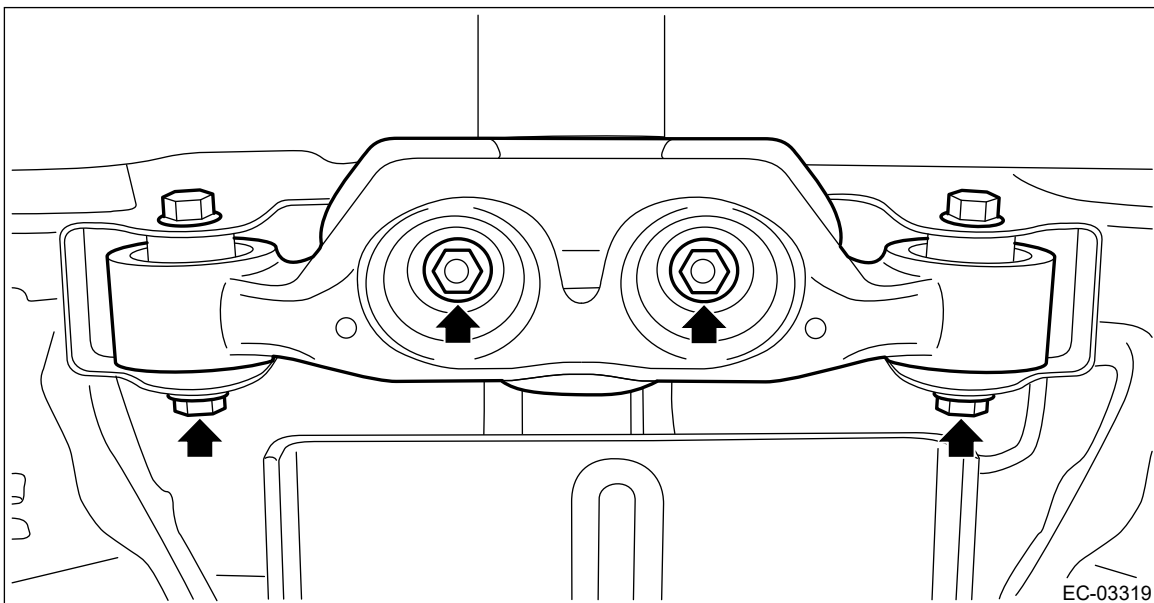
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Canister

REMOVAL

1. Lift up the vehicle.
2. Remove the rear exhaust pipe. [🔧 Ref. to EXHAUST\(H4DO\)>Rear Exhaust Pipe>REMOVAL.](#)
3. Remove the propeller shaft. [🔧 Ref. to DRIVE SHAFT SYSTEM>Propeller Shaft>REMOVAL.](#)
4. Support the rear differential with the transmission jack.
5. Remove the self-locking nuts which hold the rear differential to the rear sub frame assembly.



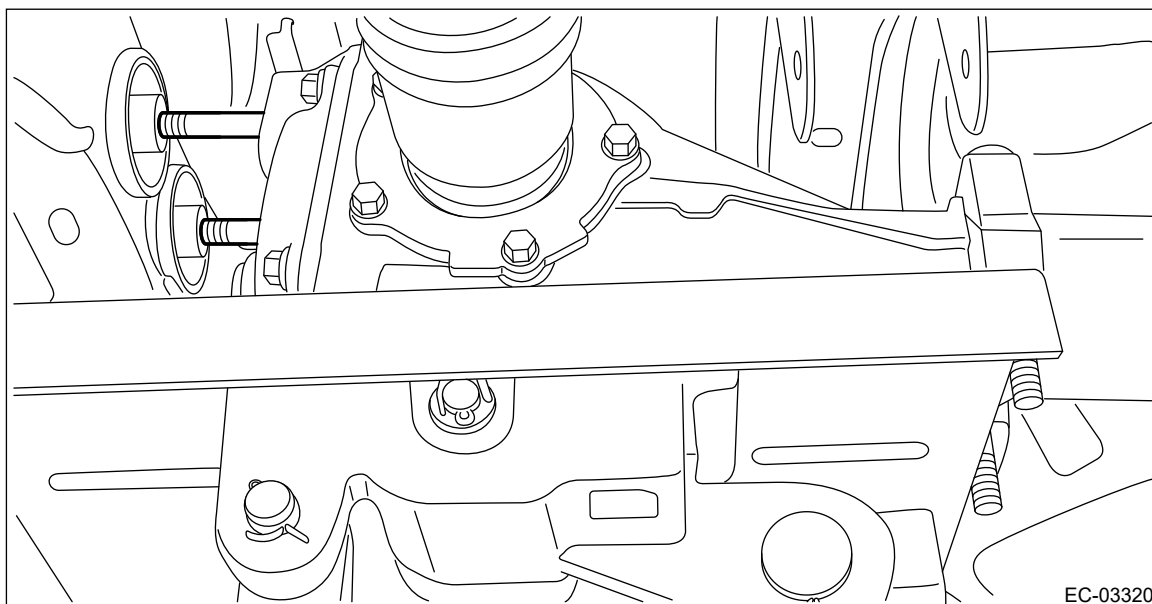
6. Remove the rear differential member from the rear sub frame assembly and the rear differential.



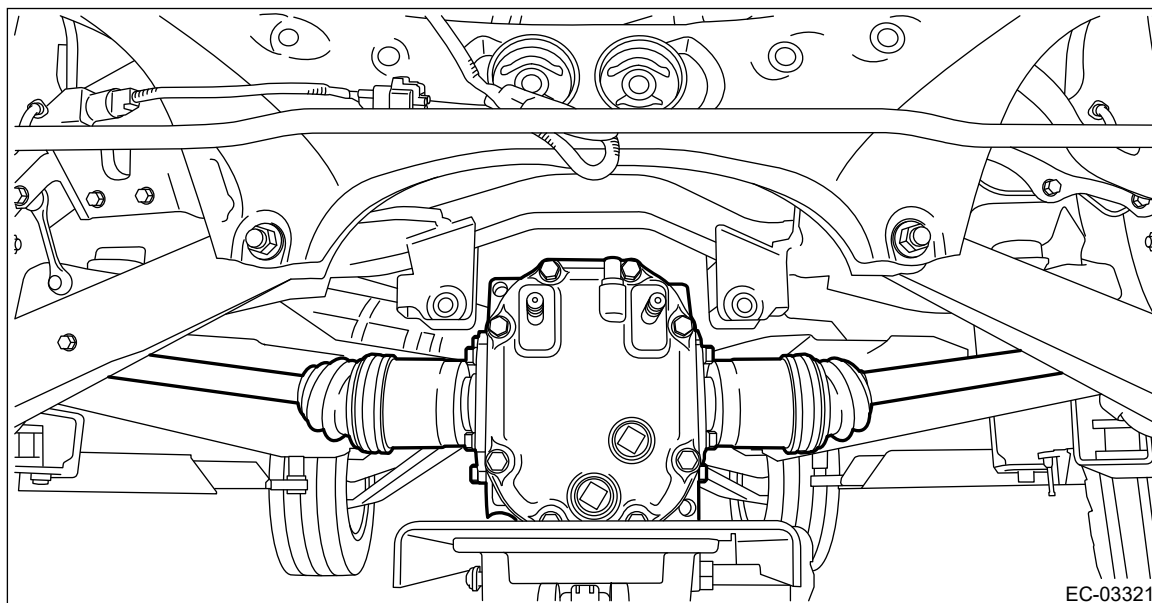
7. Lower the transmission jack gradually until the rear differential is at the position shown in the figure.

Note:

- When pulling out the stud bolt from the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.



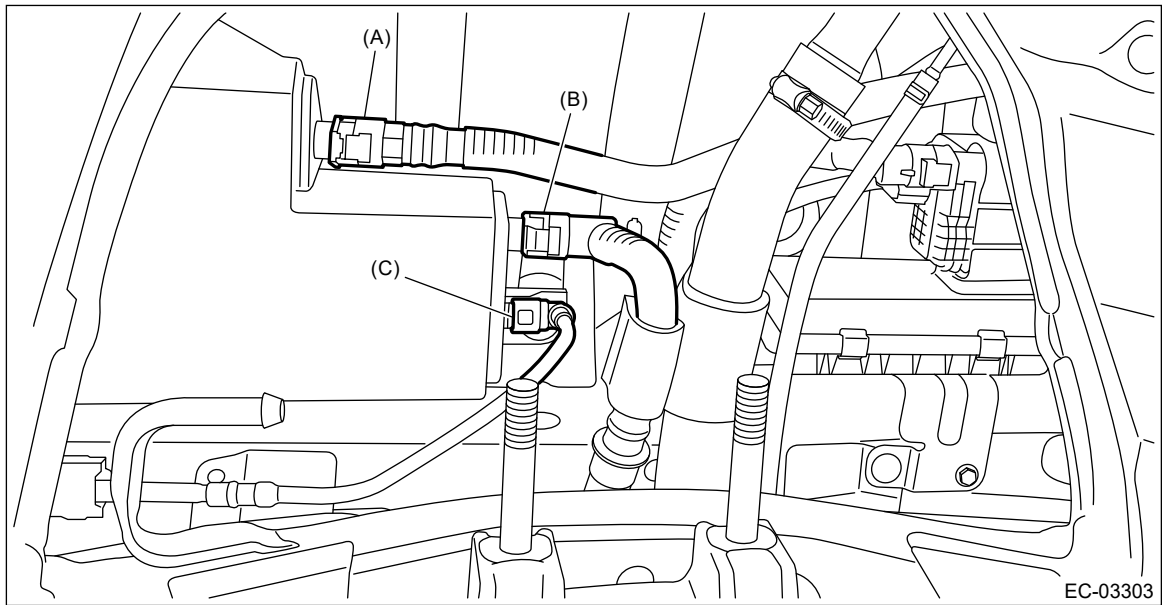
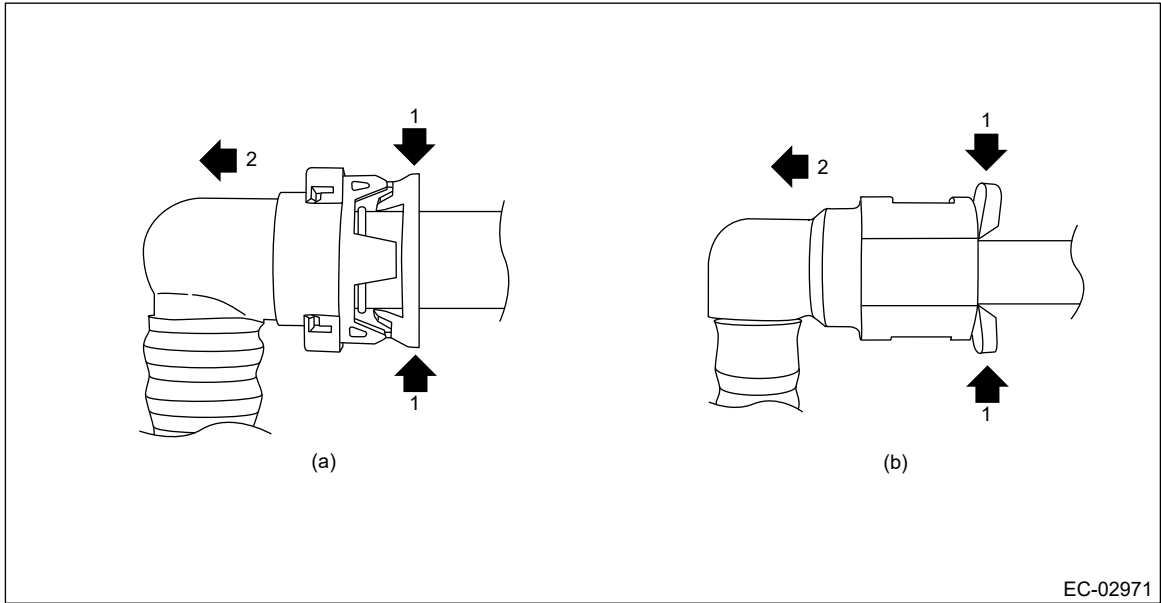
- Do not lower the rear differential excessively. Doing so may add extra load to the drive shaft or cause the falling-off of the drive shaft.



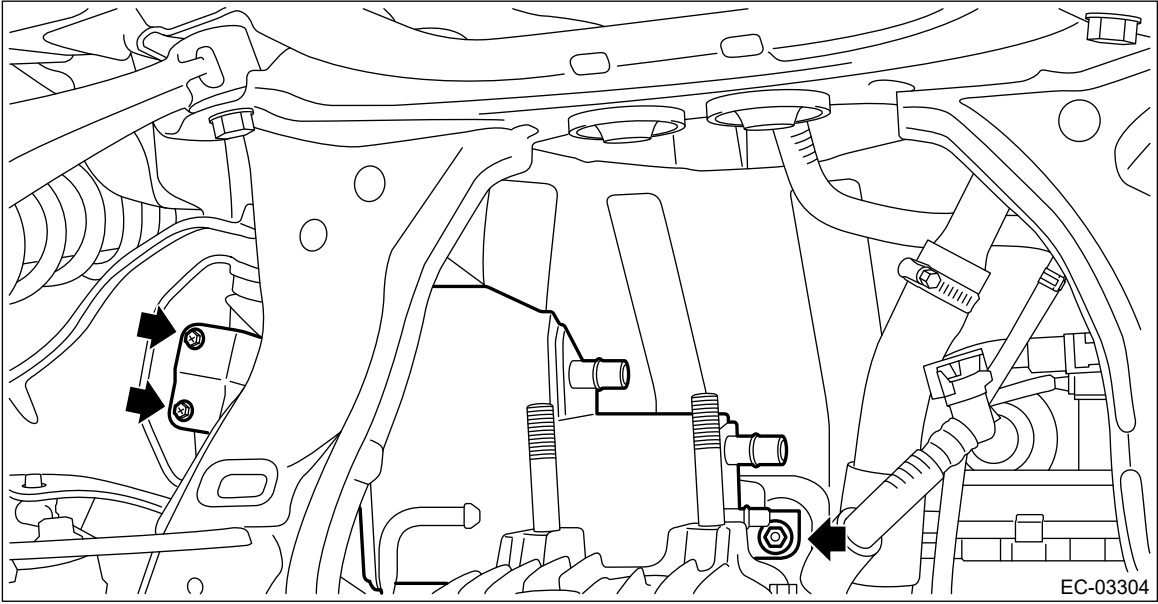
8. Disconnect the drain tube (A), vent tube (B) and purge tube (C) from the canister.

Note:

Disconnect the quick connector as shown in the figure.





9. Remove the canister from vehicle.



EC-03304

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Drain Filter

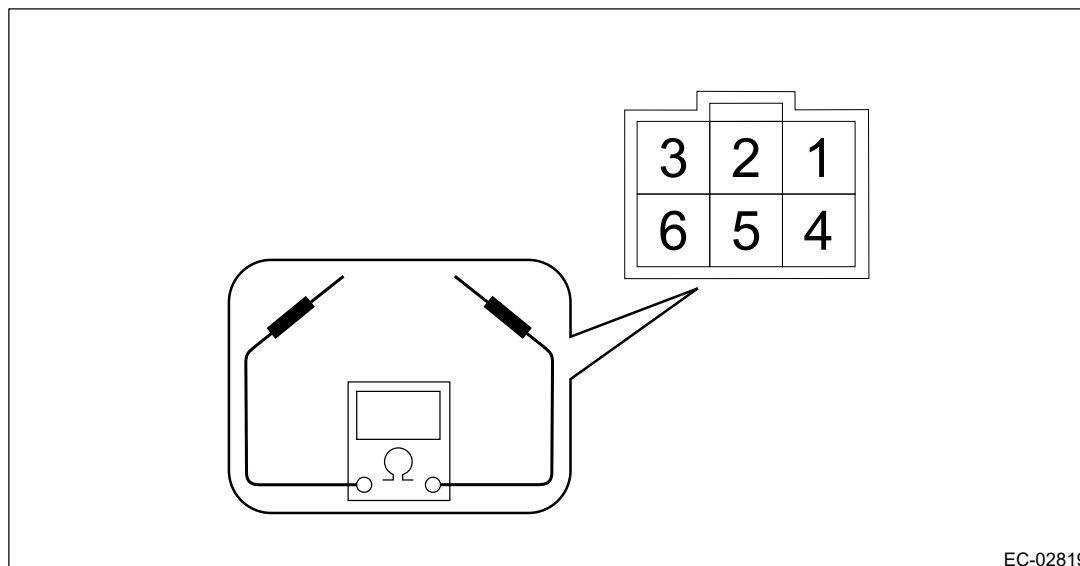
SPECIFICATION

The leak check valve assembly is a non-disassembled part. Do not remove the drain filter from the leak check valve assembly. Refer to "Leak Check Valve Assembly" for removal and installation procedures.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DO\)>Leak Check Valve Assembly>REMOVAL.](#)  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DO\)>Leak Check Valve Assembly>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > EGR Control Valve

INSPECTION

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



| Terminal No. | Standard |
|--------------|----------|
| 2 and 1 | 22±2 Ω |
| 2 and 3 | 22±2 Ω |
| 5 and 4 | 22±2 Ω |
| 5 and 6 | 22±2 Ω |

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > EGR Control Valve INSTALLATION

1. Install the EGR pipe adapter to the EGR control valve.

Note:

Use a new gasket.

Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)

2. Install the EGR control valve to the intake manifold assembly, and connect the connector to the EGR control valve.

Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)

3. Install the bolts securing the EGR cooler to the EGR control valve.

Note:

Use a new gasket.

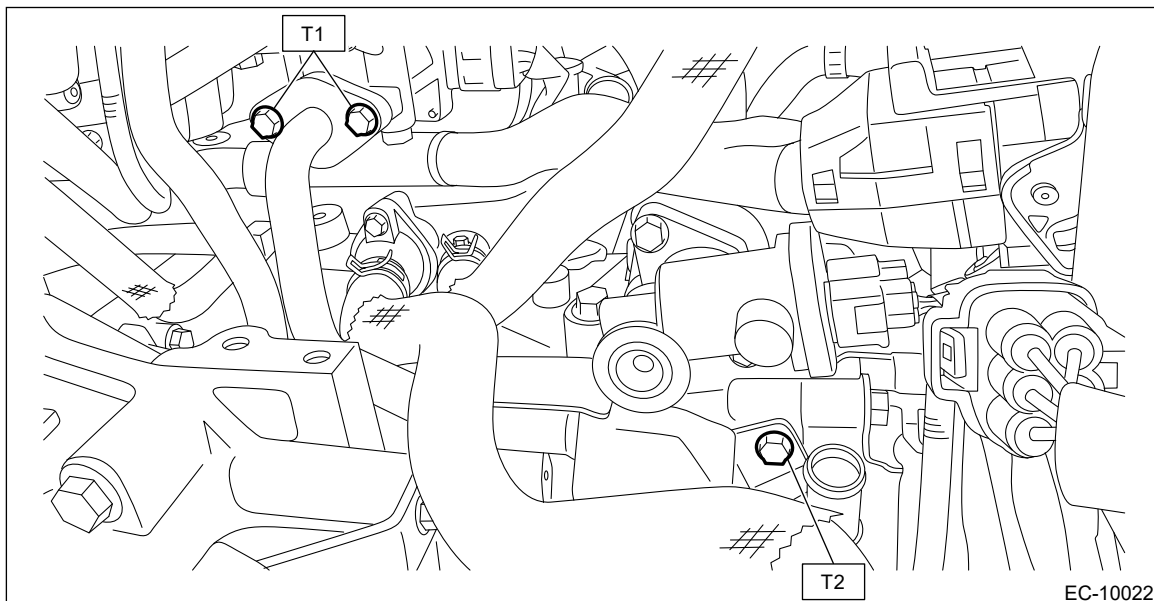
Tightening torque:


T1: 9 N·m (0.9 kgf-m, 6.6 ft-lb)

4. Tighten the bolts holding the EGR cooler to the cylinder head RH.

Tightening torque:


T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

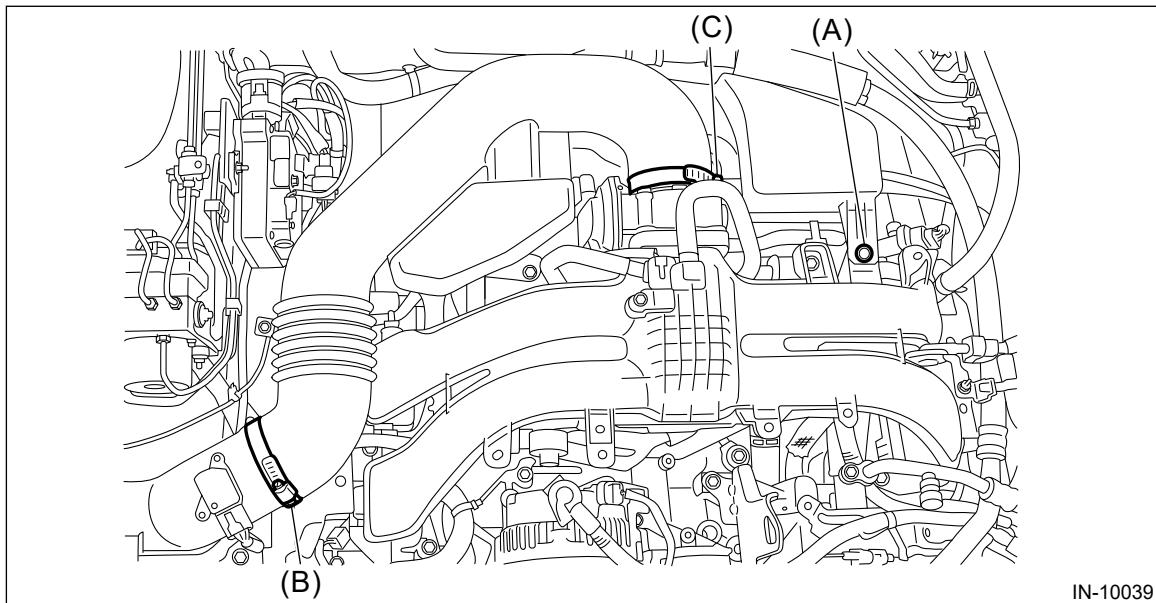


5. Install the EGR pipe.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\), \(H4DO\)>EGR Pipe>INSTALLATION.](#)
6. Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)
7. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

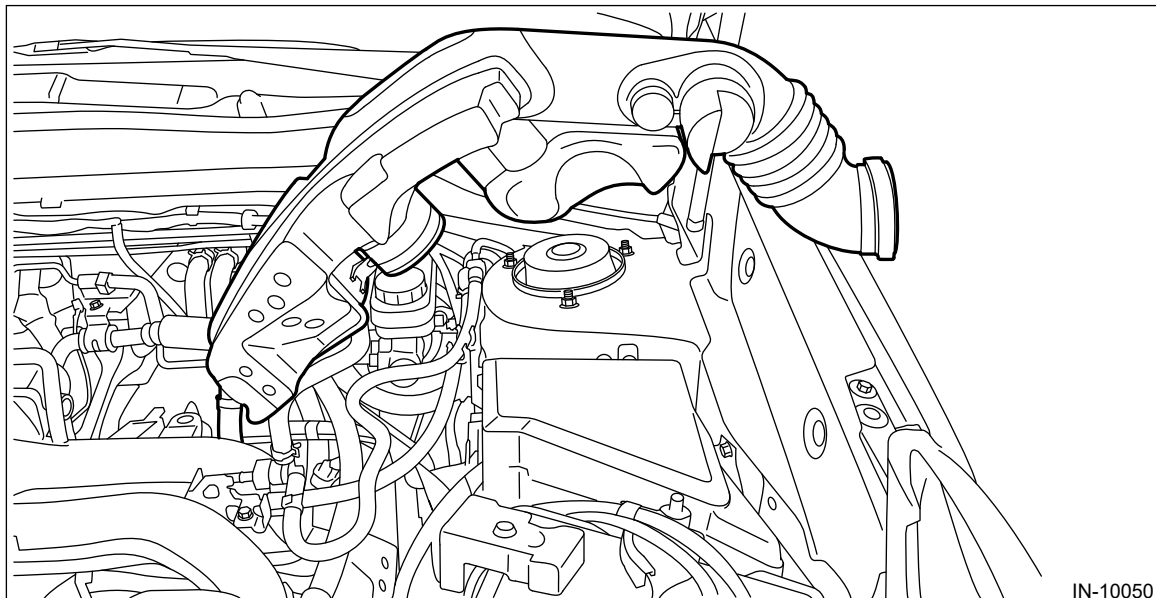
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > EGR Control Valve

REMOVAL

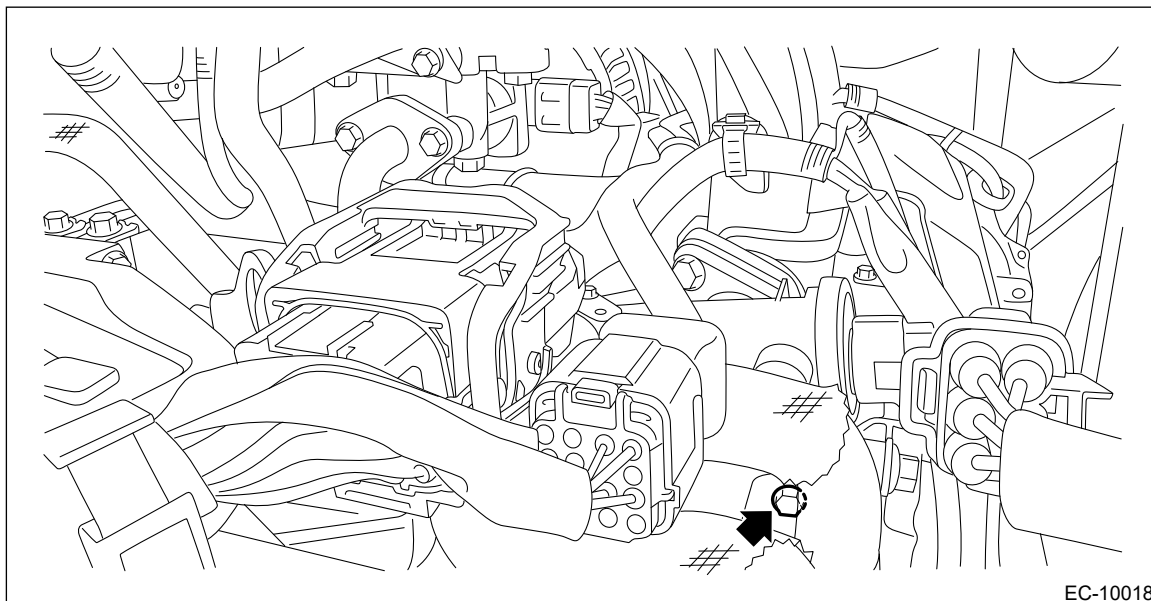
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the clip (A) from the air intake boot.
3. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
4. Loosen the clamp (C) which secures the throttle body to the air intake boot.




5. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.

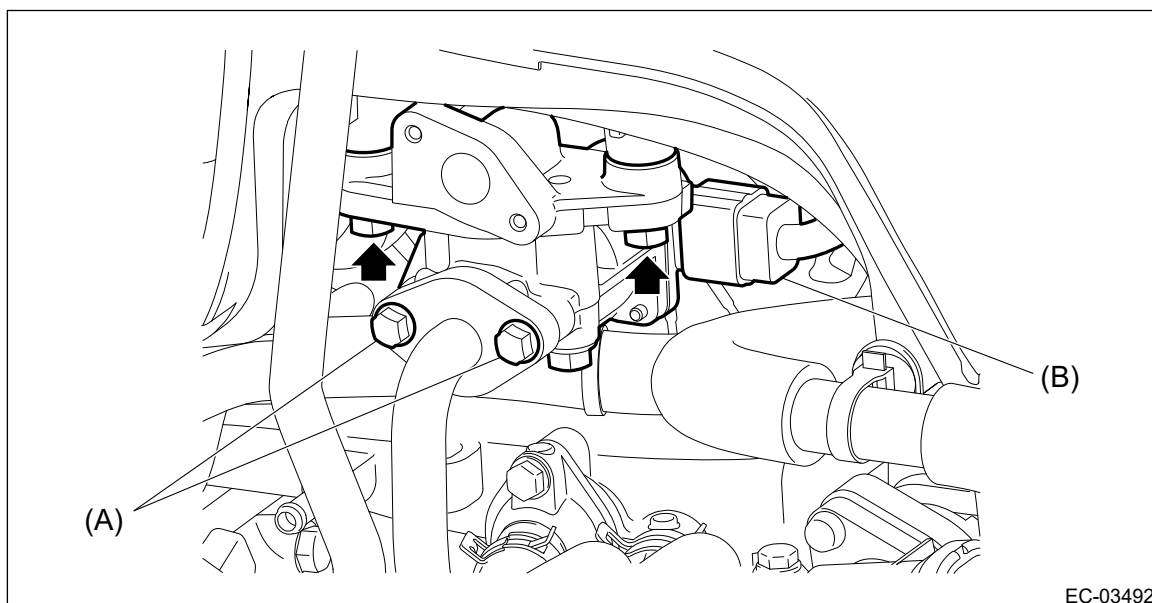


6. Loosen the bolts holding the EGR cooler to the cylinder head RH.



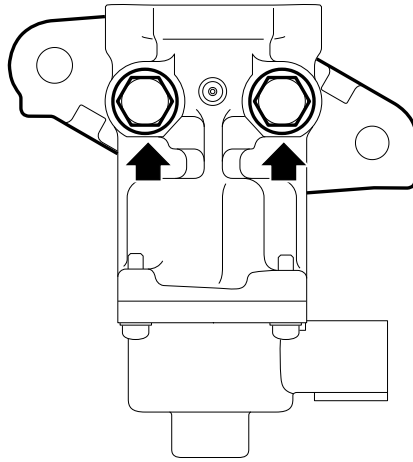
EC-10018

- 7.** Remove the EGR pipe.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DO\)>EGR Pipe>REMOVAL.](#)
- 8.** Remove the bolts (A) securing the EGR cooler to the EGR control valve.
- 9.** Disconnect the connector (B) from EGR control valve, and remove the EGR control valve from the intake manifold assembly.



EC-03492

- 10.** Remove the EGR pipe adapter from EGR control valve.



EC-03579

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > EGR Cooler

INSPECTION

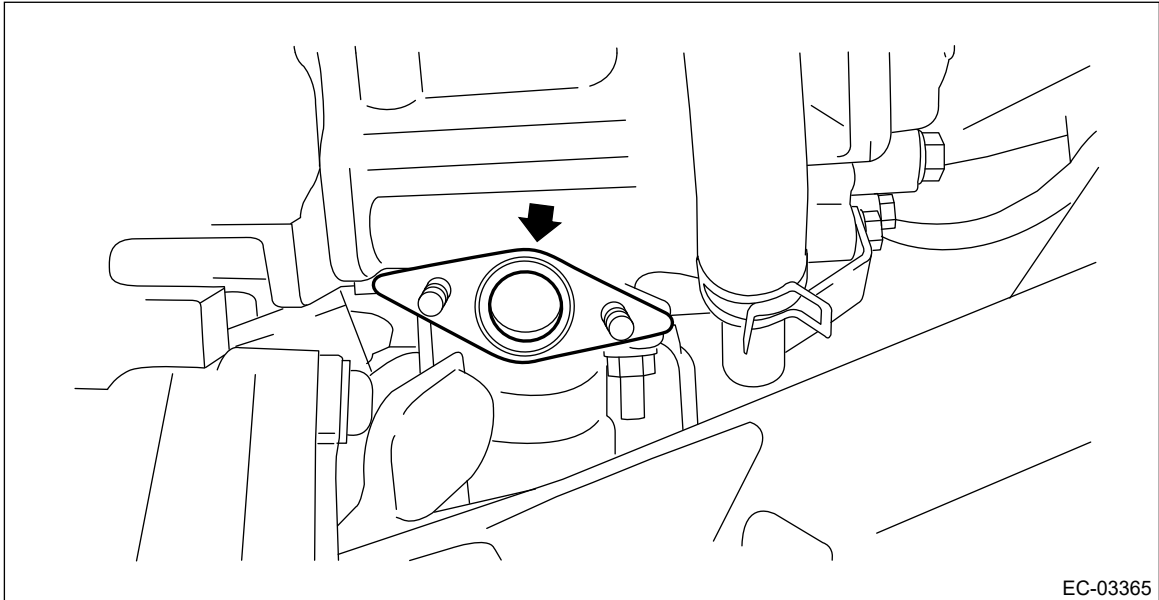
- 1.** Check that the EGR cooler has no deformation, cracks or other damages.
- 2.** Check that the hose has no cracks, damage or loose part.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > EGR Cooler
INSTALLATION

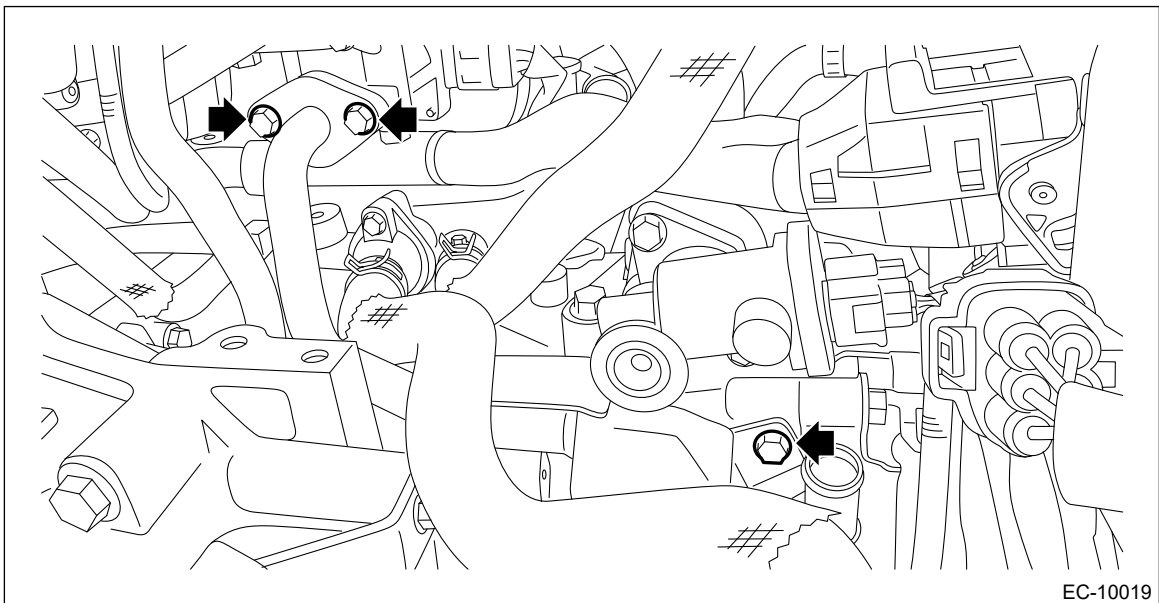
1. Set the gasket to the stud bolt.

Note:

Use a new gasket.



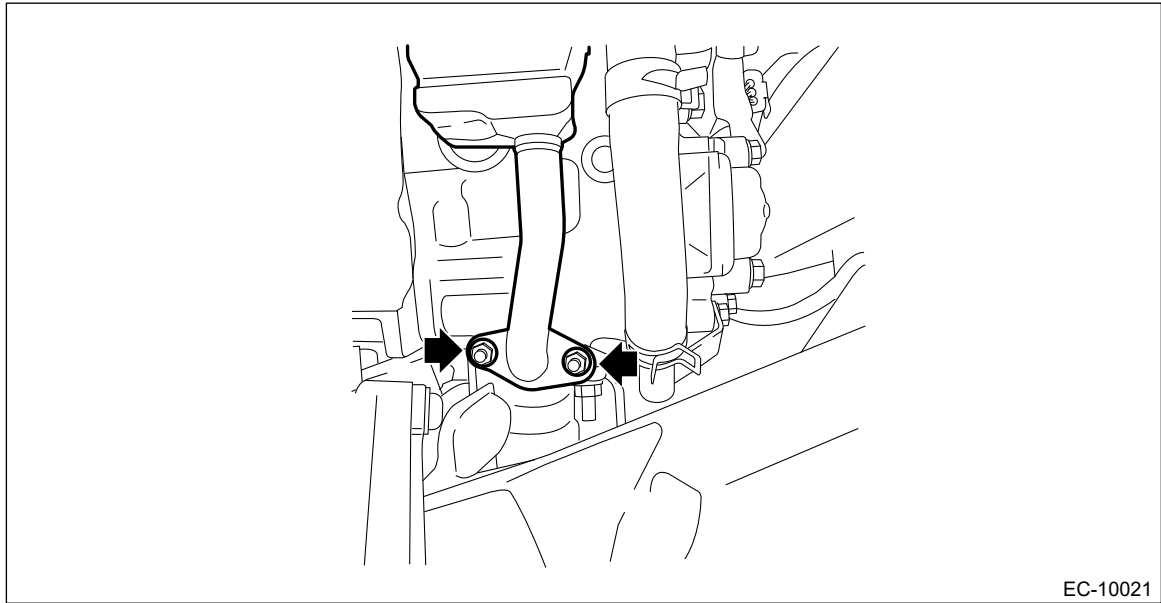
2. Set the EGR cooler, and temporarily tighten the bolts securing the EGR cooler to the EGR control valve and cylinder head RH.



3. Install the nuts securing the EGR cooler to the cylinder head RH.

Tightening torque:

9 N·m (0.9 kgf-m, 6.6 ft-lb)



4. Tighten the bolt securing the EGR cooler to the EGR control valve.

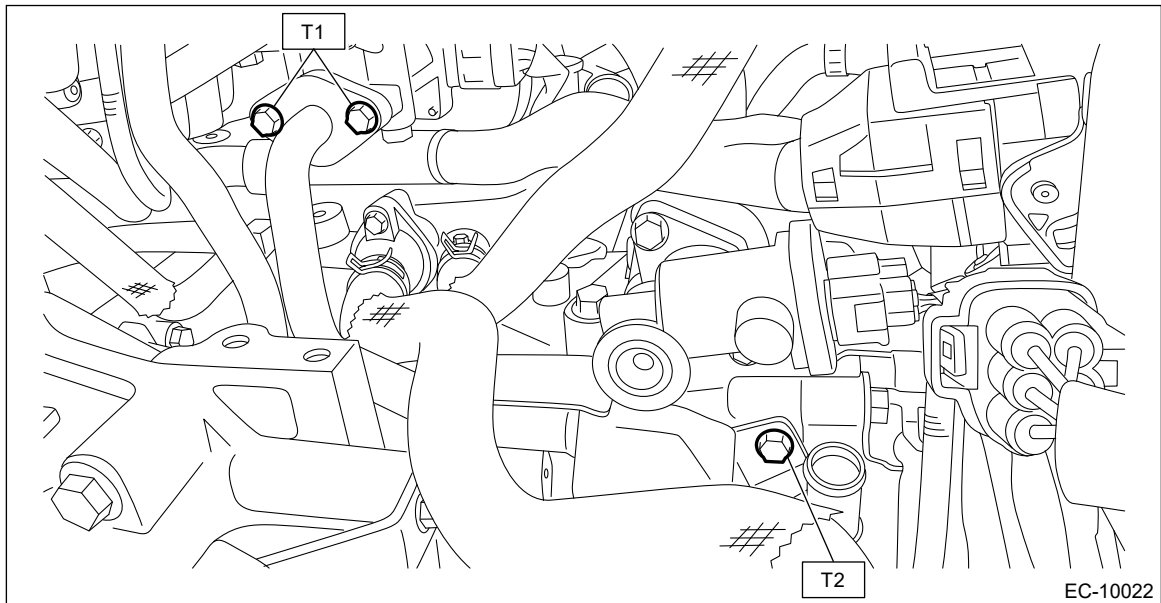
Tightening torque:

T1: 9 N·m (0.9 kgf-m, 6.6 ft-lb)

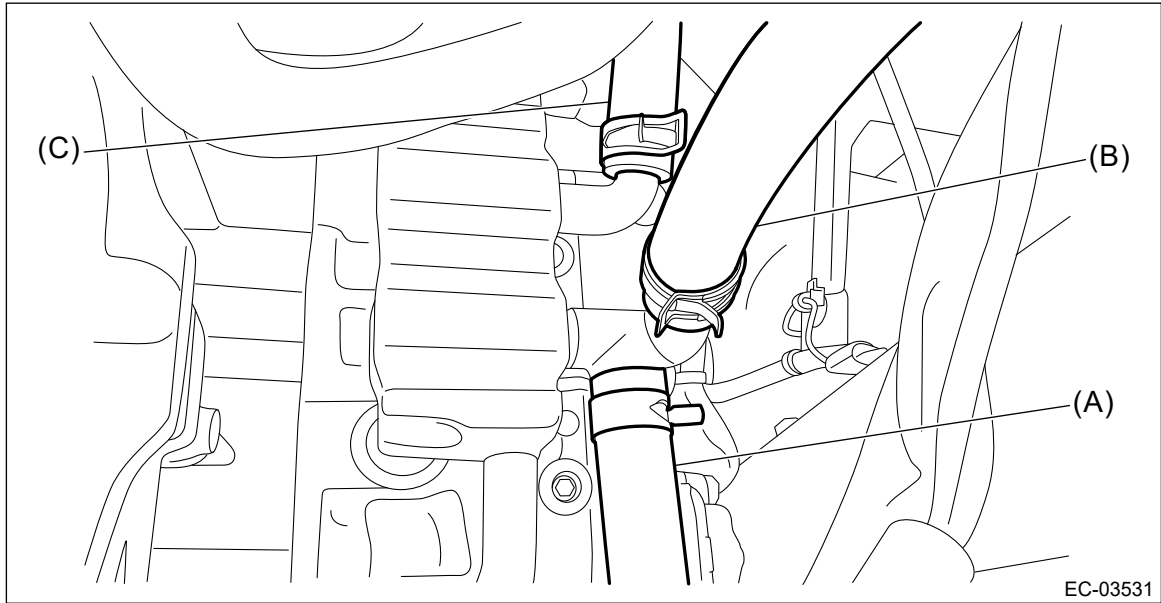
5. Tighten the bolts holding the EGR cooler to the cylinder head RH.

Tightening torque:

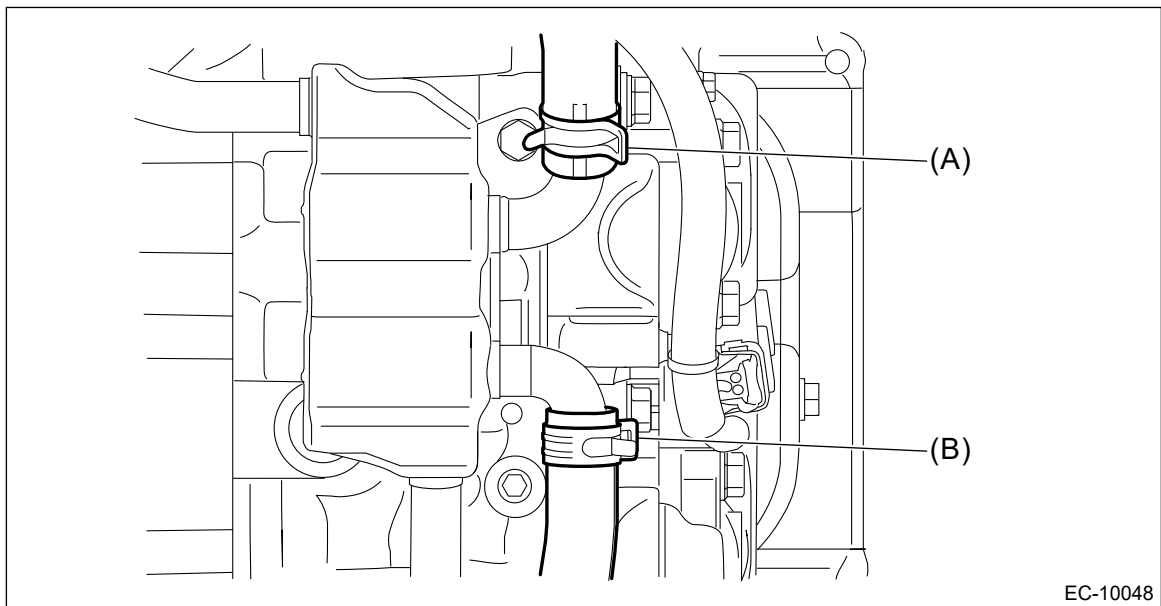
T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



6. Connect the engine coolant hose (A), engine coolant hose (B) and engine coolant hose (C) to the EGR cooler. (CVT model)



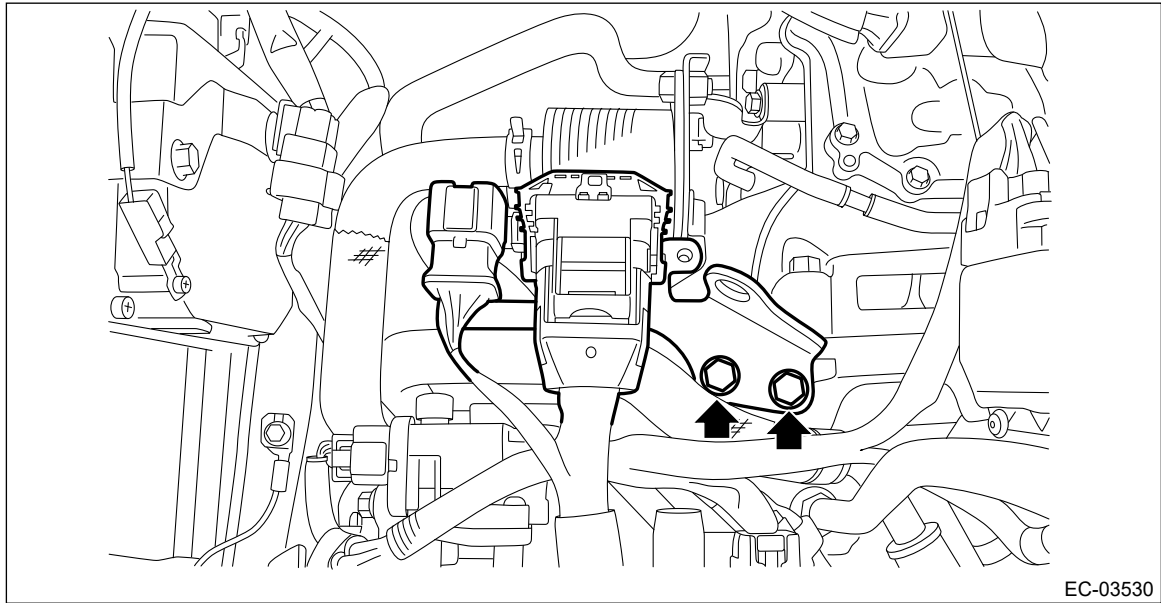
- 7.** Connect the engine coolant hose (A) and engine coolant hose (B) to the EGR cooler. (MT model)



- 8.** Install the engine rear hanger.

Tightening torque:

21 N·m (2.1 kgf-m, 15.5 ft-lb)

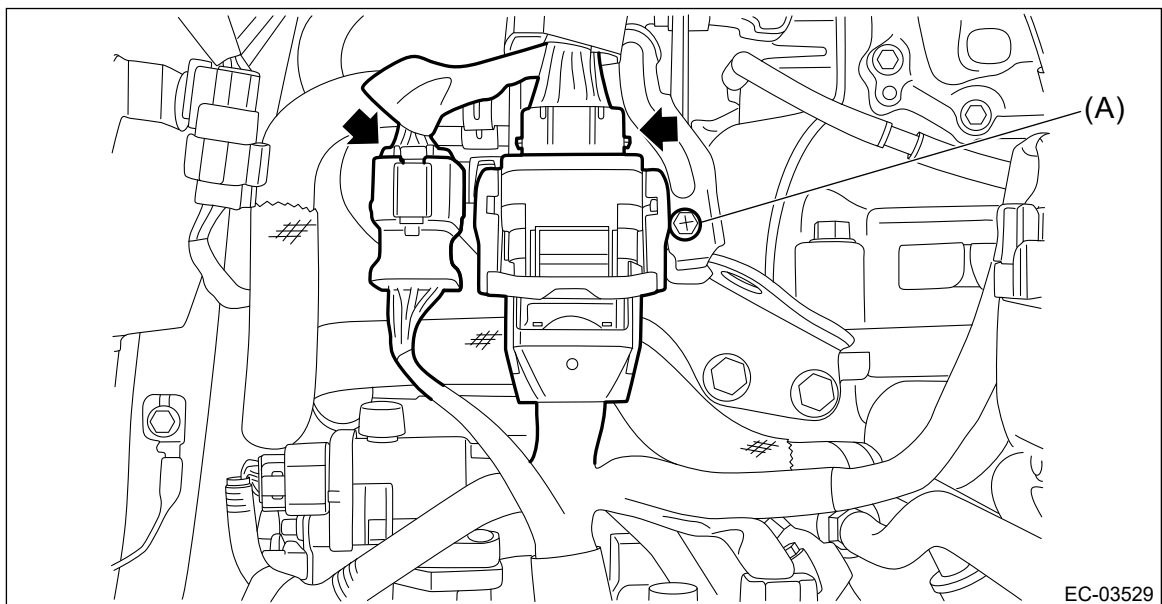



9. Connect the engine harness connector.


- (1) Connect the bulkhead harness connector to the engine harness connector (black) and engine harness connector (brown).
- (2) Install the bolt (A) which secures the bulkhead harness connector bracket.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)




10. Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)

11. Install the center exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Center Exhaust Pipe>INSTALLATION.](#)




12. Lower the vehicle.

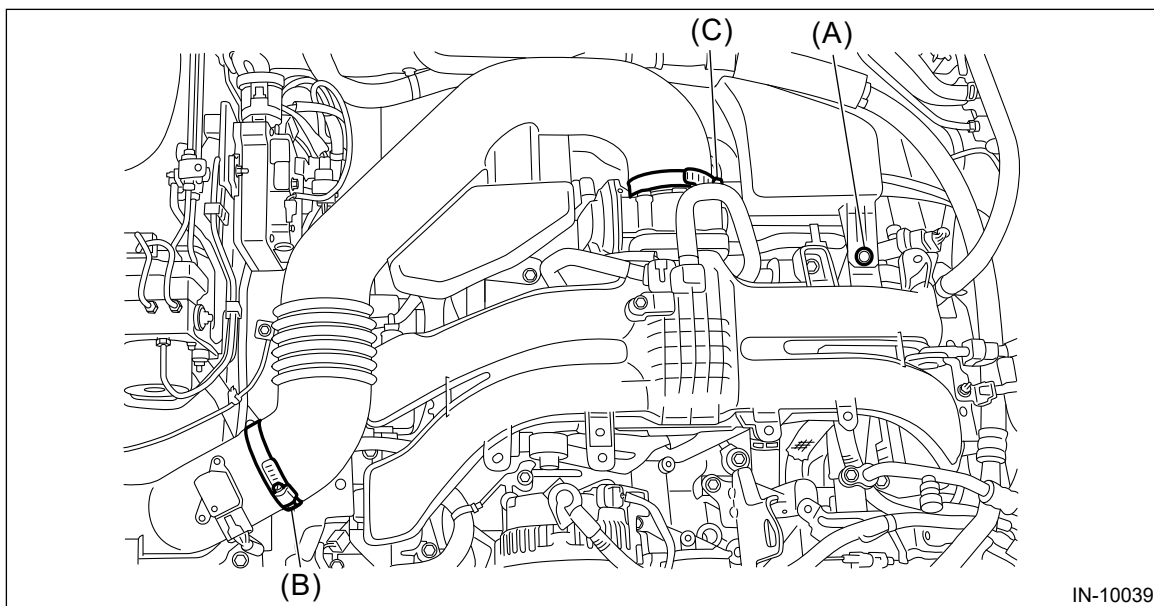
13. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

14. Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

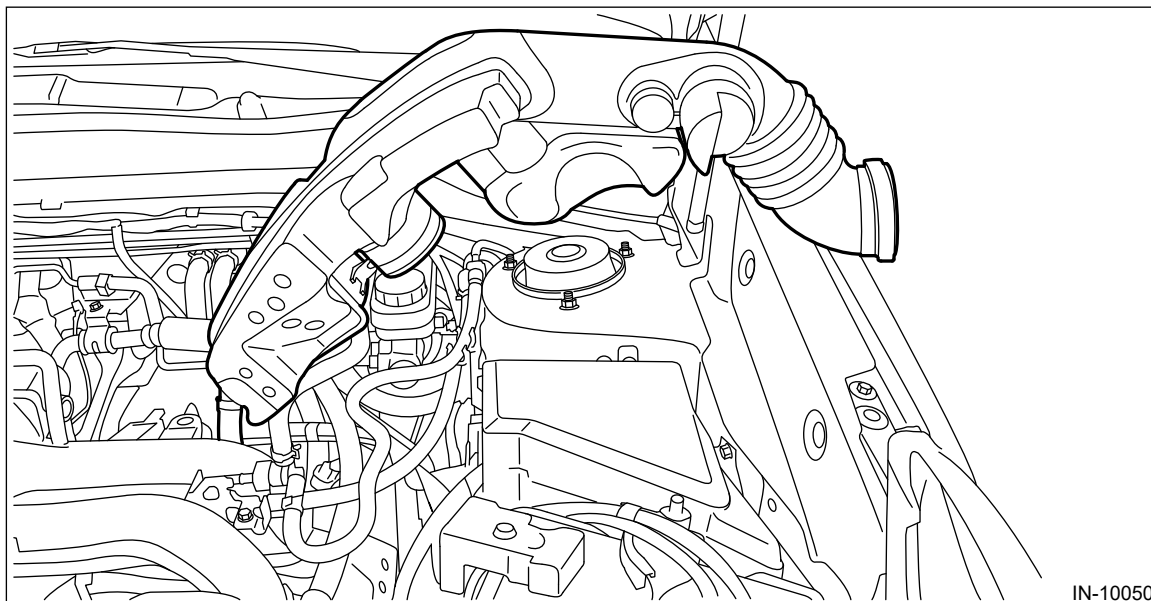
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > EGR Cooler

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Drain engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
3. Remove the center exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Center Exhaust Pipe>REMOVAL.](#)
4. Lower the vehicle.
5. Remove the clip (A) from the air intake boot.
6. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
7. Loosen the clamp (C) which secures the throttle body to the air intake boot.

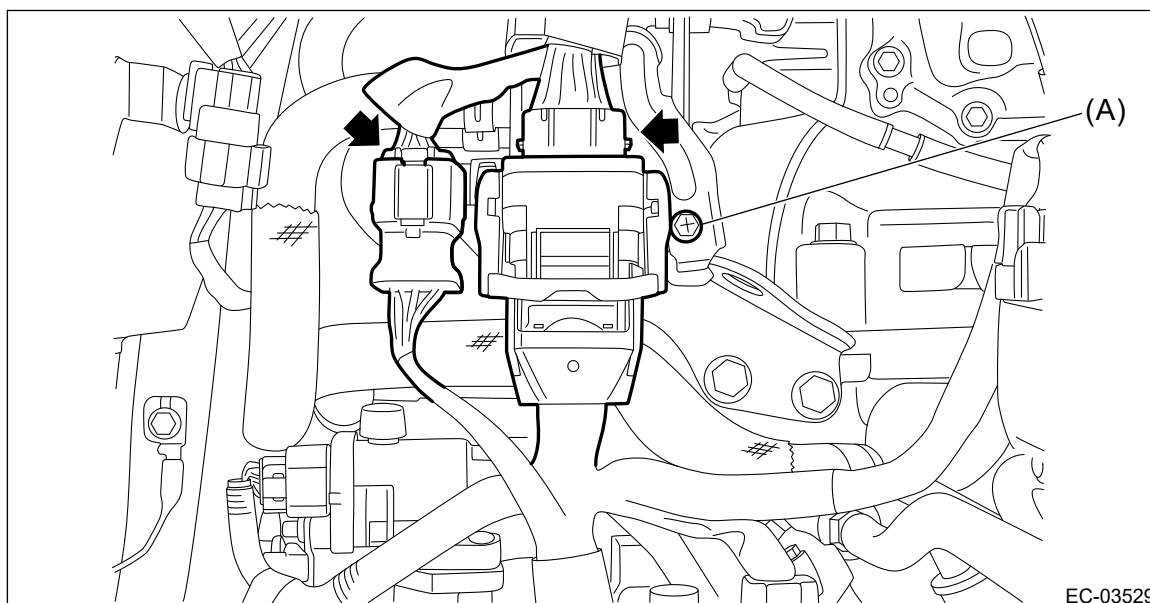


8. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.

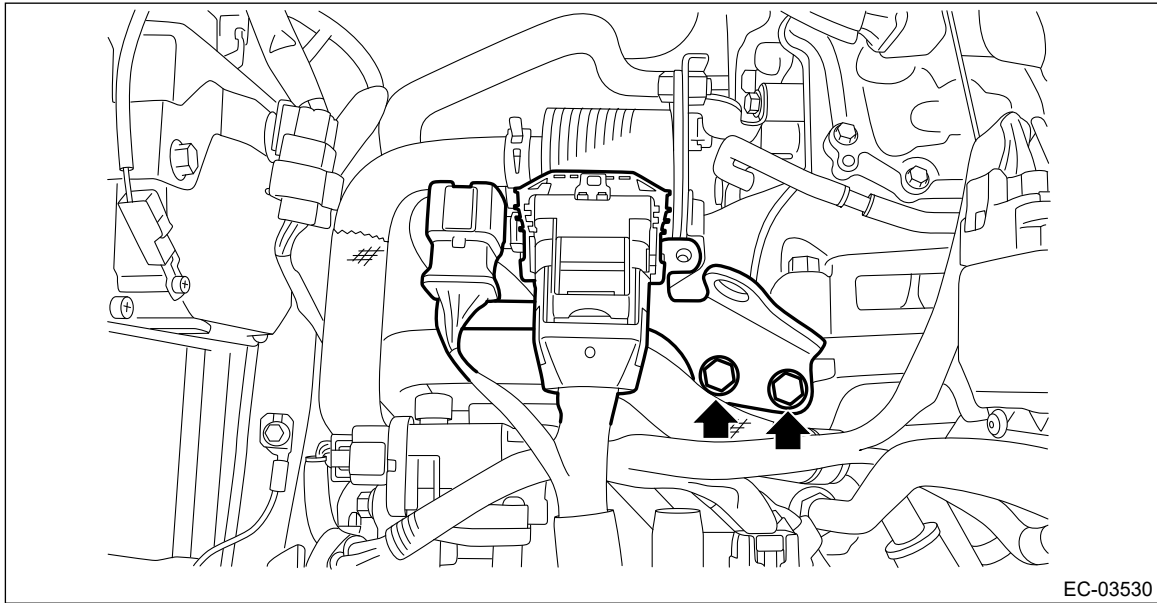


9. Disconnect the engine harness connector.

- (1) Remove the bolt (A) securing the bulkhead harness connector bracket.
- (2) Disconnect the bulkhead harness connector from the engine harness connector (black) and engine harness connector (brown).

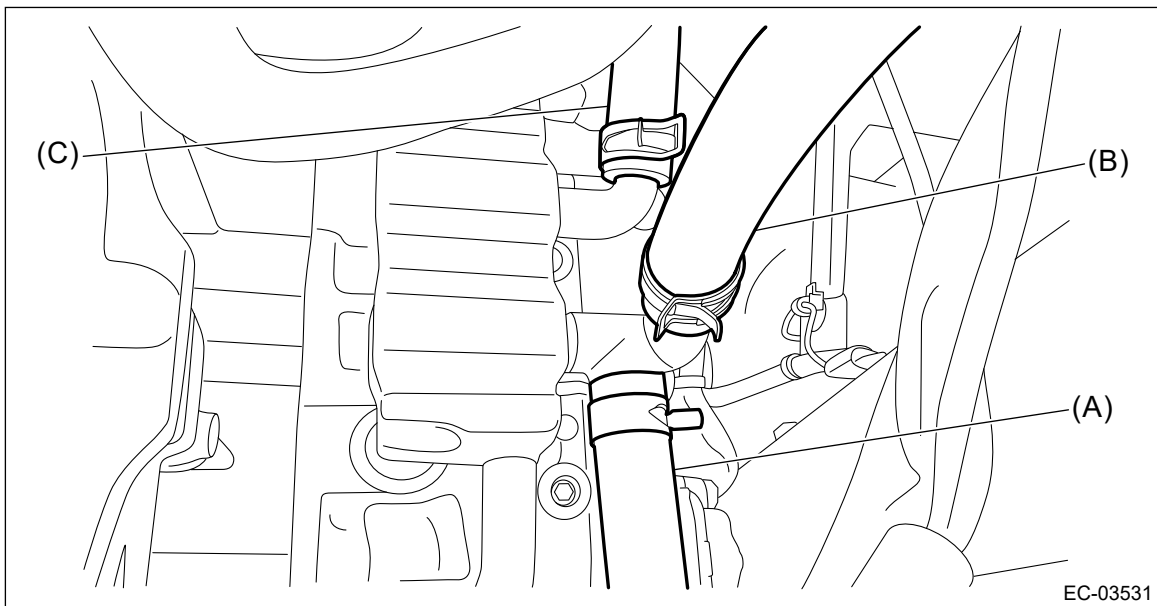


10. Remove the engine rear hanger.



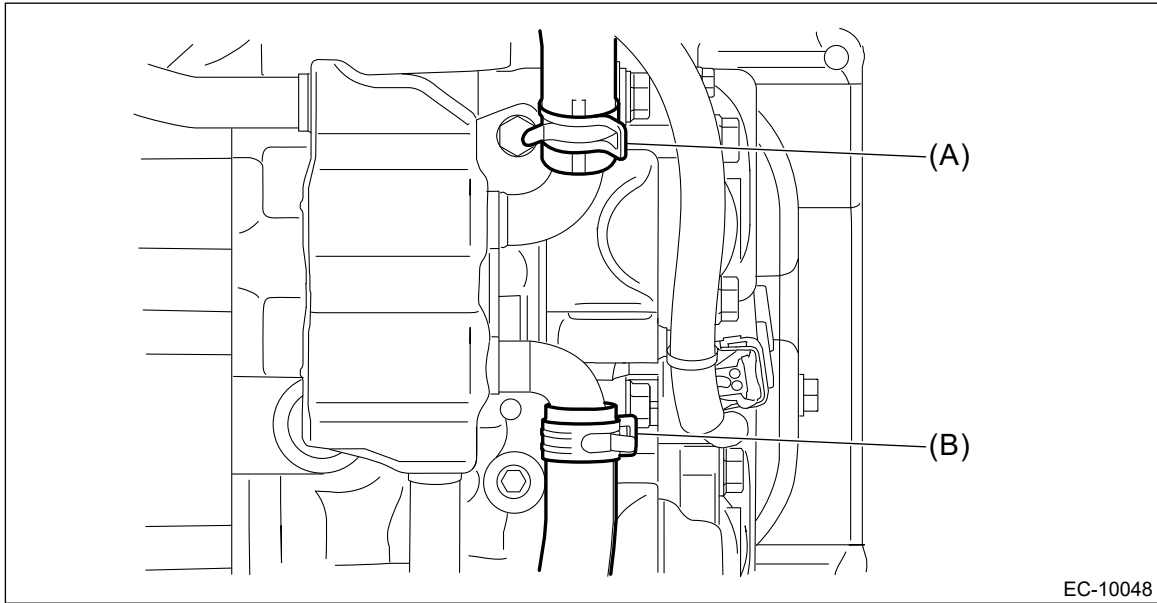
EC-03530

- 11.** Disconnect the engine coolant hose (A), engine coolant hose (B) and engine coolant hose (C) from the EGR cooler. (CVT model)



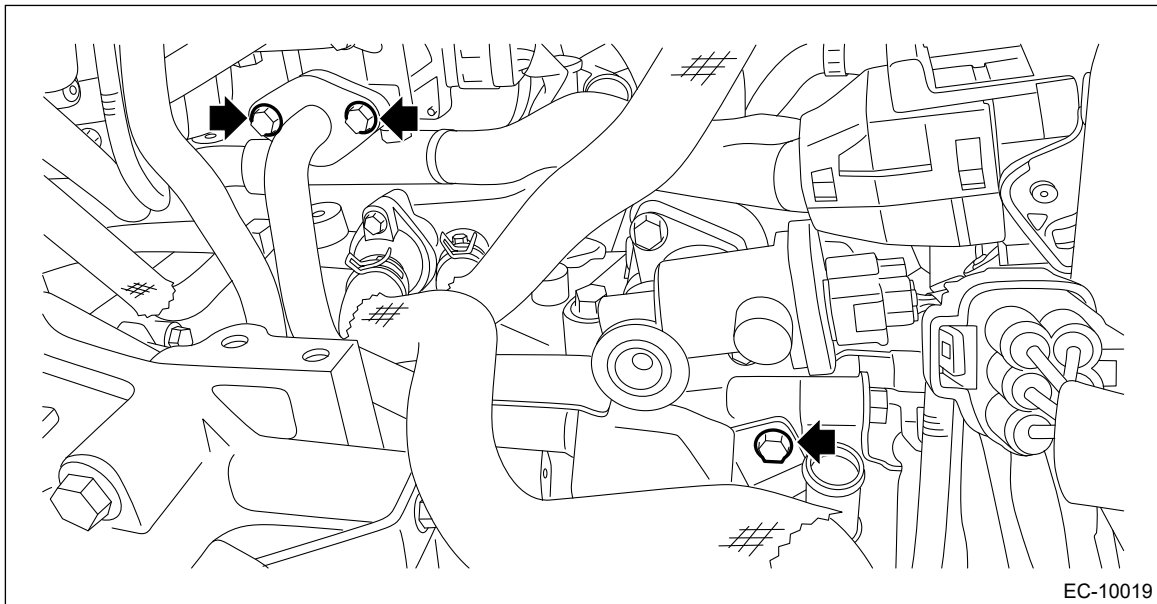
EC-03531

- 12.** Disconnect the engine coolant hose (A) and engine coolant hose (B) from the EGR cooler. (MT model)



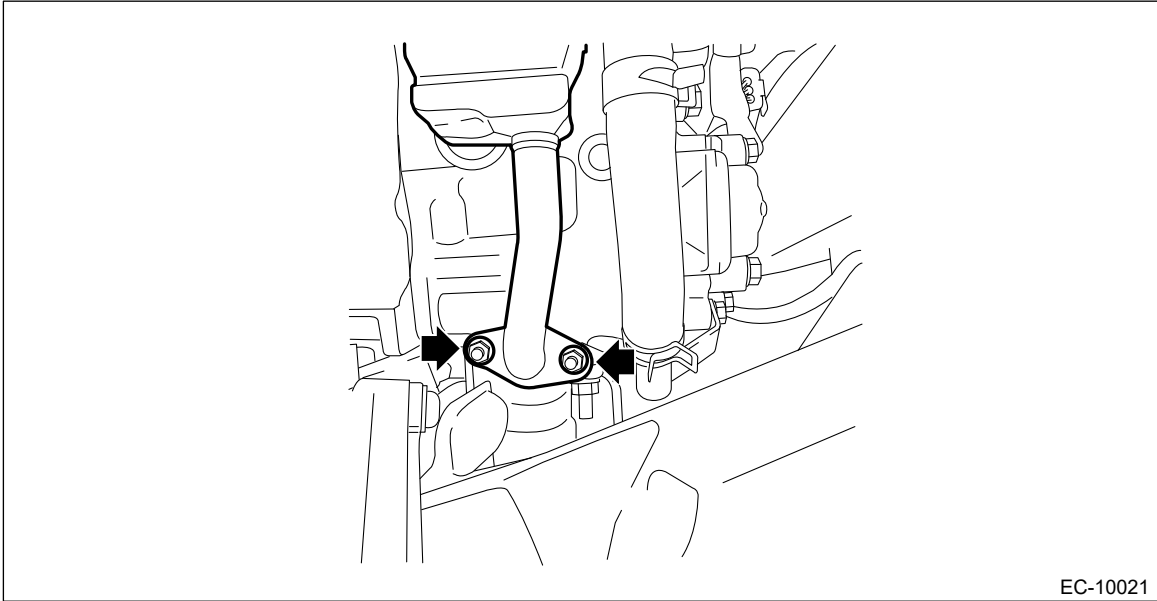
EC-10048

- 13.** Remove the bolts securing the EGR cooler to the EGR control valve and the cylinder head RH.

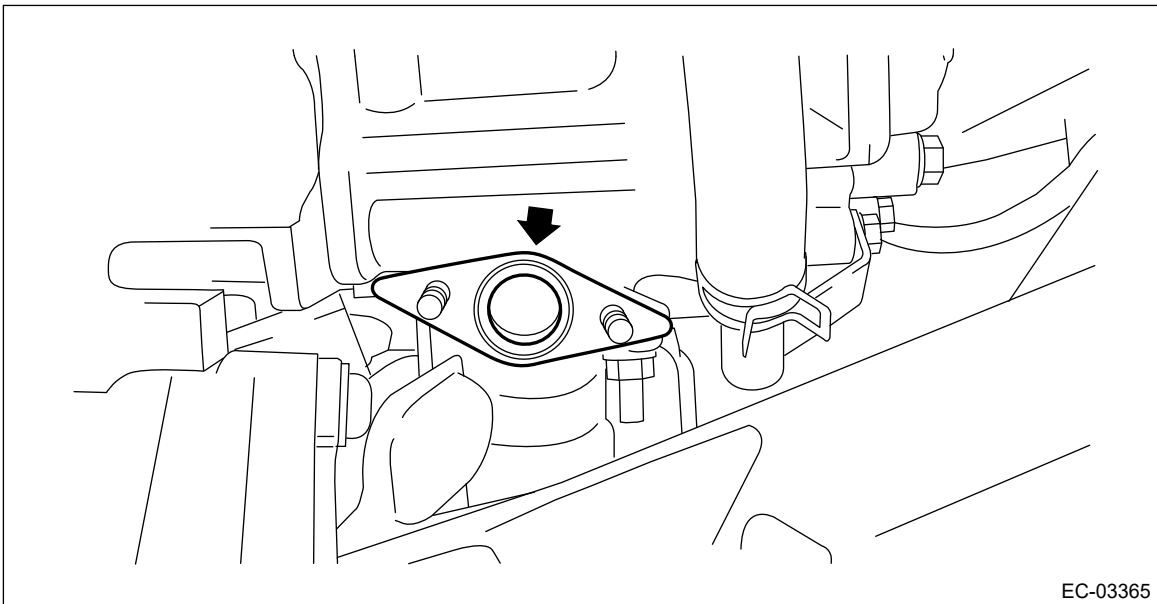


EC-10019

- 14.** Remove the nuts securing the EGR cooler to the cylinder head RH, and remove the EGR cooler.



15. Remove the gasket from the stud bolt.



EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > EGR Pipe
INSPECTION

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

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > EGR Pipe

INSTALLATION



1. Install the EGR pipe to the intake manifold assembly and EGR control valve.

Note:

Use a new gasket.


Tightening torque:

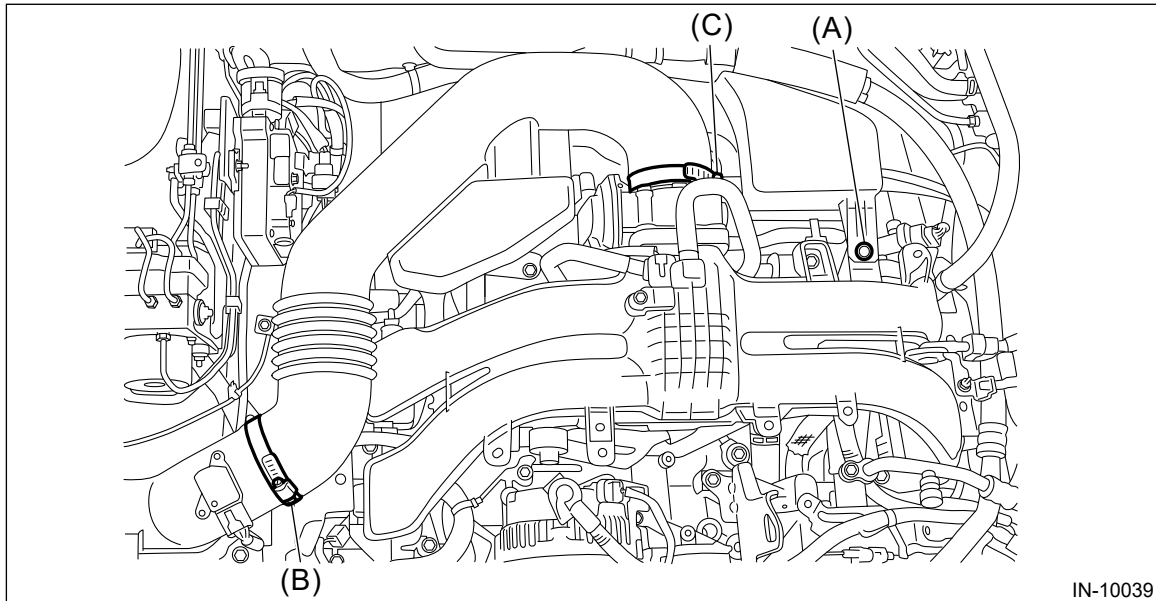
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

2. Install the throttle body.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Throttle Body>INSTALLATION.](#)
3. Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)

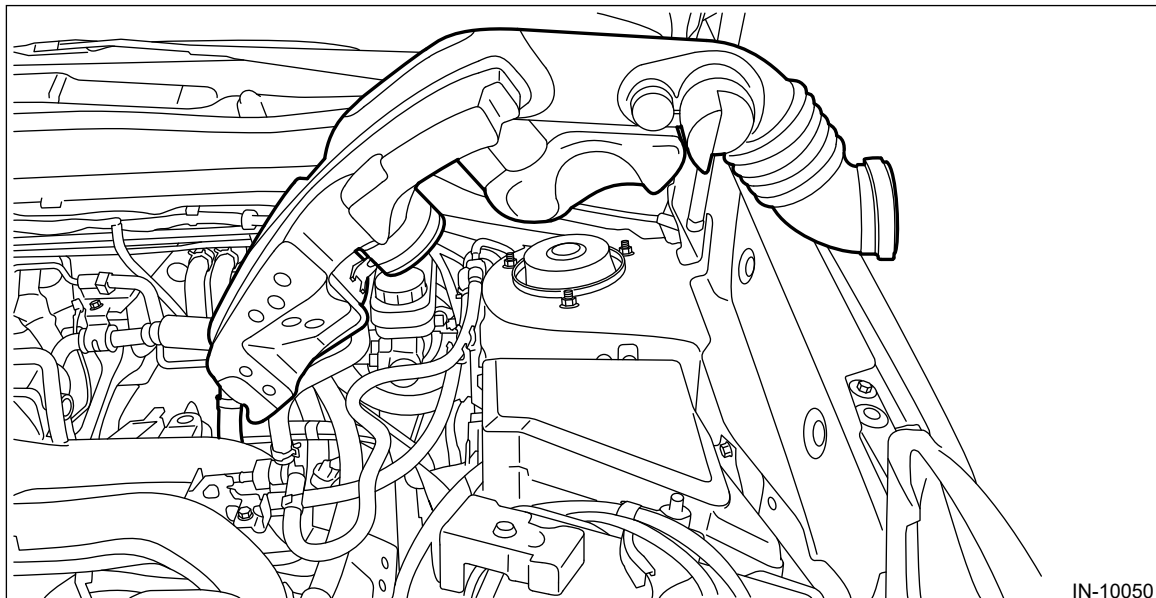
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > EGR Pipe

REMOVAL

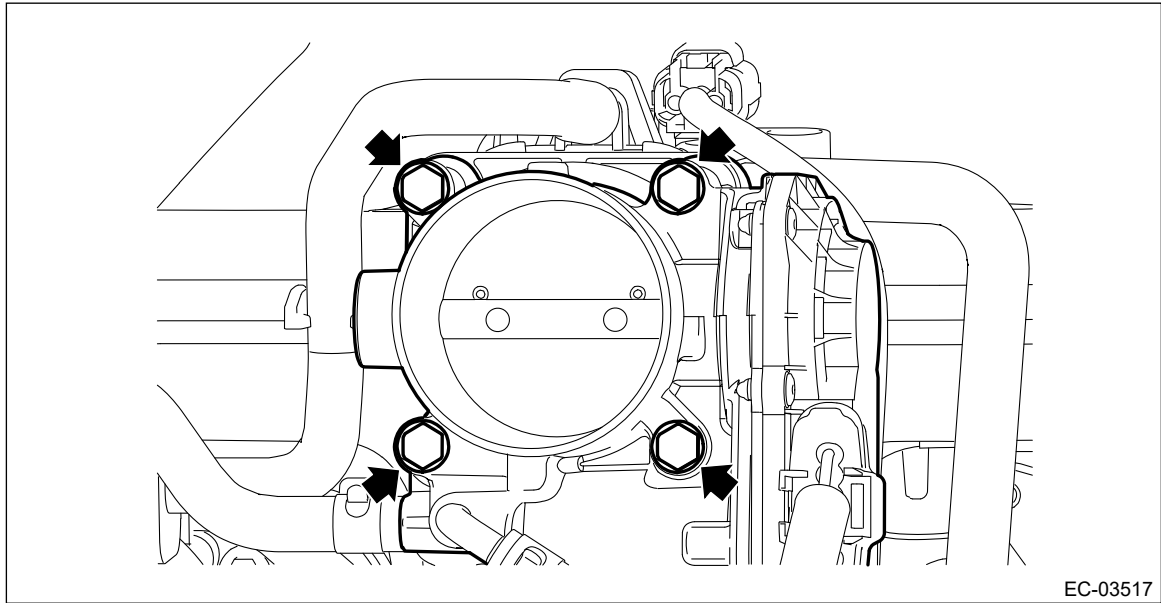
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the clip (A) from the air intake boot.
3. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
4. Loosen the clamp (C) which secures the throttle body to the air intake boot.



5. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.

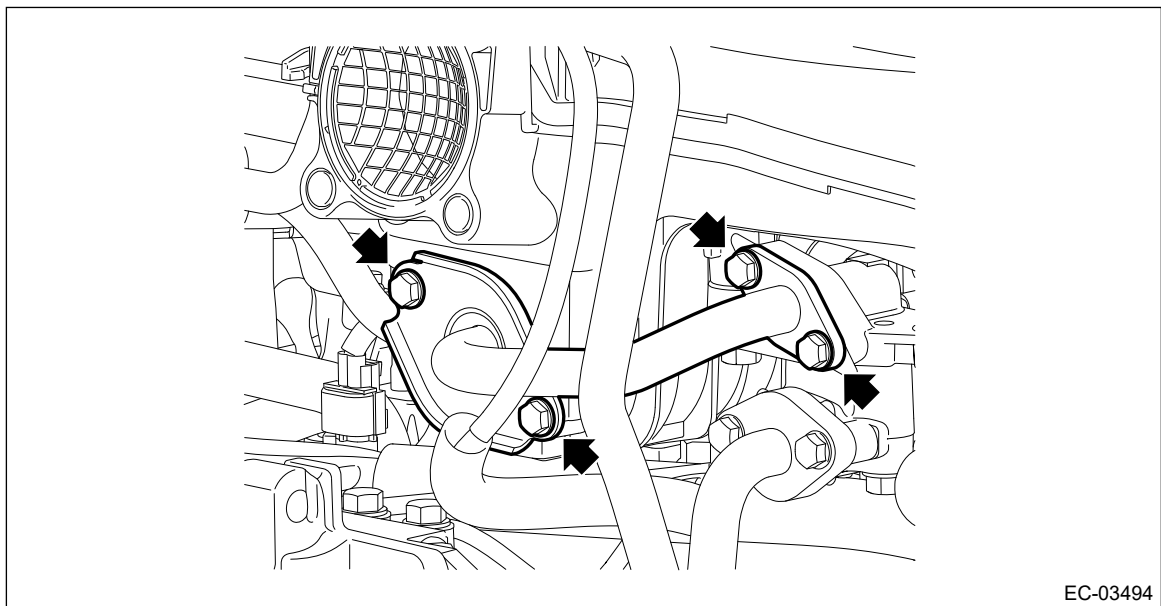


6. Remove the bolts securing the throttle body to the intake manifold assembly, and tilt the throttle body to the rear side of vehicle.



EC-03517

7. Remove the bolts securing the EGR pipe to the intake manifold assembly and EGR control valve, and remove the EGR pipe.



EC-03494


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Front Catalytic Converter

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Front Catalytic Converter

INSTALLATION


The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to "Front Exhaust Pipe" for the installation procedure.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Front Catalytic Converter


REMOVAL

The front catalytic converter is integrated into the front exhaust pipe; therefore, refer to "Front Exhaust Pipe" for the removal procedure.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Fuel Level Sensor **INSPECTION**

For inspection procedures, refer to the "FU(H4DO)" section.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Level Sensor>INSPECTION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Fuel Level Sensor **INSTALLATION**


For installation procedures, refer to the "FU(H4DO)" section.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Level Sensor>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Fuel Level Sensor **REMOVAL**

For removal procedures, refer to the "FU(H4DO)" section.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Level Sensor>REMOVAL.](#)


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Fuel Sub Level Sensor

INSPECTION

For inspection procedures, refer to the "FU(H4DO)" section.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Sub Level Sensor>INSPECTION.](#)


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Fuel Sub Level Sensor

INSTALLATION

For installation procedures, refer to the "FU(H4DO)" section.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Sub Level Sensor>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Fuel Sub Level Sensor

REMOVAL

For removal procedures, refer to the "FU(H4DO)" section.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Sub Level Sensor>REMOVAL.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > General Description

CAUTION

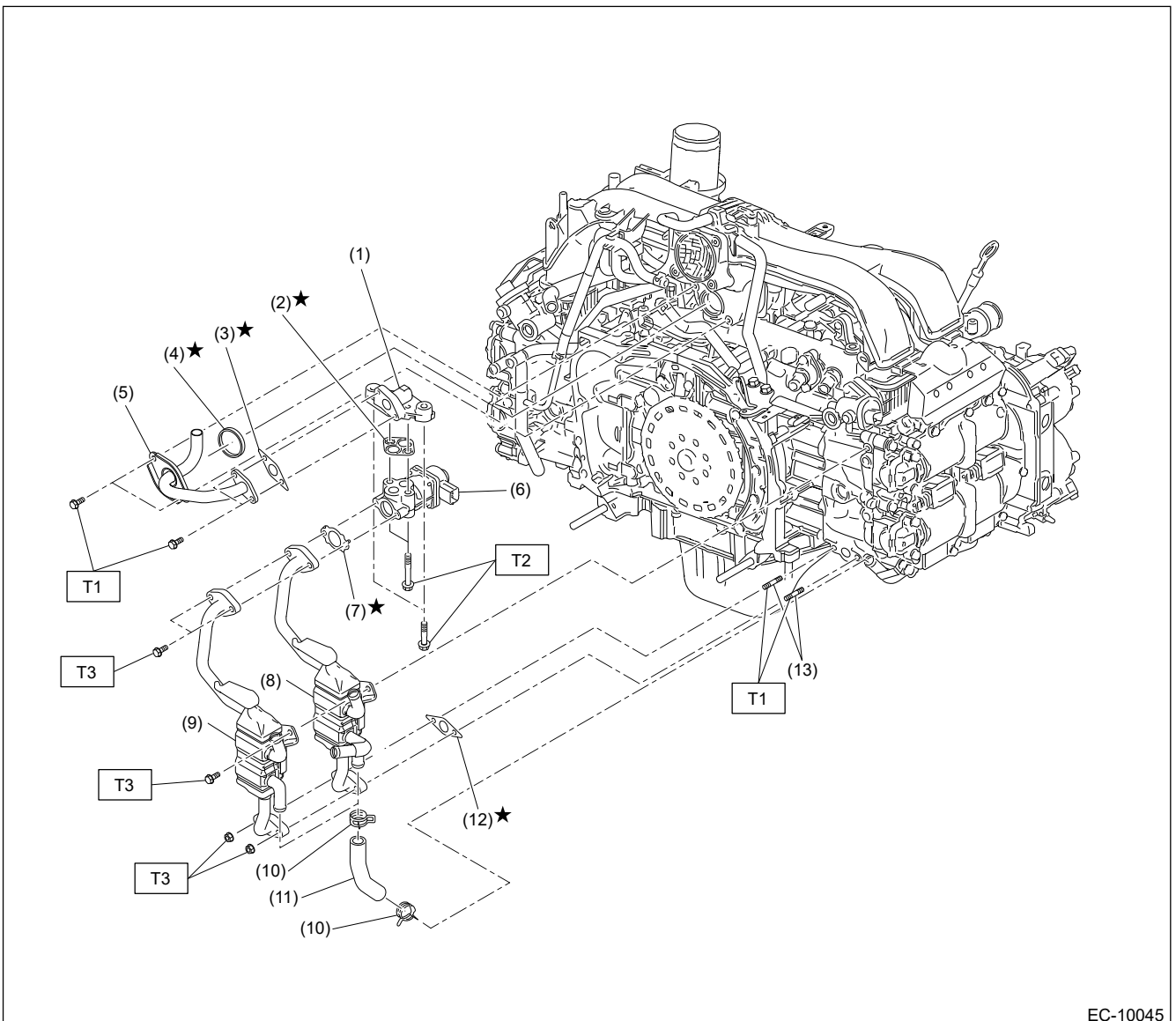
- Prior to starting work, pay special attention to the following:
 1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
 2. Protect the vehicle using a seat cover, fender cover, etc.
 3. Prepare the service tools, clean cloth,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

COMPONENT

1. CANISTER, PURGE CONTROL SOLENOID VALVE, AND LEAK CHECK VALVE ASSEMBLY

For structures of the canister, purge control solenoid valve, and leak check valve assembly, refer to FU (H4DO). [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>General Description>COMPONENT.](#)

2. EXHAUST GAS RECIRCULATION CONTROL CIRCUIT RANGE/PERFORMANCE



EC-10045

- (1) EGR pipe adapter
- (2) Gasket
- (3) Gasket

- (7) Gasket
- (8) EGR cooler (CVT model)
- (9) EGR cooler (MT model)


- (13) Stud bolt

Tightening torque: N·m (kgf·m, ft·lb)

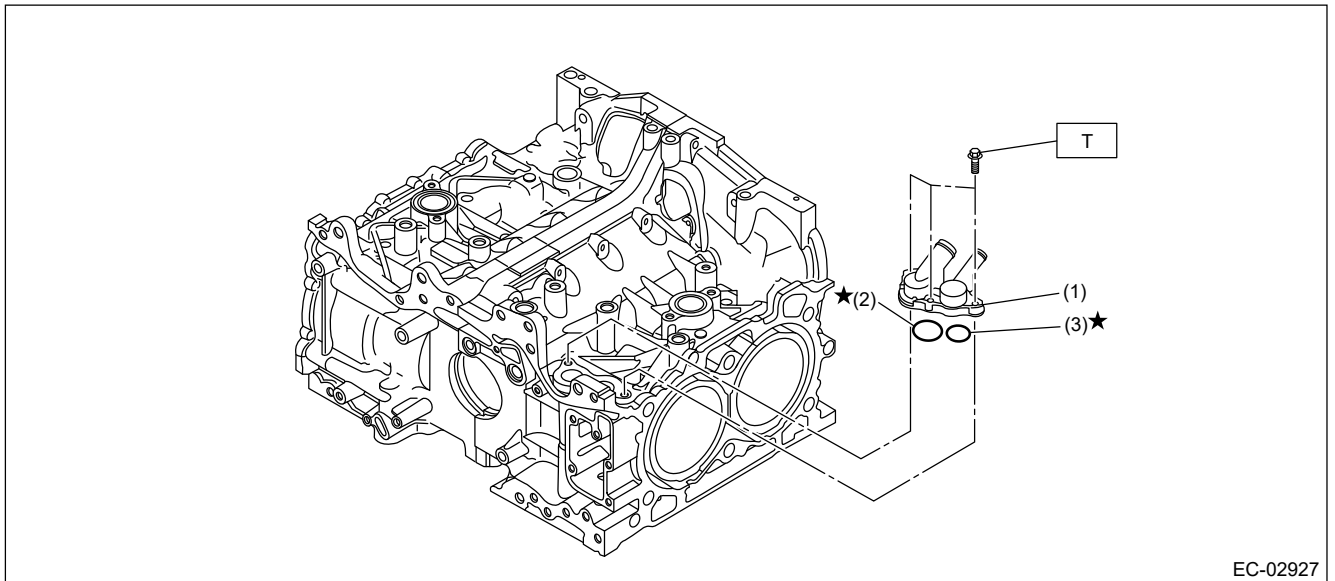
- (4) O-ring
- (5) EGR pipe
- (6) EGR control valve
- (10) Clip
- (11) Engine coolant hose
- (12) Gasket

T1: 6.4 (0.7, 4.7)

T2: 19 (1.9, 14.0)

T3:  **Ref. to EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES) (H4DO)>EGR Pipe>INSTALLATION.**

3. PCV SYSTEM 1



(1) PCV connector

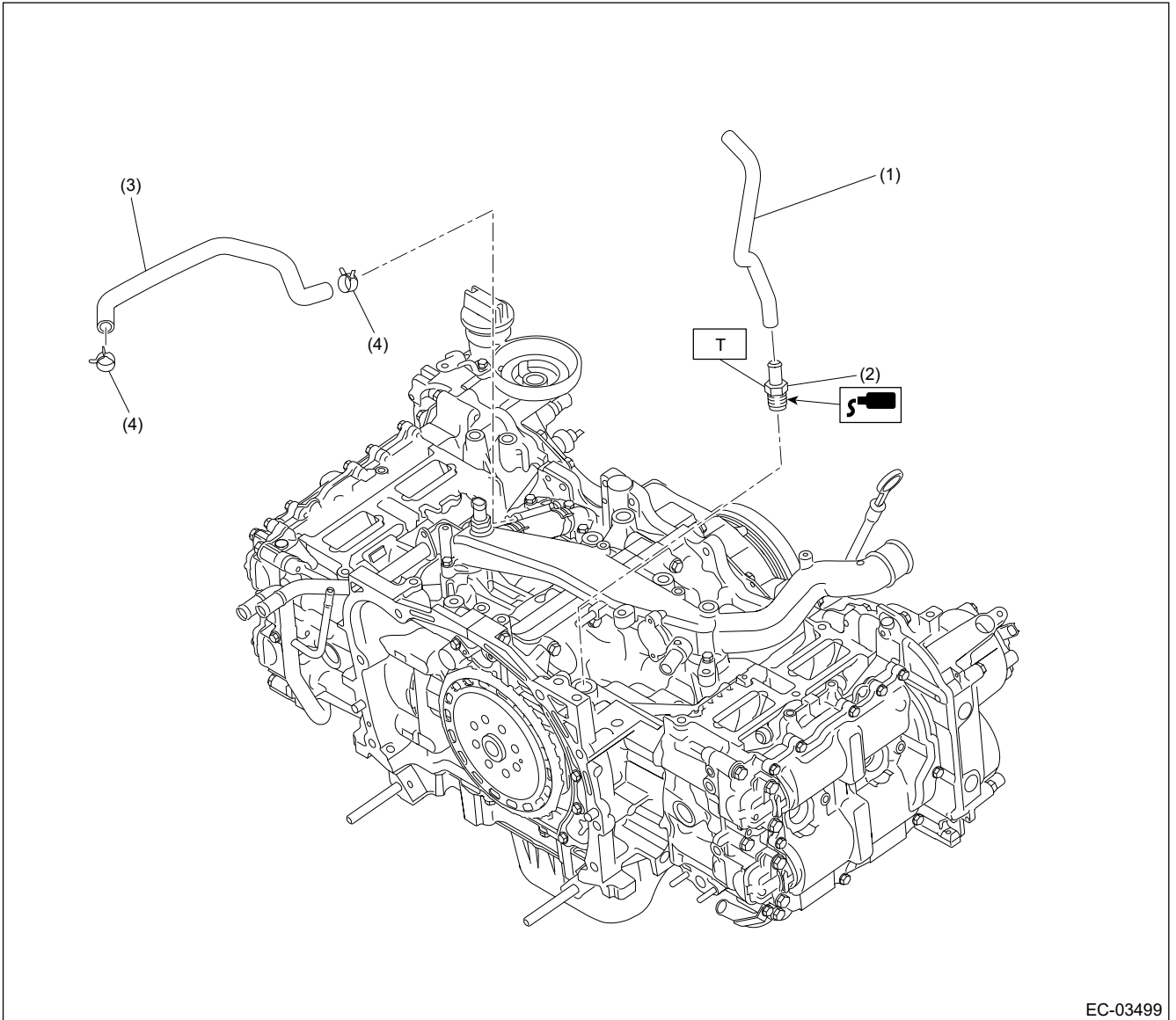
(3) O-ring

Tightening torque: N·m (kgf·m, ft·lb)

(2) O-ring

T: 6.4 (0.7, 4.7)

4. PCV SYSTEM 2



EC-03499

(1) PCV hose A

(3) PCV hose B

Tightening torque: N·m (kgf·m, ft·lb)

(2) PCV valve

(4) Clip

T: 23 (2.3, 17.0)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > General Description

PREPARATION TOOL

1. GENERAL TOOL

| TOOL NAME | REMARKS |
|------------------|---|
| Circuit tester | Used for measuring resistance, voltage and current. |

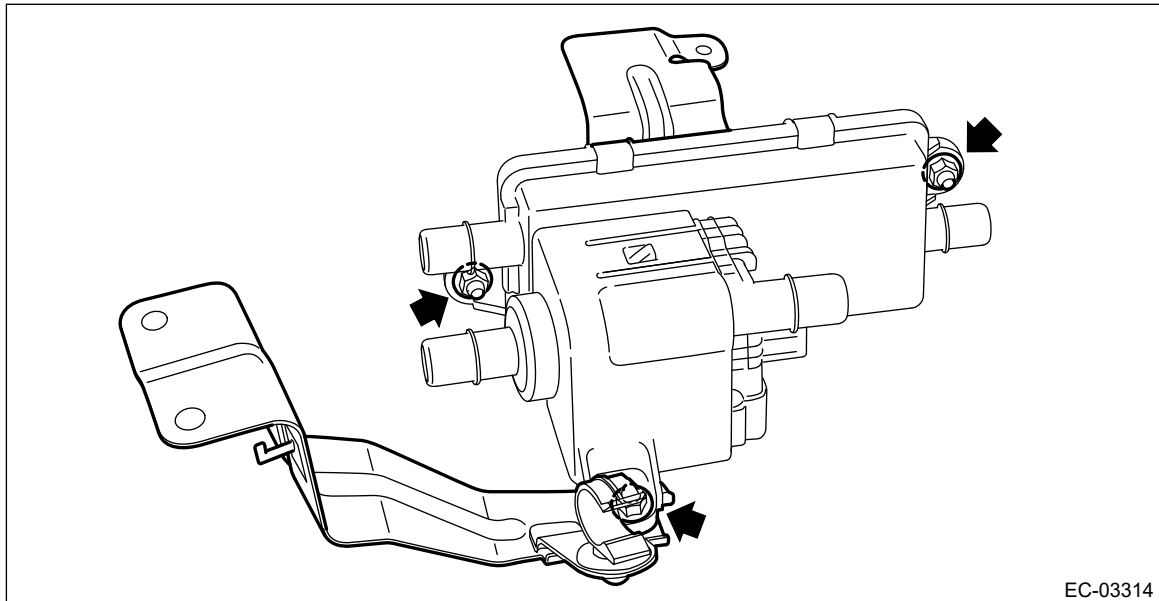
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Leak Check Valve Assembly

ASSEMBLY

1. Install the bracket to the leak check valve assembly.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



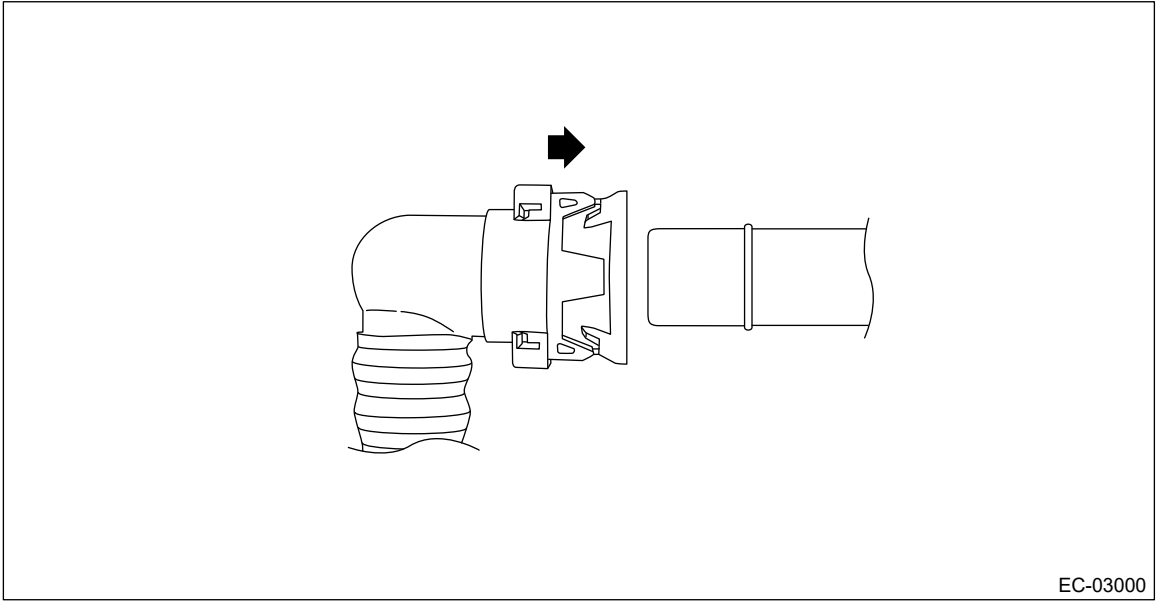
2. Install the drain tube to the leak check valve assembly.

Caution:

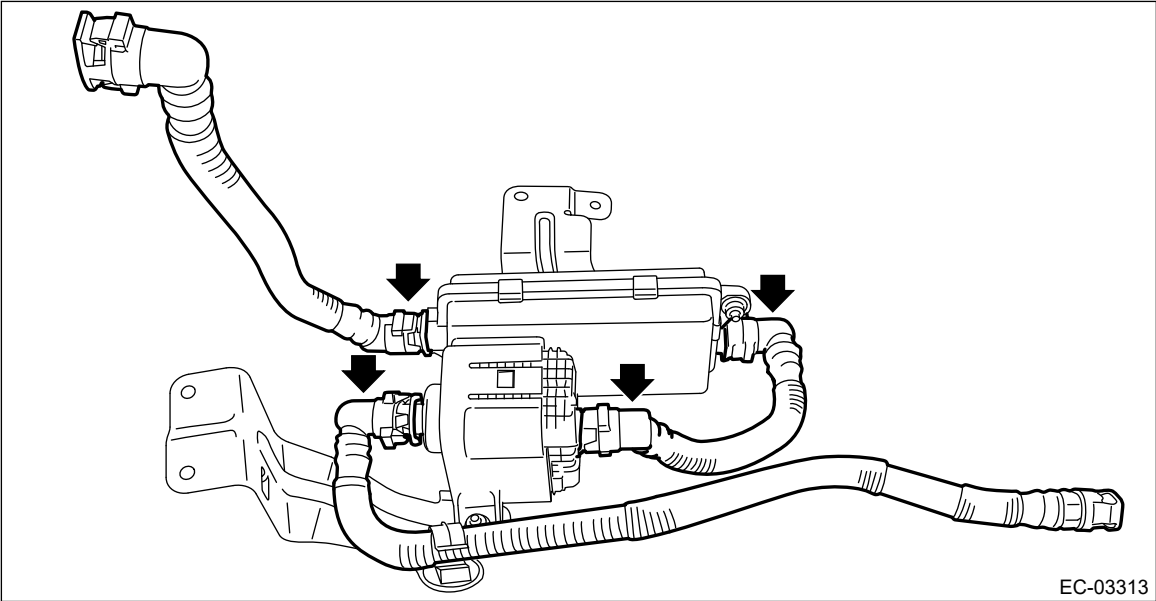
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



EC-03000



EC-03313

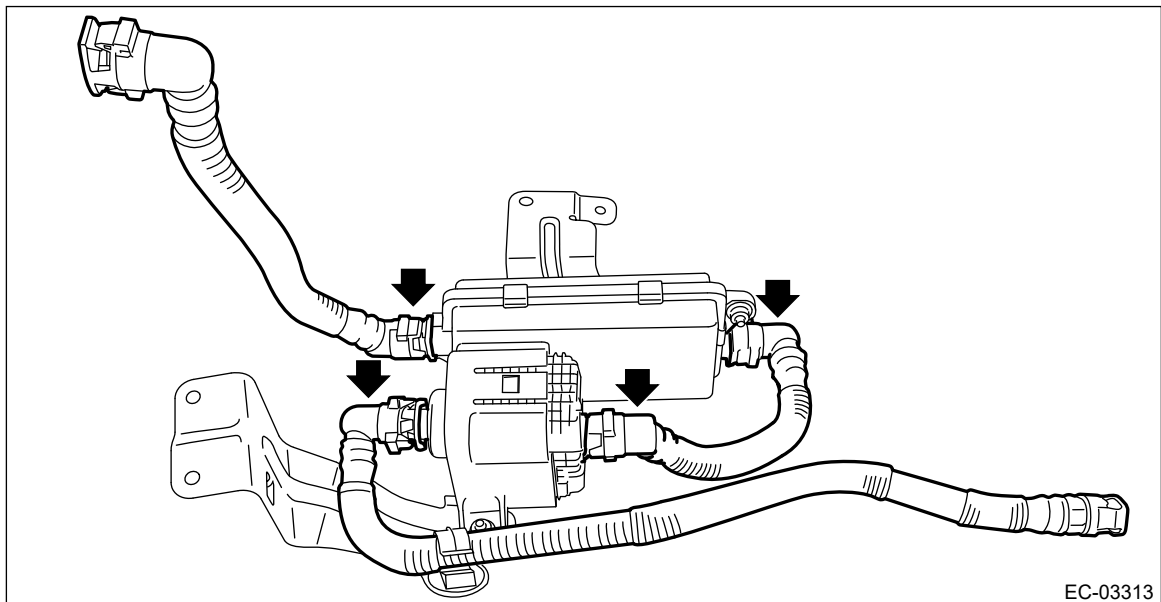
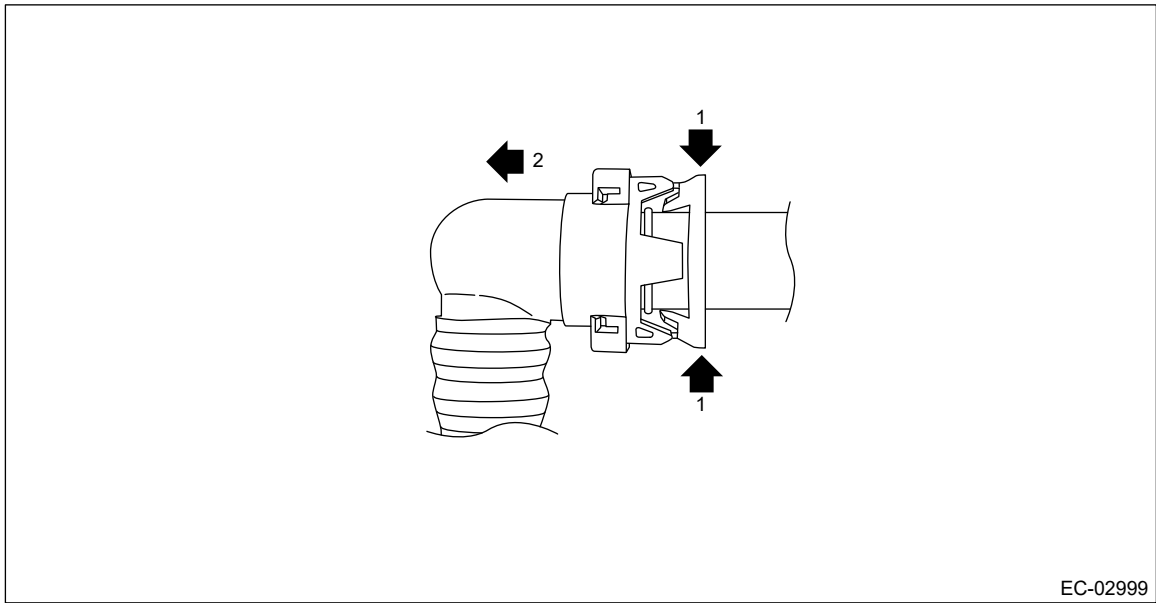
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Leak Check Valve Assembly

DISASSEMBLY

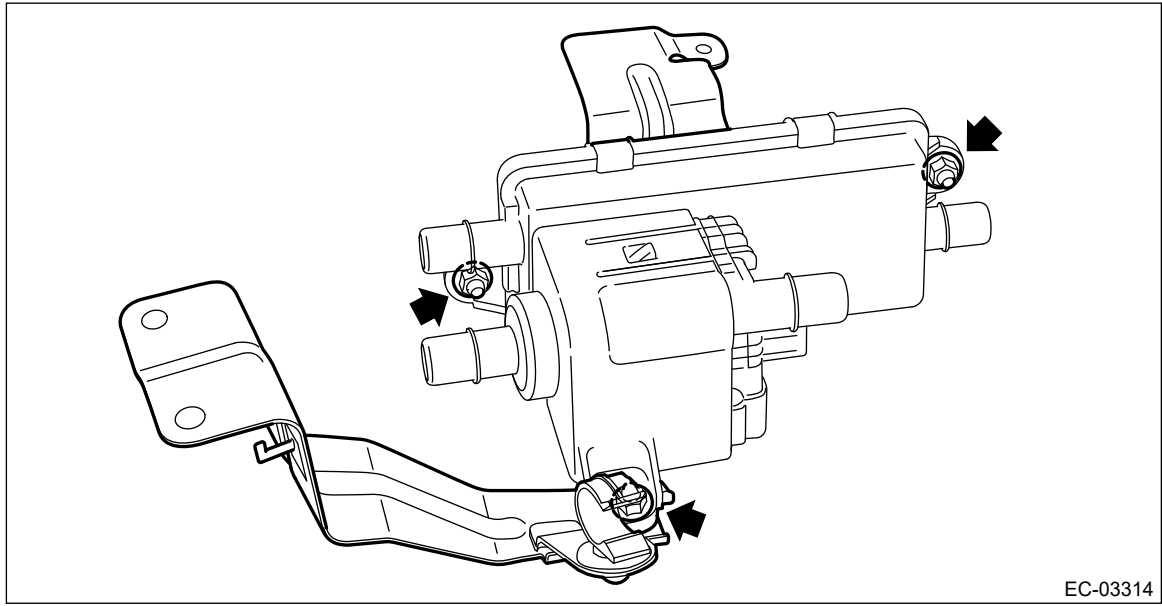
1. Disconnect the drain tube from the leak check valve assembly.

Note:

Disconnect the quick connector as shown in the figure.



2. Remove the bracket from the leak check valve assembly.



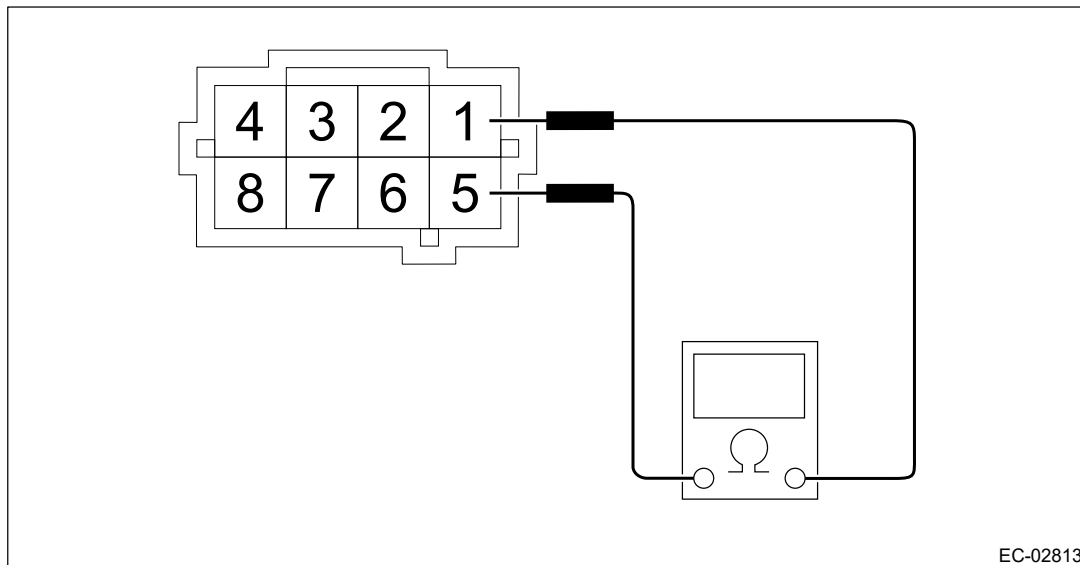
EC-03314

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Leak Check Valve Assembly

INSPECTION

1. CHECK SWITCHING VALVE

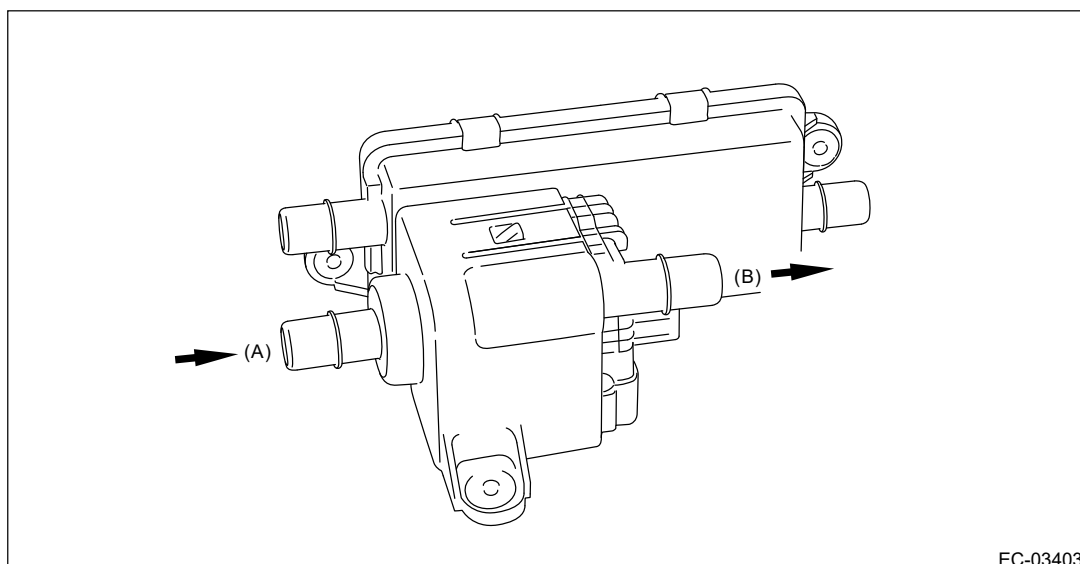
1. Check the resistance between switching valve terminals.



EC-02813

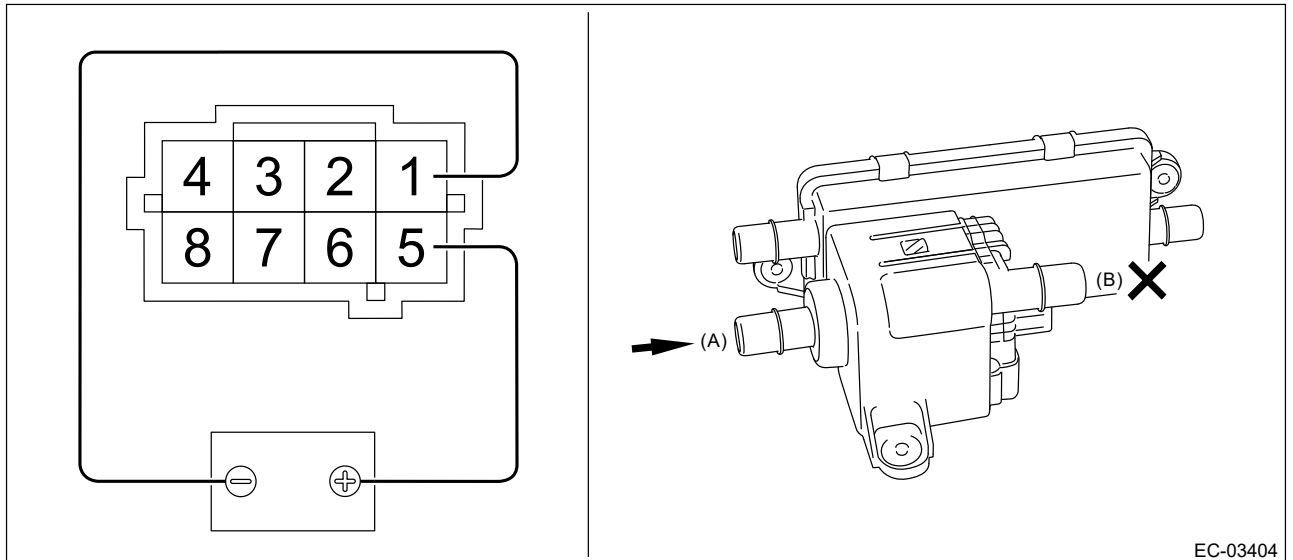
| Terminal No. | Standard |
|--------------|--|
| 1 and 5 | $27^{+3}_{-2} \Omega$ (when 20°C (68°F)) |
| | $31 \pm 4 \Omega$ (when 60°C (140°F)) |

2. Check that air is discharged from (B) when air is blown into (A).



EC-03403

3. Connect the battery positive terminal to the terminal No. 5 and the battery ground terminal to the terminal No. 1. Check that air does not come out from (B) when air is blown into (A).

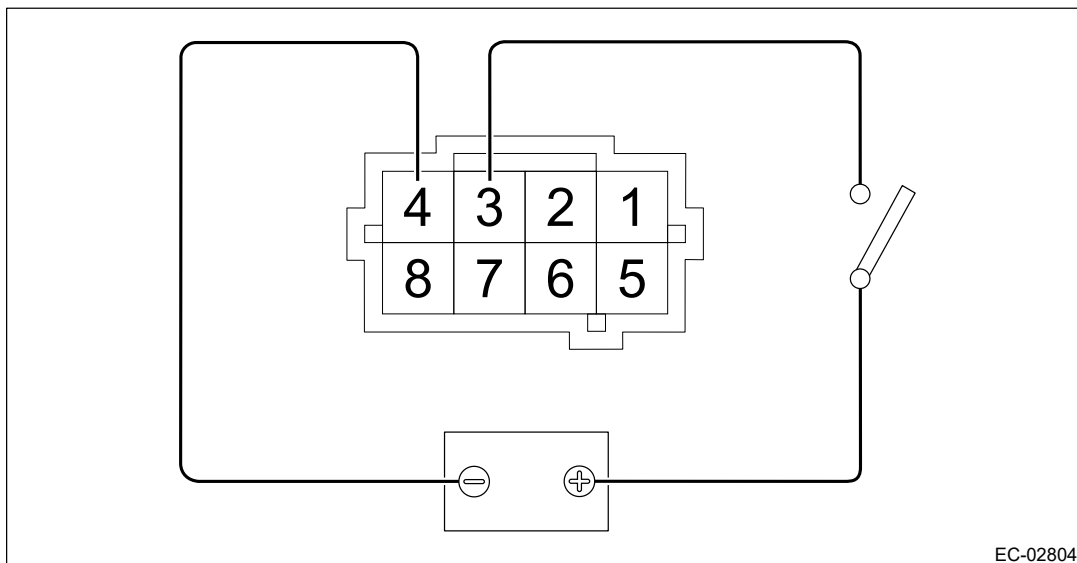


2. CHECK VACUUM PUMP

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

Caution:

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

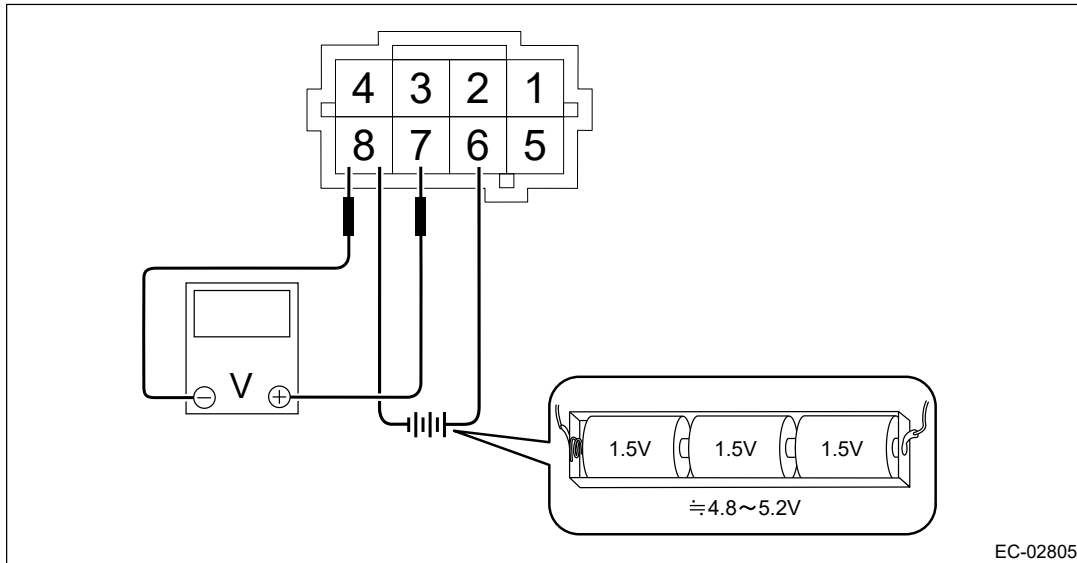


3. CHECK PRESSURE SENSOR

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

Note:

- Use new dry-cell batteries.
- Using a circuit tester, check that the initial voltage of each dry-cell battery is 1.6 V or more. And also check that the voltage of three batteries in series is between 4.8 – 5.2 V.
- For power supply, 5 V DC constant voltage power source can also be used.



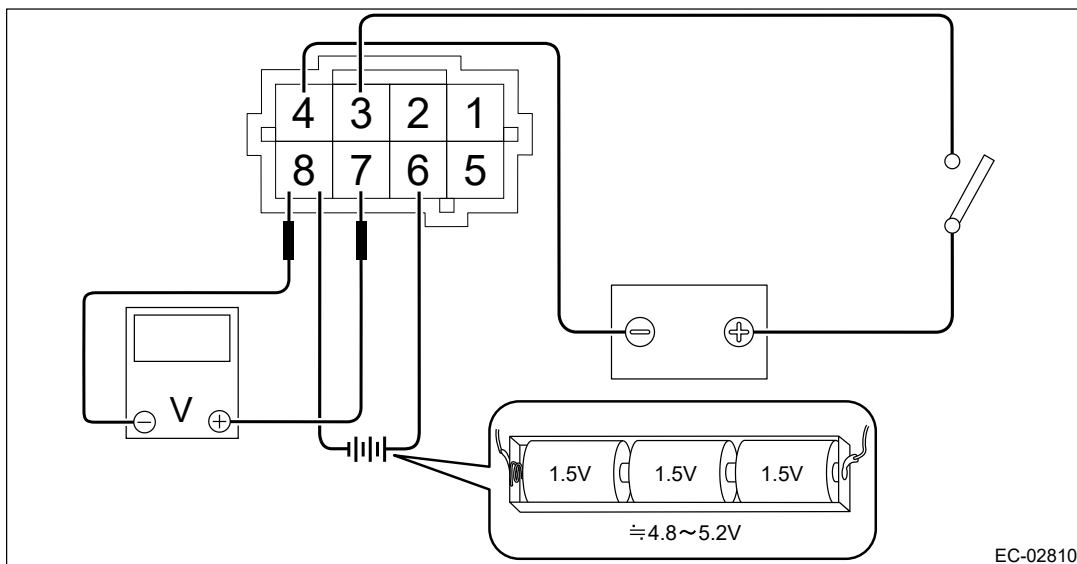
2. Check the voltage at a normal atmospheric pressure.

Note:

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

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

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



4. OTHER INSPECTIONS

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

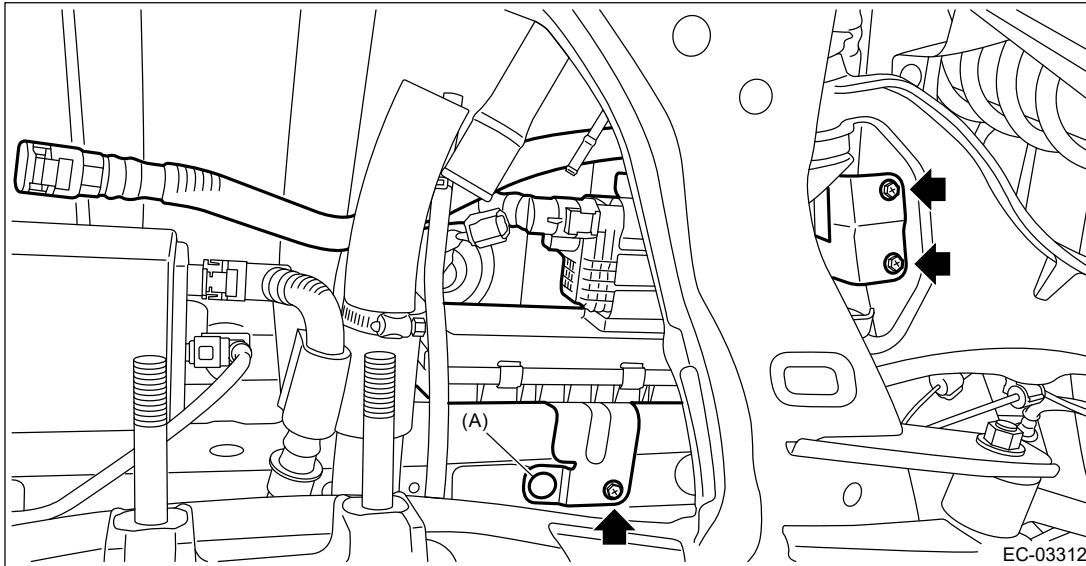
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Leak Check Valve Assembly

INSTALLATION

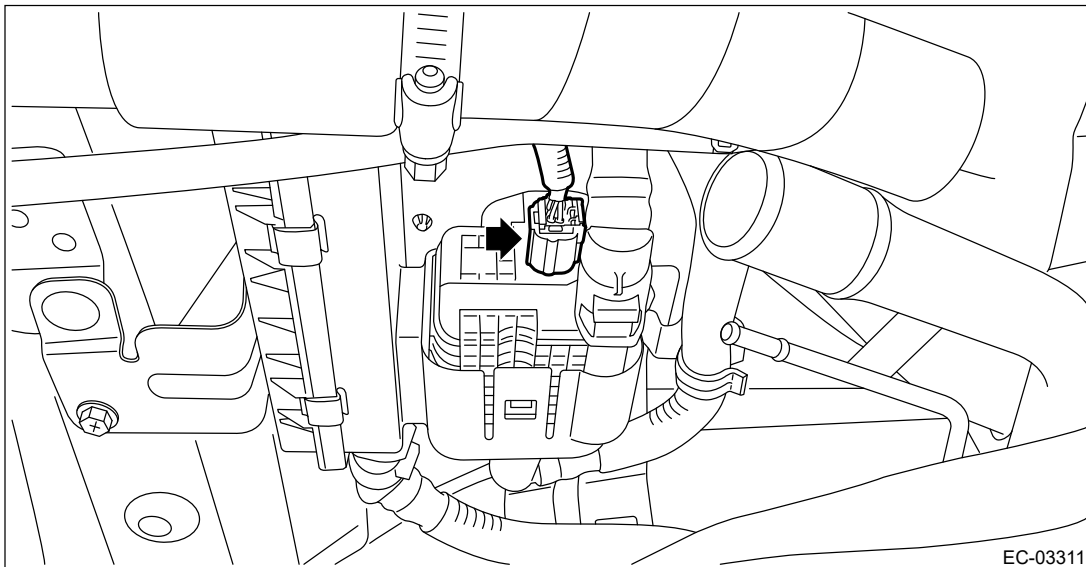
1. Install the leak check valve assembly to the vehicle with the bolt and clip (A).

Tightening torque:

7.5 N•m (0.8 kgf-m, 5.5 ft-lb)



2. Connect the connector to the leak check valve assembly.



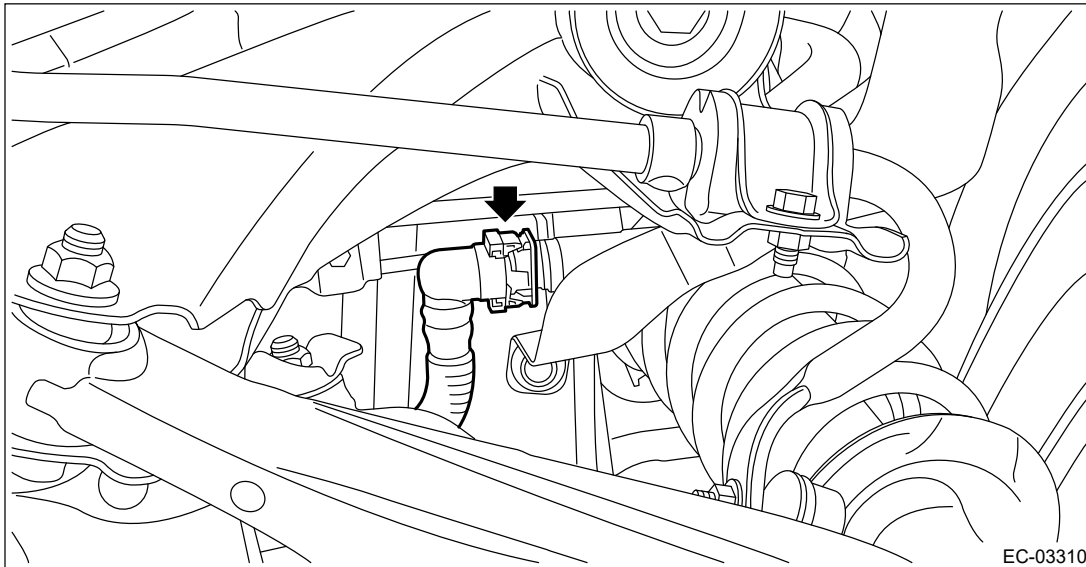
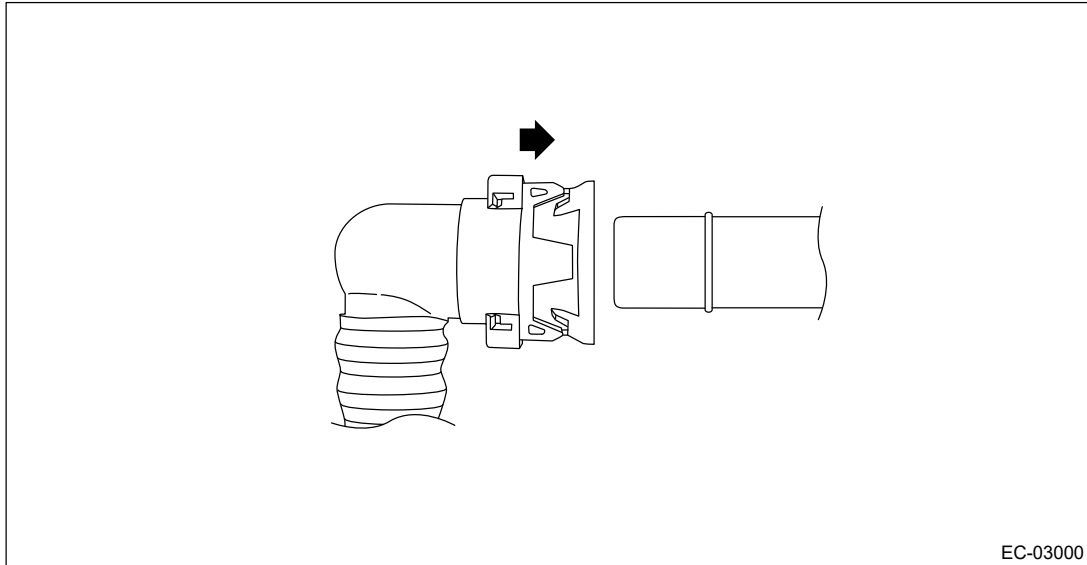
3. Connect the drain tube to the drain pipe of the fuel filler pipe assembly.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

Note:

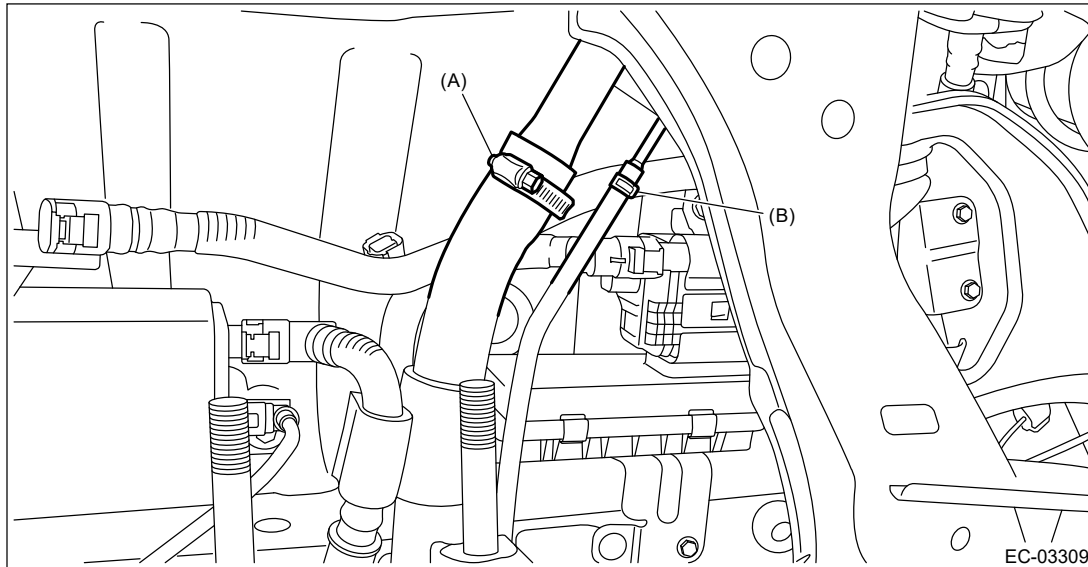
Connect the quick connector as shown in the figure.



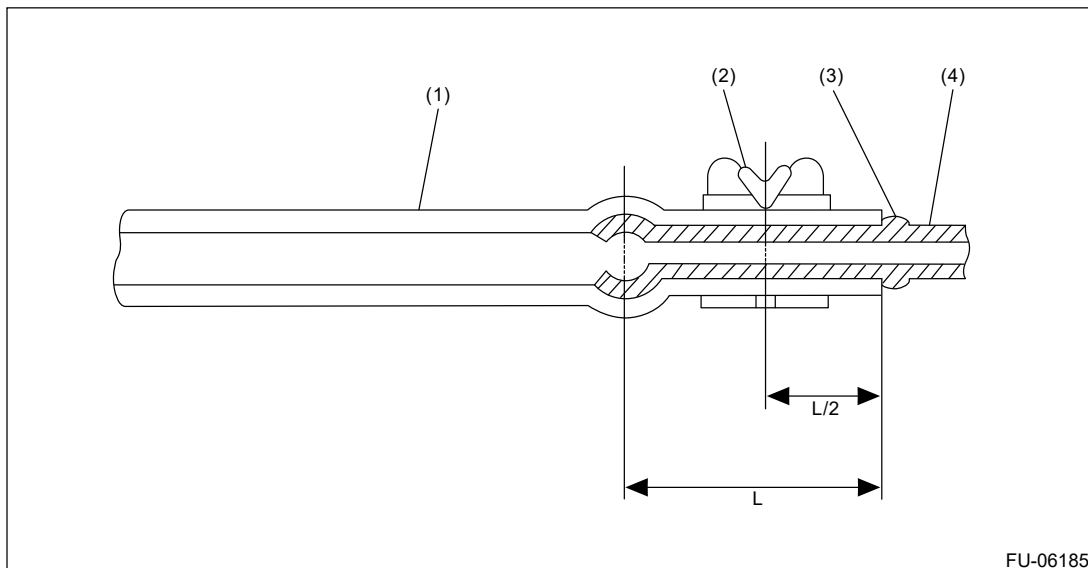
4. Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp and clip as shown in the figure.

Tightening torque:

2.5 N•m (0.3 kgf-m, 1.8 ft-lb)



EC-03309



FU-06185

(1) Hose

(3) Spool

(4) Pipe

(2) Clamp and clip

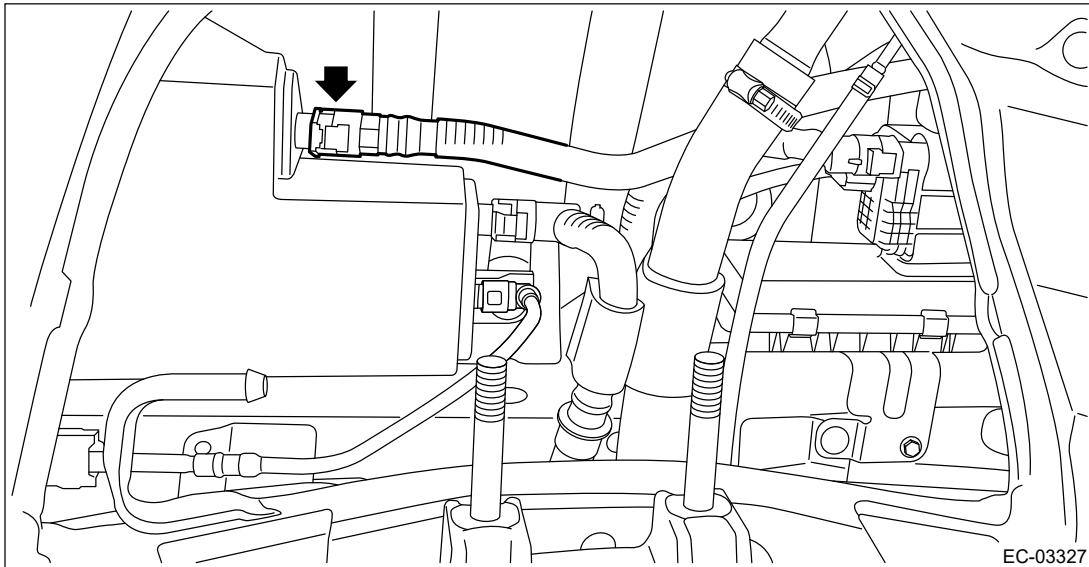
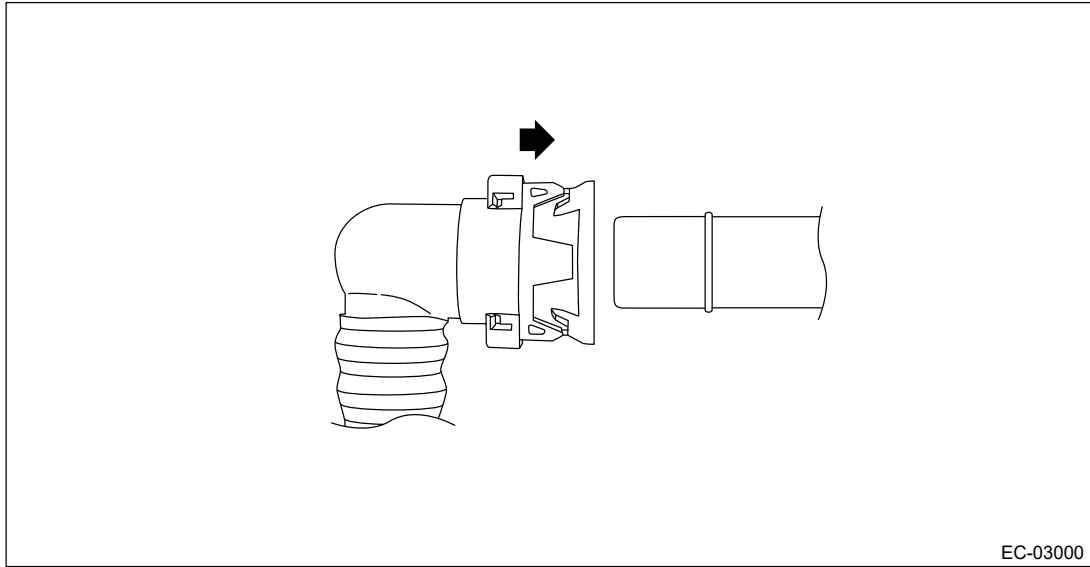
5. Connect the drain tube to the canister.

Caution:

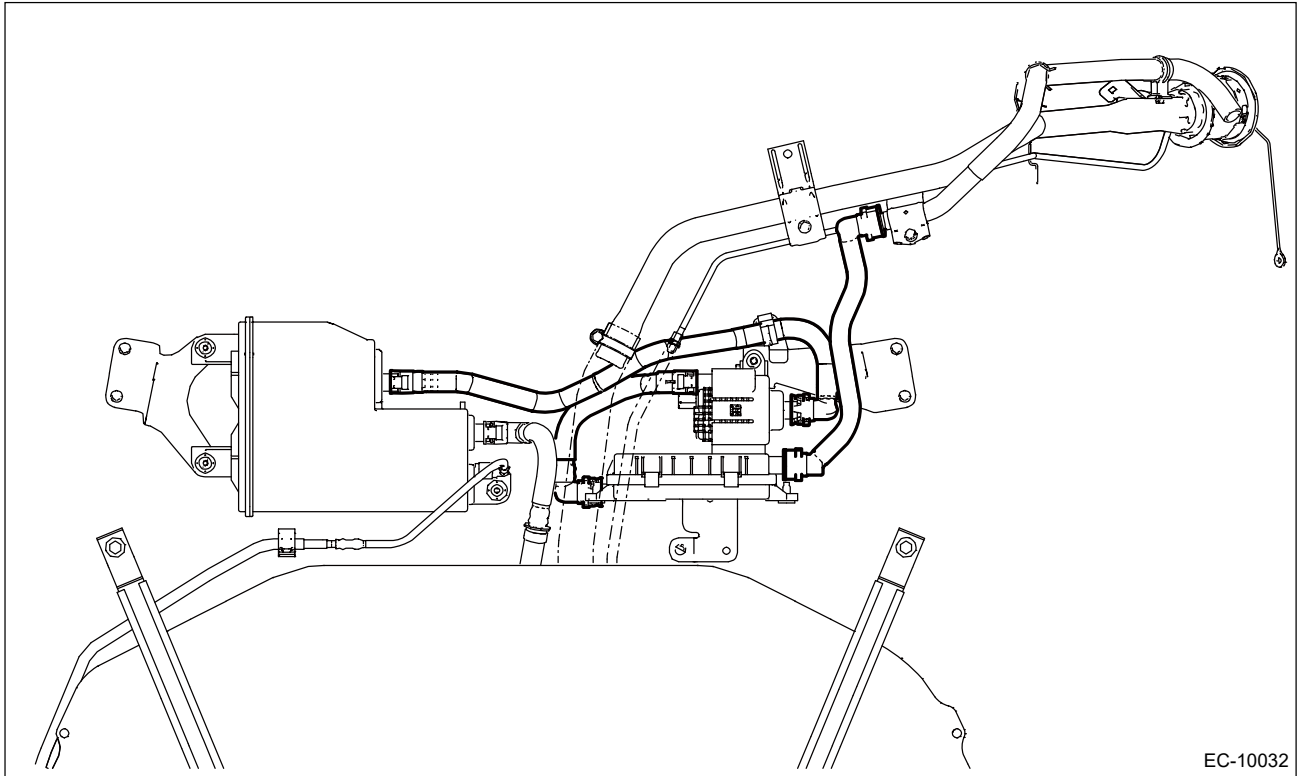
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



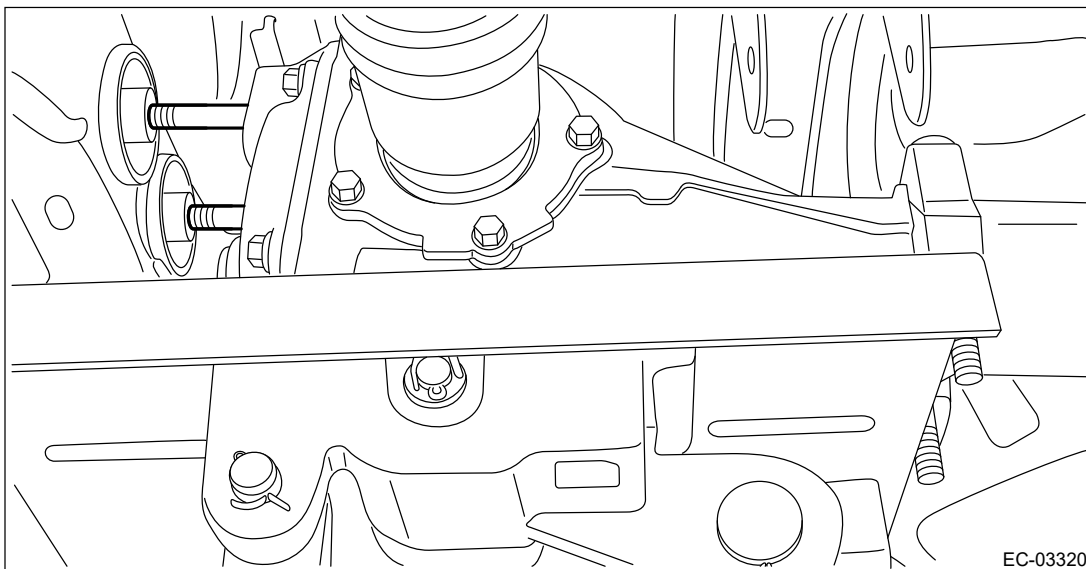
6. Check again that each tube is connected as shown in the figure.



- 7.** Lift up the transmission jack gradually, and set the rear differential to the rear sub frame assembly.

Note:

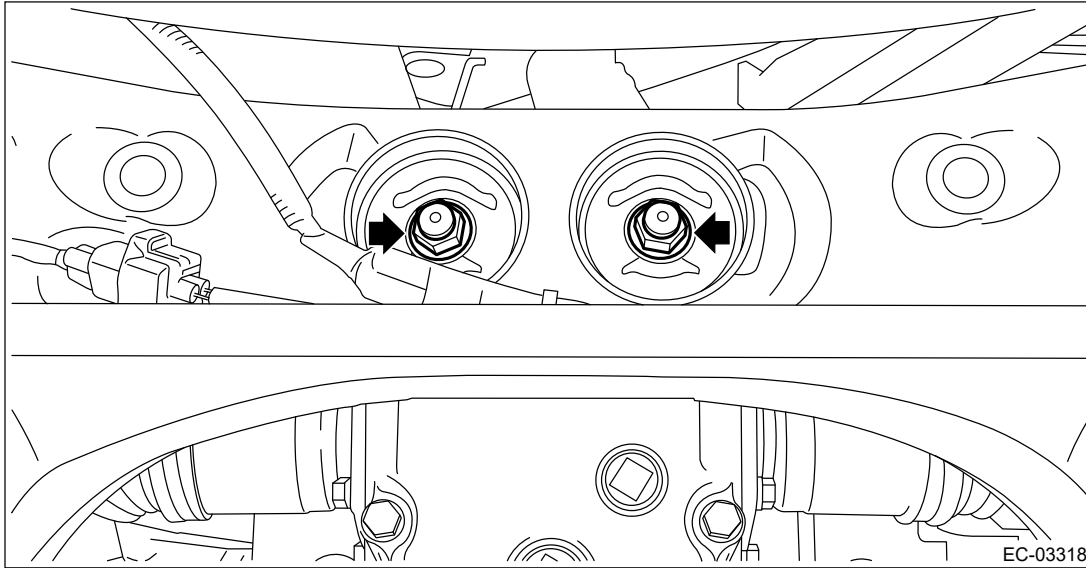
When inserting the stud bolt into the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.



- 8.** Temporarily tighten the self-locking nuts which hold the rear differential to the rear sub frame assembly.

Note:

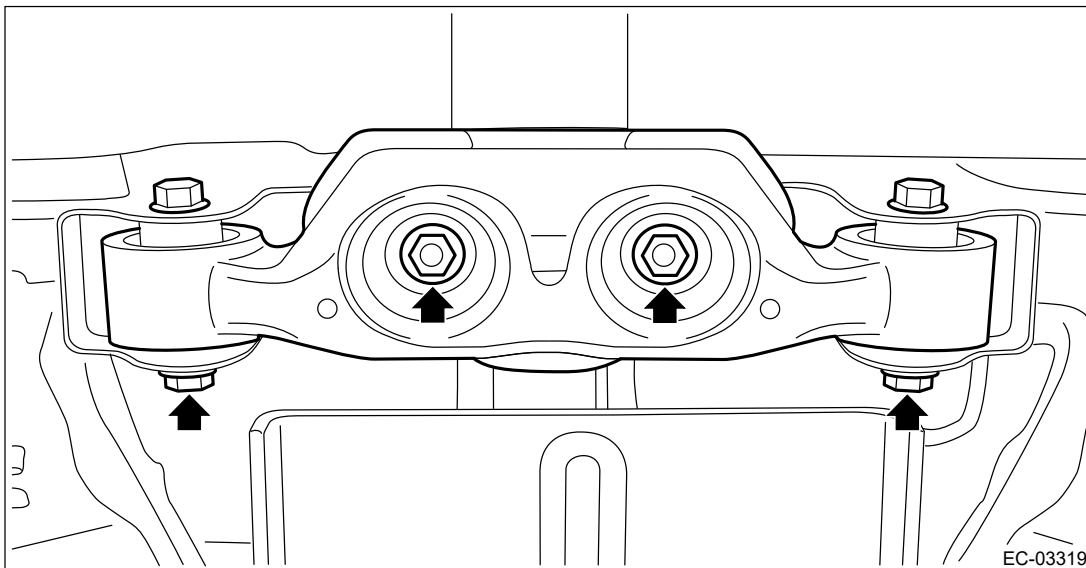
Use a new self-locking nut.



9. Set the rear differential member to the rear sub frame assembly and rear differential, and temporarily tighten the self-lock nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Note:

Use a new self-locking nut.

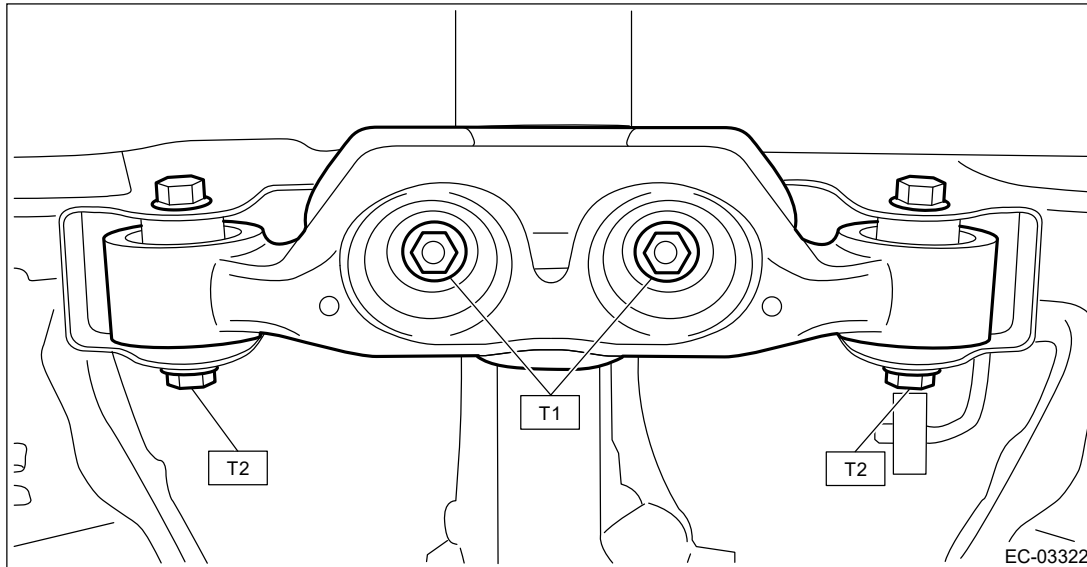


10. Remove the transmission jack from the rear differential.
11. Tighten the self-locking nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Tightening torque:

T1: 50 N•m (5.1 kgf-m, 36.9 ft-lb)

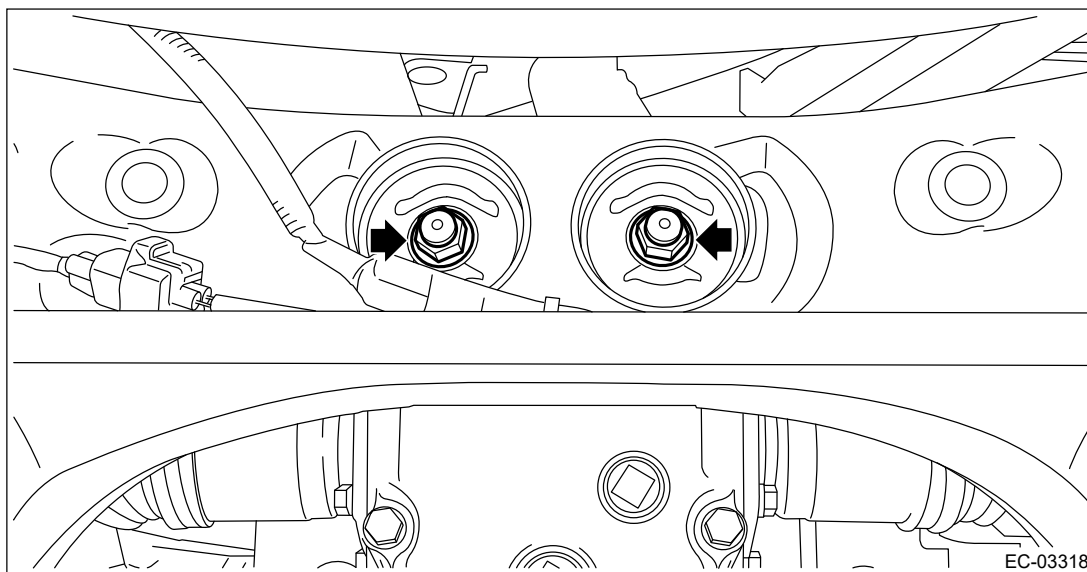
T2: 110 N•m (11.2 kgf-m, 81.1 ft-lb)



12. Tighten the self-locking nuts which secure the rear differential to the rear sub frame assembly.

Tightening torque:


70 N•m (7.1 kgf-m, 51.6 ft-lb)



13. Install the propeller shaft.  [Ref. to DRIVE SHAFT SYSTEM>Propeller Shaft>INSTALLATION.](#)

14. Install the rear exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Rear Exhaust Pipe>INSTALLATION.](#)

15. Lower the vehicle.

16. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

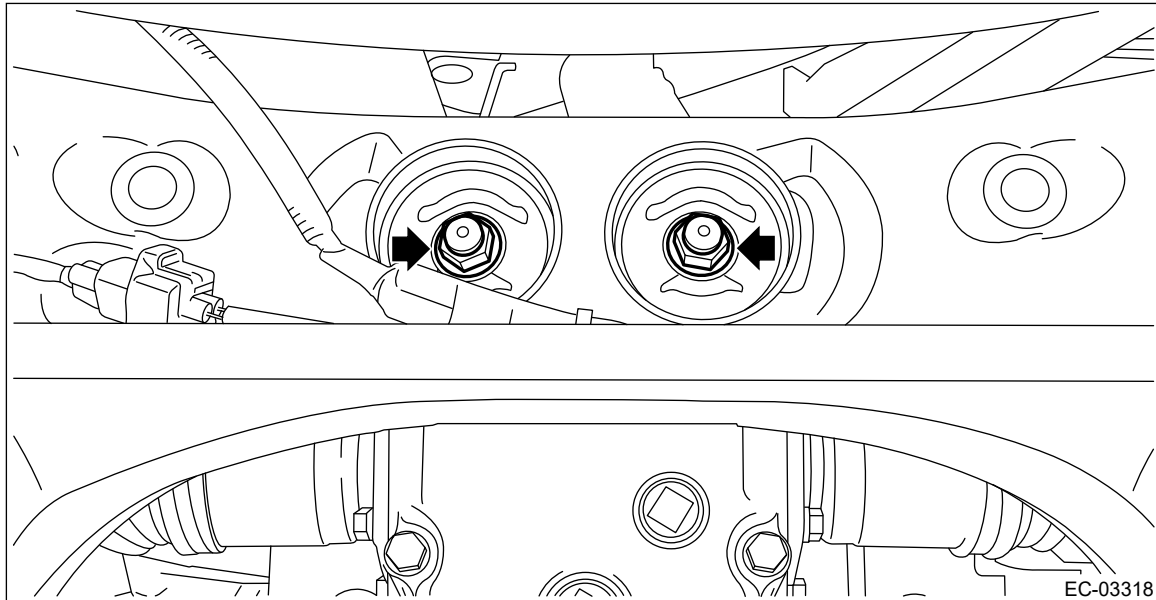
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Leak Check Valve Assembly

REMOVAL

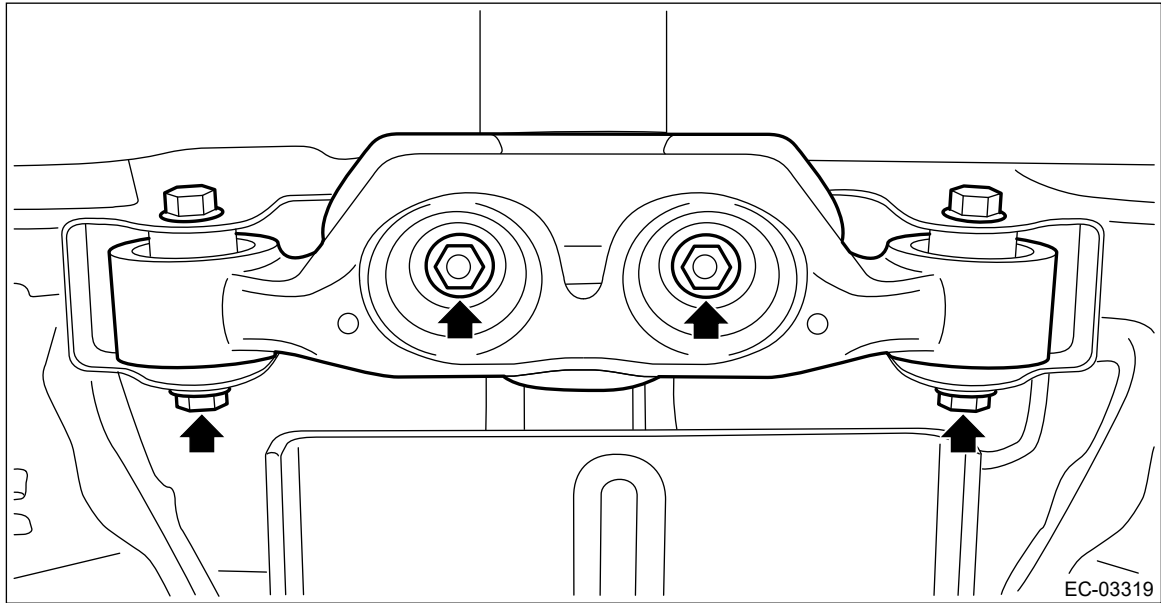
Note:

Refer to the [ENGINE \(DIAGNOSTICS\) \(H4DO\)](#) section for installation position. [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Electrical Component Location>LOCATION > SOLENOID VALVE, ACTUATOR, EMISSION CONTROL SYSTEM PARTS AND IGNITION SYSTEM PARTS.](#)

1. Disconnect the ground terminal from battery sensor. [Ref. to NOTE>NOTE > BATTERY.](#)
2. Lift up the vehicle.
3. Remove the rear exhaust pipe. [Ref. to EXHAUST\(H4DO\)>Rear Exhaust Pipe>REMOVAL.](#)
4. Remove the propeller shaft. [Ref. to DRIVE SHAFT SYSTEM>Propeller Shaft>REMOVAL.](#)
5. Support the rear differential with the transmission jack.
6. Remove the self-locking nuts which hold the rear differential to the rear sub frame assembly.



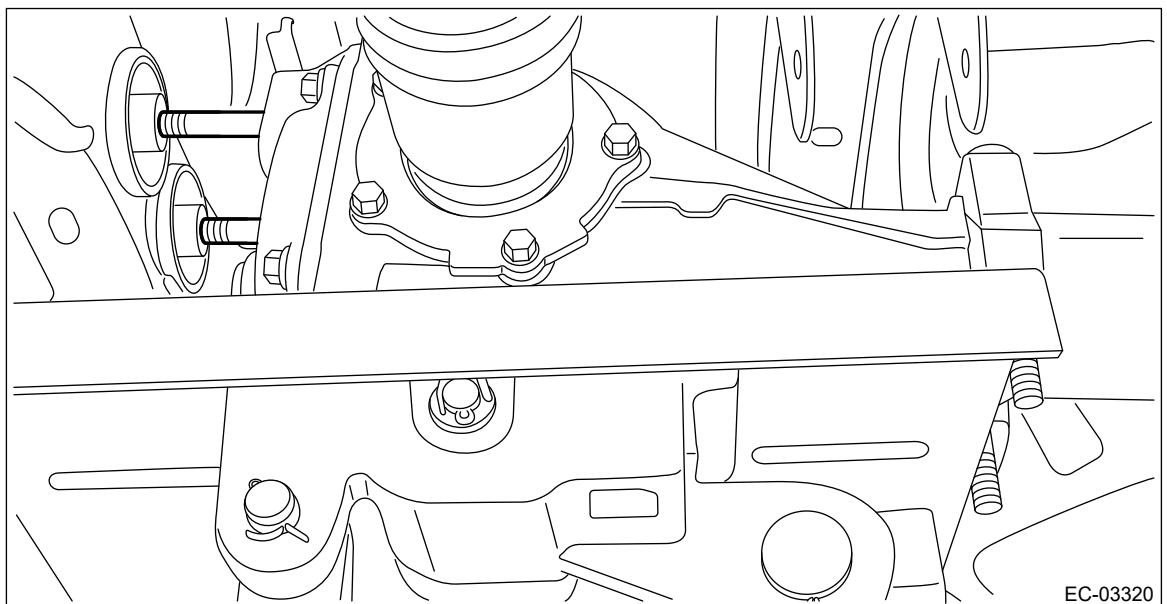
7. Remove the rear differential member from the rear sub frame assembly and the rear differential.



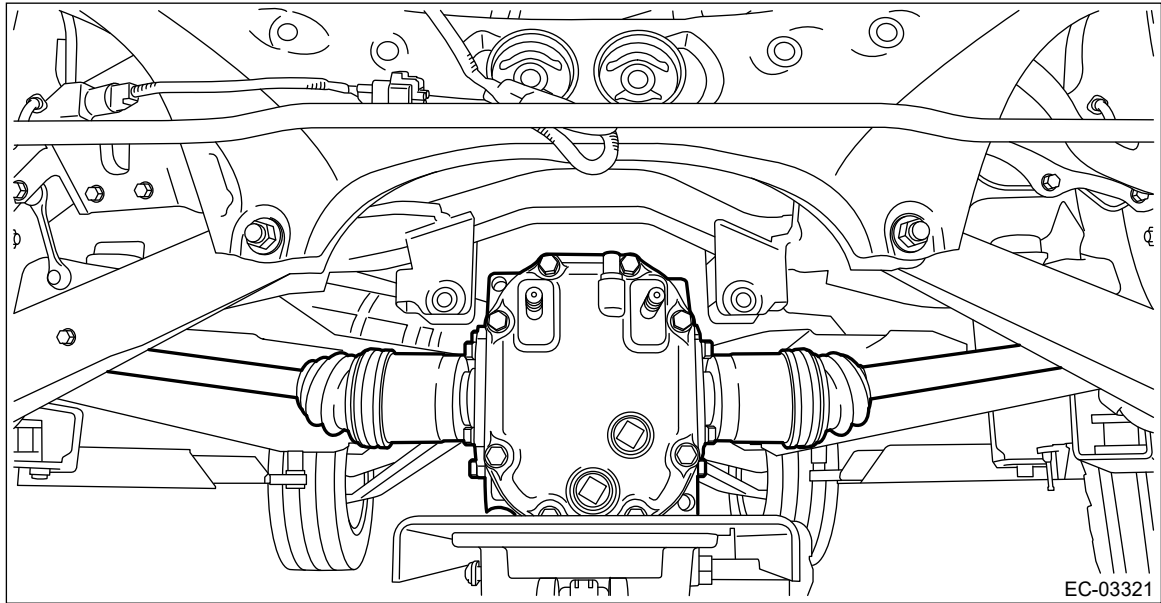
8. Lower the transmission jack gradually until the rear differential is at the position shown in the figure.

Note:

- **When pulling out the stud bolt from the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.**



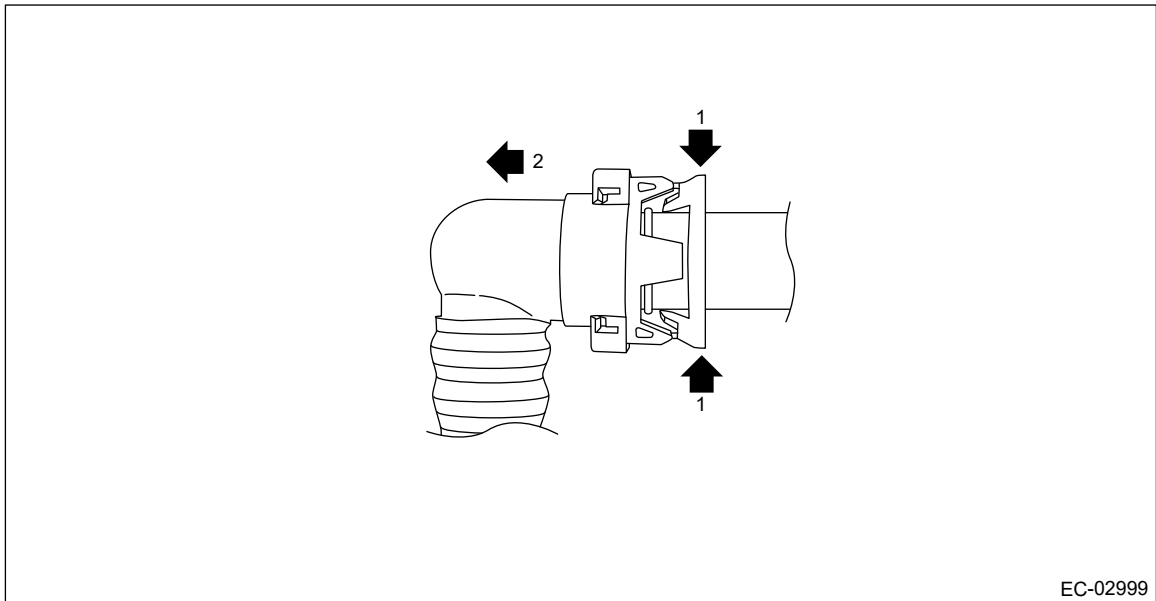
- **Do not lower the rear differential excessively. Doing so may add extra load to the drive shaft or cause the falling-off of the drive shaft.**

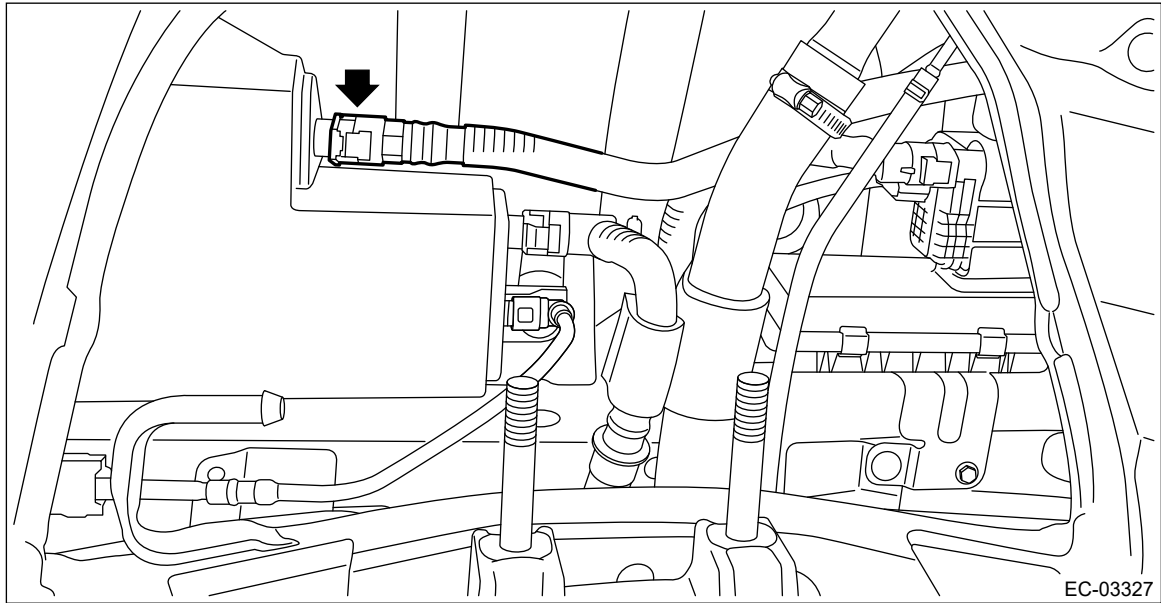


9. Disconnect the drain tube from the canister.

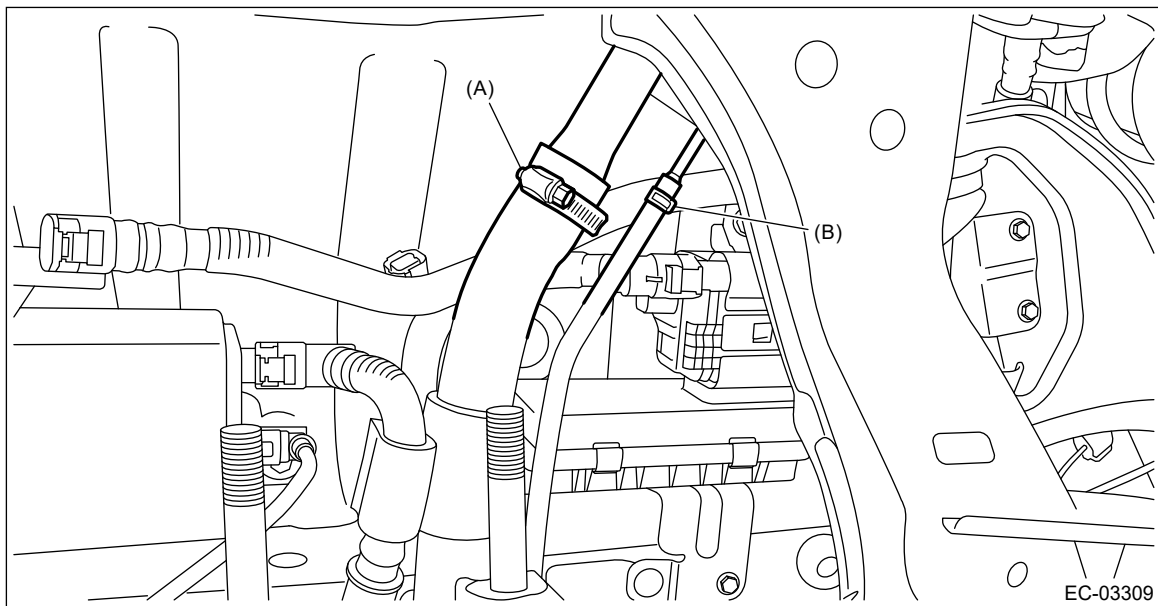
Note:

Disconnect the quick connector as shown in the figure.





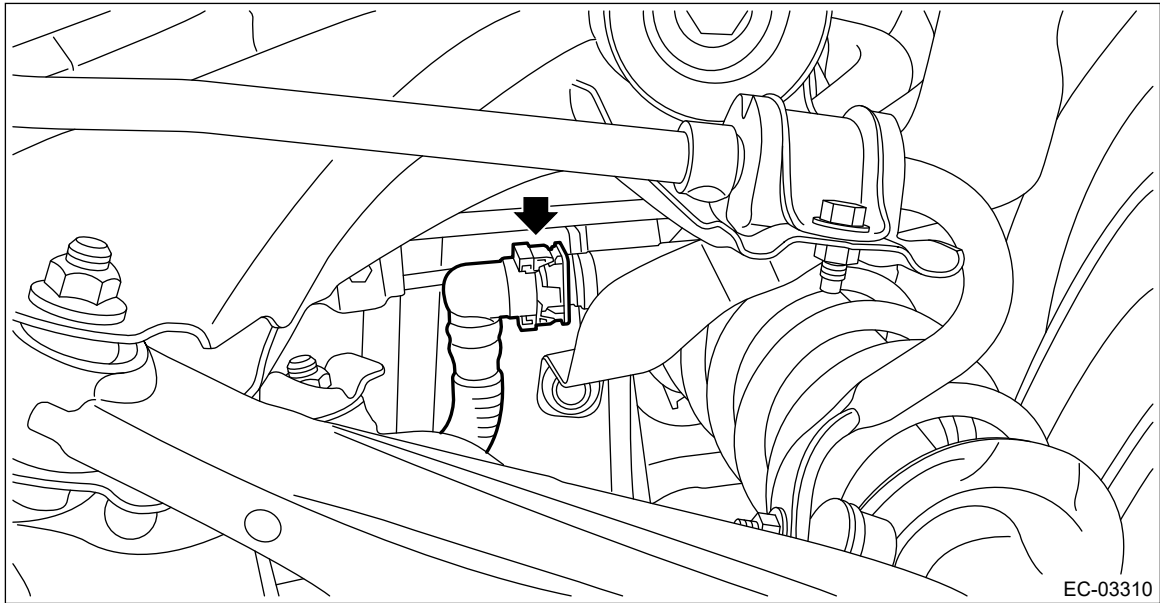
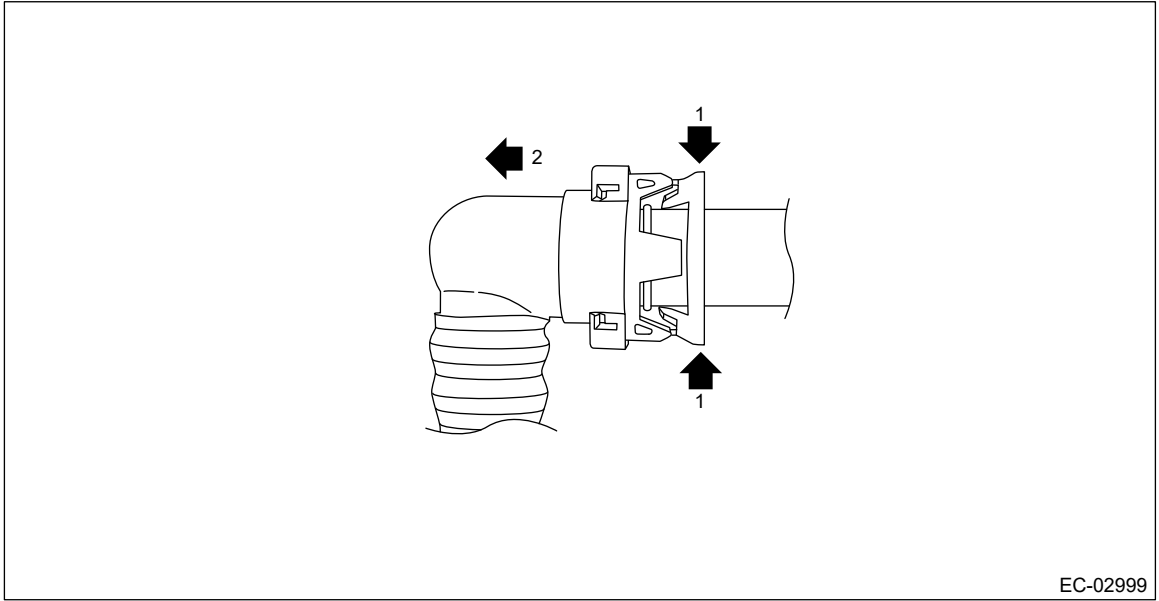
10. Disconnect the fuel filler hose (A) and evaporation hose (B).



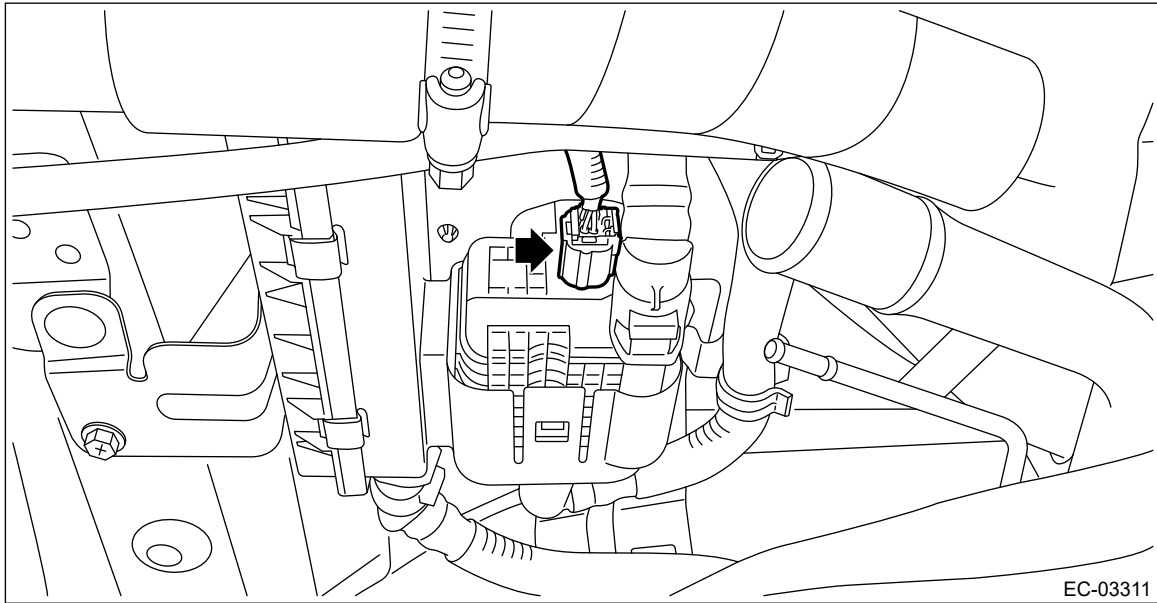
11. Disconnect the drain tube from the drain pipe of the fuel filler pipe assembly.

Note:

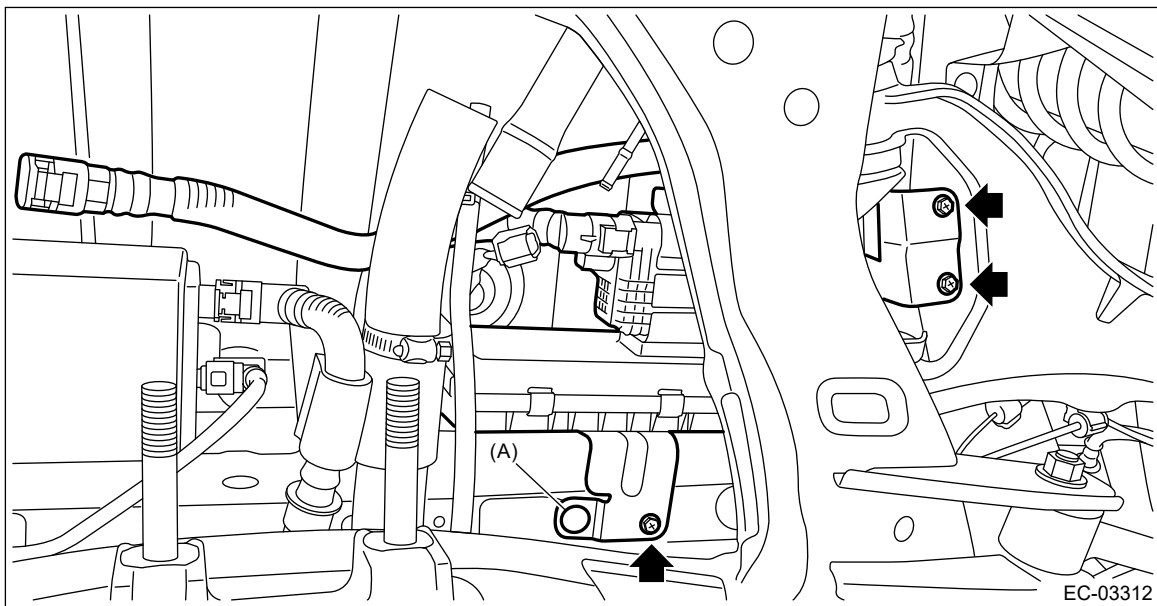
Disconnect the quick connector as shown in the figure.



12. Disconnect the connector from the leak check valve assembly.



- 13.** Remove the bolt and clip (A) which secure the leak check valve assembly to the vehicle, and remove the leak check valve assembly.





EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > PCV Hose

INSPECTION

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

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > PCV Hose

INSTALLATION

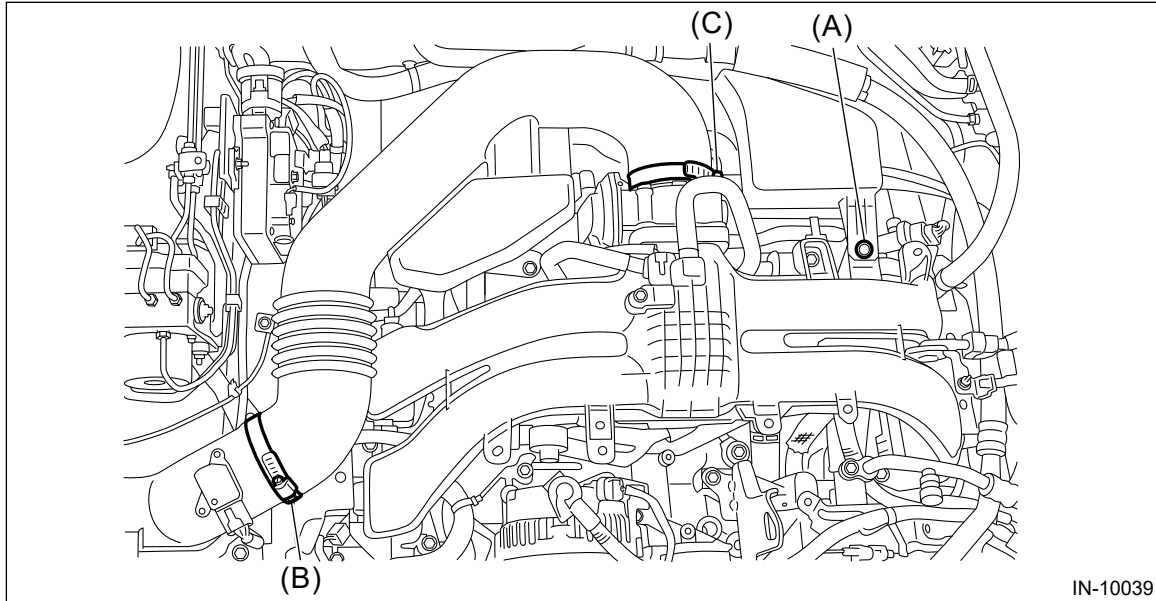
- 1.** Attach the PCV hose B to the PCV connector.
- 2.** Install the intake manifold assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>INSTALLATION.](#)
- 3.** Connect the PCV hose A to the intake manifold assembly and the PCV valve.
- 4.** Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > PCV Hose REMOVAL

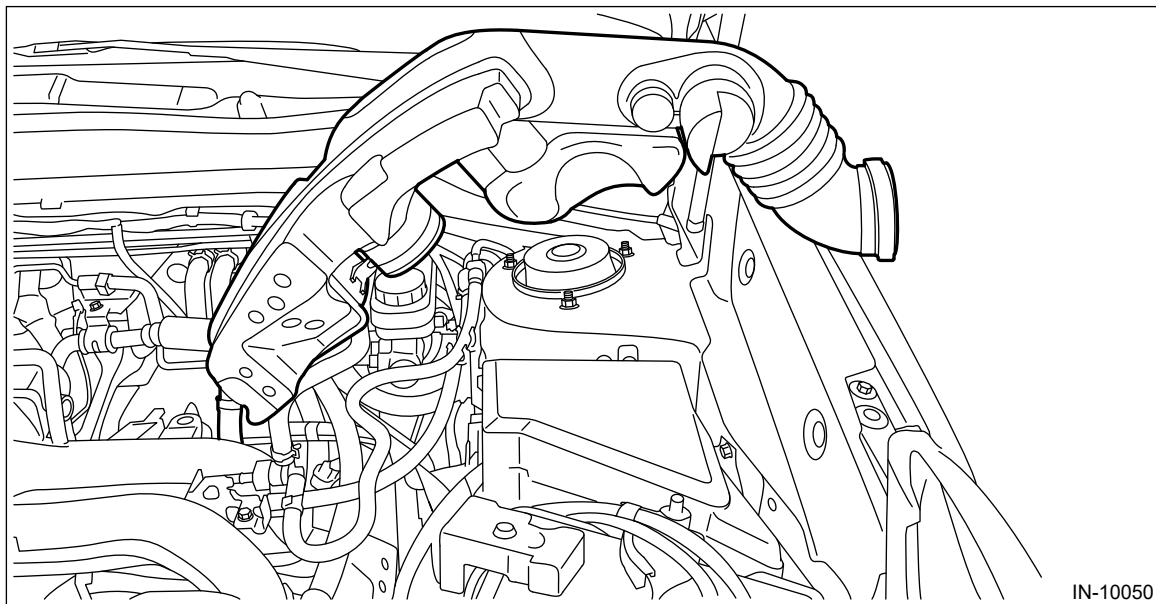
Caution:

Do not remove except when the PCV hose is broken.

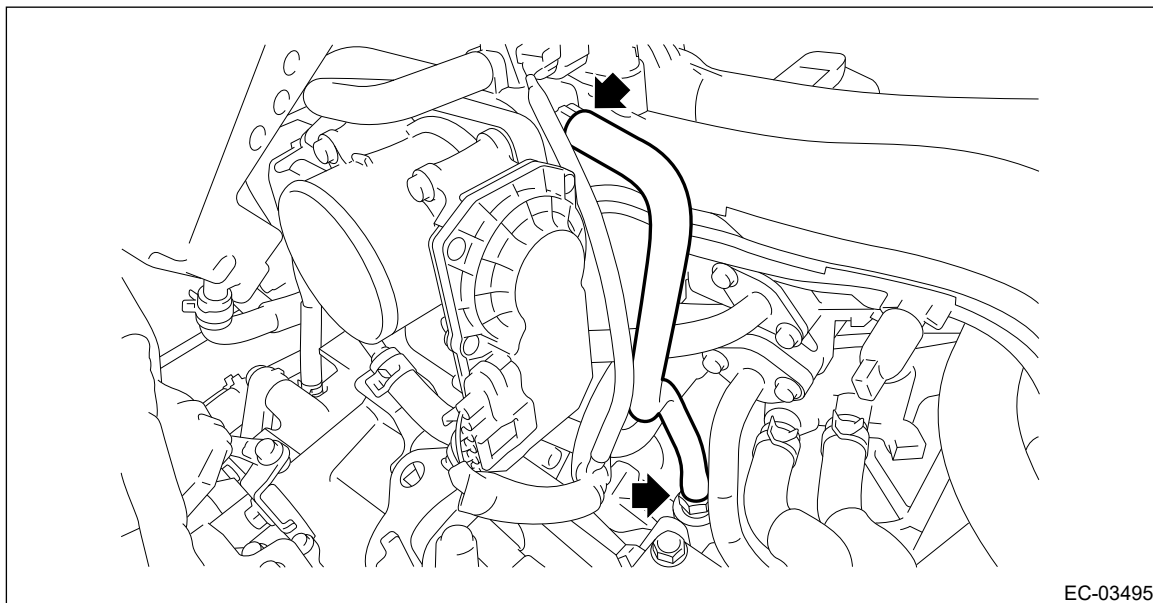
1. Remove the clip (A) from the air intake boot.
2. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
3. Loosen the clamp (C) which secures the throttle body to the air intake boot.




4. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.

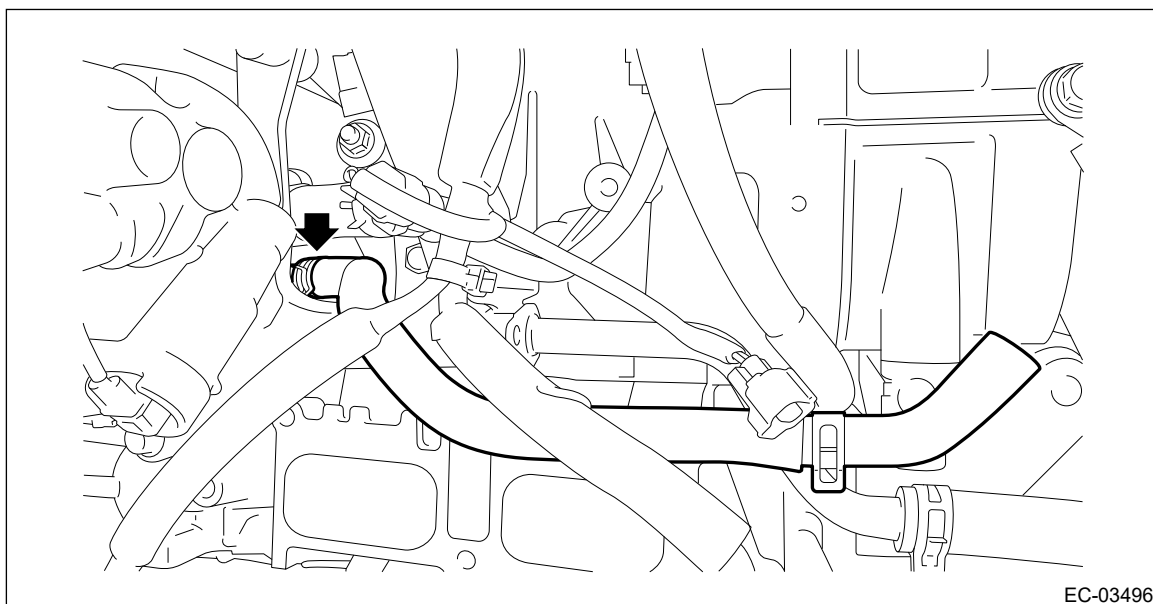


5. Disconnect the PCV hose A from the intake manifold assembly and the PCV valve, and then remove the PCV hose A.



EC-03495

6. Remove the intake manifold assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DO\)>Intake Manifold Assembly>REMOVAL.](#)
7. Remove the PCV hose B from the PCV connector.

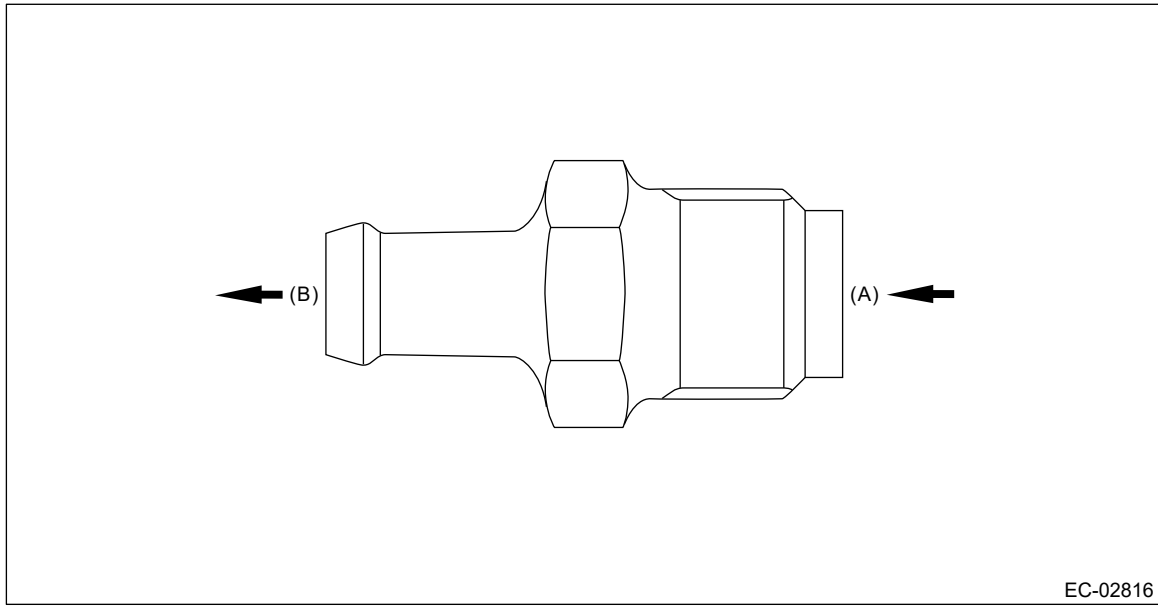


EC-03496

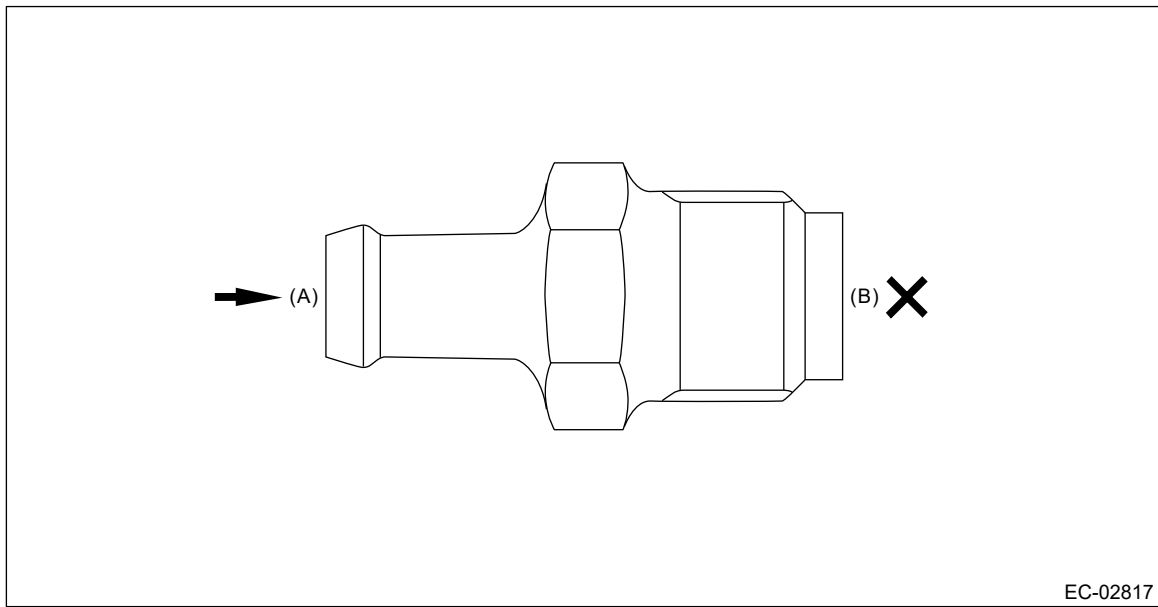
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > PCV Valve
INSPECTION

1. PCV VALVE

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



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



2. OTHER INSPECTIONS

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

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > PCV Valve

INSTALLATION

1. Install the PCV valve onto the cylinder block RH.

Note:


Apply liquid gasket to the bolt threads of PCV valve.

Liquid gasket:

THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:

23 N·m (2.3 kgf-m, 17.0 ft-lb)

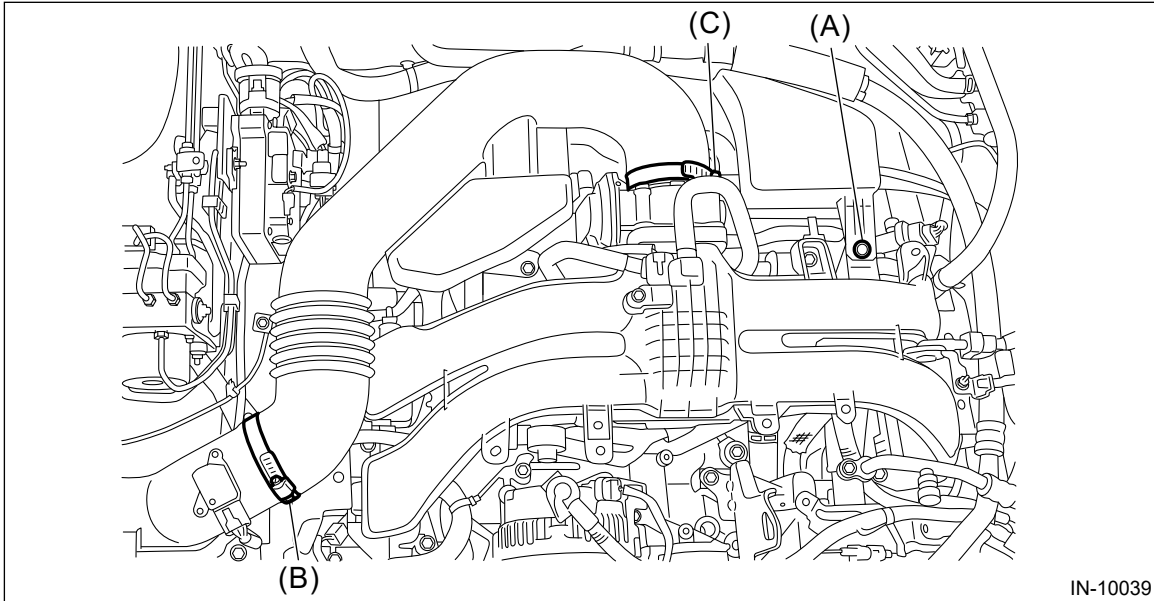
2. Connect the PCV hose to the intake manifold assembly and the PCV valve.
3. Install the air intake boot.  [Ref. to INTAKE_\(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > PCV Valve REMOVAL

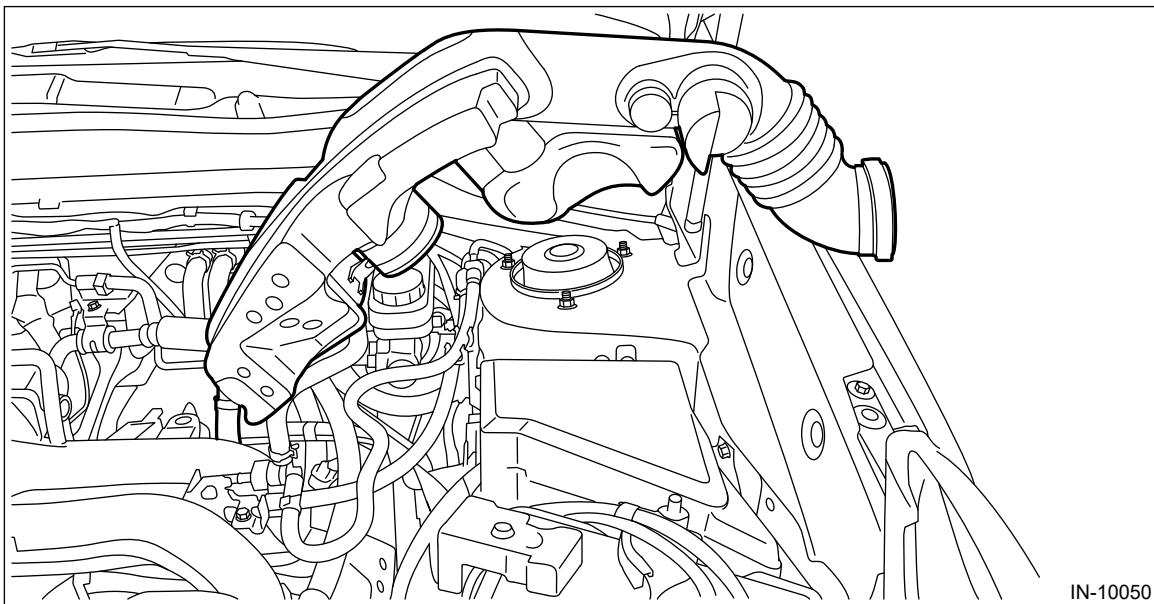
Caution:

Do not remove unless the PCV valve is broken.

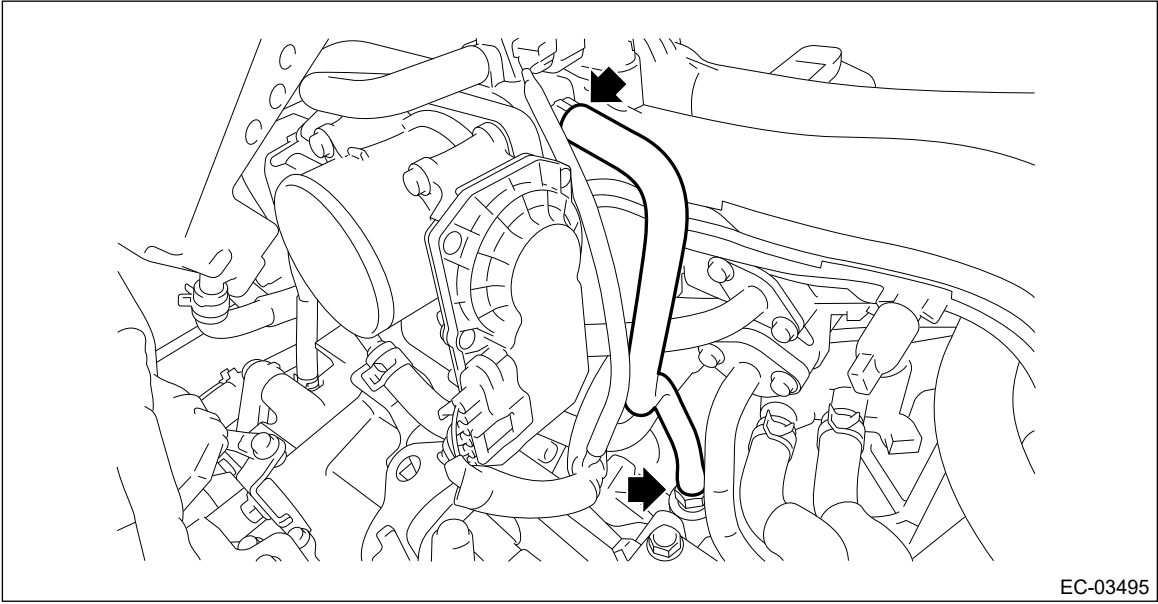
1. Remove the clip (A) from the air intake boot.
2. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
3. Loosen the clamp (C) which secures the throttle body to the air intake boot.



4. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.

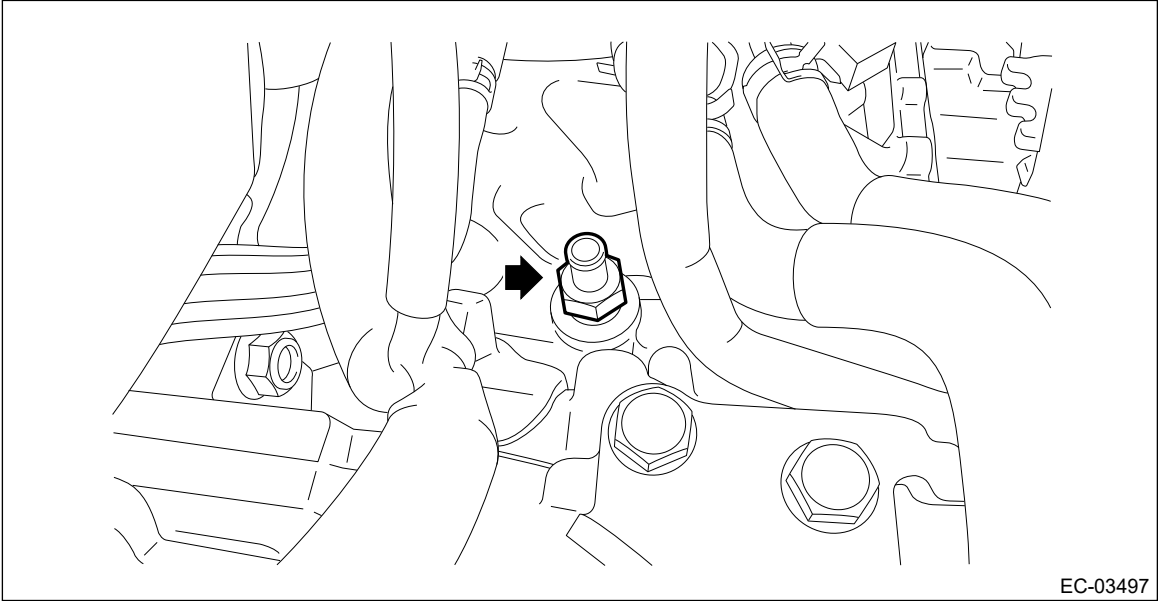


5. Disconnect the PCV hose from the intake manifold assembly and the PCV valve, and then remove the PCV hose.



EC-03495

6. Remove the PCV valve from the cylinder block RH.



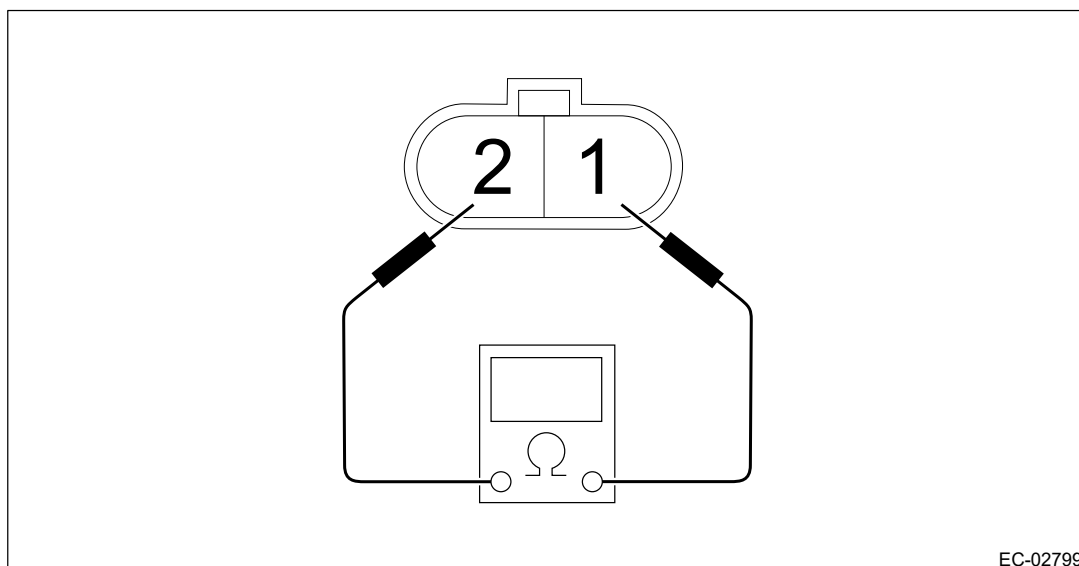
EC-03497

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Purge Control Solenoid Valve

INSPECTION

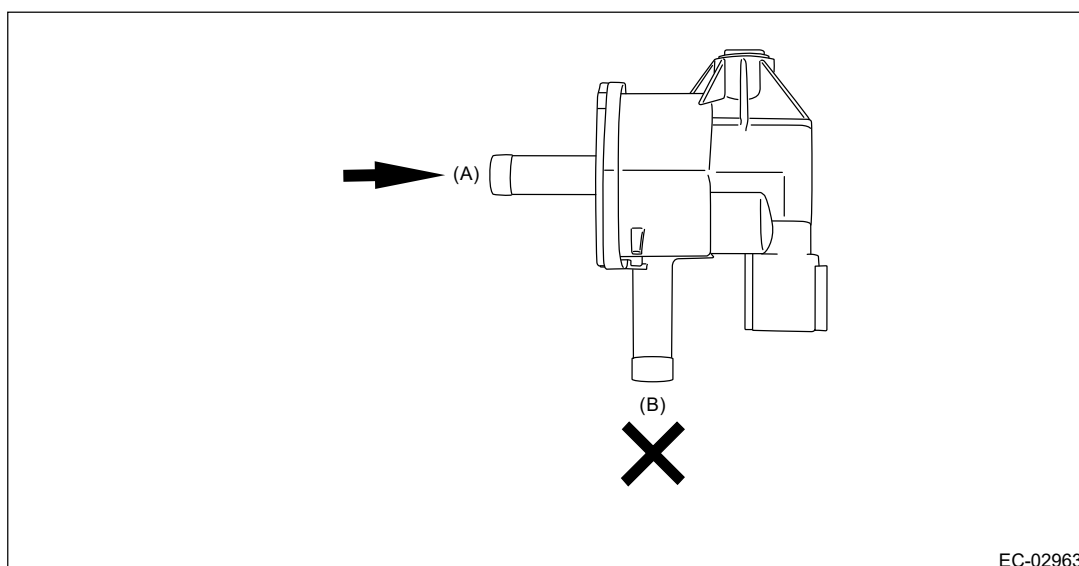
1. PURGE CONTROL SOLENOID VALVE

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

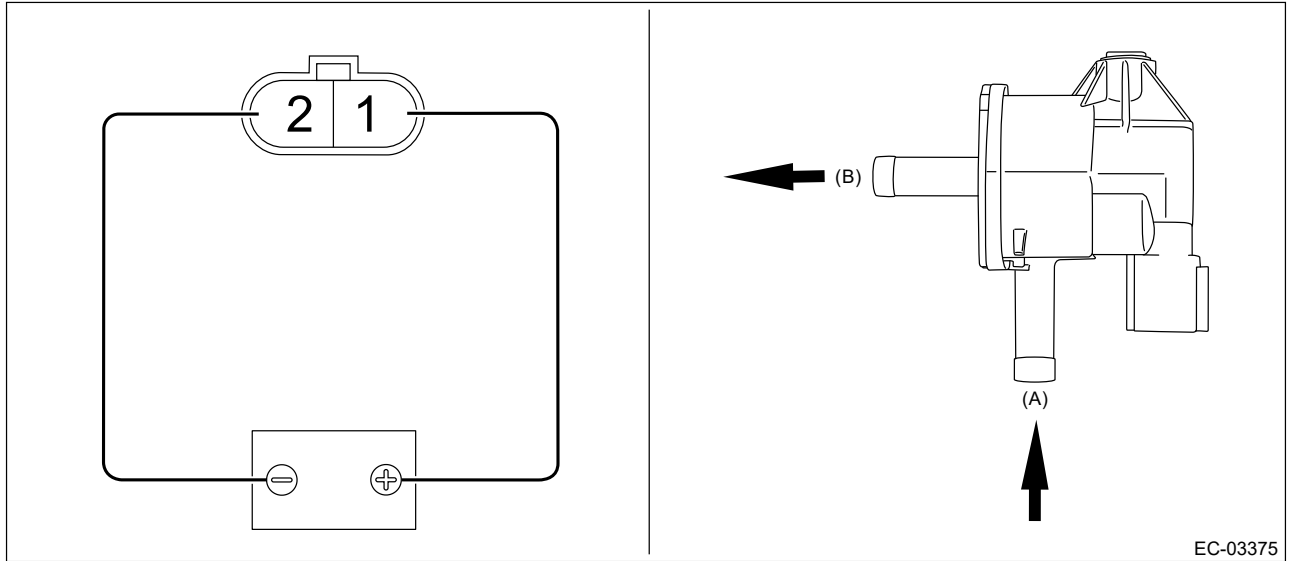


| Terminal No. | Standard |
|--------------|-------------------------------|
| 1 and 2 | 24.5±1.5 Ω (when 20°C (68°F)) |

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



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



EC-03375

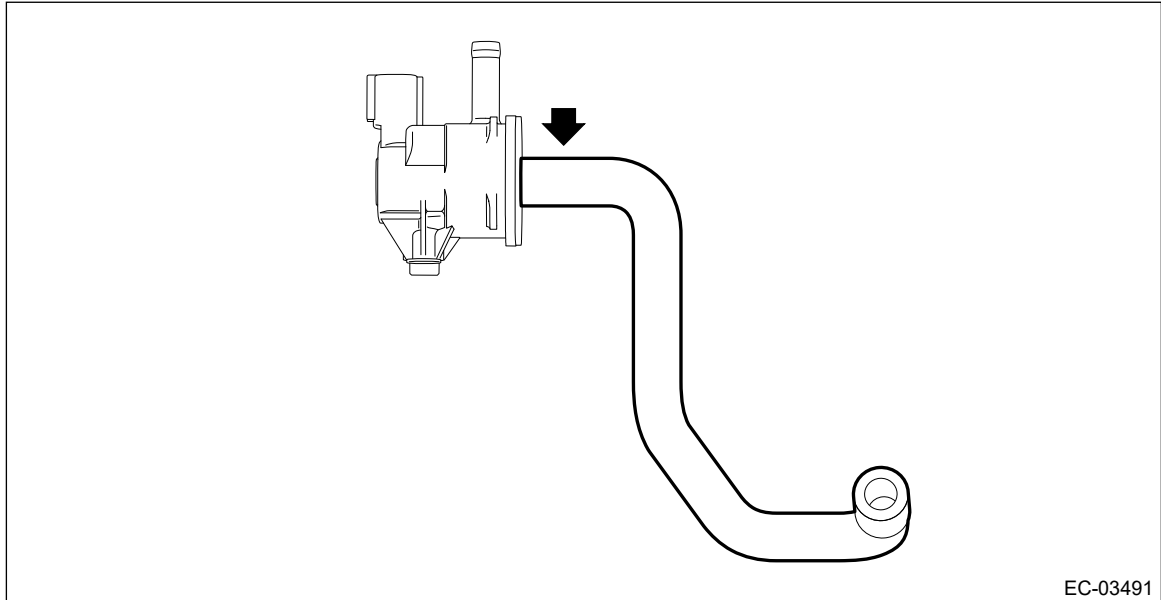
2. OTHER INSPECTIONS

Check the vacuum hose for cracks, damage or looseness.

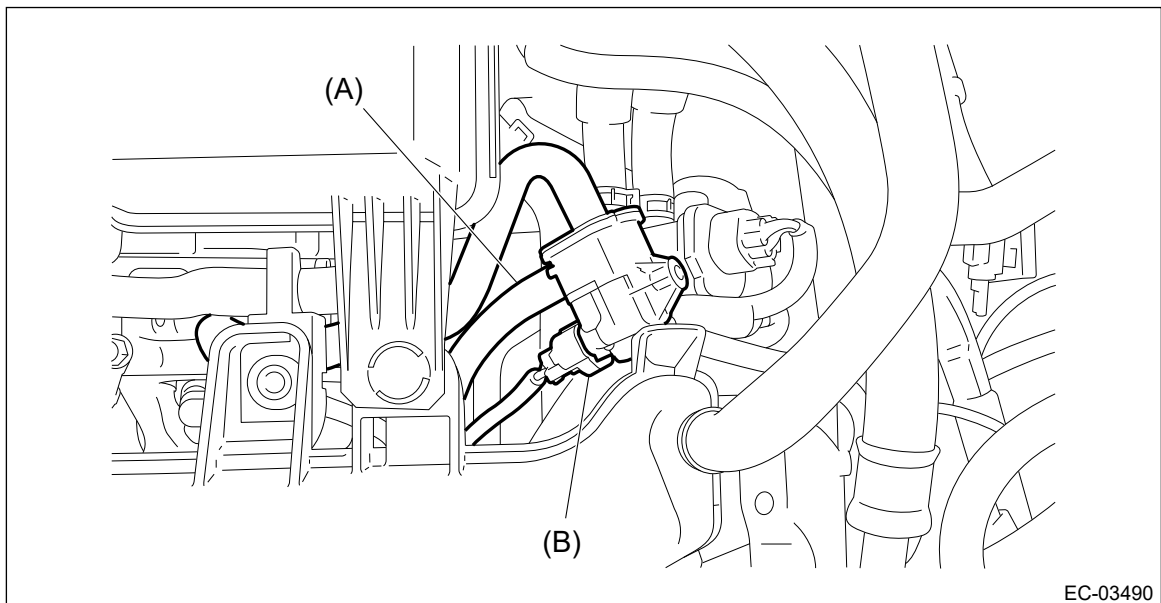
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Purge Control Solenoid Valve

INSTALLATION

1. Install the vacuum hose to the purge control solenoid valve.



2. Connect the vacuum hose (A) and connector (B) to the purge control solenoid valve.



3. Install the bolt securing the purge control solenoid valve to the intake manifold assembly.

Note:

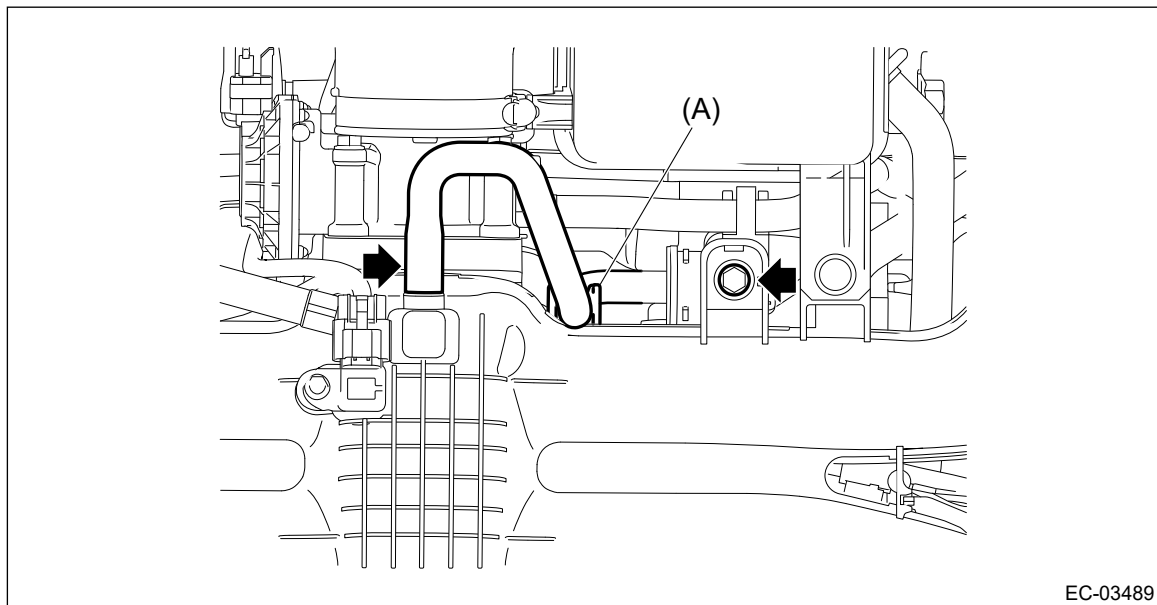
Hold the purge control solenoid valve unit by hand to prevent it from rotating together.

Tightening torque:


3.4 N•m (0.3 kgf-m, 2.5 ft-lb)

4. Secure the vacuum hose to the clip (A), and connect the vacuum hose to the intake manifold

assembly.




EC-03489

5. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Purge Control Solenoid Valve

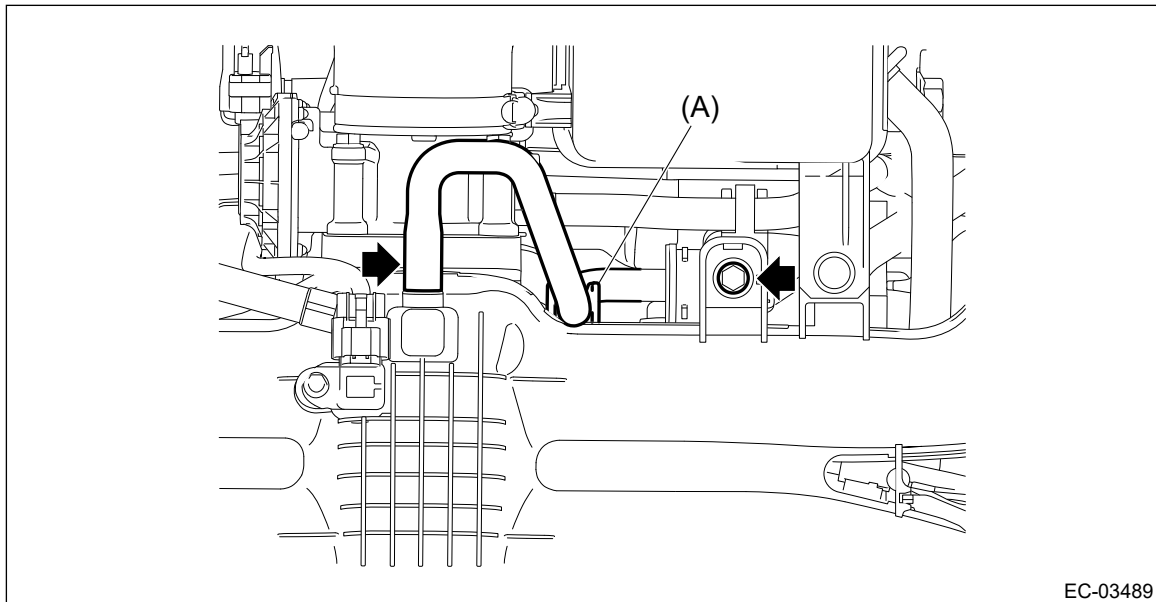
REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the bolt securing the purge control solenoid valve onto intake manifold assembly.

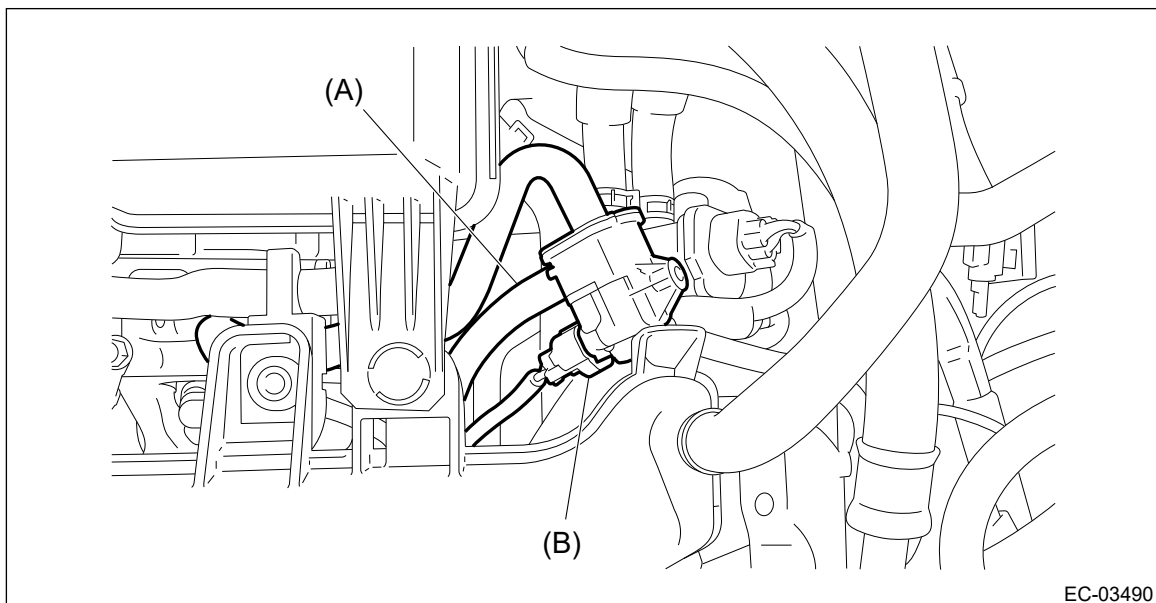
Note:

Hold the purge control solenoid valve unit by hand to prevent it from rotating together.

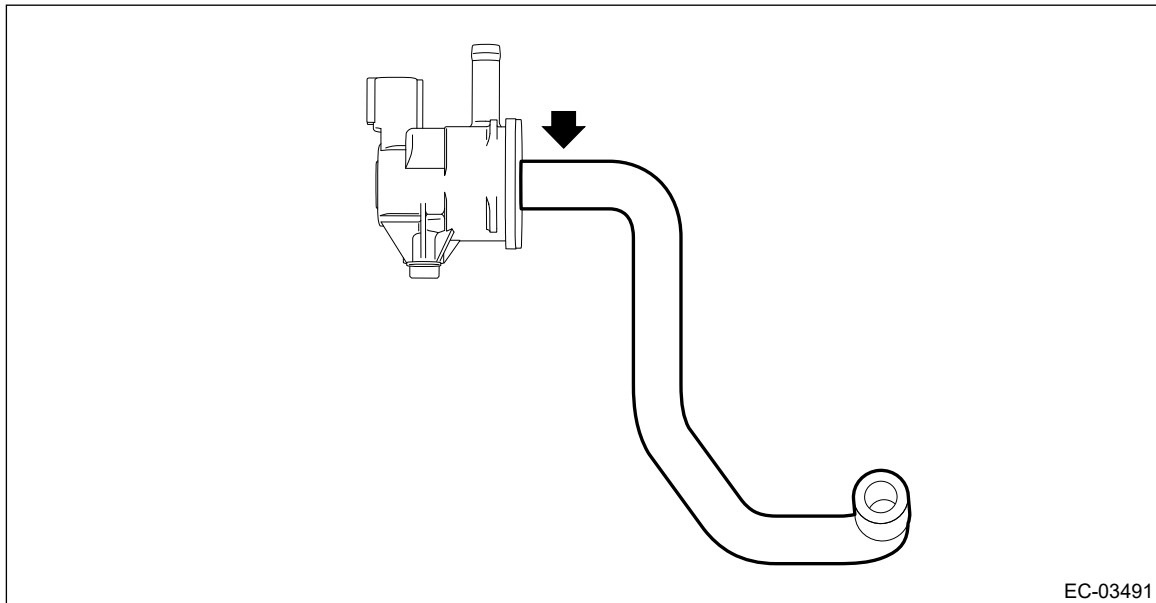
3. Disconnect the vacuum hose from the intake manifold assembly, and remove the vacuum hose from the clip (A).



4. Disconnect the vacuum hose (A) and connector (B) from the purge control solenoid valve, and remove the purge control solenoid valve.



5. Remove the vacuum hose from the purge control solenoid valve.



EC-03491


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Rear Catalytic Converter

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Rear Catalytic Converter

INSTALLATION

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to "Center Exhaust Pipe" for the installation procedure.  [Ref. to EXHAUST\(H4DO\)>Center Exhaust Pipe>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DO) > Rear Catalytic Converter

REMOVAL

The rear catalytic converter is integrated into the center exhaust pipe; therefore, refer to "Center Exhaust Pipe" for the removal procedure.  [Ref. to EXHAUST\(H4DO\)>Center Exhaust Pipe>REMOVAL.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Canister

INSPECTION

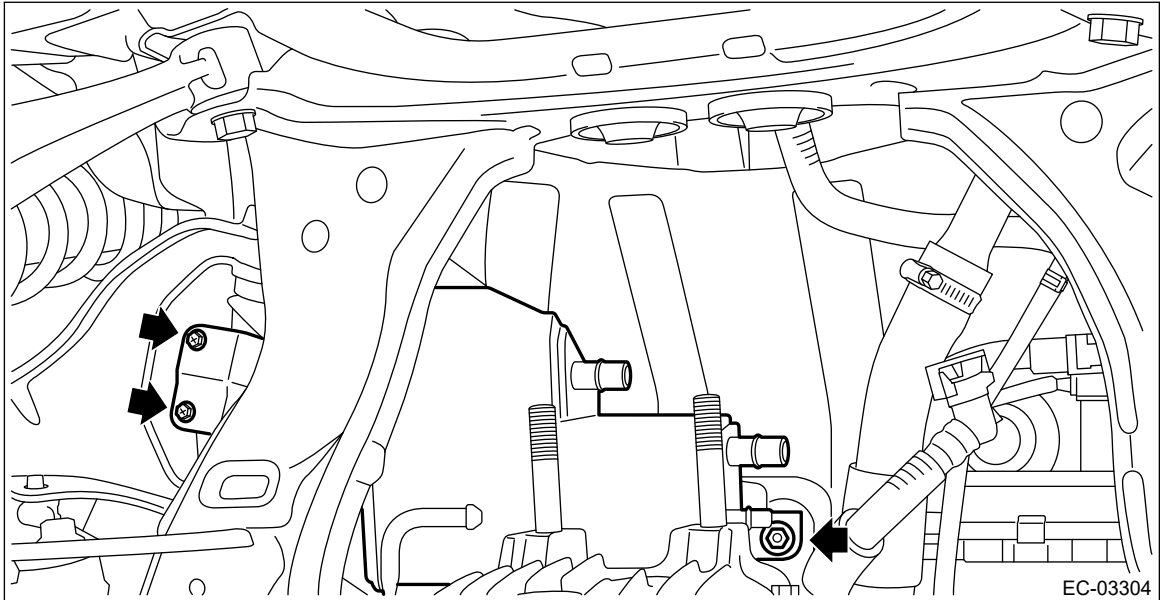
- 1.** Check that the canister has no deformation, cracks or other damages.
- 2.** Check that the tube has no cracks, damage or loose part.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Canister INSTALLATION

1. Install the canister to the vehicle.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



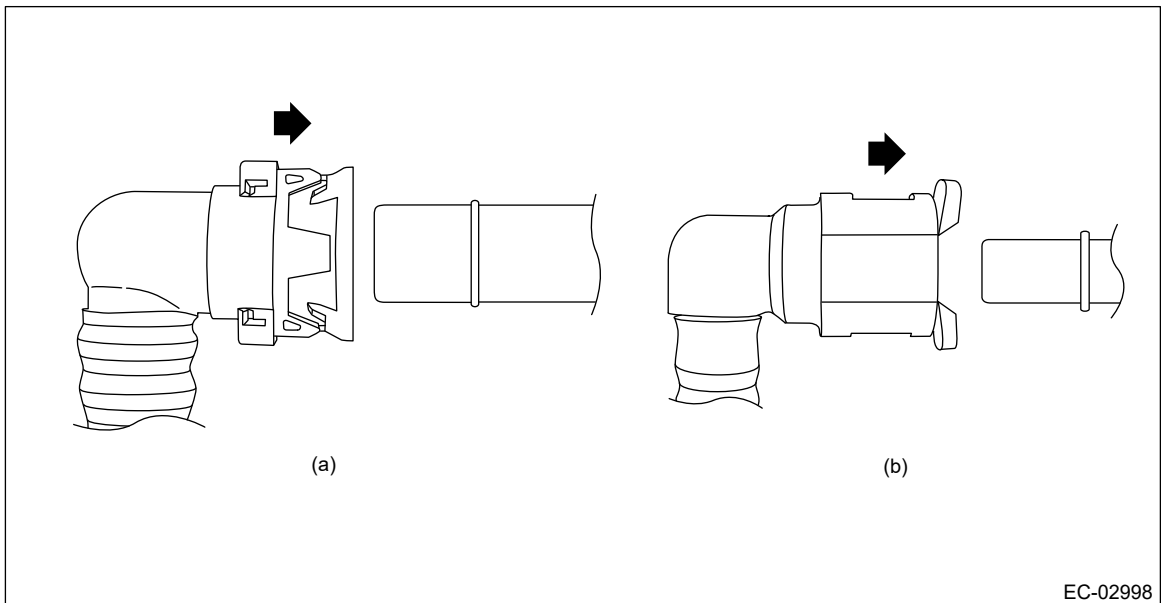
2. Install the drain tube (A), vent tube (B) and purge tube (C) to the canister.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

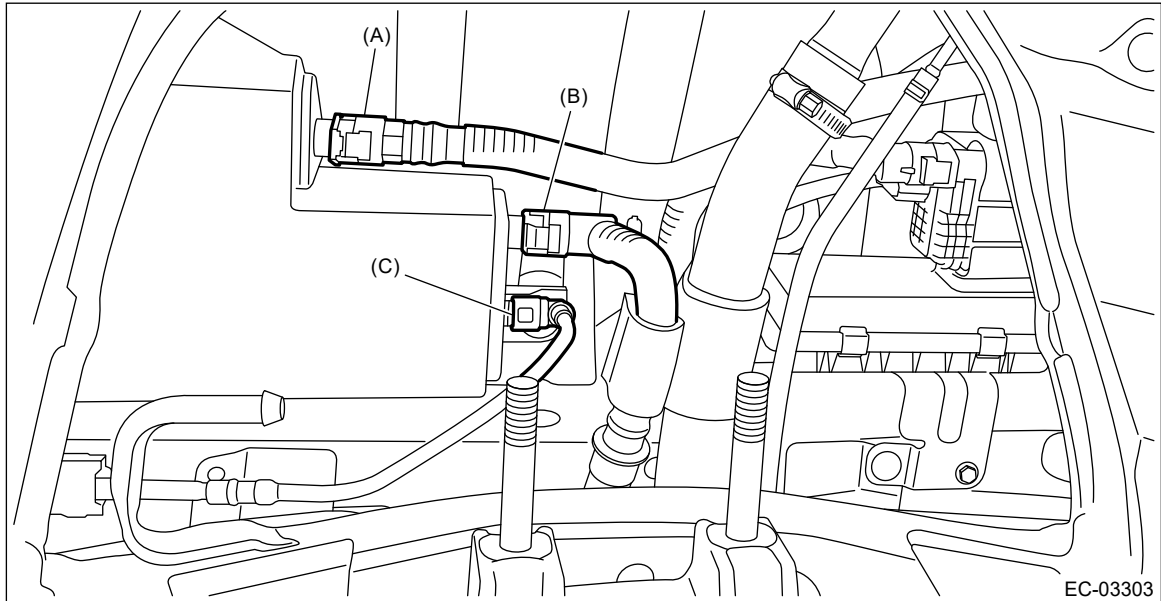
Note:

Install the quick connector as shown in the figure.



(a) Drain tube and vent tube

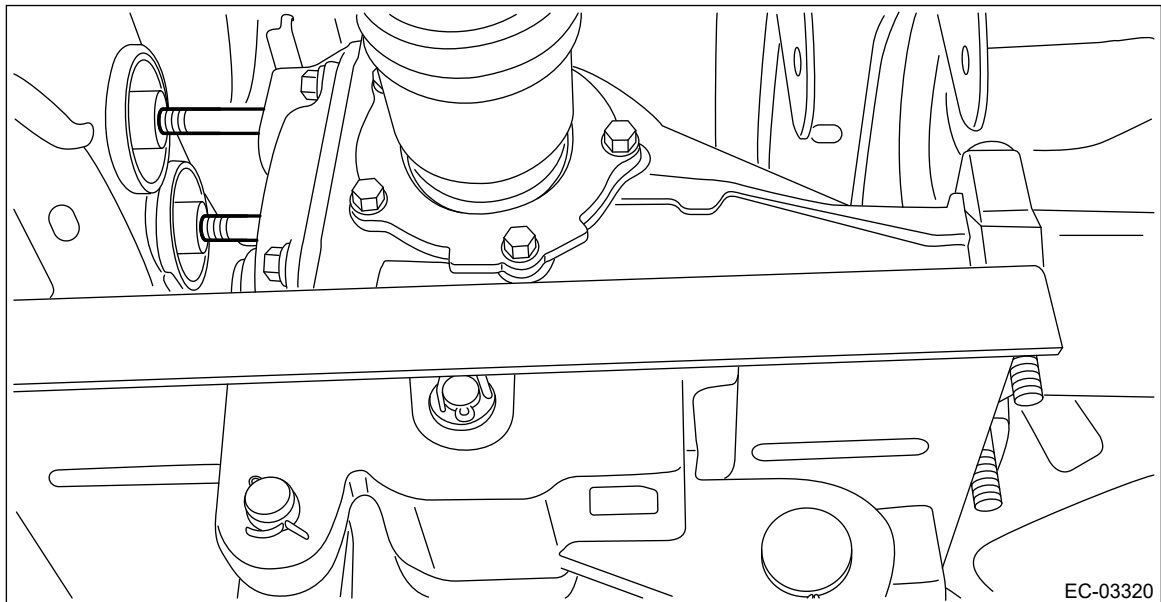
(b) Purge tube



- 3.** Lift up the transmission jack gradually, and set the rear differential to the rear sub frame assembly.

Note:

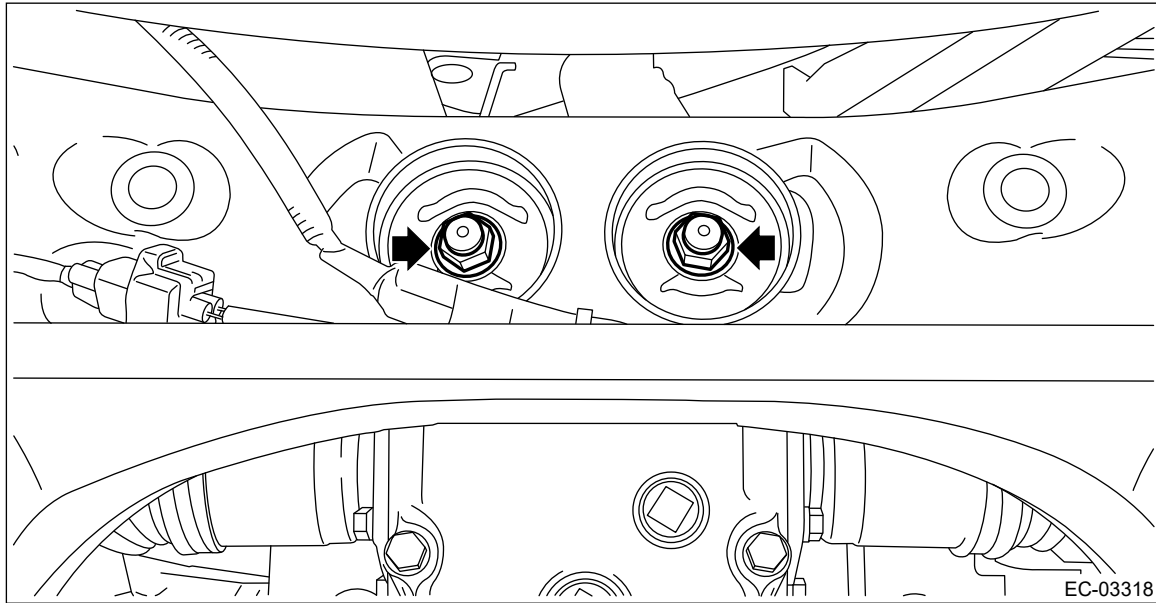
When inserting the stud bolt into the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.



- 4.** Temporarily tighten the self-locking nuts which hold the rear differential to the rear sub frame assembly.

Note:

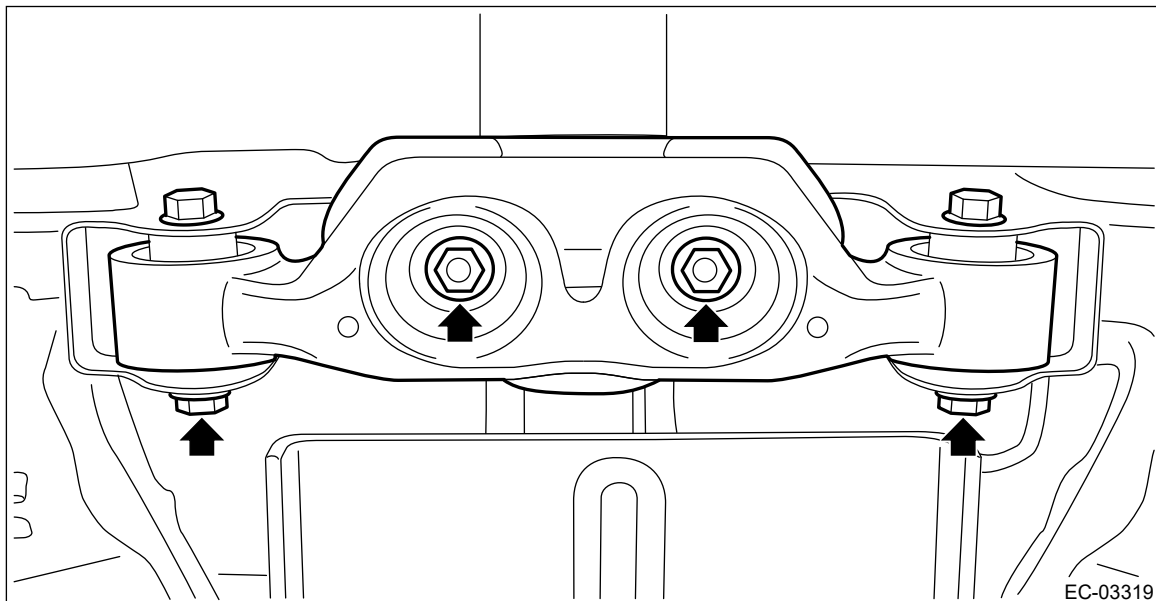
Use a new self-locking nut.



5. Set the rear differential member to the rear sub frame assembly and rear differential, and temporarily tighten the self-lock nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Note:

Use a new self-locking nut.

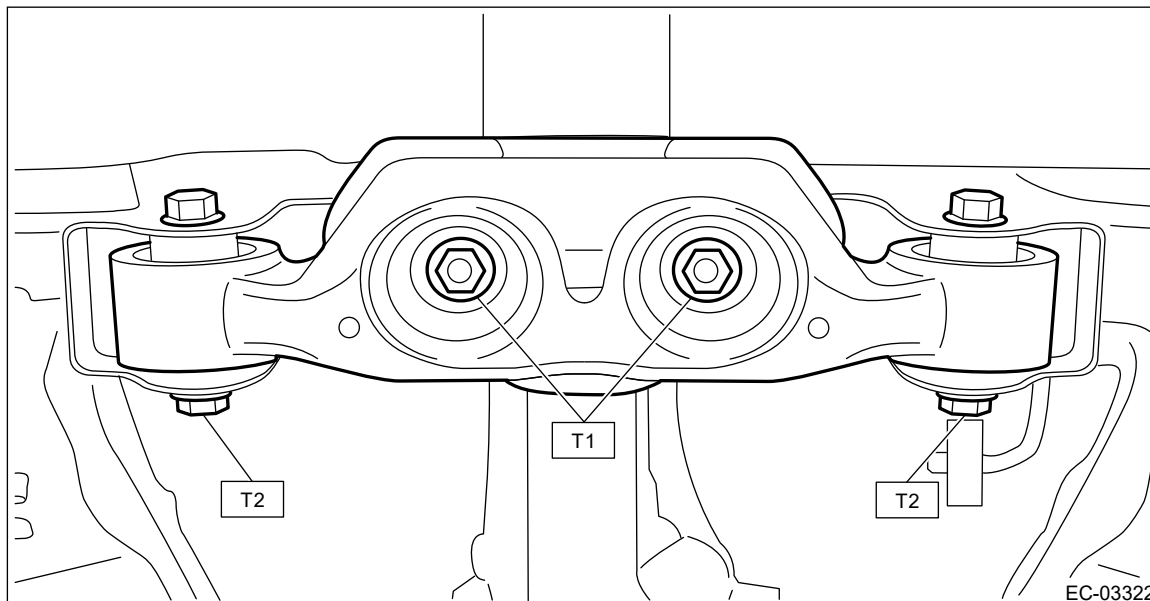


6. Remove the transmission jack from the rear differential.
7. Tighten the self-locking nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

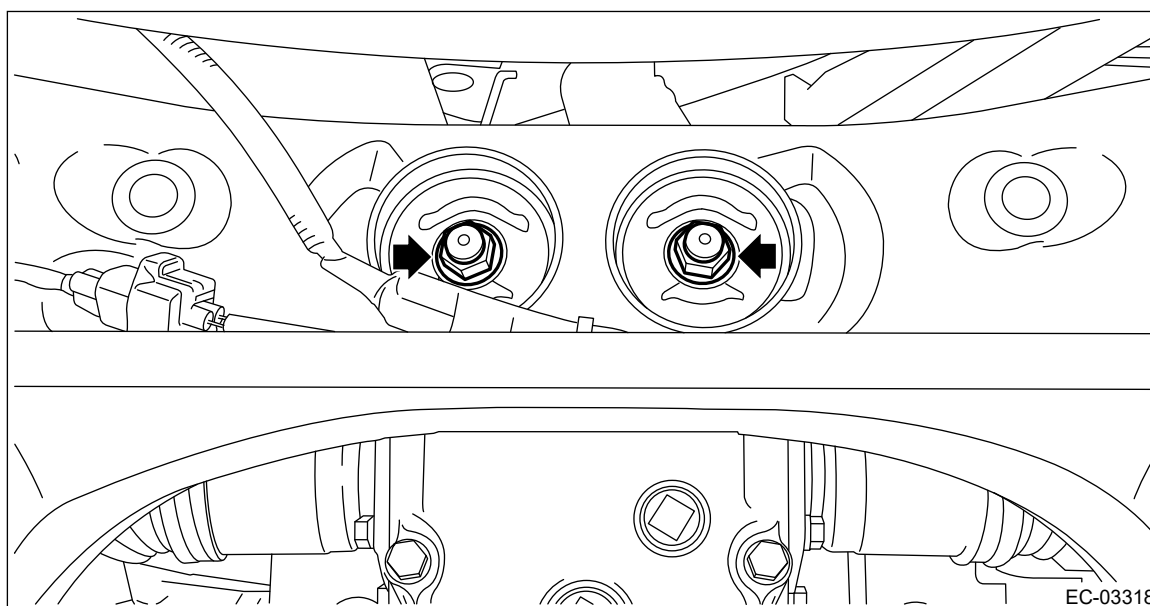
T2: 110 N·m (11.2 kgf-m, 81.1 ft-lb)



8. Tighten the self-locking nuts which secure the rear differential to the rear sub frame assembly.

Tightening torque:

70 N·m (7.1 kgf-m, 51.6 ft-lb)



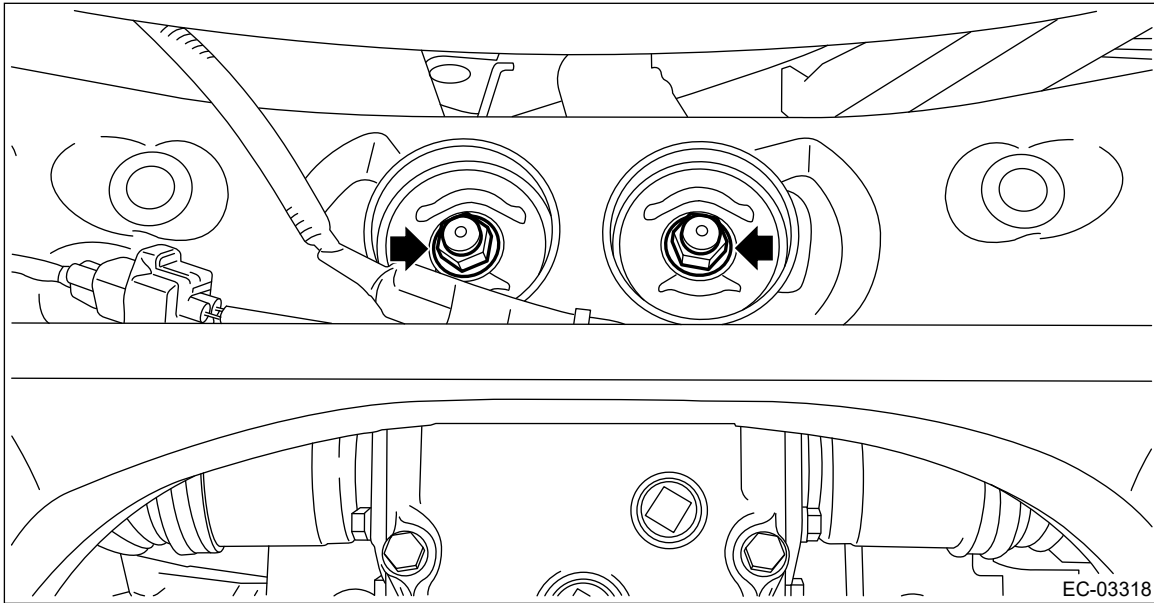
9. Install the propeller shaft.  [Ref. to DRIVE SHAFT SYSTEM>Propeller Shaft>INSTALLATION.](#)

10. Install the rear exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Rear Exhaust Pipe>INSTALLATION.](#)

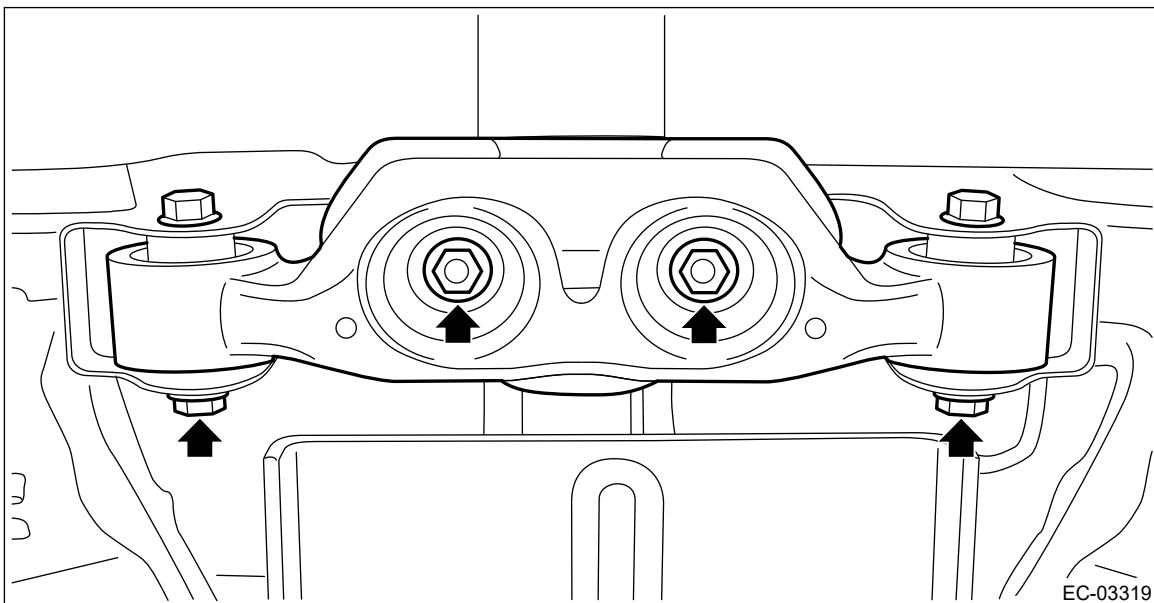
11. Lower the vehicle.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Canister REMOVAL

1. Lift up the vehicle.
2. Remove the rear exhaust pipe. [🔧 Ref. to EXHAUST\(H4DOTC\)>Rear Exhaust Pipe>REMOVAL.](#)
3. Remove the propeller shaft. [🔧 Ref. to DRIVE SHAFT SYSTEM>Propeller Shaft>REMOVAL.](#)
4. Support the rear differential with the transmission jack.
5. Remove the self-locking nuts which hold the rear differential to the rear sub frame assembly.



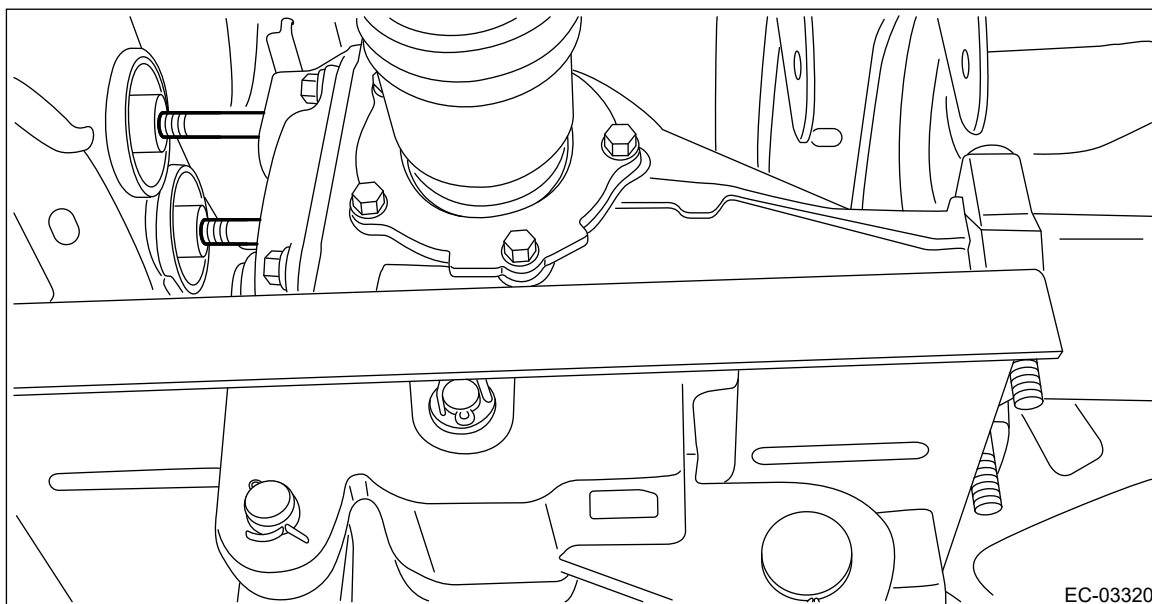
6. Remove the rear differential member from the rear sub frame assembly and the rear differential.



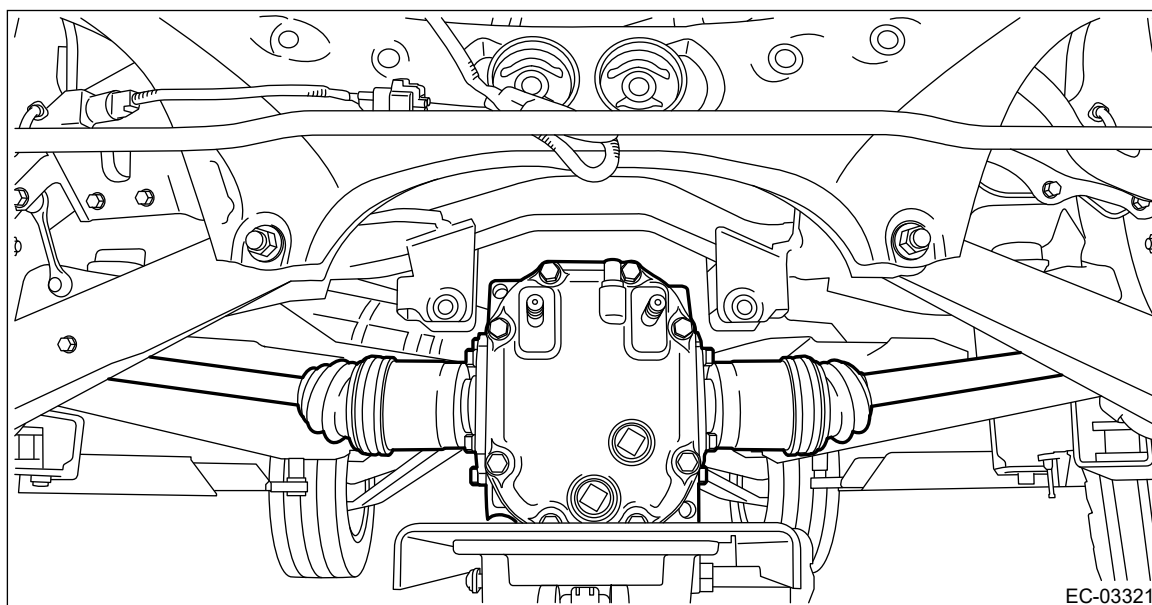
7. Lower the transmission jack gradually until the rear differential is at the position shown in the figure.

Note:

- When pulling out the stud bolt from the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.



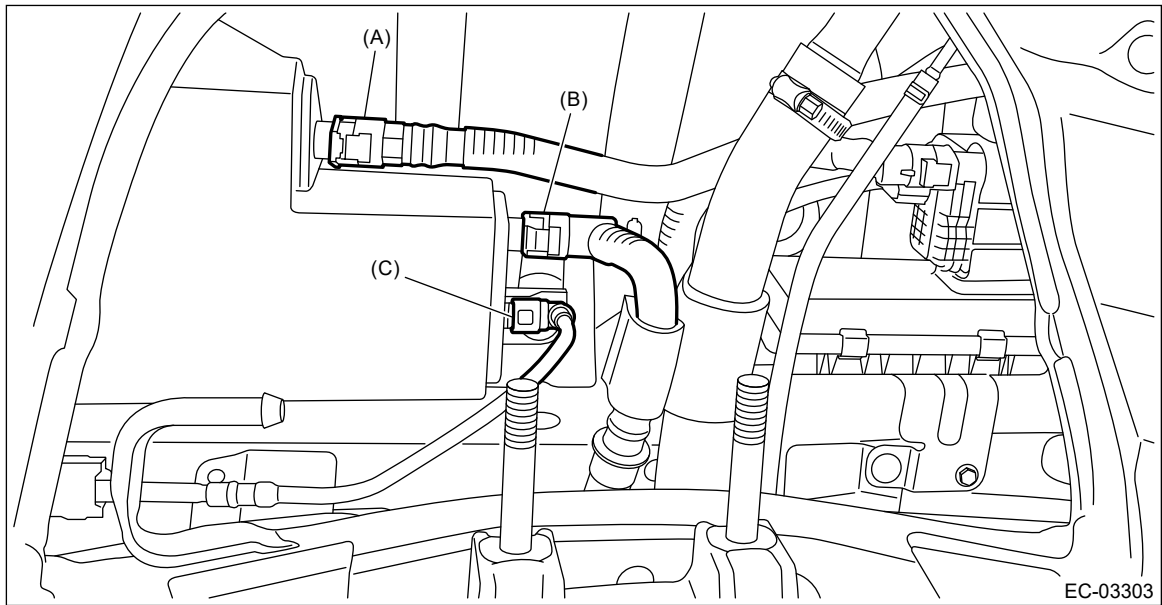
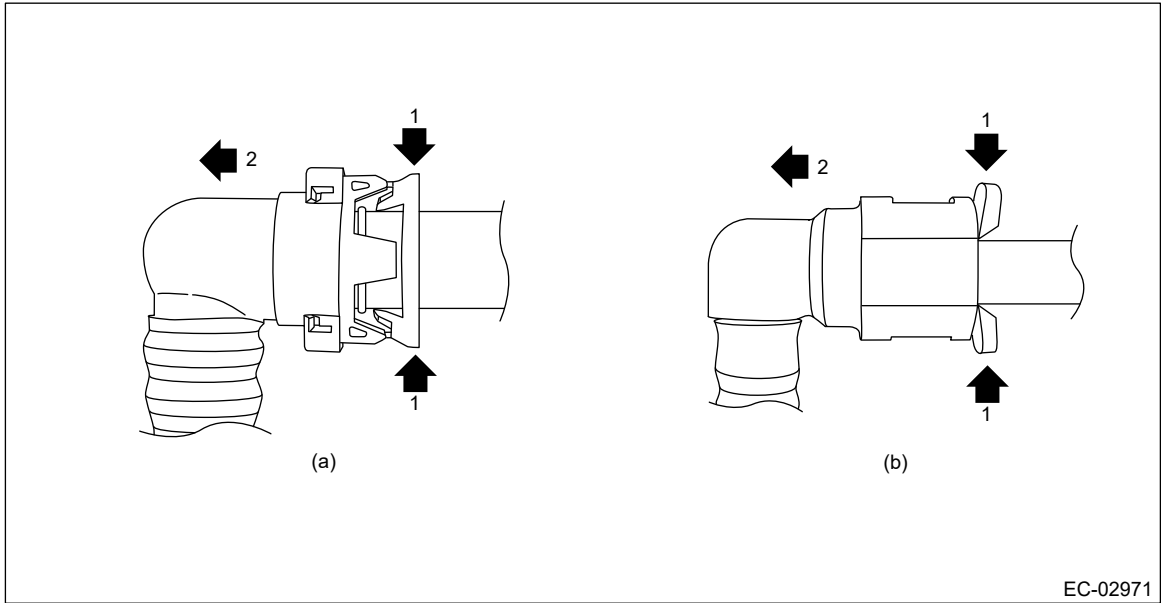
- Do not lower the rear differential excessively. Doing so may add extra load to the drive shaft or cause the falling-off of the drive shaft.



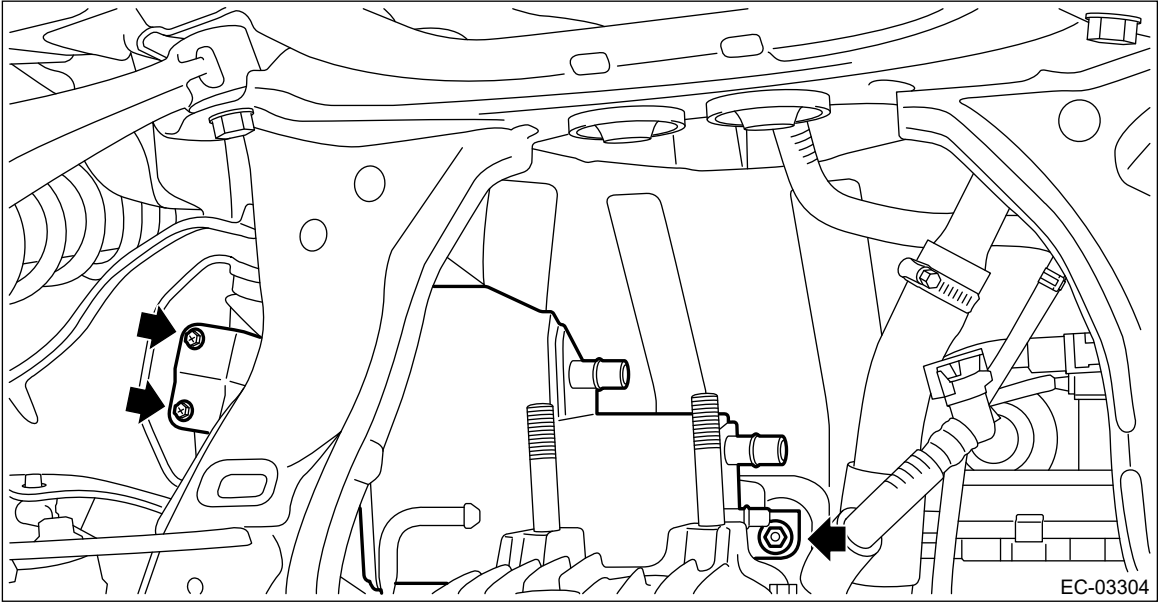
8. Disconnect the drain tube (A), vent tube (B) and purge tube (C) from the canister.

Note:

Disconnect the quick connector as shown in the figure.





9. Remove the canister from vehicle.



EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Drain Filter

SPECIFICATION

The leak check valve assembly is a non-disassembled part. Do not remove the drain filter from the leak check valve assembly. Refer to "Leak Check Valve Assembly" for removal and installation procedures.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>Leak Check Valve Assembly>REMOVAL.](#)  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>Leak Check Valve Assembly>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Control Valve

ASSEMBLY

Assemble in the reverse order of disassembly.

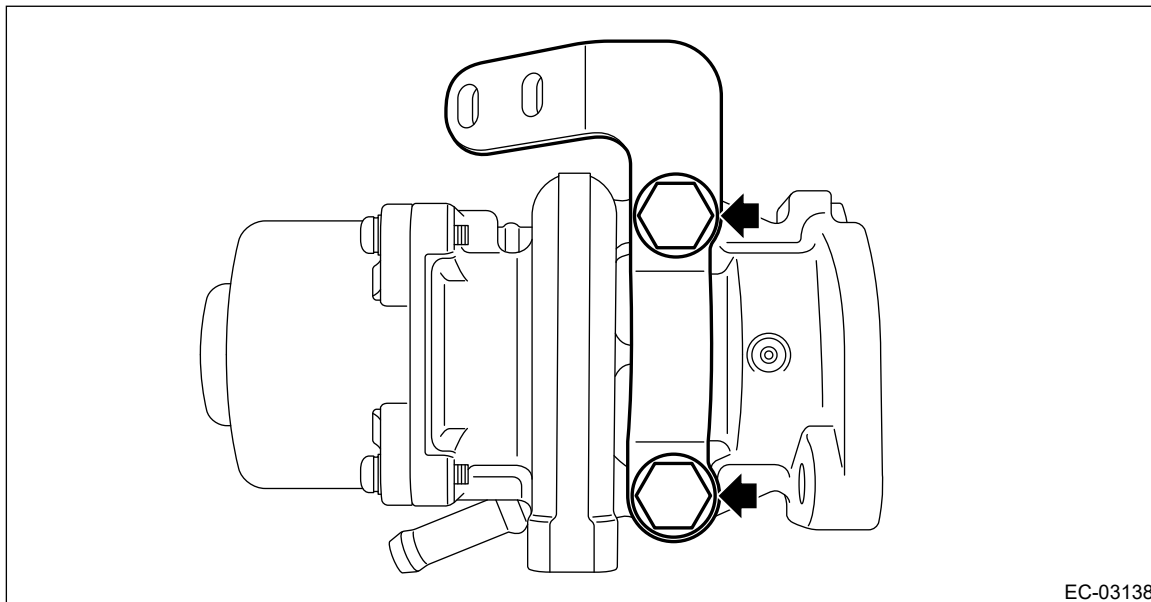
Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Control Valve

DISASSEMBLY

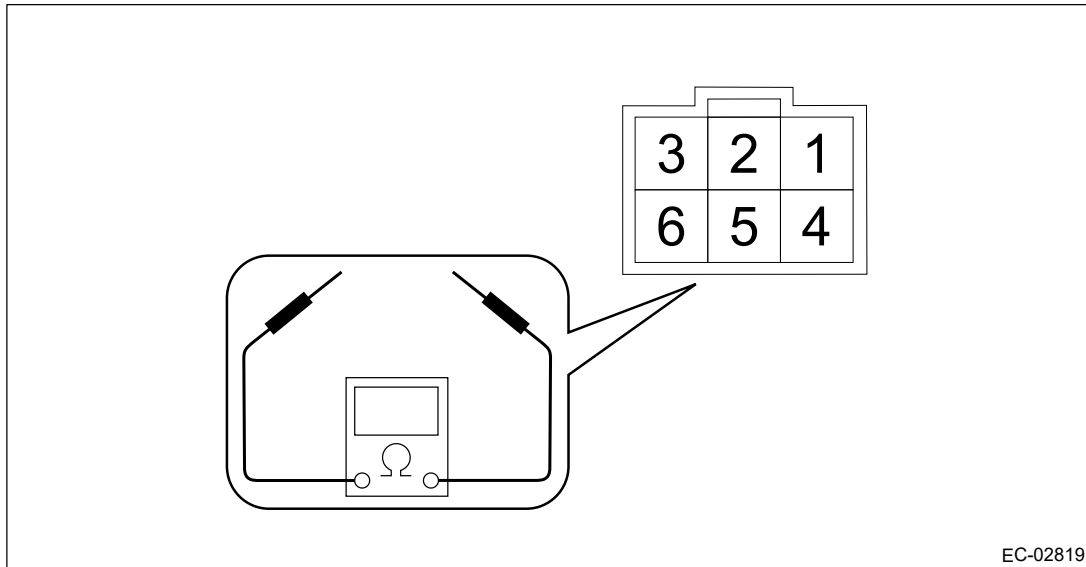
Remove the EGR control valve bracket A from the EGR control valve.



EC-03138

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Control Valve INSPECTION

1. Check that the EGR control valve and EGR control valve bracket A have no deformation, cracks or other damages.
2. Measure the resistance between EGR control valve terminals.

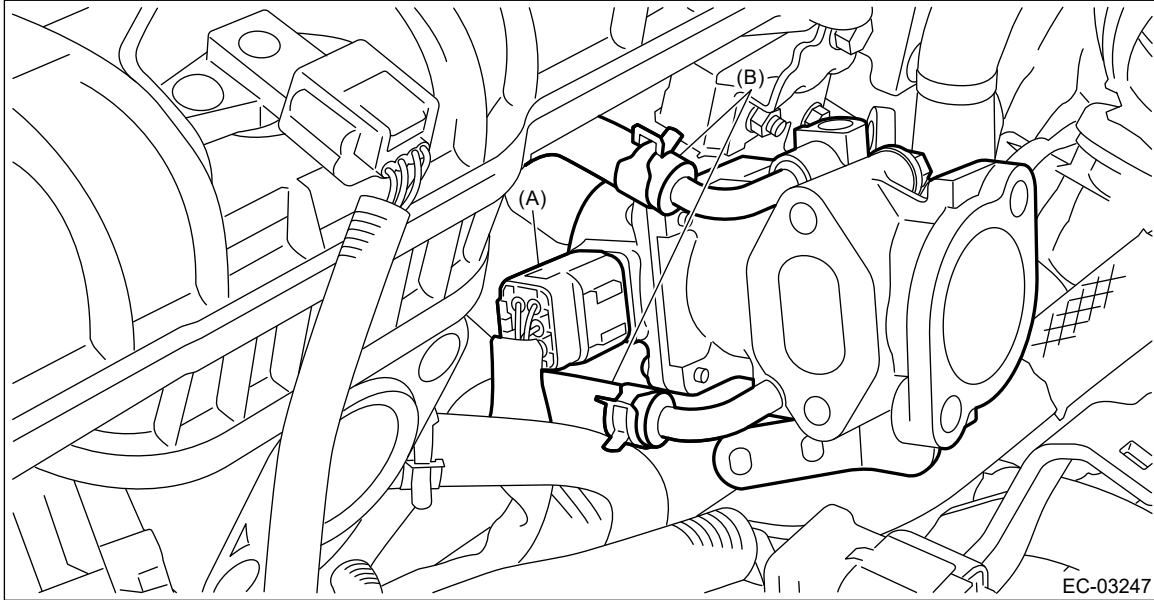


| Terminal No. | Standard |
|--------------|----------------------|
| 2 and 1 | 15±2 Ω (20°C (68°F)) |
| 2 and 3 | |
| 5 and 4 | |
| 5 and 6 | |

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Control Valve

INSTALLATION

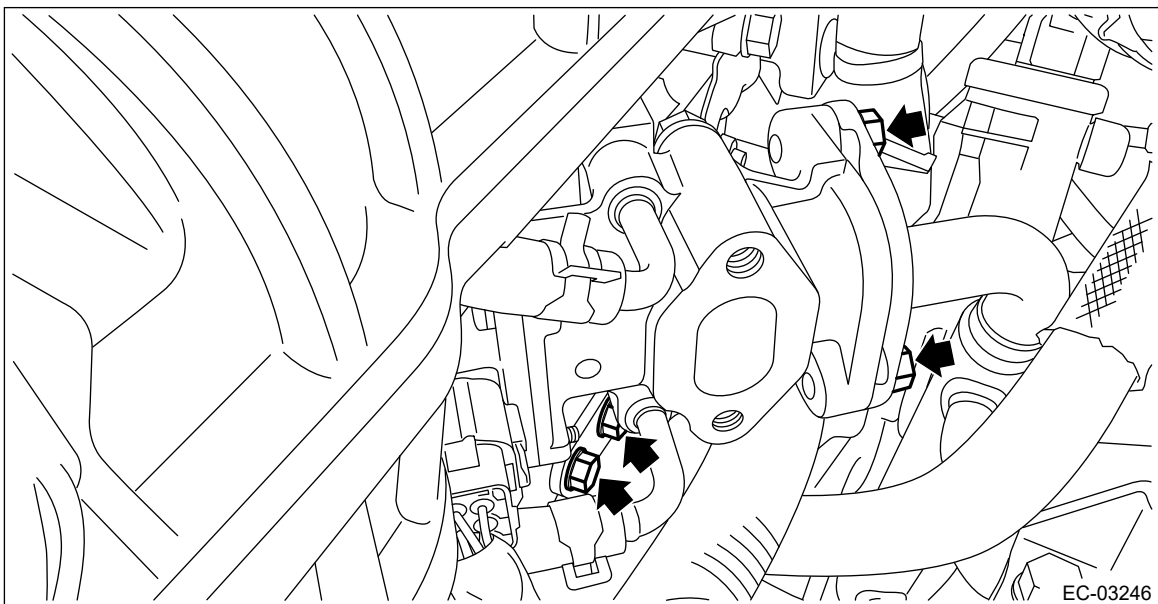
1. Connect the preheater hose (B) and connector (A) to the EGR control valve.



2. Install the EGR control valve and EGR control valve bracket A to the EGR cooler and EGR control valve bracket B.
 - (1) Set the EGR control valve and EGR control valve bracket A to the EGR cooler and EGR control valve bracket B, and temporarily tighten the bolts which secure the EGR control valve and EGR control valve bracket A to the EGR cooler and EGR control valve bracket B.

Note:

Use a new gasket.



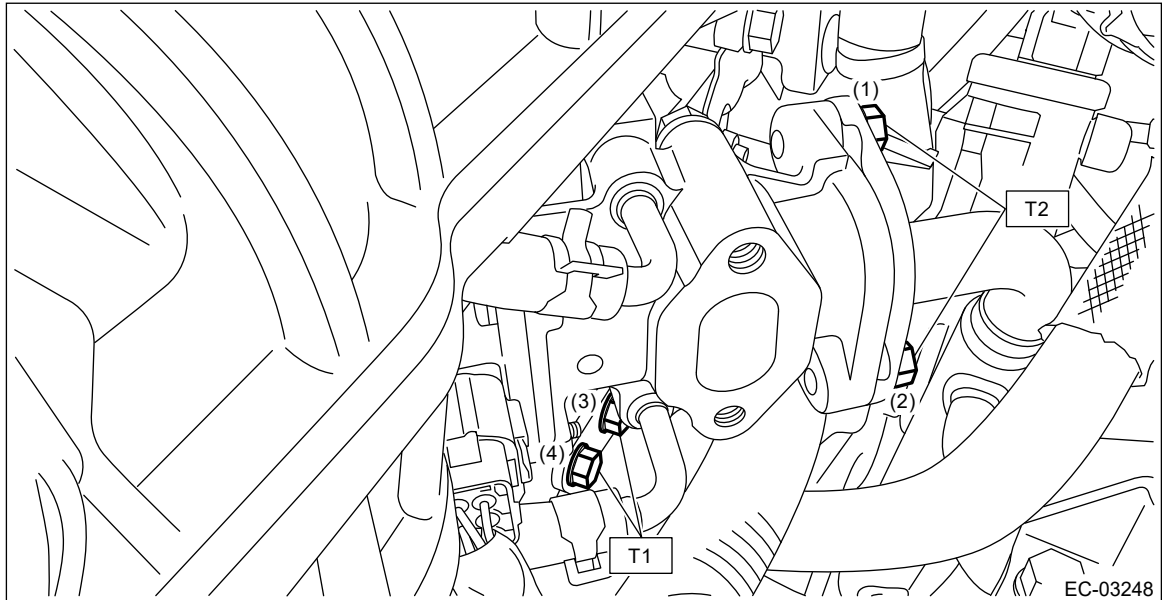
- (2) Tighten the bolts which secure the EGR control valve and EGR control valve bracket A to





the EGR cooler and EGR control valve bracket B in numerical order as shown in the figure.

Tightening torque:

T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)



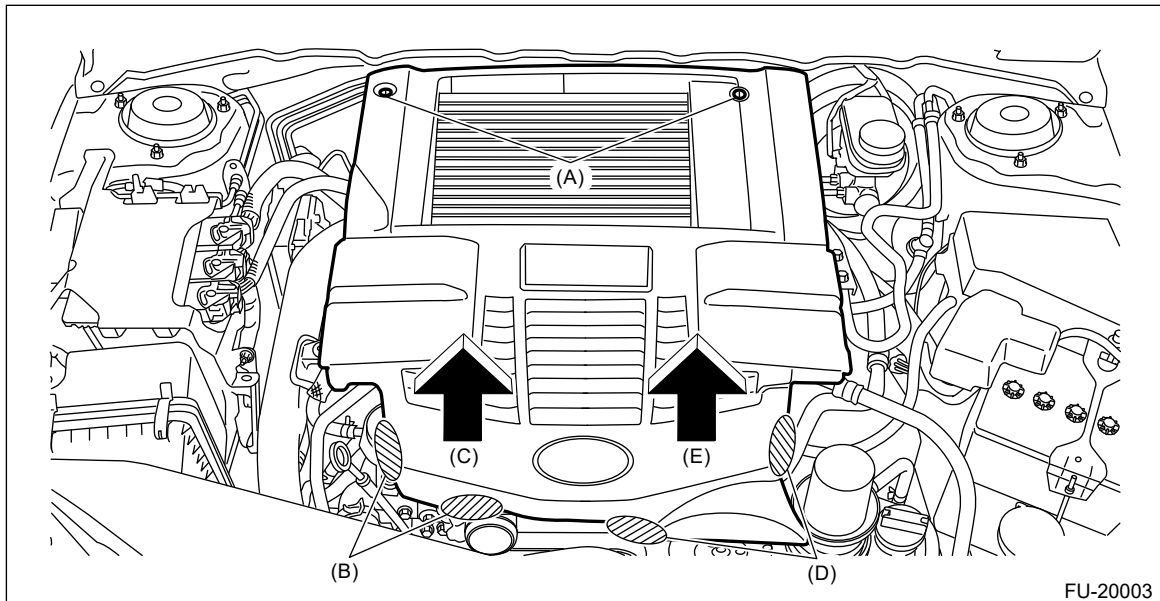
- 3.** Install the EGR pipe.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DOTC\)>EGR Pipe>INSTALLATION.](#)
- 4.** Install the intercooler.  [Ref. to INTAKE \(INDUCTION\) \(H4DOTC\)>Intercooler>INSTALLATION.](#)
- 5.** Lift up the vehicle.
- 6.** Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
- 7.** Lower the vehicle.
- 8.** Connect the battery ground terminal.
- 9.** Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
- 10.** Install the collector cover.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Control Valve

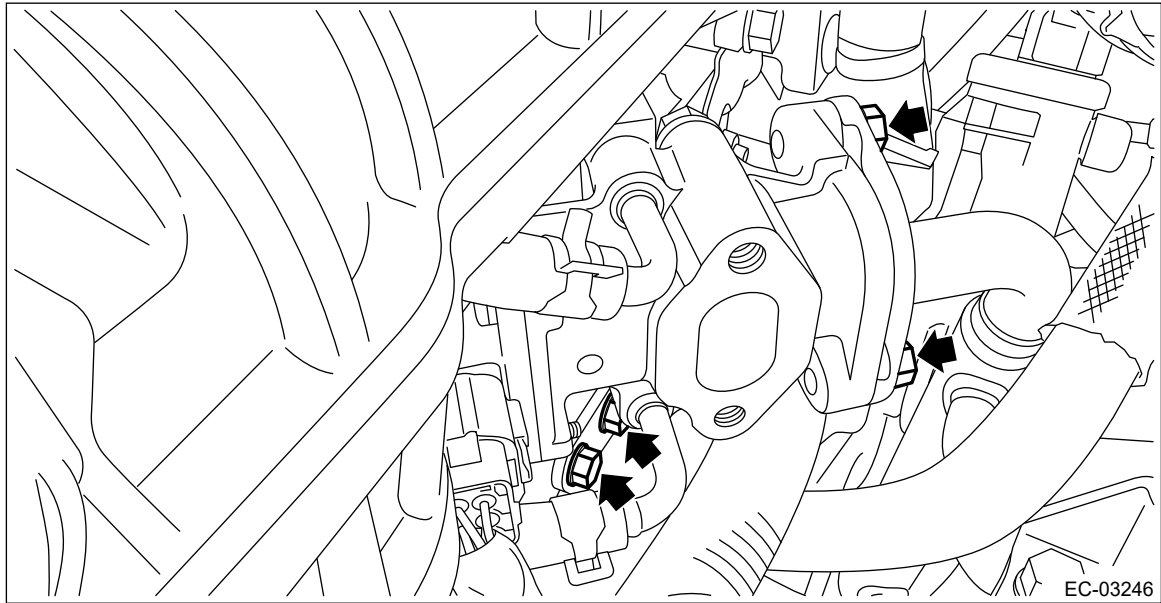
REMOVAL

1. Remove the collector cover.

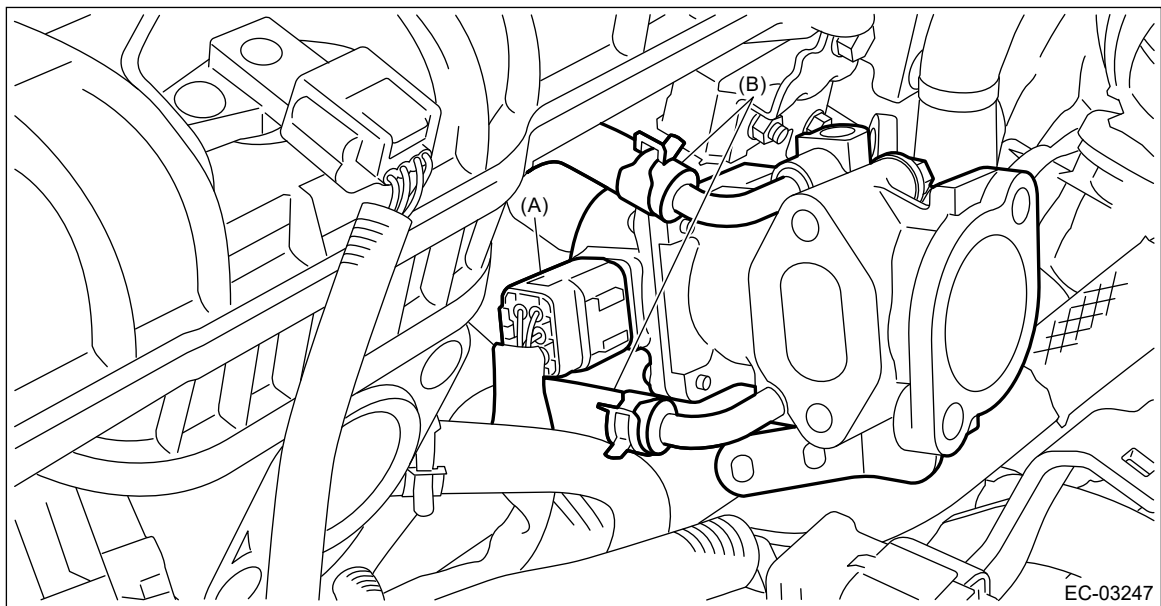
- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



- 2.** Disconnect the ground cable from battery.
- 3.** Lift up the vehicle.
- 4.** Remove the under cover. [🔧 Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
- 5.** Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant. [🔧 Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
- 6.** Remove the intercooler. [🔧 Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
- 7.** Remove the EGR pipe. [🔧 Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>EGR Pipe>REMOVAL.](#)
- 8.** Remove the bolts which secure the EGR cooler to the EGR control valve, and remove the bolts which secure the EGR control valve bracket A to the EGR control valve bracket B.



- 9.** Disconnect the connector (A) and preheater hose (B) from EGR control valve, and remove the EGR control valve.



EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Cooler

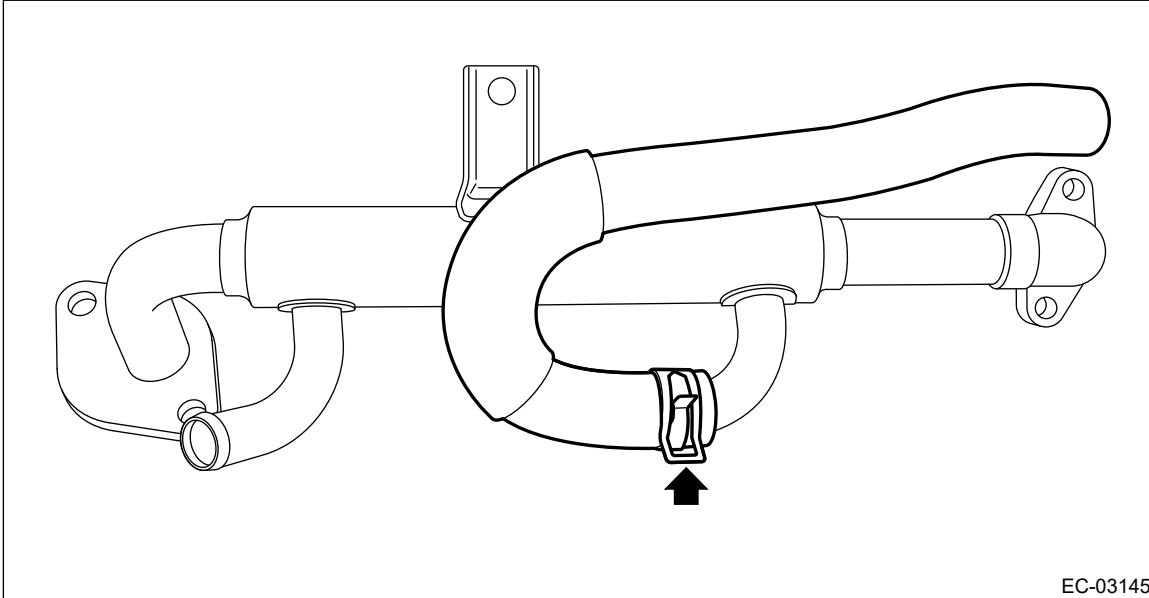
ASSEMBLY

Assemble in the reverse order of disassembly.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Cooler

DISASSEMBLY

Remove the water hose from EGR cooler.



EC-03145

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Cooler

INSPECTION

- 1.** Check that the EGR cooler has no deformation, cracks or other damages.
- 2.** Check that the water hose has no cracks, damage or loose part.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Cooler INSTALLATION

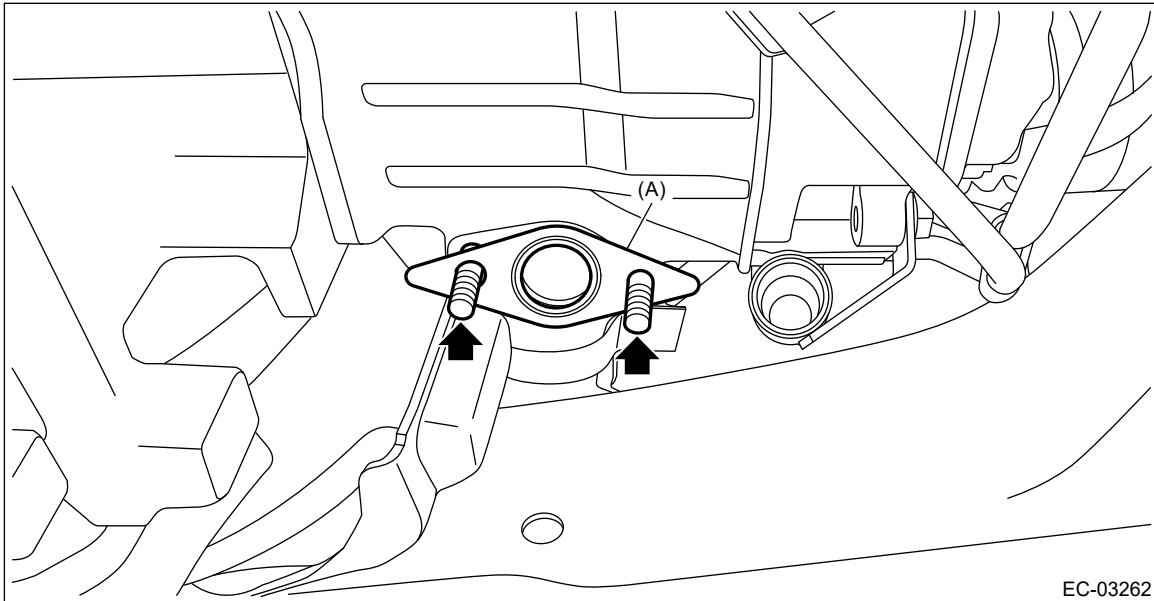
1. Install the stud bolt to the cylinder head RH, and set the gasket (A) to the stud bolt.

Note:

Use a new stud bolt and gasket.

Tightening torque:

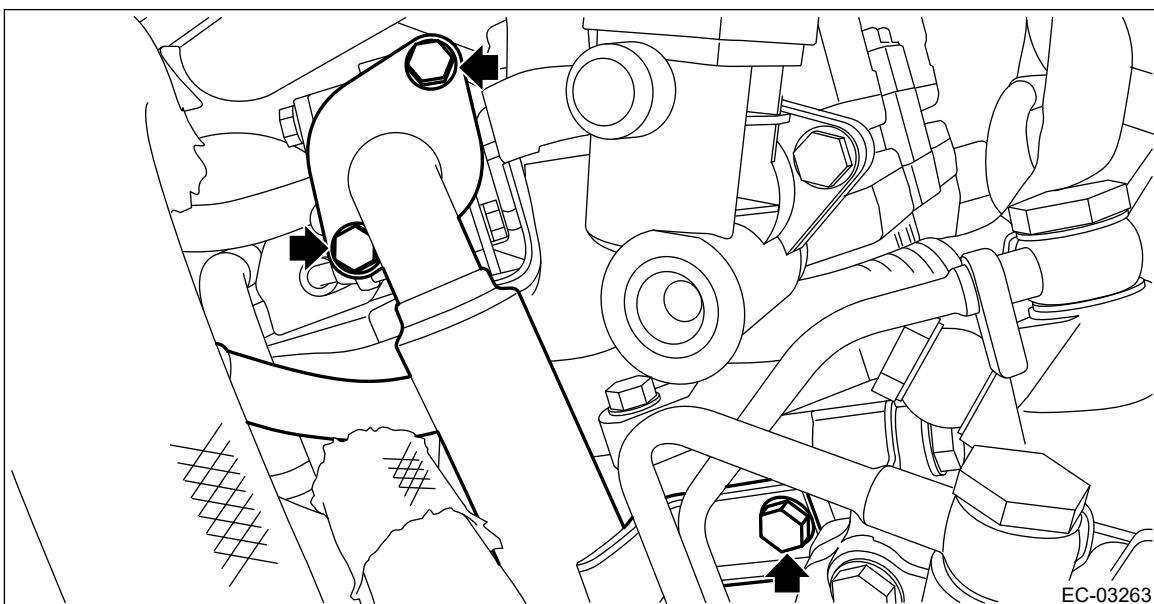
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



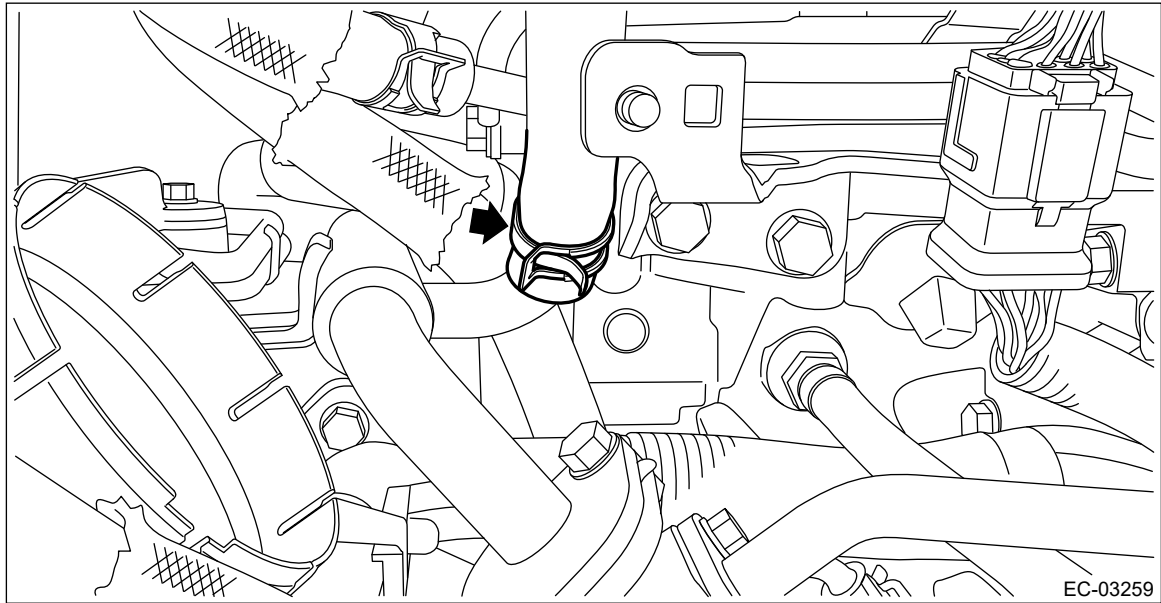
2. Set the EGR cooler to the EGR control valve and cylinder head RH, and temporarily tighten the bolts which secure the EGR cooler to the EGR control valve and cylinder head RH.

Note:

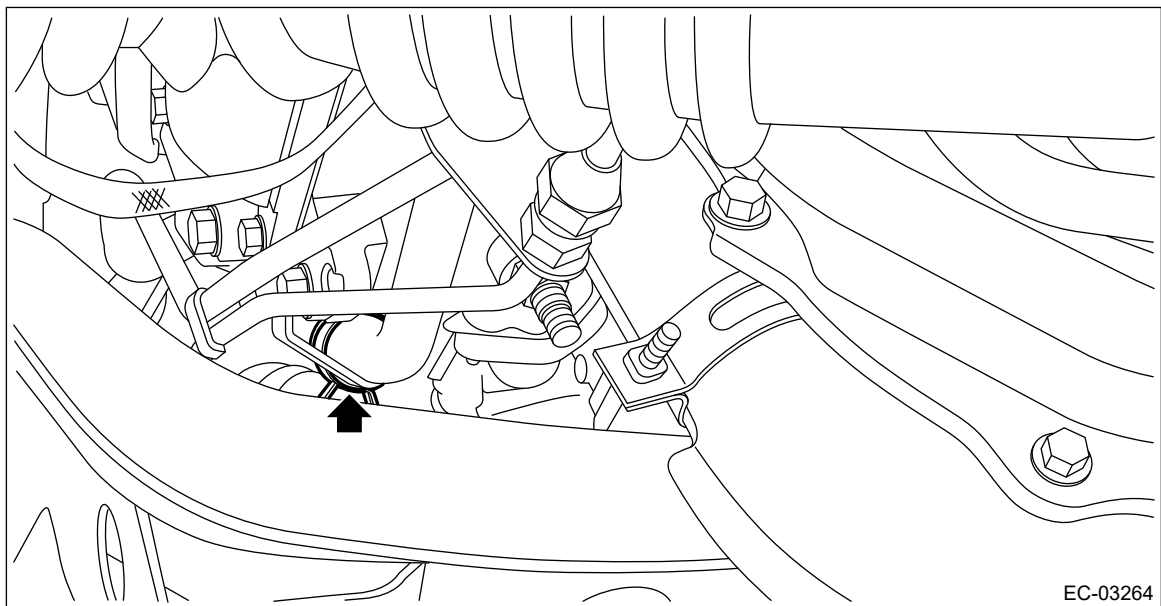
Use a new gasket.



3. Connect the engine coolant inlet hose to the EGR cooler.



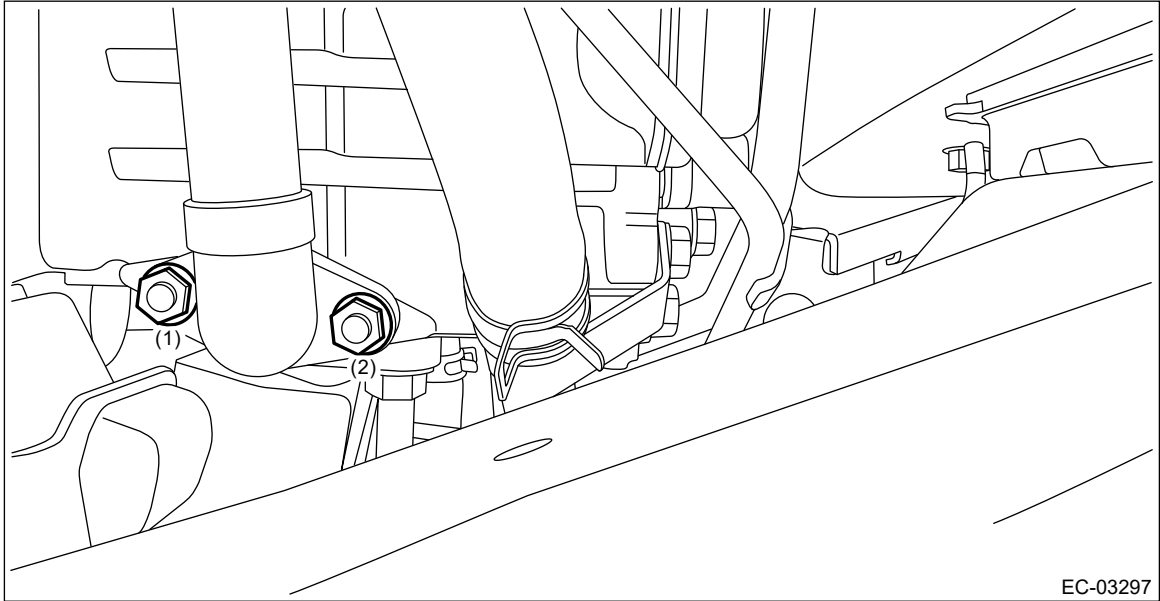
4. Lift up the vehicle.
5. Connect the water hose to the water pipe RH.



6. Install the EGR cooler to the cylinder head RH.
 - (1) Tighten the nuts which secure the EGR cooler to the cylinder head RH in numerical order as shown in the figure.

Tightening torque:

9 N·m (0.9 kgf-m, 6.6 ft-lb)

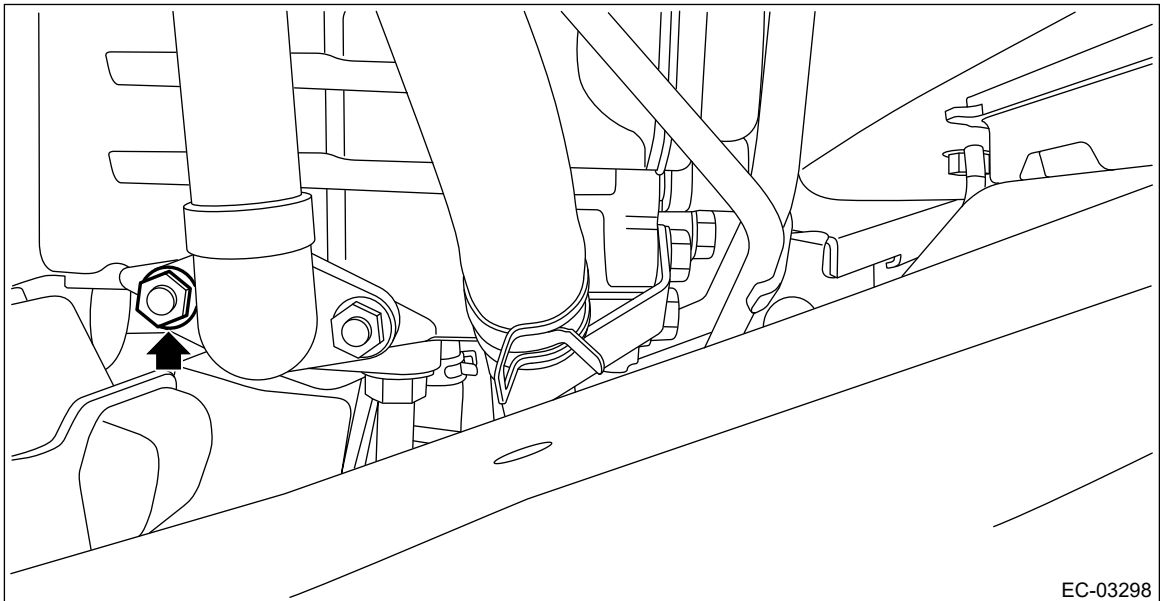


EC-03297

(2) Retighten the nut shown in the figure.

Tightening torque:

9 N·m (0.9 kgf-m, 6.6 ft-lb)



EC-03298

7. Tighten the bolts holding the EGR cooler to the cylinder head RH.

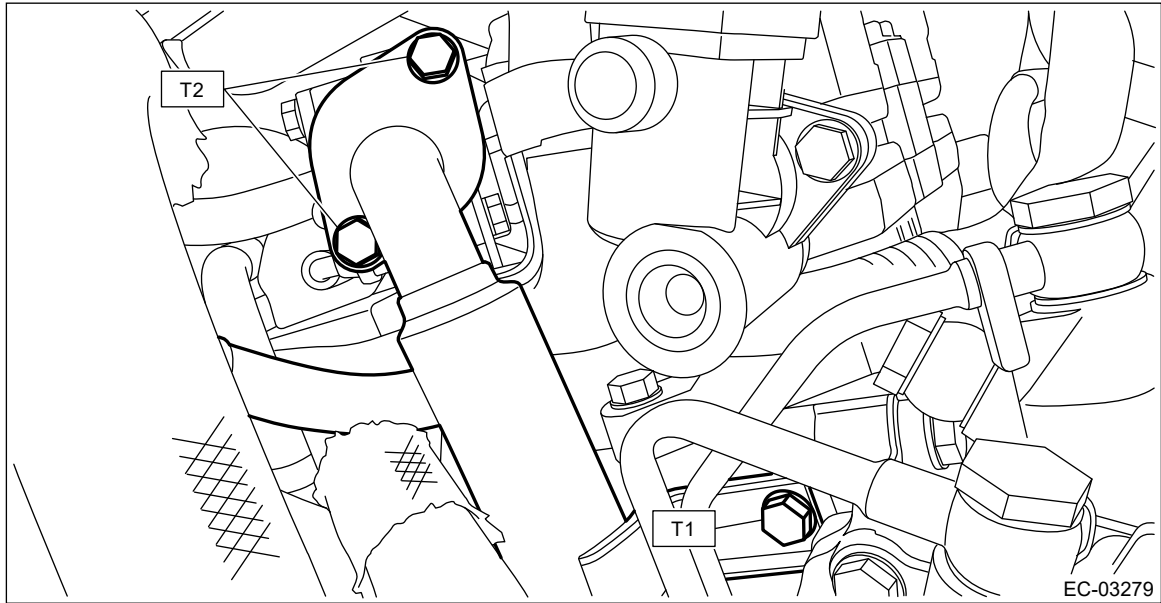
Tightening torque:

T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

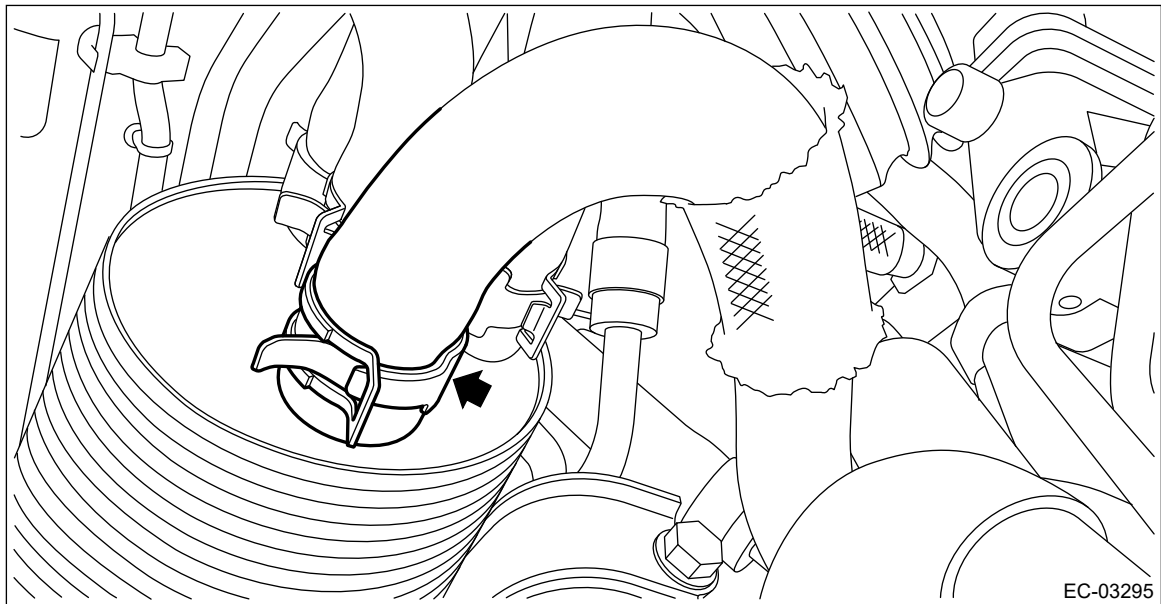
8. Tighten the bolt securing the EGR cooler to the EGR control valve.

Tightening torque:

T2: 19 N·m (1.9 kgf-m, 14.0 ft-lb)



- 9.** Connect the engine coolant outlet hose to the CVTF cooler (with warmer feature).





- 10.** Lower the vehicle.
11. Install the brake booster vacuum hose to the clip.

Note:

If the clip is removed from the intake manifold, install the clip to the position of alignment mark ▼ of intake manifold.

代替画像1

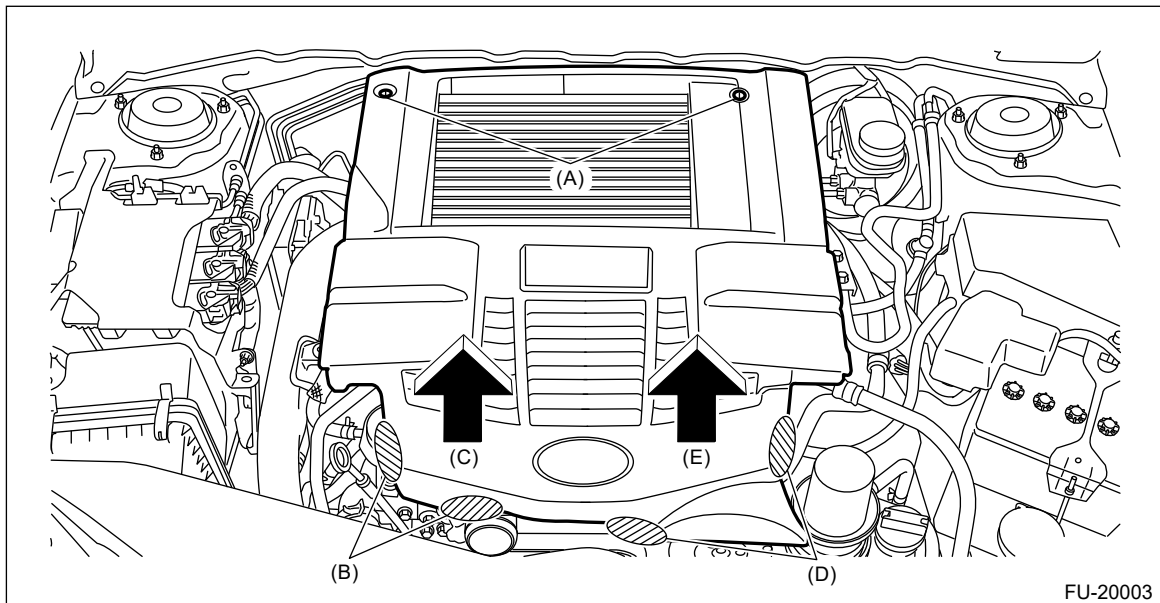
この画像は代替画像です

- 12.** Install the intercooler.  [Ref. to INTAKE \(INDUCTION\) \(H4DOTC\)>Intercooler>INSTALLATION.](#)
- 13.** Connect the battery ground terminal.
- 14.** Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
- 15.** Install the collector cover.

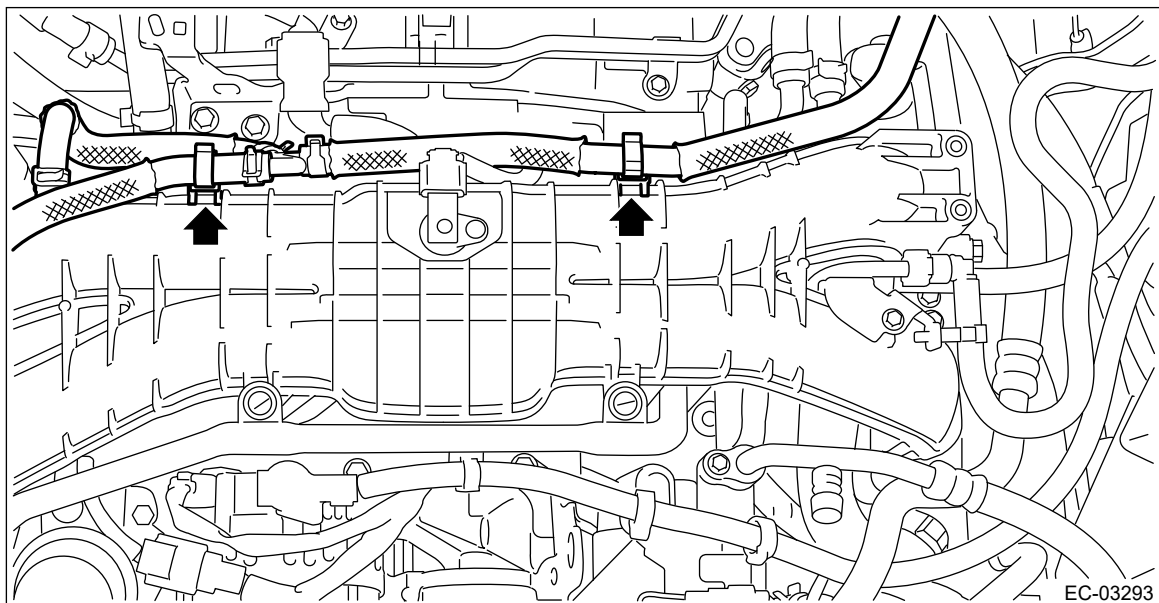
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Cooler

REMOVAL

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



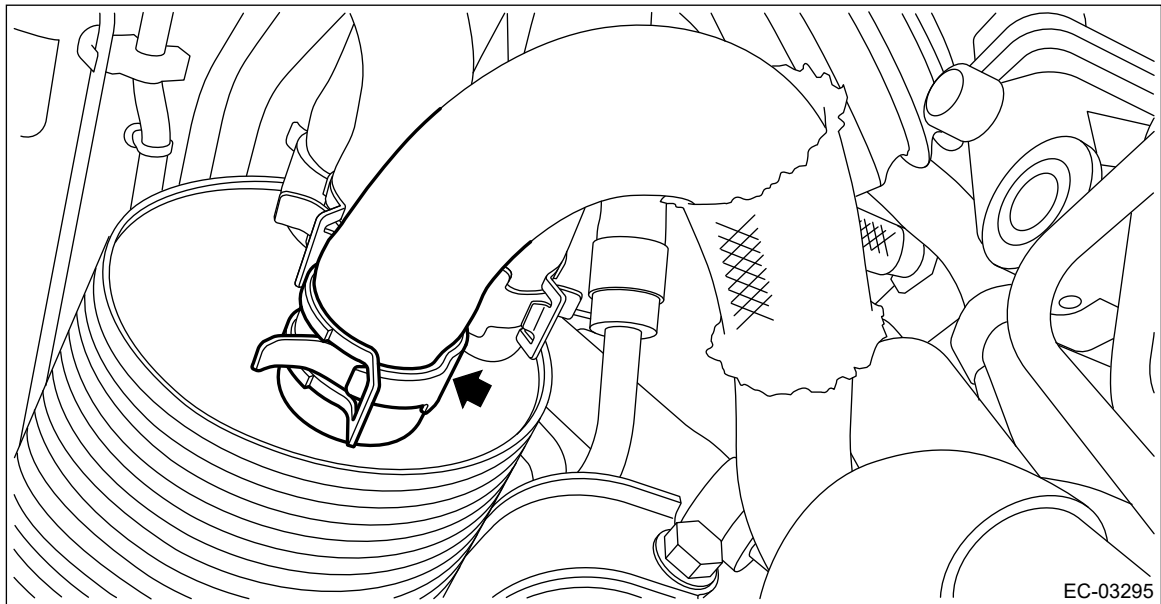
2. Disconnect the ground cable from battery.
3. Remove the intercooler. [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
4. Remove the brake booster vacuum hose from the clip, and place the brake booster vacuum hose aside so that it does not interfere with the work.



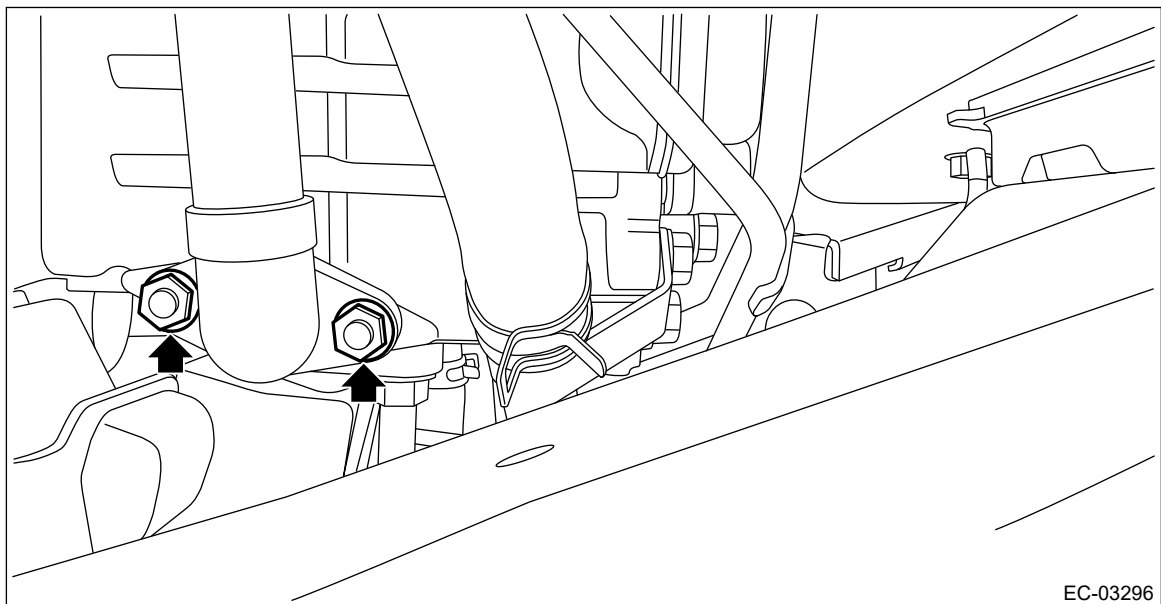
5. Lift up the vehicle.
6. Drain engine coolant. [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT >](#)

DRAINING OF ENGINE COOLANT.

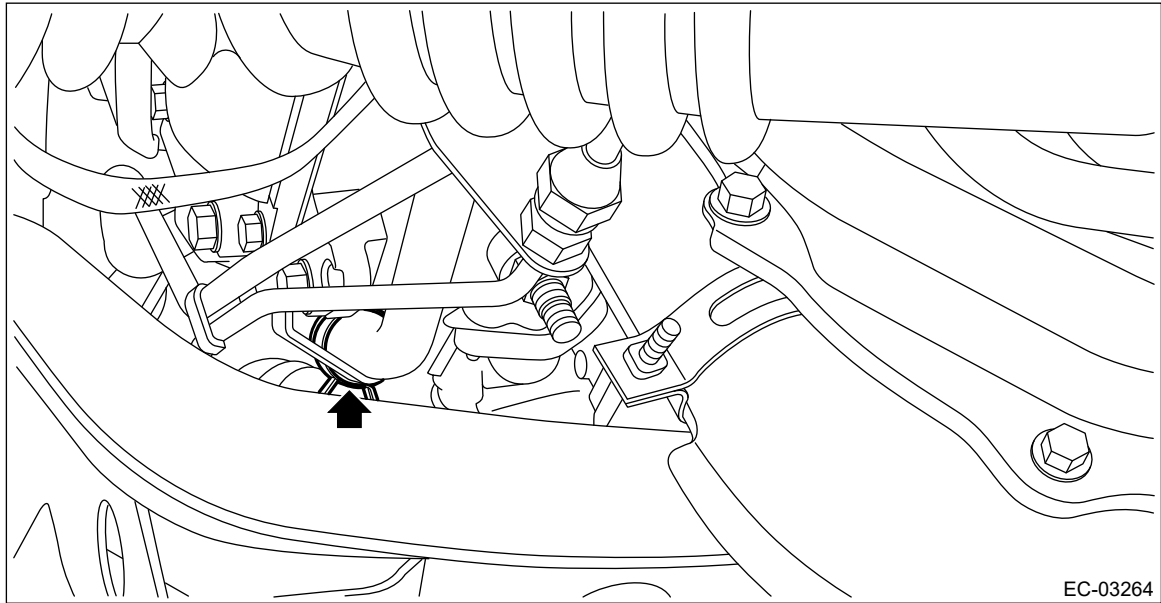
- 7.** Disconnect the engine coolant outlet hose from the CVTF cooler (with warmer feature).



- 8.** Remove the nuts which secure the EGR cooler to the cylinder head RH.

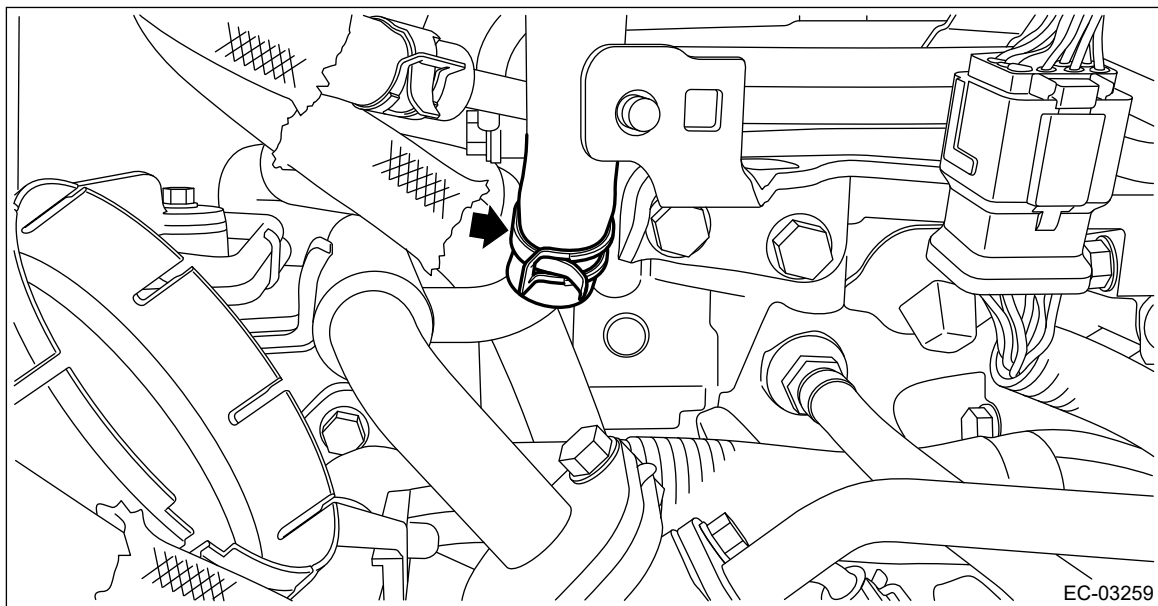


- 9.** Disconnect the water hose from the water pipe RH.

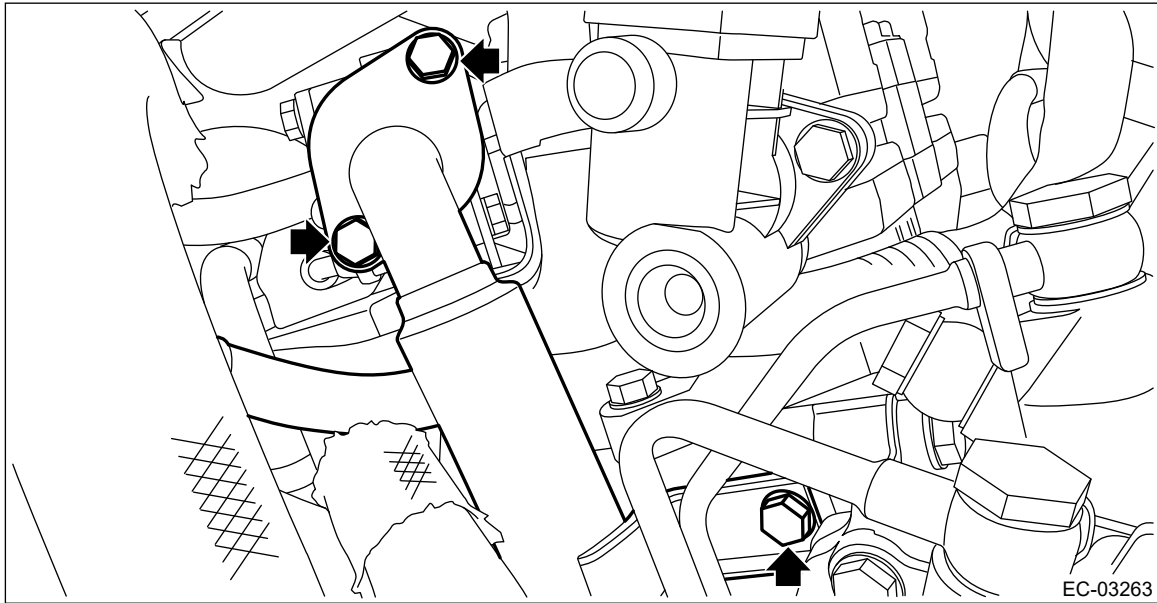


10. Lower the vehicle.

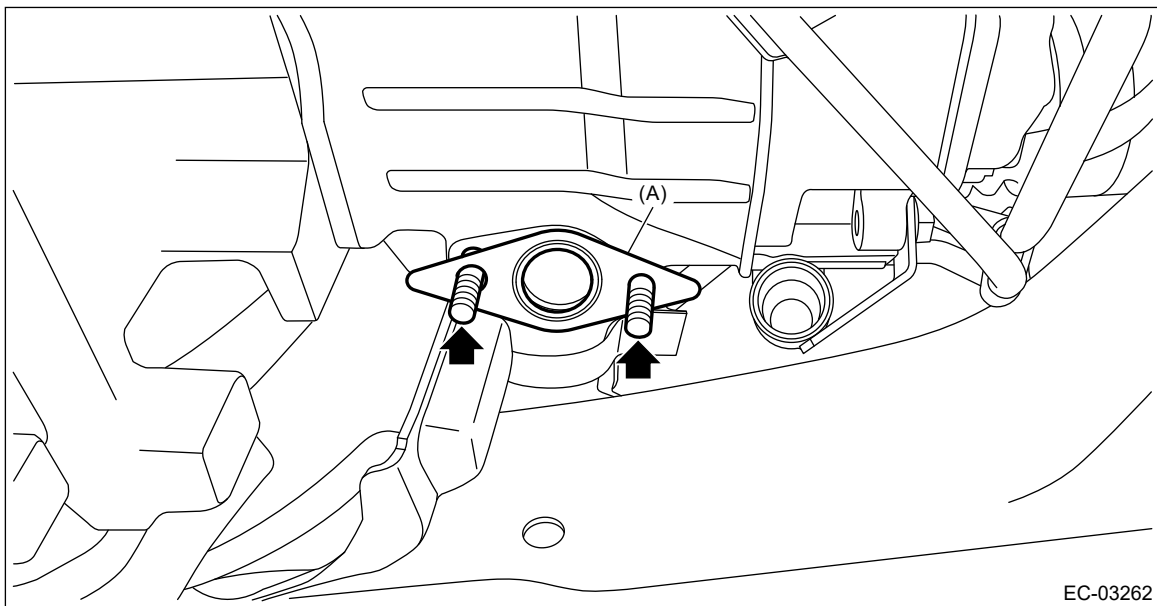
11. Disconnect the engine coolant inlet hose from the EGR cooler.



12. Remove the bolts which secure the EGR cooler to the EGR control valve and cylinder head RH, and remove the EGR cooler.



- 13.** Remove the gasket (A) from the stud bolt, and remove the stud bolt from the cylinder head RH.



**EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Pipe
INSPECTION**

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

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Pipe

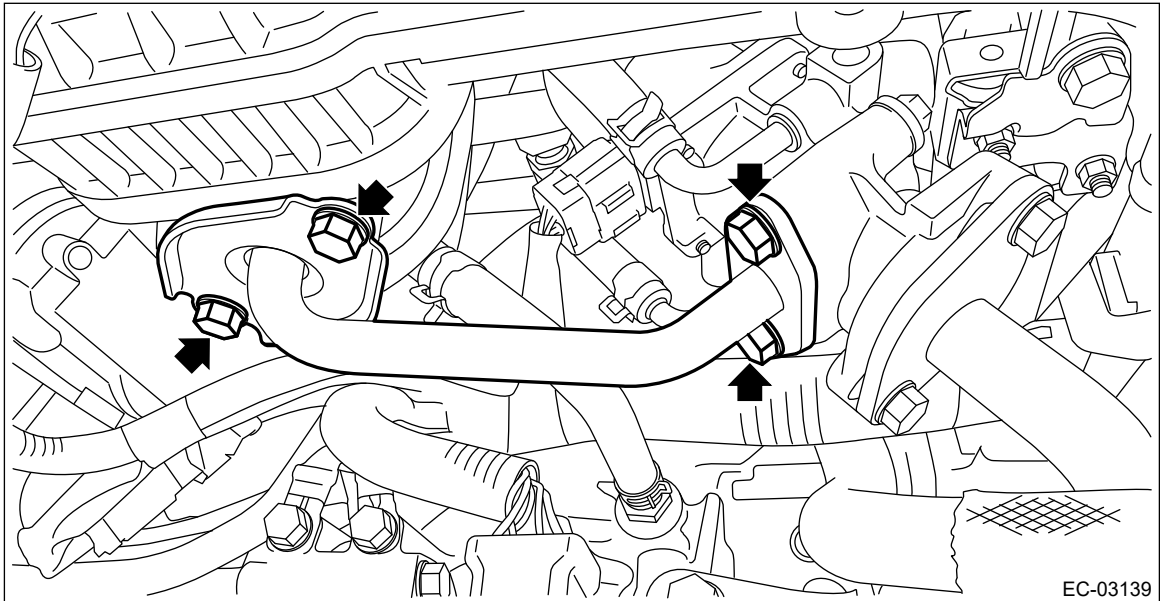
INSTALLATION

1. Install the EGR pipe to the intake manifold and EGR control valve.

- (1) Set the EGR pipe to the intake manifold and EGR control valve, and temporarily tighten the bolts which secure the EGR pipe to the intake manifold and EGR control valve.

Note:

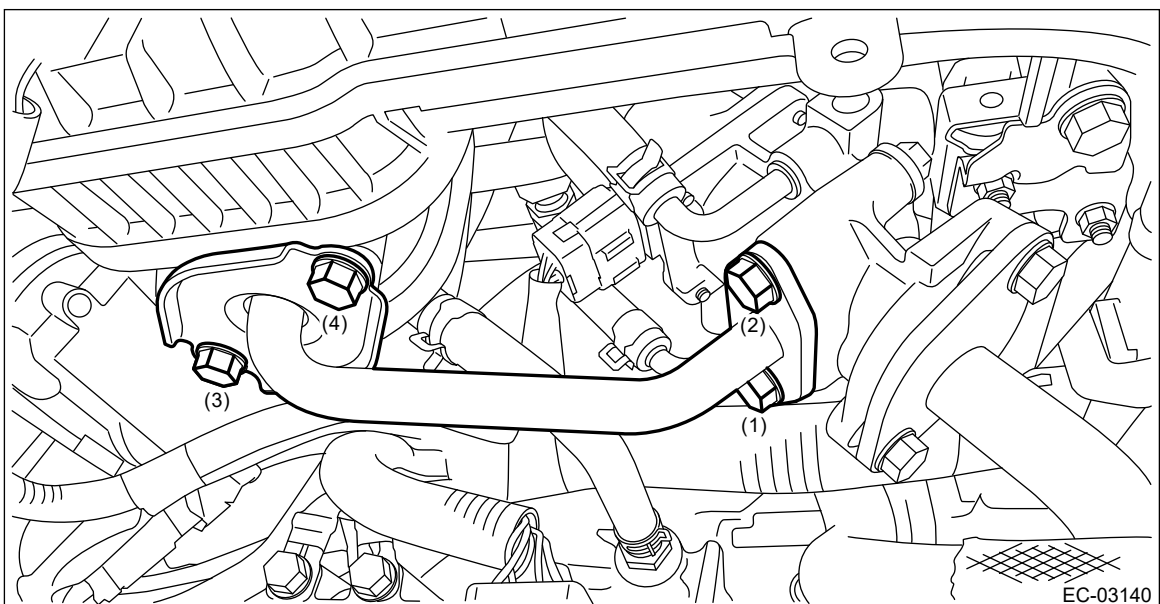
Use new gaskets and O-rings.



- (2) Tighten the bolts which secure the EGR pipe to the intake manifold and EGR control valve in numerical order as shown in the figure.

Tightening torque:

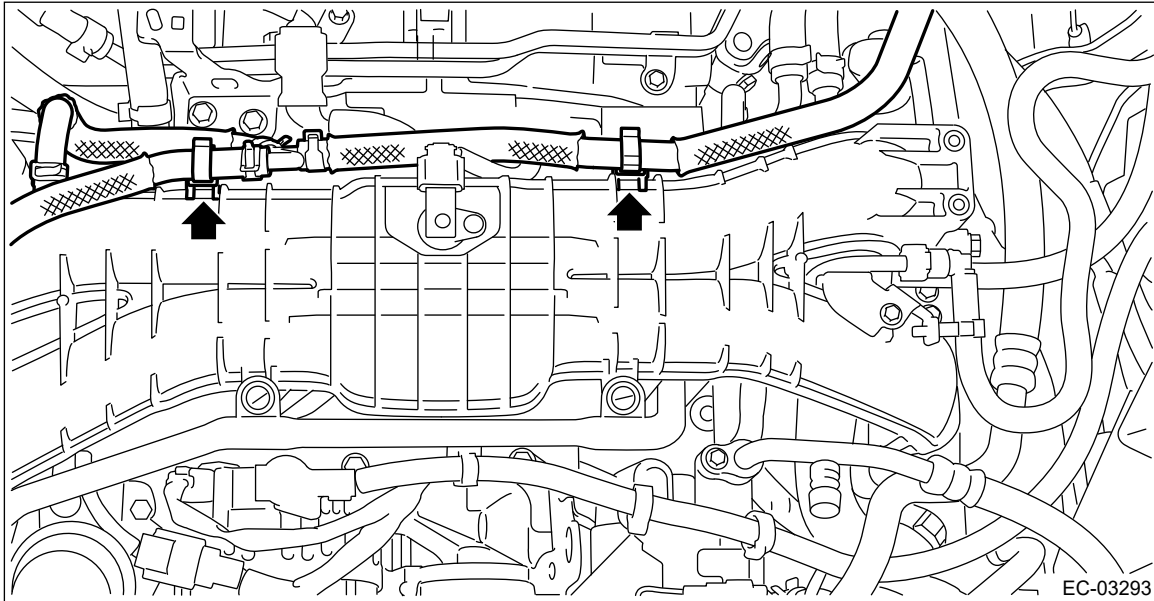
19 N·m (1.9 kgf-m, 14.0 ft-lb)




2. Install the brake booster vacuum hose to the clip.

Note:

If the clip is removed from the intake manifold, install the clip to the position of alignment mark ▼ of intake manifold.



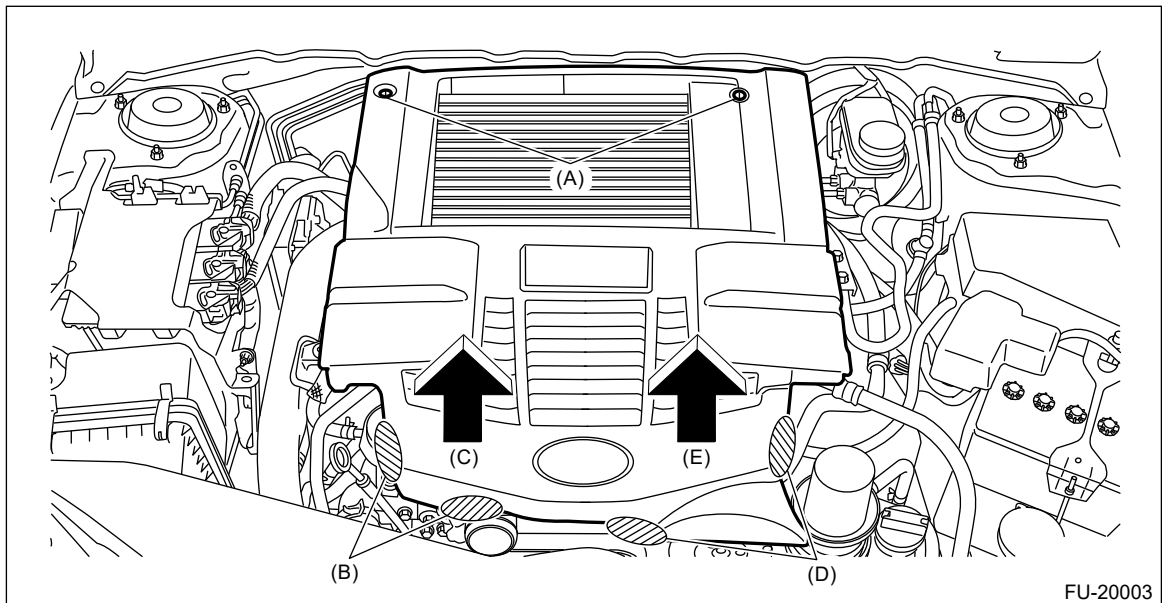
- 3.** Install the intercooler.  [Ref. to INTAKE \(INDUCTION\) \(H4DOTC\)>Intercooler>INSTALLATION.](#)
- 4.** Connect the battery ground terminal.
- 5.** Install the collector cover.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > EGR Pipe


REMOVAL

1. Remove the collector cover.

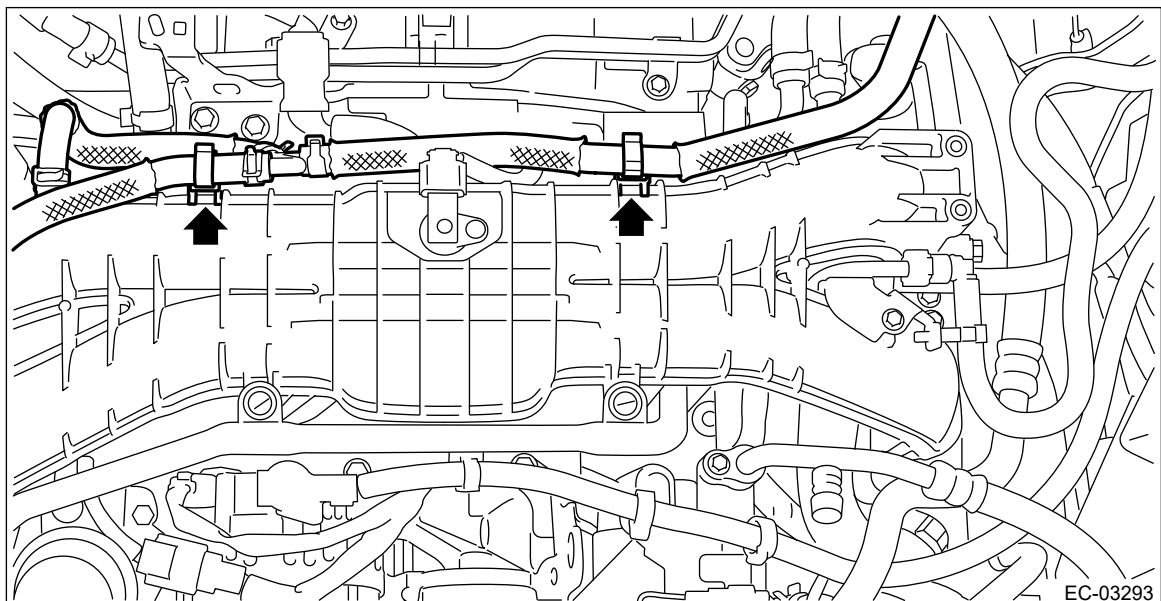
- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



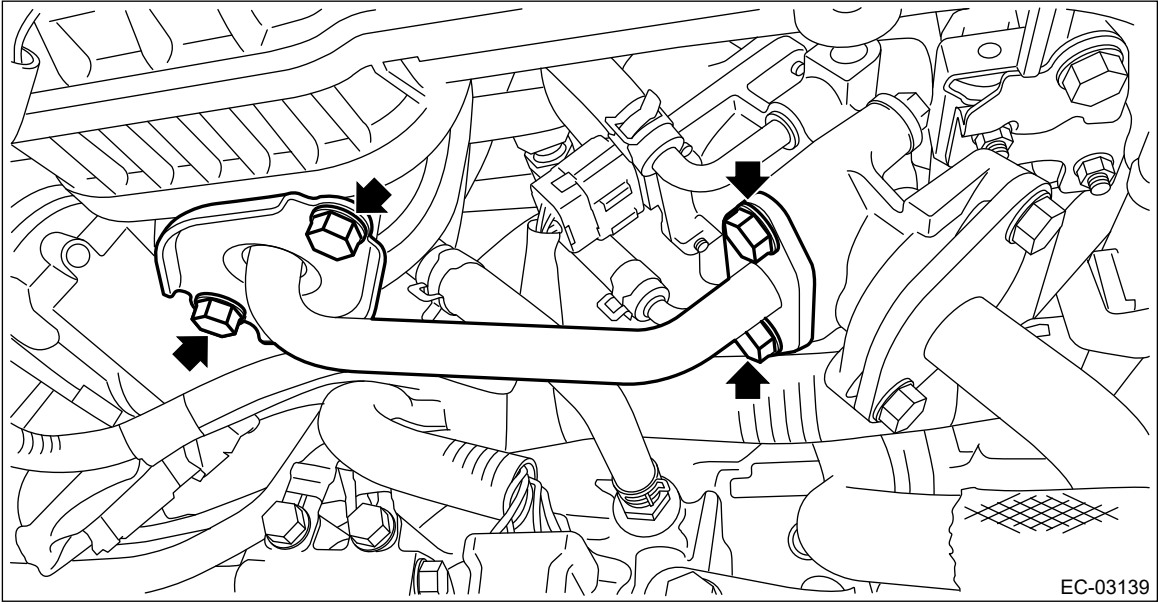
2. Disconnect the ground cable from battery.

3. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)

4. Remove the brake booster vacuum hose from the clip, and place the brake booster vacuum hose aside so that it does not interfere with the work.



5. Remove the bolts which secure the EGR pipe to the intake manifold and EGR control valve, and remove the EGR pipe.



EC-03139


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Front Catalytic Converter

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Front Catalytic Converter

INSTALLATION

The front catalytic converter is integrated into the center exhaust pipe (front). Refer to "Center Exhaust Pipe" for installation procedures.  [Ref. to EXHAUST\(H4DOTC\)>Center Exhaust Pipe>INSTALLATION.](#)


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Front Catalytic Converter

REMOVAL

The front catalytic converter is integrated into the center exhaust pipe (front). Refer to "Center Exhaust Pipe" for removal procedures.  [Ref. to EXHAUST\(H4DOTC\)>Center Exhaust Pipe>REMOVAL.](#)


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Fuel Level Sensor

INSPECTION

Refer to "Fuel Level Sensor" for the fuel level sensor inspection procedure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Level Sensor>INSPECTION.](#)


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Fuel Level Sensor

INSTALLATION

Refer to "Fuel Level Sensor" for installation procedure of the fuel level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Level Sensor>INSTALLATION.](#)


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Fuel Level Sensor

REMOVAL

Refer to "Fuel Level Sensor" for removal procedure of the fuel level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Level Sensor>REMOVAL.](#)


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Fuel Sub Level Sensor

INSPECTION

Refer to "Fuel Sub Level Sensor" for the fuel sub level sensor inspection procedure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Sub Level Sensor>INSPECTION.](#)


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Fuel Sub Level Sensor

INSTALLATION

Refer to "Fuel Sub Level Sensor" for installation procedure of the fuel sub level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Sub Level Sensor>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Fuel Sub Level Sensor

REMOVAL


Refer to "Fuel Sub Level Sensor" for removal procedure of the fuel sub level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Sub Level Sensor>REMOVAL.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > General Description

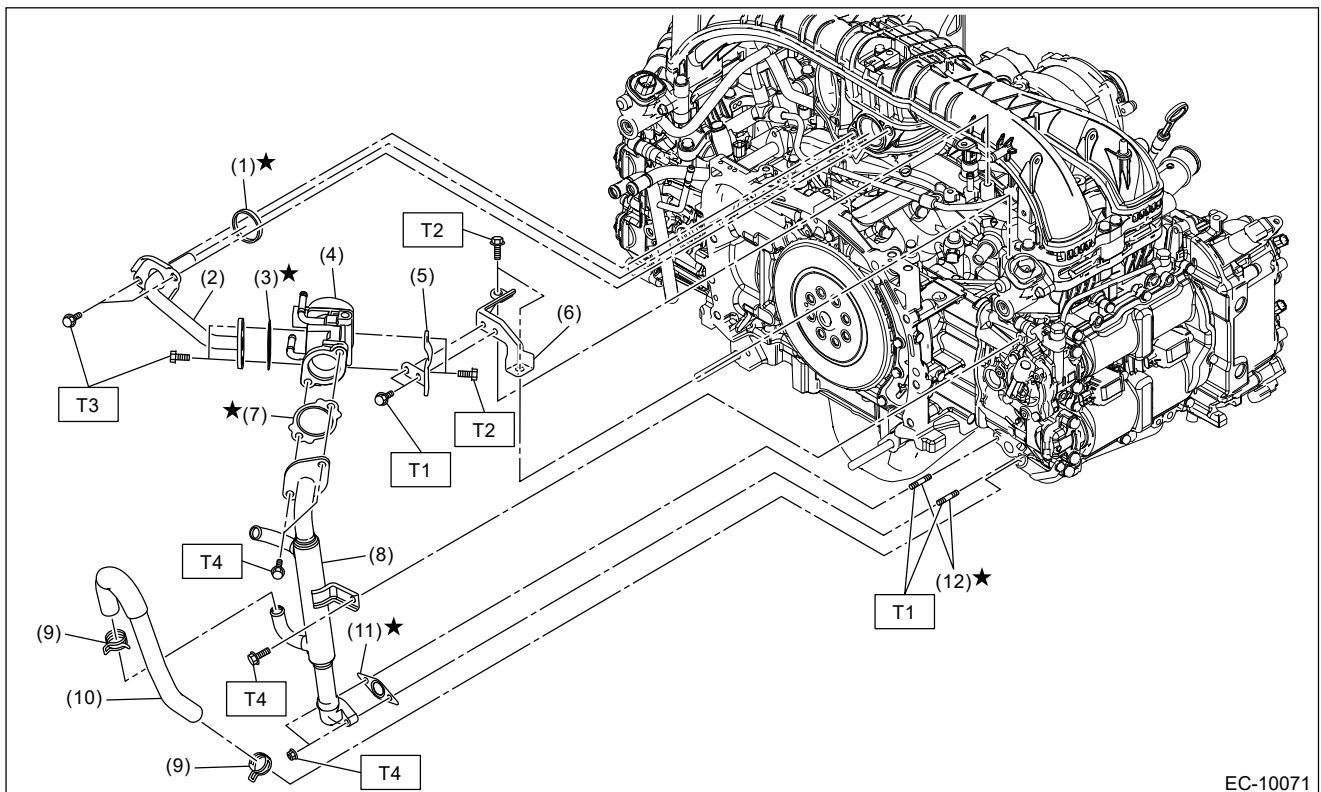
CAUTION

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

1. CANISTER, PURGE CONTROL SOLENOID VALVE, LEAK CHECK VALVE ASSEMBLY, AND PURGE DAMPER



For components of canister, purge control solenoid valve, leak check valve assembly and purge damper, refer to FU(H4DOTC).  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>General Description>COMPONENT.](#)

2. EXHAUST GAS RECIRCULATION CONTROL CIRCUIT RANGE/PERFORMANCE

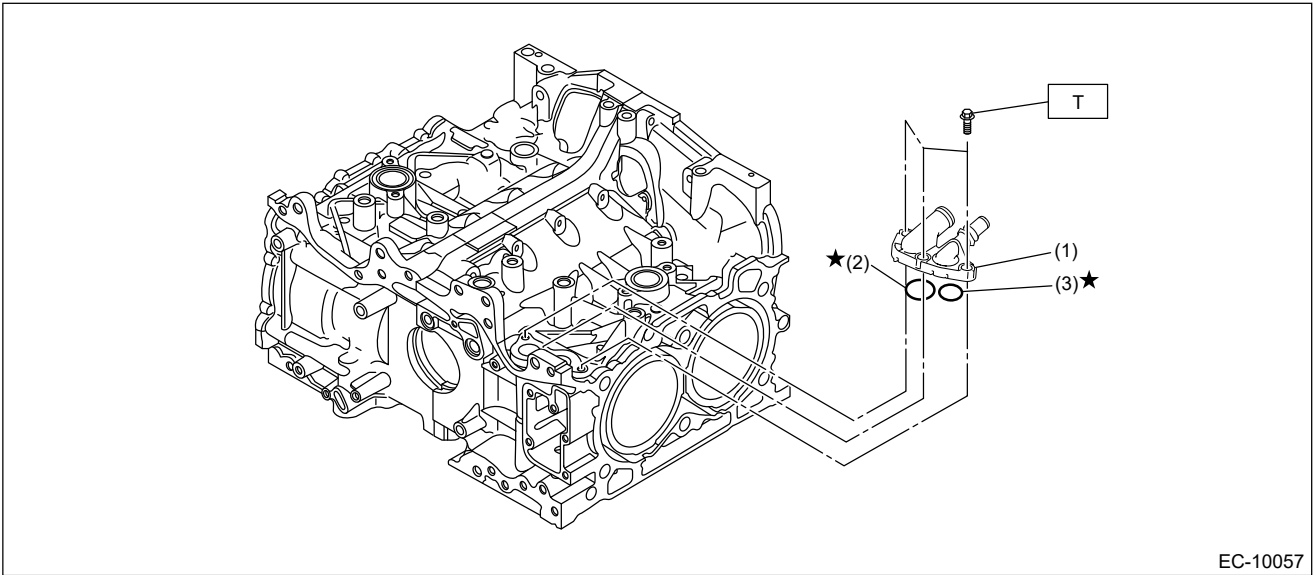


EC-10071

- | | |
|---------------------------------|-----------------|
| (1) O-ring | (7) Gasket |
| (2) EGR pipe | (8) EGR cooler |
| (3) Gasket | (9) Clip |
| (4) EGR control valve | (10) Water hose |
| (5) EGR control valve bracket A | (11) Gasket |
| (6) EGR control valve bracket B | (12) Stud bolt |

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.7, 4.7)
T2: 19 (1.9, 14.0)
T3:  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DOTC\)>EGR Pipe>INSTALLATION.](#)
T4:  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DOTC\)>EGR Cooler>INSTALLATION.](#)

3. PCV SYSTEM 1



(1) PCV connector

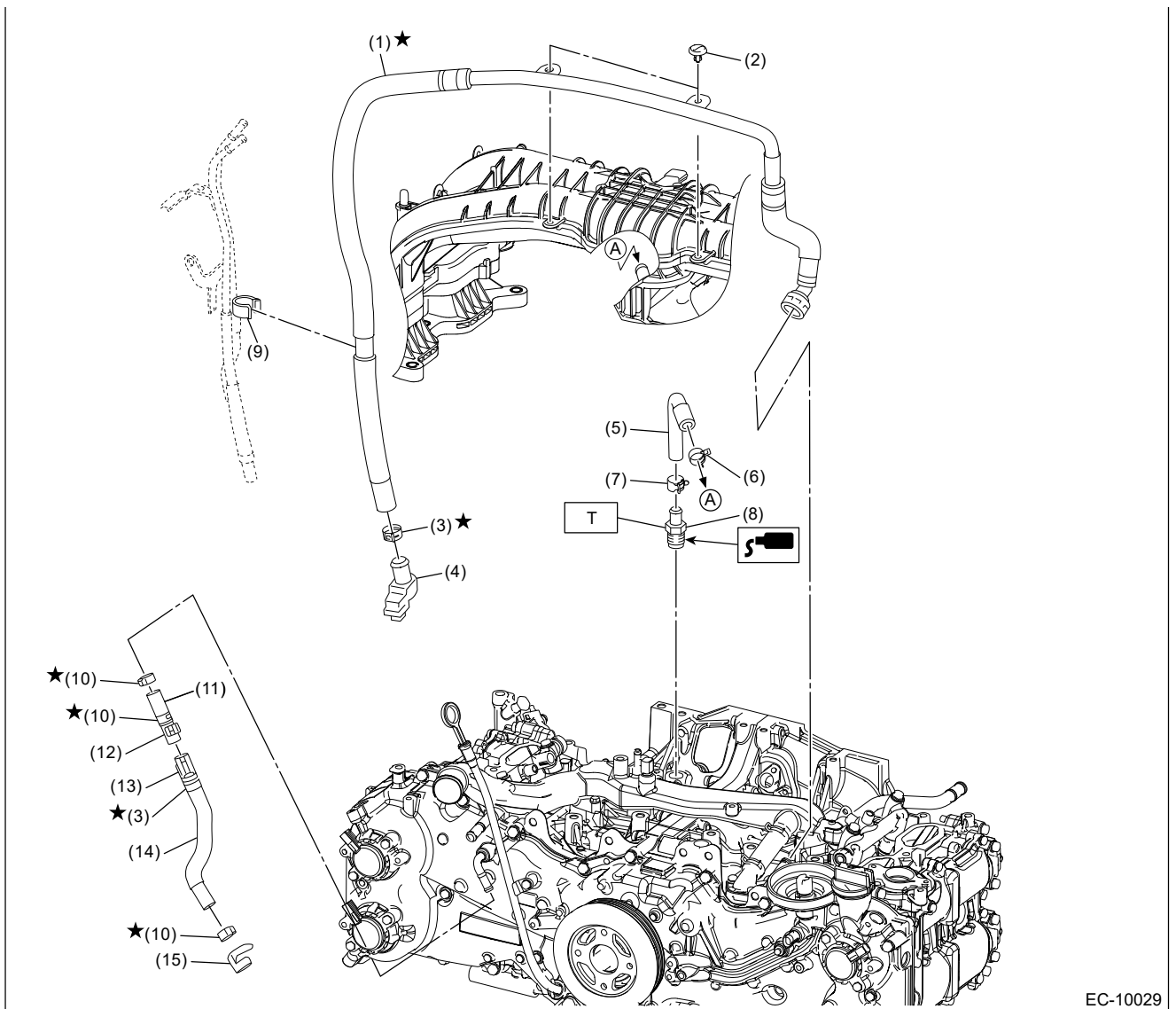
(3) O-ring

Tightening torque: N·m (kgf-m, ft-lb)

(2) O-ring

T: 6.4 (0.7, 4.7)

4. PCV SYSTEM 2



EC-10029

- | | | |
|-----------------------------------|------------------------------------|--|
| (1) PCV pipe ASSY | (7) Clip | (13) Blow-by diagnosis connector C |
| (2) Clip | (8) PCV valve | (14) PCV hose ASSY No.2 |
| (3) Clamp | (9) Clip | (15) Clamp cover |
| (4) Blow-by diagnosis connector A | (10) Clamp | |
| (5) PCV hose | (11) PCV hose ASSY No.1 | Tightening torque: N·m (kgf-m, ft-lb) |
| (6) Clip | (12) Blow-by diagnosis connector B | T: 23 (2.3, 17.0) |

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > General Description

PREPARATION TOOL

1. GENERAL TOOL

| TOOL NAME | REMARKS |
|------------------|---|
| Circuit tester | Used for measuring resistance, voltage and current. |
| Clamp pincer | <ul style="list-style-type: none">• Used for installing PCV pipe assembly and PCV hose assembly.• This tool is made by OETIKER. Product No. 14100134 |

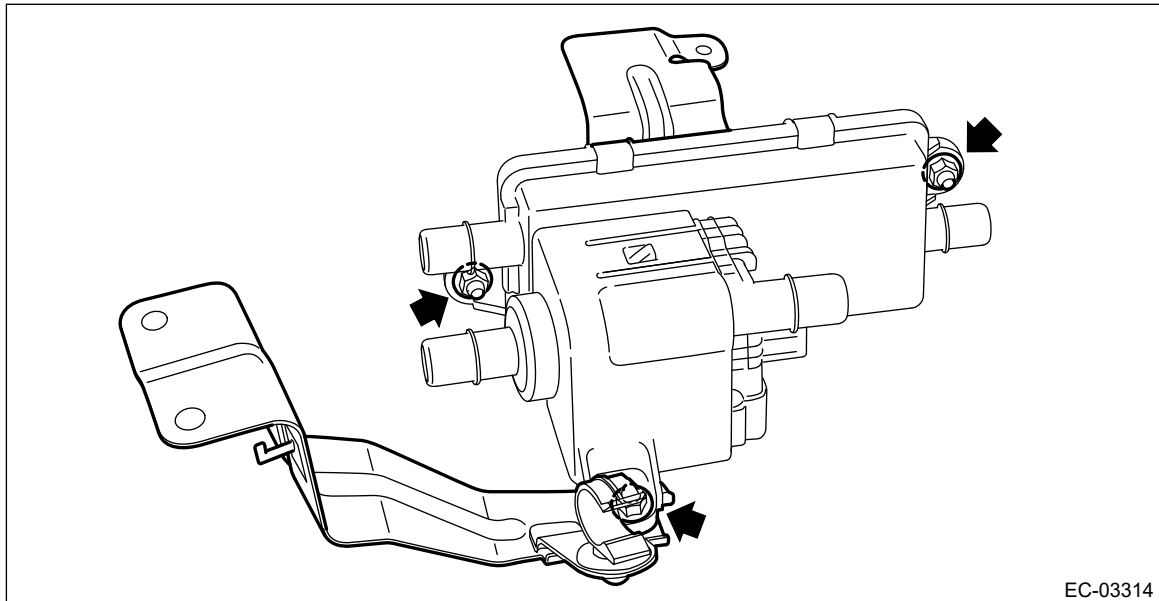
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Leak Check Valve Assembly

ASSEMBLY

1. Install the bracket to the leak check valve assembly.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



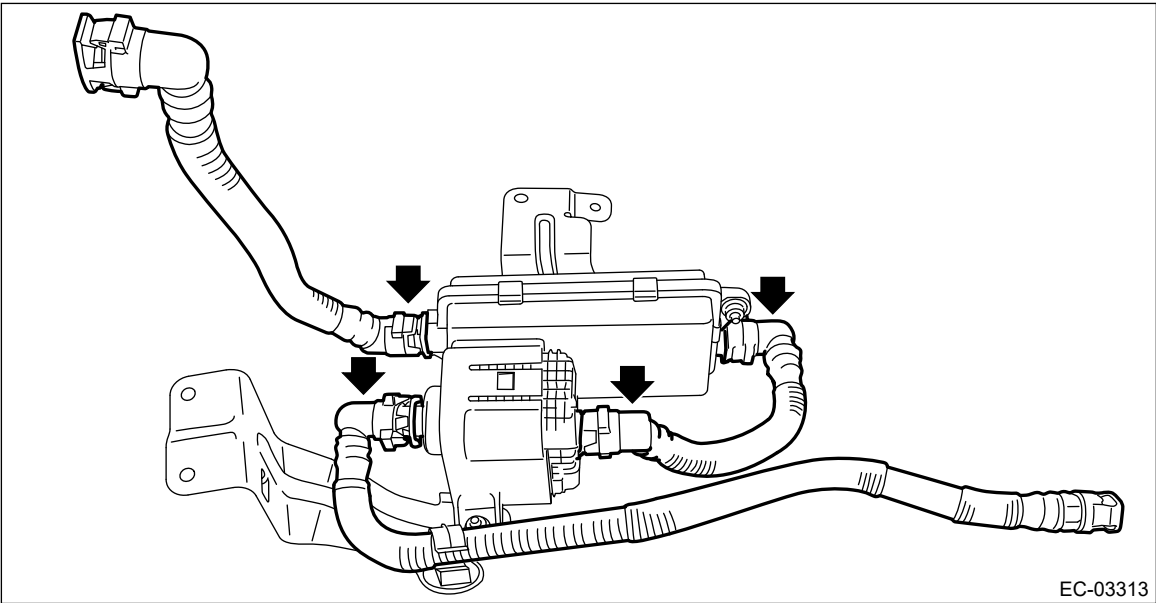
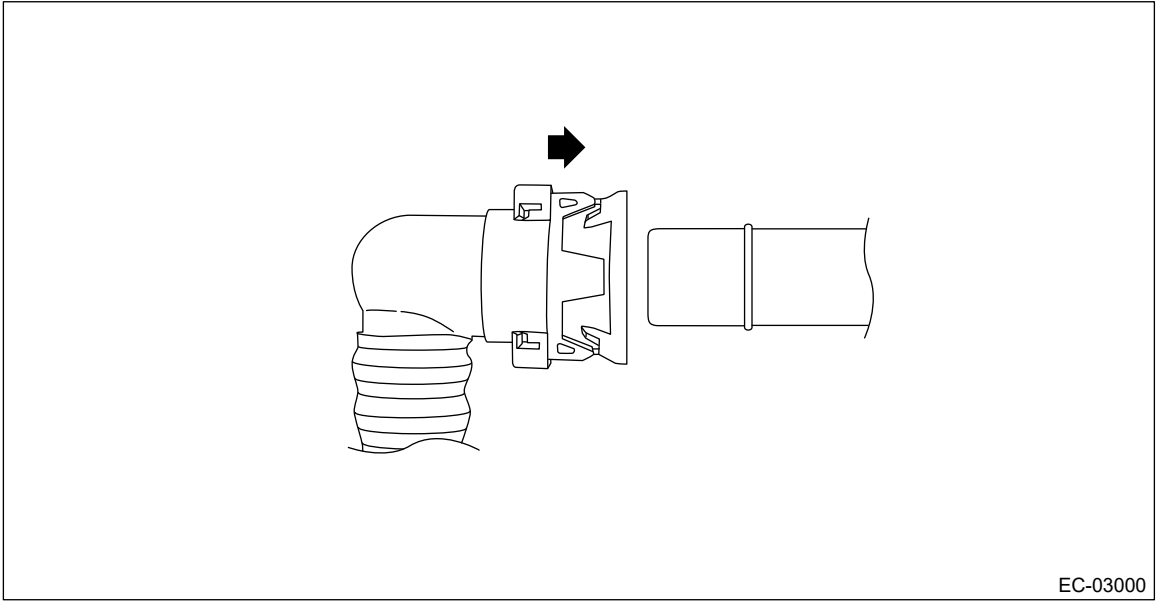
2. Install the drain tube to the leak check valve assembly.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



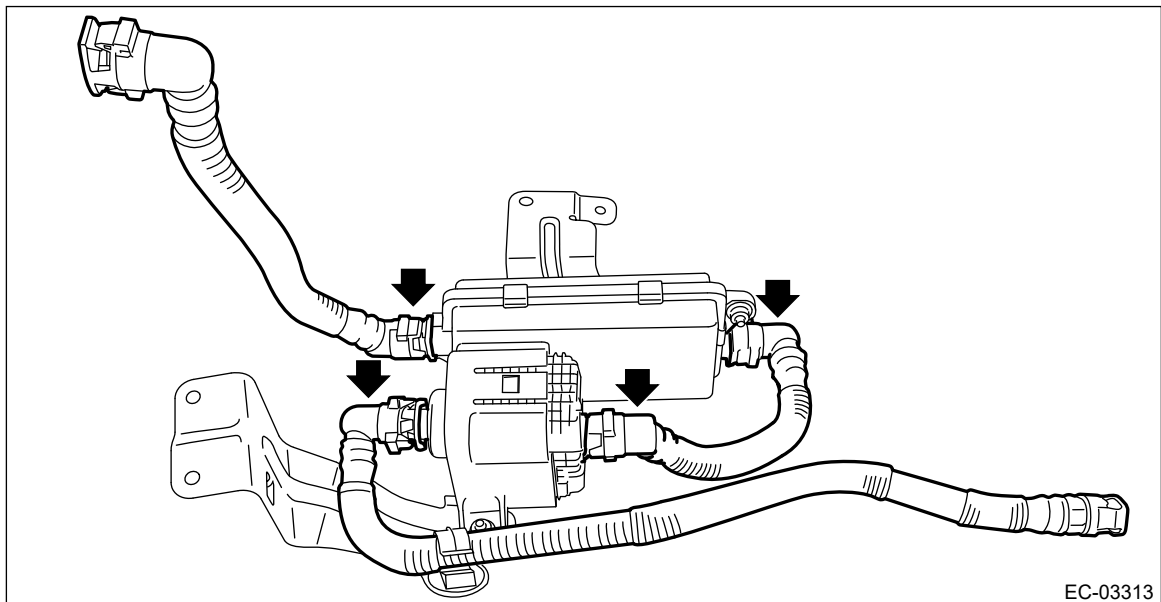
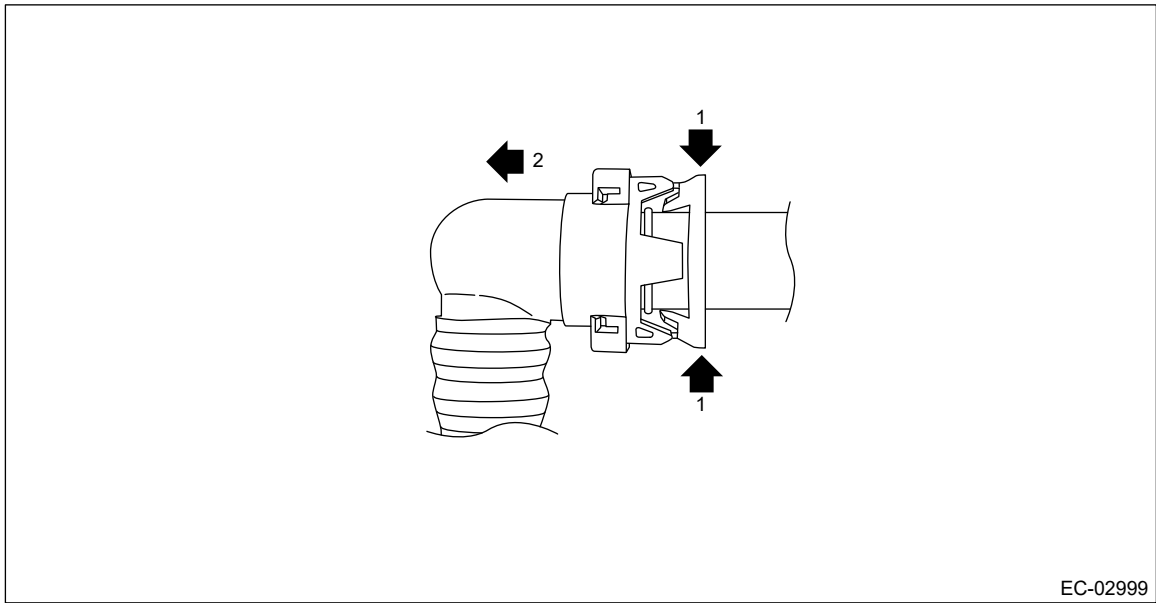
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Leak Check Valve Assembly

DISASSEMBLY

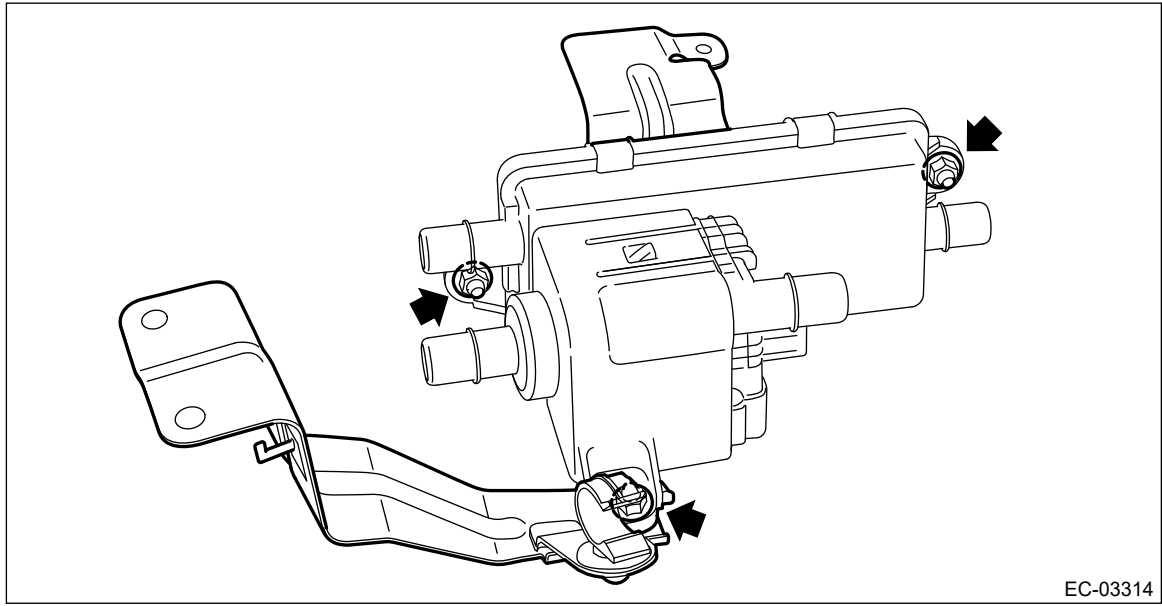
1. Disconnect the drain tube from the leak check valve assembly.

Note:

Disconnect the quick connector as shown in the figure.



2. Remove the bracket from the leak check valve assembly.



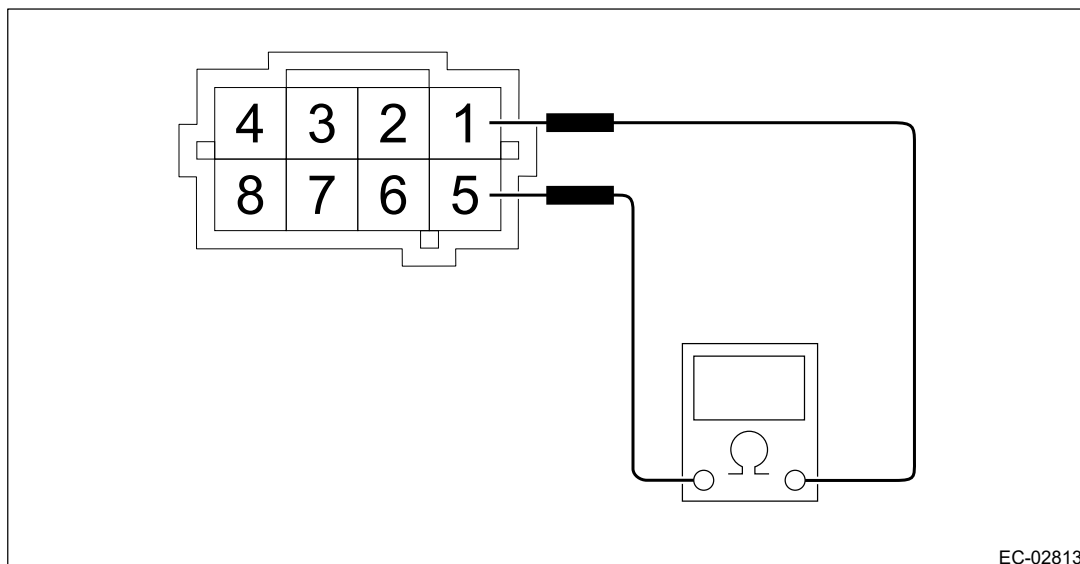
EC-03314

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Leak Check Valve Assembly

INSPECTION

1. CHECK SWITCHING VALVE

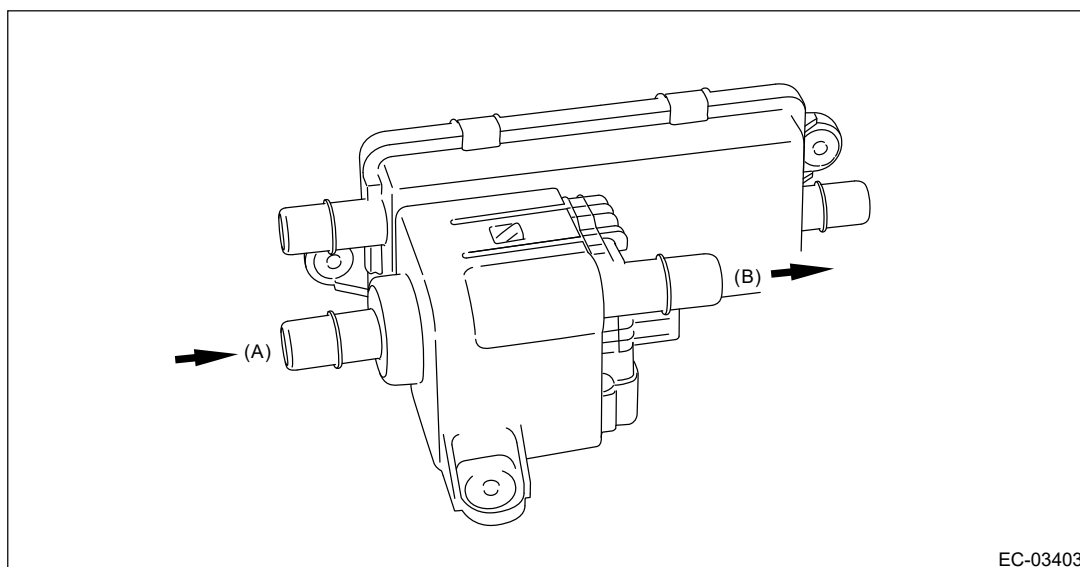
1. Check the resistance between switching valve terminals.



EC-02813

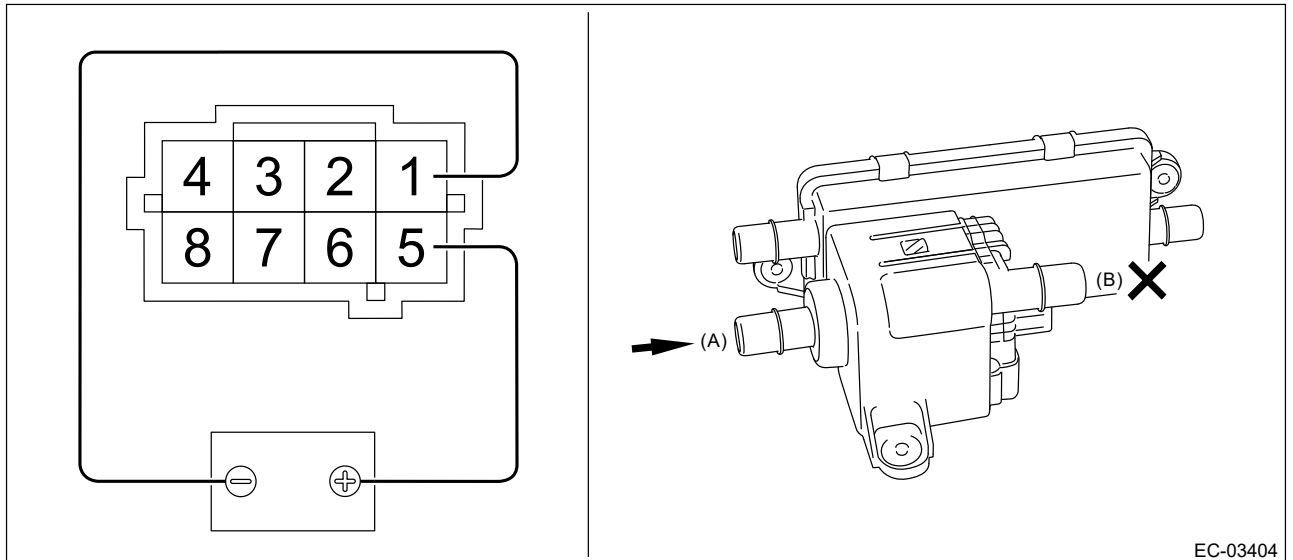
| Terminal No. | Standard |
|--------------|--|
| 1 and 5 | $27^{+3}_{-2} \Omega$ (when 20°C (68°F)) |
| | $31 \pm 4 \Omega$ (when 60°C (140°F)) |

2. Check that air is discharged from (B) when air is blown into (A).



EC-03403

3. Connect the battery positive terminal to the terminal No. 5 and the battery ground terminal to the terminal No. 1. Check that air does not come out from (B) when air is blown into (A).

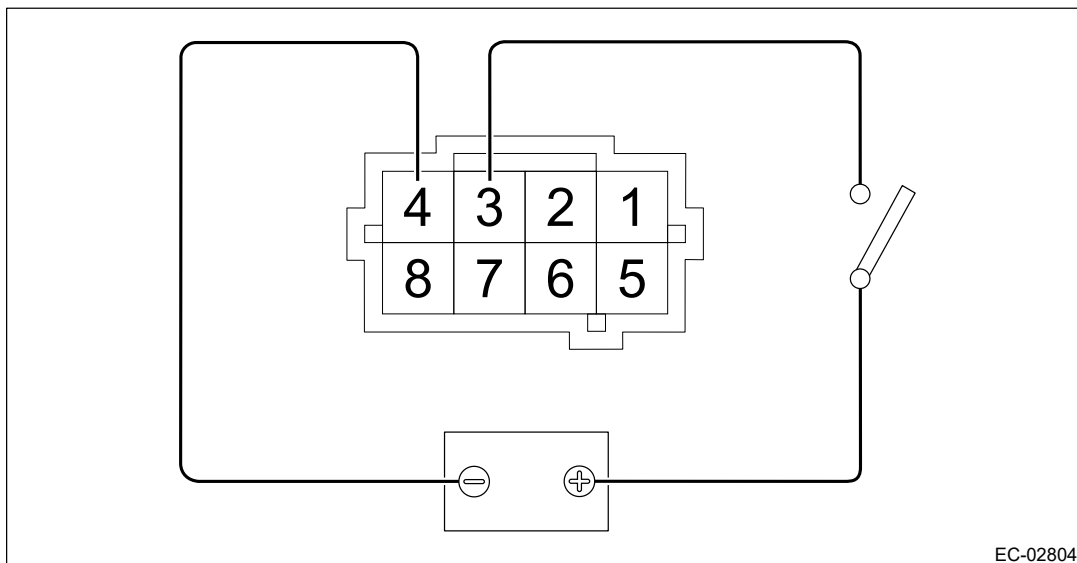


2. CHECK VACUUM PUMP

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

Caution:

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

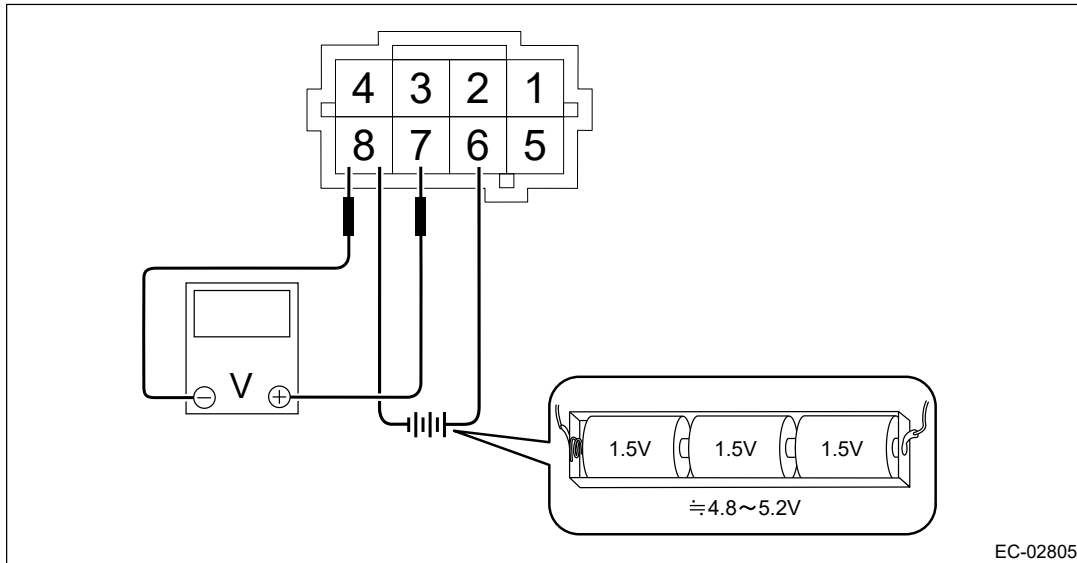


3. CHECK PRESSURE SENSOR

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

Note:

- Use new dry-cell batteries.
- Using a circuit tester, check that the initial voltage of each dry-cell battery is 1.6 V or more. And also check that the voltage of three batteries in series is between 4.8 – 5.2 V.
- For power supply, 5 V DC constant voltage power source can also be used.



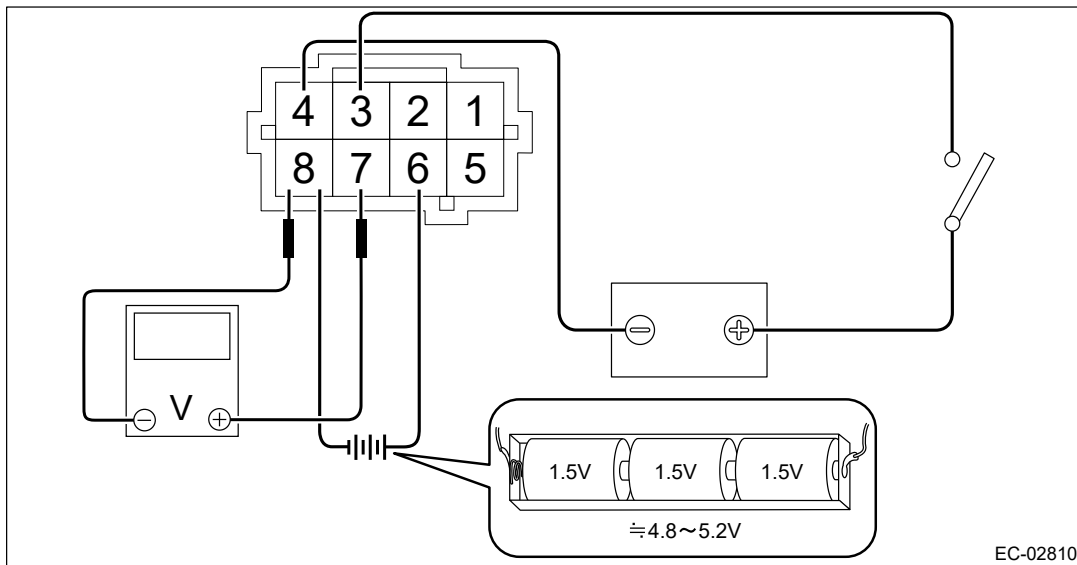
2. Check the voltage at a normal atmospheric pressure.

Note:

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

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

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



4. OTHER INSPECTIONS

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

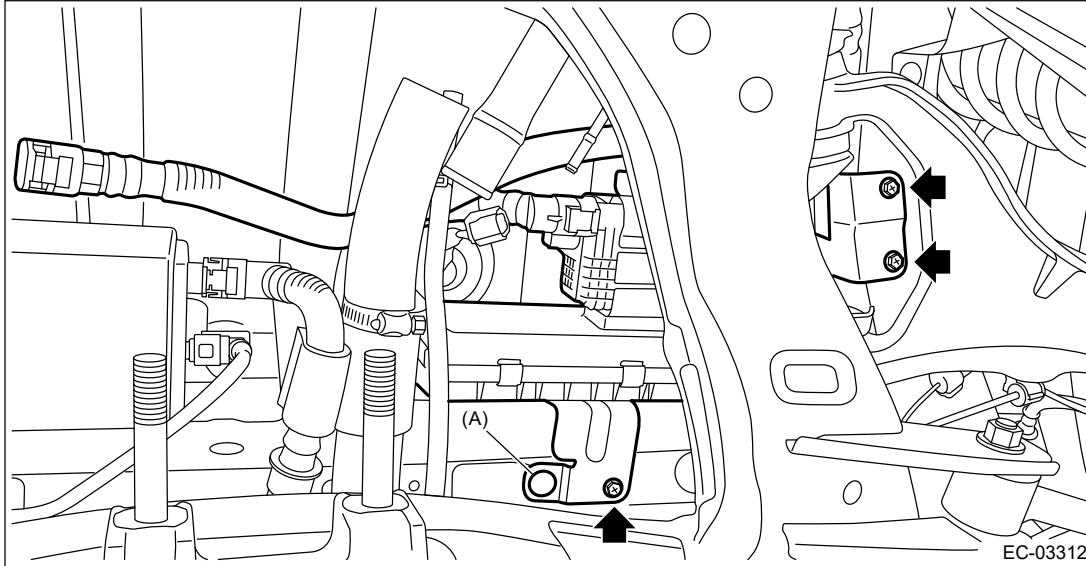
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Leak Check Valve Assembly

INSTALLATION

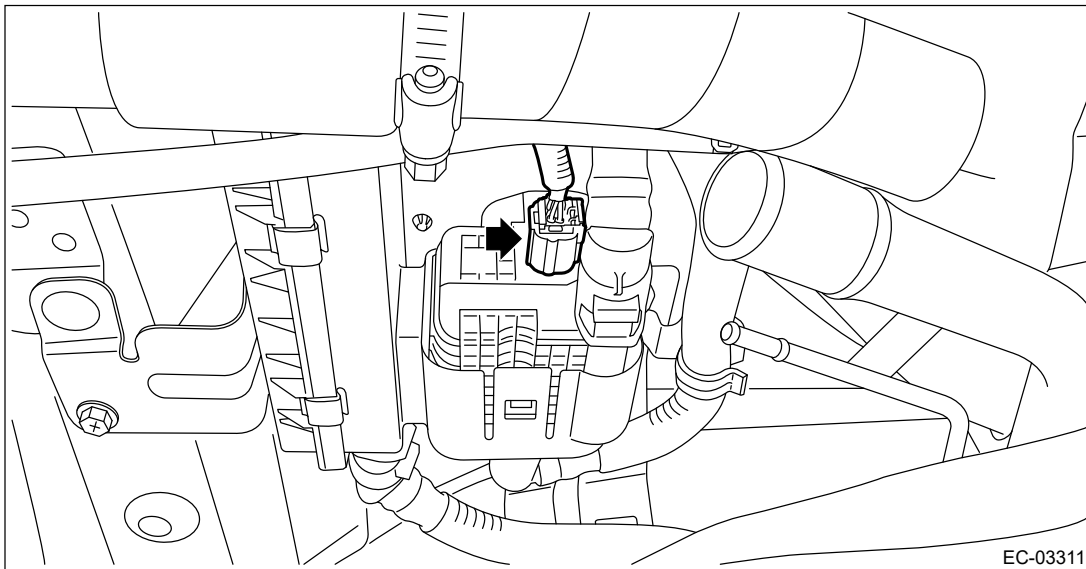
1. Install the leak check valve assembly to the vehicle with the bolt and clip (A).

Tightening torque:

7.5 N•m (0.8 kgf-m, 5.5 ft-lb)



2. Connect the connector to the leak check valve assembly.



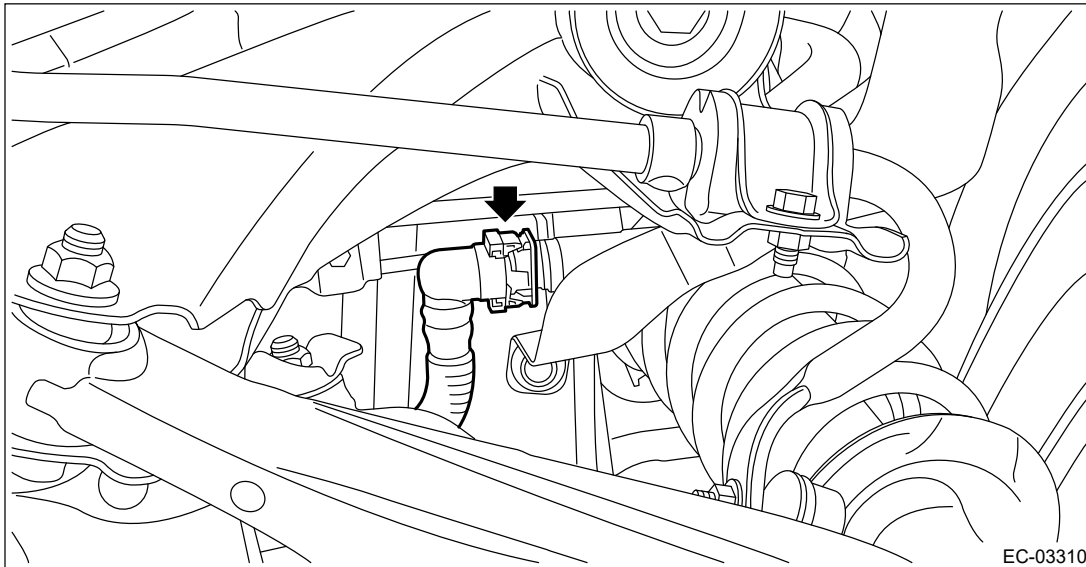
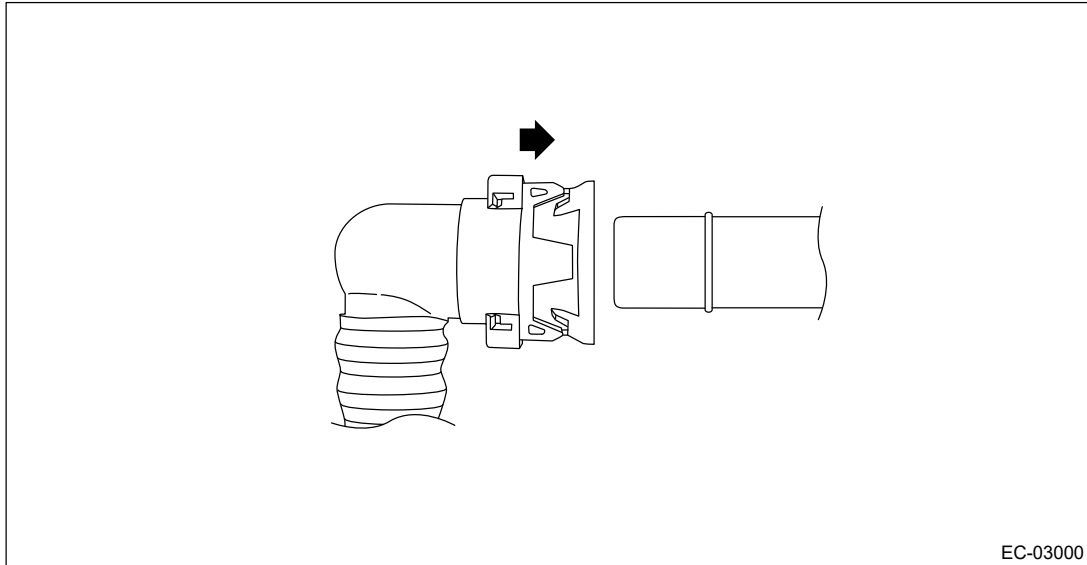
3. Connect the drain tube to the drain pipe of the fuel filler pipe assembly.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

Note:

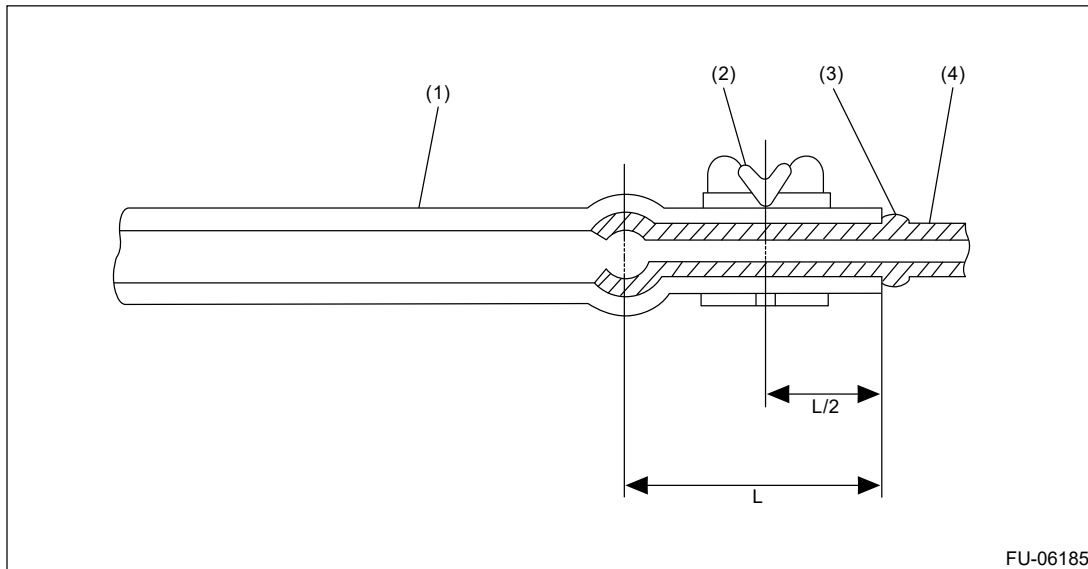
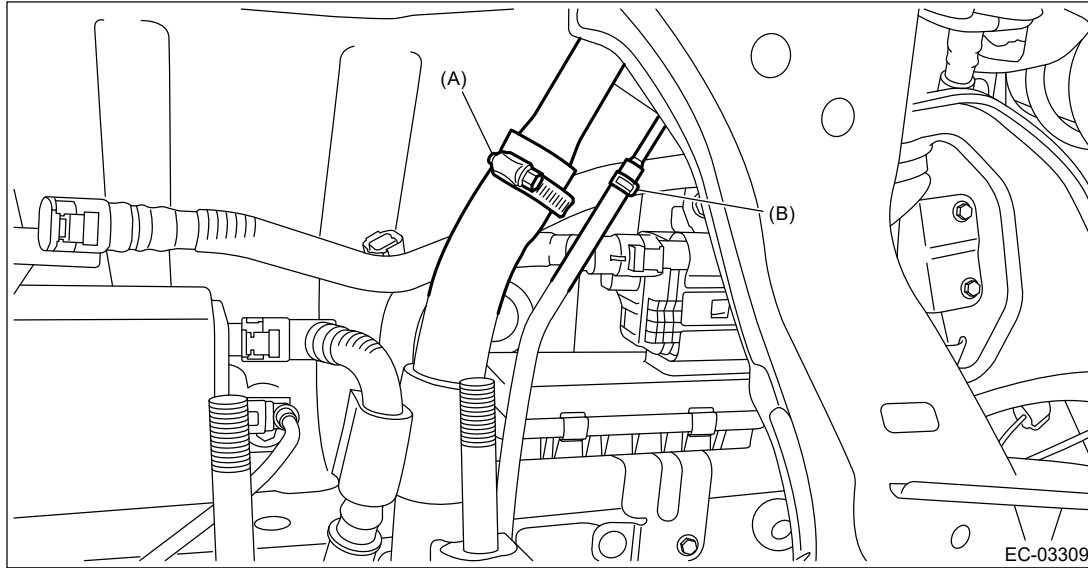
Connect the quick connector as shown in the figure.



4. Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp and clip as shown in the figure.

Tightening torque:

2.5 N•m (0.3 kgf-m, 1.8 ft-lb)



(1) Hose

(3) Spool

(4) Pipe

(2) Clamp and clip

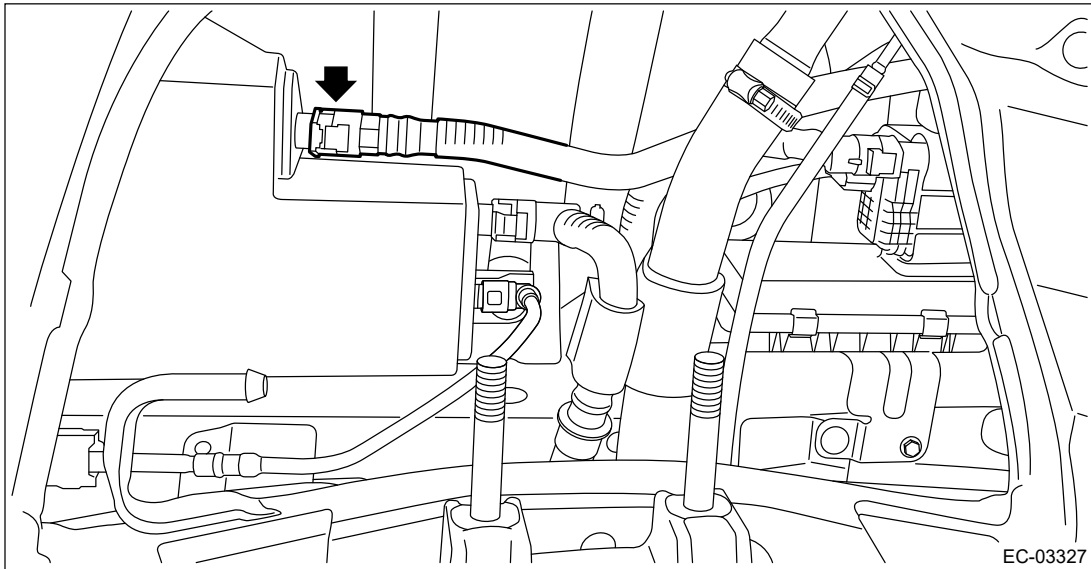
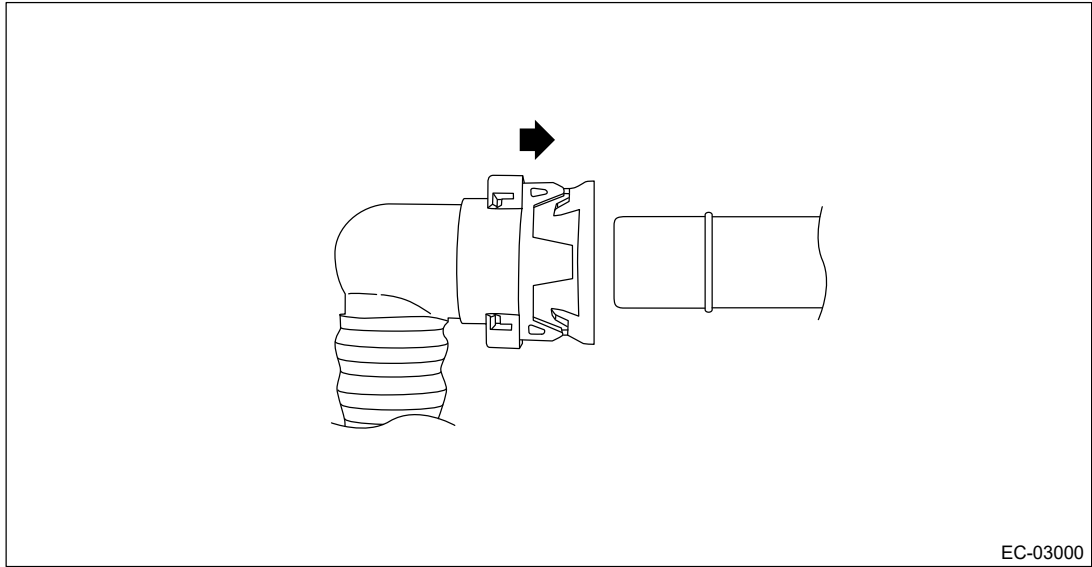
5. Connect the drain tube to the canister.

Caution:

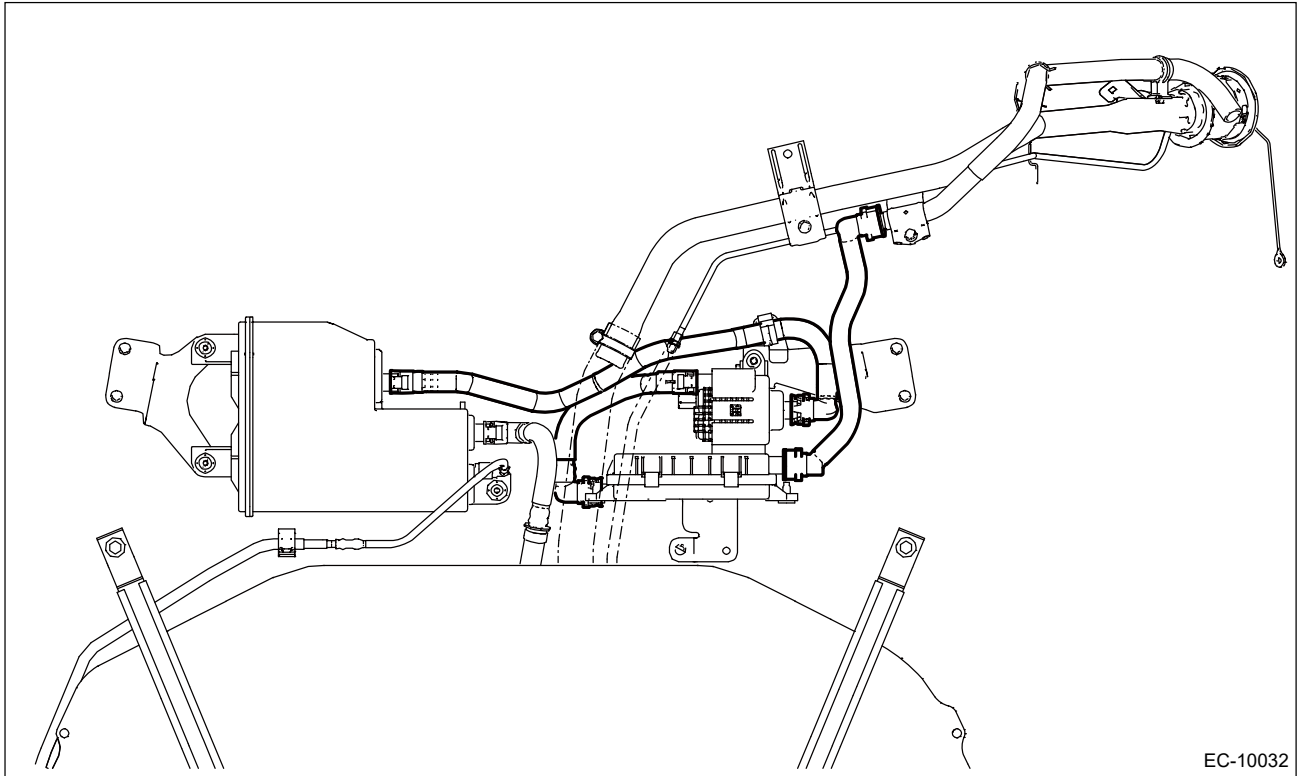
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



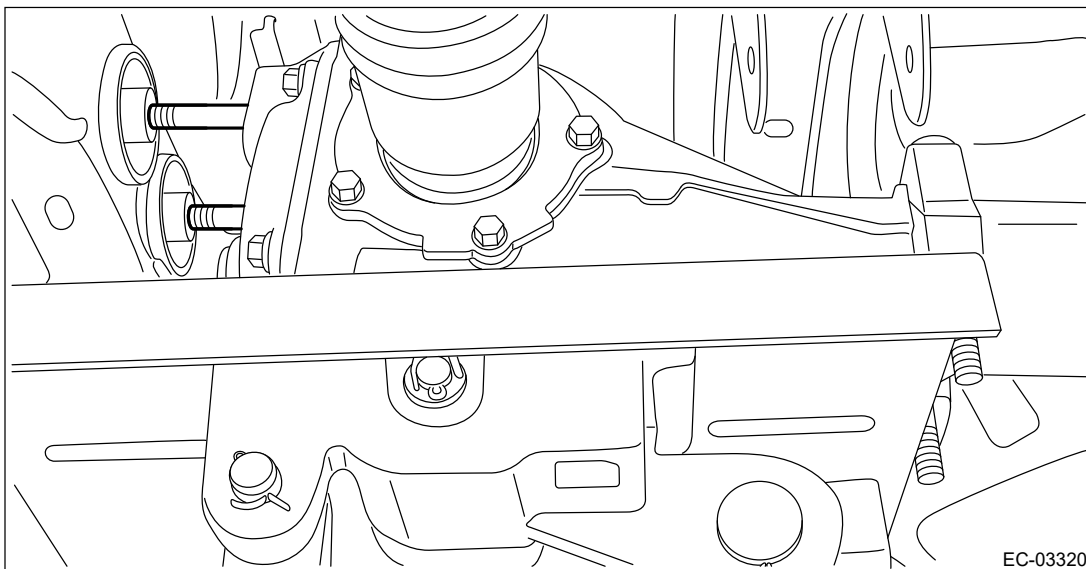
6. Check again that each tube is connected as shown in the figure.



7. Lift up the transmission jack gradually, and set the rear differential to the rear sub frame assembly.

Note:

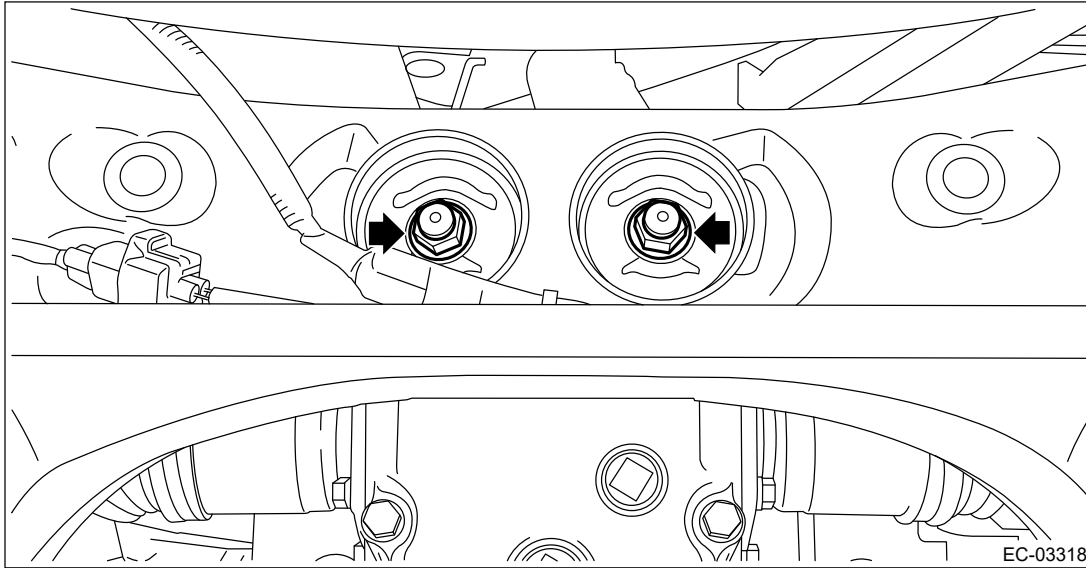
When inserting the stud bolt into the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.



8. Temporarily tighten the self-locking nuts which hold the rear differential to the rear sub frame assembly.

Note:

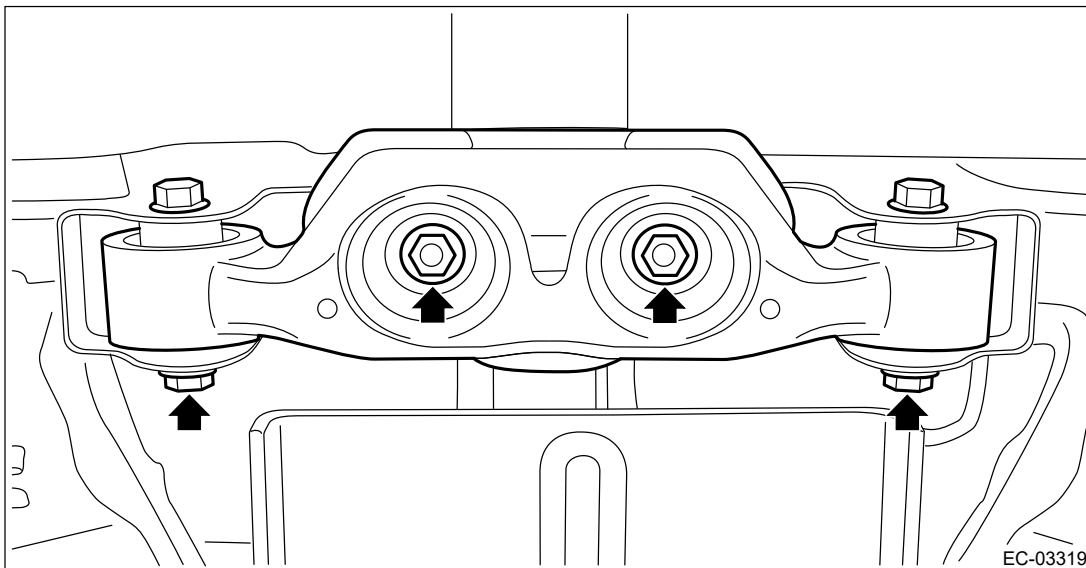
Use a new self-locking nut.



- 9.** Set the rear differential member to the rear sub frame assembly and rear differential, and temporarily tighten the self-lock nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Note:

Use a new self-locking nut.

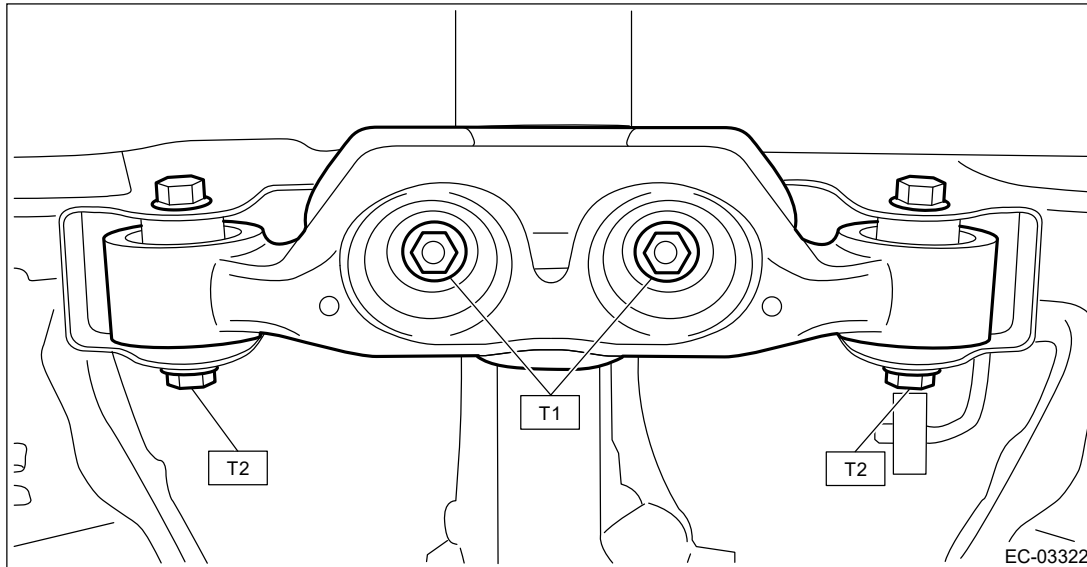


- 10.** Remove the transmission jack from the rear differential.
11. Tighten the self-locking nuts which secure the rear differential member to the rear sub frame assembly and rear differential.

Tightening torque:

T1: 50 N•m (5.1 kgf-m, 36.9 ft-lb)

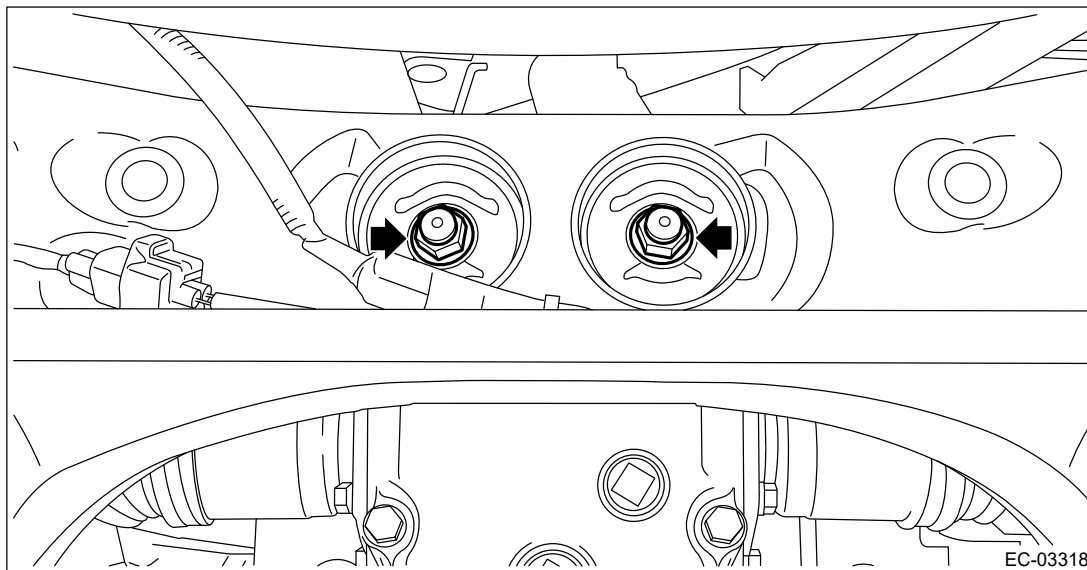
T2: 110 N•m (11.2 kgf-m, 81.1 ft-lb)





- 12.** Tighten the self-locking nuts which secure the rear differential to the rear sub frame assembly.

Tightening torque:

70 N•m (7.1 kgf-m, 51.6 ft-lb)






- 13.** Install the propeller shaft.  [Ref. to DRIVE SHAFT SYSTEM>Propeller Shaft>INSTALLATION.](#)
- 14.** Install the rear exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Rear Exhaust Pipe>INSTALLATION.](#)
- 15.** Lower the vehicle.
- 16.** Connect the battery ground terminal.

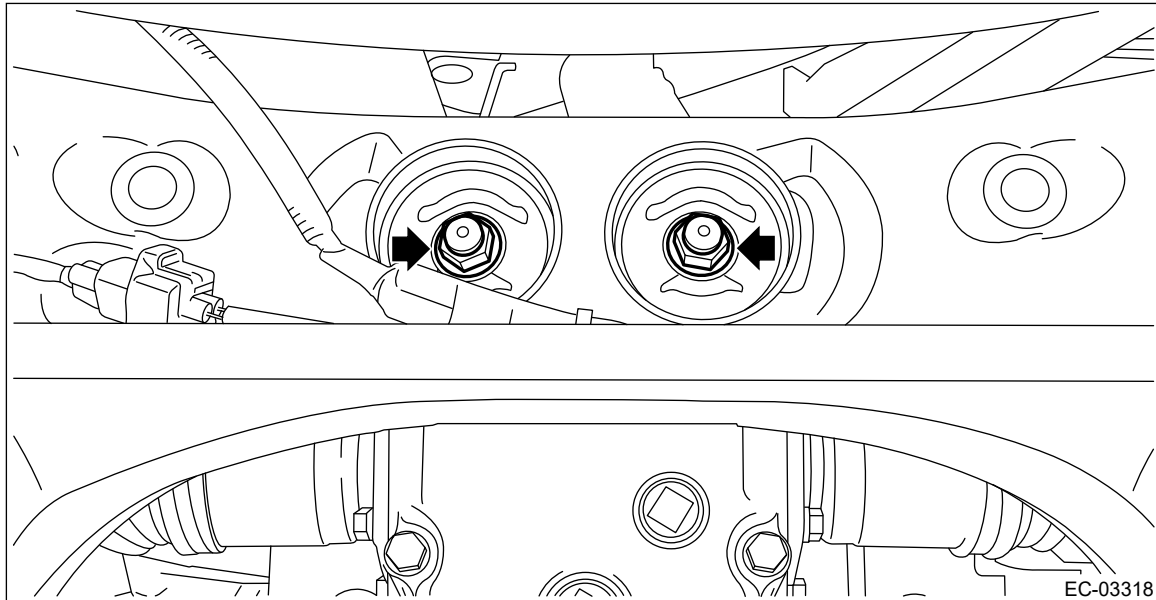
EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Leak Check Valve Assembly

REMOVAL

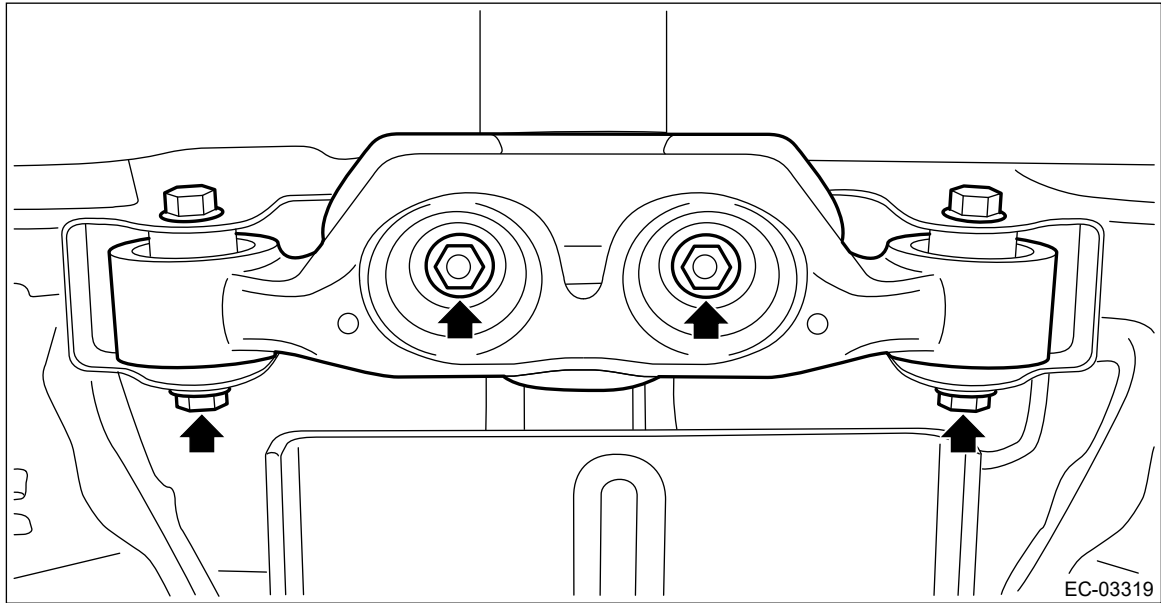
Note:

Refer to the [ENGINE \(DIAGNOSTICS\) \(H4DOTC\)](#) section for installation position. 
[Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Electrical Component Location>LOCATION > SOLENOID VALVE, ACTUATOR, EMISSION CONTROL SYSTEM PARTS AND IGNITION SYSTEM PARTS.](#)

1. Disconnect the ground cable from battery.
2. Lift up the vehicle.
3. Remove the rear exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Rear Exhaust Pipe>REMOVAL.](#)
4. Remove the propeller shaft.  [Ref. to DRIVE SHAFT SYSTEM>Propeller Shaft>REMOVAL.](#)
5. Support the rear differential with the transmission jack.
6. Remove the self-locking nuts which hold the rear differential to the rear sub frame assembly.



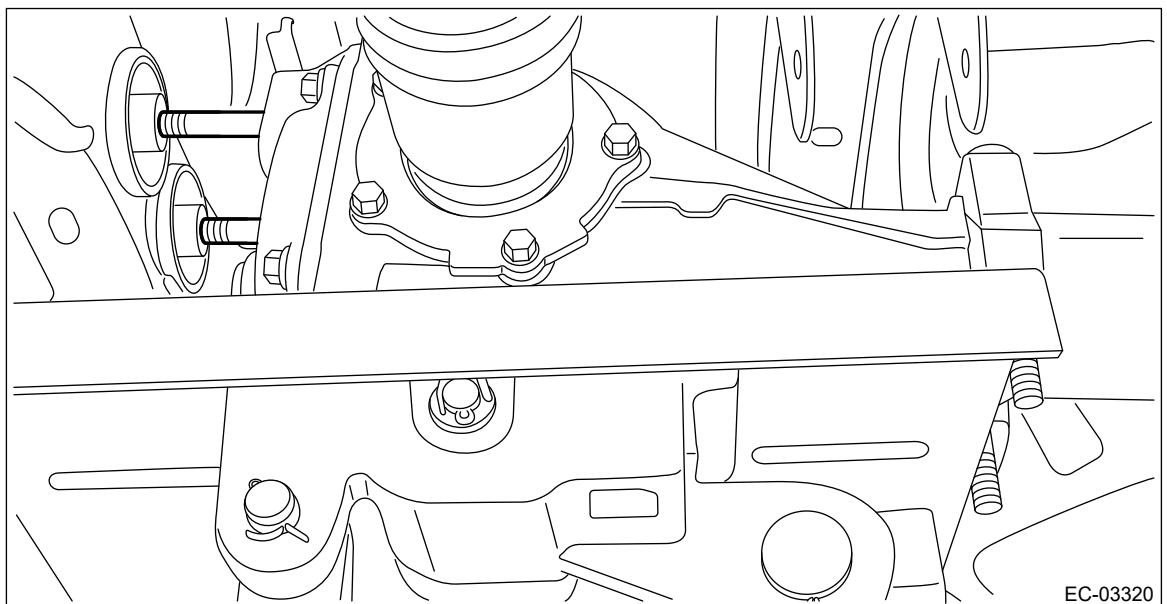
7. Remove the rear differential member from the rear sub frame assembly and the rear differential.



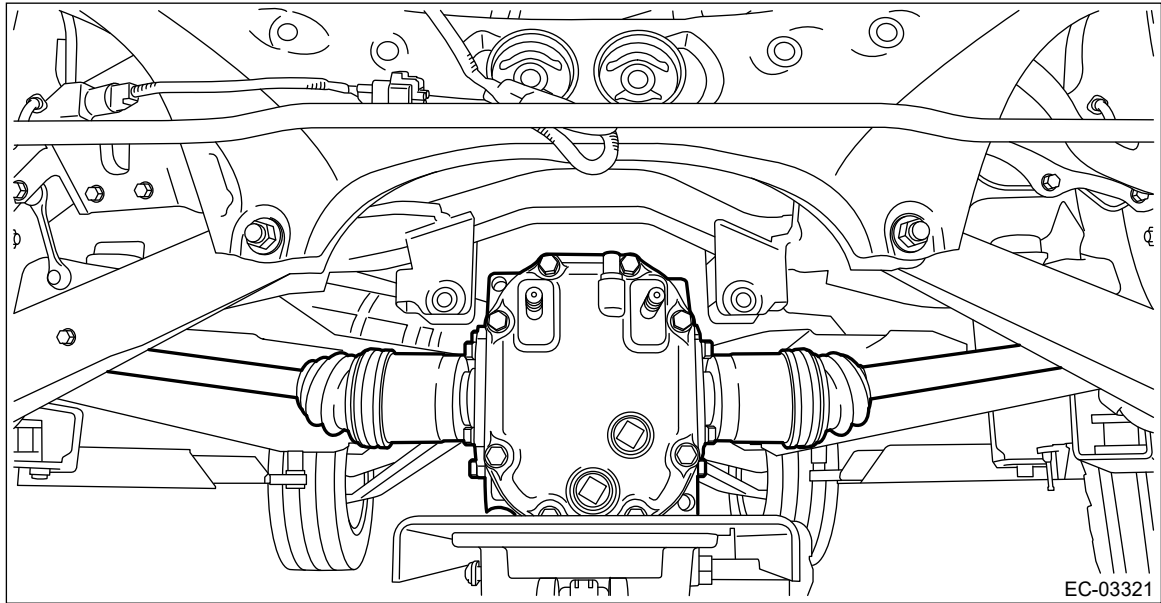
8. Lower the transmission jack gradually until the rear differential is at the position shown in the figure.

Note:

- **When pulling out the stud bolt from the bushing portion of the rear sub frame assembly, adjust the angle and location of transmission jack and jack stand.**



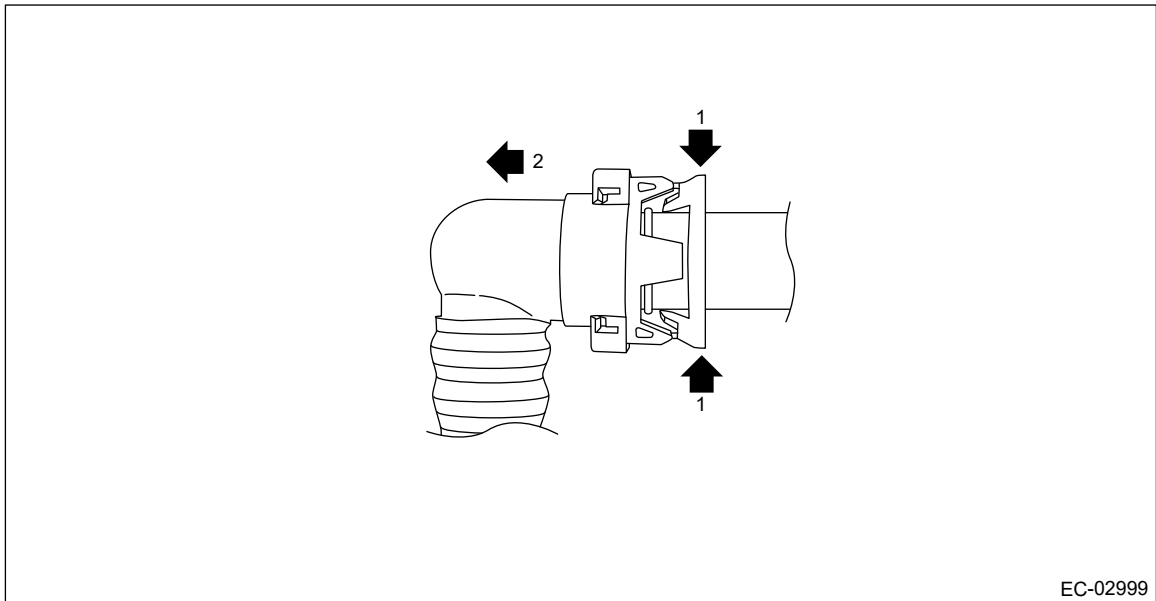
- **Do not lower the rear differential excessively. Doing so may add extra load to the drive shaft or cause the falling-off of the drive shaft.**

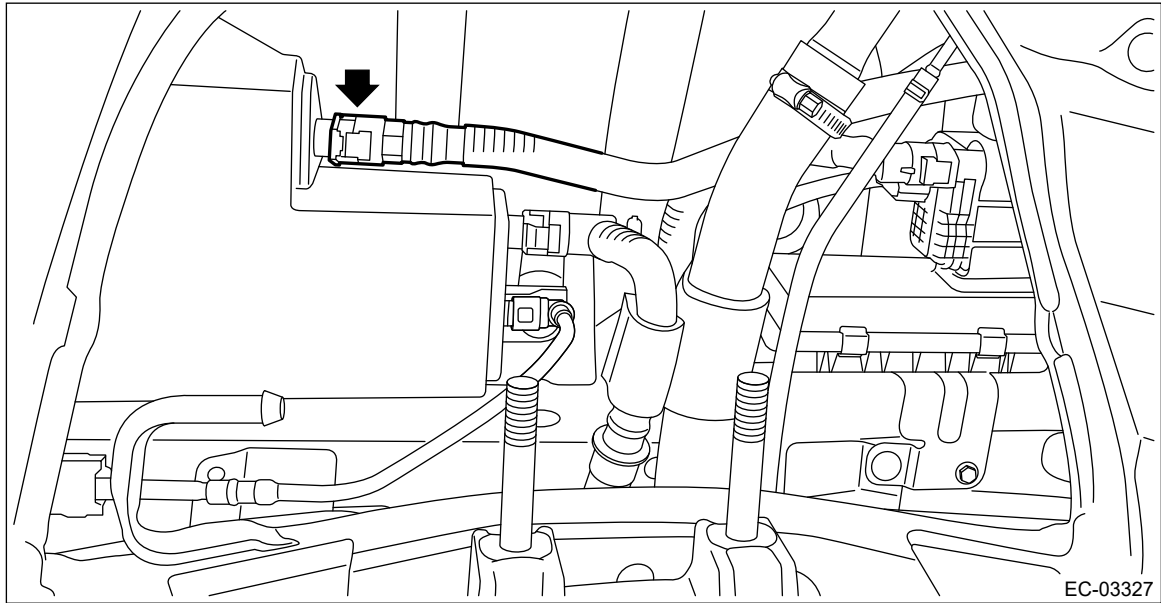


9. Disconnect the drain tube from the canister.

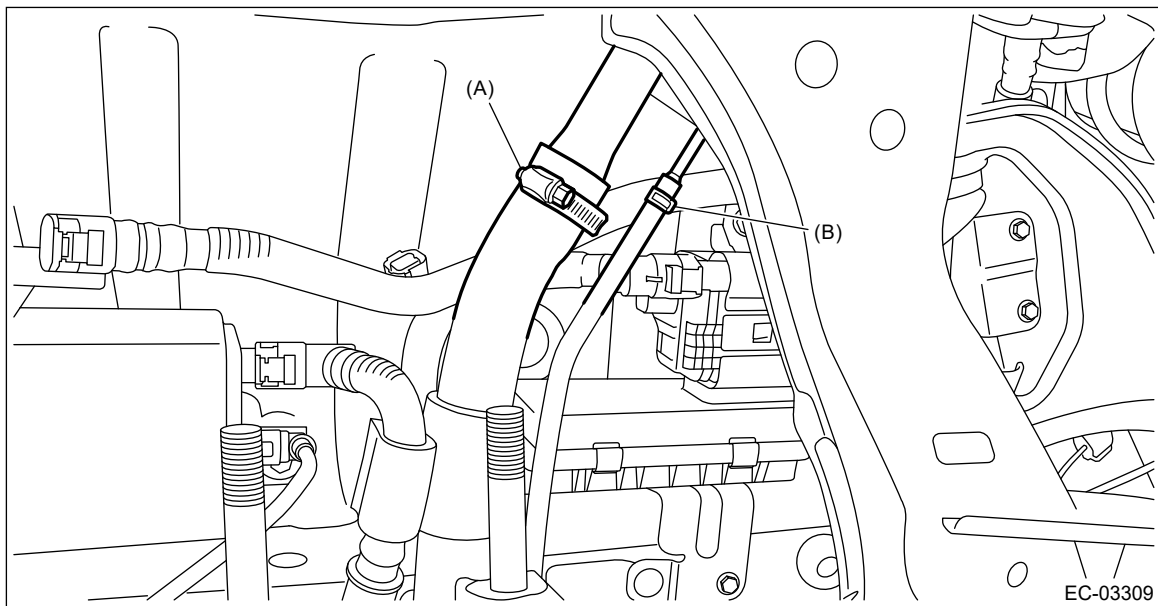
Note:

Disconnect the quick connector as shown in the figure.





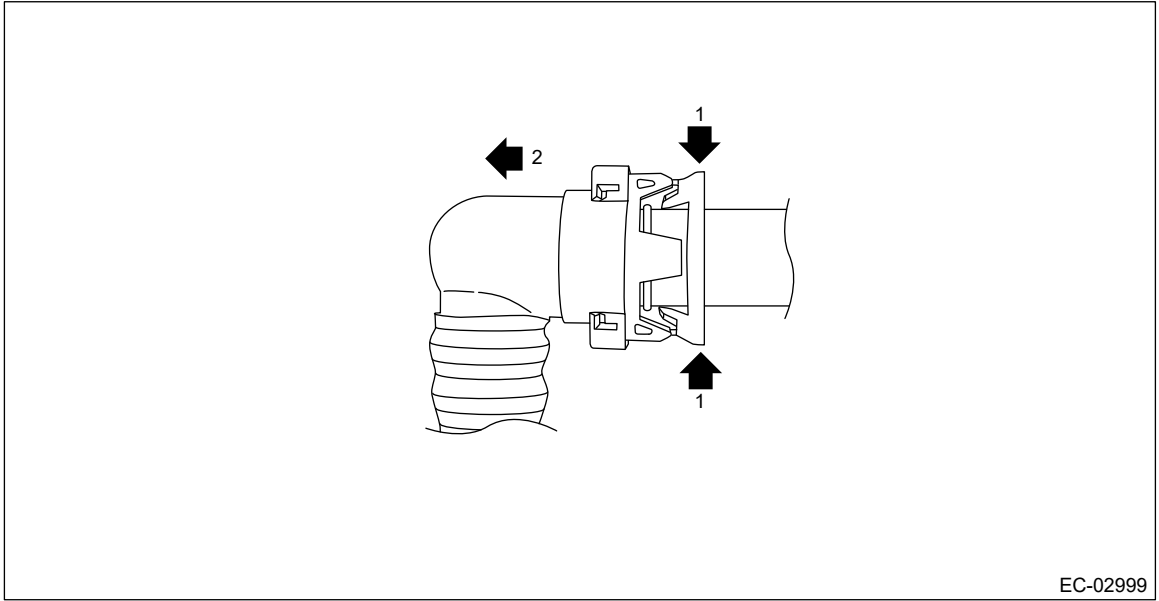
10. Disconnect the fuel filler hose (A) and evaporation hose (B).



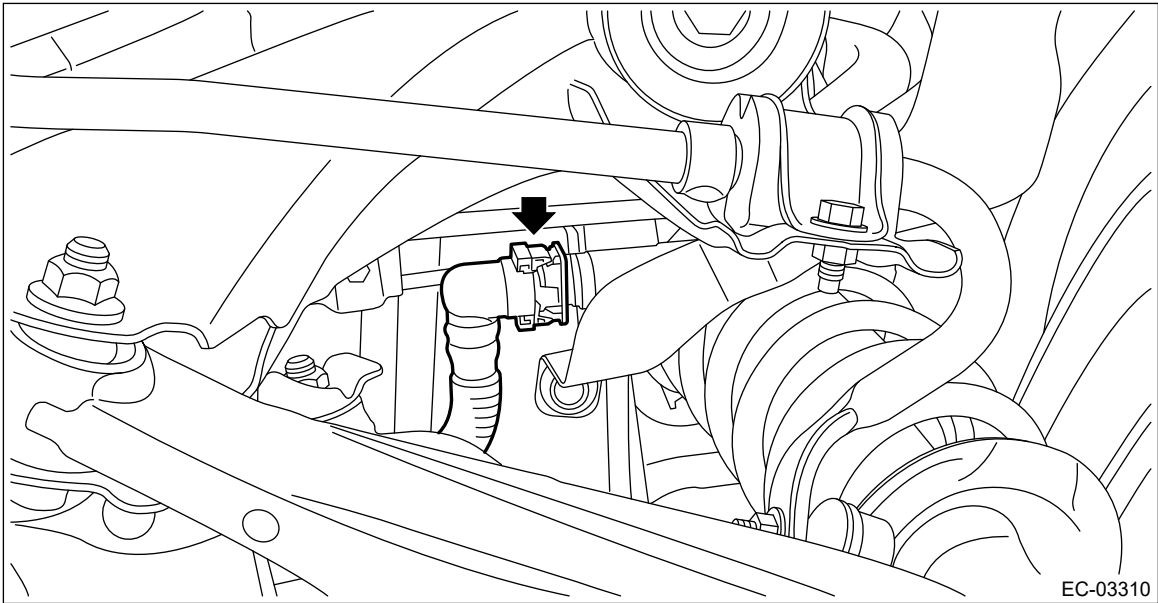
11. Disconnect the drain tube from the drain pipe of the fuel filler pipe assembly.

Note:

Disconnect the quick connector as shown in the figure.

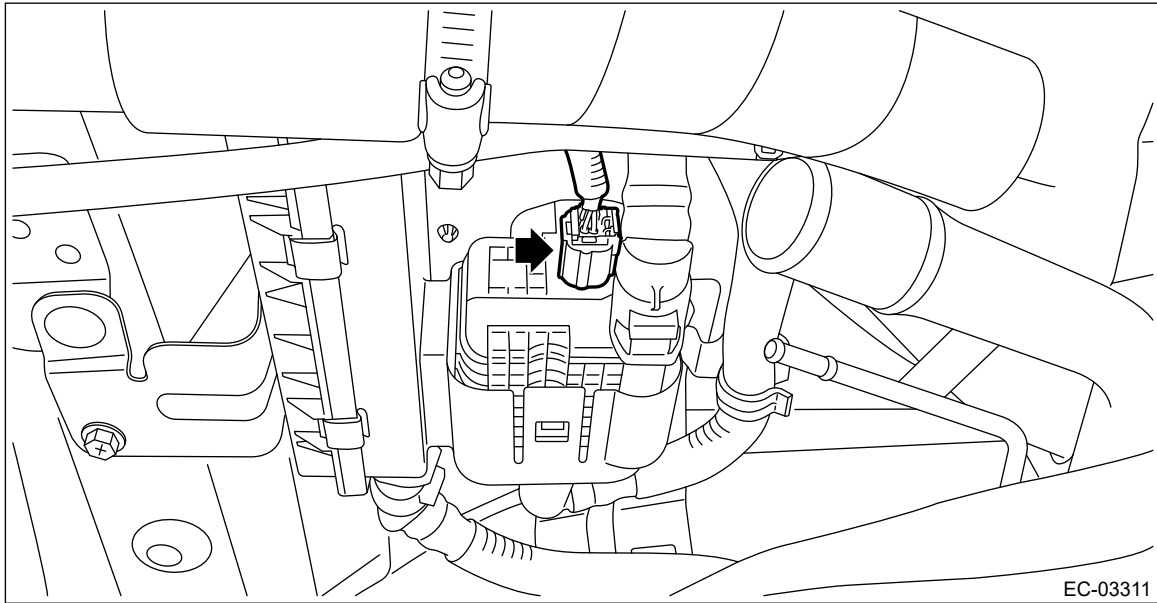


EC-02999



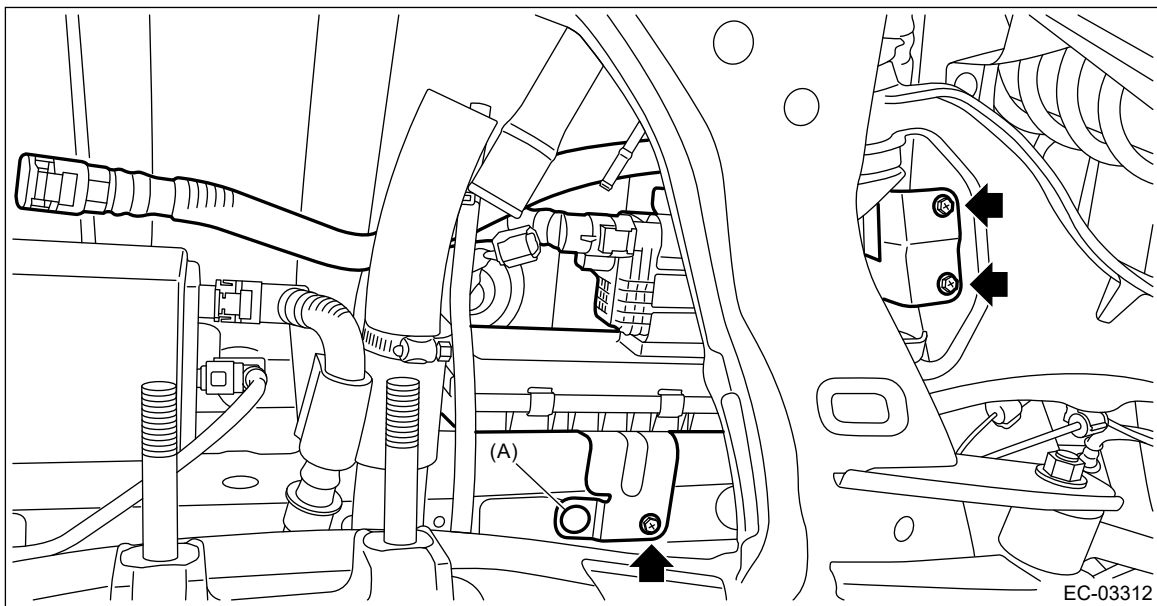
EC-03310

12. Disconnect the connector from the leak check valve assembly.



EC-03311

- 13.** Remove the bolt and clip (A) which secure the leak check valve assembly to the vehicle, and remove the leak check valve assembly.



EC-03312

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Connector
INSPECTION

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

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Connector

INSTALLATION

Install in the reverse order of removal.

Note:

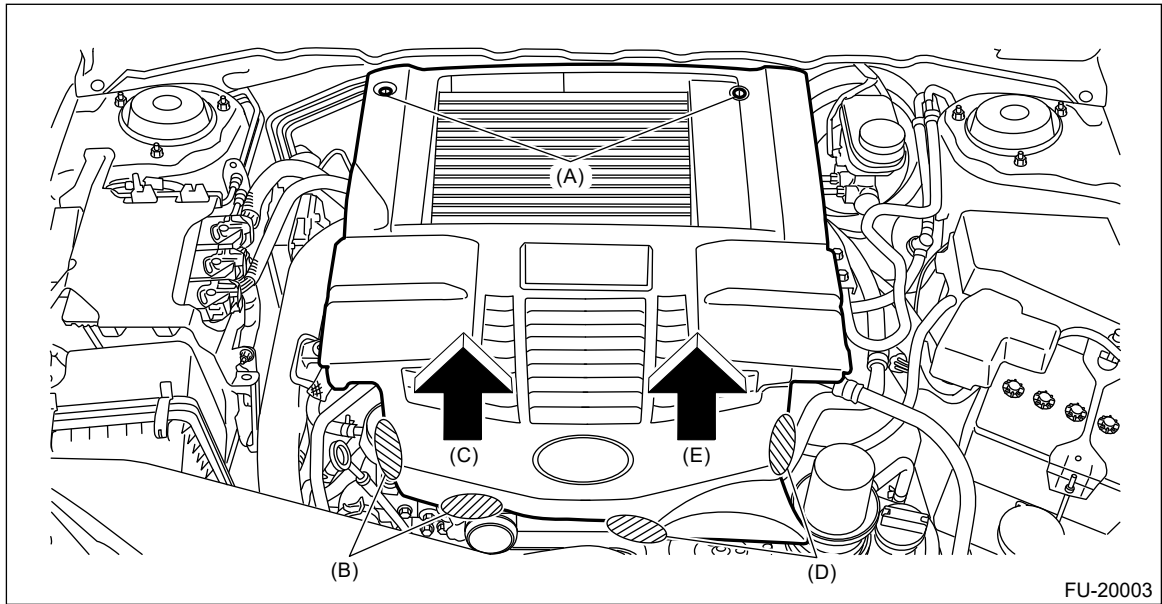
Use new O-rings.

Tightening torque:

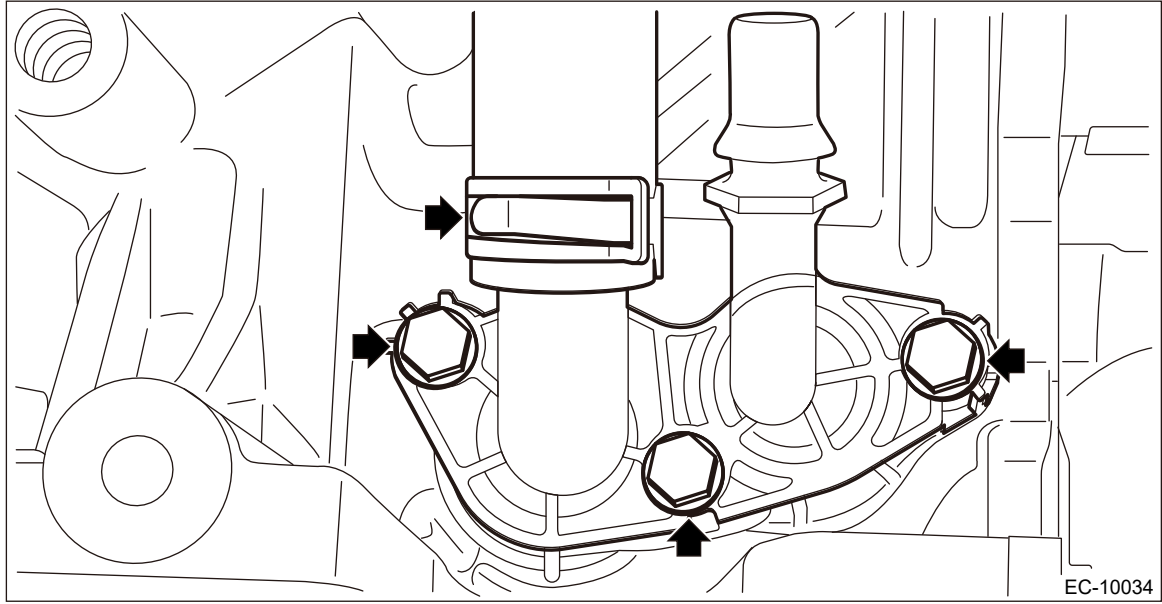
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Connector REMOVAL

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Disconnect the ground cable from battery.
3. Drain engine coolant. [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
4. Remove the PCV pipe assembly. [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>PCV Pipe>REMOVAL.](#)
5. Disconnect the preheater hose from the PCV connector, and remove the PCV connector from the cylinder block LH.

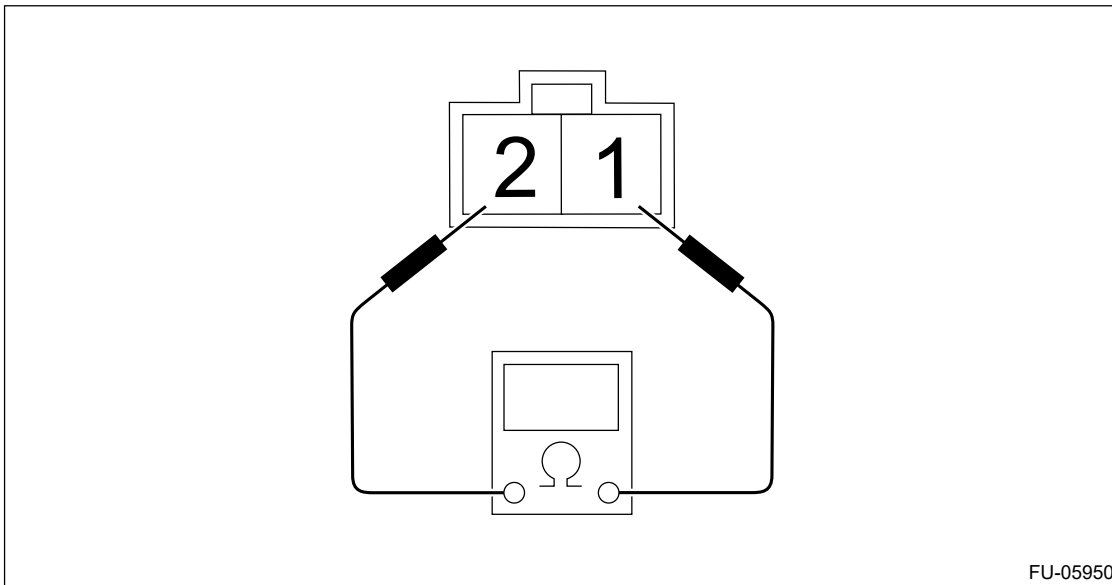


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Hose Assembly

INSPECTION

1. BLOW-BY DIAGNOSIS CONNECTOR

1. Check that the blow-by diagnosis connector has no deformation, cracks or other damages.
2. Check the resistance between blow-by diagnosis connector terminals.



| Terminal No. | Standard |
|--------------|---------------|
| 1 and 2 | Less than 1 Ω |

2. OTHER INSPECTIONS

Check the PCV hose assembly for cracks, damage or looseness.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Hose Assembly REPLACEMENT

Caution:

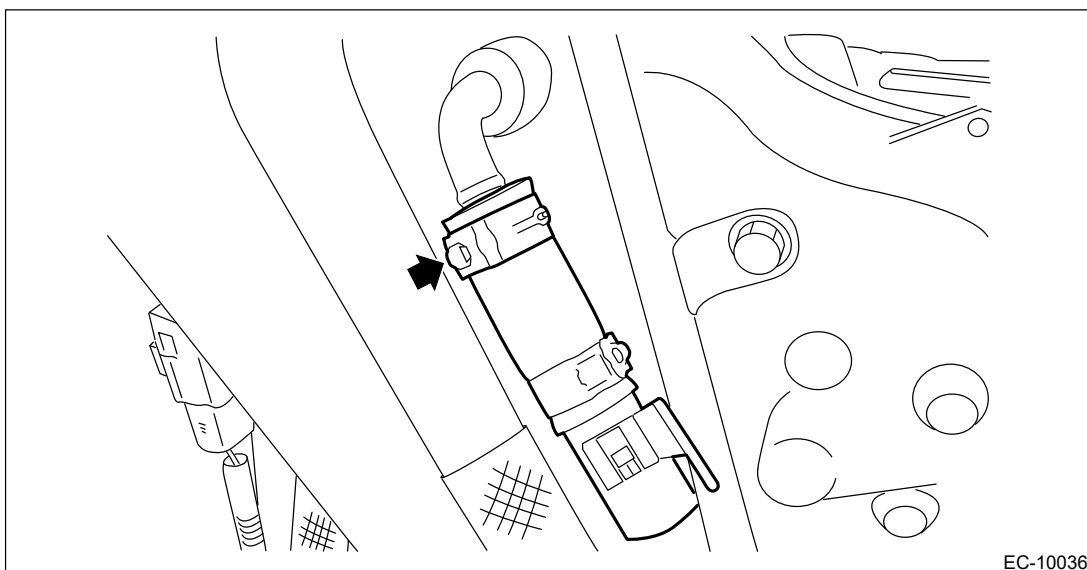
Do not remove except when the PCV hose assembly is broken.

1. PCV HOSE ASSEMBLY NO.1

1. Disconnect the ground cable from battery.
2. Remove the radiator. [🔗 Ref. to COOLING\(H4DOTC\)>Radiator>REMOVAL.](#)
3. Remove the condenser. [🔗 Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Condenser>REMOVAL.](#)
4. Unlock the blow-by diagnosis connector, and disconnect the PCV hose assembly No. 2 from the PCV hose assembly No. 1.



5. Remove the blow-by diagnosis connector harness from the PCV hose assembly No. 1.
6. Break the clamp, and remove the PCV hose assembly No. 1 from the chain cover.

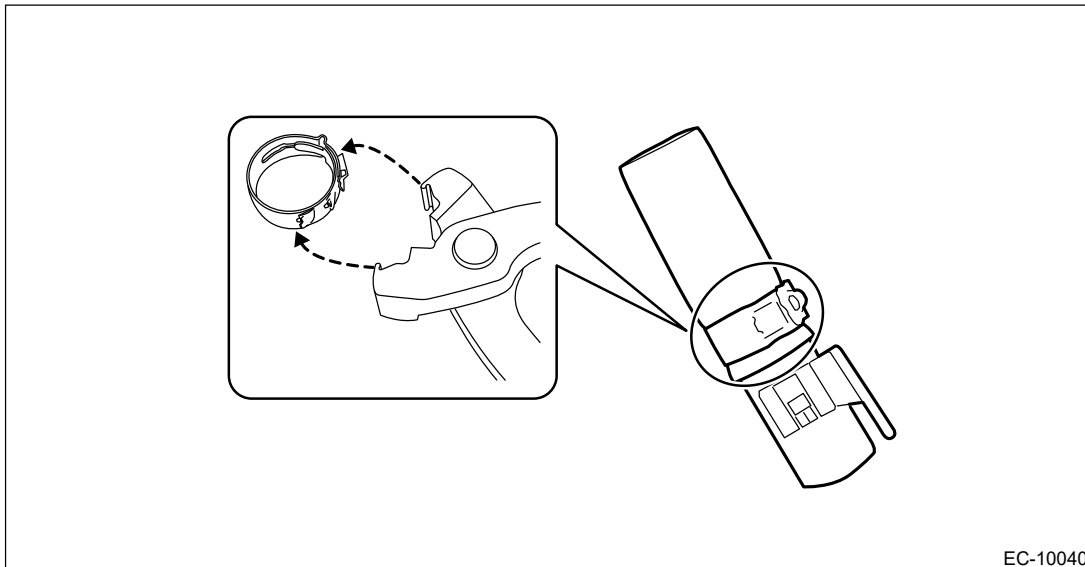


7. Break the clamp, and remove the hose connector from the PCV hose No. 1.

- 8.** Install the hose connector to the PCV hose No. 1, and install the clamp using the Clamp pincer (14100134).

Note:

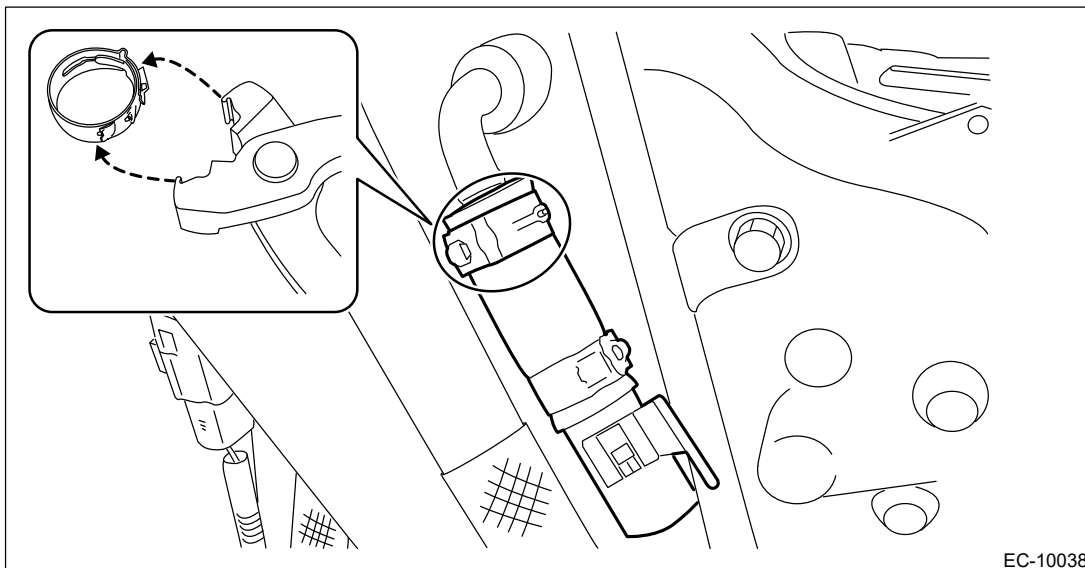
Use a new clamp.



- 9.** Install the PCV hose assembly No. 1 to the chain cover, and install the clamp using the Clamp pincer (14100134).

Note:

Use a new clamp.







- 10.** Install the blow-by diagnosis connector harness to the PCV hose assembly No. 1, and connect the PCV hose assembly No. 2 to the PCV hose assembly No. 1.

Note:


- **There are multiple blow-by diagnosis connectors. Be careful not to connect incorrectly.**
- **Make sure that the blow-by diagnosis connector is connected securely.**

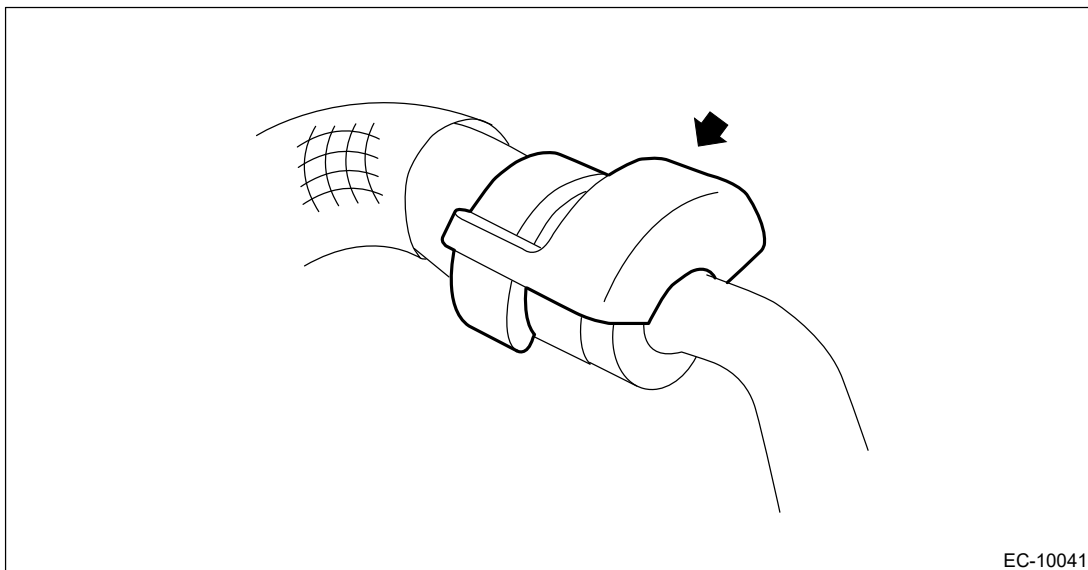


EC-10035

- 11.** Install the condenser.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Condenser>INSTALLATION.](#)
- 12.** Install the radiator.  [Ref. to COOLING\(H4DOTC\)>Radiator>INSTALLATION.](#)
- 13.** Connect the battery ground terminal.
- 14.** Charge the A/C system with refrigerant.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Refrigerant Charging Procedure>PROCEDURE.](#)
- 15.** Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

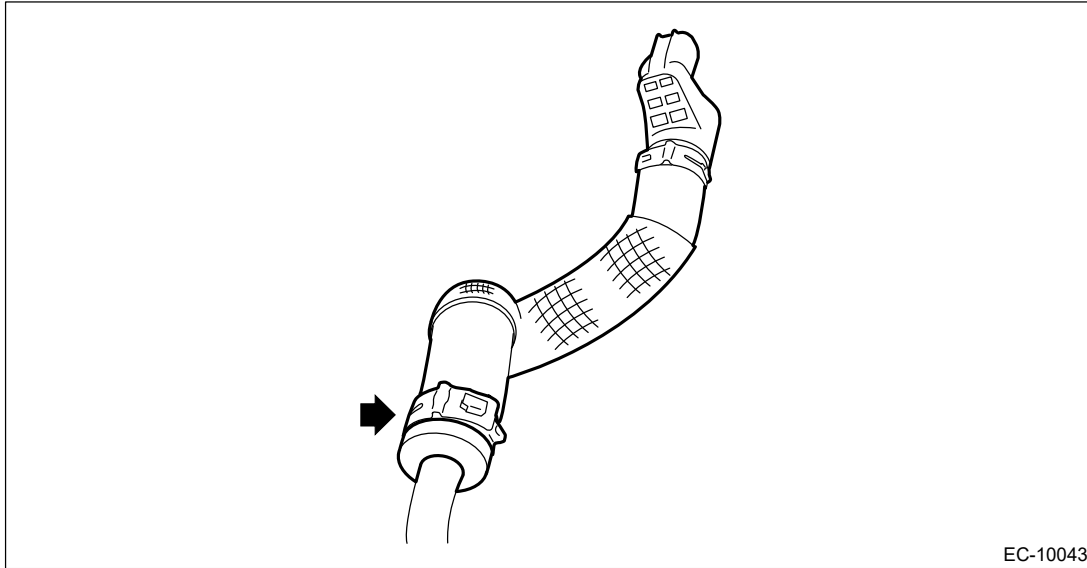
2. PCV HOSE ASSEMBLY NO.2

- 1.** Disconnect the ground cable from battery.
- 2.** Remove the oil catch tank.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Oil Catch Tank>REMOVAL.](#)
- 3.** Remove the clamp cover.



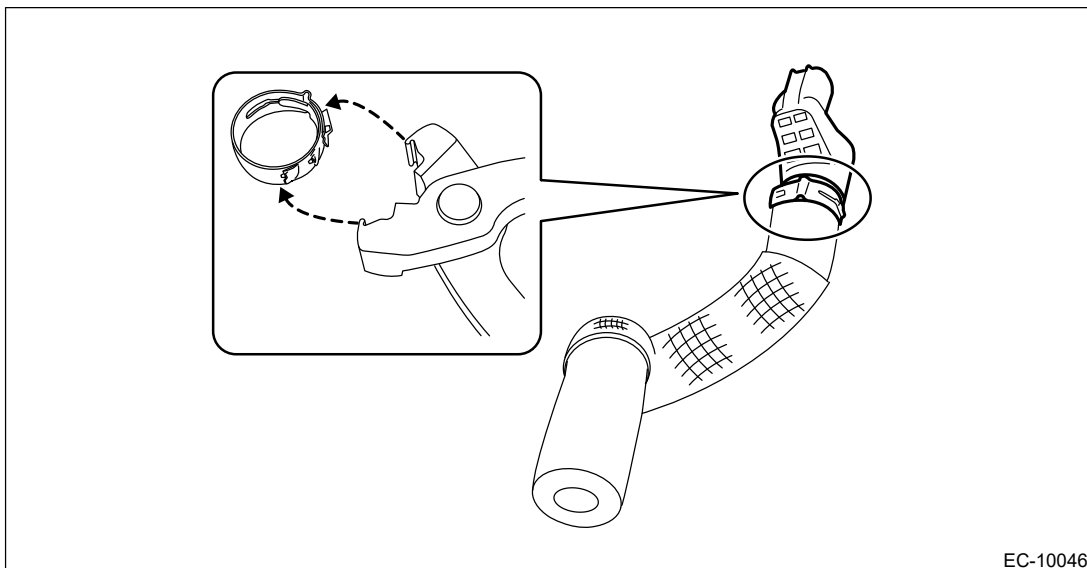
EC-10041

- 4.** Break the clamp, and remove the PCV hose assembly No. 2 from the oil catch tank.



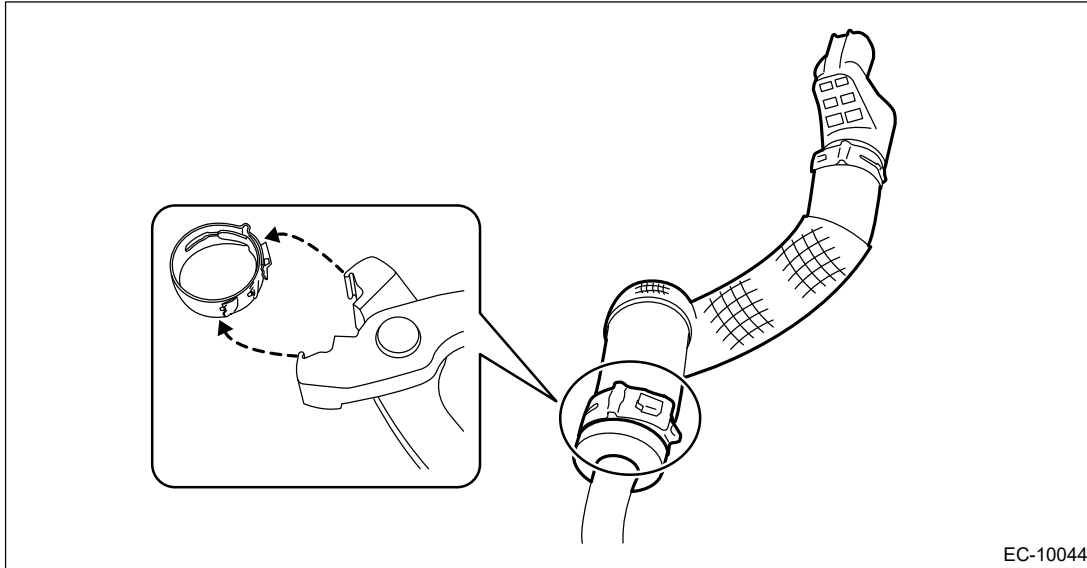
5. Break the clamp, and remove the blow-by diagnosis connector from the PCV hose No. 2.
6. Install the blow-by diagnosis connector to the PCV hose No. 2, and install the clamp using the Clamp pincer (14100134).

Note:
Use a new clamp.



7. Install the PCV hose assembly No. 2 to the oil catch tank, and install the clamp using the Clamp pincer (14100134).

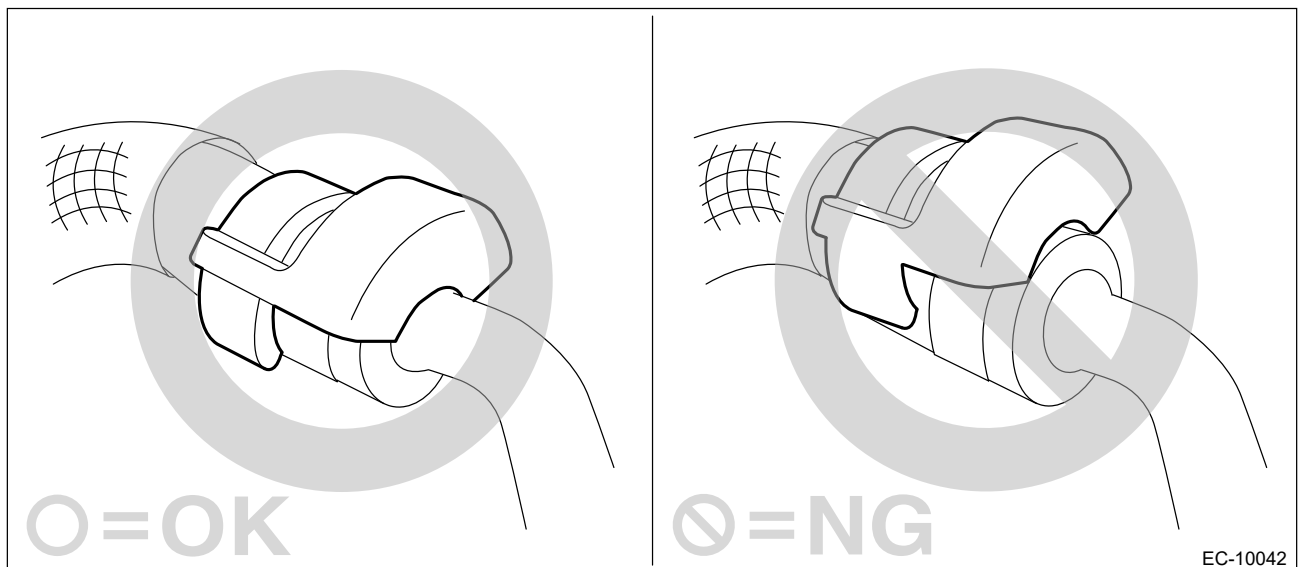
Note:
Use a new clamp.



8. Install the clamp cover.

Caution:

Be careful not to allow the lower part of the clamp cover to ride over the PCV hose assembly No. 2.



9. Install the oil catch tank.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Oil Catch Tank>INSTALLATION.](#)

10. Connect the battery ground terminal.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Hose
INSPECTION

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

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Hose

INSTALLATION

Install in the reverse order of removal.

Note:

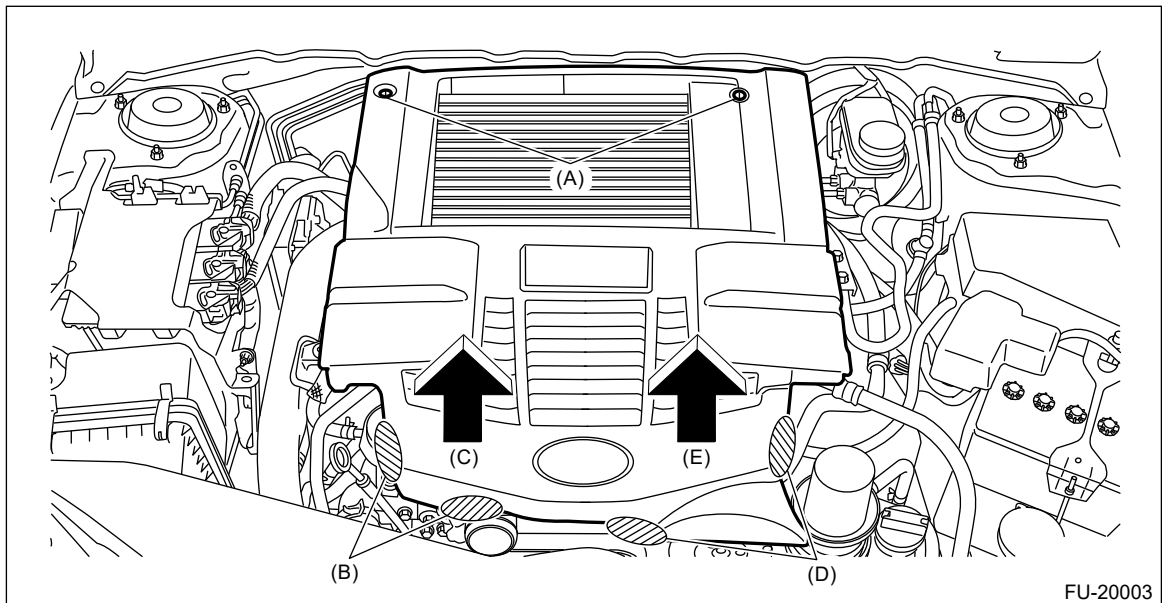
If the brake booster vacuum hose securing clip is removed from the intake manifold, install the clip to the position of alignment mark ▼ of intake manifold.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Hose


REMOVAL

1. Remove the collector cover.

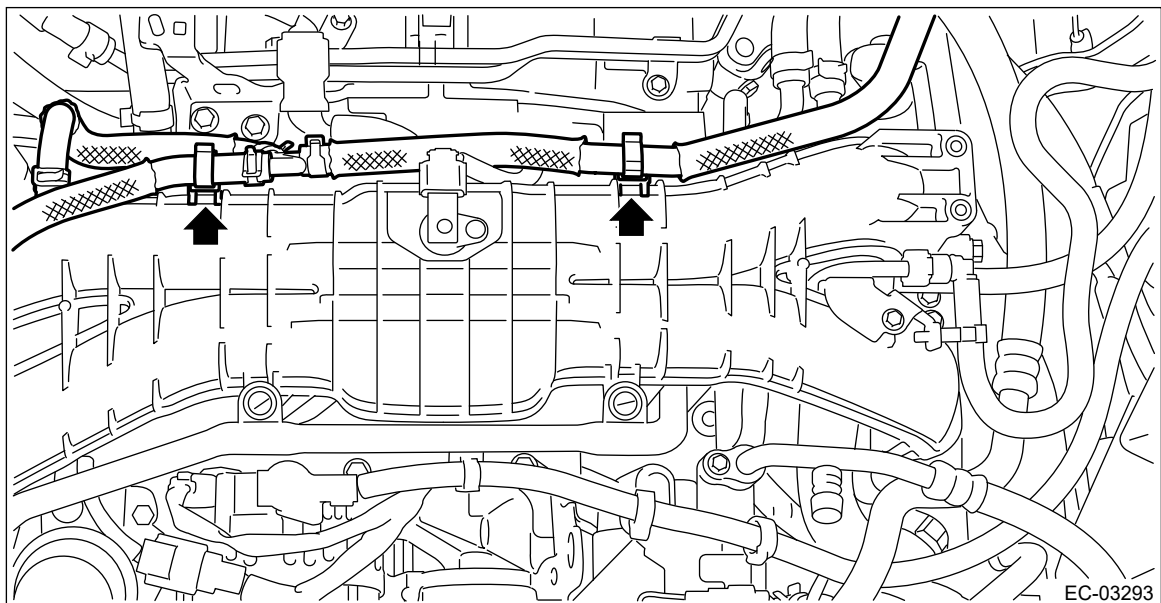
- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



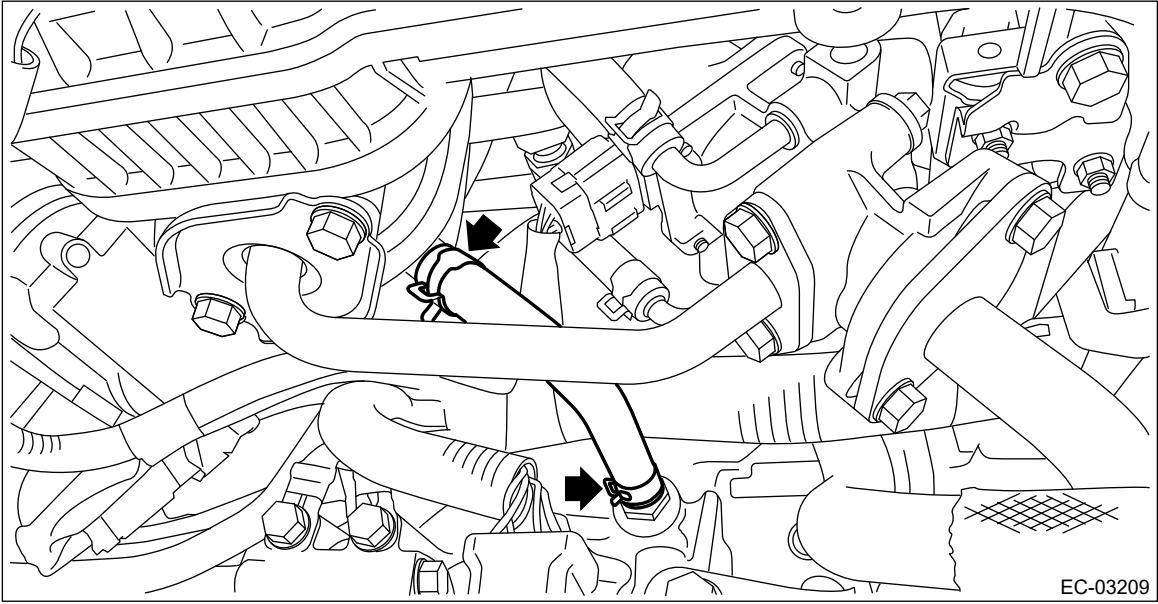
2. Disconnect the ground cable from battery.

3. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)

4. Remove the brake booster vacuum hose from the clip, and place the brake booster vacuum hose aside so that it does not interfere with the work.



5. Disconnect the PCV hose from the intake manifold, and remove the PCV hose from the PCV valve.

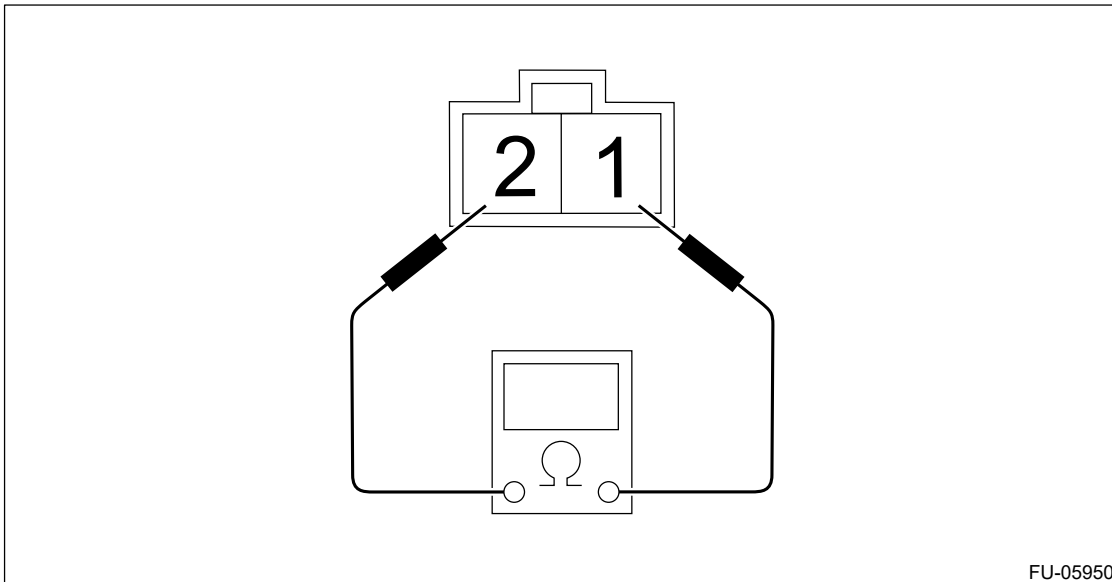


EC-03209

INSPECTION

1. BLOW-BY DIAGNOSIS CONNECTOR

1. Check that the blow-by diagnosis connector has no deformation, cracks or other damages.
2. Check the resistance between blow-by diagnosis connector terminals.



FU-05950

| Terminal No. | Standard |
|--------------|---------------|
| 1 and 2 | Less than 1 Ω |

2. OTHER INSPECTIONS

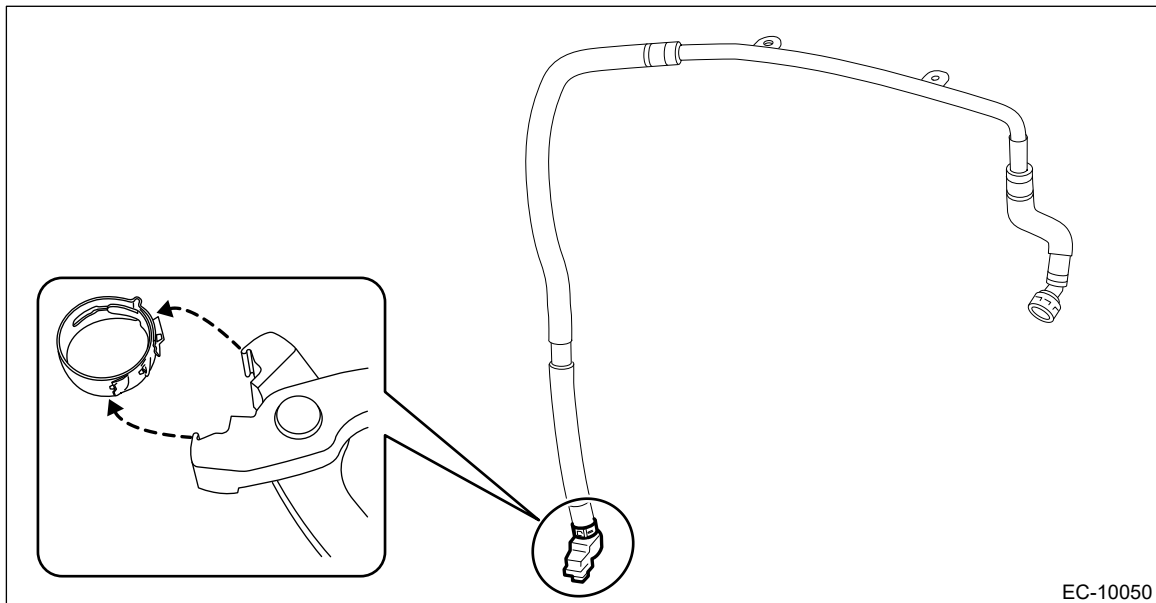
Check that the PCV pipe assembly has no cracks, damage or loose part.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Pipe INSTALLATION

1. Install the blow-by diagnosis connector to the PCV pipe assembly, and install the clamp using the Clamp pincer (14100134).

Note:

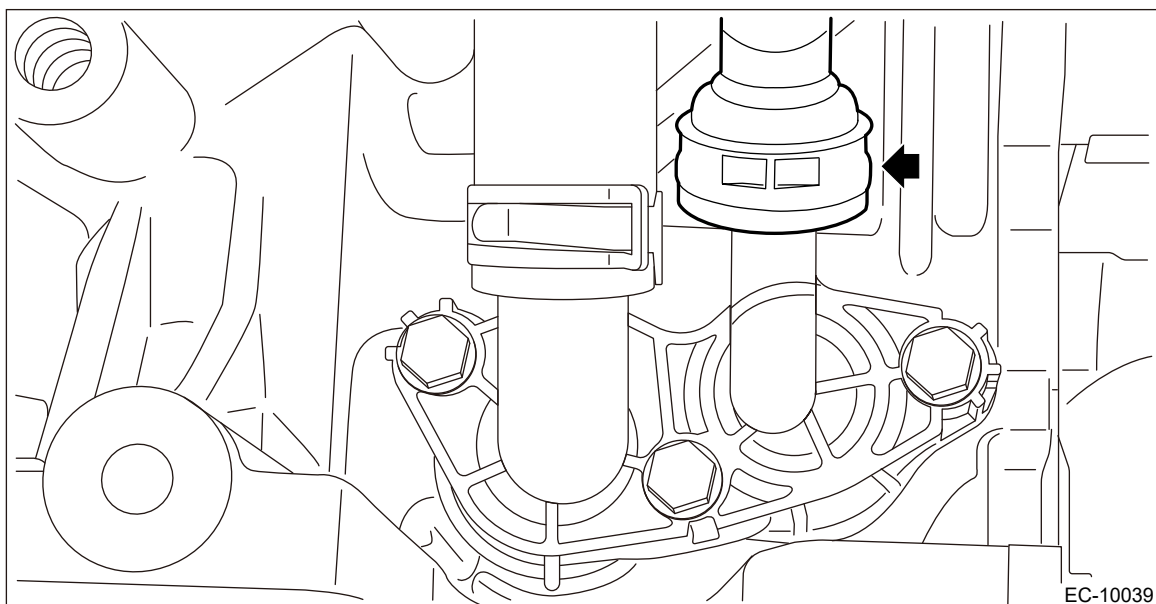
Use a new PCV pipe assembly and clamp.



2. Connect the quick connector of the PCV pipe assembly to the PCV connector.

Caution:

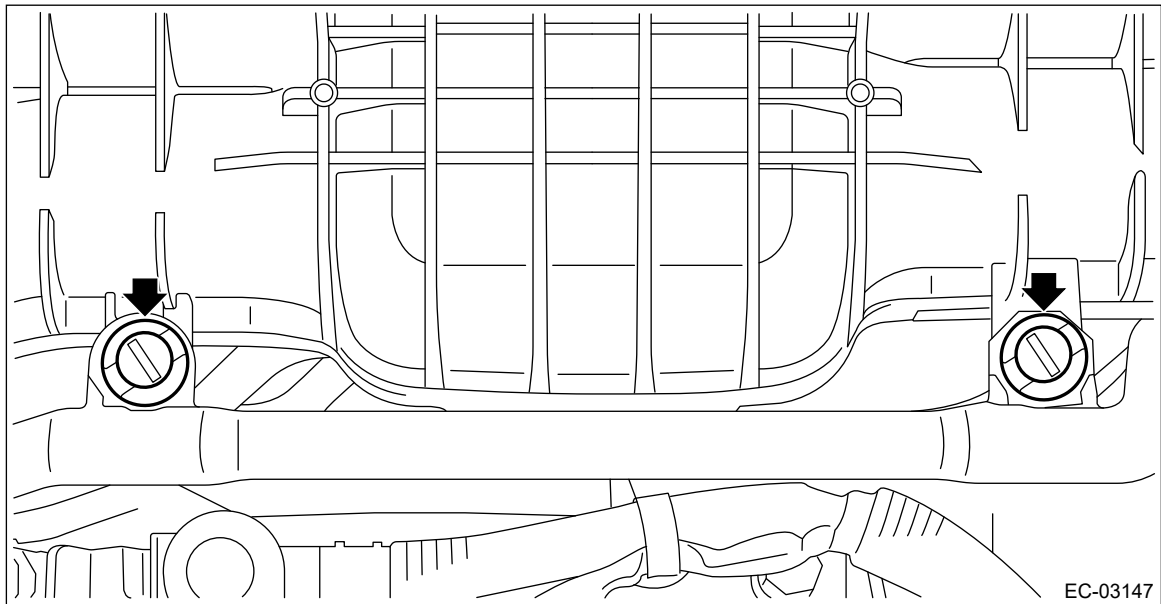
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.



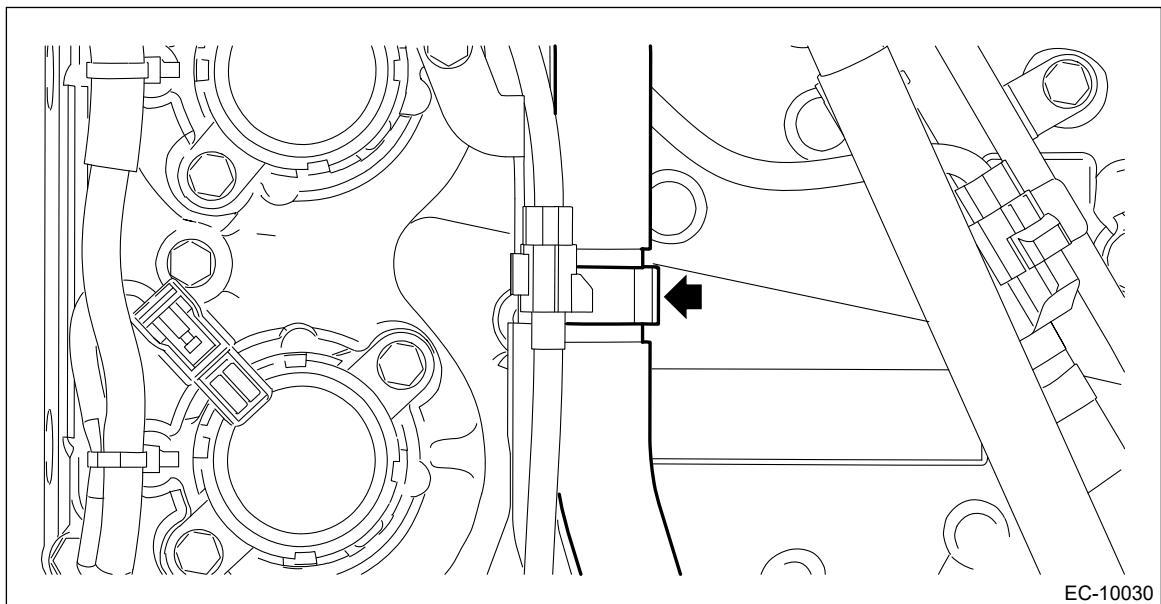
3. Install the A/C compressor.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND](#)



[A/C>Compressor>INSTALLATION.](#)

4. Attach the clips which secure the PCV pipe assembly to the intake manifold.



5. Install the PCV pipe assembly to the clip.



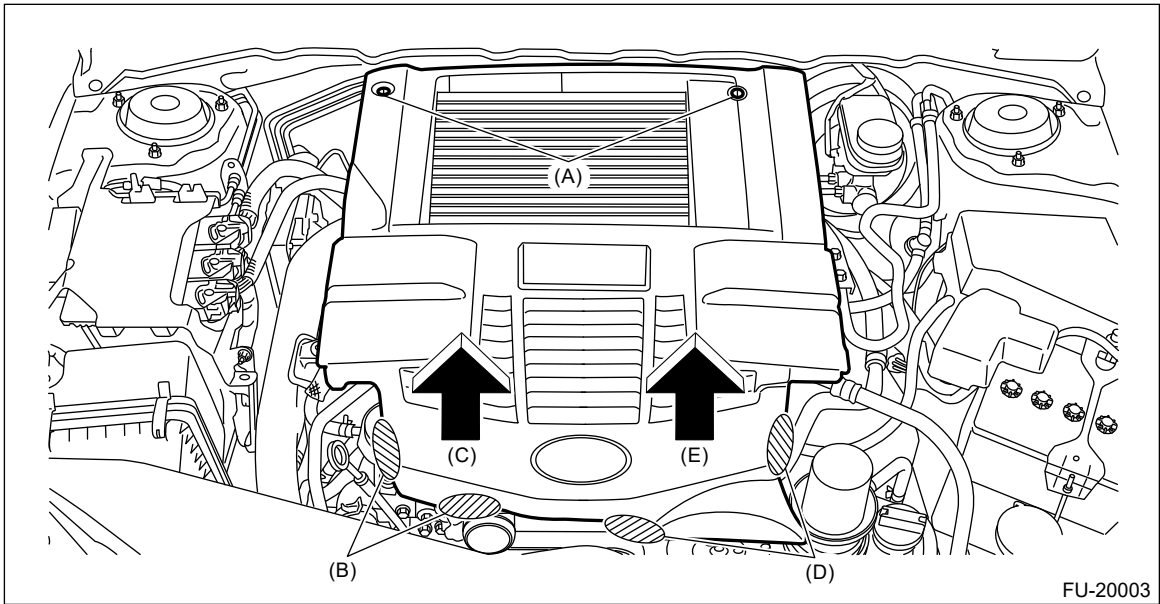
6. Install the intake duct No. 2.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>INSTALLATION > INTAKE DUCT NO. 2.](#)
7. Connect the battery ground terminal.
8. Charge the A/C system with refrigerant.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Refrigerant Charging Procedure>PROCEDURE.](#)
9. Install the collector cover.



EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Pipe REMOVAL

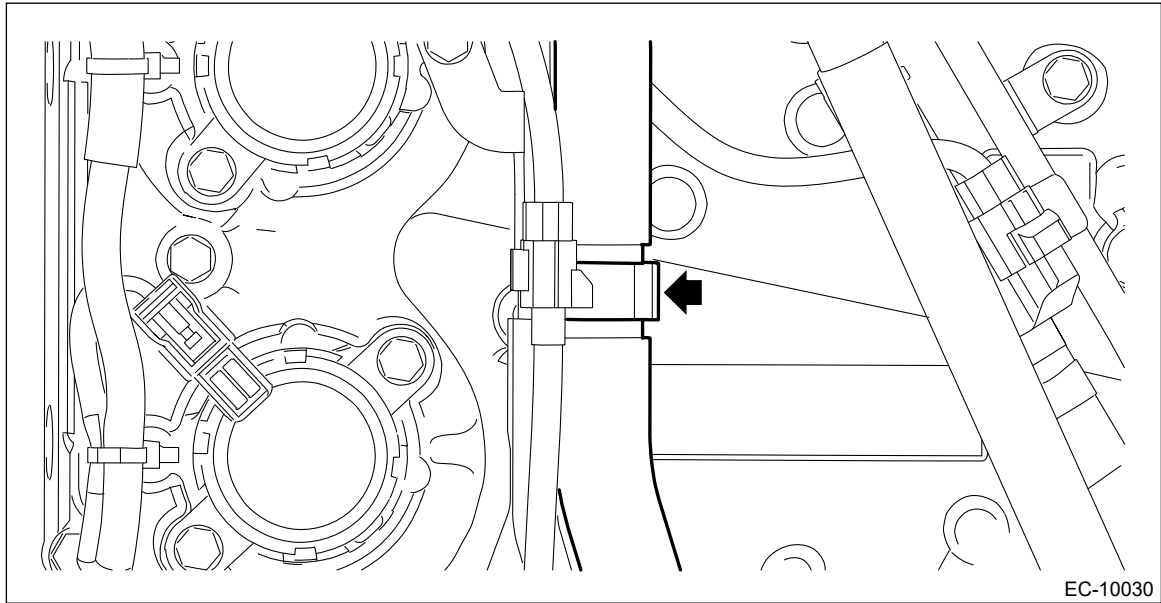
Caution:

Do not remove except when the PCV pipe assembly is broken.

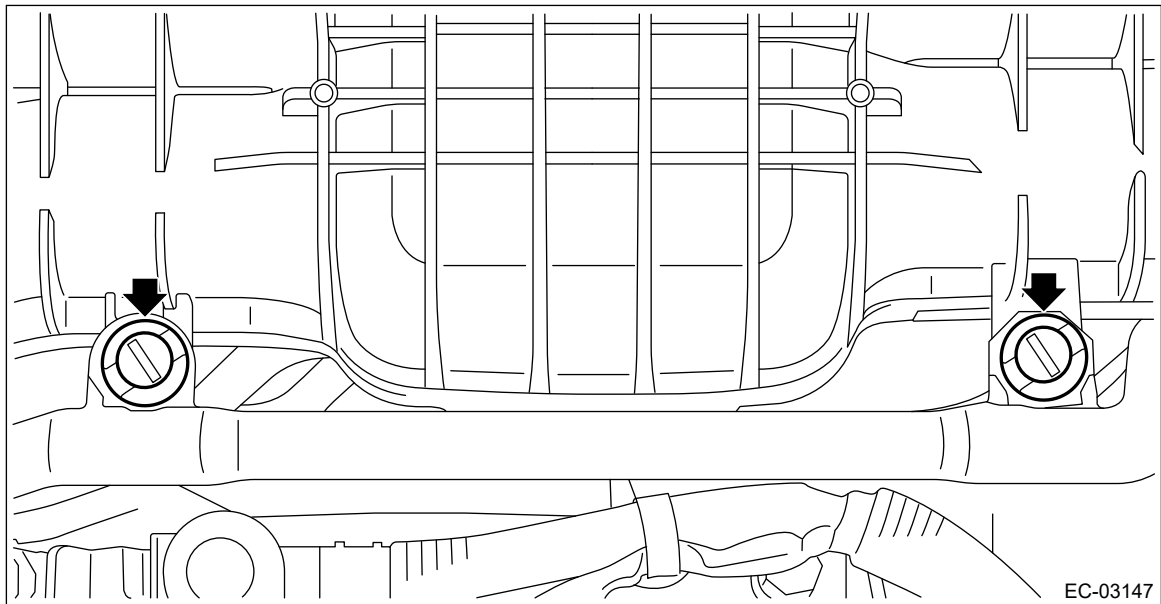
1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.




2. Collect the refrigerant from A/C system.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Refrigerant Recovery Procedure.](#)
3. Disconnect the ground cable from battery.
4. Remove the intake duct No. 2.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 2.](#)
5. Remove the PCV pipe assembly from the clip.



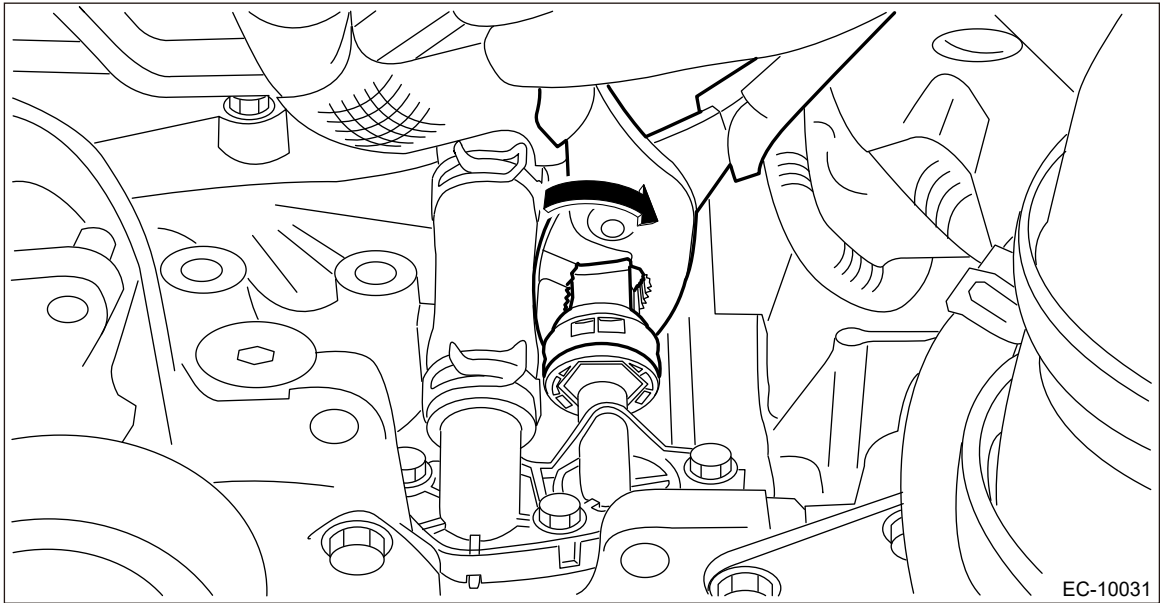
6. Remove the clip securing the PCV pipe to the intake manifold.



7. Remove the A/C compressor.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Compressor>REMOVAL.](#)
8. Remove the PCV pipe assembly from the PCV connector.
(1) Pinch the quick connector of the PCV pipe assembly using pliers and break the quick connector by twisting to the arrow direction. And then, remove the PCV pipe assembly from the PCV connector.

Caution:

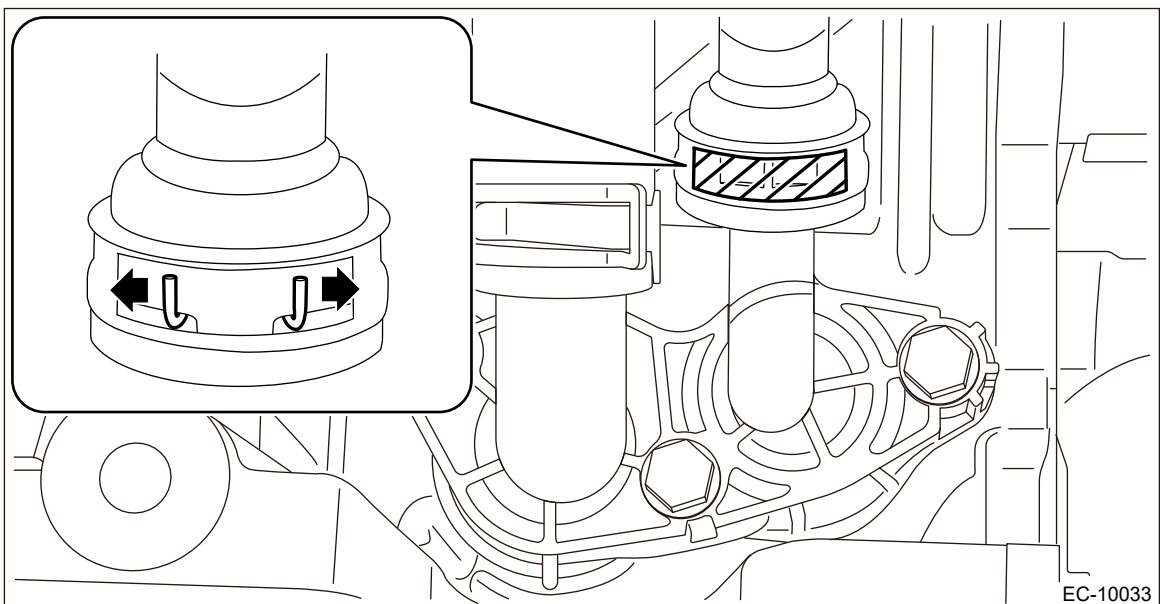
Be careful not to damage the PCV connector and preheater hose.



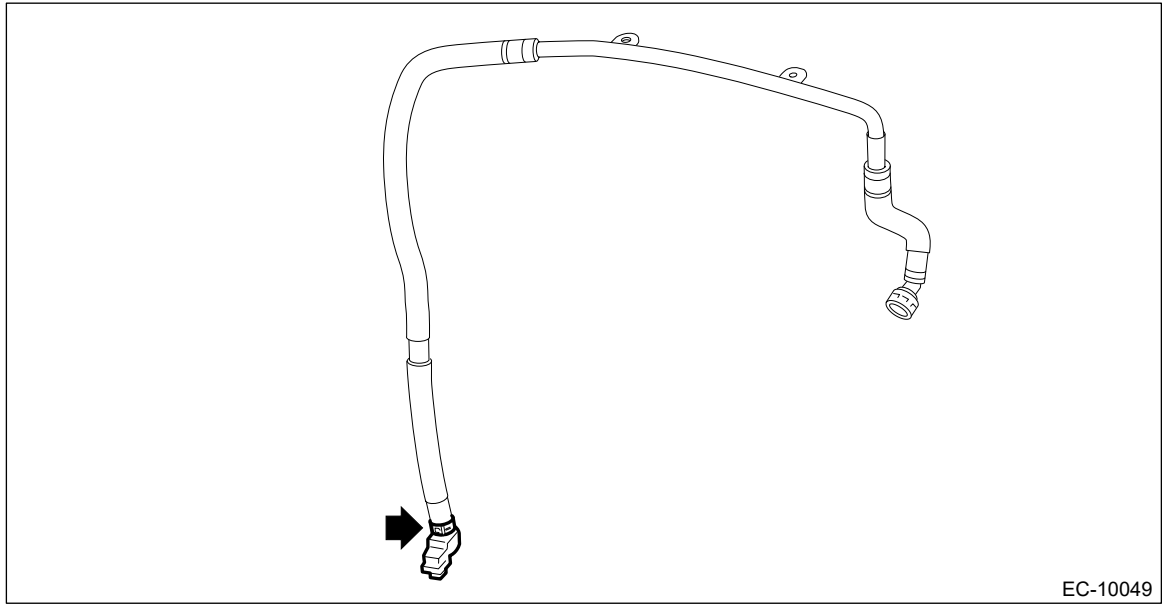
- (2) If the PCV pipe assembly cannot be removed after performing the step (1), cut out the shaded area shown in the figure using a pair of nippers and open the spring in the arrow direction to unlock using snap ring pliers. And then, remove the PCV pipe assembly from the PCV connector.

Caution:

Be careful not to damage the PCV connector and preheater hose.



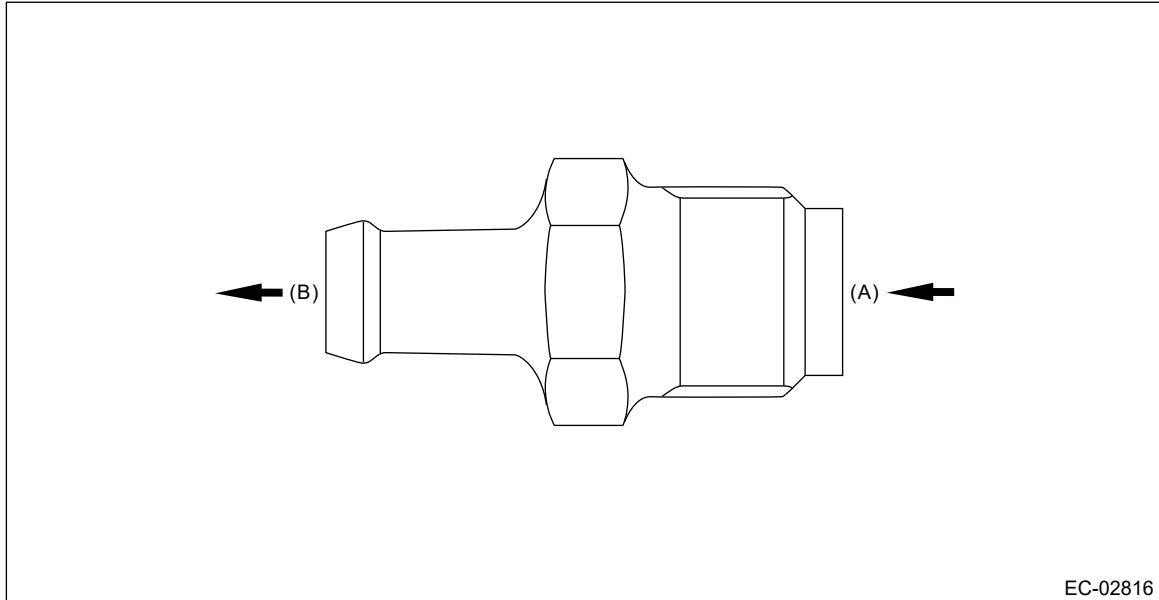
- 9.** Break the clamp, and remove the blow-by diagnosis connector from the PCV pipe assembly.



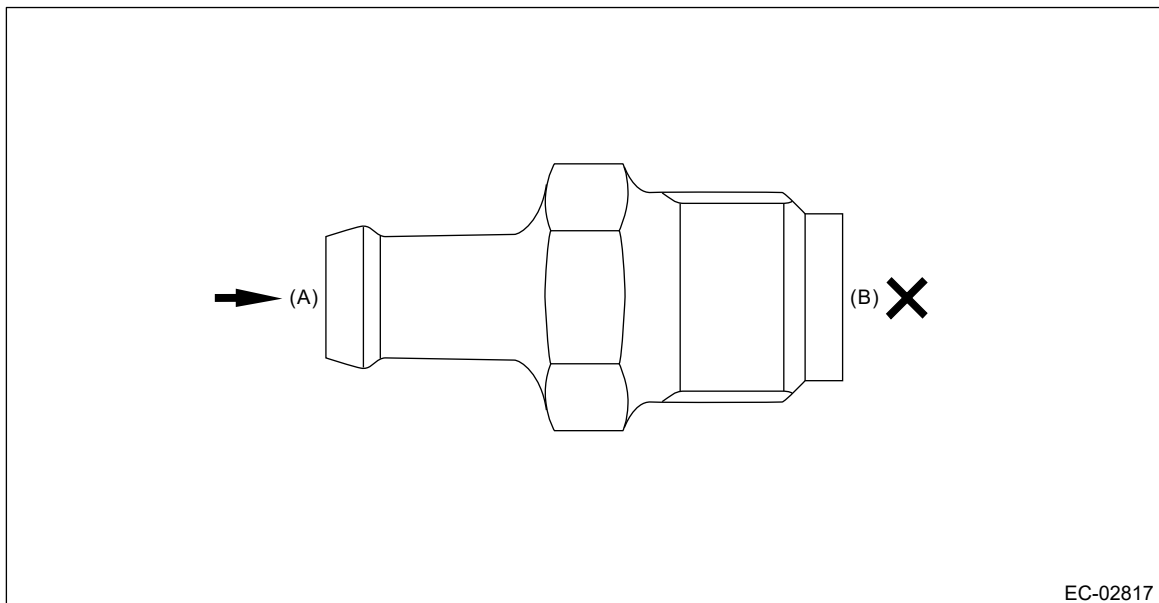
EC-10049

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Valve INSPECTION

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



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



EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Valve

INSTALLATION

Install in the reverse order of removal.

Note:

- **Apply liquid gasket to the bolt threads of PCV valve.**

Liquid gasket:

THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:

23 N·m (2.3 kgf-m, 17.0 ft-lb)

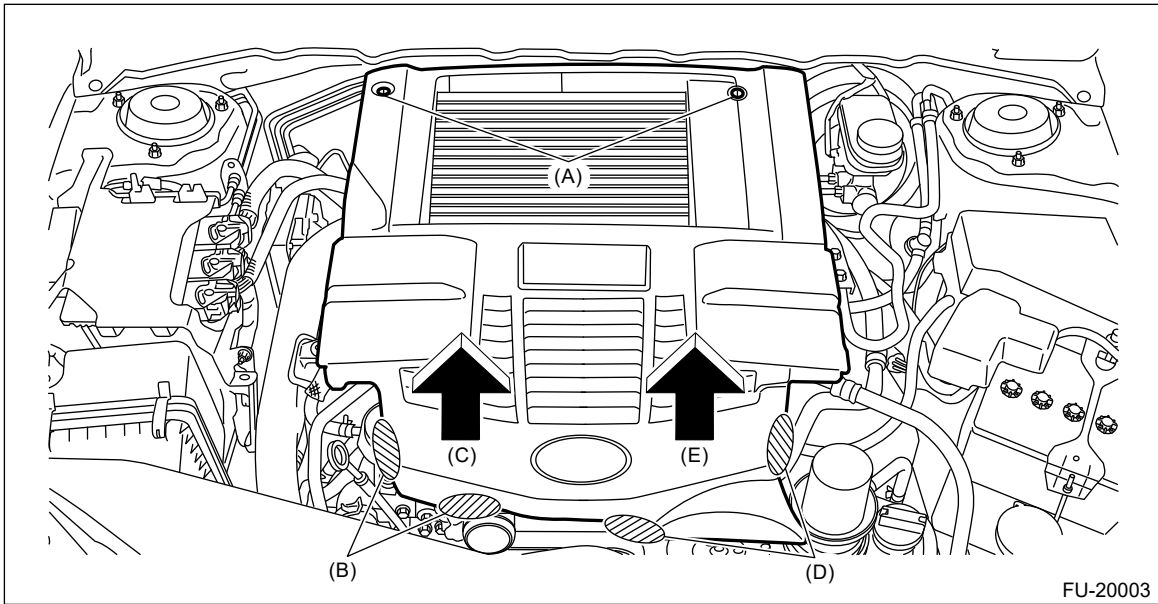
- **If the brake booster vacuum hose securing clip is removed from the intake manifold, install the clip to the position of alignment mark ▼ of intake manifold.**

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > PCV Valve REMOVAL

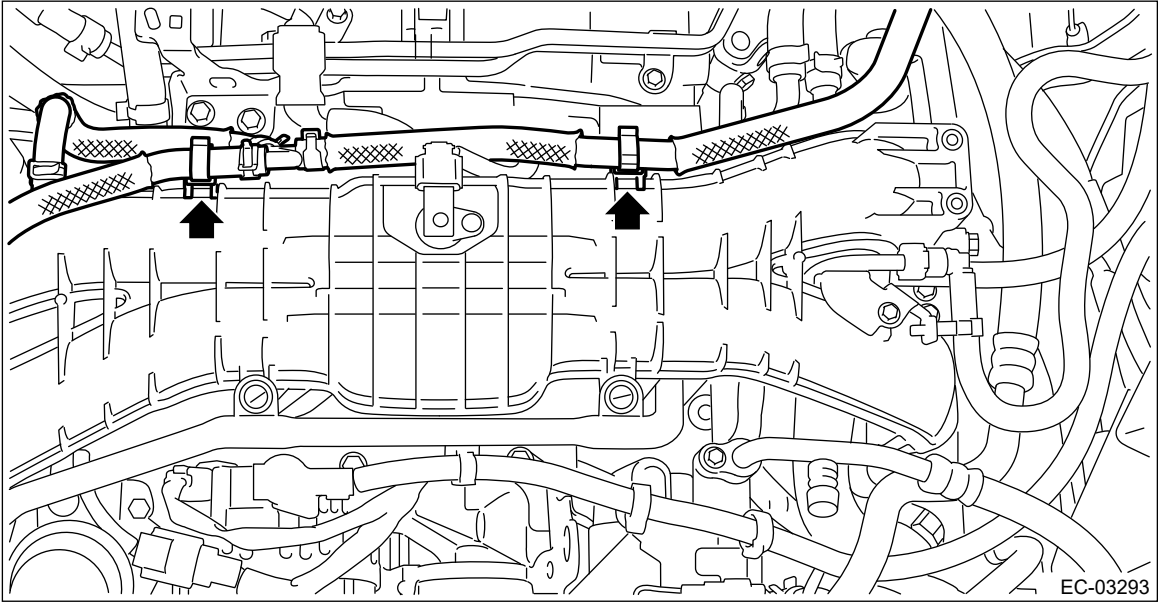
Caution:

Do not remove unless the PCV valve is broken.

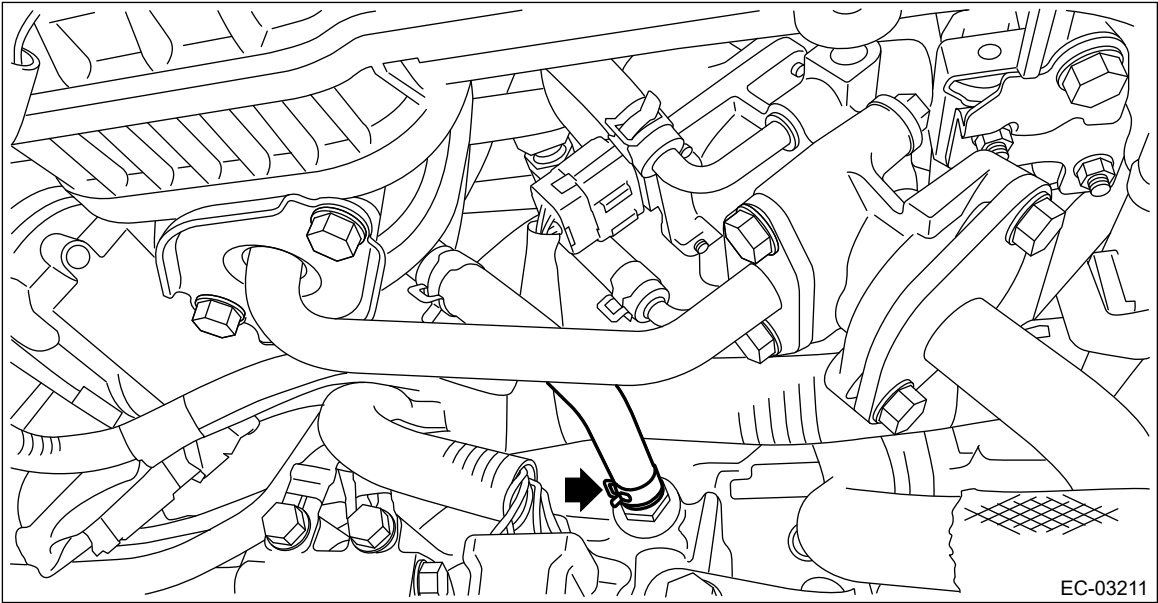
1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



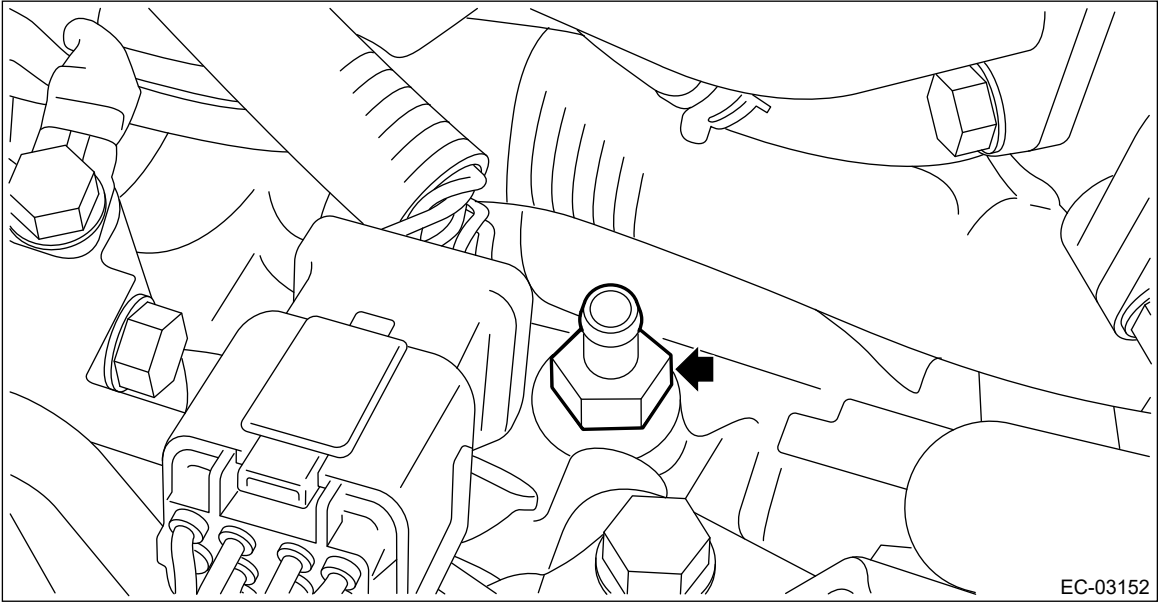
2. Disconnect the ground cable from battery.
3. Remove the intercooler. [🔗 Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
4. Remove the brake booster vacuum hose from the clip, and place the brake booster vacuum hose aside so that it does not interfere with the work.



5. Disconnect the PCV hose from the PCV valve.



6. Remove the PCV valve from the cylinder block RH.



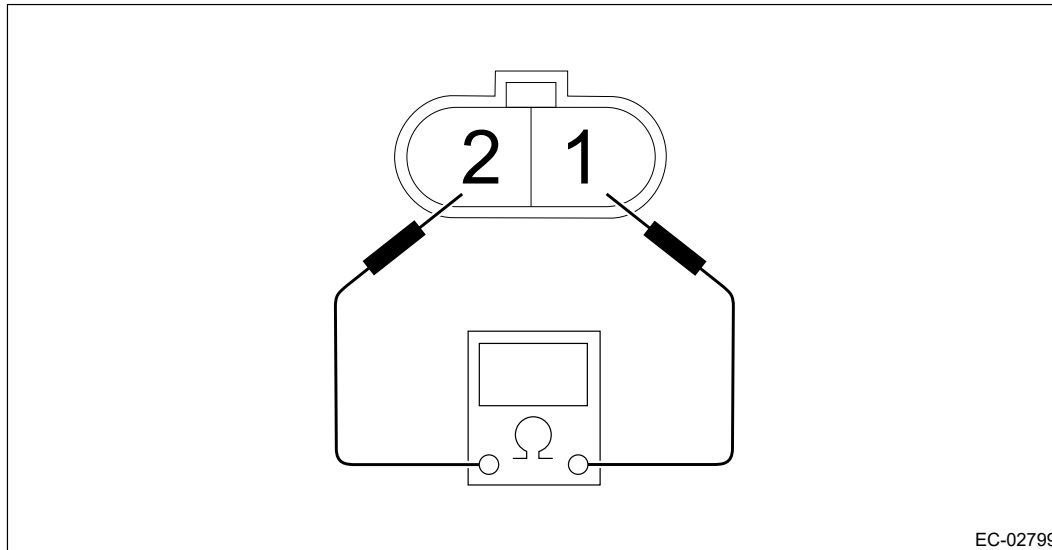
EC-03152

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Purge Control Solenoid Valve

INSPECTION

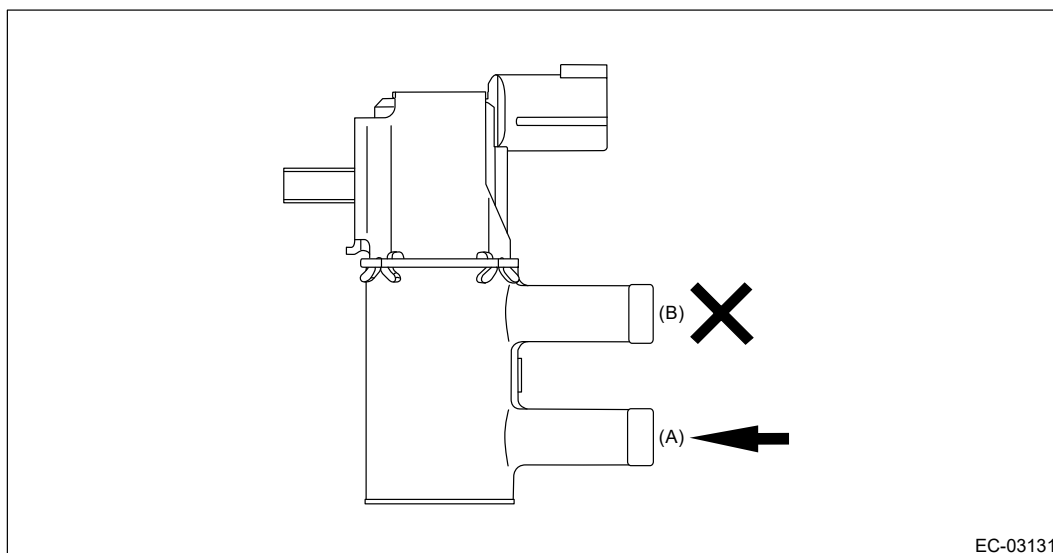
1. PURGE CONTROL SOLENOID VALVE

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

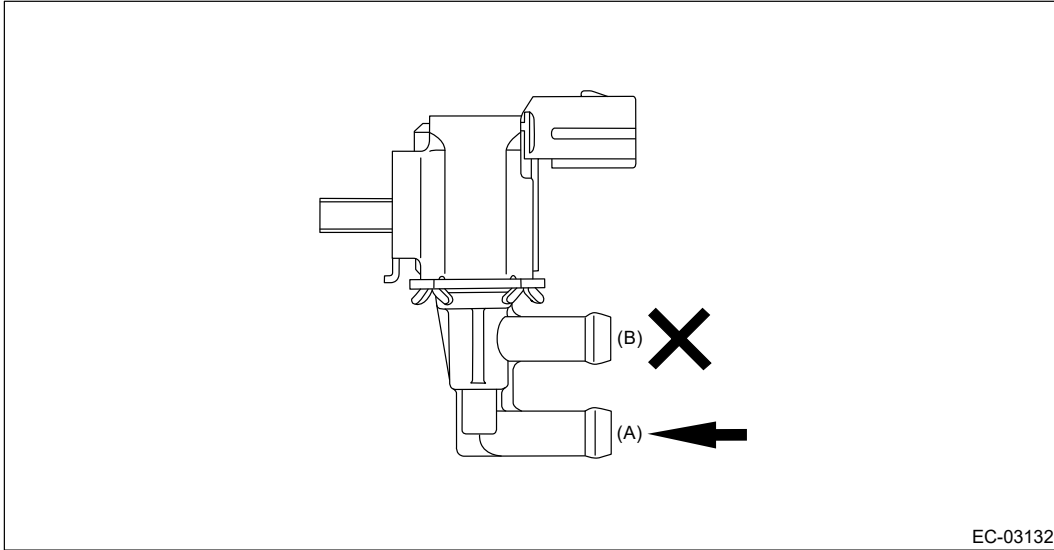


| Terminal No. | Standard |
|--------------|---------------------------------|
| 1 and 2 | $24 \pm 3 \Omega$ (20°C (68°F)) |

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

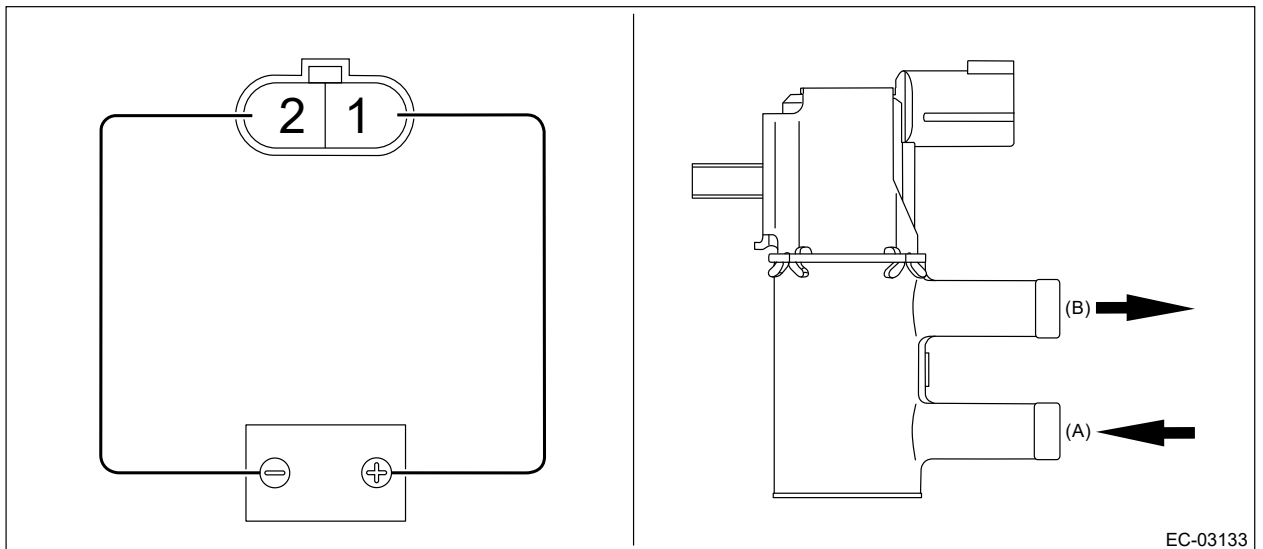


- Purge control solenoid valve 2

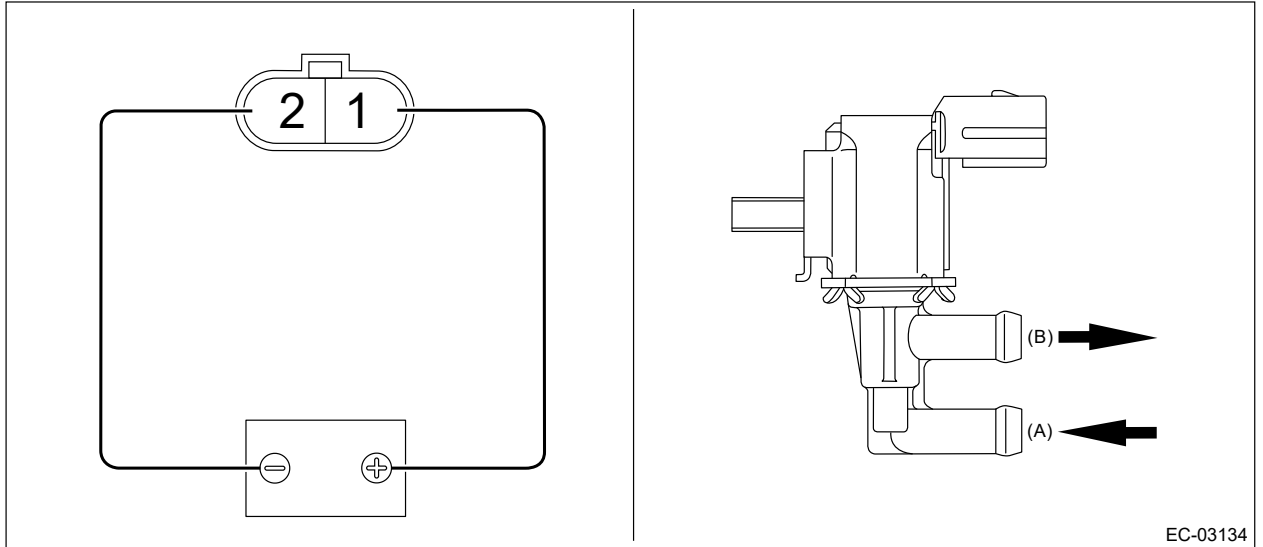


4. Connect the battery positive terminal to the terminal No.1 and the battery negative terminal to the terminal No.2. Check that air is discharged from (B), when supplying air to (A).

- Purge control solenoid valve 1



- Purge control solenoid valve 2



EC-03134

2. OTHER INSPECTIONS

Check the vacuum hose for cracks, damage or looseness.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Purge Control Solenoid Valve

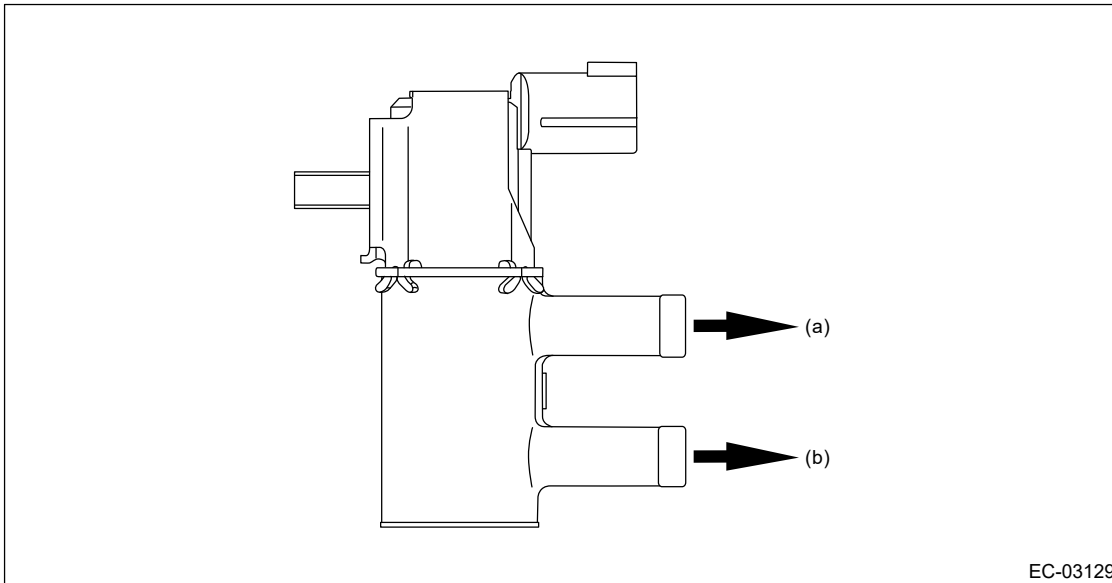
INSTALLATION

1. PURGE CONTROL SOLENOID VALVE 1

Install in the reverse order of removal.

Note:

Connect the vacuum hose as shown in the figure.

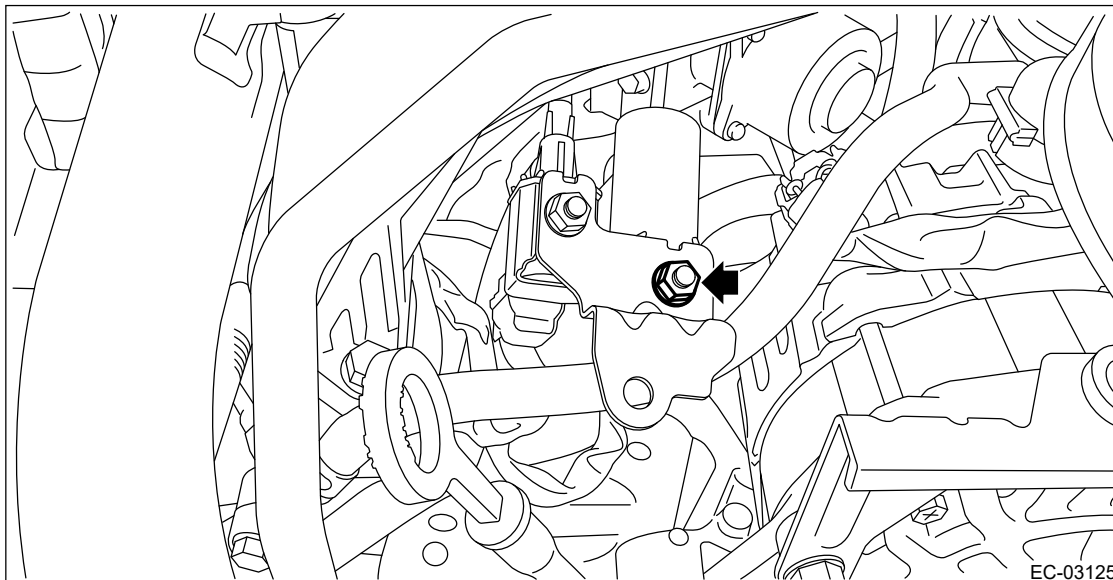


(a) To intake manifold

(b) To fuel pipe

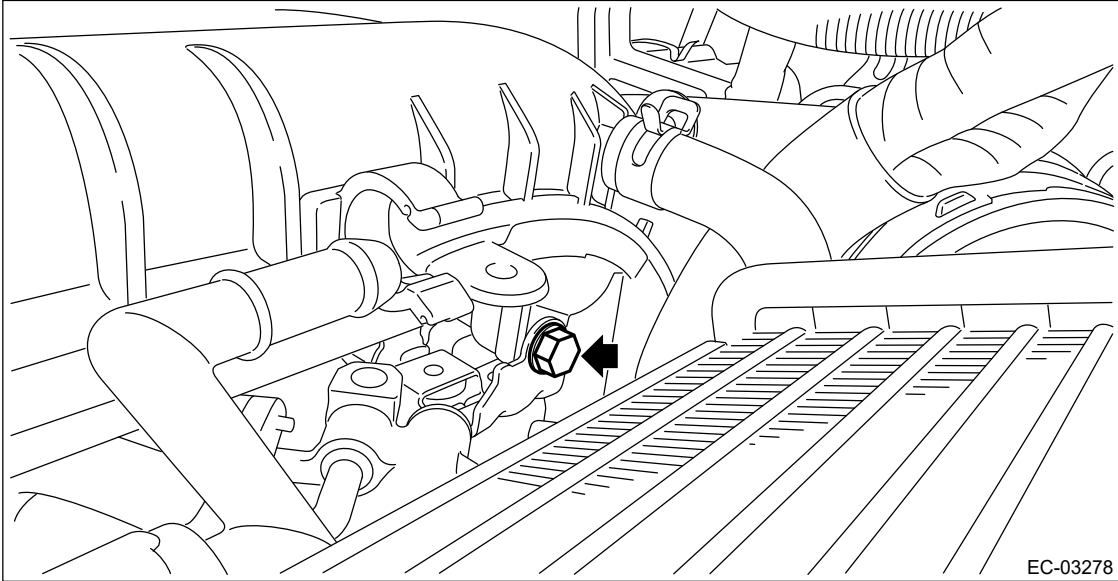
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)

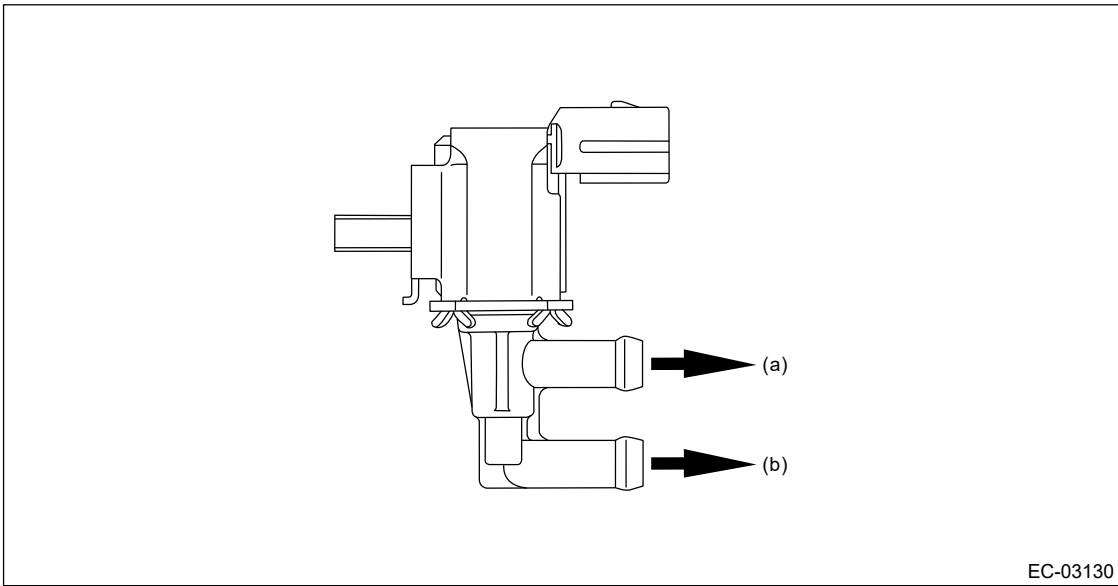


2. PURGE CONTROL SOLENOID VALVE 2

Install in the reverse order of removal.

Note:

Connect the vacuum hose as shown in the figure.

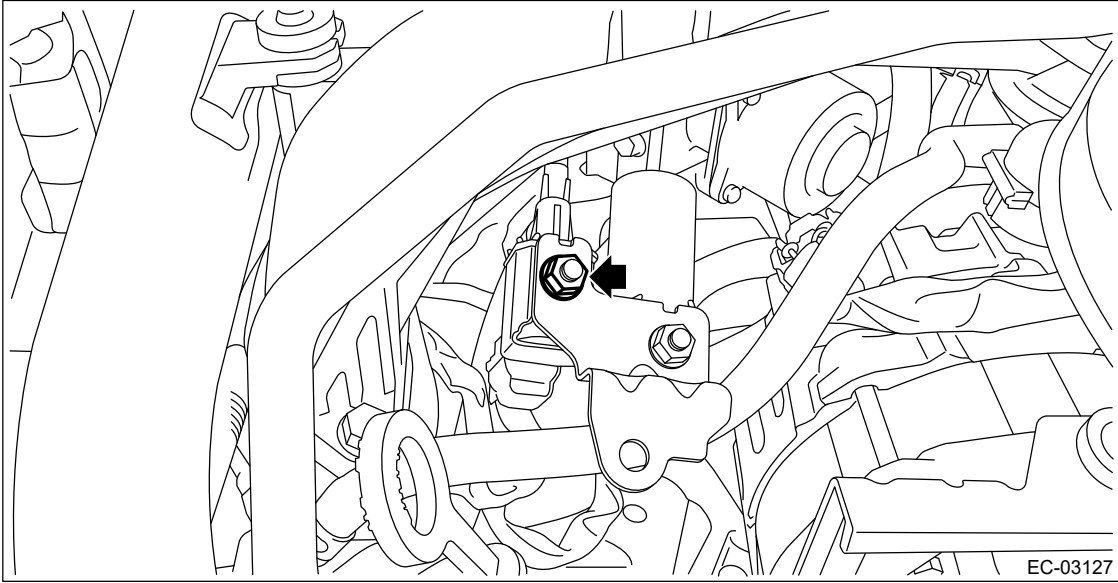


(a) To intake duct

(b) To fuel pipe

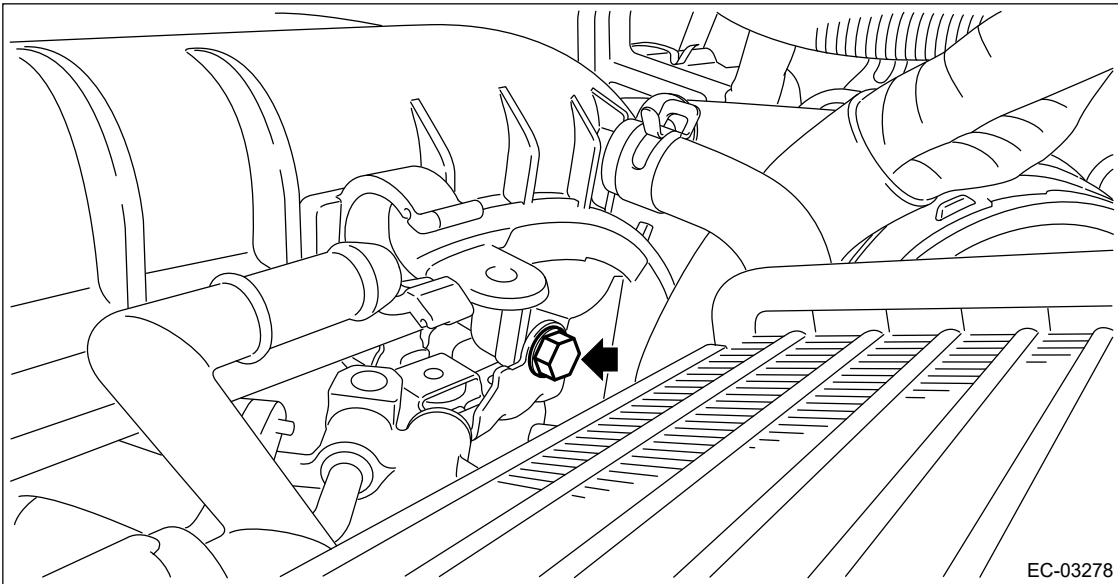
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)

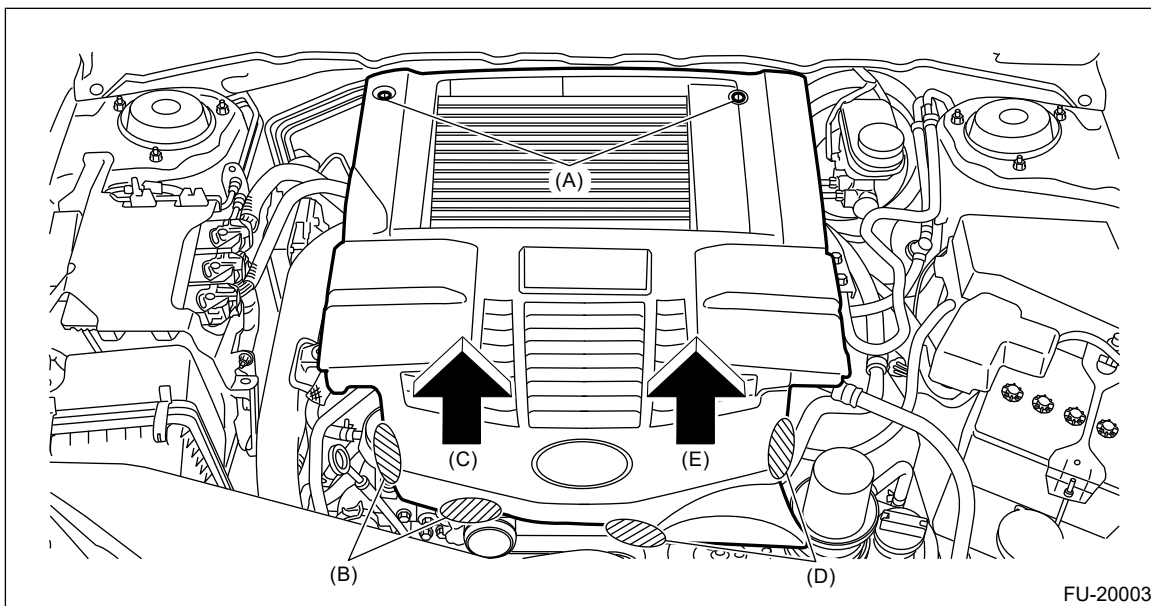



EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Purge Control Solenoid Valve

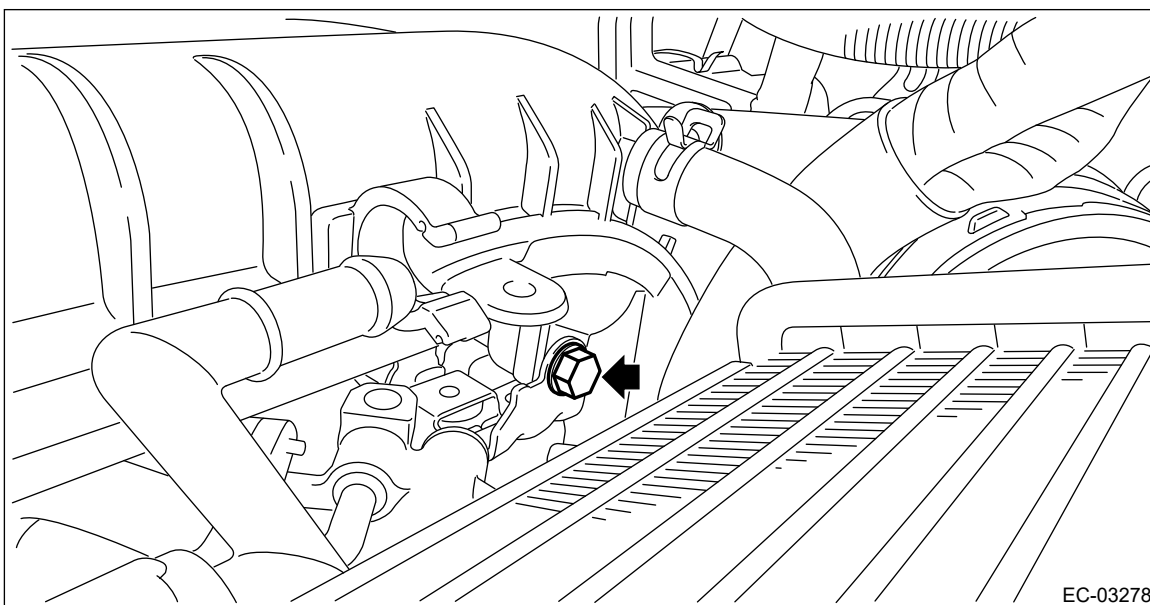
REMOVAL

1. PURGE CONTROL SOLENOID VALVE 1

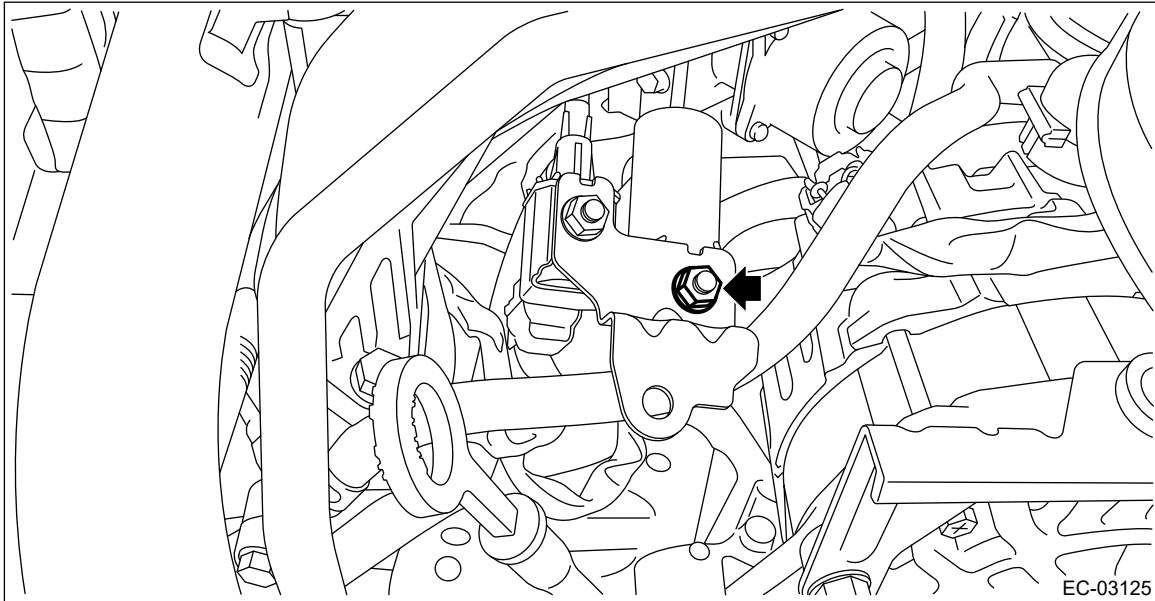
1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



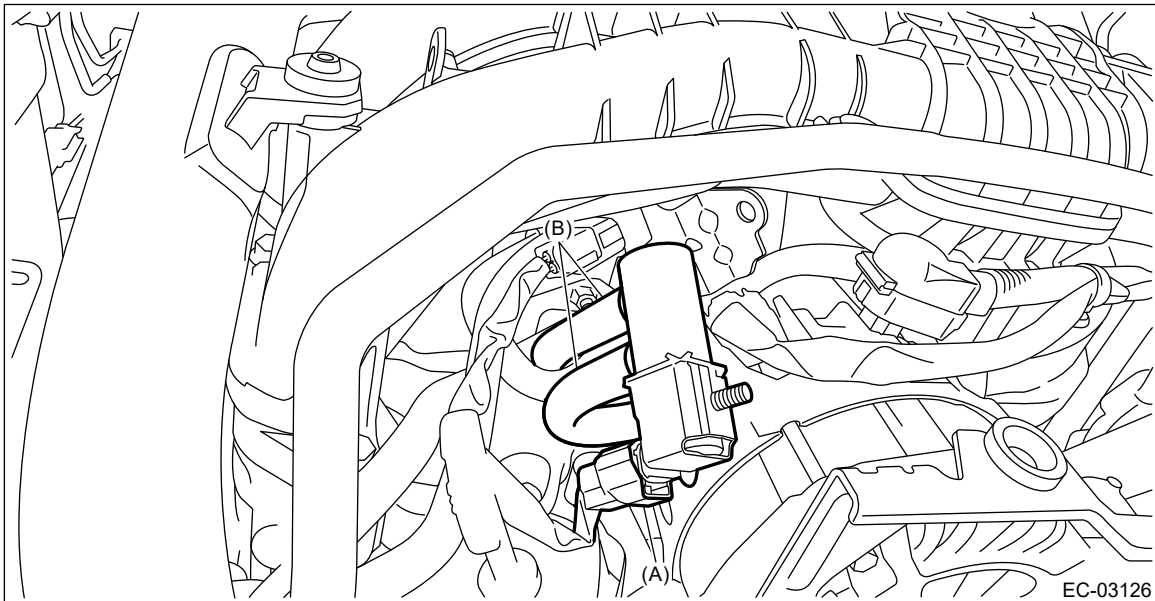
2. Disconnect the ground cable from battery.
3. Remove the brake vacuum pump.  [Ref. to BRAKE>Brake Vacuum Pump>REMOVAL.](#)
4. Remove the bolt which secures the solenoid valve bracket from the intake manifold.



5. Remove the nut which secures the purge control solenoid valve 1 to the solenoid valve bracket.

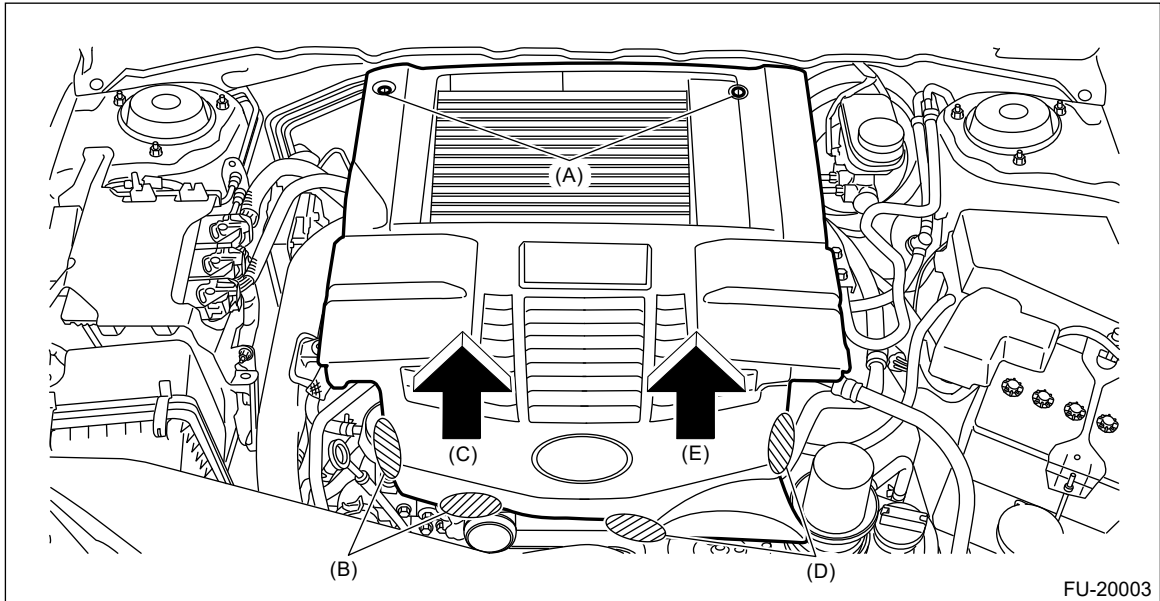


6. Disconnect the connector (A) and vacuum hose (B) from the purge control solenoid valve 1, and remove the purge control solenoid valve 1.




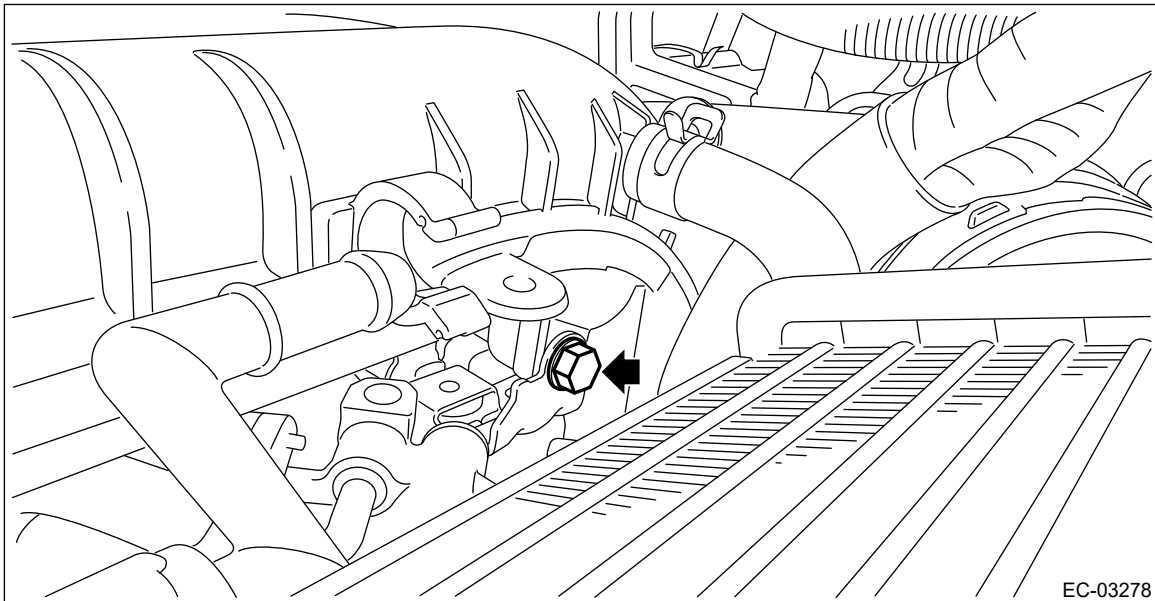
2. PURGE CONTROL SOLENOID VALVE 2

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



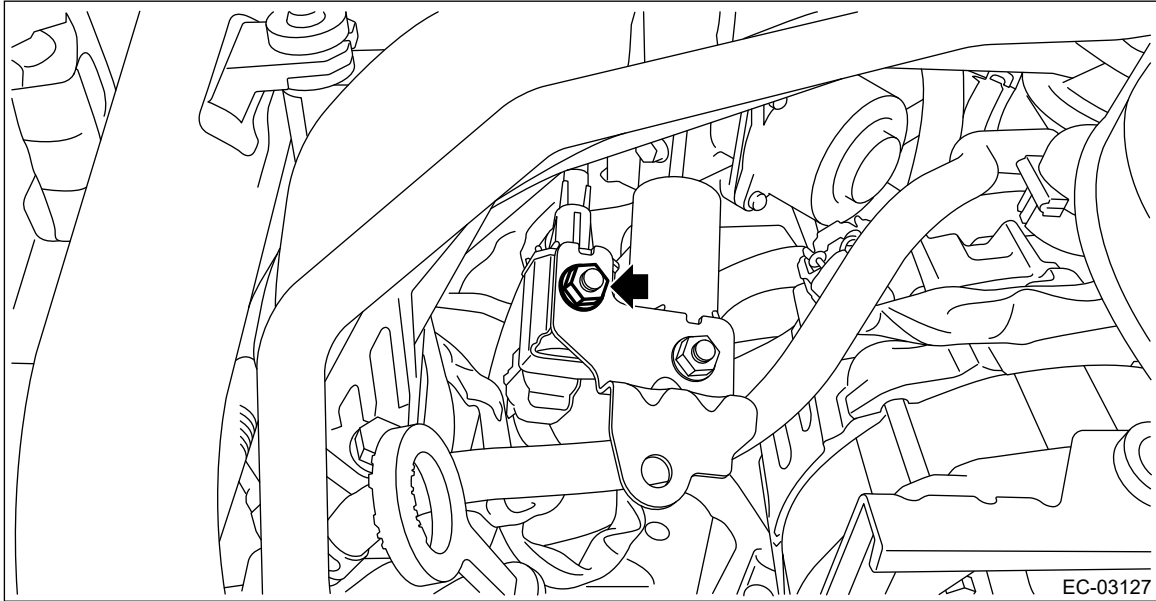
FU-20003

2. Disconnect the ground cable from battery.
3. Remove the brake vacuum pump.  [Ref. to BRAKE>Brake Vacuum Pump>REMOVAL.](#)
4. Remove the bolt which secures the solenoid valve bracket from the intake manifold.

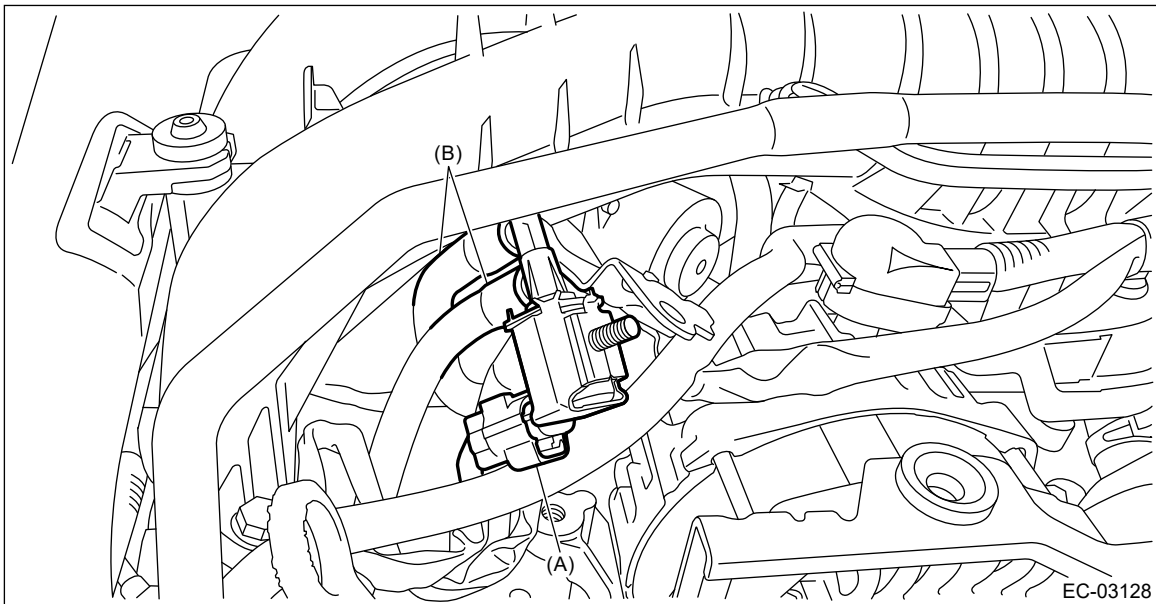


EC-03278

5. Remove the nut which secures the purge control solenoid valve 2 to the solenoid valve bracket.



- 6.** Disconnect the connector (A) and vacuum hose (B) from the purge control solenoid valve 2, and remove the purge control solenoid valve 2.



EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Purge Damper

INSPECTION

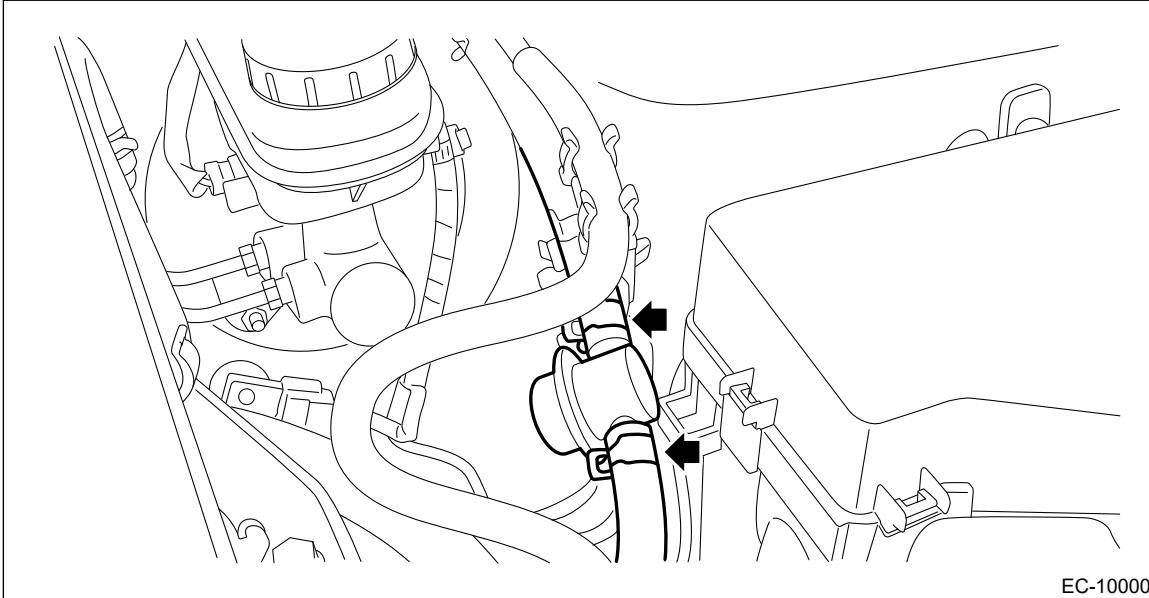
- 1.** Check that the purge damper has no deformation, cracks or other damages.
- 2.** Check that the evaporation hose has no cracks, damage or loose part.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Purge Damper
INSTALLATION

Install in the reverse order of removal.

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Purge Damper **REMOVAL**

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



EC-10000


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Rear Catalytic Converter

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.


EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Rear Catalytic Converter

INSTALLATION

The rear catalytic converter is integrated into the center exhaust pipe (rear). Refer to "Center Exhaust Pipe" for installation procedures.  [Ref. to EXHAUST\(H4DOTC\)>Center Exhaust Pipe>INSTALLATION.](#)

EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)(H4DOTC) > Rear Catalytic Converter

REMOVAL

The rear catalytic converter is integrated into the center exhaust pipe (rear). Refer to "Center Exhaust Pipe" for removal procedures.  [Ref. to EXHAUST\(H4DOTC\)>Center Exhaust Pipe>REMOVAL.](#)

EXHAUST(H4DO) > Center Exhaust Pipe

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.

EXHAUST(H4DO) > Center Exhaust Pipe

INSTALLATION

1. Install the center exhaust pipe upper cover to the center exhaust pipe.

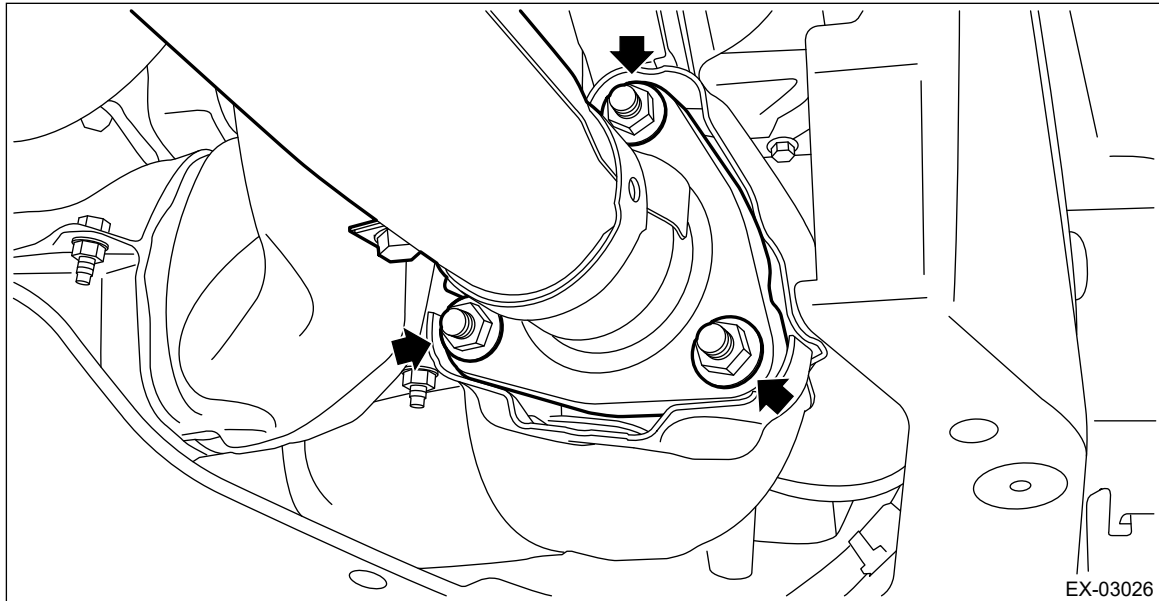
Tightening torque:

13 N·m (1.3 kgf-m, 9.6 ft-lb)

2. Temporarily tighten the nuts which secure the center exhaust pipe to the front exhaust pipe.

Note:

Use a new gasket.



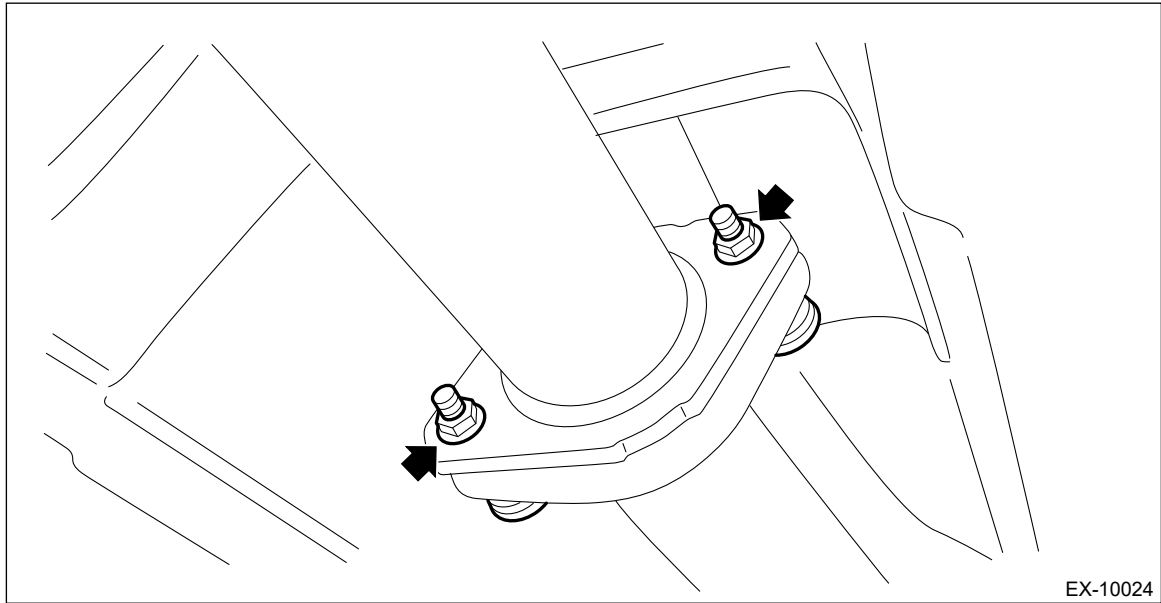
3. Install the bolts, springs, and nuts which secure the rear exhaust pipe to the center exhaust pipe.

Note:

Use a new gasket.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)

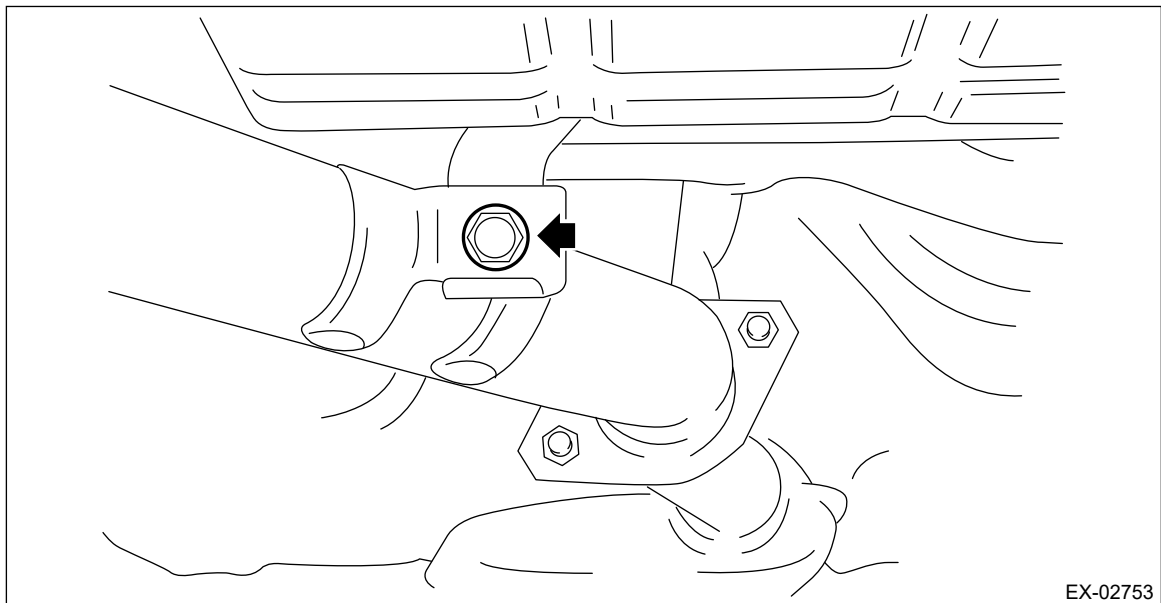


EX-10024

- 4.** Tighten the bolts which secure the center exhaust pipe to the hanger bracket.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)

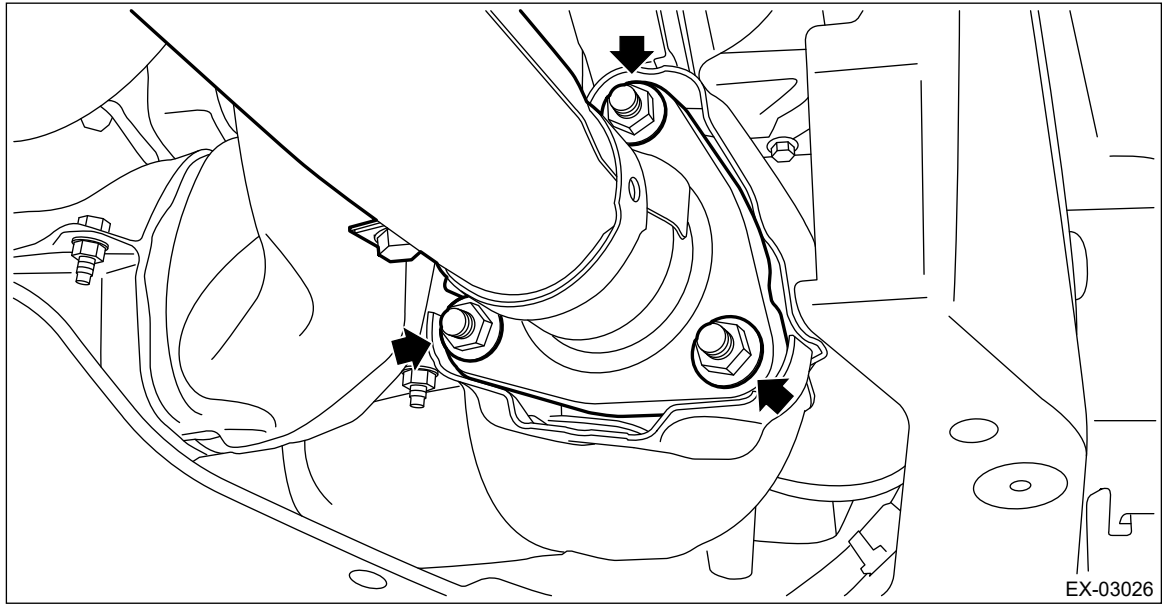


EX-02753

- 5.** Tighten the nuts which secure the center exhaust pipe to the front exhaust pipe.

Tightening torque:

42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



6. Lower the vehicle.

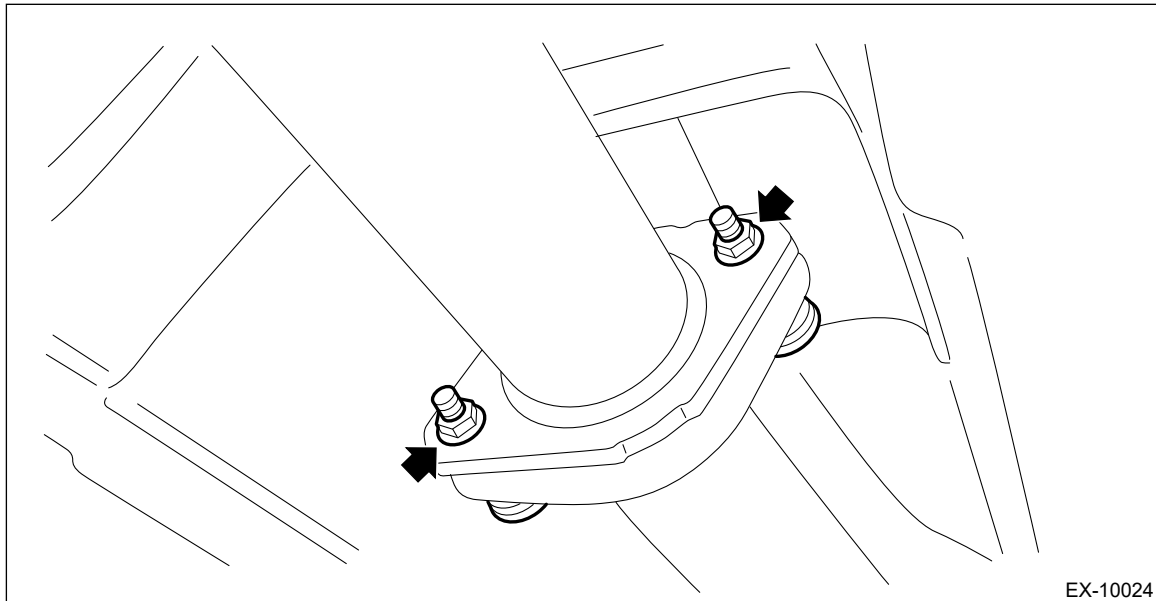
EXHAUST(H4DO) > Center Exhaust Pipe

REMOVAL

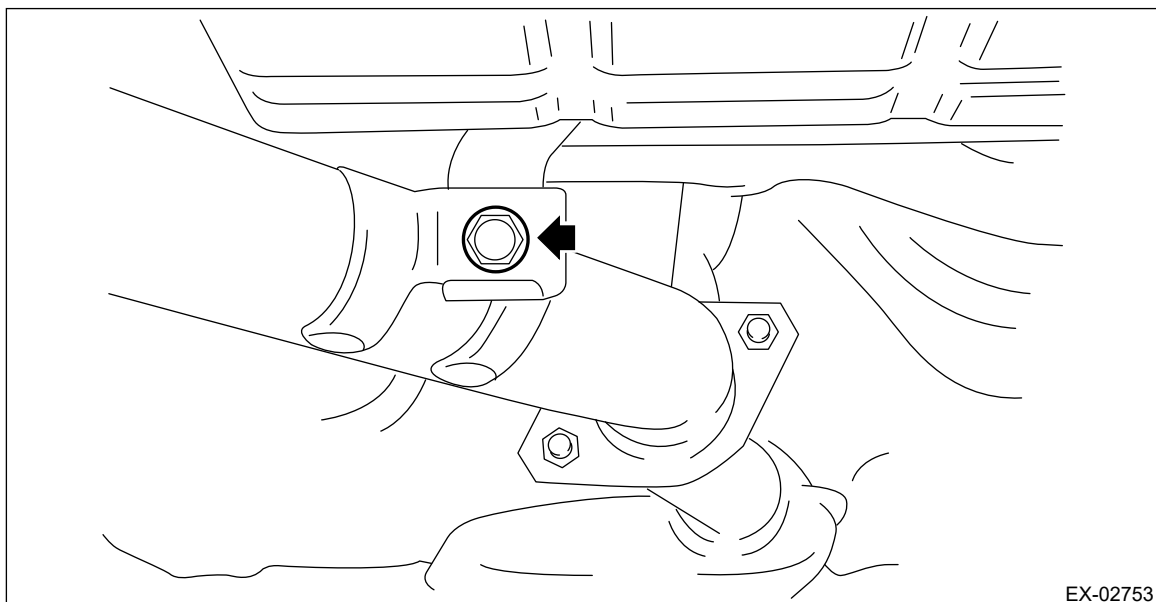
Caution:

Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

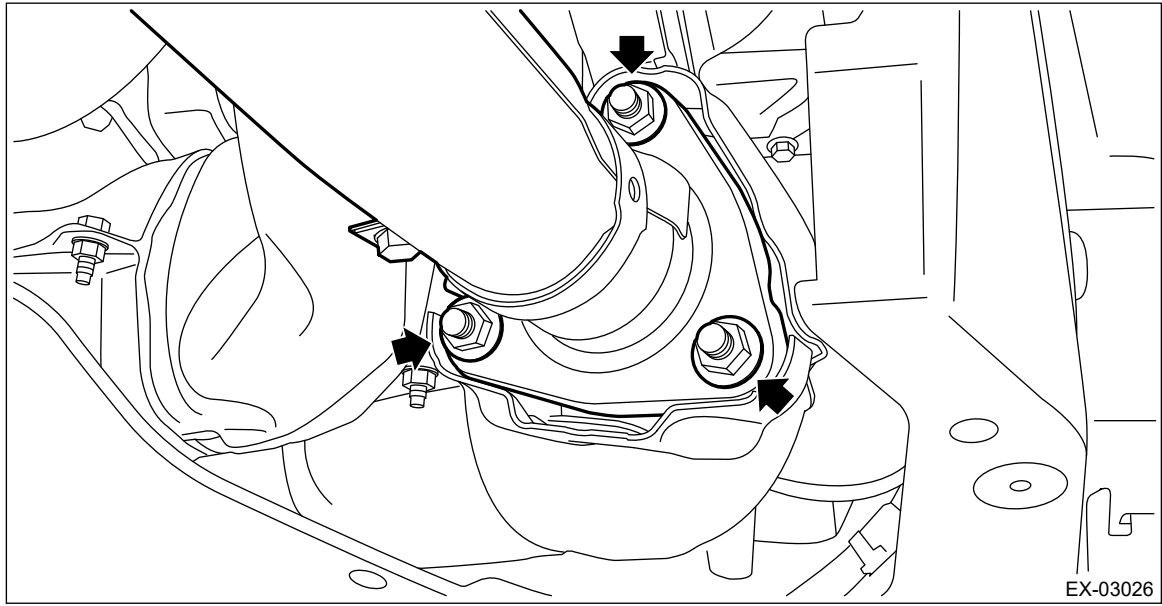
1. Lift up the vehicle.
2. Remove the bolts, springs, and nuts securing the rear exhaust pipe to the center exhaust pipe.



3. Remove the bolt which holds center exhaust pipe to hanger bracket.



4. Remove the center exhaust pipe from the front exhaust pipe.



5. Remove the center exhaust pipe upper cover from the center exhaust pipe.

EXHAUST(H4DO) > Front Exhaust Pipe

ASSEMBLY

1. Install each cover to the front exhaust pipe.

Tightening torque:

13 N·m (1.3 kgf-m, 9.6 ft-lb)



2. Install the center exhaust pipe to front exhaust pipe.

Note:

Use a new gasket.



Tightening torque:

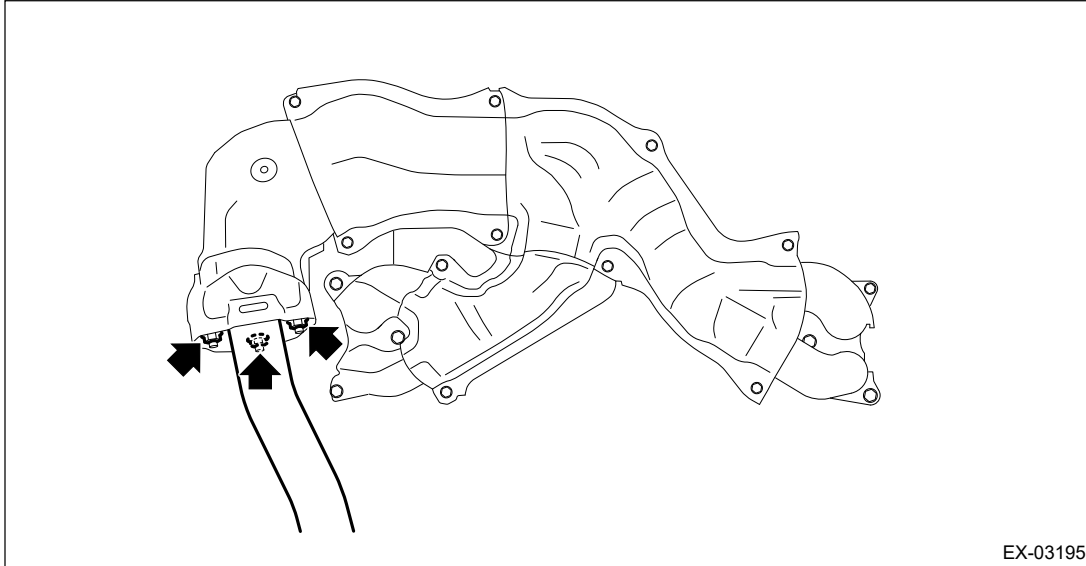
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

3. Install the front oxygen (A/F) sensor and rear oxygen sensor to the front exhaust pipe. 
[Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Front Oxygen \(A/F\) Sensor>INSTALLATION.](#)
 [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Rear Oxygen Sensor>INSTALLATION.](#)

EXHAUST(H4DO) > Front Exhaust Pipe

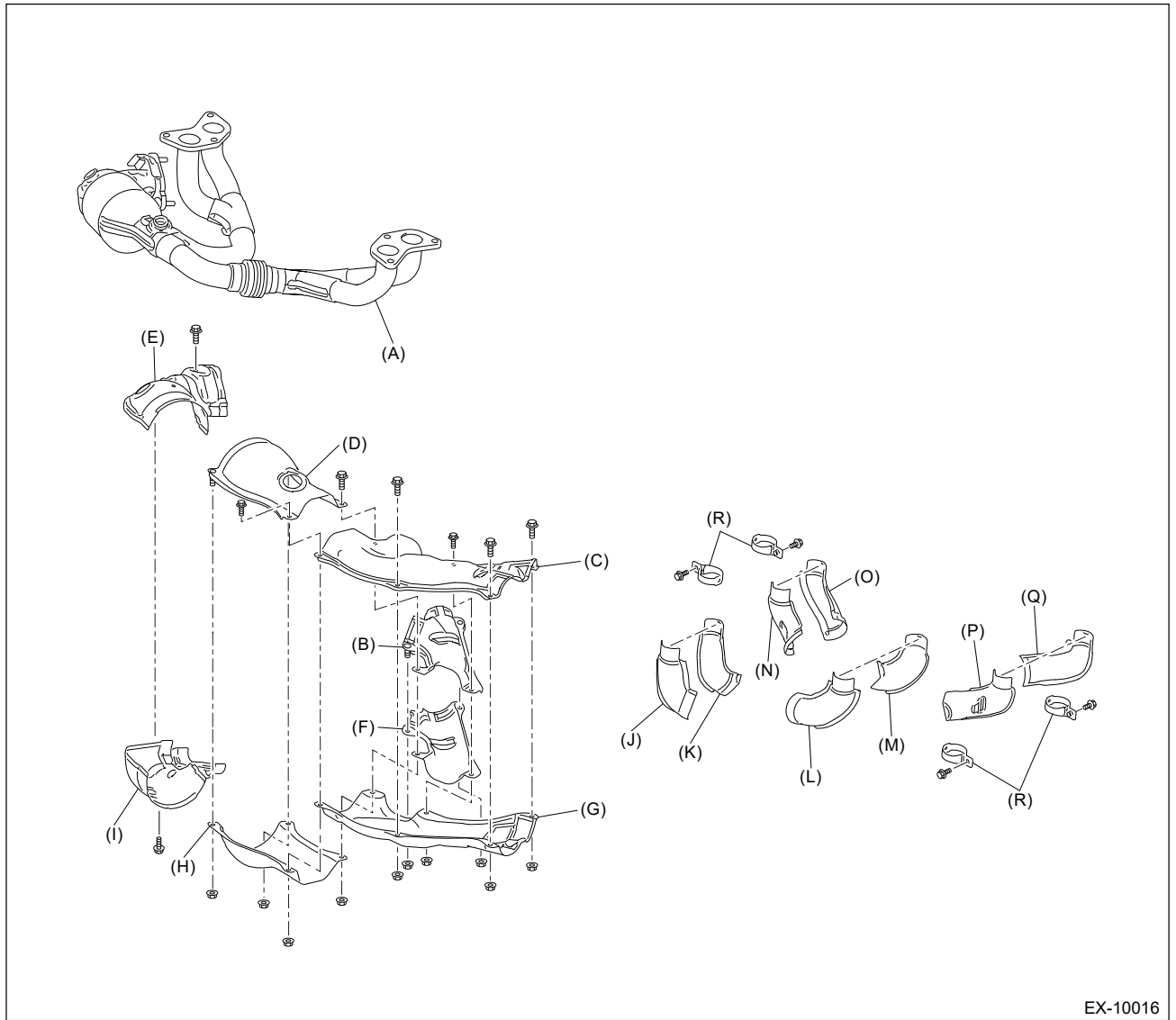
DISASSEMBLY

1. Remove the front oxygen (A/F) sensor and rear oxygen sensor from front exhaust pipe.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Front Oxygen \(A/F\) Sensor>REMOVAL](#).  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Rear Oxygen Sensor>REMOVAL](#).
2. Remove the center exhaust pipe from the front exhaust pipe.



EX-03195

3. Remove each cover from the front exhaust pipe.



EX-10016

- | | | |
|--------------------------------------|--------------------------------------|-------------------------------------|
| (A) Front exhaust pipe | (G) Front exhaust pipe lower cover B | (M) Front exhaust pipe side cover D |
| (B) Front exhaust pipe upper cover A | (H) Front exhaust pipe lower cover C | (N) Front exhaust pipe side cover E |
| (C) Front exhaust pipe upper cover B | (I) Front exhaust pipe lower cover D | (O) Front exhaust pipe side cover F |
| (D) Front exhaust pipe upper cover C | (J) Front exhaust pipe side cover A | (P) Front exhaust pipe side cover G |
| (E) Front exhaust pipe upper cover D | (K) Front exhaust pipe side cover B | (Q) Front exhaust pipe side cover H |
| (F) Front exhaust pipe lower cover A | (L) Front exhaust pipe side cover C | (R) Band |

EXHAUST(H4DO) > Front Exhaust Pipe

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.

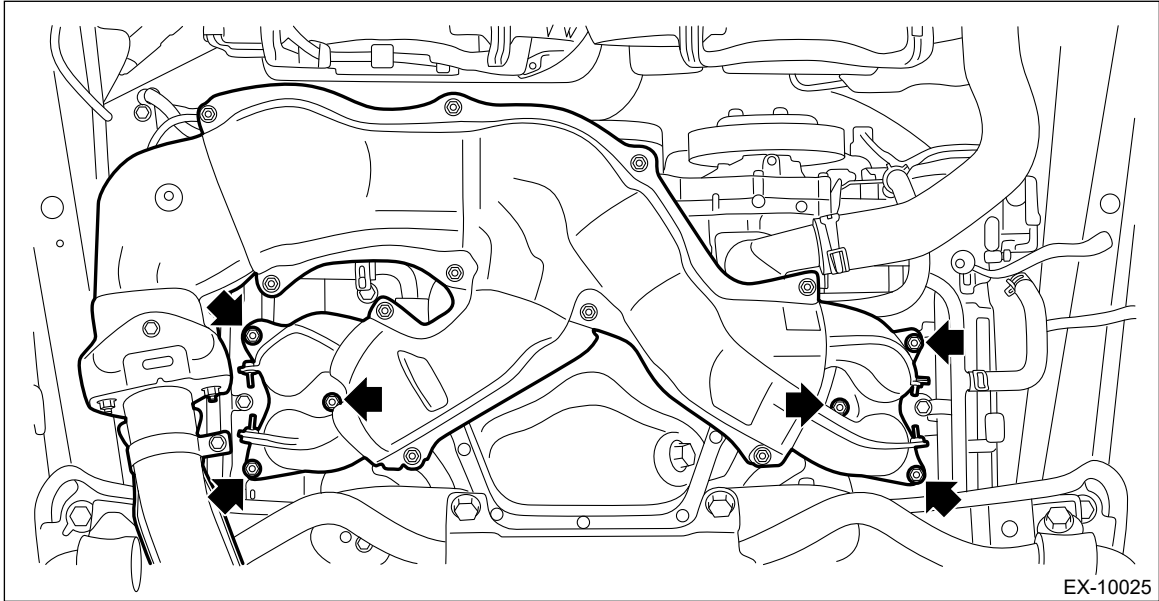
EXHAUST(H4DO) > Front Exhaust Pipe

INSTALLATION

1. Set the front exhaust pipe and center exhaust pipe to the cylinder head, and temporarily tighten the nuts which secure the front exhaust pipe to the cylinder head.

Note:

Use a new gasket.



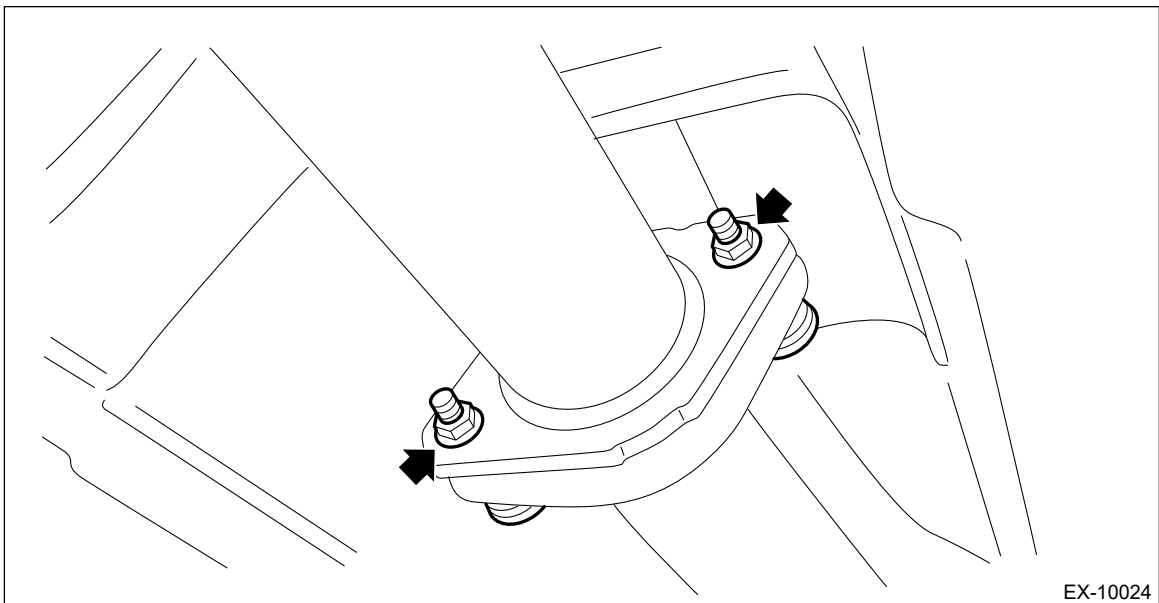
2. Install the bolts, springs, and nuts which secure the center exhaust pipe to the rear exhaust pipe.

Note:

Use a new gasket.

Tightening torque:

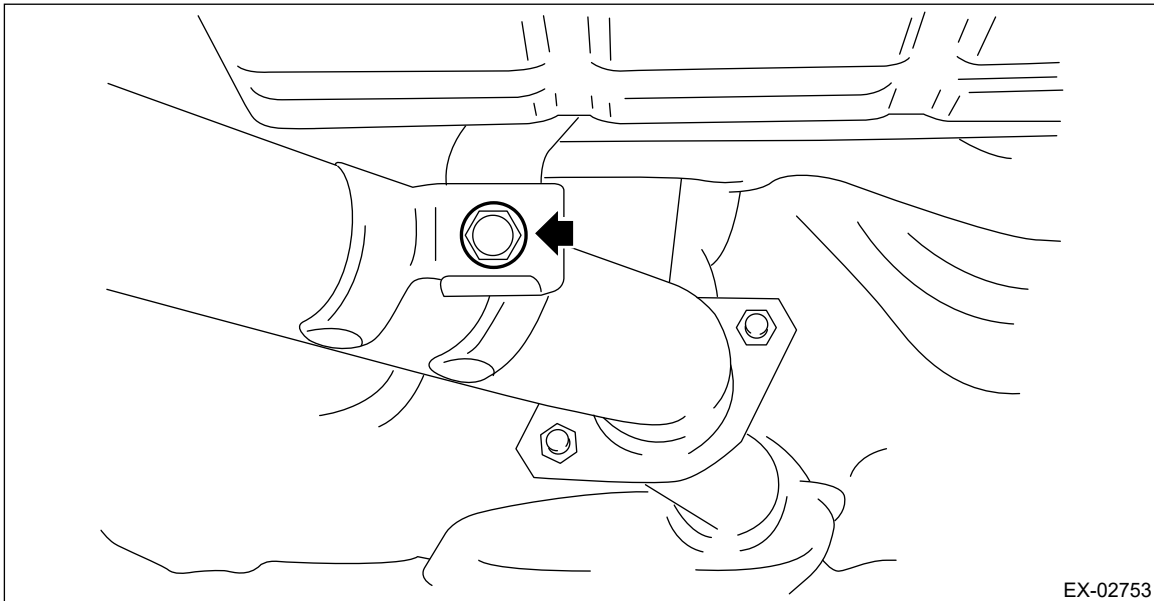
18 N•m (1.8 kgf-m, 13.3 ft-lb)



- 3.** Tighten the bolts which secure the center exhaust pipe to the hanger bracket.

Tightening torque:

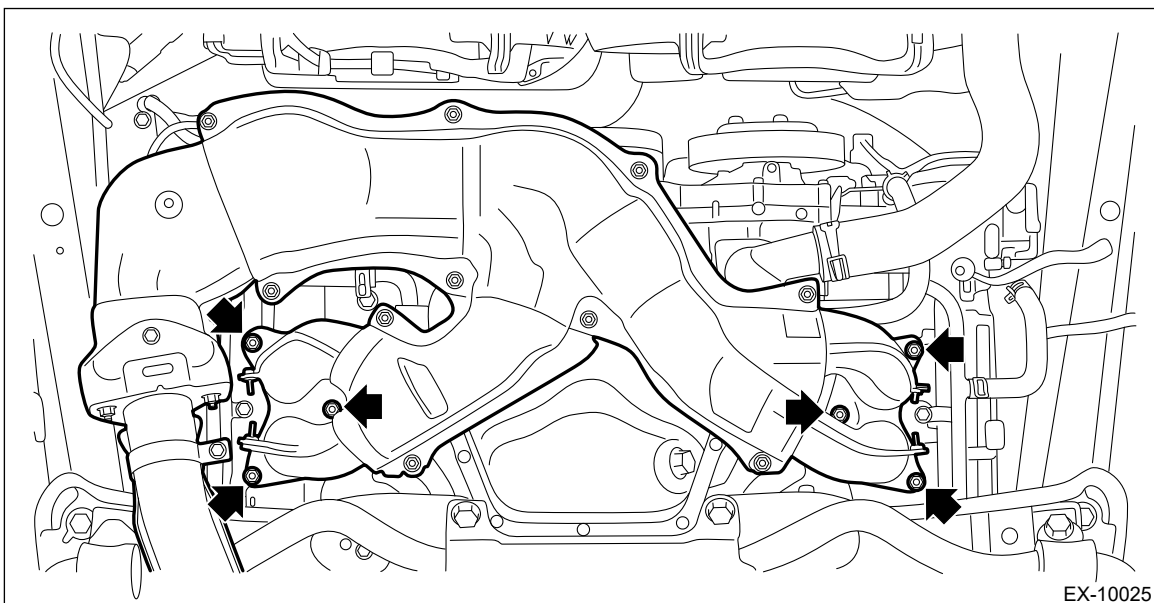
35 N•m (3.6 kgf-m, 25.8 ft-lb)



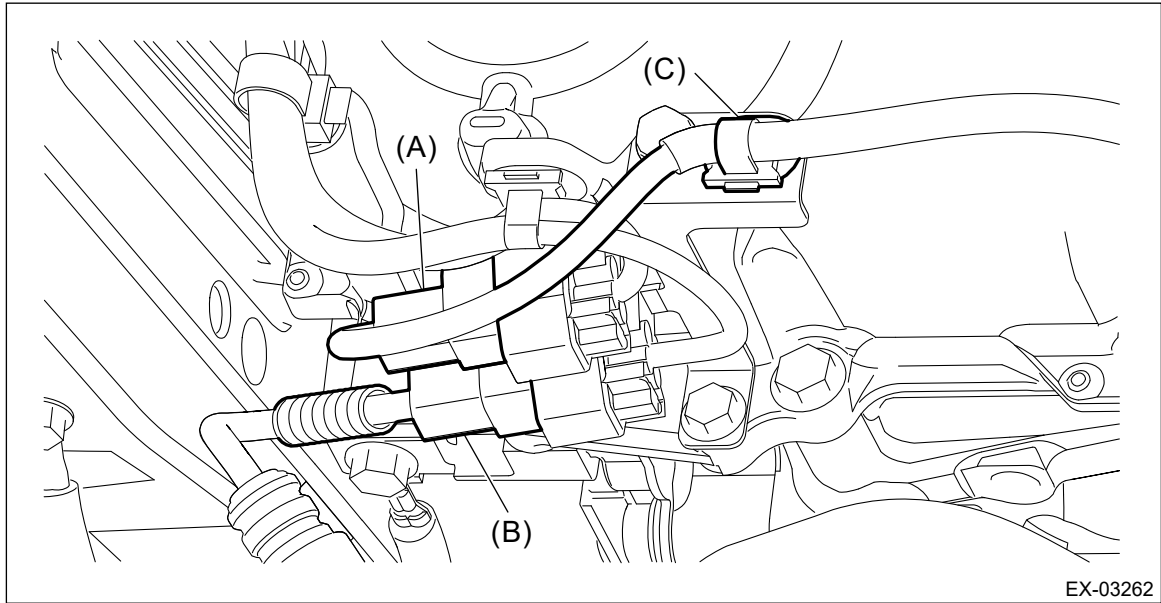
- 4.** Tighten the nuts which hold front exhaust pipe to cylinder heads.



Tightening torque:

30 N•m (3.1 kgf-m, 22.1 ft-lb)



- 5.** Connect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B), and fasten the harness with the clip (C).





6. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
7. Lower the vehicle.
8. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

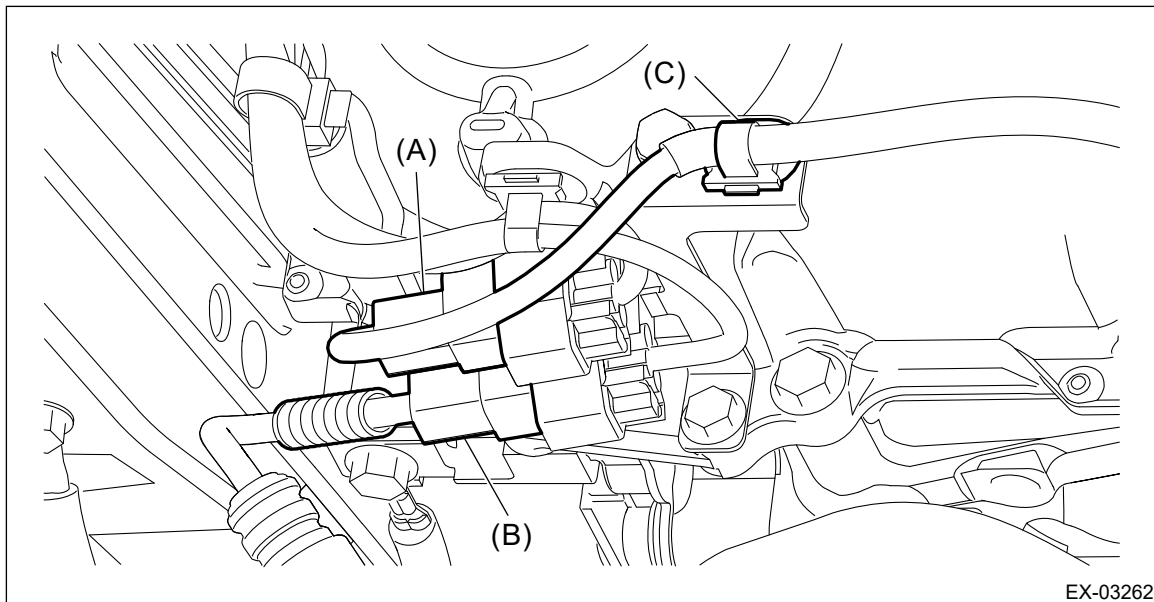
EXHAUST(H4DO) > Front Exhaust Pipe

REMOVAL

Caution:

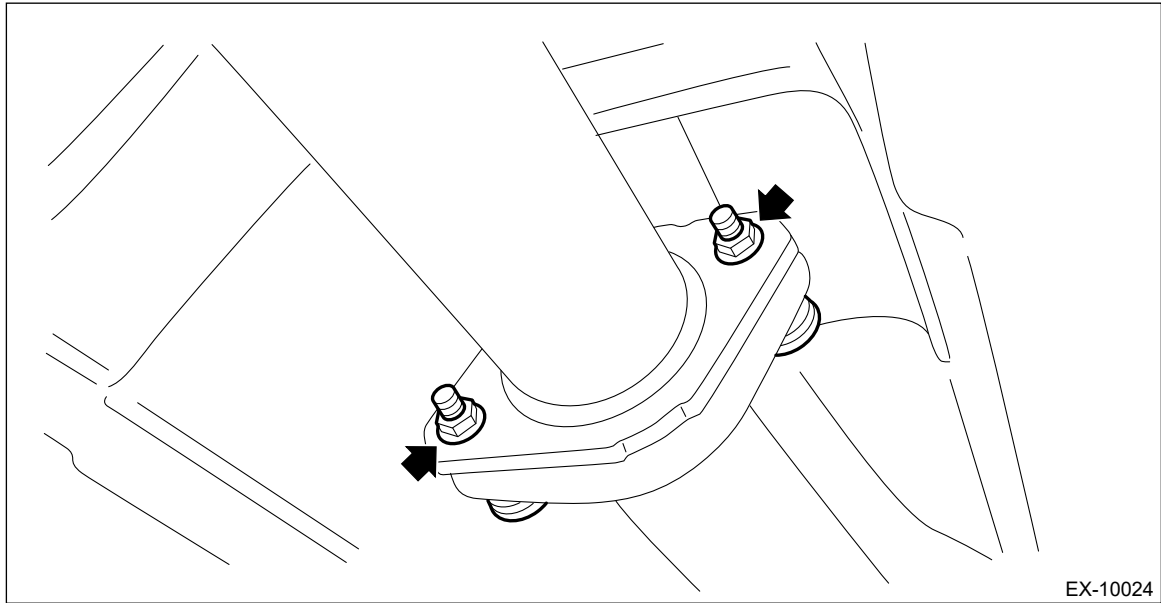
Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Lift up the vehicle.
3. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
4. Disconnect the front oxygen (A/F) sensor connector (A) and rear oxygen sensor connector (B) and remove the clip (C) fastening the harness.

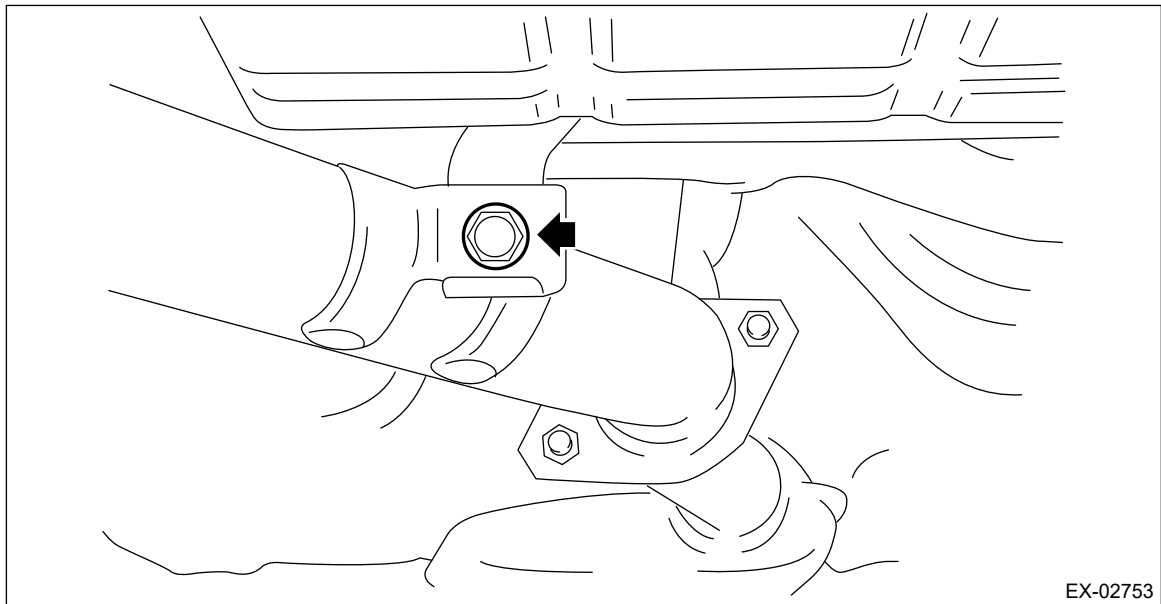


EX-03262

5. Remove the bolts, springs, and nuts securing the rear exhaust pipe to the center exhaust pipe.



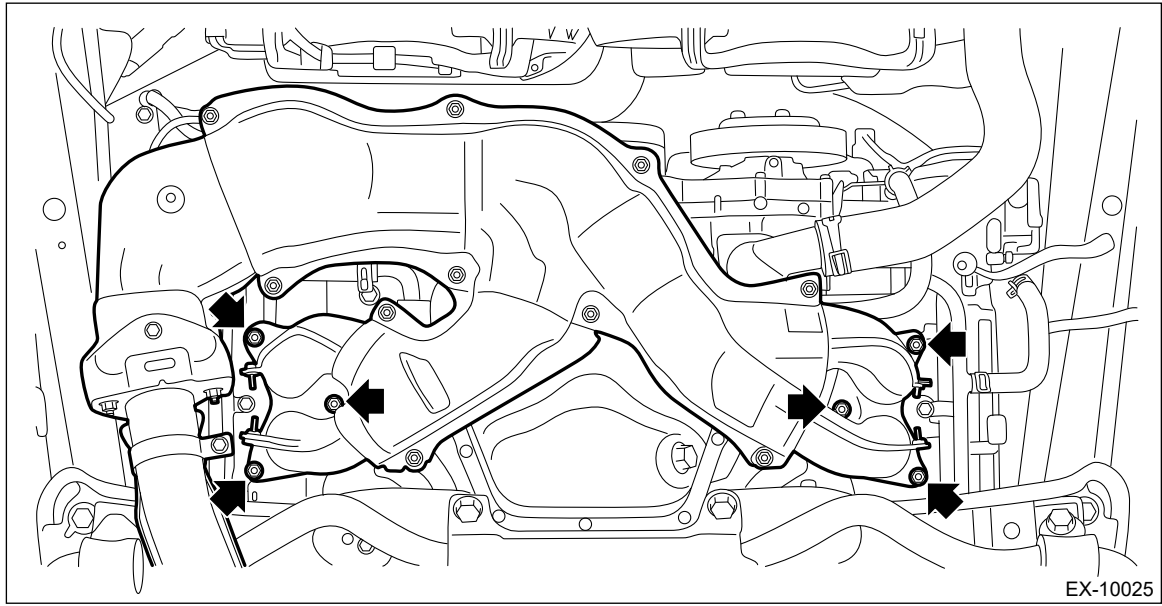
6. Remove the bolt which holds center exhaust pipe to hanger bracket.



7. Remove the nuts which hold the front exhaust pipe to the cylinder head, and remove the front exhaust pipe and center exhaust pipe as a unit.

Caution:

- **The front exhaust pipe and center exhaust pipe are very heavy. Be careful not to drop the exhaust pipes when removing.**
- **After removing the front exhaust pipe and center exhaust pipe, do not pull the rear exhaust pipe with excessive force.**



EX-10025

EXHAUST(H4DO) > General Description

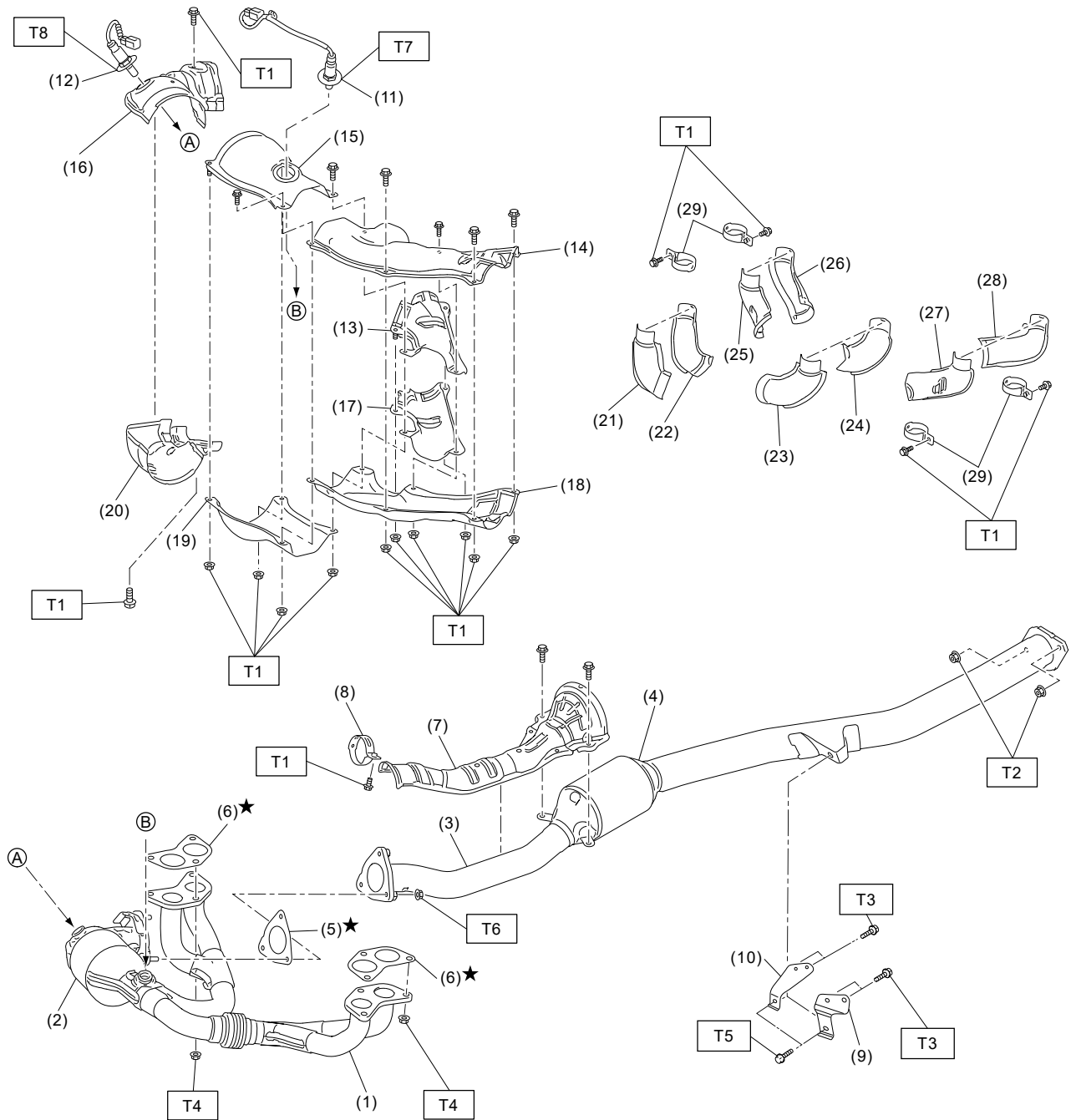
CAUTION

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

EXHAUST(H4DO) > General Description



COMPONENT

1. FRONT EXHAUST PIPE AND CENTER EXHAUST PIPE

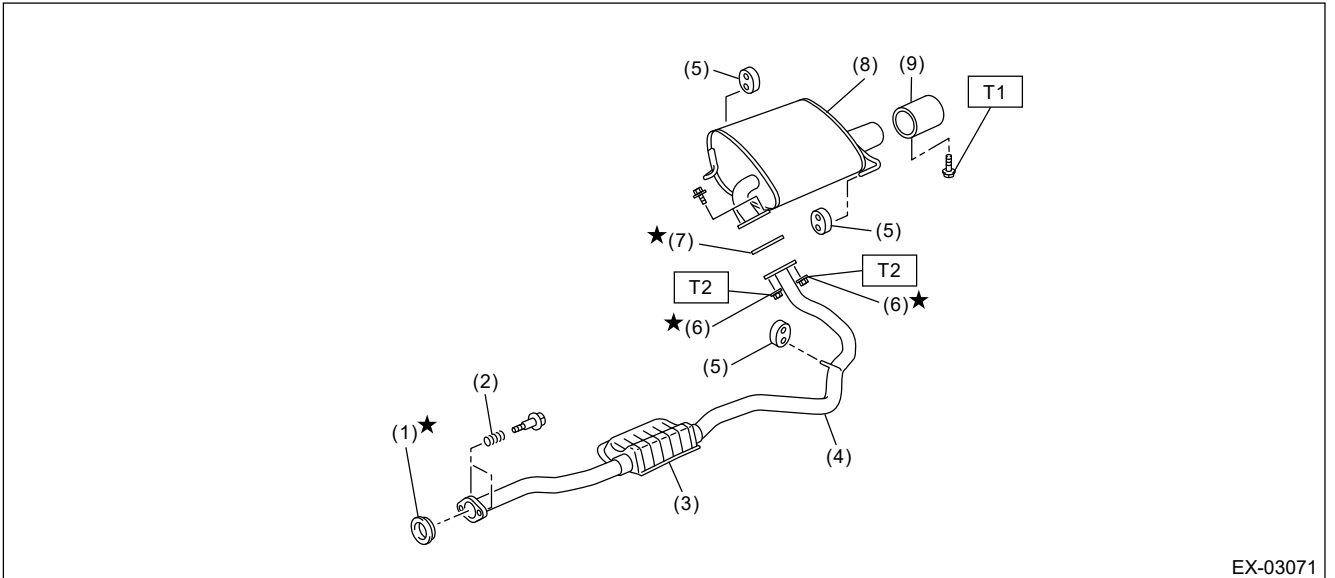


EX-10037

- | | | |
|-------------------------------|---------------------------------------|--------------------------------------|
| (1) Front exhaust pipe | (14) Front exhaust pipe upper cover B | (27) Front exhaust pipe side cover G |
| (2) Front catalytic converter | (15) Front exhaust pipe upper | (28) Front exhaust pipe side cover |

| | | |
|---------------------------------------|---------------------------------------|--|
| | cover C | H |
| (3) Center exhaust pipe | (16) Front exhaust pipe upper cover D | (29) Band |
| (4) Rear catalytic converter | (17) Front exhaust pipe lower cover A | |
| (5) Gasket | (18) Front exhaust pipe lower cover B | Tightening torque: N·m (kgf-m, ft-lb) |
| (6) Gasket | (19) Front exhaust pipe lower cover C | T1: 13 (1.3, 9.6) |
| (7) Center exhaust pipe upper cover | (20) Front exhaust pipe lower cover D | T2: 18 (1.8, 13.3) |
| (8) Band | (21) Front exhaust pipe side cover A | T3: 23 (2.3, 17.0) |
| (9) Hanger bracket (CVT model) | (22) Front exhaust pipe side cover B | T4: 30 (3.1, 22.1) |
| (10) Hanger bracket (MT model) | (23) Front exhaust pipe side cover C | T5: 35 (3.6, 25.8) |
| (11) Front oxygen (A/F) sensor | (24) Front exhaust pipe side cover D | T6: 42.5 (4.3, 31.3) |
| (12) Rear oxygen sensor | (25) Front exhaust pipe side cover E | T7:  <u>Ref. to FUEL INJECTION (FUEL SYSTEMS)(H4DO)>Front Oxygen (A/F) Sensor>INSTALLATION.</u> |
| (13) Front exhaust pipe upper cover A | (26) Front exhaust pipe side cover F | T8:  <u>Ref. to FUEL INJECTION (FUEL SYSTEMS)(H4DO)>Rear Oxygen Sensor>INSTALLATION.</u> |

2. REAR EXHAUST PIPE AND MUFFLER



EX-03071

(1) Gasket

(6) Self-locking nut

Tightening torque: N·m (kgf-m, ft-lb)

(2) Spring

(7) Gasket

T1: 7.5 (0.8, 5.5)

(3) Chamber

(8) Muffler

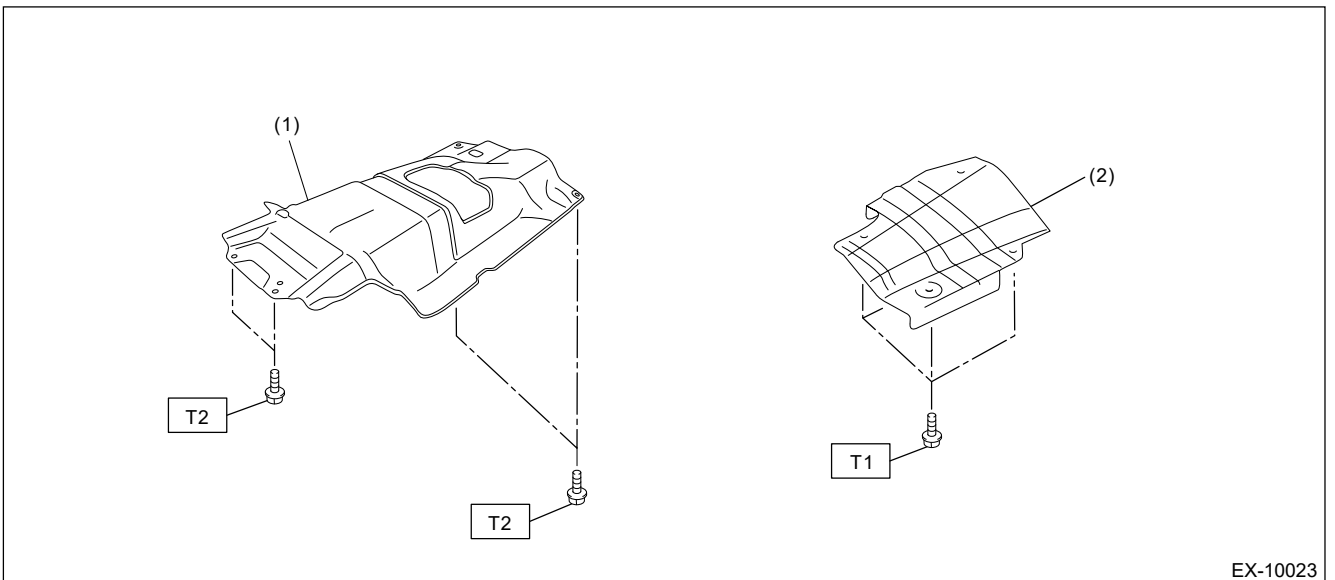
T2: 48 (4.9, 35.4)

(4) Rear exhaust pipe

(9) Muffler cutter (models with muffler cutter)

(5) Cushion rubber

3. HEAT SHIELD COVER



EX-10023

(1) Center exhaust cover

(2) Rear exhaust cover

Tightening torque: N·m (kgf-m, ft-lb)

T1: 10 (1.0, 7.4)

T2: 18 (1.8, 13.3)

EXHAUST(H4DO) > Muffler

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.
- 3.** Check the cushion rubber for wear or crack.

EXHAUST(H4DO) > Muffler

INSTALLATION

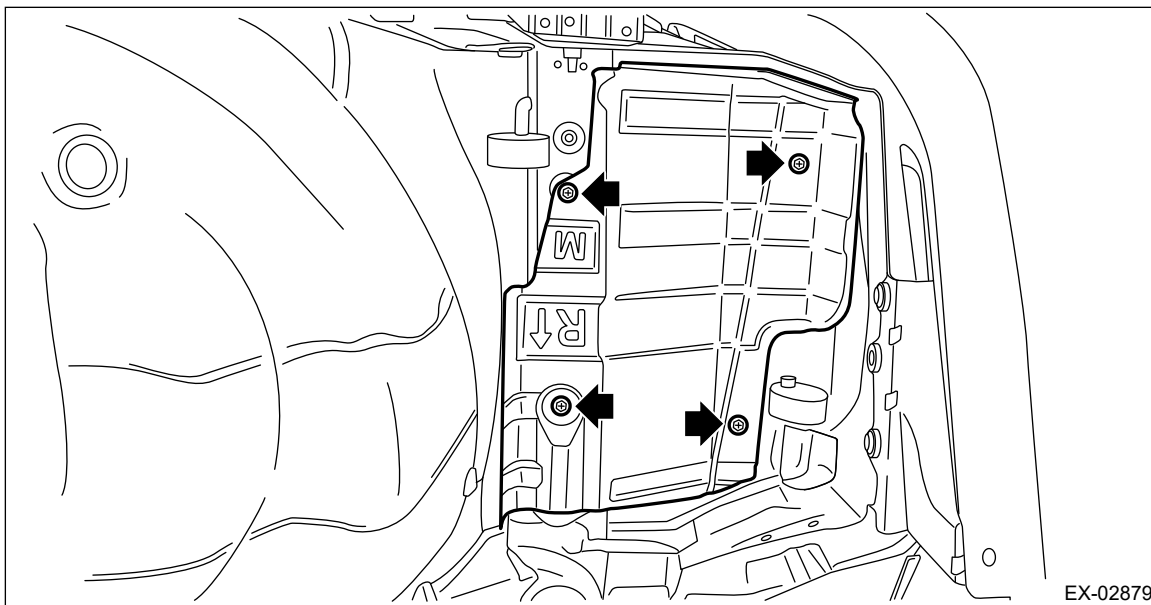
Install in the reverse order of removal.

Note:

- Use a new gasket and self-locking nut.
- After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

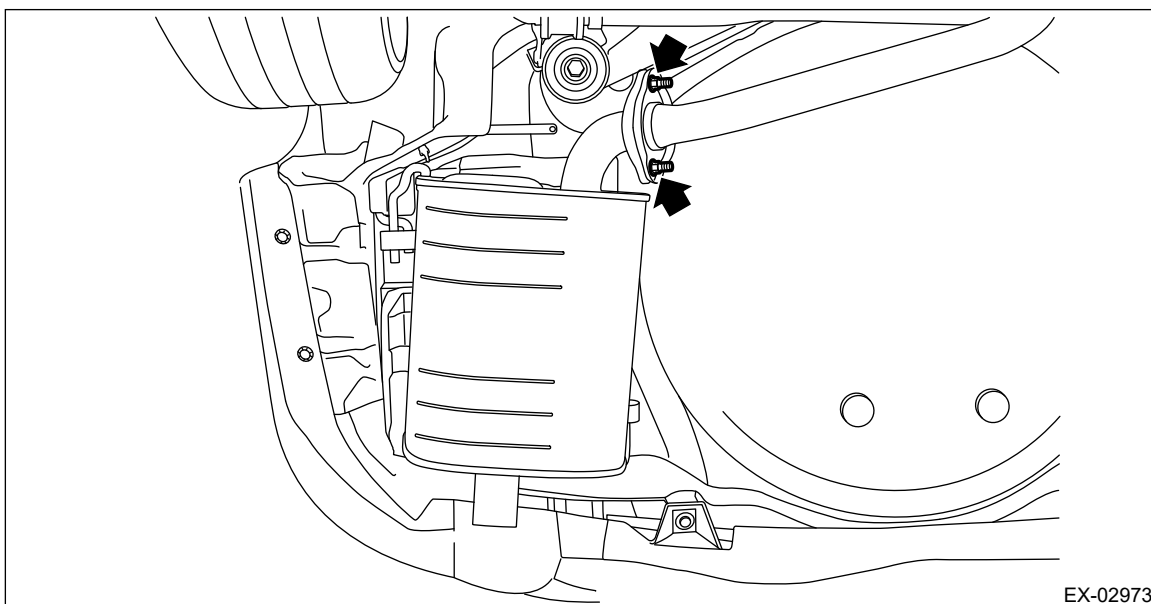
Tightening torque:

10 N·m (1.0 kgf-m, 7.4 ft-lb)



Tightening torque:

48 N·m (4.9 kgf-m, 35.4 ft-lb)



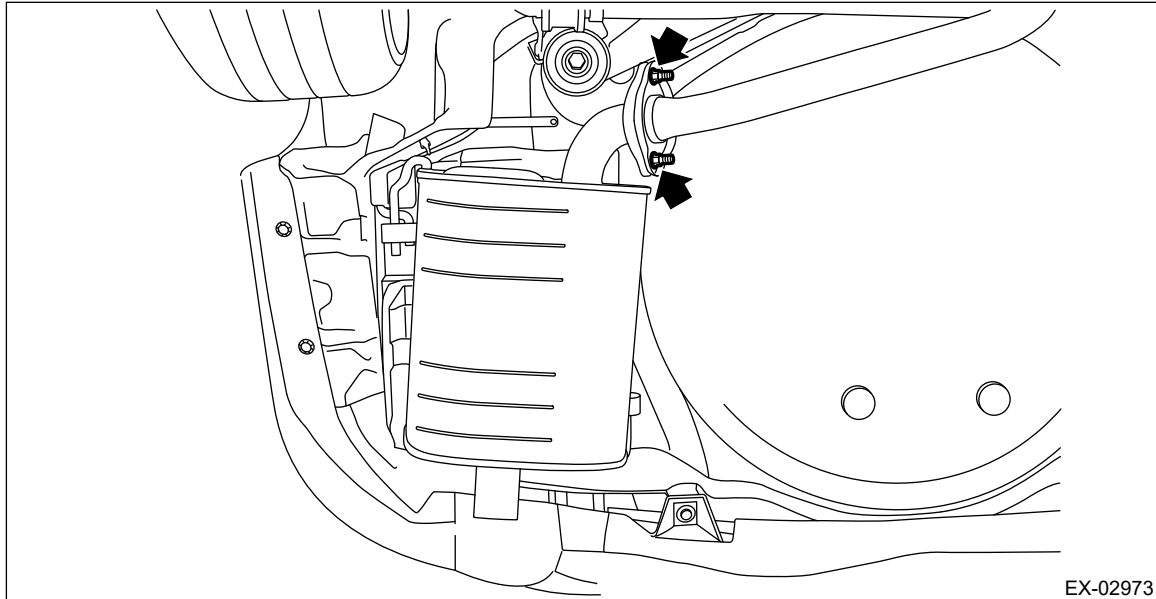
EXHAUST(H4DO) > Muffler

REMOVAL

Caution:

Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

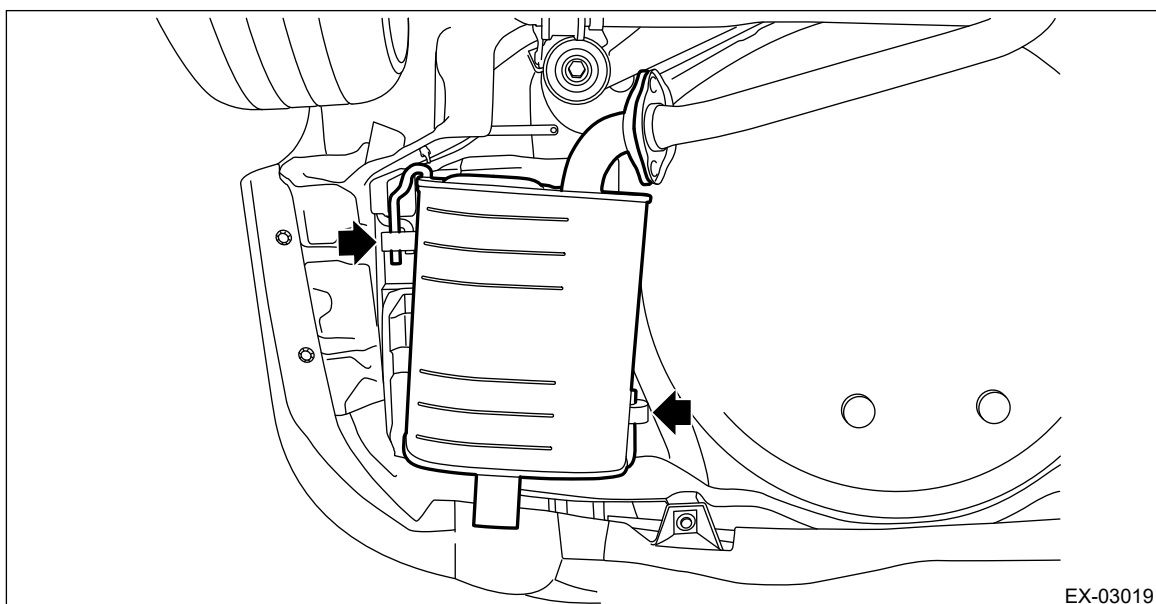
1. Lift up the vehicle.
2. Remove the bolts and self-locking nuts which secure the rear exhaust pipe to the muffler.



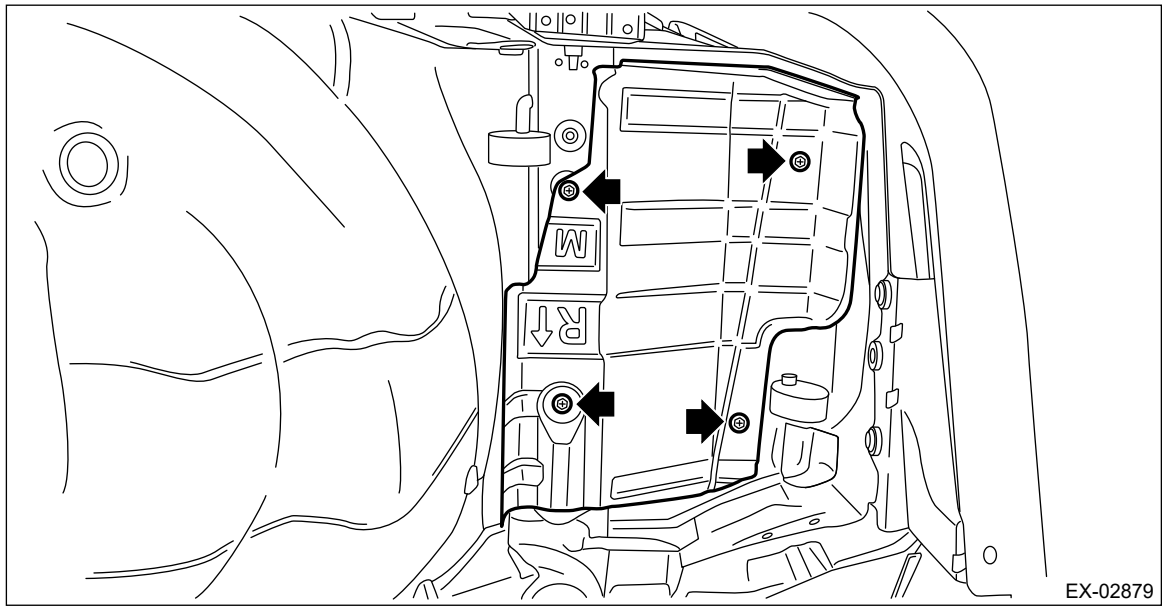
3. Apply a coat of spray type lubricant to the mating area of cushion rubber.
4. Remove the muffler from the cushion rubber.

Caution:

Be careful not to drop the muffler during removal.



5. Remove the heat shield cover from the vehicle.



EX-02879

EXHAUST(H4DO) > Rear Exhaust Pipe

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.
- 3.** Check the cushion rubber for wear or crack.

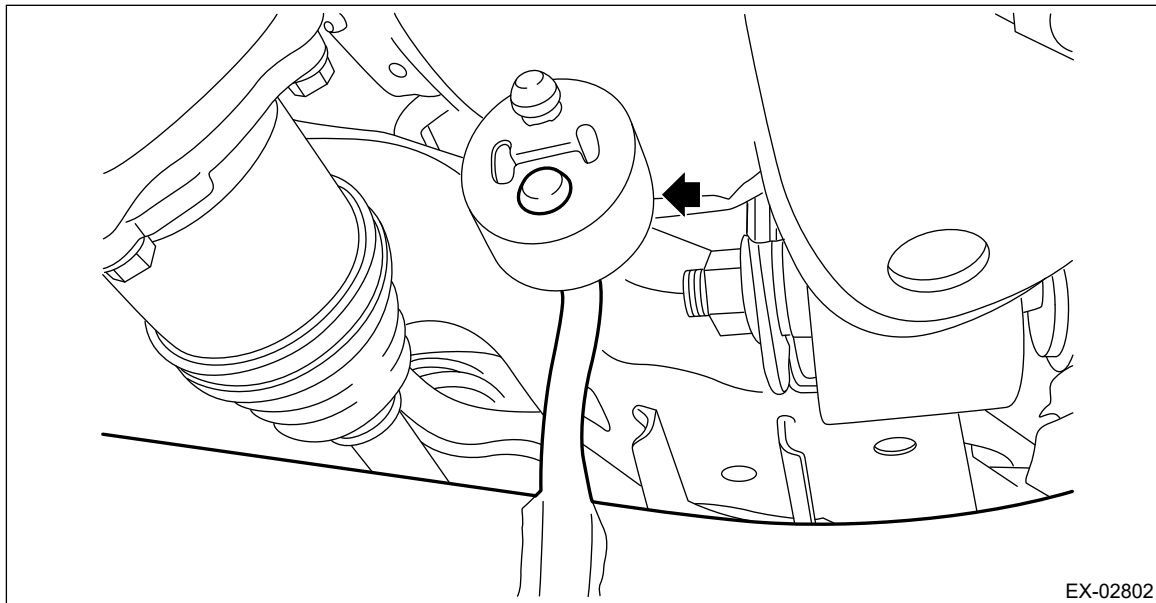
EXHAUST(H4DO) > Rear Exhaust Pipe

INSTALLATION

1. Apply a coat of spray type lubricant to the mating area of cushion rubber.
2. Install the rear exhaust pipe to cushion rubber.

Note:

After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.



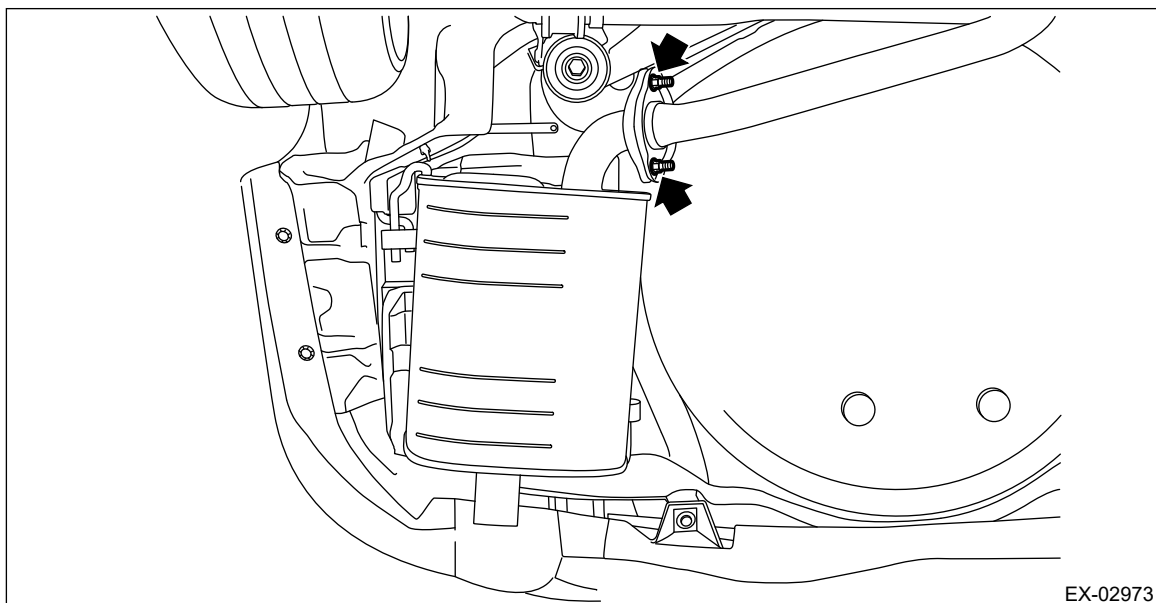
3. Install the bolts and self-locking nuts which secure the muffler to the rear exhaust pipe.

Note:

Use a new gasket and self-locking nut.

Tightening torque:

48 N•m (4.9 kgf-m, 35.4 ft-lb)



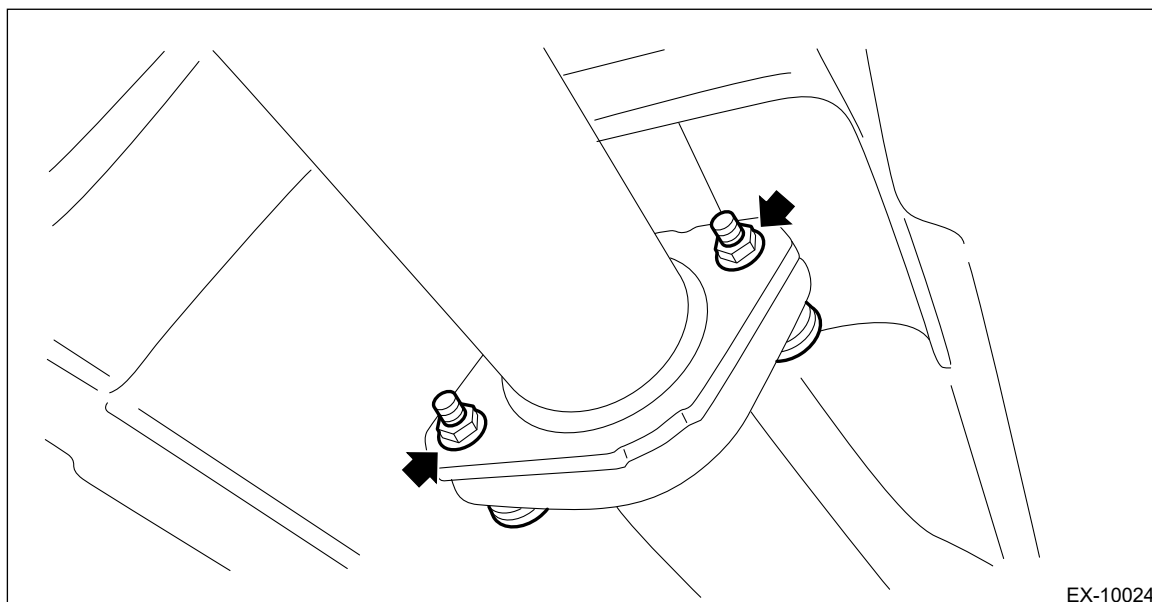
4. Install the bolts, springs, and nuts which secure the center exhaust pipe to the rear exhaust pipe.

Note:

Use a new gasket.

Tightening torque:

18 N•m (1.8 kgf-m, 13.3 ft-lb)



EX-10024

5. Lower the vehicle.

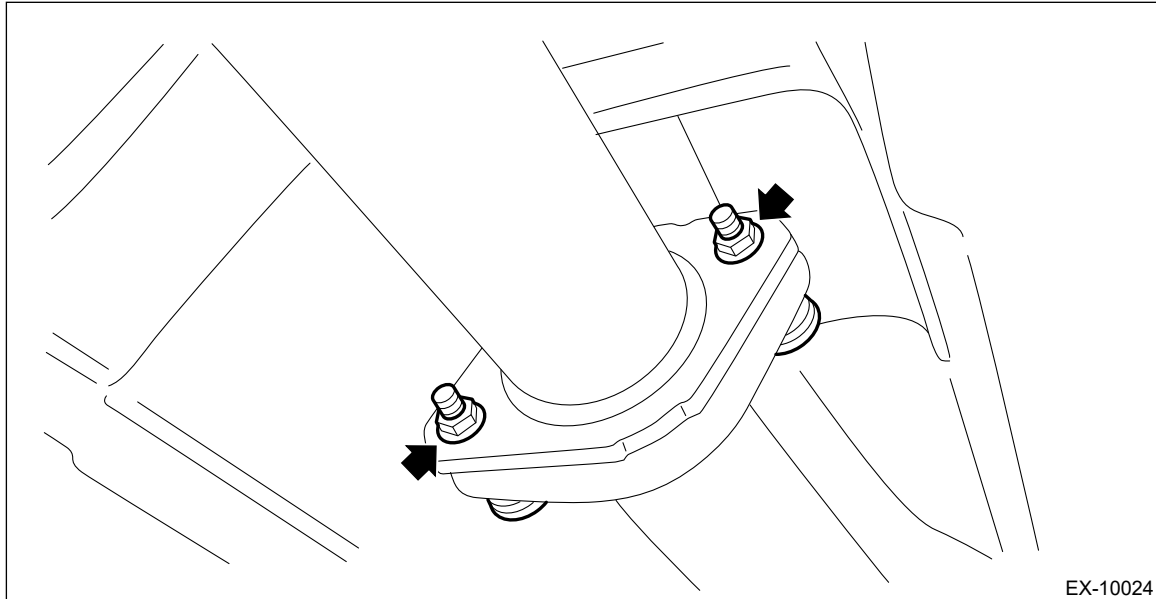
EXHAUST(H4DO) > Rear Exhaust Pipe

REMOVAL

Caution:

Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

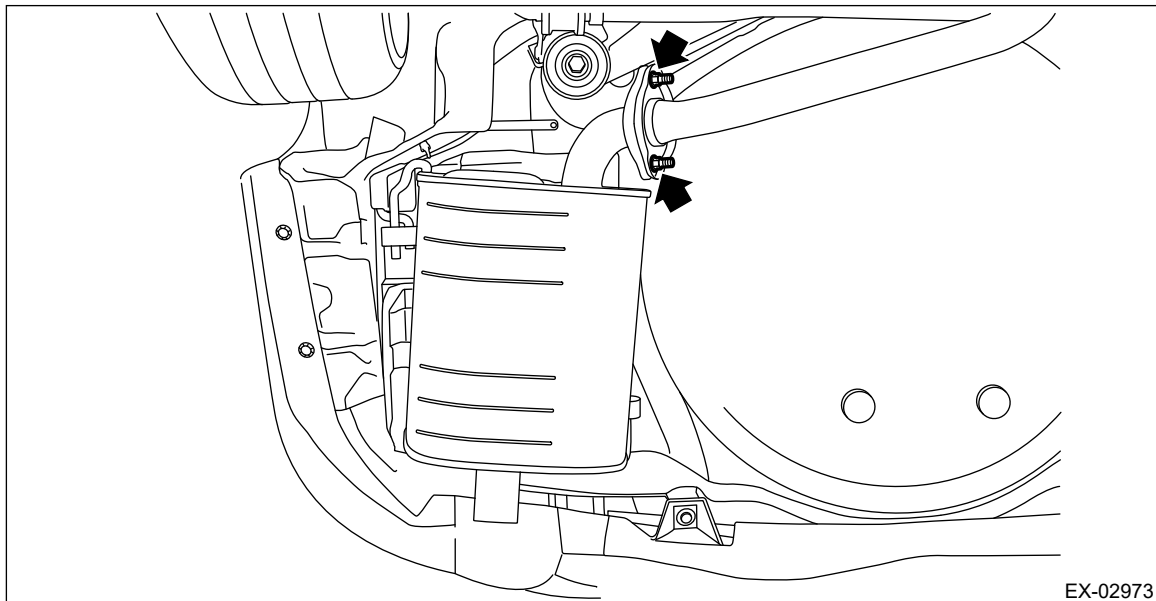
1. Lift up the vehicle.
2. Remove the bolts, springs, and nuts securing the rear exhaust pipe to the center exhaust pipe.



3. Remove the bolts and self-locking nuts securing the mufflers to the rear exhaust pipes.

Caution:

Be careful not to drop the rear exhaust pipe.

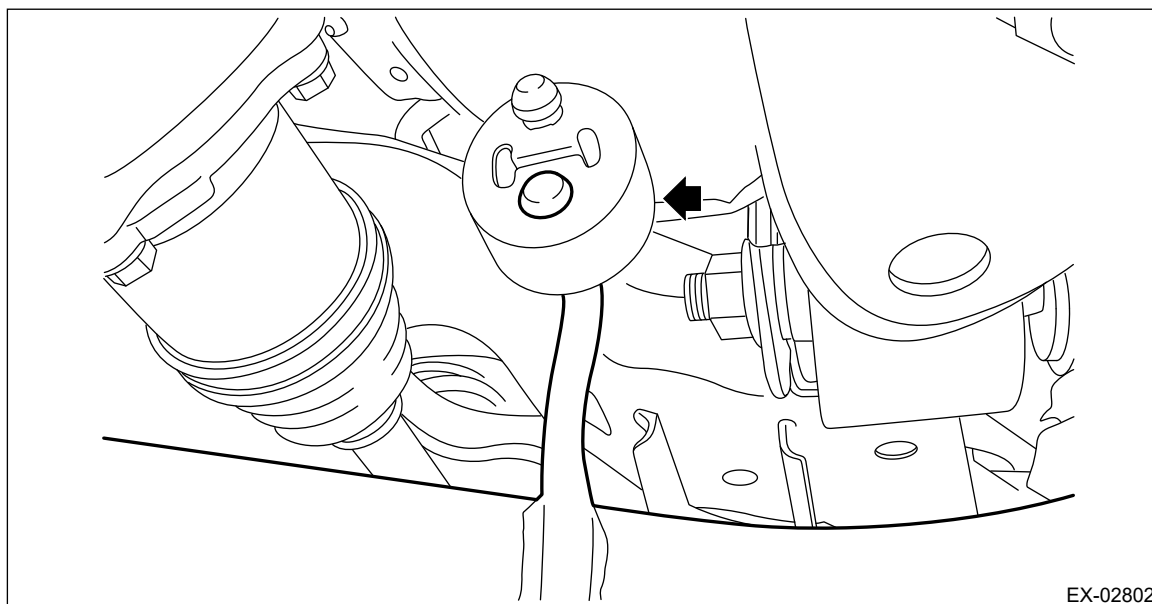


4. Apply a coat of spray type lubricant to the mating area of cushion rubber.

5. Remove the rear exhaust pipe from the cushion rubber.

Caution:

Be careful not to let the muffler contact the rear bumper.



EXHAUST(H4DOTC) > Center Exhaust Pipe

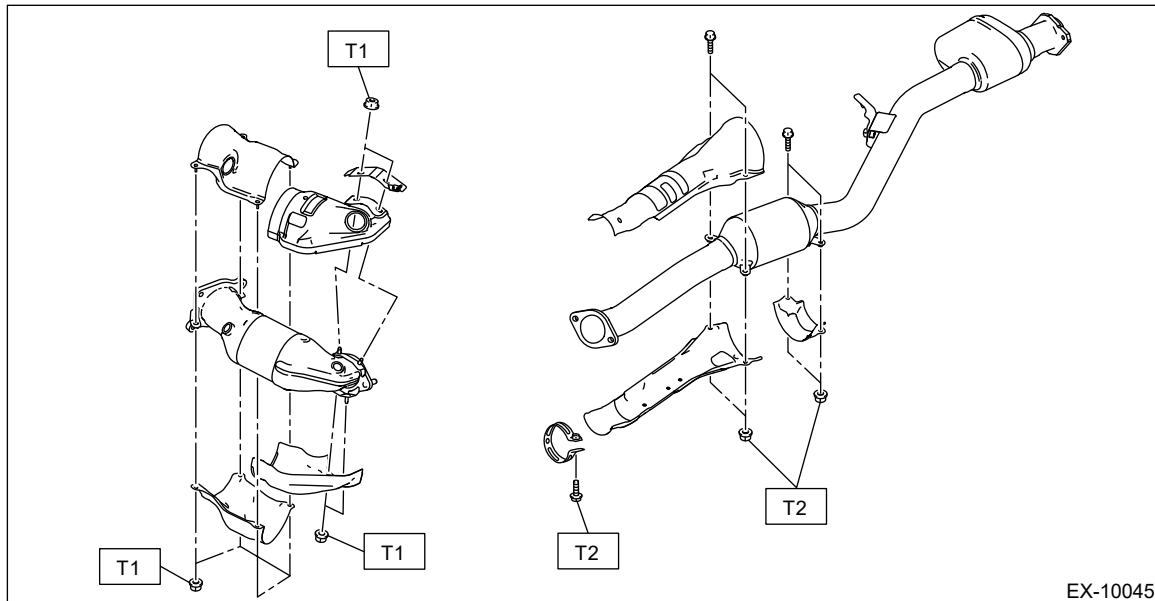
ASSEMBLY



1. Install the exhaust pipe cover to the center exhaust pipe (front) and center exhaust pipe (rear).

Tightening torque:

T1: 7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



T2: 13 N·m (1.3 kgf-m, 9.6 ft-lb)

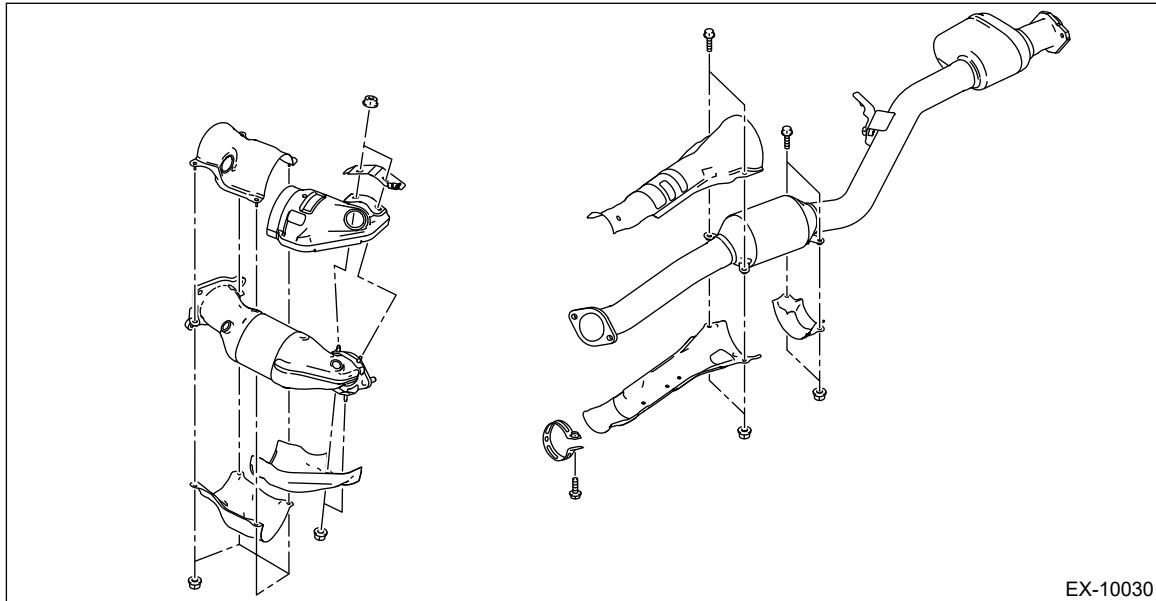


2. Install the front oxygen (A/F) sensor and rear oxygen sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Front Oxygen \(A/F\) Sensor>INSTALLATION.](#)  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Rear Oxygen Sensor>INSTALLATION.](#)

EXHAUST(H4DOTC) > Center Exhaust Pipe

DISASSEMBLY

1. Remove the front oxygen (A/F) sensor and rear oxygen sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Front Oxygen \(A/F\) Sensor>REMOVAL.](#)  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Rear Oxygen Sensor>REMOVAL.](#)
2. Remove the exhaust pipe cover from the center exhaust pipe (front) and center exhaust pipe (rear).



EXHAUST(H4DOTC) > Center Exhaust Pipe

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.

EXHAUST(H4DOTC) > Center Exhaust Pipe

INSTALLATION

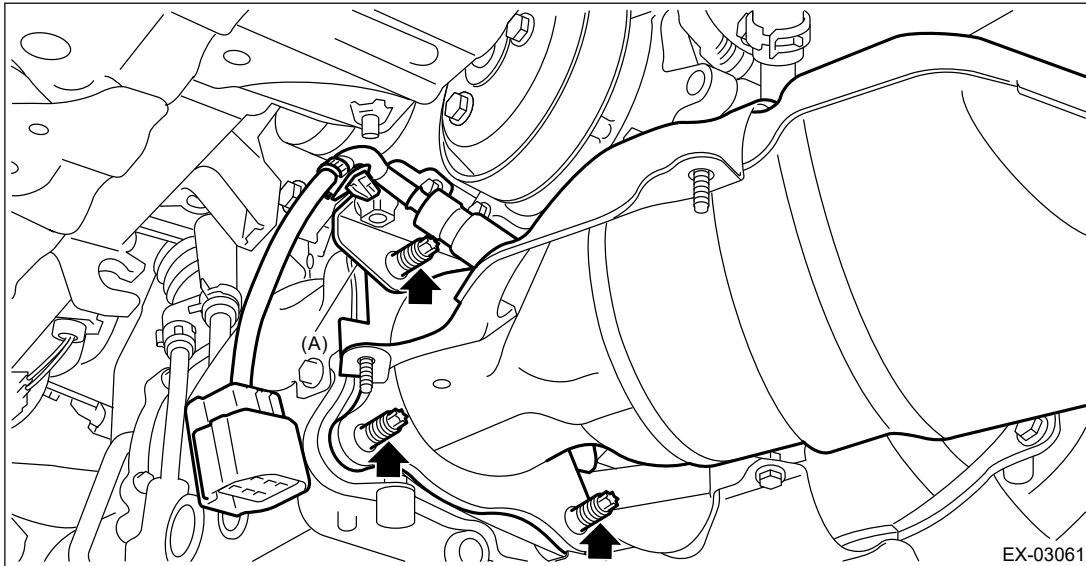
1. Set the center exhaust pipe (front) together with turbocharger upper stay (A), and install stud bolts (3 places) to the turbocharger by using the TORX® socket E10.

Note:

Use a new gasket.

Tightening torque:

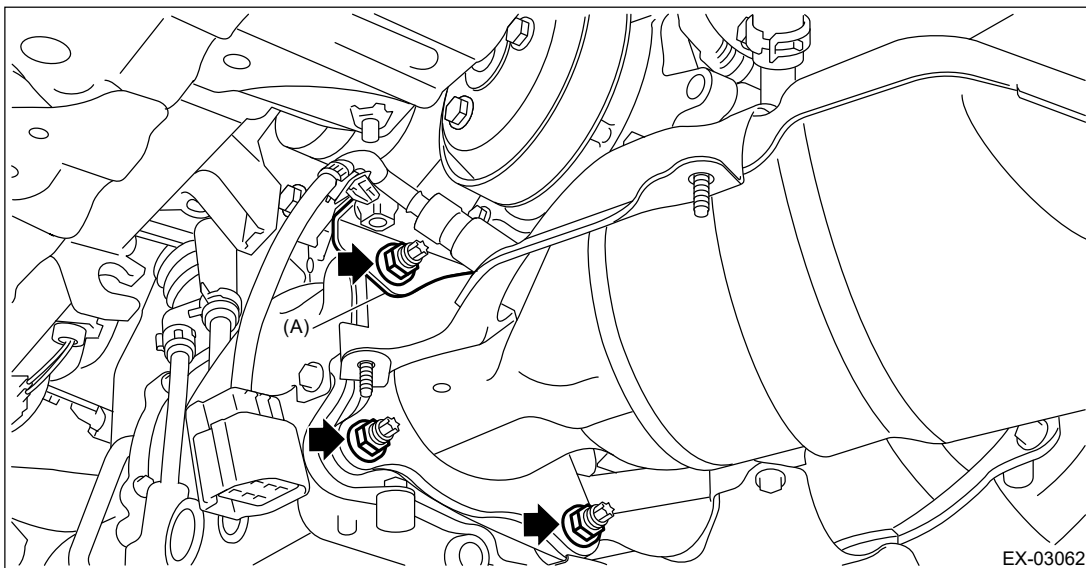
14.7 N·m (1.5 kgf-m, 10.8 ft-lb)



2. Temporarily tighten the nuts (3 places) which secure the center exhaust pipe (front) to the turbocharger together with the turbocharger upper stay (A).

Note:

Use a new self-locking nut.



3. Using ST, install the nut (1 place) which secures the center exhaust pipe (front) to the turbocharger.

Note:

Use a new self-locking nut.

ST 18283AA010 WRENCH ADAPTER

Tightening torque:

Calculation formula

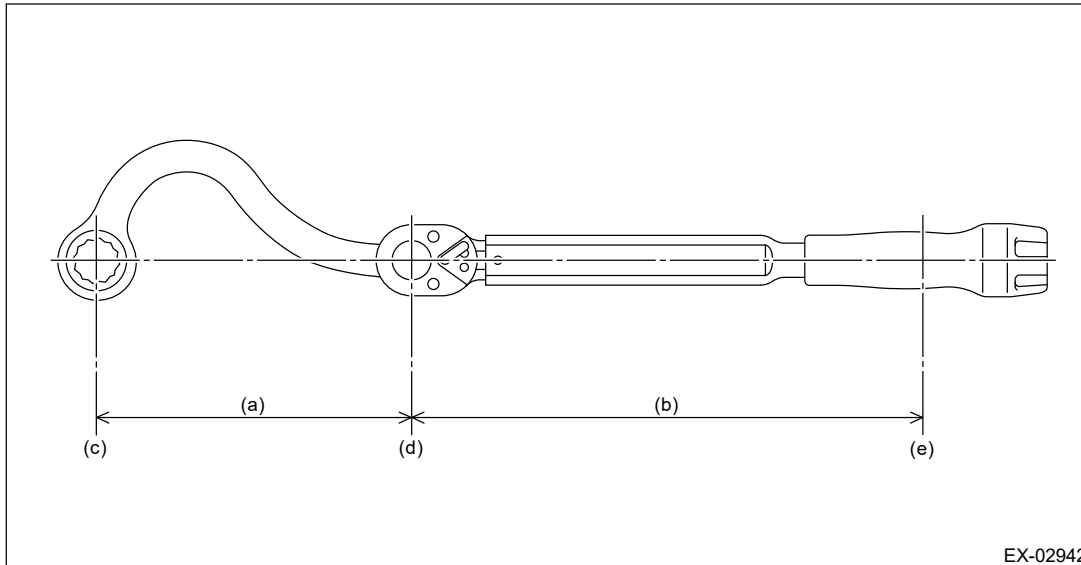
$$T = L / (120 \text{ mm (4.72 in)} + L) \times 42.5 \text{ N}\cdot\text{m (4.3 kgf}\cdot\text{m, 31.3 ft}\cdot\text{lb)}$$

T: Tightening torque

L: Effective length of torque wrench

Note:

If the effective length of the torque wrench used is unknown, consult the manufacturer of the torque wrench.



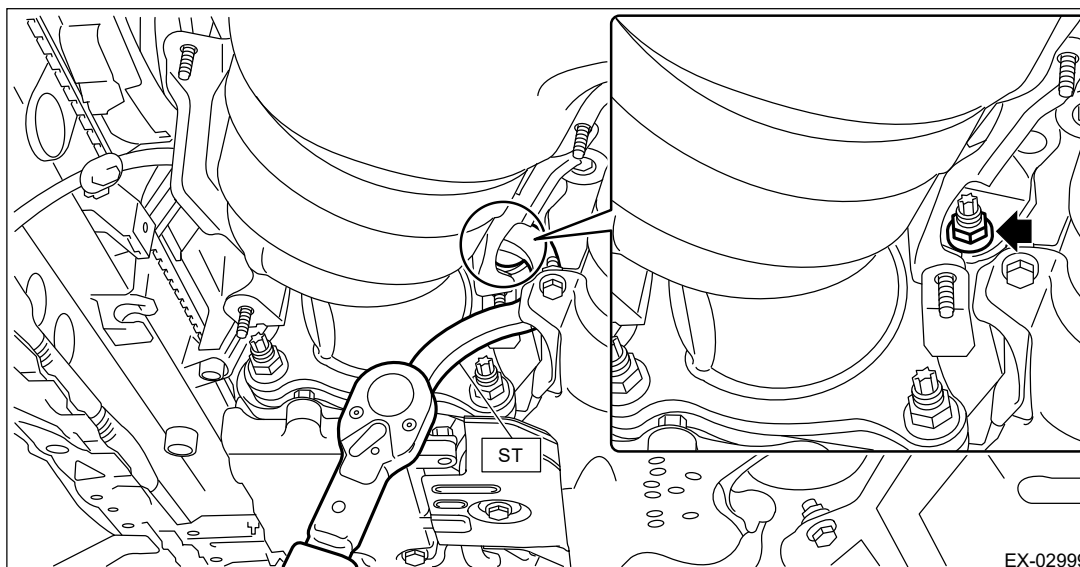
(a) Effective length of the ST

(b) Effective length of the torque wrench

(c) Center of drive angle of the ST

(d) Center of drive angle of the torque wrench

(e) Center of the position where a force is applied by hand

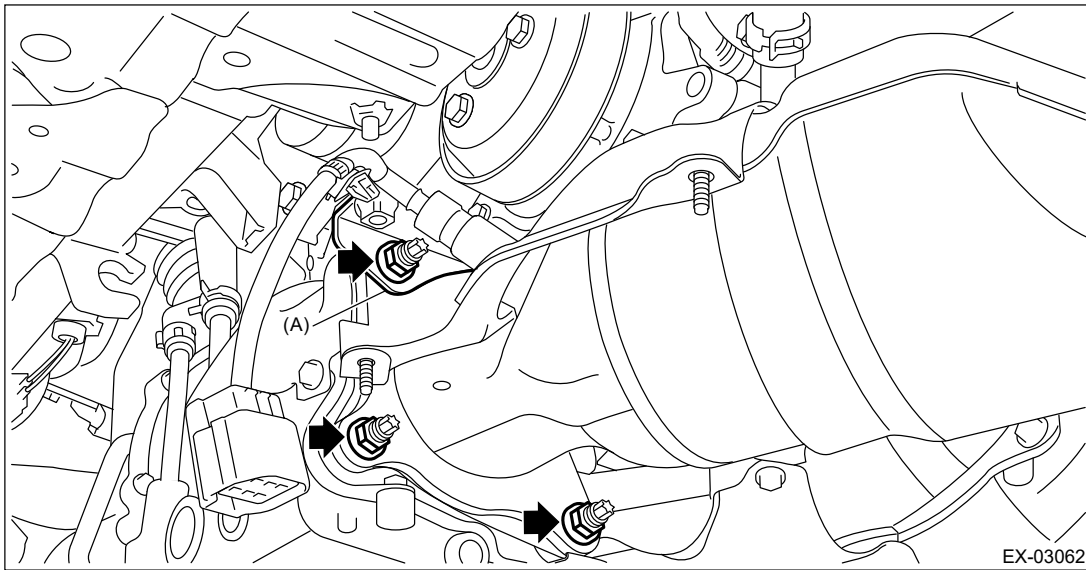


4. Temporarily tighten the nuts (3 places) which secure the center exhaust pipe (front) to the

turbocharger together with the turbocharger stay (A).

Tightening torque:

42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

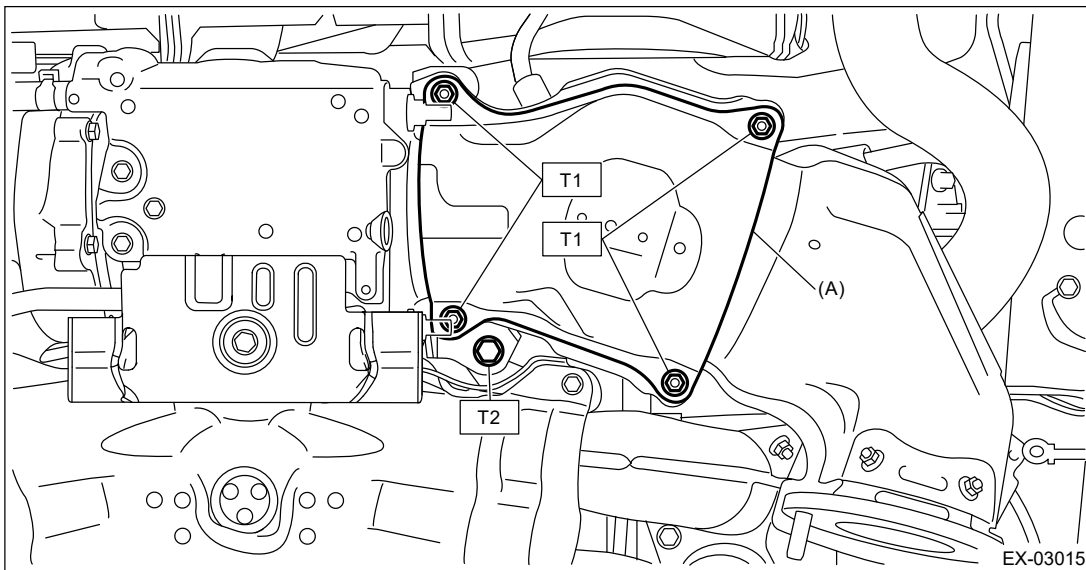


- 5.** Install the bolt which secures the turbocharger stay, and install the exhaust pipe cover (A) to the center exhaust pipe (front).

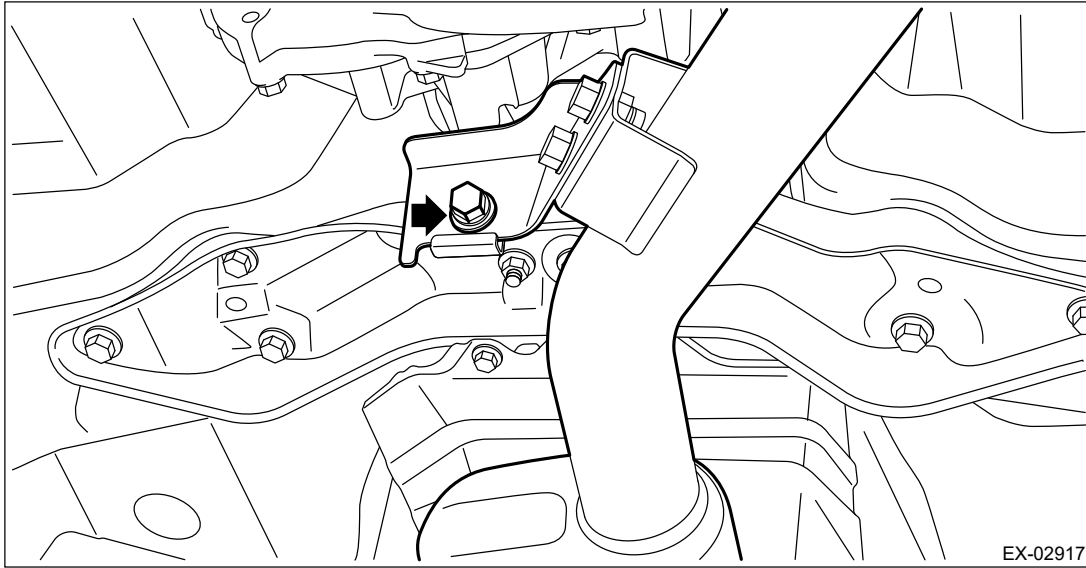
Tightening torque:

T1: 7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

T2: 33 N·m (3.4 kgf-m, 24.3 ft-lb)



- 6.** Install the center exhaust pipe (rear) and temporarily tighten the bolt which holds center exhaust pipe (rear) to the hanger bracket.



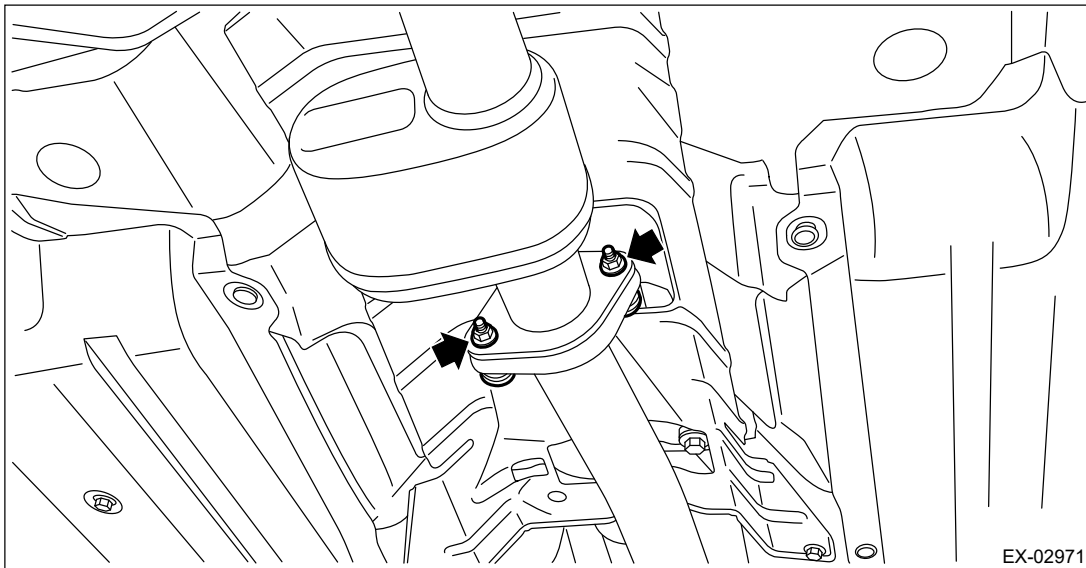
7. Install the bolts, springs, and nuts which secure the rear exhaust pipe to the center exhaust pipe (rear).

Note:

Use a new gasket.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



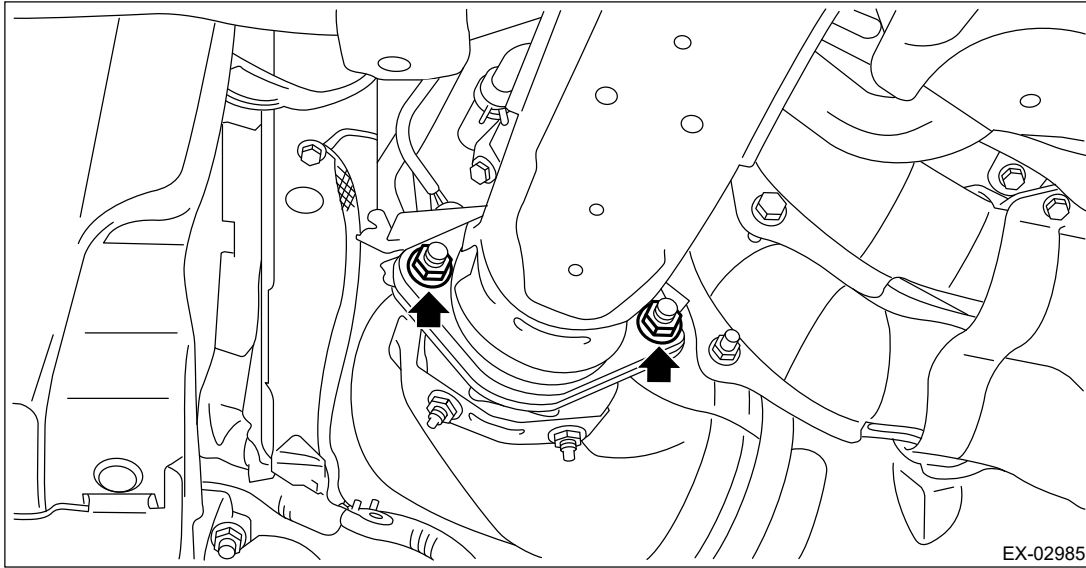
8. Install the nuts which secure the center exhaust pipe (front) to the center exhaust pipe (rear).

Note:

Use a new gasket.

Tightening torque:

42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

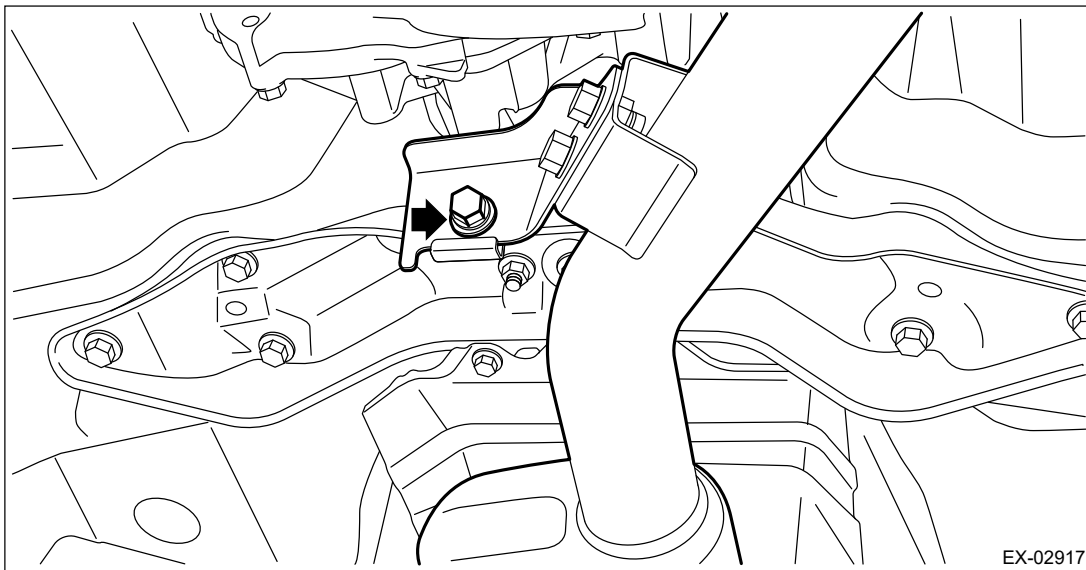


EX-02985

- 9.** Tighten the bolts which hold center exhaust pipe (rear) to the hanger bracket.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)



EX-02917

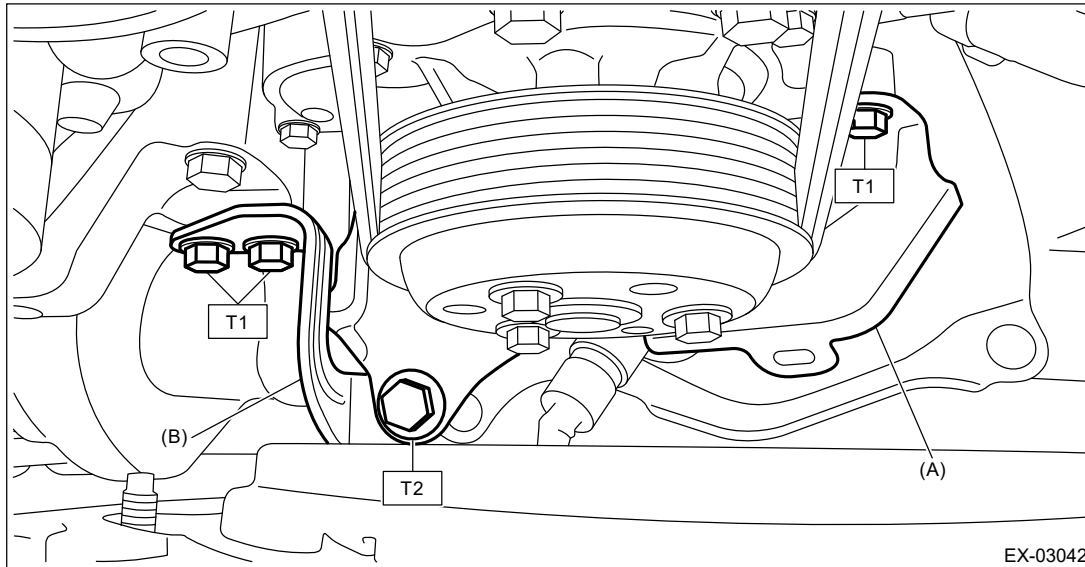
- 10.** Lower the vehicle.

- 11.** Install the exhaust pipe stay (B) and water pump pulley cover (A) to the turbocharger stay and water pump, and install the bolts which secure the water pump pulley cover (A) and exhaust pipe stay (B) to the turbocharger stay.

Tightening torque:

T1: 19 N·m (1.9 kgf-m, 14.0 ft-lb)

T2: 33 N·m (3.4 kgf-m, 24.3 ft-lb)

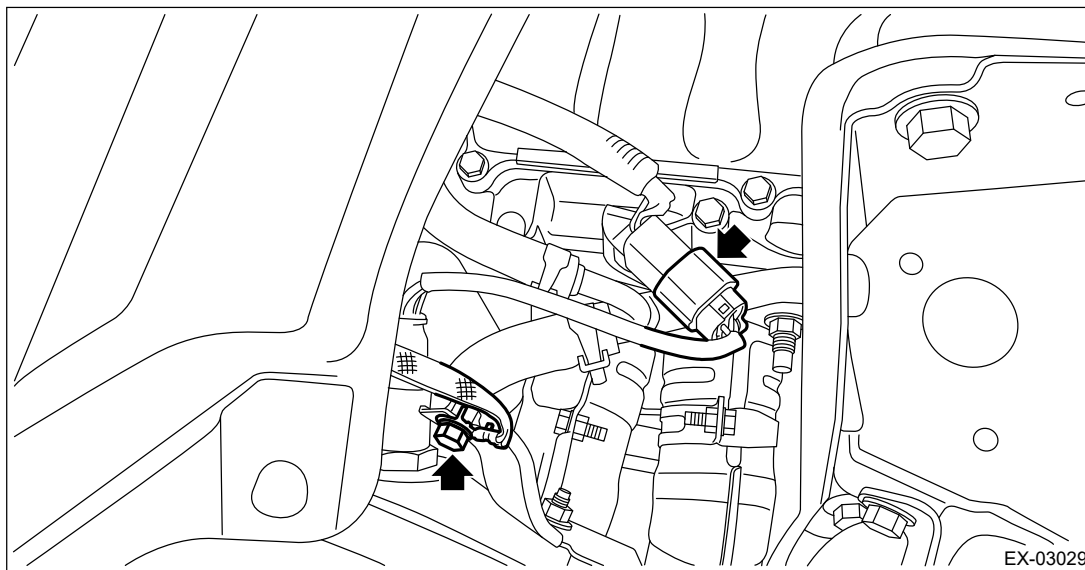


12. Lift up the vehicle.

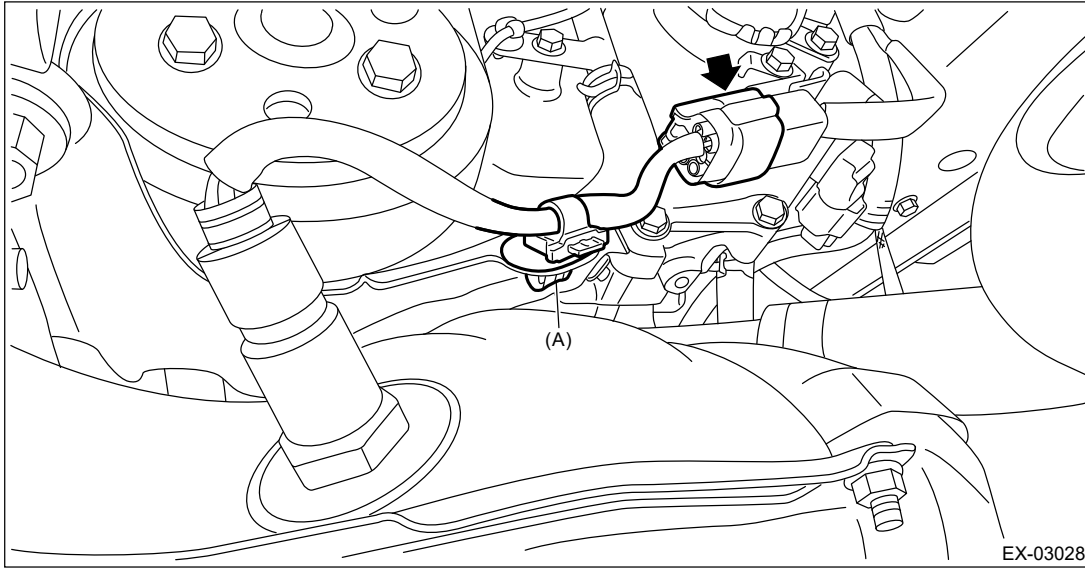
13. Connect the connector on the rear oxygen sensor to the engine harness, and connect the ground cable to the exhaust pipe cover.



Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



14. Secure the front oxygen (A/F) sensor harness to the water pump pulley cover with the clip (A), and connect the front oxygen (A/F) sensor connector to the engine harness.

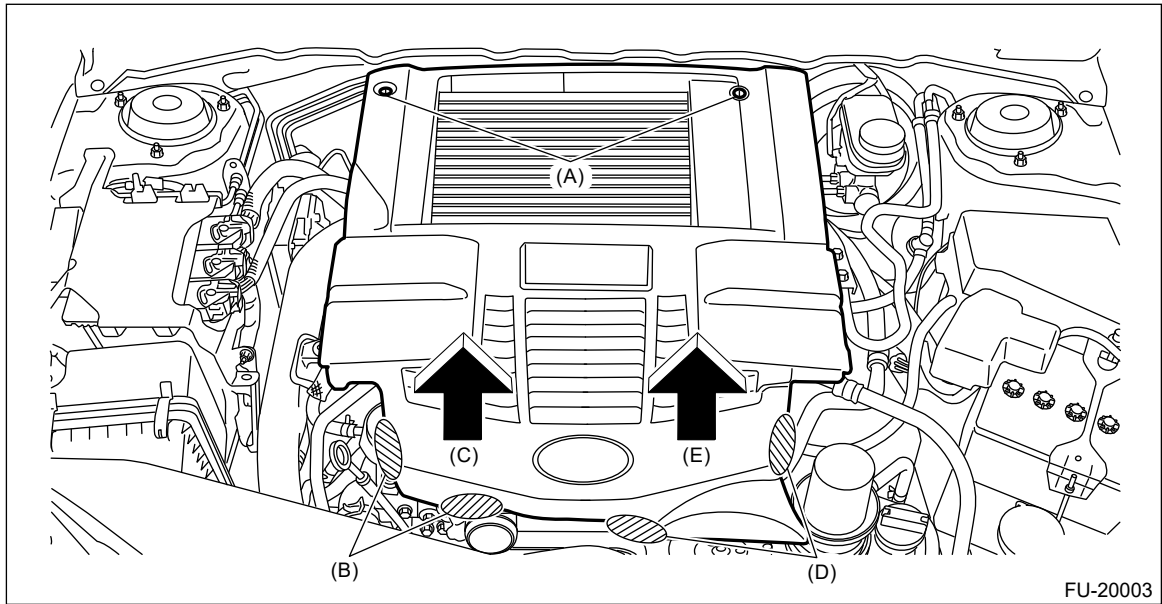




- 15.** Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
- 16.** Lower the vehicle.
- 17.** Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 18.** Install the collector cover.

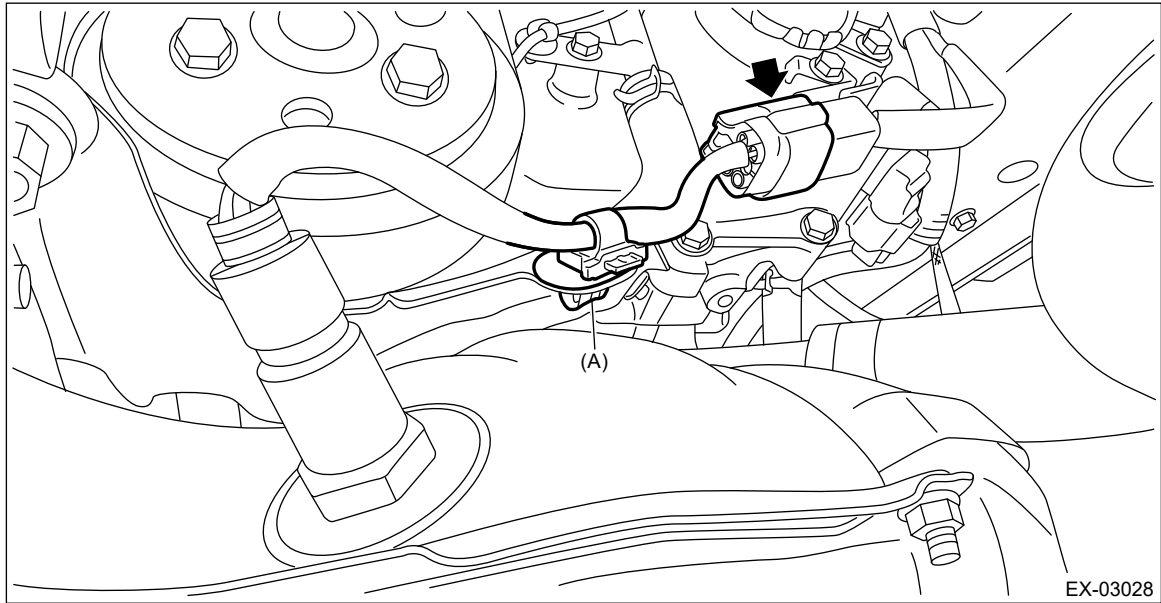
EXHAUST(H4DOTC) > Center Exhaust Pipe

REMOVAL

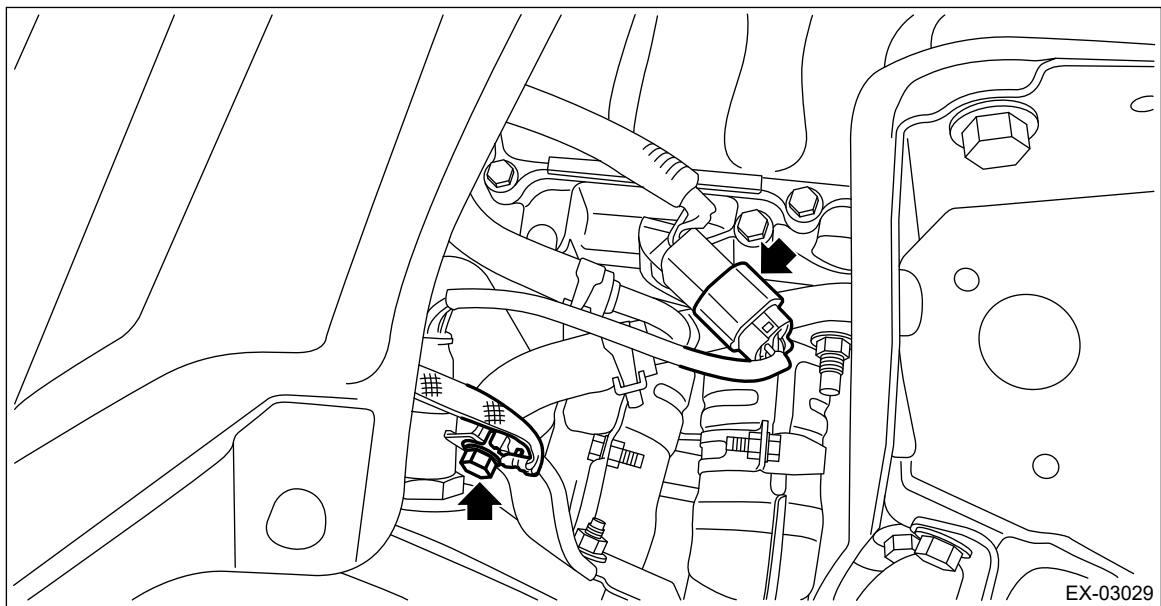
1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



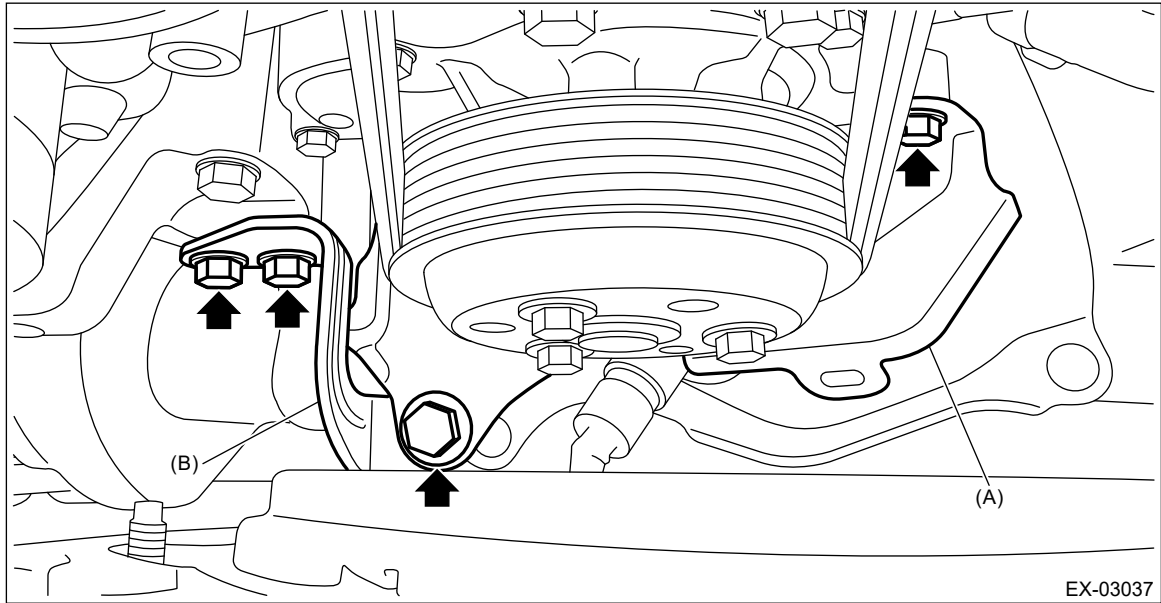
2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Lift up the vehicle.
4. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
5. Disconnect the connector on the front oxygen (A/F) sensor from the engine harness, and remove the clip (A) which secures the front oxygen (A/F) sensor harness to the water pump pulley cover.



6. Disconnect the connector on the rear oxygen sensor from the engine harness, and disconnect the ground cable from the exhaust pipe cover.

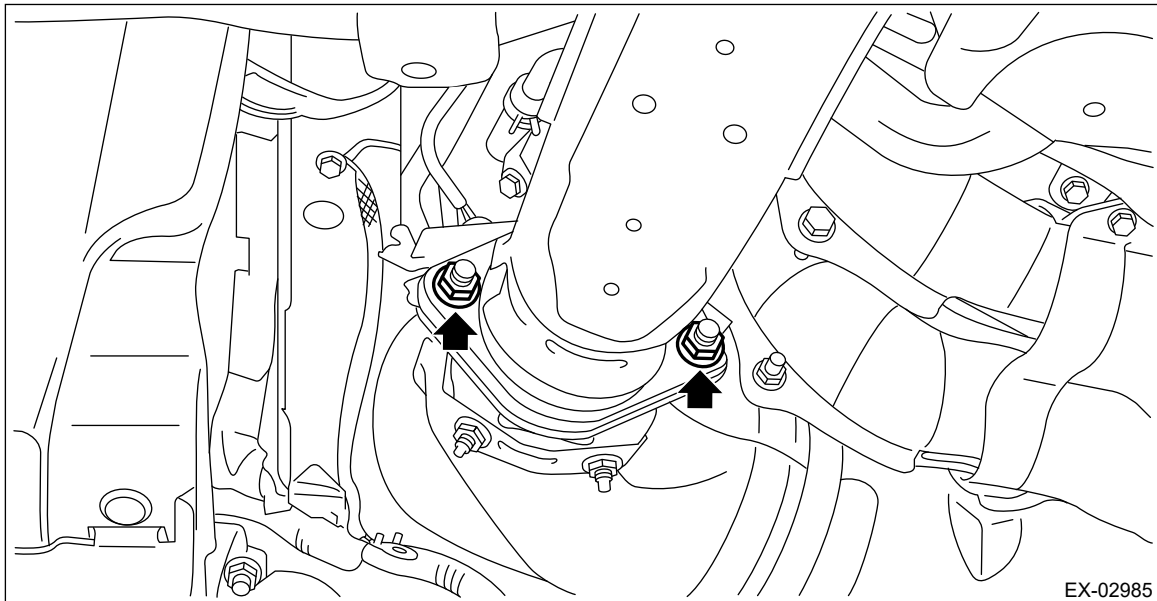


7. Lower the vehicle.
8. Remove the bolts which secure the water pump pulley cover (A) and exhaust pipe stay (B) to the turbocharger stay, and remove the water pump pulley cover (A) and exhaust pipe stay (B) from the water pump and turbocharger stay.

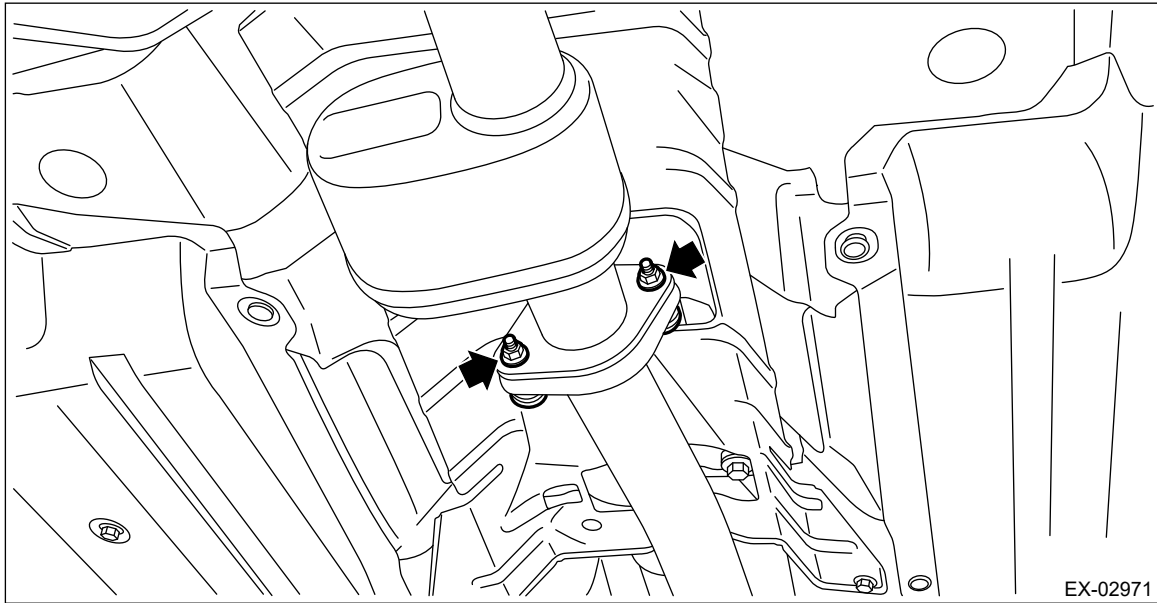


9. Lift up the vehicle.

10. Remove the nuts which secure the center exhaust pipe (rear) to the center exhaust pipe (front).



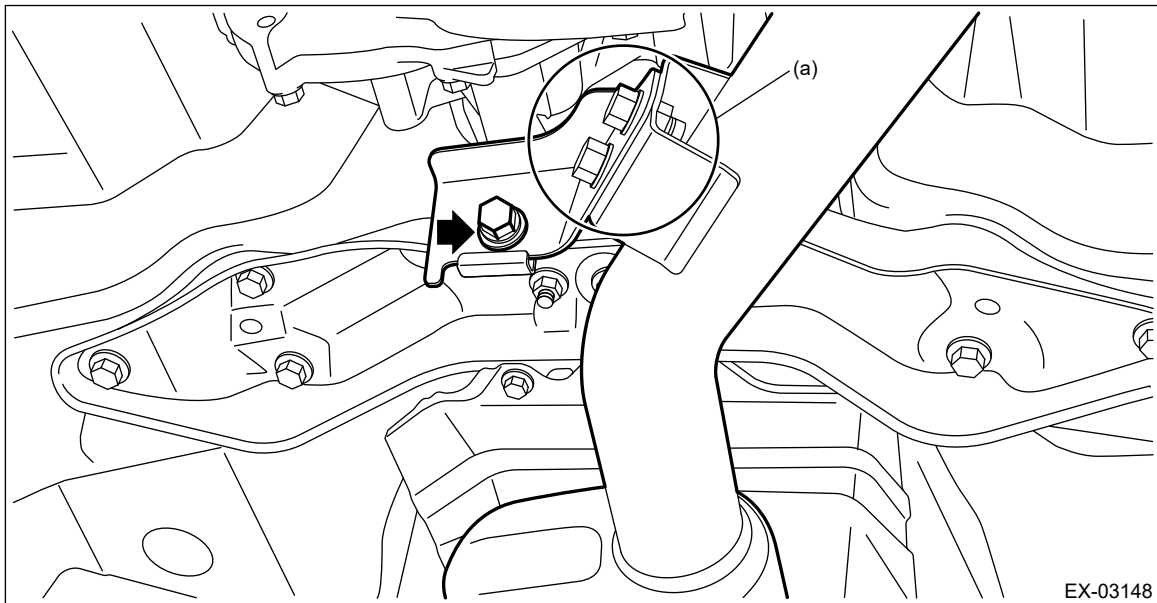
11. Remove the bolts, springs, and nuts which secure the rear exhaust pipe to the center exhaust pipe (rear).



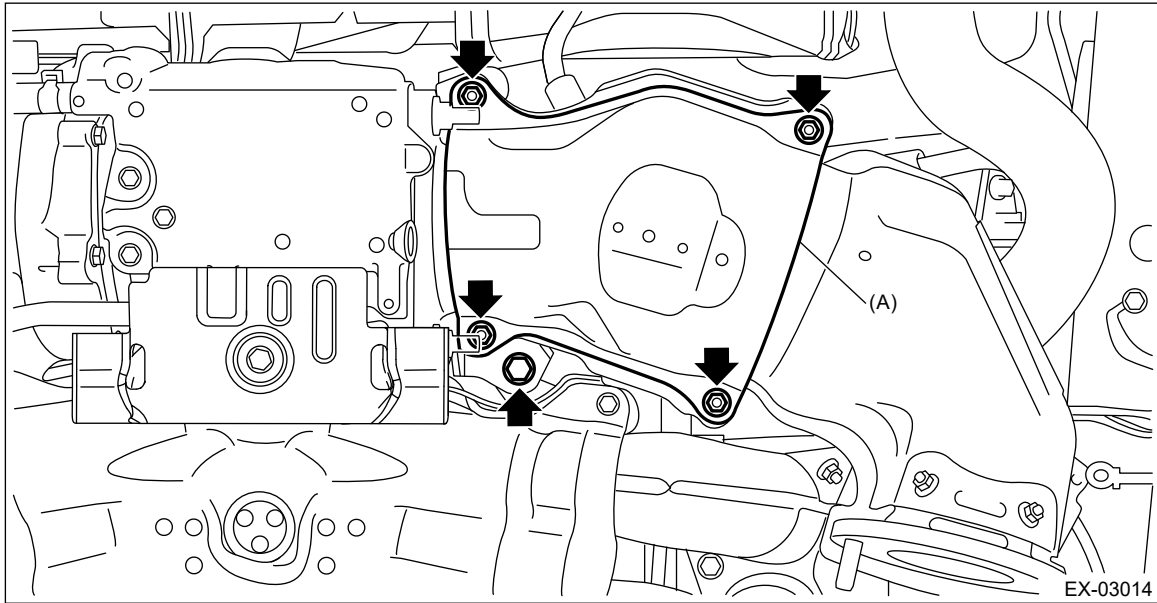
- 12.** Remove the bolt which holds center exhaust pipe (rear) to the hanger bracket, and remove the center exhaust pipe (rear).

Note:

Removing the exhaust pipe bracket from the center exhaust pipe (rear) will adversely affect the positioning accuracy. Therefore, do not remove the bolts in section (a) shown in the figure.

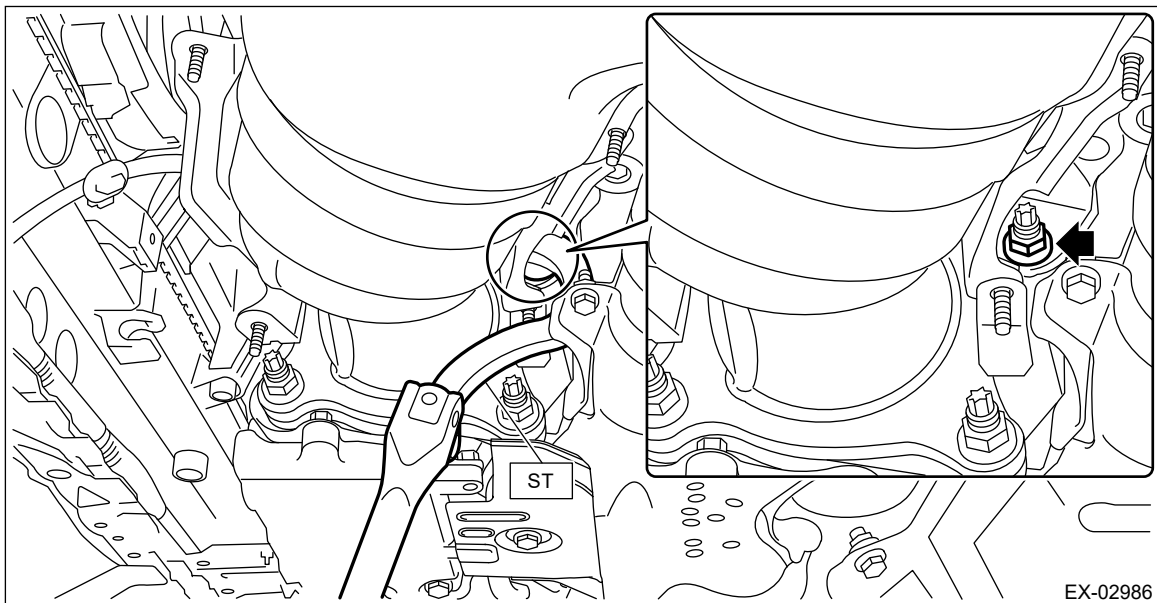


- 13.** Remove the exhaust pipe cover (A) from the center exhaust pipe (front), and remove the bolts which secure the turbocharger stay.

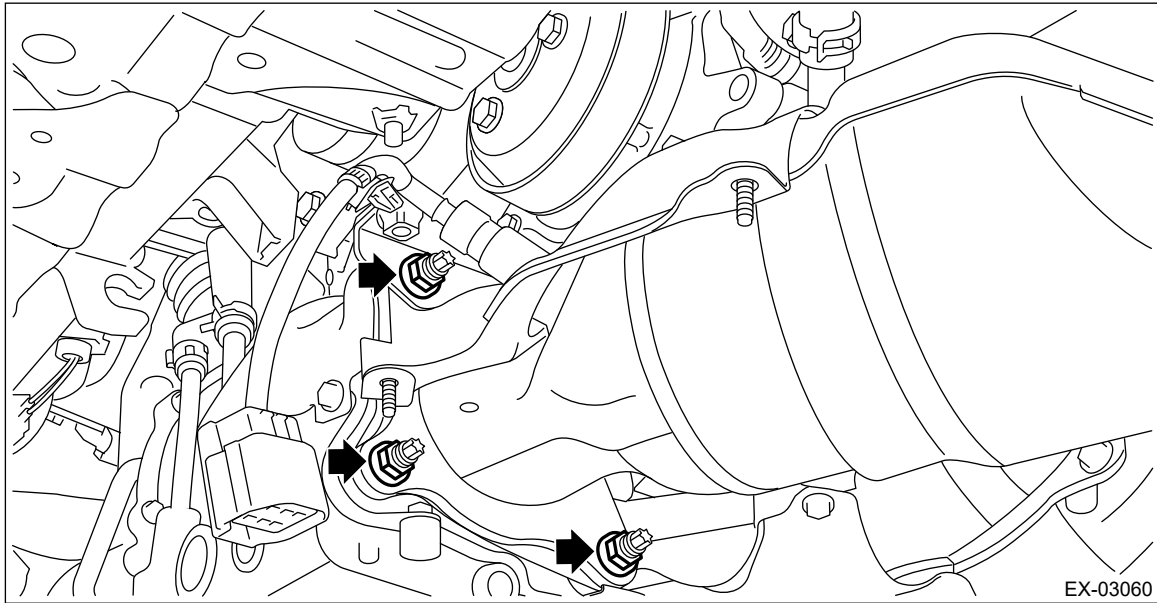


- 14.** Using ST, remove the nut (1 place) which secures the center exhaust pipe (front) to the turbocharger.

ST 18283AA010 WRENCH ADAPTER

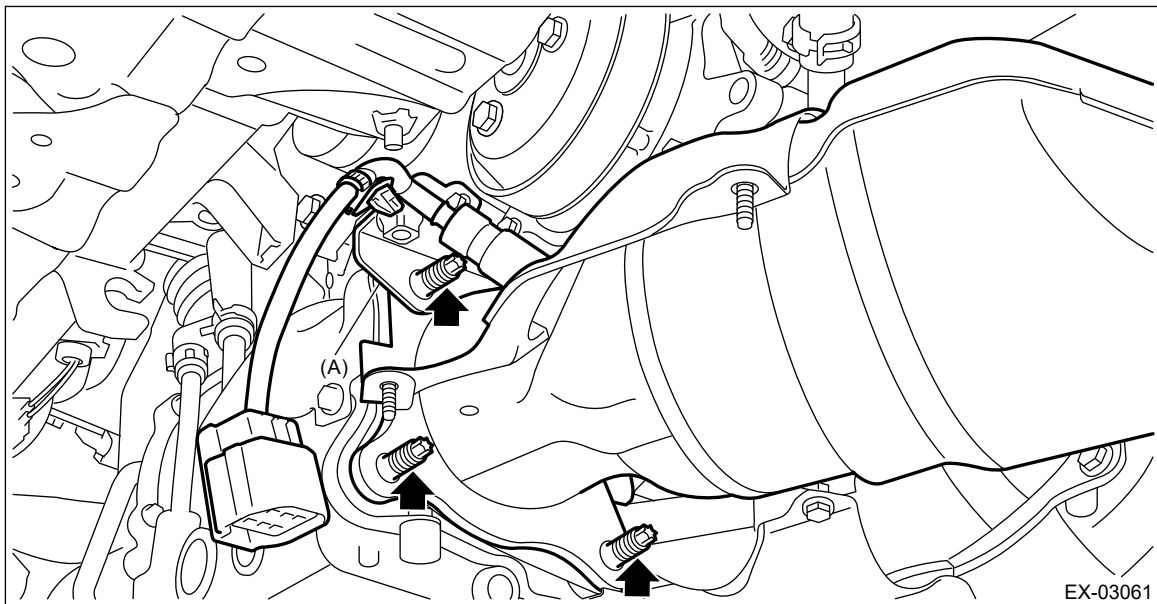


- 15.** Remove the nuts (3 places) which secure the center exhaust pipe (front) to the turbocharger.



EX-03060

- 16.** Using the TORX[®] socket E10, remove stud bolts (3 places) from the turbocharger, and remove the center exhaust pipe (front) together with turbocharger stay (A).



EX-03061

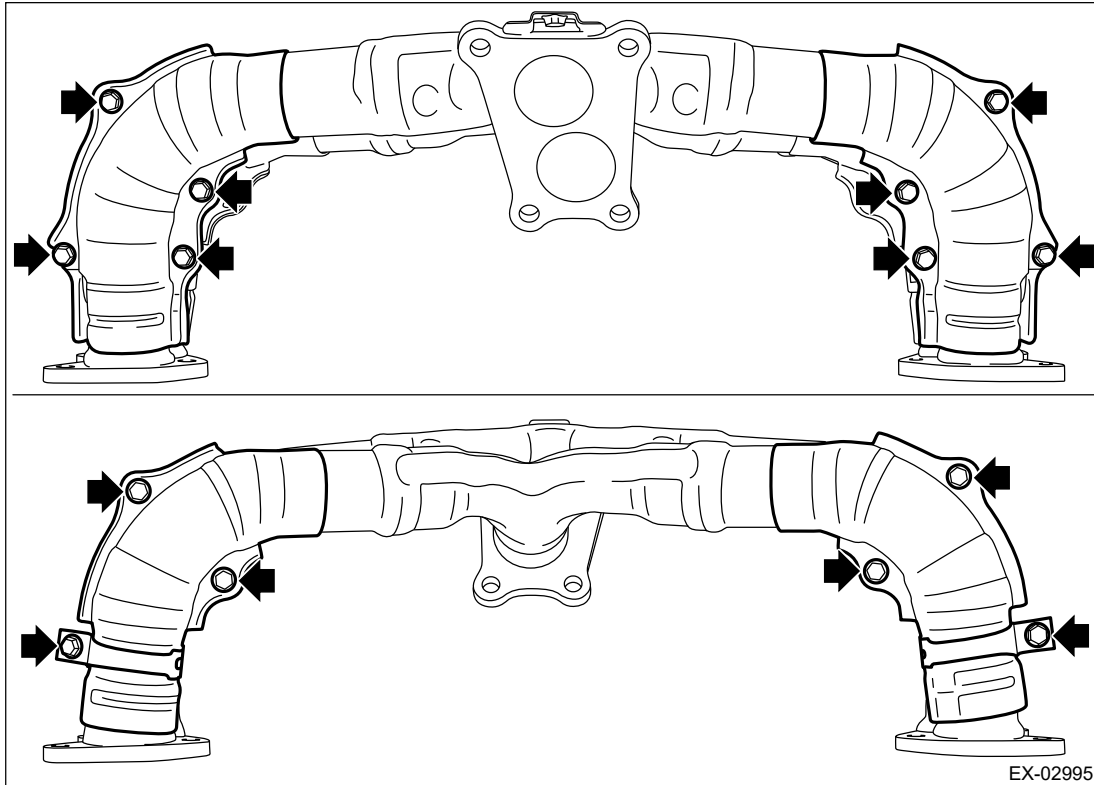
EXHAUST(H4DOTC) > Front Exhaust Pipe

ASSEMBLY

1. Install the exhaust pipe cover to the front exhaust pipe.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



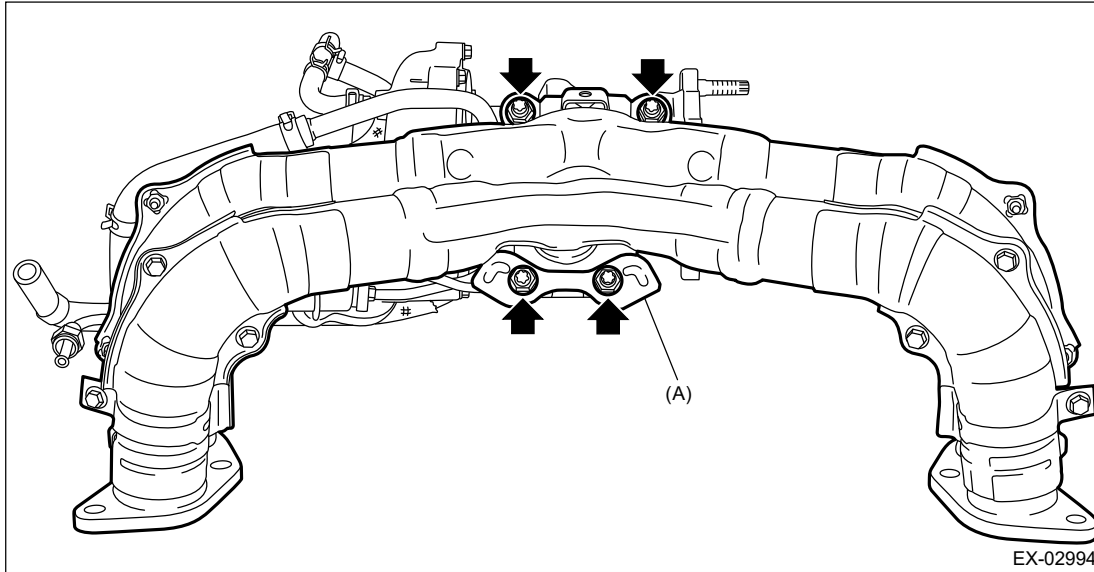
2. Install the front exhaust pipe together with the turbocharger stay (A) to the turbocharger.

Note:

Use a new gasket and self-locking nut.

Tightening torque:

42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

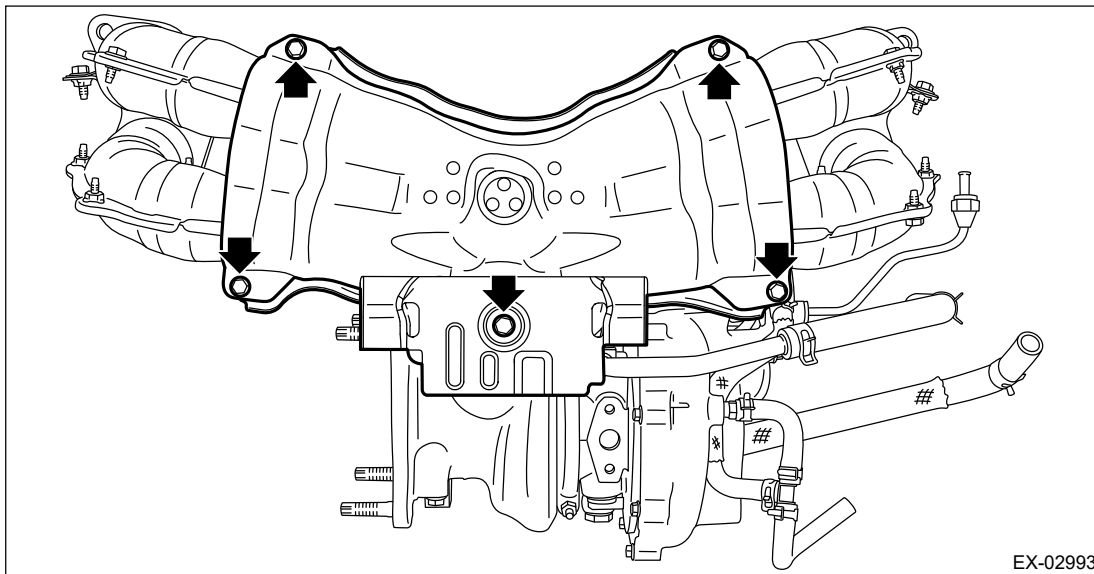


EX-02994

- 3.** Install the exhaust pipe cover to the front exhaust pipe.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



EX-02993

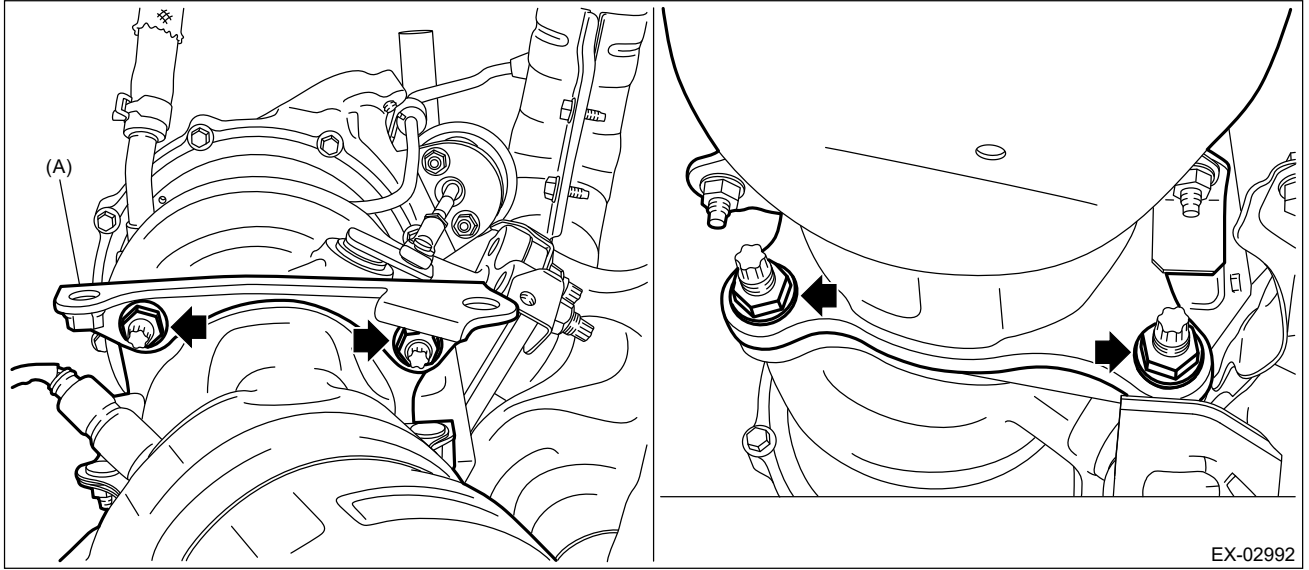
- 4.** Install the center exhaust pipe (front) together with the turbocharger stay (A) to the turbocharger.

Note:

Use a new gasket and self-locking nut.

Tightening torque:

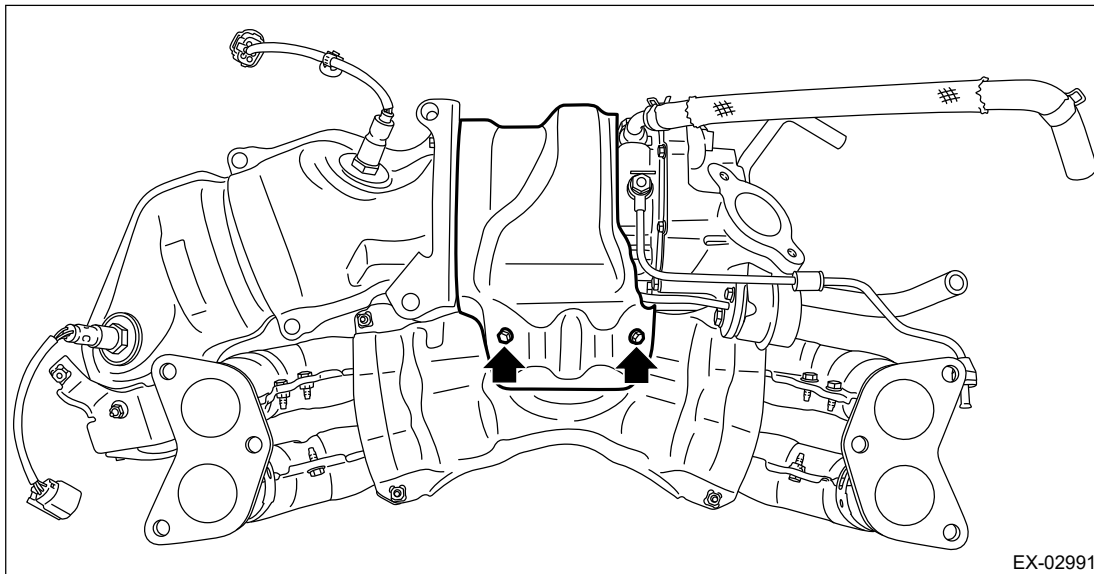
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



5. Install the exhaust pipe cover to the turbocharger stay.

Tightening torque:

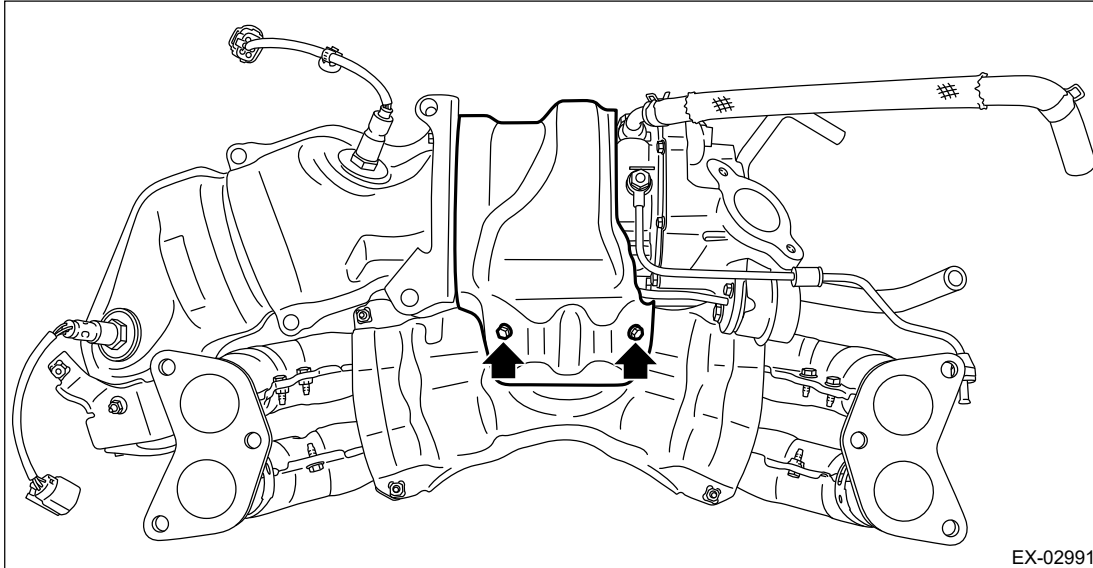
7.5 N·m (0.8 kgf·m, 5.5 ft-lb)



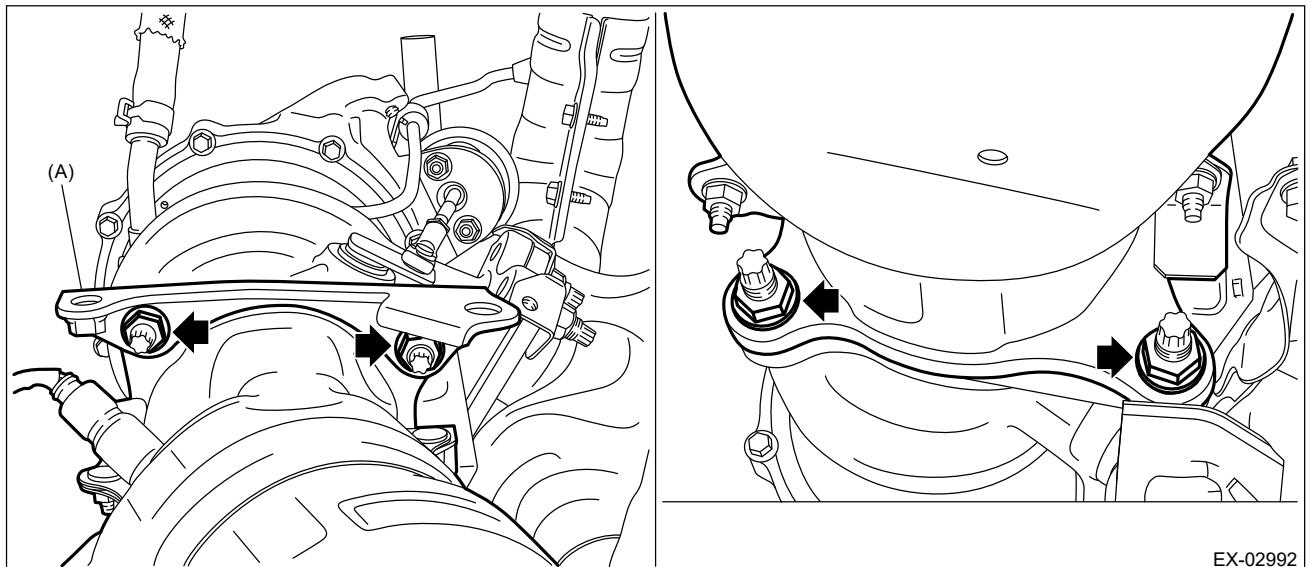
EXHAUST(H4DOTC) > Front Exhaust Pipe

DISASSEMBLY

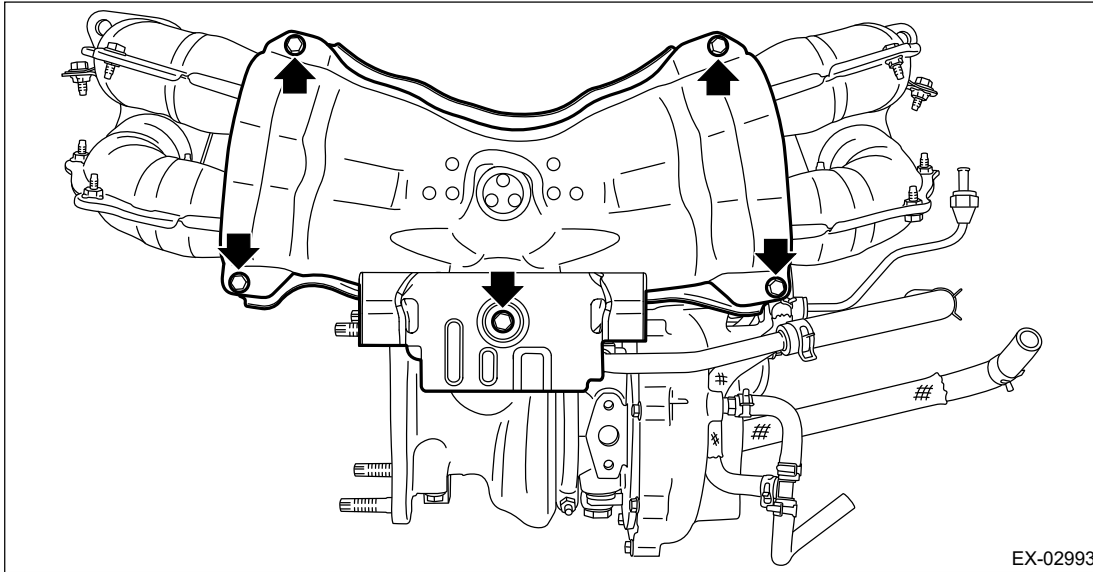
1. Remove the exhaust pipe cover from the turbocharger stay.



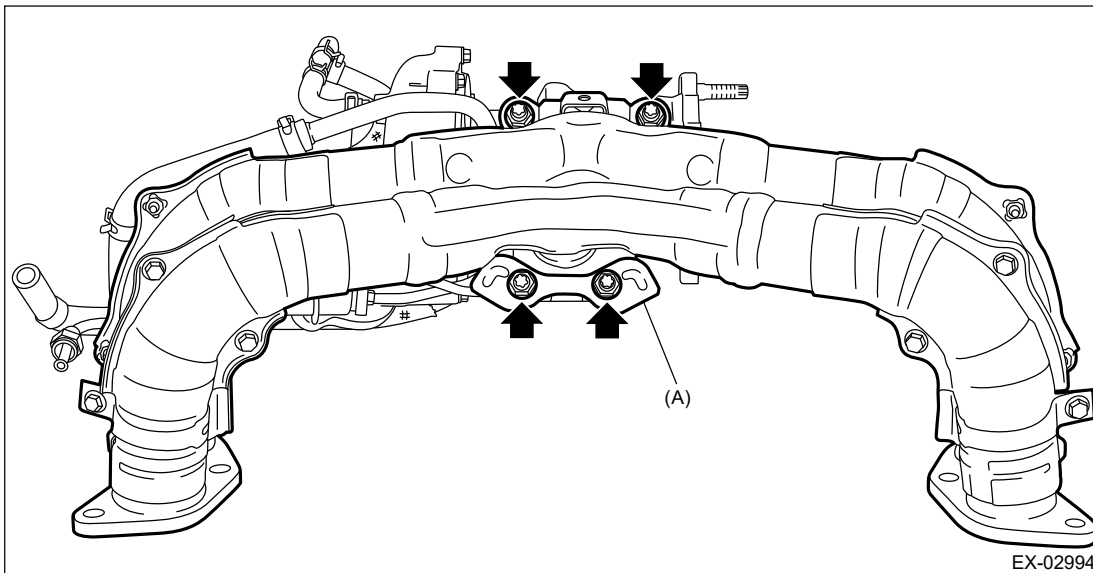
2. Remove nuts which hold the center exhaust pipe (front) to the turbocharger, and remove the center exhaust pipe (front) together with the turbocharger stay (A).



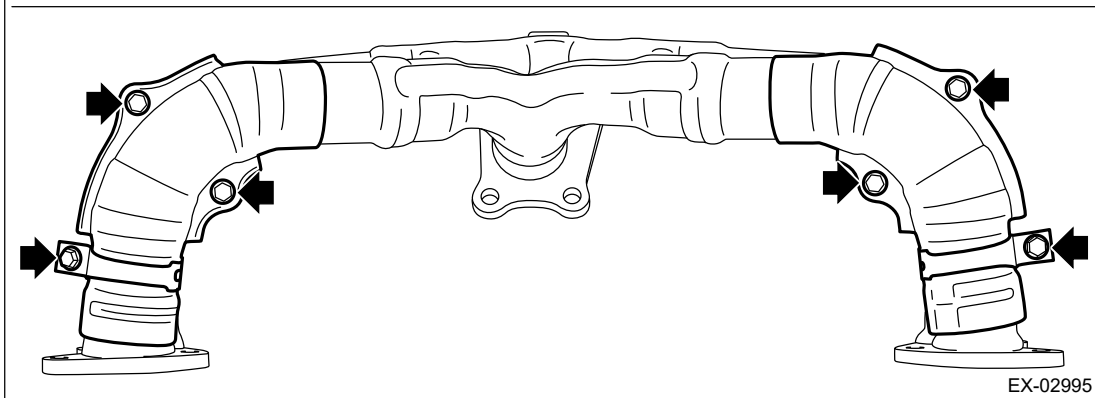
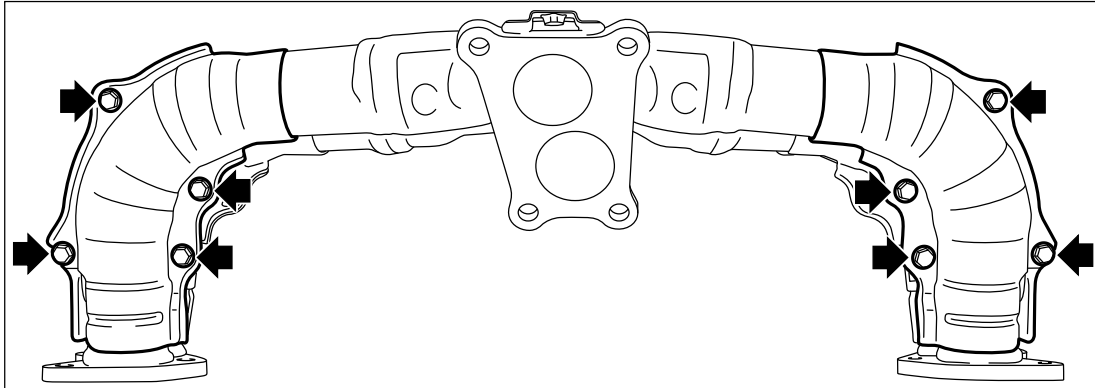
3. Remove the exhaust pipe cover from the front exhaust pipe.



- 4.** Remove nuts which secure the front exhaust pipe to the turbocharger, and remove the front exhaust pipe together with the turbocharger stay (A).



- 5.** Remove the exhaust pipe cover from the front exhaust pipe.



EX-02995

EXHAUST(H4DOTC) > Front Exhaust Pipe

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.

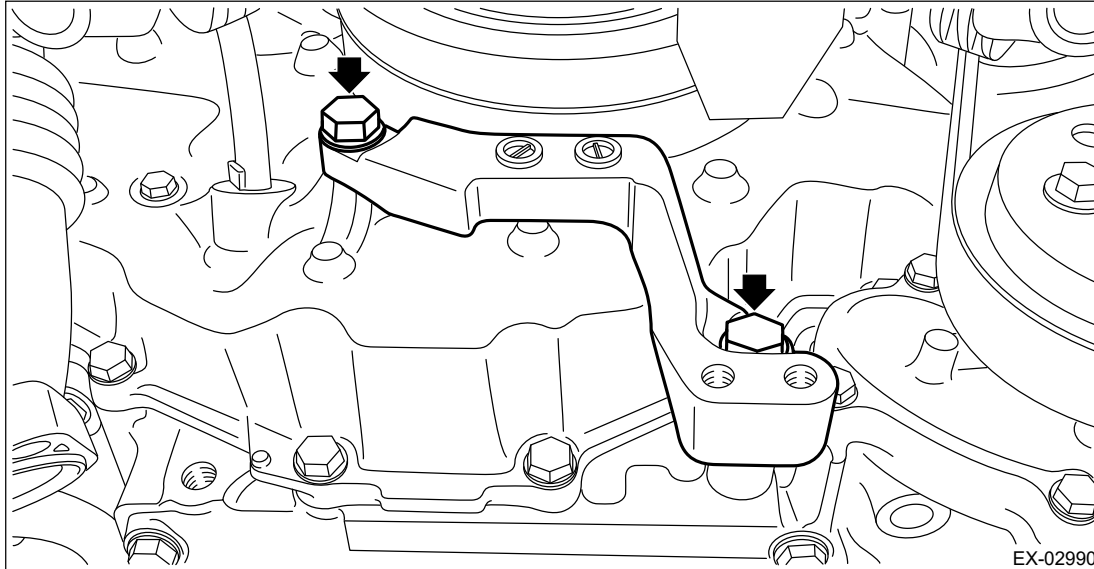
EXHAUST(H4DOTC) > Front Exhaust Pipe

INSTALLATION

1. Install the turbocharger stay to the engine.

Tightening torque:

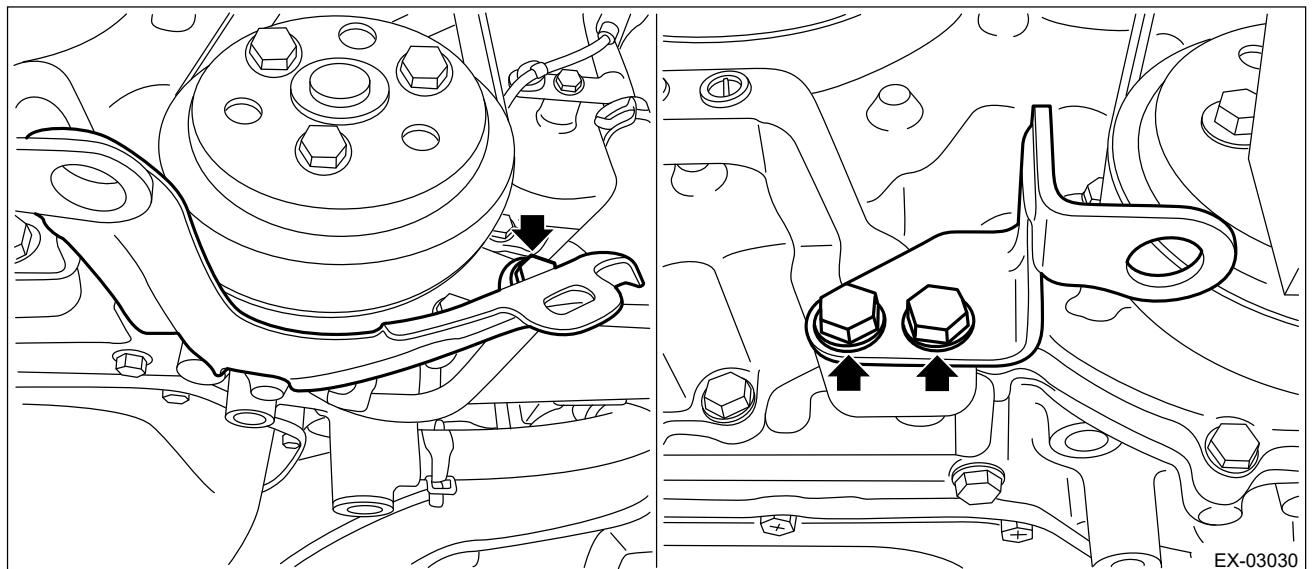
30 N·m (3.1 kgf-m, 22.1 ft-lb)



2. Install the water pump pulley cover and exhaust pipe stay to the engine and turbocharger stay.

Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)



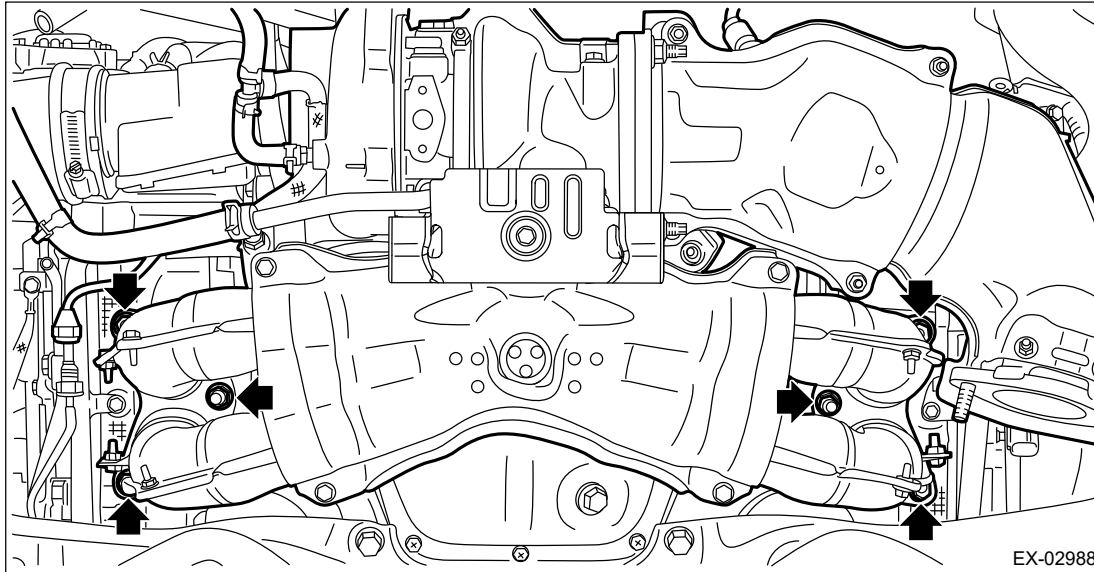
3. While holding the front exhaust pipe with transmission jack, set the front exhaust pipe, and temporarily install the front exhaust pipe to the cylinder head exhaust port.

Caution:

Be sure to install the front exhaust pipe to the cylinder head.

Note:

Use a new gasket.



EX-02988

4. Tighten the nuts in the numerical order as shown in the figure.

Tightening torque:

42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

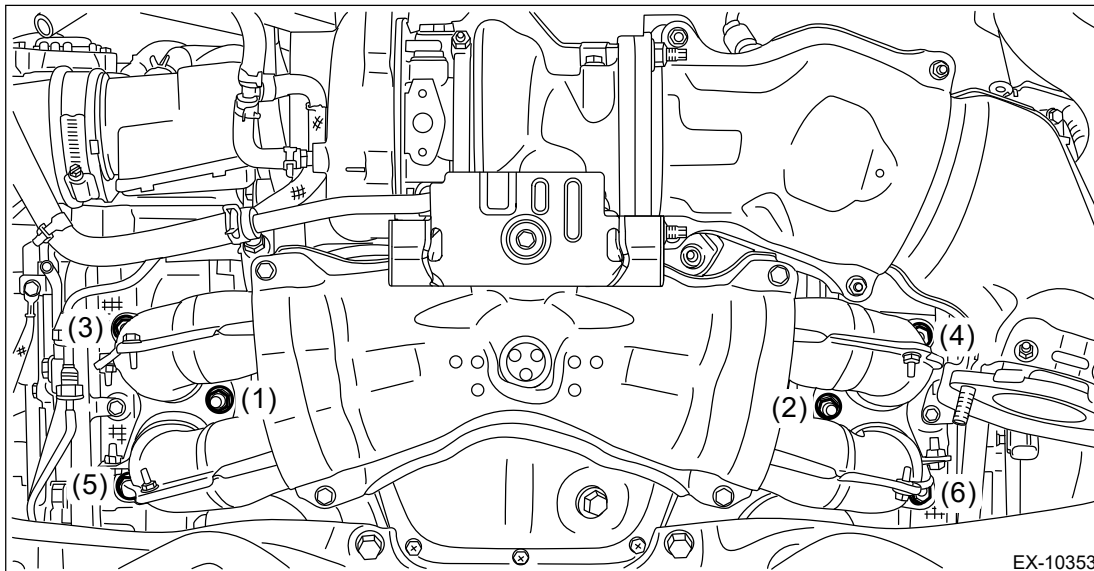
5. Retighten the nuts in the numerical order as shown in the figure.

Note:

This procedure is required to securely install the front exhaust pipe to the cylinder head.

Tightening torque:

42.5 N·m (4.3 kgf-m, 31.3 ft-lb)

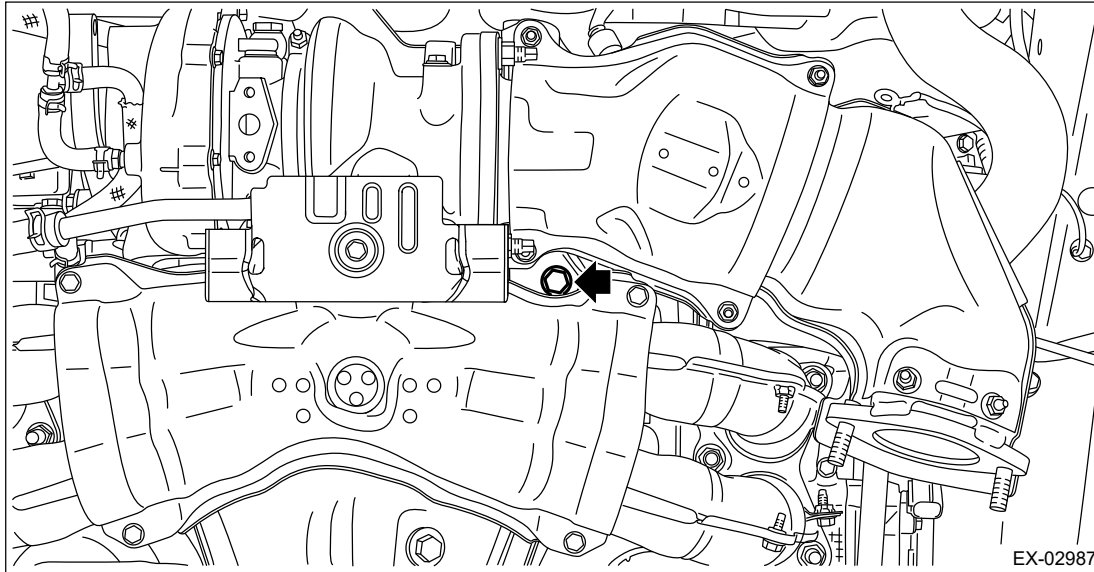



EX-10353

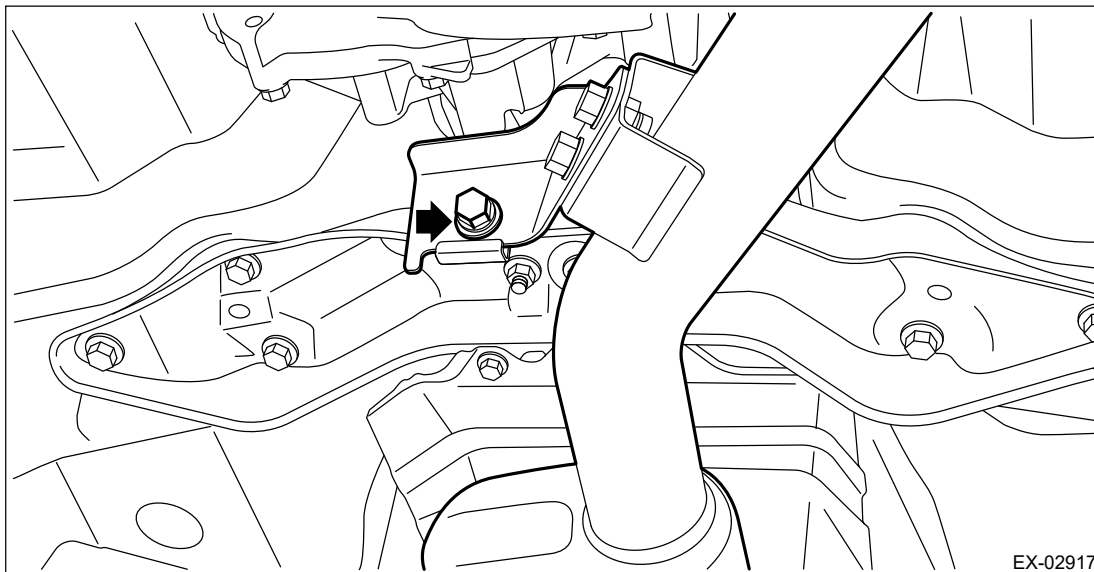
6. Attach the bolt which holds the turbocharger stay.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)



7. Install the oil catch tank.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Oil Catch Tank>INSTALLATION.](#)
8. Set the center exhaust pipe (rear), and temporarily tighten the bolt which holds the center exhaust pipe (rear) to the hanger bracket.



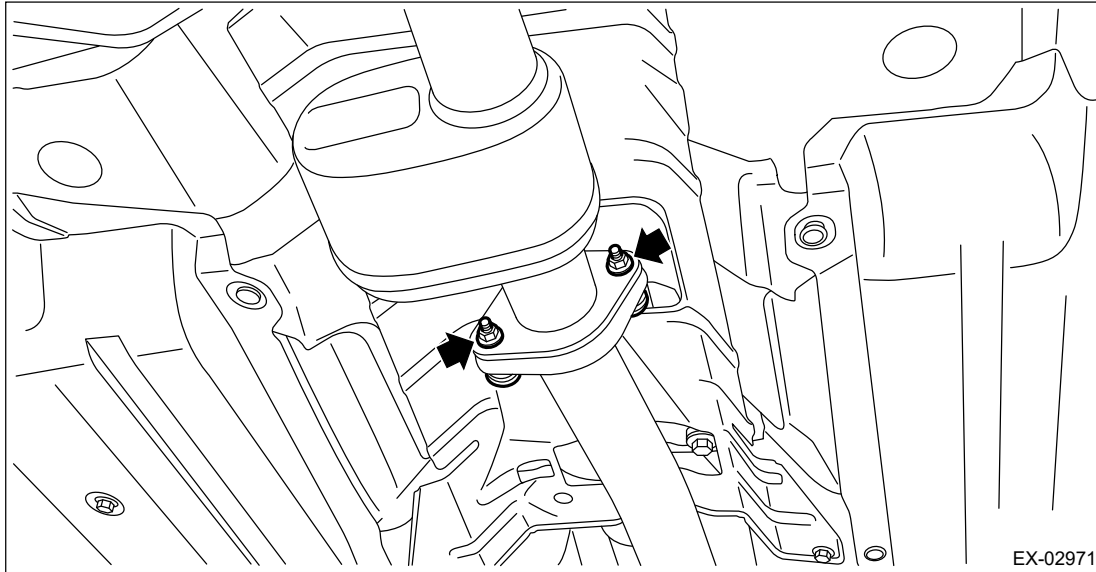
9. Install the bolts, springs, and nuts which secure the rear exhaust pipe to the center exhaust pipe (rear).

Note:

Use a new gasket.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



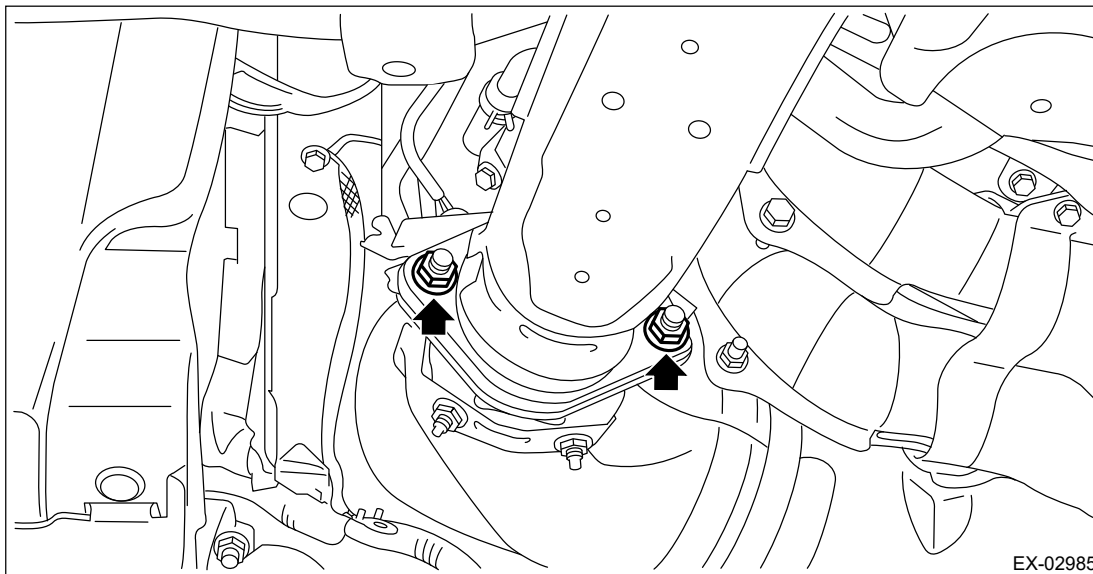
10. Install the nuts which secure the center exhaust pipe (rear) to the center exhaust pipe (front).

Note:

Use a new gasket.

Tightening torque:

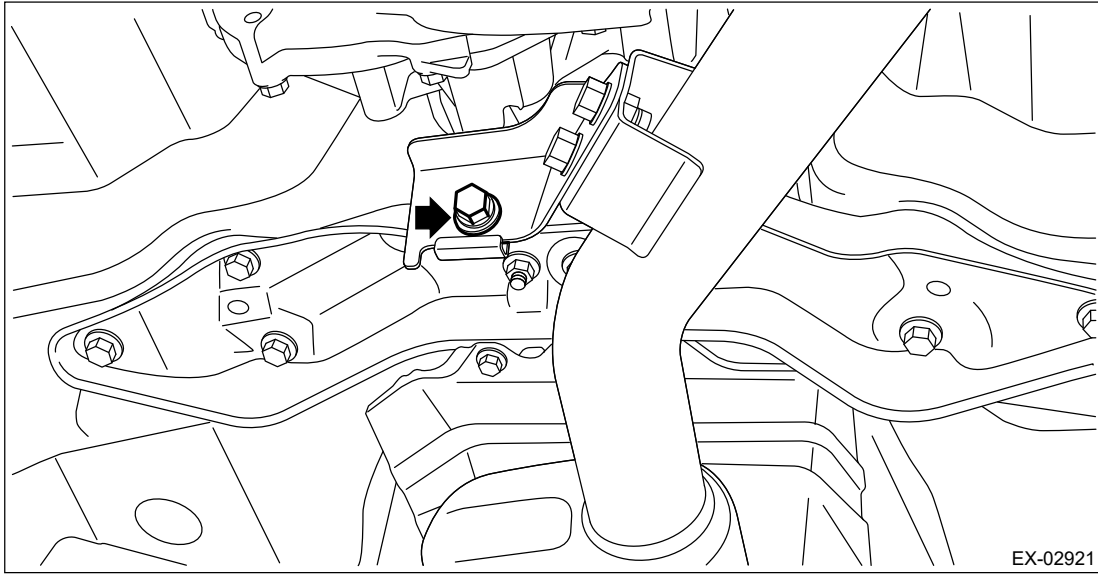
42.5 N·m (4.3 kgf-m, 31.3 ft-lb)



11. Tighten the bolts which hold center exhaust pipe (rear) to the hanger bracket.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)



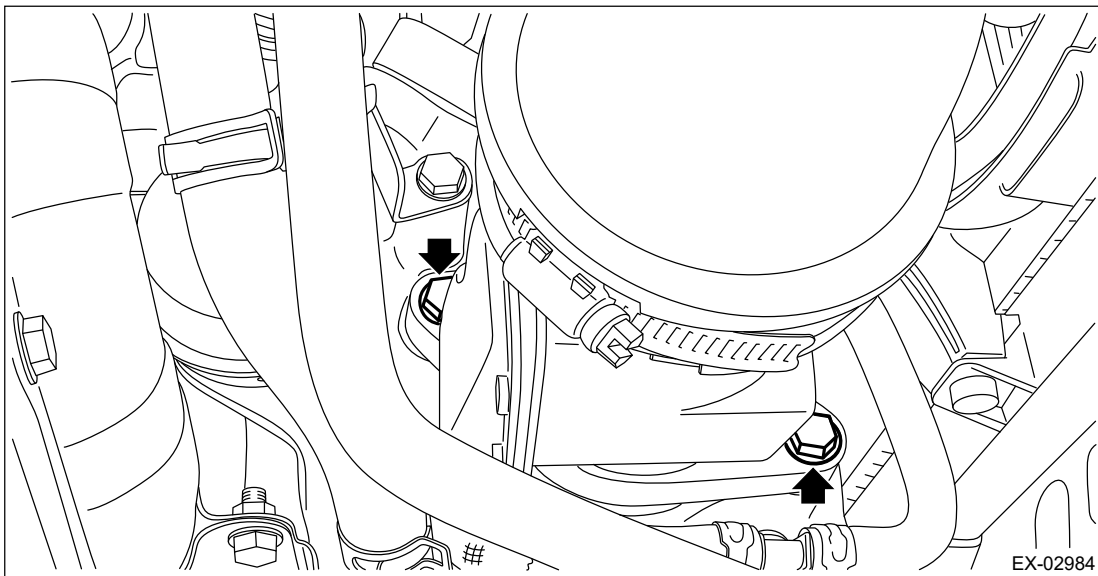
12. Install the bolts which secure the intake duct No. 1 to the turbocharger.

Note:

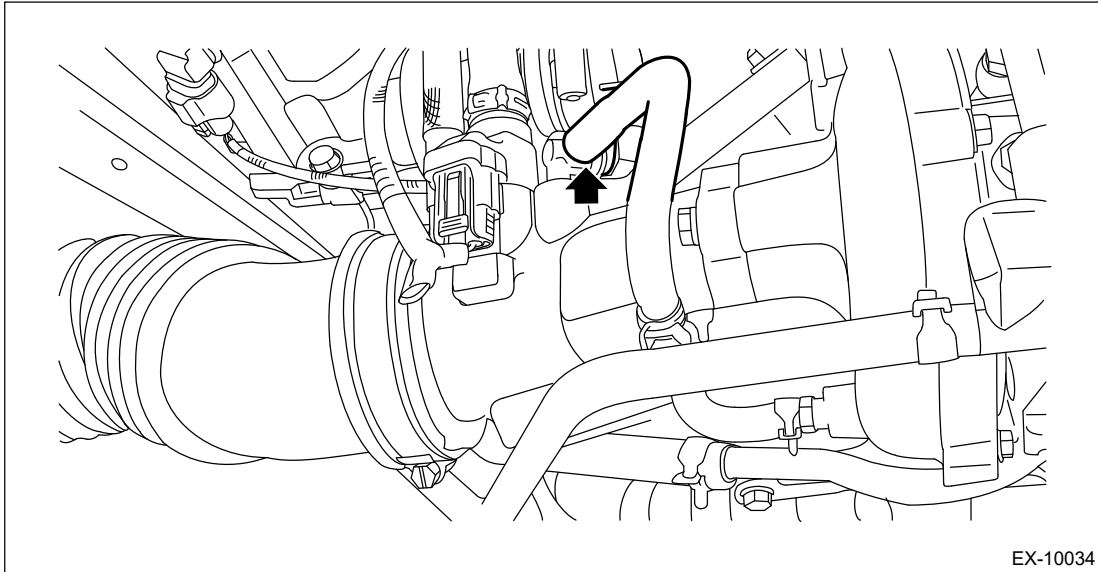
- Use new O-rings.
- Be careful not to pinch the O-ring.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



13. Connect the vacuum control hose to the wastegate control solenoid valve.



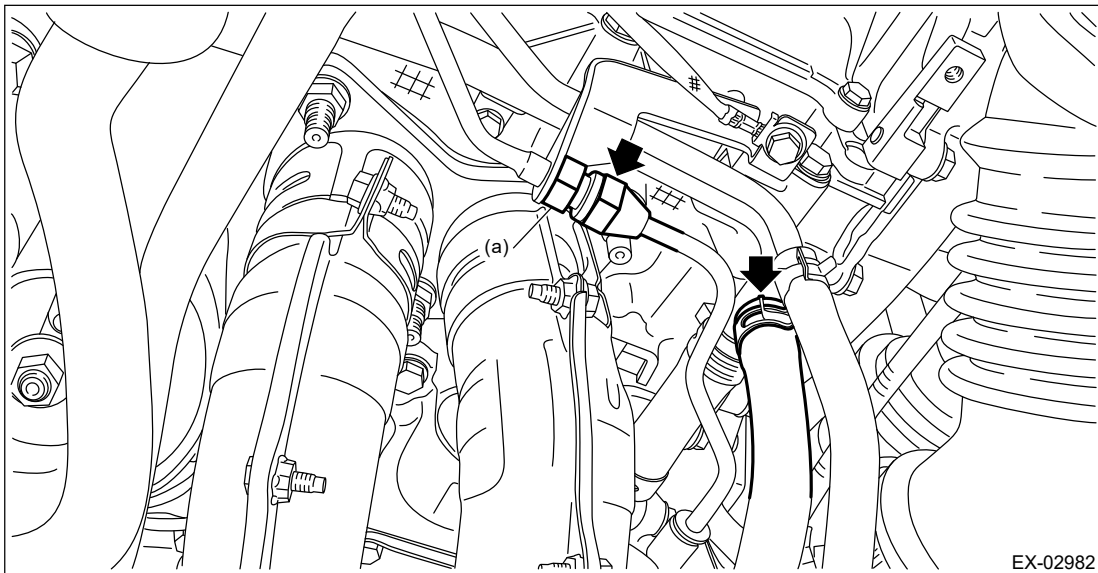
- 14.** Connect the union screw pipe assembly to the oil pipe assembly, and connect the engine coolant hose to the water pipe RH.

Caution:

In order to prevent damaging the oil pipe assembly, fix the section (a) shown in the figure when tightening the flare nut on the union screw pipe assembly, and avoid the part from rotating together while tightening the nut.

Tightening torque:

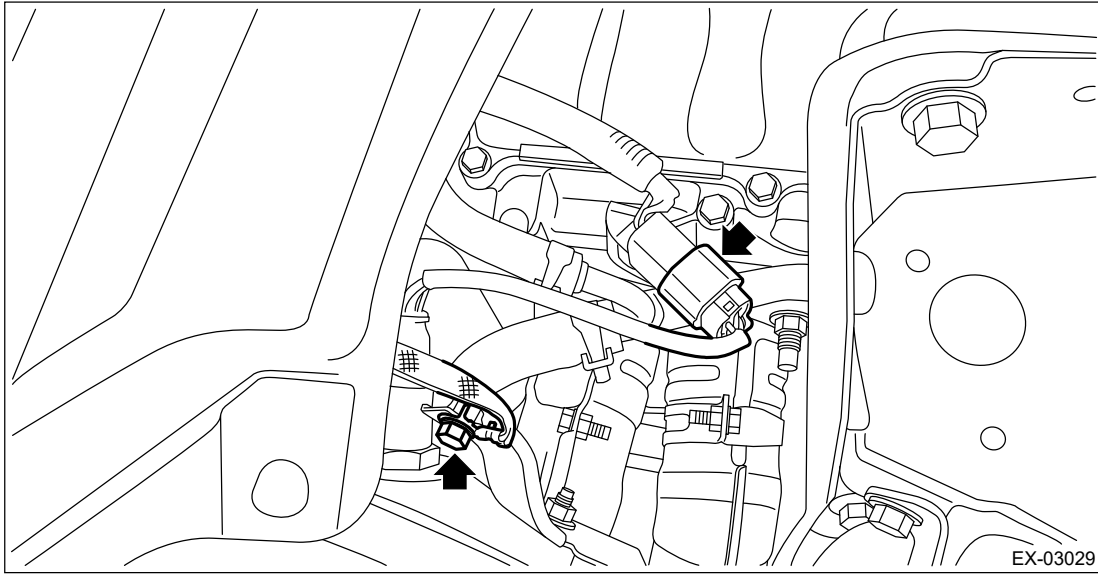
20 N·m (2.0 kgf-m, 14.8 ft-lb)



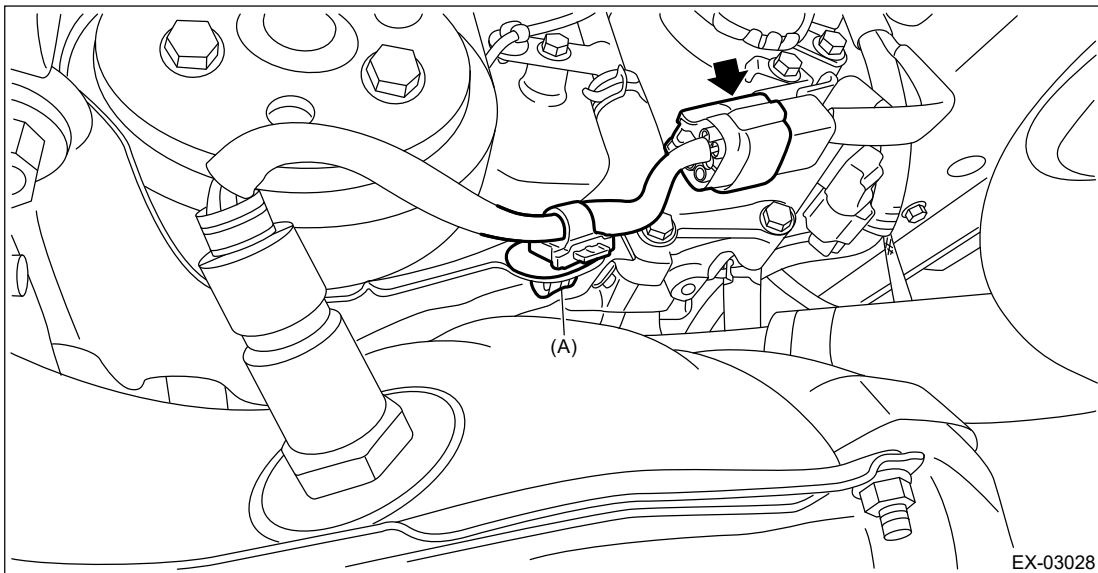
- 15.** Connect the connector on the rear oxygen sensor to the engine harness, and connect the ground cable to the exhaust pipe cover.


Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



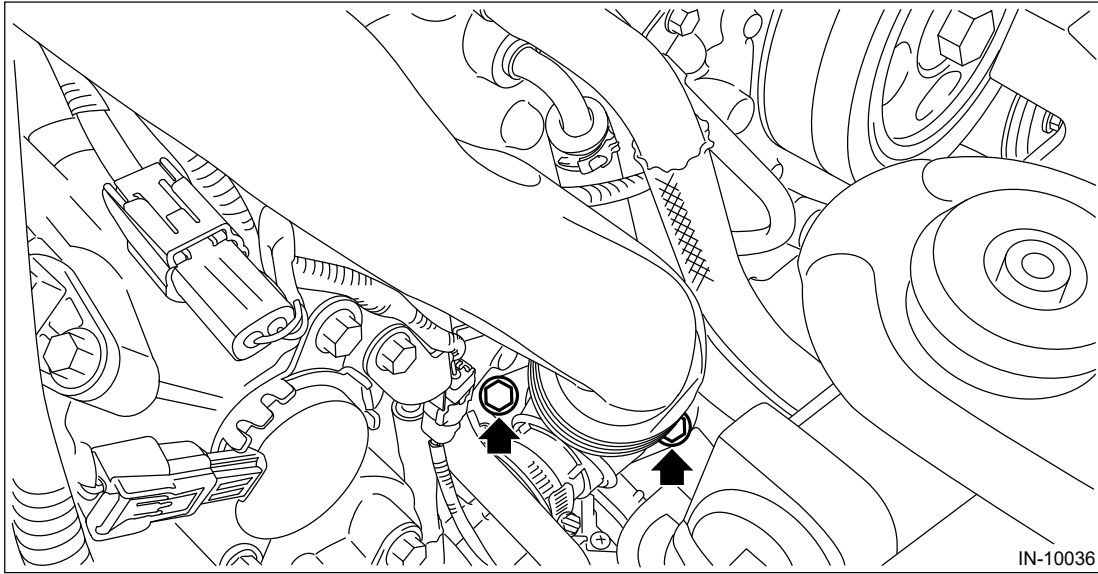
- 16.** Secure the front oxygen (A/F) sensor harness to the water pump pulley cover with the clip (A), and connect the front oxygen (A/F) sensor connector to the engine harness.



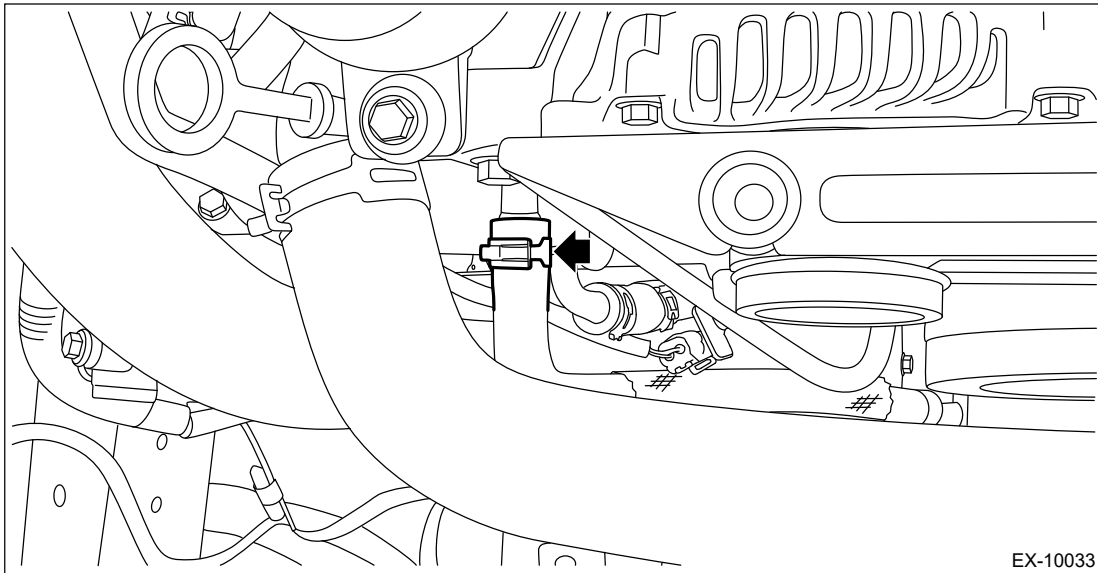
- 17.** Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
- 18.** Lower the vehicle.
- 19.** Install the bolt which secures the intake duct No.2 to the turbocharger.

Tightening torque:

16 N·m (1.6 kgf-m, 11.8 ft-lb)



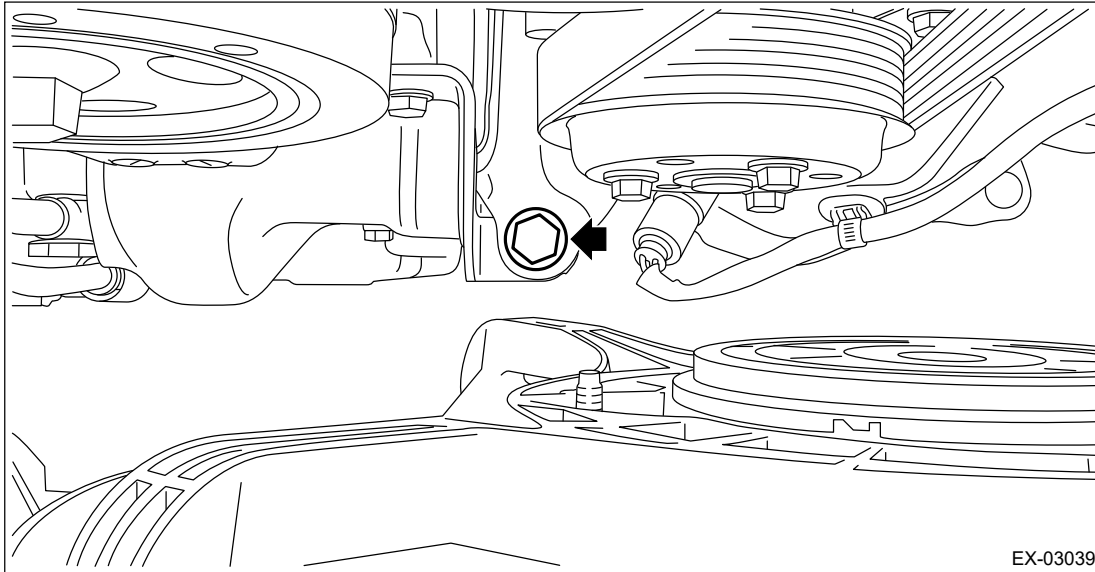
20. Connect the engine coolant hoses to the water pipe assembly.








21. Attach the bolt which secures the water pump pulley cover to the turbocharger stay.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)



- 22.** Install the radiator sub fan and fan motor assembly.  [Ref. to COOLING\(H4DOTC\)>Radiator Sub Fan and Fan Motor>INSTALLATION.](#)
- 23.** Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
- 24.** Check the engine oil level and replenish the engine oil if necessary.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>INSPECTION.](#)
- 25.** Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 26.** Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
- 27.** Install the collector cover.

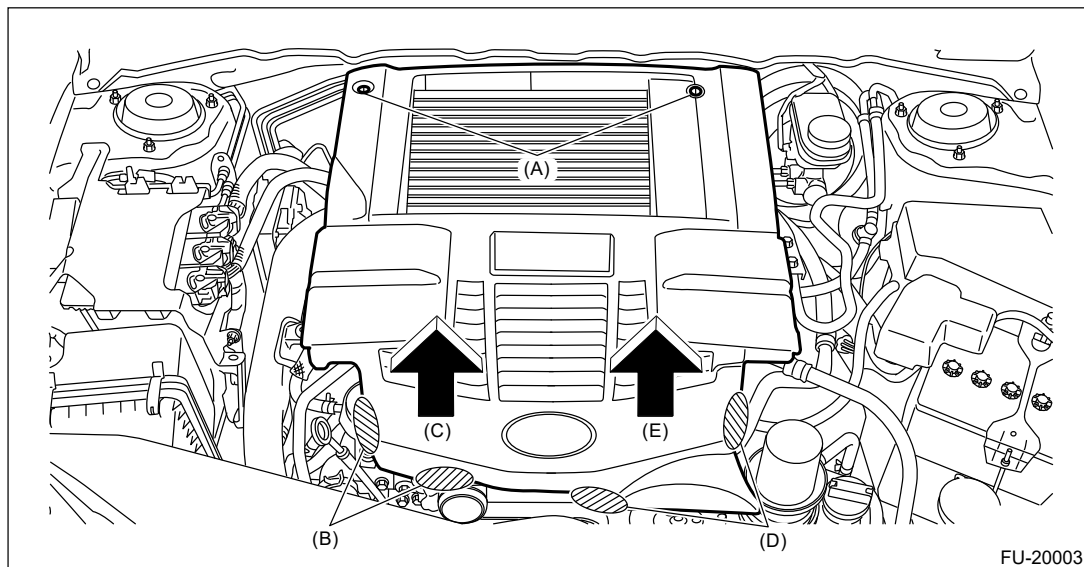
EXHAUST(H4DOTC) > Front Exhaust Pipe





REMOVAL

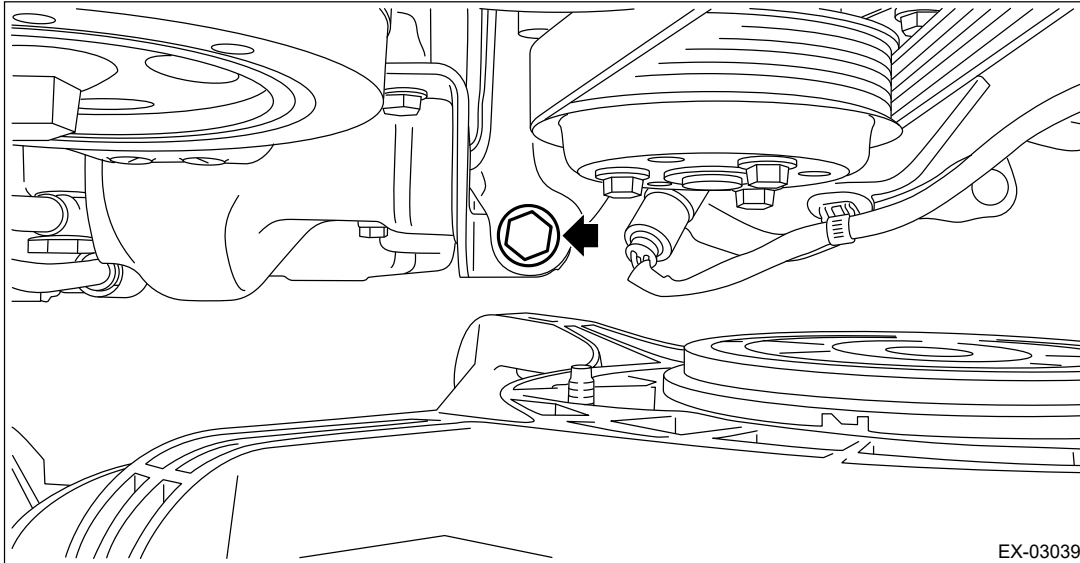
Caution:

Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

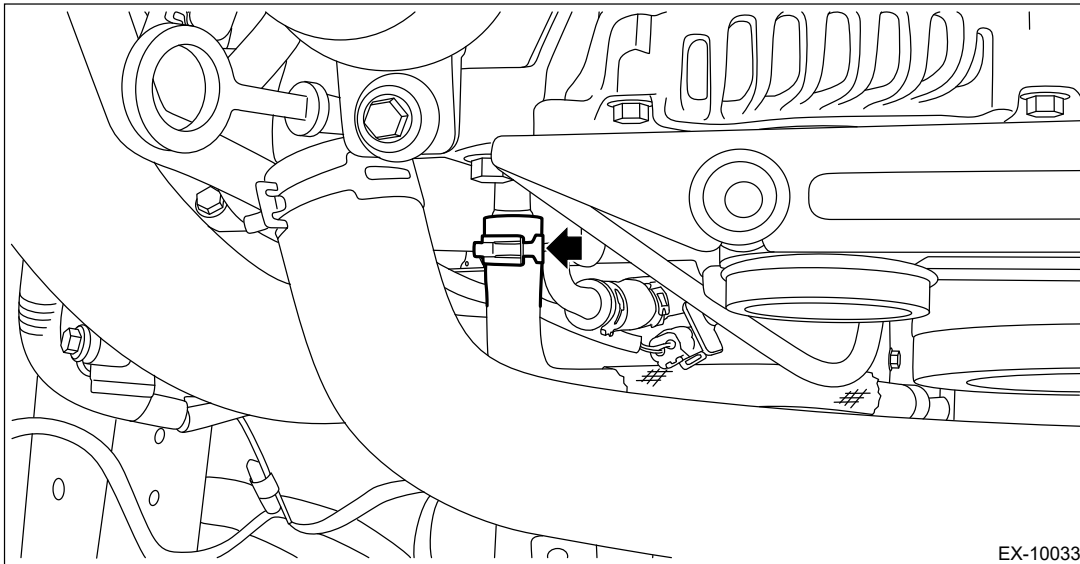
- 1.** Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



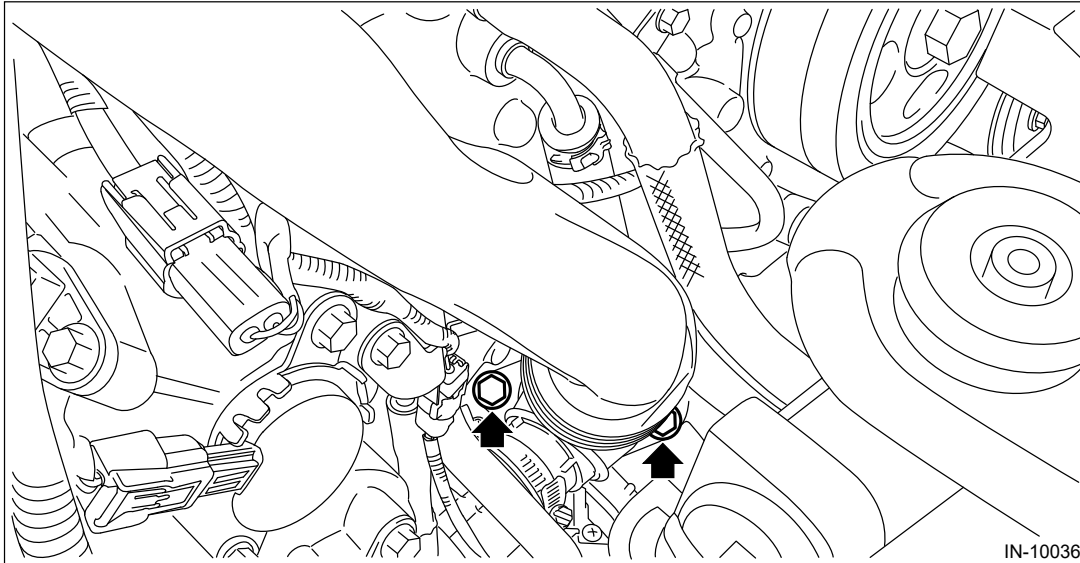
- 2.** Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 3.** Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
- 4.** Remove the radiator sub fan and fan motor assembly.  [Ref. to COOLING\(H4DOTC\)>Radiator Sub Fan and Fan Motor>REMOVAL.](#)
- 5.** Drain engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
- 6.** Lower the vehicle.
- 7.** Remove the bolts which secure the water pump pulley cover to the turbocharger stay.



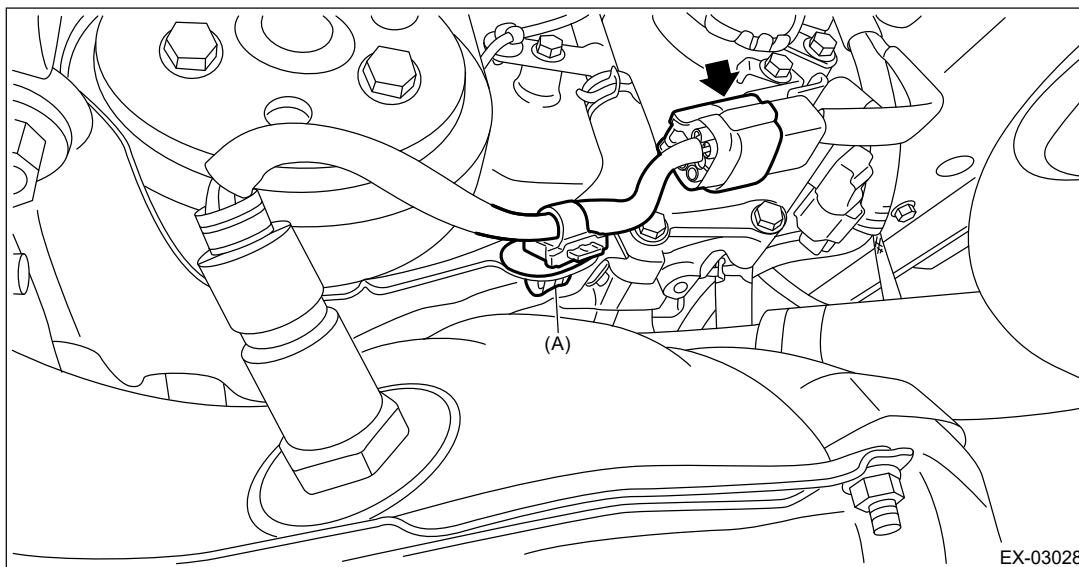
8. Disconnect the engine coolant hose from the water pipe assembly.



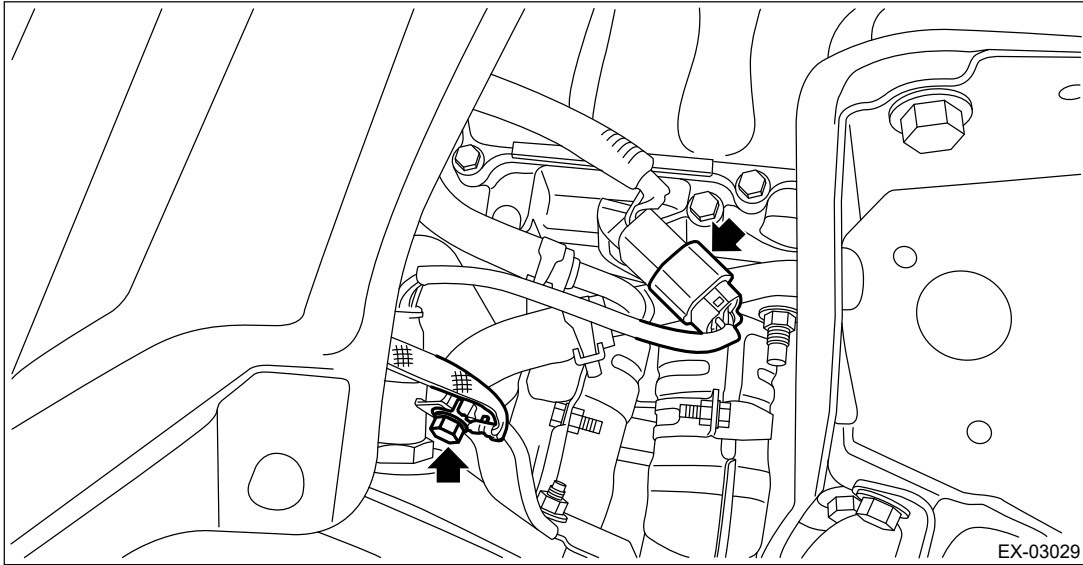
9. Remove the bolts which secure the intake duct No. 2 to the turbocharger.



- 10.** Lift up the vehicle.
- 11.** Disconnect the connector on the front oxygen (A/F) sensor from the engine harness, and remove the clip (A) which secures the front oxygen (A/F) sensor harness to the water pump pulley cover.



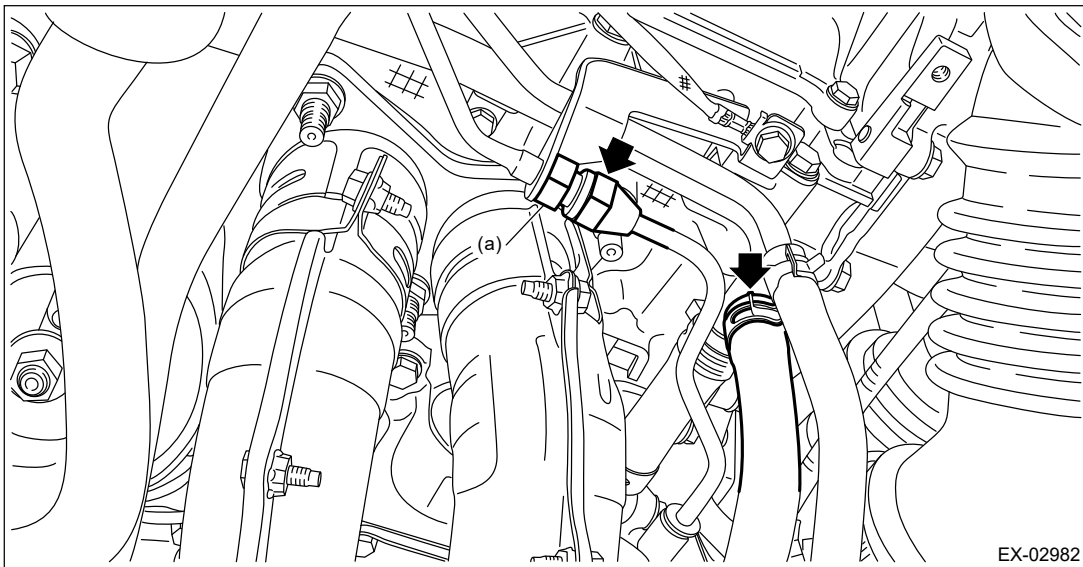
- 12.** Disconnect the connector on the rear oxygen sensor from the engine harness, and disconnect the ground cable from the exhaust pipe cover.



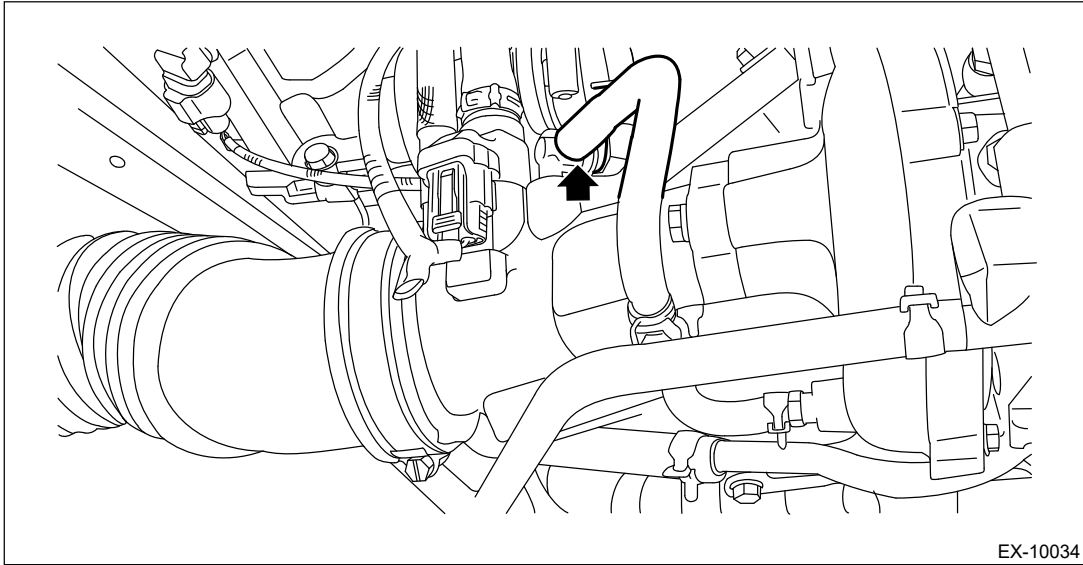
- 13.** Disconnect the union screw pipe assembly from the oil pipe assembly, and disconnect the engine coolant hose from the water pipe RH.

Caution:

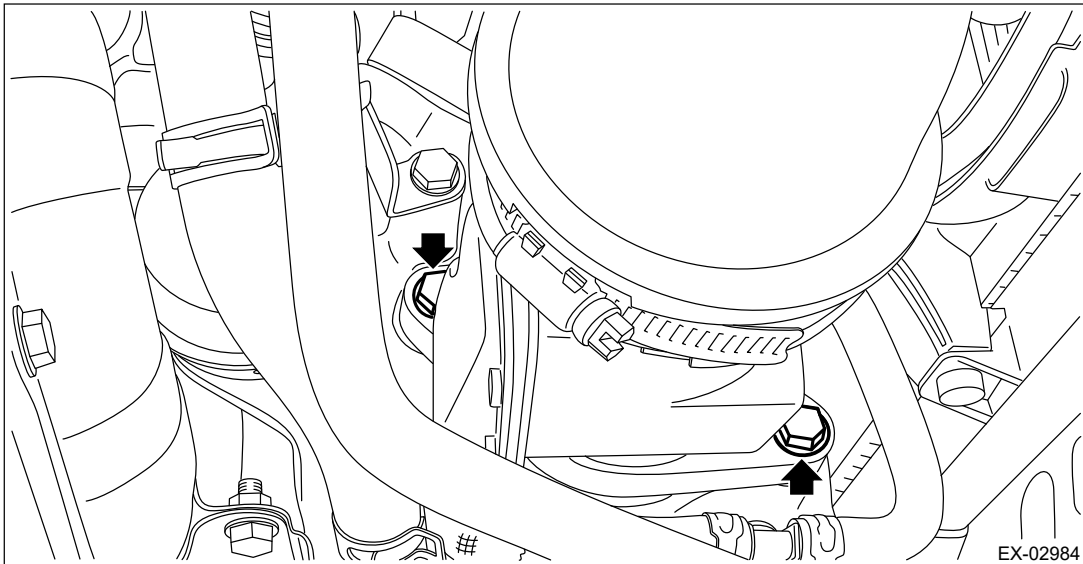
In order to prevent damaging the oil pipe assembly, fix the section (a) shown in the figure when loosening the flare nut on the union screw pipe assembly, and avoid the part from rotating together while loosening the nut.



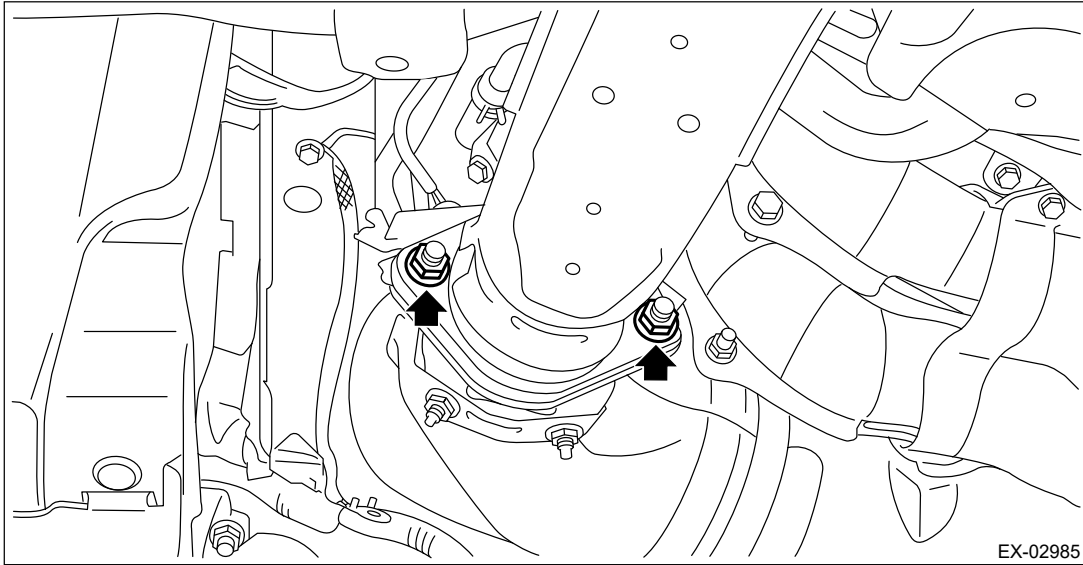
- 14.** Disconnect the vacuum control hose from the wastegate control solenoid valve.



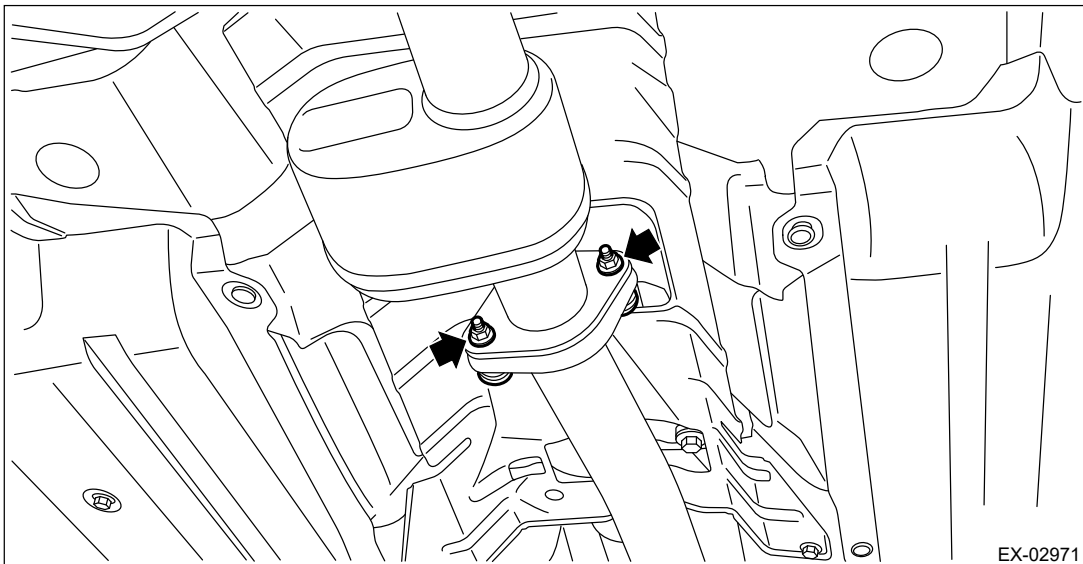
15. Remove the bolts which secure the intake duct No. 1 to the turbocharger.



16. Remove the nuts which secure the center exhaust pipe (rear) to the center exhaust pipe (front).



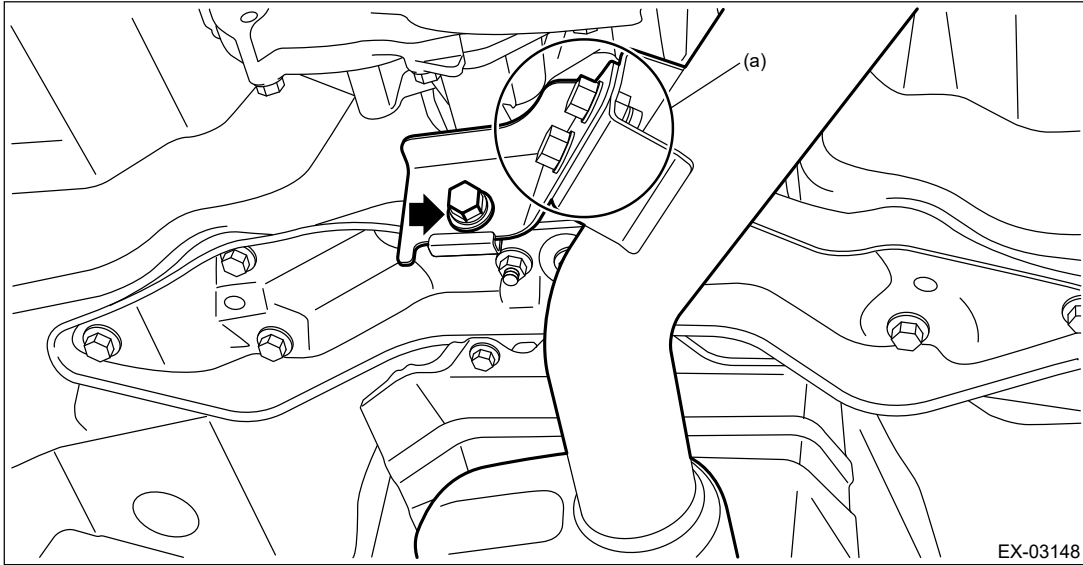
- 17.** Remove the bolts, springs, and nuts which secure the rear exhaust pipe to the center exhaust pipe (rear).




- 18.** Remove the bolt which holds center exhaust pipe (rear) to the hanger bracket, and remove the center exhaust pipe (rear).

Note:

Removing the exhaust pipe bracket from the center exhaust pipe (rear) will adversely affect the positioning accuracy. Therefore, do not remove the bolts in section (a) shown in the figure.

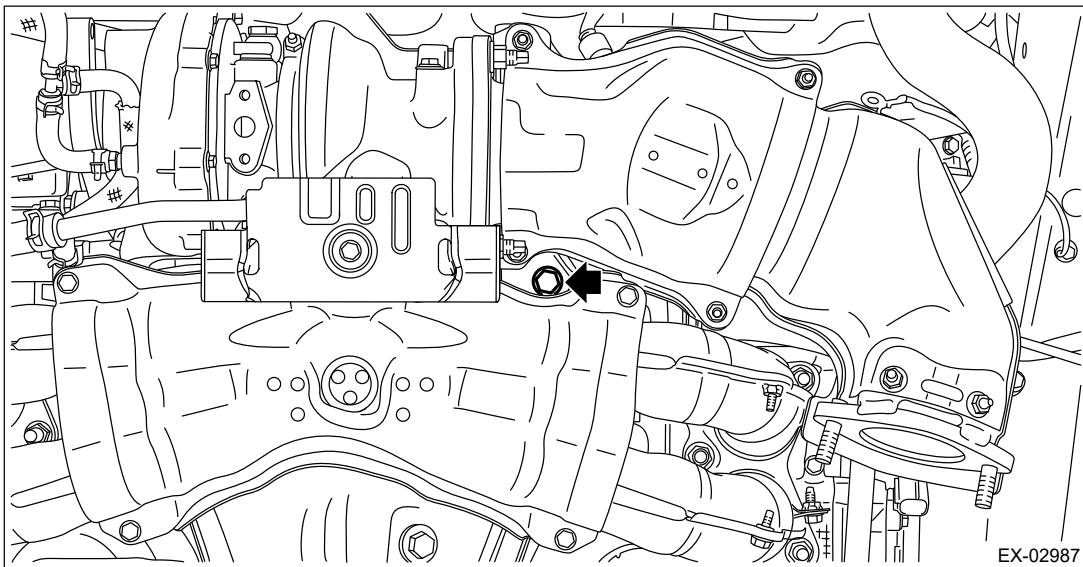


- 19.** Remove the oil catch tank.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Oil Catch Tank>REMOVAL.](#)

Caution:

This procedure is required to prevent oil from remaining in the compressor and turbine areas if the residual oil inside the oil catch tank back flows.

- 20.** Remove the bolts which secure the turbocharger stay.

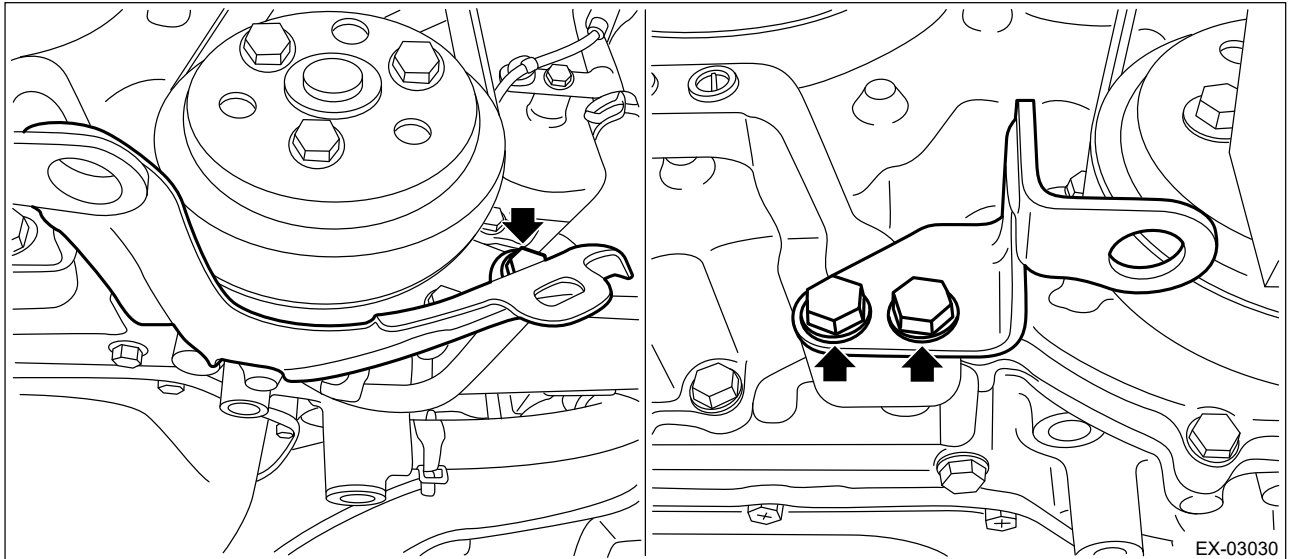


- 21.** While holding the front exhaust pipe with transmission jack, remove the nuts which hold the front exhaust pipe to the cylinder head exhaust port, and remove the front exhaust pipe.

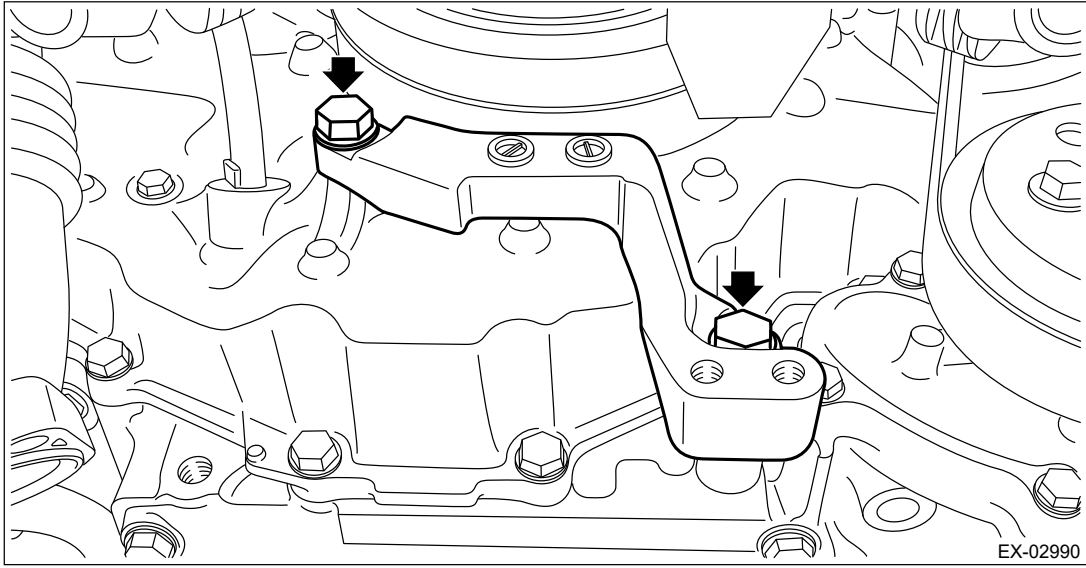
代替画像1

この画像は代替画像です

- 22.** Remove the water pump pulley cover and exhaust pipe stay from the engine and turbocharger stay.



- 23.** Remove the turbocharger stay from the engine.



EX-02990

EXHAUST(H4DOTC) > General Description

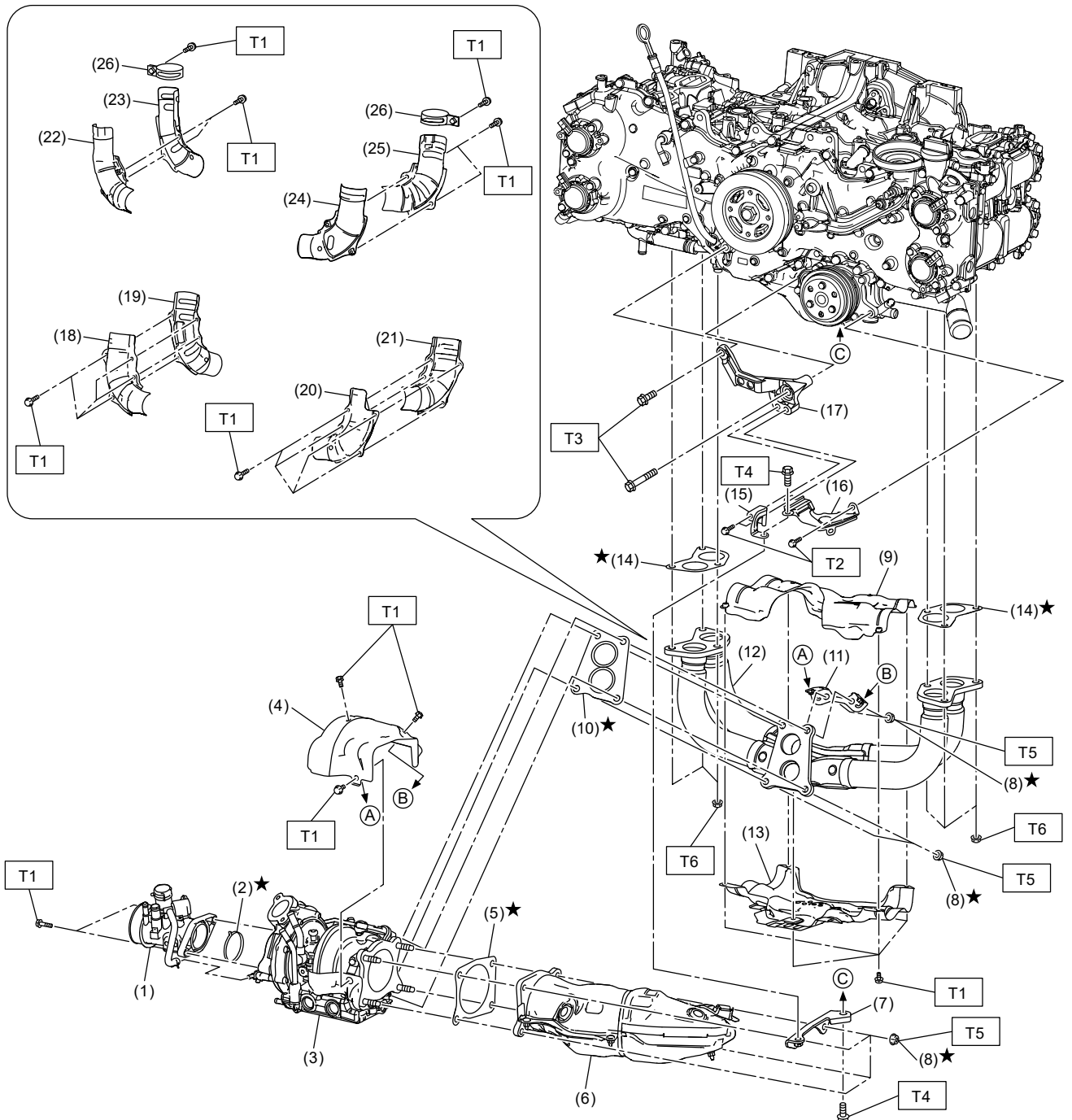
CAUTION

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

EXHAUST(H4DOTC) > General Description

COMPONENT

1. FRONT EXHAUST PIPE



EX-10360

- | | | |
|-----------------------|---------------------------|------------------------------|
| (1) Intake duct No. 1 | (13) Exhaust pipe cover C | (25) Exhaust pipe cover K |
| (2) O-ring | (14) Gasket | (26) Front exhaust pipe band |
| (3) Turbocharger | (15) Exhaust pipe stay B | |

- (4) Exhaust pipe cover A
- (5) Gasket
- (6) Center exhaust pipe (front)
- (7) Turbocharger stay A
- (8) Self-locking nut
- (9) Exhaust pipe cover B
- (10) Gasket
- (11) Exhaust pipe stay A
- (12) Front exhaust pipe
- (16) Water pump pulley cover
- (17) Turbocharger stay B
- (18) Exhaust pipe cover D
- (19) Exhaust pipe cover E
- (20) Exhaust pipe cover F
- (21) Exhaust pipe cover G
- (22) Exhaust pipe cover H
- (23) Exhaust pipe cover I
- (24) Exhaust pipe cover J

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

T1: 7.5 (0.8, 5.5)

T2: 19 (1.9, 14.0)

T3: 30 (3.1, 22.1)

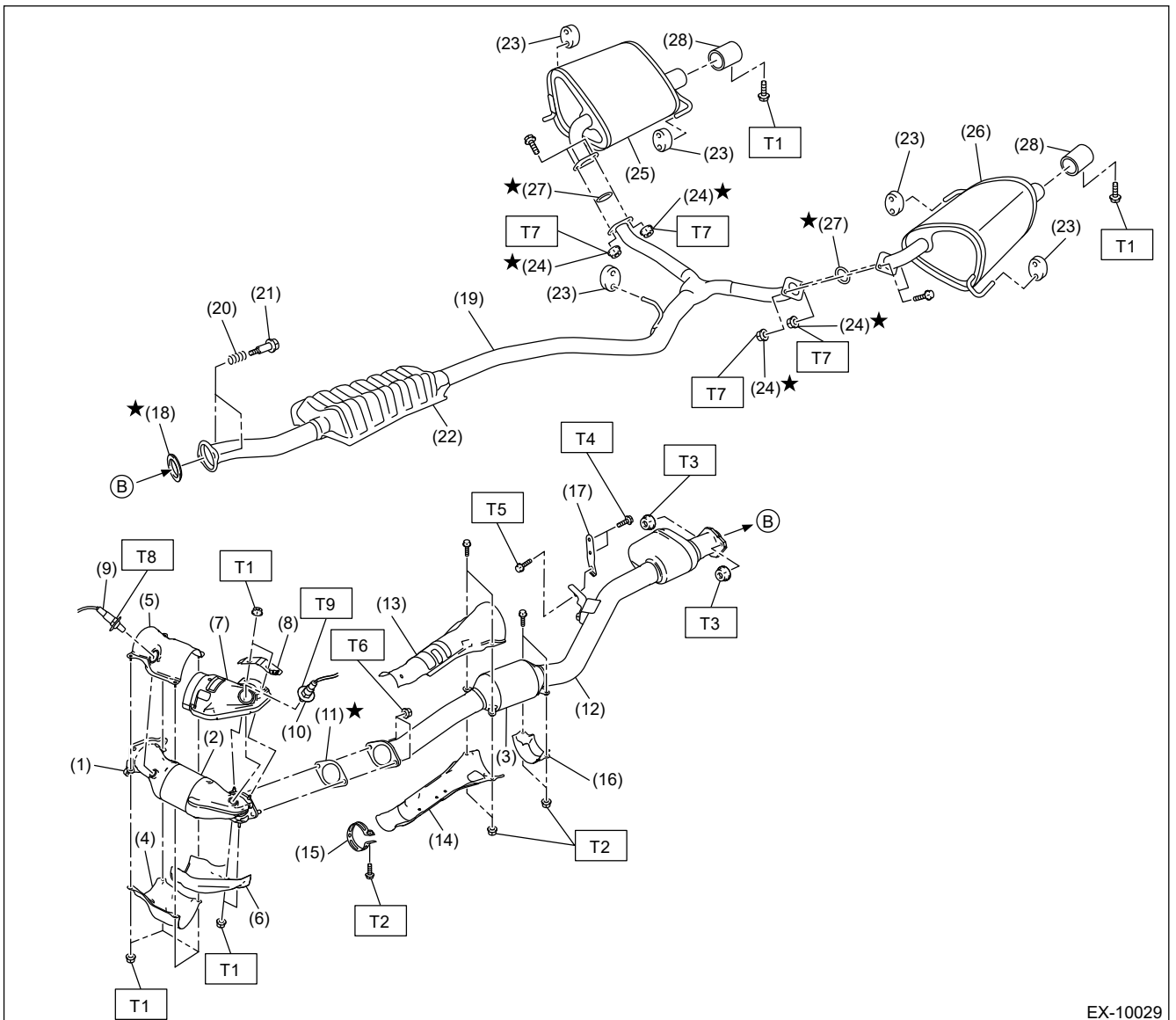
T4: 33 (3.4, 24.3)

T5: 42.5 (4.3, 31.3)

T6:  **Ref. to**

[EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)

2. CENTER AND REAR EXHAUST PIPE, AND MUFFLER



- (1) Center exhaust pipe (front)
- (2) Front catalytic converter
- (3) Rear catalytic converter
- (4) Exhaust pipe cover A
- (5) Exhaust pipe cover B
- (6) Exhaust pipe cover C
- (7) Exhaust pipe cover D
- (8) Exhaust pipe cover E
- (9) Front oxygen (A/F) sensor
- (10) Rear oxygen sensor
- (11) Gasket
- (12) Center exhaust pipe (rear)
- (14) Exhaust pipe cover G
- (15) Center exhaust pipe band
- (16) Exhaust pipe cover H
- (17) Hanger bracket
- (18) Gasket
- (19) Rear exhaust pipe
- (20) Spring
- (21) BOLT
- (22) Chamber
- (23) Cushion rubber
- (24) Self-locking nut
- (25) Muffler RH

- (27) Gasket
- (28) Muffler cutter

Tightening torque: N·m (kgf-m, ft-lb)

T1: 7.5 (0.8, 5.5)

T2: 13 (1.3, 9.6)

T3: 18 (1.8, 13.3)

T4: 23 (2.3, 17.0)

T5: 35 (3.6, 25.8)

T6: 42.5 (4.3, 31.3)

T7: 48 (4.9, 35.4)

T8:  Ref. to FUEL

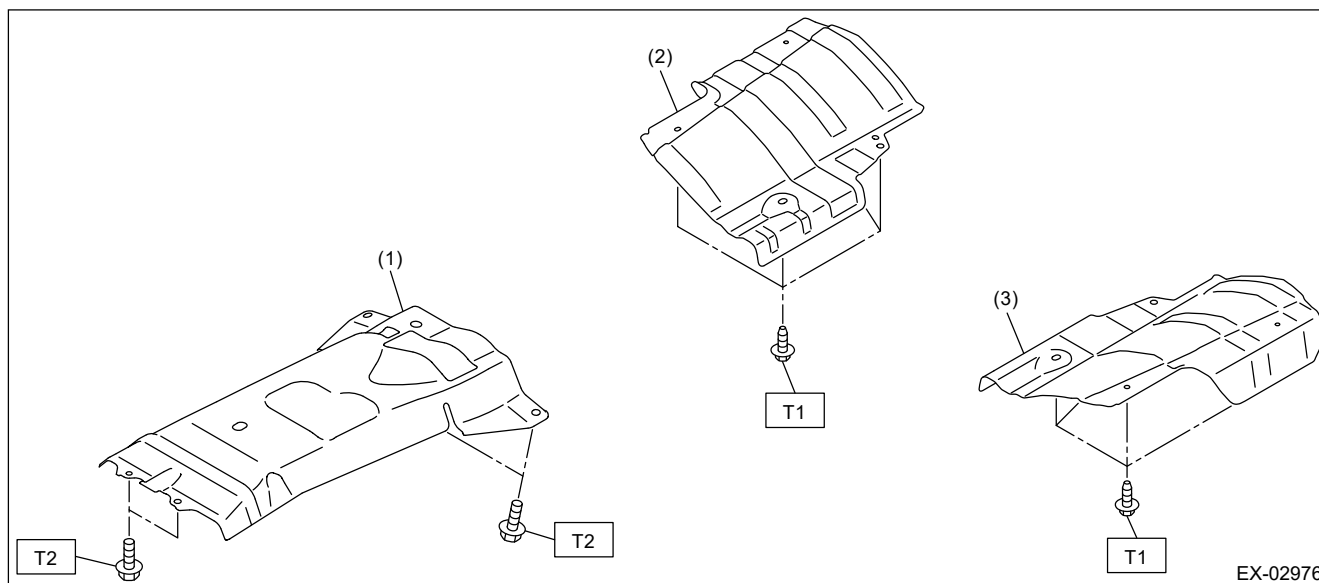
INJECTION (FUEL SYSTEMS)(H4DOTC)>Front Oxygen (A/F) Sensor>INSTALLATION.

T9:  Ref. to FUEL

INJECTION (FUEL SYSTEMS)(H4DOTC)>Rear Oxygen Sensor>INSTALLATION.

- (13) Exhaust pipe cover F
- (26) Muffler LH

3. HEAT SHIELD COVER



- (1) Center exhaust cover
- (2) Rear exhaust cover RH
- (3) Rear exhaust cover LH

Tightening torque: N·m (kgf-m, ft-lb)

T1: 10 (1.0, 7.4)

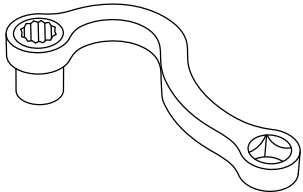
T2: 18 (1.8, 13.3)

EX-02976

EXHAUST(H4DOTC) > General Description

PREPARATION TOOL

1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|-------------|-------------------|--|
|  <p>ST18283AA010</p> | 18283AA010 | WRENCH ADAPTER | Used for removing and installing center exhaust pipe (front). |

2. GENERAL TOOL

| TOOL NAME | REMARKS |
|------------------|---|
| TORX® socket E10 | Used for removing and installing center exhaust pipe (front). |

EXHAUST(H4DOTC) > Muffler

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.
- 3.** Check the cushion rubber for wear or crack.

EXHAUST(H4DOTC) > Muffler

INSTALLATION

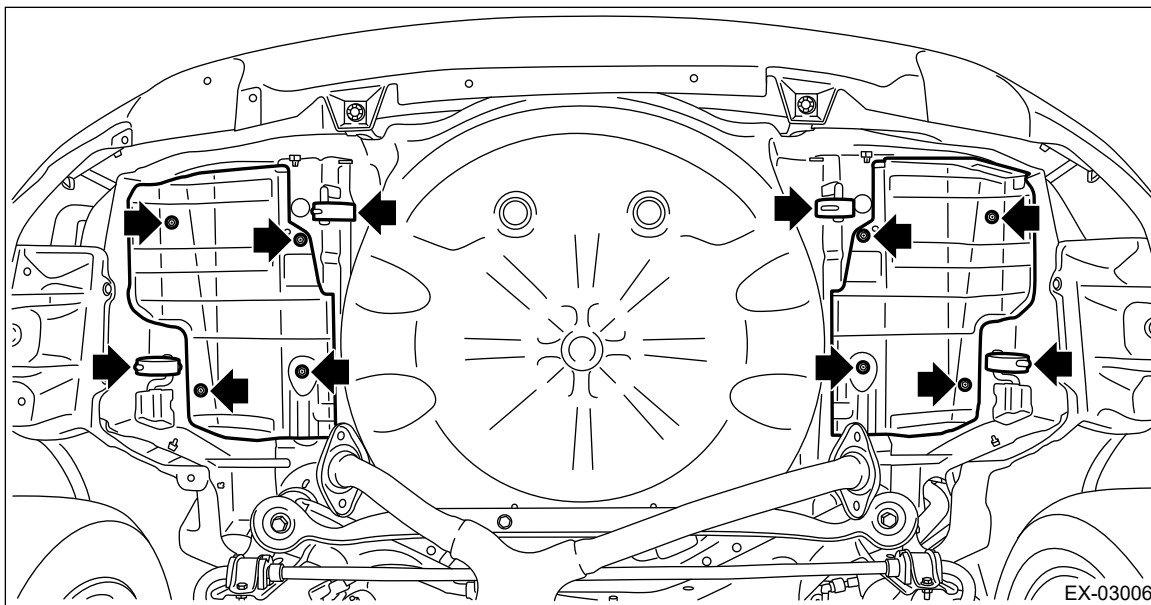
Install in the reverse order of removal.

Note:

- Use a new gasket and self-locking nut.
- After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.

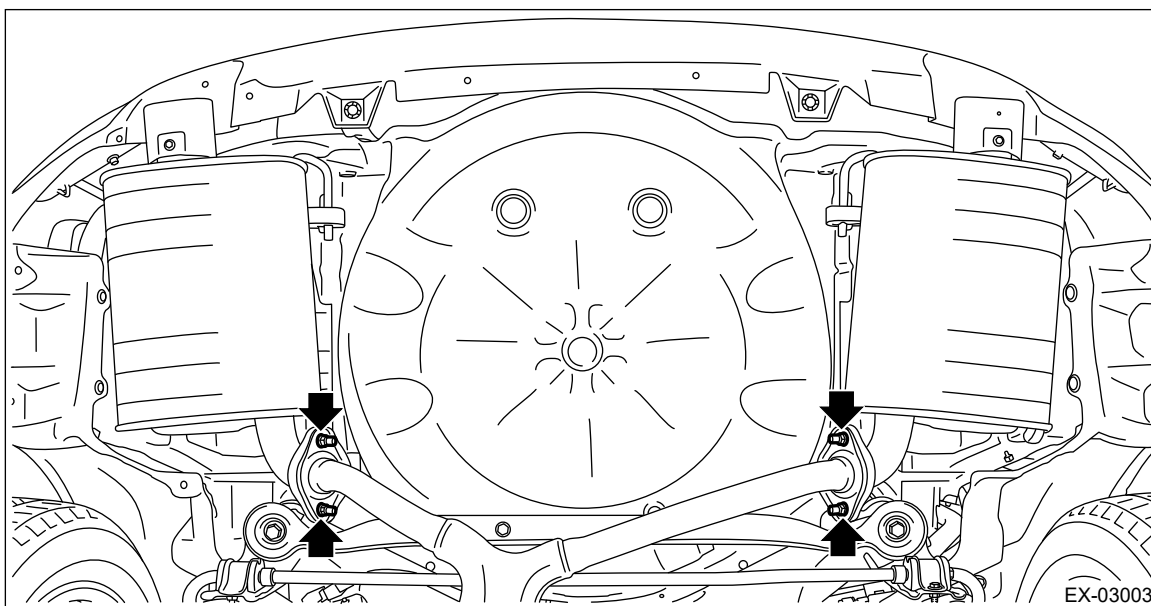
Tightening torque:

10 N·m (1.0 kgf-m, 7.4 ft-lb)



Tightening torque:

48 N·m (4.9 kgf-m, 35.4 ft-lb)



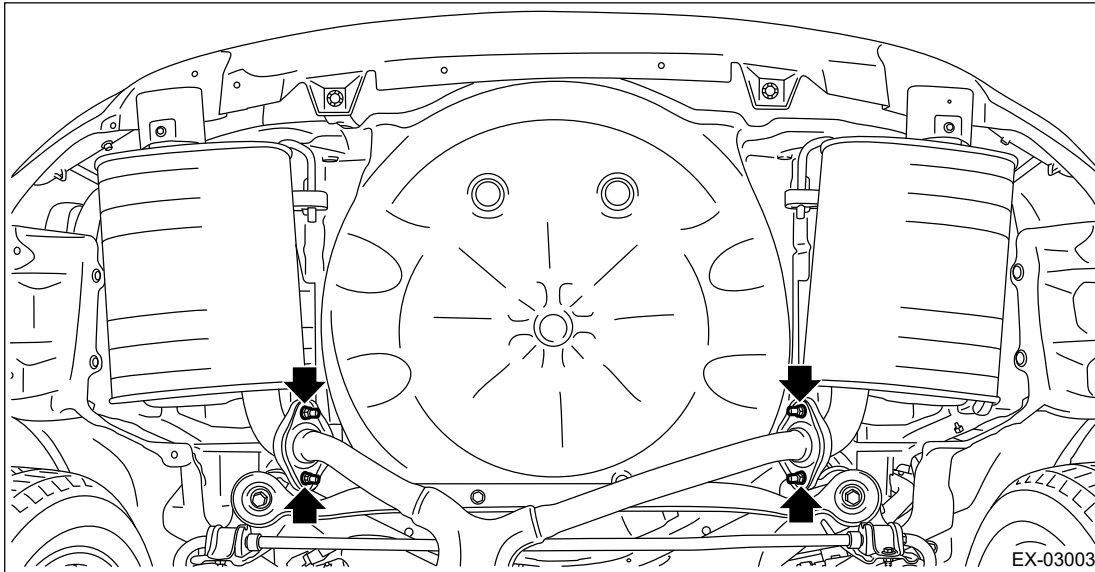
EXHAUST(H4DOTC) > Muffler

REMOVAL

Caution:

Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

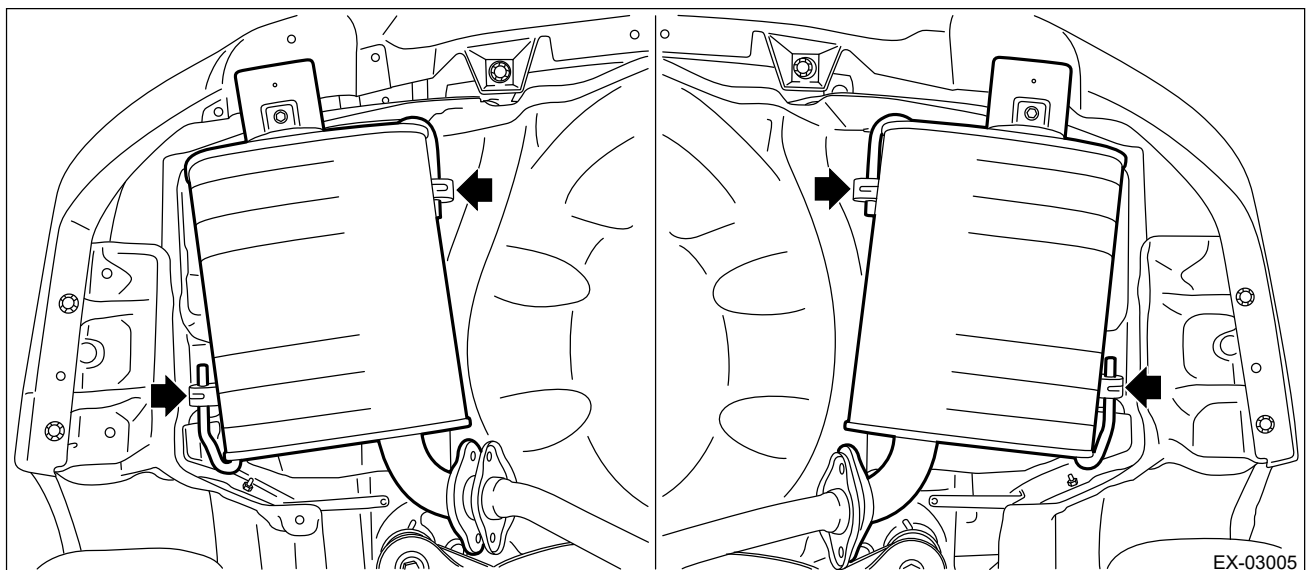
1. Lift up the vehicle.
2. Remove the bolts and self-locking nuts which secure the rear exhaust pipe to the muffler.



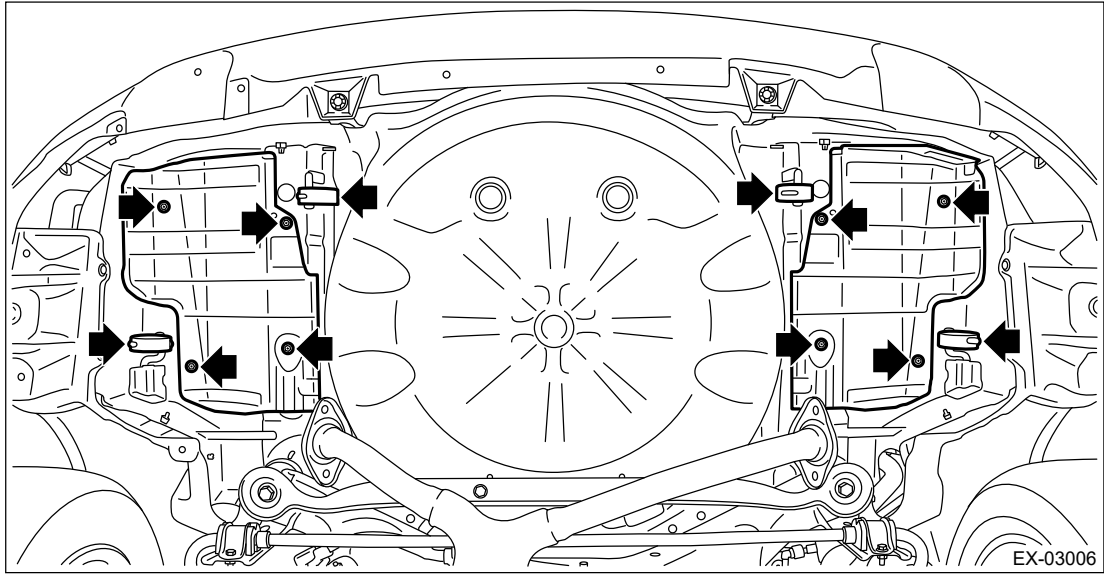
3. Apply a coat of spray type lubricant to the mating area of cushion rubber.
4. Remove the muffler from the cushion rubber.

Caution:

Be careful not to drop the muffler during removal.



5. Remove the cushion rubber and rear exhaust cover from the vehicle.



EXHAUST(H4DOTC) > Rear Exhaust Pipe

INSPECTION

- 1.** Check the connections and welded parts for exhaust leaks.
- 2.** Make sure there are no holes or rusting.
- 3.** Check the cushion rubber for wear or crack.

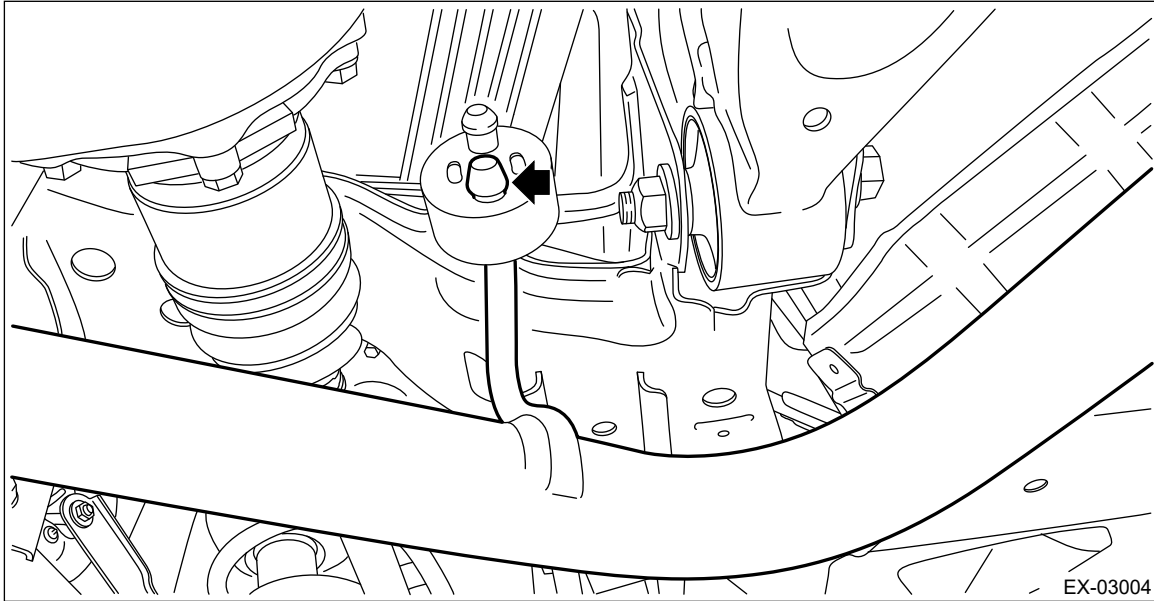
EXHAUST(H4DOTC) > Rear Exhaust Pipe

INSTALLATION

1. Apply a coat of spray type lubricant to the mating area of cushion rubber.
2. Install the rear exhaust pipe to cushion rubber.

Note:

After assembling, degrease the lubricant which was applied to the cushion rubber while removing/installing.



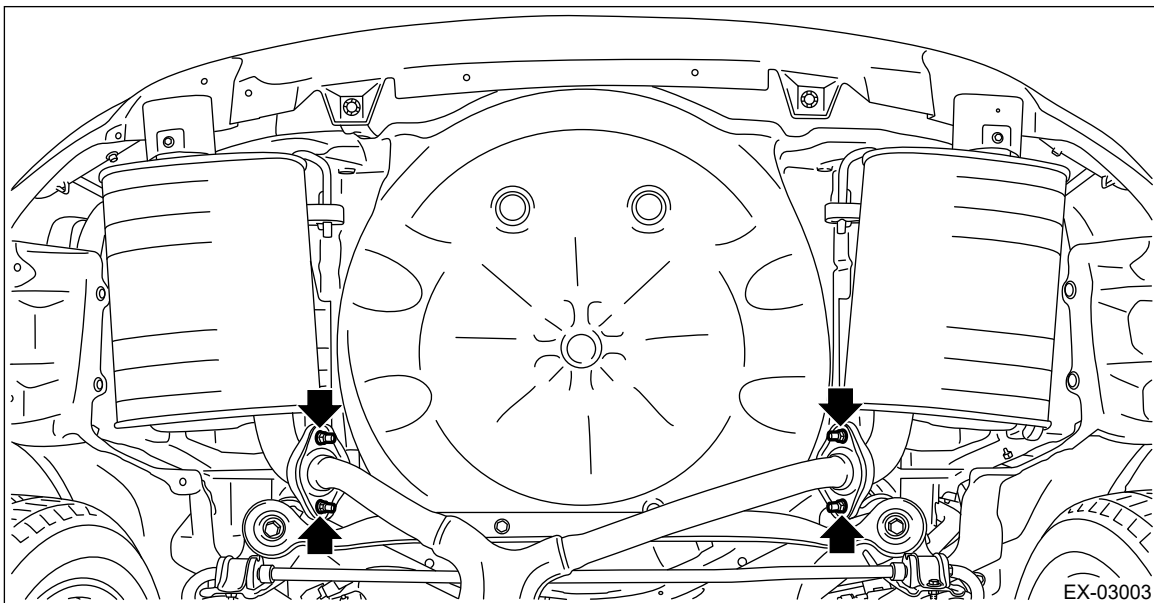
3. Install the bolts and self-locking nuts which secure the muffler to the rear exhaust pipe.

Note:

Use a new gasket and self-locking nut.

Tightening torque:

48 N·m (4.9 kgf-m, 35.4 ft-lb)



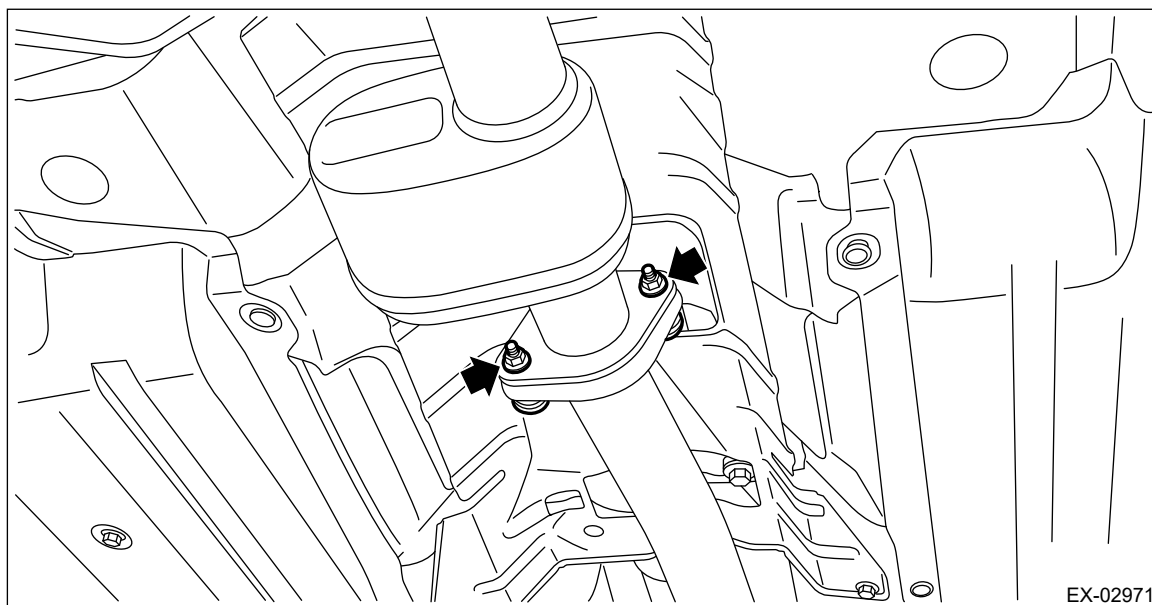
4. Install the bolts, springs, and nuts which secure the center exhaust pipe (rear) to the rear exhaust pipe.

Note:

Use a new gasket.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



5. Lower the vehicle.

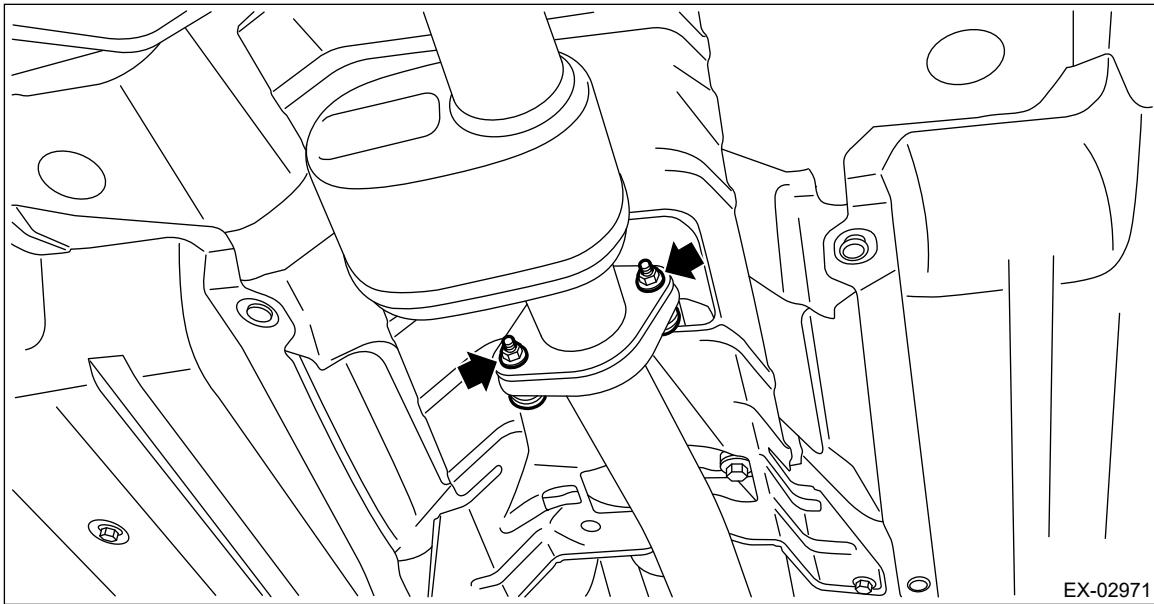
EXHAUST(H4DOTC) > Rear Exhaust Pipe

REMOVAL

Caution:

Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.

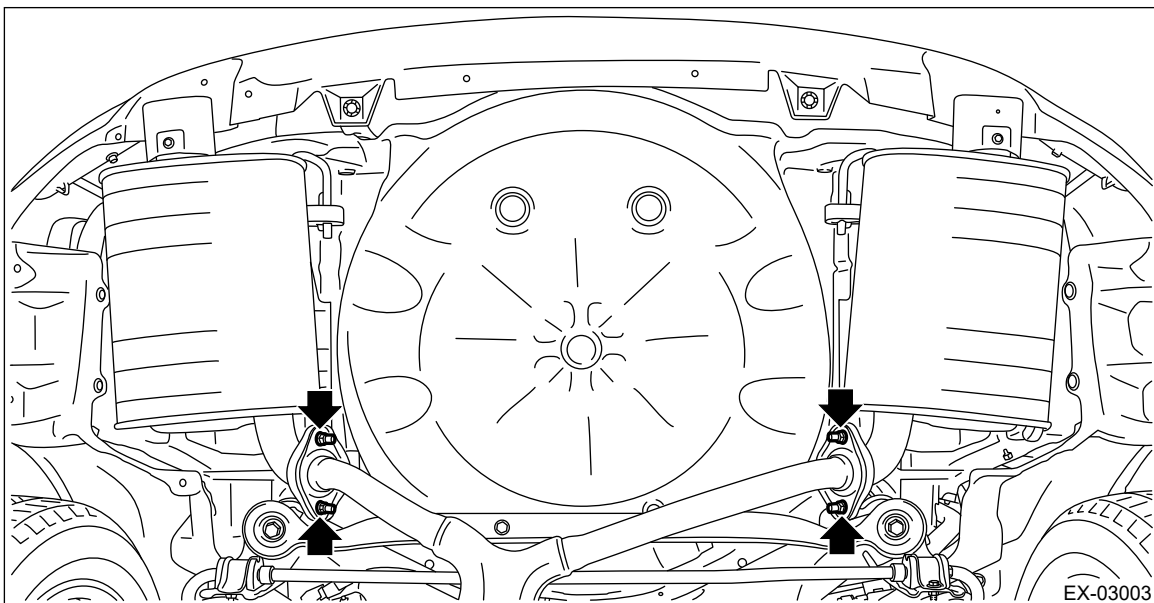
1. Lift up the vehicle.
2. Remove the bolts, springs, and nuts which secure the center exhaust pipe (rear) to the rear exhaust pipe.



3. Remove the bolts and self-locking nuts securing the mufflers to the rear exhaust pipes.

Caution:

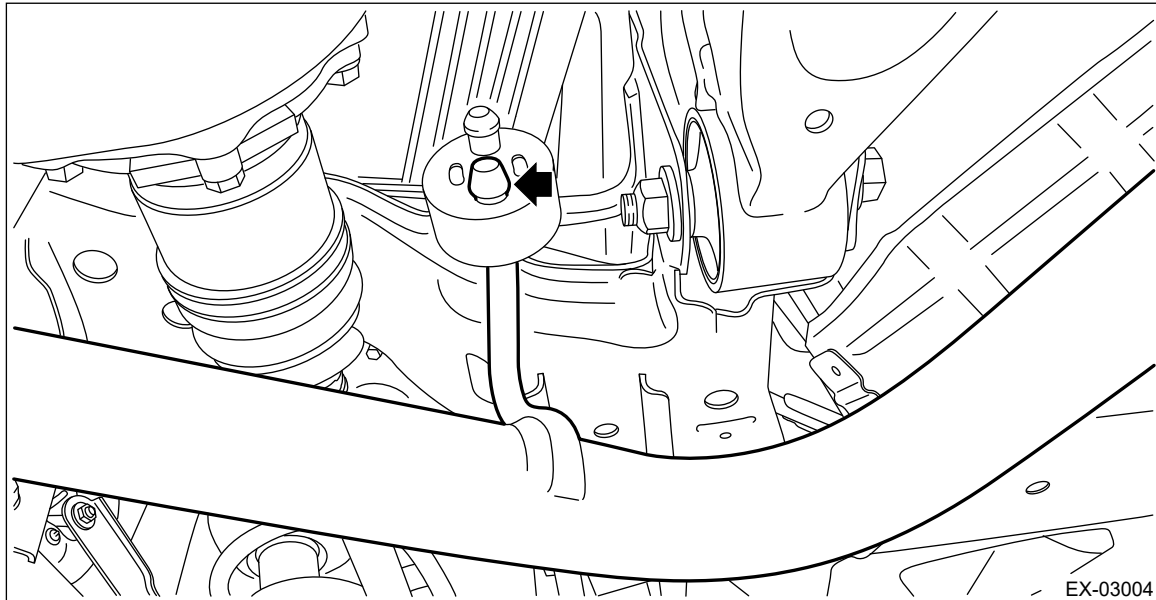
Be careful not to drop the rear exhaust pipe.



4. Apply a coat of spray type lubricant to the mating area of cushion rubber.
5. Remove the rear exhaust pipe from the cushion rubber.

Caution:




Be careful not to let the muffler contact the rear bumper.



FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Camshaft Position Sensor

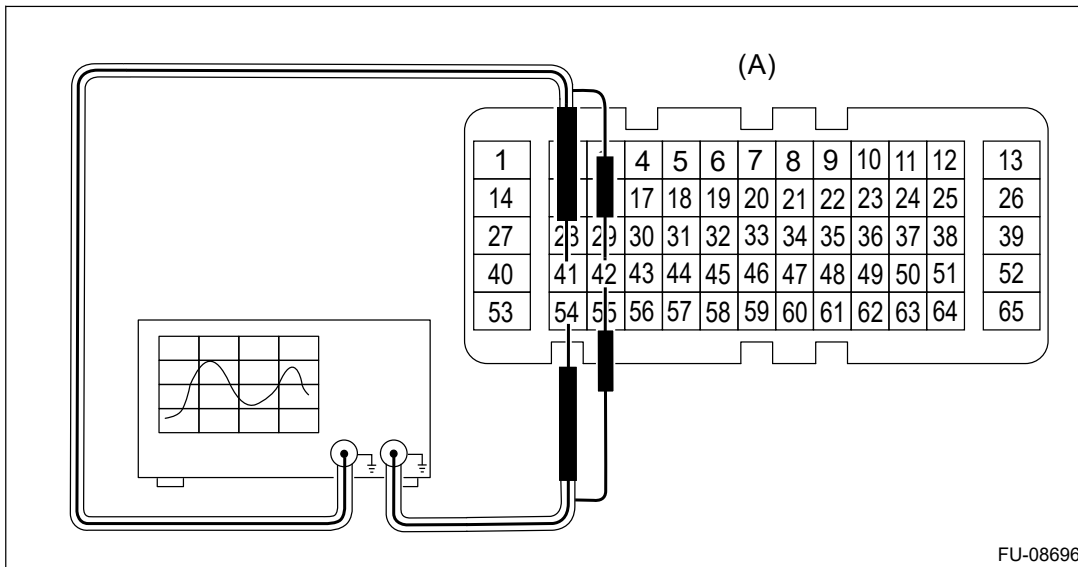
INSPECTION

1. CAMSHAFT POSITION SENSOR

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Prepare an oscilloscope.
3. Remove the ECM.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Control Module \(ECM\)>REMOVAL.](#)
4. Attach the ST between the ECM and bulkhead wiring harness.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>General Description>CAUTION.](#)

ST 18460AA050 CHECK BOARD

5. Connect the probe to ST.




(A) To the check board connector (ECM connector)

| Camshaft position sensor | Terminal No. | Probe |
|--------------------------|--------------|-------|
| RH | 54 | + |
| LH | 41 | + |
| RH and LH | 42 | - |

6. Start the engine and let it idle.
7. Check the waveforms and voltage.

Note:

For waveform and voltage, refer to "Engine Control Module (ECM) I/O Signal".  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Engine Control Module \(ECM\) I/O Signal>ELECTRICAL SPECIFICATION.](#)

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

2. OTHER INSPECTIONS

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

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Camshaft Position Sensor

INSTALLATION


1. Install the camshaft position sensor to the chain cover, and connect the connector to the camshaft position sensor.

Note:

- Use new O-rings.
- Apply engine oil to O-ring.



Tightening torque:

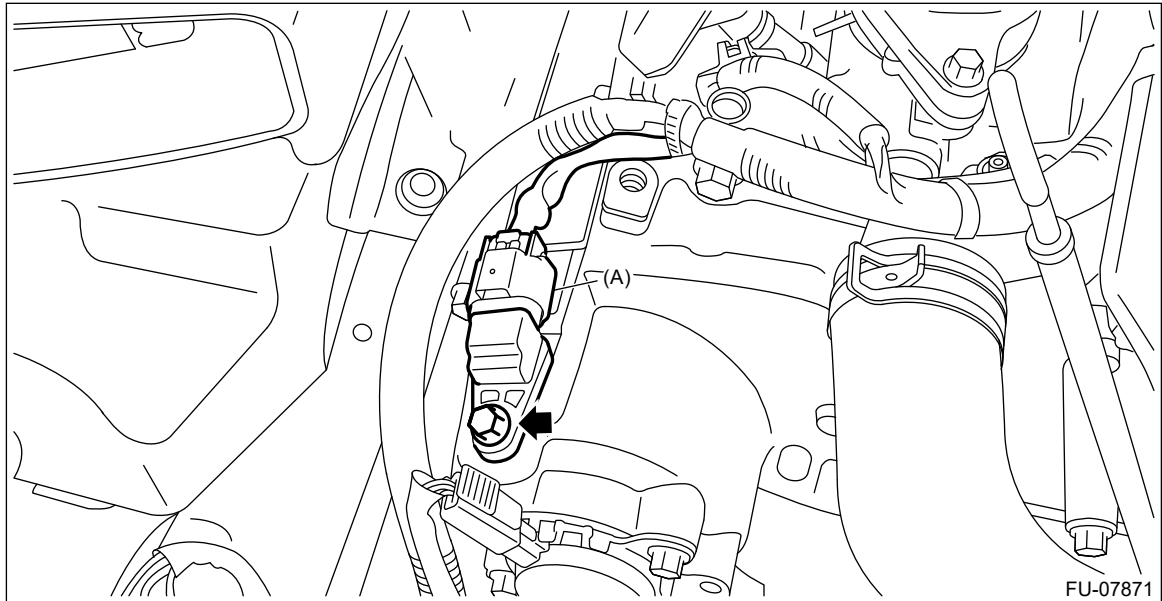
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

2. Install the air intake duct (rear). (RH side only)  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>INSTALLATION.](#)

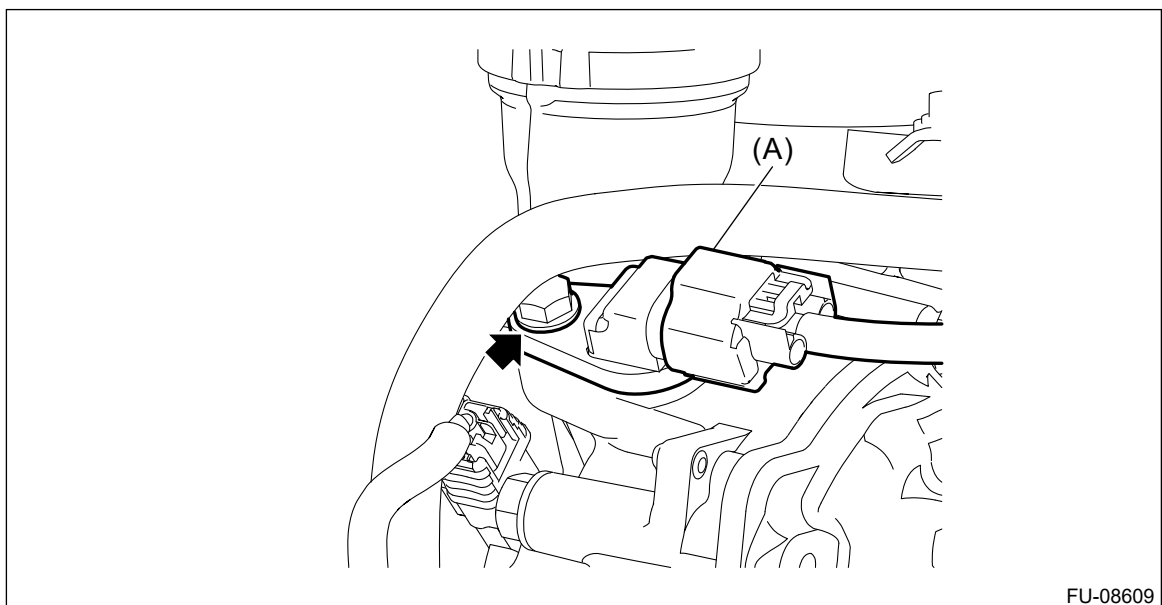
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Camshaft Position Sensor

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct (rear). (RH side only)  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
3. Disconnect the connector (A) from the camshaft position sensor, and remove the camshaft position sensor from the chain cover.
 - RH side



- LH side





FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Crankshaft Position Sensor Plate

INSPECTION

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



FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Crankshaft Position Sensor Plate

INSTALLATION

The crankshaft position sensor plate is tightened together with the drive plate or flywheel; therefore, refer to "Drive Plate" or "Flywheel" for installation procedure.  [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR580\)>Drive Plate>INSTALLATION.](#)  [Ref. to CLUTCH SYSTEM>Flywheel>INSTALLATION.](#)




FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Crankshaft Position Sensor Plate

REMOVAL

The crankshaft position sensor plate is tightened together with the drive plate or flywheel; therefore, refer to "Drive Plate" or "Flywheel" for removal procedure.  [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR580\)>Drive Plate>REMOVAL.](#)  [Ref. to CLUTCH SYSTEM>Flywheel>REMOVAL.](#)

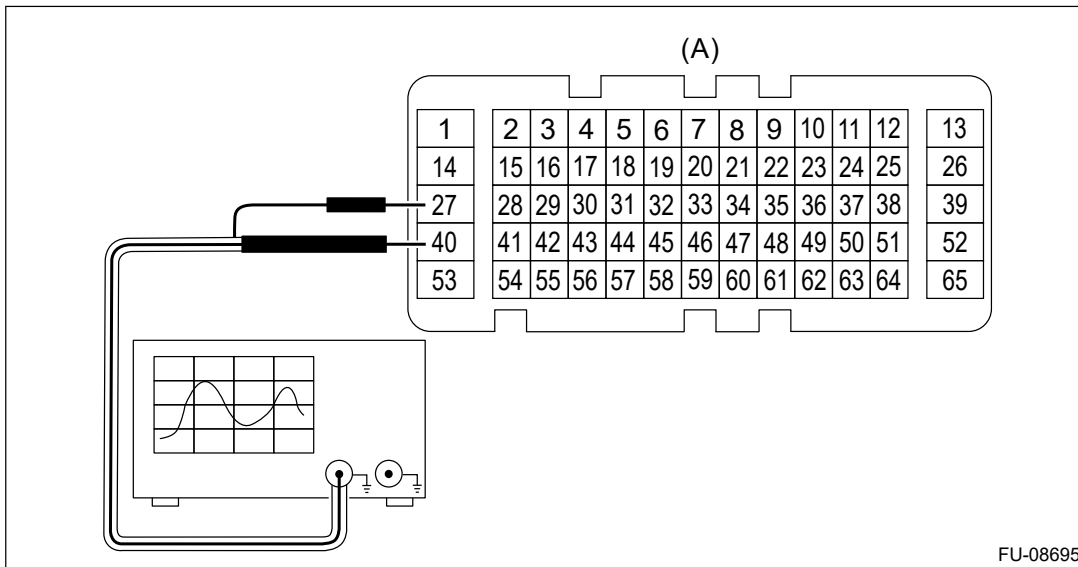
INSPECTION

1. CRANKSHAFT POSITION SENSOR

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Prepare an oscilloscope.
3. Remove the ECM.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Control Module \(ECM\)>REMOVAL.](#)
4. Attach the ST between the ECM and bulkhead wiring harness.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>General Description>CAUTION.](#)

ST 18460AA050 CHECK BOARD

5. Connect the probe to ST.




(A) To the check board connector (ECM connector)

| Terminal No. | Probe |
|--------------|-------|
| 40 | + |
| 27 | - |

6. Start the engine and let it idle.
7. Check the waveforms and voltage.

Note:

For waveform and voltage, refer to “Engine Control Module (ECM) I/O Signal”.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Engine Control Module \(ECM\) I/O Signal>ELECTRICAL SPECIFICATION.](#)

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

2. OTHER INSPECTIONS

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



FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Crankshaft Position Sensor

INSTALLATION

1. Install the crankshaft position sensor to the cylinder block, and connect the connector to the crankshaft position sensor.


Tightening torque:

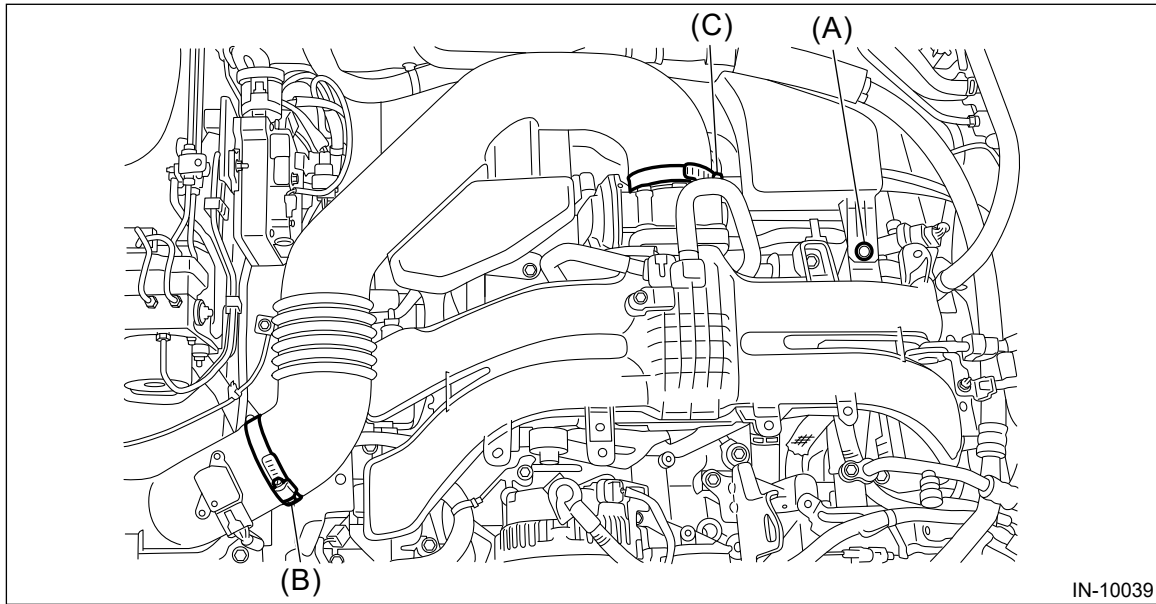
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

2. Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)
3. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

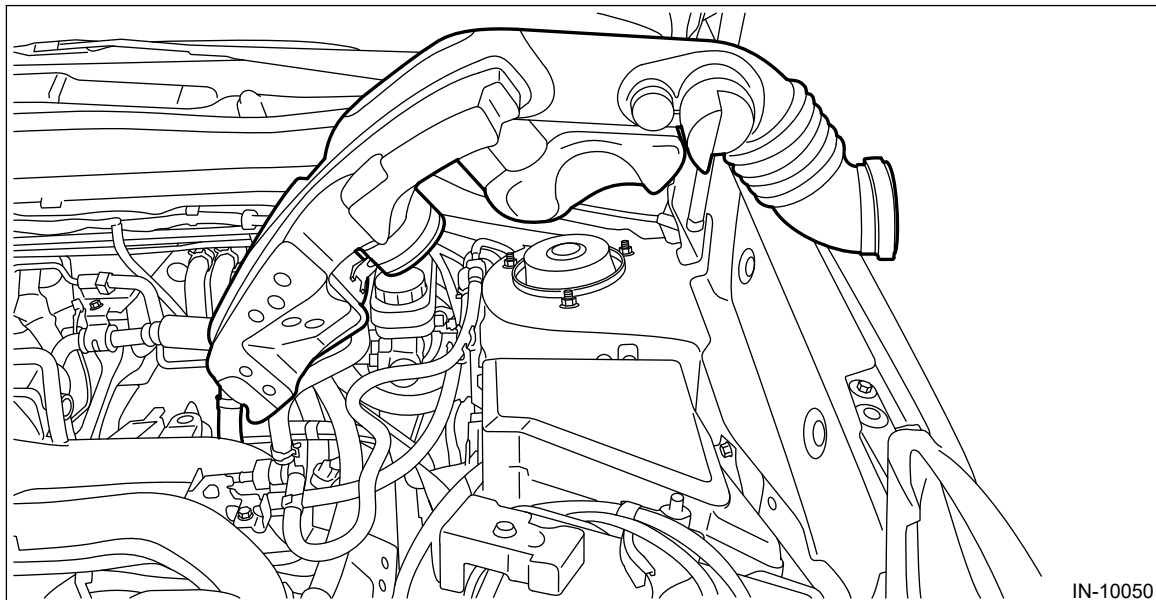
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Crankshaft Position Sensor

REMOVAL

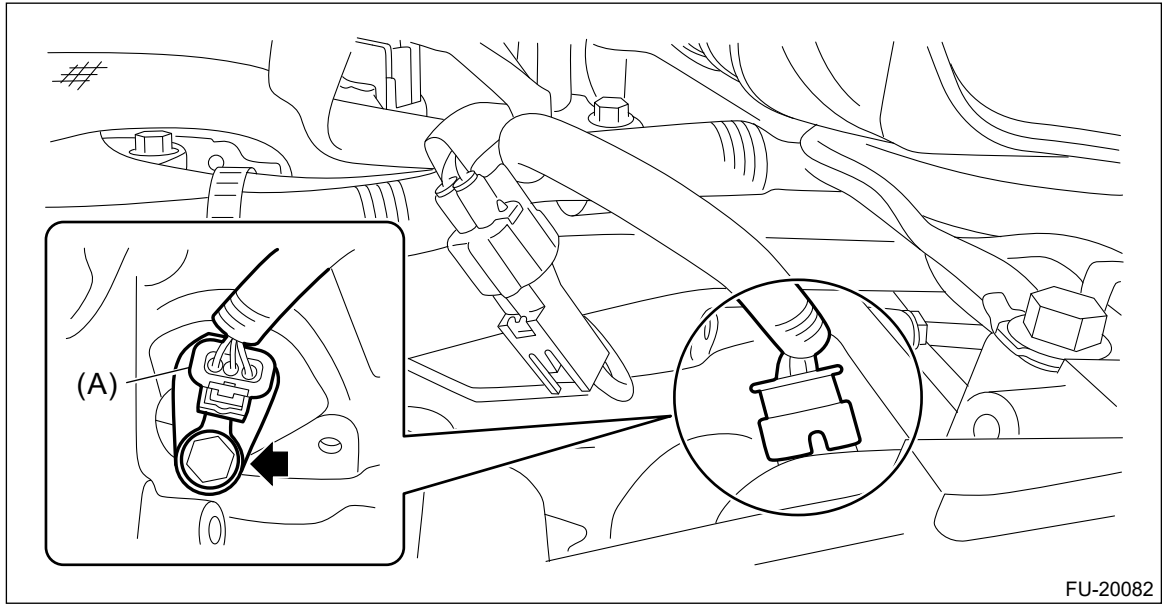
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the clip (A) from the air intake boot.
3. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
4. Loosen the clamp (C) which secures the throttle body to the air intake boot.



5. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.



6. Disconnect the connector (A) from the crankshaft position sensor, and remove the crankshaft position sensor from the cylinder block.

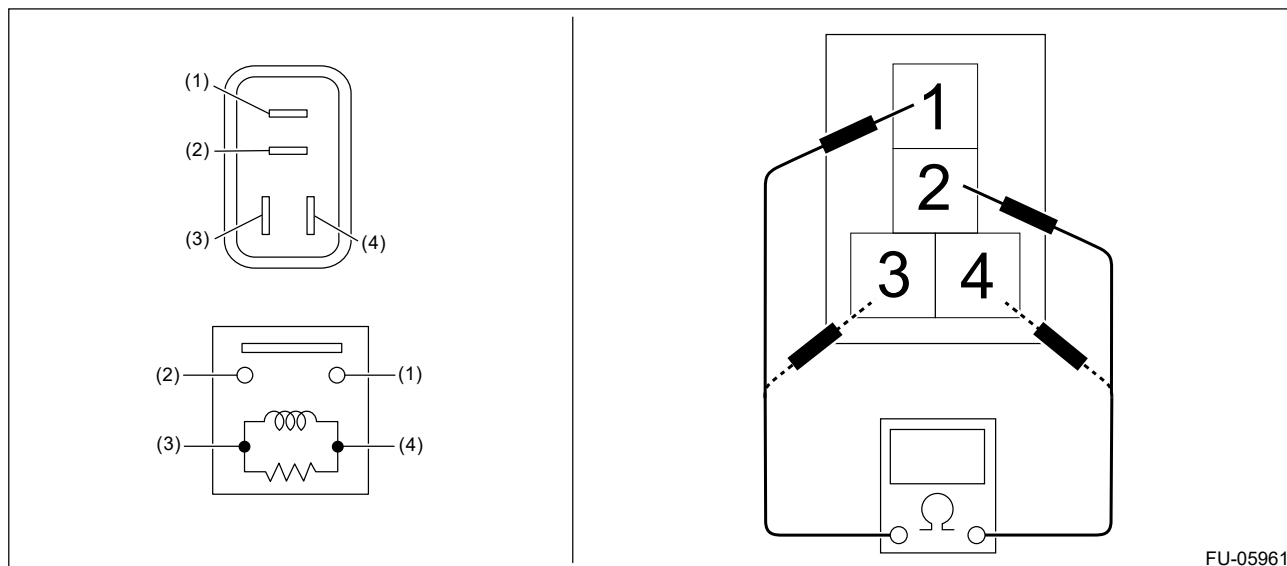


FU-20082

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Electronic Throttle Control Relay

INSPECTION

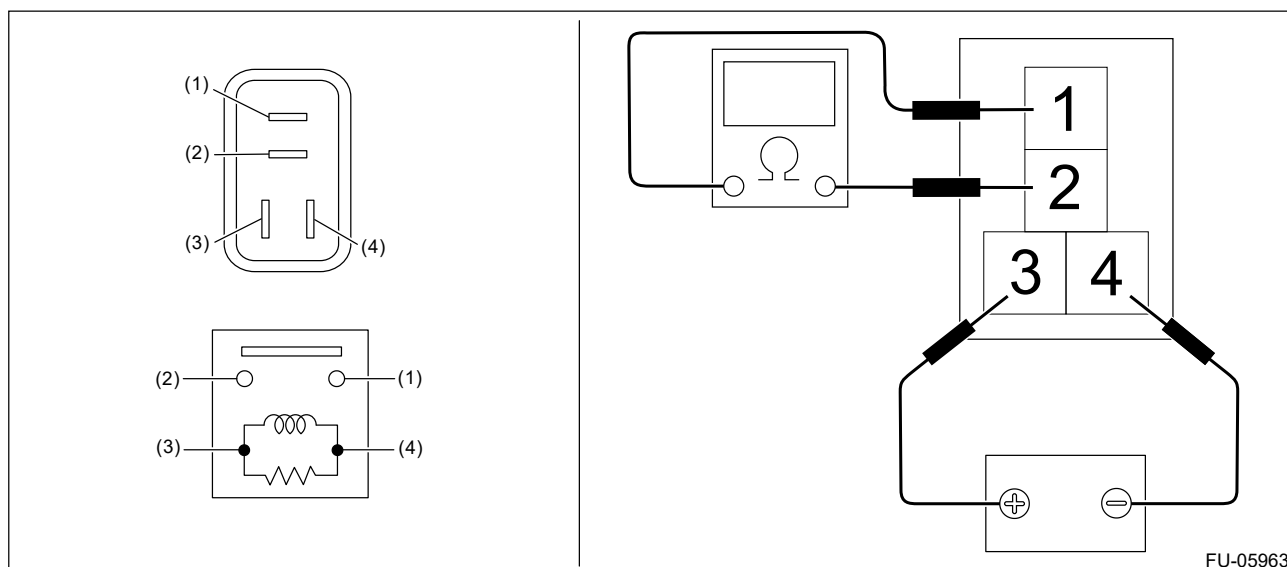
1. Check that the electronic throttle control relay has no deformation, cracks or other damages.
2. Measure the resistance between electronic throttle control relay terminals.



FU-05961

| Terminal No. | Standard |
|--------------|--|
| 1 and 2 | 1 M Ω or more |
| 3 and 4 | 93.8—136.4 Ω (when 20°C (68°F)) |

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



FU-05963

| Terminal No. | Standard |
|--------------|----------------------|
| 1 and 2 | Less than 1 Ω |


FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Electronic Throttle Control Relay

INSTALLATION

1. Install the electronic throttle control relay to the relay block.
2. Install the fuse block.



Tightening torque:

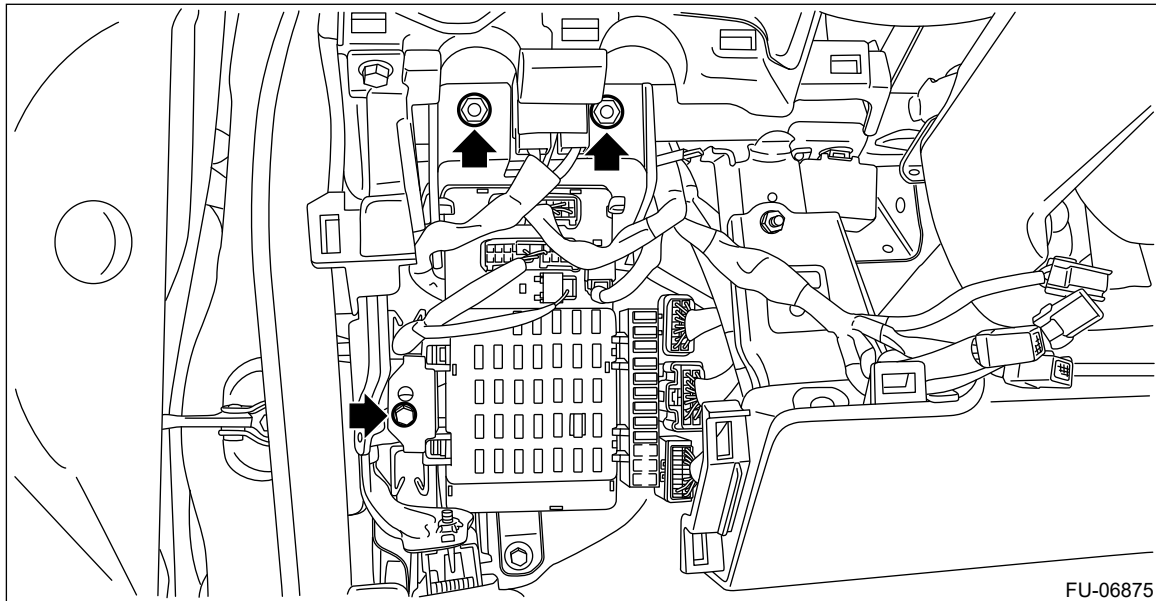
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

3. Install the instrument panel lower cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Instrument Panel Lower Cover>INSTALLATION.](#)
4. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

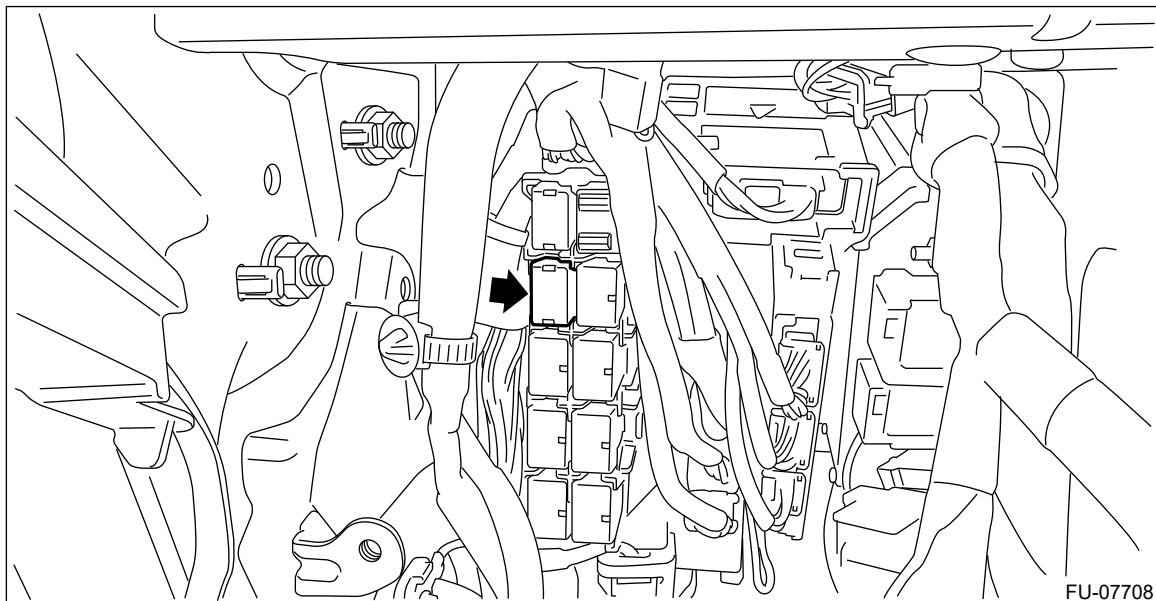
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Electronic Throttle Control Relay

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the instrument panel lower cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Instrument Panel Lower Cover>REMOVAL.](#)
3. Remove the bolts and nuts securing the fuse block and move down the fuse block.



4. Remove the electronic throttle control relay from the relay block.



FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Control Module (ECM)


INSPECTION

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

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Control Module (ECM)

INSTALLATION

Caution:

- When the ECM of model with immobilizer has been replaced, be sure to perform the registration of immobilizer system.
 - For model without keyless access with push button start, refer to the Type B in "REGISTRATION MANUAL FOR IMMOBILIZER".
 - For model with keyless access with push button start, refer to the Type D in "REGISTRATION MANUAL FOR IMMOBILIZER".
- When the ECM has been replaced, be sure to perform the registration of VIN. 
[Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Subaru Select Monitor>OPERATION > V.I.N REGISTRATION.](#)

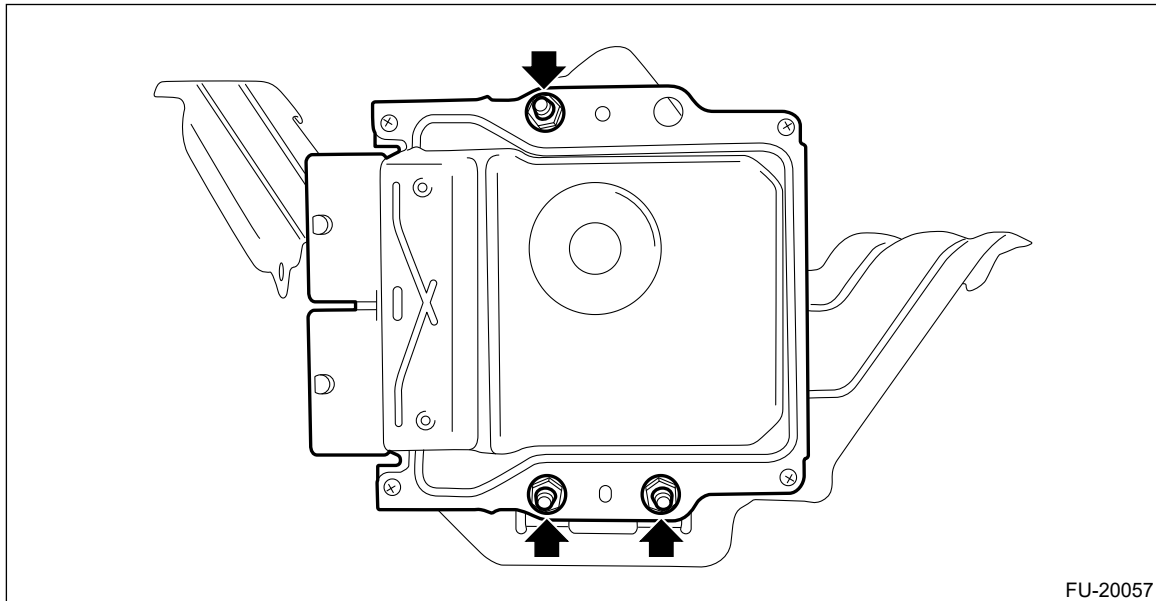
Note:

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

1. Install the bracket to ECM.

Tightening torque:

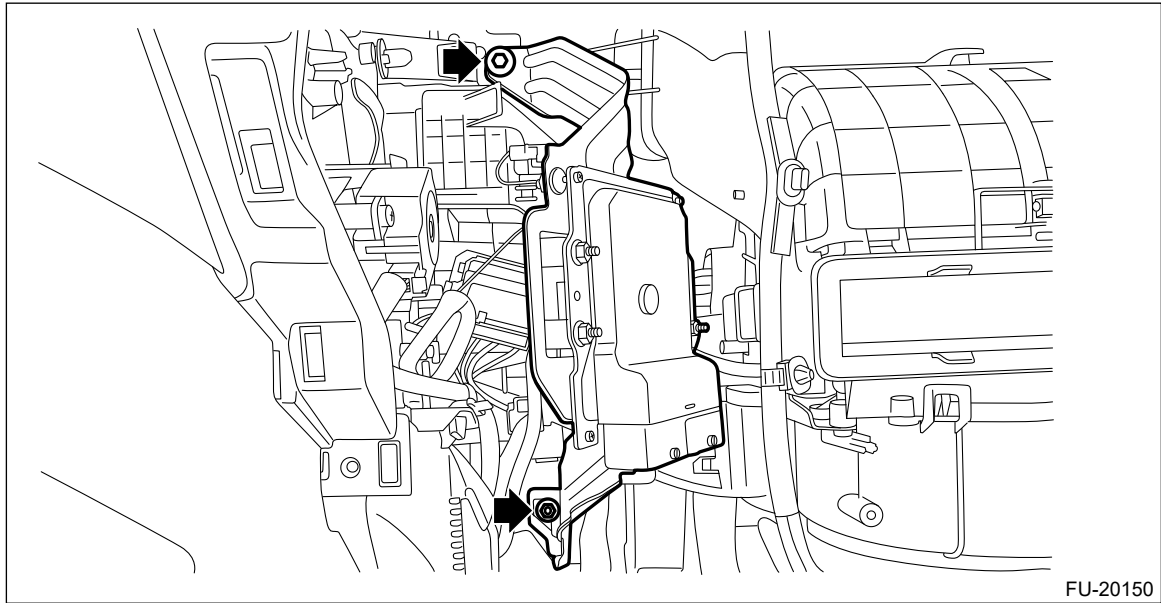
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



2. Install ECM to the vehicle.

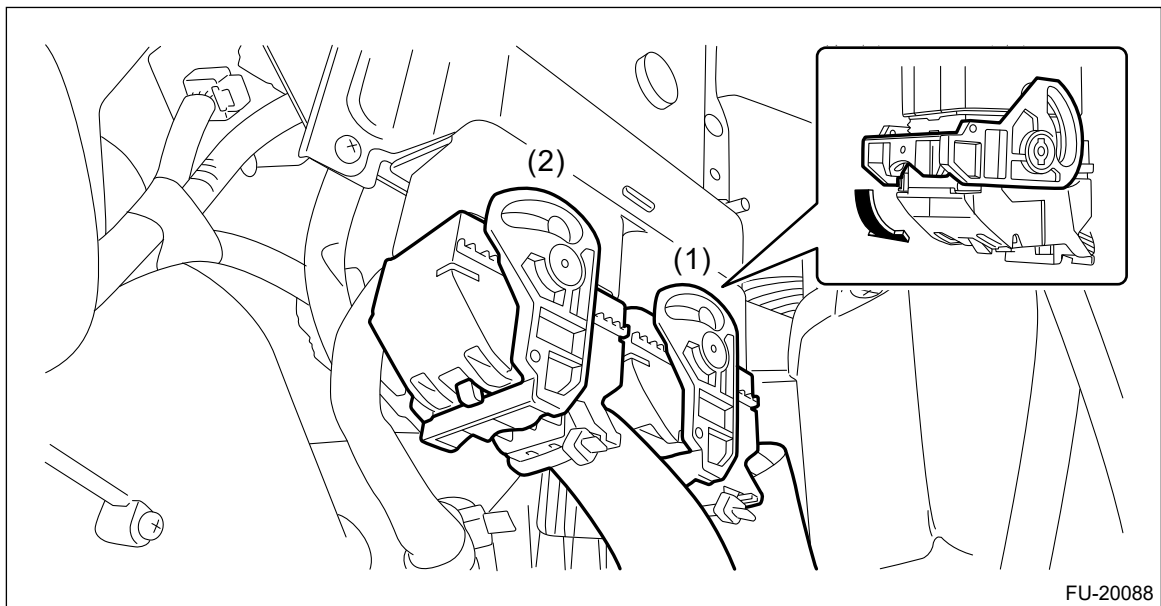
Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)




FU-20150

3. Move the lock lever in the direction of the arrow, and connect the bulkhead harness connector to the ECM in numerical order as shown in the figure.





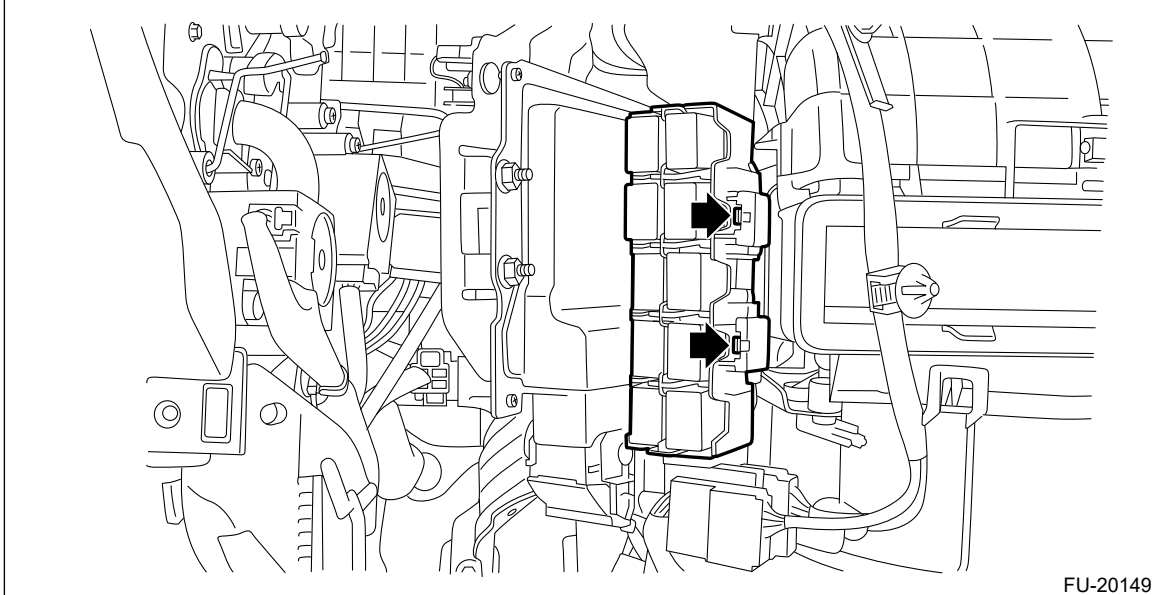
FU-20088

4. Install the relay block.
5. Install the glove box.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>INSTALLATION.](#)
6. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

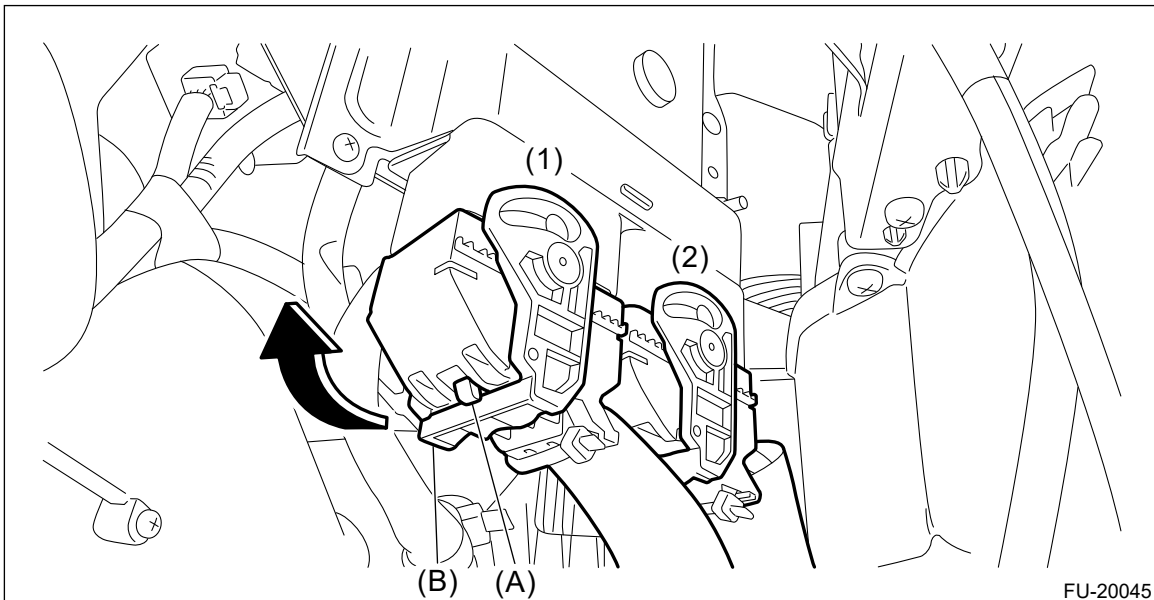
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Control Module (ECM)

REMOVAL

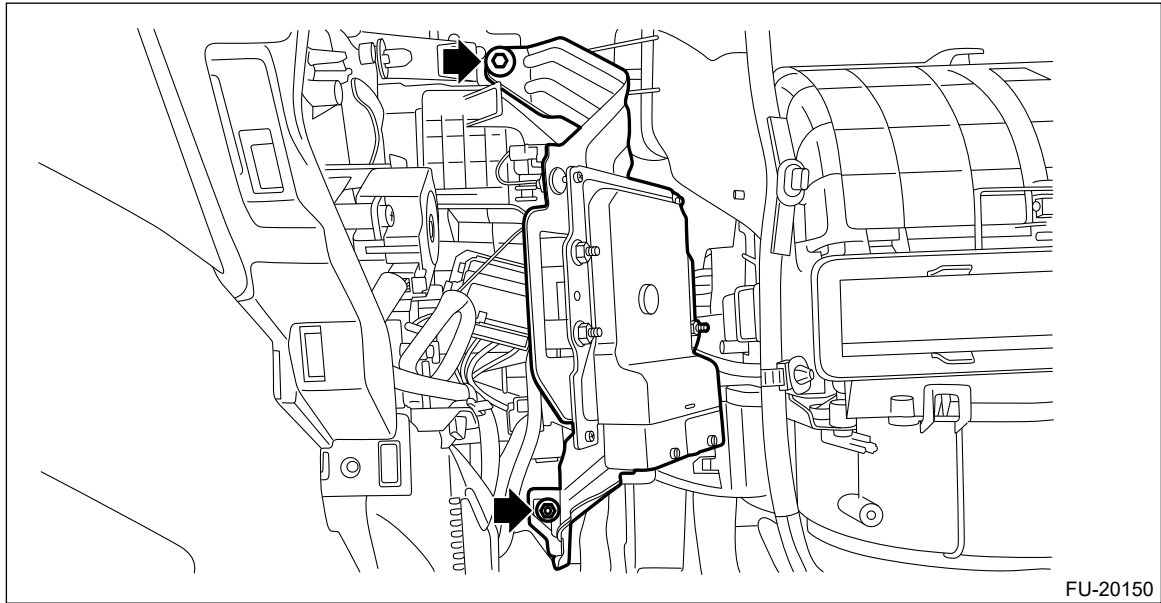
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the glove box.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>REMOVAL.](#)
3. Push down the claws, and remove the relay block.



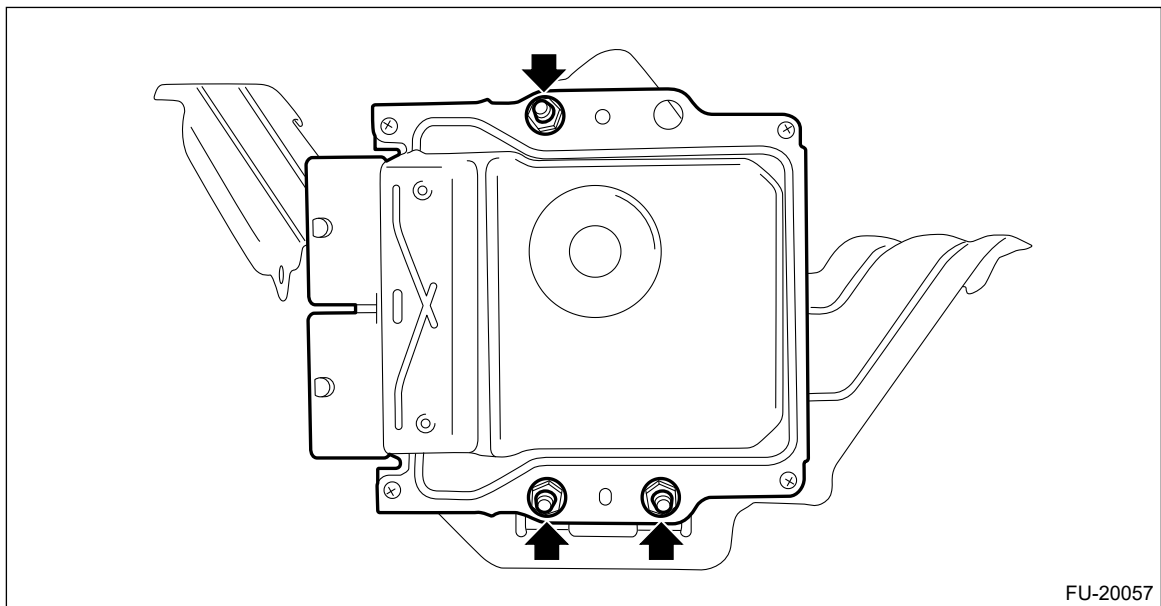
4. While pressing the section (A) shown in the figure, move the lock lever (B) in the direction of the arrow to disconnect the bulkhead harness connectors from the ECM in numerical order as shown in the figure.



5. Remove the bolts and nuts, and remove the ECM.



6. Remove the ECM from the bracket.



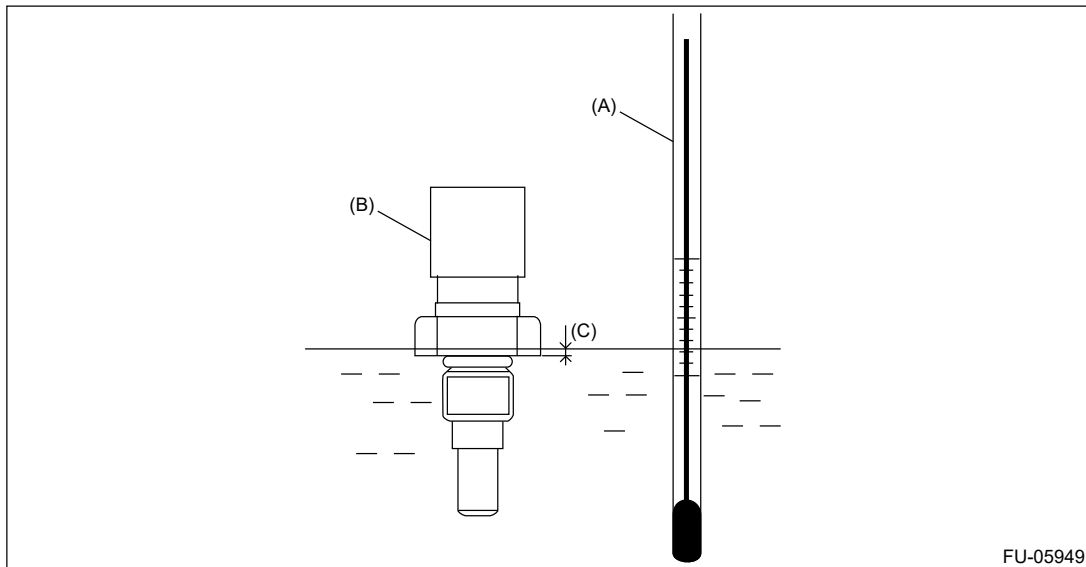
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Coolant Temperature Sensor

INSPECTION

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

Caution:

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



(A) Thermometer

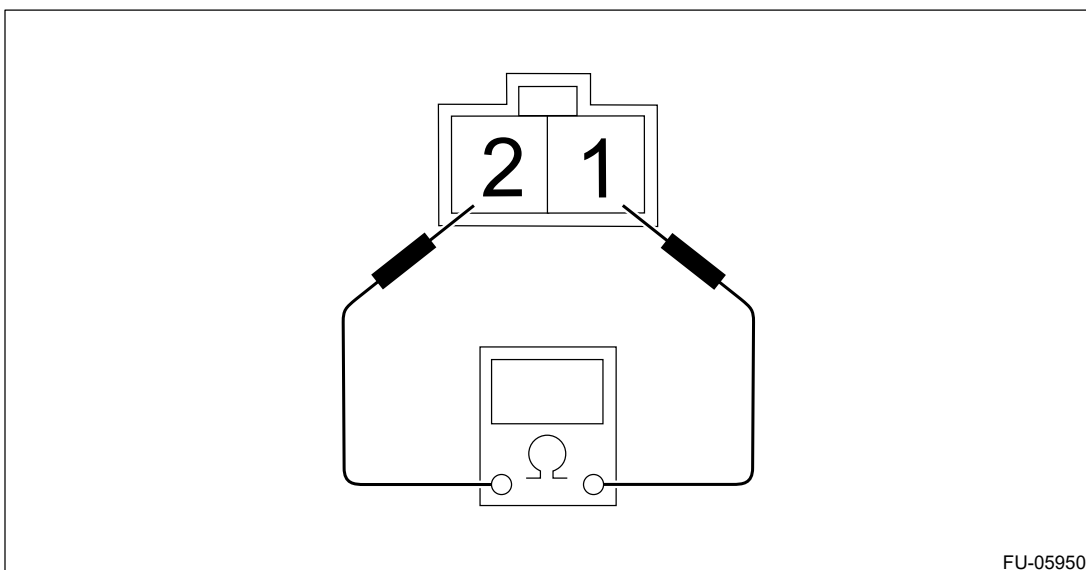
(B) Engine coolant temperature sensor

(C) Hexagonal part height: To approx. $\frac{1}{3}$

3. Raise water temperature gradually, measure the resistance between the engine coolant temperature sensor terminals when the temperature is 20°C (68°F) and 80°C (176°F).

Note:

Agitate the water for even temperature distribution.



| Water temperature | Terminal No. | Standard |
|-------------------|--------------|----------|
|-------------------|--------------|----------|

| | | |
|--------------|---------|------------------------|
| 20°C (68°F) | 1 and 2 | Approx. 2.45±0.2 kΩ |
| 80°C (176°F) | | Approx. 0.318±0.013 kΩ |

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Coolant Temperature Sensor

INSTALLATION



1. Install the engine coolant temperature sensor, and connect the connector to the engine coolant temperature sensor.

Note:

Use a new gasket.



Tightening torque:

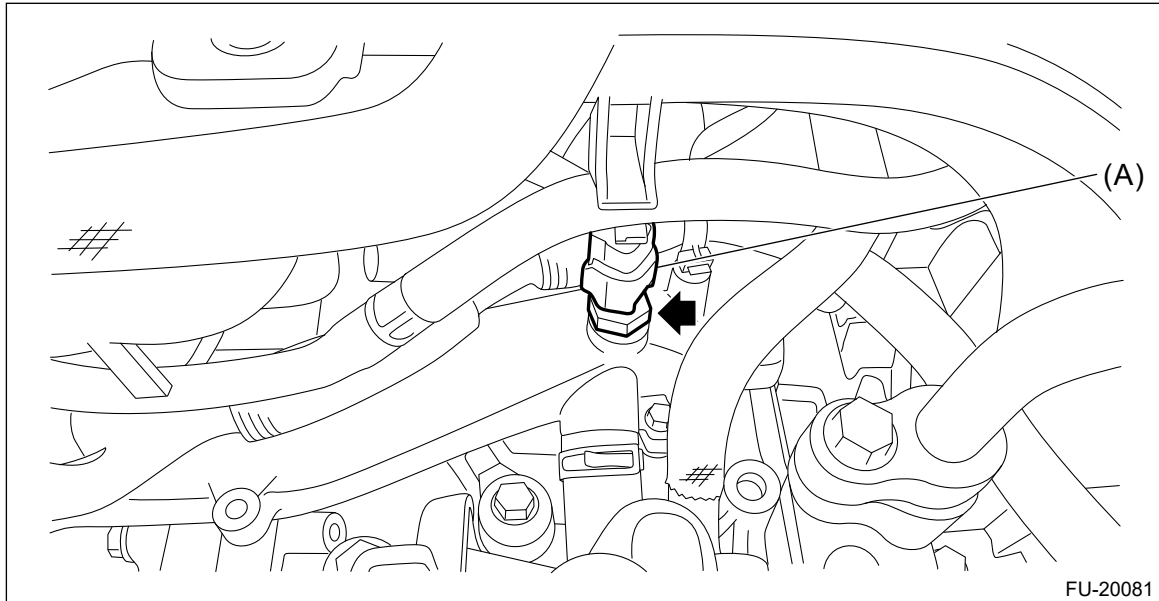
18 N·m (1.8 kgf-m, 13.3 ft-lb)

2. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Coolant Temperature Sensor

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Drain engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
3. Disconnect the connector (A) from the engine coolant temperature sensor, and remove the engine coolant temperature sensor.



FU-20081

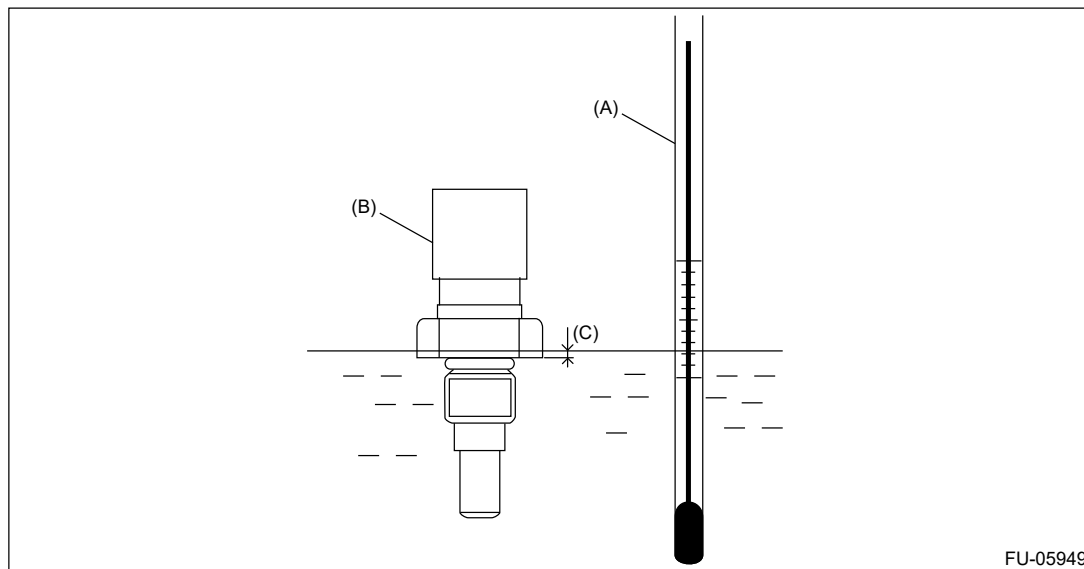
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Oil Temperature Sensor

INSPECTION

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

Caution:

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



(A) Thermometer

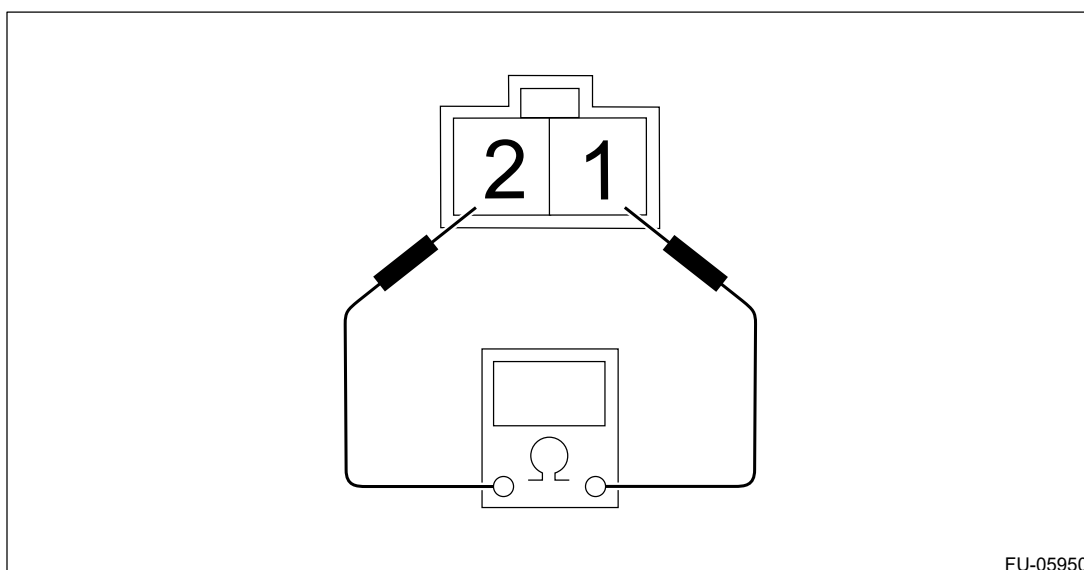
(B) Engine oil temperature sensor

(C) Hexagonal part height: To approx. $\frac{1}{3}$

3. Raise water temperature gradually, measure the resistance between the engine oil temperature sensor terminals when the temperature is 20°C (68°F) and 80°C (176°F).

Note:

Agitate the water for even temperature distribution.



| Water temperature | Terminal No. | Standard |
|-------------------|--------------|----------|
|-------------------|--------------|----------|

| | | |
|--------------|---------|------------------------|
| 20°C (68°F) | 1 and 2 | Approx. 2.45±0.2 kΩ |
| 80°C (176°F) | | Approx. 0.318±0.013 kΩ |

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Oil Temperature Sensor

INSTALLATION


1. Install the engine oil temperature sensor to the chain cover, and connect the connector to the engine oil temperature sensor.

Note:

Use a new gasket.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)


2. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

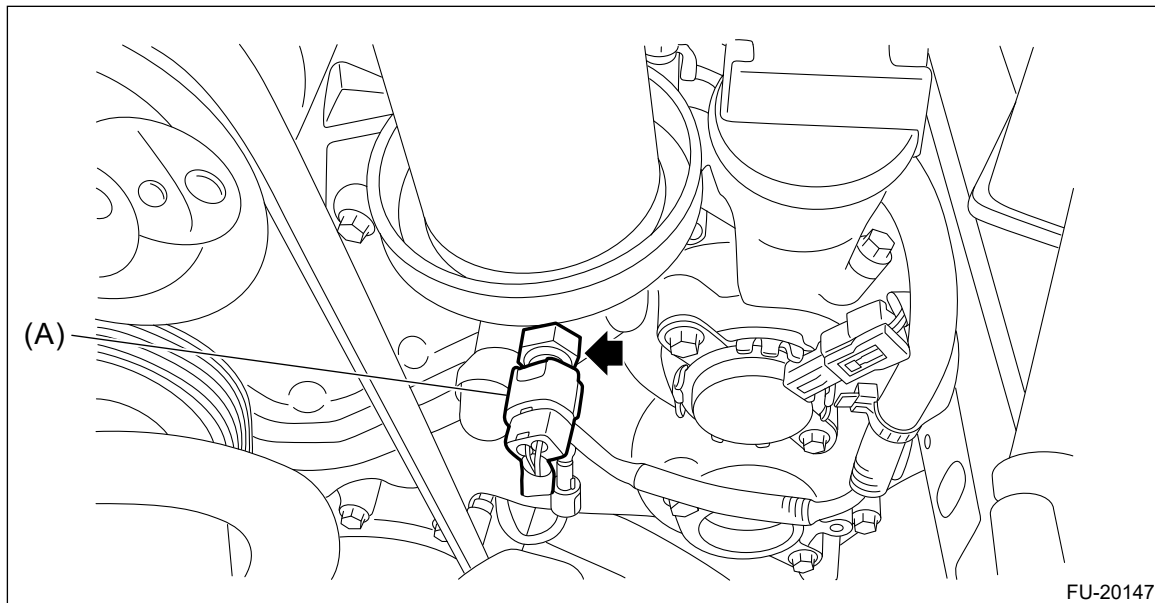
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Oil Temperature Sensor

REMOVAL

Caution:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emission of smoke or causing a fire.

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Disconnect the connector (A) from the engine oil temperature sensor, and remove the engine oil temperature sensor from the chain cover.



FU-20147

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Wiring Harness

INSPECTION

Check that the engine wiring harness does not have deformation, cracks and any other damage.

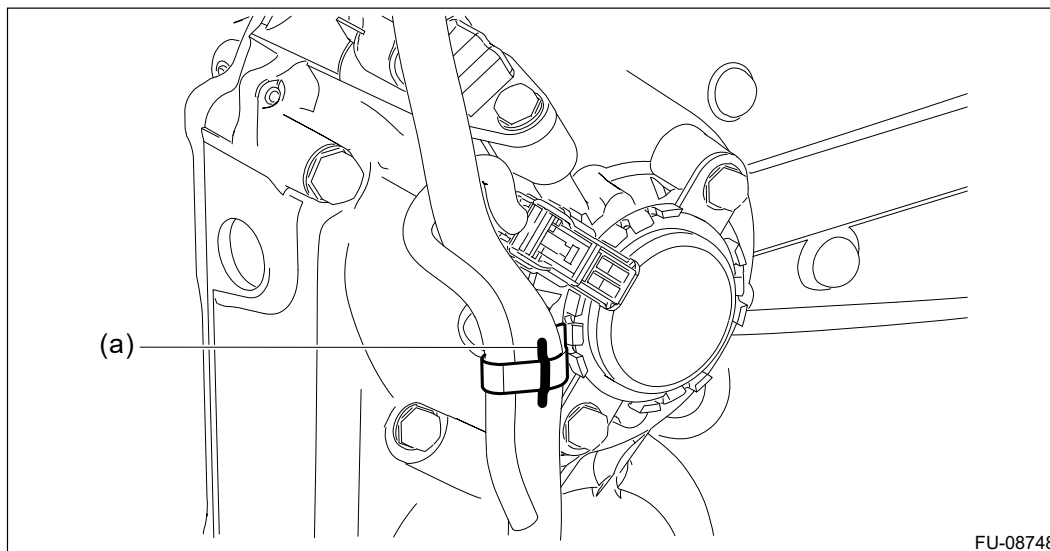
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Wiring Harness

INSTALLATION

1. Set the engine wiring harness to the engine, and connect the connector.

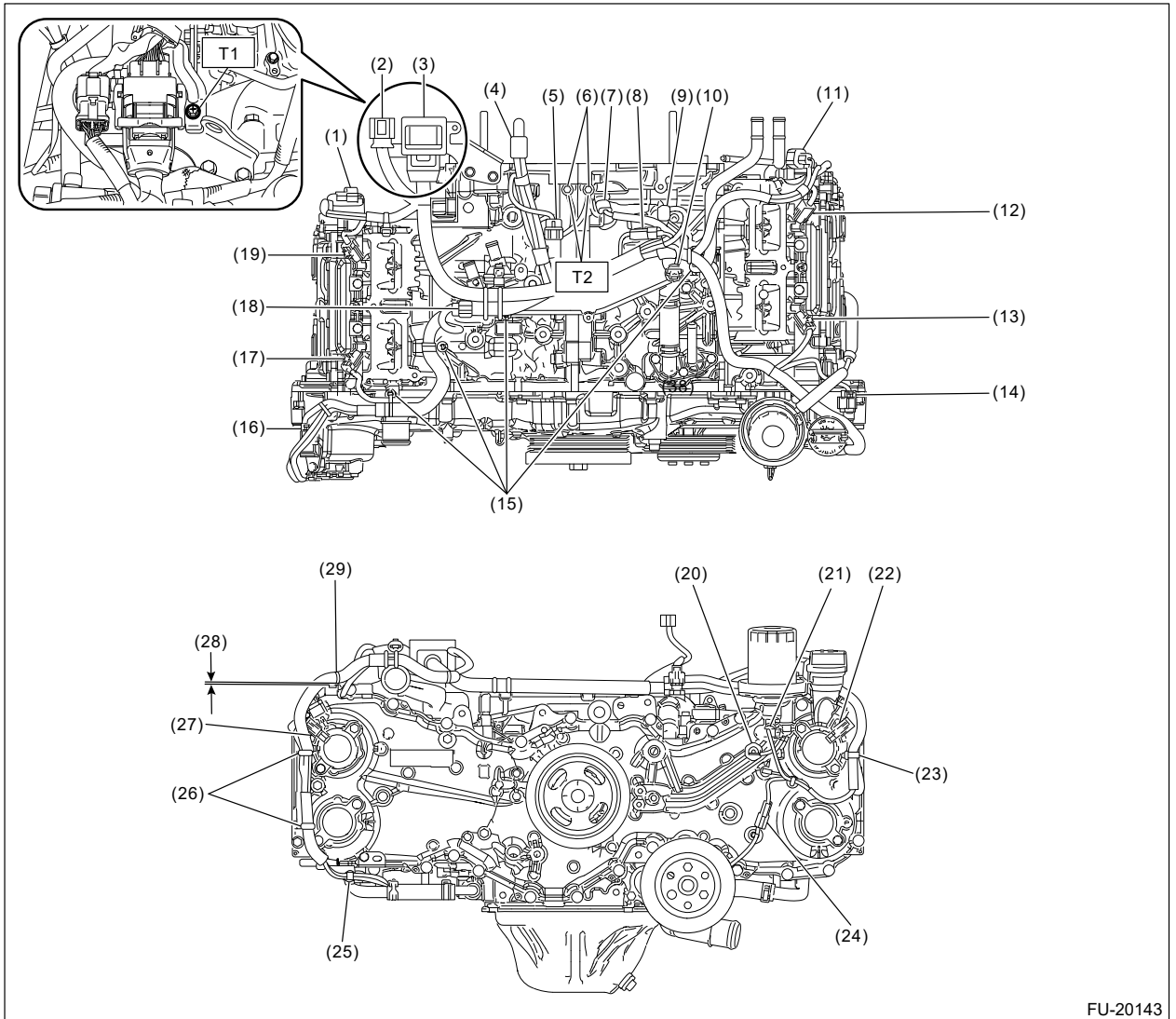
Note:

- If the clip is damaged, replace it with a new part.
- Before replacing the clip, put an alignment mark (a) on both engine wiring harness and clip to remove the clip, and then align to the alignment mark (a) to attach a new clip to the engine wiring harness.



FU-08748

- Structural diagram 1



FU-20143

- (1) Tumble generator valve actuator RH
- (2) Engine harness connector (16P)
- (3) Engine harness connector (54P)
- (4) Throttle position sensor connector
- (5) Manifold absolute pressure sensor connector
- (6) Engine ground (2 locations)
- (7) Crankshaft position sensor
- (8) Knock sensor
- (9) Purge control solenoid valve connector
- (10) Engine coolant temperature sensor
- (11) Tumble generator valve actuator LH
- (12) Fuel injector (#4)
- (13) Fuel injector (#2)
- (14) Camshaft position sensor LH
- (15) Secure the clip to the screw hole.
- (16) Camshaft position sensor RH
- (17) Fuel injector (#1)
- (18) EGR control valve

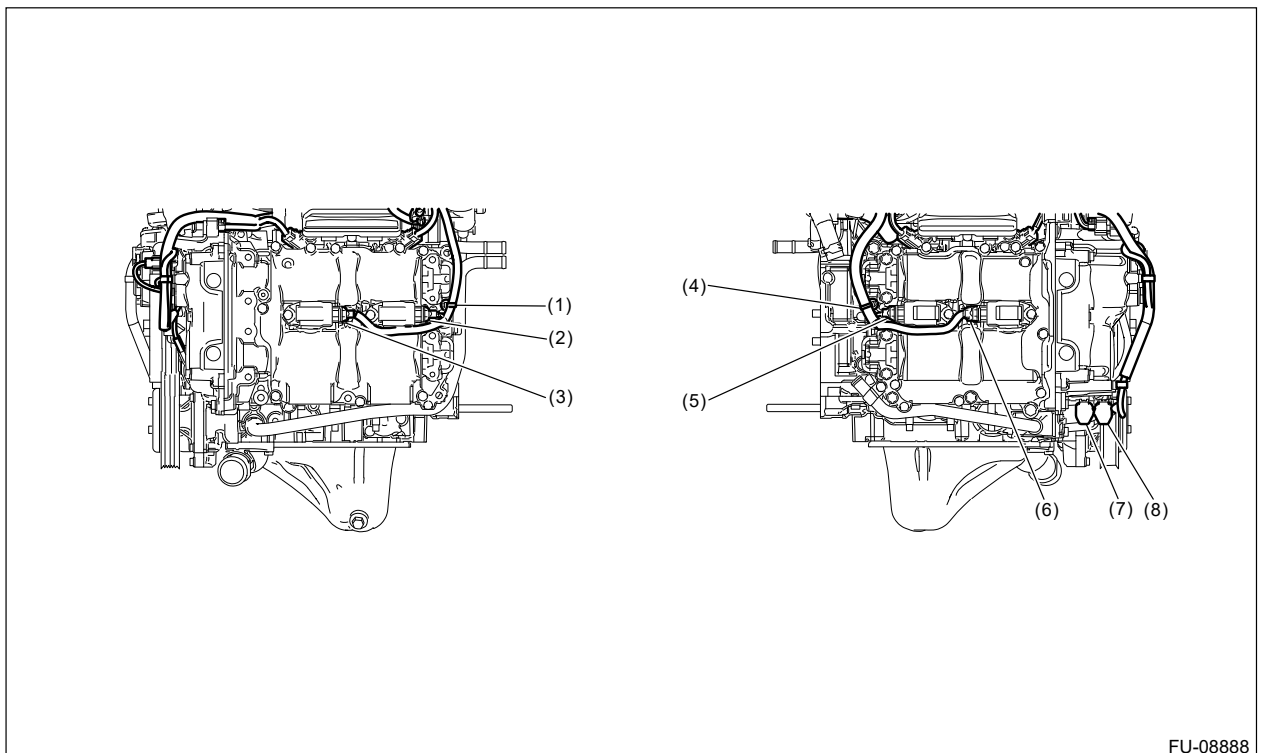
- (19) Fuel injector (#3)
- (20) Oil pressure switch
- (21) Engine oil temperature sensor
- (22) Intake oil control solenoid LH
- (23) Secure the clip to the screw hole.
- (24) Oil level switch
- (25) Secure the clip to the oval hole.
- (26) Secure the clip to the screw hole.
- (27) Intake oil control solenoid RH
- (28) Maximum of 0 – 2 mm (0 – 0.079 in) gap is allowed.
- (29) Secure the clip to the screw hole.

Tightening torque: N·m (kgf·m, ft·lb)

T1: 7.5 (0.8, 5.5)

T2: 19 (1.9, 14.0)

- Structural diagram 2




FU-08888

- (1) Secure the clip to the screw hole.
- (2) Ignition coil No. 4
- (3) Ignition coil No. 2
- (4) Secure the clip to the screw hole.
- (5) Ignition coil No. 3
- (6) Ignition coil No. 1
- (7) Rear oxygen sensor
- (8) Front oxygen (A/F) sensor



2. Install the intake manifold assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake](#)

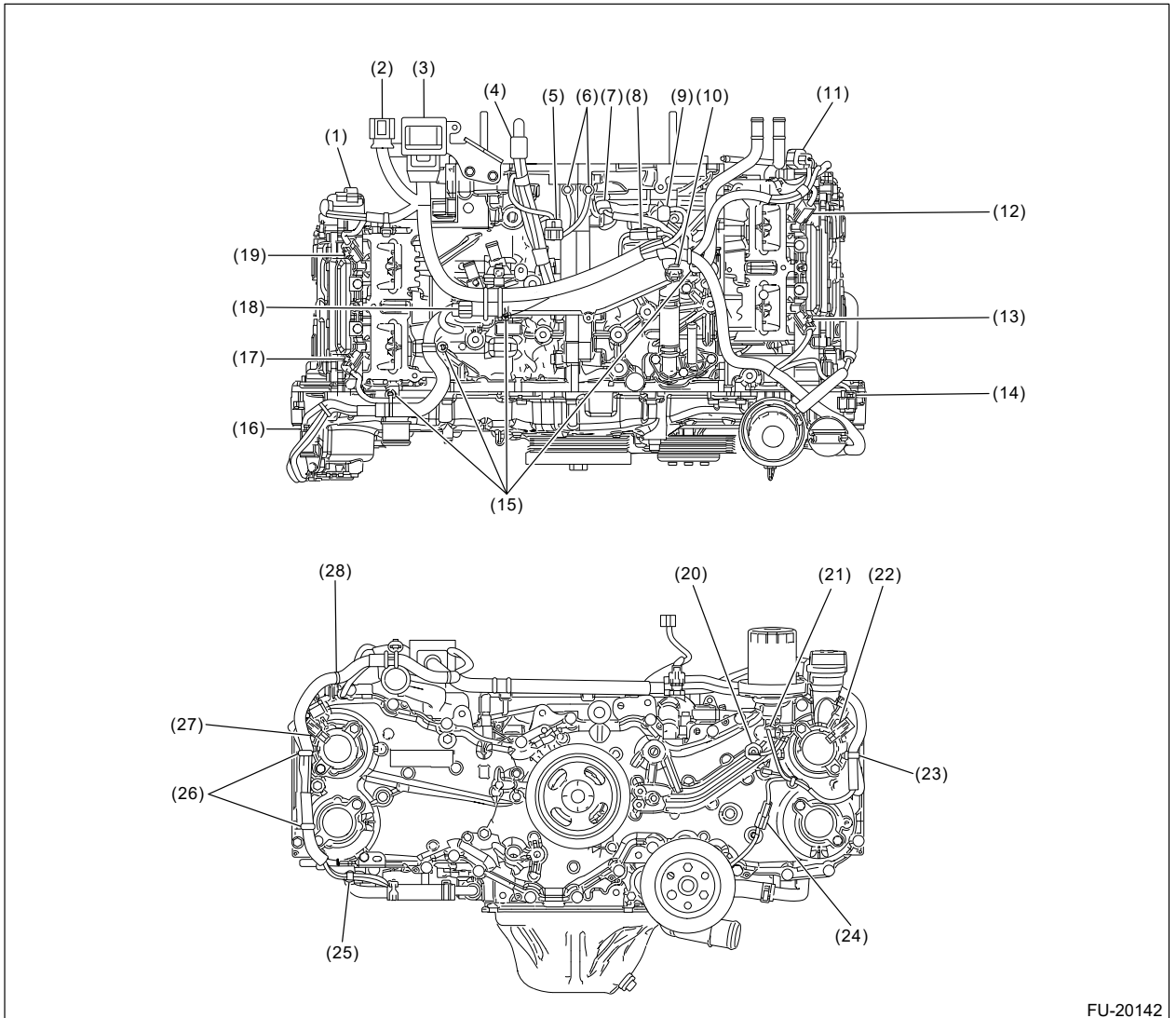
[Manifold Assembly>INSTALLATION.](#)

3. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Engine Wiring Harness

REMOVAL

1. Disconnect the ground terminal from battery sensor.  Ref. to [NOTE>NOTE > BATTERY](#).
2. Remove the intake manifold assembly.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>REMOVAL](#).
3. Disconnect each connector to remove the engine wiring harness.
 - Structural diagram 1

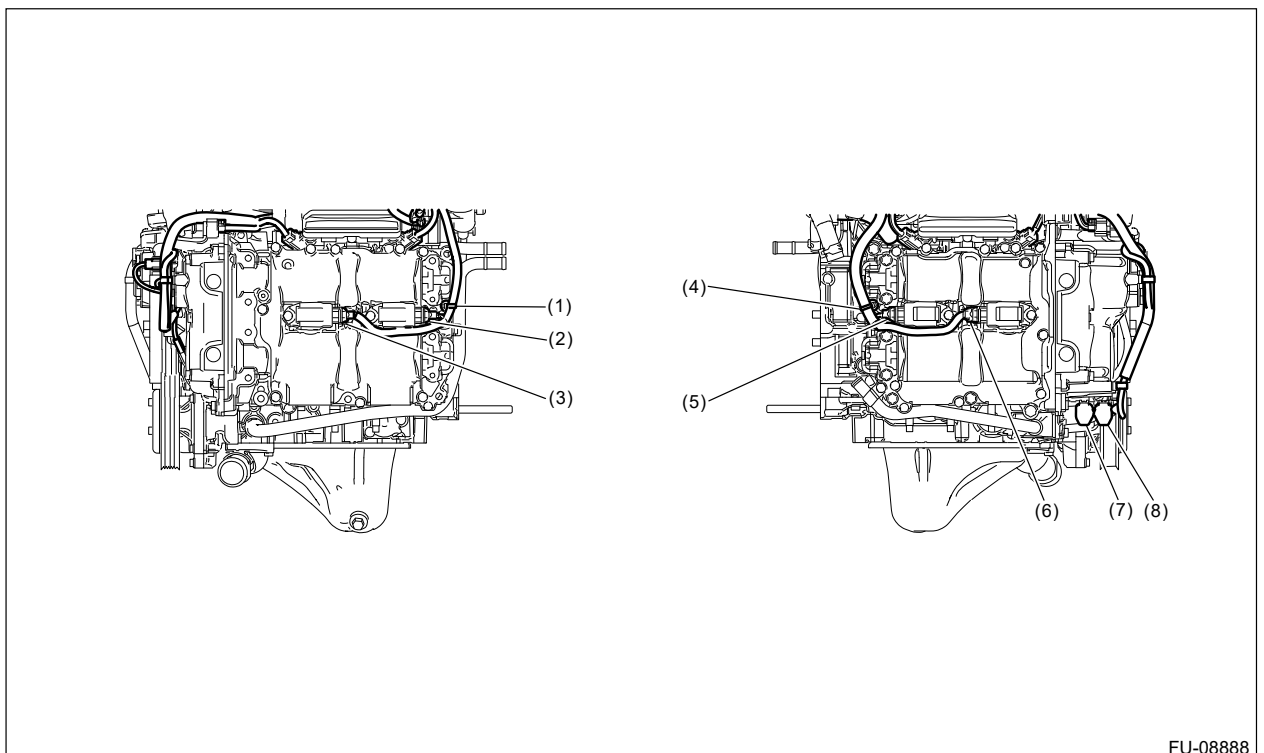


FU-20142

- (1) Tumble generator valve actuator RH
- (2) Engine harness connector (16P)
- (3) Engine harness connector (54P)
- (4) Throttle position sensor connector
- (5) Manifold absolute pressure sensor connector
- (6) Engine ground (2 locations)
- (7) Crankshaft position sensor
- (8) Knock sensor
- (9) Purge control solenoid valve connector
- (10) Engine coolant temperature sensor

- (11) Tumble generator valve actuator LH
- (12) Fuel injector (#4)
- (13) Fuel injector (#2)
- (14) Camshaft position sensor LH
- (15) Remove the clip from the screw hole.
- (16) Camshaft position sensor RH
- (17) Fuel injector (#1)
- (18) EGR control valve
- (19) Fuel injector (#3)
- (20) Oil pressure switch
- (21) Engine oil temperature sensor
- (22) Intake oil control solenoid LH
- (23) Remove the clip from the screw hole.
- (24) Oil level switch
- (25) Remove the clip from the oval hole.
- (26) Remove the clip from the screw hole.
- (27) Intake oil control solenoid RH
- (28) Remove the clip from the screw hole.

- Structural diagram 2



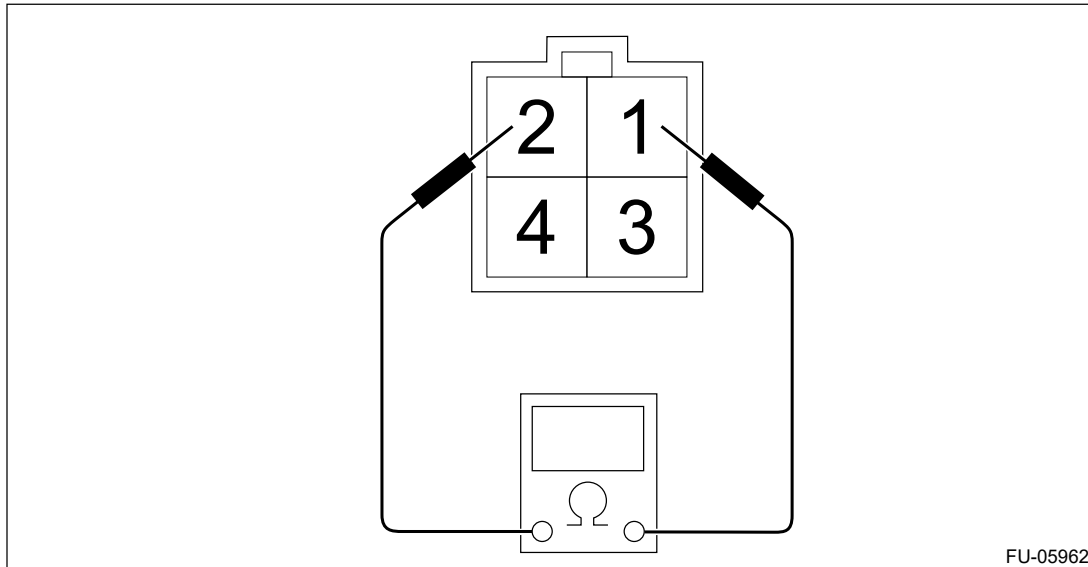
- (1) Remove the clip from the screw hole.
- (2) Ignition coil No. 4
- (3) Ignition coil No. 2
- (4) Remove the clip from the screw hole.
- (5) Ignition coil No. 3
- (6) Ignition coil No. 1

- (7) Rear oxygen sensor
- (8) Front oxygen (A/F) sensor

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Front Oxygen (A/F) Sensor

INSPECTION

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



| Terminal No. | Standard |
|--------------|--|
| 1 and 2 | $2.0^{+0.42}_{-0.2} \Omega$ (when 20°C (68°F)) |

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Front Oxygen (A/F) Sensor

INSTALLATION

Caution:

If lubricant is spilt over the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

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

Caution:

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

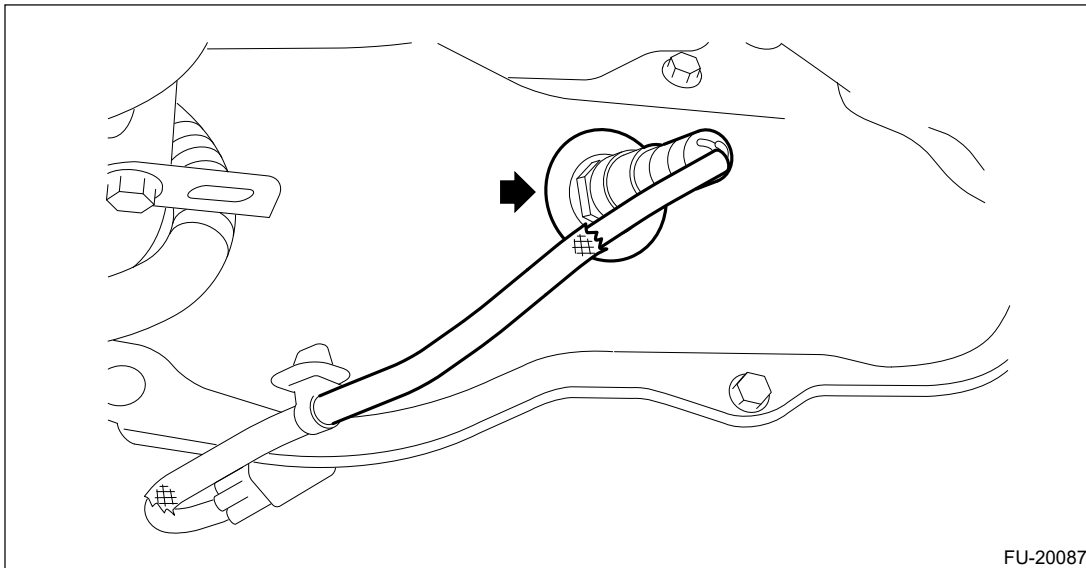
Anti-seize compound:

NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent

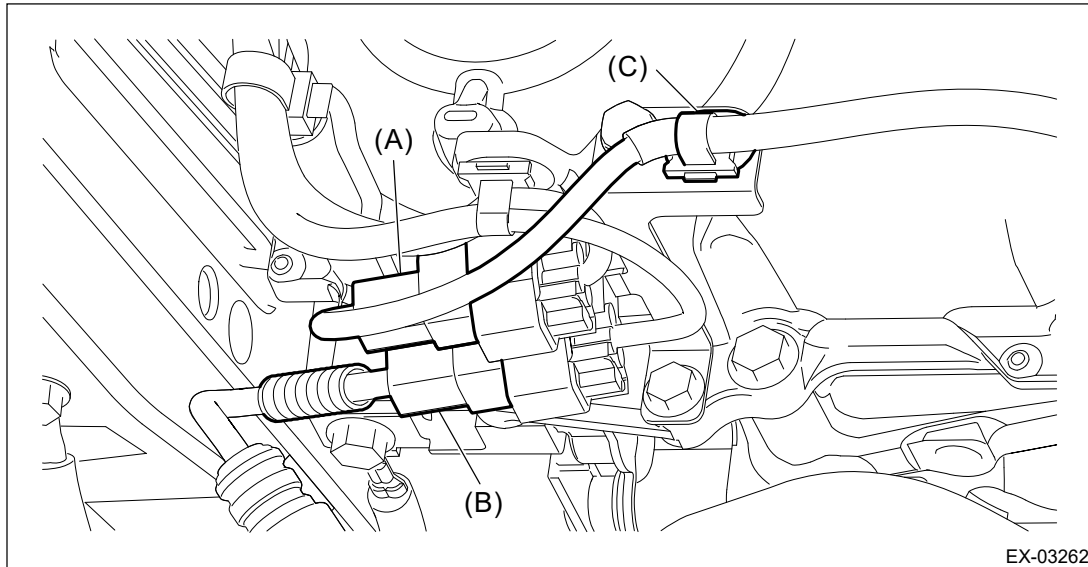
2. Install the front oxygen (A/F) sensor.

Tightening torque:




21 N·m (2.1 kgf-m, 15.5 ft-lb)



3. Lift up the vehicle.
4. Connect the front oxygen (A/F) sensor connector, and secure the front oxygen (A/F) sensor harness by using the clip.






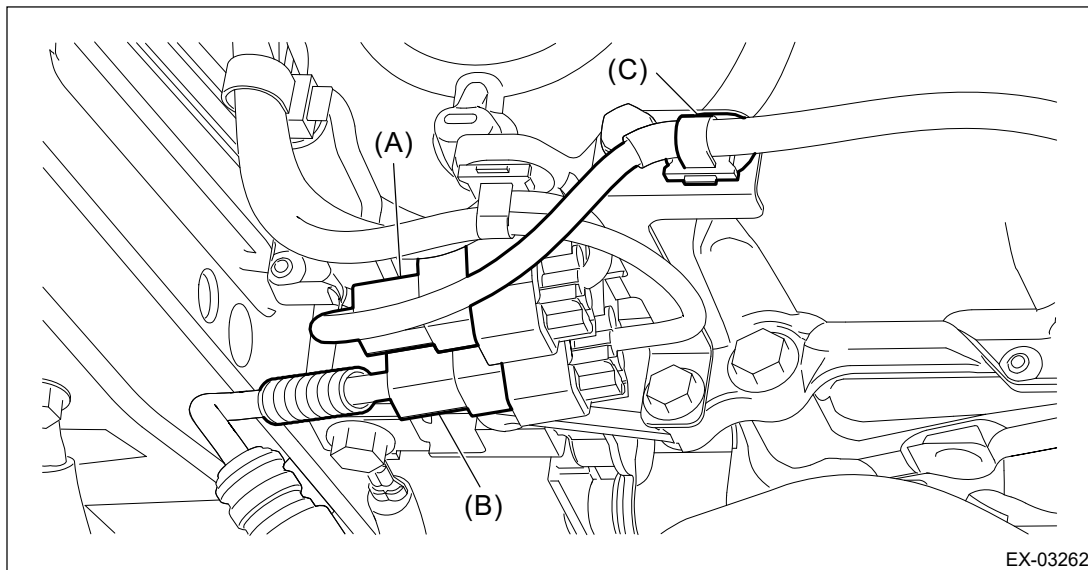
(A) Front oxygen (A/F) sensor (B) Rear oxygen sensor connector (C) Clip connector

5. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
6. Lower the vehicle.
7. Install the radiator sub fan and fan motor assembly.  [Ref. to COOLING\(H4DO\)>Radiator Sub Fan and Fan Motor>INSTALLATION.](#)
8. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Front Oxygen (A/F) Sensor

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the radiator sub fan and fan motor assembly.  [Ref. to COOLING\(H4DO\)>Radiator Sub Fan and Fan Motor>REMOVAL.](#)
3. Lift up the vehicle.
4. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
5. Disconnect the front oxygen (A/F) sensor connector, and remove the clip holding the front oxygen (A/F) sensor harness.

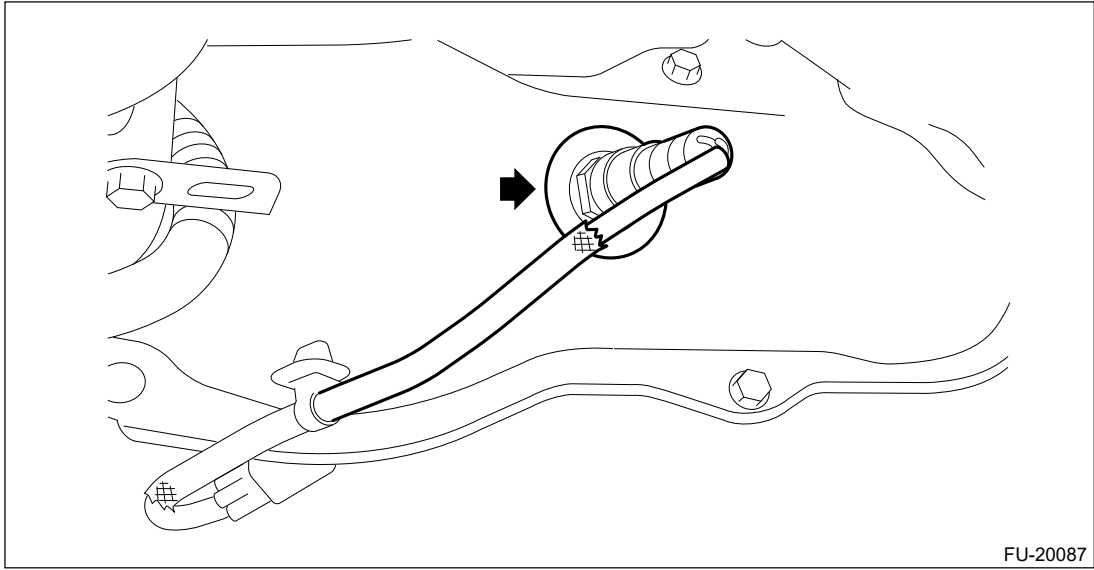


(A) Front oxygen (A/F) sensor (B) Rear oxygen sensor connector (C) Clip connector

6. Lower the vehicle.
7. Apply spray-type lubricant (004301003) or equivalent to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.
8. Remove the front oxygen (A/F) sensor.

Caution:

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



FU-20087

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Delivery and Evaporation Lines

INSPECTION

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

INSTALLATION

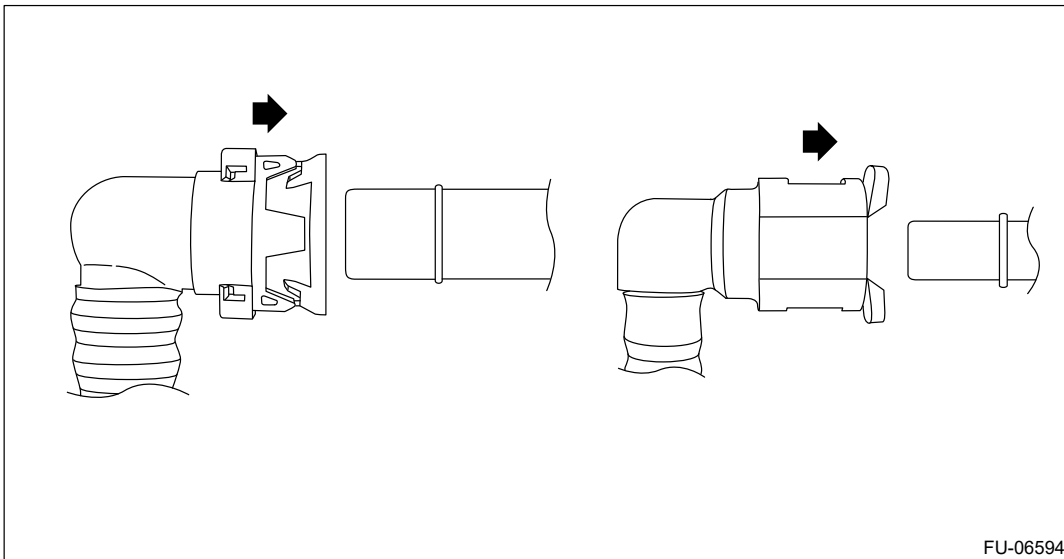
Install in the reverse order of removal while being careful of the following.

1. CONNECTING THE EVAPORATION LINE QUICK CONNECTOR

Connect the quick connector as shown in the figure.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.



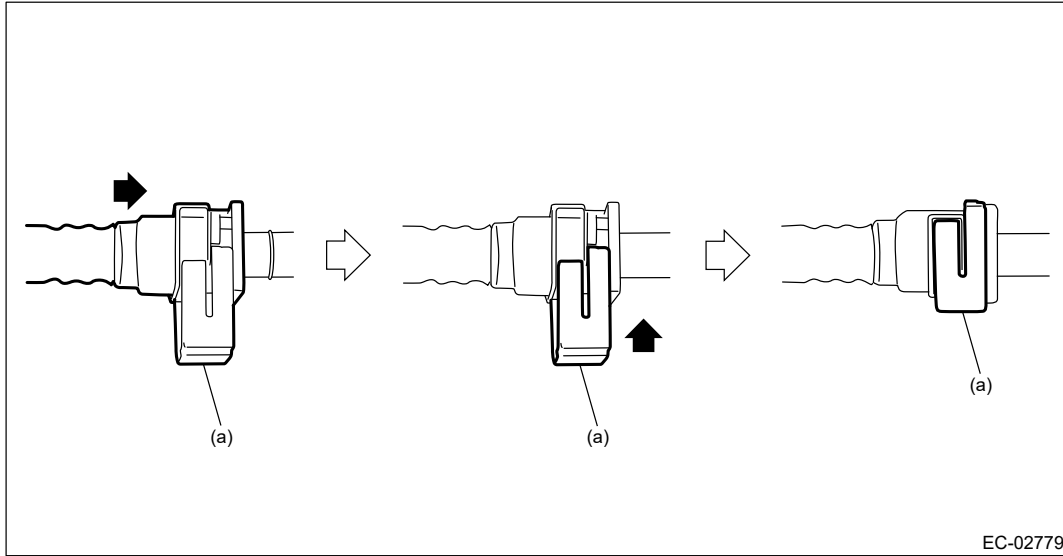
FU-06594

2. CONNECTING THE FUEL LINE QUICK CONNECTOR

Connect the quick connector as shown in the figure.

Caution:

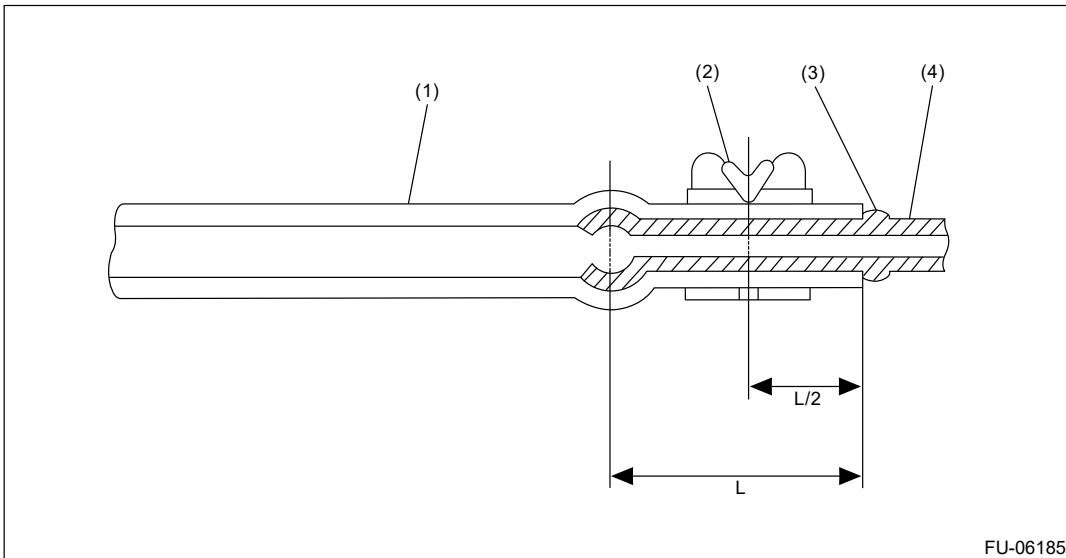
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.



(a) Slider

3. EVAPORATION HOSE CONNECTION

Connect the evaporation hose by inserting it to the pipe until the hose reaches the spool or bump.



(1) Hose

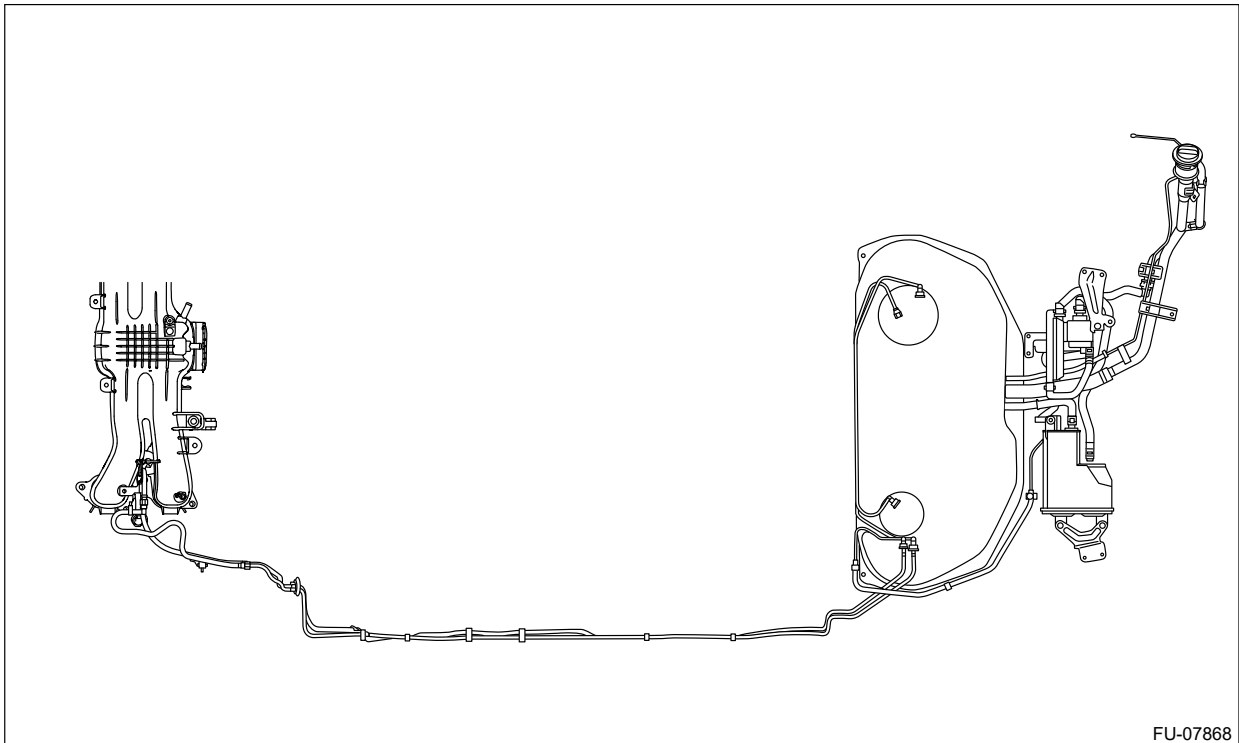
(3) Spool or bump

(4) Pipe

(2) Clip

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Delivery and Evaporation Lines

REMOVAL




Warning:

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


Caution:

Be careful not to spill fuel.

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Open the fuel filler lid and remove the fuel filler cap.

Note:

This operation is required to release the inner pressure of the fuel tank.

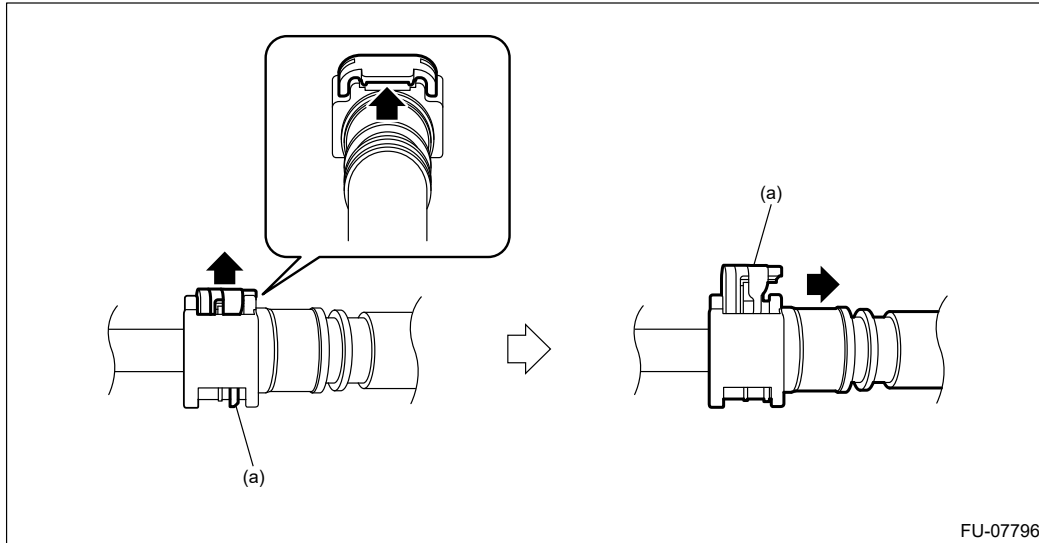
3. Remove the floor mat.  [Ref. to EXTERIOR/INTERIOR TRIM>Floor Mat>REMOVAL.](#)
4. In the engine compartment, disconnect the fuel delivery tube (A) and evaporation hose (B).

Caution:

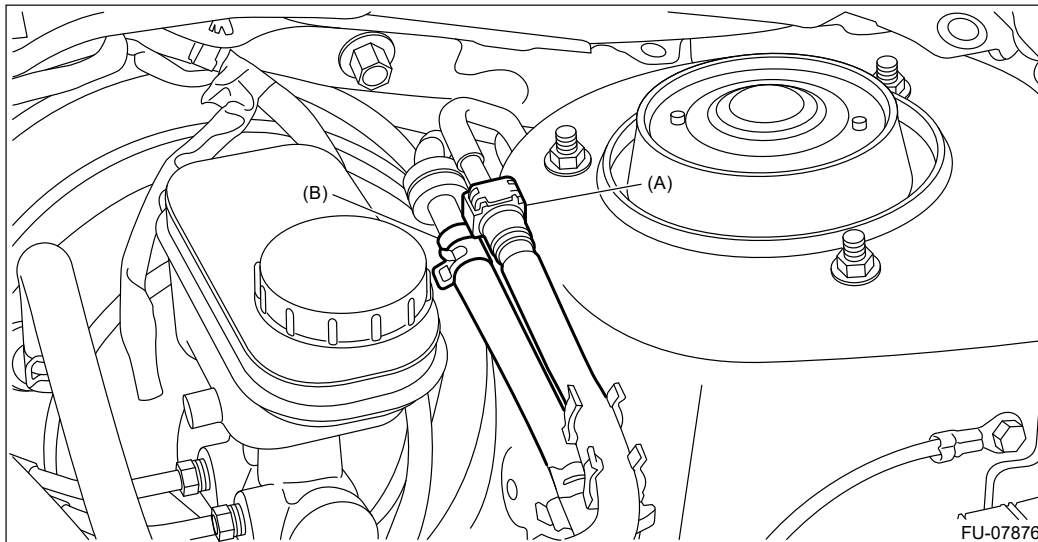
- Be careful not to spill fuel.
- Catch the fuel from the tubes using a container or cloth.


Note:

Disconnect the quick connector as shown in the figure.



(a) Slider



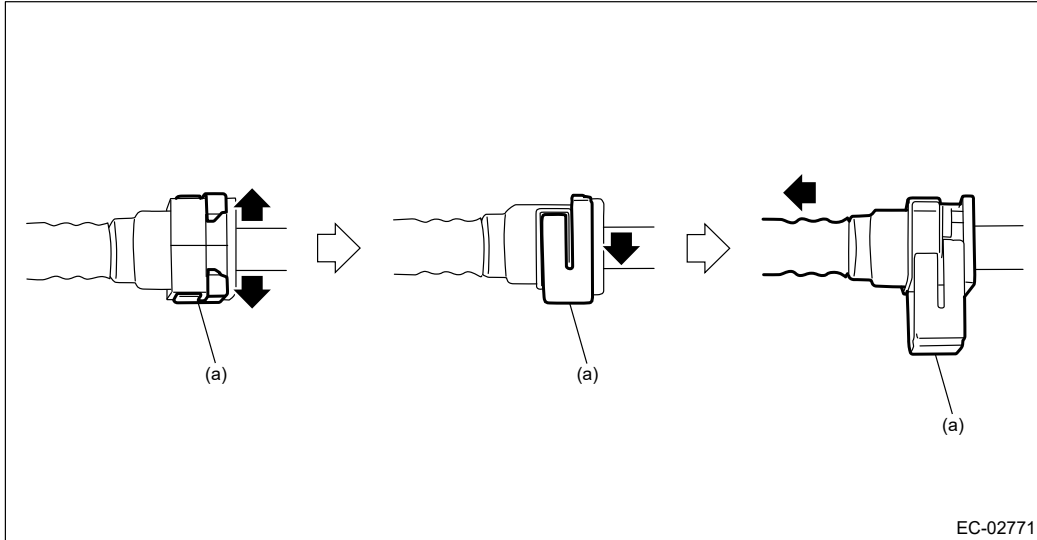
5. Remove the fuel tank.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Tank>REMOVAL.](#)
6. Disconnect the quick connector, and remove the fuel delivery tube and jet pump tube from the fuel tank.

Caution:

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

Note:

Disconnect the quick connector as shown in the figure.

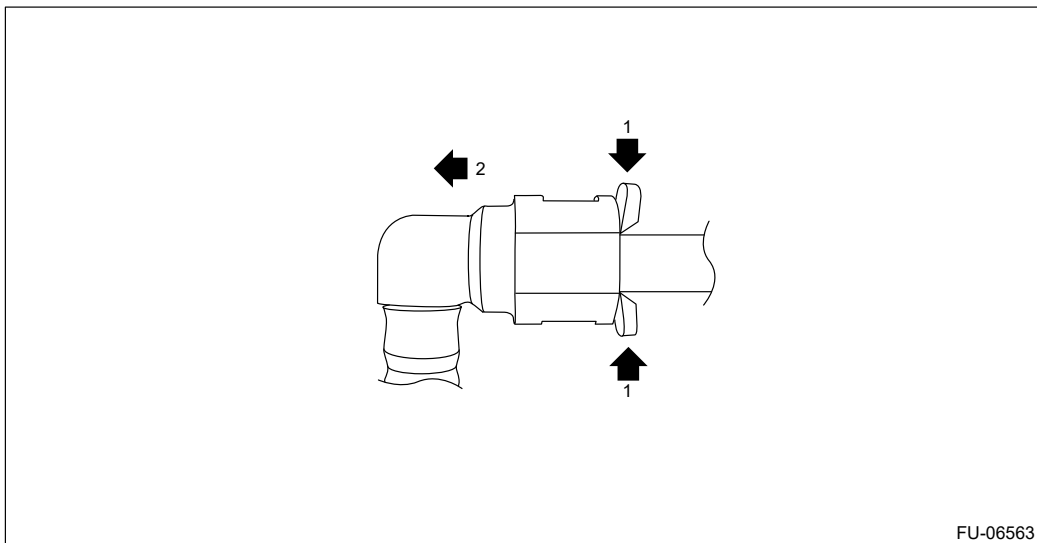


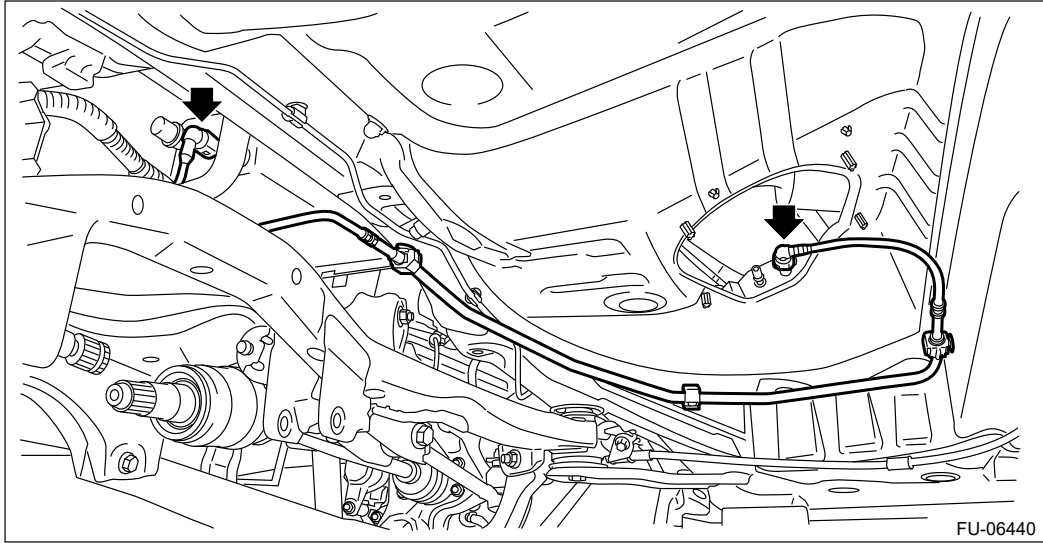
(a) Slider

7. Disconnect the quick connector and remove the purge pipe.

Note:

Disconnect the quick connector as shown in the figure.





8. Remove the body integrated unit.  [Ref. to SECURITY AND LOCKS>Body Integrated Unit>REMOVAL.](#)
9. Remove the fuel pipe assembly from vehicle.

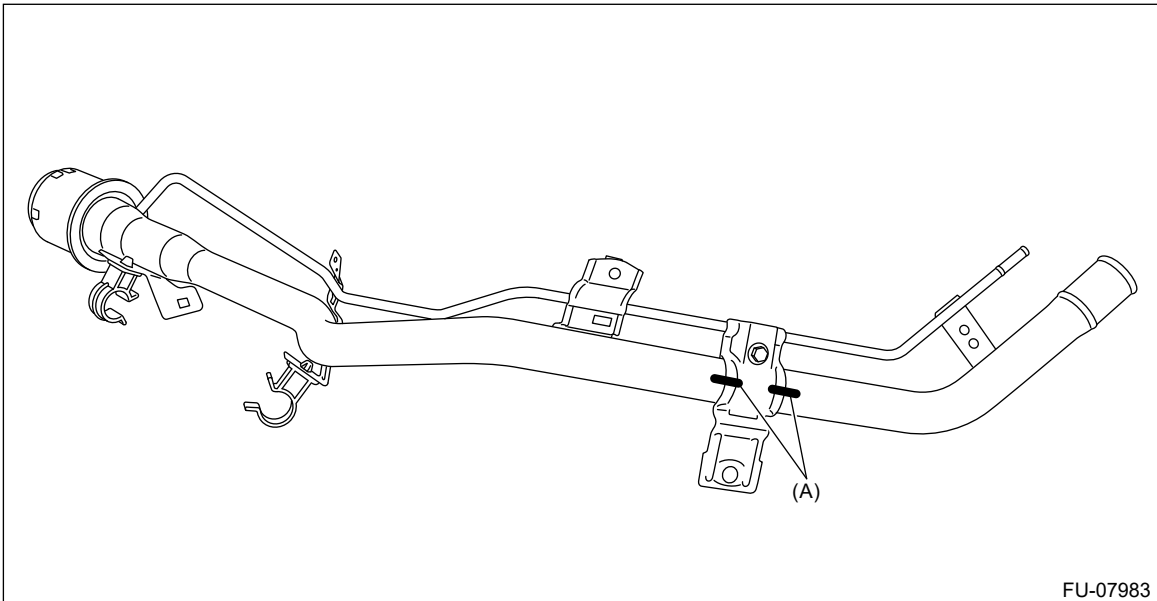
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Filler Pipe

ASSEMBLY

Assemble in the reverse order of disassembly.

Note:

- Use a new neck holder.
- Install the bracket to the fuel filler pipe by aligning the alignment marks (A).



FU-07983

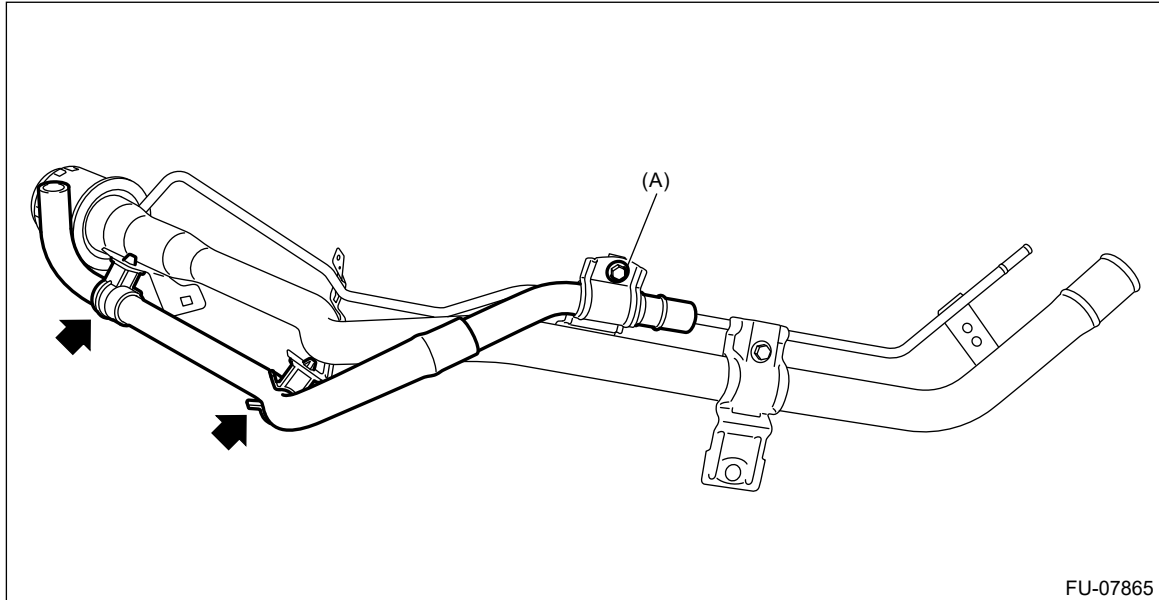
Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

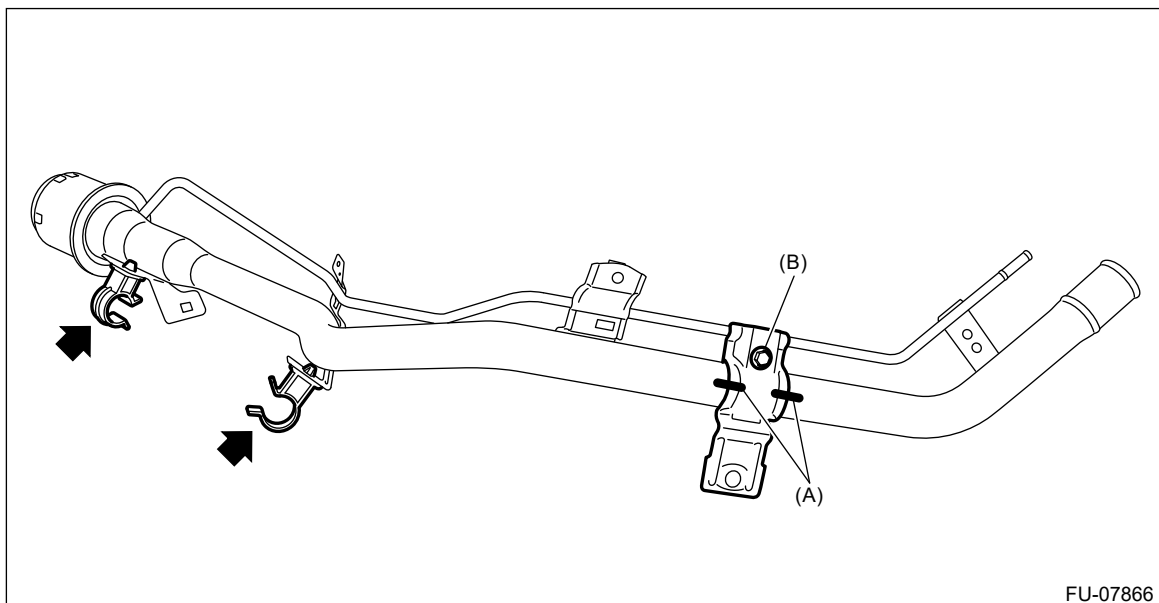
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Filler Pipe

DISASSEMBLY

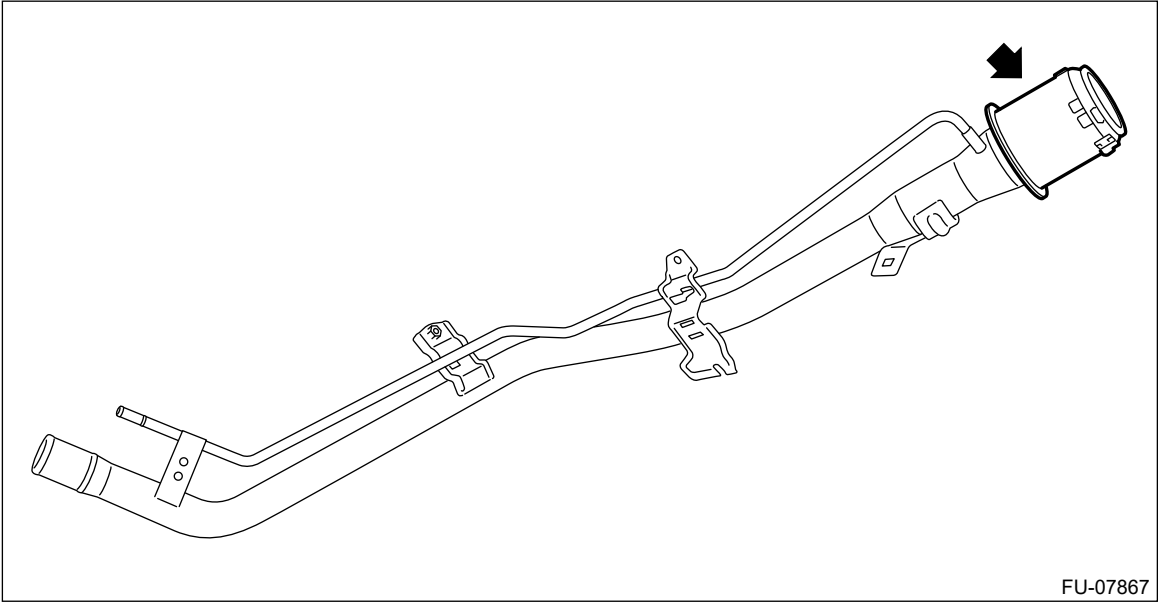
1. Remove the bracket bolt (A) securing the drain pipe, and remove the drain hose from the clip for the fuel filler pipe.



2. Using a marker pen, make alignment marks (A) on the fuel filler pipe and the bracket.
3. Remove the bracket bolt (B) securing the fuel filler pipe, and remove the clip from the fuel filler pipe.



4. Remove the neck holder from the fuel filler pipe.



FU-07867

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Filler Pipe

INSPECTION

- 1.** Check that the fuel filler pipe assembly has no deformation, cracks or other damages.
- 2.** Check that the fuel hose has no cracks, damage or loose part.

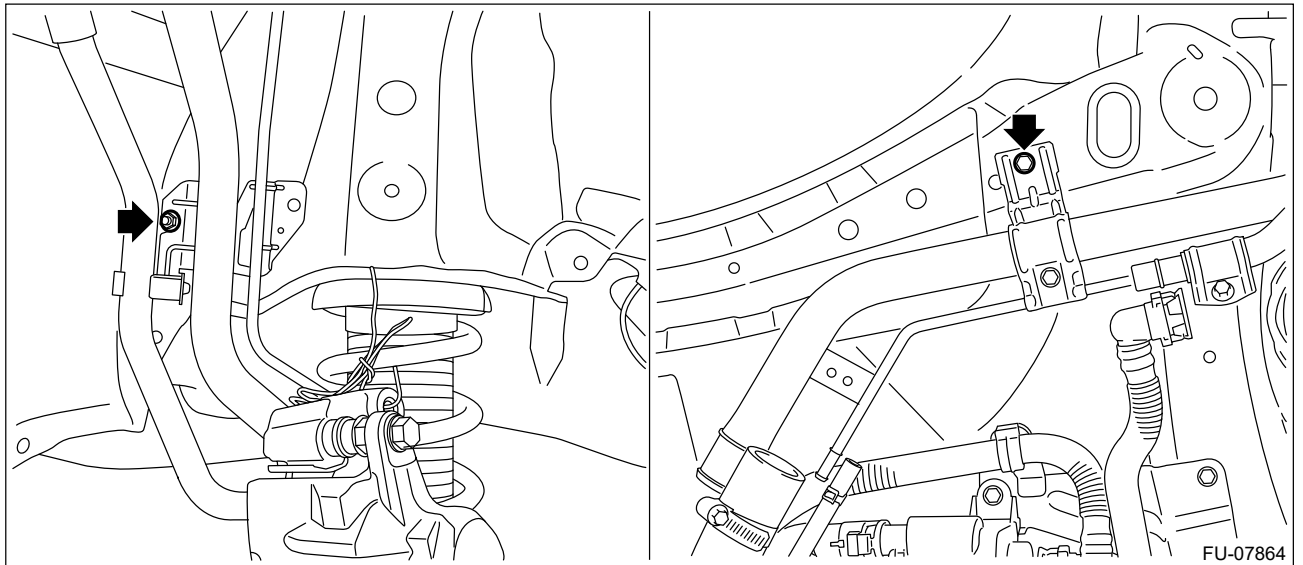
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Filler Pipe

INSTALLATION

1. Open the fuel filler lid.
2. Insert the fuel filler pipe assembly into the rubber saucer from inside of the rear fender.
3. Install the fuel filler pipe assembly to the vehicle.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



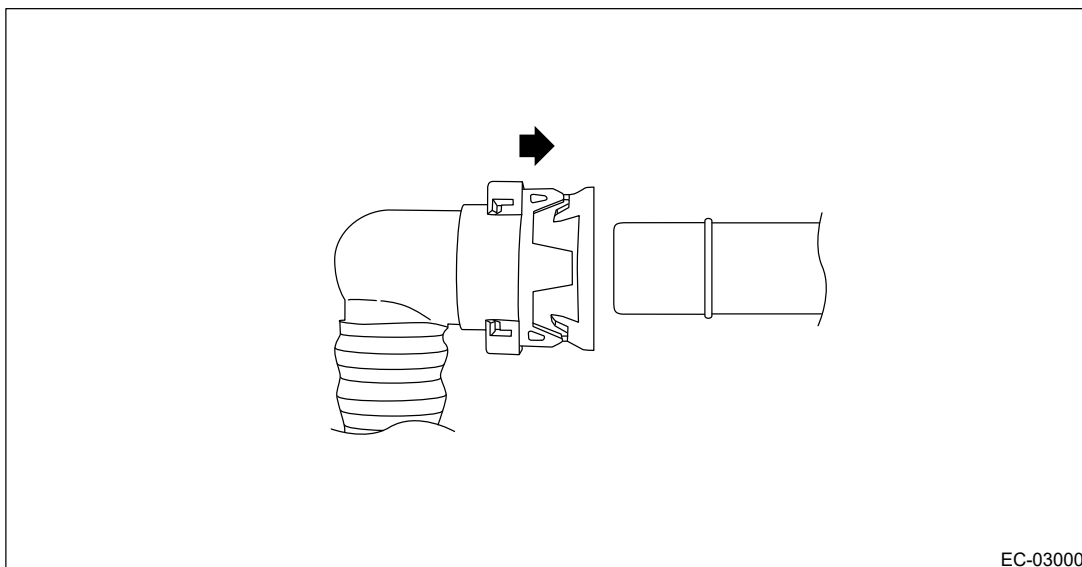
4. Connect the quick connector for drain pipe to the fuel filler pipe assembly.

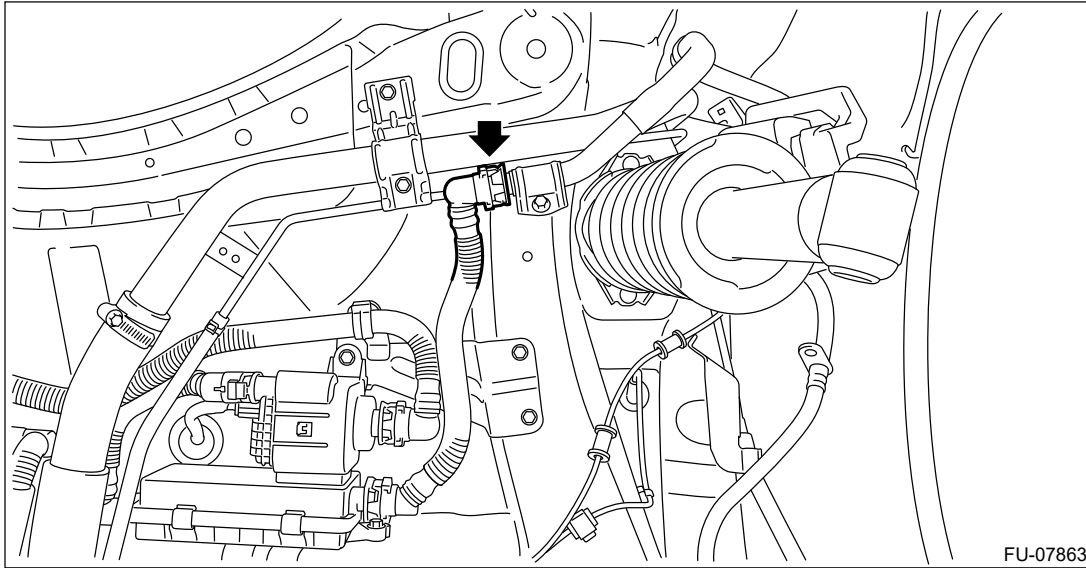
Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

Note:

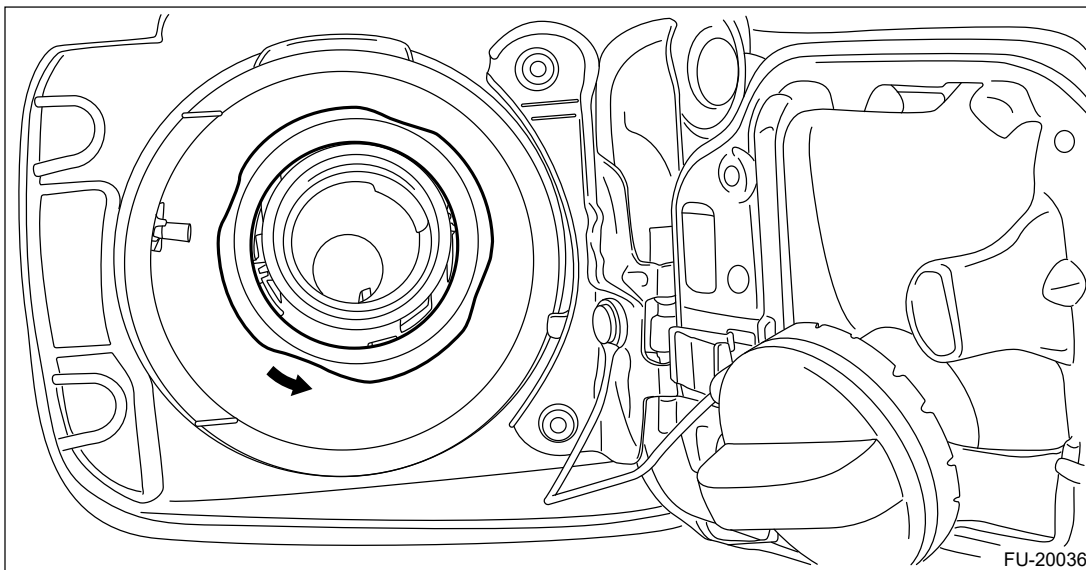
Connect the quick connector as shown in the figure.





FU-07863

5. Align the cutout on the fuel filler pipe protector and the protrusion of the neck holder and insert them all the way, and then turn the fuel filler pipe protector in the direction of the arrow until it is locked.

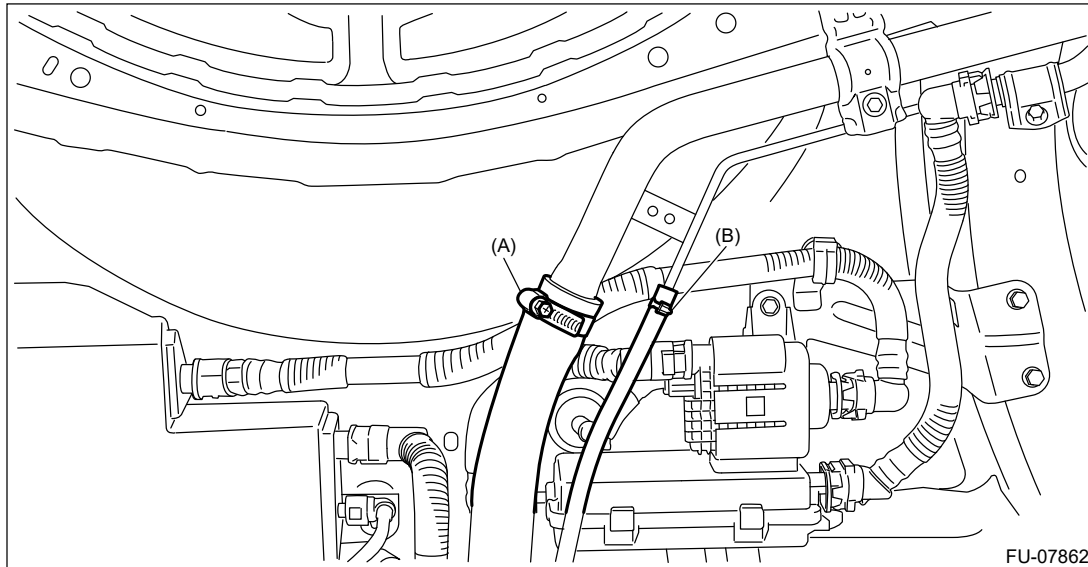


FU-20036

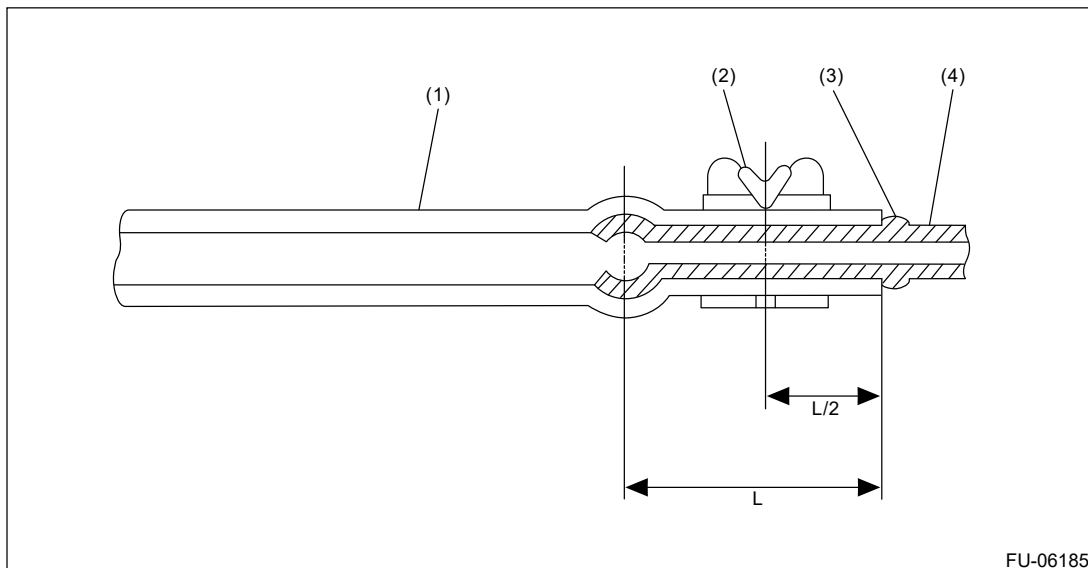
6. Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp or clip as shown in the figure.

Tightening torque:

2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



FU-07862





FU-06185

(1) Hose

(3) Spool

(4) Pipe

(2) Clamp or clip

7. Install the rear mud guard RH.  [Ref. to EXTERIOR/INTERIOR TRIM>Mud Guard>INSTALLATION.](#)
8. Install the rear sub frame assembly.  [Ref. to REAR SUSPENSION>Rear Sub Frame>INSTALLATION.](#)
9. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Filler Pipe




REMOVAL

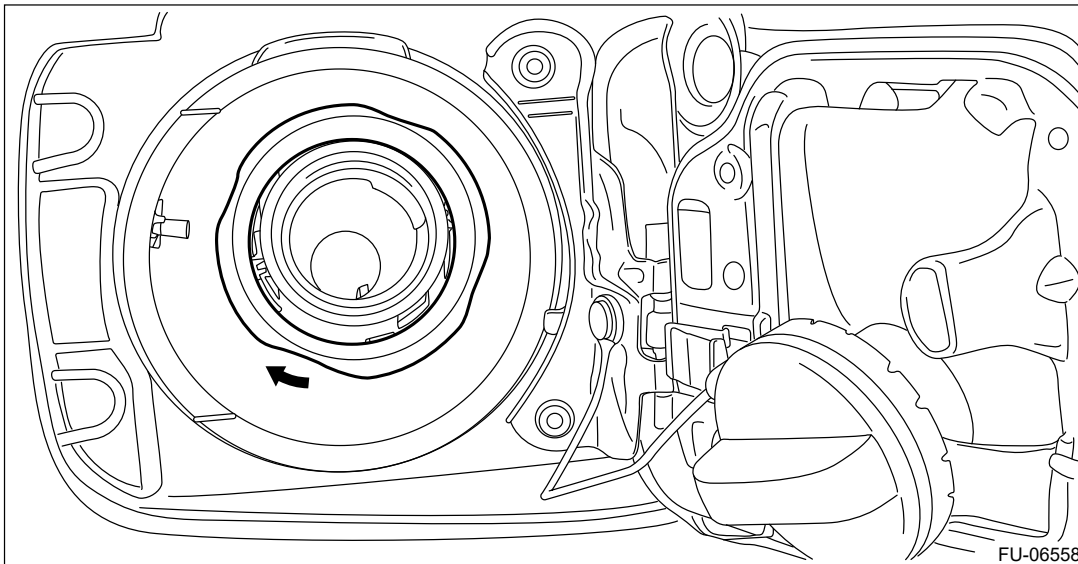
Warning:



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

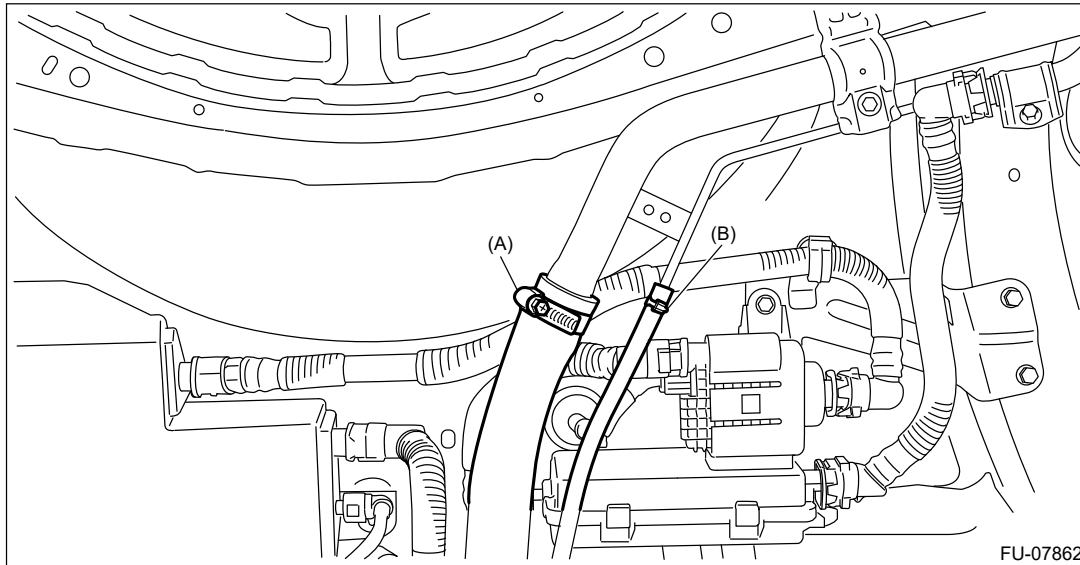
Caution:

Be careful not to spill fuel.

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Drain fuel.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > DRAINING FUEL \(WITH SUBARU SELECT MONITOR\).](#)
3. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
4. Open the fuel filler lid and remove the fuel filler cap.
5. Turn the fuel filler pipe protector in the direction of the arrow to unlock and remove it.



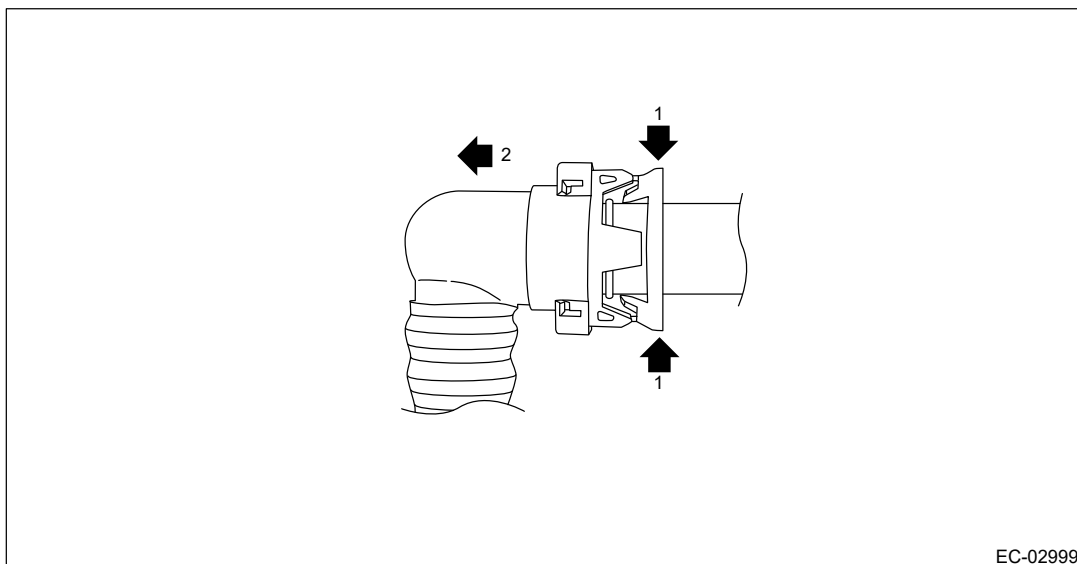
6. Remove the rear sub frame assembly.  [Ref. to REAR SUSPENSION>Rear Sub Frame>REMOVAL.](#)
7. Remove the rear mud guard RH.  [Ref. to EXTERIOR/INTERIOR TRIM>Mud Guard>REMOVAL.](#)
8. Disconnect the fuel filler hose (A) and evaporation hose (B) from the fuel filler pipe assembly.

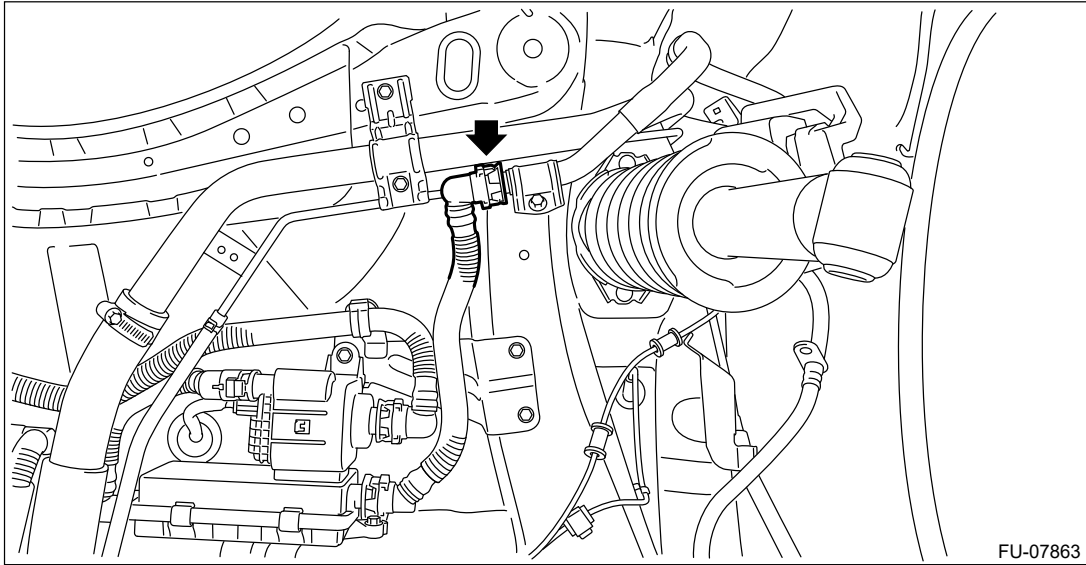


9. Disconnect the quick connectors for the drain pipe from the fuel filler pipe assembly.

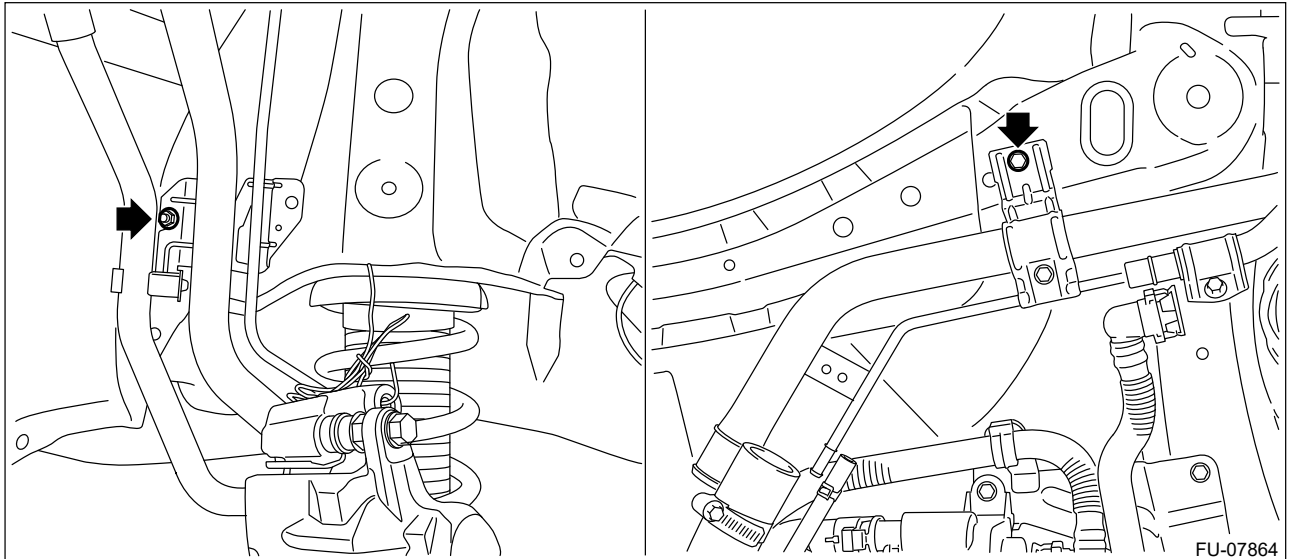
Note:

Disconnect the quick connector as shown in the figure.





10. Remove the bolts and nuts which secure the fuel filler pipe assembly to the vehicle.



11. Remove the fuel filler pipe assembly from the underside of the vehicle.

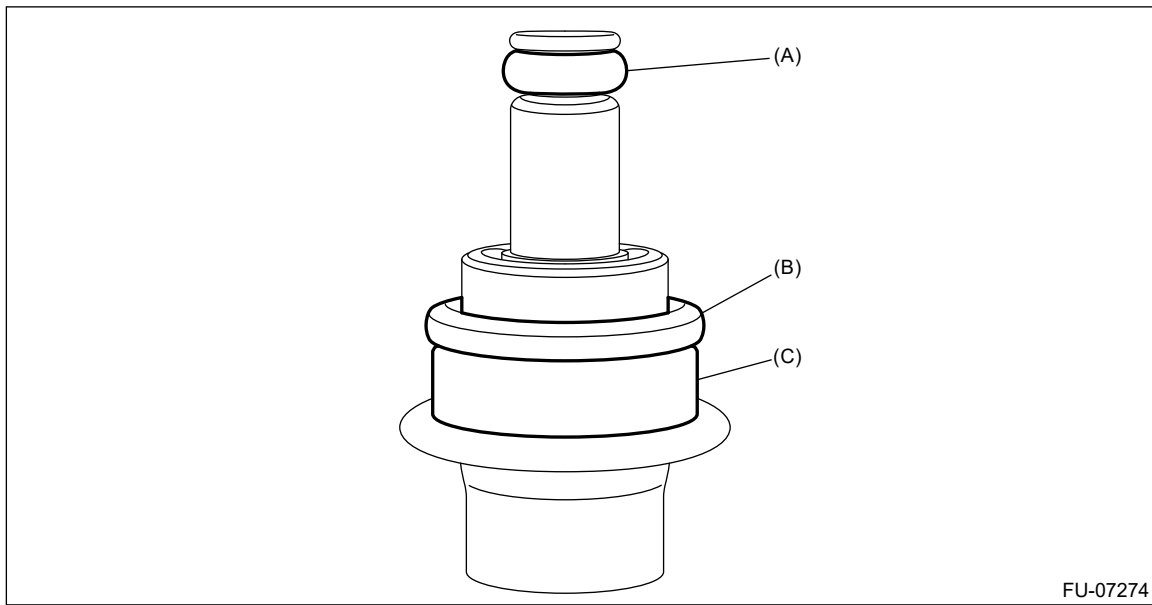
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Filter

INSTALLATION

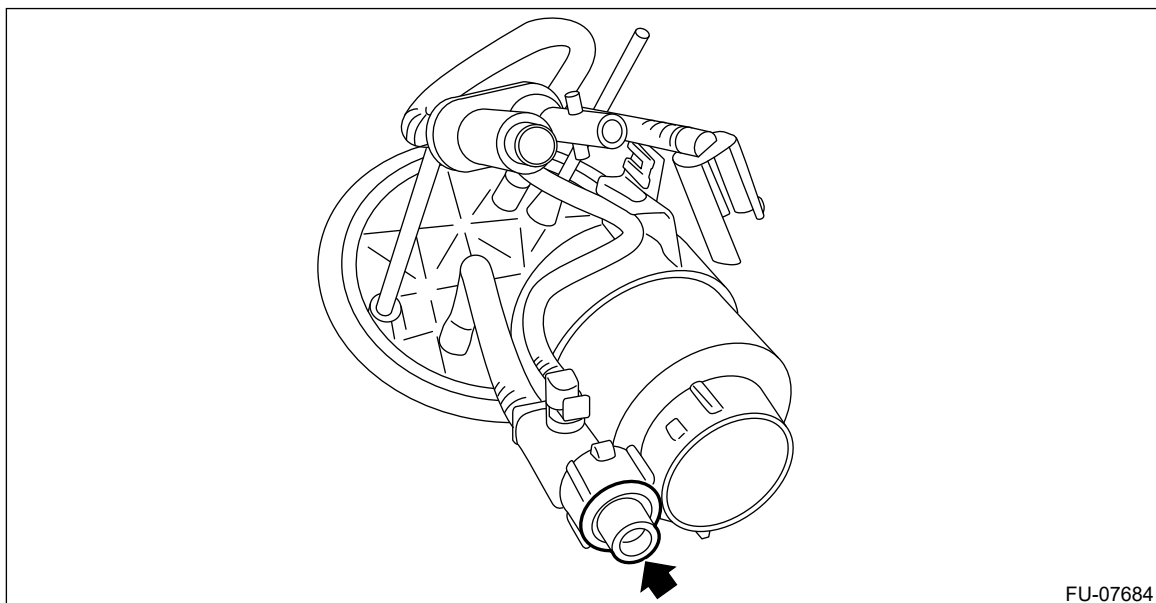
1. Install O-ring (A), O-ring (B), and backup ring (C) to the pressure regulator.

Note:

- Use new O-rings.
- Apply gasoline to the O-ring and backup ring.



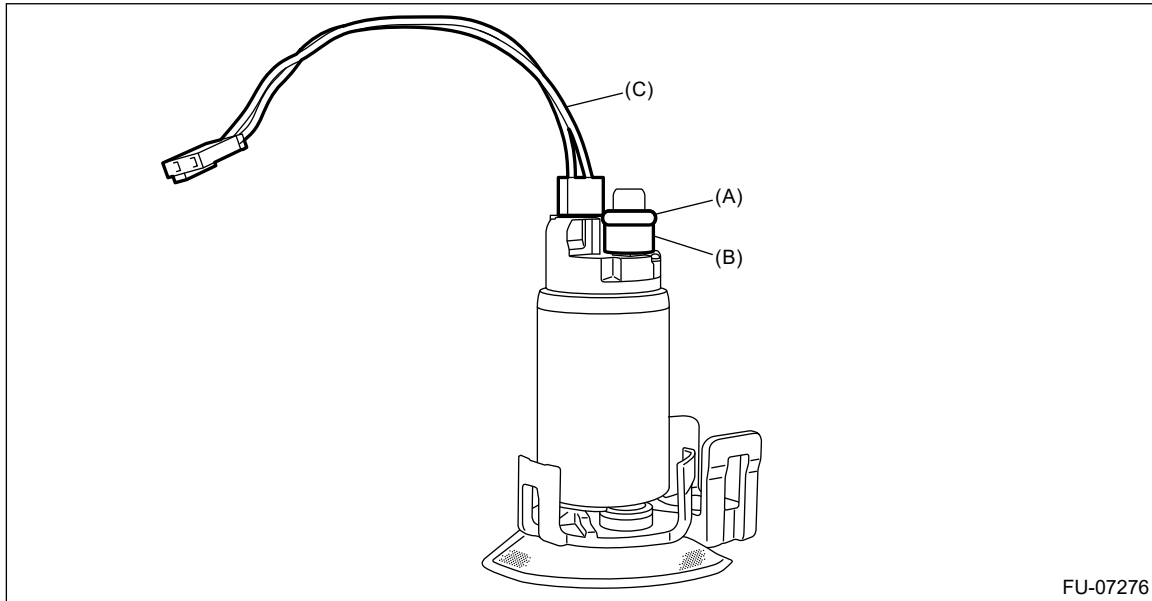
2. Install the pressure regulator to the fuel filter assembly.



3. Install O-ring (A), spacer (B), and connector cable (C) to the fuel pump.

Note:

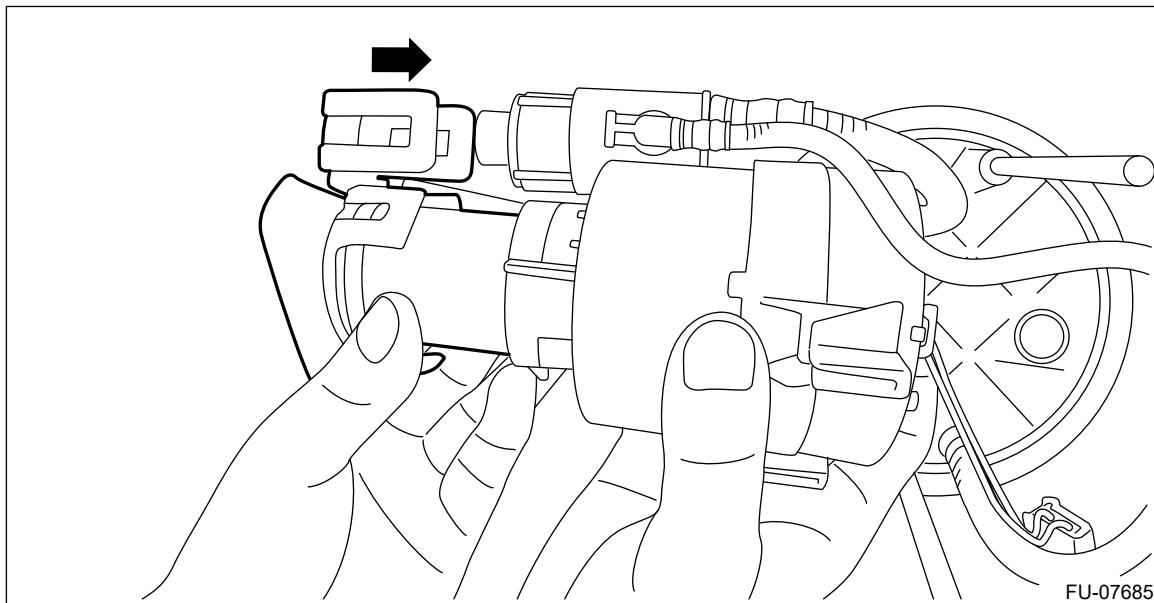
- Use new O-rings and the connector cable.
- Apply gasoline to the O-rings and the spacer.



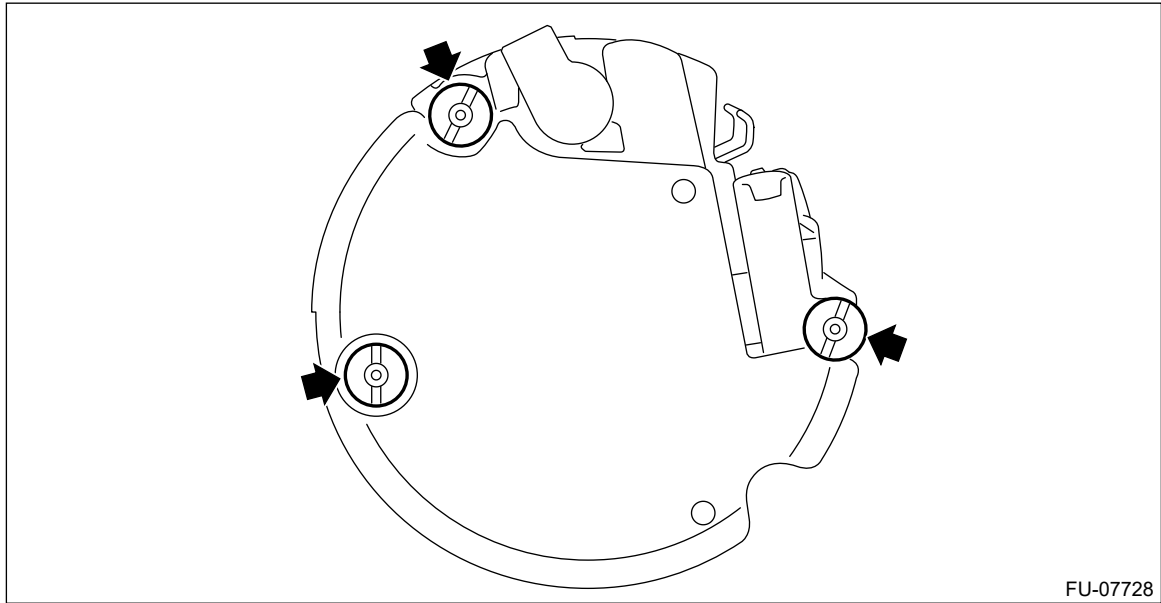
4. Install the fuel pump to the fuel filter assembly.

Note:

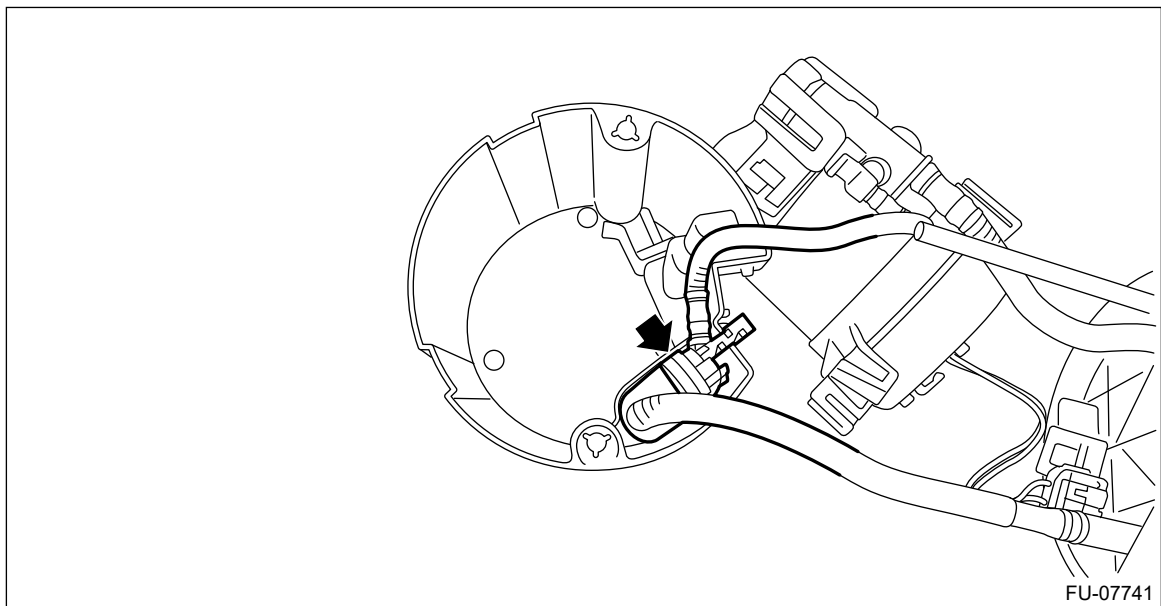
After installation, make sure five claws are correctly engaged in each position.



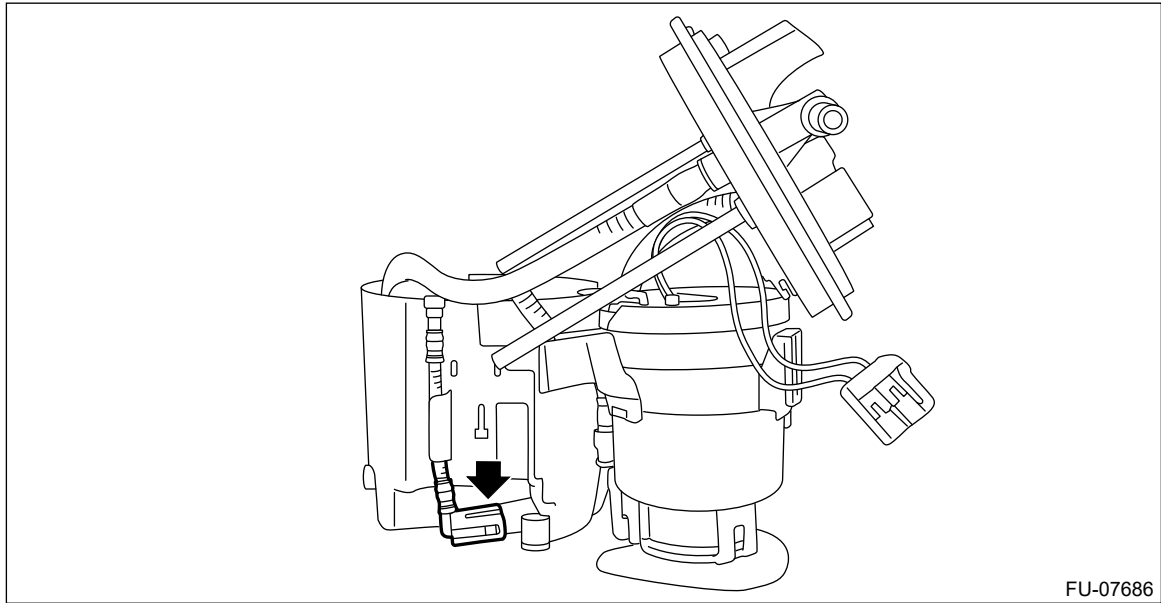
5. Check that the cushions of the fuel chamber assembly for dislocation. If any of them is dislocated, install a new cushion.



6. Slowly press in and install the tube assembly to the fuel chamber assembly until a clicking sound is heard.



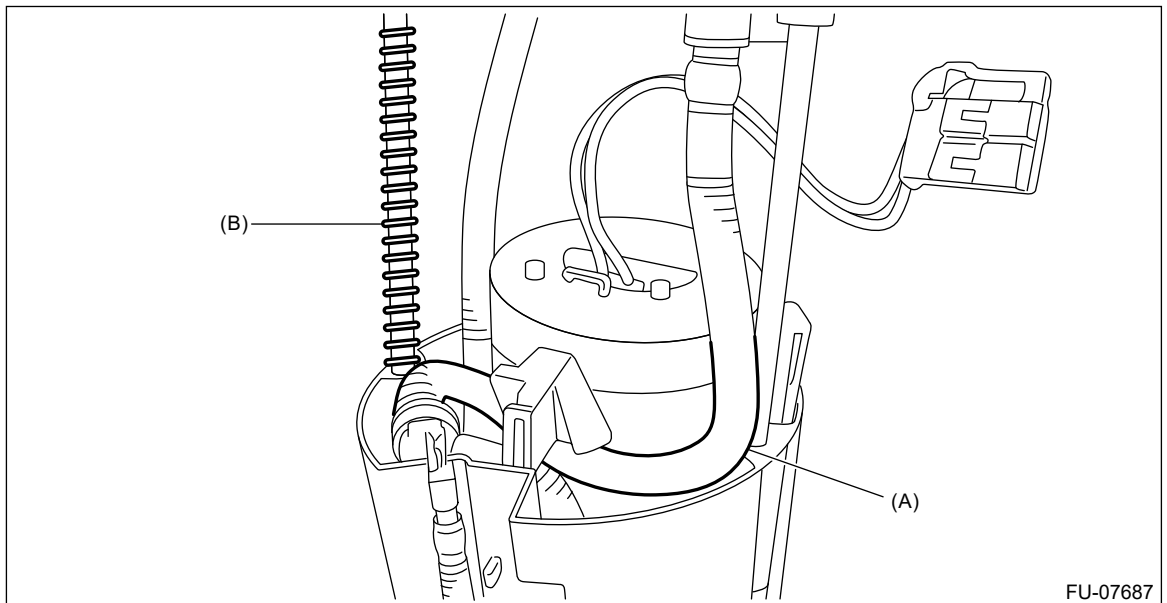
7. Install the tube assembly to the fuel chamber assembly, and connect the tube assembly to the fuel chamber assembly.



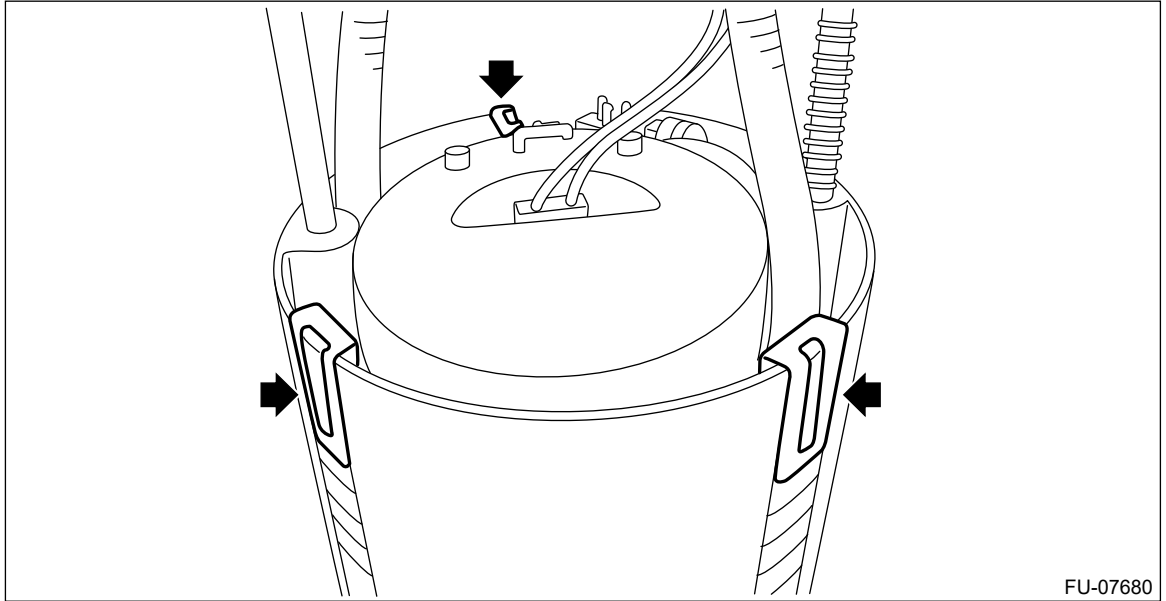
8. Install the fuel filter assembly to the fuel chamber assembly.

Note:

- **Set the tube (A) and spring (B) for the fuel filter assembly as shown in the figure.**



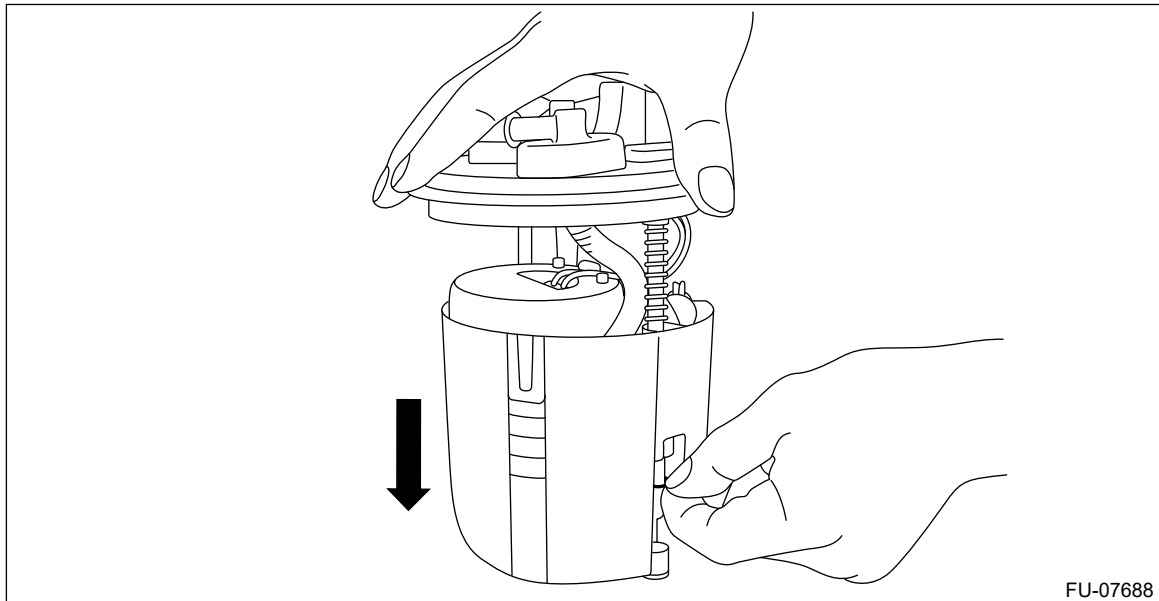
- **Check that the claw connecting the fuel chamber assembly and the fuel filter assembly is securely fastened.**



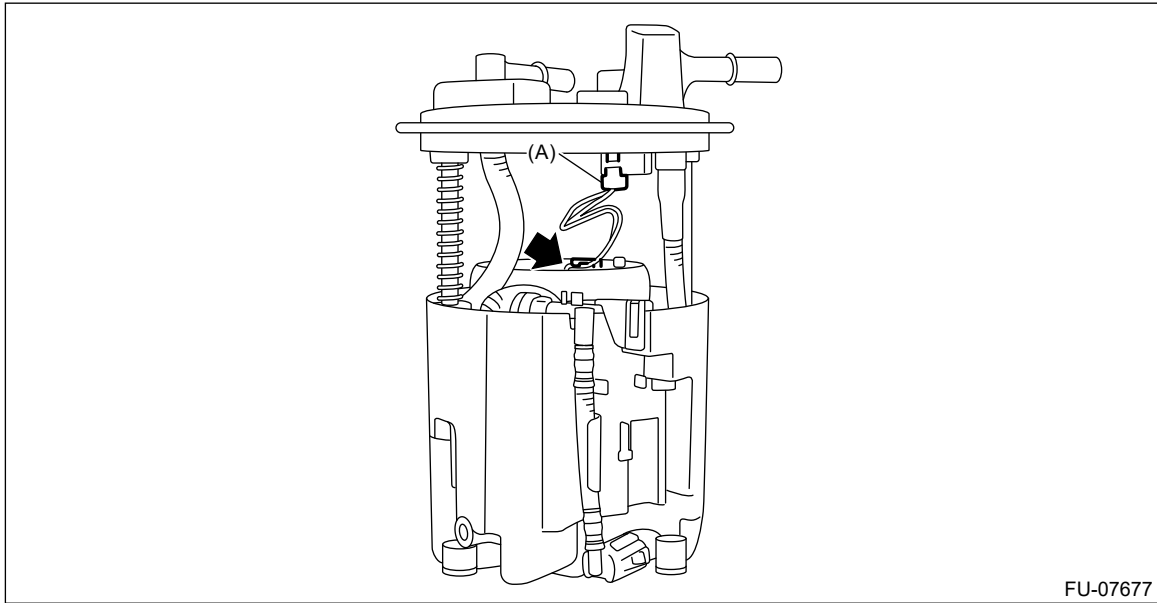
9. Push the fuel filter assembly in the direction of the arrow to compress, and attach the clip.




Note:

Use a new clip.



10. Secure the connector cable with the clip, and connect the connector (A) of the connector cable.



- 11.** Install the fuel level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Level Sensor>INSTALLATION.](#)
- 12.** Inspect the fuel level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Level Sensor>INSPECTION.](#)
- 13.** Install the fuel pump assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Pump>INSTALLATION.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Filter

REMOVAL

Warning:



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

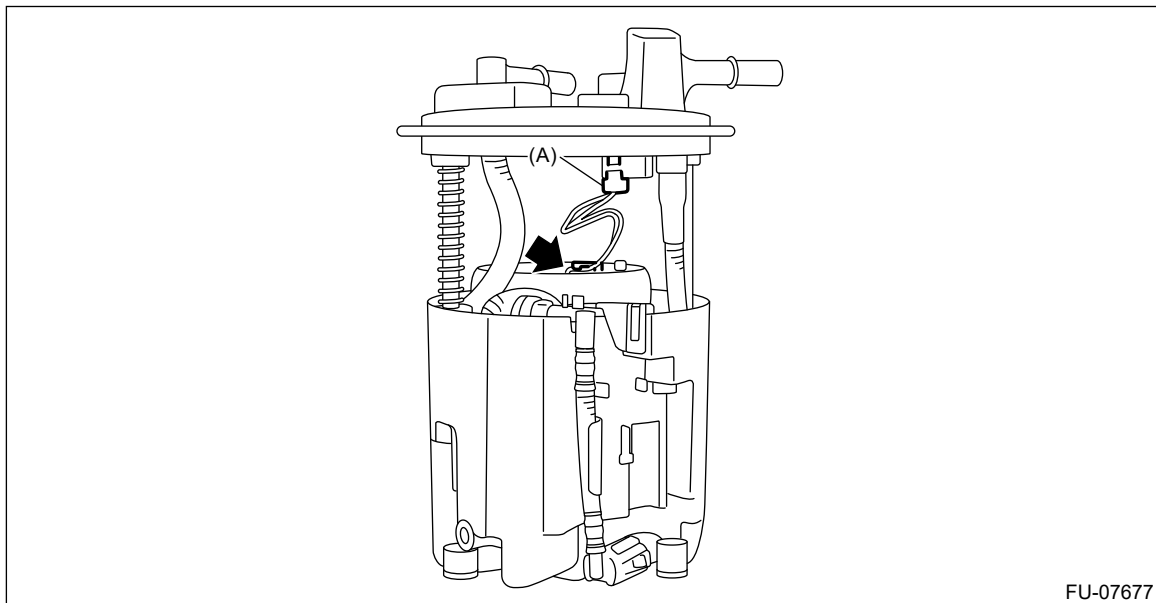
Caution:

- Be careful not to spill fuel.
- If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.
- Be careful not to drop or apply any impact to the fuel pump during work. This may deteriorate its performance.

Note:

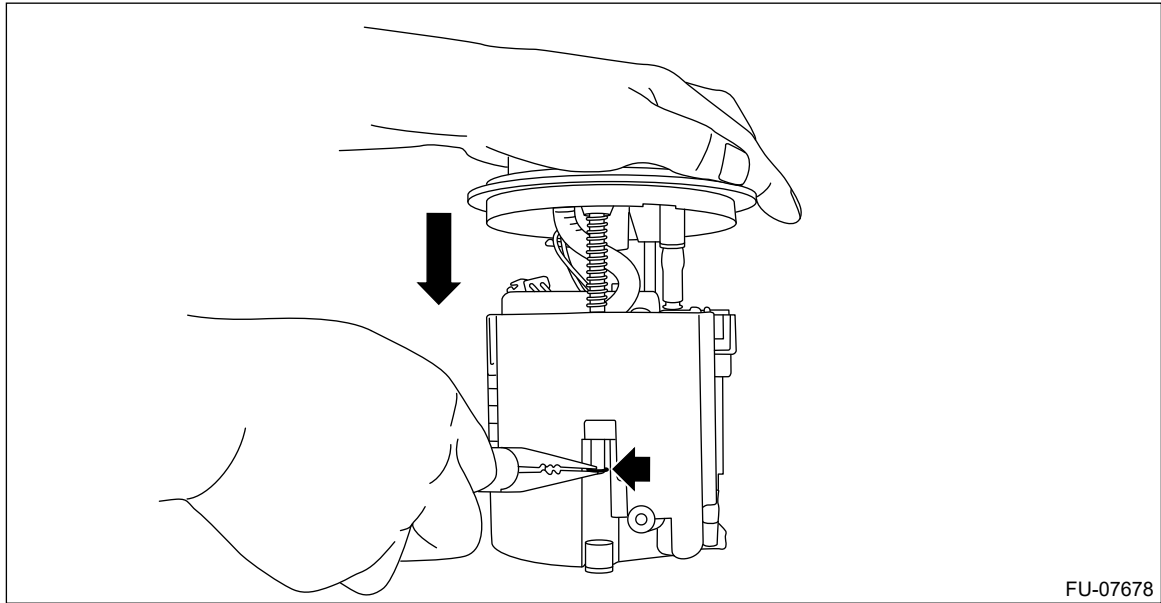
The fuel filter is built in fuel pump assembly.

1. Remove the fuel pump assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Pump>REMOVAL.](#)
2. Remove the fuel level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Level Sensor>REMOVAL.](#)
3. Remove the connector cable from the clip, and disconnect the connector (A) of the connector cable.



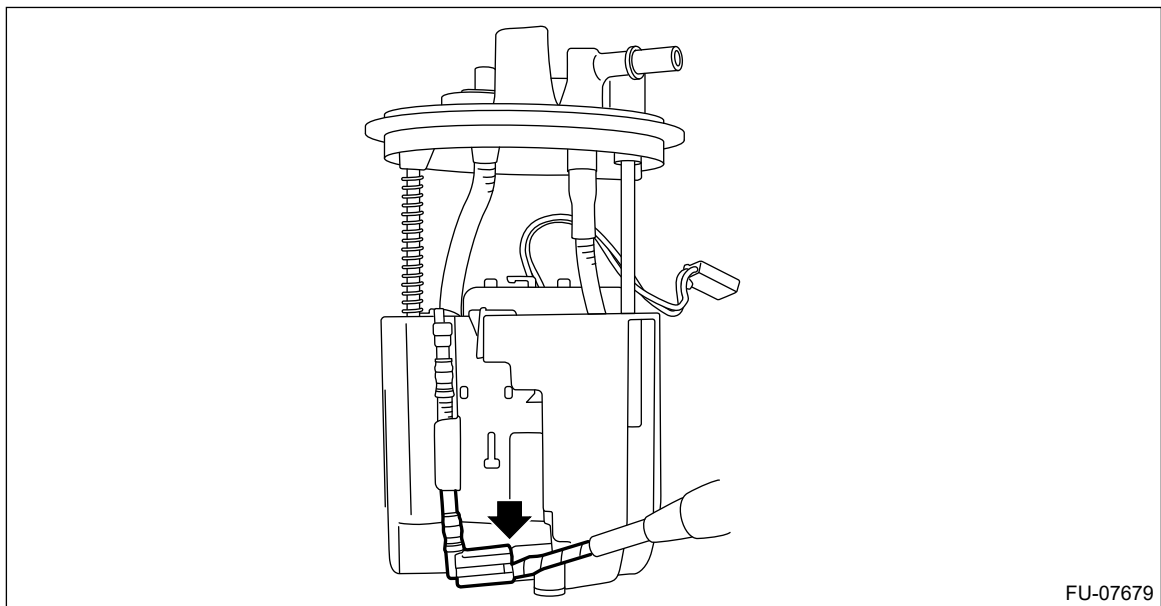
FU-07677

4. Push the fuel filter assembly in the direction of the arrow to compress, and detach the connecting clip.



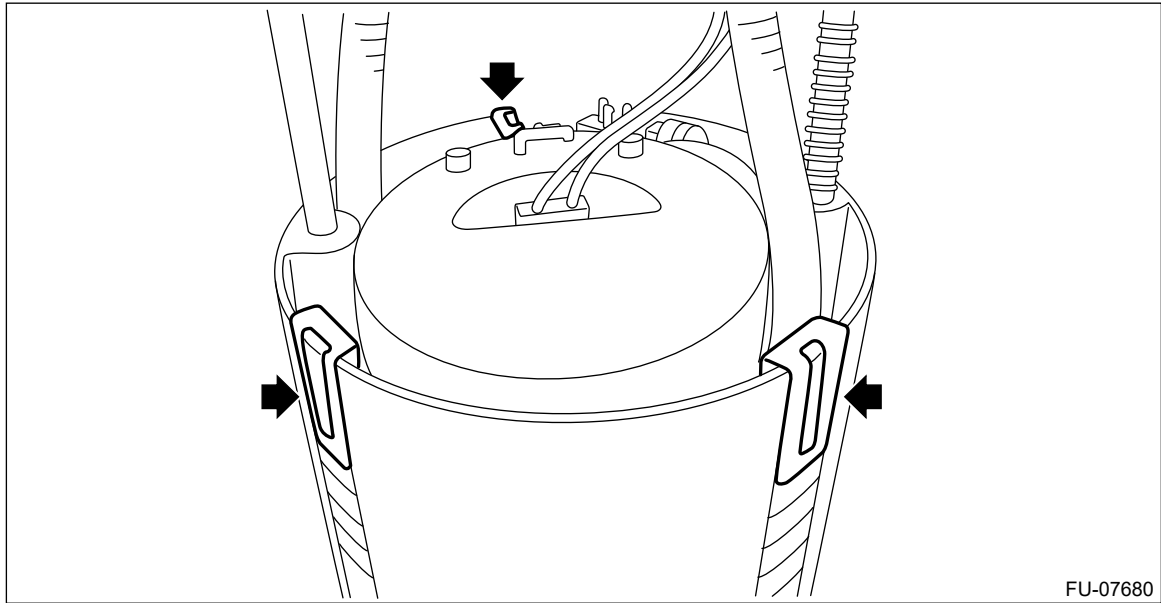
FU-07678

5. Release the claw using a flat tip screwdriver or similar tool wrapped with a protection tape, and remove the tube assembly from the fuel chamber assembly.

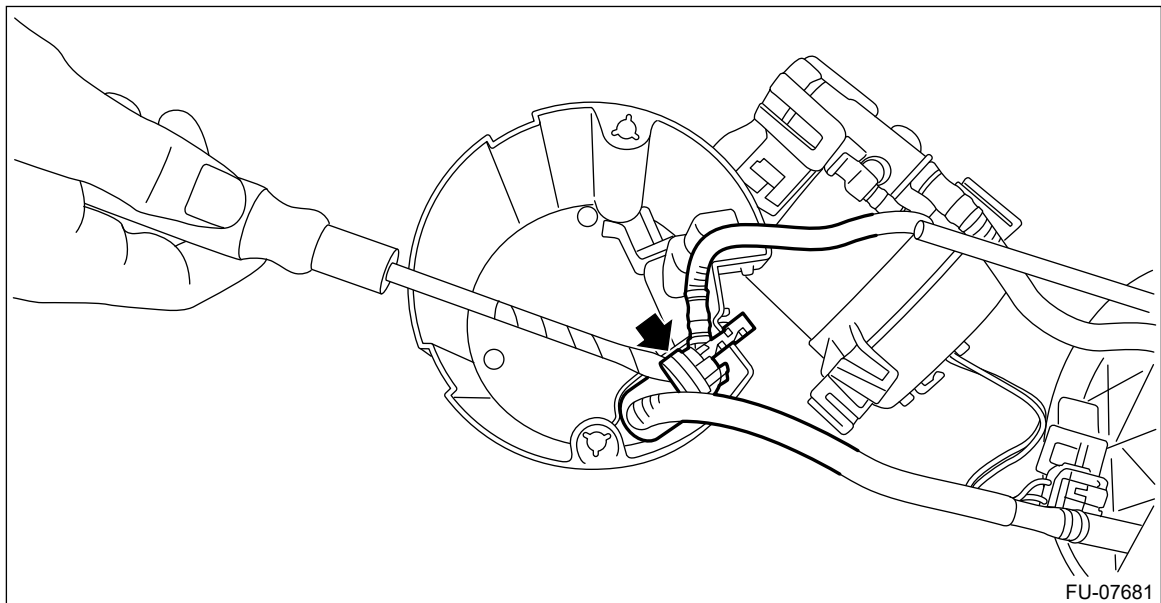


FU-07679

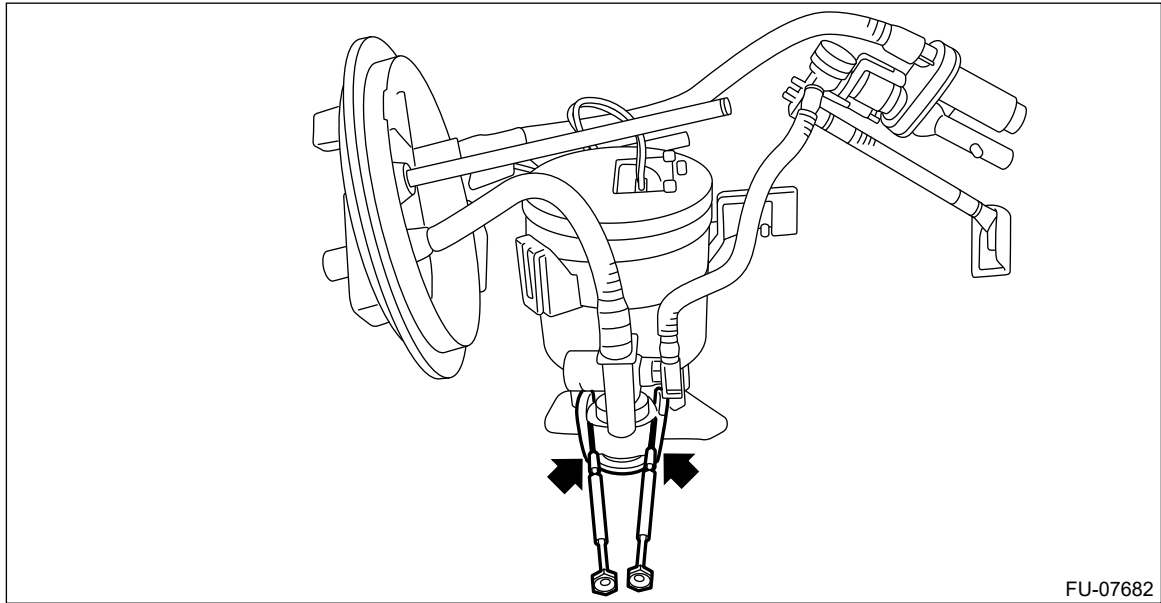
6. Release three claws on the fuel pump holder from the fuel chamber assembly, and raise the fuel filter assembly.



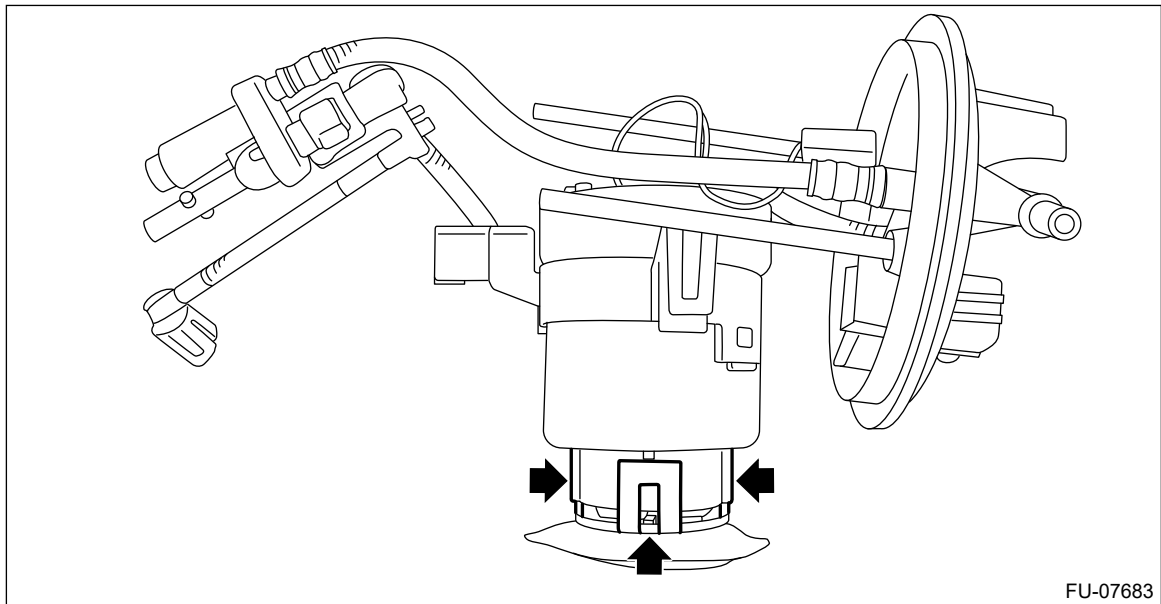
7. Using a flat tip screwdriver or similar tool wrapped with a protection tape, remove the tube assembly from the fuel chamber assembly, and separate the fuel filter assembly and fuel chamber assembly.



8. Using a precision driver or similar tool wrapped with a protection tape, expand the claws on the fuel pump.



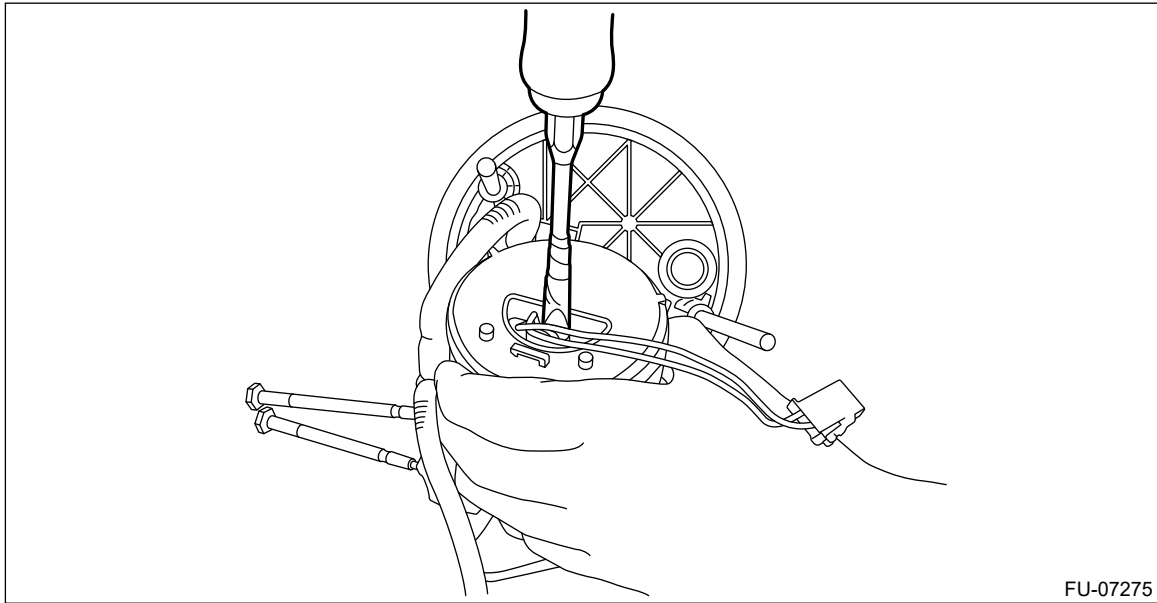
9. Release the claws on the fuel pump.



10. Using a flat tip screwdriver or similar tool wrapped with a protection tape, press on the fuel pump and remove the fuel pump together with the fuel pump holder from the fuel filter assembly.

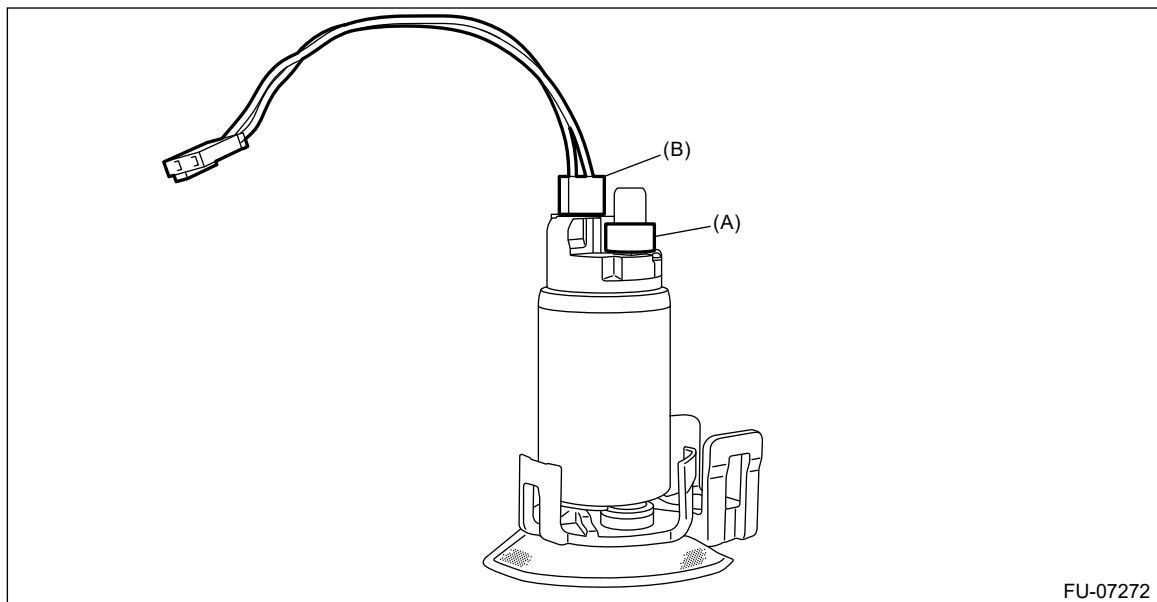
Caution:

If O-rings remain on the fuel filter assembly side, carefully remove them with a precision screwdriver or similar tool wrapped with a protection tape.



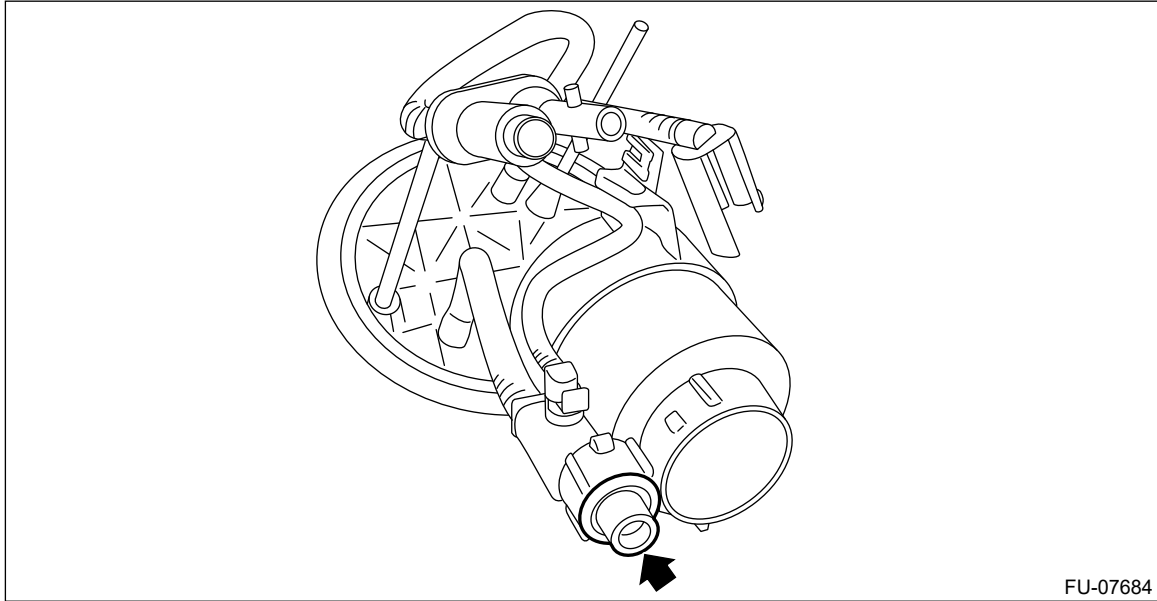
FU-07275

- 11.** Remove the spacer (A) and connector cable (B) from the fuel pump.



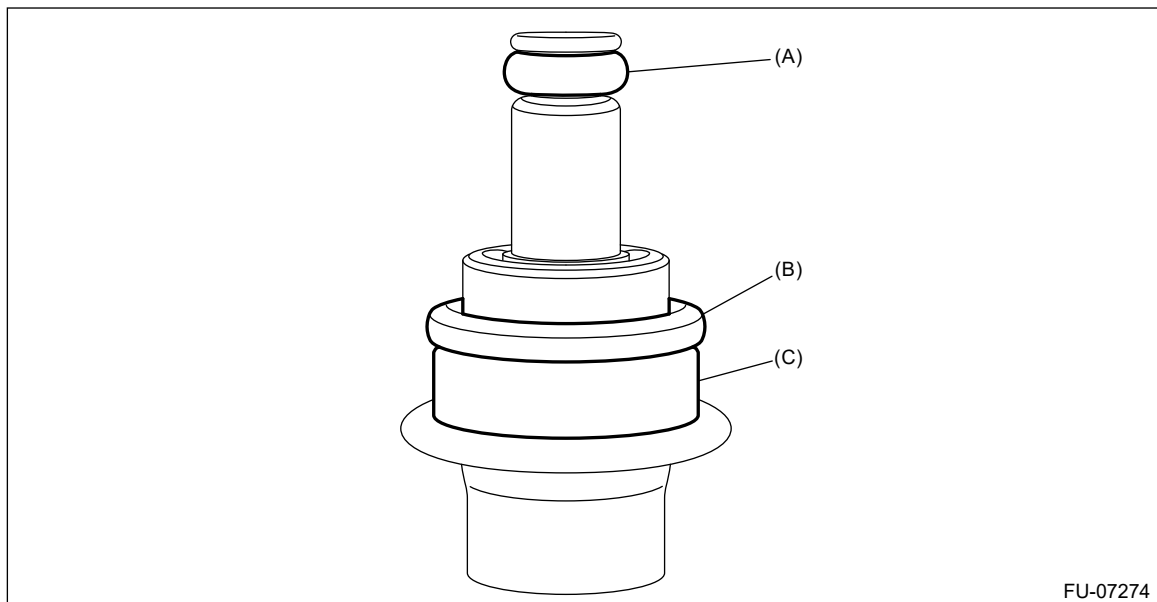
FU-07272

- 12.** Remove the pressure regulator from the fuel filter assembly.



FU-07684

13. Remove O-ring (A), O-ring (B), and backup ring (C) from the pressure regulator.

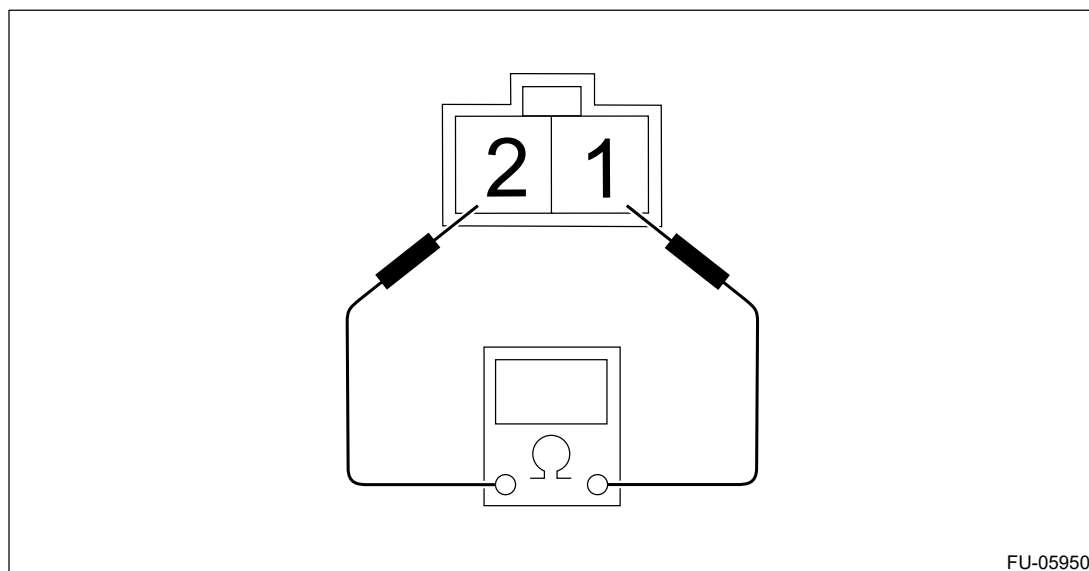


FU-07274

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Injector

INSPECTION

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



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

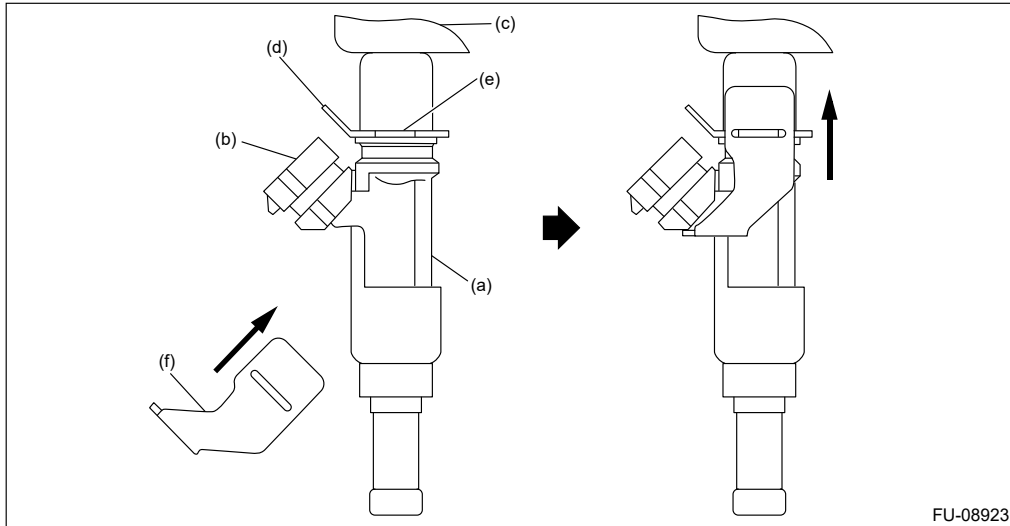
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Injector

INSTALLATION

1. Install the fuel injector to the fuel pipe.

Note:

- Use a new fuel injector holder, O-ring and rubber.
- Install the fuel injector so that the connector joint faces the connector rotation stopper side of the fuel pipe.
- Securely put the flange section of fuel pipe into the groove of fuel injector holder.



- | | | |
|--------------------------------|---------------------|--------------------------|
| (a) Fuel injector | (b) Connector joint | (c) Fuel pipe |
| (d) Connector rotation stopper | (e) Flange section | (f) Fuel injector holder |

2. Install the fuel injector and fuel pipe as a unit, and install the bolt securing the fuel pipe to the cam carrier.

Note:

Use new seal rings.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

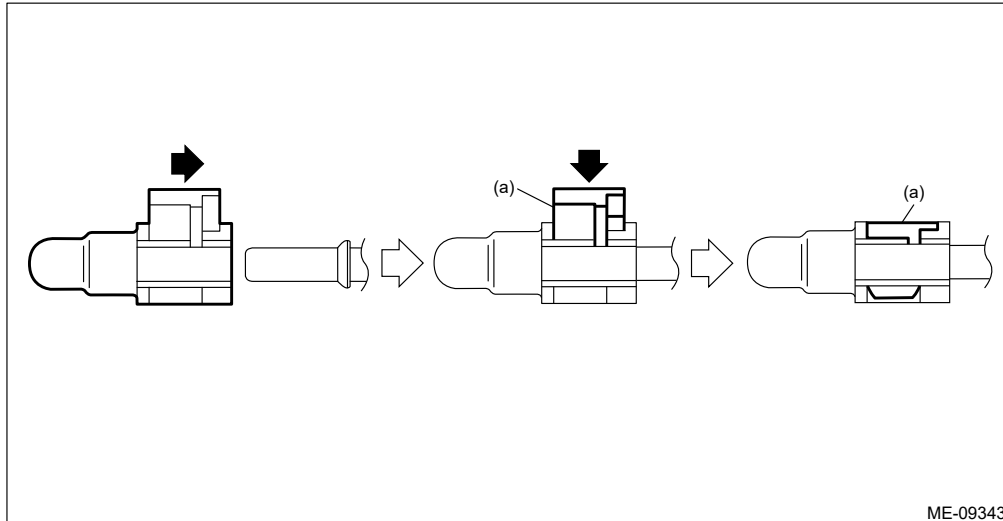
3. Connect the fuel delivery pipe (B) to the fuel pipe LH.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

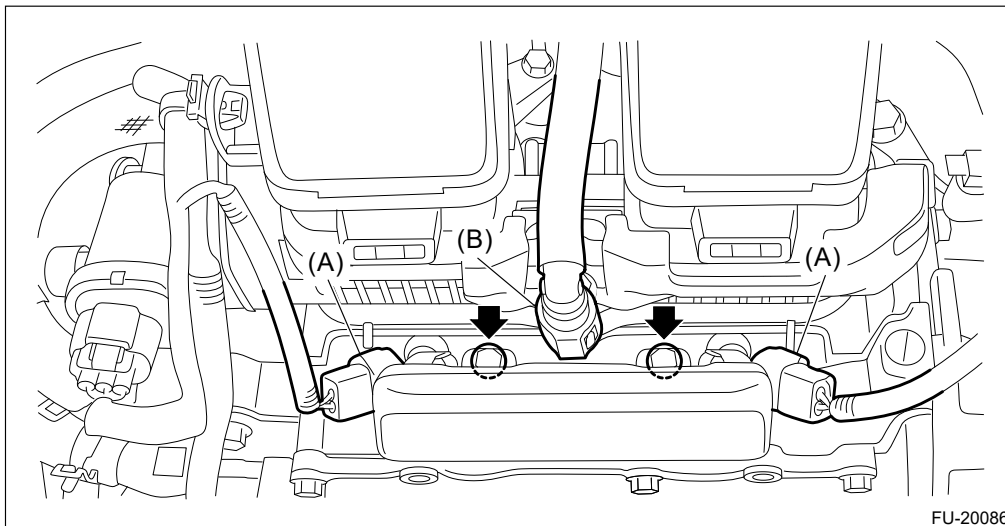
Note:

Connect the quick connector as shown in the figure.



(a) Slider

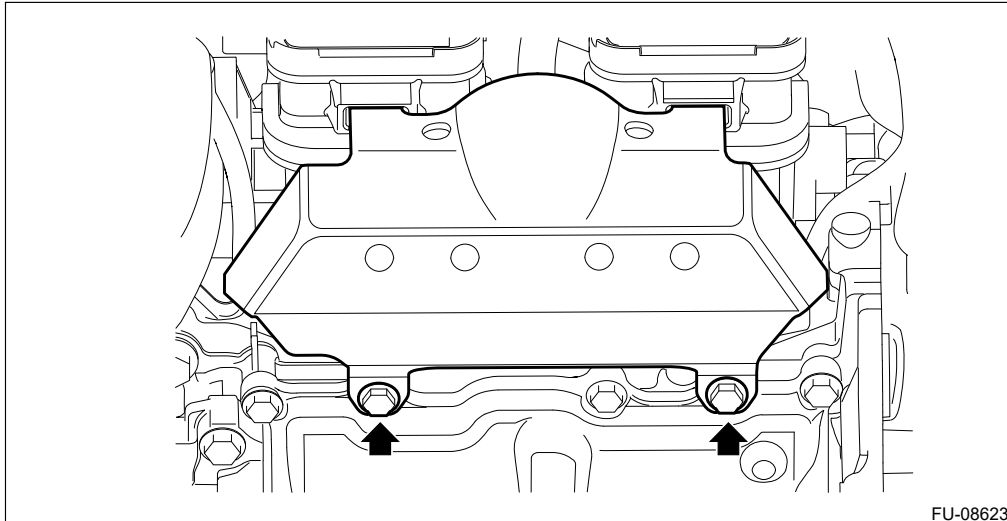
4. Connect the connectors (A) to fuel injector.



5. Install the intake manifold protector No. 1 RH and the intake manifold protector No. 1 LH.


Tightening torque:

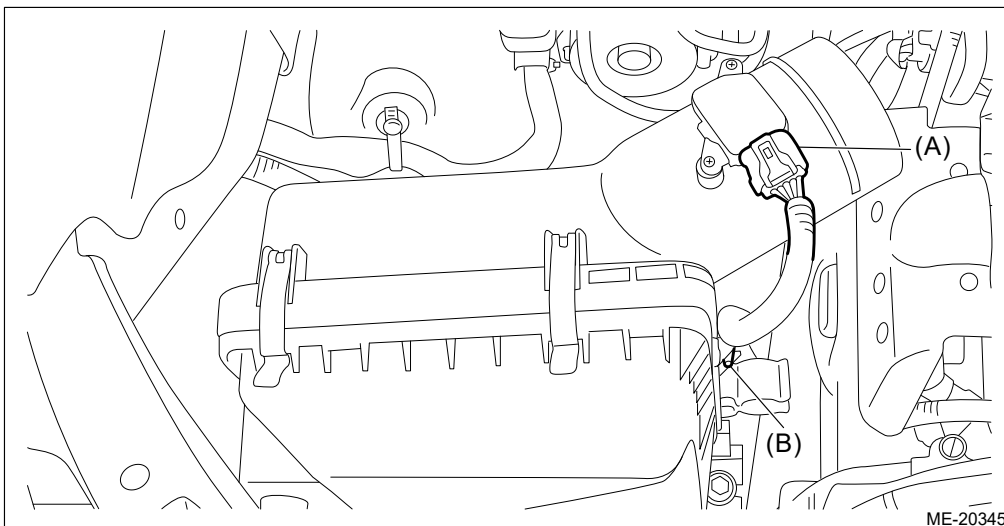
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



FU-08623


6. When installing the RH side, perform the following steps.

- (1) Install the air cleaner case (rear) together with the air cleaner element.  [Ref. to INTAKE \(INDUCTION\) \(H4DO\)>Air Cleaner Case>INSTALLATION.](#)
- (2) Secure the bulkhead wiring harness with clip (B) and connect the connector (A) to the mass air flow and intake air temperature sensor.





ME-20345

- (3) Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)

7. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Injector

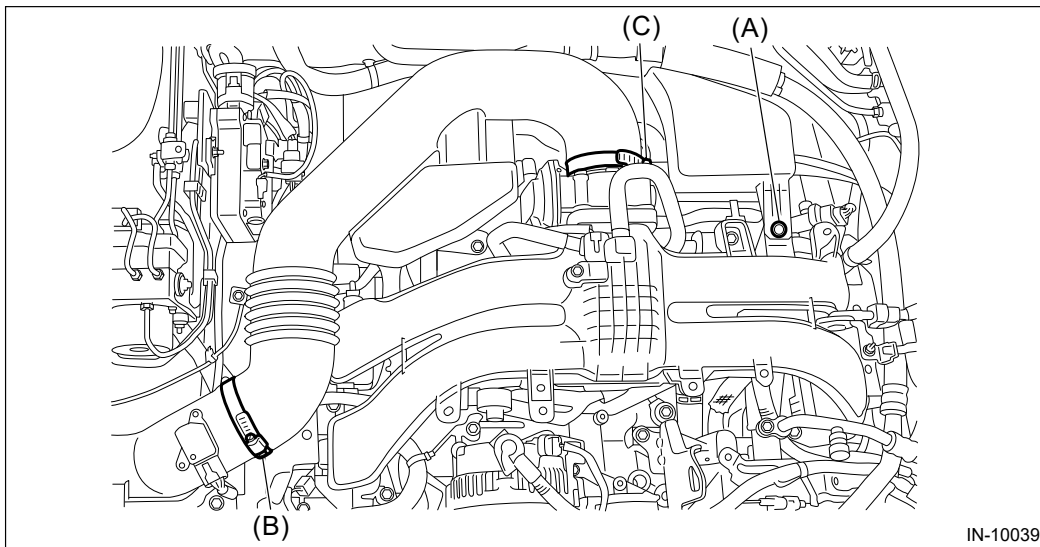
REMOVAL

1. Release the fuel pressure.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Disconnect the ground terminal from battery sensor.  Ref. to [NOTE>NOTE > BATTERY.](#)
3. Open the fuel filler lid and remove the fuel filler cap.

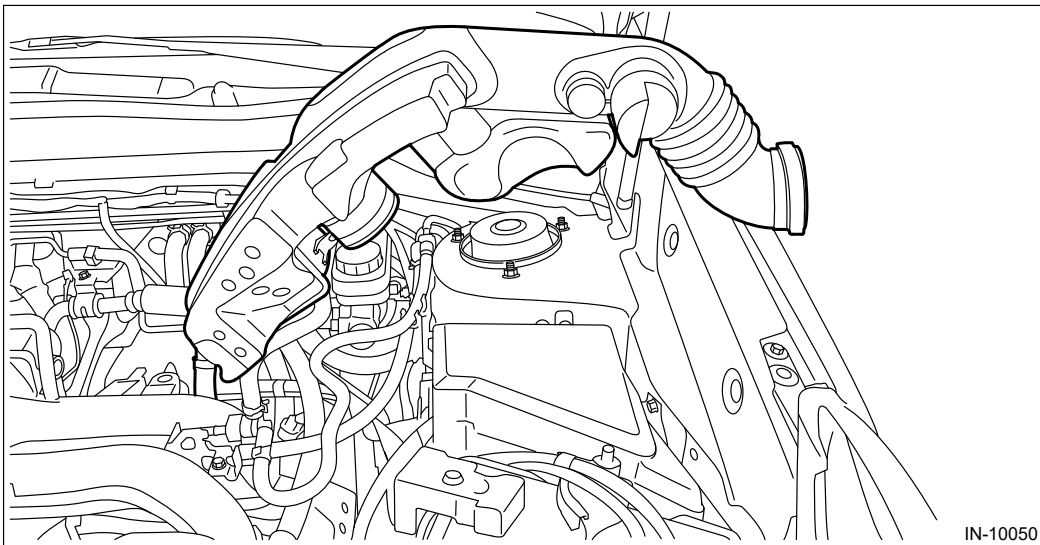
Note:

This operation is required to release the inner pressure of the fuel tank.

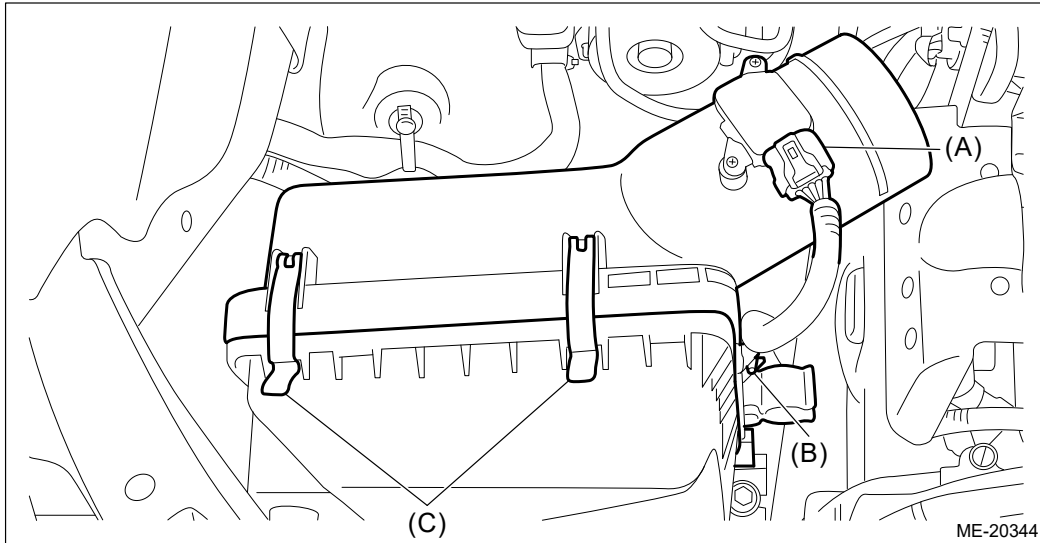
4. When removing the RH side, also perform the following steps.
 - (1) Remove the clip (A) from the air intake boot.
 - (2) Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
 - (3) Loosen the clamp (C) which secures the throttle body to the air intake boot.



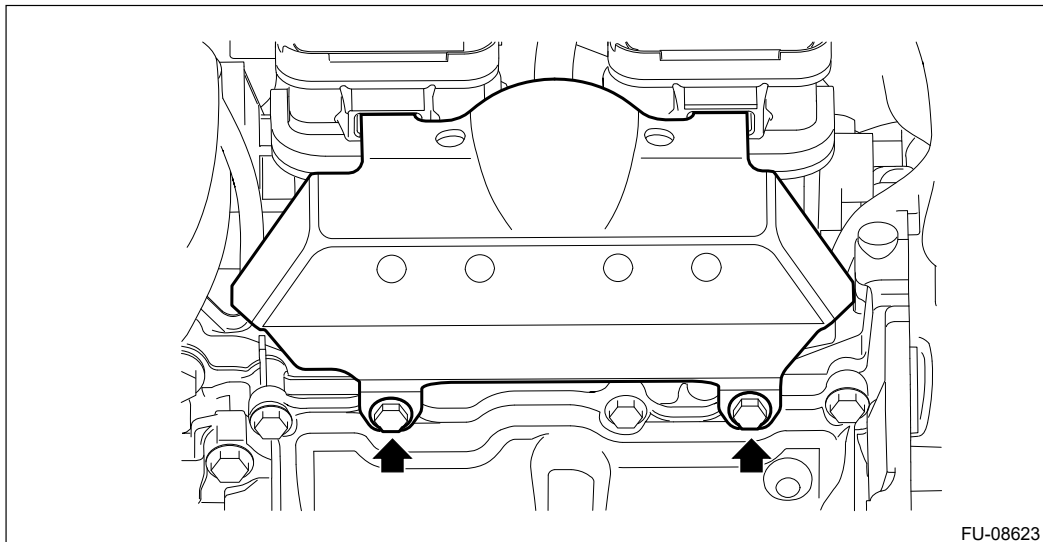
- (4) Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.



- (5) Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B) securing the bulkhead wiring harness.
- (6) Remove the clip (C), and the air cleaner case (rear) together with the air cleaner element.



5. Remove the intake manifold protector No. 1 RH and the intake manifold protector No. 1 LH.



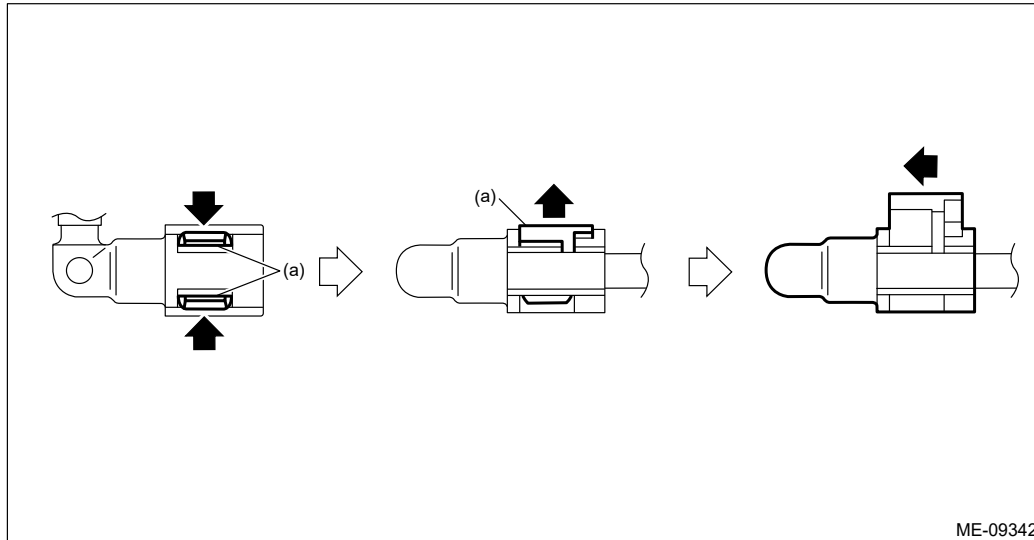
6. Disconnect the connectors (A) from fuel injector.
7. Disconnect the fuel delivery pipe (B) from the fuel pipe.

Caution:

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

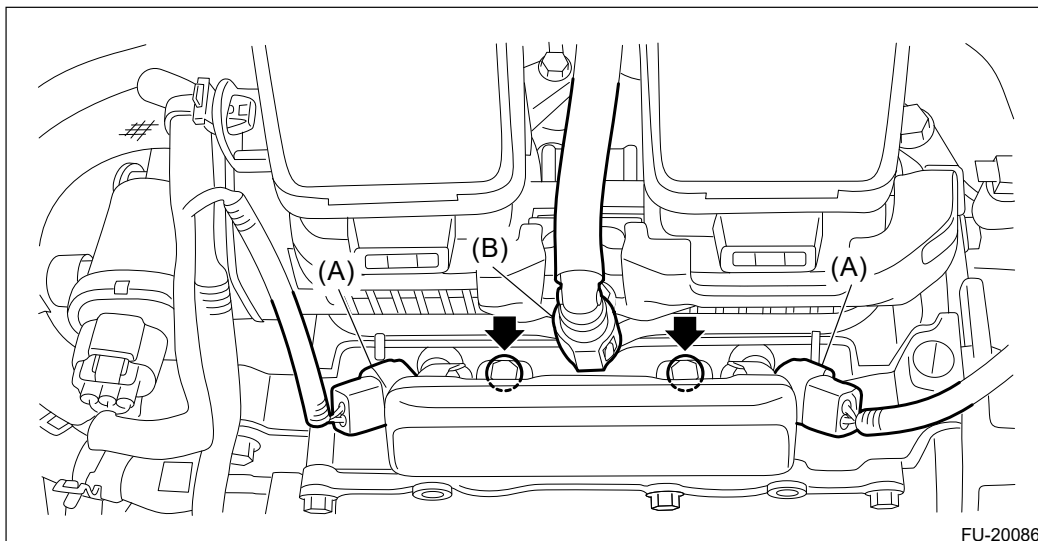
Note:

Disconnect the quick connector as shown in the figure.



(a) Slider

8. Remove the bolt securing the fuel pipe to the cam carrier, and remove the fuel injector together with the fuel pipe.

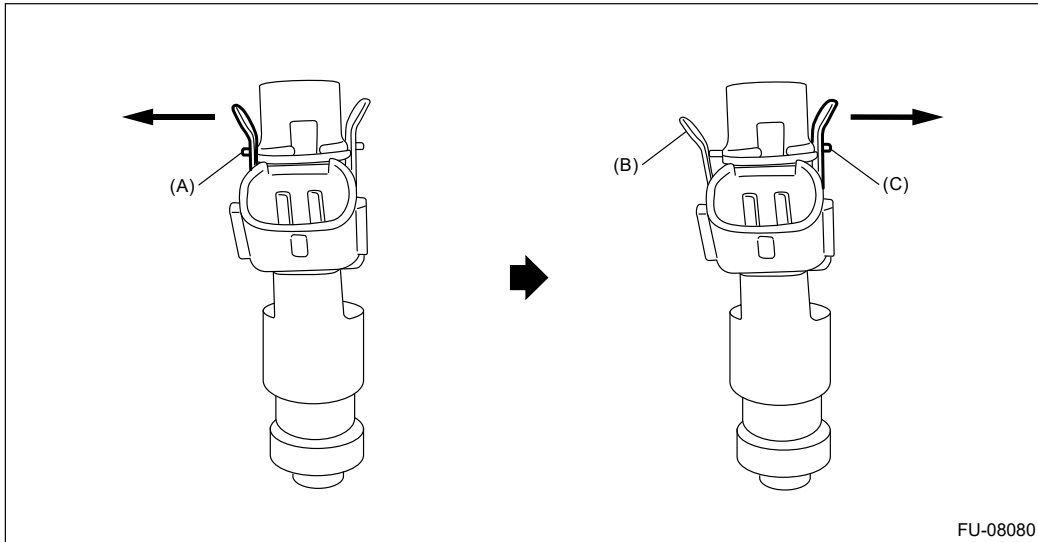


9. Remove the fuel injector from the fuel pipe.

Caution:

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

- (1) Remove the fuel injector holder from one side of flange section (A) of the fuel pipe.
- (2) While holding one side of fuel injector holder (B) you removed in step (1) by finger, remove the other side of fuel injector holder from the flange section (C) of the fuel pipe.



- (3) Remove the fuel injector holder from the fuel pipe and fuel injector, and remove the fuel injector from the fuel pipe.

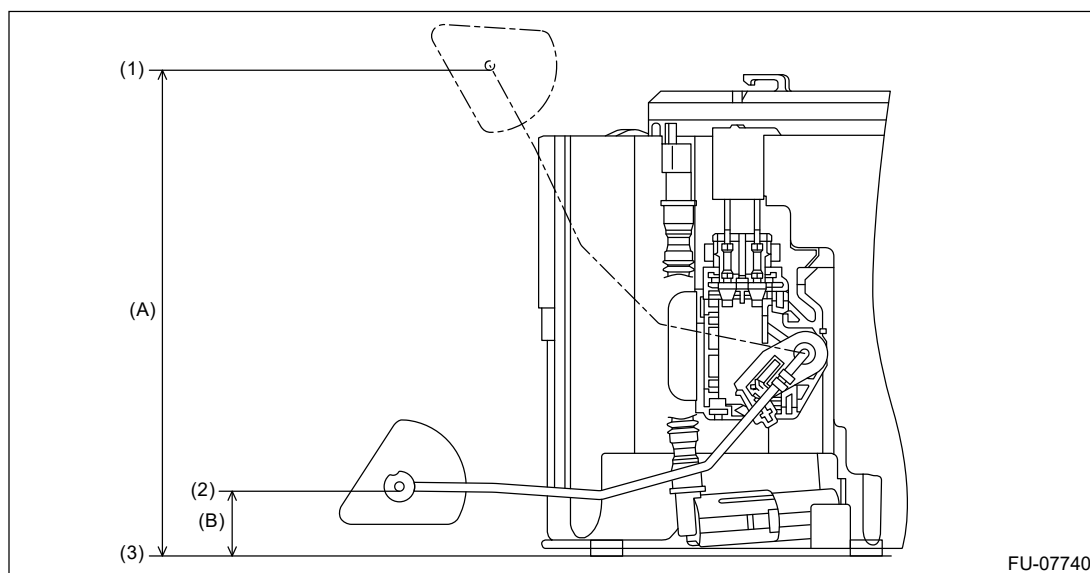
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Level Sensor

INSPECTION

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

Note:

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



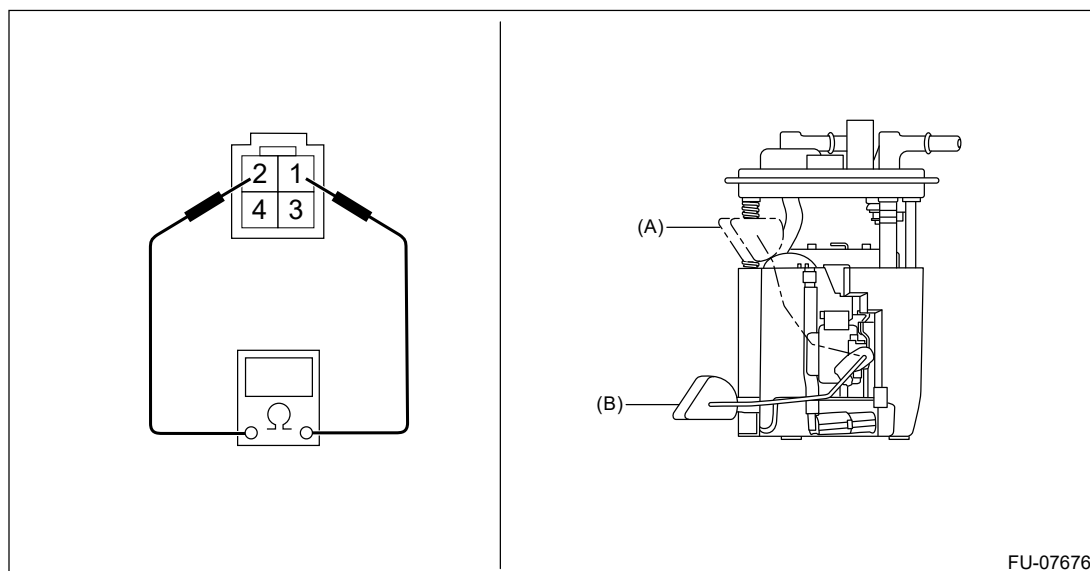
(1) FULL

(2) EMPTY

(3) Fuel tank seating surface

| Float position | Standard |
|--|-----------------------------|
| FULL to Fuel tank seating surface (A) | 133.0±4 mm (5.236±0.157 in) |
| EMPTY to Fuel tank seating surface (B) | 21.6±4 mm (0.850±0.157 in) |

3. Check the resistance between fuel level sensor terminals by the connector on top of the fuel pump.



| Float position | Terminal No. | Standard |
|----------------|--------------|----------|
|----------------|--------------|----------|

| | | |
|-----------|---------|------------------------|
| FULL (A) | 1 and 2 | $8.7 \pm 1.0 \Omega$ |
| EMPTY (B) | | $139.1 \pm 2.0 \Omega$ |

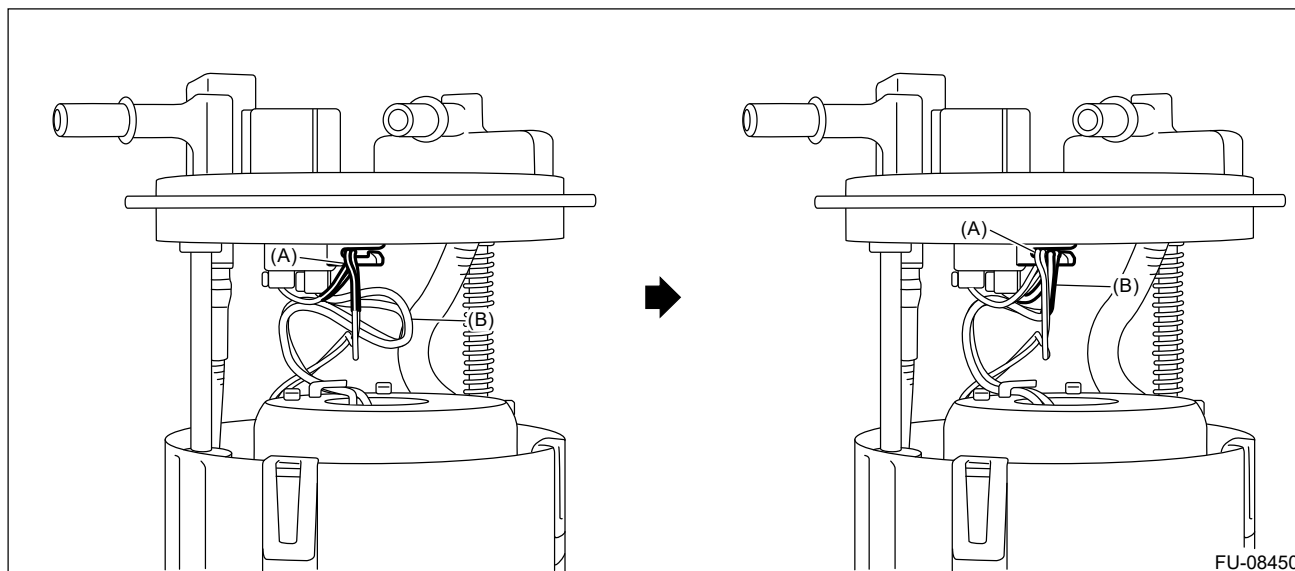
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Level Sensor

INSTALLATION

Install in the reverse order of removal.

Caution:

Be sure to install the fuel level sensor harness to the clip first, then install the connector cable. Otherwise, malfunction may occur.



FU-08450

(A) Fuel level sensor harness

(B) Connector cable

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Level Sensor

REMOVAL

Warning:


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

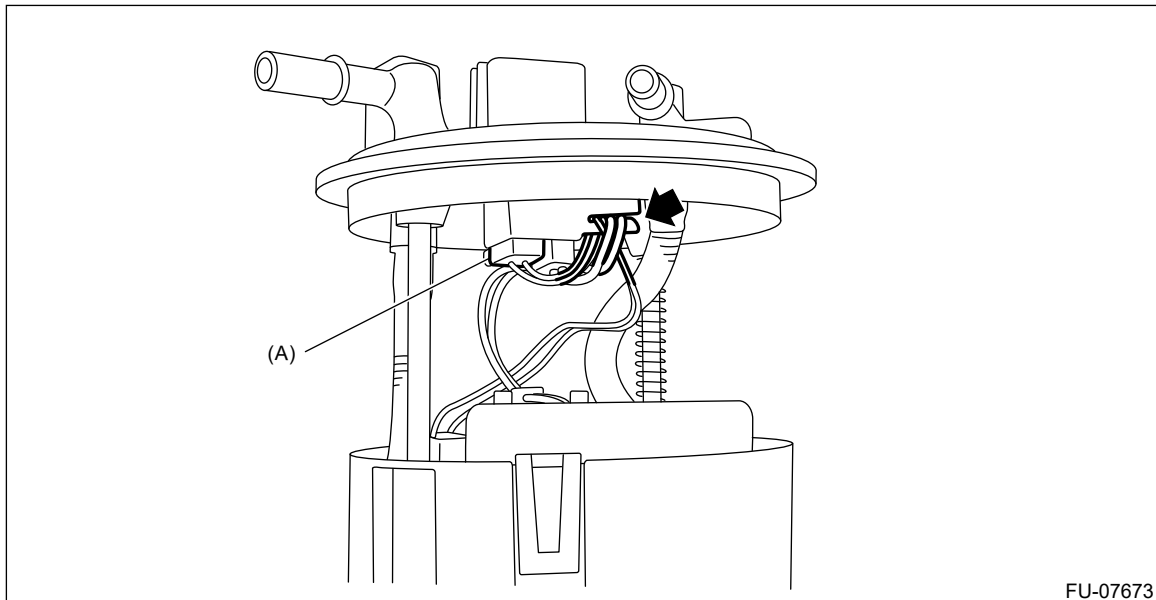
Caution:

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

Note:

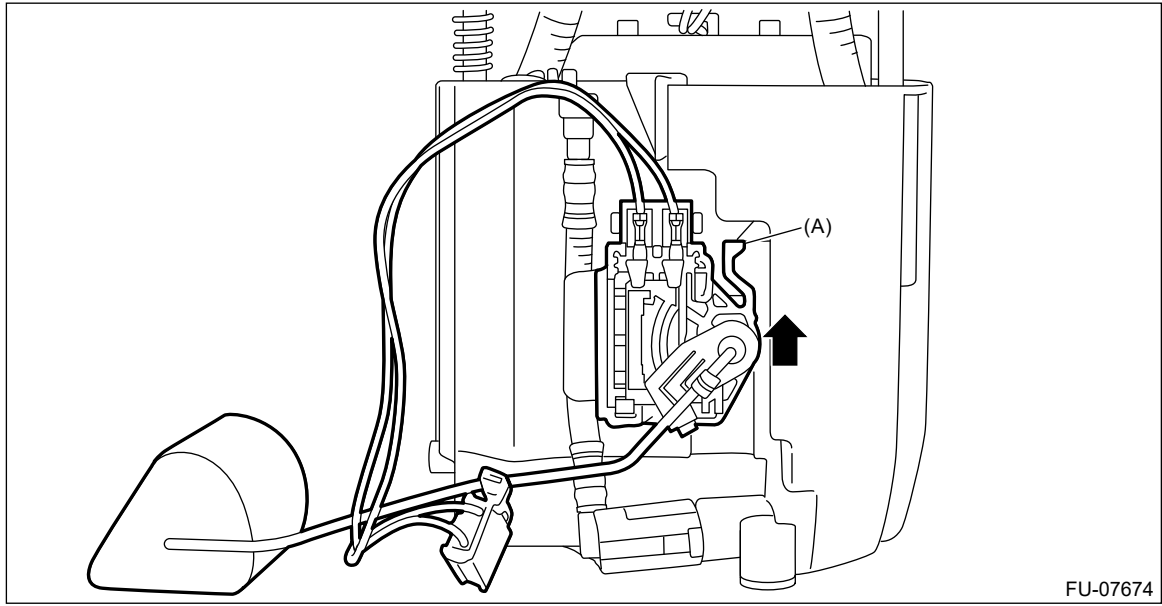
The fuel level sensor is built in fuel pump assembly.

1. Remove the fuel pump assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Pump>REMOVAL.](#)
2. Disconnect the fuel level sensor connector (A), and pull out the connector cable and fuel level sensor harness from the clip.



FU-07673

3. While pressing the claw (A) of the fuel level sensor, slide the fuel level sensor in the direction of the arrow, and remove the fuel level sensor.

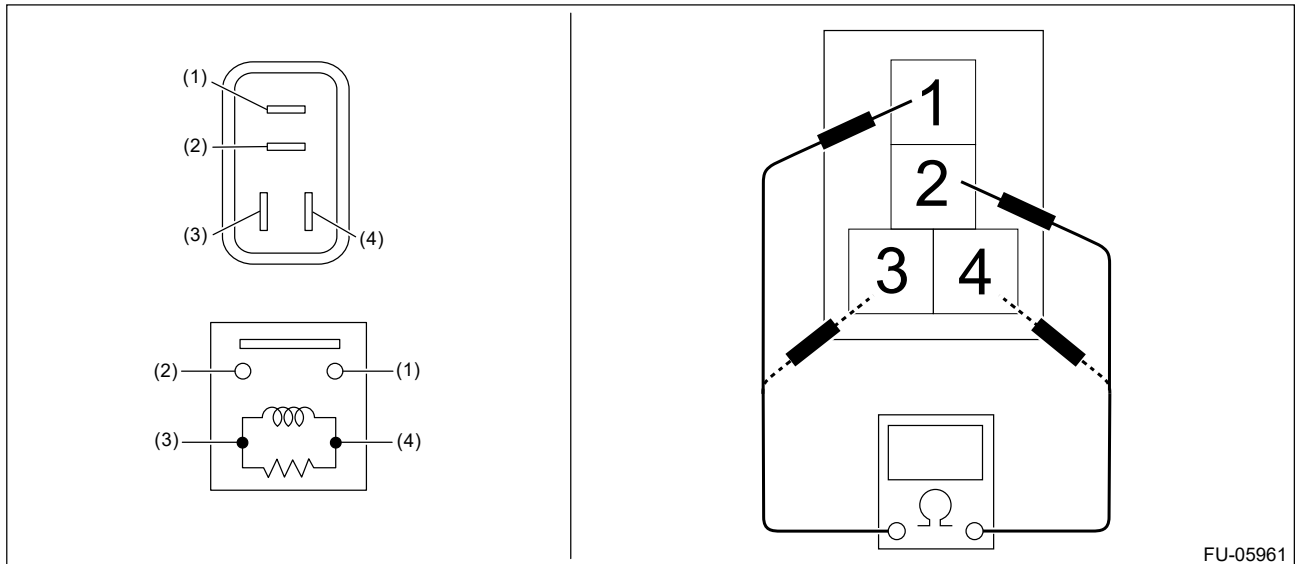


FU-07674

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Pump Relay

INSPECTION

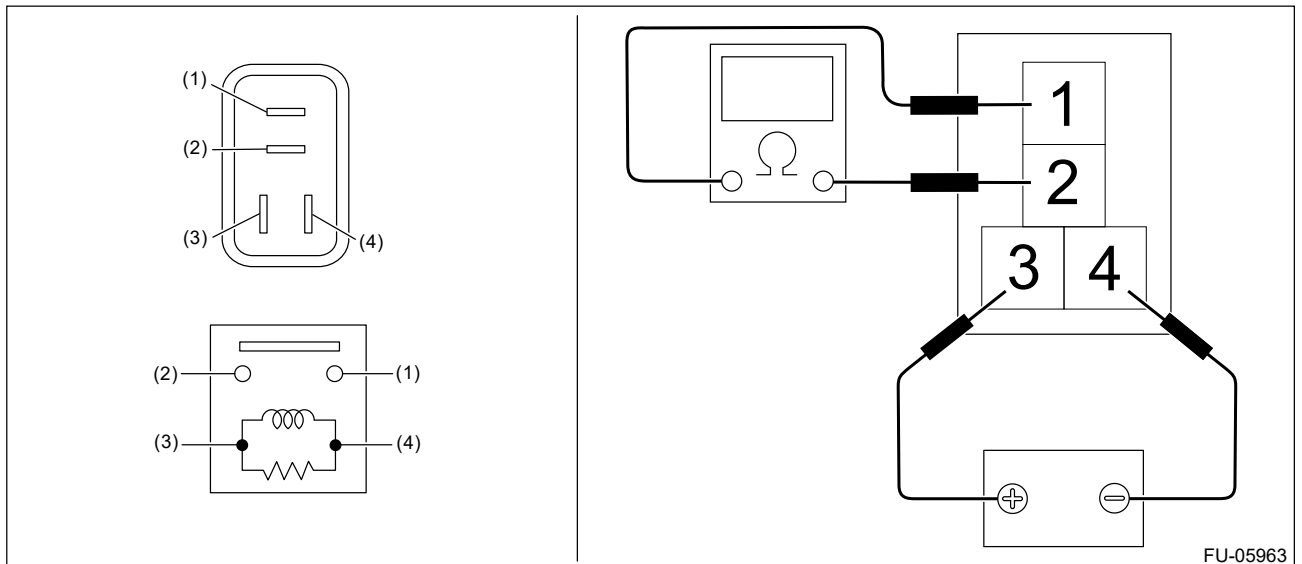
1. Check that the fuel pump relay has no deformation, cracks or other damages.
2. Measure the resistance between fuel pump relay terminals.



FU-05961

| Terminal No. | Standard |
|--------------|---|
| 1 and 2 | 1 M Ω or more |
| 3 and 4 | 130.4 – 230.8 Ω (when 20°C (68°F)) |

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





FU-05963

| Terminal No. | Standard |
|--------------|----------------------|
| 1 and 2 | Less than 1 Ω |



FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Pump Relay

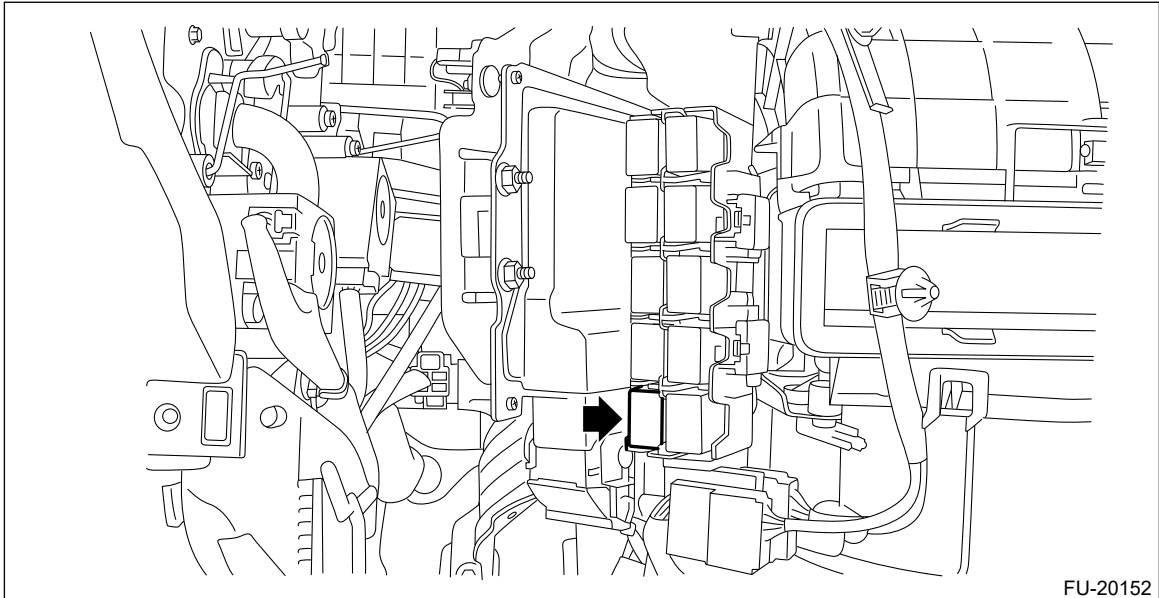
INSTALLATION

1. Install the fuel pump relay to the relay block.
2. Install the glove box.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>INSTALLATION.](#)
3. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Pump Relay

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the glove box.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>REMOVAL.](#)
3. Remove the fuel pump relay from relay block.



FU-20152

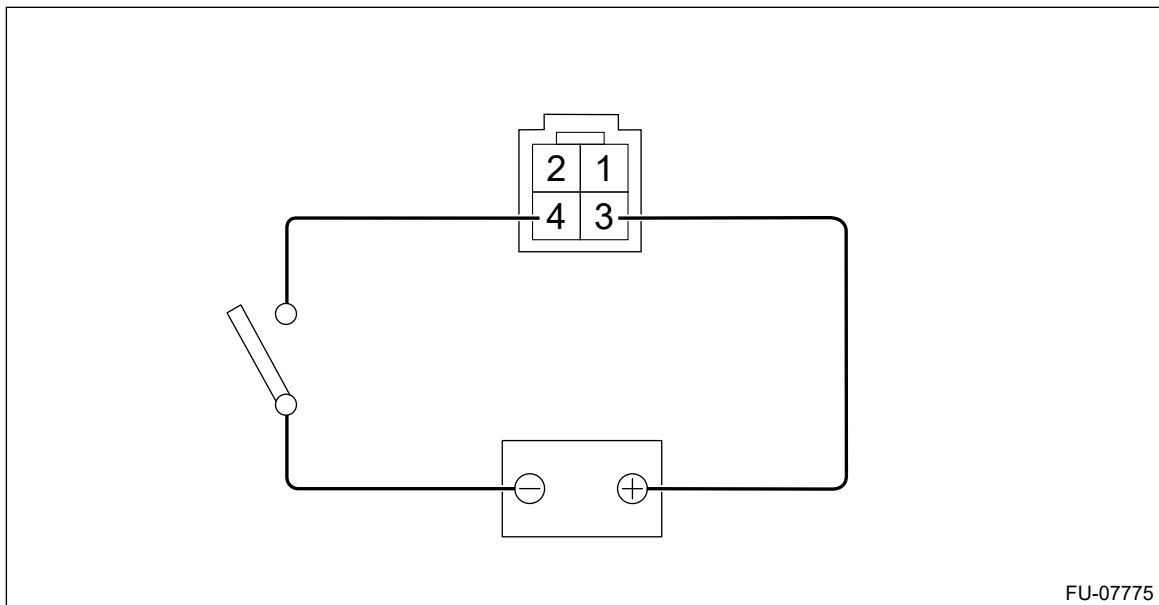
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Pump

INSPECTION

1. Check that the fuel pump has no deformation, cracks or other damages.
2. Connect the battery positive terminal to terminal No.3 and the battery ground terminal to terminal No.4, and inspect the fuel pump operation.

Warning:

- **Wipe off fuel completely.**
- **Keep the battery as far apart from fuel pump as possible.**
- **Do not run the fuel pump for a long time under non-load condition.**



FU-07775

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Pump

INSTALLATION

1. Install the fuel pump assembly to the fuel tank.

- (1) Make sure the sealing portion is free from fuel or foreign matter before installation.
- (2) Align the protrusion (A) of the gasket to the position shown in the figure, and install the gasket from the lower side of the fuel pump assembly.

Note:

Use a new gasket.

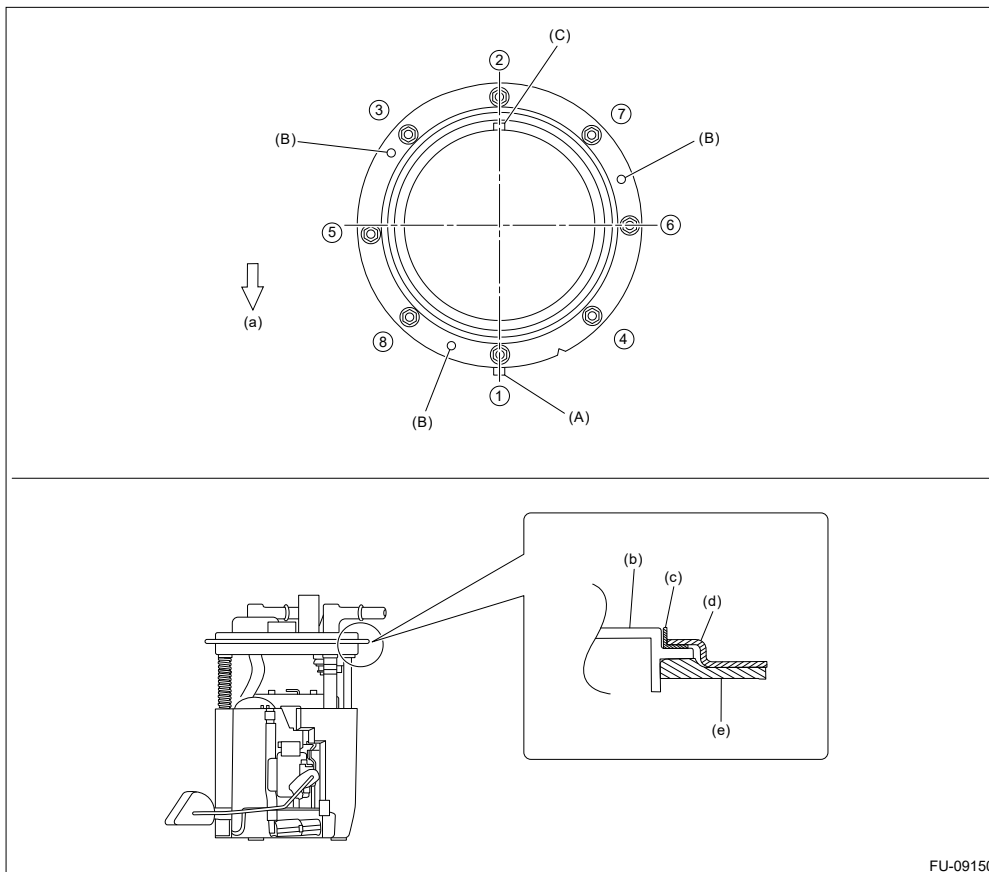
- (3) Align the protrusion (C) of fuel pump upper plate cushion with the protrusion (C) of the fuel pump assembly as shown in the figure, and install the fuel pump upper plate cushion from the upper side of the fuel pump assembly.
- (4) Align the cutout of the fuel pump upper plate with the protrusion (C), and install the fuel pump upper plate from the upper side of the fuel pump assembly so that the protrusions (B) (3 places) of the gasket fit the holes of the fuel pump upper plate.
- (5) Install the fuel pump assembly to the fuel tank in the direction shown in the figure, and tighten the nuts to the specified torque in the order as shown in the figure.

Caution:

Set the arm and float of the fuel level sensor while paying attention to prevent them from contacting the fuel tank. If the arm of the fuel level sensor is bent, the fuel gauge may not read correctly.

Tightening torque:

4.4 N·m (0.4 kgf·m, 3.2 ft·lb)



FU-09150

(a) Front side of vehicle

(c) Fuel pump upper plate cushion

(e) Gasket

(b) Fuel pump ASSY

(d) Fuel pump upper plate

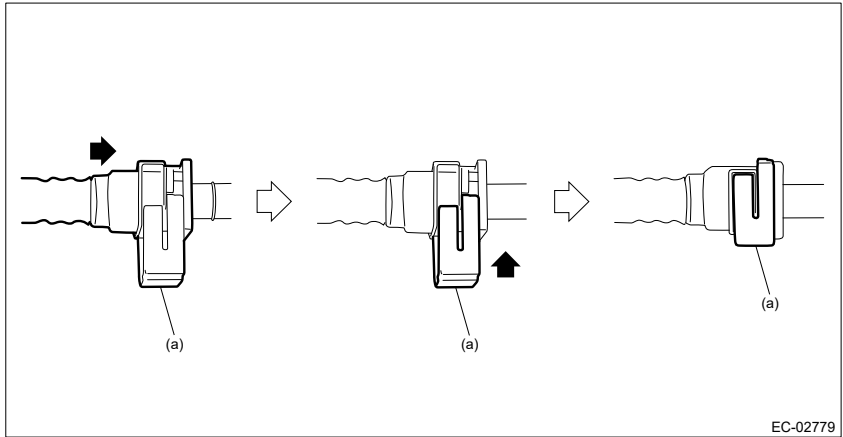
2. Connect the quick connector of the fuel delivery tube and the jet pump tube.

Caution:

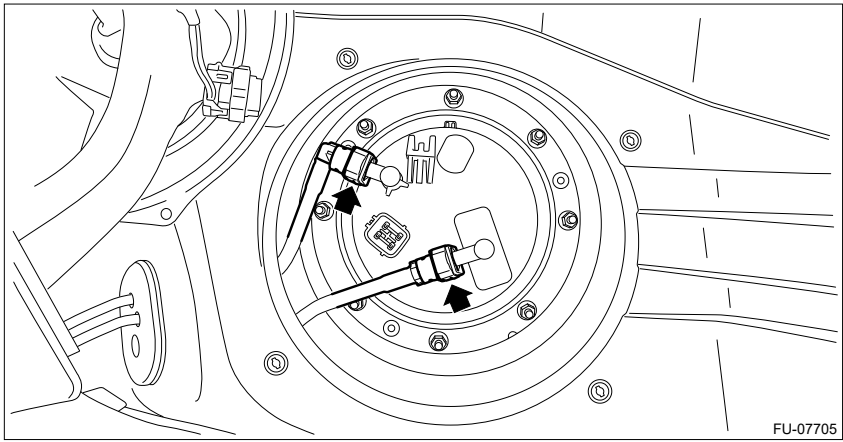
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

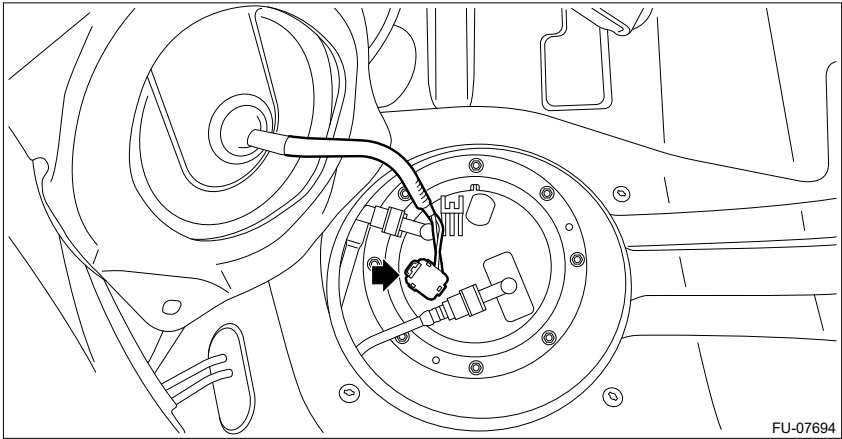
Connect the quick connector as shown in the figure.



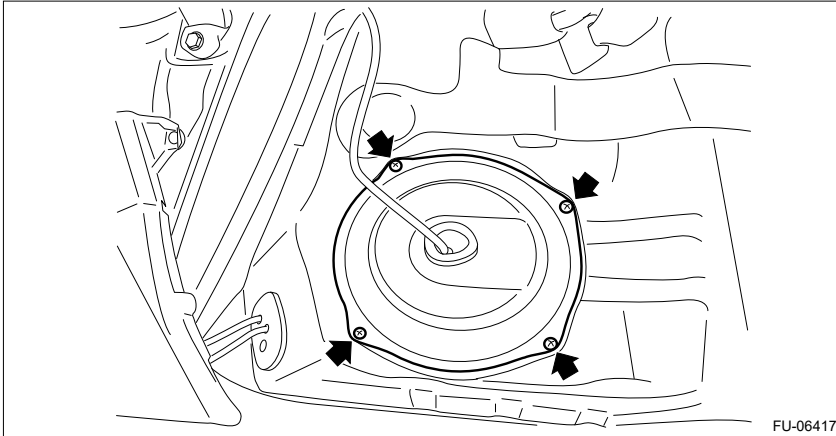
(a) Slider





3. Connect the connector to the fuel pump.



4. Install the service hole cover of fuel pump.



5. Install the rear seat cushion.  [Ref. to SEATS>Rear Seat>INSTALLATION.](#)
6. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Pump

REMOVAL

Warning:





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

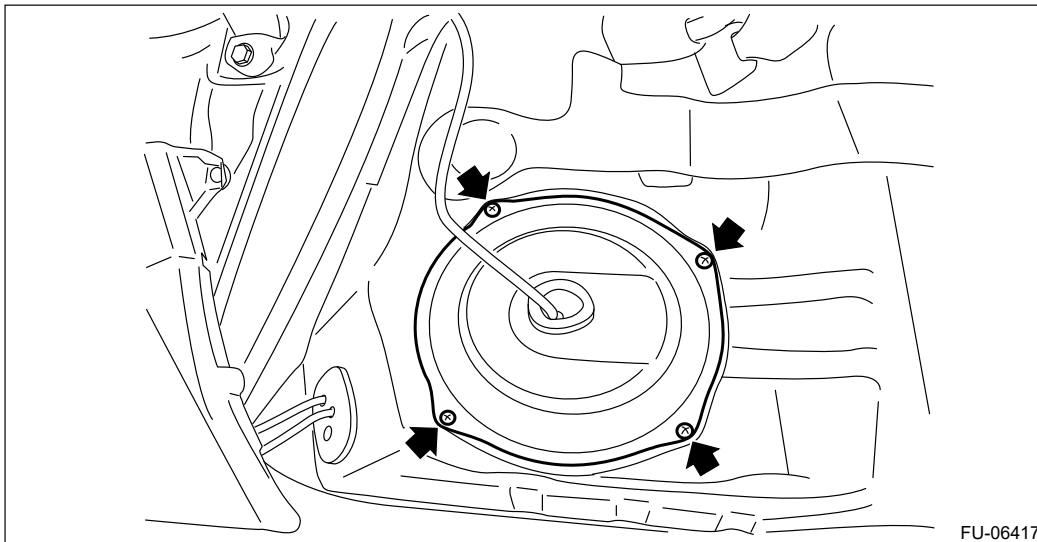
Caution:

- Be careful not to spill fuel.
- Catch the fuel from the tubes using a container or cloth.
- If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.

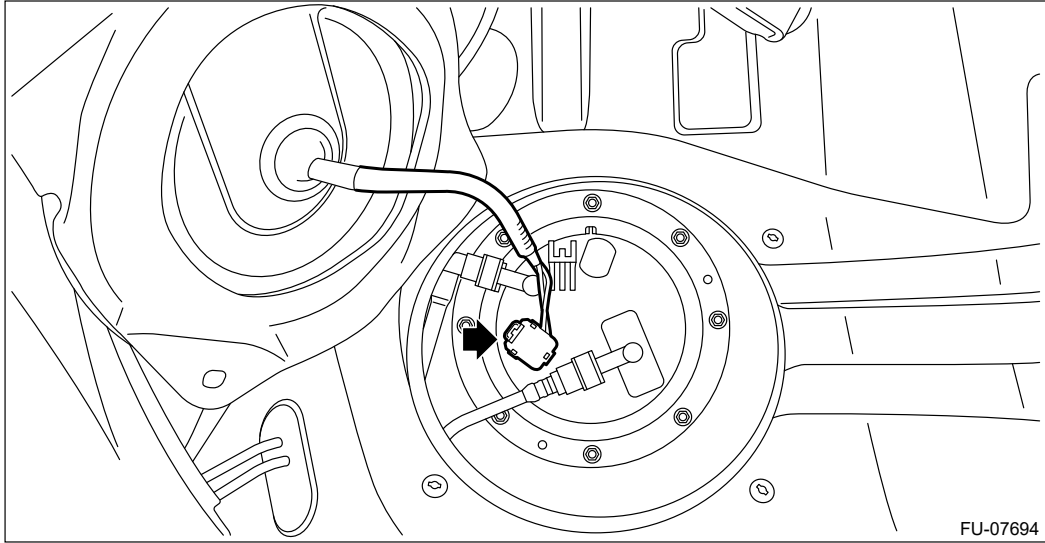
Note:

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

1. Release the fuel pressure.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Drain fuel.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > DRAINING FUEL \(WITH SUBARU SELECT MONITOR\).](#)
3. Disconnect the ground terminal from battery sensor.  Ref. to [NOTE>NOTE > BATTERY.](#)
4. Remove the rear seat cushion.  Ref. to [SEATS>Rear Seat>REMOVAL.](#)
5. Remove the service hole cover of fuel pump.



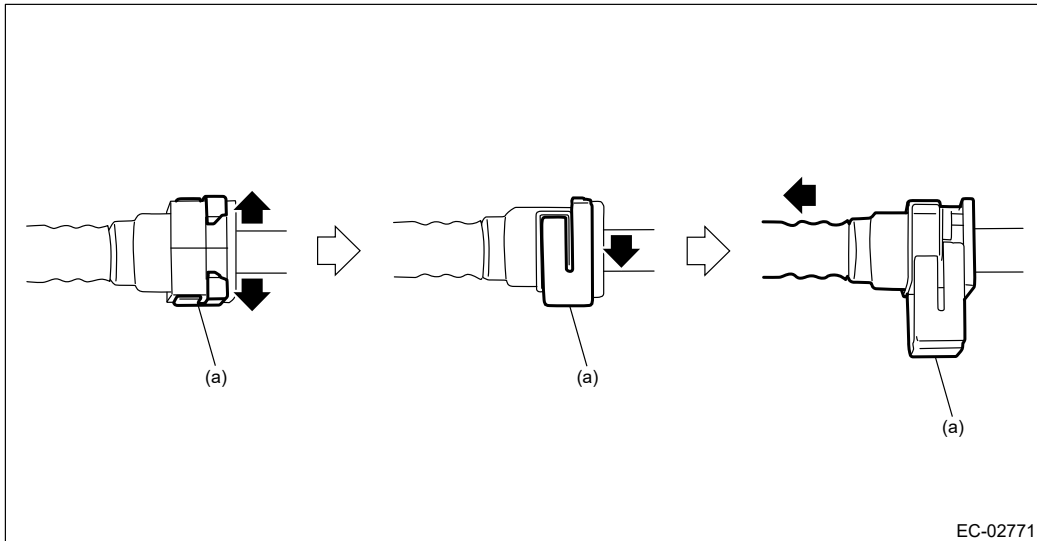
6. Disconnect connectors from the fuel pump, and move aside the service hole cover.



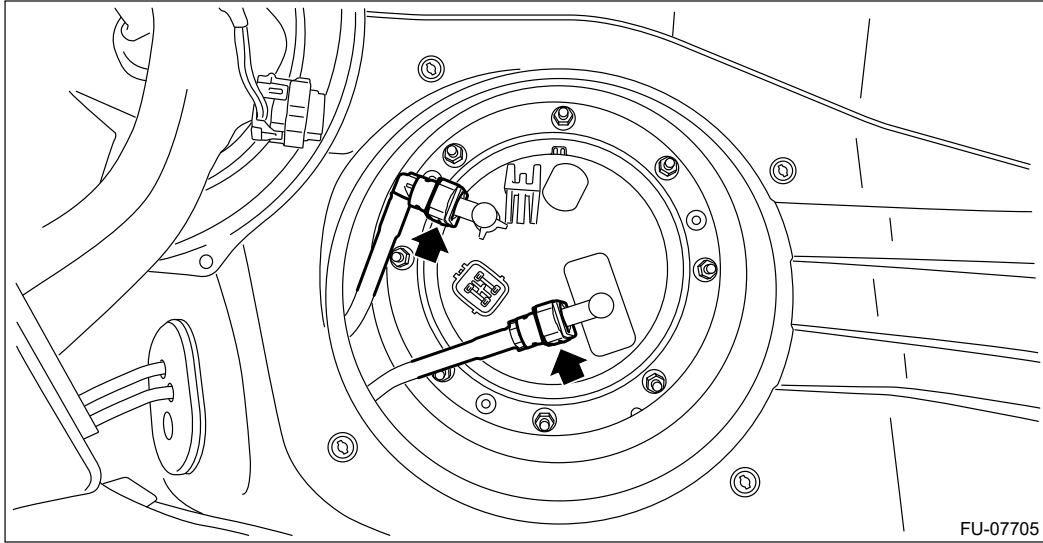
7. Disconnect the quick connector of fuel delivery tube and jet pump tube.

Note:

Disconnect the quick connector as shown in the figure.

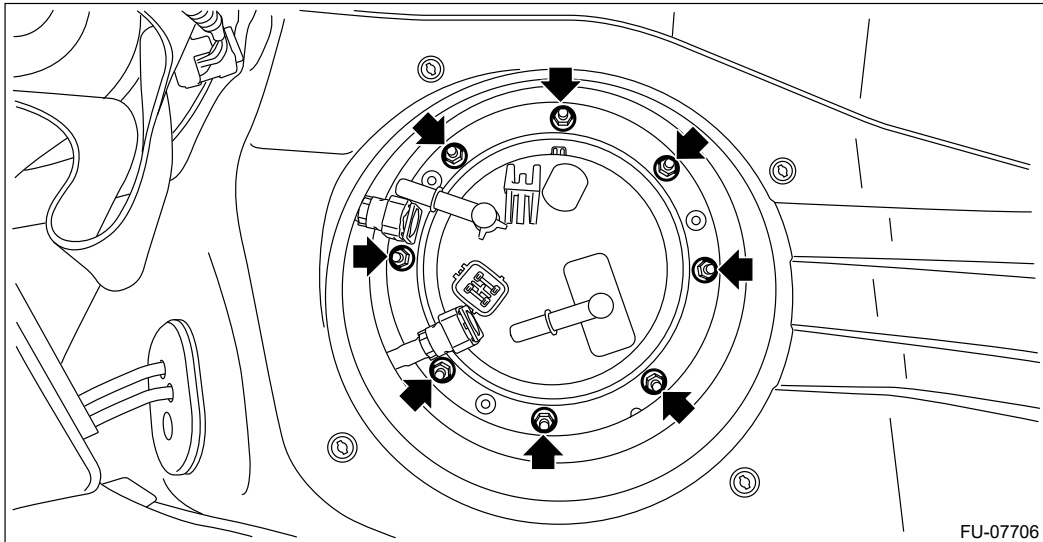


(a) Slider



FU-07705

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



FU-07706

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

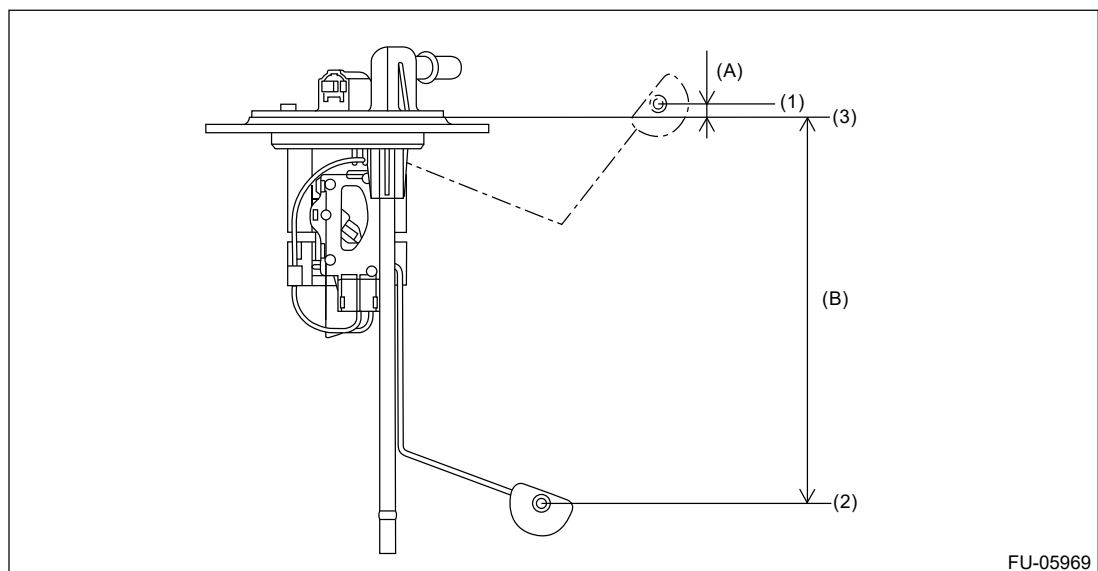
Caution:

Be careful not to let the arm and float of fuel level sensor contact the fuel tank.

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Sub Level Sensor

INSPECTION

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



FU-05969

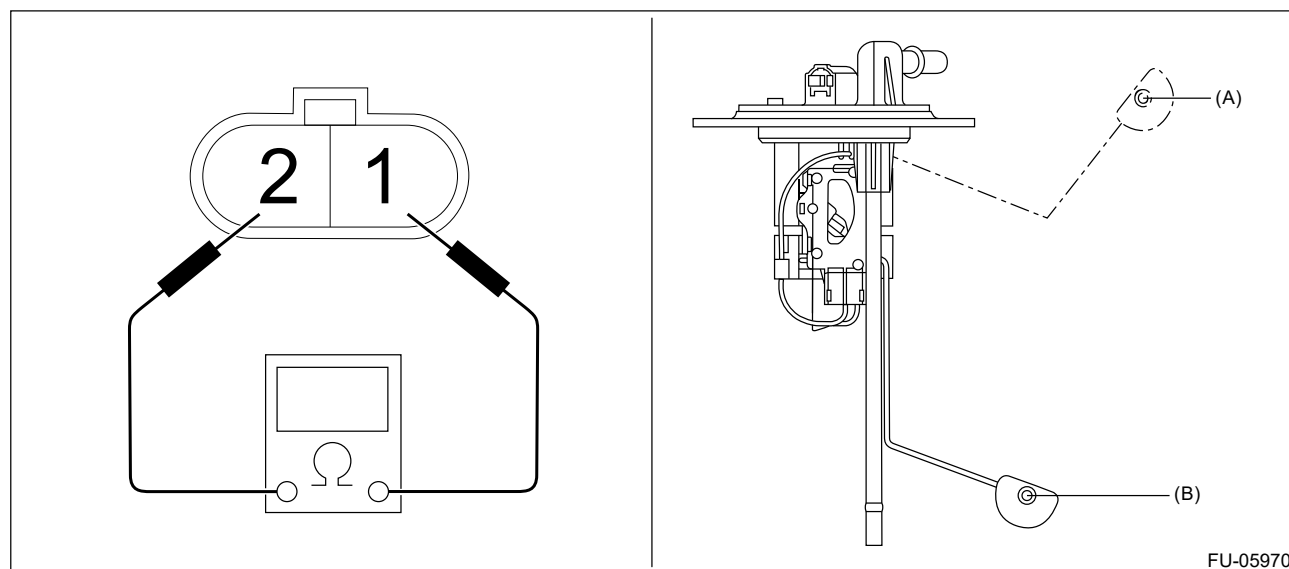
(1) FULL

(2) EMPTY

(3) Datum points

| Float position | Standard |
|--------------------------|------------------------------|
| FULL to Datum point (A) | 5.31±3.5 mm (0.209±0.138 in) |
| EMPTY to Datum point (B) | 160.6±3.5 mm (6.32±0.138 in) |

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



FU-05970

| Float position | Terminal No. | Standard |
|----------------|--------------|-------------|
| FULL (A) | 1 and 2 | 8.7±1.0 Ω |
| EMPTY (B) | | 270.9±4.0 Ω |

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Sub Level Sensor

INSTALLATION

1. Install the fuel sub level sensor to the fuel tank.

- (1) Make sure the sealing portion is free from fuel or foreign matter before installation.
- (2) Align the cutout (B) as shown in the figure, and install the fuel sub level sensor upper plate cushion to the fuel sub level sensor upper plate.
- (3) Align the cutout of the fuel sub level sensor upper plate with the protrusion (B) of the fuel sub level sensor as shown in the figure, and install the fuel sub level sensor upper plate from the upper side of the fuel sub level sensor.
- (4) Install the gasket from the lower side of the fuel sub level sensor so that the protrusion (B) of the fuel sub level sensor and the protrusion (A) of the gasket are positioned as shown in the figure.

Note:

Use a new gasket.

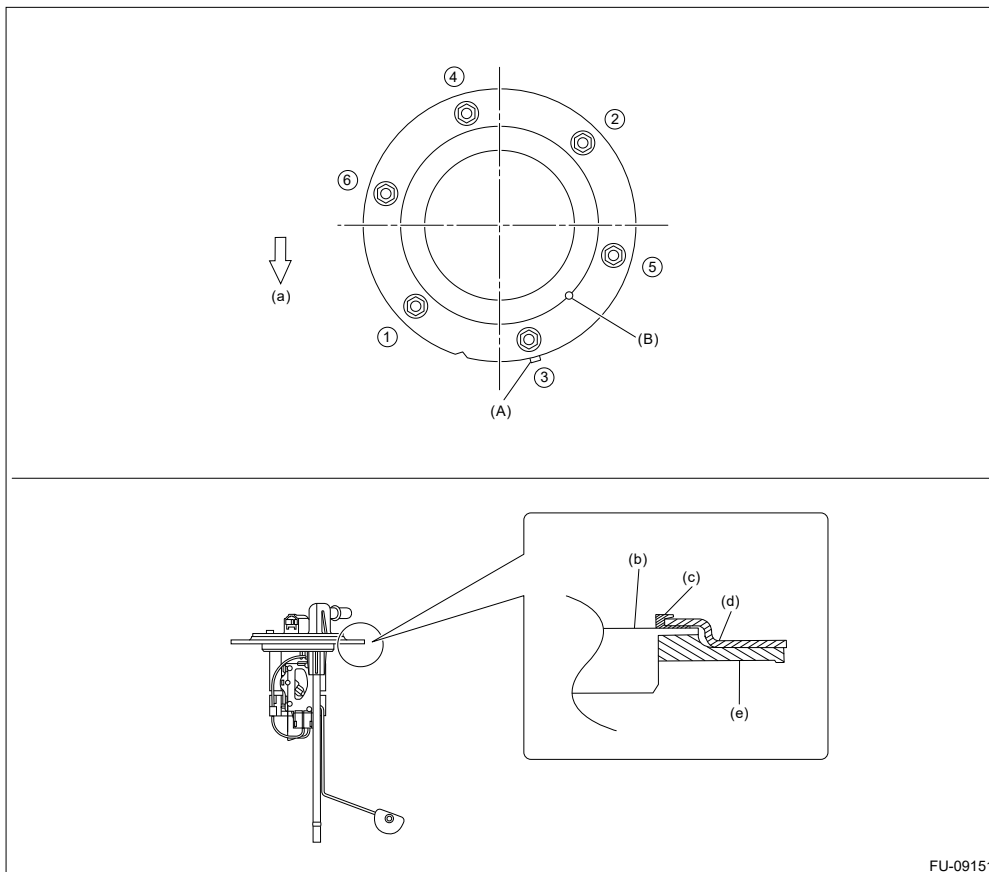
- (5) Install the fuel sub level sensor to the fuel tank in the direction shown in the figure, and tighten the nuts to the specified torque in the order as shown in the figure.

Caution:

Set the arm and float of the fuel sub level sensor while paying attention to prevent them from contacting the fuel tank. If the arm of the fuel sub level sensor is bent, the fuel gauge may not read correctly.

Tightening torque:

4.4 N·m (0.4 kgf·m, 3.2 ft·lb)



(a) Front side of vehicle

(c) Fuel sub level sensor upper plate cushion

(e) Gasket

(b) Fuel sub level sensor

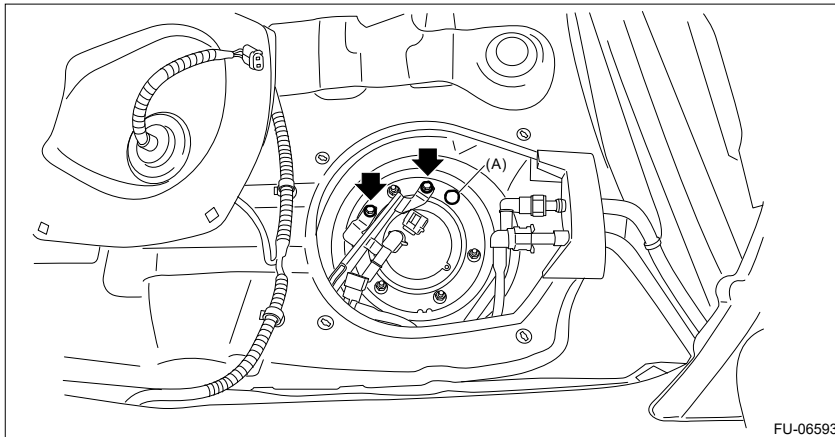
(d) Fuel sub level sensor upper plate

2. Install the fuel sub level sensor protector, and install the rubber cap (A).

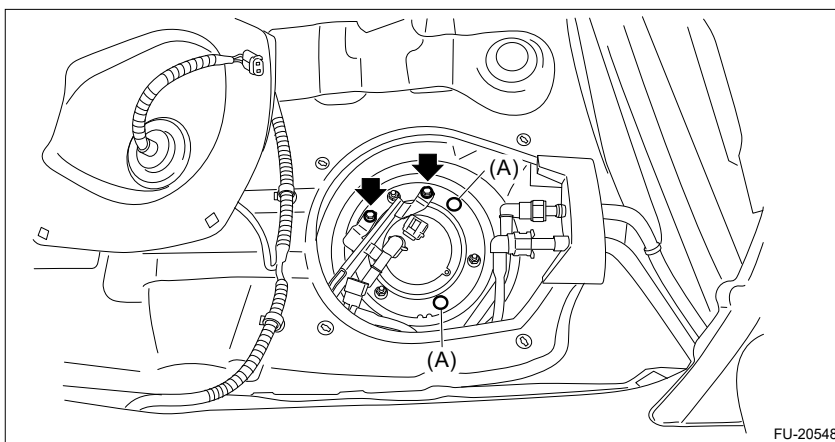
Tightening torque:

4.4 N·m (0.4 kgf·m, 3.2 ft·lb)

- Single-piece type



- Two-piece type



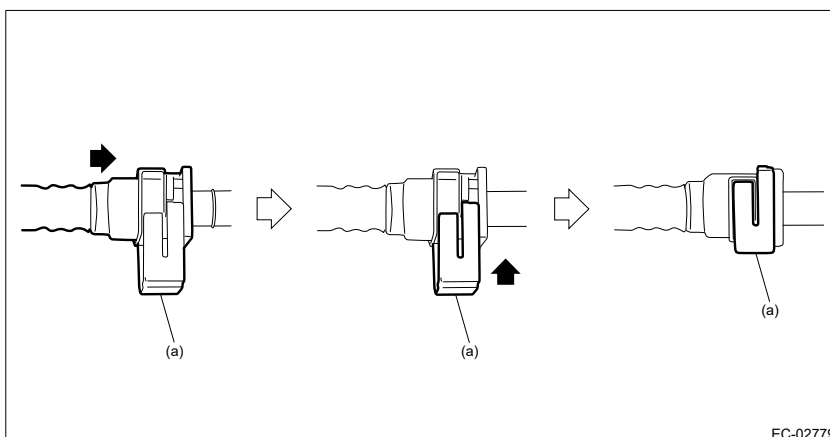
3. Connect the quick connector of the jet pump tube.

Caution:

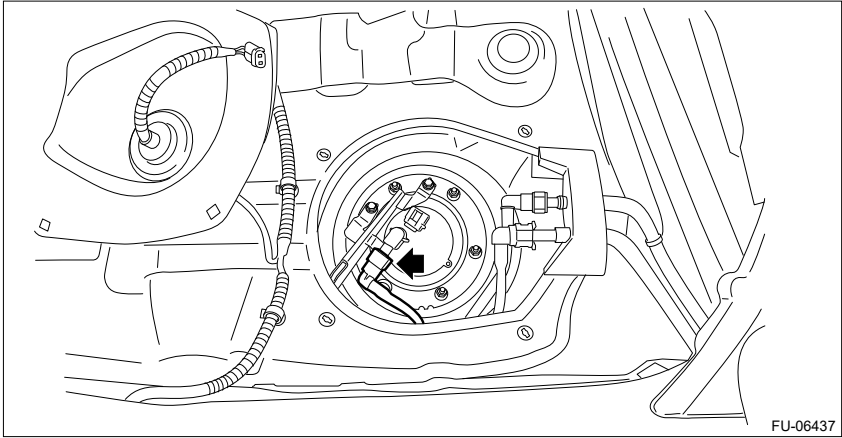
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

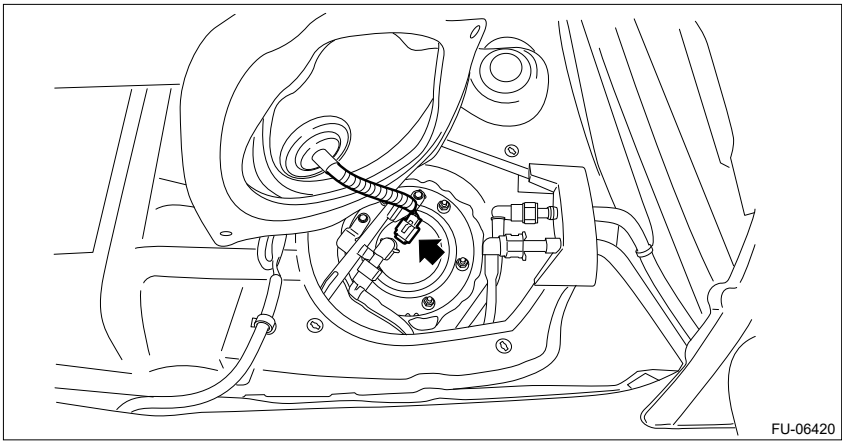
Connect the quick connector as shown in the figure.



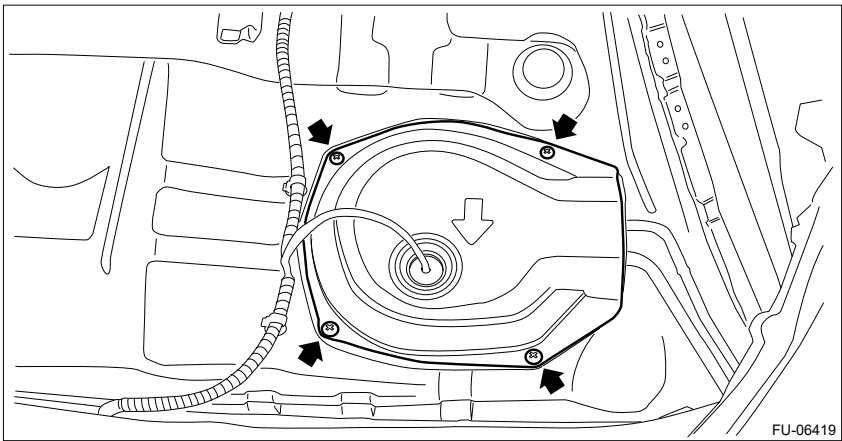
(a) Slider





4. Connect the connector to the fuel sub level sensor.



5. Install the service hole cover of fuel sub level sensor.



6. Install the rear seat cushion.  [Ref. to SEATS>Rear Seat>INSTALLATION.](#)
7. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Sub Level Sensor





REMOVAL

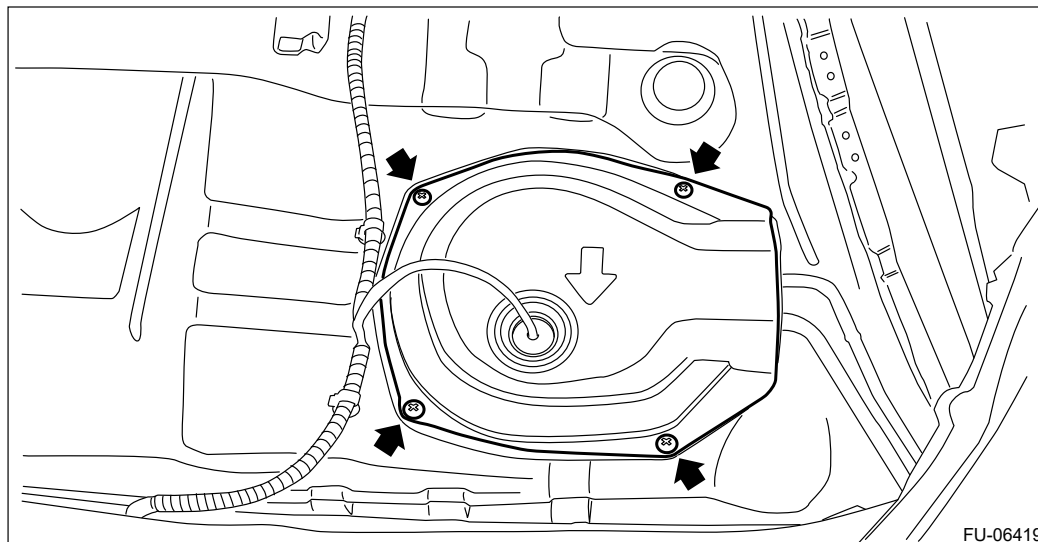
Warning:

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

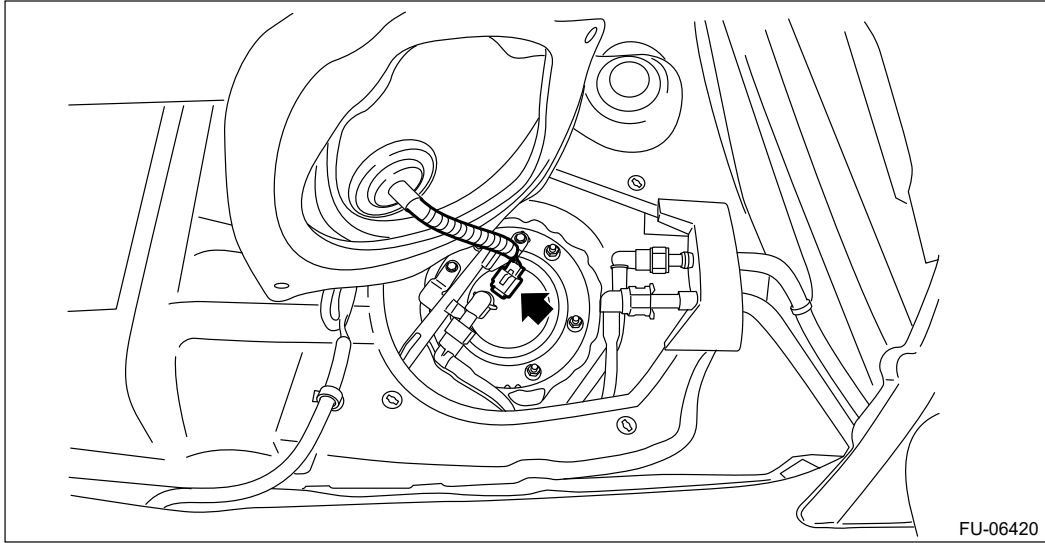
Caution:

- Be careful not to spill fuel.
- Catch the fuel from the tubes using a container or cloth.
- If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Drain fuel.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > DRAINING FUEL \(WITH SUBARU SELECT MONITOR\).](#)
3. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
4. Remove the rear seat cushion.  [Ref. to SEATS>Rear Seat>REMOVAL.](#)
5. Remove the service hole cover of fuel sub level sensor.



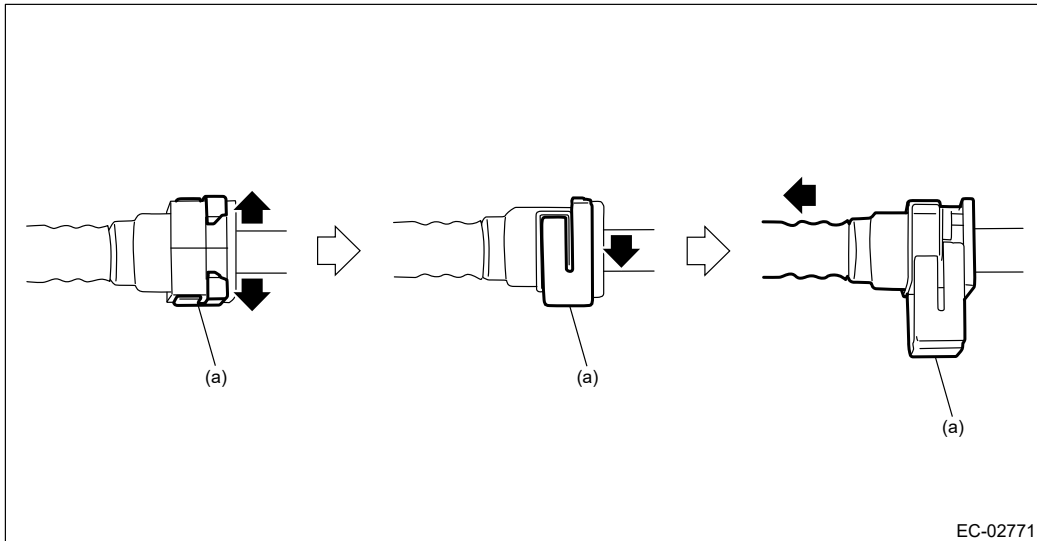
6. Disconnect the connector from the fuel sub level sensor, and move aside the service hole cover.



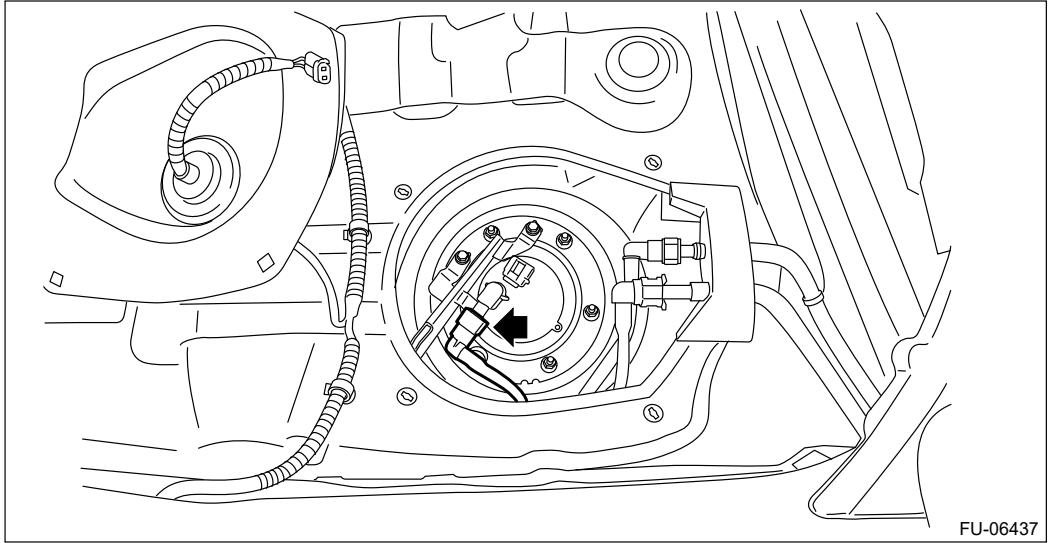
7. Disconnect the quick connector of the jet pump tube.

Note:

Disconnect the quick connector as shown in the figure.



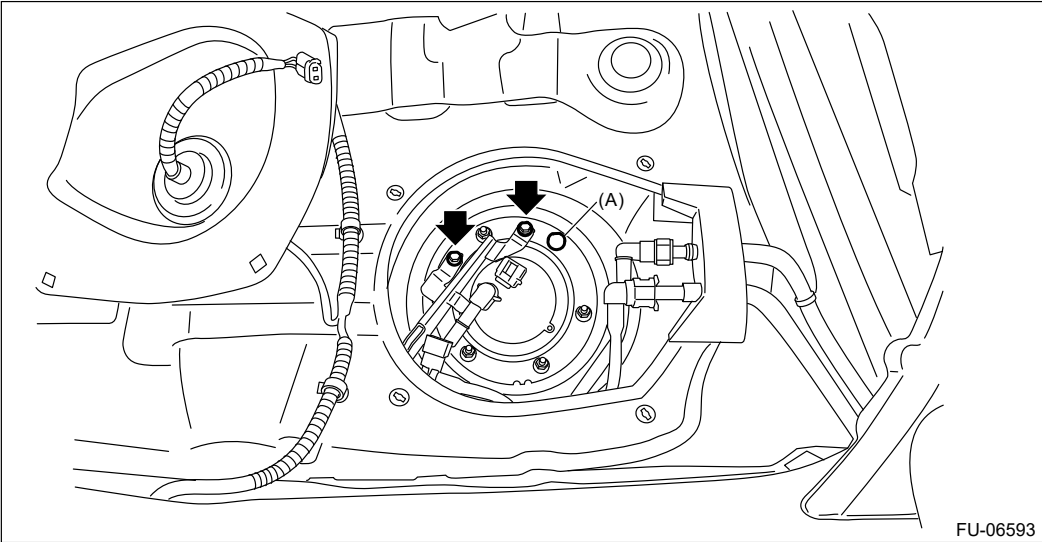
(a) Slider



FU-06437

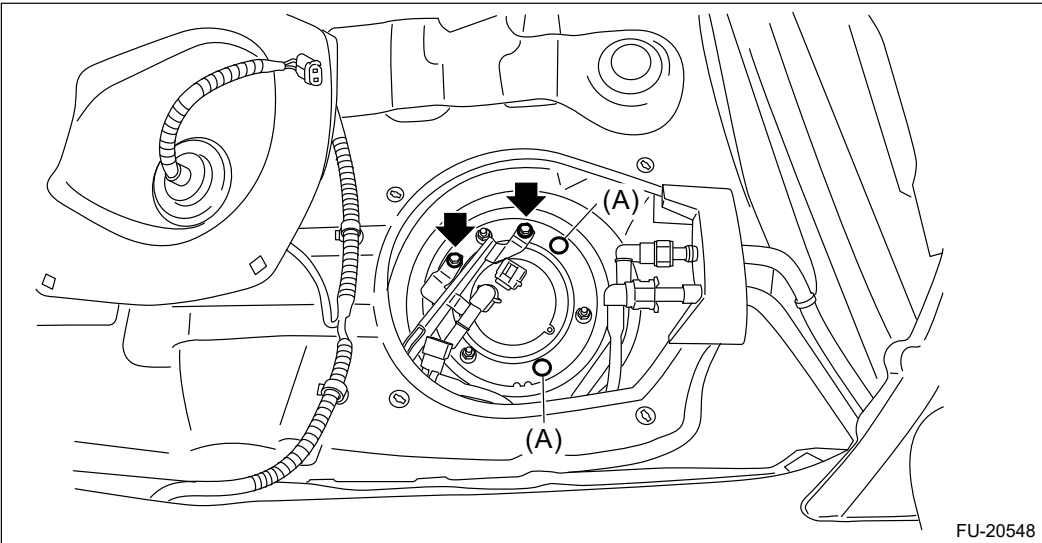
8. Remove the fuel sub level sensor protector, and remove the rubber cap (A) from nut.

- Single-piece type



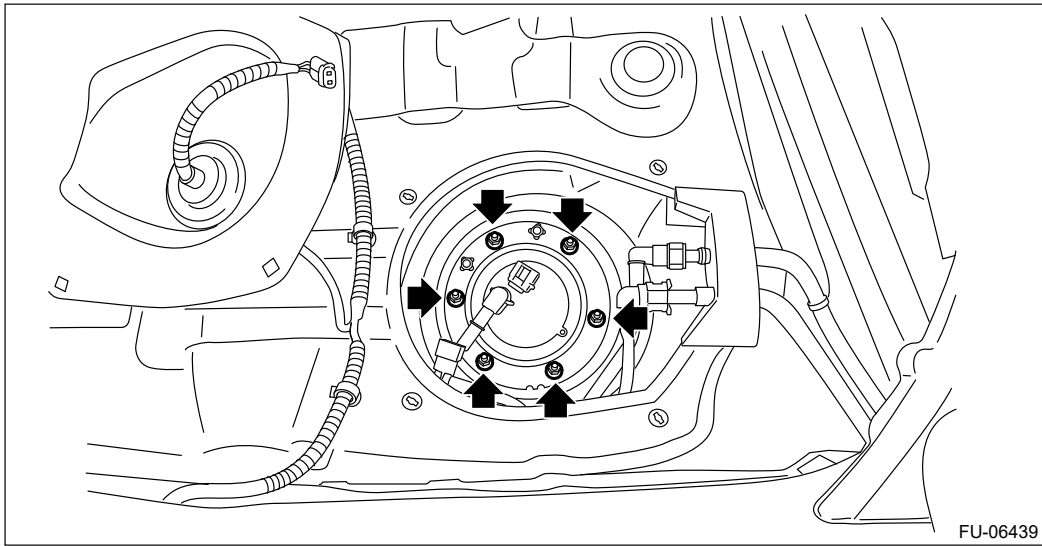
FU-06593

- Two-piece type



FU-20548

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




- 10.** Remove the fuel sub level sensor from the fuel tank.

Caution:

Be careful not to let the arm and float of the fuel sub level sensor contact the fuel tank.

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel System Trouble in General

INSPECTION

| Trouble | Possible cause | Corrective action |
|---|---|---|
| Insufficient fuel supply to fuel injector | a. Fuel pump does not operate. | |
| | Defective terminal contact | Inspect contact, especially ground, and tighten it securely. |
| | Trouble in electromagnetic or electronic circuit parts | Replace the faulty parts. |
| | b. Decline of fuel pump function | Replace the fuel pump. |
| | c. Clogged fuel filter | Replace the fuel filter. Clean or replace the fuel tank if necessary. |
| | d. Clogged or bent fuel line pipe, hose or tube | Clean, correct or replace the fuel line pipe, hose or tube. |
| | e. Air is mixed in fuel system. | Check the fuel line connections, correct or replace the defective part. |
| | f. Damaged diaphragm of pressure regulator | Replace the fuel filter assembly. |
| Leakage or blow out of fuel | a. Loose connections of fuel line pipe, hose or tube | Check the fuel line connections, correct or replace the defective part. |
| | b. Cracked fuel line pipe, hose or tube | Replace the fuel line pipe, hose or tube. |
| | c. Cracked fuel tank or defective welding part | Replace the fuel tank. |
| | d. Clogged or bent fuel line pipe, hose or tube | Clean, correct or replace the fuel line pipe, hose or tube. |
| Gasoline smell inside of compartment | a. Loose connections of fuel line pipe, hose or tube | Check the fuel line connections, correct or replace the defective part. |
| | b. Defective gasket of fuel saucer or fuel filler pipe assembly | Correct or replace the gasket. |
| | c. Defective canister | Replace the canister. |
| Defective fuel gauge | a. Defective operation of fuel level sensor | Replace the fuel level sensor. |
| | b. Defective operation of combination meter  Ref. to COMBINATION METER (DIAGNOSTICS)>Basic Diagnostic Procedure>PROCEDURE. | Replace the combination meter. |
| Noise | a. Large operation noise or vibration of fuel pump | Replace the fuel pump. |

Note:

- **When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill fuel fully to prevent the problem.**

- **In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop to 0°C (32°F) or less throughout the winter season, use a water removing agent in the fuel system to prevent freezing fuel system and accumulating water.**
- **When water is accumulated in fuel filter, fill the water removing agent in the fuel tank.**
- **Before using water removing agent, follow the cautions noted on the bottle.**

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Tank Protector

INSTALLATION

Install in the reverse order of removal.

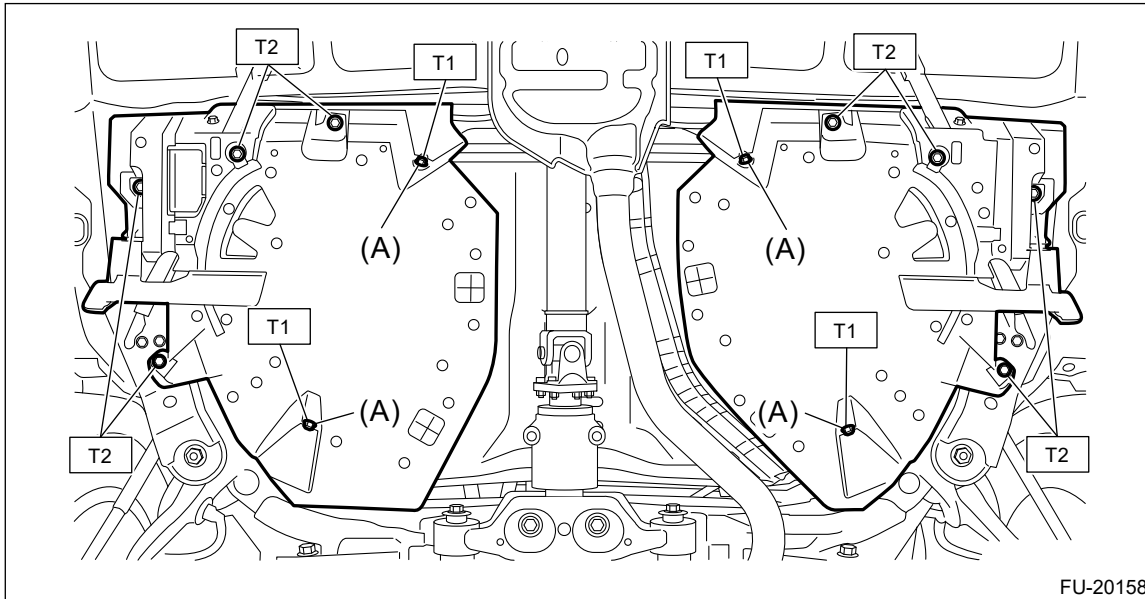
Note:

Use a new self-locking nut.

Tightening torque:

T1: 9 N•m (0.9 kgf-m, 6.6 ft-lb)

T2: 18 N•m (1.8 kgf-m, 13.3 ft-lb)

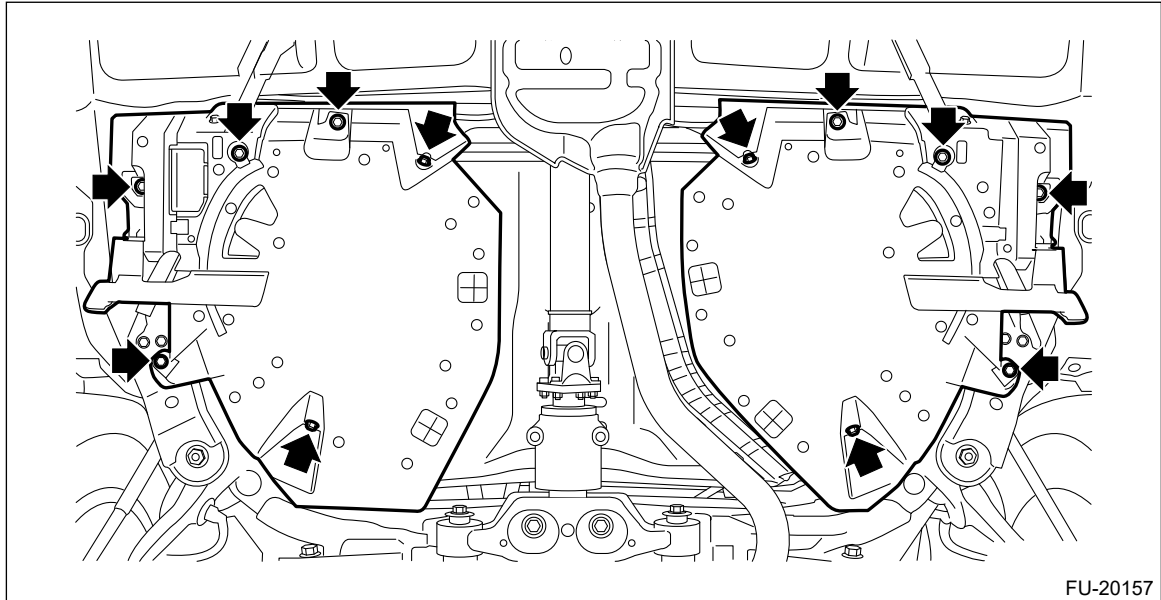


(A) Self-locking nut

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Tank Protector

REMOVAL

1. Lift up the vehicle.
2. Remove the bolt and nuts and remove the fuel tank protector.



FU-20157

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Tank

INSPECTION

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

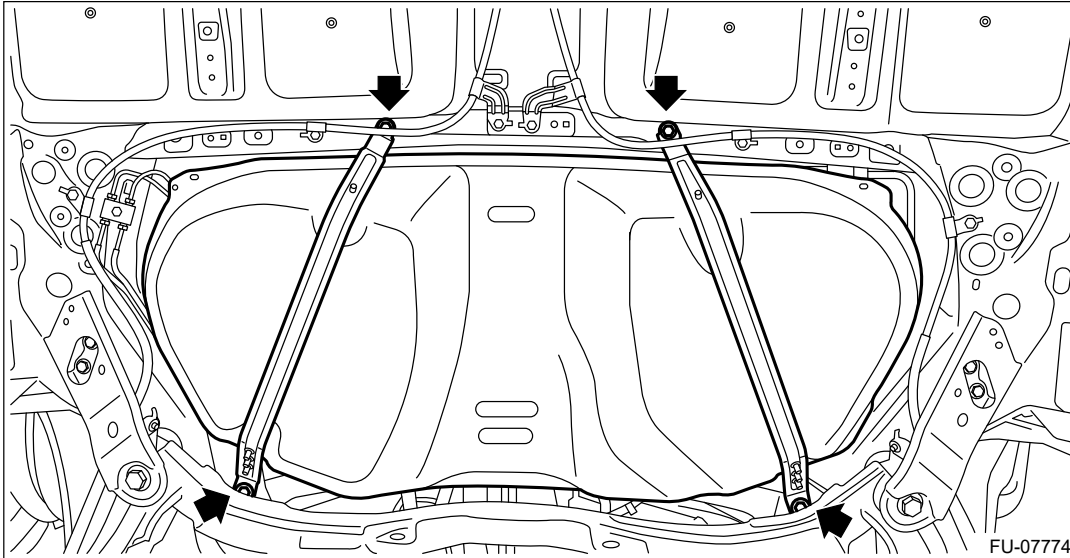
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Tank

INSTALLATION

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

Warning:

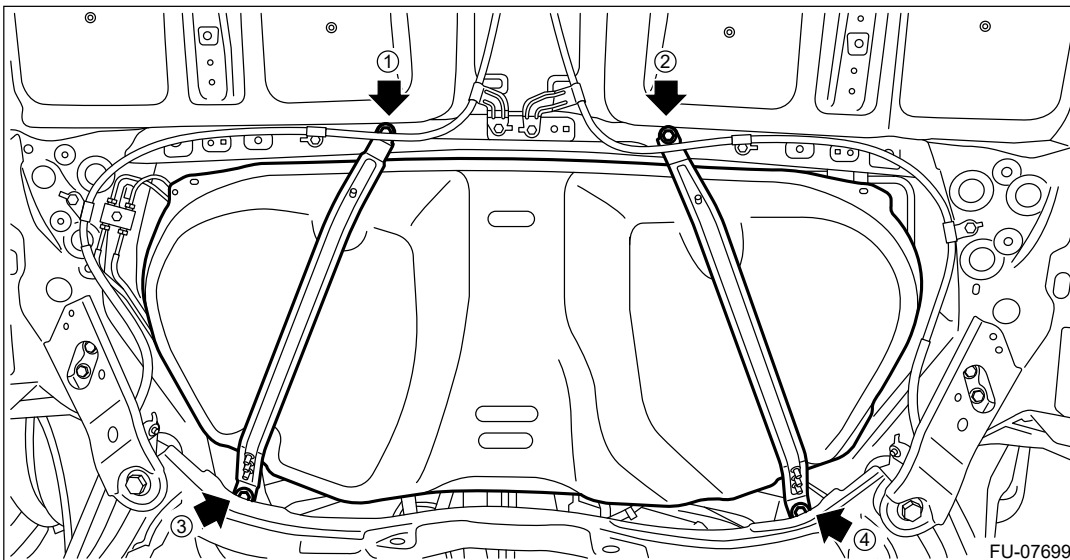
A helper is required to perform this work.



2. Tighten the bolts of the fuel tank band in the order shown in the figure.

Tightening torque:

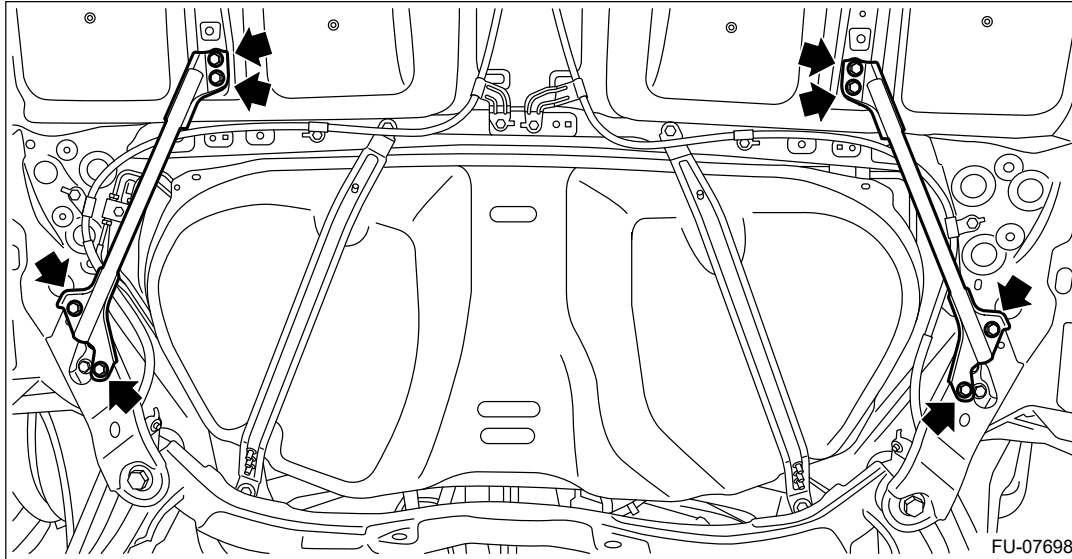
33 N•m (3.4 kgf-m, 24.3 ft-lb)



3. Install the stay - rear frame COMPL.

Tightening torque:

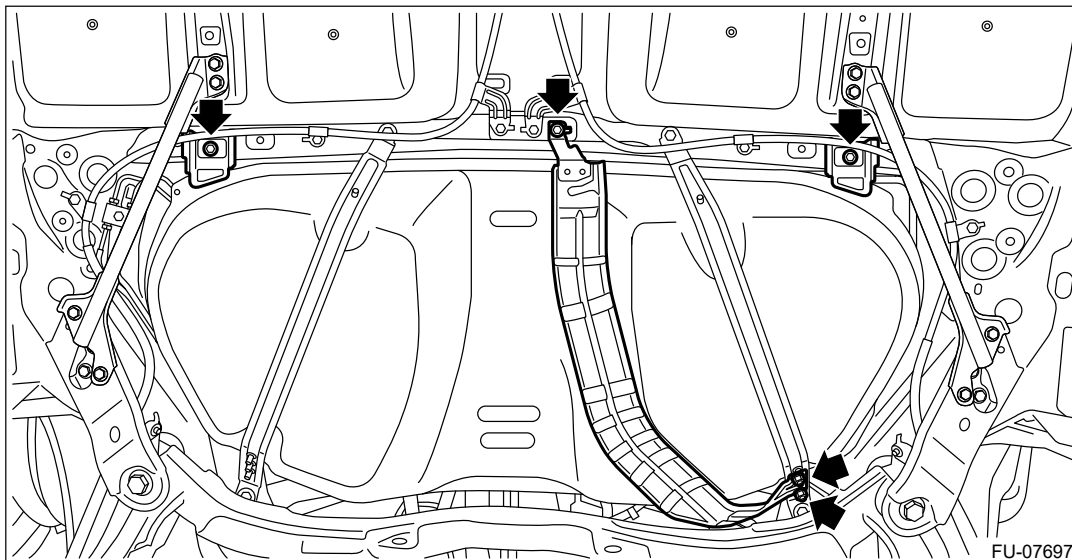
33 N•m (3.4 kgf-m, 24.3 ft-lb)



4. Install the heat shield cover and stopper.

Tightening torque:

18 N•m (1.8 kgf-m, 13.3 ft-lb)



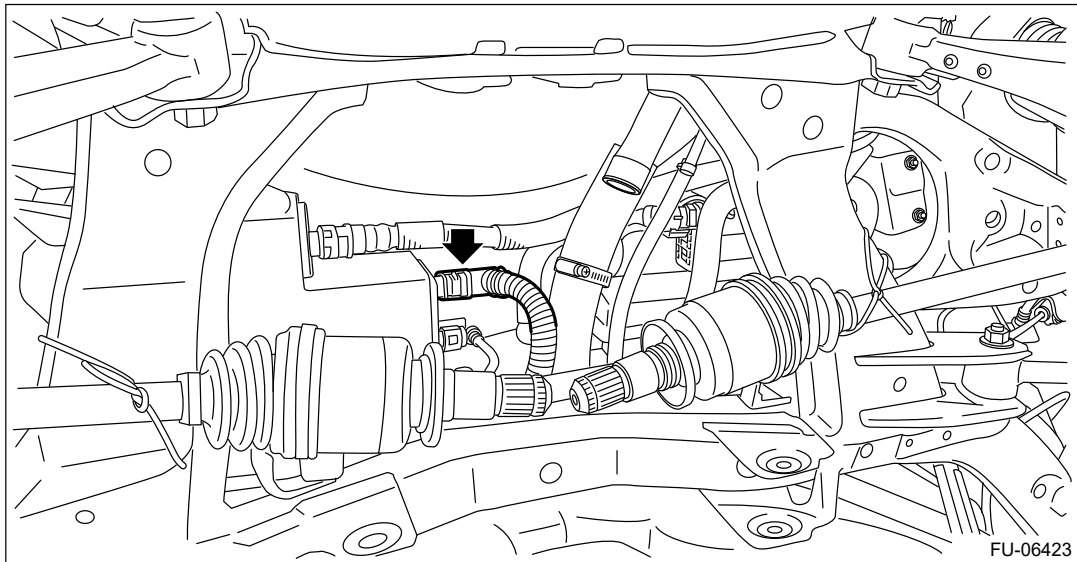
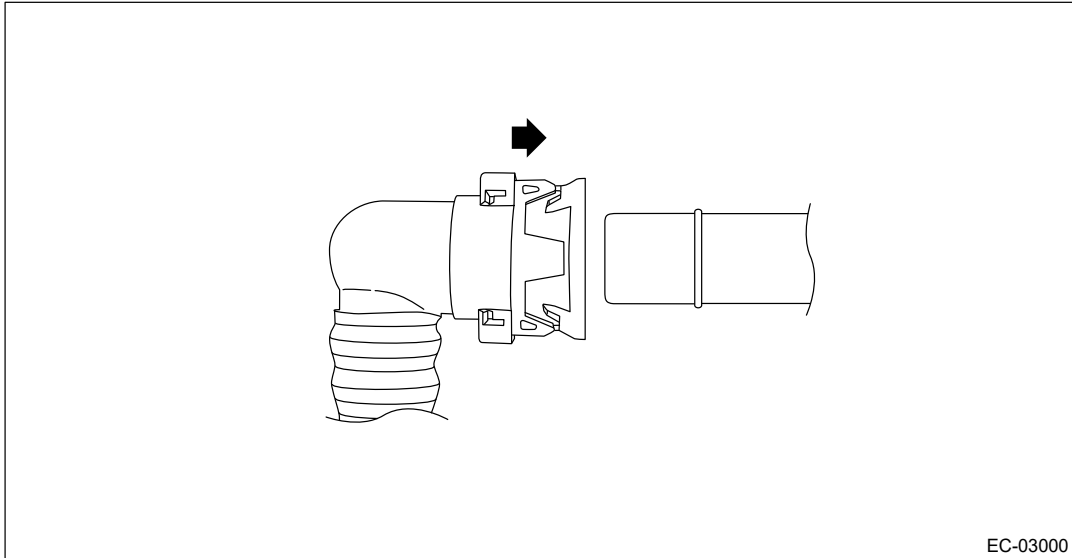
5. Install the fuel tank protector.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Tank Protector>INSTALLATION.](#)
6. Connect the vent tube to the canister.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

Note:

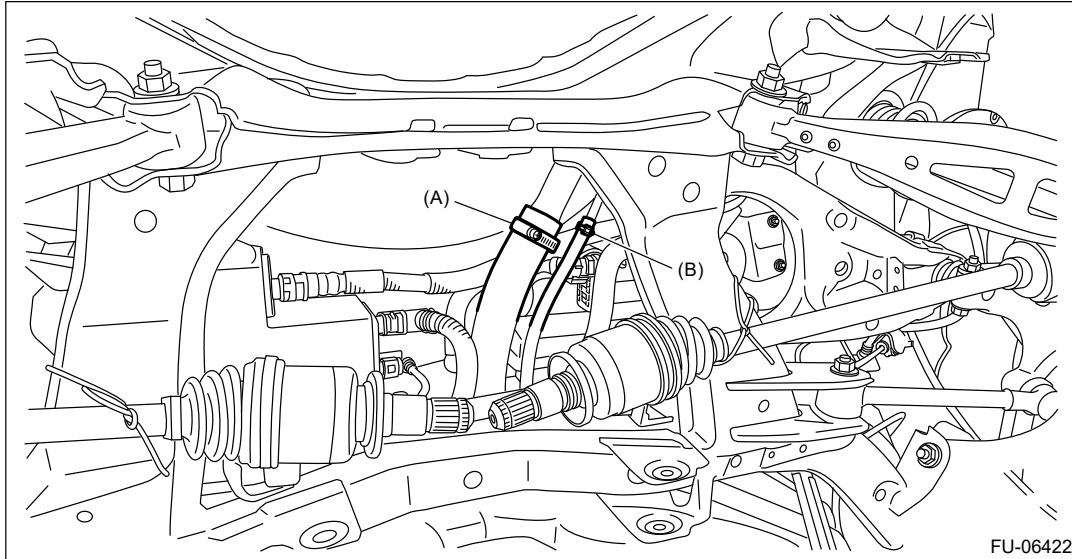
Connect the quick connector as shown in the figure.



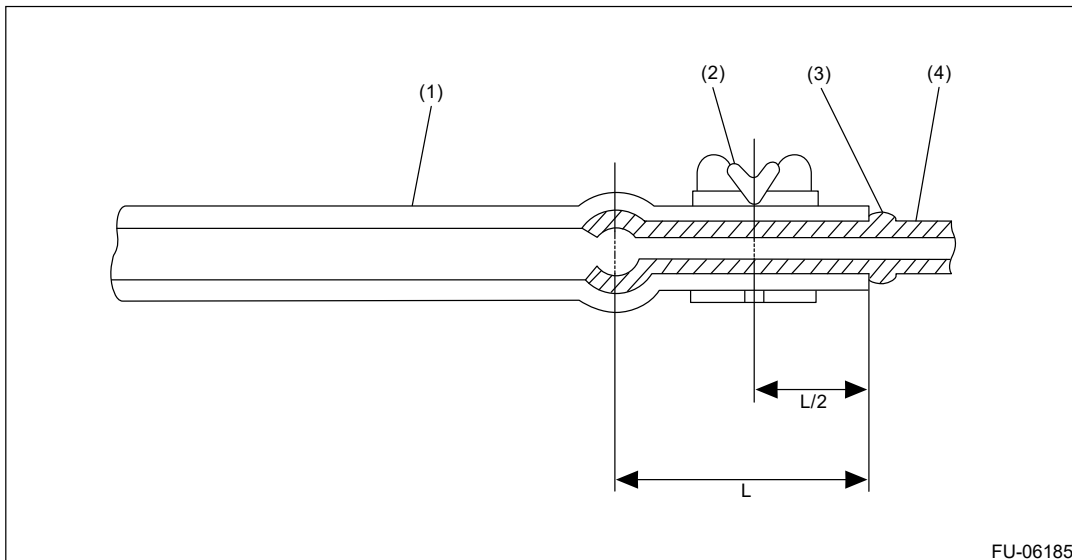
7. Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp or clip as shown in the figure.

Tightening torque:

2.5 N•m (0.3 kgf-m, 1.8 ft-lb)



FU-06422



FU-06185

(1) Hose

(3) Spool

(4) Pipe

(2) Clamp or clip

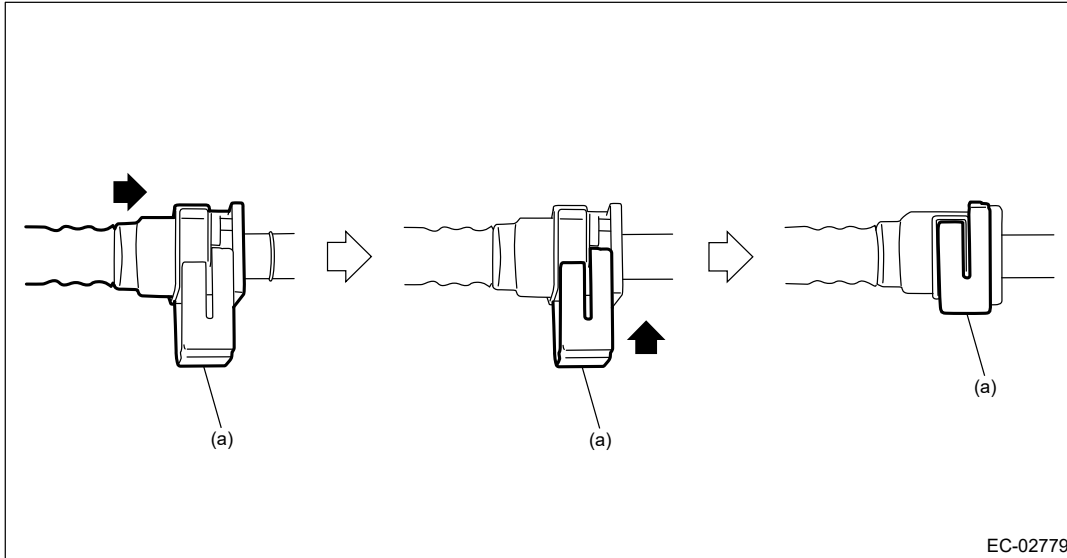
8. Install the rear differential. [📄 Ref. to DIFFERENTIALS>Rear Differential \(T-type\)>INSTALLATION.](#) [📄 Ref. to DIFFERENTIALS>Rear Differential \(VA-type\)>INSTALLATION.](#)
9. Install the rear exhaust pipe and muffler. [📄 Ref. to EXHAUST\(H4DO\)>Rear Exhaust Pipe>INSTALLATION.](#) [📄 Ref. to EXHAUST\(H4DO\)>Muffler>INSTALLATION.](#)
10. Connect the quick connector of the fuel delivery tube.

Caution:

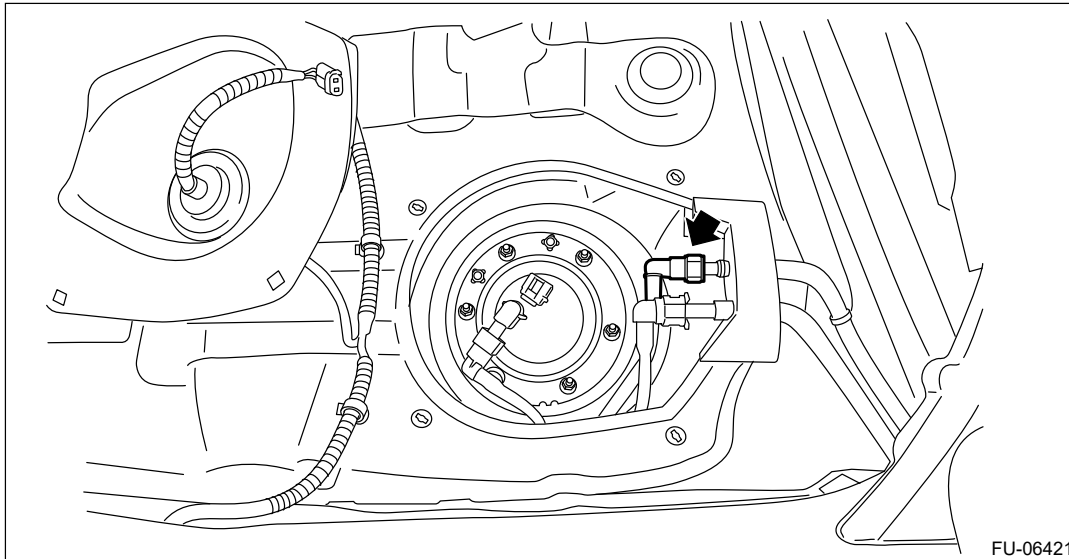
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

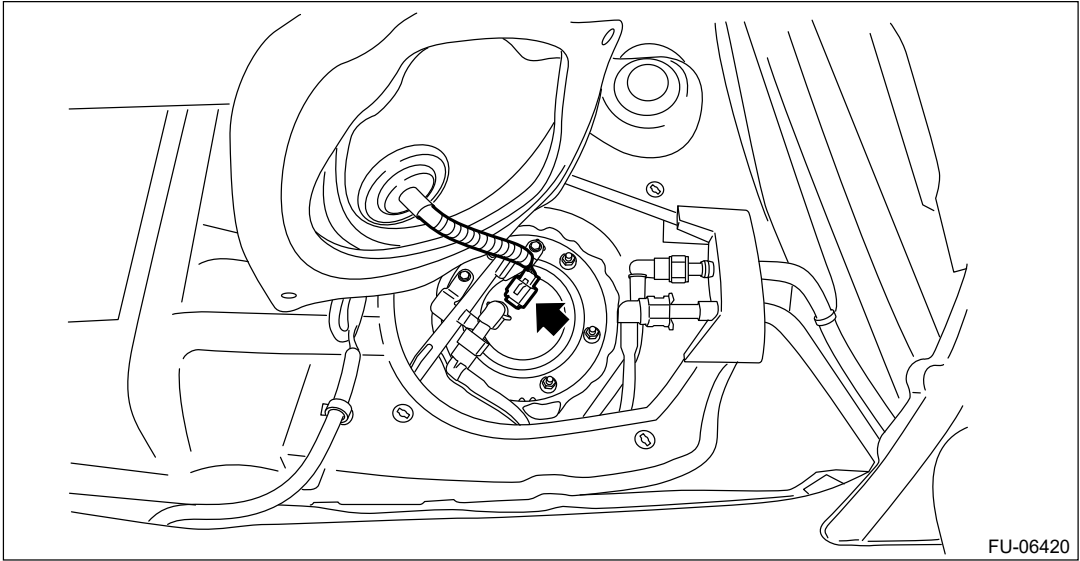
Connect the quick connector as shown in the figure.



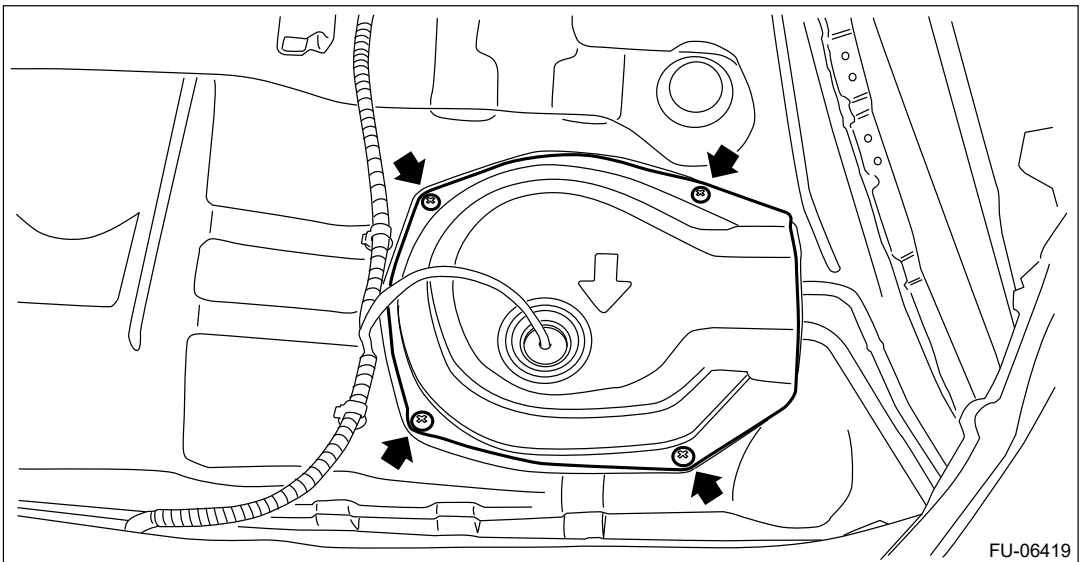
(a) Slider



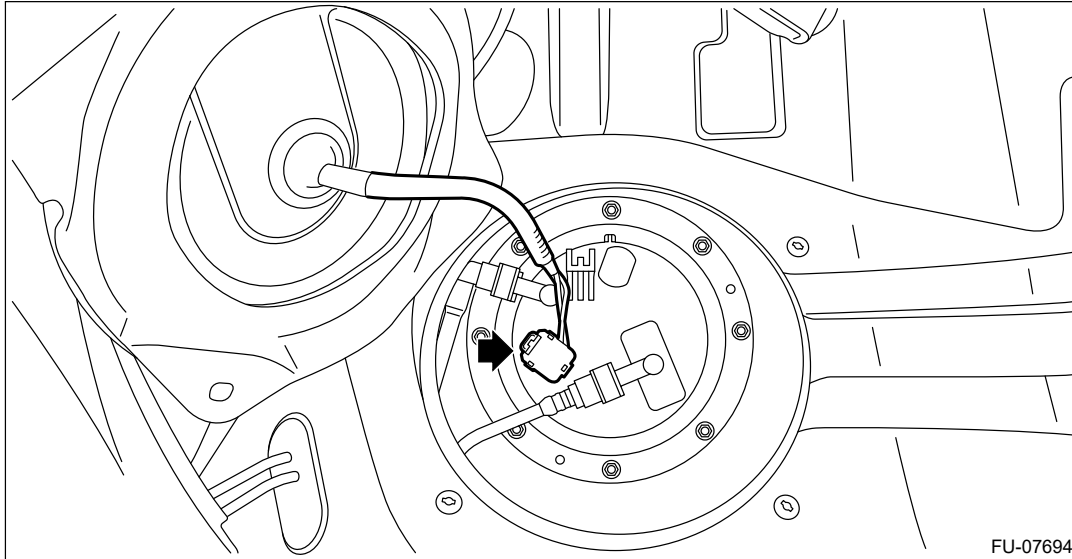
- 11.** Connect the connector to the fuel sub level sensor.



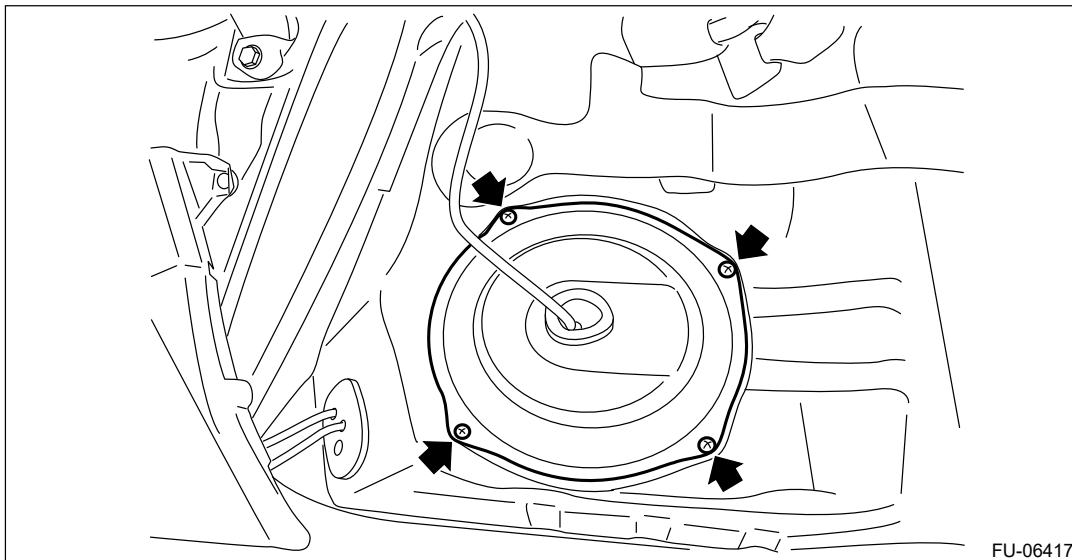
12. Install the service hole cover of fuel sub level sensor.




13. Connect the connector to the fuel pump.



14. Install the service hole cover of fuel pump.



15. Install the rear seat cushion.  [Ref. to SEATS>Rear Seat>INSTALLATION.](#)

16. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Fuel Tank





REMOVAL

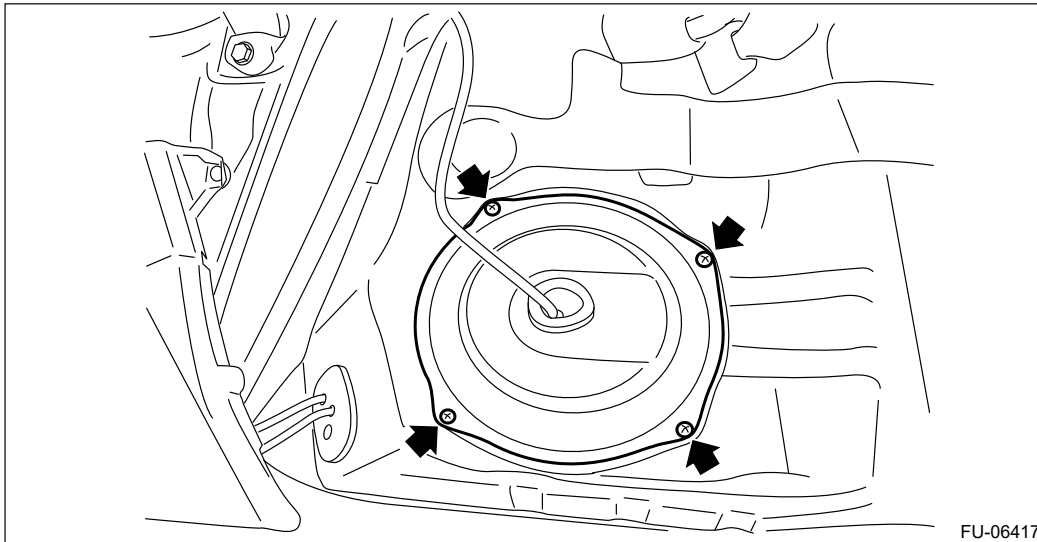
Warning:

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

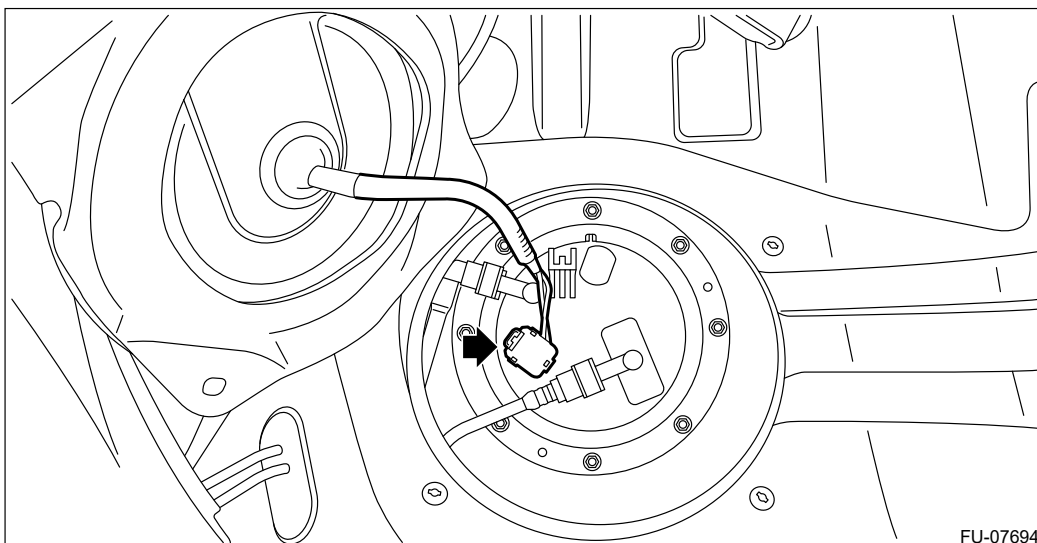
Caution:

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

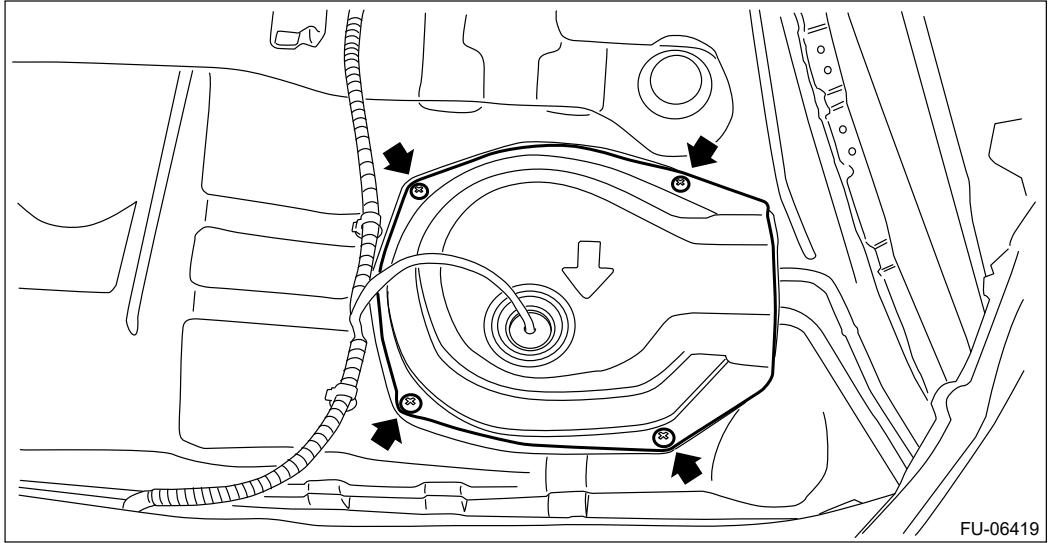
1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Drain fuel.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > DRAINING FUEL \(WITH SUBARU SELECT MONITOR\).](#)
3. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
4. Remove the rear seat cushion.  [Ref. to SEATS>Rear Seat>REMOVAL.](#)
5. Remove the service hole cover of fuel pump.



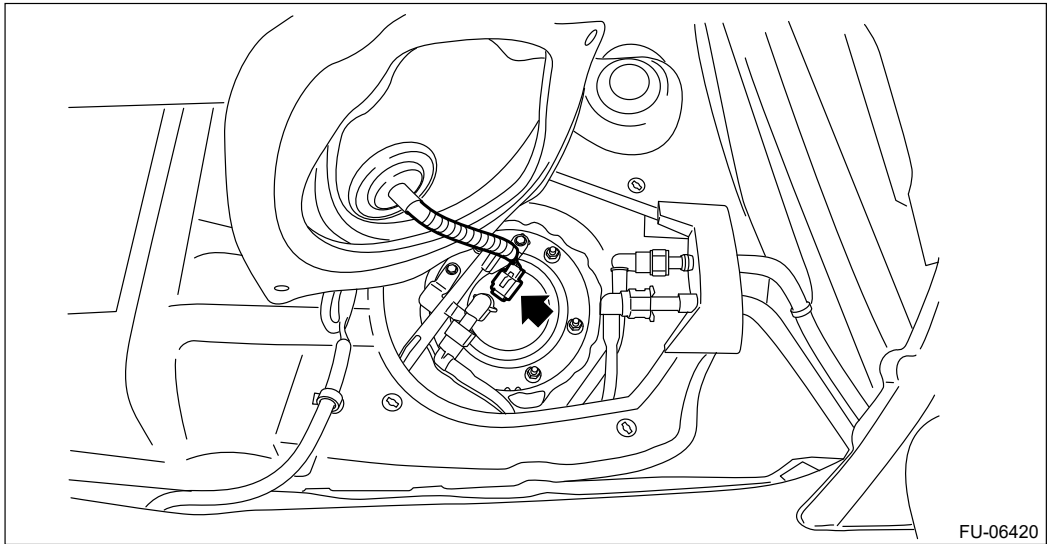
6. Disconnect connectors from the fuel pump, and move aside the service hole cover.



7. Remove the service hole cover of fuel sub level sensor.



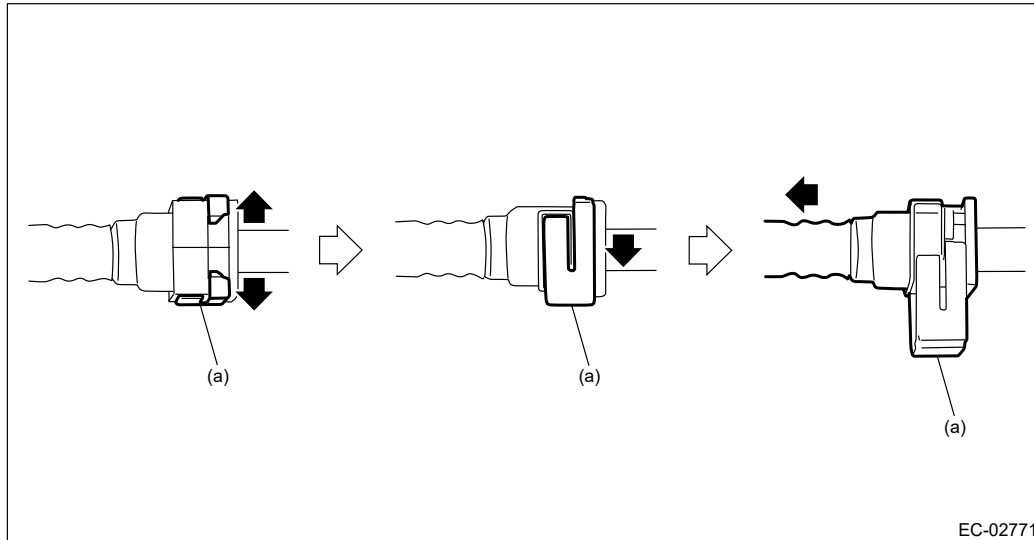
- 8.** Disconnect the connector from the fuel sub level sensor, and move aside the service hole cover.



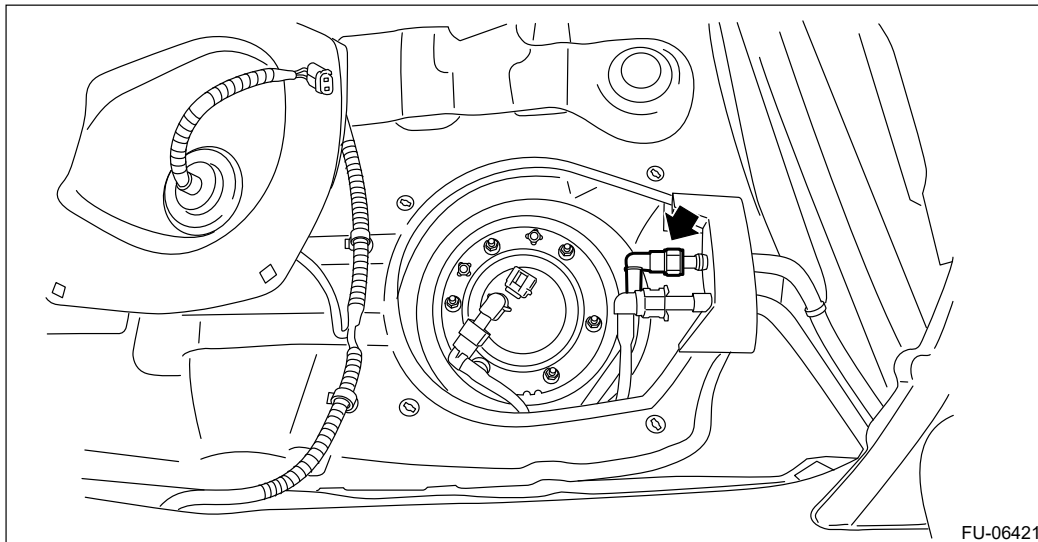
- 9.** Disconnect the quick connector on the fuel delivery tube.





Note:

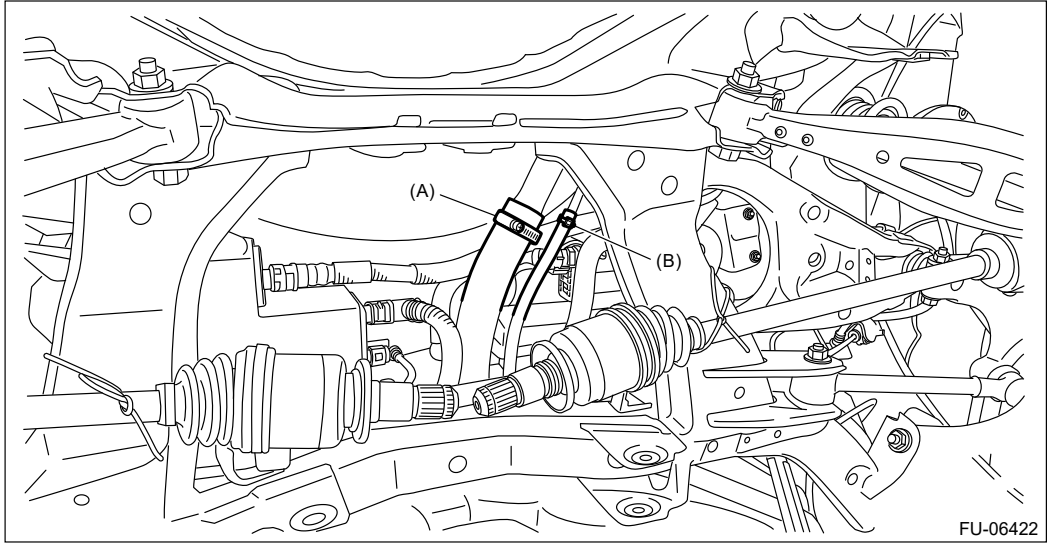
Disconnect the quick connector as shown in the figure.



(a) Slider



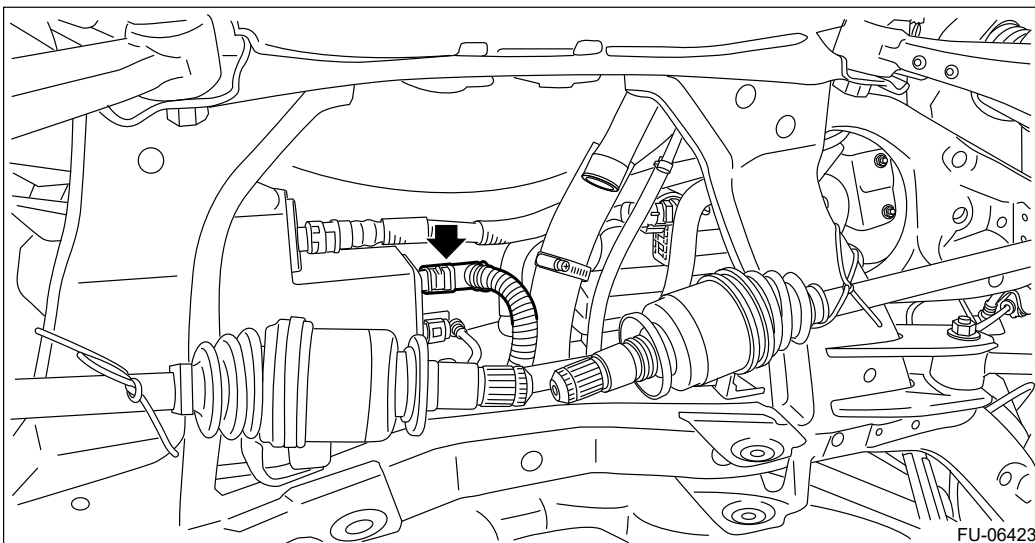
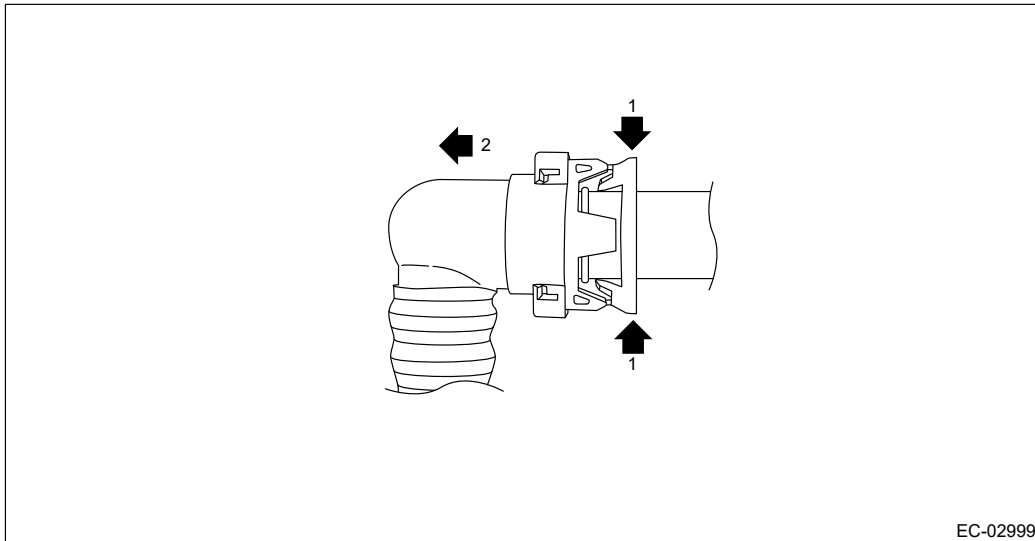
- 10.** Lift up the vehicle.
- 11.** Remove the rear exhaust pipe and muffler.  [Ref. to EXHAUST\(H4DO\)>Rear Exhaust Pipe>REMOVAL.](#)
 [Ref. to EXHAUST\(H4DO\)>Muffler>REMOVAL.](#)
- 12.** Remove the rear differential.  [Ref. to DIFFERENTIALS>Rear Differential \(T-type\)>REMOVAL.](#)  [Ref. to DIFFERENTIALS>Rear Differential \(VA-type\)>REMOVAL.](#)
- 13.** Disconnect fuel filler hose (A) and air vent hose (B) from the fuel filler pipe assembly.




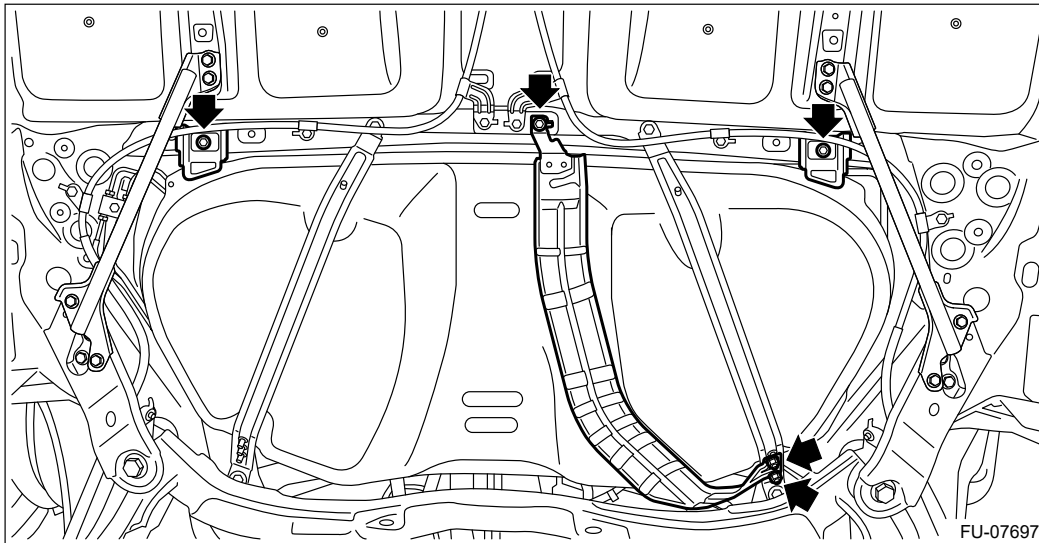
14. Disconnect the vent tube from canister.

Note:

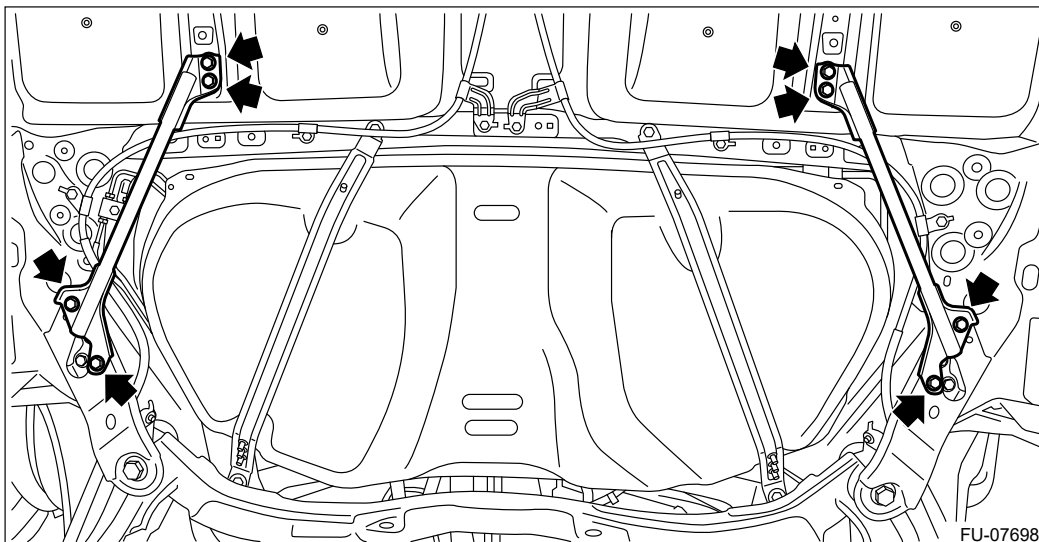
Disconnect the quick connector as shown in the figure.



- 15.** Remove the fuel tank protector.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Tank Protector>REMOVAL.](#)
- 16.** Remove the heat shield cover and stopper.



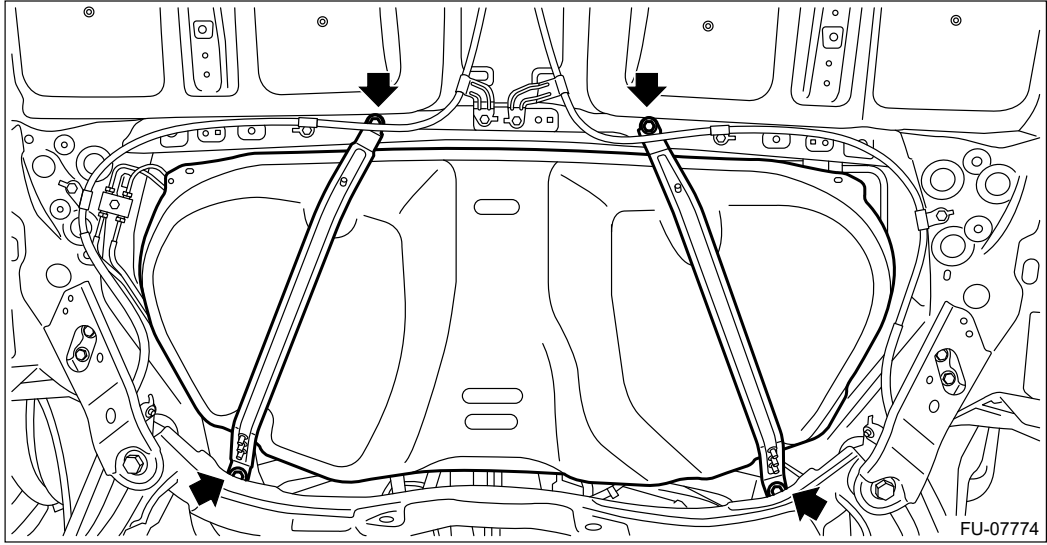
- 17.** Remove the stay - rear frame COMPL.



- 18.** Support the fuel tank with a transmission jack, remove the bolts from the fuel tank band, and remove the fuel tank from the vehicle.

Warning:

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



PROCEDURE

1. RELEASING OF FUEL PRESSURE

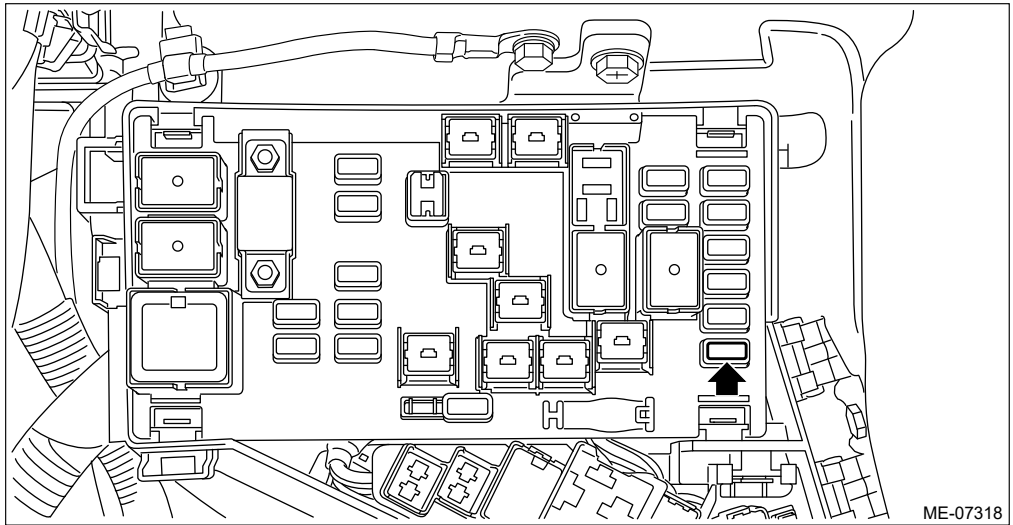
Warning:

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

Caution:

Be careful not to spill fuel.

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



2. Start the engine and run it until it stalls.
3. After the engine stalls, crank it for five more seconds.
4. Turn the ignition switch to OFF.
5. Install the fuse of fuel pump to the main fuse box.

2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)

Warning:

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

Caution:

Be careful not to spill fuel.

Note:

- If the fuel pump cannot be driven, refer to the procedures for draining from the fuel filler hose. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > DRAINING FUEL \(THROUGH THE FUEL FILLER HOSE\).](#)
- Be careful not to let the battery run-out.
- Be aware that the fuel may remain in the fuel tank after draining the fuel.

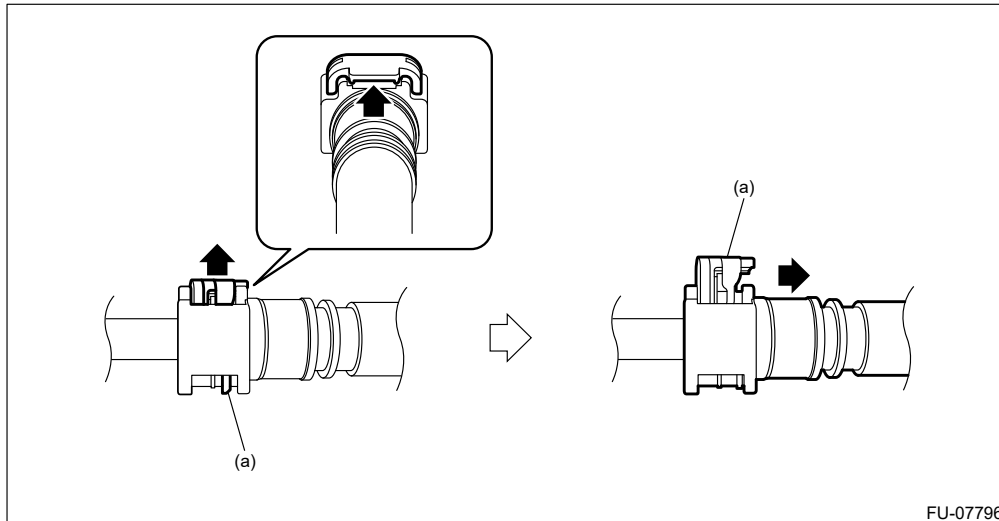
1. Release the fuel pressure. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube to the fuel pipe assembly.

Caution:

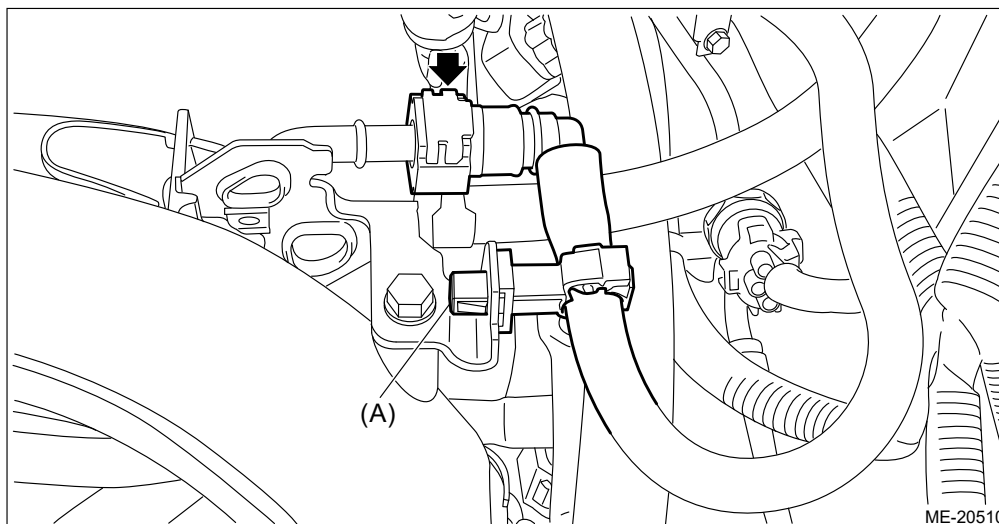
- Be careful not to spill fuel.
- Catch the fuel from the tubes using a container or cloth.

Note:

Disconnect the quick connector as shown in the figure.



(a) Slider



3. Connect ST to the fuel delivery tube.

ST 18471AA000 FUEL PIPE ADAPTER

4. Connect the gasoline proof hose to ST and put the end of the hose in the container.

5. Drive the fuel pump and drain the fuel using Subaru Select Monitor.

Caution:

Be careful not to spill fuel.

Note:

For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".

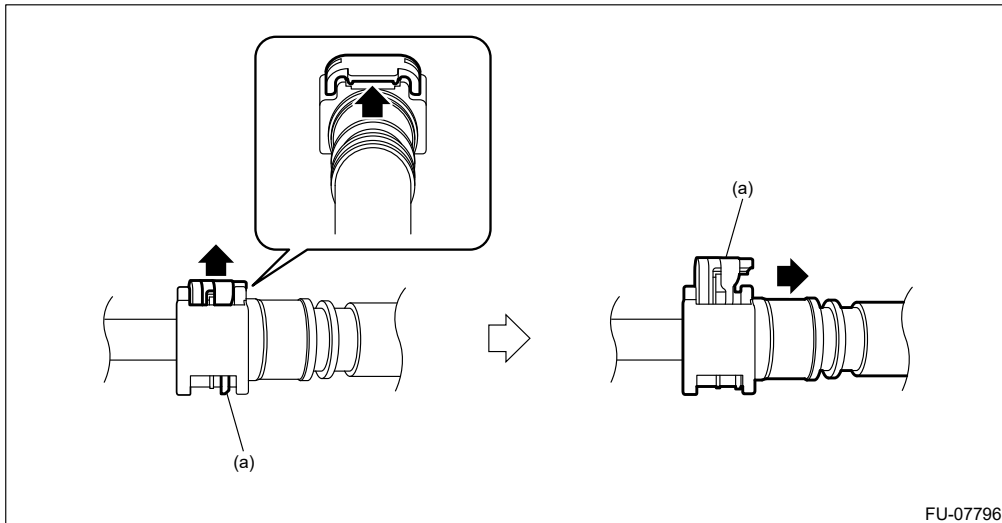
6. Install the related parts in the reverse order after draining the fuel.

Caution:

- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**
- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **When connecting the quick connector, make sure to insert it all the way in before locking the slider.**
- **When it is difficult to lock the slider, check that the connector is fully inserted.**
- **After locking the slider, check that the quick connector is securely connected.**

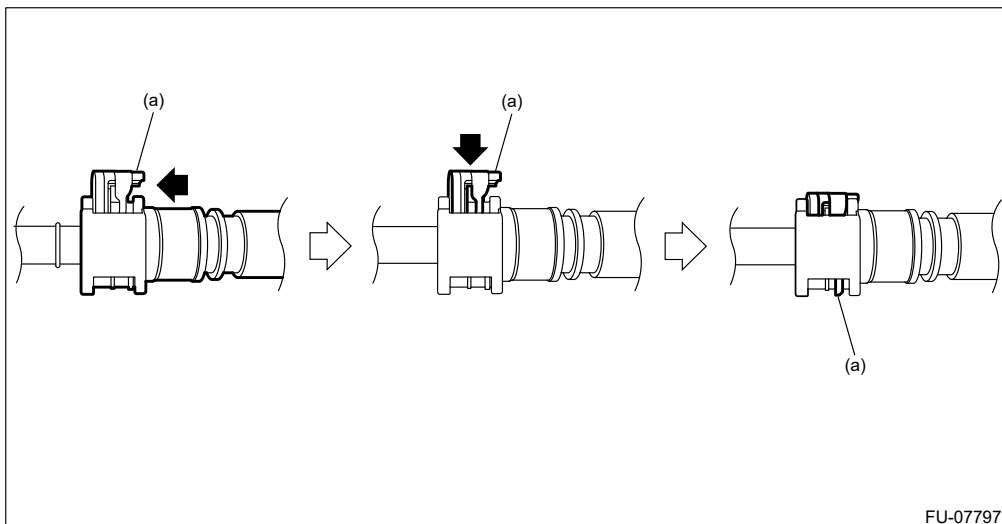
Note:

- **Disconnect the quick connector on the fuel delivery tube as shown in the figure.**



(a) Slider

- **Connect the quick connector on the fuel delivery tube as shown in the figure.**



(a) Slider

3. DRAINING FUEL (THROUGH THE FUEL FILLER HOSE)

Warning:


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

Caution:

- Be careful not to spill fuel.
- Fuel may remain in the fuel filler pipe. Drain the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the operation.

Note:

Be aware that the fuel may remain in the fuel tank after draining the fuel.

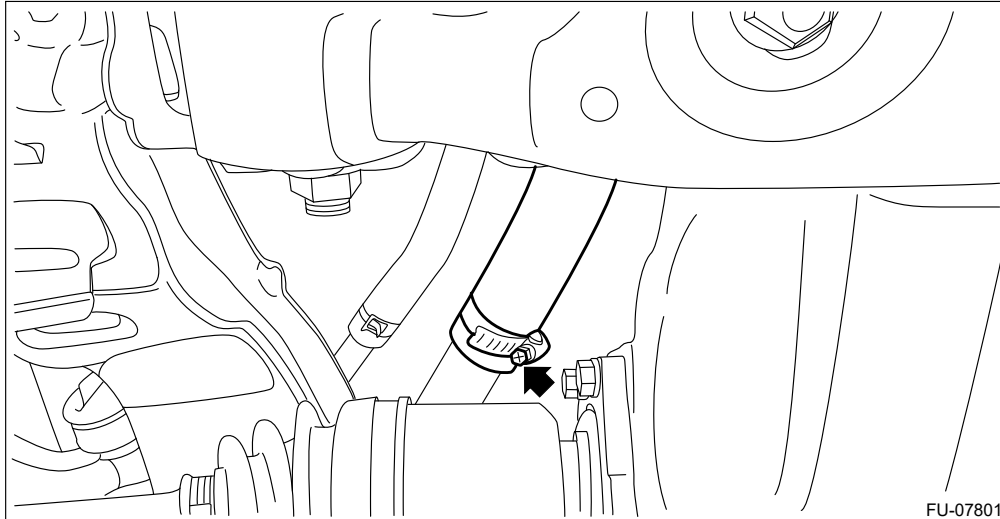
1. Lift up the vehicle.
2. Remove the rear exhaust pipe and muffler.  [Ref. to EXHAUST\(H4DO\)>Rear Exhaust Pipe>REMOVAL.](#) 

[Ref. to EXHAUST\(H4DO\)>Muffler>REMOVAL.](#)

3. Open the fuel filler lid and remove the fuel filler cap.
4. Drain the fuel from the fuel filler pipe through the filler opening using the gasoline proof pump and the gasoline proof hose ($\varnothing 10$ or less).
5. Disconnect the fuel filler hose from the fuel filler pipe assembly.

Caution:

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



FU-07801

6. Set the container under the vehicle and insert the gasoline proof hose ($\varnothing 10$ or less) into the fuel filler hose to drain the fuel.

Caution:

- **Be careful not to spill fuel.**

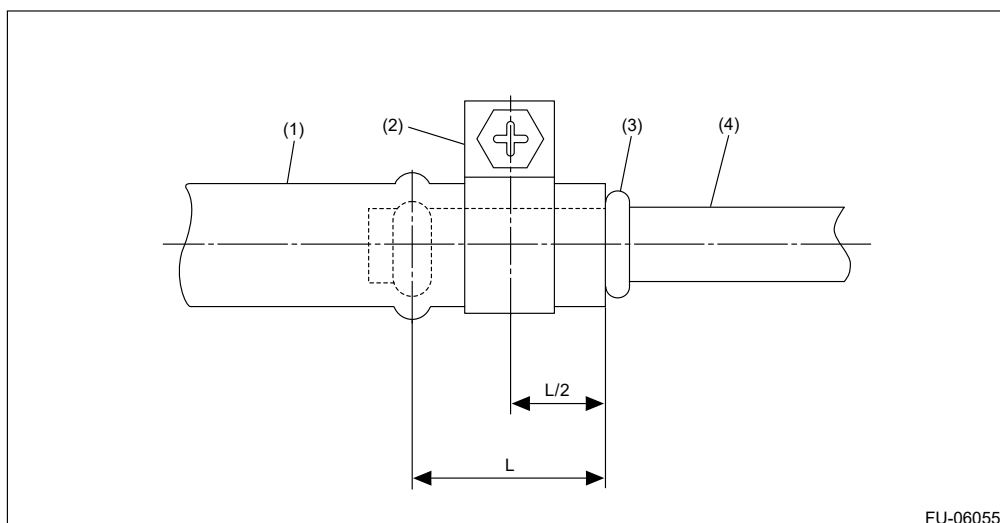
7. Install the related parts in the reverse order after draining the fuel.

Note:

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

Tightening torque:

2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



FU-06055

(1) Fuel filler hose
(2) Clamp

(3) Spool

(4) Fuel filler pipe

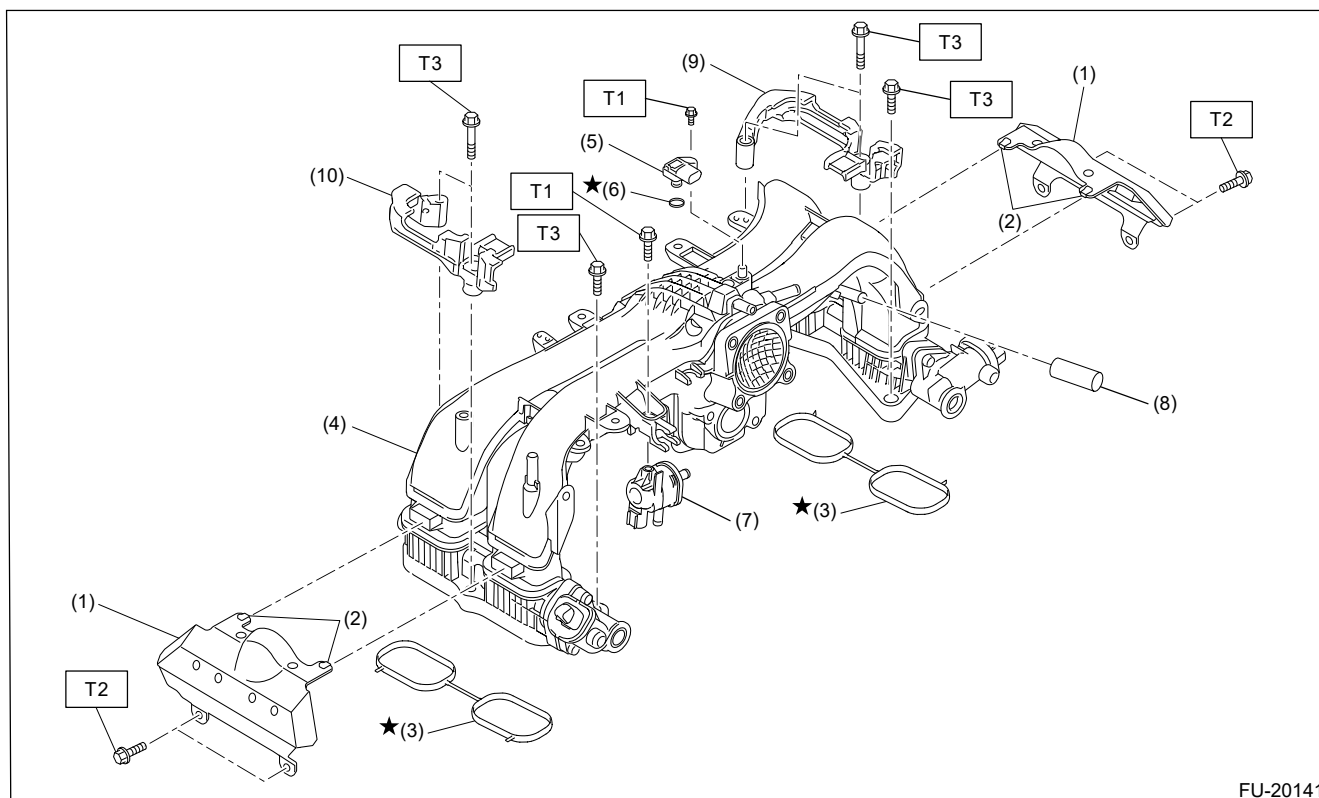
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > General Description

CAUTION

- Prior to starting work, pay special attention to the following:
 1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
 2. Protect the vehicle using a seat cover, fender cover, etc.
 3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Place "NO OPEN FLAMES" signs near the working area.
- Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Always inspect for fuel leaks after removing/installing the fuel system components.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.

COMPONENT

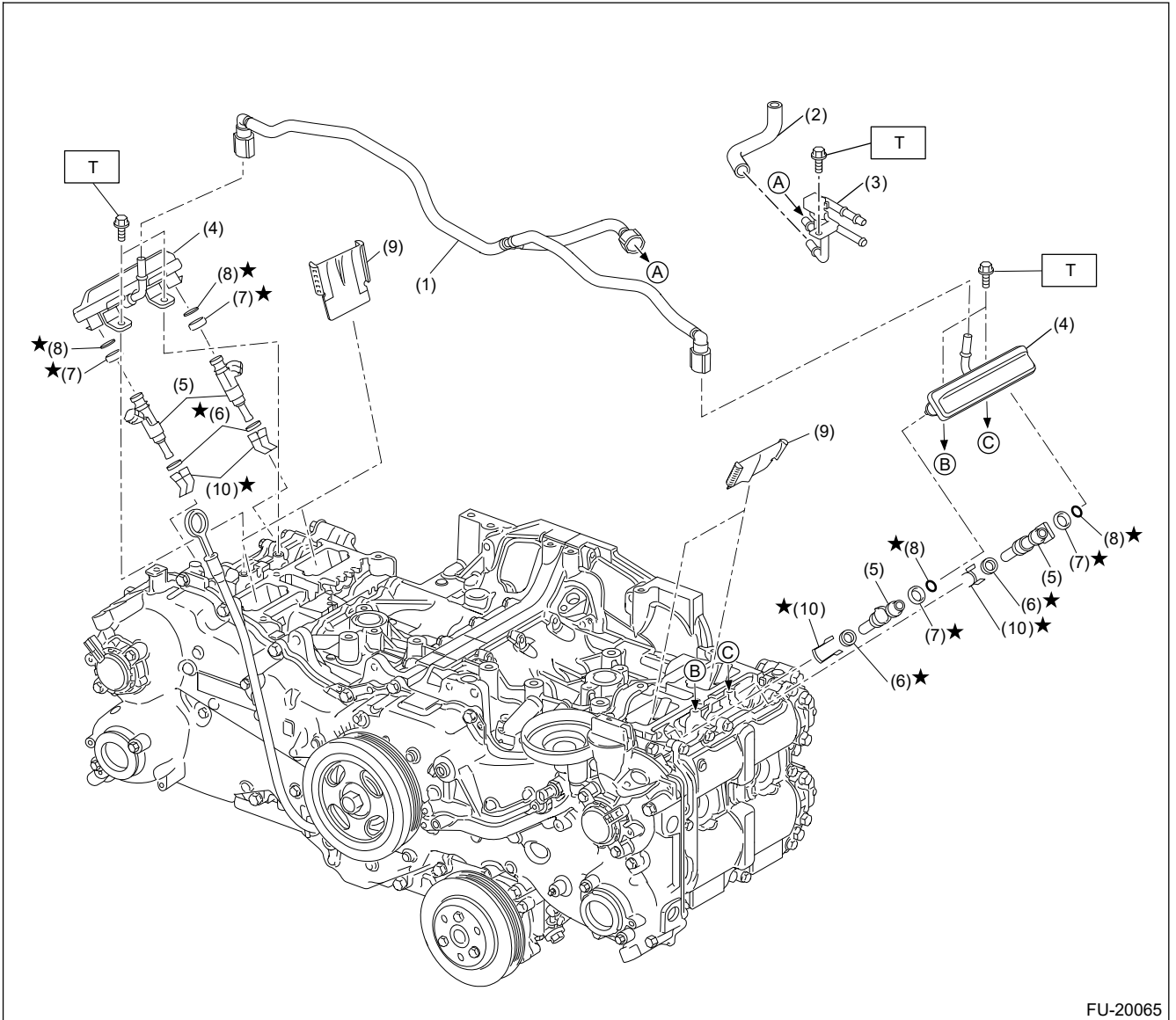
1. INTAKE MANIFOLD ASSEMBLY 1



FU-20141

- | | | |
|---------------------------------------|--------------------------------------|--|
| (1) Intake manifold protector No. 1 | (6) O-ring | Tightening torque: N·m (kgf-m, ft-lb) |
| (2) Cushion | (7) Purge control solenoid valve | |
| (3) Gasket | (8) Cap | |
| (4) Intake manifold ASSY | (9) Intake manifold protector No. 2 | T1: 3.4 (0.3, 2.5) |
| (5) Manifold absolute pressure sensor | (10) Intake manifold protector No. 3 | T2: 6.4 (0.7, 4.7) |
| | | T3: 25 (2.5, 18.4) |

2. INTAKE MANIFOLD ASSEMBLY 2



FU-20065

(1) Fuel delivery pipe

(6) Seal ring

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

(2) Vacuum hose

(7) Rubber

T: 6.4 (0.7, 4.7)

(3) Fuel pipe ASSY

(8) O-ring

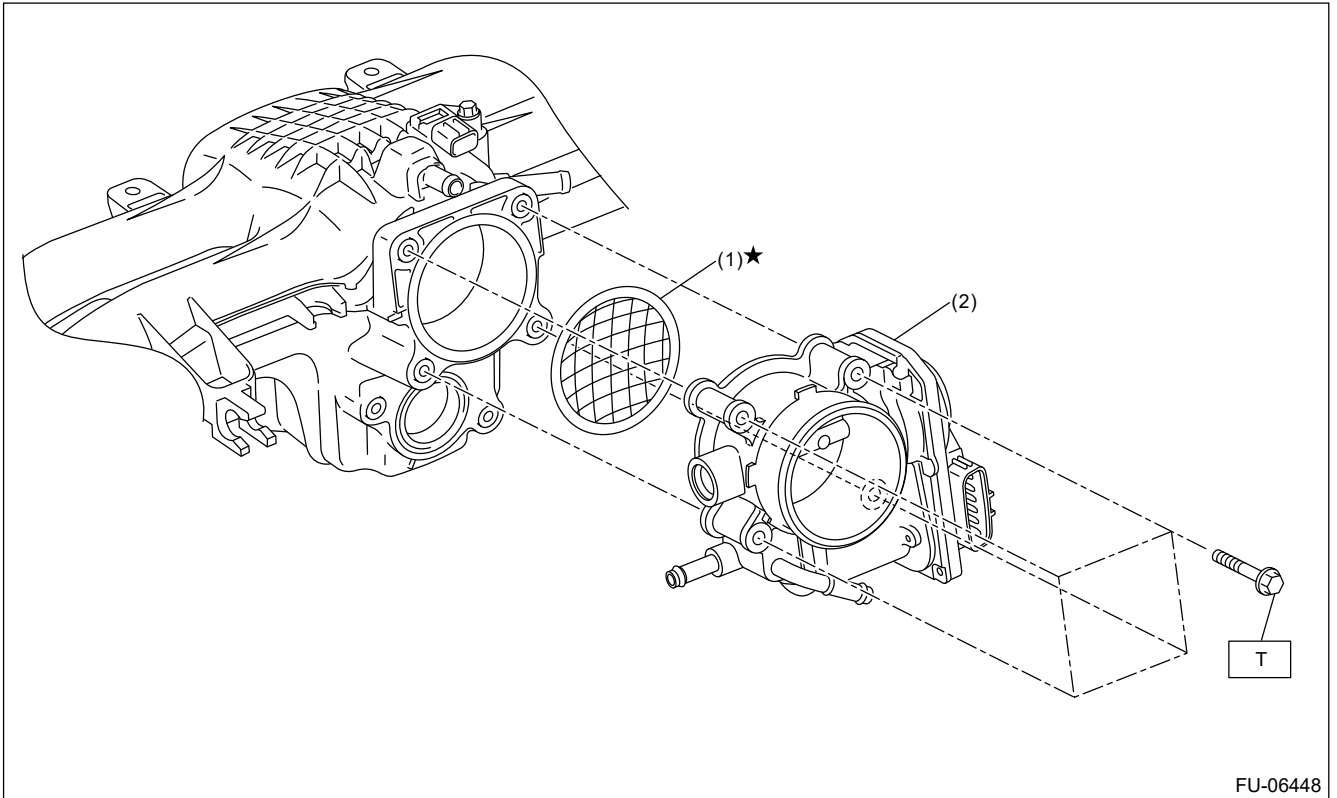
(4) Fuel pipe

(9) Cylinder head plate

(5) Fuel injector

(10) Fuel injector holder

3. THROTTLE BODY



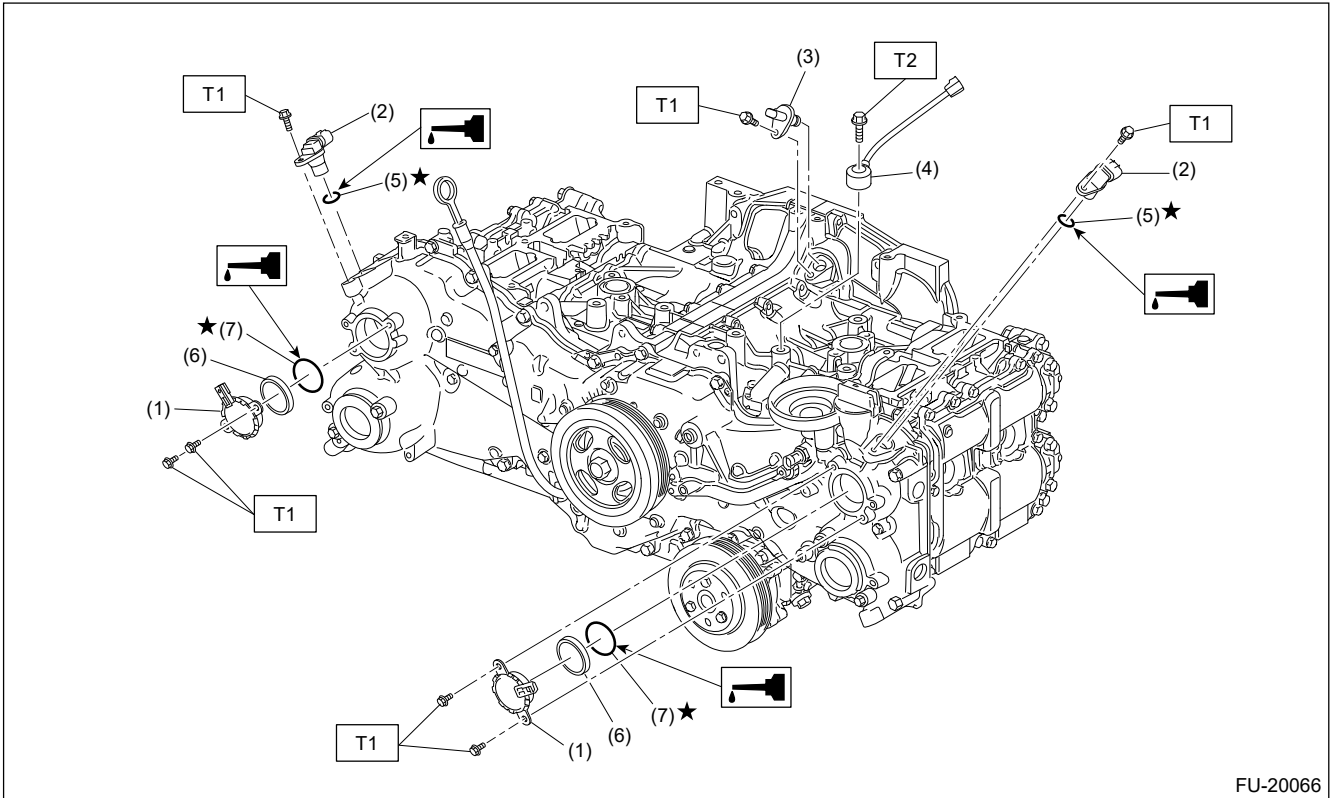
(1) Gasket

(2) Throttle body

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

T: 8 (0.8, 5.9)

4. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



FU-20066

(1) Oil control solenoid

(5) O-ring

Tightening torque: N·m (kgf-m, ft-lb)

(2) Camshaft position sensor

(6) Back-up ring

T1: 6.4 (0.7, 4.7)

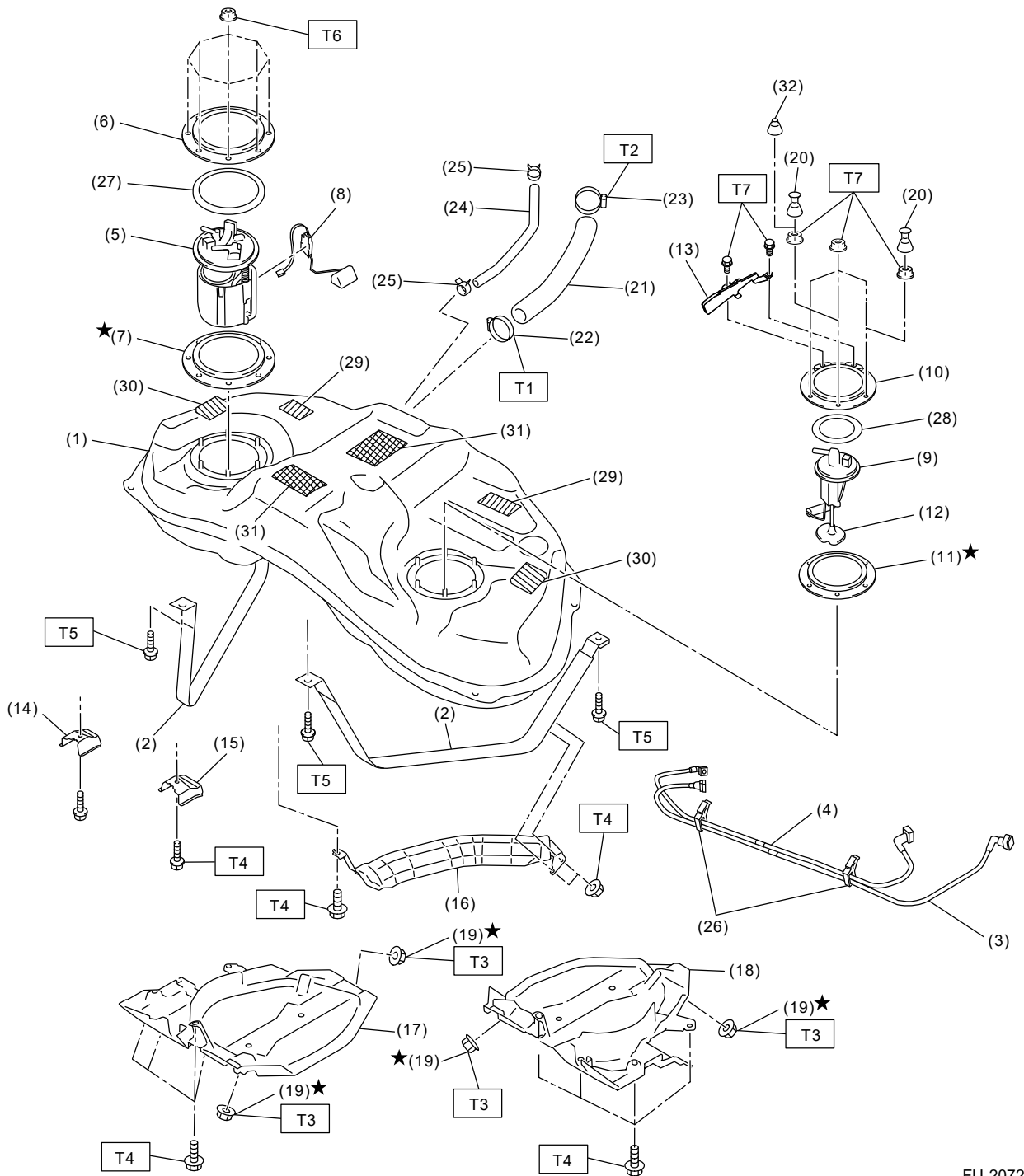
(3) Crankshaft position sensor

(7) O-ring

T2: 24 (2.4, 17.7)

(4) Knock sensor

5. FUEL TANK



FU-20724

- | | | |
|---------------------------|----------------------------------|-------------------------------------|
| (1) Fuel tank | (15) Stopper LH | (29) Cushion |
| (2) Fuel tank band | (16) Heat shield cover | (30) Cushion |
| (3) Delivery tube | (17) Fuel tank protector RH | (31) Cushion |
| (4) Jet pump tube | (18) Fuel tank protector LH | (32) Rubber cap (single-piece type) |
| (5) Fuel pump ASSY | (19) Self-locking nut | |
| (6) Fuel pump upper plate | (20) Rubber cap (two-piece type) | |

Tightening torque: N·m (kgf·m, ft·lb)

- | | | |
|--|-----------------------|---------------------------|
| (7) Fuel pump gasket | (21) Fuel filler hose | T1: 2 (0.2, 1.5) |
| (8) Fuel level sensor | (22) Clamp | T2: 2.5 (0.3, 1.8) |
| (9) Fuel sub level sensor | (23) Clamp | T3: 9 (0.9, 6.6) |
| (10) Fuel sub level sensor upper plate | (24) Air vent hose | T4: 18 (1.8, 13.3) |

(11) Fuel sub level sensor gasket (25) Clip

T5:  Ref. to FUEL INJECTION (FUEL SYSTEMS)(H4DO)>Fuel Tank>INSTALLATION.

(12) Fuel sub level sensor filter (26) Tube clamp

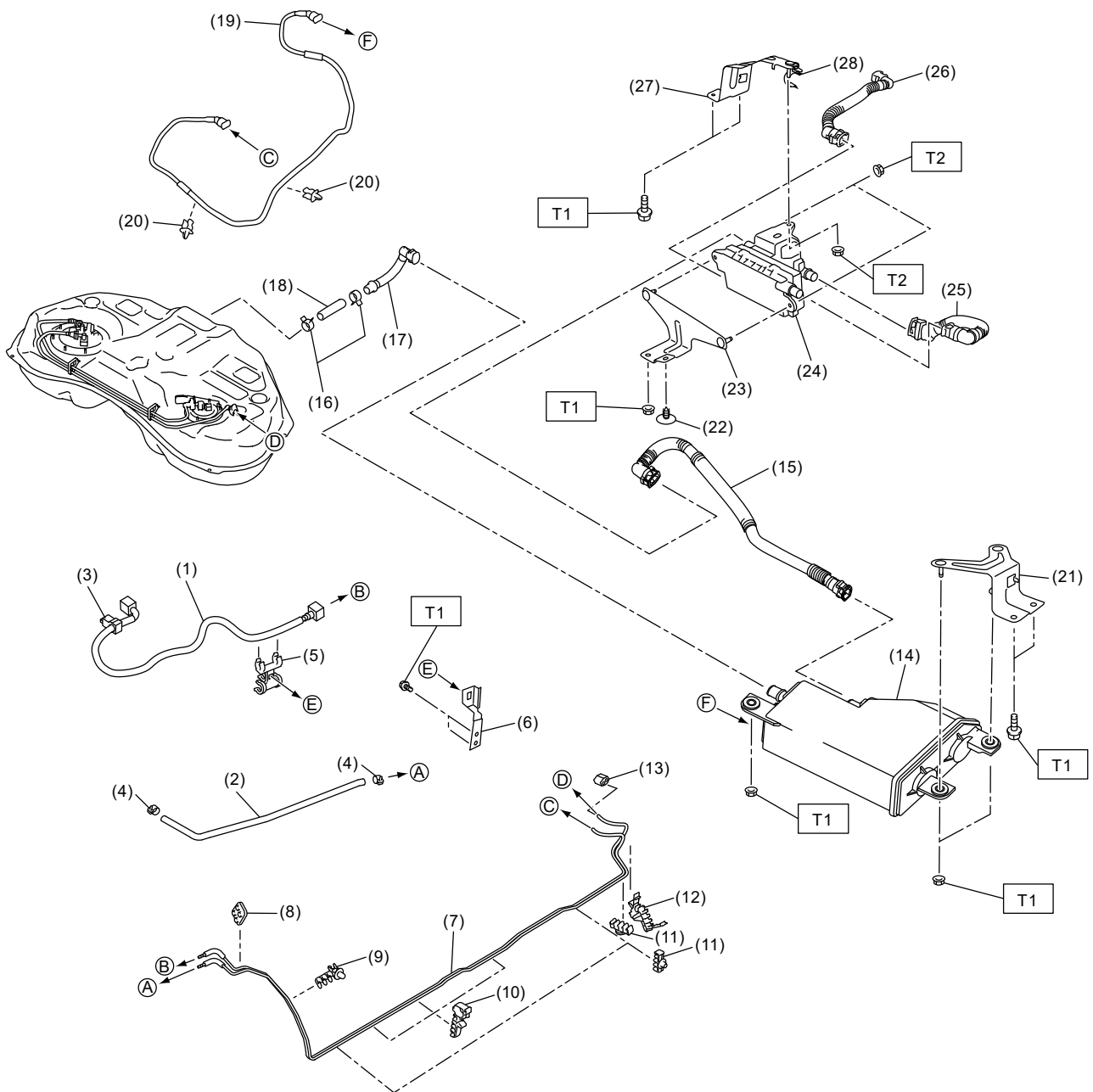
T6:  Ref. to FUEL INJECTION (FUEL SYSTEMS)(H4DO)>Fuel Pump>INSTALLATION.

(13) Fuel sub level sensor protector (27) Fuel pump upper plate cushion

T7:  Ref. to FUEL INJECTION (FUEL SYSTEMS)(H4DO)>Fuel Sub Level Sensor>INSTALLATION.

(14) Stopper RH (28) Fuel sub level sensor upper plate cushion

6. FUEL LINE



FU-07857

- | | | |
|-----------------------------|-----------------------------|---------------------------------|
| (1) Fuel delivery tube | (12) Pipe clamp | (23) Leak check valve bracket A |
| (2) Evaporation hose | (13) Fuel pipe rear grommet | (24) Leak check valve ASSY |
| (3) Tube clamp | (14) Canister | (25) Drain tube B |
| (4) Clip | (15) Drain tube A | (26) Drain tube C |
| (5) Hose clamp | (16) Clip | (27) Leak check valve bracket B |
| (6) Hose clamp bracket | (17) Vent tube | (28) Tube clamp |
| (7) Fuel pipe ASSY | (18) Vent hose | |
| (8) Fuel pipe front grommet | (19) Purge pipe | |

Tightening torque: N·m (kgf·m,

ft-lb)

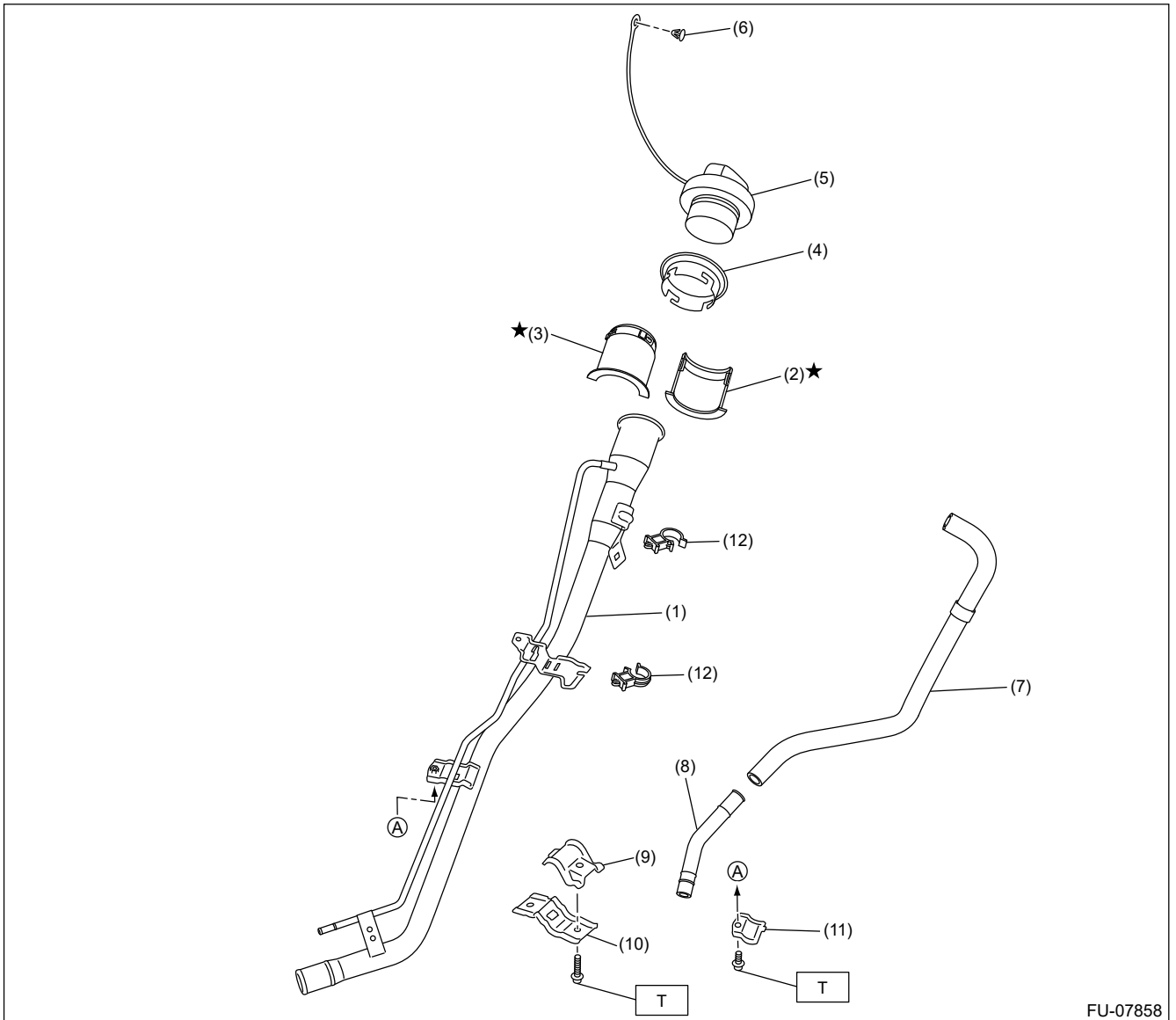
- (9) Pipe clamp
- (10) Pipe clamp
- (11) Pipe clamp

- (20) Pipe clamp
- (21) Canister bracket
- (22) Clip

T1: 7.5 (0.8, 5.5)

T2: 18 (1.8, 13.3)

7. FUEL FILLER PIPE



- (1) Fuel filler pipe ASSY
- (2) Neck holder A
- (3) Neck holder B
- (4) Fuel filler pipe protector
- (5) Fuel filler cap

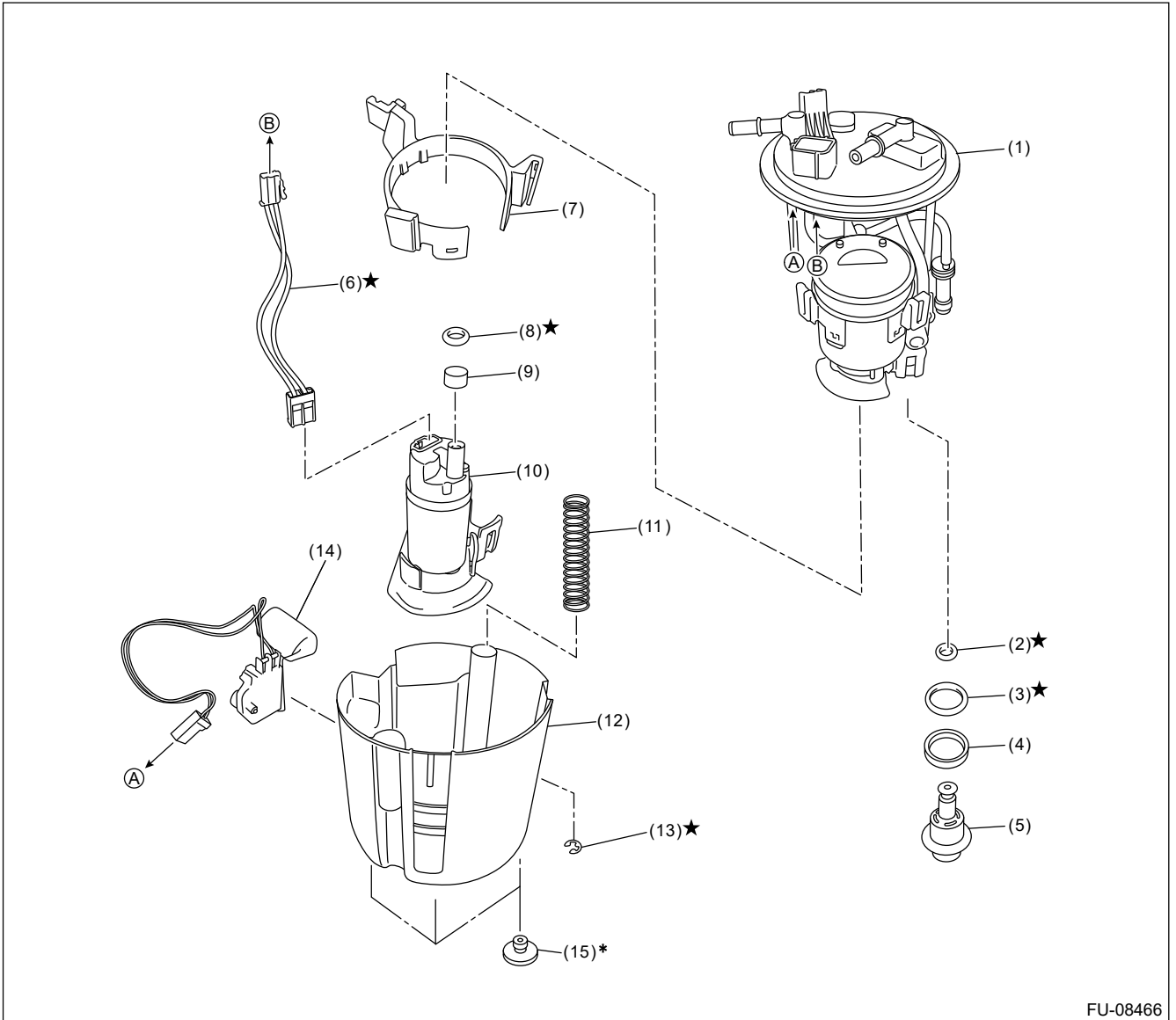
- (6) Clip
- (7) Drain hose
- (8) Drain pipe
- (9) Upper bracket
- (10) Lower bracket

- (11) Drain lower bracket
- (12) Drain hose clamp

Tightening torque: N·m (kgf-m, ft-lb)

T: 7.5 (0.8, 5.5)

8. FUEL PUMP



FU-08466

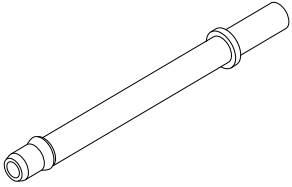
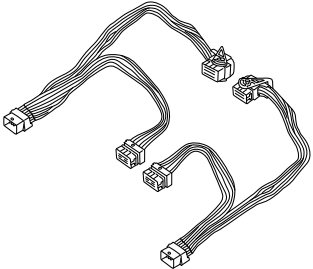

- | | | |
|------------------------|----------------------|------------------------|
| (1) Fuel filter ASSY | (6) Connector cable | (11) Spring |
| (2) O-ring | (7) Fuel pump holder | (12) Fuel chamber ASSY |
| (3) O-ring | (8) O-ring | (13) Clip |
| (4) Back-up ring | (9) Spacer | (14) Fuel level sensor |
| (5) Pressure regulator | (10) Fuel pump | (15) Cushion |

* When removing the cushion from the fuel chamber assembly, replace it with a new part.

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > General Description

PREPARATION TOOL

1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|--|---------------------------|-------------------------|---|
|  <p>ST18471AA000</p> | 18471AA000 | FUEL PIPE ADAPTER | Used for draining fuel. |
|  <p>ST18460AA050</p> | 18460AA050 | CHECK BOARD | Used for measuring voltage and resistance of ECM terminals. |
|  <p>STSSM4</p> | — (Newly adopted tool) | SUBARU SELECT MONITOR 4 | Used for setting of each function and troubleshooting for electrical system. Note: For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help". |

2. GENERAL TOOL

| TOOL NAME | REMARKS |
|----------------|--|
| Circuit tester | Used for measuring resistance, voltage and current. |
| Oscilloscope | Used for inspecting the waveform of each sensor. |
| Mighty Vac | Used for inspecting the manifold absolute pressure sensor. |
| DST-i | Used together with Subaru Select Monitor 4. |

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > General Description

SPECIFICATION

| | | |
|-------------|----------------------------|--|
| Fuel tank | Capacity | 60 L (15.9 US gal, 13.2 Imp gal) |
| | Location | Under rear seat |
| Fuel pump | Type | Impeller |
| | Shutoff discharge pressure | 840 kPa (8.6 kg/cm ² , 121.8 psi) or less |
| | Discharge rate | 114 L (30.1 US gal, 25.1 Imp gal)/h or more [12 V at 343 kPa (3.5 kg/cm ² , 49.7 psi)] |
| Fuel filter | | In-tank type |

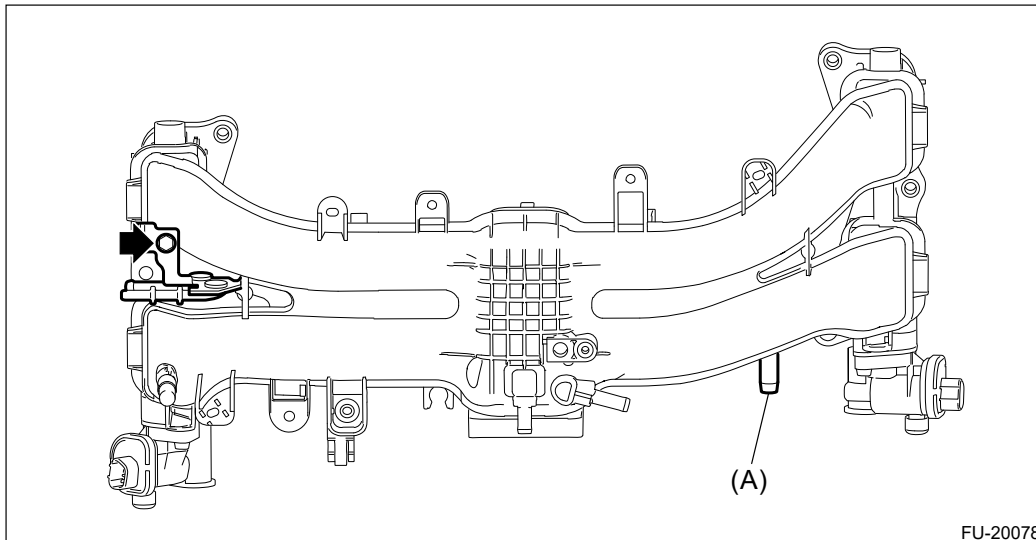
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Intake Manifold Assembly

ASSEMBLY

1. Install the fuel pipe assembly and cap (A) to the intake manifold assembly.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



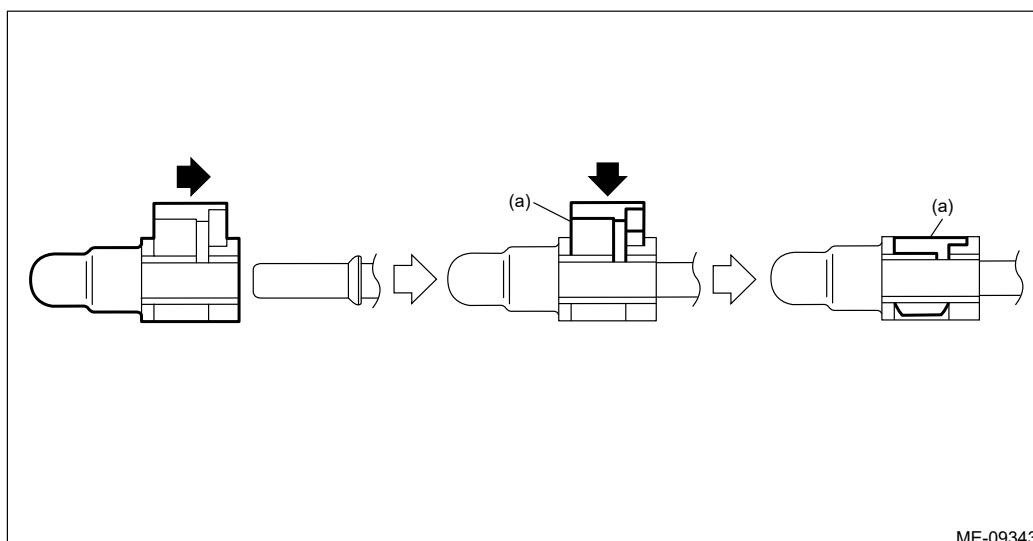
2. Install the fuel delivery pipe to the intake manifold assembly.

Caution:

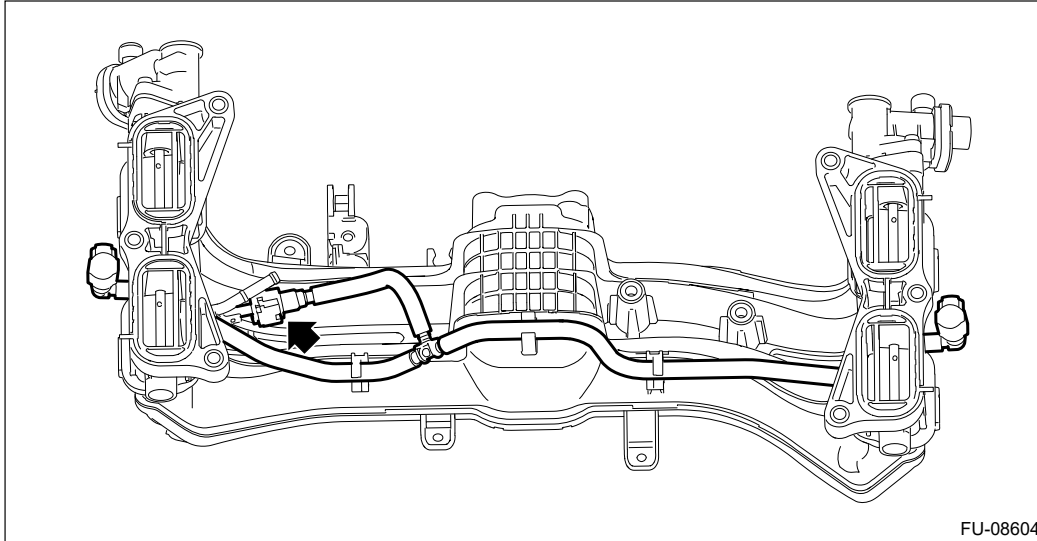
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:






Connect the quick connector as shown in the figure.



(a) Slider








FU-08604

- 3.** Install the manifold absolute pressure sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DO\)>Manifold Absolute Pressure Sensor>INSTALLATION.](#)
- 4.** Install the purge control solenoid valve.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DO\)>Purge Control Solenoid Valve>INSTALLATION.](#)
- 5.** Install the EGR control valve.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DO\)>EGR Control Valve>INSTALLATION.](#)
- 6.** Install the EGR pipe.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DO\)>EGR Pipe>INSTALLATION.](#)
- 7.** Install the throttle body.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Throttle Body>INSTALLATION.](#)

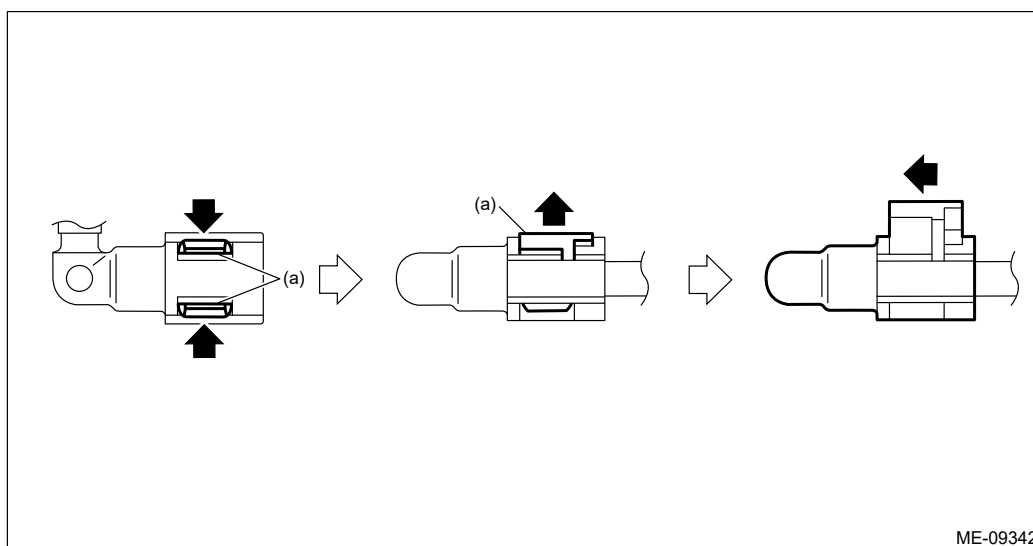
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Intake Manifold Assembly

DISASSEMBLY

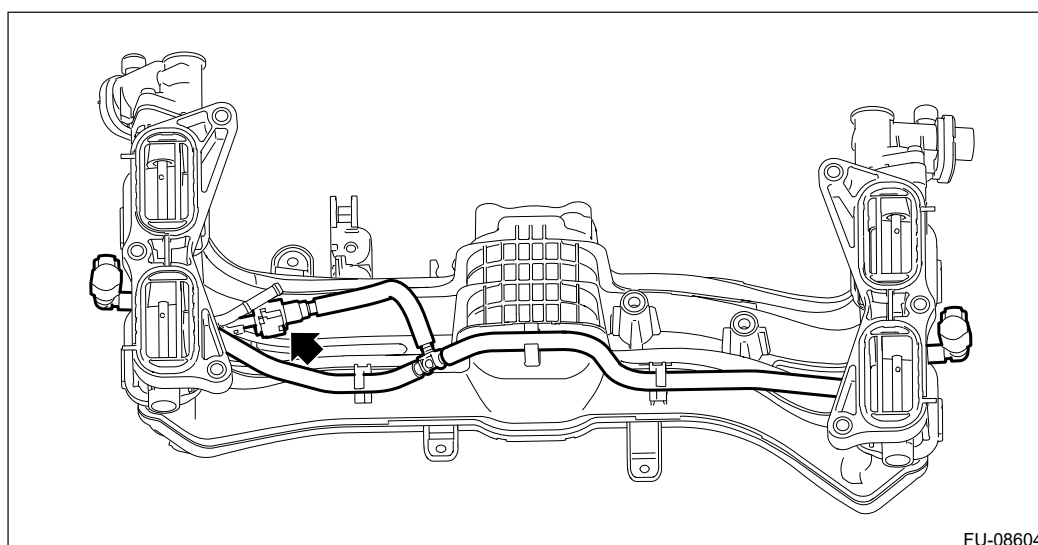
1. Remove the throttle body.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Throttle Body>REMOVAL](#).
2. Remove the EGR pipe.  Ref. to [EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DO\)>EGR Pipe>REMOVAL](#).
3. Remove the EGR control valve.  Ref. to [EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DO\)>EGR Control Valve>REMOVAL](#).
4. Remove the purge control solenoid valve.  Ref. to [EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DO\)>Purge Control Solenoid Valve>REMOVAL](#).
5. Remove the manifold absolute pressure sensor.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\) \(H4DO\)>Manifold Absolute Pressure Sensor>REMOVAL](#).
6. Remove the fuel delivery pipe assembly from the intake manifold assembly.

Note:

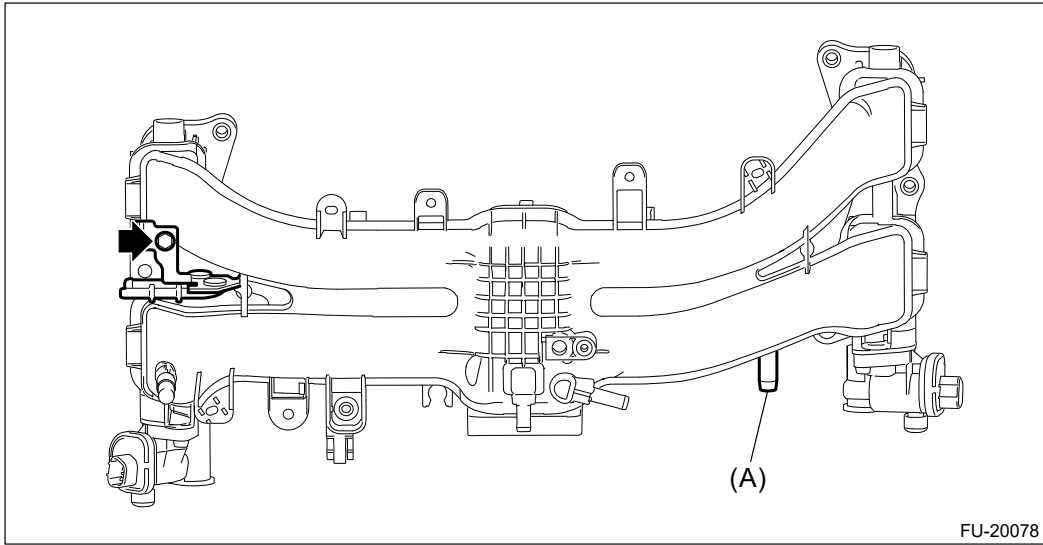
Disconnect the quick connector as shown in the figure.



(a) Slider



7. Remove the fuel pipe assembly and cap (A) from the intake manifold assembly.



FU-20078

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Intake Manifold Assembly

INSPECTION

- 1.** Check that the intake manifold assembly and fuel pipe assembly have no deformation, cracks and other damages.
- 2.** Check that the hose has no cracks, damage or loose part.
- 3.** Check tumble generator valve for contamination or clogging.

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Intake Manifold Assembly

INSTALLATION

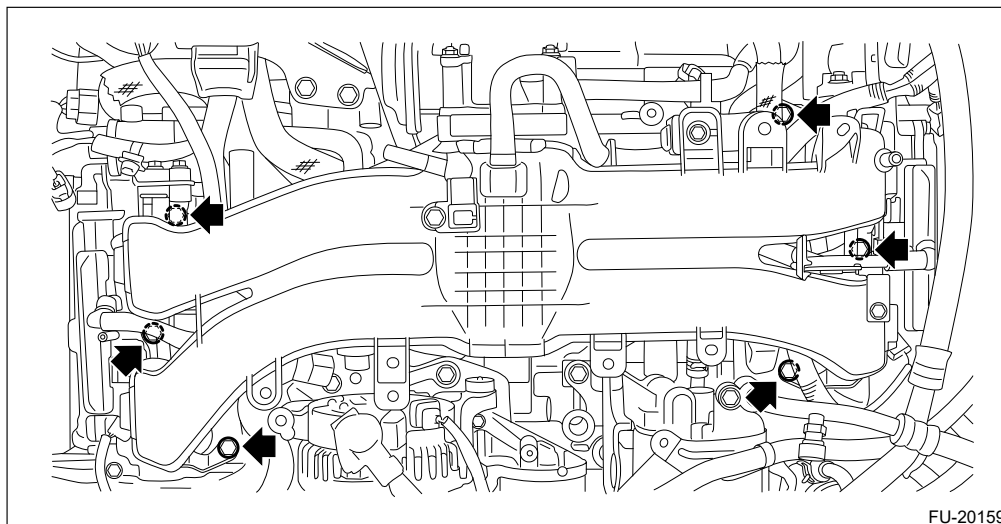
1. Install the intake manifold assembly to the cylinder head together with the intake manifold protector No. 2 and the intake manifold protector No. 3.

Note:

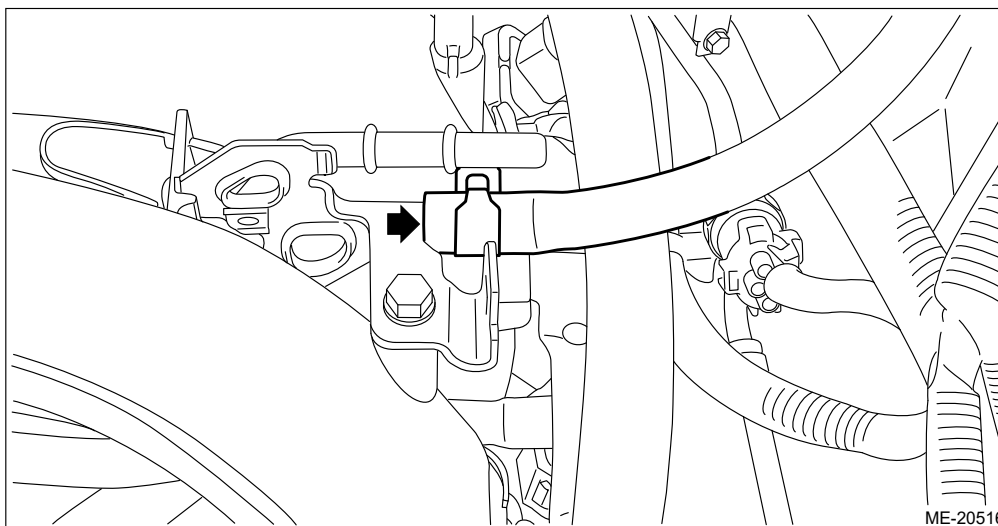
- Use a new gasket.
- Be careful not to let the engine harness be caught by the parts.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)



2. Connect the fuel delivery tube and evaporation hose.
 - (1) Connect the evaporation hose to fuel pipe assembly.



- (2) Connect the quick connector on the fuel delivery tube to the fuel pipe assembly, and fix the fuel delivery tube using clip (A).

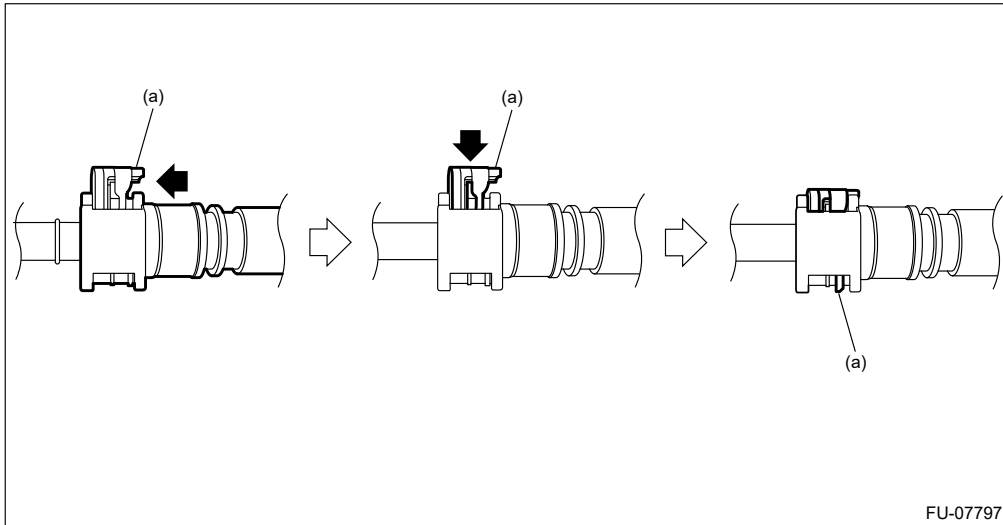
Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.

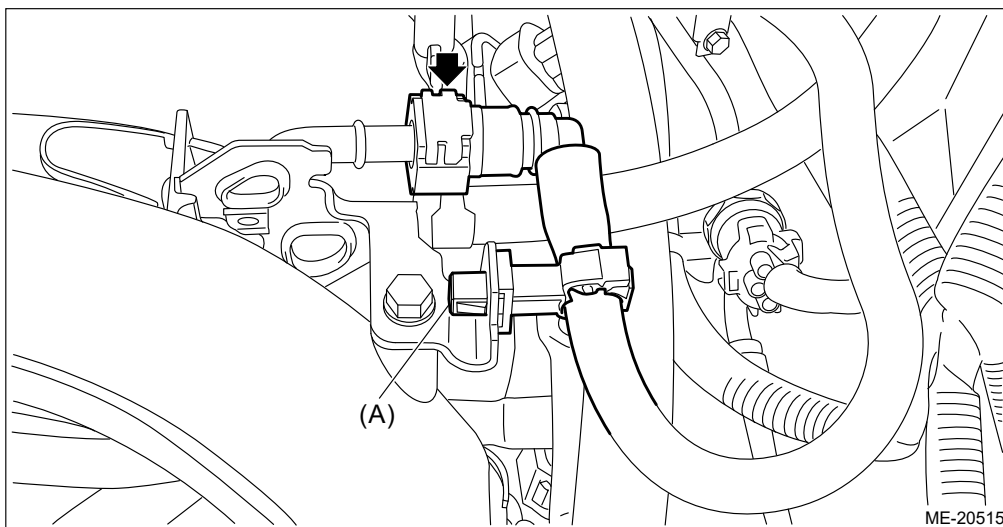
- After locking the slider, check that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



(a) Slider



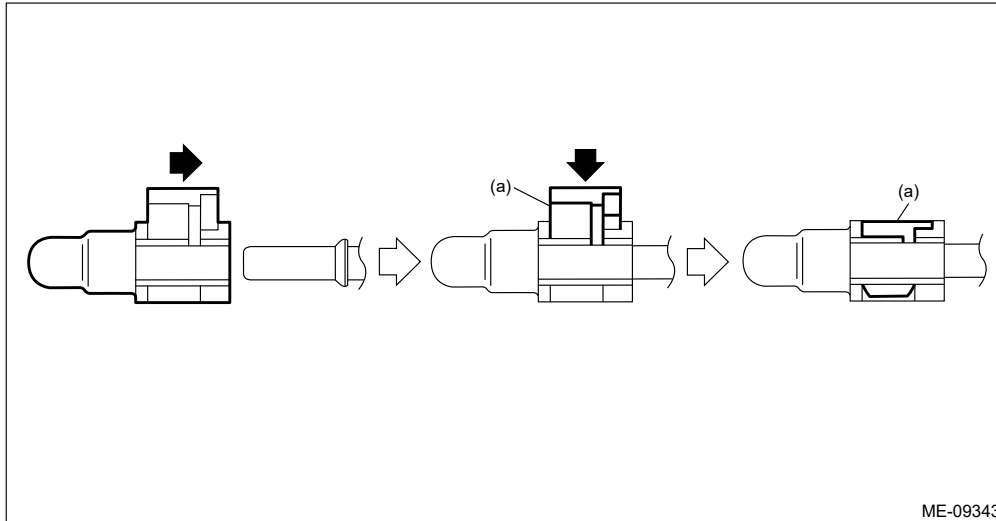
3. Connect the fuel delivery pipe to the fuel pipe LH.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

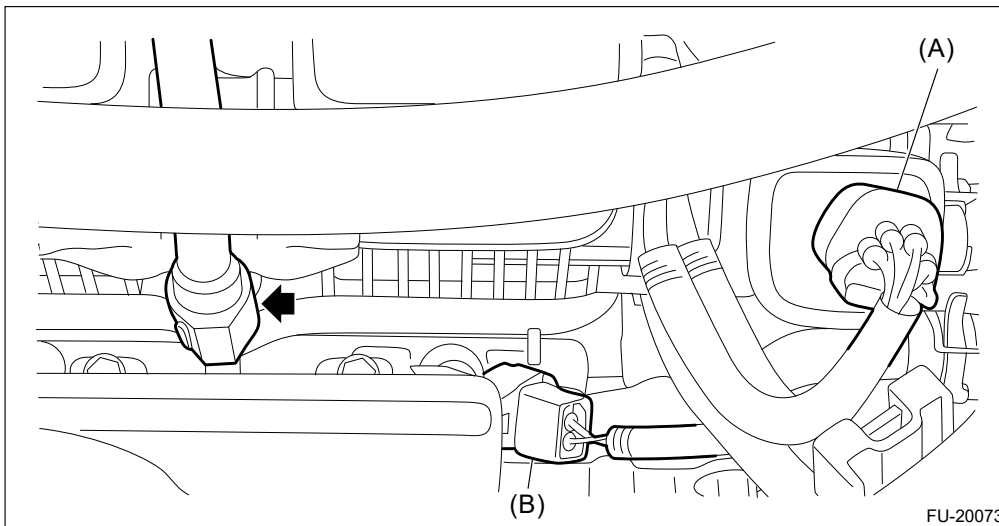
Connect the quick connector as shown in the figure.



ME-09343

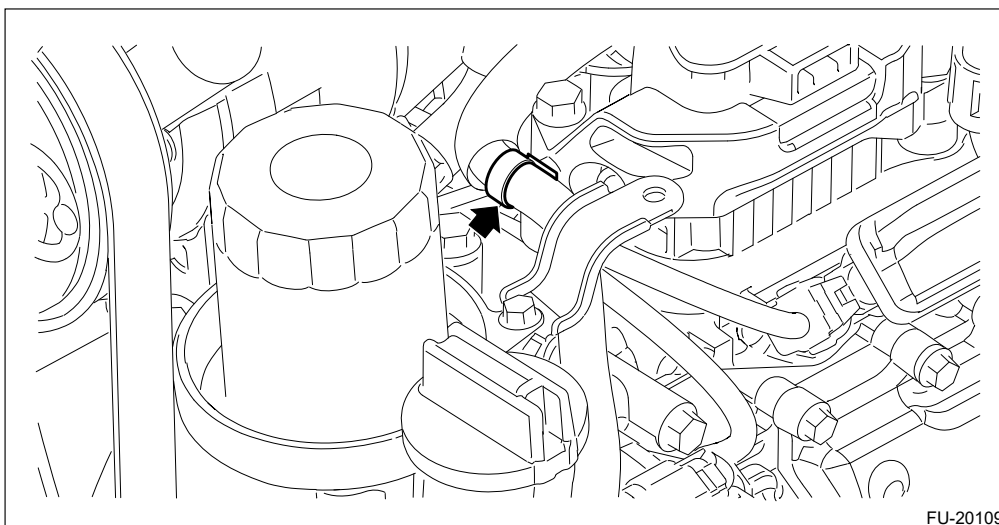
(a) Slider

4. Connect the connector (A) to the tumble generator valve, and connect the connector (B) to the fuel injector #4.



FU-20073

5. Install the engine harness fixing clip to the intake manifold protector No. 3.

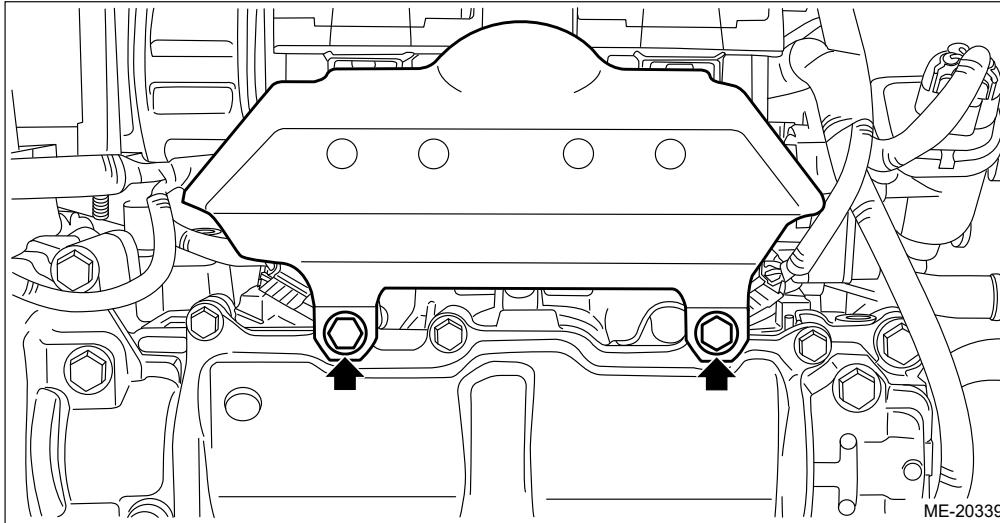


FU-20109

6. Install the intake manifold protector No. 1 LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



7. Install the clip (A) securing the engine harness to the intake manifold assembly, and connect the connector (B) to the tumble generator valve and connect the connector (C) to the fuel injector #3.

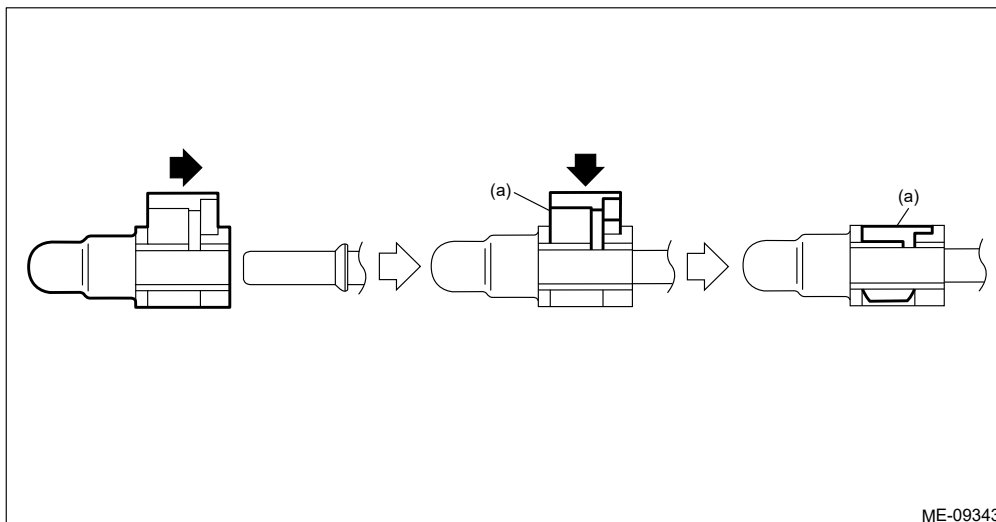
8. Connect the fuel delivery pipe to the fuel pipe RH.

Caution:

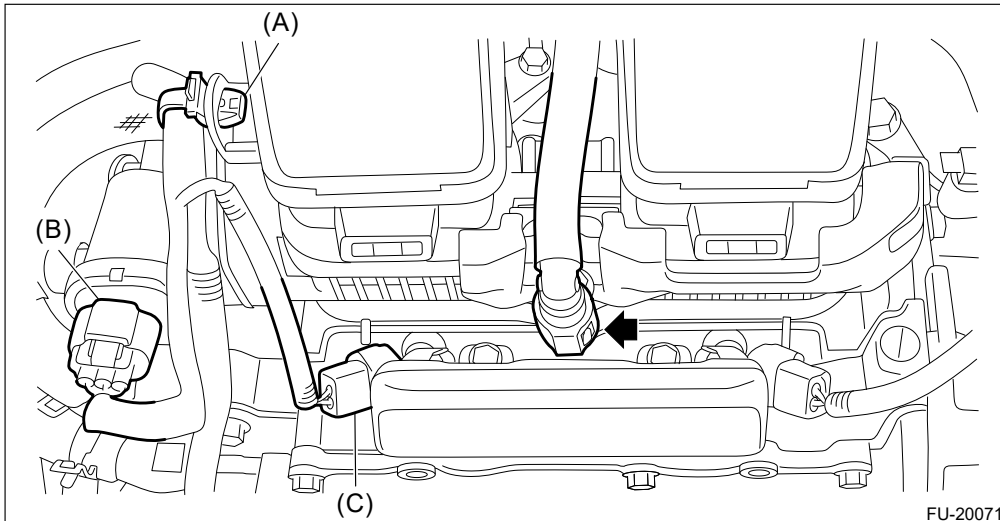
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



(a) Slider

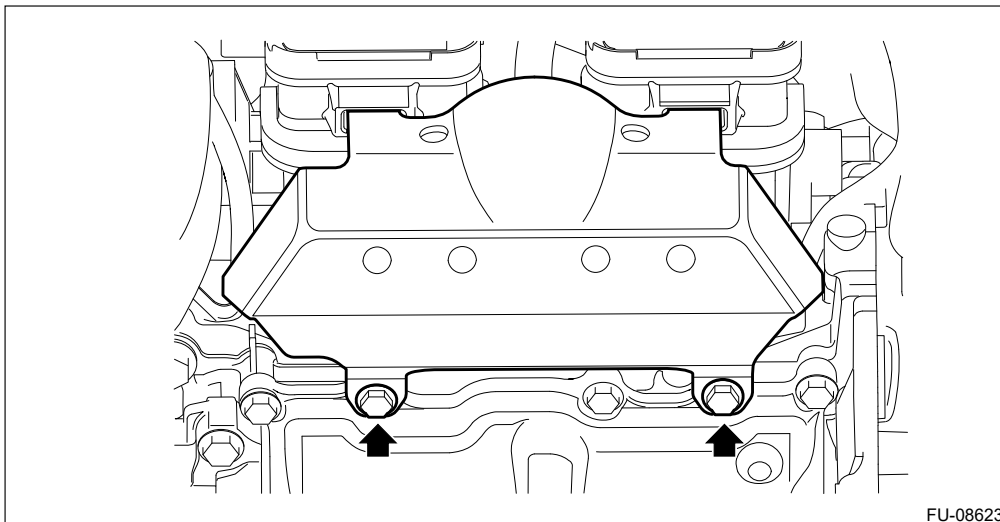


FU-20071

9. Install the intake manifold protector No. 1 RH.

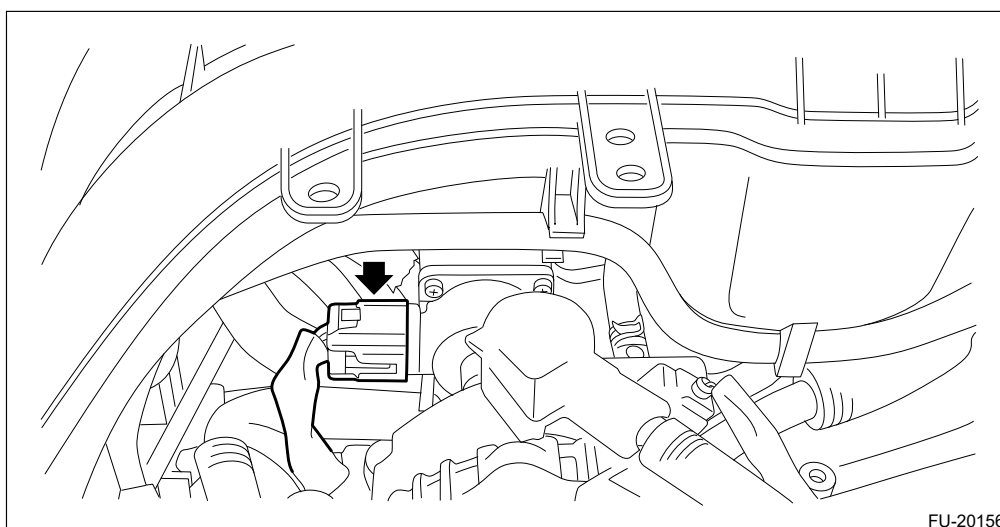
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)




FU-08623

10. Connect the connector to the EGR control valve.

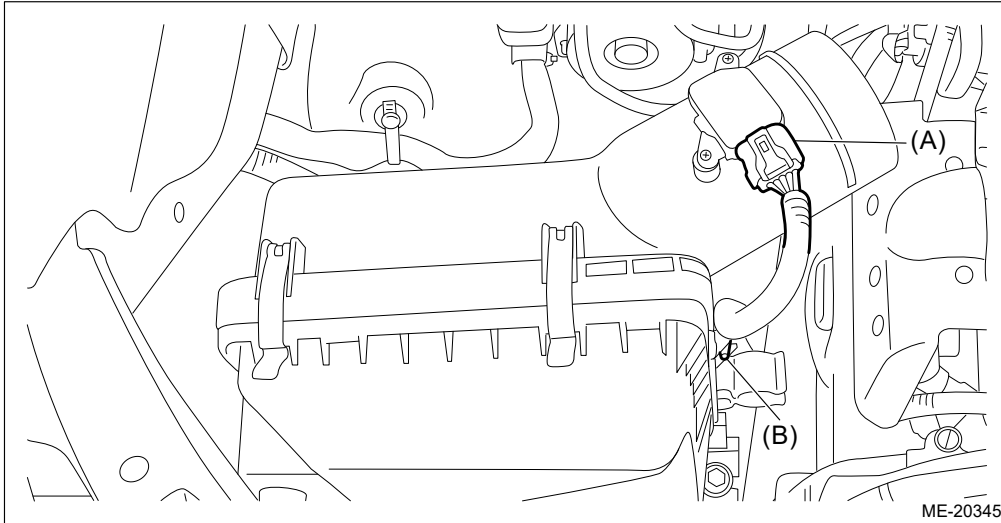


FU-20156

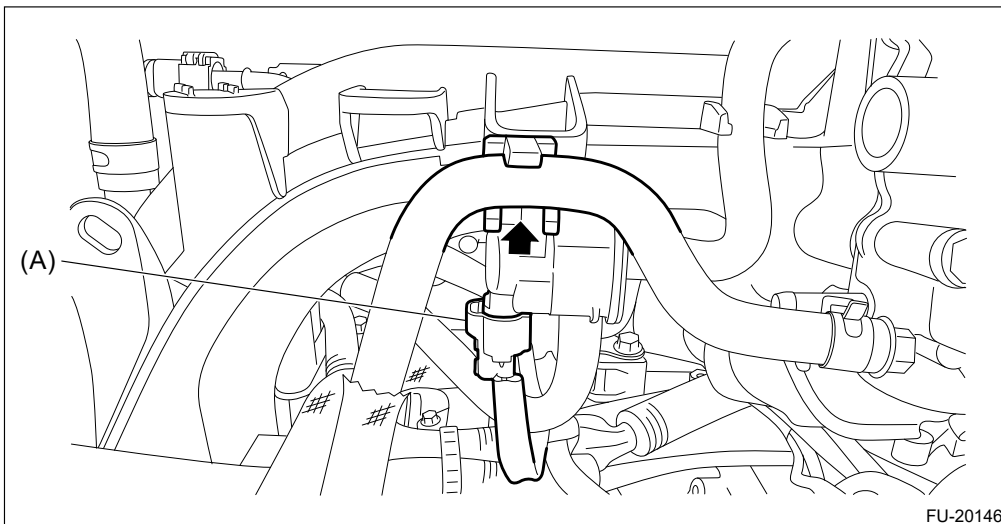
11. Install the air cleaner case (rear) together with the air cleaner element.  [Ref. to INTAKE \(INDUCTION\)](#)

[\(H4DO\)>Air Cleaner Case>INSTALLATION.](#)

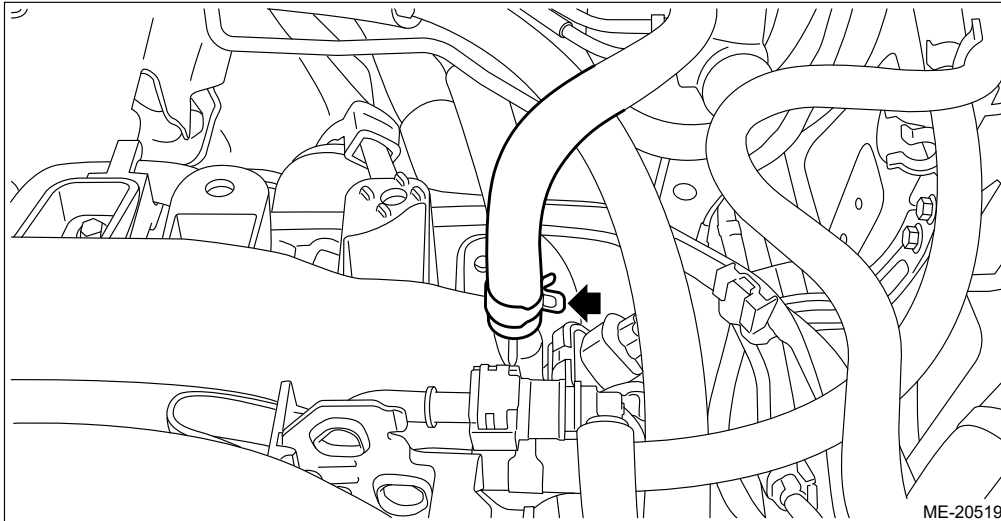
12. Secure the bulkhead wiring harness with clip (B) and connect the connector (A) to the mass air flow and intake air temperature sensor.



13. Connect the connector (A) to the purge control solenoid valve.
14. Install the preheater hose to the intake manifold.



15. Connect the brake booster vacuum hose to the intake manifold.



ME-20519

- 16.** Tighten the bolt securing the EGR cooler to the EGR control valve.

Note:

Use a new gasket.

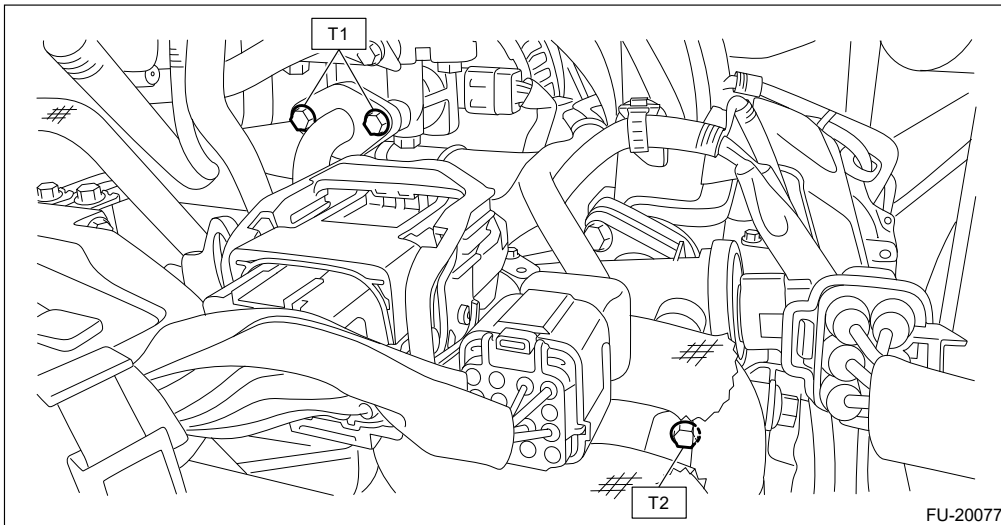
Tightening torque:

T1: 9 N·m (0.9 kgf-m, 6.6 ft-lb)

- 17.** Tighten the bolts holding the EGR cooler to the cylinder head RH.

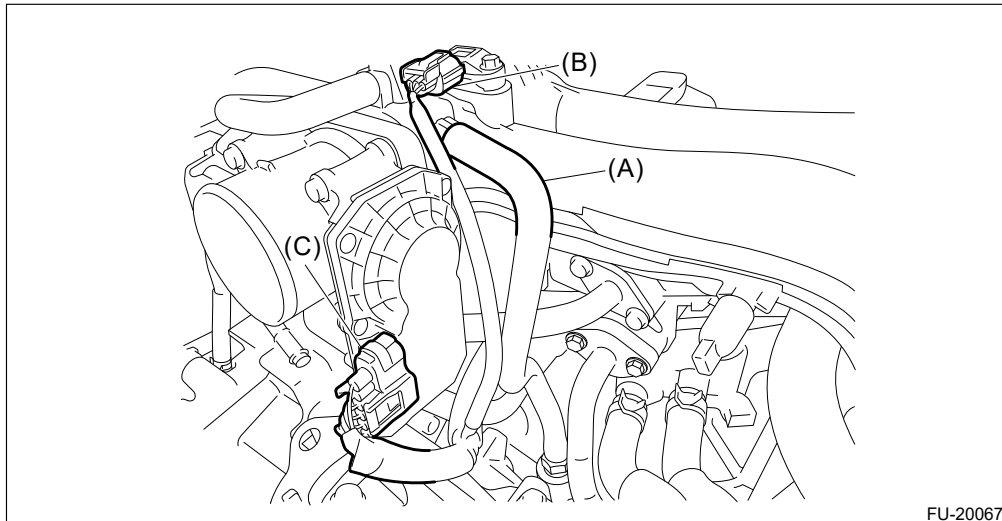
Tightening torque:

T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



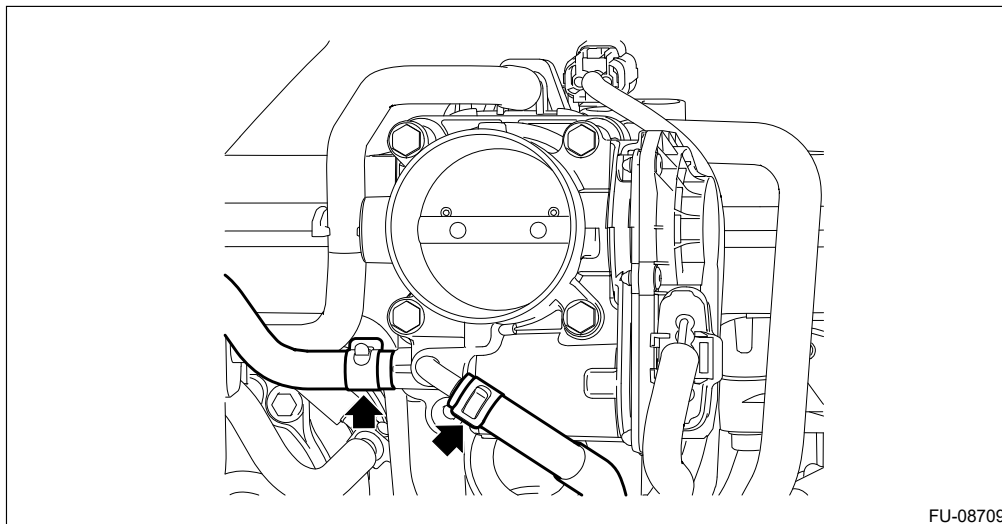
FU-20077

- 18.** Connect the PCV hose (A) to intake manifold assembly.
19. Connect the connector (B) to the manifold absolute pressure sensor.
20. Connect the connector (C) to throttle body.






FU-20067

- 21.** Connect the preheater hoses to the throttle body.





FU-08709

- 22.** Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)
- 23.** Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 24.** Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)


FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Intake Manifold Assembly

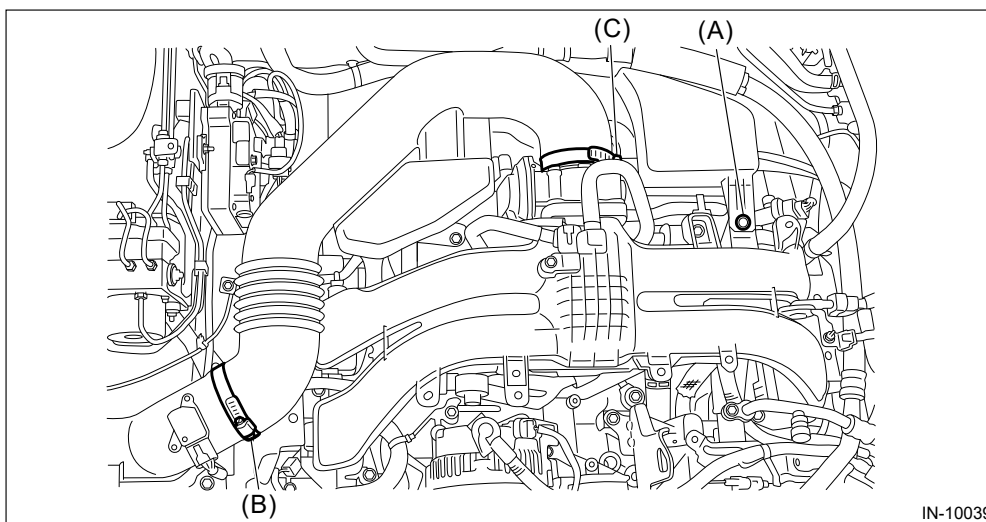
REMOVAL

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Open the fuel filler lid and remove the fuel filler cap.

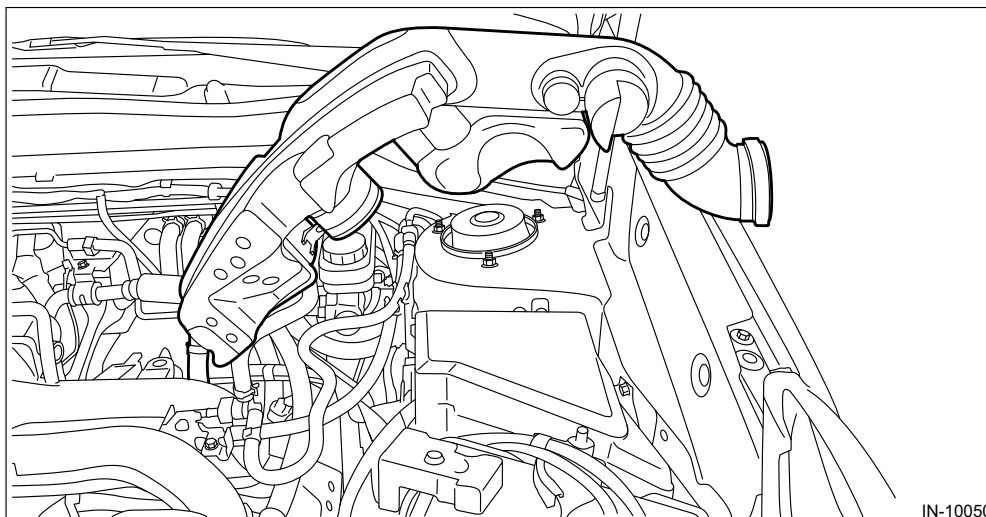
Note:

This operation is required to release the inner pressure of the fuel tank.

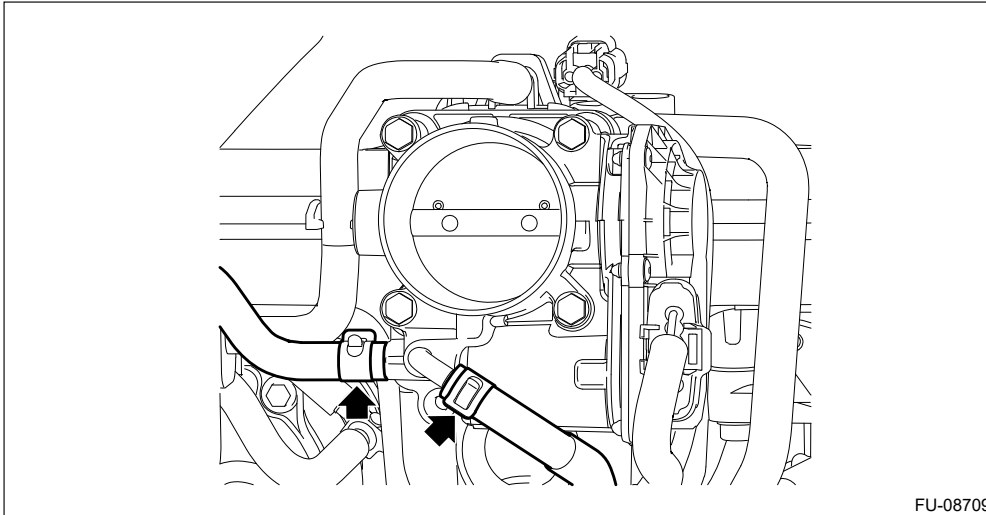
4. Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
5. Remove the clip (A) from the air intake boot.
6. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
7. Loosen the clamp (C) which secures the throttle body to the air intake boot.



8. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.

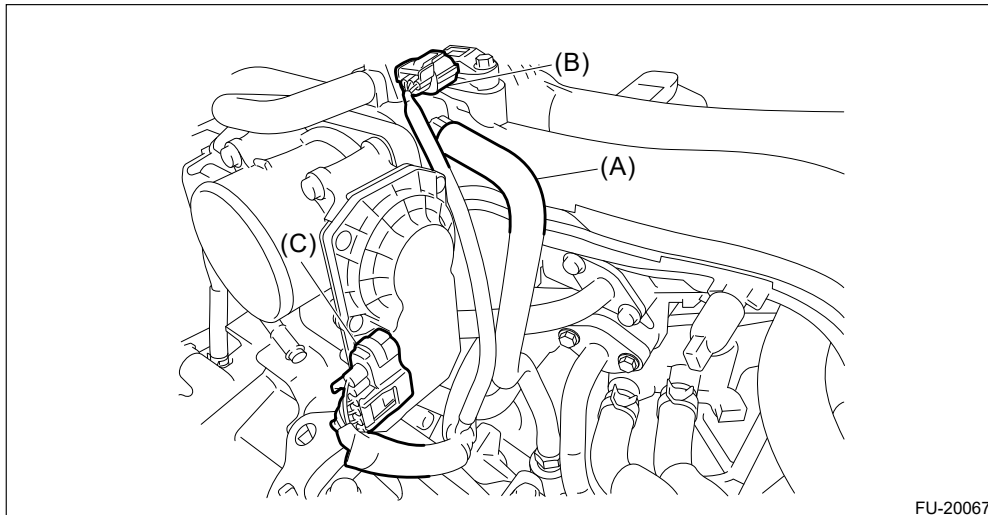


9. Disconnect the preheater hose from throttle body.



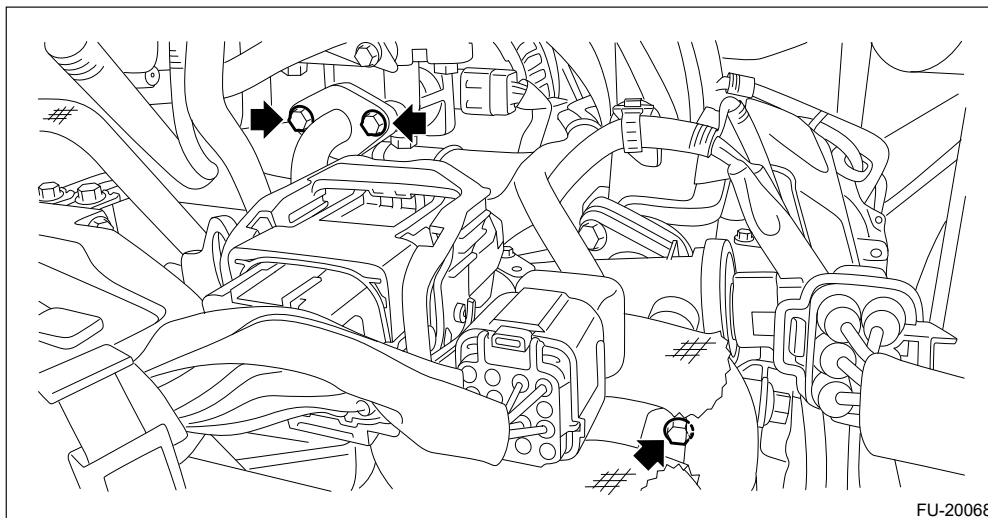
FU-08709

- 10.** Disconnect the PCV hose (A) from intake manifold assembly.
- 11.** Disconnect the connector (B) from manifold absolute pressure sensor.
- 12.** Disconnect the connector (C) from throttle body.



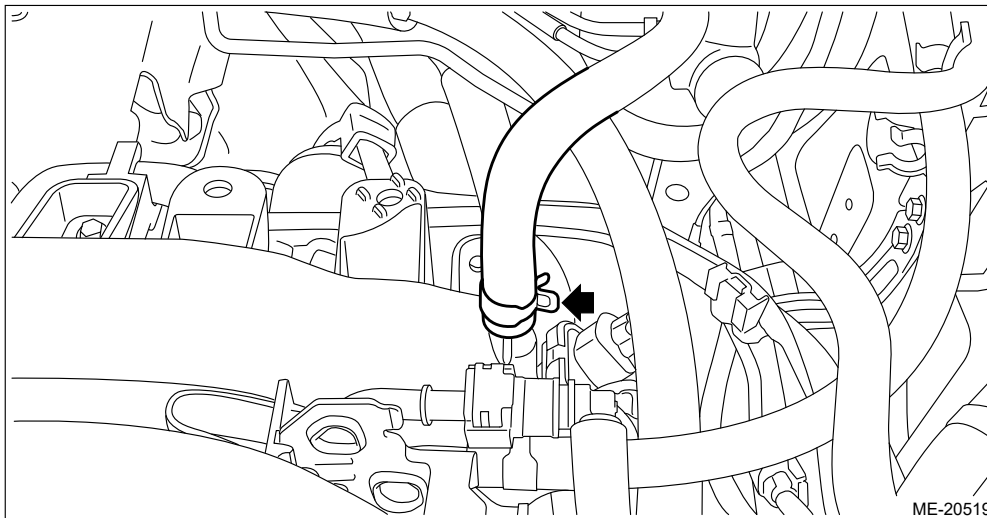
FU-20067

- 13.** Remove the bolt securing the EGR cooler to the EGR control valve.
- 14.** Loosen the bolts holding the EGR cooler to the cylinder head RH.



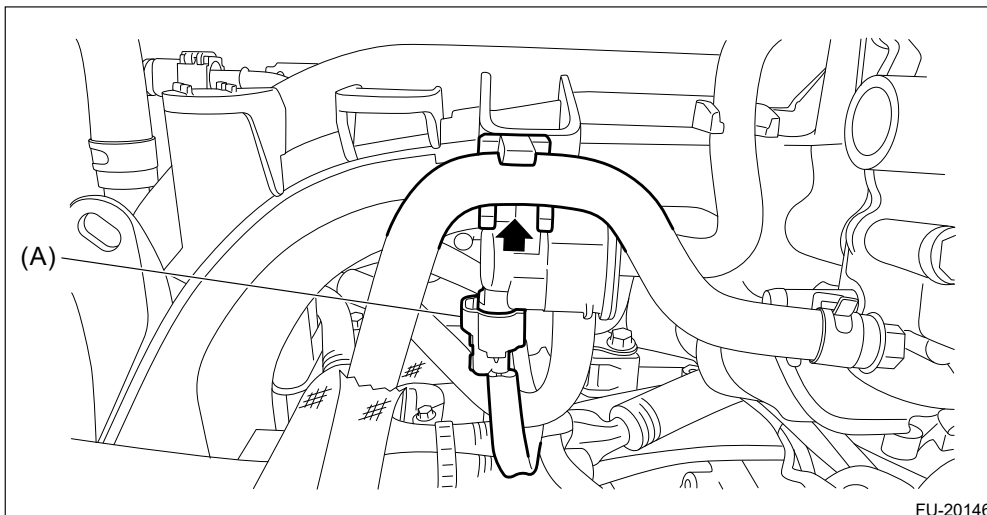
FU-20068

15. Disconnect the brake booster vacuum hose from the intake manifold.



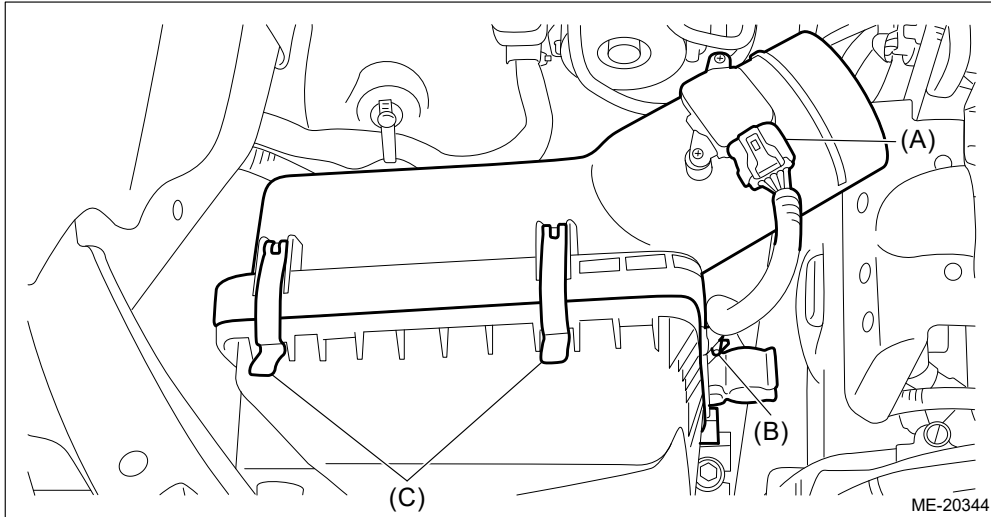
16. Disconnect the connector (A) from the purge control solenoid valve.

17. Remove the preheater hose from the intake manifold.

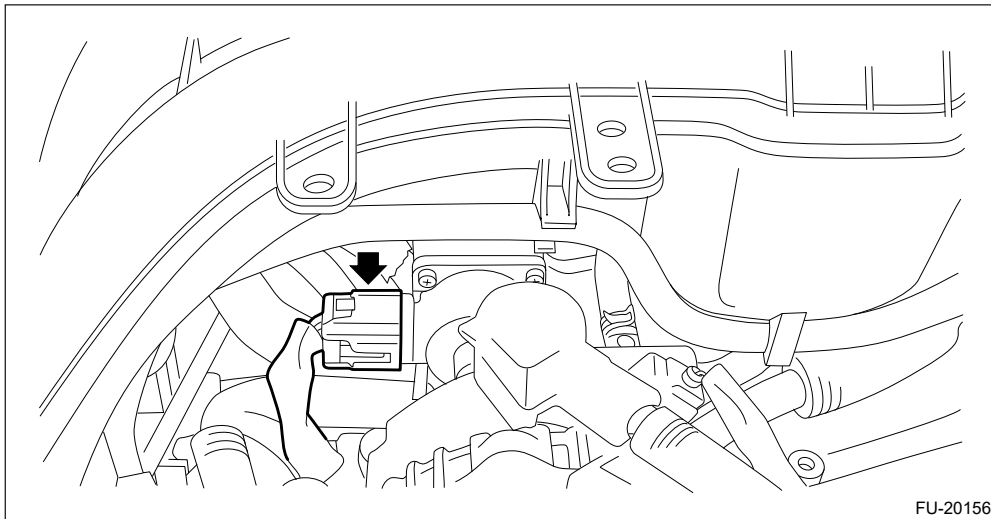


18. Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B) securing the bulkhead wiring harness.

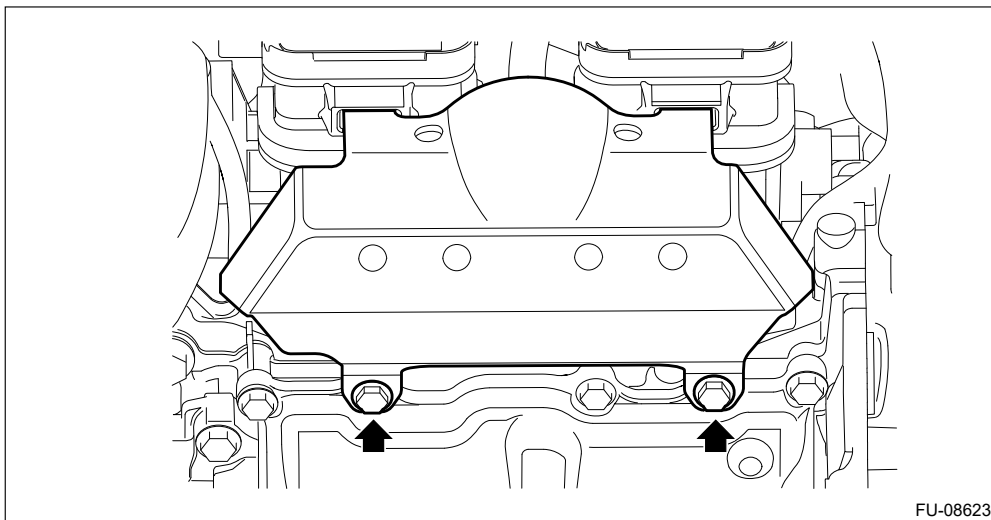
19. Remove the clip (C), and the air cleaner case (rear) together with the air cleaner element.



20. Disconnect the connector from the EGR control valve.



21. Remove the intake manifold protector No. 1 RH.



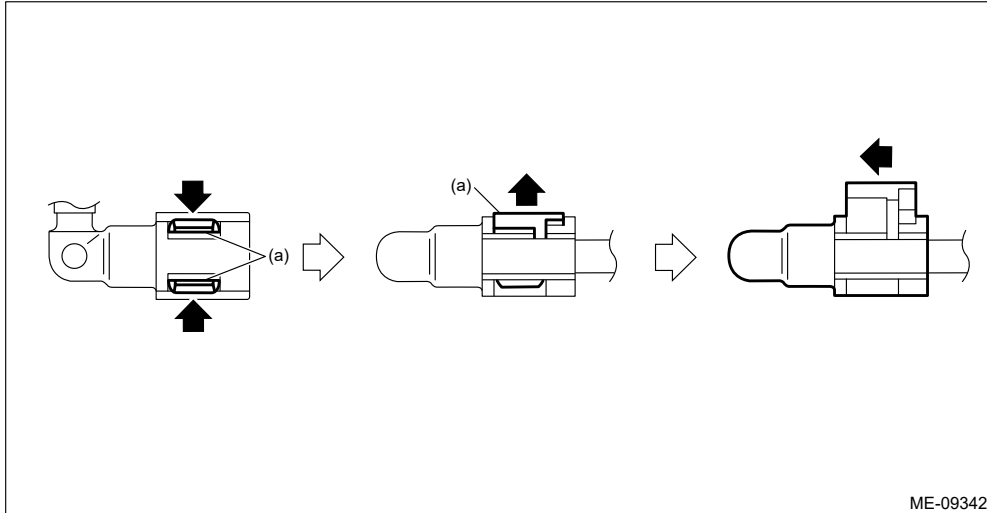
- 22.** Remove the clip (A) securing the engine harness to the intake manifold assembly, and disconnect the connector (B) from the tumble generator valve and disconnect the connector (C) from the fuel injector #3.
- 23.** Disconnect the fuel delivery pipe from the fuel pipe RH.

Caution:

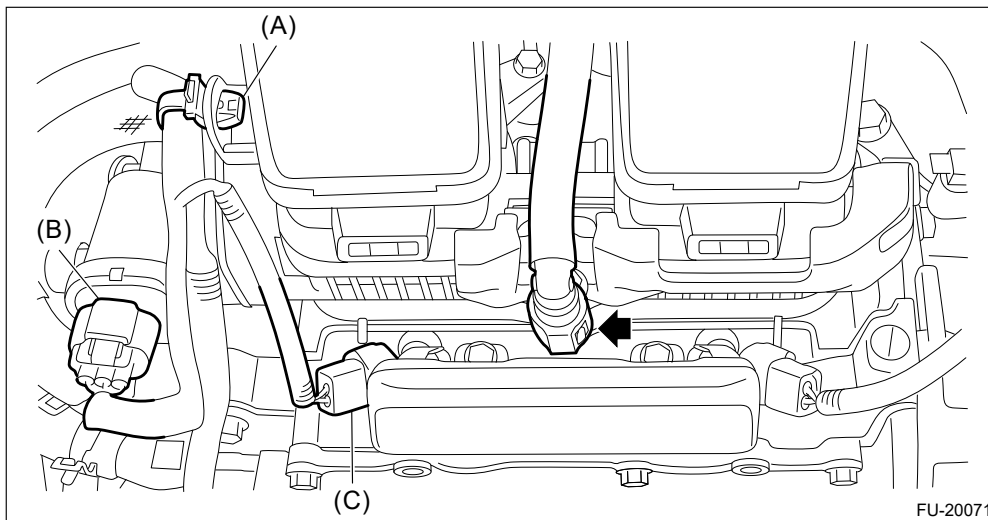
- Be careful not to spill fuel.
- Catch the fuel from the pipes using a container or cloth.

Note:

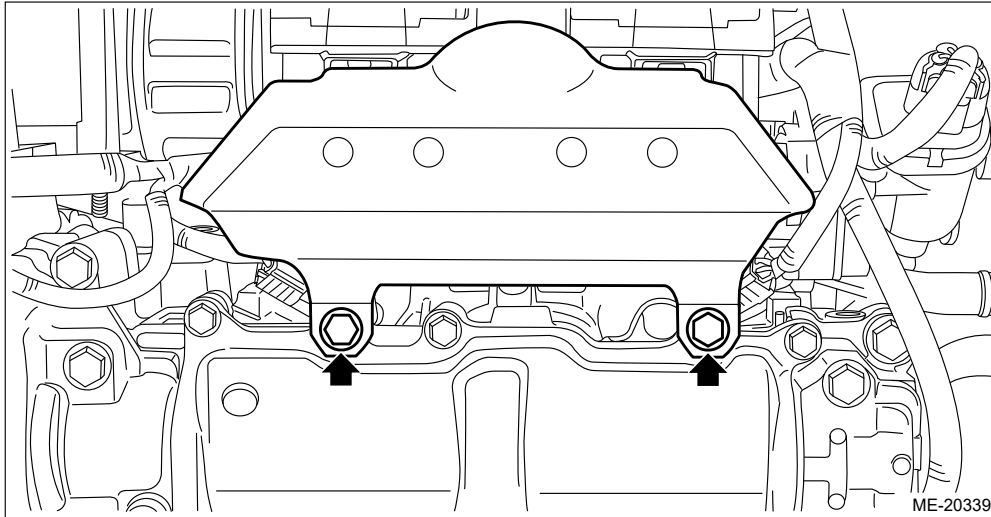
Disconnect the quick connector as shown in the figure.



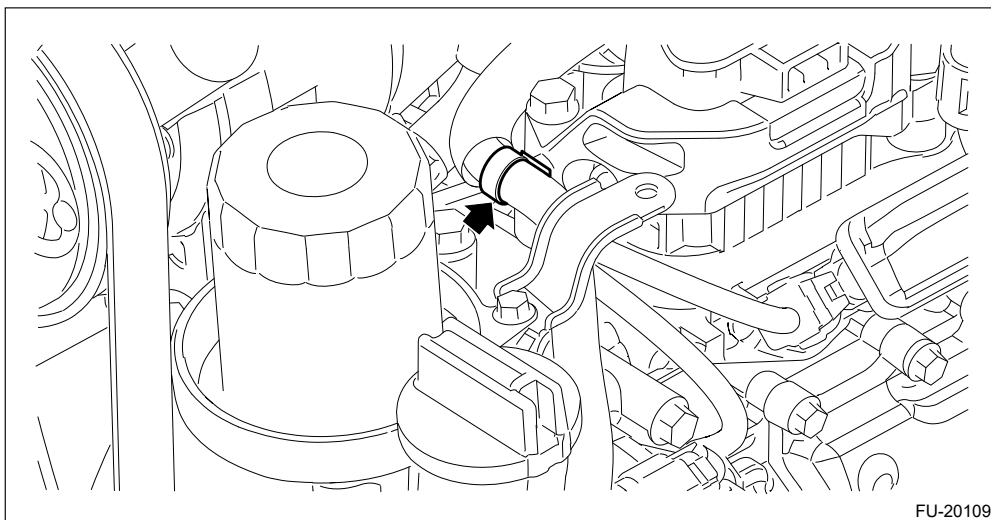
(a) Slider



24. Remove the intake manifold protector No. 1 LH.



- 25.** Remove the clip which secures the engine harness to the intake manifold protector No. 3.



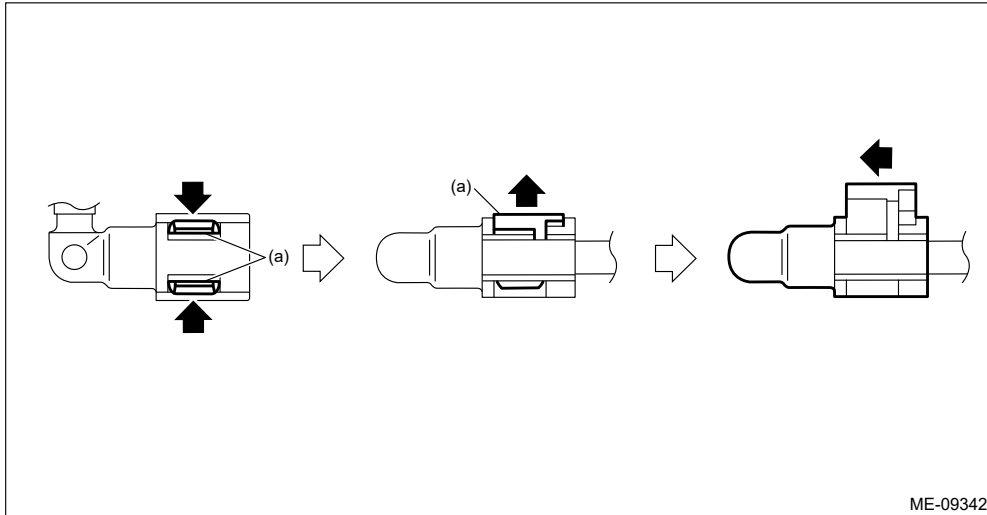
- 26.** Disconnect the connector (A) from the tumble generator valve, and disconnect the connector (B) from the fuel injector #4.
- 27.** Disconnect the fuel delivery pipe from the fuel pipe LH.

Caution:

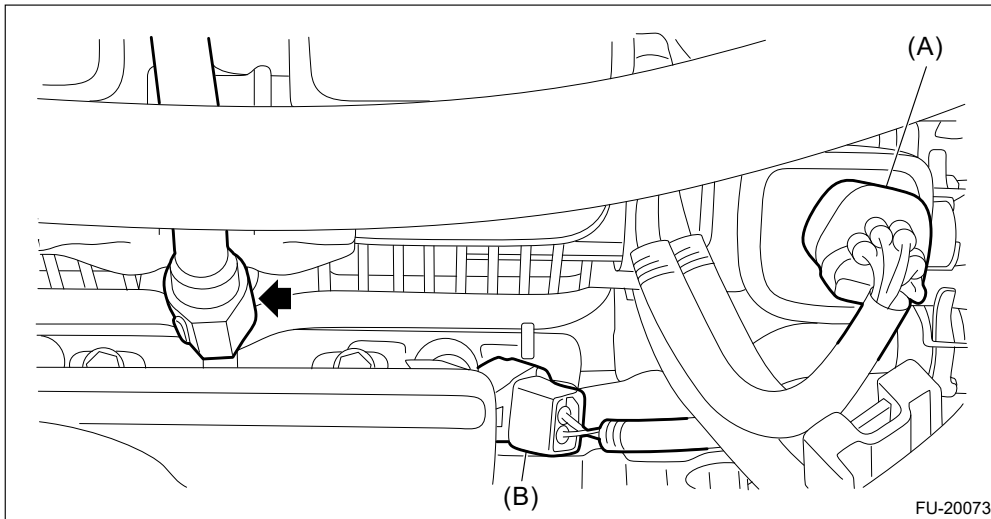
- **Be careful not to spill fuel.**
- **Catch the fuel from the pipes using a container or cloth.**

Note:

Disconnect the quick connector as shown in the figure.



(a) Slider



28. Disconnect the fuel delivery tube and evaporation hose.

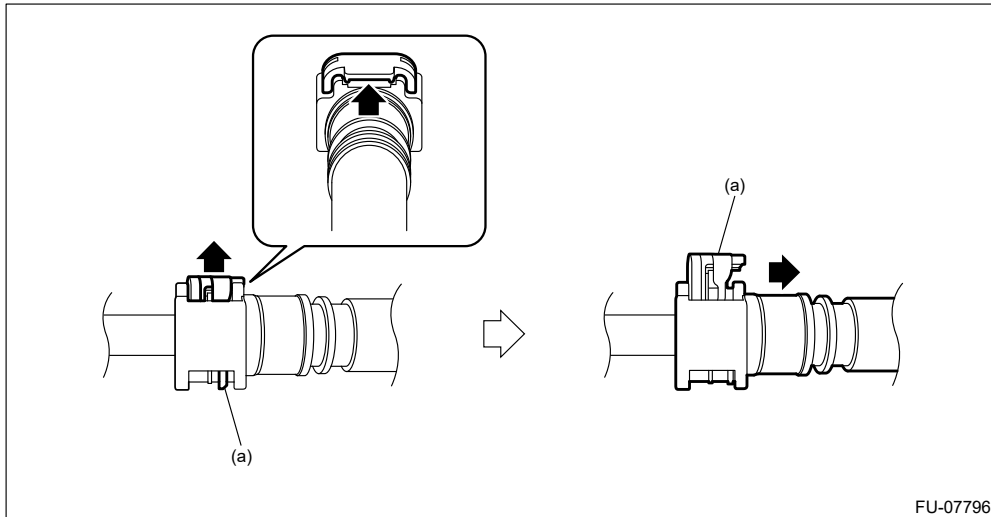
Caution:

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

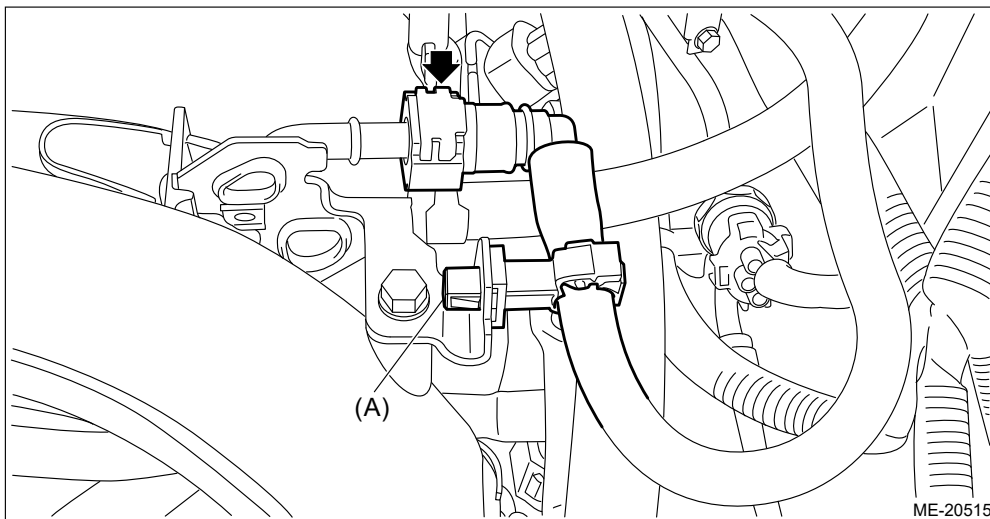
(1) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube.

Note:

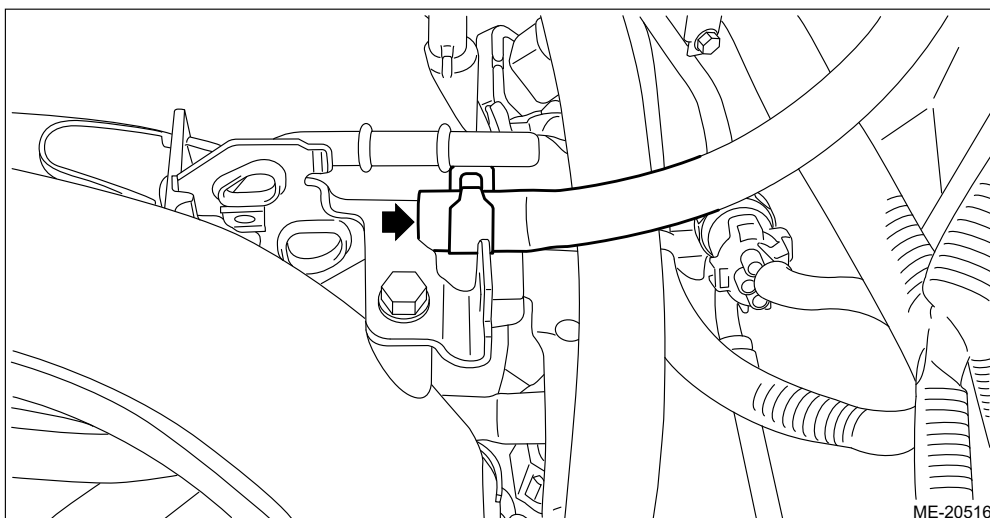
Disconnect the quick connector as shown in the figure.



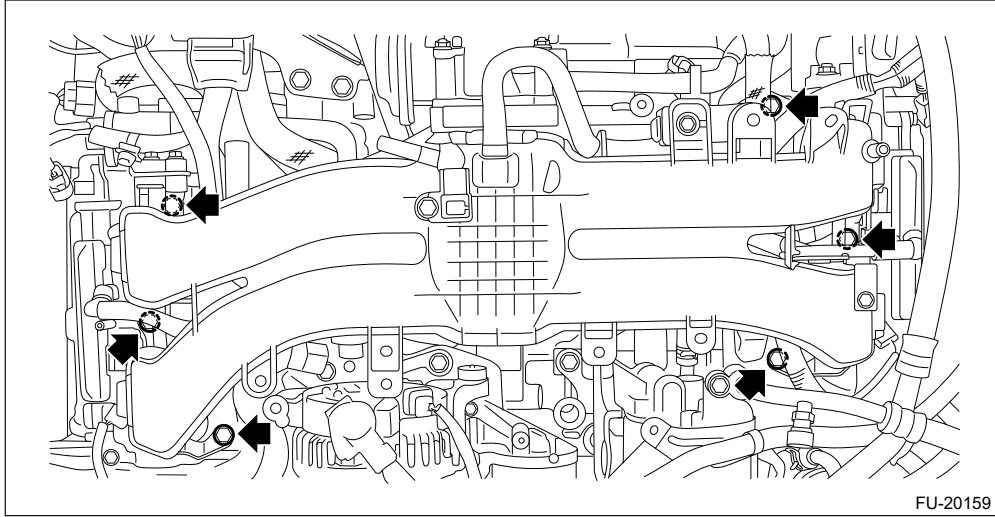
(a) Slider



(2) Disconnect the evaporation hose from the fuel pipe assembly.



29. Remove the intake manifold assembly from the cylinder head together with the intake manifold protector No. 2 and the intake manifold protector No. 3.

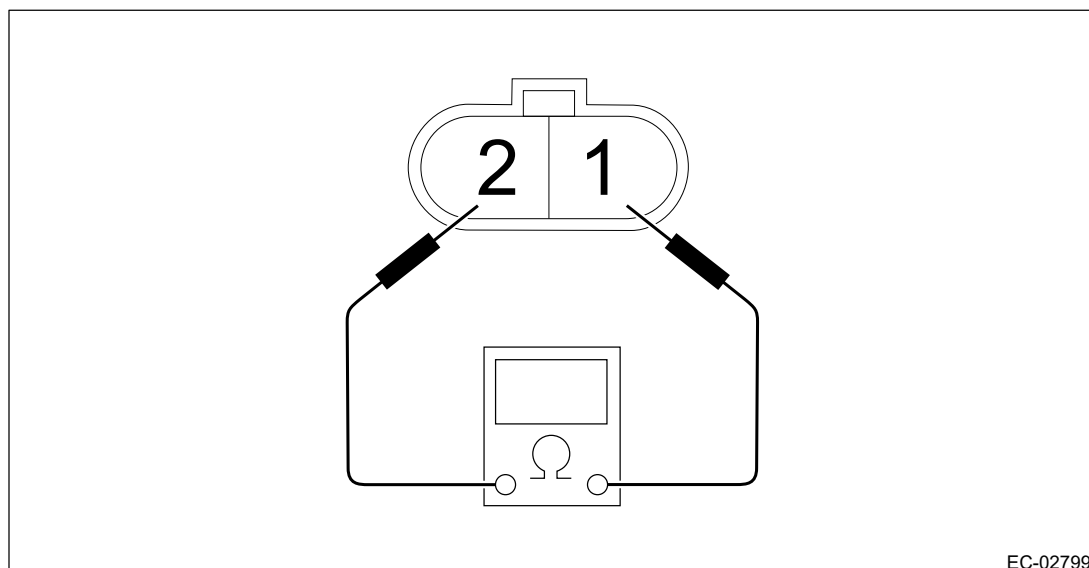


FU-20159

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Knock Sensor

INSPECTION

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



| Terminal No. | Standard |
|--------------|-----------|
| 1 and 2 | 560±28 kΩ |

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Knock Sensor

INSTALLATION

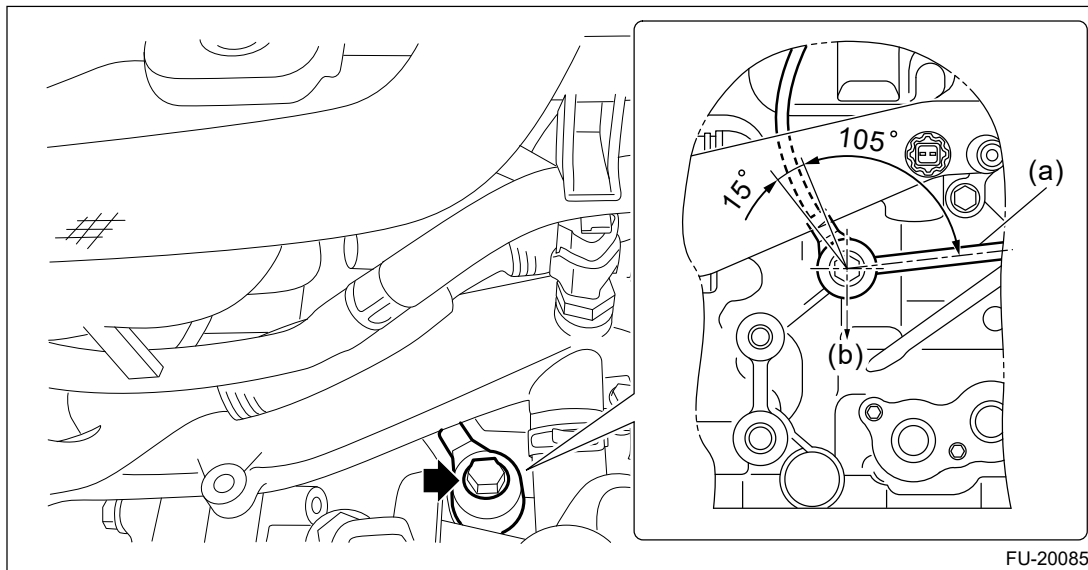
1. Install the knock sensor to the cylinder block by routing it under the water pipe assembly, and connect the connector to the knock sensor.

Note:

- The knock sensor should be installed so that the center of the knock sensor is positioned at a $105^\circ - 120^\circ$ angle from the cylinder block rib (a) relative to the front of engine.
- Make sure that the knock sensor and its connector do not touch the adjacent parts.

Tightening torque:

24 N·m (2.4 kgf-m, 17.7 ft-lb)




(a) Rib

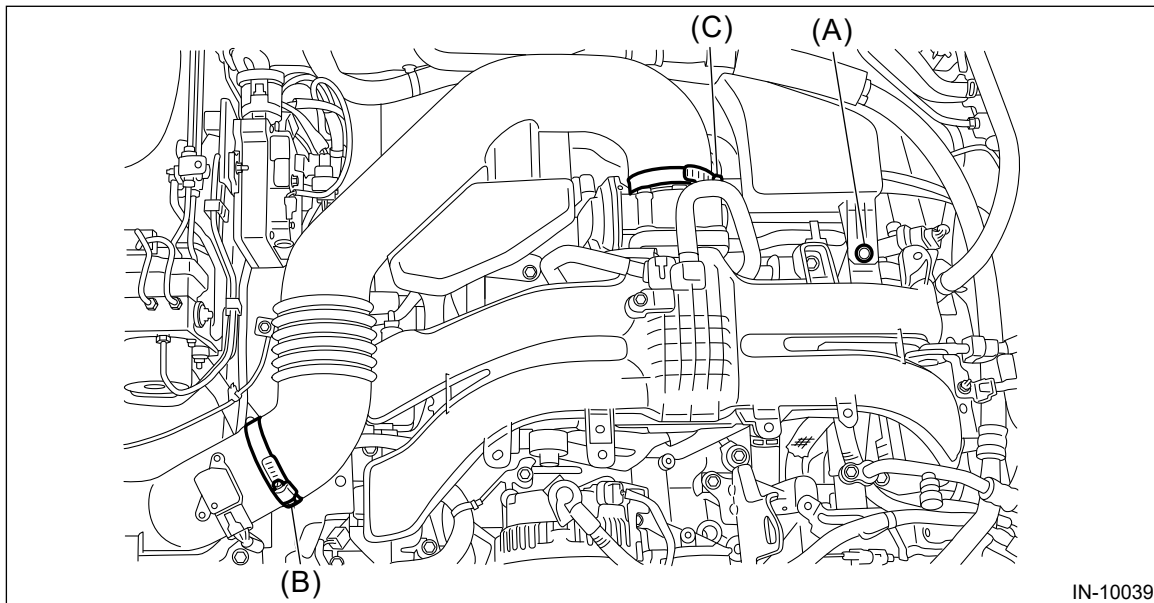
(b) Front of engine

2. Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)
3. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

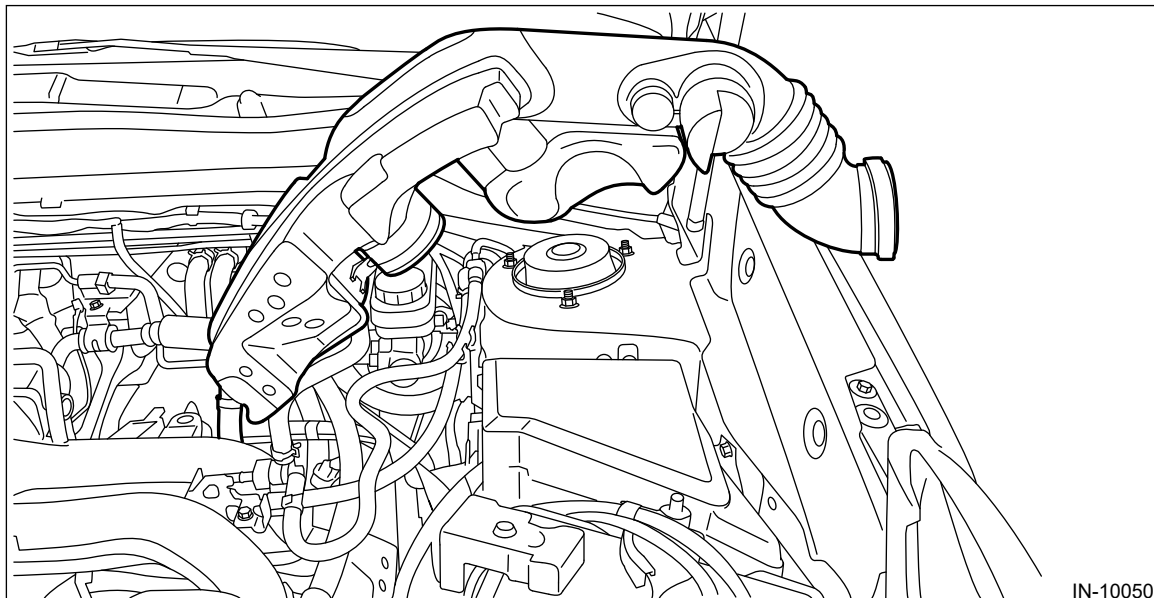
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Knock Sensor

REMOVAL

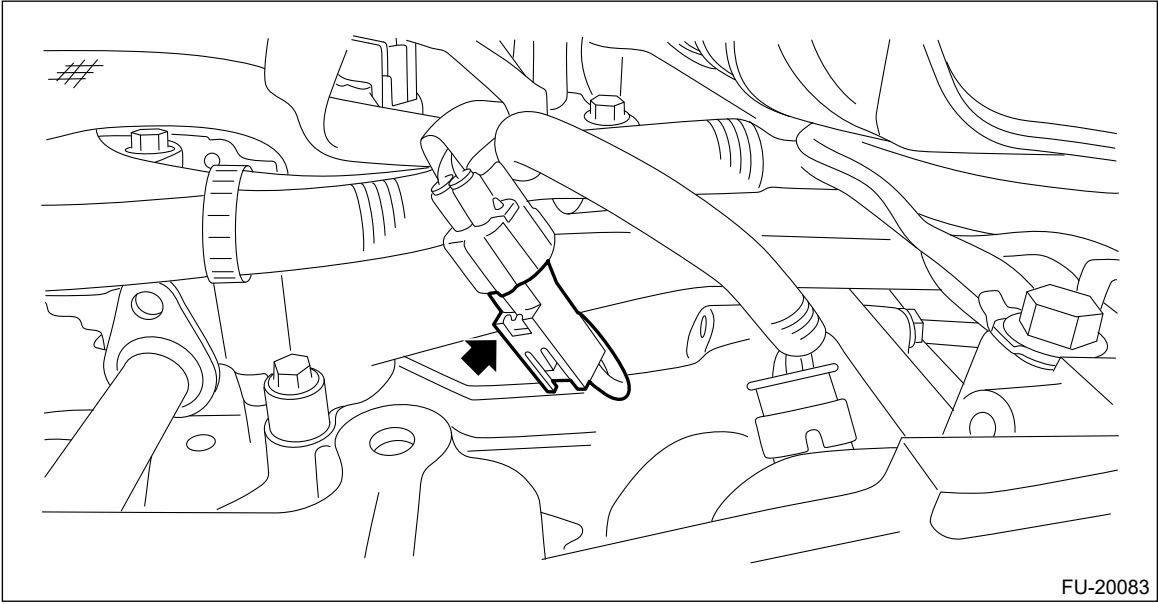
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the clip (A) from the air intake boot.
3. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
4. Loosen the clamp (C) which secures the throttle body to the air intake boot.



5. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.

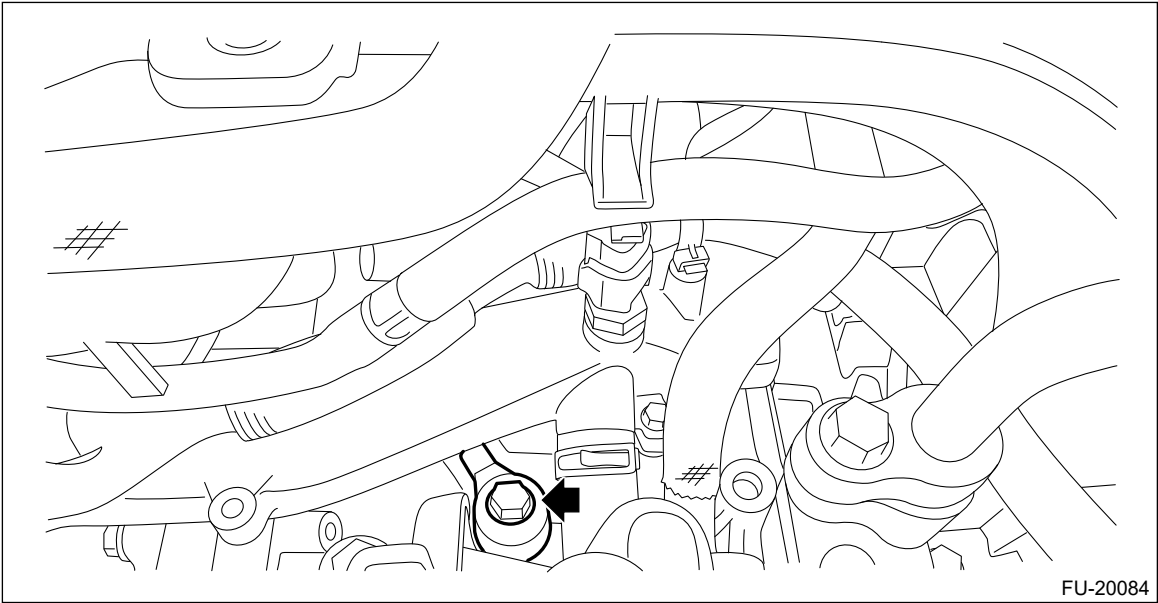


6. Disconnect the connector from the knock sensor.



FU-20083

7. Remove the knock sensor from cylinder block.

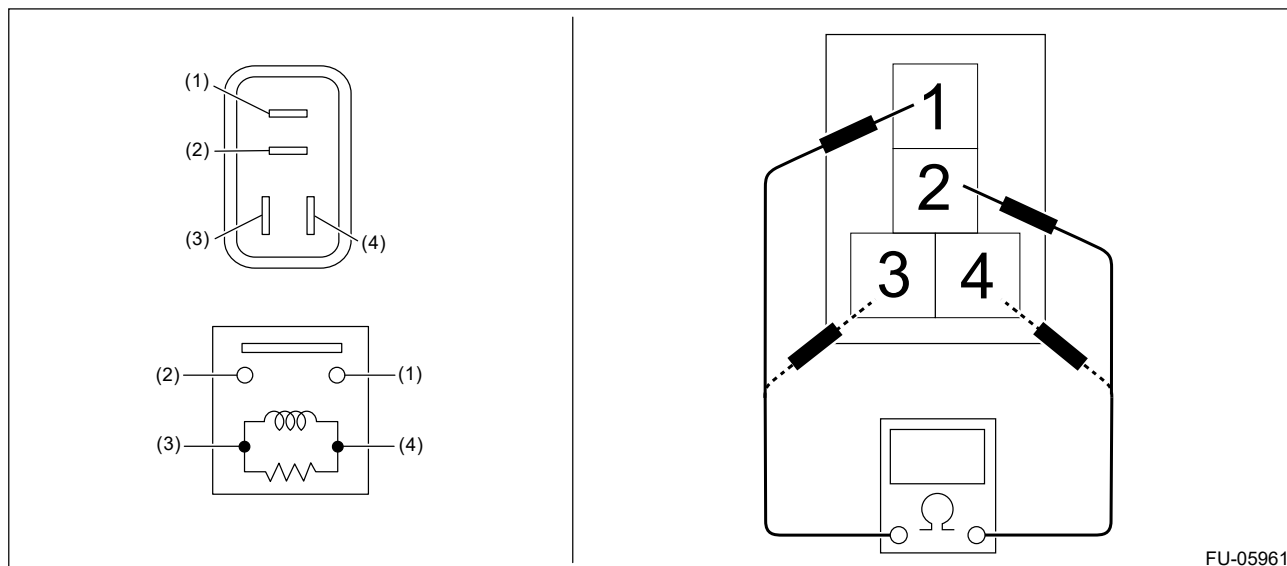


FU-20084

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Main Relay

INSPECTION

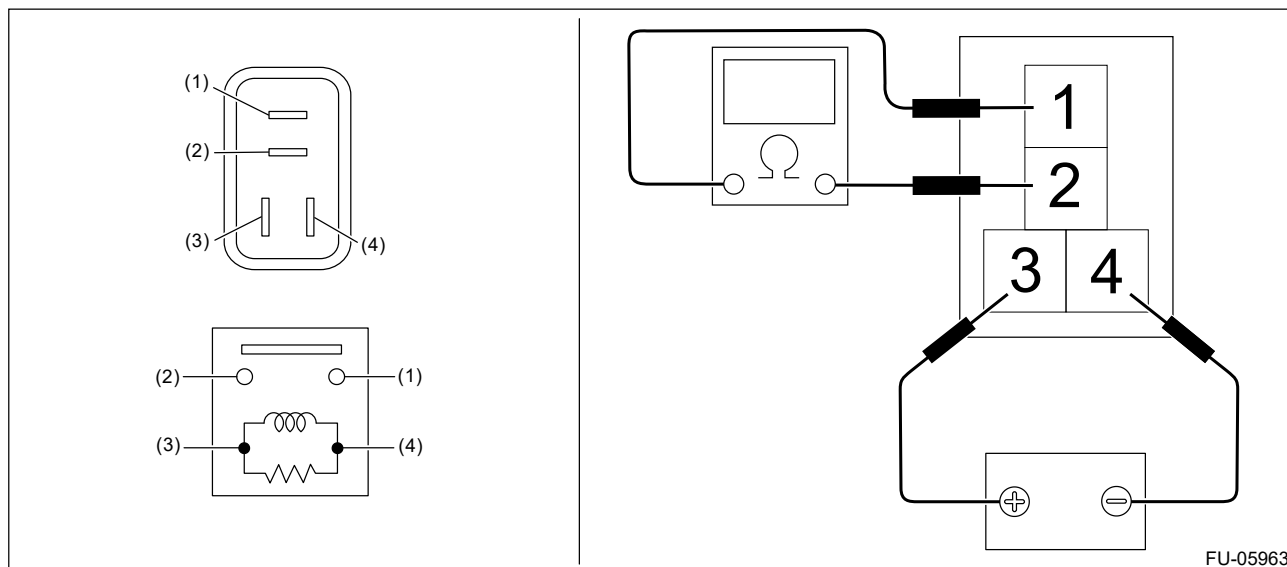
1. Check that the main relay has no deformation, cracks or other damages.
2. Measure the resistance between main relay terminals.



FU-05961

| Terminal No. | Standard |
|--------------|---|
| 1 and 2 | 1 M Ω or more |
| 3 and 4 | 130.4–230.8 Ω (when 20°C (68°F)) |

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





FU-05963

| Terminal No. | Standard |
|--------------|----------------------|
| 1 and 2 | Less than 1 Ω |



FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Main Relay

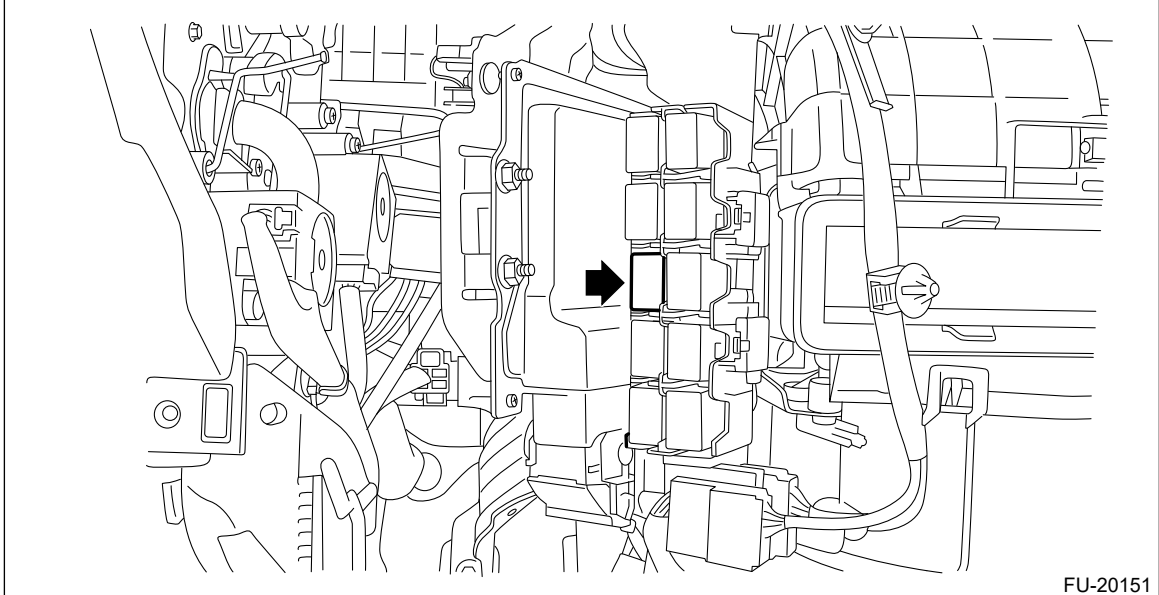
INSTALLATION

- 1.** Install the main relay to the relay block.
- 2.** Install the glove box.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>INSTALLATION.](#)
- 3.** Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Main Relay

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the glove box.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>REMOVAL.](#)
3. Remove the main relay from relay block.



FU-20151

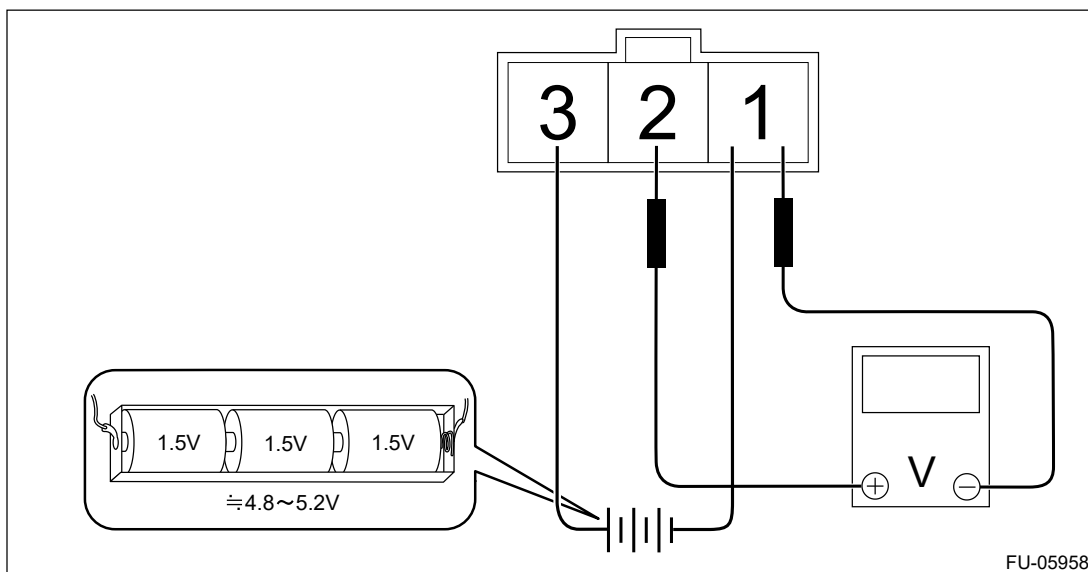
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Manifold Absolute Pressure Sensor

INSPECTION

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

Note:

- Use new dry-cell batteries.
- Using a circuit tester, check that the initial voltage of each dry-cell battery is 1.6 V or more. And also check that the voltage of three batteries in series is between 4.8 –5.2 V.
- For power supply, 5 V DC constant voltage power source can also be used.



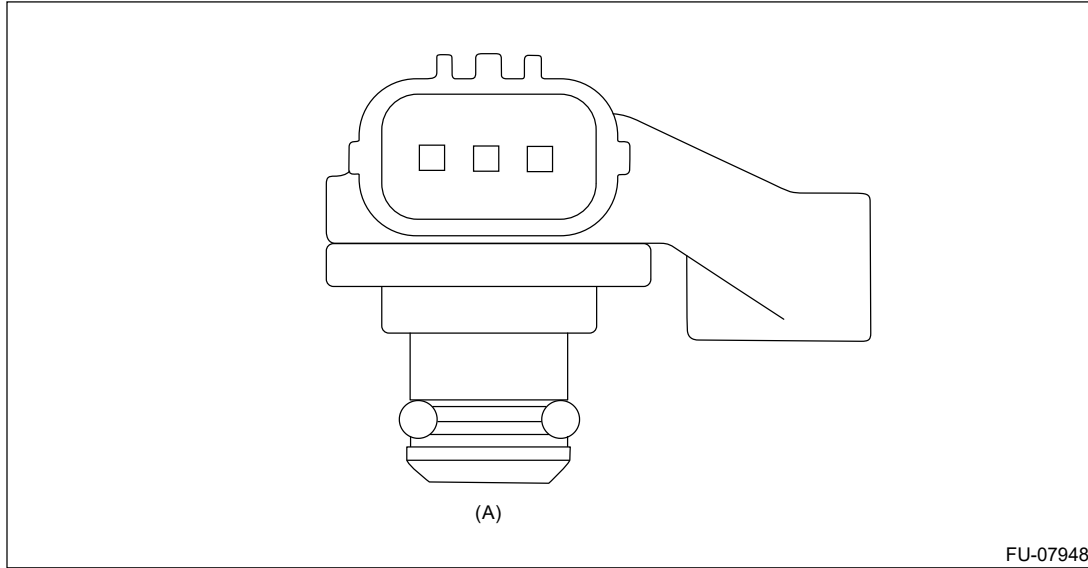
3. Check the voltage at a normal atmospheric pressure.

Note:

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

| Terminal No. | Standard |
|-----------------|----------------------------------|
| 2 (+) and 1 (-) | Approx. 4.2 V (when 25°C (77°F)) |

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



5. Check the voltage when generating vacuum using Mighty Vac.

Caution:

Do not apply a vacuum that exceeds -88 kPa (-0.9 kg/cm^2 , -12.8 psi). Doing so may damage the manifold absolute pressure sensor.

Note:

When vacuum occurs at the pressure port of manifold absolute pressure sensor, the voltage will drop from the value as in step 3).

| Pressure | Terminal No. | Standard |
|---|-----------------|--|
| -88 kPa (-0.9 kg/cm^2 , -12.8 psi) | 2 (+) and 1 (-) | Approx. 1 V (when 25°C (77°F)) |

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Manifold Absolute Pressure Sensor

INSTALLATION


1. Install the manifold absolute pressure sensor to the intake manifold assembly, and connect the connector to the manifold absolute pressure sensor.

Note:

Use new O-rings.


Tightening torque:

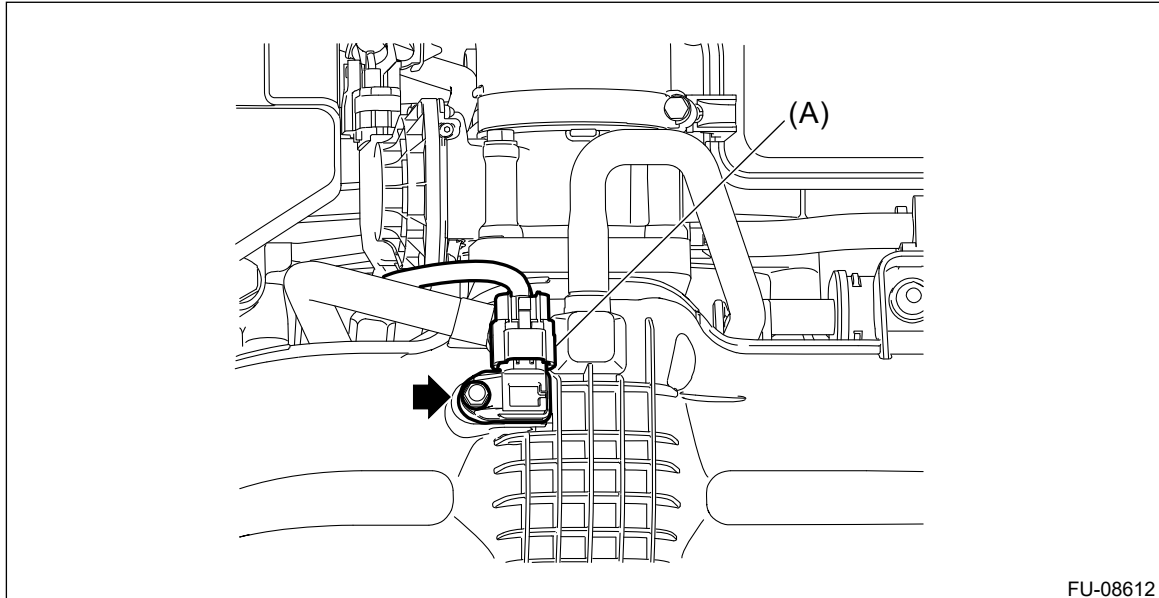
3.4 N·m (0.3 kgf-m, 2.5 ft-lb)

2. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Manifold Absolute Pressure Sensor

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Disconnect the connector (A) from the manifold absolute pressure sensor, and remove the manifold absolute pressure sensor from intake manifold assembly.



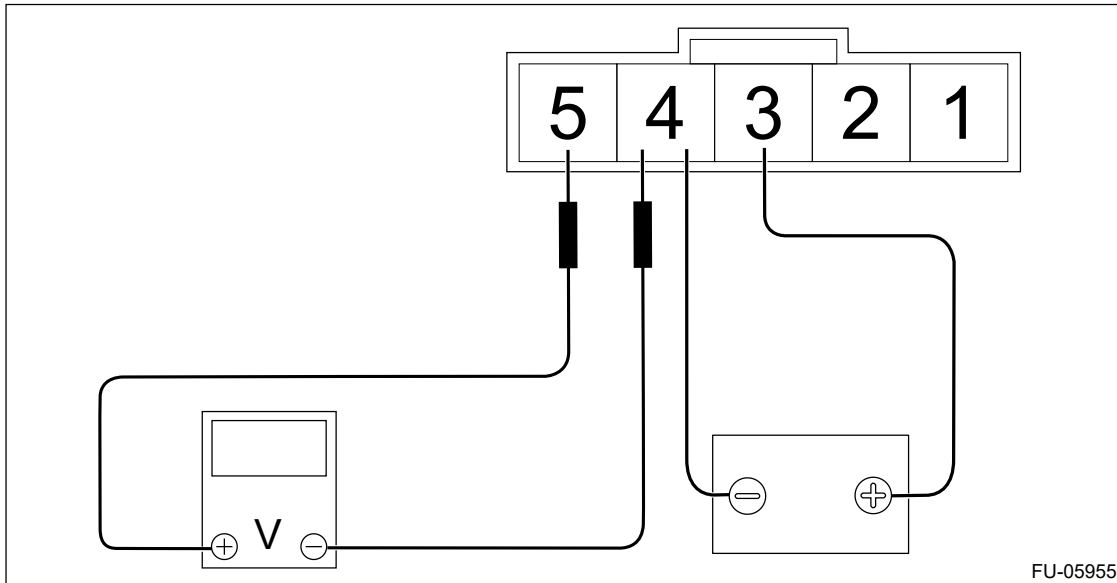
FU-08612

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Mass Air Flow and Intake Air Temperature Sensor

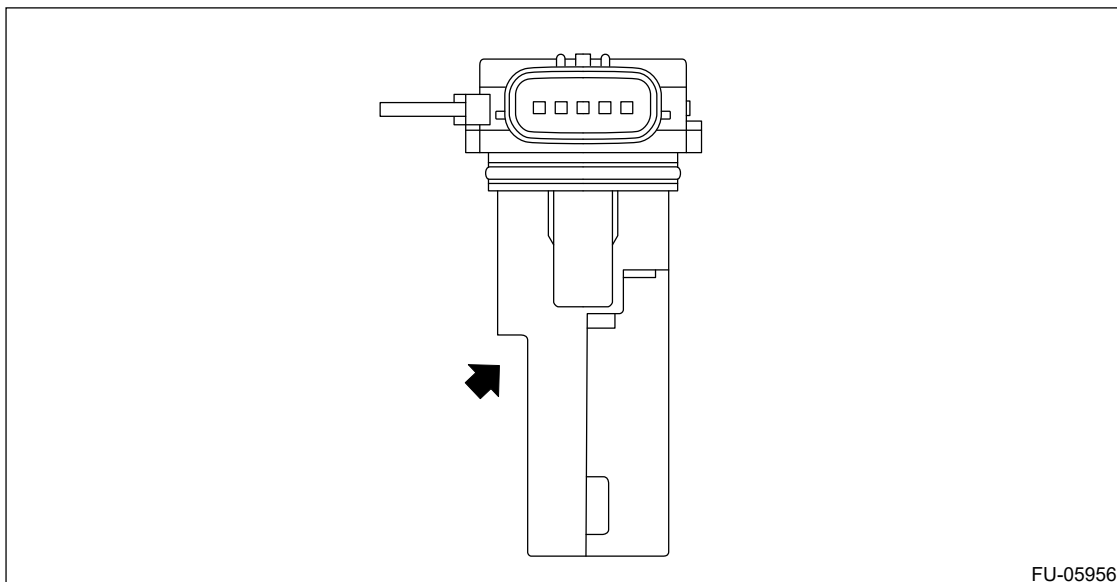
INSPECTION

1. CHECK THE MASS AIR FLOW SENSOR UNIT

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

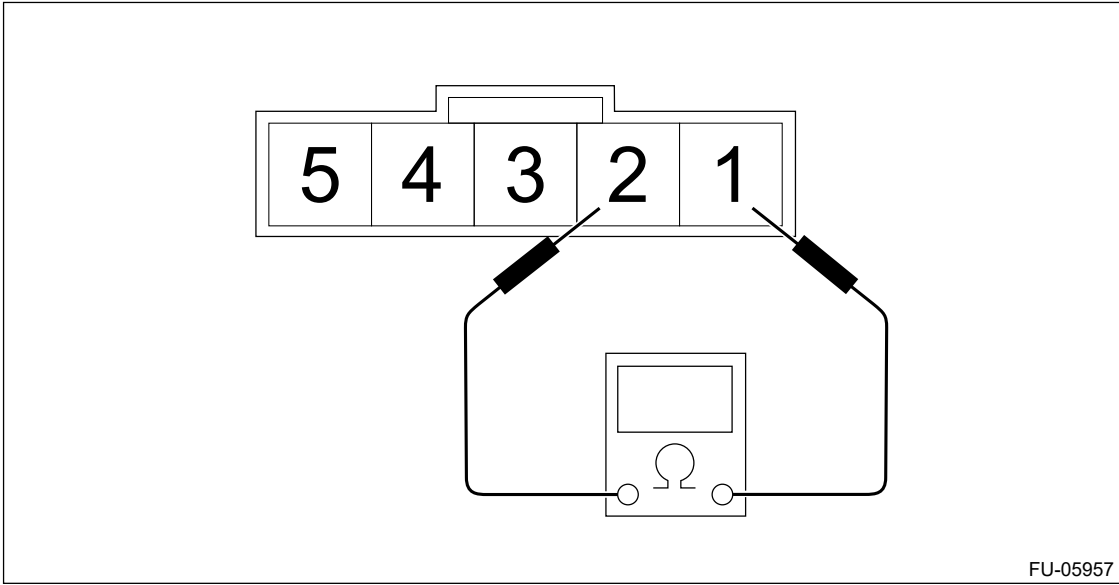


2. Check the voltage changes when air is blown from the arrow pointing area to the mass air flow sensor unit.



2. CHECK THE INTAKE AIR TEMPERATURE SENSOR UNIT

Measure the resistance between intake air temperature sensor terminals.



| Temperature | Terminal No. | Standard |
|--------------|--------------|---------------|
| -20°C (-4°F) | 1 and 2 | 16.0±2.4 kΩ |
| 20°C (68°F) | | 2.45±0.24 kΩ |
| 60°C (140°F) | | 0.58±0.087 kΩ |

3. OTHER INSPECTIONS

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


FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Mass Air Flow and Intake Air Temperature Sensor

INSTALLATION

1. Install the mass air flow and intake air temperature sensor, and connect the connector to the mass air flow and intake air temperature sensor.


Tightening torque:

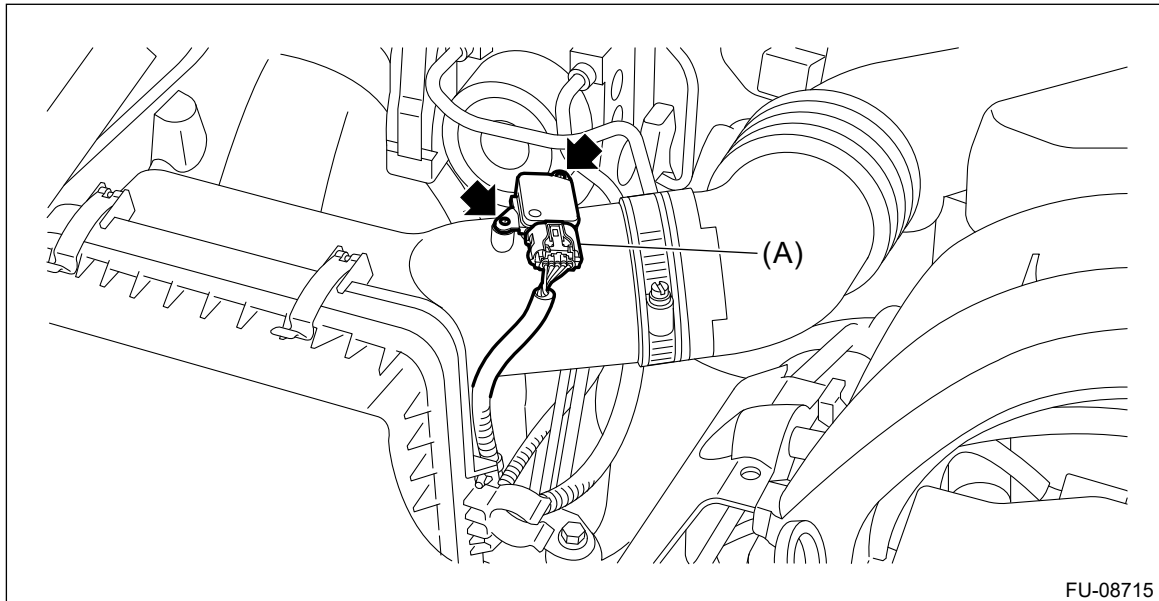
1 N·m (0.1 kgf-m, 0.7 ft-lb)

2. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Mass Air Flow and Intake Air Temperature Sensor

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the mass air flow and intake air temperature sensor.

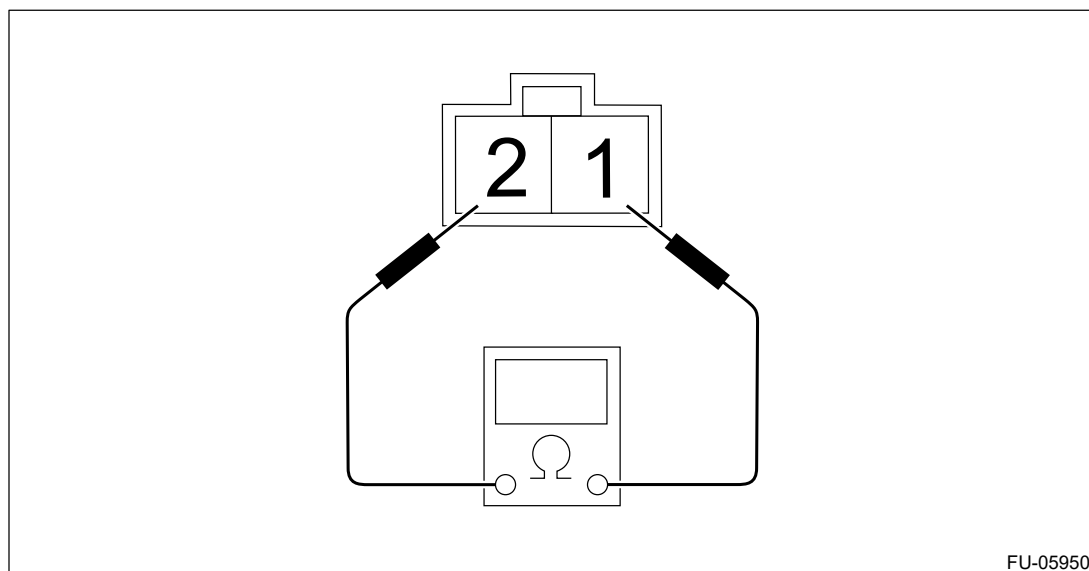


FU-08715

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Oil Control Solenoid

INSPECTION

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



| Terminal No. | Standard |
|--------------|-------------------------------|
| 1 and 2 | 7.25±0.4 Ω (when 20°C (68°F)) |

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Oil Control Solenoid

INSTALLATION




1. Install the intake oil control solenoid to the chain cover, and connect the connector to the intake oil control solenoid.

Note:

- Use new O-rings.
- Apply engine oil to O-ring.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)




2. Install the air intake duct (rear). (RH side only)  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>INSTALLATION.](#)
3. Install the reservoir tank. (LH side only)  [Ref. to COOLING\(H4DO\)>Reservoir Tank>INSTALLATION.](#)
4. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

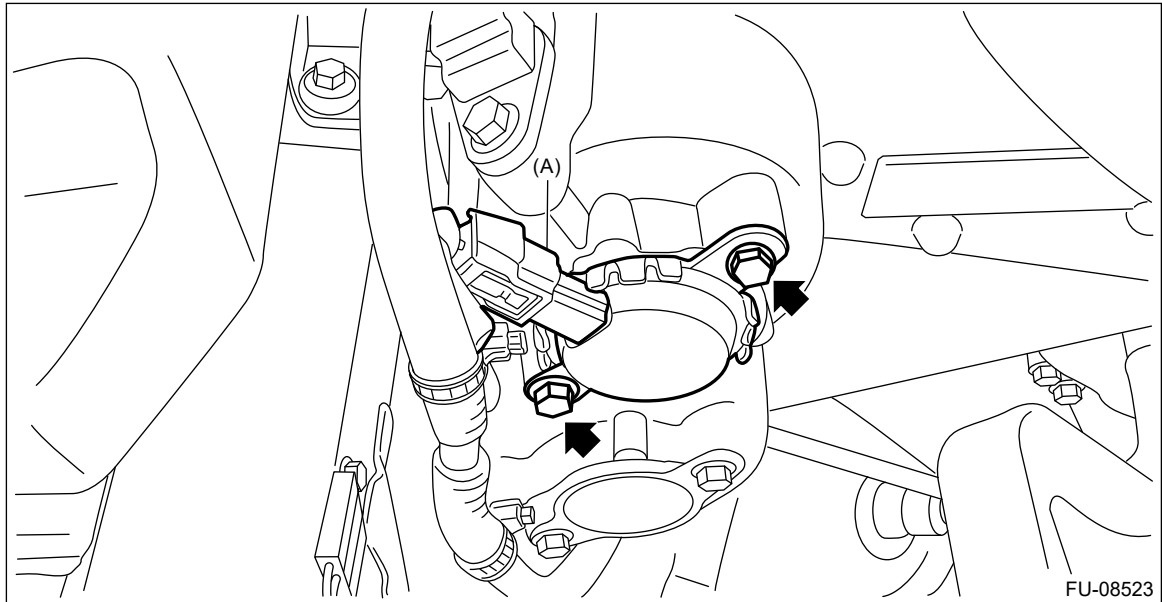
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Oil Control Solenoid

REMOVAL

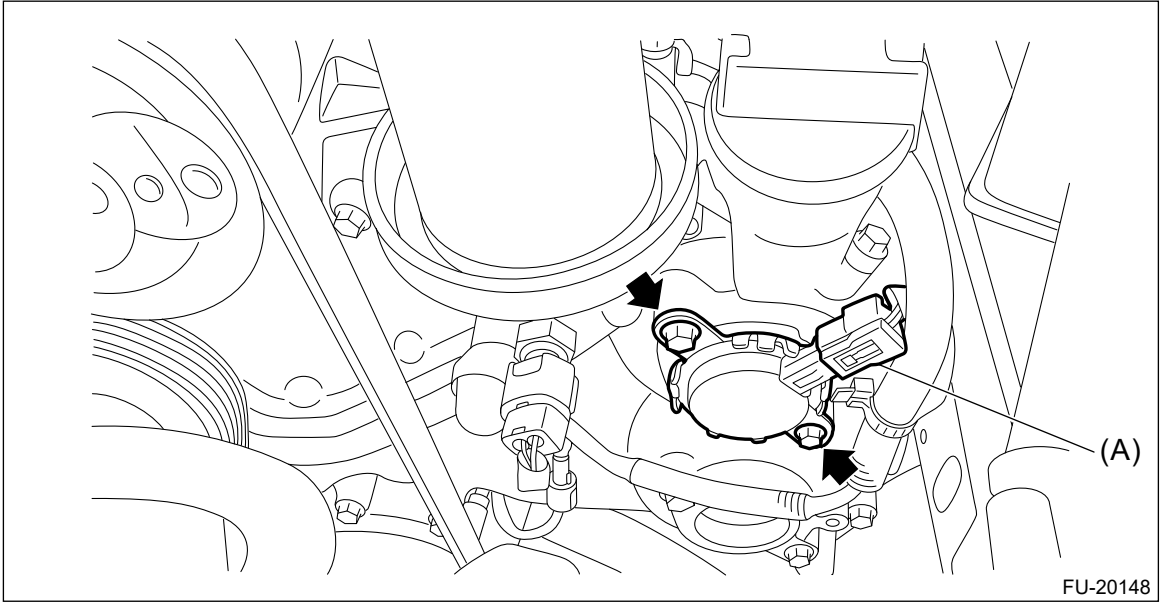
Caution:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emission of smoke or causing a fire.

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct (rear). (RH side only)  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
3. Remove the reservoir tank. (LH side only)  [Ref. to COOLING\(H4DO\)>Reservoir Tank>REMOVAL.](#)
4. Disconnect the connector (A) from the intake oil control solenoid, and remove the intake oil control solenoid from the chain cover.
 - RH side



- LH side

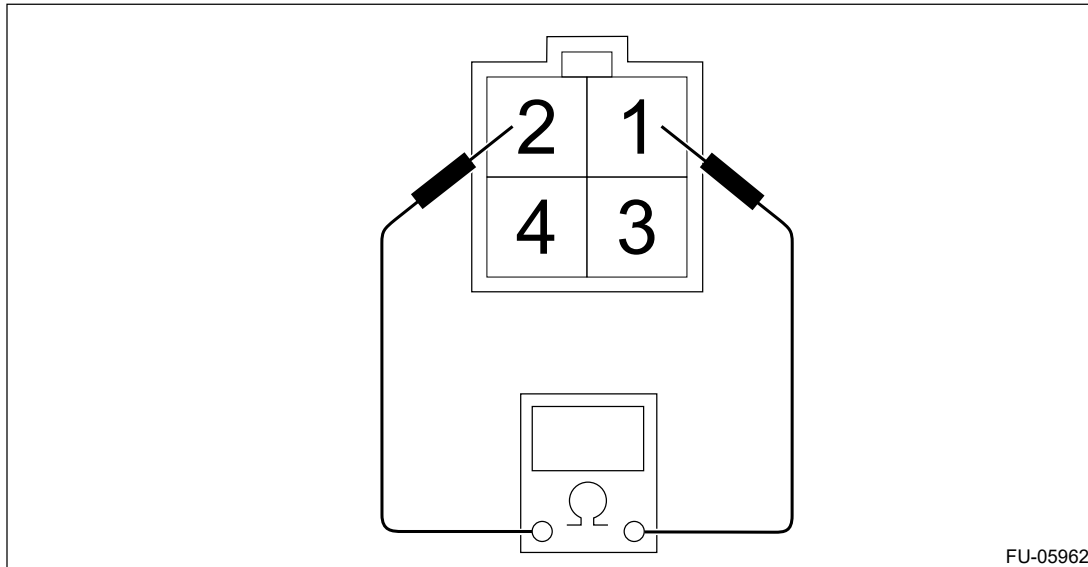


FU-20148

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Rear Oxygen Sensor

INSPECTION

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



| Terminal No. | Standard |
|--------------|---|
| 1 and 2 | $5.6^{+1.7}_{-0.6} \Omega$ (when 20°C (68°F)) |

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Rear Oxygen Sensor

INSTALLATION

Caution:

If lubricant is spilt over the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

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

Caution:

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

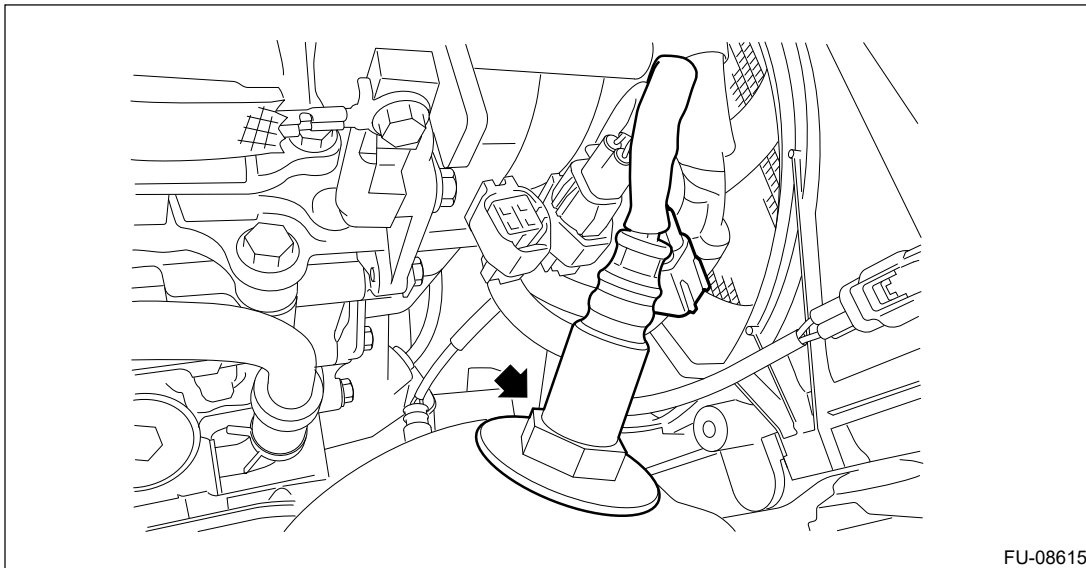
Anti-seize compound:

NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent

2. Install the rear oxygen sensor.

Tightening torque:

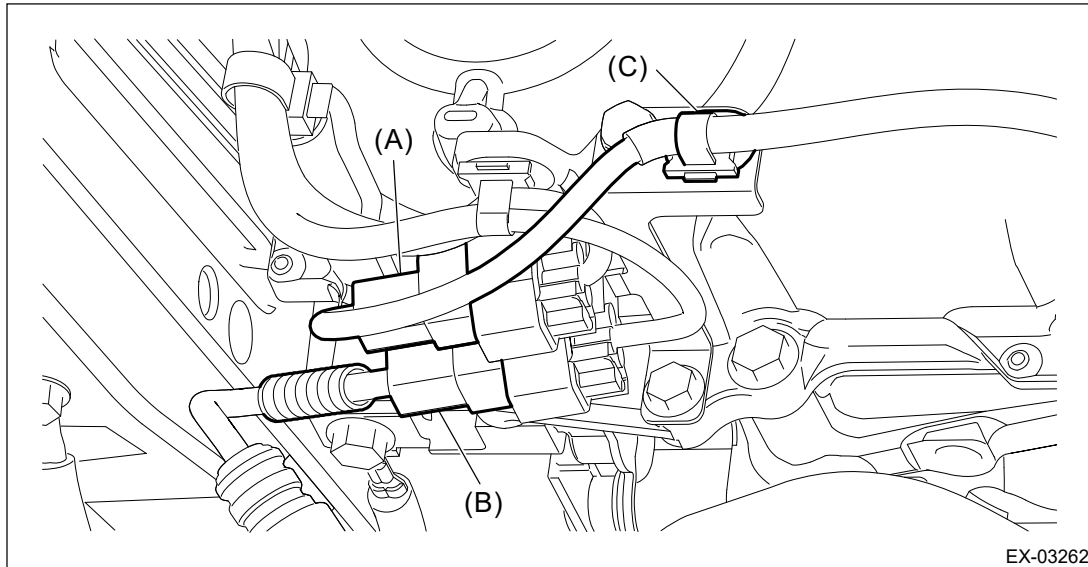
21 N·m (2.1 kgf-m, 15.5 ft-lb)





3. Connect the rear oxygen sensor connector.

Note:

Be careful not to allow the rear oxygen sensor harness to interfere with the sensor unit and the front oxygen (A/F) sensor harness.





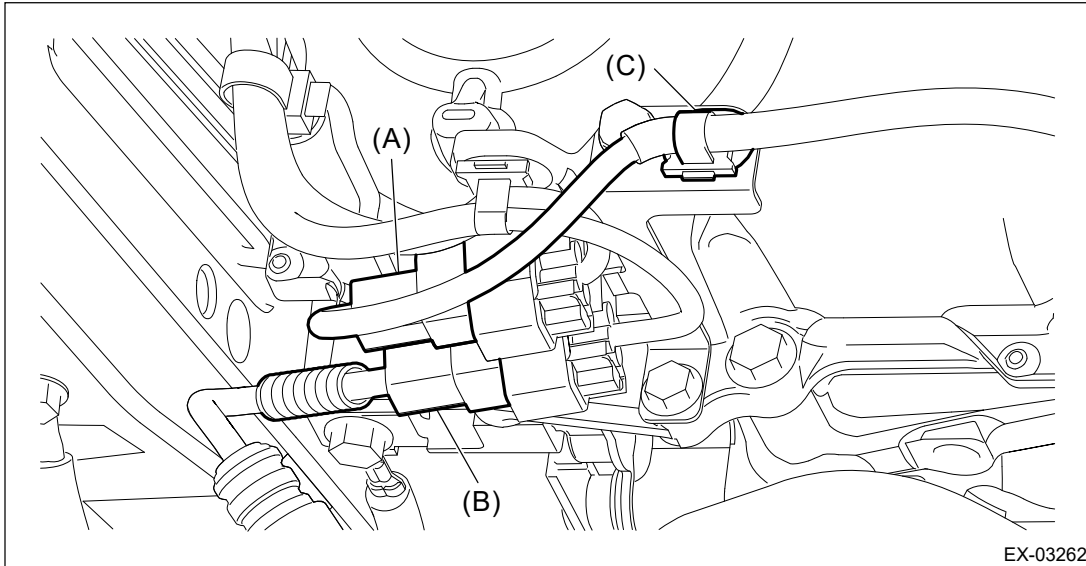
(A) Front oxygen (A/F) sensor (B) Rear oxygen sensor connector (C) Clip connector

- 4.** Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
- 5.** Lower the vehicle.
- 6.** Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Rear Oxygen Sensor

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Lift up the vehicle.
3. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
4. Disconnect the rear oxygen sensor connector.

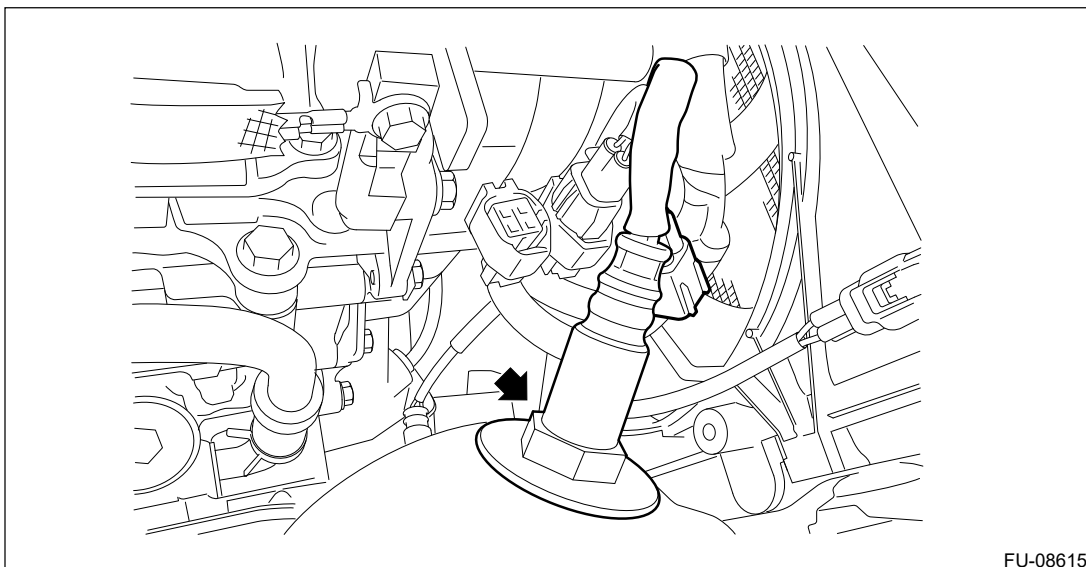


(A) Front oxygen (A/F) sensor (B) Rear oxygen sensor connector (C) Clip connector

5. Apply spray-type lubricant (004301003) or equivalent to the threaded portion of rear oxygen sensor, and leave it for one minute or more.
6. Remove the rear oxygen sensor.

Caution:




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



FUEL INJECTION (FUEL SYSTEMS)(H4DO) > SI-DRIVE (SUBARU Intelligent Drive) Selector

SPECIFICATION

SI-DRIVE (SUBARU Intelligent Drive) selector is integrated as a unit with the cruise control command switch.

For removal, installation and inspection, refer to "Cruise Control Command Switch".  [Ref. to CRUISE CONTROL SYSTEM>Cruise Control Command Switch>REMOVAL.](#)  [Ref. to CRUISE CONTROL SYSTEM>Cruise Control Command Switch>INSTALLATION.](#)  [Ref. to EyeSight>Switches and Harness>INSPECTION.](#)

INSPECTION

1. THROTTLE SENSOR (METHOD WITH CIRCUIT TESTER)

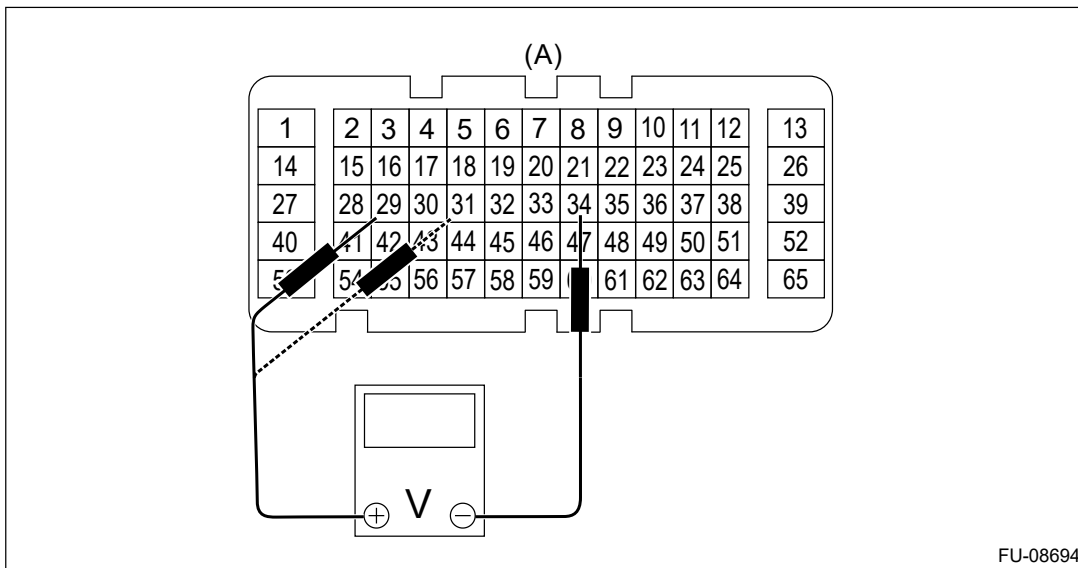
Note:

Individual difference of the accelerator pedal may not be corrected sufficiently on the ECM side after DTCs were cleared or the battery was removed and installed on the vehicle. Therefore, when the reference voltage is not reached after following the procedure, repeat the ignition switch ON (engine OFF) and ignition switch OFF operations 40 times at intervals of three seconds or more, and then measure the voltage again.

1. Disconnect the ground terminal from battery sensor. [🔗 Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the ECM. [🔗 Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Control Module \(ECM\)>REMOVAL.](#)
3. Attach the ST between the ECM and bulkhead wiring harness. [🔗 Ref. to ENGINE \(DIAGNOSTICS\) \(H4DO\)>General Description>CAUTION.](#)

ST 18460AA050 CHECK BOARD

4. Connect the ground terminal to battery sensor. [🔗 Ref. to NOTE>NOTE > BATTERY.](#)
5. Turn the ignition switch to ON. (Engine OFF)
6. Using the ST, measure the voltage between ECM connector terminals when accelerator pedal is fully closed.



(A) To the check board connector (ECM connector)

| Throttle sensor | Accelerator pedal | Terminal No. | Standard |
|-----------------|-----------------------------|-------------------|---------------------|
| Main | Not depressed (full closed) | 29 (+) and 34 (-) | Approx. 0.6 – 1.2 V |
| | Depressed (full opened) | | Approx. 3.8 – 4.4 V |
| Sub | Not depressed (full closed) | 31 (+) and 34 (-) | Approx. 1.4 – 2.0 V |

| | | |
|--|-------------------------|---------------------|
| | Depressed (full opened) | Approx. 4.0 — 4.6 V |
|--|-------------------------|---------------------|

7. Start the engine.
8. Measure the voltage between ECM connector terminals when accelerator pedal is fully open.

Caution:

When depressing the accelerator pedal to fully open, perform it in as short a time as possible, but within the range where the inspection result is not adversely affected.

Note:


Perform the inspection in the following conditions.


- For AT model or CVT model: Select lever is in "P" range.
- For MT model: Gear shift lever is in the neutral position.
- Parking brake activated

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


2. THROTTLE SENSOR (METHOD WITH SUBARU SELECT MONITOR)

Note:

- Individual difference of the accelerator pedal may not be corrected sufficiently on the ECM side after DTCs were cleared or the battery was removed and installed on the vehicle. Therefore, using the Subaru Select Monitor, check that the accelerator opening angle signal indicates 100%, when the accelerator pedal is fully depressed, and then perform the inspection.
- If the accelerator opening angle signal does not indicate 100%, check the accelerator pedal.  [Ref. to SPEED CONTROL SYSTEMS\(H4DO\)>Accelerator Pedal>INSPECTION.](#)

1. Turn the ignition switch to ON. (Engine OFF)
2. Using the Subaru Select Monitor, read the accelerator opening angle signal and throttle sensor voltage when accelerator pedal is fully closed.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

| Throttle sensor | Acceleration opening angle signal | Standard |
|-----------------|-----------------------------------|---------------------|
| Main | 0.0% | Approx. 0.6 — 1.2 V |
| | 100.0% | Approx. 3.8 — 4.4 V |
| Sub | 0.0% | Approx. 1.4 — 2.0 V |
| | 100.0% | Approx. 4.0 — 4.6 V |

3. Start the engine.
4. Using the Subaru Select Monitor, read the accelerator opening angle signal and throttle sensor voltage when accelerator pedal is fully open.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Caution:

When depressing the accelerator pedal to fully open, perform it in as short a time as possible, but within the range where the inspection result is not adversely affected.

Note:

Perform the inspection in the following conditions.

- For AT model or CVT model: Select lever is in "P" range.
- For MT model: Gear shift lever is in the neutral position.
- Parking brake activated

3. OTHER INSPECTIONS

- 1.** Check that the throttle body has no deformation, cracks or other damages.
- 2.** Check that the preheater hose has no cracks, damage or loose part.

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Throttle Body

INSTALLATION




1. Install the throttle body to the intake manifold assembly.

Note:

Use a new gasket.



Tightening torque:

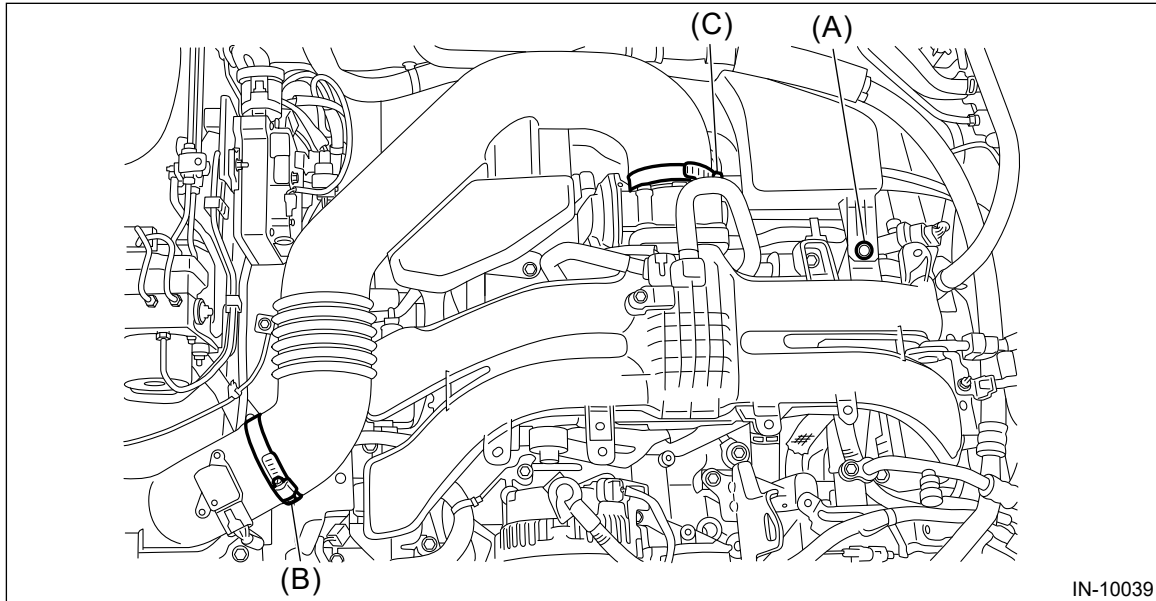
8 N·m (0.8 kgf-m, 5.9 ft-lb)

2. Connect the connector to the throttle position sensor.
3. Connect the preheater hoses to the throttle body.
4. Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)
5. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
6. Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

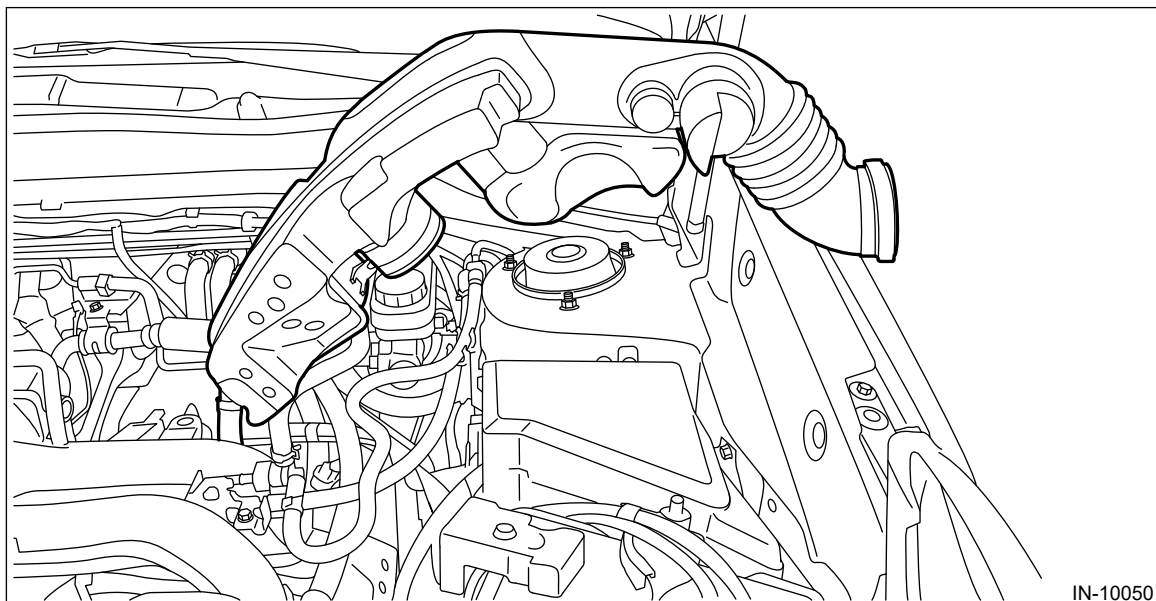
FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Throttle Body

REMOVAL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
3. Remove the clip (A) from the air intake boot.
4. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
5. Loosen the clamp (C) which secures the throttle body to the air intake boot.

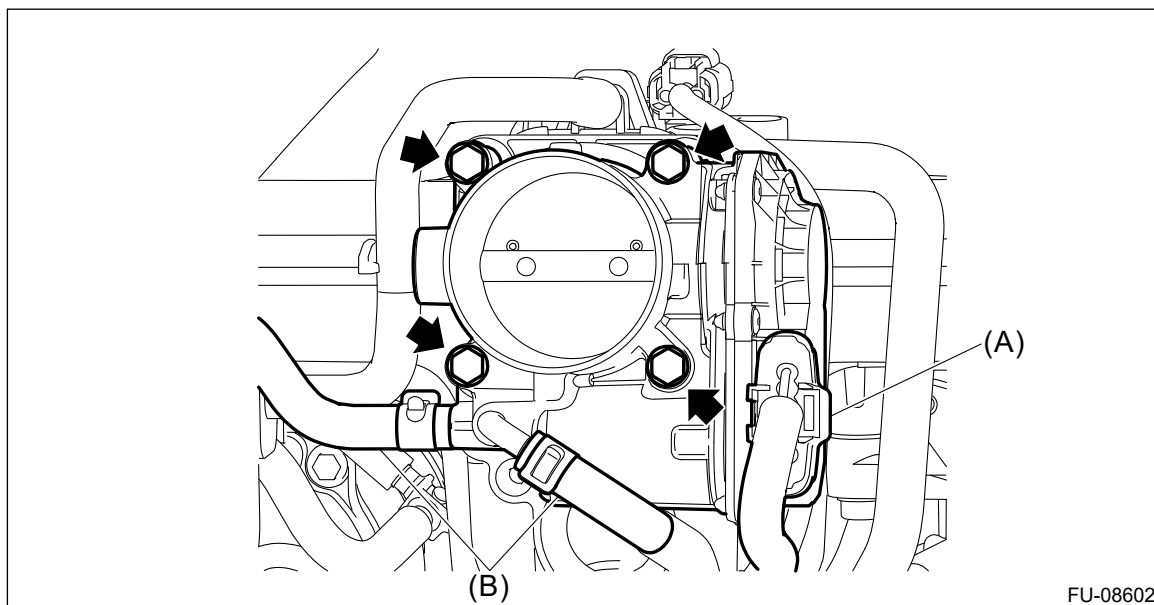


6. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.



7. Disconnect the connectors (A) from the throttle position sensor.
8. Disconnect the preheater hose (B) from the throttle body.

9. Remove the throttle body from the intake manifold assembly.





FU-08602

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Throttle Position Sensor

SPECIFICATION



Throttle body is a non-disassembled part, so do not remove the throttle position sensor from throttle body.

Refer to "Throttle Body" for removal and installation procedure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Throttle Body>REMOVAL.](#)  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Throttle Body>INSTALLATION.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Tumble Generator Valve Actuator

SPECIFICATION



The tumble generator valve actuator must not be removed from the intake manifold assembly since it is integrated in the intake manifold assembly.

Refer to "Intake Manifold Assembly" for removal and installation.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>REMOVAL.](#)  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>INSTALLATION.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DO) > Tumble Generator Valve

SPECIFICATION

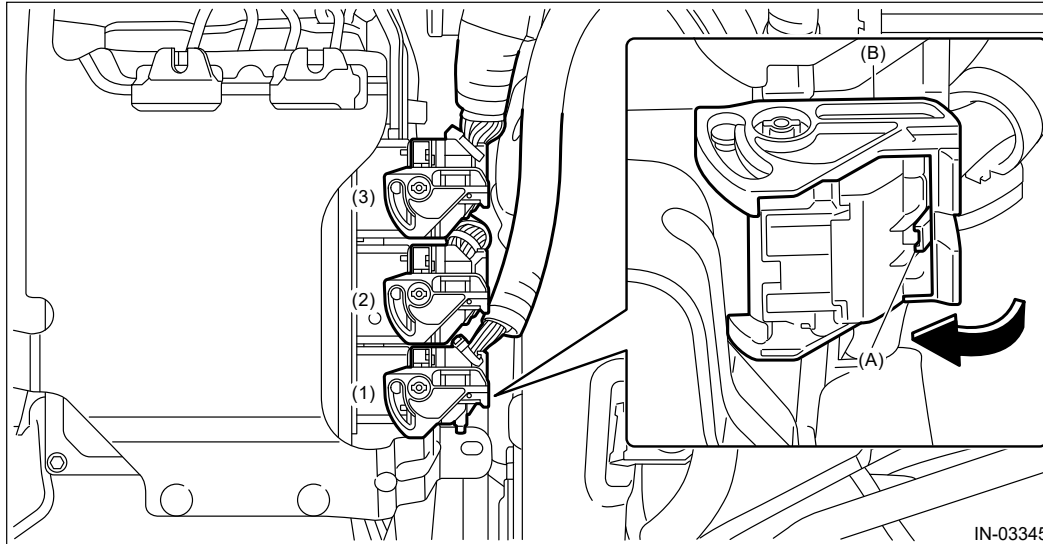
The tumble generator valve is integrated in the intake manifold assembly.


Refer to "Intake Manifold Assembly" for removal and installation.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>REMOVAL.](#)  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>INSTALLATION.](#)

INSPECTION

1. CAMSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

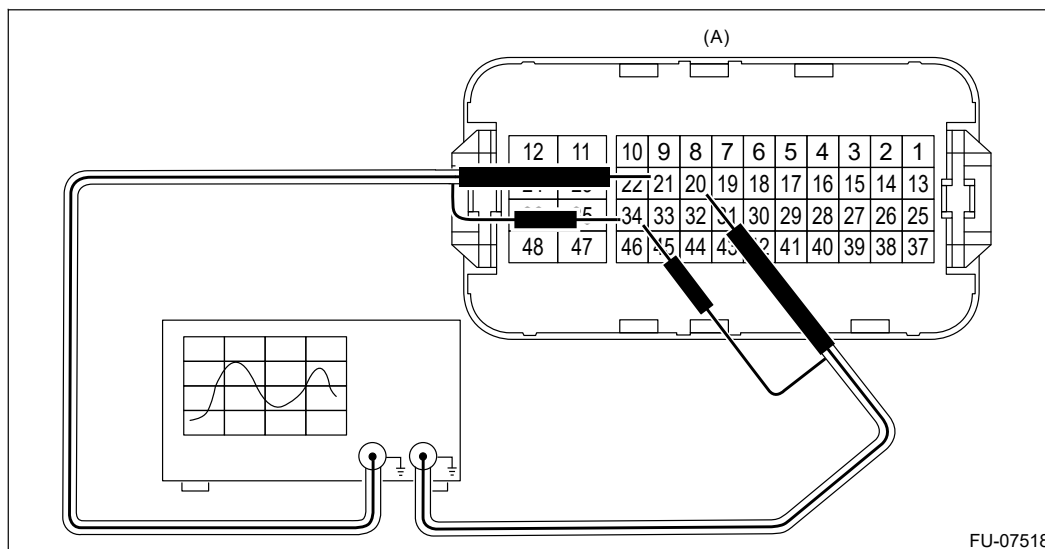
1. Disconnect the ground cable from battery.
2. Prepare an oscilloscope.
3. While pressing the section (A) shown in the figure, move the lock lever (B) in the direction of the arrow to disconnect the connectors from the ECM in numerical order as shown in the figure.



4. Install the special tool between the ECM and body harness and the engine harness.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>General Description>CAUTION.](#)

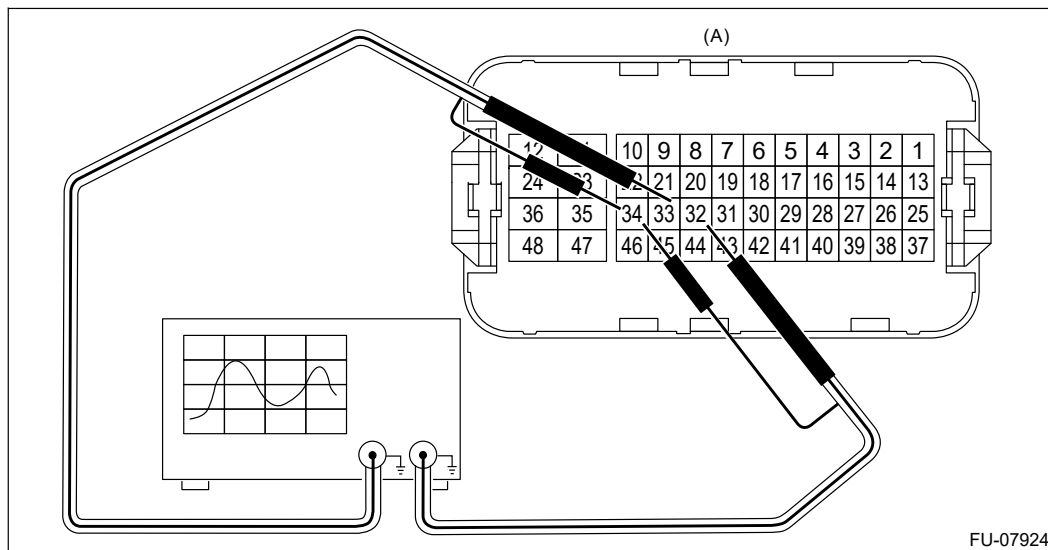
ST 18460AA030 CHECK BOARD

5. Connect the battery ground terminal.
6. Connect the probe to ST.
 - Intake camshaft position sensor



(A) To the check board connector
(ECM connector)

- Exhaust camshaft position sensor



(A) To the check board connector
(ECM connector)

| Camshaft position sensor | | Terminal No. | Probe |
|--------------------------|----|--------------|-------|
| Intake | RH | 20 | + |
| | LH | 21 | + |
| Exhaust | RH | 32 | + |
| | LH | 33 | + |
| RH and LH | | 34 | - |

7. Start the engine and let it idle.
8. Check the waveforms and voltage.

Note:

For waveform and voltage, refer to "Control Module I/O Signal".  Ref. to [ENGINE \(DIAGNOSTICS\)\(H4DO\)>Engine Control Module \(ECM\) I/O Signal>ELECTRICAL SPECIFICATION.](#)

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

2. OTHER INSPECTIONS

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

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Camshaft Position Sensor

INSTALLATION

Install in the reverse order of removal.

Note:


- **Use new O-rings.**
- **Apply engine oil to O-ring.**

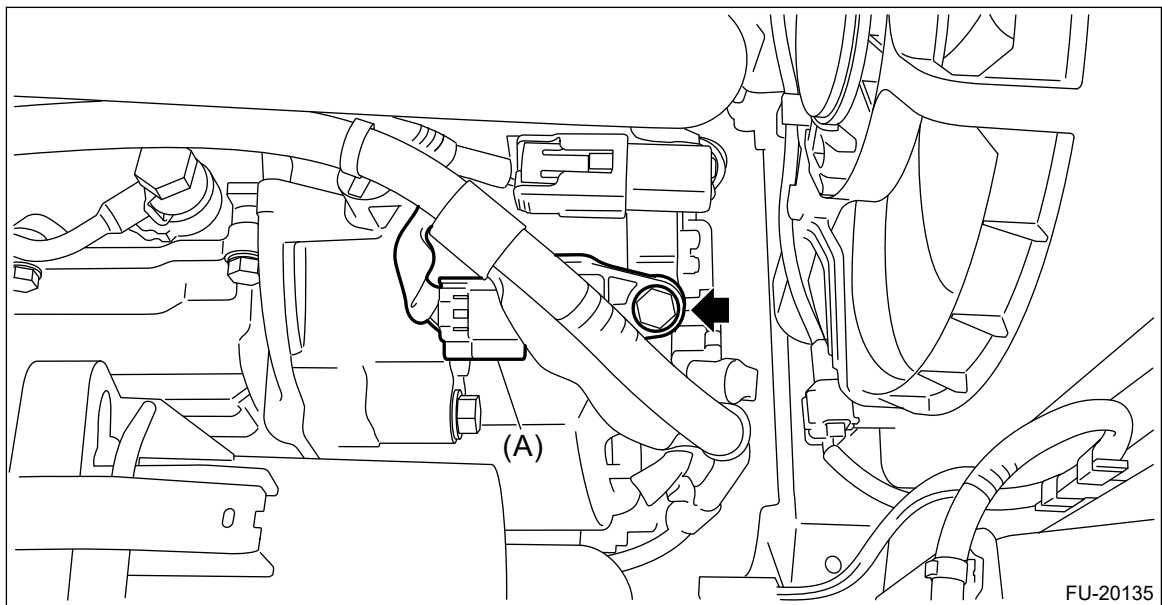
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

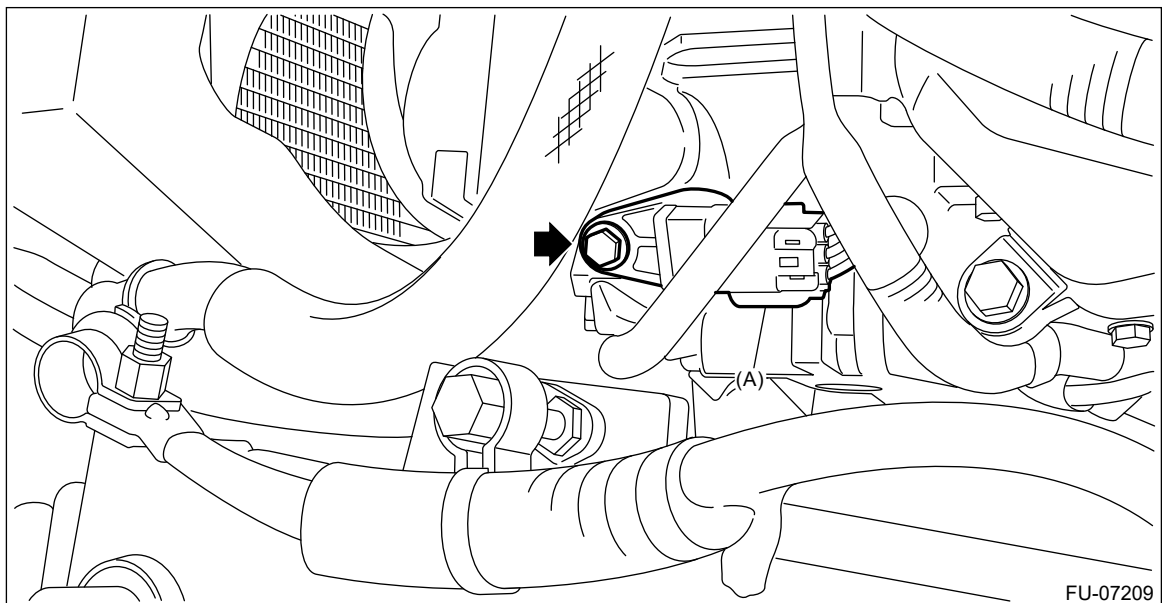
REMOVAL

1. INTAKE SIDE


1. Disconnect the ground cable from battery.
2. Remove the air intake duct (rear). (RH side only)  [Ref. to INTAKE \(INDUCTION\) \(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
3. Disconnect the connector (A) from the camshaft position sensor, and remove the camshaft position sensor from the chain cover.
 - RH side

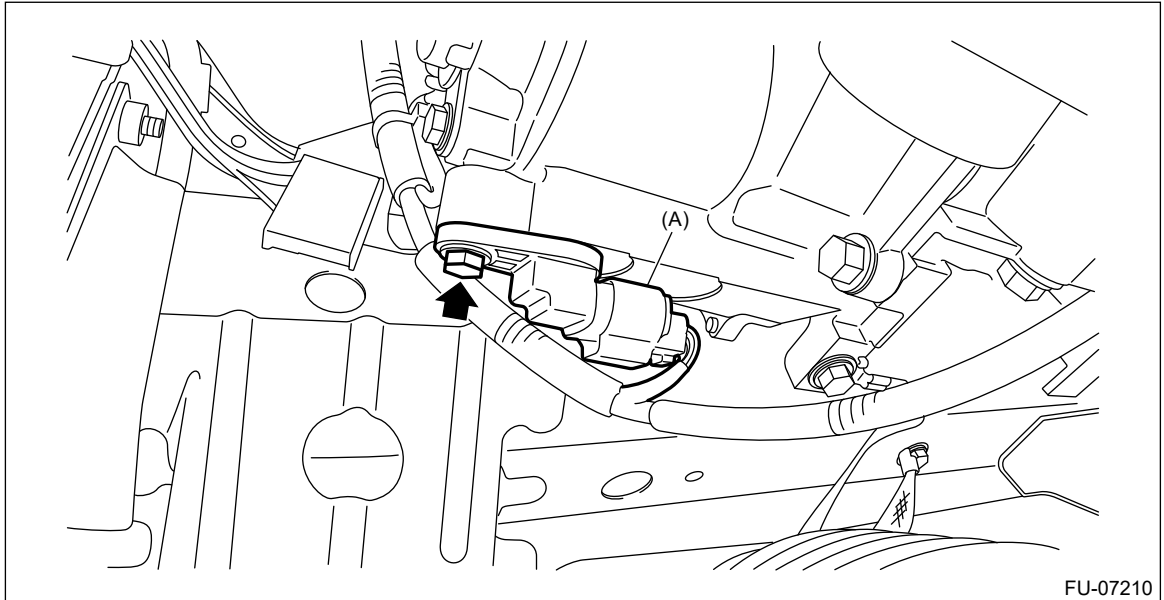


- LH side

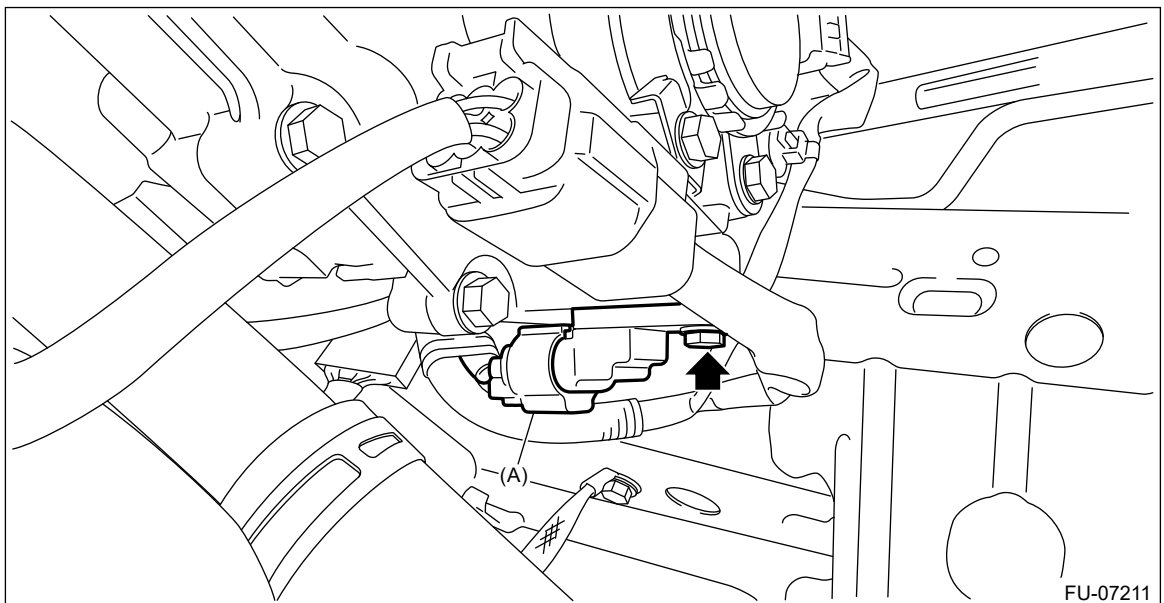


2. EXHAUST SIDE

1. Disconnect the ground cable from battery.
2. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
3. Disconnect the connector (A) from the camshaft position sensor, and remove the camshaft position sensor from the chain cover.
 - RH side



- LH side




FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Crankshaft Position Sensor Plate

INSPECTION

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


FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Crankshaft Position Sensor Plate

INSTALLATION

The crankshaft position sensor plate is tightened together with the drive plate; therefore, refer to "Drive Plate" for installation procedure.  [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR690\)>Drive Plate>INSTALLATION.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Crankshaft Position Sensor Plate

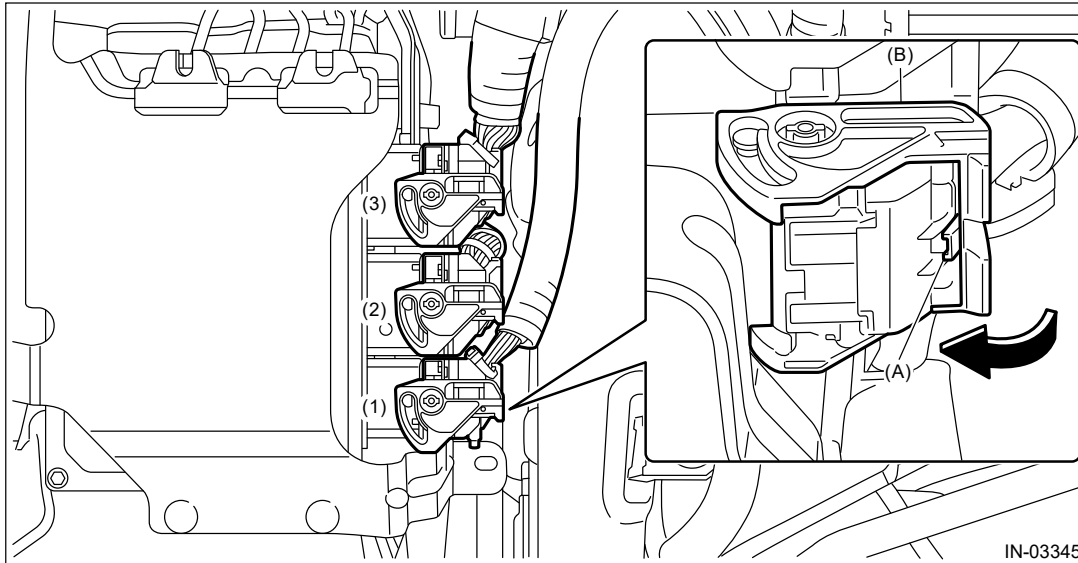
REMOVAL

The crankshaft position sensor plate is tightened together with the drive plate; therefore, refer to "Drive Plate" for removal procedure.  [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR690\)>Drive Plate>REMOVAL.](#)


INSPECTION

1. CRANKSHAFT POSITION SENSOR (METHOD WITH OSCILLOSCOPE)

1. Disconnect the ground cable from battery.
2. Prepare an oscilloscope.
3. While pressing the section (A) shown in the figure, move the lock lever (B) in the direction of the arrow to disconnect the connectors from the ECM in numerical order as shown in the figure.

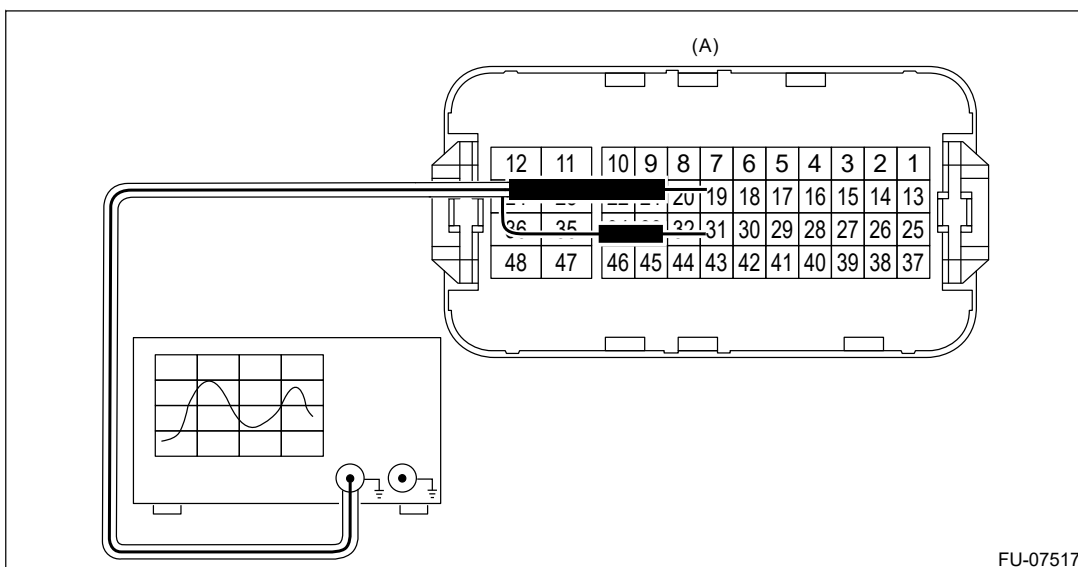


IN-03345

4. Install the special tool between the ECM and body harness and the engine harness.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>General Description>CAUTION.](#)

ST 18460AA030 CHECK BOARD

5. Connect the battery ground terminal.
6. Connect the probe to ST.



FU-07517

(A) To the check board connector

(ECM connector)

| Terminal No. | Probe |
|--------------|-------|
| 19 | + |
| 31 | - |

7. Start the engine and let it idle.
8. Check the waveforms and voltage.

Note:

For waveform and voltage, refer to "Control Module I/O Signal".  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Engine Control Module \(ECM\) I/O Signal>ELECTRICAL SPECIFICATION.](#)

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

2. OTHER INSPECTIONS

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

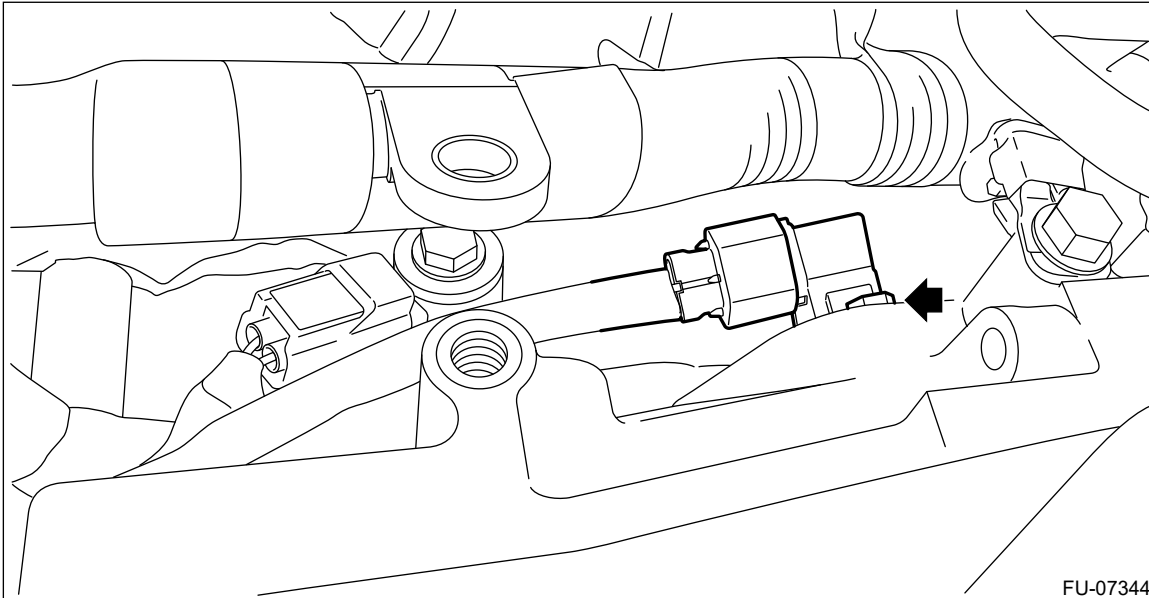
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Crankshaft Position Sensor

INSTALLATION

Install in the reverse order of removal.

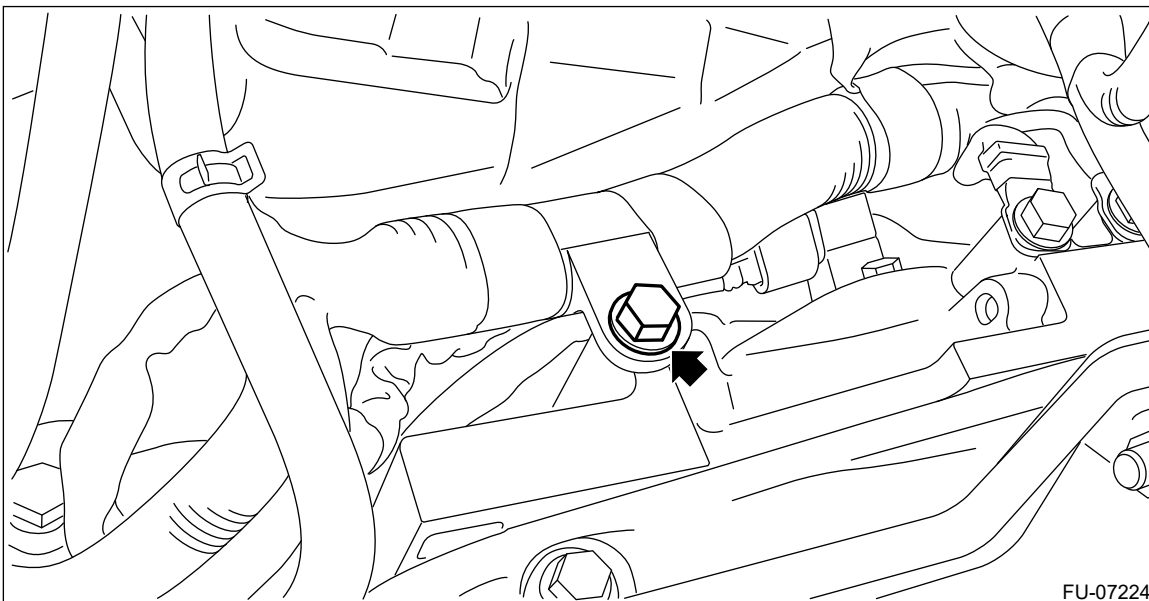
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



Tightening torque:

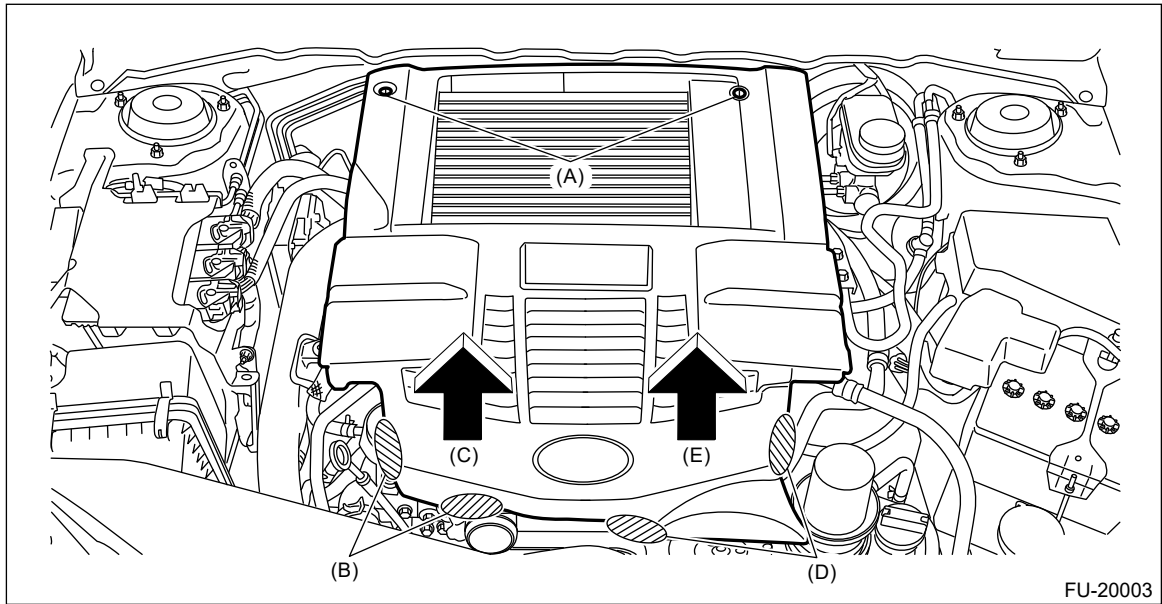
19 N·m (1.9 kgf-m, 14.0 ft-lb)



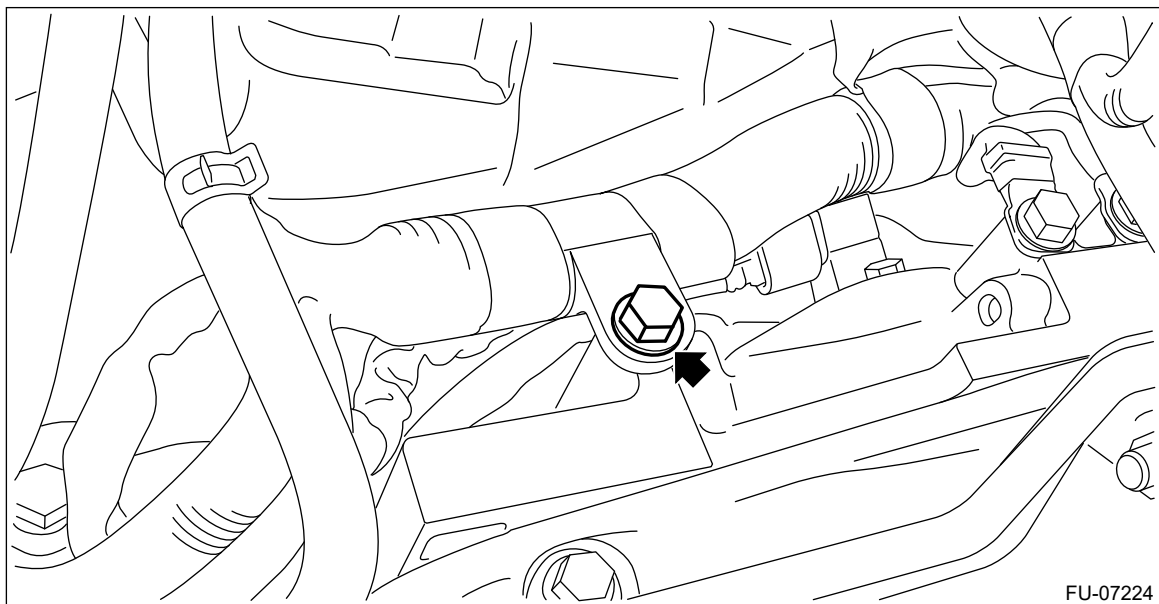
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Crankshaft Position Sensor

REMOVAL

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.

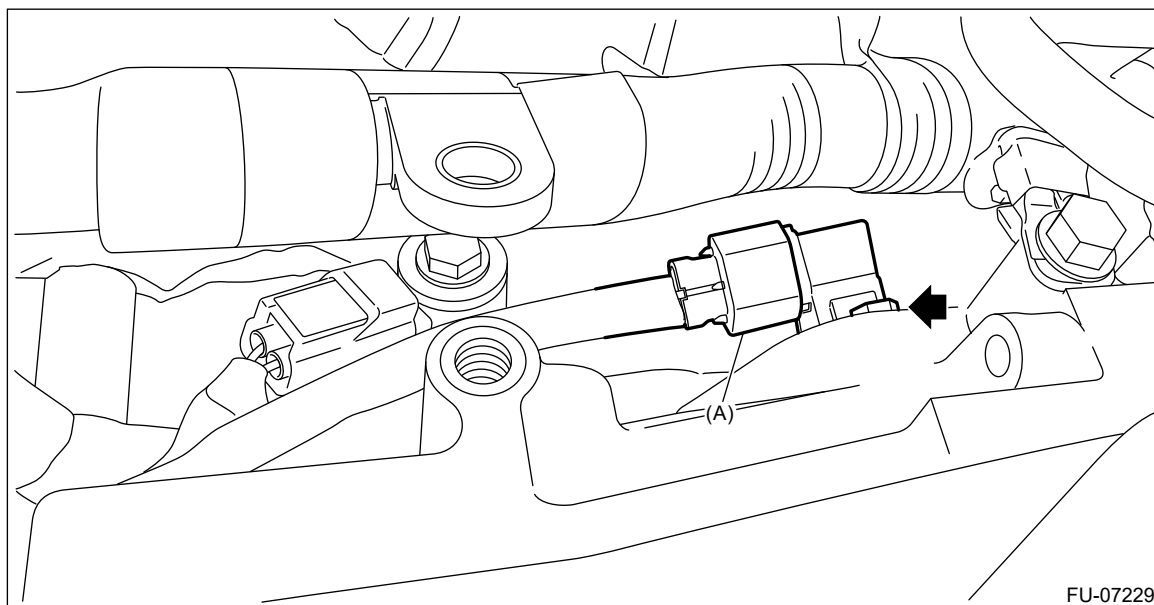


2. Disconnect the ground cable from battery.
3. Remove the intercooler. [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
4. Remove the throttle body. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Throttle Body>REMOVAL.](#)
5. Remove the bolts securing the engine harness.



6. Disconnect the connector (A) from the crankshaft position sensor, and remove the crankshaft

position sensor from the cylinder block.

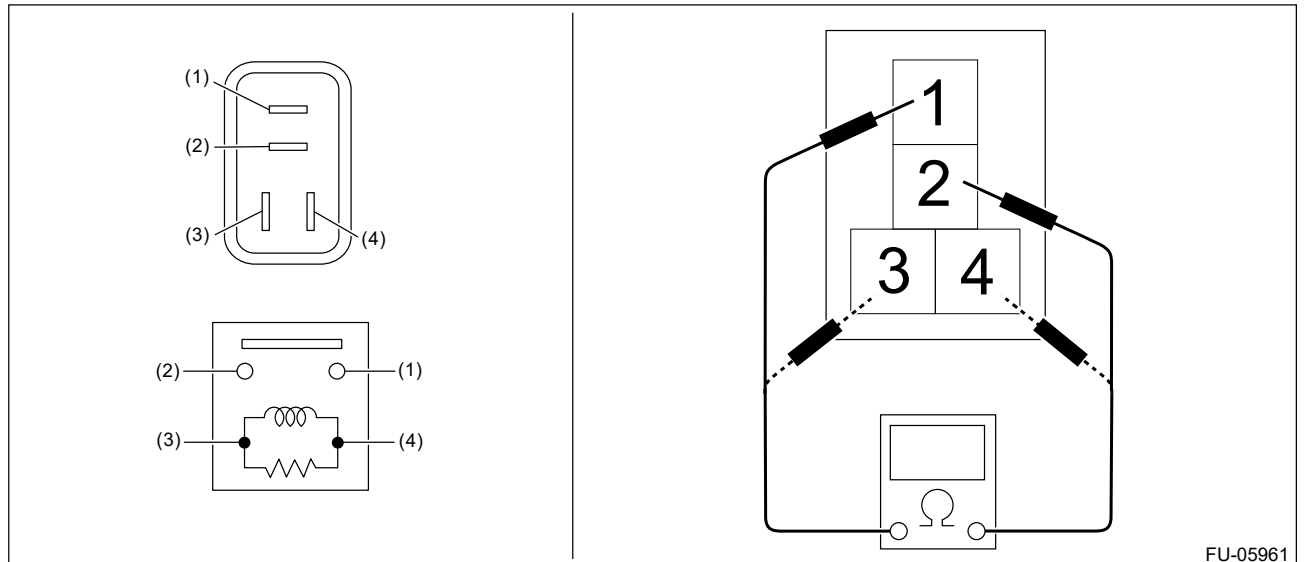


FU-07229

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Electronic Throttle Control Relay

INSPECTION

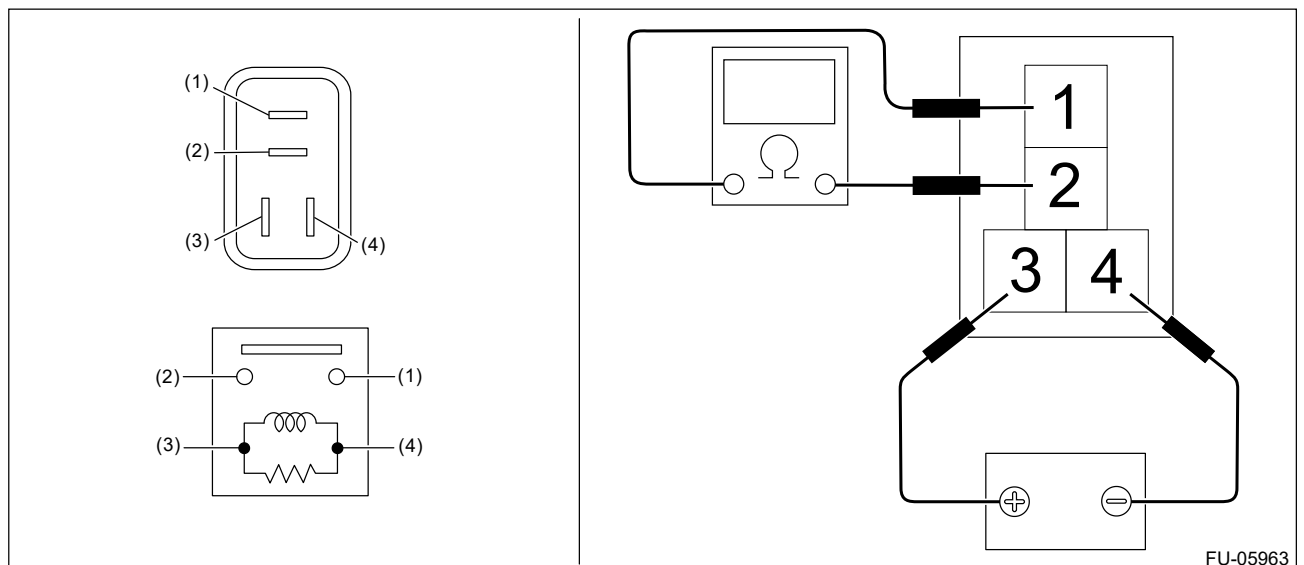
1. Check that the electronic throttle control relay has no deformation, cracks or other damages.
2. Measure the resistance between electronic throttle control relay terminals.



FU-05961

| Terminal No. | Standard |
|--------------|--|
| 1 and 2 | 1 M Ω or more |
| 3 and 4 | 93.8—136.4 Ω (when 20°C (68°F)) |

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



FU-05963

| Terminal No. | Standard |
|--------------|----------------------|
| 1 and 2 | Less than 1 Ω |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Electronic Throttle Control Relay

INSTALLATION


Install in the reverse order of removal.

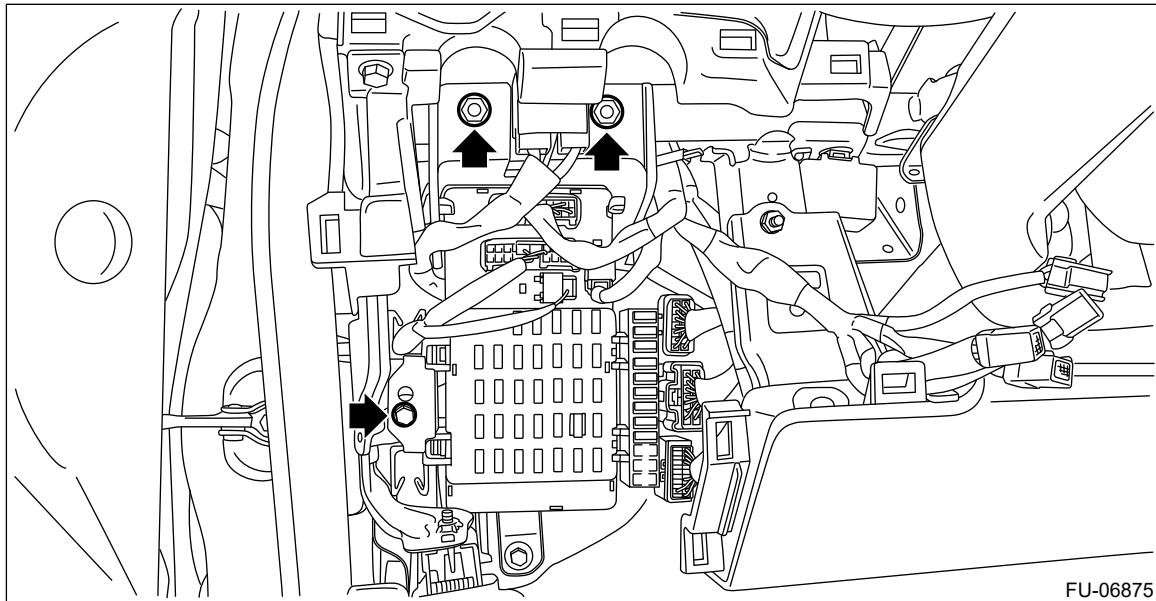
Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

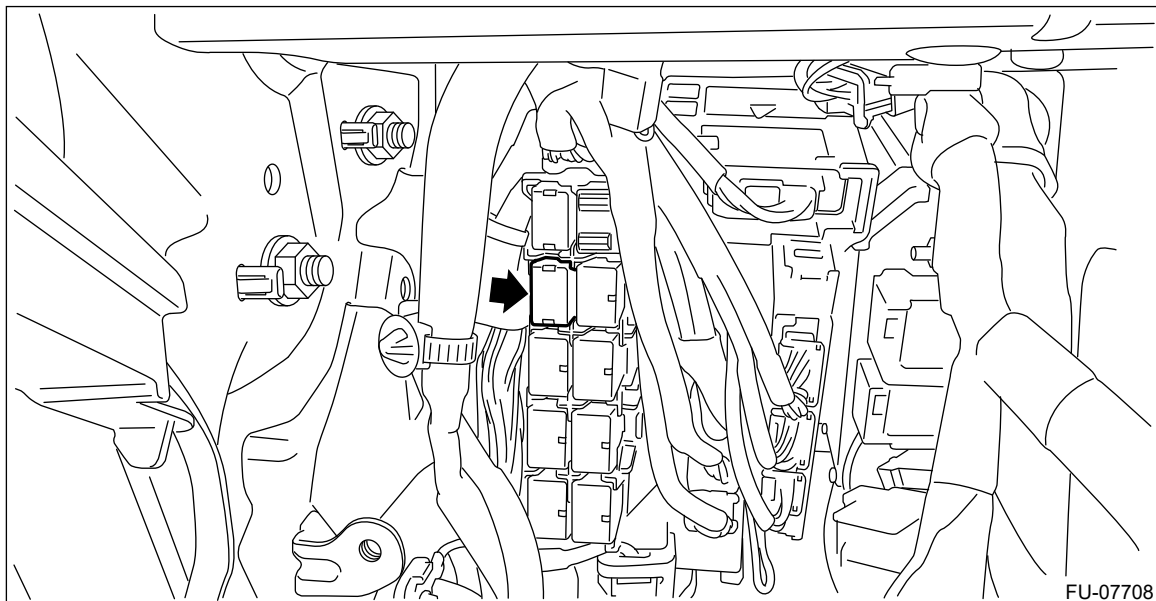
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Electronic Throttle Control Relay

REMOVAL

1. Disconnect the ground cable from battery.
2. Remove the instrument panel lower cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Instrument Panel Lower Cover>REMOVAL.](#)
3. Remove the nut and bolt, and move the fuse block downwards.



4. Remove the electronic throttle control relay from the relay block.



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Control Module (ECM)

INSPECTION


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

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Control Module (ECM)

INSTALLATION

Install in the reverse order of removal.

Caution:

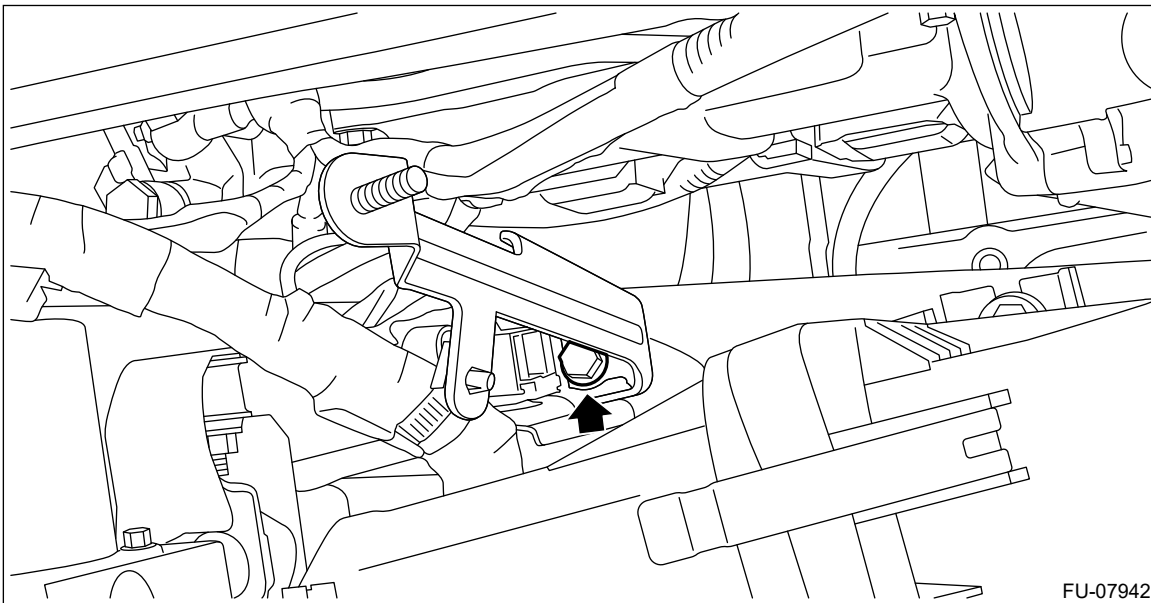
- When the ECM of model with immobilizer has been replaced, be sure to perform the registration of immobilizer system.
 - For model without keyless access with push button start, refer to the Type B in "REGISTRATION MANUAL FOR IMMOBILIZER".
 - For model with keyless access with push button start, refer to the Type D in "REGISTRATION MANUAL FOR IMMOBILIZER".
- When the ECM has been replaced, be sure to perform the registration of VIN. 
[Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Subaru Select Monitor>OPERATION > V.I.N REGISTRATION.](#)

Note:

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

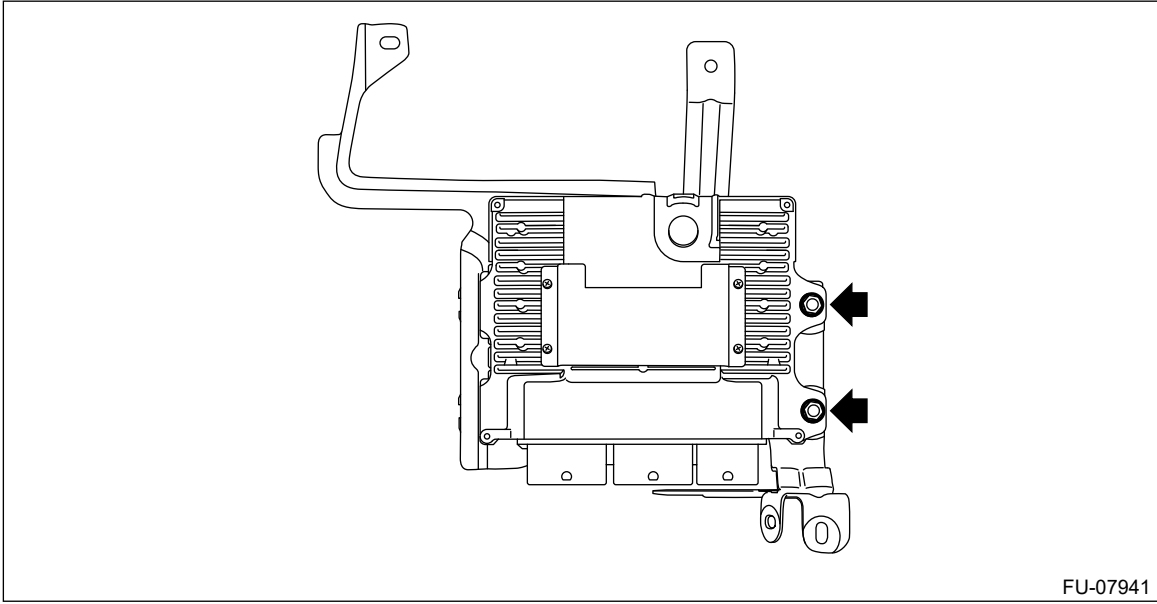
Tightening torque:

33 N•m (3.4 kgf-m, 24.3 ft-lb)

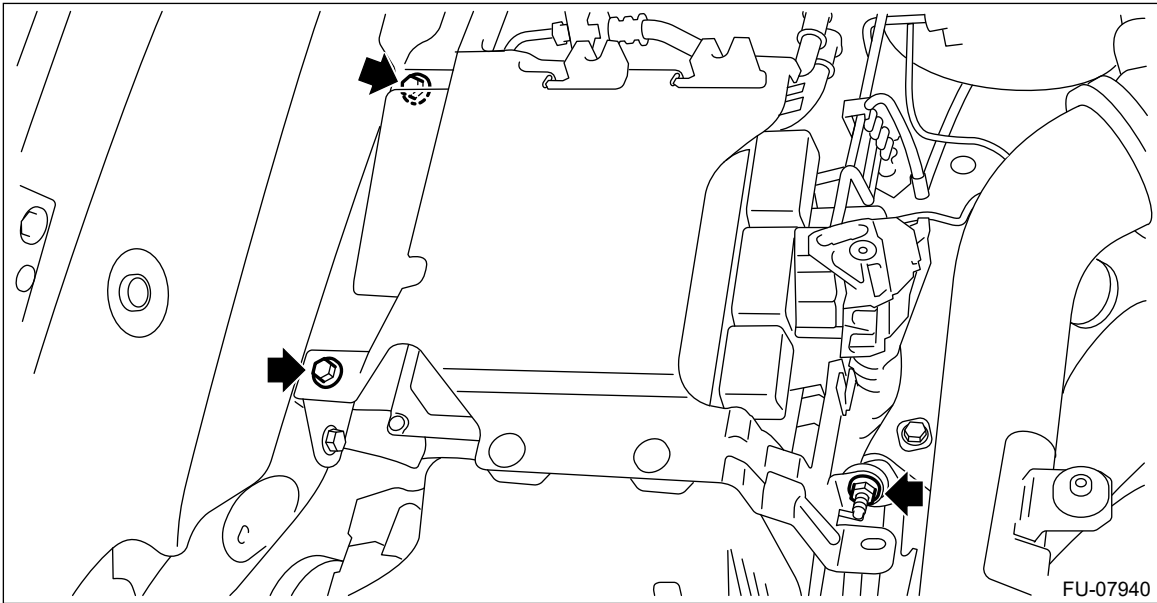


Tightening torque:

7.5 N•m (0.8 kgf-m, 5.5 ft-lb)



FU-07941

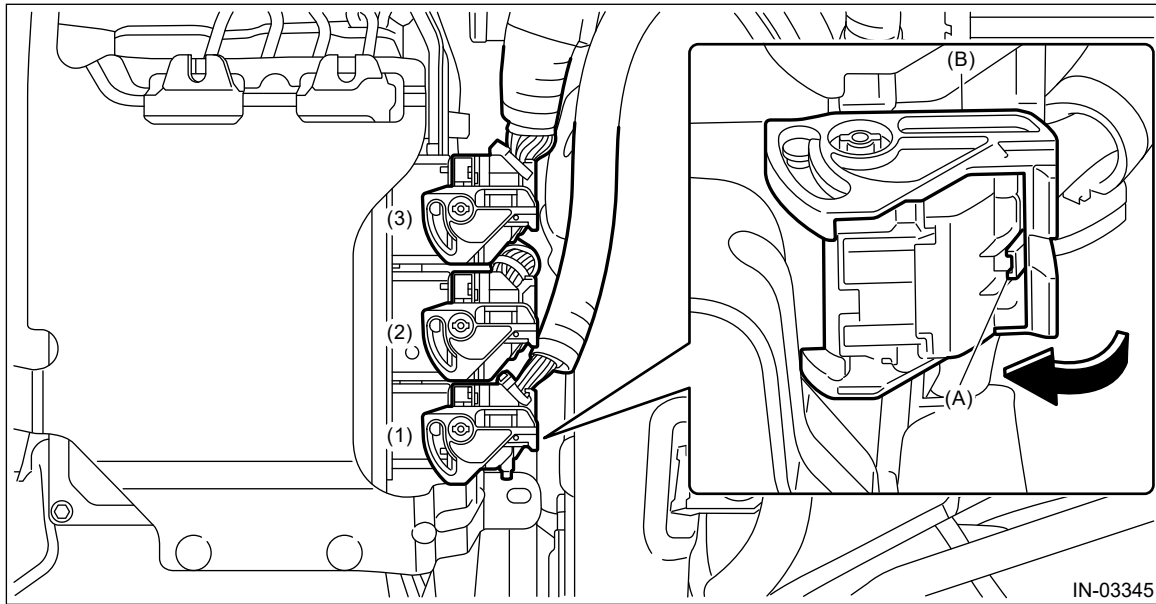


FU-07940

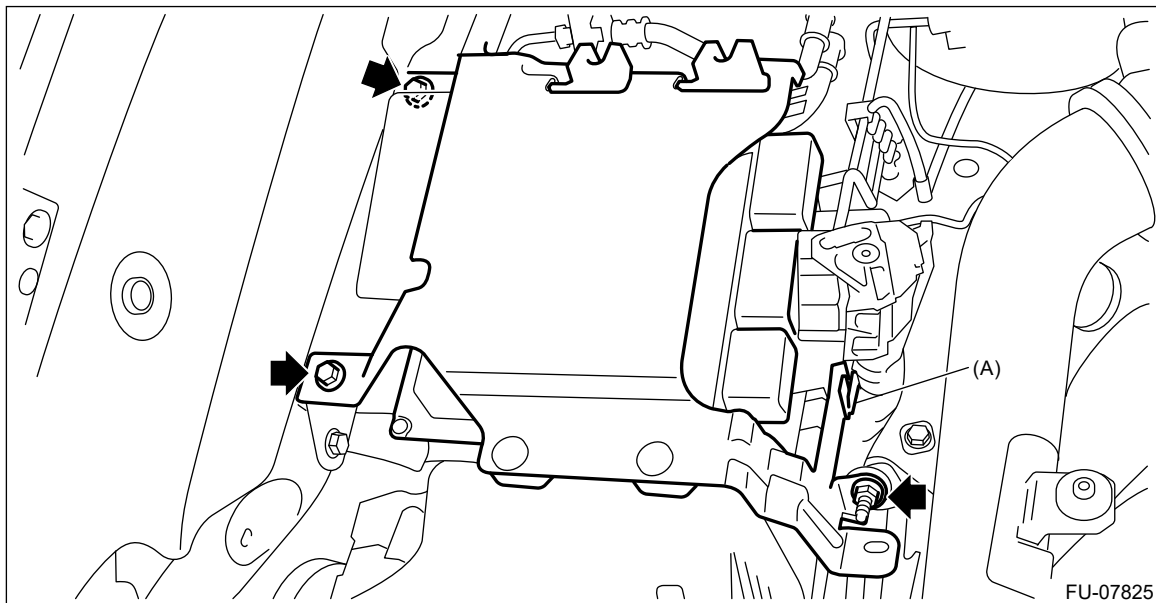
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Control Module (ECM)

REMOVAL

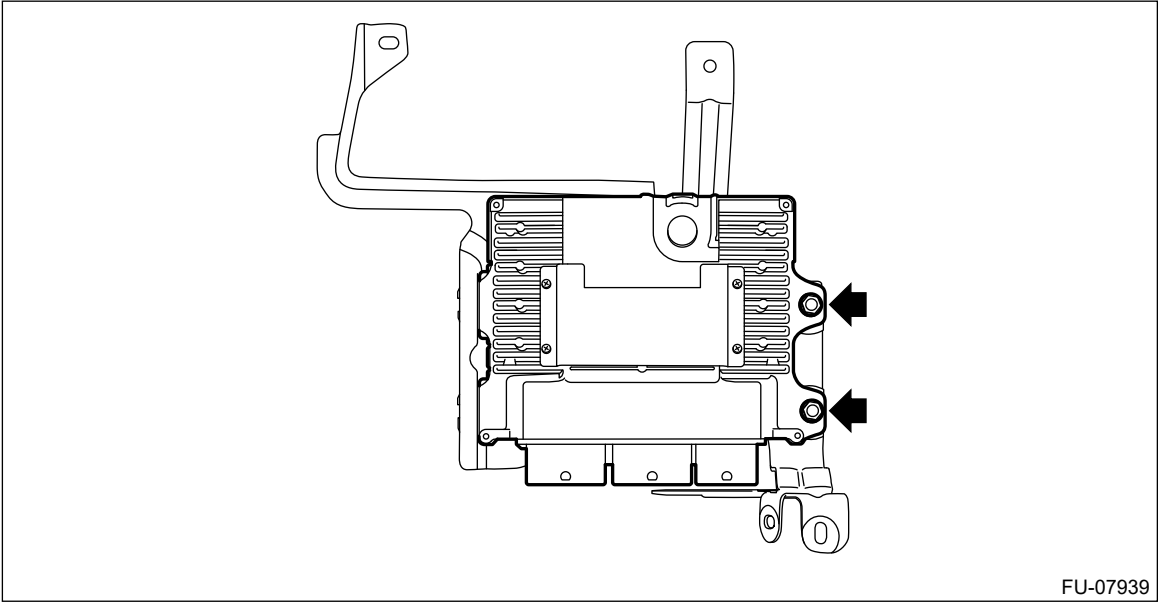
1. Disconnect the ground cable from battery.
2. While pressing the section (A) shown in the figure, move the lock lever (B) in the direction of the arrow to disconnect the connectors from the ECM in numerical order as shown in the figure.



3. Remove the bolt, nut, and clip (A), and remove the ECM.

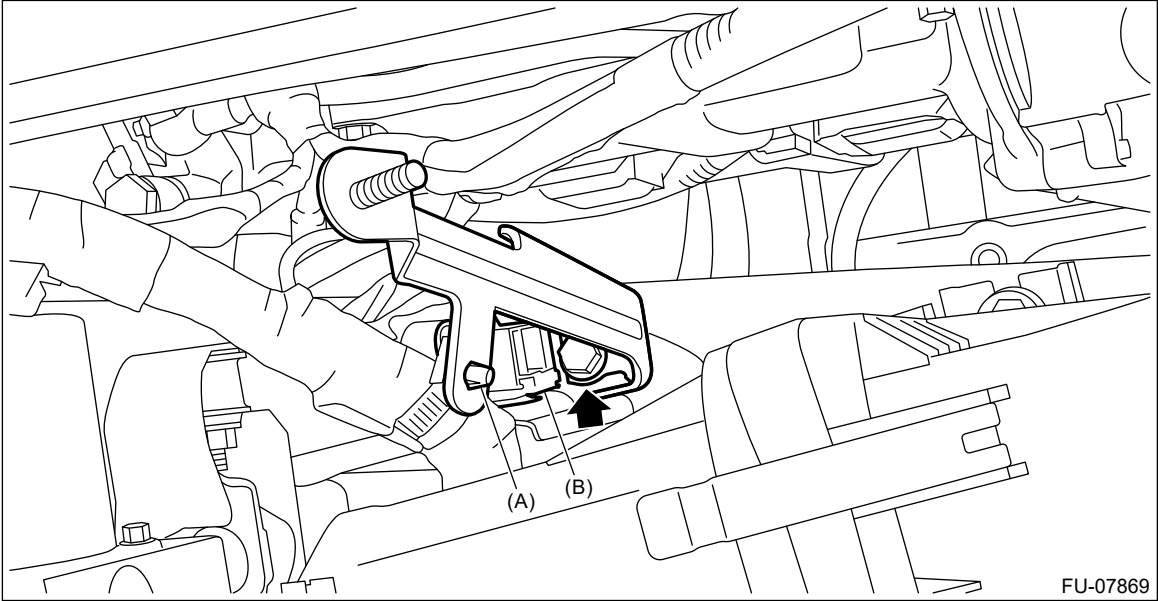


4. Remove the ECM from the bracket.



FU-07939

5. Remove clip (A) and connector (B), and remove the ECM bracket.



FU-07869

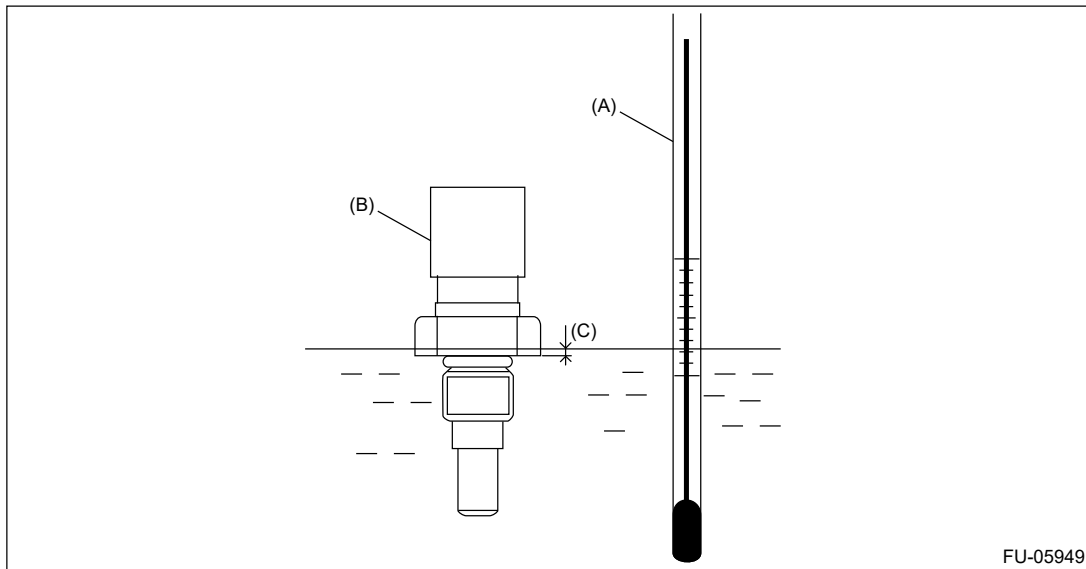
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Coolant Temperature Sensor

INSPECTION

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

Caution:

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



(A) Thermometer

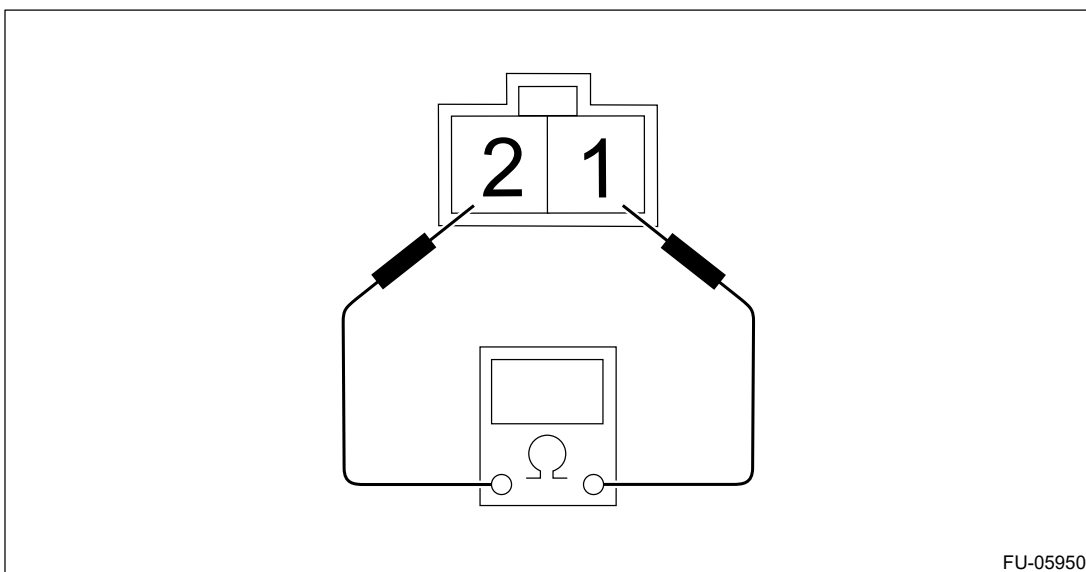
(B) Engine coolant temperature sensor

(C) Hexagonal part height: To approx. $\frac{1}{3}$

3. Raise water temperature gradually, measure the resistance between the engine coolant temperature sensor terminals when the temperature is 20°C (68°F) and 80°C (176°F).

Note:

Agitate the water for even temperature distribution.



FU-05950

| Water temperature | Terminal No. | Standard |
|-------------------|--------------|----------|
|-------------------|--------------|----------|

| | | |
|--------------|---------|------------------------|
| 20°C (68°F) | 1 and 2 | Approx. 2.45±0.2 kΩ |
| 80°C (176°F) | | Approx. 0.318±0.013 kΩ |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Coolant Temperature Sensor

INSTALLATION

Install in the reverse order of removal.

Note:

Use a new gasket.

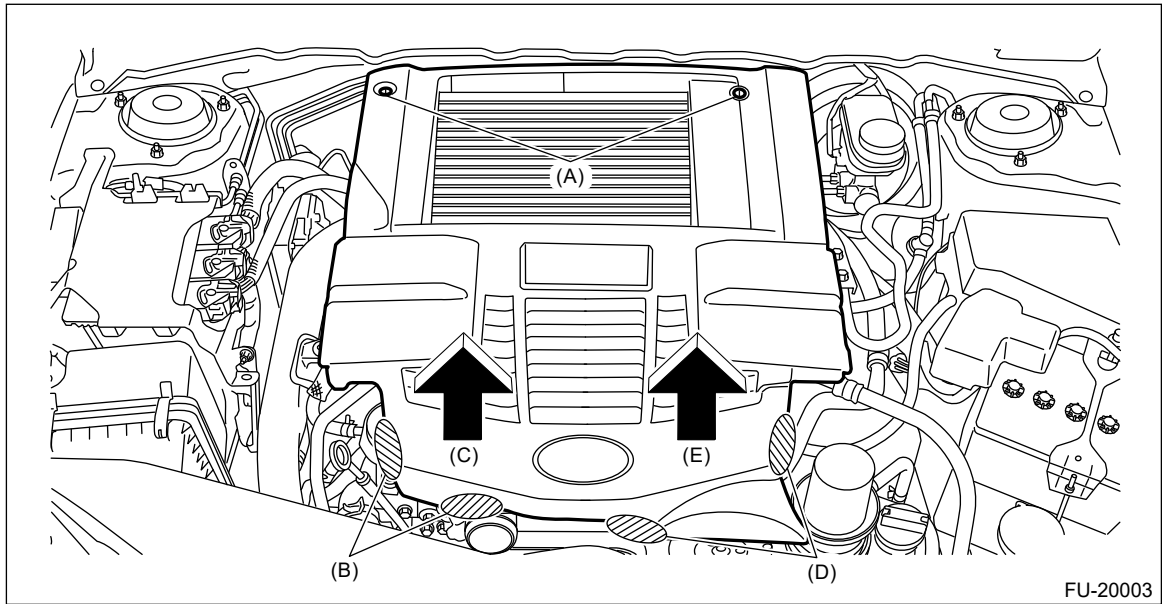
Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)

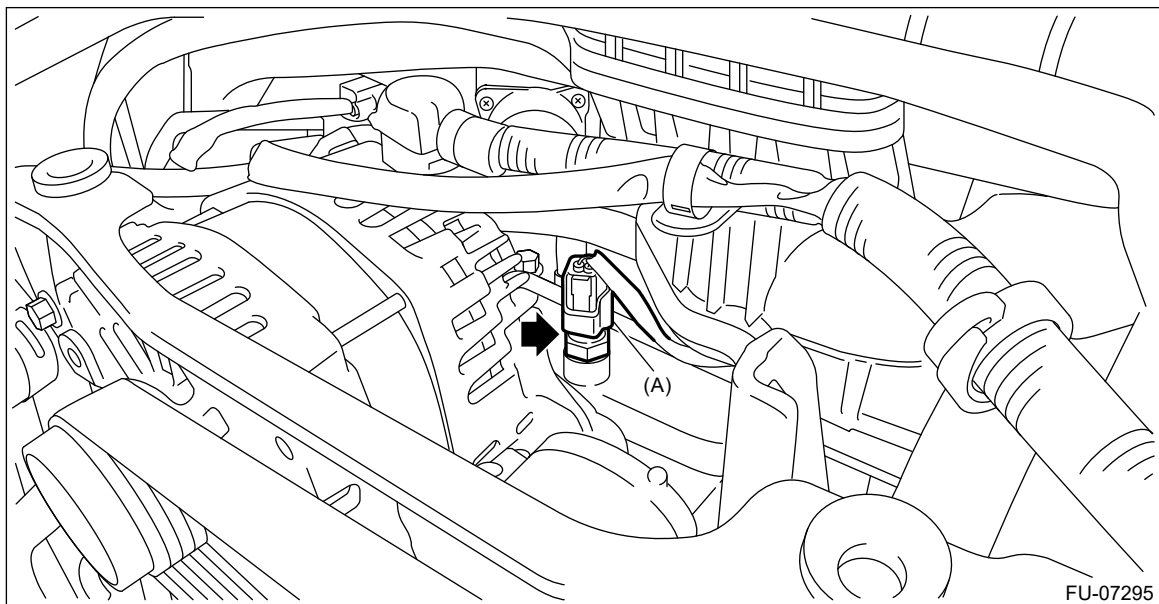
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Coolant Temperature Sensor

REMOVAL

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Disconnect the ground cable from battery.
3. Drain engine coolant. [🔗 Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
4. Disconnect the connector (A) from the engine coolant temperature sensor, and remove the engine coolant temperature sensor.



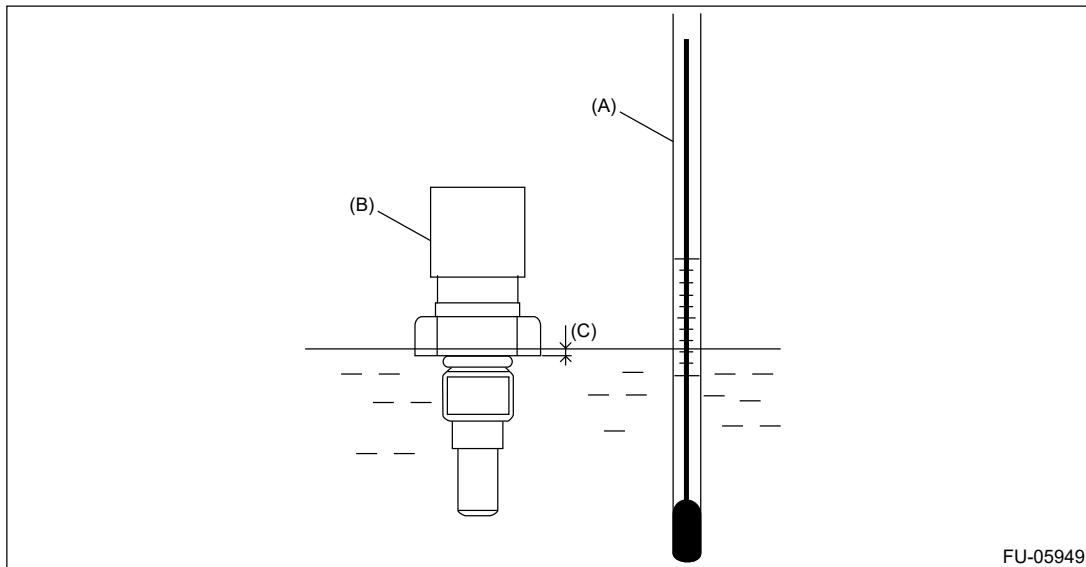
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Oil Temperature Sensor

INSPECTION

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

Caution:

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



(A) Thermometer

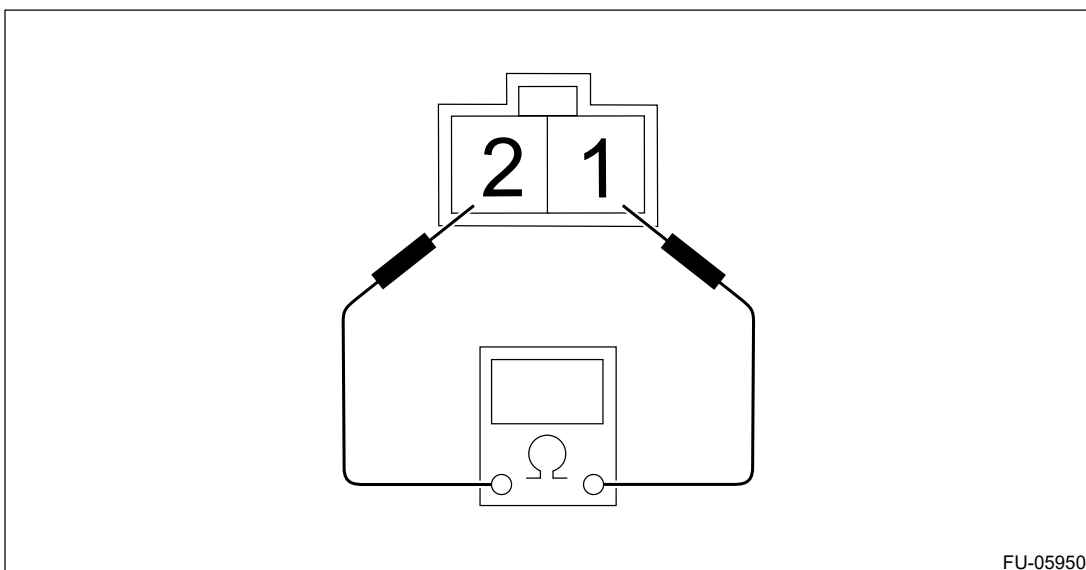
(B) Engine oil temperature sensor

(C) Hexagonal part height: To approx. $\frac{1}{3}$

3. Raise water temperature gradually, measure the resistance between the engine oil temperature sensor terminals when the temperature is 20°C (68°F) and 80°C (176°F).

Note:

Agitate the water for even temperature distribution.



| Water temperature | Terminal No. | Standard |
|-------------------|--------------|----------|
|-------------------|--------------|----------|

| | | |
|--------------|---------|------------------------|
| 20°C (68°F) | 1 and 2 | Approx. 2.45±0.2 kΩ |
| 80°C (176°F) | | Approx. 0.318±0.013 kΩ |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Oil Temperature Sensor

INSTALLATION

Install in the reverse order of removal.

Note:

Use a new gasket.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)

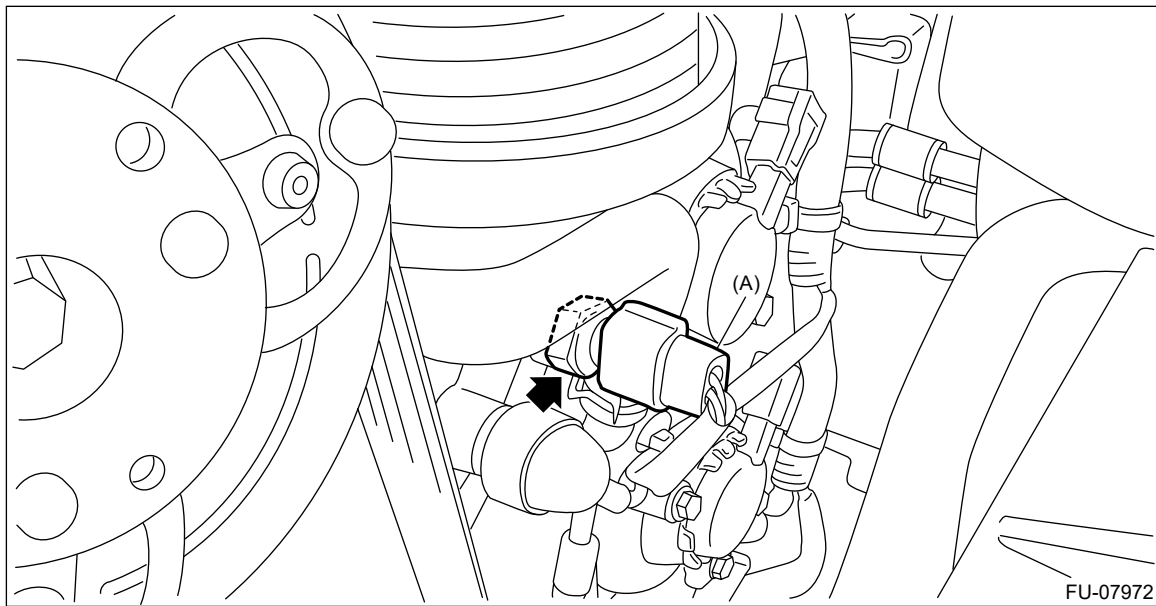
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Oil Temperature Sensor

REMOVAL

Caution:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emission of smoke or causing a fire.

- 1.** Disconnect the ground cable from battery.
- 2.** Disconnect the connector (A) from the engine oil temperature sensor, and remove the engine oil temperature sensor from the chain cover.



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Wiring Harness

INSPECTION

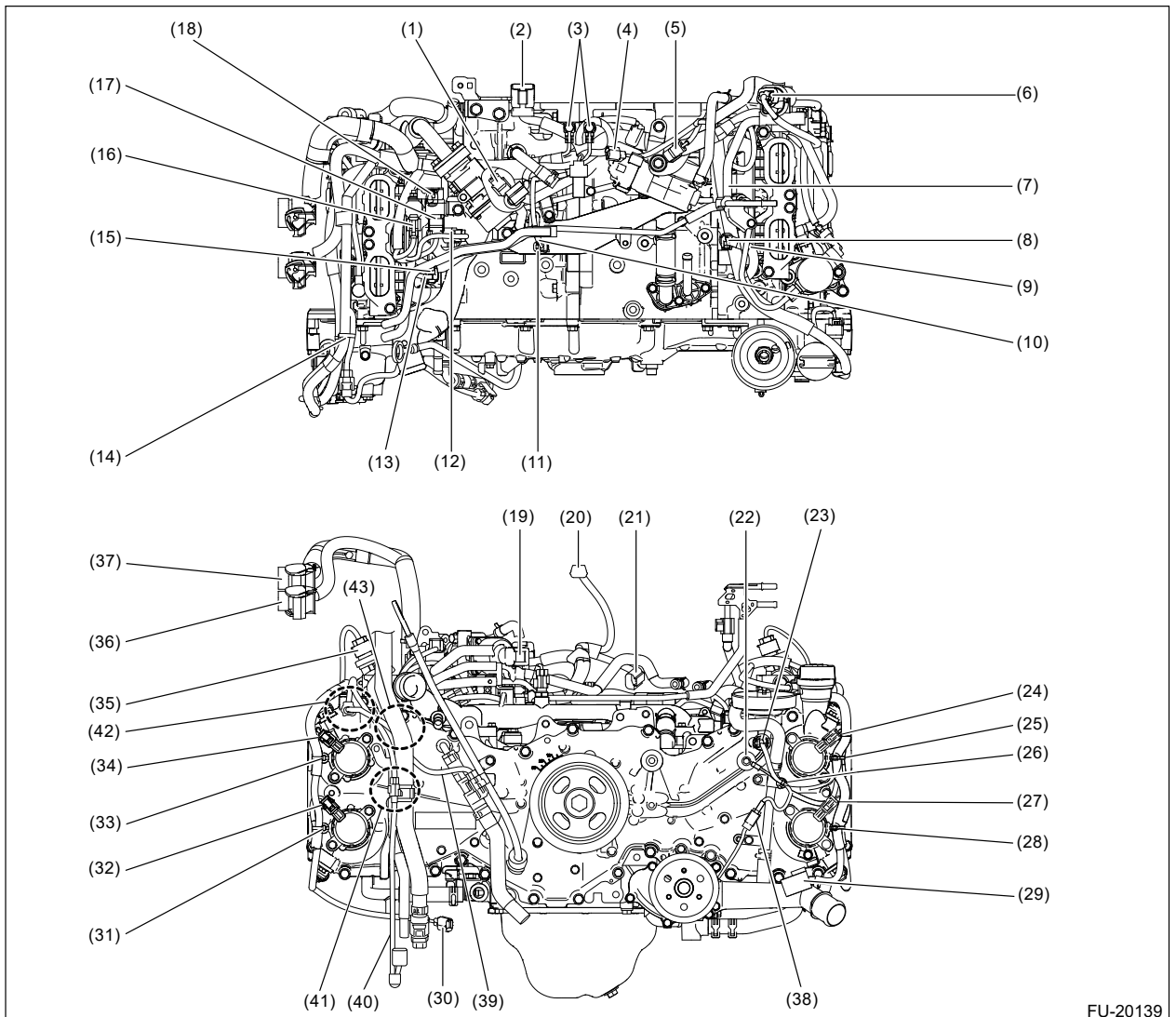
- 1.** Check that the engine wiring harness does not have deformation, cracks and any other damage.
- 2.** Check the engine wiring harness for contamination or clogging.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Wiring Harness

INSTALLATION

1. Set the engine wiring harness to the engine, and connect the connector.

- Structural diagram 1

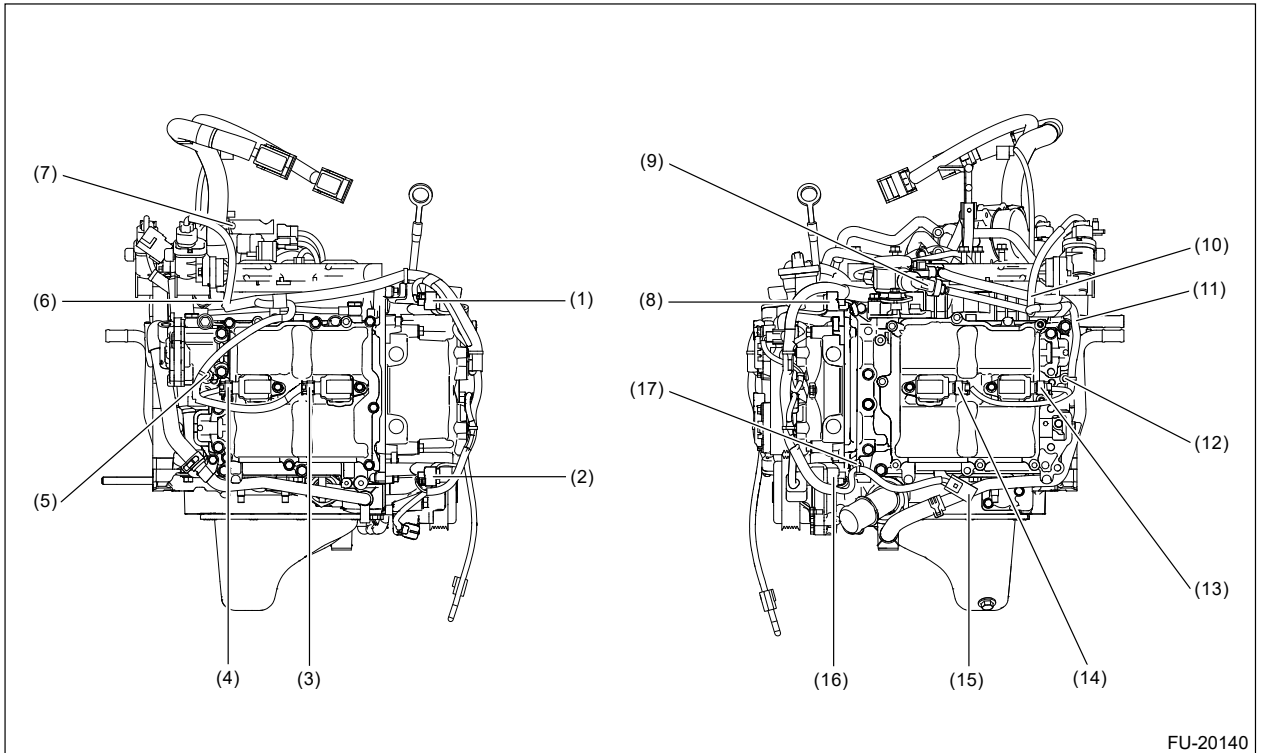


FU-20139

- (1) Knock sensor RH (routed under the insulator)
- (2) Engine harness connector (16P) (secured to engine hanger)
- (3) Engine ground (2 places) (During installation, let the terminal tip come in contact with the block step.)
- (4) Crankshaft position sensor
- (5) Knock sensor LH (routed under the insulator)
- (6) Tumble generator valve actuator LH
- (7) Fuel injector (#4) (routed under the insulator)
- (8) Fuel injector (#2) (routed under the insulator)
- (9) White tape
- (10) White tape
- (11) Engine coolant temperature sensor
- (12) Fuel pressure sensor

- (13) White tape
- (14) Secure the clip to the screw hole.
- (15) Fuel injector (#1) (routed under the insulator)
- (16) Purge control solenoid valve (#2) (black connector)
- (17) Purge control solenoid valve (#1) (blue connector)
- (18) Fuel injector (#3) (routed under the insulator)
- (19) EGR valve
- (20) Manifold absolute pressure and intake air temperature sensor
- (21) Throttle position sensor
- (22) Oil pressure switch
- (23) Engine oil temperature sensor
- (24) Intake oil control solenoid LH
- (25) Secure the clip to the screw hole.
- (26) Secure the clip to the round hole of stay.
- (27) Exhaust oil control solenoid LH
- (28) Secure the clip to the screw hole.
- (29) Front oxygen (A/F) sensor (Secured to the front oxygen (A/F) sensor bracket.)
- (30) Wastegate solenoid
- (31) Secure the clip to the screw hole.
- (32) Exhaust oil control solenoid RH
- (33) Secure the clip to the screw hole.
- (34) Intake oil control solenoid RH
- (35) Tumble generator valve actuator RH
- (36) Engine harness connector (32P)
- (37) Engine harness connector (48P)
- (38) Oil level switch
- (39) Blow-by diagnosis harness connector 1
- (40) Blow-by diagnosis harness connector 2
- (41) Install the harness connector to the stay.
- (42) Install the harness connector to the stay.
- (43) Pass the blow-by diagnosis connector harness 1 through between the PCV pipe assembly and the vacuum hose.

- Structural diagram 2



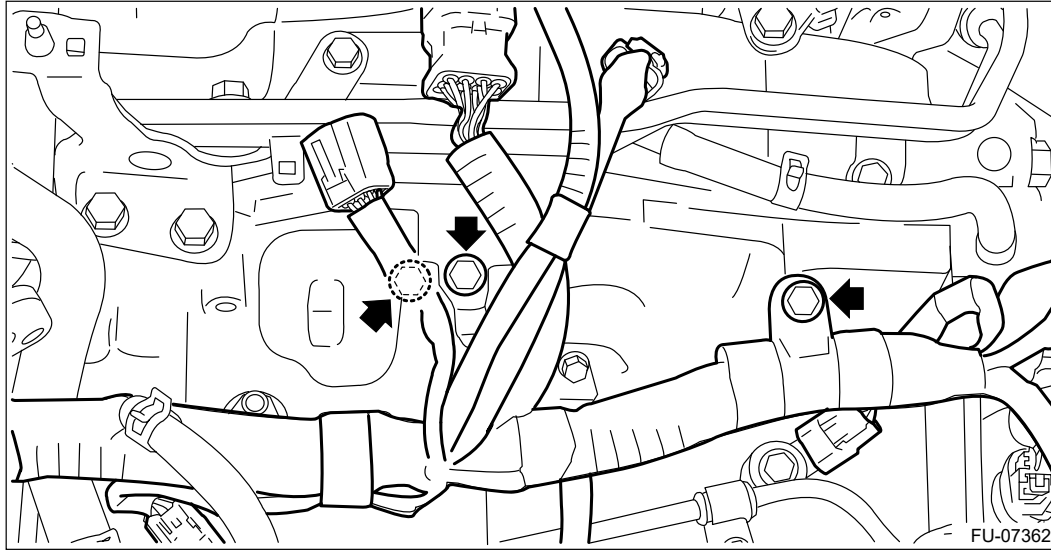
FU-20140


- (1) Intake camshaft position sensor RH
- (2) Exhaust camshaft position sensor RH
- (3) Ignition coil No. 1
- (4) Ignition coil No. 3
- (5) Secure the clip to the screw hole.
- (6) Route under the tumble generator valve.
- (7) Secure the clip to the round hole.
- (8) Intake camshaft position sensor LH
- (9) High-pressure fuel pump
- (10) Route outside of the fuel tube.
- (11) Route under the tumble generator valve.
- (12) Secure the clip to the screw hole.
- (13) Ignition coil No. 4
- (14) Ignition coil No. 2
- (15) Oxygen sensor (secured to the heater pipe)
- (16) Exhaust camshaft position sensor LH
- (17) Secure the clip to the screw hole.

2. Install the engine wiring harness.

Tightening torque:



19 N•m (1.9 kgf-m, 14.0 ft-lb)

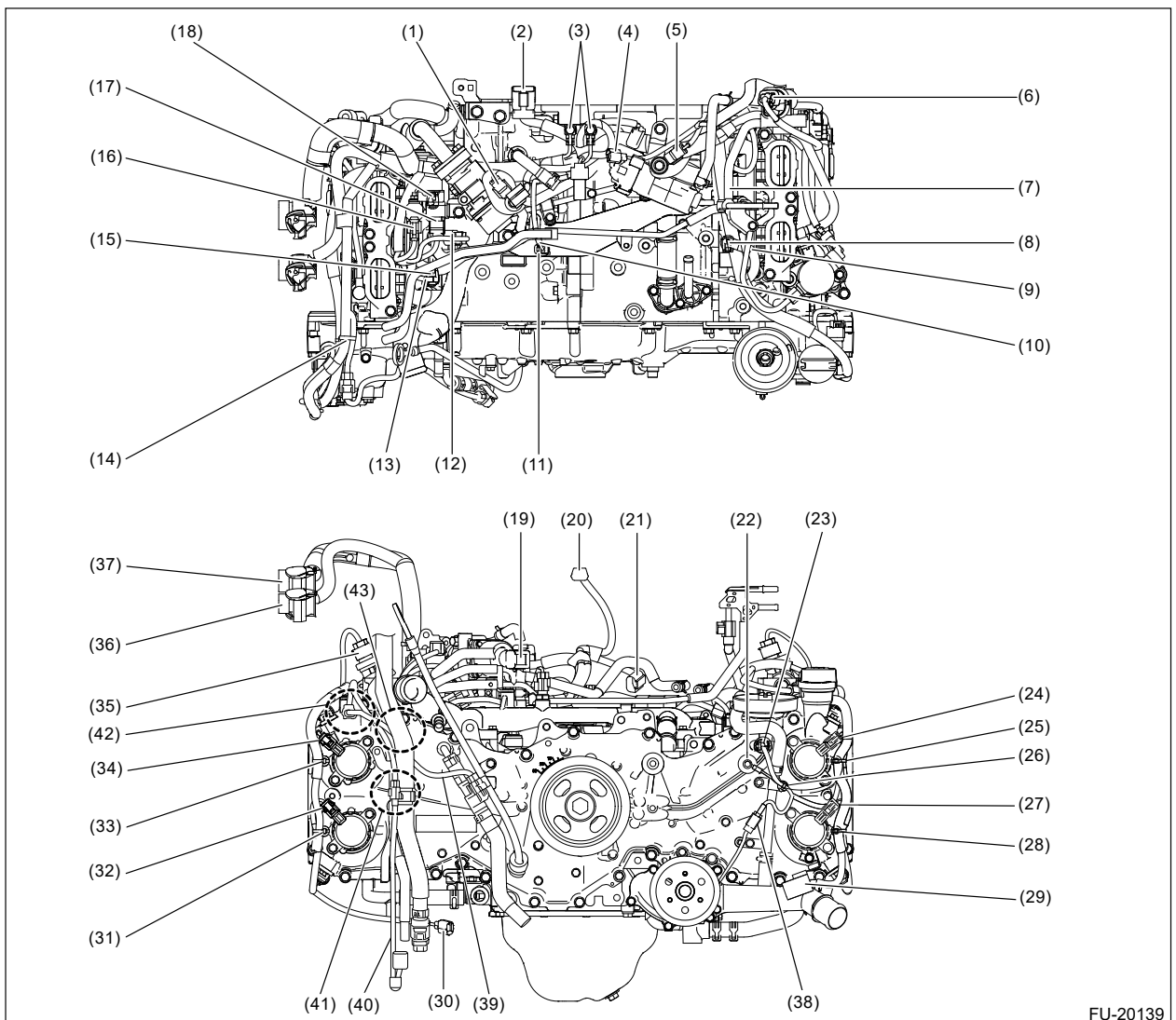


3. Install the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>INSTALLATION.](#)
4. Connect the battery ground terminal.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Engine Wiring Harness

REMOVAL

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Disconnect the ground cable from battery.
3. Open the fuel filler lid and remove the fuel filler cap.
4. Remove the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
5. Disconnect the connector from the engine.
 - Structural diagram 1

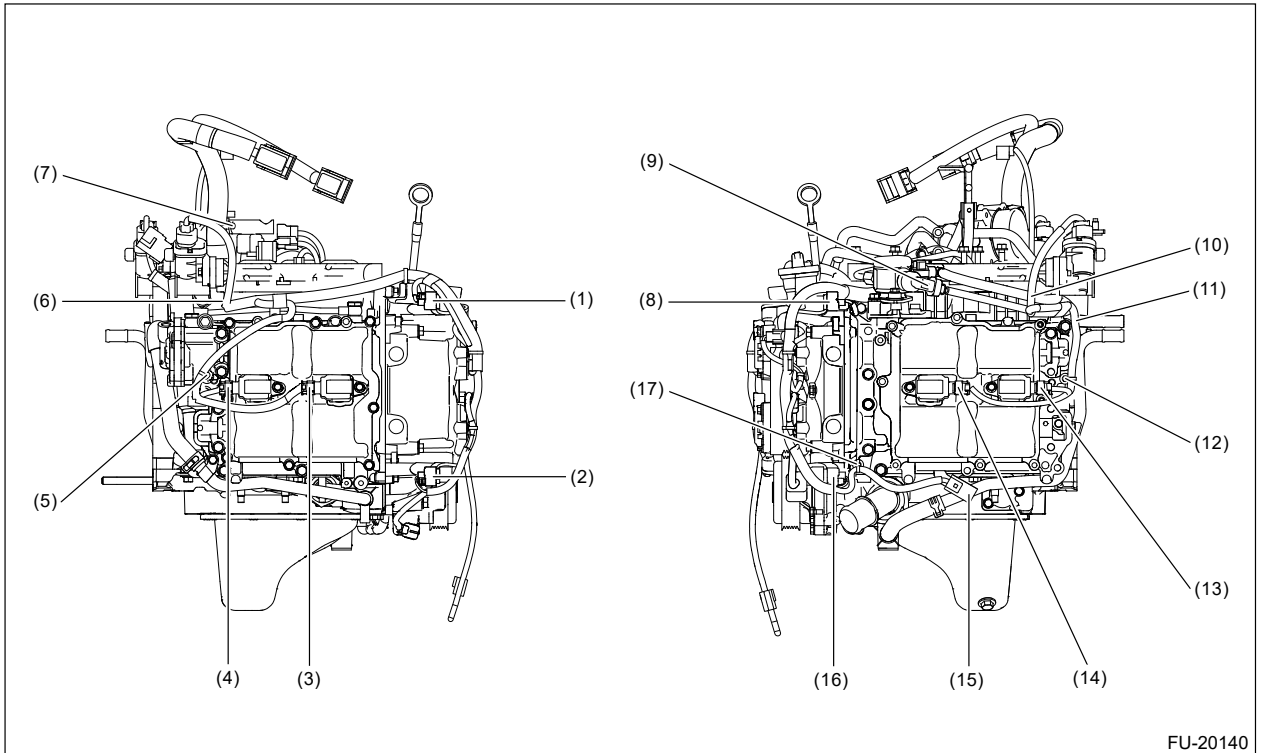


FU-20139

- (1) Knock sensor RH
- (2) Engine harness connector (16P)
- (3) Engine ground (2 locations)
- (4) Crankshaft position sensor
- (5) Knock sensor LH
- (6) Tumble generator valve actuator LH
- (7) Fuel injector (#4)

- (8) Fuel injector (#2)
- (9) White tape
- (10) White tape
- (11) Engine coolant temperature sensor
- (12) Fuel pressure sensor
- (13) White tape
- (14) Remove clip from screw hole.
- (15) Fuel injector (#1)
- (16) Purge control solenoid valve (#2) (black connector)
- (17) Purge control solenoid valve (#1) (blue connector)
- (18) Fuel injector (#3)
- (19) EGR valve
- (20) Manifold absolute pressure and intake air temperature sensor
- (21) Throttle position sensor
- (22) Oil pressure switch
- (23) Engine oil temperature sensor
- (24) Intake oil control solenoid LH
- (25) Remove clip from screw hole.
- (26) Remove clip from the round hole of stay.
- (27) Exhaust oil control solenoid LH
- (28) Remove clip from screw hole.
- (29) Front oxygen (A/F) sensor (Secured to the front oxygen (A/F) sensor bracket.)
- (30) Wastegate solenoid
- (31) Remove clip from screw hole.
- (32) Exhaust oil control solenoid RH
- (33) Remove clip from screw hole.
- (34) Intake oil control solenoid RH
- (35) Tumble generator valve actuator RH
- (36) Engine harness connector (32P)
- (37) Engine harness connector (48P)
- (38) Oil level switch
- (39) Blow-by diagnosis connector harness 1
- (40) Blow-by diagnosis connector harness 2
- (41) Remove the harness connector from the stay.
- (42) Remove the harness connector from the stay.
- (43) Pull out the blow-by diagnosis connector harness 1 from between the PCV pipe assembly and the vacuum hose.

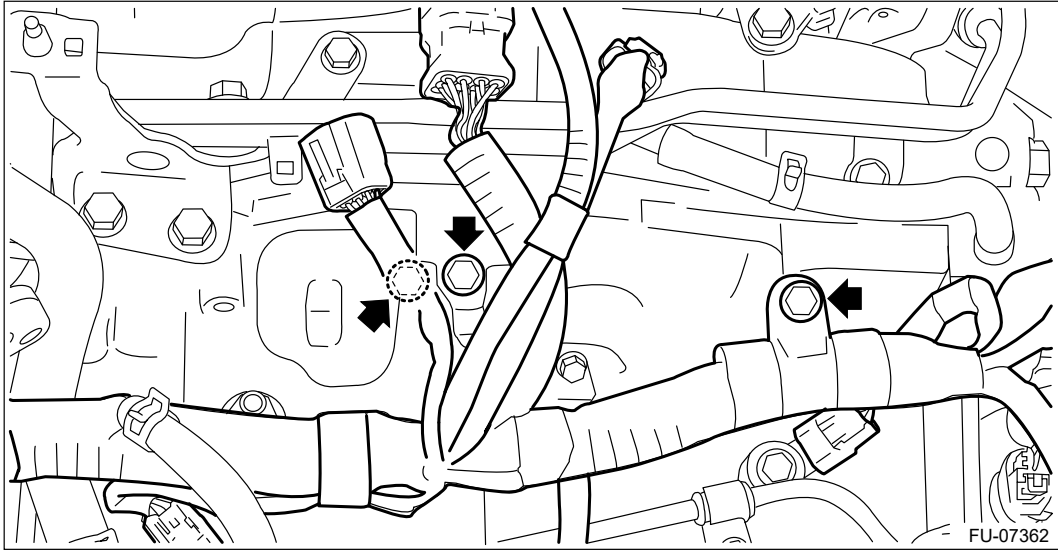
- Structural diagram 2



FU-20140

- (1) Intake camshaft position sensor RH
- (2) Exhaust camshaft position sensor RH
- (3) Ignition coil No. 1
- (4) Ignition coil No. 3
- (5) Remove clip from screw hole.
- (6) Tumble generator valve RH
- (7) Remove clip from the round hole.
- (8) Intake camshaft position sensor LH
- (9) High-pressure fuel pump
- (10) Pull out from the outside of the fuel tube.
- (11) Pull out from the lower side of the tumble generator valve LH.
- (12) Remove clip from screw hole.
- (13) Ignition coil No. 4
- (14) Ignition coil No. 2
- (15) Oxygen sensor
- (16) Exhaust camshaft position sensor LH
- (17) Remove clip from screw hole.

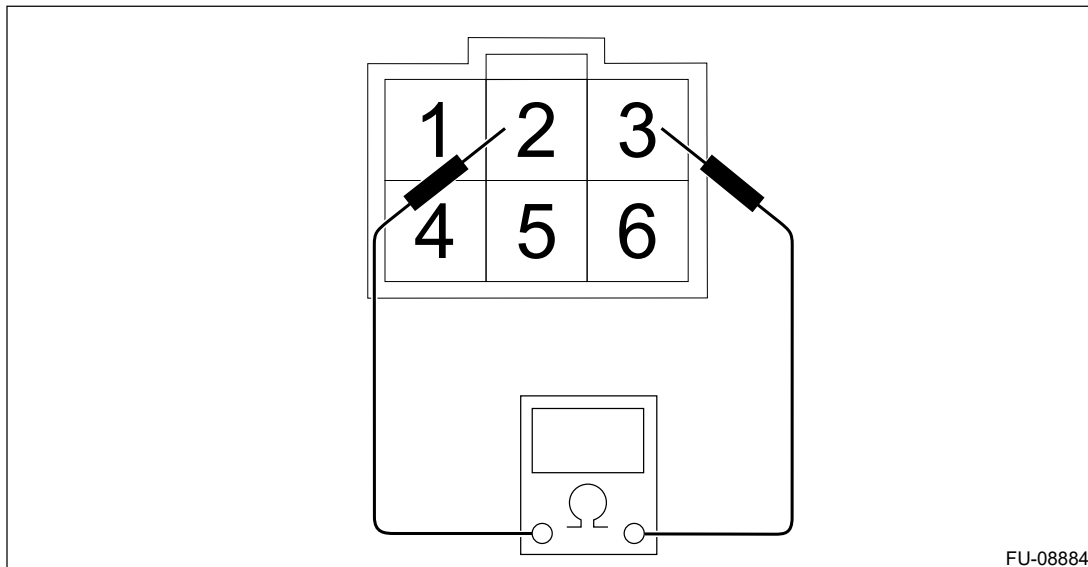
6. Remove the engine wiring harness.



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Front Oxygen (A/F) Sensor

INSPECTION

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



| Terminal No. | Standard |
|--------------|---------------------------|
| 2 and 3 | 2.5—4.0Ω (at 20°C (68°F)) |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Front Oxygen (A/F) Sensor

INSTALLATION

Caution:

If lubricant is spilt over the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

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

Caution:

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

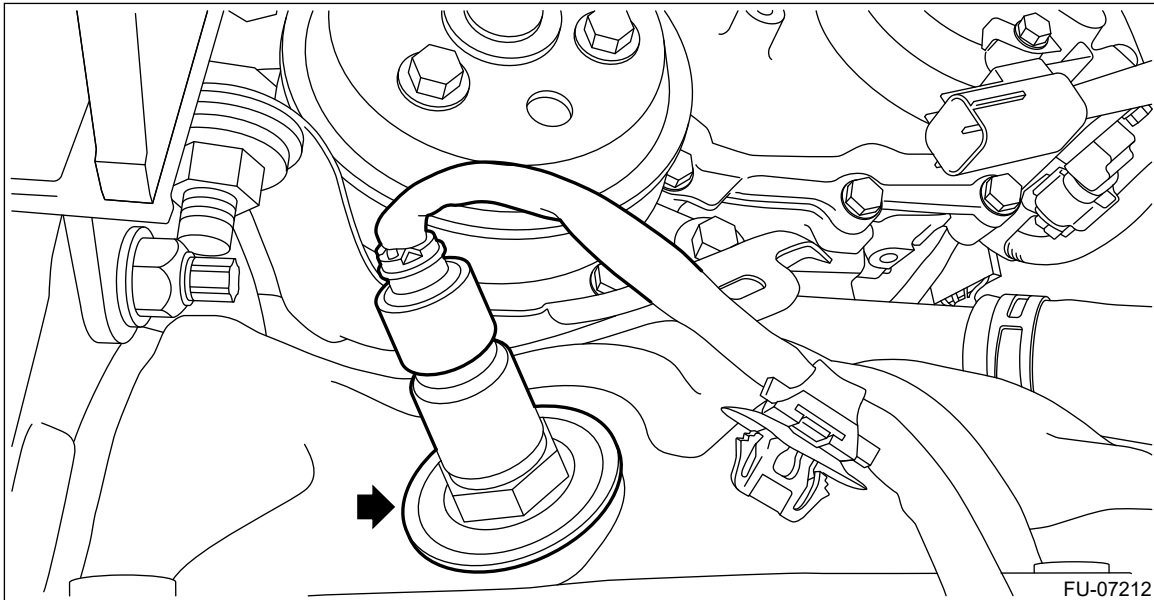
Anti-seize compound:

NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent

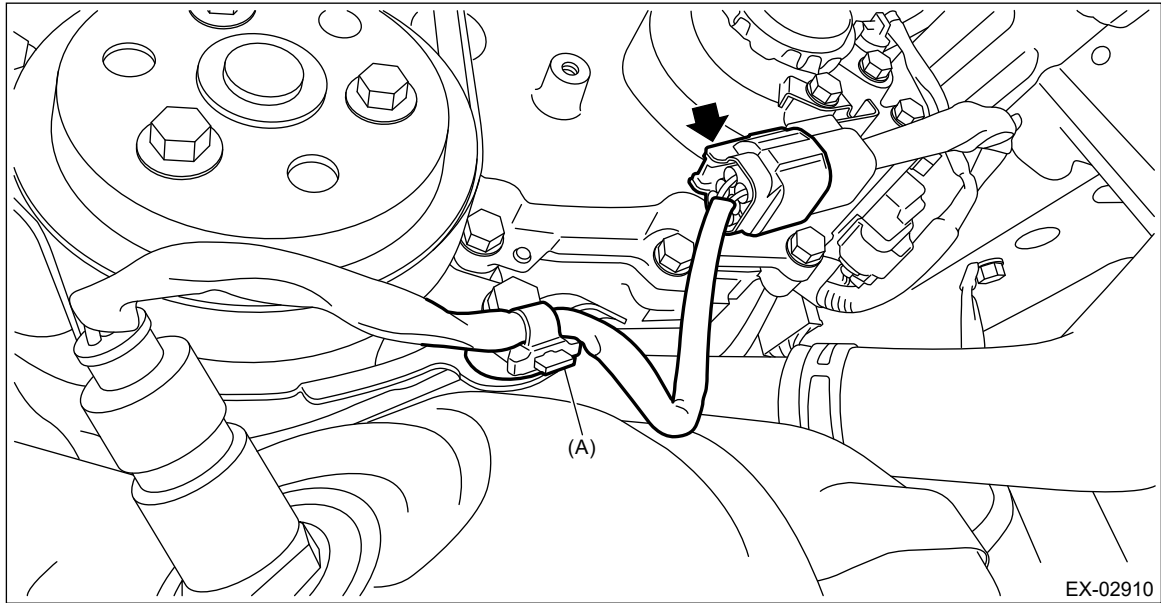
2. Install the front oxygen (A/F) sensor.



Tightening torque:

30 N·m (3.1 kgf-m, 22.1 ft-lb)





3. Lift up the vehicle.
4. Secure the front oxygen (A/F) sensor harness to the water pump cover using clip (A), and connect the front oxygen (A/F) sensor connector to the engine harness.

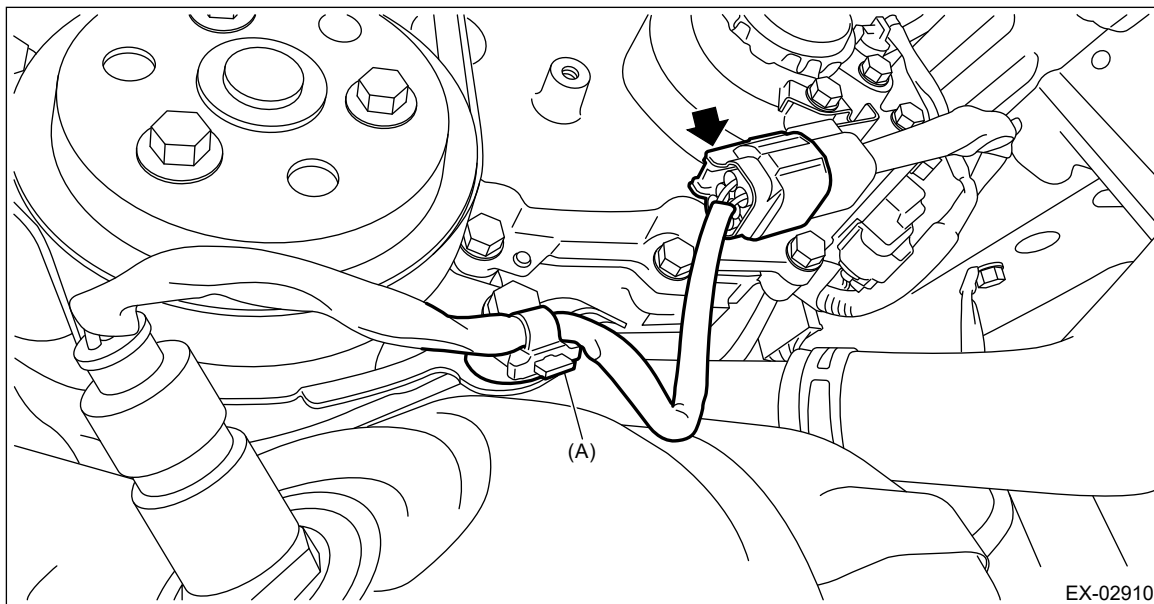


- 5.** Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
- 6.** Lower the vehicle.
- 7.** Install the radiator sub fan and fan motor assembly.  [Ref. to COOLING\(H4DOTC\)>Radiator Sub Fan and Fan Motor>INSTALLATION.](#)
- 8.** Connect the battery ground terminal.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Front Oxygen (A/F) Sensor

REMOVAL

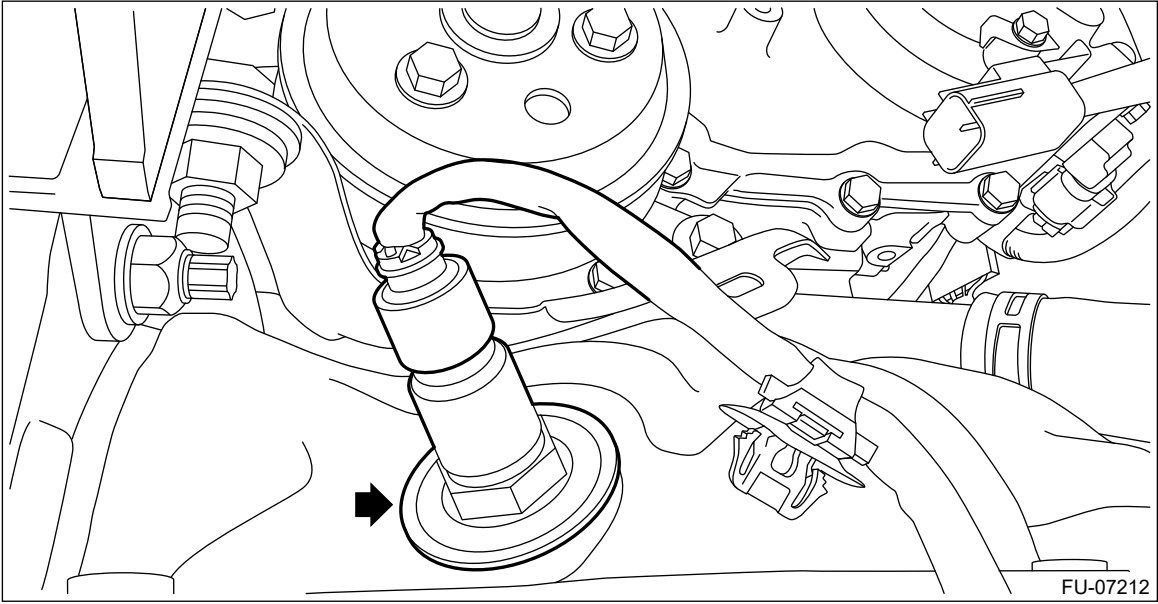
1. Disconnect the ground cable from battery.
2. Remove the radiator sub fan and fan motor assembly.  [Ref. to COOLING\(H4DOTC\)>Radiator Sub Fan and Fan Motor>REMOVAL.](#)
3. Lift up the vehicle.
4. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
5. Disconnect the connector on the front oxygen (A/F) sensor from the engine harness, and remove the clip (A) securing the front oxygen (A/F) sensor harness to the water pump cover.



6. Apply spray-type lubricant (004301003) to the threaded portion of front oxygen (A/F) sensor, and leave it for one minute or more.
7. Remove the front oxygen (A/F) sensor.

Caution:

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



FU-07212

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Delivery and Evaporation Lines

INSPECTION

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

INSTALLATION

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

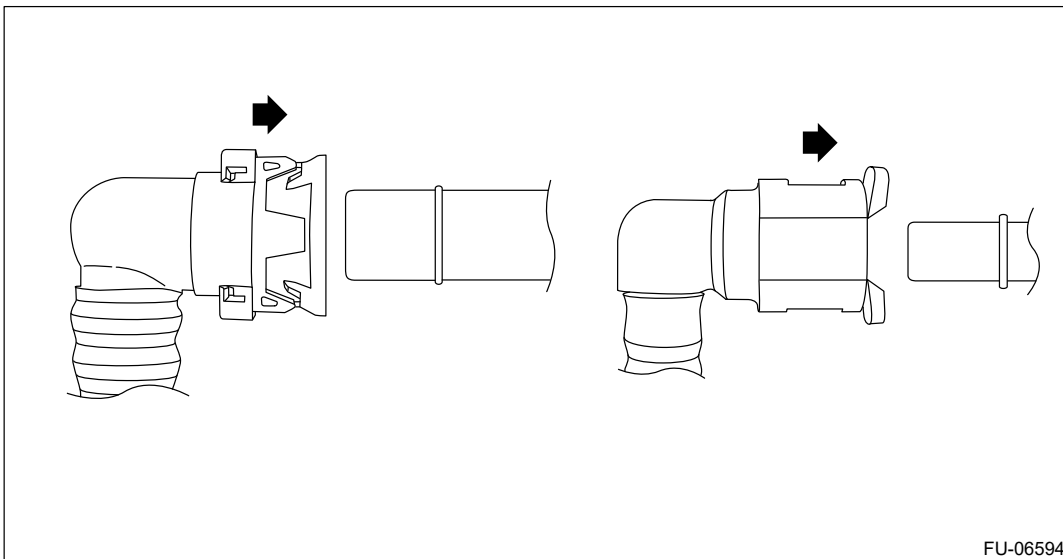
1. CONNECTING THE EVAPORATION LINE QUICK CONNECTOR

Note:

Connect the quick connector as shown in the figure.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

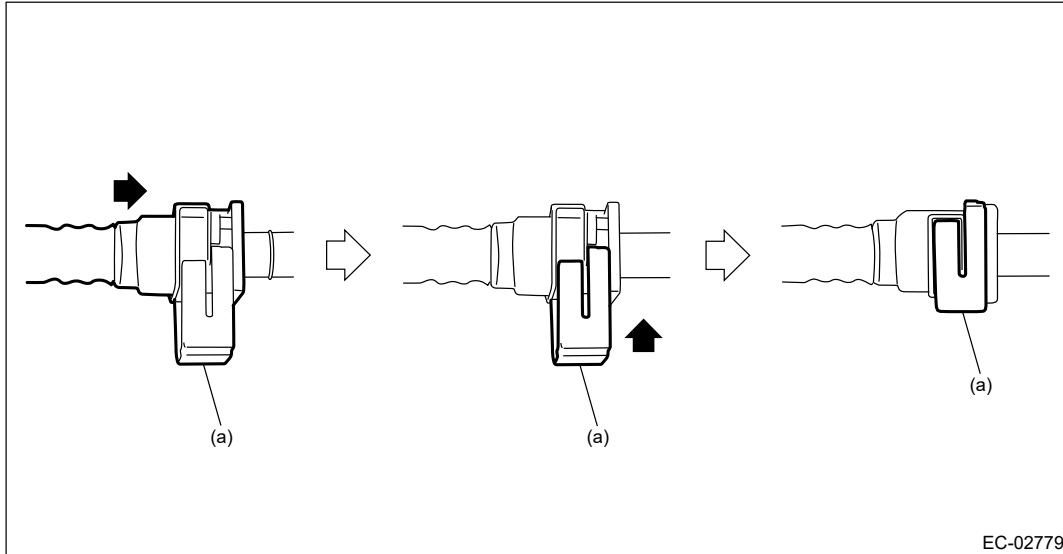


2. CONNECTING THE FUEL LINE QUICK CONNECTOR

Connect the quick connector as shown in the figure.

Caution:

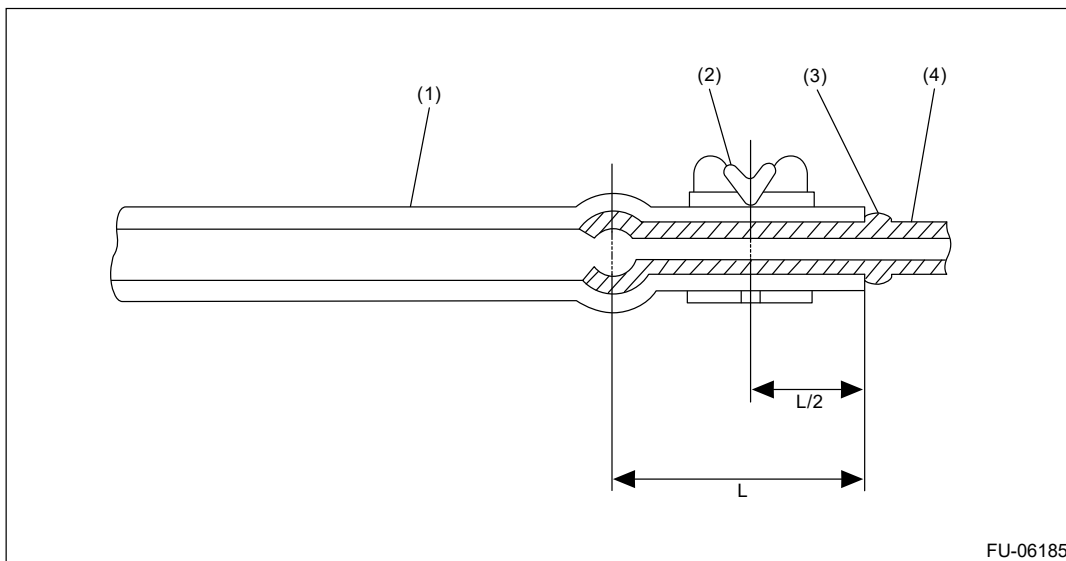
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.



(a) Slider

3. EVAPORATION HOSE CONNECTION

Connect the evaporation hose by inserting it to the pipe until the hose reaches the spool or bump.



(1) Hose

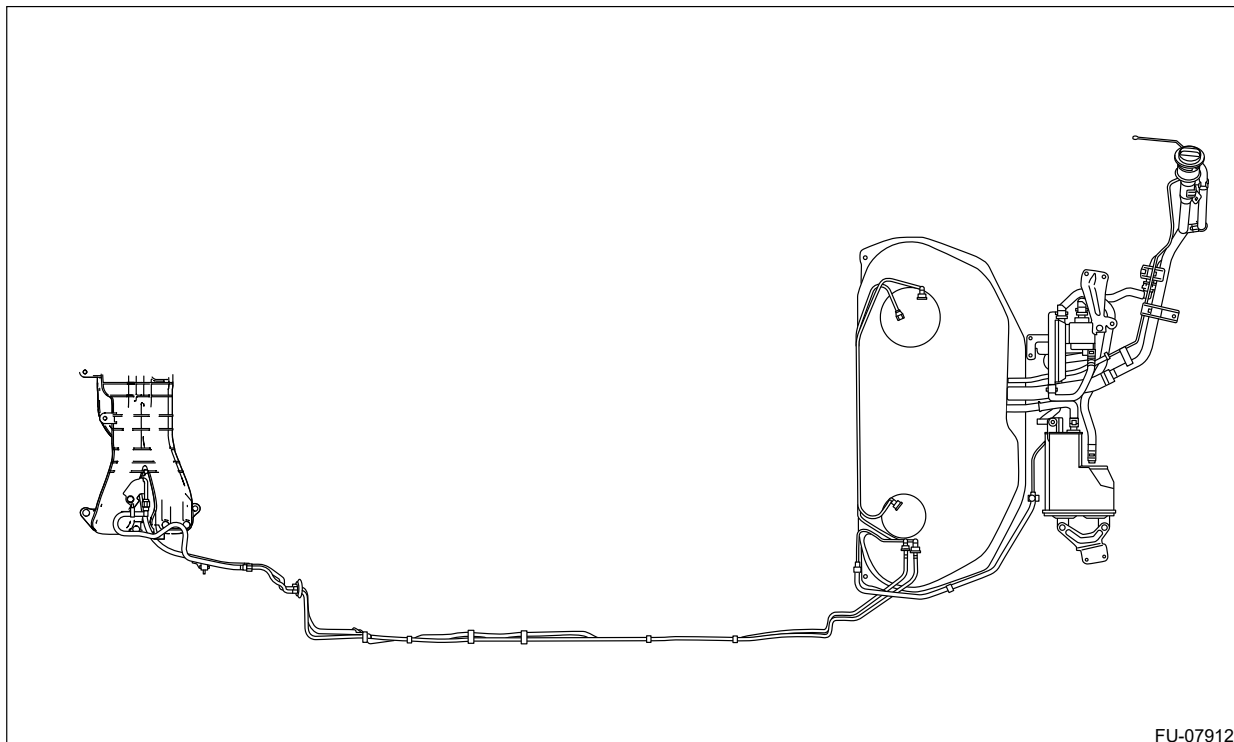
(3) Spool or bump

(4) Pipe

(2) Clip

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Delivery and Evaporation Lines

REMOVAL




Warning:

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


Caution:

Be careful not to spill fuel.

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Open the fuel filler lid and remove the fuel filler cap.

Note:

This operation is required to release the inner pressure of the fuel tank.

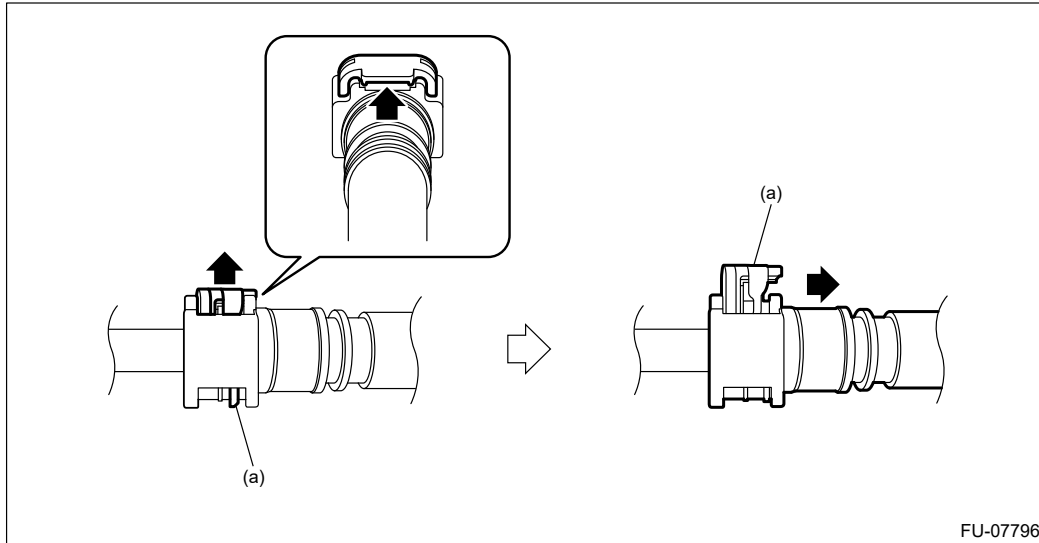
3. Remove the floor mat.  [Ref. to EXTERIOR/INTERIOR TRIM>Floor Mat>REMOVAL.](#)
4. In the engine compartment, disconnect the fuel delivery tube (A) and evaporation hose (B).

Caution:

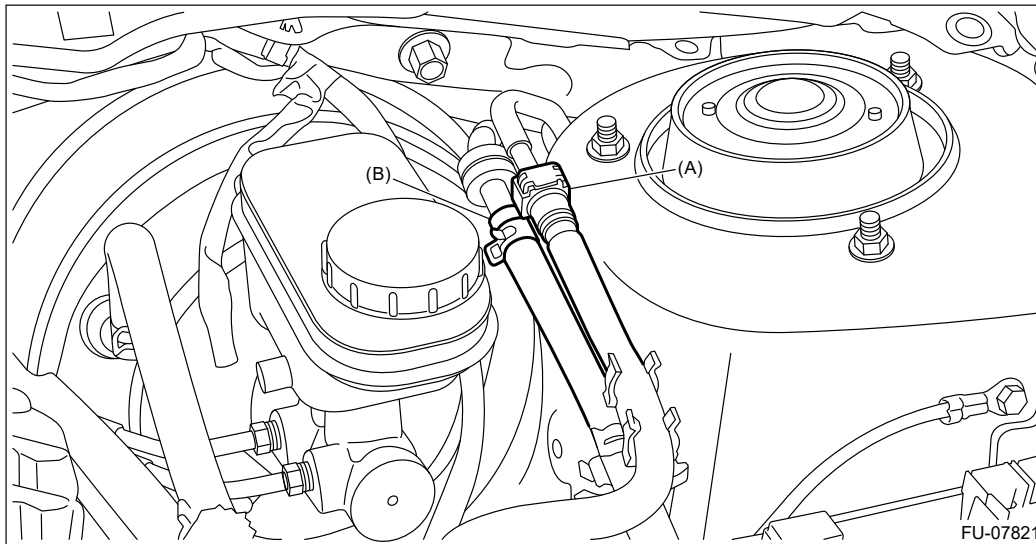
- **Be careful not to spill fuel.**
- **Catch the fuel from the tubes using a container or cloth.**


Note:

Disconnect the quick connector as shown in the figure.



(a) Slider



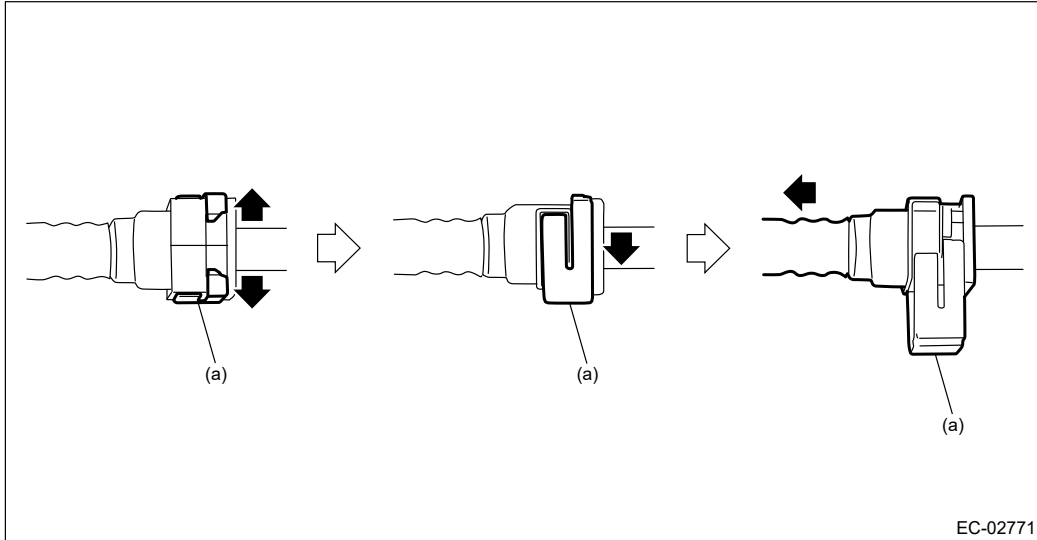
5. Remove the fuel tank.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Tank>REMOVAL.](#)
6. Disconnect the quick connector, and remove the fuel delivery tube and jet pump tube from the fuel tank.

Caution:

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

Note:

Disconnect the quick connector as shown in the figure.

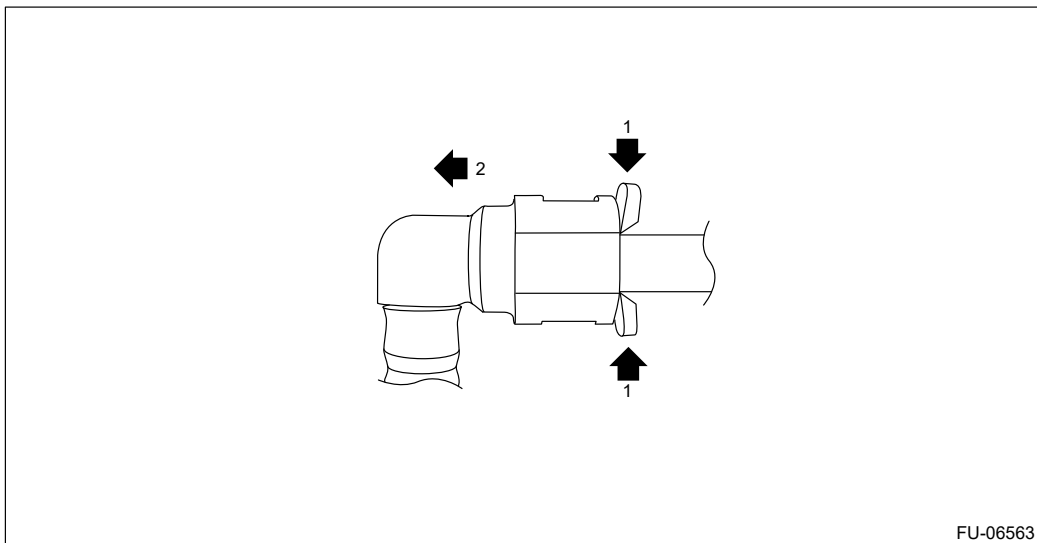


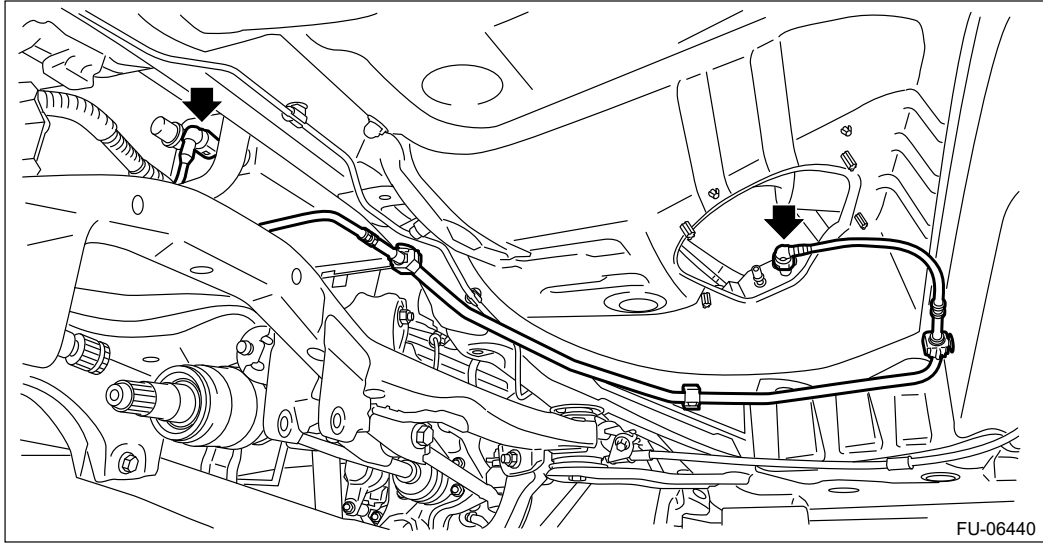
(a) Slider

7. Disconnect the quick connector and remove the purge pipe.

Note:

Disconnect the quick connector as shown in the figure.





8. Remove the body integrated unit.  [Ref. to SECURITY AND LOCKS>Body Integrated Unit>REMOVAL.](#)
9. Remove the fuel pipe assembly from vehicle.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Filler Pipe

ASSEMBLY

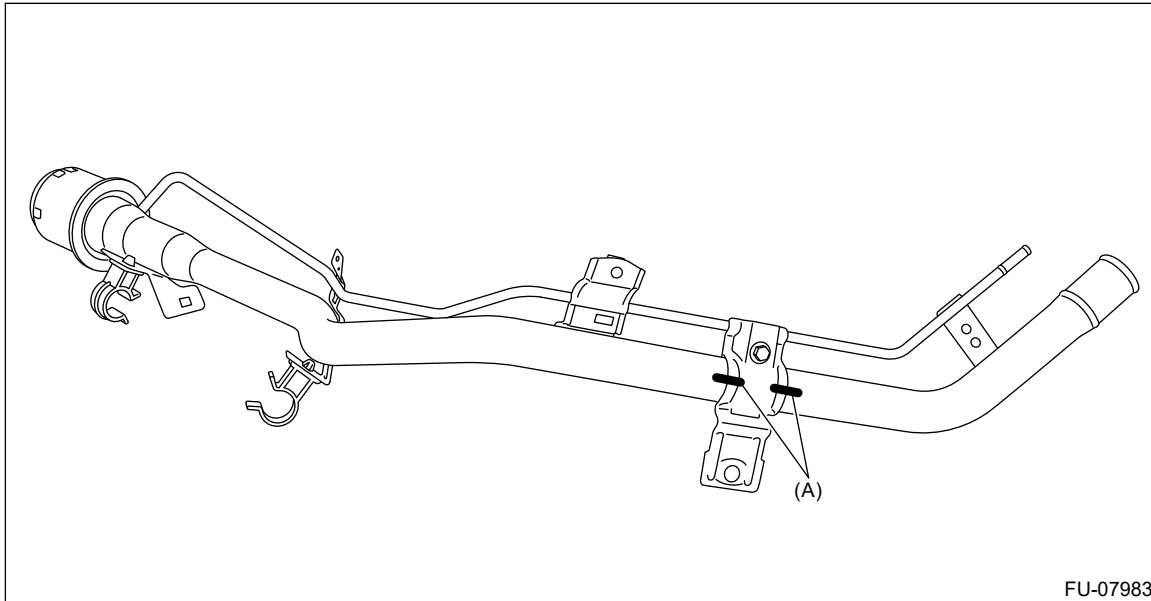
Assemble in the reverse order of disassembly.

Note:

- Use a new neck holder.
- Install the bracket to the fuel filler pipe by aligning the alignment marks (A).

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

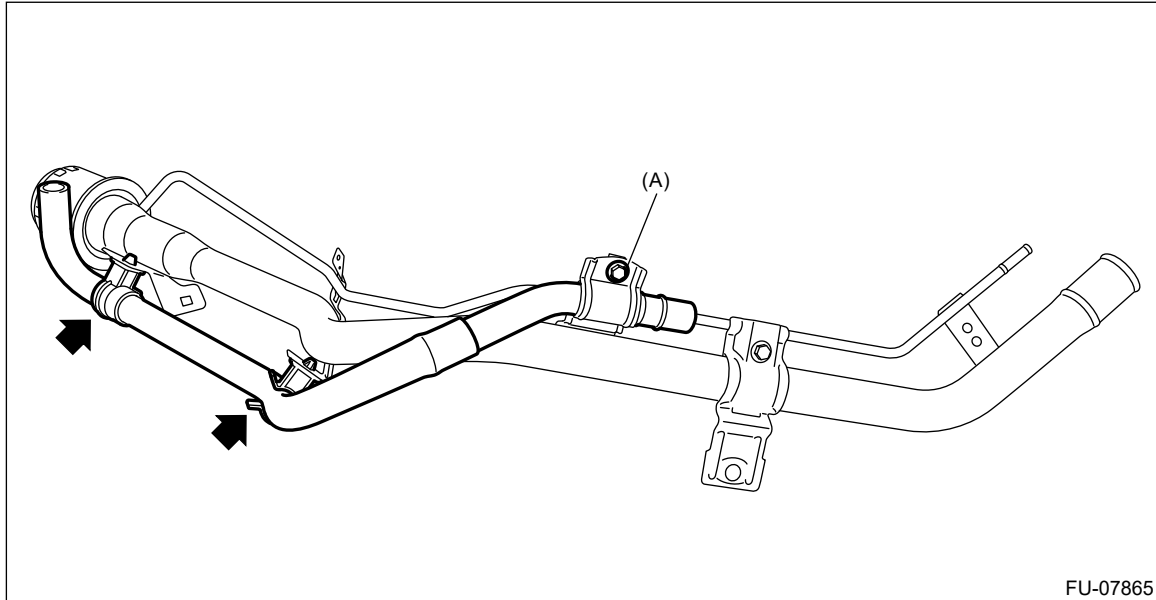


FU-07983

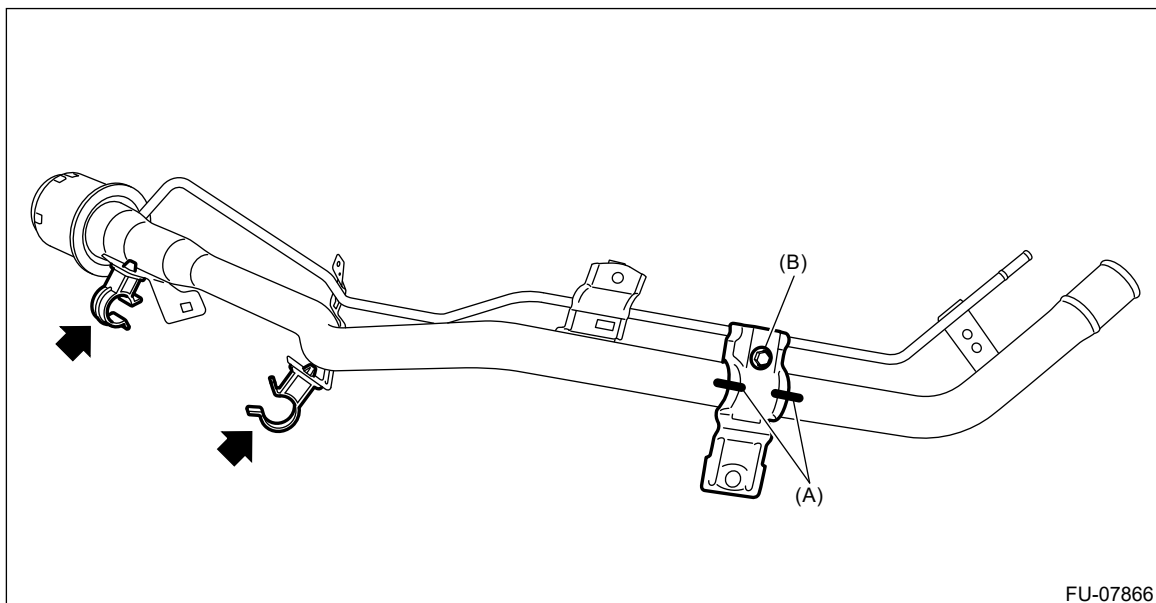
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Filler Pipe

DISASSEMBLY

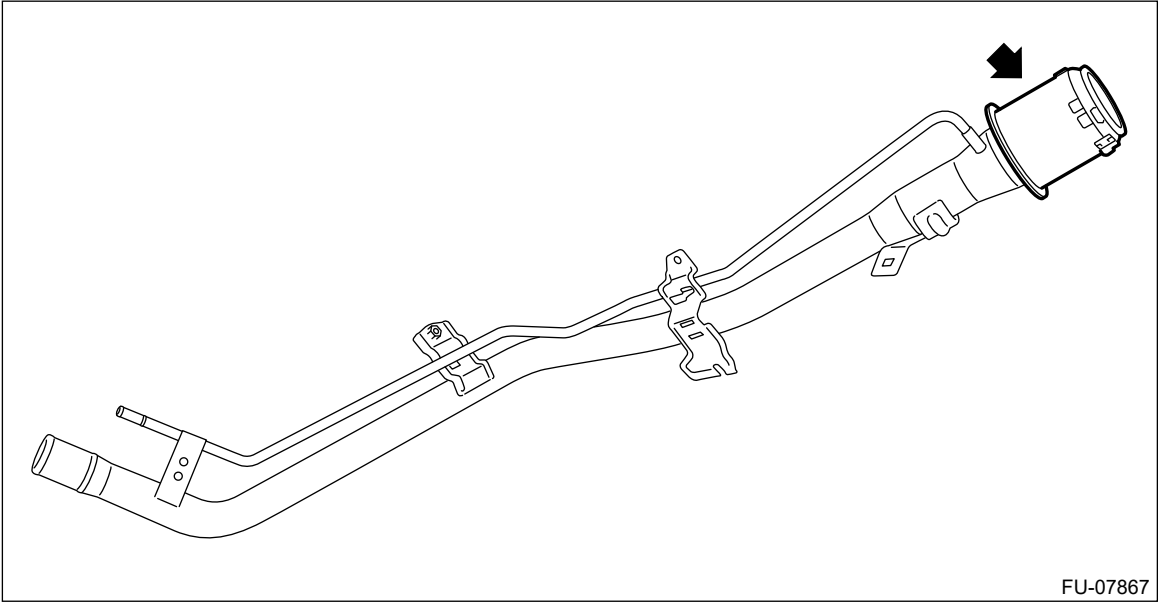
1. Remove the bracket bolt (A) securing the drain pipe, and remove the drain hose from the clip for the fuel filler pipe.



2. Using a marker pen, make alignment marks (A) on the fuel filler pipe and the bracket.
3. Remove the bracket bolt (B) securing the fuel filler pipe, and remove the clip from the fuel filler pipe.



4. Remove the neck holder from the fuel filler pipe.



FU-07867

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Filler Pipe

INSPECTION

- 1.** Check that the fuel filler pipe assembly has no deformation, cracks or other damages.
- 2.** Check that the fuel hose has no cracks, damage or loose part.

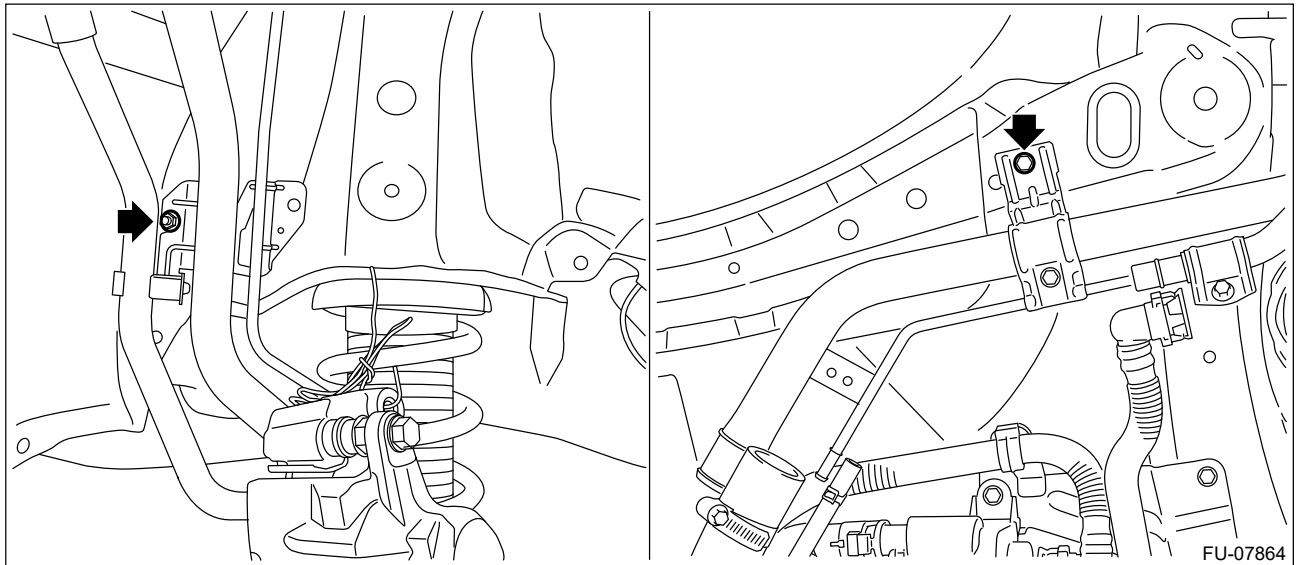
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Filler Pipe

INSTALLATION

1. Open the fuel filler lid.
2. Insert the fuel filler pipe assembly into the rubber saucer from inside of the rear fender.
3. Install the fuel filler pipe assembly to the vehicle.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



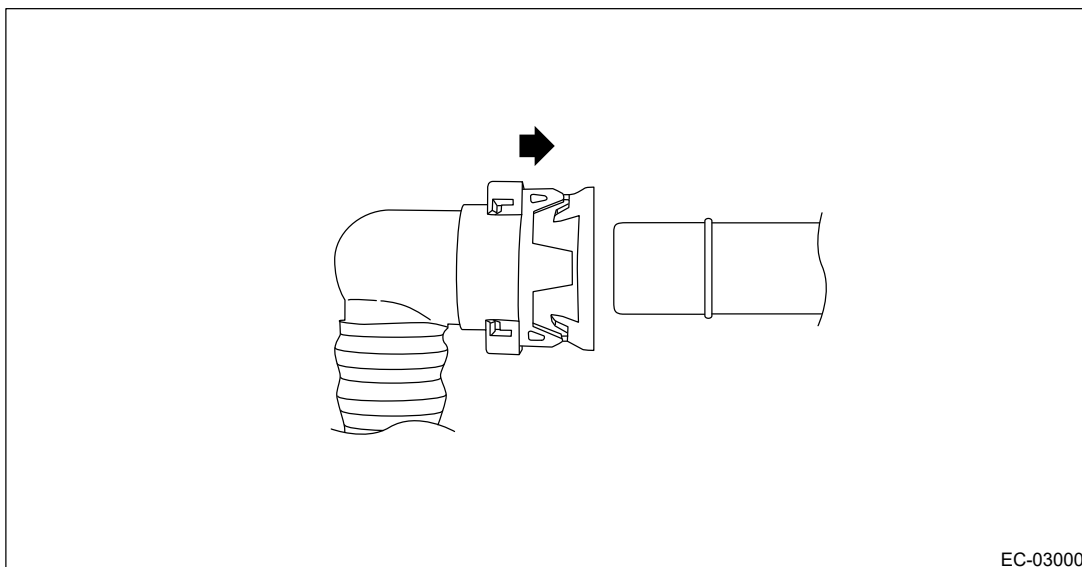
4. Connect the quick connector for drain pipe to the fuel filler pipe assembly.

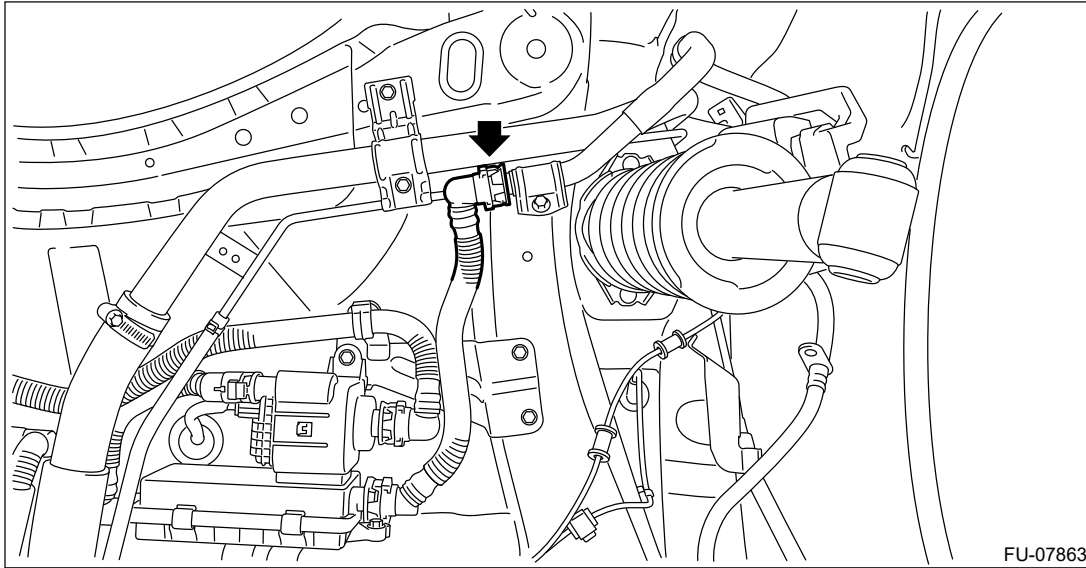
Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

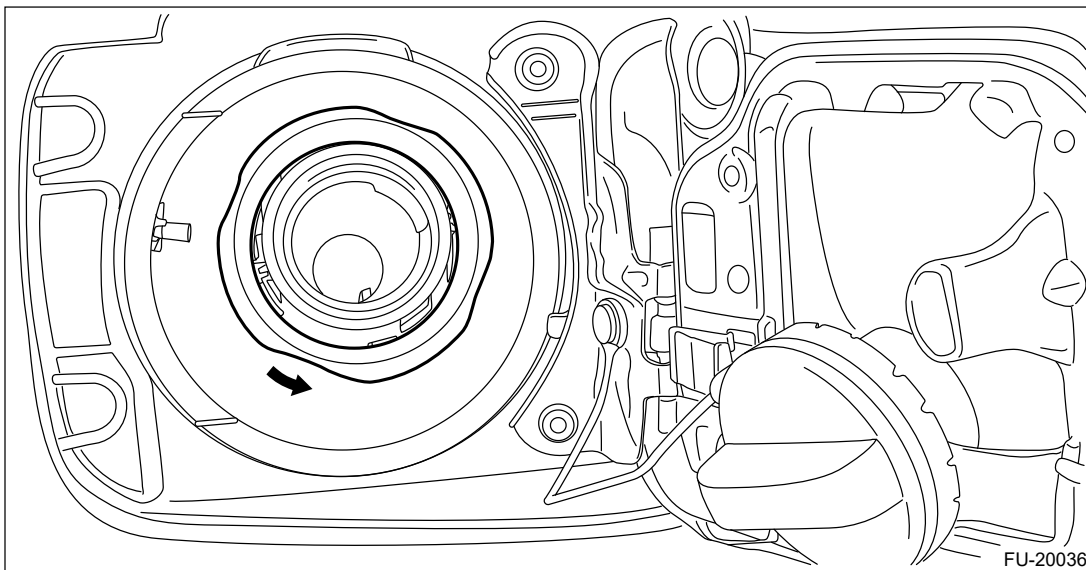
Note:

Connect the quick connector as shown in the figure.





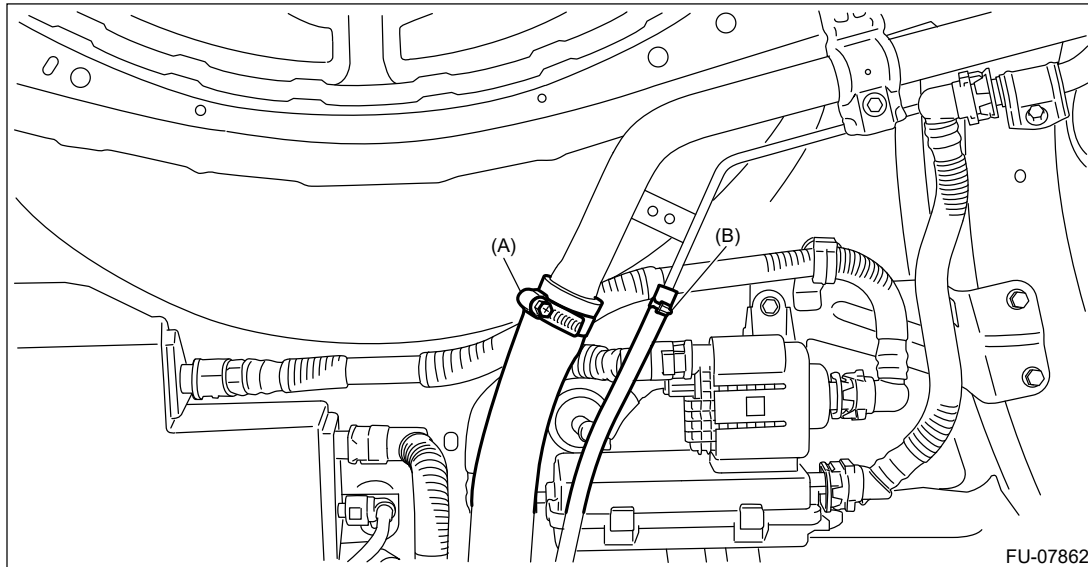
5. Align the cutout on the fuel filler pipe protector and the protrusion of the neck holder and insert them all the way, and then turn the fuel filler pipe protector in the direction of the arrow until it is locked.



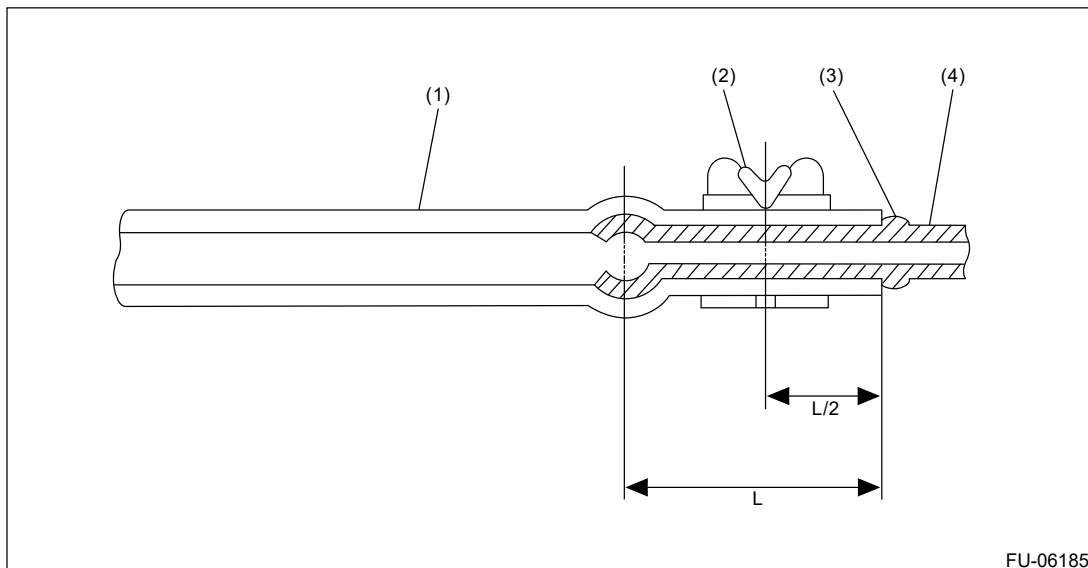
6. Securely insert the fuel filler hose (A) and air vent hose (B) to the spool, then install the clamp or clip as shown in the figure.

Tightening torque:

2.5 N·m (0.3 kgf-m, 1.8 ft-lb)








FU-07862



FU-06185

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

- 7.** Install the rear mud guard RH.  [Ref. to EXTERIOR/INTERIOR TRIM>Mud Guard>INSTALLATION.](#)
- 8.** Install the rear sub frame assembly.  [Ref. to REAR SUSPENSION>Rear Sub Frame>INSTALLATION.](#)
- 9.** Connect the battery ground terminal.
- 10.** Inspect the wheel alignment and adjust if necessary.  [Ref. to FRONT SUSPENSION>Wheel Alignment.](#)
- 11.** Perform reinitialization of the auto headlight beam leveler system. (Model with auto headlight beam leveler)  [Ref. to LIGHTING SYSTEM>Auto Headlight Beam Leveler System>PROCEDURE.](#)
- 12.** Adjust the steering angle sensor.  [Ref. to VEHICLE DYNAMICS CONTROL \(VDC\)>VDC Control Module and Hydraulic Control Unit \(VDCCM&H/U\)>ADJUSTMENT.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Filler Pipe



REMOVAL

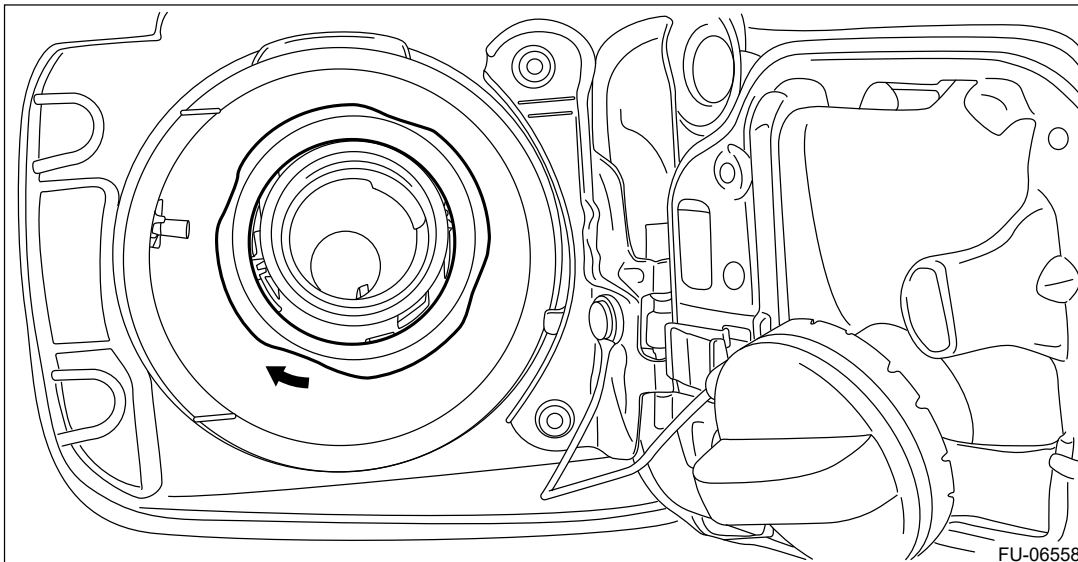
Warning:



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

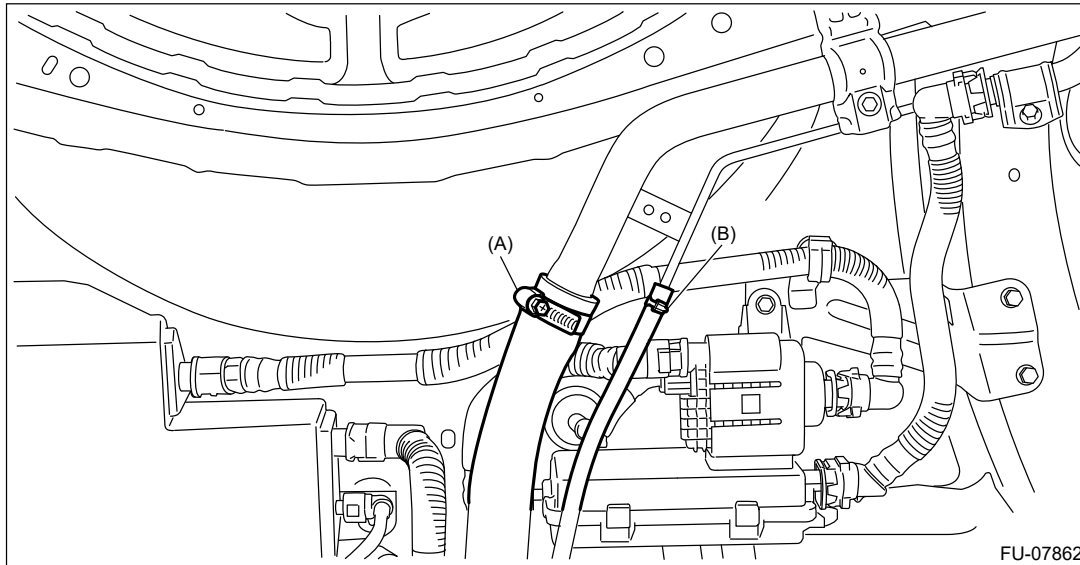
Caution:

Be careful not to spill fuel.

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Drain fuel.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > DRAINING FUEL \(WITH SUBARU SELECT MONITOR\).](#)
3. Disconnect the ground cable from battery.
4. Open the fuel filler lid and remove the fuel filler cap.
5. Turn the fuel filler pipe protector in the direction of the arrow to unlock and remove it.



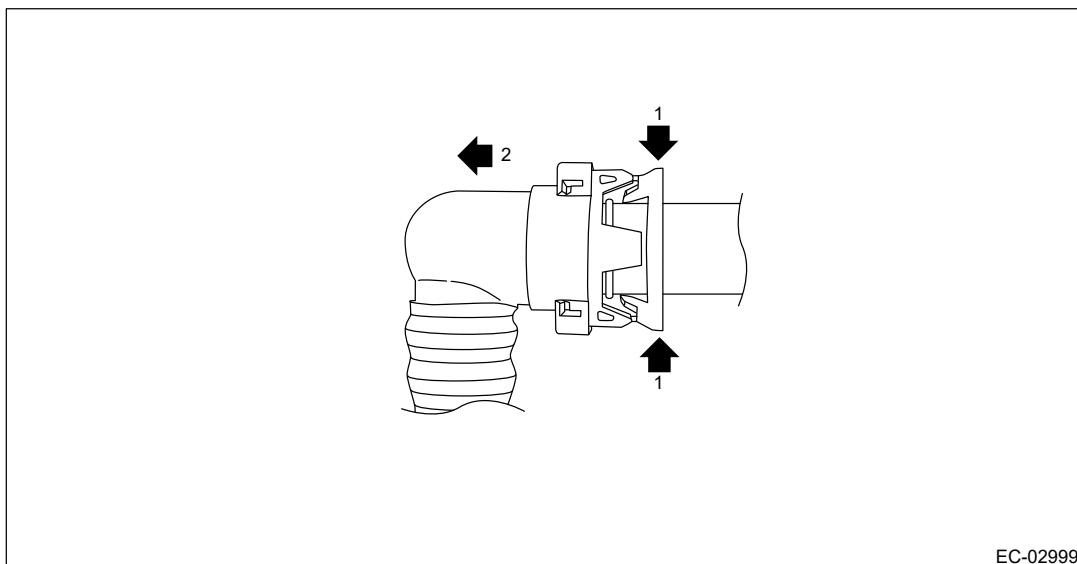
6. Remove the rear sub frame assembly.  [Ref. to REAR SUSPENSION>Rear Sub Frame>REMOVAL.](#)
7. Remove the rear mud guard RH.  [Ref. to EXTERIOR/INTERIOR TRIM>Mud Guard>REMOVAL.](#)
8. Disconnect fuel filler hose (A) and air vent hose (B) from the fuel filler pipe assembly.

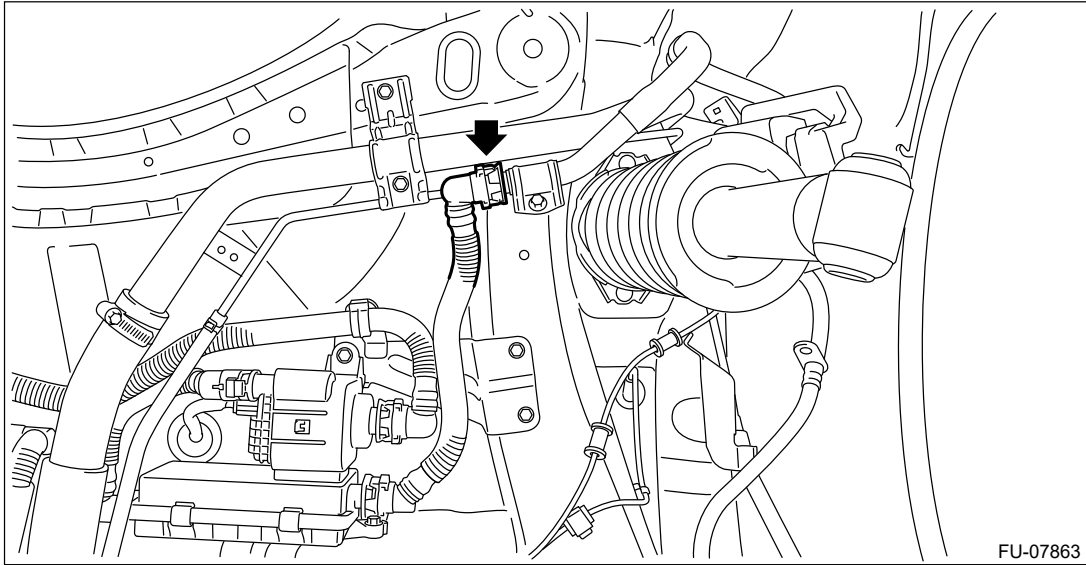


9. Disconnect the quick connectors for the drain pipe from the fuel filler pipe assembly.

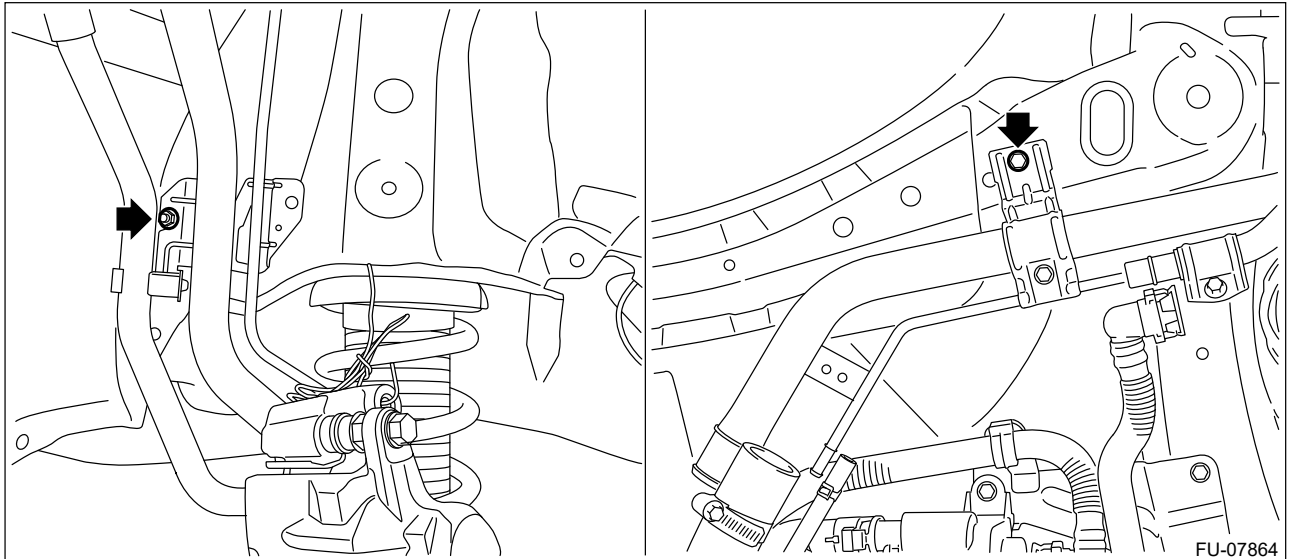
Note:

Disconnect the quick connector as shown in the figure.





10. Remove the bolts and nuts which secure the fuel filler pipe assembly to the vehicle.



11. Remove the fuel filler pipe assembly from the underside of the vehicle.

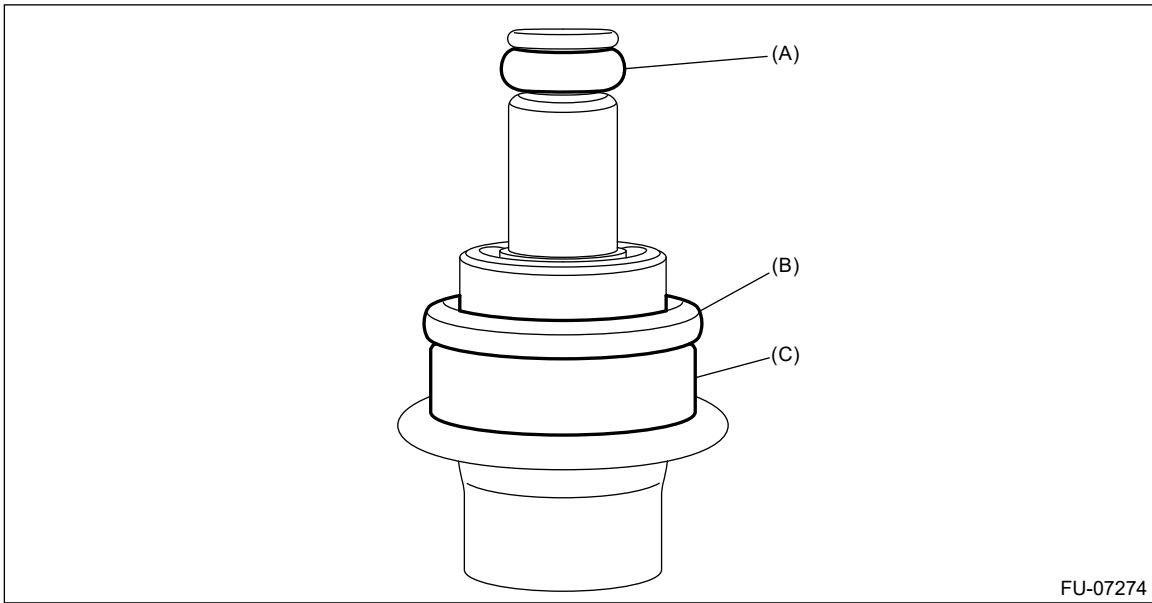
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Filter

INSTALLATION

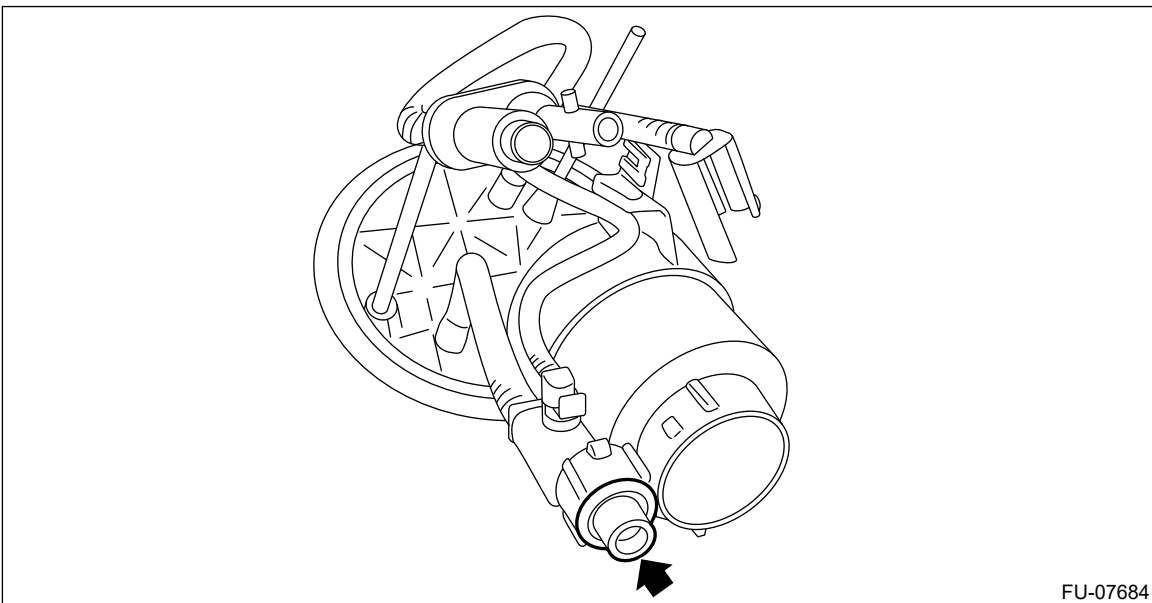
1. Install O-ring (A), O-ring (B), and backup ring (C) to the pressure regulator.

Note:

- Use new O-rings.
- Apply gasoline to the O-ring and backup ring.



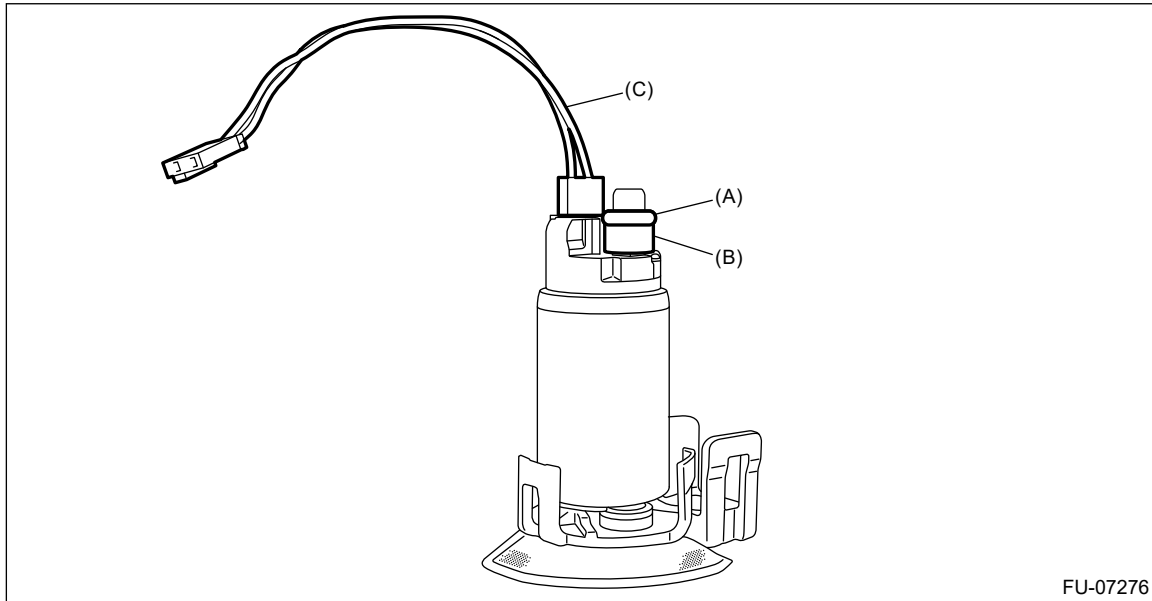
2. Install the pressure regulator to the fuel filter assembly.



3. Install O-ring (A), spacer (B), and connector cable (C) to the fuel pump.

Note:

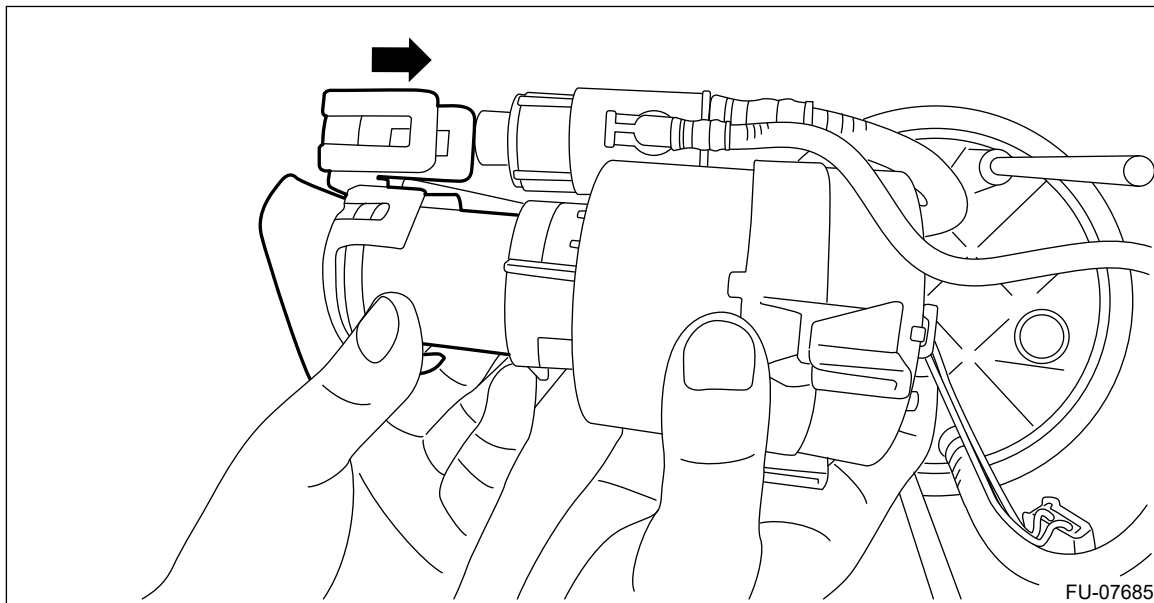
- Use new O-rings and the connector cable.
- Apply gasoline to the O-rings and the spacer.



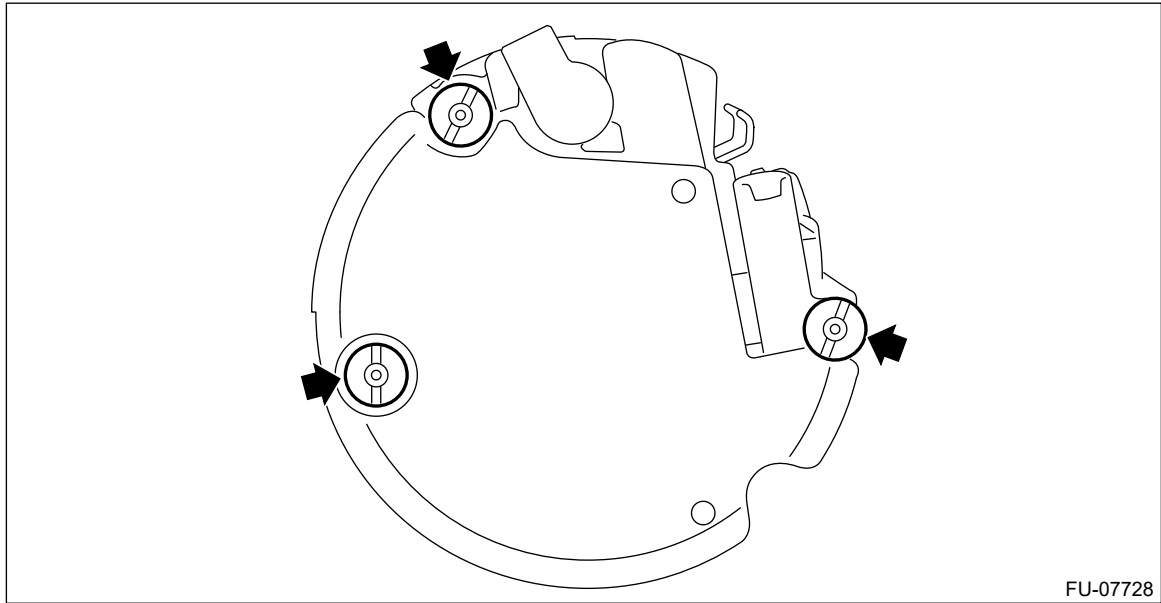
4. Install the fuel pump to the fuel filter assembly.

Note:

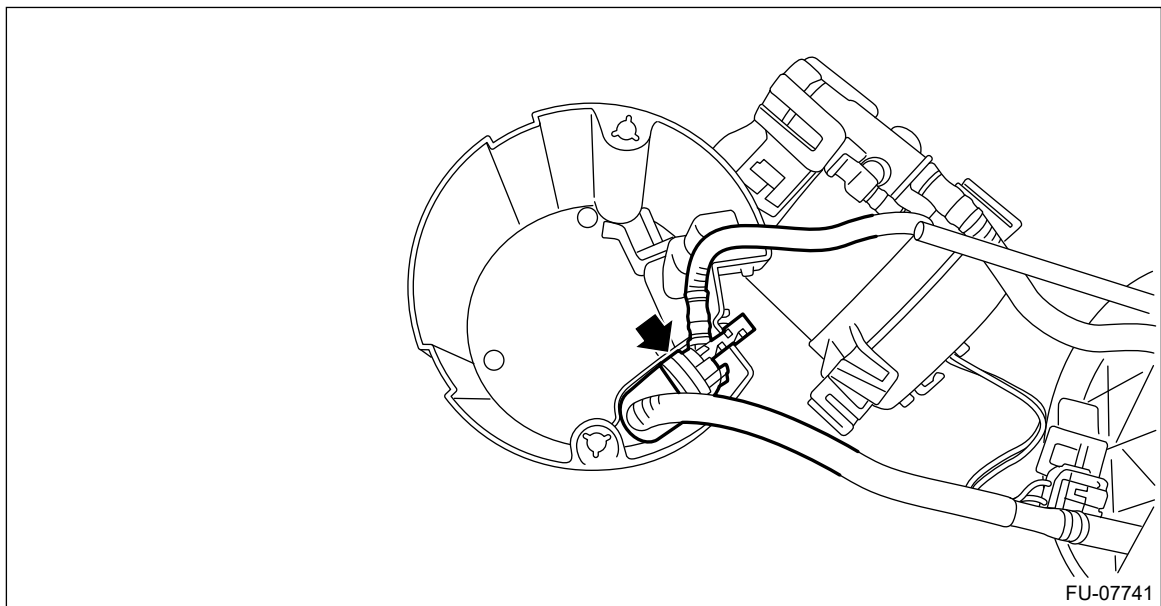
After installation, make sure five claws are correctly engaged in each position.



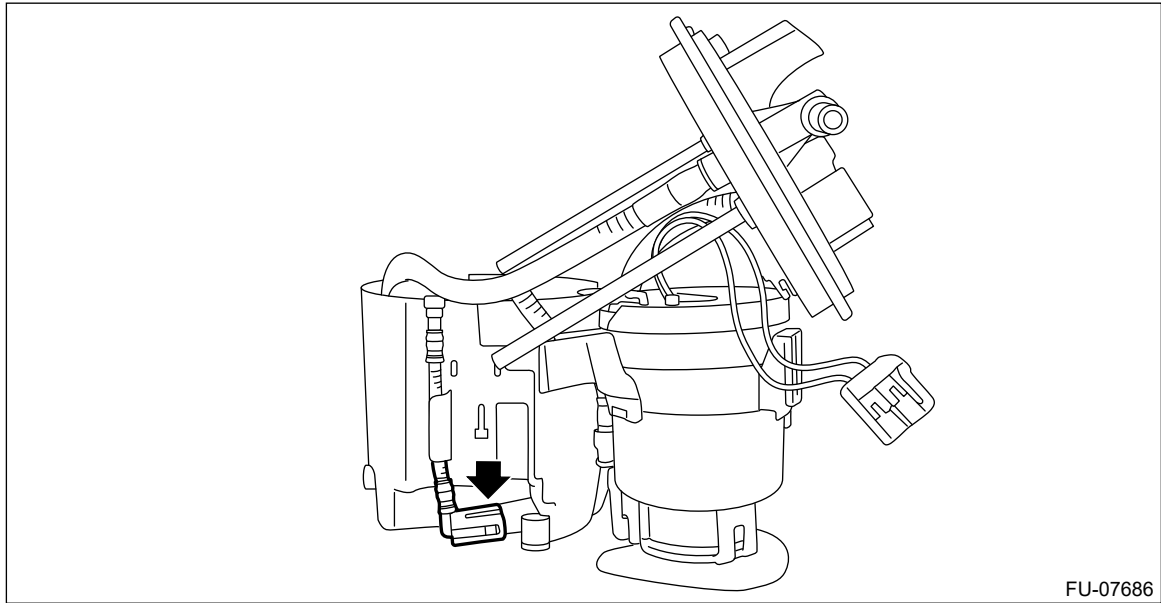
5. Check that the cushions of the fuel chamber assembly for dislocation. If any of them is dislocated, install a new cushion.



6. Slowly press in and install the tube assembly to the fuel chamber assembly until a clicking sound is heard.



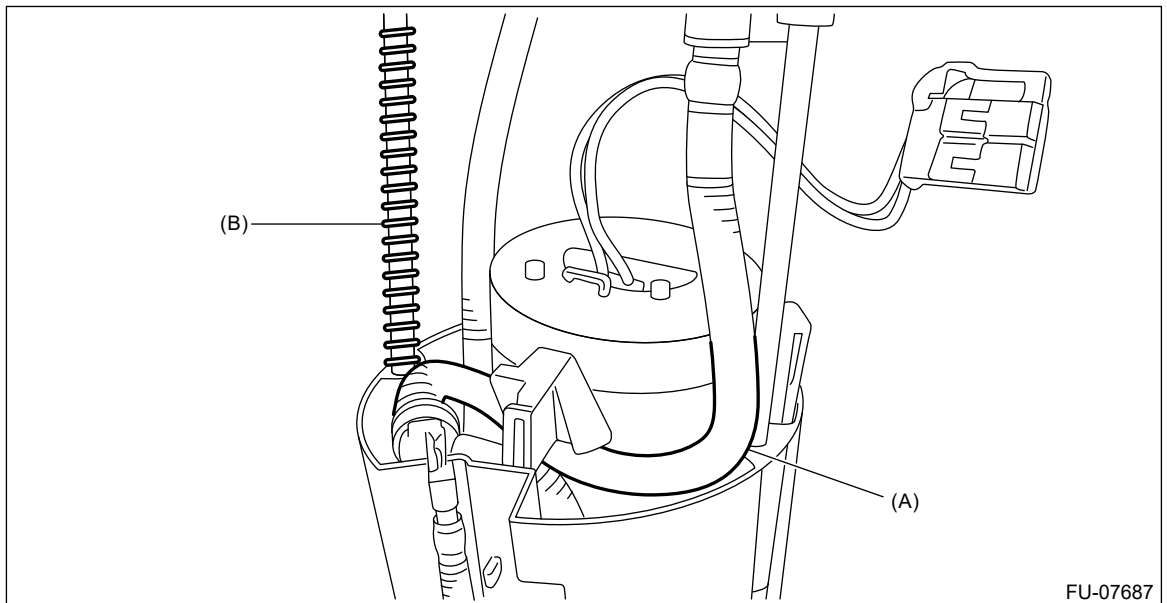
7. Install the tube assembly to the fuel chamber assembly, and connect the tube assembly to the fuel chamber assembly.



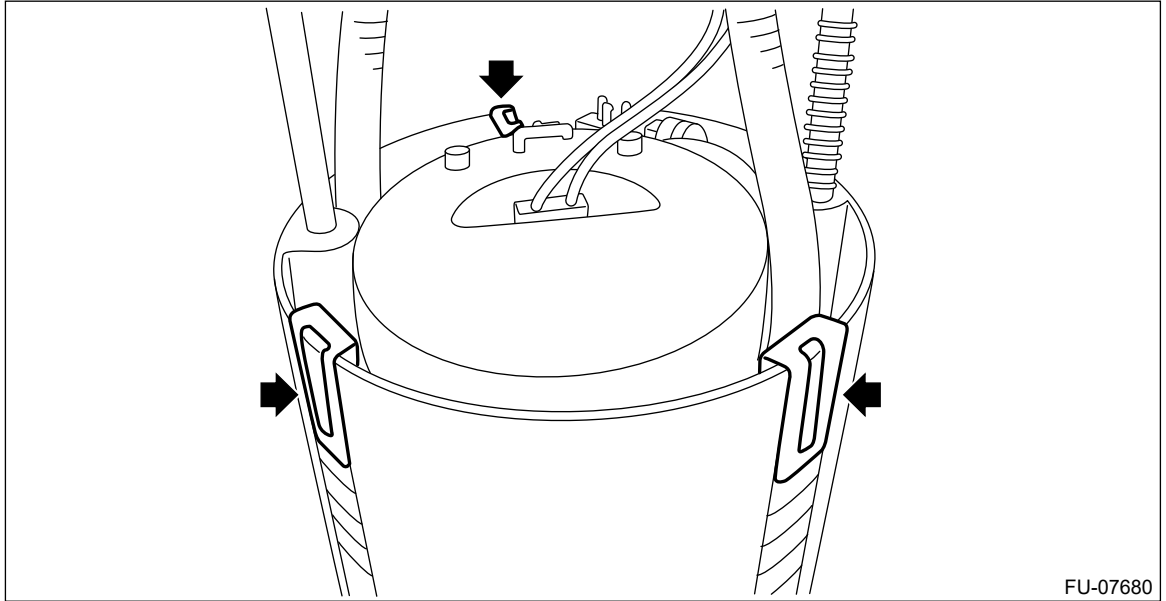
8. Install the fuel filter assembly to the fuel chamber assembly.

Note:

- **Set the tube (A) and spring (B) for the fuel filter assembly as shown in the figure.**



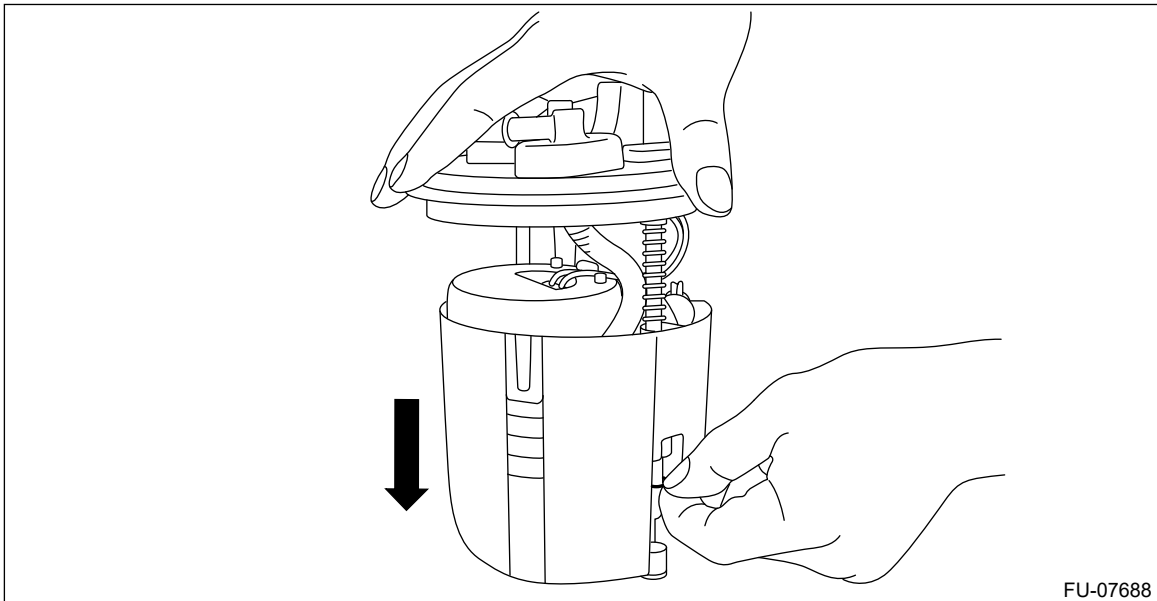
- **Check that the claw connecting the fuel chamber assembly and the fuel filter assembly is securely fastened.**



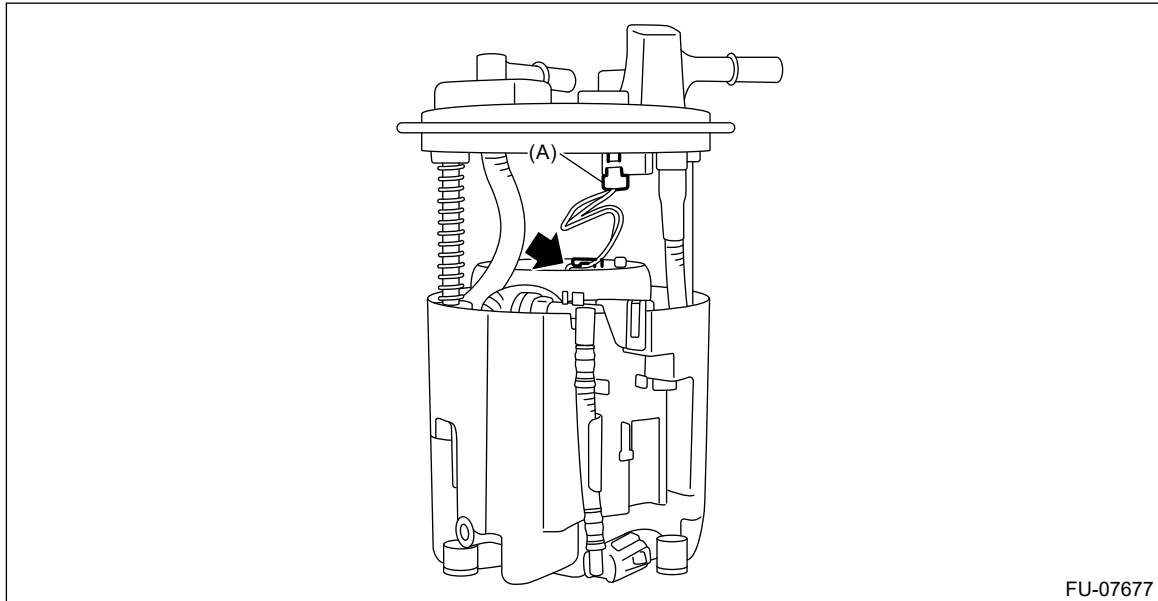
9. Push the fuel filter assembly in the direction of the arrow to compress, and attach the clip.




Note:

Use a new clip.



10. Secure the connector cable with the clip, and connect the connector (A) of the connector cable.



- 11.** Install the fuel level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Level Sensor>INSTALLATION.](#)
- 12.** Inspect the fuel level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Level Sensor>INSPECTION.](#)
- 13.** Install the fuel pump assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Pump>INSTALLATION.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Filter

REMOVAL

Warning:



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

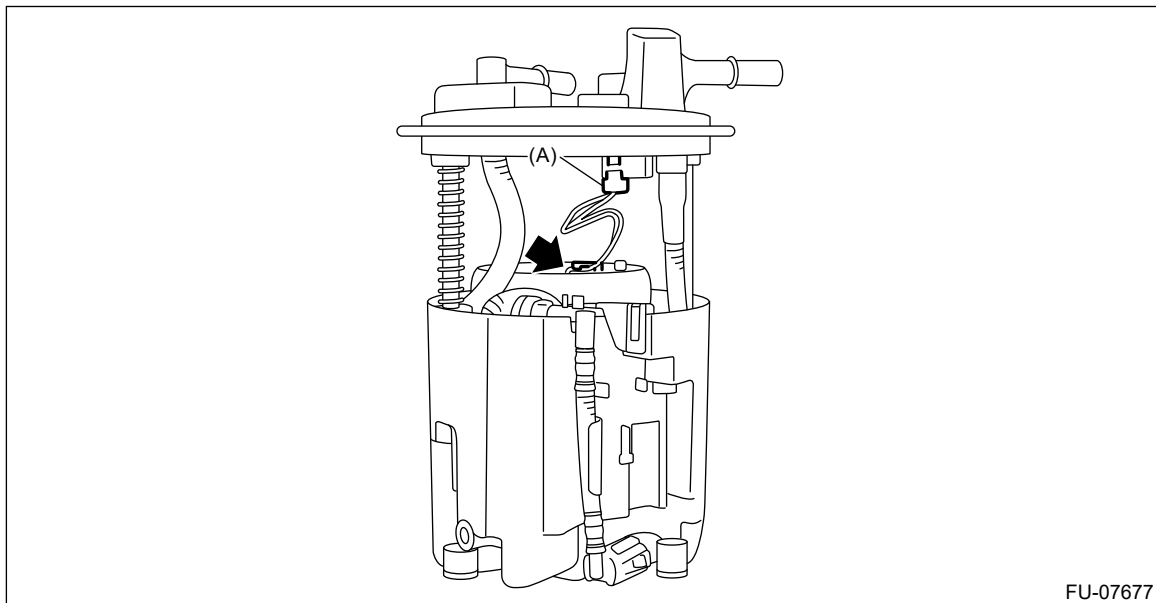
Caution:

- Be careful not to spill fuel.
- If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.
- Be careful not to drop or apply any impact to the fuel pump during work. This may deteriorate its performance.

Note:

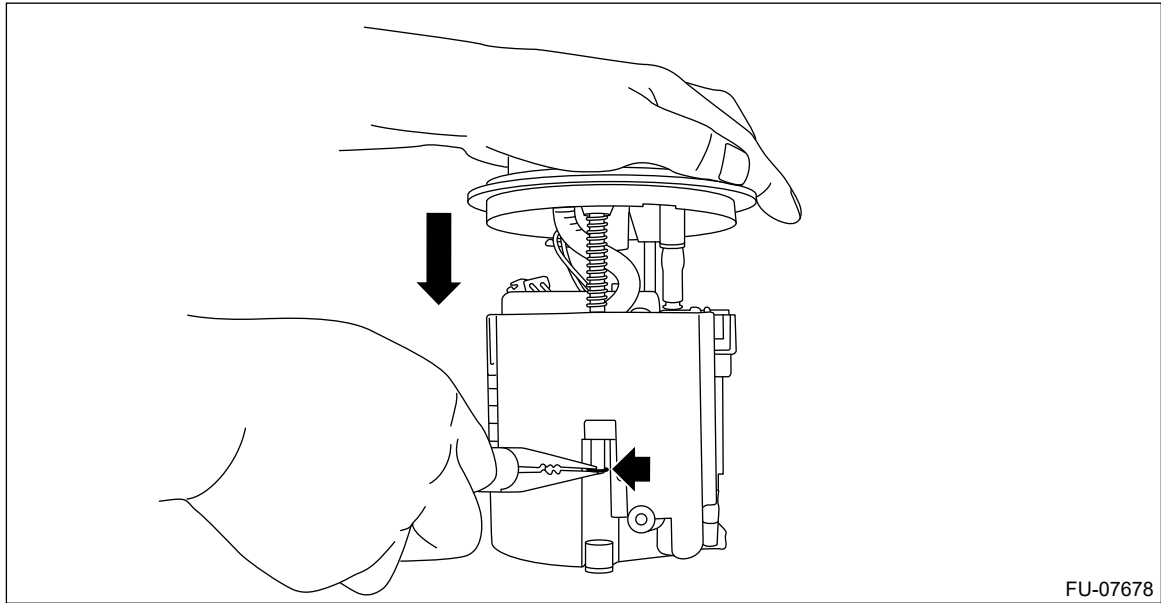
The fuel filter is built in fuel pump assembly.

1. Remove the fuel pump assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Pump>REMOVAL.](#)
2. Remove the fuel level sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Level Sensor>REMOVAL.](#)
3. Remove the connector cable from the clip, and disconnect the connector (A) of the connector cable.



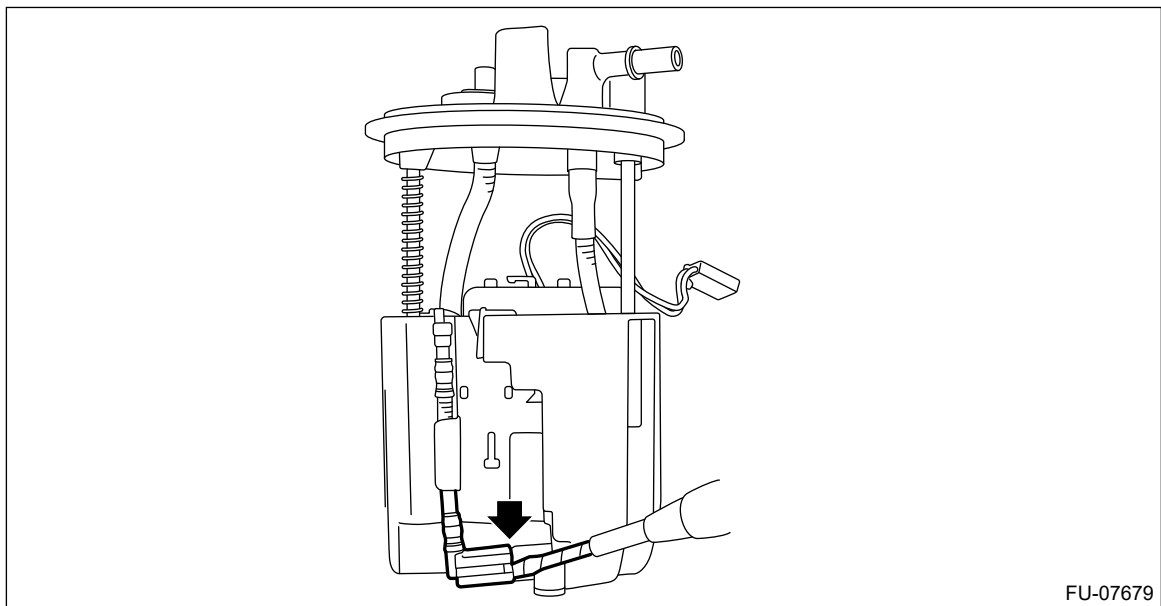
FU-07677

4. Push the fuel filter assembly in the direction of the arrow to compress, and detach the connecting clip.



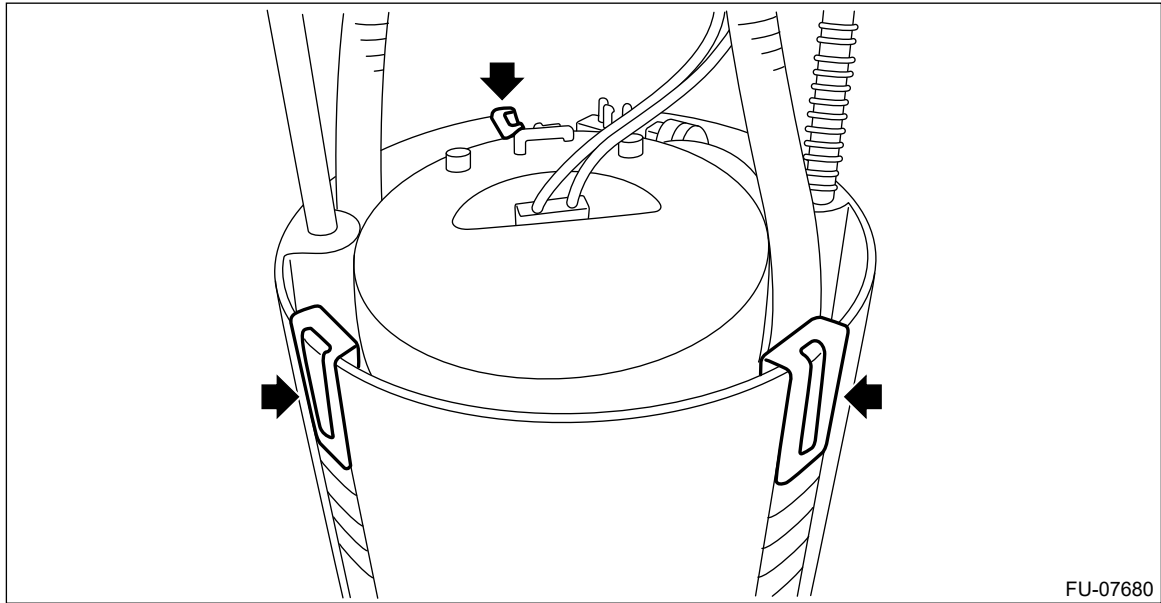
FU-07678

5. Release the claw using a flat tip screwdriver or similar tool wrapped with a protection tape, and remove the tube assembly from the fuel chamber assembly.

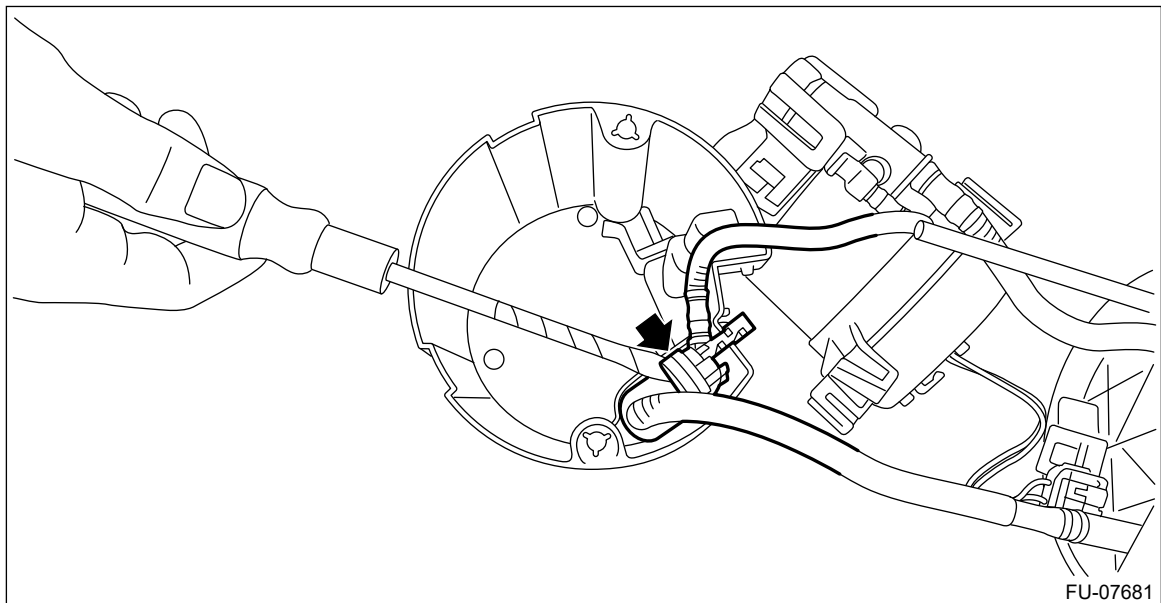


FU-07679

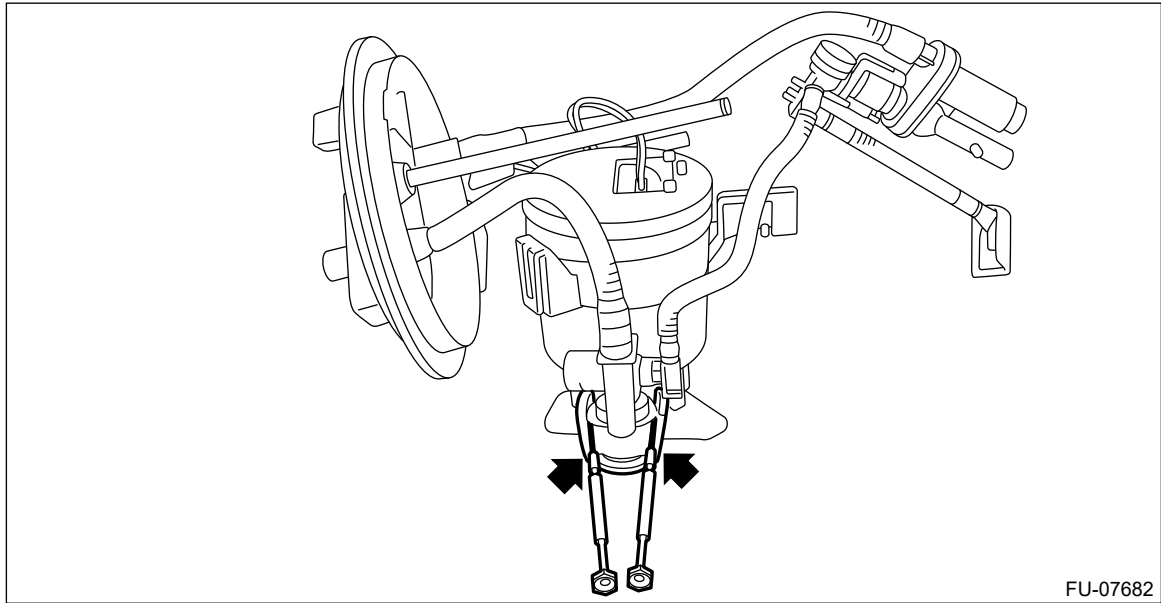
6. Release three claws on the fuel pump holder from the fuel chamber assembly, and raise the fuel filter assembly.



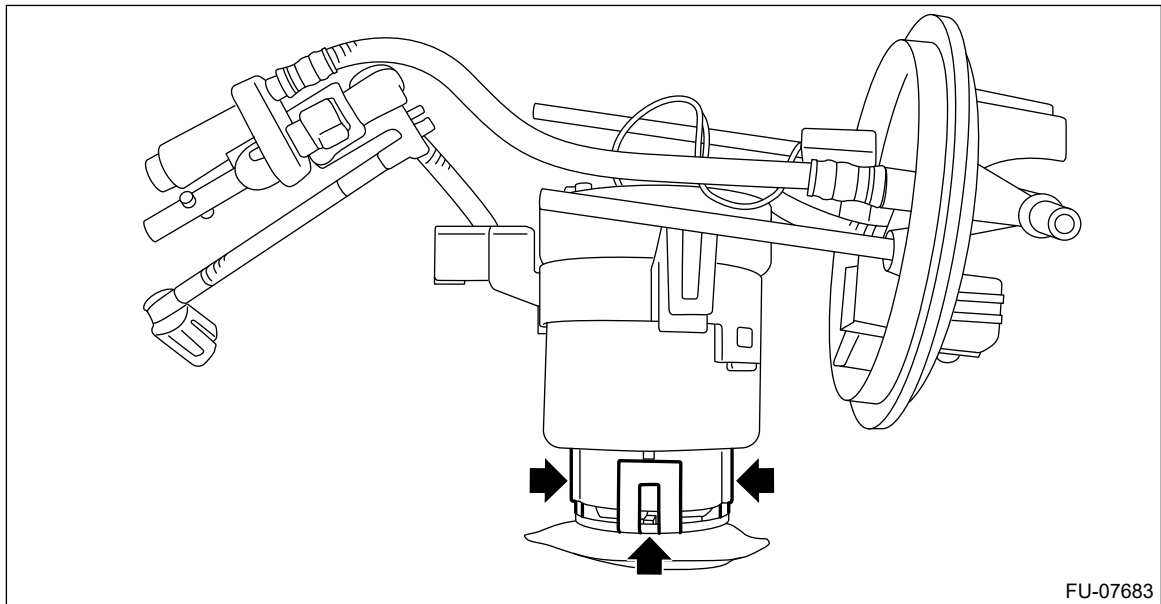
7. Using a flat tip screwdriver or similar tool wrapped with a protection tape, remove the tube assembly from the fuel chamber assembly, and separate the fuel filter assembly and fuel chamber assembly.



8. Using a precision driver or similar tool wrapped with a protection tape, expand the claws on the fuel pump.



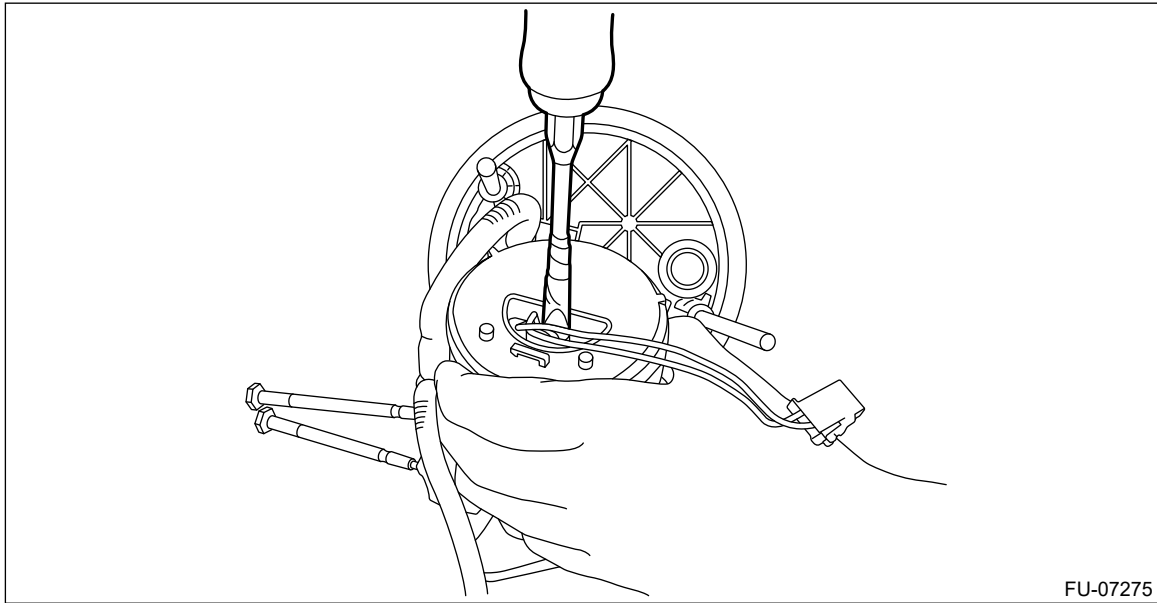
9. Release the claws on the fuel pump.



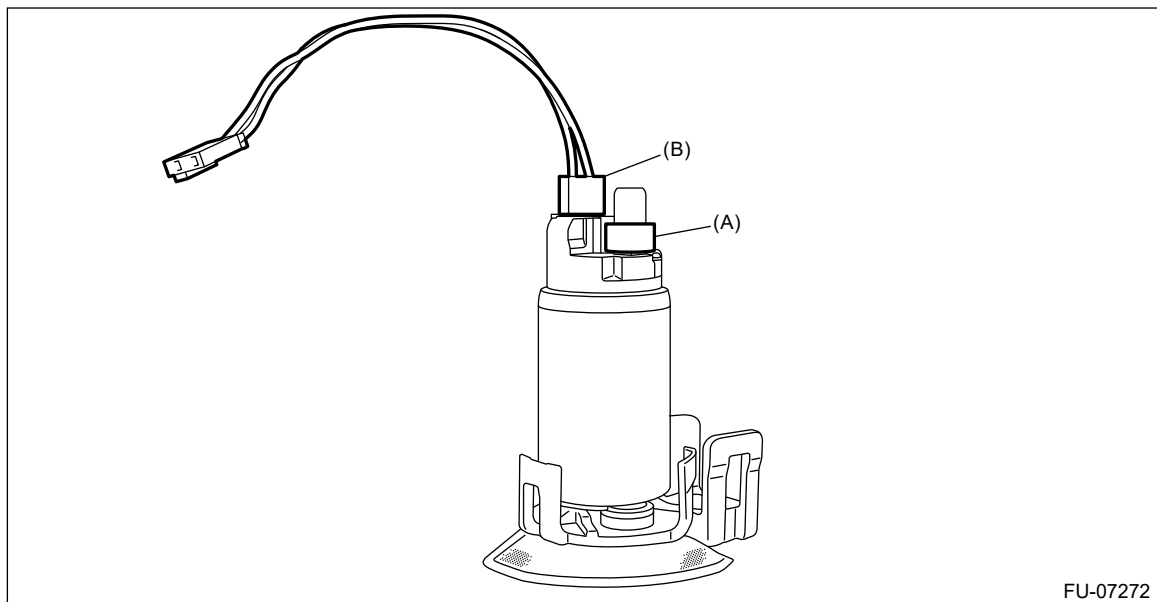
10. Using a flat tip screwdriver or similar tool wrapped with a protection tape, press on the fuel pump and remove the fuel pump together with the fuel pump holder from the fuel filter assembly.

Caution:

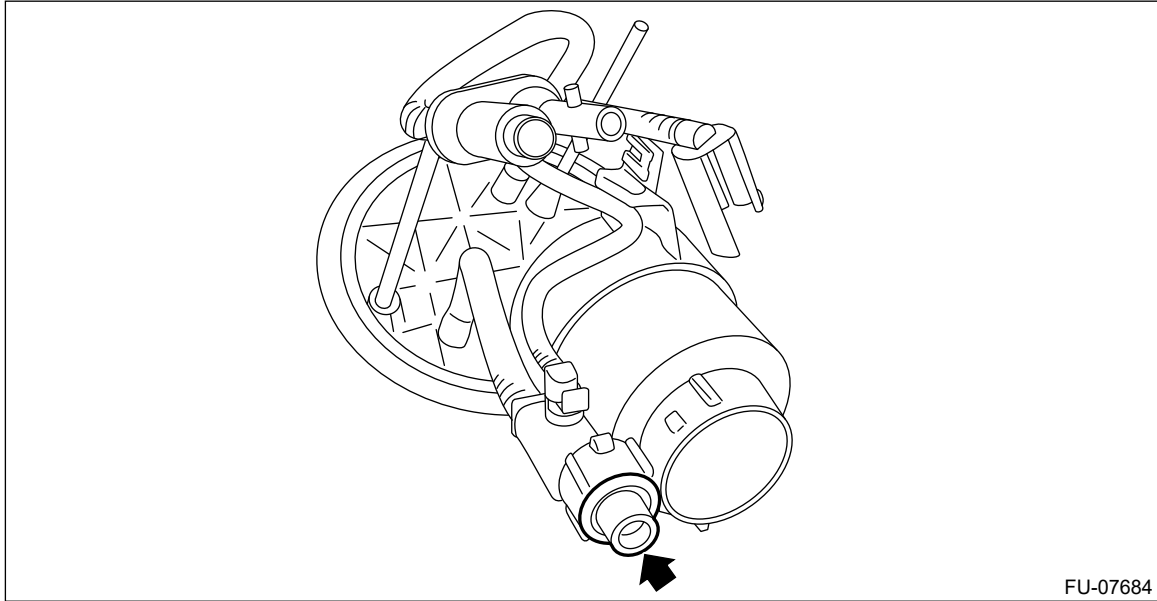
If O-rings remain on the fuel filter assembly side, carefully remove them with a precision screwdriver or similar tool wrapped with a protection tape.



11. Remove the spacer (A) and connector cable (B) from the fuel pump.

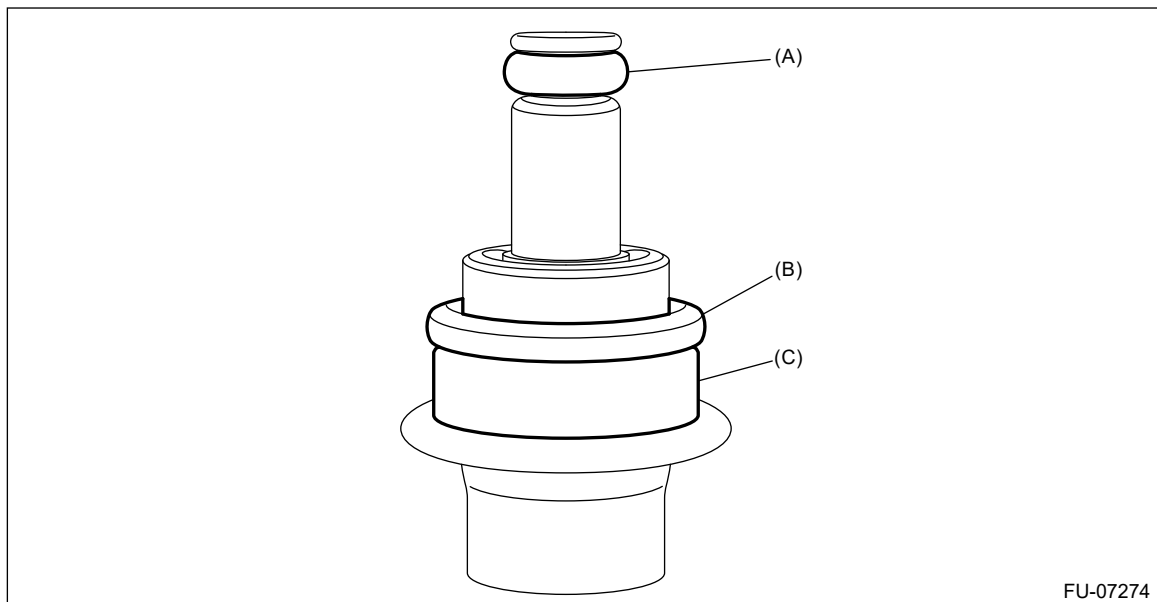


12. Remove the pressure regulator from the fuel filter assembly.



FU-07684

13. Remove O-ring (A), O-ring (B), and backup ring (C) from the pressure regulator.

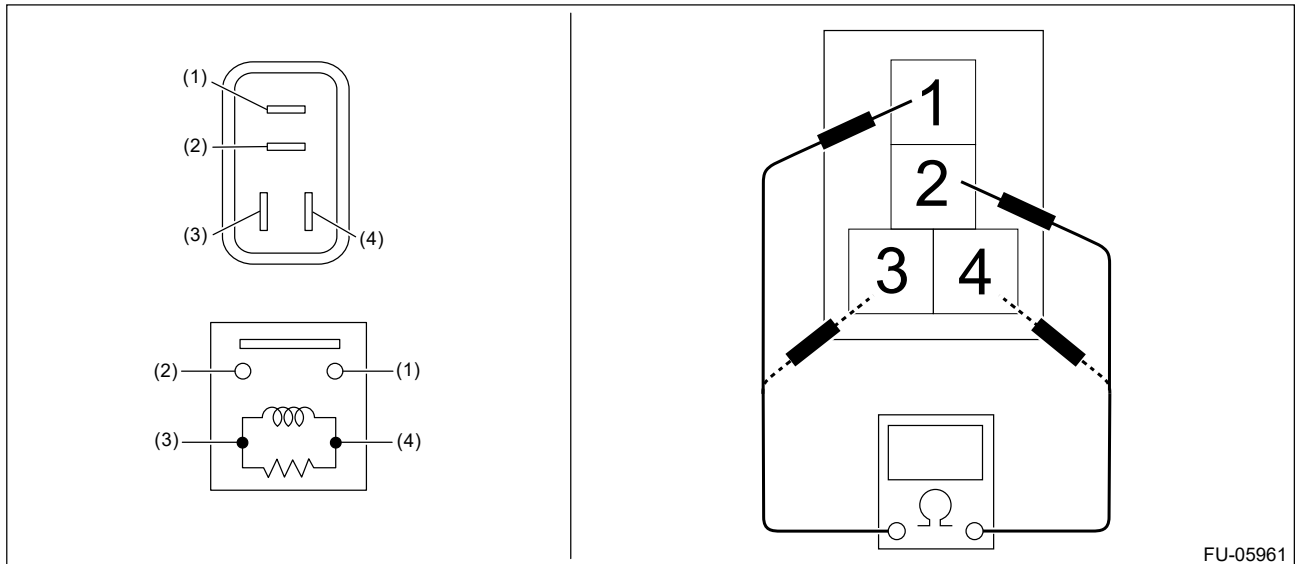


FU-07274

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Injector Relay

INSPECTION

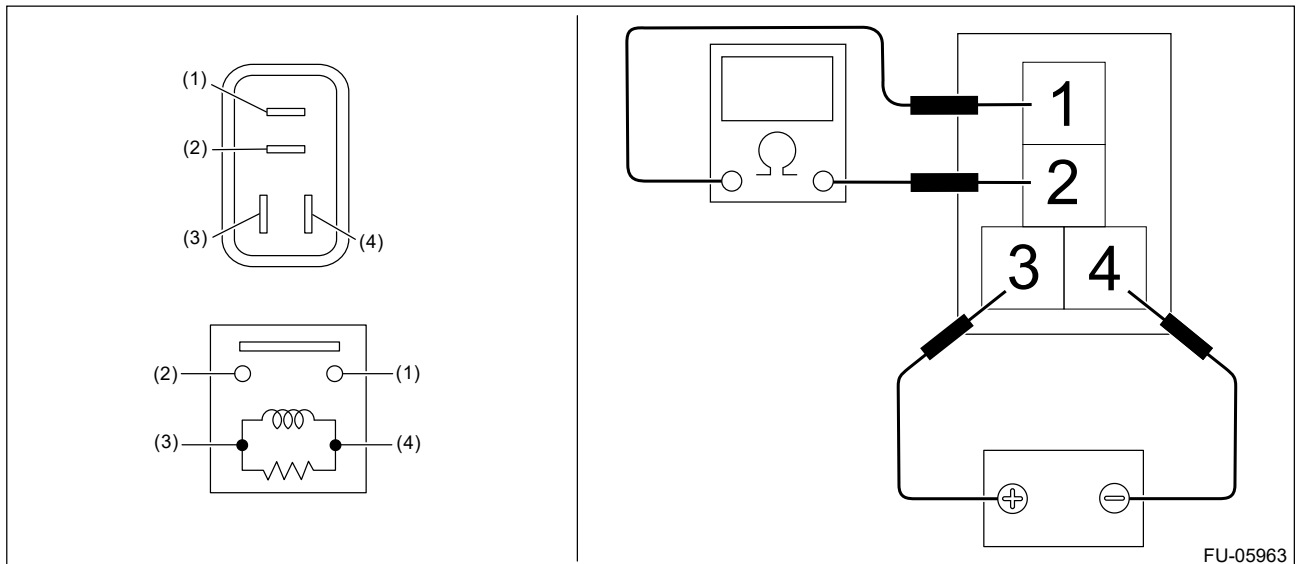
1. Check that the fuel injector relay has no deformation, cracks or other damages.
2. Measure the resistance between fuel injector relay terminals.



FU-05961

| Terminal No. | Standard |
|--------------|---------------------------------|
| 1 and 2 | 1 MΩ or more |
| 3 and 4 | 93.8—136.4 Ω (when 20°C (68°F)) |

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



FU-05963

| Terminal No. | Standard |
|--------------|---------------|
| 1 and 2 | Less than 1 Ω |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Injector Relay

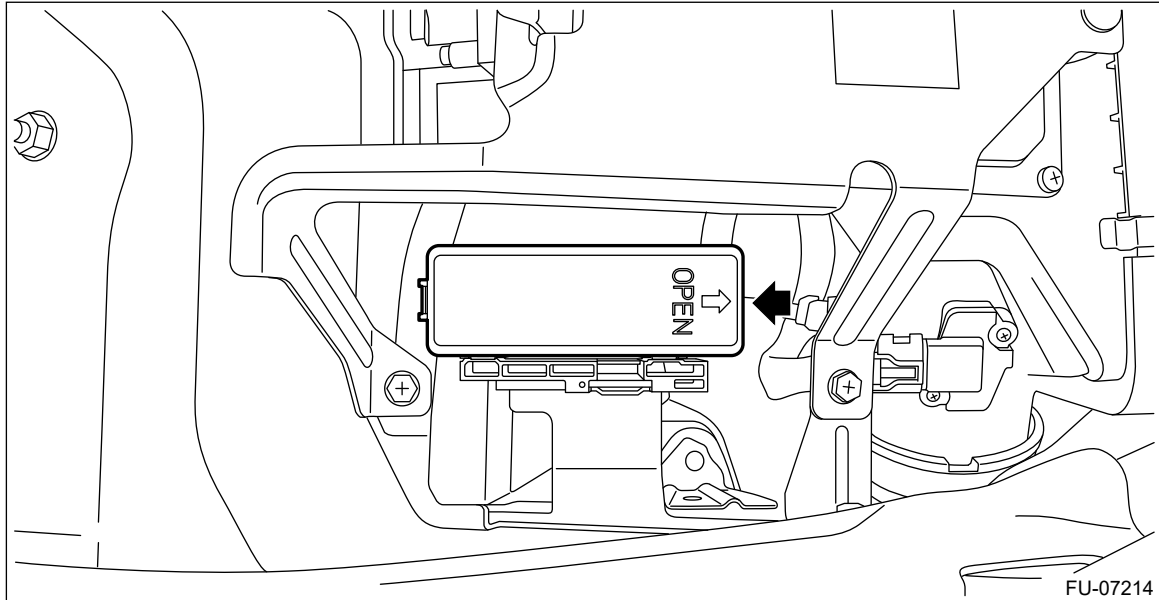
INSTALLATION

Install in the reverse order of removal.

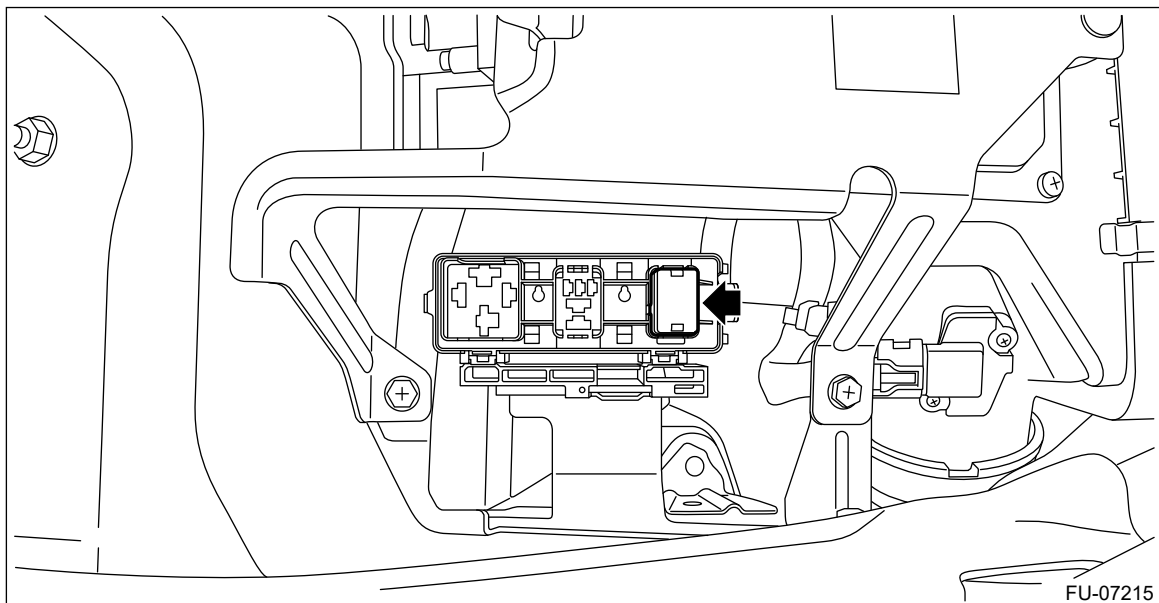
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Injector Relay

REMOVAL

1. Disconnect the ground cable from battery.
2. Remove the cover from the relay block on the front side of the front strut RH.



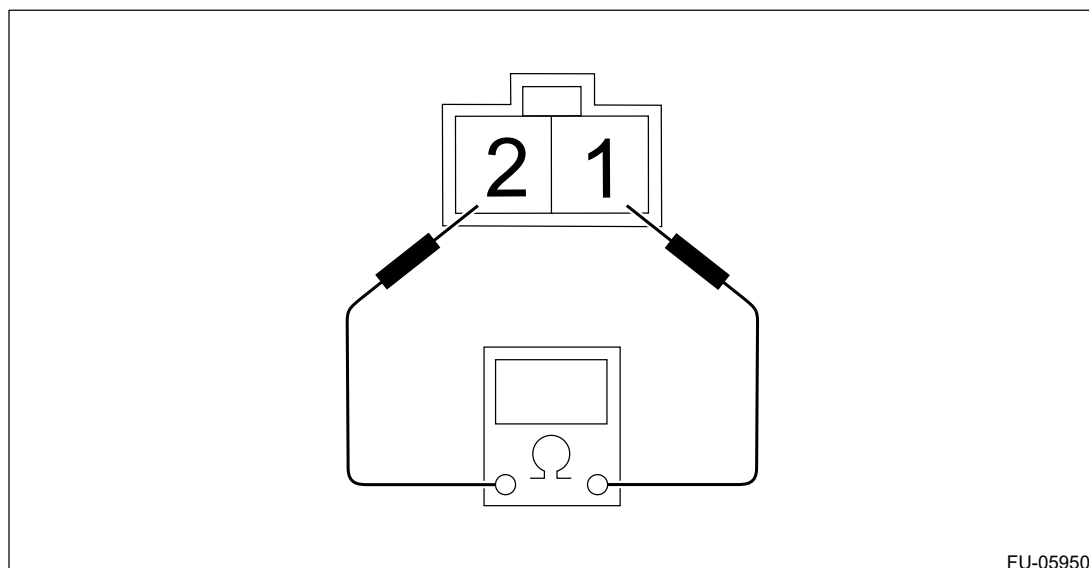
3. Remove the fuel injector relay from relay block.



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Injector

INSPECTION

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




| Terminal No. | Standard |
|--------------|---|
| 1 and 2 | Approx. 2.1 Ω (when 20°C (68°F)) |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Injector

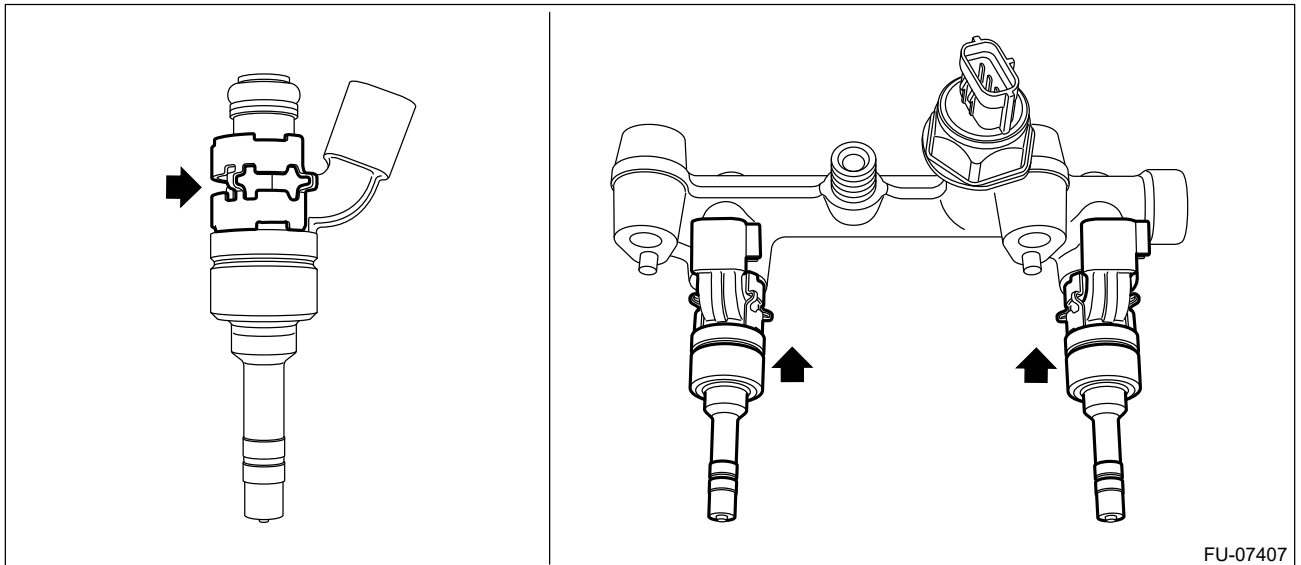
INSTALLATION

1. FUEL INJECTOR RH

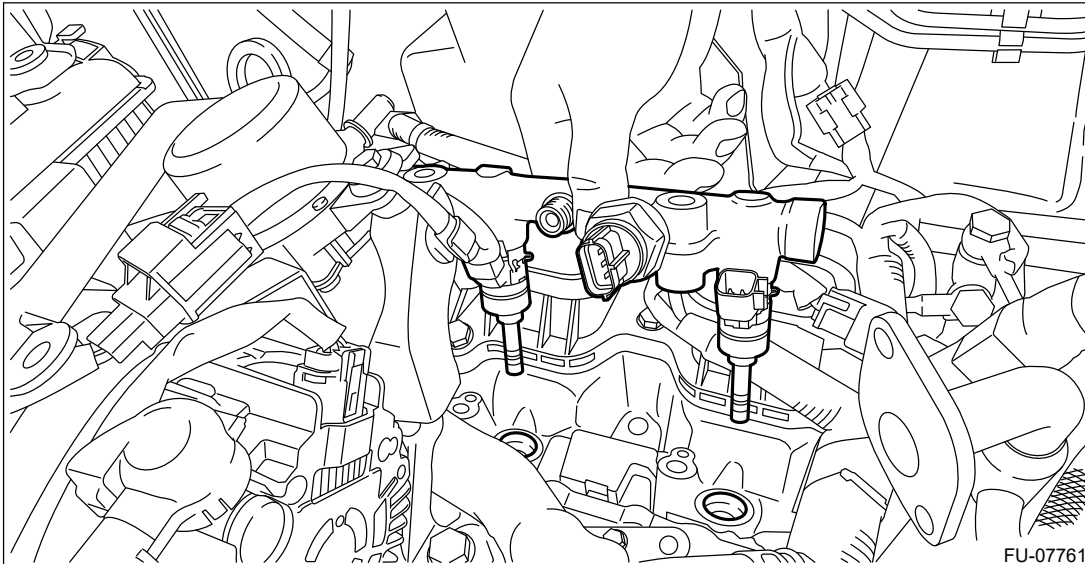
1. Replace injector seal, retainer, and O-ring with a new part.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Injector>REPLACEMENT](#).
2. Set the holder to the fuel injector, and install it to the fuel injector pipe RH.

Caution:

Always use a new holder.



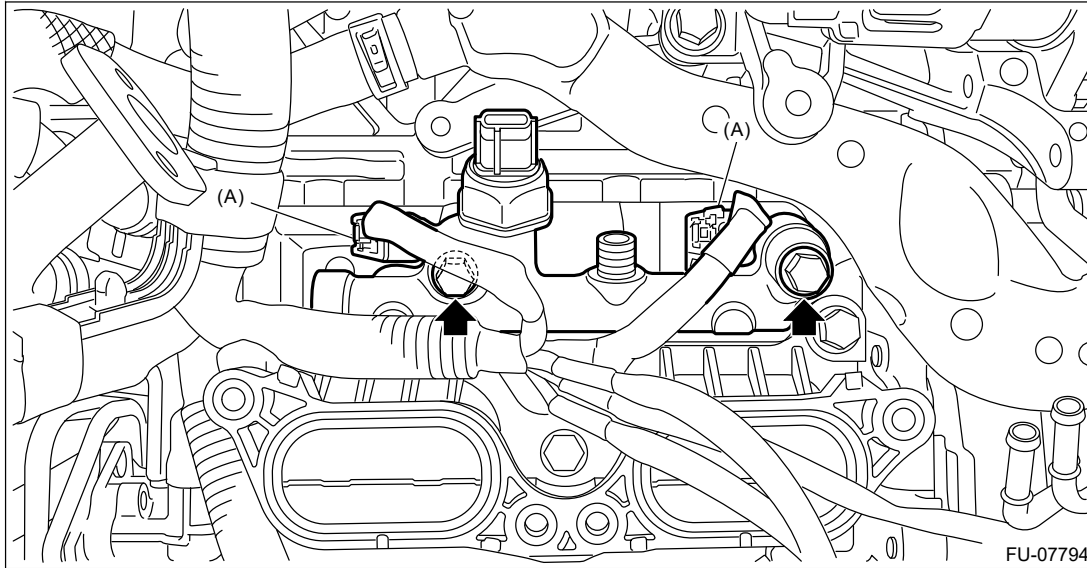
3. Install the fuel injector pipe RH and fuel injector as a single unit to the cylinder head.



4. Tighten the bolt on fuel pipe RH, and connect the connector (A) to the fuel injector.


Tightening torque:

19 N•m (1.9 kgf-m, 14.0 ft-lb)

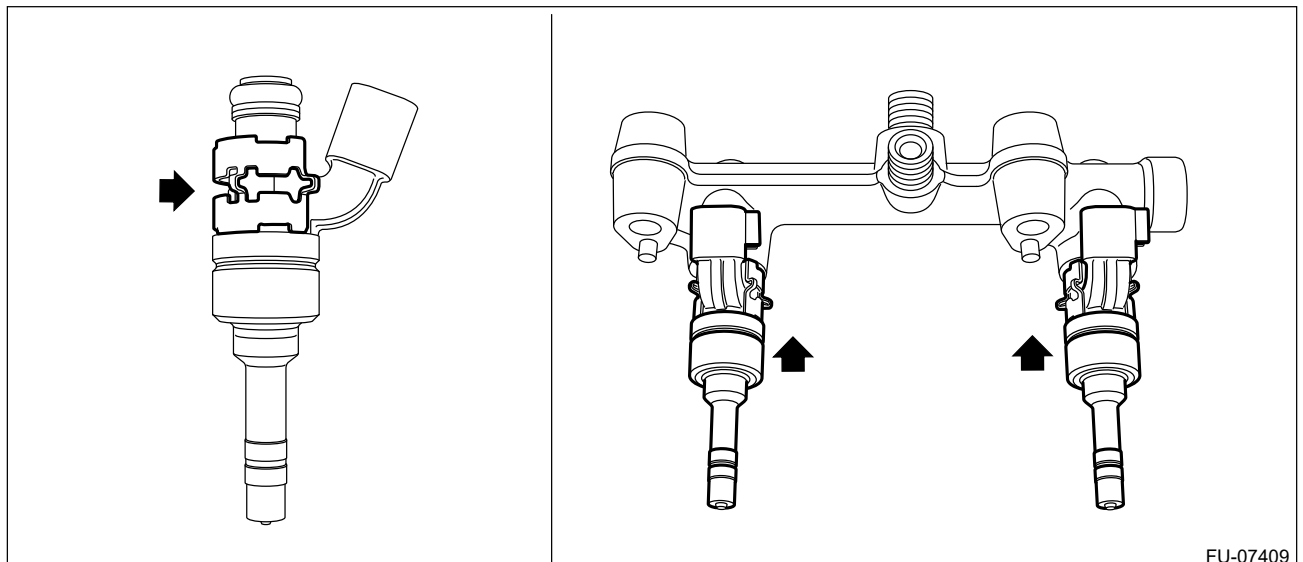


5. Install the high-pressure fuel delivery pipe assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Delivery Pipe>INSTALLATION > HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY.](#)
6. Connect the battery ground terminal.

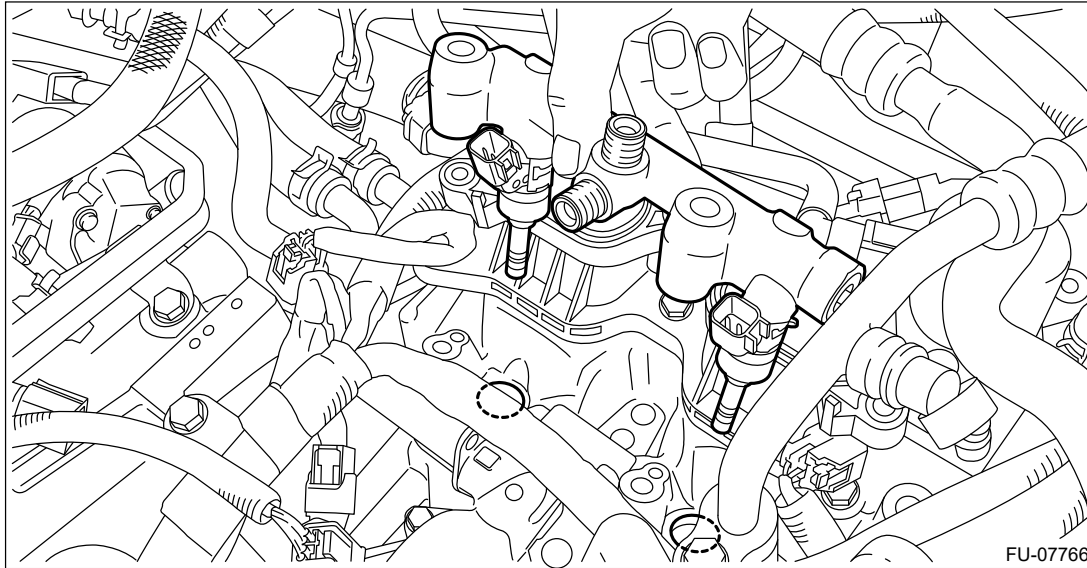
2. FUEL INJECTOR LH

1. Replace injector seal, retainer, and O-ring with a new part.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Injector>REPLACEMENT.](#)
2. Set the holder to the fuel injector, and install it to the fuel injector pipe LH.

Caution:
Always use a new holder.



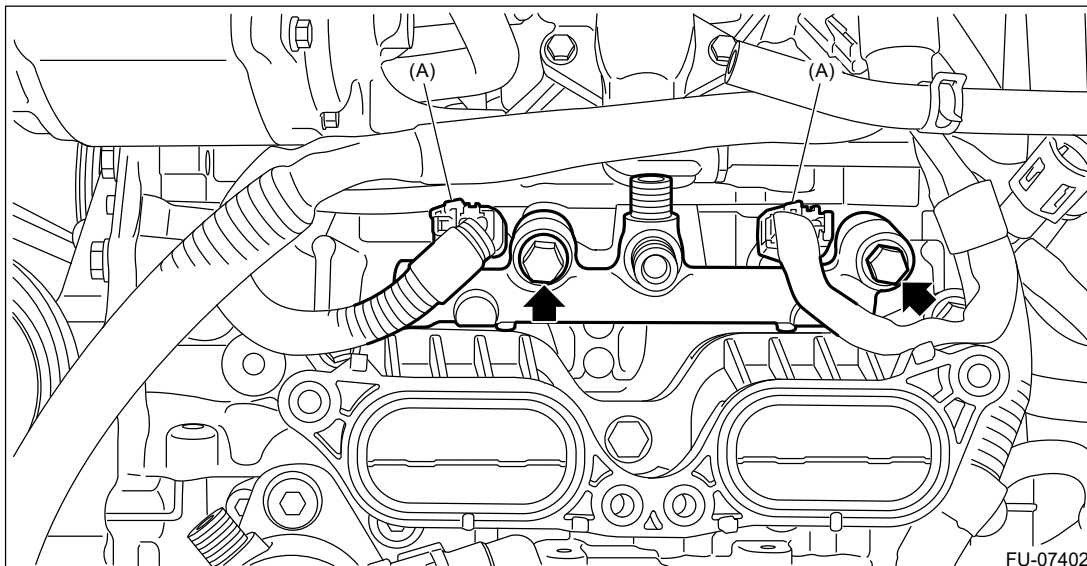
3. Install the fuel injector pipe LH and fuel injector as a single unit to the cylinder head.





4. Tighten the bolt on fuel injector pipe LH, and connect the connector (A) to the fuel injector.

Tightening torque:

19 N•m (1.9 kgf-m, 14.0 ft-lb)




5. Install the high-pressure fuel delivery pipe assembly.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Delivery Pipe>INSTALLATION > HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY.](#)
6. Install the high-pressure fuel delivery pipe.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Delivery Pipe>INSTALLATION > HIGH-PRESSURE FUEL DELIVERY PIPE.](#)
7. Connect the battery ground terminal.

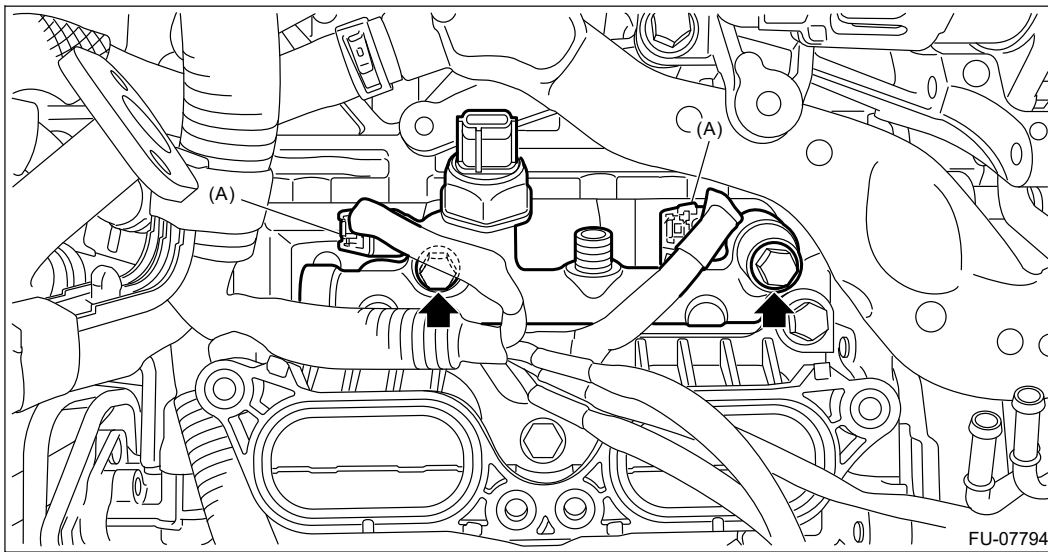
REMOVAL

1. FUEL INJECTOR RH

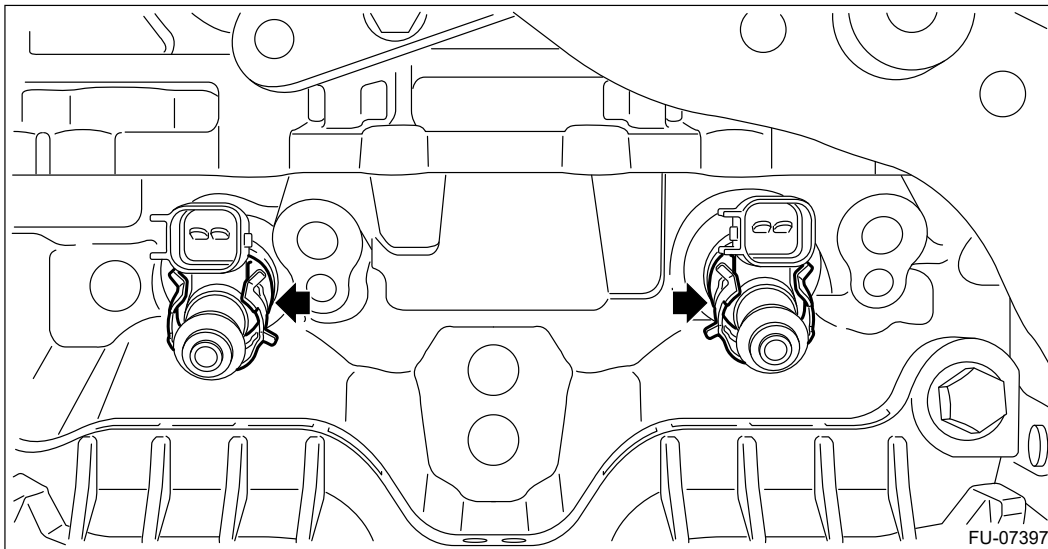
Caution:

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

1. Disconnect the ground cable from battery.
2. Remove the high-pressure fuel delivery pipe assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Delivery Pipe>REMOVAL > HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY.](#)
3. Disconnect the connector (A) from fuel injector, and remove the fuel injector pipe.



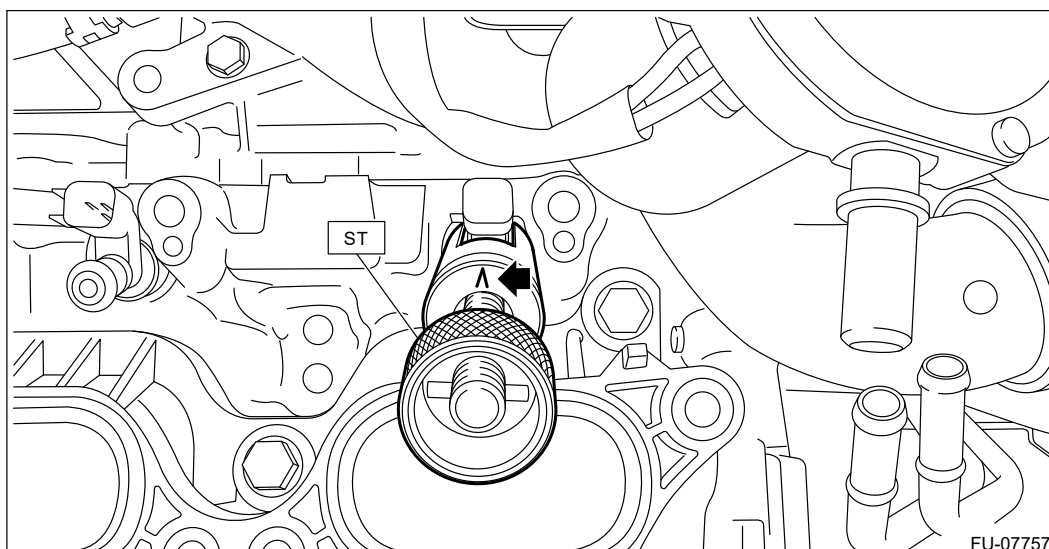
4. Remove the holder from the fuel injector.



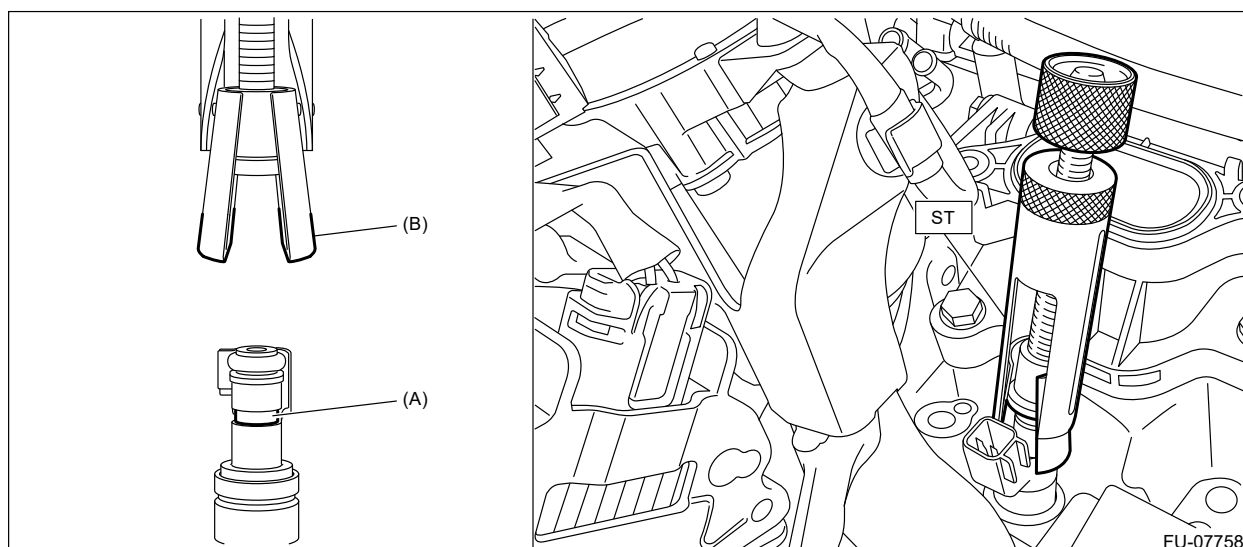
5. Using ST, remove the fuel injector from the cylinder head.

ST 18356AA000 INJECTOR REMOVER

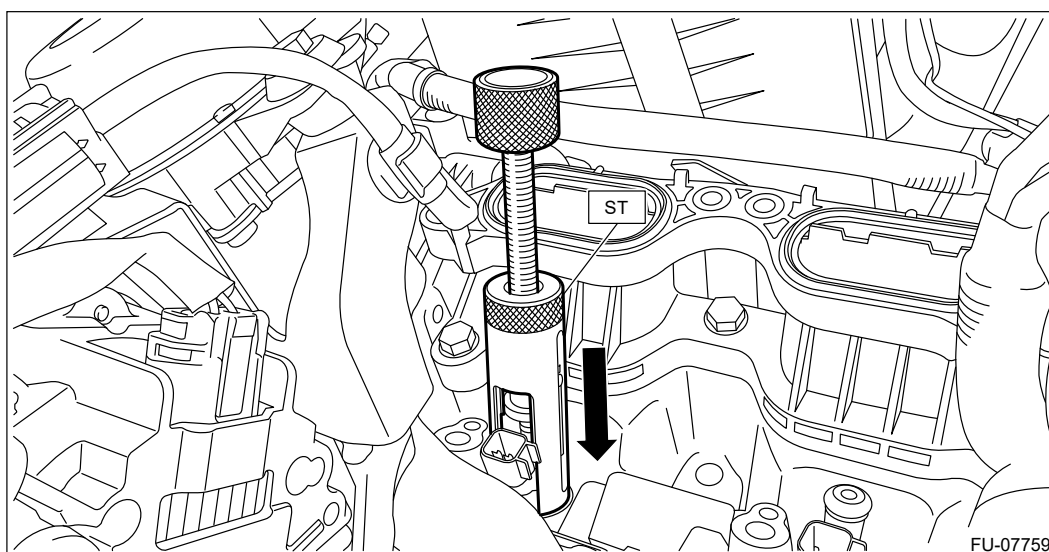
(1) Set the ST so that its mark faces the center of the engine.



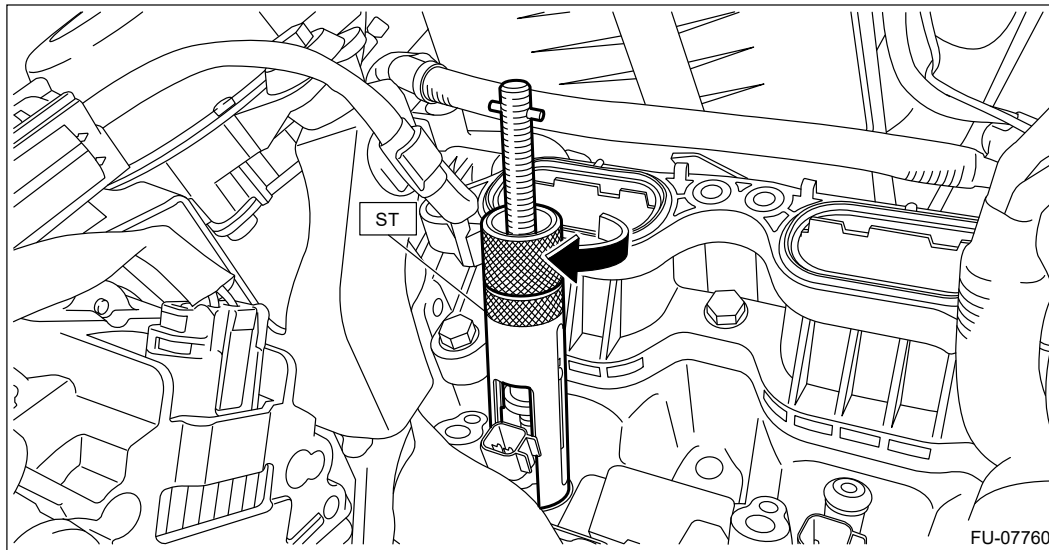
(2) Pinch the fuel injector groove (A) with the claw section (B) of ST.



(3) Press the ST to the cylinder head.





- (4) Screw in the threaded section of the ST clockwise, and remove the fuel injector from the cylinder head.

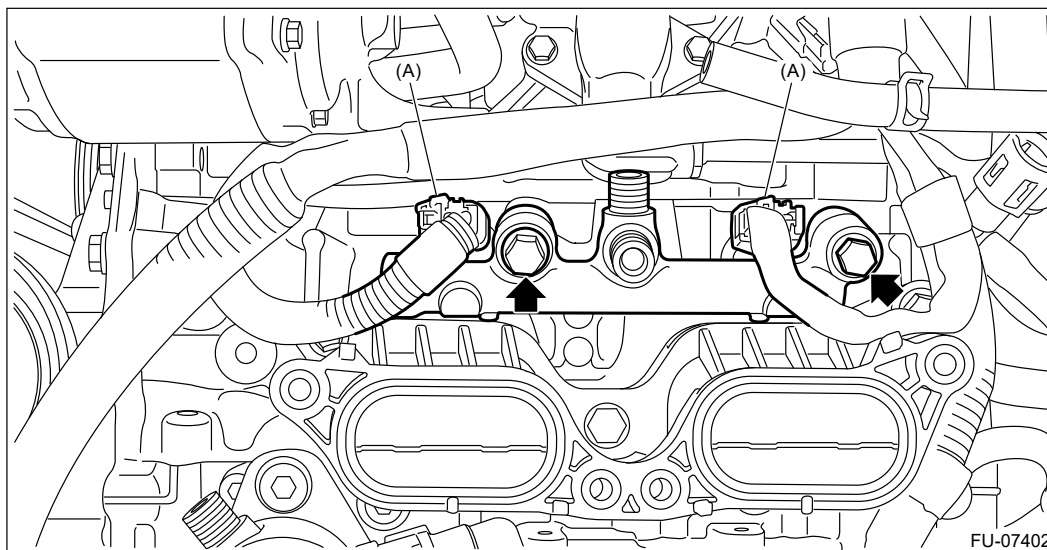


2. FUEL INJECTOR LH

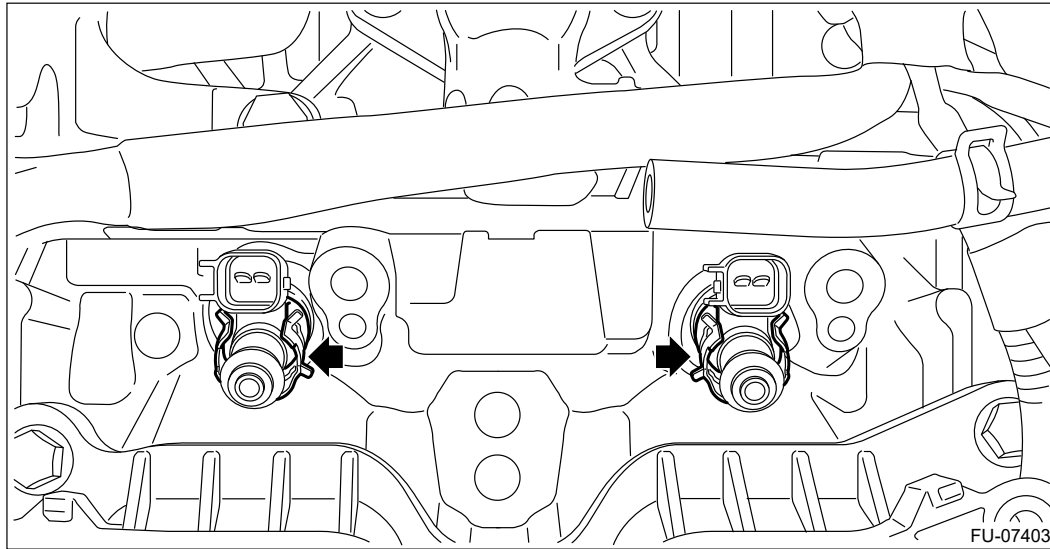
Caution:

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

1. Disconnect the ground cable from battery.
2. Remove the high-pressure fuel delivery pipe assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Delivery Pipe>REMOVAL > HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY.](#)
3. Remove the high-pressure fuel delivery pipes.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Delivery Pipe>REMOVAL > HIGH-PRESSURE FUEL DELIVERY PIPE.](#)
4. Disconnect the connector (A) from fuel injector, and remove the fuel injector pipe LH.



5. Remove the holder from the fuel injector.

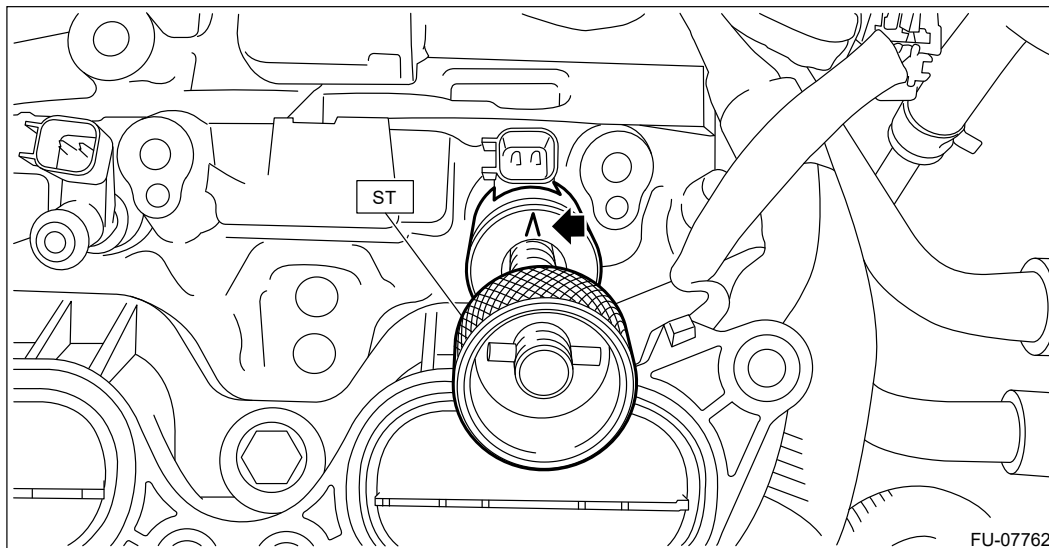


FU-07403

6. Using ST, remove the fuel injector from the cylinder head.

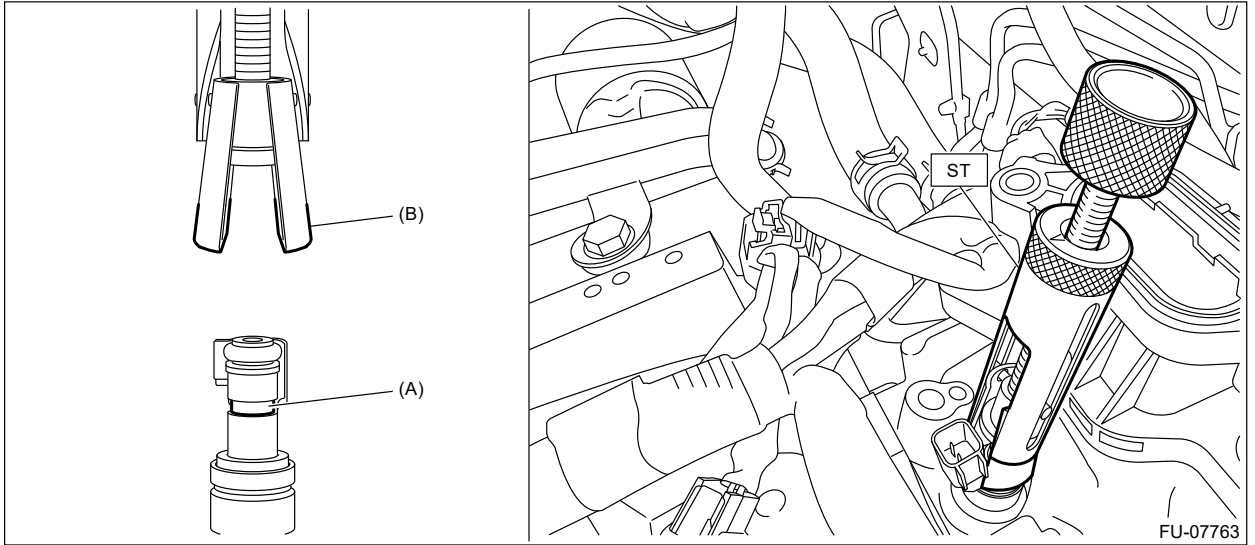
ST 18356AA000 INJECTOR REMOVER

(1) Set the ST so that its mark faces the center of the engine.

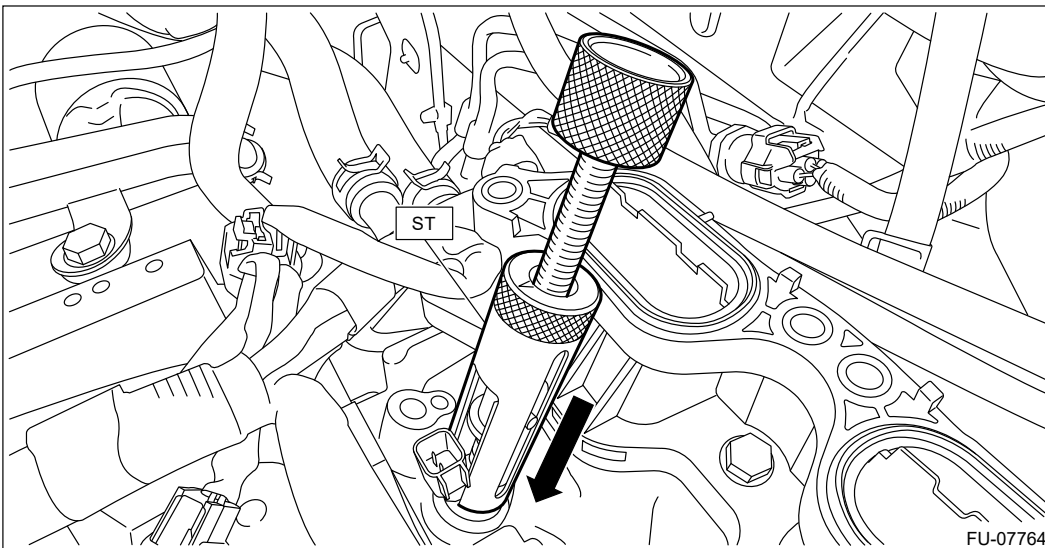


FU-07762

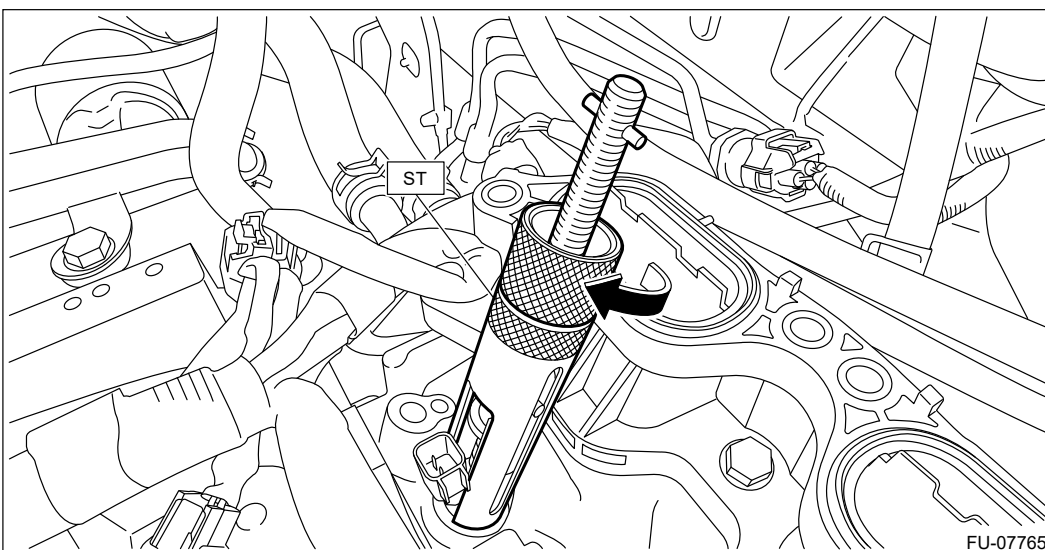
(2) Pinch the fuel injector groove (A) with the claw section (B) of ST.



(3) Press the ST to the cylinder head.



(4) Screw in the threaded section of the ST clockwise, and remove the fuel injector from the cylinder head.

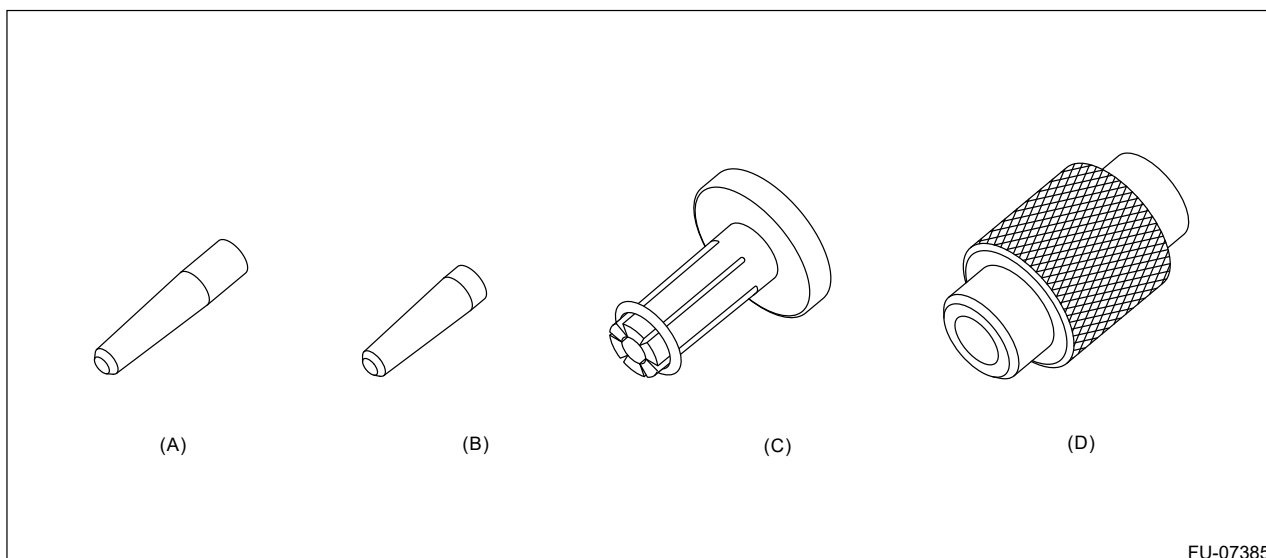


FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Injector REPLACEMENT

Caution:

- Perform work without using gloves.
- Always use the ST when installing the injector seal.

ST 18683AA000 INJECTOR SEAL INSTALLER



(A) Seal guide A

(B) Seal guide B

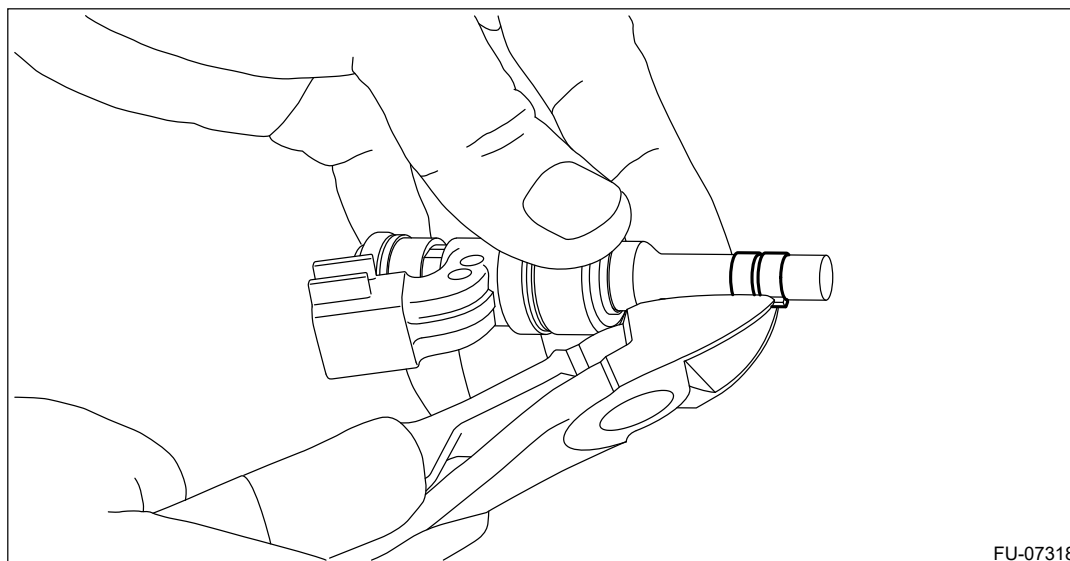
(C) INJECTOR SEAL INSTALLER

(D) Injector seal adjuster

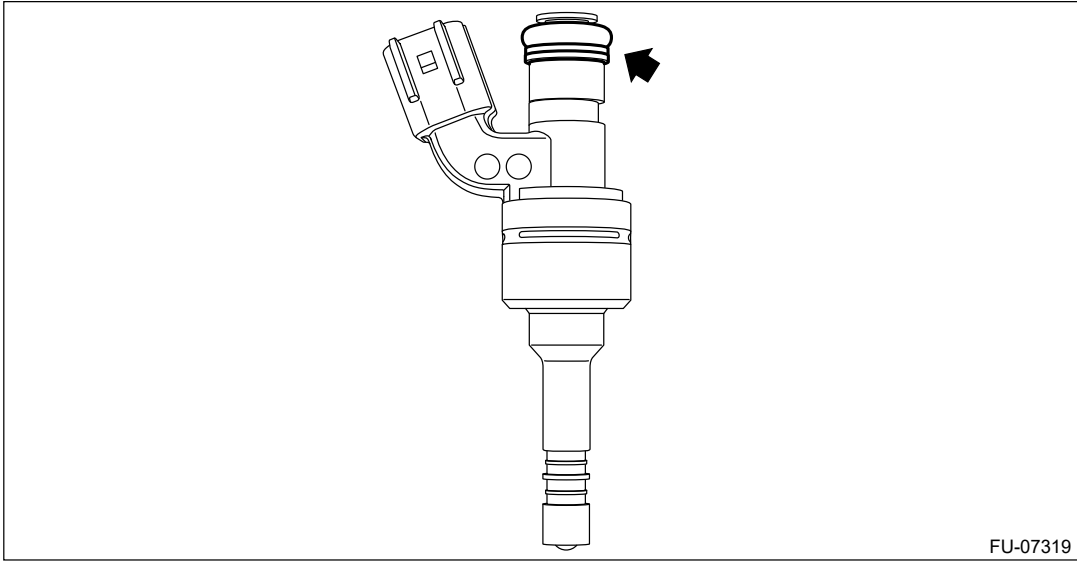
1. Using a pair of nippers, cut off the injector seal by pinching it.

Caution:

Be careful not to damage the fuel injector.



2. Remove the O-ring and backup ring from the fuel injector.

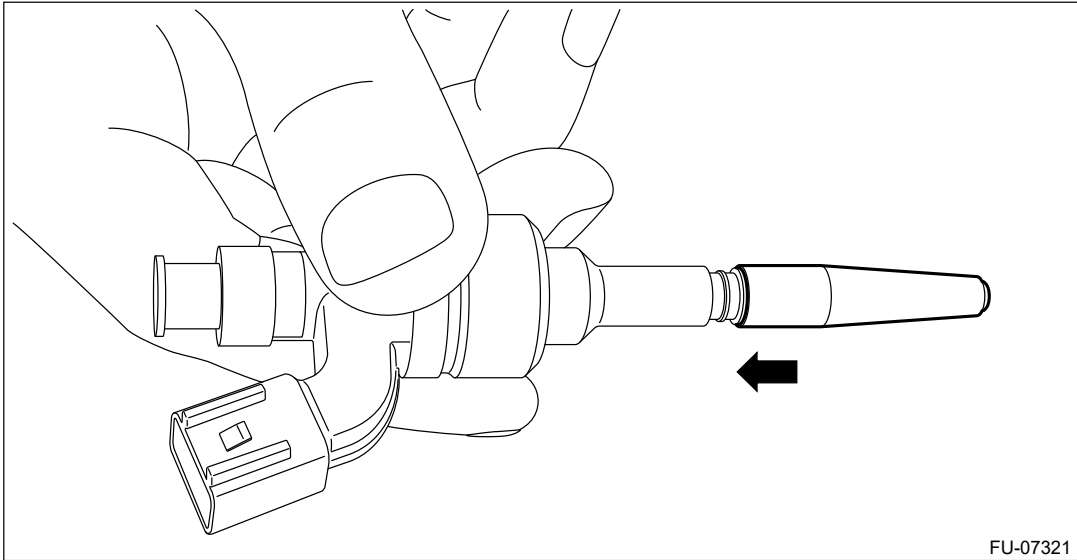


FU-07319

3. Attach the seal guide A to the fuel injector.

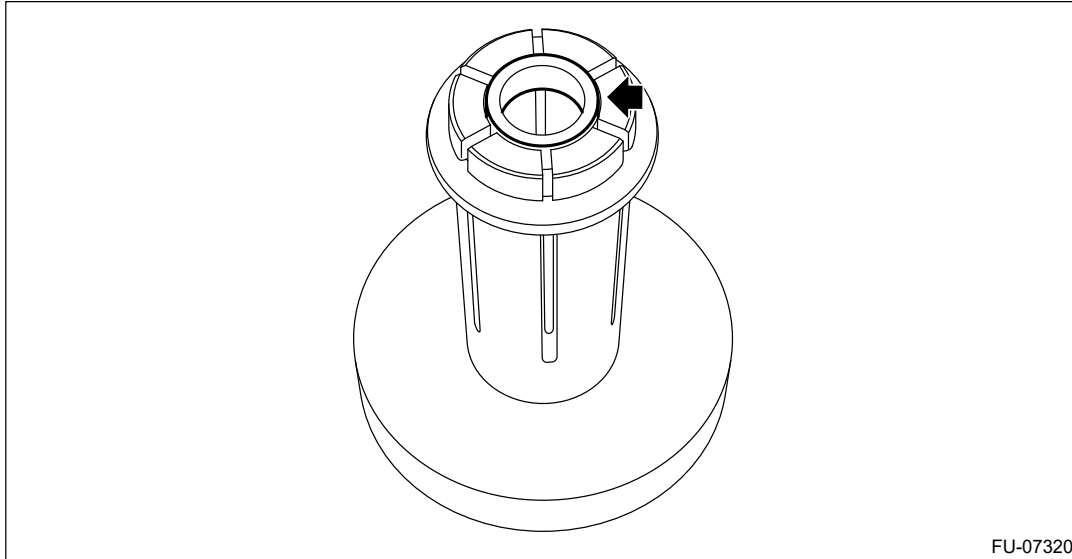
Note:

Two types of seal guides are provided. So, do not mix up the type to be used.



FU-07321

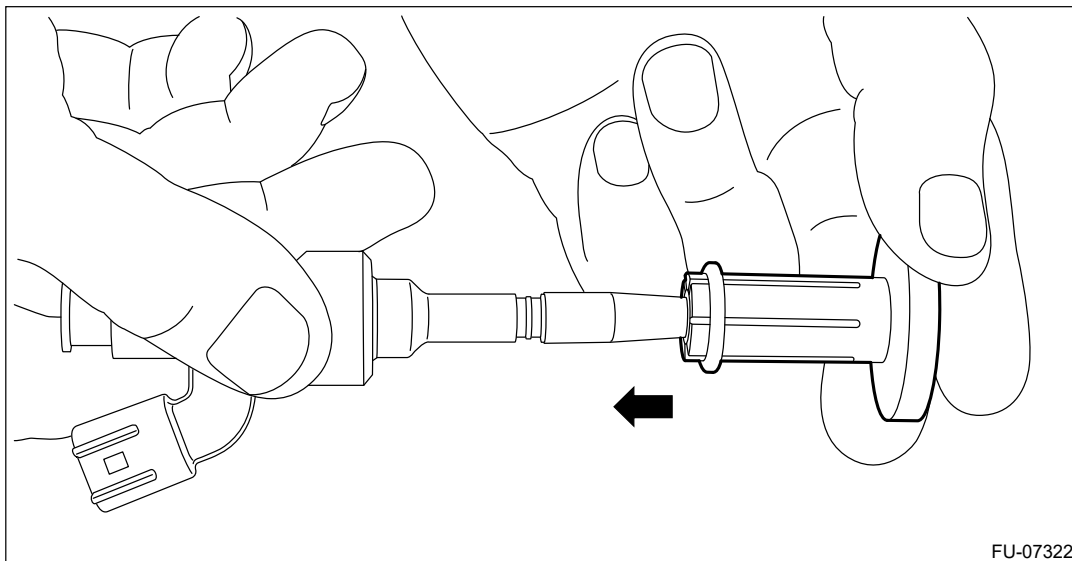
4. Set the injector seal to the injector seal installer.



5. Push in the injector seal installer slowly in the direction of the arrow, and attach the injector seal to the fuel injector.

Caution:

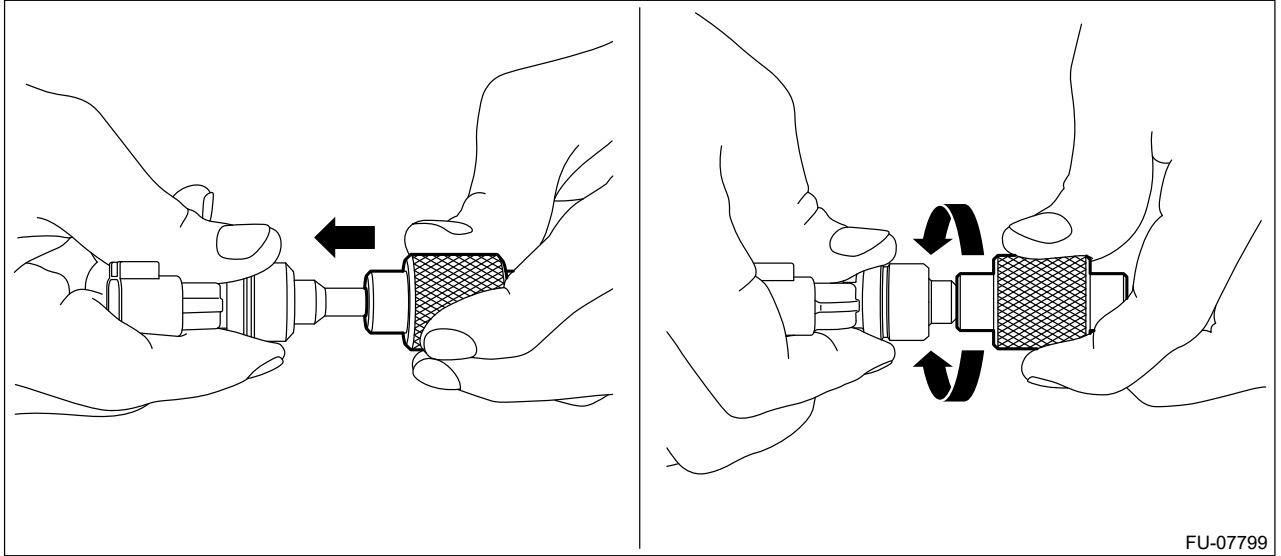
- Insert it so that the injector seal is installed straight.
- Be careful that the injector seal does not go beyond the fuel injector groove.



6. While rotating the injector seal adjuster to left and right by 90 for each side, slowly insert it all the way.

Note:

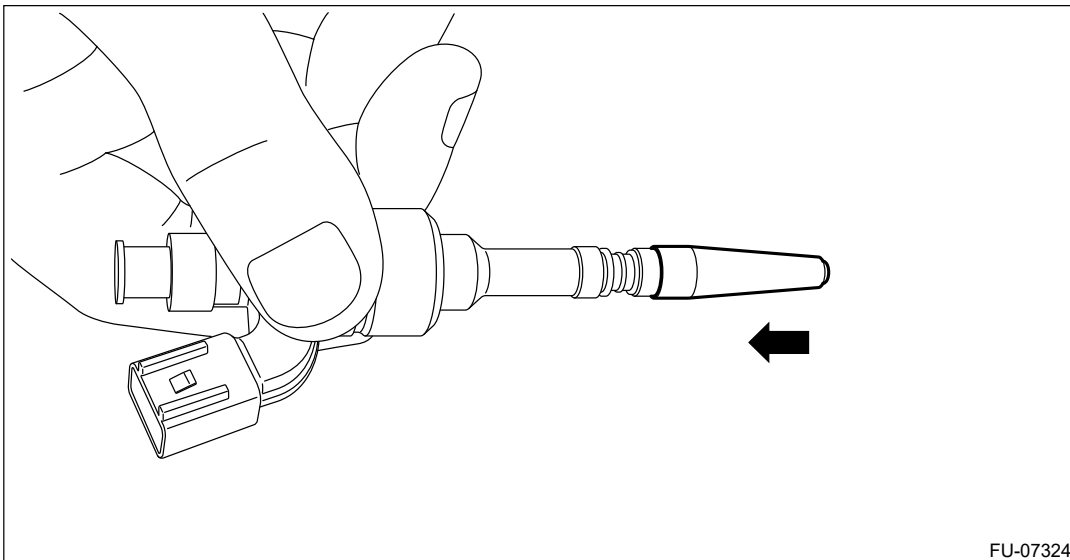
- Apply a thin coat of gasoline to the injector seal and injector seal adjuster.
- With the injector seal adjuster fully inserted, rotate it to left and right approx. ten times by 90 for each side to normalize the injector seal.



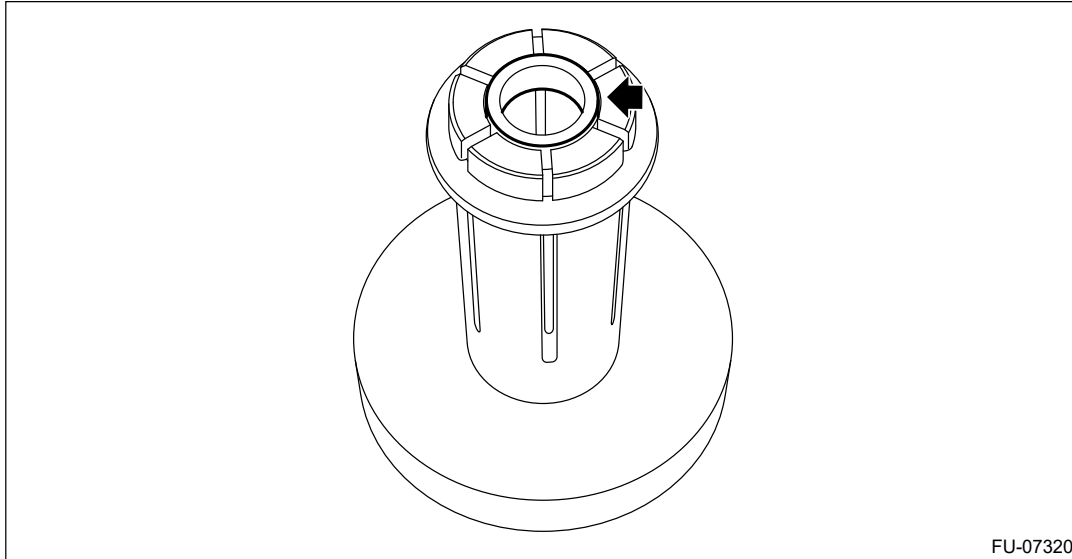
- 7.** Attach the seal guide B to the fuel injector.

Note:

Two types of seal guides are provided. So, do not mix up the type to be used.



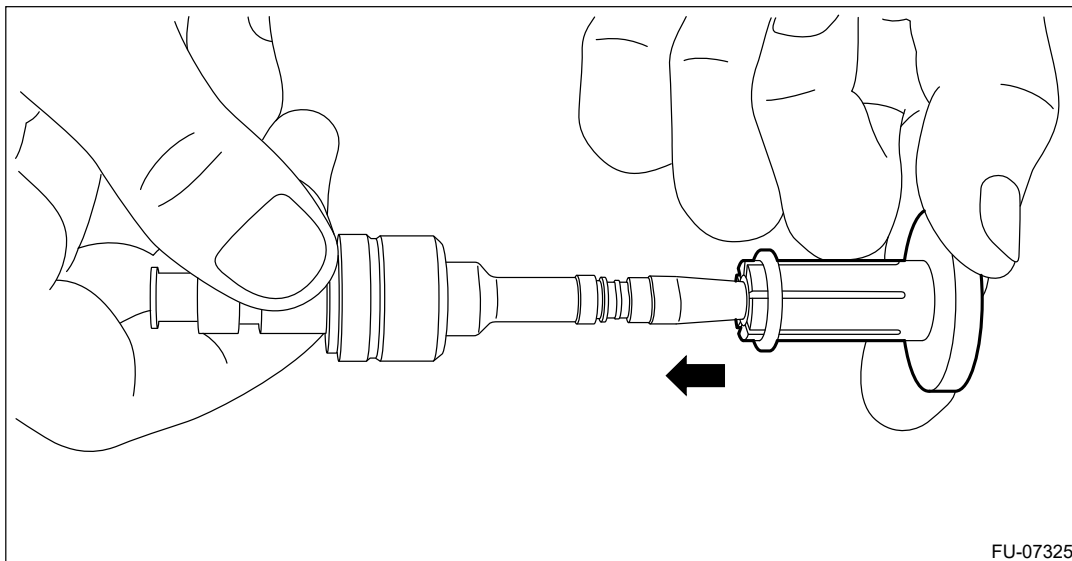
- 8.** Set the injector seal to the injector seal installer.



- 9.** Push in the injector seal installer slowly in the direction of the arrow, and attach the injector seal to the fuel injector.

Caution:

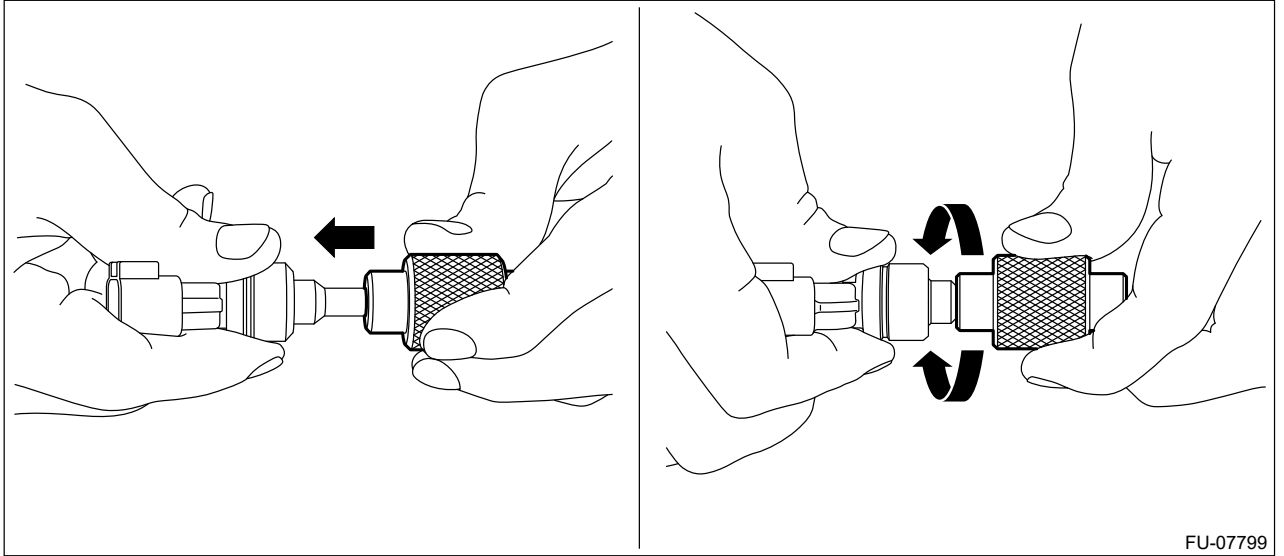
- **Insert it so that the injector seal is installed straight.**
- **Be careful that the injector seal does not go beyond the fuel injector groove.**



- 10.** While rotating the injector seal adjuster to left and right by 90 for each side, slowly insert it all the way.

Note:

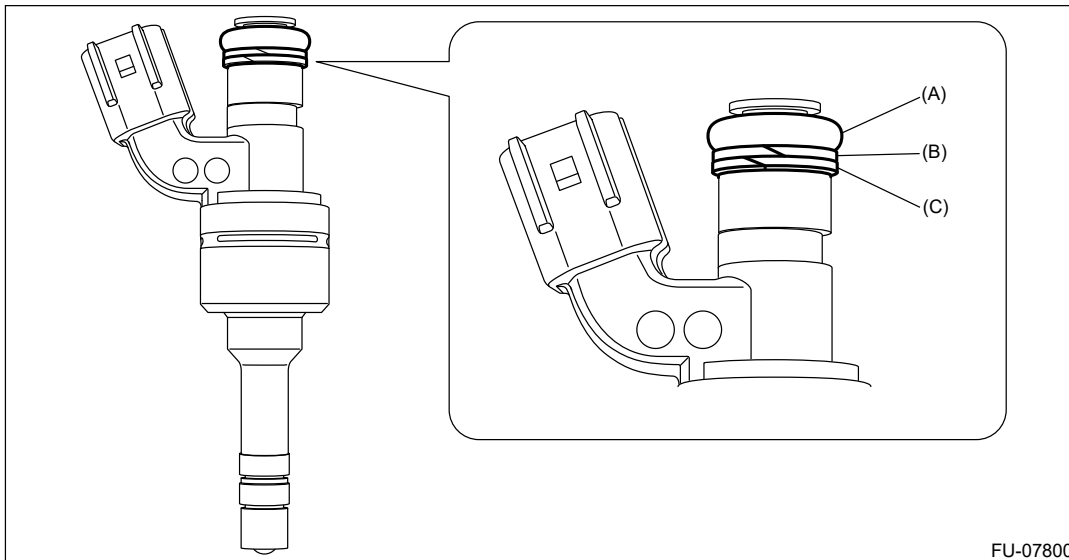
- **Apply a thin coat of gasoline to the injector seal and injector seal adjuster.**
- **With the injector seal adjuster fully inserted, rotate it to left and right approx. ten times by 90 for each side to normalize the injector seal.**



11. Attach two backup rings and O-ring to the fuel injector.

Note:

Use new backup rings and O-ring.



(A) O-ring

(B) Backup ring (brown)

(C) Backup ring (white)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Insulator

INSPECTION

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

INSTALLATION

1. FUEL PUMP INSULATOR

Install in the reverse order of removal.

Tightening torque:

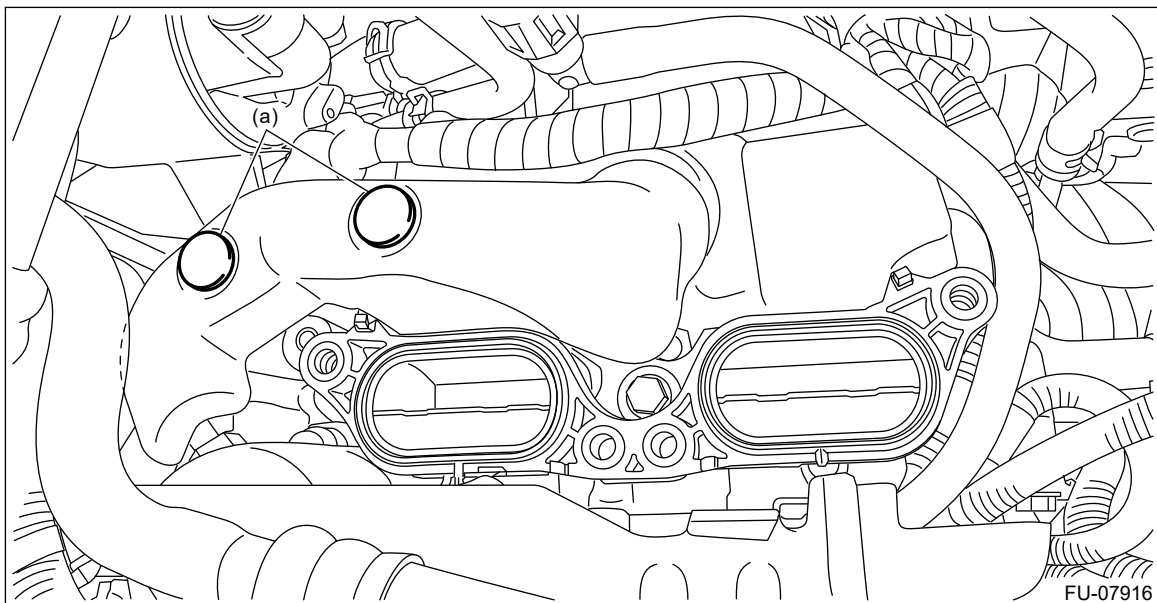
19 N·m (1.9 kgf-m, 14.0 ft-lb)

2. FUEL PIPE INSULATOR NO. 1

Install in the reverse order of removal.

Note:

Push the sections (a) for the fuel pipe insulator No.1, and secure them to the high-pressure fuel delivery pipe.



3. FUEL PIPE INSULATOR NO. 2

Install in the reverse order of removal.

4. FUEL PIPE INSULATOR NO. 3

Install in the reverse order of removal.

Note:



Use a new gasket.

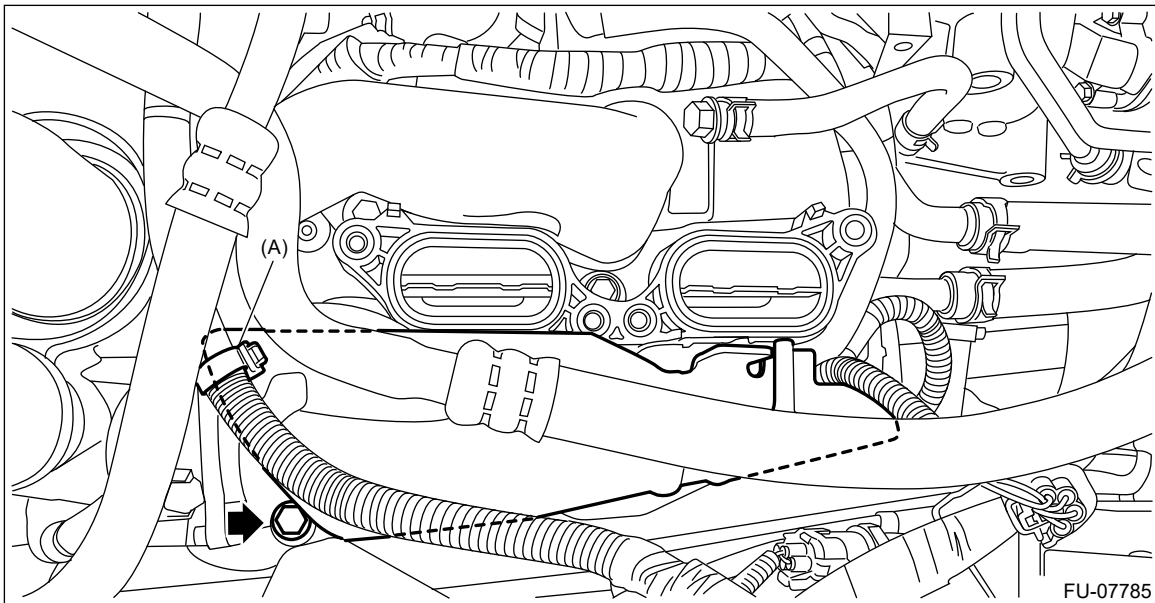
Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)

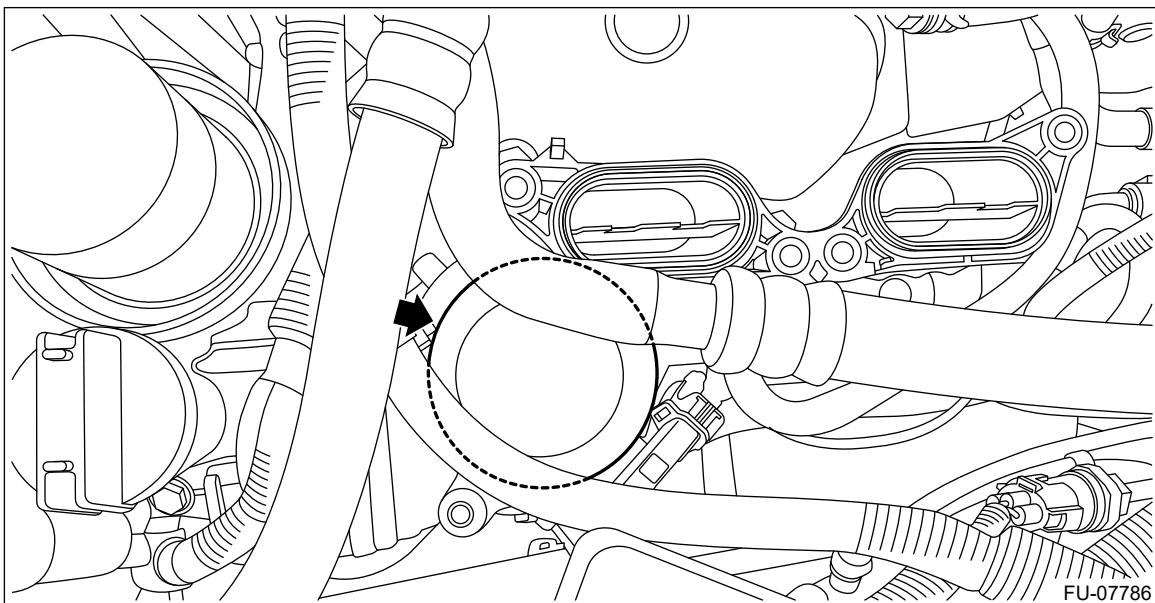
REMOVAL

1. FUEL PUMP INSULATOR



1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Disconnect the ground cable from battery.
3. Open the fuel filler lid and remove the fuel filler cap.
4. Remove the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
5. Remove the clip (A) on the generator cord, and remove the fuel pipe protector.

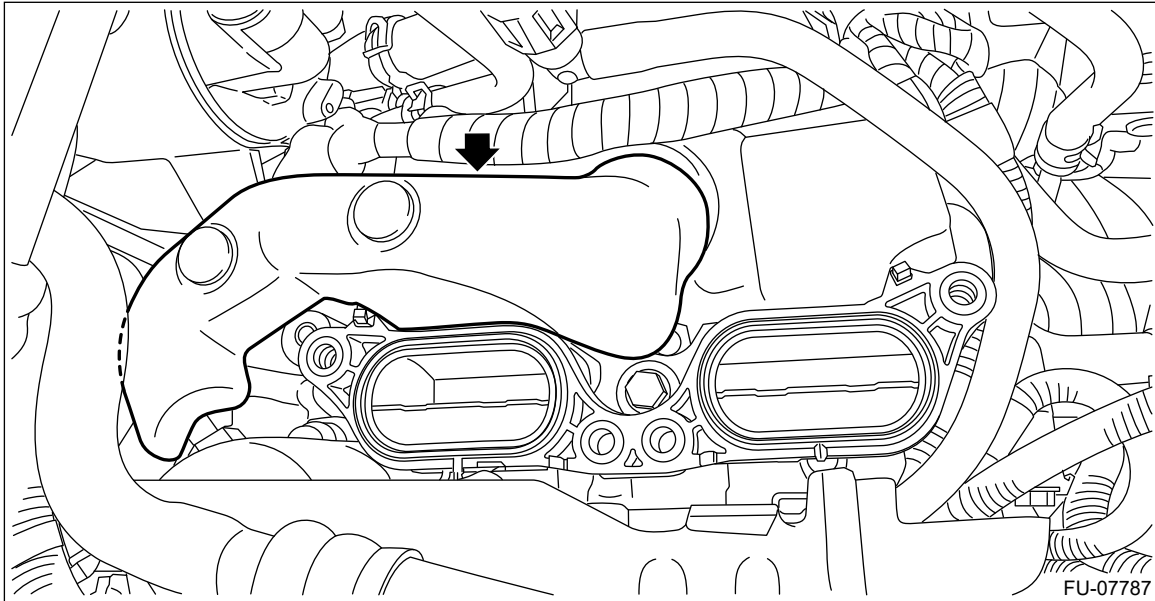


6. Remove the fuel pump insulator.




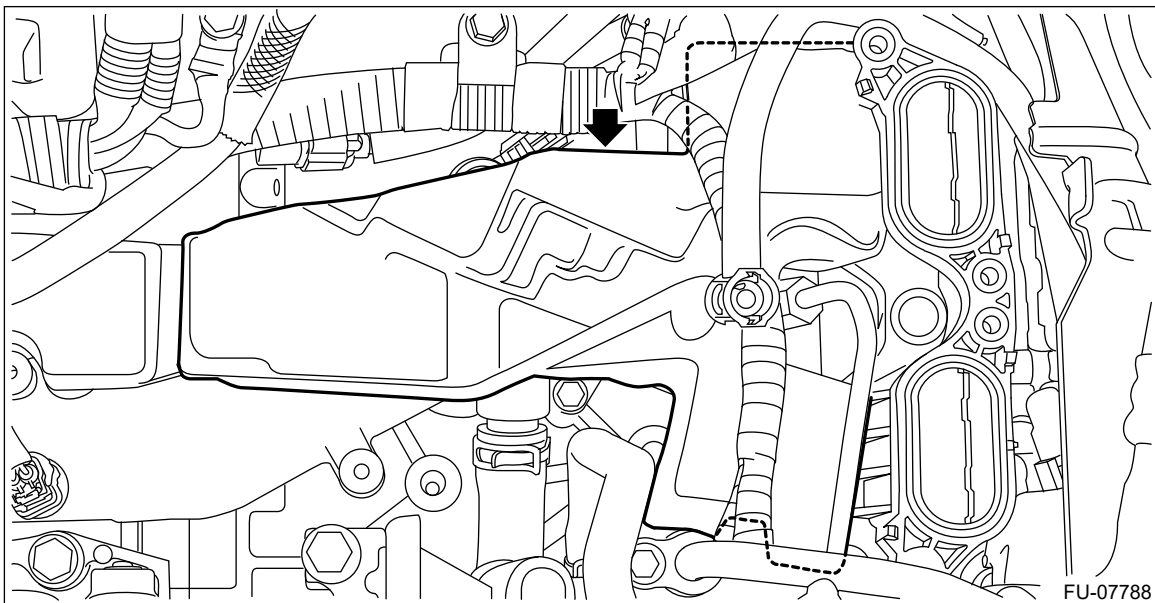
2. FUEL PIPE INSULATOR NO. 1

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel>PROCEDURE > DRAINING FUEL \(WITH SUBARU SELECT MONITOR\).](#)
2. Disconnect the ground cable from battery.
3. Open the fuel filler lid and remove the fuel filler cap.
4. Remove the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
5. Remove the fuel pipe insulator No.1.





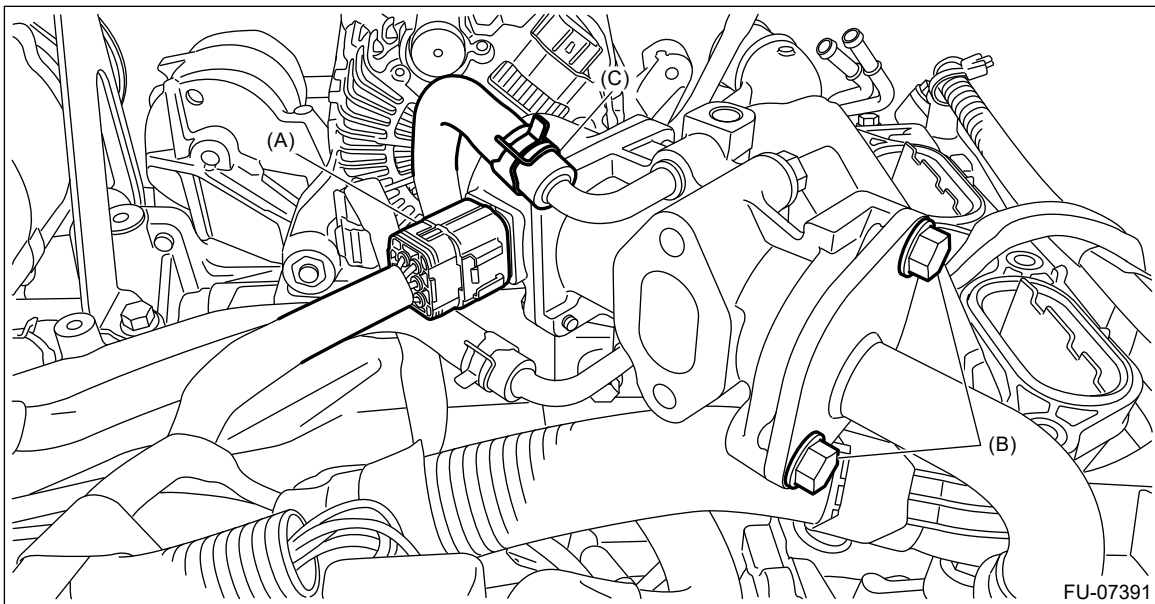
3. FUEL PIPE INSULATOR NO. 2

1. Remove the fuel pipe insulator No.1.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>REMOVAL > FUEL PIPE INSULATOR NO. 1.](#)
2. Remove the fuel pipe insulator No.2.

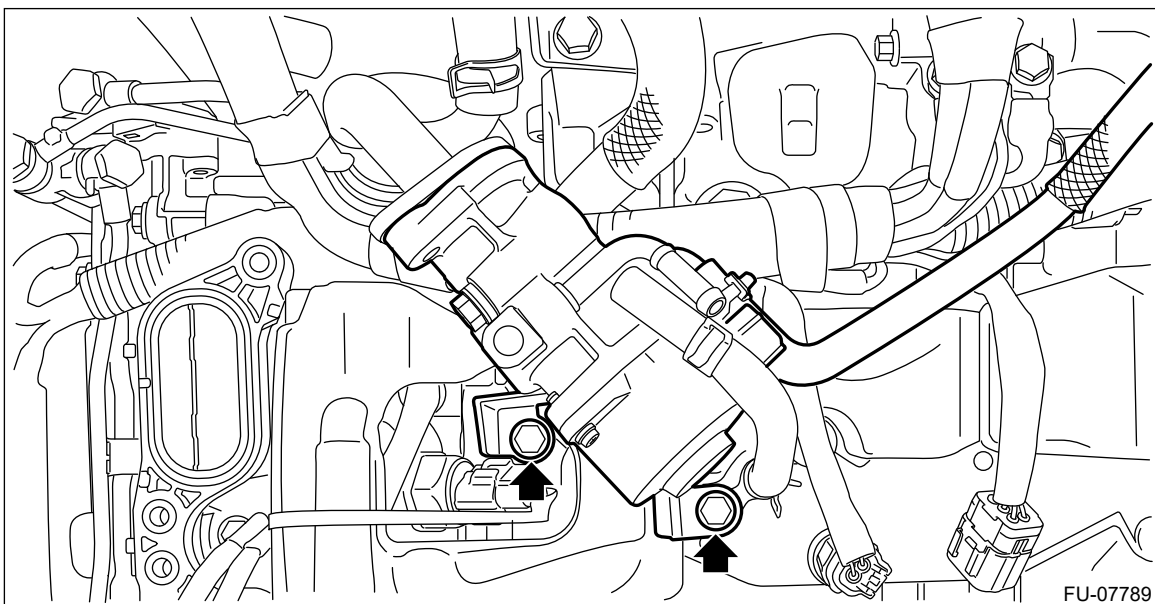


4. FUEL PIPE INSULATOR NO. 3

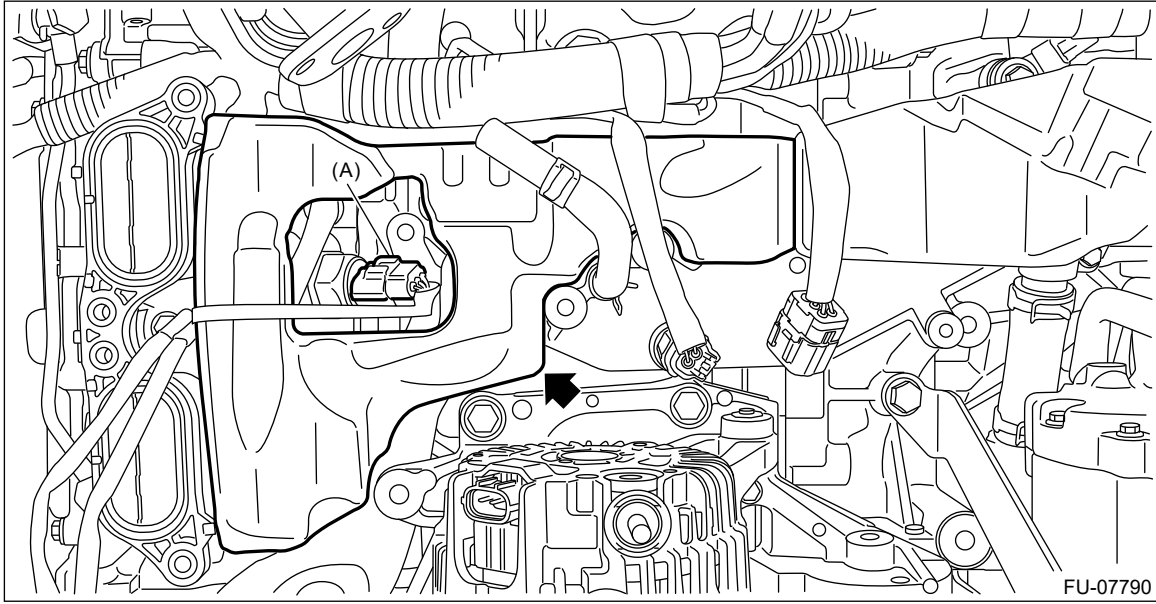
1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel>PROCEDURE > DRAINING FUEL \(WITH SUBARU SELECT MONITOR\).](#)
2. Disconnect the ground cable from battery.
3. Open the fuel filler lid and remove the fuel filler cap.
4. Remove the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
5. Disconnect the connector (A) from the EGR control valve.
6. Remove the bolts (B) securing the EGR cooler to the EGR control valve.
7. Remove the preheater hose (C) from the EGR control valve.



8. Remove the EGR control valve.



9. Disconnect the connector (A) on the fuel pressure sensor, and remove the fuel pipe insulator No.3.



FU-07790

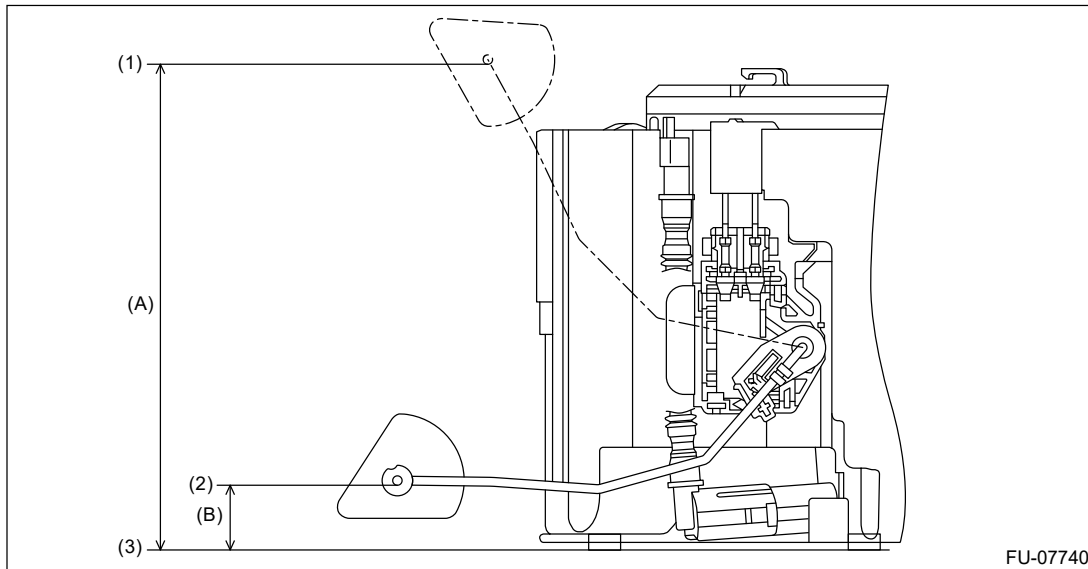
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Level Sensor

INSPECTION

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

Note:

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



FU-07740

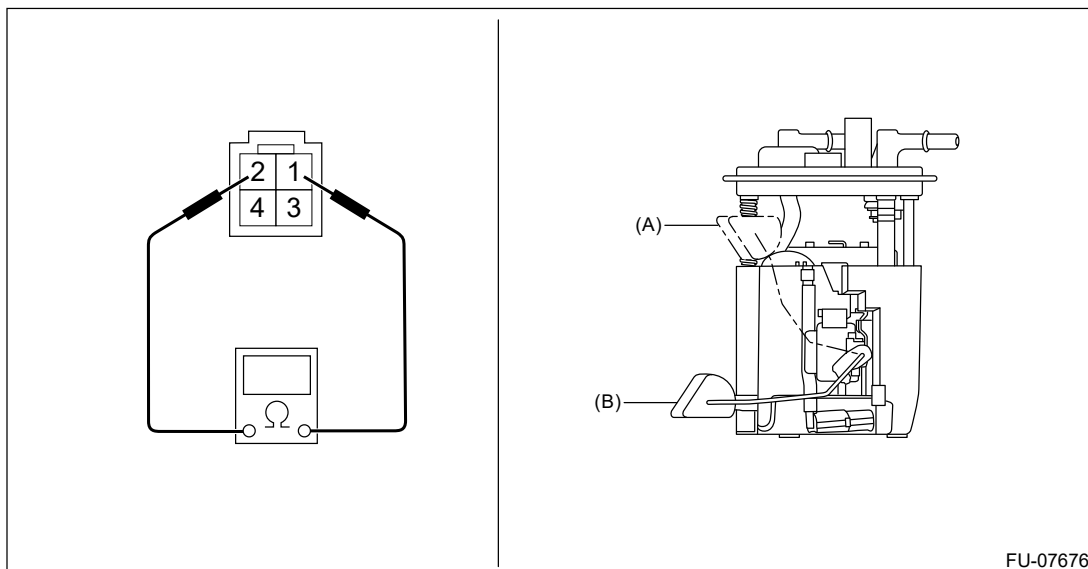
(1) FULL

(2) EMPTY

(3) Fuel tank seating surface

| Float position | Standard |
|--|-----------------------------|
| FULL to Fuel tank seating surface (A) | 133.0±4 mm (5.236±0.157 in) |
| EMPTY to Fuel tank seating surface (B) | 21.6±4 mm (0.850±0.157 in) |

3. Check the resistance between fuel level sensor terminals by the connector on top of the fuel pump.



FU-07676

| Float position | Terminal No. | Standard |
|----------------|--------------|----------|
|----------------|--------------|----------|

| | | |
|-----------|---------|------------------------|
| FULL (A) | 1 and 2 | $8.7 \pm 1.0 \Omega$ |
| EMPTY (B) | | $139.1 \pm 2.0 \Omega$ |

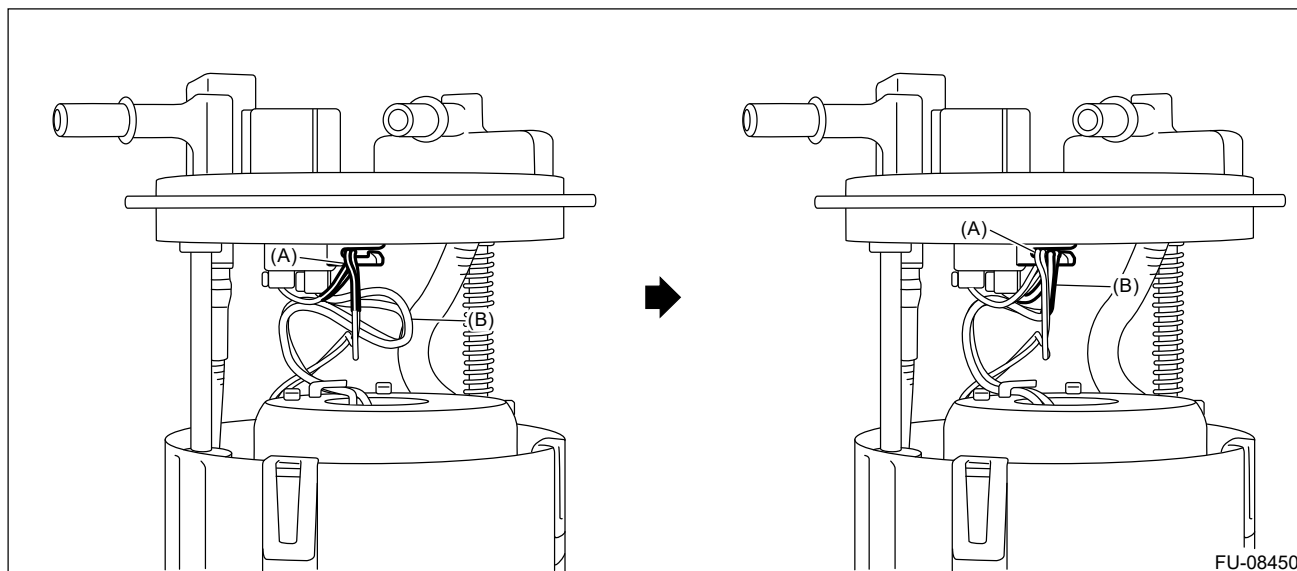
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Level Sensor

INSTALLATION

Install in the reverse order of removal.

Caution:

Be sure to install the fuel level sensor harness to the clip first, then install the connector cable. Otherwise, malfunction may occur.



(A) Fuel level sensor harness

(B) Connector cable

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Level Sensor

REMOVAL

Warning:


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

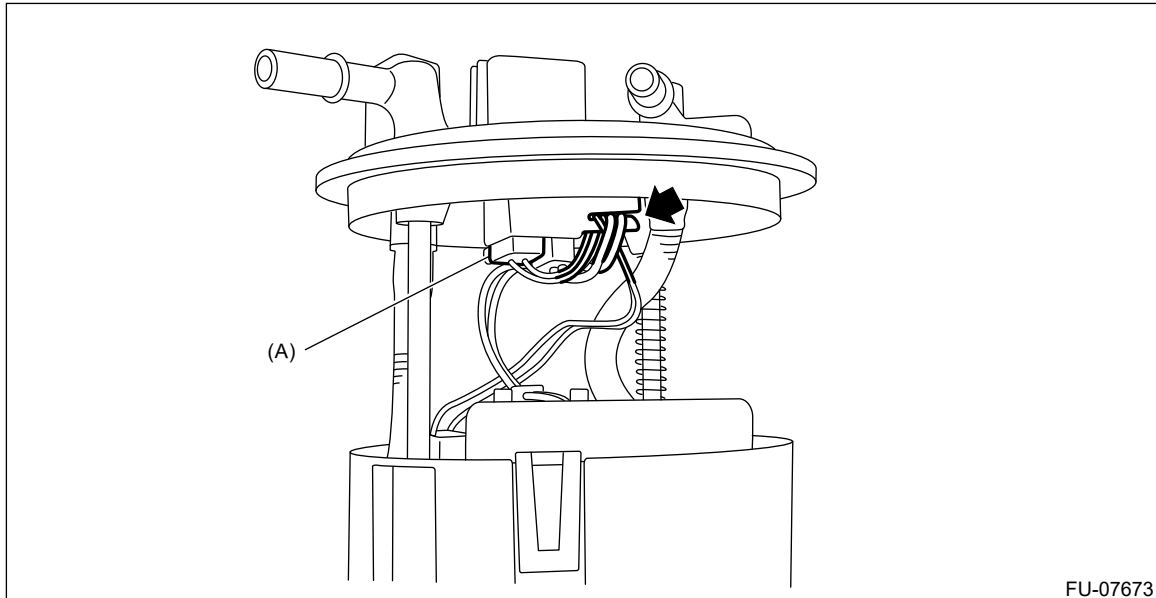
Caution:

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

Note:

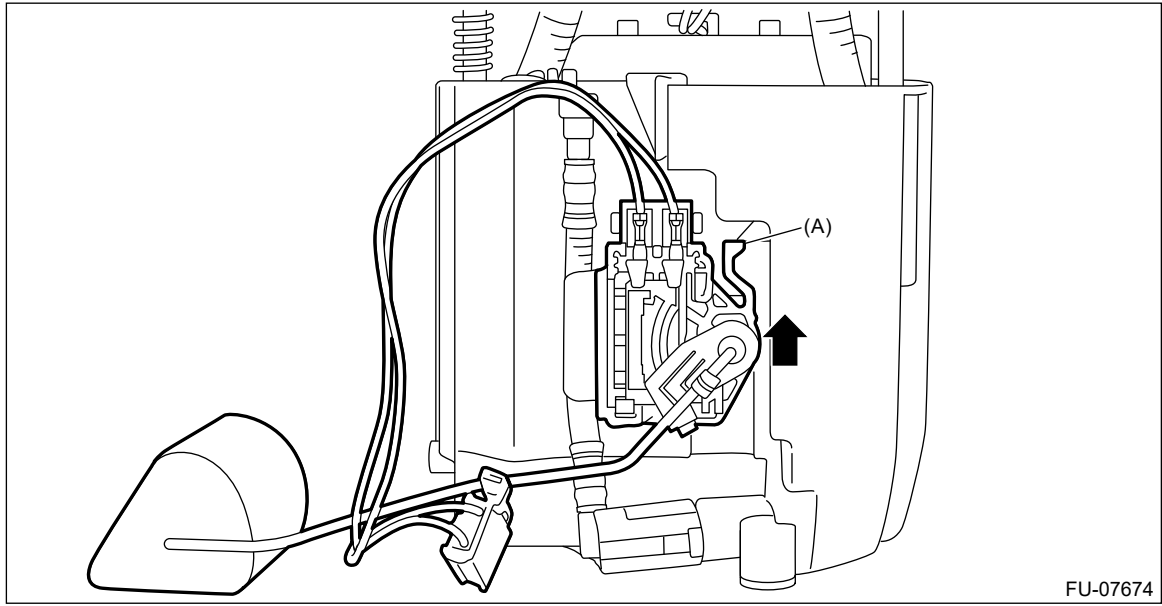
The fuel level sensor is built in fuel pump assembly.

1. Remove the fuel pump assembly.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Pump>REMOVAL.](#)
2. Disconnect the fuel level sensor connector (A), and pull out the connector cable and fuel level sensor harness from the clip.



FU-07673

3. While pressing the claw (A) of the fuel level sensor, slide the fuel level sensor in the direction of the arrow, and remove the fuel level sensor.



FU-07674


FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pressure Sensor

INSPECTION

Check that the fuel pressure sensor has no deformation, cracks or other damages.

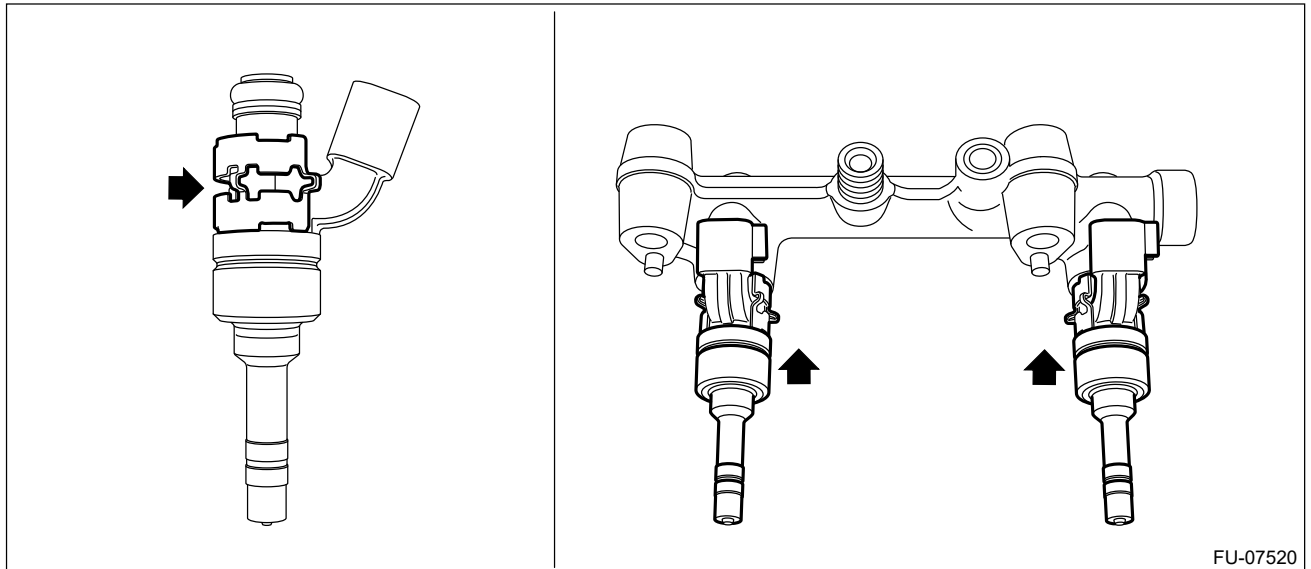
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pressure Sensor

INSTALLATION

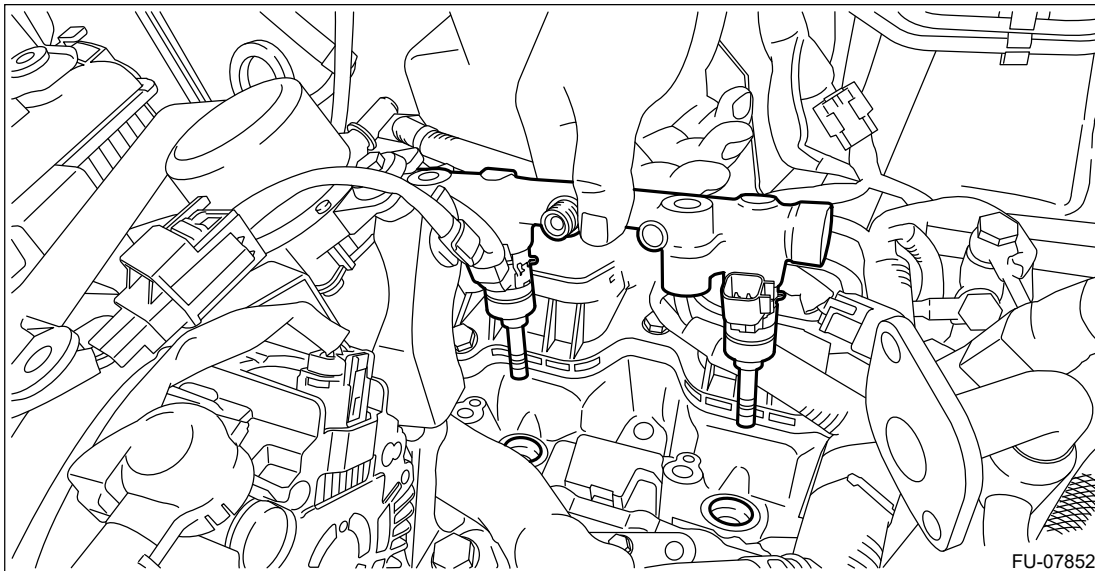
1. Replace injector seal, retainer, and O-ring with a new part.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Injector>REPLACEMENT.](#)
2. Set the holder to the fuel injector, and install it to the fuel injector pipe RH.

Caution:

- Always use a new holder.
- Always use a new fuel injector pipe RH.



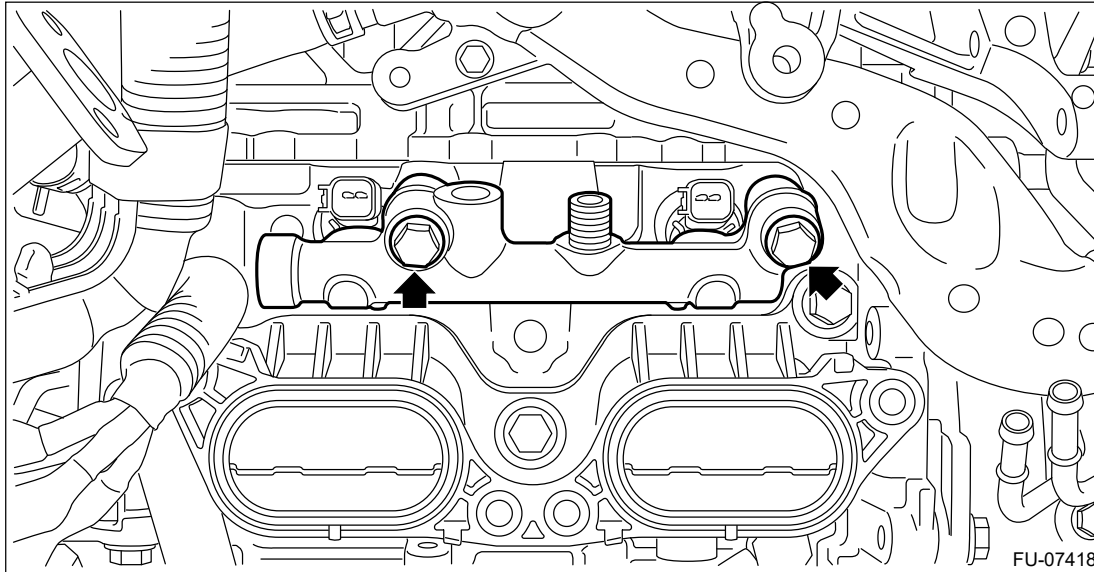
3. Install the fuel injector pipe RH and fuel injector as a single unit to the cylinder head.



4. Tighten the fuel injector pipe RH.

Tightening torque:

19 N•m (1.9 kgf-m, 14.0 ft-lb)



FU-07418

5. Temporarily tighten the fuel pressure sensor to the fuel injector pipe RH until it cannot be turned by hand.

Caution:

Always use a new fuel pressure sensor.

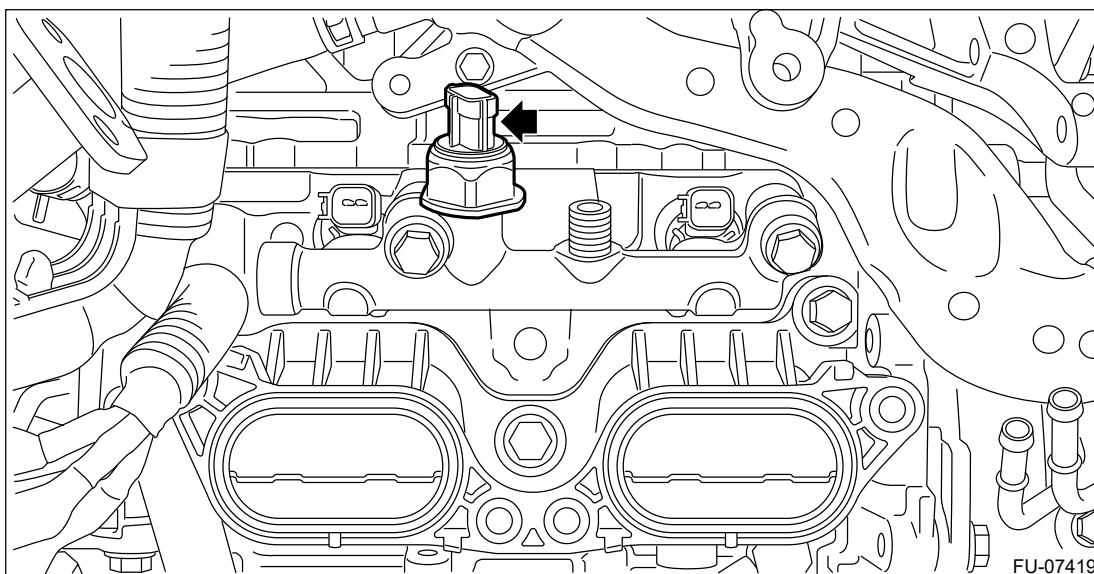
6. Tighten the fuel pressure sensor.

Caution:

- Be careful not to spill oil on the screw sections of the fuel pressure sensor and the fuel injector pipe RH.
- Be careful not to let foreign matter enter into the fuel pressure sensor during installation.
- Do not recheck the tightening torque after tightening the fuel pressure sensor with specified torque.

Tightening torque:

46 N•m (4.7 kgf-m, 33.9 ft-lb)



FU-07419

7. Install the high-pressure fuel delivery pipe assembly. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Delivery Pipe>INSTALLATION > HIGH-PRESSURE FUEL DELIVERY](#)

PIPE ASSEMBLY.




- 8.** Connect the battery ground terminal.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pressure Sensor

REMOVAL

Caution:

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

- 1.** Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
- 2.** Disconnect the ground cable from battery.
- 3.** Open the fuel filler lid and remove the fuel filler cap.
- 4.** Remove the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
- 5.** Remove the fuel injector RH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Injector>REMOVAL > FUEL INJECTOR RH.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pump Control Unit

INSPECTION

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

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pump Control Unit

INSTALLATION


Install in the reverse order of removal.

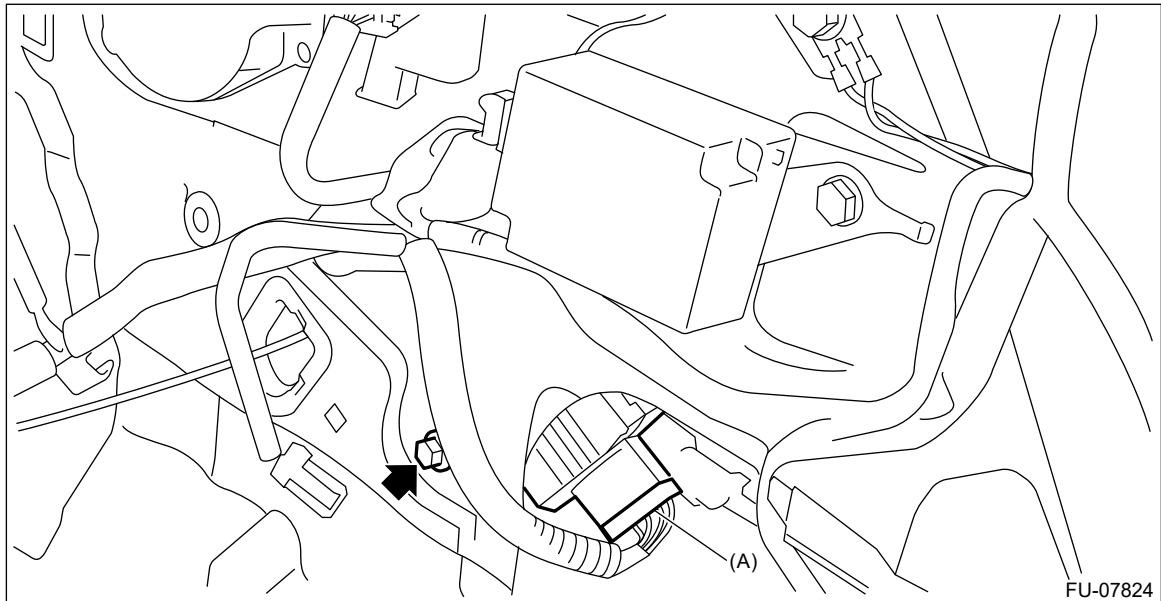
Tightening torque:

5 N·m (0.5 kgf-m, 3.7 ft-lb)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pump Control Unit

REMOVAL

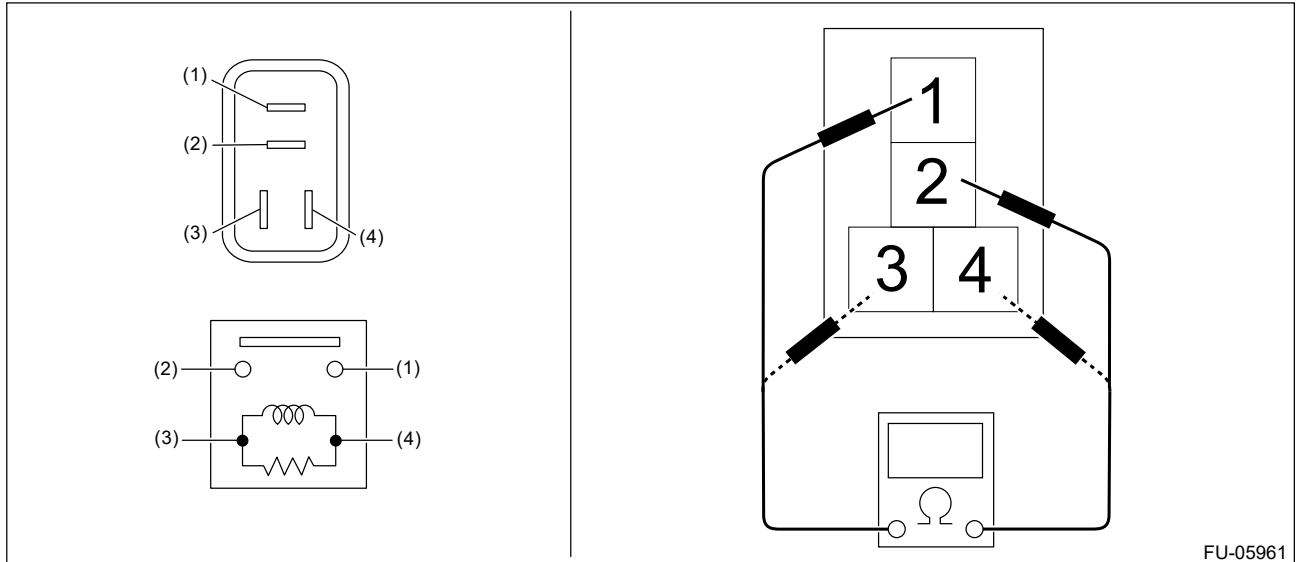
1. Disconnect the ground cable from battery.
2. Remove the right side rear quarter trim.  [Ref. to EXTERIOR/INTERIOR TRIM>Rear Quarter Trim>REMOVAL.](#)
3. Disconnect the connector (A), and remove the fuel pump control unit.



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pump Relay

INSPECTION

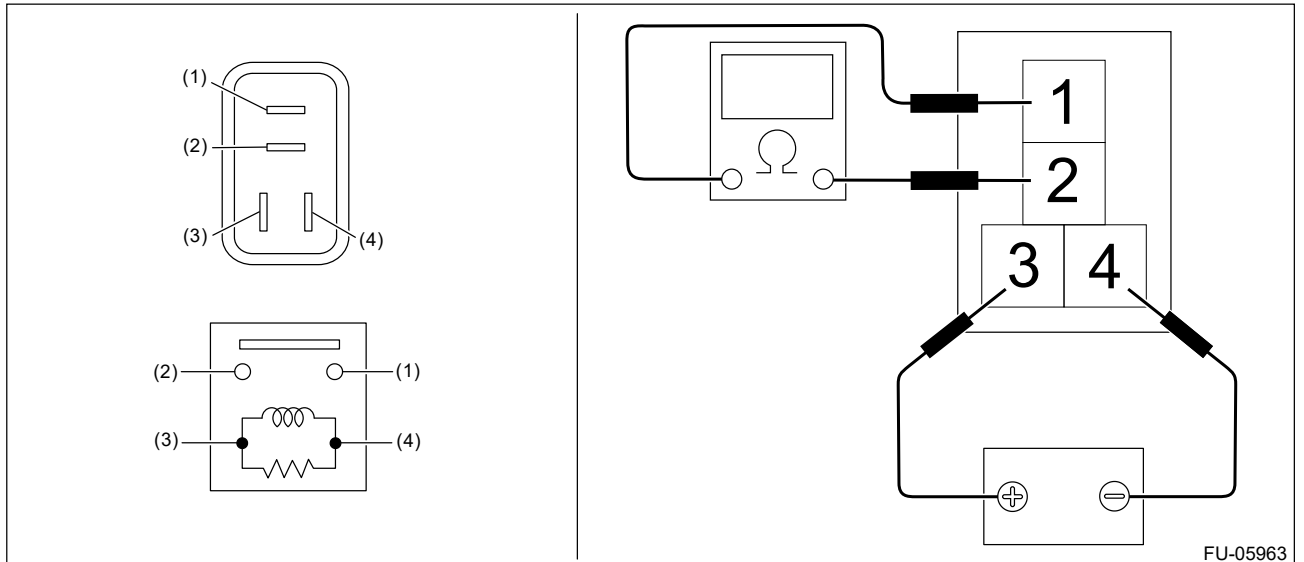
1. Check that the fuel pump relay has no deformation, cracks or other damages.
2. Measure the resistance between fuel pump relay terminals.



FU-05961

| Terminal No. | Standard |
|--------------|---------------------------------|
| 1 and 2 | 1 MΩ or more |
| 3 and 4 | 93.8—136.4 Ω (when 20°C (68°F)) |

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



FU-05963

| Terminal No. | Standard |
|--------------|---------------|
| 1 and 2 | Less than 1 Ω |


FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pump Relay

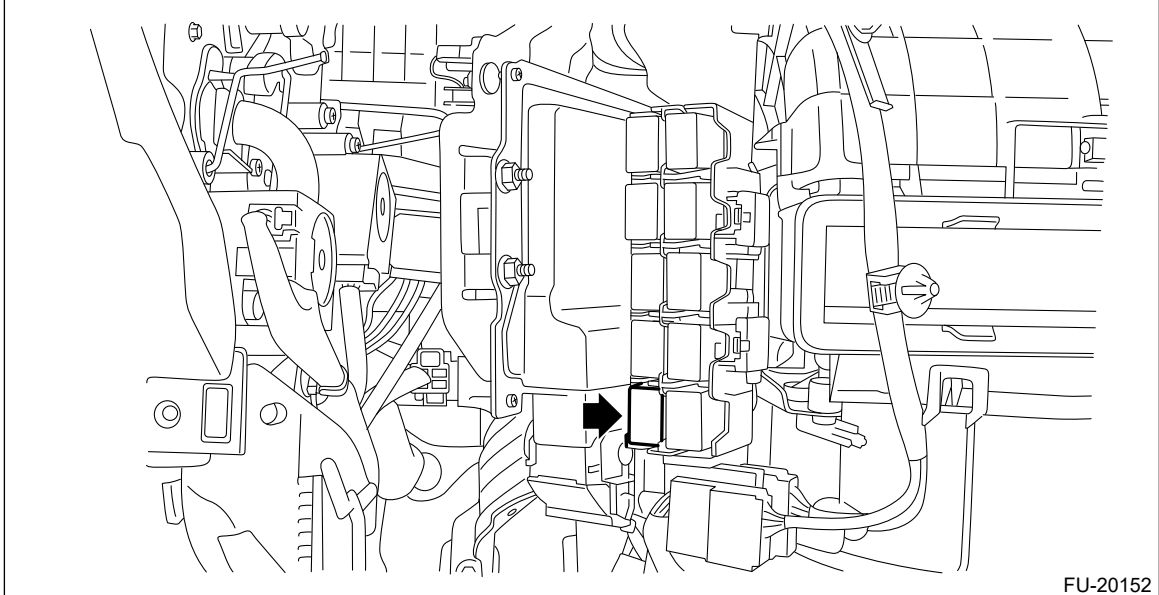
INSTALLATION

Install in the reverse order of removal.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pump Relay

REMOVAL

1. Disconnect the ground cable from battery.
2. Remove the glove box.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>REMOVAL.](#)
3. Remove the fuel pump relay.



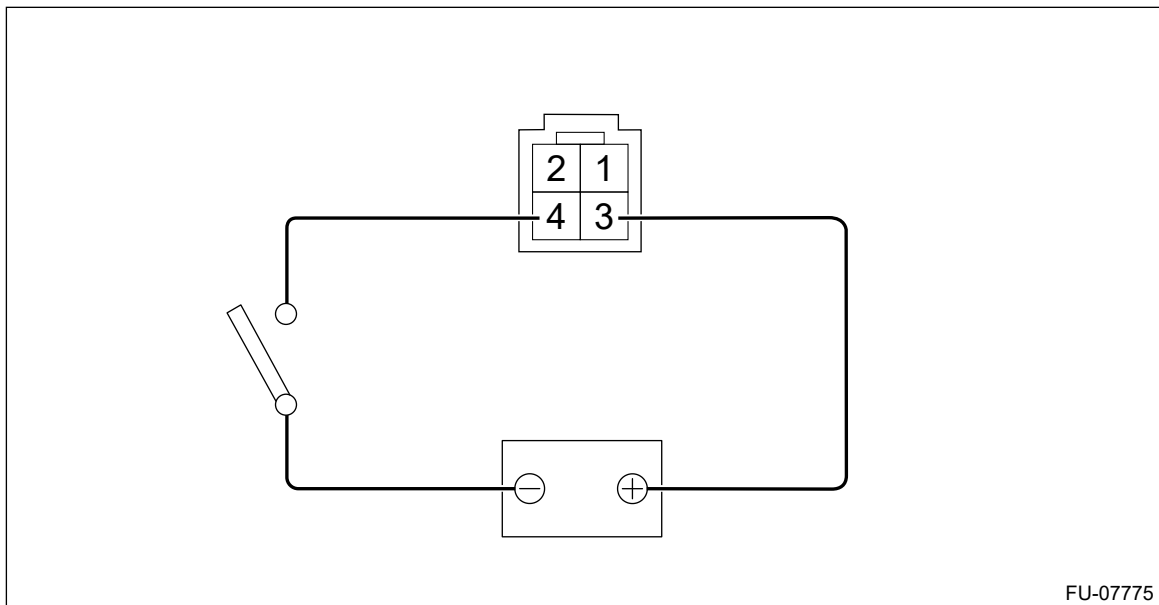
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pump

INSPECTION

1. Check that the fuel pump has no deformation, cracks or other damages.
2. Connect the battery positive terminal to terminal No.3 and the battery ground terminal to terminal No.4, and inspect the fuel pump operation.

Warning:

- **Wipe off fuel completely.**
- **Keep the battery as far apart from fuel pump as possible.**
- **Do not run the fuel pump for a long time under non-load condition.**



FU-07775

INSTALLATION

1. Install the fuel pump assembly to the fuel tank.

- (1) Make sure the sealing portion is free from fuel or foreign matter before installation.
- (2) Align the protrusion (A) of the gasket to the position shown in the figure, and install the gasket from the lower side of the fuel pump assembly.

Note:

Use a new gasket.

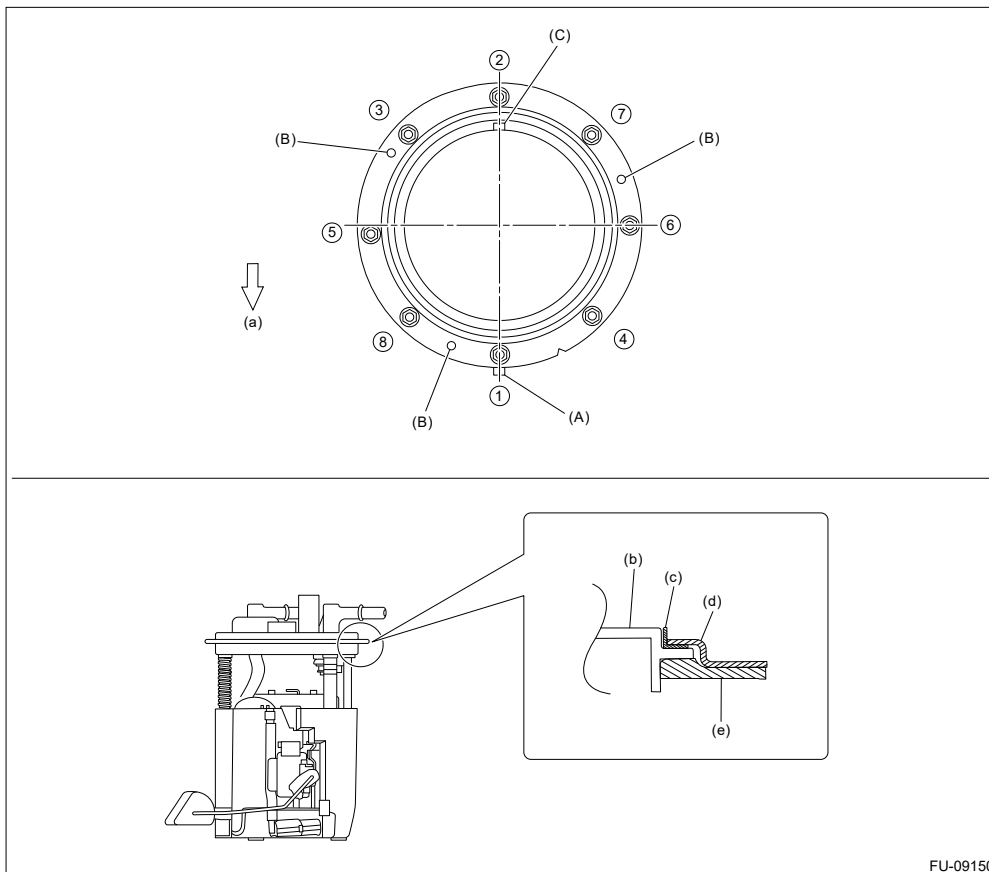
- (3) Align the protrusion (C) of fuel pump upper plate cushion with the protrusion (C) of the fuel pump assembly as shown in the figure, and install the fuel pump upper plate cushion from the upper side of the fuel pump assembly.
- (4) Align the cutout of the fuel pump upper plate with the protrusion (C), and install the fuel pump upper plate from the upper side of the fuel pump assembly so that the protrusions (B) (3 places) of the gasket fit the holes of the fuel pump upper plate.
- (5) Install the fuel pump assembly to the fuel tank in the direction shown in the figure, and tighten the nuts to the specified torque in the order as shown in the figure.

Caution:

Set the arm and float of the fuel level sensor while paying attention to prevent them from contacting the fuel tank. If the arm of the fuel level sensor is bent, the fuel gauge may not read correctly.

Tightening torque:

4.4 N·m (0.4 kgf·m, 3.2 ft·lb)



(a) Front side of vehicle

(c) Fuel pump upper plate cushion

(e) Gasket

(b) Fuel pump ASSY

(d) Fuel pump upper plate

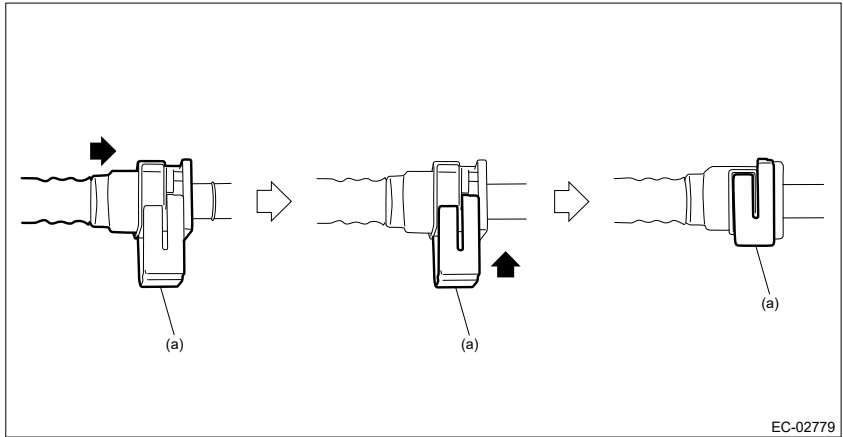
2. Connect the quick connector of the fuel delivery tube and the jet pump tube.

Caution:

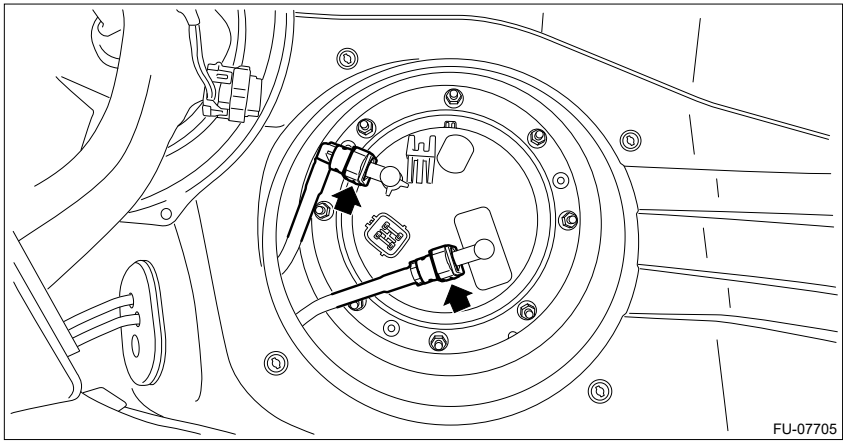
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

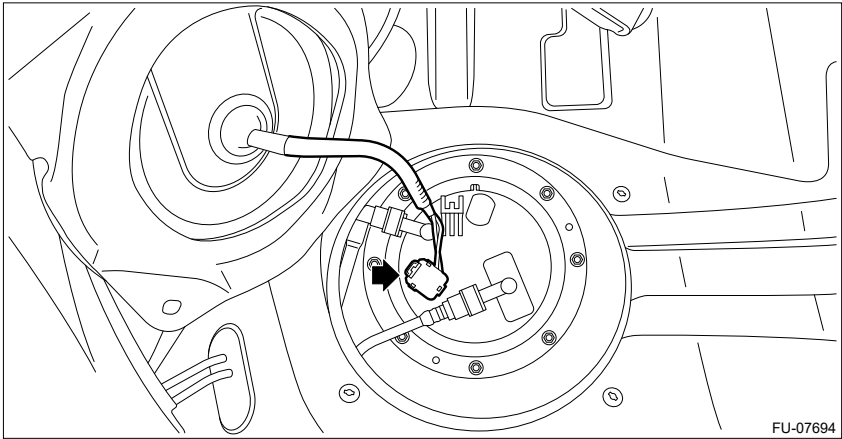
Connect the quick connector as shown in the figure.



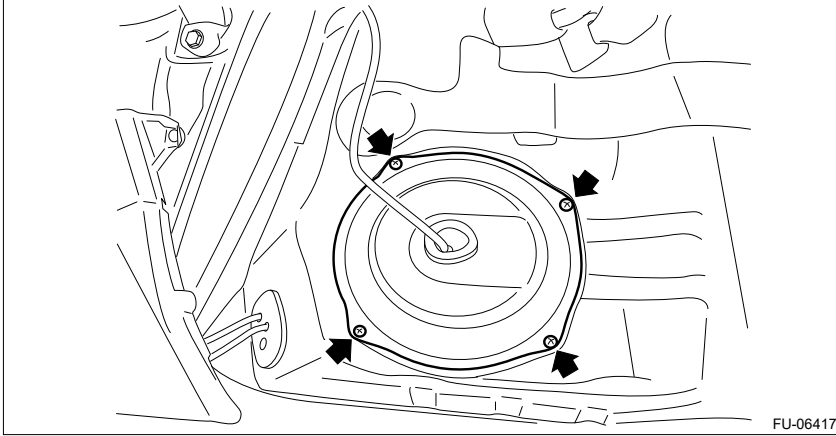
(a) Slider




3. Connect the connector to the fuel pump.



4. Install the service hole cover of fuel pump.



FU-06417

5. Install the rear seat cushion.  [Ref. to SEATS>Rear Seat>INSTALLATION.](#)
6. Connect the battery ground terminal.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Pump REMOVAL

Warning:




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

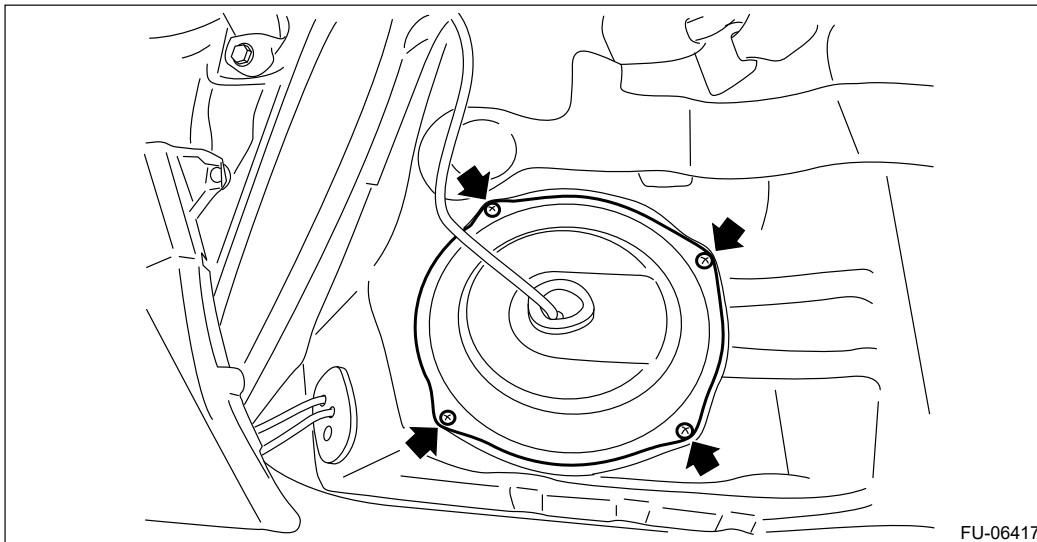
Caution:

- Be careful not to spill fuel.
- Catch the fuel from the tubes using a container or cloth.
- If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.

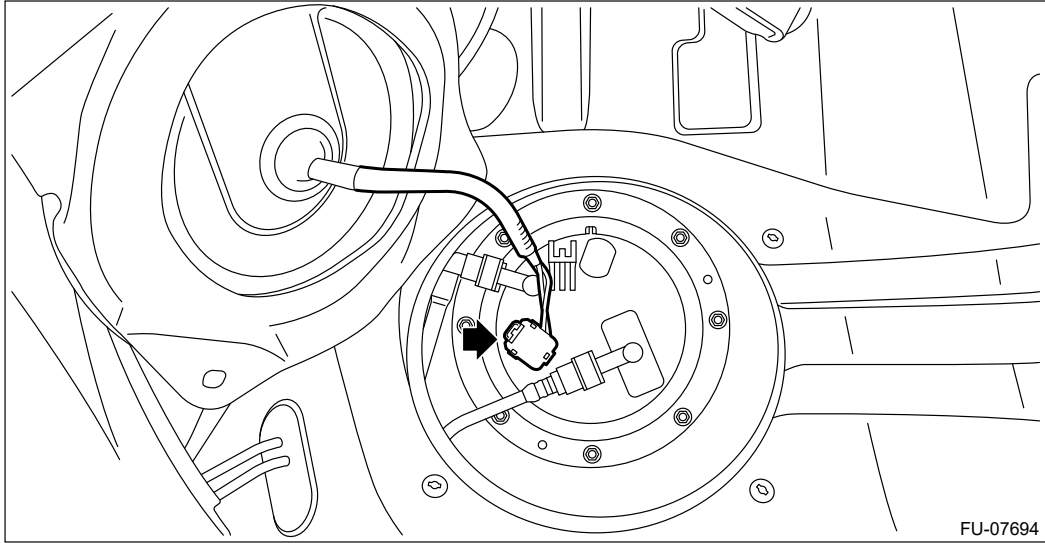
Note:

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

1. Release the fuel pressure.  Ref. to FUEL INJECTION (FUEL SYSTEMS)(H4DOTC)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.
2. Drain fuel.  Ref. to FUEL INJECTION (FUEL SYSTEMS)(H4DOTC)>Fuel>PROCEDURE > DRAINING FUEL (WITH SUBARU SELECT MONITOR).
3. Disconnect the ground cable from battery.
4. Remove the rear seat cushion.  Ref. to SEATS>Rear Seat>REMOVAL.
5. Remove the service hole cover of fuel pump.



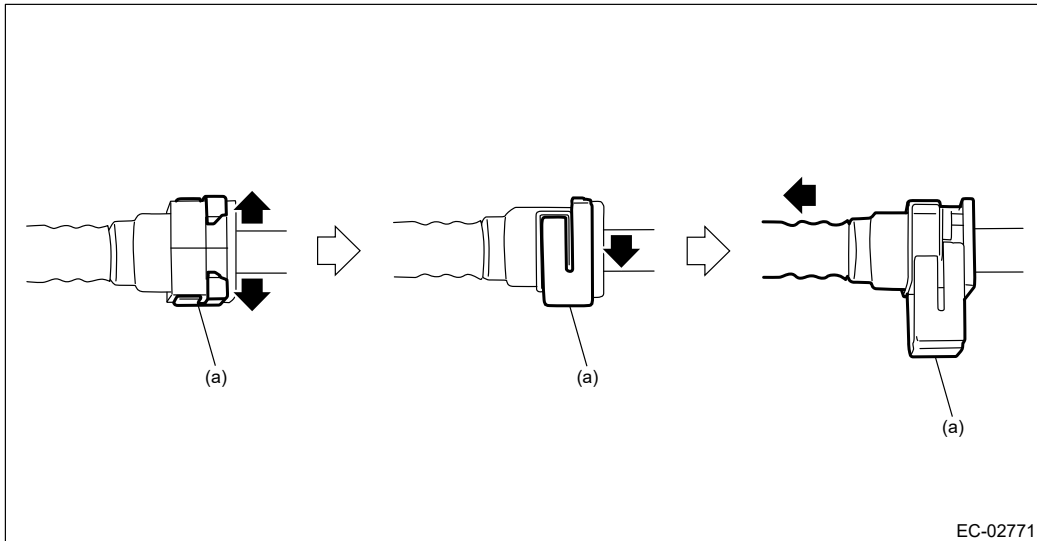
6. Disconnect connectors from the fuel pump, and move aside the service hole cover.



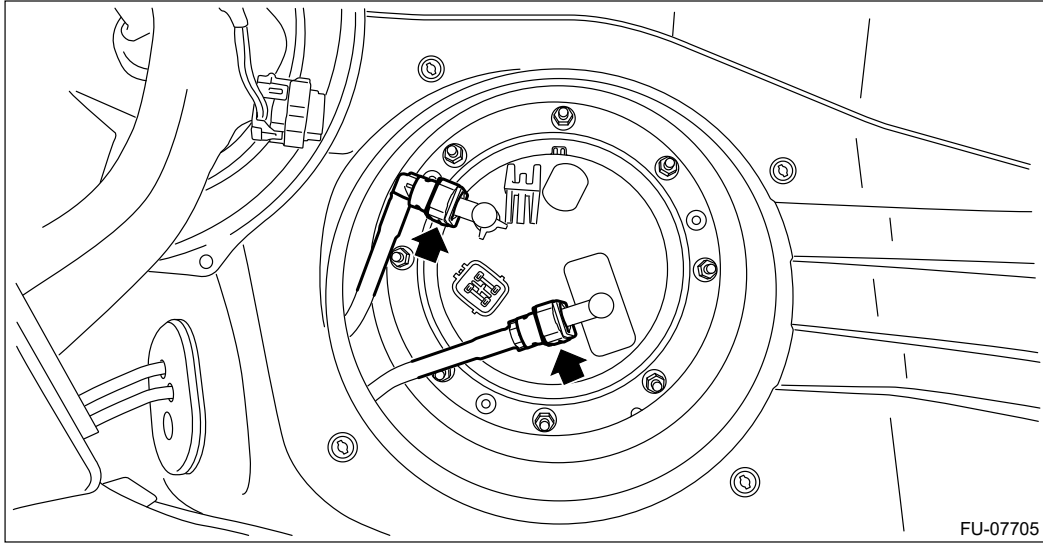
7. Disconnect the quick connector of fuel delivery tube and jet pump tube.

Note:

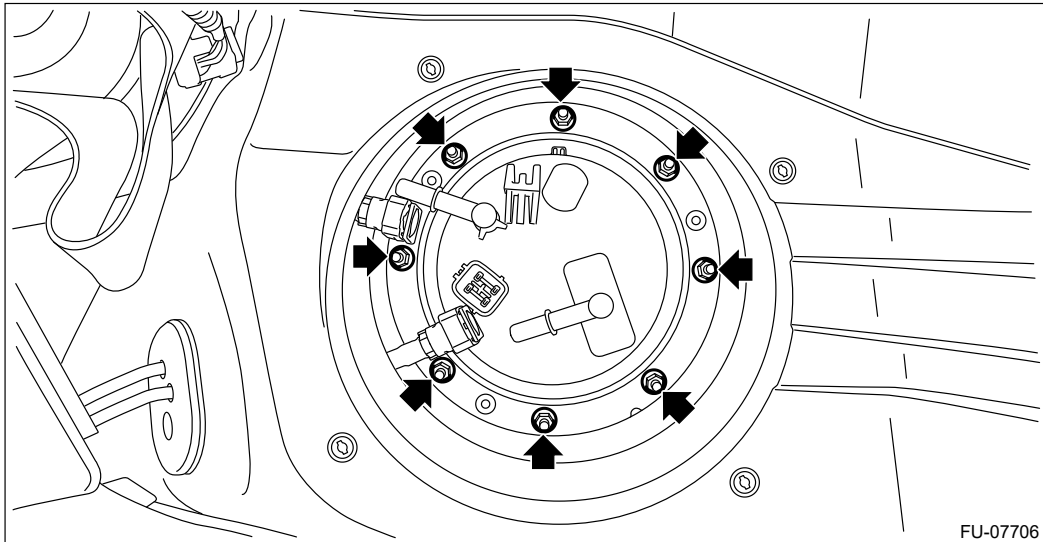
Disconnect the quick connector as shown in the figure.



(a) Slider



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



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

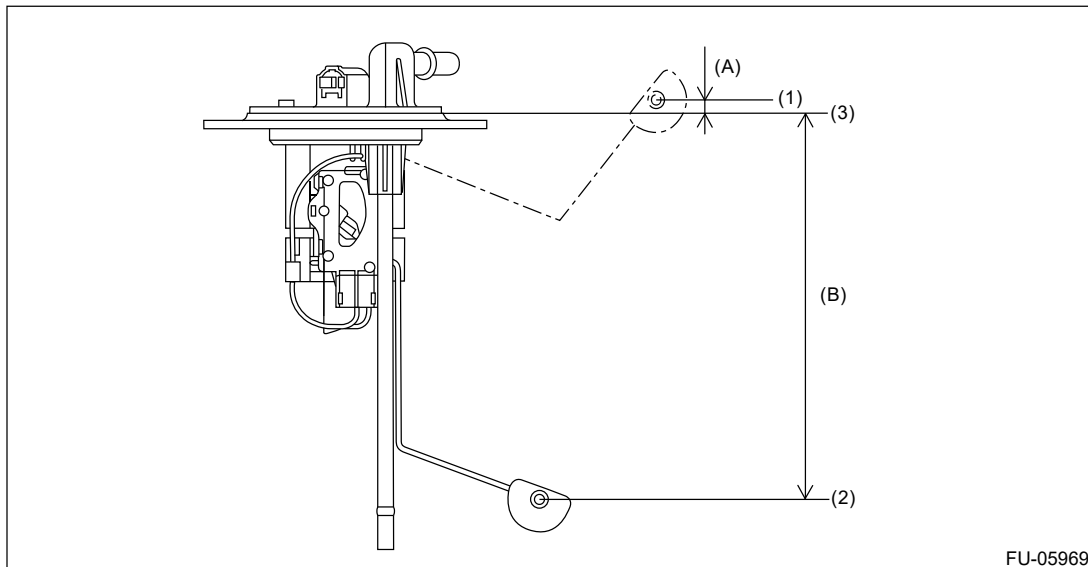
Caution:

Be careful not to let the arm and float of fuel level sensor contact the fuel tank.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Sub Level Sensor

INSPECTION

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



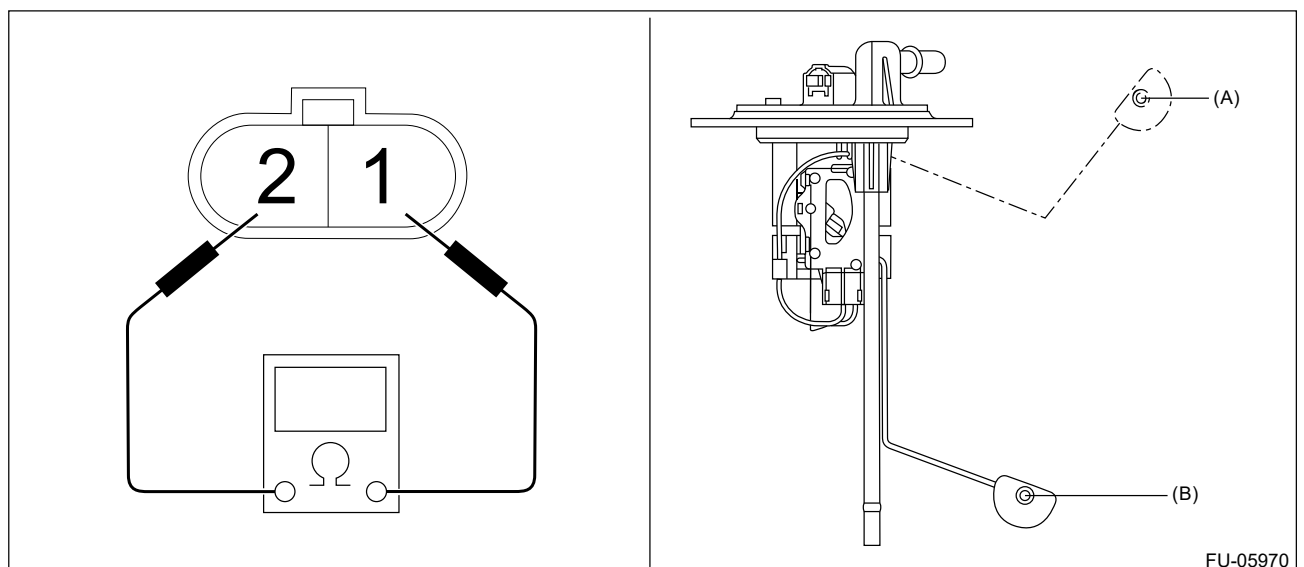
(1) FULL

(2) EMPTY

(3) Datum points

| Float position | Standard |
|--------------------------|------------------------------|
| FULL to Datum point (A) | 5.31±3.5 mm (0.209±0.138 in) |
| EMPTY to Datum point (B) | 160.6±3.5 mm (6.32±0.138 in) |

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



| Float position | Terminal No. | Standard |
|----------------|--------------|-------------|
| FULL (A) | 1 and 2 | 8.7±1.0 Ω |
| EMPTY (B) | | 270.9±4.0 Ω |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Sub Level Sensor

INSTALLATION

1. Install the fuel sub level sensor to the fuel tank.

- (1) Make sure the sealing portion is free from fuel or foreign matter before installation.
- (2) Align the cutout (B) as shown in the figure, and install the fuel sub level sensor upper plate cushion to the fuel sub level sensor upper plate.
- (3) Align the cutout of the fuel sub level sensor upper plate with the protrusion (B) of the fuel sub level sensor as shown in the figure, and install the fuel sub level sensor upper plate from the upper side of the fuel sub level sensor.
- (4) Install the gasket from the lower side of the fuel sub level sensor so that the protrusion (B) of the fuel sub level sensor and the protrusion (A) of the gasket are positioned as shown in the figure.

Note:

Use a new gasket.

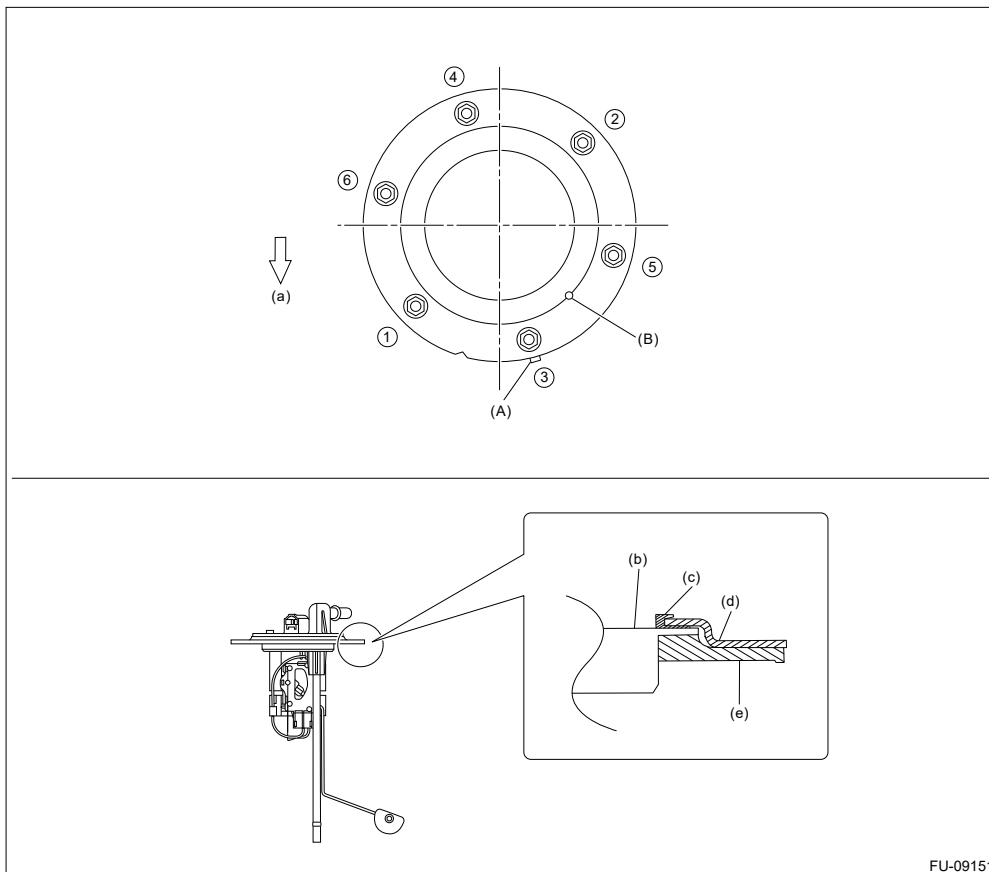
- (5) Install the fuel sub level sensor to the fuel tank in the direction shown in the figure, and tighten the nuts to the specified torque in the order as shown in the figure.

Caution:

Set the arm and float of the fuel sub level sensor while paying attention to prevent them from contacting the fuel tank. If the arm of the fuel sub level sensor is bent, the fuel gauge may not read correctly.

Tightening torque:

4.4 N·m (0.4 kgf·m, 3.2 ft·lb)



(a) Front side of vehicle

(c) Fuel sub level sensor upper plate cushion

(e) Gasket

(b) Fuel sub level sensor

(d) Fuel sub level sensor upper plate

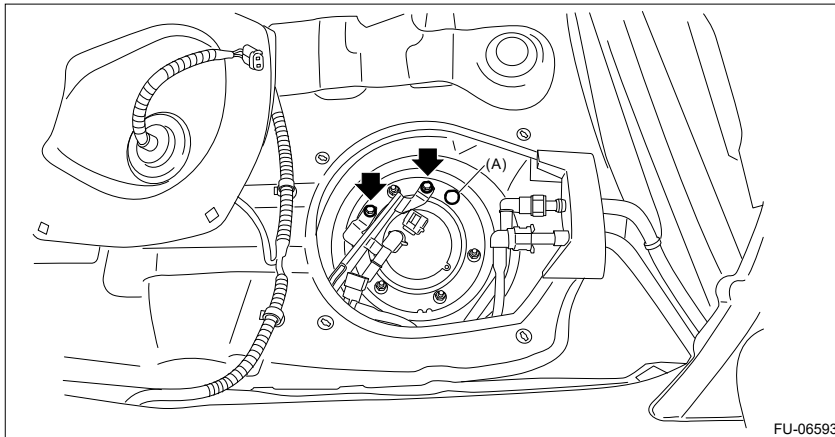
FU-09151

2. Install the fuel sub level sensor protector, and install the rubber cap (A).

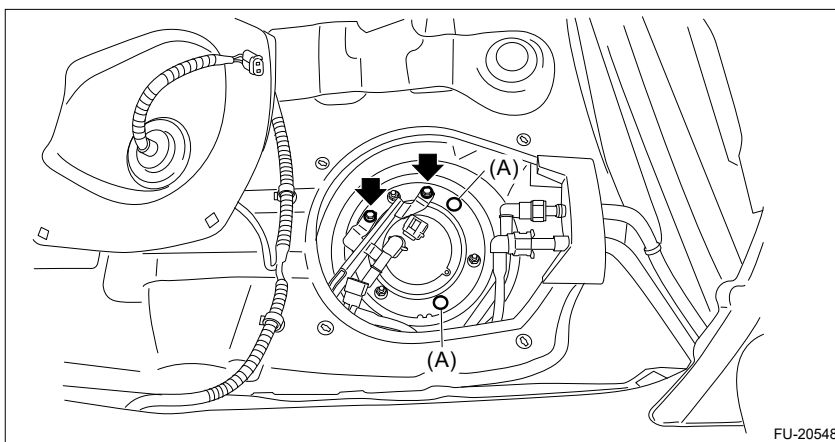
Tightening torque:

4.4 N·m (0.4 kgf·m, 3.2 ft·lb)

- Single-piece type



- Two-piece type



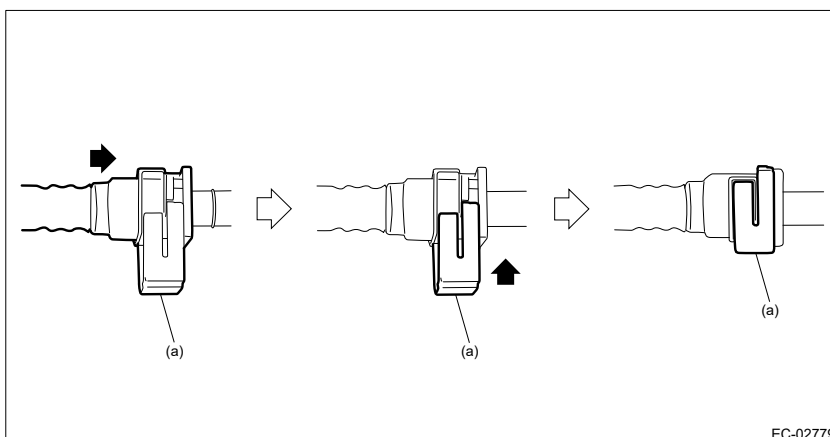
3. Connect the quick connector of the jet pump tube.

Caution:

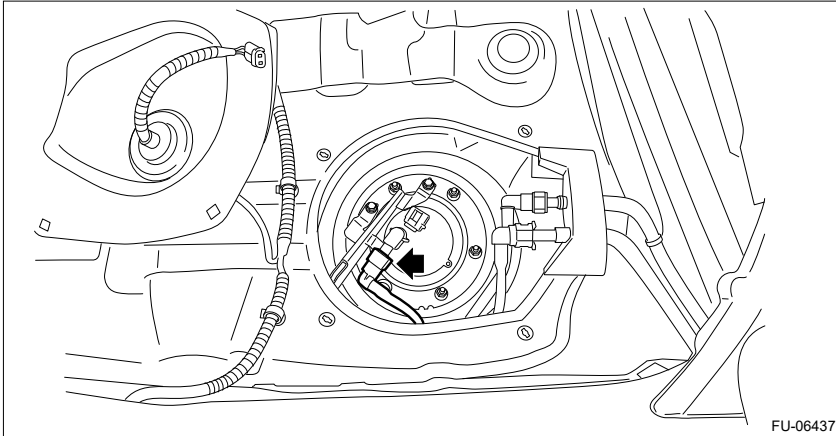
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

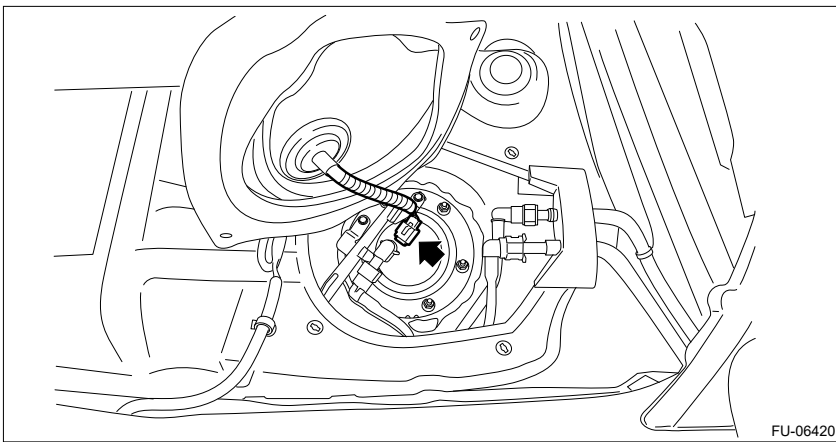
Connect the quick connector as shown in the figure.



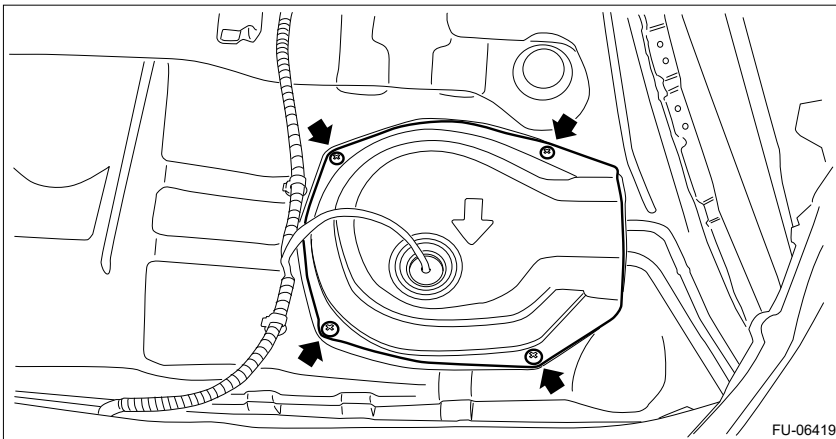
(a) Slider




4. Connect the connector to the fuel sub level sensor.



5. Install the service hole cover of fuel sub level sensor.



6. Install the rear seat cushion.  [Ref. to SEATS>Rear Seat>INSTALLATION.](#)
7. Connect the battery ground terminal.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Sub Level Sensor




REMOVAL

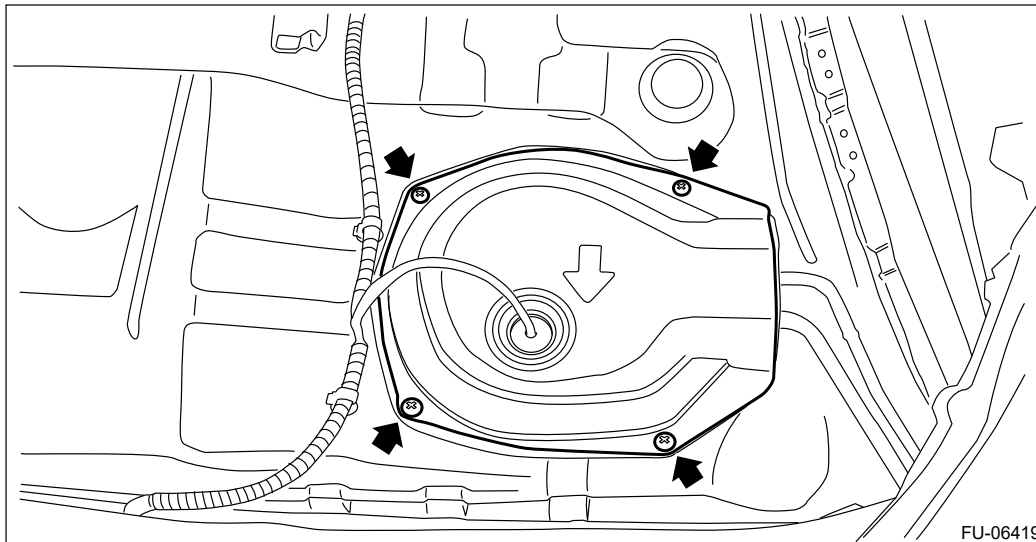
Warning:

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

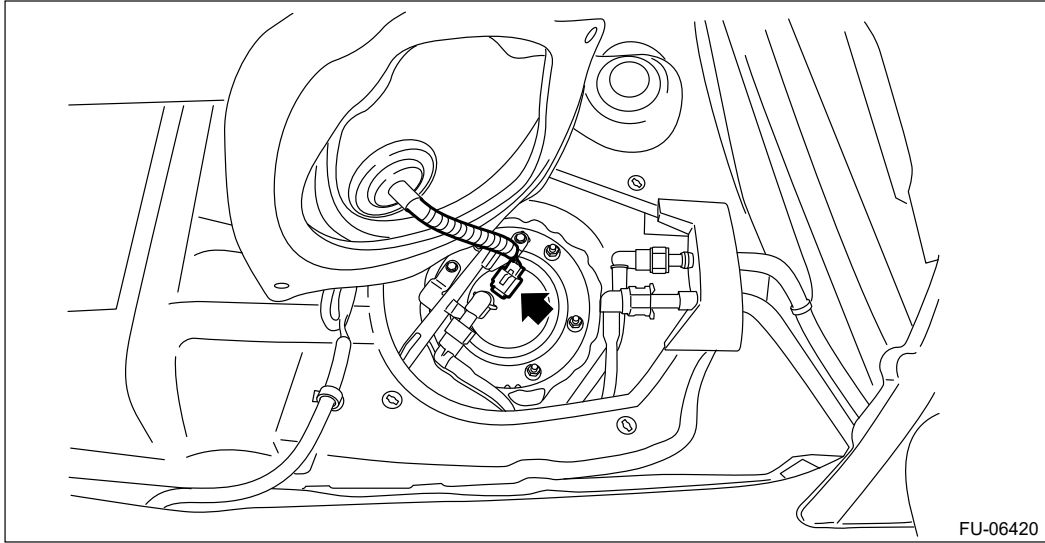
Caution:

- Be careful not to spill fuel.
- Catch the fuel from the tubes using a container or cloth.
- If the fuel gauge indicates that two thirds or more of the fuel is remaining, be sure to drain fuel before starting work to avoid the fuel to spill.

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Drain fuel.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > DRAINING FUEL \(WITH SUBARU SELECT MONITOR\).](#)
3. Disconnect the ground cable from battery.
4. Remove the rear seat cushion.  [Ref. to SEATS>Rear Seat>REMOVAL.](#)
5. Remove the service hole cover of fuel sub level sensor.



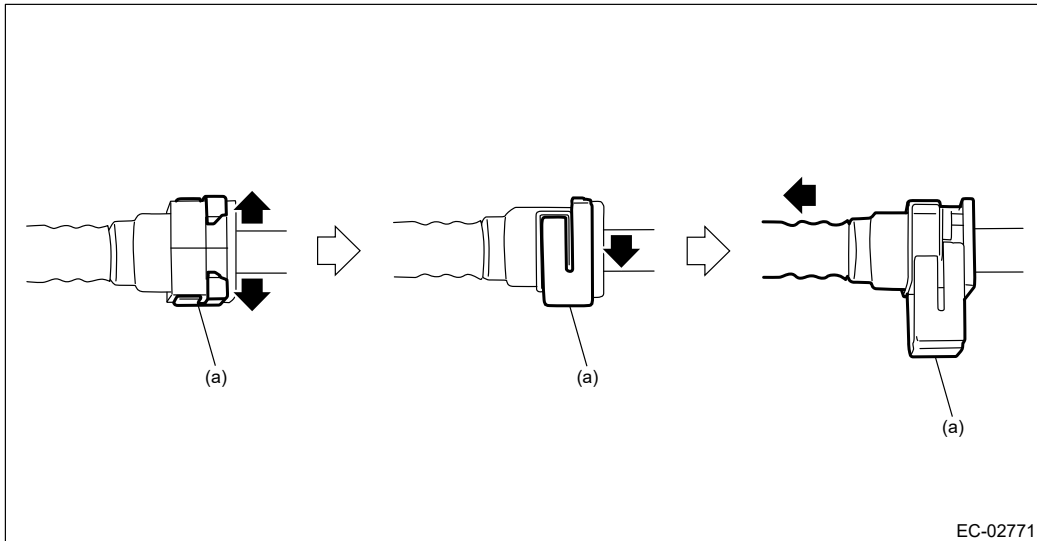
6. Disconnect the connector from the fuel sub level sensor, and move aside the service hole cover.



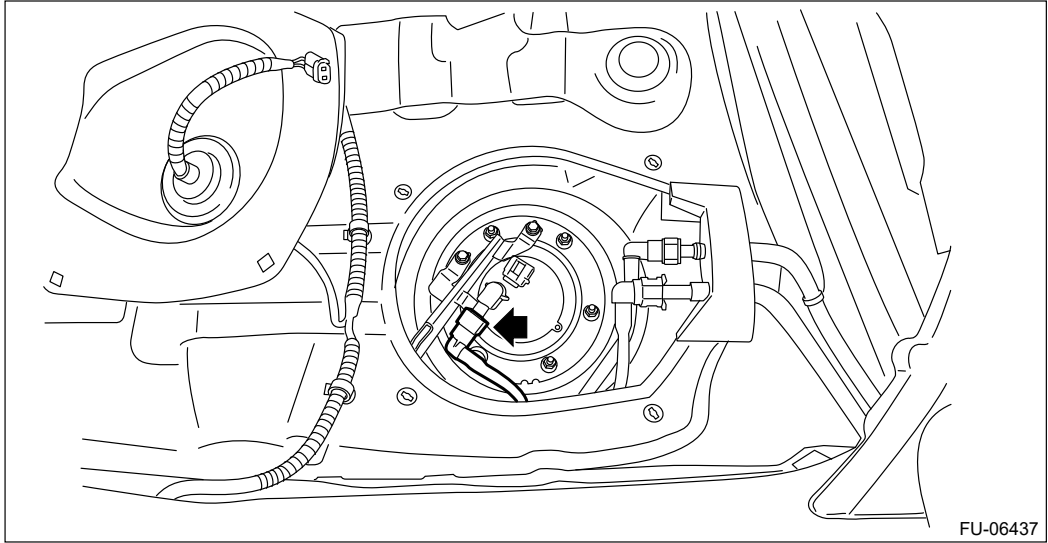
7. Disconnect the quick connector of the jet pump tube.

Note:

Disconnect the quick connector as shown in the figure.



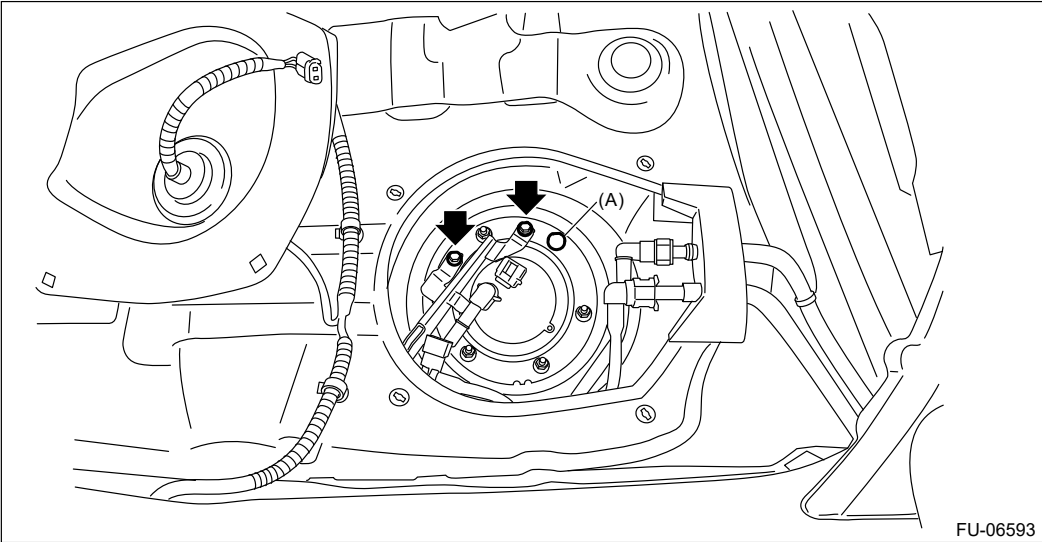
(a) Slider



FU-06437

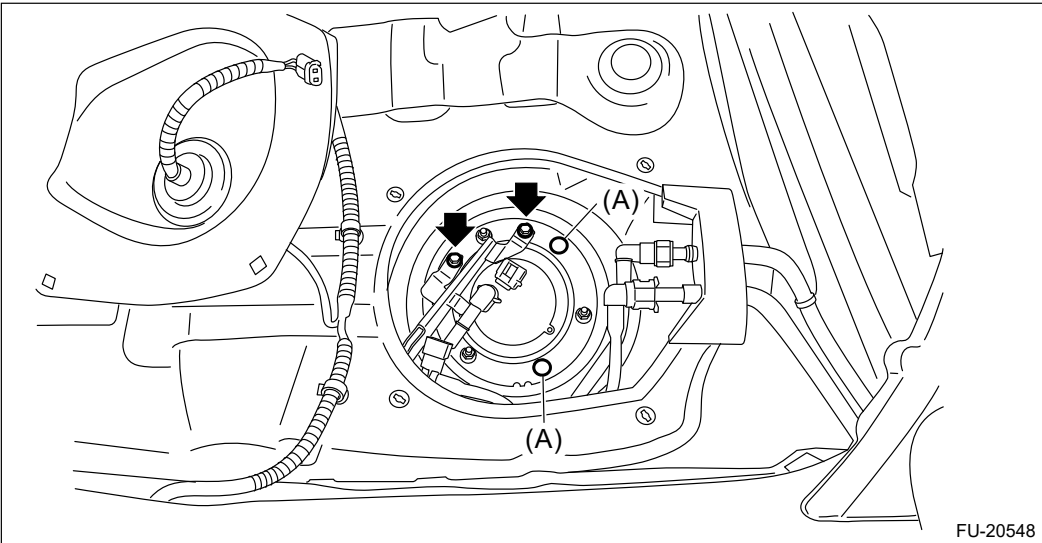
8. Remove the fuel sub level sensor protector, and remove the rubber cap (A) from nut.

- Single-piece type



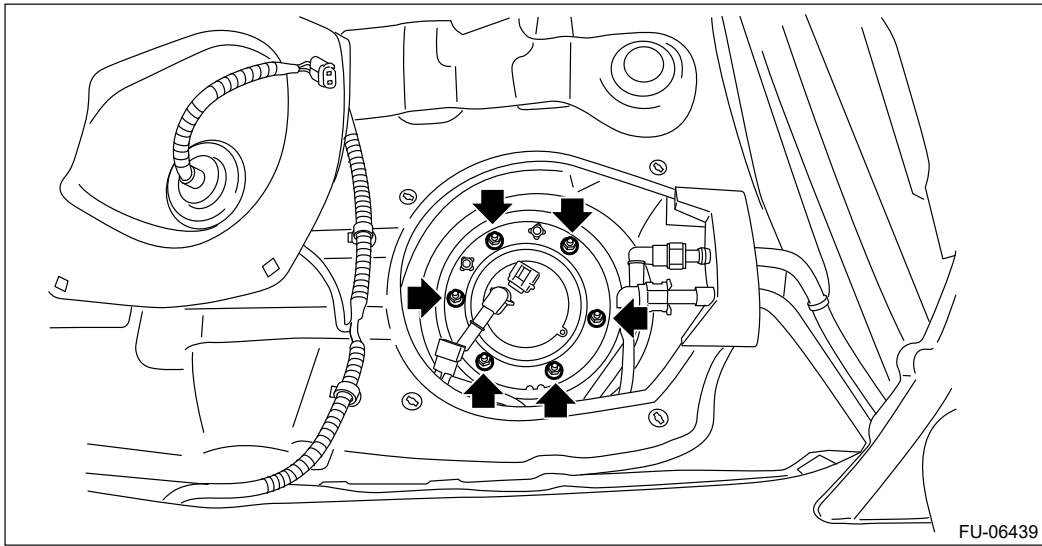
FU-06593

- Two-piece type



FU-20548

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




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

Caution:

Be careful not to let the arm and float of the fuel sub level sensor contact the fuel tank.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel System Trouble in General

INSPECTION

| Trouble | Possible cause | Corrective action |
|---|---|---|
| Insufficient fuel supply to fuel injector | a. Fuel pump does not operate. | |
| | Defective terminal contact | Inspect contact, especially ground, and tighten it securely. |
| | Trouble in electromagnetic or electronic circuit parts | Replace the faulty parts. |
| | b. Decline of fuel pump function | Replace the fuel pump. |
| | c. Clogged fuel filter | Replace the fuel filter. Clean or replace the fuel tank if necessary. |
| | d. Clogged or bent fuel line pipe, hose or tube | Clean, correct or replace the fuel line pipe, hose or tube. |
| | e. Air is mixed in fuel system. | Check the fuel line connections, correct or replace the defective part. |
| | f. Damaged diaphragm of pressure regulator | Replace the pressure regulator. |
| Leakage or blow out of fuel | a. Loose connections of fuel line pipe, hose or tube | Check the fuel line connections, correct or replace the defective part. |
| | b. Cracked fuel line pipe, hose or tube | Replace the fuel line pipe, hose or tube. |
| | c. Cracked fuel tank or defective welding part | Replace the fuel tank. |
| | d. Clogged or bent fuel line pipe, hose or tube | Clean, correct or replace the fuel line pipe, hose or tube. |
| Gasoline smell inside of compartment | a. Loose connections of fuel line pipe, hose or tube | Check the fuel line connections, correct or replace the defective part. |
| | b. Improper installation of rubber saucer | Correct or replace the rubber saucer. |
| | c. Defective canister | Replace the canister. |
| Defective fuel gauge | a. Defective operation of fuel level sensor | Replace the fuel level sensor. |
| | b. Defective operation of combination meter  Ref. to COMBINATION METER (DIAGNOSTICS)>Basic Diagnostic Procedure>PROCEDURE. | Replace the combination meter. |
| Noise | a. Large operation noise or vibration of fuel pump | Replace the fuel pump. |

Note:

- **When the vehicle is left unattended for an extended period of time, water may accumulate in the fuel tank. Fill fuel fully to prevent the problem.**

- **In snow-covered areas, mountainous areas, skiing areas, etc. where ambient temperatures drop to 0°C (32°F) or less throughout the winter season, use a water removing agent in the fuel system to prevent freezing fuel system and accumulating water.**
- **When water is accumulated in fuel filter, fill the water removing agent in the fuel tank.**
- **Before using water removing agent, follow the cautions noted on the bottle.**

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Tank Protector

INSTALLATION

Install in the reverse order of removal.

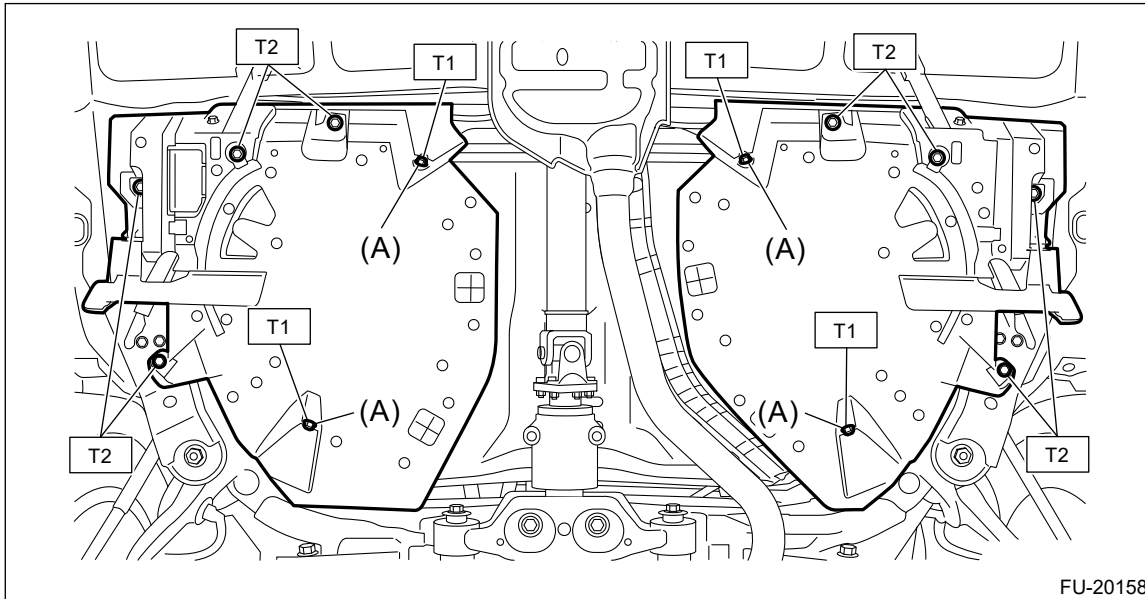
Note:

Use a new self-locking nut.

Tightening torque:

T1: 9 N•m (0.9 kgf-m, 6.6 ft-lb)

T2: 18 N•m (1.8 kgf-m, 13.3 ft-lb)

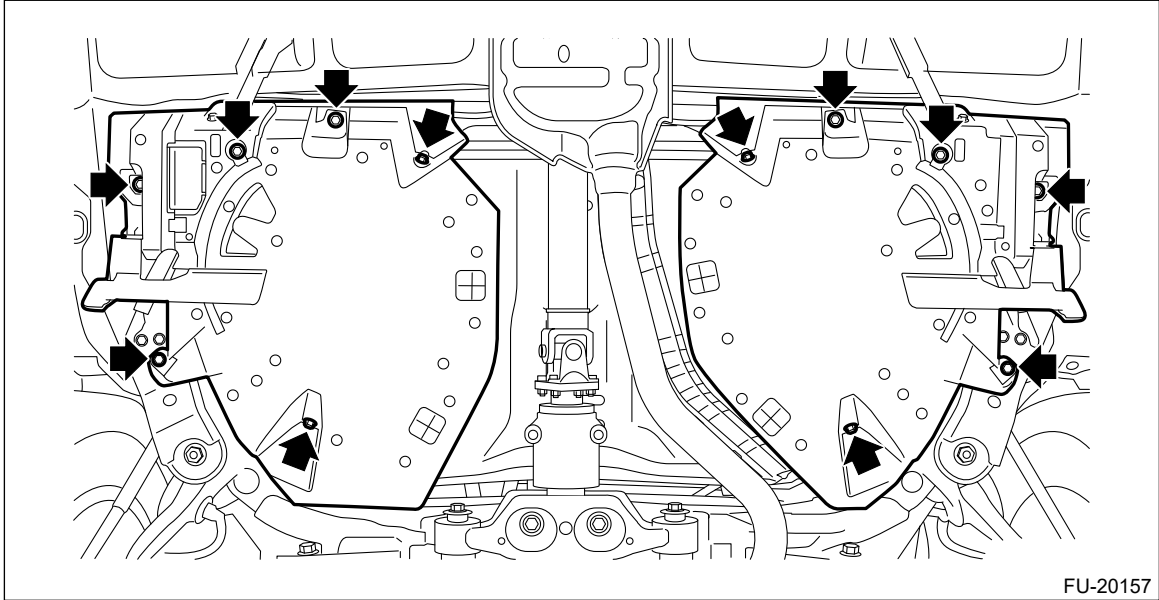


(A) Self-locking nut

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Tank Protector

REMOVAL

1. Lift up the vehicle.
2. Remove the bolt and nuts and remove the fuel tank protector.



FU-20157

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Tank

INSPECTION

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

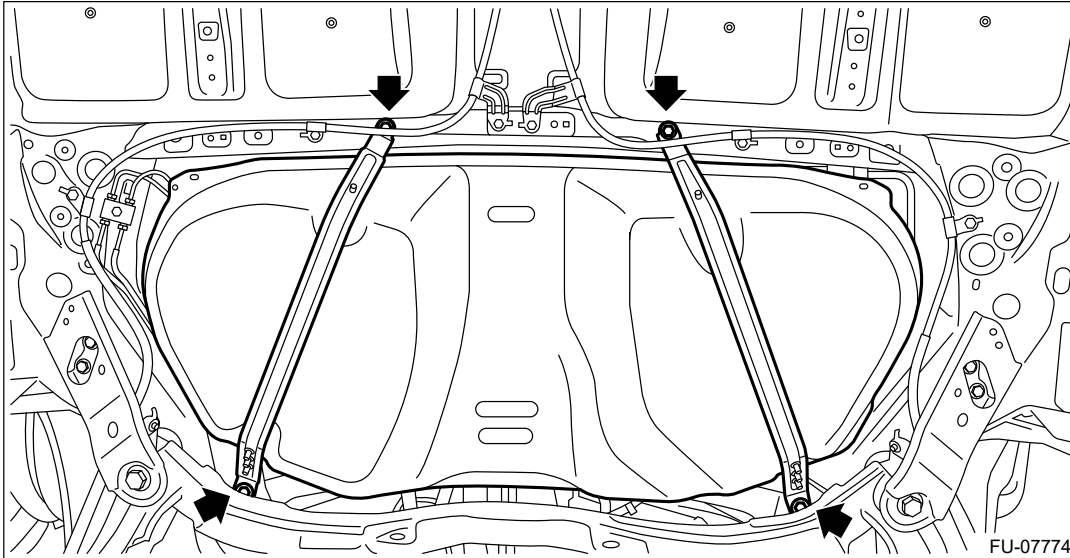
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Tank

INSTALLATION

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

Warning:

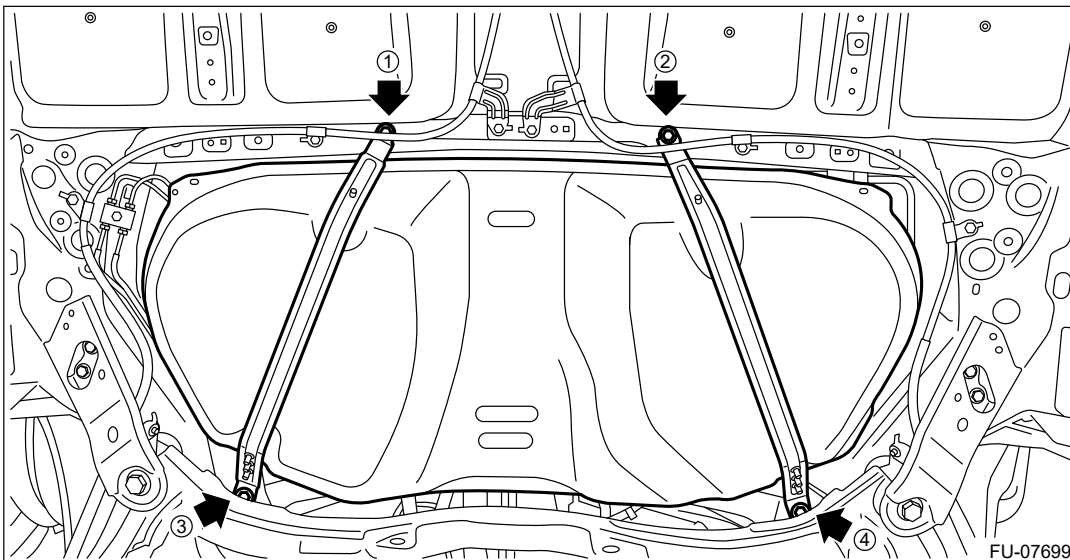
A helper is required to perform this work.



2. Tighten the bolts of the fuel tank band in the order shown in the figure.

Tightening torque:

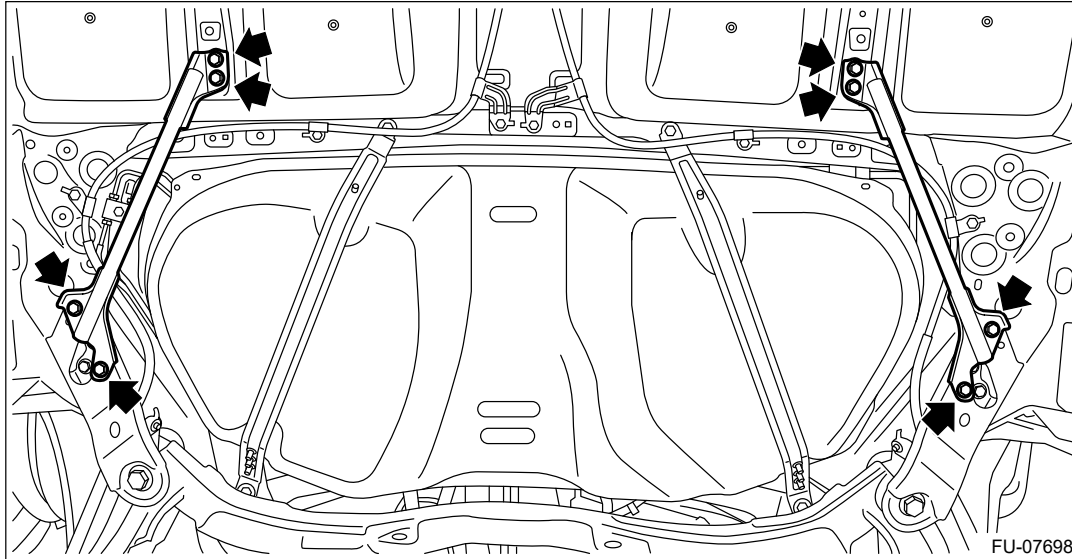
33 N•m (3.4 kgf-m, 24.3 ft-lb)



3. Install the stay - rear frame COMPL.

Tightening torque:

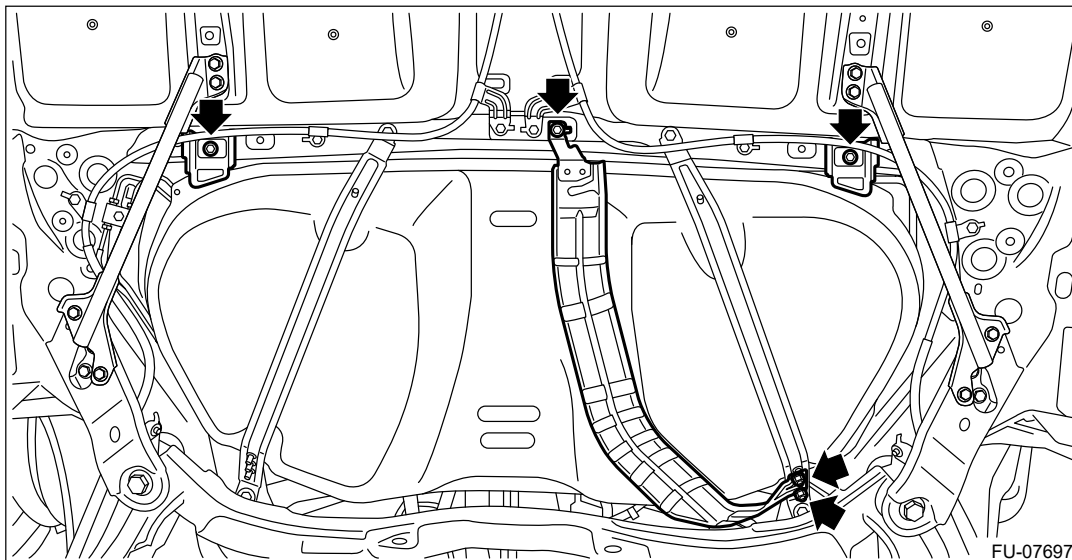
33 N•m (3.4 kgf-m, 24.3 ft-lb)




4. Install the heat shield cover and stopper.

Tightening torque:

18 N•m (1.8 kgf-m, 13.3 ft-lb)



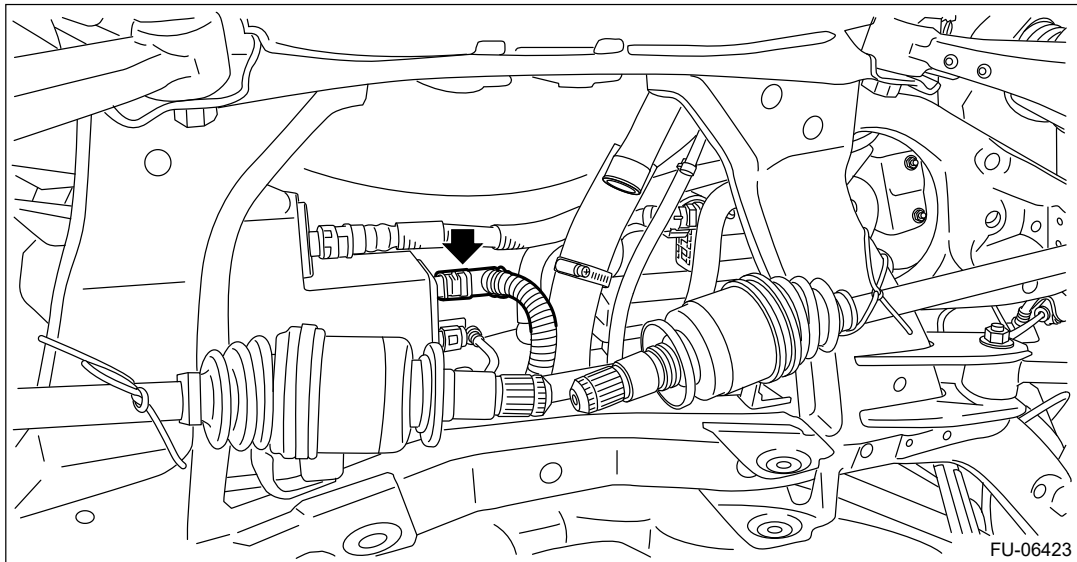
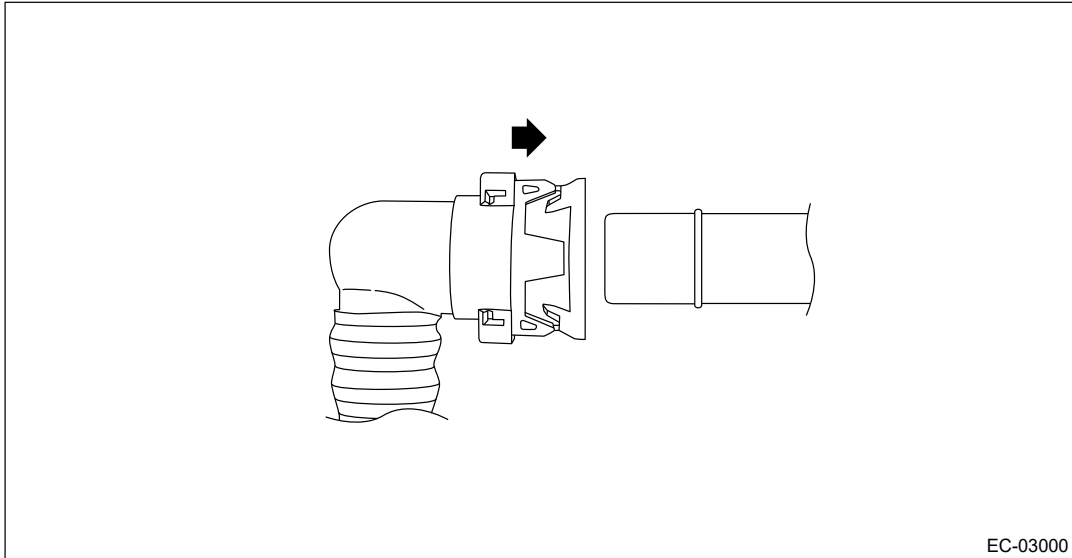
5. Install the fuel tank protector.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Tank Protector>INSTALLATION.](#)
6. Connect the vent tube to the canister.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- Make sure that the quick connector is securely connected.

Note:

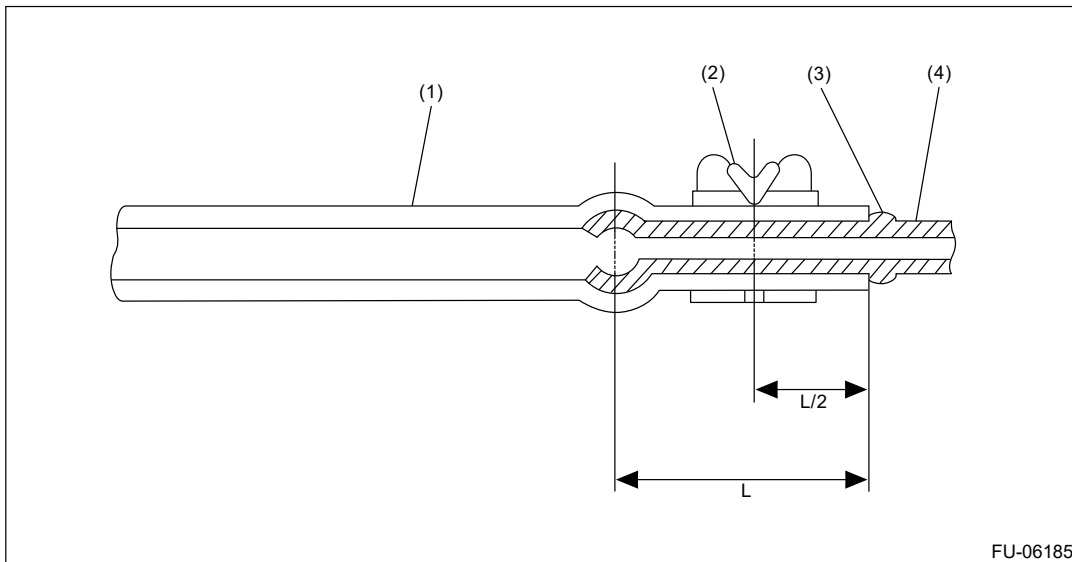
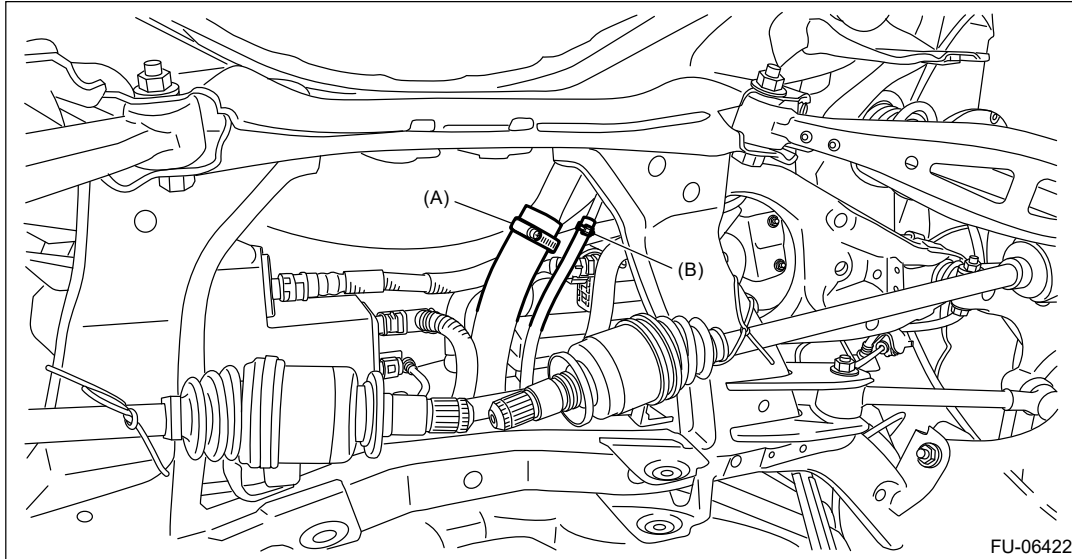
Connect the quick connector as shown in the figure.



7. Securely insert the fuel filler hose (A) and evaporation hose (B) until the hose end contacts the spool, then attach the clamp or clip as shown in the figure.

Tightening torque:

2.5 N•m (0.3 kgf-m, 1.8 ft-lb)





(1) Hose

(3) Spool

(4) Pipe

(2) Clamp or clip

8. Install the rear differential.  [Ref. to DIFFERENTIALS>Rear Differential \(T-type\)>INSTALLATION.](#)

9. Install the rear exhaust pipe and muffler.  [Ref. to EXHAUST\(H4DOTC\)>Rear Exhaust Pipe>INSTALLATION.](#)  [Ref. to EXHAUST\(H4DOTC\)>Muffler>INSTALLATION.](#)

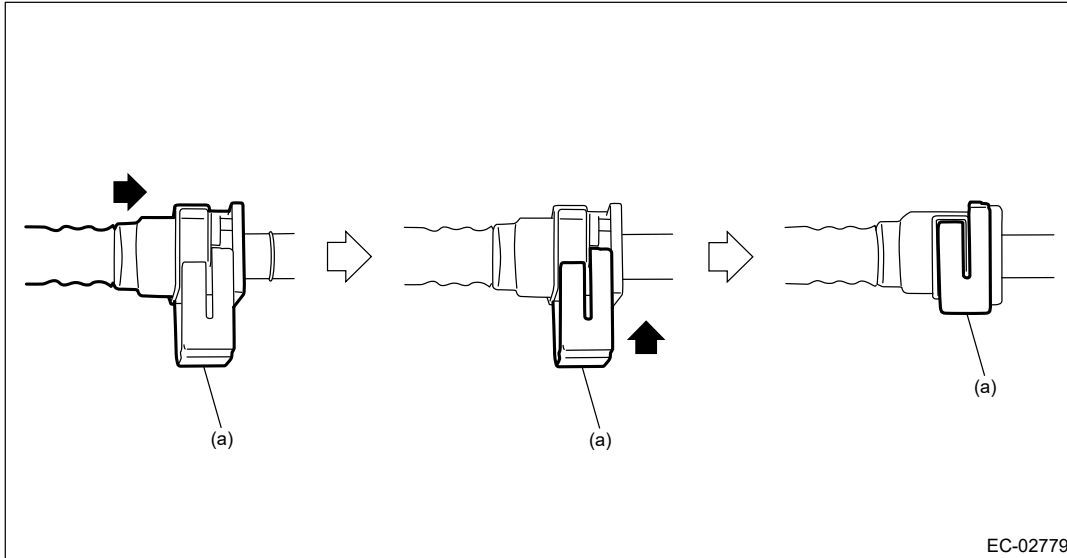
10. Connect the quick connector of the fuel delivery tube.

Caution:

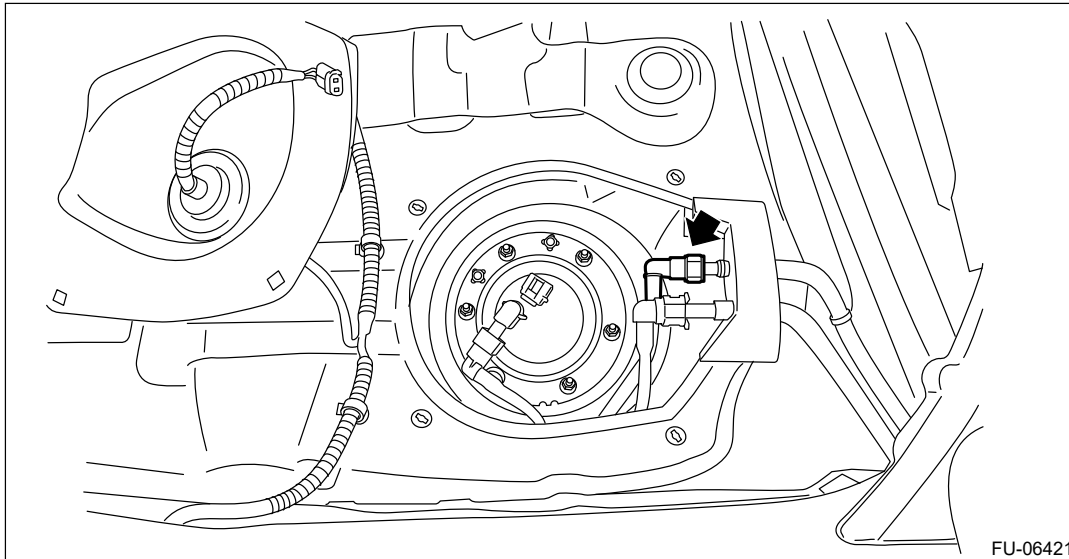
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

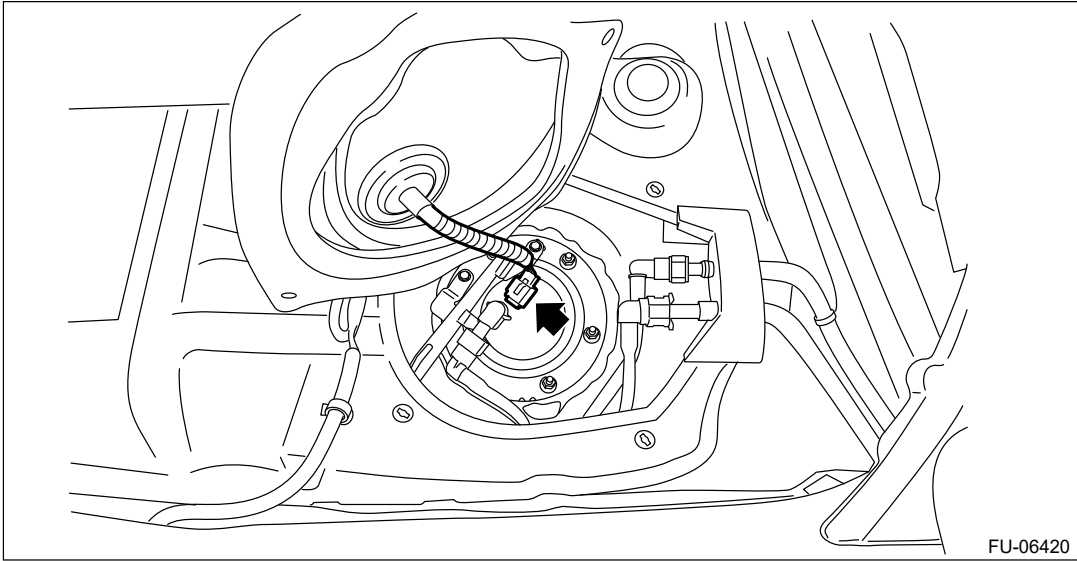
Connect the quick connector as shown in the figure.



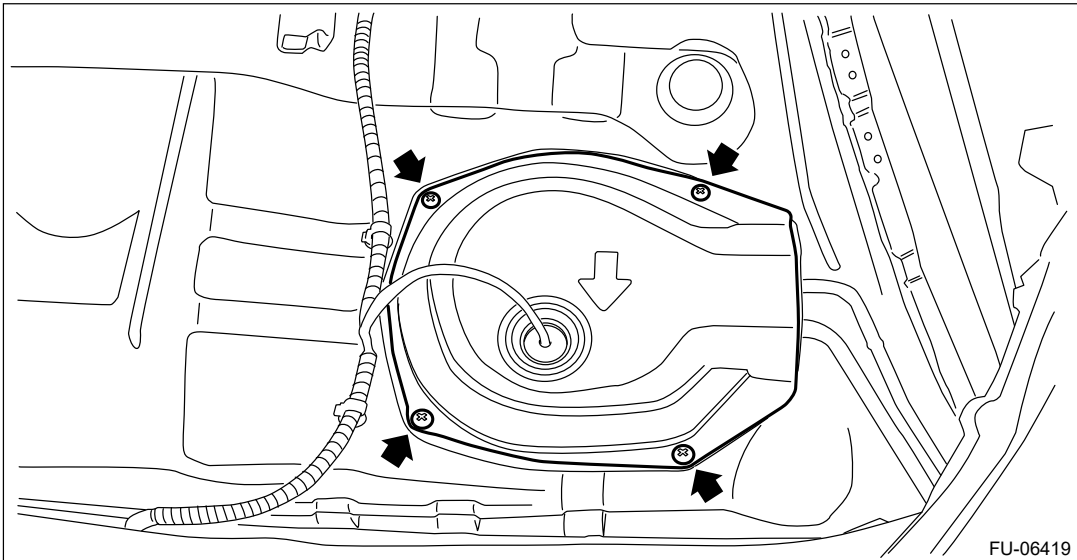
(a) Slider



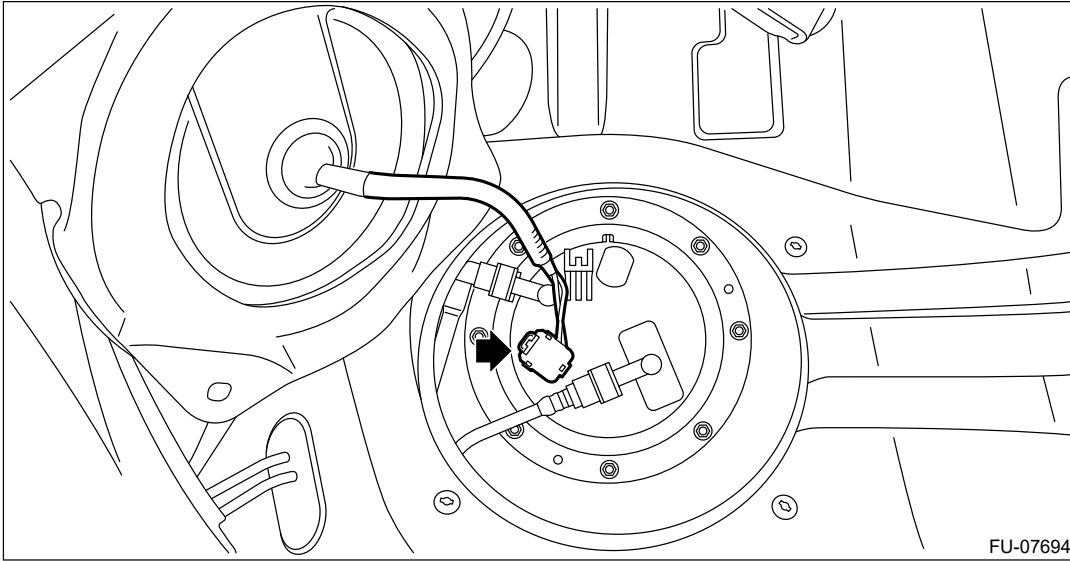
- 11.** Connect the connector to the fuel sub level sensor.



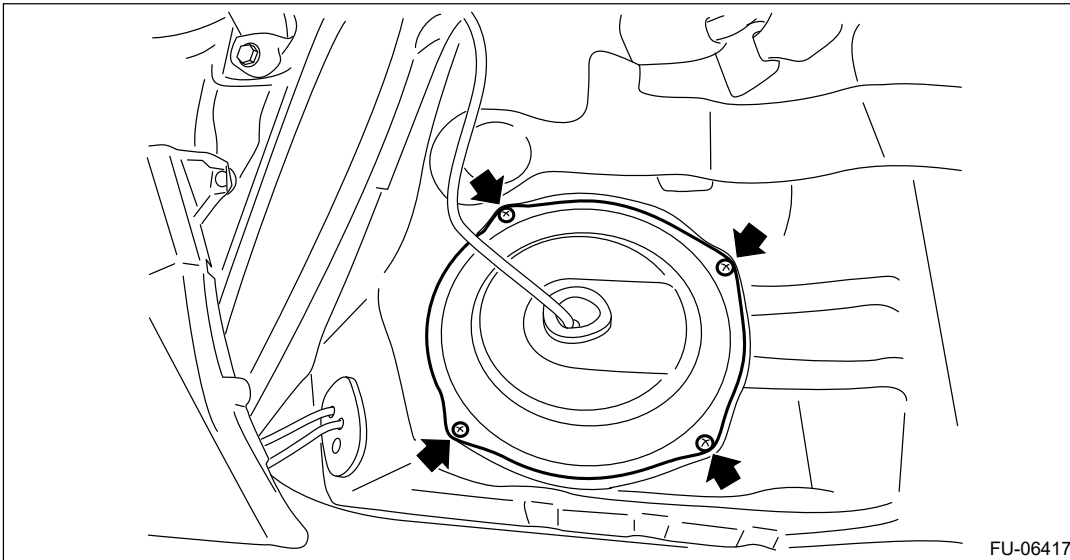
12. Install the service hole cover of fuel sub level sensor.



13. Connect the connector to the fuel pump.



14. Install the service hole cover of fuel pump.



15. Install the rear seat cushion.  [Ref. to SEATS>Rear Seat>INSTALLATION.](#)

16. Connect the battery ground terminal.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Fuel Tank




REMOVAL

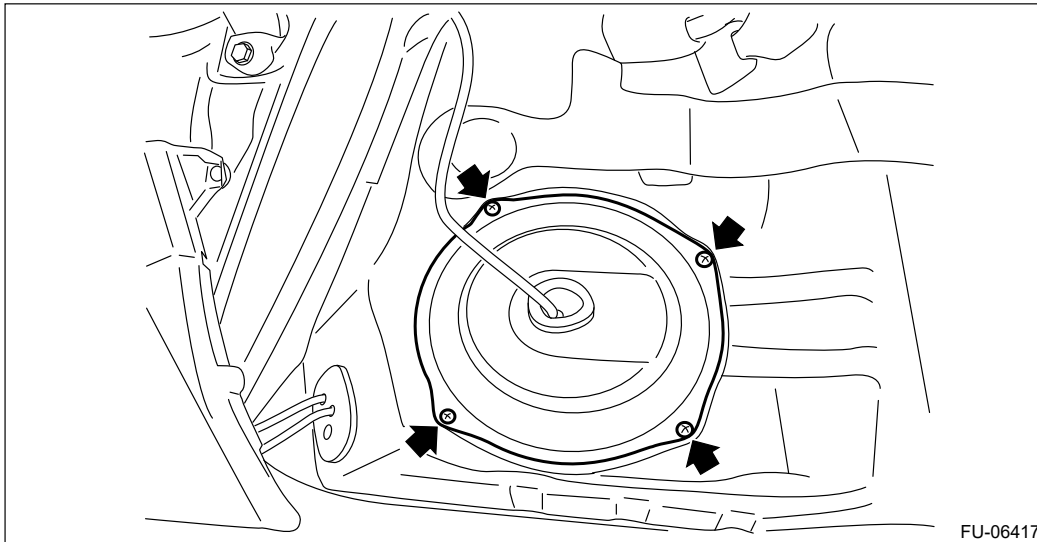
Warning:

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

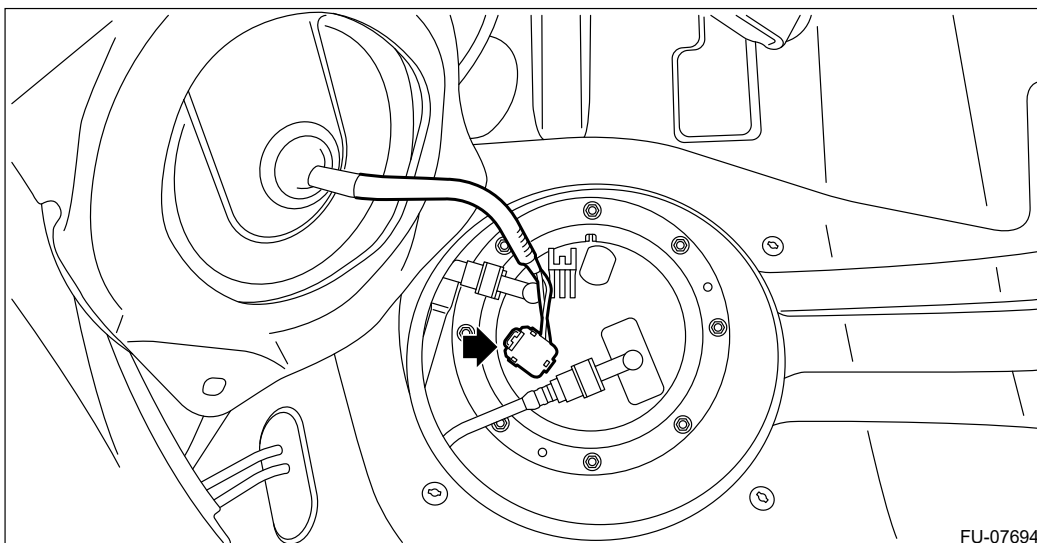
Caution:

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

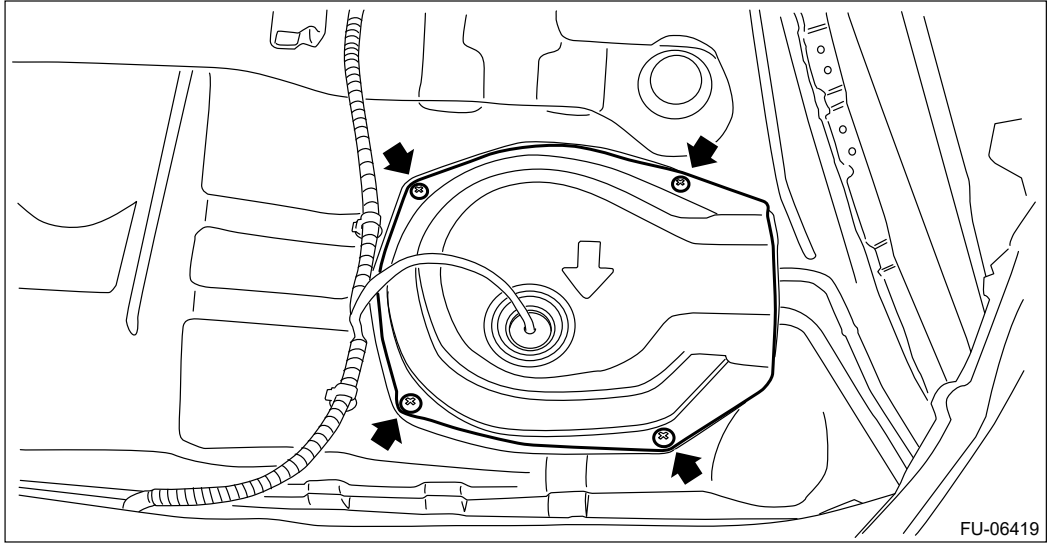
1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Drain fuel.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > DRAINING FUEL \(WITH SUBARU SELECT MONITOR\).](#)
3. Disconnect the ground cable from battery.
4. Remove the rear seat cushion.  [Ref. to SEATS>Rear Seat>REMOVAL.](#)
5. Remove the service hole cover of fuel pump.



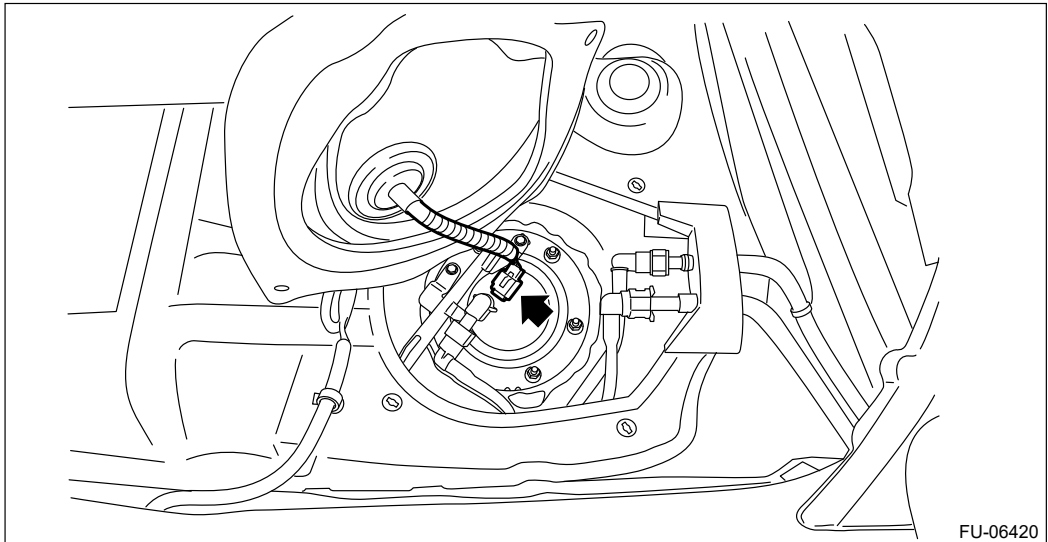
6. Disconnect connectors from the fuel pump, and move aside the service hole cover.



7. Remove the service hole cover of fuel sub level sensor.



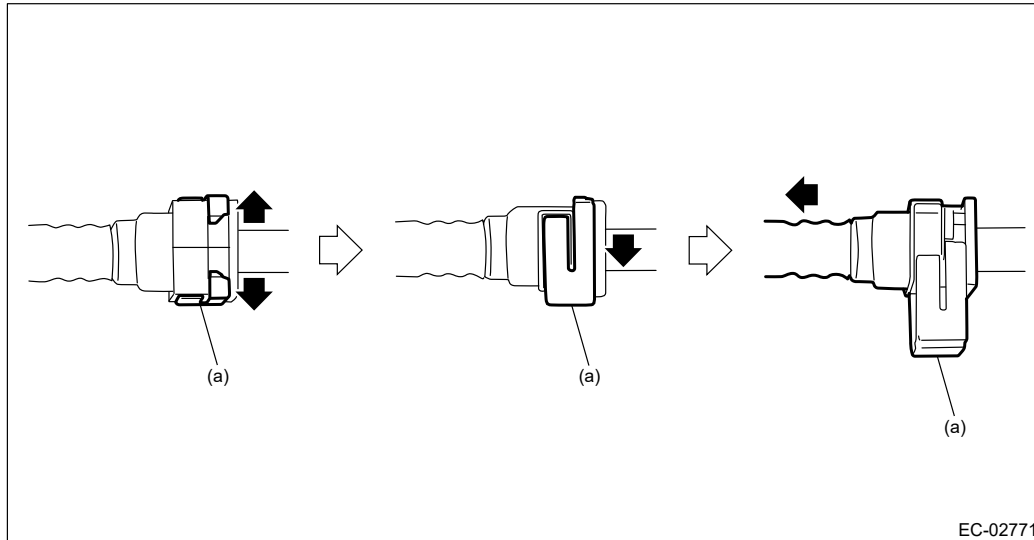
- 8.** Disconnect the connector from the fuel sub level sensor, and move aside the service hole cover.



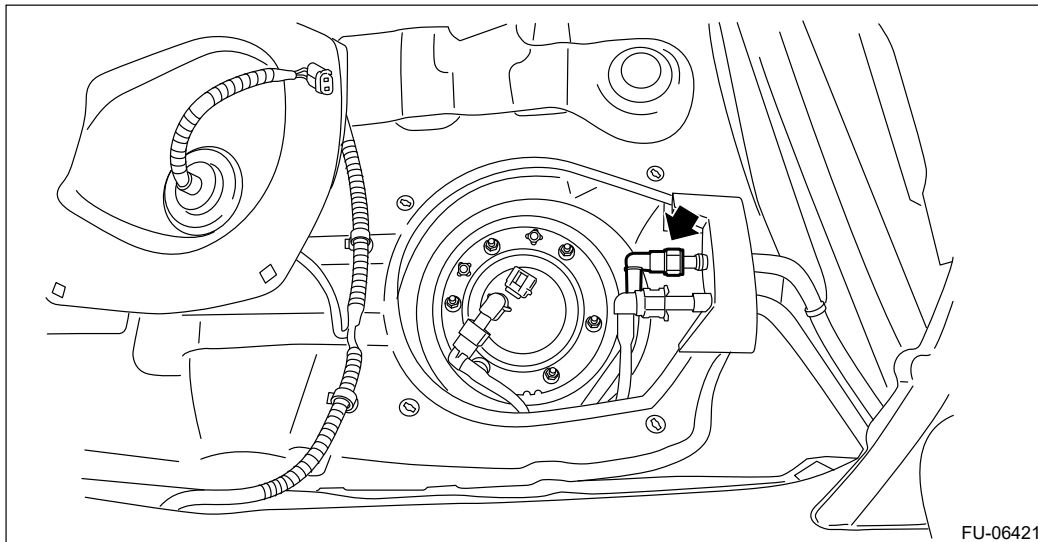
- 9.** Disconnect the quick connector on the fuel delivery tube.




Note:

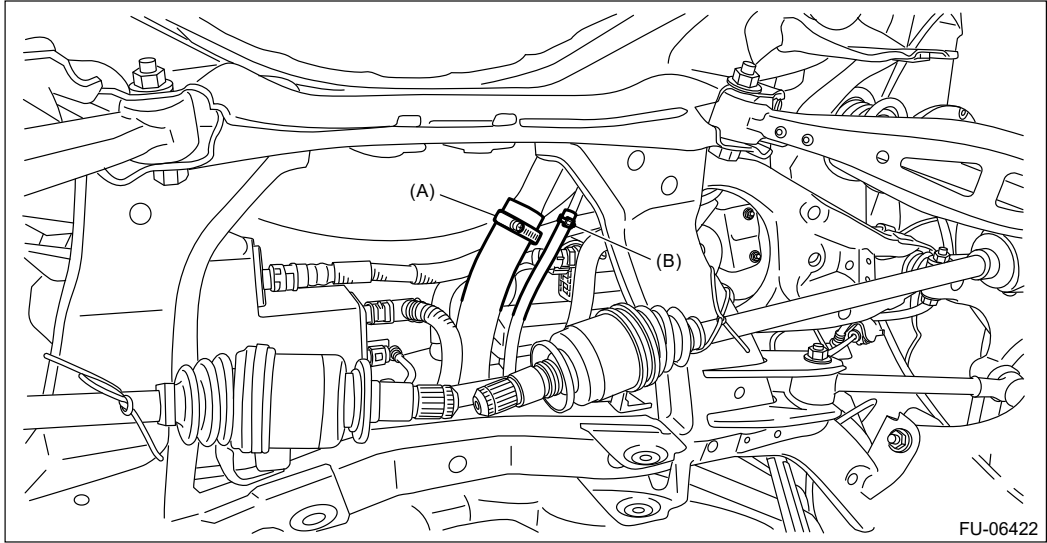
Disconnect the quick connector as shown in the figure.



(a) Slider



- 10.** Lift up the vehicle.
- 11.** Remove the rear exhaust pipe and muffler.  [Ref. to EXHAUST\(H4DOTC\)>Rear Exhaust Pipe>REMOVAL.](#)  [Ref. to EXHAUST\(H4DOTC\)>Muffler>REMOVAL.](#)
- 12.** Remove the rear differential.  [Ref. to DIFFERENTIALS>Rear Differential \(T-type\)>REMOVAL.](#)
- 13.** Disconnect fuel filler hose (A) and air vent hose (B) from the fuel filler pipe assembly.

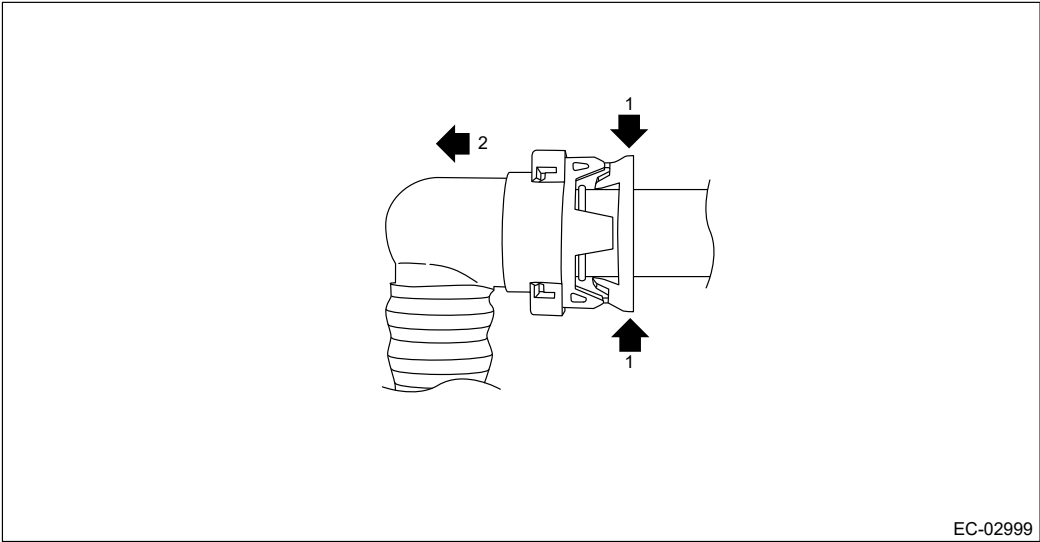


FU-06422

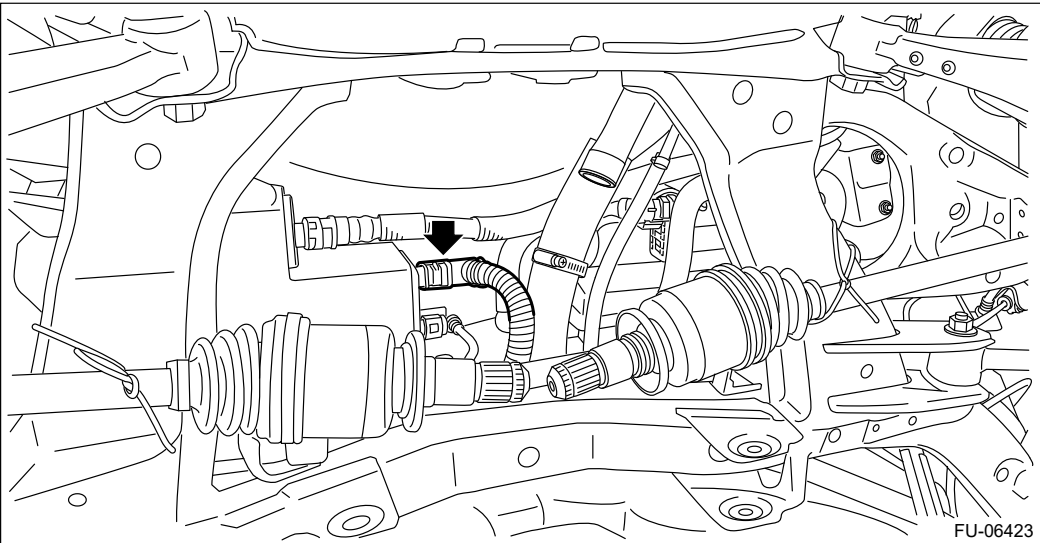
14. Disconnect the vent tube from canister.

Note:

Disconnect the quick connector as shown in the figure.

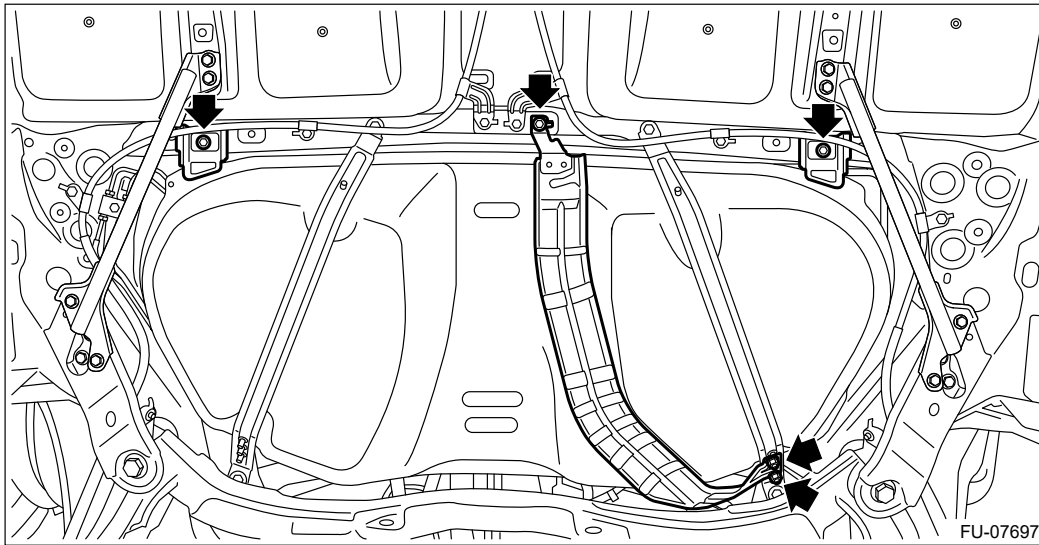


EC-02999

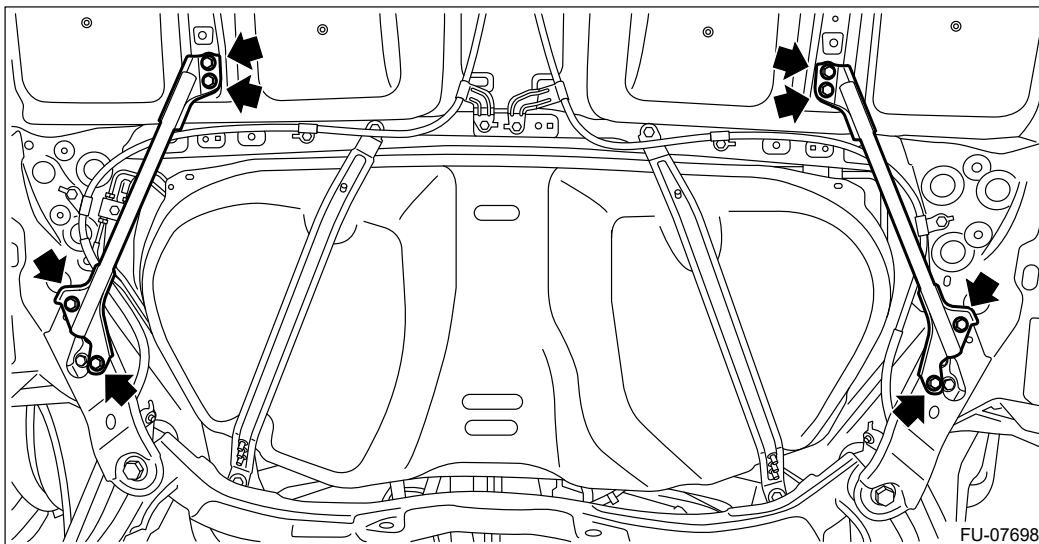


FU-06423

- 15.** Remove the fuel tank protector.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Tank Protector>REMOVAL.](#)
- 16.** Remove the heat shield cover and stopper.



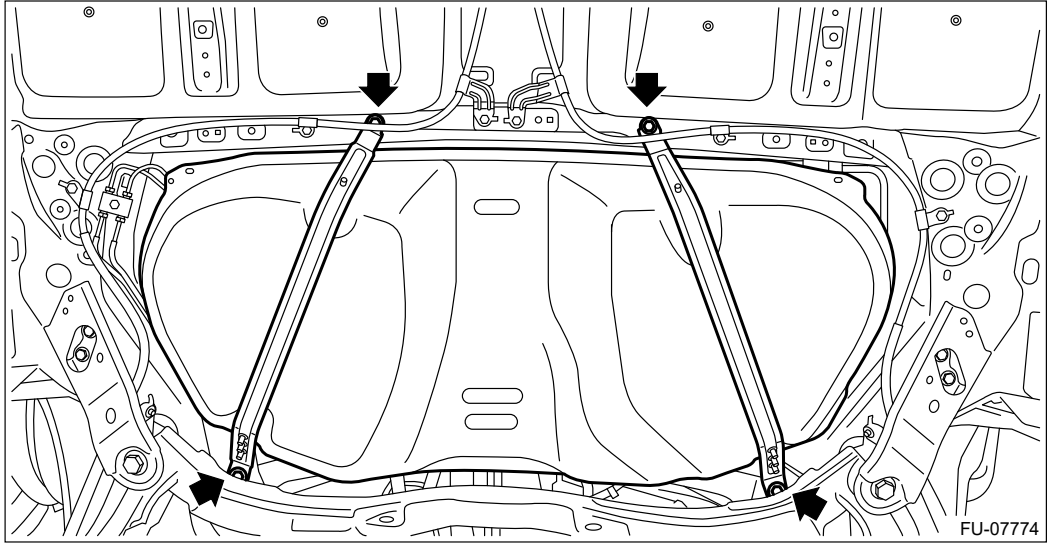
- 17.** Remove the stay - rear frame COMPL.



- 18.** Support the fuel tank with a transmission jack, remove the bolts from the fuel tank band, and remove the fuel tank from the vehicle.

Warning:

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



PROCEDURE

1. RELEASING OF FUEL PRESSURE

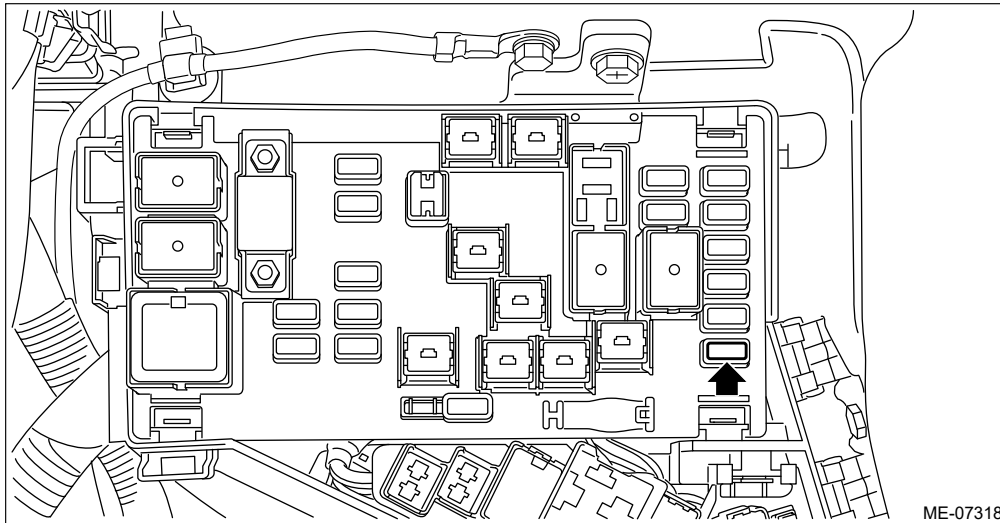
Warning:

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

Caution:


Be careful not to spill fuel.

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



2. Start the engine and run it until it stalls.
3. After the engine stalls, crank it for five more seconds.
4. Turn the ignition switch to OFF.
5. Install the fuse of fuel pump to the main fuse box.
6. Make sure that the malfunction indicator light is not lit.

Note:

When the fuel pressure is released, the malfunction indicator light illuminates and DTC (P0087) may be stored in ECM. When the malfunction indicator light has illuminated, perform the Clear Memory Mode.  Ref. to [ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Clear Memory Mode.](#)

2. DRAINING FUEL (WITH SUBARU SELECT MONITOR)


Warning:


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

Caution:

Be careful not to spill fuel.

Note:

- If the fuel pump cannot be driven, refer to the procedures for draining from the fuel filler hose.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > DRAINING FUEL \(THROUGH THE FUEL FILLER HOSE\).](#)
- Be careful not to let the battery run-out.
- Be aware that the fuel may remain in the fuel tank after draining the fuel.

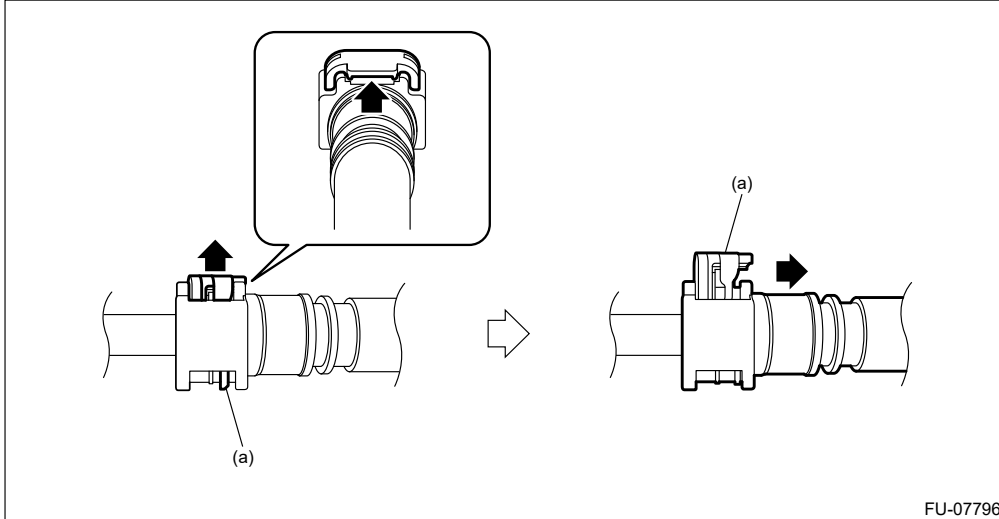
1. Release the fuel pressure.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Disconnect the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube.

Caution:

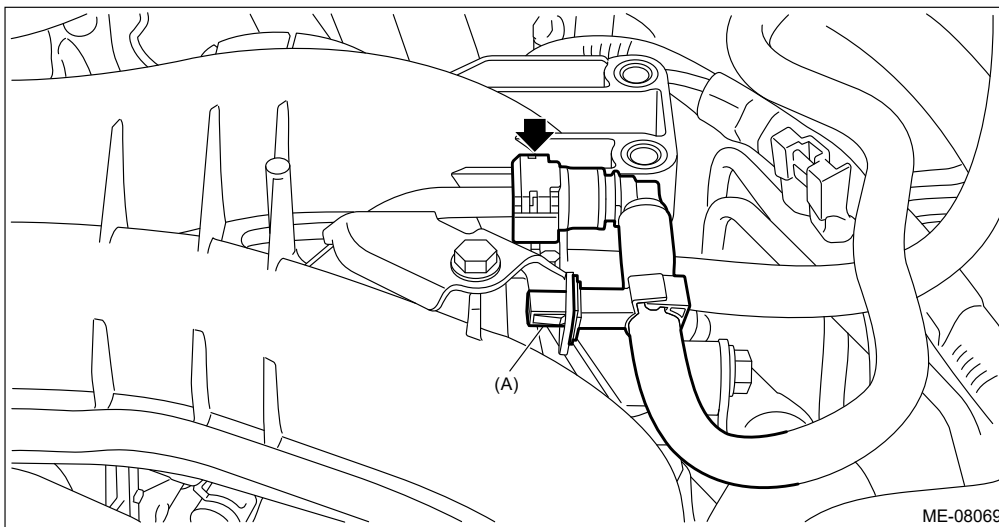
- Be careful not to spill fuel.
- Catch the fuel from the tubes using a container or cloth.

Note:

Disconnect the quick connector as shown in the figure.



(a) Slider



3. Connect ST to the fuel delivery tube.

ST 18471AA000 FUEL PIPE ADAPTER

4. Connect the gasoline proof hose to ST and put the end of the hose in the container.
5. Drive the fuel pump and drain the fuel using Subaru Select Monitor.

Caution:

Be careful not to spill fuel.

Note:

For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".

6. Install the related parts in the reverse order after draining the fuel.

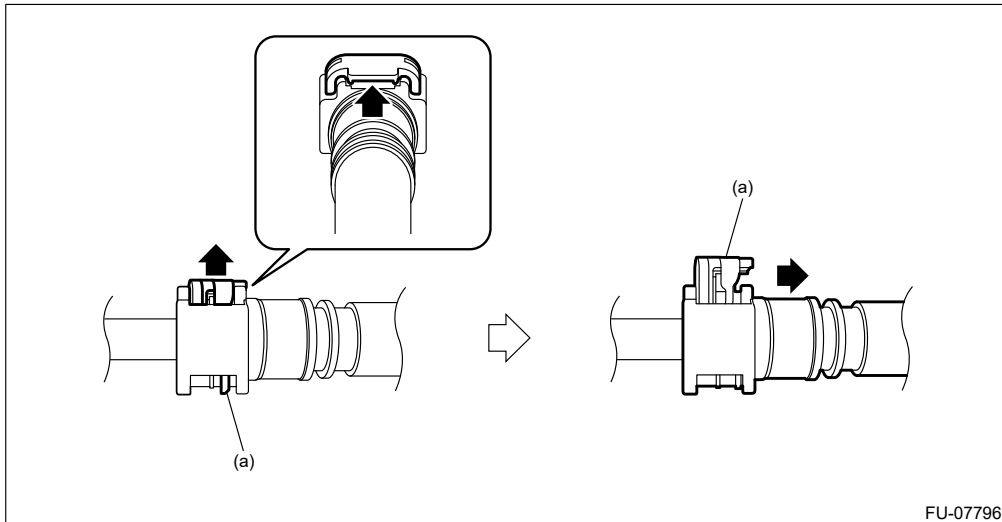
Caution:

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

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

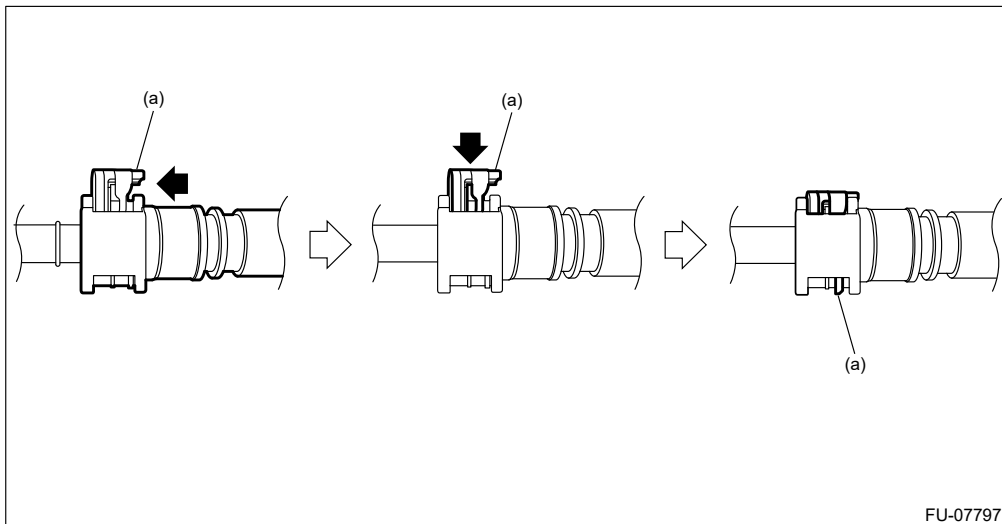
Note:

- Disconnect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

- Connect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

3. DRAINING FUEL (THROUGH THE FUEL FILLER HOSE)

Warning:

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



Caution:

- Be careful not to spill fuel.
- Fuel may remain in the fuel filler pipe. Drain the fuel from the fuel filler pipe through the fill opening using the gasoline proof pump and the gasoline proof hose (ø10 or less) before the

operation.

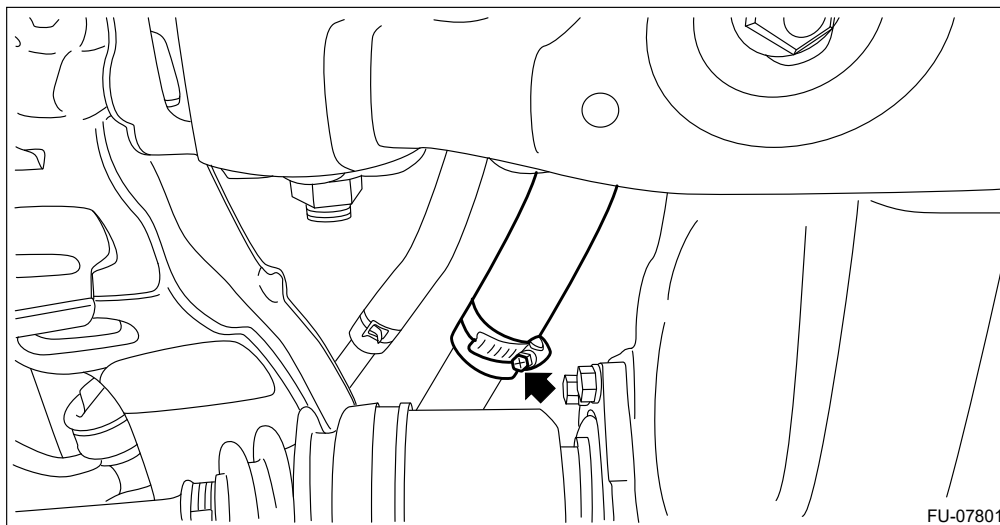
Note:

Be aware that the fuel may remain in the fuel tank after draining the fuel.

1. Lift up the vehicle.
2. Remove the rear exhaust pipe and muffler.  [Ref. to EXHAUST\(H4DOTC\)>Rear Exhaust Pipe>REMOVAL.](#) 
[Ref. to EXHAUST\(H4DOTC\)>Muffler>REMOVAL.](#)
3. Open the fuel filler lid and remove the fuel filler cap.
4. Drain the fuel from the fuel filler pipe through the filler opening using the gasoline proof pump and the gasoline proof hose (ø10 or less).
5. Disconnect the fuel filler hose from the fuel filler pipe assembly.

Caution:

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



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

Caution:

Be careful not to spill fuel.

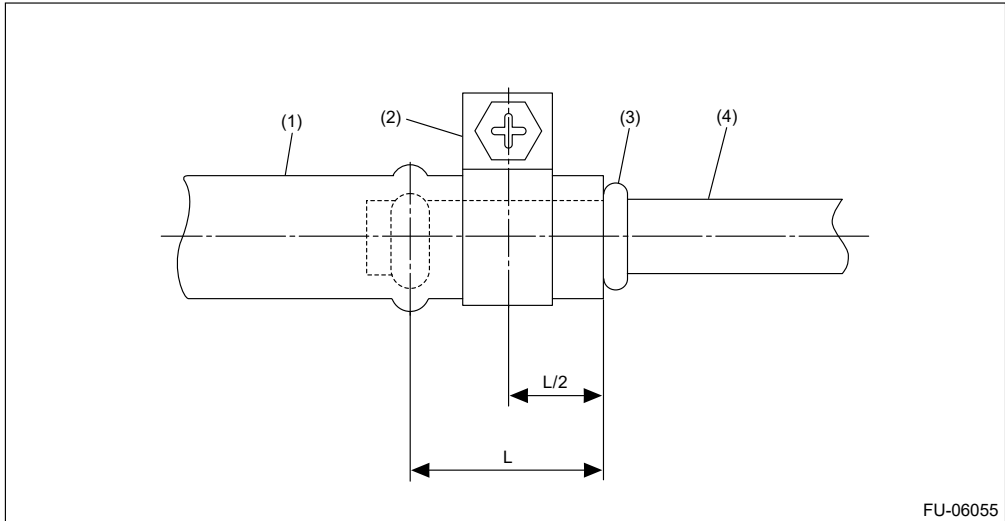
7. Install the related parts in the reverse order after draining the fuel.

Note:

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

Tightening torque:

2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



FU-06055

(1) Fuel filler hose

(3) Spool

(4) Fuel filler pipe

(2) Clamp

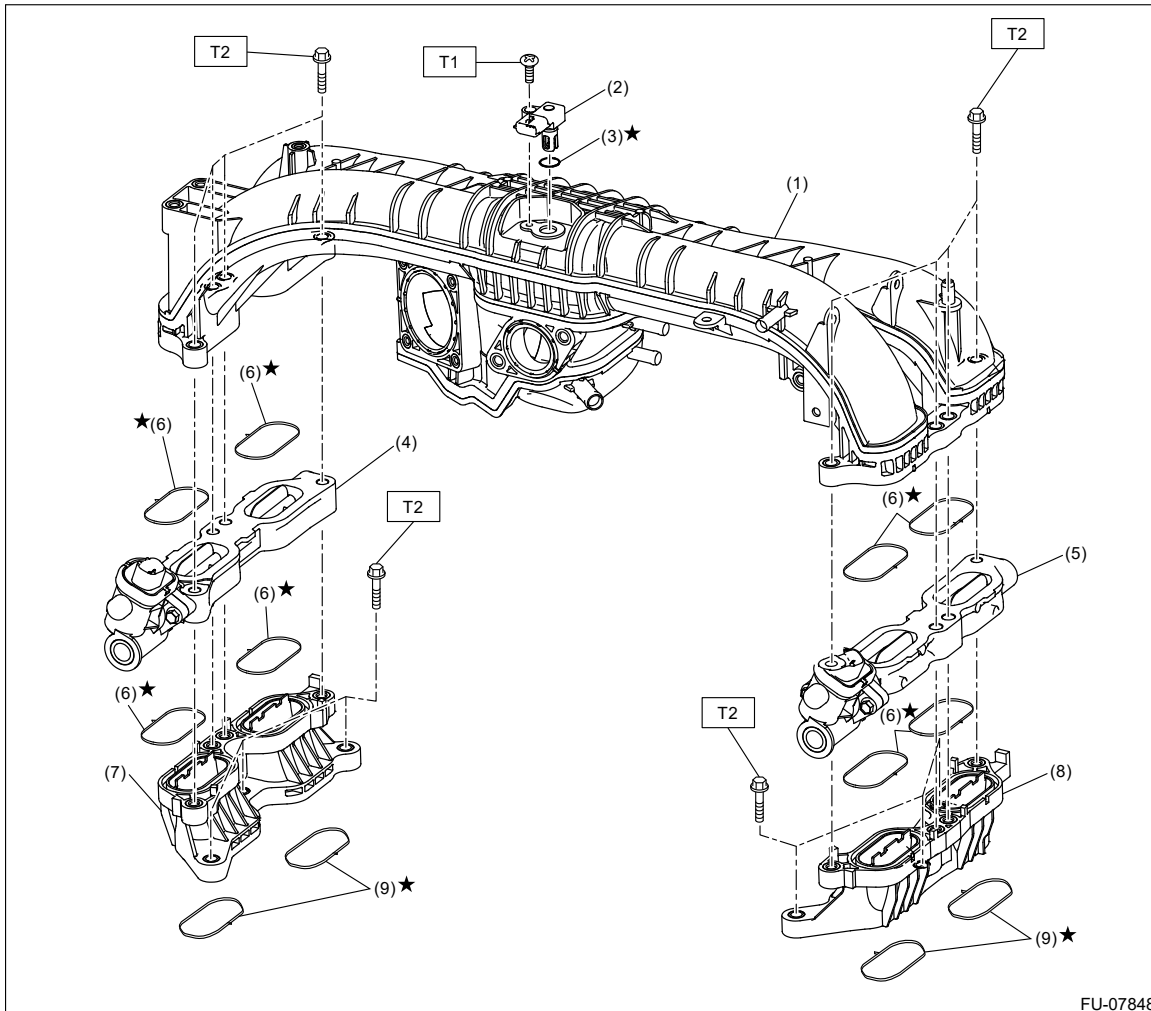
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > General Description

CAUTION

- Prior to starting work, pay special attention to the following:
 1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
 2. Protect the vehicle using a seat cover, fender cover, etc.
 3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Place "NO OPEN FLAMES" signs near the working area.
- Prepare a container and cloth to prevent scattering of fuels when performing work where fuels can be spilled. If the oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Always inspect for fuel leaks after removing/installing the fuel system components.
- Follow all government and local regulations concerning disposal of refuse when disposing fuel.

COMPONENT

1. INTAKE MANIFOLD



FU-07848

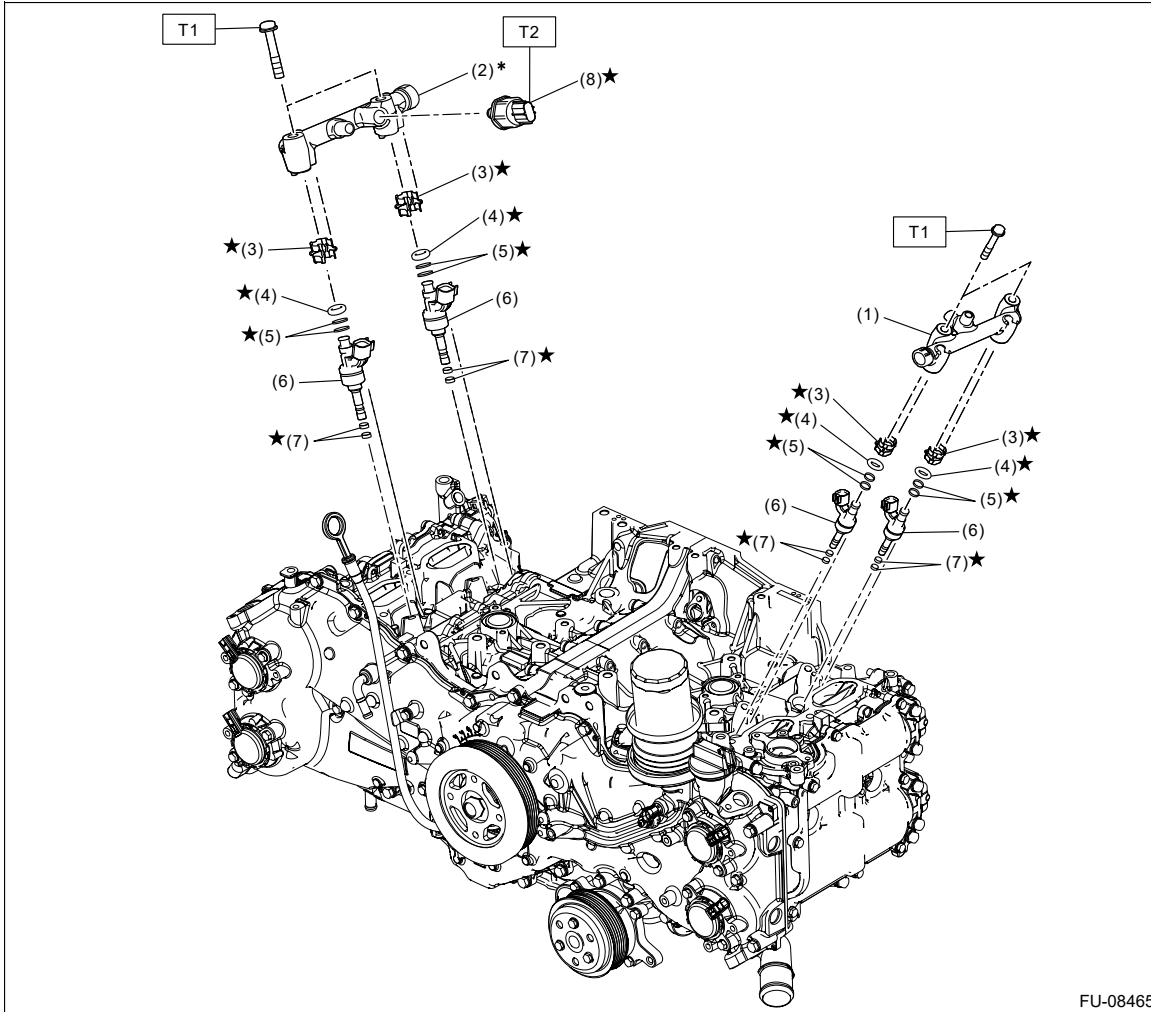
- | | |
|--|---------------------------|
| (1) Intake manifold | (6) Gasket |
| (2) Manifold absolute pressure and intake air temperature sensor | (7) Air intake adapter LH |
| (3) O-ring | (8) Air intake adapter RH |
| (4) Tumble generator valve ASSY LH | (9) Gasket |
| (5) Tumble generator valve ASSY RH | |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 3.5 (0.4, 2.6)

T2: 25 (2.5, 18.4)

2. FUEL INJECTOR 1



FU-08465

(1) Fuel injector pipe LH

(5) Back-up ring

Tightening torque: N·m (kgf·m, ft·lb)

(2) Fuel injector pipe RH

(6) Fuel injector

T1: 19 (1.9, 14.0)

(3) HOLDER

(7) Injector seal

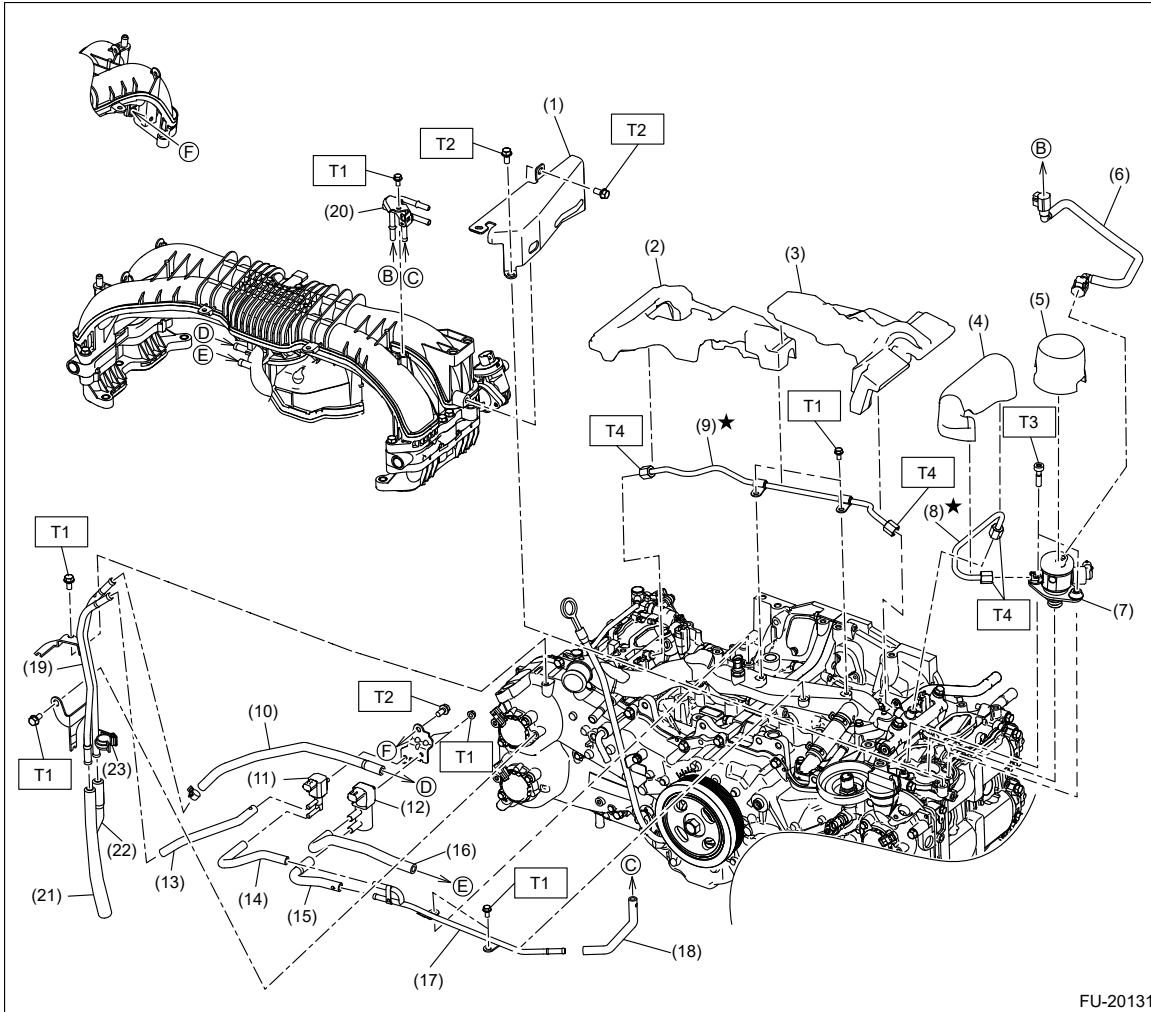
T2: 46 (4.7, 33.9)

(4) O-ring

(8) Fuel pressure sensor

* When removing the fuel pressure sensor from the fuel injector pipe RH, replace it with a new one.

3. FUEL INJECTOR 2



FU-20131

- | | | |
|---|-------------------------------------|--------------------|
| (1) Fuel pipe protector | (11) Purge control solenoid valve A | (21) Vacuum hose F |
| (2) Fuel pipe insulator No. 3 | (12) Purge control solenoid valve B | (22) Vacuum hose G |
| (3) Fuel pipe insulator No. 2 | (13) Vacuum hose A | (23) Pipe clamp |
| (4) Fuel pipe insulator No. 1 | (14) Vacuum hose B | |
| (5) Fuel pump insulator | (15) Vacuum hose C | |
| (6) Fuel delivery pipe | (16) Vacuum hose D | |
| (7) High-pressure fuel pump | (17) Canister pipe | |
| (8) High-pressure fuel delivery pipe | (18) Vacuum hose E | |
| (9) High-pressure fuel delivery pipe ASSY | (19) Vacuum pipe ASSY | |
| (10) Vacuum control hose | (20) Fuel pipe ASSY | |

Tightening torque: N·m (kgf-m, ft-lb)

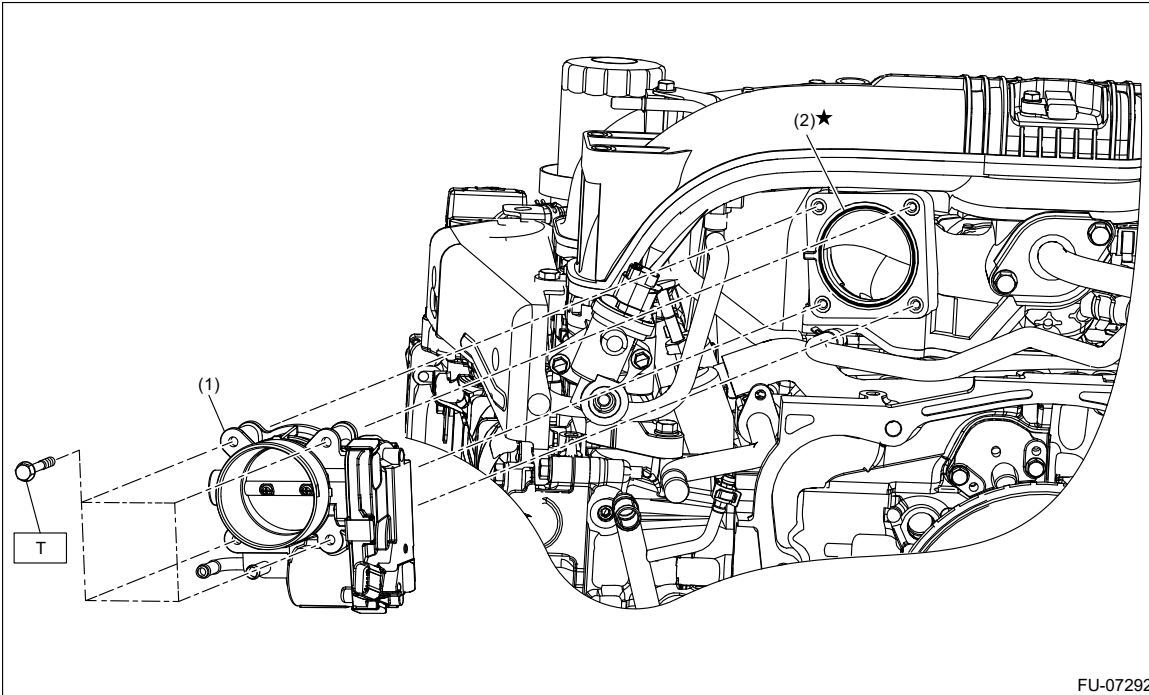
T1: 6.4 (0.7, 4.7)

T2: 19 (1.9, 14.0)

T3: 21 (2.1, 15.5)

T4: 25 (2.5, 18.4)

4. THROTTLE BODY



FU-07292

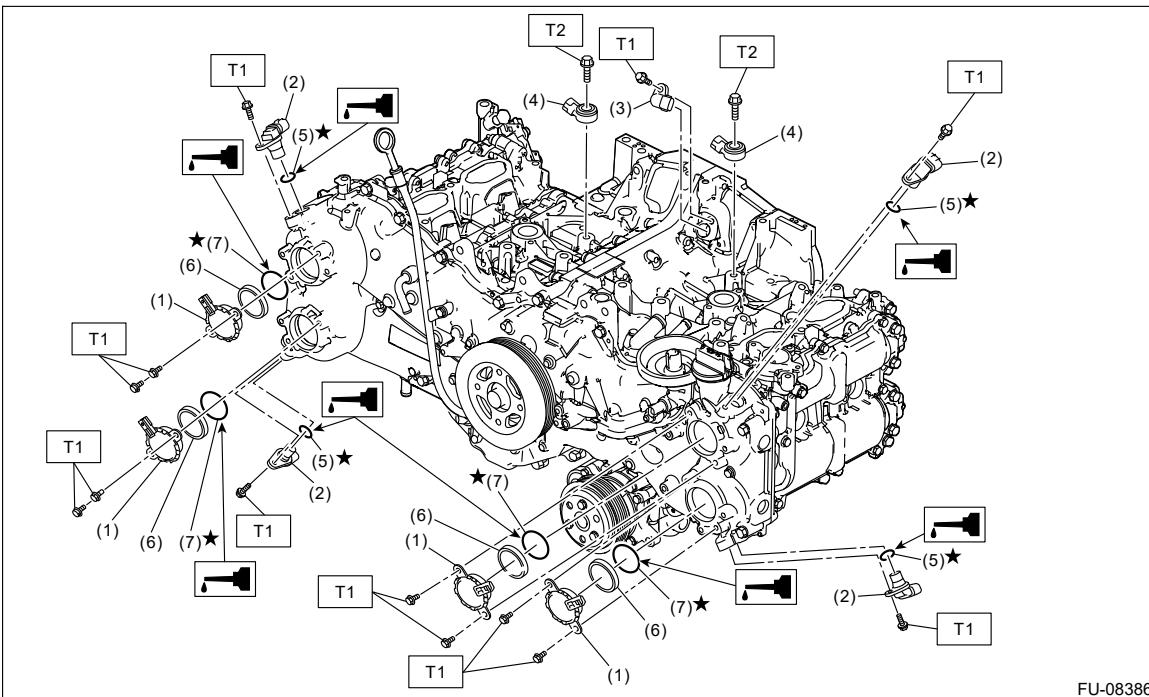
(1) Throttle body

(2) Gasket

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

T: 8 (0.8, 5.9)

5. CRANKSHAFT POSITION, CAMSHAFT POSITION AND KNOCK SENSORS



FU-08386

(1) Oil control solenoid

(5) O-ring

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

(2) Camshaft position sensor

(6) Back-up ring

T1: 6.4 (0.7, 4.7)

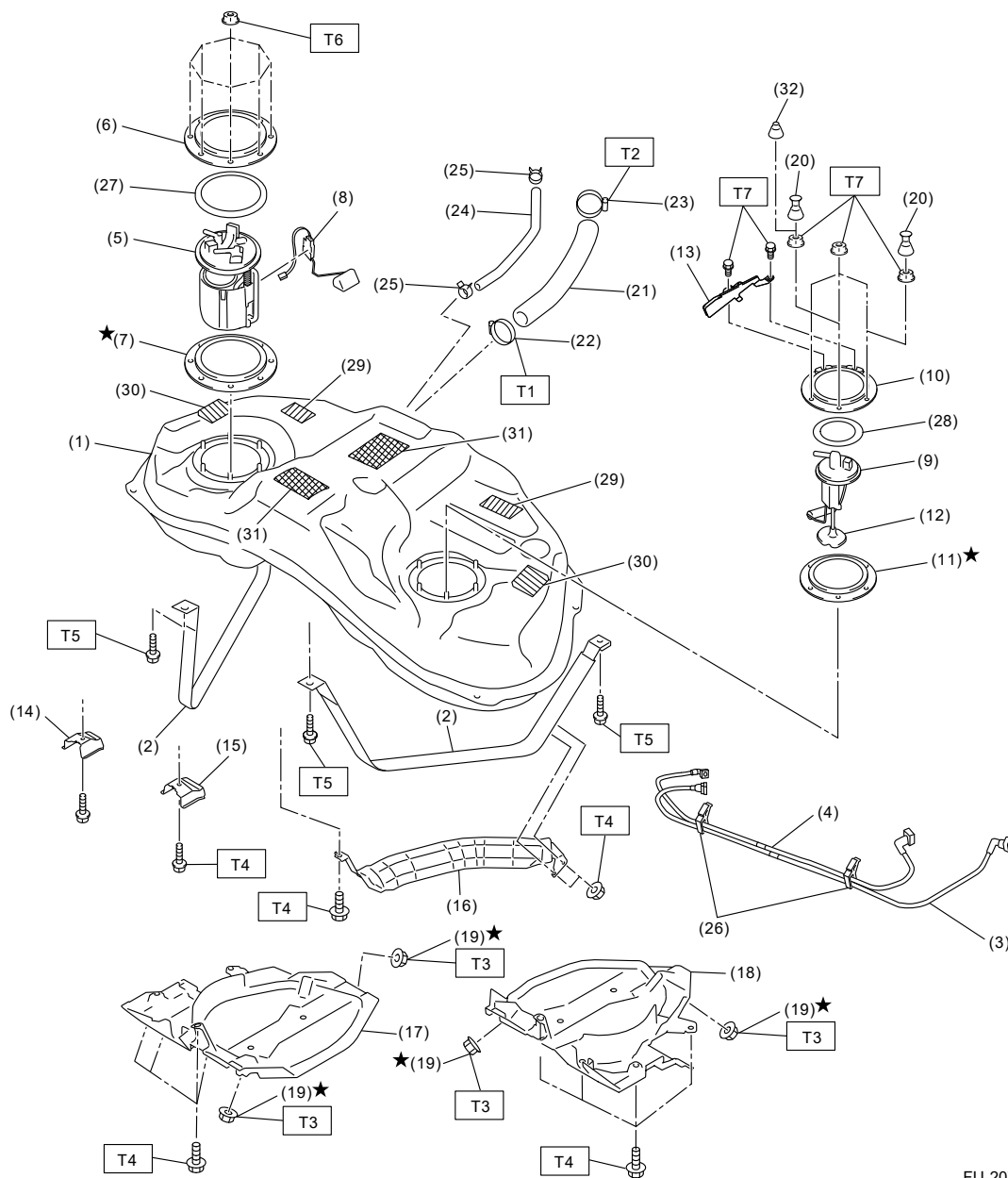
(3) Crankshaft position sensor

(7) O-ring

T2: 24 (2.4, 17.7)

(4) Knock sensor

6. FUEL TANK



FU-20724

- | | | |
|--|----------------------------------|-------------------------------------|
| (1) Fuel tank | (15) Stopper LH | (29) Cushion |
| (2) Fuel tank band | (16) Heat shield cover | (30) Cushion |
| (3) Delivery tube | (17) Fuel tank protector RH | (31) Cushion |
| (4) Jet pump tube | (18) Fuel tank protector LH | (32) Rubber cap (single-piece type) |
| (5) Fuel pump ASSY | (19) Self-locking nut | |
| (6) Fuel pump upper plate | (20) Rubber cap (two-piece type) | |
| (7) Fuel pump gasket | (21) Fuel filler hose | |
| (8) Fuel level sensor | (22) Clamp | |
| (9) Fuel sub level sensor | (23) Clamp | |
| (10) Fuel sub level sensor upper plate | (24) Air vent hose | |

Tightening torque: N·m (kgf·m, ft·lb)


T1: 2 (0.2, 1.5)


T2: 2.5 (0.3, 1.8)


T3: 9 (0.9, 6.6)

T4: 18 (1.8, 13.3)

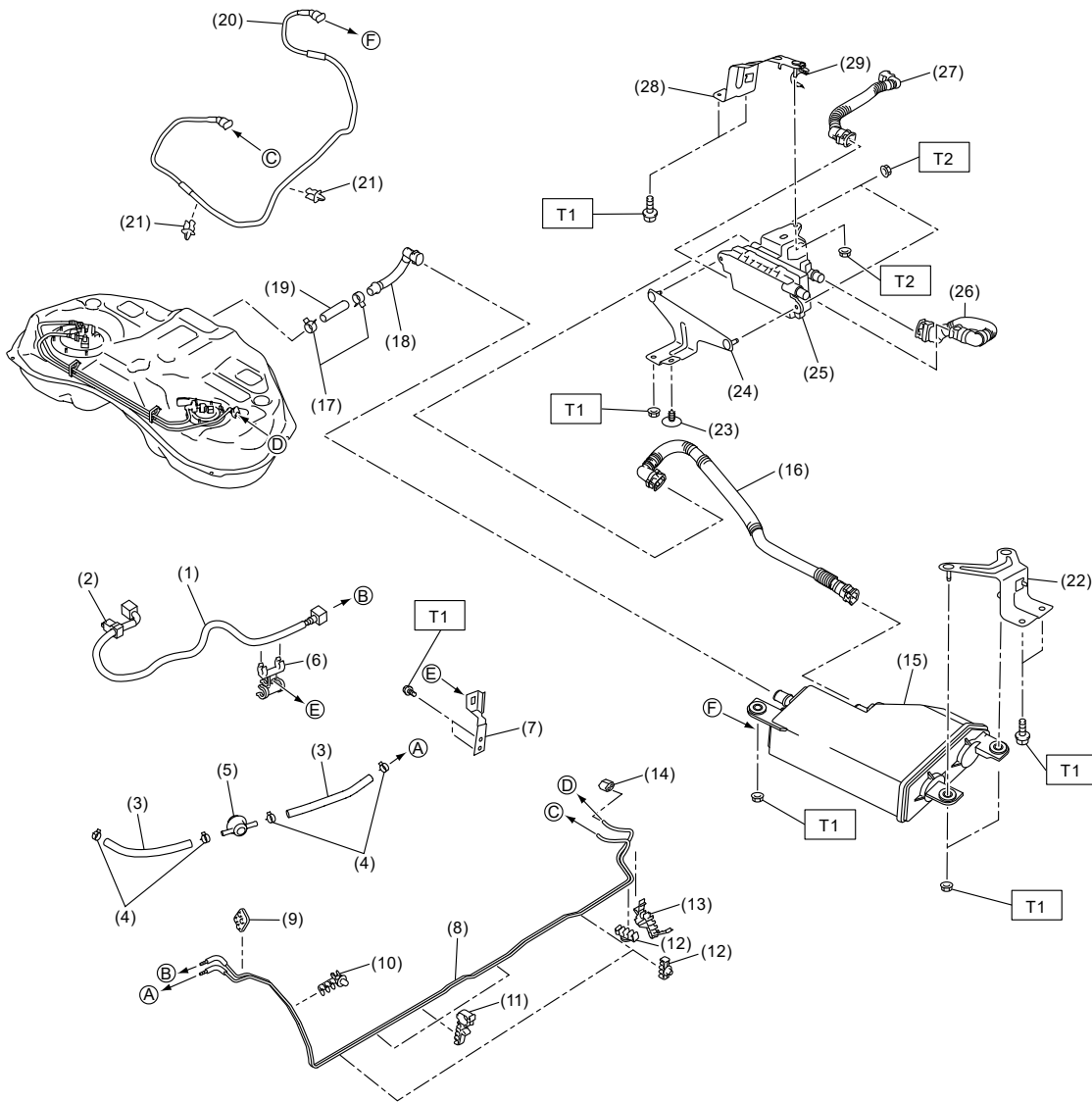
- | | |
|--------------------------------------|--|
| (11) Fuel sub level sensor gasket | (25) Clip |
| (12) Fuel sub level sensor filter | (26) Tube clamp |
| (13) Fuel sub level sensor protector | (27) Fuel pump upper plate cushion |
| (14) Stopper RH | (28) Fuel sub level sensor upper plate cushion |

T5:  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Tank>INSTALLATION.](#)

T6:  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Pump>INSTALLATION.](#)

T7:  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Sub Level Sensor>INSTALLATION.](#)

7. FUEL LINE

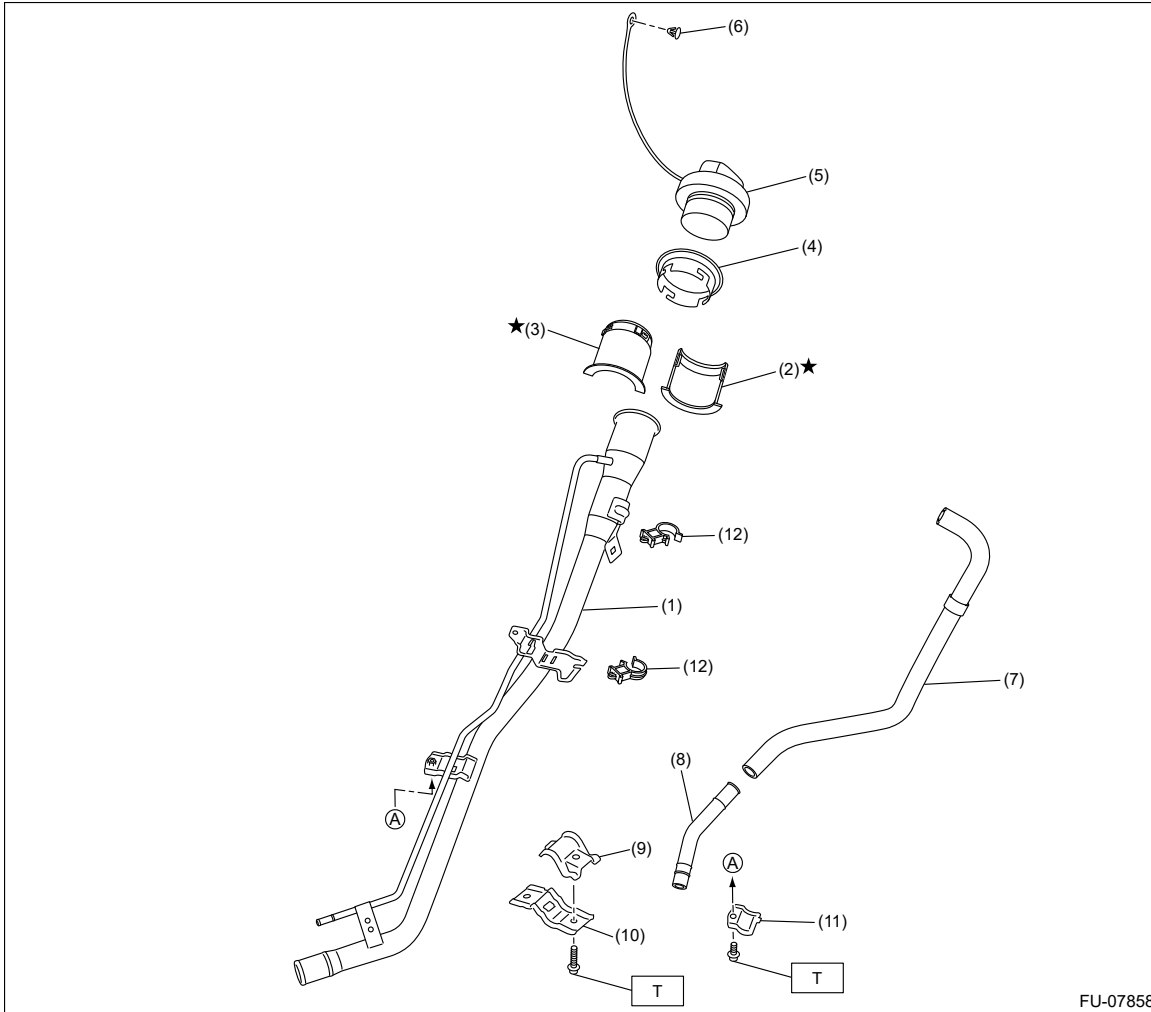


FU-20002

- | | | |
|-----------------------------|-----------------------------|---------------------------------|
| (1) Fuel delivery tube | (12) Pipe clamp | (23) Clip |
| (2) Tube clamp | (13) Pipe clamp | (24) Leak check valve bracket A |
| (3) Evaporation hose | (14) Fuel pipe rear grommet | (25) Leak check valve ASSY |
| (4) Clip | (15) Canister | (26) Drain tube B |
| (5) Purge damper | (16) Drain tube A | (27) Drain tube C |
| (6) Hose clamp | (17) Clip | (28) Leak check valve bracket B |
| (7) Hose clamp bracket | (18) Vent tube | (29) Tube clamp |
| (8) Fuel pipe ASSY | (19) Vent hose | |
| (9) Fuel pipe front grommet | (20) Purge pipe | |
| (10) Pipe clamp | (21) Pipe clamp | |
| (11) Pipe clamp | (22) Canister bracket | |

Tightening torque: N·m (kgf-m, ft-lb)
T1: 7.5 (0.8, 5.5)
T2: 18 (1.8, 13.3)

8. FUEL FILLER PIPE



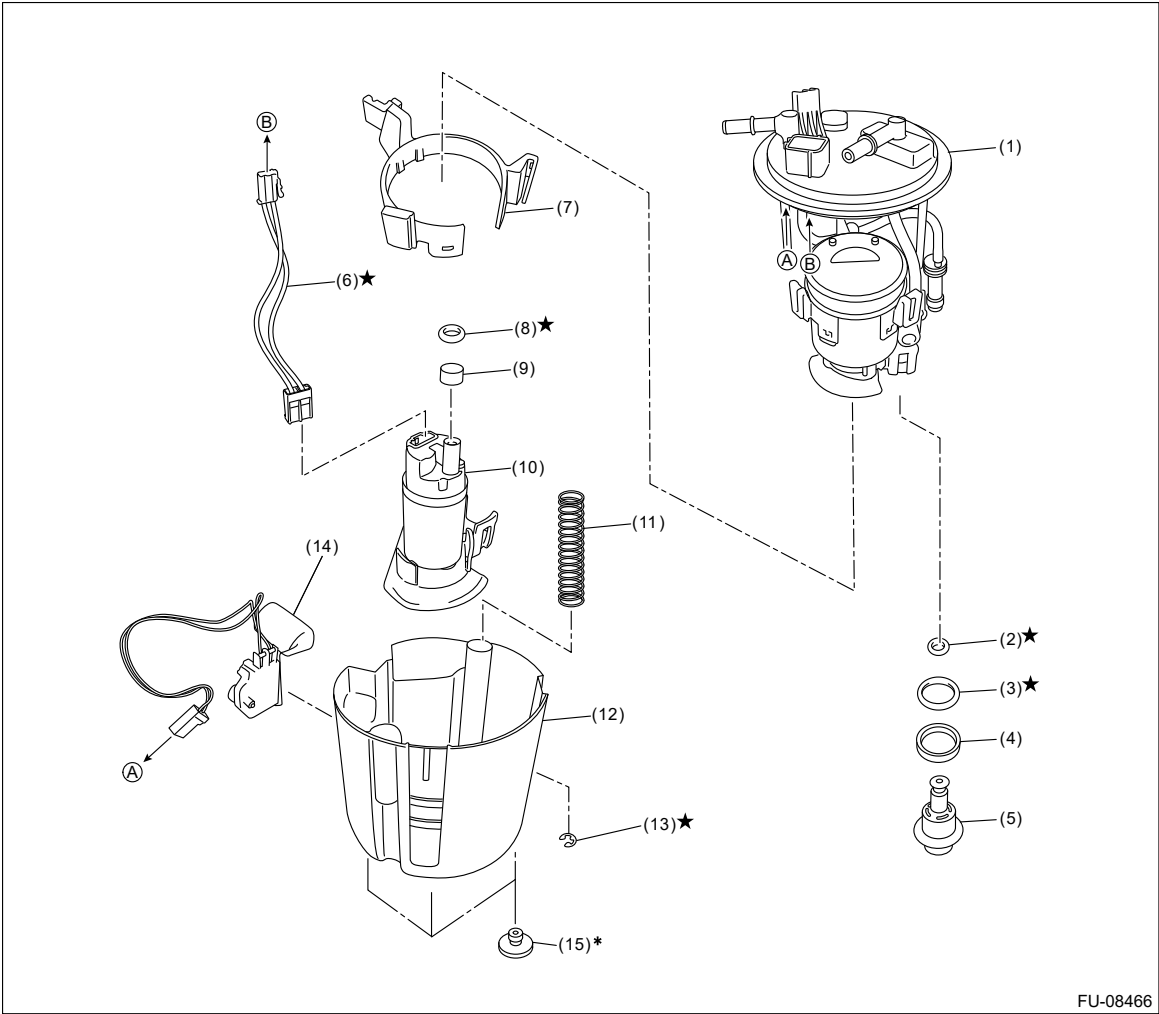
FU-07858

- | | | |
|--------------------------------|--------------------|--------------------------|
| (1) Fuel filler pipe ASSY | (6) Clip | (11) Drain lower bracket |
| (2) Neck holder A | (7) Drain hose | (12) Drain hose clamp |
| (3) Neck holder B | (8) Drain pipe | |
| (4) Fuel filler pipe protector | (9) Upper bracket | |
| (5) Fuel filler cap | (10) Lower bracket | |

Tightening torque: N·m (kgf-m, ft-lb)

T: 7.5 (0.8, 5.5)

9. FUEL PUMP



FU-08466


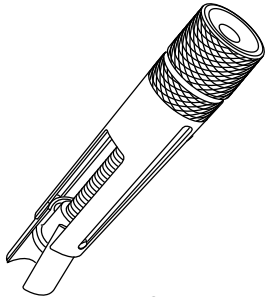
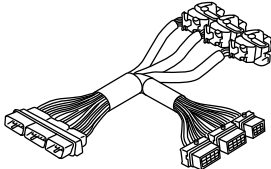
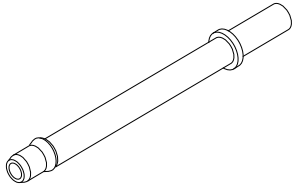
- | | | |
|------------------------|----------------------|------------------------|
| (1) Fuel filter ASSY | (6) Connector cable | (11) Spring |
| (2) O-ring | (7) Fuel pump holder | (12) Fuel chamber ASSY |
| (3) O-ring | (8) O-ring | (13) Clip |
| (4) Back-up ring | (9) Spacer | (14) Fuel level sensor |
| (5) Pressure regulator | (10) Fuel pump | (15) Cushion |

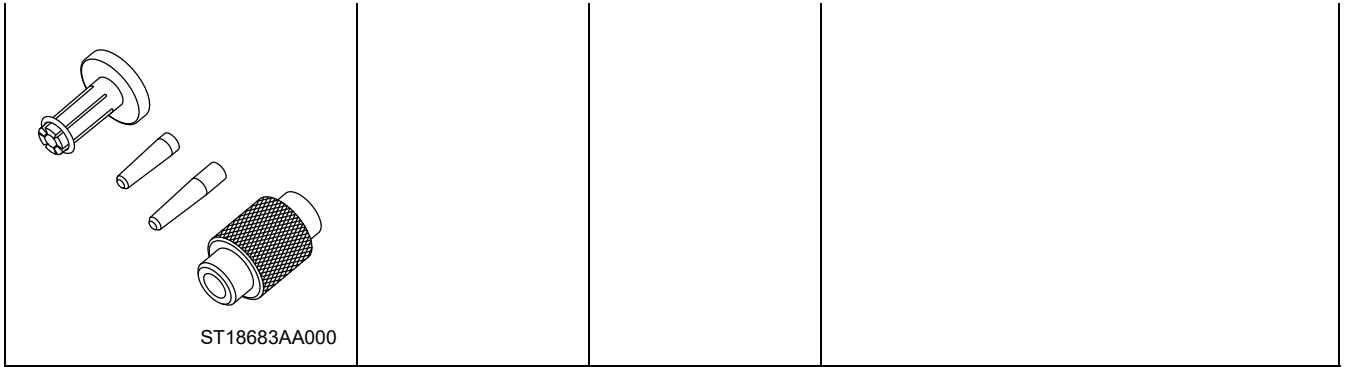
* When removing the cushion from the fuel chamber assembly, replace it with a new part.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > General Description

PREPARATION TOOL

1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|-----------------------------------|--------------------------------|---|
|  <p>STSSM4</p> | <p>— (Newly adopted tool)</p> | <p>SUBARU SELECT MONITOR 4</p> | <p>Used for setting of each function and troubleshooting for electrical system. Note: For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".</p> |
|  <p>ST18356AA000</p> | <p>18356AA000</p> | <p>INJECTOR REMOVER</p> | <p>Used for removing the injector.</p> |
|  <p>ST18460AA030</p> | <p>18460AA030</p> | <p>CHECK BOARD</p> | <p>Used for measuring voltage and resistance of ECM terminals.</p> |
|  <p>ST18471AA000</p> | <p>18471AA000</p> | <p>FUEL PIPE ADAPTER</p> | <p>Used for draining fuel.</p> |
| | <p>18683AA000</p> | <p>INJECTOR SEAL INSTALLER</p> | <p>Used for installing the injector seal.</p> |



2. GENERAL TOOL

| TOOL NAME | REMARKS |
|---------------------|---|
| Circuit tester | Used for measuring resistance, voltage and current. |
| Oscilloscope | Used for inspecting the waveform of each sensor. |
| TORX PLUS® bit 40IP | Used for removing and installing high-pressure fuel pump. |
| Mighty Vac | Used for inspecting the manifold absolute pressure and intake air temperature sensor. |
| DST-i | Used together with Subaru Select Monitor 4. |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > General Description

SPECIFICATION

| | | |
|-------------|----------------------------|--|
| Fuel tank | Capacity | 60 L (15.9 US gal, 13.2 Imp gal) |
| | Location | Under rear seat |
| Fuel pump | Type | Impeller |
| | Shutoff discharge pressure | 940 kPa (9.6 kg/cm ² , 136.3 psi) or less |
| | Discharge rate | 153 L (40.4 US gal, 33.7 Imp gal)/h or more [12.5 V at 343 kPa (3.5 kg/cm ² , 49.7 psi)] |
| Fuel filter | | In-tank type |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > High Pressure Fuel Delivery Pipe

INSPECTION

Check that the high-pressure fuel delivery pipe and the high-pressure fuel delivery pipe assembly have no deformation, cracks and other damages.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > High Pressure Fuel Delivery Pipe INSTALLATION

1. HIGH-PRESSURE FUEL DELIVERY PIPE

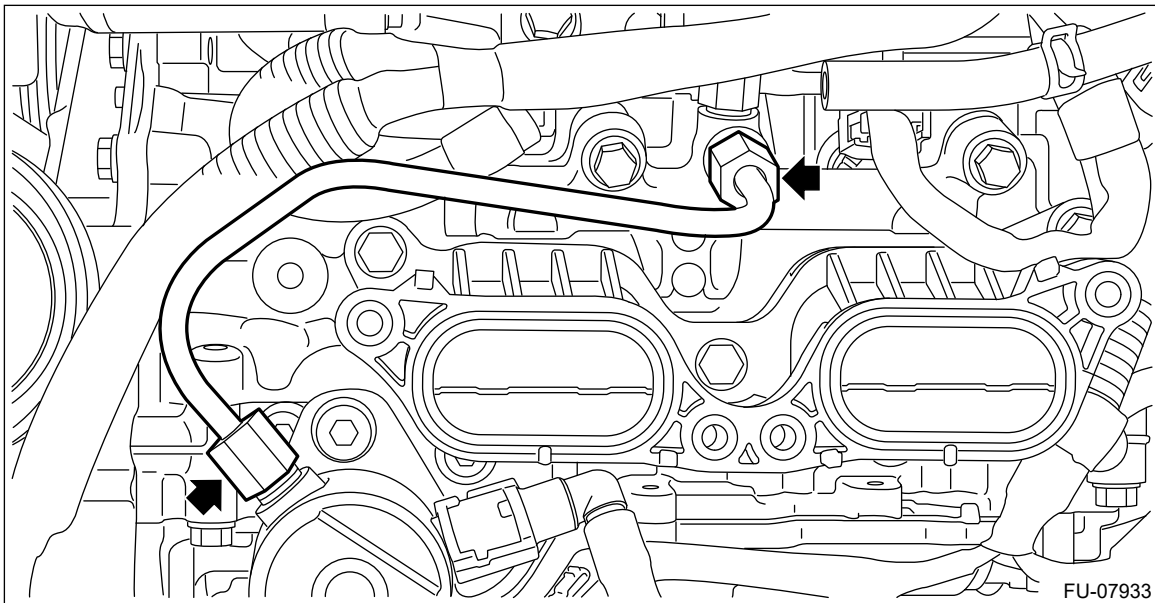
1. Temporarily tighten the high-pressure fuel delivery pipe by hand until it is seated, and tighten the flare nuts on both ends.





Caution:

Always use a new high-pressure fuel delivery pipe.

Tightening torque:

25 N•m (2.5 kgf-m, 18.4 ft-lb)



2. Install the fuel pipe insulator No. 2.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>INSTALLATION > FUEL PIPE INSULATOR NO. 2.](#)
3. Install the fuel pipe insulator No. 1.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>INSTALLATION > FUEL PIPE INSULATOR NO. 1.](#)
4. Install the fuel pump insulator.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Insulator>INSTALLATION > FUEL PUMP INSULATOR.](#)
5. Install the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>INSTALLATION.](#)
6. Connect the battery ground terminal.

2. HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY

1. Install the high-pressure fuel delivery pipe assembly.

Caution:

Always use a new high-pressure fuel delivery pipe assembly.

- (1) Temporarily tighten the flare nut (A) to the fuel injector pipe by hand until it is seated, and secure the high-pressure fuel delivery pipe assembly to the water pipe assembly using bolts (B).

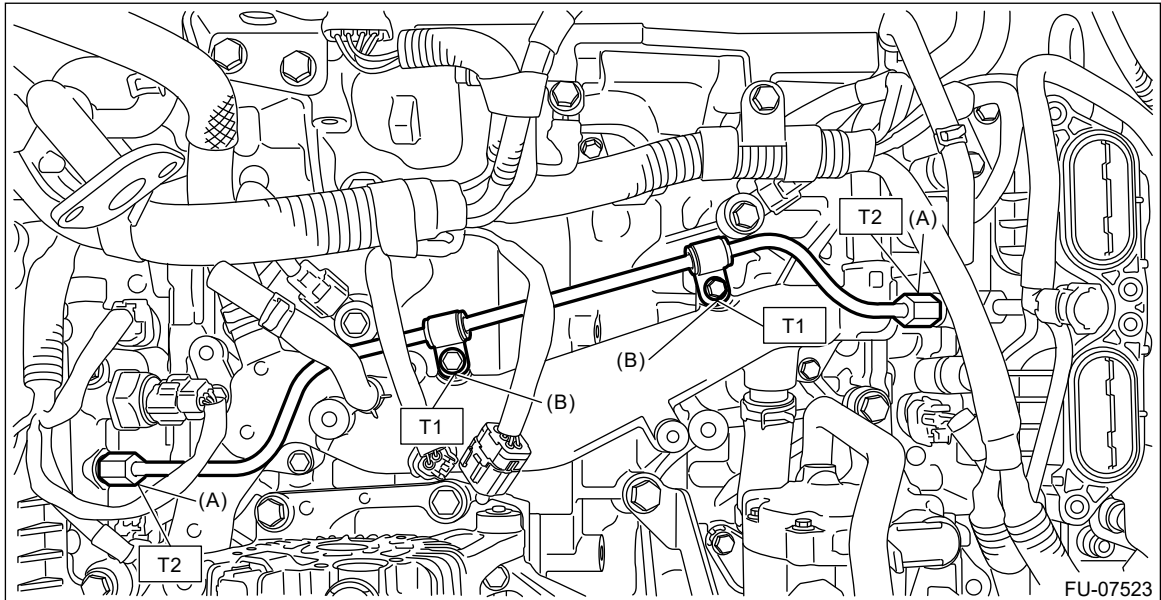
Tightening torque:





T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

(2) Tighten the flare nuts (A).

Tightening torque:

T2: 25 N·m (2.5 kgf-m, 18.4 ft-lb)



- 2.** Install the fuel pipe insulator No. 3.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>INSTALLATION > FUEL PIPE INSULATOR NO. 3.](#)
- 3.** Install the fuel pipe insulator No. 2.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>INSTALLATION > FUEL PIPE INSULATOR NO. 2.](#)
- 4.** Install the fuel pipe insulator No. 1.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>INSTALLATION > FUEL PIPE INSULATOR NO. 1.](#)
- 5.** Install the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>INSTALLATION.](#)
- 6.** Connect the battery ground terminal.

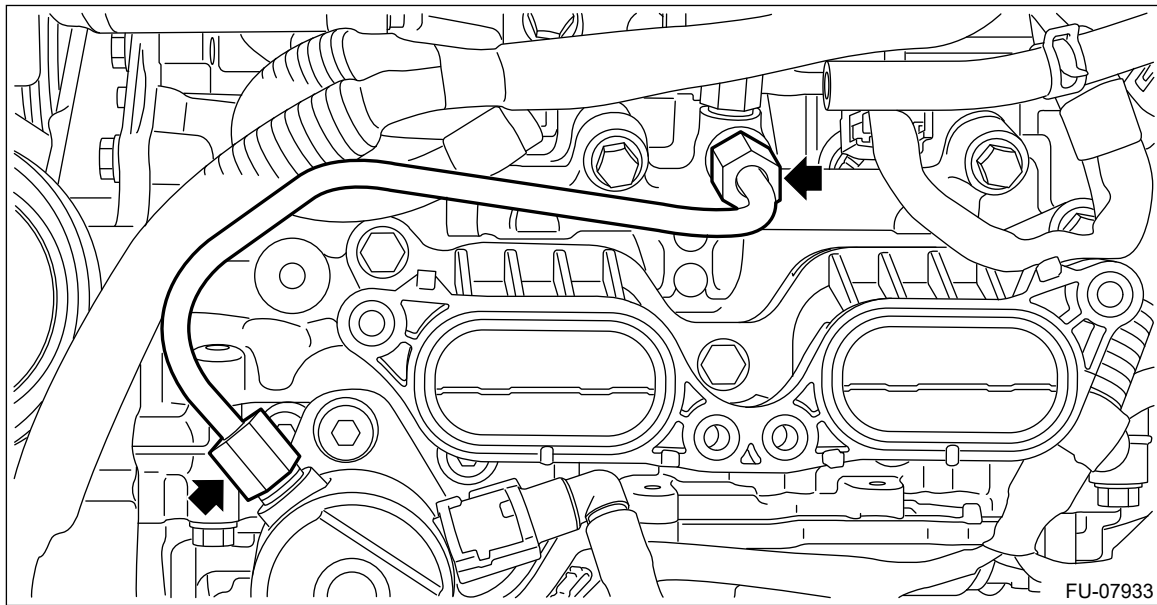
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > High Pressure Fuel Delivery Pipe REMOVAL

1. HIGH-PRESSURE FUEL DELIVERY PIPE

Caution:

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

1. Disconnect the ground cable from battery.
2. Remove the intake manifold. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
3. Remove the fuel pump insulator. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>REMOVAL > FUEL PUMP INSULATOR.](#)
4. Remove the fuel pipe insulator No. 1. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>REMOVAL > FUEL PIPE INSULATOR NO. 1.](#)
5. Remove the fuel pipe insulator No. 2. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>REMOVAL > FUEL PIPE INSULATOR NO. 2.](#)
6. Remove the high-pressure fuel delivery pipes.





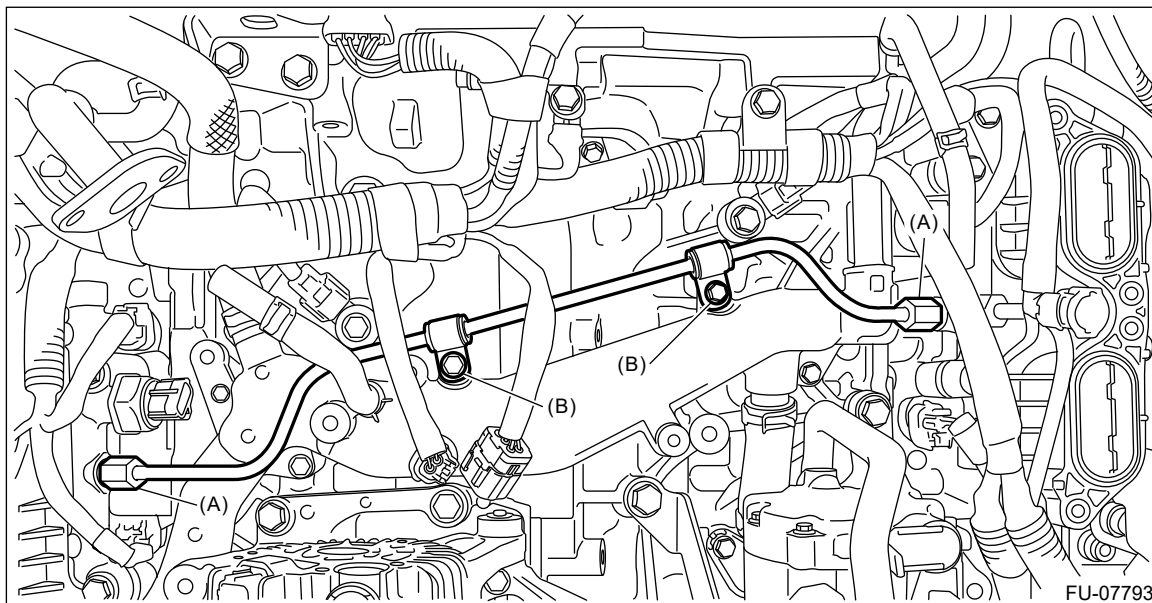
2. HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY

Caution:

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

1. Disconnect the ground cable from battery.
2. Remove the intake manifold. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
3. Remove the fuel pipe insulator No. 1. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>REMOVAL > FUEL PIPE INSULATOR NO. 1.](#)

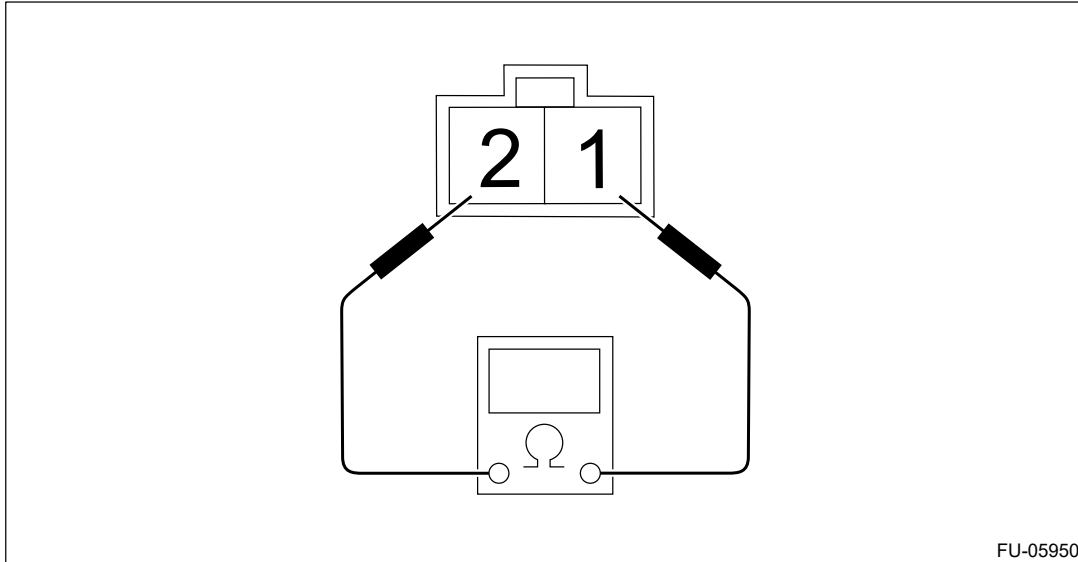
4. Remove the fuel pipe insulator No. 2.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>REMOVAL > FUEL PIPE INSULATOR NO. 2.](#)
5. Remove the fuel pipe insulator No. 3.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Insulator>REMOVAL > FUEL PIPE INSULATOR NO. 3.](#)
6. Remove the flare nut (A) and bolt (B), and then remove the high-pressure fuel delivery pipe assembly.



INSPECTION

1. CHECK HIGH-PRESSURE FUEL PUMP

1. Check that the high-pressure fuel pump has no deformation, cracks or other damages.
2. Measure the resistance between high-pressure fuel pump terminals.



| Terminal No. | Standard |
|--------------|--|
| 1 and 2 | $10 \pm 1 \ \Omega$ (when 20°C (68°F)) |

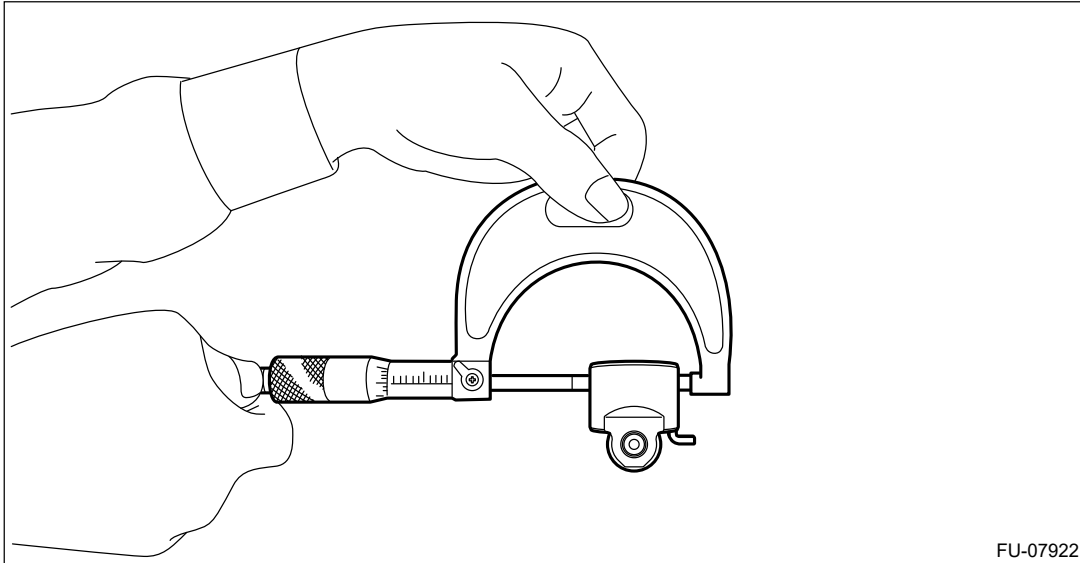
2. CHECK HIGH-PRESSURE FUEL PUMP CASE

1. Check that the high-pressure fuel pump case has no deformation, cracks or other damages.
2. Check the clearance between the fuel pump lifter and high-pressure fuel pump case bore. Check the clearance between fuel pump lifter and high-pressure fuel pump case bore by measuring the outer diameter of fuel pump lifter and the inner diameter of high-pressure fuel pump case bore respectively.

(1) Measure the outer diameter of fuel pump lifter with a micrometer.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Record the measured value.

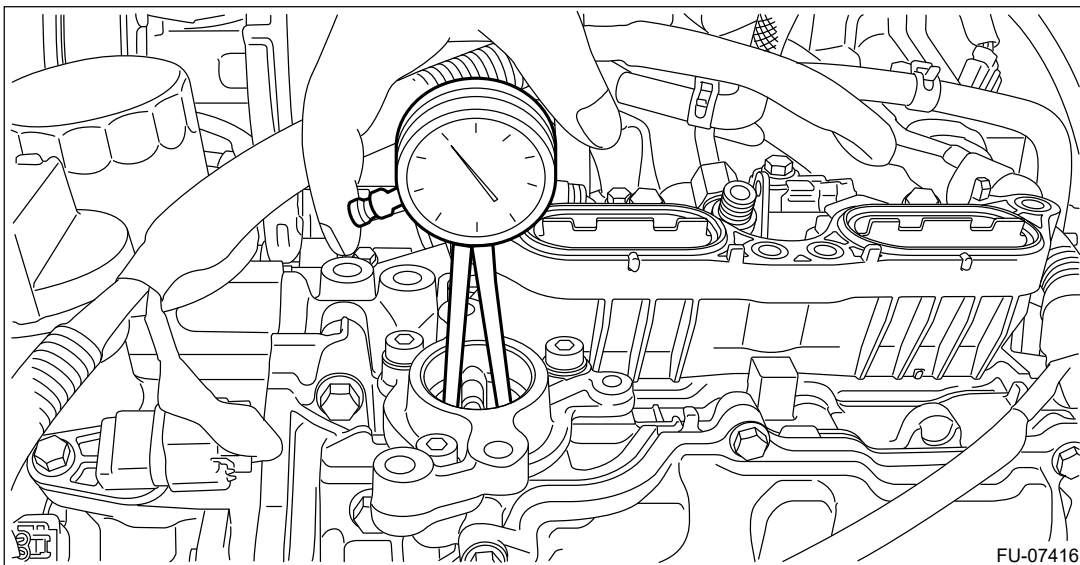


FU-07922

(2) Using a caliper gauge, measure the inner diameter of high-pressure fuel pump case bore.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Record the measured value.**



FU-07416

(3) Calculate the clearance between the fuel pump lifter and high-pressure fuel pump case bore. If it is not within the standard, replace the fuel pump lifter and high-pressure fuel pump case as a set.

Clearance between fuel pump lifter and high-pressure fuel pump case bore:

Standard

0.065—0.134 mm (0.0026—0.0053 in)

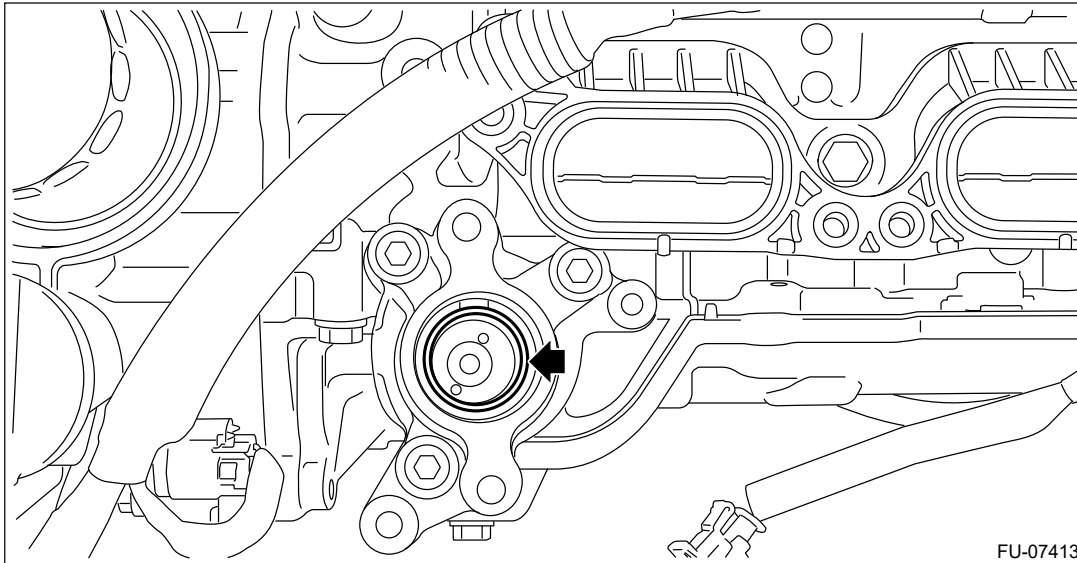
INSTALLATION

1. HIGH-PRESSURE FUEL PUMP

1. Install the fuel pump lifter to the high-pressure fuel pump case.

Note:

Apply engine oil to the side of the high-pressure fuel pump case and to the bottom surface of the fuel pump lifter.



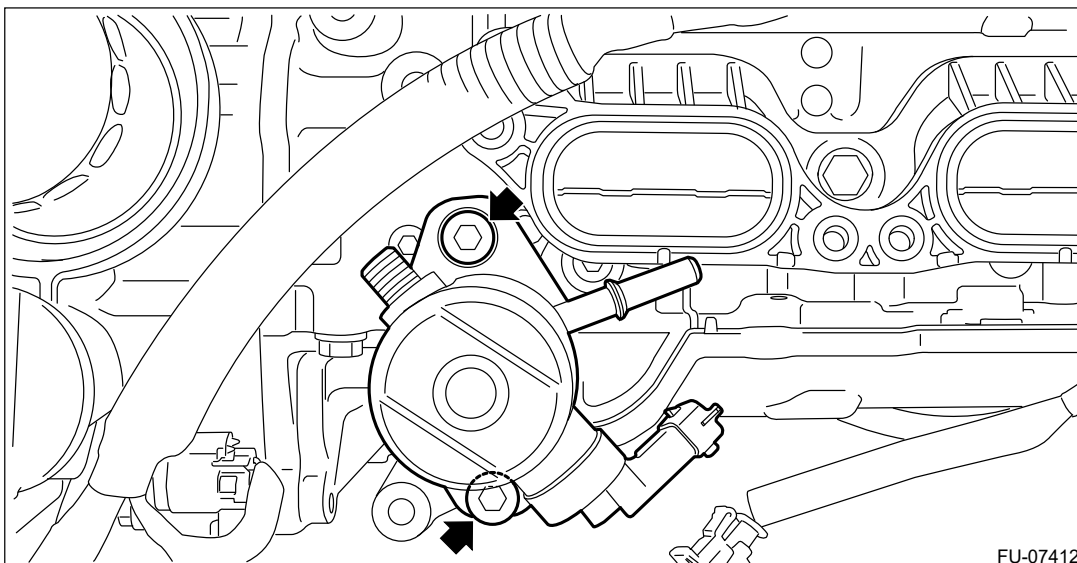
2. Using TORX PLUS® bit 40IP, install the high-pressure fuel pump.

Note:

Use new O-rings.

Tightening torque:

21 N·m (2.1 kgf-m, 15.5 ft-lb)



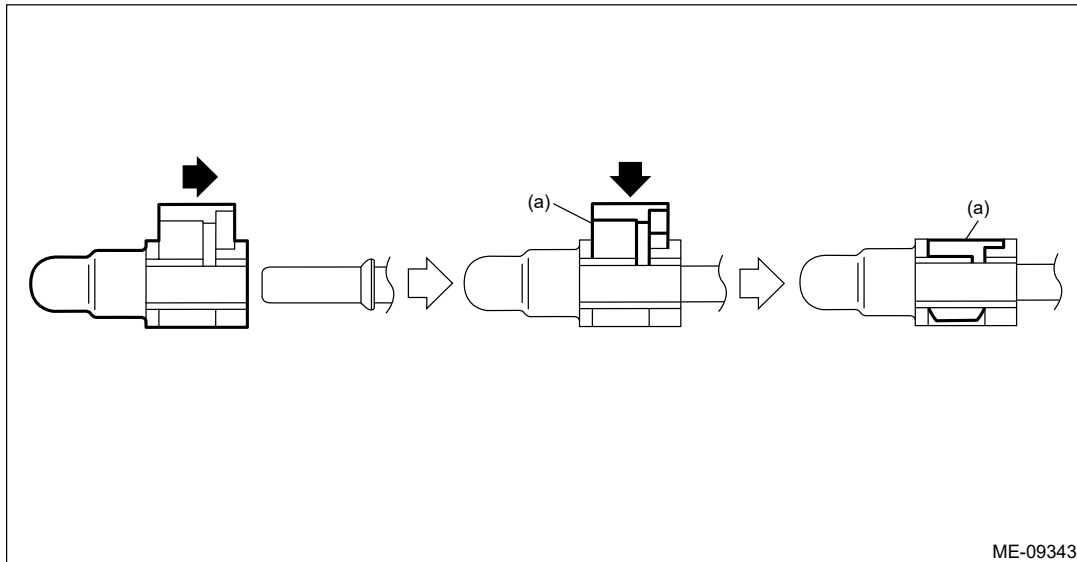
3. Connect the connector (B) to the high-pressure fuel pump, and install the fuel delivery pipe (A) to the high-pressure fuel pump.

Caution:

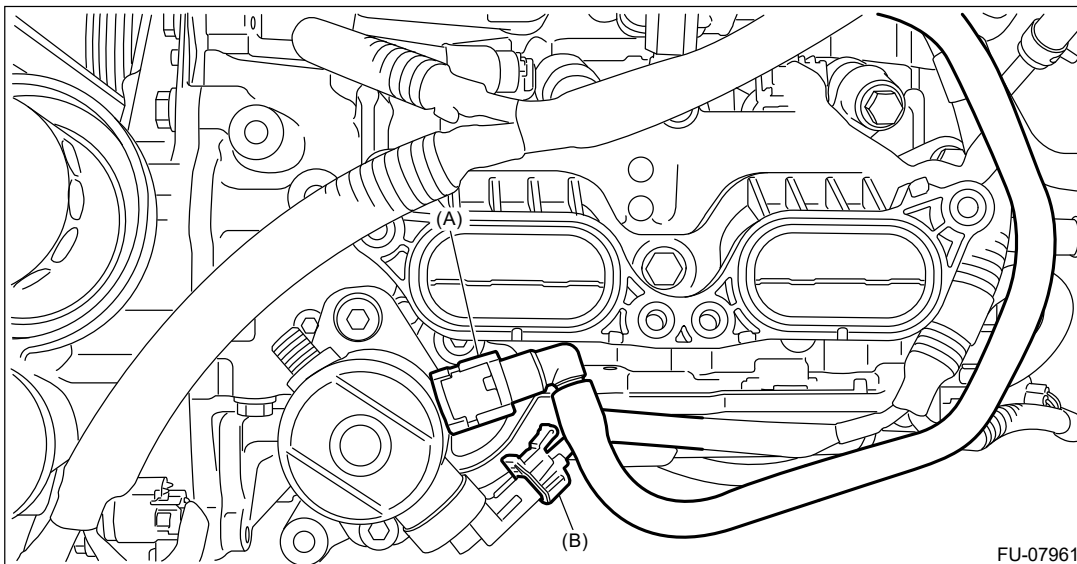
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



(a) Slider



4. Install the high-pressure fuel delivery pipe. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Delivery Pipe>INSTALLATION > HIGH-PRESSURE FUEL DELIVERY PIPE.](#)
5. Connect the battery ground terminal.

2. HIGH-PRESSURE FUEL PUMP CASE

1. Apply liquid gasket to the mating surfaces of fuel pump case, and install the high-pressure fuel pump case.

Note:

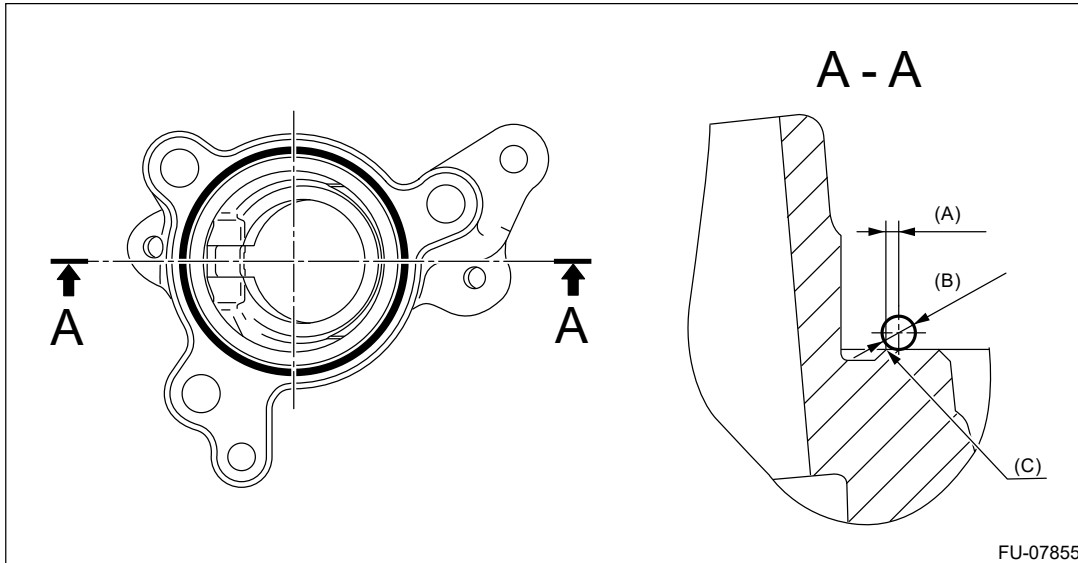
- Clean the mating surface of the high-pressure fuel pump case and cam carrier assembly LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3 ± 1 mm (0.1181 ± 0.0394 in)



(A) Within 1 mm (within
0.0394 in)

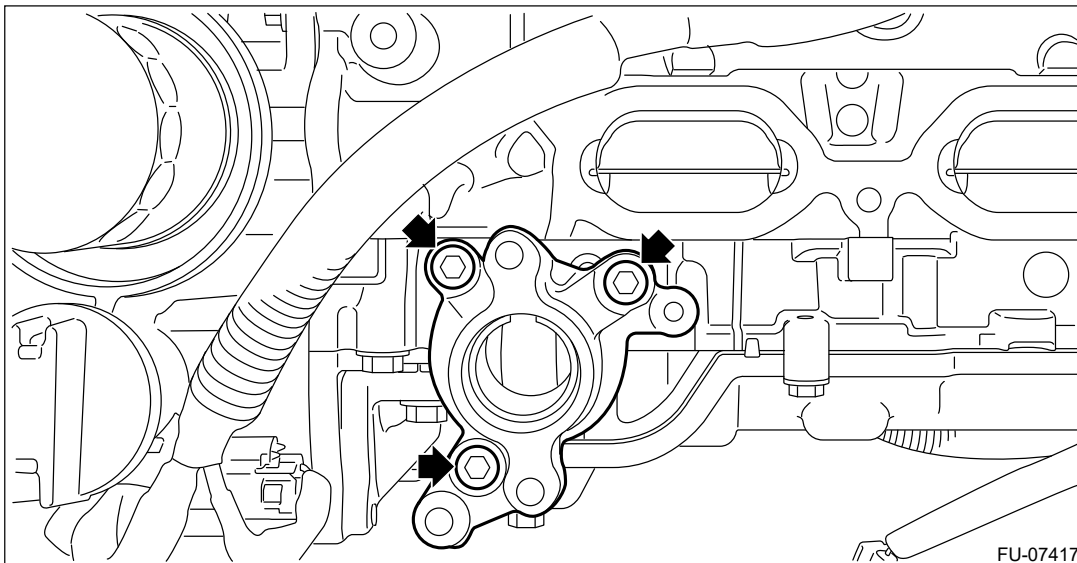
(B) 3 mm (0.1181 in)

(C) Chamfer edge

2. Install the high-pressure fuel pump case to the cam carrier assembly LH.

Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)



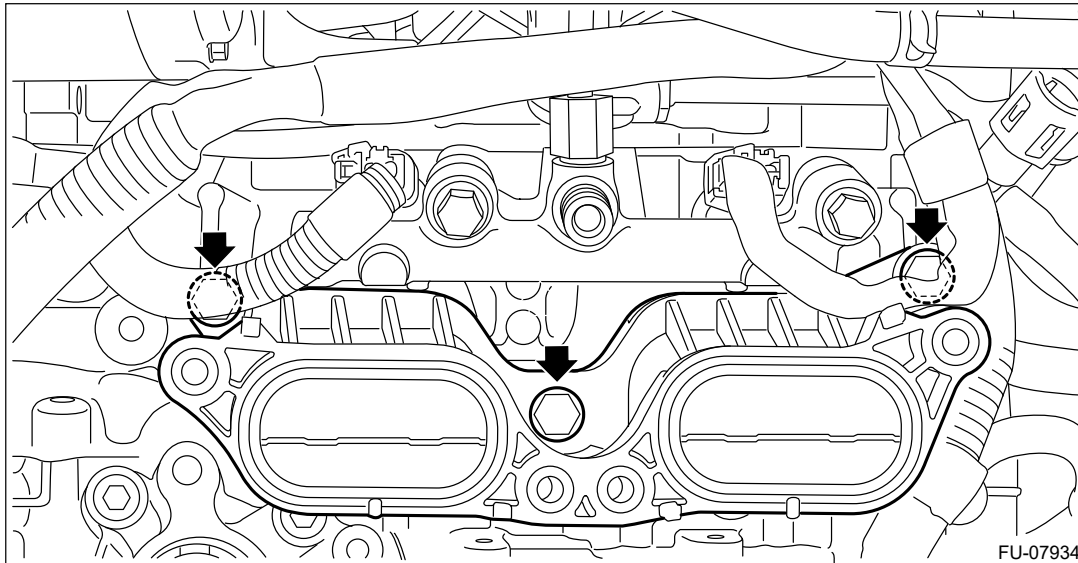
3. Install the air intake adapter LH to cylinder heads.


Note:

Use a new gasket.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)




4. Install the high-pressure fuel pump.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>High Pressure Fuel Pump>INSTALLATION > HIGH-PRESSURE FUEL PUMP.](#)

REMOVAL

1. HIGH-PRESSURE FUEL PUMP

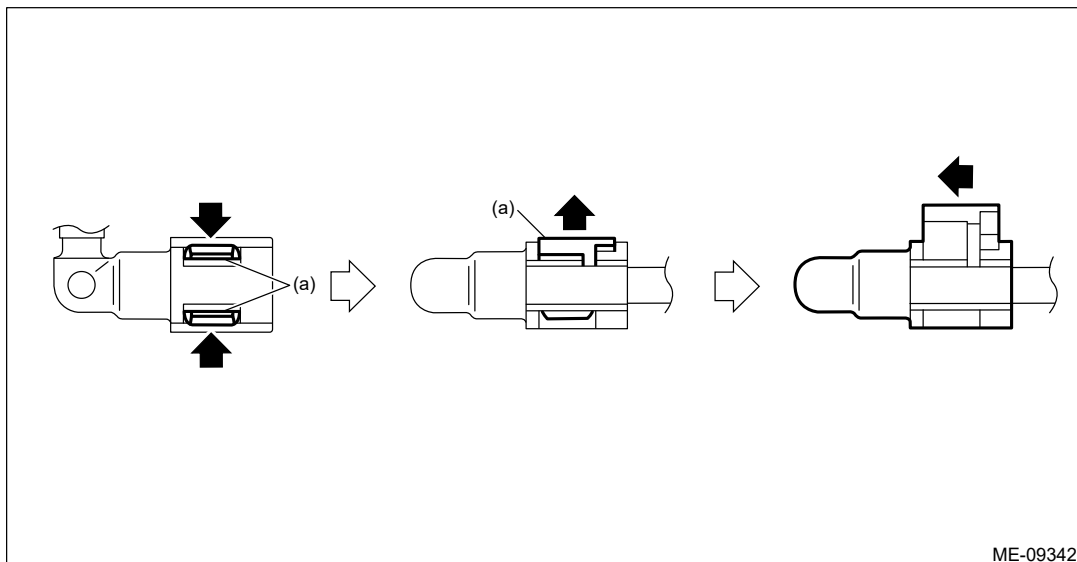
Caution:

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

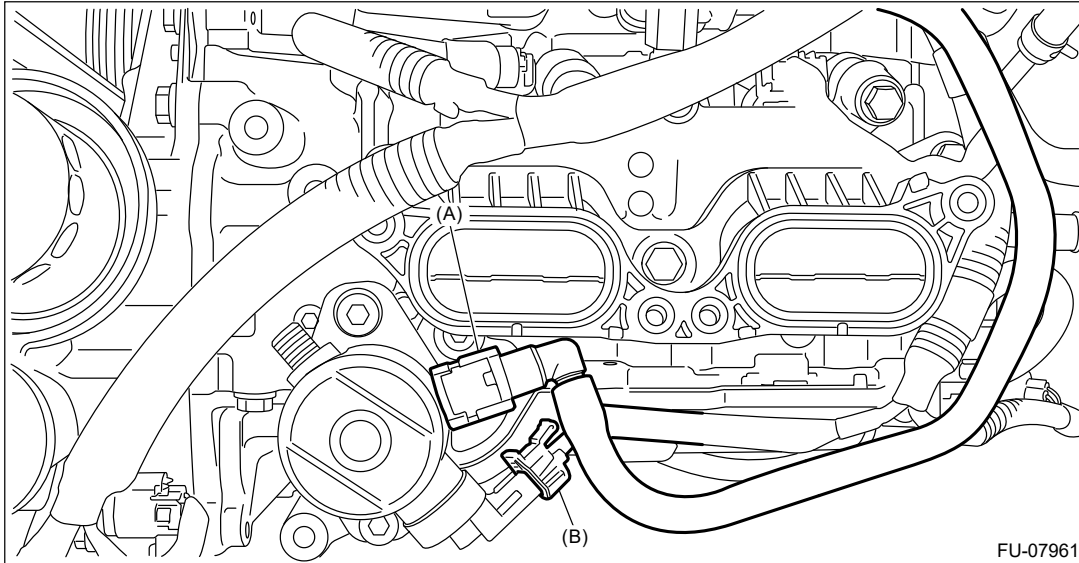
1. Disconnect the ground cable from battery.
2. Remove the high-pressure fuel delivery pipes.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Delivery Pipe>REMOVAL > HIGH-PRESSURE FUEL DELIVERY PIPE.](#)
3. Remove the fuel delivery pipe (A) from the high-pressure fuel pump, and disconnect the connector (B) from the high-pressure fuel pump.

Note:

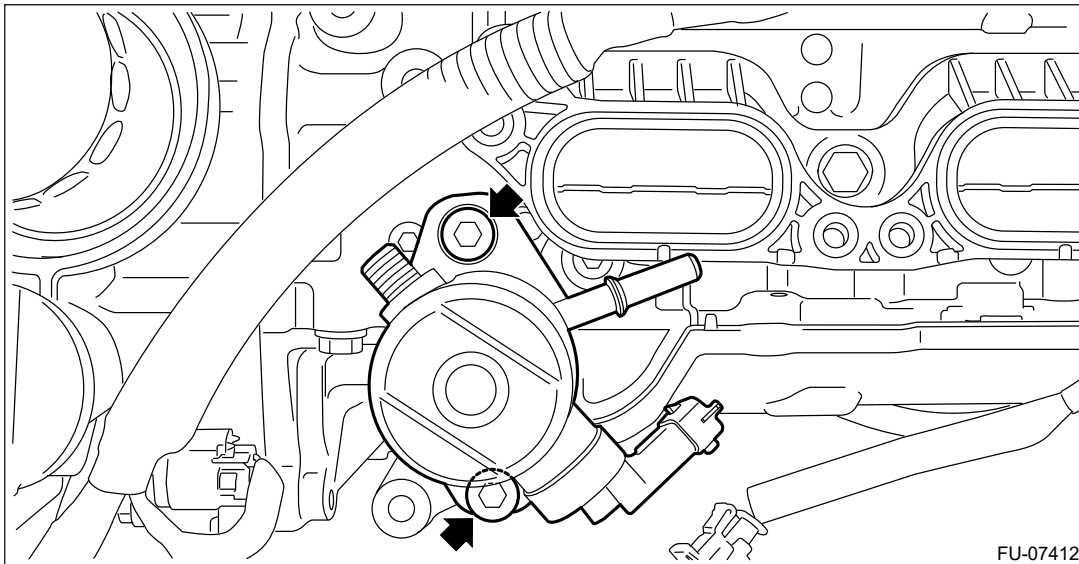
Disconnect the quick connector as shown in the figure.



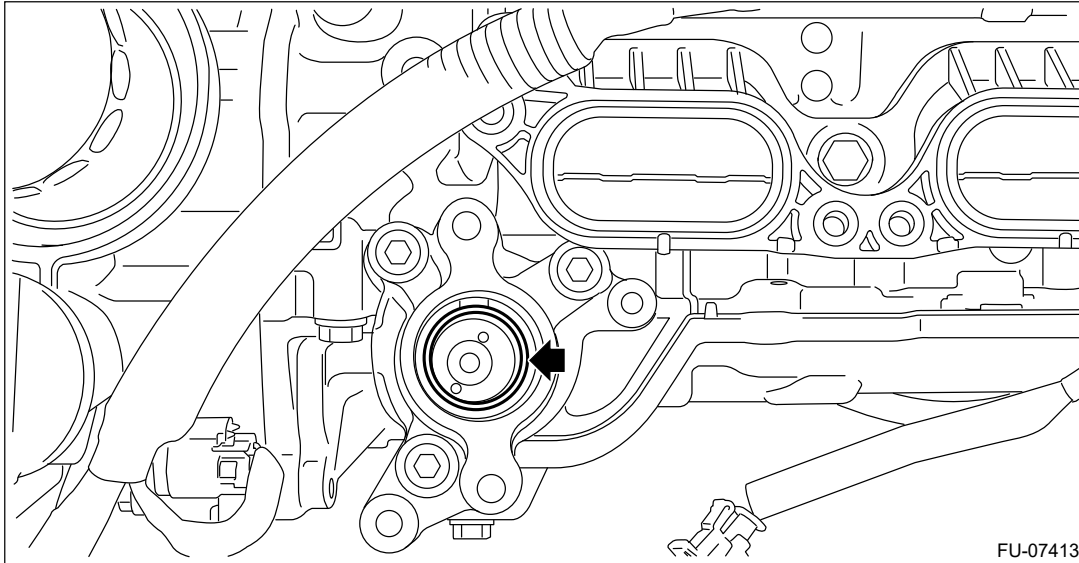
(a) Slider




- 4.** Using TORX PLUS[®] bit 40IP, remove the high-pressure fuel pump.

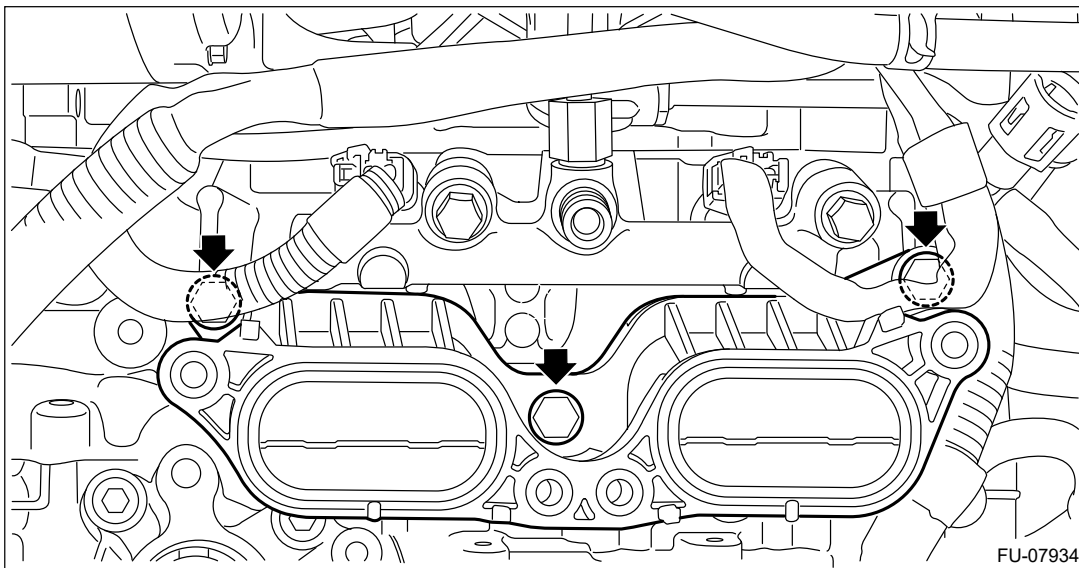


- 5.** Remove the fuel pump lifter from the fuel pump case.

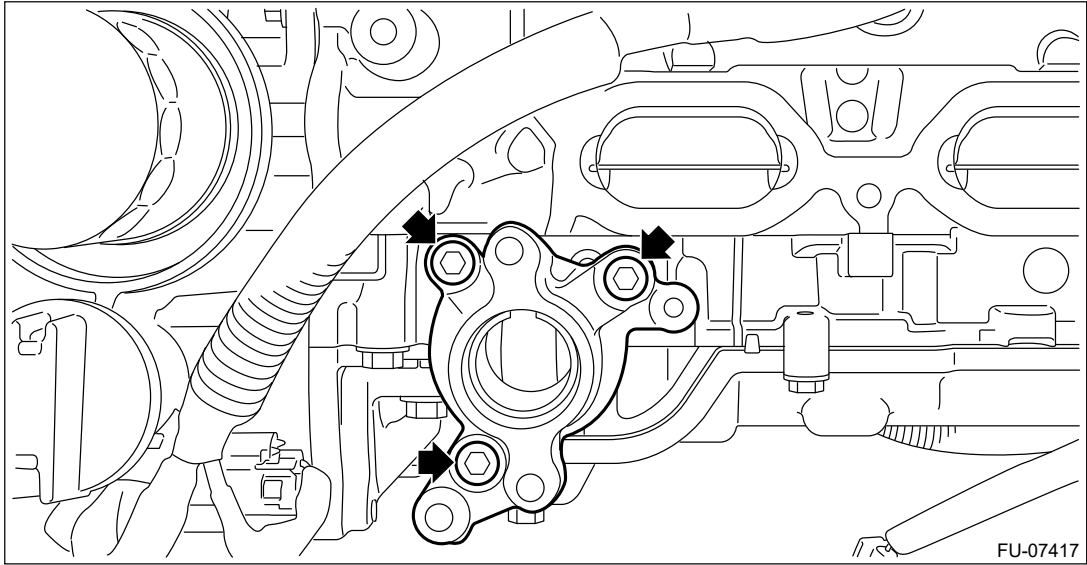


2. HIGH-PRESSURE FUEL PUMP CASE

1. Remove the high-pressure fuel pump.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>High Pressure Fuel Pump>REMOVAL > HIGH-PRESSURE FUEL PUMP.](#)
2. Remove the air intake adapter LH from the cylinder head.



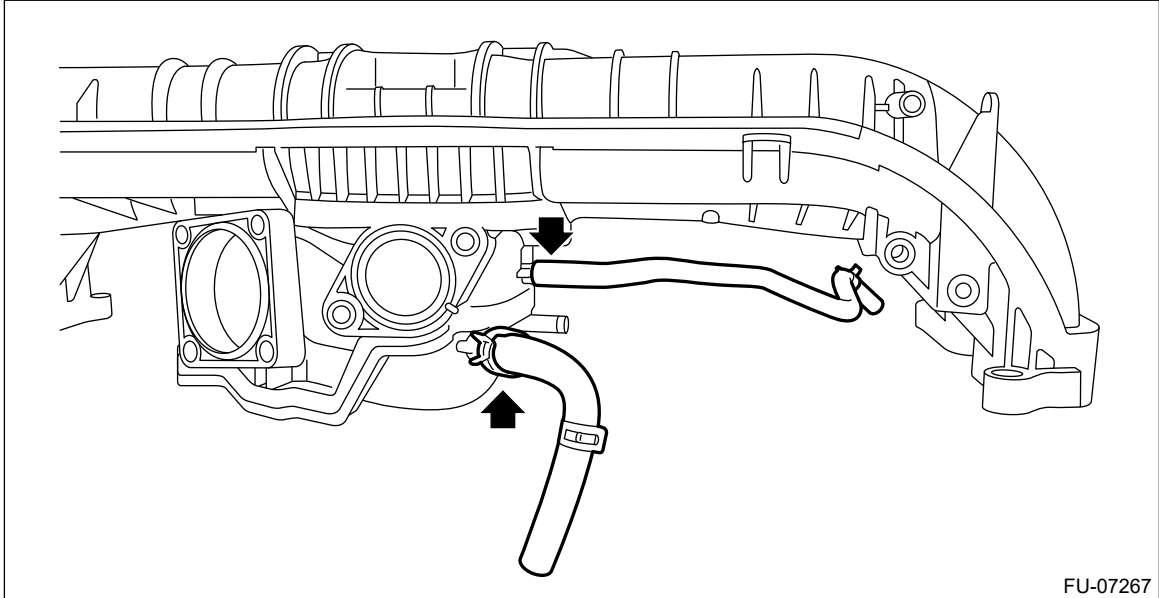
3. Remove the high-pressure fuel pump case from the cam carrier assembly LH.



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Intake Manifold

ASSEMBLY

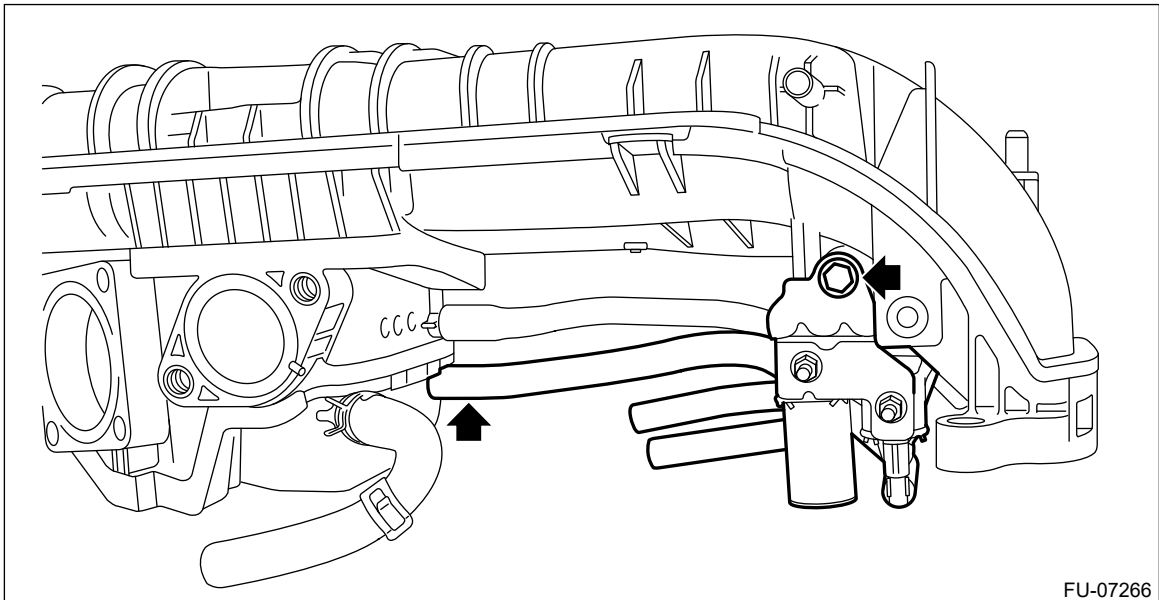
1. Connect the PCV hose and vacuum control hose to intake manifold.



2. Connect the vacuum hose to the intake manifold, and install the purge control solenoid valve.

Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)



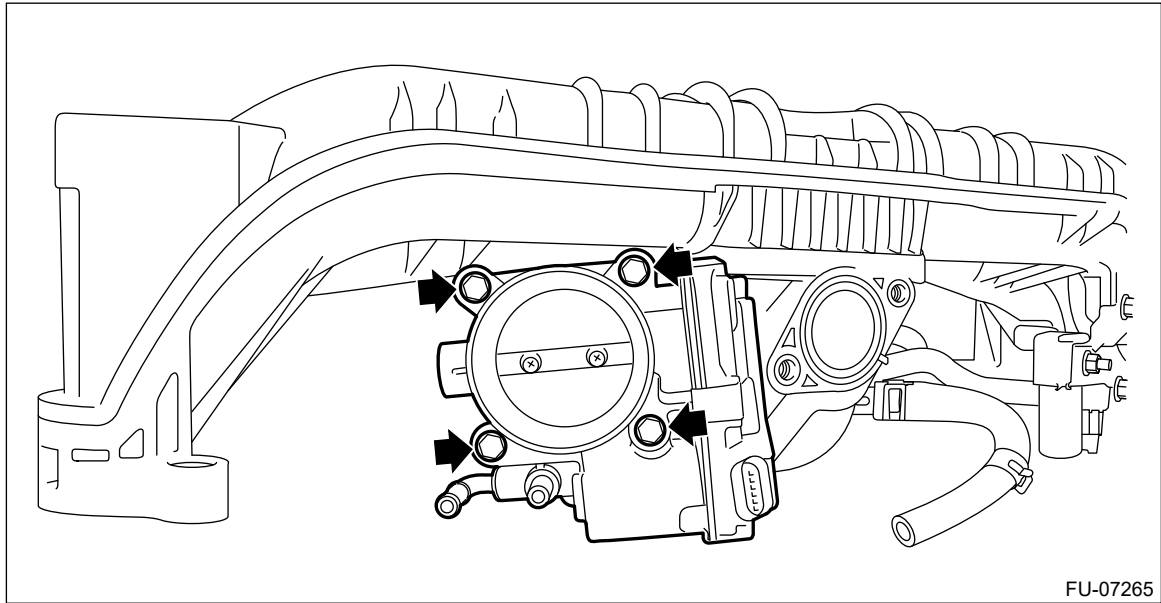
3. Install the throttle body to the intake manifold.

Note:

Use a new gasket.


Tightening torque:

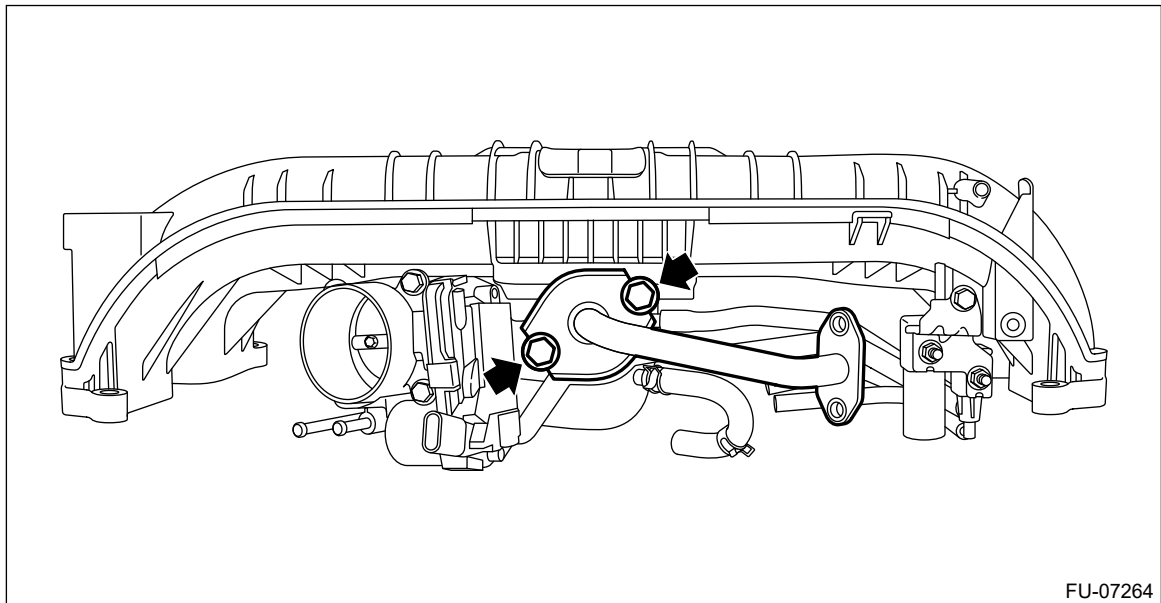
8 N·m (0.8 kgf-m, 5.9 ft-lb)



4. Temporarily install the EGR pipe to the intake manifold.

Note:

- Use new O-rings.
- Tighten the EGR pipe when installing the intake manifold.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>EGR Pipe>INSTALLATION.](#)



5. Install the manifold absolute pressure & intake air temperature sensor to the intake manifold.

Note:

Use new O-rings.

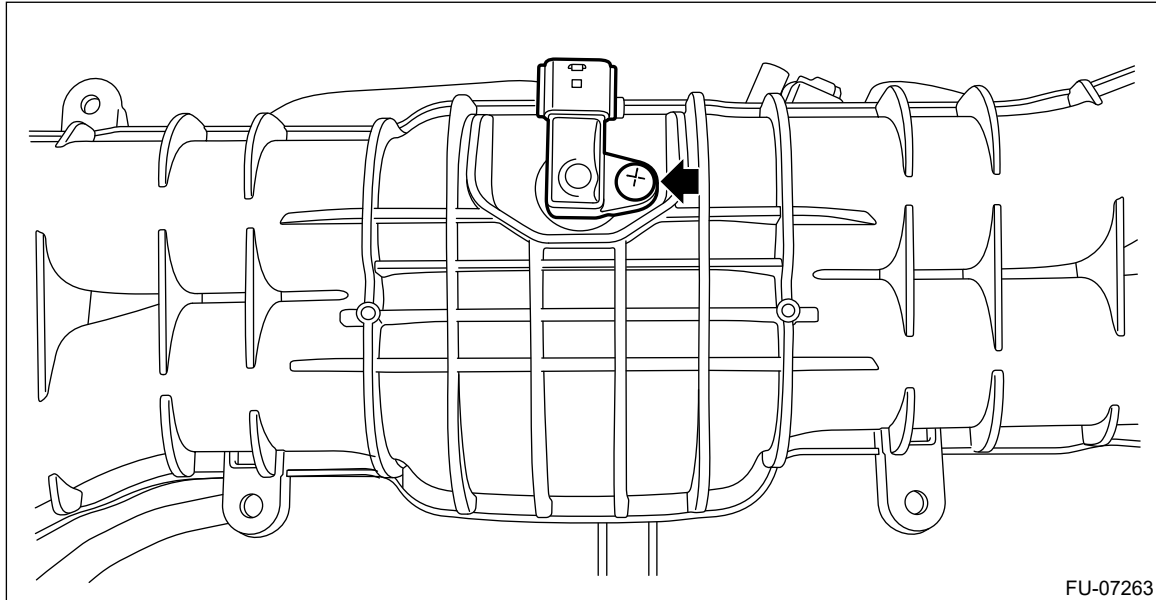
Tightening torque:

3.5 N·m (0.3 kgf-m, 2.5 ft-lb)

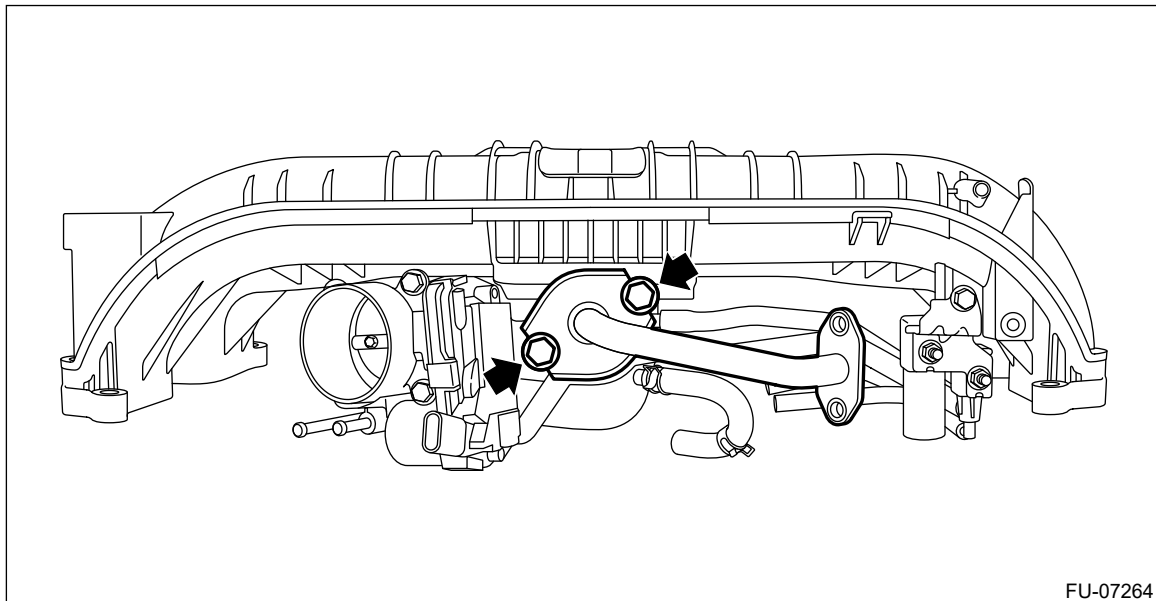
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Intake Manifold

DISASSEMBLY

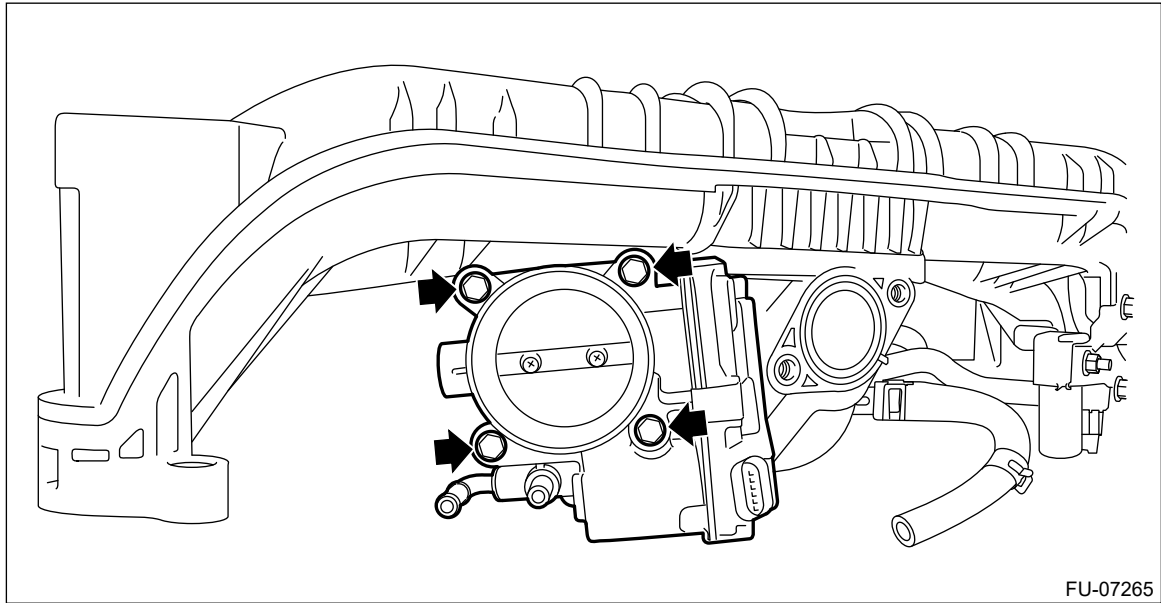
1. Remove the manifold absolute pressure & intake air temperature sensor from the intake manifold.



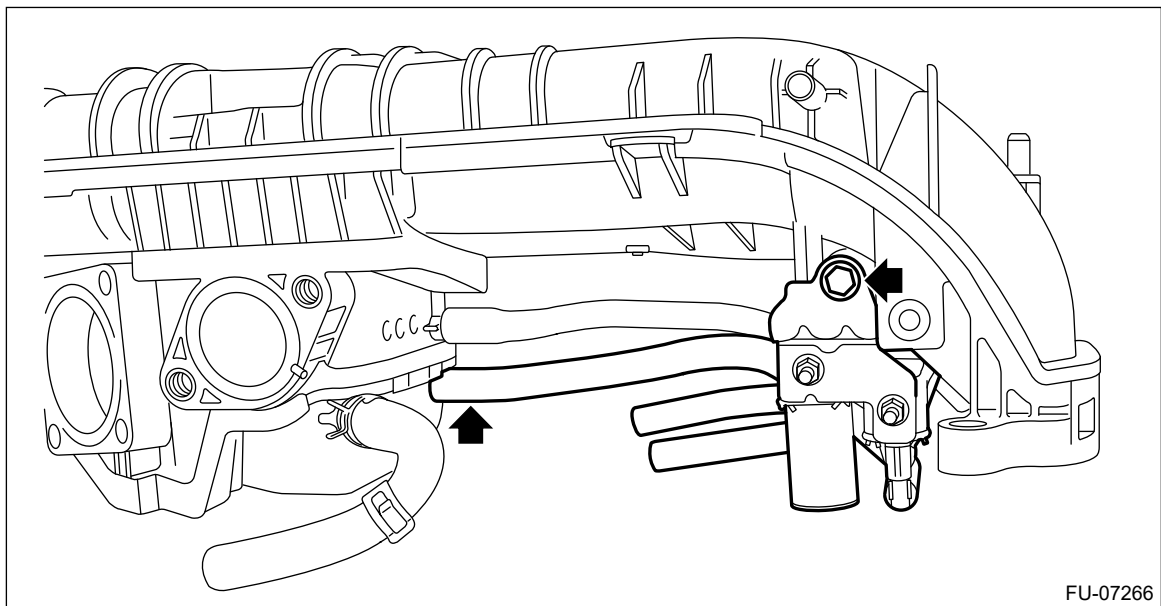
2. Remove the EGR pipe from intake manifold.



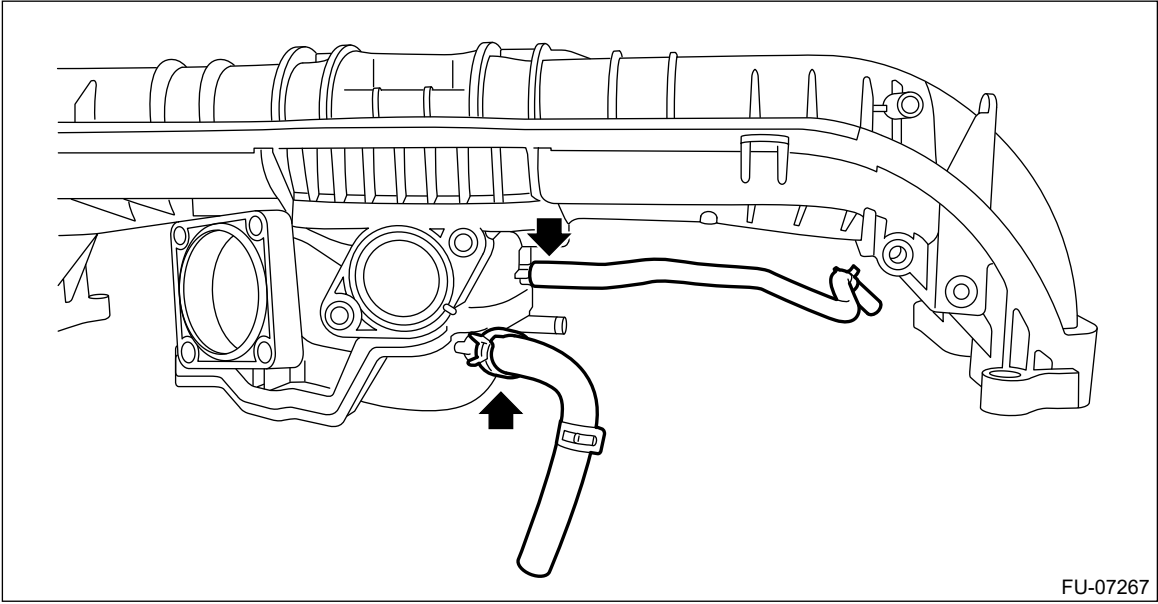
3. Remove the throttle body from the intake manifold.



4. Disconnect the vacuum hose from the intake manifold, and remove the purge control solenoid valve.



5. Disconnect the PCV hose and vacuum control hose from the intake manifold.



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FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Intake Manifold

INSPECTION

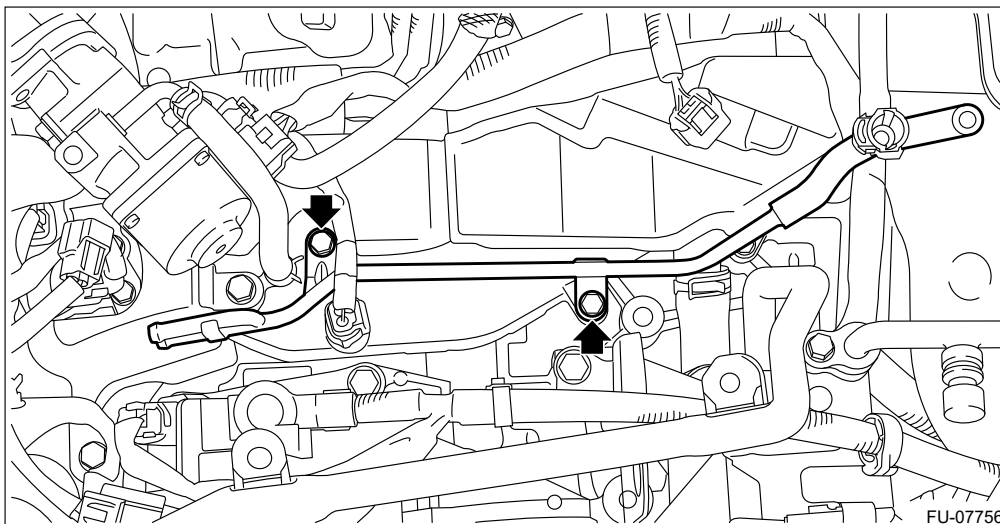
- 1.** Check that the intake manifold and fuel pipe have no deformation, cracks and other damages.
- 2.** Check that the hose has no cracks, damage or loose part.

INSTALLATION

1. Install the vacuum hose assembly to the water pipe assembly.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



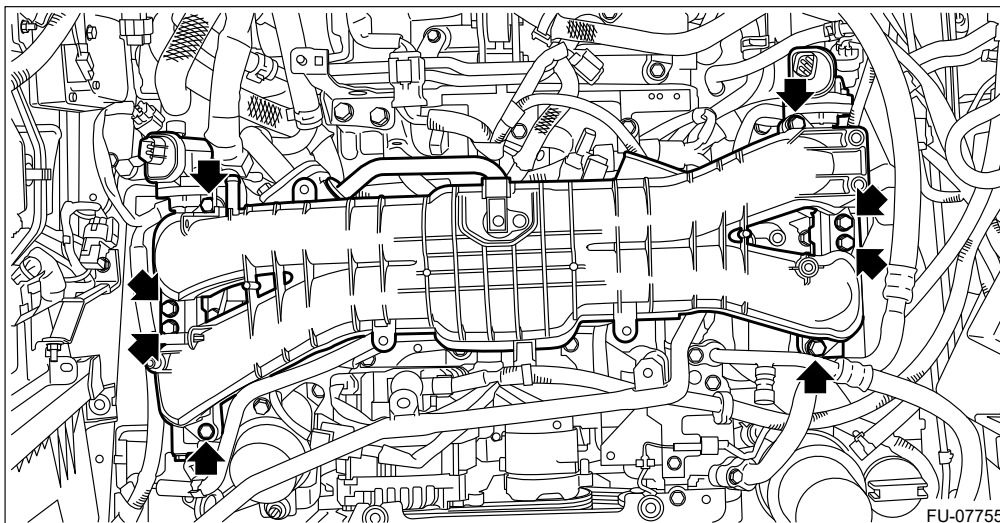
2. Install the intake manifold and tumble generator valve assembly to the air intake adapter.

Note:

Use a new gasket.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)



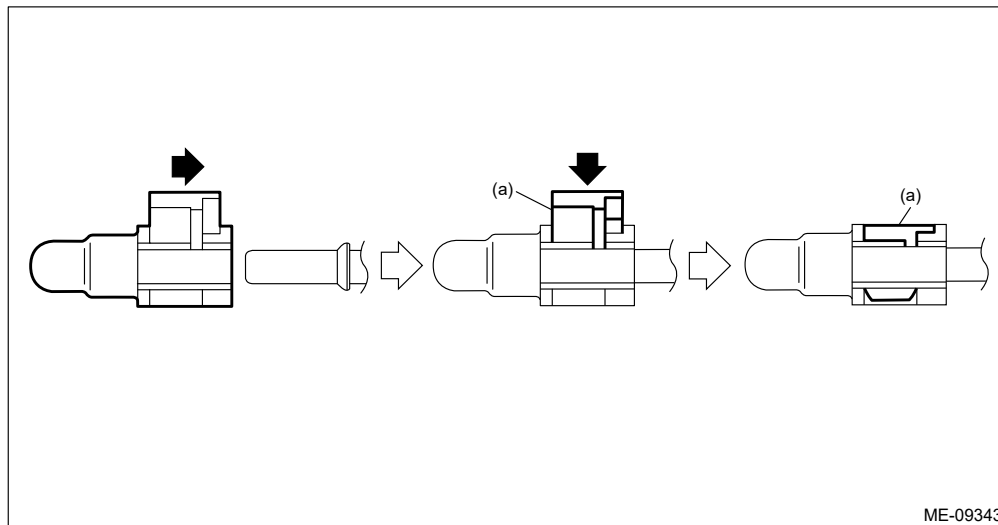
3. Connect the fuel delivery pipe (A) and vacuum hose (B) to the fuel pipe assembly.

Caution:

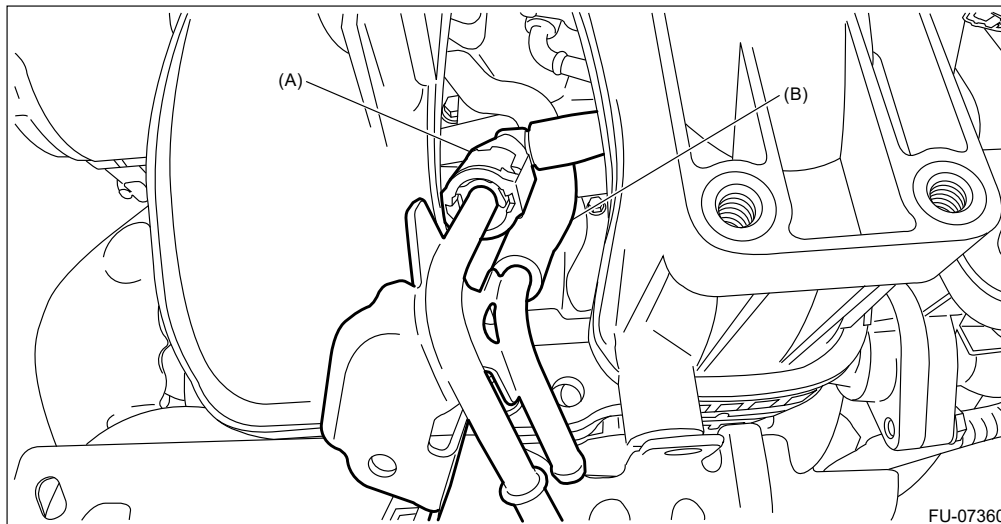
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



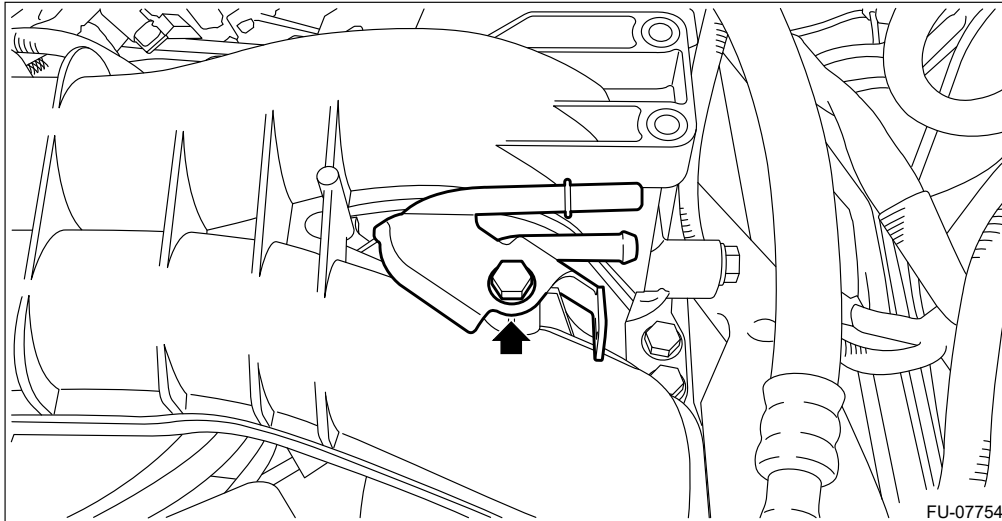
(a) Slider



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

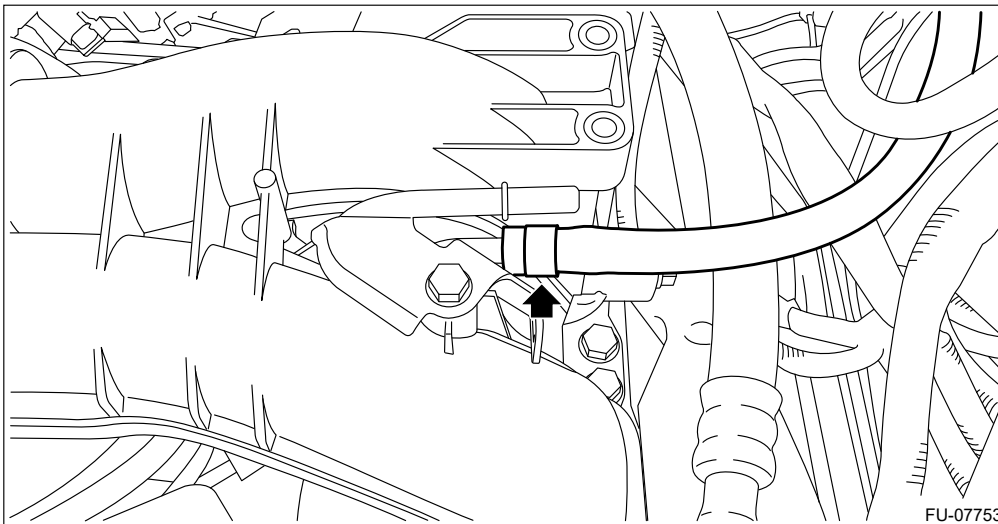
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



5. Connect the fuel delivery tube and evaporation hose.

- (1) Connect the evaporation hose to fuel pipe assembly.



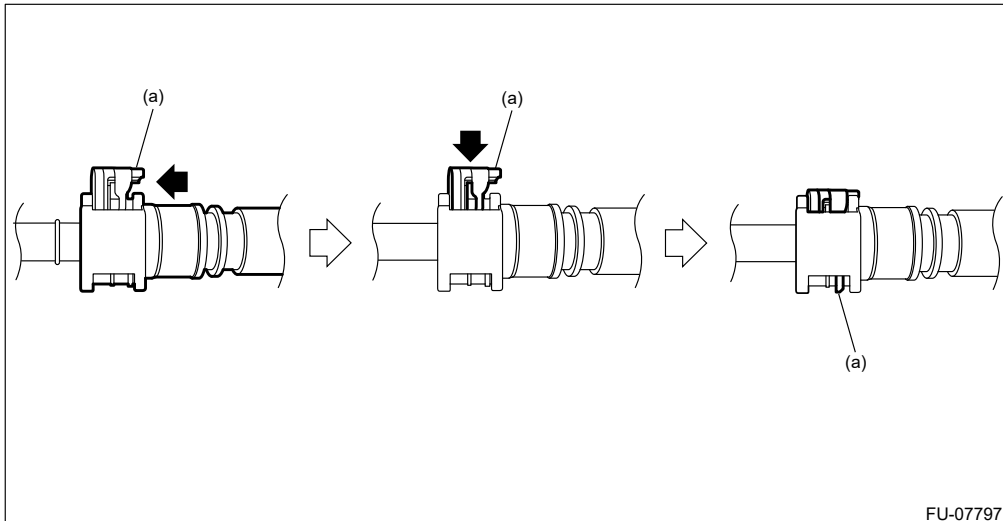
- (2) Connect the connector on the fuel delivery tube to the fuel pipe assembly, and secure the fuel delivery tube using clip (A).

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

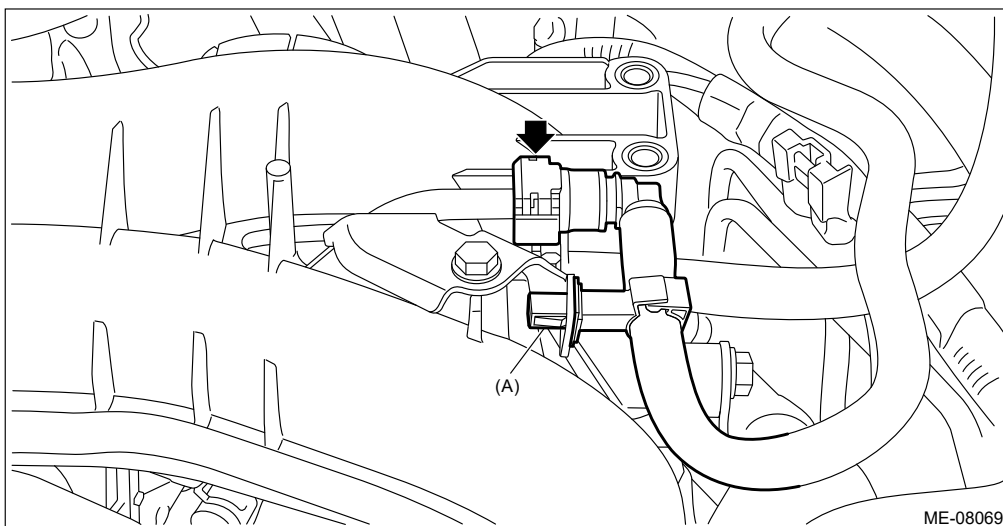
Note:

Connect the quick connector as shown in the figure.




FU-07797

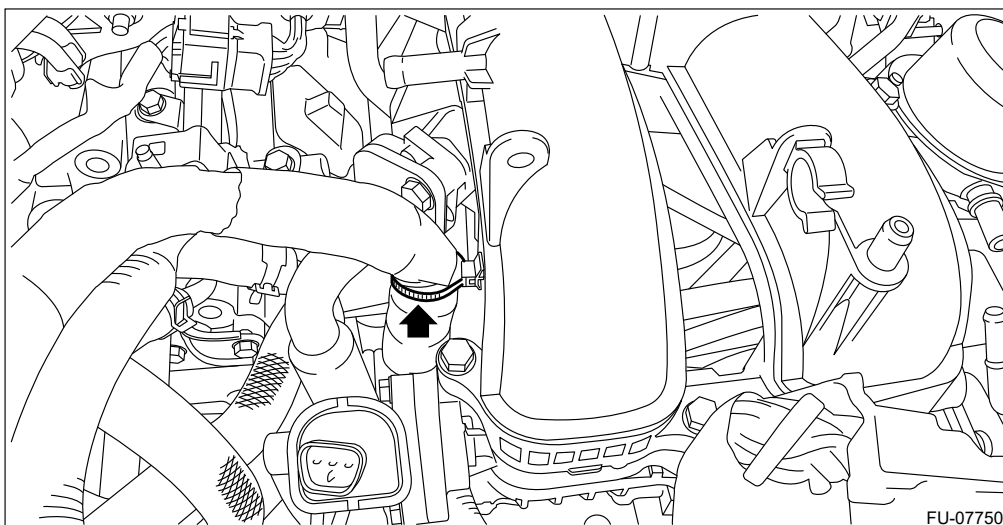
(a) Slider



ME-08069

6. Install the EGR pipe.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>EGR Pipe>INSTALLATION.](#)

7. Secure the engine harness to the intake manifold using clip.

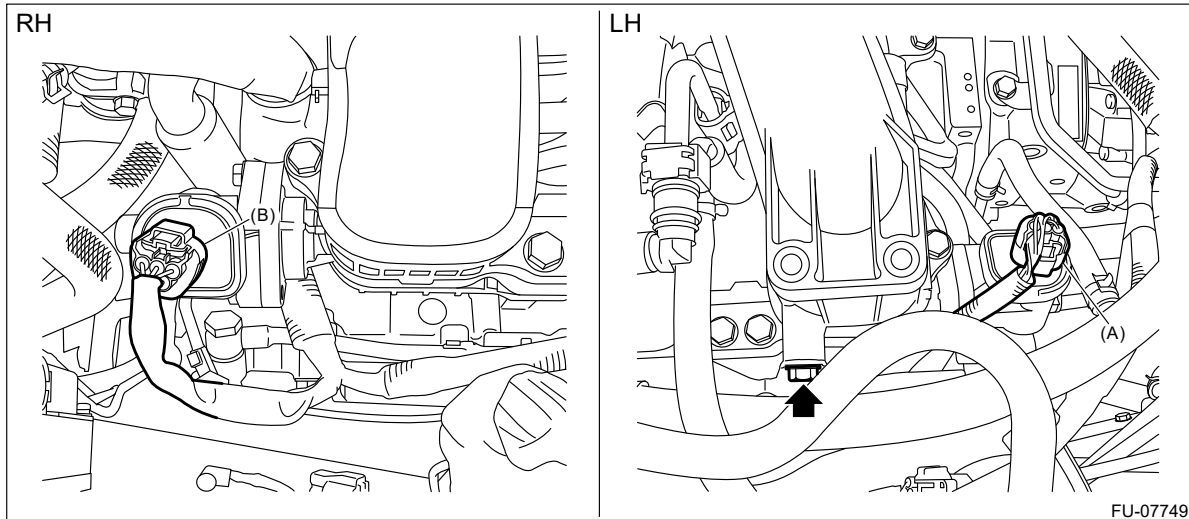


FU-07750

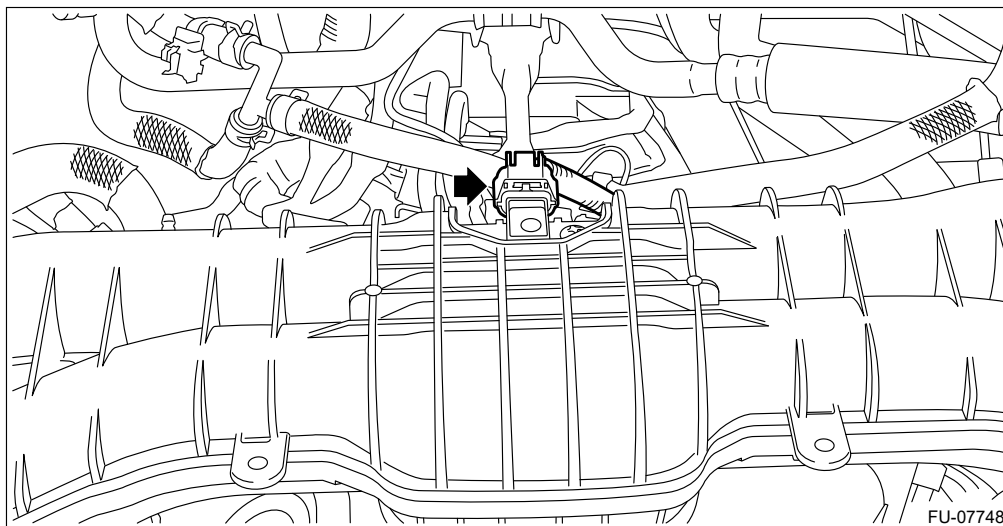
8. Connect the connector (B) to the tumble generator valve RH.
9. Connect the connector (A) to the tumble generator valve LH, and secure the fuel pipe protector to the intake manifold.

Tightening torque:

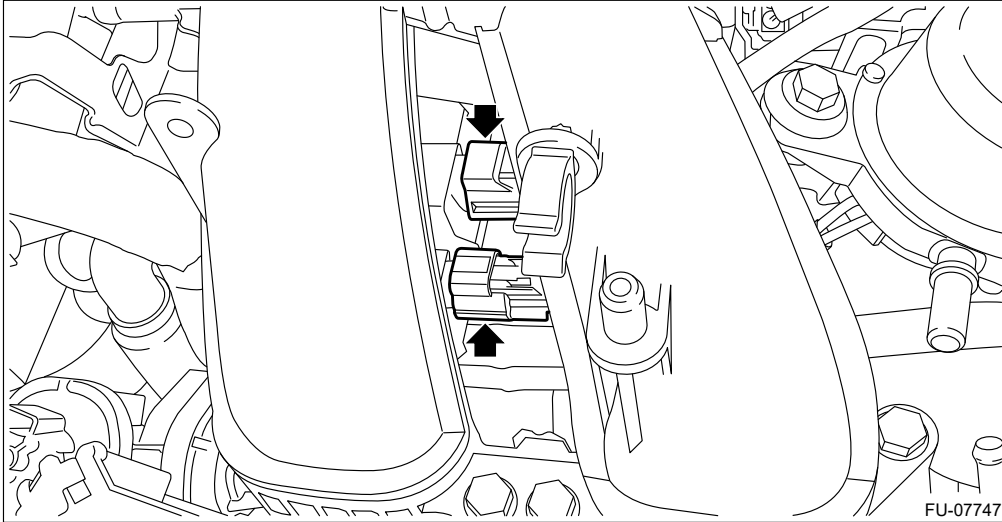
19 N·m (1.9 kgf-m, 14.0 ft-lb)



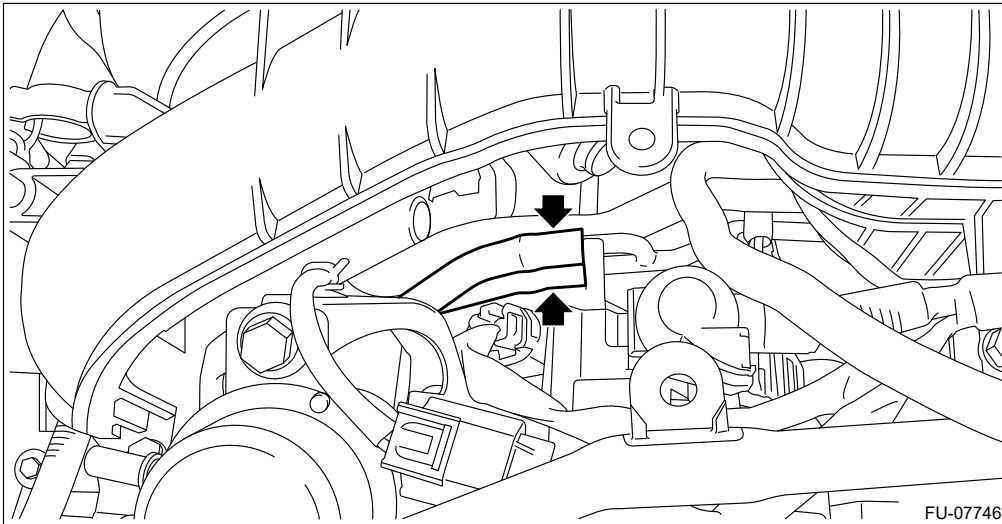
10. Connect connectors to the manifold absolute pressure & intake air temperature sensor.



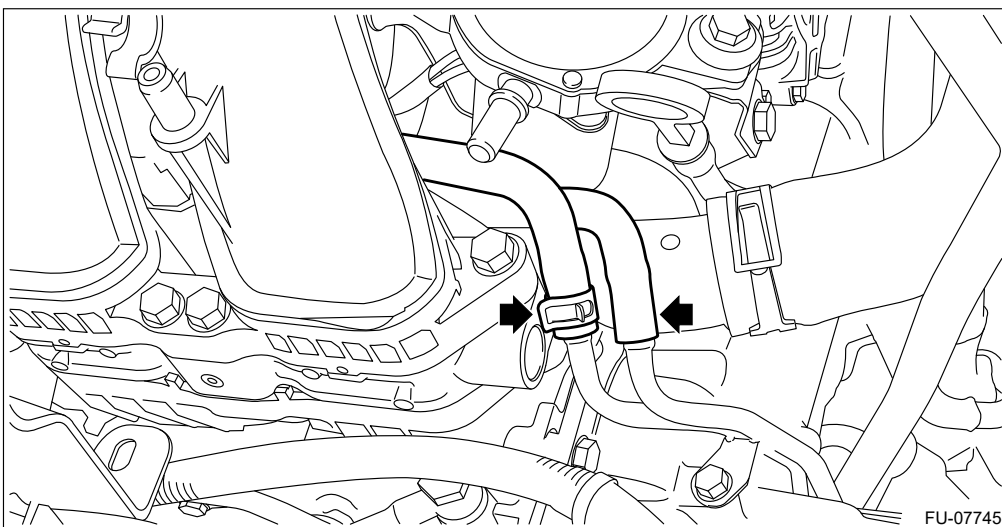
11. Connect the connector to the purge control solenoid valve.



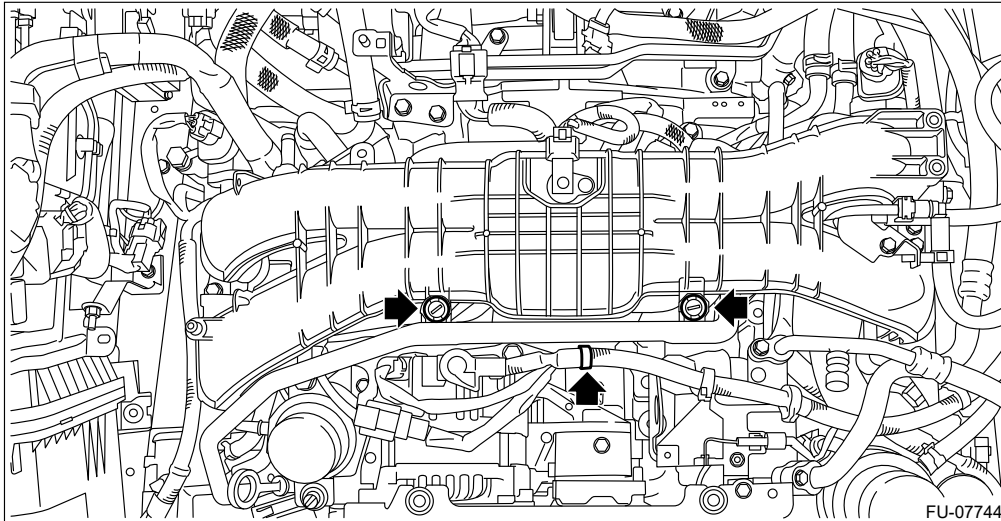
12. Connect the vacuum hose to the canister pipe.



13. Connect the vacuum control hose and vacuum hose to the vacuum pipe assembly.



14. Secure the PCV pipe and generator cord to the intake manifold using the clip.

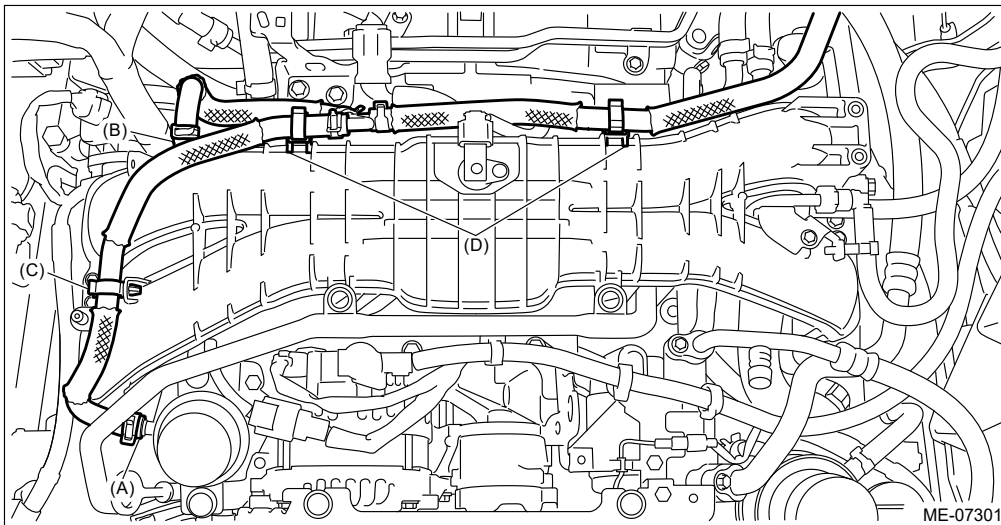


15. Install the brake booster vacuum hose to the clip (D).

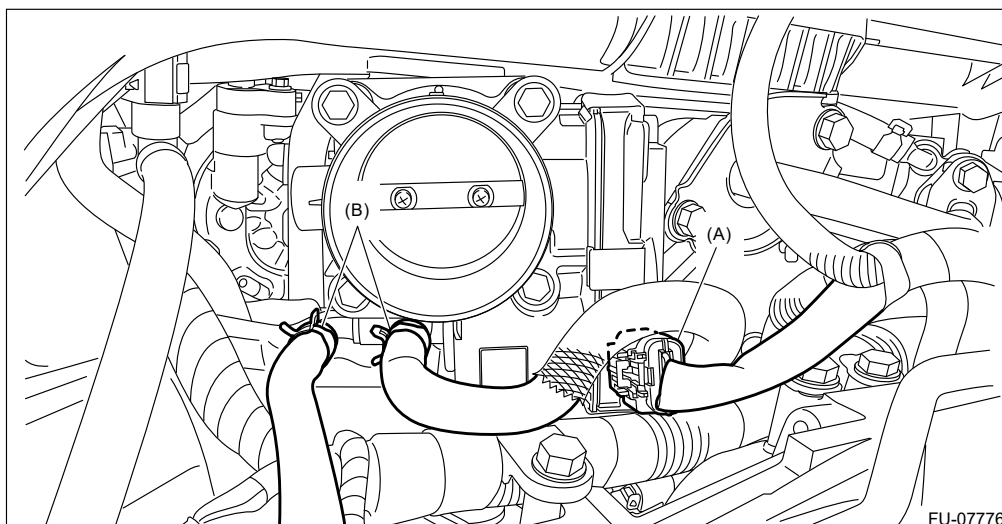
Note:

If the clip is removed from the intake manifold, install the clip to the position of alignment mark ▼ of intake manifold.

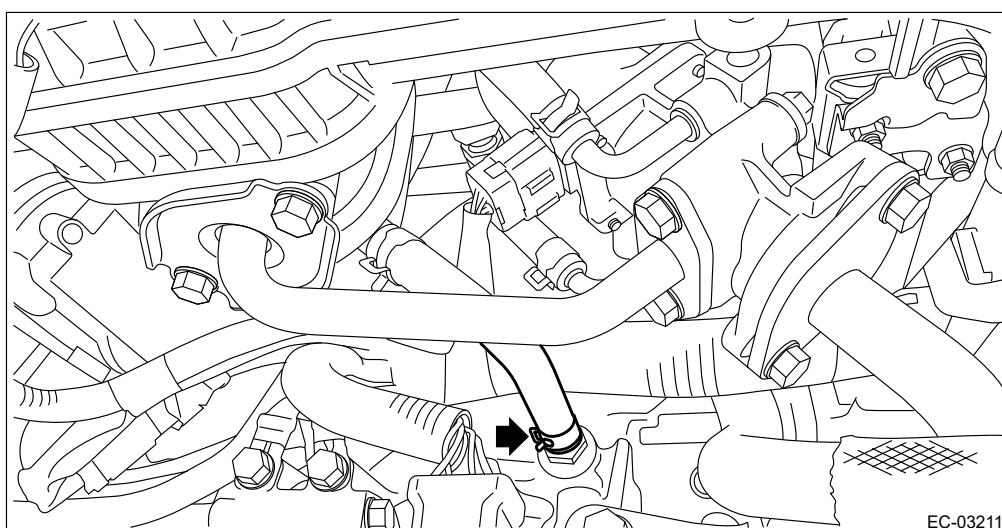
16. Connect sections (A) and (B) of the brake booster vacuum hose to the brake vacuum pump and intake manifold, and install the brake booster vacuum hose to the clip (C).








17. Connect the preheater hose (B) to the throttle body, and connect the connector (A) to the throttle body.



- 18.** Connect the PCV hose to the PCV valve.

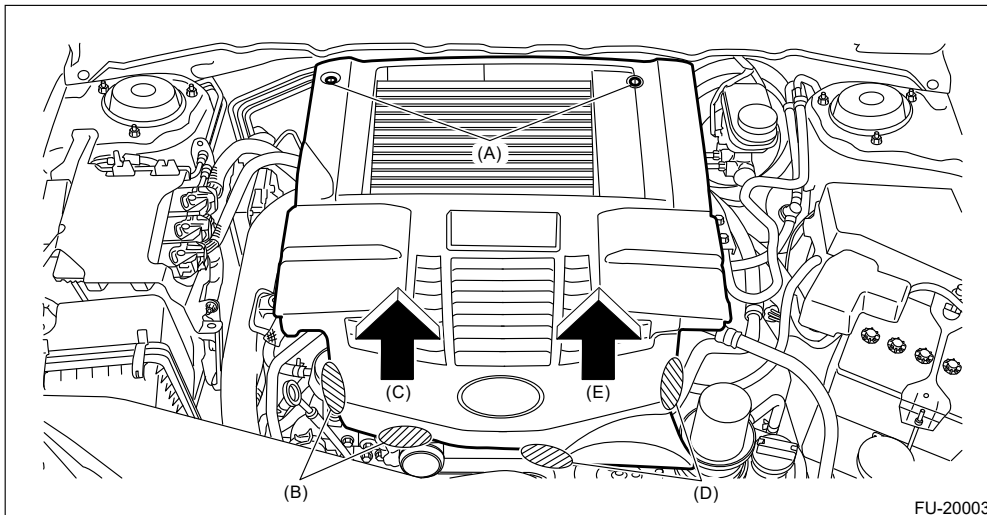








- 19.** Install the intake duct No. 3.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>INSTALLATION > INTAKE DUCT NO. 3.](#)
- 20.** Install the intake duct No. 2.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>INSTALLATION > INTAKE DUCT NO. 2.](#)
- 21.** Install the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>INSTALLATION.](#)
- 22.** Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
- 23.** Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
- 24.** Lower the vehicle.
- 25.** Connect the battery ground terminal.
- 26.** Install the collector cover.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Intake Manifold

REMOVAL

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.

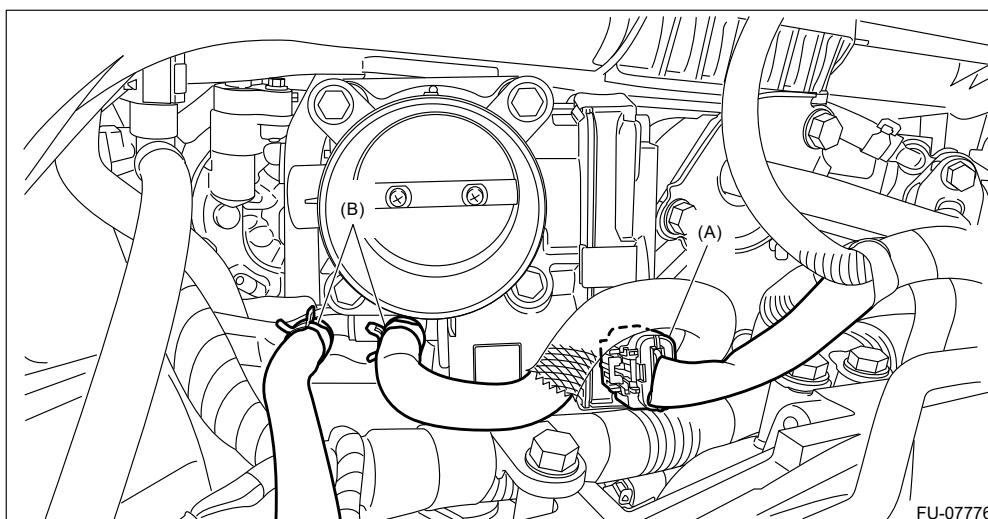


2. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
3. Disconnect the ground cable from battery.
4. Open the fuel filler lid and remove the fuel filler cap.
Note:
This operation is required to release the inner pressure of the fuel tank.
5. Lift up the vehicle.
6. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
7. Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
8. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
9. Remove the intake duct No. 2.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 2.](#)
10. Remove the intake duct No. 3.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 3.](#)
11. Disconnect the PCV hose from the PCV valve.

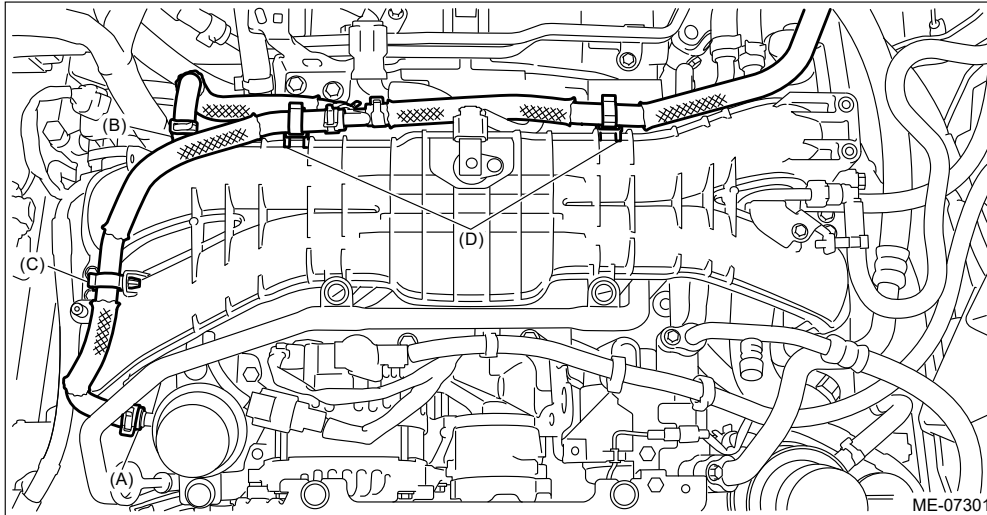
代替画像1

この画像は代替画像です

12. Disconnect the connector (A) from the throttle body, and disconnect the preheater hose (B) from the throttle body.

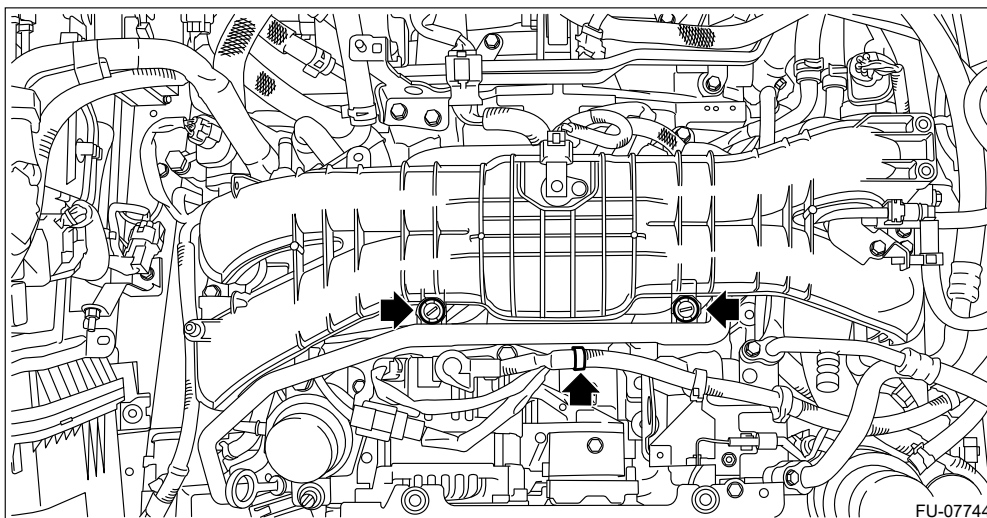


13. Disconnect sections (A) and (B) of the brake booster vacuum hose from the brake vacuum pump and intake manifold, and remove the brake booster vacuum hose from the clip (C).
14. Remove the brake booster vacuum hose from the clip (D), and place the brake booster vacuum hose aside so that it does not interfere with the work.



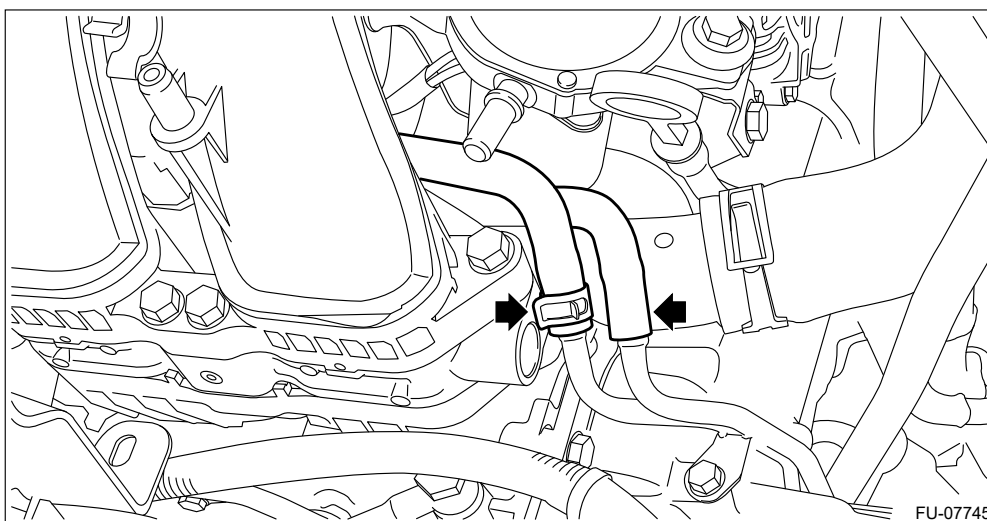
ME-07301

- 15.** Remove the clips securing the PCV pipe and generator cord to the intake manifold.



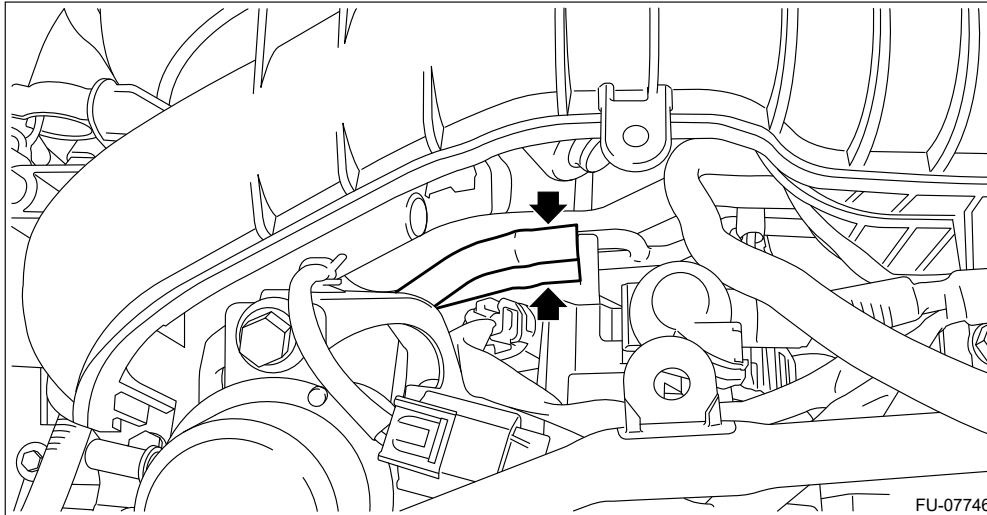
FU-07744

- 16.** Disconnect the vacuum control hose and vacuum hose from the vacuum pipe assembly.



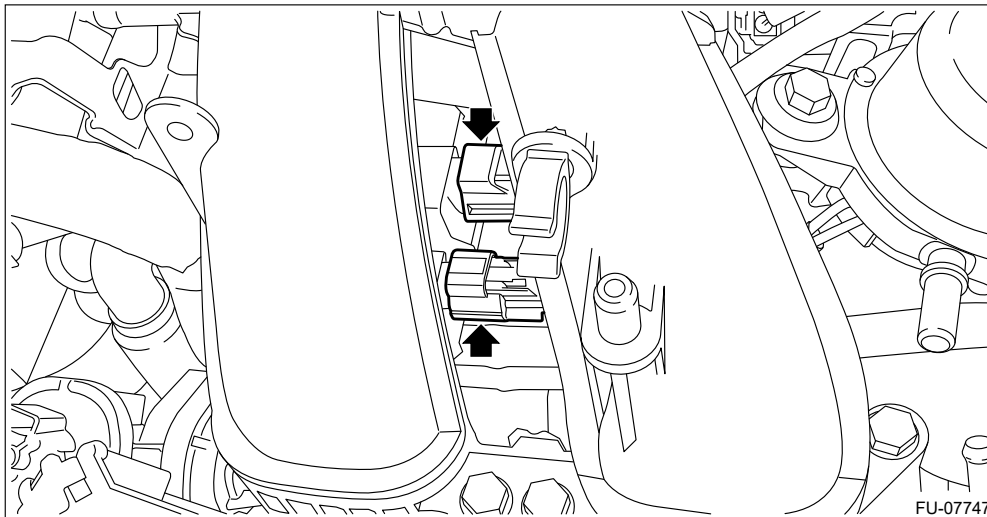
FU-07745

- 17.** Disconnect two vacuum hoses from the canister pipe.



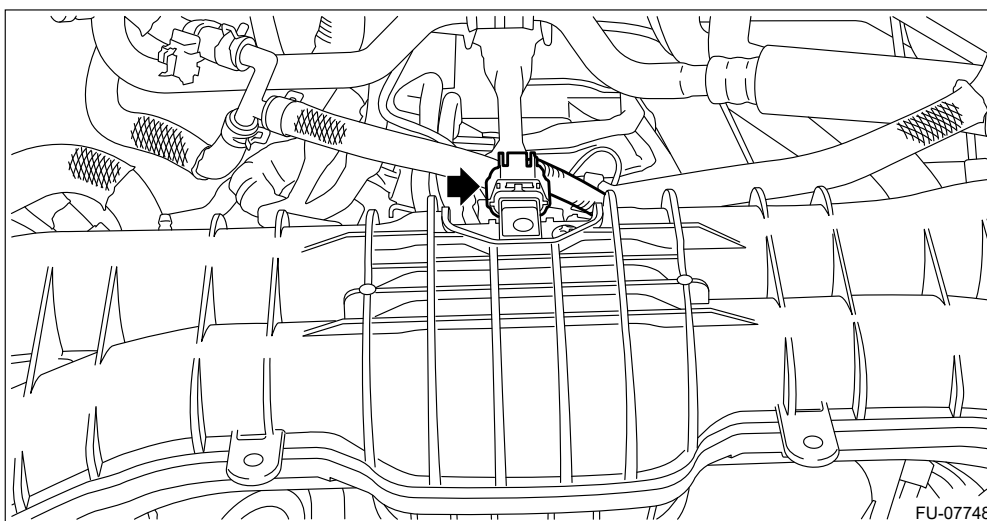
FU-07746

- 18.** Disconnect the connector from the purge control solenoid valve.



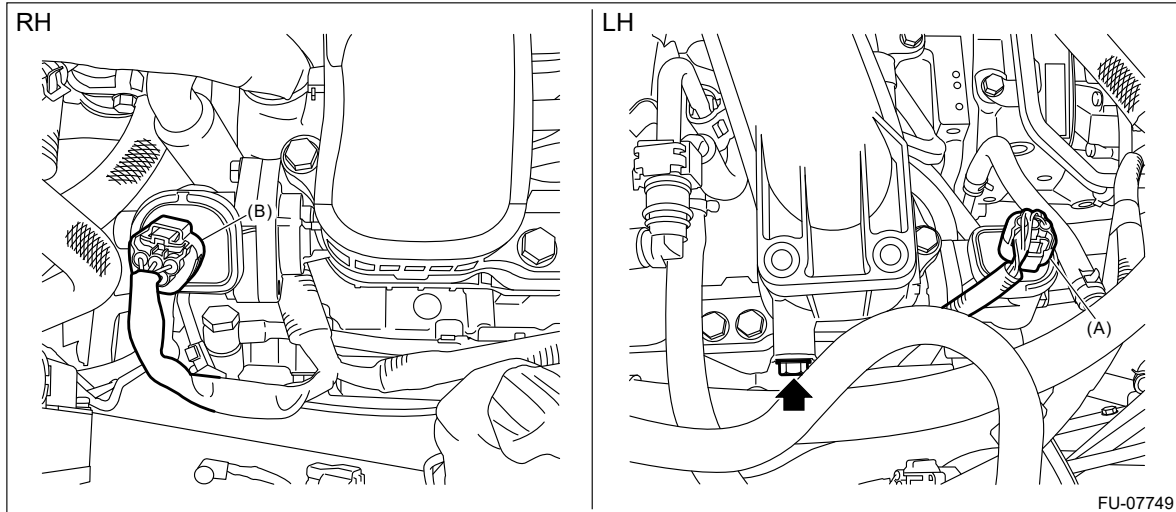
FU-07747

- 19.** Disconnect the connector from the manifold absolute pressure and intake air temperature sensor.



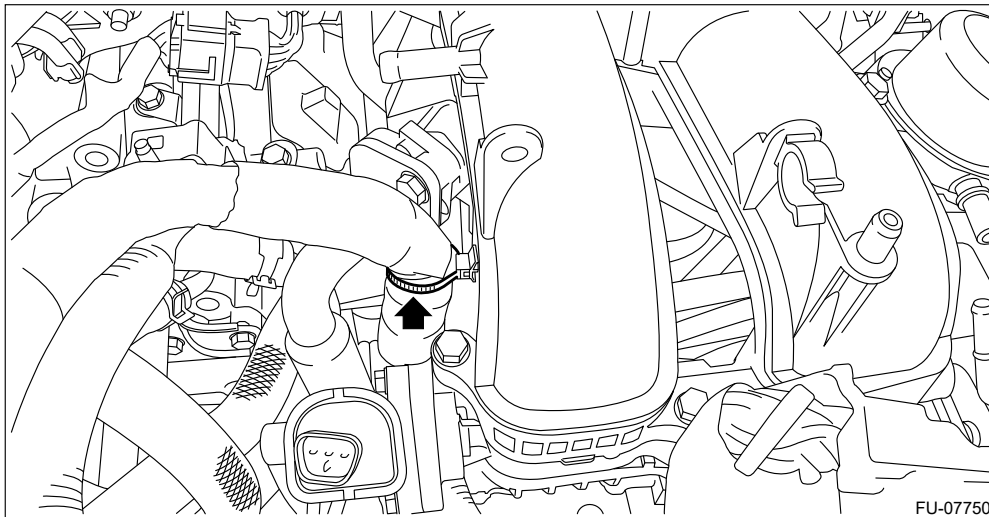
FU-07748

- 20.** Disconnect the connector (A) from the tumble generator valve LH, and remove the bolt securing the fuel pipe protector to the intake manifold.
- 21.** Disconnect the connector (B) from the tumble generator valve RH.



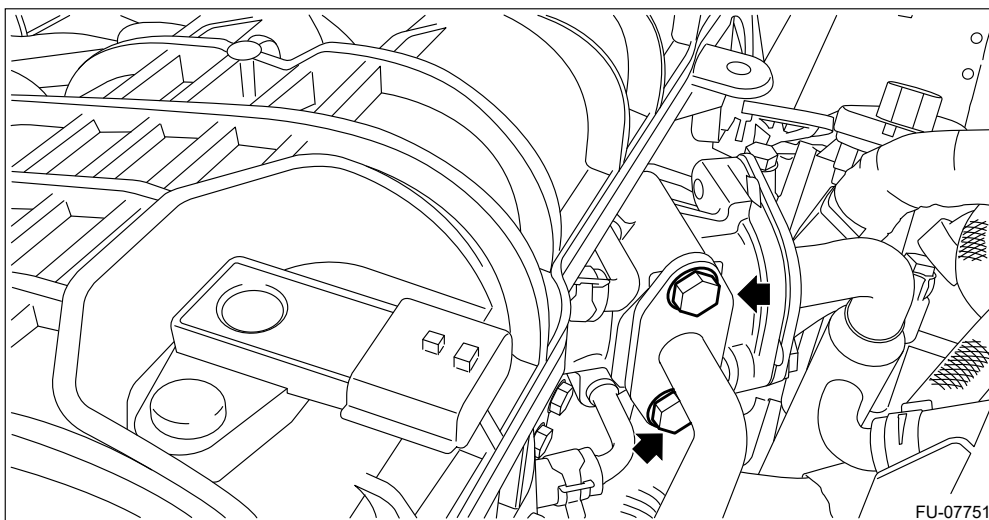
FU-07749

22. Remove the engine harness clip from the intake manifold.



FU-07750

23. Remove the bolt securing the EGR pipe to the EGR valve.



FU-07751

24. Disconnect the fuel delivery tube and evaporation hose.

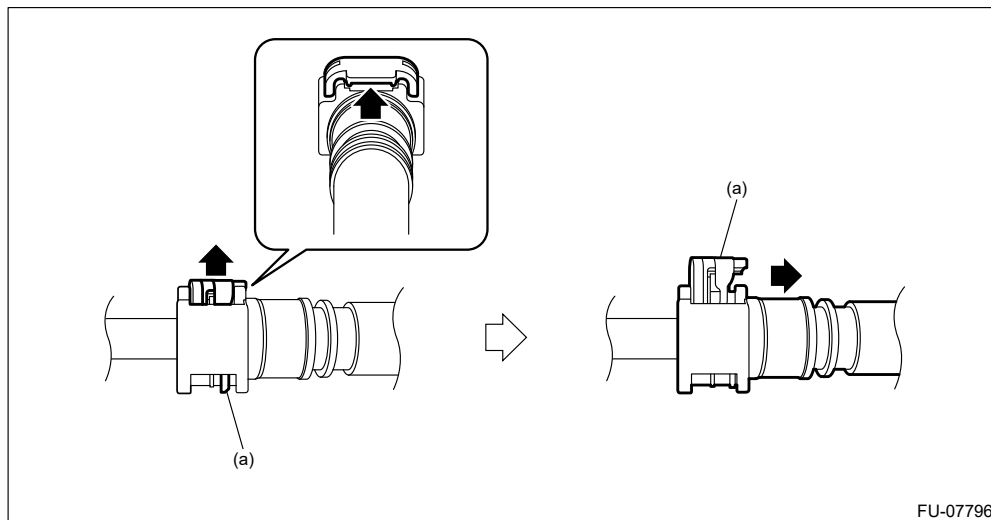
Caution:

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

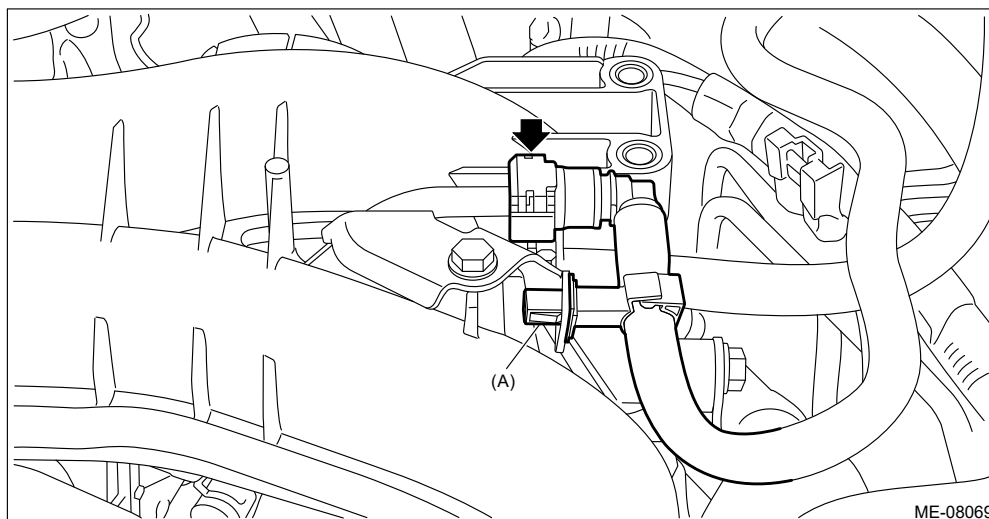
- (1) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube.

Note:

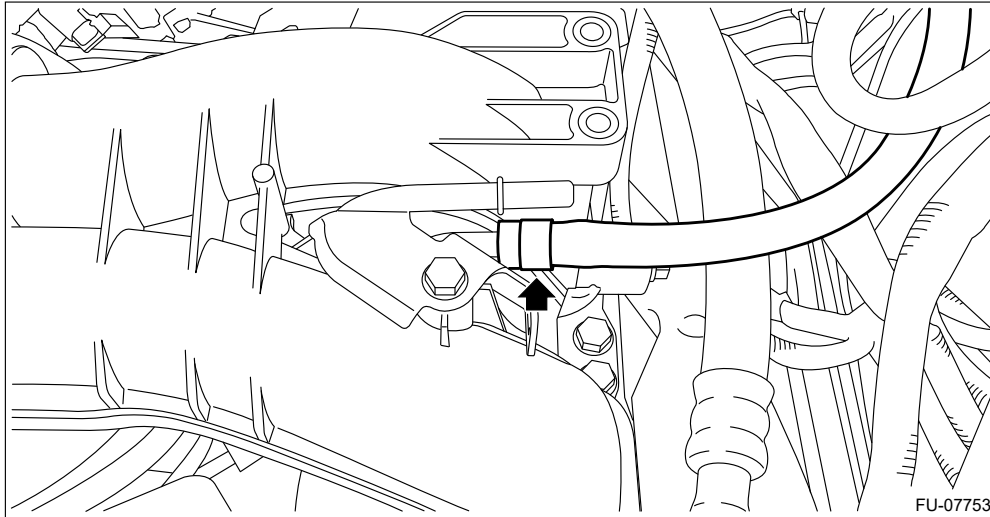
Disconnect the quick connector as shown in the figure.



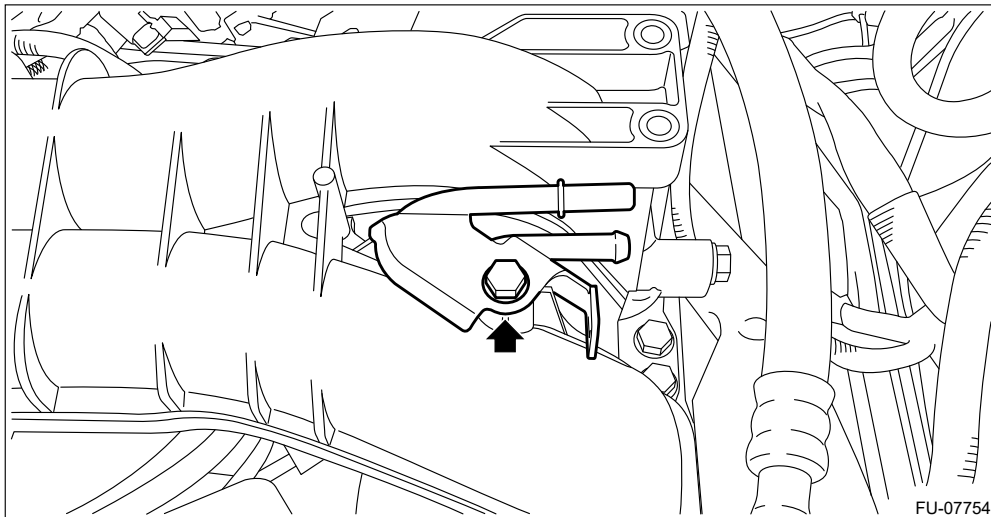
(a) Slider



- (2) Disconnect the evaporation hose from the fuel pipe assembly.



25. Remove the bolts securing the fuel pipe assembly to the intake manifold.



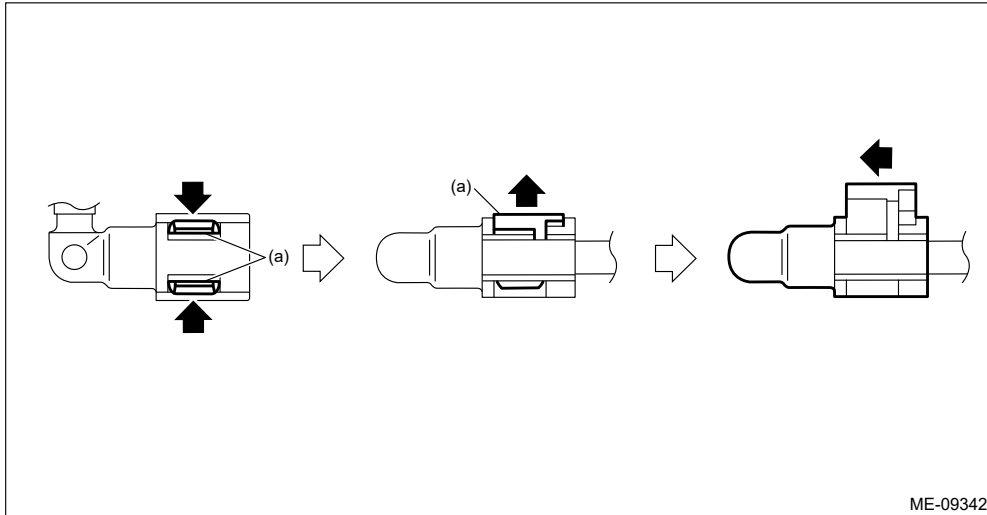
26. Disconnect the fuel delivery pipe (A) and vacuum hose (B), and remove the fuel pipe assembly.

Caution:

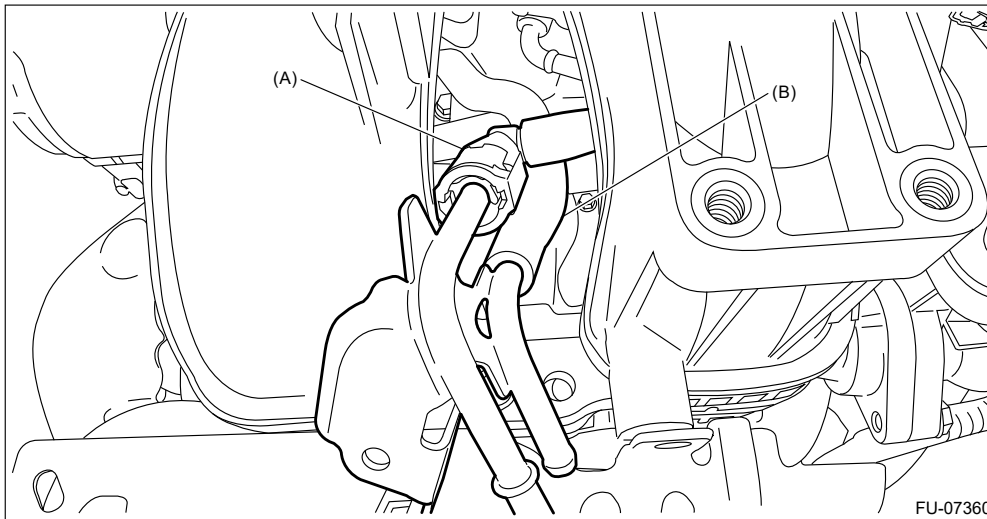
- **Be careful not to spill fuel.**
- **Catch the fuel from the pipes using a container or cloth.**

Note:

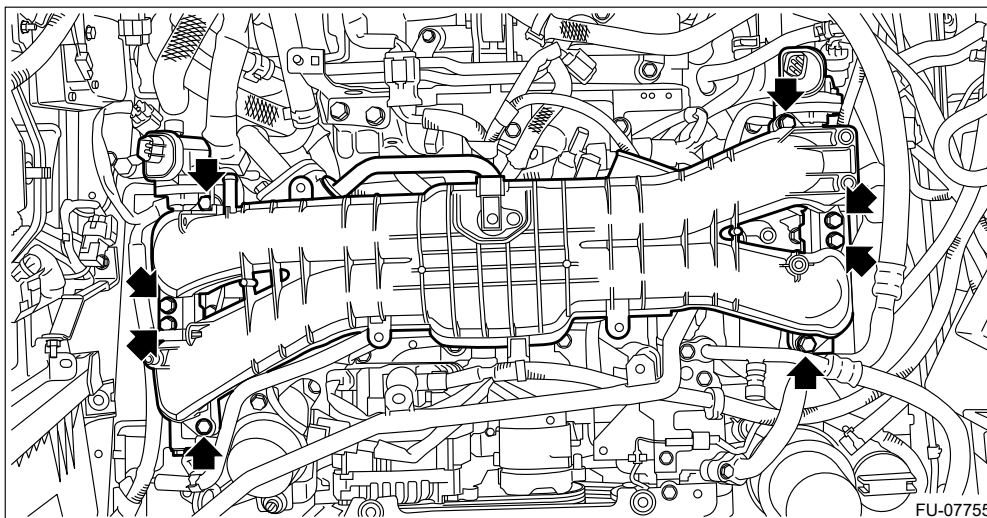
Disconnect the quick connector as shown in the figure.



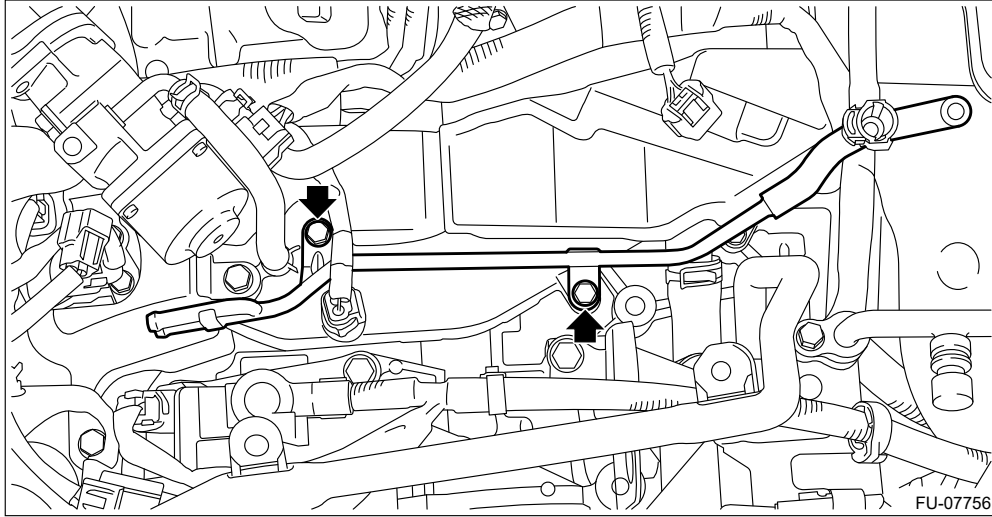
(a) Slider



27. Remove the intake manifold from the air intake adapter together with the tumble generator valve assembly.



28. Remove the vacuum hose assembly from the water pipe assembly.

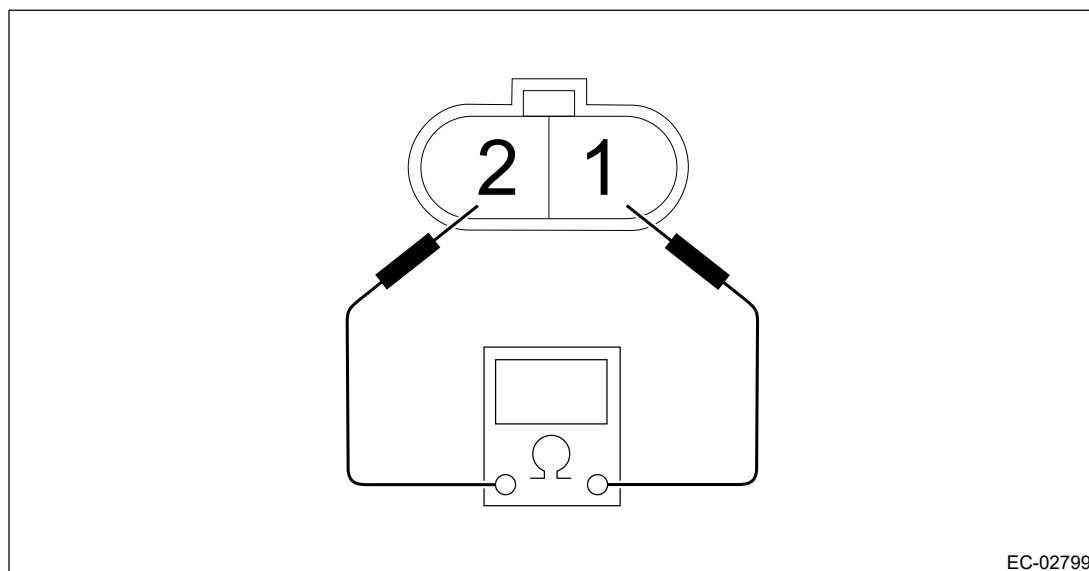


FU-07756

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Knock Sensor

INSPECTION

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



| Terminal No. | Standard |
|--------------|-----------|
| 1 and 2 | 560±28 kΩ |

INSTALLATION

1. RH SIDE

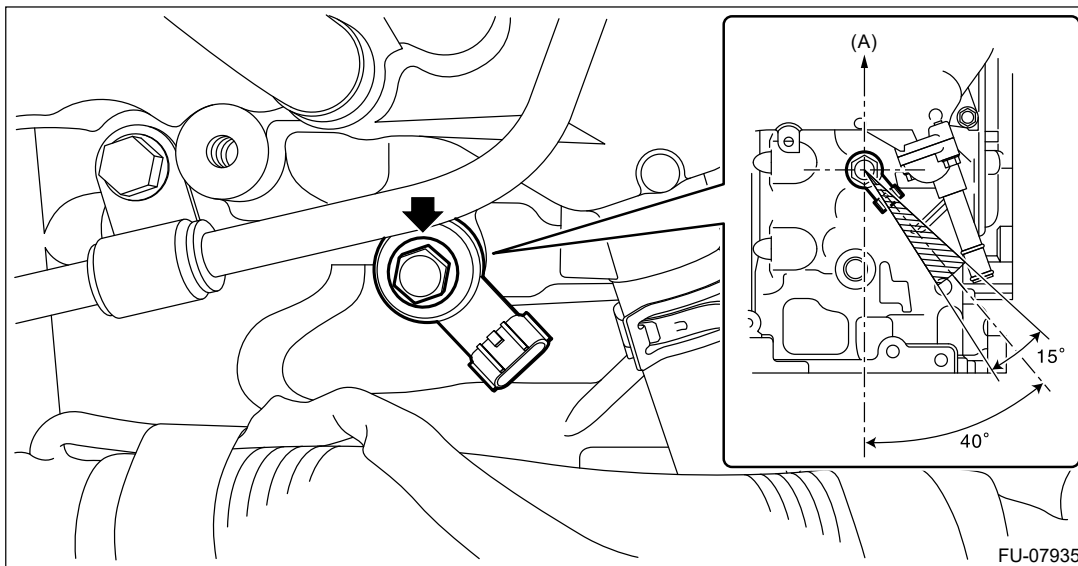
1. Install the knock sensor to the cylinder block.

Note:

The knock sensor should be installed so that the center of the connector is positioned at a 32.5–47.5° angle relative to the rear of engine.

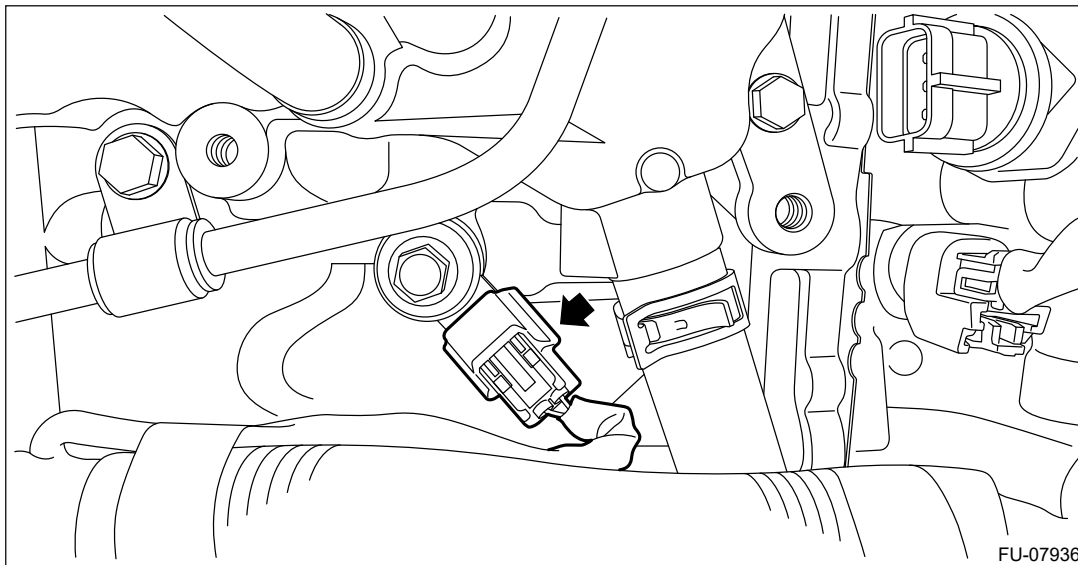
Tightening torque:



24 N·m (2.4 kgf-m, 17.7 ft-lb)



(A) Front of engine

2. Connect the connector to the knock sensor.



3. Install the fuel pipe insulator No.3.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Insulator>INSTALLATION > FUEL PIPE INSULATOR NO. 3.](#)
4. Install the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake](#)

Manifold>INSTALLATION.

5. Connect the battery ground terminal.
6. Install the collector cover.

2. LH SIDE

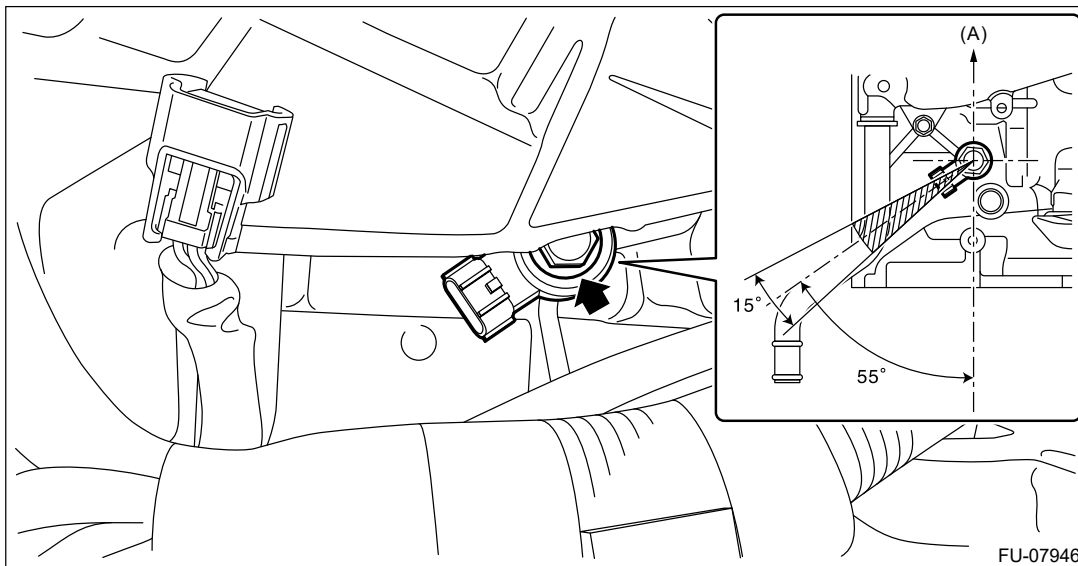
1. Install the knock sensor to the cylinder block.

Note:

The knock sensor should be installed so that the center of the connector is positioned at a 47.5–62.5° angle relative to the rear of engine.

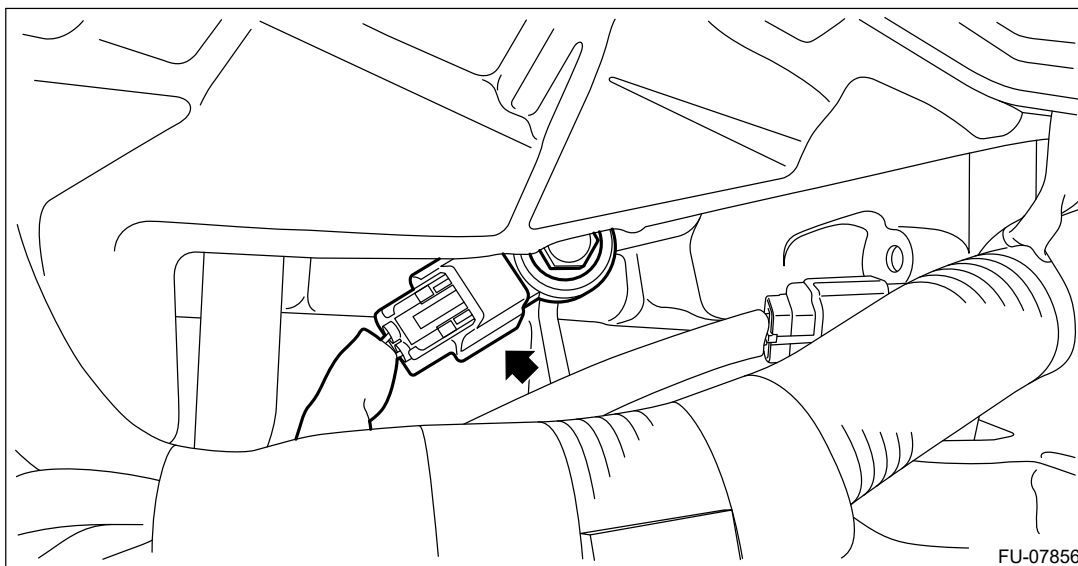
Tightening torque:

24 N·m (2.4 kgf-m, 17.7 ft-lb)



(A) Front of engine

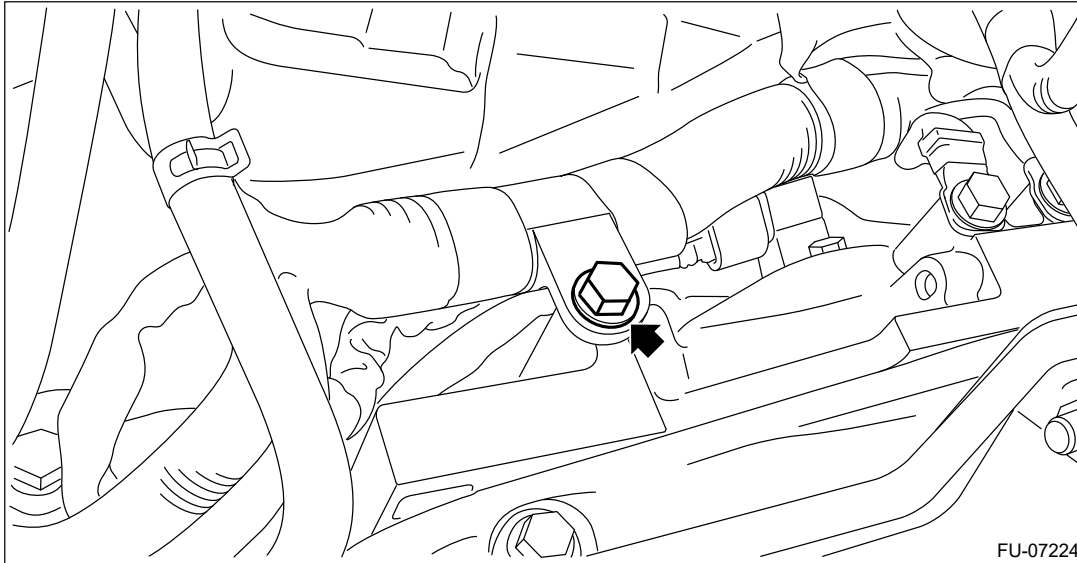
2. Connect the connector to the knock sensor.





3. Install the bolts securing the engine harness.

Tightening torque:

19 N·m (1.9 kgf-m, 14.0 ft-lb)



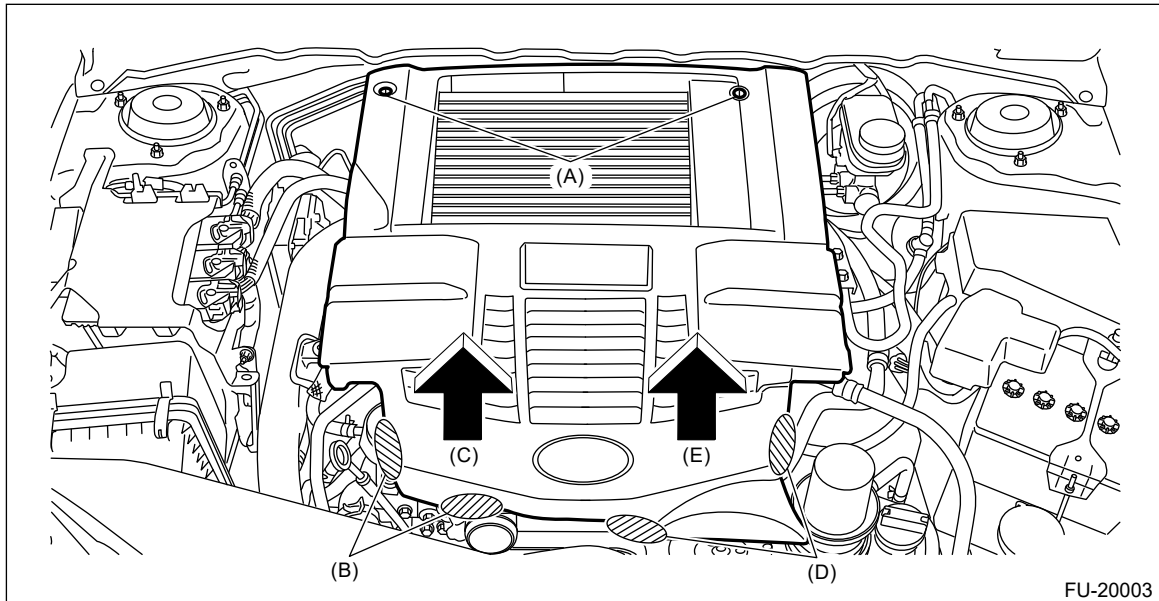
- 4.** Install the throttle body.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Throttle Body>INSTALLATION.](#)
- 5.** Install the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>INSTALLATION.](#)
- 6.** Connect the battery ground terminal.
- 7.** Install the collector cover.



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Knock Sensor

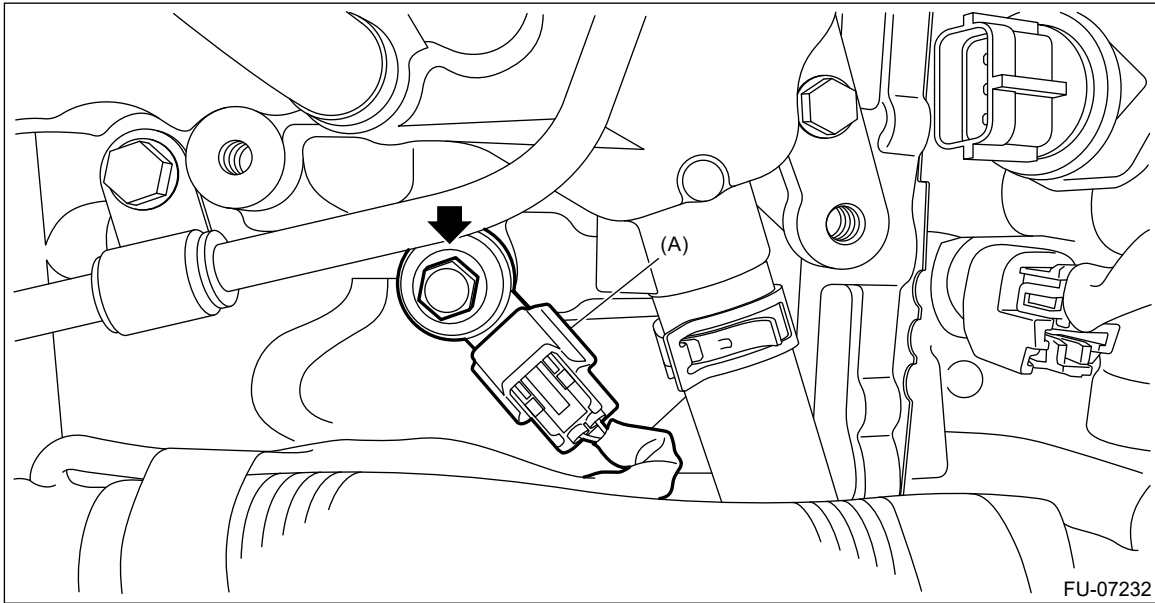
REMOVAL

1. RH SIDE

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



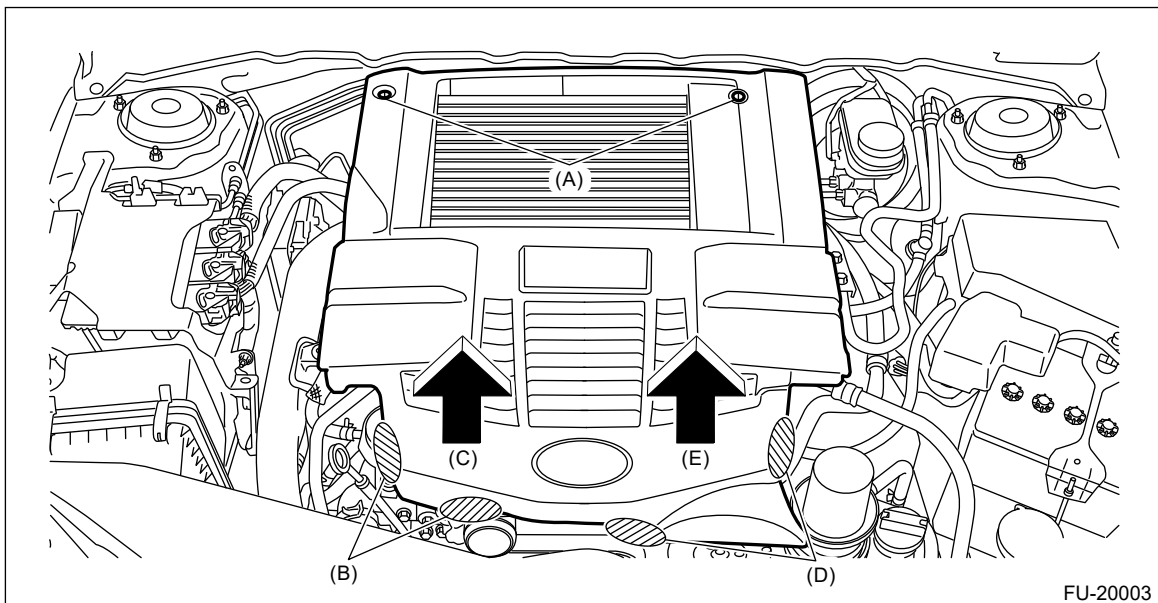
2. Disconnect the ground cable from battery.
3. Remove the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
4. Remove the fuel pipe insulator No. 3.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Insulator>REMOVAL > FUEL PIPE INSULATOR NO. 3.](#)
5. Disconnect the connector (A) from the knock sensor, and remove the knock sensor from the cylinder block.





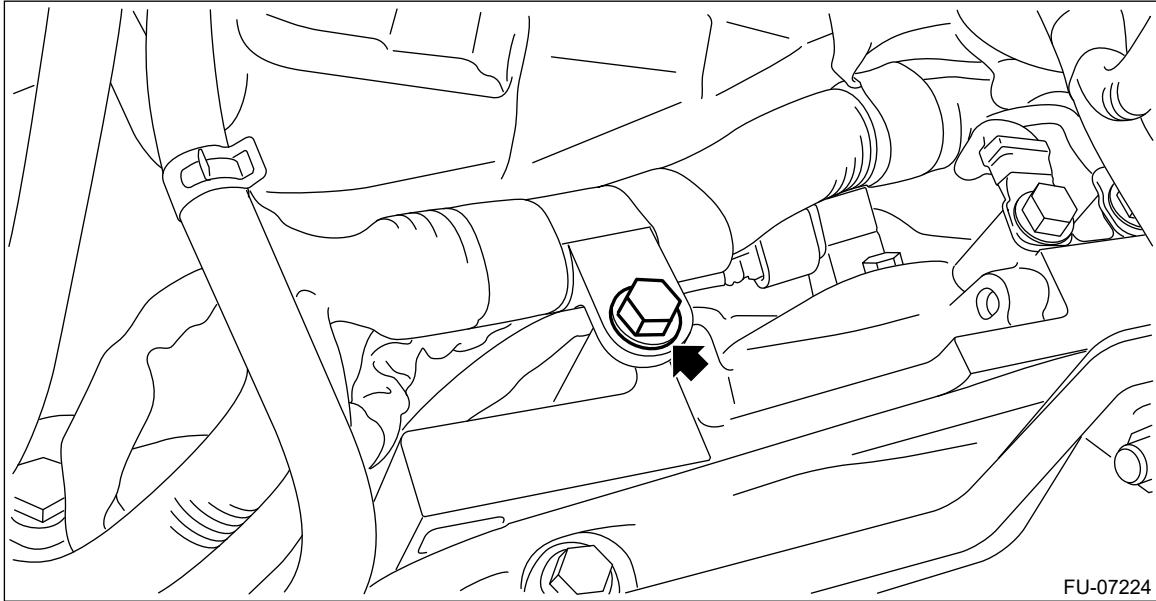
2. LH SIDE

1. Remove the collector cover.

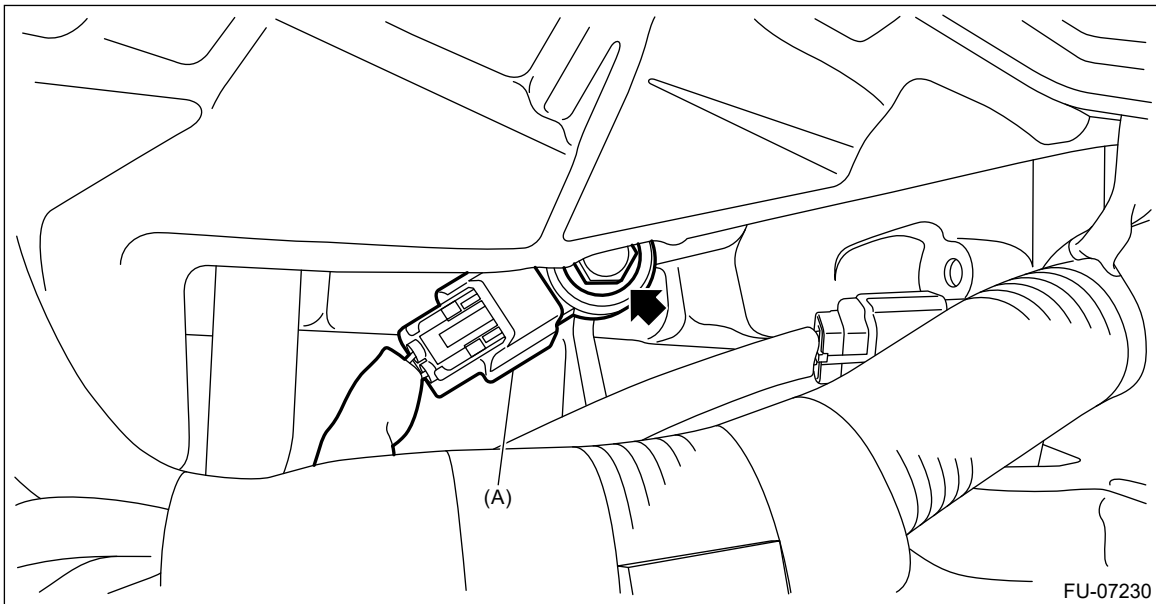
- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Disconnect the ground cable from battery.
3. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
4. Remove the throttle body.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Throttle Body>REMOVAL.](#)
5. Remove the bolts securing the engine harness.



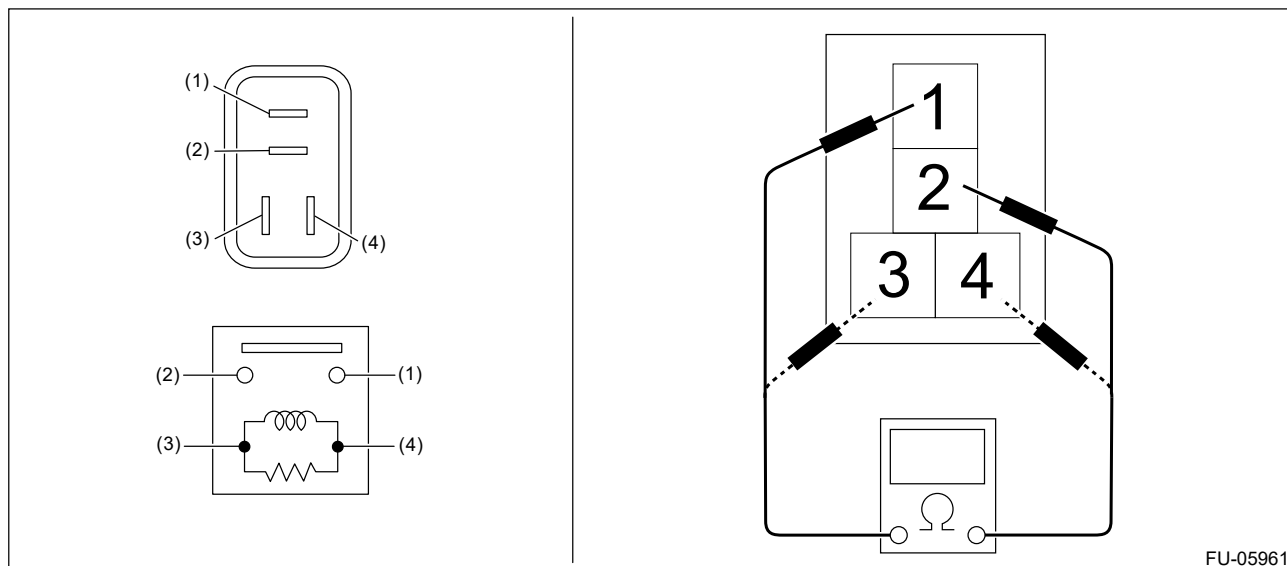
- 6.** Disconnect the connector (A) from the knock sensor, and remove the knock sensor from the cylinder block.



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Main Relay

INSPECTION

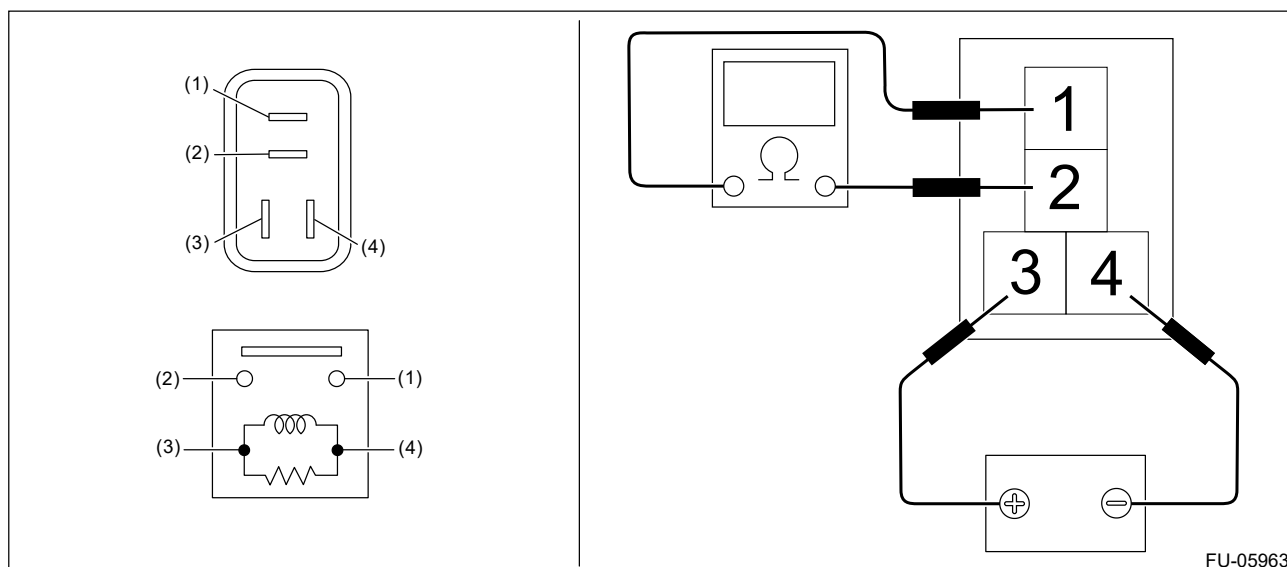
1. Check that the main relay has no deformation, cracks or other damages.
2. Measure the resistance between main relay terminals.



FU-05961

| Terminal No. | Standard |
|--------------|---|
| 1 and 2 | 1 M Ω or more |
| 3 and 4 | 130.4–230.8 Ω (when 20°C (68°F)) |

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



FU-05963

| Terminal No. | Standard |
|--------------|----------------------|
| 1 and 2 | Less than 1 Ω |


FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Main Relay

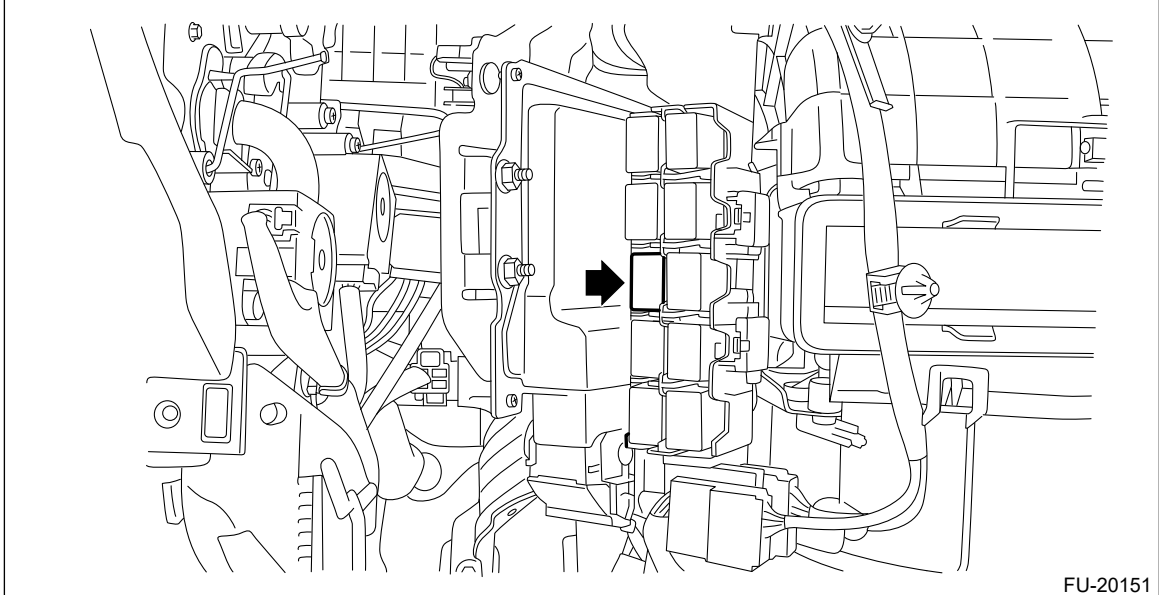
INSTALLATION

Install in the reverse order of removal.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Main Relay

REMOVAL

1. Disconnect the ground cable from battery.
2. Remove the glove box.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>REMOVAL.](#)
3. Remove the main relay.



FU-20151

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Manifold Absolute Pressure and Intake Air Temperature Sensor

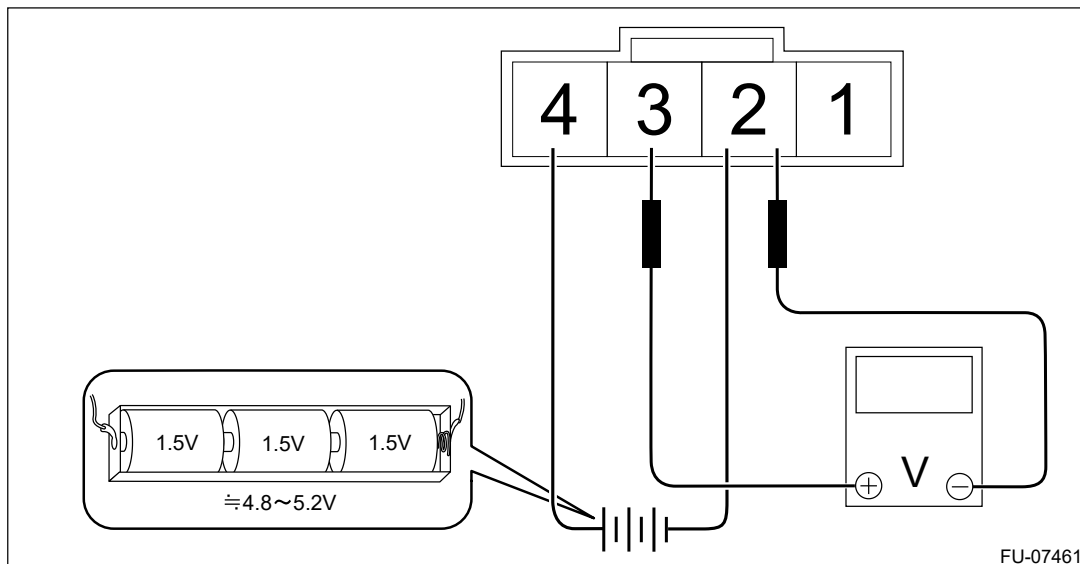
INSPECTION

1. CHECK MANIFOLD ABSOLUTE PRESSURE SENSOR

1. Connect dry-cell battery positive terminal to terminal No. 4 and dry-cell battery ground terminal to terminal No. 2, circuit tester positive side to terminal No. 3 and the circuit tester ground side to terminal No. 2.

Note:

- Use new dry-cell batteries.
- Using a circuit tester, check that the initial voltage of each dry-cell battery is 1.6 V or more. And also check that the voltage of three batteries in series is between 4.8 –5.2 V.
- For power supply, 5 V DC constant voltage power source can also be used.



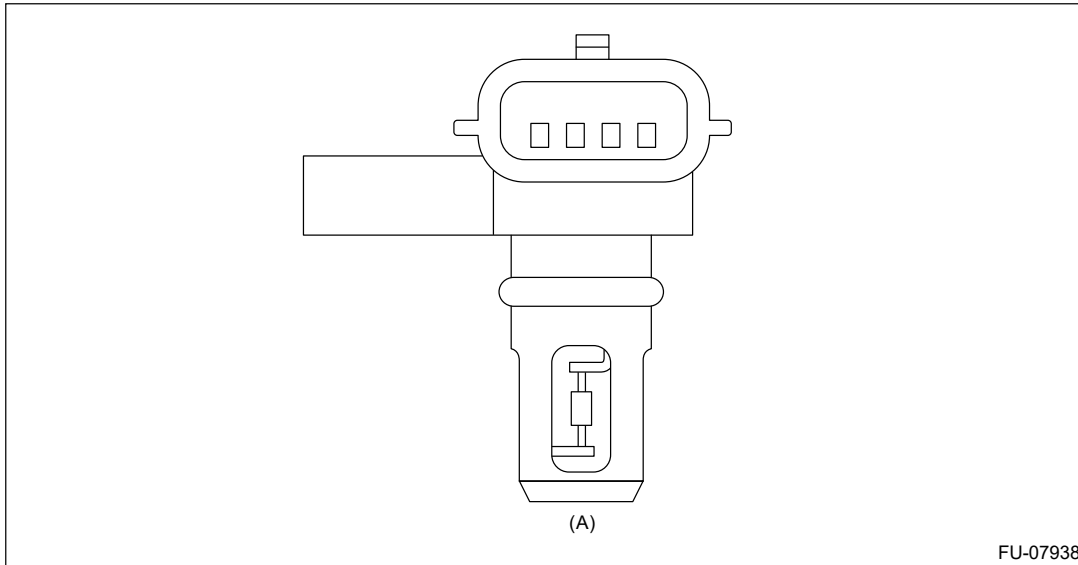
2. Check the voltage at a normal atmospheric pressure.

Note:

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

| Terminal No. | Standard |
|-----------------|--------------------------------|
| 3 (+) and 2 (-) | Approx. 2 V (when 25°C (77°F)) |

3. Connect the Mighty Vac to the pressure port (A).



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

Caution:

Do not apply a vacuum that exceeds -88 kPa (-0.9 kg/cm^2 , -12.8 psi). Doing so may damage the manifold absolute pressure sensor.

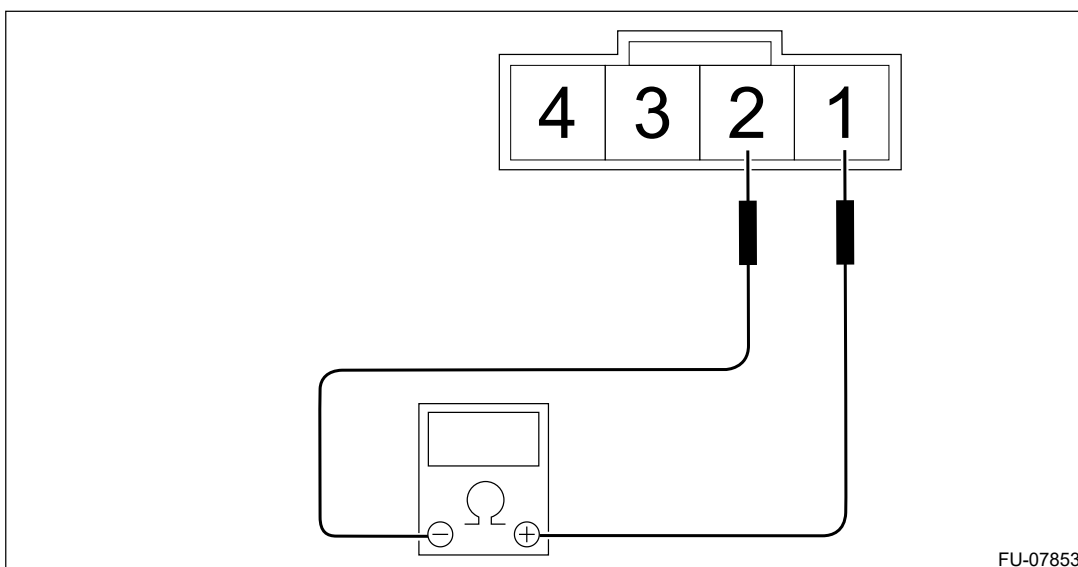
Note:

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

| Pressure | Terminal No. | Standard |
|--|-----------------|--|
| -88 kPa (-0.9 kg/cm^2 , -12.8 psi) | 3 (+) and 2 (-) | Approx. 1 V (when 25°C (77°F)) |

2. CHECK MANIFOLD TEMPERATURE SENSOR UNIT

1. Measure the resistance between engine coolant temperature sensor terminals.



| Temperature | Terminal No. | Standard |
|-------------|--------------|----------|
| | | |

| | | |
|--------------|---------|----------------------|
| -20°C (-4°F) | 1 and 2 | Approx. 14.7±2.2 kΩ |
| 25°C (77°F) | | Approx. 2.0±0.2 kΩ |
| 60°C (140°F) | | Approx. 0.59±0.09 kΩ |

3. OTHER INSPECTIONS

Check that the manifold pressure & intake air temperature sensor has no deformation, cracks or other damages.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Manifold Absolute Pressure and Intake Air Temperature Sensor

INSTALLATION

Install in the reverse order of removal.

Note:

Use new O-rings.

Tightening torque:

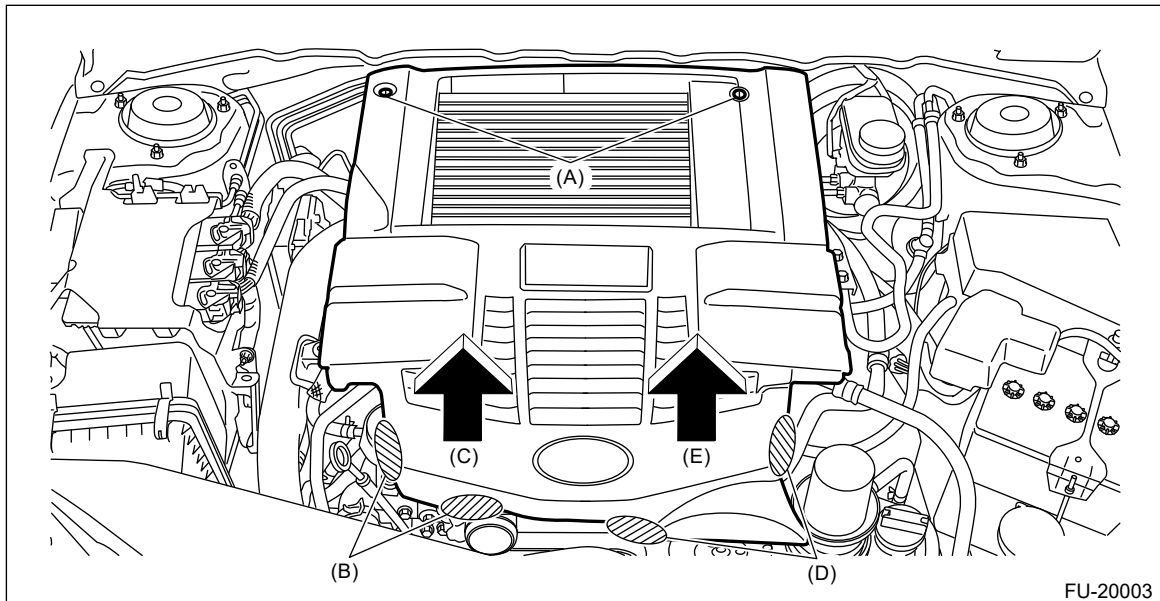
3.5 N·m (0.4 kgf-m, 2.6 ft-lb)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Manifold Absolute Pressure and Intake Air Temperature Sensor

REMOVAL

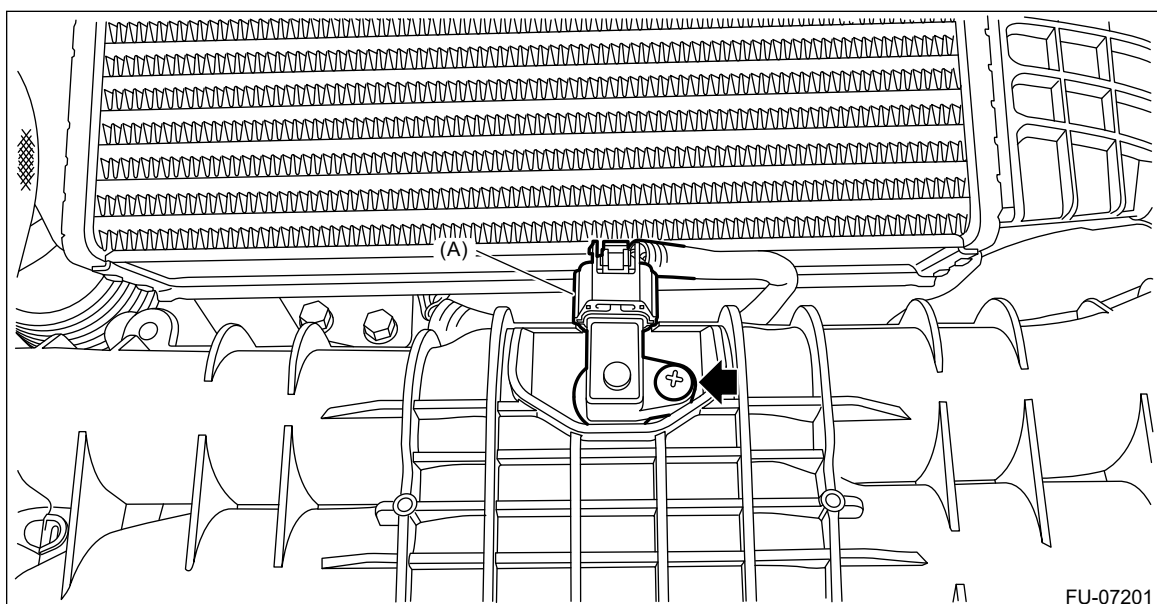
1. Remove the collector cover.

- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Disconnect the ground cable from battery.

3. Disconnect the connector (A) from the manifold absolute pressure & intake air temperature sensor, and remove the manifold absolute pressure & intake air temperature sensor from the intake manifold.

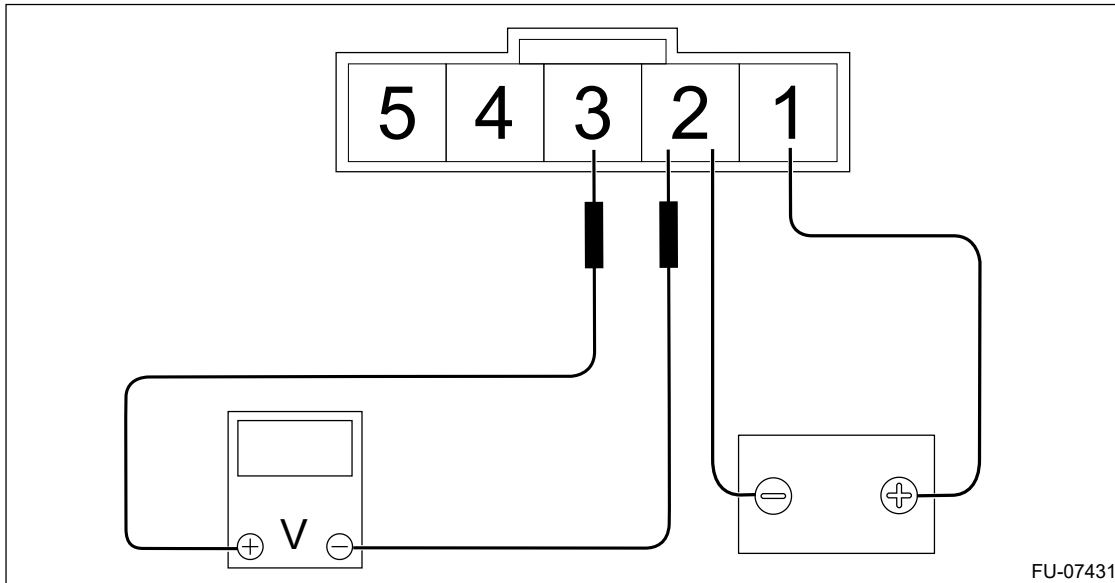


FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Mass Air Flow and Intake Air Temperature Sensor

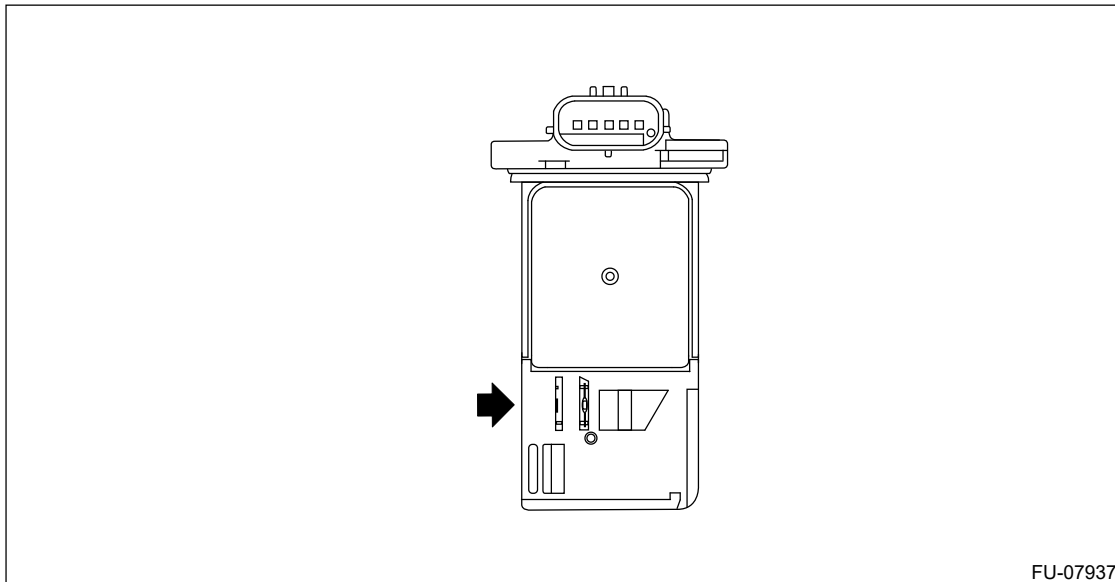
INSPECTION

1. CHECK THE MASS AIR FLOW SENSOR UNIT

1. Connect the battery positive terminal to terminal No.1 and the battery ground terminal to terminal No.2, the circuit tester positive terminal to terminal No.3 and the circuit tester ground terminal to terminal No.2.

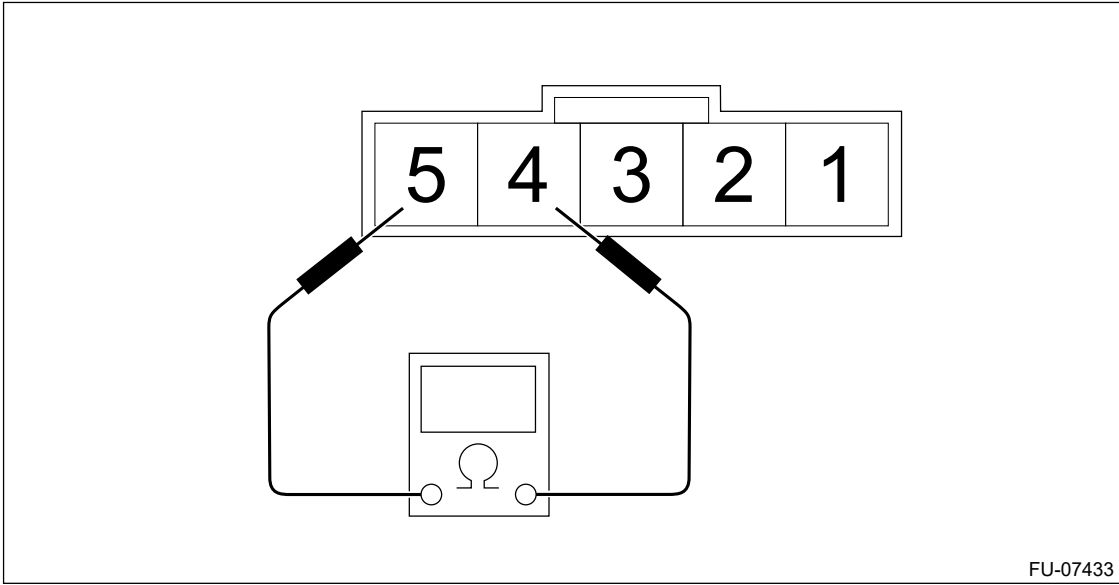


2. Check the voltage changes when air is blown to the mass air flow sensor unit in arrow direction.



2. CHECK THE INTAKE AIR TEMPERATURE SENSOR UNIT

Measure the resistance between intake air temperature sensor terminals.



| Temperature | Terminal No. | Standard |
|--------------|--------------|--------------|
| -20°C (-4°F) | 4 and 5 | 14.7±2.2 kΩ |
| 25°C (77°F) | | 2.0±0.2 kΩ |
| 60°C (140°F) | | 0.59±0.09 kΩ |

3. OTHER INSPECTIONS

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

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Mass Air Flow and Intake Air Temperature Sensor

INSTALLATION

Install in the reverse order of removal.

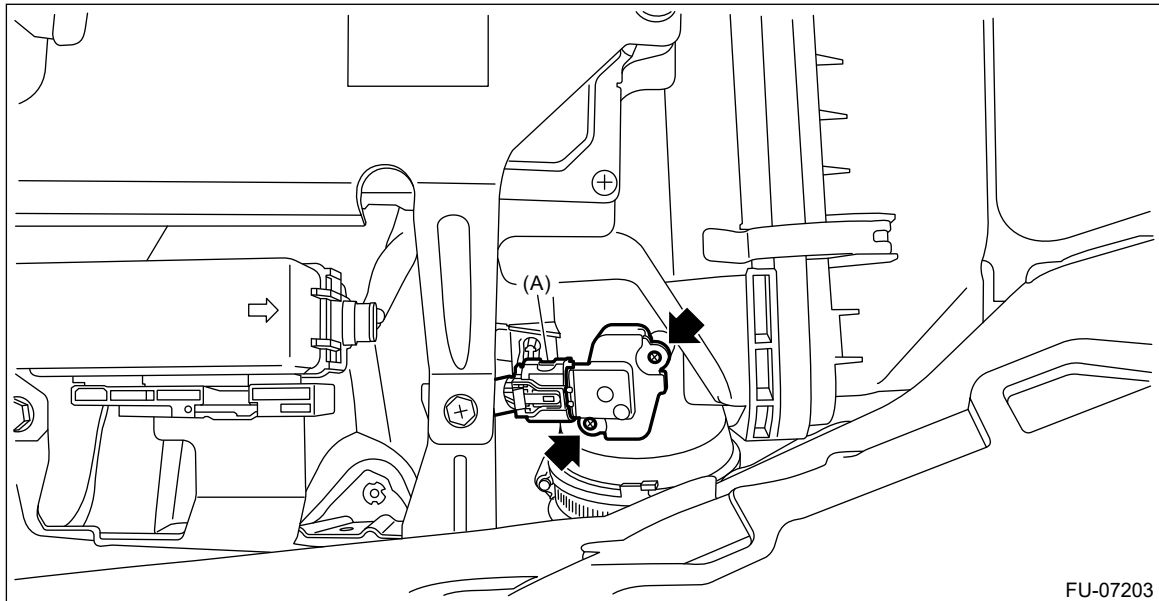
Tightening torque:

1 N·m (0.1 kgf-m, 0.7 ft-lb)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Mass Air Flow and Intake Air Temperature Sensor

REMOVAL

1. Disconnect the ground cable from battery.
2. Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the mass air flow and intake air temperature sensor.

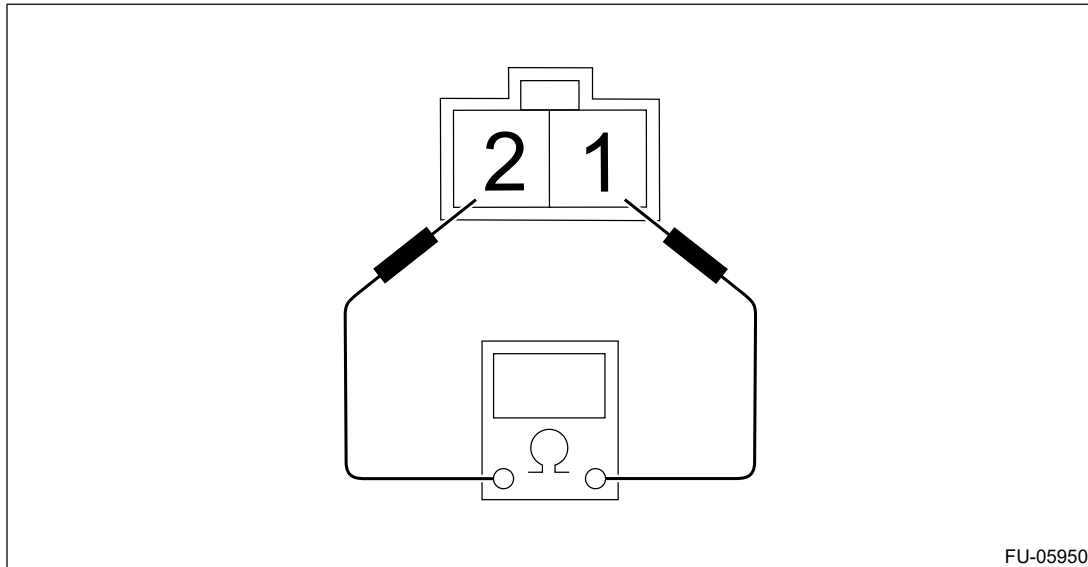


FU-07203

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Oil Control Solenoid

INSPECTION

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



| Terminal No. | Standard |
|--------------|-------------------------------|
| 1 and 2 | 7.25±0.4 Ω (when 20°C (68°F)) |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Oil Control Solenoid

INSTALLATION

Install in the reverse order of removal.

Note:

- **Use new O-rings.**
- **Apply engine oil to O-ring.**

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)


FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Oil Control Solenoid

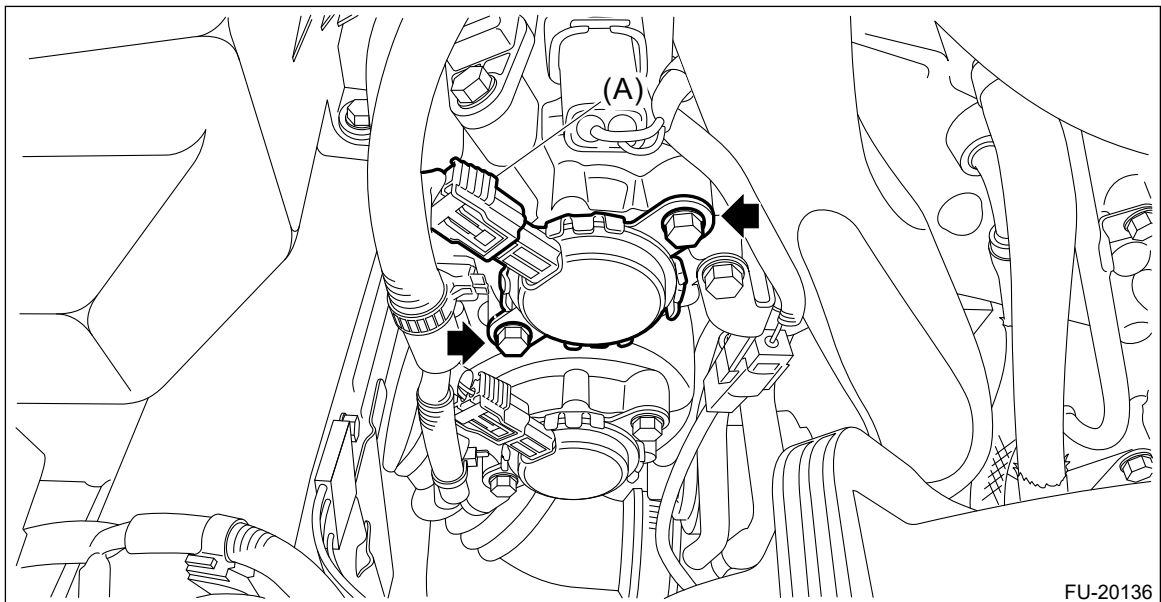
REMOVAL

Caution:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emission of smoke or causing a fire.

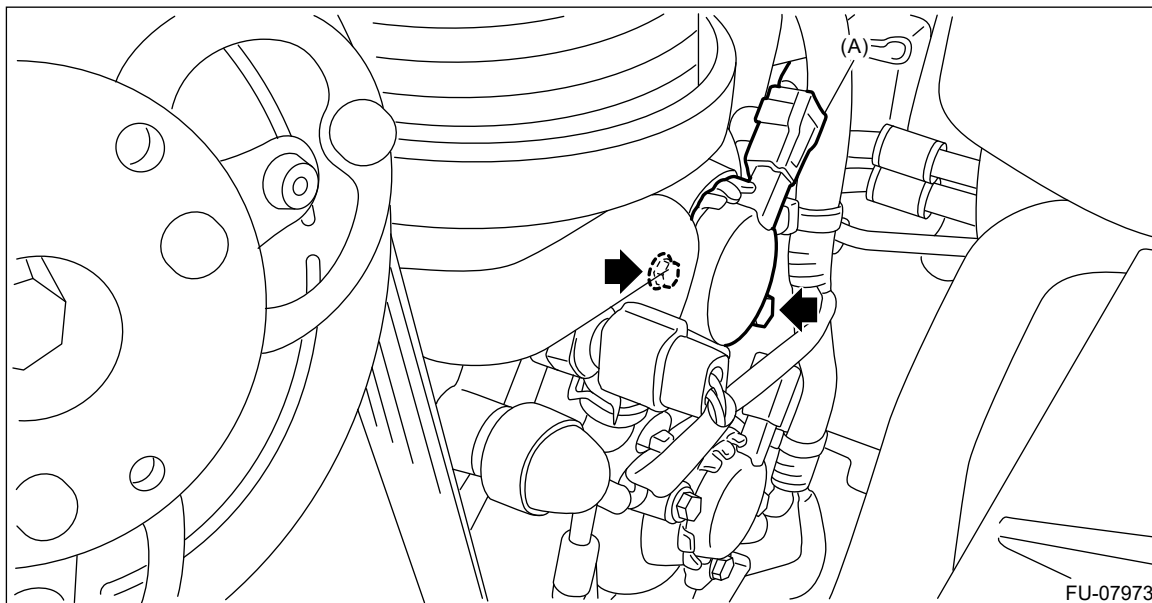
1. INTAKE SIDE

1. Disconnect the ground cable from battery.
2. Remove the air intake duct (rear). (RH side only)  [Ref. to INTAKE \(INDUCTION\) \(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
3. Disconnect the connector (A) from the oil control solenoid, and remove the oil control solenoid from the chain cover.
 - RH side




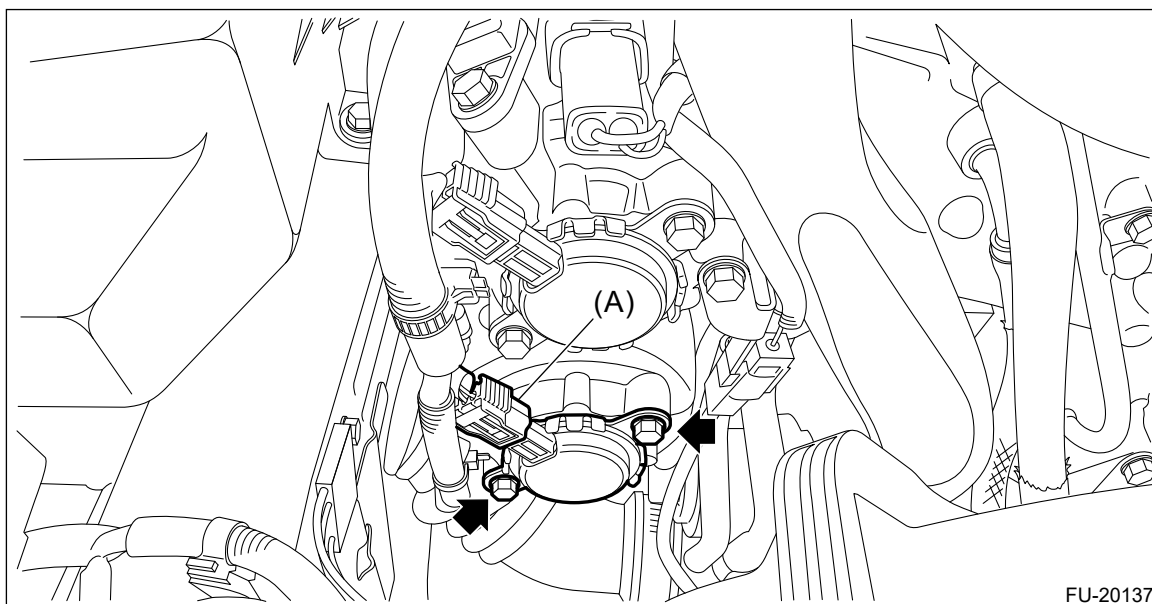
FU-20136

- LH side

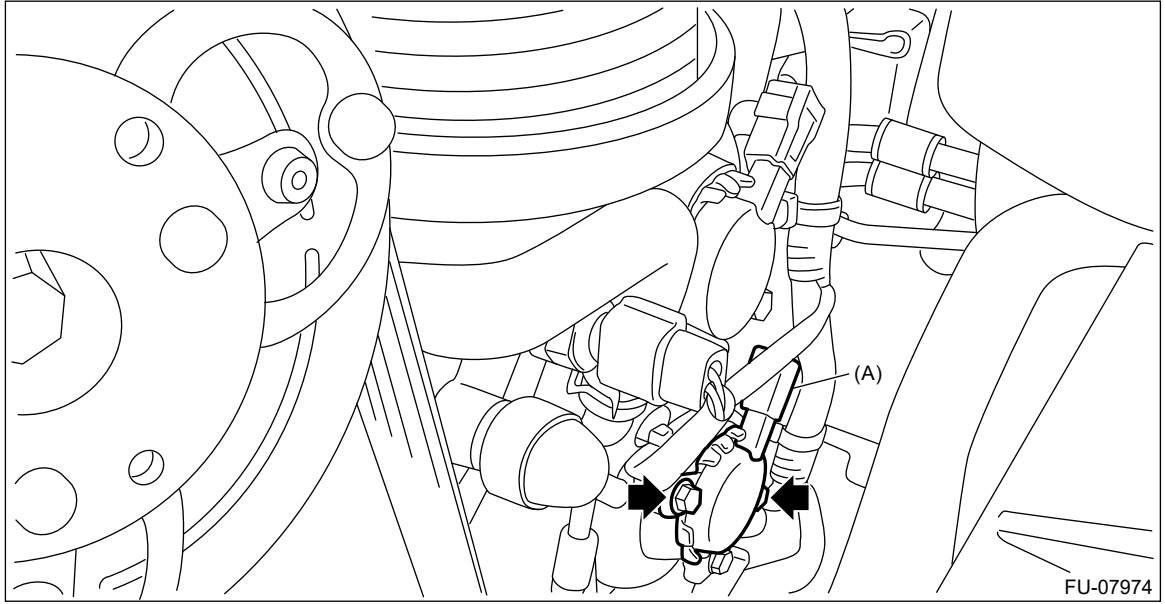


2. EXHAUST SIDE

1. Disconnect the ground cable from battery.
2. Remove the air intake duct (rear). (RH side only)  [Ref. to INTAKE \(INDUCTION\) \(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
3. Disconnect the connector (A) from the oil control solenoid, and remove the oil control solenoid from the chain cover.
 - RH side



- LH side

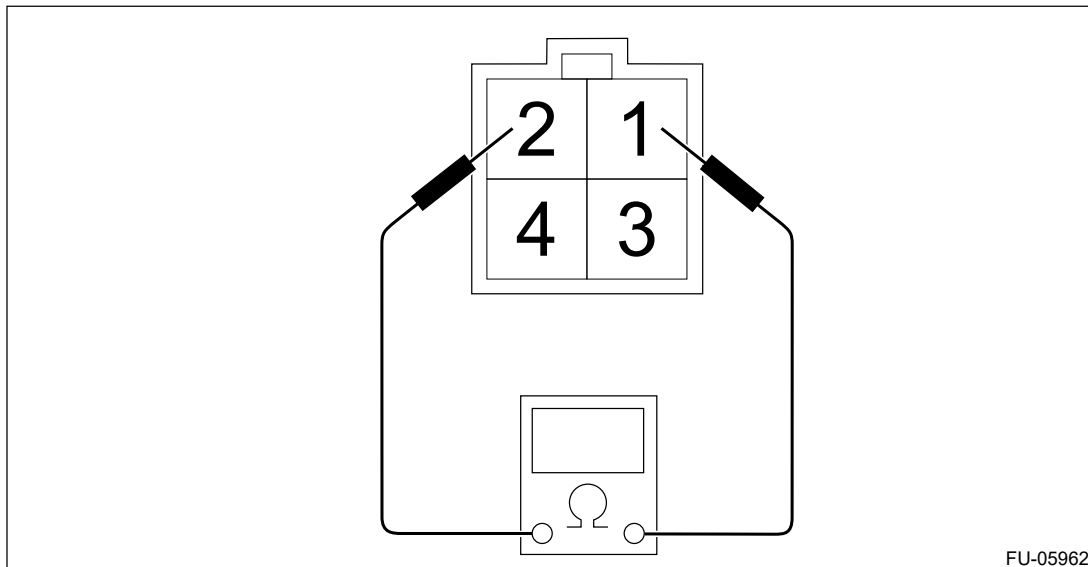


FU-07974

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Rear Oxygen Sensor

INSPECTION

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



| Terminal No. | Standard |
|--------------|--|
| 1 and 2 | $13.0^{+1.5}_{-1.3} \Omega$ (when 20°C (68°F)) |

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Rear Oxygen Sensor

INSTALLATION

Caution:

If lubricant is spilled over the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

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

Caution:

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

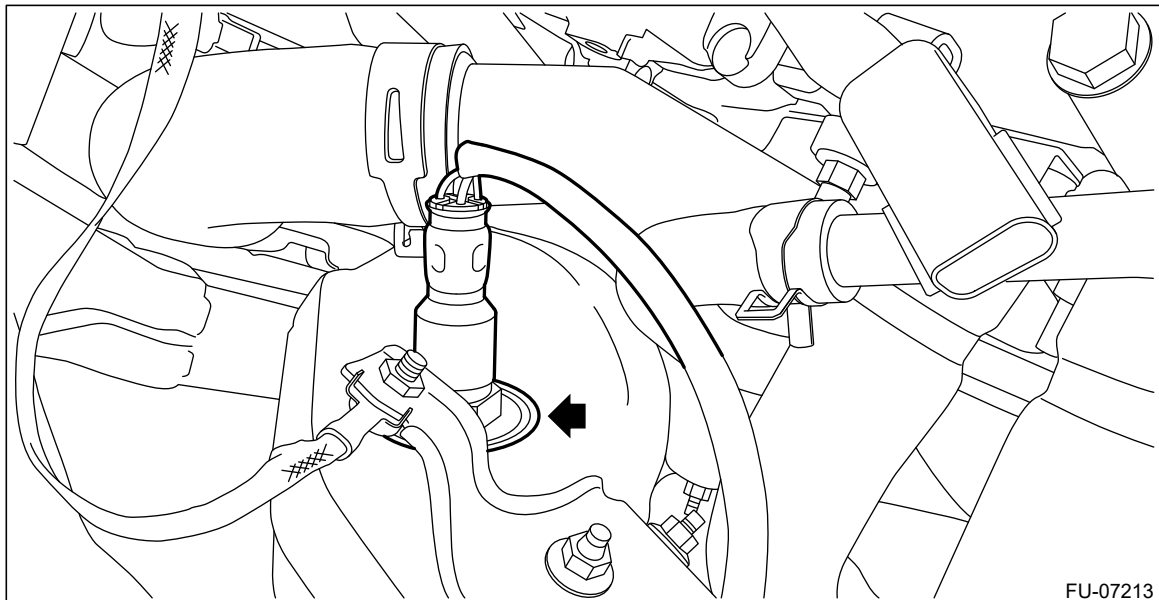
Anti-seize compound:

NEVER-SEEZ NSN, JET LUBE SS-30 or equivalent

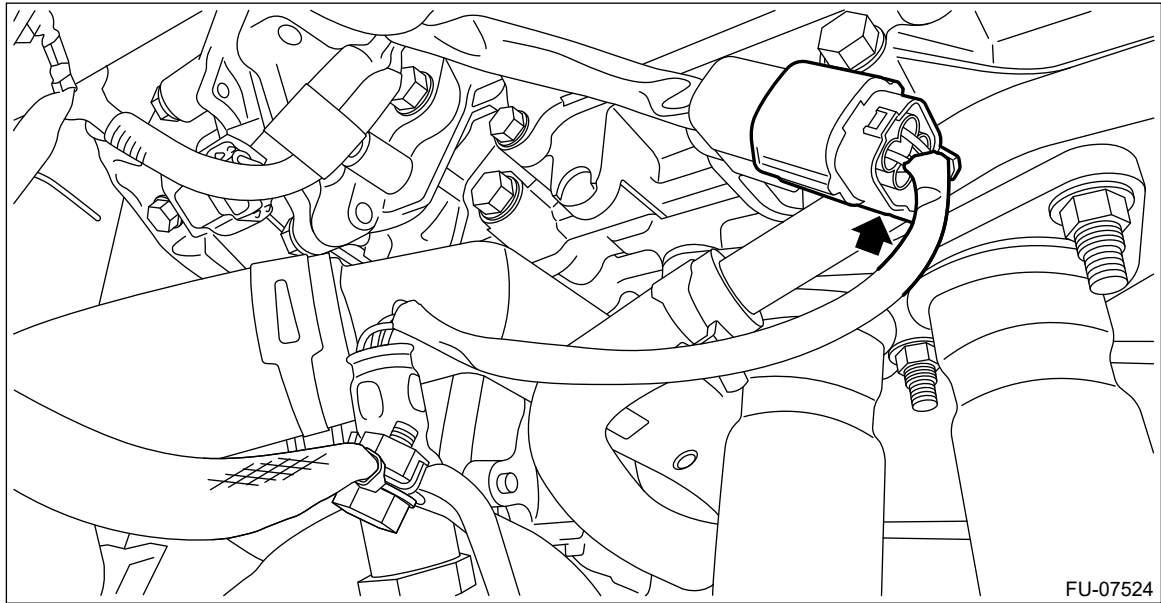
2. Install the rear oxygen sensor.


Tightening torque:

30 N·m (3.1 kgf-m, 22.1 ft-lb)




3. Connect the rear oxygen sensor connector to the engine harness.

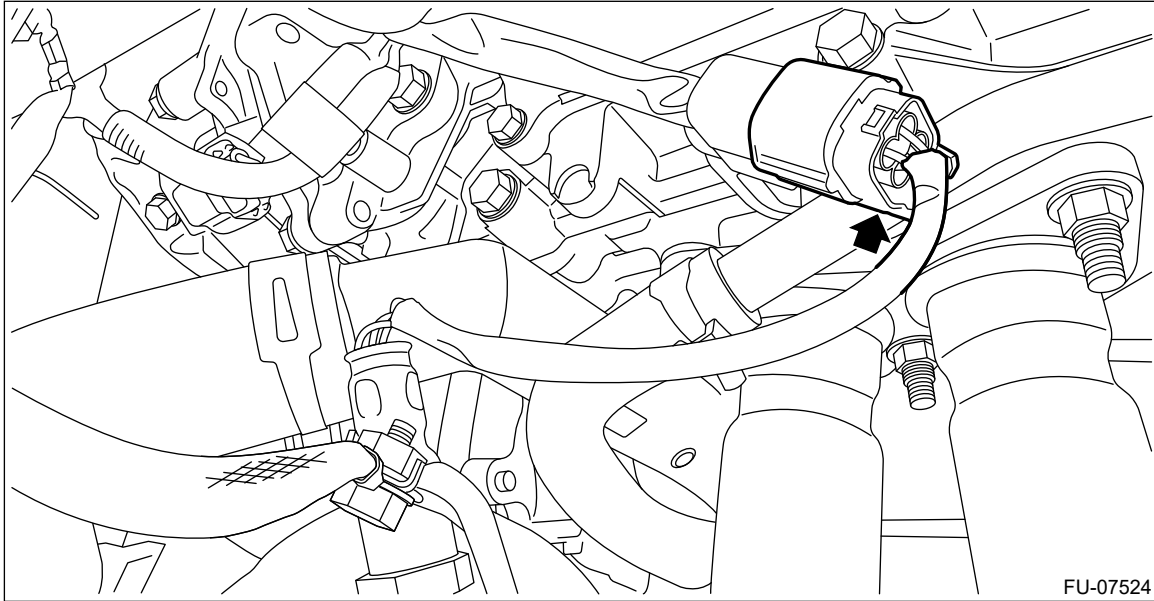


- 4.** Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
- 5.** Lower the vehicle.
- 6.** Connect the battery ground terminal.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Rear Oxygen Sensor

REMOVAL

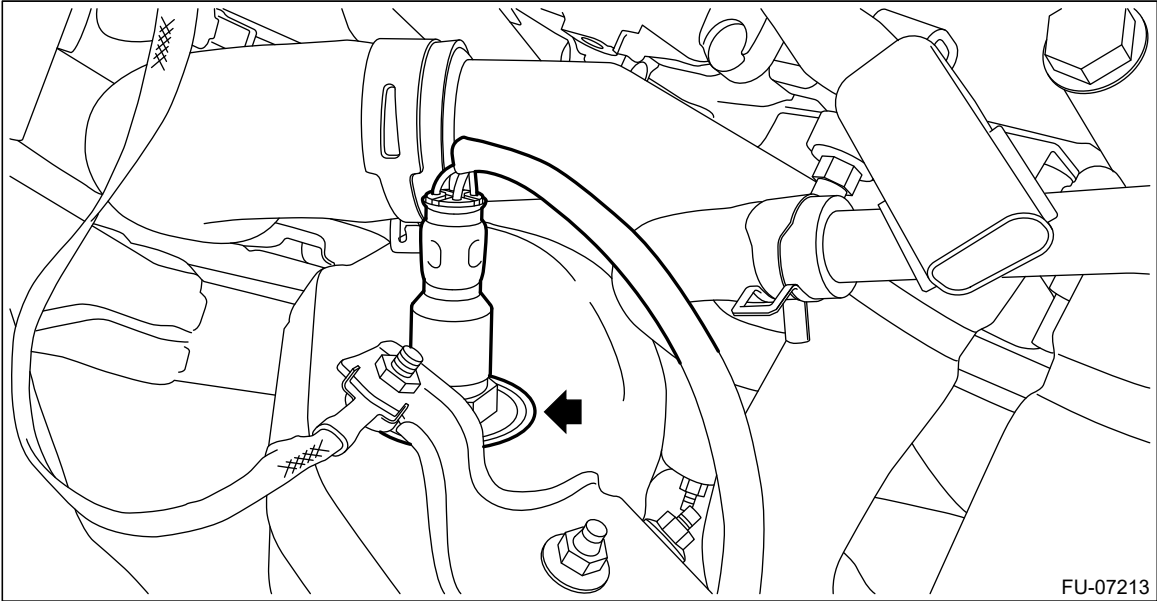
1. Disconnect the ground cable from battery.
2. Lift up the vehicle.
3. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
4. Disconnect the connector on the rear oxygen sensor from the engine harness.



5. Apply spray-type lubricant (004301003) to the threaded portion of rear oxygen sensor, and leave it for one minute or more.
6. Remove the rear oxygen sensor.

Caution:

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






FU-07213

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > SI-DRIVE (SUBARU Intelligent Drive) Selector

SPECIFICATION

SI-DRIVE (SUBARU Intelligent Drive) selector is integrated as a unit with the cruise control command switch.

For removal and installation, refer to "Cruise Control Command Switch". For inspection, refer to "Switches and Harness".  [Ref. to CRUISE CONTROL SYSTEM>Cruise Control Command Switch>REMOVAL.](#)  [Ref. to CRUISE CONTROL SYSTEM>Cruise Control Command Switch>INSTALLATION.](#)  [Ref. to EyeSight>Switches and Harness>INSPECTION.](#)

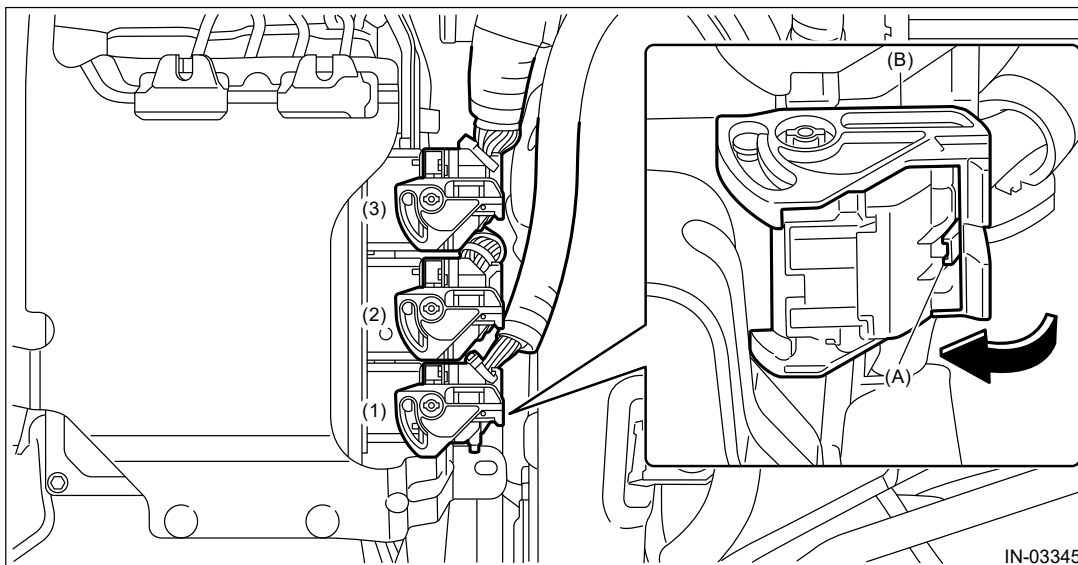
INSPECTION


1. THROTTLE SENSOR (METHOD WITH CIRCUIT TESTER)

Note:

Individual difference of the accelerator pedal may not be corrected sufficiently on the ECM side after DTCs were cleared or the battery was removed and installed on the vehicle. Therefore, when the reference voltage is not reached after following the procedure, repeat the ignition switch ON (engine OFF) and ignition switch OFF operations 40 times at intervals of three seconds or more, and then measure the voltage again.

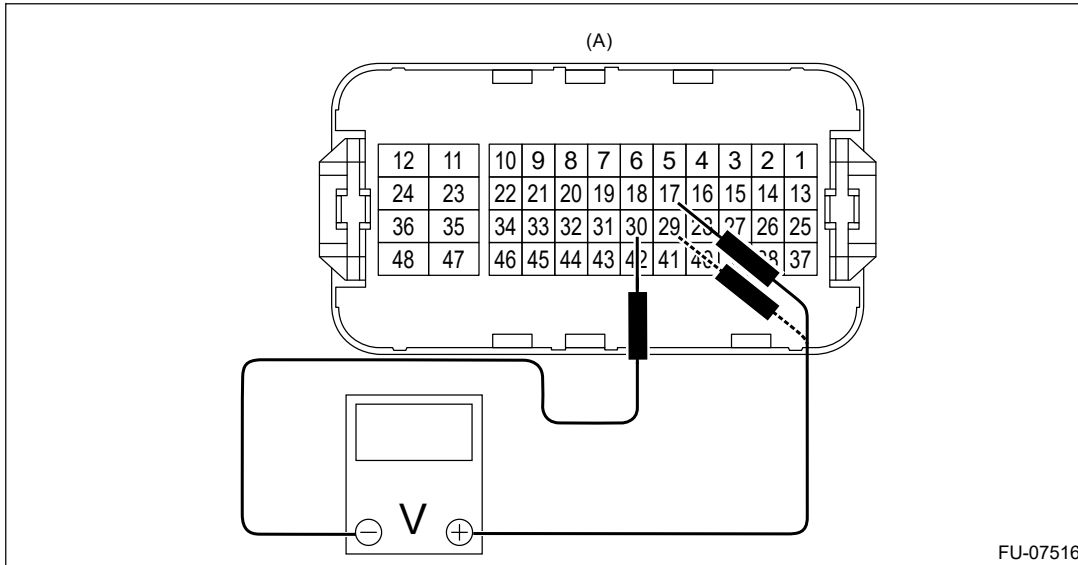
1. Disconnect the ground cable from battery.
2. While pressing the section (A) shown in the figure, move the lock lever (B) in the direction of the arrow to disconnect the connectors from the ECM in numerical order as shown in the figure.



3. Install the special tool between the ECM and body harness and the engine harness.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>General Description>CAUTION.](#)

ST 18460AA030 CHECK BOARD

4. Connect the battery ground terminal.
5. After warming-up the engine, turn the ignition switch to OFF.
6. Turn the ignition switch to ON. (engine OFF)
7. Measure the voltage between ECM connector terminals using ST.



(A) To the check board connector
(ECM connector)

| Throttle sensor | Accelerator pedal | Terminal No. | Standard |
|-----------------|-----------------------------|-------------------|---------------|
| Main | Not depressed (full closed) | 17 (+) and 30 (-) | Approx. 0.7 V |
| | Depressed (full opened) | | Approx. 3.9 V |
| [Sub] | Not depressed (full closed) | 29 (+) and 30 (-) | Approx. 4.4 V |
| | Depressed (full opened) | | Approx. 1.1 V |

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

2. THROTTLE SENSOR (METHOD WITH SUBARU SELECT MONITOR)

Note:

- Individual difference of the accelerator pedal may not be corrected sufficiently on the ECM side after DTCs were cleared or the battery was removed and installed on the vehicle. Therefore, using the Subaru Select Monitor, check that the accelerator opening angle signal indicates 100%, when the accelerator pedal is fully depressed, and then perform the inspection.
- If the accelerator opening angle signal does not indicate 100%, check the accelerator pedal. Ref. to [SPEED CONTROL SYSTEMS\(H4DO\)>Accelerator Pedal>INSPECTION.](#)

1. After warming-up the engine, turn the ignition switch to OFF.
2. Turn the ignition switch to ON. (engine OFF)
3. While reading the accelerator opening angle signal and throttle sensor voltage using Subaru Select Monitor, depress the accelerator pedal to fully open and fully closed. Ref. to [ENGINE \(DIAGNOSTICS\)\(H4DO\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Note:

Due to the specification of the Subaru Select Monitor, value read from the accelerator opening angle signal is highlighted and displayed as the voltage readings of sub throttle sensor.

| | | |
|--|--|--|
| | | |
|--|--|--|

| Throttle sensor | Acceleration opening angle signal | Standard |
|-----------------|-----------------------------------|---------------|
| Main | 0.0% | Approx. 0.7 V |
| | 100.0% | Approx. 3.9 V |
| [Sub] | 0.0% | Approx. 1.1 V |
| | 100.0% | Approx. 4.4 V |

3. OTHER INSPECTIONS

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

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Throttle Body

INSTALLATION

Install in the reverse order of removal.

Note:

Use a new gasket.

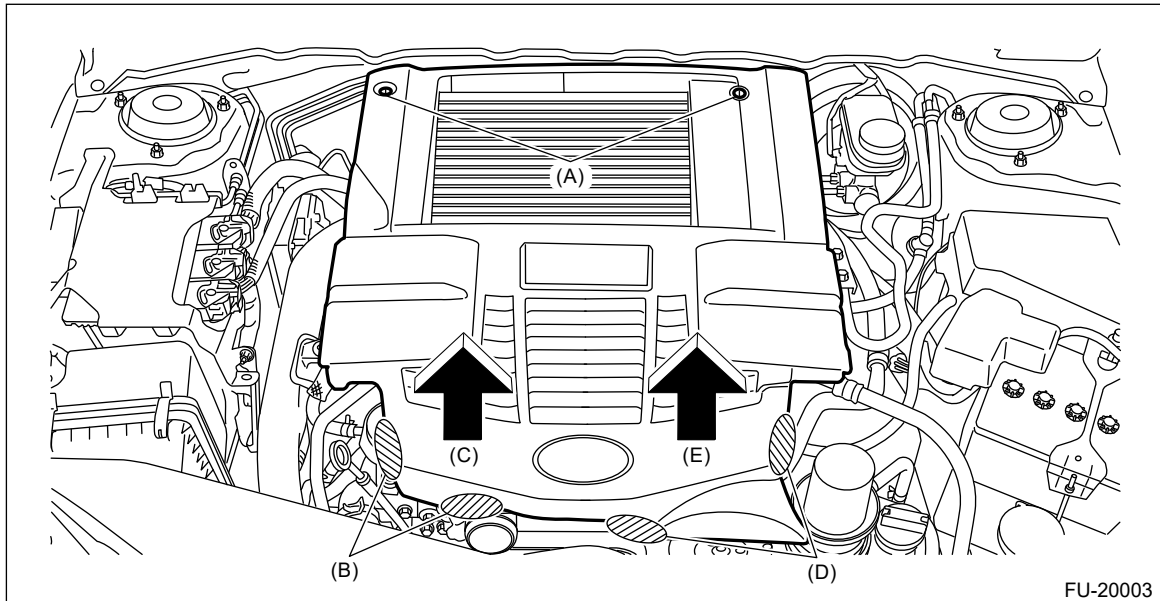
Tightening torque:





8 N·m (0.8 kgf-m, 5.9 ft-lb)

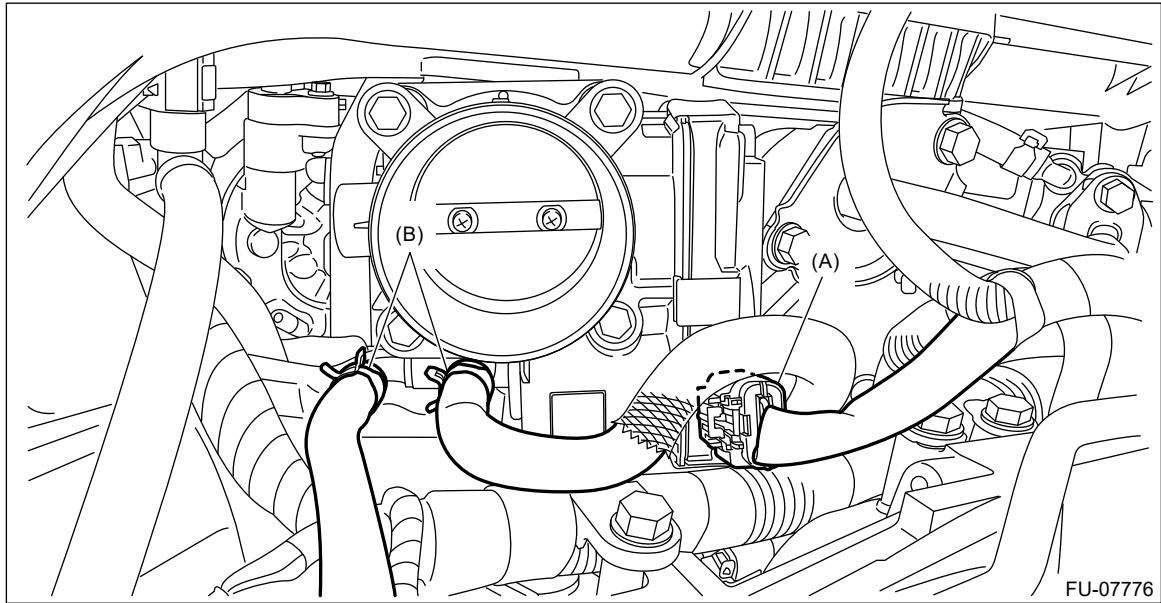
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Throttle Body

REMOVAL

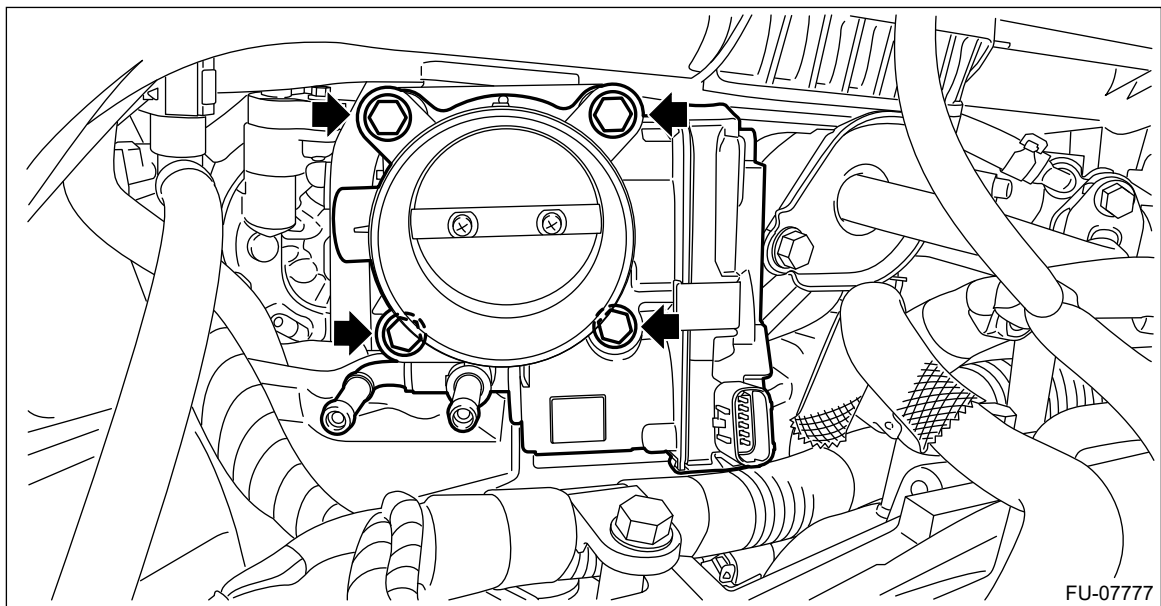
1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Disconnect the ground cable from battery.
3. Lift up the vehicle.
4. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
5. Drain approximately 3.0 L (3.2 US qt, 2.6 Imp qt) of coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
6. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
7. Remove the intake duct No. 3.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 3.](#)
8. Disconnect the connector (A) from the throttle position sensor, and disconnect the preheater hose (B) from the throttle body.





9. Remove the throttle body from the intake manifold.



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Throttle Position Sensor

SPECIFICATION



Throttle body is a non-disassembled part, so do not remove the throttle position sensor from throttle body.

Refer to "Throttle Body" for removal and installation procedure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Throttle Body>REMOVAL.](#)  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Throttle Body>INSTALLATION.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Tumble Generator Valve Actuator

SPECIFICATION

The tumble generator valve assembly cannot be disassembled.

Refer to "Tumble Generator Valve Assembly" for removal and installation procedures.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Tumble Generator Valve Assembly>REMOVAL.](#)  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Tumble Generator Valve Assembly>INSTALLATION.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Tumble Generator Valve Assembly

INSPECTION

- 1.** Check that the tumble generator valve assembly and air intake adapter have no deformation, cracks or other damages.
- 2.** Check tumble generator valve assembly and air intake adapter for contamination or clogging.

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Tumble Generator Valve Assembly

INSTALLATION

Install in the reverse order of removal.

Note:

Use a new gasket.

Tightening torque:



25 N·m (2.5 kgf-m, 18.4 ft-lb)

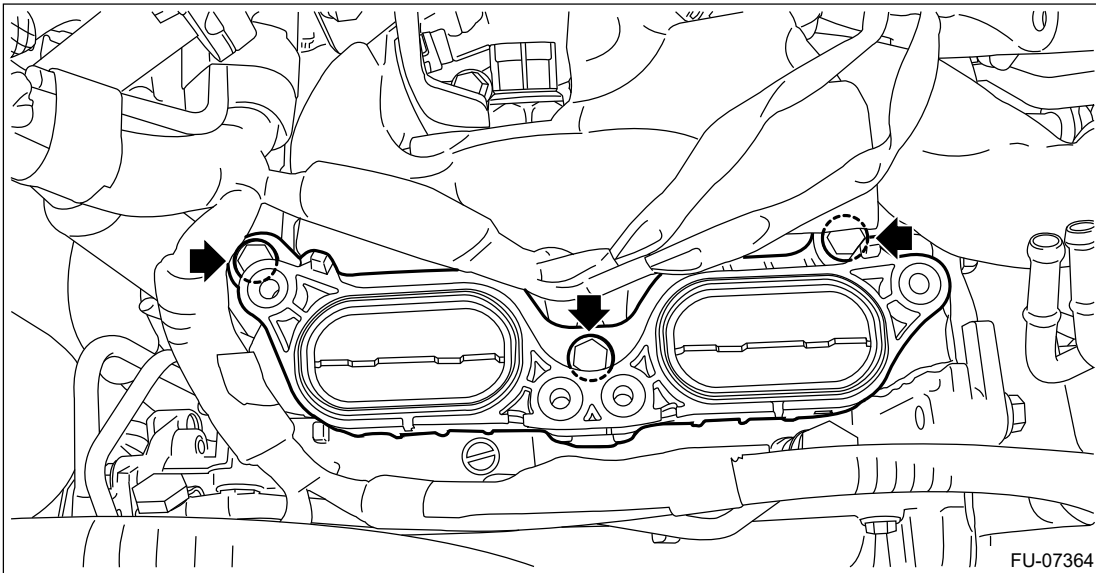
FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Tumble Generator Valve Assembly

REMOVAL

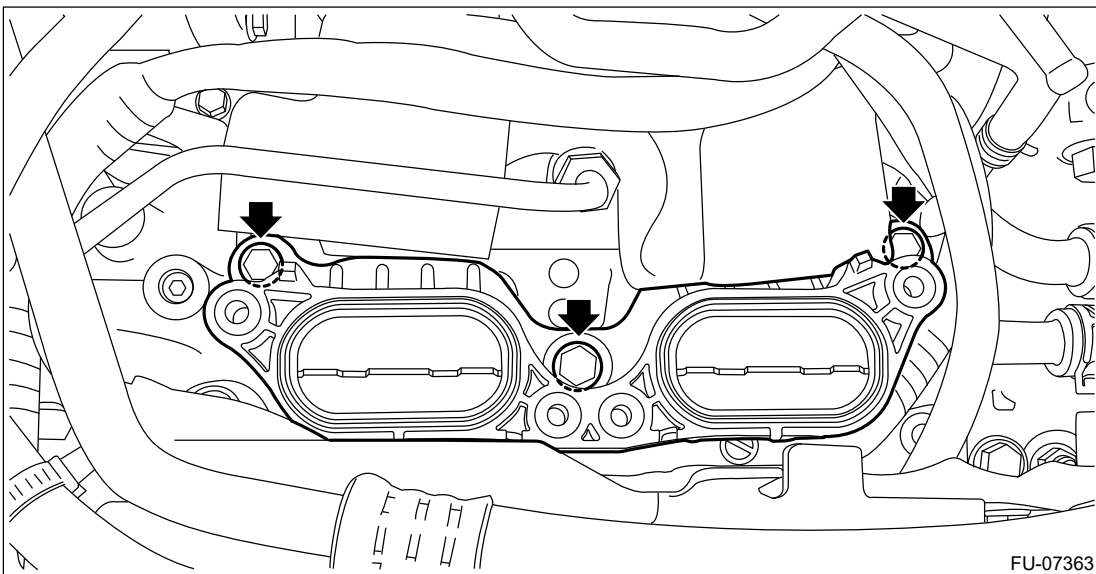
Note:

The tumble generator valve assembly is tightened together with the intake manifold.

1. Release the fuel pressure.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
2. Disconnect the ground cable from battery.
3. Open the fuel filler lid and remove the fuel filler cap.
4. Remove the intake manifold.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
5. Remove the air intake adapter from the cylinder head.
 - RH side

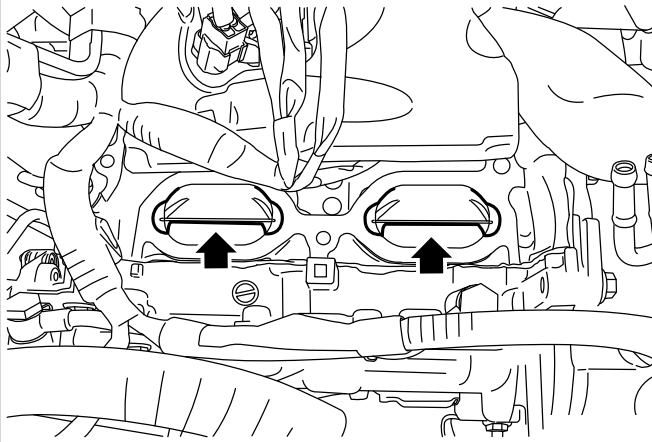


- LH side

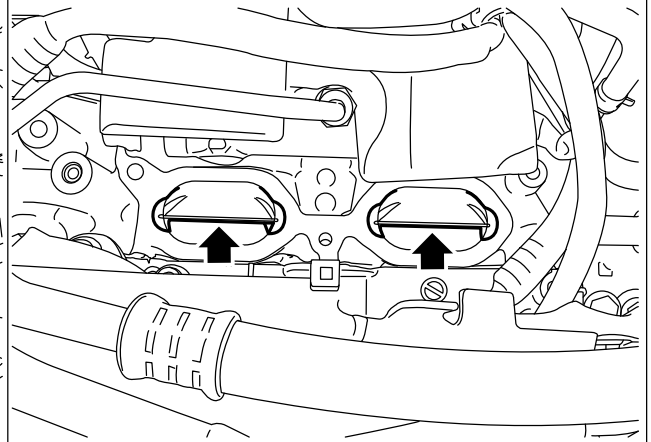


6. Remove the cylinder head plate from cylinder head.

RH



LH

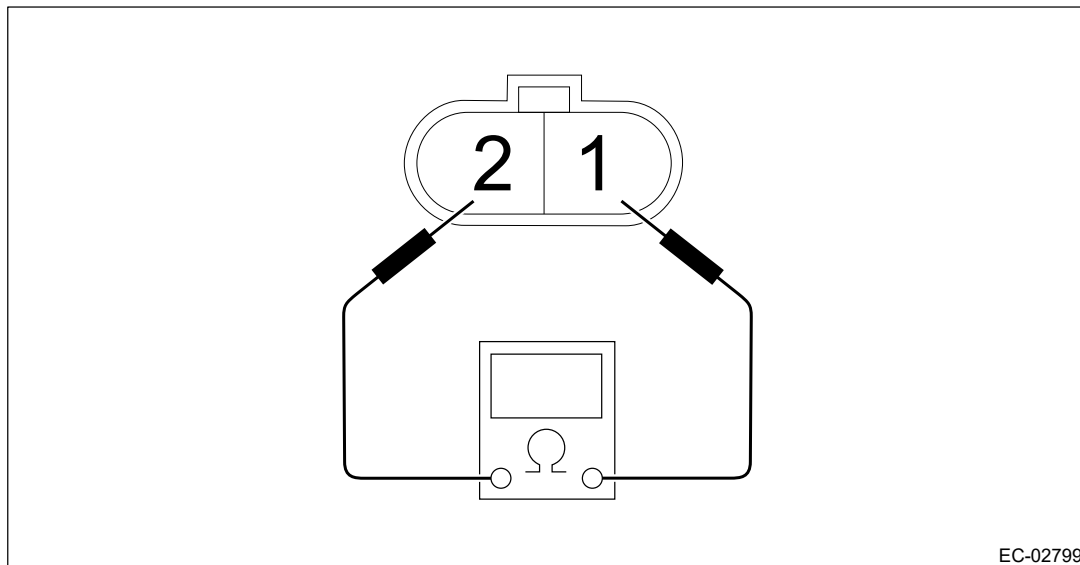


FU-07957

INSPECTION

1. WASTEGATE CONTROL SOLENOID VALVE

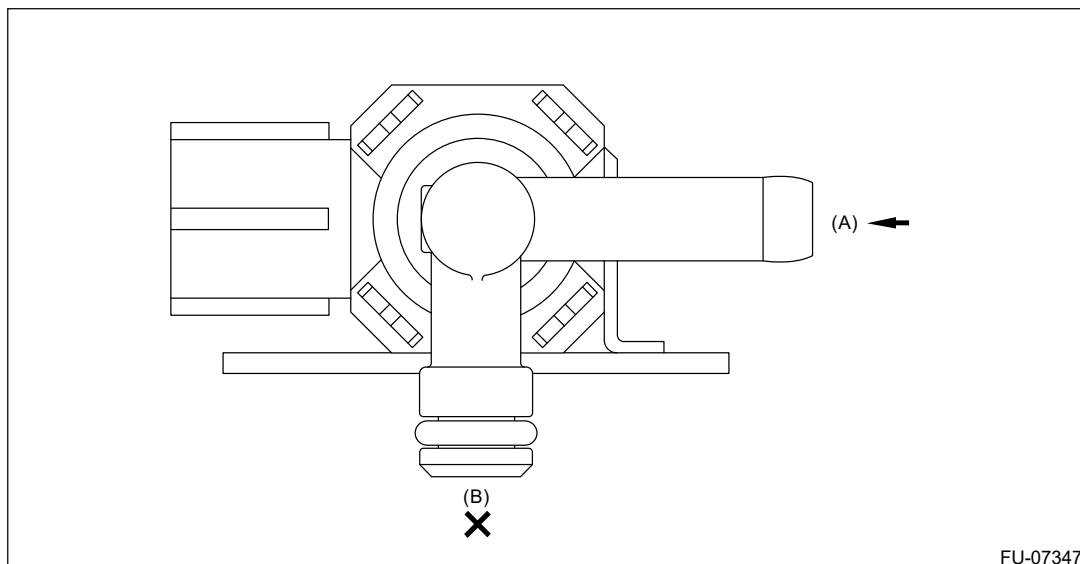
1. Check that the wastegate control solenoid valve has no deformation, cracks or other damages.
2. Check the resistance between the wastegate control solenoid valve terminals.



EC-02799

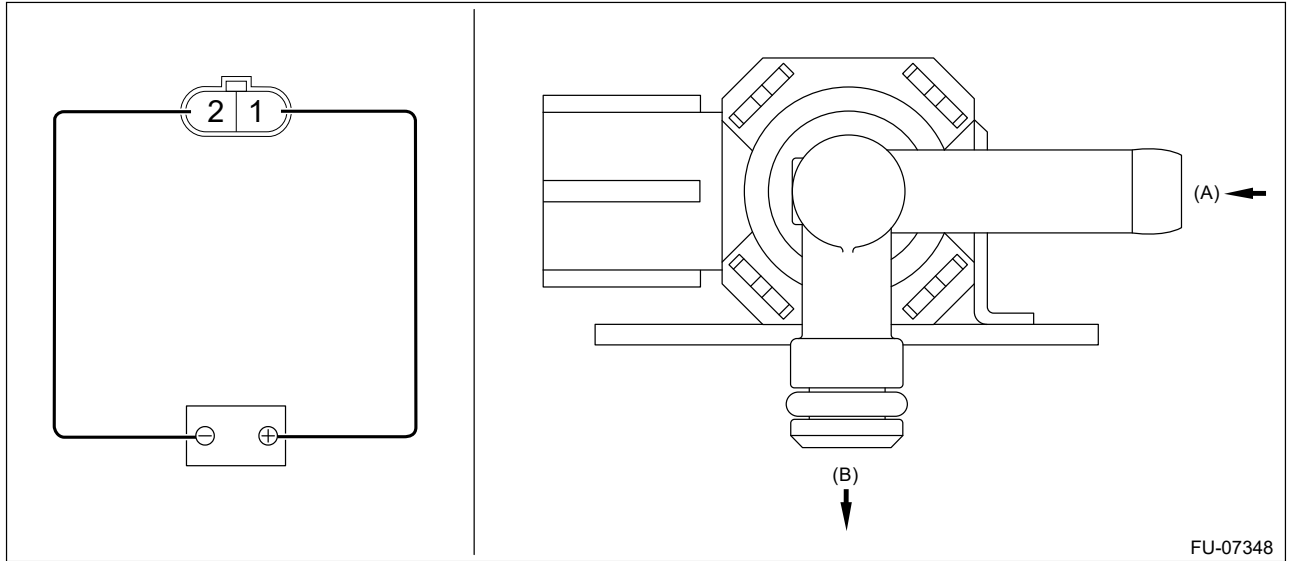
| Terminal No. | Standard |
|--------------|---------------------------|
| 1 and 2 | 24±3 Ω (when 20°C (68°F)) |

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



FU-07347

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





2. OTHER INSPECTIONS

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



FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Wastegate Control Solenoid Valve

INSTALLATION

For installation procedures of wastegate control solenoid valve, refer to "Intake Duct No. 1".  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>INSTALLATION > INTAKE DUCT NO. 1.](#)  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>ASSEMBLY > INTAKE DUCT NO. 1.](#)

FUEL INJECTION (FUEL SYSTEMS)(H4DOTC) > Wastegate Control Solenoid Valve

REMOVAL

For removal procedures of wastegate control solenoid valve, refer to "Intake Duct No. 1".  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 1.](#)  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>DISASSEMBLY > INTAKE DUCT NO. 1.](#)

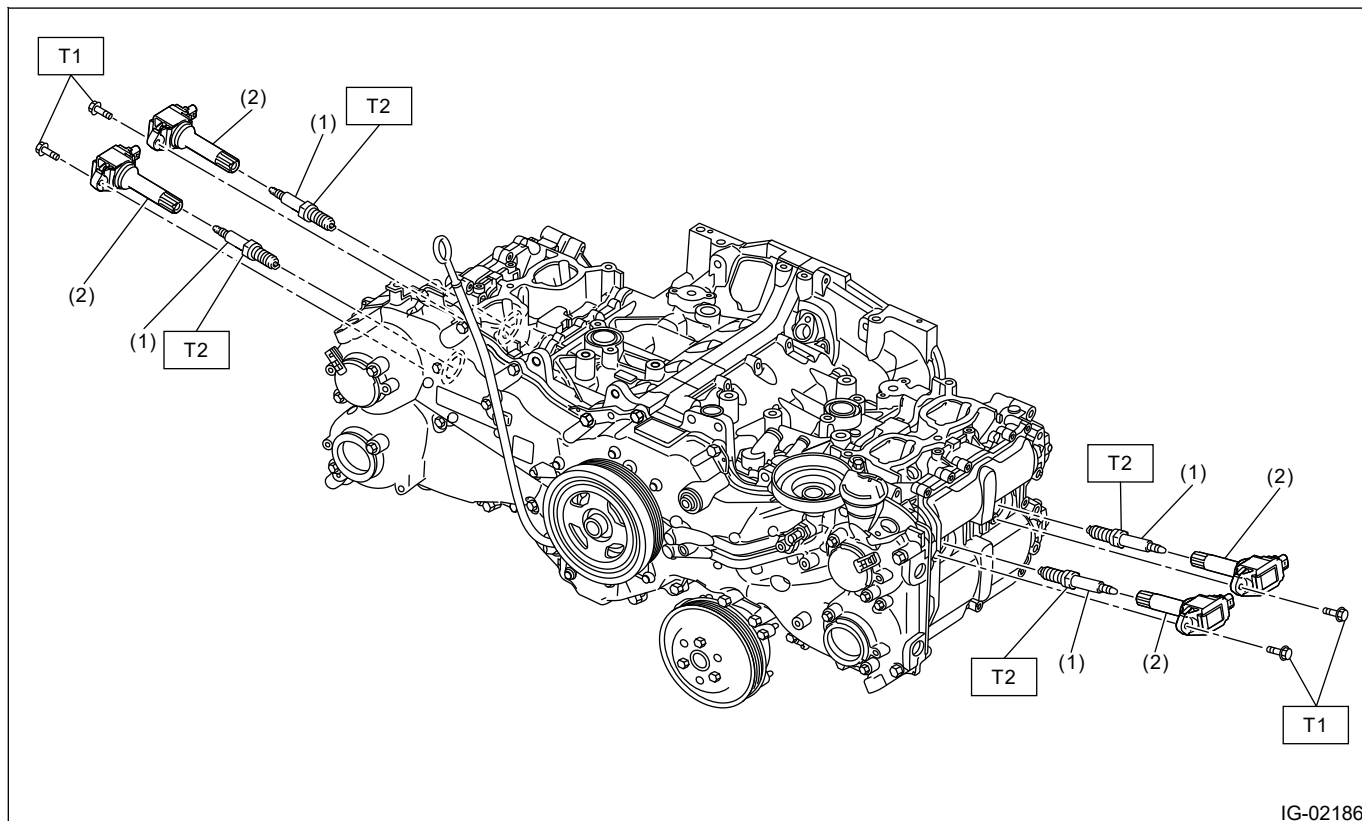
IGNITION(H4DO) > General Description

CAUTION

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

IGNITION(H4DO) > General Description

COMPONENT



(1) Spark plug

(2) Ignition coil

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

T1: 8.5 (0.9, 6.3)

T2: 17.5 (1.8, 12.9)


IGNITION(H4DO) > General Description

SPECIFICATION

| Item | | | Specifications |
|---------------|---------------------------------------|---------|---|
| Ignition coil | Type | | FK0463 |
| | Ignition system | | Independent ignition coil |
| | Manufacturer | | Diamond Electric |
| Spark plug | Manufacturer and type | | NGK: SILZKAR7B11 |
| | Thread size (diameter, pitch, length) | mm | 12, 1.25, 26.5 |
| | Spark plug gap | mm (in) | Standard 1.0 — 1.1 (0.039 — 0.043) |
| | Electrode | | Center electrode: Iridium Ground electrode: Platinum |


IGNITION(H4DO) > Ignition Coil

INSPECTION

For inspection procedure, refer to "Diagnostics for Engine Starting Failure".  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Diagnostics for Engine Starting Failure>IGNITION CONTROL SYSTEM.](#)

IGNITION(H4DO) > Ignition Coil

INSTALLATION

Direct ignition type is adopted. Refer to "Spark Plug" for the installation procedure.  [Ref. to IGNITION\(H4DO\)>Spark Plug>INSTALLATION.](#)

IGNITION(H4DO) > Ignition Coil

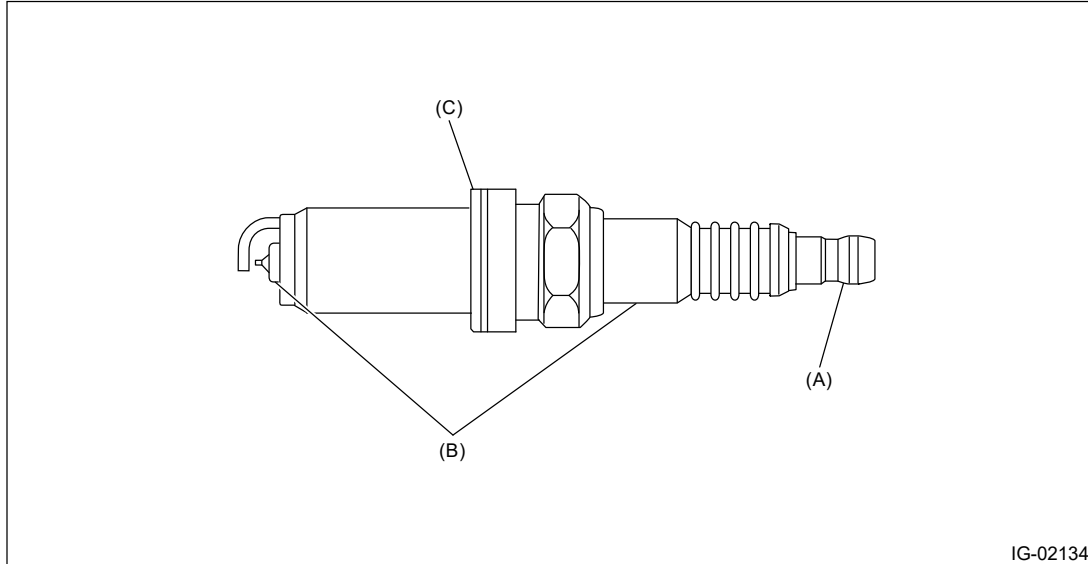
REMOVAL

Direct ignition type is adopted. Refer to "Spark Plug" for removal procedure.  [Ref. to IGNITION\(H4DO\)>Spark Plug>REMOVAL.](#)

IGNITION(H4DO) > Spark Plug

INSPECTION

1. Check the spark plug for abnormalities. If defective, replace the spark plug.

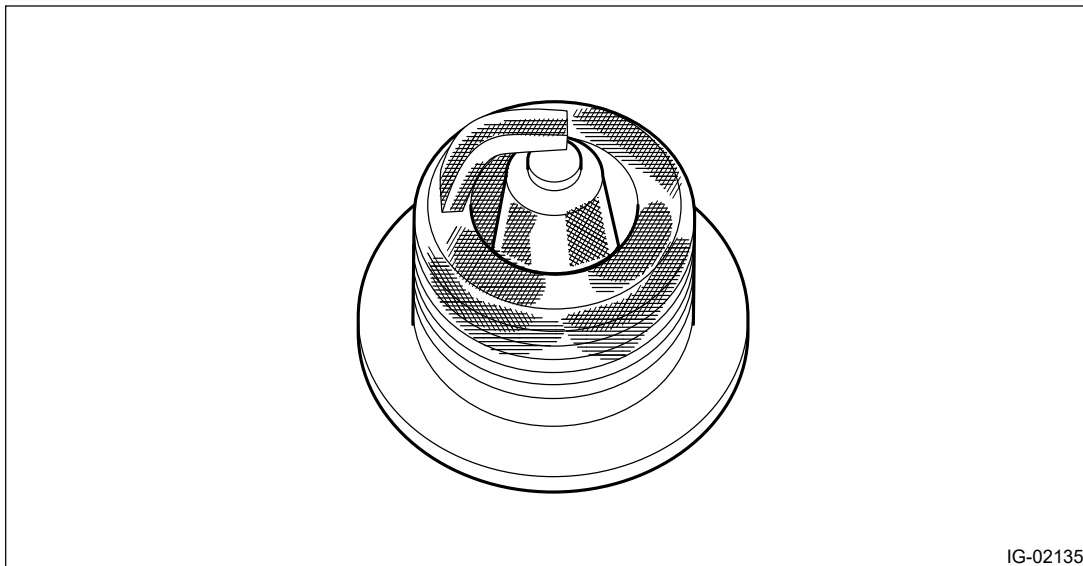


(A) Terminal damage (B) Crack or damage in insulator (C) Damaged gasket

2. Check the spark plug electrode and condition of the insulator. If abnormal, check and repair the cause and replace the spark plug.

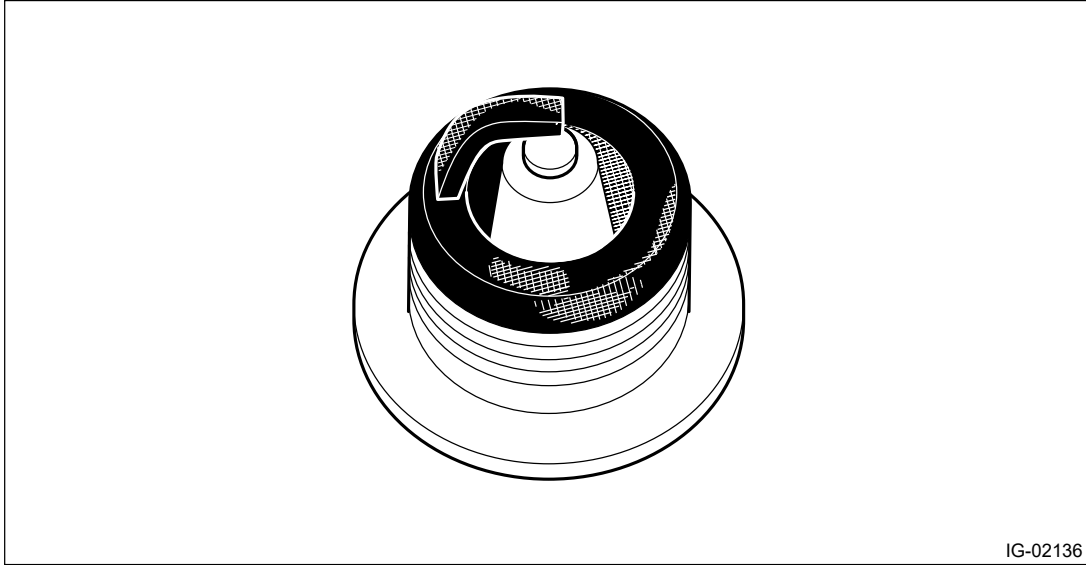
(1) Normal:

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



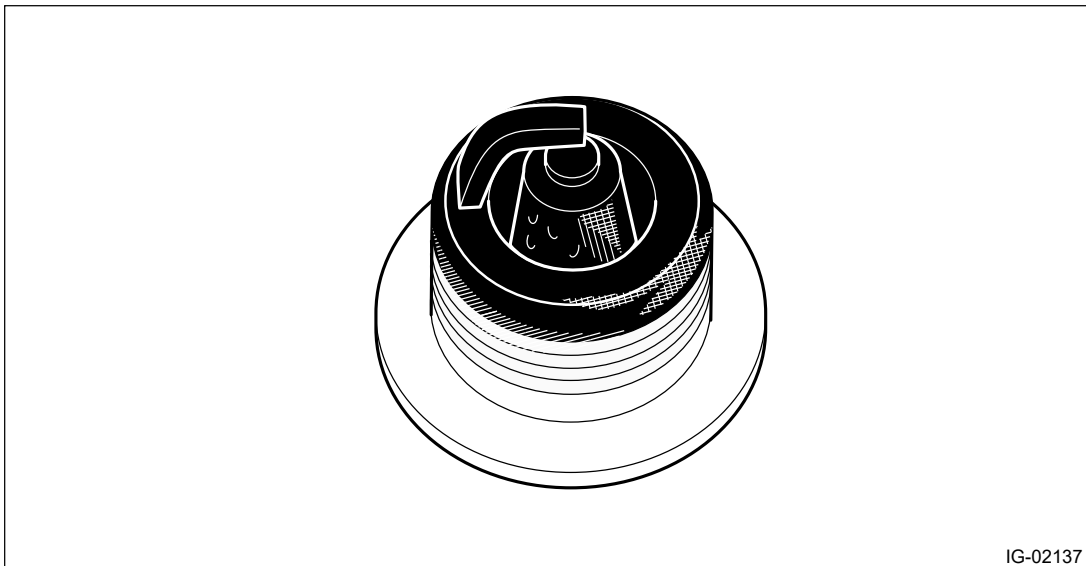
(2) Carbon fouled:

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



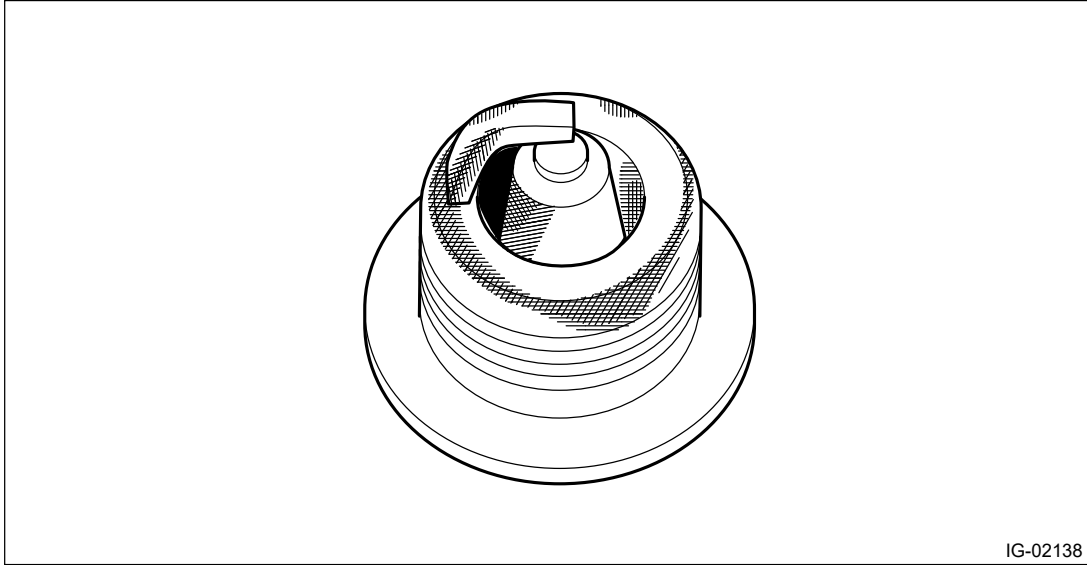
(3) Oil fouled:

Wet black deposits show oil entrance into combustion chamber through worn piston rings or increased clearance between valve guides and valve stems.



(4) Overheating:

A white or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, wrong selection of fuel, or loose spark plugs.



IG-02138

- 3.** Using a nylon brush, etc., clean and remove the carbon or oxide deposits from the spark plug. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, check the spark plug gap "L" using a gap gauge. If it is not within the standard, replace the spark plug.

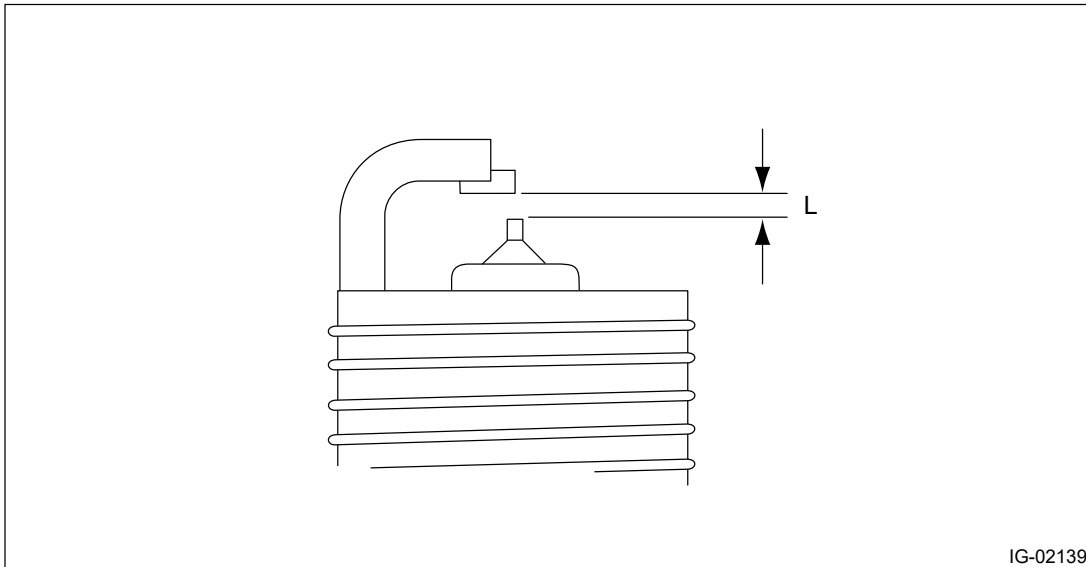
Note:

- **Never use a plug cleaner.**
- **Do not use a metal brush as it may damage the electrode area.**

Spark plug gap L:

Standard

1.0—1.1 mm (0.039—0.043 in)



IG-02139

IGNITION(H4DO) > Spark Plug

INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

Caution:

Degrease the ignition coil installation portion and the ignition coil mounting bolt.

Tightening torque:

Spark plug:

17.5 N·m (1.8 kgf-m, 12.9 ft-lb)

Ignition coil:

8.5 N·m (0.9 kgf-m, 6.3 ft-lb)

2. LH SIDE

Install in the reverse order of removal.

Caution:

Degrease the ignition coil installation portion and the ignition coil mounting bolt.

Tightening torque:

Spark plug:

17.5 N·m (1.8 kgf-m, 12.9 ft-lb)


Ignition coil:

8.5 N·m (0.9 kgf-m, 6.3 ft-lb)



IGNITION(H4DO) > Spark Plug

REMOVAL

Spark plug:

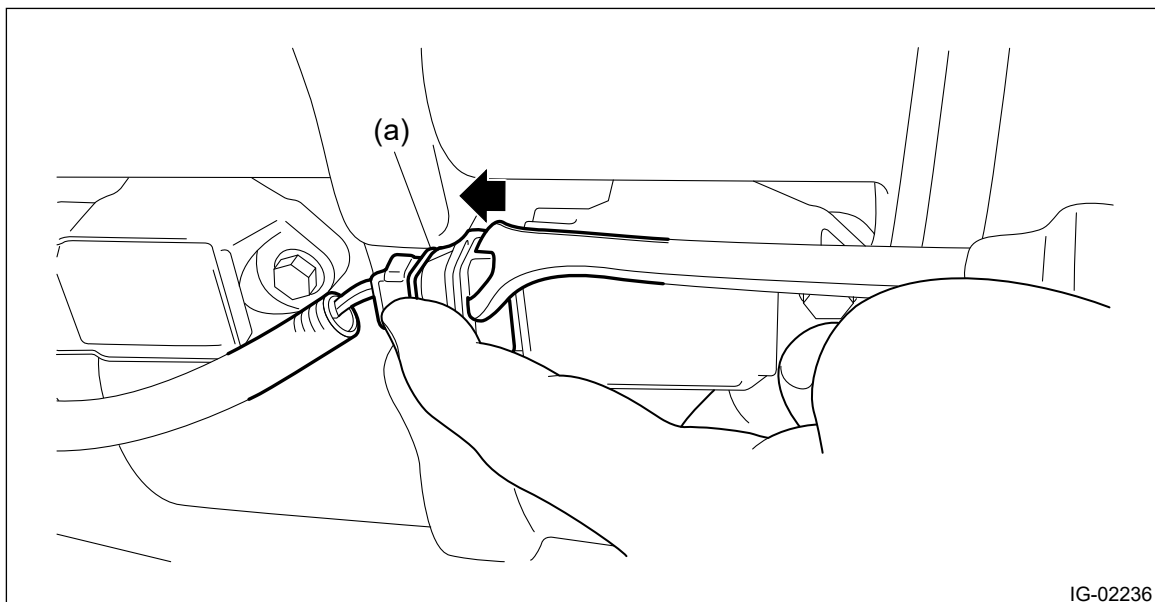
Refer to "SPECIFICATION" for spark plug.  [Ref. to IGNITION\(H4DO\)>General Description>SPECIFICATION.](#)

1. RH SIDE

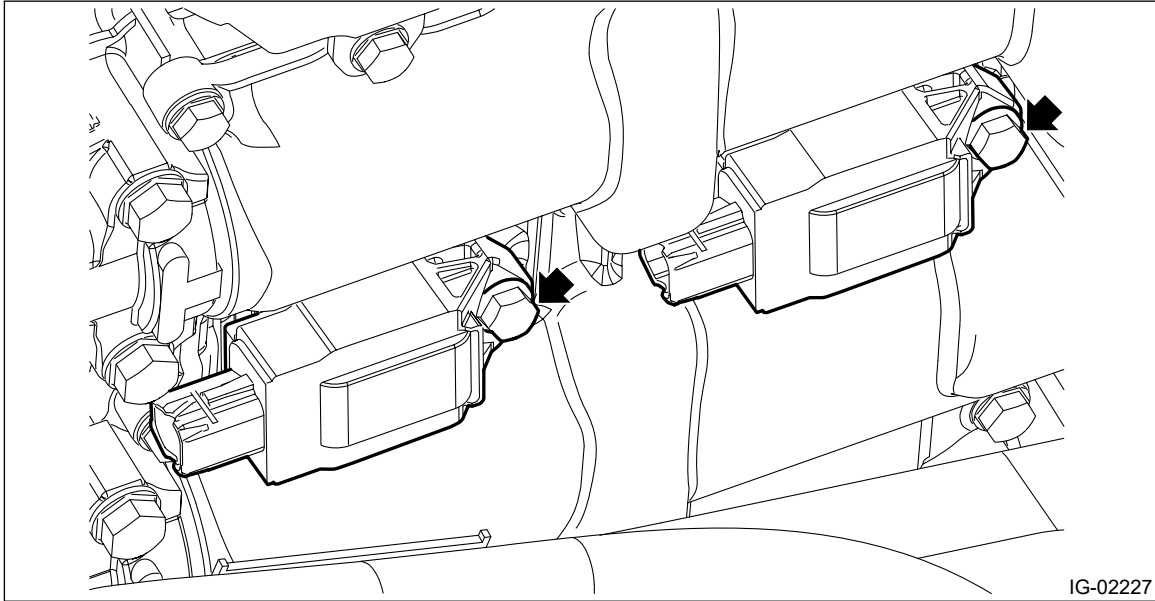
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air cleaner case (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Cleaner Case>REMOVAL.](#)
3. Disconnect the connector from ignition coil.

Note:

While pressing the spring (a) shown in the figure, slide it in the direction of the arrow with a clip remover.




4. Remove the ignition coil.



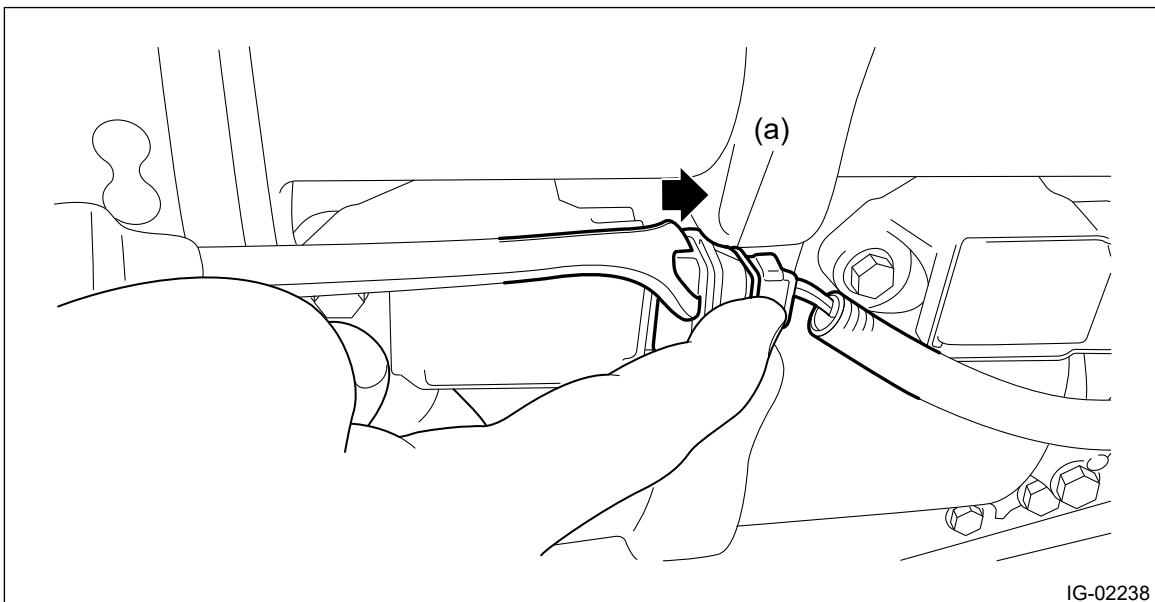
5. Remove the spark plug with a spark plug socket.

2. LH SIDE

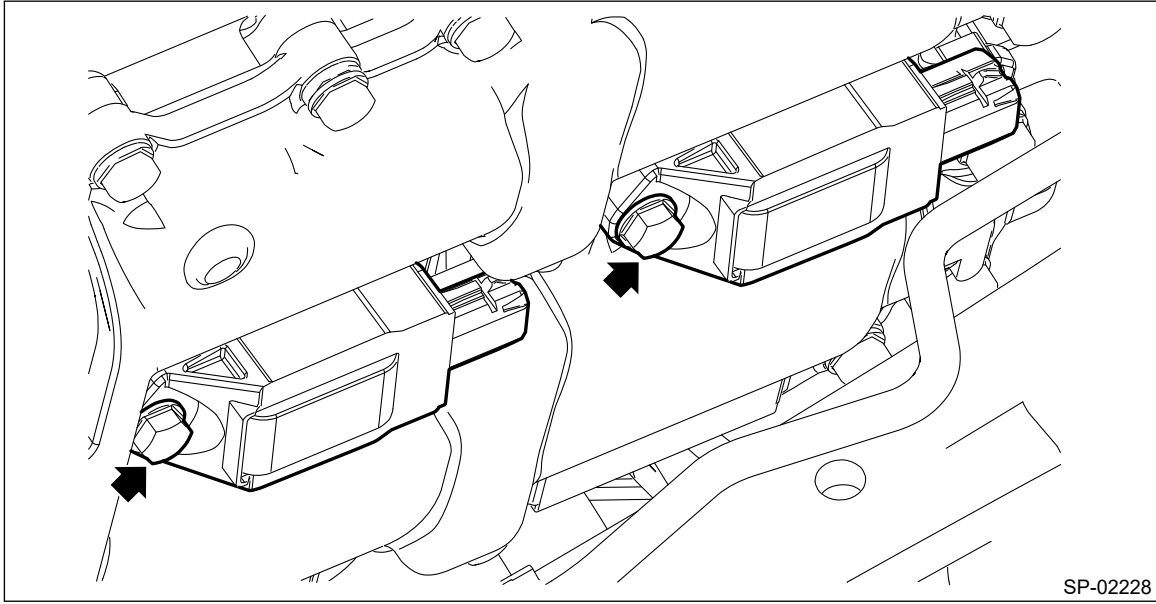
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Disconnect the connector from ignition coil.

Note:

While pressing the spring (a) shown in the figure, slide it in the direction of the arrow with a clip remover.



3. Remove the ignition coil.



SP-02228

4. Remove the spark plug with a spark plug socket.

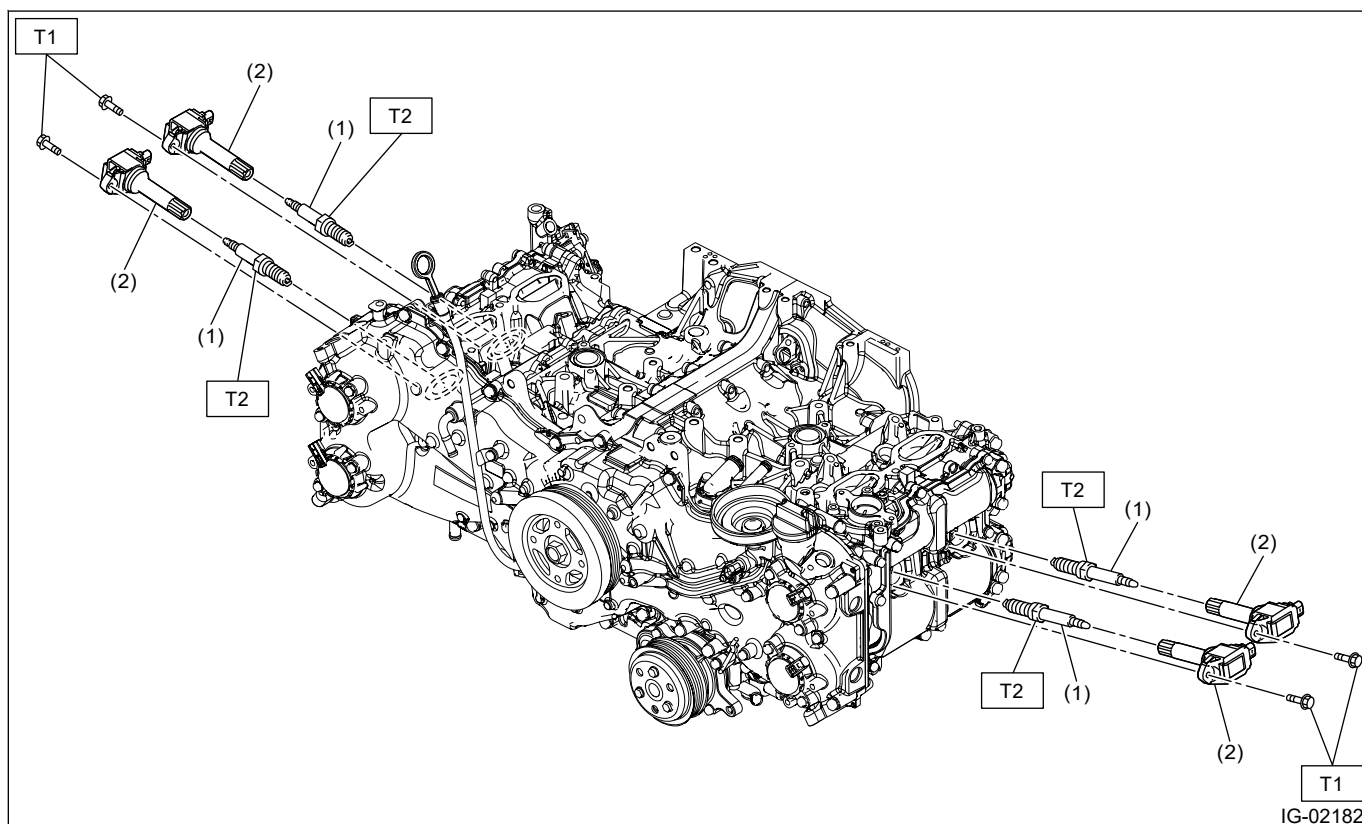
IGNITION(H4DOTC) > General Description

CAUTION

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

IGNITION(H4DOTC) > General Description

COMPONENT



(1) Spark plug

(2) Ignition coil

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

T1: 8.5 (0.9, 6.3)

T2: 17.5 (1.8, 12.9)


IGNITION(H4DOTC) > General Description

SPECIFICATION

| Item | | | | Specifications |
|---------------|---------------------------------------|---------|----------|---|
| Ignition coil | Type | | | FK0463 |
| | Ignition system | | | Independent ignition coil |
| | Manufacturer | | | Diamond Electric |
| Spark plug | Manufacturer and type | | | NGK: ILKAR8H6 |
| | Thread size (diameter, pitch, length) | | mm | 12, 1.25, 26.5 |
| | Spark plug gap | mm (in) | Standard | 0.50 — 0.55 (0.020 — 0.022) |
| | Electrode | | | Center electrode: Iridium Ground electrode: Platinum |


IGNITION(H4DOTC) > Ignition Coil

INSPECTION

For inspection procedure, refer to "Diagnostics for Engine Starting Failure".  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Diagnostics for Engine Starting Failure>IGNITION CONTROL SYSTEM.](#)

IGNITION(H4DOTC) > Ignition Coil

INSTALLATION

Direct ignition type is adopted. Refer to "Spark Plug" for the installation procedure.  [Ref. to IGNITION\(H4DOTC\)>Spark Plug>INSTALLATION.](#)

IGNITION(H4DOTC) > Ignition Coil

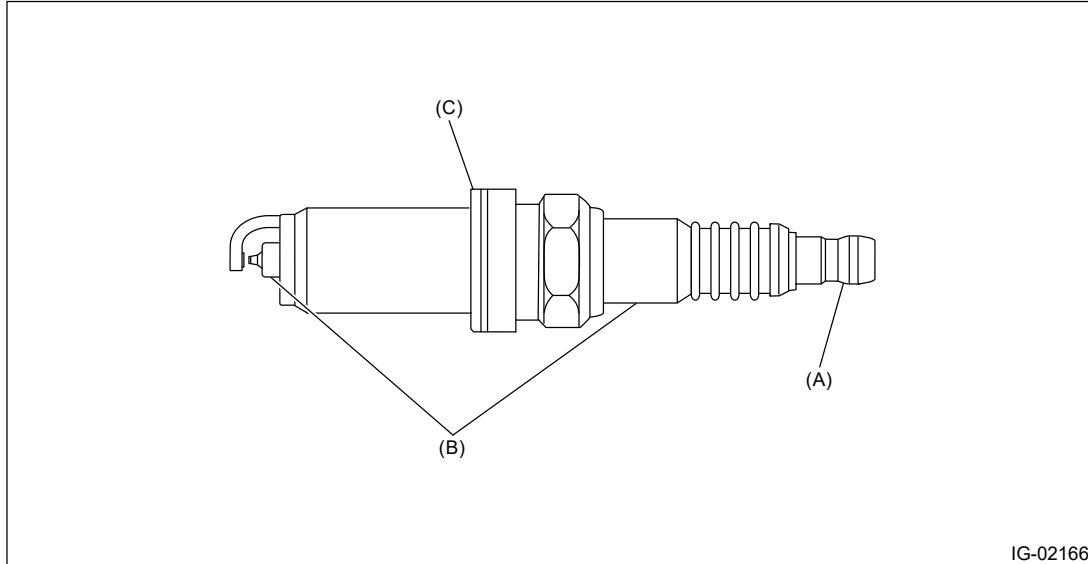
REMOVAL

Direct ignition type is adopted. Refer to "Spark Plug" for removal procedure.  [Ref. to IGNITION\(H4DOTC\)>Spark Plug>REMOVAL.](#)

IGNITION(H4DOTC) > Spark Plug

INSPECTION

1. Check the spark plug for abnormalities. If defective, replace the spark plug.

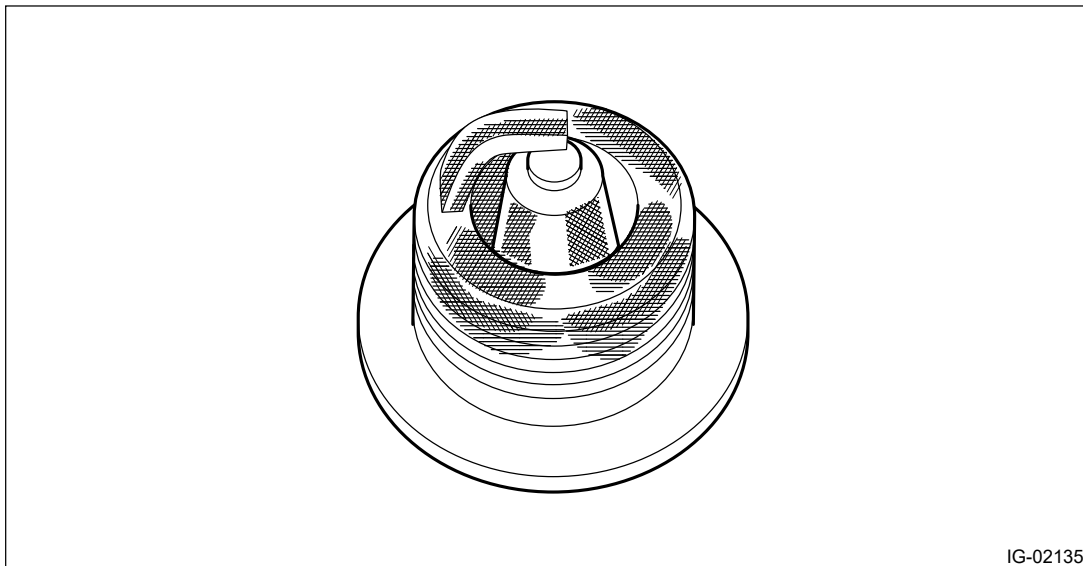


(A) Terminal damage (B) Crack or damage in insulator (C) Damaged gasket

2. Check the spark plug electrode and condition of the insulator. If abnormal, check and repair the cause and replace the spark plug.

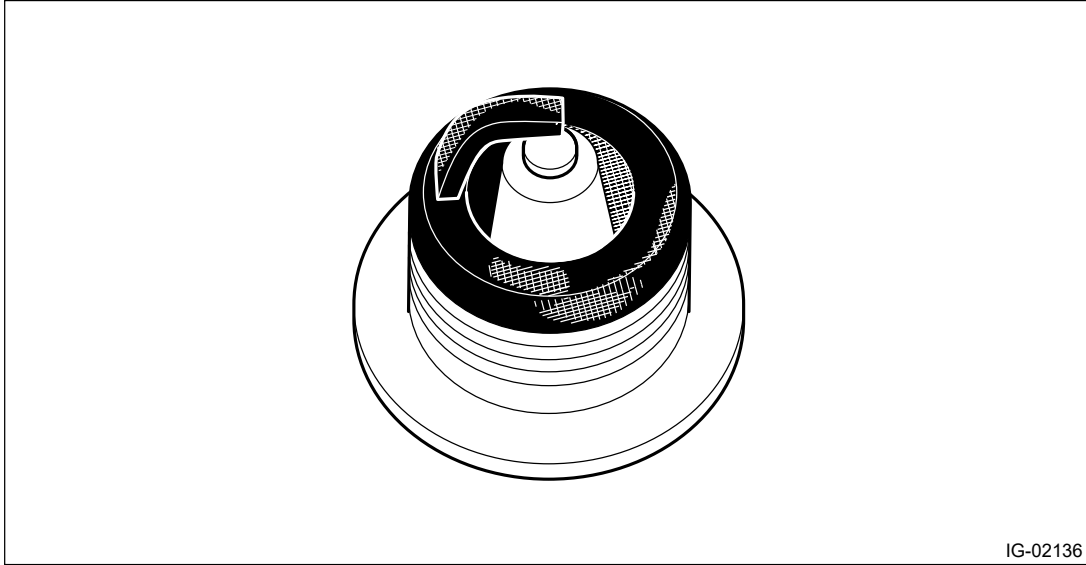
(1) Normal:

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



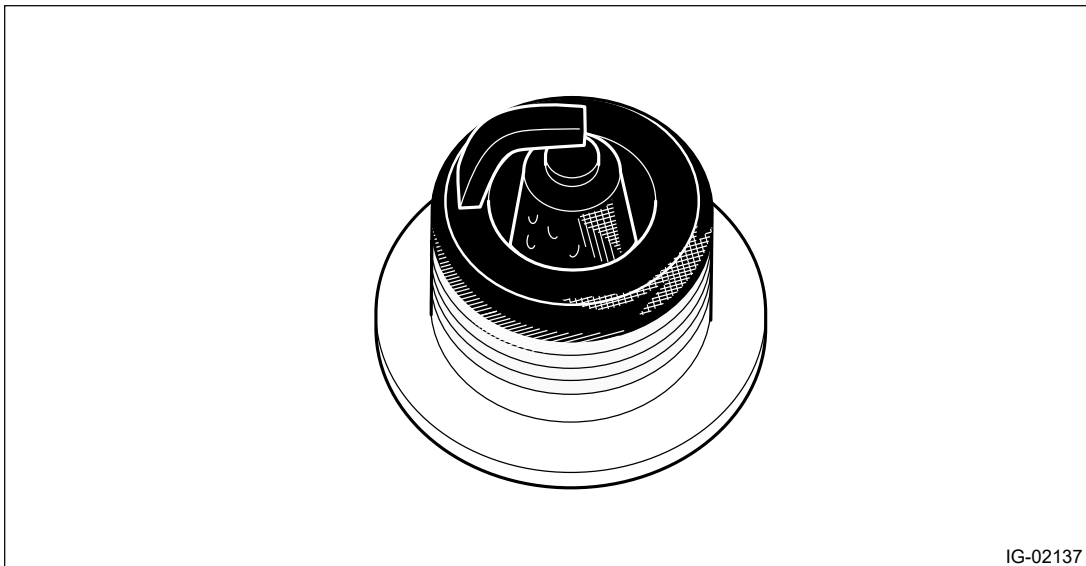
(2) Carbon fouled:

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



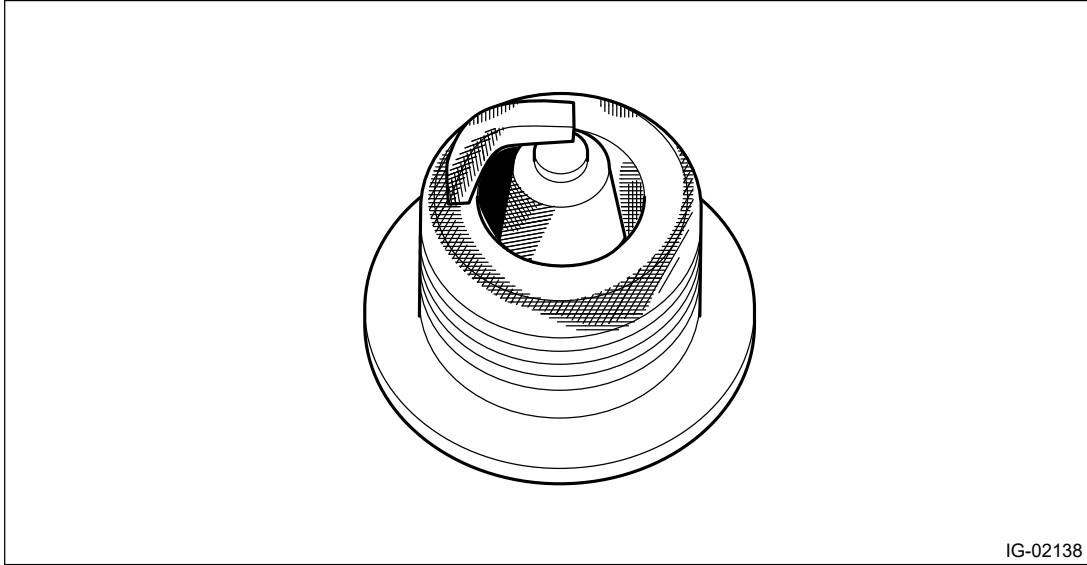
(3) Oil fouled:

Wet black deposits show oil entrance into combustion chamber through worn piston rings or increased clearance between valve guides and valve stems.



(4) Overheating:

A white or light gray insulator with black or brown spots and bluish burnt electrodes indicate engine overheating, wrong selection of fuel, or loose spark plugs.



IG-02138

- 3.** Using a nylon brush, etc., clean and remove the carbon or oxide deposits from the spark plug. If deposits are too stubborn, replace the spark plugs. After cleaning the spark plugs, check the spark plug gap "L" using a gap gauge. If it is not within the standard, replace the spark plug.

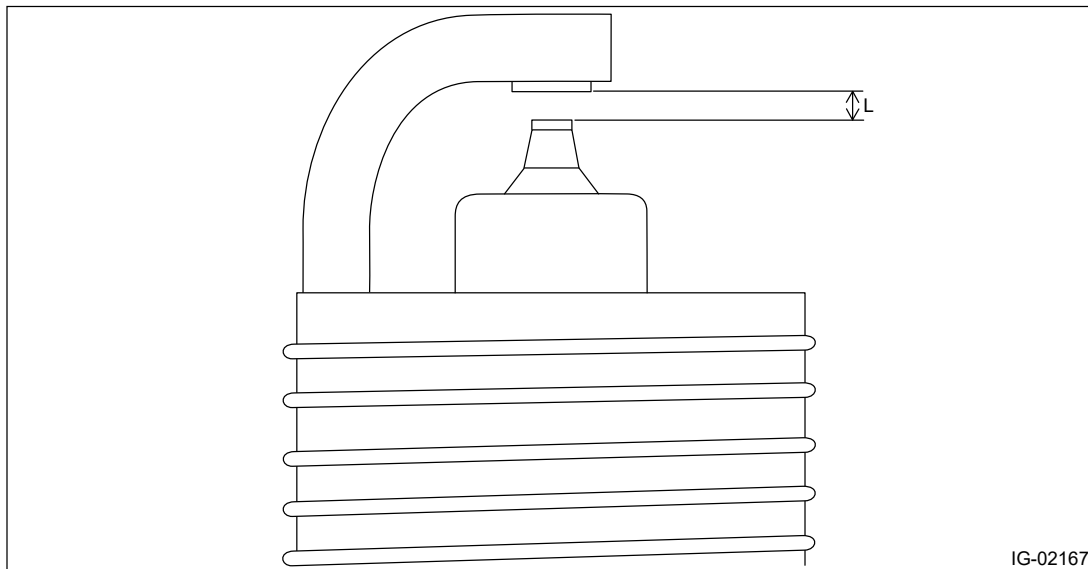
Note:

- **Never use a plug cleaner.**
- **Do not use a metal brush as it may damage the electrode area.**

Spark plug gap L:

Standard

0.50—0.55 mm (0.020—0.022 in)



IG-02167

IGNITION(H4DOTC) > Spark Plug

INSTALLATION

1. RH SIDE

Install in the reverse order of removal.

Caution:

Degrease the ignition coil installation portion and the ignition coil mounting bolt.

Tightening torque:

Spark plug:

17.5 N·m (1.8 kgf-m, 12.9 ft-lb)

Ignition coil:

8.5 N·m (0.9 kgf-m, 6.3 ft-lb)

2. LH SIDE

Install in the reverse order of removal.

Caution:

Degrease the ignition coil installation portion and the ignition coil mounting bolt.

Tightening torque:

Spark plug:

17.5 N·m (1.8 kgf-m, 12.9 ft-lb)


Ignition coil:

8.5 N·m (0.9 kgf-m, 6.3 ft-lb)



IGNITION(H4DOTC) > Spark Plug

REMOVAL

Spark plug:

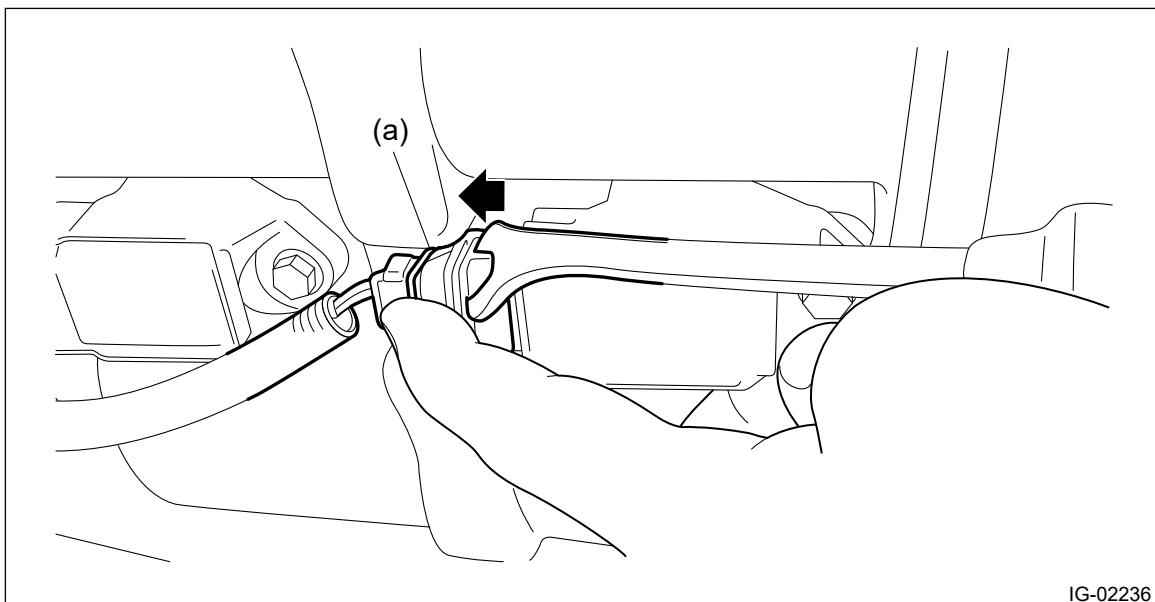
Refer to "SPECIFICATION" for spark plug.  [Ref. to IGNITION\(H4DOTC\)>General Description>SPECIFICATION.](#)

1. RH SIDE

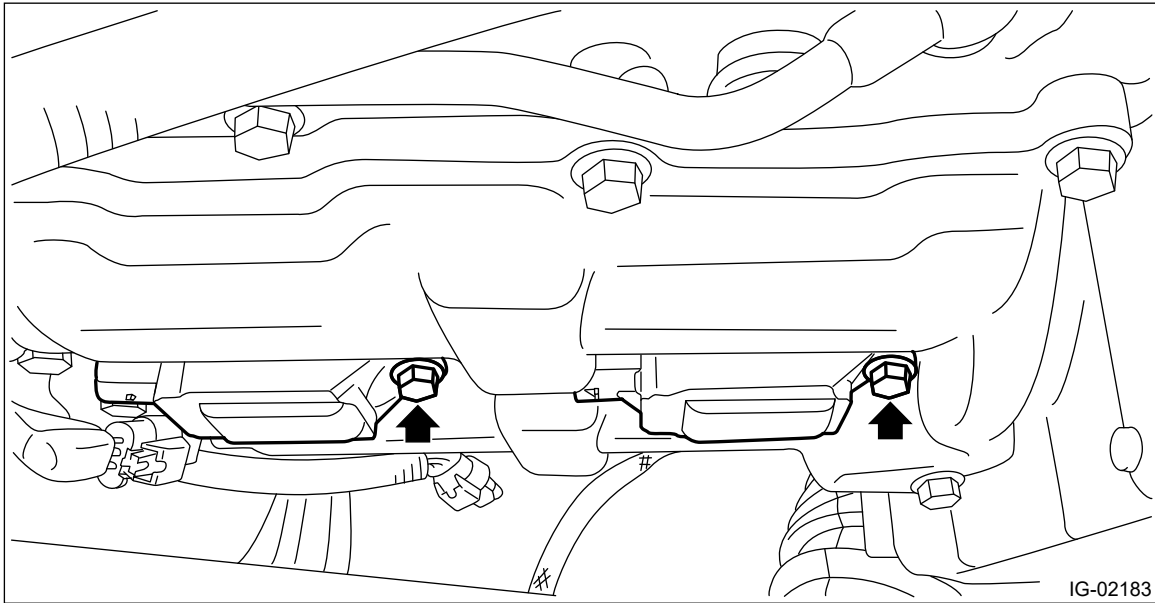
1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the engine control module (ECM).  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Engine Control Module \(ECM\)>REMOVAL.](#)
3. Disconnect the connector from ignition coil.

Note:

While pressing the spring (a) shown in the figure, slide it in the direction of the arrow with a clip remover.




4. Remove the ignition coil.



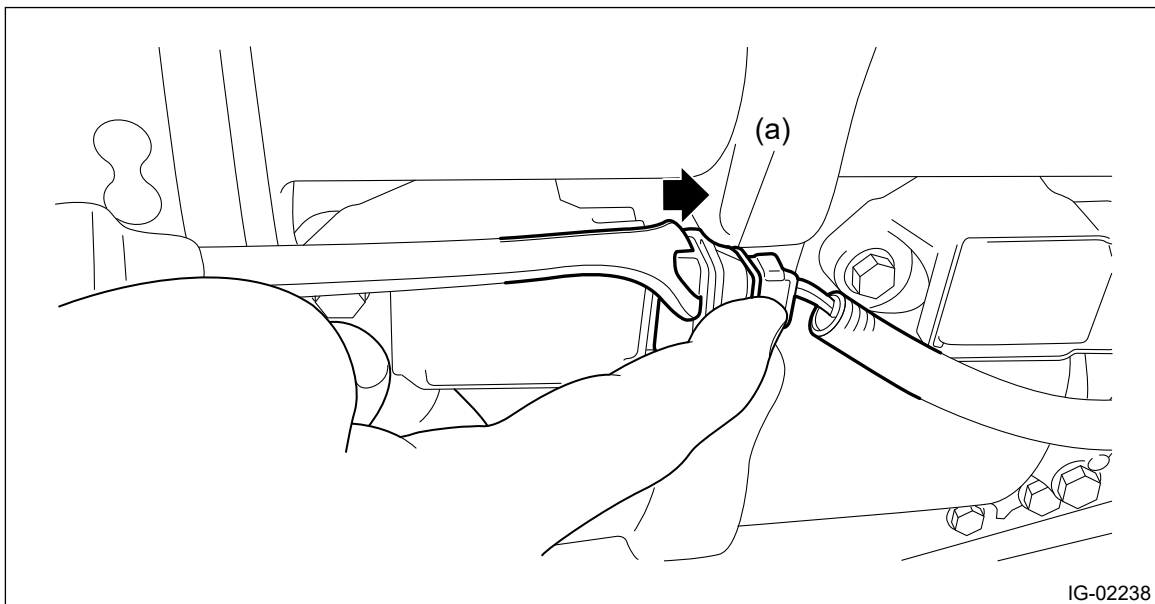
5. Remove the spark plug with a spark plug socket.

2. LH SIDE

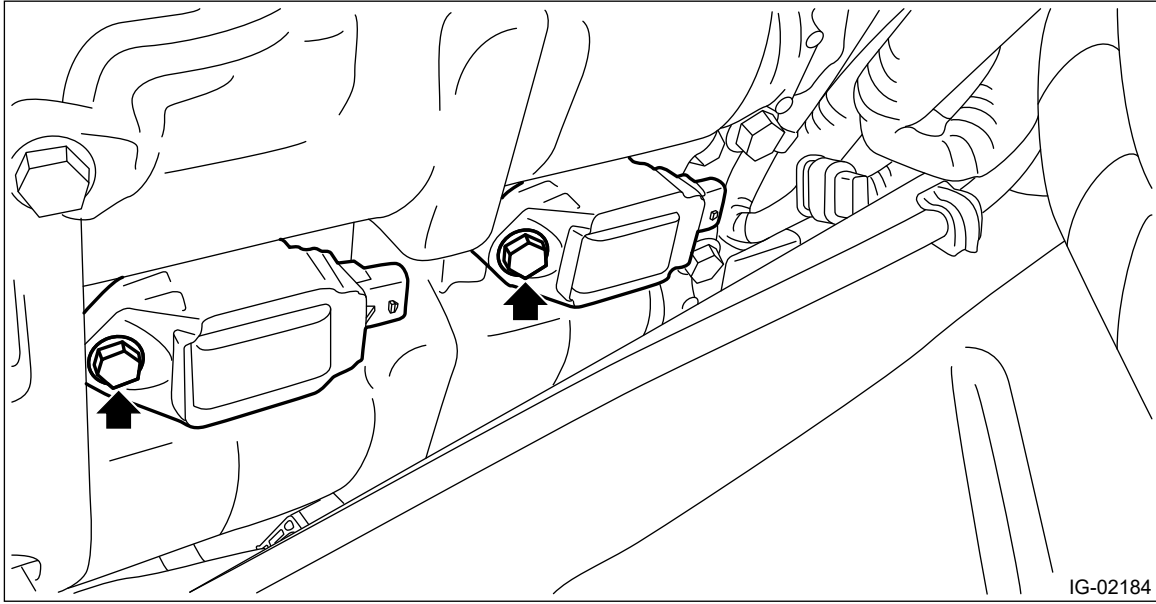
1. Remove the battery.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Battery>REMOVAL.](#)
2. Disconnect the connector from ignition coil.

Note:

While pressing the spring (a) shown in the figure, slide it in the direction of the arrow with a clip remover.



3. Remove the ignition coil.



4. Remove the spark plug with a spark plug socket.

INTAKE (INDUCTION)(H4DO) > Air Cleaner Case

INSPECTION

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

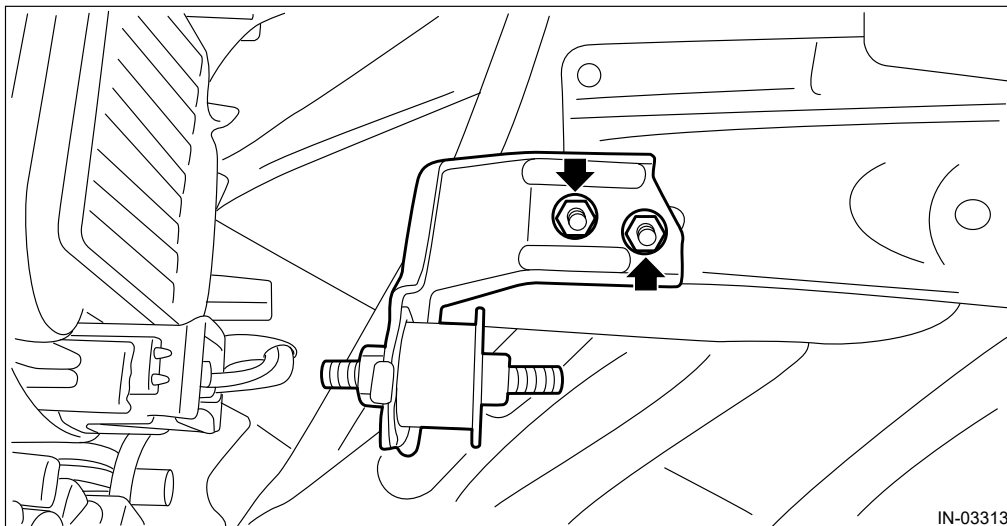
INTAKE (INDUCTION)(H4DO) > Air Cleaner Case

INSTALLATION

1. Install the air cleaner case bracket to the vehicle.

Tightening torque:

7.5 N•m (0.8 kgf-m, 5.5 ft-lb)



2. Install the bolt (A) and nut (B) which secure the air cleaner case (front) to the vehicle and to the air cleaner case bracket.

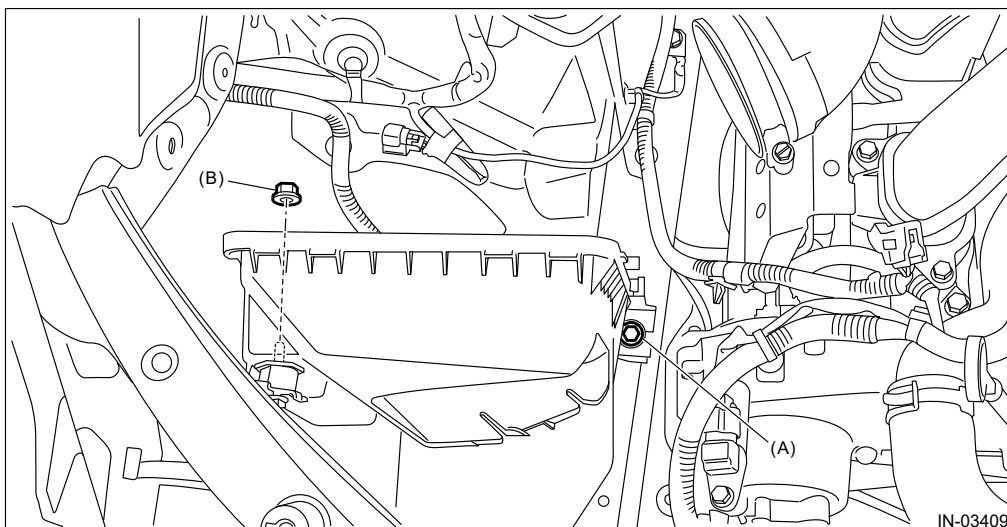
Tightening torque:

Bolt (A)

6 N•m (0.6 kgf-m, 4.4 ft-lb)

Nut (B)

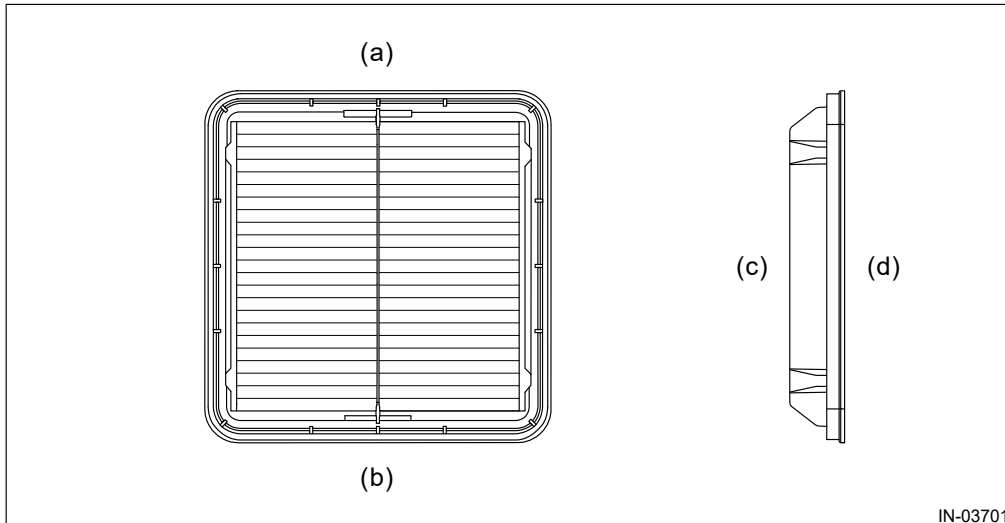
7.5 N•m (0.8 kgf-m, 5.5 ft-lb)



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

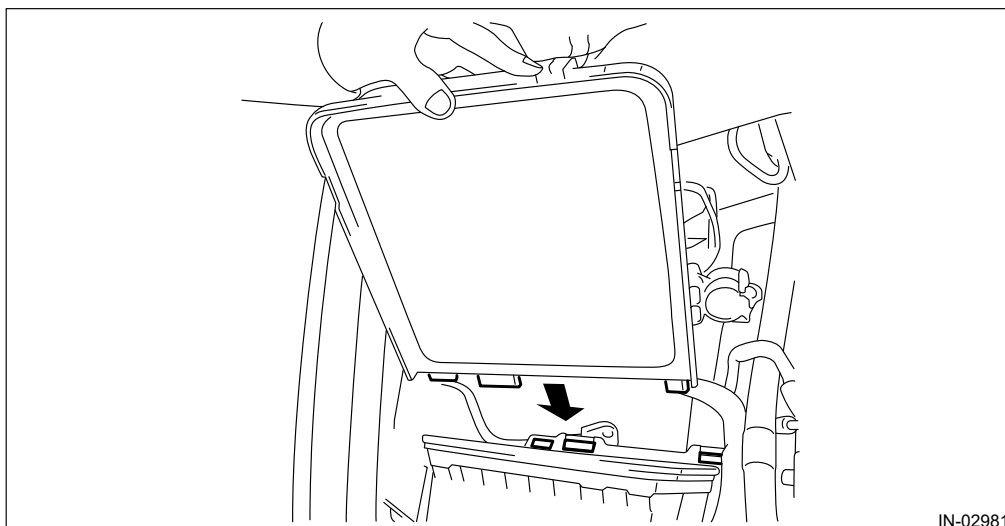
Note:

- Check that there is no dirt or dust within the air cleaner case. If any dirt or dust is found, clean it.
- Install the air cleaner element as shown in the figure.



(a) Upside (b) Downside (c) Air cleaner case (front) side
 (d) Air cleaner case (rear) side

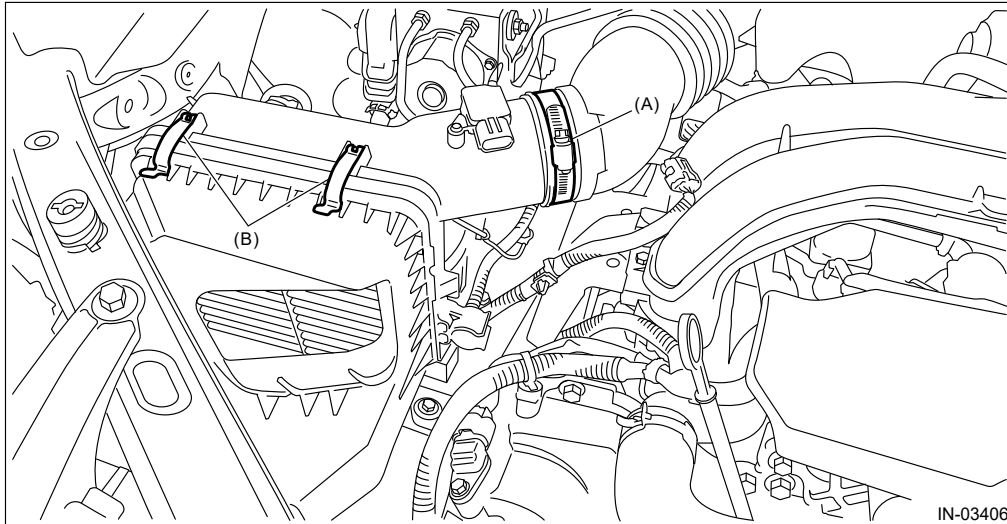
- **When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.**



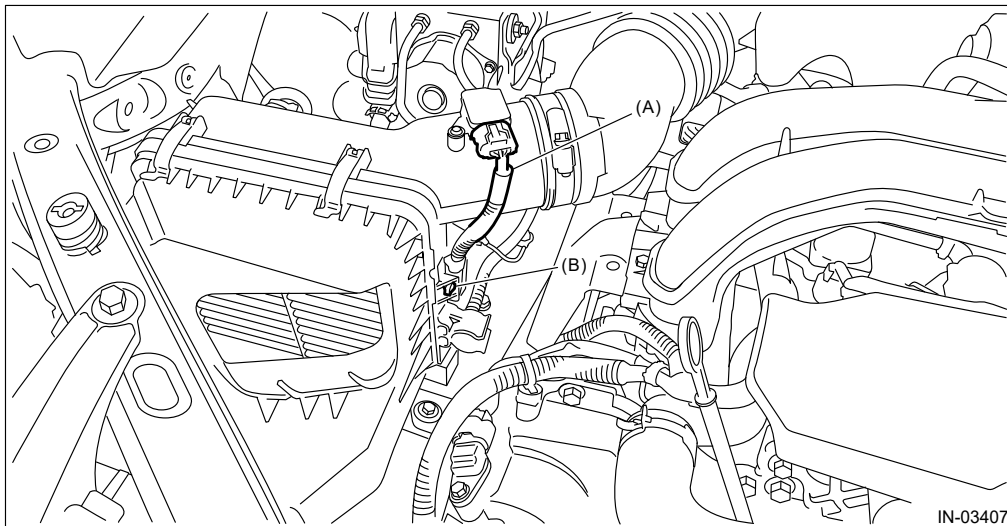
4. Install the clips (B) to the air cleaner case (front), then tighten the clamp (A) that secures the air cleaner case (rear) and air intake boot.



Tightening torque:

3 N•m (0.3 kgf-m, 2.2 ft-lb)





5. Connect the connector (A) to the mass air flow and intake air temperature sensor and secure the harness with clip (B).

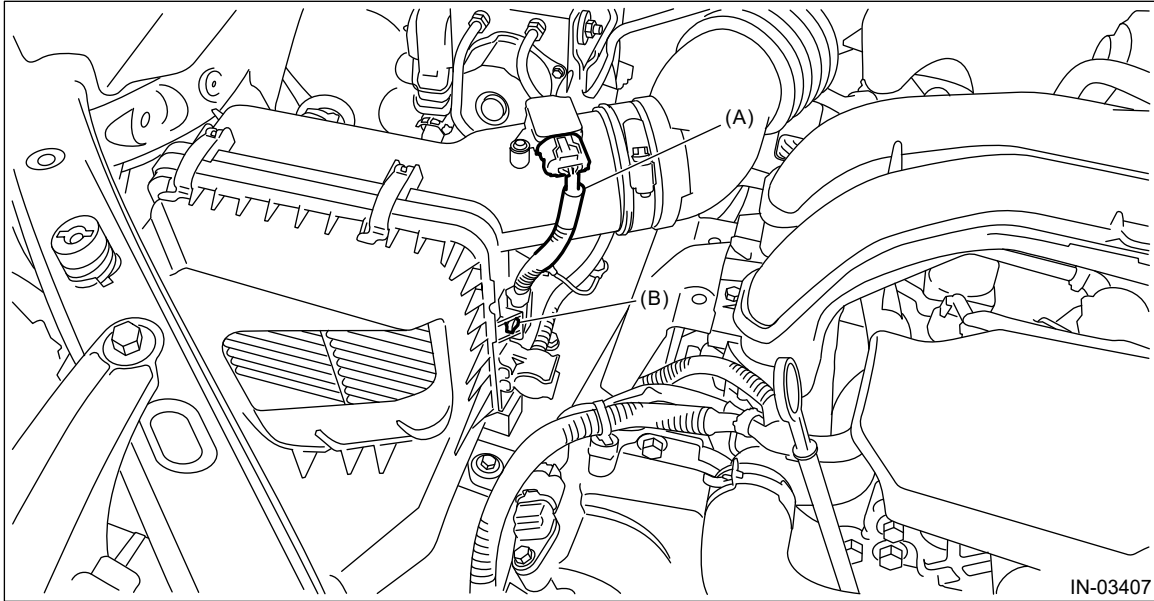


6. Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>INSTALLATION.](#)
7. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)

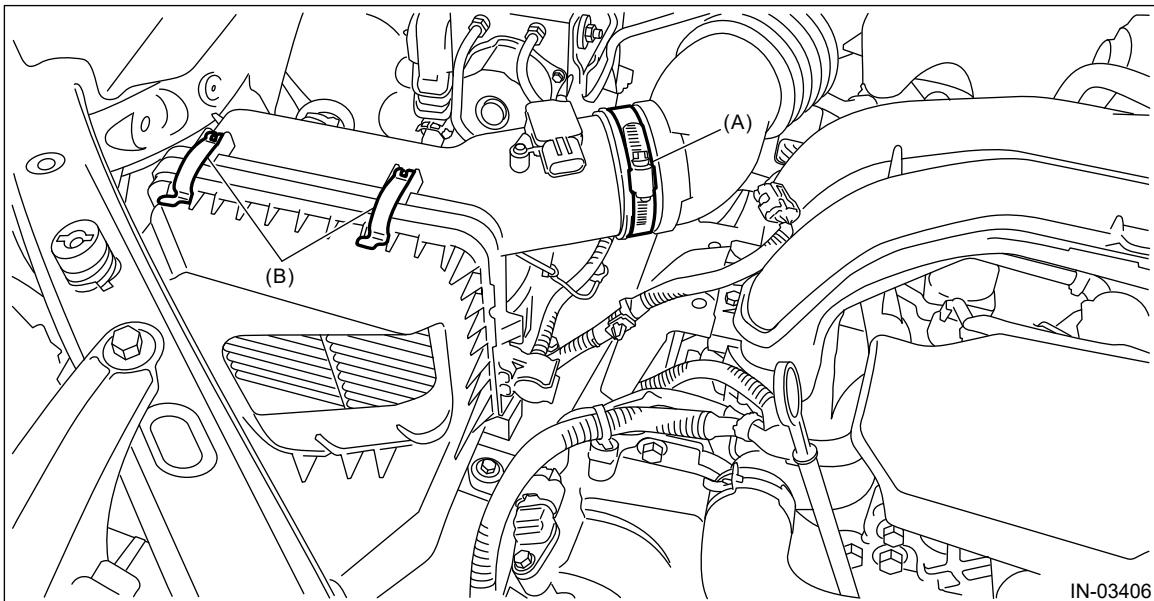
INTAKE (INDUCTION)(H4DO) > Air Cleaner Case

REMOVAL

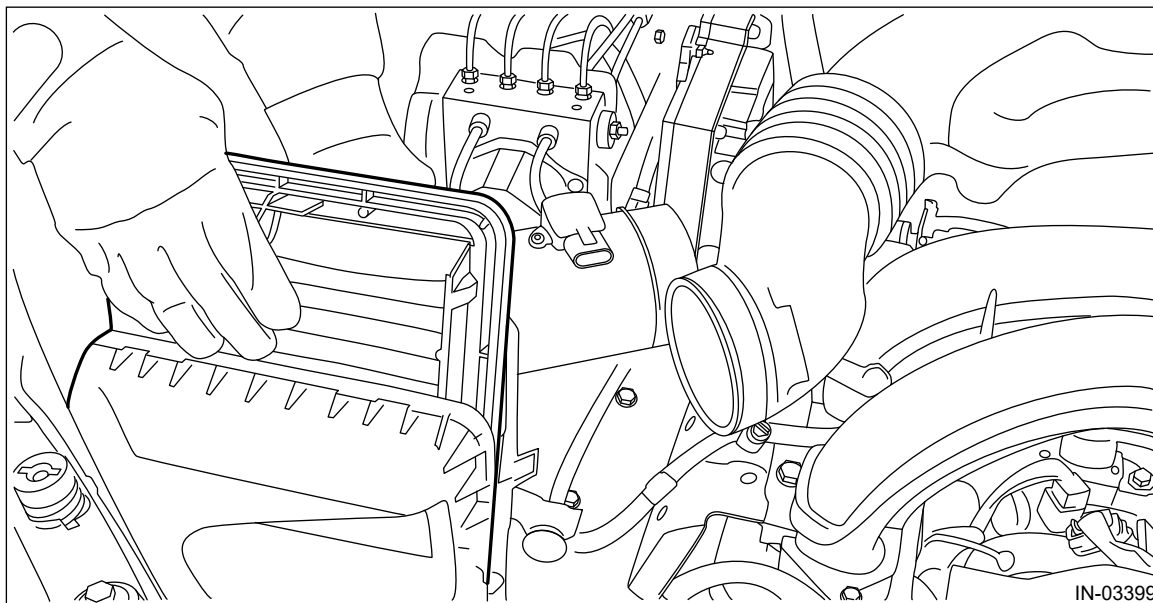
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
3. Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B).



4. Loosen the clamp (A) which connects the air intake boot to the air cleaner case (rear), and then remove the clip (B) from the air cleaner case (front).

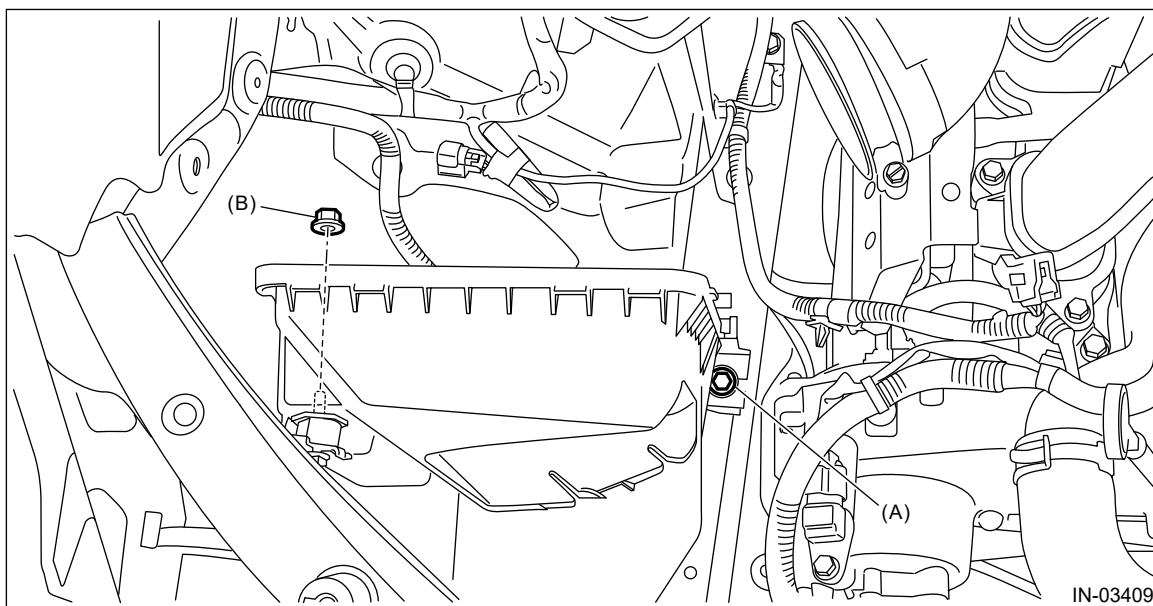


5. Remove the air cleaner case (rear) and air cleaner element.



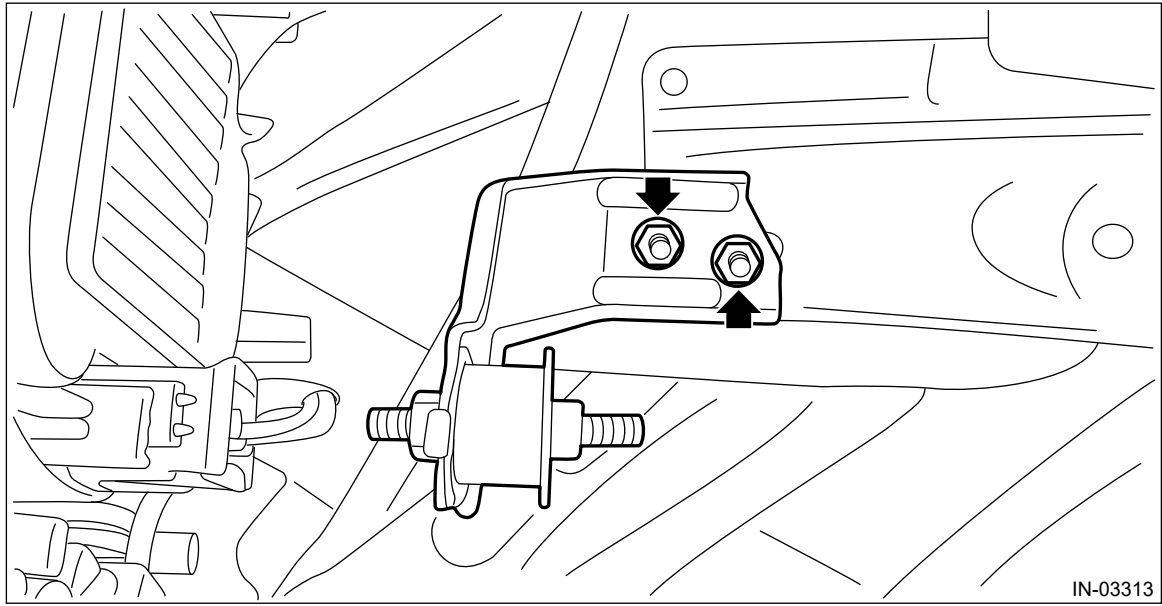
IN-03399

6. Remove the bolt (A) and nut (B) which secure the air cleaner case (front) to the vehicle and to the air cleaner case bracket.



IN-03409

7. Remove the air cleaner case (front).
8. Remove the air cleaner case bracket from the vehicle.



IN-03313

INTAKE (INDUCTION)(H4DO) > Air Cleaner Element

INSPECTION

- 1.** Check that the air cleaner element has no deformation, cracks or other damages.
- 2.** Check the air cleaner element for excessive dirt.
- 3.** Replace the air cleaner case (rear) if the HC absorption filter is damaged.

INTAKE (INDUCTION)(H4DO) > Air Cleaner Element

INSTALLATION

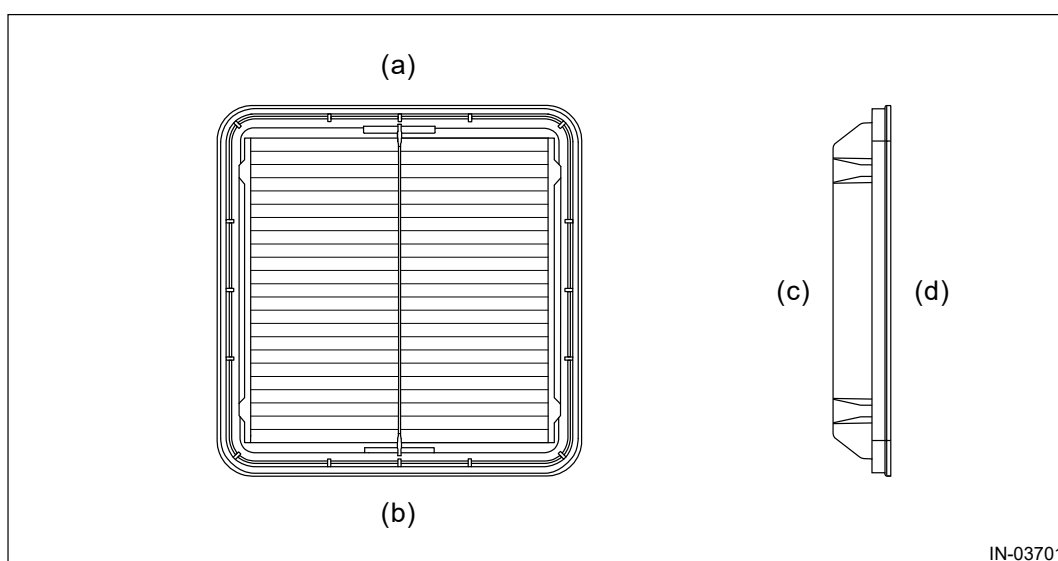
Install in the reverse order of removal.

Caution:

Be sure to use SUBARU genuine air cleaner element depending on the engine type when replacing the air cleaner elements. Using other air cleaner element may affect the engine performance.

Note:

- Check that there is no dirt or dust within the air cleaner case. If any dirt or dust is found, clean it.
- Install the air cleaner element as shown in the figure.



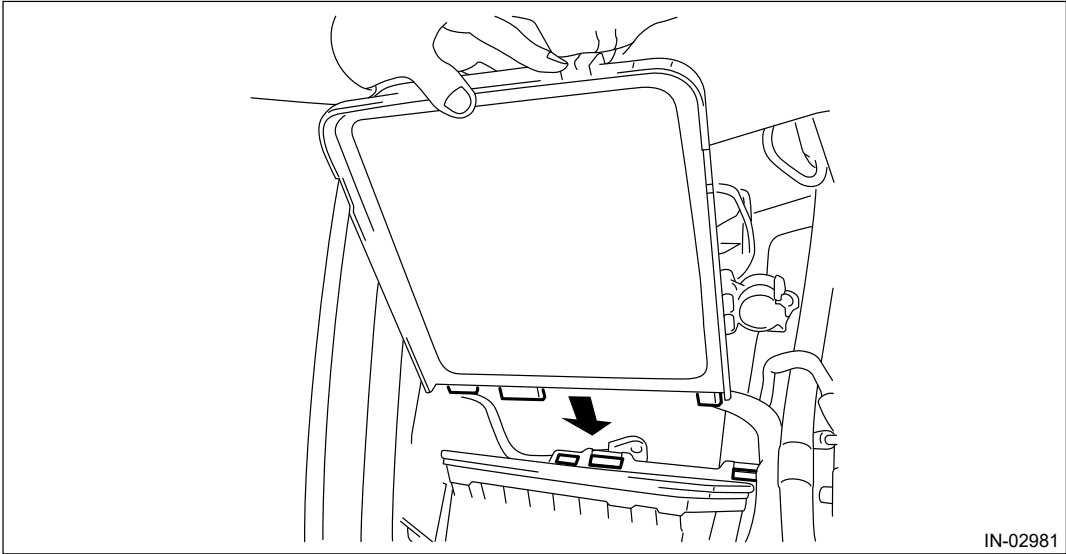
(a) Upside

(b) Downside

(c) Air cleaner case (front) side

(d) Air cleaner case (rear) side

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

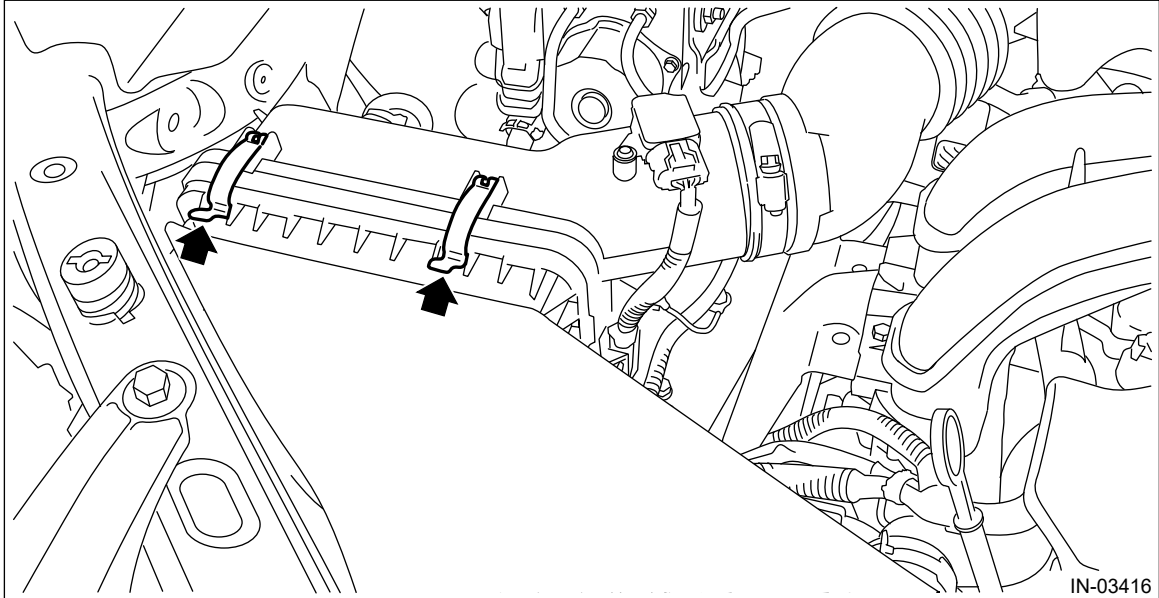


IN-02981

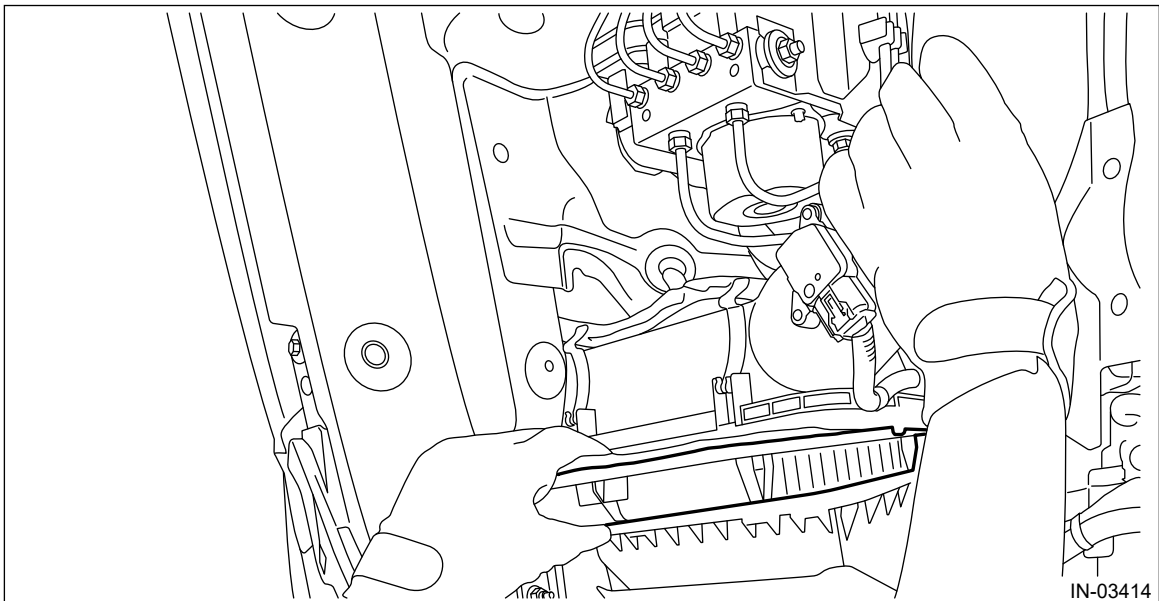
INTAKE (INDUCTION)(H4DO) > Air Cleaner Element

REMOVAL

1. Remove the clips from air cleaner case (front).



2. Open the air cleaner case, and remove the air cleaner element.



INTAKE (INDUCTION)(H4DO) > Air Intake Boot

INSPECTION

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

INTAKE (INDUCTION)(H4DO) > Air Intake Boot

INSTALLATION

Install in the reverse order of removal.

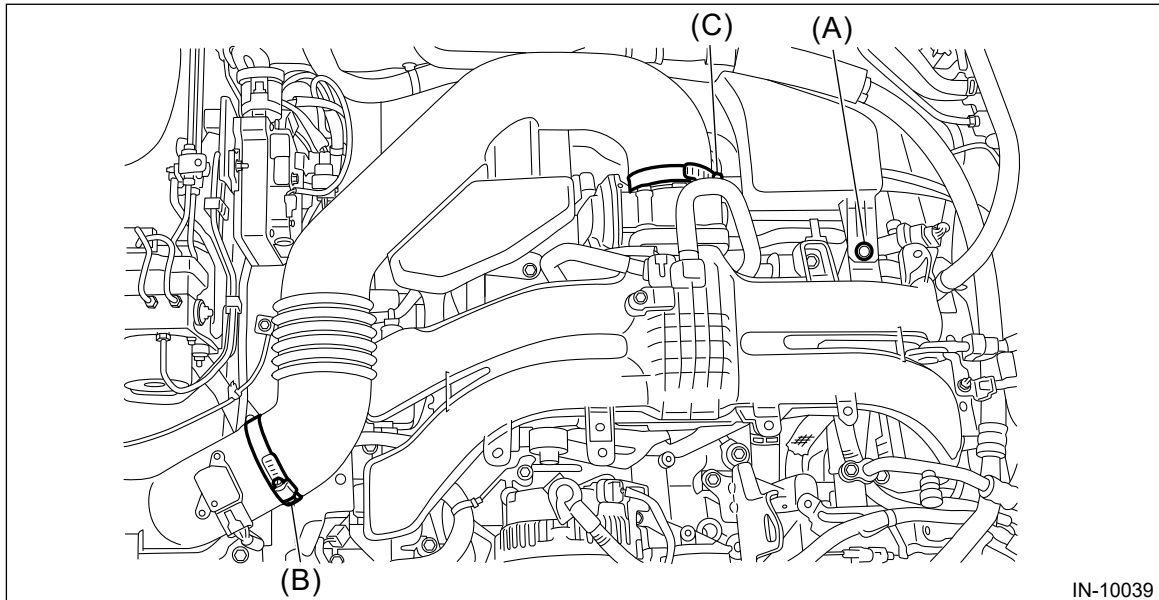
Tightening torque:

3 N·m (0.3 kgf-m, 2.2 ft-lb)

INTAKE (INDUCTION)(H4DO) > Air Intake Boot

REMOVAL

1. Remove the clip (A) from the air intake boot.
2. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
3. Loosen the clamp (C) which secures the throttle body to the air intake boot.



IN-10039

4. Disconnect the PCV hose and remove the air intake boot.

INTAKE (INDUCTION)(H4DO) > Air Intake Duct

INSPECTION

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

INTAKE (INDUCTION)(H4DO) > Air Intake Duct

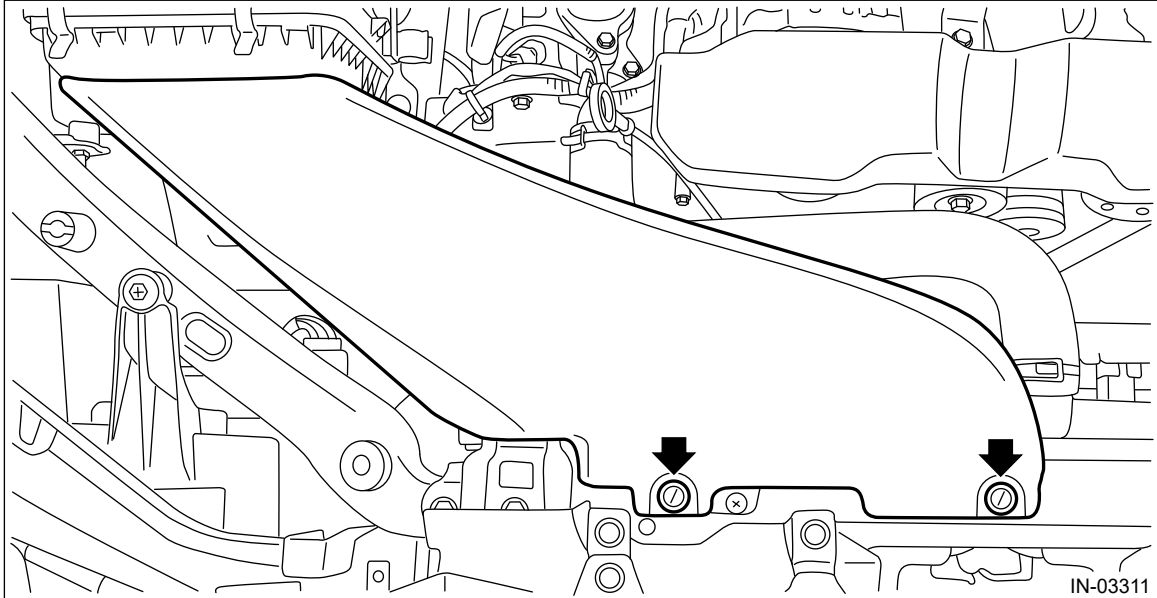
INSTALLATION

Install in the reverse order of removal.

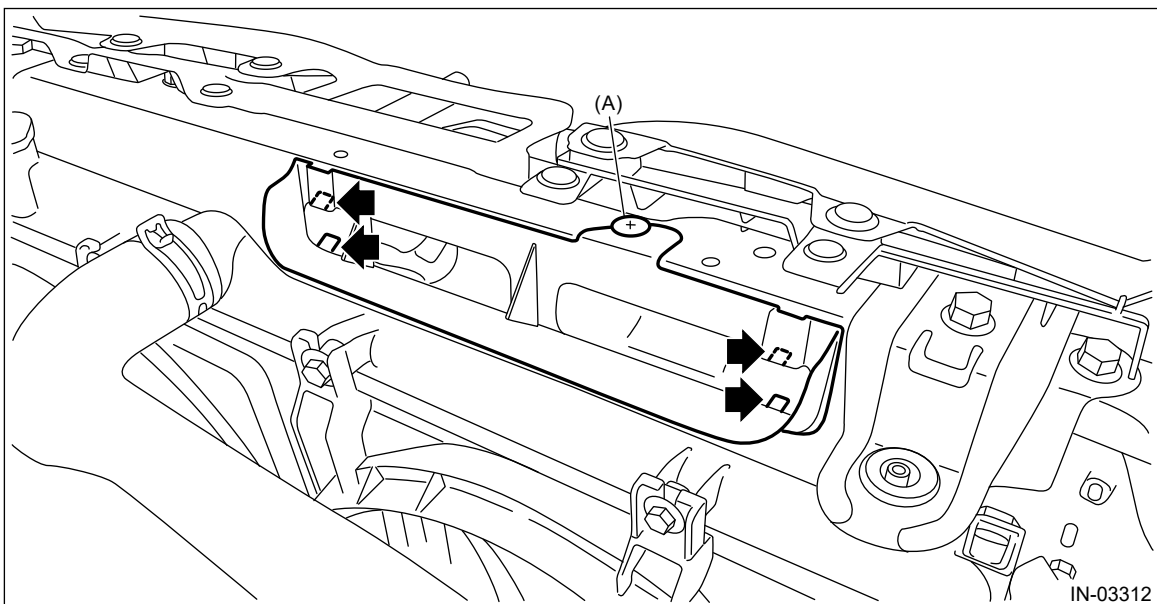
INTAKE (INDUCTION)(H4DO) > Air Intake Duct

REMOVAL

1. Remove the clip which secures air intake duct (rear), and remove the air intake duct (rear).



2. Remove the clip (A) and four claws and then remove the air intake duct (front).



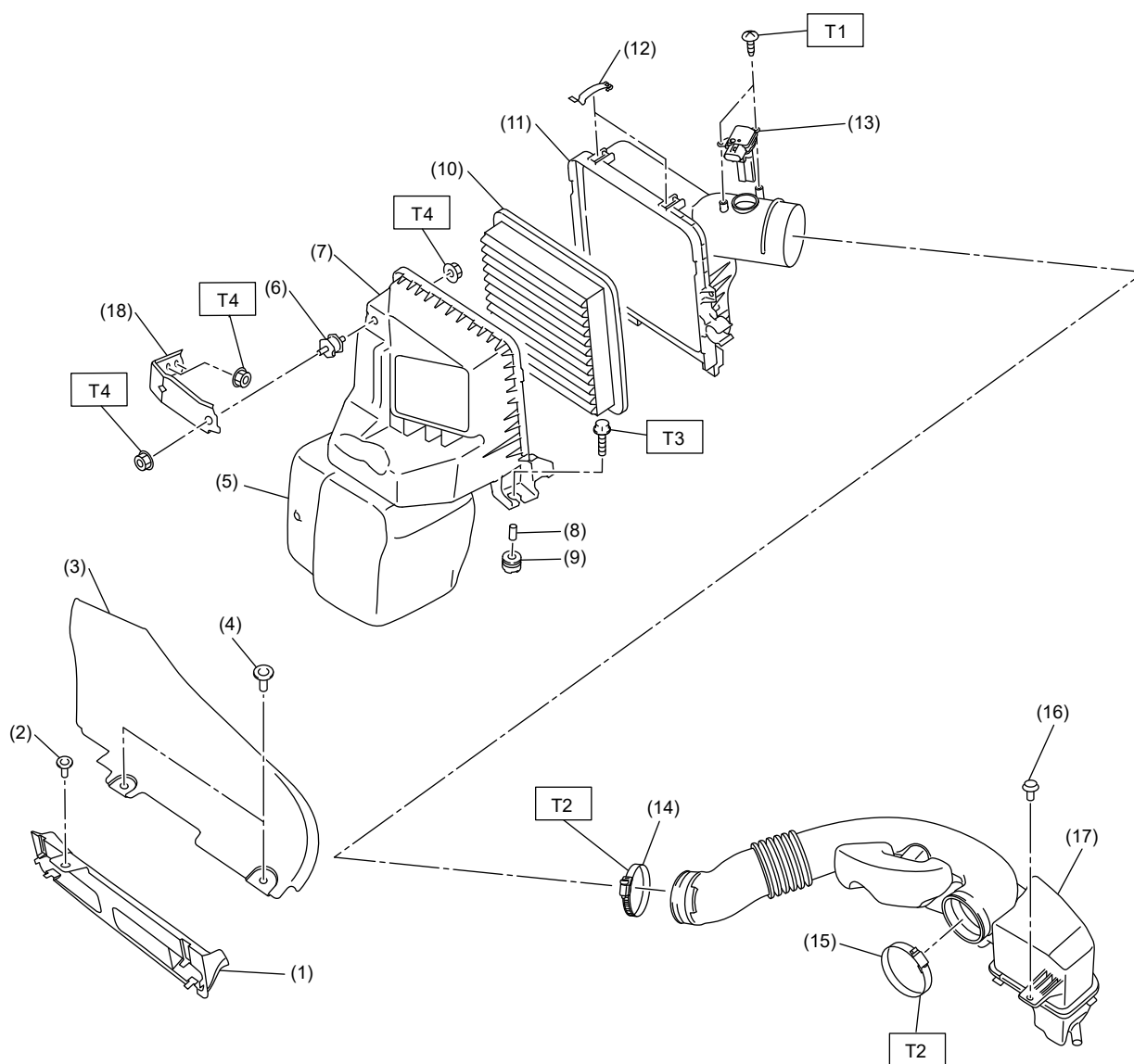
INTAKE (INDUCTION)(H4DO) > General Description

CAUTION

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

INTAKE (INDUCTION)(H4DO) > General Description

COMPONENT



IN-10038

- (1) Air intake duct (front)
- (2) Clip
- (3) Air intake duct (rear)
- (4) Clip

- (9) Cushion
- (10) Air cleaner element
- (11) Air cleaner case (rear)
- (12) Clip

- (17) Air intake boot
- (18) Air cleaner case bracket

Tightening torque: N·m (kgf·m,

ft-lb)

| | | |
|------------------------------|--|---------------------------|
| (5) Resonator chamber | (13) Mass air flow and intake air temperature sensor | T1: 1 (0.1, 0.7) |
| (6) Cushion | (14) Clamp | T2: 3 (0.3, 2.2) |
| (7) Air cleaner case (front) | (15) Clamp | T3: 6 (0.6, 4.4) |
| (8) Spacer | (16) Clip | T4: 7.5 (0.8, 5.5) |


INTAKE (INDUCTION)(H4DO) > Resonator Chamber

INSPECTION

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


INTAKE (INDUCTION)(H4DO) > Resonator Chamber

INSTALLATION

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to "Air Cleaner Case" for installation procedure.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Cleaner Case>INSTALLATION.](#)

INTAKE (INDUCTION)(H4DO) > Resonator Chamber

REMOVAL

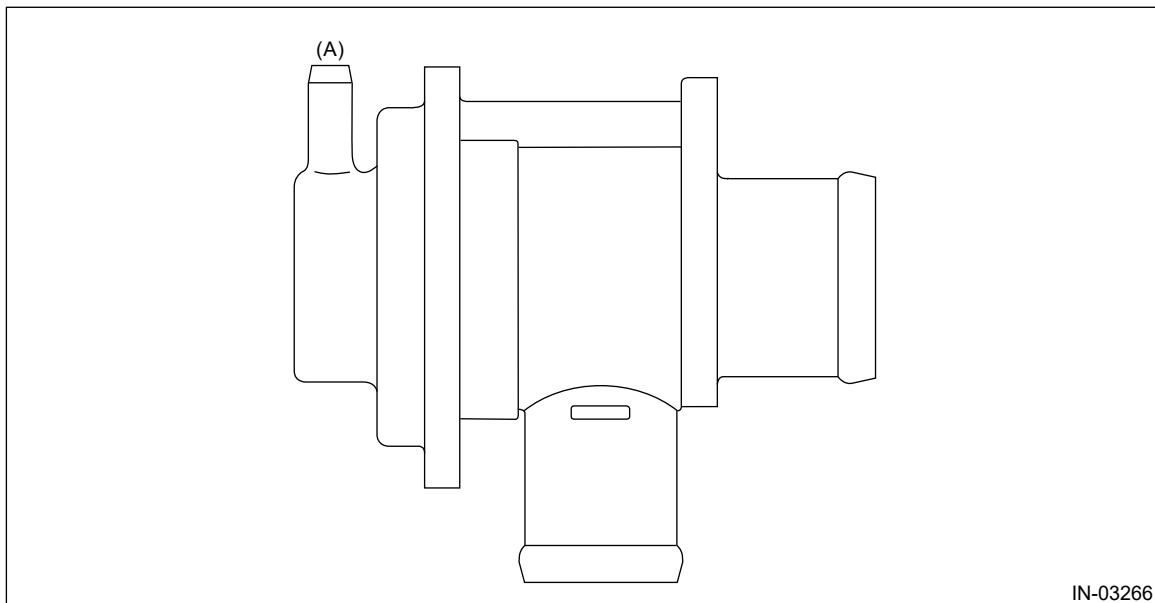
The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to "Air Cleaner Case" for removal procedure.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Cleaner Case>REMOVAL.](#)

INTAKE (INDUCTION)(H4DOTC) > Air By-pass Valve

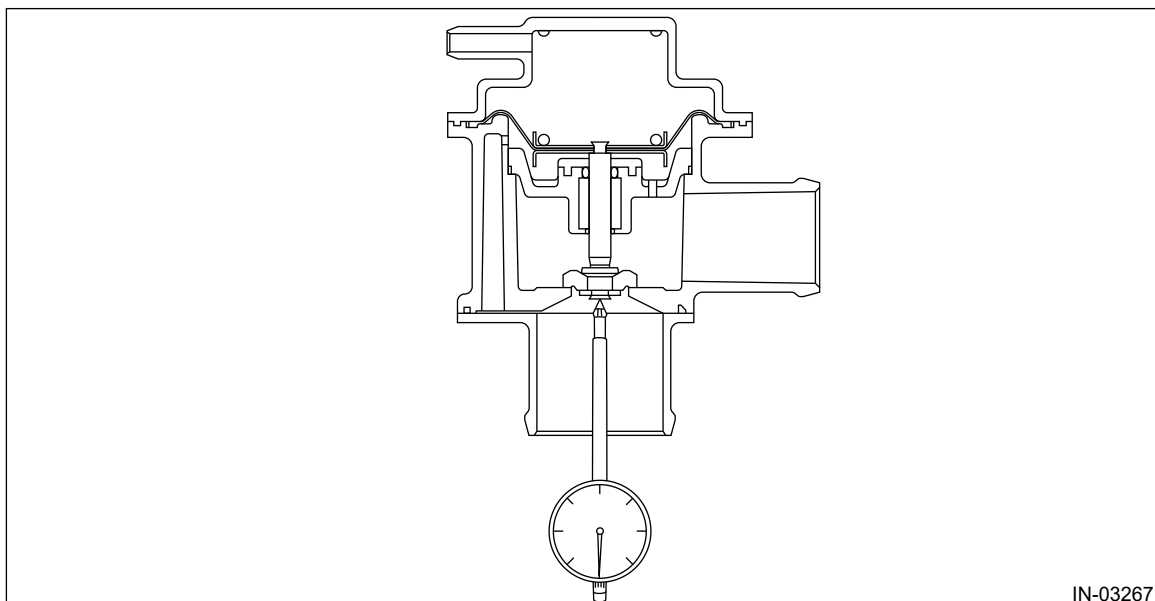
INSPECTION

1. AIR BY-PASS VALVE

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



3. Using the Mighty Vac, generate the vacuum pressure to -93.3 kPa (-0.95 kg/cm^2 , -13.5 psi). Check that the Mighty Vac gauge needle indication holds 10 seconds without dropping down to lower than -92.6 kPa (-0.94 kg/cm^2 , -13.4 psi).
4. Set a dial gauge to the end of valve rod of the air by-pass valve.



5. Using the Mighty Vac, generate the vacuum pressure, and check the pressure when dial gauge needle (valve stroke) shows 0.5 mm (0.02 in). If it is not within the standard, replace

the air by-pass valve.

Opening pressure (valve stroke 0.5 mm (0.02 in)):

Standard

–13.3– –21.3 kPa (–0.14– –0.22 kg/cm², –1.93– –3.09 psi)

2. OTHER INSPECTIONS

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

INTAKE (INDUCTION)(H4DOTC) > Air By-pass Valve

INSTALLATION


Install in the reverse order of removal.

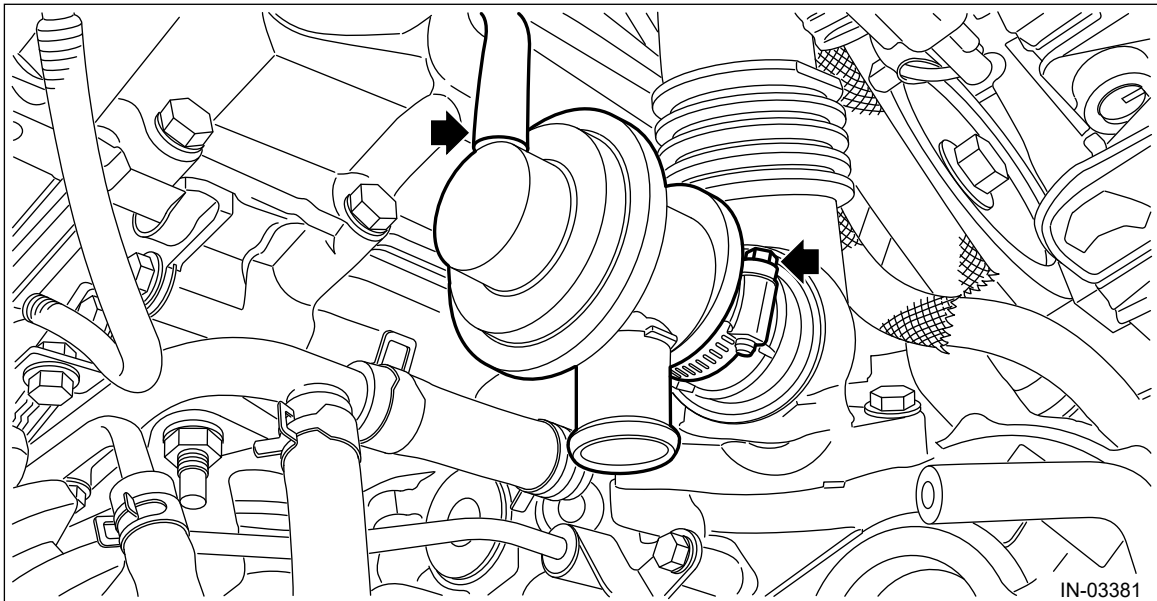
Tightening torque:

3 N·m (0.3 kgf-m, 2.2 ft-lb)

INTAKE (INDUCTION)(H4DOTC) > Air By-pass Valve

REMOVAL

1. Remove the intake duct No. 1.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 1.](#)
2. Disconnect the vacuum hose from the air by-pass valve, and remove the air by-pass valve from the intake duct No. 2.



INTAKE (INDUCTION)(H4DOTC) > Air Cleaner Case

INSPECTION

Check that the air cleaner case has no deformation, cracks or other damages.

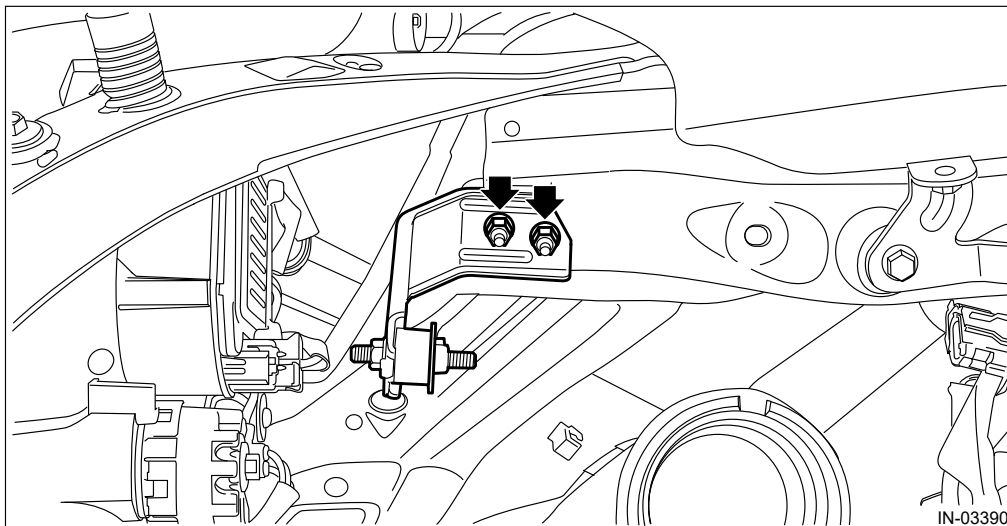
INTAKE (INDUCTION)(H4DOTC) > Air Cleaner Case

INSTALLATION

1. Install the air cleaner case bracket to the vehicle.

Tightening torque:

7.5 N•m (0.8 kgf-m, 5.5 ft-lb)



2. Install the bolt (A) and nut (B) which secure the air cleaner case (front) to the vehicle and to the air cleaner case bracket.

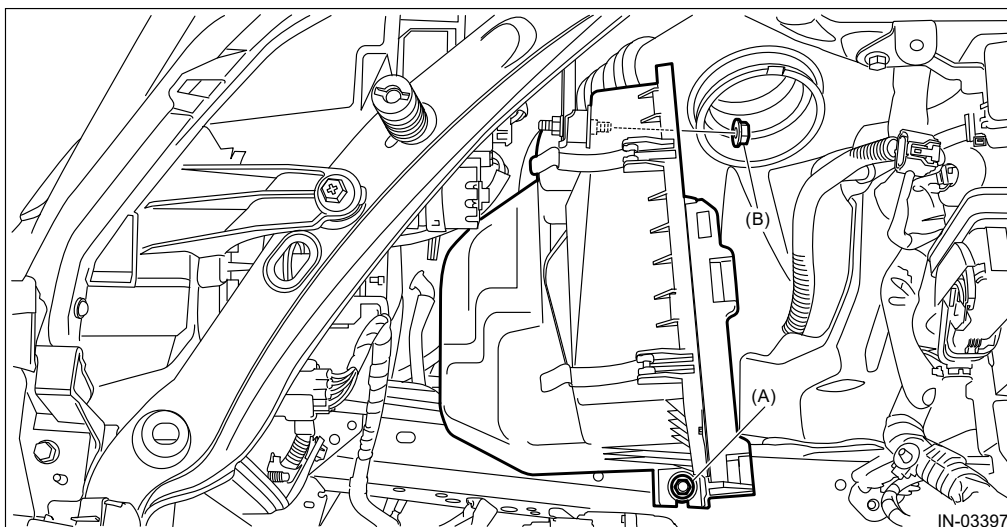
Tightening torque:

Bolt (A)

6 N•m (0.6 kgf-m, 4.4 ft-lb)

Nut (B)

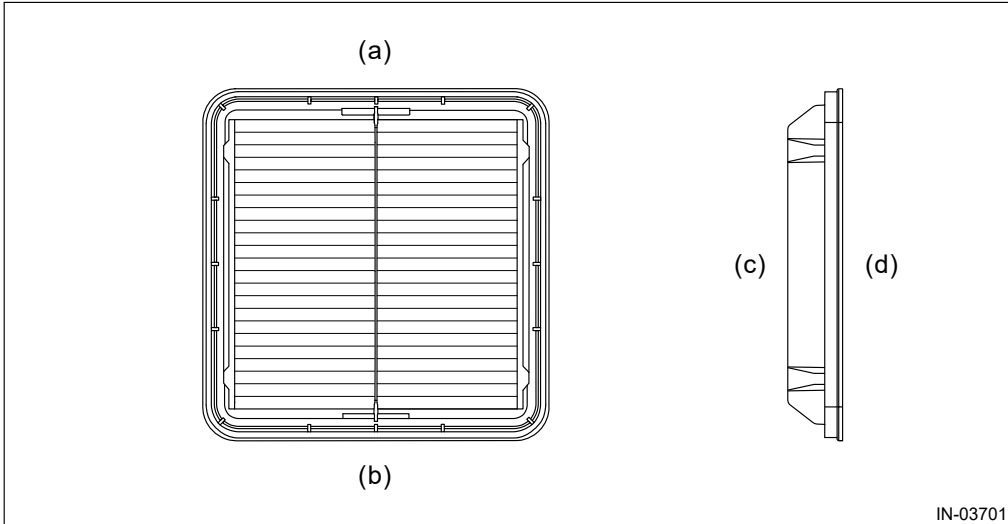
7.5 N•m (0.8 kgf-m, 5.5 ft-lb)



3. Set the air cleaner element to the air cleaner case (front), and install the air cleaner case (rear).

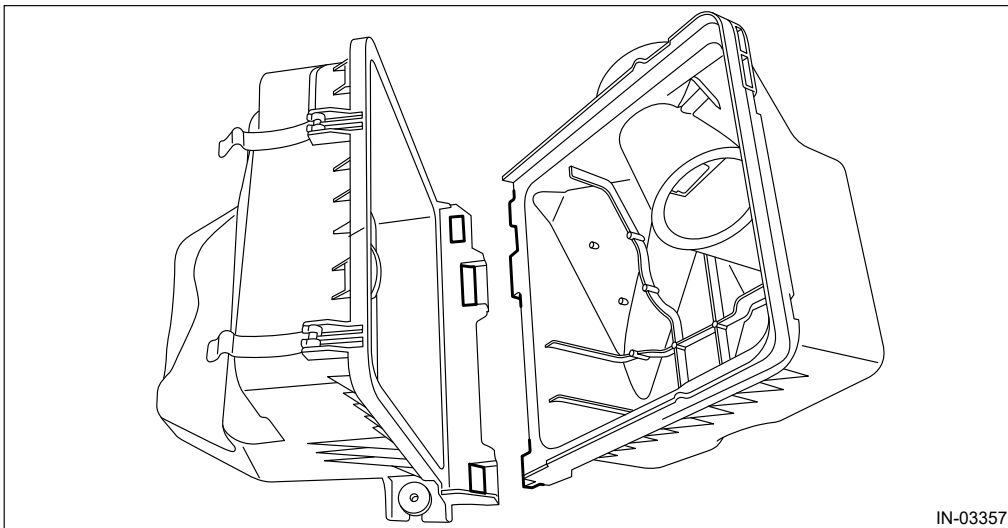
Note:

- Check that there is no dirt or dust within the air cleaner case. If any dirt or dust is found, clean it.
- Install the air cleaner element as shown in the figure.

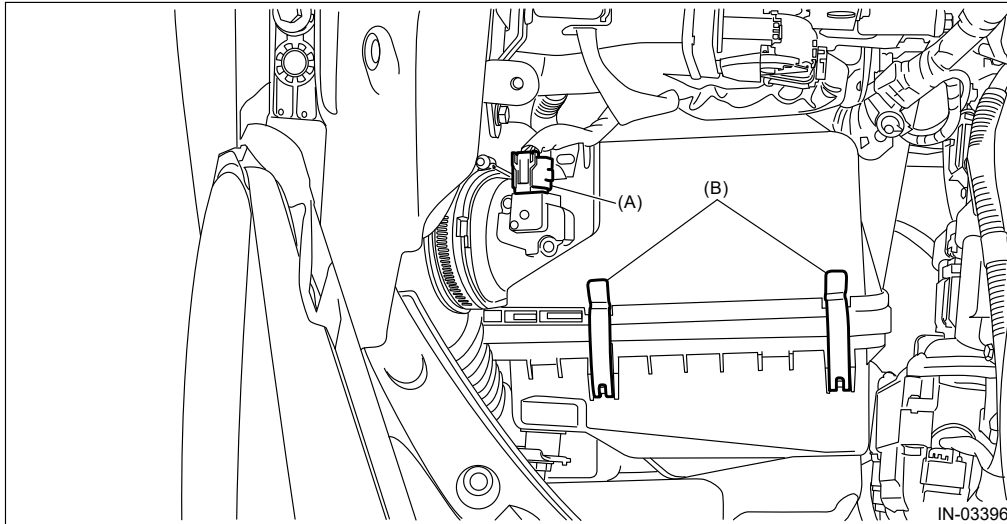


- (a) Upside
- (b) Downside
- (c) Air cleaner case (front) side
- (d) Air cleaner case (rear) side

- **When installing the air cleaner case (rear), align the protrusion of the air cleaner case (rear) to the hole on the air cleaner case (front) to install.**



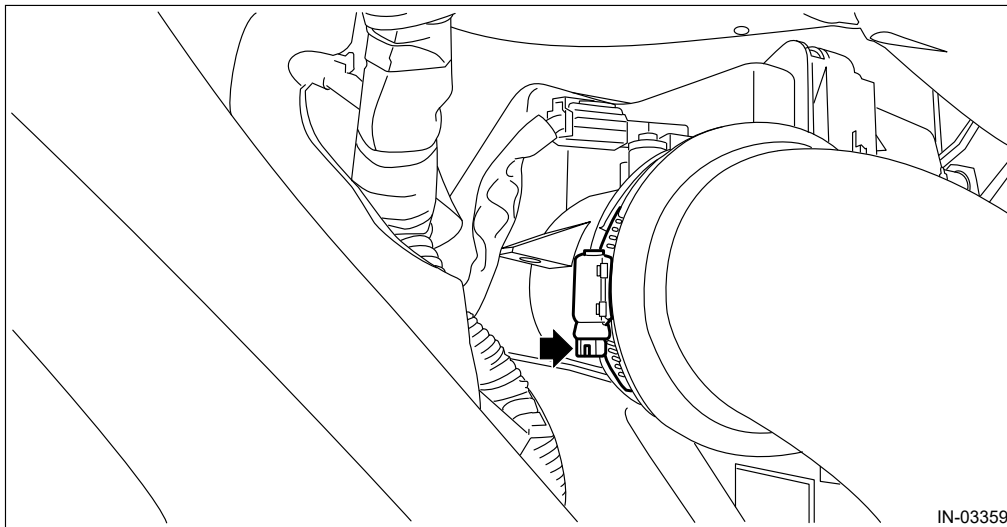
4. Install the clip (B) to the air cleaner case (rear), and connect the connector (A) to the mass air flow and intake air temperature sensor.



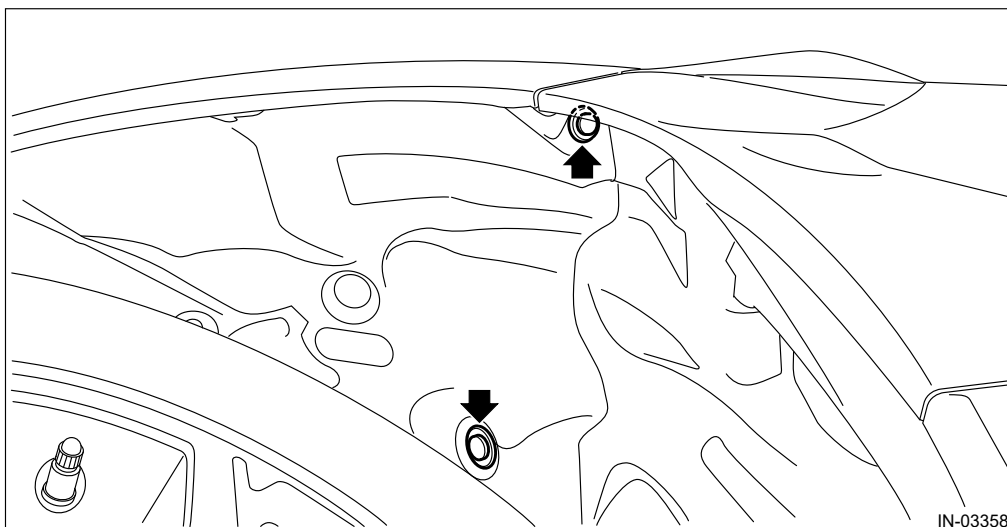
5. Tighten the clamp which secures the air intake boot to the air cleaner case (rear).

Tightening torque:

2.5 N•m (0.3 kgf-m, 1.8 ft-lb)





6. Set the front mud guard RH to the vehicle, and install the clips which secure the front mud guard RH.






7. Install the engine control module (ECM).  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine](#)

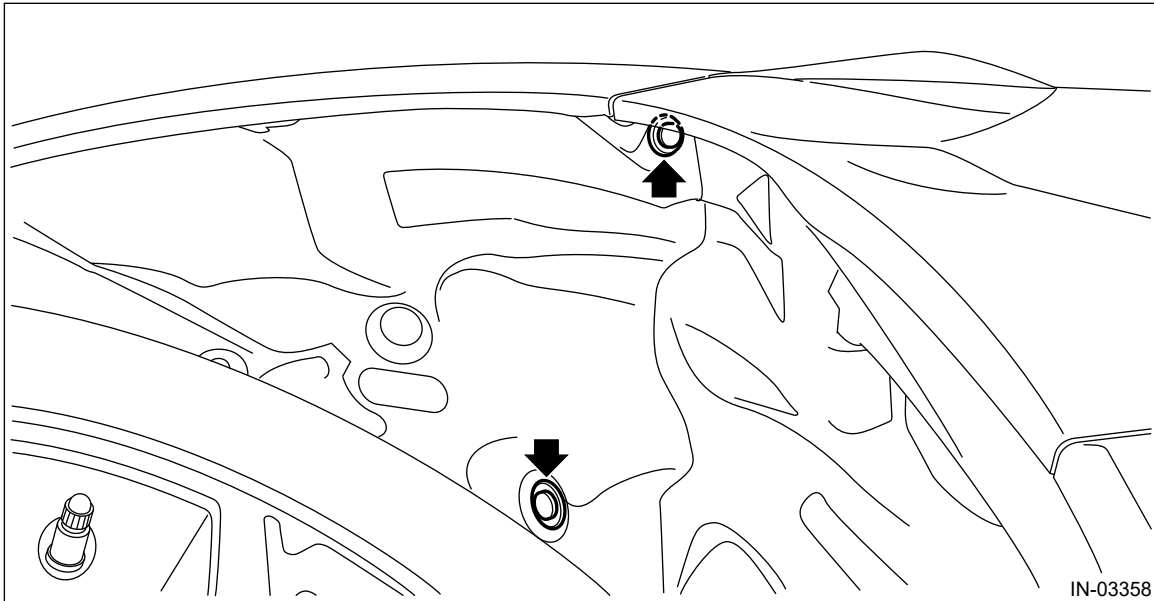
Control Module (ECM)>INSTALLATION.

- 8.** Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
- 9.** Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)

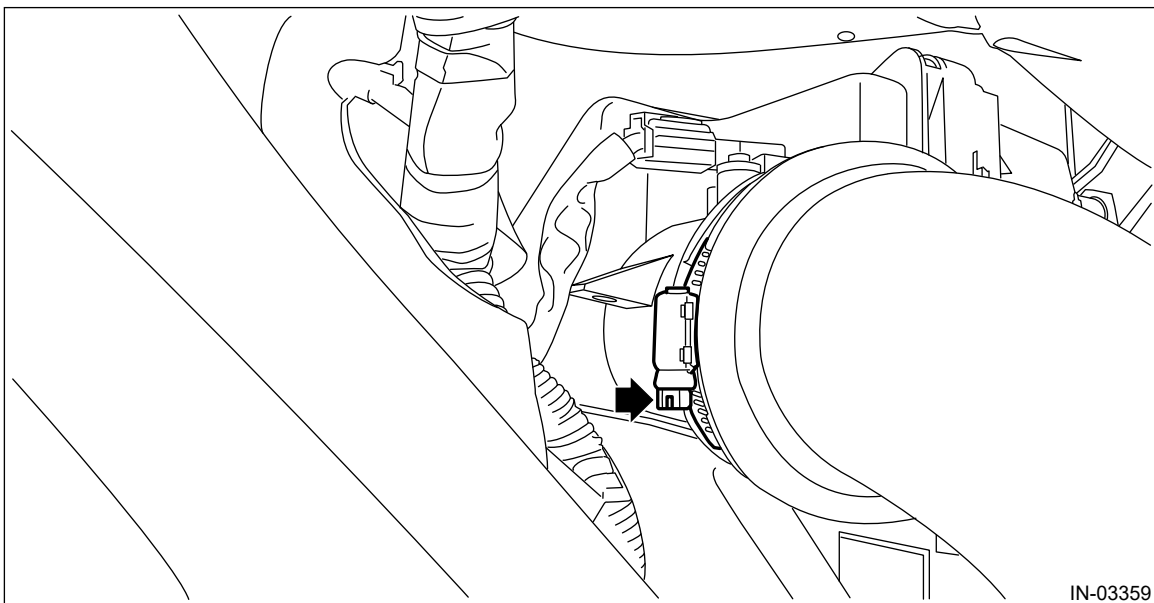
INTAKE (INDUCTION)(H4DOTC) > Air Cleaner Case

REMOVAL

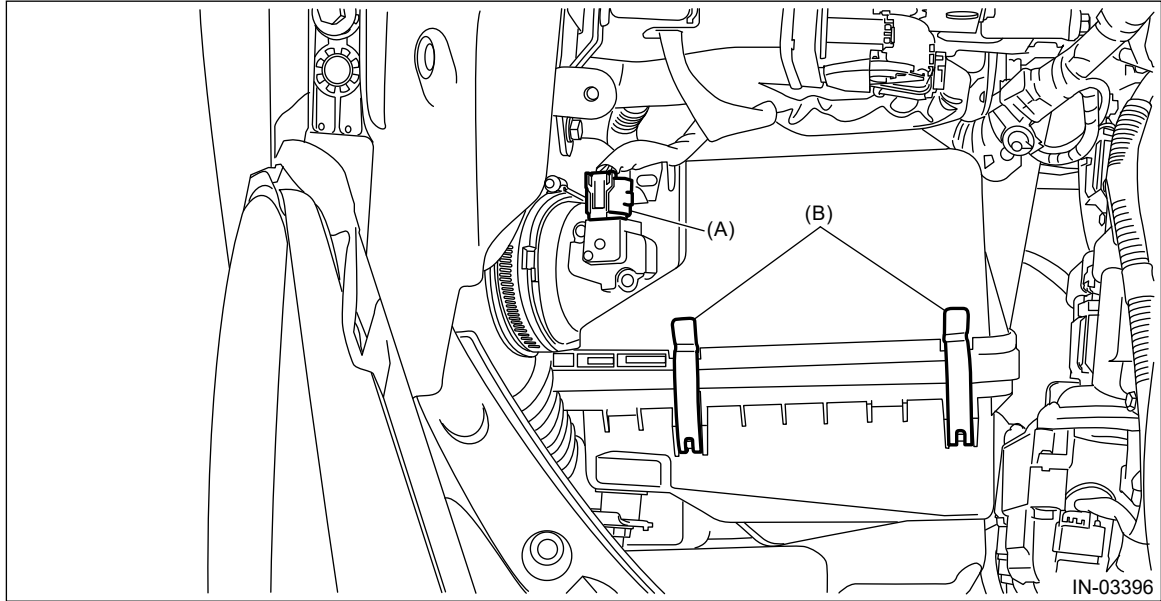
1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
3. Remove the engine control module (ECM).  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Engine Control Module \(ECM\)>REMOVAL.](#)
4. Remove the clips (2 places) which secure the front mud guard RH to the vehicle.



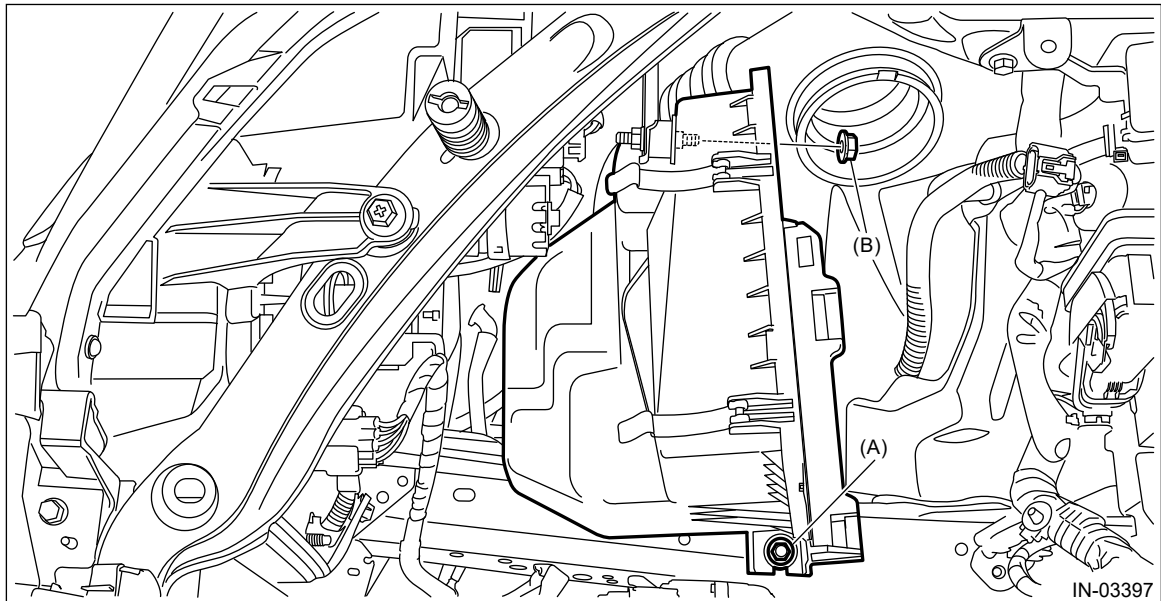
5. Turn over the front mud guard RH, and loosen the clamp which secures the air intake boot to the air cleaner case (rear).



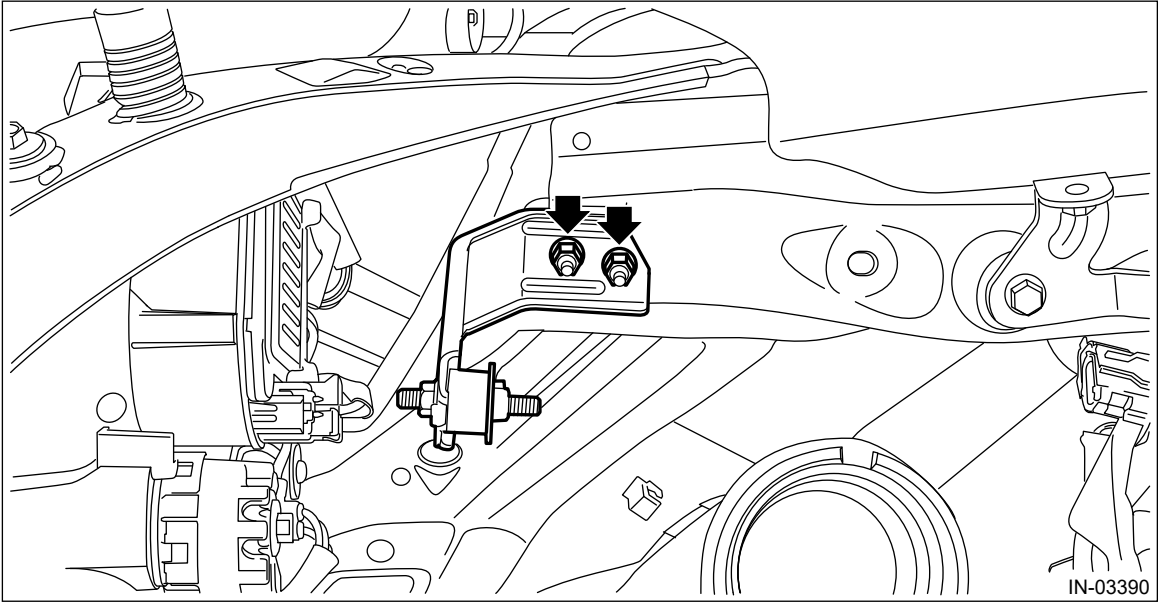
6. Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B) from the air cleaner case (rear).



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



9. Remove the air cleaner case bracket from the vehicle.



IN-03390

INTAKE (INDUCTION)(H4DOTC) > Air Cleaner Element

INSPECTION

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

INTAKE (INDUCTION)(H4DOTC) > Air Cleaner Element

INSTALLATION

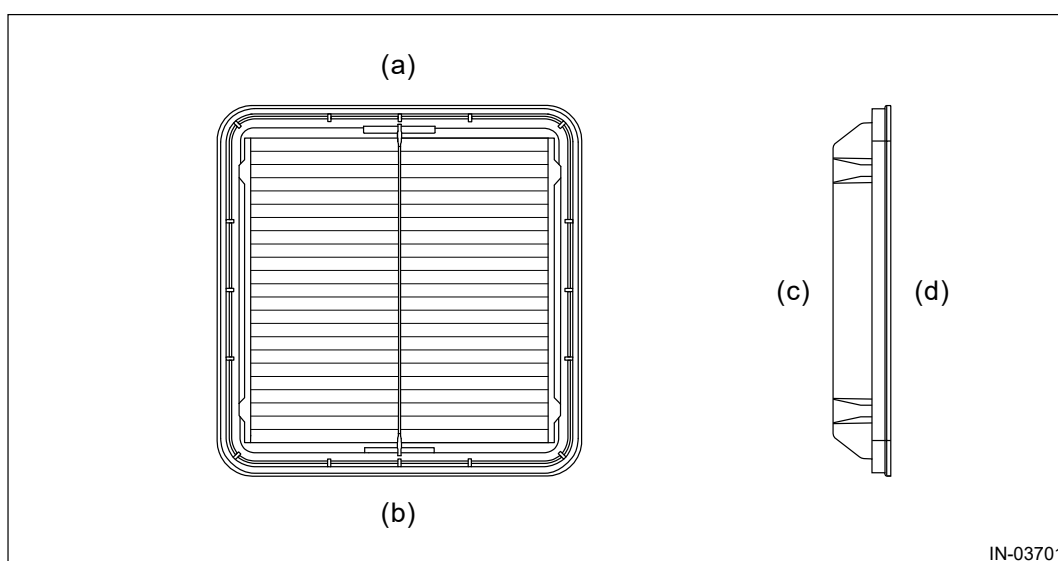
Install in the reverse order of removal.

Caution:

Be sure to use SUBARU genuine air cleaner element depending on the engine type when replacing the air cleaner elements. Using other air cleaner element may affect the engine performance.

Note:

- Check that there is no dirt or dust within the air cleaner case. If any dirt or dust is found, clean it.
- Install the air cleaner element as shown in the figure.



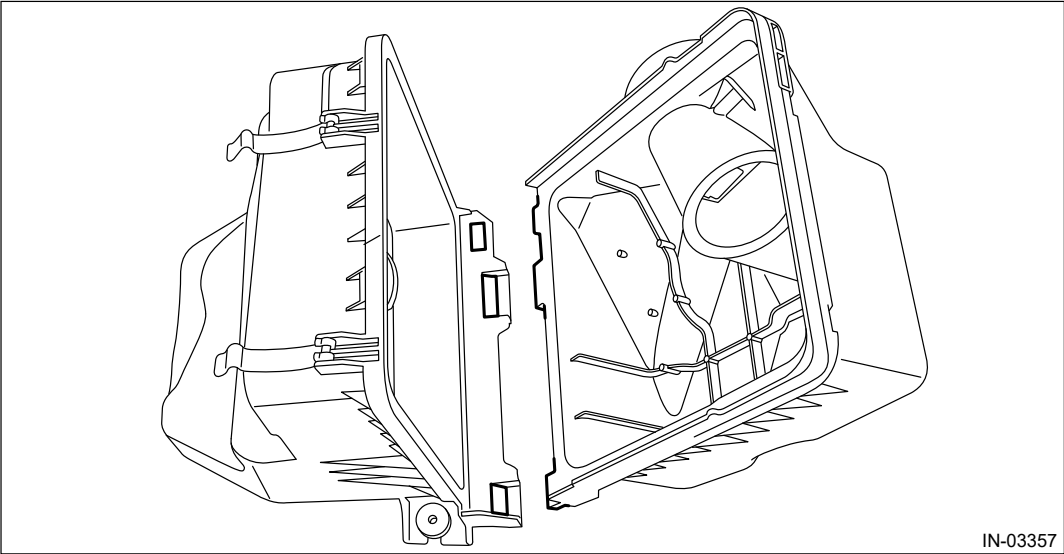
(a) Upside

(b) Downside

(c) Air cleaner case (front) side

(d) Air cleaner case (rear) side

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

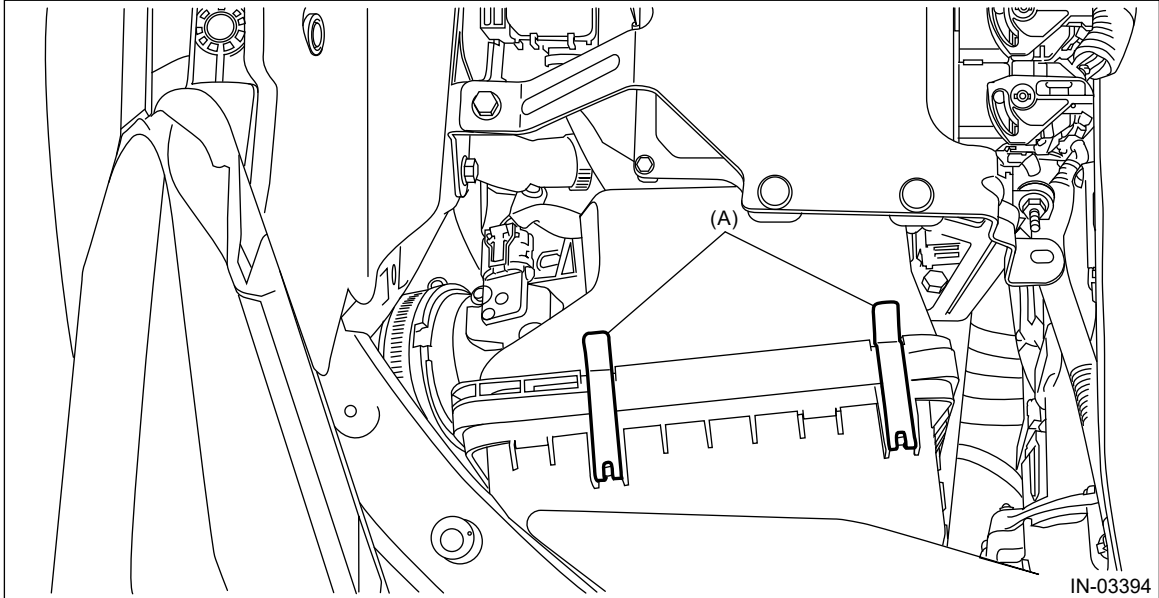


IN-03357

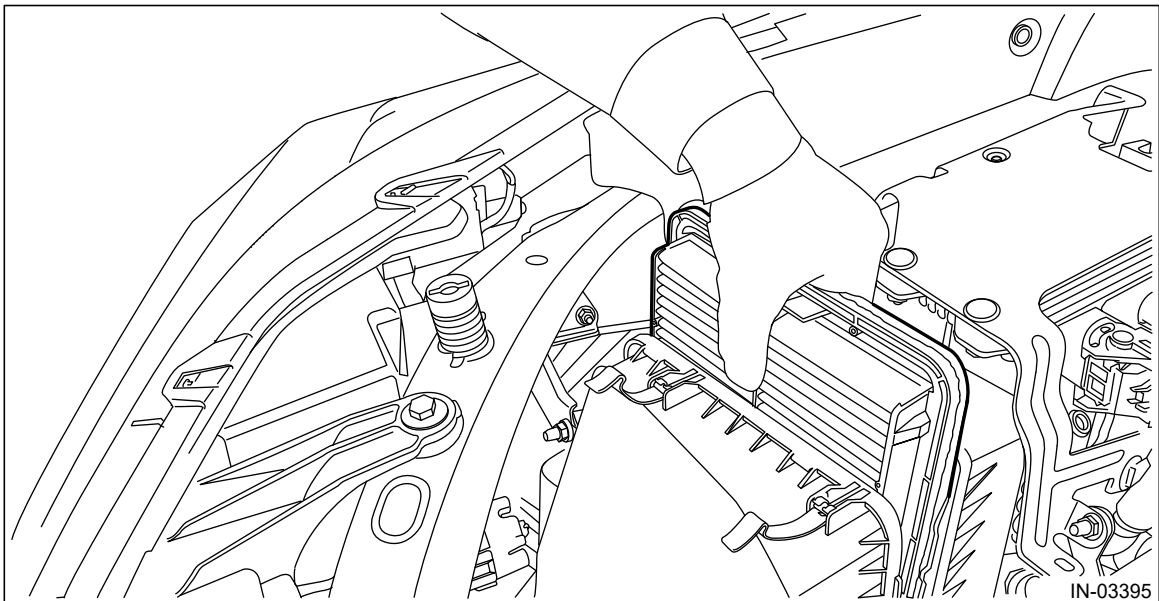
INTAKE (INDUCTION)(H4DOTC) > Air Cleaner Element

REMOVAL

1. Remove the clip (A) from the air cleaner case (rear).



2. Open the air cleaner case, and remove the air cleaner element.



INTAKE (INDUCTION)(H4DOTC) > Air Intake Boot

ASSEMBLY

Assemble in the reverse order of disassembly.

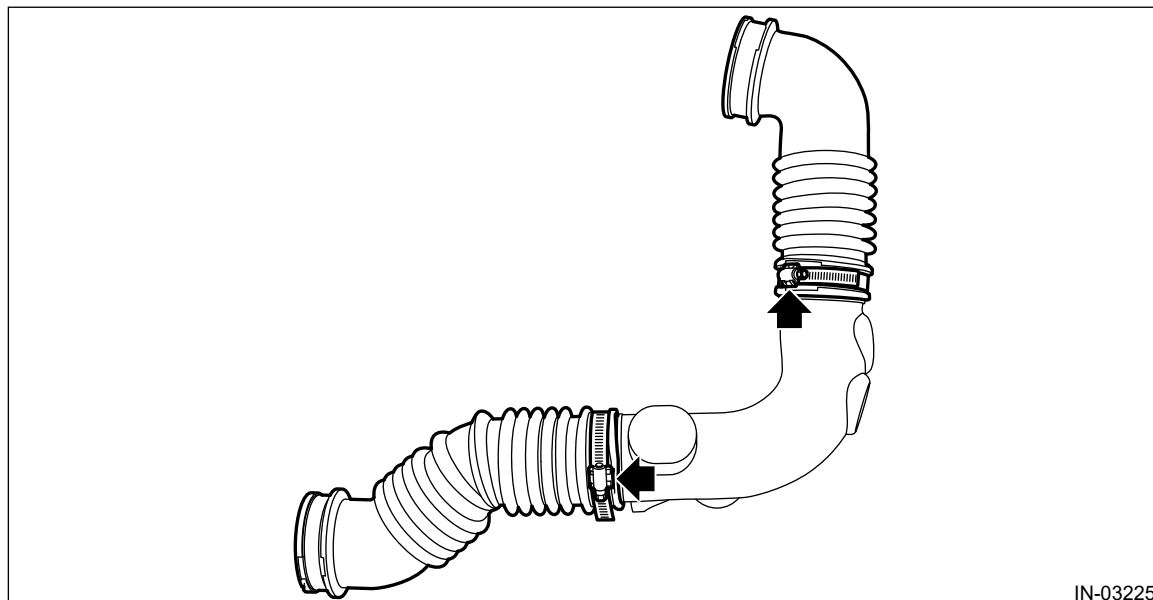
Tightening torque:

2.5 N·m (0.3 kgf-m, 1.8 ft-lb)

INTAKE (INDUCTION)(H4DOTC) > Air Intake Boot

DISASSEMBLY

Remove the air intake boot from the turbo duct.



IN-03225

INTAKE (INDUCTION)(H4DOTC) > Air Intake Boot

INSPECTION

Check that the air intake boot and turbo duct have no cracks, damage or loose part.

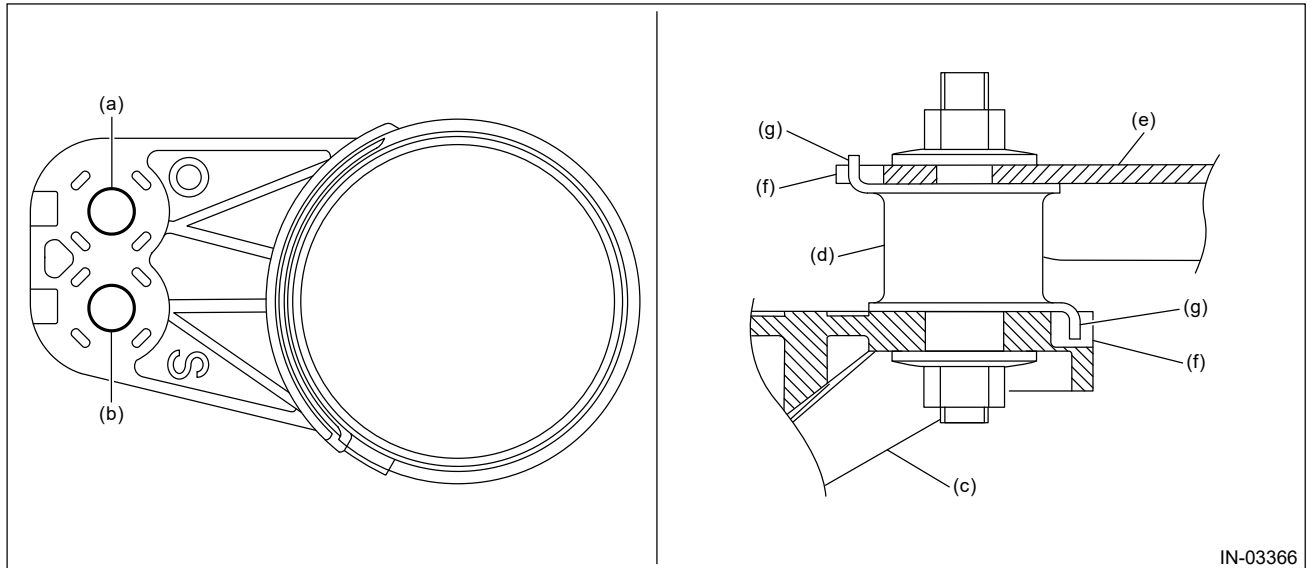
INTAKE (INDUCTION)(H4DOTC) > Air Intake Boot

INSTALLATION

Install in the reverse order of removal.

Note:

When installing the air intake boot to the vehicle, pay attention to the mounting hole position, and align the protrusion for stopping rotation of cushion to the cutout portion on the turbo duct.



(a) Attachment hole

(b) Not used

(c) Turbo duct

(d) Cushion

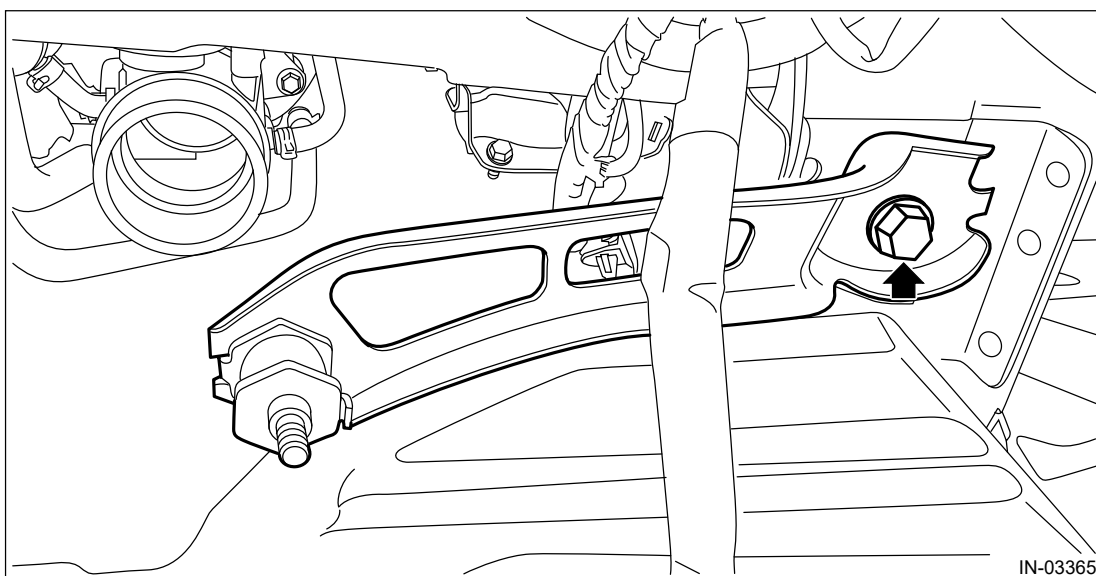
(e) Duct bracket

(f) Cutout portion

(g) Protrusion portion

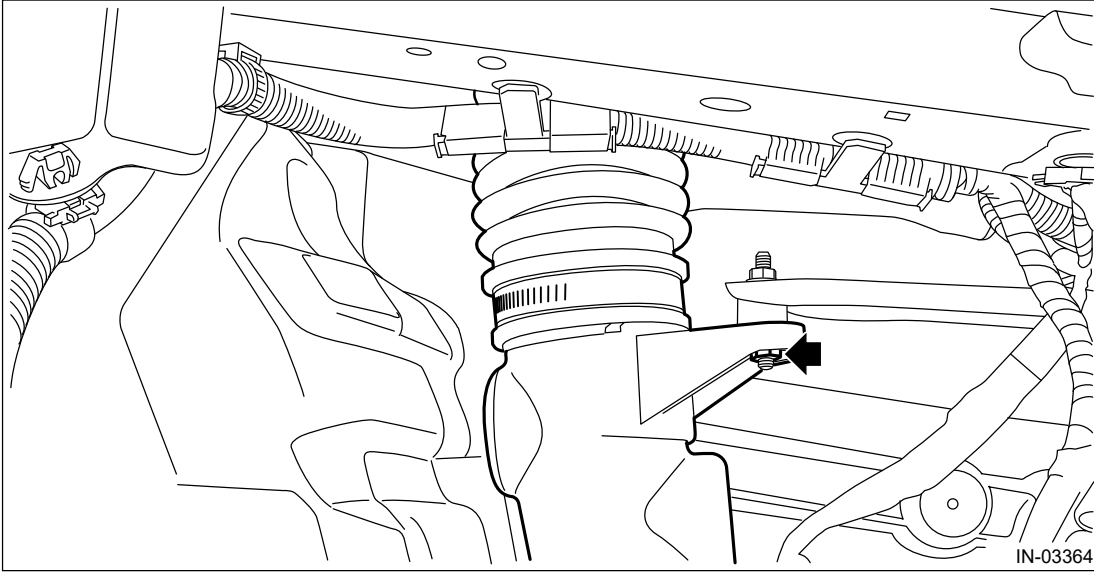
Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



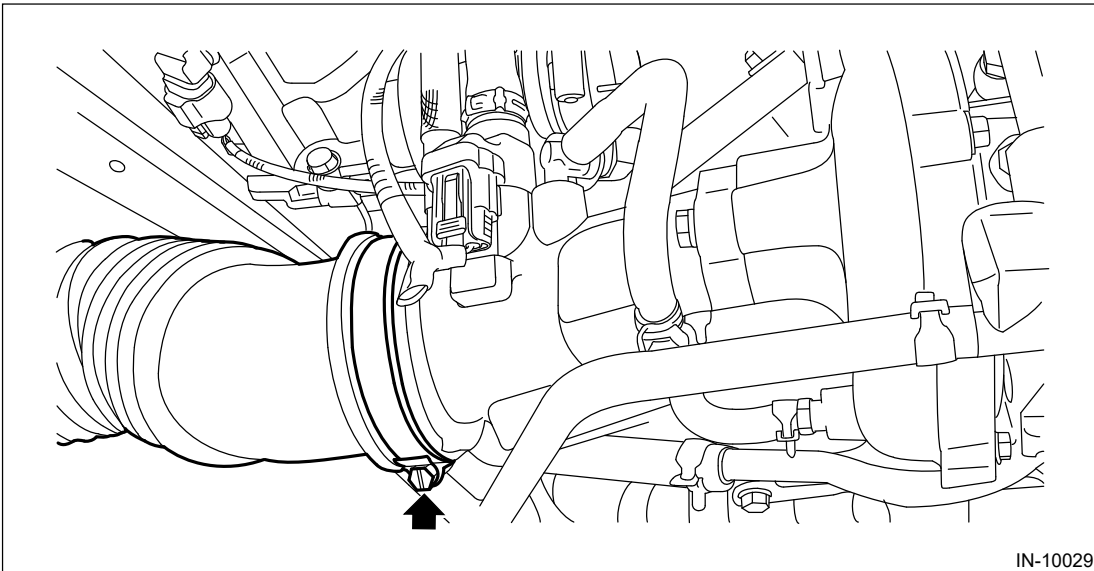
Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)






Tightening torque:

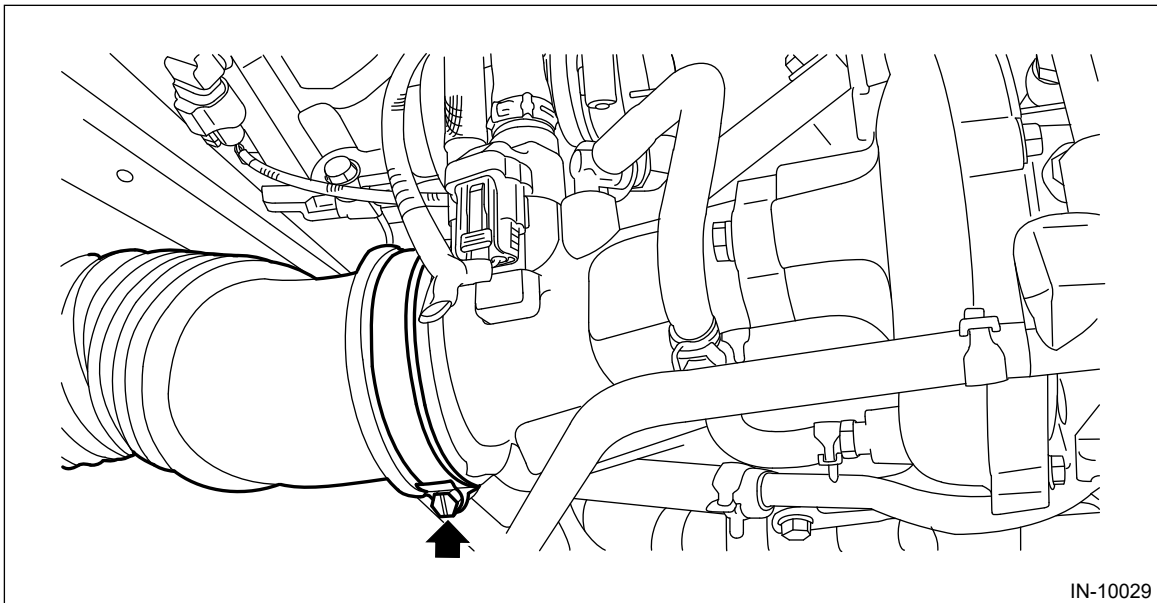
2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



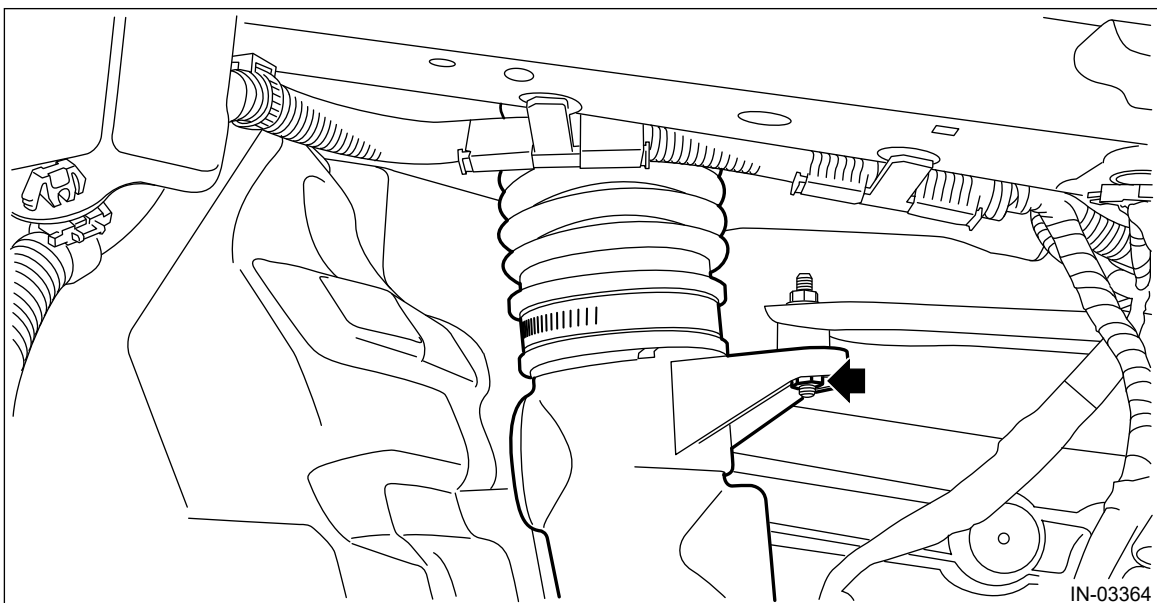
INTAKE (INDUCTION)(H4DOTC) > Air Intake Boot

REMOVAL

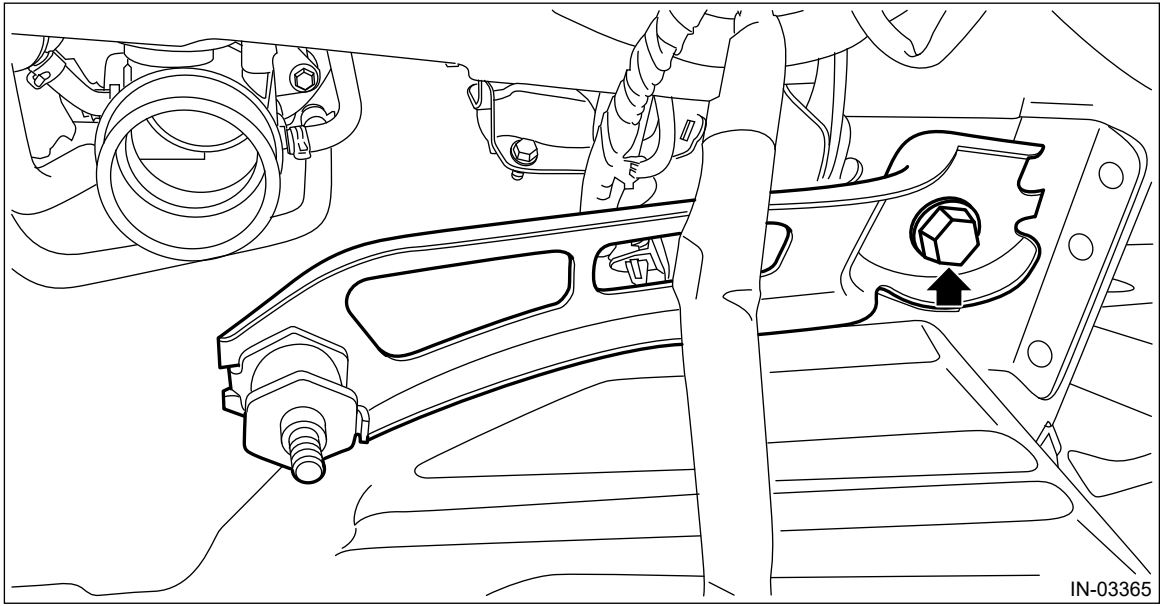
1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air cleaner case.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Cleaner Case>REMOVAL.](#)
3. Lift up the vehicle.
4. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
5. Remove the air intake boot from the intake duct No. 1.



6. Lower the vehicle.
7. Remove the nuts which secure the turbo duct to the vehicle, and remove the air intake boot from the upper side of the vehicle together with the turbo duct.



8. Remove the duct bracket from the vehicle.



INTAKE (INDUCTION)(H4DOTC) > Air Intake Duct

INSPECTION

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

INTAKE (INDUCTION)(H4DOTC) > Air Intake Duct

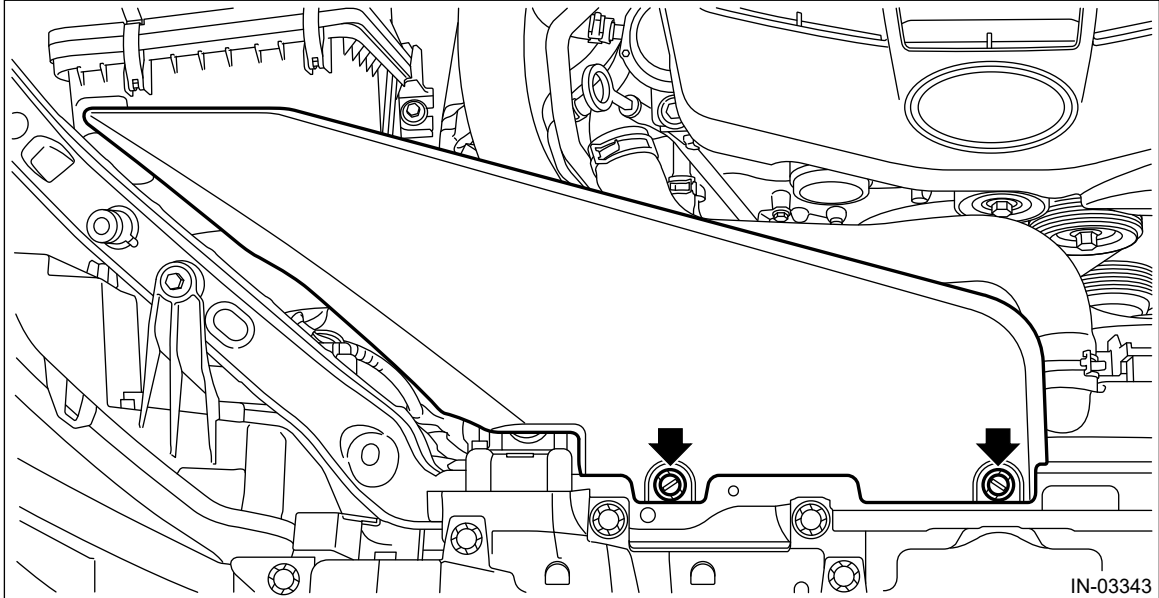
INSTALLATION

Install in the reverse order of removal.

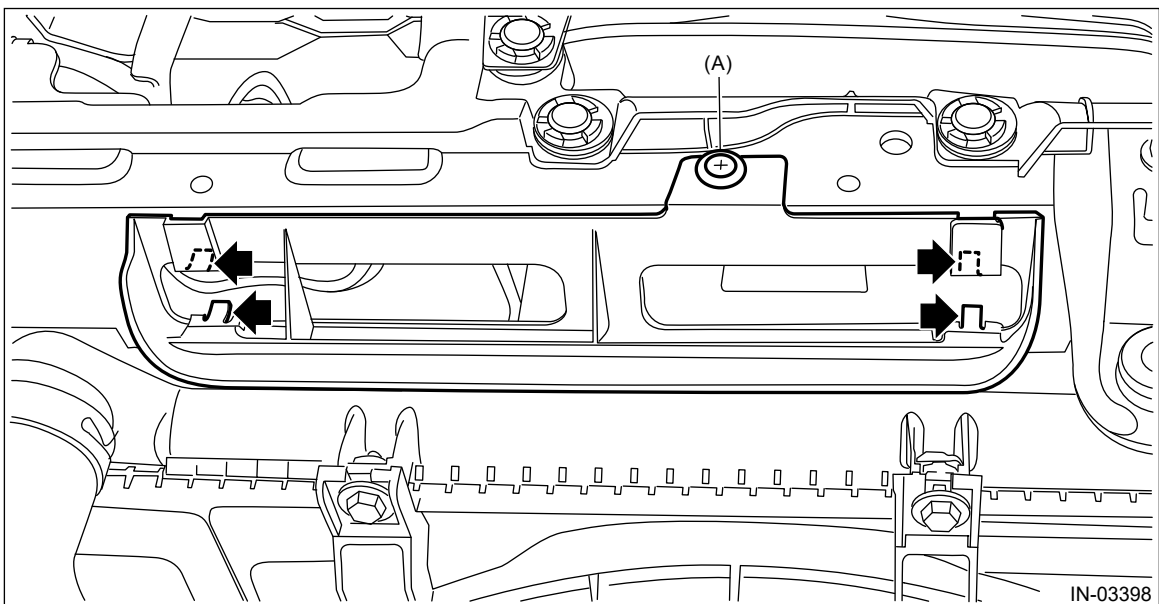
INTAKE (INDUCTION)(H4DOTC) > Air Intake Duct

REMOVAL

1. Remove the clip which secures air intake duct (rear), and remove the air intake duct (rear).



2. Remove the clip (A) and four claws and then remove the air intake duct (front).



INTAKE (INDUCTION)(H4DOTC) > General Description

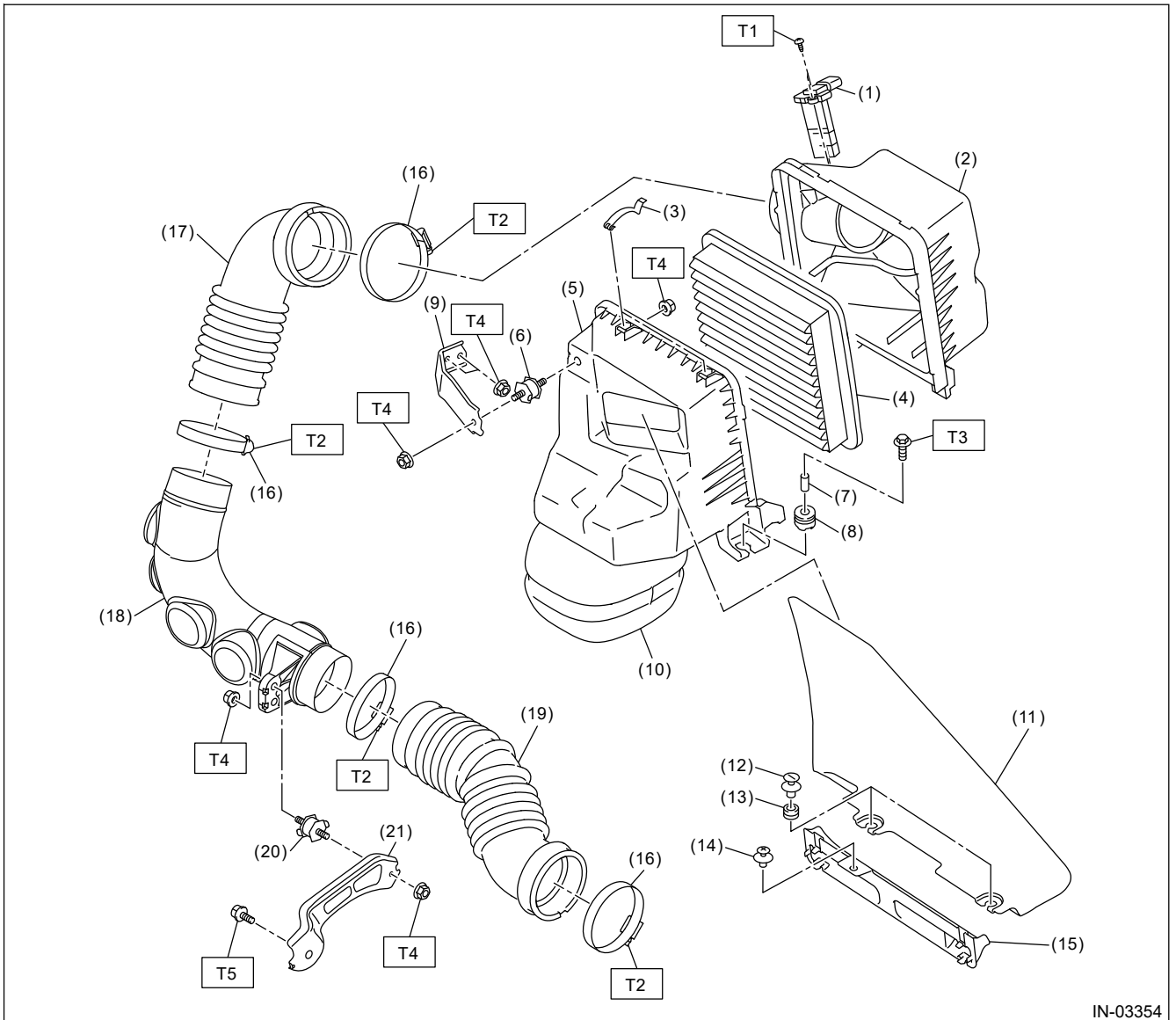
CAUTION

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

INTAKE (INDUCTION)(H4DOTC) > General Description

COMPONENT

1. AIR CLEANER



IN-03354

- | | | |
|---|------------------------------|-------------------|
| (1) Mass air flow and intake air temperature sensor | (11) Air intake duct (rear) | (21) Duct bracket |
| (2) Air cleaner case (rear) | (12) Clip | |
| (3) Clip | (13) Cushion | |
| (4) Air cleaner element | (14) Clip | |
| (5) Air cleaner case (front) | (15) Air intake duct (front) | |
| (6) Cushion | (16) Clamp | |
| (7) Spacer | (17) Air intake boot A | |
| (8) Cushion | (18) Turbo duct | |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 1 (0.1, 0.7)

T2: 2.5 (0.3, 1.8)

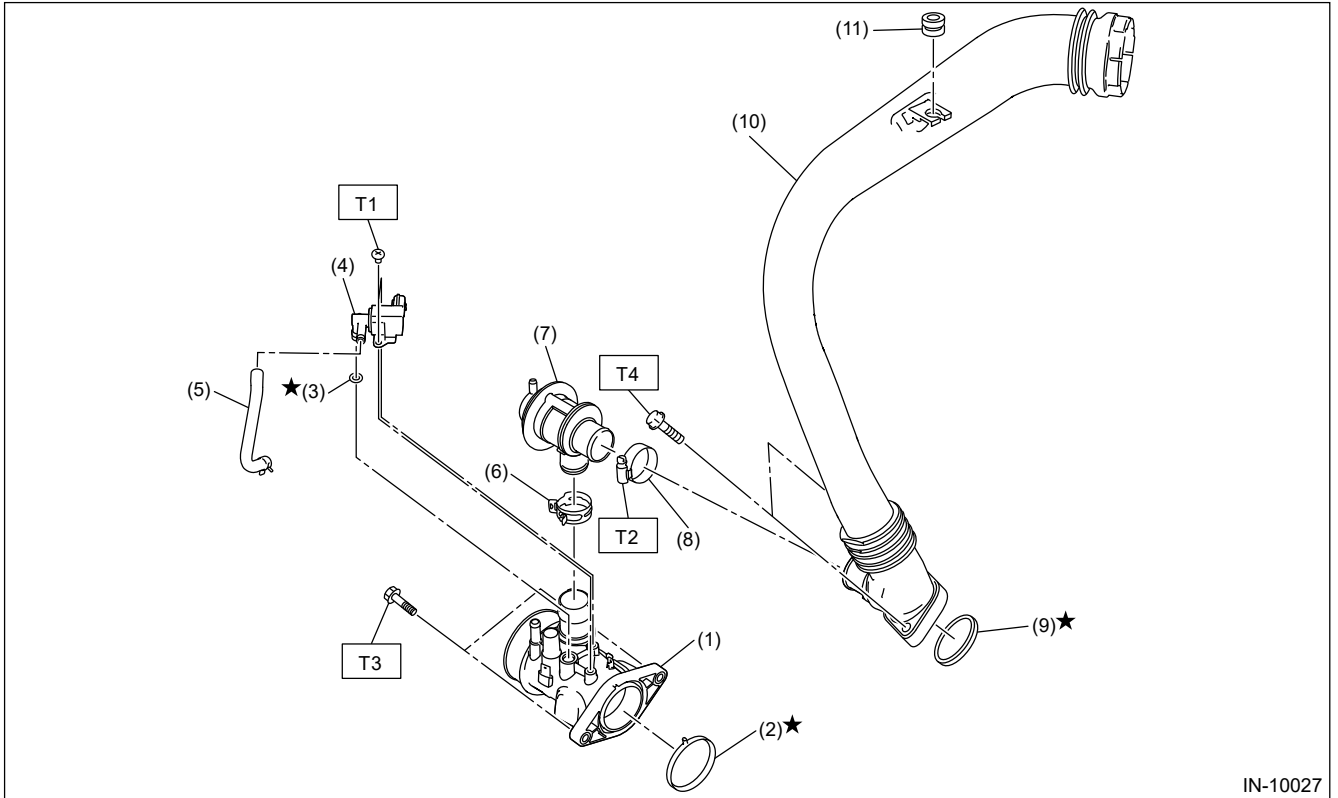
T3: 6 (0.6, 4.4)

T4: 7.5 (0.8, 5.5)

T5: 18 (1.8, 13.3)

- (9) Air cleaner case bracket
- (10) Resonator chamber
- (19) Air intake boot B
- (20) Cushion

2. INTAKE DUCT



- (1) Intake duct No. 1
- (2) O-ring
- (3) O-ring
- (4) Wastegate control solenoid valve
- (5) Vacuum control hose
- (6) Clip
- (7) Air by-pass valve
- (8) Clamp
- (9) O-ring
- (10) Intake duct No. 2
- (11) Cushion

Tightening torque: N·m (kgf-m, ft-lb)

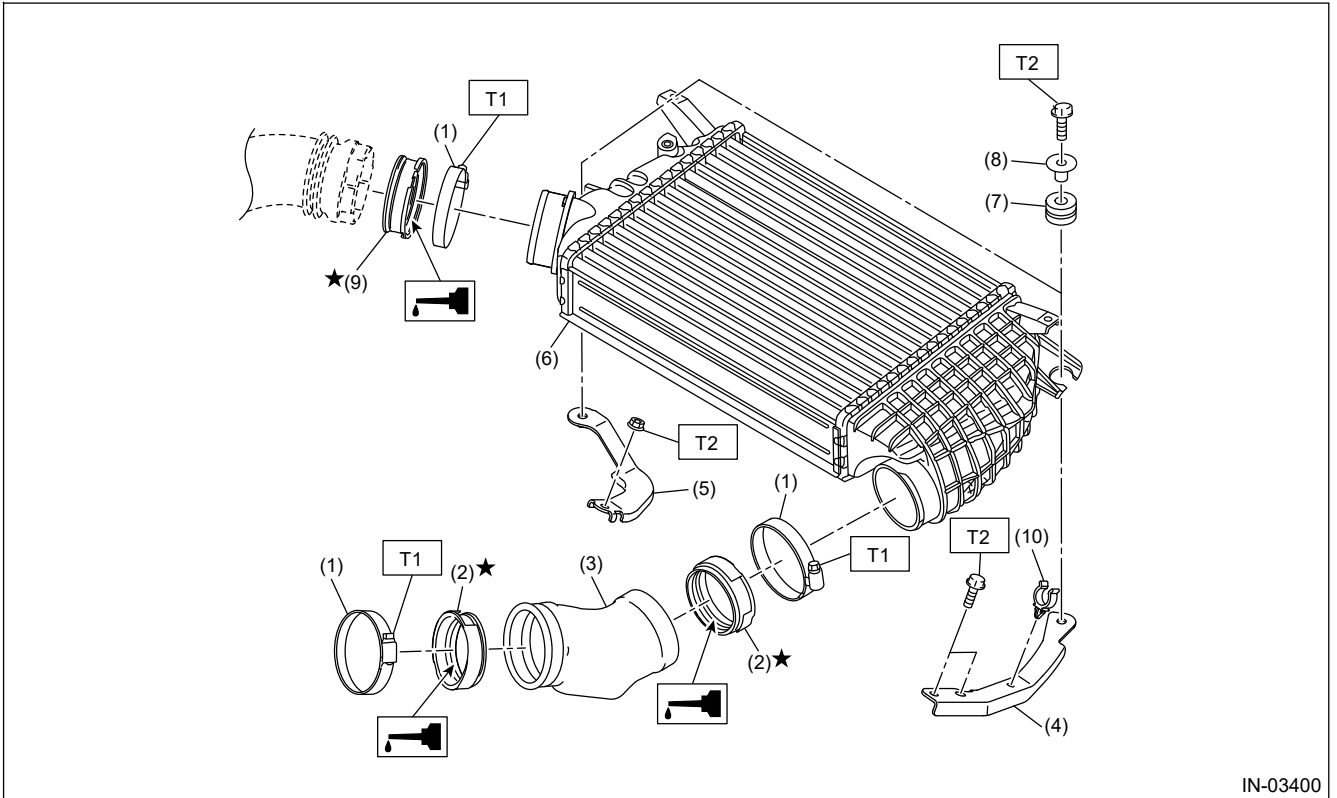
T1: 2.8 (0.3, 2.1)

T2: 3 (0.3, 2.2)

T3: 7.5 (0.8, 5.5)

T4: 16 (1.6, 11.8)

3. INTAKE DUCT AND INTERCOOLER



IN-03400

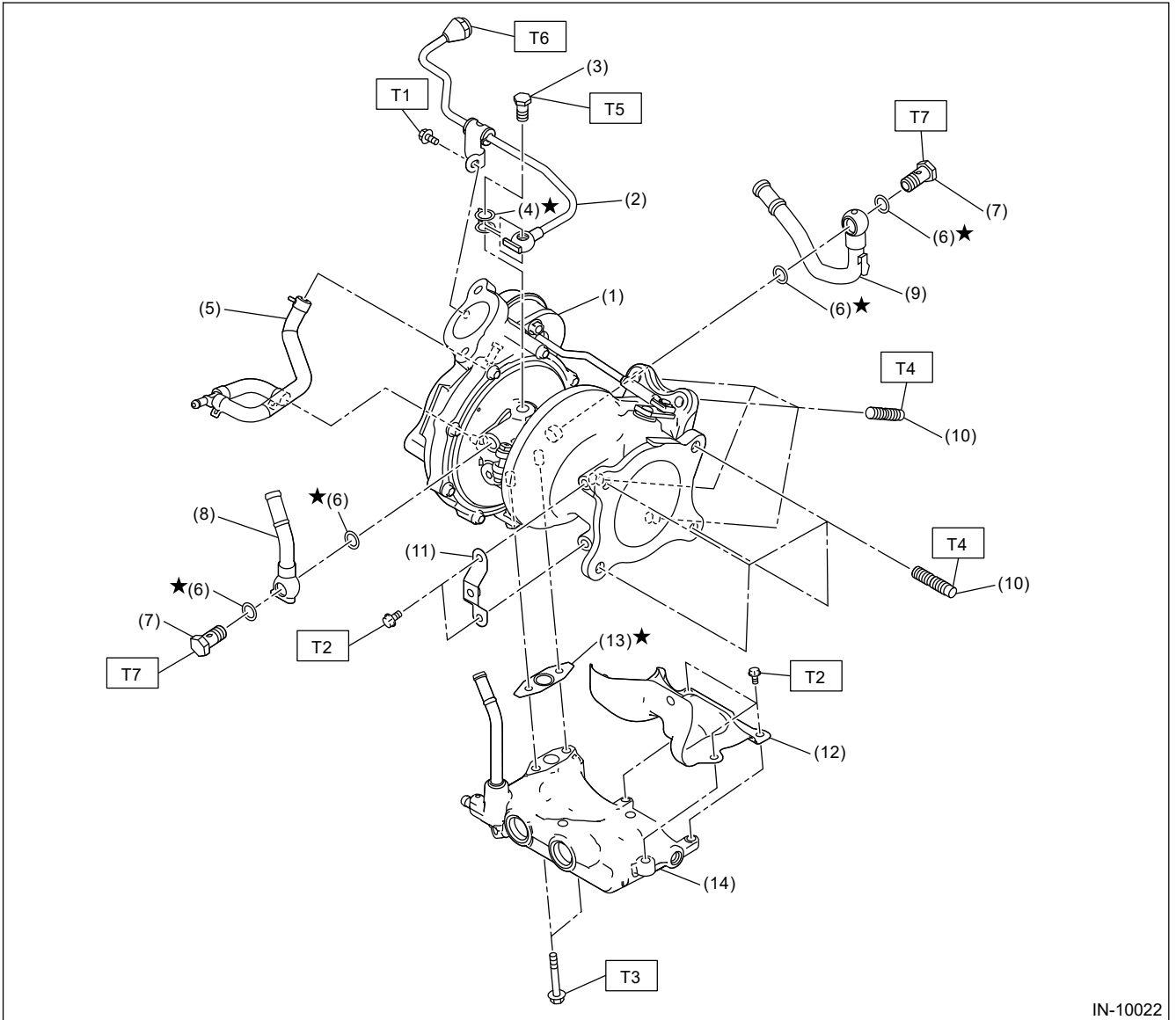
- (1) Clamp
- (2) Insulator
- (3) Intake duct No. 3
- (4) Intercooler stay LH
- (5) Intercooler stay RH
- (6) Intercooler
- (7) Cushion
- (8) Spacer
- (9) Insulator
- (10) Clip

Tightening torque: N·m (kgf-m, ft-lb)

T1: 3 (0.3, 2.2)

T2: 16 (1.6, 11.8)

4. TURBOCHARGER



IN-10022

(1) Turbocharger

(9) Turbocharger pipe B

Tightening torque: N·m (kgf·m, ft·lb)

(2) Union screw pipe ASSY

(10) Stud bolt

T1: 6.8 (0.7, 5.1)

(3) Union bolt

(11) Exhaust stay

T2: 7.15 (0.7, 5.3)

(4) Gasket

(12) Exhaust cover

T3: 10.5 (1.1, 7.7)

(5) Air control hose ASSY

(13) Gasket

T4: 14.7 (1.5, 10.8)

(6) Gasket

(14) Oil catch tank

T5: 16 (1.6, 11.8)

(7) Union bolt

T6: 20 (2.0, 14.8)

(8) Turbocharger pipe A

T7: 31.5 (3.2, 23.2)

INTAKE (INDUCTION)(H4DOTC) > General Description

PREPARATION TOOL

1. GENERAL TOOL

| TOOL NAME | REMARKS |
|------------------------------|--|
| TORX [®] socket E10 | Used for disassembling and assembling the turbocharger. |
| Mighty Vac | Used for checking waste gate actuator and air by-pass valve. |

INTAKE (INDUCTION)(H4DOTC) > Intake Duct

ASSEMBLY

1. INTAKE DUCT NO. 1

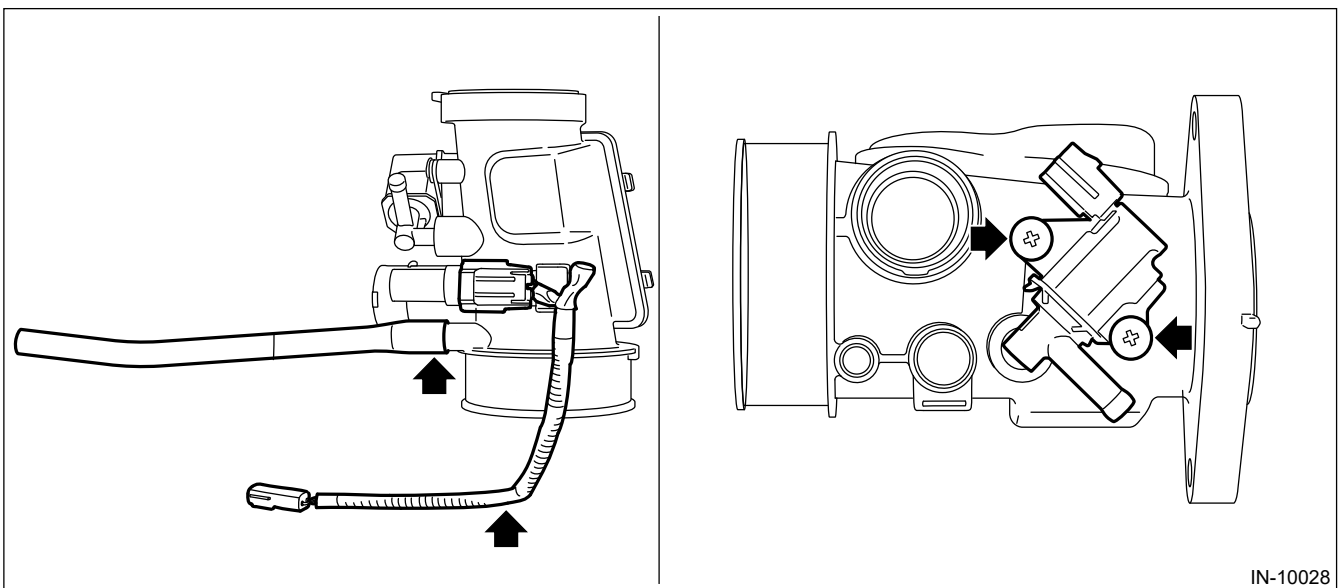
Install the vacuum hose, blow-by diagnosis connector harness and wastegate control solenoid valve to the intake duct No. 1.

Note:

- Use new O-rings.
- When tightening the wastegate control solenoid valve, check that it is securely seated.

Tightening torque:

2.8 N•m (0.3 kgf-m, 2.1 ft-lb)



2. INTAKE DUCT NO. 2

Assemble in the reverse order of disassembly.

Tightening torque:

3 N•m (0.3 kgf-m, 2.2 ft-lb)

3. INTAKE DUCT NO. 3

Assemble in the reverse order of disassembly.

Note:

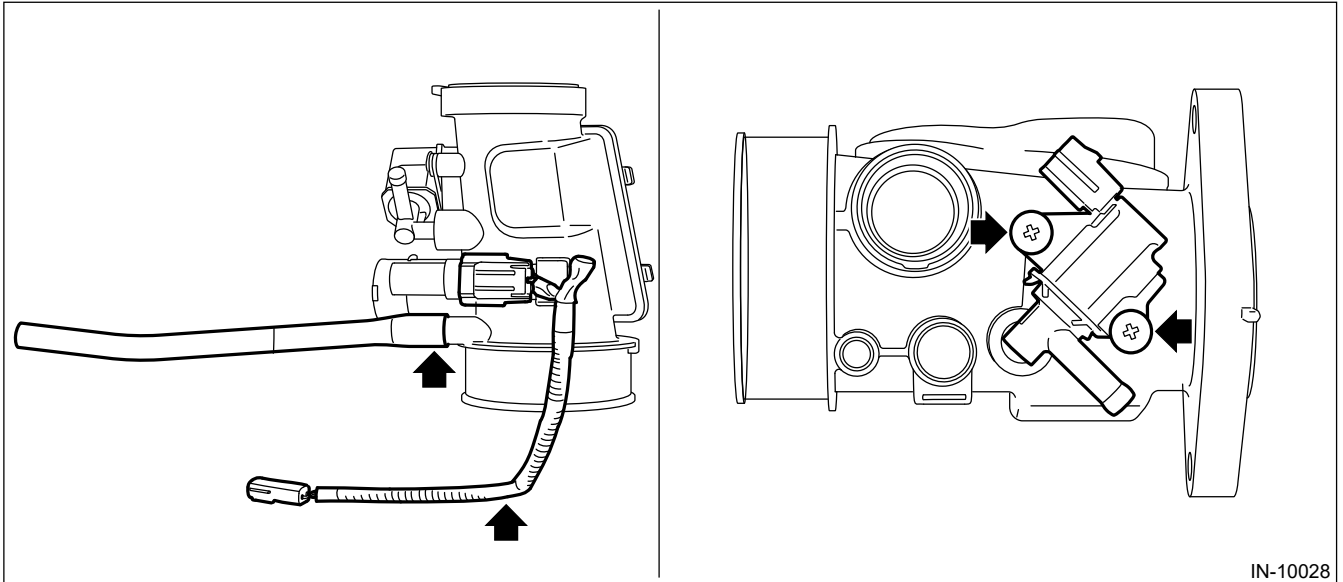
Use a new insulator.

INTAKE (INDUCTION)(H4DOTC) > Intake Duct

DISASSEMBLY

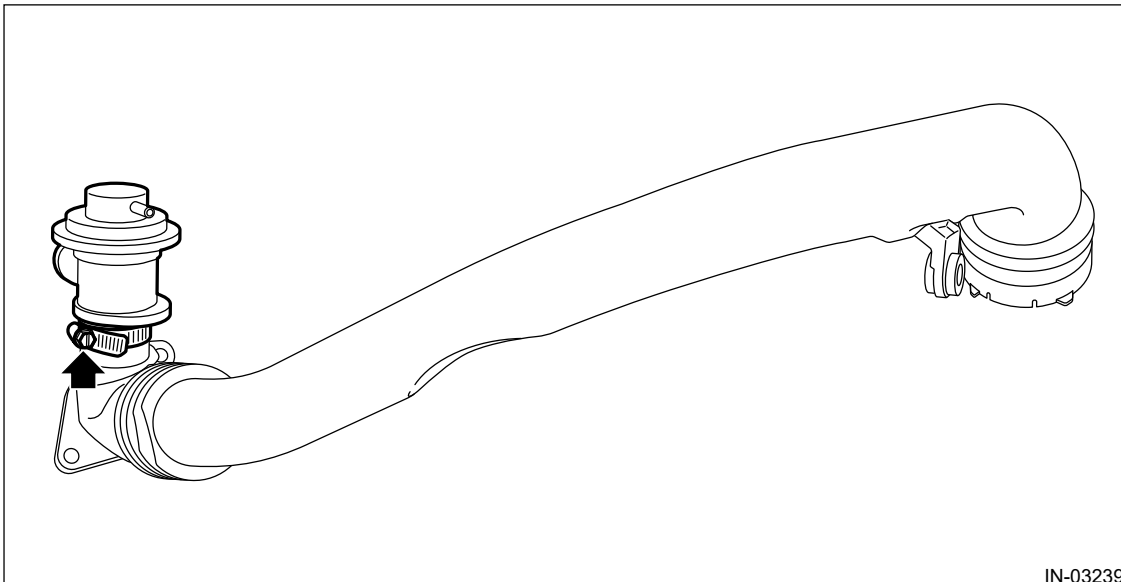
1. INTAKE DUCT NO. 1

Remove the vacuum hose, blow-by diagnosis connector harness and wastegate control solenoid valve from the intake duct.



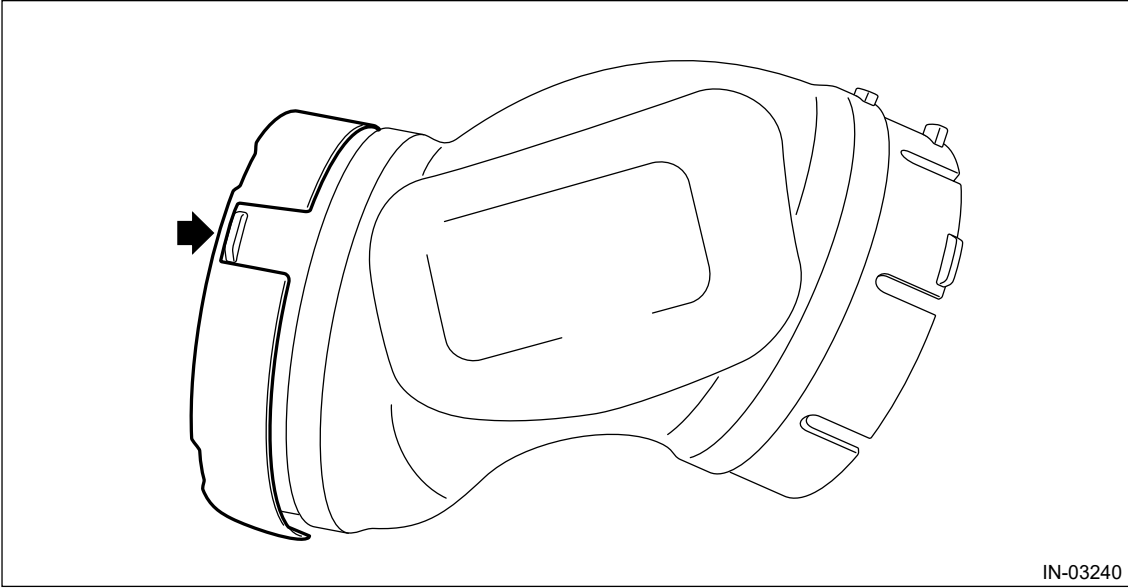
2. INTAKE DUCT NO. 2

Remove the air by-pass valve from the intake duct No. 2.



3. INTAKE DUCT NO. 3

Remove the insulator from the intake duct No. 3.



IN-03240

INTAKE (INDUCTION)(H4DOTC) > Intake Duct

INSPECTION

- 1.** Check that the intake duct has no deformation, cracks or other damages.
- 2.** Check the vacuum hose for cracks, damage or looseness.

INTAKE (INDUCTION)(H4DOTC) > Intake Duct

INSTALLATION

1. INTAKE DUCT NO. 1

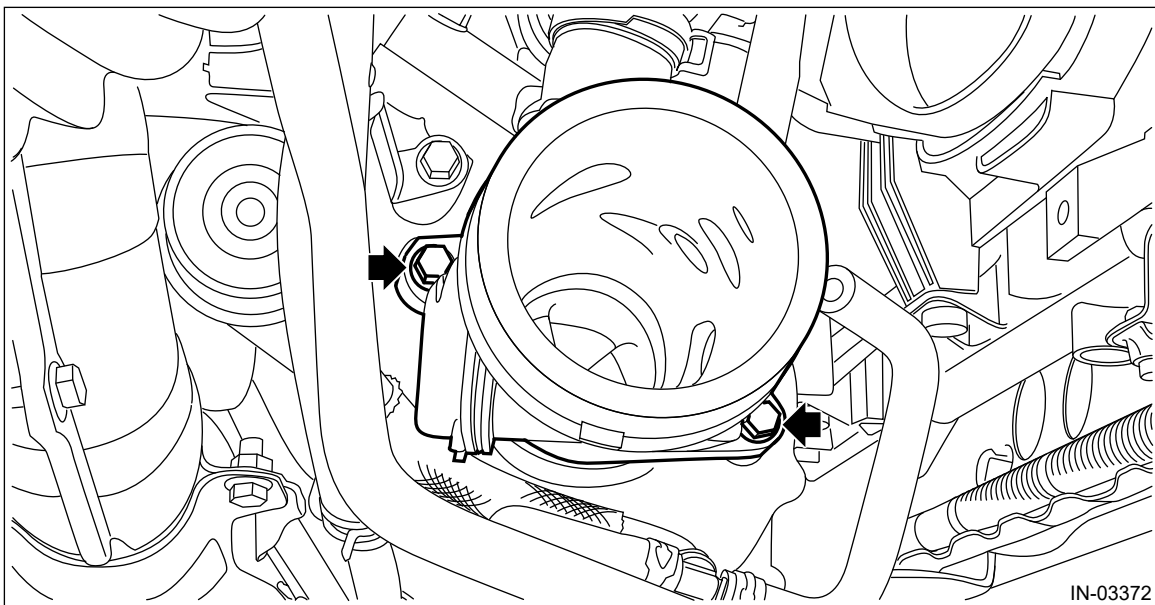
1. Install the intake duct No. 1 to the turbocharger.

Note:

- Use new O-rings.
- Be careful not to pinch the O-ring.
- Check that the air by-pass valve is firmly inserted into the intake duct No. 1.

Tightening torque:

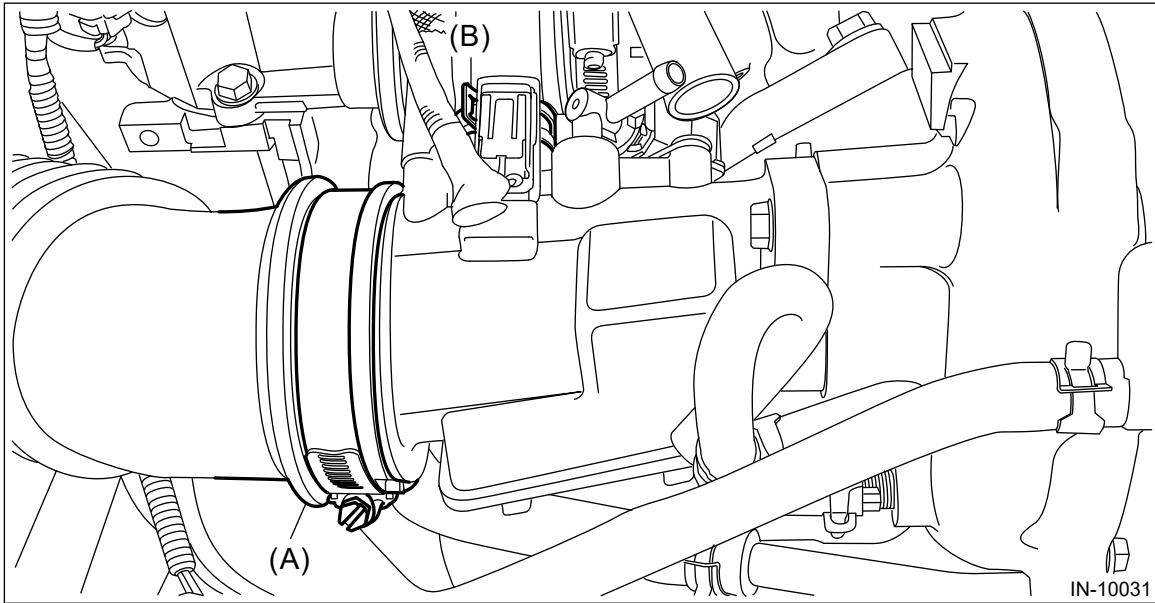
7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



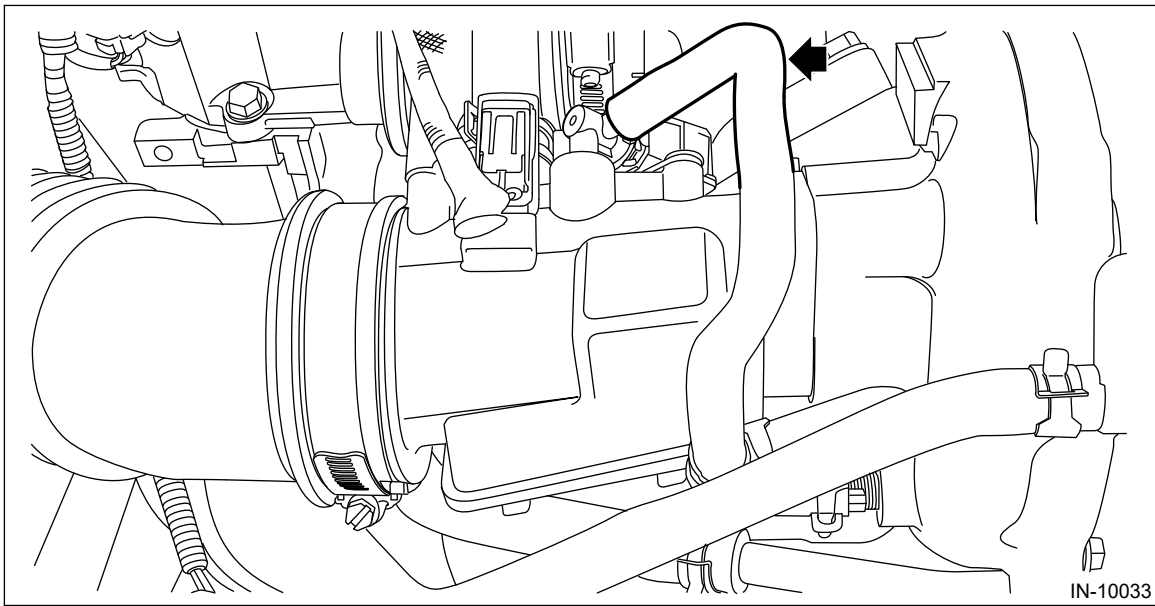
2. Install the air intake boot (A) to the intake duct No. 1, and engage the clip (B) which secures the air by-pass valve to the intake duct No. 1.

Tightening torque:

2.5 N·m (0.3 kgf-m, 1.8 ft-lb)



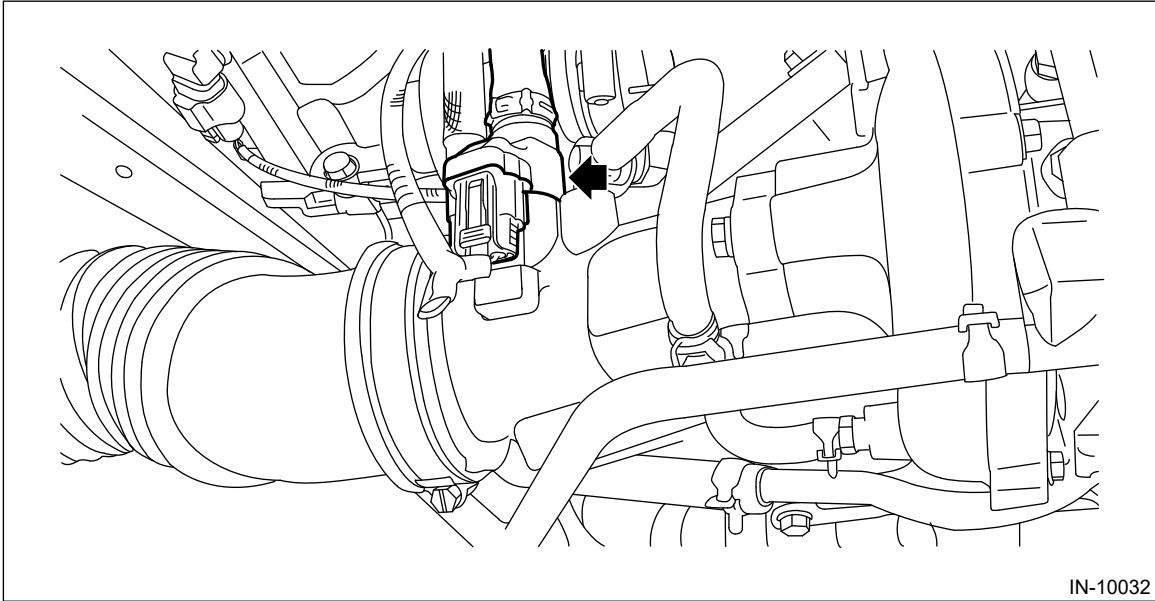
3. Connect the vacuum control hose to the wastegate control solenoid valve.



4. Connect the PCV pipe assembly to the intake duct No. 1.

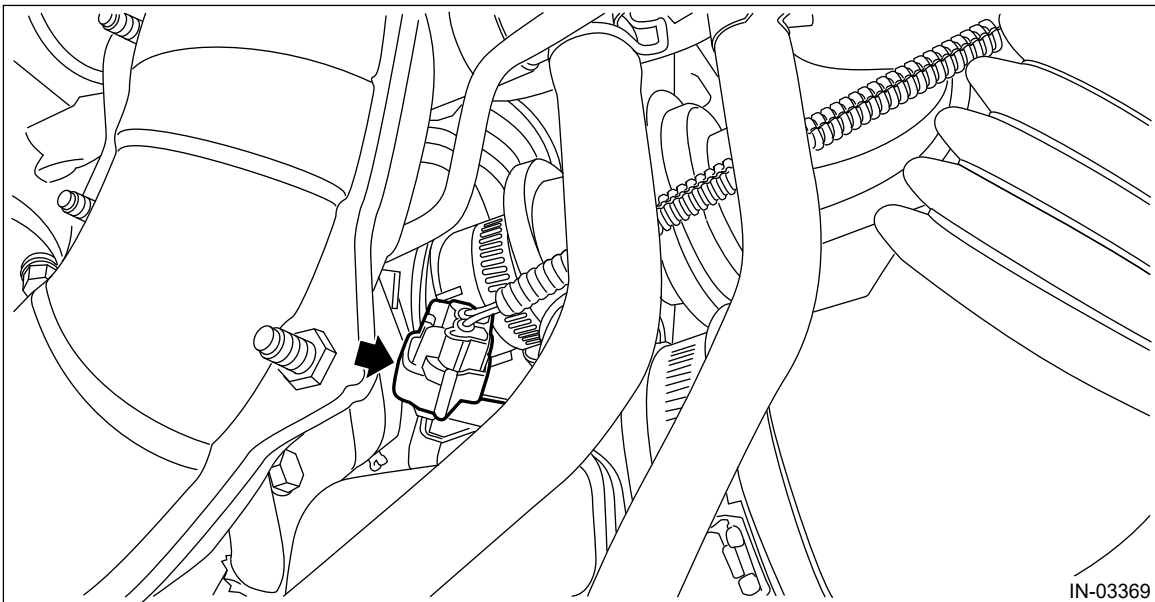
Note:

Make sure that the blow-by diagnosis connector is connected securely.



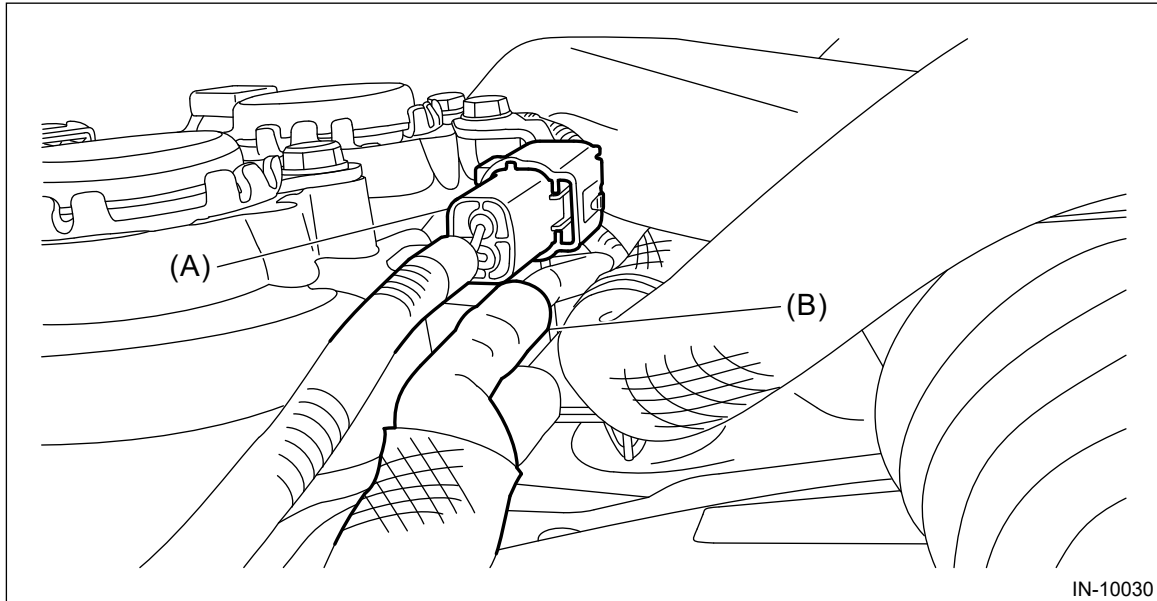
IN-10032




5. Connect the connector to the wastegate control solenoid valve.



IN-03369

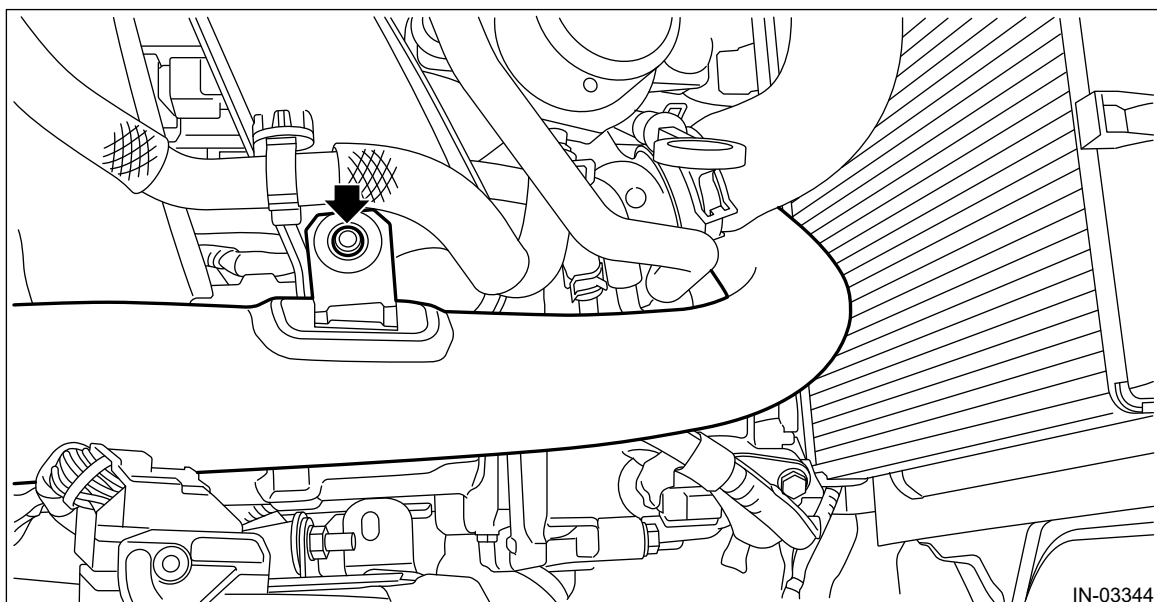
6. Connect the blow-by diagnosis connector (A) to the engine wiring harness, and connect the vacuum hose (B) to the vacuum pipe assembly.



7. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
8. Lower the vehicle.
9. Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
10. Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)

2. INTAKE DUCT NO. 2

1. Set the air by-pass valve to the intake duct No.1, and install the intake duct No. 2 to the intake manifold.



2. Install the bolts which secure the intake duct No. 2 to the turbocharger.

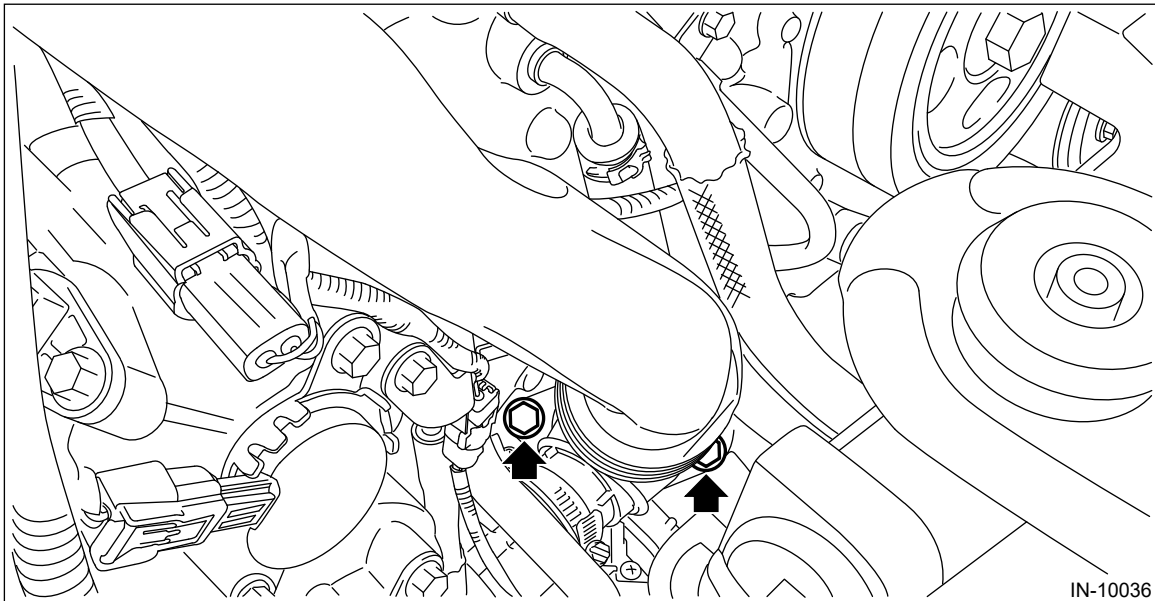
Note:

- Use new O-rings.
- Be careful not to pinch the O-ring.

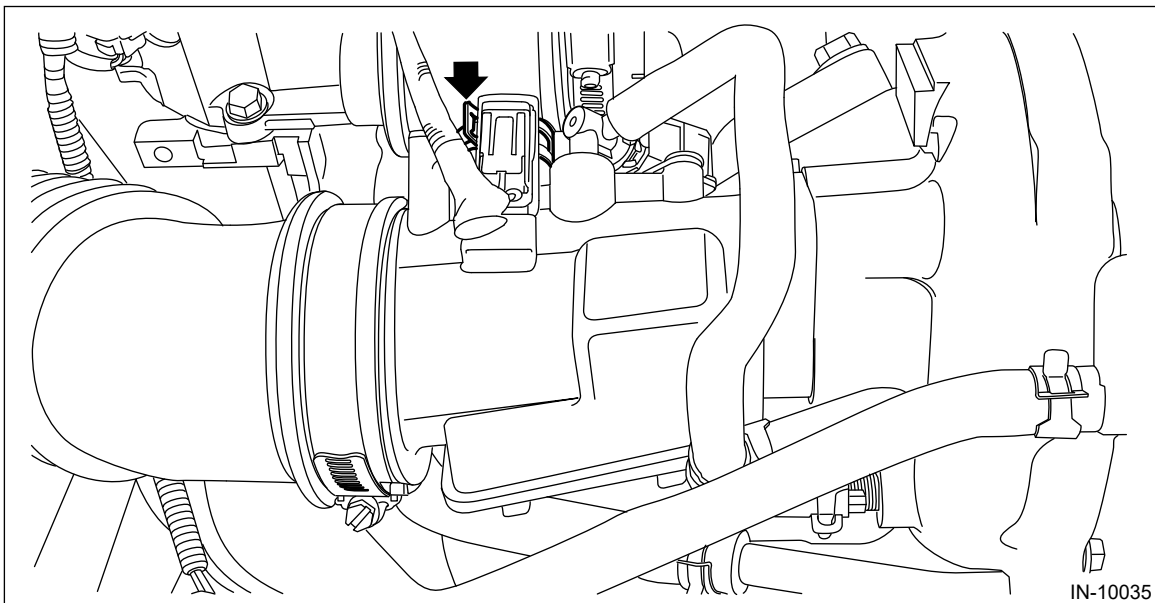
- Check that the air by-pass valve is firmly inserted into the intake duct No. 1.

Tightening torque:

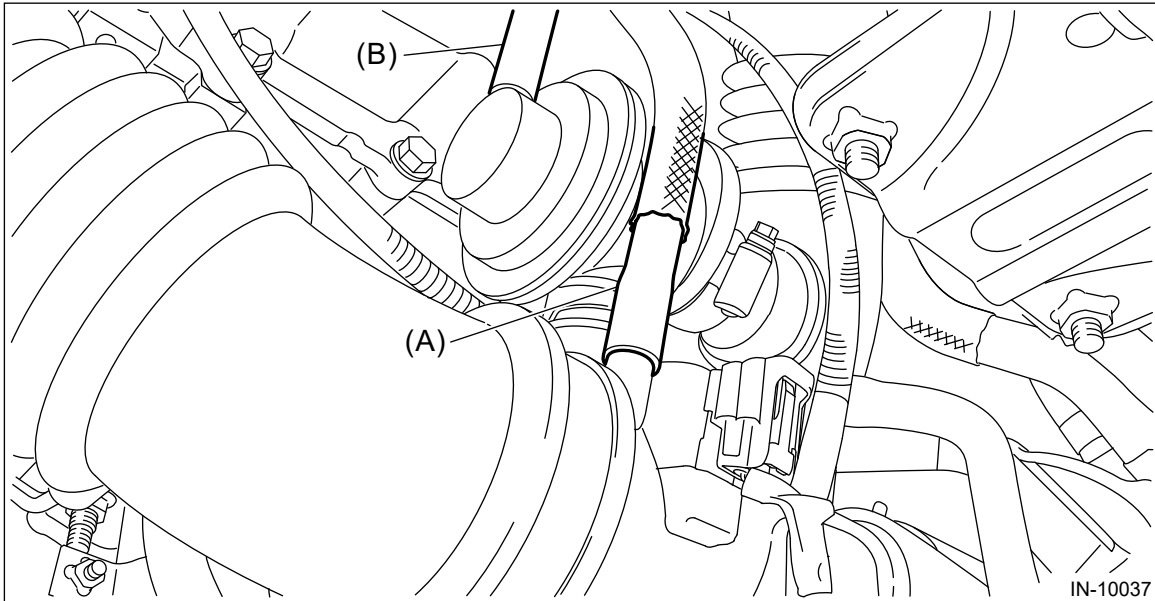
16 N·m (1.6 kgf-m, 1.8 ft-lb)



3. Lift up the vehicle.
4. Engage the clip which secures the air by-pass valve to the intake duct No.1.



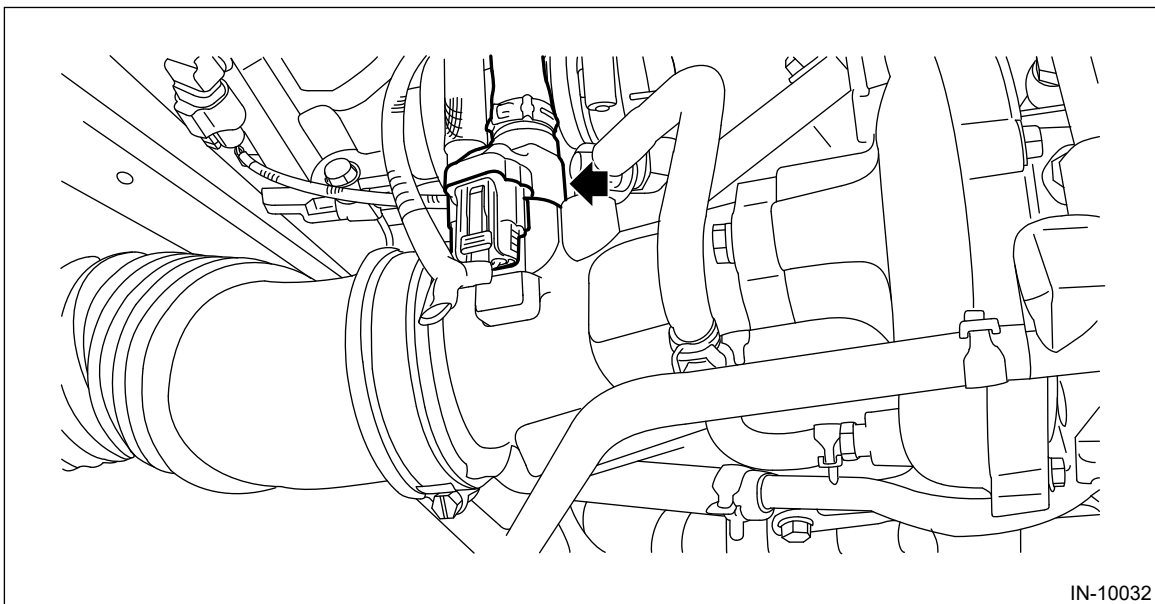
5. Connect the vacuum hose (A) to the intake duct No. 1, and connect the vacuum hose (B) to the air by-pass valve.








6. Connect the PCV pipe assembly to the intake duct No. 1.

Note:

Make sure that the blow-by diagnosis connector is connected securely.



7. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
8. Lower the vehicle.
9. Install the radiator sub fan and fan motor assembly.  [Ref. to COOLING\(H4DOTC\)>Radiator Sub Fan and Fan Motor>INSTALLATION.](#)
10. Install the intercooler.  [Ref. to INTAKE \(INDUCTION\) \(H4DOTC\)>Intercooler>INSTALLATION.](#)
11. Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
12. Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
13. Install the collector cover.

3. INTAKE DUCT NO. 3

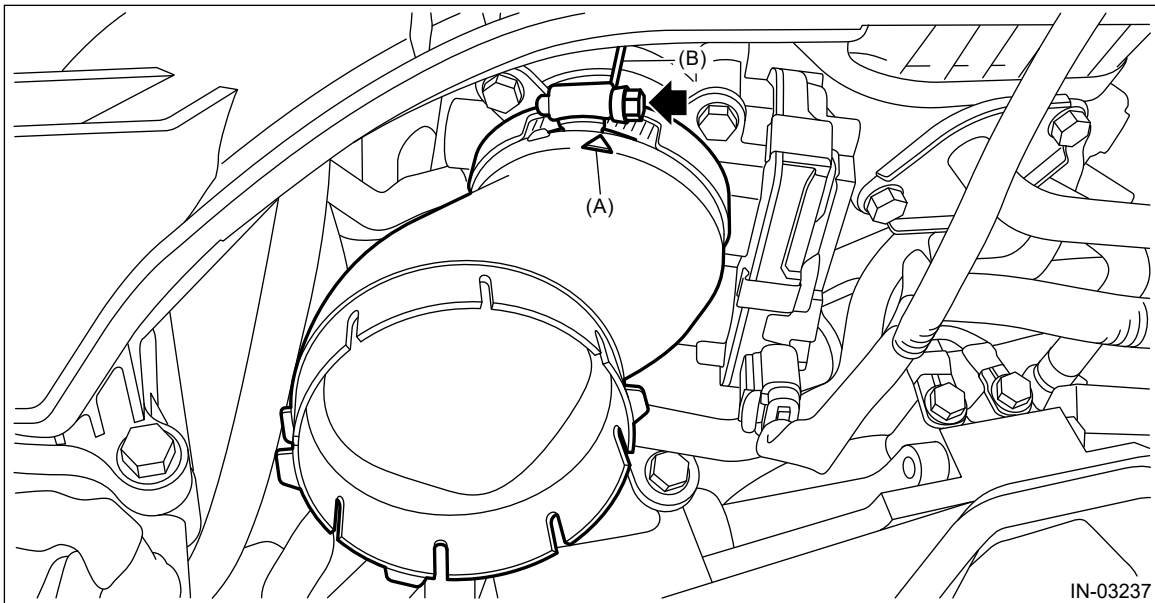
1. Align the triangle mark (A) on the intake duct No. 3 to the rib (B) on the throttle body, and install the intake duct No. 3 to the throttle body.

Note:

- Use a new insulator.
- Apply a thin coat of SUBARU PS fluid (K0515YA000) or liquid paraffin to the inner periphery of the insulator.
- When inserting the intake duct No.3 to the throttle body, be careful that the insulator is not turned over.

Tightening torque:

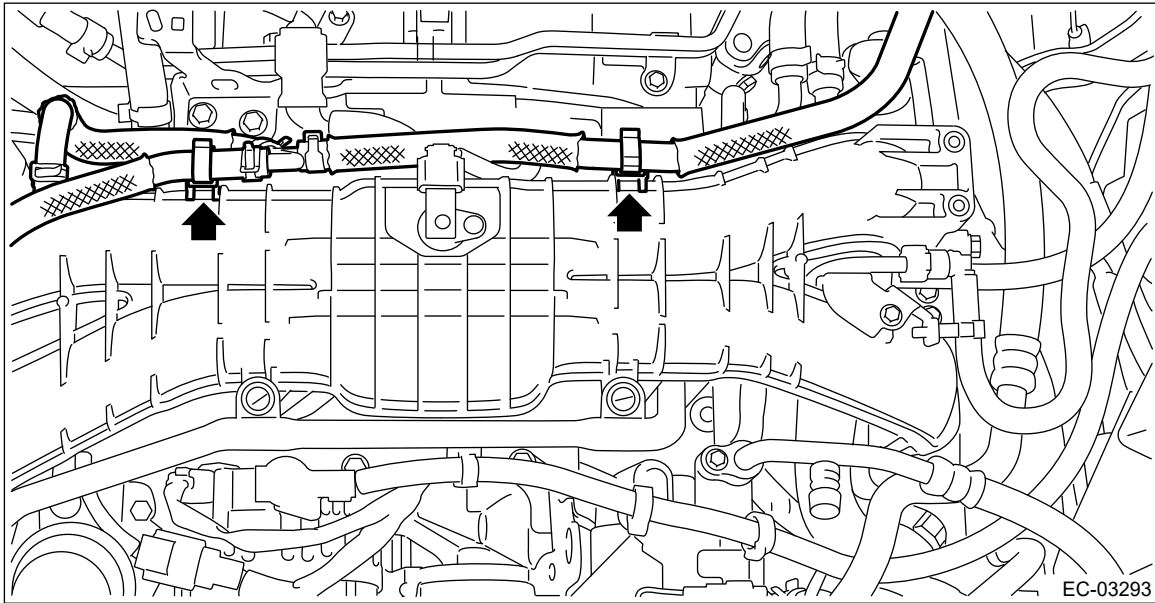
3 N·m (0.3 kgf-m, 2.2 ft-lb)





2. Install the brake booster vacuum hose to the clip.

Note:

If the clip is removed from the intake manifold, install the clip to the position of alignment mark ▼ of intake manifold.






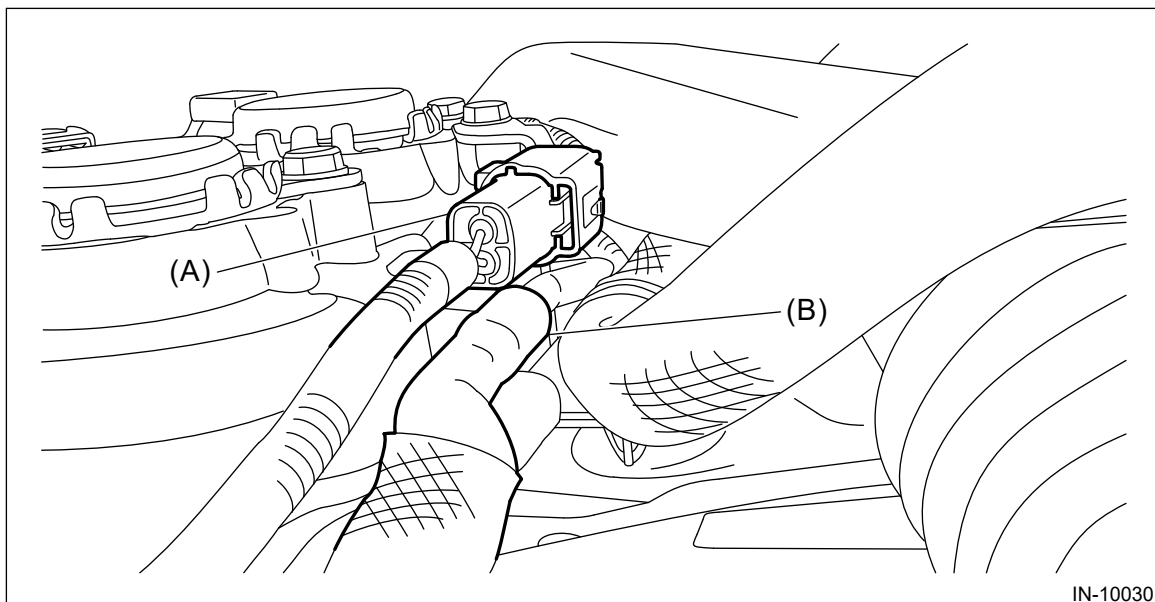
- 3.** Install the intercooler.  [Ref. to INTAKE \(INDUCTION\) \(H4DOTC\)>Intercooler>INSTALLATION.](#)
- 4.** Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 5.** Install the collector cover.

INTAKE (INDUCTION)(H4DOTC) > Intake Duct

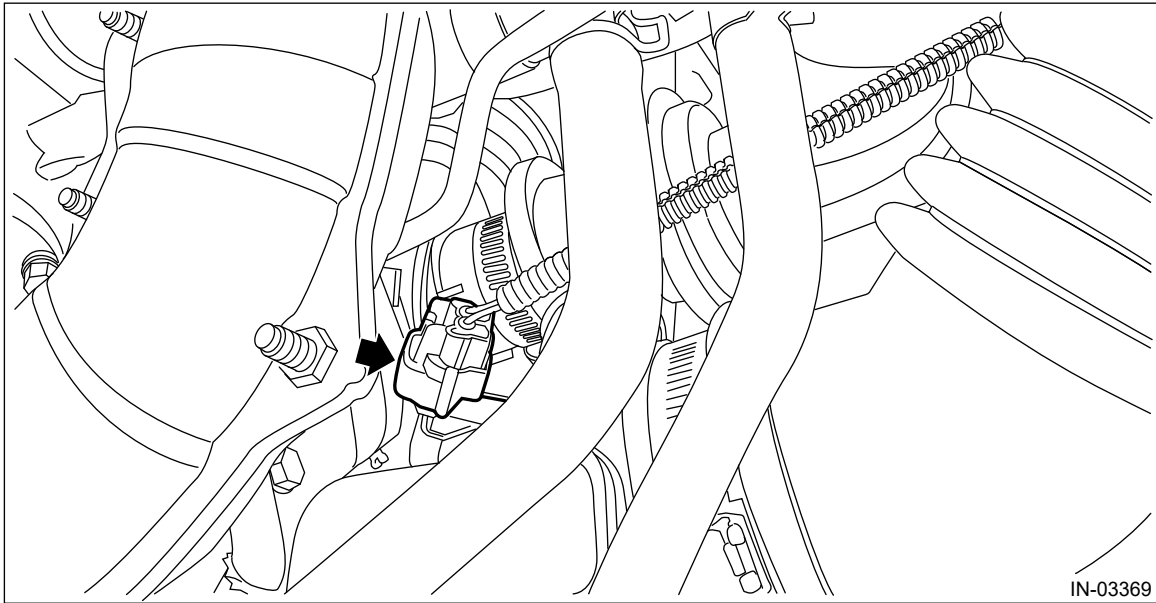
REMOVAL

1. INTAKE DUCT NO. 1

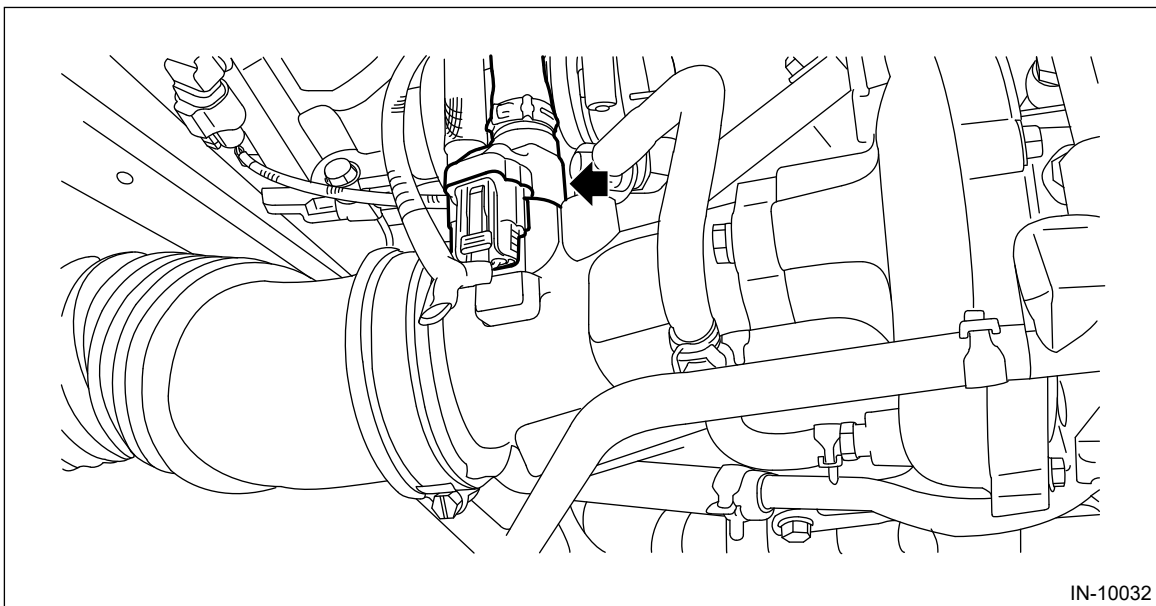
1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
3. Lift up the vehicle.
4. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
5. Disconnect the blow-by diagnosis connector (A) from the engine wiring harness, and disconnect the vacuum hose (B) from the vacuum pipe assembly.



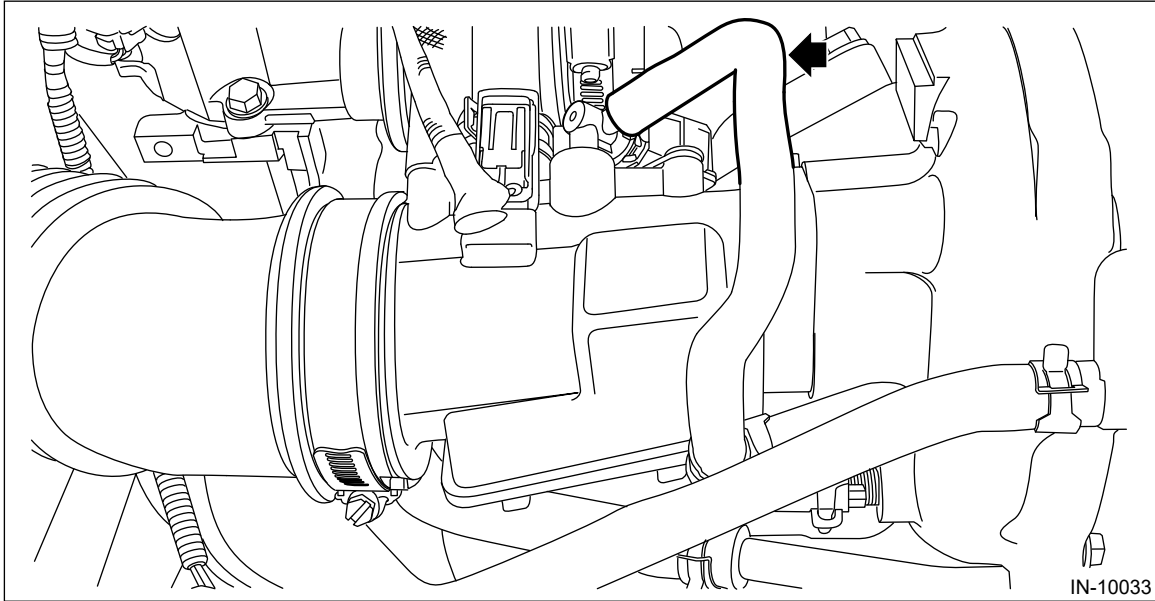
6. Disconnect the connector from the wastegate control solenoid valve.



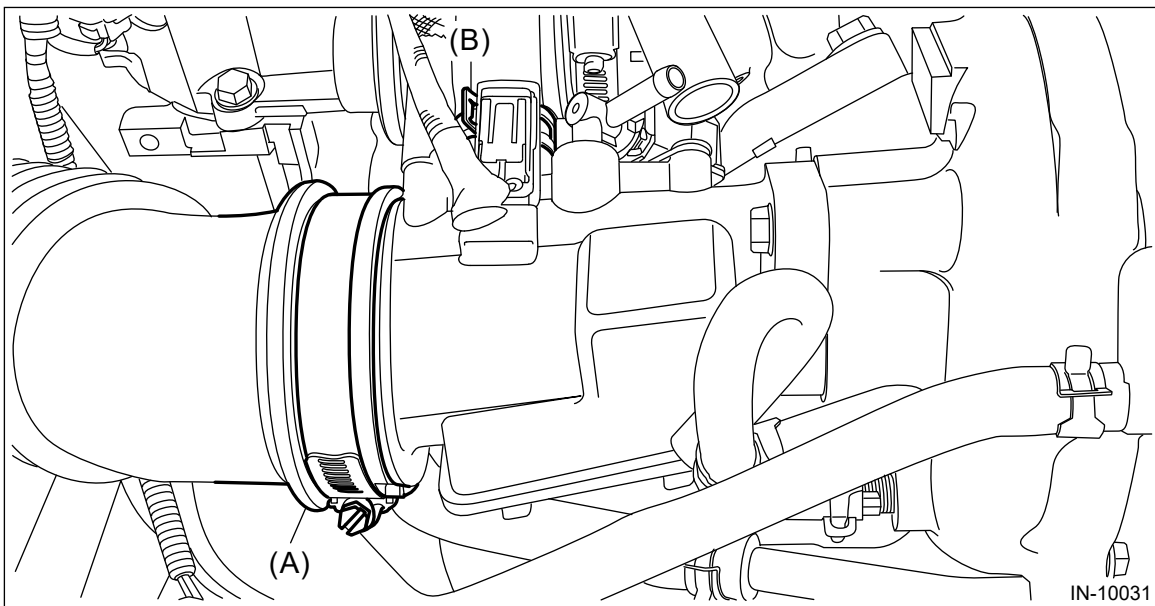
7. Unlock the blow-by diagnosis connector, and disconnect the PCV pipe assembly from the intake duct No. 1.



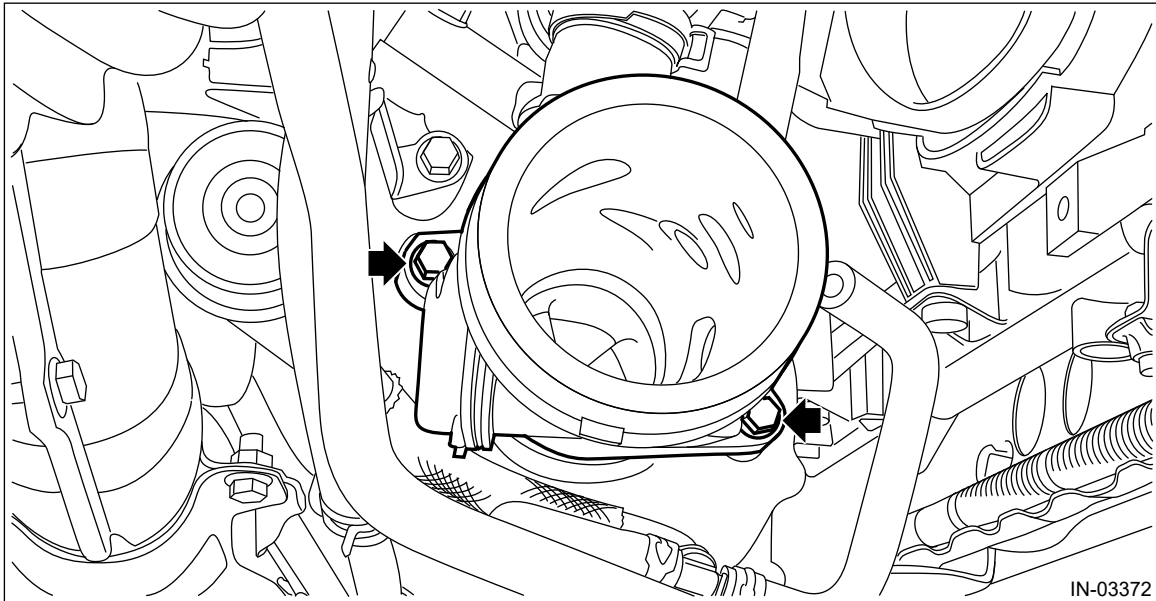
8. Disconnect the vacuum control hose from the wastegate control solenoid valve.



- 9.** Remove the air intake boot (A) from the intake duct No. 1, and disengage the clip (B) which secures the air by-pass valve to the intake duct No. 1.



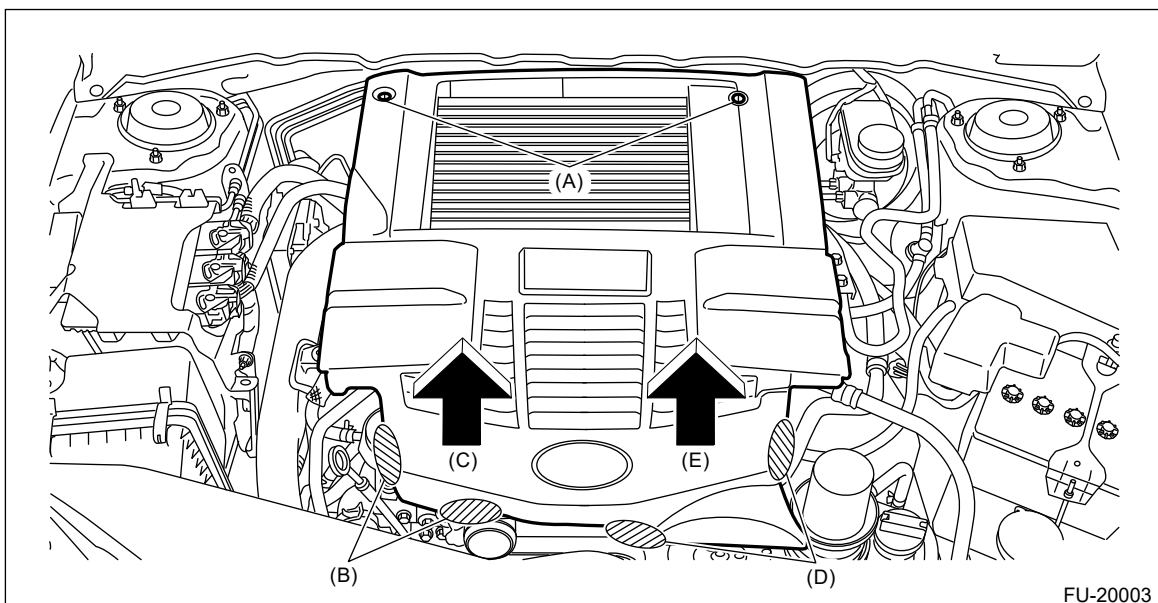
- 10.** Remove the bolts which secure the intake duct No. 1 to the turbocharger, and remove the intake duct No. 1.








IN-03372

2. INTAKE DUCT NO. 2

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.

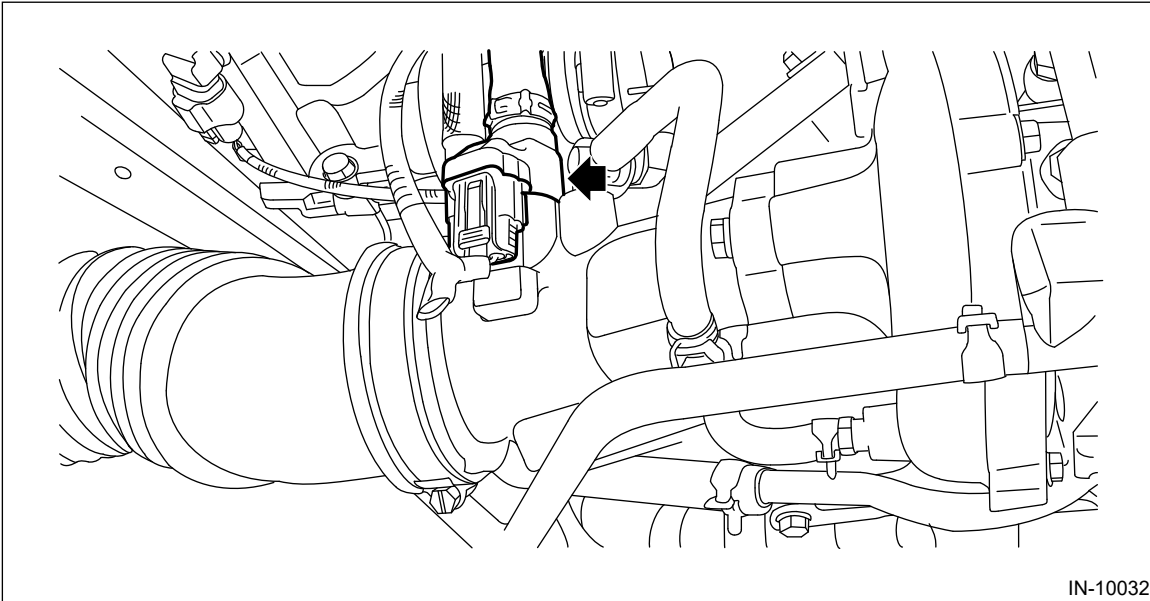


FU-20003

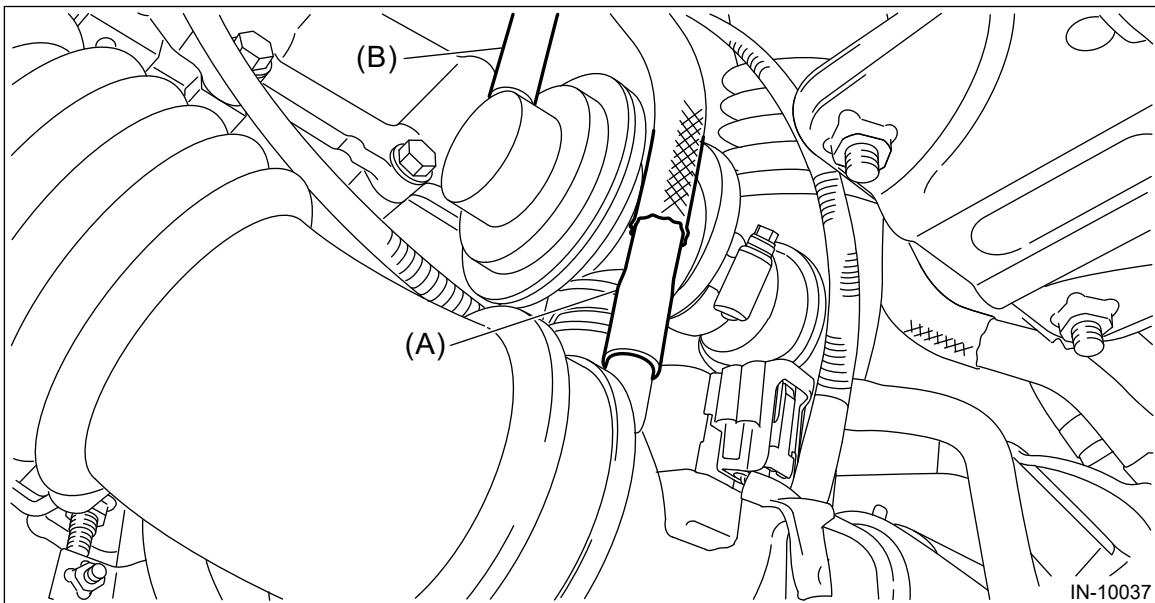
2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\),\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
4. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\),\(H4DOTC\)>Intercooler>REMOVAL.](#)
5. Remove the radiator sub fan and fan motor assembly.  [Ref. to COOLING\(H4DOTC\)>Radiator Sub Fan and Fan Motor>REMOVAL.](#)
6. Lift up the vehicle.
7. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under](#)

Cover>REMOVAL.

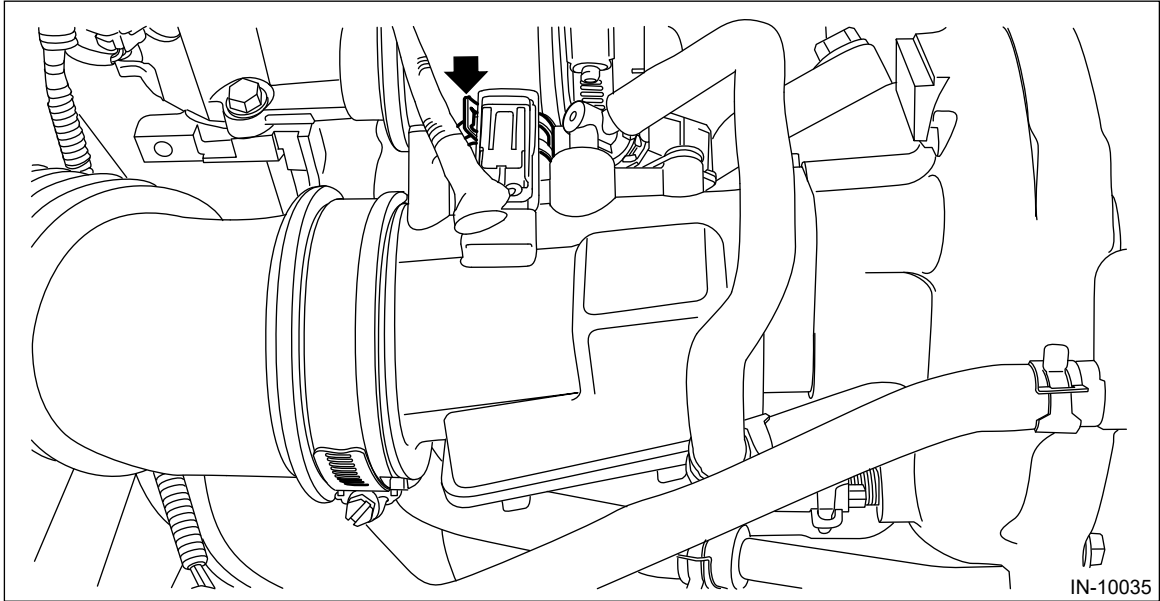
8. Unlock the blow-by diagnosis connector, and disconnect the PCV pipe assembly from the intake duct No. 1.



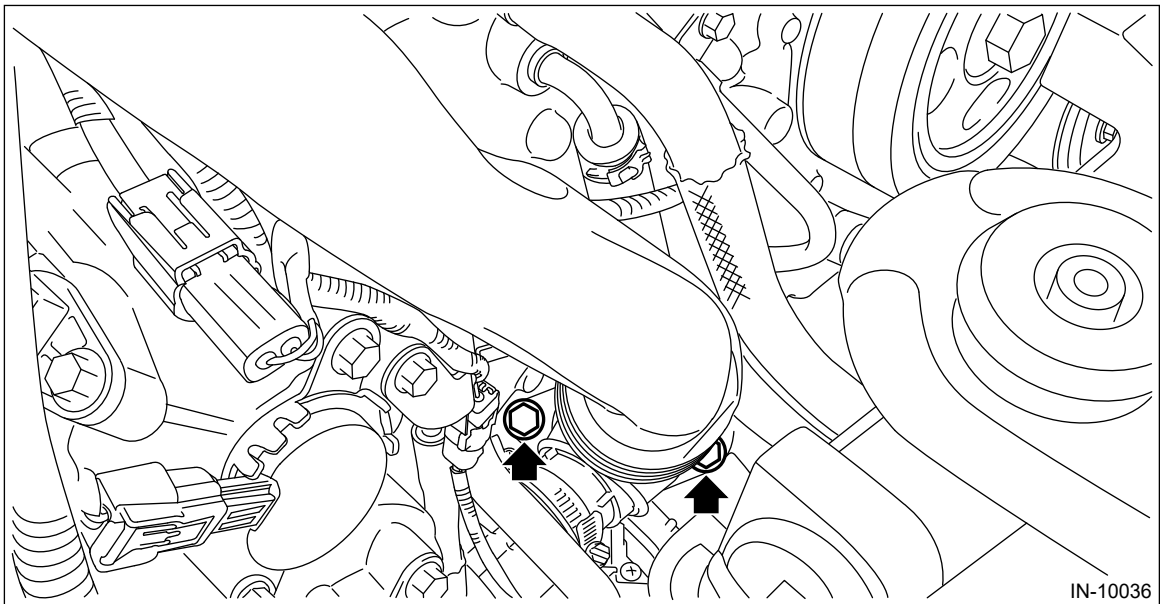
9. Disconnect the vacuum hose (A) from the intake duct No. 1, and disconnect the vacuum hose (B) from the air by-pass valve.



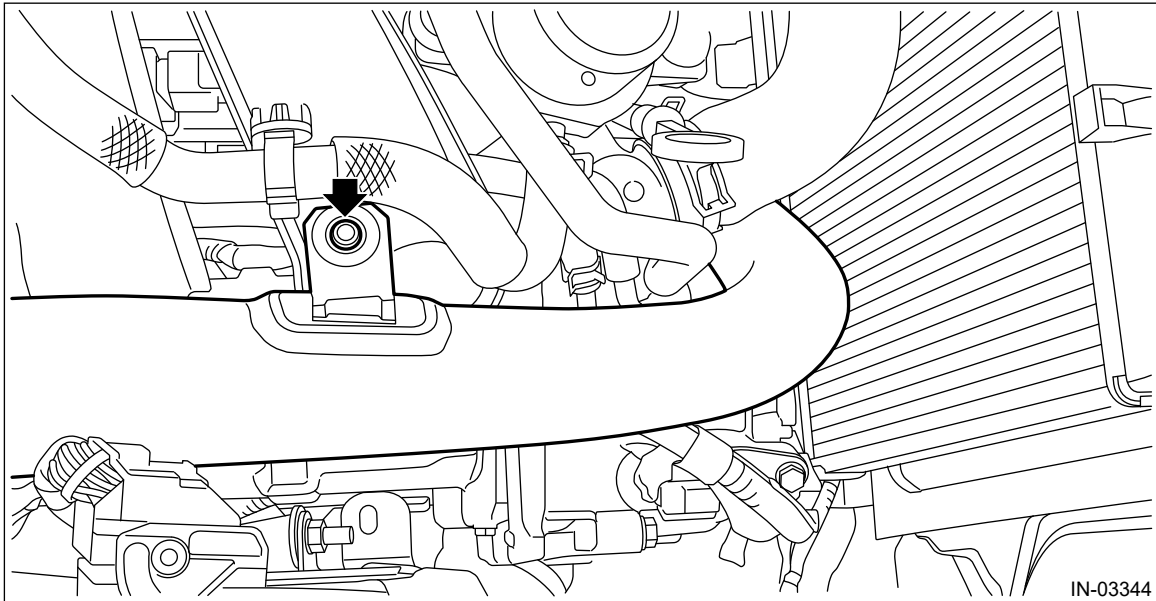
10. Disengage the clip which secures the air by-pass valve to the intake duct No. 1.



- 11.** Lower the vehicle.
- 12.** Remove the bolts which secure the intake duct No. 2 to the turbocharger.



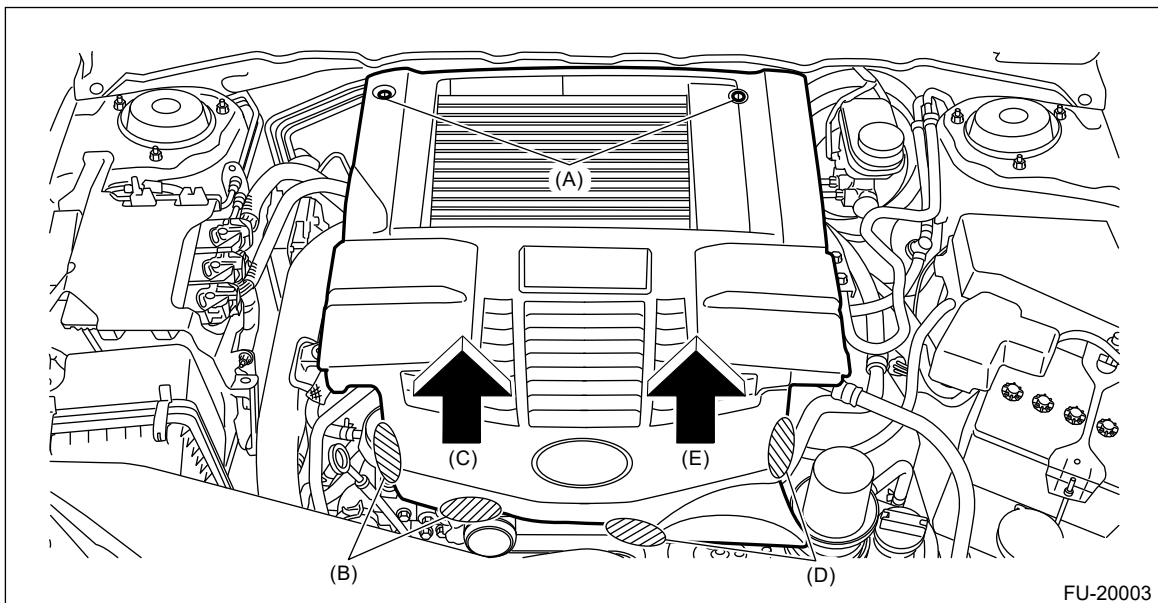
- 13.** Pull out the air by-pass valve from the intake duct No. 1, and remove the intake duct No. 2 from the intake manifold.





IN-03344

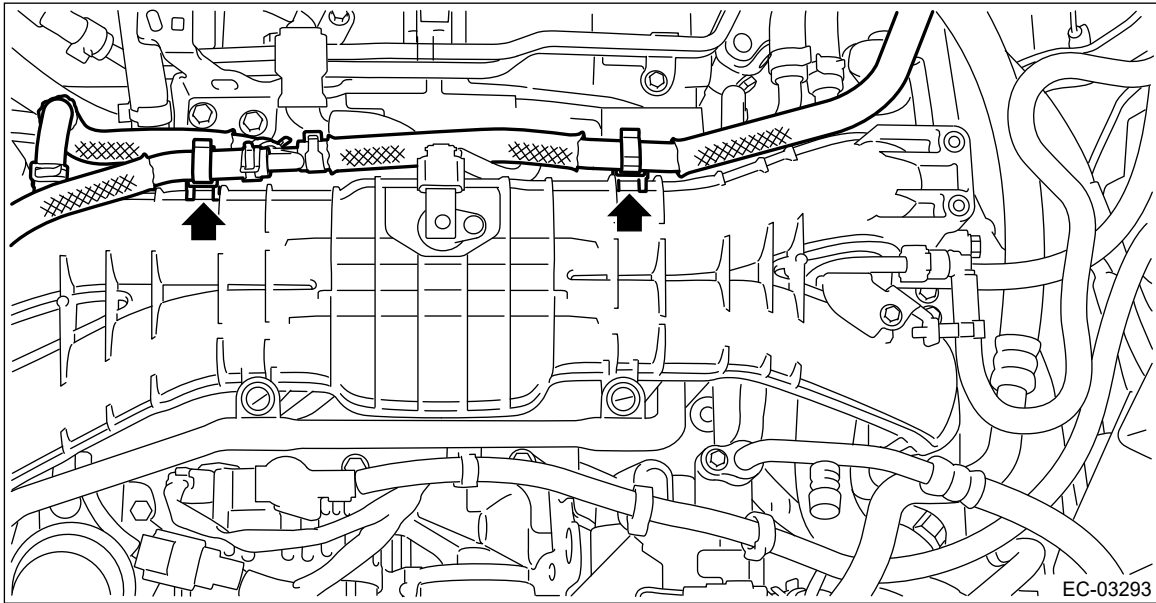
3. INTAKE DUCT NO. 3

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.

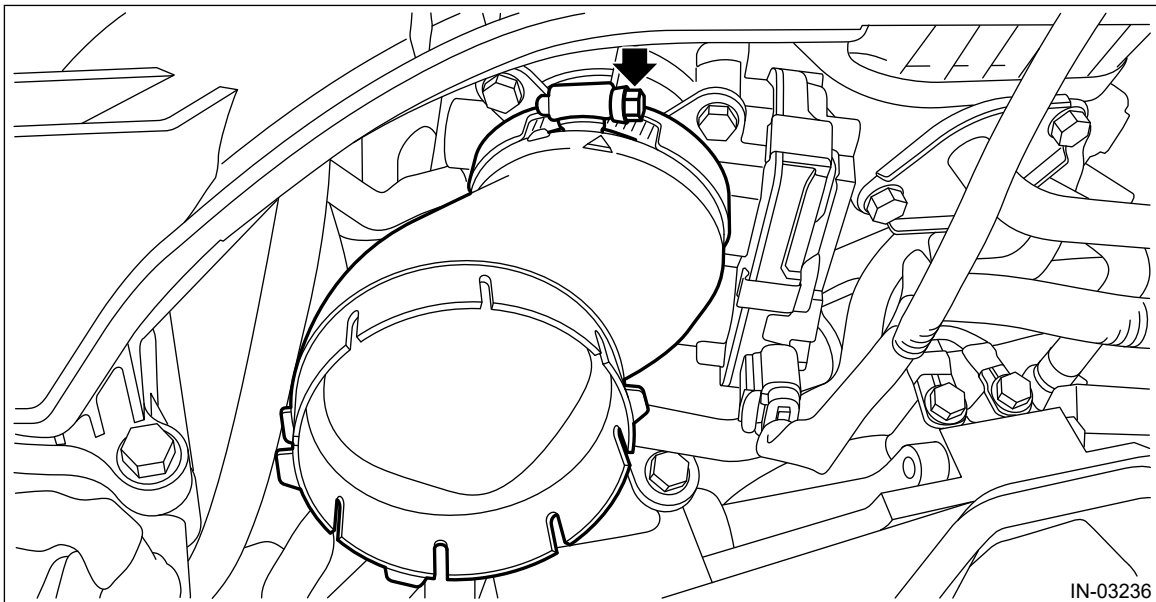


FU-20003

2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\),\(H4DOTC\)>Intercooler>REMOVAL.](#)
4. Remove the brake booster vacuum hose from the clip, and place the brake booster vacuum hose aside so that it does not interfere with the work.



5. Remove the intake duct No. 3 from the throttle body.



INTAKE (INDUCTION)(H4DOTC) > Intercooler

INSPECTION

Check that the intercooler and intercooler stay have no deformation, cracks or other damages.

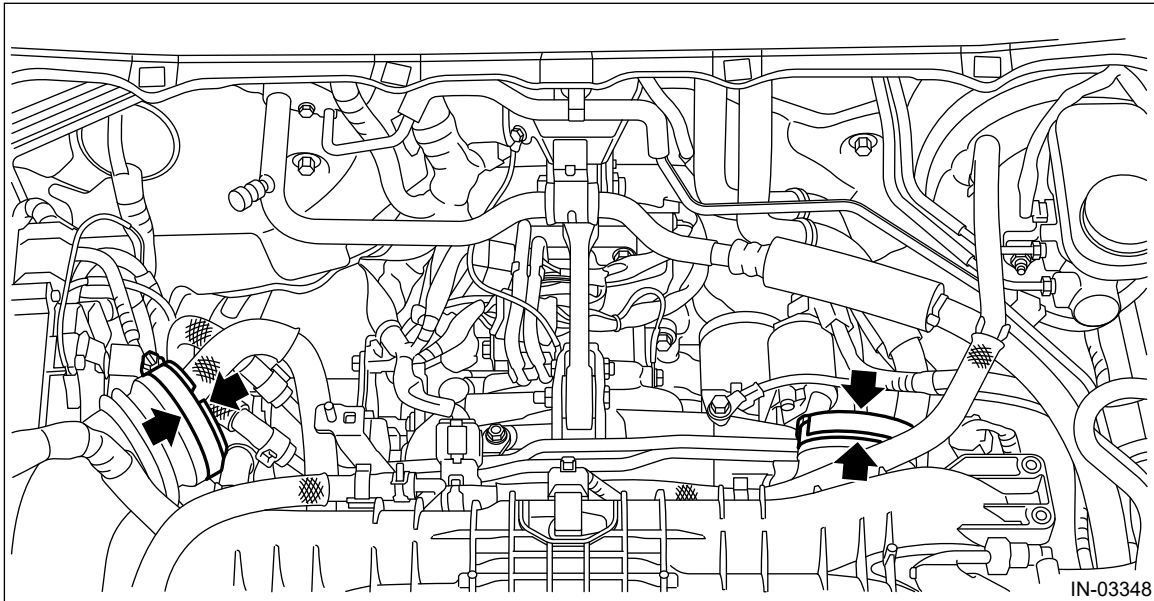
INTAKE (INDUCTION)(H4DOTC) > Intercooler

INSTALLATION

1. Install the insulator and clamp to the intake duct.

Note:

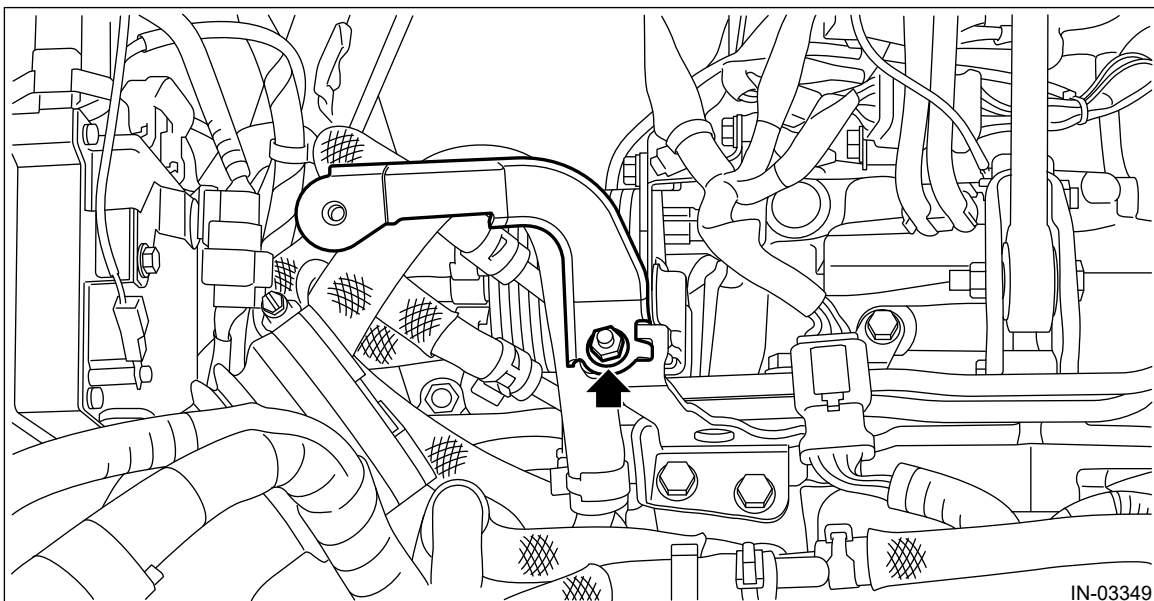
- Use a new insulator.
- Apply a thin coat of SUBARU PS fluid (K0515YA000) or liquid paraffin to the inner periphery of the insulator.



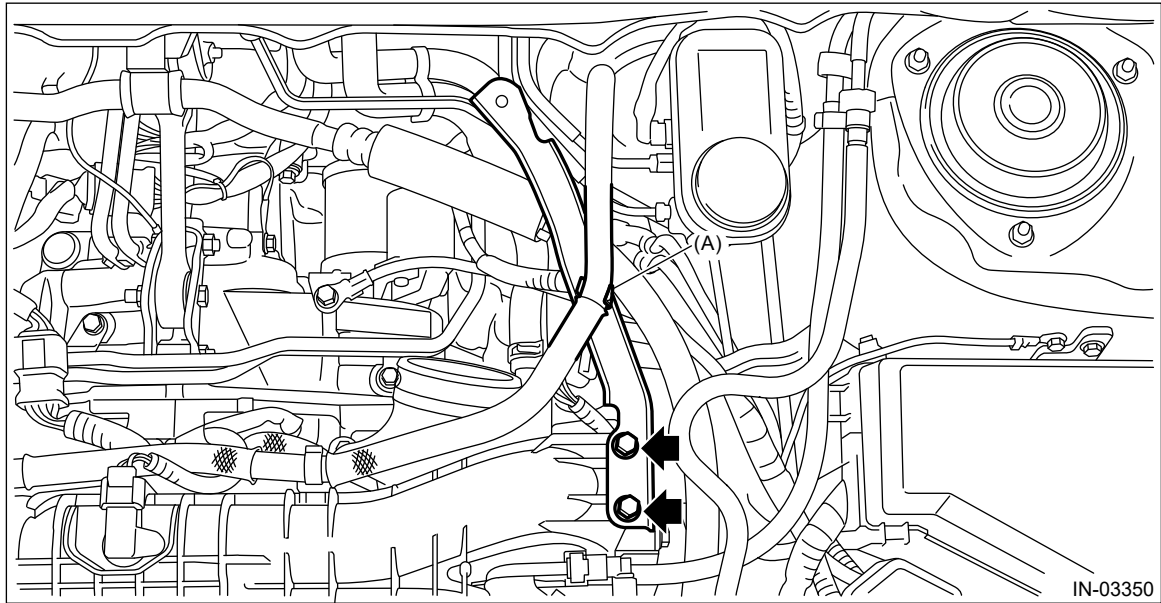
2. Install the intercooler stay RH to the engine hanger stay.

Tightening torque:

16 N•m (1.6 kgf-m, 11.8 ft-lb)



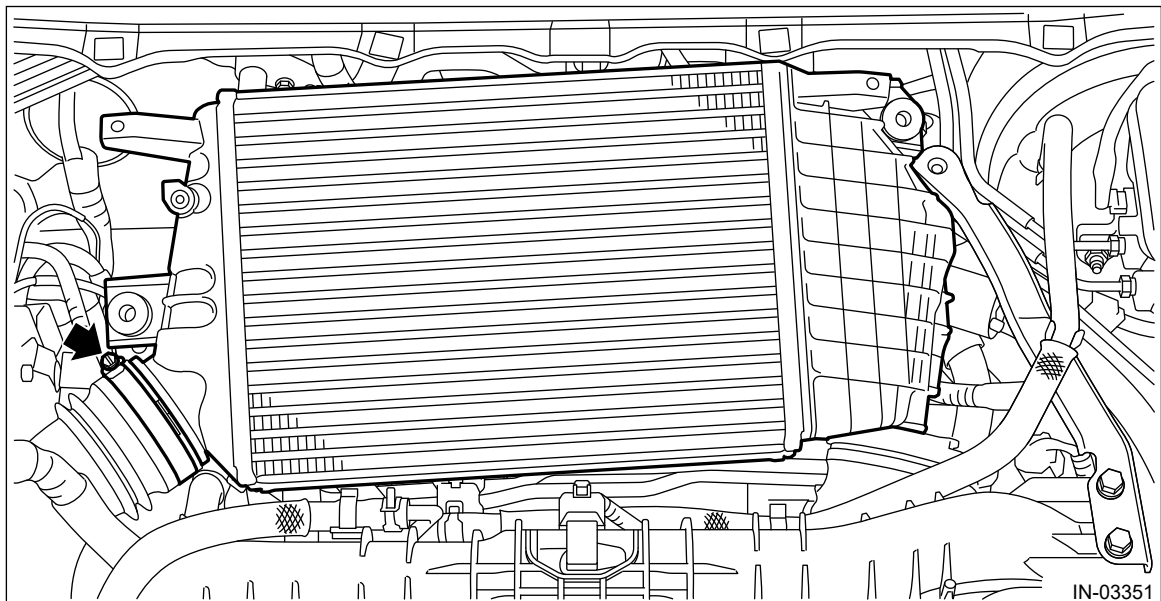
3. Temporarily tighten the intercooler stay LH to the intake manifold.
4. Install the brake booster vacuum hose to the clip (A).



5. Insert the intercooler into the intake duct No. 2, and temporarily tighten the clamp which secures the intake duct No. 2 to the intercooler.

Note:

When inserting the intercooler into the intake duct No. 2, be careful that the insulator is not turned over.



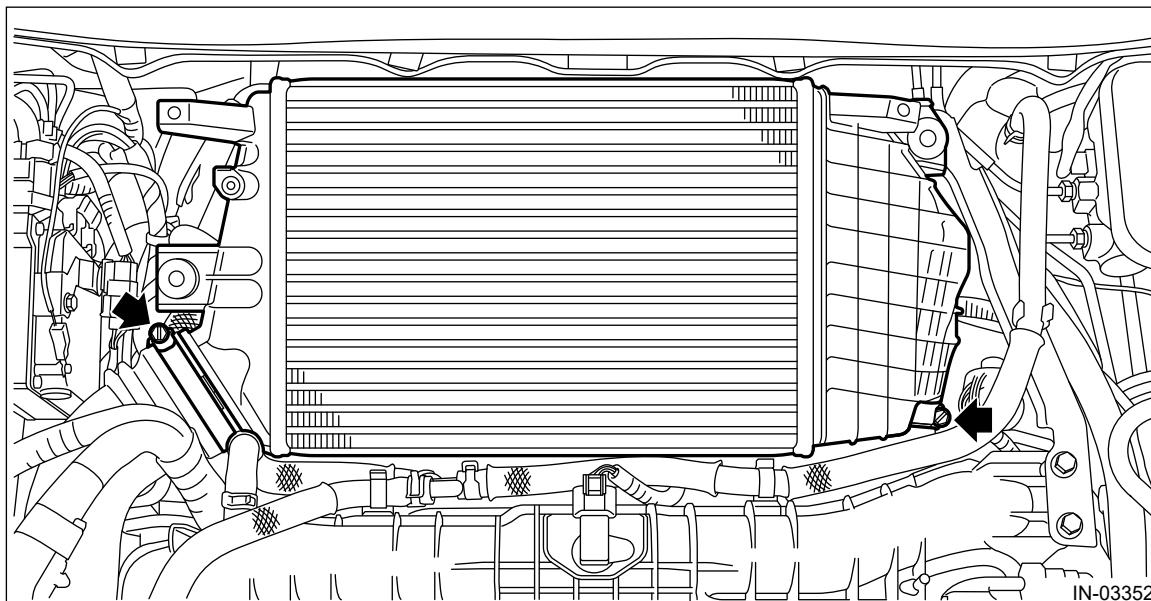
6. Insert the intercooler into the intake duct No. 3, and tighten the clamp which secures the intake duct to the intercooler.

Note:

When inserting the intercooler into the intake duct No. 3, be careful that the insulator is not turned over.

Tightening torque:

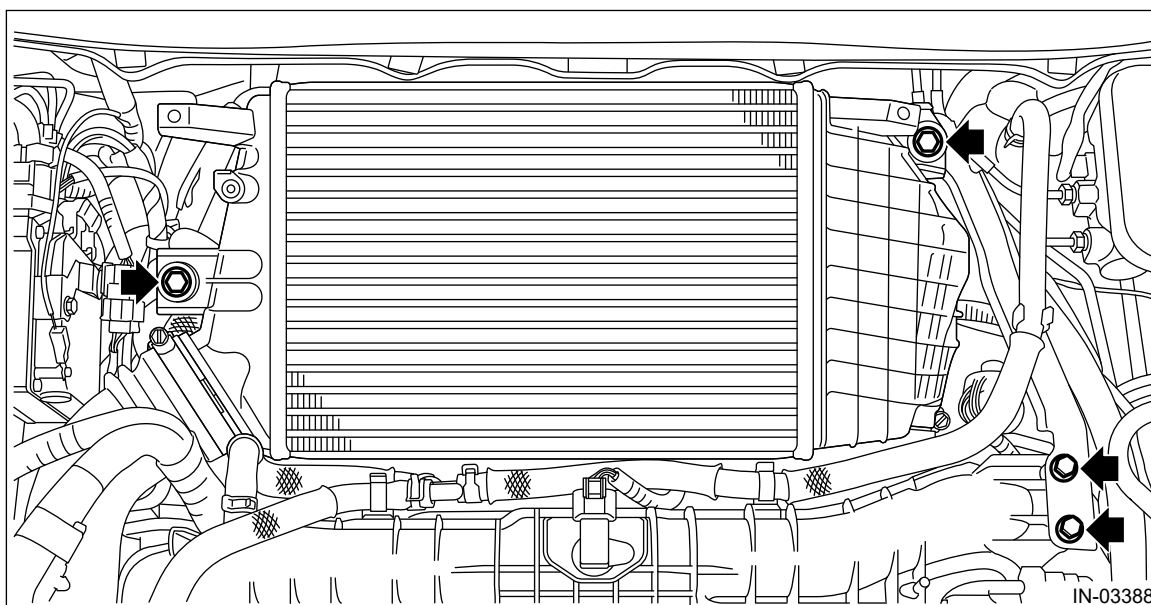
3 N•m (0.3 kgf-m, 2.2 ft-lb)



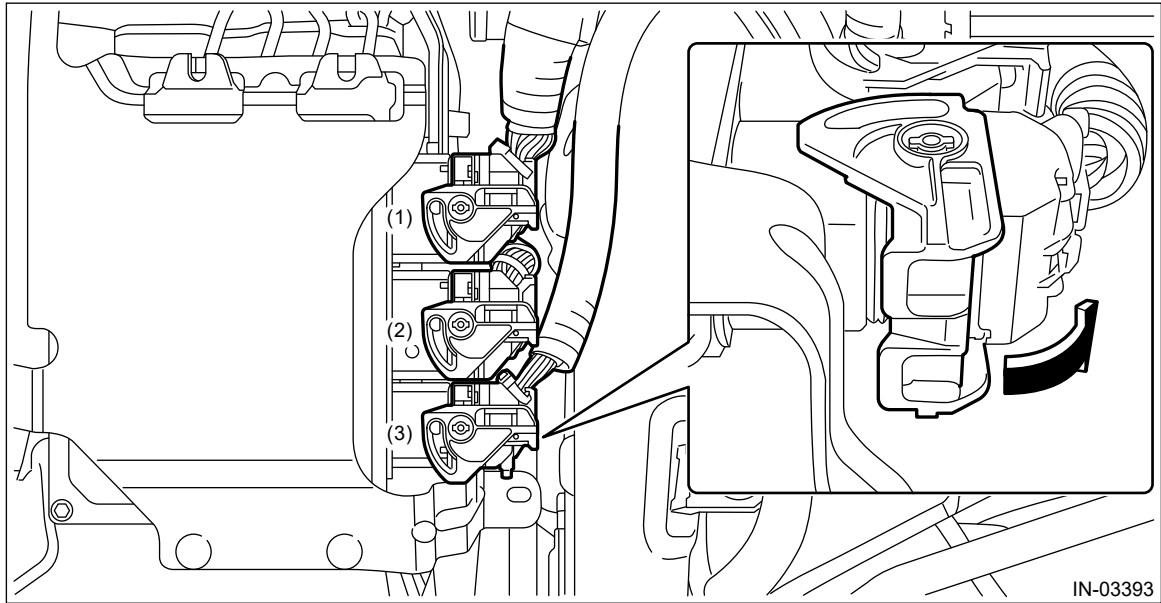
7. Install the bolts which secure the intercooler to the intercooler stay, and tighten the bolt which secures the intercooler stay LH to the intake manifold.


Tightening torque:

16 N•m (1.6 kgf-m, 11.8 ft-lb)



8. Move the lock lever in the direction of the arrow, and connect the connector to the ECM in numerical order as shown in the figure.

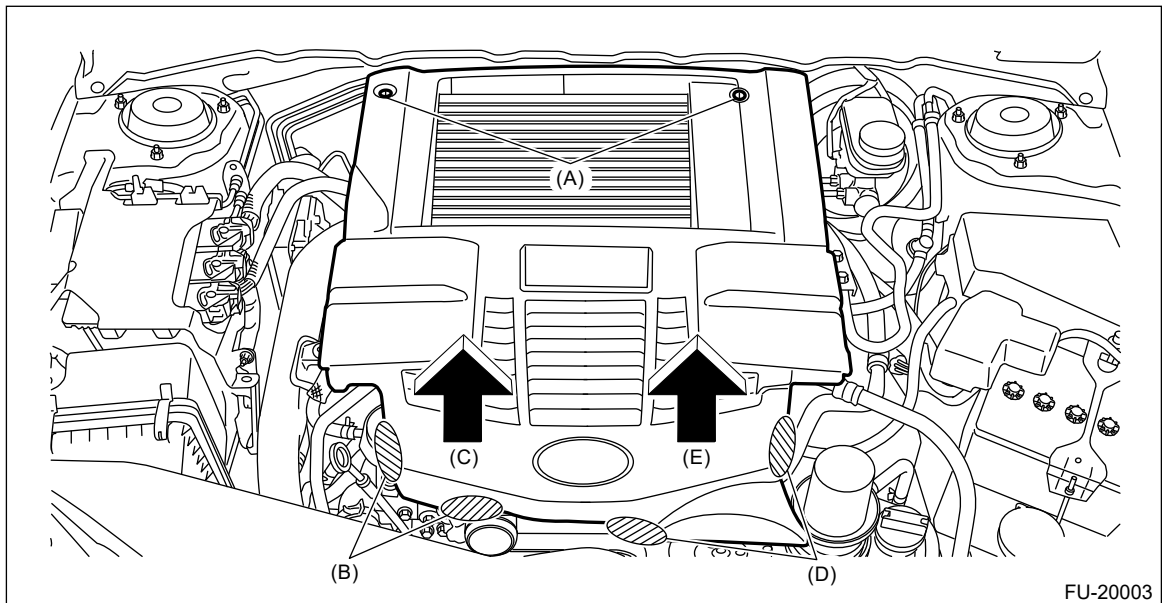



- 9.** Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 10.** Install the collector cover.

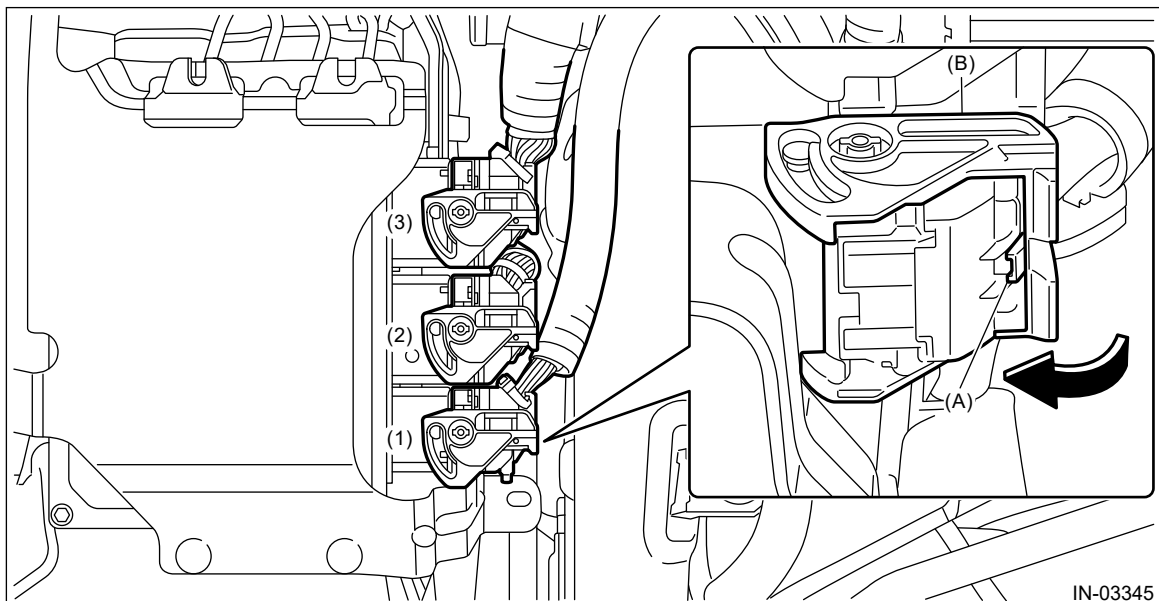
INTAKE (INDUCTION)(H4DOTC) > Intercooler

REMOVAL

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.

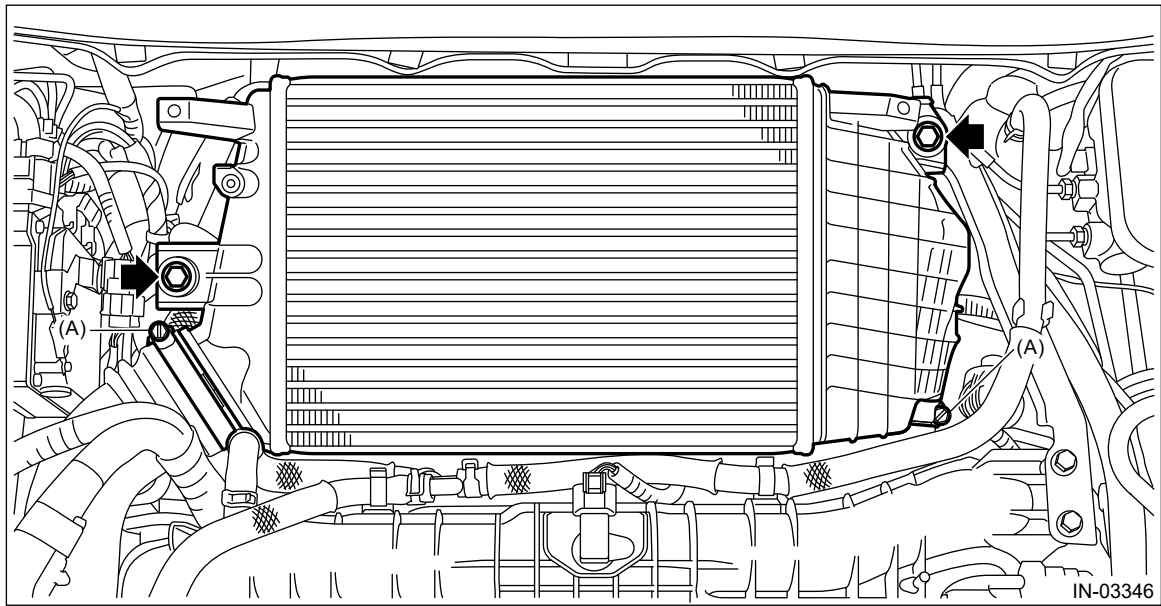


2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. While pressing the section (A) shown in the figure, move the lock lever (B) in the direction of the arrow to disconnect the connectors from the ECM in numerical order as shown in the figure.

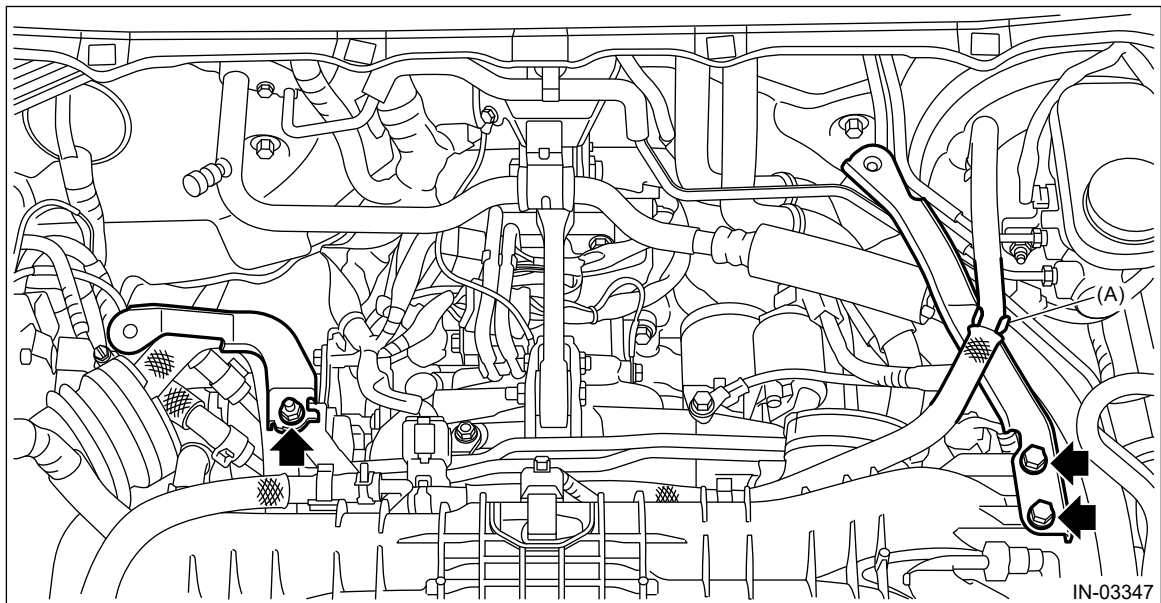


4. Loosen the clamp (A) which holds the intake duct to intercooler.
5. Remove the bolts which secure the intercooler to the intercooler stay, and remove the

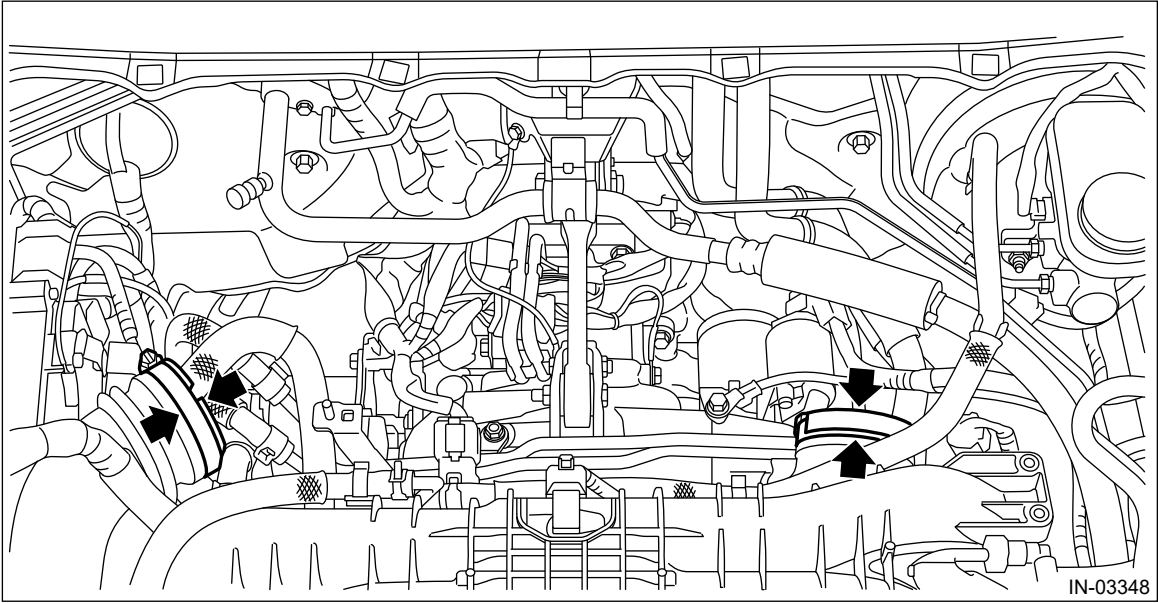
intercooler.



6. Remove the brake booster vacuum hose from the clip (A).
7. Remove the intercooler stay RH from the engine hanger stay, and remove the intercooler stay LH from the intake manifold.



8. Remove the insulator and clamp from intake duct.



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INTAKE (INDUCTION)(H4DOTC) > Oil Catch Tank

ASSEMBLY


Assemble in the reverse order of disassembly.

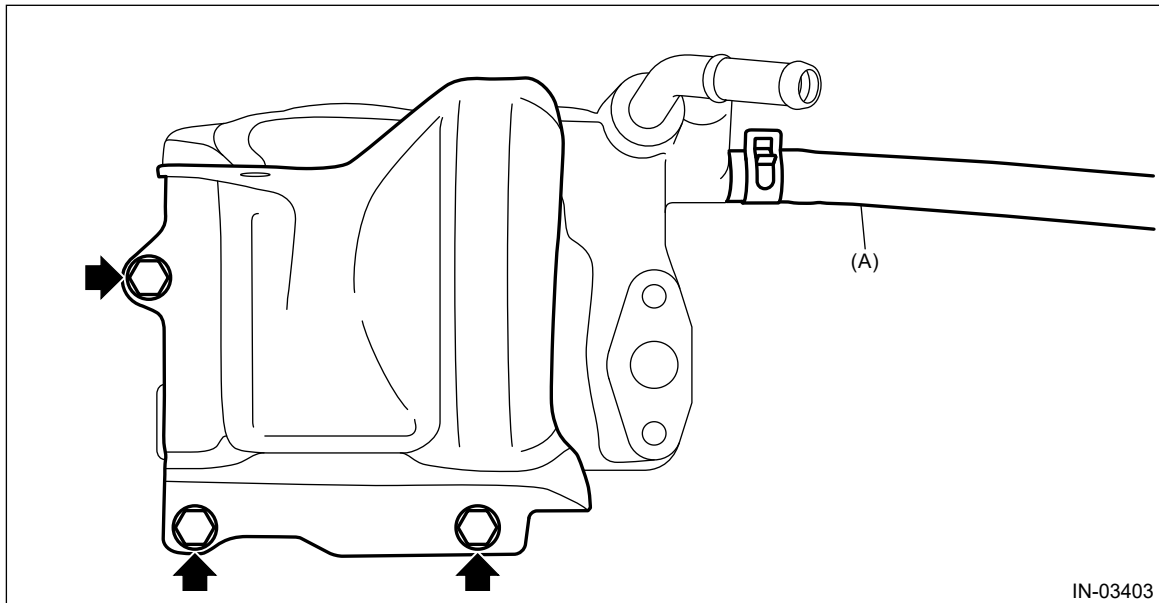
Tightening torque:

7.15 N·m (0.7 kgf-m, 5.3 ft-lb)

INTAKE (INDUCTION)(H4DOTC) > Oil Catch Tank

DISASSEMBLY

1. Remove the PCV hose assembly No. 2.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>PCV Hose Assembly>REPLACEMENT > PCV HOSE ASSEMBLY NO.2.](#)
2. Disconnect the turbo charger hose (A) from the oil catch tank, and remove the exhaust cover from the oil catch tank.



INTAKE (INDUCTION)(H4DOTC) > Oil Catch Tank

INSPECTION

- 1.** Check that the oil catch tank does not have deformation, cracks or damage.
- 2.** Check that the PCV hose and turbocharger hose have no cracks, damage or loose part.

INTAKE (INDUCTION)(H4DOTC) > Oil Catch Tank

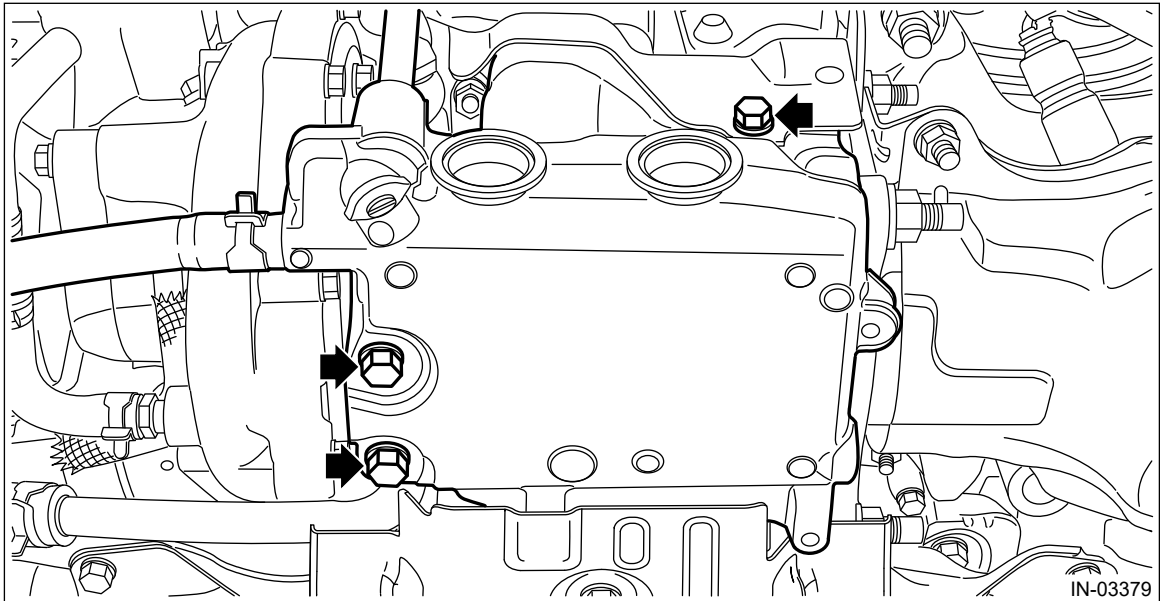
INSTALLATION

1. Install the oil catch tank to the turbocharger and exhaust stay.

- (1) Set the oil catch tank to the turbocharger, and temporarily tighten the bolts which secure the oil catch tank to the turbocharger and exhaust stay.

Note:

Use a new gasket.

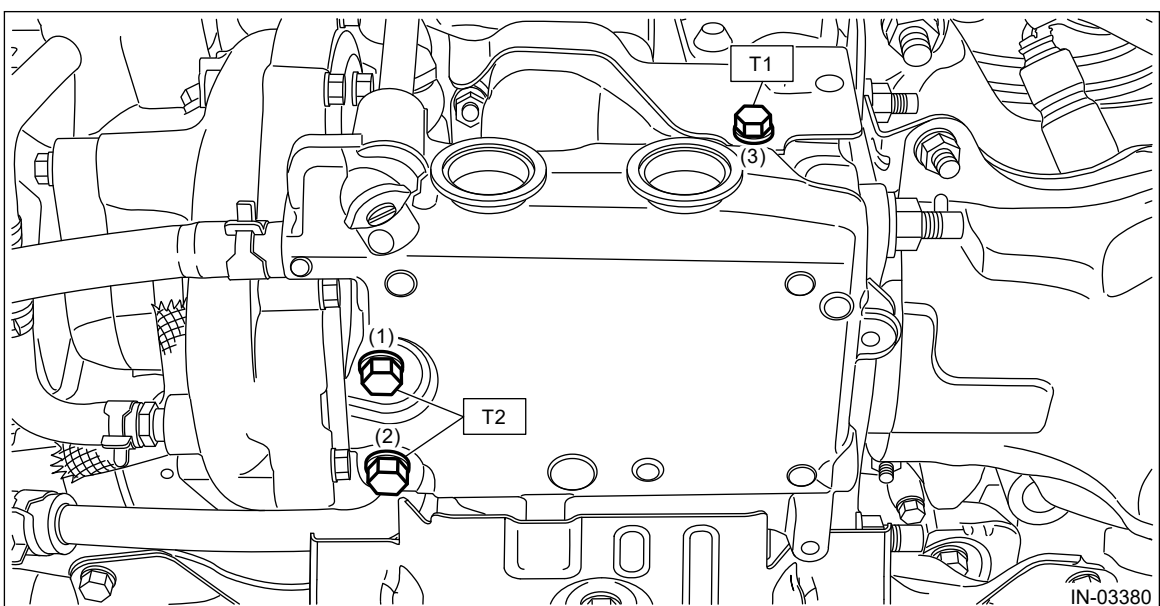


- (2) Tighten the bolts which secure the oil catch tank to the turbocharger and exhaust stay in numerical order as shown in the figure.

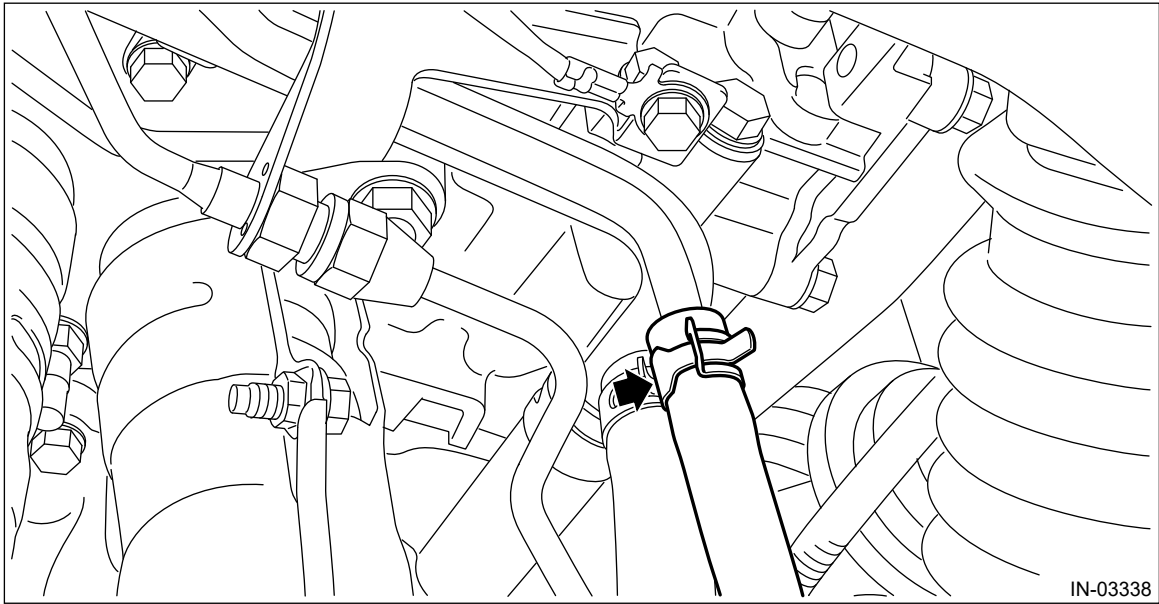
Tightening torque:

T1: 7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

T2: 10.5 N·m (1.1 kgf-m, 7.7 ft-lb)



2. Connect the turbocharger hose to the oil pipe.



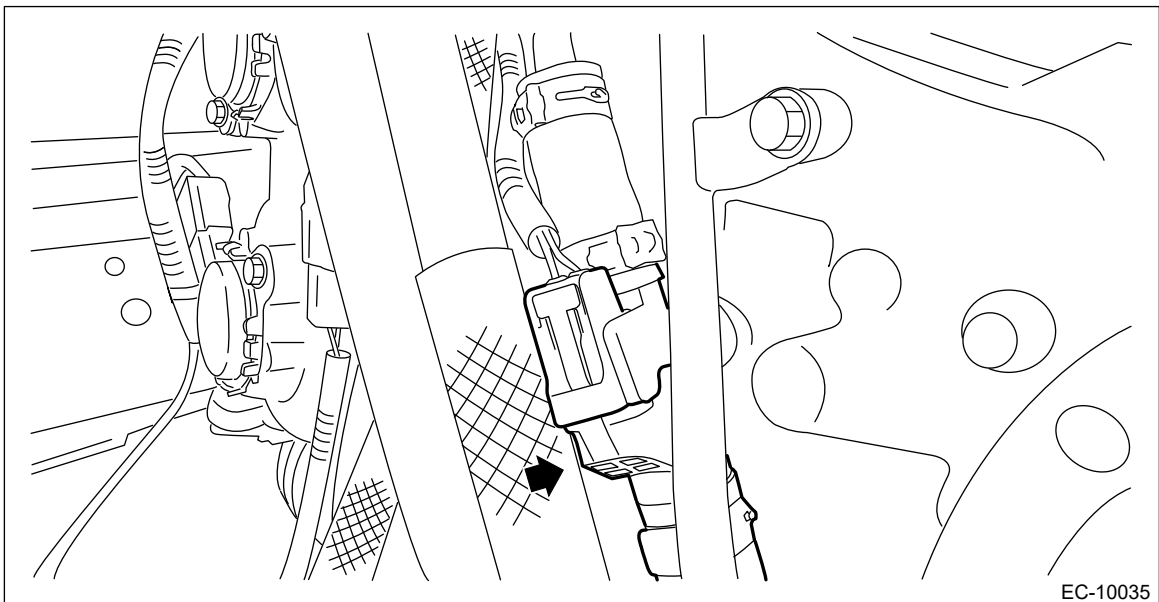
3. Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)


4. Lower the vehicle.


5. Connect the PCV hose assembly No. 2 to the PCV hose assembly No. 1.

Note:

- **There are multiple blow-by diagnosis connectors. Be careful not to connect incorrectly.**
- **Make sure that the blow-by diagnosis connector is connected securely.**





6. Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)

7. Check the engine oil level and replenish the engine oil if necessary.  [Ref. to LUBRICATION\(H4DQ\)>Engine Oil>INSPECTION.](#)


8. Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)

INTAKE (INDUCTION)(H4DOTC) > Oil Catch Tank

REMOVAL

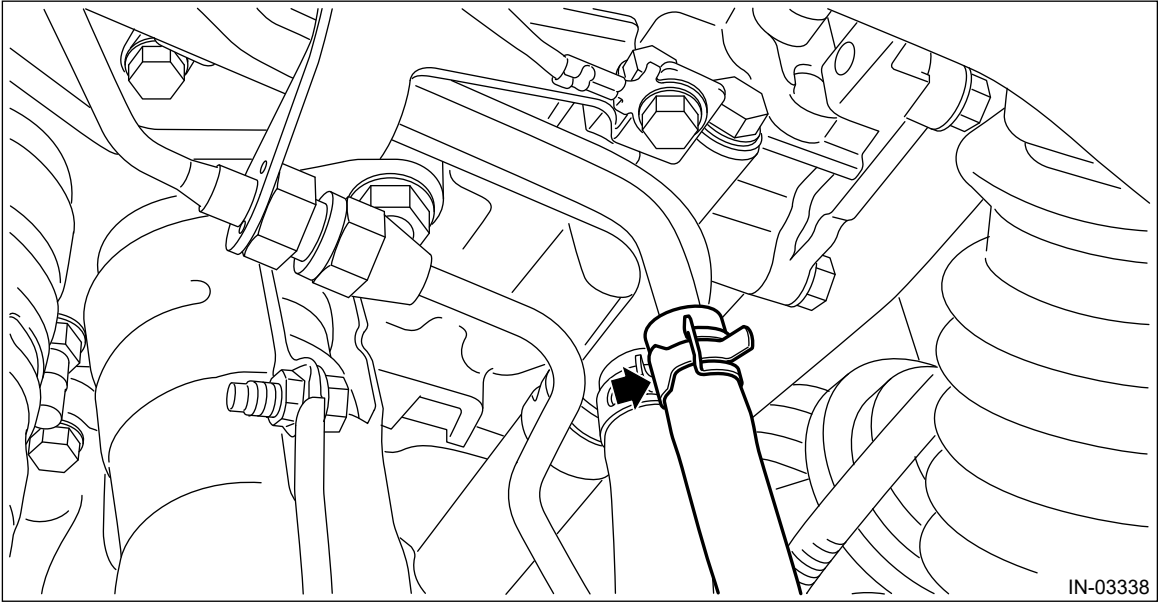
1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
3. Unlock the blow-by diagnosis connector, and disconnect the PCV hose assembly No. 2 from the PCV hose assembly No. 1.



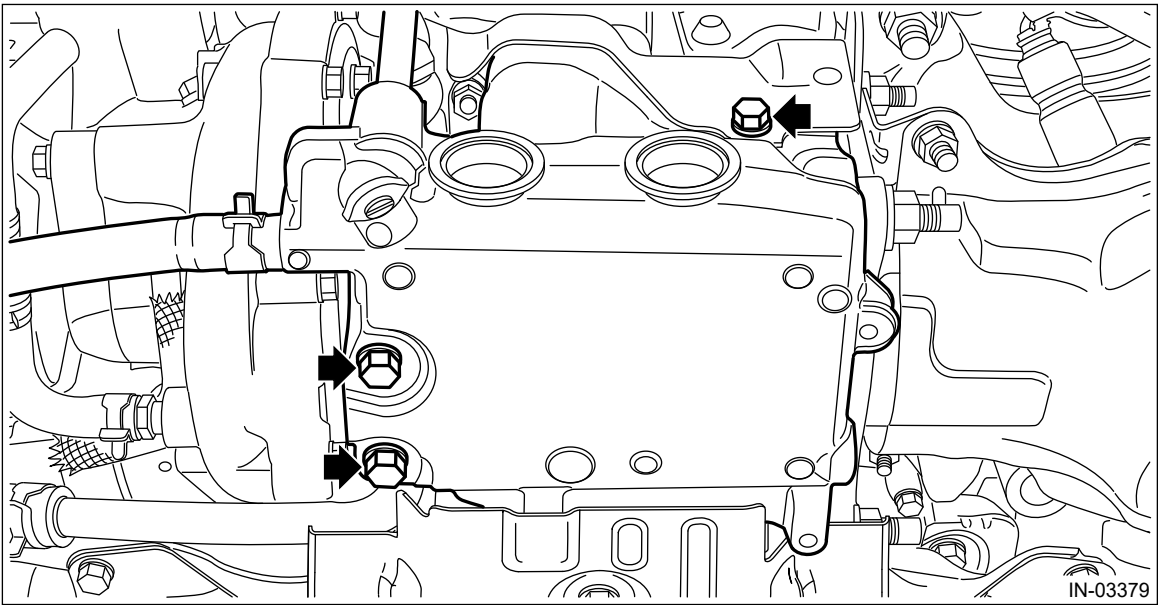
4. Lift up the vehicle.
5. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
6. Disconnect the turbocharger hose from the oil pipe, and drain the engine oil in the oil catch tank.

Note:

Prepare the container for draining of engine oil.



7. Remove bolts which secure the oil catch tank to the turbocharger and exhaust stay, and remove the oil catch tank.




INTAKE (INDUCTION)(H4DOTC) > Resonator Chamber

INSPECTION

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


INTAKE (INDUCTION)(H4DOTC) > Resonator Chamber

INSTALLATION

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to "Air Cleaner Case" for installation procedure.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Cleaner Case>INSTALLATION.](#)


INTAKE (INDUCTION)(H4DOTC) > Resonator Chamber

REMOVAL

The resonator chamber and air cleaner case are integrated into one unit; therefore, refer to "Air Cleaner Case" for removal procedure.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Cleaner Case>REMOVAL.](#)


INTAKE (INDUCTION)(H4DOTC) > Scavenge Pump

INSPECTION

Refer to "Scavenge Pump" for inspection procedure of scavenge pump.  [Ref. to LUBRICATION\(H4DO\)>Scavenge Pump>INSPECTION.](#)


INTAKE (INDUCTION)(H4DOTC) > Scavenge Pump

INSTALLATION

Refer to "Scavenge Pump" for installation procedure of scavenge pump.  [Ref. to LUBRICATION\(H4DO\)>Scavenge Pump>INSTALLATION.](#)

INTAKE (INDUCTION)(H4DOTC) > Scavenge Pump

REMOVAL

Refer to "Scavenge Pump" for removal procedure of scavenge pump.  [Ref. to LUBRICATION\(H4DO\)>Scavenge Pump>REMOVAL.](#)

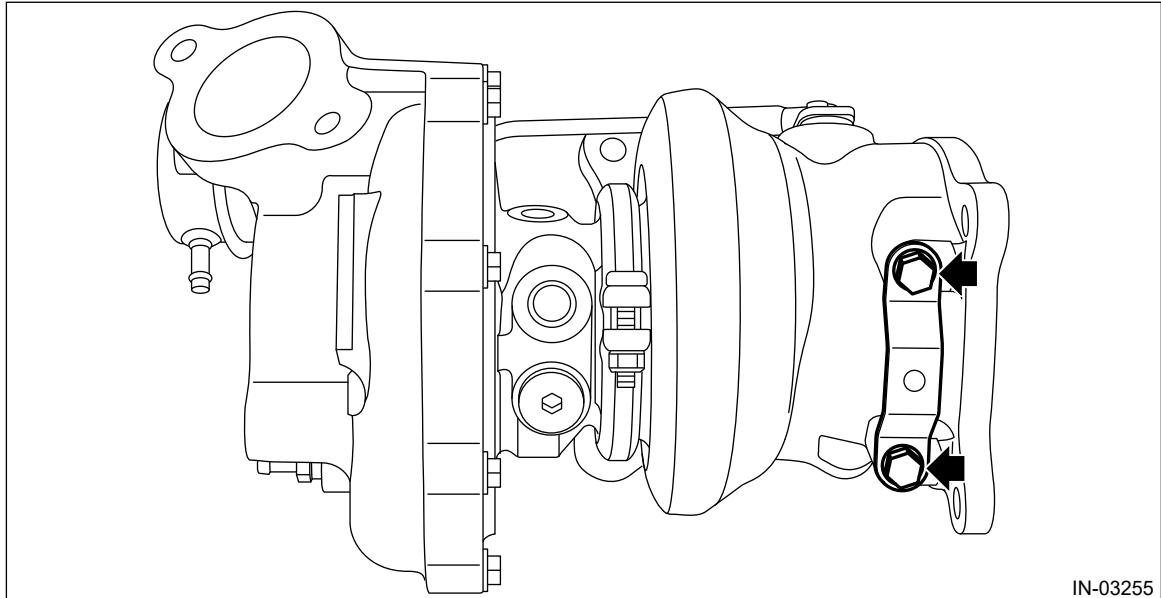
INTAKE (INDUCTION)(H4DOTC) > Turbocharger

ASSEMBLY

1. Install the exhaust stay to the turbocharger.

Tightening torque:

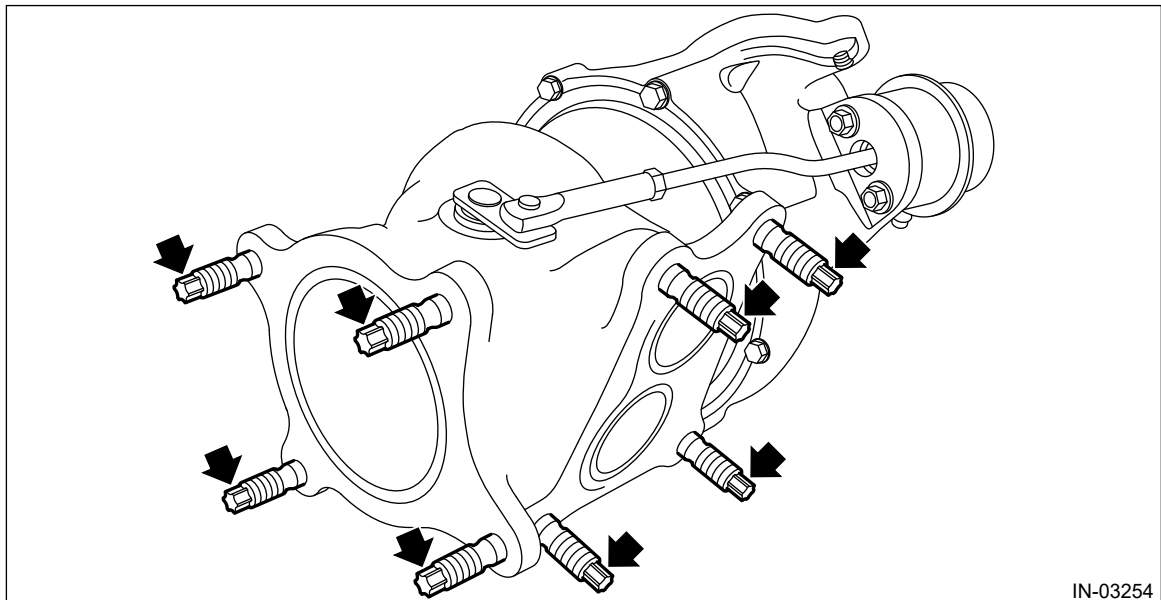
7.15 N·m (0.7 kgf-m, 5.3 ft-lb)



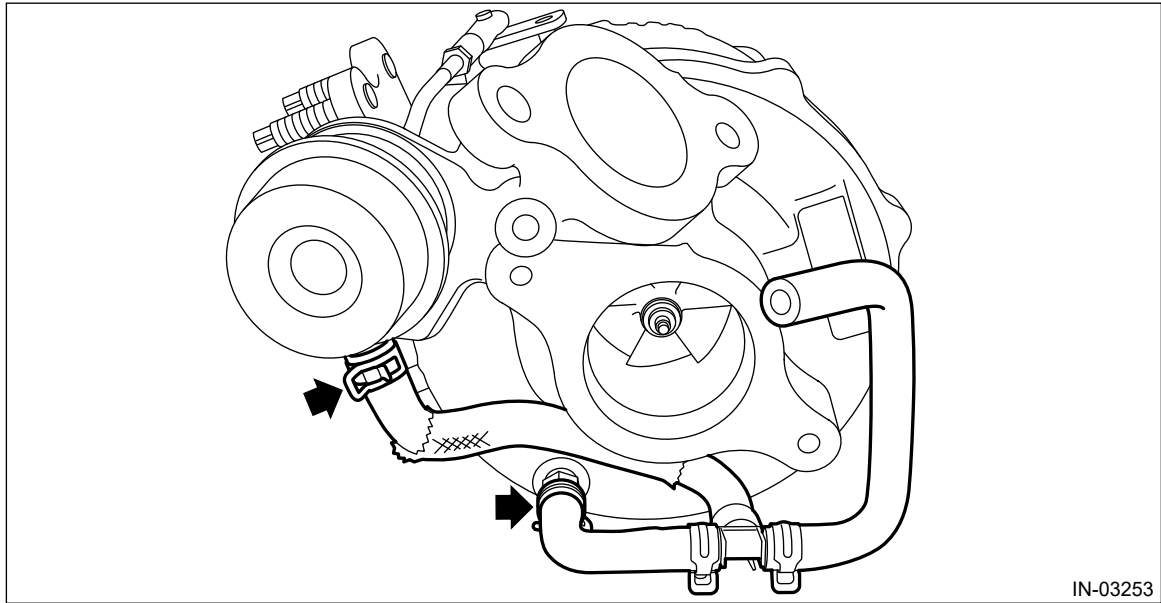
2. Attach the stud bolts to the turbocharger.

Tightening torque:

14.7 N·m (1.5 kgf-m, 10.8 ft-lb)



3. Install the air control hose to the turbocharger.



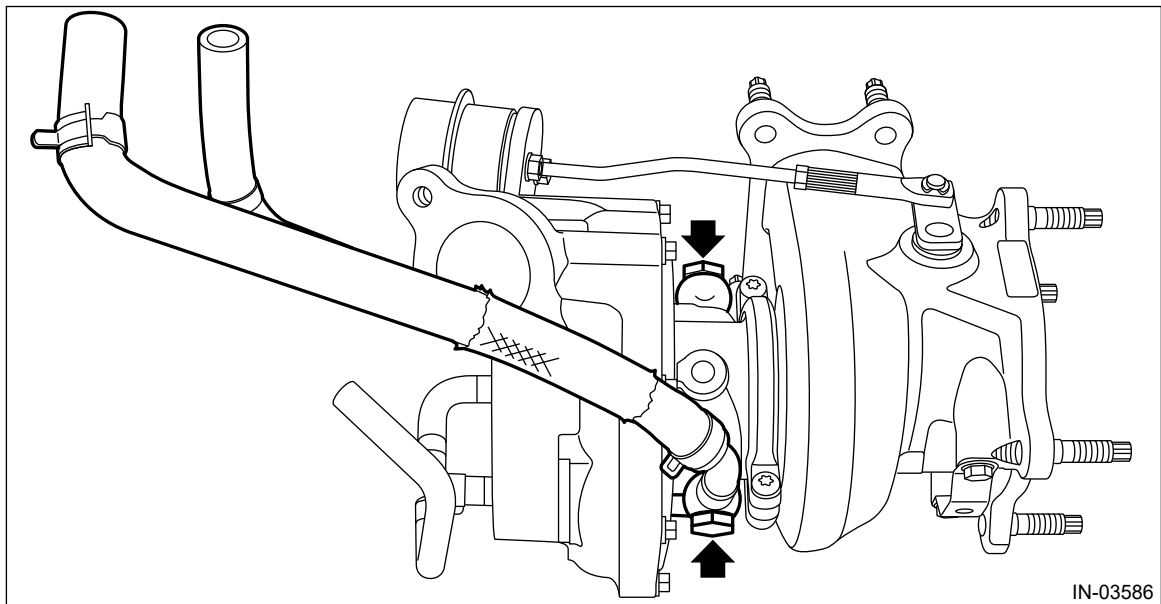
4. Install the turbocharger pipe to the turbocharger.

Note:

Use a new gasket.

Tightening torque:

31.5 N·m (3.2 kg-m, 23.2 ft-lb)



5. Install the union screw pipe assembly to the turbocharger.

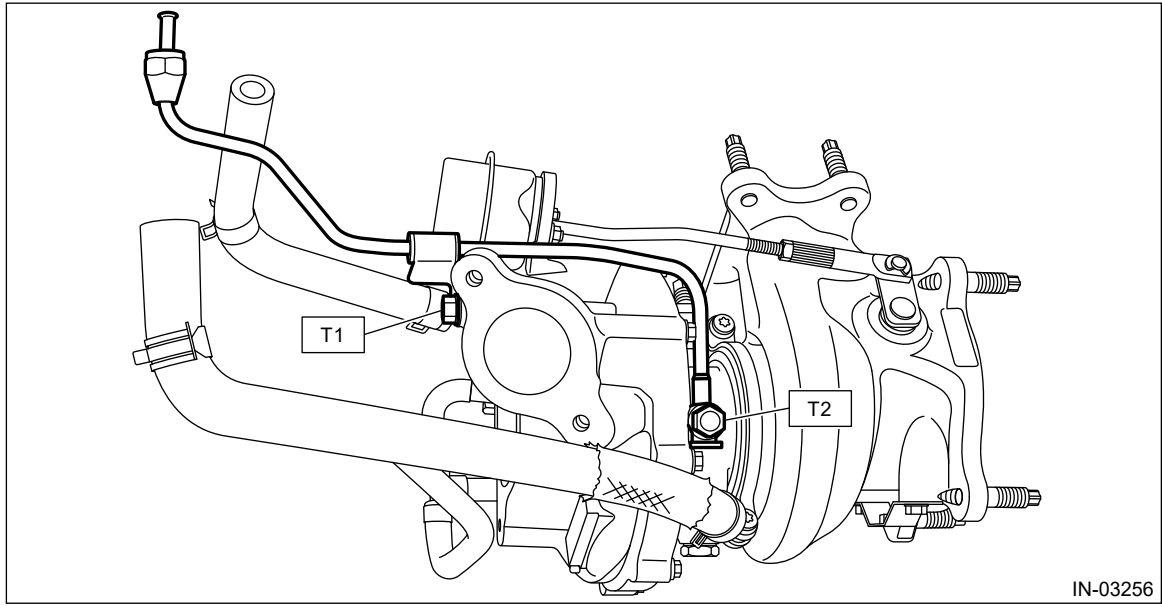
Note:

Use a new gasket.

Tightening torque:

T1: 6.8 N·m (0.7 kgf-m, 5.1 ft-lb)

T2: 16 N·m (1.6 kgf-m, 11.8 ft-lb)

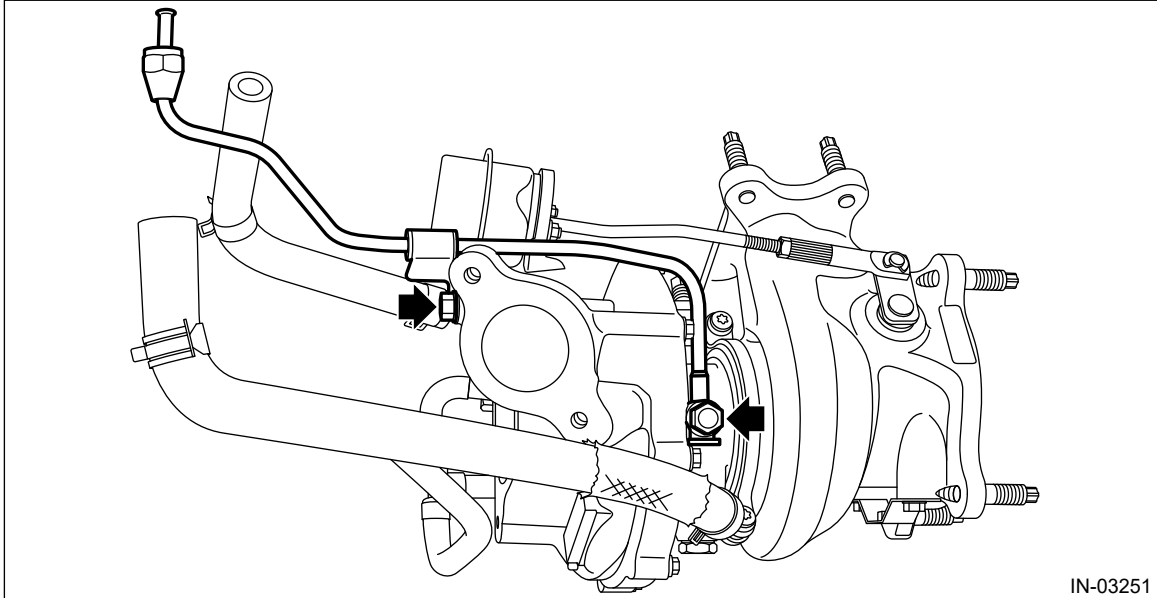


IN-03256

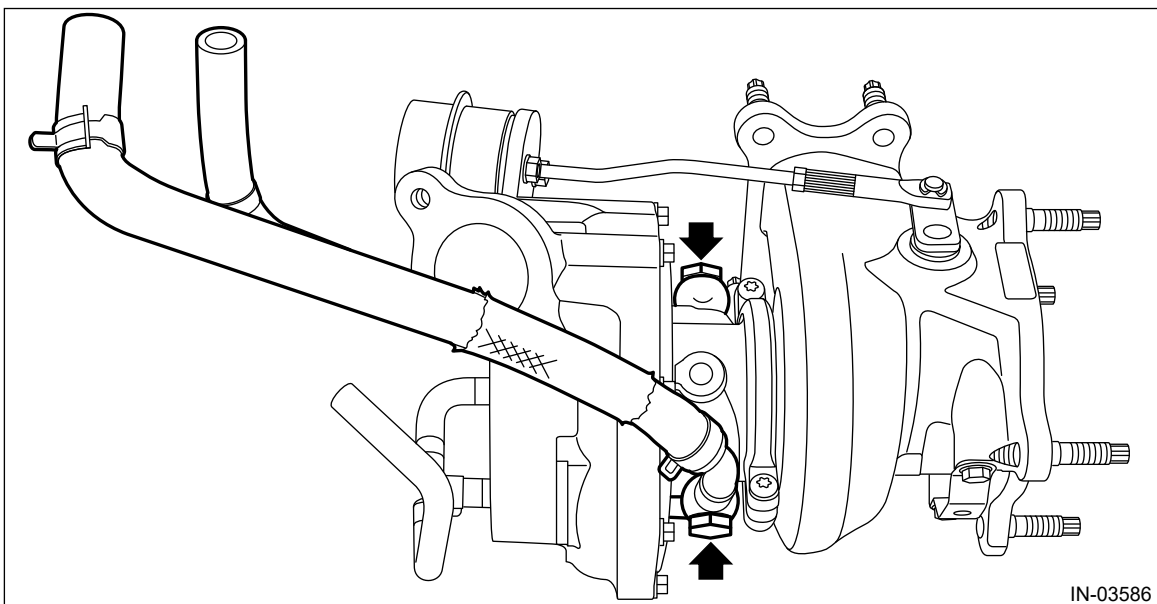
INTAKE (INDUCTION)(H4DOTC) > Turbocharger

DISASSEMBLY

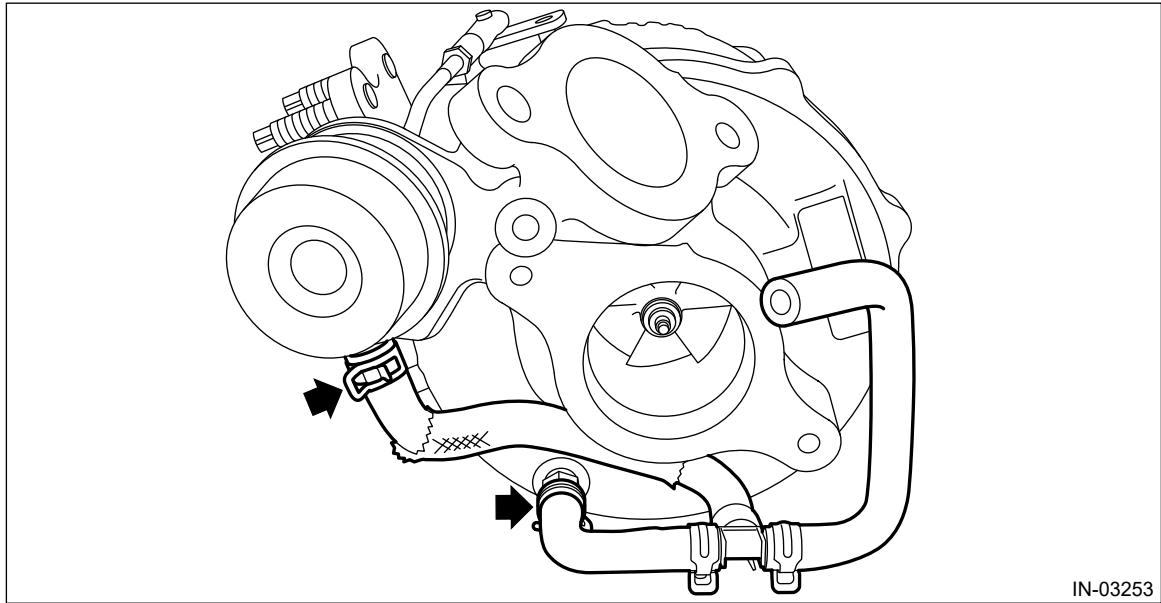
1. Remove the union screw pipe assembly from the turbocharger.



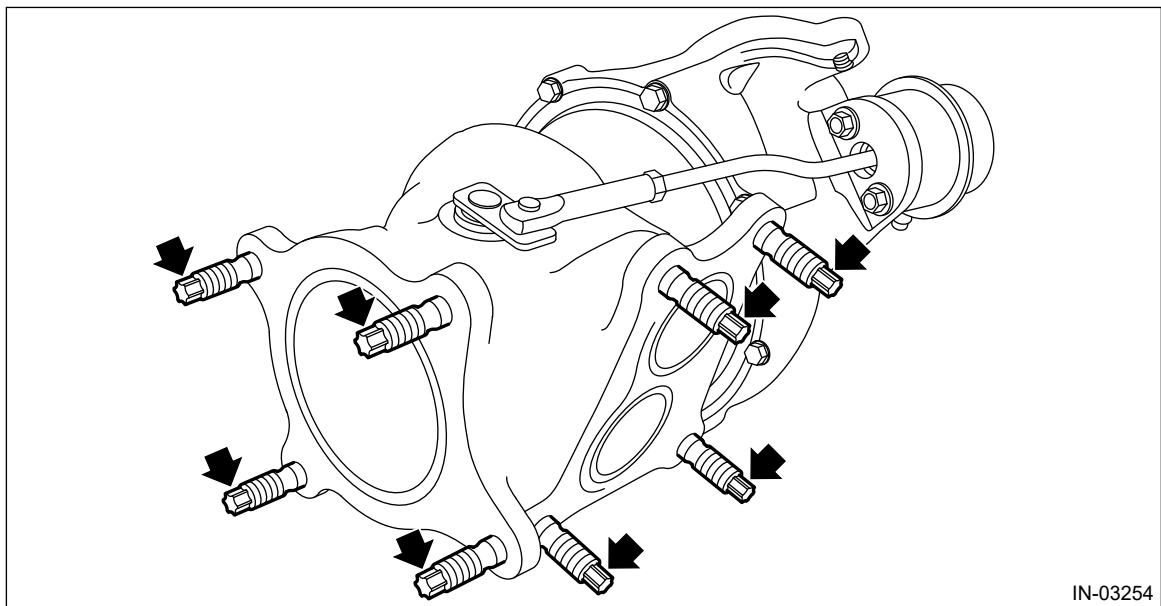
2. Remove the turbocharger pipe from the turbocharger.



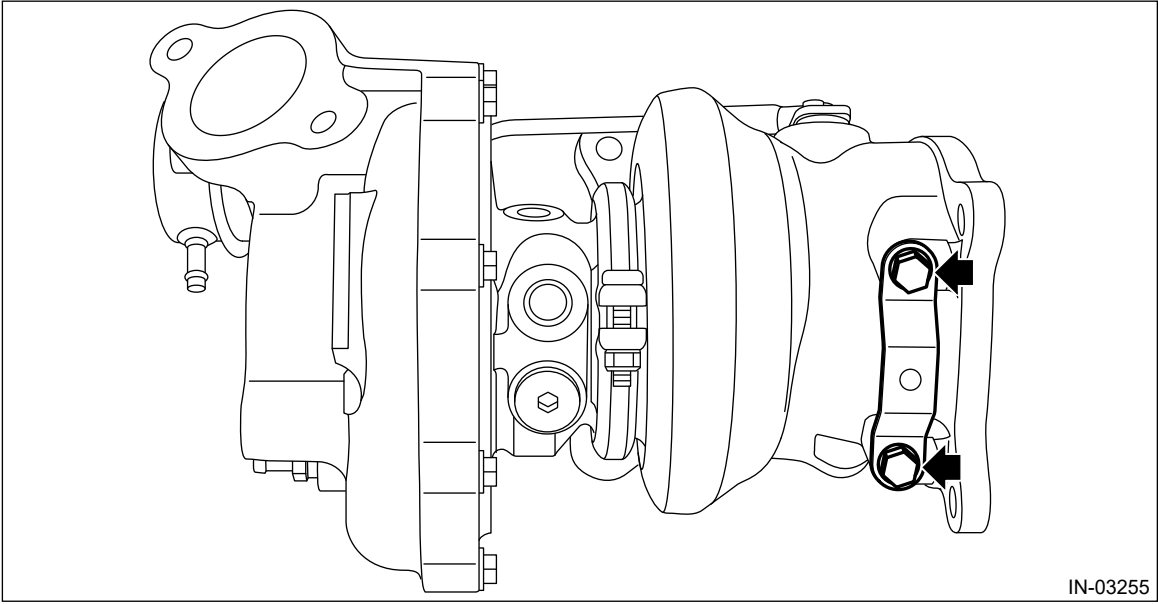
3. Remove the air control hose from the turbocharger.



4. Remove the stud bolt from the turbocharger.



5. Remove the exhaust stay from the turbocharger.



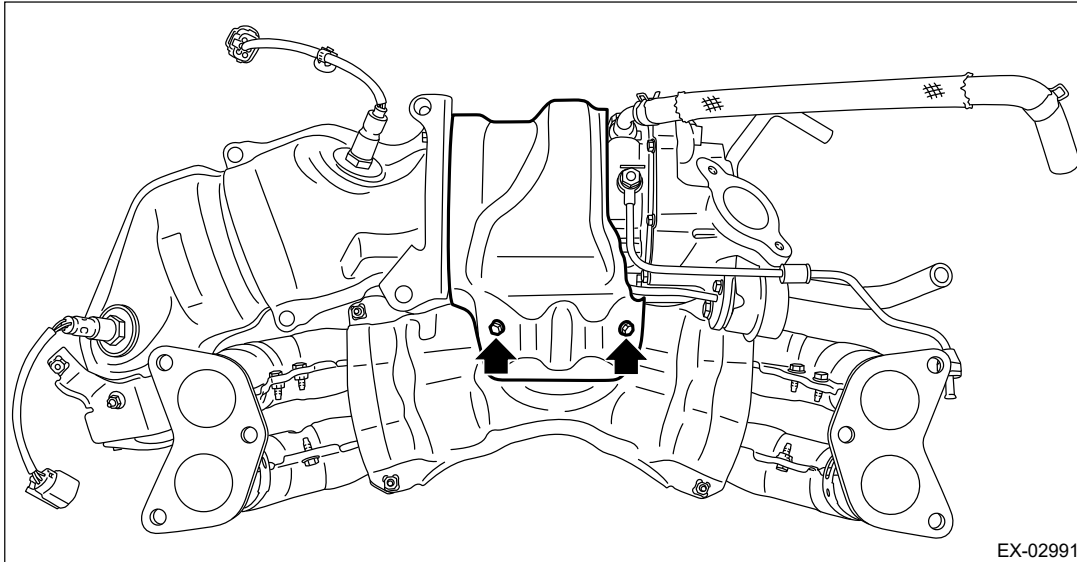
IN-03255

INTAKE (INDUCTION)(H4DOTC) > Turbocharger

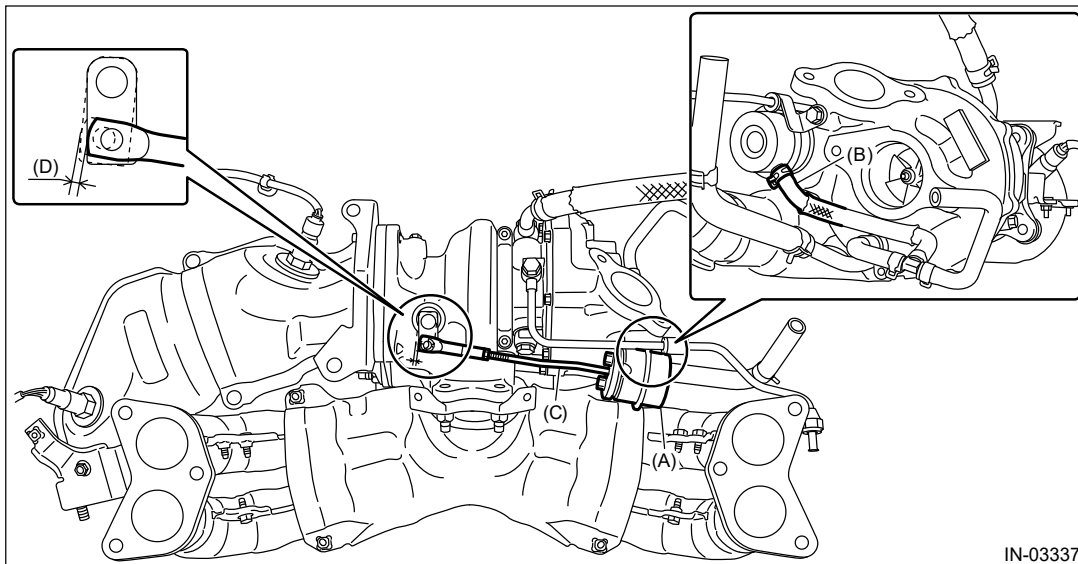
INSPECTION

1. WASTE GATE ACTUATOR

1. Remove the front exhaust pipe.  Ref. to EXHAUST(H4DOTC)>Front Exhaust Pipe>REMOVAL.
2. Remove the exhaust cover.



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



- (A) Waste gate actuator (C) Control rod (D) Control rod stroke
(B) Vacuum control hose

4. Pressurize slowly with the Mighty Vac, and check the pressure when the control rod stroke (D) becomes 1 ± 0.15 mm (0.0394 ± 0.0059 in). If it is not within the standard, replace the turbocharger assembly.

Caution:

Do not pressurize over 112.7 kPa (1.15 kg/cm², 16.34 psi) to prevent damaging the waste gate actuator.

Operating pressure (control rod stroke 1±0.15 mm (0.0394±0.0059 in)):

Standard

84.0—88.0 kPa (0.86—0.90 kg/cm², 12.18—12.76 psi)

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

Tightening torque:



6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

2. OTHER INSPECTIONS

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



INTAKE (INDUCTION)(H4DOTC) > Turbocharger

INSTALLATION

Refer to "Front Exhaust Pipe" for the installation procedure.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>ASSEMBLY.](#)

INTAKE (INDUCTION)(H4DOTC) > Turbocharger

REMOVAL

Remove the turbo charger and front exhaust pipe as a unit. Refer to "Front Exhaust Pipe" for the removal procedure.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>REMOVAL.](#)  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>DISASSEMBLY.](#)

LUBRICATION(H4DO) > Engine Lubrication System Trouble in General

INSPECTION

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

| Trouble | Possible cause | Corrective action |
|--------------------------------------|---|-------------------|
| Warning light remains ON. | a. Oil pressure switch failure | |
| | ○Cracked diaphragm or oil leakage within switch | Replace. |
| | ○Broken spring or seized contacts | Replace. |
| | b. Low oil pressure | |
| | ○Clogging of oil filter | Replace. |
| | ○Malfunction of oil by-pass valve in oil filter | Replace. |
| | ○Clogged oil passage | Clean. |
| | ○Excessive tip clearance and side clearance of oil pump rotor | Replace. |
| | ○Clogged oil strainer or broken pipe | Clean or replace. |
| | c. No oil pressure | |
| | ○Insufficient engine oil (degradation, etc.) | Replace. |
| | ○Broken pipe of oil strainer | Replace. |
| | ○Stuck oil pump rotor | Replace. |
| Warning light does not illuminate. | a. Malfunction of combination meter | Replace. |
| | b. Poor contact of switch contact points | Replace. |
| | c. Disconnection of wiring | Repair. |
| Warning light flickers momentarily. | a. Defective terminal contact | Repair. |
| | b. Defective wiring harness | Repair. |
| | c. Oil pressure switch failure | |
| | ○Cracked diaphragm or oil leakage within switch | Replace. |
| | ○Broken spring or seized contacts | Replace. |
| | d. Low oil pressure | |
| | ○Clogging of oil filter | Replace. |
| | ○Malfunction of oil by-pass valve in oil filter | Replace. |
| | ○Clogged oil passage | Clean. |
| | ○Excessive tip clearance and side clearance of oil pump rotor | Replace. |
| ○Clogged oil strainer or broken pipe | Clean or replace. | |

LUBRICATION(H4DO) > Engine Oil Cooler Pipe

INSPECTION

- 1.** Check that the engine oil cooler pipes have no deformation, cracks or other damages.
- 2.** Make sure the engine oil cooler hoses are not cracked, damaged or loose.

LUBRICATION(H4DO) > Engine Oil Cooler Pipe

INSTALLATION

1. FRONT ENGINE OIL COOLER PIPE

Install in the reverse order of removal.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

2. SIDE ENGINE OIL COOLER PIPE

Install in the reverse order of removal.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

LUBRICATION(H4DO) > Engine Oil Cooler Pipe

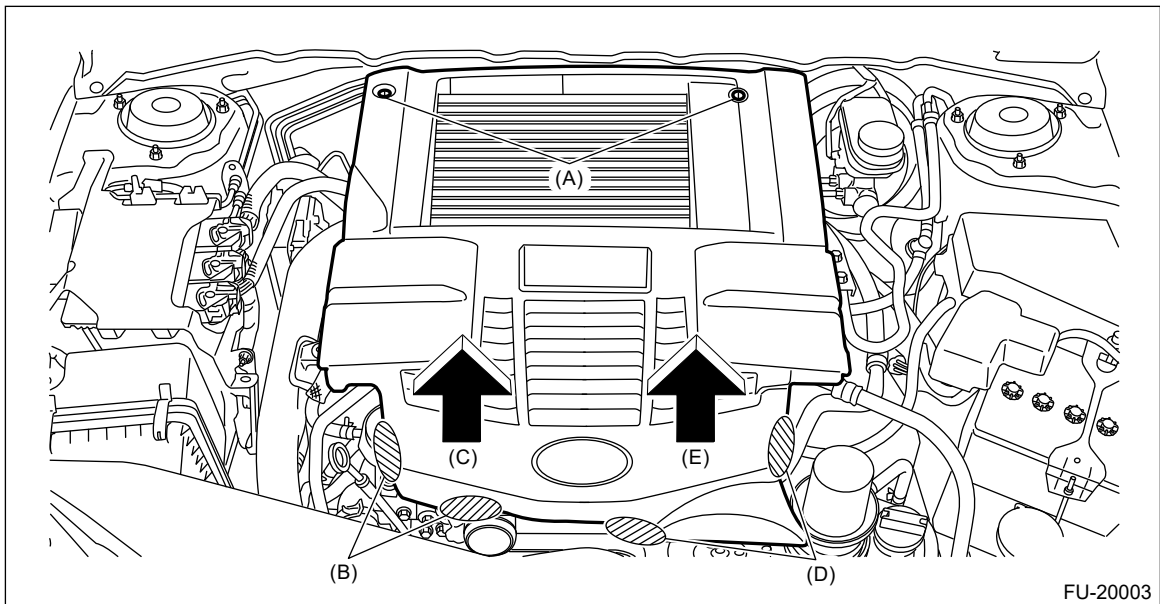
REMOVAL




Note:

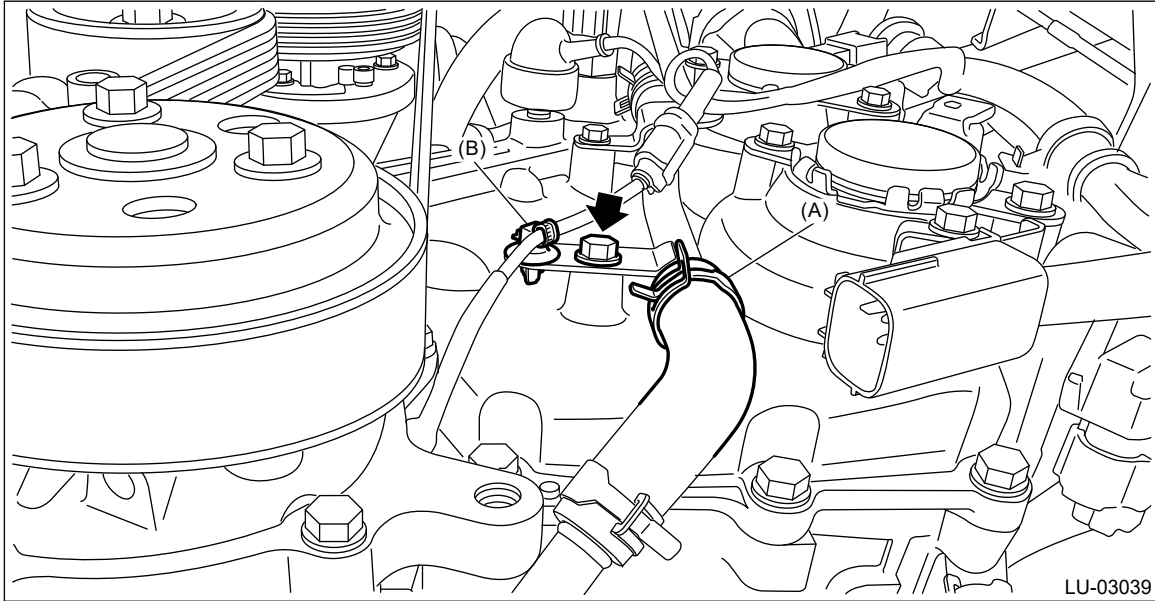
Turbo model is equipped with engine oil cooler pipe.

1. FRONT ENGINE OIL COOLER PIPE

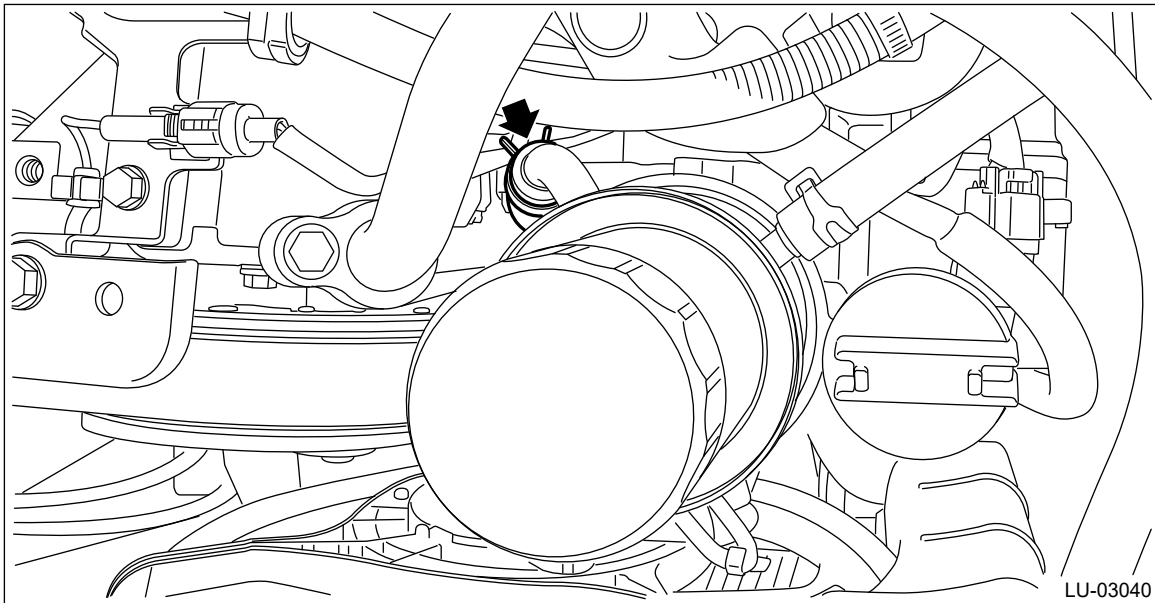
1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



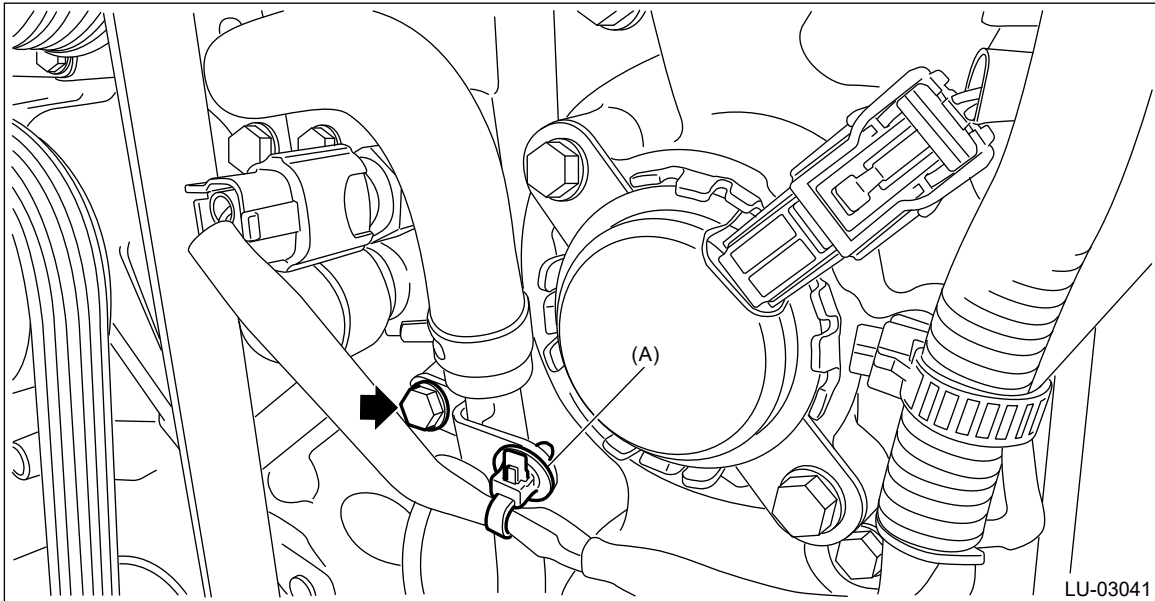
2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Drain engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
4. Remove the center exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Center Exhaust Pipe>REMOVAL.](#)
5. Remove the clip (B) which holds the front engine oil cooler hose B (A) and the oil level switch harness from the front engine oil cooler pipe. Remove the bolt which secures the front engine oil cooler pipe to the chain cover.



6. Lower the vehicle.
7. Disconnect the front engine oil cooler hose A from the engine oil cooler.



8. Remove the clip (A) holding the engine oil temperature sensor harness from the front engine oil cooler pipe.
9. Remove the bolt which secures the front engine oil cooler pipe to the chain cover. Remove the front engine oil cooler pipe together with the front engine oil cooler hose A.



10. Remove the front engine oil cooler hose A from the front engine oil cooler pipe.

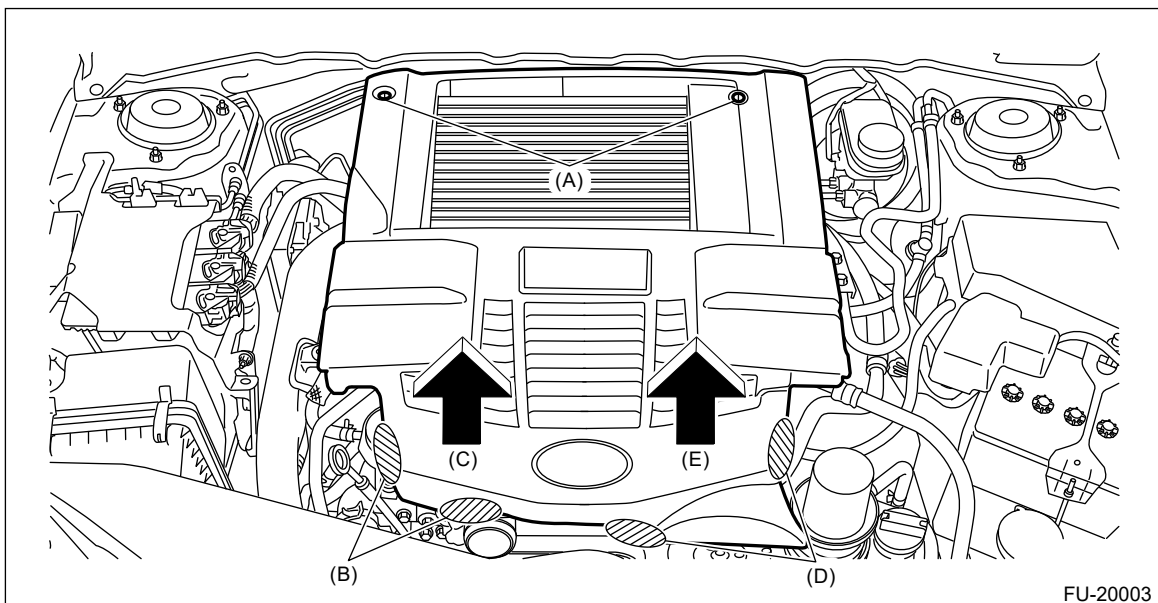
2. SIDE ENGINE OIL COOLER PIPE

1. Remove the collector cover.


(1) Remove the clip (A).

(2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.

(3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



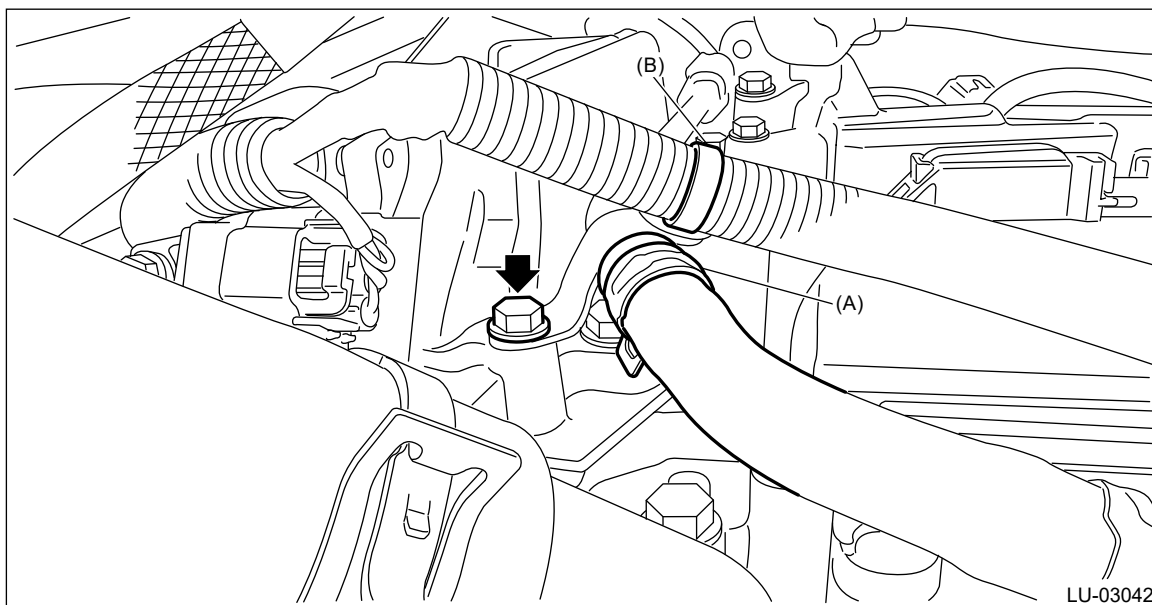
2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)

3. Drain engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)

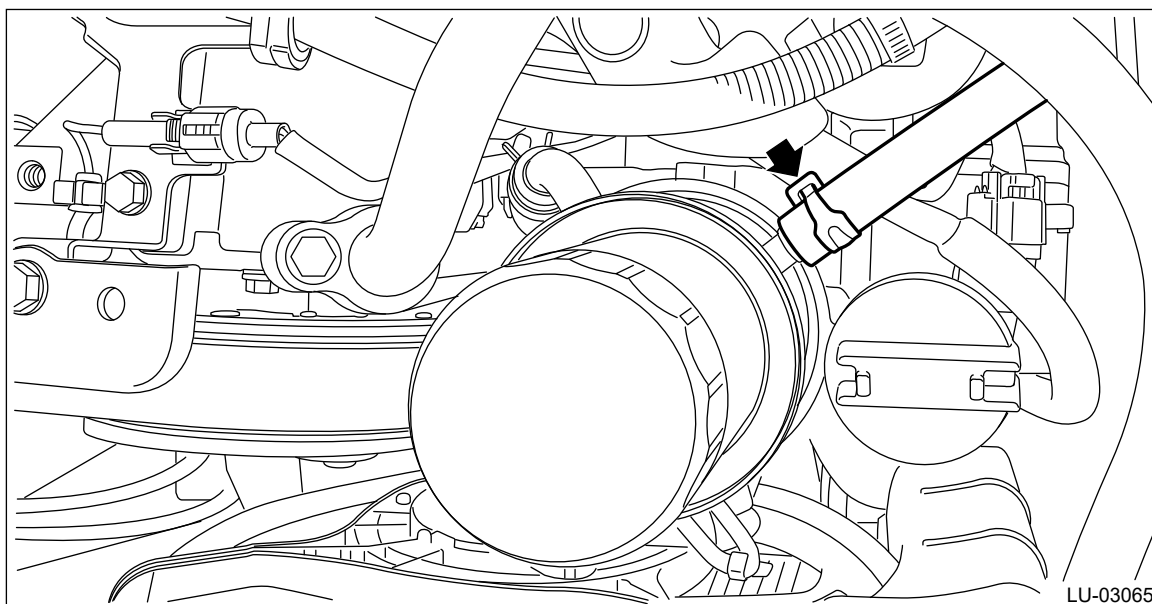
4. Remove the center exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Center Exhaust Pipe>REMOVAL.](#)

5. Remove the clip (B) which holds the side engine oil cooler hose B (A) and the rear oxygen sensor harness from the side engine oil cooler pipe. Remove the bolt which secures the side

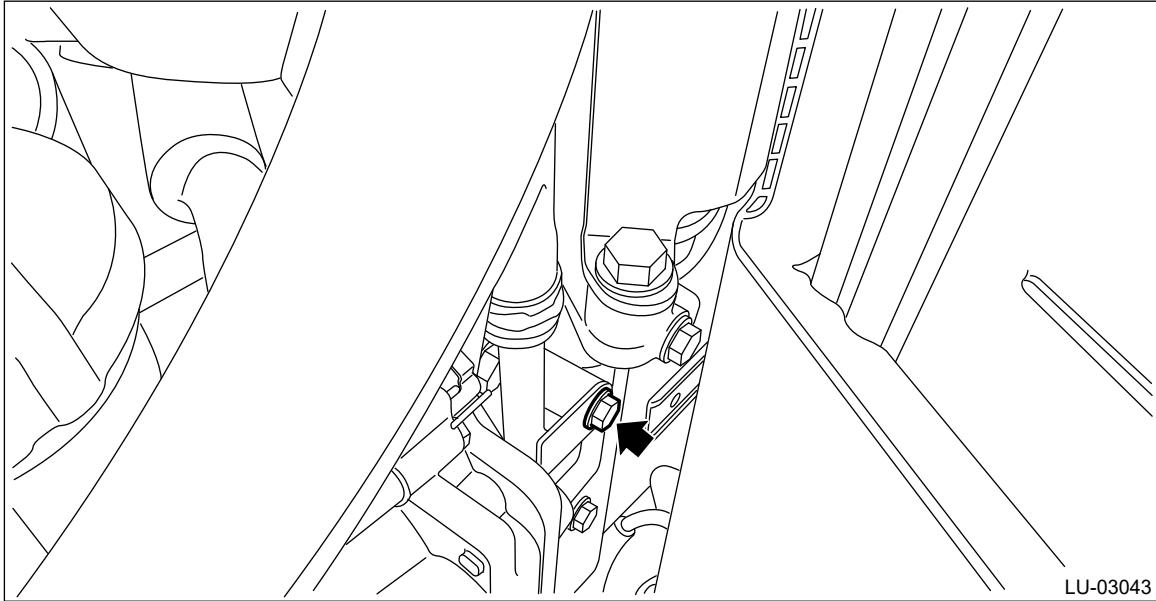
engine oil cooler pipe to the cam carrier RH.



6. Lower the vehicle.
7. Disconnect the side engine oil cooler hose A from the engine oil cooler.



8. Remove the bolt which secures the side engine oil cooler pipe to the cam carrier RH. Remove the side engine oil cooler pipe together with the side engine oil cooler hose A.



9. Remove the side engine oil cooler hose A from the side engine oil cooler pipe.

LUBRICATION(H4DO) > Engine Oil Cooler

INSPECTION

- 1.** Check that the engine oil cooler, engine oil cooler pipe, and oil cooler connector do not have deformation, cracks or damage.
- 2.** Make sure the engine oil cooler hoses are not cracked, damaged or loose.
- 3.** Blow with compressed air to make sure the coolant passages are not clogged.
- 4.** Make sure the mating surfaces of the chain cover do not have damage.

LUBRICATION(H4DO) > Engine Oil Cooler

INSTALLATION

Install in the reverse order of removal.

Note:

- Use a new gasket.
- After installing, check the engine oil level and replenish it if necessary.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>INSPECTION.](#)

Tightening torque:

45 N·m (4.6 kgf-m, 33.2 ft-lb)

LUBRICATION(H4DO) > Engine Oil Cooler

REMOVAL

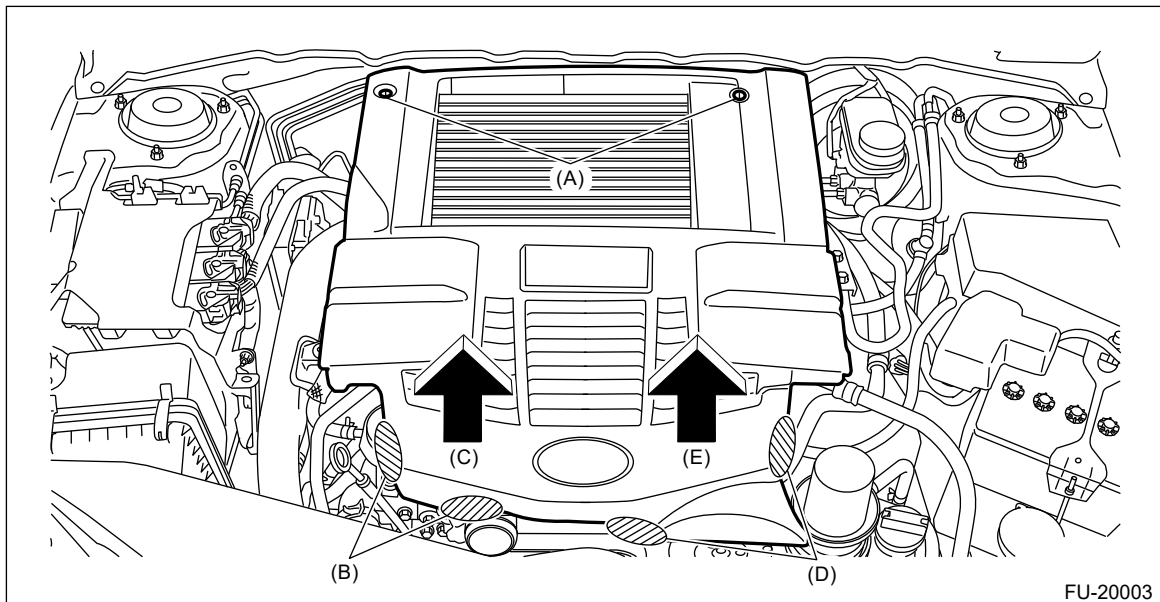
Caution:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

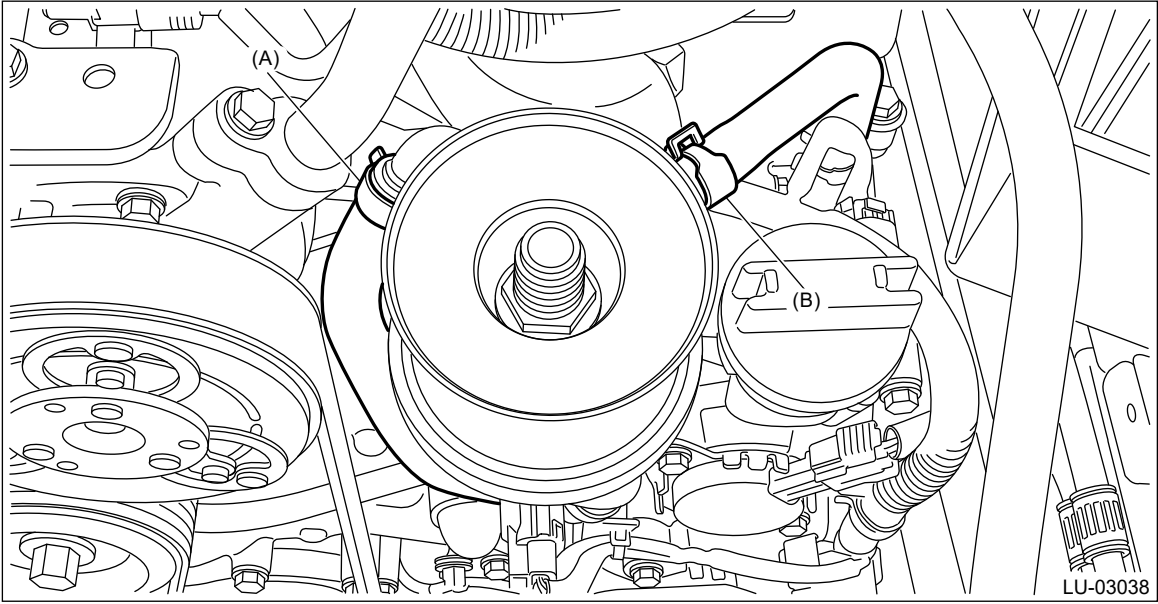
Note:

Turbo model is equipped with engine oil cooler.

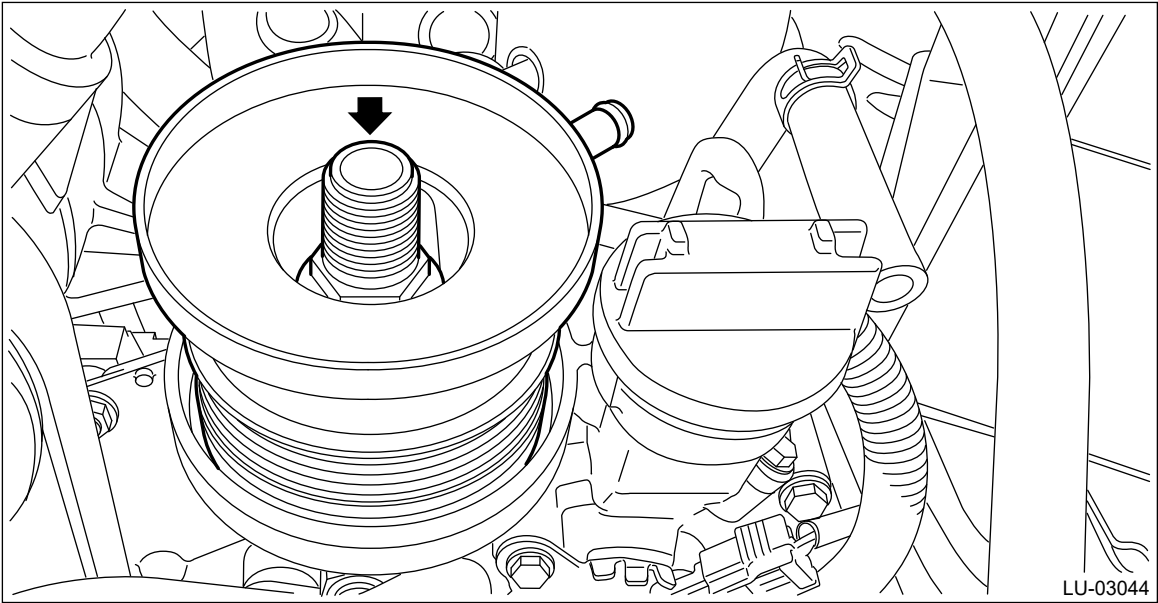
1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Drain engine coolant. [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
3. Lower the vehicle.
4. Remove the engine oil filter. [Ref. to LUBRICATION\(H4DO\)>Engine Oil Filter>REMOVAL > OIL FILTER.](#)
5. Disconnect the front engine oil cooler hose A (A) and the side engine oil cooler hose A (B) from the engine oil cooler.



6. Remove the oil cooler connector and remove the engine oil cooler.



LUBRICATION(H4DO) > Engine Oil Filter

INSPECTION

1. After installing the oil filter, run the engine and check for oil leakage.

Note:

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


2. Check the engine oil level.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>INSPECTION.](#)

INSTALLATION

1. OIL FILTER

Caution:

Do not tighten excessively, or oil may leak.

1. Clean the oil filter installation surface.
2. Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.
3. Install the oil filter by turning it by hand, being careful not to damage the seal rubber of the oil filter.
 - Tighten the oil filter (black) with an outer diameter of 68 mm (2.68 in) further by approx. 1 turn after the seal rubber of the oil filter comes in contact with the chain cover or oil cooler. When using a torque wrench, tighten to 14 N•m (1.4 kgf-m, 10.3 ft-lb).
 - Tighten the oil filter (blue) with an outer diameter of 67.4 mm (2.65 in) further by approx. 7/8 turn after the seal rubber of the oil filter comes in contact with the chain cover or oil cooler. When using a torque wrench, tighten to 12 N•m (1.2 kgf-m, 8.9 ft-lb).
4. After installing, check the engine oil level and replenish it if necessary.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>INSPECTION.](#)

2. OIL PUMP UNION

Install in the reverse order of removal.

Tightening torque:

45 N•m (4.6 kgf-m, 33.2 ft-lb)

LUBRICATION(H4DO) > Engine Oil Filter

REMOVAL

Caution:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1. OIL FILTER

Remove the oil filter.

Note:

Clean off water or dust from the oil element mating surface using air.

- Oil filter (black)

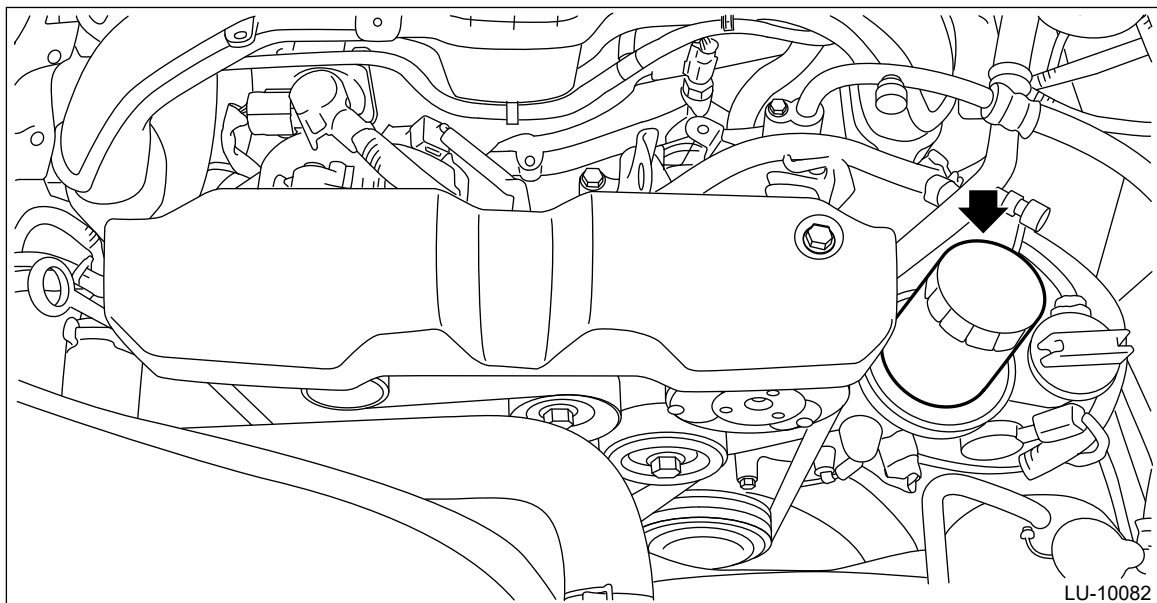
Remove the oil filter using ST.

ST 18332AA000 OIL FILTER WRENCH

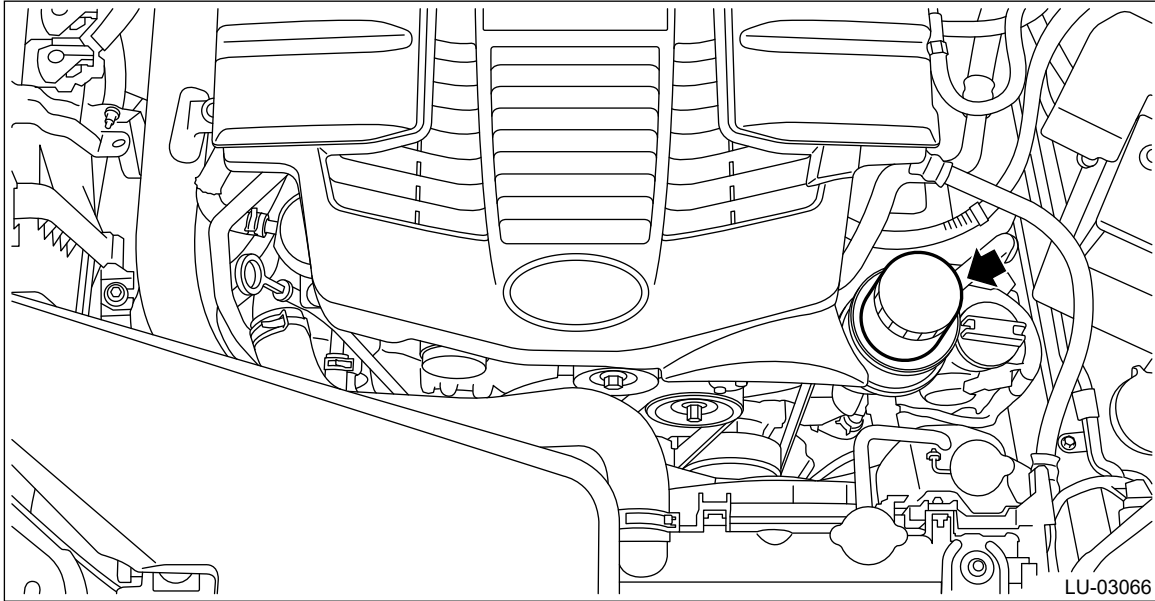
- Oil filter (blue)

Remove using a general tool (65/67 mm 14 Flutes).

- Non-turbo model




- Turbo model

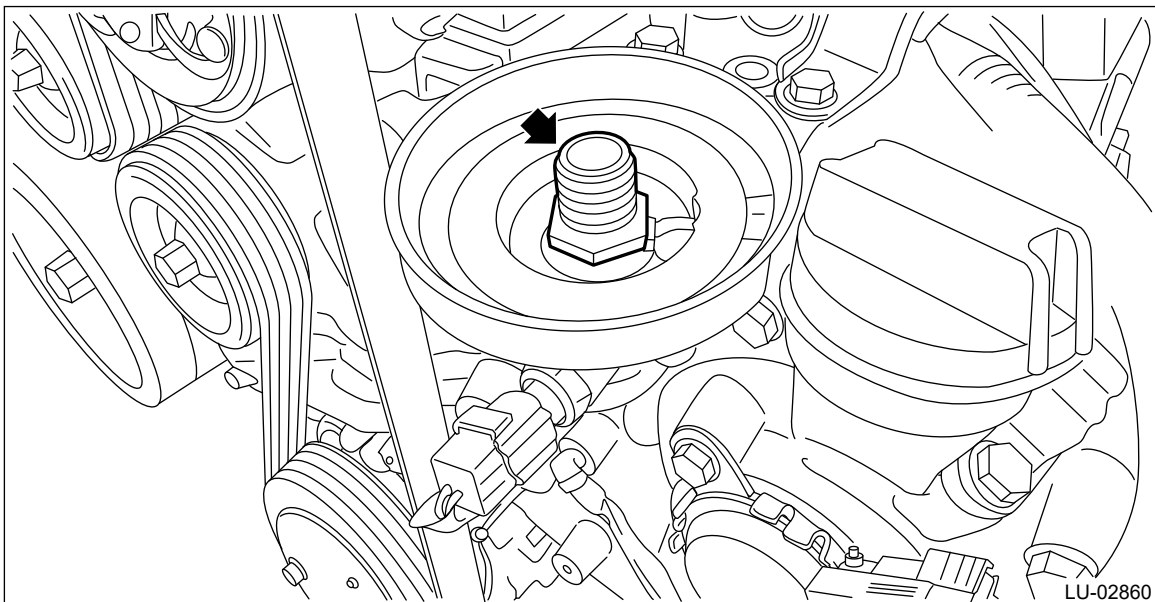


2. OIL PUMP UNION

Note:

Non-turbo model is equipped with the oil pump union.

1. Remove the oil filter.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil Filter>REMOVAL > OIL FILTER.](#)
2. Remove the oil pump union from the chain cover.



LUBRICATION(H4DO) > Engine Oil

INSPECTION

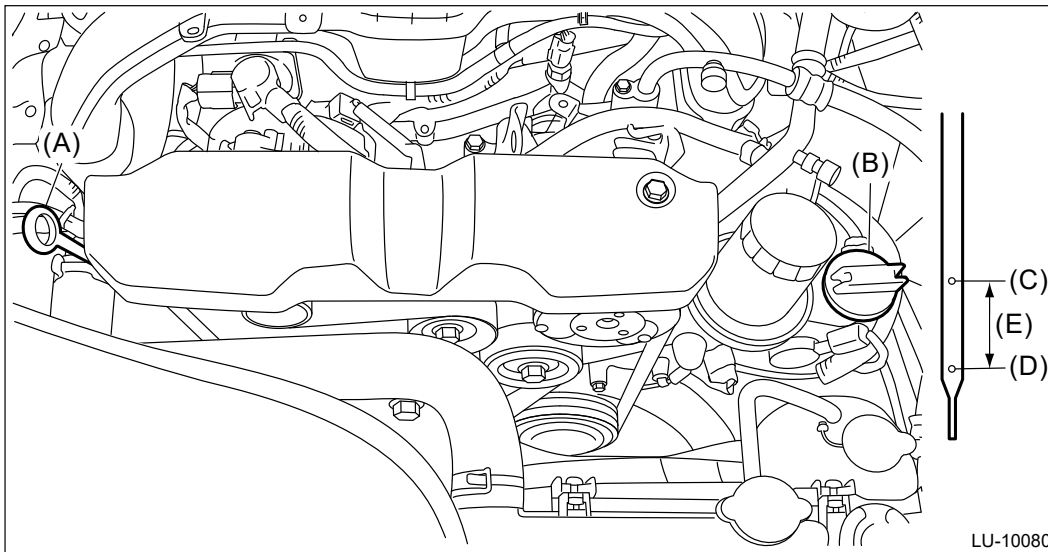
Caution:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1. Park the vehicle on a level surface.
2. Remove the oil level gauge and wipe away the oil.
3. Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted and properly orientated.
4. Pull out the oil level gauge again, and check both sides of the oil level gauge. Use a lower side to determine the engine oil level. If the engine oil level is below "L" line, check for oil leakage from engine and add oil to bring the level up to "F" line.
5. Start the engine to circulate the oil in engine.
6. After turning off the engine, wait a few minutes for the oil to return to the oil pan before checking the level.

Note:

- To prevent overfilling of engine oil, do not add oil above "F" line when the engine is cold.
 - As the oil level gauge is used for daily maintenance, "F" line and "L" line is set assuming that the engine is cold.
- Non-turbo model



(A) Oil level gauge

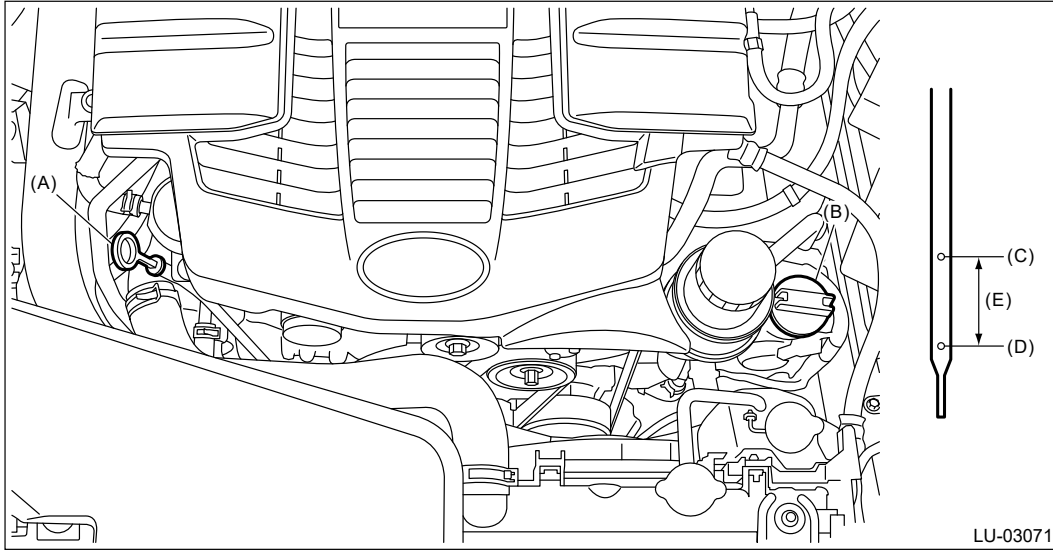
(B) Oil filler cap

(C) "F" line

(D) "L" line

(E) Approx. 1.0 L (1.1 US qt, 0.9
Imp qt)

- Turbo model



LU-03071

(A) Oil level gauge

(B) Oil filler cap

(C) "F" line

(D) "L" line

(E) Approx. 1.0 L (1.1 US qt, 0.9
Imp qt)

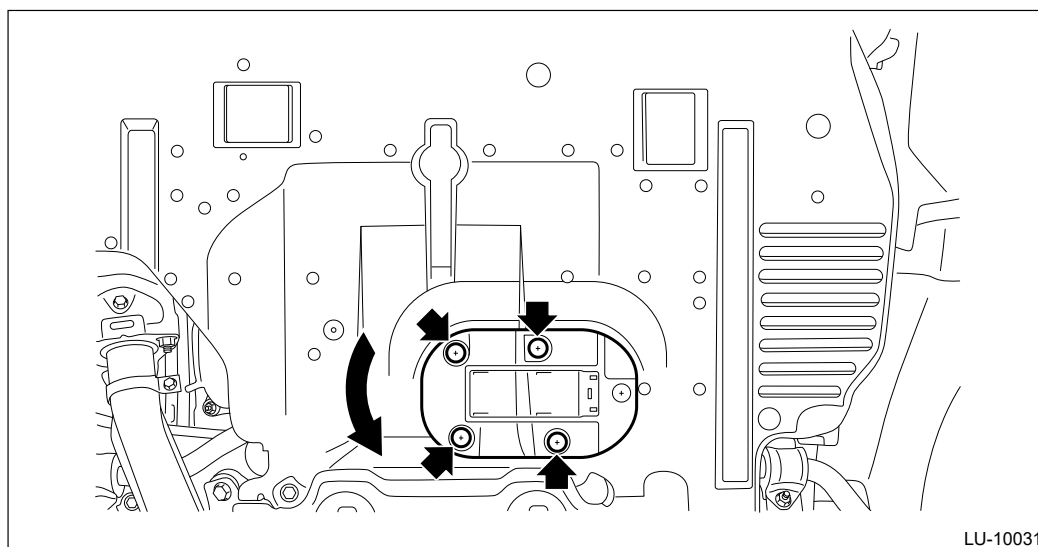
LUBRICATION(H4DO) > Engine Oil

REPLACEMENT

Caution:

If the engine oil is spilled over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1. Open the oil filler cap for quick draining of engine oil.
2. Lift up the vehicle.
3. Out of all the clips that secure the engine oil drain cover, remove the four clips shown in the figure, and turn the engine oil drain cover 180° counterclockwise. (Non-turbo model)

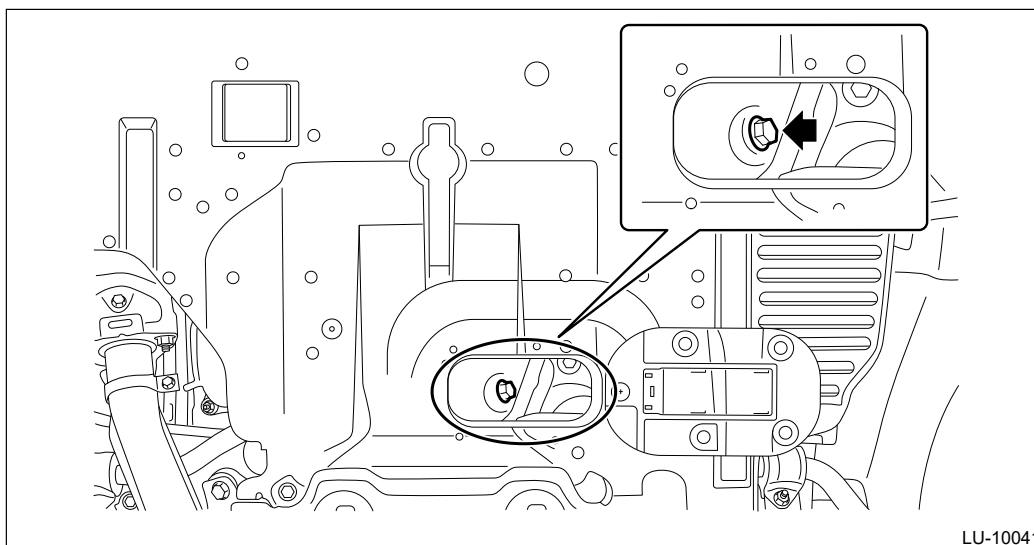


4. Drain engine oil by loosening the drain plug.

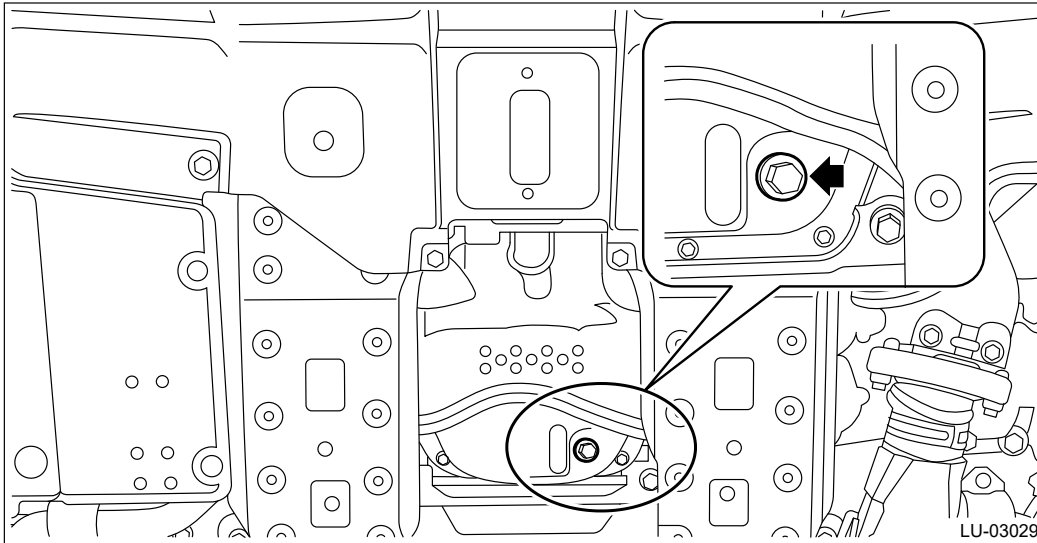
Note:

Prepare the container for draining of engine oil.

- Non-turbo model



- Turbo model



5. After draining the engine oil, tighten the engine oil drain plug.

Note:


Use a new drain plug gasket.

Tightening torque:

41.7 N·m (4.3 kgf-m, 30.8 ft-lb)

6. Return the engine oil drain cover to the original position, and install the clips. (Non-turbo model)
7. Lower the vehicle.
8. Select engine oil of adequate quality and viscosity and fill it through the chain cover to the "F" line on the oil level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

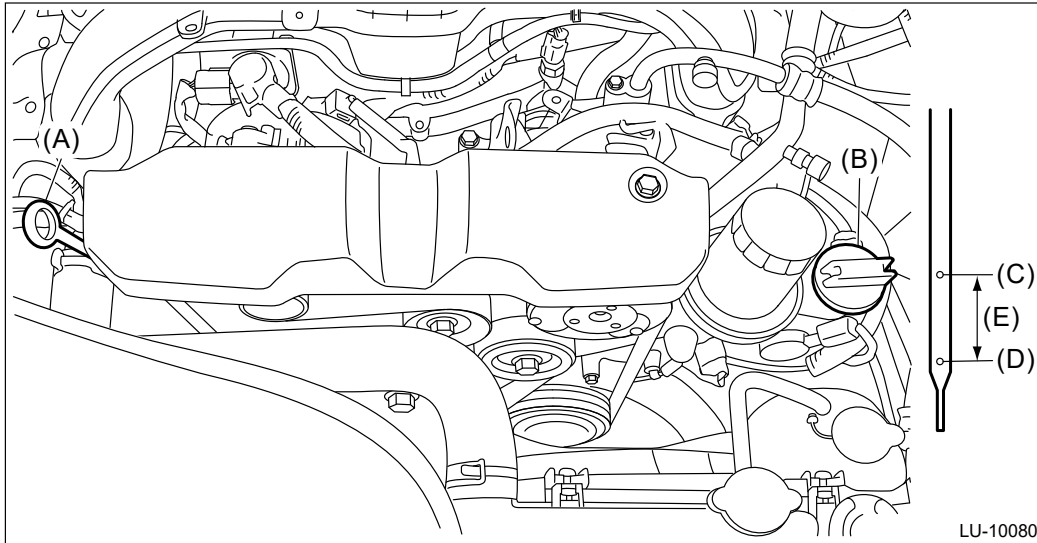
Recommended oil:

Refer to "SPECIFICATION" for recommended oil.  [Ref. to LUBRICATION\(H4DO\)>General Description>SPECIFICATION.](#)

Engine oil capacity:

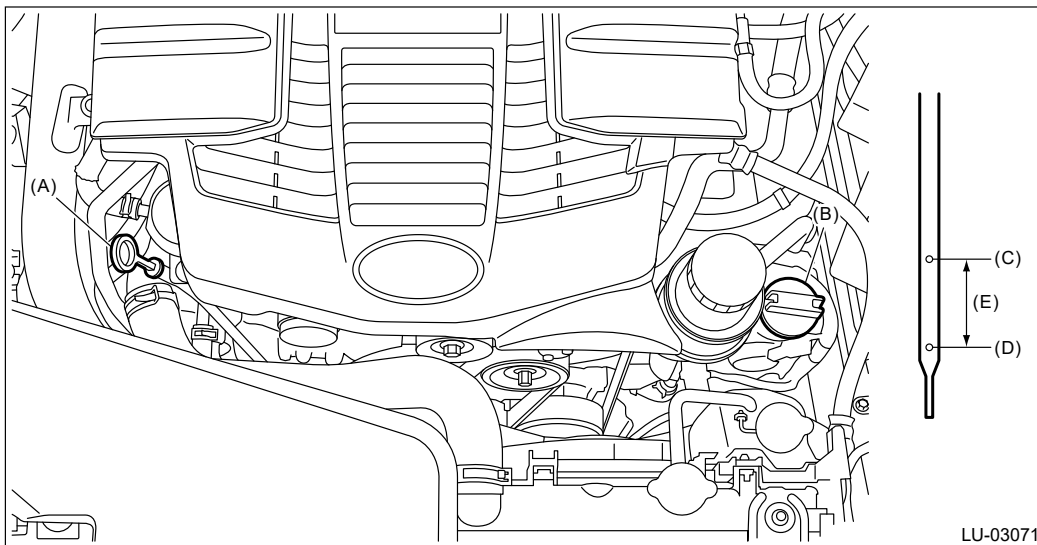
Refer to "SPECIFICATION" for engine oil capacity.  [Ref. to LUBRICATION\(H4DO\)>General Description>SPECIFICATION.](#)

9. Close the oil filler cap.
10. Start the engine to circulate the oil in engine.
11. Stop the engine and pull out the oil level gauge again, and check both sides of the oil level gauge. Use a lower side to check the engine oil level. If necessary, add engine oil up to the "F" line on oil level gauge.
 - Non-turbo model



- (A) Oil level gauge
- (B) Oil filler cap
- (C) "F" line
- (D) "L" line
- (E) Approx. 1.0 L (1.1 US qt, 0.9 Imp qt)

• Turbo model



- (A) Oil level gauge
- (B) Oil filler cap
- (C) "F" line
- (D) "L" line
- (E) Approx. 1.0 L (1.1 US qt, 0.9 Imp qt)

LUBRICATION(H4DO) > General Description

CAUTION

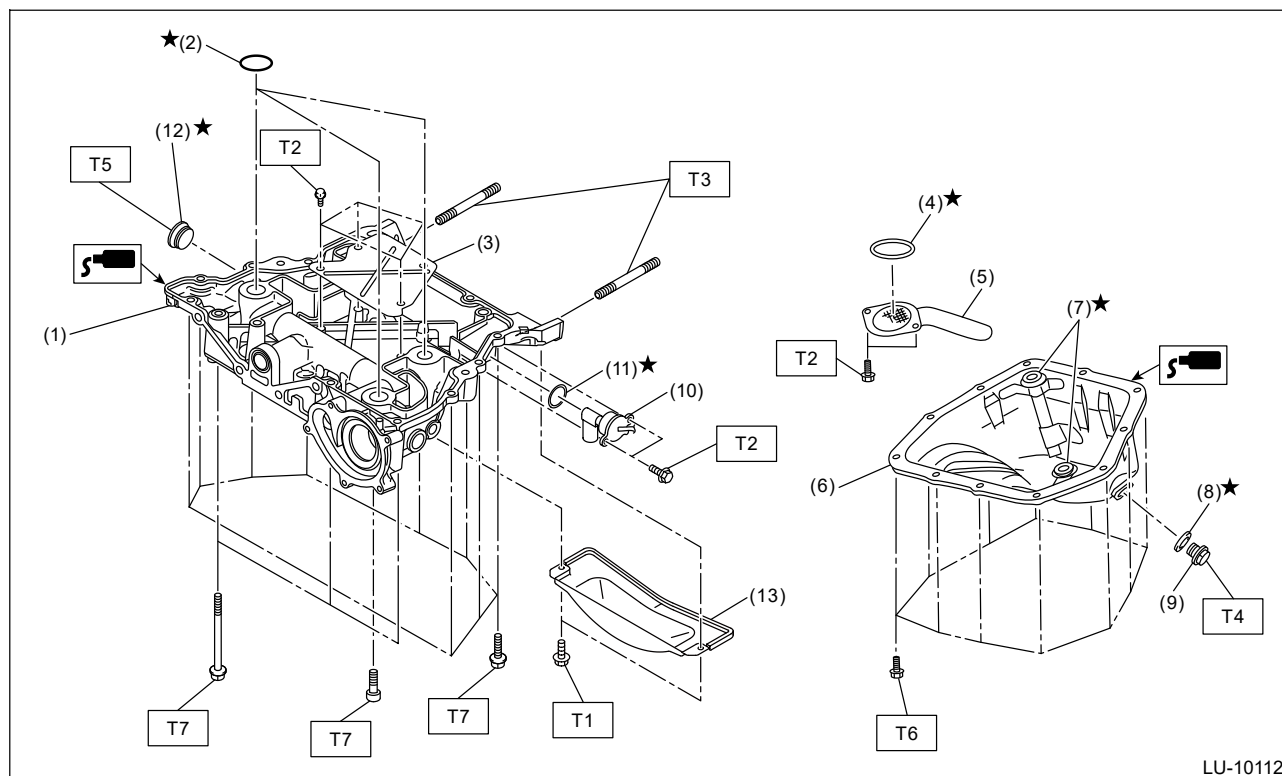
- Prior to starting work, pay special attention to the following:
 1. Always wear work clothes, a work cap, and protective shoes. Additionally, wear a helmet, protective goggles, etc. if necessary.
 2. Protect the vehicle using a seat cover, fender cover, etc.
 3. Prepare the service tools, clean cloth, containers to catch grease and oil, etc.
- Prepare a container and cloth when performing work which oil possibly spills. If oil spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Vehicle components are extremely hot immediately after driving. Be wary of receiving burns from heated parts.
- When performing a repair, identify the cause of trouble and avoid unnecessary removal, disassembly and replacement.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- Always use the jack-up point when the shop jacks or rigid racks are used to support the vehicle.
- Remove contamination including dirt and corrosion before removal, installation, disassembly or assembly.
- Keep the removed parts in order and protect them from dust and dirt.
- All removed parts, if to be reused, should be reinstalled in the original positions with attention to the correct directions, etc.
- Bolts, nuts and washers should be replaced with new parts as required.
- Be sure to tighten the fasteners including bolts and nuts to the specified torque.
- If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.
- Follow all government and local regulations concerning disposal of refuse when disposing of oil.

LUBRICATION(H4DO) > General Description

COMPONENT

1. OIL PAN

- Non-turbo model



(1) Oil pan upper

(9) Drain plug

Tightening torque: N·m (kgf-m, ft-lb)

(2) O-ring

(10) Oil level switch

T1: 5 (0.5, 3.7)

(3) Baffle plate

(11) O-ring

T2: 6.4 (0.7, 4.7)

(4) O-ring

(12) PLUG

T3: 10 (1.0, 7.4)

(5) Oil strainer

(13) Clutch housing cover (MT model)

T4: 41.7 (4.3, 30.8)

(6) Oil pan

T5: 90 (9.2, 66.4)

(7) Oil pan seal ring

T6:  Ref. to

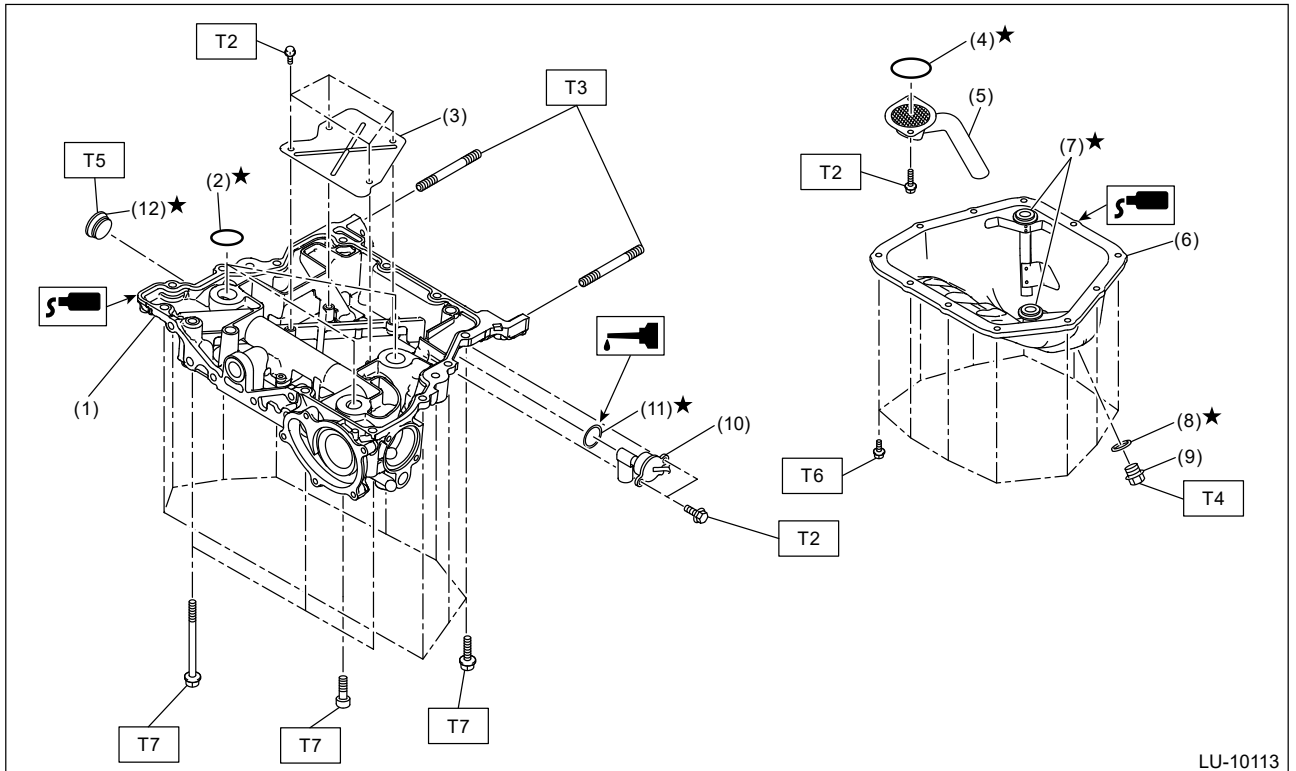
[LUBRICATION\(H4DO\)>Oil Pan>INSTALLATION > OIL PAN.](#)

(8) Drain plug gasket

T7:  Ref. to

[LUBRICATION\(H4DO\)>Oil Pan>INSTALLATION > OIL PAN UPPER.](#)

- Turbo model



LU-10113

- | | |
|-------------------|-----------------------|
| (1) Oil pan upper | (7) Oil pan seal ring |
| (2) O-ring | (8) Drain plug gasket |
| (3) Baffle plate | (9) Drain plug |
| (4) O-ring | (10) Oil level switch |
| (5) Oil strainer | (11) O-ring |
| (6) Oil pan | (12) PLUG |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 6.4 (0.7, 4.7)

T2: 10 (1.0, 7.4)

T3: 41.7 (4.3, 30.8)

T4: 90 (9.2, 66.4)

T5:  **Ref. to**

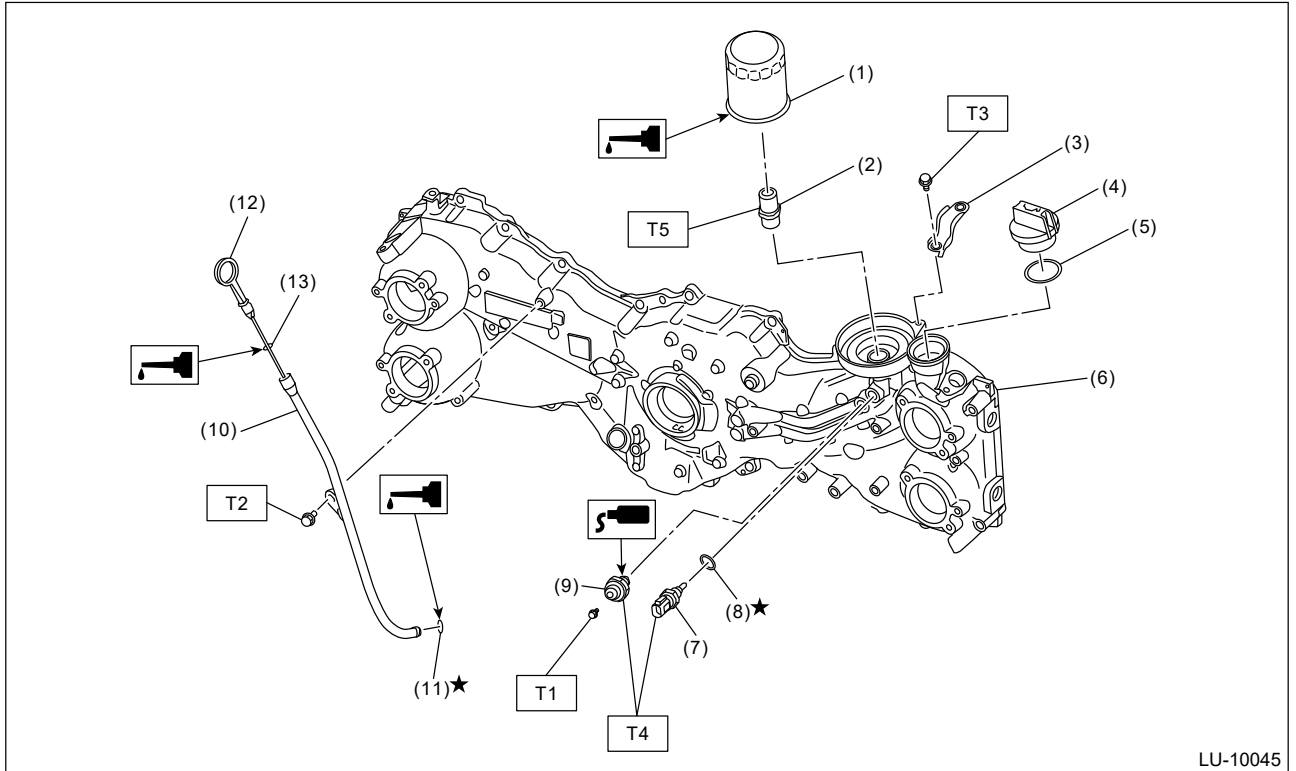
[LUBRICATION\(H4DO\)>Oil Pan>INSTALLATION > OIL PAN.](#)

T6:  **Ref. to**

[LUBRICATION\(H4DO\)>Oil Pan>INSTALLATION > OIL PAN UPPER.](#)

2. OIL FILTER AND OIL LEVEL GAUGE

- Non-turbo model



LU-10045

(1) Engine oil filter

(8) Gasket

Tightening torque: N·m (kgf-m, ft-lb)

(2) Oil pump union

(9) Oil pressure switch

T1: 1.5 (0.2, 1.1)

(3) Generator cord stay

(10) Oil level gauge guide

T2: 6.4 (0.7, 4.7)

(4) Oil filler cap

(11) O-ring

T3: 8.0 (0.8, 5.9)

(5) Gasket

(12) Oil level gauge

T4: 18 (1.8, 13.3)

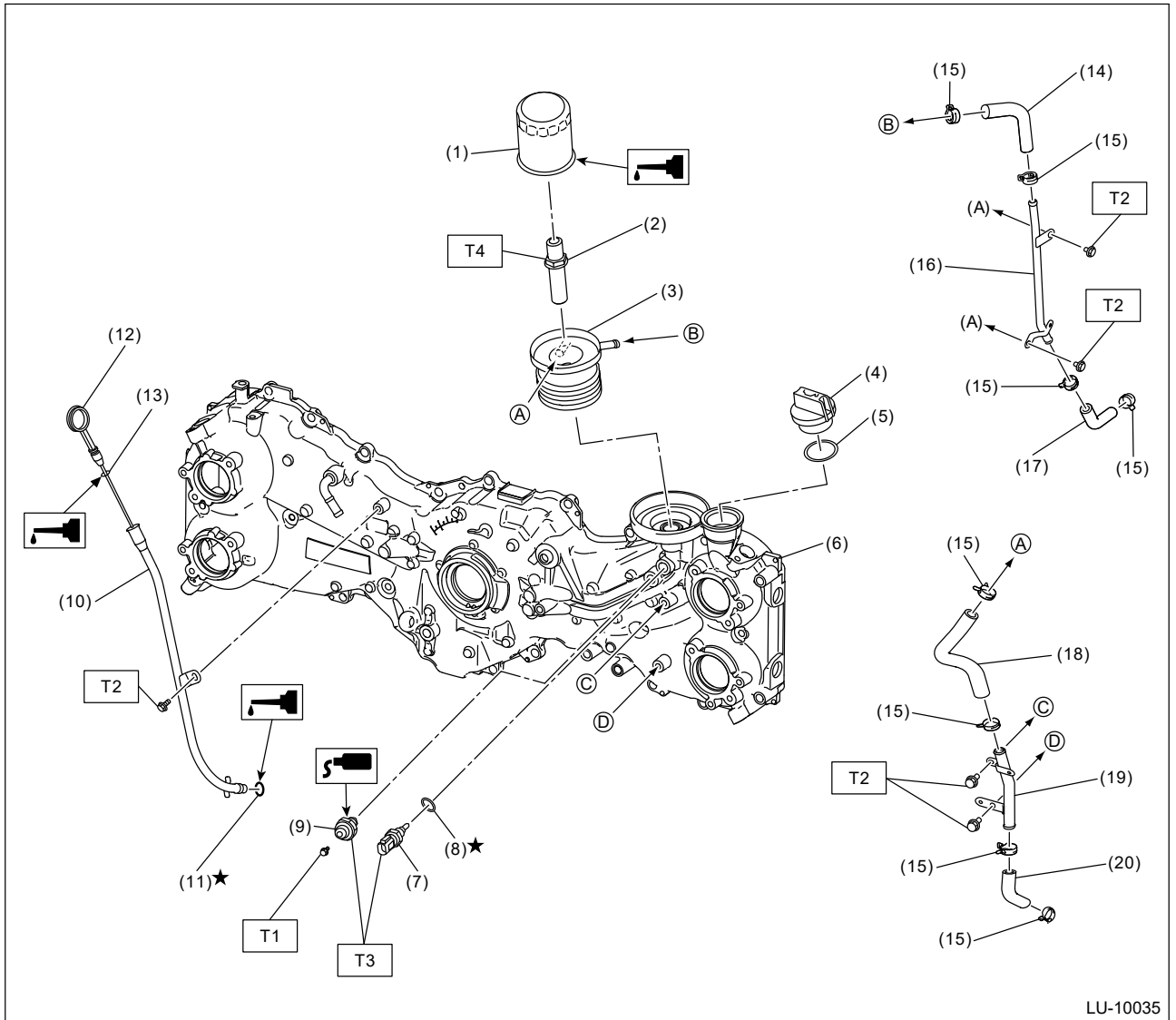
(6) Chain cover

(13) O-ring

T5: 45 (4.6, 33.2)

(7) Engine oil temperature sensor

- Turbo model



(A) To front camshaft cap LH

- | | |
|-----------------------------------|-------------------------------------|
| (1) Engine oil filter | (10) Oil level gauge guide |
| (2) Oil cooler connector | (11) O-ring |
| (3) Engine Oil Cooler | (12) Oil level gauge |
| (4) Oil filler cap | (13) O-ring |
| (5) Gasket | (14) Side engine oil cooler hose A |
| (6) Chain cover | (15) Clip |
| (7) Engine oil temperature sensor | (16) Side engine oil cooler pipe |
| (8) Gasket | (17) Side engine oil cooler hose B |
| (9) Oil pressure switch | (18) Front engine oil cooler hose A |

- | |
|-------------------------------------|
| (19) Front engine oil cooler pipe |
| (20) Front engine oil cooler hose B |

Tightening torque: N·m (kgf-m, ft-lb)

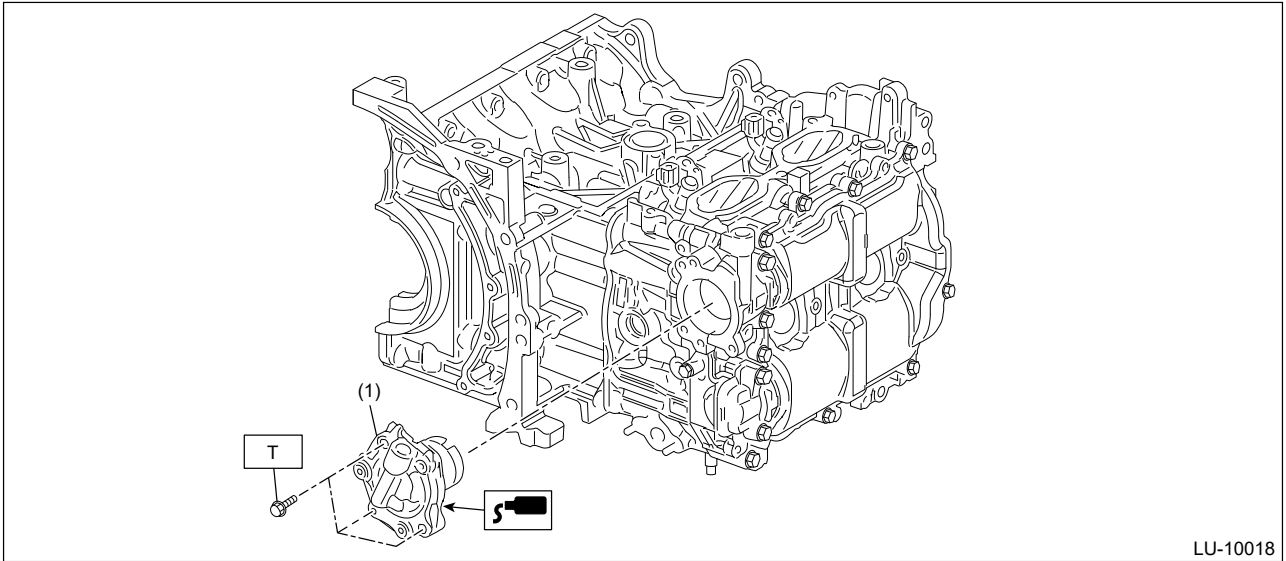
T1: 1.5 (0.2, 1.1)

T2: 6.4 (0.7, 4.7)

T3: 18 (1.8, 13.3)

T4: 45 (4.6, 33.2)

3. SCAVENGE PUMP



LU-10018

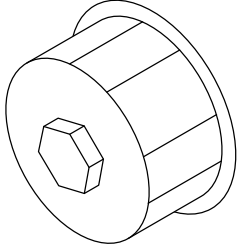
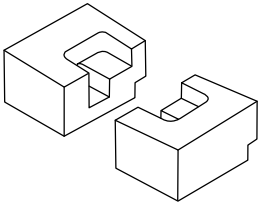

(1) Scavenge pump

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

T: 6.4 (0.7, 4.7)

PREPARATION TOOL

1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|--|---------------------------|-------------------------|---|
|  <p>ST18332AA000</p> | 18332AA000 | OIL FILTER WRENCH | Used for removing and installing the oil filter (black) with outer diameter of 68 mm (2.68 in). |
|  <p>ST18632AA020</p> | 18632AA020 | STAND ASSY | Used for removing and installing oil pan. (Turbo model) |
|  <p>STSSM4</p> | — (Newly adopted tool) | SUBARU SELECT MONITOR 4 | Used for setting of each function and troubleshooting for electrical system. Note: For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help". |

2. GENERAL TOOL

| TOOL NAME | REMARKS |
|--|--|
| Oil filter wrench (65/67 mm 14 Flutes) | Used for removing and installing the oil filter (blue) with outer diameter of 67.4 mm (2.65 in). |
| Circuit tester | Used for measuring resistance, voltage and current. |
| DST-i | Used together with Subaru Select Monitor 4. |
| TORX® bit T45 | Used for removing and installing oil pan upper. |

LUBRICATION(H4DO) > General Description

SPECIFICATION

- Non-turbo model

| | | | | | |
|-----------------------------------|---|-------------------------|--|--------------------------------|-------------------------|
| Lubrication method | | | | Forced lubrication | |
| Oil pump | Pump type | | | Trochoid type | |
| | Number of teeth | Inner rotor | | 11 | |
| | | Outer rotor | | 12 | |
| | Outer rotor diameter × Thickness | | mm (in) | 77 × 12 (3.03 × 0.47) | |
| | Performance (Oil temperature 120°C (248°F)) | 600 r/min | Discharge pressure | kPa (kg/cm ² , psi) | 40 (0.4, 5.8) |
| | | | Discharge rate | L (US qt, Imp qt)/min | 5.8 (6.1, 5.1) or more |
| | | 6,000 r/min | Discharge pressure | kPa (kg/cm ² , psi) | 323 (3.3, 46.8) |
| | | | Discharge rate | L (US qt, Imp qt)/min | 55 (58.1, 48.4) or more |
| | Relief valve working pressure (2-step relief) | 1st opening pressure | | kPa (kg/cm ² , psi) | 150 (1.5, 21.7) |
| | | Main opening pressure | | kPa (kg/cm ² , psi) | 570 (5.8, 82.6) |
| Oil filter | Filter type | | | Full-flow filter type | |
| | Filtration area | cm ² (sq in) | Outer diameter: 68 mm (2.68 in) (black) | 1,100 (171) | |
| | | | Outer diameter: 67.4 mm (2.65 in) (blue) | 867 (134.3) | |
| | By-pass valve opening pressure | | kPa (kg/cm ² , psi) | 160 (1.6, 23.2) | |
| | Outer diameter × Width | mm (in) | Outer diameter: 68 mm (2.68 in) (black) | 68 × 85 (2.68 × 3.35) | |
| | | | Outer diameter: 67.4 mm (2.65 in) (blue) | 67.4 × 87.1 (2.65 × 3.43) | |
| Installation screw specifications | | | M 20 × 1.5 | | |
| Oil pressure switch | Type | | | Immersed contact point type | |
| | Operating voltage | | | 12 V | |
| | Warning light operating pressure | | kPa (kg/cm ² , | 14.7 (0.1, 2.1) | |

| | | | |
|------------|--|-----------------------------------|-----------------|
| | | psi) | |
| | Proof pressure | kPa (kg/cm ² , psi) | 981 (10, 142.2) |
| Engine oil | Total capacity (at overhaul) | L (US qt, Imp qt) | 5.7 (6.0, 5.0) |
| | When replacing engine oil and oil filter | L (US qt, Imp qt) | 4.8 (5.1, 4.2) |
| | When replacing engine oil only | L (US qt, Imp qt) | 4.6 (4.9, 4.0) |

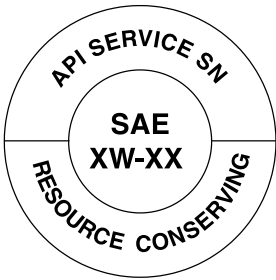

Specified oil:

Caution:

- Use 0W-20 (synthetic oil).
- It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use the following engine oil specified by Subaru.

Note:

The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.

| Engine oil standard | | SAE viscosity No. |
|--|----|---|
|  <p>RM-00081</p> <p>Those with SN "Resource Conserving" logo in case of API standard.</p> | or |  <p>RM-00002</p> <p>Those with GF-5 "starburst mark" displayed on top of the container in case of ILSAC standard.</p> |
| | | 0W-20 (synthetic oil) |

- Turbo model

| | | | | |
|--------------------|---|-------------|--------------------------|-----------------------------------|
| Lubrication method | | | | Forced lubrication |
| Oil pump | Pump type | | | Trochoid type |
| | Number of teeth | Inner rotor | | 11 |
| | | Outer rotor | | 12 |
| | Outer rotor diameter × Thickness | | mm (in) | 77 × 14 (3.03 × 0.55) |
| | Performance (Oil temperature 120°C (248°F)) | 600 r/min | Discharge pressure | kPa (kg/cm ² , psi) |
| Discharge | | | L (US qt, Imp qt)/min | 7.4 (7.8, 6.5) or more |

| | | | | | |
|---------------------|--|-------------------------|--|--------------------------------|-----------------------------|
| | | | rate | | |
| | | 6.700 r/min | Discharge pressure | kPa (kg/cm ² , psi) | 321 (3.3, 46.6) |
| | | | Discharge rate | L (US qt, Imp qt)/min | 60.2 (63.6, 53.0) or more |
| | Relief valve working pressure | | | kPa (kg/cm ² , psi) | 700 (7.1, 102) |
| Oil filter | Filter type | | | | Full-flow filter type |
| | Filtration area | cm ² (sq in) | Outer diameter: 68 mm (2.68 in) (black) | | 1,100 (171) |
| | | | Outer diameter: 67.4 mm (2.65 in) (blue) | | 867 (134.3) |
| | By-pass valve opening pressure | | | kPa (kg/cm ² , psi) | 160 (1.6, 23.2) |
| | Outer diameter × Width | mm (in) | Outer diameter: 68 mm (2.68 in) (black) | | 68 × 85 (2.68 × 3.35) |
| | | | Outer diameter: 67.4 mm (2.65 in) (blue) | | 67.4 × 87.1 (2.65 × 3.43) |
| | Installation screw specifications | | | | M 20 × 1.5 |
| Oil pressure switch | Type | | | | Immersed contact point type |
| | Operating voltage | | | | 12 V |
| | Warning light operating pressure | | | kPa (kg/cm ² , psi) | 14.7 (0.1, 2.1) |
| | Proof pressure | | | kPa (kg/cm ² , psi) | 981 (10, 142.2) |
| Engine oil | Total capacity (at overhaul) | | | L (US qt, Imp qt) | 6.0 (6.3, 5.3) |
| | When replacing engine oil and oil filter | | | L (US qt, Imp qt) | 5.1 (5.4, 4.5) |
| | When replacing engine oil only | | | L (US qt, Imp qt) | 4.9 (5.2, 4.3) |

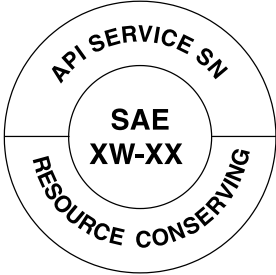

Specified oil:

Caution:

- Use 5W-30 (synthetic oil).
- It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use the following engine oil specified by Subaru.
- Do not use 0W-20 for turbo model. If used for turbo model, it may lead to trouble.


Note:

The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.

| Engine oil standard | | SAE viscosity No. | |
|--|----|--|-----------------------|
|  <p>RM-00081</p> <p>Those with SN "Resource Conserving" logo in case of API standard.</p> | or |  <p>RM-00002</p> <p>Those with GF-5 "starburst mark" displayed on top of the container in case of ILSAC standard.</p> | 5W-30 (synthetic oil) |


LUBRICATION(H4DO) > Oil Catch Tank

INSPECTION

Refer to "Oil Catch Tank" for inspection procedure of the oil catch tank.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Oil Catch Tank>INSPECTION.](#)


LUBRICATION(H4DO) > Oil Catch Tank

INSTALLATION

Refer to "Oil Catch Tank" for installation procedure of the oil catch tank.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Oil Catch Tank>INSTALLATION.](#)


LUBRICATION(H4DO) > Oil Catch Tank

REMOVAL

Refer to "Oil Catch Tank" for removal procedure of the oil catch tank.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Oil Catch Tank>REMOVAL.](#)

INSPECTION

1. INSPECTION WHILE LOW ENGINE OIL WARNING LIGHT IS ON (NON-TURBO MODEL)


1. CHECK ENGINE OIL LEVEL. 

Is engine oil level normal?

[Go to 2.](#)

Replace engine oil or refill, and check again while the oil level is normal condition. [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#) To turn off the low engine oil warning light, install the spare fuse at the delivery mode fuse in the main fuse box. Then turn the ignition switch to ON (engine OFF) again to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish.


Note:
The engine oil level switch is normal if the low engine oil level warning light turns off with the delivery mode fuse inserted.

2. CHECK LAN SYSTEM. 

Has a DTC of the LAN system been input?

Perform the diagnosis according to DTC.

[Go to 3.](#)

3. CHECK OIL LEVEL SWITCH CIRCUIT. 

1. Turn the ignition switch to ON (engine OFF).
2. Read the current data for engine in the Subaru Select Monitor to confirm the item for "Oil level switch". [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Is the "Oil level switch" signal displayed in Subaru Select Monitor HIGH?

To turn off the low engine oil warning light, install the spare fuse at the

Yes

delivery mode fuse in the main fuse box. Then turn the ignition switch to ON (engine OFF) again to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish.


Note:

The engine oil level switch is normal if the low engine oil level warning light turns off with the delivery mode fuse inserted.

No

 [Go to 4.](#)

4. CHECK COMBINATION METER.


Perform the self-diagnosis of combination meter to check if there are any faults in the combination meter.  [Ref. to INSTRUMENTATION/DRIVER INFO>Combination Meter System>OPERATION.](#)

Is combination meter OK?

Yes

 [Go to 5.](#)

No

Replace the combination meter.  [Ref. to INSTRUMENTATION/DRIVER INFO>Combination Meter>REMOVAL.](#)

5. CHECK SECURE CONNECTION OF CONNECTOR BETWEEN ENGINE HARNESS AND OIL LEVEL SWITCH.

Is there any insecure connection?

Yes

Remedy the connection condition. Then, to turn off the low engine oil warning light, install the spare fuse at the delivery mode fuse in the main fuse box. Then turn the ignition switch to ON (engine OFF) again to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish.


Note:

The engine oil level switch is normal if the low engine oil level warning light turns off with the delivery mode fuse inserted.

No

 [Go to 6.](#)

6. CHECK OIL LEVEL SWITCH.


1. Deliberately short circuits by connecting the engine harness connector terminal and chassis ground.
2. Turn the ignition switch to ON (engine OFF).
3. Read the current data for engine in the Subaru Select Monitor to confirm the item for "Oil level switch".  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Connector & terminal

(E130) No. 1 — Chassis ground:

Is the "Oil level switch" signal displayed in Subaru Select Monitor HIGH?

Yes

Replace the oil level switch.  [Ref. to LUBRICATION\(H4DO\)>Oil Level Switch>REMOVAL.](#)

No

 [Go to 7.](#)

7. CHECK SECURE CONNECTION OF CONNECTOR BETWEEN BULKHEAD HARNESS AND ENGINE HARNESS.

Is there any insecure connection?

Yes

Remedy the connection condition. Then, to turn off the low engine oil warning light, install the spare fuse at the delivery mode fuse in the main fuse box. Then turn the ignition switch to ON (engine OFF) again to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish.

Note:

The engine oil level switch is normal if the low engine oil level warning light turns off with the delivery mode fuse inserted.

No

 [Go to 8.](#)

8. CHECK ENGINE HARNESS.


1. Disconnect the connector on the oil level switch side for the engine harness.
2. Disconnect the connector on the bulkhead harness side for the engine harness.
3. Measure the resistance between connector terminals.

Connector & terminal

(E2) No. 1 — (E130) No. 1:

Is the resistance less than 1 Ω ?

Yes

 [Go to 9.](#)

No

Repair or replace the open circuit of engine harness.

9. CHECK SECURE CONNECTION OF CONNECTOR BETWEEN ENGINE CONTROL MODULE (ECM) AND BULKHEAD HARNESS.

Remove the glove box lid assembly.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>REMOVAL.](#)

Is there any insecure connection?

Yes

Remedy the connection condition. Then, to turn off the low engine oil warning light, install the spare fuse at the delivery mode fuse in the main fuse box. Then turn the ignition switch to ON (engine OFF) again to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish.


Note:

The engine oil level switch is normal if the low engine oil level warning light turns off with the delivery mode fuse inserted.

No

 [Go to 10.](#)

10. CHECK BULKHEAD HARNESS.


1. Remove the glove box lid assembly.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>REMOVAL.](#)
2. Disconnect the engine control module (ECM) side connector for the bulkhead harness.
3. Disconnect the engine harness connectors from the bulkhead harness.
4. Measure the resistance between connector terminals.

Connector & terminal

(B136) No. 24 — (B21) No. 1:

Is the resistance less than 1 Ω?

Yes

Replace the engine control module (ECM).  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Control Module \(ECM\)>REMOVAL.](#)

No

Repair or replace the open circuit of the bulkhead harness.

2. INSPECTION WHILE LOW ENGINE OIL WARNING LIGHT IS ON (TURBO MODEL)


1. CHECK ENGINE OIL LEVEL.

Is engine oil level normal?

Yes

 [Go to 2.](#)

No

Replace engine oil or refill, and check again while the oil level is normal condition.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
To turn off the low engine oil warning light, install the spare fuse at the delivery mode fuse in the main fuse box. Then turn the ignition switch to ON (engine OFF) again to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish.

Note:

The engine oil level switch is normal if the low engine oil level warning light turns off with the delivery mode fuse inserted.

2. CHECK LAN SYSTEM.

Has a DTC of the LAN system been input?


Yes

Perform the diagnosis according to DTC.

No

 [Go to 3.](#)

3. CHECK OIL LEVEL SWITCH CIRCUIT.

1. Turn the ignition switch to ON (engine OFF).
2. Read the current data for engine in the Subaru Select Monitor to confirm the item for "Oil level switch".  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Is the "Oil level switch" signal displayed in Subaru Select Monitor HIGH?

Yes

To turn off the low engine oil warning light, install the spare fuse at the delivery mode fuse in the main fuse box. Then turn the ignition switch to ON (engine OFF) again to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish.


Note:

The engine oil level switch is normal if the low engine oil level warning light turns off with the delivery mode fuse inserted.

No

 [Go to 4.](#)

4. CHECK COMBINATION METER.

Perform the self-diagnosis of combination meter to check if there are any faults in the combination meter.  [Ref. to INSTRUMENTATION/DRIVER INFO>Combination Meter System>OPERATION.](#)

Is combination meter OK?

Yes

 [Go to 5.](#)

No

Replace the combination meter.  [Ref. to INSTRUMENTATION/DRIVER INFO>Combination Meter>REMOVAL.](#)

5. CHECK SECURE CONNECTION OF CONNECTOR BETWEEN ENGINE HARNESS AND OIL LEVEL SWITCH.

Is there any insecure connection?

Yes

Remedy the connection condition. Then, to turn off the low engine oil warning light, install the spare fuse at the delivery mode fuse in the main fuse box. Then turn the ignition switch to ON (engine OFF) again to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish.

Note:


The engine oil level switch is normal if the low engine oil level warning light turns off with the delivery mode fuse inserted.

No

 [Go to 6.](#)

6. CHECK OIL LEVEL SWITCH.

1. Deliberately short circuits by connecting the engine harness connector terminal and chassis ground.
2. Turn the ignition switch to ON (engine OFF).
3. Read the current data for engine in the Subaru Select Monitor to confirm the item for


"Oil level switch".  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Connector & terminal

(E130) No. 1 — Chassis ground:

Is the "Oil level switch" signal displayed in Subaru Select Monitor HIGH?

Yes

Replace the oil level switch.  [Ref. to LUBRICATION\(H4DO\)>Oil Level Switch>REMOVAL.](#)

No

 [Go to 7.](#)

7. CHECK SECURE CONNECTION OF CONNECTOR BETWEEN ENGINE CONTROL MODULE (ECM) AND ENGINE HARNESS.

Is there any insecure connection?

Yes

Remedy the connection condition. Then, to turn off the low engine oil warning light, install the spare fuse at the delivery mode fuse in the main fuse box. Then turn the ignition switch to ON (engine OFF) again to confirm the low engine oil warning light turns off. Remove the spare fuse installed to finish.

Note:

The engine oil level switch is normal if the low engine oil level warning light turns off with the delivery mode fuse inserted.

No

 [Go to 8.](#)

8. CHECK ENGINE HARNESS.


1. Disconnect the engine control module (ECM) side connector.
2. Disconnect the connector between the engine harness and the oil level switch.
3. Measure the resistance between connector terminals.

Connector & terminal

(B158) No. 44 — (E130) No. 1:

Is the resistance less than 1 Ω ?

Yes

Replace the engine control module (ECM).  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Control Module \(ECM\)>REMOVAL.](#)

No

Repair or replace the open circuit of engine harness.



3. OTHER INSPECTIONS

- 1.** Check that the oil level switch does not have deformation, cracks, or damage.
- 2.** Check the oil level switch installation part for oil leakage and oil seepage.

INSTALLATION

1. NON-TURBO MODEL

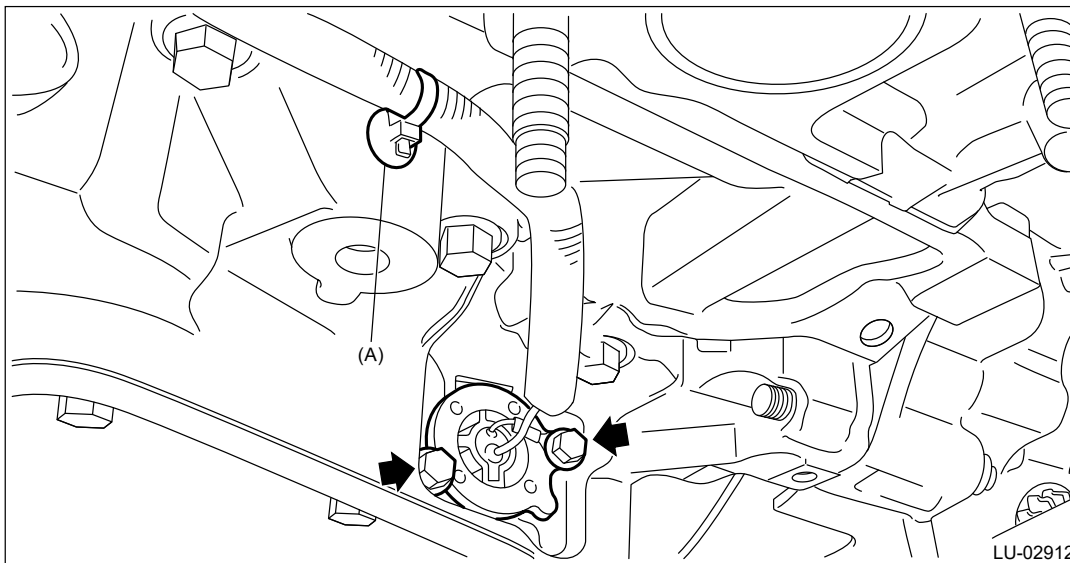
1. Install the oil level switch and the clip (A) to the oil pan upper.

Note:

- Use new O-rings.
- Apply a coat of engine oil to the O-rings.

Tightening torque:

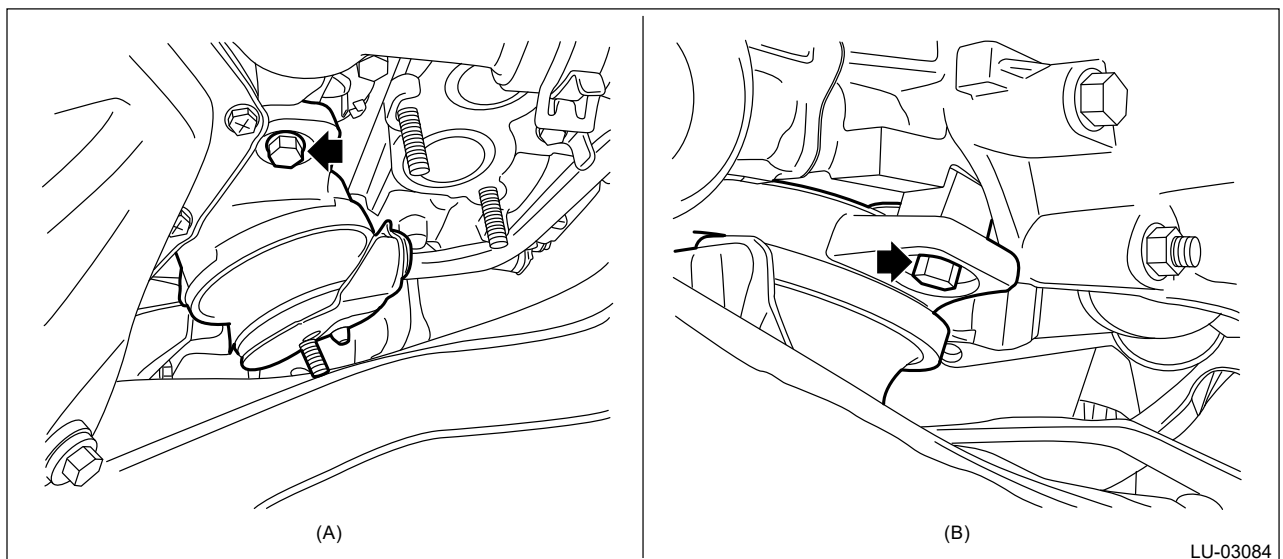
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



2. Install the engine mounting LH onto the engine.

Tightening torque:

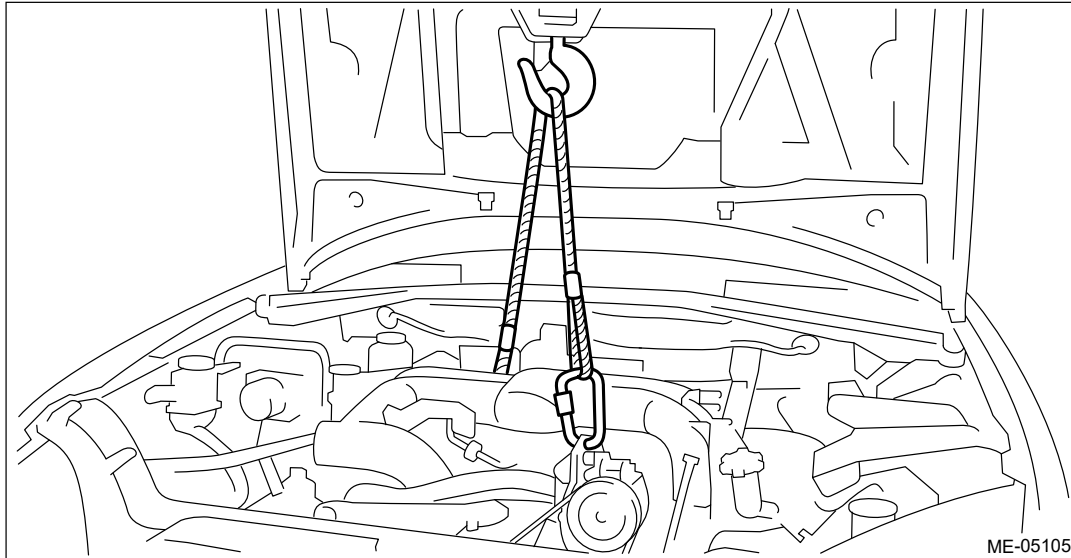
35 N·m (3.6 kgf-m, 25.8 ft-lb)



(A) Front side

(B) Rear side

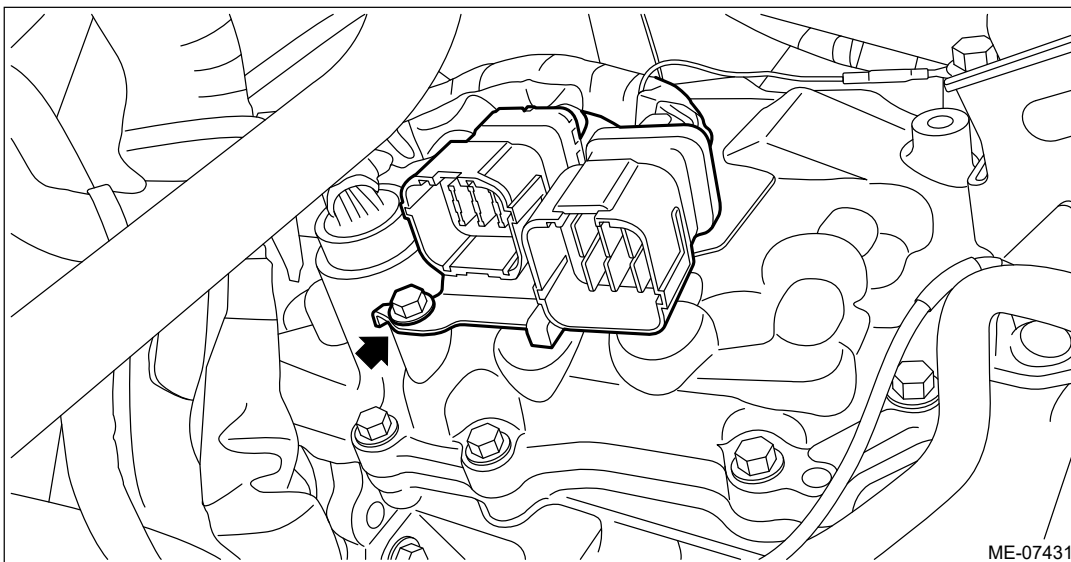
3. Lower the engine and remove the lifting device and wire ropes.



- 4.** Install the transmission harness stay. (CVT model)

Tightening torque:

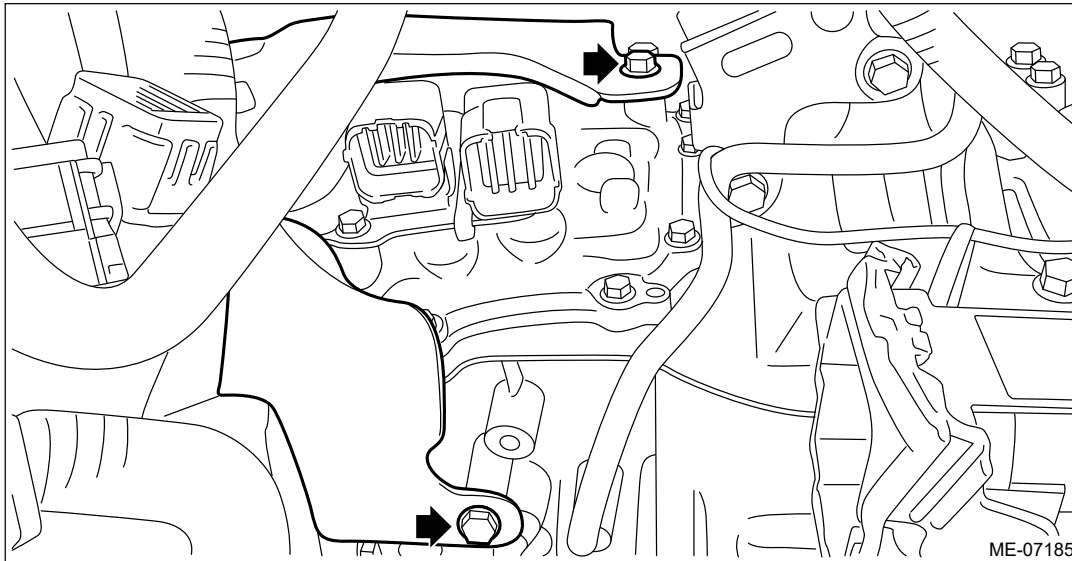
7 N·m (0.7 kgf-m, 5.2 ft-lb)



- 5.** Install the transmission case cover. (CVT model)

Tightening torque:

8 N·m (0.8 kgf-m, 5.9 ft-lb)

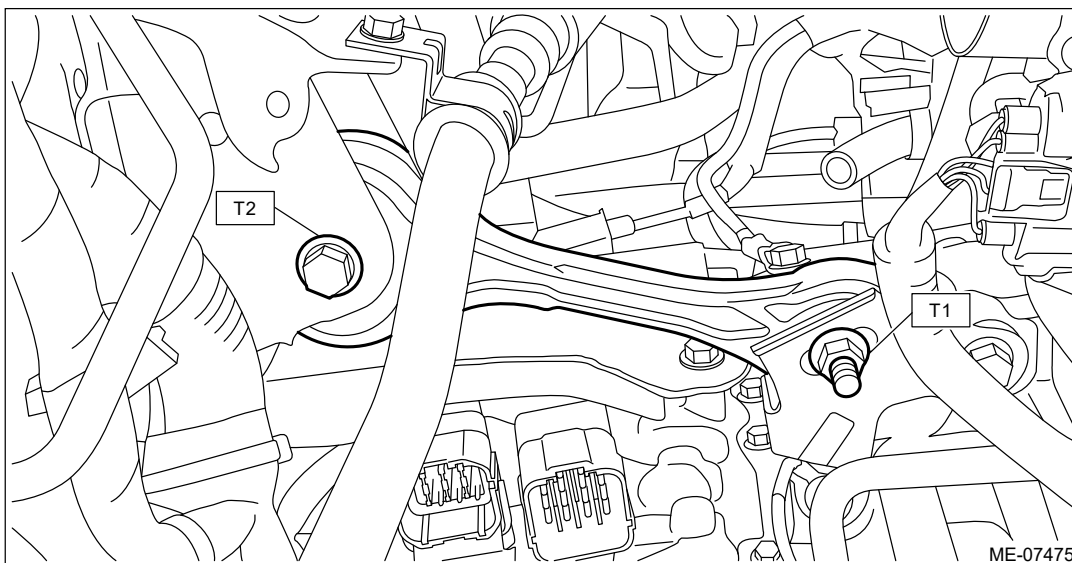


- 6.** Install the pitching stopper.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

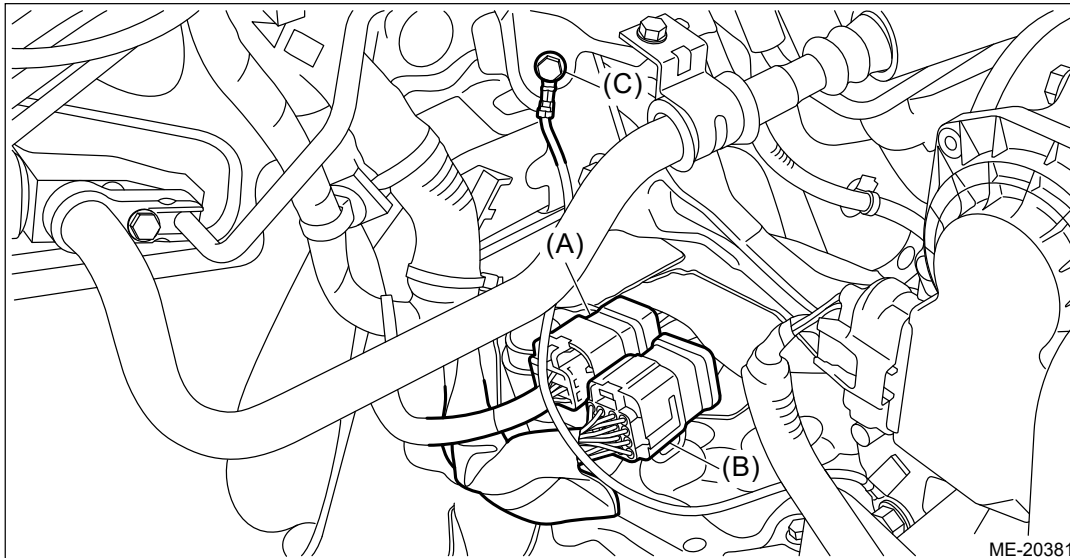
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)





- 7.** Connect the bulkhead harness connector to the transmission harness connector (A) and the inhibitor harness connector (B), and connect the transmission radio ground terminal (C) to the vehicle body. (CVT model)

Tightening torque:

13 N·m (1.3 kgf-m, 9.6 ft-lb)



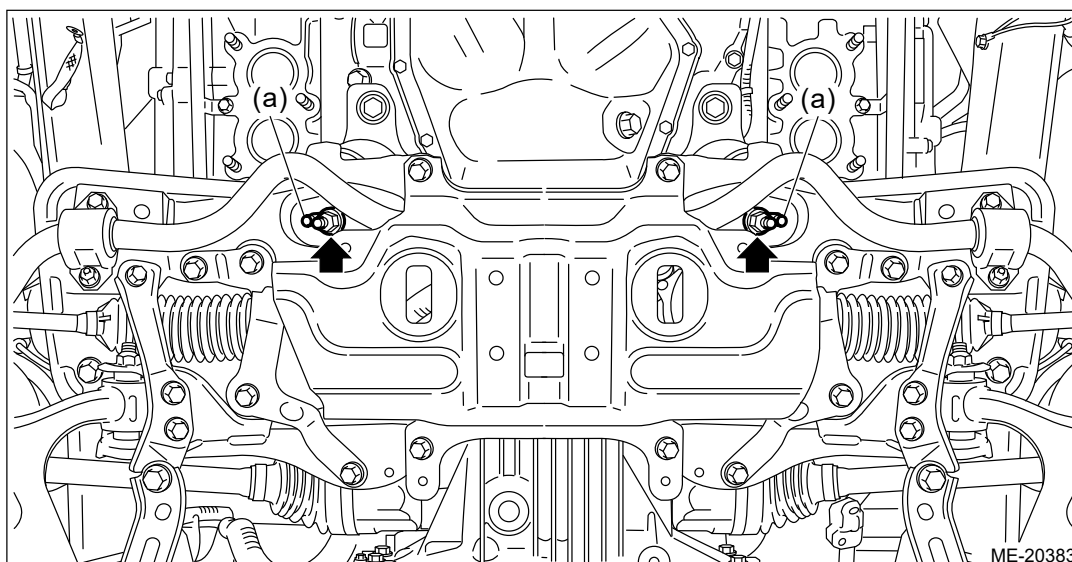
- 8.** Install the electric power steering gearbox.  Ref. to [POWER ASSISTED SYSTEM \(POWER STEERING\)>Electric Power Steering Gearbox>INSTALLATION.](#)
- 9.** Install the front drive shaft LH.  Ref. to [DRIVE SHAFT SYSTEM>Front Drive Shaft>INSTALLATION.](#)
- 10.** Install the nuts which hold the engine mounting to the front crossmember. (Hydraulic engine mounting model)

Note:

- **Make sure that locators (a) of the engine mounting are securely inserted.**
- **Use a new nut.**

Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)



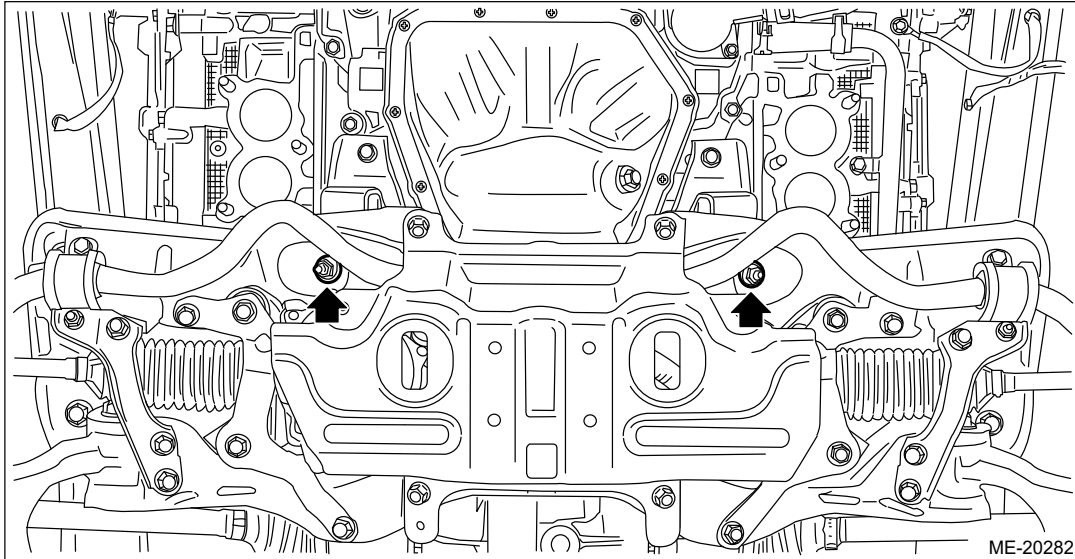
- 11.** Install the nuts which hold the engine mounting to the front crossmember. (Solid engine mounting model)

Note:

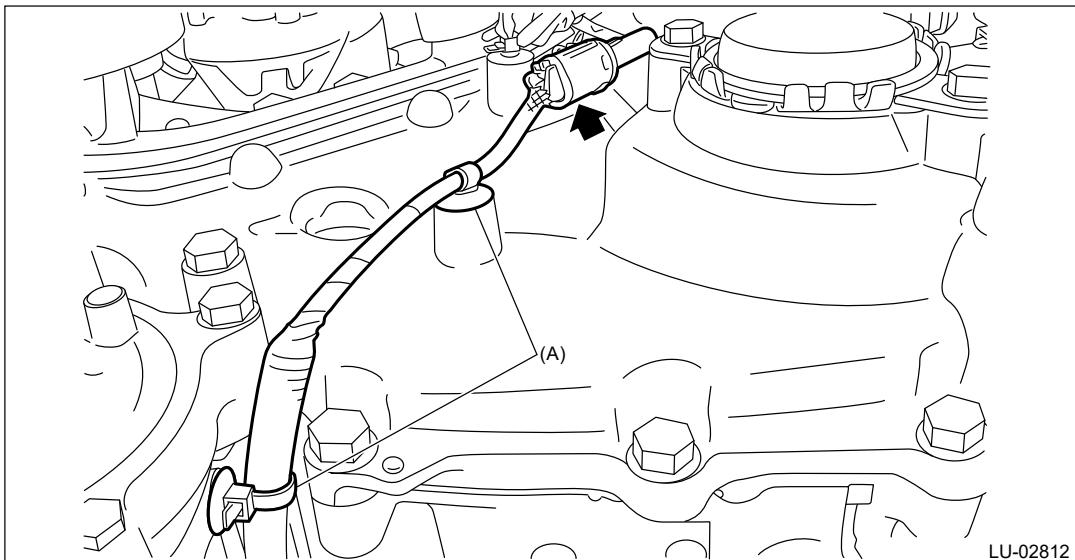
- **Use a new nut.**








Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)



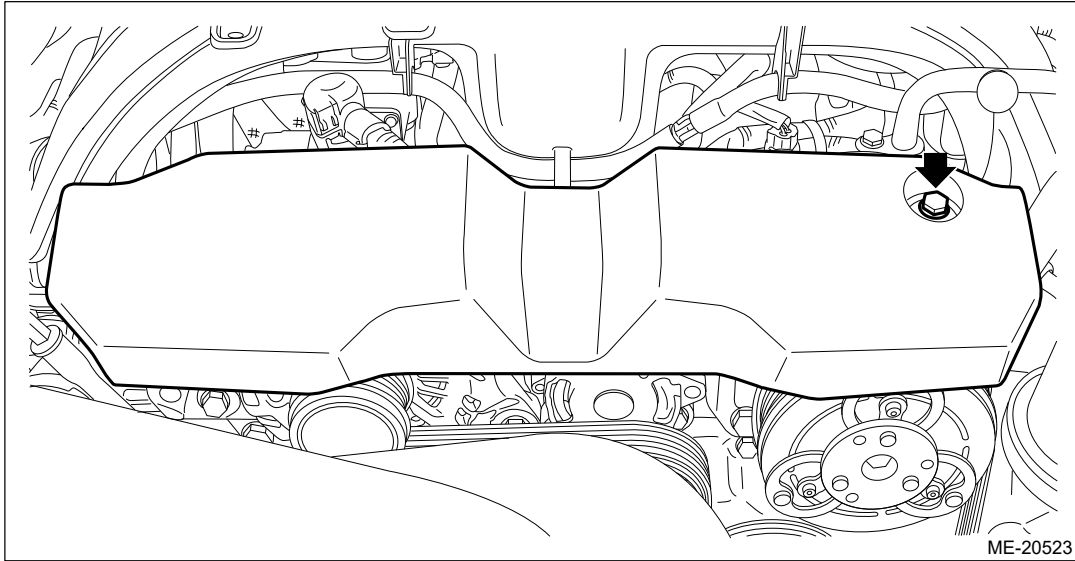
- 12.** Connect the connector of oil level switch to the engine harness, and install the clip (A) securing the harness.



- 13.** Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>INSTALLATION.](#)
- 14.** Install the under cover front - transmission.  [Ref. to EXTERIOR/INTERIOR TRIM>General Description>COMPONENT > FLOOR UNDER PROTECTOR.](#)
- 15.** Install the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>INSTALLATION.](#)
- 16.** Lower the vehicle.
- 17.** Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)
- 18.** Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>INSTALLATION.](#)
- 19.** Refill the engine oil.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 20.** Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 21.** Install the V-belt cover.

Tightening torque:

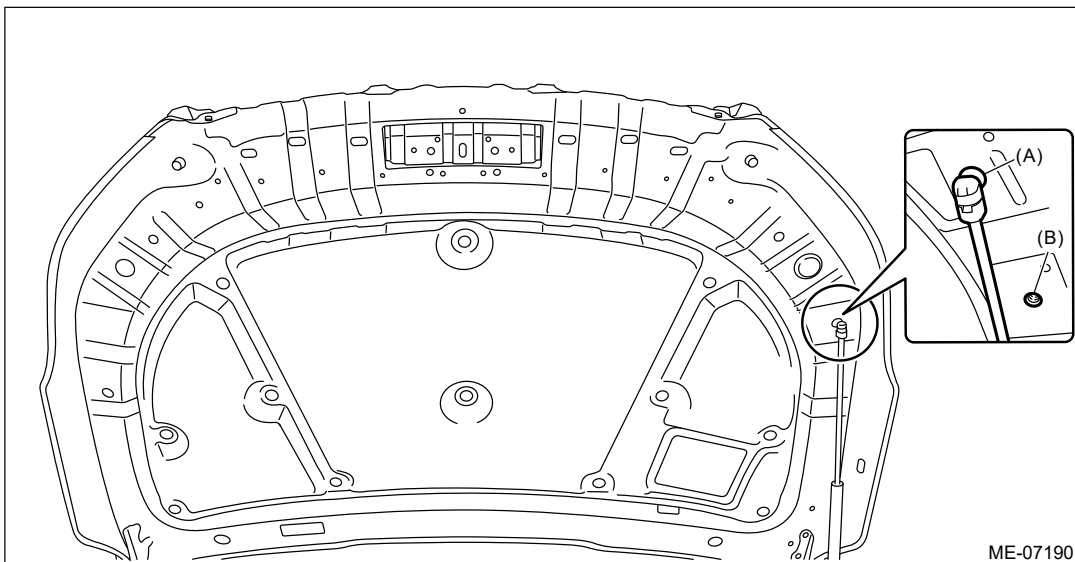
7 N·m (0.7 kgf-m, 5.2 ft-lb)



22. Change the installation position of the front hood damper from (B) to (A).

Tightening torque:

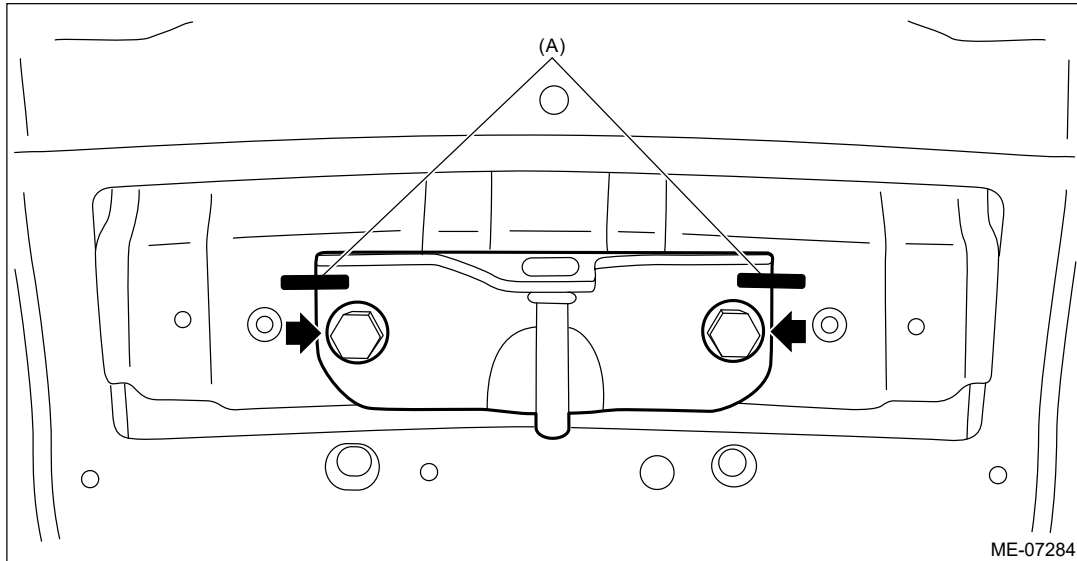
20 N·m (2.0 kgf-m, 14.8 ft-lb)




23. Align the alignment marks (A), and install the front hood striker to the front hood.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)



- 24.** Install the bracket - grille UPR, and the grille assembly - front CTR.  Ref. to [EXTERIOR/INTERIOR TRIM>Front Grille>INSTALLATION.](#)

2. TURBO MODEL

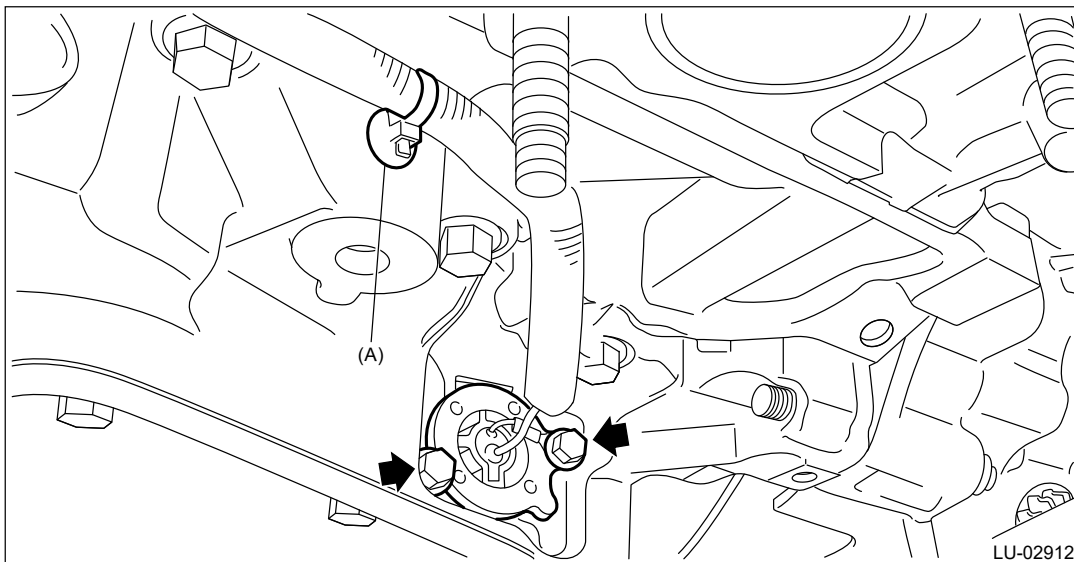
- 1.** Install the oil level switch and the clip (A) to the oil pan upper.

Note:

- Use new O-rings.
- Apply a coat of engine oil to the O-rings.

Tightening torque:

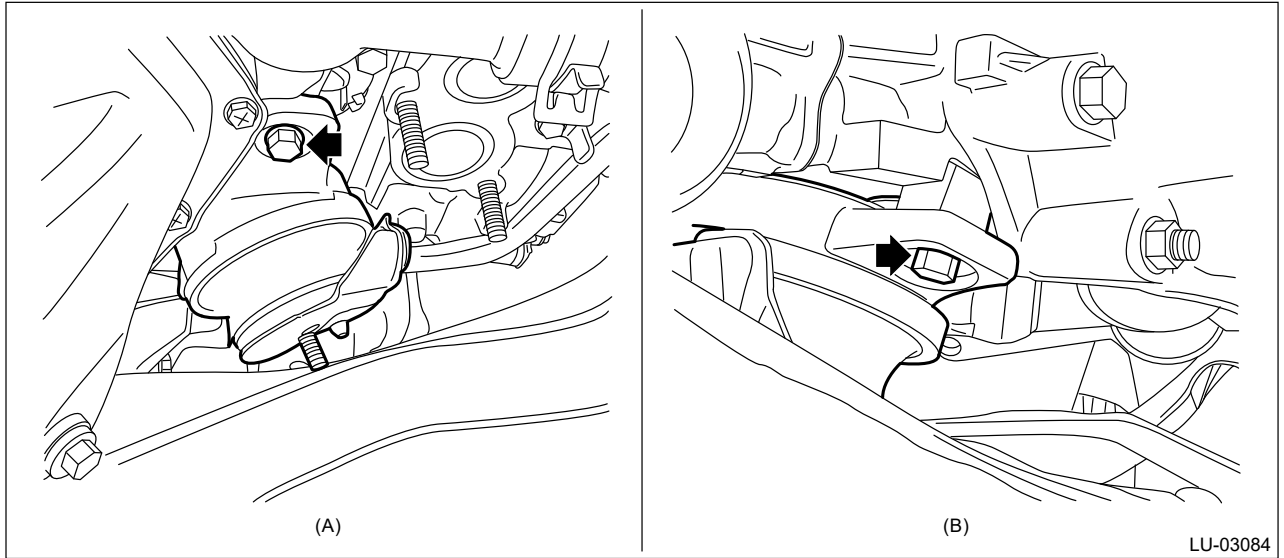
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



- 2.** Install the engine mounting LH onto the engine.

Tightening torque:

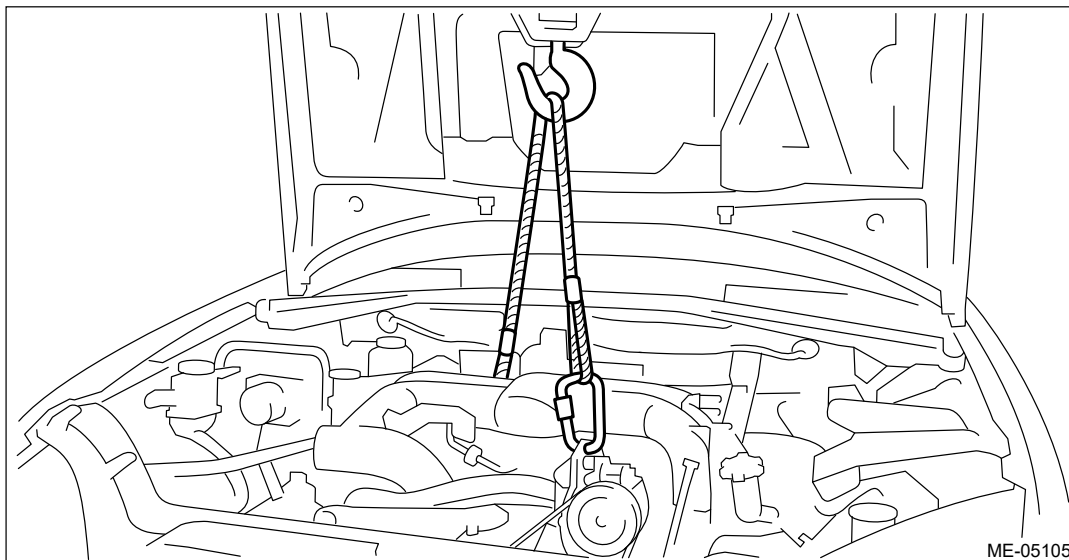
35 N·m (3.6 kgf-m, 25.8 ft-lb)



(A) Front side

(B) Rear side

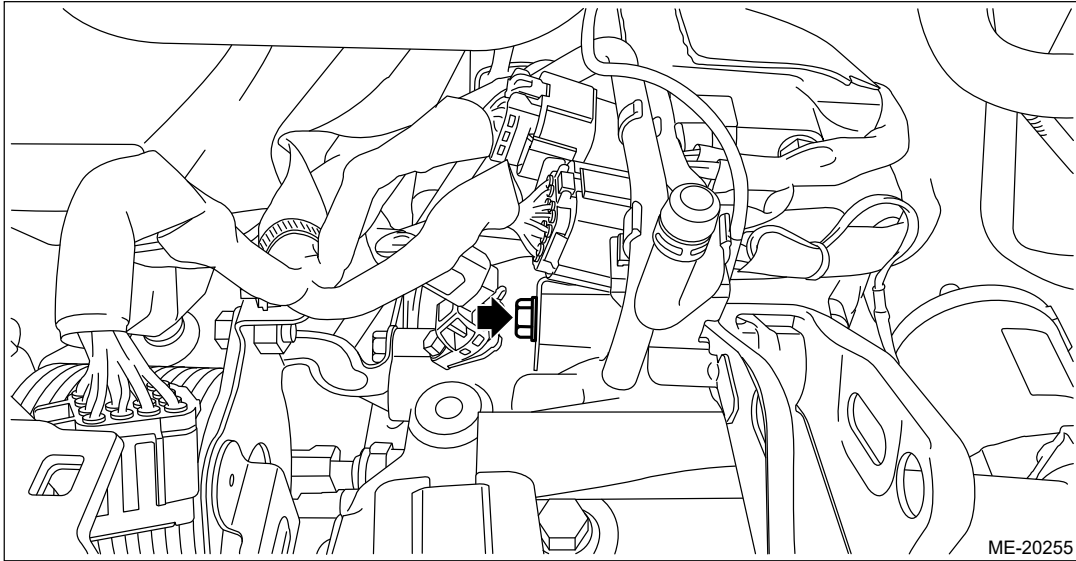
- 3.** Lower the engine and remove the lifting device and wire ropes.



- 4.** Install the bolt which secures the transmission harness stay to the CVT.

Tightening torque:

16 N·m (1.6 kgf-m, 11.8 ft-lb)

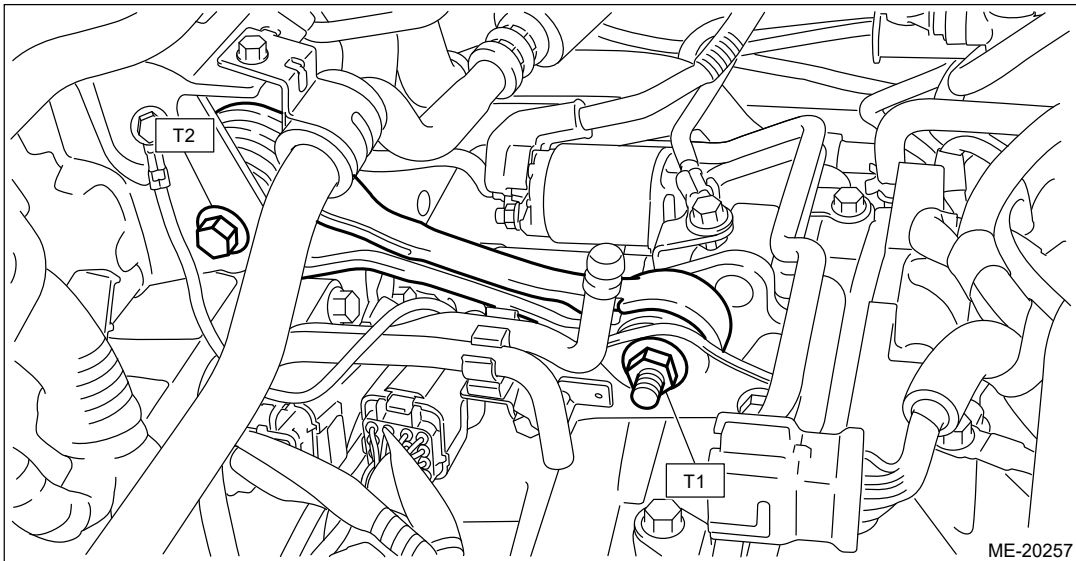


5. Install the pitching stopper.

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)



6. Install the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>INSTALLATION.](#)

7. Lift up the vehicle.

8. Install the electric power steering gearbox.  [Ref. to POWER ASSISTED SYSTEM \(POWER STEERING\)>Electric Power Steering Gearbox>INSTALLATION.](#)

9. Install the front drive shaft LH.  [Ref. to DRIVE SHAFT SYSTEM>Front Drive Shaft>INSTALLATION.](#)

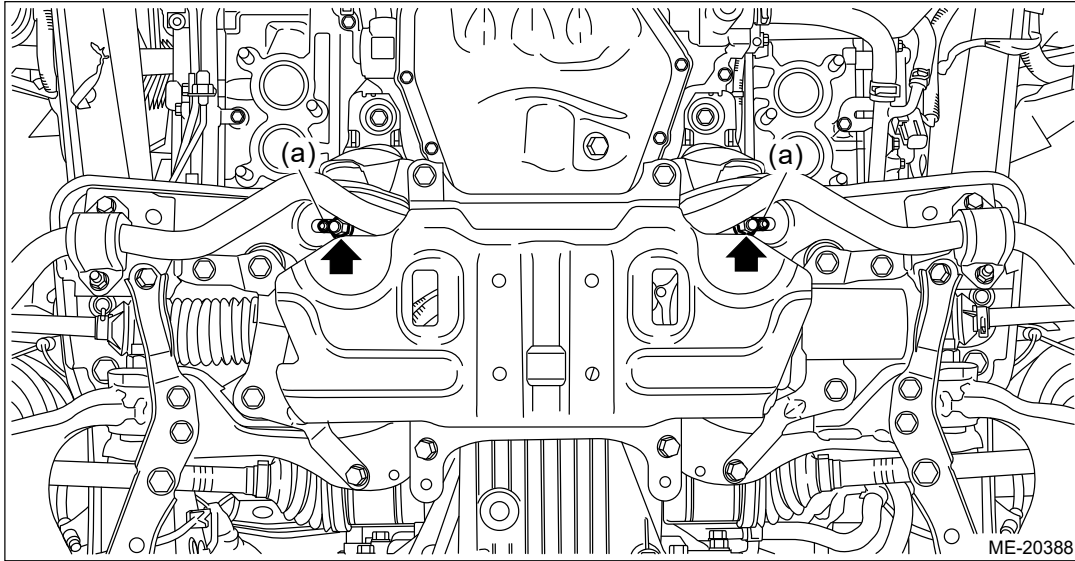
10. Install the nuts which hold the engine mounting to the front crossmember.

Note:

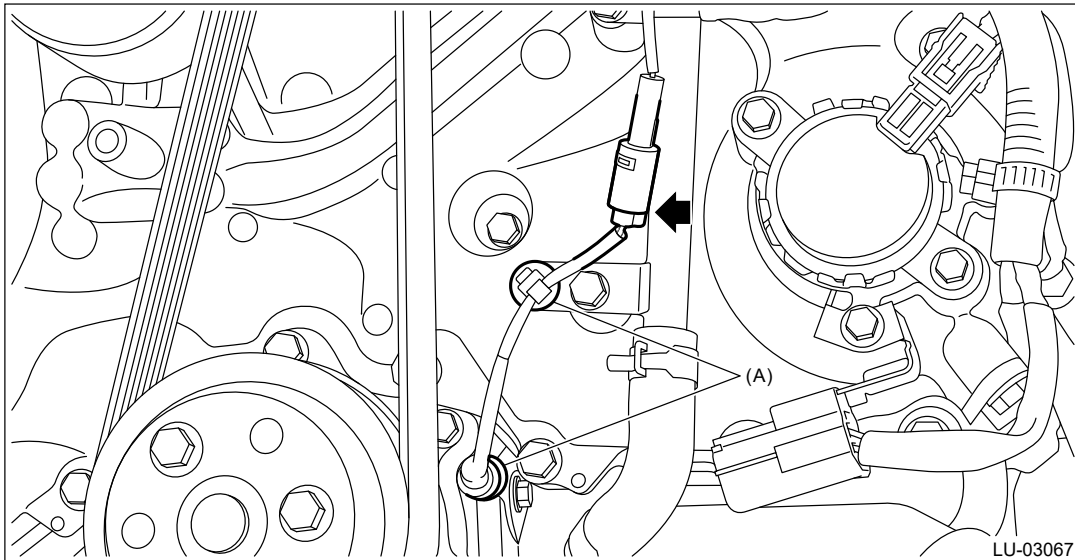
- **Make sure that locators (a) of the engine mounting are securely inserted.**
- **Use a new nut.**






Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)



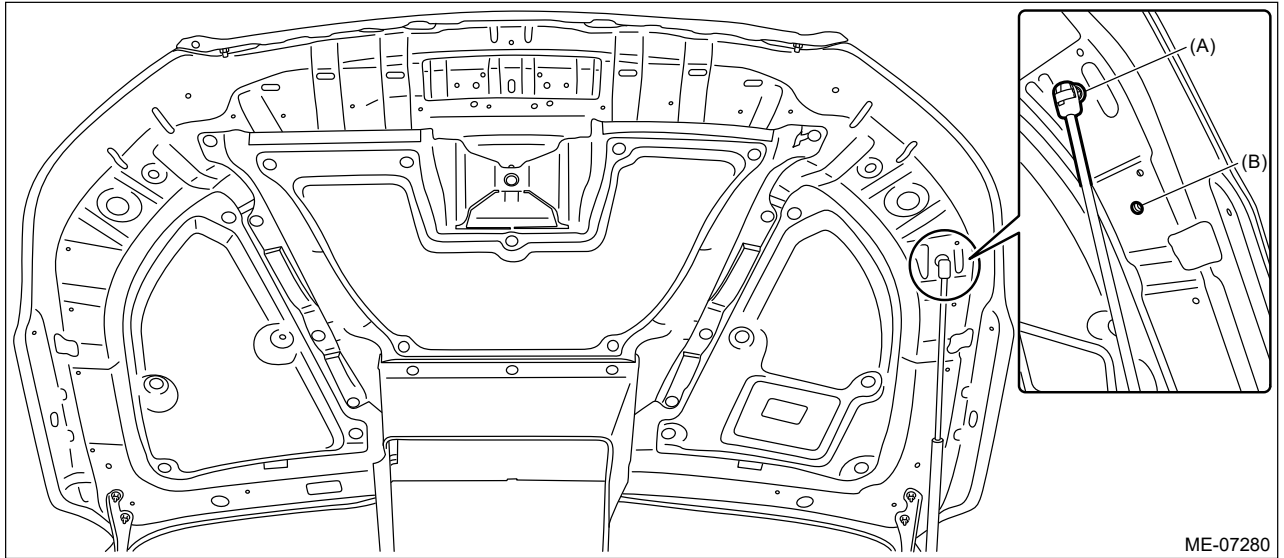
- 11.** Connect the connector of oil level switch to the engine harness, and install the clip (A) securing the harness.



- 12.** Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)
- 13.** Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
- 14.** Refill the engine oil.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 15.** Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 16.** Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
- 17.** Install the collector cover.
- 18.** Change the installation position of the front hood damper from (B) to (A).

Tightening torque:

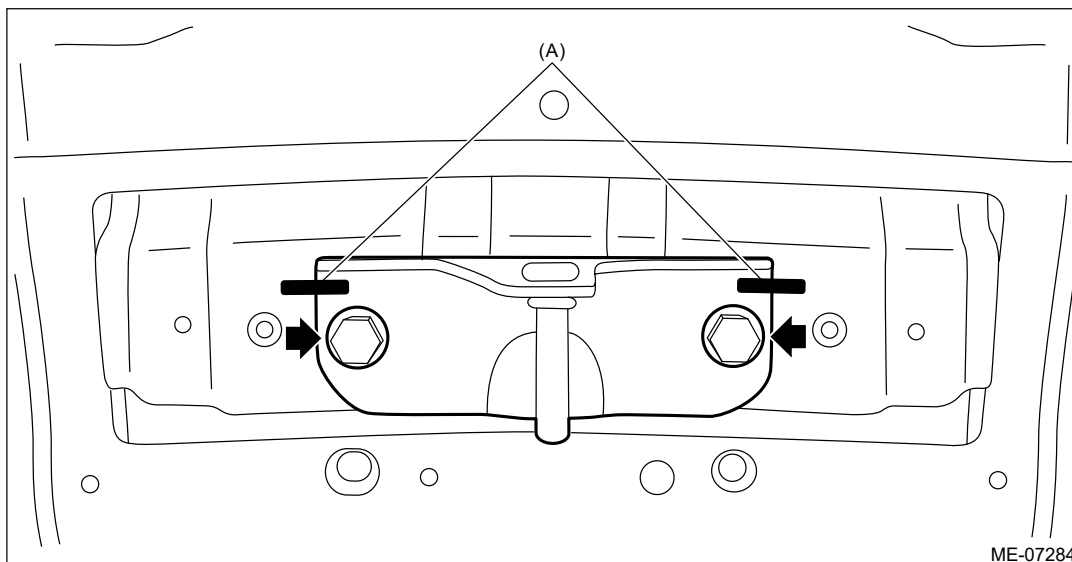
20 N·m (2.0 kgf-m, 14.8 ft-lb)




- 19.** Align the alignment marks (A), and install the front hood striker to the front hood.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)




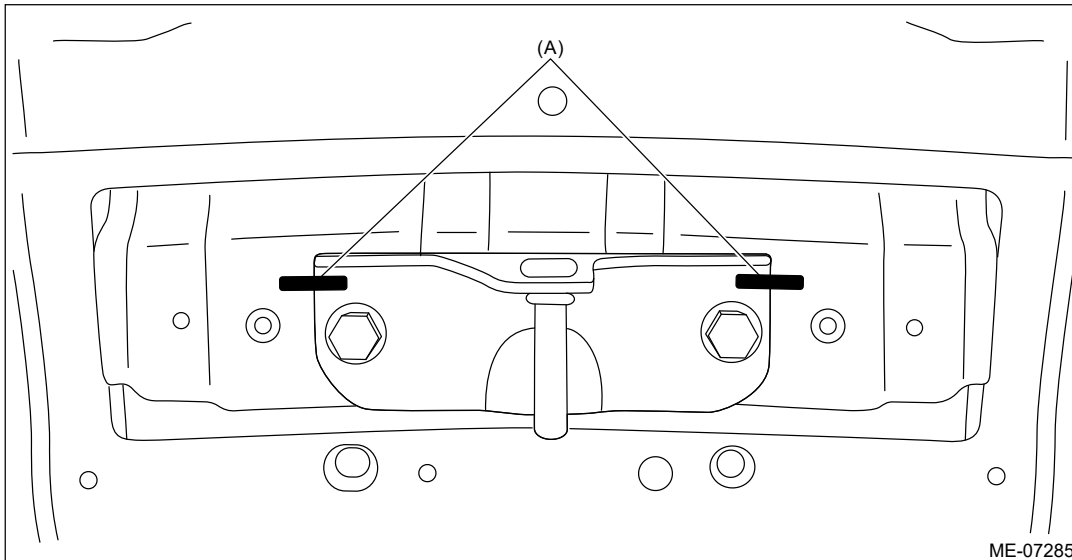
- 20.** Install the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>INSTALLATION.](#)

LUBRICATION(H4DO) > Oil Level Switch

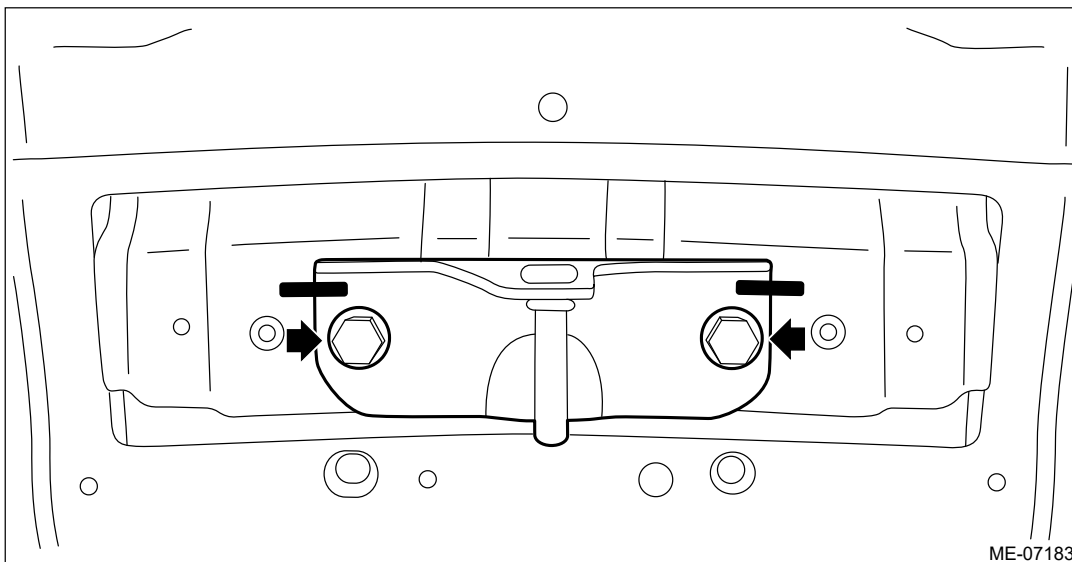
REMOVAL

1. NON-TURBO MODEL

1. Remove the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>REMOVAL > FRONT GRILLE UPPER.](#)
2. Using a marker pen, make alignment marks (A) on both the front hood striker and the front hood.



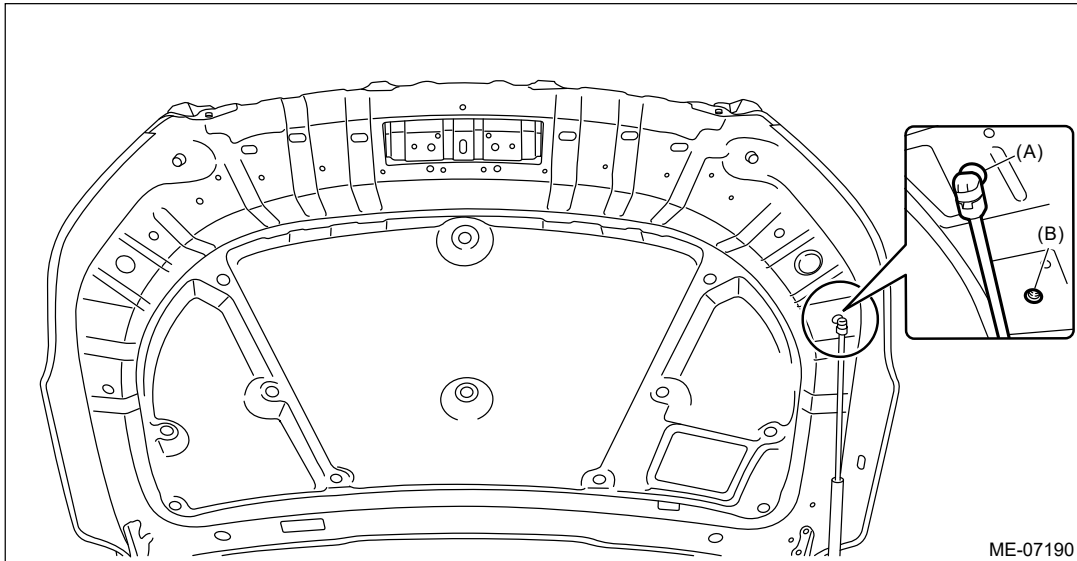
3. Remove the front hood striker from the front hood.



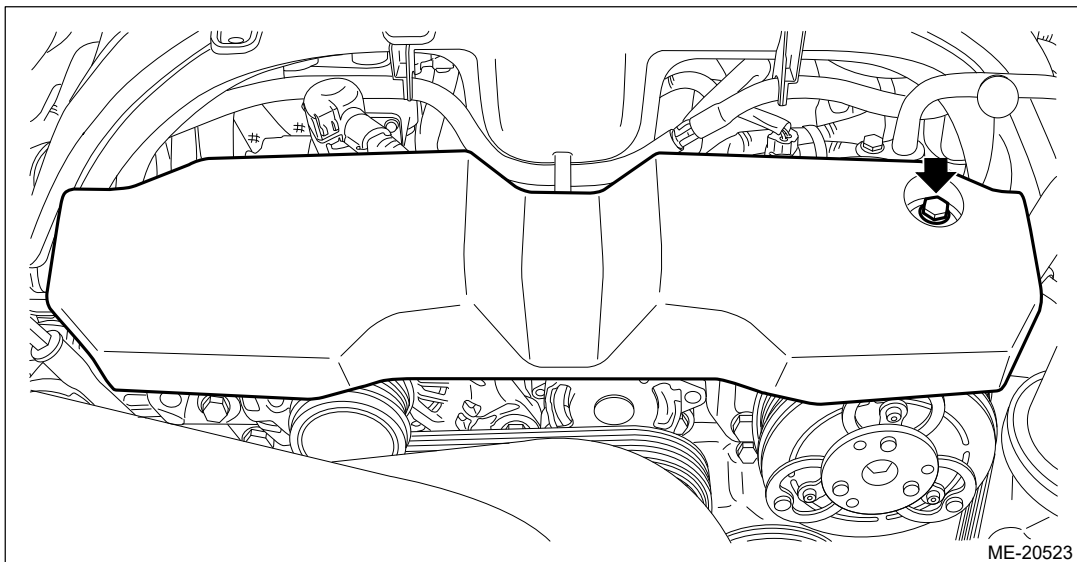
4. Change the front hood damper mounting position from (A) to (B), and completely open the front hood.



Tightening torque:

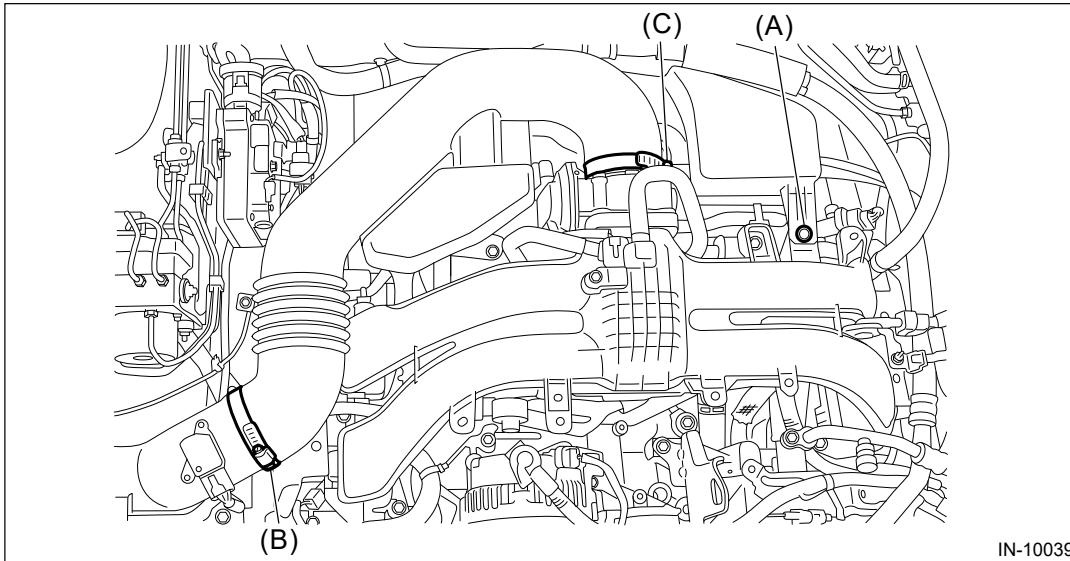
20 N·m (2.0 kgf-m, 14.8 ft-lb)



5. Remove the V-belt covers.

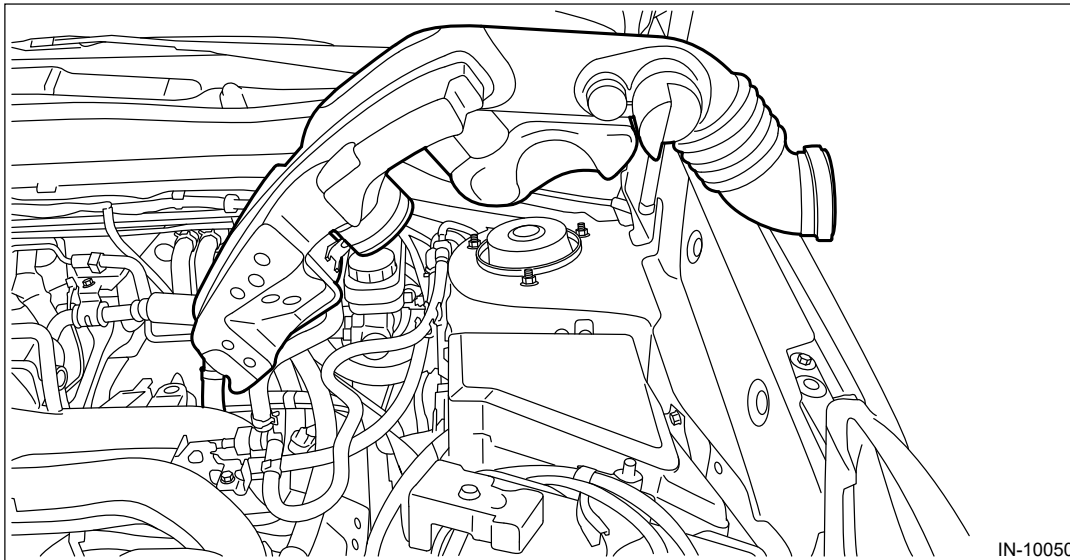


6. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
7. Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
8. Remove the clip (A) from the air intake boot.
9. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
10. Loosen the clamp (C) which secures the throttle body to the air intake boot.







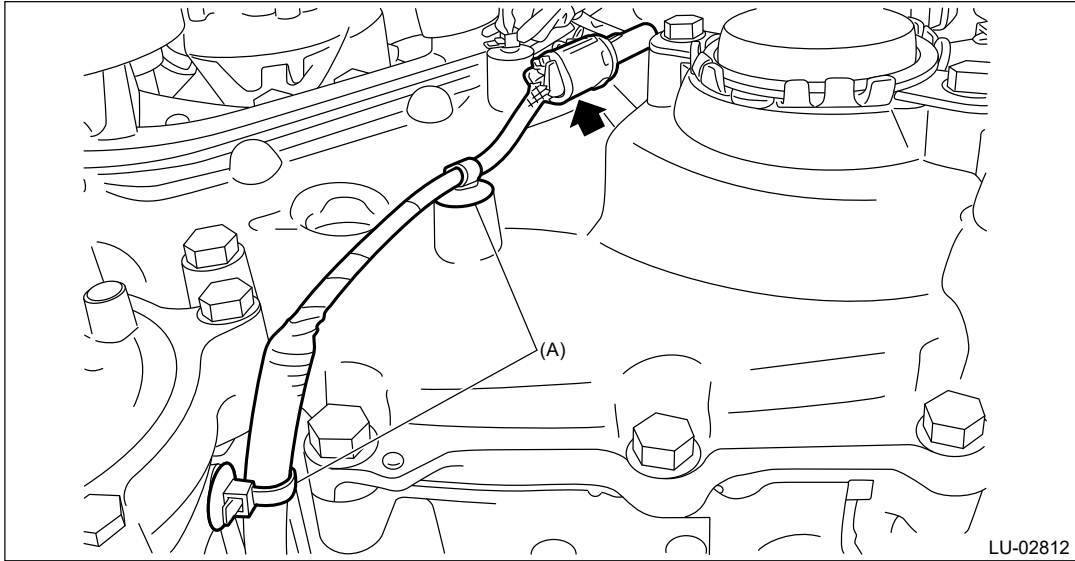
IN-10039

- 11.** Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.

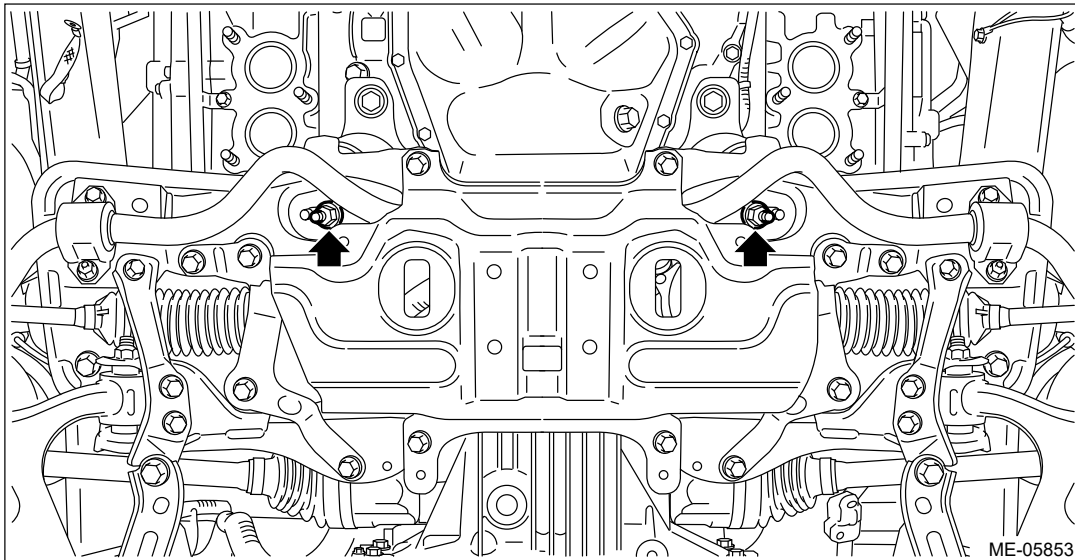


IN-10050

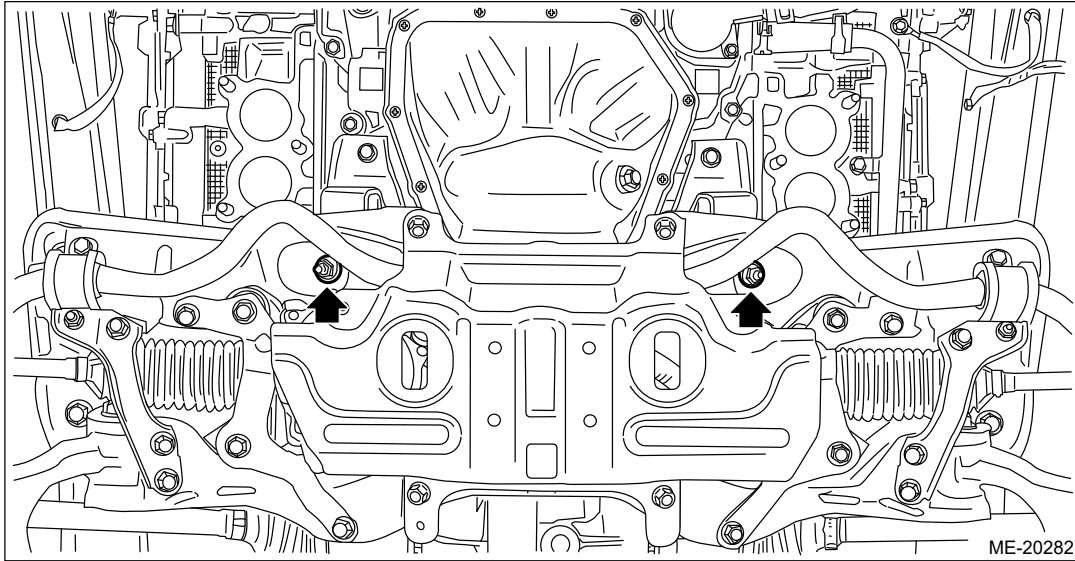
- 12.** Lift up the vehicle.
- 13.** Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
- 14.** Remove the under cover front - transmission.  [Ref. to EXTERIOR/INTERIOR TRIM>General Description>COMPONENT > FLOOR UNDER PROTECTOR.](#)
- 15.** Drain the engine oil.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 16.** Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)
- 17.** Disconnect the oil level switch connector from the engine harness, and remove the clip (A) securing the harness.





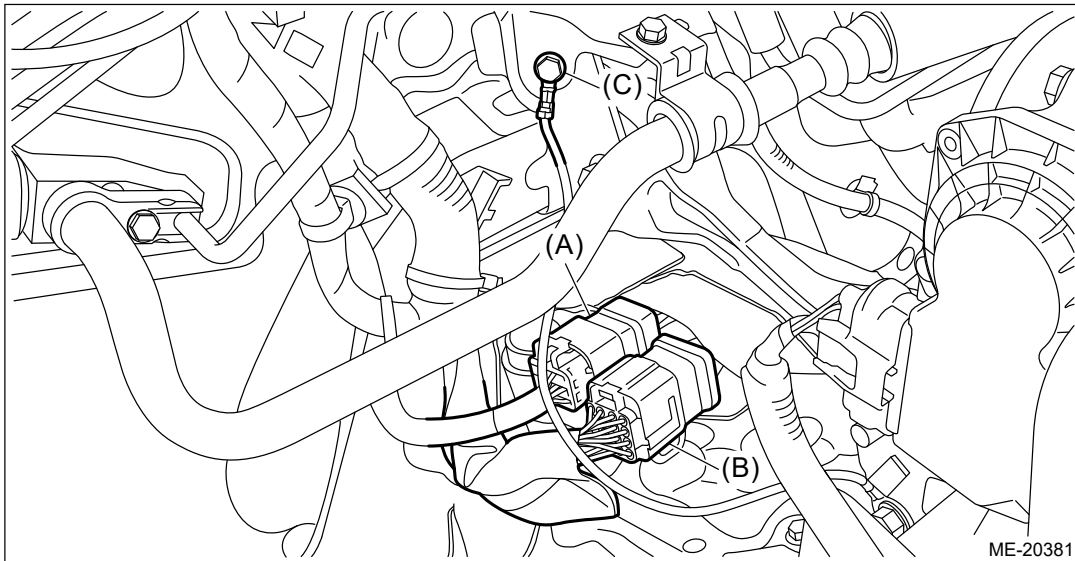
- 18.** Remove the nuts which secure the engine mounting to the front crossmember. (Hydraulic engine mounting model)



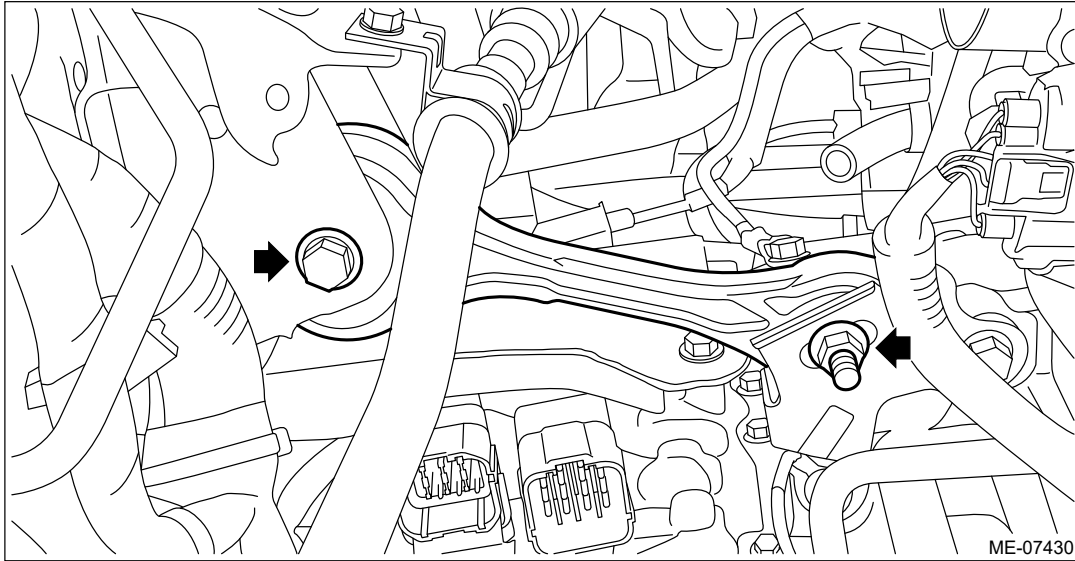
- 19.** Remove the nuts which secure the engine mounting to the front crossmember. (Solid engine mounting model)



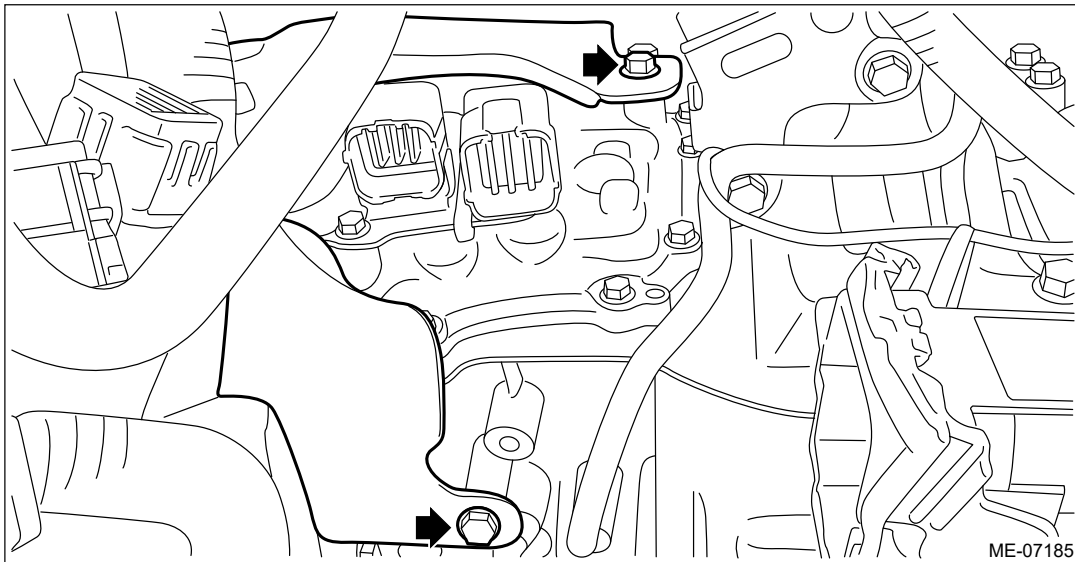
- 20.** Remove the electric power steering gearbox.  [Ref. to POWER ASSISTED SYSTEM \(POWER STEERING\)>Electric Power Steering Gearbox>REMOVAL.](#)
- 21.** Remove the front drive shaft LH.  [Ref. to DRIVE SHAFT SYSTEM>Front Drive Shaft>REMOVAL.](#)
- 22.** Lower the vehicle.
- 23.** Disconnect the bulkhead connector from the transmission harness connector (A) and the inhibitor harness connector (B), and remove the transmission radio ground terminal (C) from the vehicle. (CVT model)



- 24.** Remove the pitching stopper.



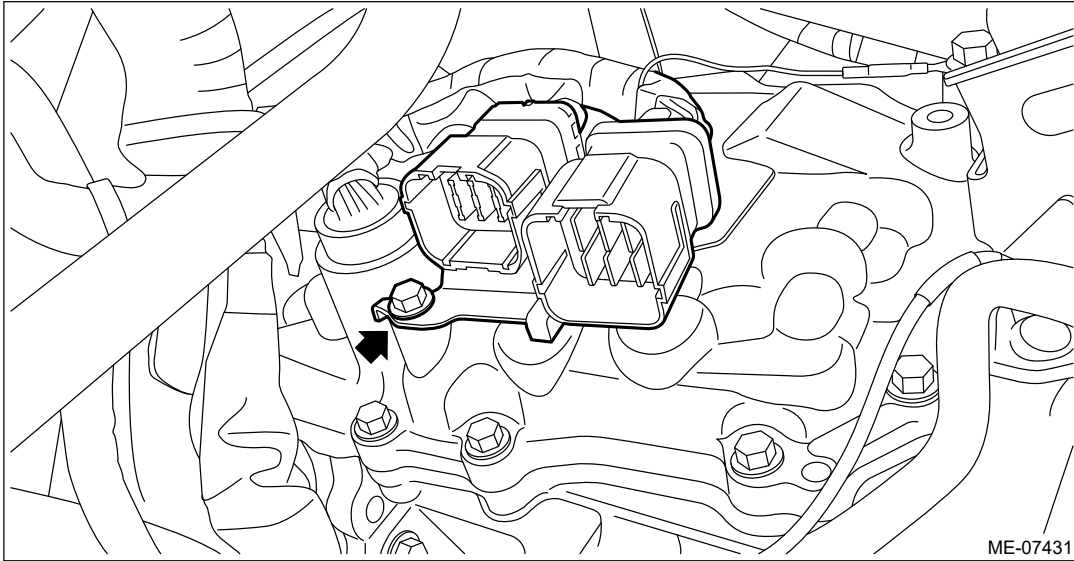
25. Remove the transmission cover. (CVT model)



26. Remove the transmission harness stay and move to the engine side. (CVT model)

Note:

This procedure is required to prevent the transmission connector from touching the A/C pressure hose during engine lift-up.

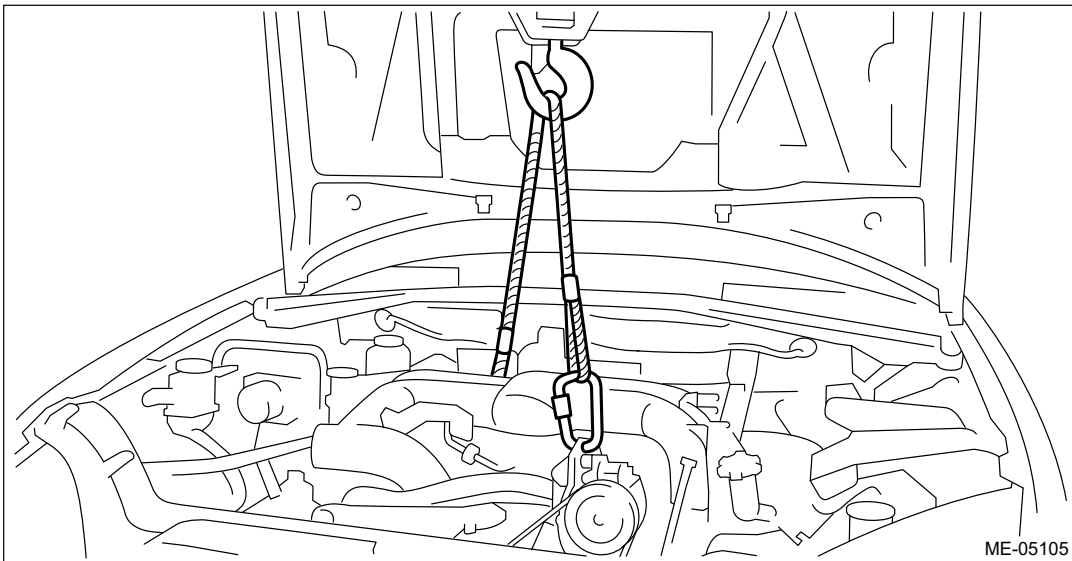


ME-07431

27. Lift up the engine with a lifting device and wire ropes.

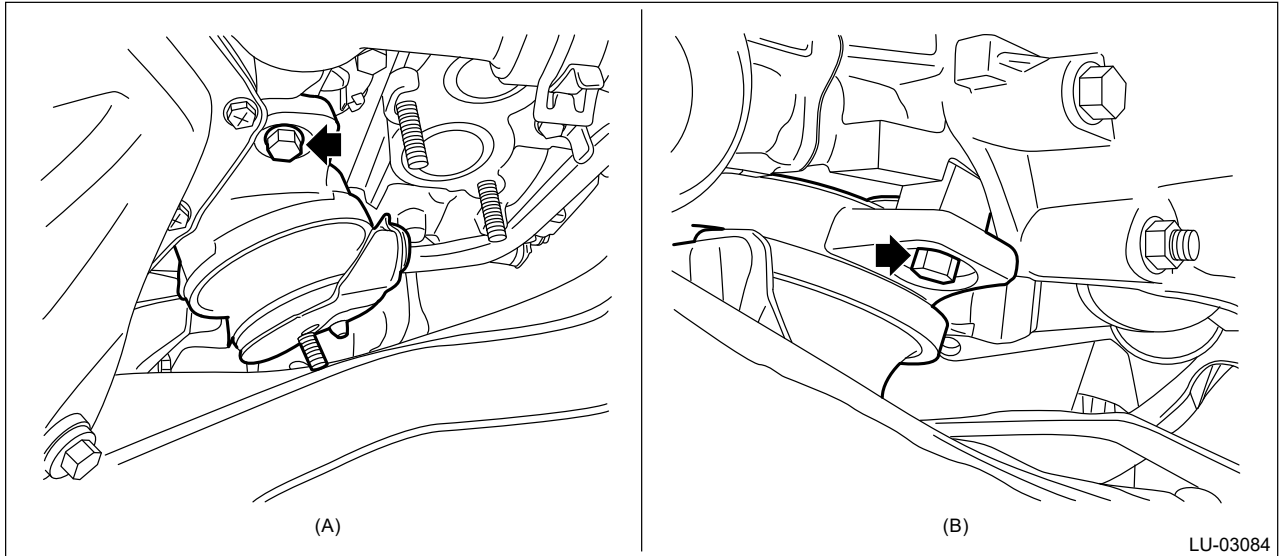
Caution:

When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.



ME-05105

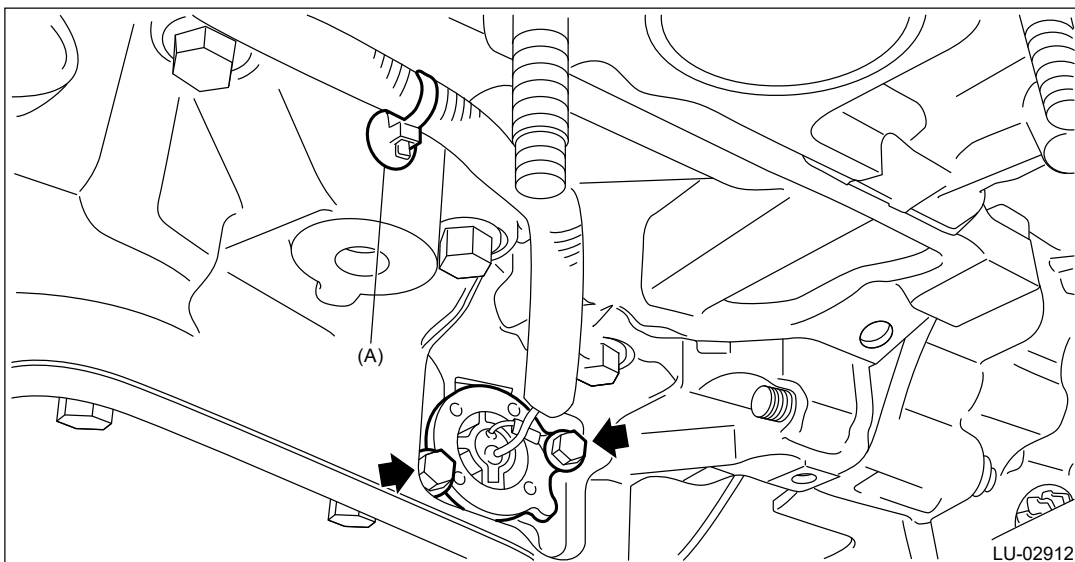
28. Remove the engine mounting LH from the engine.




(A) Front side

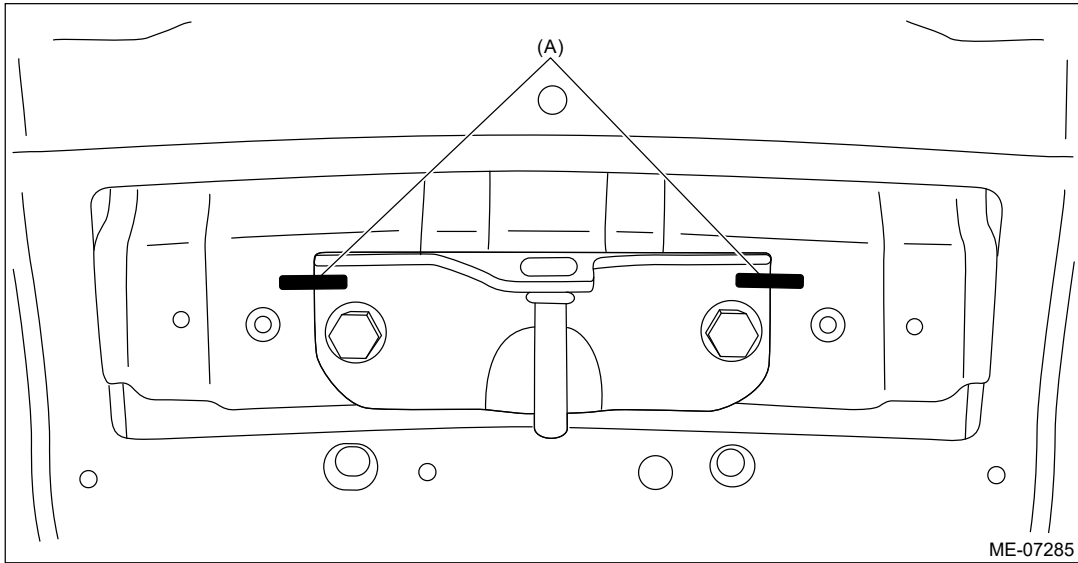
(B) Rear side

29. Remove clip (A) from the oil pan upper, and remove the oil level switch.

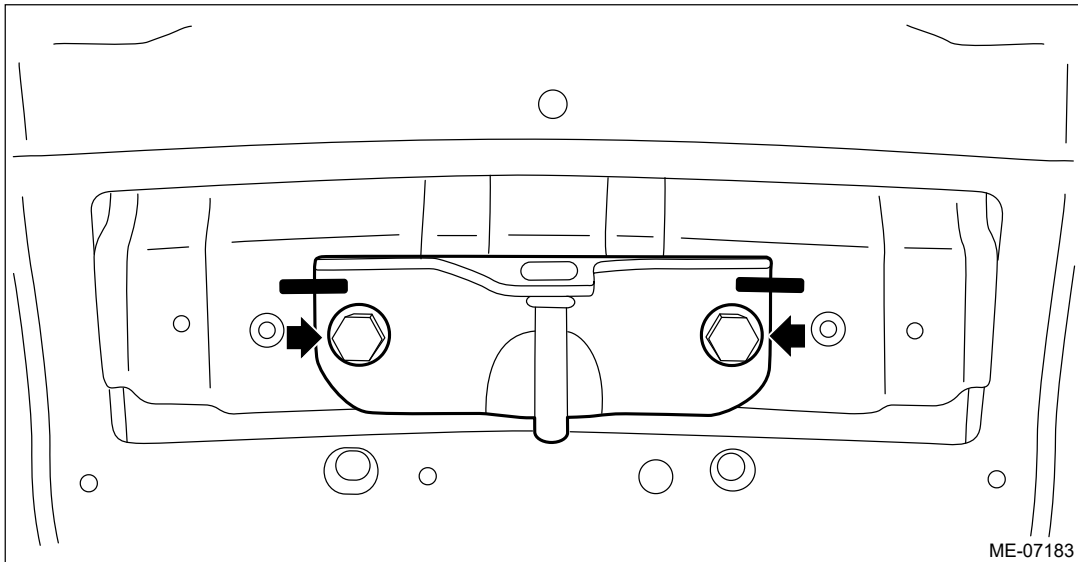


2. TURBO MODEL

- 1.** Remove the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>REMOVAL > FRONT GRILLE UPPER.](#)
- 2.** Using a marker pen, make alignment marks (A) on both the front hood and the front hood striker.



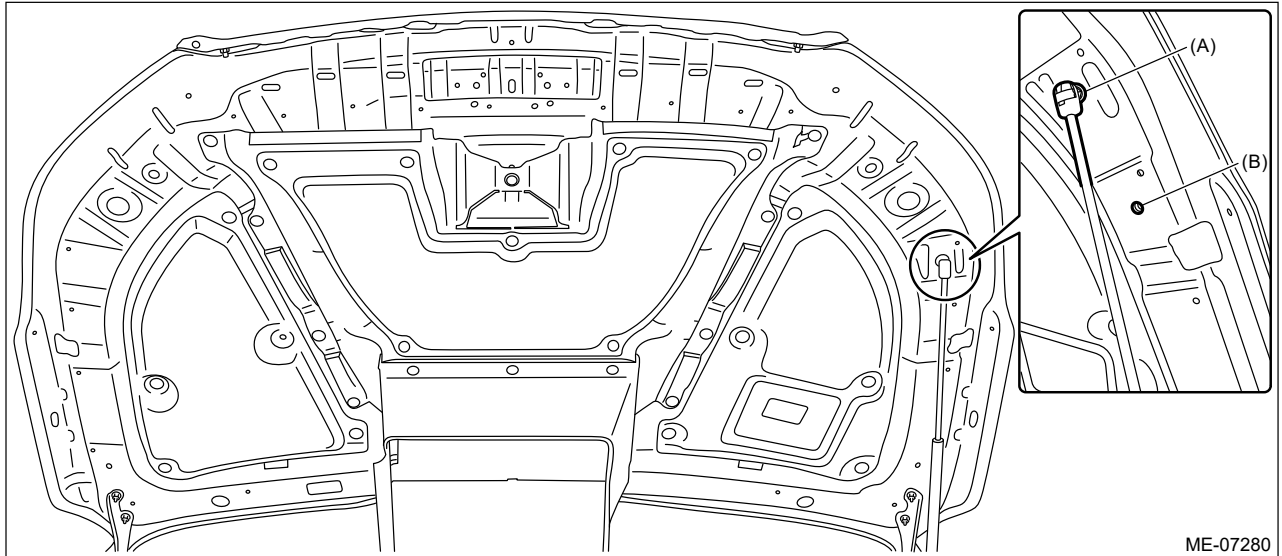
3. Remove the front hood striker from the front hood.



4. Change the front hood damper mounting position from (A) to (B), and completely open the front hood.

Tightening torque:

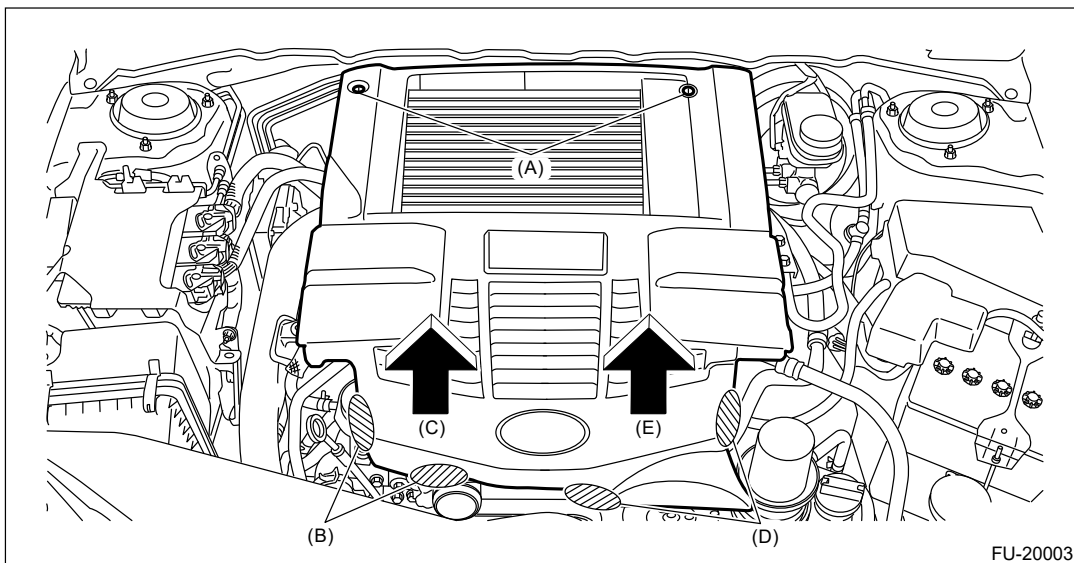
20 N·m (2.0 kgf-m, 14.8 ft-lb)








ME-07280

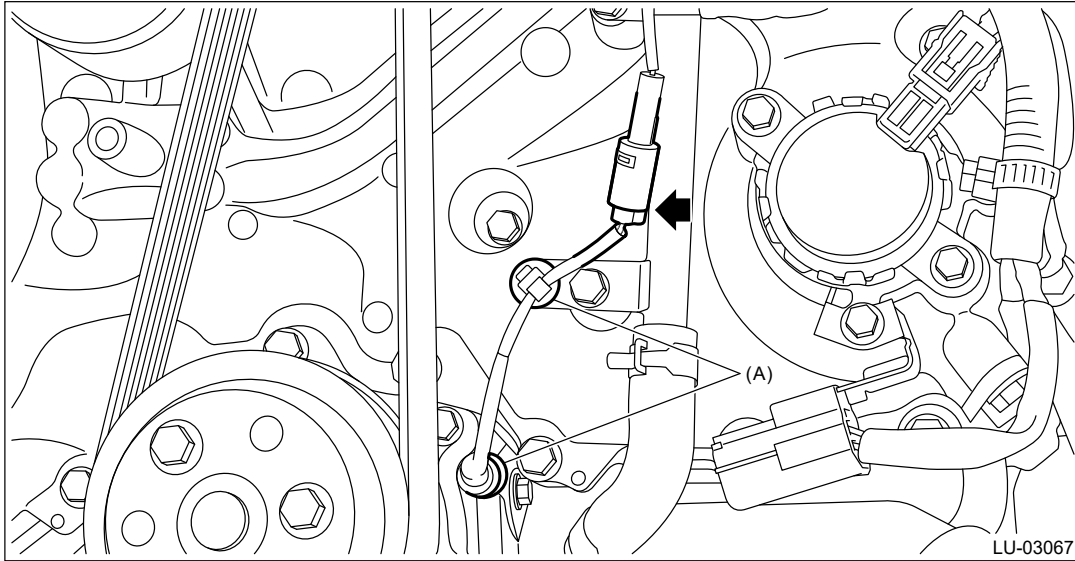
5. Remove the collector cover.

- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.

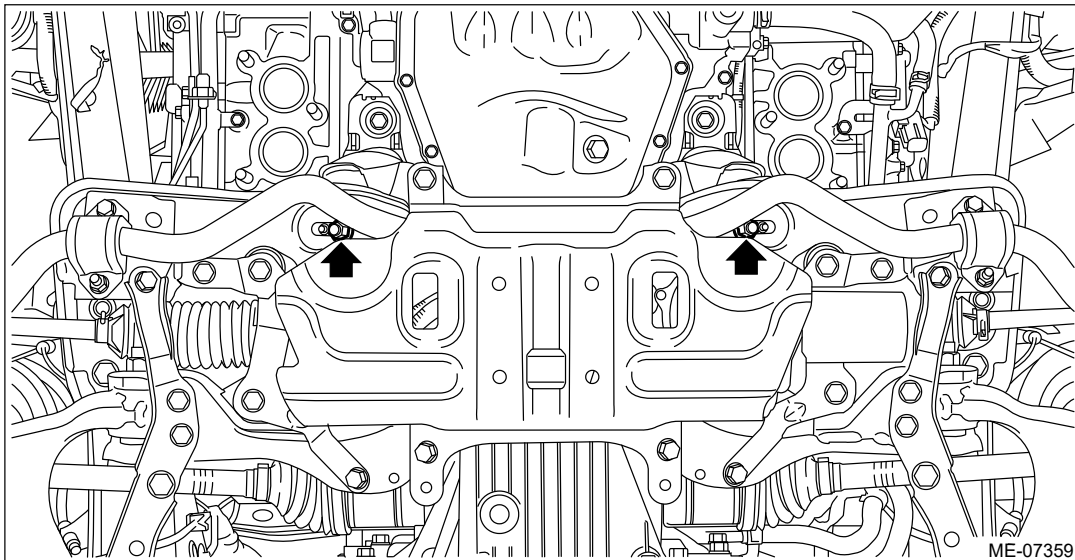





FU-20003

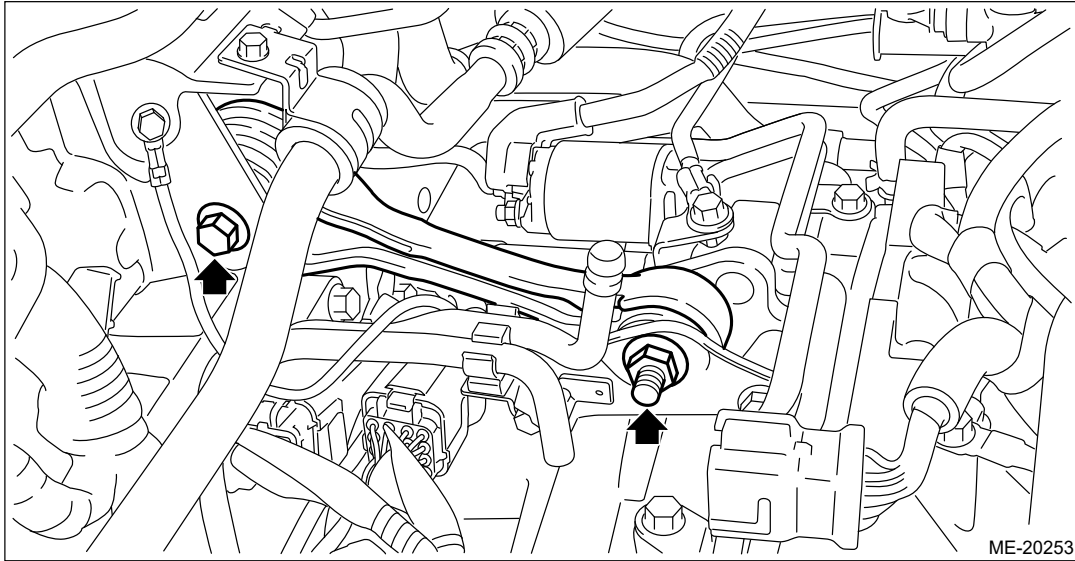
- 6.** Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 7.** Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
- 8.** Drain engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
- 9.** Drain the engine oil.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 10.** Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>REMOVAL.](#)
- 11.** Disconnect the oil level switch connector from the engine harness, and remove the clip (A) securing the harness.



- 12.** Remove the nuts which secure the engine mounting to the front crossmember.



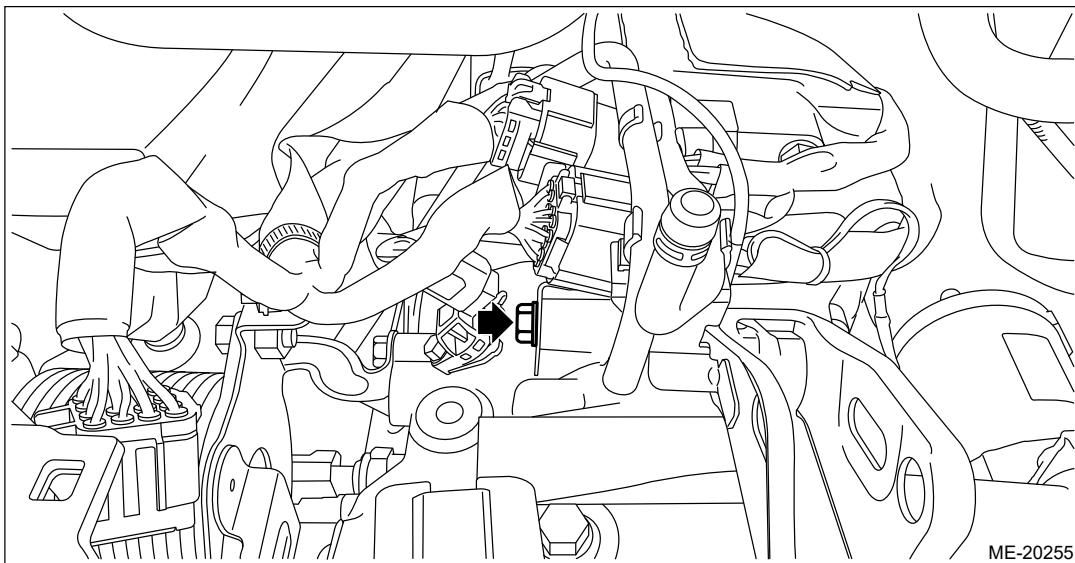
- 13.** Remove the electric power steering gearbox.  [Ref. to POWER ASSISTED SYSTEM \(POWER STEERING\)>Electric Power Steering Gearbox>REMOVAL.](#)
- 14.** Remove the front drive shaft LH.  [Ref. to DRIVE SHAFT SYSTEM>Front Drive Shaft>REMOVAL.](#)
- 15.** Lower the vehicle.
- 16.** Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
- 17.** Remove the pitching stopper.



- 18.** Remove the bolt securing the transmission harness stay to the CVT.

Note:

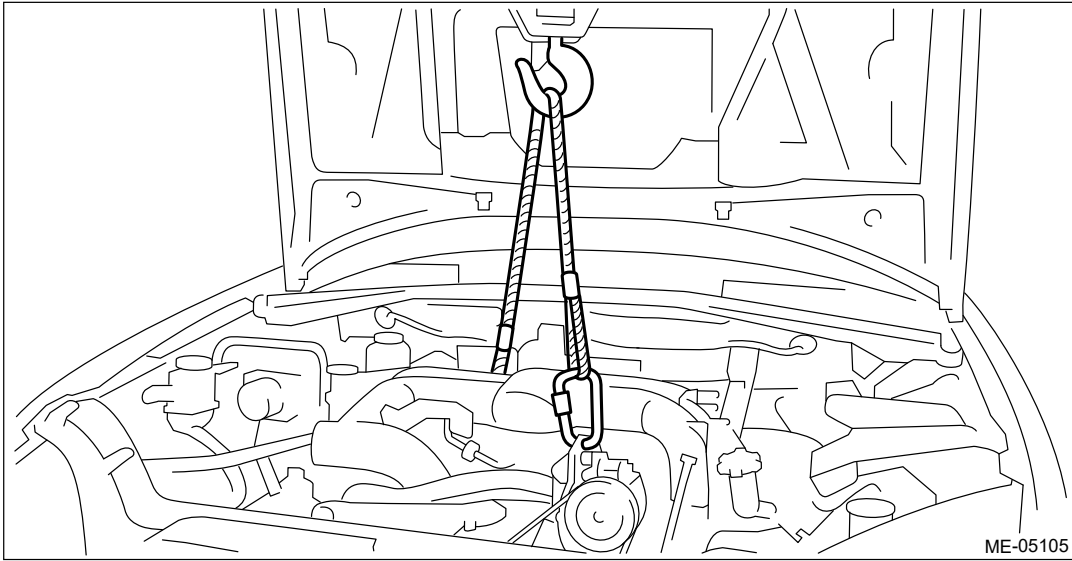
This procedure is required to prevent the transmission connector from touching the A/C pressure hose during engine lift-up.



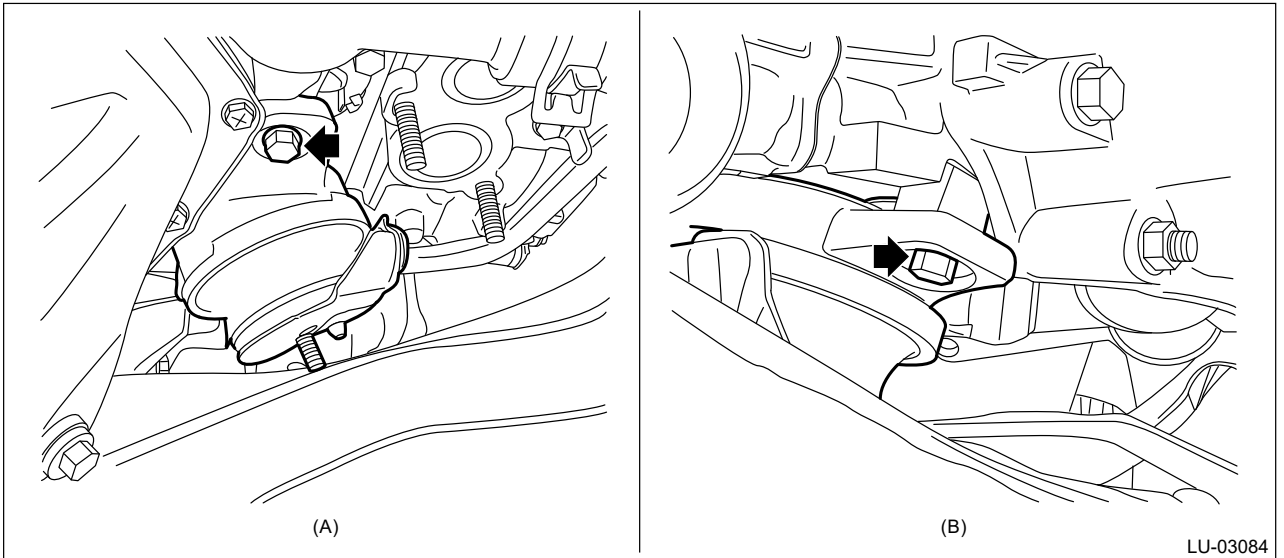
- 19.** Lift up the engine with a lifting device and wire ropes.

Caution:

When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.



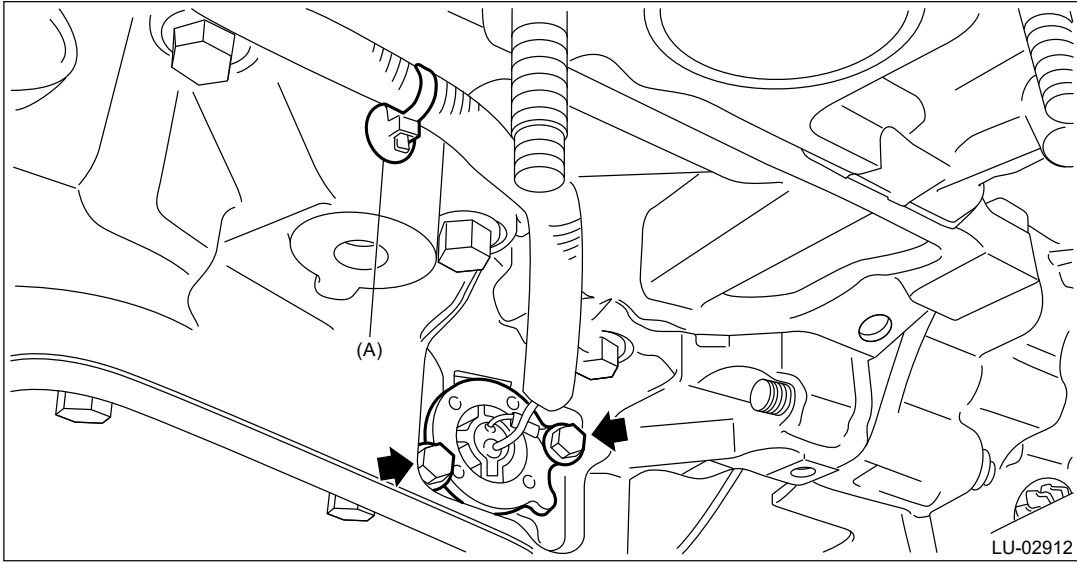
20. Remove the engine mounting LH from the engine.



(A) Front side



(B) Rear side

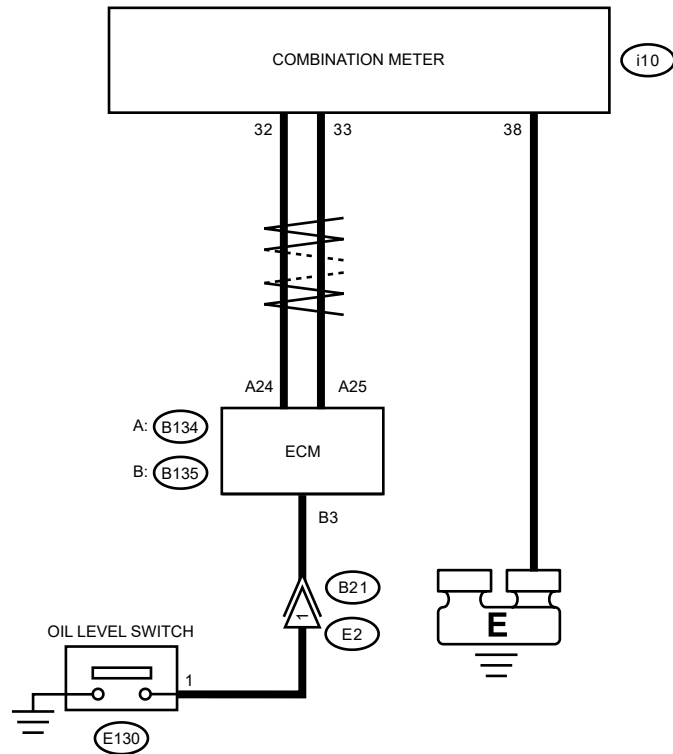
21. Remove clip (A) from the oil pan upper, and remove the oil level switch.



LUBRICATION(H4DO) > Oil Level Switch

WIRING DIAGRAM

- Engine electrical system  [Ref. to WIRING SYSTEM>Engine Electrical System>WIRING DIAGRAM.](#)
- CAN communication system  [Ref. to WIRING SYSTEM>CAN Communication System>WIRING DIAGRAM.](#)
- Non-turbo model



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 | 35 | 36 | 37 | 38 | 39 |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 |
| 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 |

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 | 36 | 37 | 38 | 39 |
| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 |
| 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 |

i10

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 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 |

i102

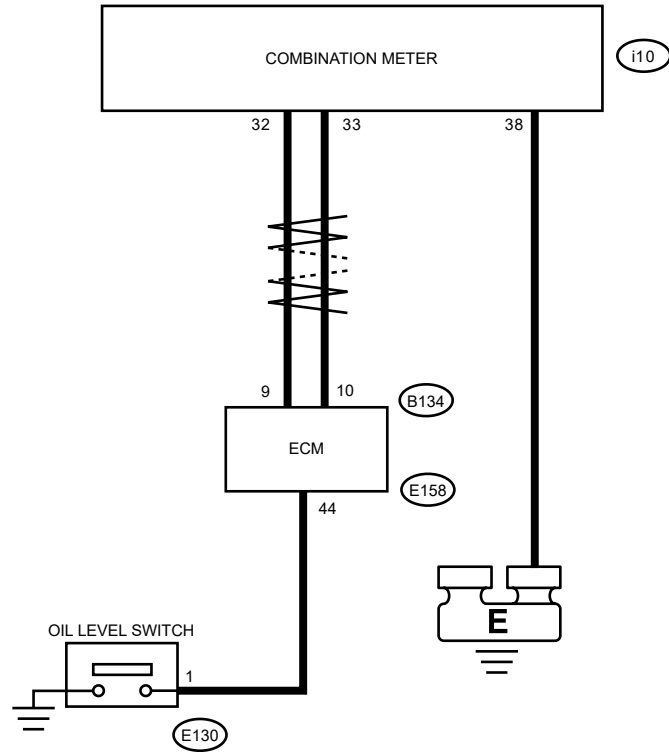
| | | | | | | |
|----|----|----|----|----|----|----|
| 1 | 2 | | | | | |
| 3 | 4 | 5 | 6 | | | |
| 7 | 8 | 9 | 10 | 11 | 12 | |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |

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-10083

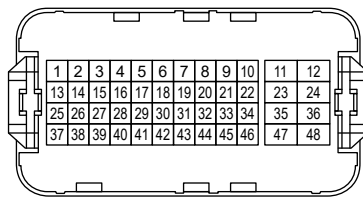
- Turbo model



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 | 35 | 36 |
| 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |

E158



i10

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 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 |

i102

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

LUBRICATION(H4DO) > Oil Pan

INSPECTION

Check that the oil pan, oil pan upper, oil strainer and baffle plate do not have deformation, cracks or damage.

INSTALLATION

1. OIL PAN

• NON-TURBO MODEL

1. Apply liquid gasket to the mating surface of the oil pan upper as shown in the figure, and install the oil pan.

Note:

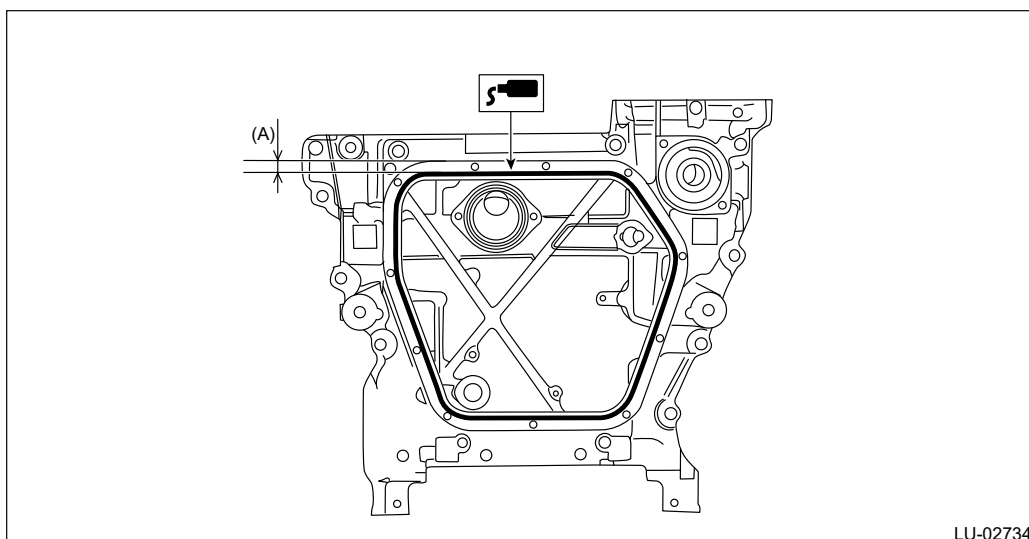
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the oil pan and the oil pan upper.
- Use a new oil pan seal ring.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

5±1 mm (0.1969±0.0394 in)

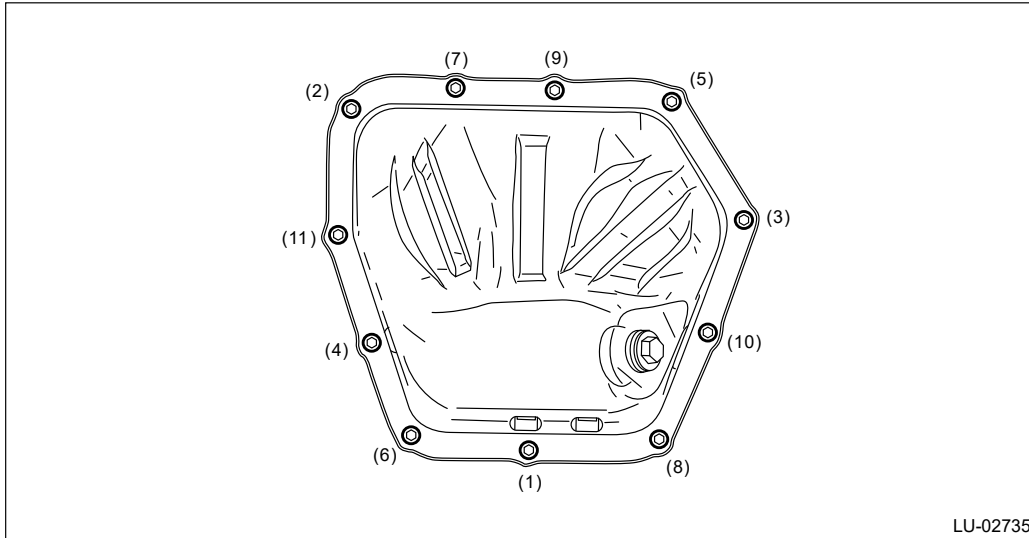


(A) 7.5 mm (0.295 in)

2. Tighten the bolts to secure the oil pan to the oil pan upper in the numerical order shown in the figure.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



LU-02735

3. Install the front exhaust pipe. [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>INSTALLATION.](#)
4. Refill the engine oil. [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
5. Connect the ground terminal to battery sensor. [Ref. to NOTE>NOTE > BATTERY.](#)

● **TURBO MODEL**

1. Apply liquid gasket to the mating surface of the oil pan upper as shown in the figure, and install the oil pan.

Note:

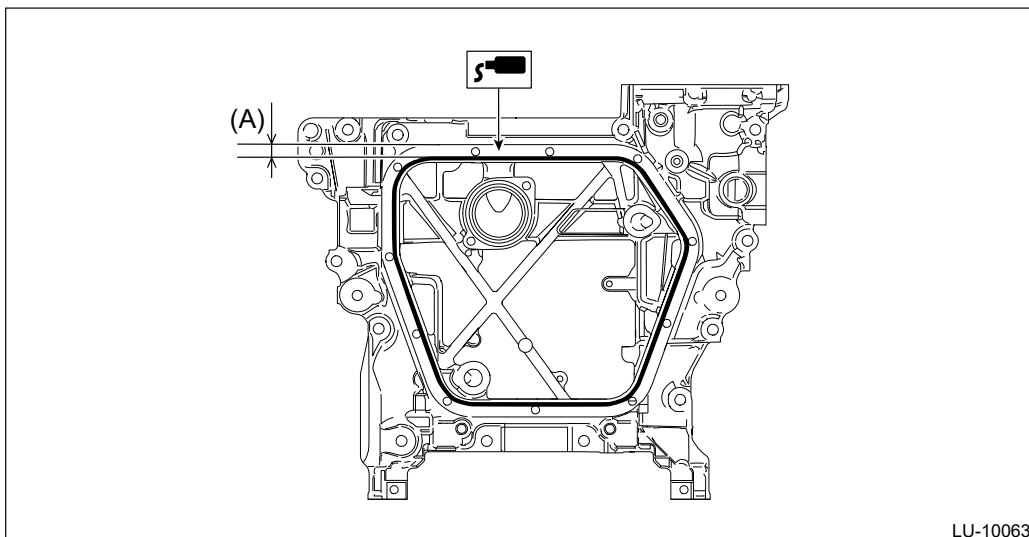
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the oil pan and the oil pan upper.
- Use a new oil pan seal ring.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

5±1 mm (0.1969±0.0394 in)



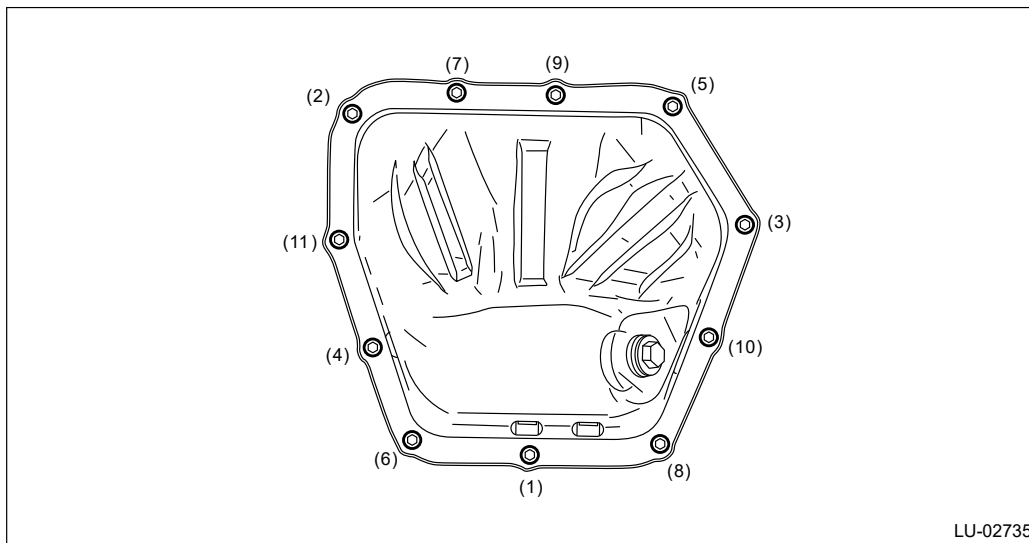
LU-10063

(A) 9.5 mm (0.374 in)

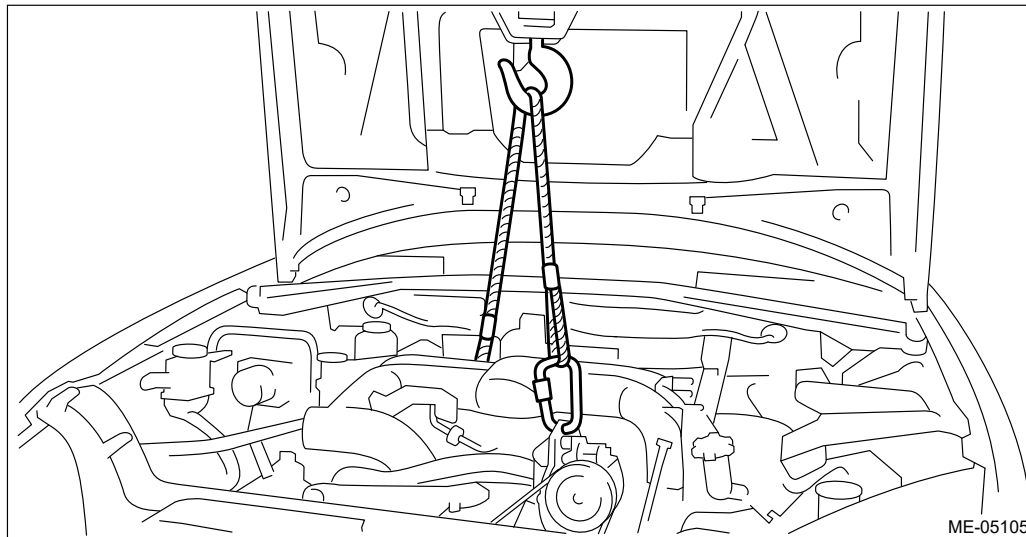
2. Tighten the bolts to secure the oil pan to the oil pan upper in the numerical order shown in the figure.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



3. Lower the vehicle.
4. Support the engine with a lifting device and wire ropes.

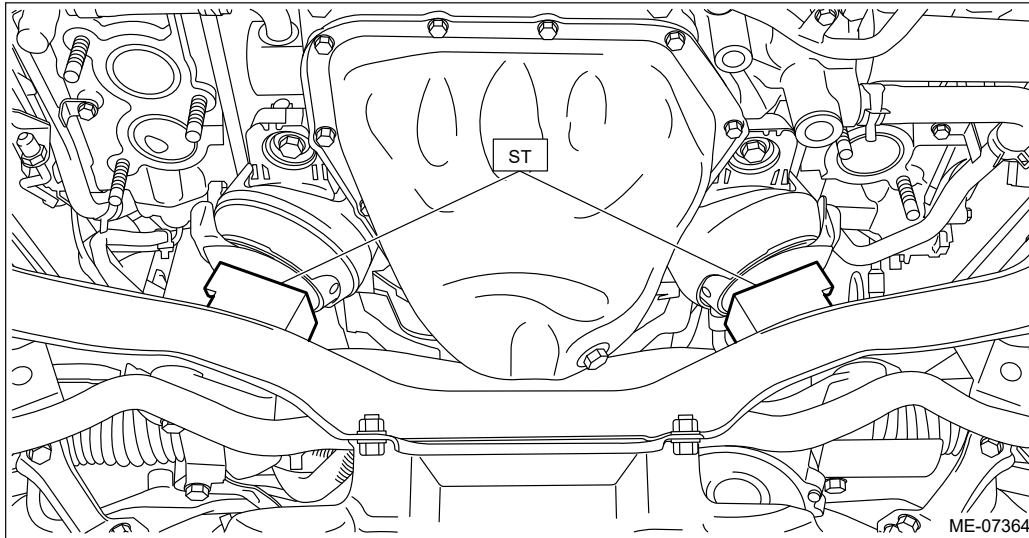


5. Lift the engine, and remove the ST.

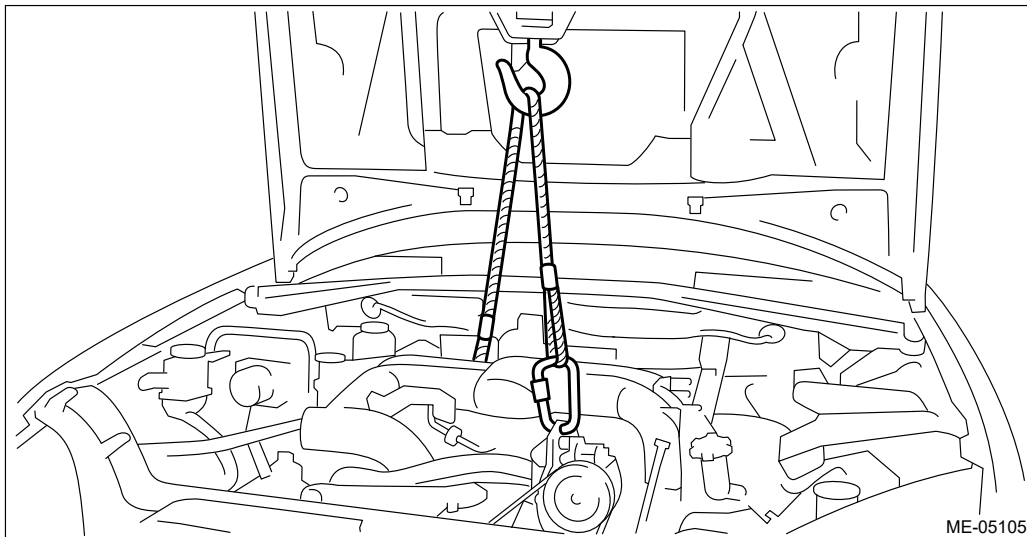
Caution:

When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.

ST 18632AA020 STAND ASSY



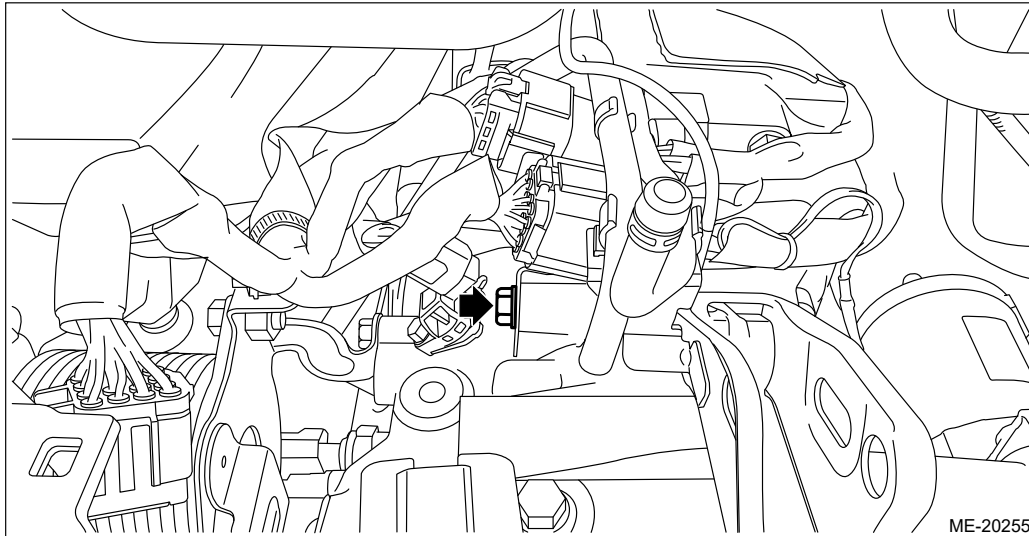
6. Lower the engine and remove the lifting device and wire ropes.



7. Install the bolt which secures the transmission harness stay to the CVT.

Tightening torque:

16 N·m (1.6 kgf-m, 11.8 ft-lb)

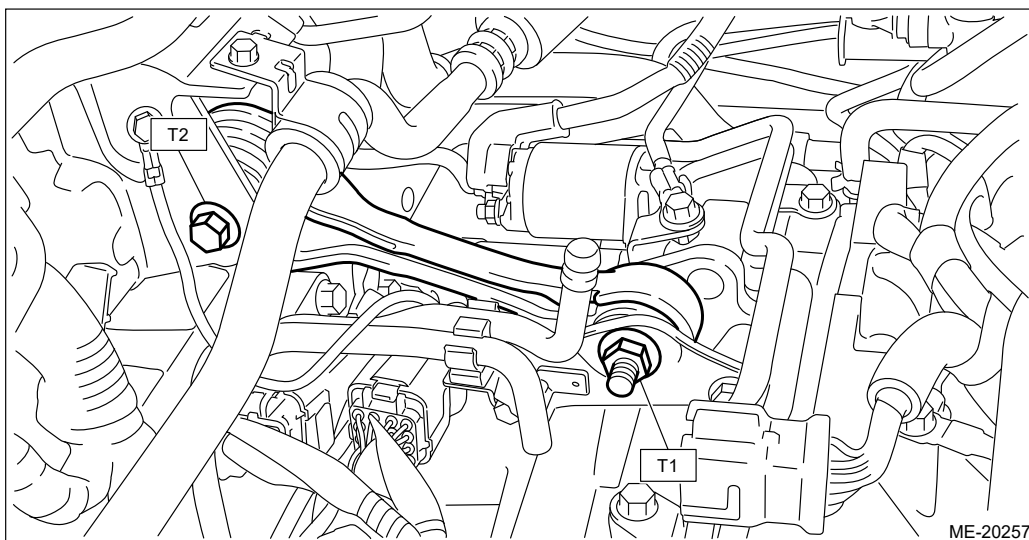


8. Install the pitching stopper.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



9. Install the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>INSTALLATION.](#)

10. Lift up the vehicle.

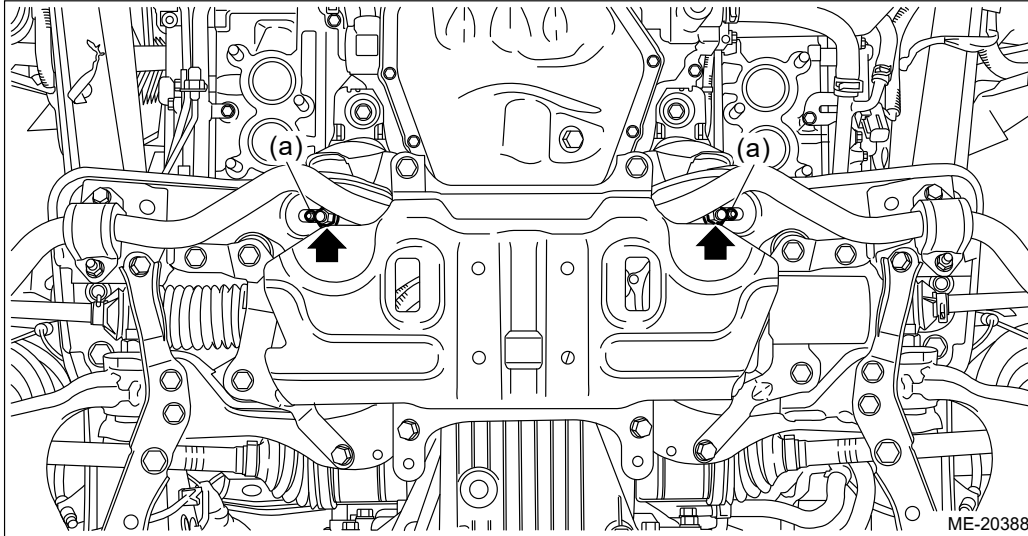
11. Install the nuts which hold the engine mounting to the front crossmember.

Note:

- **Make sure that locators (a) of the engine mounting are securely inserted.**
- **Use a new nut.**

Tightening torque:

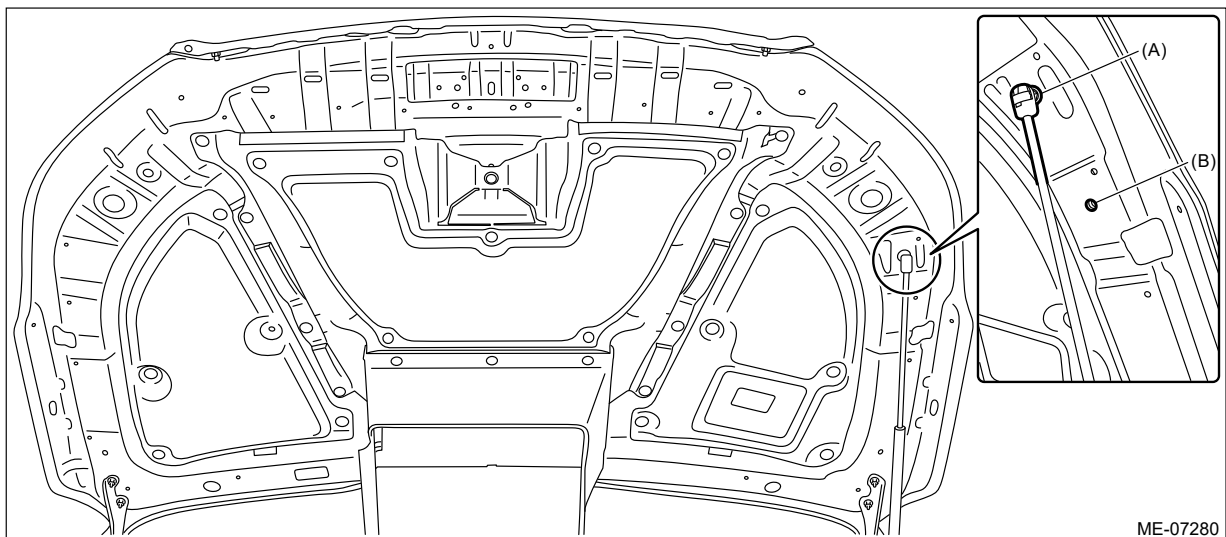
60 N·m (6.1 kgf-m, 44.3 ft-lb)



- 12.** Install the front exhaust pipe. [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)
- 13.** Install the air intake duct (rear). [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
- 14.** Refill the engine oil. [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 15.** Connect the battery ground terminal. [Ref. to NOTE>NOTE > BATTERY.](#)
- 16.** Fill engine coolant. [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
- 17.** Install the collector cover.
- 18.** Change the installation position of the front hood damper from (B) to (A).

Tightening torque:

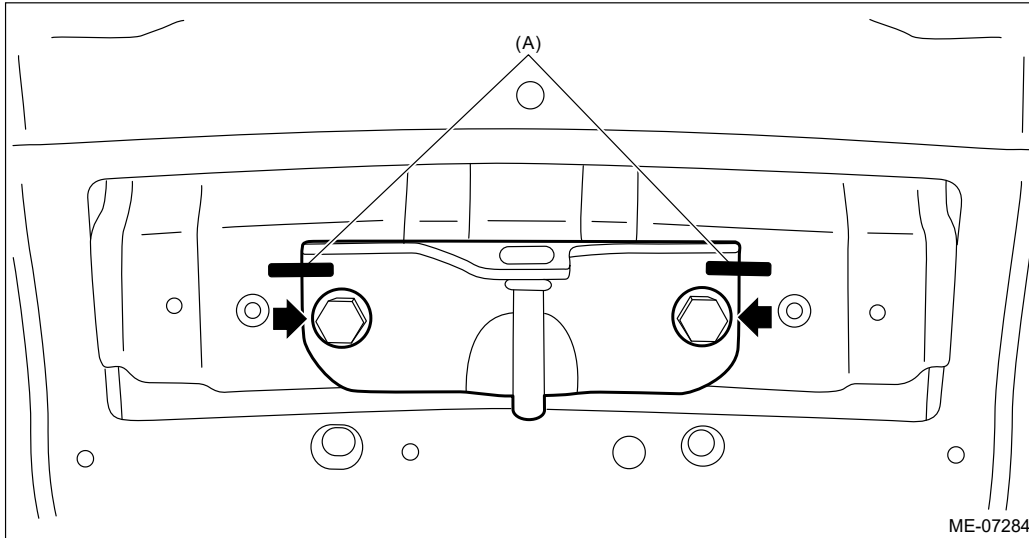
20 N·m (2.0 kgf-m, 14.8 ft-lb)




- 19.** Align the alignment marks (A), and install the front hood striker to the front hood.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)



- 20.** Install the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>INSTALLATION.](#)

2. OIL PAN UPPER

1. Install the O-ring to the cylinder block.

Note:

- Use new O-rings.

2. Attach the clutch housing cover to the oil pan upper. (MT model)
3. Attach the stud bolts to the oil pan upper.
4. Attach the oil strainer to the oil pan upper.

Note:

Use new O-rings.

5. Attach the baffle plate to the oil pan upper.

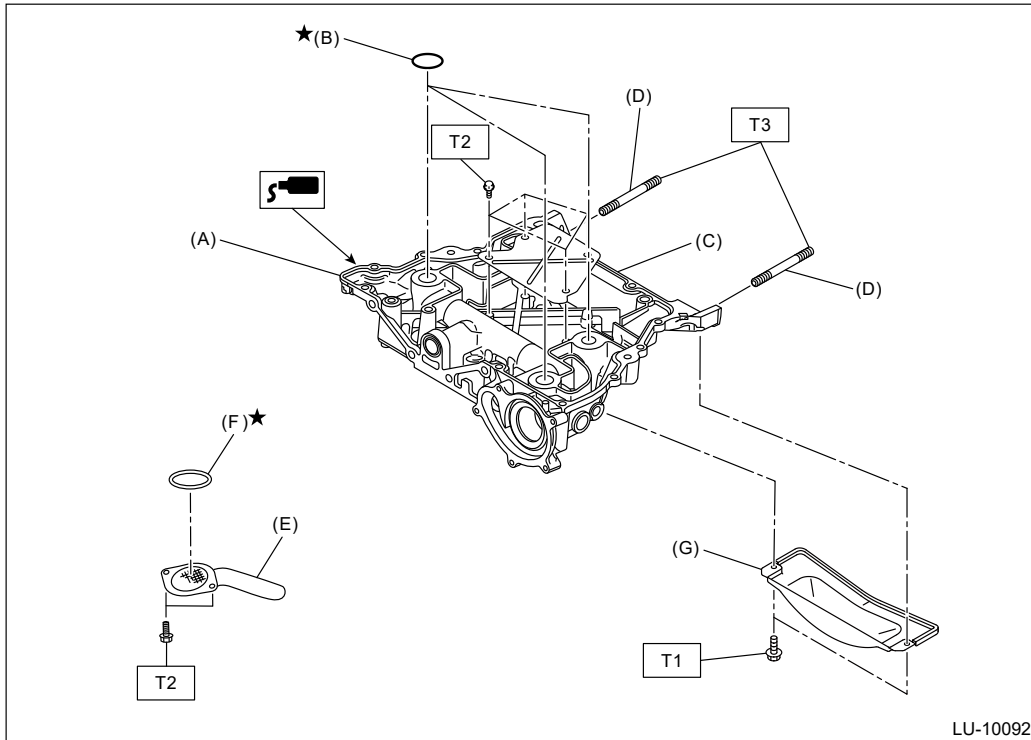
- Non-turbo model

Tightening torque:

T1: 5 N·m (0.5 kgf-m, 3.7 ft-lb)

T2: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

T3: 10 N·m (1.0 kgf-m, 7.4 ft-lb)



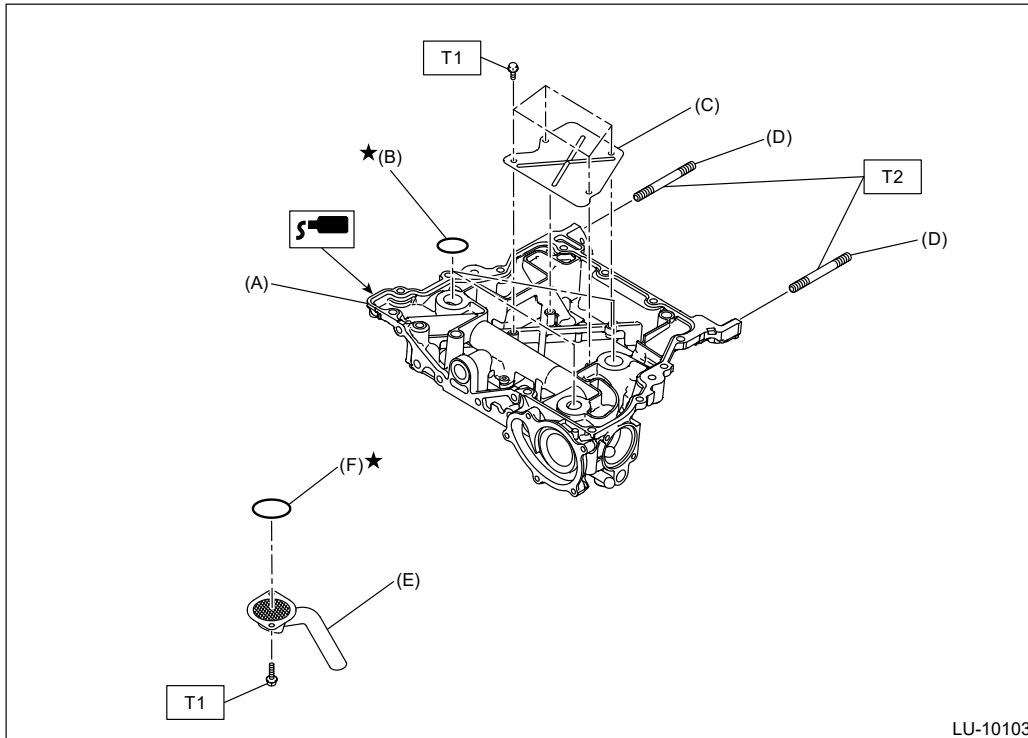
- | | | |
|-------------------------------------|------------------|------------------|
| (A) Oil pan upper | (B) O-ring | (C) Baffle plate |
| (D) Stud bolt | (E) Oil strainer | (F) O-ring |
| (G) Clutch housing cover (MT model) | | |

- Turbo model

Tightening torque:

T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

T2: 10 N·m (1.0 kgf-m, 7.4 ft-lb)



(A) Oil pan upper

(B) O-ring

(C) Baffle plate

(D) Stud bolt

(E) Oil strainer

(F) O-ring

- 6.** Apply liquid gasket to the mating surface of the oil pan upper as shown in the figure, and install the oil pan upper to the cylinder block.

Note:

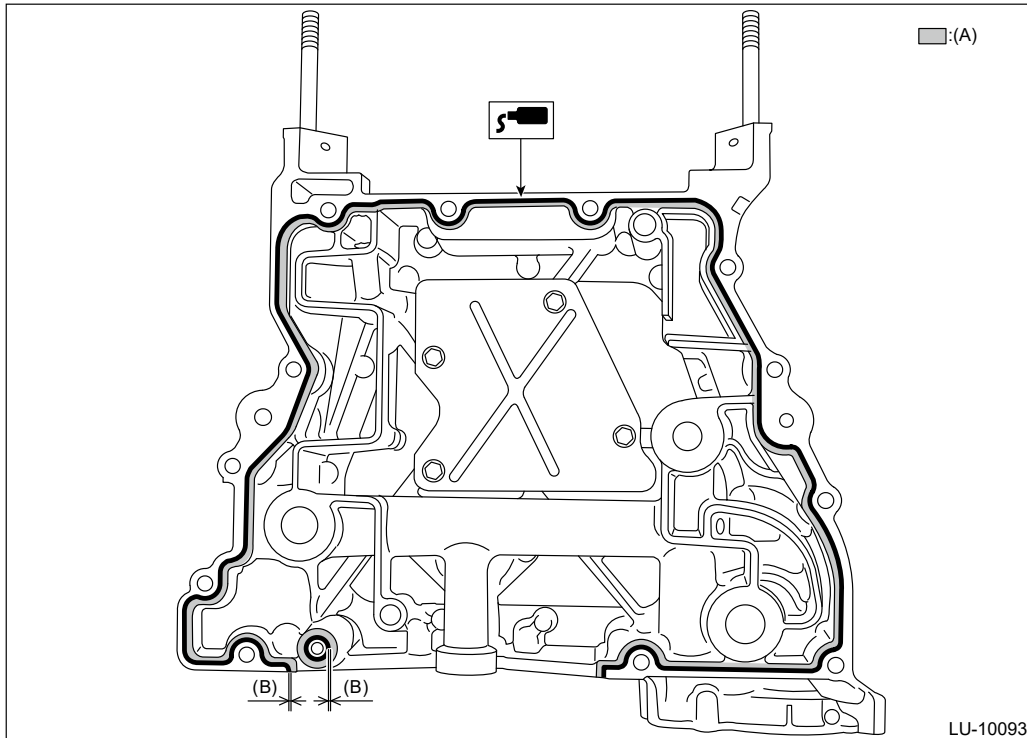
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the oil pan upper and the cylinder block.
- Install within 5 min. after applying liquid gasket.
- Apply liquid gasket 1.5 mm (0.0591 in) outside from the chamfer surface. However, application of liquid gasket on the chamfer surface around the bolt hole is allowed.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

5±1 mm (0.1969±0.0394 in)



(A) Chamfer surface

(B) 1.5 mm (0.0591 in)

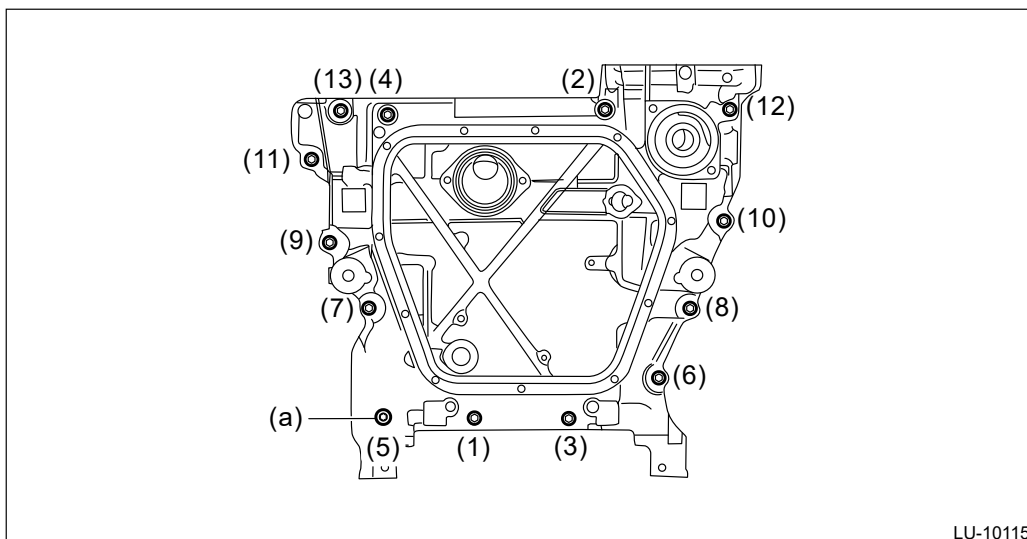
7. Tighten the bolts to secure the oil pan upper to the cylinder block in the numerical order shown in the figure.

Note:

- Install the bolt (a) shown in the figure using TORX® bit T45.
- After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

Tightening torque:












18 N·m (1.8 kgf-m, 13.3 ft-lb)



8. Install the oil level switch. Ref. to [LUBRICATION\(H4DO\)>Oil Level Switch>INSTALLATION](#).

9. Install the oil pan. Ref. to [LUBRICATION\(H4DO\)>Oil Pan](#).




10. Install the chain cover. Ref. to [MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION](#). Ref. to [MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION](#).

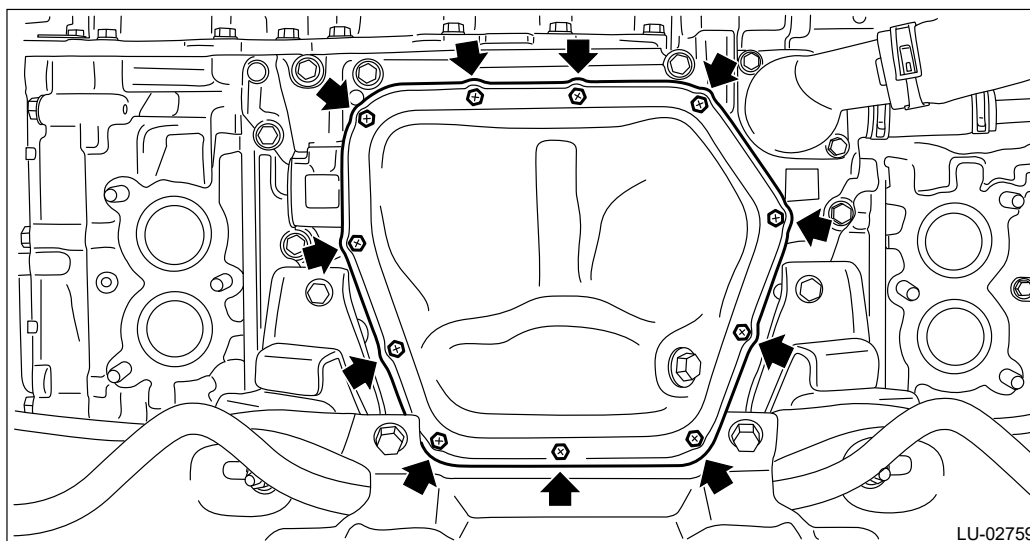
- 11.** Install the water pipe assembly.  [Ref. to COOLING\(H4DO\)>Water Pipe Assembly>INSTALLATION.](#) 
[Ref. to COOLING\(H4DOTC\)>Water Pipe Assembly>INSTALLATION.](#)
- 12.** Install the thermostat cover.  [Ref. to COOLING\(H4DO\)>Thermostat>INSTALLATION.](#)  [Ref. to COOLING\(H4DOTC\)>Thermostat>INSTALLATION.](#)
- 13.** Install the water pump.  [Ref. to COOLING\(H4DO\)>Water Pump>INSTALLATION.](#)  [Ref. to COOLING\(H4DOTC\)>Water Pump>INSTALLATION.](#)
- 14.** Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>INSTALLATION.](#) 
[Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>INSTALLATION.](#)
- 15.** Refill the engine oil.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 16.** Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)

REMOVAL

1. OIL PAN

• NON-TURBO MODEL

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Drain the engine oil.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
3. Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)
4. Remove the bolts which secure oil pan to oil pan upper.




5. Insert an oil pan cutter blade into the gap between oil pan upper and oil pan, and remove the oil pan.

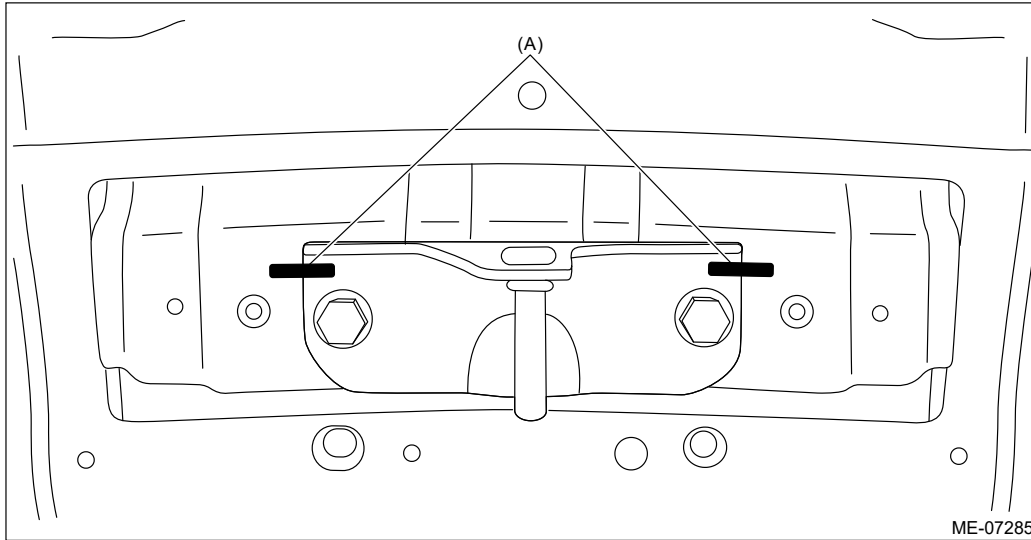
Caution:

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

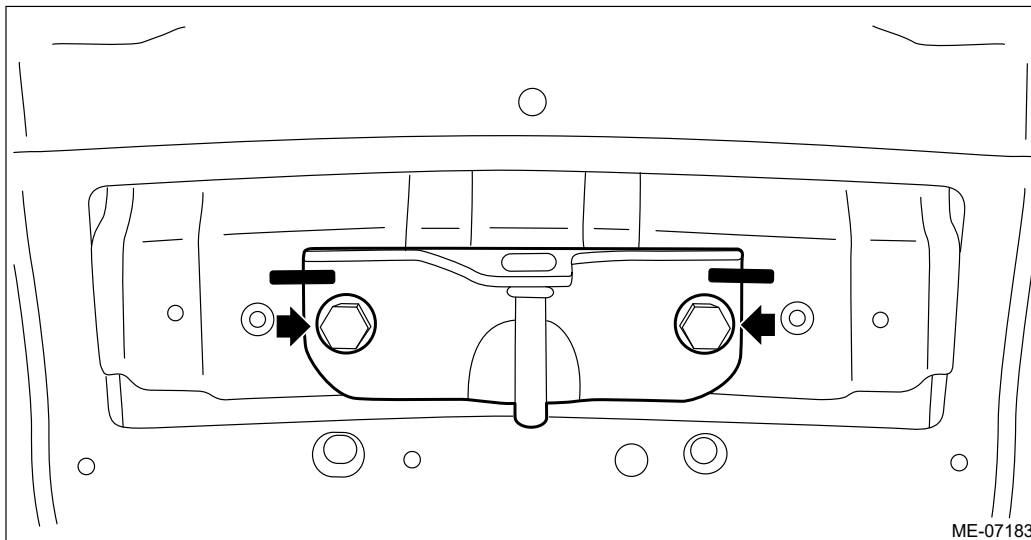
6. Remove the liquid gasket from the oil pan and the oil pan upper.

• TURBO MODEL

1. Remove the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>REMOVAL > FRONT GRILLE UPPER.](#)
2. Using a marker pen, make alignment marks (A) on both the front hood and the front hood striker.



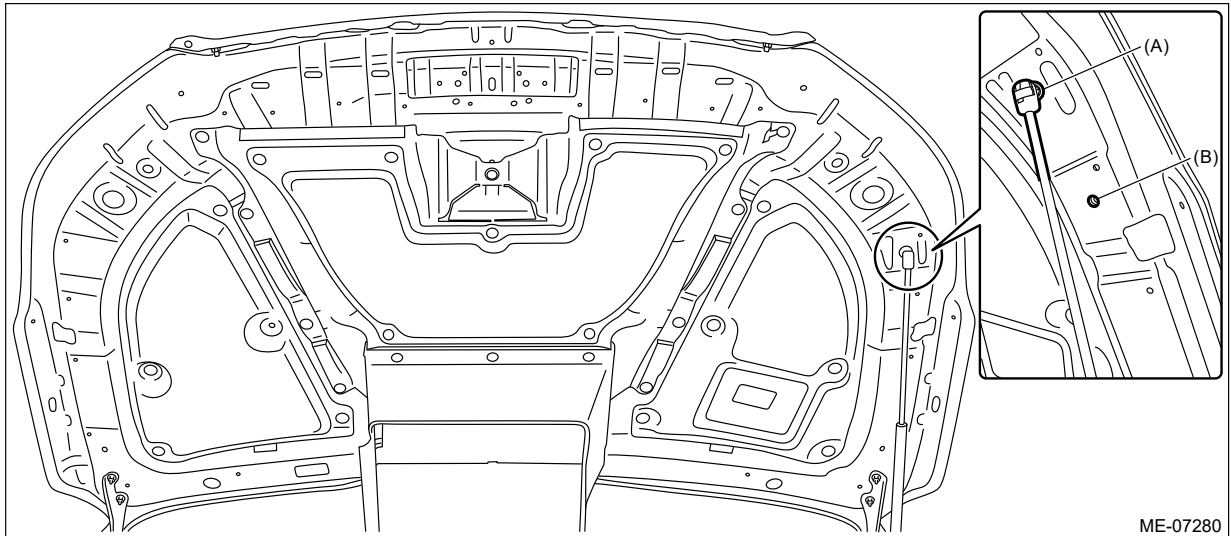
- 3.** Remove the front hood striker from the front hood.



- 4.** Change the front hood damper mounting position from (A) to (B), and completely open the front hood.

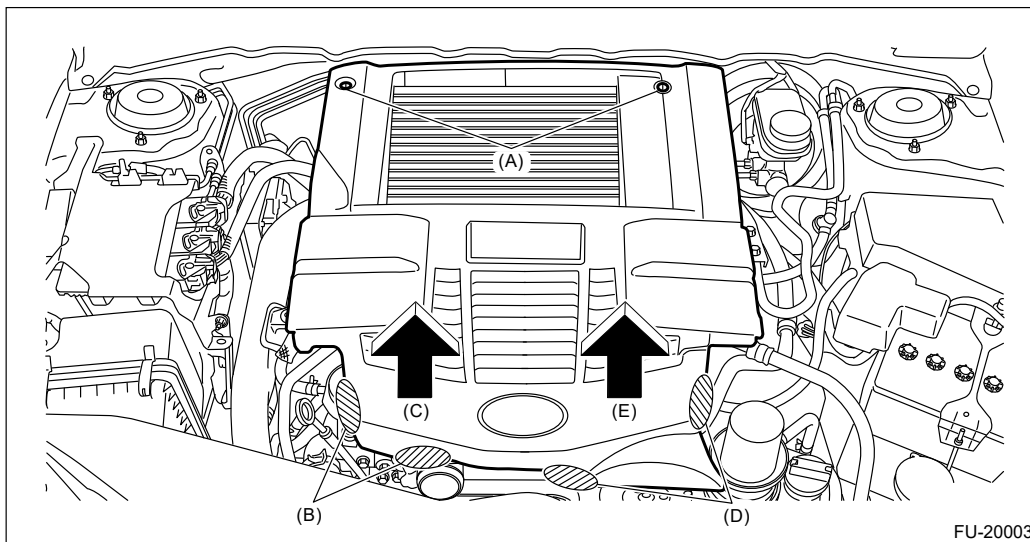
Tightening torque:

20 N·m (2.0 kgf-m, 14.8 ft-lb)

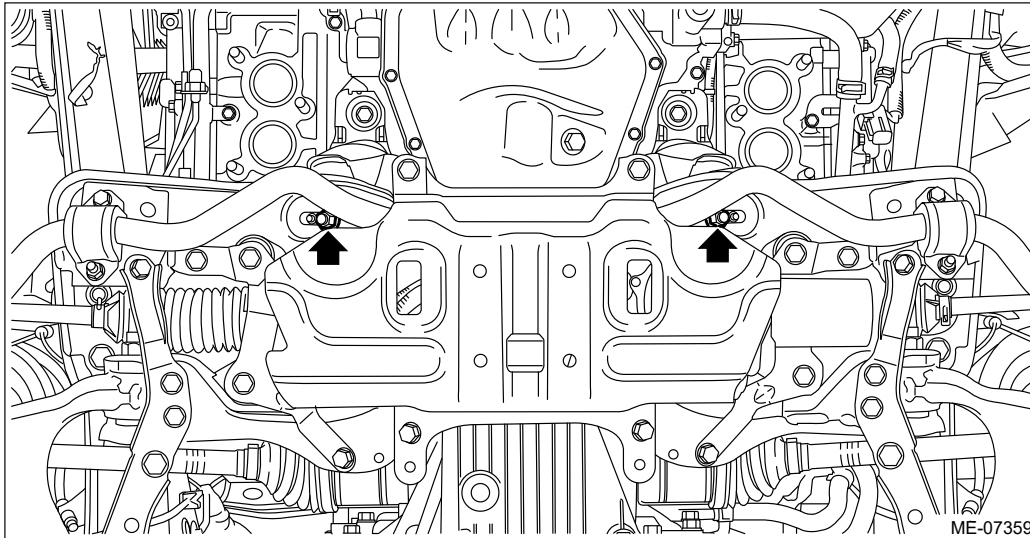


5. Remove the collector cover.


- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



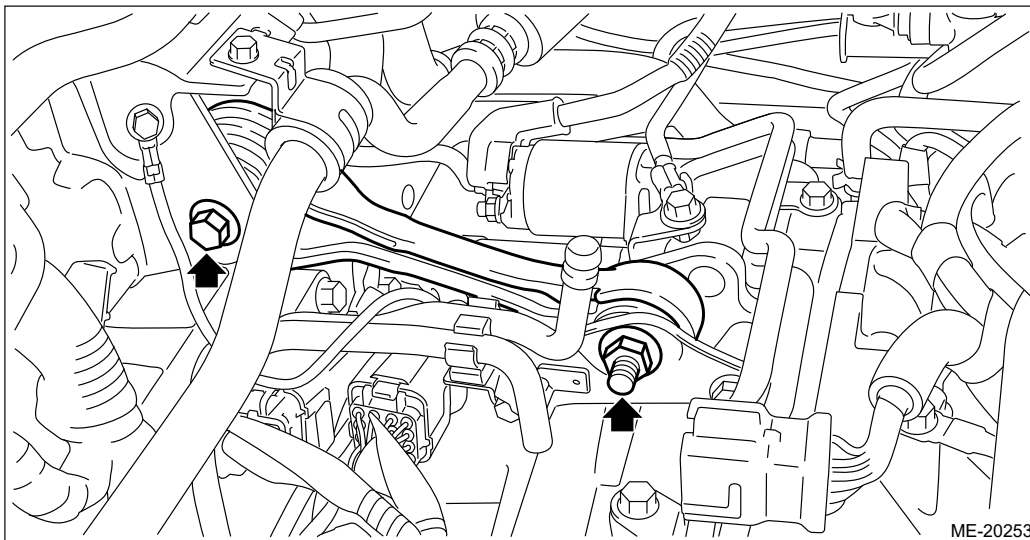
- 6.** Disconnect the ground cable from battery. [🔧 Ref. to NOTE>NOTE > BATTERY.](#)
- 7.** Remove the air intake duct (rear). [🔧 Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
- 8.** Drain engine coolant. [🔧 Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > DRAINING OF ENGINE COOLANT.](#)
- 9.** Drain the engine oil. [🔧 Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 10.** Remove the front exhaust pipe. [🔧 Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>REMOVAL.](#)
- 11.** Remove the nuts which secure the engine mounting to the front crossmember.



12. Lower the vehicle.

13. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)

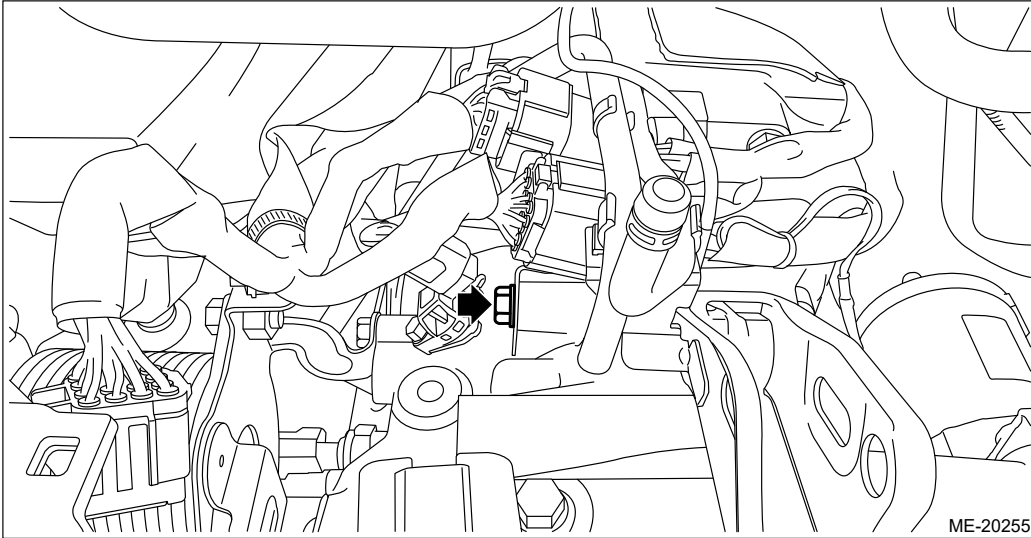
14. Remove the pitching stopper.



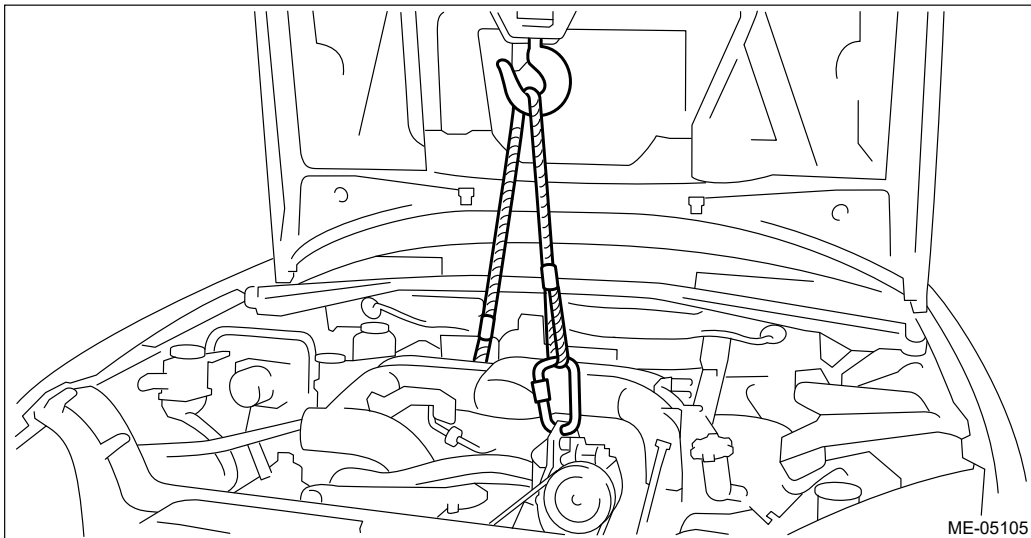
15. Remove the bolt securing the transmission harness stay to the CVT.

Note:

This procedure is required to prevent the transmission connector from touching the A/C pressure hose during engine lift-up.



- 16.** Support the engine with a lifting device and wire ropes.



- 17.** Lift the engine high enough until the stud bolt of the engine mount is drawn out of the front crossmember.

Caution:

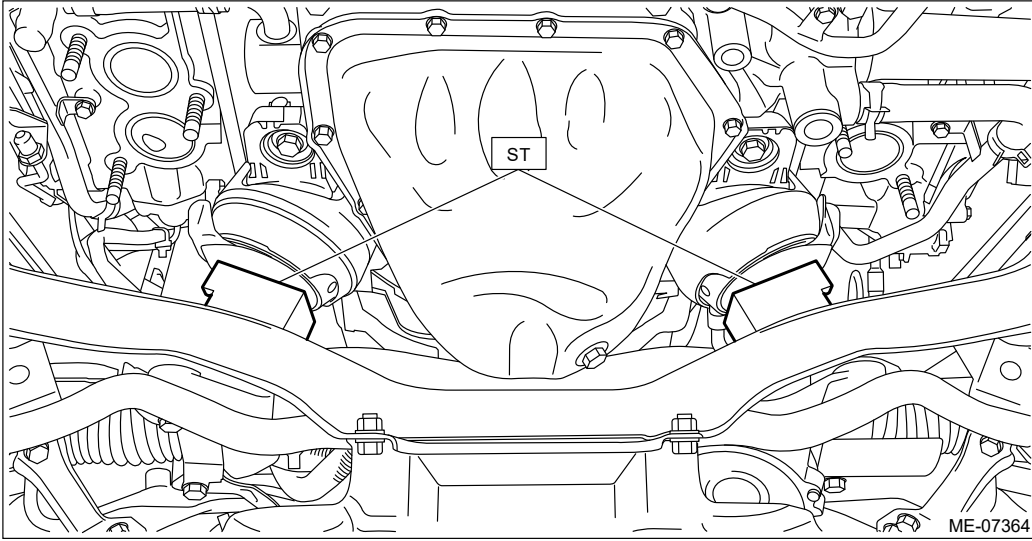
When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.

- 18.** Set the ST between the engine mount and front crossmember, and slowly lower the engine.

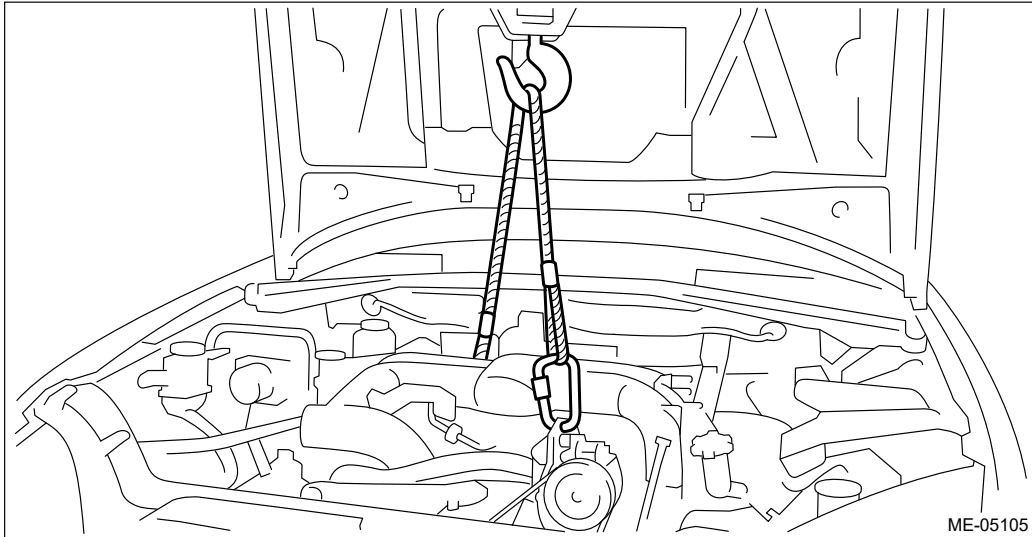
Caution:

After lowering the engine, check that the ST does not come off even if the engine is bounced.

ST 18632AA020 STAND ASSY

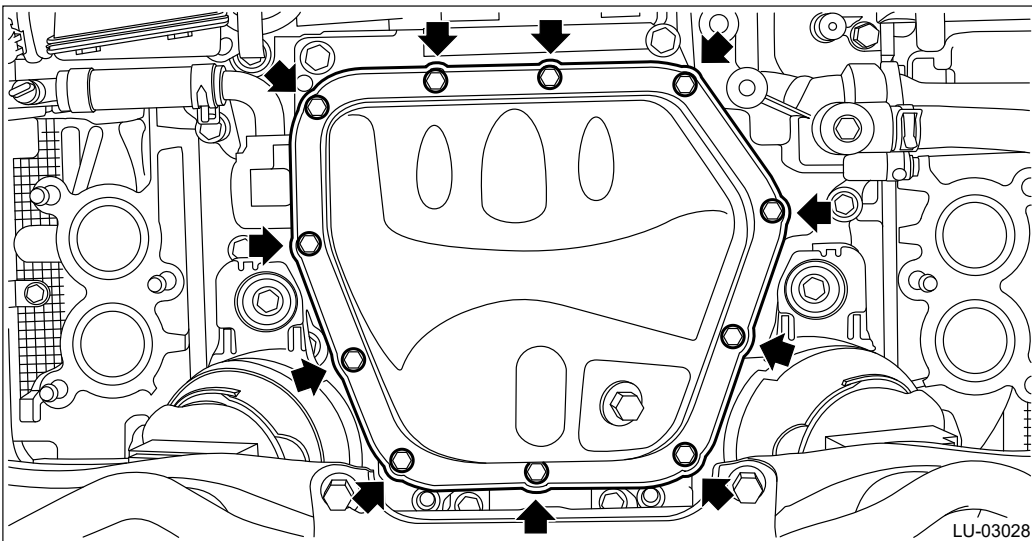


19. Remove the lifting device and wire ropes.



20. Lift up the vehicle.

21. Remove the bolts which secure oil pan to oil pan upper.



22. Insert an oil pan cutter blade into the gap between oil pan upper and oil pan, and remove the oil pan.

Caution:

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

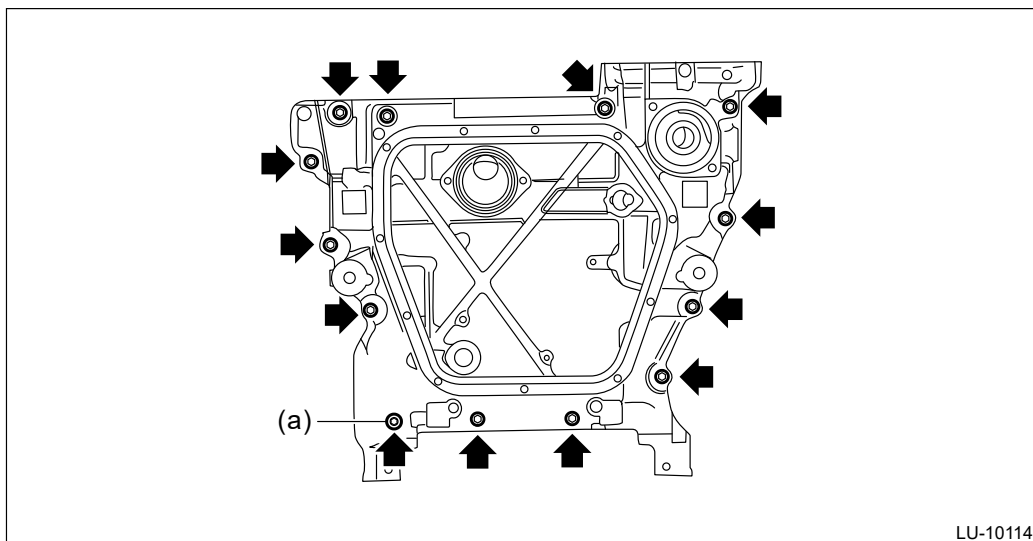
23. Remove the liquid gasket from the oil pan and the oil pan upper.

2. OIL PAN UPPER

1. Remove the engine from the vehicle. [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>REMOVAL.](#)
2. Remove the water pump. [Ref. to COOLING\(H4DO\)>Water Pump>REMOVAL.](#)
3. Remove the thermostat cover. [Ref. to COOLING\(H4DO\)>Thermostat>REMOVAL.](#)
4. Remove the water pipe assembly. [Ref. to COOLING\(H4DO\)>Water Pipe Assembly>REMOVAL.](#)
5. Remove the chain cover. [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
6. Remove the oil pan. [Ref. to LUBRICATION\(H4DO\)>Oil Pan>REMOVAL.](#)
7. Remove the oil level switch. [Ref. to LUBRICATION\(H4DO\)>Oil Level Switch>REMOVAL.](#)
8. Remove the bolts which secure oil pan upper to cylinder block, and remove the oil pan upper.

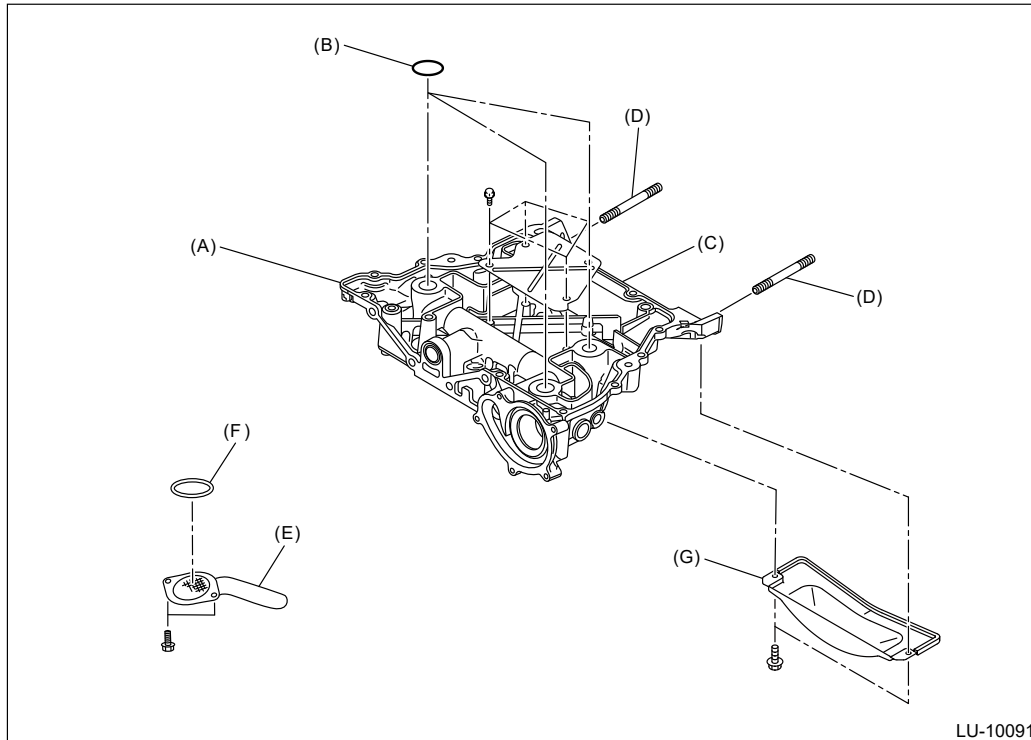
Note:

Remove the bolt (a) shown in the figure using TORX® bit T45.



LU-10114

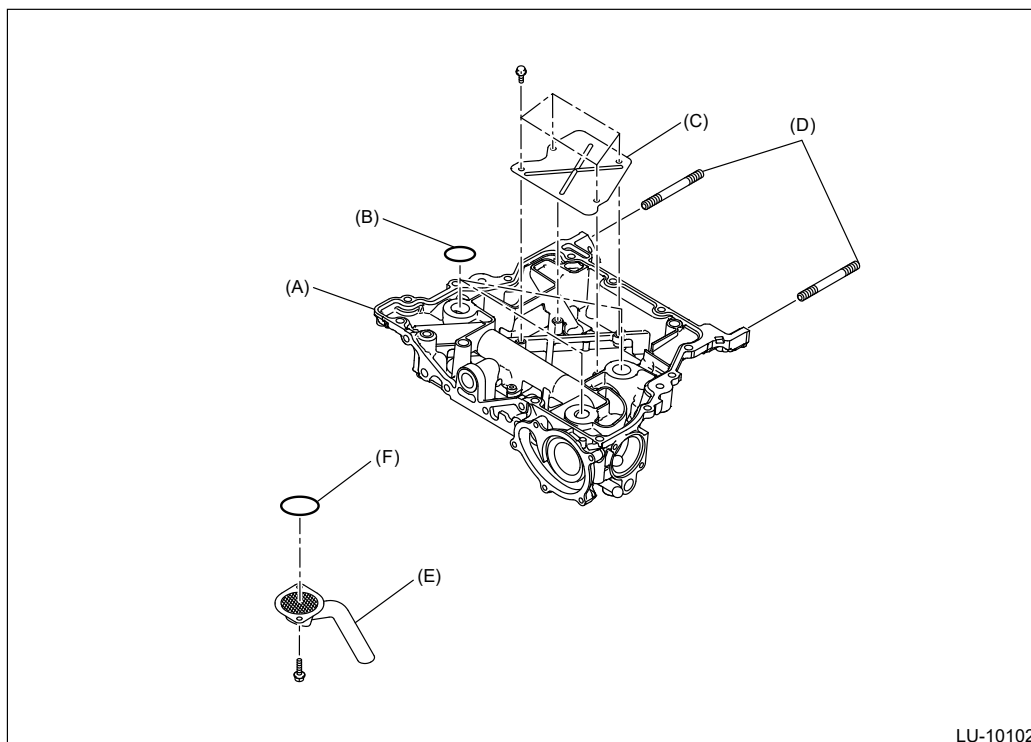
9. Remove the baffle plate from the oil pan upper.
10. Remove the oil strainer from the oil pan upper.
11. Remove stud bolts from the oil pan upper.
12. Remove the clutch housing cover from the oil pan upper. (MT model)
13. Remove the O-ring from the cylinder block.
 - Non-turbo model



LU-10091

- | | | |
|-------------------------------------|------------------|------------------|
| (A) Oil pan upper | (B) O-ring | (C) Baffle plate |
| (D) Stud bolt | (E) Oil strainer | (F) O-ring |
| (G) Clutch housing cover (MT model) | | |

- Turbo model



LU-10102

- | | | |
|-------------------|------------------|------------------|
| (A) Oil pan upper | (B) O-ring | (C) Baffle plate |
| (D) Stud bolt | (E) Oil strainer | (F) O-ring |

14. Remove the liquid gasket from oil pan upper and cylinder block.

LUBRICATION(H4DO) > Oil Pipe

INSPECTION

- 1.** Check that the oil pipe assembly, oil pipes, and the union bolts have no deformation, cracks and other damages.
- 2.** Check that there are no oil leaks or oil oozing from the areas where the oil pipe assembly and oil pipes are installed.

INSTALLATION

1. OIL PIPE ASSEMBLY

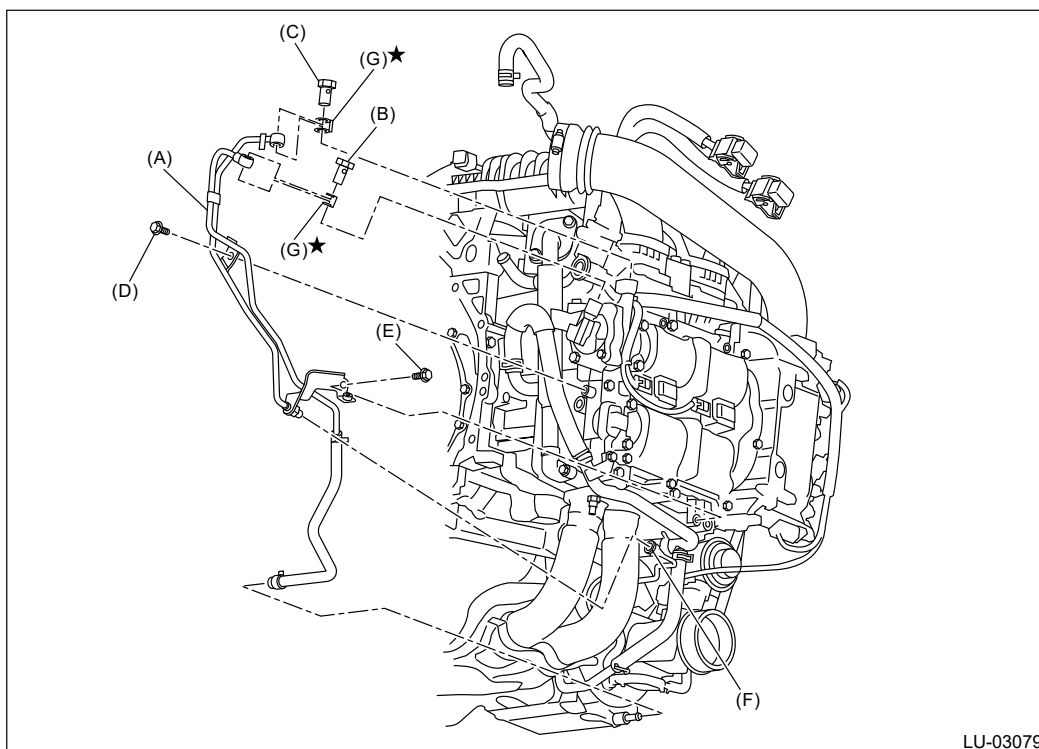
1. Temporarily install the oil pipe assembly.

- (1) Temporarily tighten the union bolts (B) and (C) which secure the oil pipe assembly (A) to the scavenge pump and the intake rear camshaft cap RH.

Note:

Use a new gasket.

- (2) Temporarily tighten the bolts (D) and (E) which secure the oil pipe assembly (A) to the cam carrier RH.
- (3) Temporarily tighten the union screw pipe assembly (F) to the oil pipe assembly (A).



LU-03079

(A) Oil pipe ASSY

(B) Union bolt

(C) Union bolt

(D) BOLT

(E) BOLT

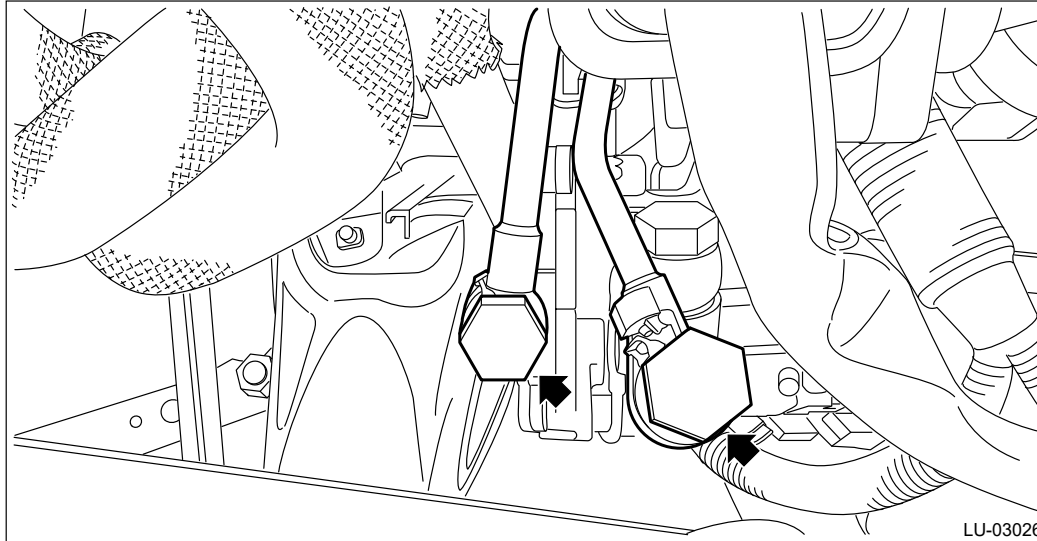
(F) Union screw pipe ASSY

(G) Gasket

2. Tighten the union bolts which secure the oil pipe assembly to the scavenge pump and the intake rear camshaft cap RH.

Tightening torque:

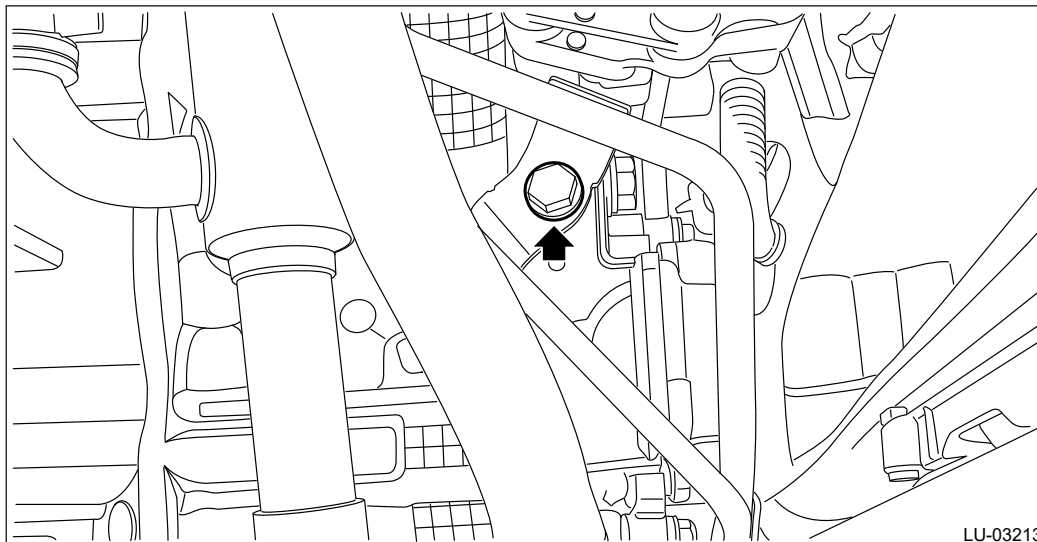
31.5 N·m (3.2 kgf-m, 23.2 ft-lb)



3. Lift up the vehicle.
4. Tighten the bolt which secures the oil pipe assembly to the cam carrier RH.

Tightening torque:

6.8 N·m (0.7 kgf-m, 5.0 ft-lb)



5. Tighten the union screw pipe assembly to the oil pipe assembly, and tighten the oil pipe assembly mounting bolts.

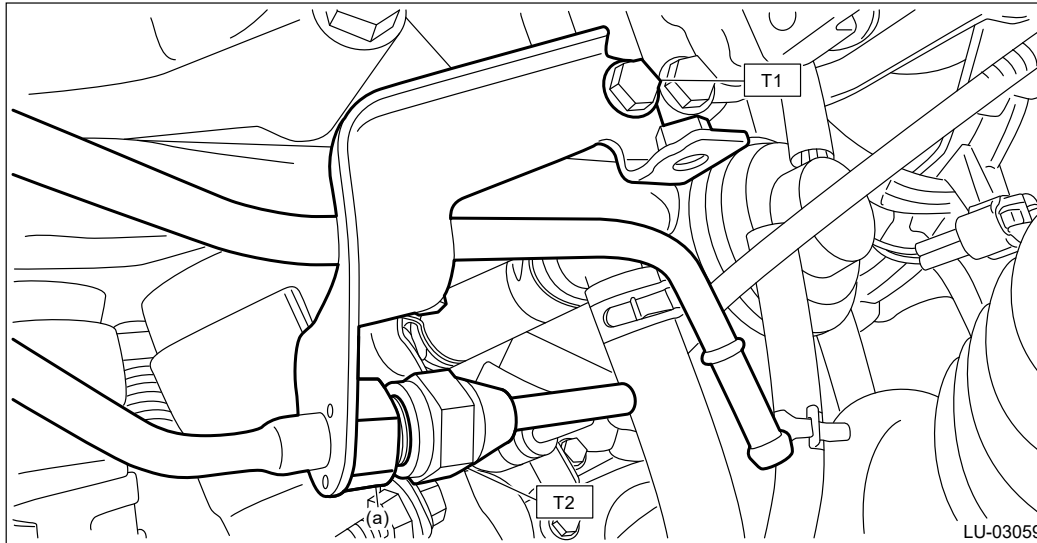
Caution:

In order to prevent damaging the oil pipe assembly, fix the section (a) shown in the figure when tightening the flare nut on the union screw pipe assembly, and avoid the part from rotating together while tightening the nut.

Tightening torque:

T1: 6.8 N·m (0.7 kgf-m, 5.0 ft-lb)

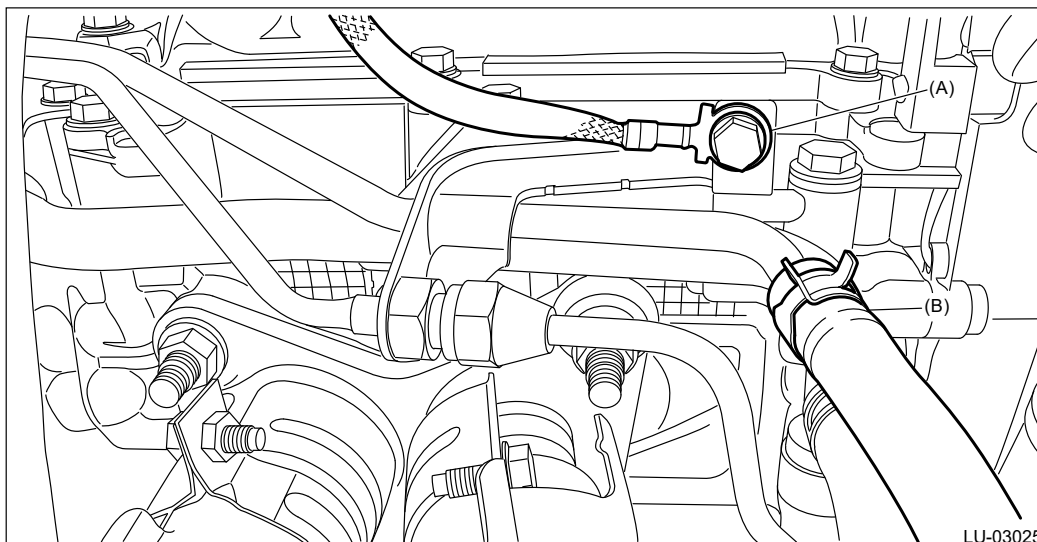
T2: 20 N·m (2.0 kgf-m, 14.8 ft-lb)






- 6.** Connect the oil outlet hose (B) to the oil pipe assembly, and install the ground cable (A) to the oil pipe assembly.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



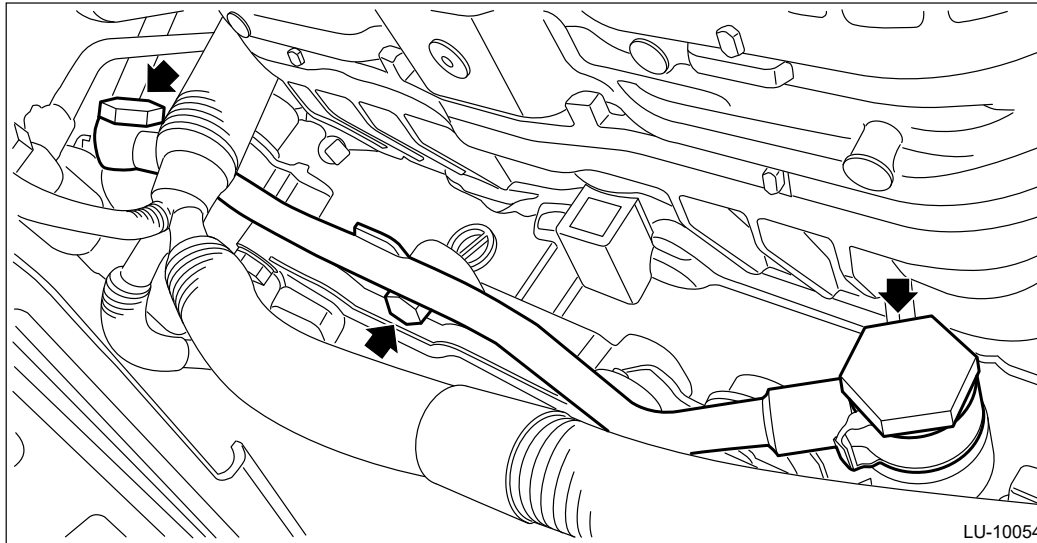
- 7.** Lower the vehicle.
- 8.** Install the intake duct No. 2.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>INSTALLATION > INTAKE DUCT NO. 2.](#)
- 9.** After installing, check the engine oil level and replenish it if necessary.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>INSPECTION.](#)
- 10.** Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 11.** Install the collector cover.

2. OIL PIPE

- 1.** Temporarily tighten the union bolts and bolt which secure the oil pipe to the intake rear camshaft cap RH and the cam carrier RH.

Note:

Use a new gasket.



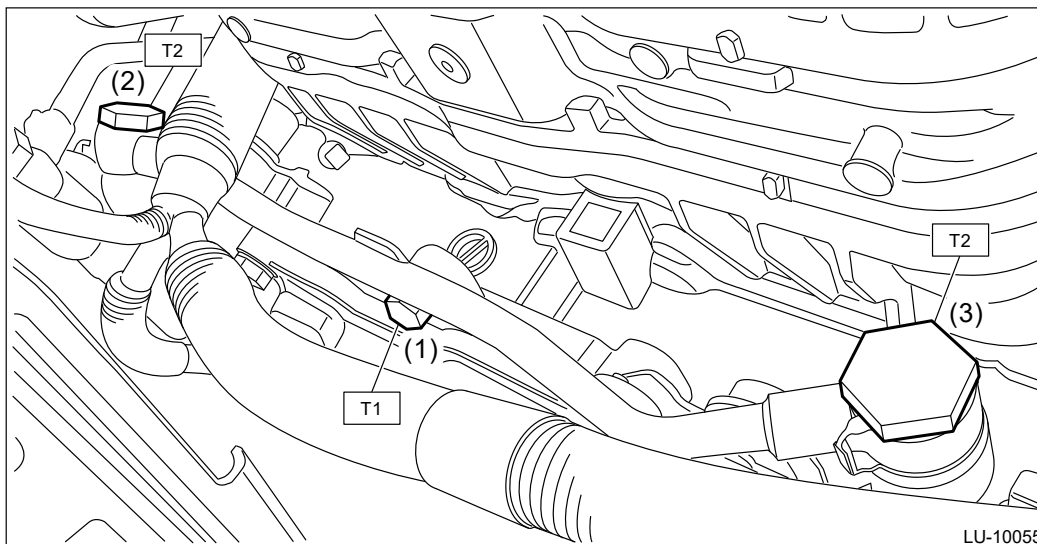
LU-10054

2. Tighten the union bolts and bolt in the numerical order as shown in the figure.



Tightening torque:

T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

T2: 31 N·m (3.2 kgf-m, 22.9 ft-lb)



LU-10055

3. Install the intake duct No. 2.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>INSTALLATION > INTAKE DUCT NO. 2.](#)
4. After installing, check the engine oil level and replenish it if necessary.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil>INSPECTION.](#)
5. Install the collector cover.

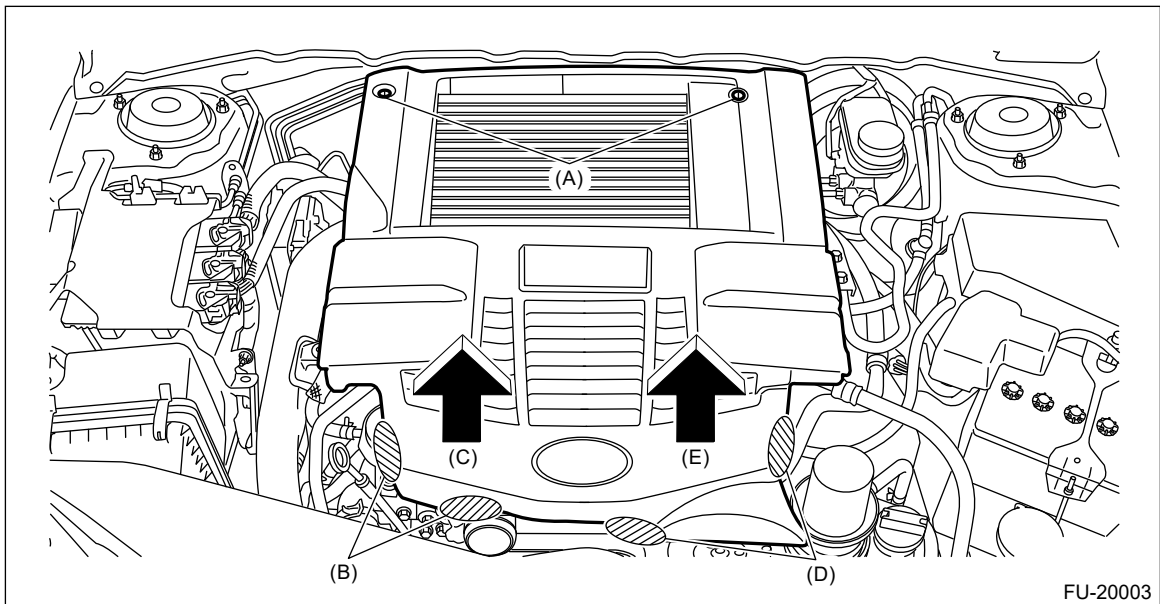
REMOVAL




Note:

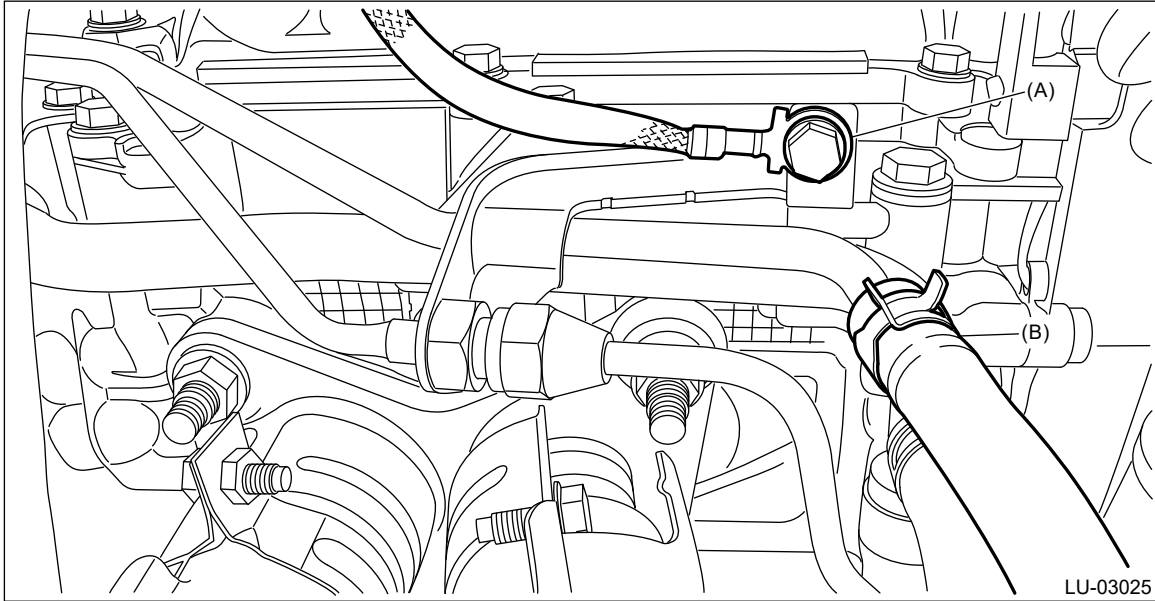
Turbo model is equipped with the oil pump assembly and oil pipe.

1. OIL PIPE ASSEMBLY

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



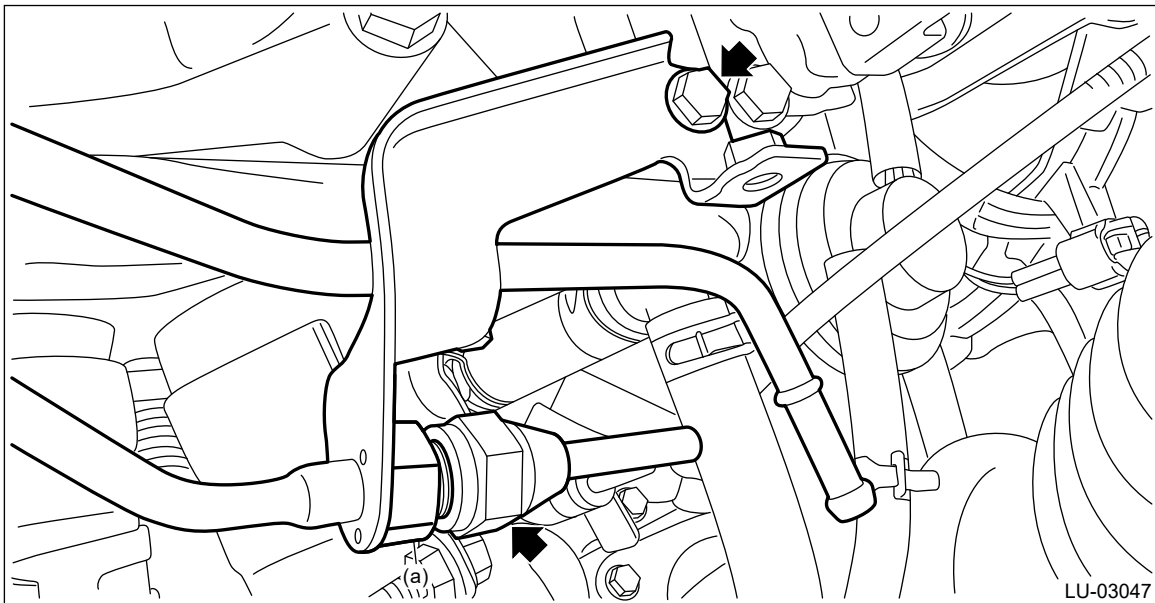
2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Remove the intake duct No. 2.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 2.](#)
4. Lift up the vehicle.
5. Remove the under cover.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Under Cover>REMOVAL.](#)
6. Remove the ground cable (A) from the oil pipe assembly, and disconnect the oil outlet hose (B) from the oil pipe assembly.



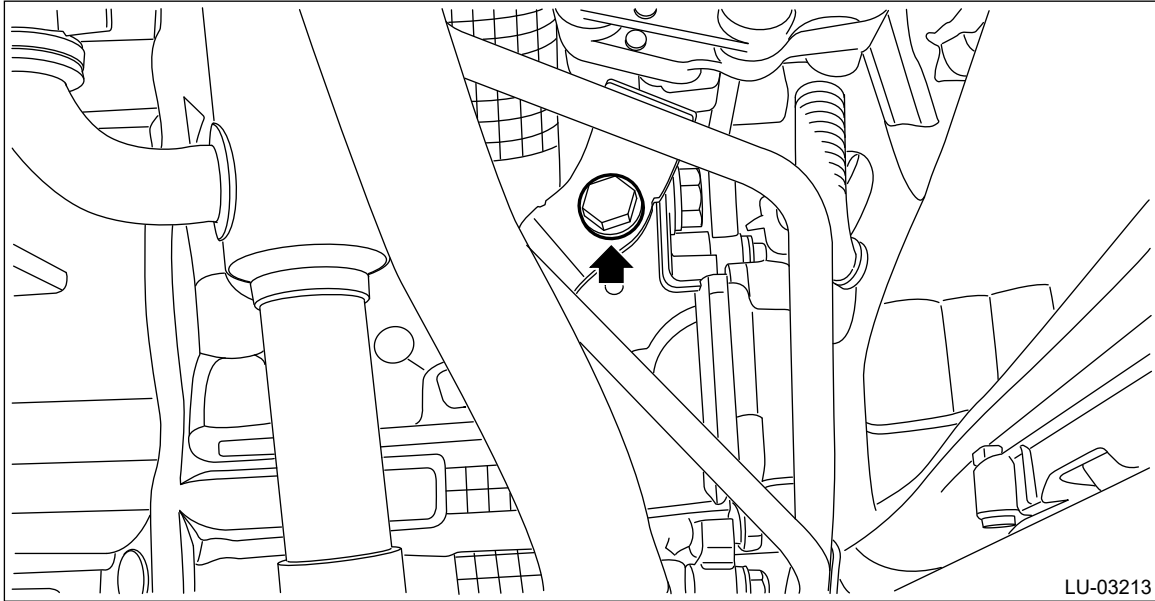
7. Disconnect the union screw pipe assembly from the oil pipe assembly, and remove the bolt which holds the oil pipe assembly.

Caution:

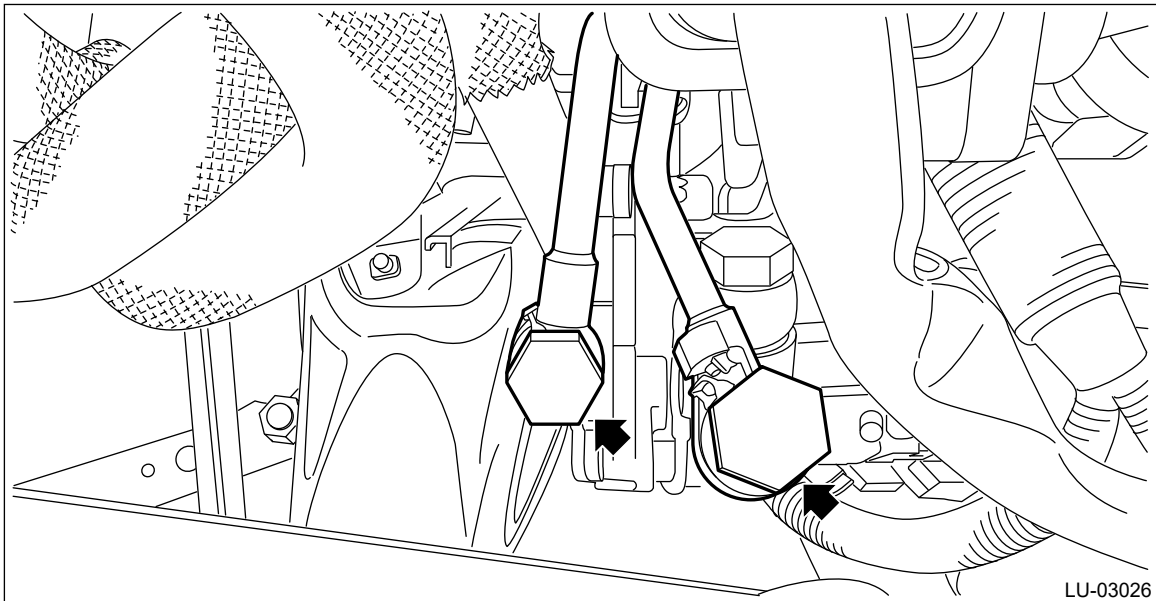
In order to prevent damaging the oil pipe assembly, fix the section (a) shown in the figure when loosening the flare nut on the union screw pipe assembly, and avoid the part from rotating together while loosening the nut.



8. Remove the bolt which secures the oil pipe assembly to the cam carrier RH.

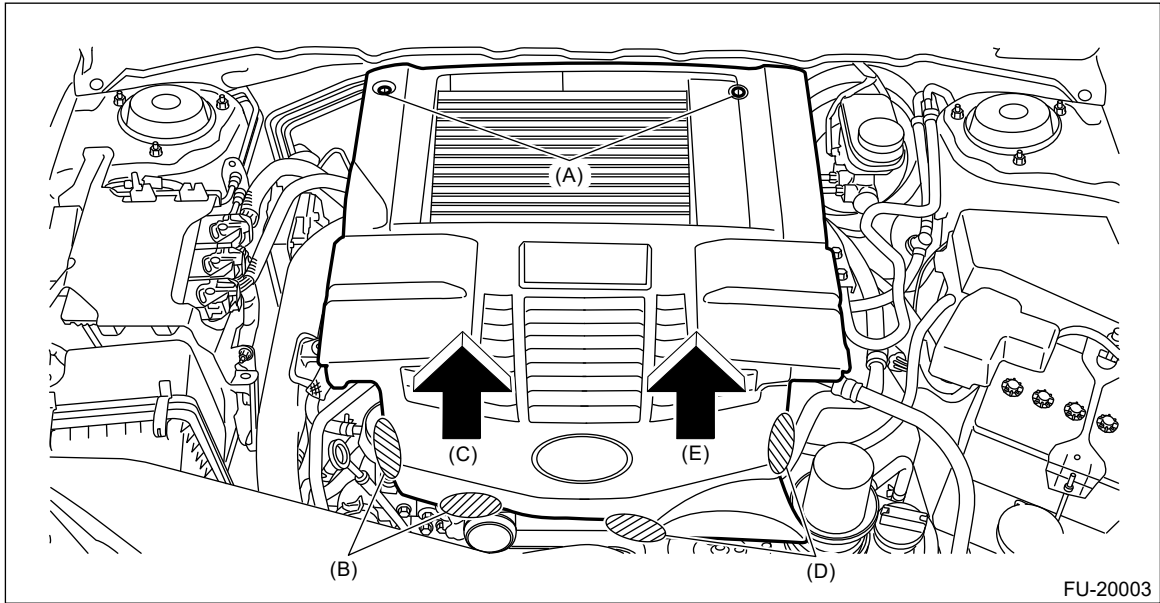



9. Lower the vehicle.
10. Remove the union bolts which secure the oil pipe assembly from the scavenge pump and the intake rear camshaft cap RH, and remove the oil pipe assembly.

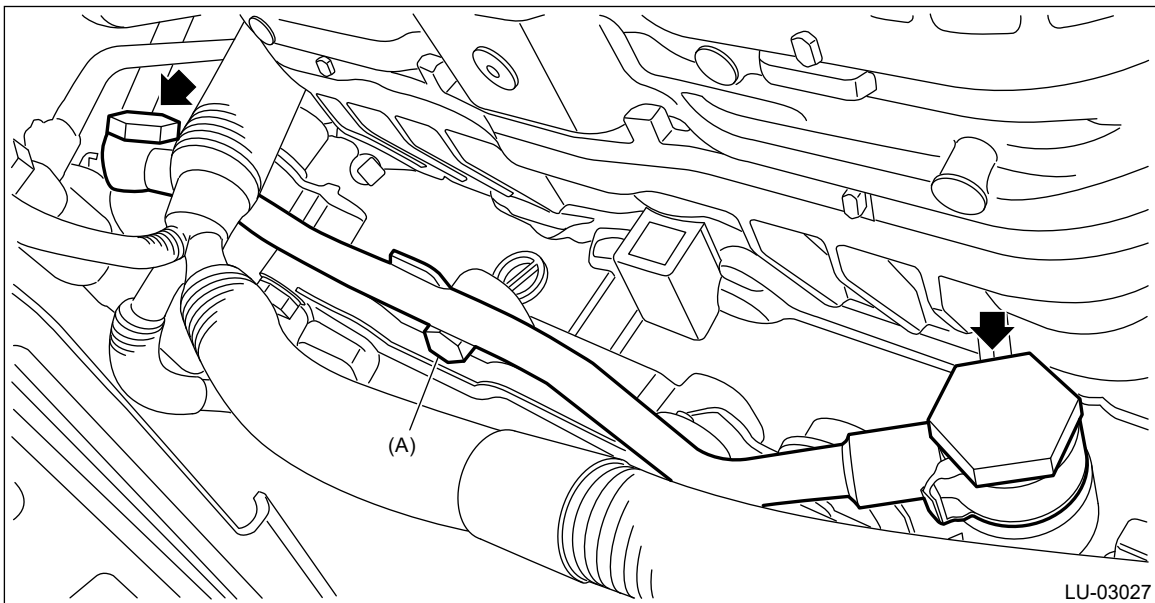


2. OIL PIPE

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Remove the intake duct No. 2.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 2.](#)
3. Remove the bolt (A) which secures the oil pipe to the cam carrier RH. Remove the union bolts which secure the oil pipe from the intake rear camshaft cap RH and the cam carrier RH.



LUBRICATION(H4DO) > Oil Pressure Switch

INSPECTION

- 1.** Check that the oil pressure switch does not have deformation, cracks or damage.
- 2.** Check the oil pressure switch installation portion for oil leakage and oil seepage.

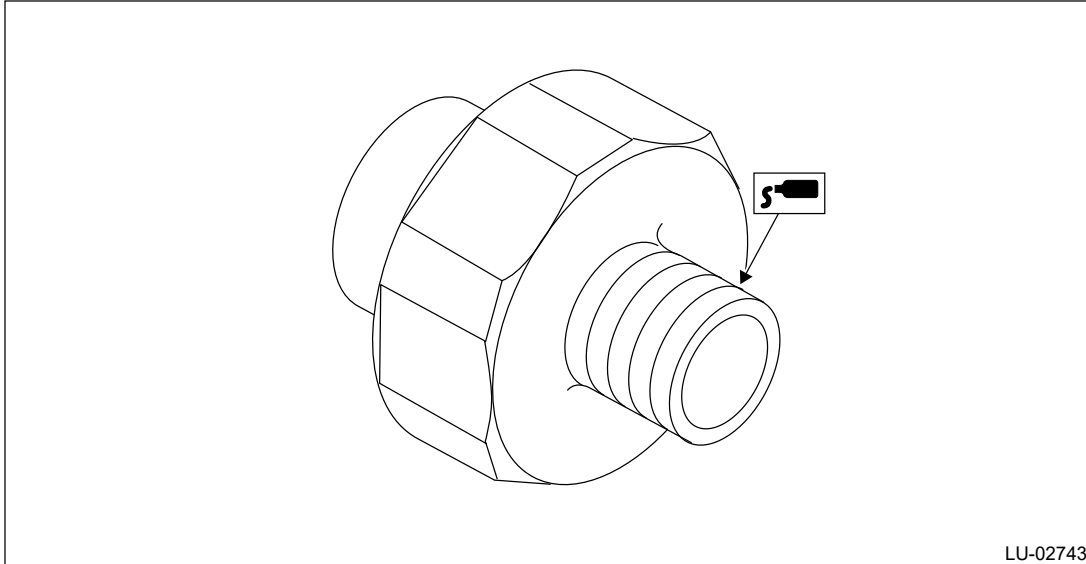
LUBRICATION(H4DO) > Oil Pressure Switch

INSTALLATION

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

Liquid gasket:

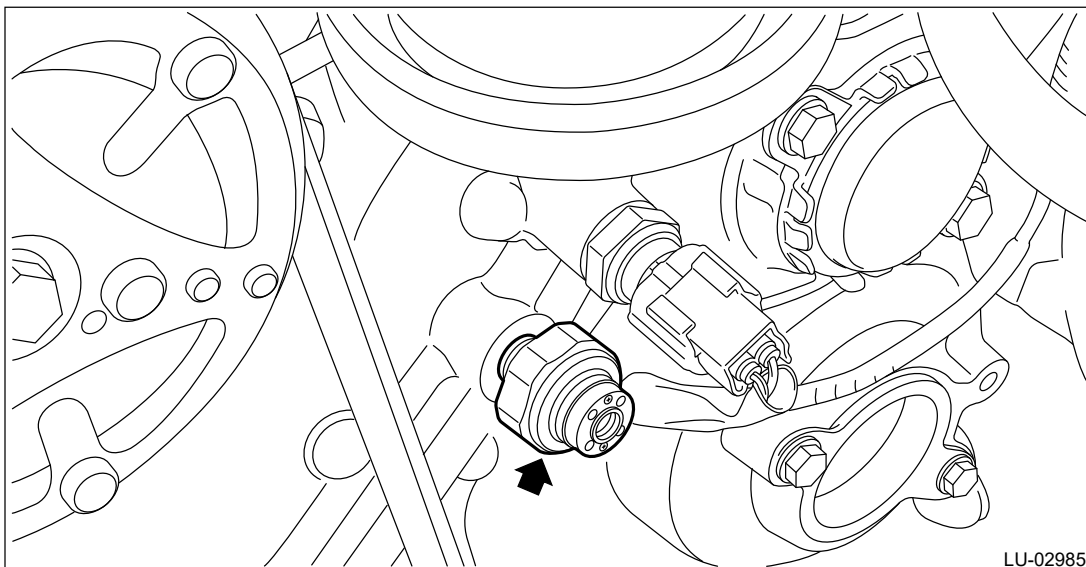
THREE BOND 1324 (Part No. 004403042) or equivalent



2. Install the oil pressure switch to the chain cover.

Tightening torque:

18 N•m (1.8 kgf-m, 13.3 ft-lb)



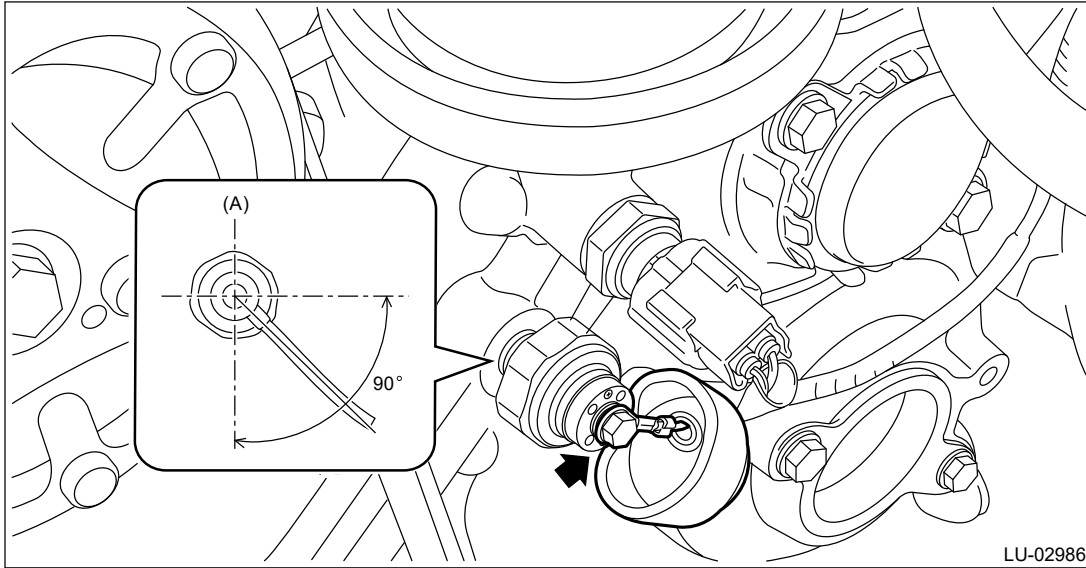
3. Connect the terminal to the oil pressure switch.

Note:

The oil pressure switch harness must be tightened within the range of a 90° angle as shown below.

Tightening torque:

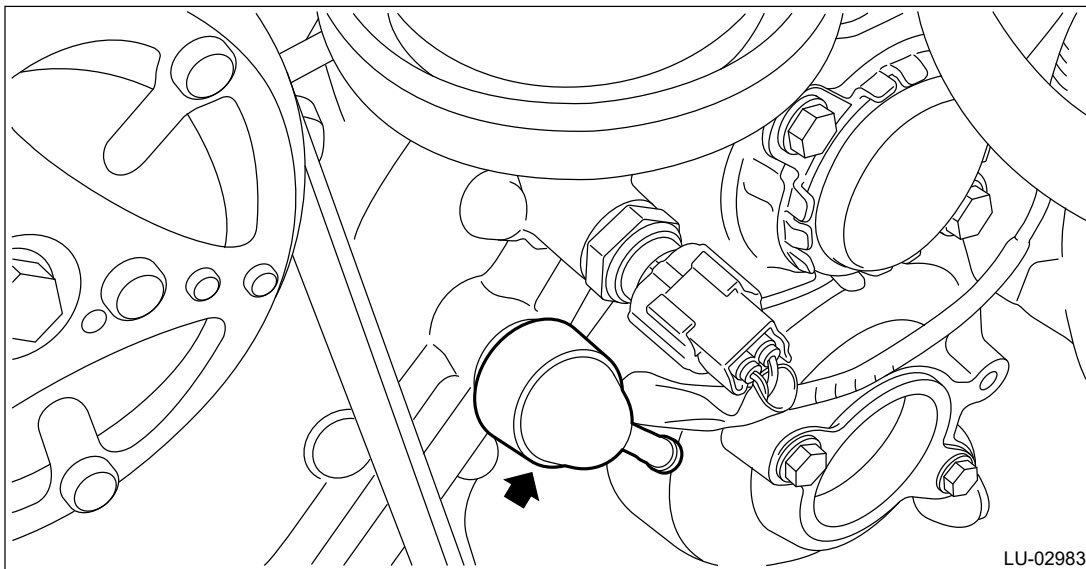
1.5 N•m (0.2 kgf-m, 1.1 ft-lb)




LU-02986

(A) Upper side of the engine

4. Attach the rubber cap.



LU-02983

5. Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)

LUBRICATION(H4DO) > Oil Pressure Switch

REMOVAL

Caution:

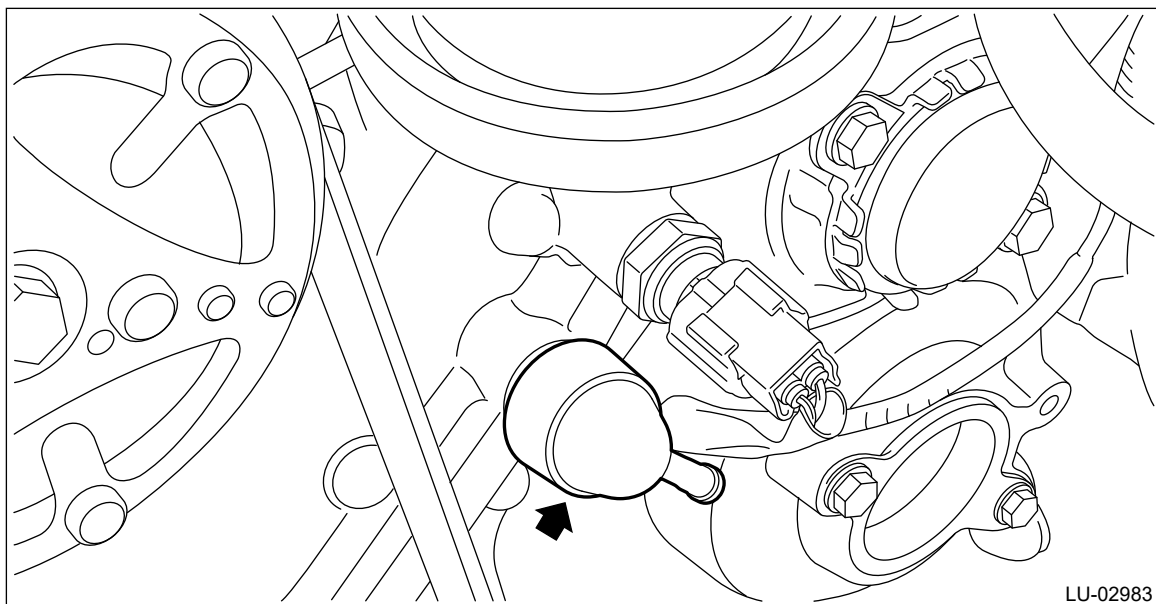
If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)

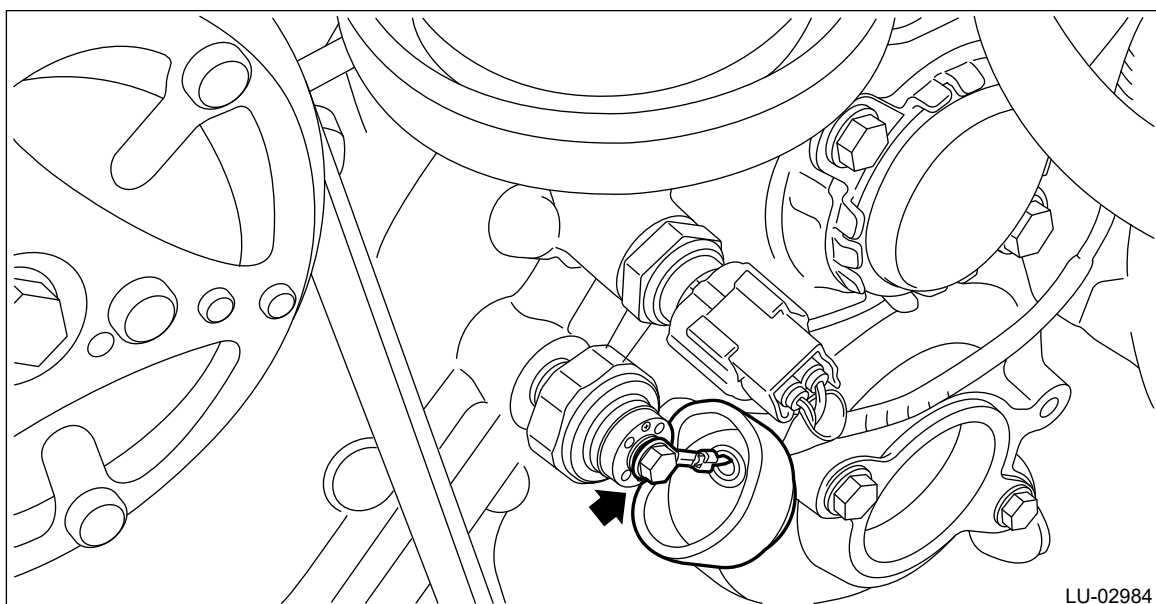
Note:

For model with battery sensor, disconnect the ground terminal from battery sensor.

2. Remove the rubber cap.



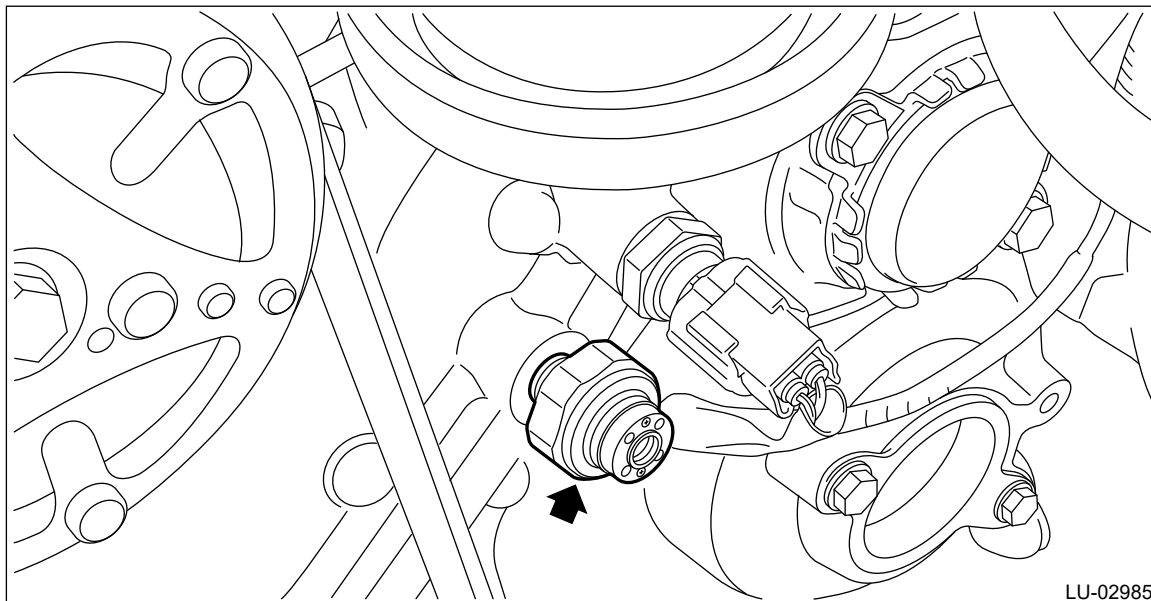
3. Disconnect the terminal from oil pressure switch.



4. Remove the oil pressure switch.

Caution:

Catch the engine oil using cloth to prevent it from splashing.



INSPECTION

1. CHECK ENGINE OIL AMOUNT.

Is the engine oil amount normal? [Ref. to LUBRICATION\(H4DO\)>Engine Oil>INSPECTION.](#)

Yes

[Go to 2.](#)

No

Adjust the engine oil amount. [Ref. to LUBRICATION\(H4DO\)>Engine Oil>INSPECTION.](#)

After the operation is complete, go to the next step. [Go to 2.](#)

2. CHECK DTC.

Is DTC for engine displayed? [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Read Diagnostic Trouble Code \(DTC\).](#) [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Read Diagnostic Trouble Code \(DTC\).](#)

Yes

Check the appropriate DTC using the "List of Diagnostic Trouble Code (DTC)".

[Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Read Diagnostic Trouble Code \(DTC\).](#) [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>List of Diagnostic Trouble Code \(DTC\).](#)

No

[Go to 3.](#)

3. CHECK POWER SUPPLY TO OIL PRESSURE SWITCH.

1. Turn the ignition switch to OFF.
2. Disconnect the terminal from oil pressure switch.
3. Turn the ignition switch to ON (engine OFF).
4. Measure the voltage of harness between oil pressure switch harness terminal and chassis ground.

Terminals

(E11) No. 1 (+) — Chassis ground (-):


Is the voltage 10 V or more?

Yes


Replace the oil pressure switch. [Ref. to LUBRICATION\(H4DO\)>Oil](#)

[Pressure Switch.](#)

No

 [Go to 4.](#)

4. CHECK COMBINATION METER.

Perform the self-diagnosis of combination meter to check if there are any faults in the combination meter.  [Ref. to INSTRUMENTATION/DRIVER INFO>Combination Meter System>OPERATION.](#)

Is combination meter OK?

Yes


repair the harness and connector.

Note:

In this case, repair the following item:

- **Open circuit or short circuit of harness between combination meter and oil pressure switch**
- **Poor contact of combination meter connector**
- **Poor contact of oil pressure switch terminal**
- **Poor contact of coupling connector**

No

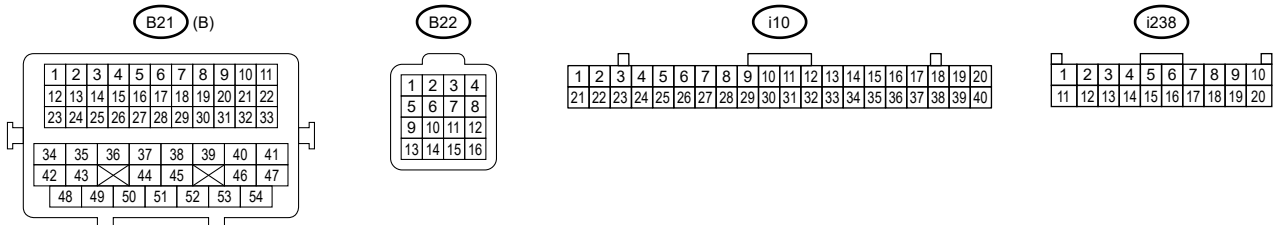
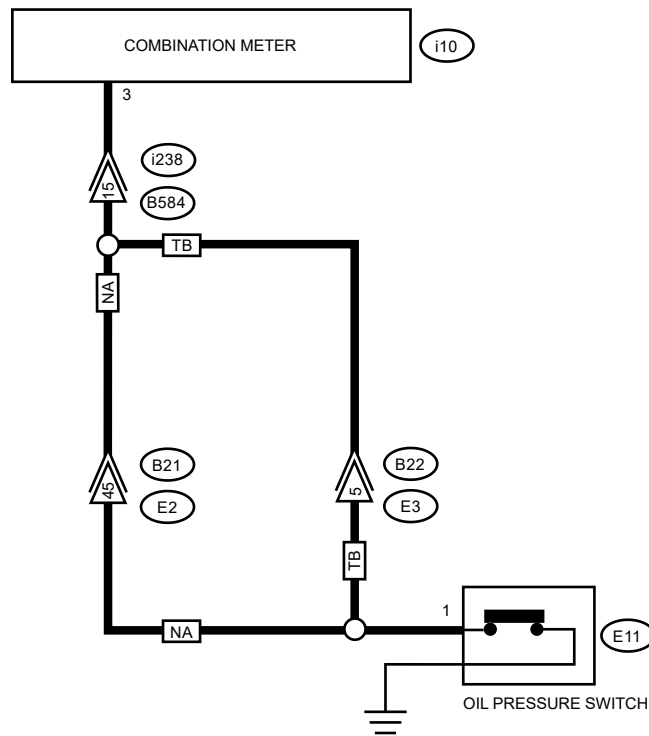
Repair or replace the combination meter.  [Ref. to INSTRUMENTATION/DRIVER INFO>Combination Meter System>INSPECTION.](#)

LUBRICATION(H4DO) > Oil Pressure System

WIRING DIAGRAM

Oil pressure warning system  [Ref. to WIRING SYSTEM>Oil Pressure Warning Light System>WIRING DIAGRAM.](#)





| | |
|----|-------------------|
| NA | : NON-TURBO MODEL |
| TB | : TURBO MODEL |



LUBRICATION(H4DO) > Oil Pump

SPECIFICATION

The oil pump cannot be disassembled.

Refer to "Chain Cover" for removal and installation procedures.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)

LUBRICATION(H4DO) > Scavenge Pump

INSPECTION

- 1.** Check that the scavenge hose has no deformation, cracks or other damages.
- 2.** Check that the scavenge pump has no crack, damage, or looseness.

LUBRICATION(H4DO) > Scavenge Pump

INSTALLATION

Install in the reverse order of removal.

Caution:

Do not start applying the gasket in the (a) range shown in the figure.

Note:

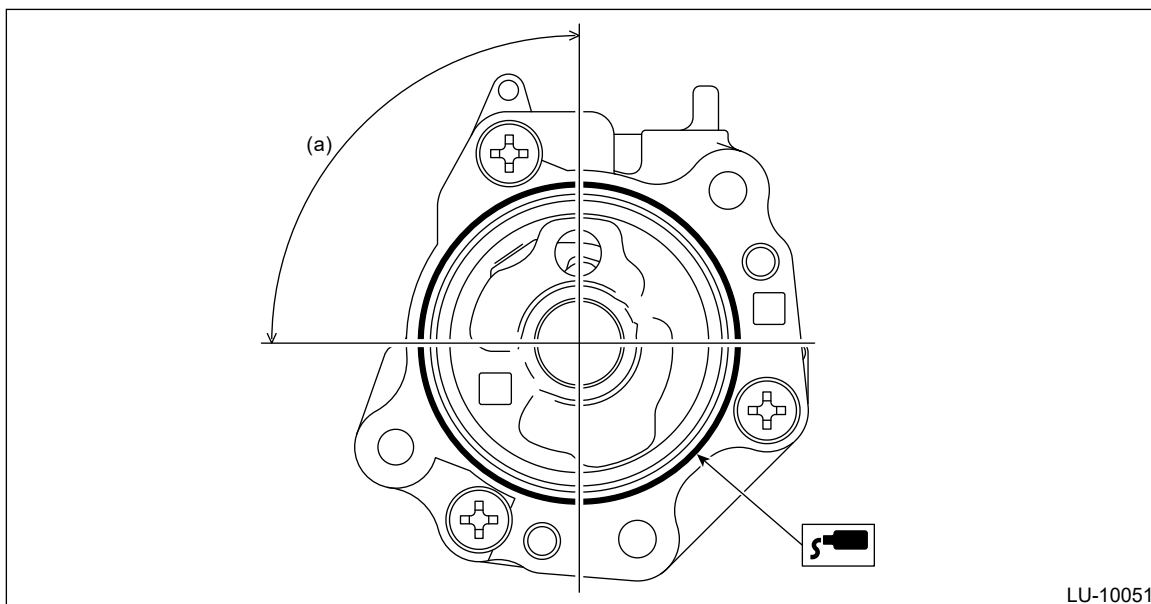
- Before applying liquid gasket, degrease the liquid gasket seal surface of the scavenge pump, intake rear camshaft cap RH, and cam carrier RH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3±1 mm (0.1181±0.0394 in)



Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

LUBRICATION(H4DO) > Scavenge Pump


REMOVAL

Caution:

If engine oil is spilt onto the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

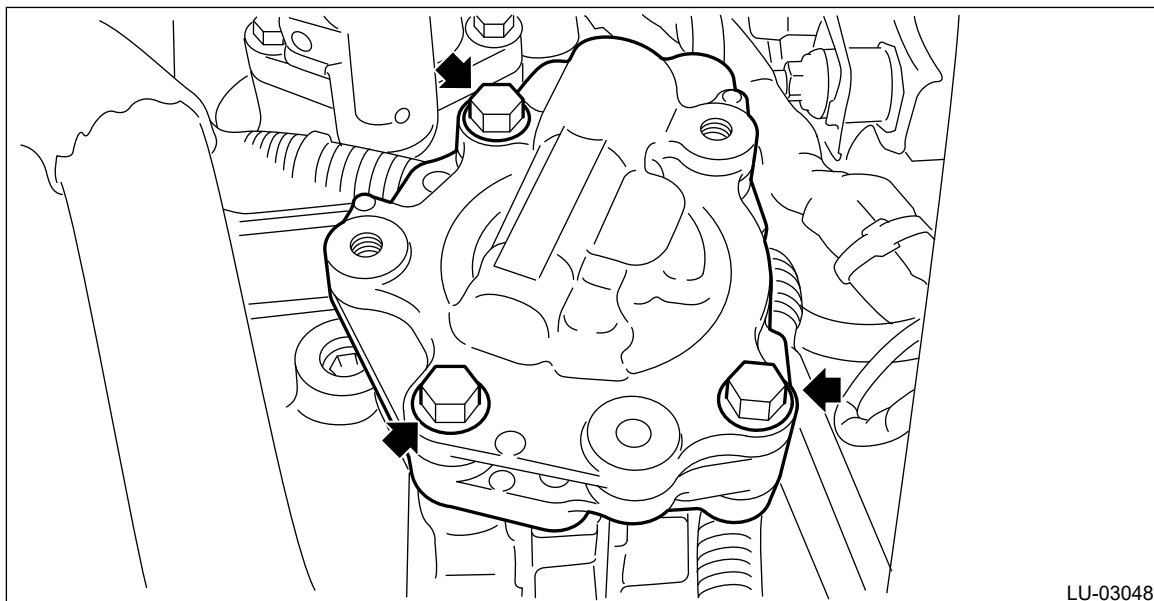
Note:

The scavenge pump is installed on turbo models.

1. Remove the oil pipe assembly.  [Ref. to LUBRICATION\(H4DO\)>Oil Pipe>REMOVAL > OIL PIPE ASSEMBLY.](#)
2. Remove the bolts which secure the scavenge pump to the intake rear camshaft cap RH and the cam carrier RH. Using a flat tip screwdriver or similar tool wrapped with protective tape, remove the scavenge pump.

Caution:


Be careful not to damage the mating surfaces of the cylinder head and scavenge pump.



3. Remove the liquid gasket from the scavenge pump, intake rear camshaft cap RH, and cam carrier RH.

LUBRICATION(H4DOTC) > General Description

SPECIFICATION

Specifications for the turbo model are included in the LU (H4DO) section.  [Ref. to LUBRICATION\(H4DO\)>General Description.](#)

ASSEMBLY

1. CAM CARRIER RH

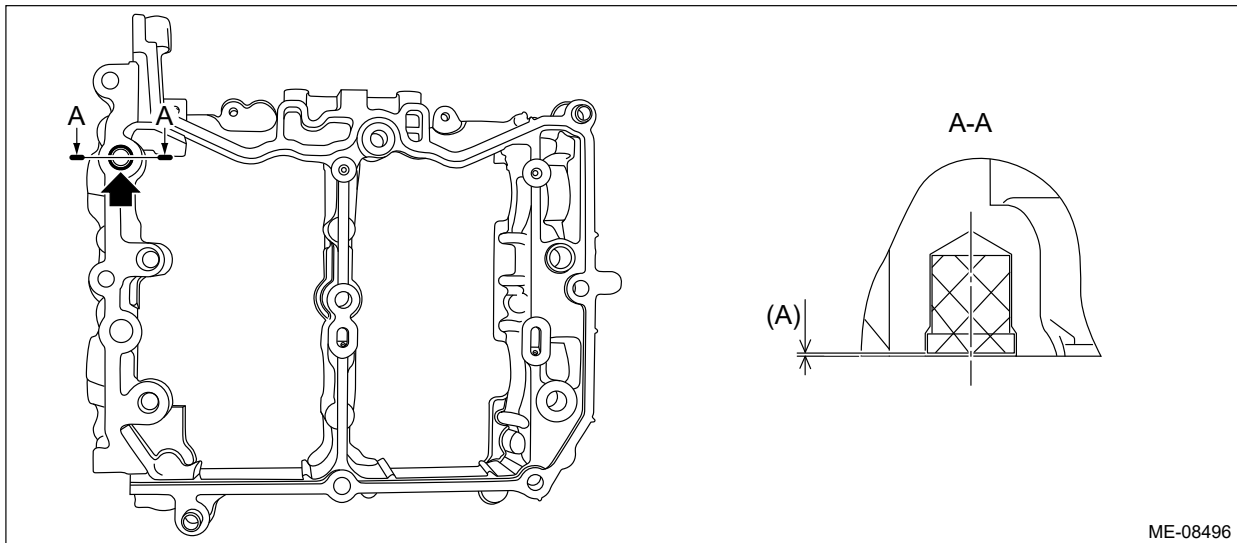
1. Install the filter to the cam carrier RH.

Note:

Use a new filter.

Filter insert position:

$0^{+0}_{-0.5}$ mm ($+0_{-0.0197}$ in) position from cam carrier RH end face



(A) 0 – 0.5 mm (0 – 0.0197 in)

2. Set the intake camshaft RH and the exhaust camshaft RH to the cam carrier RH.

Note:

Apply engine oil to the journals of cam carrier RH before setting the intake camshaft RH and exhaust camshaft RH.

3. Install the front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH and exhaust rear camshaft cap RH.

- (1) Apply liquid gasket to the mating surface of front camshaft cap RH, intake rear camshaft cap RH and exhaust rear camshaft cap RH as shown in the figure.

Caution:

- **Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to flow toward camshaft journal, resulting in engine seizure.**
- **Do not apply liquid gasket excessively to the intake center camshaft cap RH and exhaust center camshaft cap RH.**

Note:

- **Before applying liquid gasket, degrease the old liquid gasket seal surface of the front camshaft cap RH, intake rear camshaft cap RH, exhaust rear camshaft cap RH, and cam carrier RH.**
- **Install within 5 min. after applying liquid gasket.**

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

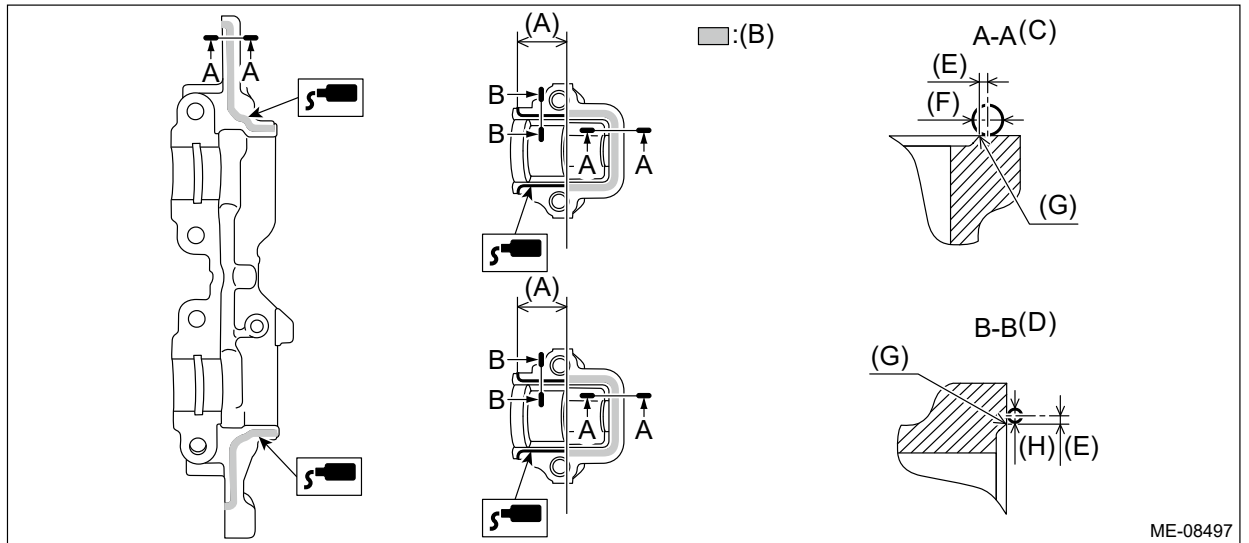
Liquid gasket applying diameter:

Mating surfaces other than range A

2±0.5 mm (0.0787±0.0197 in)

Mating surfaces of range A

3.5±0.5 mm (0.1378±0.0197 in)



(A) 28.5 mm (1.122 in)

(D) Liquid gasket applying position of mating surfaces other than range A

(G) Chamfer edge

(B) Range A

(E) Within 1 mm (0.0394 in)

(H) $\varnothing 2 \pm 0.5$ mm
(0.0787±0.0197 in)

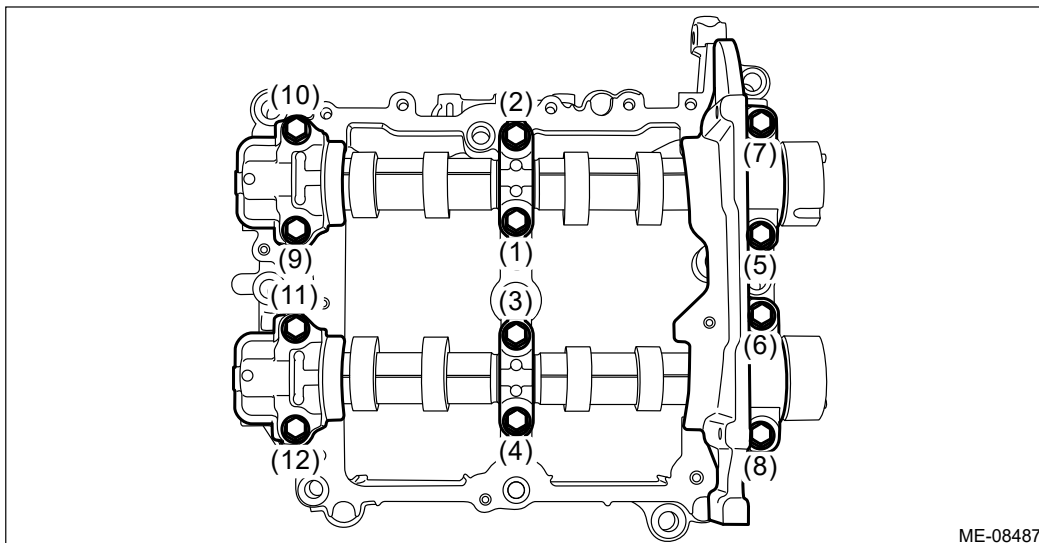
(C) Liquid gasket applying position of mating surfaces of range A

(F) $\varnothing 3.5 \pm 0.5$ mm
(0.1378±0.0197 in)

- (2) Apply engine oil to the journals of each camshaft cap before setting the camshaft cap.
- (3) Tighten the bolts which secure front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH and exhaust rear camshaft cap RH in numerical order as shown in the figure.

Tightening torque:

18 N·m (1.8 kgf·m, 13.3 ft·lb)



2. CAM CARRIER LH

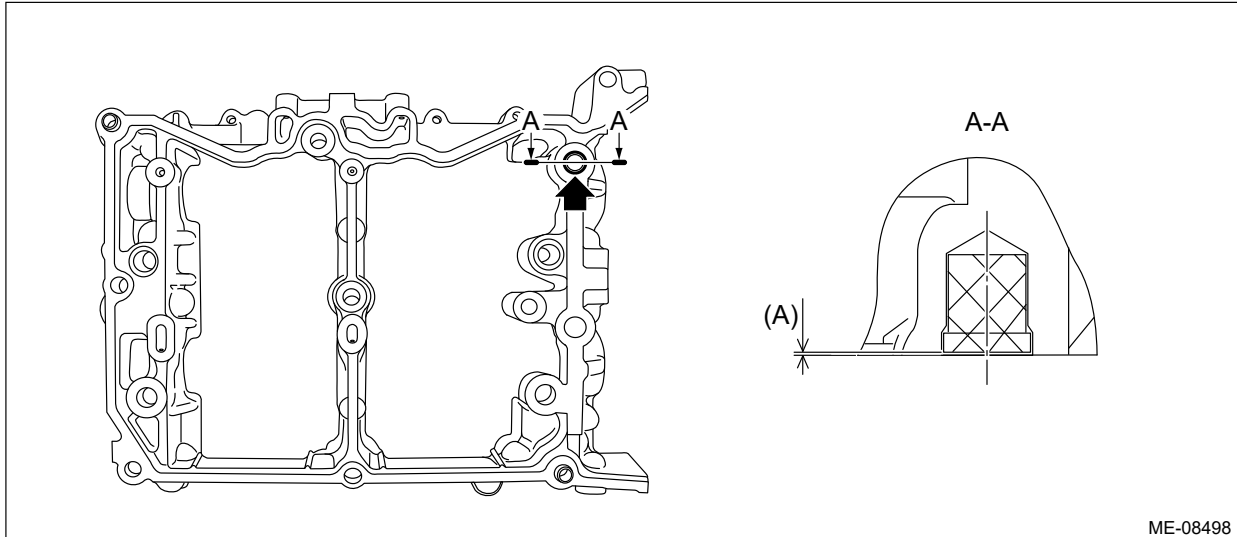
1. Install the filter to the cam carrier LH.

Note:

Use a new filter.

Filter insert position:

$0^{+0}_{-0.5}$ mm ($^{+0}_{-0.0197}$ in) position from cam carrier LH end face



(A) $0 - 0.5$ mm ($0 - 0.0197$ in)

2. Set the intake camshaft LH and the exhaust camshaft LH to the cam carrier LH.

Note:

Apply engine oil to the journals of cam carrier LH before setting the intake camshaft LH and exhaust camshaft LH.

3. Install the front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH.

(1) Apply liquid gasket to the mating surface of front camshaft cap LH, intake rear camshaft cap LH and exhaust rear camshaft cap LH as shown in the figure.

Caution:

- **Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to flow toward camshaft journal, resulting in engine seizure.**
- **Do not apply liquid gasket excessively to the intake center camshaft cap LH and exhaust center camshaft cap LH.**

Note:

- **Before applying liquid gasket, degrease the old liquid gasket seal surface of the front camshaft cap LH, intake rear camshaft cap LH, exhaust rear camshaft cap LH, and cam carrier LH.**
- **Install within 5 min. after applying liquid gasket.**

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

Mating surfaces other than ranges A, B and C

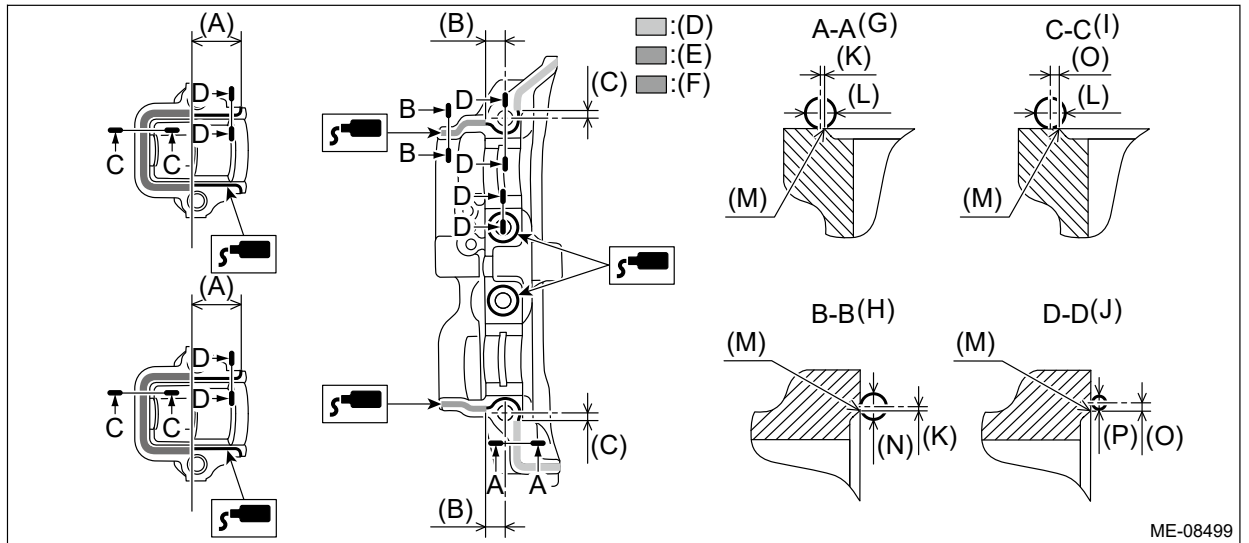
2 ± 0.5 mm (0.0787 ± 0.0197 in)

Mating surfaces of ranges A and C

3.5 ± 0.5 mm (0.1378 ± 0.0197 in)

Mating surfaces of range B

$3^{+0.5}_{-0}$ mm ($0.1181^{+0.0197}_{-0}$ in)



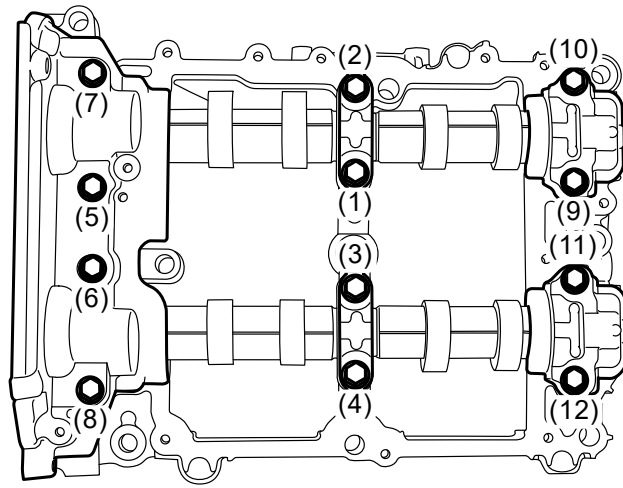
ME-08499

- | | | |
|-------------------------|--|--|
| (A) 28.5 mm (1.122 in) | (G) Liquid gasket applying position of mating surfaces of range A | (M) Chamfer edge |
| (B) 11.6 mm (0.4567 in) | (H) Liquid gasket applying position of mating surfaces of range B | (N) $\varnothing 3^{+0.5}_{-0}$ mm ($0.1181^{+0.0197}_{-0}$ in) |
| (C) 5.1 mm (0.2008 in) | (I) Liquid gasket applying position of mating surfaces of range C | (O) Within 1 mm (0.0394 in) |
| (D) Range A | (J) Liquid gasket applying position of mating surfaces other than range A, range B and range C | (P) $\varnothing 2 \pm 0.5$ mm (0.0787 ± 0.0197 in) |
| (E) Range B | (K) 0.5 mm (0.0197 in) | |
| (F) Range C | (L) $\varnothing 3.5 \pm 0.5$ mm (0.1378 ± 0.0197 in) | |

- (2) Apply engine oil to the journals of each camshaft cap before setting the camshaft cap.
- (3) Tighten the bolts which secure front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH in numerical order as shown in the figure.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



ME-08488

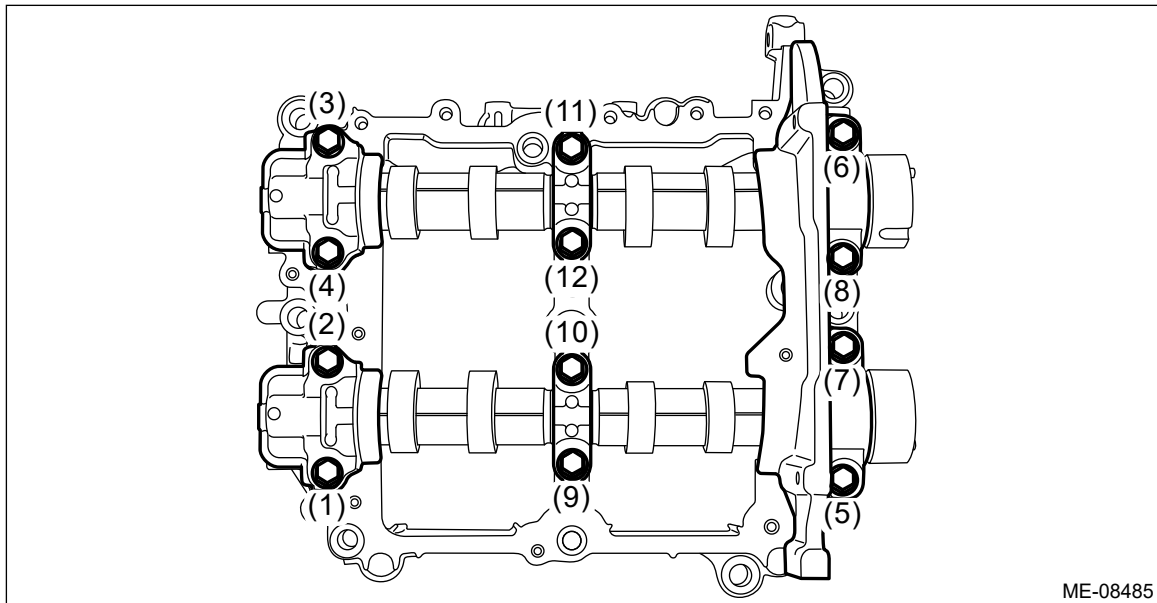
DISASSEMBLY

1. CAM CARRIER RH

1. Loosen the bolts (front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH, and exhaust rear camshaft cap RH) equally, a little at a time in numerical sequence as shown in the figure, and remove each camshaft cap.

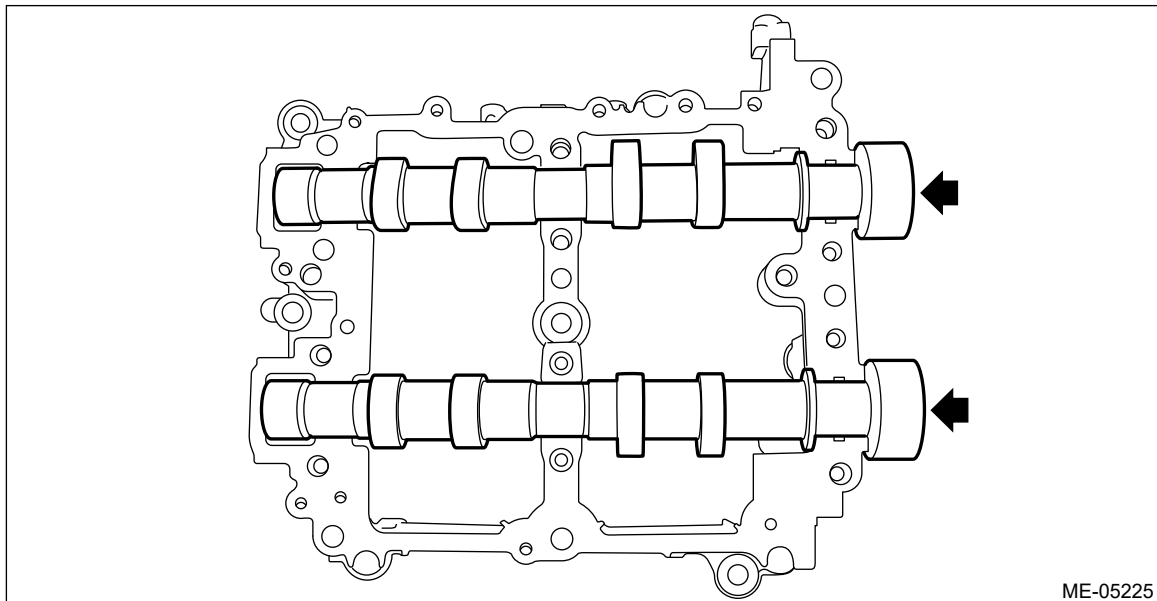
Note:

Arrange camshaft caps in order so that they can be installed in their original positions.



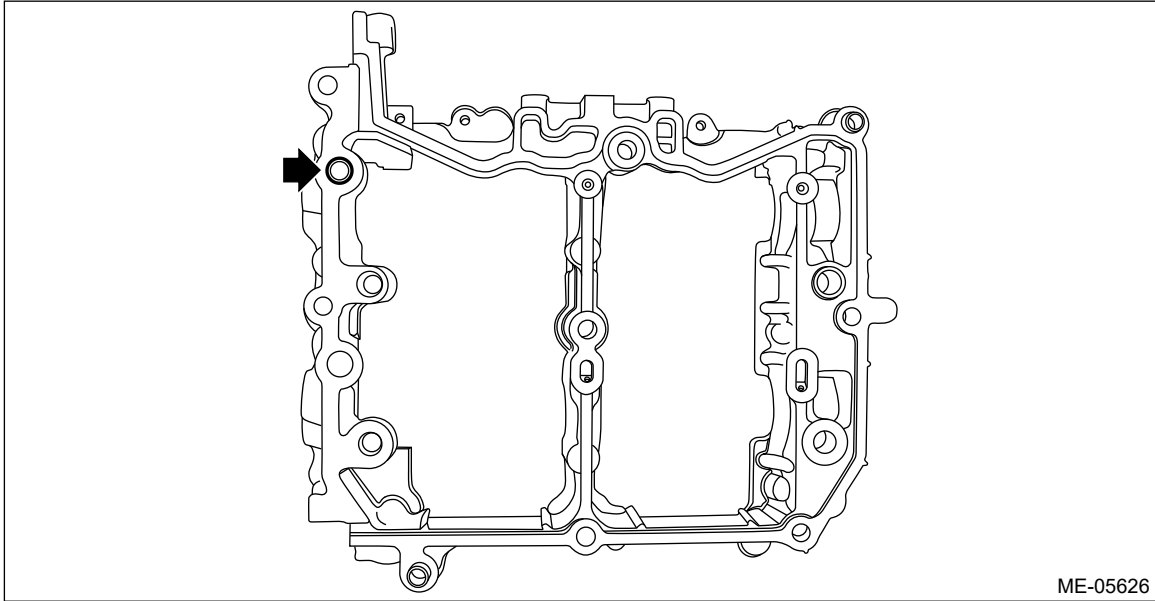
ME-08485

2. Remove the intake camshaft RH and the exhaust camshaft RH from cam carrier RH.



ME-05225

3. Remove the filter from cam carrier RH.



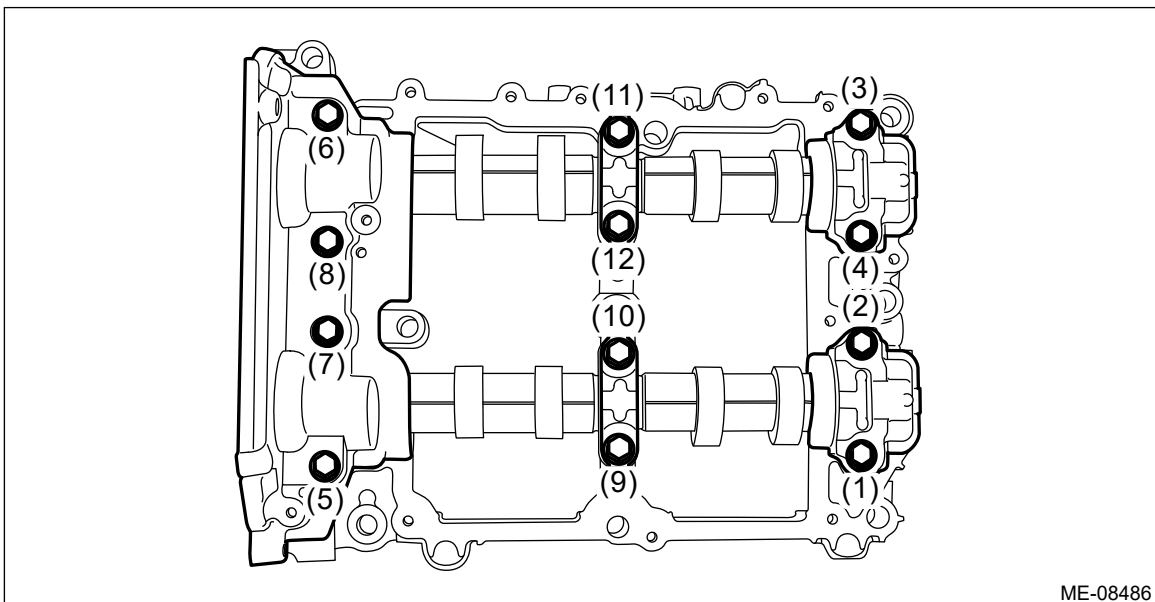
4. Remove the liquid gasket from cam carrier RH and front camshaft cap RH, intake rear camshaft cap RH and exhaust rear camshaft cap RH.

2. CAM CARRIER LH

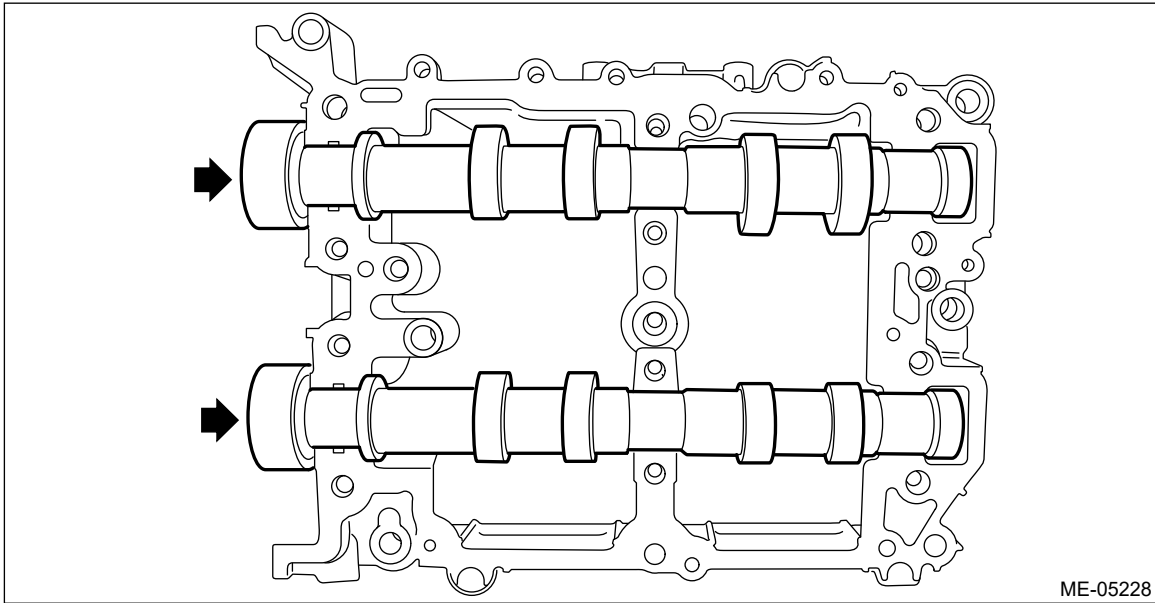
1. Loosen the bolts (front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH) equally, a little at a time in numerical sequence as shown in the figure, and remove each camshaft cap.

Note:

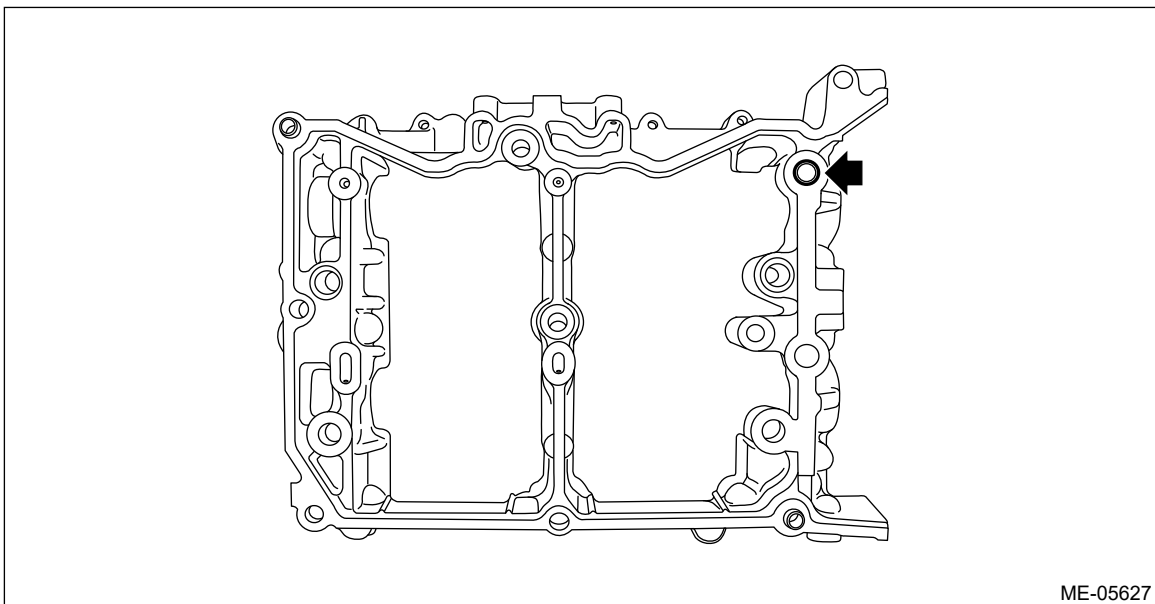
Arrange camshaft caps in order so that they can be installed in their original positions.



2. Remove the intake camshaft LH and the exhaust camshaft LH from cam carrier LH.



3. Remove the filter from cam carrier LH.

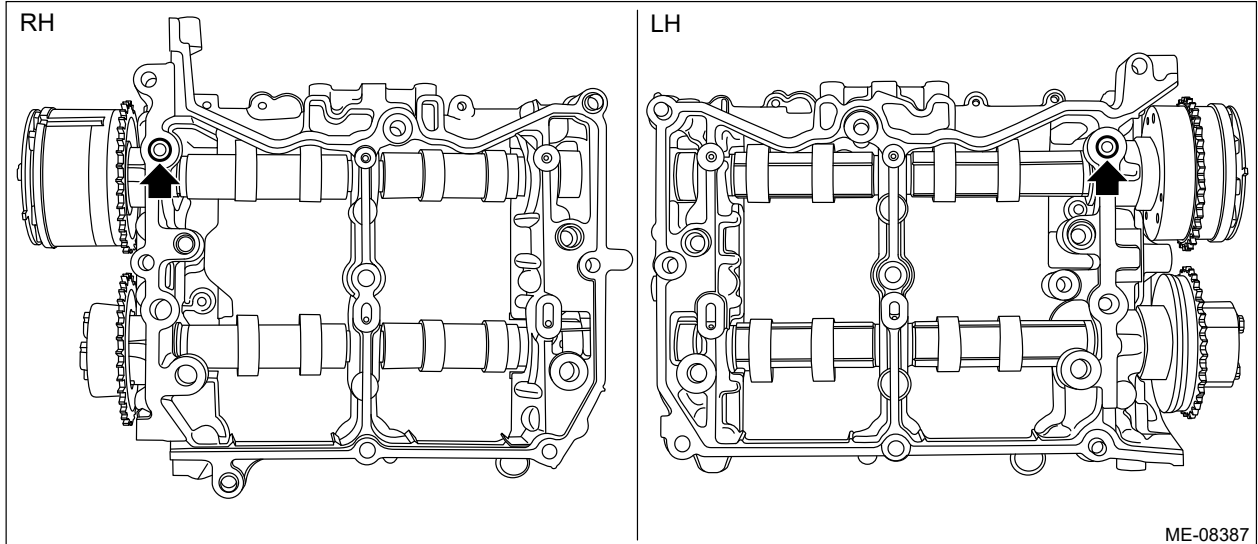


4. Remove the liquid gasket from cam carrier LH and front camshaft cap LH, intake rear camshaft cap LH and exhaust rear camshaft cap LH.

MECHANICAL(H4DO) > Cam Carrier

INSPECTION

1. Visually check the cam carrier filter, and if clogging is found, replace with a new part.



2. Check the camshaft journals for damage and wear. Replace the camshaft if faulty.
3. Check the cam face condition of camshaft, and remove the minor faults by grinding with oil stone. Replace the camshaft if uneven wear is found.
4. Using a dial gauge, check the camshaft bend. If it exceeds the limit, replace the camshaft.

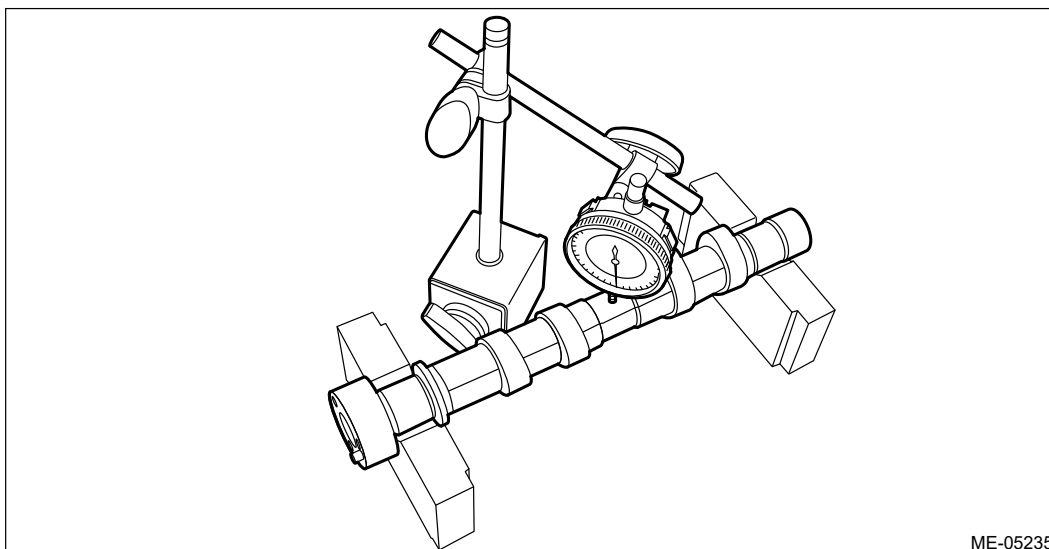
Note:

Measurement should be performed at a temperature of 20°C (68°F).

Camshaft bend:

Limit

0.020 mm (0.0008 in)



5. Check the cam lobe height "H" and cam base circle diameter "A" of camshaft as shown in the figure, using micrometer. If it is not within the standard, replace the camshaft.

Note:

Measurement should be performed at a temperature of 20°C (68°F).

Camshaft cam lobe overall height H:

Intake

Standard

40.34 — 40.44 mm (1.588 — 1.592 in)

Exhaust

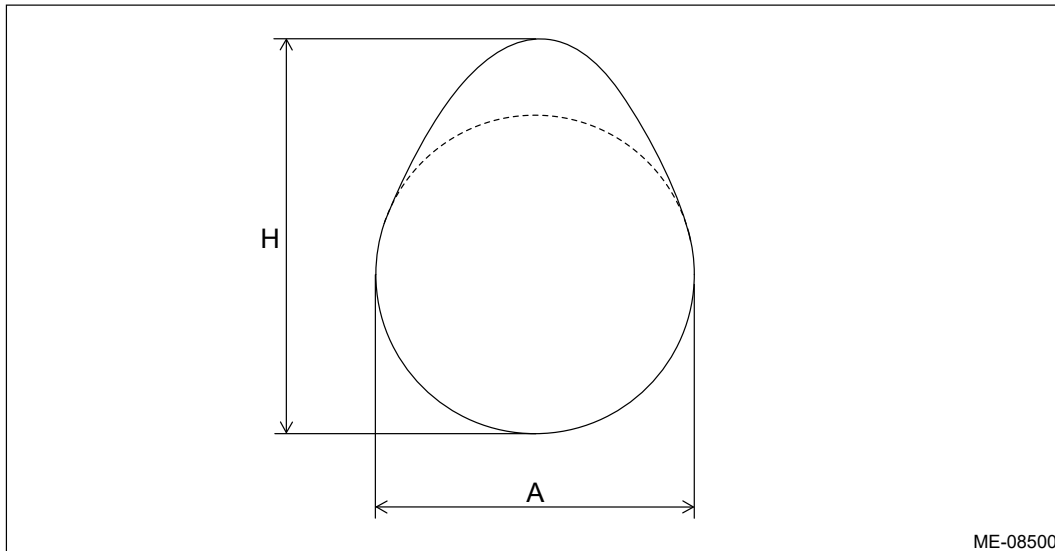
Standard

39.66 — 39.76 mm (1.561 — 1.565 in)

Camshaft cam base circle diameter A:

Standard

34.0 mm (1.339 in)



ME-08500

6. Check the camshaft journal outer diameter using micrometer. If it is not within the standard, replace the camshaft.

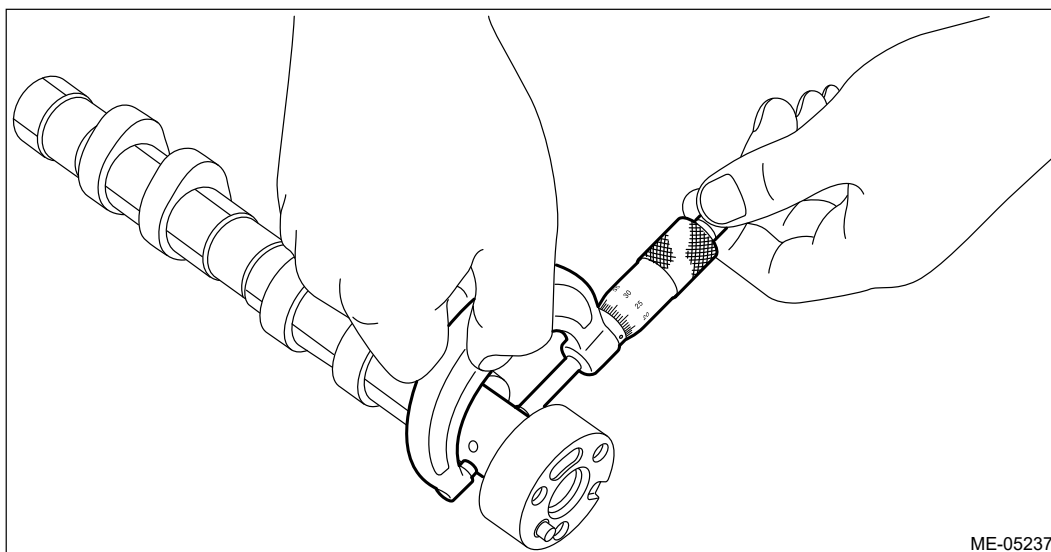
Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Measure outer diameter of each journal at several points, and read the value of most worn location.**

Camshaft journal outer diameter:

Standard

25.946 — 25.963 mm (1.0215 — 1.0222 in)



ME-05237

7. Using a dial gauge, check the thrust clearance of the camshaft. If it is not within the standard or if uneven wear is found, replace each camshaft cap and cam carrier as a set. If necessary replace the camshaft.

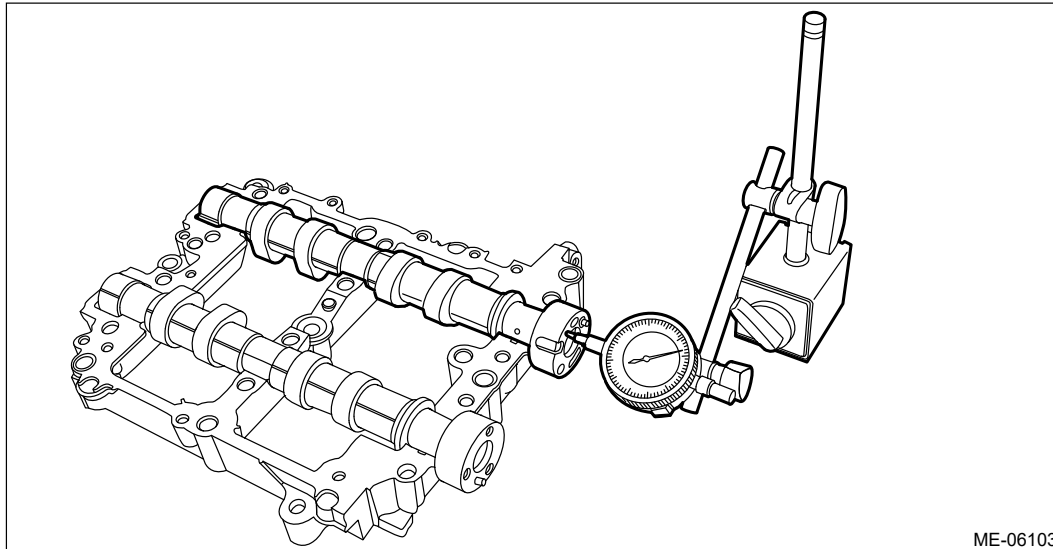
Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Set the dial gauge at end surface of camshaft.**

Camshaft thrust clearance:

Standard

0.068 – 0.116 mm (0.0027 – 0.0047 in)



8. Check the oil clearance on the camshaft using a plastigauge.

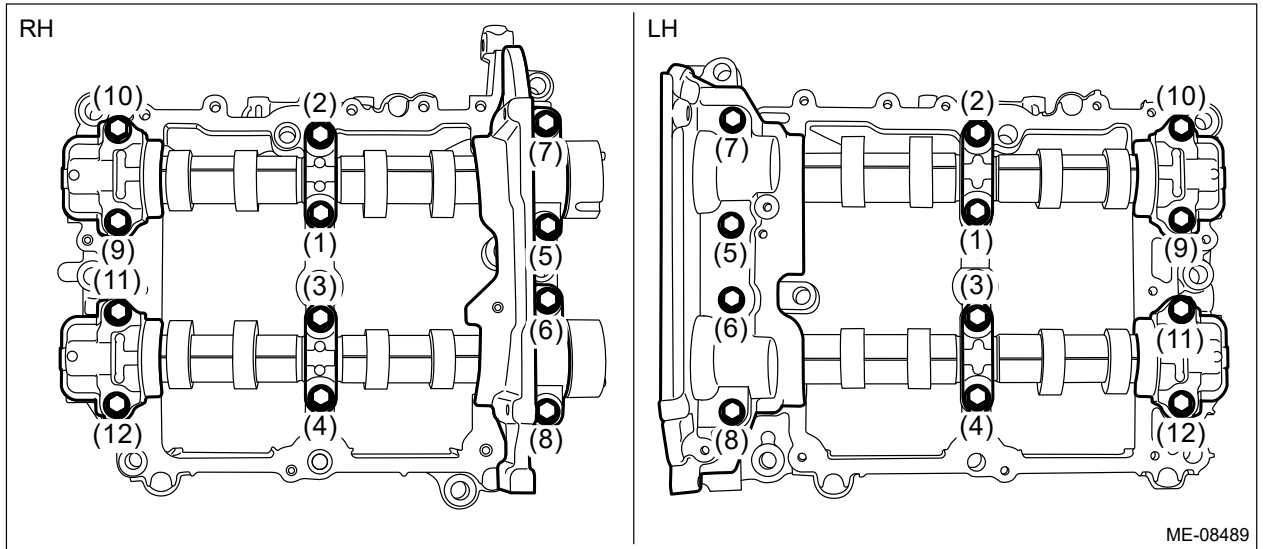
Note:

Measurement should be performed at a temperature of 20°C (68°F).

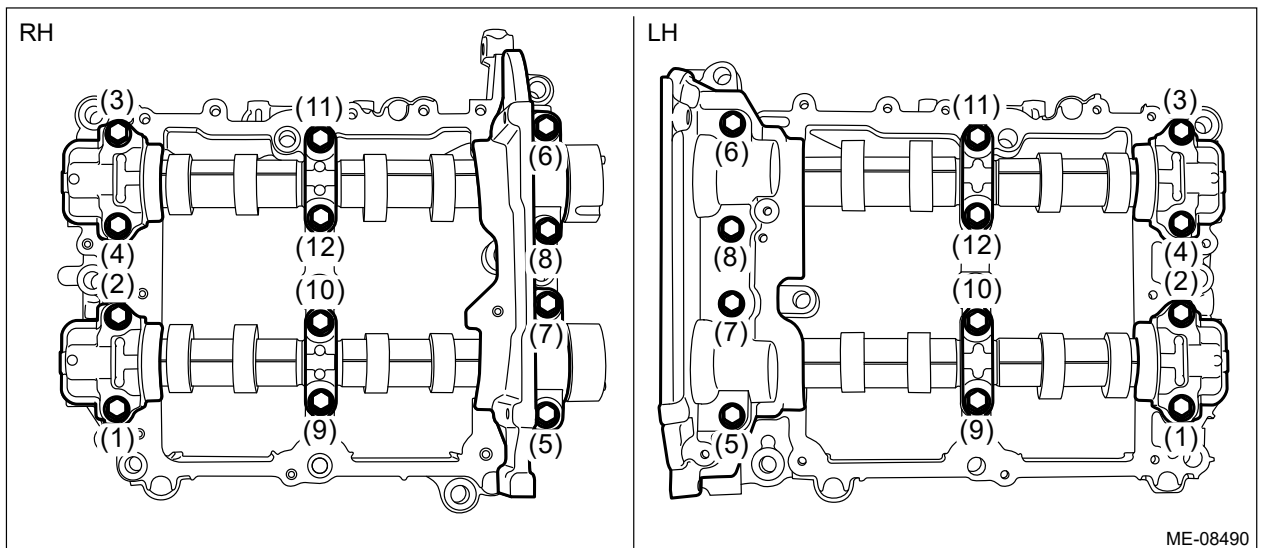
- (1) Remove the liquid gasket from cam carrier and front camshaft cap, intake rear camshaft cap and exhaust rear camshaft cap.
- (2) Clean each camshaft cap and cam carrier journals.
- (3) Set the camshaft to the cam carrier.
- (4) Place a plastigauge across the camshaft journals of each camshaft and set the camshaft caps.
- (5) Tighten the bolts which secure front camshaft cap, intake center camshaft cap, intake rear camshaft cap, exhaust center camshaft cap and exhaust rear camshaft cap in numerical order as shown in the figure.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



- (6) Loosen the bolts (front camshaft cap, intake center camshaft cap, intake rear camshaft cap, exhaust center camshaft cap and exhaust rear camshaft cap) equally, a little at a time in numerical sequence as shown in the figure, and remove each camshaft cap.

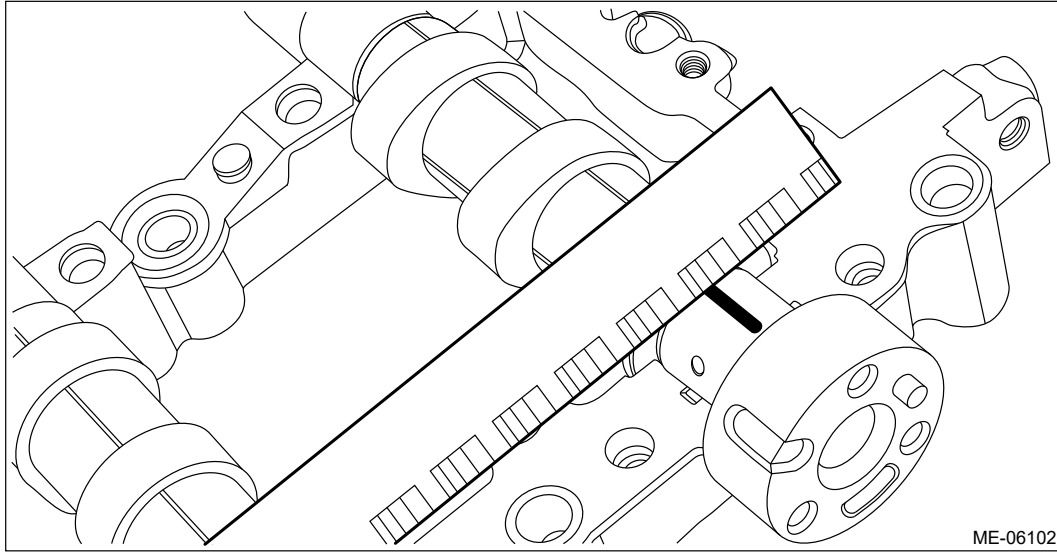


- (7) Determine camshaft oil clearance by matching the widest point of plastigauge on each journal against scale printed on a package of plastigauge. If it is not within the standard, replace each camshaft cap and cam carrier as a set. If necessary replace the camshaft.

Camshaft oil clearance:

Standard

0.037 – 0.072 mm (0.0015 – 0.0028 in)



ME-06102

(8) Completely remove the plastigauge.

INSTALLATION

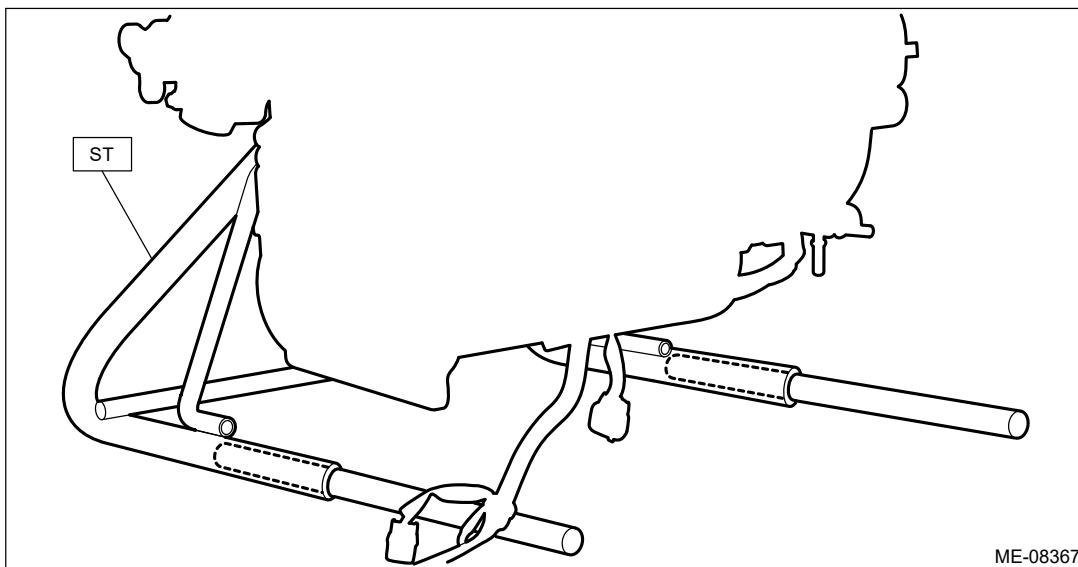
1. CAM CARRIER RH

1. Insert the steel rods into ST, and set the engine so that the camshaft RH is facing up.

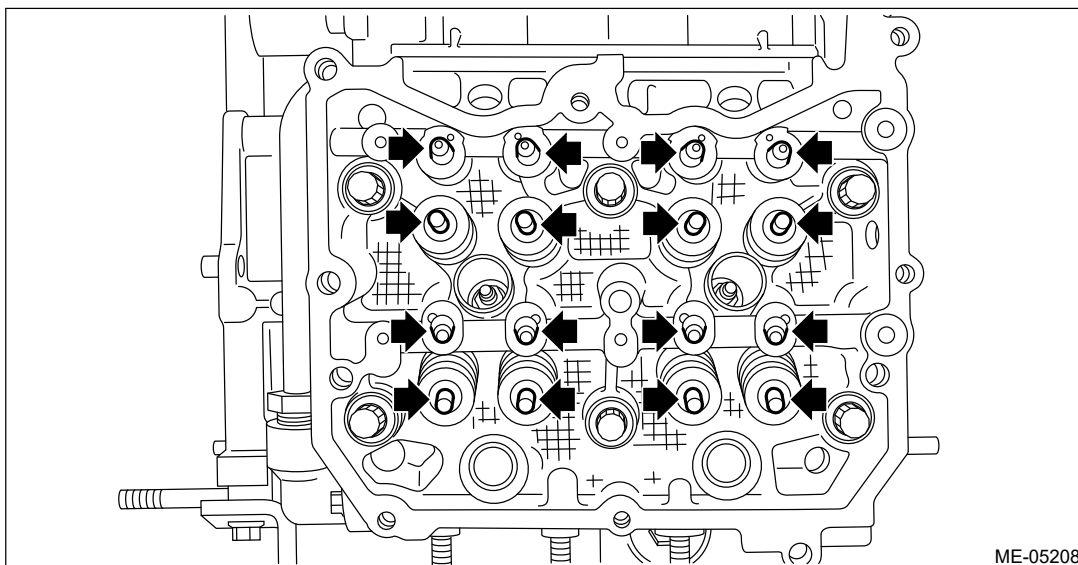
Caution:

- If the engine is standing on one side without inserting the steel rod into ST, engine may lose balance and fall down. Be sure to insert the steel rod into ST to extend the length.
- Use the steel rod with enough strength.
- Be careful not to pinch the engine harness with ST.

ST 499817100 ENGINE STAND



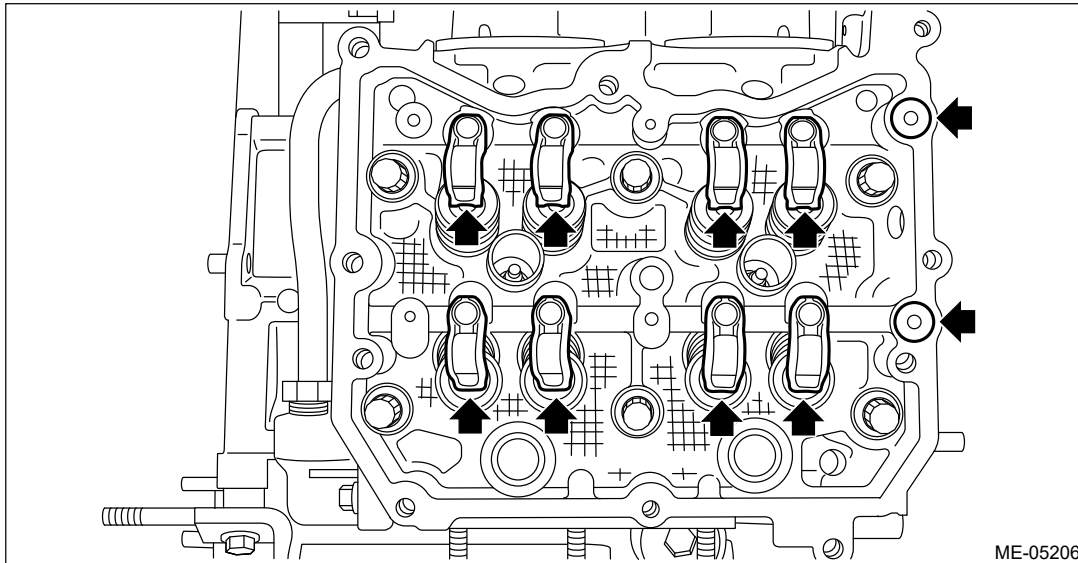
2. Apply engine oil to the valve shim and the roller rocker arm pivot, and install the valve shim and the roller rocker arm pivot to the cylinder head RH.



3. Apply engine oil to the O-ring and the roller rocker arm, and install the O-ring and the roller rocker arm to the cylinder head RH.

Note:

Use new O-rings.



4. Apply liquid gasket to the mating surface of cam carrier RH as shown in the figure.

Note:

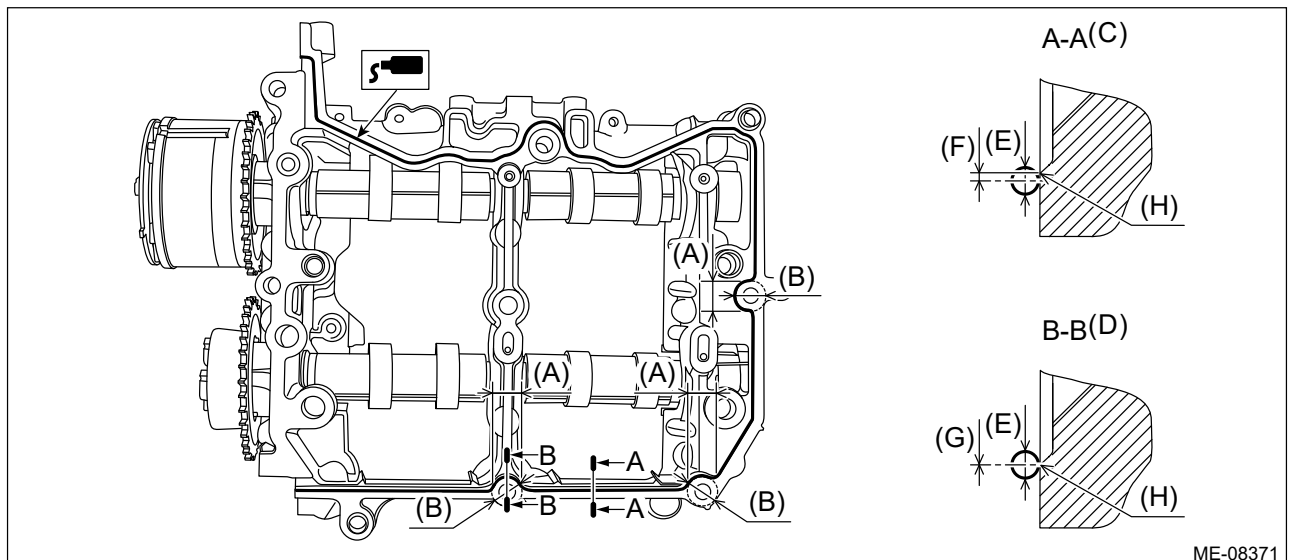
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder head RH and cam carrier RH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3.1 ± 0.5 mm (0.1220 ± 0.0197 in)



(A) Range A

(D) Liquid gasket applying position of mating surfaces of range A

(G) 0 ± 0.5 mm (0 ± 0.0197 in)

(B) $\varnothing 18$ mm (0.7087 in)

(E) $\varnothing 3.1 \pm 0.5$ mm

(H) Chamfer edge

(0.1220±0.0197 in)

(C) Liquid gasket applying
position of mating surfaces
other than range A

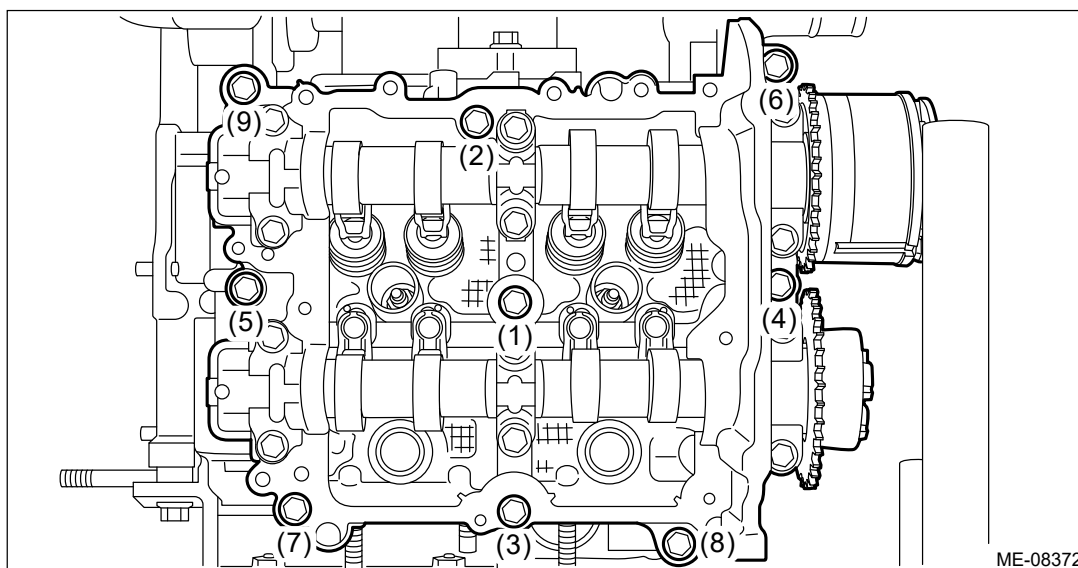
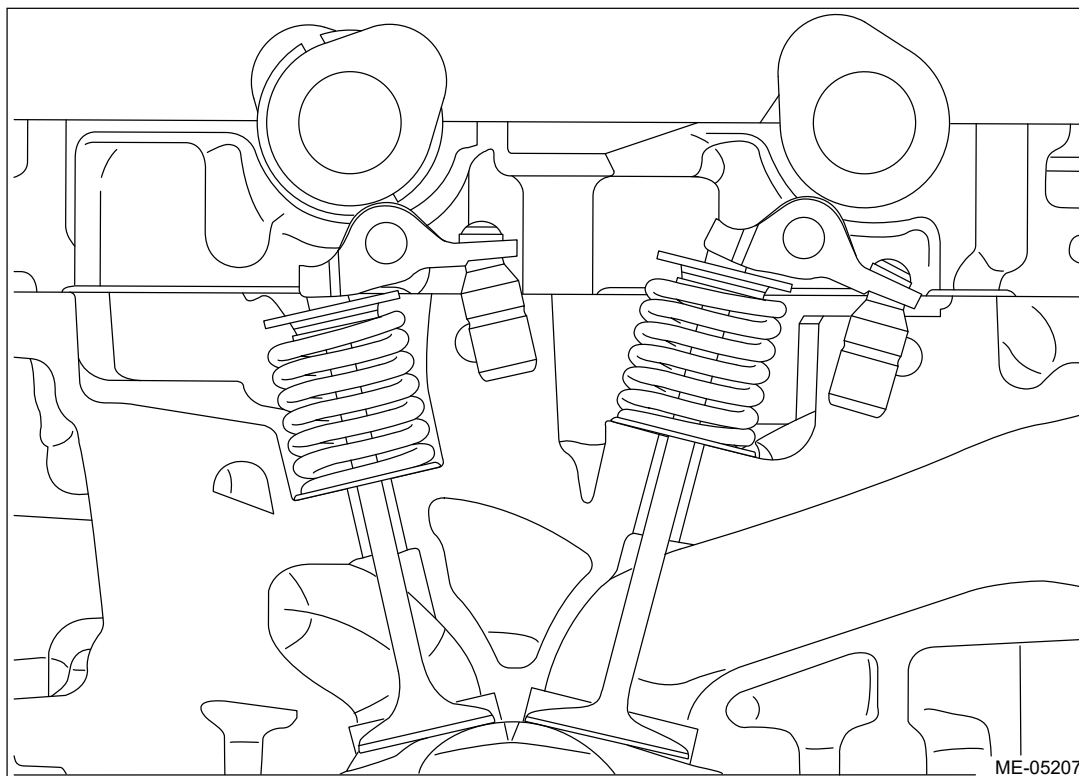
(F) Within 1 mm (0.0394 in)

5. Install the cam carrier RH to the cylinder head RH.

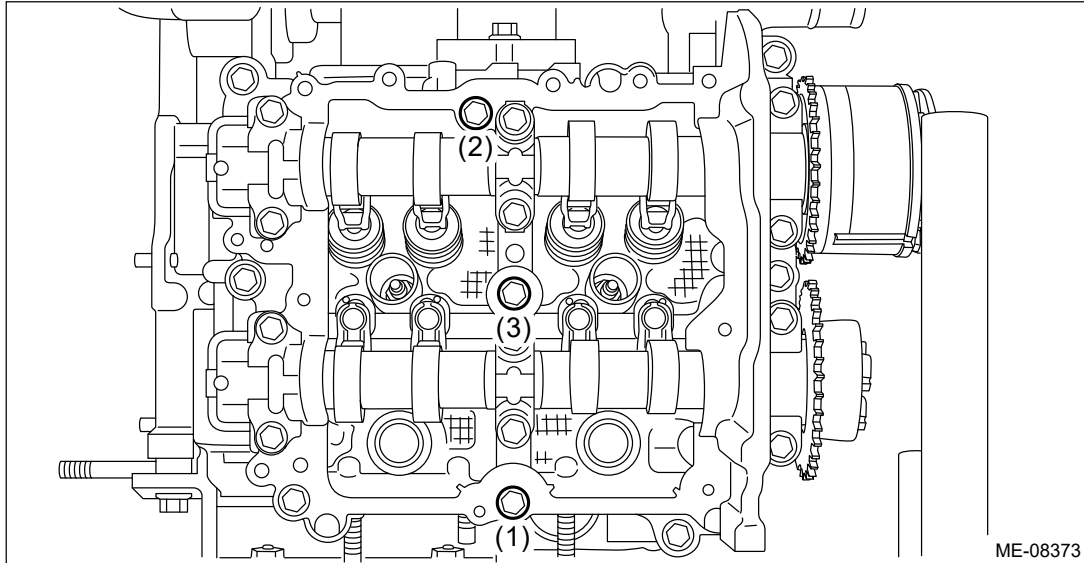
- (1) Mount the cam carrier RH, then tighten all bolts with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

Note:

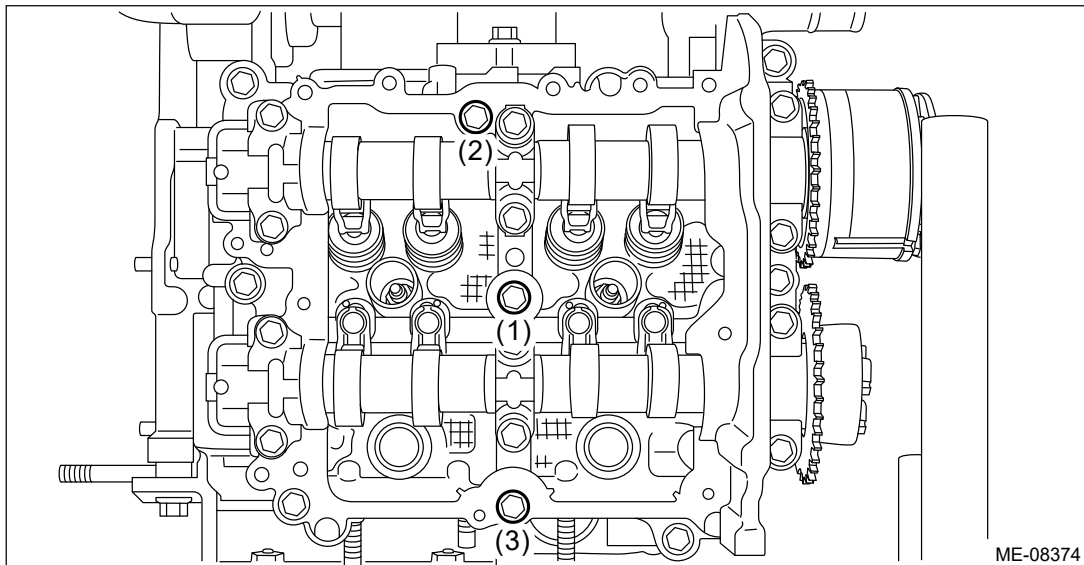
Set the intake camshaft RH and the exhaust camshaft RH to the zero-lift position.



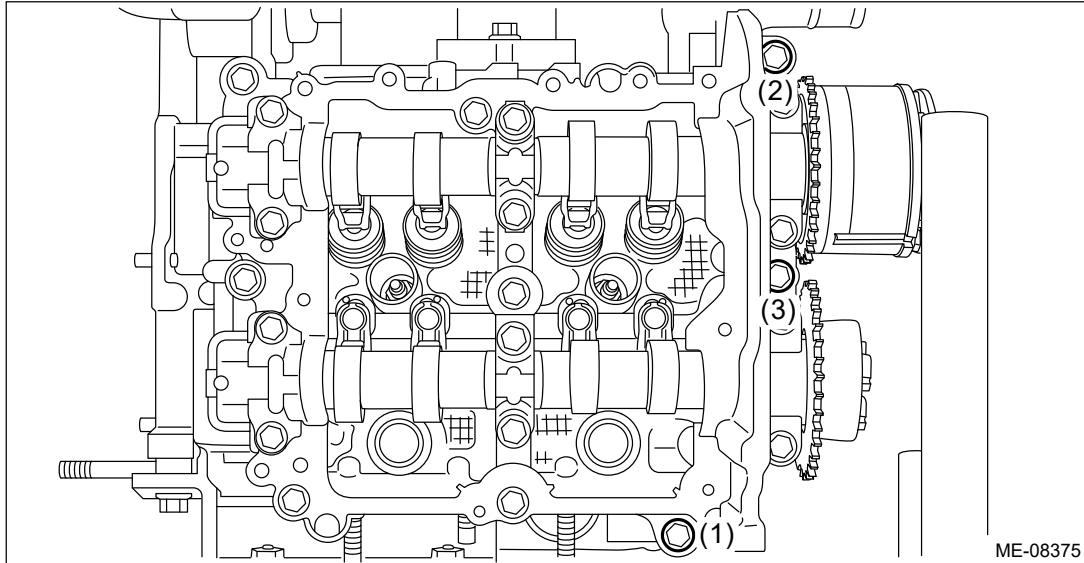
- (2) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



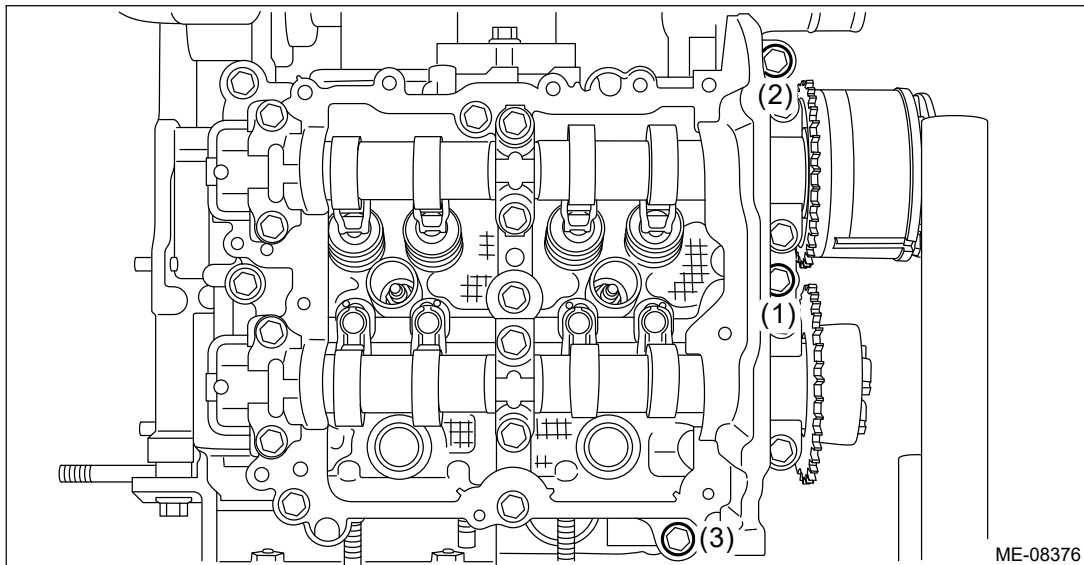
(3) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



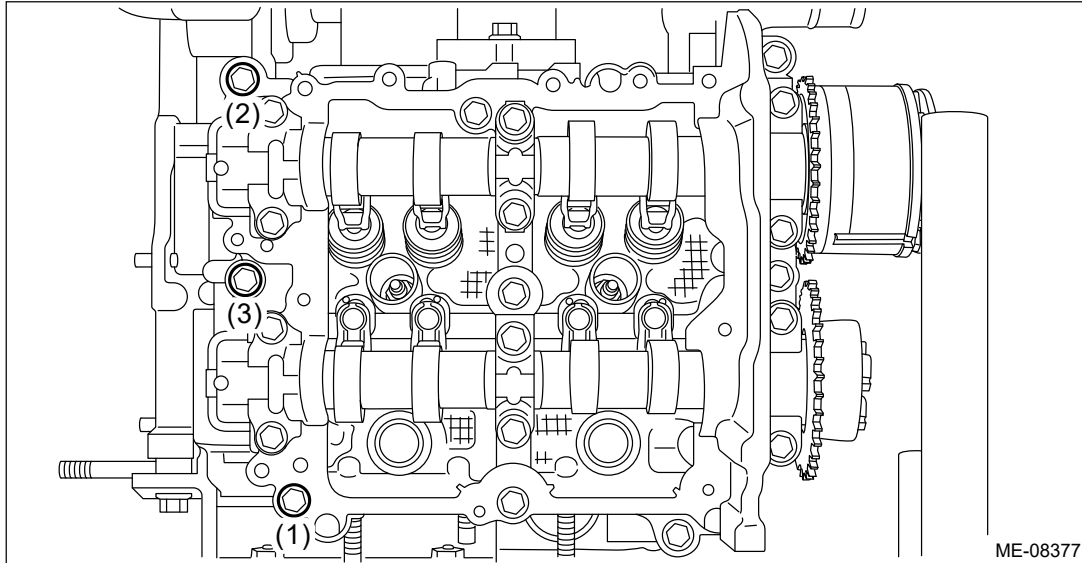
(4) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



(5) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



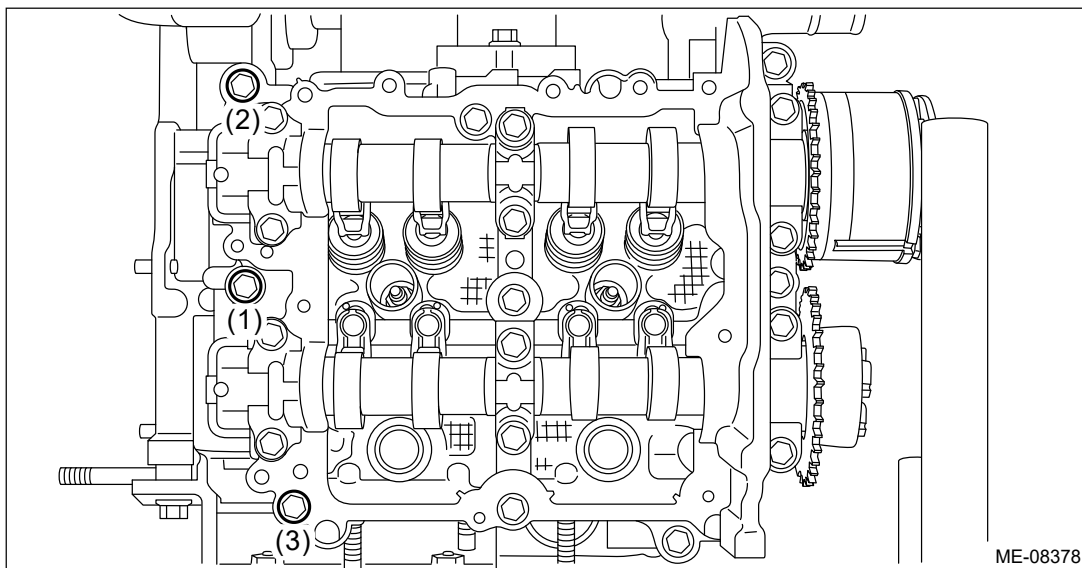
(6) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



- (7) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

Note:

After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

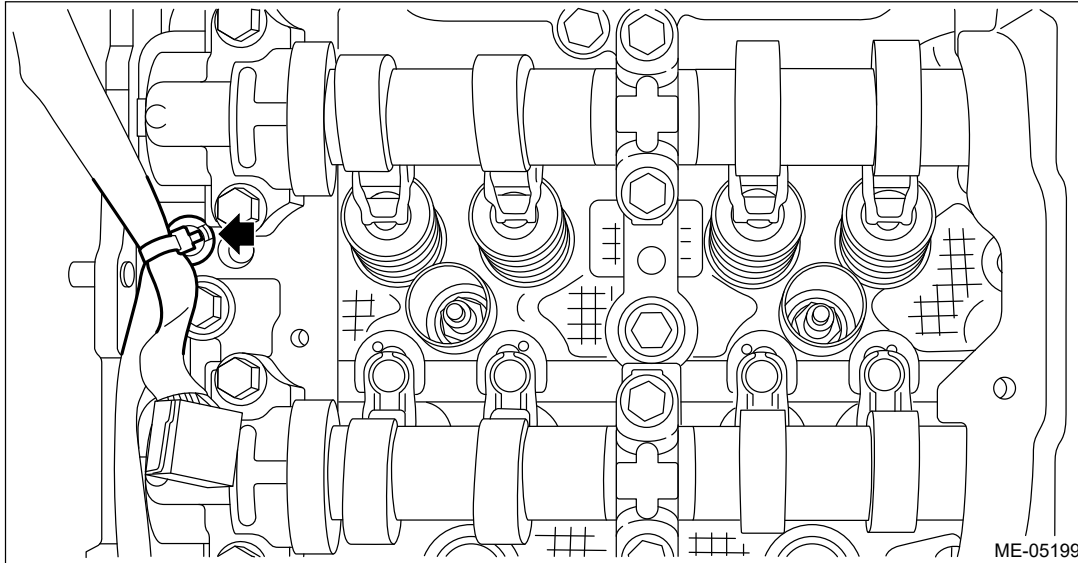







6. Set the part so that the intake manifold is on the upper side.
 7. Install the cam sprocket RH. [🔧 Ref. to MECHANICAL\(H4DO\)>Cam Sprocket>INSTALLATION > CAM SPROCKET RH.](#)

Note:

This procedure is required only when the cam carrier RH is removed for disassembly.

8. Check the cam clearance. [🔧 Ref. to MECHANICAL\(H4DO\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)
 9. Install the timing chain RH. [🔧 Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN RH.](#)
 10. Secure the engine harness to the cam carrier RH with a clip.



- 11.** Install the rocker cover RH.  [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>INSTALLATION > ROCKER COVER RH.](#)
- 12.** Install the water pipe assembly RH.  [Ref. to COOLING\(H4DO\)>Water Pipe Assembly>INSTALLATION > WATER PIPE ASSEMBLY RH.](#)
- 13.** Install the fuel injector RH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Injector>INSTALLATION.](#)
- 14.** Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)
- 15.** Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>INSTALLATION.](#)

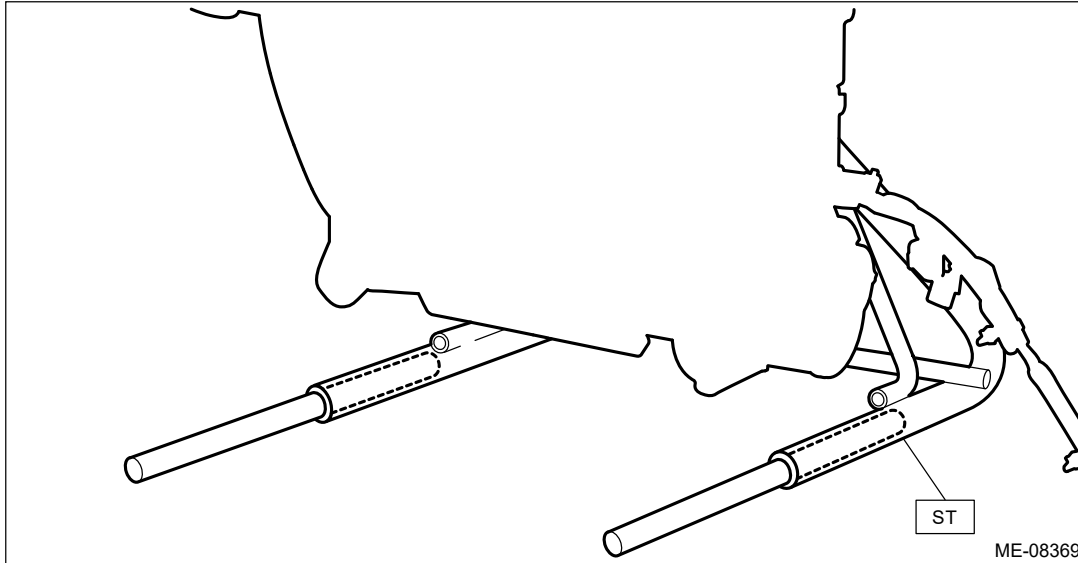
2. CAM CARRIER LH

- 1.** Insert the steel rods into ST, and set the engine so that the camshaft LH is facing up.

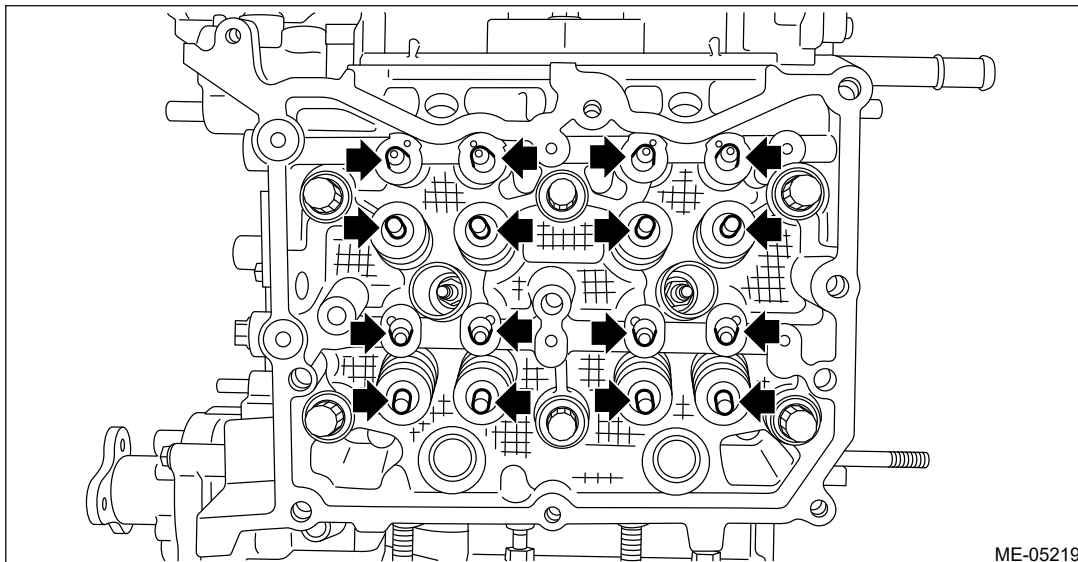
Caution:

- **If the engine is standing on one side without inserting the steel rod into ST, engine may lose balance and fall down. Be sure to insert the steel rod into ST to extend the length.**
- **Use the steel rod with enough strength.**
- **Be careful not to pinch the engine harness with ST.**

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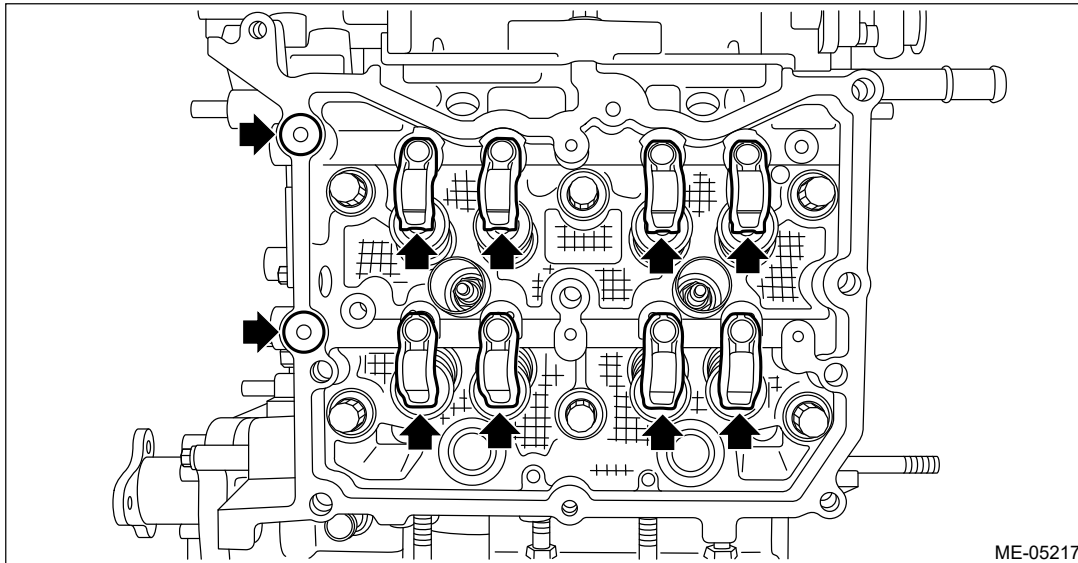


2. Apply engine oil to the valve shim and the roller rocker arm pivot, and install the valve shim and the roller rocker arm pivot to the cylinder head LH.



3. Apply engine oil to the O-ring and the roller rocker arm, and install the O-ring and the roller rocker arm to the cylinder head LH.

Note:
Use new O-rings.



4. Apply liquid gasket to the mating surface of cam carrier LH as shown in the figure.

Note:

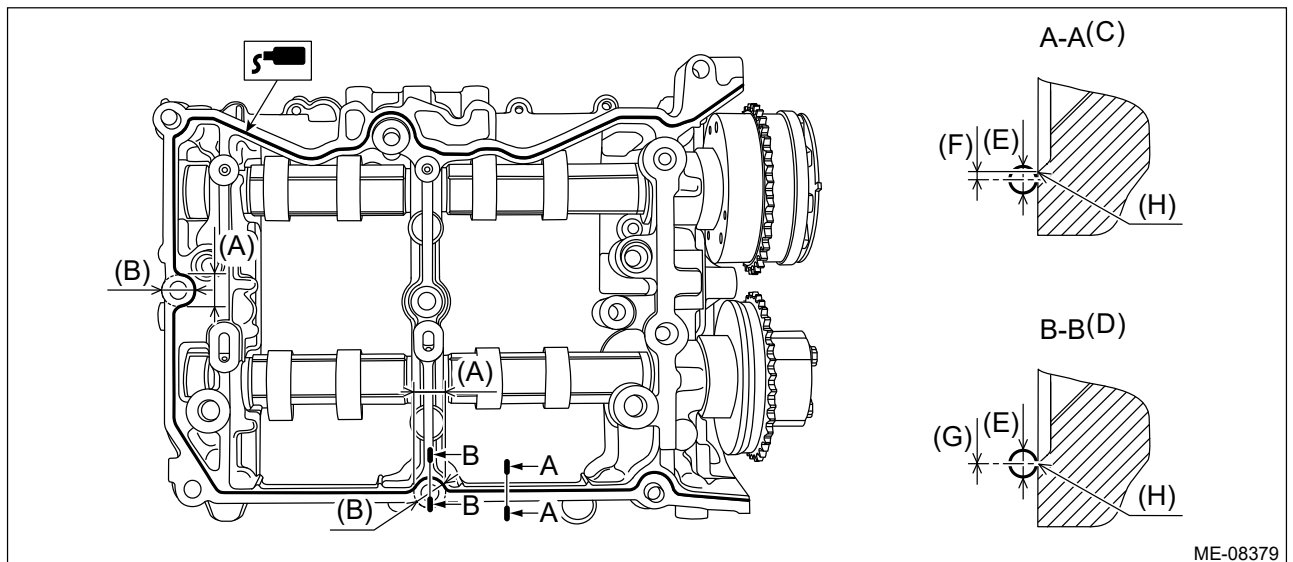
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder head LH and cam carrier LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3.1±0.5 mm (0.1220±0.0197 in)



(A) Range A

(B) $\varnothing 18$ mm (0.7087 in)

(C) Liquid gasket applying position of mating surfaces other than range A

(D) Liquid gasket applying position of mating surfaces of range A

(E) $\varnothing 3.1 \pm 0.5$ mm (0.1220±0.0197 in)

(F) Within 1 mm (0.0394 in)

(G) 0 ± 0.5 mm (0 ± 0.0197 in)

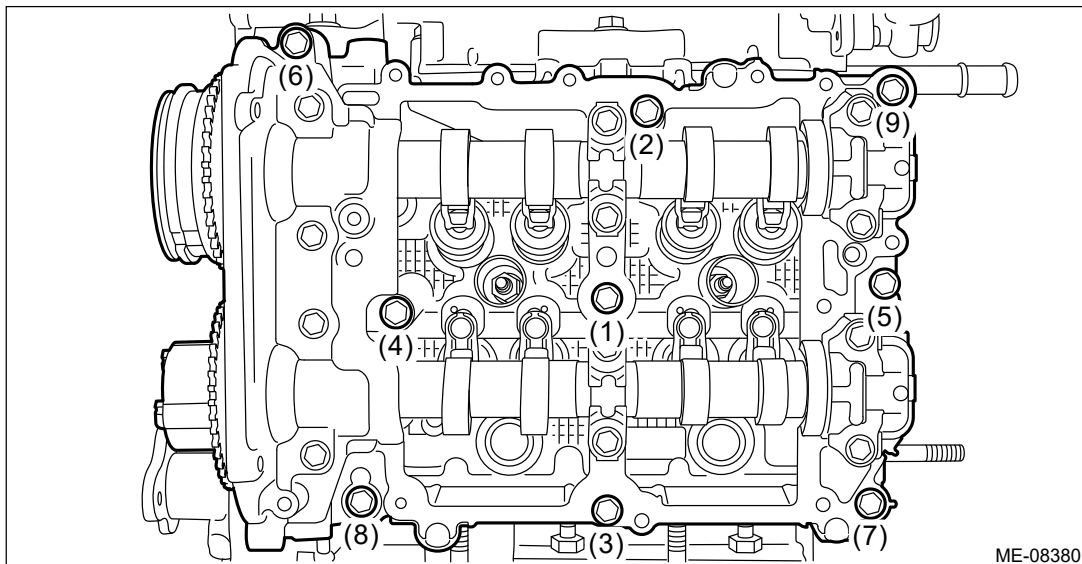
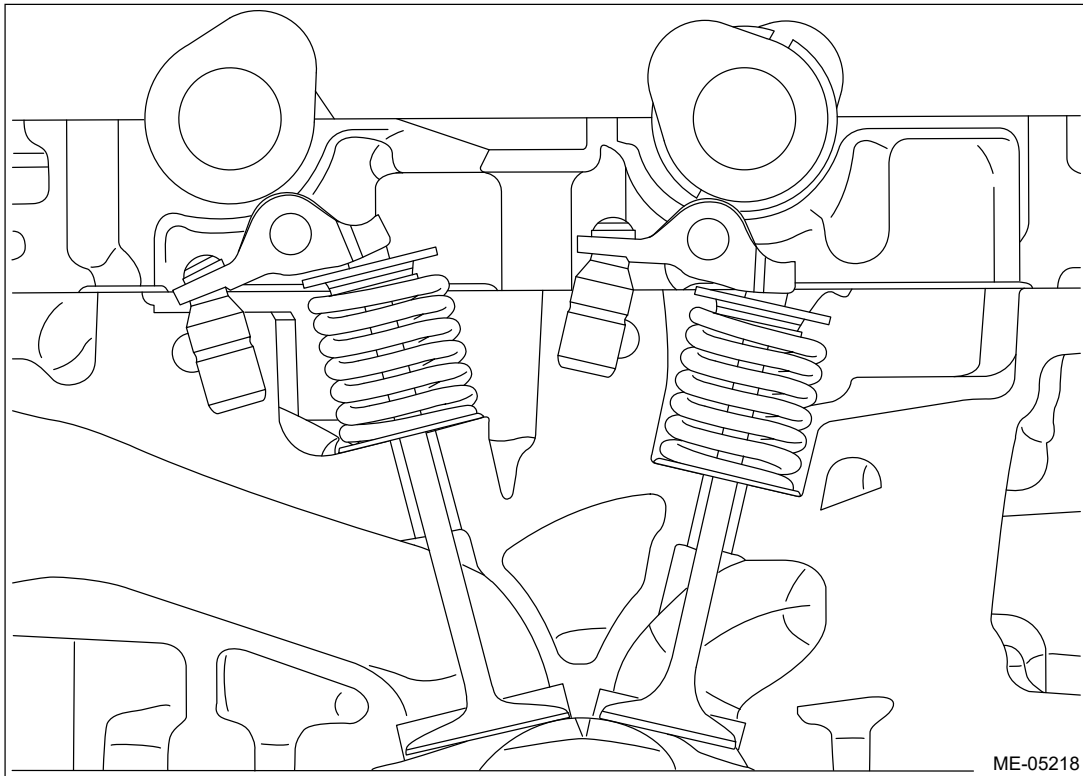
(H) Chamfer edge

5. Install the cam carrier LH to the cylinder head LH.

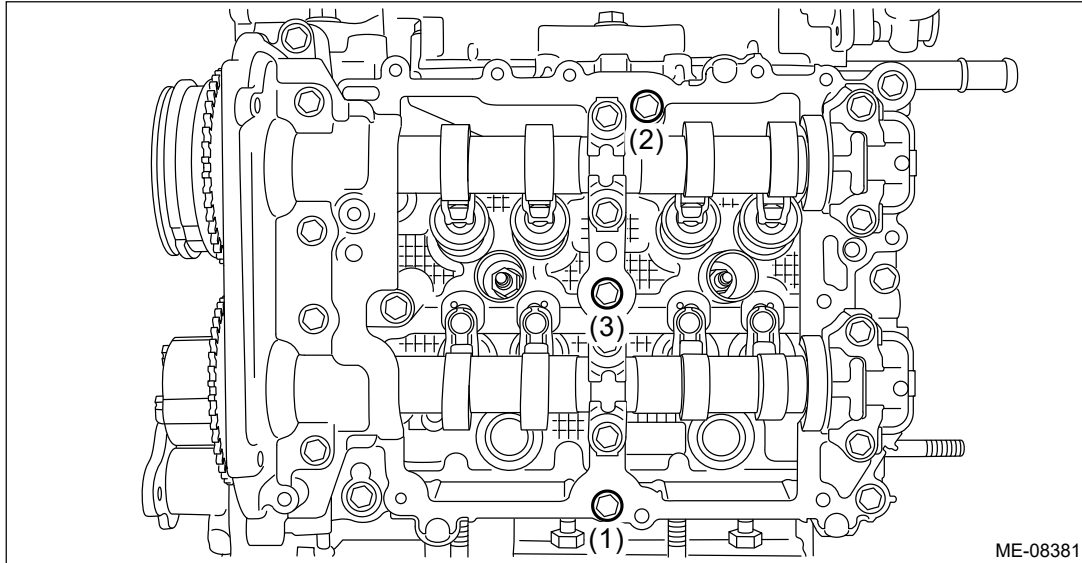
- (1) Mount the cam carrier LH, then tighten all bolts with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

Note:

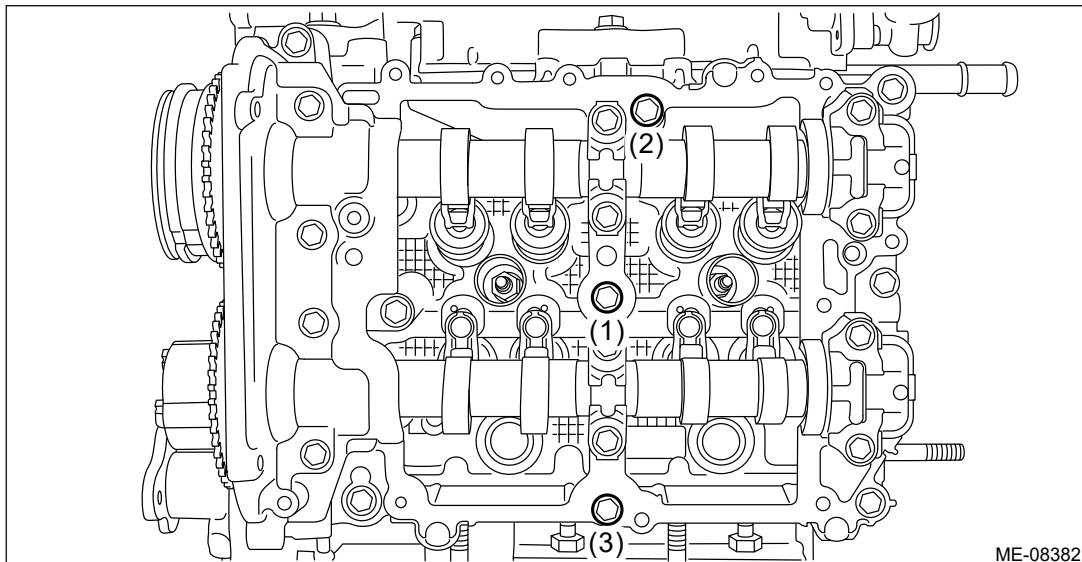
Set the intake camshaft LH and the exhaust camshaft LH to the zero-lift position.



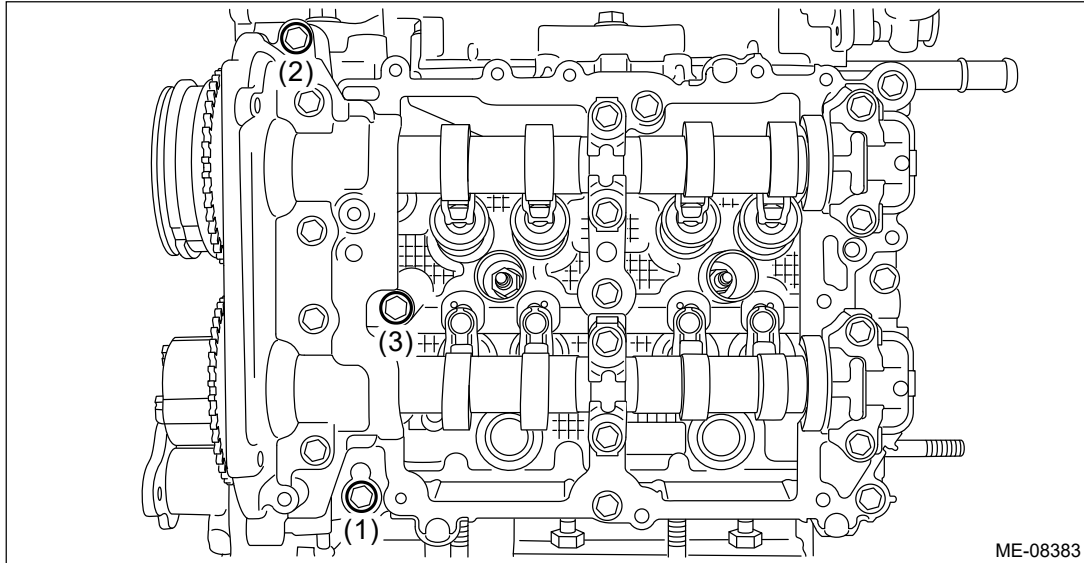
- (2) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



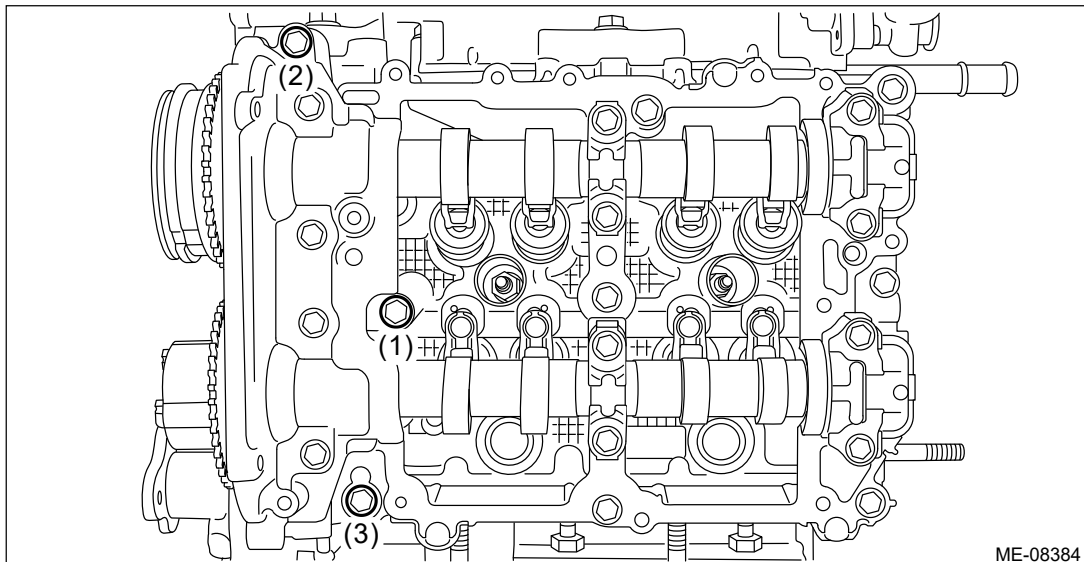
(3) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



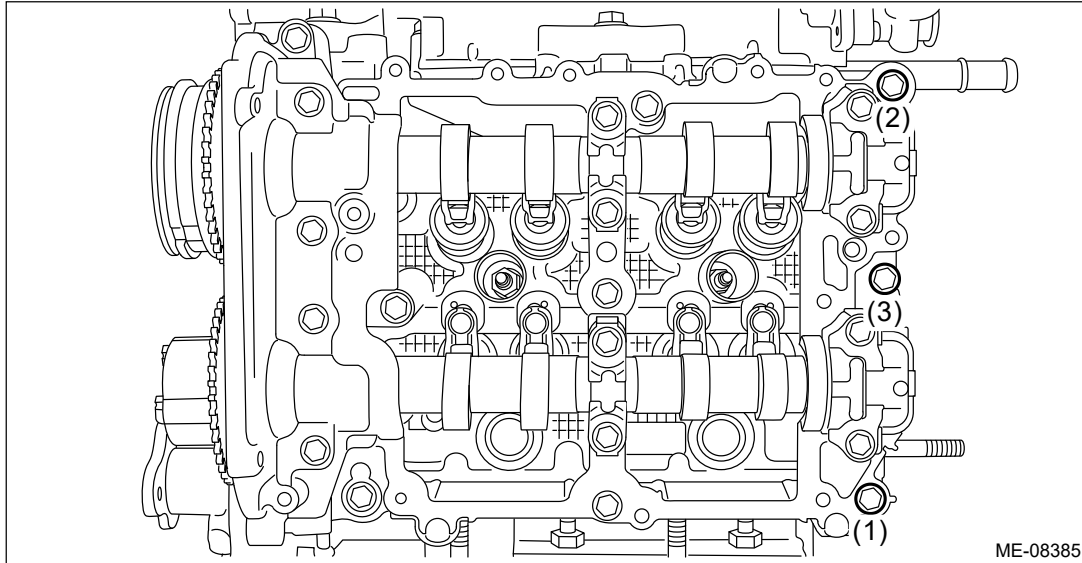
(4) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



(5) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



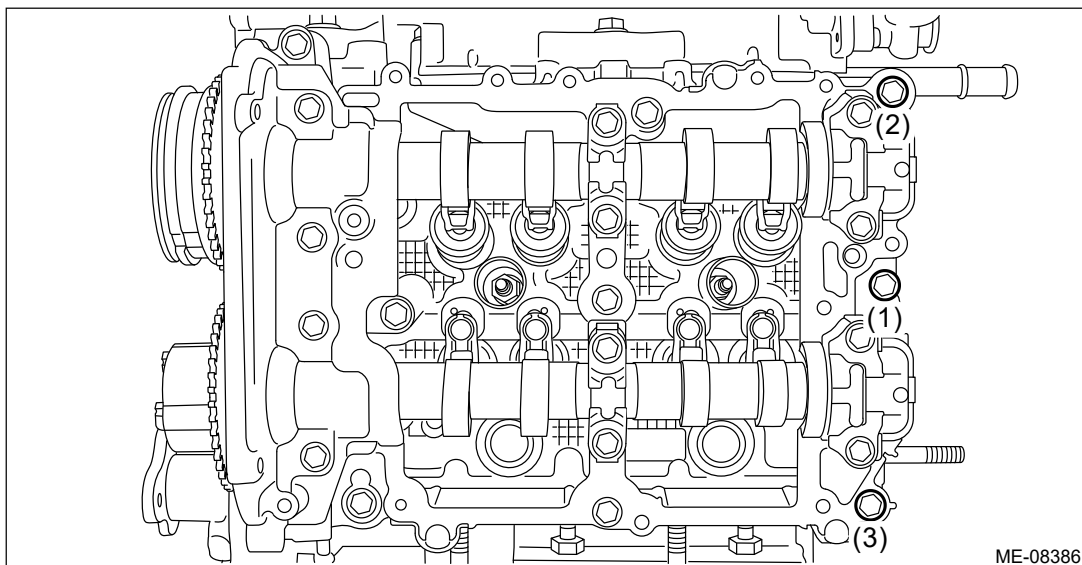
(6) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



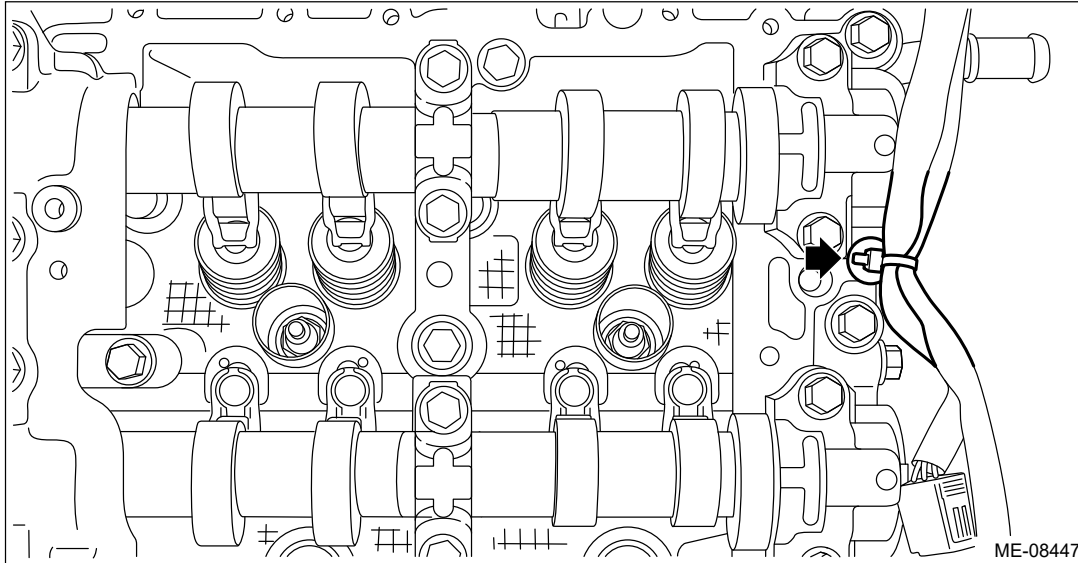
- (7) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.






Note:

After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.



- 6.** Set the part so that the intake manifold is on the upper side.
- 7.** Install the cam sprocket LH. [🔧 Ref. to MECHANICAL\(H4DO\)>Cam Sprocket>INSTALLATION > CAM SPROCKET LH.](#)
- Note:**
This procedure is required only when the cam carrier LH is removed for disassembly.
- 8.** Check the cam clearance. [🔧 Ref. to MECHANICAL\(H4DO\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)
- 9.** Install timing chain LH. [🔧 Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN LH.](#)
- 10.** Secure the engine harness to the cam carrier LH with a clip.







- 11.** Install the rocker cover LH.  [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>INSTALLATION > ROCKER COVER LH.](#)
- 12.** Install the water pipe assembly LH.  [Ref. to COOLING\(H4DO\)>Water Pipe Assembly>INSTALLATION > WATER PIPE ASSEMBLY LH.](#)
- 13.** Install the fuel injector LH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Injector>INSTALLATION.](#)
- 14.** Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)
- 15.** Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>INSTALLATION.](#)

MECHANICAL(H4DO) > Cam Carrier




REMOVAL

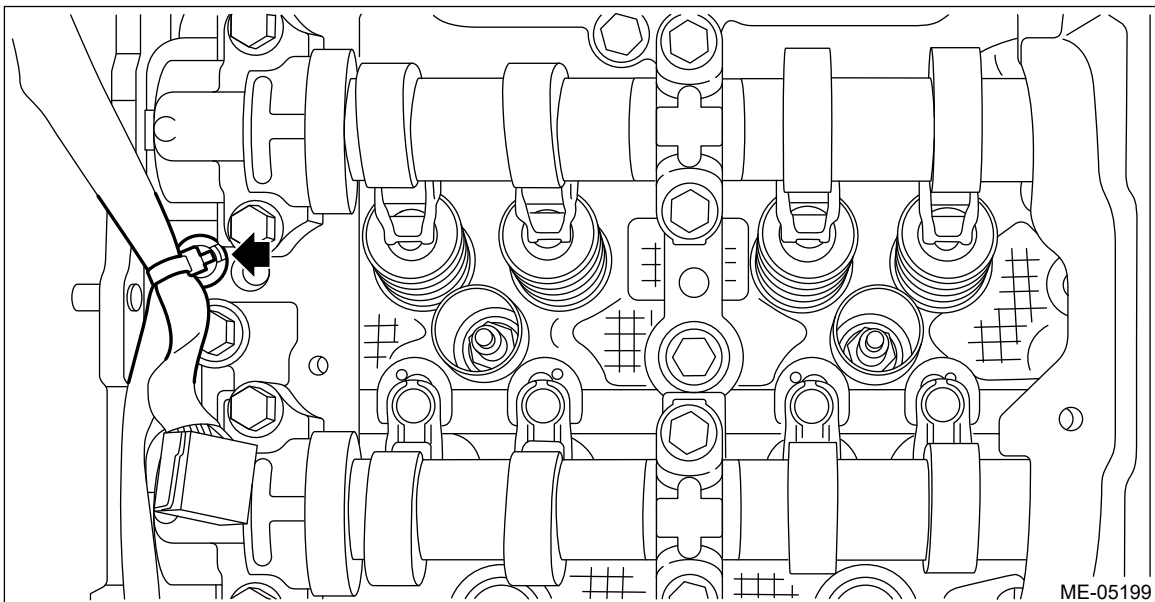
1. CAM CARRIER RH

1. Remove the engine from the vehicle.  [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>REMOVAL.](#)
2. Remove the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
3. Remove the timing chain RH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
4. Remove the cam sprocket RH.  [Ref. to MECHANICAL\(H4DO\)>Cam Sprocket>REMOVAL > CAM SPROCKET RH.](#)

Note:

This operation is required only when disassembling the cam carrier RH.

5. Remove the fuel injector RH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Injector>REMOVAL.](#)
6. Remove the water pipe assembly RH.  [Ref. to COOLING\(H4DO\)>Water Pipe Assembly>REMOVAL > WATER PIPE ASSEMBLY RH.](#)
7. Remove the rocker cover RH.  [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>REMOVAL > ROCKER COVER RH.](#)
8. Remove the clip holding the engine harness from cam carrier RH.

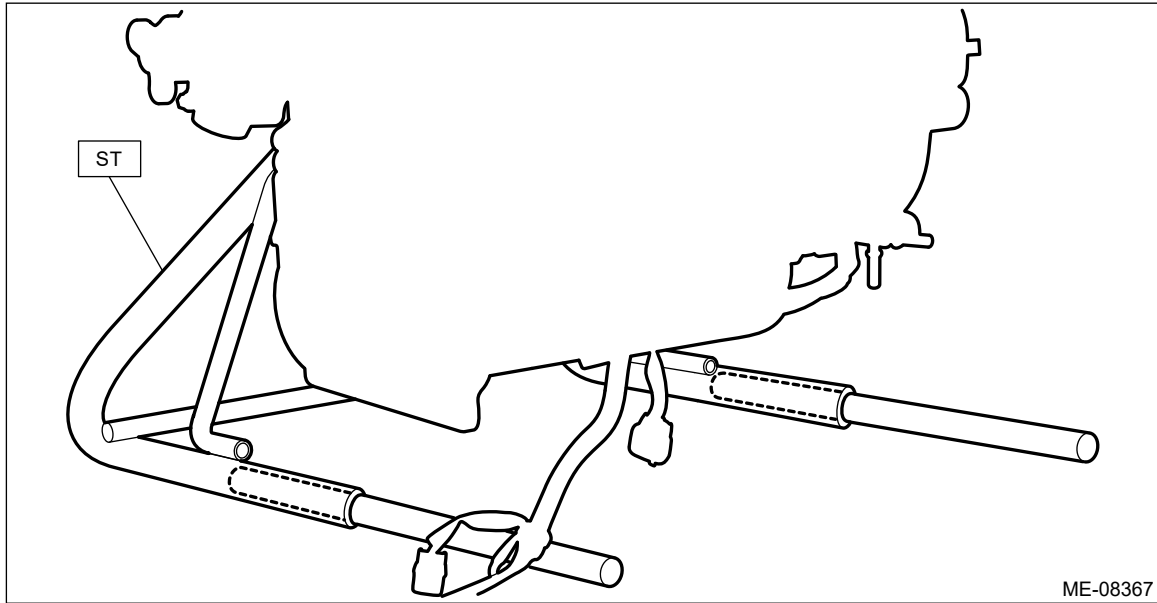


9. Insert the steel rods into ST, and set the engine so that the camshaft RH is facing up.

Caution:

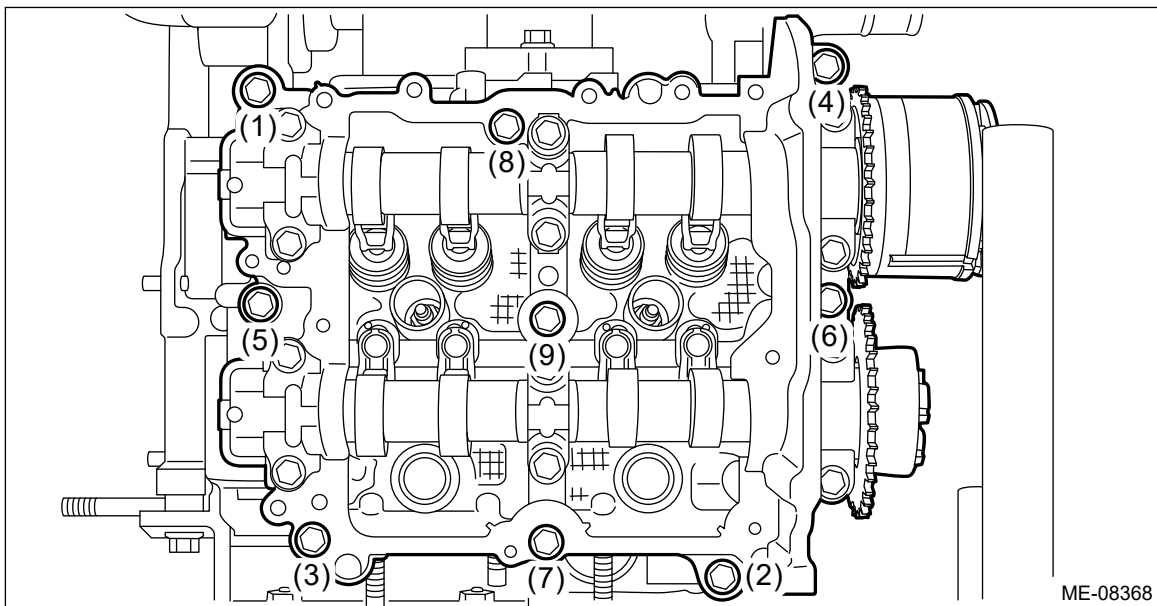
- **If the engine is standing on one side without inserting the steel rod into ST, engine may lose balance and fall down. Be sure to insert the steel rod into ST to extend the length.**
- **Use the steel rod with enough strength.**
- **Be careful not to pinch the engine harness with ST.**

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ME-08367

- 10.** Loosen the bolts holding the cam carrier RH equally, a little at a time in numerical sequence as shown in the figure and remove the cam carrier RH.

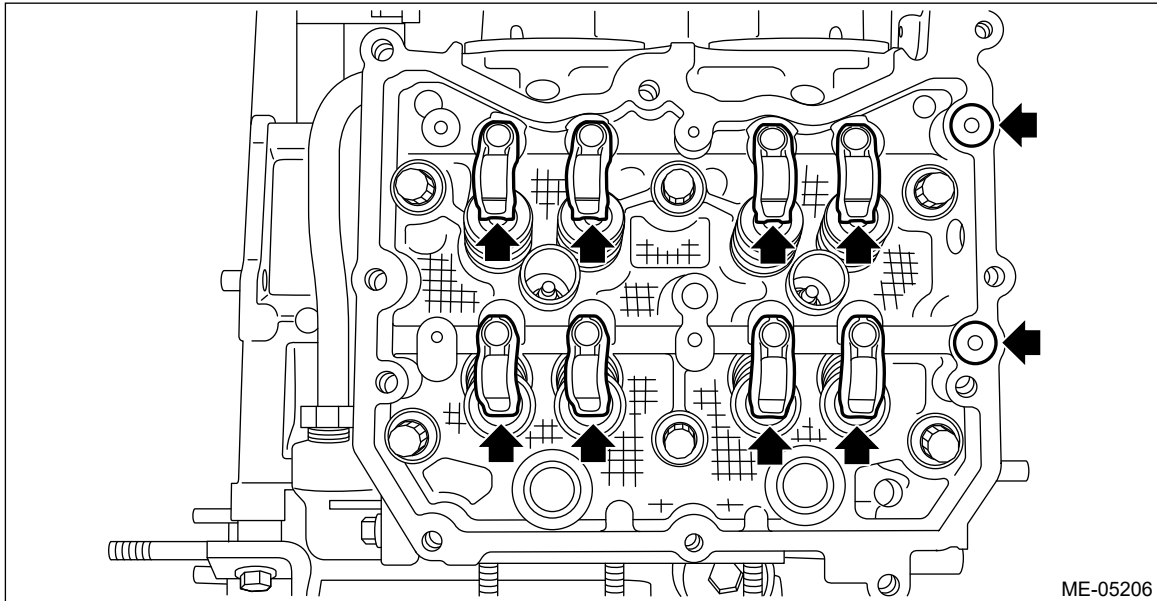


ME-08368

- 11.** Remove the O-ring and the roller rocker arm from cylinder head RH.

Note:

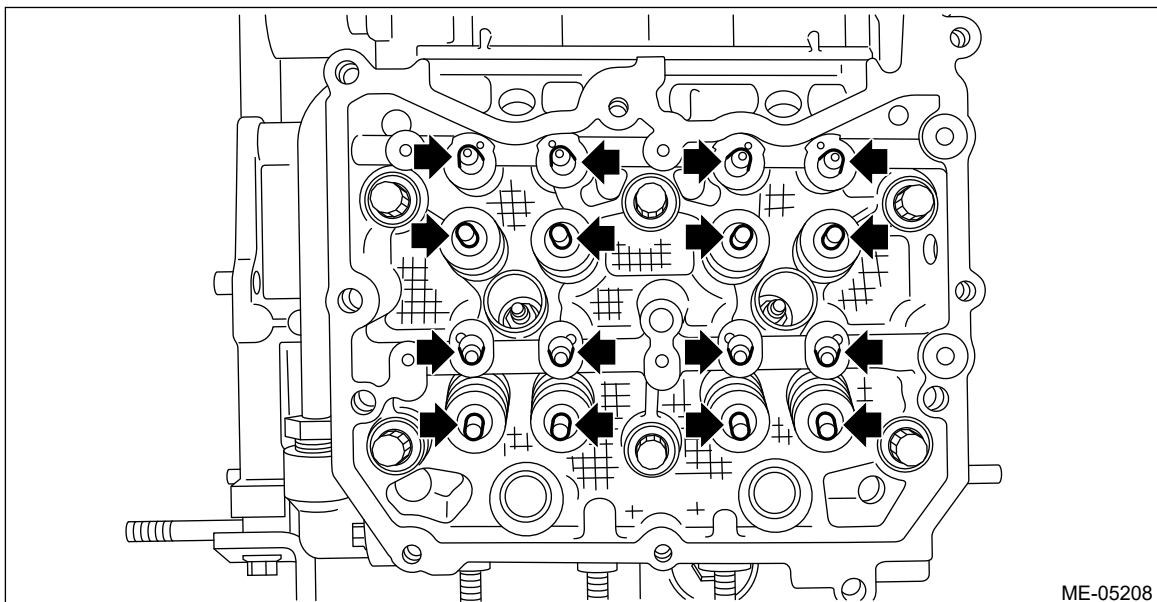
Be careful not to confuse the roller rocker arms.



12. Remove the valve shim and the roller rocker arm pivot from cylinder head RH.





Note:

Be careful not to confuse the valve shim and the roller rocker arm pivot.






13. Remove the liquid gasket from cam carrier RH and cylinder head RH.

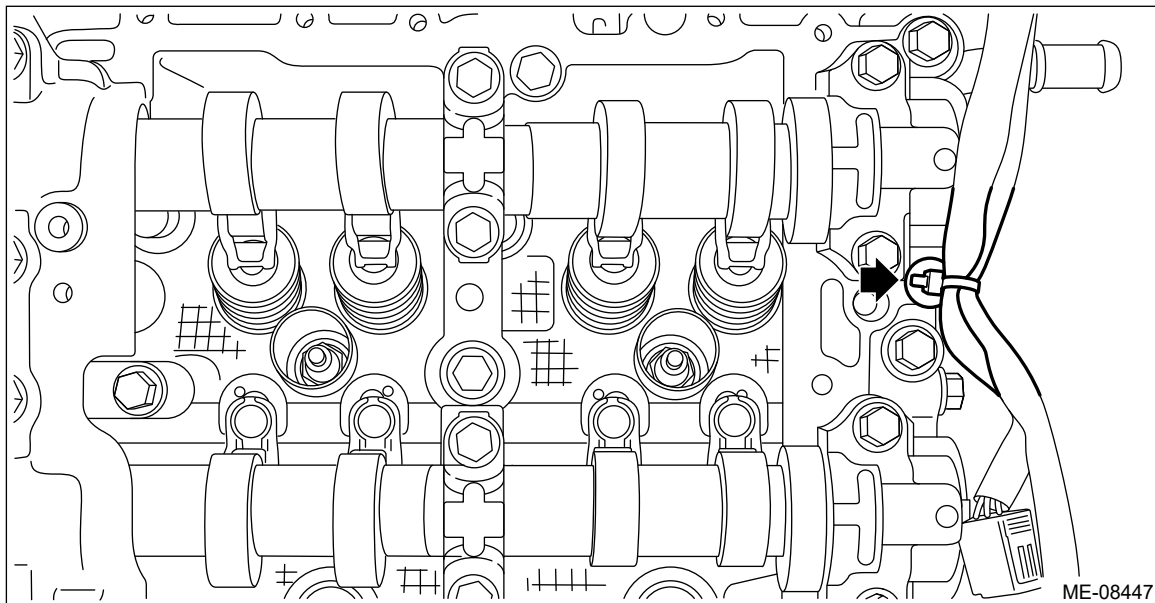
2. CAM CARRIER LH

- 1.** Remove the engine from the vehicle.  [Ref. to MECHANICAL\(H4DQ\)>Engine Assembly>REMOVAL.](#)
- 2.** Remove the chain cover.  [Ref. to MECHANICAL\(H4DQ\)>Chain Cover>REMOVAL.](#)
- 3.** Remove the timing chain LH.  [Ref. to MECHANICAL\(H4DQ\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN LH.](#)
- 4.** Remove the cam sprocket LH.  [Ref. to MECHANICAL\(H4DQ\)>Cam Sprocket>REMOVAL > CAM SPROCKET LH.](#)

Note:

This operation is required only when disassembling the cam carrier LH.

5. Remove the fuel injector LH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel Injector>REMOVAL.](#)
6. Remove the water pipe assembly LH.  [Ref. to COOLING\(H4DO\)>Water Pipe Assembly>REMOVAL > WATER PIPE ASSEMBLY LH.](#)
7. Remove the rocker cover LH.  [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>REMOVAL > ROCKER COVER LH.](#)
8. Remove the clip holding the engine harness from cam carrier LH.

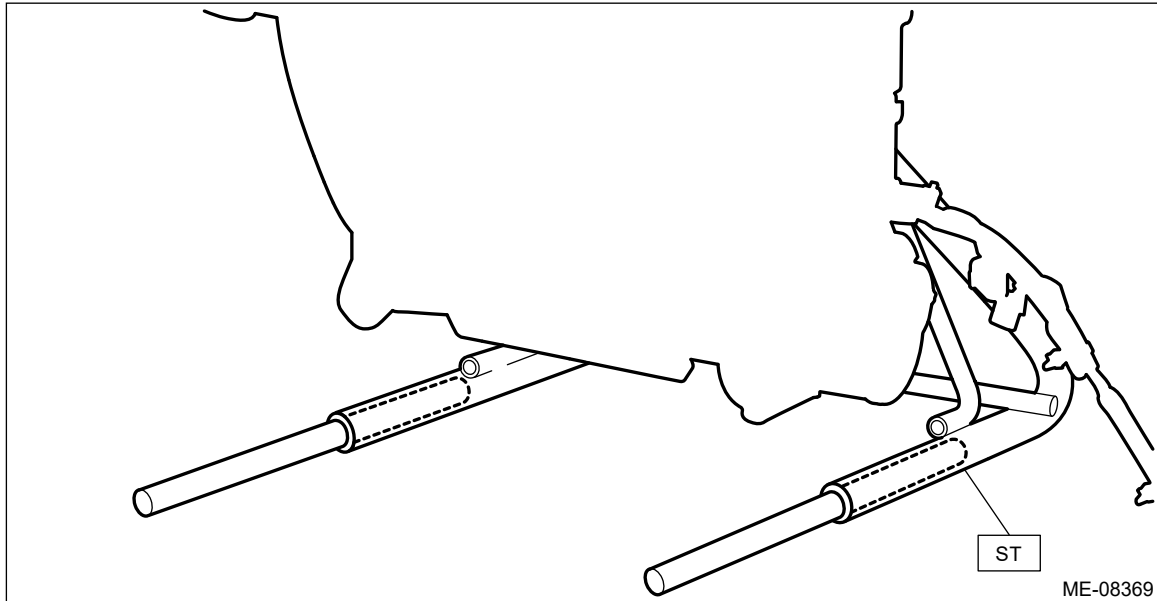


9. Insert the steel rods into ST, and set the engine so that the camshaft LH is facing up.

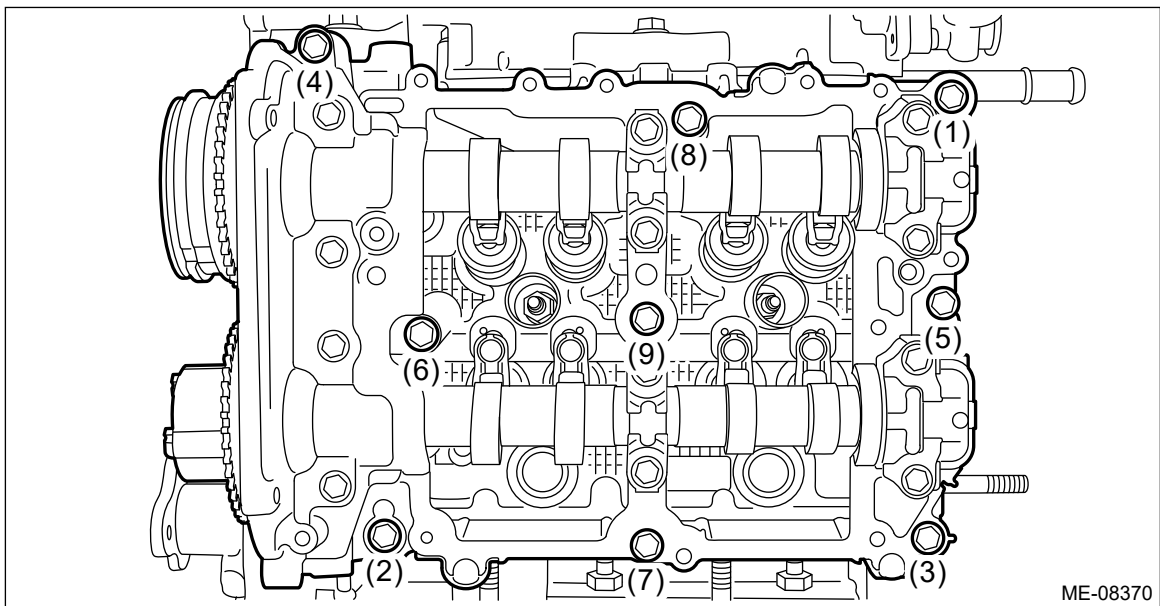
Caution:

- **If the engine is standing on one side without inserting the steel rod into ST, engine may lose balance and fall down. Be sure to insert the steel rod into ST to extend the length.**
- **Use the steel rod with enough strength.**
- **Be careful not to pinch the engine harness with ST.**

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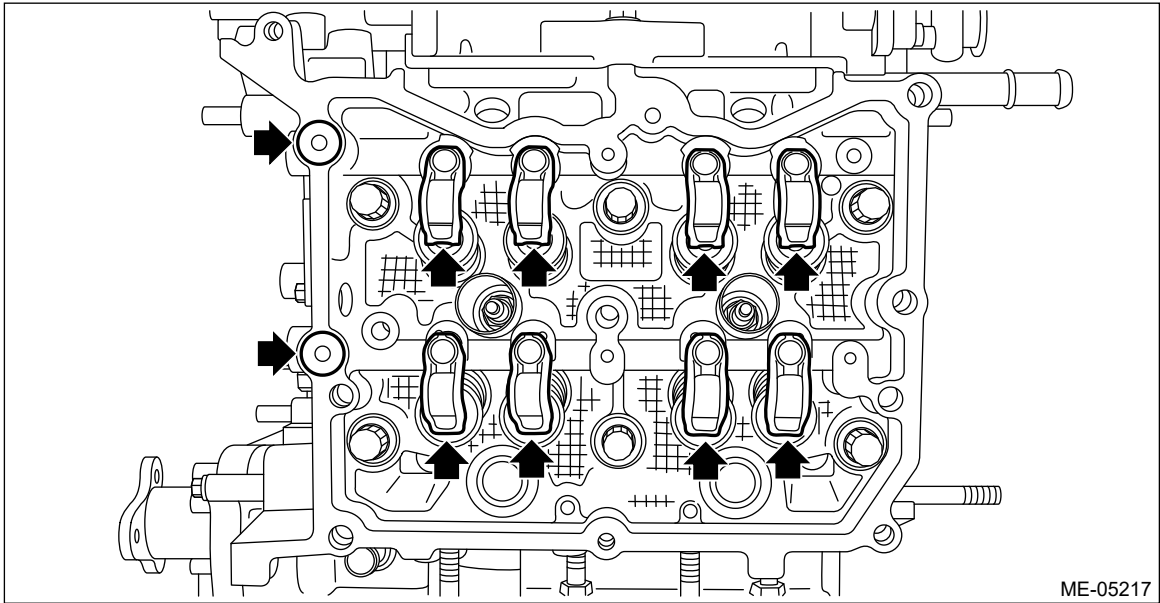
- 10.** Loosen the bolts holding the cam carrier LH equally, a little at a time in numerical sequence as shown in the figure and remove the cam carrier LH.



- 11.** Remove the O-ring and the roller rocker arm from cylinder head LH.

Note:

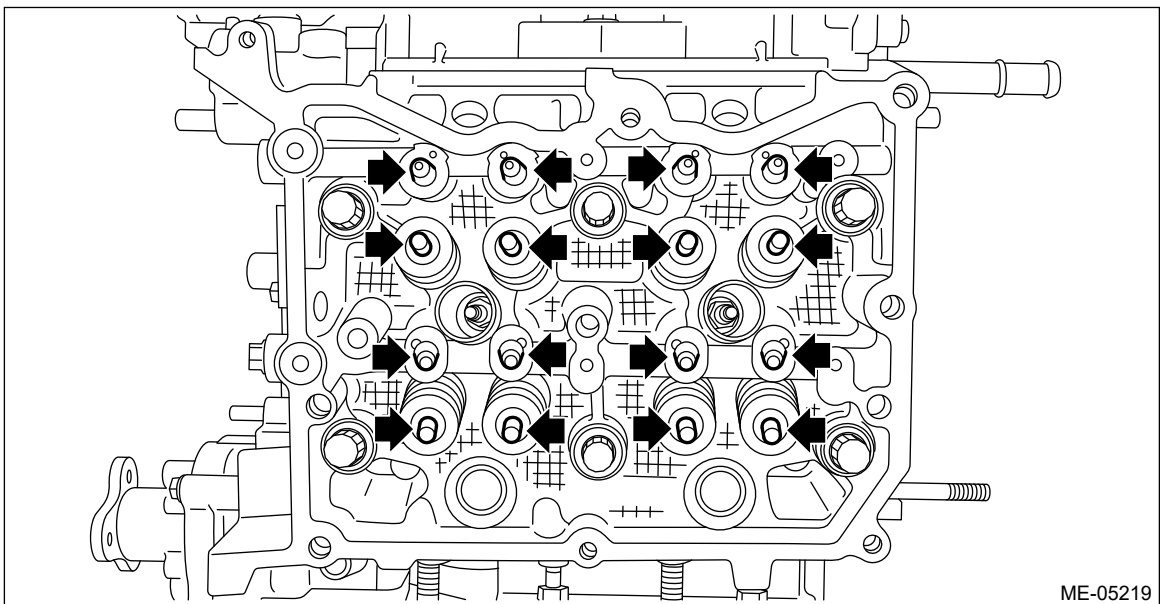
Be careful not to confuse the roller rocker arms.



12. Remove the valve shim and the roller rocker arm pivot from cylinder head LH.

Note:

Be careful not to confuse the valve shim and the roller rocker arm pivot.



13. Remove the liquid gasket from cam carrier LH and cylinder head LH.

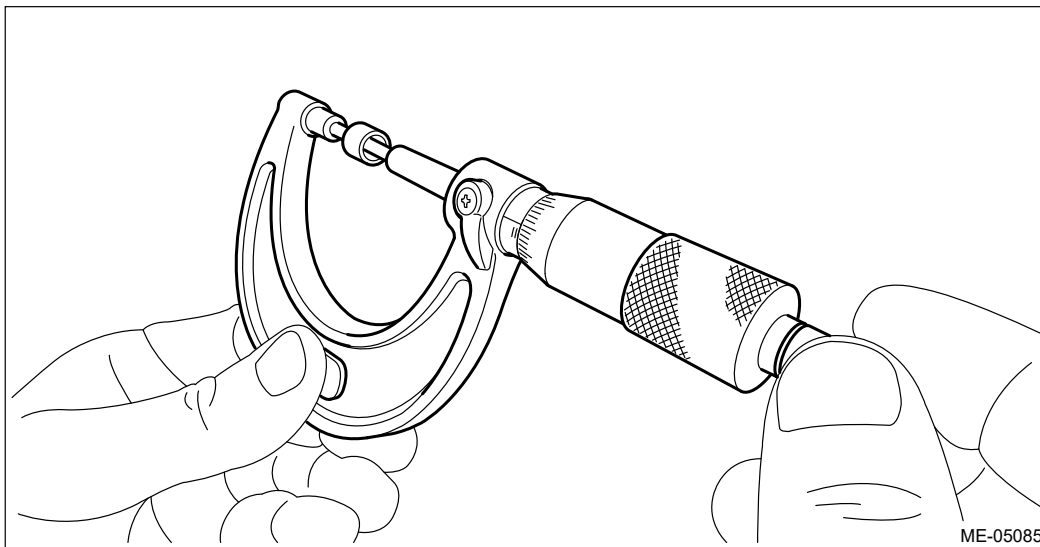
MECHANICAL(H4DO) > Cam Clearance

ADJUSTMENT

1. Remove the engine from the vehicle. [🔗 Ref. to MECHANICAL\(H4DO\)>Engine Assembly>REMOVAL.](#)
2. Remove the chain cover. [🔗 Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
3. When adjusting #1 and #3 cylinders
 - (1) Remove the timing chain RH. [🔗 Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
 - (2) Remove the cam carrier RH. [🔗 Ref. to MECHANICAL\(H4DO\)>Cam Carrier>REMOVAL > CAM CARRIER RH.](#)
 - (3) Measure the thickness of valve shim using micrometer.

Note:

Measurement should be performed at a temperature of 20°C (68°F).



- (4) Select a valve shim of suitable thickness using the measured cam clearance and valve shim thickness.

Note:

Use a new valve shim.

| |
|---|
| Intake side: $S = T + 1.69 \times (V - 0.13 \text{ mm (0.0051 in)})$ |
| Exhaust side: $S = T + 1.87 \times (V - 0.22 \text{ mm (0.0087 in)})$ |
| S: Valve shim thickness required |
| V: Measured cam clearance |
| T: Current valve shim thickness |

- (5) Install the cam carrier RH. [🔗 Ref. to MECHANICAL\(H4DO\)>Cam Carrier>INSTALLATION > CAM CARRIER RH.](#)
- (6) Check all the cam clearance of RH side at this time. If the cam clearance is not within the standard value, repeat the procedure over again from step (2).

Note:

When the removing/installing of cam carrier RH has been performed, cam clearance may be outside the standard value. Checking of all cam clearance of RH side is necessary. Refer to INSPECTION of "Cam Clearance" for the cam clearance inspection.
[🔗 Ref. to MECHANICAL\(H4DO\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)

Cam clearance:

Intake

Standard



$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

Exhaust

Standard

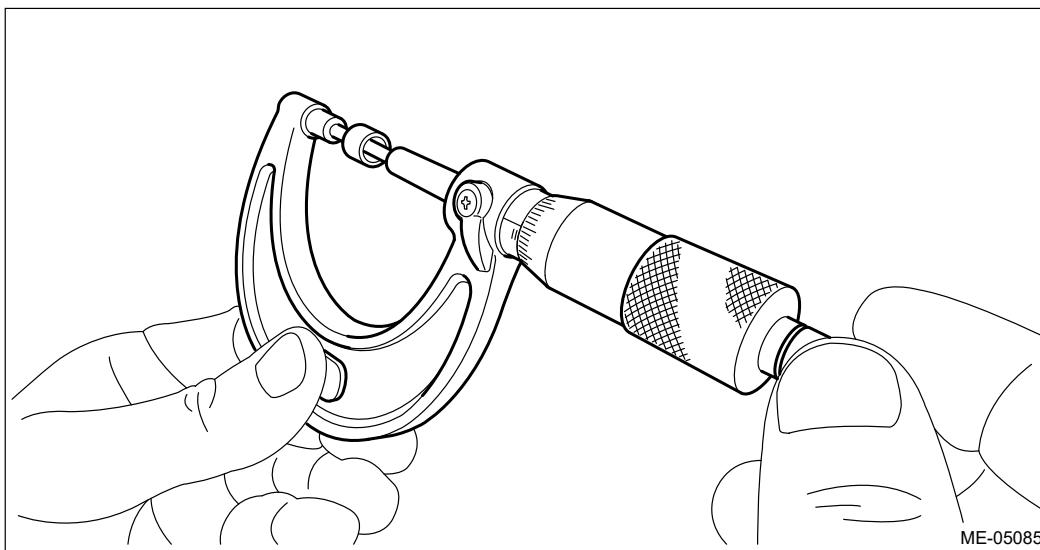
0.22 ± 0.02 mm (0.0087 ± 0.0008 in)

4. When adjusting #2 and #4 cylinders

- (1) Remove the timing chain LH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN LH.](#)
- (2) Remove the cam carrier LH.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>REMOVAL > CAM CARRIER LH.](#)
- (3) Measure the thickness of valve shim using micrometer.

Note:

Measurement should be performed at a temperature of 20°C (68°F).




- (4) Select a valve shim of suitable thickness using the measured cam clearance and valve shim thickness.


Note:

Use a new valve shim.

| |
|---|
| Intake side: $S = T + 1.69 \times (V - 0.13 \text{ mm (0.0051 in)})$ Exhaust side: $S = T + 1.87 \times (V - 0.22 \text{ mm (0.0087 in)})$ |
| S: Valve shim thickness required V: Measured cam clearance T: Current valve shim thickness |

- (5) Install the cam carrier LH.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>INSTALLATION > CAM CARRIER LH.](#)
- (6) Check all the cam clearance of LH side at this time. If the cam clearance is not within the standard value, repeat the procedure over again from step (2).

Note:

When the removing/installing of cam carrier LH has been performed, cam clearance may be outside the standard value. Checking of all cam clearance of LH side is necessary. Refer to INSPECTION of "Cam Clearance" for the cam clearance inspection.
 [Ref. to MECHANICAL\(H4DO\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)

Cam clearance:

Intake

Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

Exhaust

Standard

0.22 ± 0.02 mm (0.0087 ± 0.0008 in)

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

INSPECTION

1. WHEN TIMING CHAIN ASSEMBLY IS NOT REMOVED

Caution:

When working on the vehicle, if engine oil is spilt onto the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

Note:

- Inspection of cam clearance should be performed while engine is cold.
- If the engine is removed from vehicle, performing the steps 1) to 2) is not necessary.

1. Disconnect the ground terminal from battery sensor. [🔗 Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the air intake duct. [🔗 Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
3. Remove the V-belts. [🔗 Ref. to MECHANICAL\(H4DO\)>V-belt>REMOVAL > V-BELT.](#)
4. When inspecting #1 and #3 cylinders
 - (1) Remove the rocker cover RH. [🔗 Ref. to MECHANICAL\(H4DO\)>Rocker Cover>REMOVAL > ROCKER COVER RH.](#)

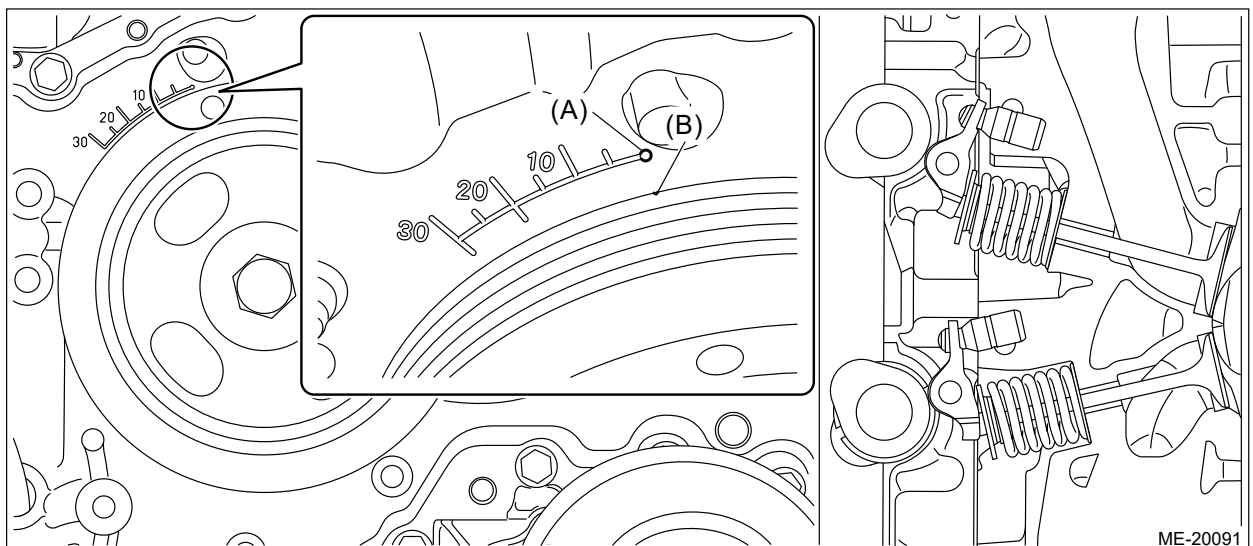
Note:

When working on the vehicle, place a suitable container under the vehicle.

- (2) Set #1 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

Note:

When the timing mark (B) on crank pulley is aligned to the 0° in timing gauge (A) on chain cover as shown in the figure, the #1 cylinder piston is located at TDC of compression stroke if the intake camshaft and exhaust camshaft does not depress the #1 cylinder intake side roller rocker arm (intake valve) and exhaust side roller rocker arm (exhaust valve). If roller rocker arm (valve) is depressed, turn the crank pulley by 360° in order to make #1 cylinder piston at TDC of compression stroke.



- (3) Check the cam clearance for #1 cylinder intake, #1 cylinder exhaust and #3 cylinder exhaust.

Note:

- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).

- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Intake

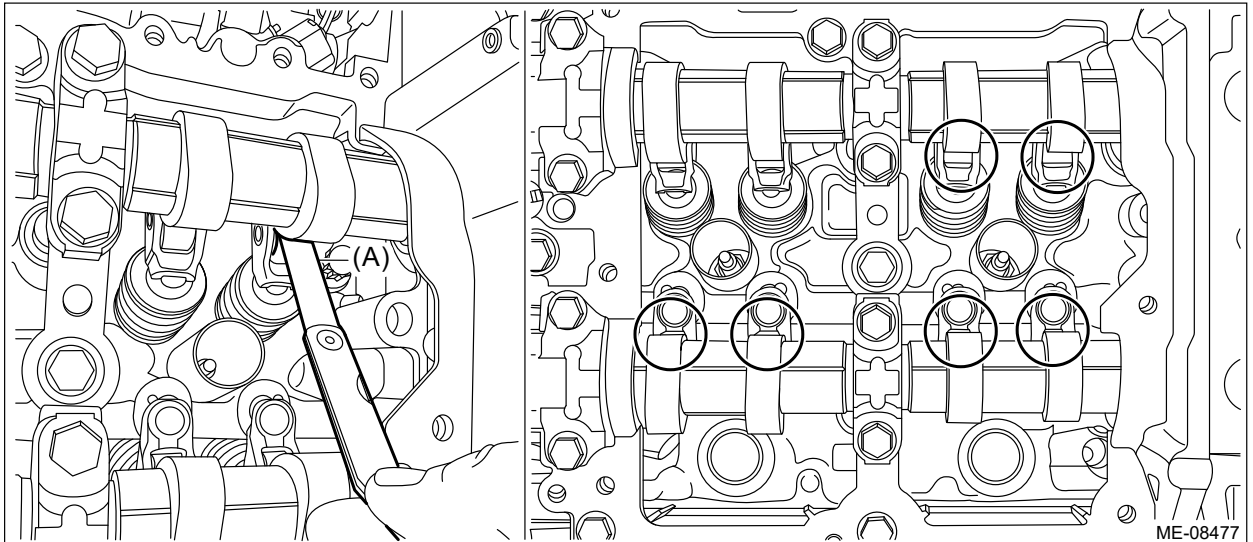
Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

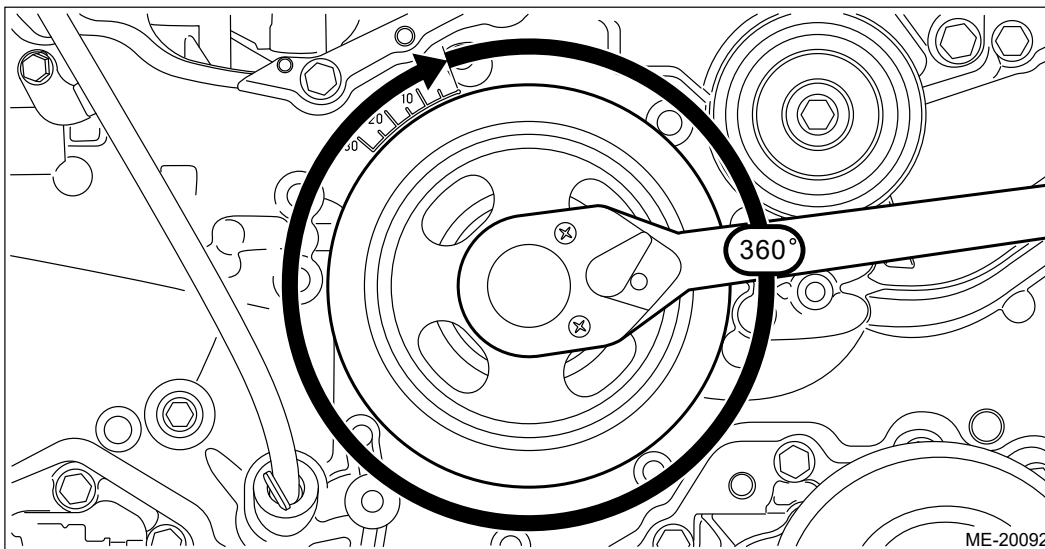
Exhaust

Standard

0.22 ± 0.02 mm (0.0087 ± 0.0008 in)



- (4) Turn the crank pulley by 360°.



- (5) Check the cam clearance of #3 cylinder intake.

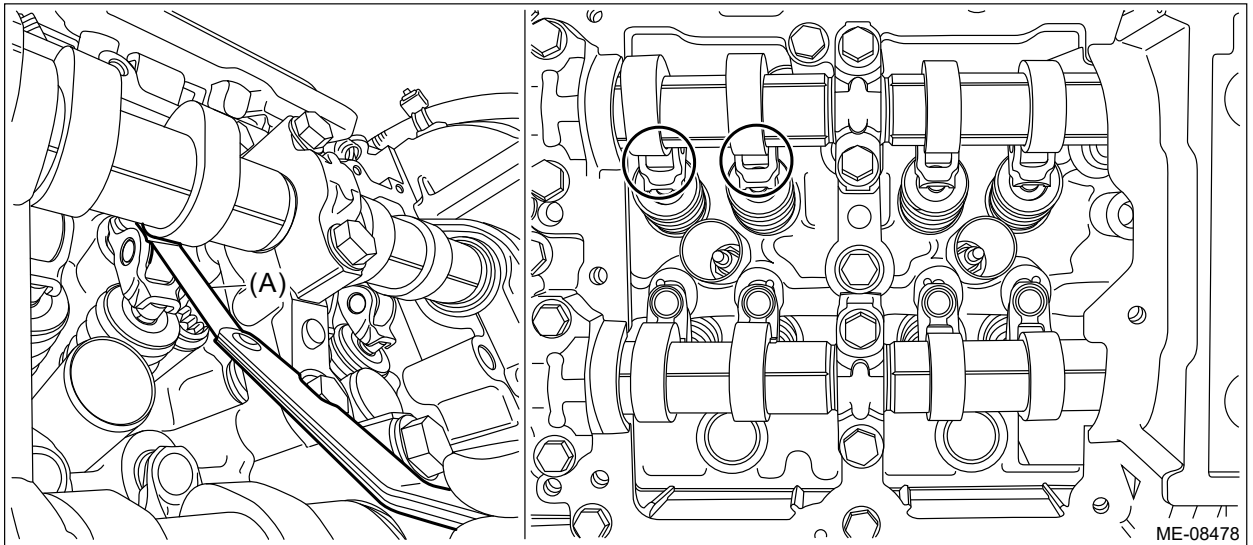
Note:

- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)



5. When inspecting #2 and #4 cylinders

- (1) Remove the rocker cover LH.  Ref. to [MECHANICAL\(H4DO\)>Rocker Cover>REMOVAL >ROCKER COVER LH.](#)

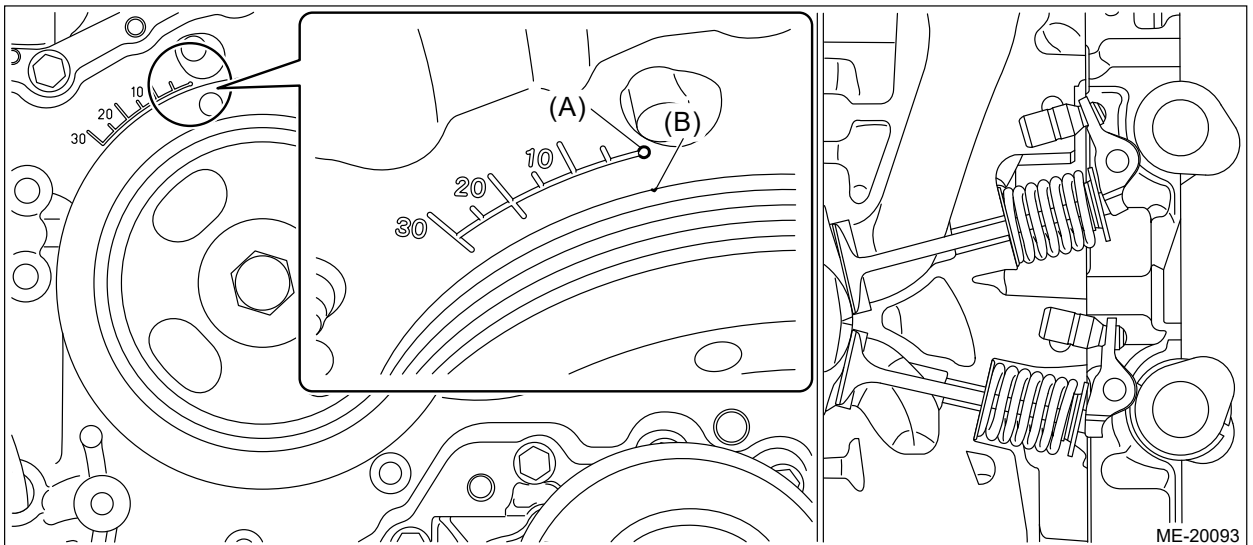
Note:

When working on the vehicle, place a suitable container under the vehicle.

- (2) Set #2 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

Note:

When the timing mark (B) on crank pulley is aligned to the 0° in timing gauge (A) on chain cover as shown in the figure, the #2 cylinder piston is located at TDC of compression stroke if the intake camshaft and exhaust camshaft does not depress the #2 cylinder intake side roller rocker arm (intake valve) and exhaust side roller rocker arm (exhaust valve). If roller rocker arm (valve) is depressed, turn the crank pulley by 360° in order to make #2 cylinder piston at TDC of compression stroke.



- (3) Check the cam clearance for #2 cylinder intake, #2 cylinder exhaust and #4 cylinder exhaust.

Note:

- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Intake

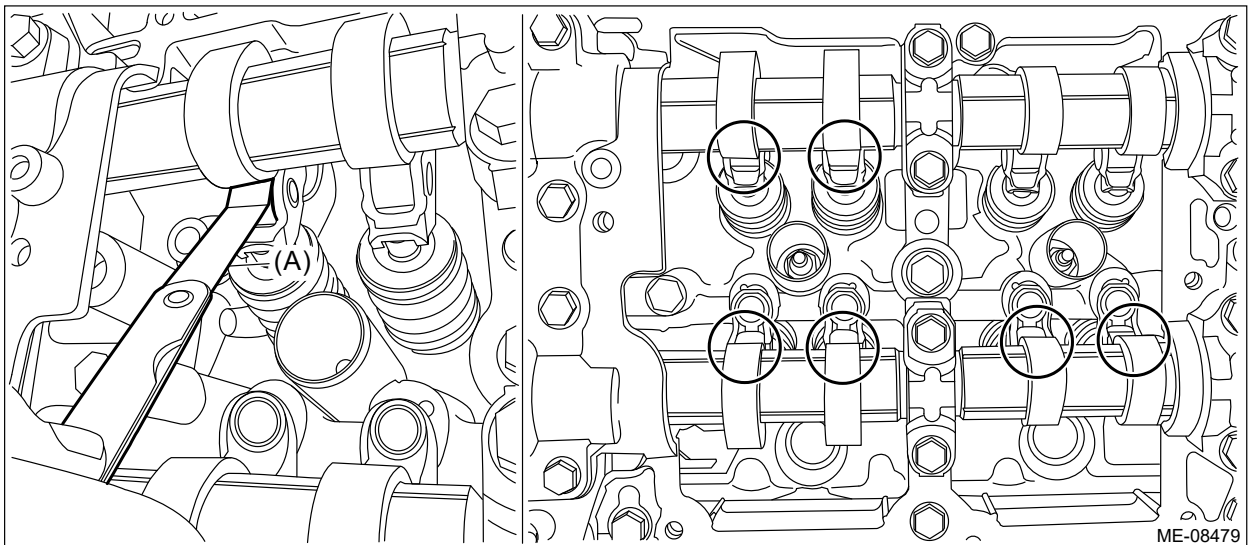
Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

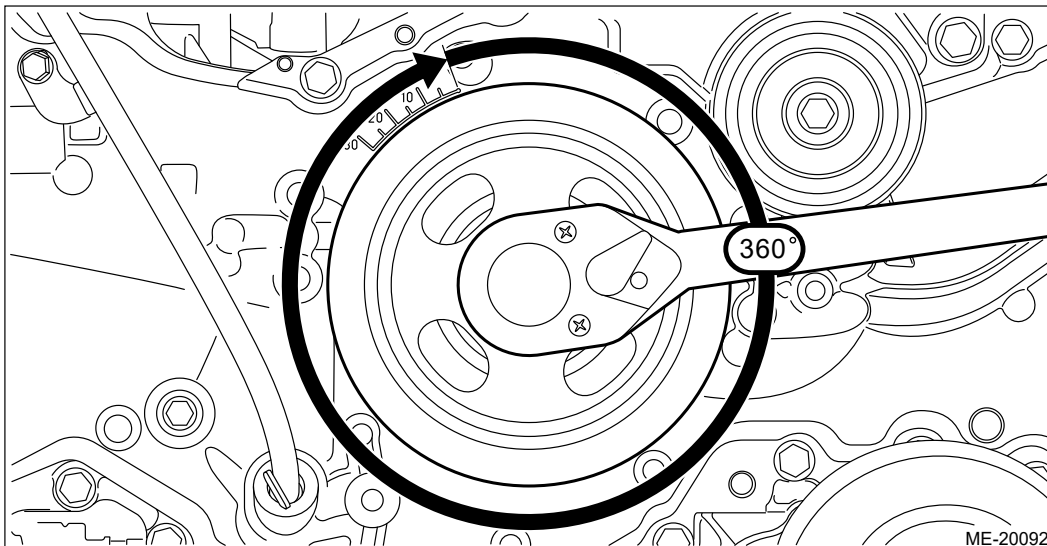
Exhaust

Standard

0.22 ± 0.02 mm (0.0087 ± 0.0008 in)



- (4) Turn the crank pulley by 360°.



- (5) Check the cam clearance of #4 cylinder intake.

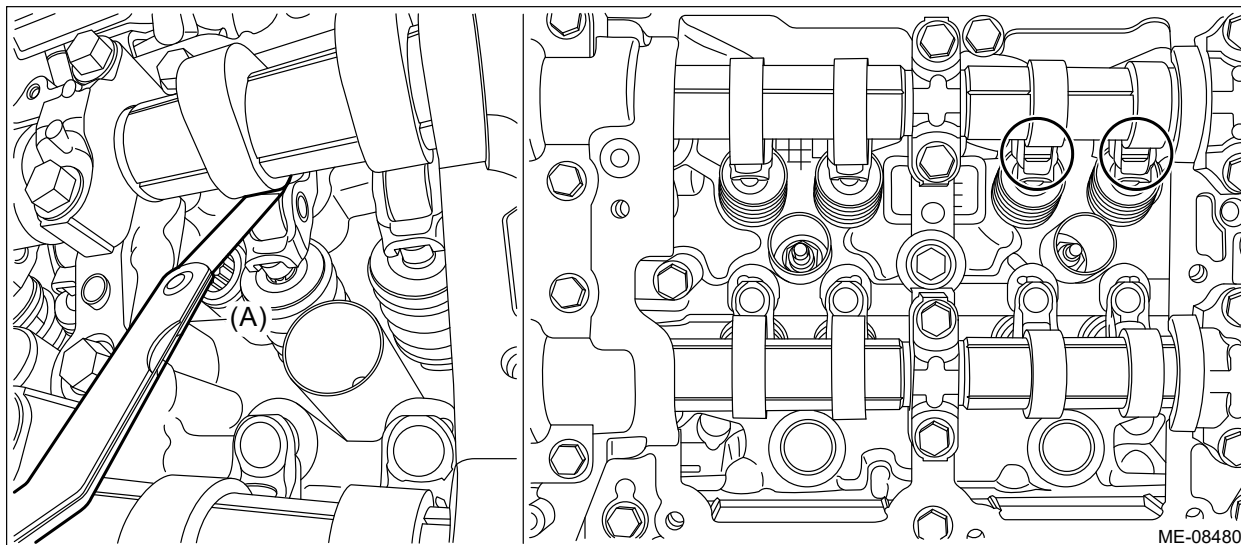
Note:

- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)



6. If necessary, adjust the cam clearance.  [Ref. to MECHANICAL\(H4DO\)>Cam Clearance>ADJUSTMENT.](#)

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

2. WHEN TIMING CHAIN ASSEMBLY IS REMOVED

Note:

Inspection of cam clearance should be performed while engine is cold.

1. When inspecting #1 and #3 cylinders

(1) Remove the rocker cover RH.  [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>REMOVAL > ROCKER COVER RH.](#)

Note:

When working on the vehicle, place a suitable container under the vehicle.

(2) Check the #1 and #3 cylinder cam clearance.

Caution:

Intake and exhaust camshafts can be independently rotated with the timing chain removed. When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn it to the outside of range of zero lift (cam base circle position) (in range where it can be turned lightly by hand).

Note:

- For cam clearance inspection, adjust the cam base circle position so that the thickness gauge (A) can be inserted easily by hand turning the camshaft (cam sprocket) to be measured.
- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Intake

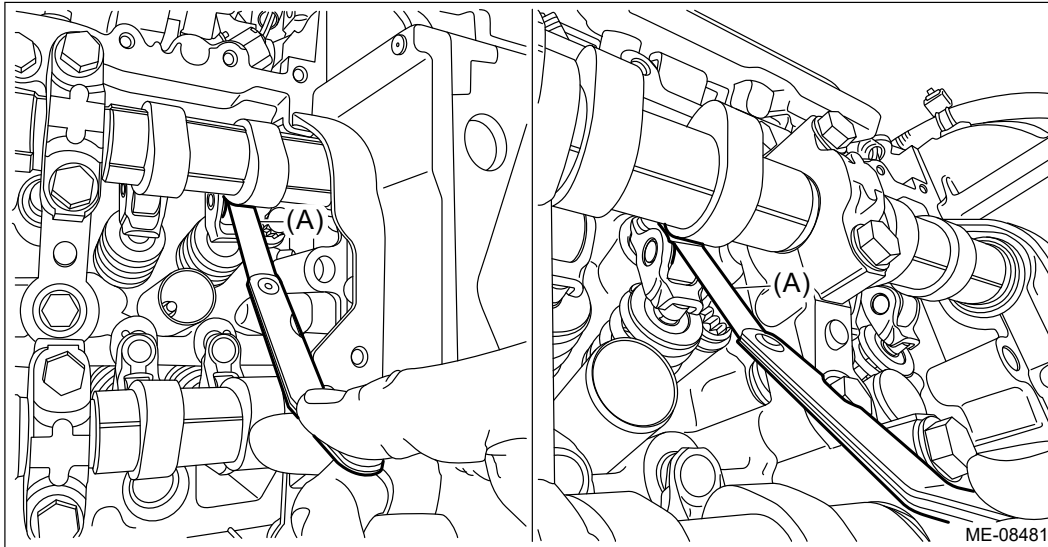
Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

Exhaust

Standard

0.22 ± 0.02 mm (0.0087 ± 0.0008 in)



2. When inspecting #2 and #4 cylinders

- (1) Remove the rocker cover LH.  Ref. to [MECHANICAL\(H4DO\)>Rocker Cover>REMOVAL > ROCKER COVER LH.](#)

Note:

When working on the vehicle, place a suitable container under the vehicle.

- (2) Check the #2 and #4 cylinder cam clearance.

Caution:

Intake and exhaust camshafts can be independently rotated with the timing chain removed. When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn it to the outside of range of zero lift (cam base circle position) (in range where it can be turned lightly by hand).

Note:

- For cam clearance inspection, adjust the cam base circle position so that the thickness gauge (A) can be inserted easily by hand turning the camshaft (cam sprocket) to be measured.
- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Intake

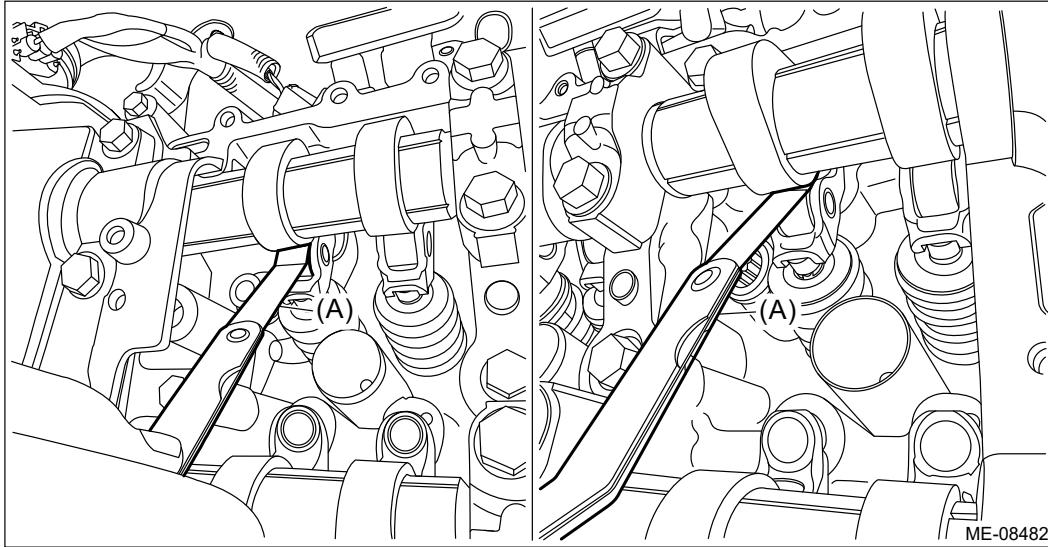
Standard


$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

Exhaust

Standard

0.22 ± 0.02 mm (0.0087 ± 0.0008 in)



- 3.** If necessary, adjust the cam clearance.  [Ref. to MECHANICAL\(H4DO\)>Cam Clearance>ADJUSTMENT.](#)
- 4.** After inspection, install the related parts in the reverse order of removal.

MECHANICAL(H4DO) > Cam Sprocket

INSPECTION

Check the cam sprocket teeth for abnormal wear and scratches.

INSTALLATION

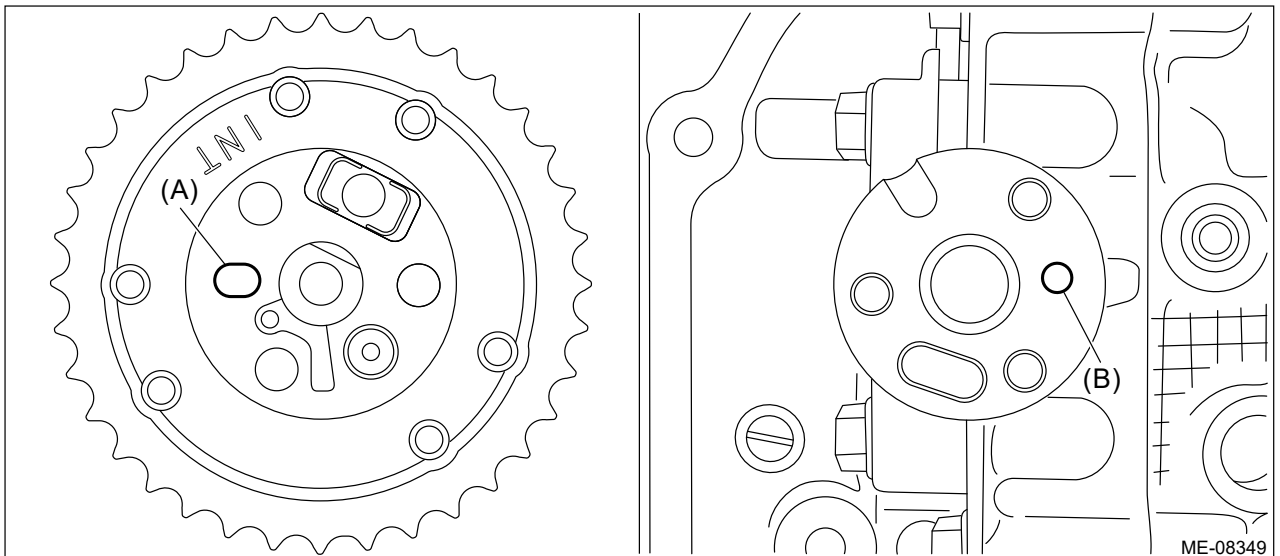
1. CAM SPROCKET RH

• INTAKE CAM SPROCKET RH

1. Install the intake cam sprocket RH by aligning the knock hole (A) of intake cam sprocket RH and the knock pin (B) of intake camshaft RH.

Note:

Before installation, check that there is no foreign matter on the intake cam sprocket RH and intake camshaft RH.



2. Hold the intake cam sprocket RH using the ST1 and ST2, and install the bolts using the ST3.

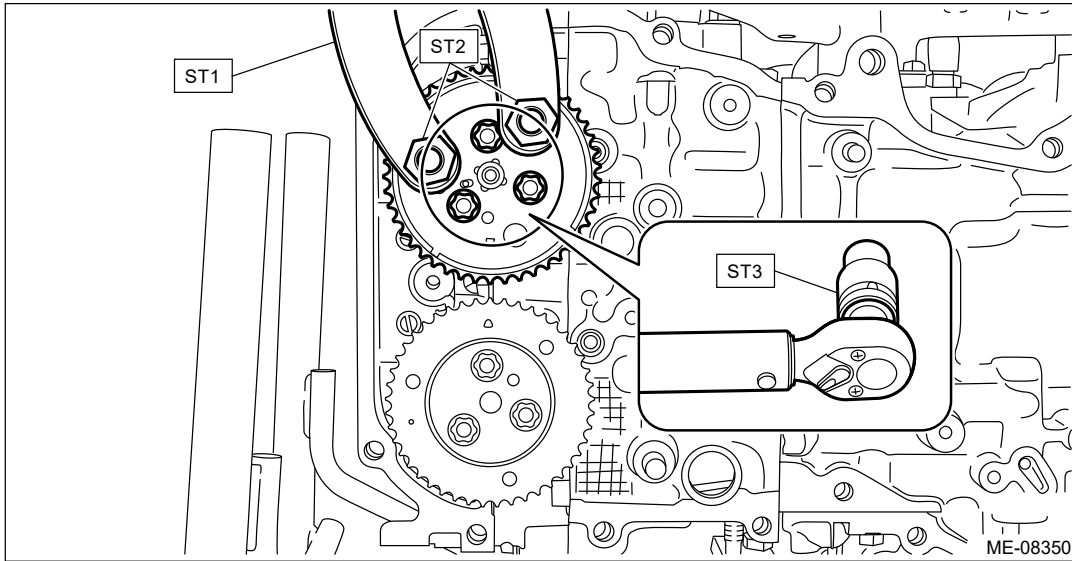
Caution:



Perform the operation carefully since the ST comes off easily.

| | | |
|------------|-------------------|------------------------------|
| ST1 | 18355AA000 | PULLEY WRENCH |
| ST2 | 18334AA020 | PULLEY WRENCH PIN SET |
| ST3 | 18270KA010 | SOCKET |

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



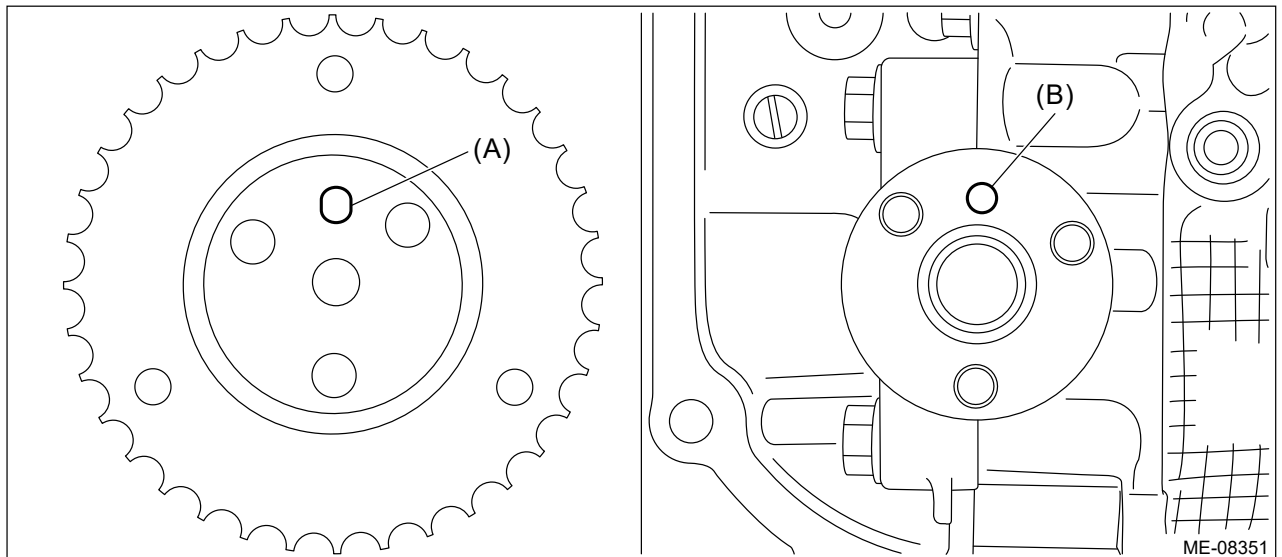
3. Install the timing chain RH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN RH.](#)
4. Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)

● **EXHAUST CAM SPROCKET RH**

1. Install the exhaust cam sprocket RH by aligning the knock hole (A) of exhaust cam sprocket RH and the knock pin (B) of exhaust camshaft RH.

Note:

Before installation, check that there is no foreign matter on the exhaust cam sprocket RH and exhaust camshaft RH.

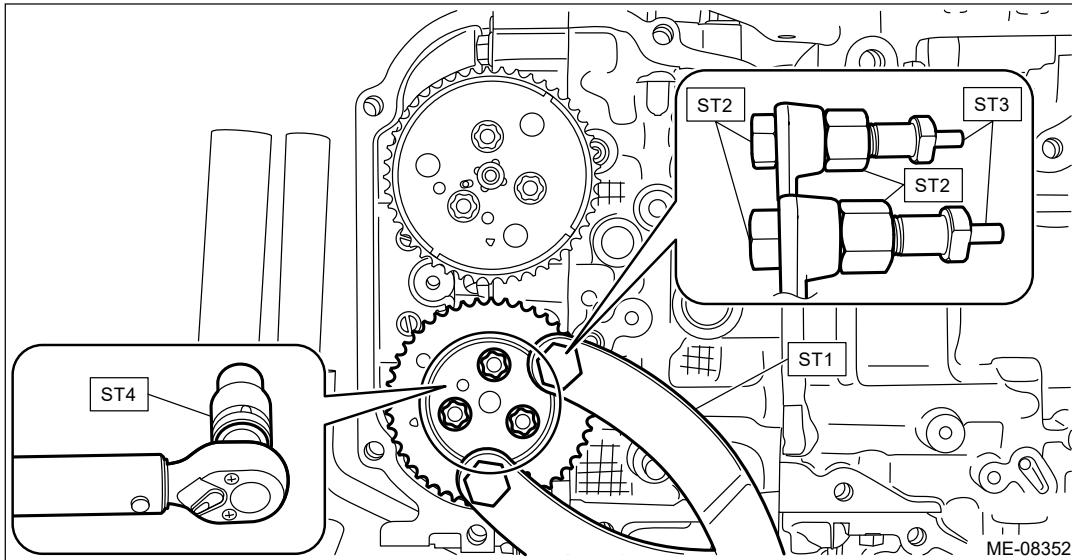




2. Hold the exhaust cam sprocket RH using the ST1, ST2 and ST3, and install the bolts using the ST4.

| | | |
|------------|-------------------|------------------------------|
| ST1 | 18355AA000 | PULLEY WRENCH |
| ST2 | 18334AA040 | PULLEY WRENCH PIN SET |
| ST3 | 18334AA020 | PULLEY WRENCH PIN SET |
| ST4 | 18270KA010 | SOCKET |

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



3. Install the timing chain RH.  [Ref. to MECHANICAL\(H4DQ\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN RH.](#)
4. Install the chain cover.  [Ref. to MECHANICAL\(H4DQ\)>Chain Cover>INSTALLATION.](#)

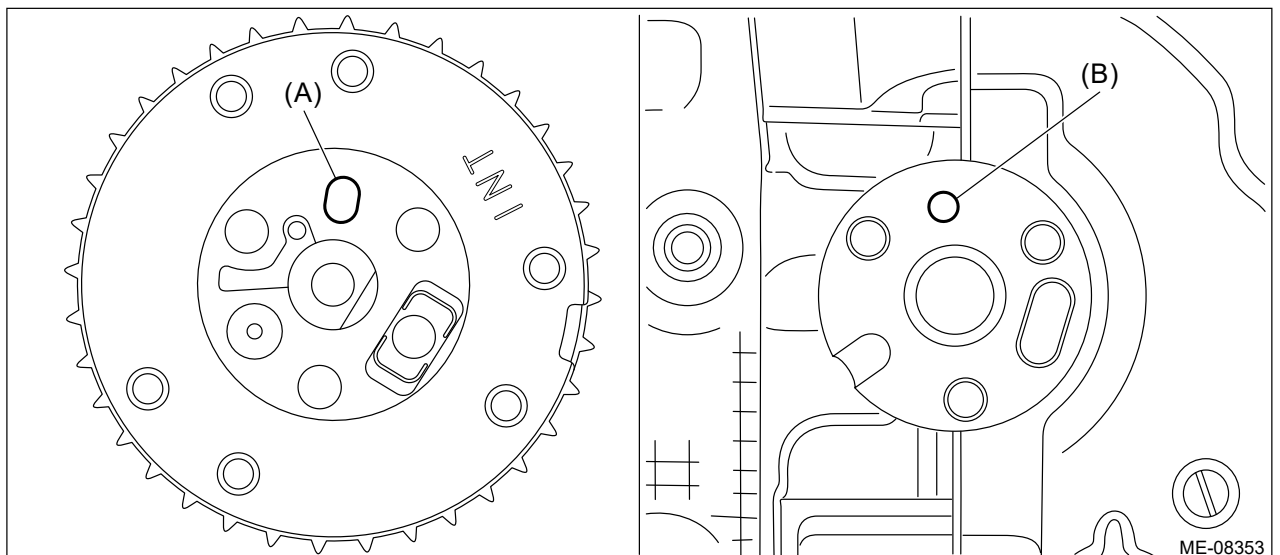
2. CAM SPROCKET LH

• INTAKE CAM SPROCKET LH

1. Install the intake cam sprocket LH by aligning the knock hole (A) of intake cam sprocket LH and the knock pin (B) of intake camshaft LH.

Note:

Before installation, check that there is no foreign matter on the intake cam sprocket LH and intake camshaft LH.



2. Hold the intake cam sprocket LH using the ST1 and ST2, and install the bolts using the ST3.

Caution:

Perform the operation carefully since the ST comes off easily.

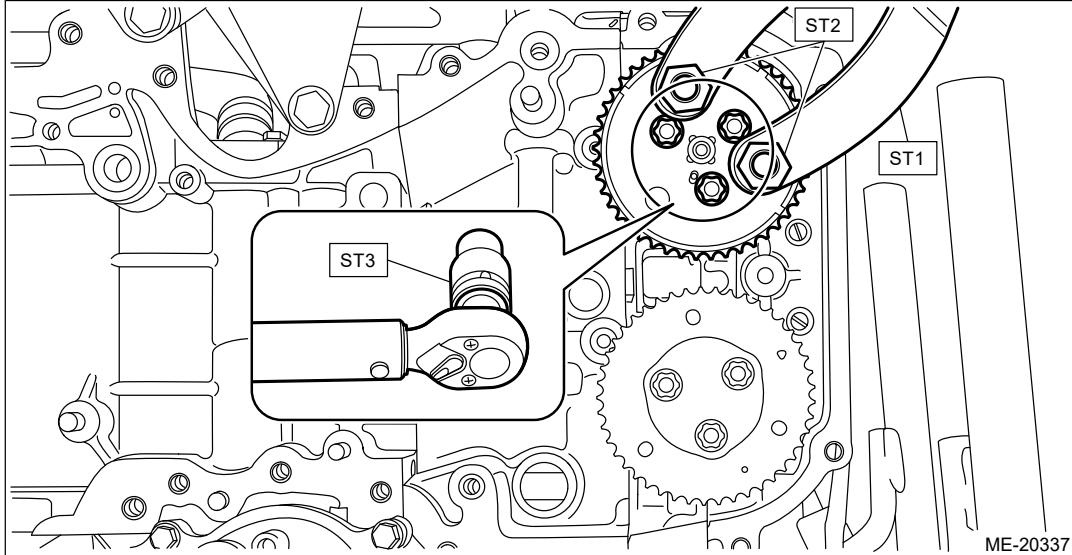
ST1 18355AA000 PULLEY WRENCH


ST2 18334AA020 PULLEY WRENCH PIN SET

ST3 18270KA010 SOCKET

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



3. Install timing chain LH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN LH.](#)

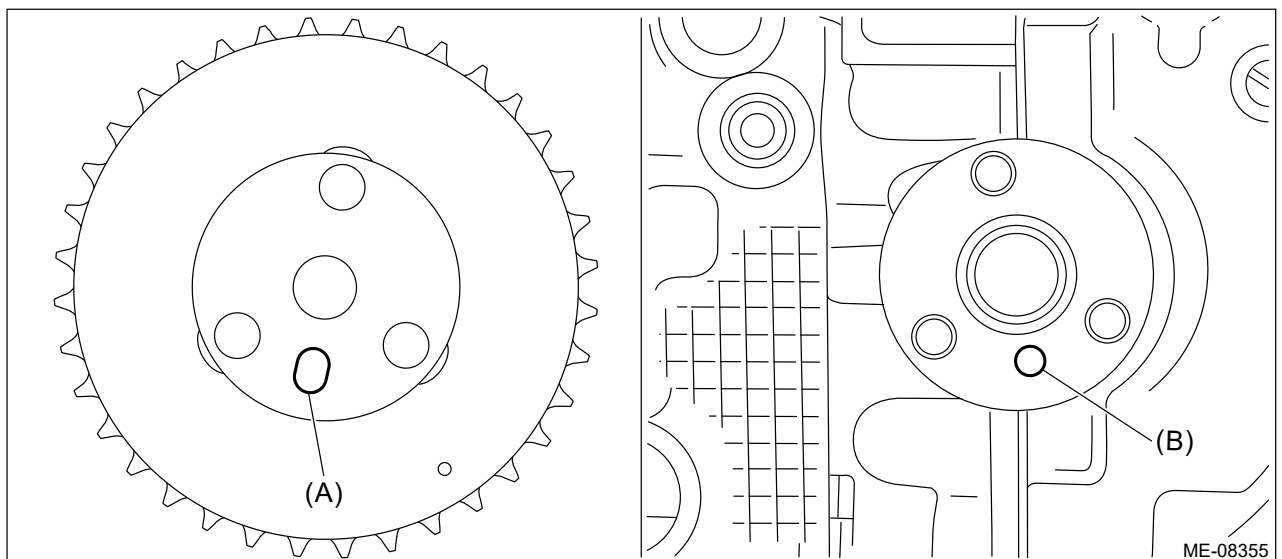
4. Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)

● **EXHAUST CAM SPROCKET LH**

1. Install the exhaust cam sprocket LH by aligning the knock hole (A) of exhaust cam sprocket LH and the knock pin (B) of exhaust camshaft LH.

Note:

Before installation, check that there is no foreign matter on the exhaust cam sprocket LH and exhaust camshaft LH.



2. Hold the exhaust cam sprocket LH using the ST1, ST2 and ST3, and install the bolts using the ST4.

ST1 18355AA000 PULLEY WRENCH

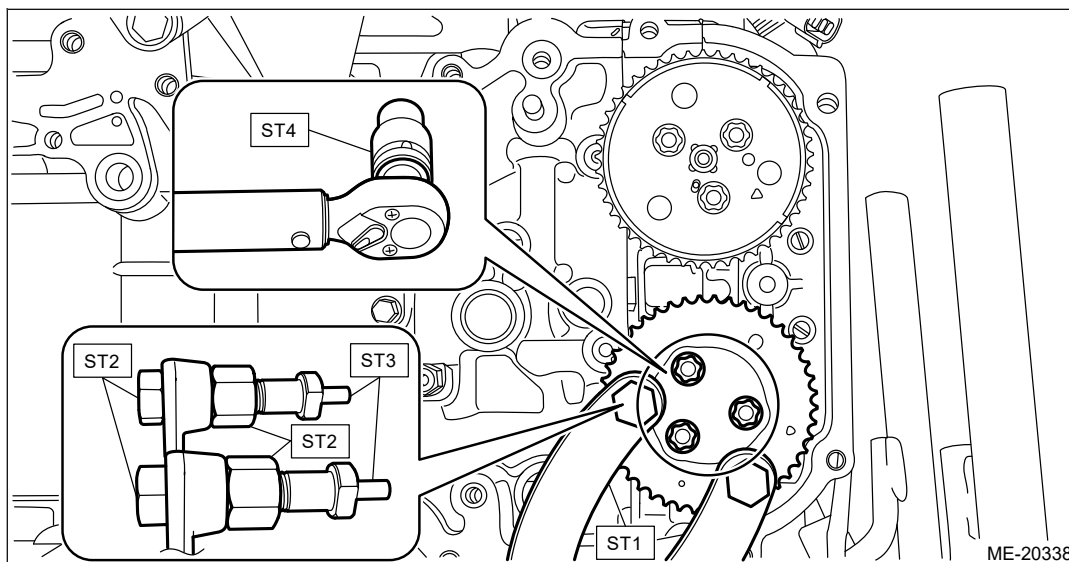
ST2 18334AA040 PULLEY WRENCH PIN SET



ST3 18334AA020 PULLEY WRENCH PIN SET

ST4 18270KA010 SOCKET

Tightening torque:

18 N·m (1.8 kgf·m, 13.3 ft·lb)



- 3.** Install timing chain LH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN LH.](#)
- 4.** Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)



REMOVAL

1. CAM SPROCKET RH

Note:

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

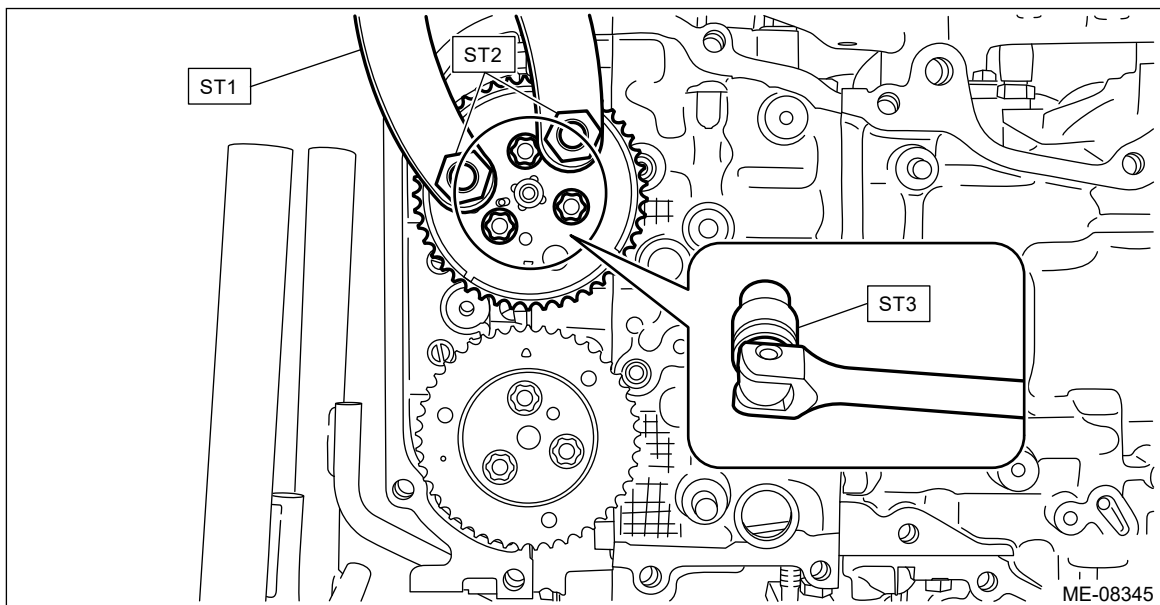
● **INTAKE CAM SPROCKET RH**

1. Remove the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain RH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
3. Hold the intake cam sprocket RH using the ST1 and ST2, and remove the bolts using the ST3.

Caution:



Perform the operation carefully since the ST comes off easily.

- | | | |
|------------|-------------------|------------------------------|
| ST1 | 18355AA000 | PULLEY WRENCH |
| ST2 | 18334AA020 | PULLEY WRENCH PIN SET |
| ST3 | 18270KA010 | SOCKET |

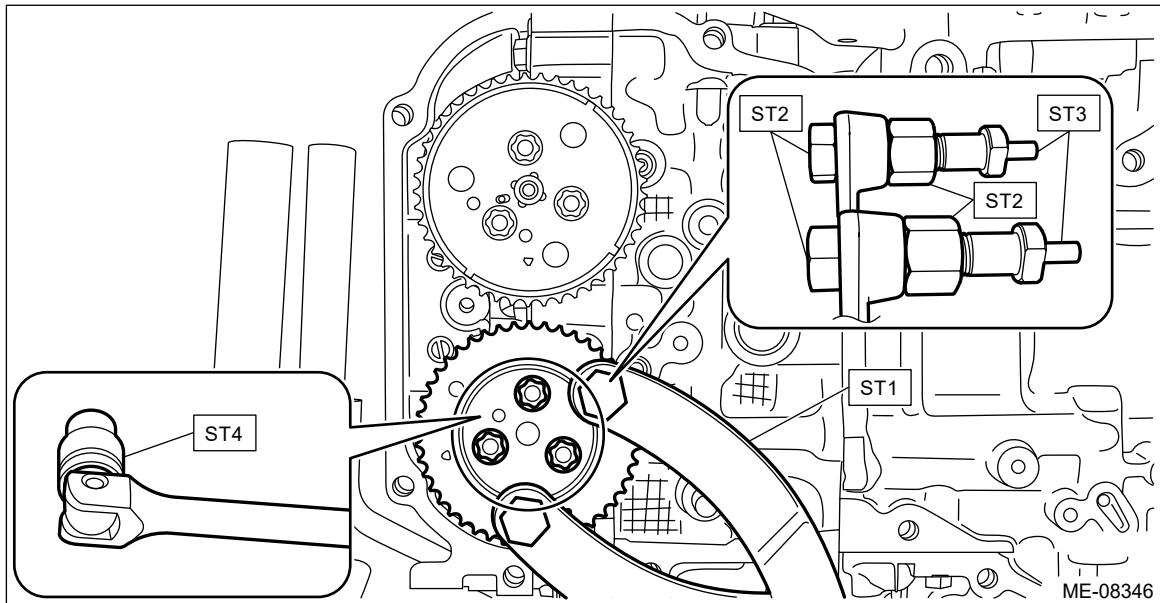


4. Remove the intake cam sprocket RH.

● **EXHAUST CAM SPROCKET RH**

1. Remove the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain RH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
3. Hold the exhaust cam sprocket RH using the ST1, ST2 and ST3, and remove the bolts using the ST4.

| | | |
|------------|-------------------|------------------------------|
| ST1 | 18355AA000 | PULLEY WRENCH |
| ST2 | 18334AA040 | PULLEY WRENCH PIN SET |
| ST3 | 18334AA020 | PULLEY WRENCH PIN SET |
| ST4 | 18270KA010 | SOCKET |



4. Remove the exhaust cam sprocket RH.

2. CAM SPROCKET LH

Note:

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

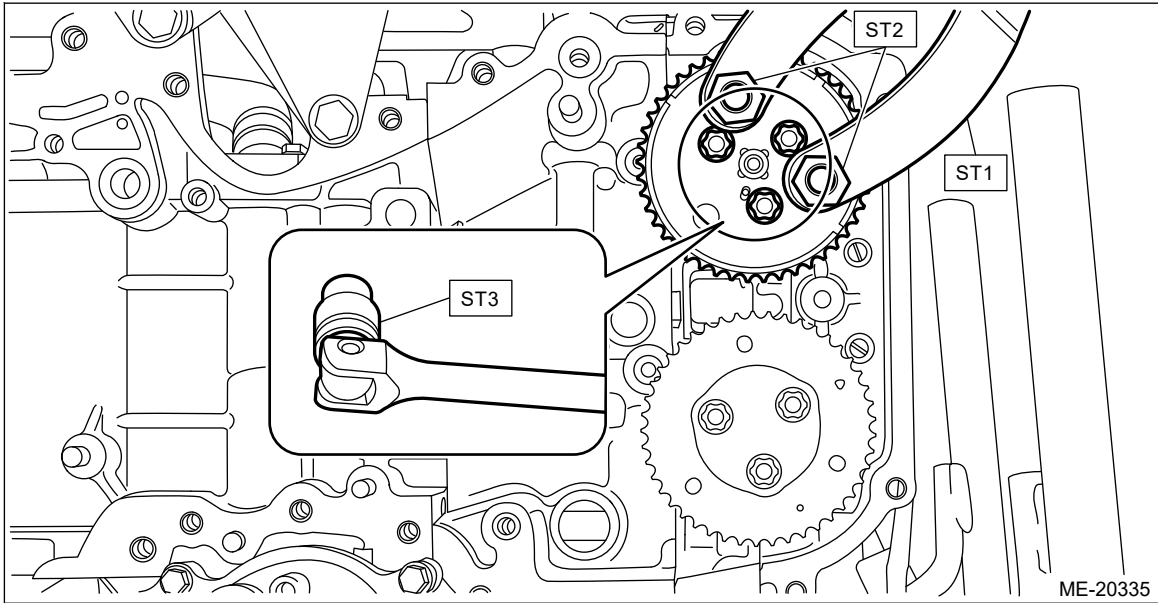
● INTAKE CAM SPROCKET LH

1. Remove the chain cover. [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain LH. [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN LH.](#)
3. Hold the intake cam sprocket LH using the ST1 and ST2, and remove the bolts using the ST3.

Caution:



Perform the operation carefully since the ST comes off easily.

| | | |
|------------|-------------------|------------------------------|
| ST1 | 18355AA000 | PULLEY WRENCH |
| ST2 | 18334AA020 | PULLEY WRENCH PIN SET |
| ST3 | 18270KA010 | SOCKET |

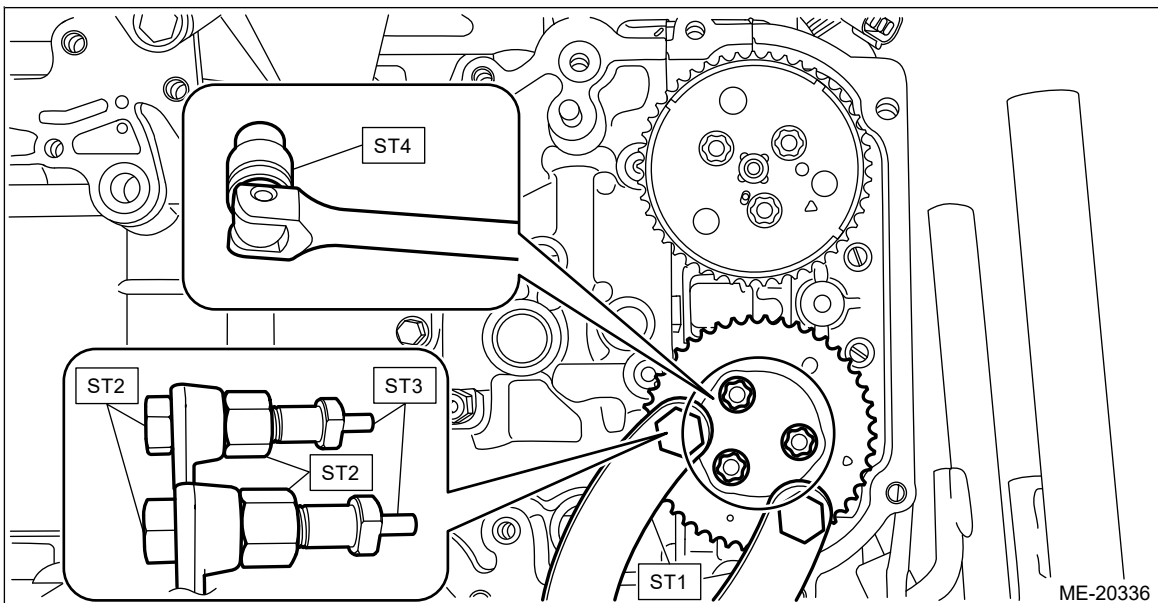


4. Remove the intake cam sprocket LH.

● **EXHAUST CAM SPROCKET LH**

1. Remove the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain LH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN LH.](#)
3. Hold the exhaust cam sprocket LH using the ST1, ST2 and ST3, and remove the bolts using the ST4.

- | | | |
|------------|-------------------|------------------------------|
| ST1 | 18355AA000 | PULLEY WRENCH |
| ST2 | 18334AA040 | PULLEY WRENCH PIN SET |
| ST3 | 18334AA020 | PULLEY WRENCH PIN SET |
| ST4 | 18270KA010 | SOCKET |





4. Remove the exhaust cam sprocket LH.



MECHANICAL(H4DO) > Camshaft

INSTALLATION

1. CAMSHAFT RH

The camshaft RH and cam carrier are designed as installing as a unit. Refer to "Cam Carrier" for installation procedures of camshaft RH.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>ASSEMBLY > CAM CARRIER RH.](#)  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>INSTALLATION > CAM CARRIER RH.](#)



2. CAMSHAFT LH

The camshaft LH and cam carrier are designed as installing as a unit. Refer to "Cam Carrier" for installation procedures of camshaft LH.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>ASSEMBLY > CAM CARRIER LH.](#)  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>INSTALLATION > CAM CARRIER LH.](#)



MECHANICAL(H4DO) > Camshaft

REMOVAL

1. CAMSHAFT RH

The camshaft RH and cam carrier are designed as removing as a unit. Refer to "Cam Carrier" for removal procedures of camshaft RH.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>REMOVAL > CAM CARRIER RH.](#)  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>DISASSEMBLY > CAM CARRIER RH.](#)

2. CAMSHAFT LH

The camshaft LH and cam carrier are designed as removing as a unit. Refer to "Cam Carrier" for removal procedures of camshaft LH.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>REMOVAL > CAM CARRIER LH.](#)  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>DISASSEMBLY > CAM CARRIER LH.](#)

MECHANICAL(H4DO) > Chain Cover

ASSEMBLY

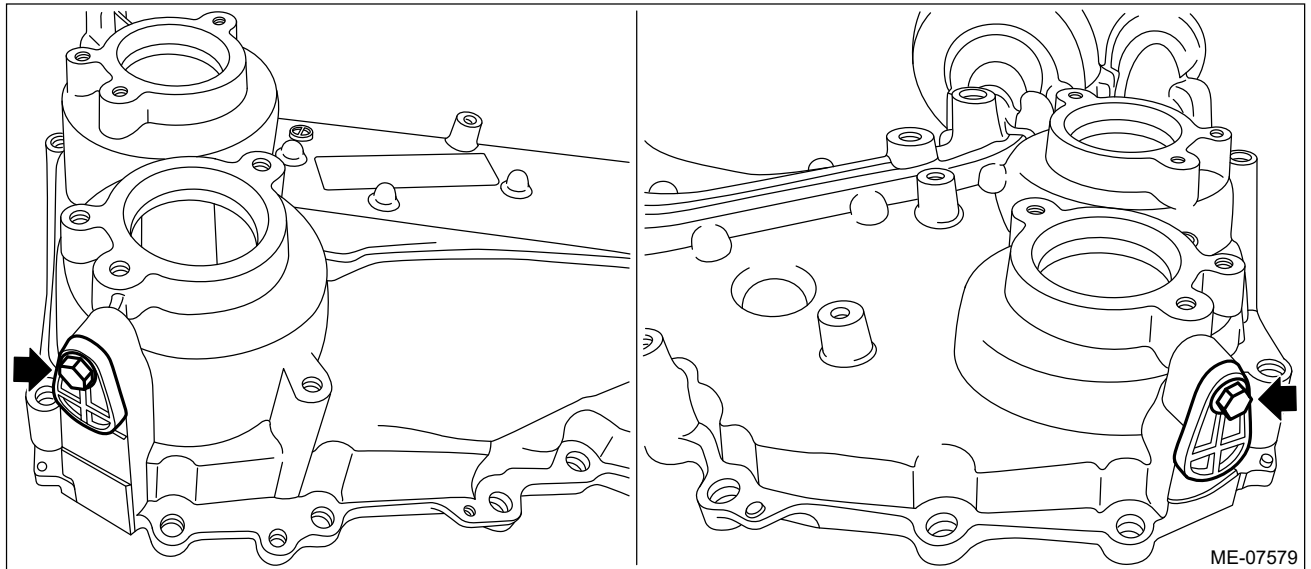
1. Install the sensor cover to the chain cover.

Note:

- Use new O-rings.
- Apply a coat of engine oil to the O-rings.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



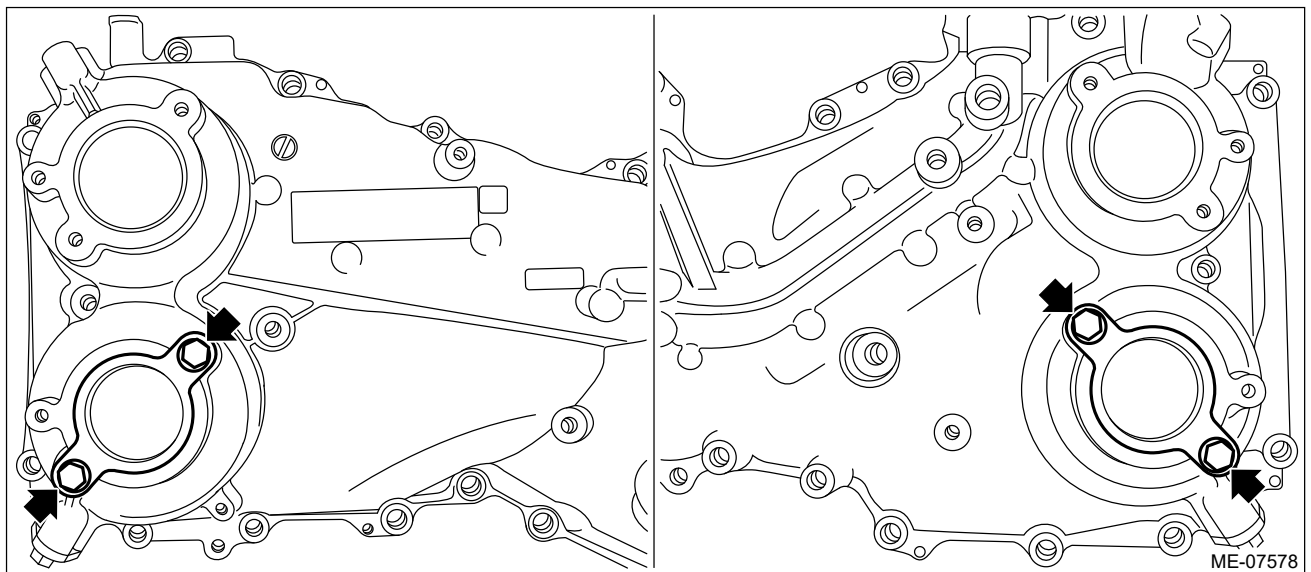
2. Install the actuator cover to chain cover.

Note:

- Use new O-rings.
- Apply a coat of engine oil to the O-rings.





Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



3. Install the camshaft position sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)](#)

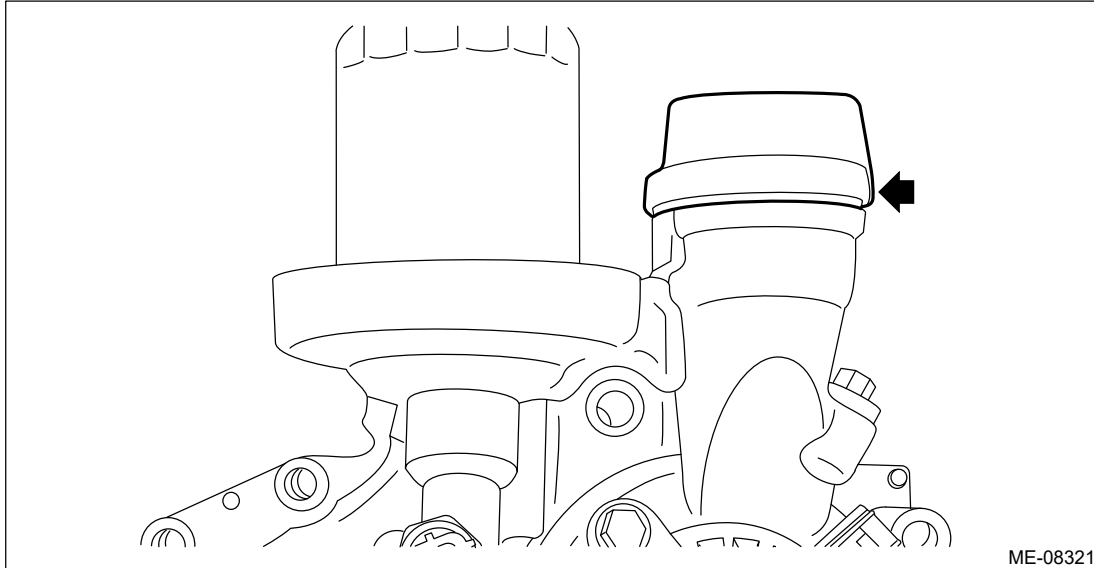
[\(H4DO\)>Camshaft Position Sensor>INSTALLATION.](#)

- 4.** Install the oil control solenoid.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Oil Control Solenoid>INSTALLATION.](#)
- 5.** Install the engine oil temperature sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Oil Temperature Sensor>INSTALLATION.](#)
- 6.** Install the oil pressure switch.  [Ref. to LUBRICATION\(H4DO\)>Oil Pressure Switch>INSTALLATION.](#)
- 7.** Install the engine oil filter and the oil pump union.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil Filter>INSTALLATION.](#)
- 8.** Install the oil filler cap.

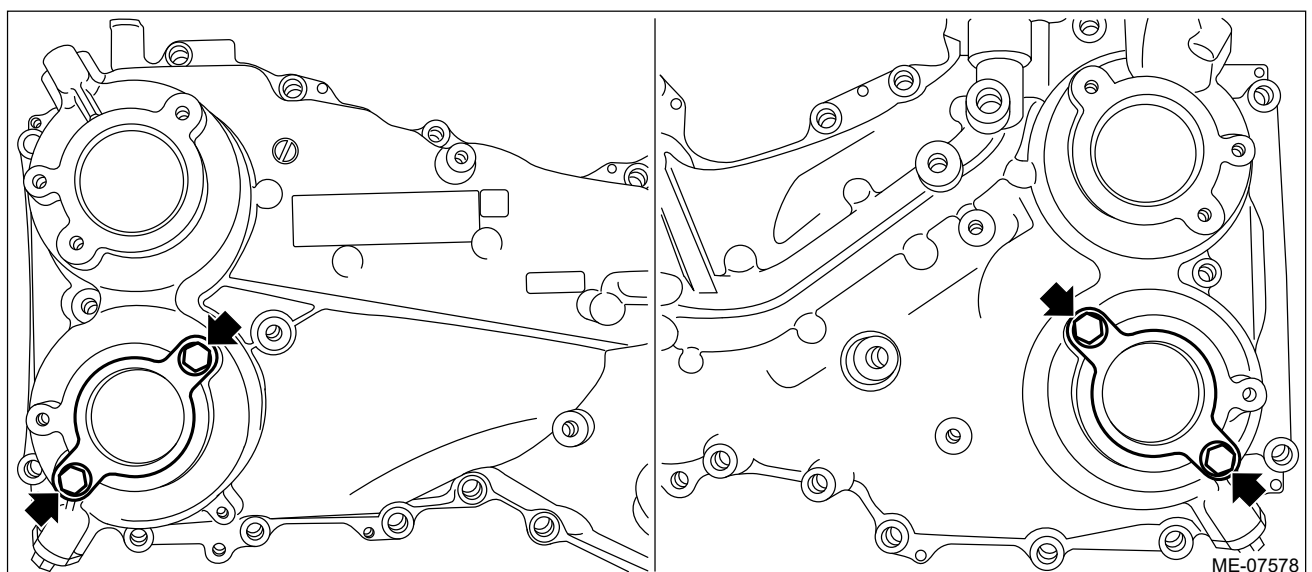
MECHANICAL(H4DO) > Chain Cover

DISASSEMBLY

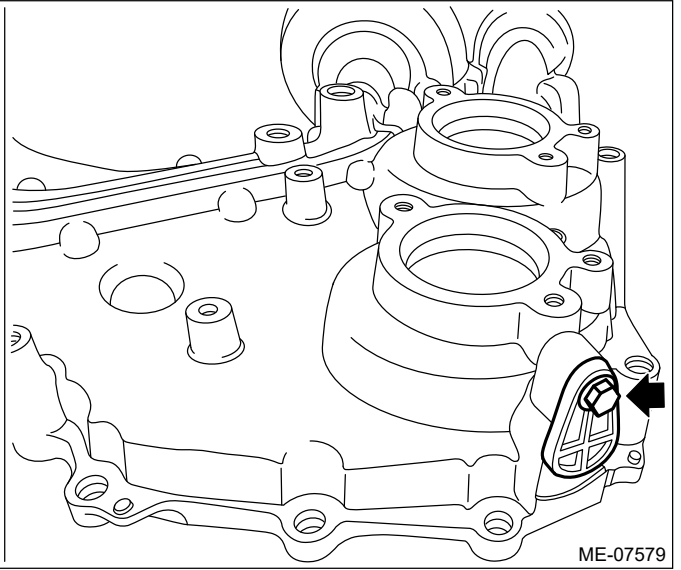
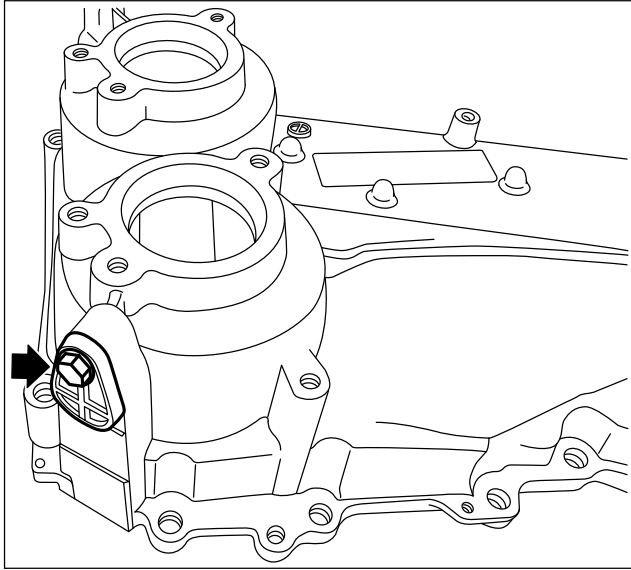
1. Remove the oil filler cap.



2. Remove the engine oil filter and the oil pump union. [Ref. to LUBRICATION\(H4DO\)>Engine Oil Filter>REMOVAL.](#)
3. Remove the oil pressure switch. [Ref. to LUBRICATION\(H4DO\)>Oil Pressure Switch>REMOVAL.](#)
4. Remove the engine oil temperature sensor. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Oil Temperature Sensor>REMOVAL.](#)
5. Remove the oil control solenoid. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Oil Control Solenoid>REMOVAL.](#)
6. Remove the camshaft position sensor. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Camshaft Position Sensor>REMOVAL.](#)
7. Remove the actuator cover from chain cover.



8. Remove the sensor cover from chain cover.



ME-07579

MECHANICAL(H4DO) > Chain Cover

INSPECTION

Check that the chain cover does not have deformation, cracks and any other damage.

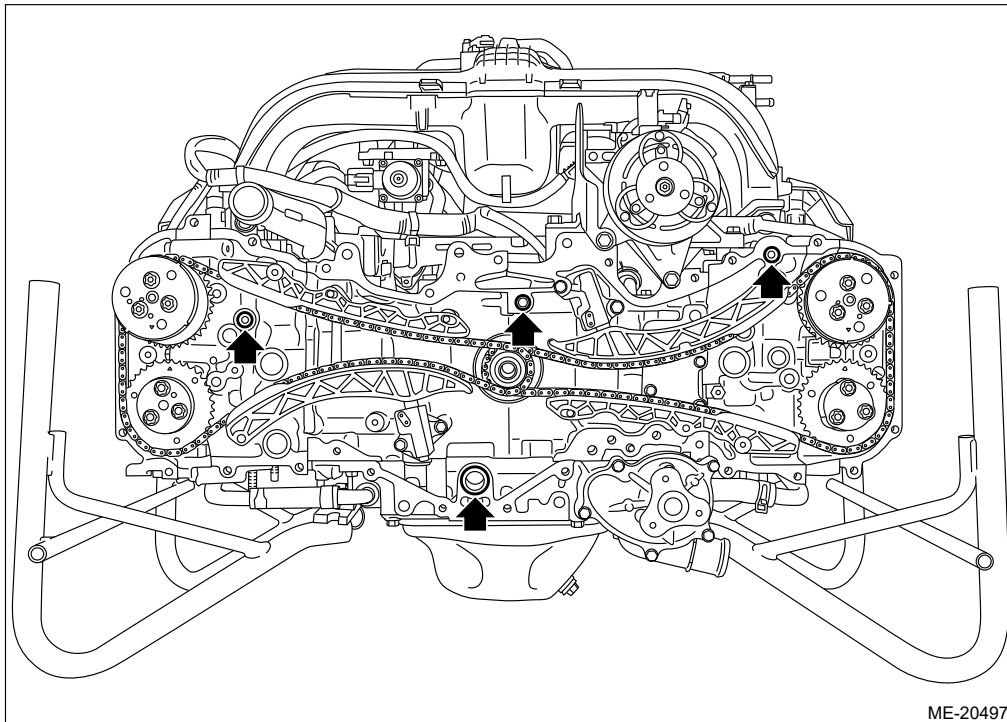
MECHANICAL(H4DO) > Chain Cover

INSTALLATION

1. Install the O-rings to cylinder head RH, cylinder head LH, cylinder block LH and oil pan upper.

Note:

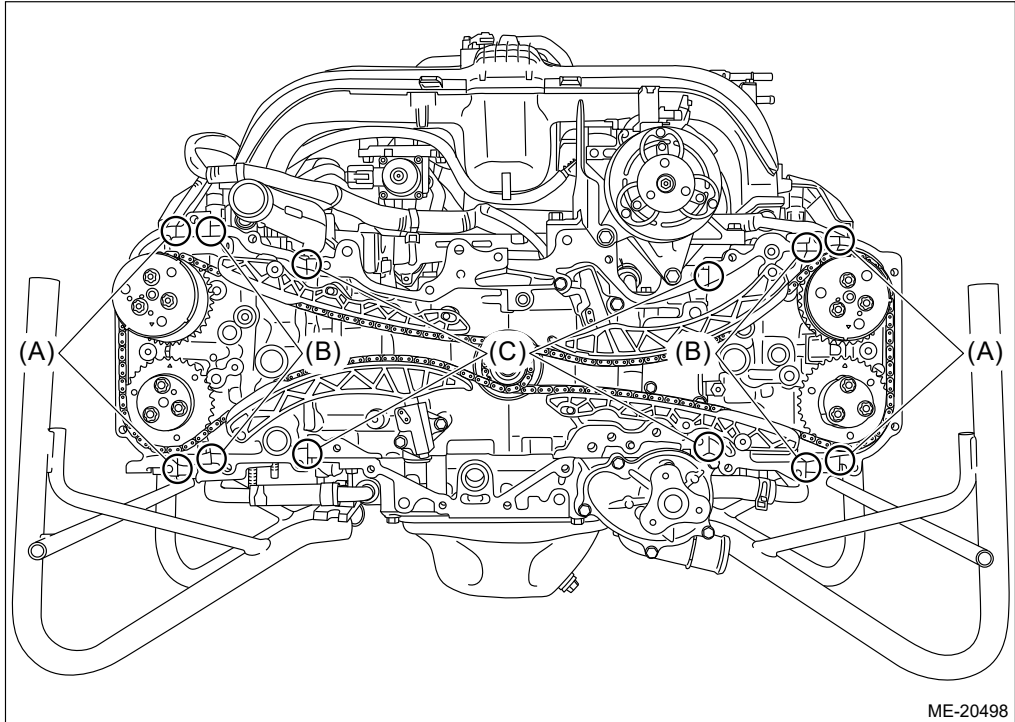
- Use new O-rings.
- Apply a coat of engine oil to the O-rings.



2. Apply liquid gasket if there are gaps between front camshaft cap and cam carrier (A), cam carrier and cylinder head (B), and cylinder head and cylinder block (C) as shown in the figure.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent



3. Apply liquid gasket to the chain cover mating surface and center boss (5 places) as shown in the figure.

Note:

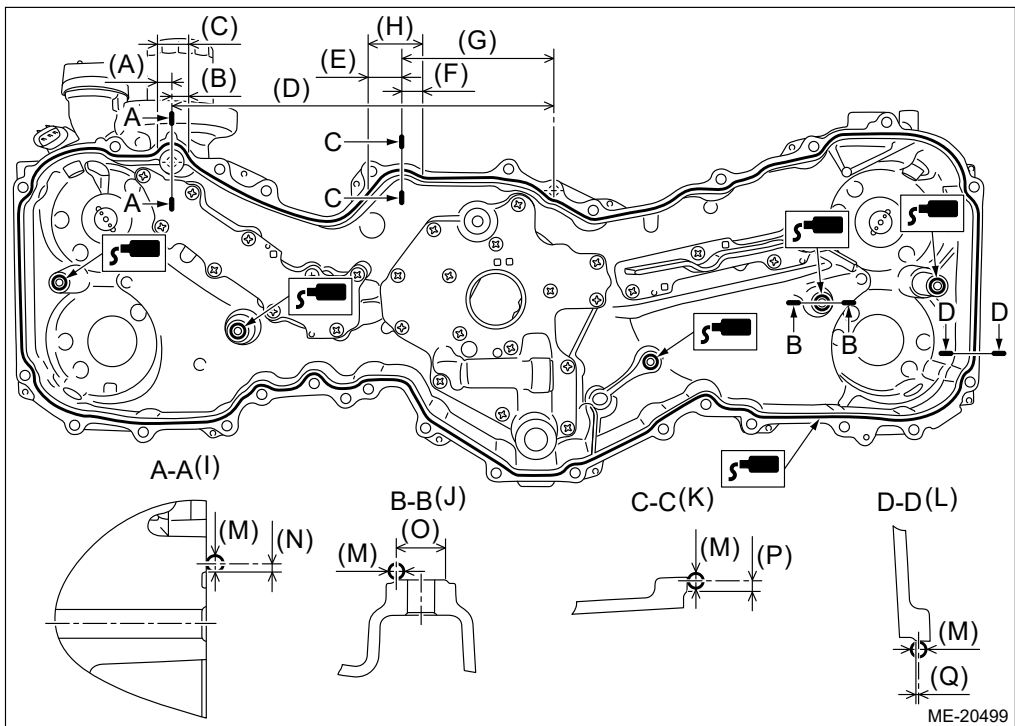
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the engine and chain cover.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

4 ± 0.5 mm (0.1575 ± 0.0197 in)

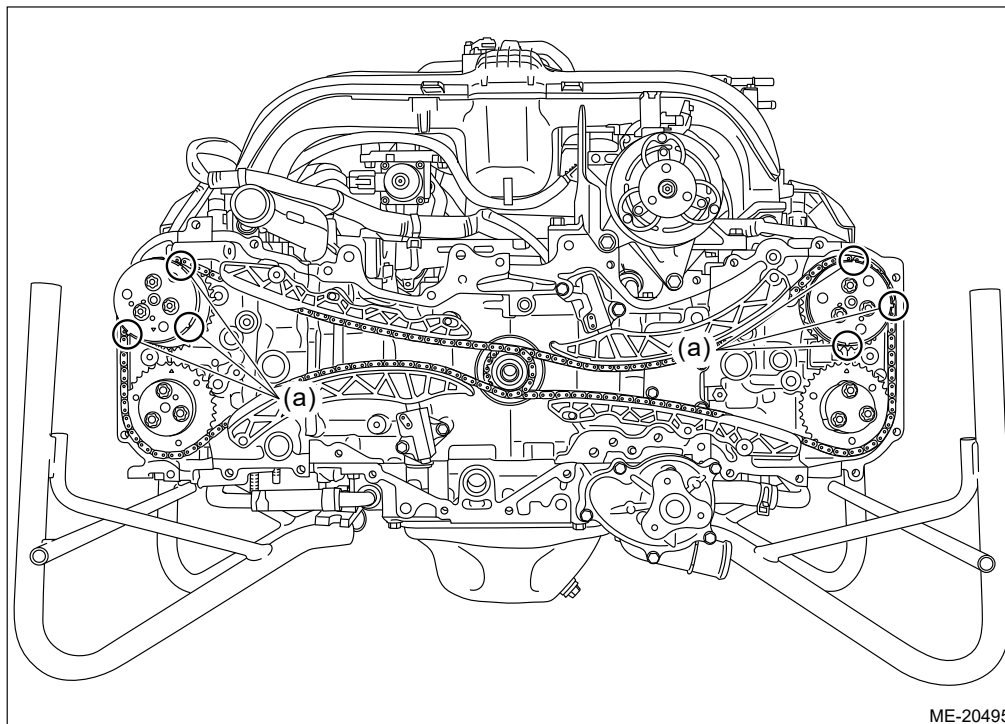


- | | | |
|---------------------------|--|--|
| (A) 14.5 mm (0.5709 in) | (G) 127 mm (5.0000 in) | (M) $\varnothing 4 \pm 0.5$ mm (0.1575 \pm 0.0197 in) |
| (B) 17.5 mm (0.6890 in) | (H) Range B | (N) 2 mm (0.0787 in) |
| (C) Range A | (I) Liquid gasket applying position of mating surfaces of range A | (O) $\varnothing 12$ mm (0.4724 in) |
| (D) 316.2 mm (12.4488 in) | (J) Liquid gasket applying position of center boss (5 places) | (P) 2.5 mm (0.0984 in) |
| (E) 24.5 mm (0.9646 in) | (K) Liquid gasket applying position of mating surfaces of range B | (Q) 0.5 mm (0.0197 in) |
| (F) 18.5 mm (0.7283 in) | (L) Liquid gasket applying position of mating surfaces other than range A and range B | |

4. Set the chain cover, and tighten the bolts in numerical order as shown in the figure.

Caution:

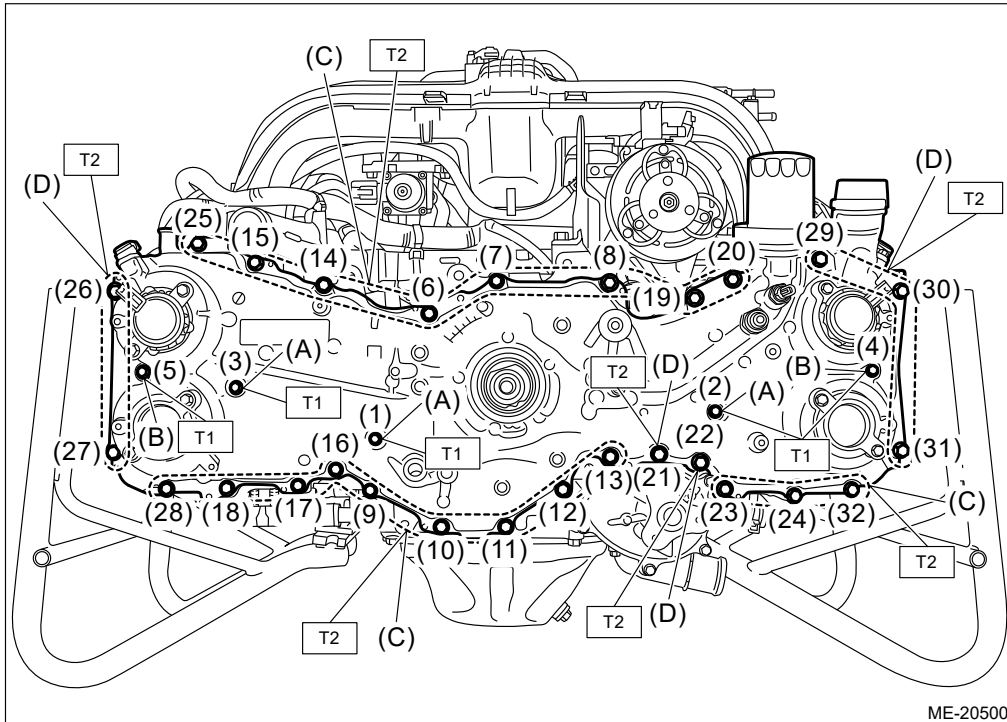
The chain cover may contact the protrusion (a) of cam sprocket sensor plate and cause damage. When setting the chain cover, move the chain cover horizontally and set it while taking care not to contact with the cam sprocket.



Tightening torque:

T1: 10 N·m (1.0 kgf-m, 7.4 ft-lb)

T2: 25 N·m (2.5 kgf-m, 18.4 ft-lb)



ME-20500

(A) M6 × 20
(B) M6 × 50

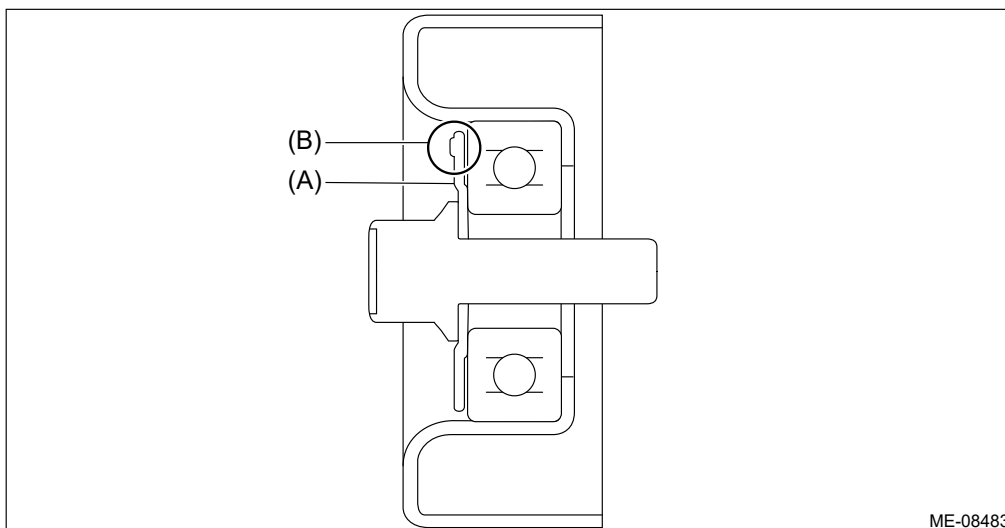
(C) M8 × 25

(D) M8 × 60

5. Install the idler pulley (C) and oil level gauge guide (B), and insert the oil level gauge (A).

Note:

- When installing the idler pulley, be careful of the idler pulley cover direction.



ME-08483

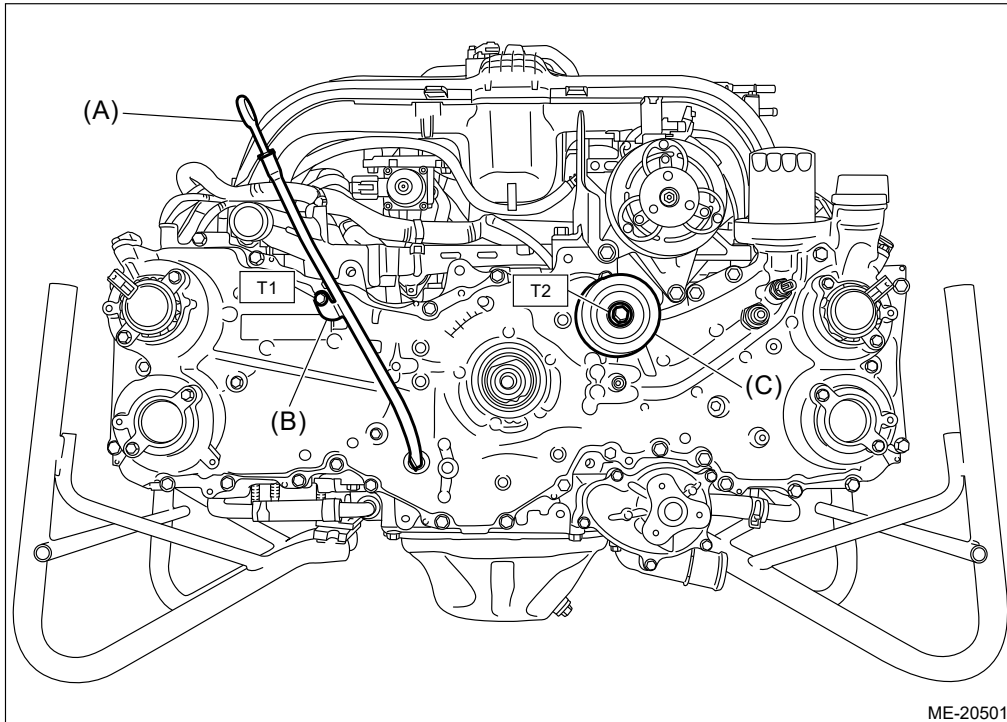
(a) Idler pulley cover

(b) Protrusion (3 places)

- Use a new O-ring to the oil level gauge guide.
- Apply a light coat of engine oil to the O-rings of the oil level gauge guide and the oil level gauge.

Tightening torque:

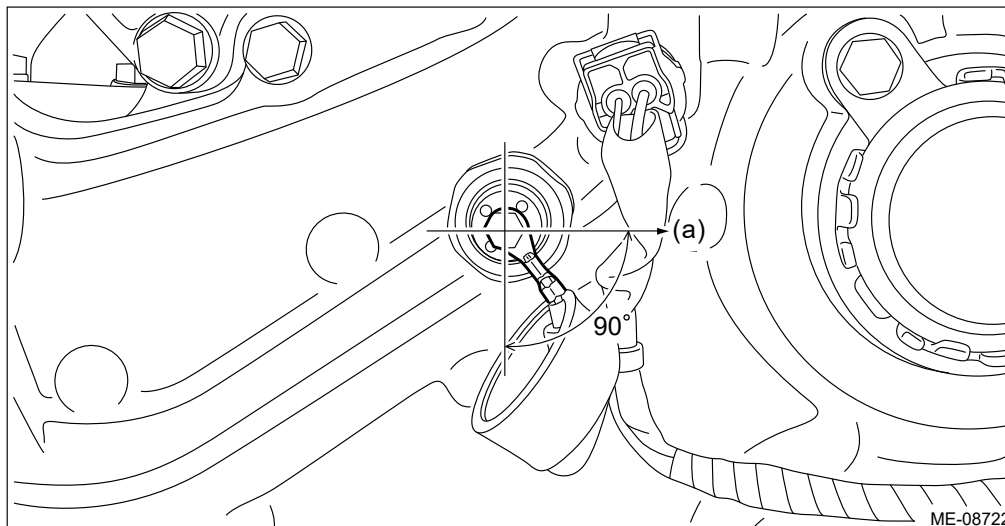
T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)
T2: 36 N·m (3.7 kgf-m, 26.6 ft-lb)



6. Connect the terminal (A), connector (B), connector (C) and connector (D), and secure the engine harness using the clip (E) and clip (F).

Note:

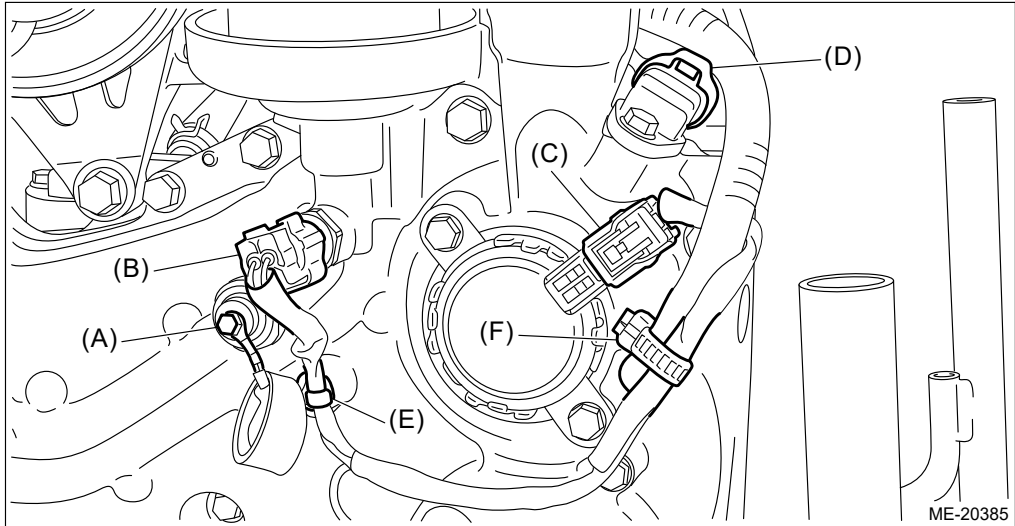
The oil pressure switch harness must be positioned toward the left lower side of the vehicle within the range of 90°.



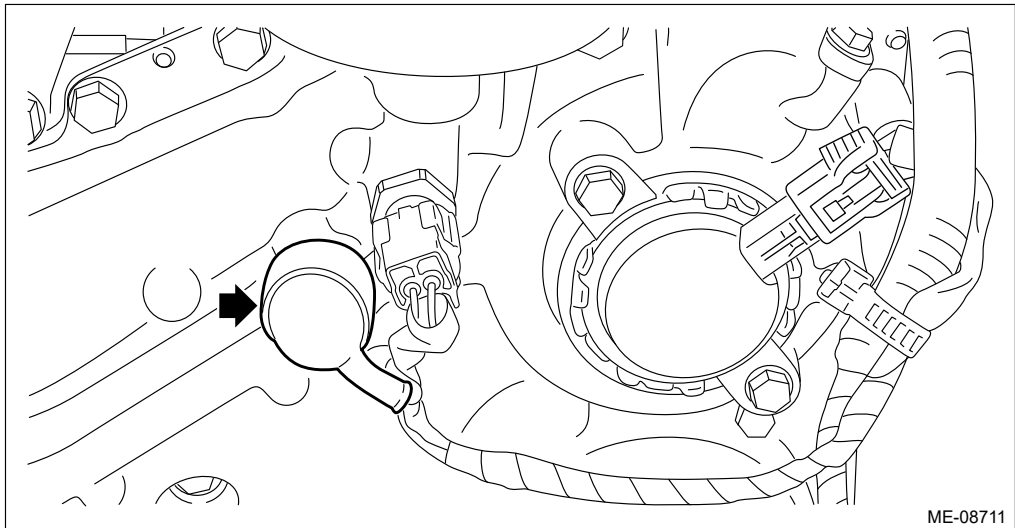
(a) Left side of vehicle

Tightening torque:

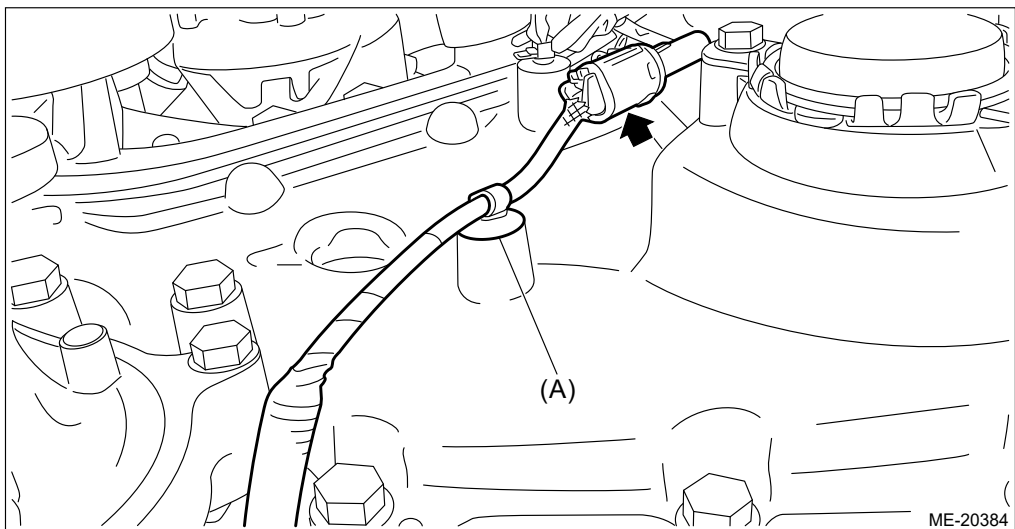
1.5 N·m (0.2 kgf-m, 1.1 ft-lb)



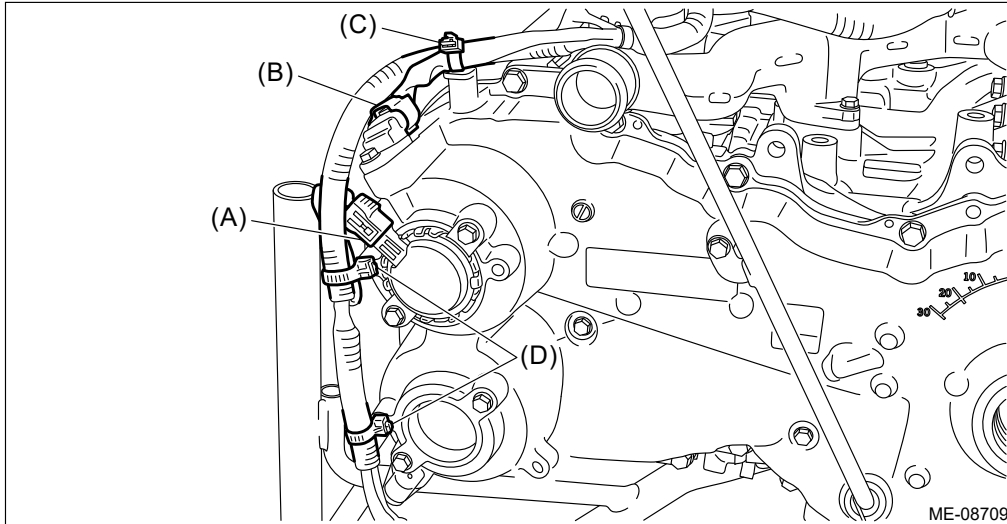
7. Attach the rubber cap to the oil pressure switch.



8. Secure the oil level switch harness with clips (A), and connect the connectors to the oil level switch.



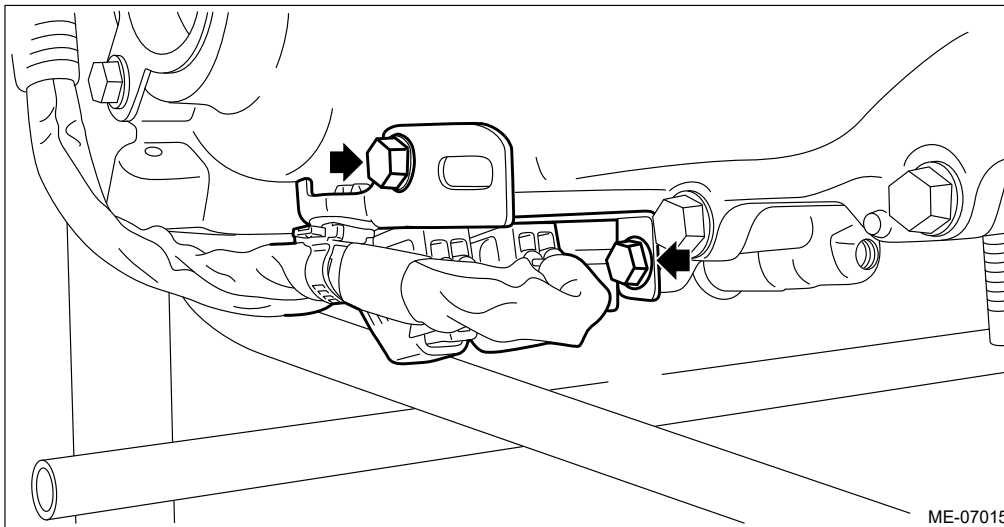
9. Connect the connector (A) and connector (B) and secure the engine harness with the clip (C) and clip (D).



- 10.** Install the engine harness stay to the chain cover.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



- 11.** Install the crank pulley. [Ref. to MECHANICAL\(H4DO\)>Crank Pulley>INSTALLATION.](#)
- 12.** Install the water pump pulley. [Ref. to COOLING\(H4DO\)>Water Pump>INSTALLATION > WATER PUMP.](#)
- 13.** Install the generator. [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Generator>INSTALLATION.](#)
- 14.** Fill engine oil. [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 15.** When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

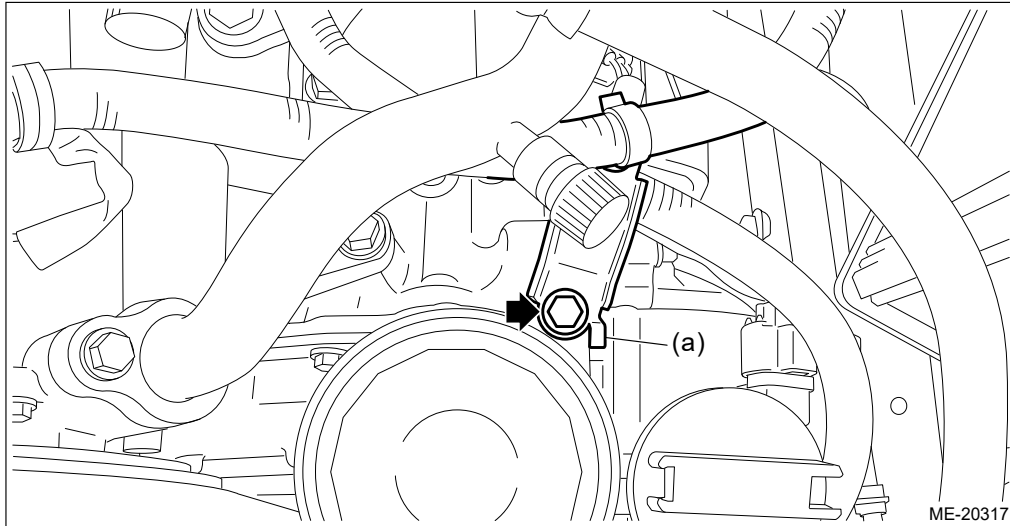
- (1) Install the generator cord stay to the chain cover.

Note:

Install the generator cord stay so that the folded end (a) touches the chain cover boss.

Tightening torque:

8 N·m (0.8 kgf-m, 5.9 ft-lb)



- (2) Install the front exhaust pipe. [🔧 Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>INSTALLATION.](#)
- (3) Install the radiator. [🔧 Ref. to COOLING\(H4DO\)>Radiator>INSTALLATION.](#)

MECHANICAL(H4DO) > Chain Cover

REMOVAL

Note:

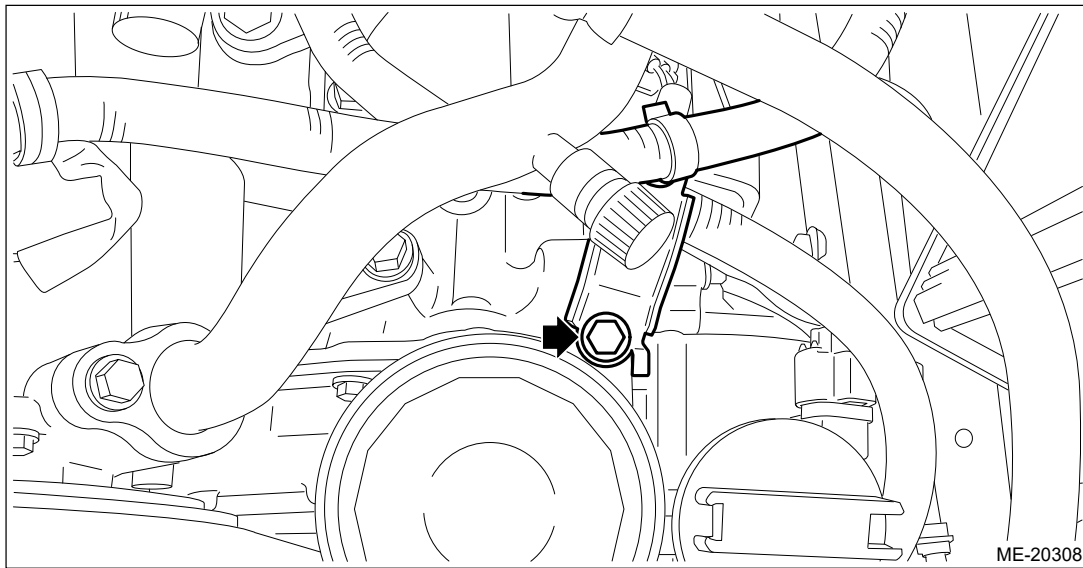
When replacing a single part, perform the work with the engine assembly installed to body.

1. When working on the vehicle

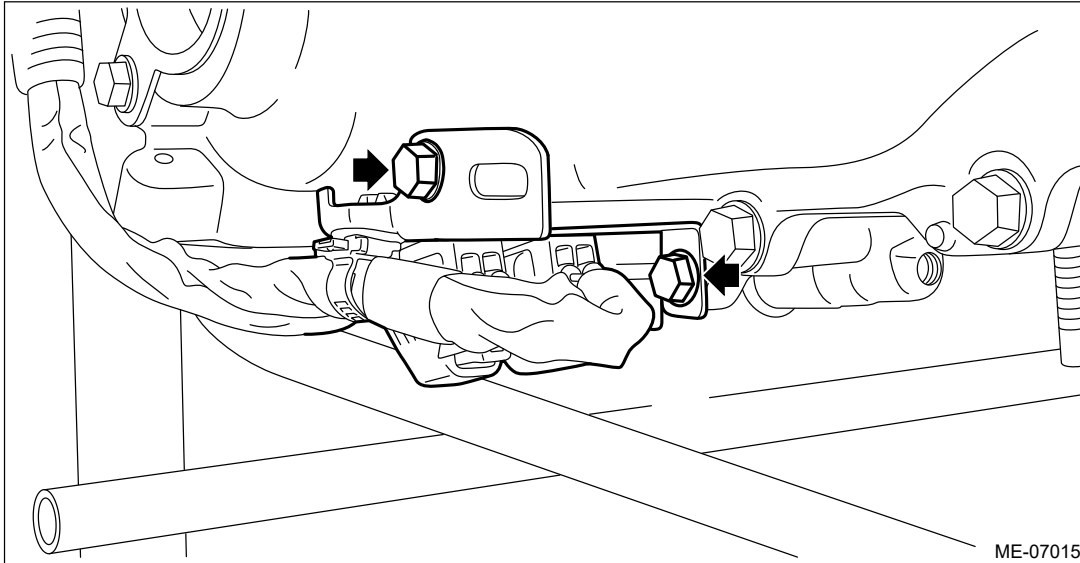
Note:

When working on the vehicle, perform the following steps also.

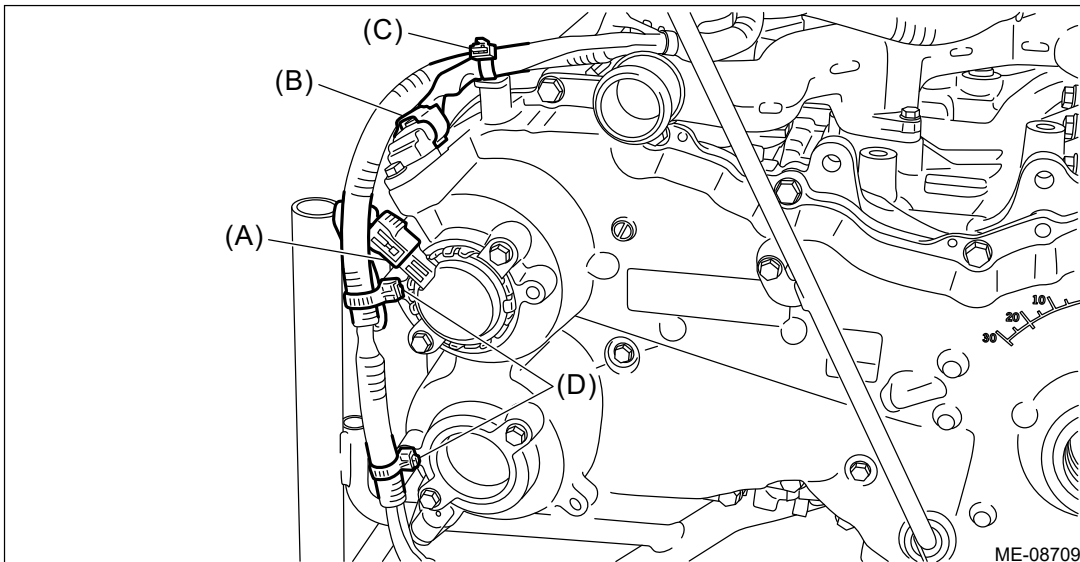
- (1) Remove the radiator. [🔧 Ref. to COOLING\(H4DO\)>Radiator>REMOVAL.](#)
- (2) Remove the front exhaust pipe. [🔧 Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)
- (3) Remove the bolts which secure the generator cord stay to the chain cover.



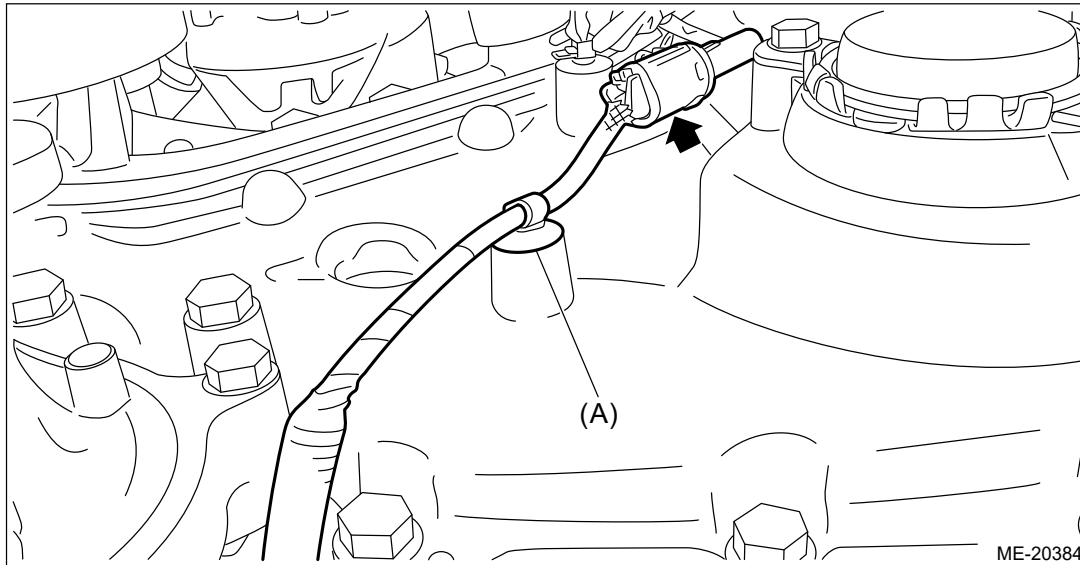
- 2.** Drain the engine oil. [🔧 Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 3.** Remove the generator. [🔧 Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Generator>REMOVAL.](#)
- 4.** Remove the water pump pulley. [🔧 Ref. to COOLING\(H4DO\)>Water Pump>REMOVAL > WATER PUMP.](#)
- 5.** Remove the crank pulley. [🔧 Ref. to MECHANICAL\(H4DO\)>Crank Pulley>REMOVAL.](#)
- 6.** Remove the bolt securing the engine harness stay.
- 7.** Remove the engine harness stay from the chain cover.



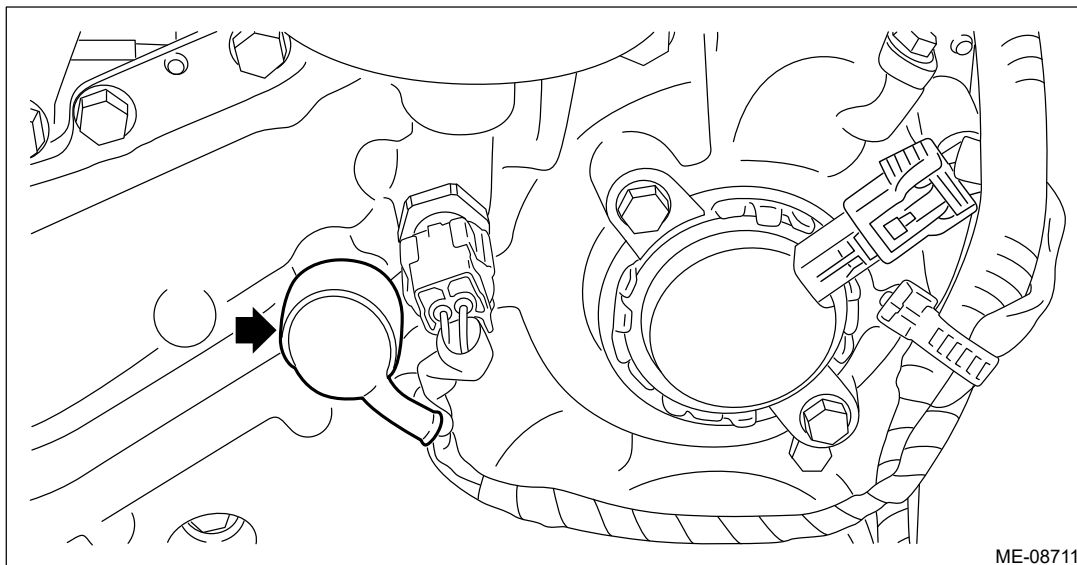
- 8.** Disconnect the connector (A) and connector (B) to remove the clip (C) and clip (D) securing the engine harness.



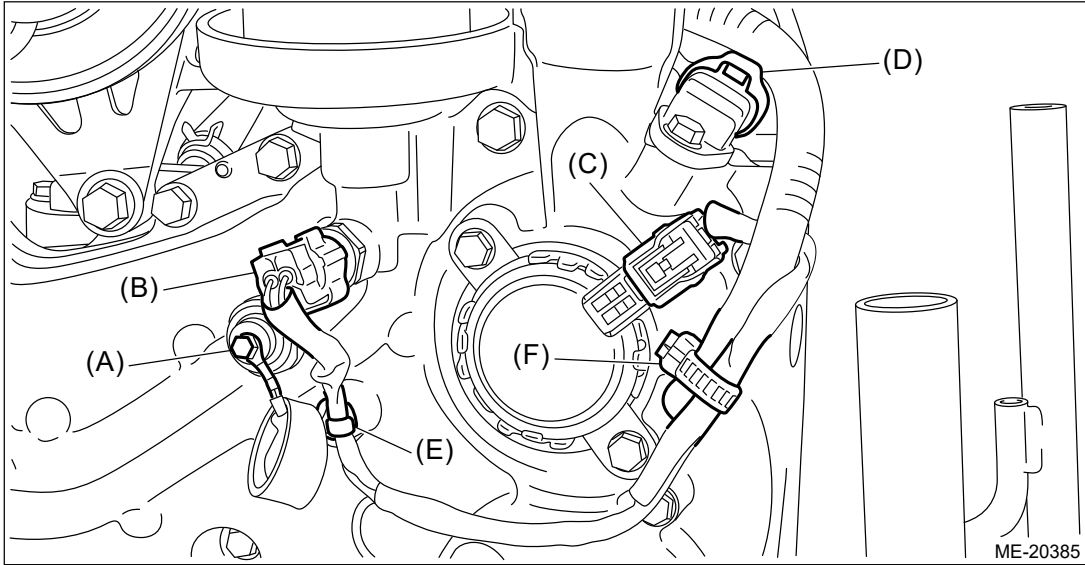
- 9.** Disconnect the connectors from the oil level switch, and remove the clip (A) which secure the oil level switch harness.



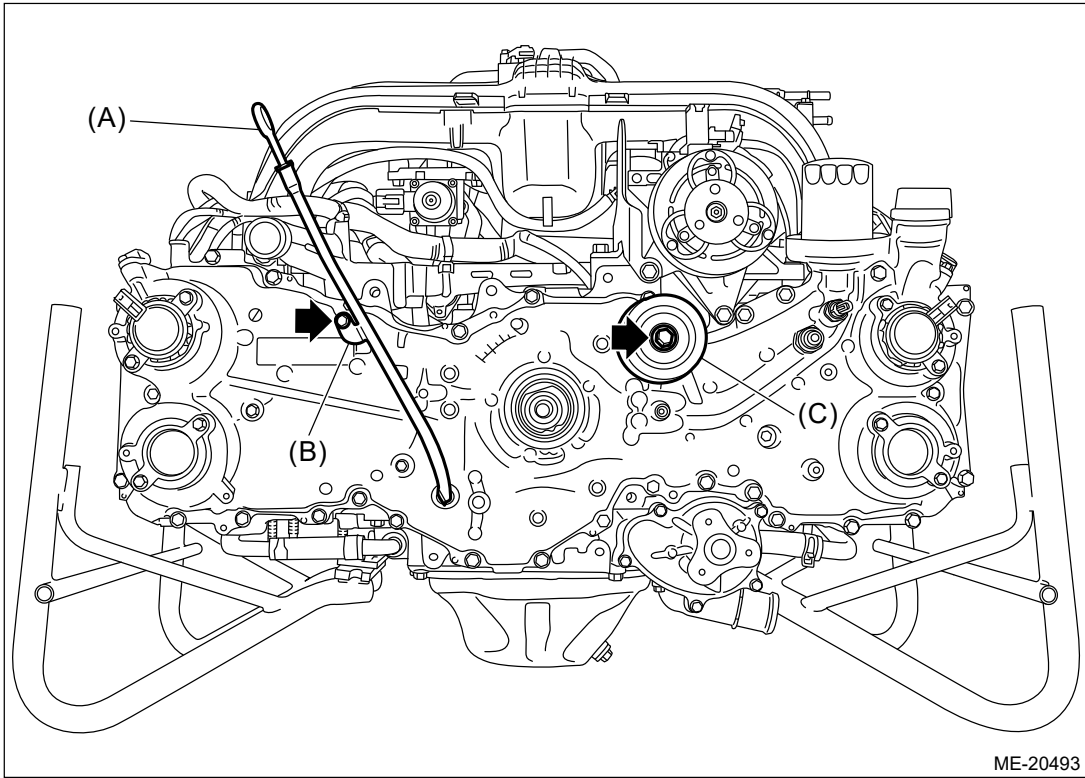
10. Remove the rubber cap from the oil pressure switch.



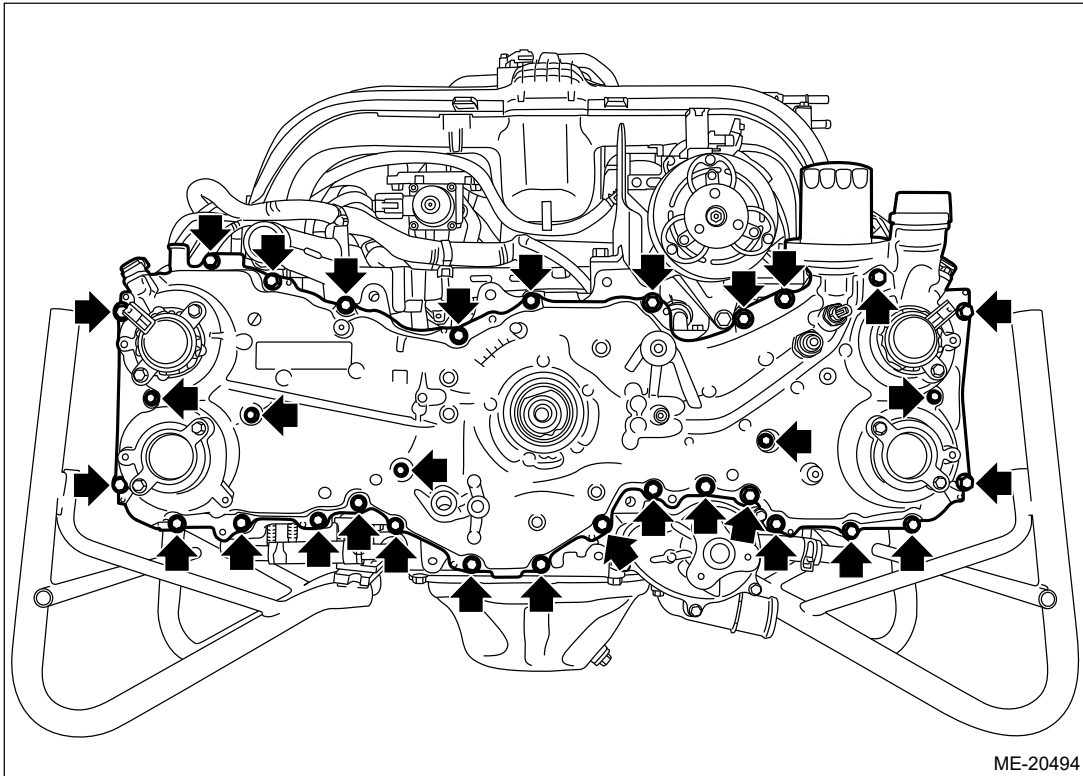
11. Disconnect the terminal (A), connector (B), connector (C) and connector (D), and remove the clip (E) (model with engine oil cooler) and clip (F) securing the engine harness.



12. Pull out the oil level gauge (A), and remove the oil level gauge guide (B) and idler pulley (C).



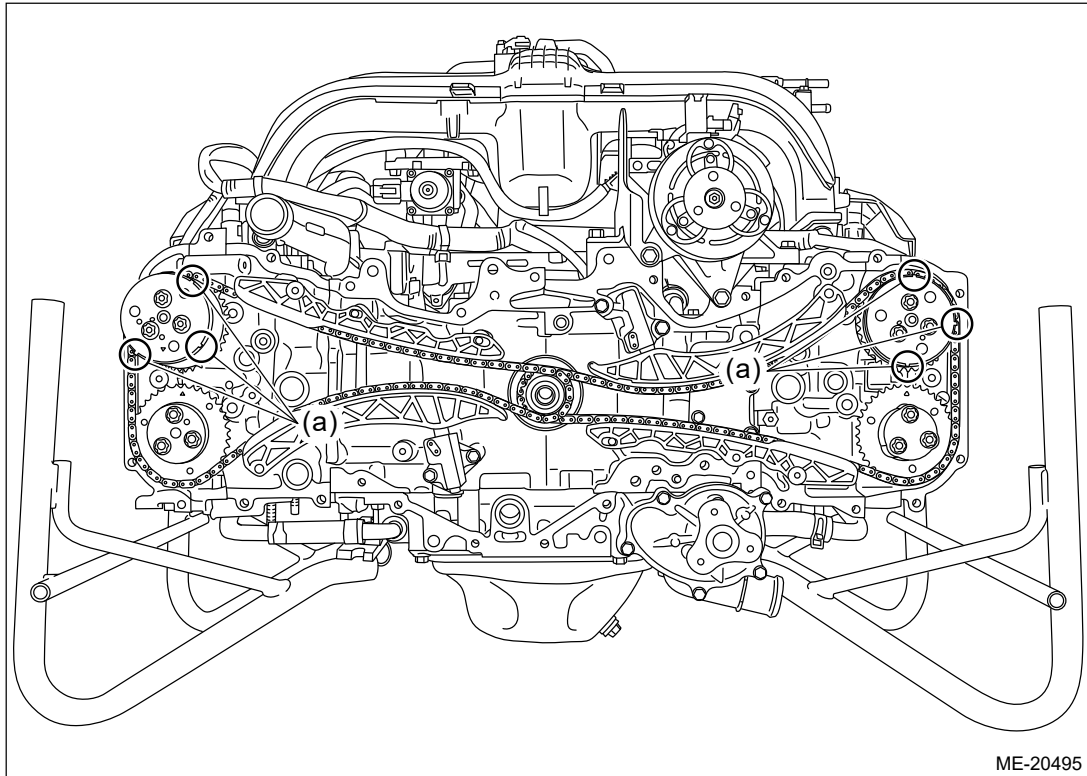
13. Remove the bolts securing the chain cover to the engine.



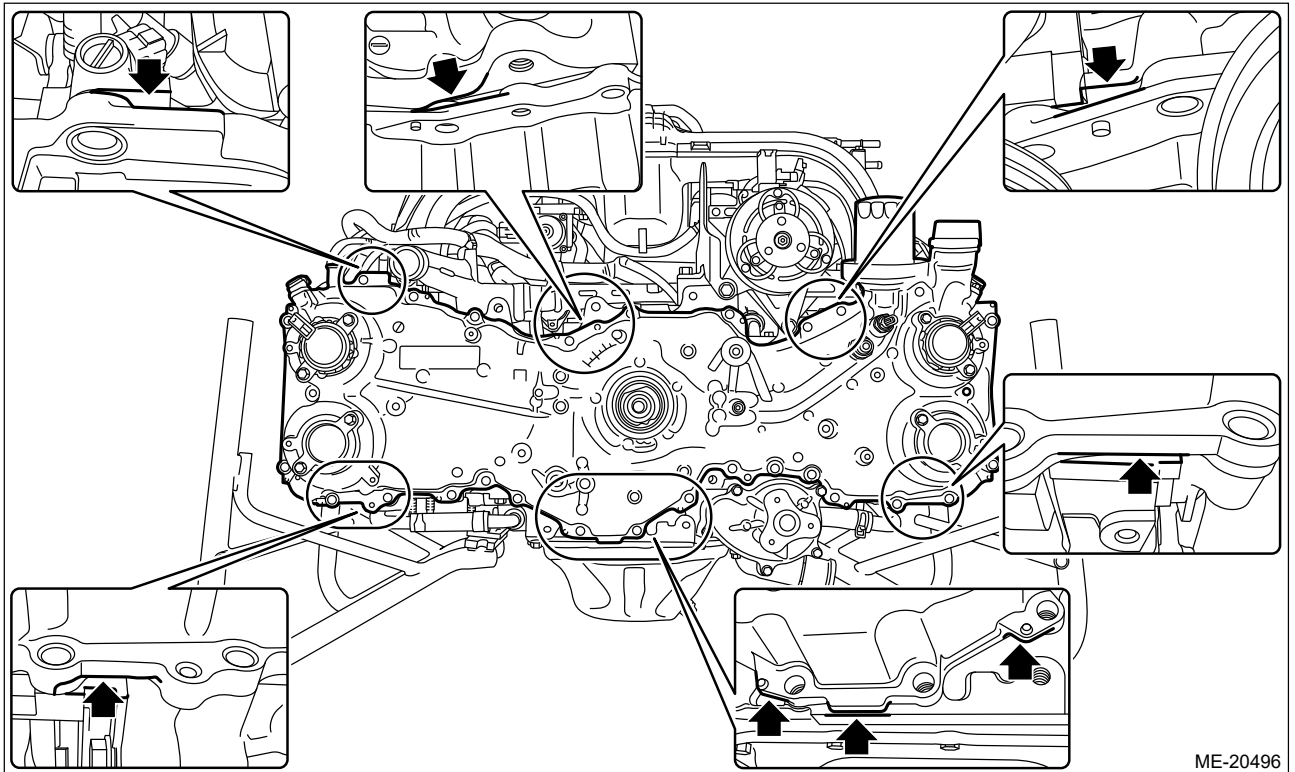
- 14.** Expand the area shown in the figure using a crowbar or a similar tool wrapped in tape for protection, and remove the chain cover from the engine.

Caution:

The chain cover may contact the protrusion (a) of cam sprocket sensor plate and cause damage. When removing the chain cover, move the chain cover horizontally until it cannot contact with the cam sprocket, and then remove it carefully.

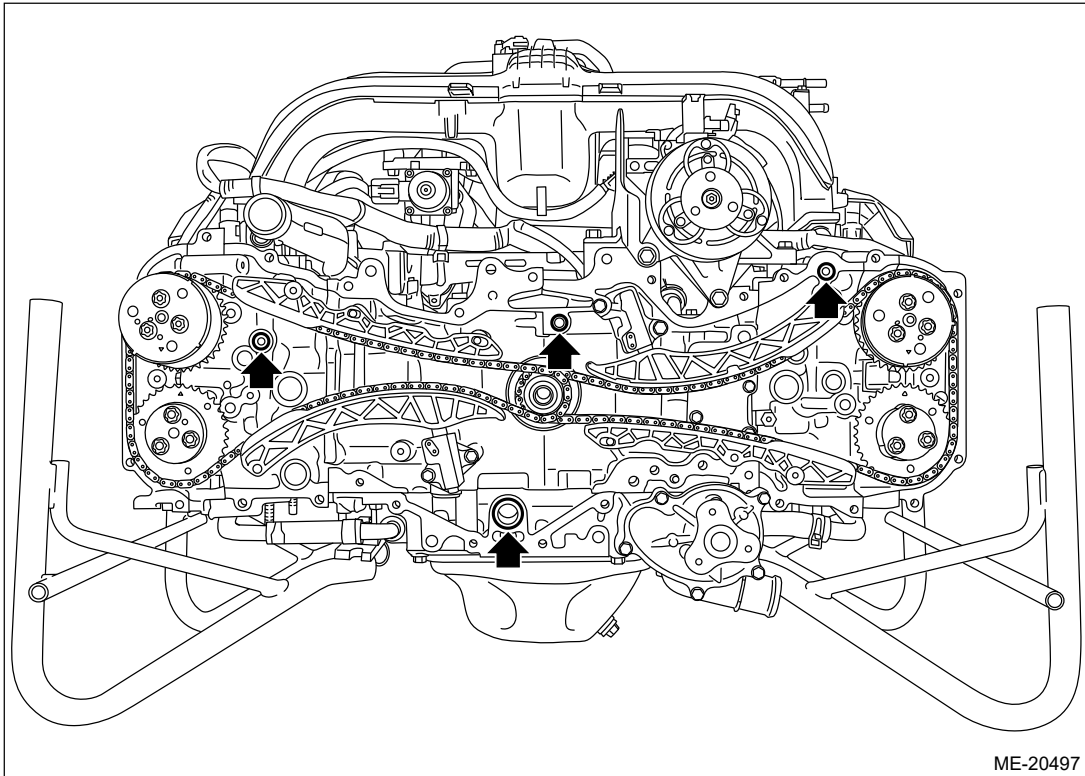


ME-20495



ME-20496

- 15.** Remove the O-rings from cylinder head RH, cylinder head LH, cylinder block LH and oil pan upper.



ME-20497

- 16.** Remove the liquid gasket from the chain cover and engine unit.

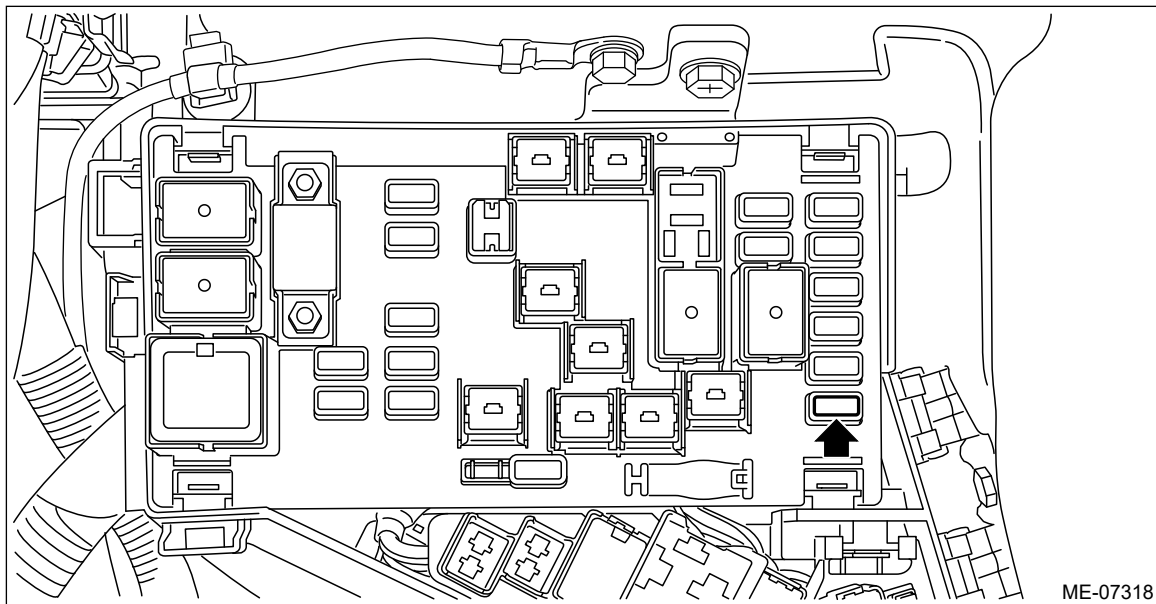
MECHANICAL(H4DO) > Compression

INSPECTION


Caution:

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

1. After warming-up the engine, turn the ignition switch to OFF.
2. Make sure that the battery is fully charged.
3. Check the starter motor for satisfactory performance and operation.
4. Remove the fuse of fuel pump from main fuse box.

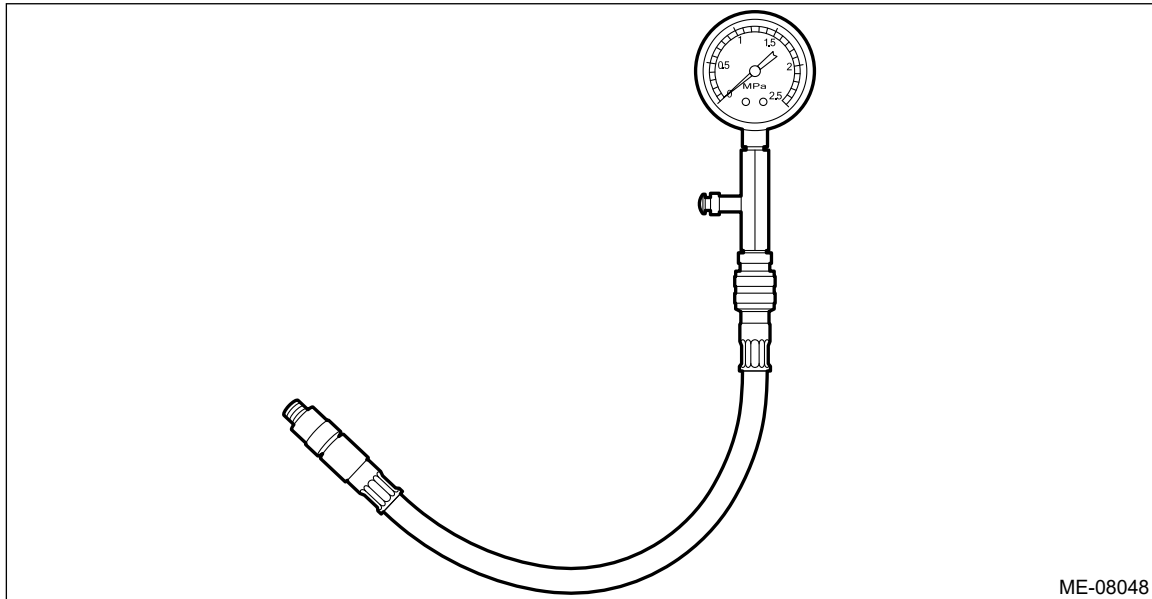



ME-07318

5. Start the engine and run it until it stalls.
6. After the engine stalls, crank it for five more seconds.
7. Turn the ignition switch to OFF.
8. Remove all spark plugs.  [Ref. to IGNITION\(H4DO\)>Spark Plug>REMOVAL.](#)
9. Install the compression gauge to the spark plug hole.

Note:

When using a screw-in type compression gauge, the screw should be less than 25 mm (0.98 in) long.



- 10.** Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
- 11.** Turn the ignition switch to ON.
- 12.** Depress the accelerator pedal to full throttle.
- 13.** Crank the engine by starter motor and read the value when the needle of the compression gauge becomes stable.

Note:

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

Compression pressure (at 200 – 300 r/min):

Standard

1,050 – 1,400 kPa (11 – 14 kgf/cm², 152 – 203 psi)

Difference between cylinders





100 kPa (1 kgf/cm², 14 psi) or less

- 14.** After inspection, install the related parts in the reverse order of removal.

MECHANICAL(H4DO) > Connecting Rod


SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of connecting rod.

 [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>INSTALLATION.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>DISASSEMBLY > PISTON AND CONNECTING ROD.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>ASSEMBLY > PISTON AND CONNECTING ROD.](#)

MECHANICAL(H4DO) > Crank Pulley

INSPECTION

- 1.** Check that the crank pulley has no deformation, cracks or other damages.
- 2.** Inspect for oil leakage from the front oil seal. If there is an oil leak, replace the front oil seal with a new one.  [Ref. to MECHANICAL\(H4DO\)>Crank Pulley>REMOVAL.](#)

MECHANICAL(H4DO) > Crank Pulley

INSTALLATION

1. Degrease the press-fit section for the chain cover front oil seal, and install the front oil seal to the chain cover using ST.

Caution:

Do not apply fluid such as engine oil to the front oil seal and the chain cover; otherwise engine oil leakage may occur.

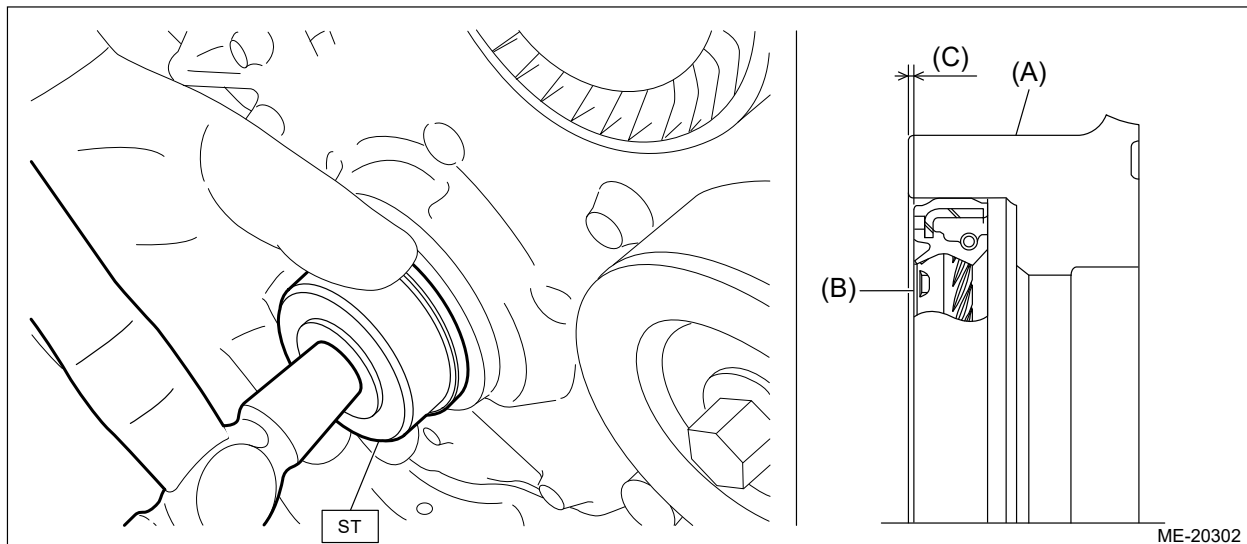
Note:

- Use a new front oil seal.
- When tapping the front oil seal in, pay special attention not to damage the radiator fin with a tool such as a plastic hammer.

ST 41399FG020 SPECIAL TOOL B

Front oil seal press-fit position:

1^{+0}_{-1} mm ($0.0039^{+0}_{-0.0039}$ in) position from chain cover end face



(A) Chain cover

(B) Oil seal

(C) Front oil seal press-fit position
 1^{+0}_{-1} mm
($0.0039^{+0}_{-0.0039}$ in) position
from chain cover end face)

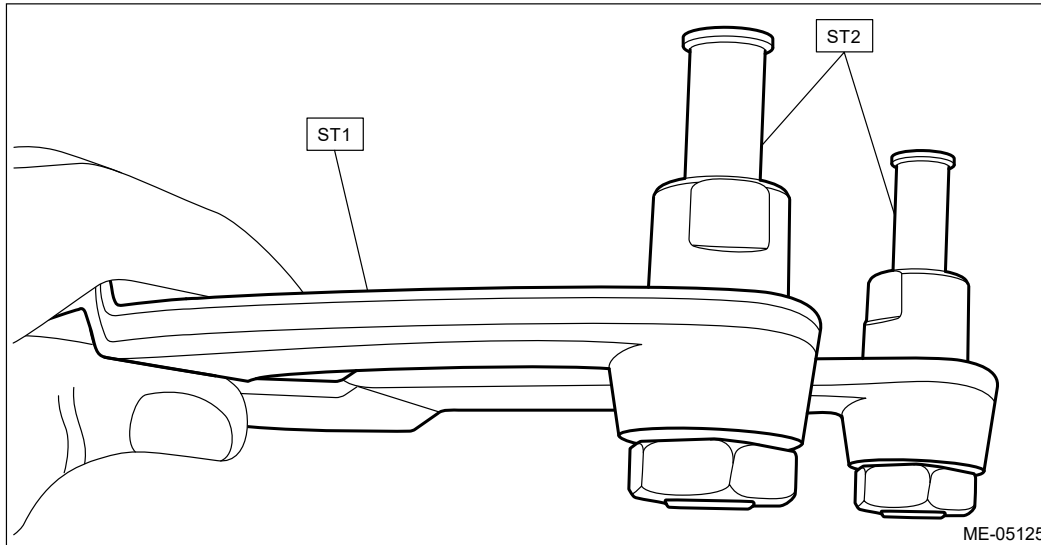
2. Clean the crankshaft thread using compressed air.
3. Apply engine oil to the crank pulley bolt seat and thread.
4. Install the crank pulley.
 - (1) Set the crank pulley to the chain cover.
 - (2) Use the ST to lock the crank pulley, and temporarily tighten the crank pulley bolt.

Note:

To prevent damaging ST1, attach the ST2 onto the ST1 as shown.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA000 PULLEY WRENCH PIN SET

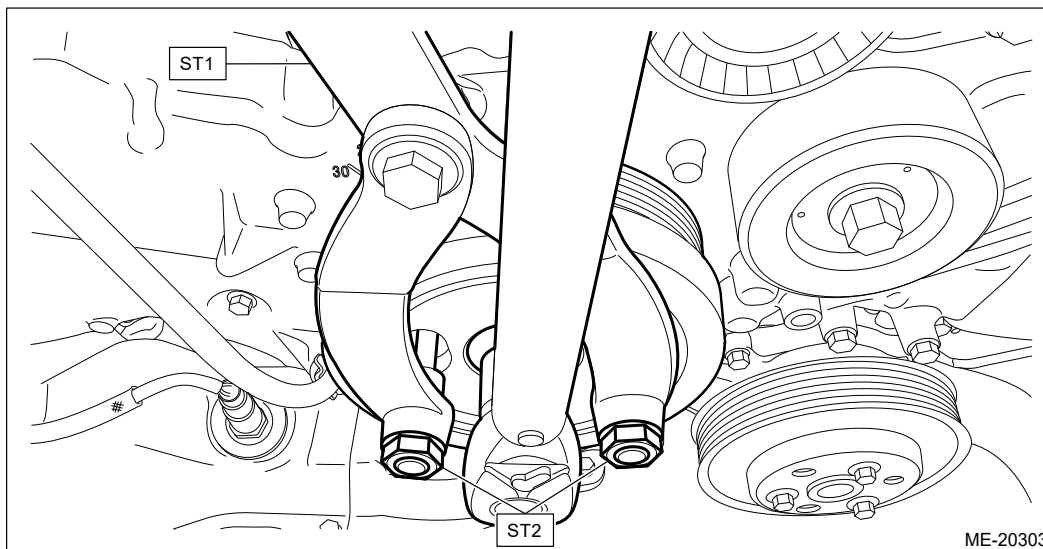


ST1 18355AA000 PULLEY WRENCH

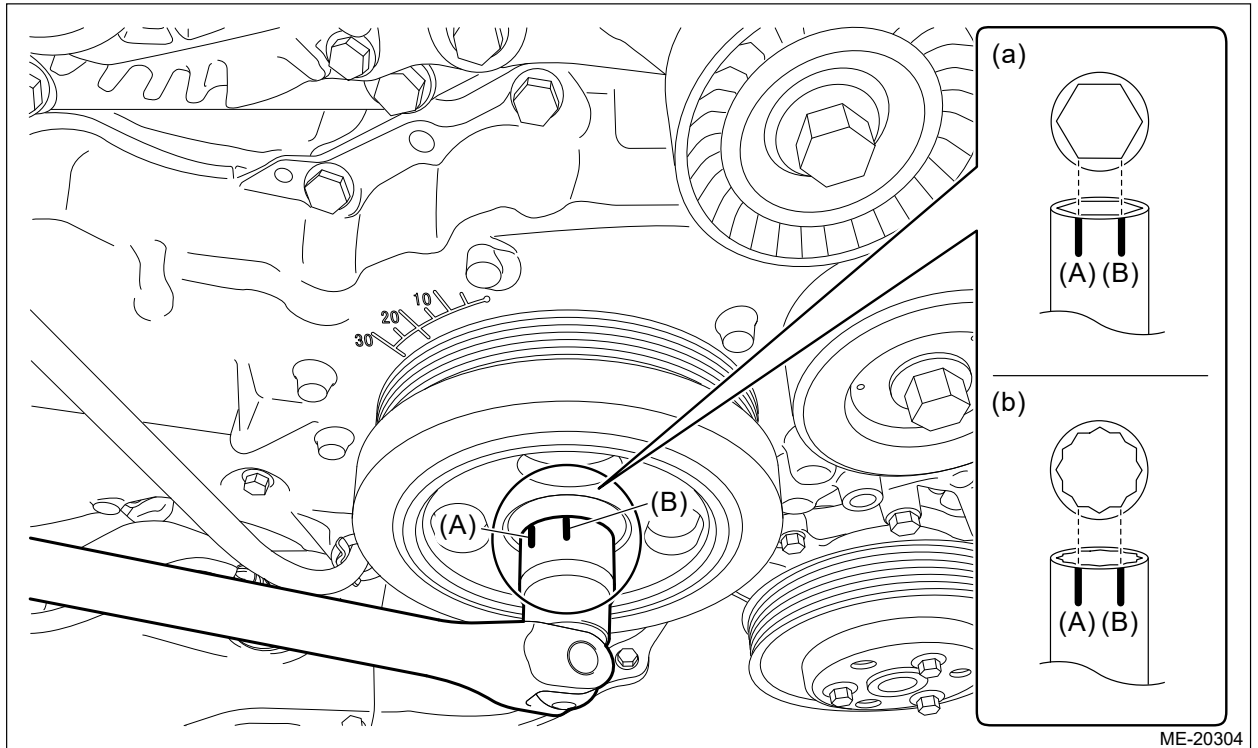
ST2 18334AA000 PULLEY WRENCH PIN SET

Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)



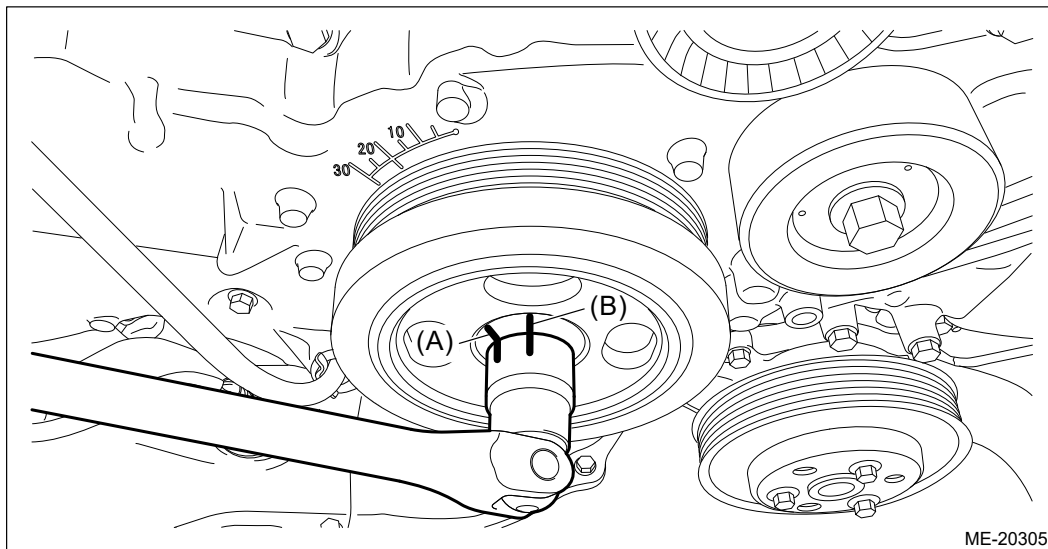
- (3) Draw reference lines (A) and (B) using a marker to set the socket to the crank pulley bolt as shown in the figure.



ME-20304

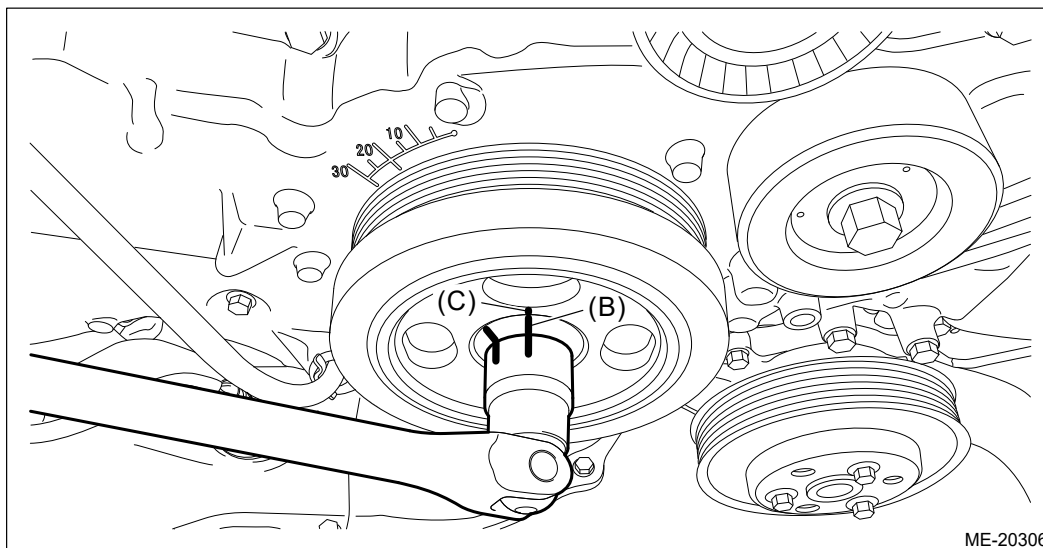
(a) When using 6-point socket (b) When using 12-point socket

(4) Draw reference lines (A) and (B) on the crank pulley bolt using a marker as shown in the figure.



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(5) Draw end line (C) on crank pulley using a marker at the same position as reference line (B) drawn on the crank pulley bolt in step (3).



- (6) Use the ST to lock the crank pulley, and tighten the crank pulley bolt to the angle where reference line (A) and end line (C) are aligned.

Note:

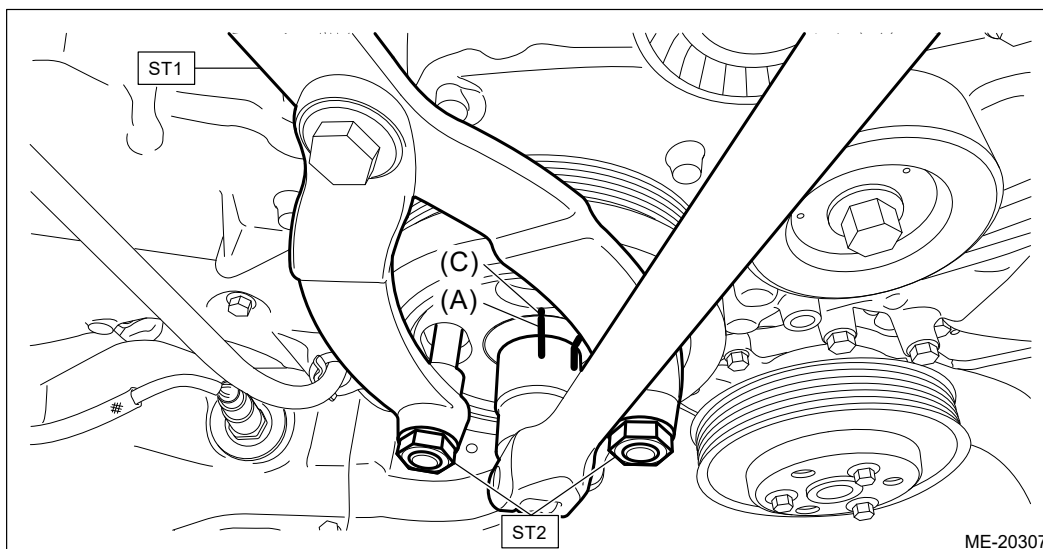
It should be approx. 60° when reference line (A) and end line (C) are aligned.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA000 PULLEY WRENCH PIN SET

Tightening angle:

60°±5°



- 5.** Install the V-belts. [Ref. to MECHANICAL\(H4DO\)>V-belt>REMOVAL > V-BELT.](#)

- 6.** When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

- (1) Install the radiator main fan & fan motor assembly and radiator sub fan & fan motor assembly. [Ref. to COOLING\(H4DO\)>Radiator Main Fan and Fan Motor>INSTALLATION.](#) [Ref. to COOLING\(H4DO\)>Radiator Sub Fan and Fan Motor>INSTALLATION.](#)

MECHANICAL(H4DO) > Crank Pulley

REMOVAL

Note:

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

1. When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

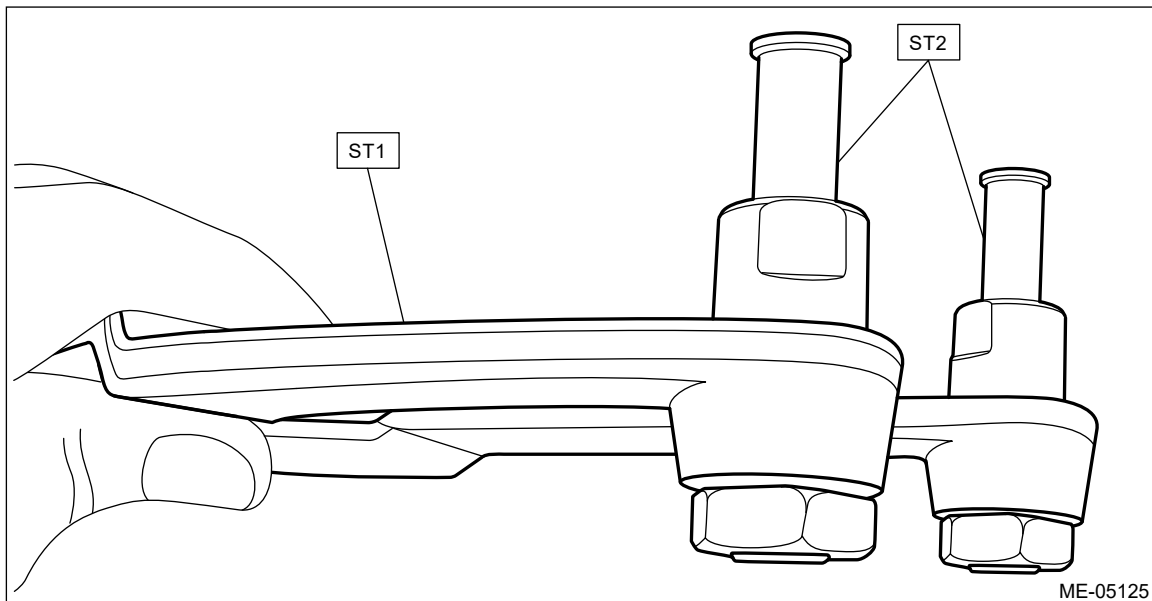
- (1) Remove the radiator main fan & fan motor assembly and radiator sub fan & fan motor assembly. [🔗 Ref. to COOLING\(H4DO\)>Radiator Main Fan and Fan Motor>REMOVAL.](#) [🔗 Ref. to COOLING\(H4DO\)>Radiator Sub Fan and Fan Motor>REMOVAL.](#)
2. Remove the V-belts. [🔗 Ref. to MECHANICAL\(H4DO\)>V-belt>REMOVAL > V-BELT.](#)
3. Use the ST to lock the crank pulley, and remove the crank pulley bolt.

Note:

To prevent damaging ST1, attach the ST2 onto the ST1 as shown.

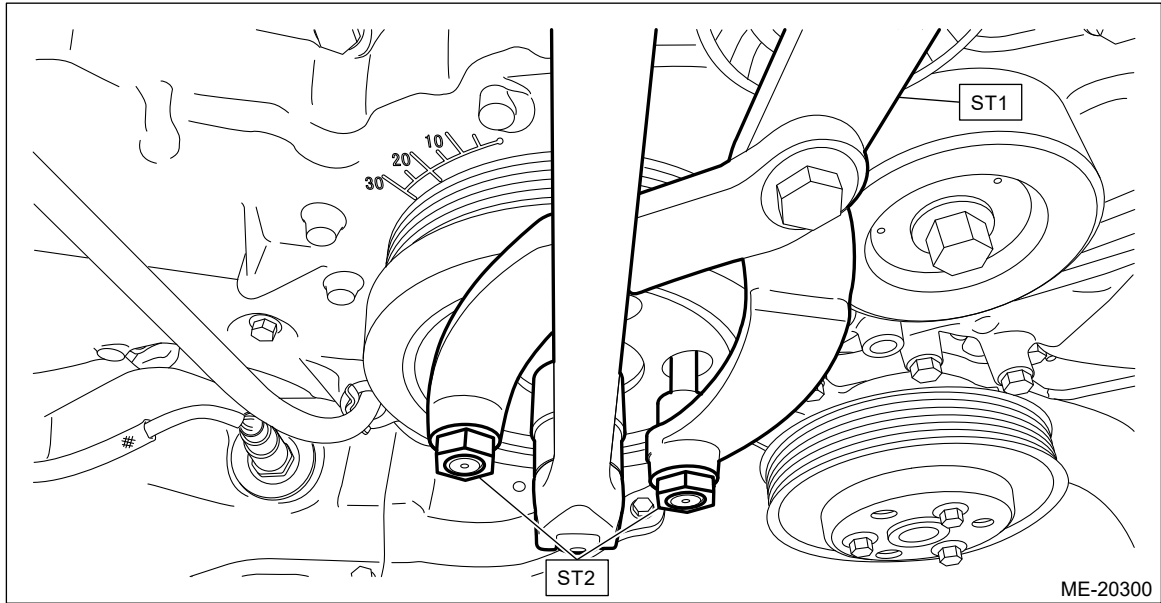
ST1 18355AA000 PULLEY WRENCH

ST2 18334AA000 PULLEY WRENCH PIN SET

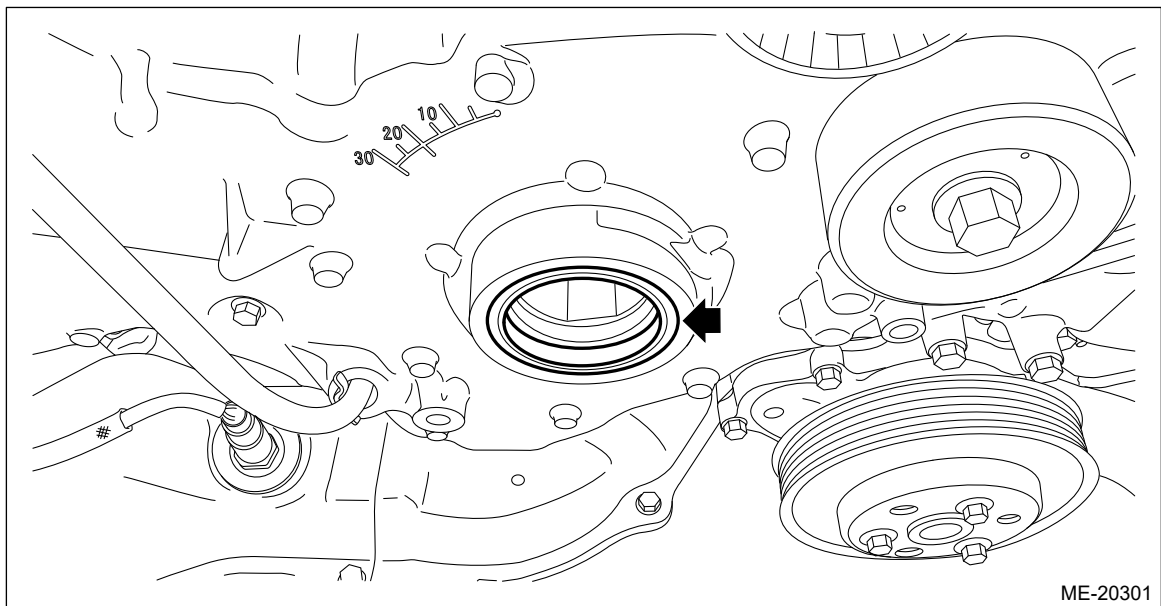


ST1 18355AA000 PULLEY WRENCH

ST2 18334AA000 PULLEY WRENCH PIN SET



4. Remove the crank pulley.
5. Remove the front oil seal from the chain cover.



MECHANICAL(H4DO) > Crank Sprocket

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.



MECHANICAL(H4DO) > Crank Sprocket

INSTALLATION

1. Install the crank sprocket.

Note:

The direction of installation is not specified for the crank sprocket.



2. Install the timing chain.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>INSTALLATION.](#)
3. Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)

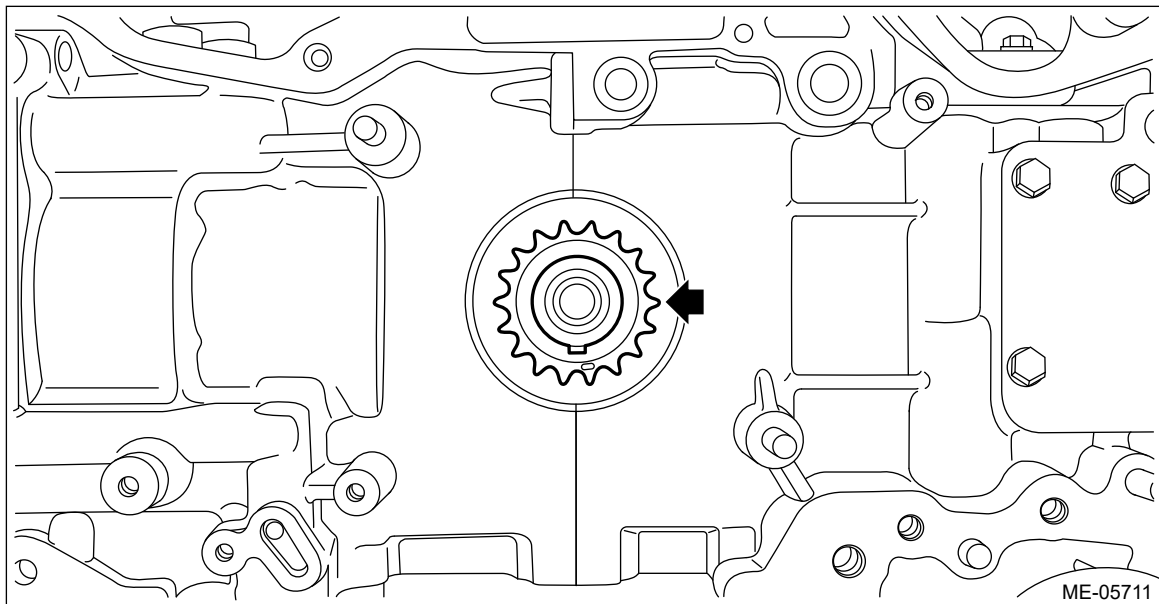
MECHANICAL(H4DO) > Crank Sprocket

REMOVAL

Note:

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

1. Remove the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>REMOVAL.](#)
3. Remove the crank sprocket.



MECHANICAL(H4DO) > Crankshaft

SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of the crankshaft.

 [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>INSTALLATION.](#)

ASSEMBLY

1. CYLINDER BLOCK

1. Apply liquid gasket to the threaded portion of the main gallery plug, and install the main gallery plug to the cylinder block LH.

Note:

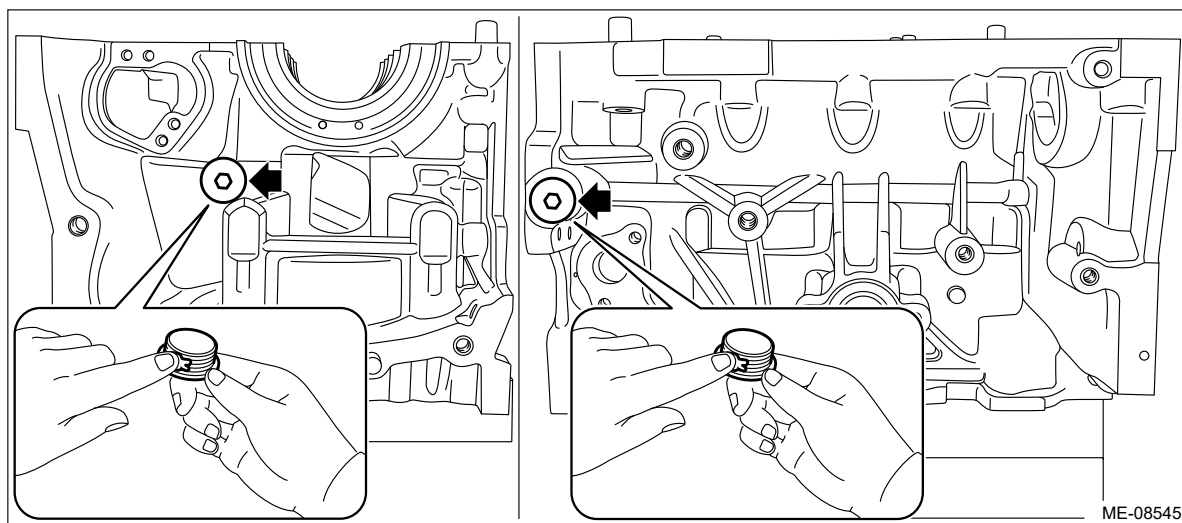
Before applying liquid gasket, degrease the thread holes of the cylinder block LH and main gallery plug.

Liquid gasket:

THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:

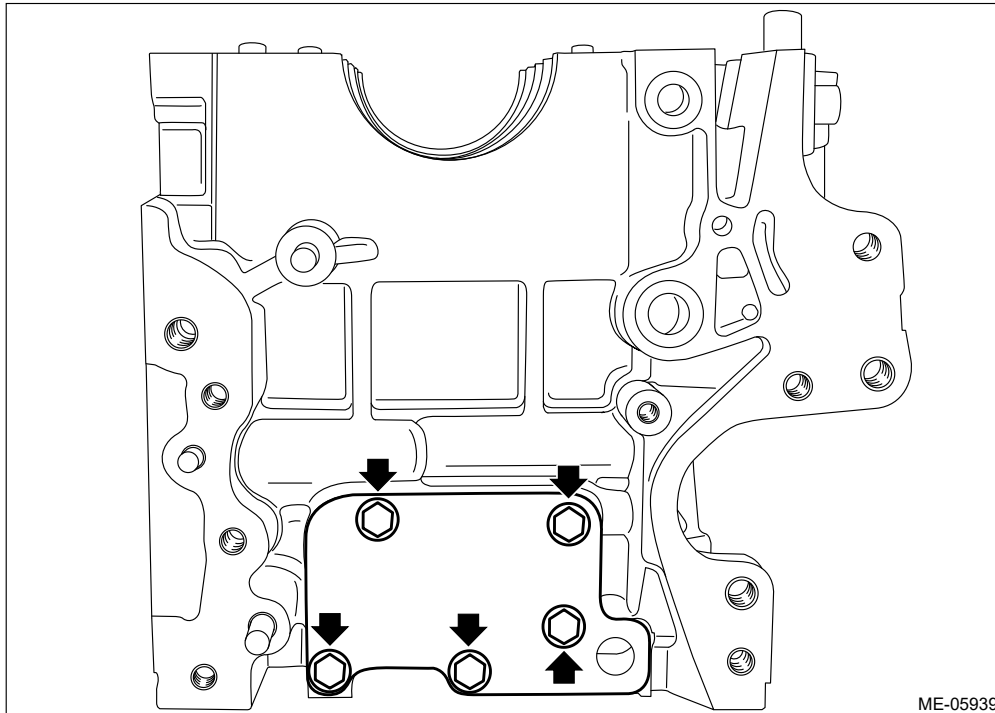
37 N·m (3.8 kgf-m, 27.3 ft-lb)



2. Install the cylinder block plate onto cylinder block LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



- 3.** Apply liquid gasket to the threaded portions of cylinder block plug and main gallery plug, and install the cylinder block plug (A) and main gallery plug (B) to cylinder block RH.

Note:

Before applying liquid gasket, degrease the thread holes of the cylinder block RH, and the threaded portions of cylinder block plug and main gallery plug.

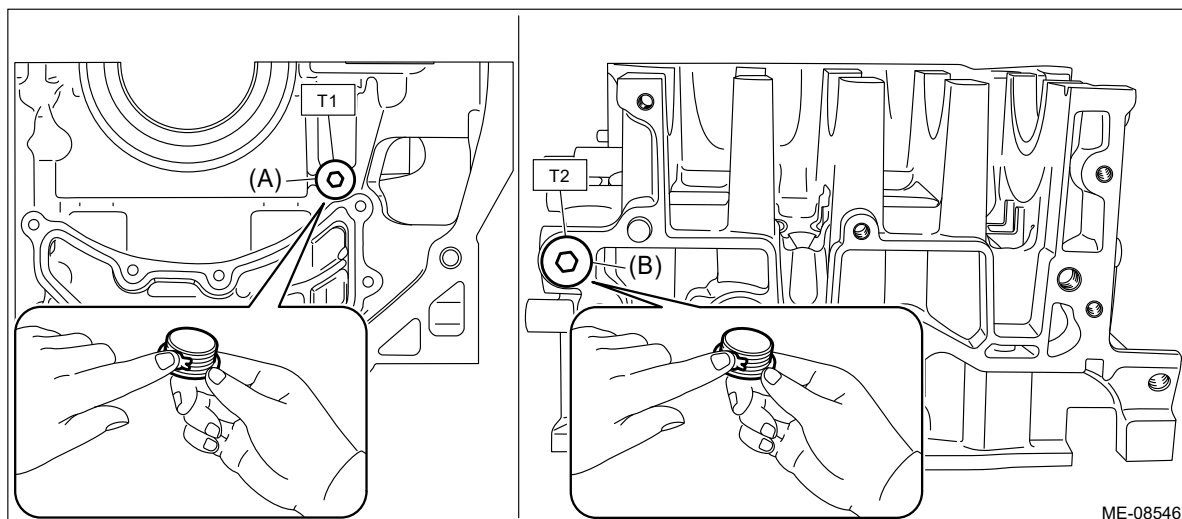
Liquid gasket:

THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:

T1: 16 N·m (1.6 kgf-m, 11.8 ft-lb)

T2: 37 N·m (3.8 kgf-m, 27.3 ft-lb)



- 4.** Install the oil separator cover to the cylinder block RH.
 (1) Apply liquid gasket to the mating surfaces of oil separator cover.

Note:

- **Use new oil separator cover.**
- **Before applying liquid gasket, degrease the old liquid gasket seal surface of cylinder block RH.**

- **Install within 5 min. after applying liquid gasket.**

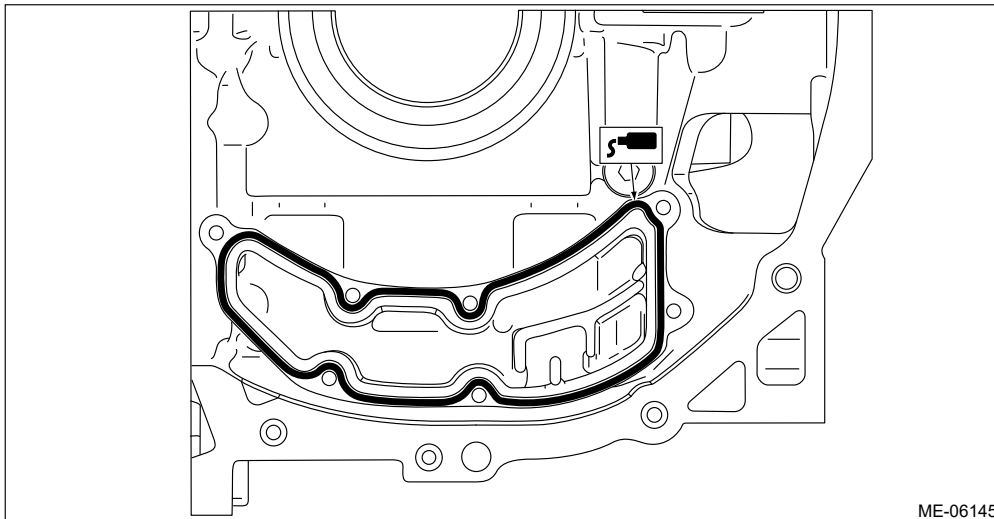
Liquid gasket:

Mating surface

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

4±1 mm (0.1772±0.0197 in)

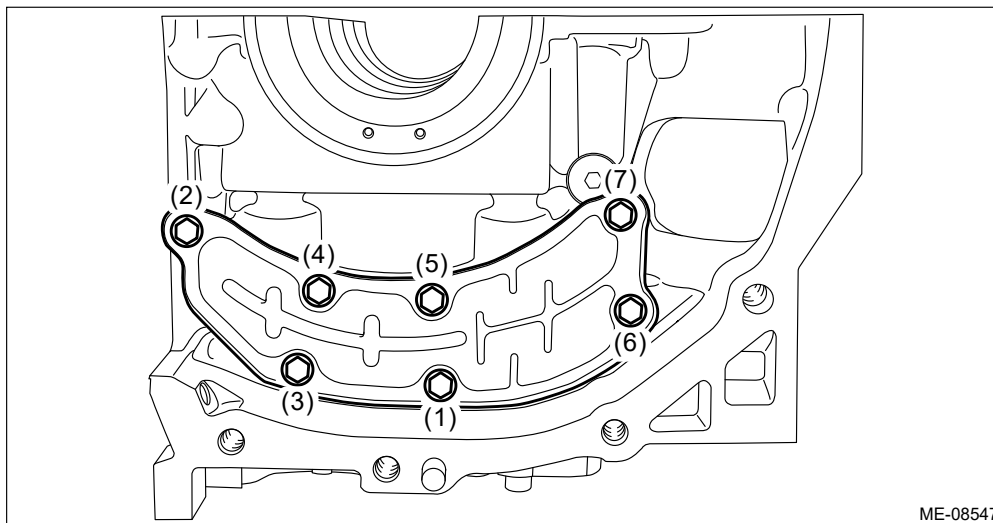


ME-06145

- (2) Install the oil separator cover to the cylinder block RH, and tighten the oil separator cover bolts in numerical order as shown in the figure.

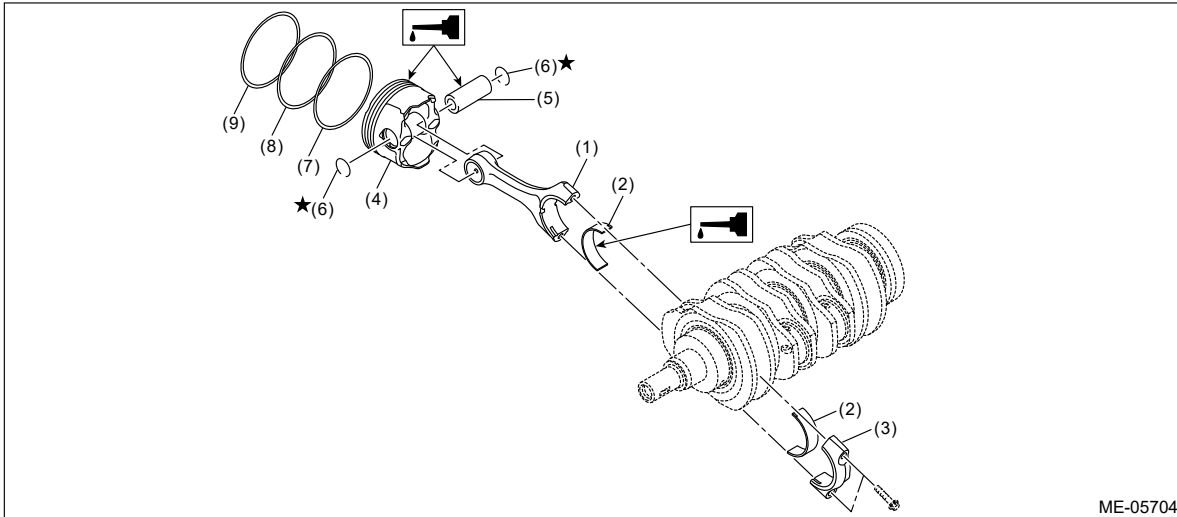
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



ME-08547

2. PISTON AND CONNECTING ROD

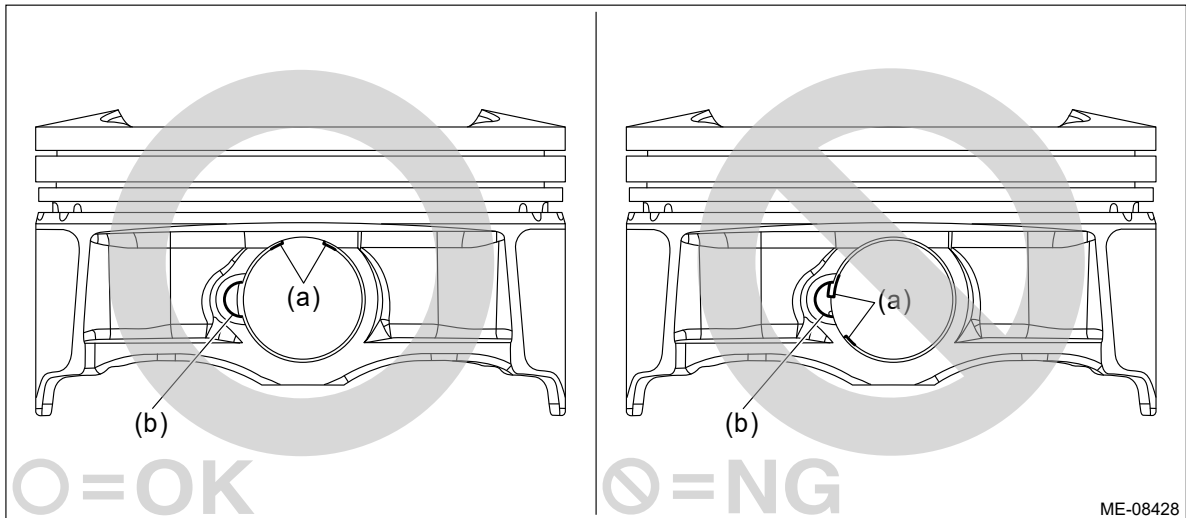


- | | | |
|----------------------------|----------------|-----------------|
| (1) Connecting rod | (4) Piston | (7) Oil ring |
| (2) Connecting rod bearing | (5) Piston pin | (8) Second ring |
| (3) Connecting rod cap | (6) Circlip | (9) Top ring |

1. Install the connecting rod bearing to the connecting rod and connecting rod cap.
2. Install the circlip on one end of the piston using a flat tip screwdriver.

Note:

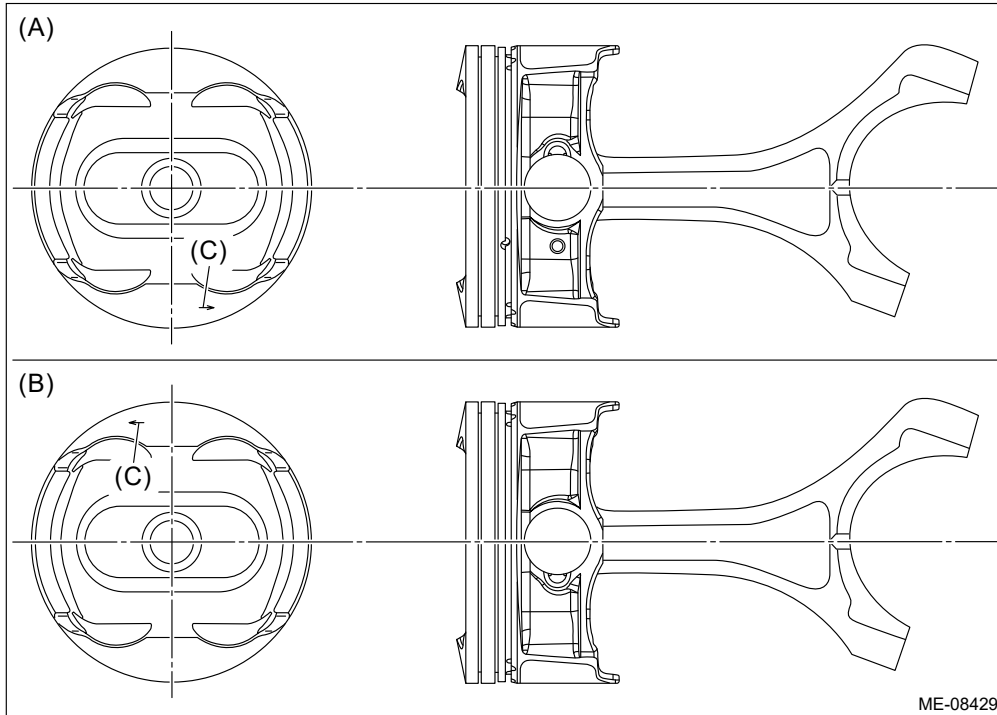
- Be careful not damage the piston, by wrapping the tip of flat tip screwdriver with tape.
- Make sure the circlip is firmly inserted into the circlip groove.
- After installing the circlip, rotate the circlip so that its end part (a) and the cutout portion of circlip groove (b) do not match.



3. Set the piston to the connecting rod.

Note:

Align the front mark of piston and the connecting rod direction correctly as shown in the figure.



(A) RH side (#1 and #3)

(B) LH side (#2 and #4)

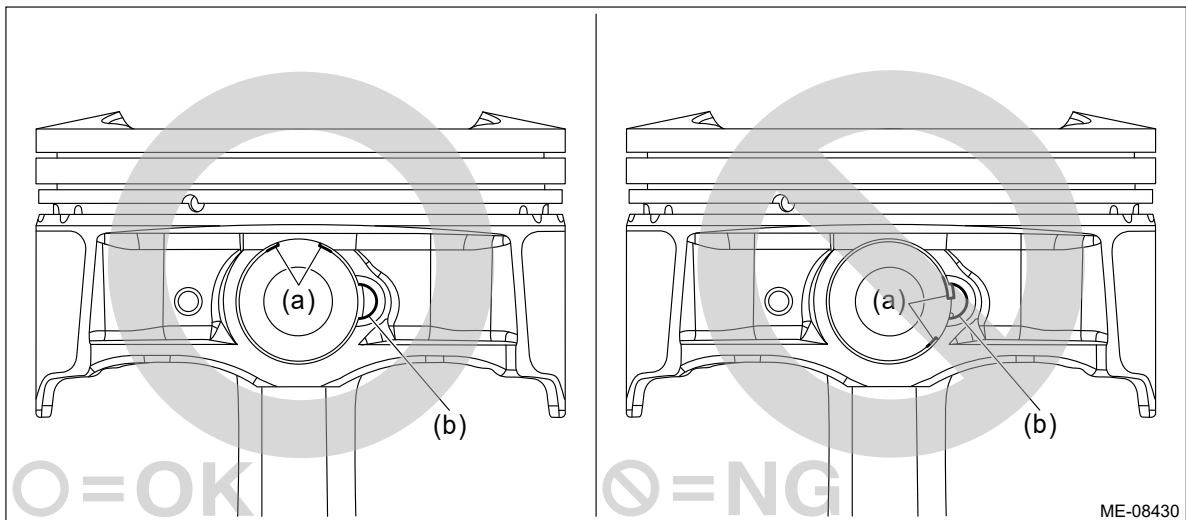
(C) Front mark

4. Apply engine oil to the piston pin, and attach the piston pin.

5. Install the circlip on the piston using a flat tip screwdriver.

Note:

- Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.
- Make sure the circlip is firmly inserted into the circlip groove.
- After installing the circlip, rotate the circlip so that its end part (a) and the cutout portion of circlip groove (b) do not match.

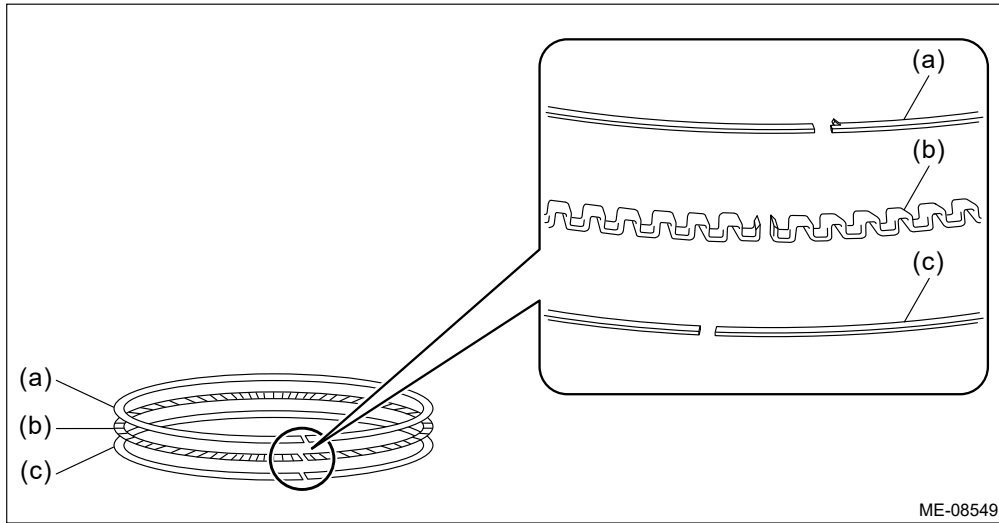


6. Install the piston rings onto the piston.

(1) Install the oil rings in the order of expander, lower rail and upper rail by hand.

Note:

Oil ring consists of the upper rail, expander and lower rail.



(a) Upper rail

(b) Expander

(c) Lower rail

(2) Install the compression rings in the order of second ring and top ring, using piston ring expander.

Note:

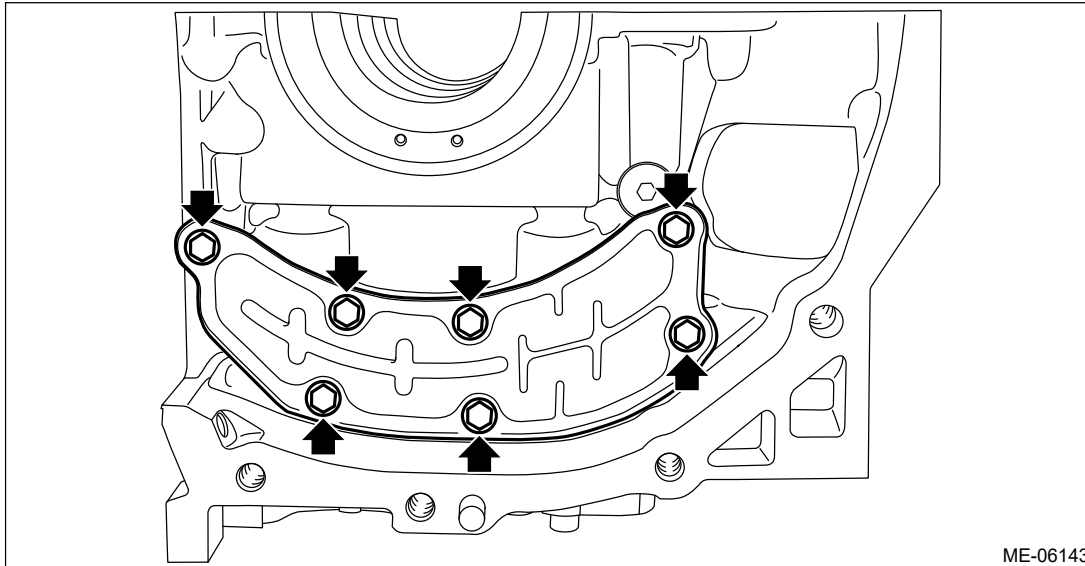
Install so that the compression ring mark faces the top side of the piston.

MECHANICAL(H4DO) > Cylinder Block

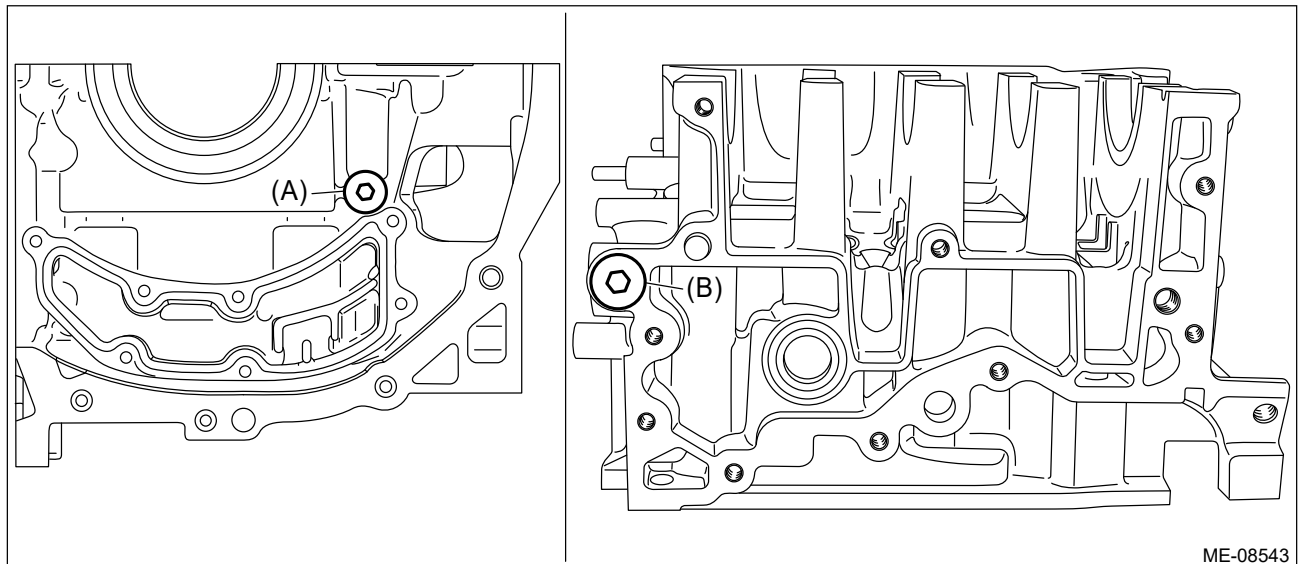
DISASSEMBLY

1. CYLINDER BLOCK

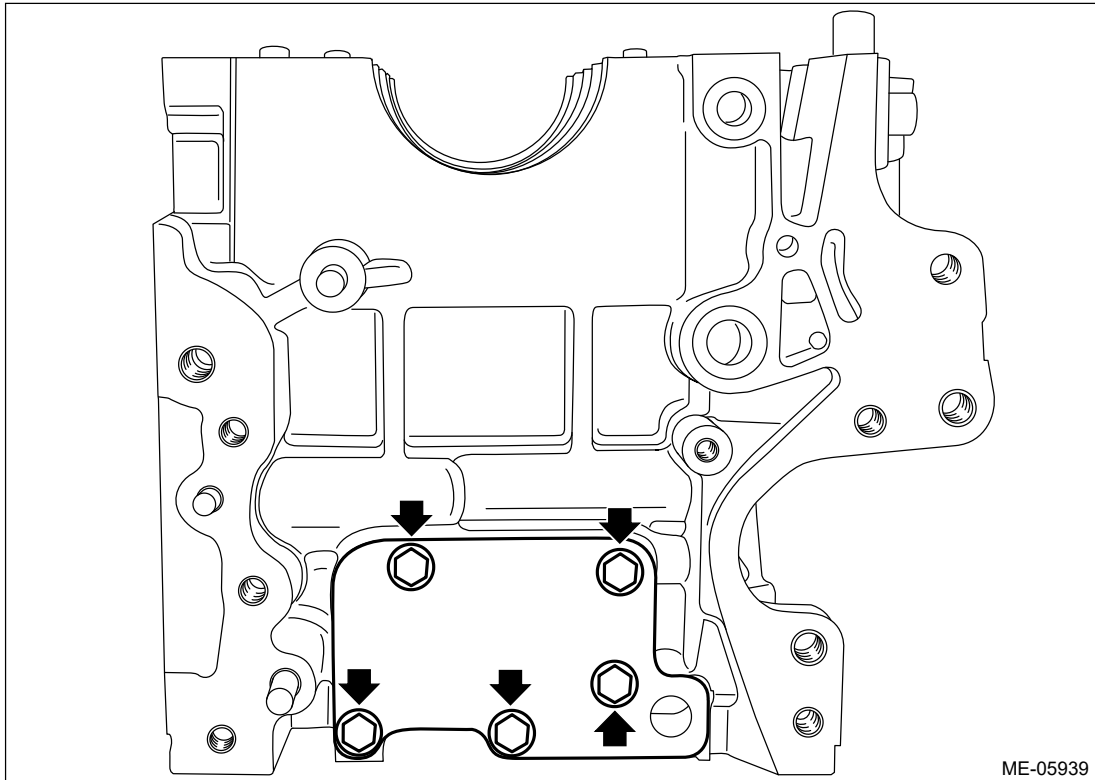
1. Remove the oil separator cover from cylinder block RH.



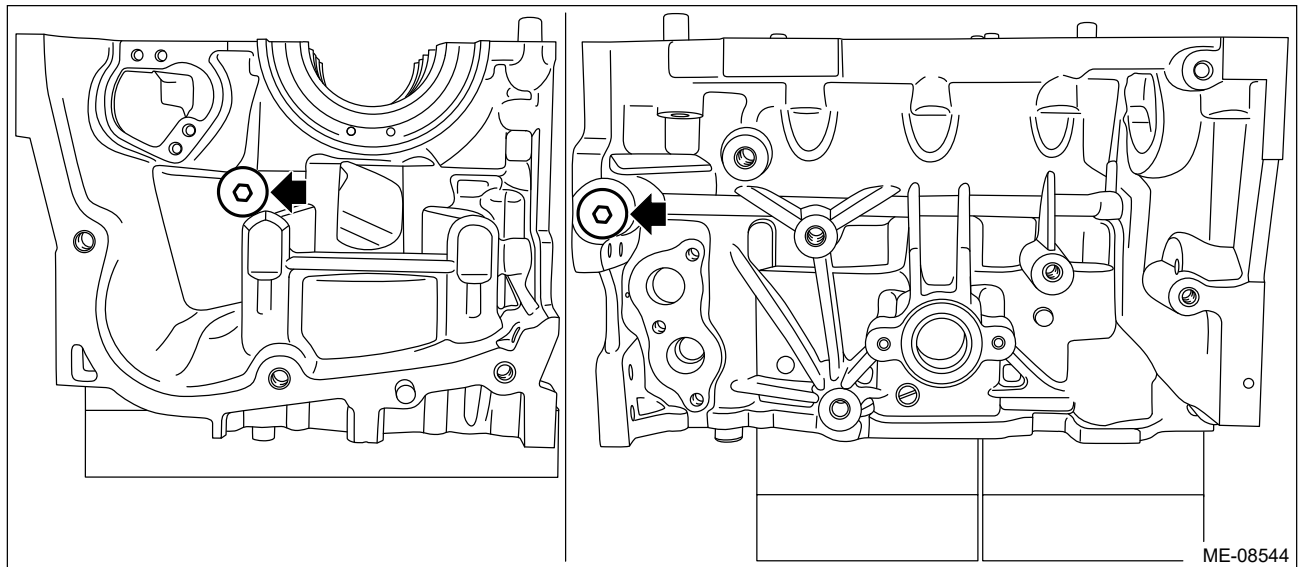
2. Remove the liquid gasket from cylinder block RH.
3. Remove the cylinder block plug (A) and the main gallery plug (B) from cylinder block RH.



4. Remove the liquid gasket from the thread holes of the cylinder block RH, and from the threaded portions of cylinder block plug and main gallery plug.
5. Remove the cylinder block plate from cylinder block LH.

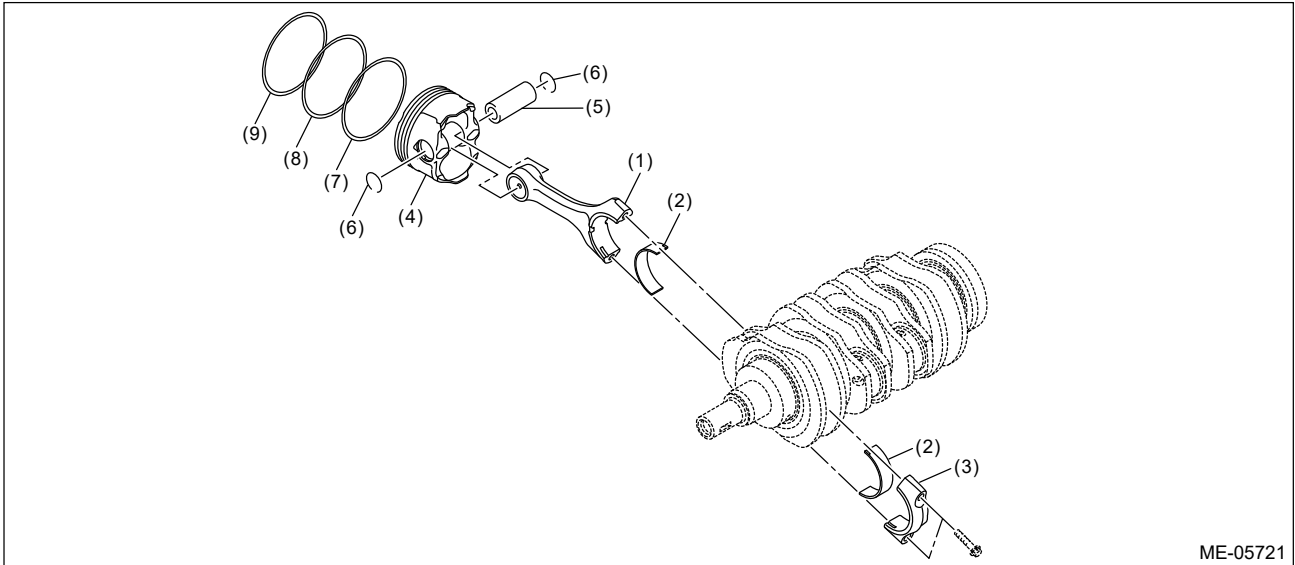


6. Remove the main gallery plug from cylinder block LH.



7. Remove the liquid gasket from the thread holes of the cylinder block LH and main gallery plug.

2. PISTON AND CONNECTING ROD



ME-05721

- | | | |
|----------------------------|----------------|-----------------|
| (1) Connecting rod | (4) Piston | (7) Oil ring |
| (2) Connecting rod bearing | (5) Piston pin | (8) Second ring |
| (3) Connecting rod cap | (6) Circlip | (9) Top ring |

Note:

To prevent confusion of various parts, mark each part.

1. Remove the connecting rod bearing from connecting rod and connecting rod cap.
2. Remove the piston rings from the piston.

Note:

Arrange the piston rings in order so that they can be installed in their original positions without confusion.

- (1) Remove the compression rings in the order of top ring and second ring, using piston ring expander.
- (2) Remove the oil rings in the order of upper rail, lower rail and expander by hand.

3. Remove the circlip on one end from the piston using a flat tip screwdriver.

Note:

Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.

4. Remove the piston pin from piston, and remove the connecting rod from piston.
5. Remove the circlip on other end from the piston using a flat tip screwdriver.

Note:

Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.

INSPECTION

1. CYLINDER BLOCK & PISTON

1. Visually inspect to make sure that there are no cracks, scratches or other damage.
2. Use liquid penetrant tester on the important sections to check for fissures.
3. Check that there are no traces of gas leaking or water leaking on the gasket attachment surface.
4. Check the oil passages for clogging.
5. Check for warpage of mating surfaces of the cylinder block that contacts cylinder head using a straight edge and thickness gauge. If it exceeds the limit, correct the surface by grinding it with a surface grinder or replace the cylinder block.

Note:

Measurement should be performed at a temperature of 20°C (68°F).

Cylinder block warpage:

Limit

0.025 mm (0.0010 in)

Grinding limit of cylinder block:

204.9 mm (8.067 in) or less

Height of cylinder block:

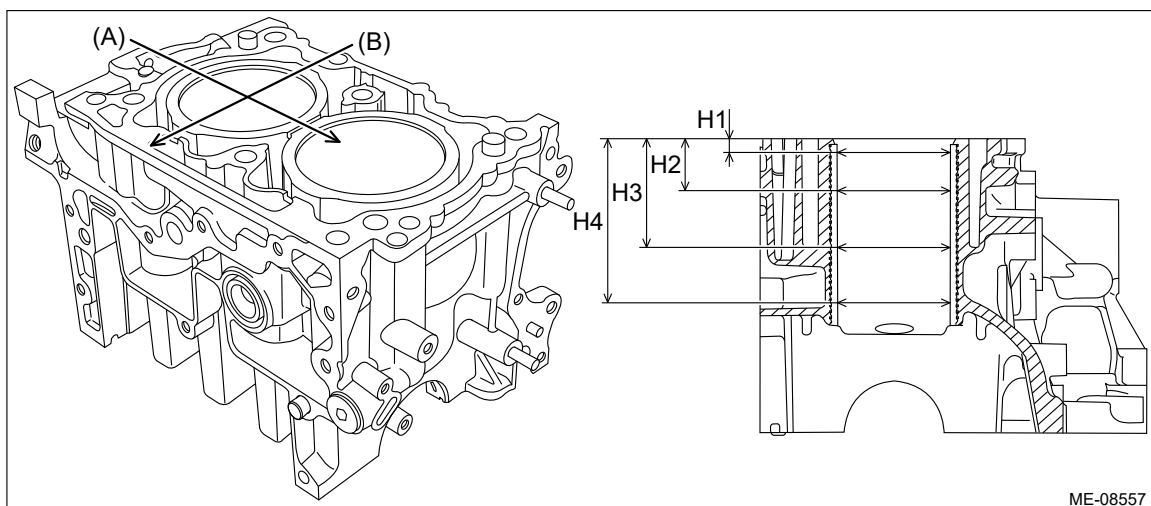
Standard

205.0 mm (8.071 in)

6. Using a cylinder bore gauge, check the cylindricity and out-of-roundness of cylinder liner. If it is not within the standard, perform reboring (including honing), or replace the cylinder block and piston as a set. For reboring and honing procedure, refer to step 8).

Note:

- Measure the cylinder liner with cylinder blocks separated (into cylinder block RH and cylinder block LH).
- Measurement should be performed at a temperature of 20°C (68°F).
- Write down all measurement values as the values are used in the next procedure.
- Measure the inner diameter of each cylinder liner in both the thrust and piston pin directions at the heights as shown in the figure.



(A) Piston pin direction

(B) Thrust direction

H1: 10 mm (0.3937 in)

H2: 45 mm (1.7717 in)

H3: 80 mm (3.1496 in)

H4: 105 mm (4.1339 in)

- Calculate the cylindricity of cylinder liner by using the following formula.

| |
|---------------------|
| Calculation formula |
|---------------------|

C = The larger value between the calculation values C' and C''

C' = (D (a) – D (b))/2

C'' = (D (c) – D (d))/2

C: Cylindricity of cylinder liner

D(a): The largest value of all the values obtained by measuring the cylinder liner inner diameter in the direction of the piston pin

D(b): The smallest value of all the values obtained by measuring the cylinder liner inner diameter in the direction of the piston pin

D(c): The largest value of all the values obtained by measuring the cylinder liner inner diameter in the thrust direction

D(d): The smallest value of all the values obtained by measuring the cylinder liner inner diameter in the thrust direction

- Calculate the out-of-roundness of cylinder liner at each measurement height by using the following formula.

Calculation formula

$R = (D (e) - D (f))/2$

R: Out-of-roundness of cylinder liner

D(e): The larger value between the measurement values in the piston pin direction and in the thrust direction of cylinder liner inner diameter

D(f): The smaller value between the measurement values in the piston pin direction and in the thrust direction of cylinder liner inner diameter

Cylindricity of cylinder liner:

Limit

0.030 mm (0.0012 in)

Out-of-roundness of cylinder liner:

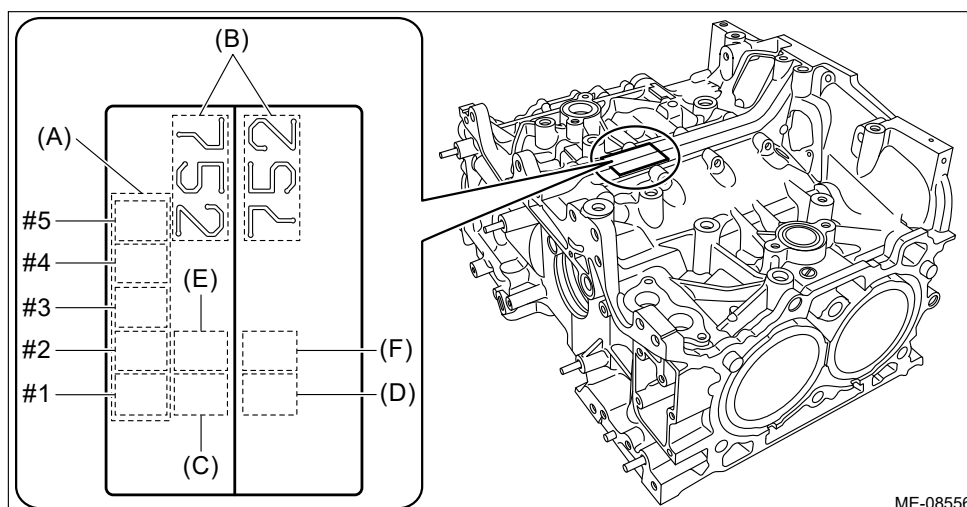
Limit

0.030 mm (0.0012 in)

7. Check the clearance between cylinder liner and piston. Check the clearance between cylinder liner and piston by measuring the inner diameter of cylinder liner and the outer diameter of piston respectively.
 - (1) Measure the inner diameter of cylinder liner. If it is not within the standard, perform reboring (including honing), or replace the cylinder block and piston as a set. For reboring and honing procedure, refer to step 8).

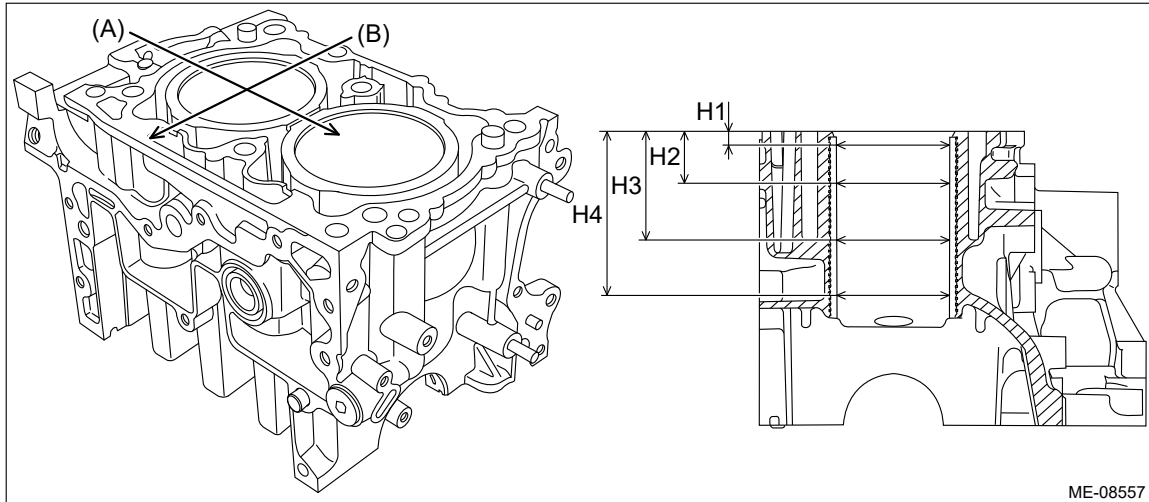
Note:

- Measure the cylinder liner with cylinder blocks separated (into cylinder block RH and cylinder block LH).
- Measurement should be performed at a temperature of 20°C (68°F).
- The cylinder bore size mark is stamped on the upper face of the cylinder block.



- (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

- **Measure the inner diameter of each cylinder liner in both the thrust and piston pin directions at the heights as shown in the figure and read the value of the most worn location.**



- (A) Piston pin direction
- (B) Thrust direction
- H1: 10 mm (0.3937 in)
- H2: 45 mm (1.7717 in)
- H3: 80 mm (3.1496 in)
- H4: 105 mm (4.1339 in)

Inner diameter of cylinder liner:

Cylinder bore size mark A

Standard

94.005 – 94.015 mm (3.7010 – 3.7014 in)

Cylinder bore size mark B

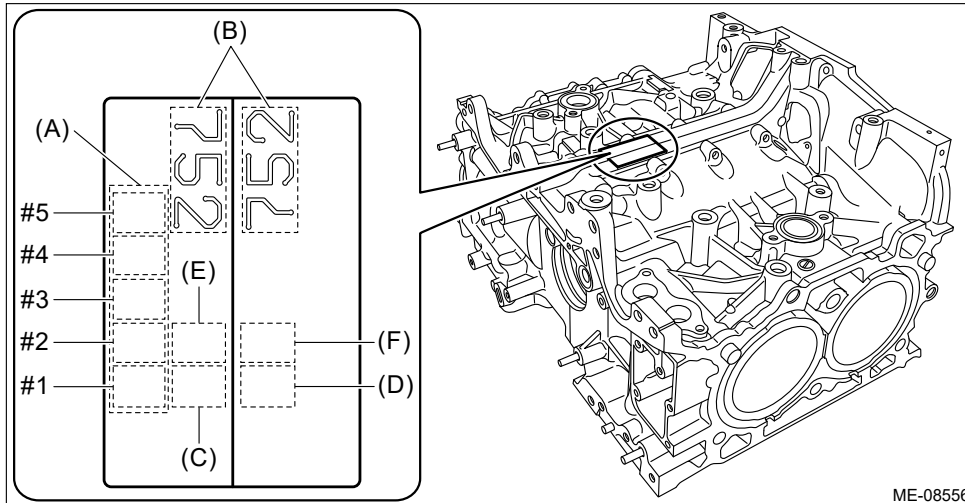
Standard

93.995 – 94.005 mm (3.7006 – 3.7010 in)

- (2) Check the outer diameter of piston with a micrometer. If it is not within the standard, replace the piston.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Measure the outer diameter of each piston in thrust direction at the height as shown in the figure.**
- **Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as guide lines in selecting a standard piston.**
- **The grade can be judged by the stamp of cylinder bore size mark on the upper face of the cylinder block.**



- (A) Main journal size mark (C) #1 cylinder bore size mark (E) #3 cylinder bore size mark
 (B) Cylinder block (RH) - (LH) combination mark (D) #2 cylinder bore size mark (F) #4 cylinder bore size mark

- If the piston is replaced, check the clearance between cylinder liner and piston in the step (3), and select a suitable sized piston.

Piston grade point H:

13.3 mm (0.52 in)

Piston outer diameter:

Standard size (grade A = cylinder bore size mark A)

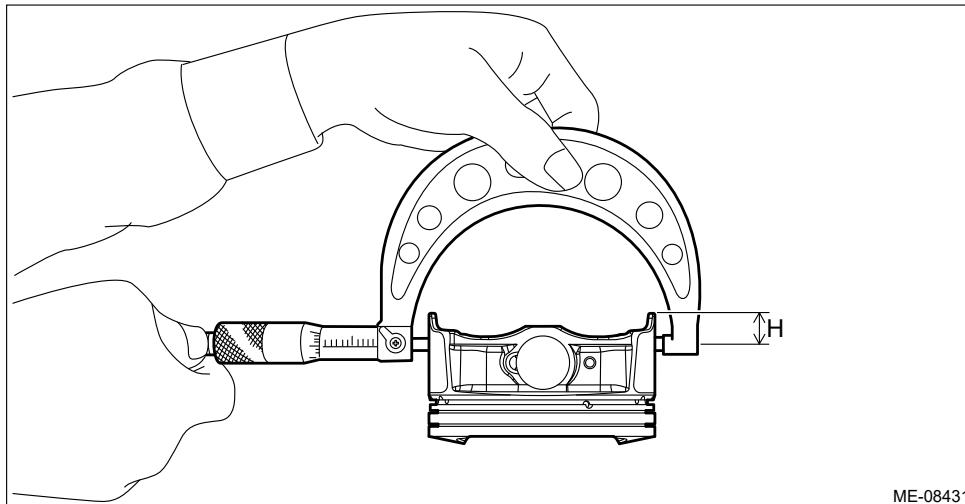
Standard

93.980 – 93.990 mm (3.7000 – 3.7004 in)

Standard size (grade B = cylinder bore size mark B)

Standard

93.970 – 93.980 mm (3.6996 – 3.7000 in)



- (3) Calculate the clearance between cylinder liner and piston. If it is not within the standard, perform reboring (including honing), or replace the cylinder block and piston as a set. For reboring and honing procedure, refer to step 8).

Note:

The clearance between cylinder liner and piston is decided by matching the cylinder block bore size mark and the grade of piston outer diameter (grade A or B).

Clearance between cylinder liner and piston:

Standard

0.015 — 0.035 mm (0.0006 — 0.0014 in)

8. Reboring and honing

- (1) If any of the cylindricity, out-of-roundness, inner diameter or clearance between cylinder liner and piston is out of standard or if there is any damage on the cylinder liner, perform reboring (including honing).

Caution:

When any of the cylinder liner needs reboring, all other cylinder liners must be rebored at the same time, and replaced with proper size pistons.

Oversize piston outer diameter:

0.25 mm (0.0098 in) oversize

Standard

94.220 — 94.240 mm (3.7094 — 3.7102 in)

0.50 mm (0.0197 in) oversize

Standard

94.470 — 94.490 mm (3.7193 — 3.7201 in)

- (2) If the inner diameter of cylinder liner exceeds the limit after reboring (including honing), replace the cylinder block and piston as a set.

Note:

- **Immediately after reboring (including honing), the inner diameter of cylinder liner may differ from its real diameter due to temperature rise. Thus, when measuring the inner diameter of cylinder liner, wait until the temperature has cooled to 20°C (68°F).**
- **For the measurement of the inner diameter of cylinder liner, refer to step 7).**

Inner diameter of cylinder liner boring limit (diameter):

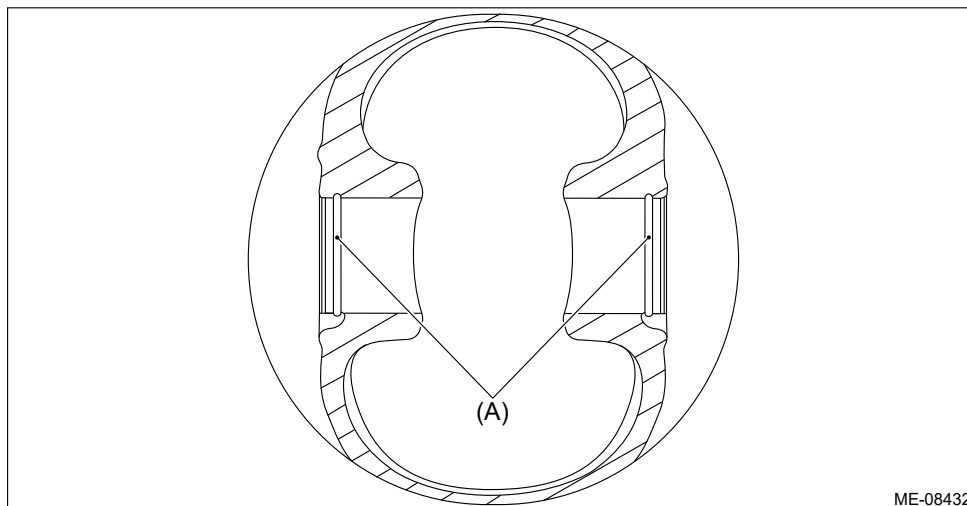
94.505 mm (3.7207 in) or less

2. PISTON AND PISTON PIN

1. Check the piston and piston pin for wear or crack.
2. Check the snap ring for distortion or wear.
3. Check the piston ring groove for damage.
4. Check the circlip groove (A) for burr.

Note:

If the burr is found, remove the burr from groove.

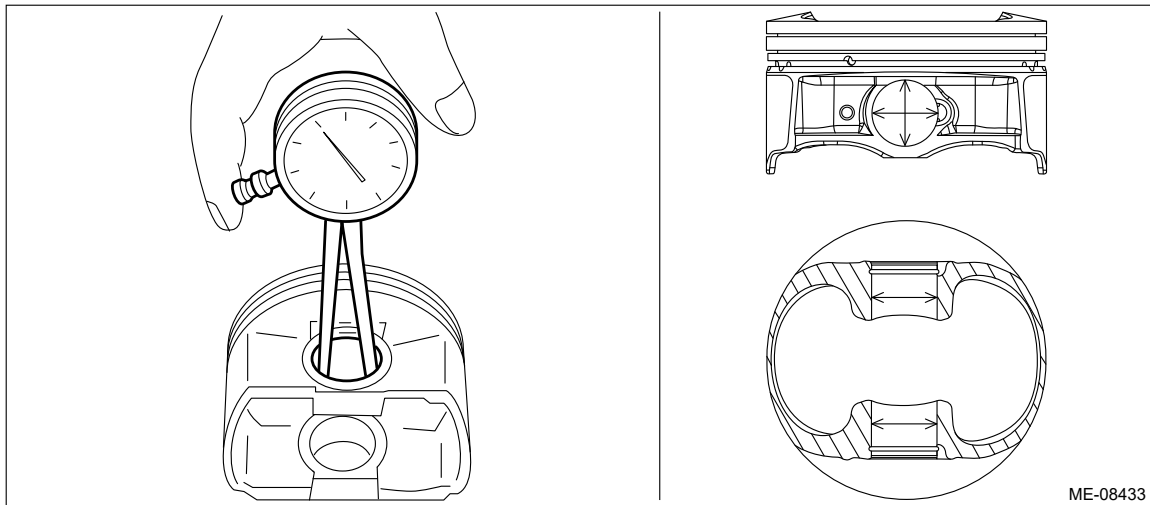


5. Check that the piston pin can be inserted into the piston with a thumb at 20°C (68°F).
6. Check the clearance between piston and piston pin. Check the clearance between piston and piston pin by measuring the inner diameter of piston pin hole and the outer diameter of piston pin respectively.
 - (1) Using a caliper gauge, measure the inner diameter of piston pin hole.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**

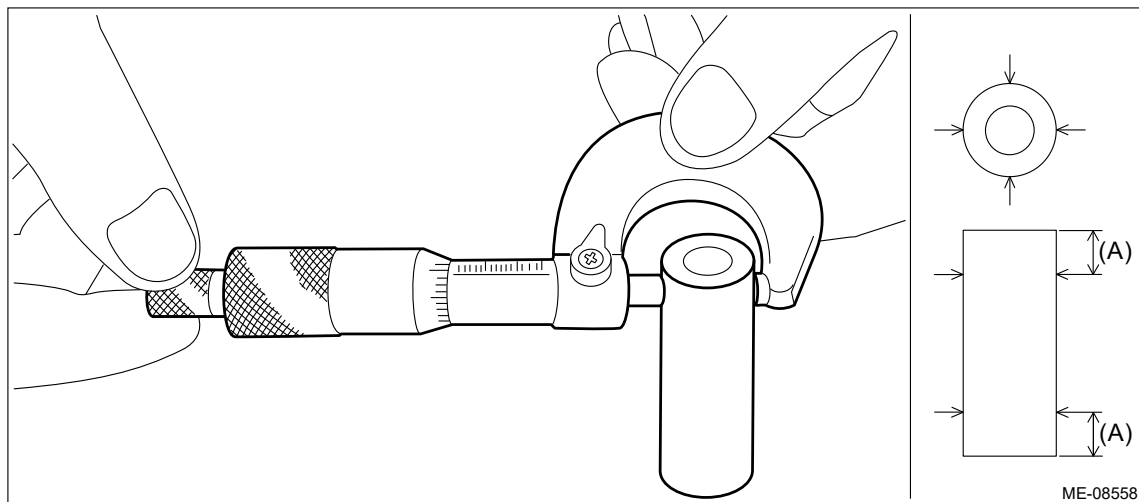
- Measure the inner diameter of the piston pin hole at the four locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(2) Measure the outer diameter of piston pin with a micrometer.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the piston pin at the four locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(A) 10 mm (0.394 in)

(3) Calculate the clearance between piston and piston pin. If it is not within the standard, replace the piston and piston pin as a set.

Clearance between piston and piston pin:

Standard

0.004 – 0.008 mm (0.0002 – 0.0003 in)

3. PISTON RING

1. Make sure the piston ring is not broken or damaged.
2. Using a cylindrical guide, insert the piston ring into the cylinder liner so that they are perpendicular to the cylinder wall, and check the piston ring gap using a thickness gauge. If it is not within the standard, replace the piston ring.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Use piston ring with same size as piston when replacing piston ring.**

Piston ring gap:

Compression ring (top ring)

Standard

0.20 — 0.25 mm (0.0079 — 0.0098 in)

Compression ring (second ring)

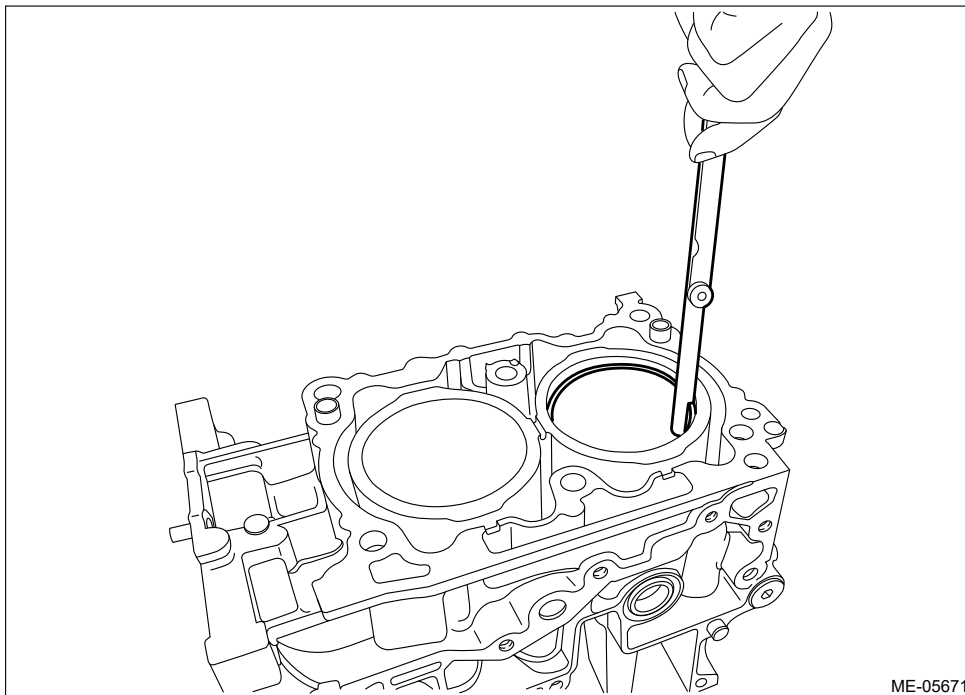
Standard

0.25 — 0.35 mm (0.0098 — 0.0138 in)

Oil ring (upper rail and lower rail)

Standard

0.10 — 0.35 mm (0.0039 — 0.0138 in)



3. Fit the compression ring straight into the piston ring groove, then check the clearance between compression ring and piston with a thickness gauge. If it is not within the standard, replace the compression ring.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Before inspecting the clearance, clean the piston ring groove and compression ring.**
- **Use compression ring with same size as piston when replacing compression ring.**

Clearance between compression ring and piston:

Top ring

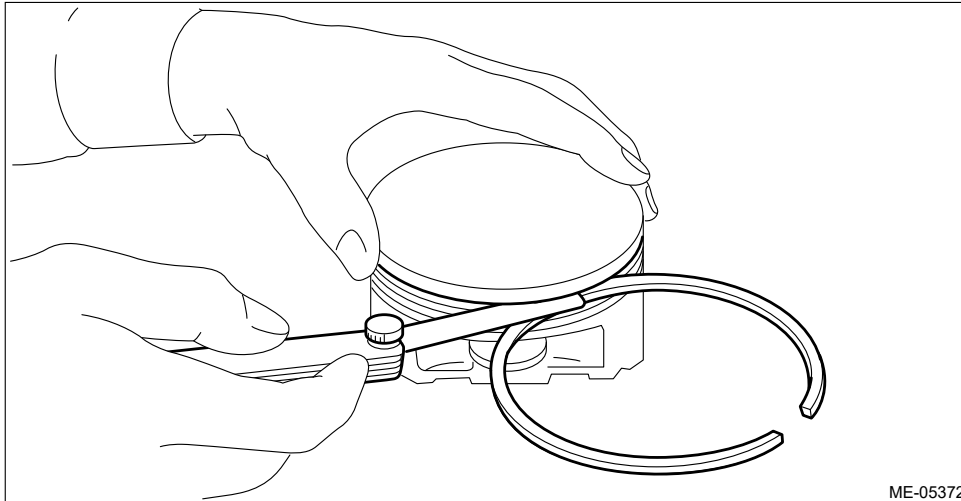
Standard

0.040 — 0.080 mm (0.0016 — 0.0031 in)

Second ring

Standard

0.030 — 0.070 mm (0.0012 — 0.0028 in)



ME-05372

4. CONNECTING ROD AND CONNECTING ROD BEARING

1. Check for bend or twist using a connecting rod aligner. If it exceeds the limit, replace the connecting rod.

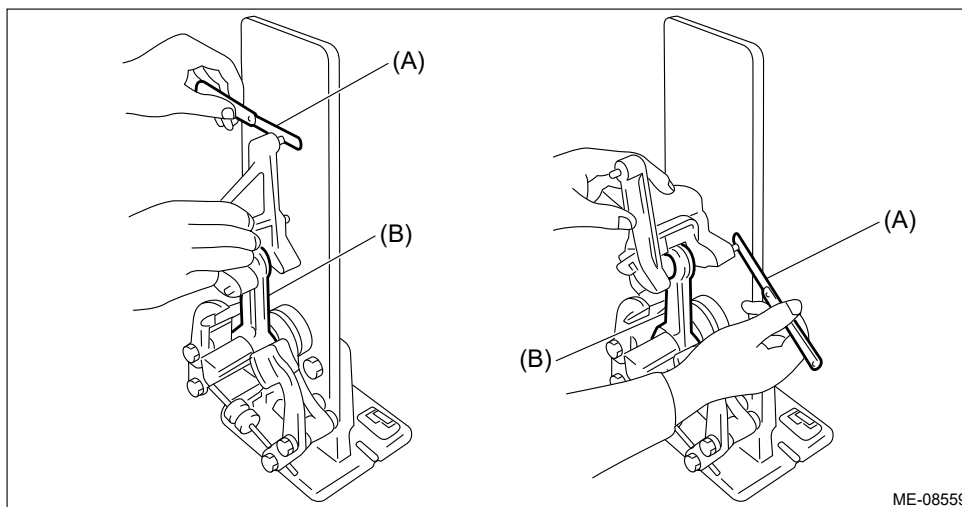
Note:

Measurement should be performed at a temperature of 20°C (68°F).

Bend or twist per 100 mm (3.94 in) in length:

Limit

0.10 mm (0.0039 in)



ME-08559

(A) Thickness gauge

(B) Connecting rod

2. Check that the large or small end thrust surface of each connecting rod is not damaged.
3. Remove carbon and sludge adhering to the inner wall of each connecting rod large end.
4. Check each connecting rod bearing for scar, peeling, seizure, melting or wear, etc.
5. Check the thrust clearance of each connecting rod using a thickness gauge.

Note:

Measurement should be performed at a temperature of 20°C (68°F).

- (1) Clean the #1 connecting rod bearing and the #1 pin of crankshaft, and apply engine oil to the #1 pin of crankshaft.
- (2) Set the #1 connecting rod bearing to the #1 connecting rod and #1 connecting rod cap.
- (3) Set the #1 connecting rod, #1 connecting rod cap and #1 connecting rod cap bolt to the #1 pin of crankshaft.

Note:

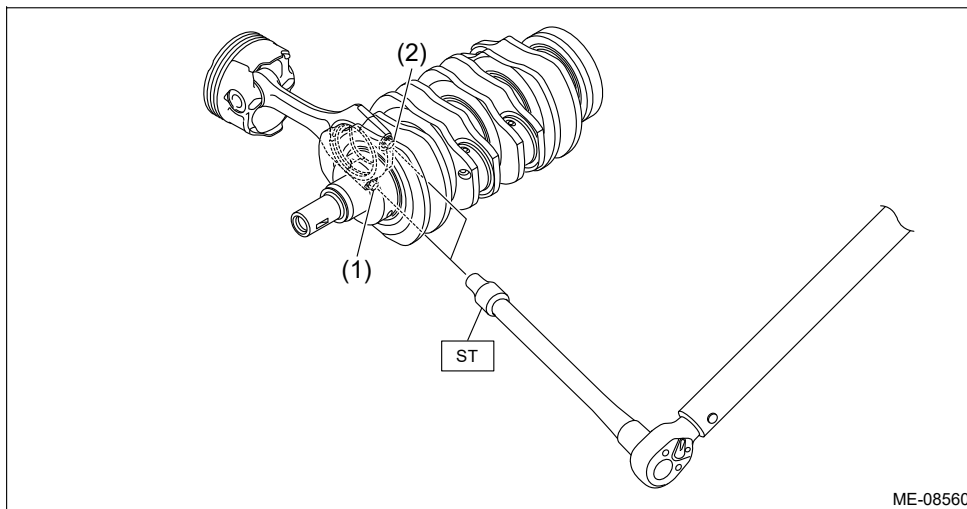
- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #1 connecting rod cap bolt thread.

(4) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

Caution:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.

ST 18270AA020 SOCKET



(5) Using ST and angle gauge, tighten the #1 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

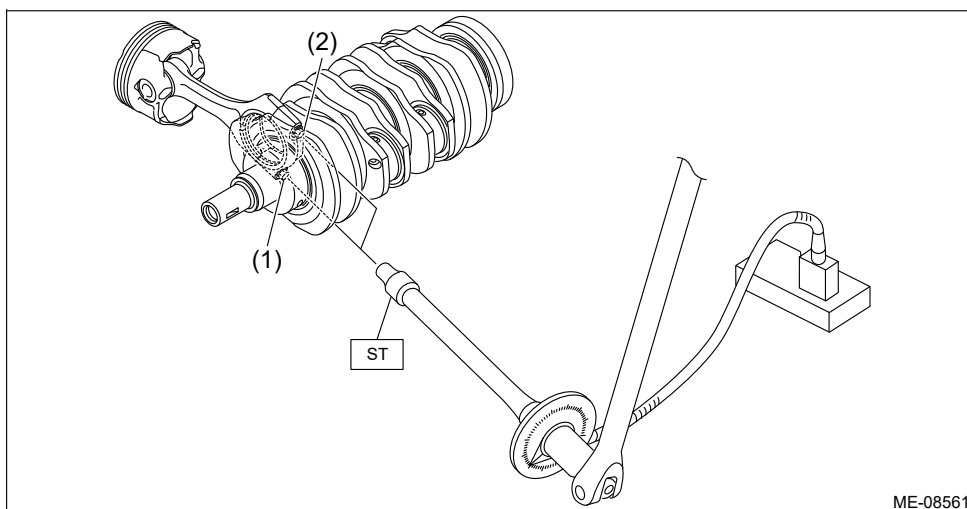
Caution:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.

ST 18270AA020 SOCKET

Tightening angle:

$$137^{\circ} + 3^{\circ} - 2^{\circ}$$



(6) In the same manner, install the #2, #3 and #4 connecting rods.

- (7) Check the thrust clearance of each connecting rod using a thickness gauge. If it is not within the standard, replace the connecting rod.

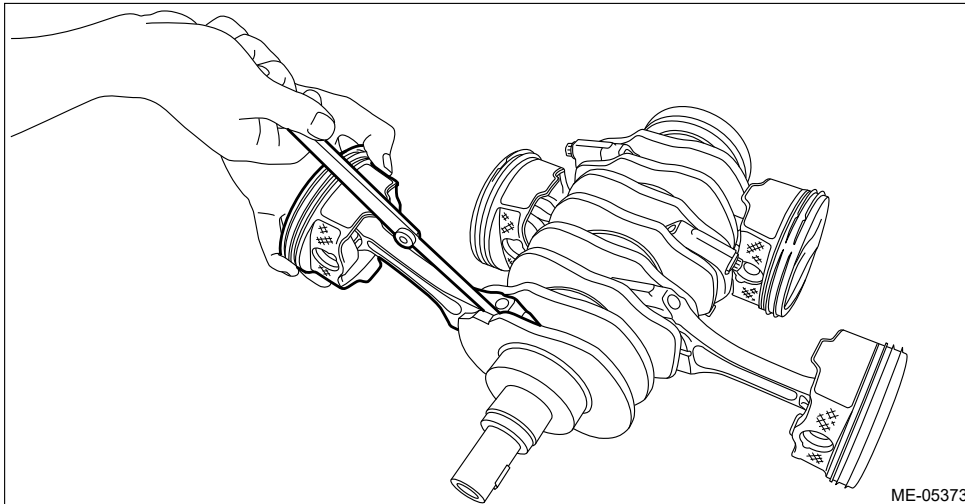
Note:

Measure the thrust clearance of each connecting rod at several points, and replace the connecting rod if there is uneven wear.

Connecting rod thrust clearance:

Standard

0.070 — 0.330 mm (0.0028 — 0.0130 in)



6. Check the oil clearance on each connecting rod bearing using plastigauge.

Note:

Measurement should be performed at a temperature of 20°C (68°F).

- (1) Clean the #1 connecting rod bearing and the #1 pin of crankshaft.
- (2) Set the #1 connecting rod bearing to the #1 connecting rod and #1 connecting rod cap.
- (3) Place a plastigauge across the #1 pin of crankshaft, and set the #1 connecting rod, #1 connecting rod cap and #1 connecting rod cap bolt to the #1 pin of crankshaft.

Note:

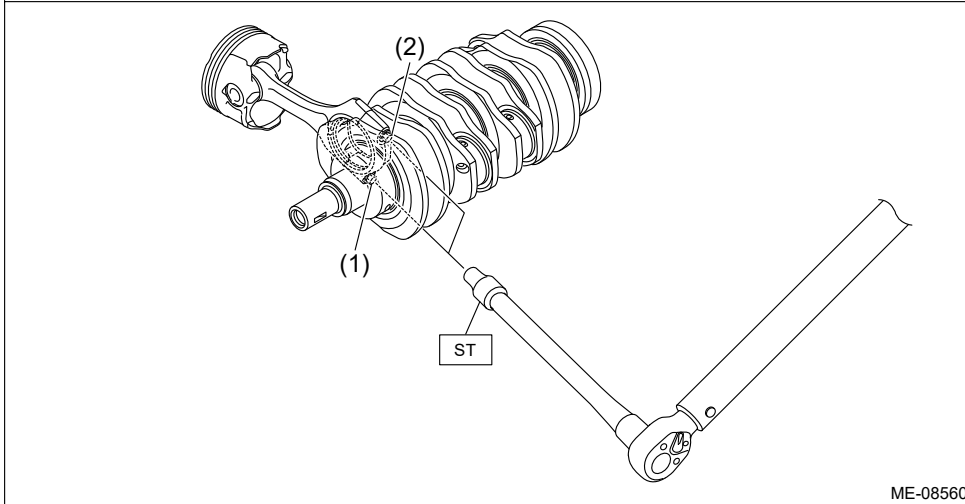
- **Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.**
- **Use a new connecting rod cap bolt.**
- **Apply a coat of engine oil to the #1 connecting rod cap bolt thread.**

- (4) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

Caution:

- **Make sure to hold the crankshaft securely during work.**
- **When holding the crankshaft, be careful not to damage the crankshaft.**
- **During tightening, be careful not to move the #1 connecting rod and the #1 connecting rod cap.**

ST 18270AA020 SOCKET



- (5) Using ST and angle gauge, tighten the #1 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

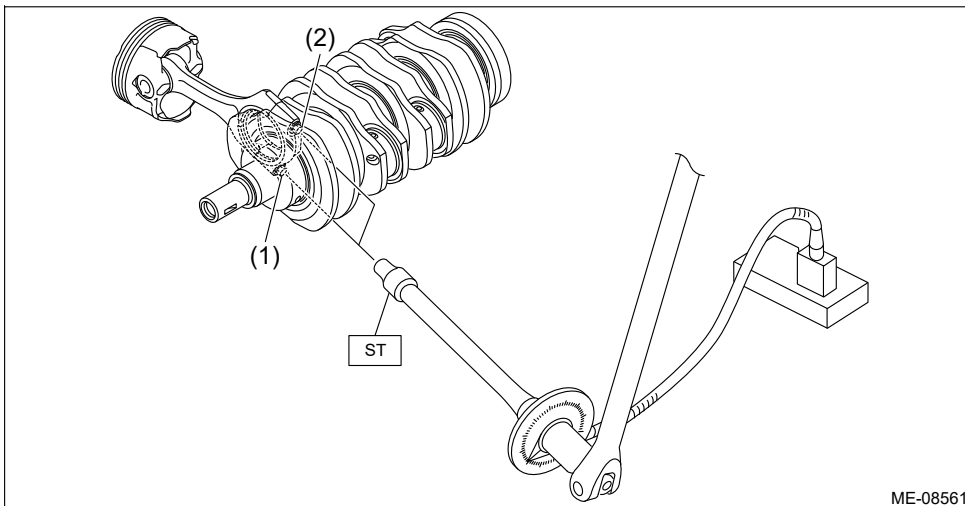
Caution:

- **Make sure to hold the crankshaft securely during work.**
- **When holding the crankshaft, be careful not to damage the crankshaft.**
- **During tightening, be careful not to move the #1 connecting rod and the #1 connecting rod cap.**

ST 18270AA020 SOCKET

Tightening angle:

$137^{\circ}+3^{\circ}-2^{\circ}$

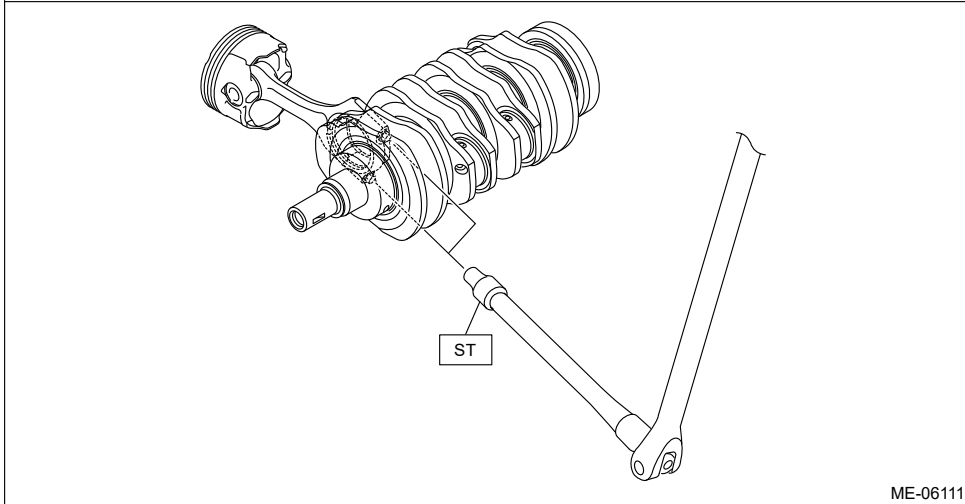


- (6) Using ST, loosen the #1 connecting rod cap bolt, and remove the #1 connecting rod cap bolt and #1 connecting rod cap.

Caution:

- **Make sure to hold the crankshaft securely during work.**
- **When holding the crankshaft, be careful not to damage the crankshaft.**
- **During removal, be careful not to move the #1 connecting rod and the #1 connecting rod cap.**

ST 18270AA020 SOCKET



- (7) Determine oil clearance of the #1 connecting rod bearing by matching the widest point of the plastigauge on #1 pin of crankshaft against scale printed on a package of the plastigauge. If it is not within the standard, replace the #1 connecting rod bearing.

Note:

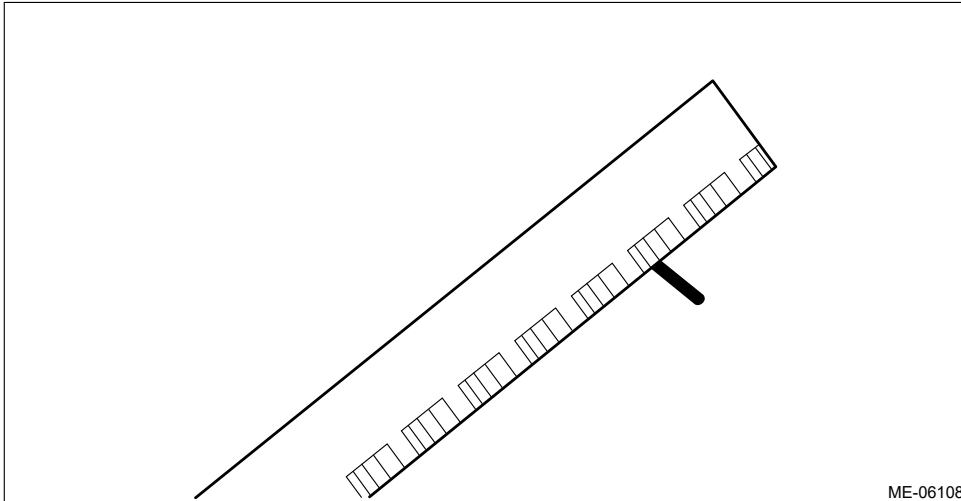
Measure the outer diameter of crankshaft pin using micrometer, and select the suitable size connecting rod bearing when replacing the connecting rod bearing.

| Unit: mm (in) | | |
|-------------------------------|--|--------------------------------------|
| Bearing | Connecting rod bearing thickness (at center) | Crankshaft pin outer diameter |
| | Standard | Standard |
| Standard size | 1.492 – 1.508 (0.0587 – 0.0594) | 47.976 – 48.000 (1.8888 – 1.8898) |
| 0.03 (0.0012) Undersize | 1.511 – 1.515 (0.0595 – 0.0596) | 47.946 – 47.970 (1.8876 – 1.8886) |
| 0.05 (0.0020) Undersize | 1.521 – 1.525 (0.0599 – 0.0600) | 47.926 – 47.950 (1.8868 – 1.8878) |
| 0.25 (0.0098) Undersize | 1.621 – 1.625 (0.0638 – 0.0640) | 47.726 – 47.750 (1.8790 – 1.8799) |

Connecting rod bearing oil clearance:

Standard

0.017 – 0.047 mm (0.0007 – 0.0019 in)



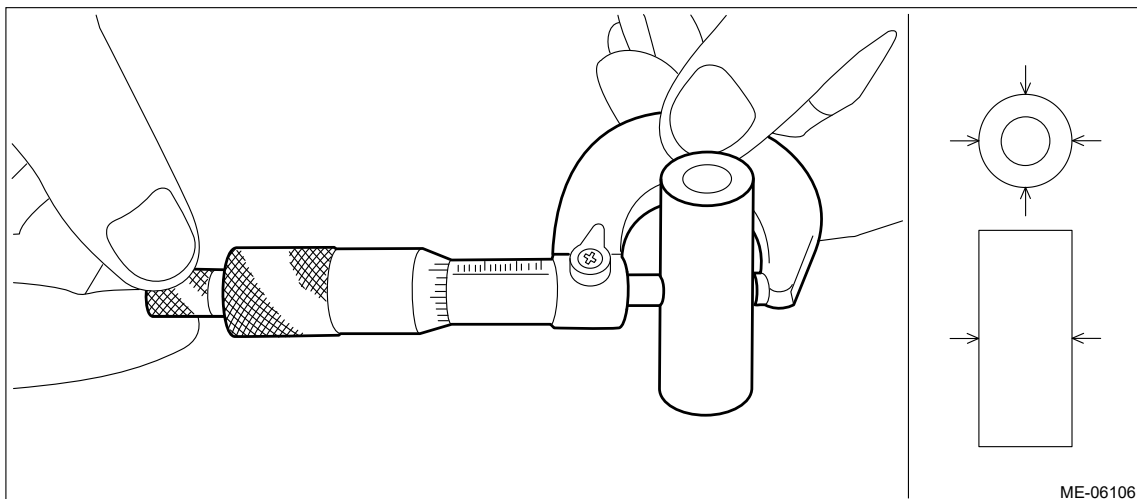
- (8) Completely remove the plastigauge.
- (9) In the same manner, check oil clearance of the #2, #3 and #4 connecting rod bearings.

5. PISTON PIN & CONNECTING ROD BUSHING

1. Check that the connecting rod bushing is not damaged.
2. Check the clearance between piston pin and connecting rod bushing. Check the clearance between piston pin and connecting rod bushing by measuring the outer diameter of piston pin and the inner diameter of connecting rod bushing respectively.
 - (1) Measure the outer diameter of piston pin with a micrometer.

Note:

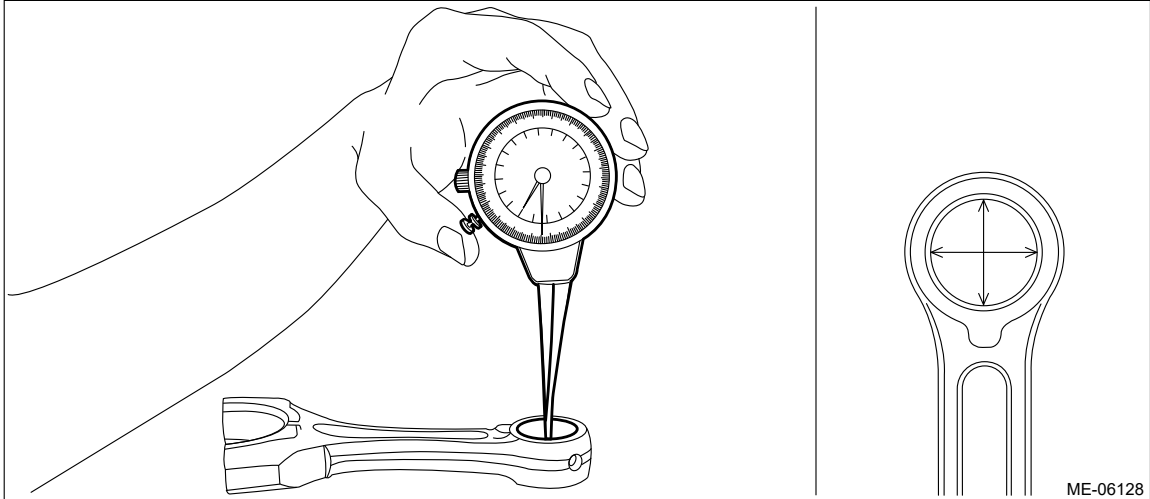
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the piston pin at the two locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



- (2) Using a caliper gauge, measure the inner diameter of connecting rod bushing.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of the connecting rod bushing at the two locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(3) Calculate the clearance between piston pin and connecting rod bushing.

Clearance between piston pin and connecting rod bushing:

Standard

0.004 — 0.026 mm (0.0002 — 0.0010 in)

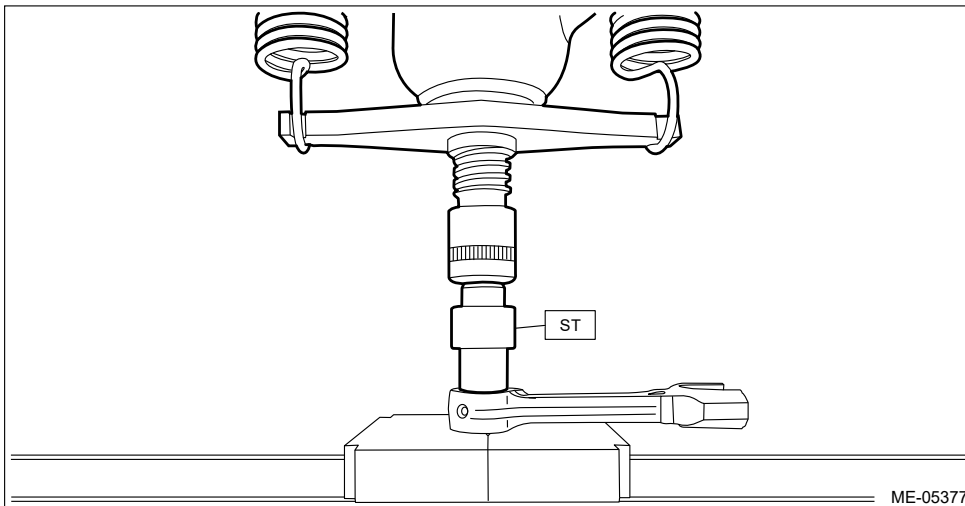
3. If the clearance between piston pin and connecting rod bushing is not within the standard, replace the connecting rod bushing and piston pin as a set. For replacement procedure of connecting rod bushing, refer to the following.

(1) Using the ST and a press, pull out the connecting rod bushing from the small end of the connecting rod.

Note:

The direction of ST for pulling out and for press fitting is different. Therefore, attention must be paid to the direction of usage for ST.

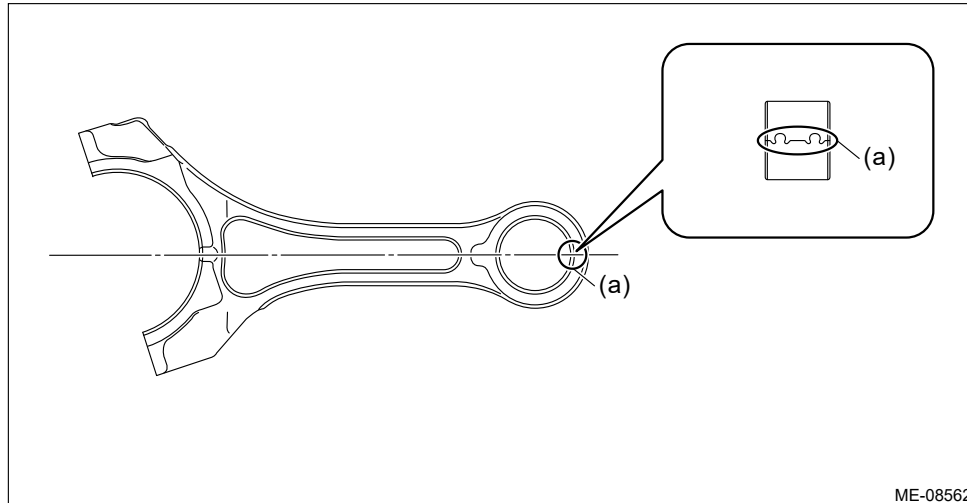
ST 18350AA000 CONNECTING ROD BUSHING REMOVER AND INSTALLER



(2) Press the connecting rod bushing with ST and the press, after applying engine oil on the periphery of connecting rod bushing.

Note:

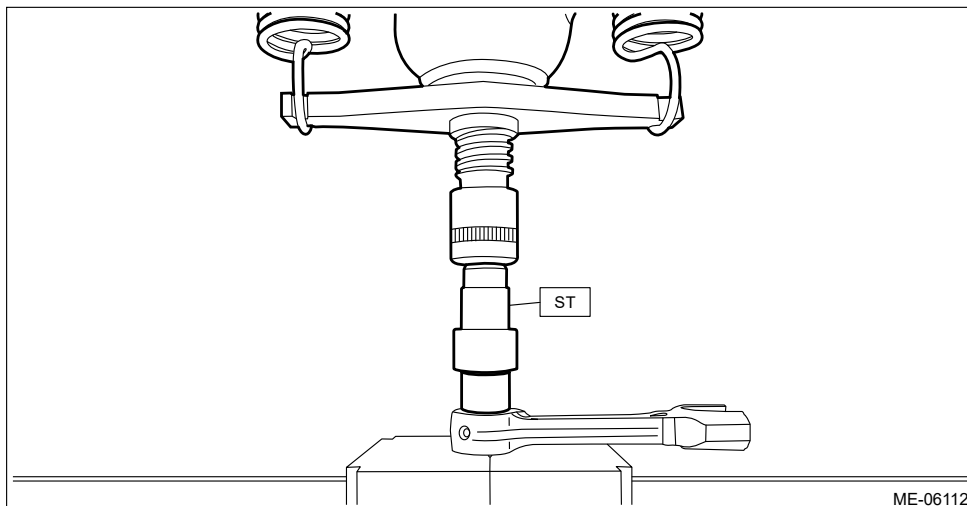
- **Clinch area of the connecting rod bushing is as shown in the figure.**



(a) Clinch area of connecting rod bushing

- The direction of ST for pulling out and for press fitting is different. Therefore, attention must be paid to the direction of usage for ST.

ST 18350AA000 CONNECTING ROD BUSHING REMOVER AND INSTALLER



- (3) Make two 3 mm (0.12 in) holes in the pressed connecting rod bushing by aligning with the pre-manufactured holes provided on the small end of the connecting rod.
- (4) Using a reamer, ream the inside surface of the connecting rod bushing. Insert the reamer in the connecting rod bushing, and turn slowly clockwise while pushing lightly. Bring the reamer back while rotating it clockwise.

Note:

- Use a reamer with a diameter of $\varnothing 22$.
- Apply engine oil to the reamer.
- If the inner surface of connecting rod bushing is damaged, the edge of reamer should be slightly ground with oil stone.
- If the inner surface of connecting rod bushing becomes lustrous and the reamer does not chip, use a new reamer or remedy the reamer.

- (5) After completion of reaming, clean the connecting rod bushing to remove chips.

6. CRANKSHAFT AND CRANKSHAFT BEARING

1. Clean the crankshaft completely, and check it for cracks using liquid penetrant tester.
2. Using a dial gauge, check the crankshaft bend. If it exceeds the limit, grind to correct the crankshaft journal or replace the crankshaft.

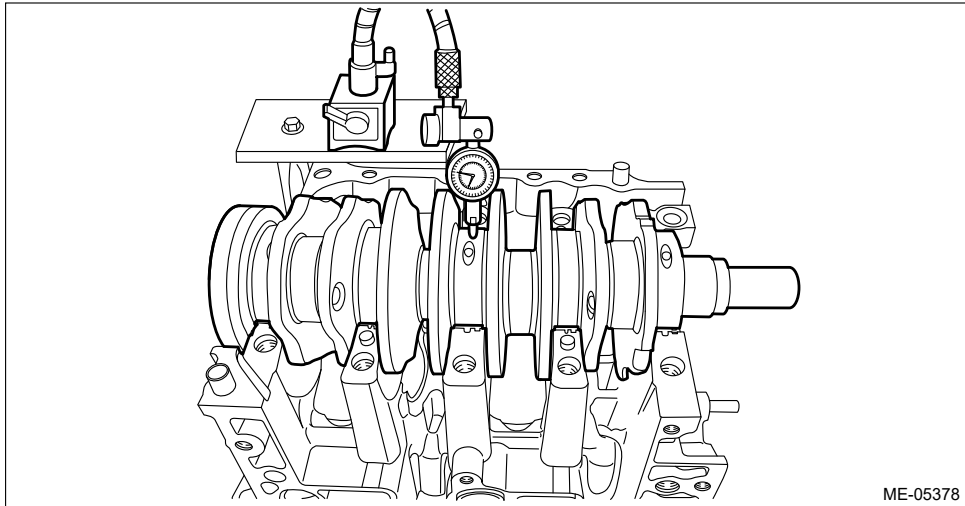
Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.
- When grinding to correct the crankshaft journal, refer to step 3).

Crankshaft bend:

Limit

0.035 mm (0.0014 in)



- 3.** Using a micrometer, check the outer diameter of crankshaft pin, outer diameter of journal, cylindricity, and out-of-roundness. If it is not within the standard, replace the connecting rod bearing or crankshaft bearing, and grind to correct the crankshaft pin or journal or replace the crankshaft as required.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Select the suitable size connecting rod bearing or crankshaft bearing when replacing the connecting rod bearing or crankshaft bearing.
- When grinding to correct the crankshaft pin or journal, finish them to the suitable outer diameter as shown in the table below according to the undersize bearing to be used.

| Unit: mm (in) | | | | | |
|----------------------------|--|--------------------------------------|--|------------------------------------|--------------------------------------|
| Bearing | Connecting rod bearing thickness (at center) | Crankshaft pin outer diameter | Crankshaft bearing thickness (at center) | | Crankshaft journal outer diameter |
| | | | #1, #2, #3, #4 | #5 | |
| | Standard | Standard | Standard | Standard | Standard |
| Standard size | 1.492 – 1.508 (0.0587 – 0.0594) | 47.976 – 48.000 (1.8888 – 1.8898) | 2.498 – 2.513 (0.0983 – 0.0989) | 2.496 – 2.511 (0.0983 – 0.0989) | 67.985 – 68.003 (2.6766 – 2.6773) |
| 0.03 (0.0012) Undersize | 1.511 – 1.515 (0.0595 – 0.0596) | 47.946 – 47.970 (1.8876 – 1.8886) | 2.519 – 2.522 (0.0992 – 0.0993) | 2.517 – 2.520 (0.0991 – 0.0992) | 67.955 – 67.979 (2.6754 – 2.6763) |
| 0.05 (0.0020) Undersize | 1.521 – 1.525 (0.0599 – 0.0600) | 47.926 – 47.950 (1.8868 – 1.8878) | 2.529 – 2.532 (0.0996 – 0.0997) | 2.527 – 2.530 (0.0995 – 0.0996) | 67.935 – 67.959 (2.6746 – 2.6755) |
| 0.25 (0.0098) | 1.621 – 1.625 | 47.726 – | 2.629 – 2.632 | 2.627 – 2.630 | 67.735 – |

| | | | | | |
|-----------|----------------------|--------------------------------|----------------------|----------------------|--------------------------------|
| Undersize | (0.0638 — 0.0640) | 47.750 (1.8790 — 1.8799) | (0.1035 — 0.1036) | (0.1034 — 0.1035) | 67.759 (2.6667 — 2.6677) |
|-----------|----------------------|--------------------------------|----------------------|----------------------|--------------------------------|

Crankshaft pin:

Cylindricity

Limit

0.006 mm (0.0002 in)

Out-of-roundness

Limit

0.005 mm (0.0002 in)

Grinding limit (dia.)

47.726 mm (1.8790 in) or less

Crankshaft journal:

Cylindricity

Limit

0.006 mm (0.0002 in)

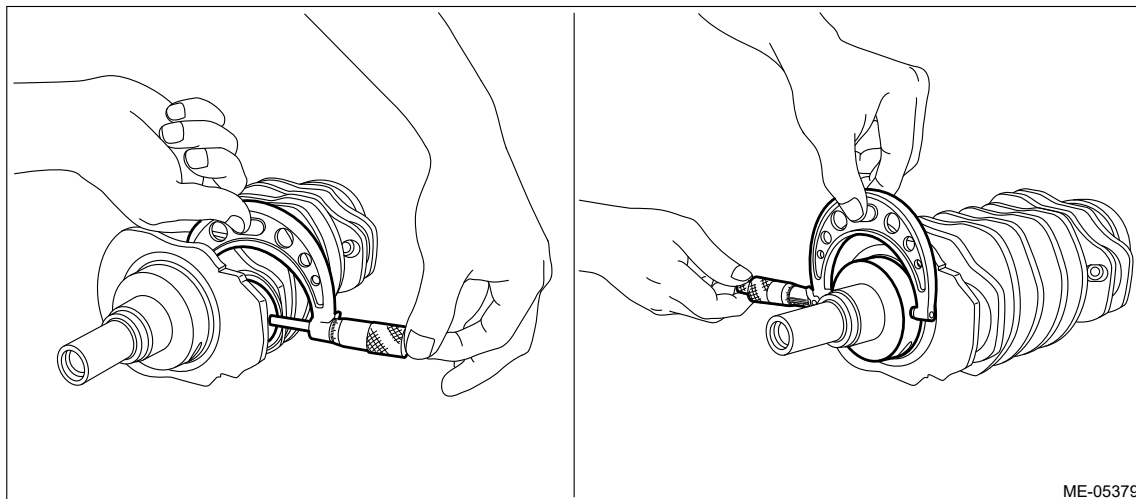
Out-of-roundness

Limit

0.005 mm (0.0002 in)

Grinding limit (dia.)

67.735 mm (2.6667 in) or less



ME-05379

4. Inspect the crankshaft bearing for scar, peeling, seizure, melting or wear, etc.
5. Use a thickness gauge to check the thrust clearance of crankshaft at thrust of #5 crankshaft bearing. If it is not within the standard, replace the #5 crankshaft bearing.

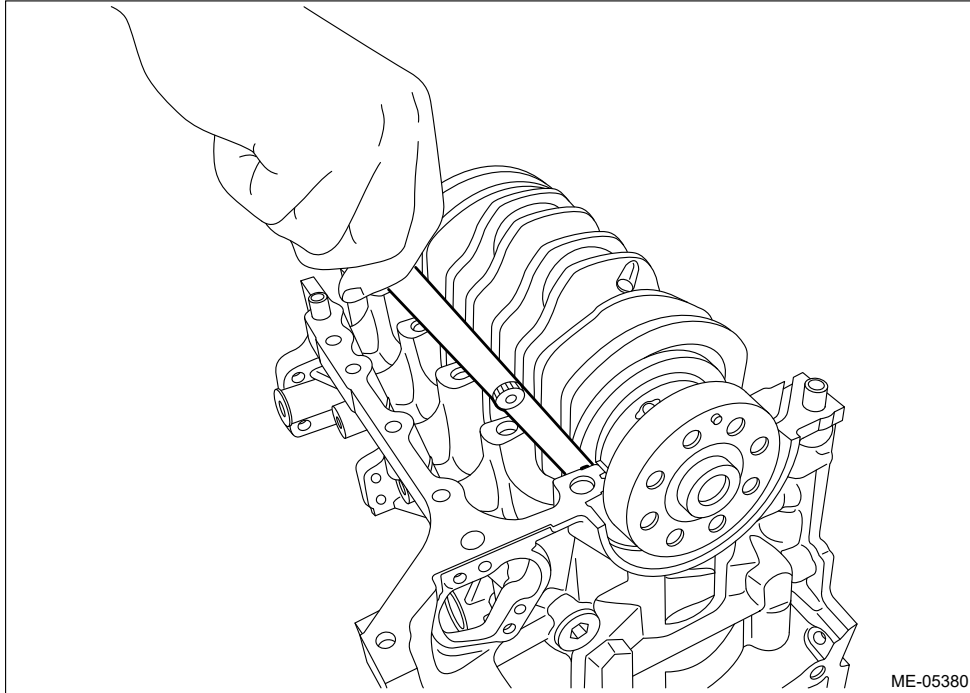
Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Set all the crankshaft bearings onto the cylinder block, then mount the crankshaft on the cylinder block, and use a thickness gauge to measure the thrust clearance of crankshaft.**
- **Select the #5 crankshaft bearing of suitable size by referring to step 3) when replacing #5 crankshaft bearing.**

Crankshaft thrust clearance:

Standard

0.130 — 0.308 mm (0.0051 — 0.0121 in)



6. Check the oil clearance on each crankshaft bearing using plastigauge.

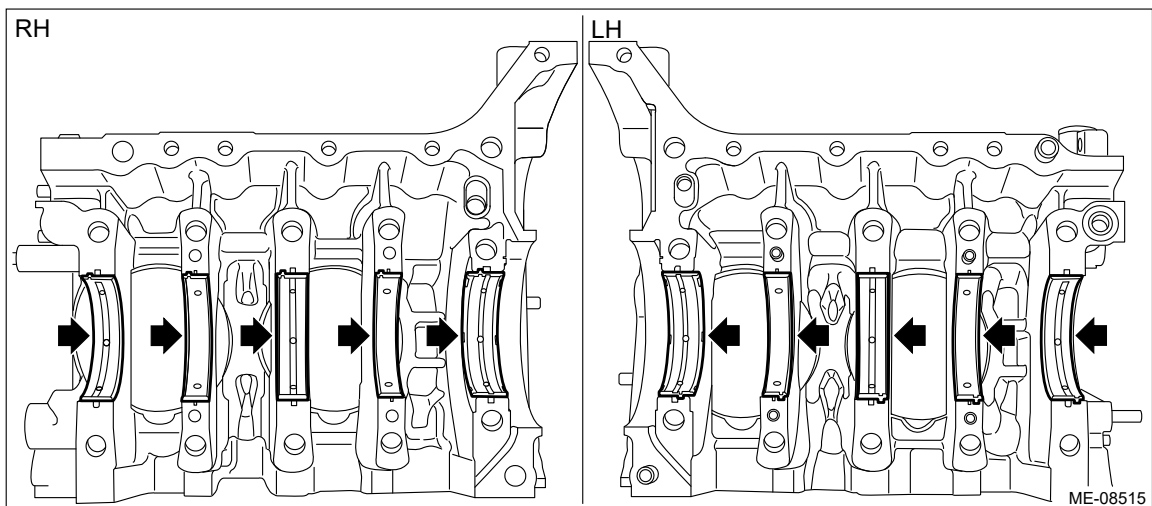
Note:

Measurement should be performed at a temperature of 20°C (68°F).

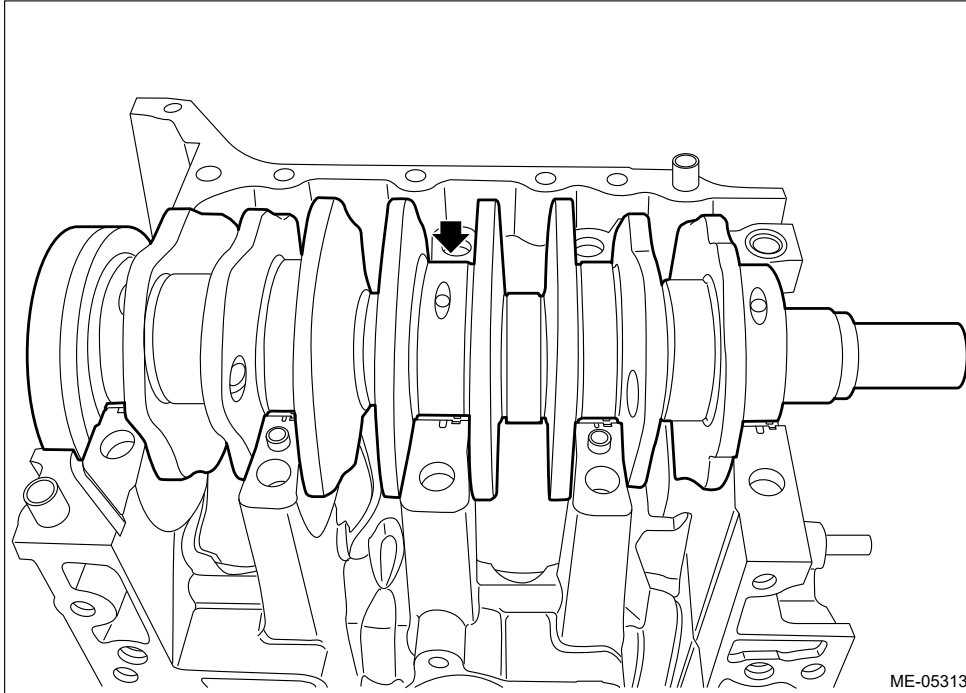
- (1) Remove the liquid gasket from cylinder block.
- (2) Clean each crankshaft bearing and crankshaft journal.
- (3) Set each crankshaft bearing to the cylinder block.

Caution:

- Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
- Be careful not to scratch the mating surface of cylinder block during work.



- (4) Set the crankshaft to the cylinder block LH.



- (5) Place a plastigauge across the crankshaft journals and set the cylinder block RH to the cylinder block LH.
- (6) Apply a coat of engine oil to the washers and cylinder block mounting bolt threads.

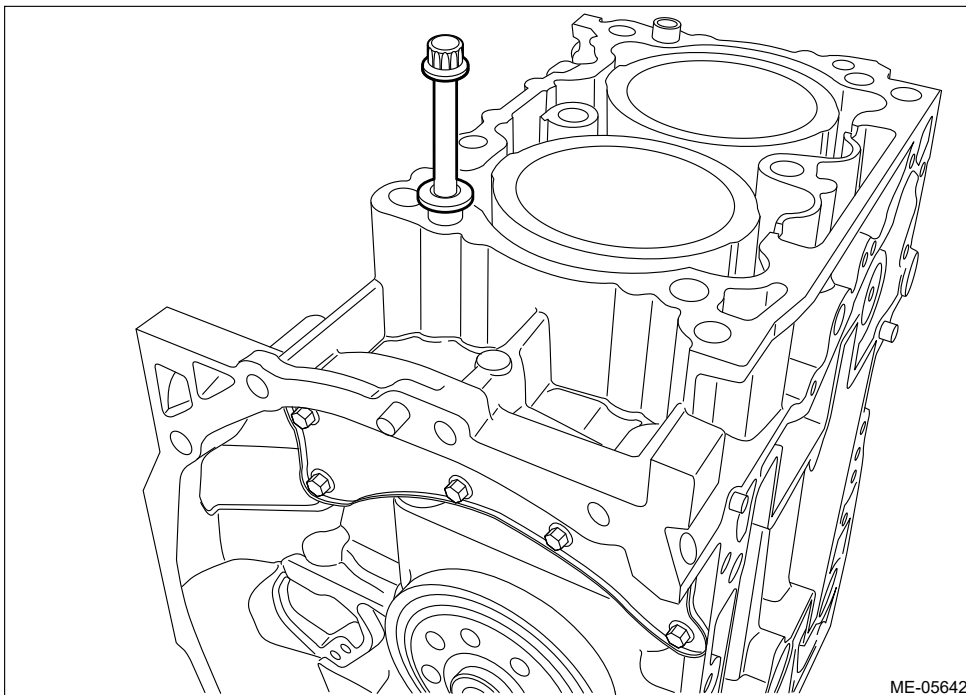
Note:

To prevent mixture of engine oil into the water jacket, do not apply a large amount.

- (7) Install the cylinder head bolt at the locations shown in the figure.

Note:

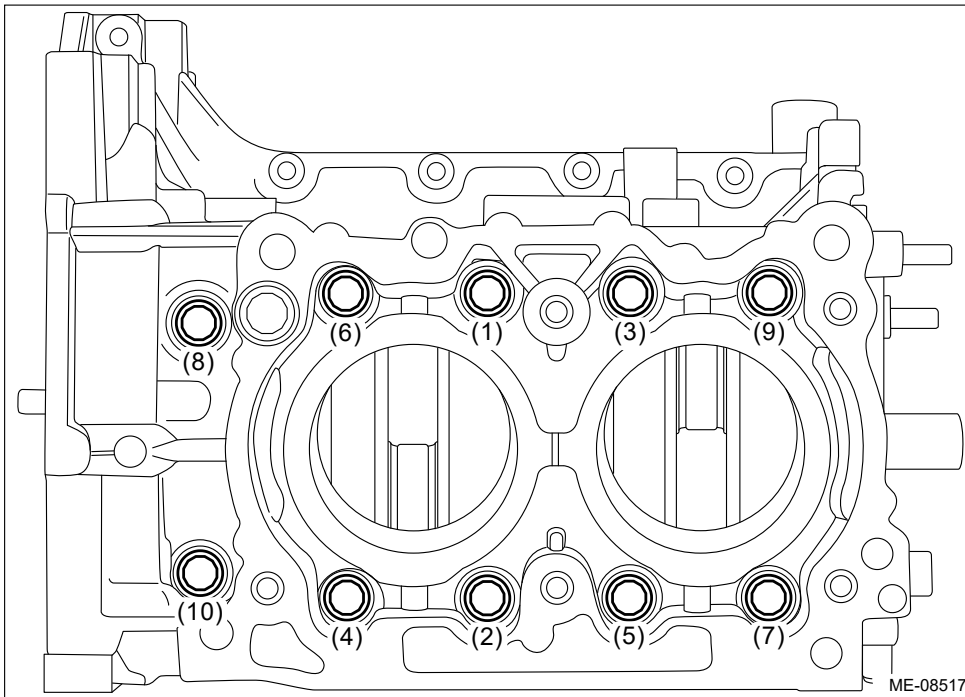
This procedure is required to tighten the cylinder block mounting bolts with specified angle using angle gauge.



- (8) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

Caution:

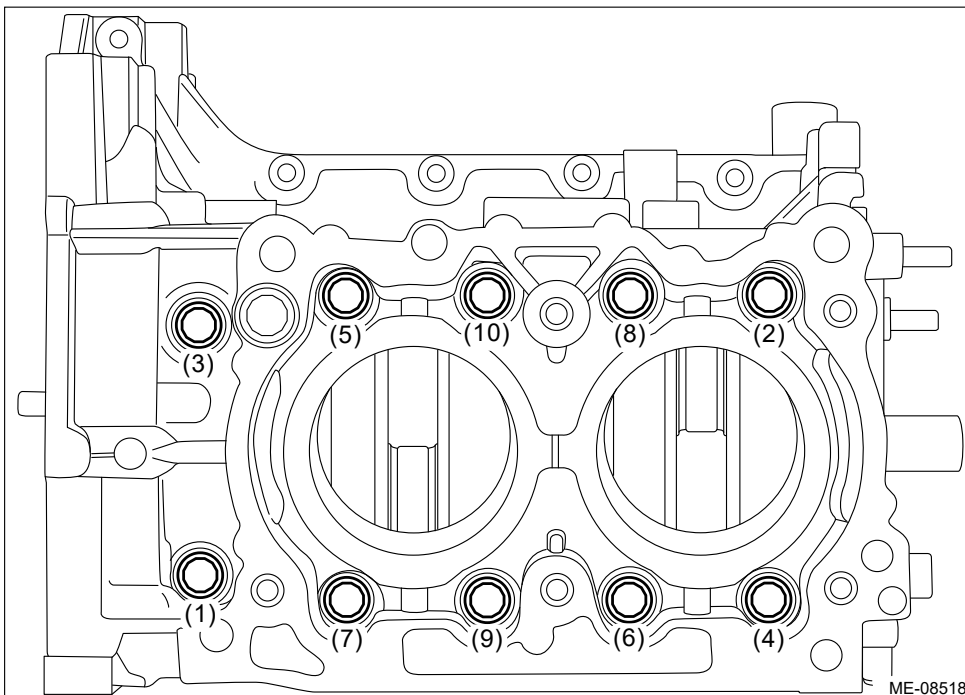
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(9) Loosen all mounting bolts by 180° in numerical order as shown in the figure.

Caution:

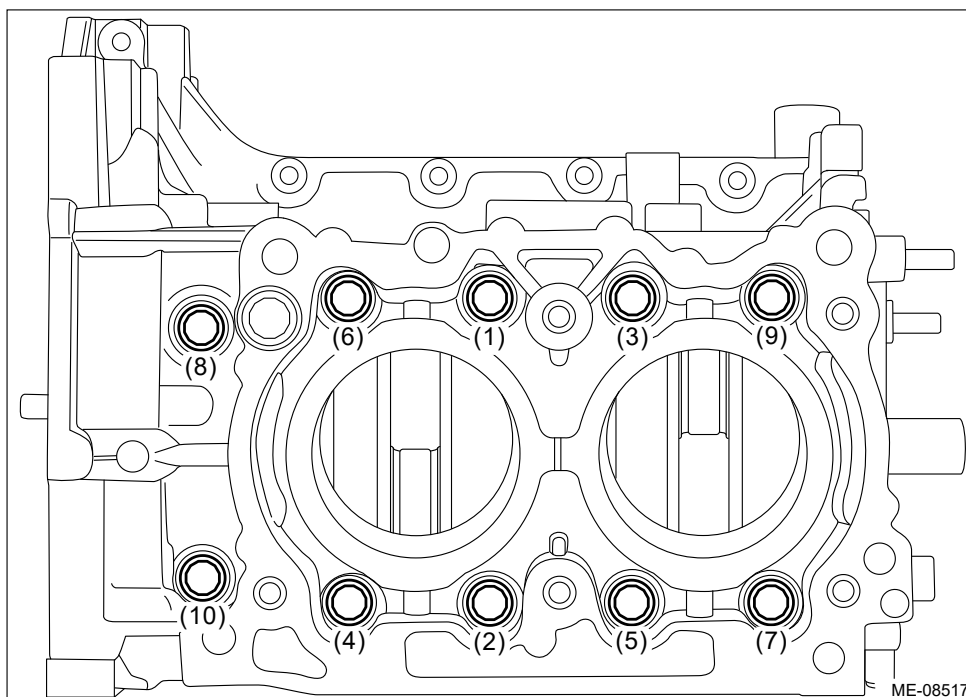
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(10) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf·m, 25.8 ft·lb) in numerical order as shown in the figure.

Caution:

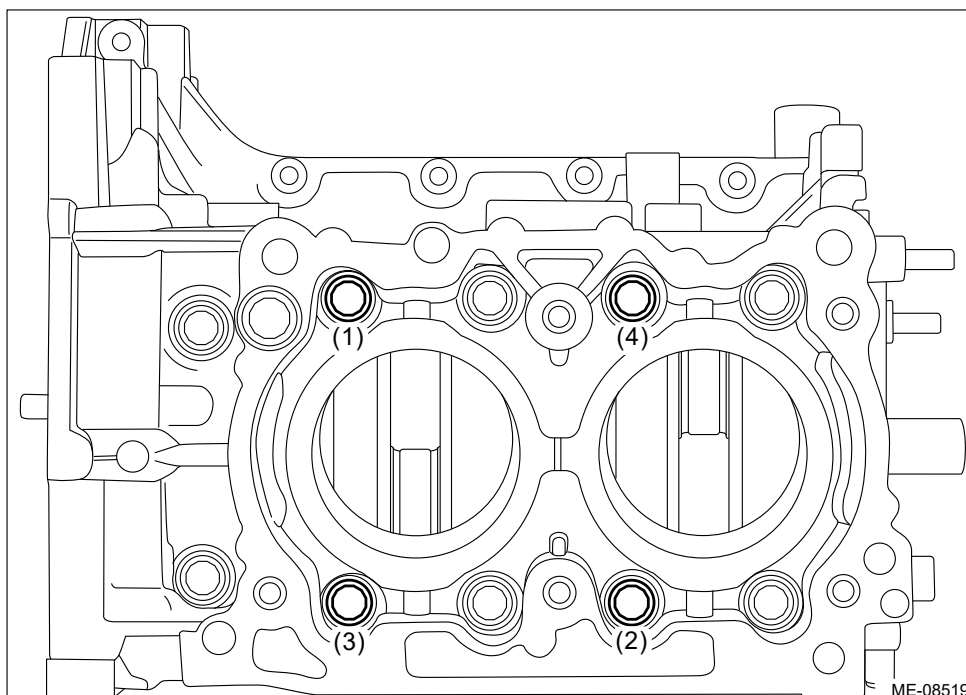
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(11) Loosen the mounting bolts (4 places) by 180° in numerical order as shown in the figure.

Caution:

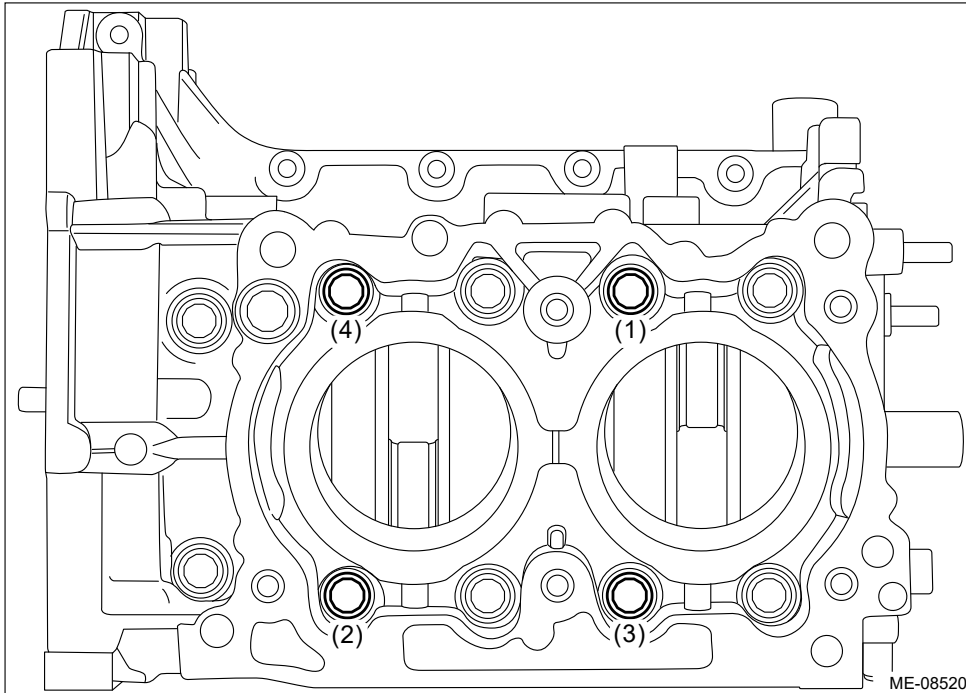
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(12) Tighten the mounting bolts (4 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



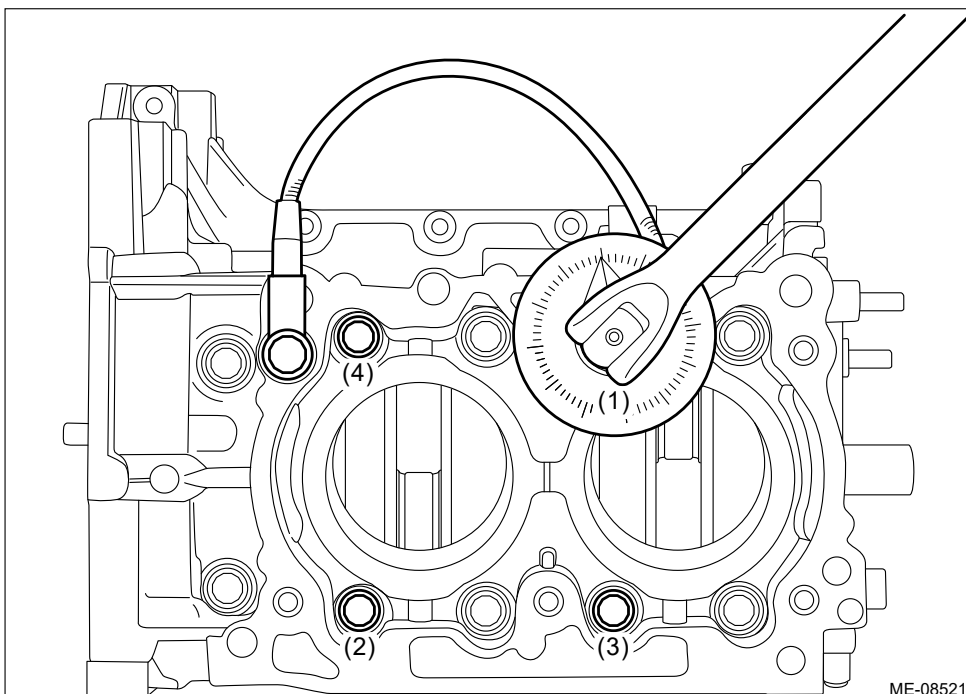
(13) Using angle gauge, tighten the mounting bolts (4 places) with specified angle in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:

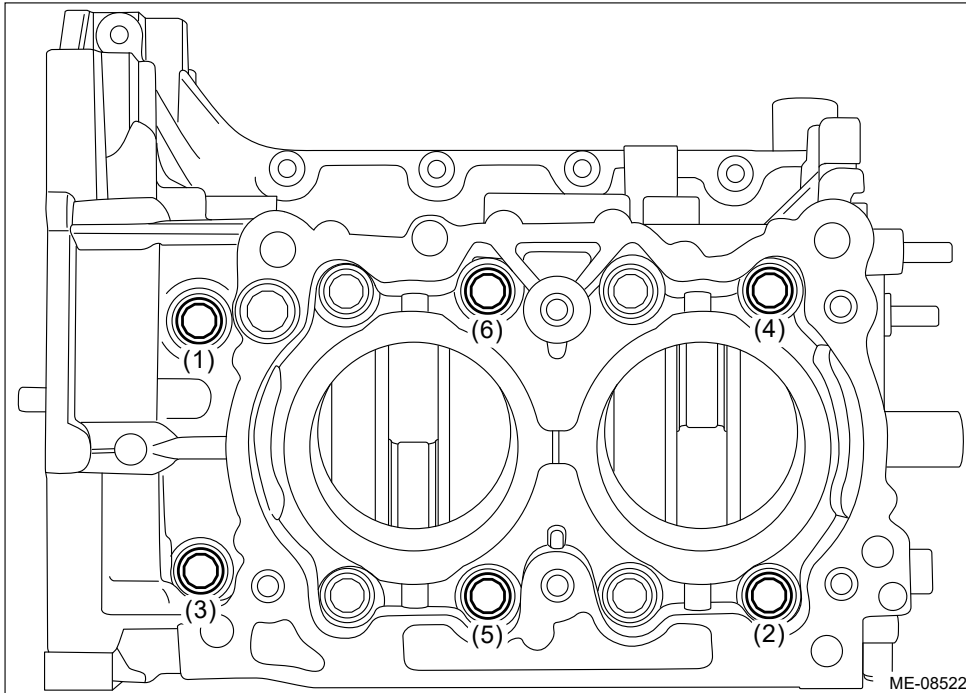
$60^{\circ} \pm 2^{\circ}$



(14) Loosen the mounting bolts (6 places) by 180° in numerical order as shown in the figure.

Caution:

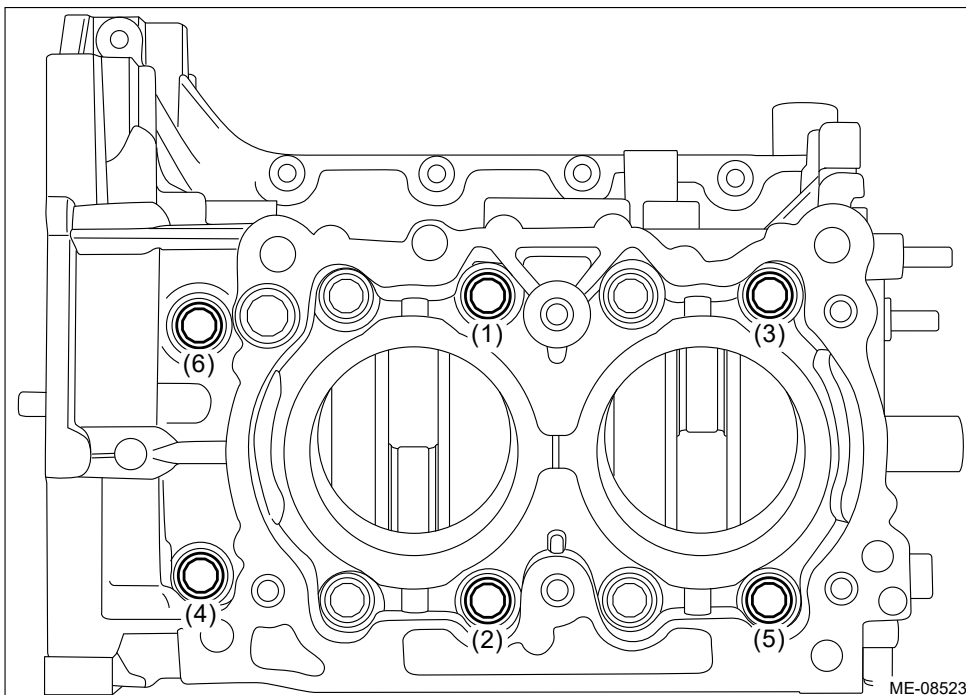
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



- (15) Tighten the mounting bolts (6 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



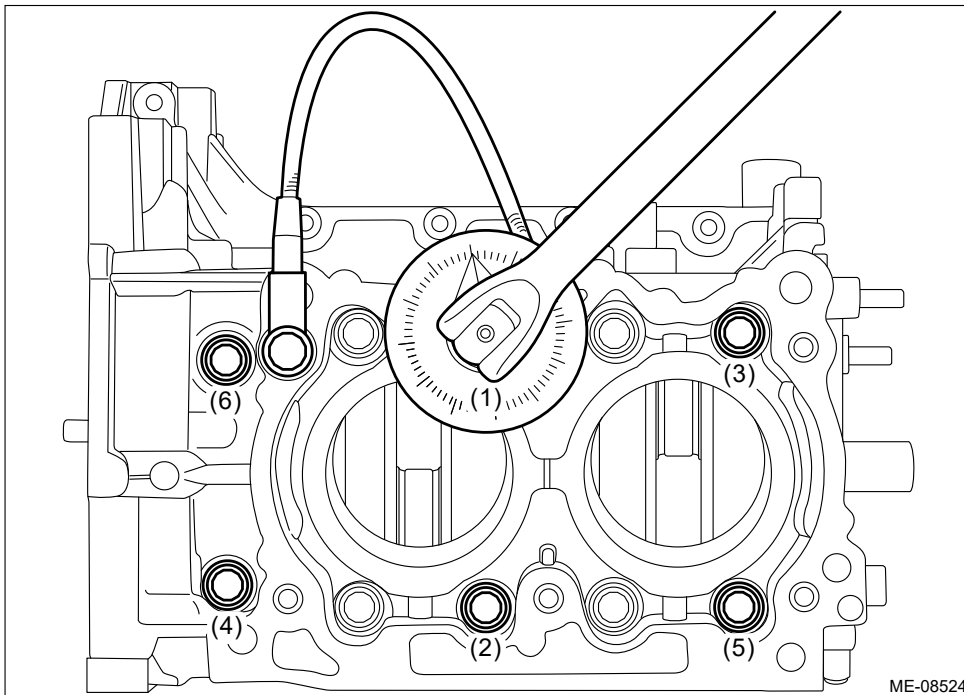
- (16) Using angle gauge, tighten the mounting bolts (6 places) with specified angle in numerical order as shown in the figure.

Caution:

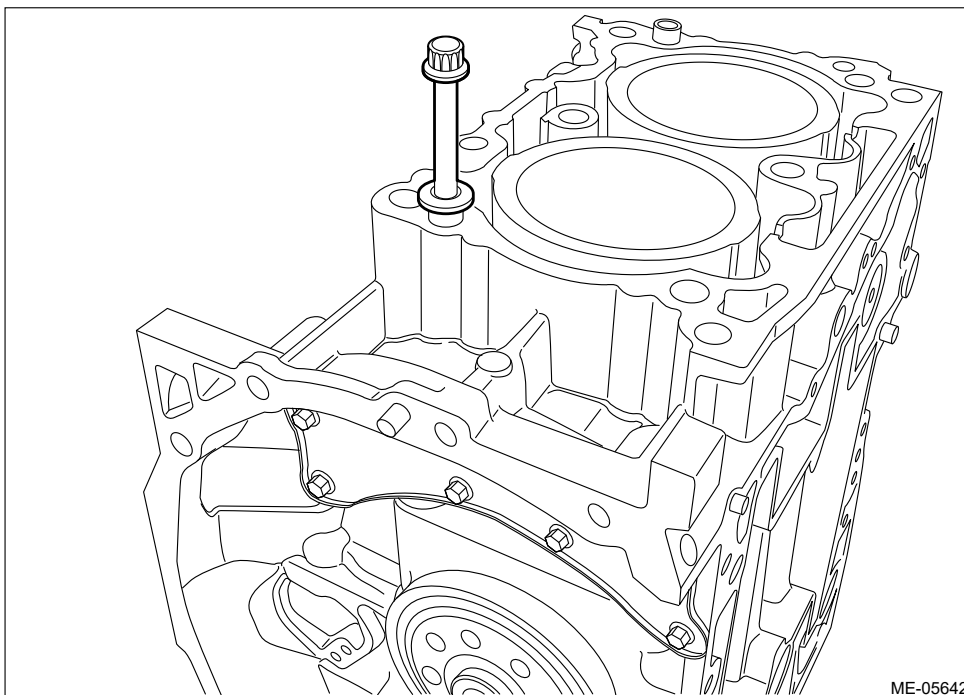
When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:

60°±2°



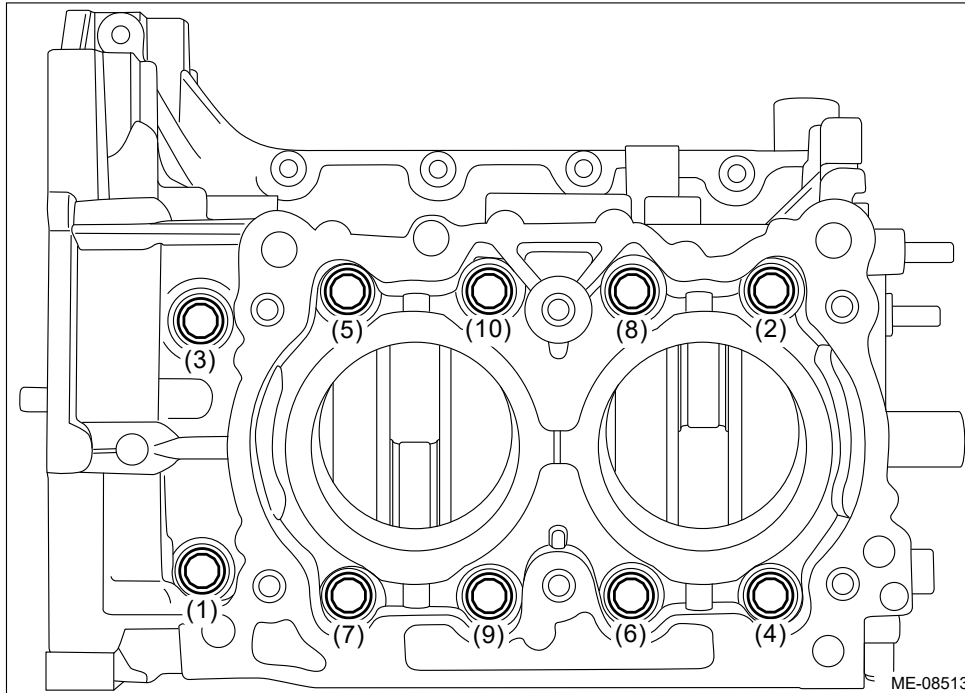
(17) Remove the cylinder head bolt attached at the locations shown in the figure.



(18) Loosen the cylinder block mounting bolts in numerical order as shown in the figure, and separate the cylinder block RH and LH.

Note:

Lift the cylinder block RH slightly, and confirm that the crankshaft is remaining in the cylinder block LH. If the cylinder block RH is lifted carelessly when separating, the crankshaft may stick to cylinder block RH, then fall off.



(19) Determine the crankshaft oil clearance by matching the widest point of the plastigauge on each journal against scale printed on a package of the plastigauge. If it is not within the standard, replace the crankshaft bearing, and grind to correct the crankshaft journal or replace the crankshaft as required.

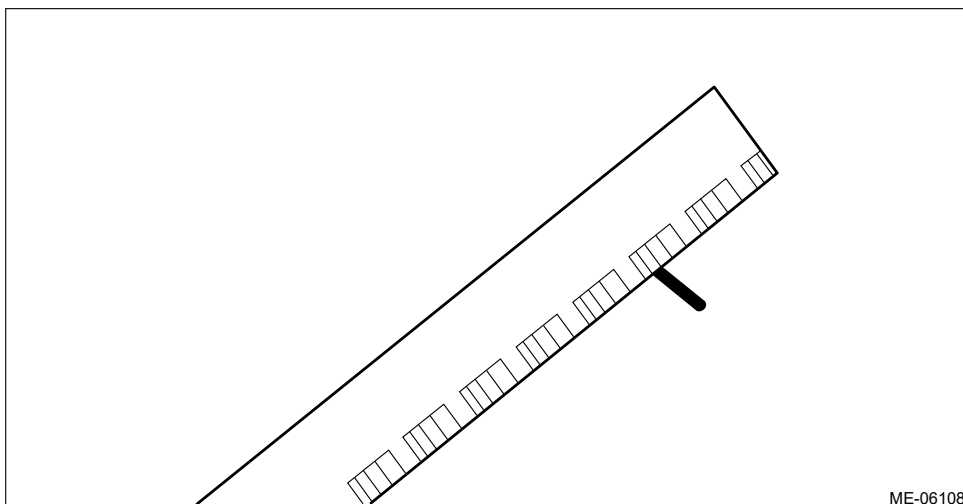
Note:

- **Select the crankshaft bearing of suitable size by referring to step 3) when replacing crankshaft bearing.**
- **When grinding to correct the crankshaft journal, finish it to the suitable outer diameter by referring to step 3) according to the undersize bearing to be used.**

Crankshaft oil clearance:

Standard

0.013 – 0.031 mm (0.0005 – 0.0012 in)



(20) Completely remove the plastigauge.

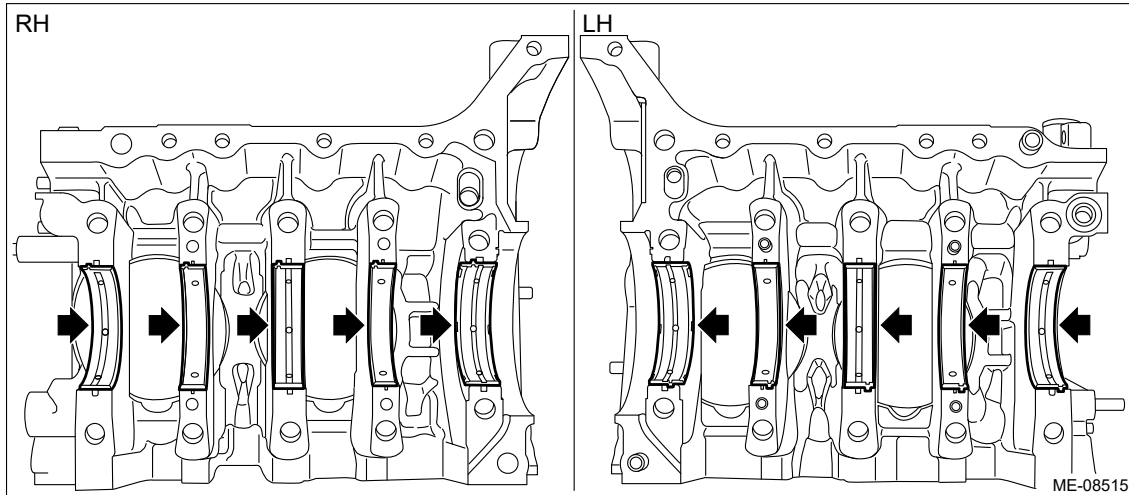
MECHANICAL(H4DO) > Cylinder Block

INSTALLATION

1. Apply engine oil to the crankshaft bearing, and install the crankshaft bearing to the cylinder block.

Caution:

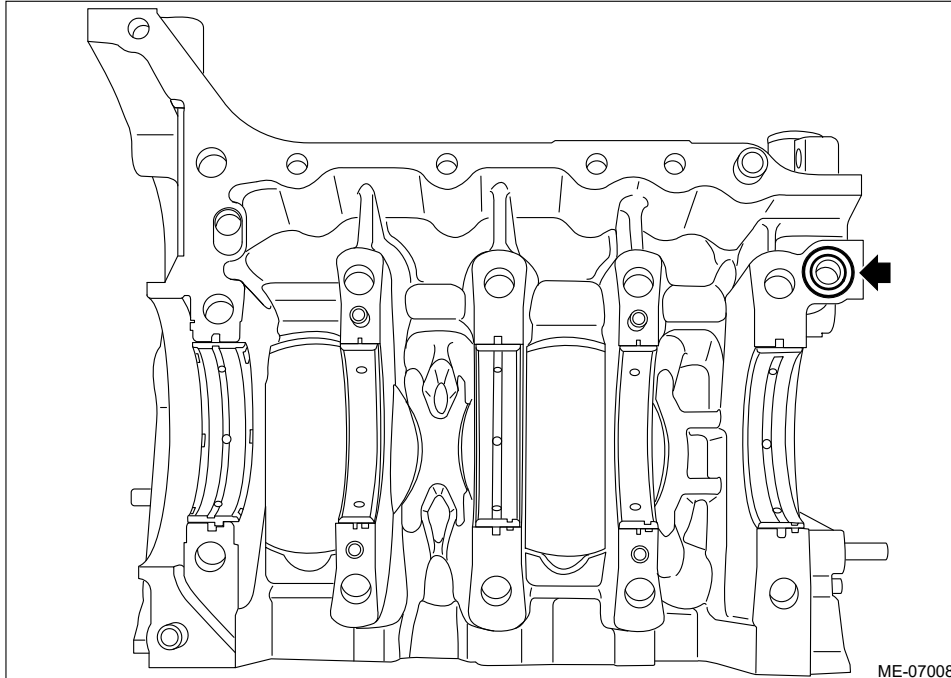
- Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
- Be careful not to scratch the mating surface of cylinder block during work.



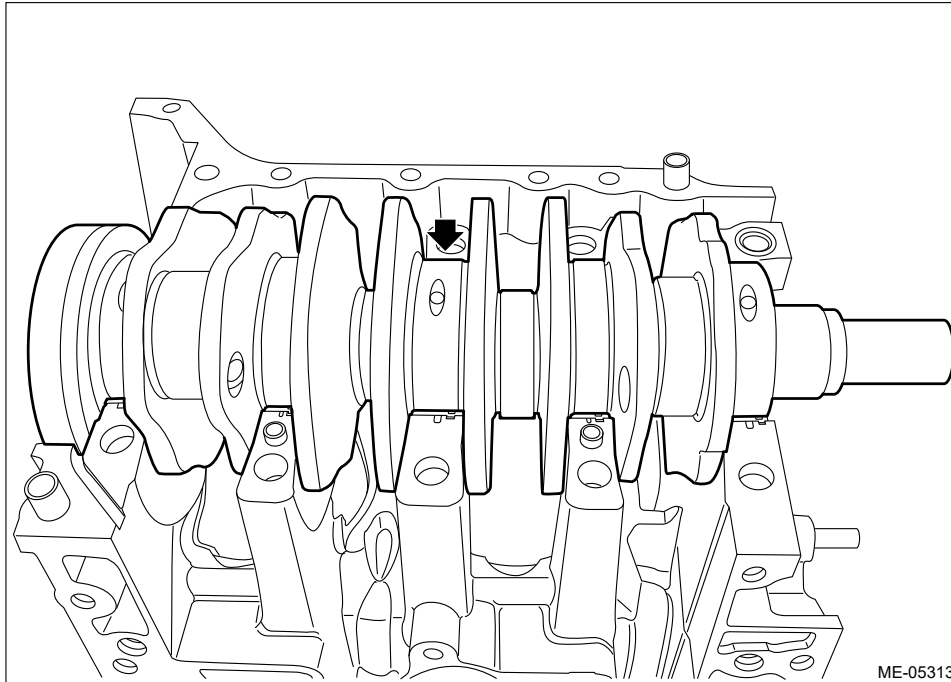
2. Install O-rings to the cylinder block LH.

Note:

Use new O-rings.



3. Apply engine oil to the crankshaft journal, and set the crankshaft to cylinder block LH.



4. Apply liquid gasket to the mating surface of cylinder block RH as shown in the figure.

Caution:

Do not let the liquid gasket overflow to the oil passage and crankshaft bearing portions, because the engine seizure may result.

Note:

- Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder block RH and cylinder block LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

Mating surfaces other than ranges A, B and C

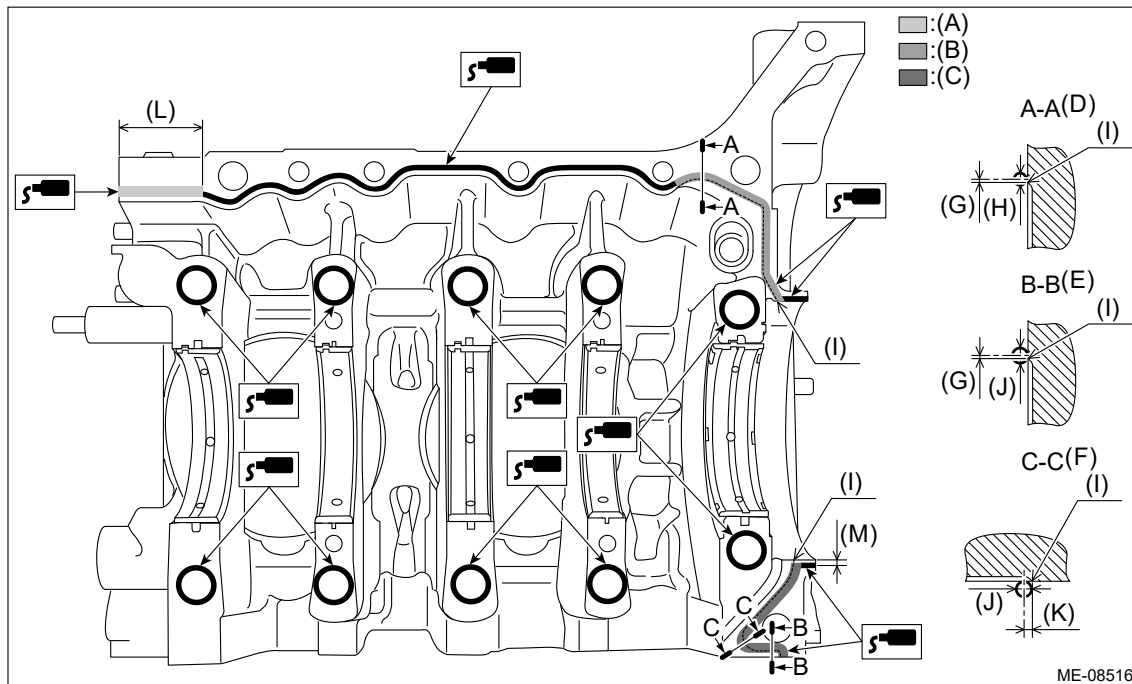
1 ± 0.5 mm (0.0394 \pm 0.0197 in)

Mating surfaces of ranges A and C

4 ± 0.5 mm (0.1575 \pm 0.0197 in)

Mating surfaces of range B

3.2 ± 0.5 mm (0.1260 \pm 0.0197 in)



- | | | |
|---|--|------------------------|
| (A) Range A | (F) Liquid gasket applying position of mating surfaces (the edge) of range C | (K) 2 mm (0.0787 in) |
| (B) Range B | (G) Within 1 mm (0.0394 in) | (L) 36 mm (1.4173 in) |
| (C) Range C | (H) $\varnothing 3.2 \pm 0.5$ mm (0.1260 \pm 0.0197 in) | (M) 2.5 mm (0.0984 in) |
| (D) Liquid gasket applying position of mating surfaces of range B | (I) Chamfer edge | |
| (E) Liquid gasket applying position of mating surfaces (other than the edge) of range C | (J) $\varnothing 4 \pm 0.5$ mm (0.1575 \pm 0.0197 in) | |

5. Install the cylinder block RH to the cylinder block LH.

6. Join the cylinder blocks.

(1) Apply a coat of engine oil to the washers and cylinder block mounting bolt threads.

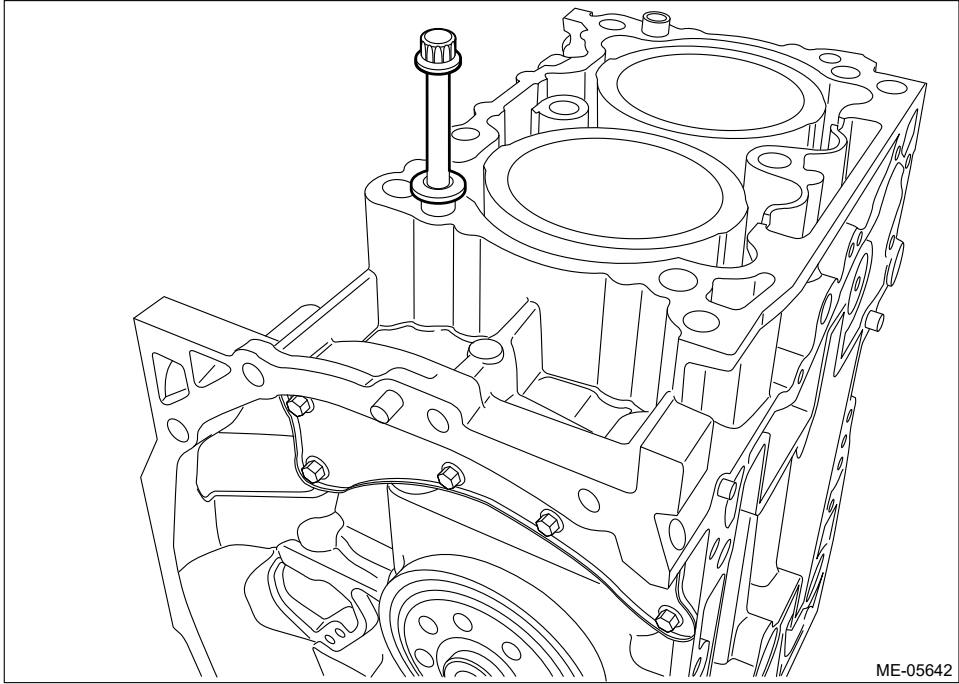
Note:

To prevent mixture of engine oil into the water jacket, do not apply a large amount.

(2) Install the cylinder head bolt at the locations shown in the figure.

Note:

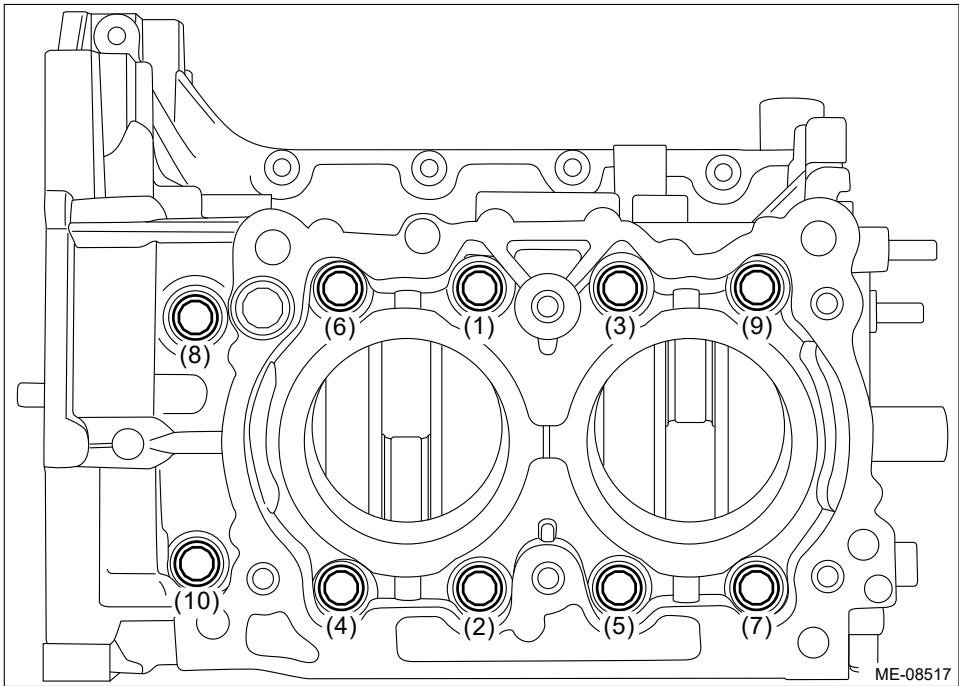
This procedure is required to tighten the cylinder block mounting bolts with specified angle using angle gauge.



(3) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

Caution:

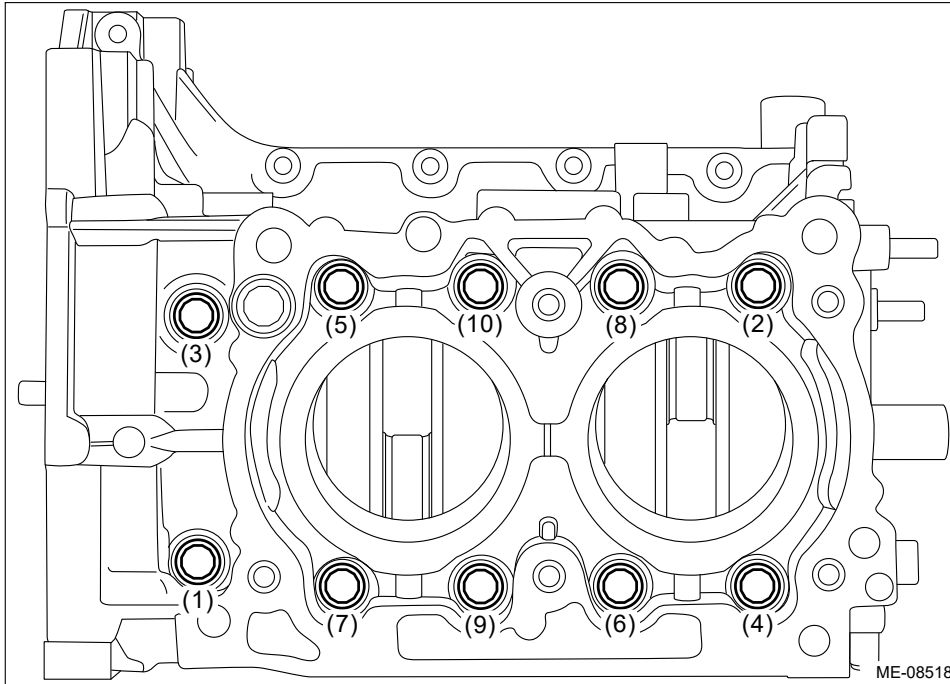
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(4) Loosen all mounting bolts by 180° in numerical order as shown in the figure.

Caution:

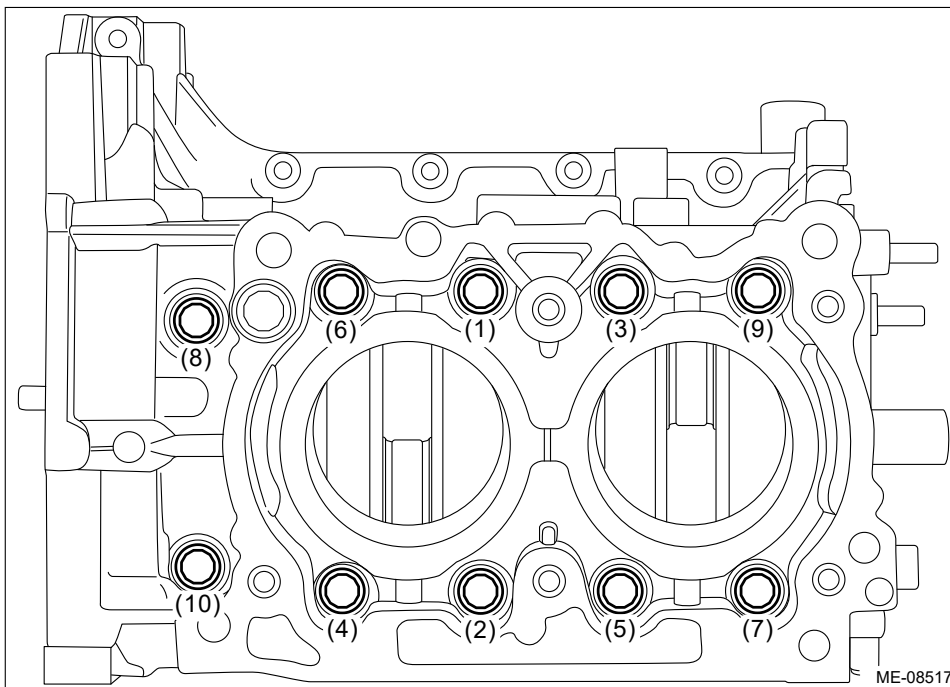
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(5) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf·m, 25.8 ft·lb) in numerical order as shown in the figure.

Caution:

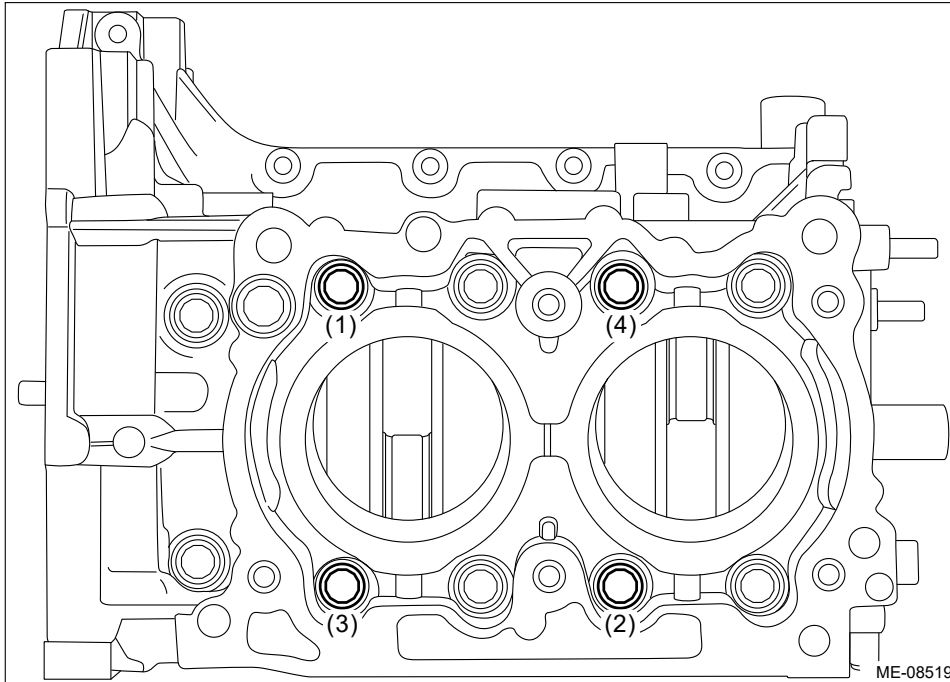
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(6) Loosen the mounting bolts (4 places) by 180° in numerical order as shown in the figure.

Caution:

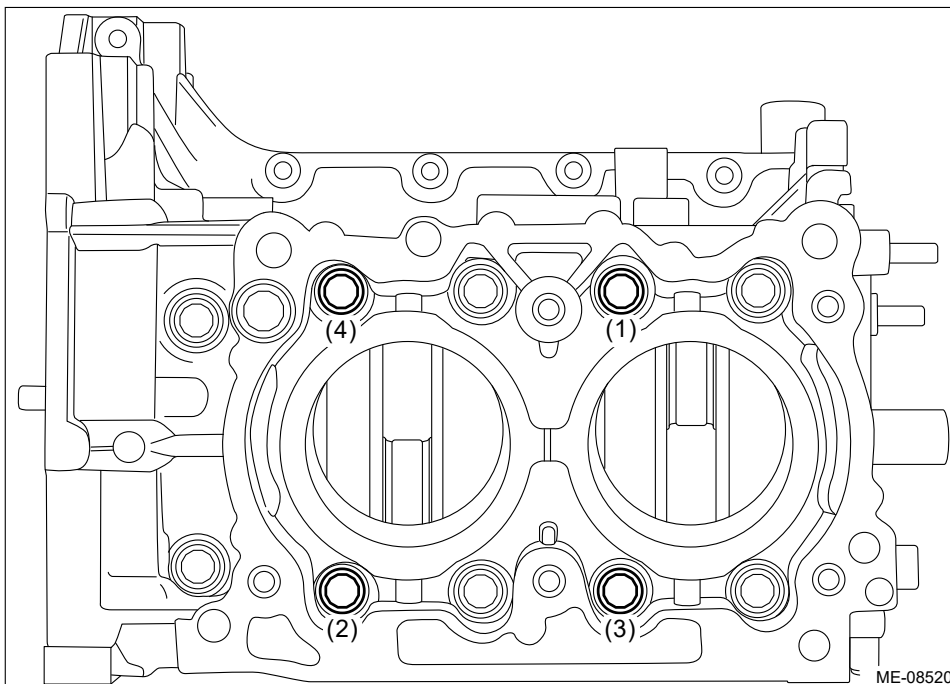
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(7) Tighten the mounting bolts (4 places) with a torque of 17 N·m (1.7 kgf·m, 12.5 ft·lb) in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



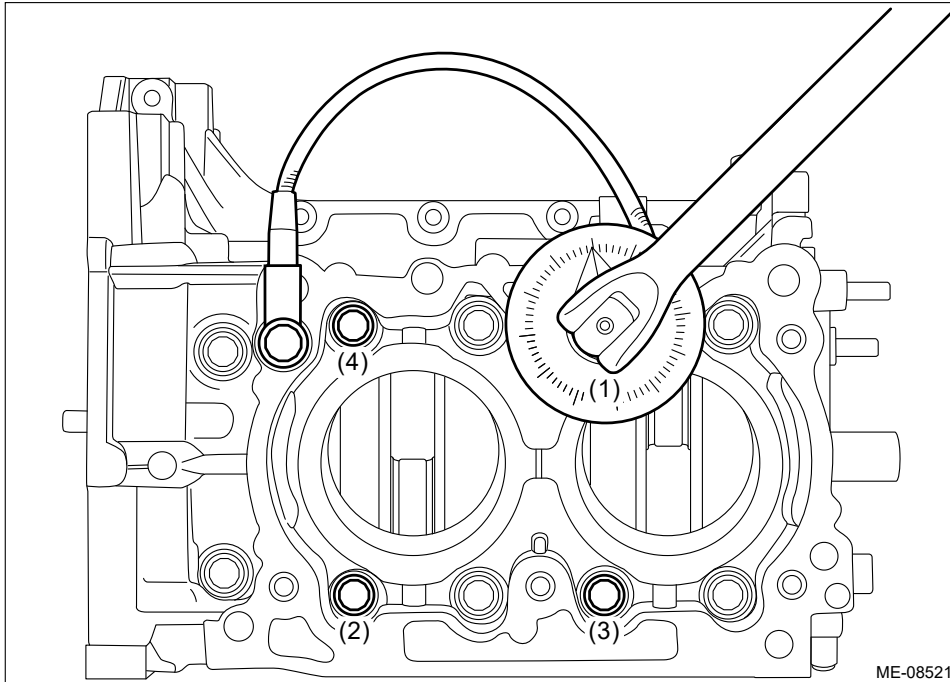
(8) Using angle gauge, tighten the mounting bolts (4 places) with specified angle in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:

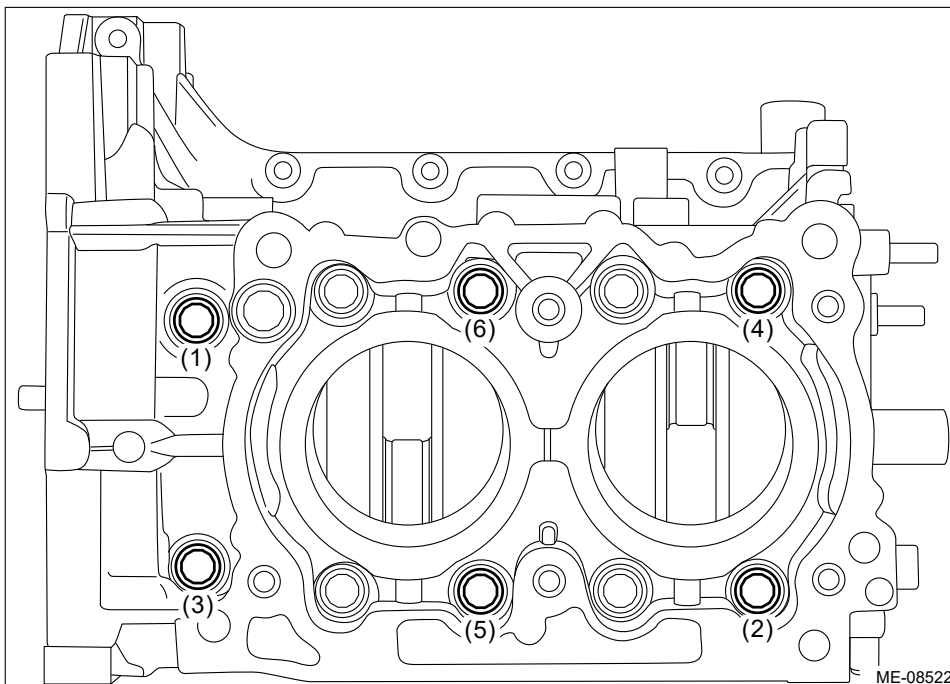
$60^{\circ} \pm 2^{\circ}$



(9) Loosen the mounting bolts (6 places) by 180° in numerical order as shown in the figure.

Caution:

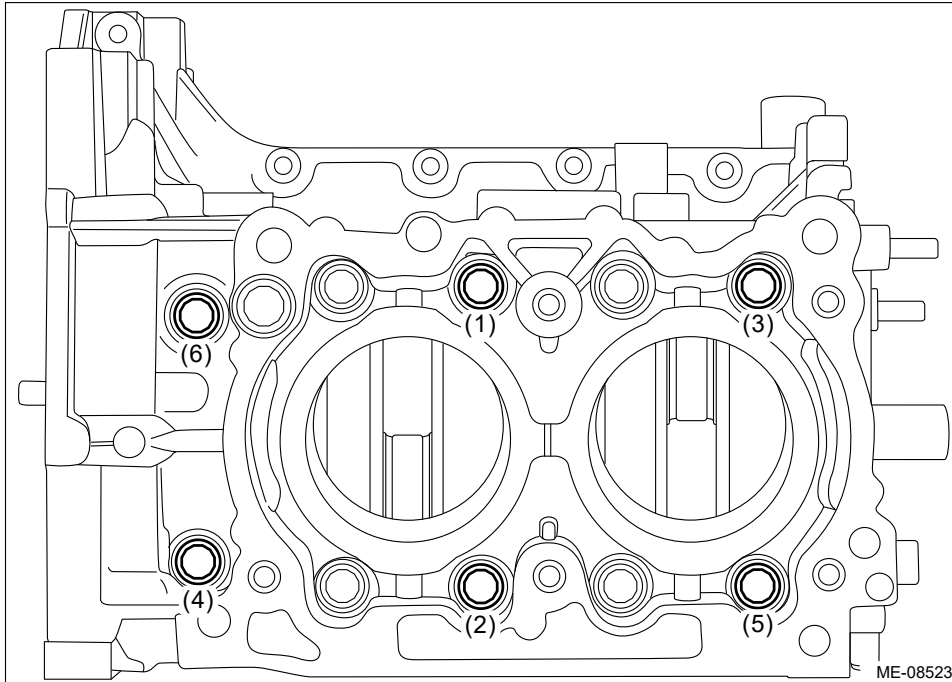
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(10) Tighten the mounting bolts (6 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



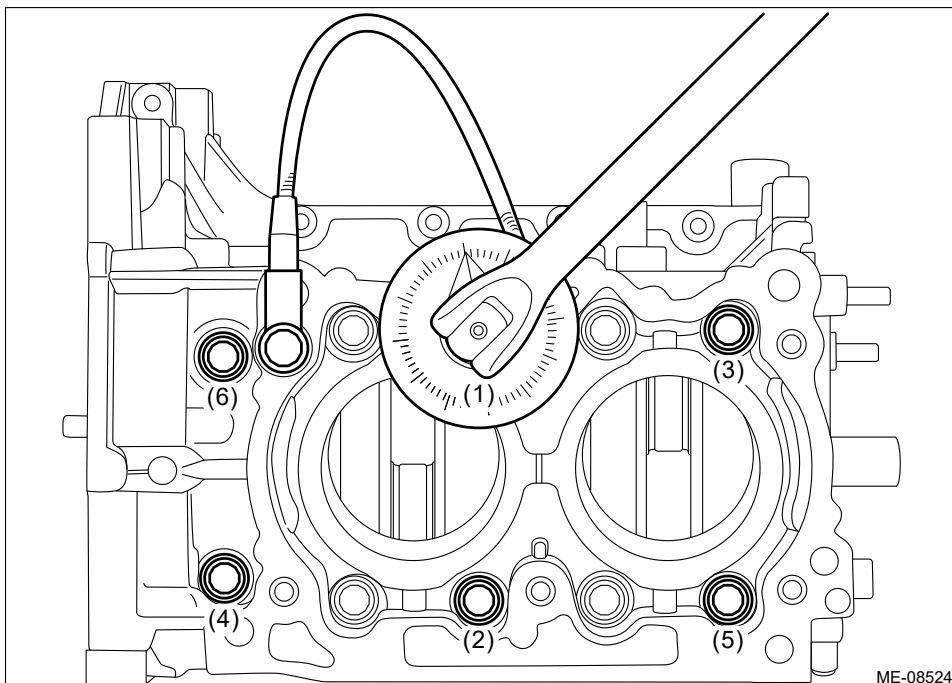
(11) Using angle gauge, tighten the mounting bolts (6 places) with specified angle in numerical order as shown in the figure.

Caution:

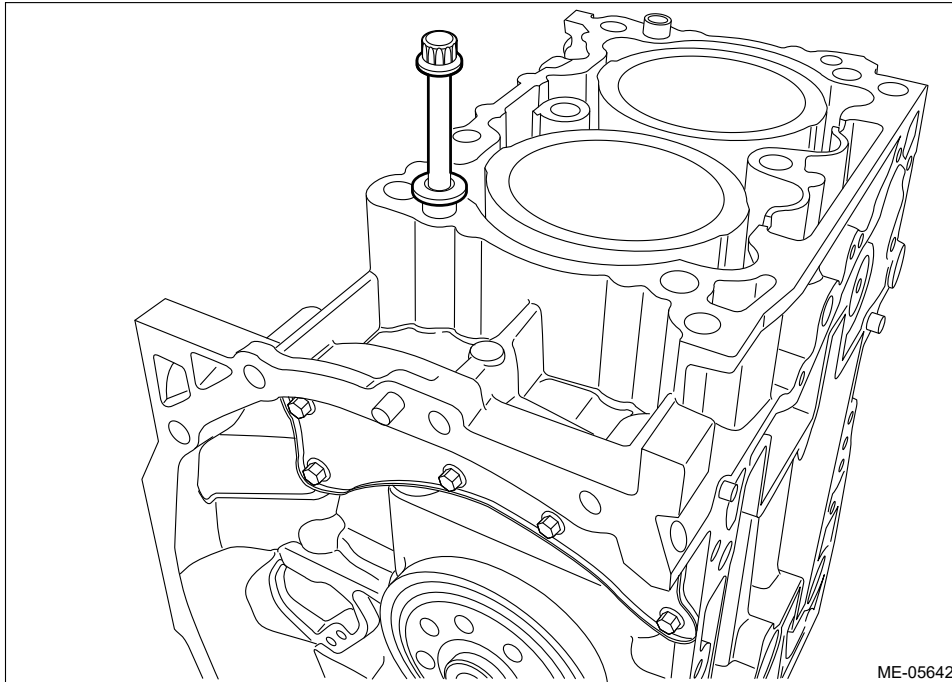
When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:

$60^{\circ} \pm 2^{\circ}$



(12) Remove the cylinder head bolt attached at the locations shown in the figure.



ME-05642

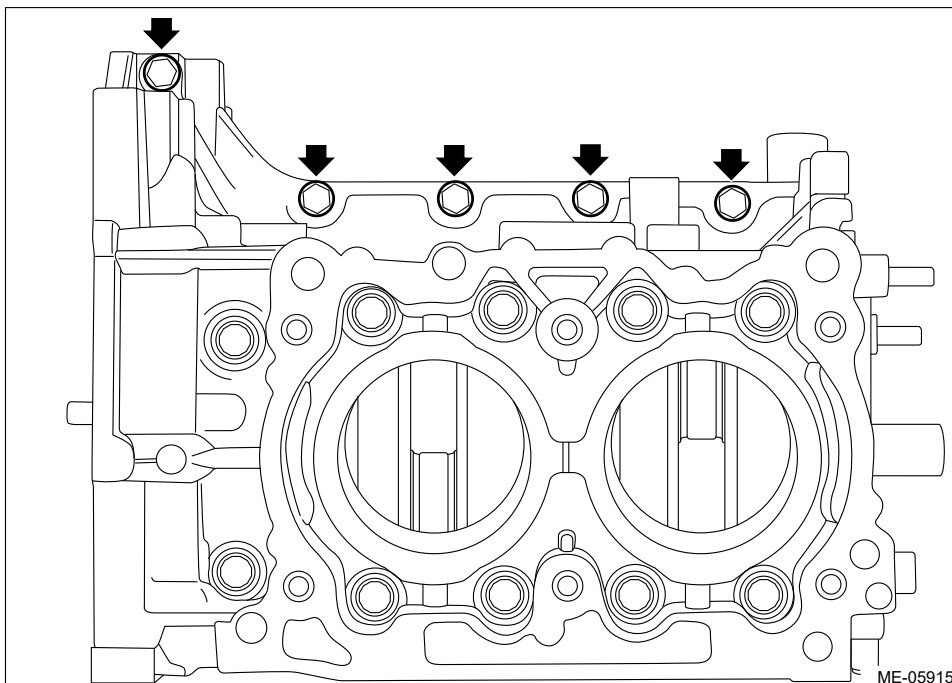
(13) Install the bolt shown in the figure.

Note:

After tightening, if the liquid gasket is squeezed out in the seal surface area of the chain cover and oil pan upper, completely remove any liquid gasket that is squeezed out. Any liquid gasket on the chamfer area, however, should not be removed.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)



ME-05915

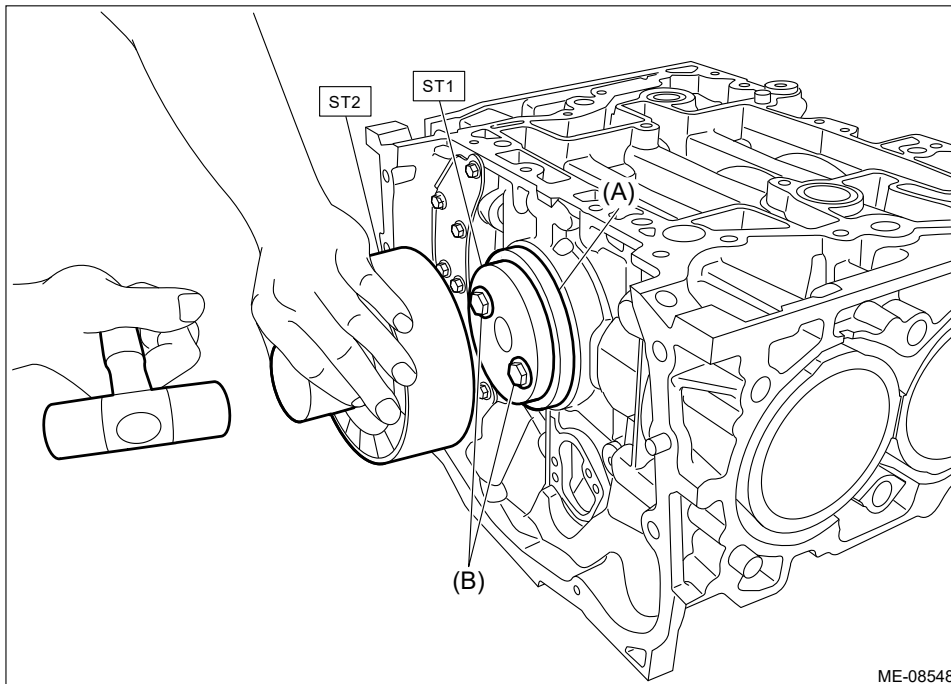
7. Set the part so that the oil pan side of cylinder block is on the upper side.
8. Apply a coat of engine oil to the oil seal inner periphery and outer periphery, and install the rear oil seal using ST1 and ST2.

Note:

Use a new rear oil seal.

ST1 18671AA020 OIL SEAL GUIDE

ST2 18657AA030 OIL SEAL INSTALLER



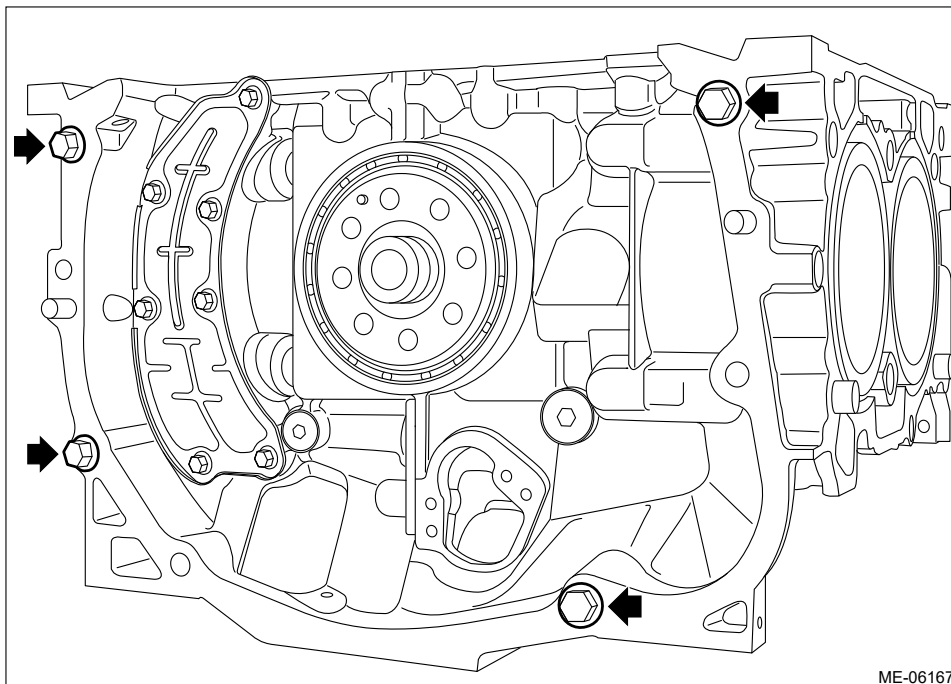
(A) Rear oil seal

(B) Drive plate mounting bolt or
flywheel mounting bolt

9. Install a bolt of suitable length (M10 × P1.25) at the locations shown in the figure.

Note:

- This procedure is required to prevent the knock pin damage when the cylinder block is raised in the next step.
- Use the same length of bolt for the four bolts.



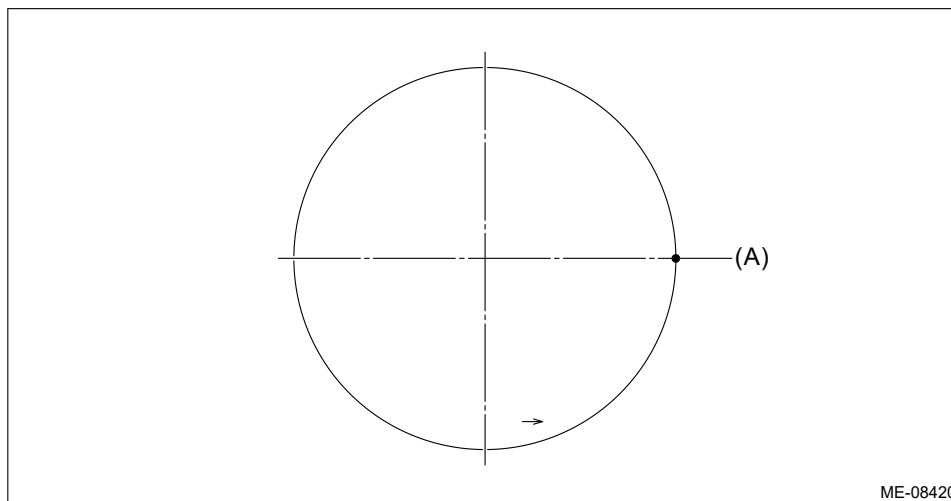
10. Raise the cylinder block so that the rear oil seal is on the lower side.

11. Adjust the positions of piston ring gap for each piston.

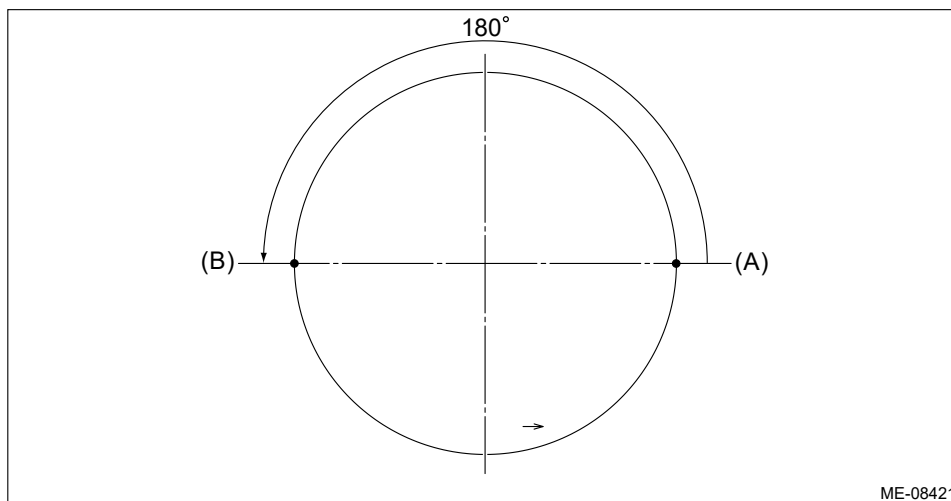
Note:

Check that the piston ring mark of compression ring faces the top side of the piston.

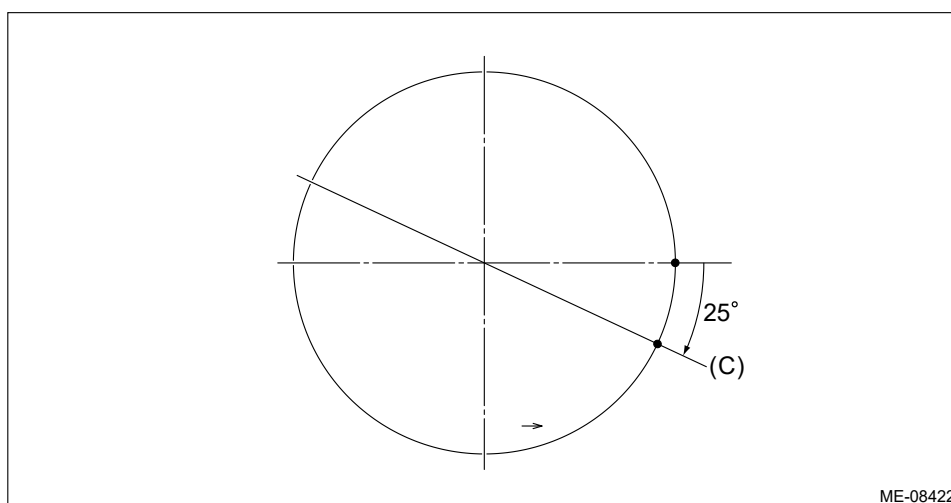
(1) Set the ring gap of the top ring to the position (A) in the figure.



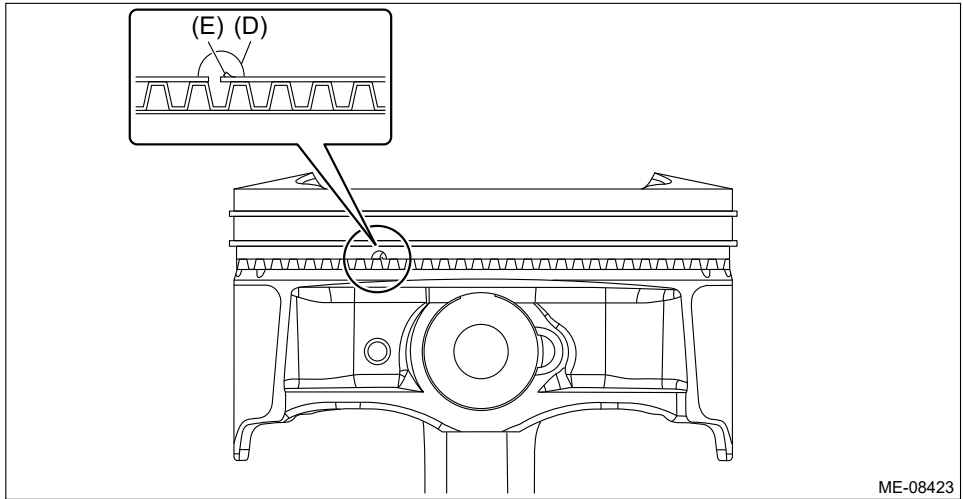
(2) Position the ring gap of second ring at (B) in the figure on the 180° opposite direction of (A).



(3) Set the ring gap of the upper rail to the position (C) in the figure.

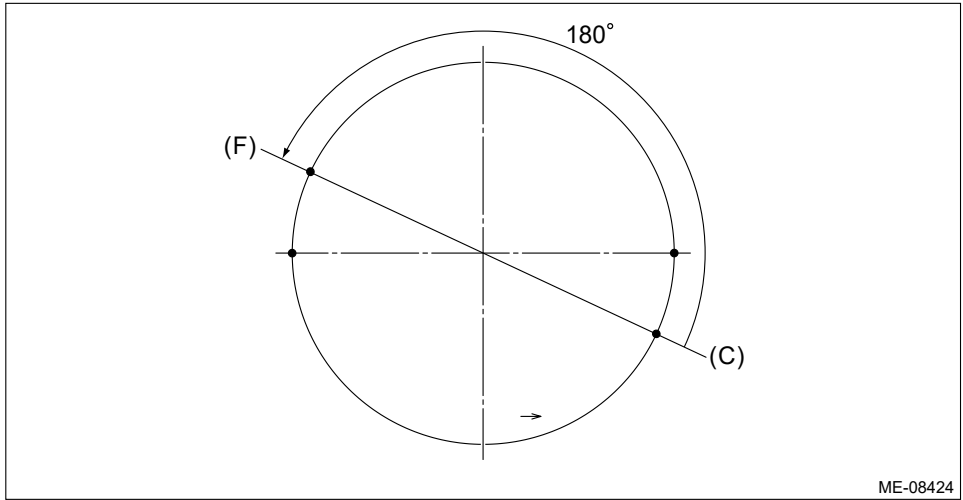


(4) Align the upper rail spin stopper (E) to the side hole (D) on the piston.



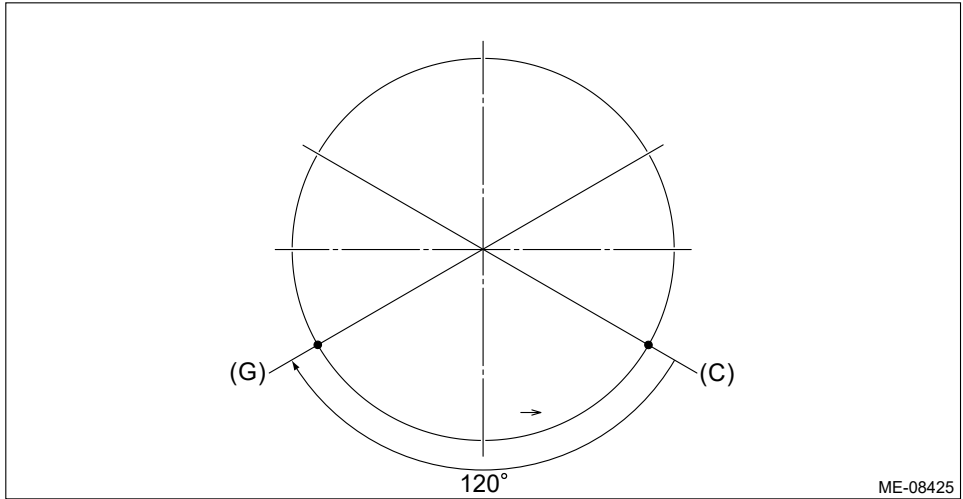
ME-08423

(5) Position the ring gap of expander at (F) in the figure on the 180° opposite direction of (C).



ME-08424

(6) Set the ring gap of lower rail at position (G), located 120° clockwise from (C) in the figure.



ME-08425

(7) Check that the positions of piston ring gap are properly adjusted.

Note:

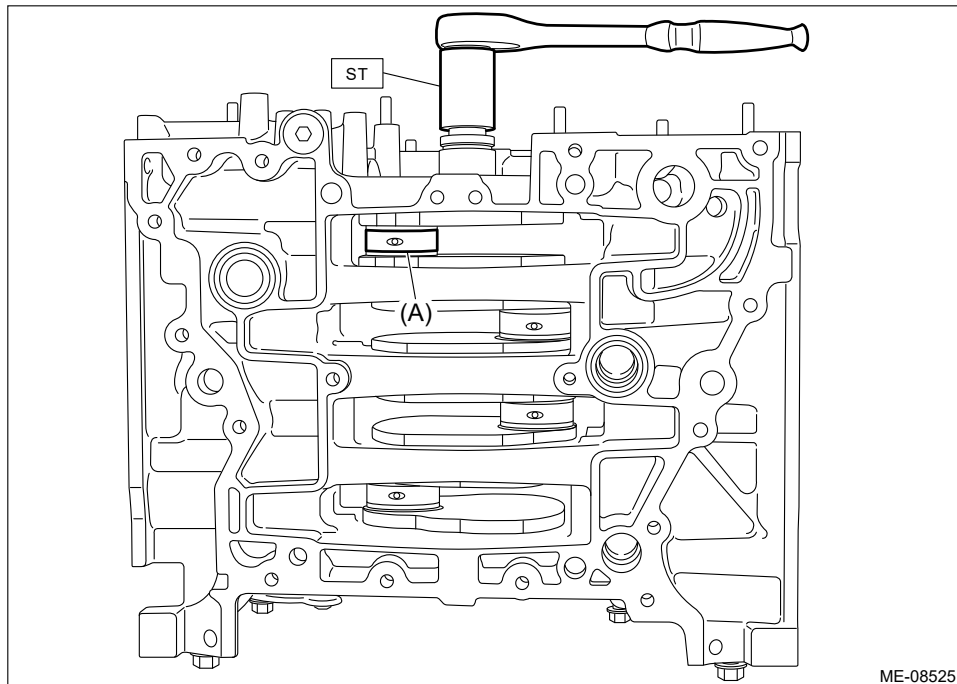
When checking the positions of piston ring gap, also check that the piston ring gaps are not positioned within the range of piston skirt extended line.

12. Install the piston and connecting rod to the cylinder block.

(1) Apply engine oil to the outer circumference of each piston, crankshaft pin, and in the cylinder block.

(2) Turn the crankshaft so that the #1 pin (A) of crankshaft is positioned at TDC using ST.

ST 18252AA000 CRANKSHAFT SOCKET



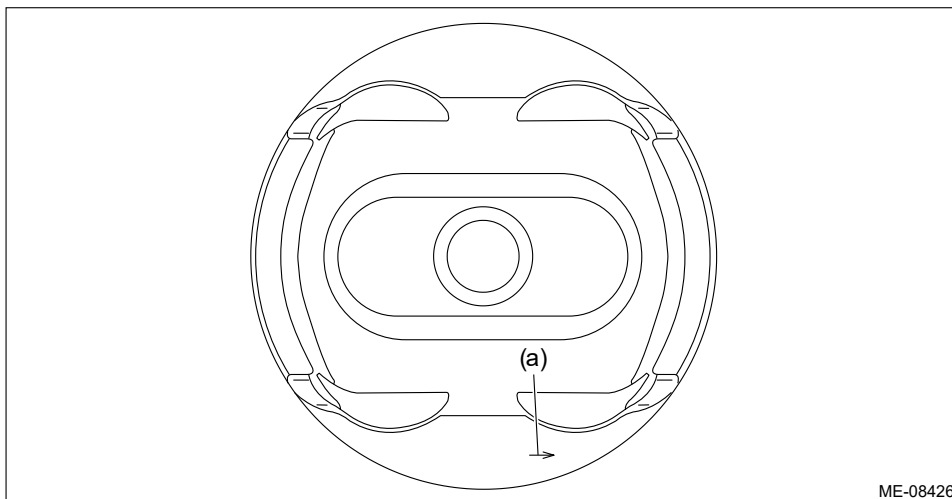
(3) Compress the piston ring using piston ring compressor, and insert the #1 connecting rod with #1 piston into cylinder block.

Caution:

- Be careful not to damage the cylinder liner and #1 pin of crankshaft by the #1 connecting rod large end.
- Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.

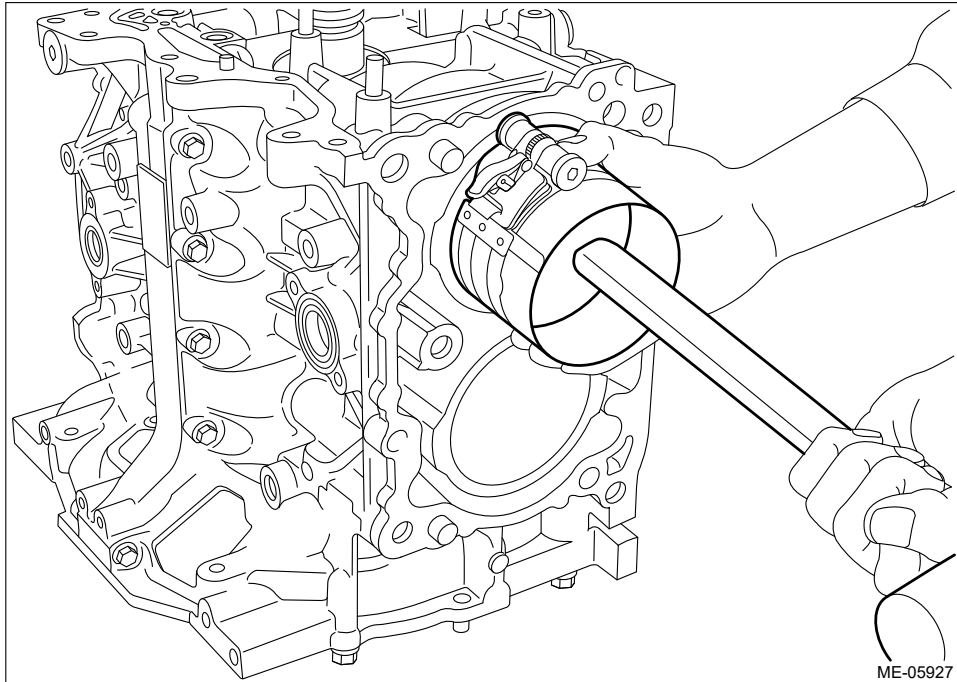
Note:

- Face the piston front mark (arrow) towards the front of the engine.



(a) Front mark

- Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.



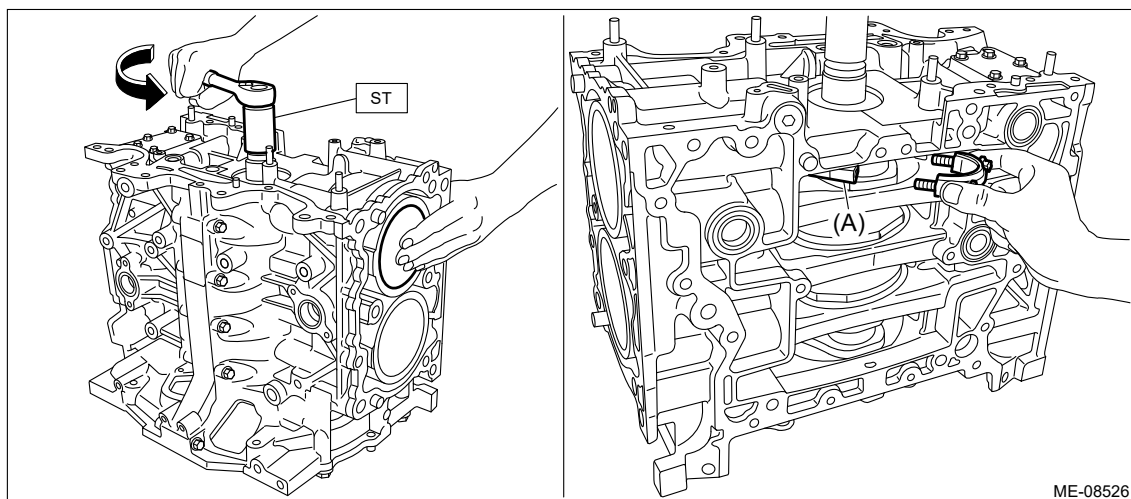
ME-05927

- (4) Turn the crankshaft counterclockwise so that the #1 pin of crankshaft and the large end (A) of #1 connecting rod are positioned as shown in the figure using ST, while pressing the #1 piston crown, and then set the #1 connecting rod cap and #1 connecting rod cap cap bolt.

Note:

- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #1 connecting rod cap seat and the connecting rod cap bolt threads.

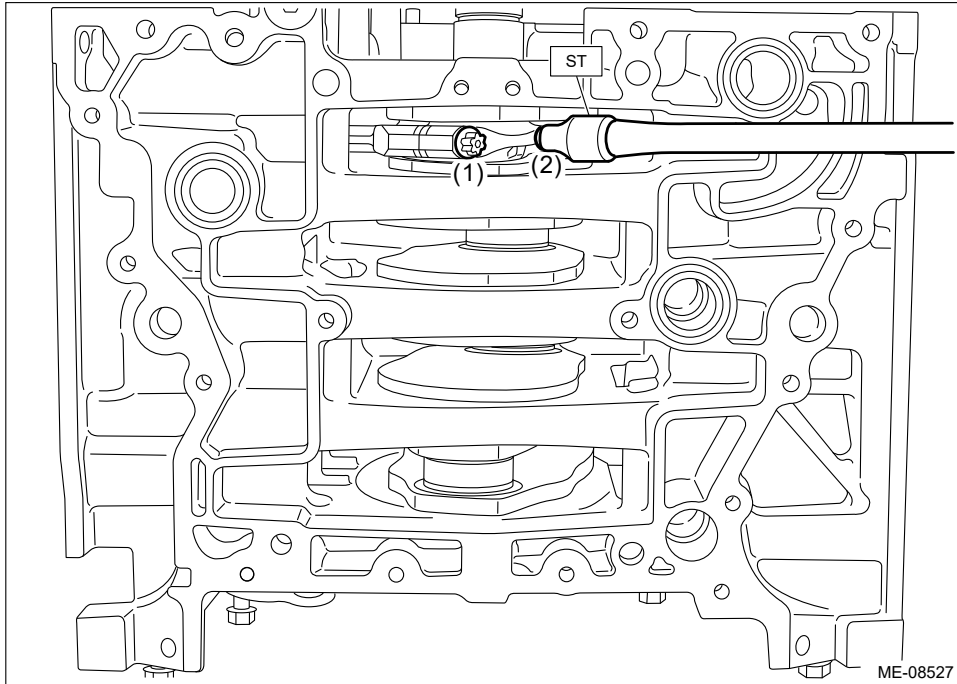
ST 18252AA000 CRANKSHAFT SOCKET



ME-08526

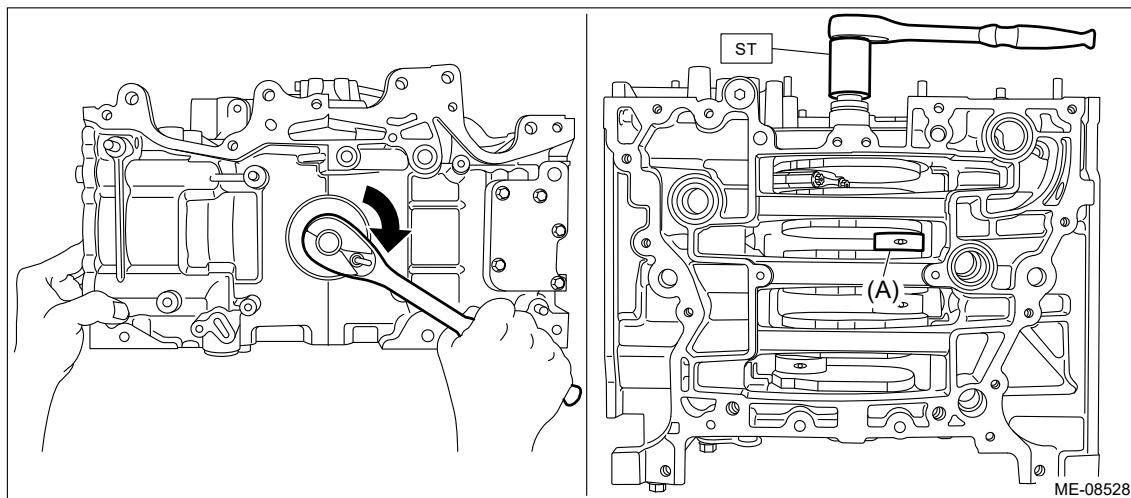
- (5) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



(6) Turn the crankshaft clockwise so that the #2 pin (A) of crankshaft is positioned at TDC using ST.

ST 18252AA000 CRANKSHAFT SOCKET



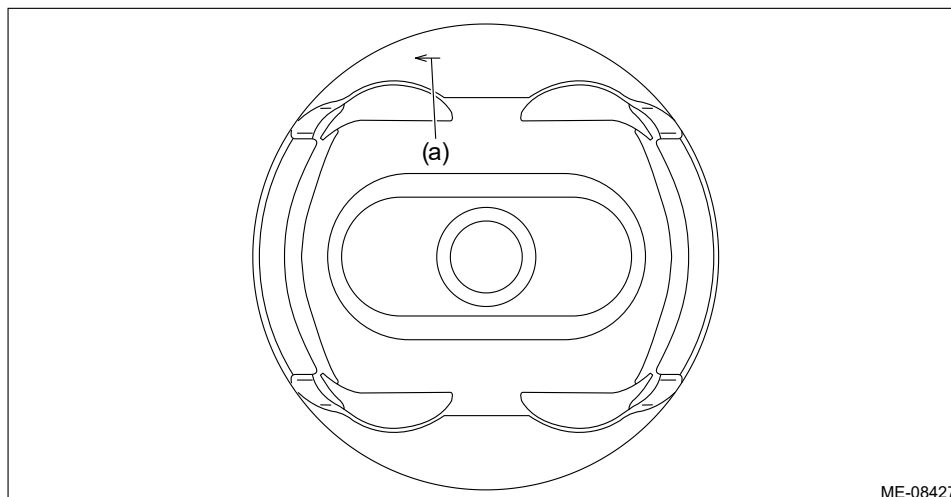
(7) Compress the piston ring using piston ring compressor, and insert the #2 connecting rod with #2 piston into cylinder block.

Caution:

- Be careful not to damage the cylinder liner and #2 pin of crankshaft by the #2 connecting rod large end.
- Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.

Note:

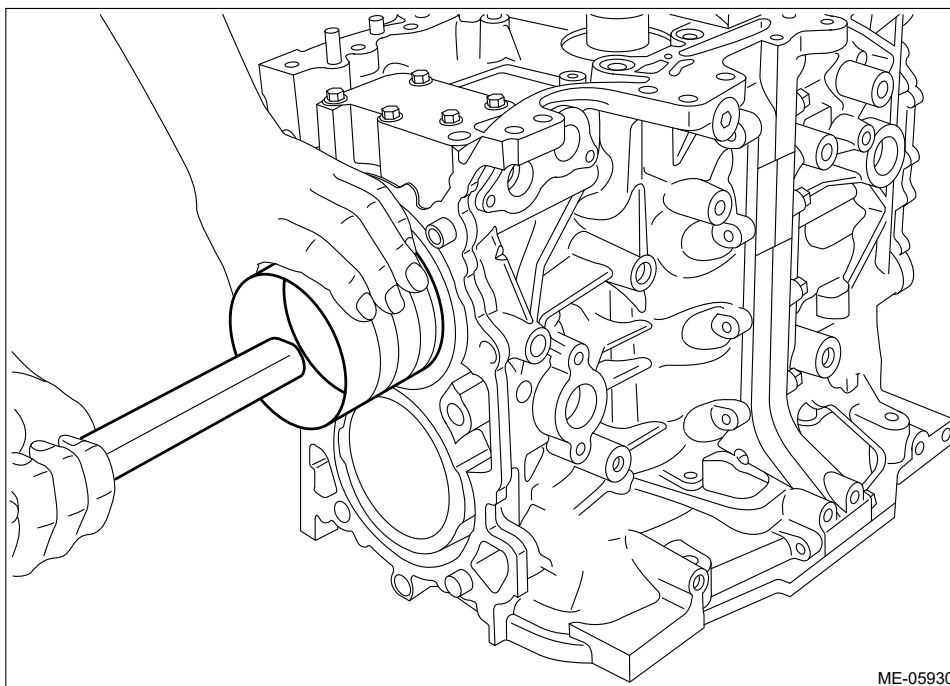
- Face the piston front mark (arrow) towards the front of the engine.



ME-08427

(a) Front mark

- **Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.**



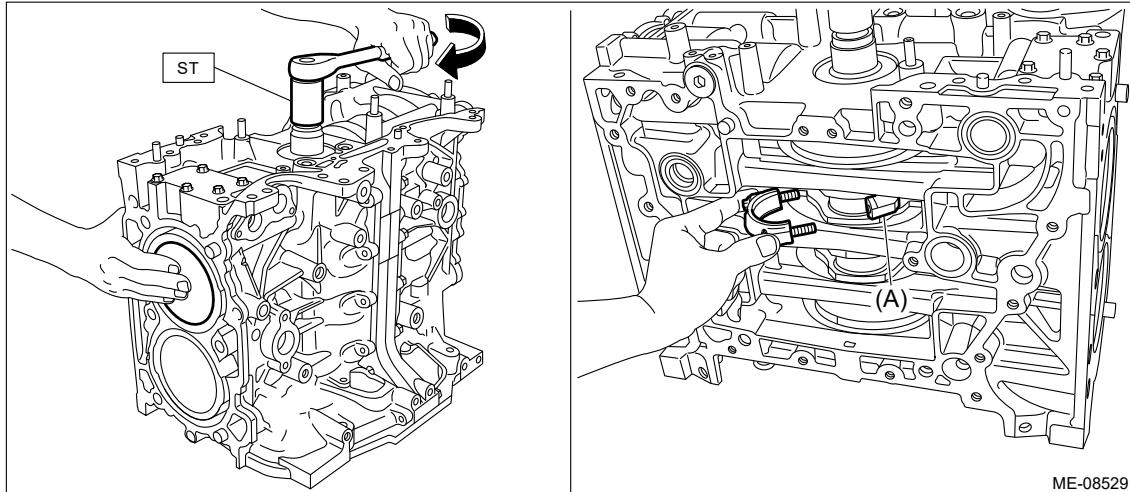
ME-05930

- (8) Turn the crankshaft clockwise so that the #2 pin of crankshaft and the large end (A) of #2 connecting rod are positioned as shown in the figure using ST, while pressing the #2 piston crown, and then set the #2 connecting rod cap and #2 connecting rod cap bolt.

Note:

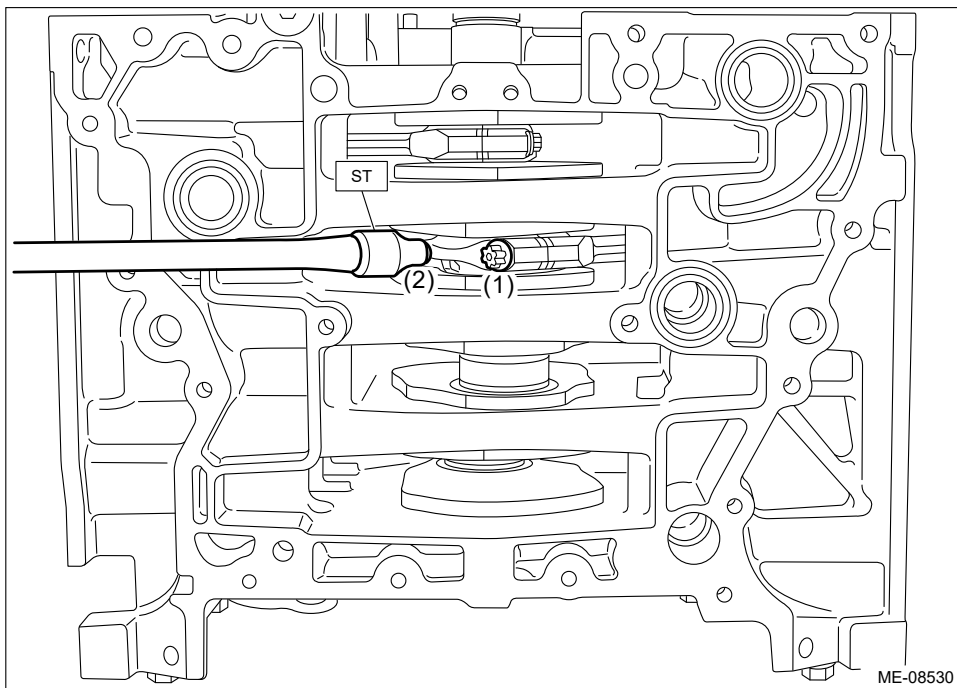
- **Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.**
- **Use a new connecting rod cap bolt.**
- **Apply a coat of engine oil to the #2 connecting rod cap seat and the connecting rod cap bolt threads.**

ST 18252AA000 CRANKSHAFT SOCKET



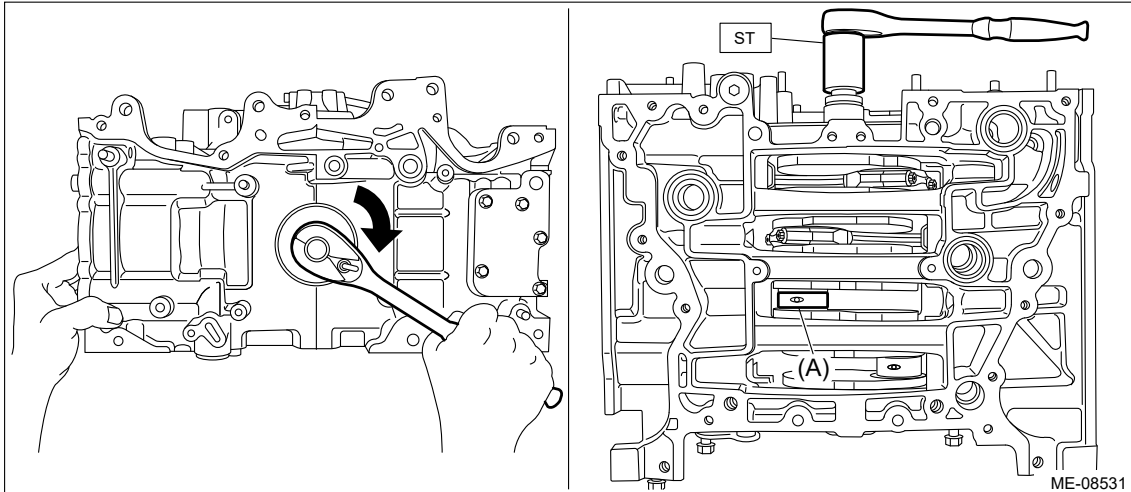
- (9) Using ST, tighten the #2 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



- (10) Turn the crankshaft clockwise so that the #3 pin (A) of crankshaft is positioned at TDC using ST.

ST 18252AA000 CRANKSHAFT SOCKET



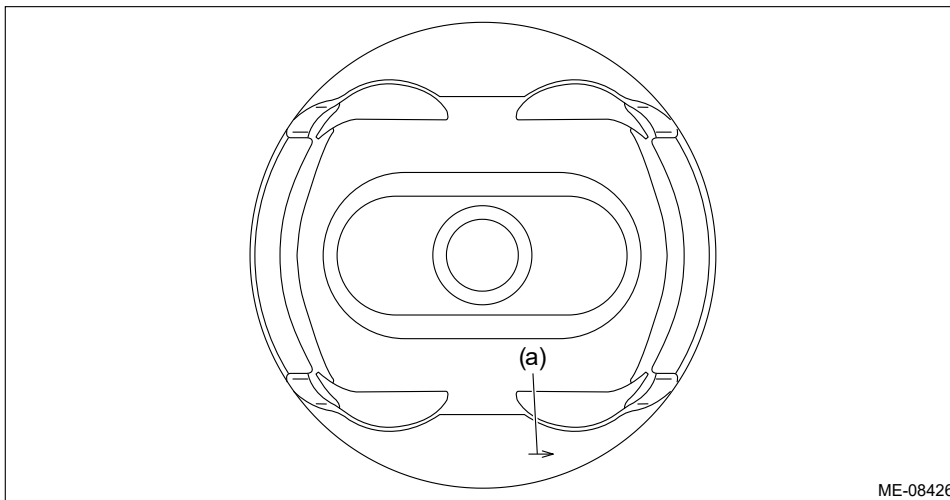
(11) Compress the piston ring using piston ring compressor, and insert the #3 connecting rod with #3 piston into cylinder block.

Caution:

- Be careful not to damage the cylinder liner and #3 pin of crankshaft by the #3 connecting rod large end.
- Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.

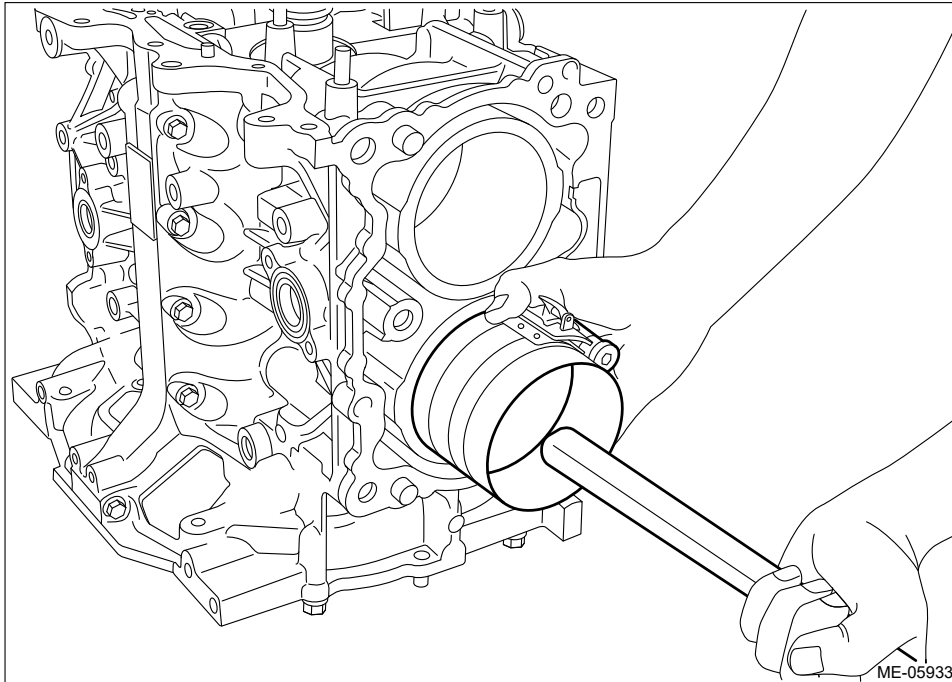
Note:

- Face the piston front mark (arrow) towards the front of the engine.



(a) Front mark

- Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.

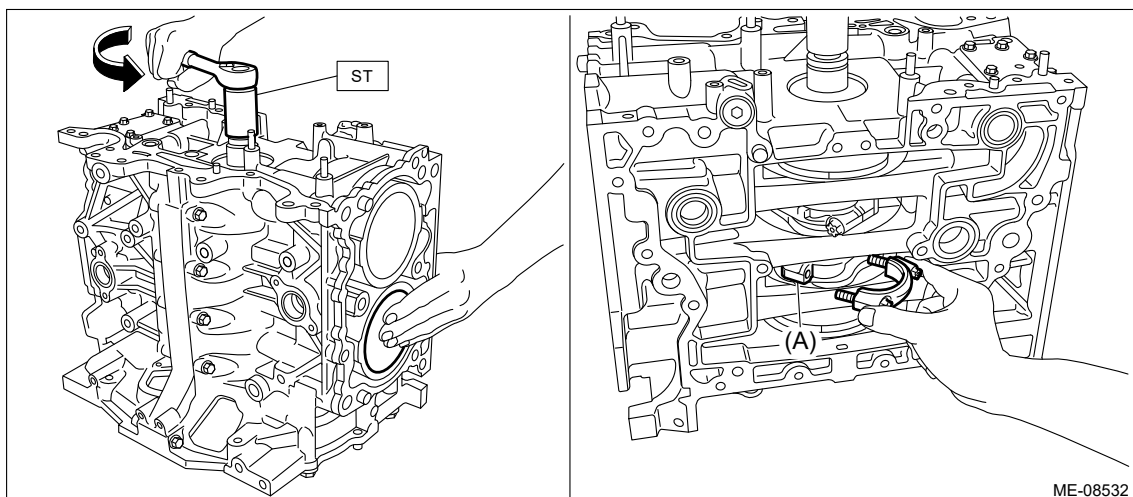


(12) Turn the crankshaft counterclockwise so that the #3 pin of crankshaft and the large end (A) of #3 connecting rod are positioned as shown in the figure using ST, while pressing the #3 piston crown, and then set the #3 connecting rod cap and #3 connecting rod cap bolt.

Note:

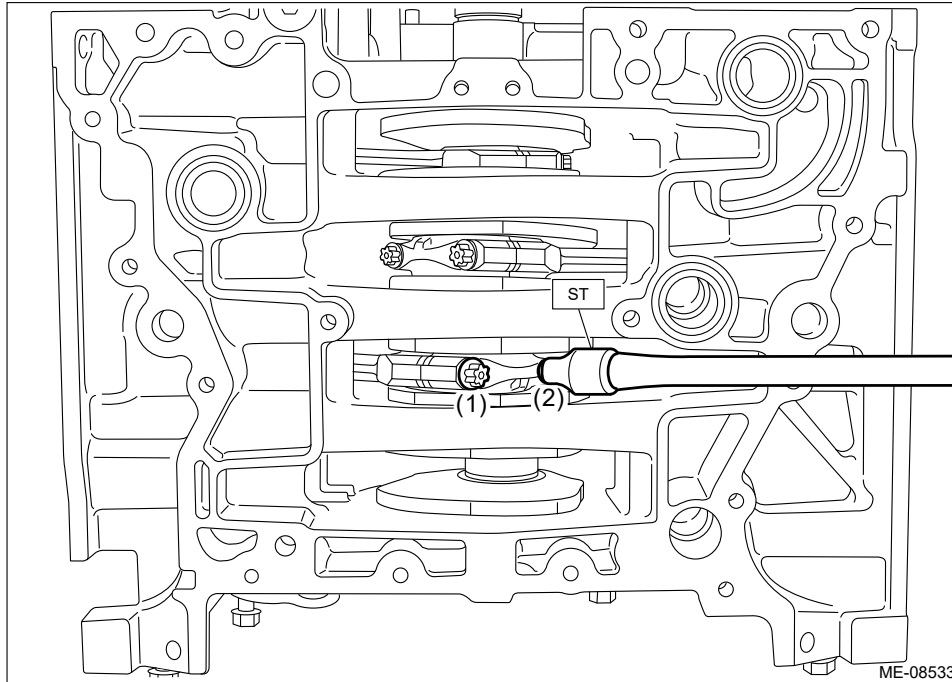
- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #3 connecting rod cap seat and the connecting rod cap bolt threads.

ST 18252AA000 CRANKSHAFT SOCKET



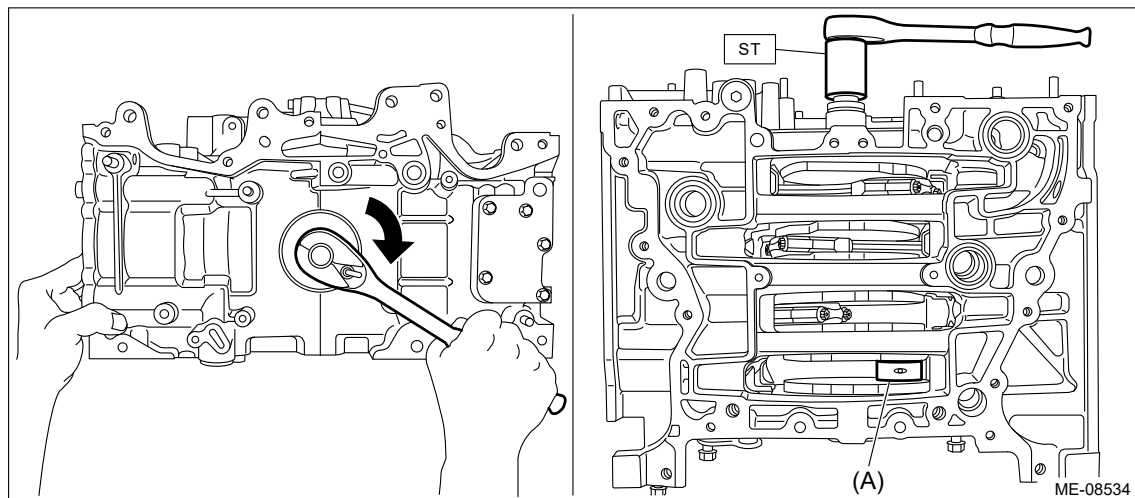
(13) Using ST, tighten the #3 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



(14) Turn the crankshaft clockwise so that the #4 pin (A) of crankshaft is positioned at TDC using ST.

ST 18252AA000 CRANKSHAFT SOCKET



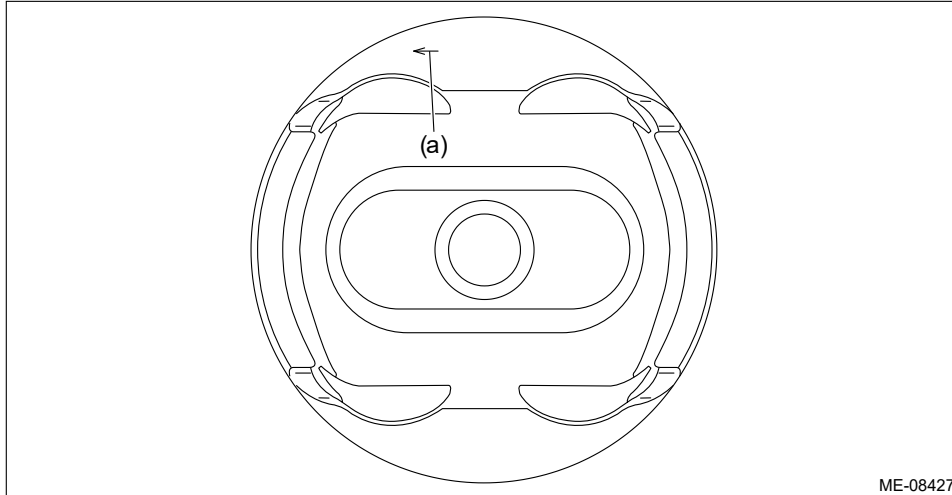
(15) Compress the piston ring using piston ring compressor, and insert the #4 connecting rod with #4 piston into cylinder block.

Caution:

- Be careful not to damage the cylinder liner and #4 pin of crankshaft by the #4 connecting rod large end.
- Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.

Note:

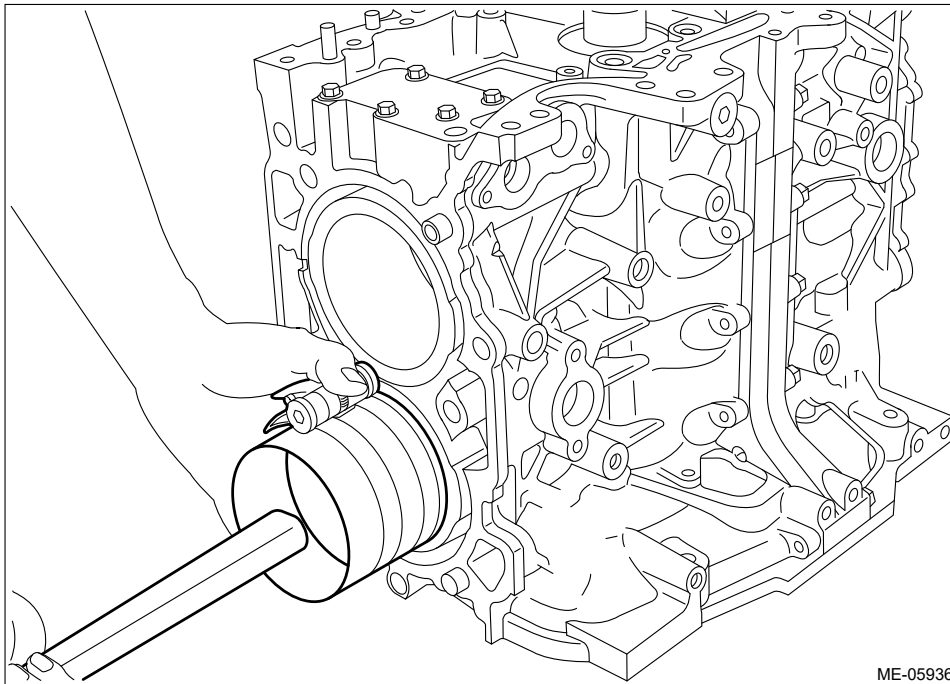
- Face the piston front mark (arrow) towards the front of the engine.



ME-08427

(a) Front mark

- **Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.**



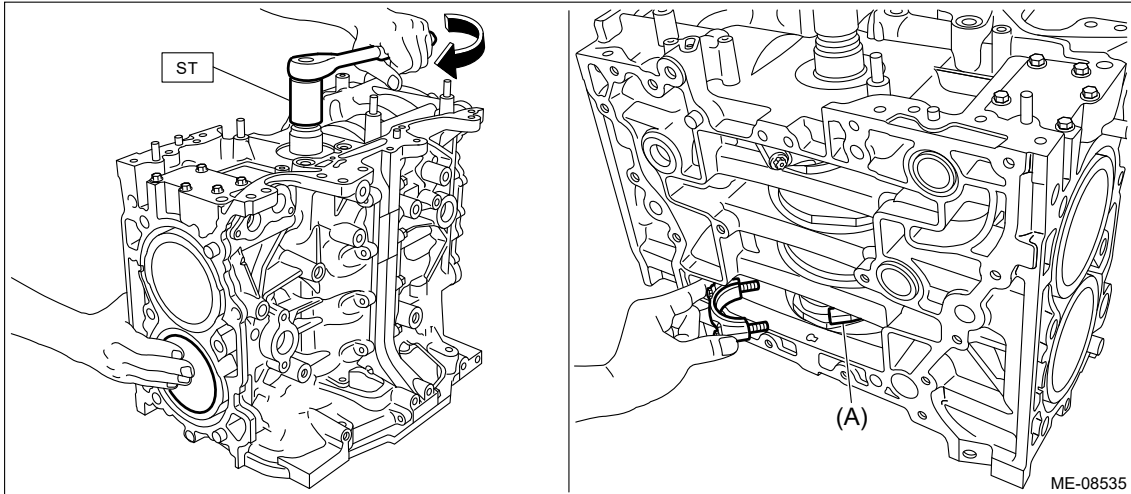
ME-05936

- (16) Turn the crankshaft clockwise so that the #4 pin of crankshaft and the large end (A) of #4 connecting rod are positioned as shown in the figure using ST, while pressing the #4 piston crown, and then set the #4 connecting rod cap and #4 connecting rod cap bolt.

Note:

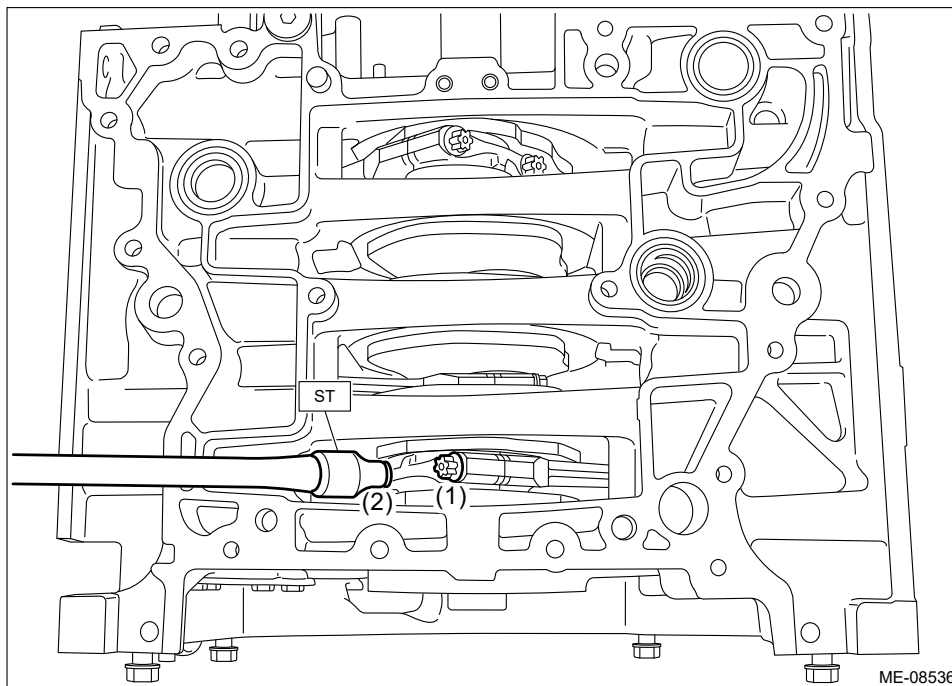
- **Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.**
- **Use a new connecting rod cap bolt.**
- **Apply a coat of engine oil to the #4 connecting rod cap seat and the connecting rod cap bolt threads.**

ST 18252AA000 CRANKSHAFT SOCKET



- (17) Using ST, tighten the #4 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 22 N·m (2.2 kgf-m, 16.2 ft-lb) in numerical order as shown in the figure.

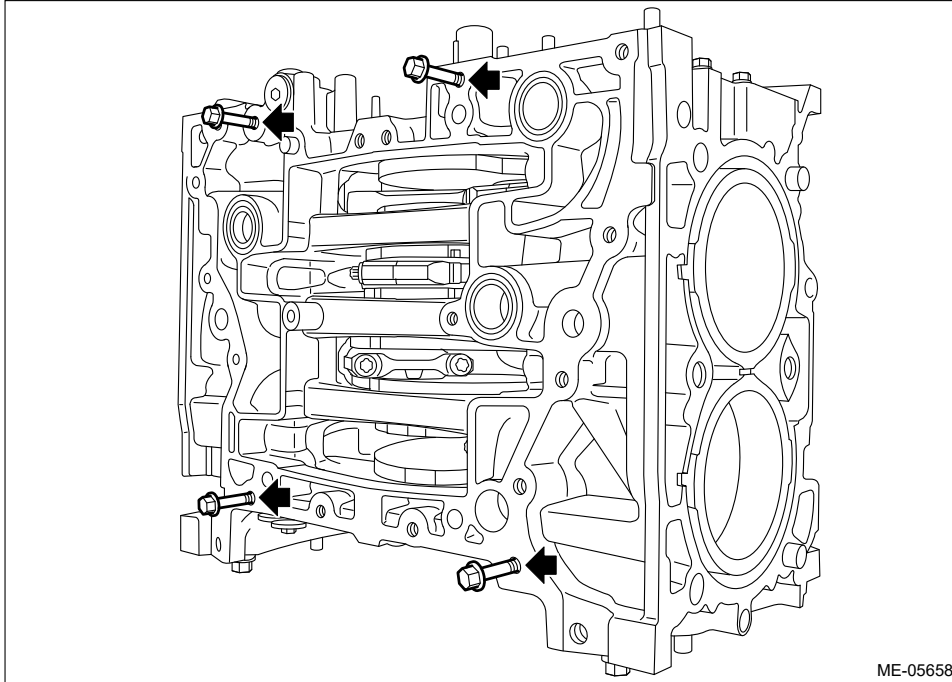
ST 18270AA020 SOCKET



- (18) Install the cam carrier mounting bolts at the locations shown in the figure.

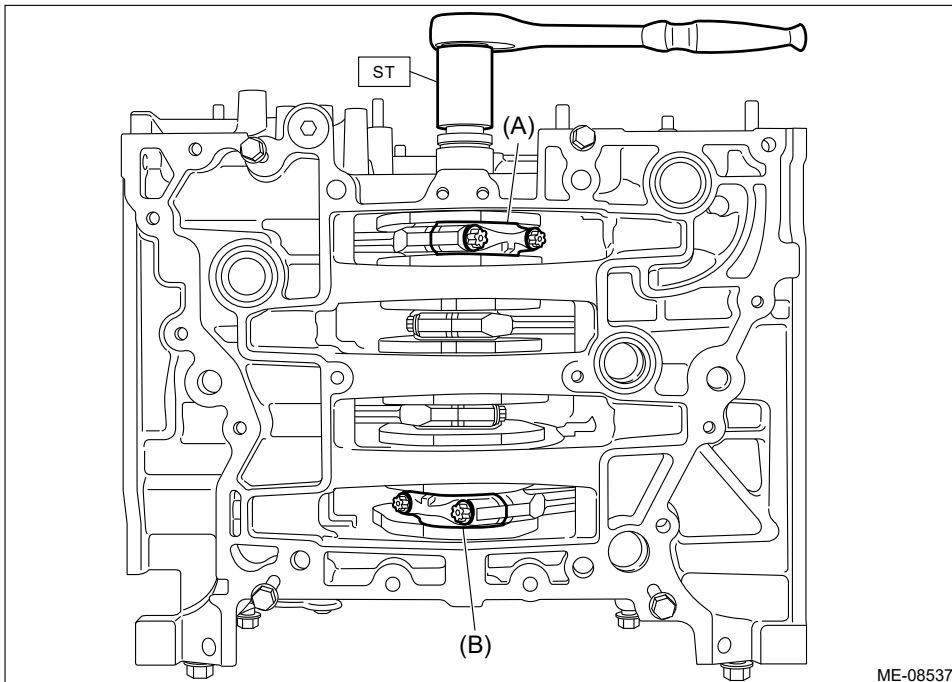
Note:

This procedure is required to tighten the connecting rod cap bolts with specified angle using angle gauge.



(19) Turn the crankshaft so that the #1 connecting rod cap (A) and #4 connecting rod cap (B) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET

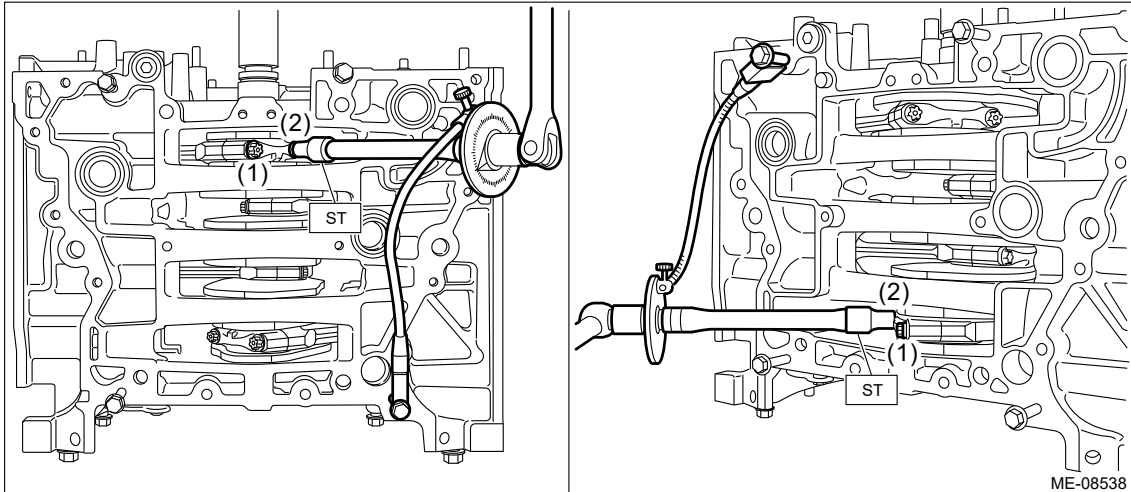


(20) Using ST and angle gauge, tighten the #1 connecting rod cap bolts and #4 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

ST 18270AA020 SOCKET

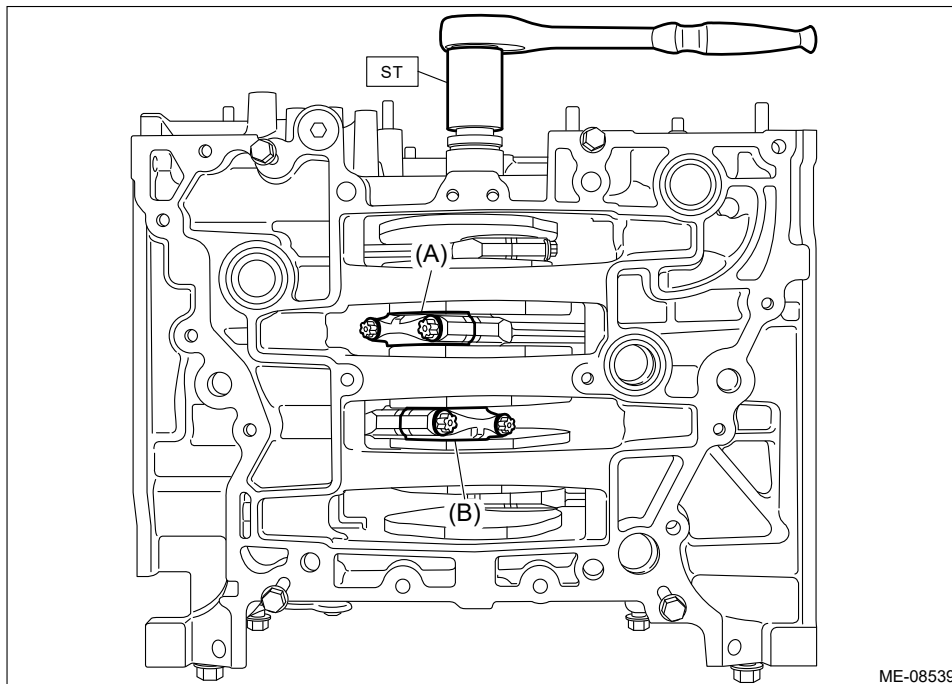
Tightening angle:

$137^{\circ}+3^{\circ}-2^{\circ}$



(21) Turn the crankshaft so that the #2 connecting rod cap (A) and #3 connecting rod cap (B) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET

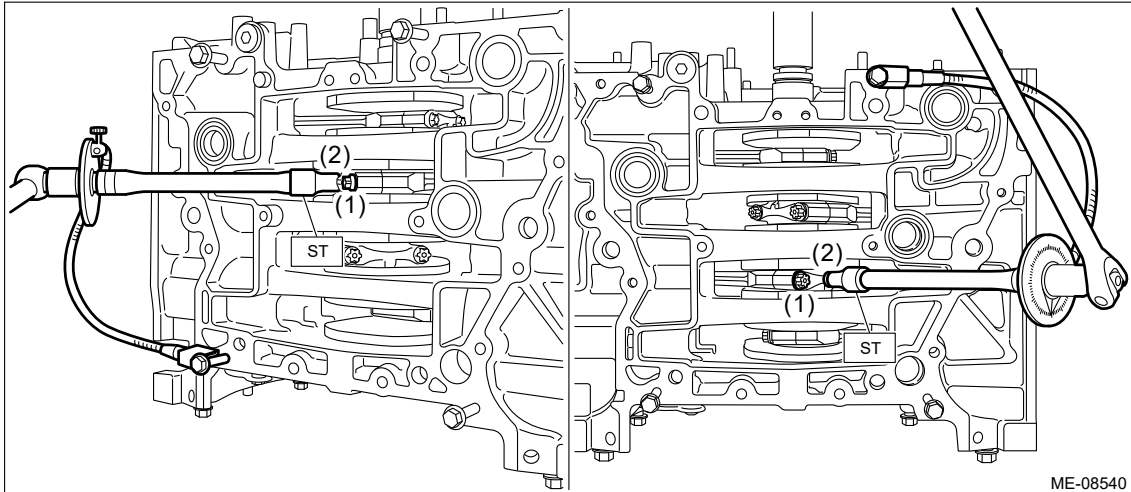


(22) Using ST and angle gauge, tighten the #2 connecting rod cap bolts and #3 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

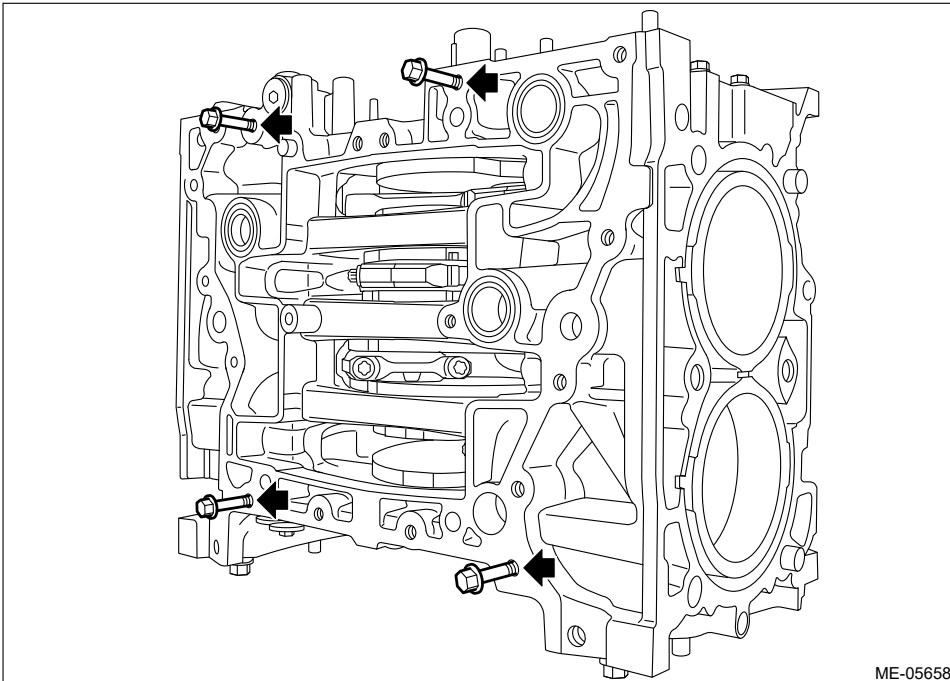
ST 18270AA020 SOCKET

Tightening angle:

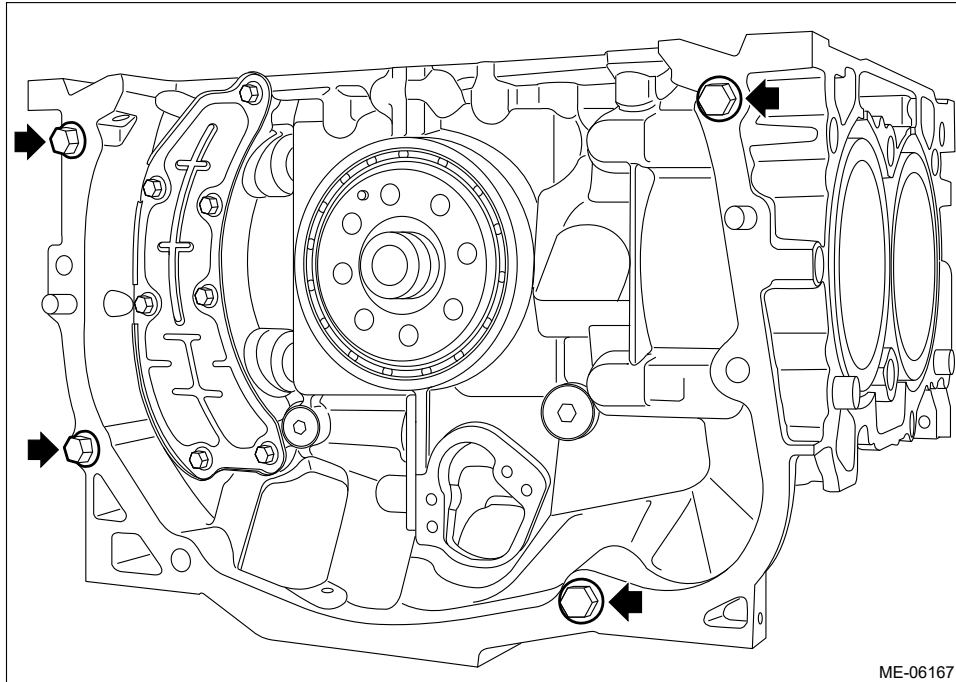
$137^{\circ} + 3^{\circ} - 2^{\circ}$




(23) Remove the cam carrier mounting bolts attached at the locations shown in the figure.



13. Set the cylinder block so that the oil pan side of the block faces upward, and remove the mounting bolts attached to the locations shown in the figure.



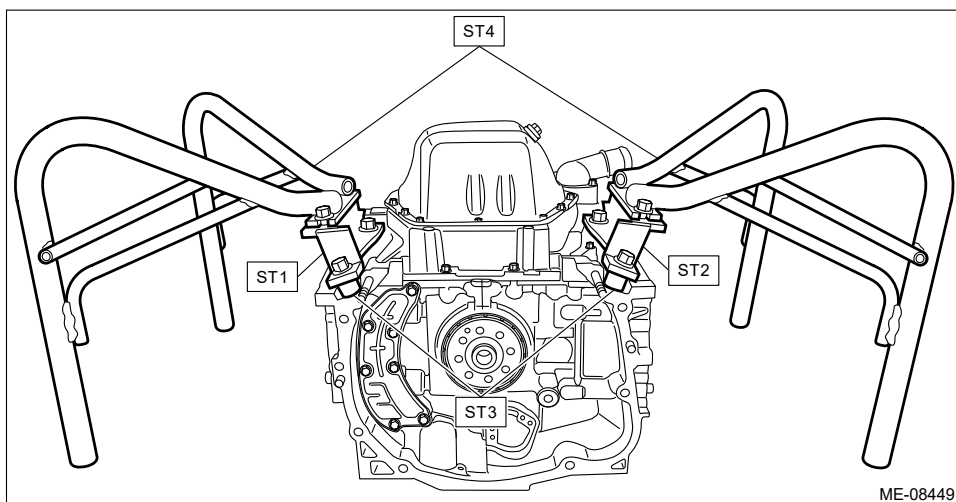
ME-06167

- 14.** Install the oil pan upper.  [Ref. to LUBRICATION\(H4DO\)>Oil Pan>INSTALLATION > OIL PAN UPPER.](#)
- 15.** Install the ST1, ST2, ST3 and ST4 to the cylinder block and oil pan upper.

- ST1 498457000 ENGINE STAND ADAPTER RH**
- ST2 498457100 ENGINE STAND ADAPTER LH**
- ST3 18362AA020 ADAPTER**
- ST4 499817100 ENGINE STAND**

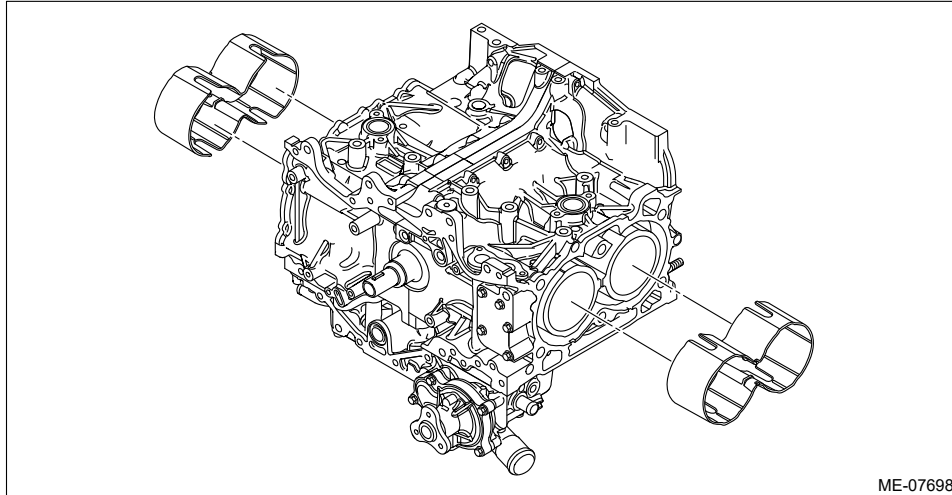
Tightening torque:

35 N·m (3.6 kgf·m, 25.8 ft·lb)



ME-08449

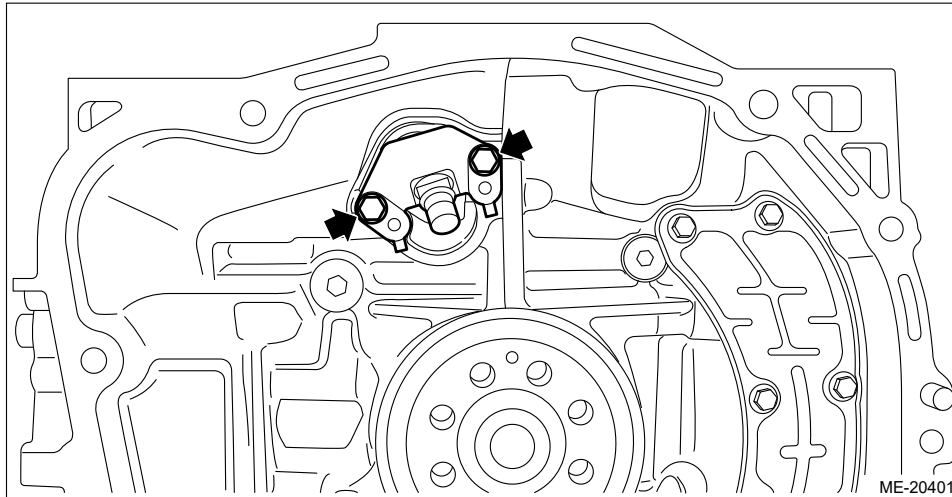
- 16.** Install the water jacket spacer to the cylinder block RH and cylinder block LH.








- 17.** Install the crankshaft position sensor with crankshaft position sensor holder to the cylinder block LH.

Tightening torque:

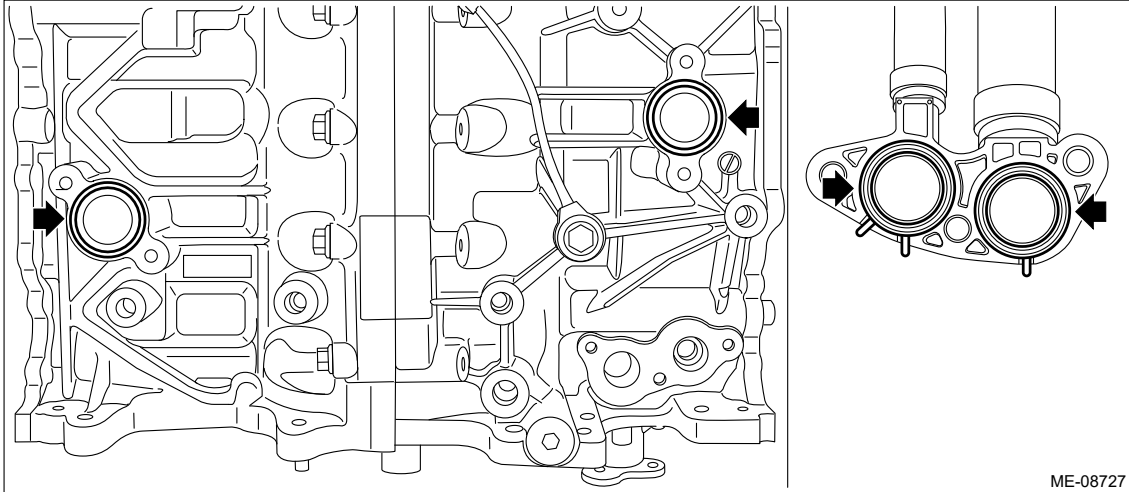
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



- 18.** Install the crankshaft position sensor plate with drive plate. (CVT model)  [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR580\)>Drive Plate>INSTALLATION.](#)
- 19.** Install the crankshaft position sensor plate with flywheel. (MT model)  [Ref. to CLUTCH SYSTEM>Flywheel>INSTALLATION.](#)
- 20.** Install the clutch disc and cover. (MT model)  [Ref. to CLUTCH SYSTEM>Clutch Disc and Cover>INSTALLATION.](#)
- 21.** Install the PCV valve.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DO\)>PCV Valve>INSTALLATION.](#)
- 22.** Install the knock sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Knock Sensor>INSTALLATION.](#)
- 23.** Install the O-ring to the cylinder block and PCV connector.

Note:

Use new O-rings.

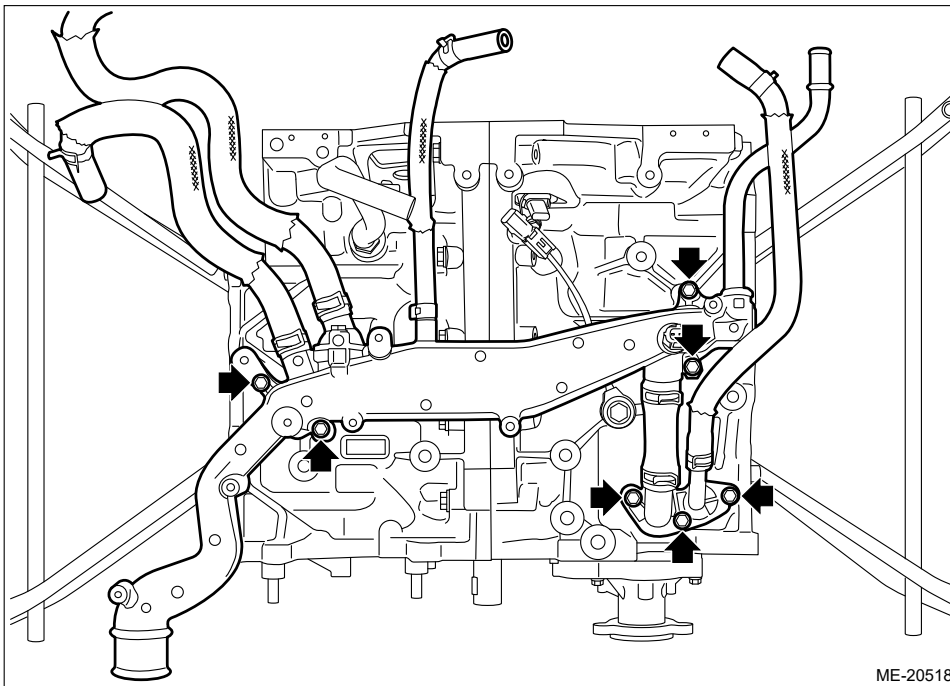


24. Set the water pipe assembly and PCV connector to the cylinder block, and install the bolts which secure the water pipe assembly and PCV connector to the cylinder block.

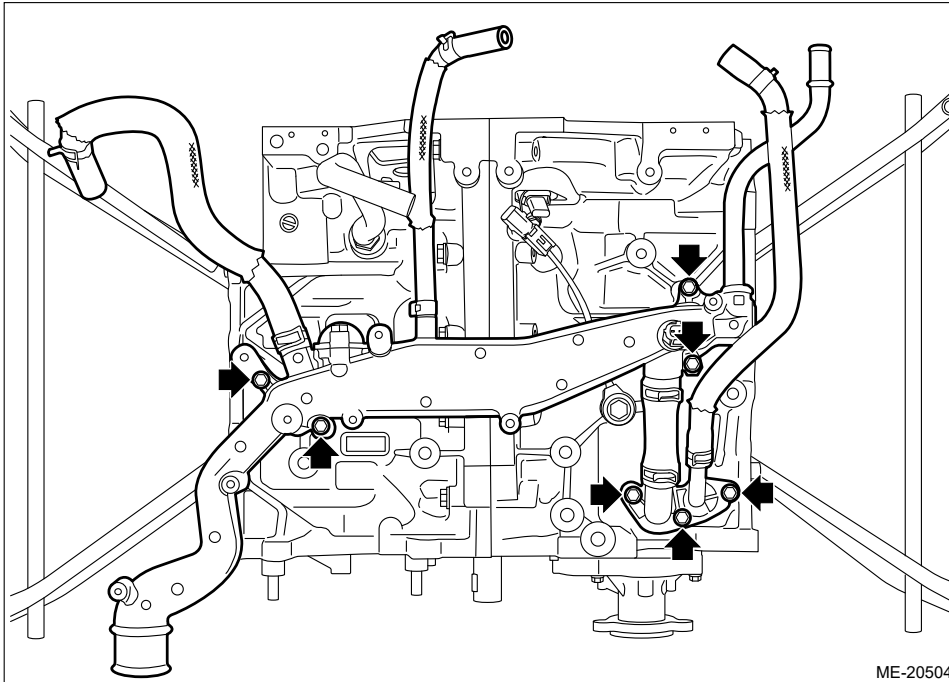
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

- CVT model



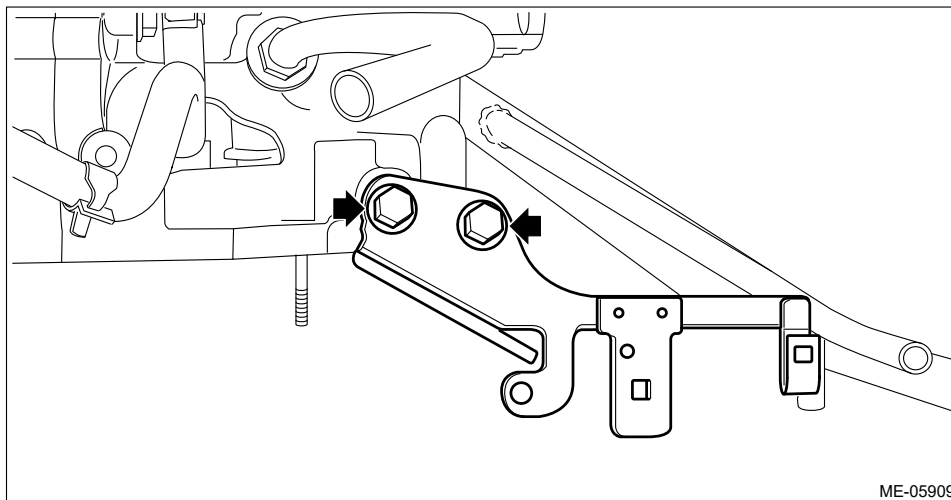
- MT model











25. Install the engine rear hanger to the cylinder block RH.

Tightening torque:

21 N·m (2.1 kgf-m, 15.5 ft-lb)

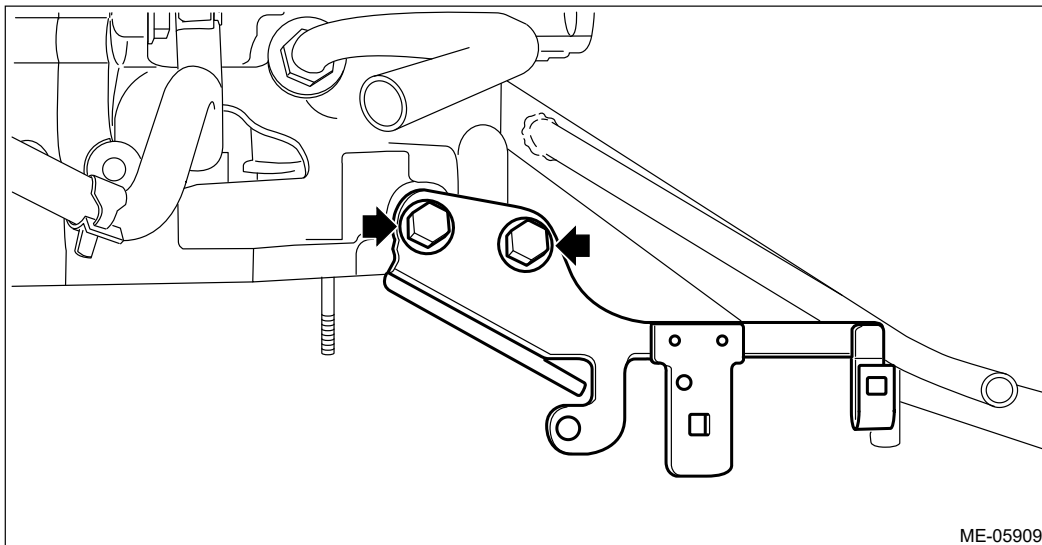


- 26.** Install the crank sprocket.  [Ref. to MECHANICAL\(H4DO\)>Crank Sprocket>INSTALLATION.](#)
- 27.** Install the cylinder head.  [Ref. to MECHANICAL\(H4DO\)>Cylinder Head>INSTALLATION.](#)
- 28.** Install the cam carrier.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>INSTALLATION.](#)
- 29.** Install the rocker cover.  [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>INSTALLATION.](#)
- 30.** Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)
- 31.** Install the engine wiring harness.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Wiring Harness>INSTALLATION.](#)
- 32.** Install the intake manifold assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>INSTALLATION.](#)
- 33.** Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>INSTALLATION.](#)

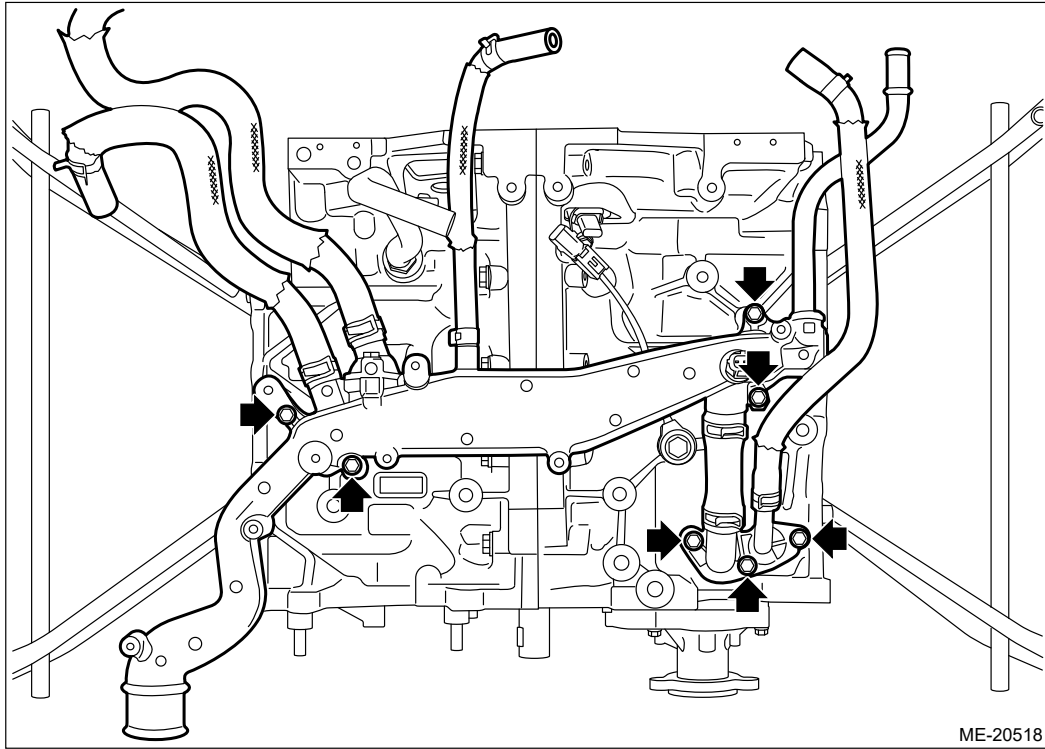
MECHANICAL(H4DO) > Cylinder Block

REMOVAL

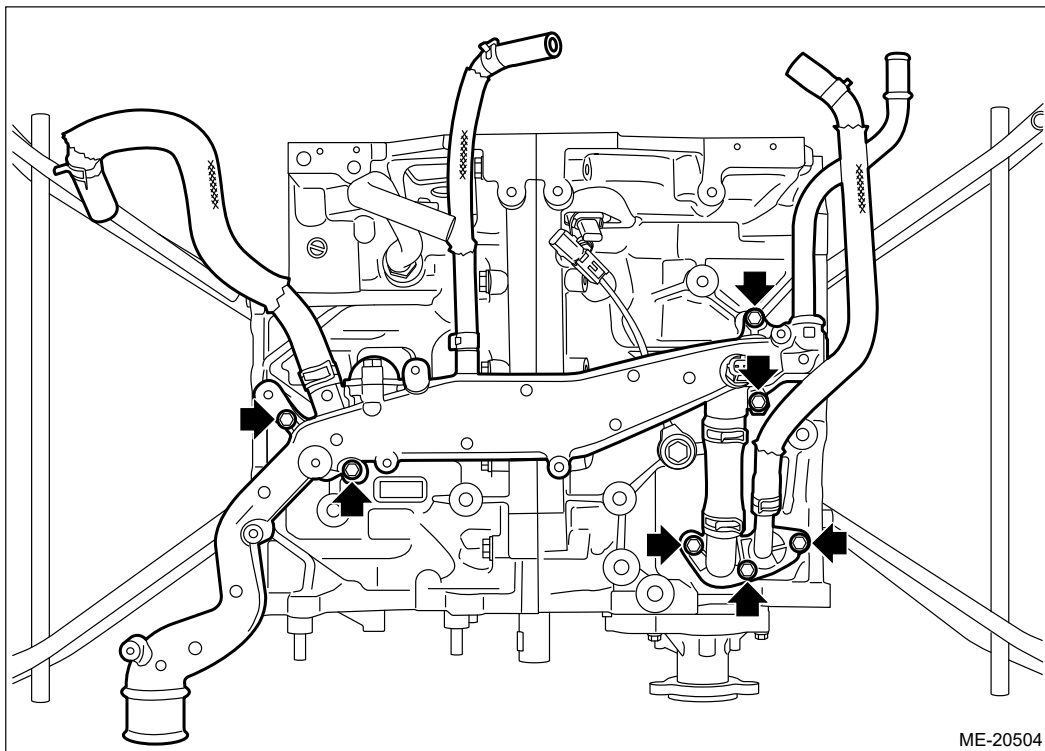
1. Remove the engine from the vehicle. [🔗 Ref. to MECHANICAL\(H4DO\)>Engine Assembly>REMOVAL.](#)
2. Remove the intake manifold assembly. [🔗 Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>REMOVAL.](#)
3. Remove the engine wiring harness. [🔗 Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Wiring Harness>REMOVAL.](#)
4. Remove the chain cover. [🔗 Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
5. Remove the rocker cover. [🔗 Ref. to MECHANICAL\(H4DO\)>Rocker Cover>REMOVAL.](#)
6. Remove the cam carrier. [🔗 Ref. to MECHANICAL\(H4DO\)>Cam Carrier>REMOVAL.](#)
7. Remove the cylinder head. [🔗 Ref. to MECHANICAL\(H4DO\)>Cylinder Head>REMOVAL.](#)
8. Remove the crank sprocket. [🔗 Ref. to MECHANICAL\(H4DO\)>Crank Sprocket>REMOVAL.](#)
9. Remove the engine rear hanger from cylinder block RH.



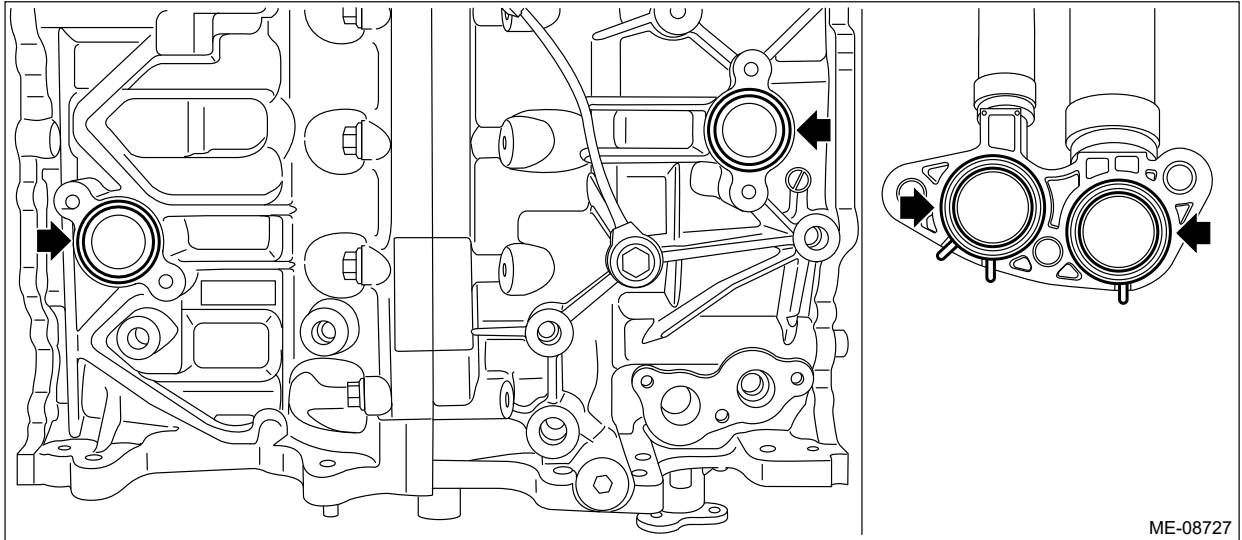
10. Remove the bolts securing the water pipe assembly and PCV connector to the cylinder block, and remove the water pipe assembly and PCV connector as a set from cylinder block.
 - CVT model








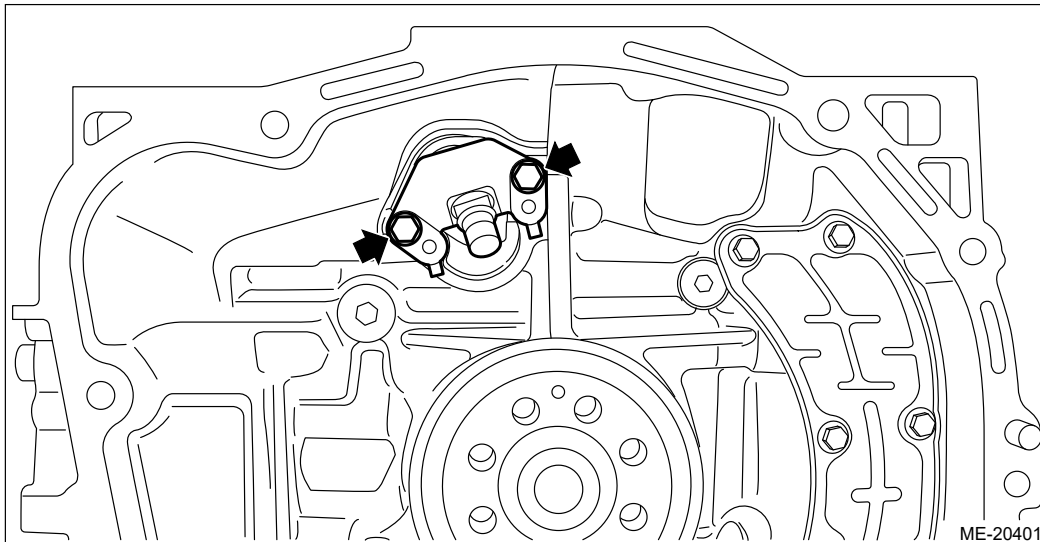
- MT model



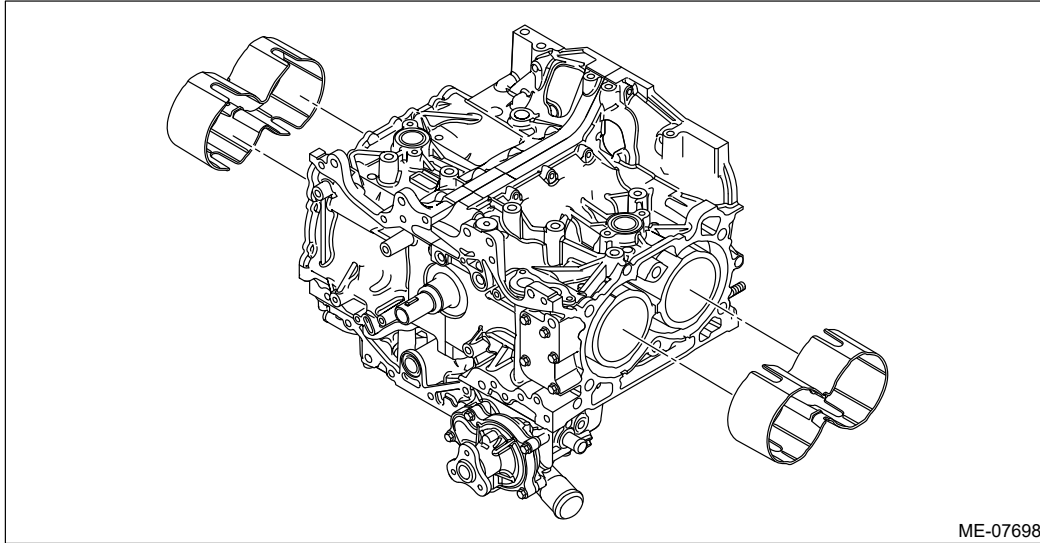
11. Remove the O-ring from the cylinder block and PCV connector.



- 12.** Remove the knock sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Knock Sensor>REMOVAL.](#)
- 13.** Remove the PCV valve.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DO\)>PCV Valve>REMOVAL.](#)
- 14.** Remove the crankshaft position sensor plate with drive plate. (CVT model)  [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR580\)>Drive Plate>REMOVAL.](#)
- 15.** Remove the clutch disc and cover. (MT model)  [Ref. to CLUTCH SYSTEM>Clutch Disc and Cover>REMOVAL.](#)
- 16.** Remove the crankshaft position sensor plate with flywheel. (MT model)  [Ref. to CLUTCH SYSTEM>Flywheel>REMOVAL.](#)
- 17.** Remove the bolts securing the crankshaft position sensor holder from the cylinder block LH, and remove the crankshaft position sensor with crankshaft position sensor holder.



- 18.** Remove the water jacket spacer from the cylinder block RH and cylinder block LH.



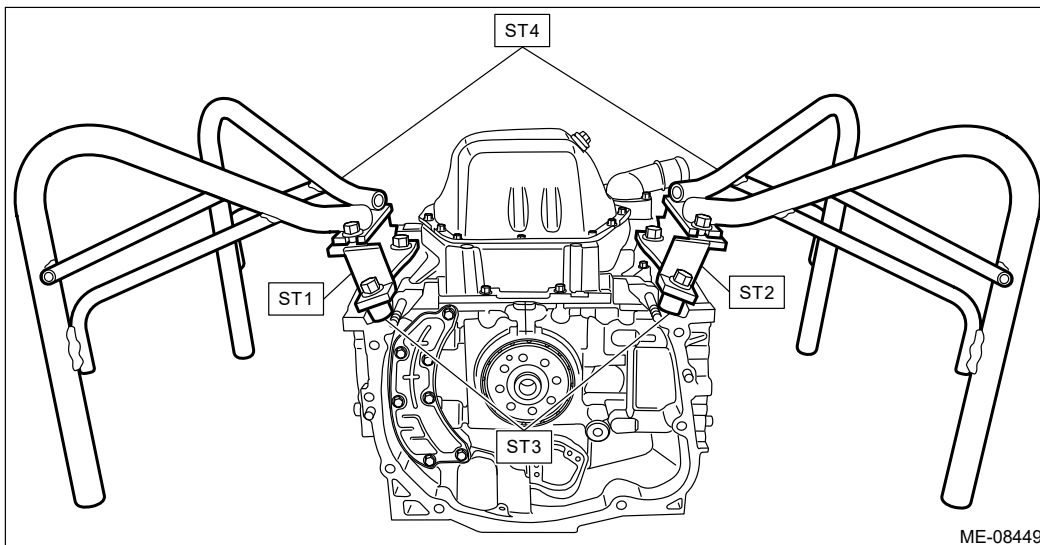
19. Set the cylinder block so that the oil pan is on the upper side, remove the ST1, ST2, ST3 and ST4 from cylinder block and oil pan upper.

ST1 498457000 ENGINE STAND ADAPTER RH

ST2 498457100 ENGINE STAND ADAPTER LH

ST3 18362AA020 ADAPTER

ST4 499817100 ENGINE STAND

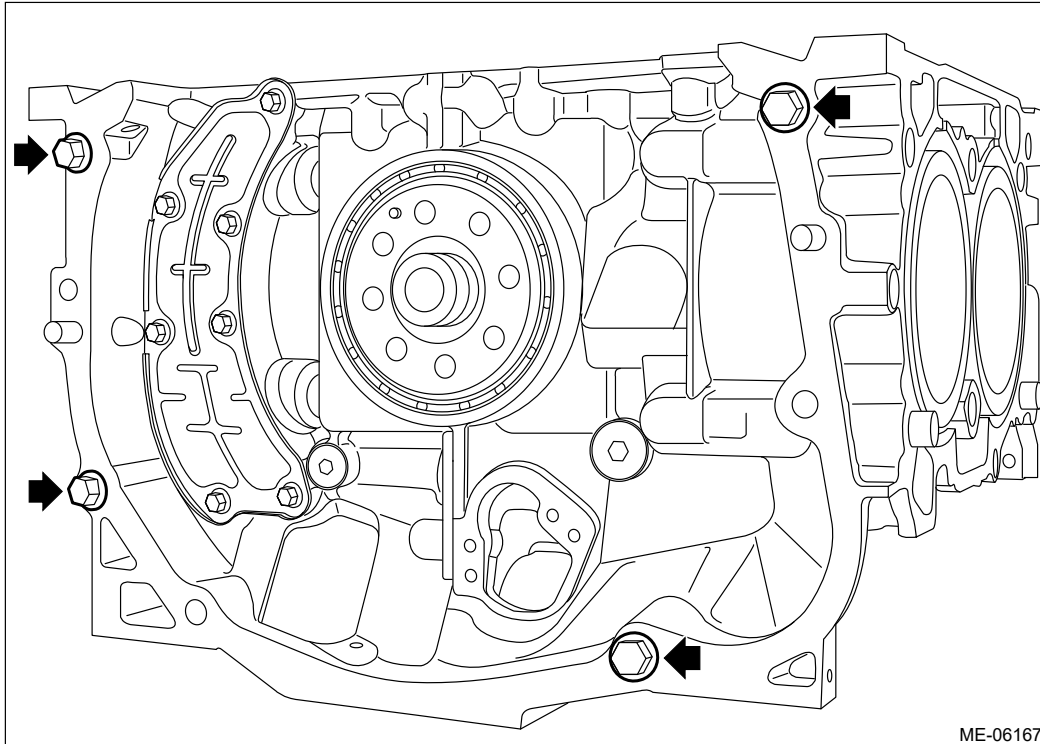


20. Remove the oil pan upper.  [Ref. to LUBRICATION\(H4DO\)>Oil Pan>REMOVAL > OIL PAN UPPER.](#)

21. Install a bolt of suitable length (M10 × P1.25) at the locations shown in the figure.

Note:

- This procedure is required to prevent the knock pin damage when the cylinder block is raised in the next step.
- Use the same length of bolt for the four bolts.



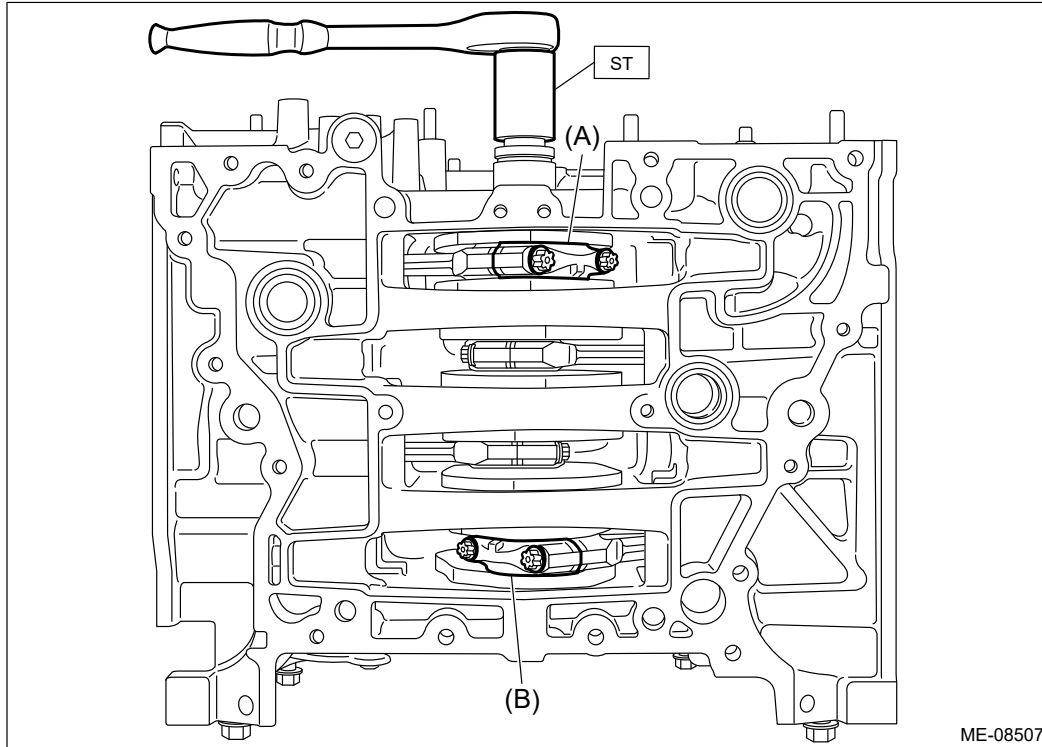
- 22.** Raise the cylinder block so that the rear oil seal is on the lower side.
- 23.** Remove the #1 and #4 connecting rod caps and pistons from the cylinder block.

Note:

Mark each connecting rod cap and piston with a cylinder number.

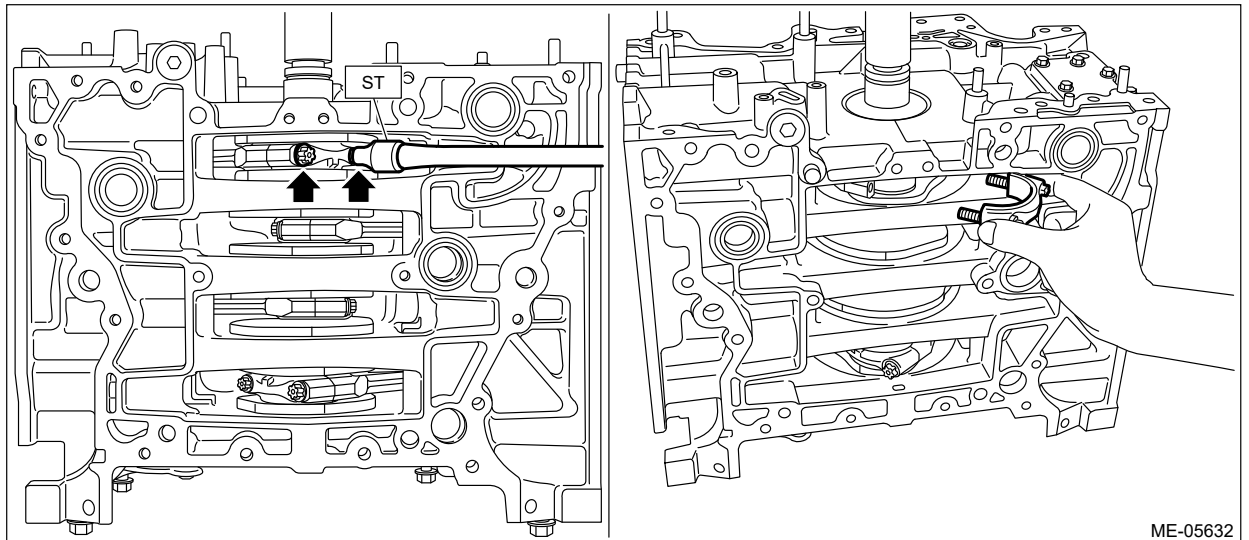
- (1) Turn the crankshaft so that the #1 connecting rod cap (A) and #4 connecting rod cap (B) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET



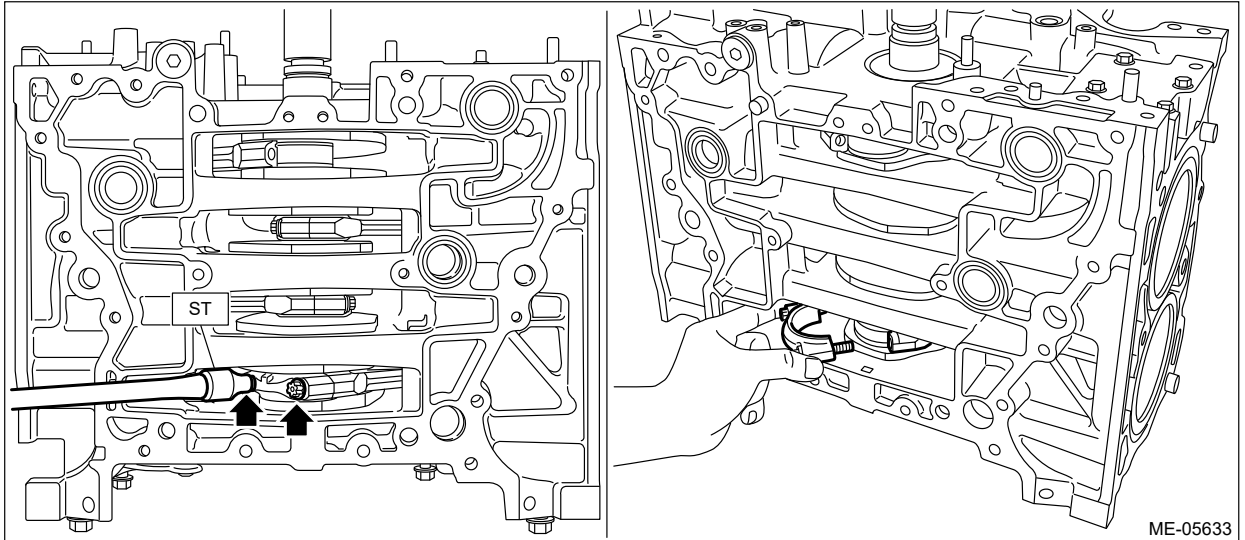
- (2) Using ST, loosen the #1 connecting rod cap bolt, and remove the #1 connecting rod cap bolt and #1 connecting rod cap.

ST 18270AA020 SOCKET



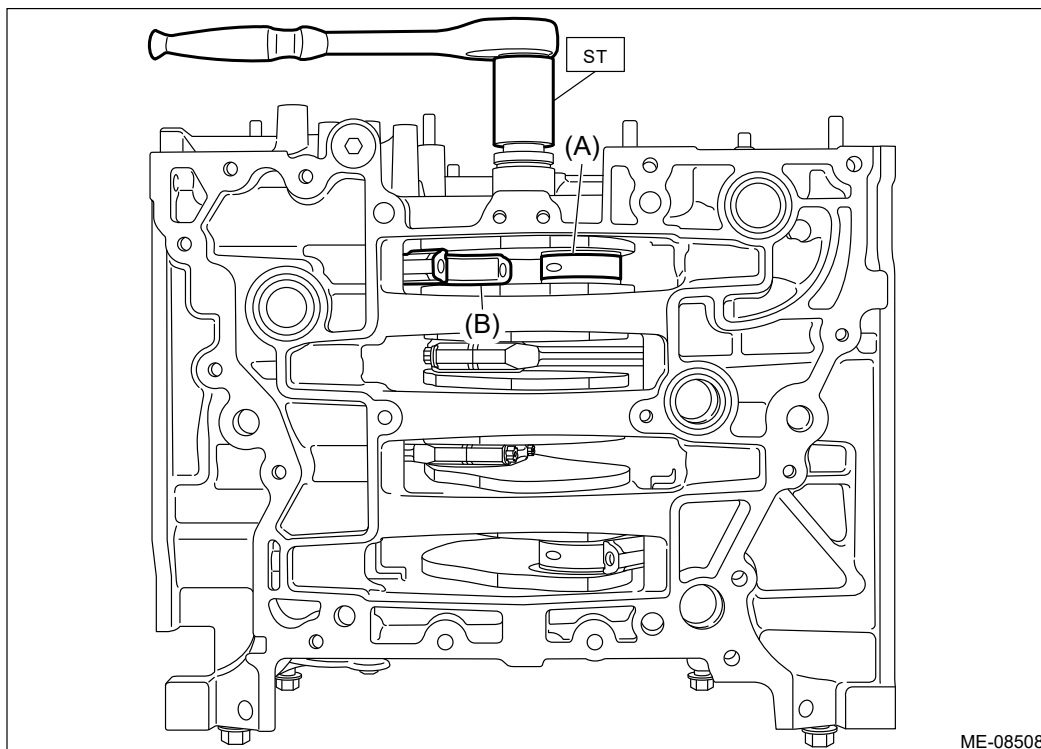
- (3) Using ST, loosen the #4 connecting rod cap bolt, and remove the #4 connecting rod cap bolt and #4 connecting rod cap.

ST 18270AA020 SOCKET

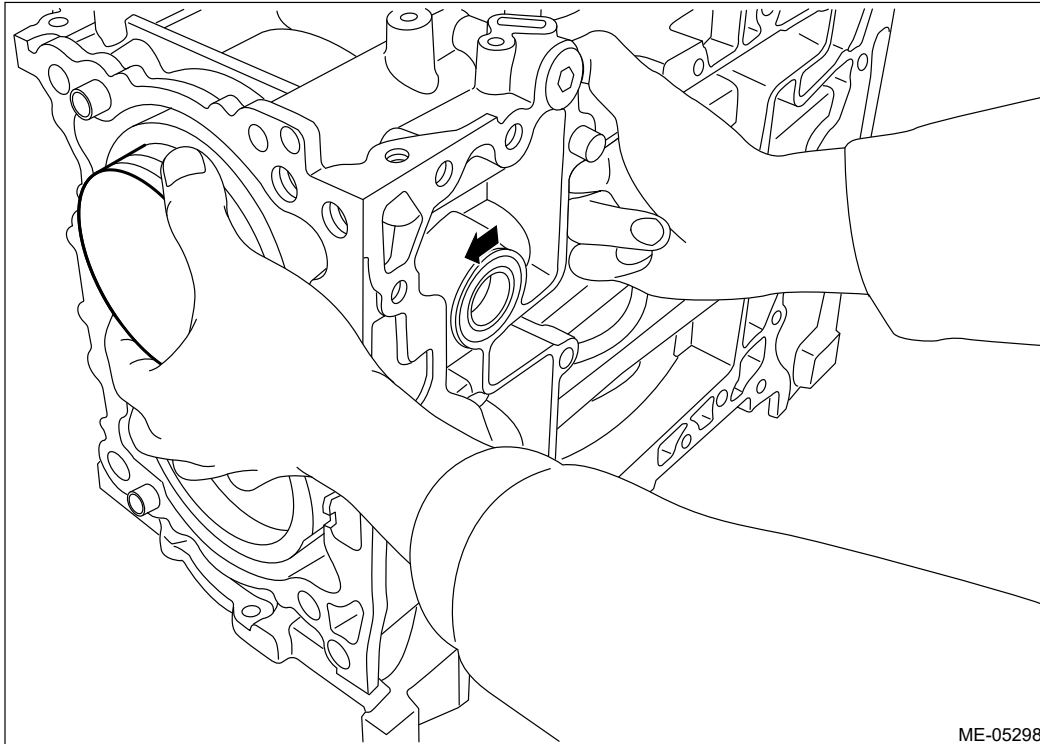


- (4) Using the ST, turn the crankshaft counterclockwise and separate the positions of the #1 pin (A) of crankshaft and the large end (B) of #1 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET



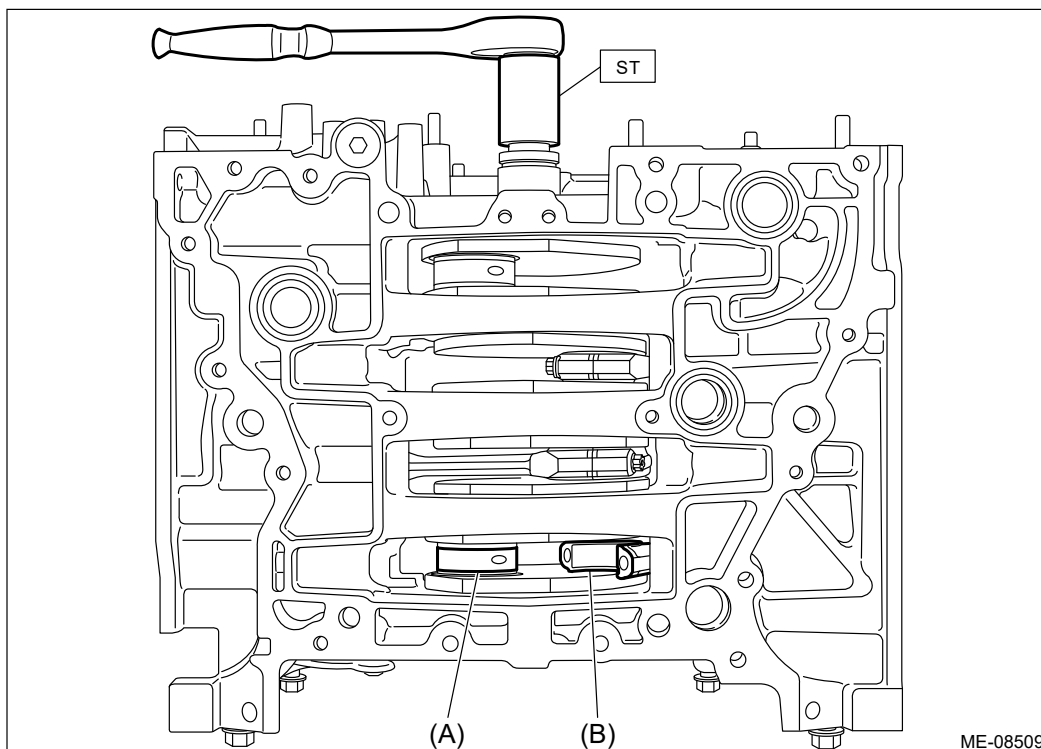
- (5) Push the #1 connecting rod in the direction of the arrow, and remove the #1 piston with #1 connecting rod from the cylinder block.



ME-05298

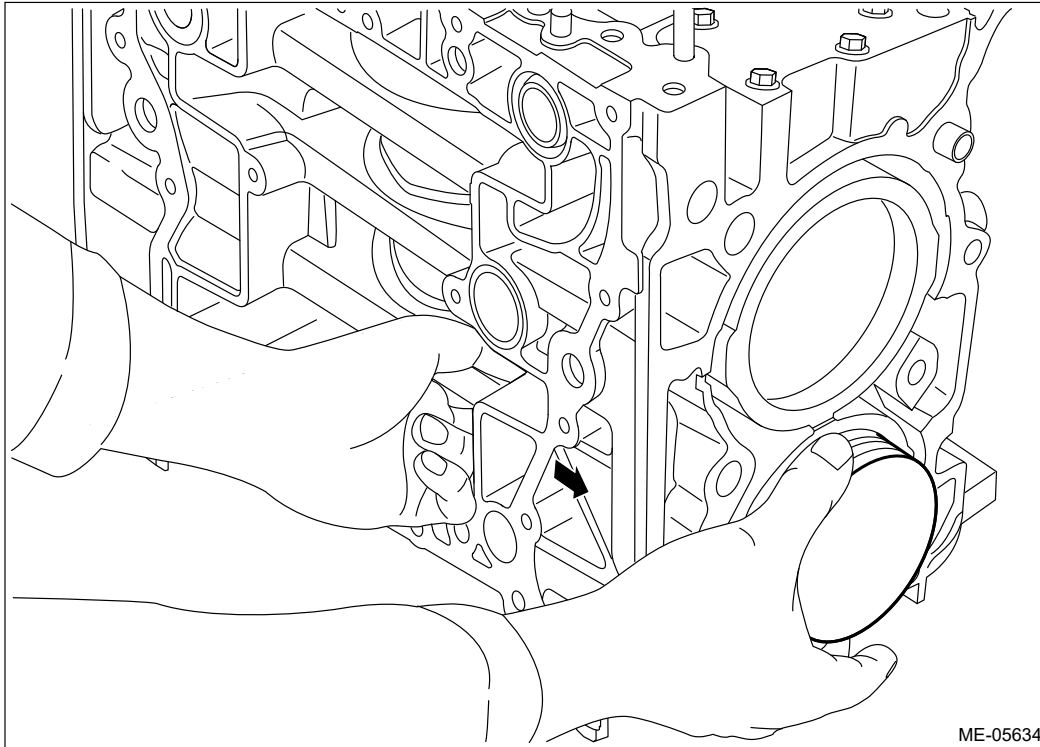
- (6) Using the ST, turn the crankshaft clockwise and separate the positions of the #4 pin (A) of crankshaft and the large end (B) of #4 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET



ME-08509

- (7) Push the #4 connecting rod in the direction of the arrow, and remove the #4 piston with #4 connecting rod from the cylinder block.



ME-05634

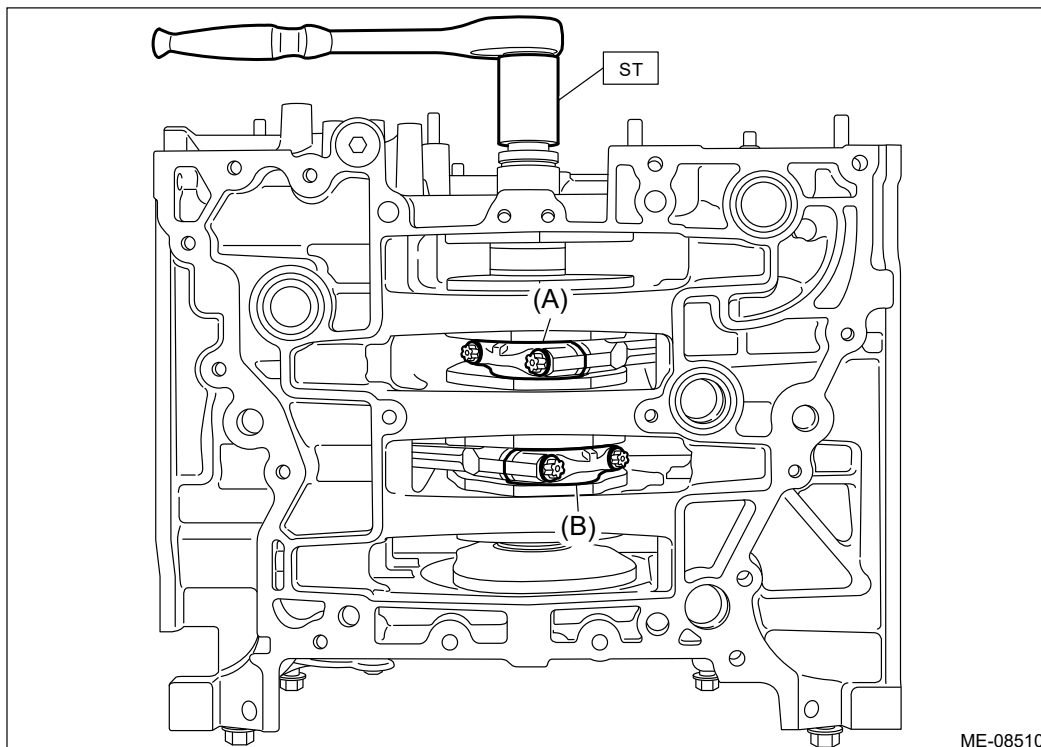
- 24.** Remove the #2 and #3 connecting rod caps and pistons from the cylinder block.

Note:

Mark each connecting rod cap and piston with a cylinder number.

- (1) Turn the crankshaft so that the #2 connecting rod cap (A) and #3 connecting rod cap (B) is located at the position shown in the figure using ST.

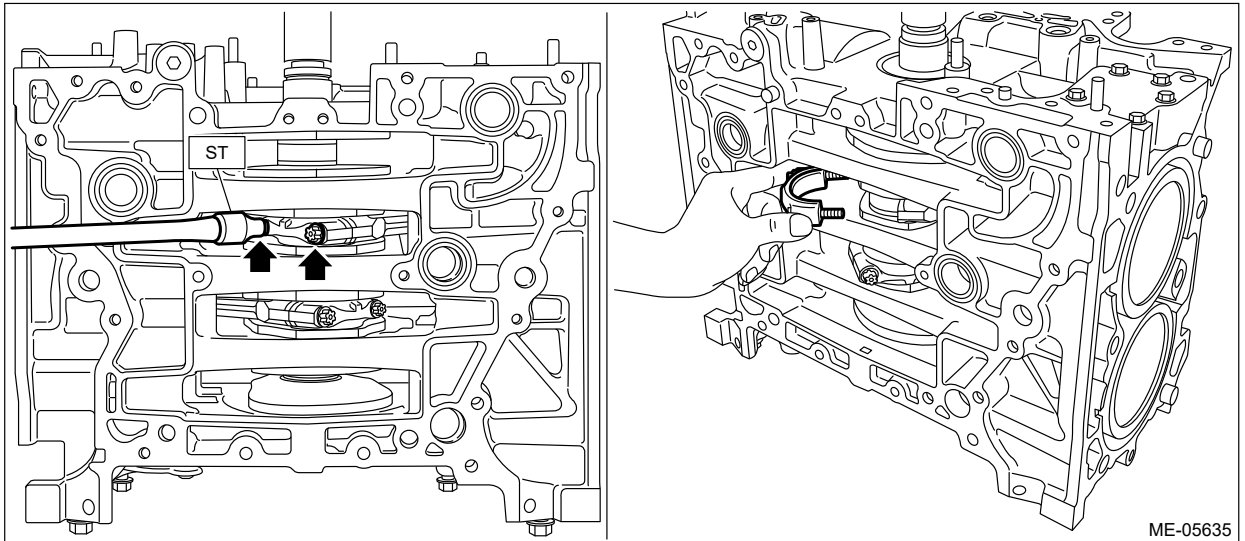
ST 18252AA000 CRANKSHAFT SOCKET



ME-08510

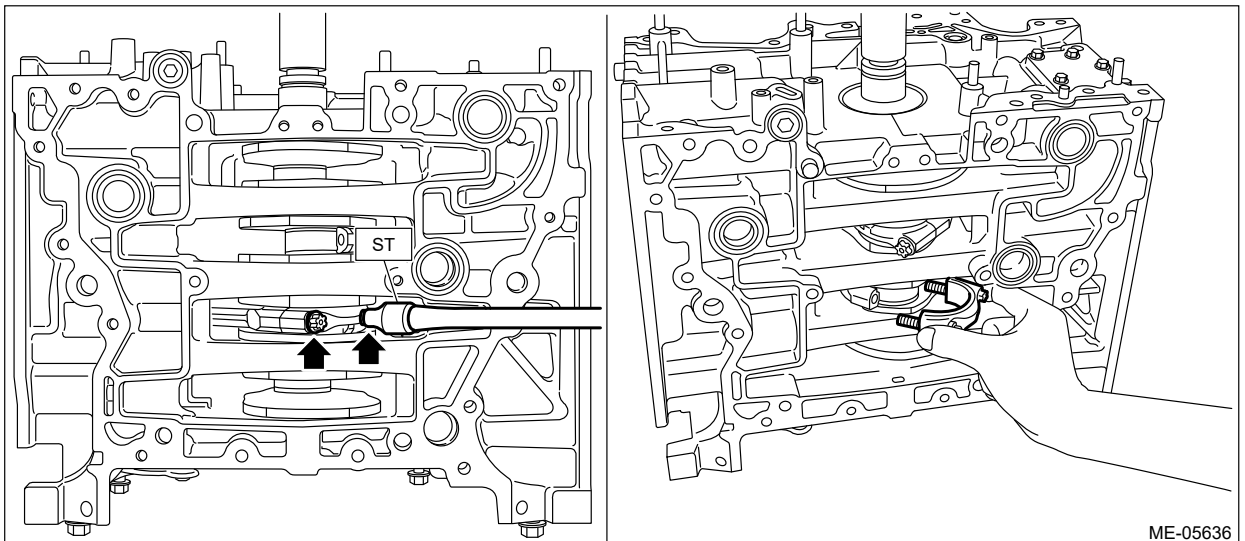
- (2) Using ST, loosen the #2 connecting rod cap bolt, and remove the #2 connecting rod cap bolt and #2 connecting rod cap.

ST 18270AA020 SOCKET



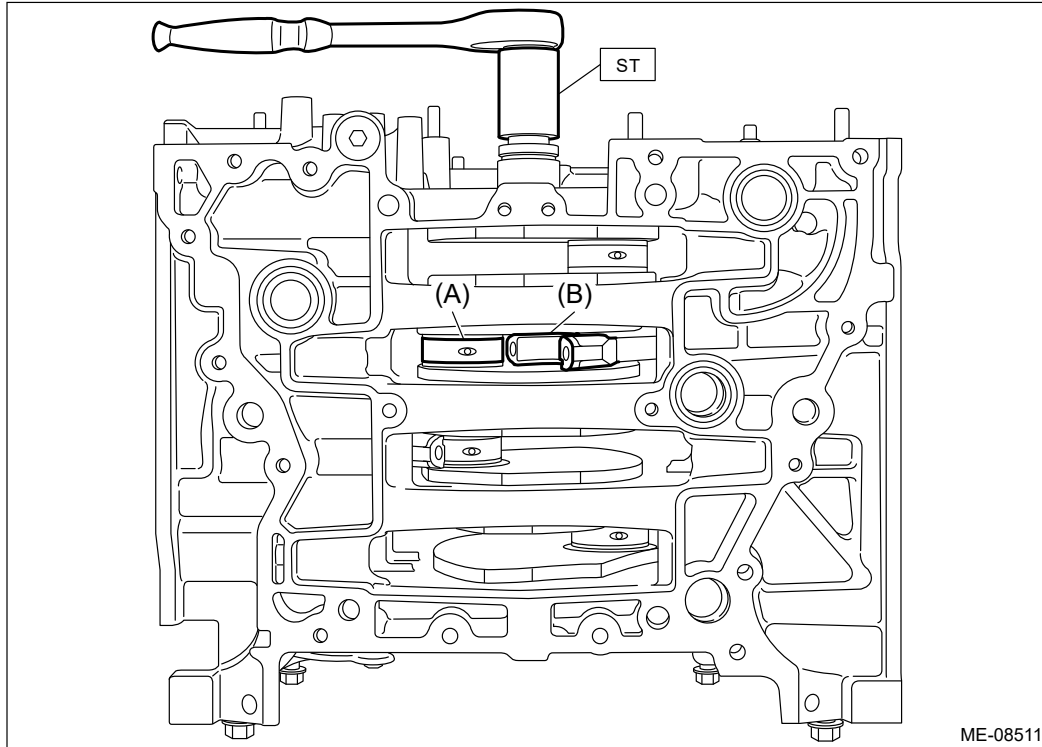
- (3) Using ST, loosen the #3 connecting rod cap bolt, and remove the #3 connecting rod cap bolt and #3 connecting rod cap.

ST 18270AA020 SOCKET

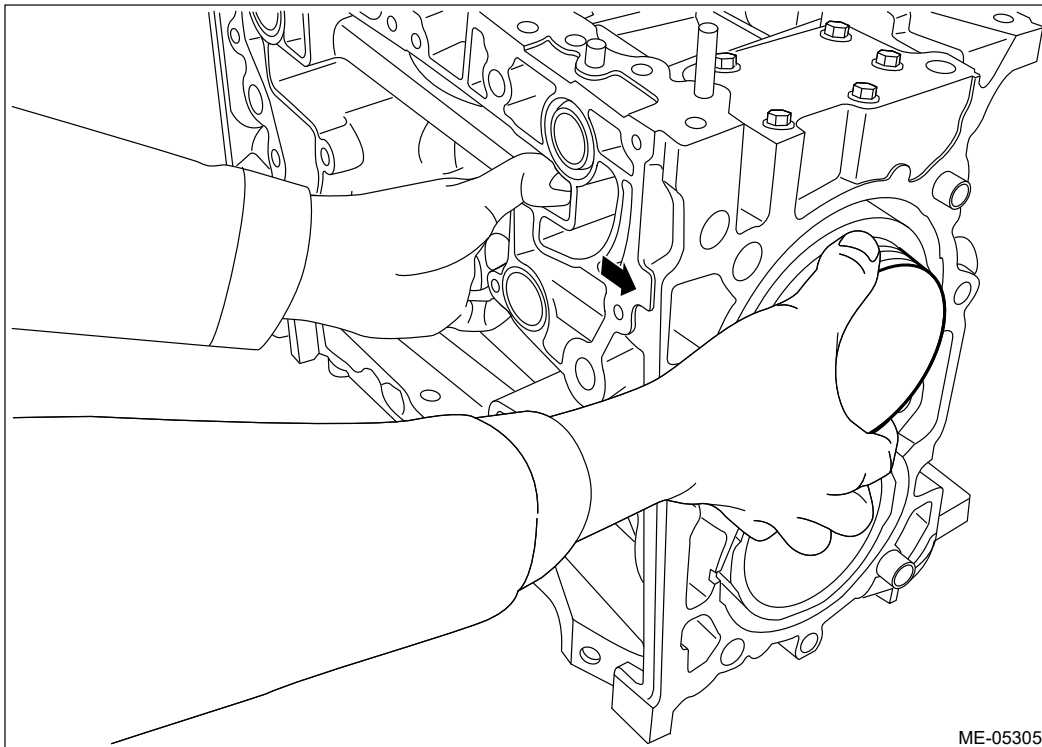


- (4) Using the ST, turn the crankshaft clockwise and separate the positions of the #2 pin (A) of crankshaft and the large end (B) of #2 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET

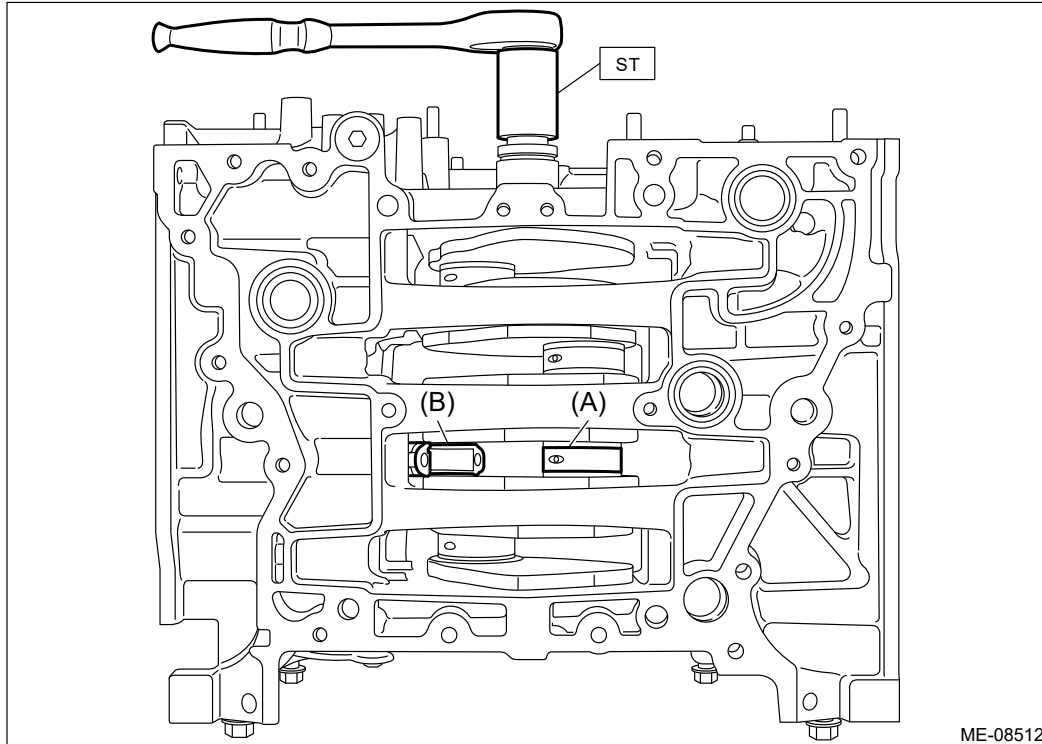


- (5) Push the #2 connecting rod in the direction of the arrow, and remove the #2 piston with #2 connecting rod from the cylinder block.



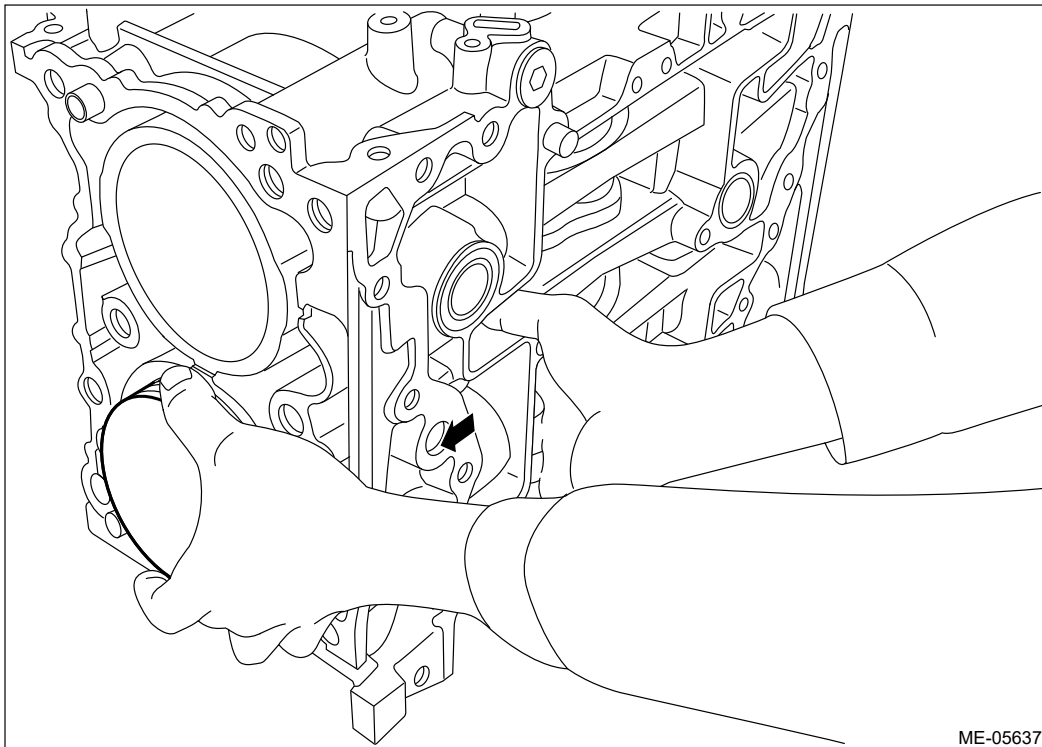
- (6) Using the ST, turn the crankshaft counterclockwise and separate the positions of the #3 pin (A) of crankshaft and the large end (B) of #3 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET



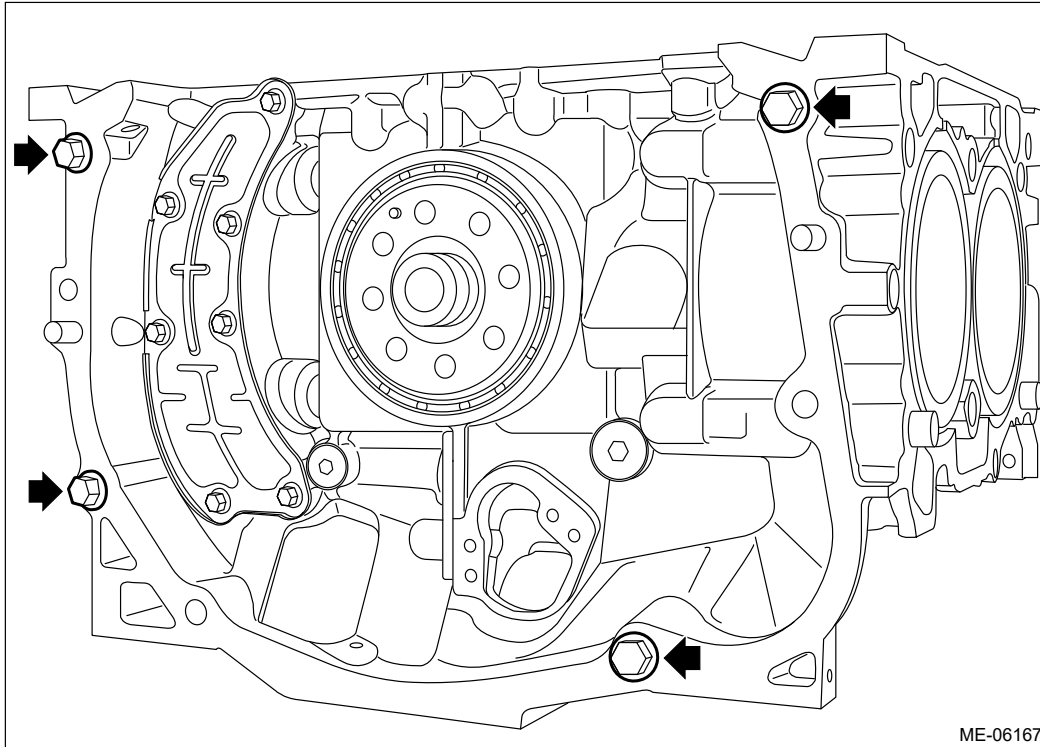
ME-08512

- (7) Push the #3 connecting rod in the direction of the arrow, and remove the #3 piston with #3 connecting rod from the cylinder block.



ME-05637

- 25.** Set the cylinder block so that the oil pan side of the block faces upward, and remove the mounting bolts attached to the locations shown in the figure.

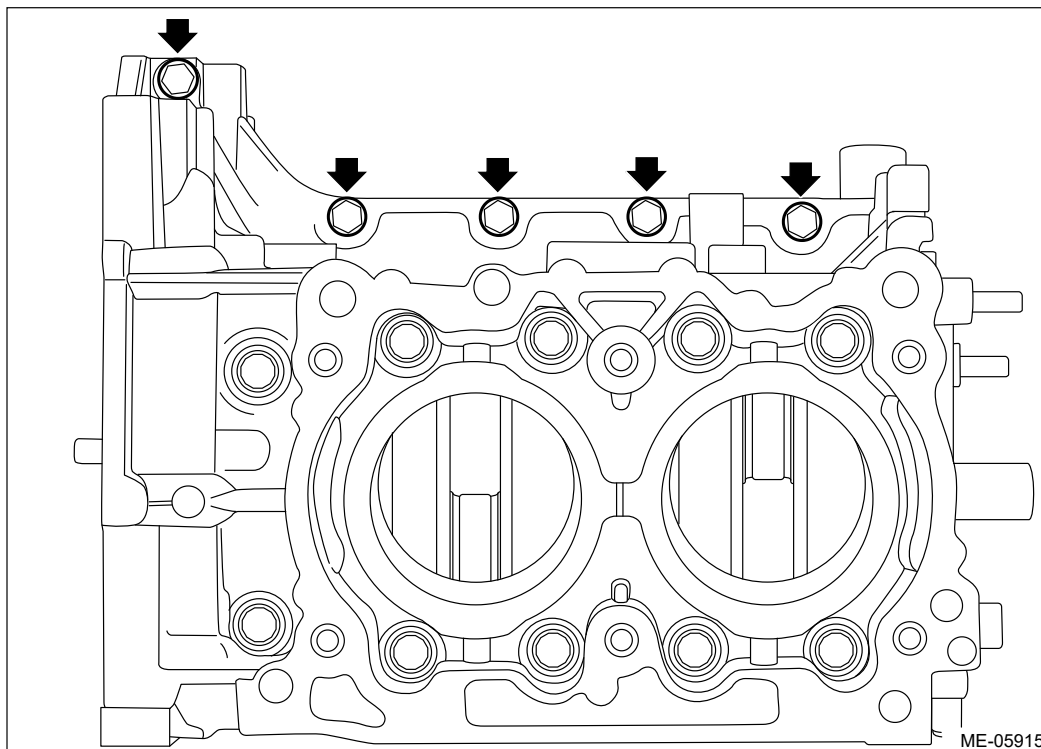


26. Set the part so that the cylinder block RH is on the upper side, and separate the cylinder block.

Caution:

- Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
- Be careful not to scratch the mating surface of cylinder block during work.

(1) Remove the bolt shown in the figure.

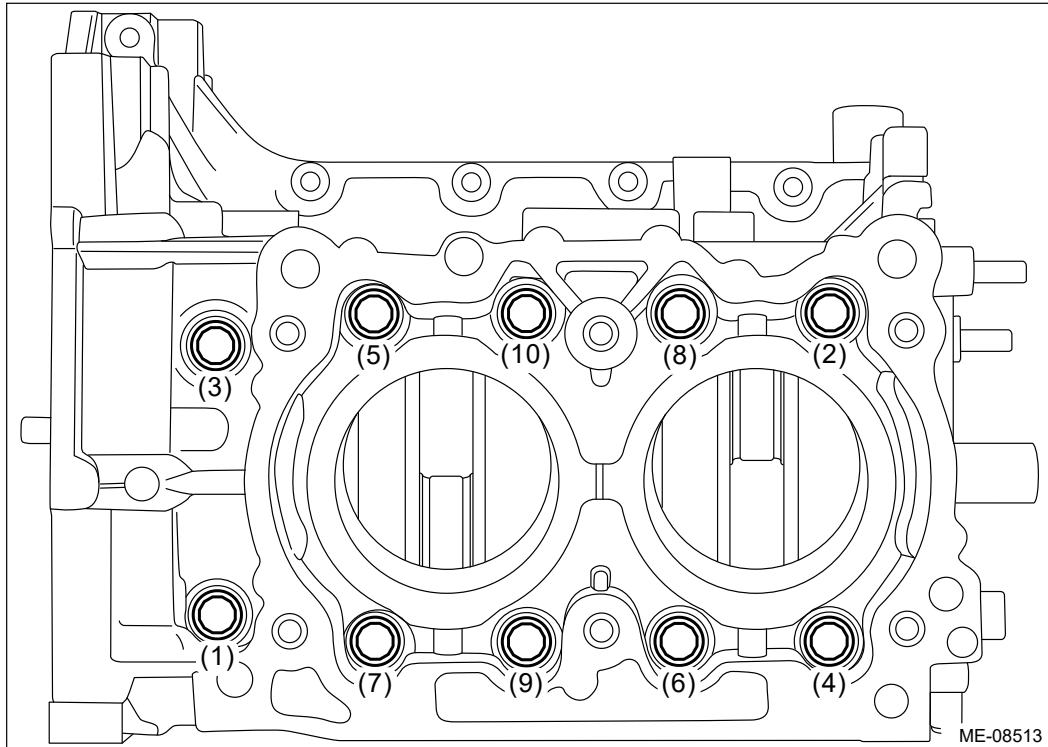


(2) Loosen the cylinder block mounting bolts in numerical order as shown in the figure, and separate

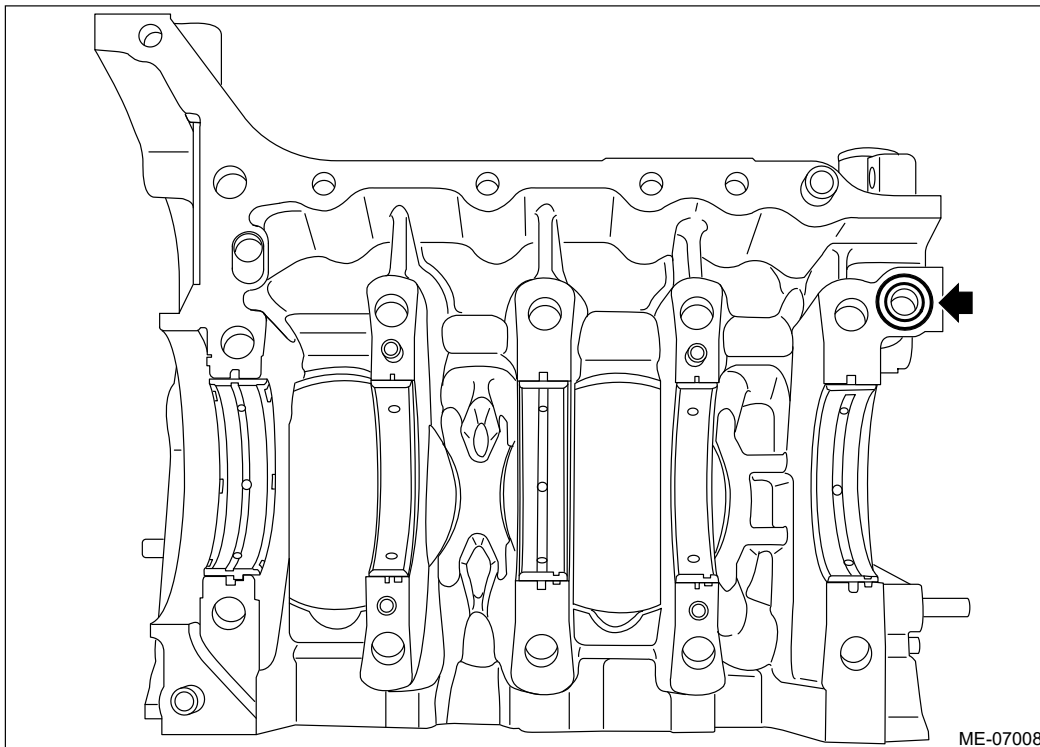
the cylinder block RH and LH.

Note:

Lift the cylinder block RH slightly, and confirm that the crankshaft is remaining in the cylinder block LH. If the cylinder block RH is lifted carelessly when separating, the crankshaft may stick to cylinder block RH, then fall off.



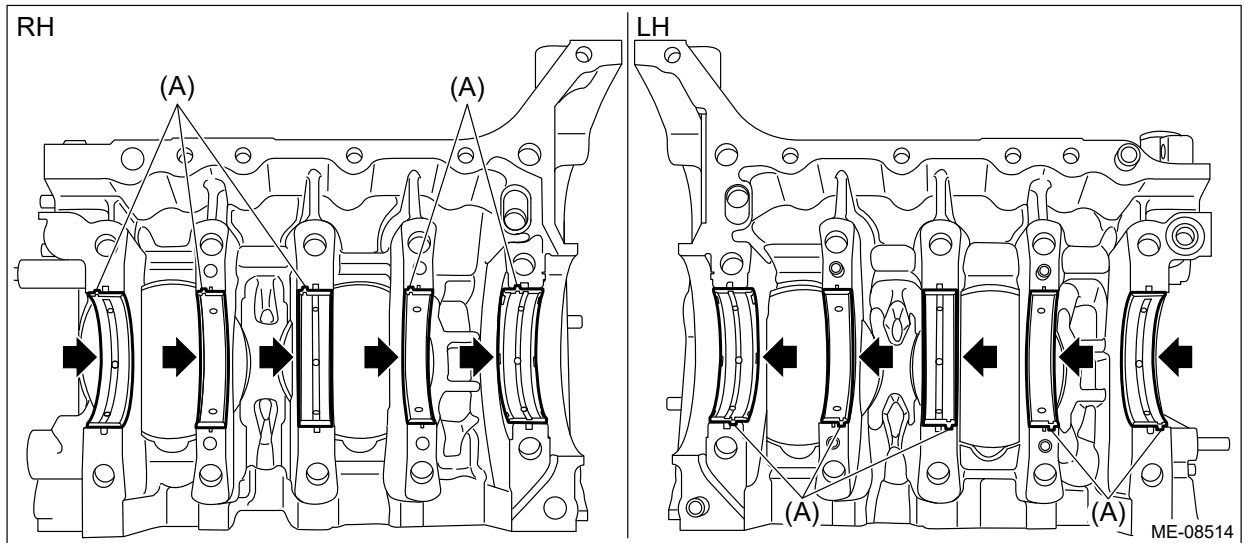
- 27.** Remove the crankshaft from cylinder block LH, and remove the rear oil seal.
- 28.** Remove the O-ring from the cylinder block LH.



29. Remove the crankshaft bearings from the cylinder block.

Note:

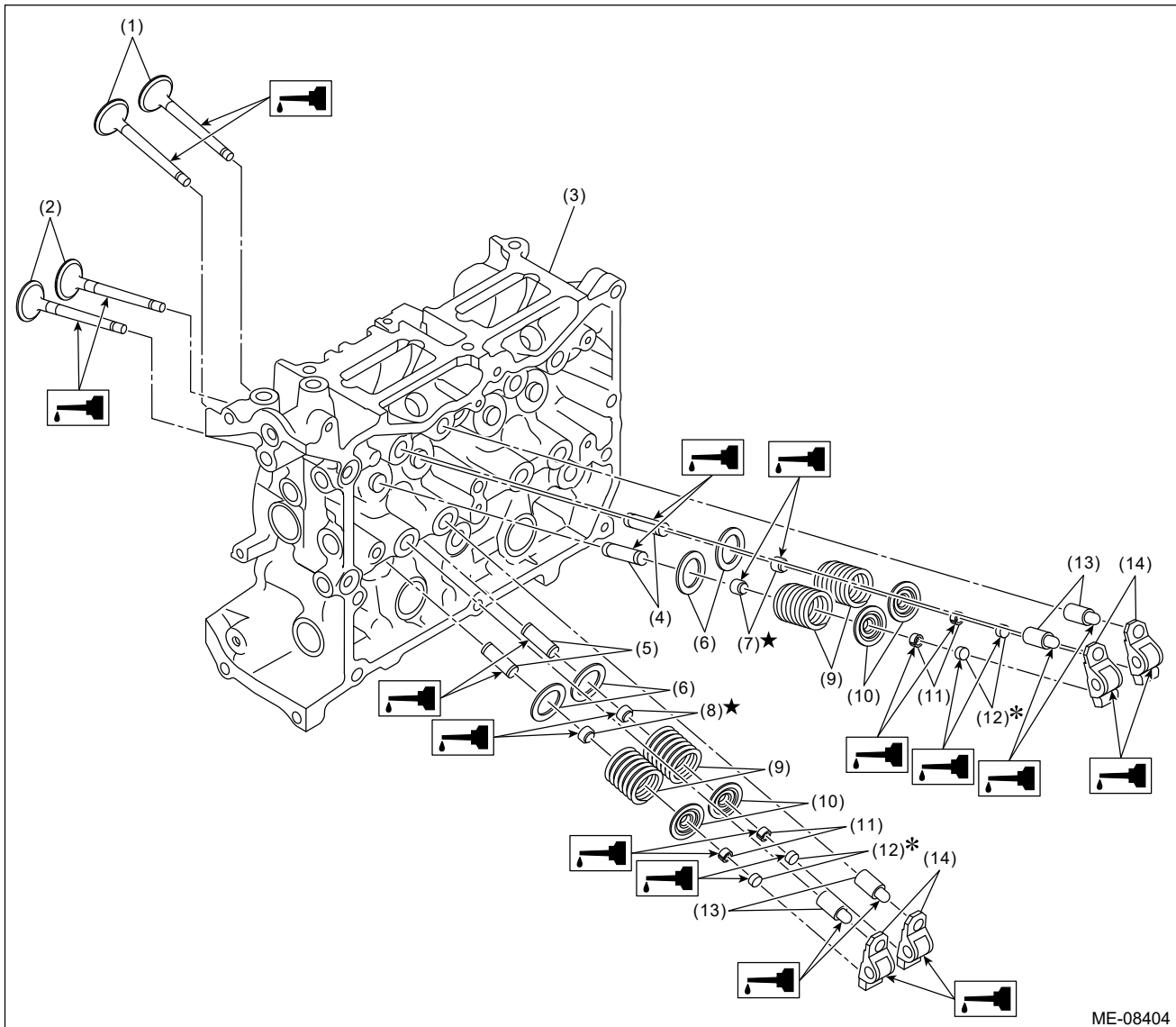
- **Be careful not to confuse the crankshaft bearing combination.**
- **Press the bearing at the end opposite to locking lip (A).**



30. Remove the liquid gasket from cylinder block.

MECHANICAL(H4DO) > Cylinder Head

ASSEMBLY



ME-08404

- | | | |
|-------------------------|----------------------------|------------------------------|
| (1) Exhaust valve | (6) Valve spring seat | (11) Valve collet |
| (2) Intake valve | (7) Intake valve oil seal | (12) Valve shim |
| (3) Cylinder head | (8) Exhaust valve oil seal | (13) Roller rocker arm pivot |
| (4) Intake valve guide | (9) Valve spring | (14) Roller rocker arm |
| (5) Exhaust valve guide | (10) Valve spring retainer | |

1. Using the ST, install the valve oil seals to valve guides of cylinder head RH.

Caution:

- **During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.**
- **Use special care not to damage the cylinder head RH and guide during work.**
- **When installing the valve oil seal, press the ST with hands to install it and never drive the ST with a plastic hammer, otherwise the valve oil seal can be damaged.**

Note:

- Use a new valve oil seal.
- Apply engine oil to valve oil seal before installing.
- The intake valve oil seals and exhaust valve oil seals are distinguished by their colors.

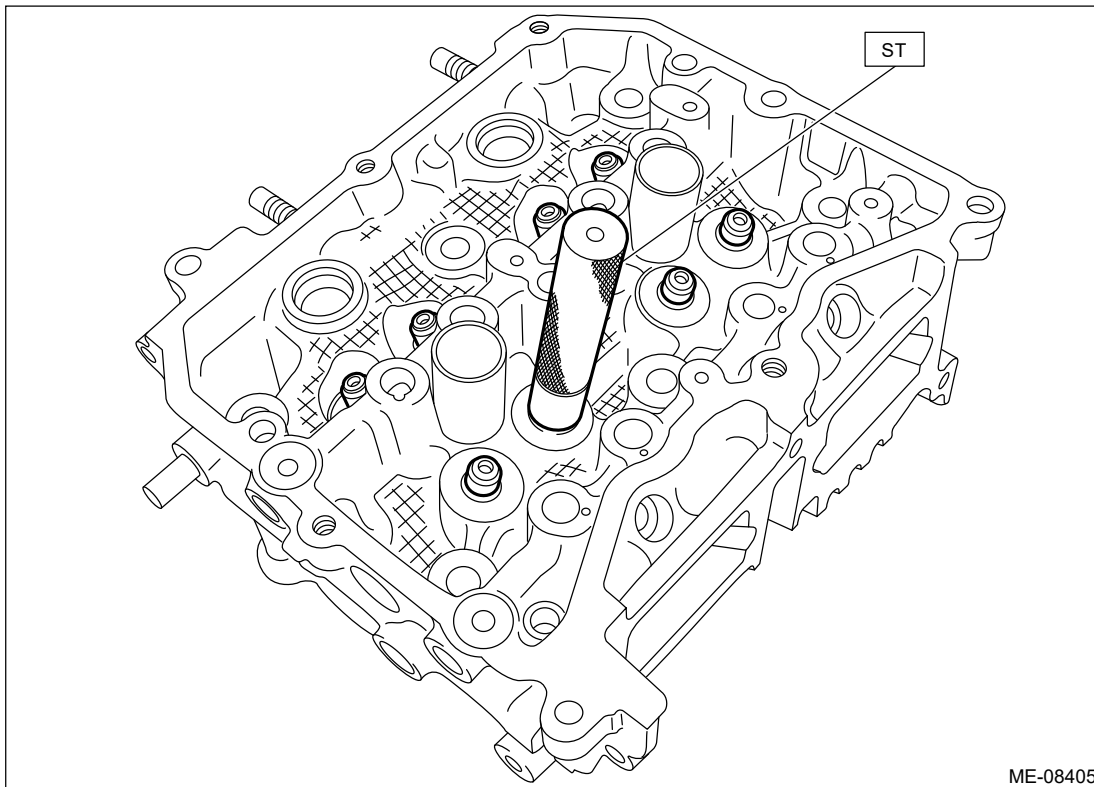
Identification colors:

Intake [Gray]

Exhaust [Green]

- For installation of valve guide, refer to INSPECTION.  Ref. to [MECHANICAL\(H4DO\)>Cylinder Head>INSPECTION > VALVE & VALVE GUIDE.](#)

ST 18261AA010 VALVE OIL SEAL GUIDE



2. For cylinder head LH, install the valve oil seal in the same manner.
3. Install the valve spring seat, valve spring, valve spring retainer, valve and valve collet to the cylinder head RH.

Caution:

During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.

- (1) Set the valve spring seat, valve spring and valve spring retainer onto the cylinder head RH.

Note:

Be sure to install the valve spring with its close-coiled end facing the cylinder head side.

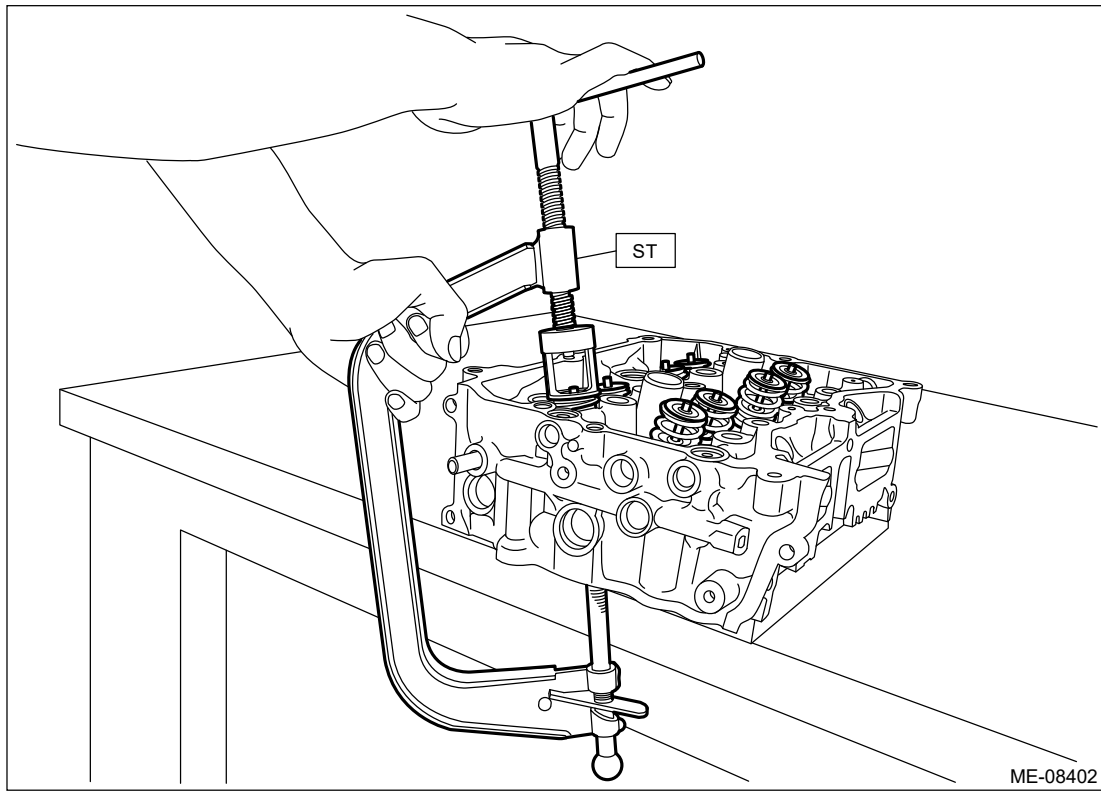
- (2) Coat the valve stem of each valve with engine oil and insert the valve into valve guide.

Note:

When inserting the valve into valve guide, use special care not to damage the oil seal lip.

(3) Compress the valve spring and install the valve collet using ST.

ST 0920287002000 REMOVER AND REPLACER

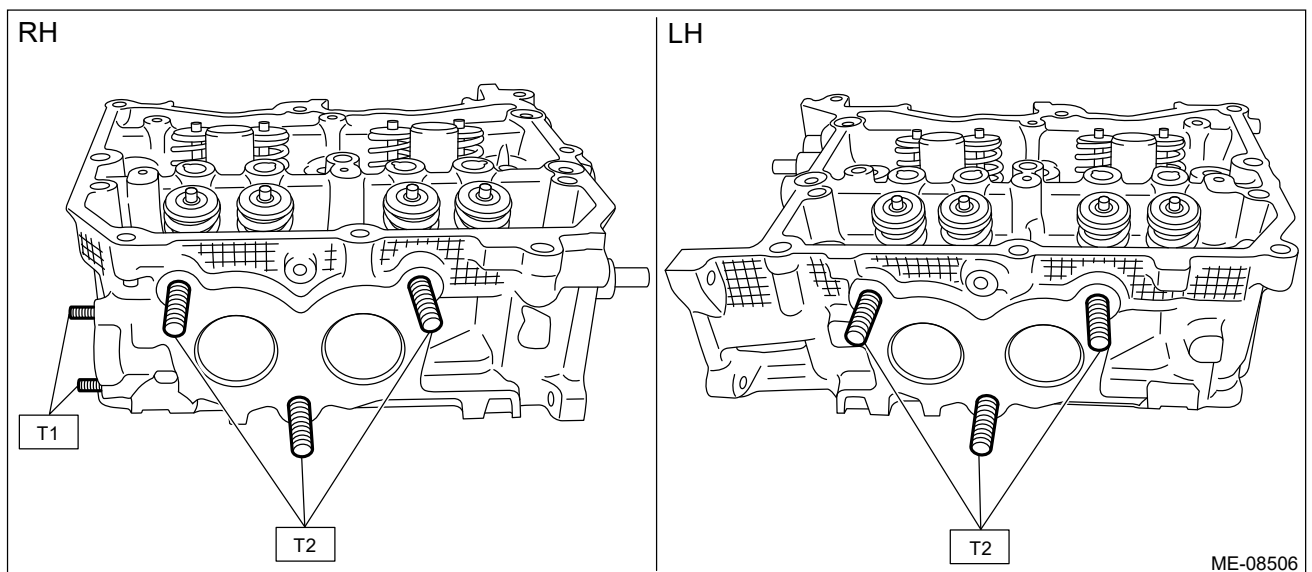


4. Install the valve spring seat, valve spring, valve spring retainer, valve and valve collet to the cylinder head LH.
5. Lightly tap the valve spring retainer with a plastic hammer, and make sure that the valve collet is securely attached.
6. Install the stud bolts onto cylinder heads.

Tightening torque:

T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

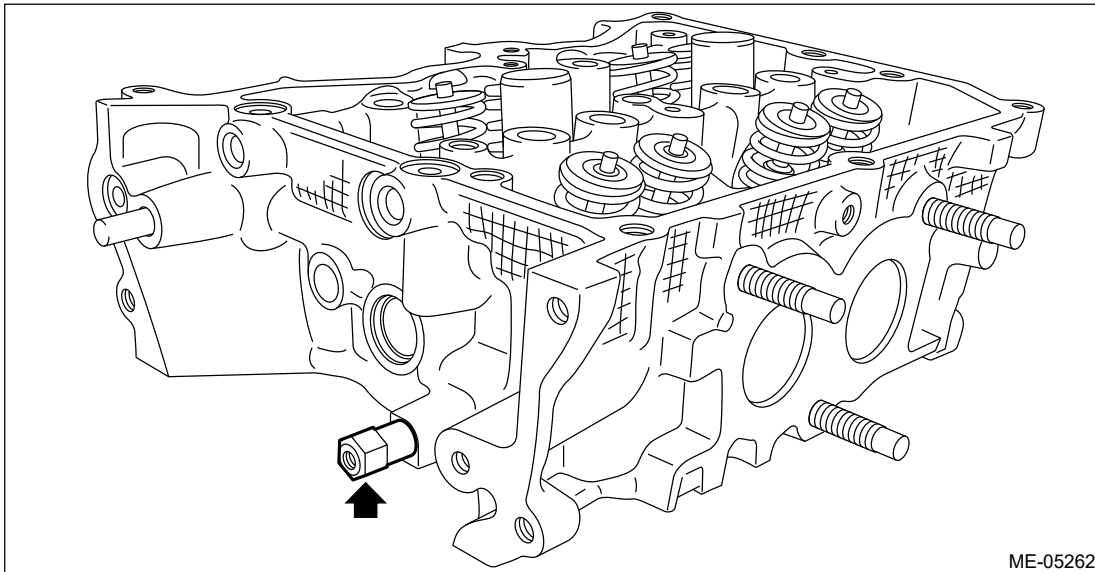
T2: 18 N·m (1.8 kgf-m, 13.3 ft-lb)



7. Install the chain cover securing bolt to the cylinder head LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

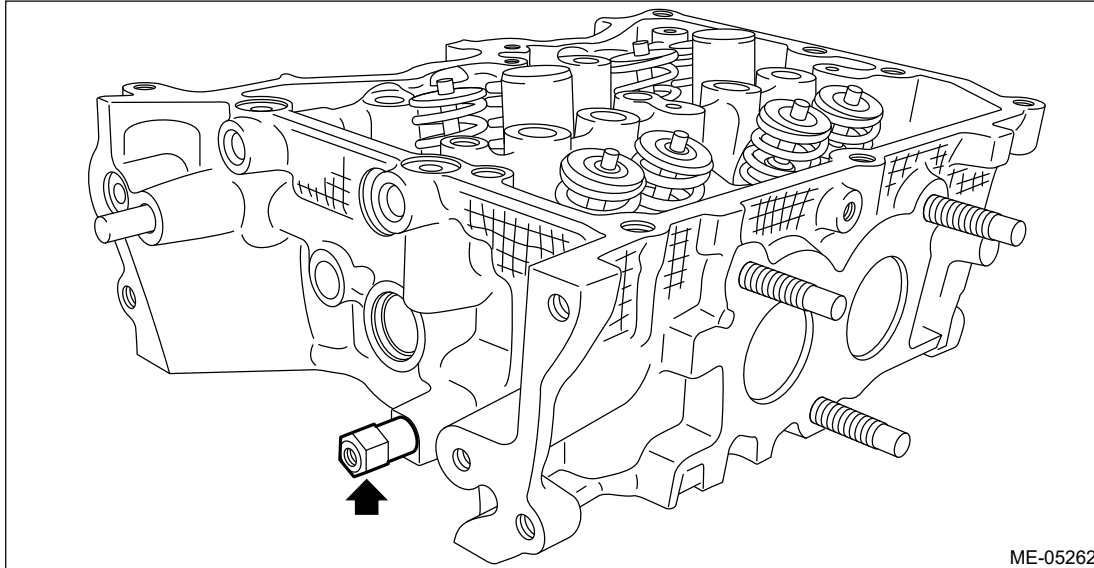


ME-05262

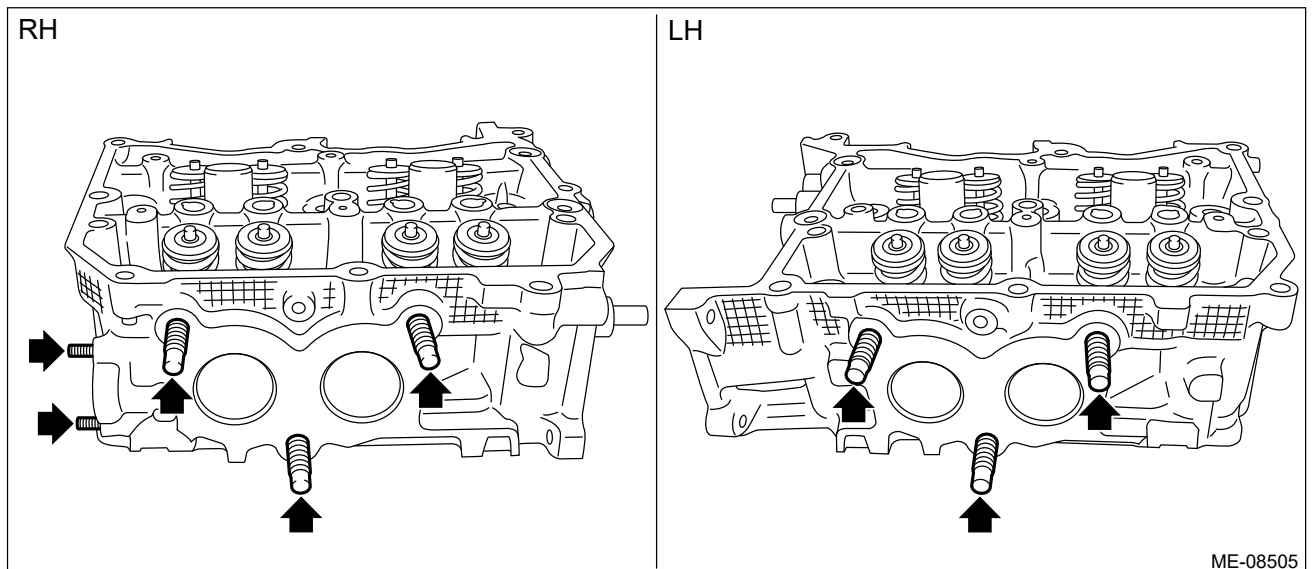
MECHANICAL(H4DO) > Cylinder Head

DISASSEMBLY

1. Remove the chain cover securing bolt from the cylinder head LH.



2. Remove the stud bolts from the cylinder head.



3. Remove the valve collet, valve, valve spring retainer, valve spring and valve spring seat from the cylinder head RH.

Caution:

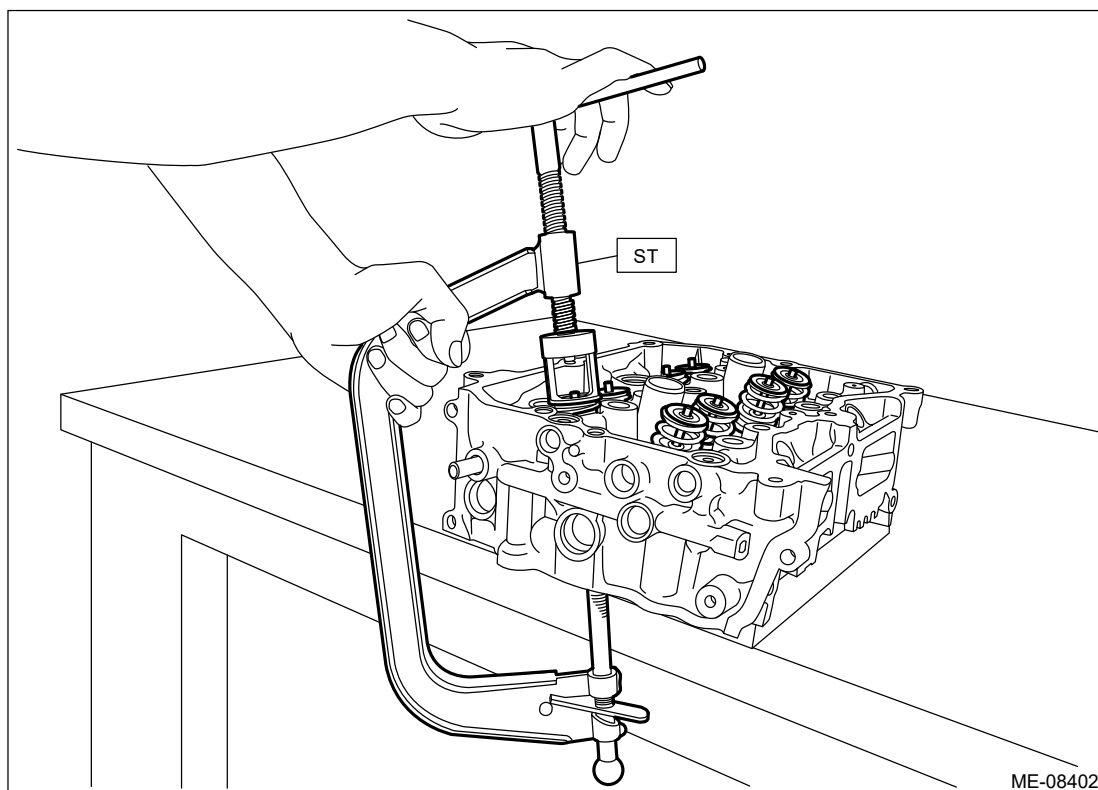
During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.

Note:

- Mark each part to prevent confusion.
- Keep all the removed parts in order for re-installing in their original positions.

- (1) Compress the valve spring and remove the valve collet using ST.

ST 0920287002000 REMOVER AND REPLACER



(2) Remove valve, valve spring retainer, valve spring and valve spring seat.

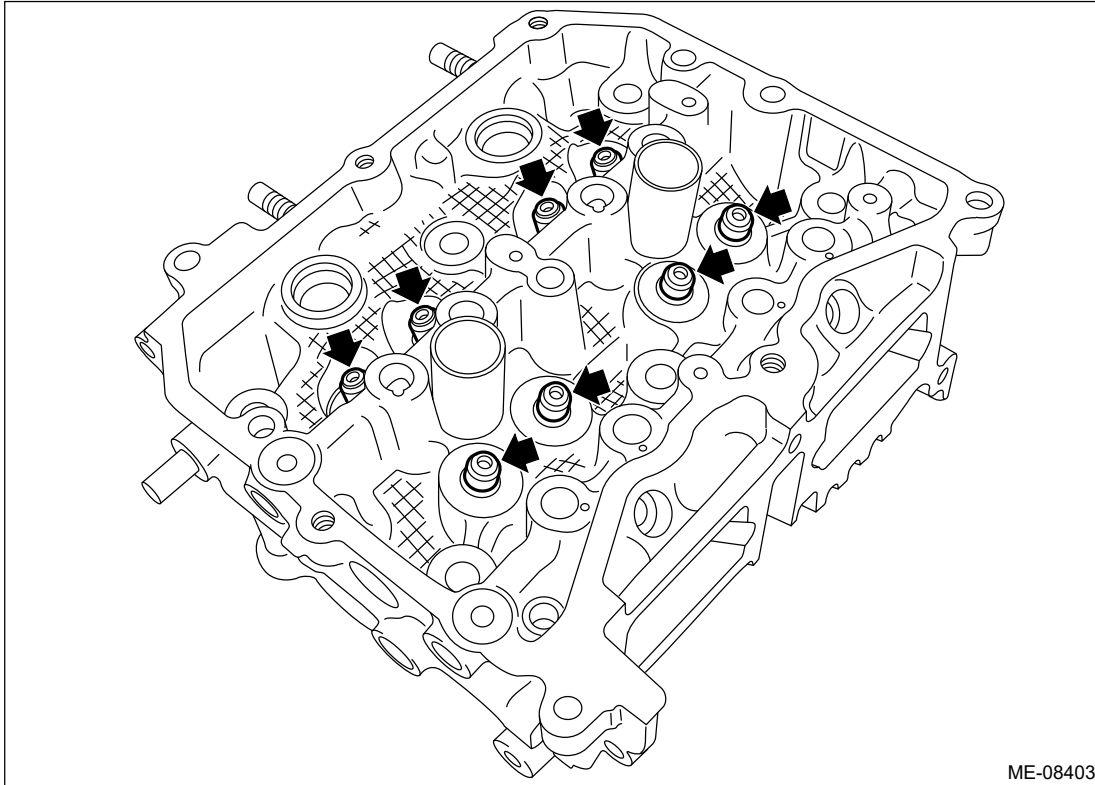
4. Remove the valve collet, valve, valve spring retainer, valve spring and valve spring seat from the cylinder head LH.
5. Remove the valve oil seals from valve guides of cylinder head RH.

Caution:

- **During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.**
- **Use special care not to damage the cylinder head RH and guide during work.**

Note:

For removal of valve guide, refer to INSPECTION.  Ref. to [MECHANICAL\(H4DO\)>Cylinder Head>INSPECTION > VALVE & VALVE GUIDE.](#)



ME-08403


6. For cylinder head LH, remove the valve oil seal in the same manner.

INSPECTION

1. CYLINDER HEAD

1. Visually inspect to make sure that there are no cracks, scratches or other damage.
2. Use liquid penetrant tester on the important sections to check for fissures.
3. Check that there are no marks of gas leaking or water leaking on gasket attachment surface.
4. Check the warping of the cylinder head mating surface that mates with cylinder block at the locations shown in the figure using a straight edge (A) and thickness gauge (B). If it exceeds the limit, correct the surface by grinding it with a surface grinder or replace the cylinder head.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
 - **If there is warpage on the cylinder head mating surface, the cylinder head bolt tightening torque and angle tightening may be improper. When installing the cylinder head, make sure that tightening torque and angle tightening work is performed precisely according to the operation procedures.**
 - **When the cylinder head is replaced, lap each valve. Refer to "VALVE SEAT" for lapping. **
- [Ref. to MECHANICAL\(H4DO\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)**

Cylinder head warpage:

Limit

0.020 mm (0.0008 in)

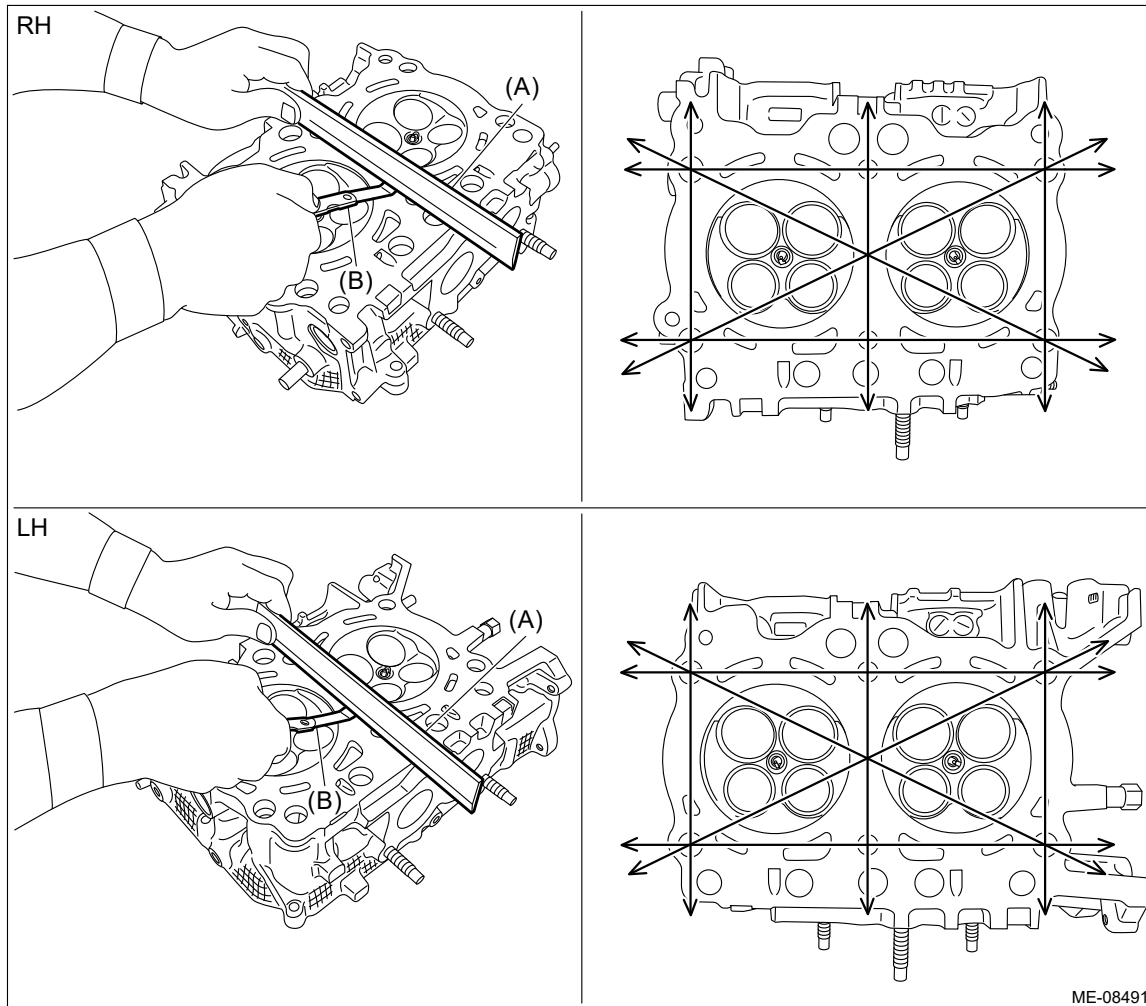
Cylinder head grinding limit:

98.4 mm (3.874 in) or less

Cylinder head height:

Standard

98.5 mm (3.878 in)



2. VALVE & VALVE GUIDE

1. Check the valve flange and stem for damage, wear or deformation.
2. Measure the thickness "H" of valve head edge as shown in the figure using a caliper gauge. If it is not within the standard, replace the valve.

Note:

- It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

Valve overall length:

Intake

104.95 mm (4.132 in)

Exhaust

96.5 mm (3.799 in)

- When the valve is replaced, lap the valve. Refer to "VALVE SEAT" for lapping.  Ref. to [MECHANICAL\(H4DO\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

Valve head edge thickness H:

Intake (A)

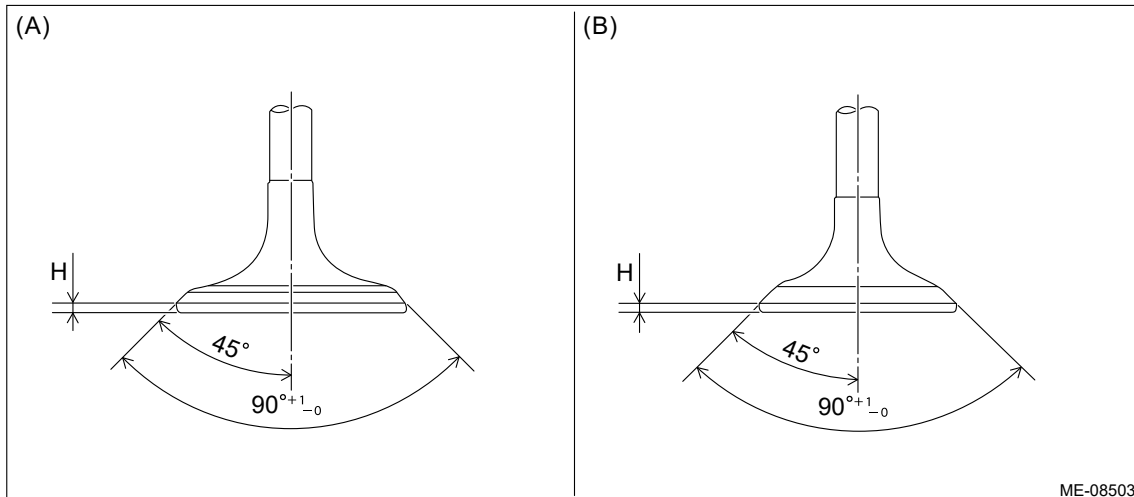
Standard

0.8—1.2 mm (0.031—0.047 in)

Exhaust (B)


Standard

1.0—1.4 mm (0.039—0.055 in)



3. Check the clearance between valve and valve guide. Check the clearance between valve and valve guide by measuring the outer diameter of valve stem and the inner diameter of valve guide respectively.
- (1) Measure the outer diameter of valve stem with a micrometer. If it is not within the standard, replace the valve.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the valve stem at the six locations as shown in the figure, and read the value of most worn location.
- When the valve is replaced, lap the valve. Refer to "VALVE SEAT" for lapping.  [Ref. to MECHANICAL\(H4DO\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

Valve stem outer diameter:

Intake

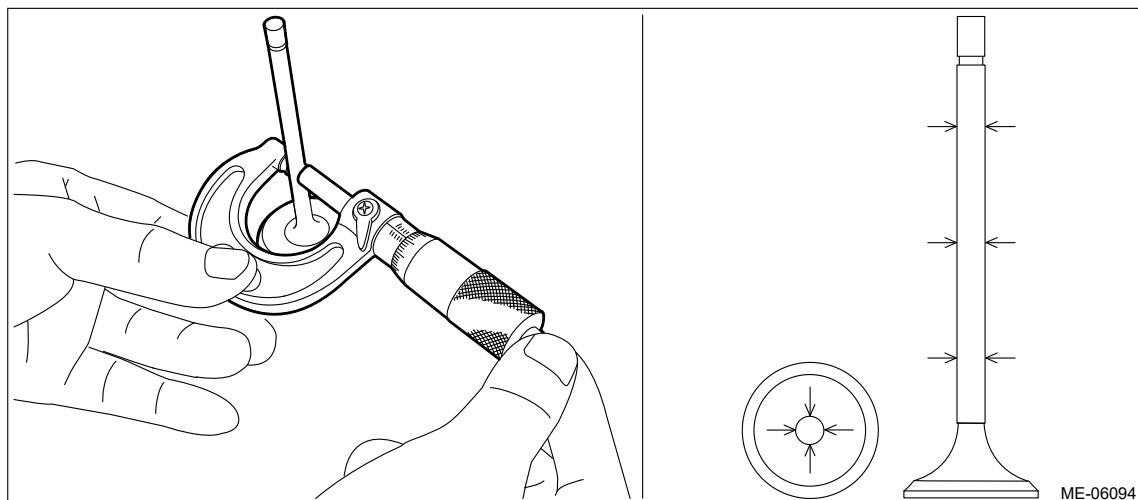
Standard

5.455—5.470 mm (0.2148—0.2154 in)

Exhaust

Standard

5.445—5.460 mm (0.2144—0.2150 in)



- (2) Using a caliper gauge, measure the inner diameter of valve guide. If it is not within the standard, replace the valve guide. For replacement procedure, refer to step 4).

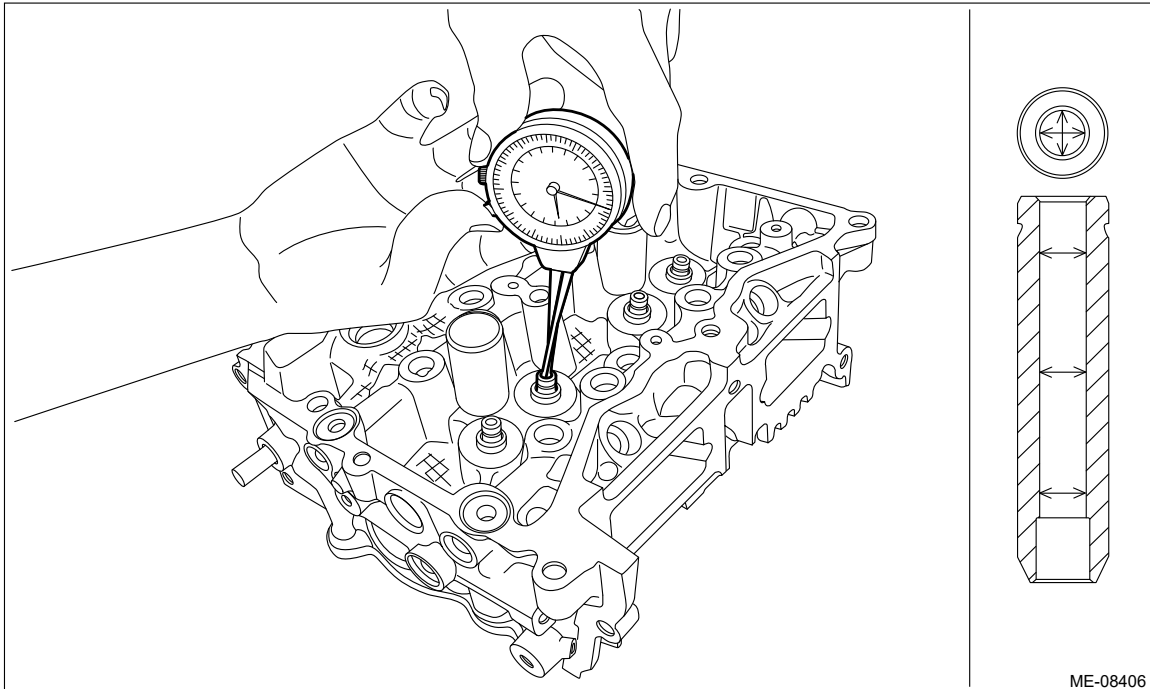
Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of the valve guide at the six locations as shown in the figure, and read the value of most worn location.

Valve guide inner diameter:

Standard

5.500—5.512 mm (0.2165—0.2170 in)



- (3) Calculate the clearance between valve and valve guide.

Clearance between valve and valve guide:

Intake

Standard

0.030—0.057 mm (0.0012—0.0022 in)

Exhaust

Standard

0.040—0.067 mm (0.0016—0.0026 in)

4. If the clearance between valve and valve guide exceeds the standard, replace the valve or valve guide, whichever shows the greater amount of wear or damage. For replacement procedure of valve guide, refer to the following.

Note:

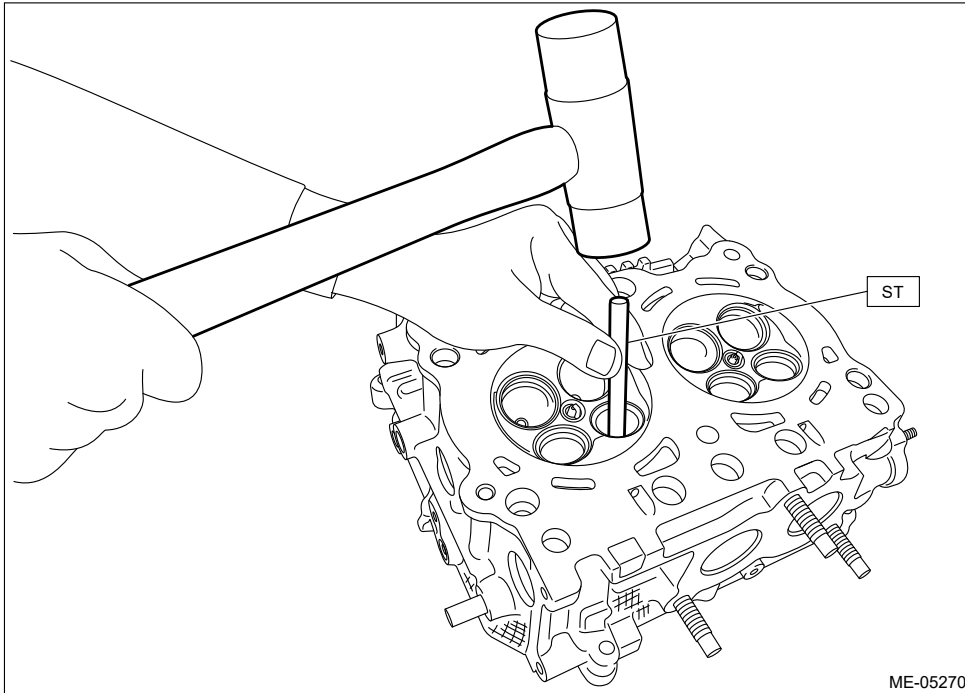
When the valve is replaced, lap the valve. Refer to "VALVE SEAT" for lapping.  Ref. to [MECHANICAL\(H4DO\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

- (1) Insert ST into the valve guide with the combustion chamber upward and remove the valve guide using plastic hammer.

Caution:

- **Place a wood board wrapped with a waste cloth to stabilize the cylinder head before work.**
- **Use special care not to damage the cylinder head during work.**
- **Always strike the ST vertically with a plastic hammer. Otherwise, the ST can be damaged.**

ST 499765700 VALVE GUIDE REMOVER AND INSTALLER



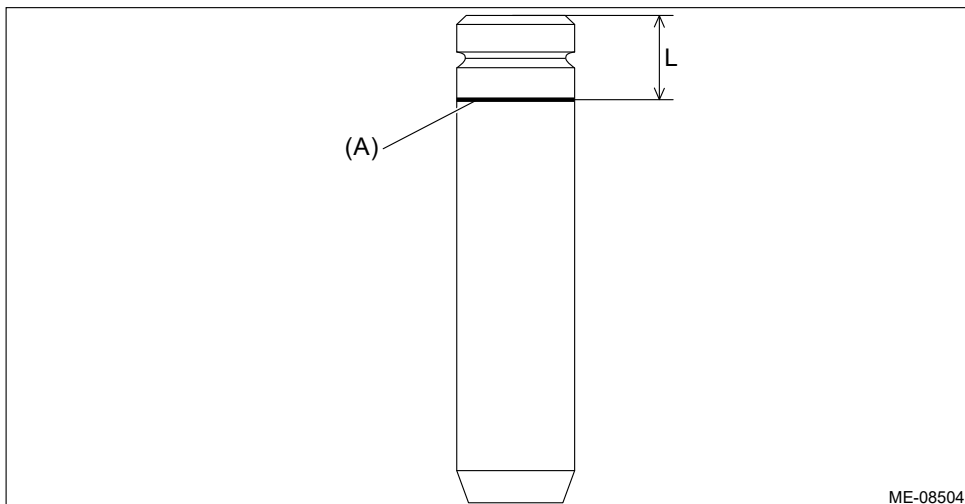
- (2) Before installing the valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide installation holes of cylinder head.
- (3) Draw a reference line (A) for insert on the valve guide using a marker as shown in the figure.

Note:

- Use a new valve guide.
- A reference line for insert is used as a guide when tapping-in the valve guide.

Valve guide inserting reference line position L:

15 mm (0.5906 in)

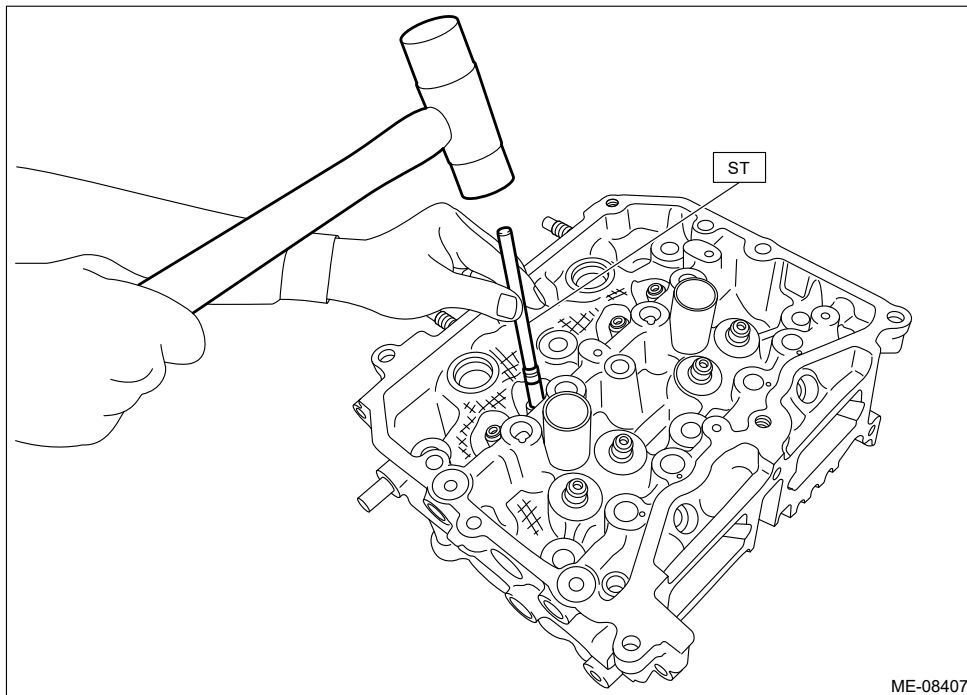


- (4) Apply a enough coat of engine oil to the valve guide, and set the valve guide on the cylinder head with the combustion chamber downward.
- (5) Insert the ST into the valve guide, and tap-in the valve guide to the reference line (A) for insert using plastic hammer.

Caution:

- During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head.
- Use special care not to damage the cylinder head during work.
- Always strike the ST vertically with a plastic hammer. Otherwise, the ST can be damaged.

ST 499765700 VALVE GUIDE REMOVER AND INSTALLER



- (6) Measure the valve guide protrusion amount "L" as shown in the figure using a caliper gauge. Insert the ST into the valve guide again, and tap-in the valve guide so that it is positioned within standard by referring to the measured value using plastic hammer.

Caution:

- During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head.
- Use special care not to damage the cylinder head during work.
- Always strike the ST vertically with a plastic hammer. Otherwise, the ST can be damaged.

Note:

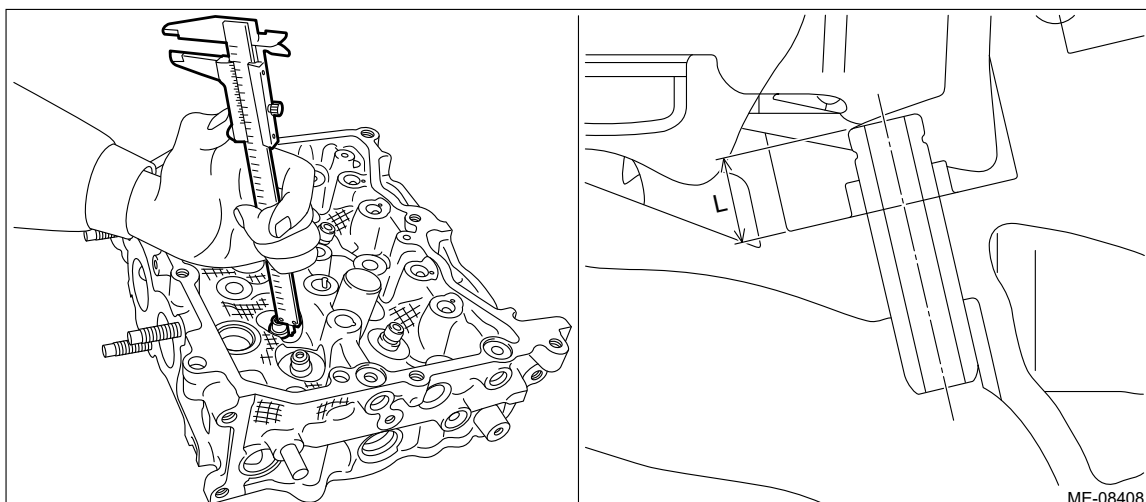
Be careful not to tap-in excessively by repeating the steps of Tapping-in → Measurement → Tapping-in → Measurement ... when installing the valve guide.

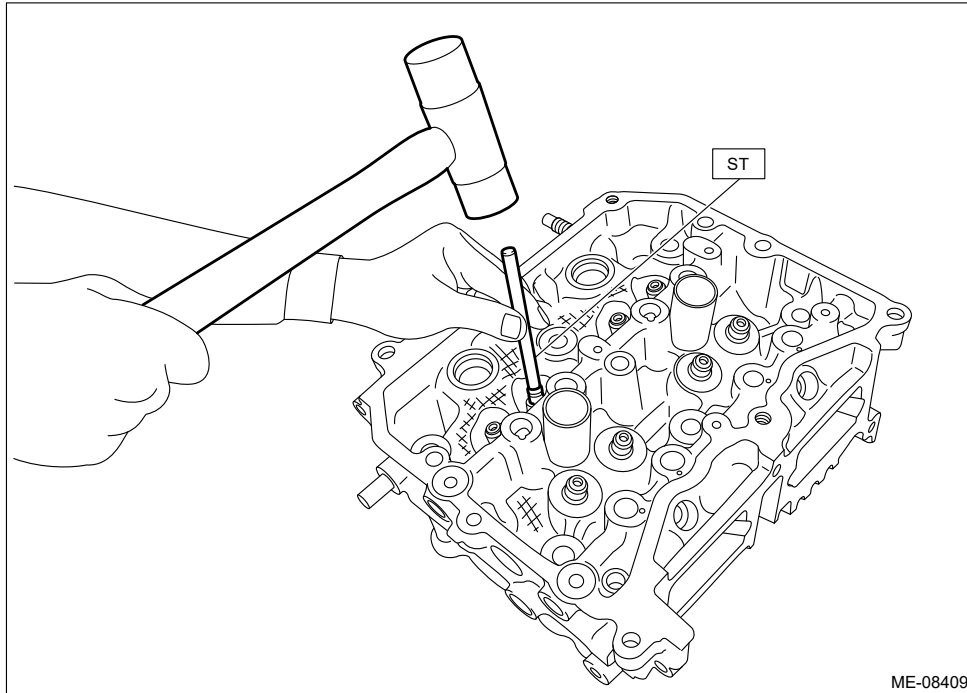
ST 499765700 VALVE GUIDE REMOVER AND INSTALLER

Valve guide protrusion amount L:

Standard

11.4–11.8 mm (0.449–0.465 in)





- (7) Ream the inside of valve guide with the combustion chamber upward using the ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

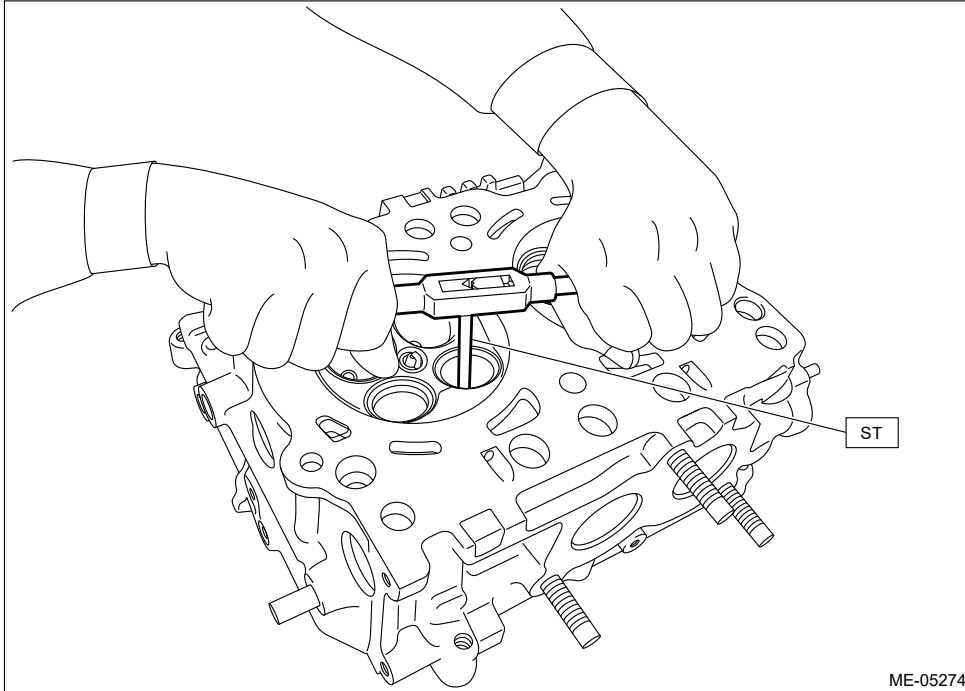
Caution:


- **Place a wood board wrapped with a waste cloth to stabilize the cylinder head before work.**
- **Use special care not to damage the cylinder head during work.**

Note:

- **Apply engine oil to the ST.**
- **If the inner surface of valve guide is damaged, the edge of ST should be slightly ground with oil stone.**
- **If the inner surface of valve guide becomes lustrous and the ST does not chip, use a new ST or remedy the ST.**

ST 499765900 VALVE GUIDE REAMER




- (8) After reaming, clean the valve guide to remove chips.
- (9) Check the seating width between valve and valve seat.  [Ref. to MECHANICAL\(H4DO\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

3. VALVE & VALVE SHIM

- 1. Visually check the valve shim for damage.
- 2. Check the clearance between valve and valve shim. Check the clearance between valve and valve shim by measuring the outer diameter of valve stem end and the inner diameter of valve shim respectively.
 - (1) Measure the outer diameter of valve stem end with a micrometer. If it is not within the standard, replace the valve.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Measure the outer diameter of the valve stem end at the two locations as shown in the figure, and read the value of most worn location.**
- **When the valve is replaced, lap the valve. Refer to "VALVE SEAT" for lapping.**  [Ref. to MECHANICAL\(H4DO\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

Valve stem end outer diameter:

Intake

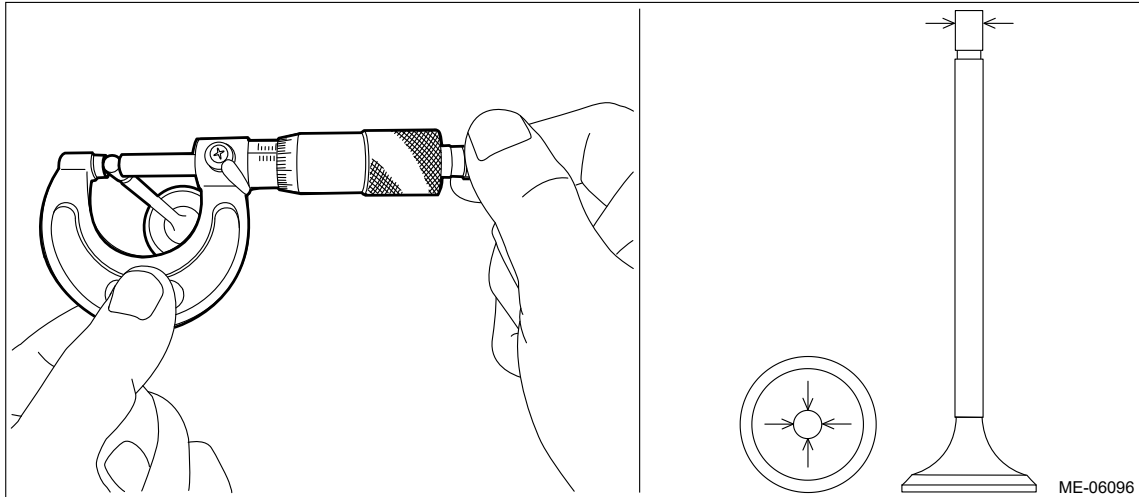
Standard

5.455—5.470 mm (0.2148—0.2154 in)

Exhaust


Standard

5.445—5.460 mm (0.2144—0.2150 in)



(2) Using a caliper gauge, measure the inner diameter of valve shim. If it is not within the standard, replace the valve shim.

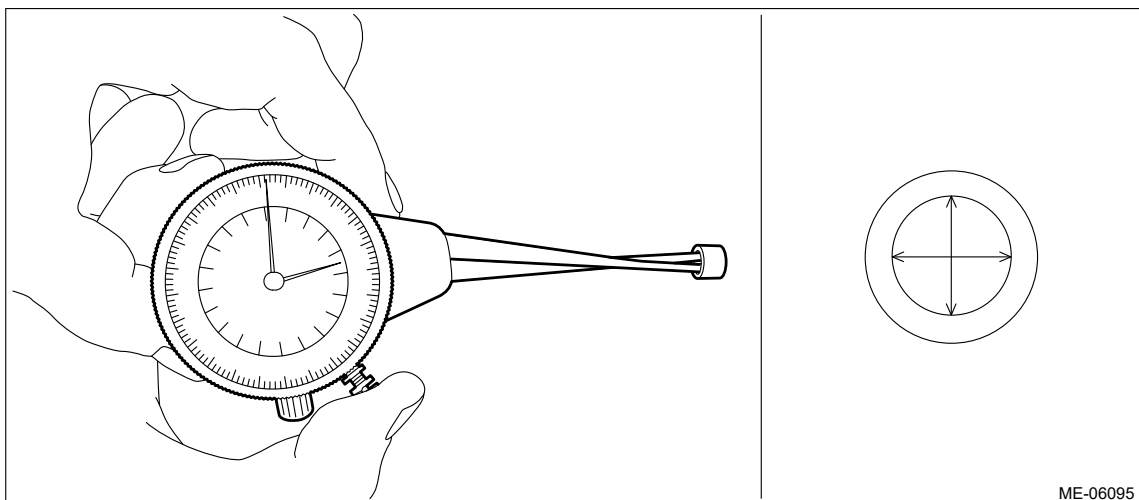
Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Measure the inner diameter of the valve shim at the two locations as shown in the figure, and read the value of most worn location.**
- **If the valve shim has to be replaced, check the cam clearance and replace with the suitable valve shim.  Ref. to [MECHANICAL\(H4DO\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)**

Valve shim inner diameter:



Standard

5.500—5.560 mm (0.2165—0.2189 in)



(3) Calculate the clearance between valve and valve shim. If the clearance exceeds the standard, replace the valve or valve shim, whichever shows the greater amount of wear or damage.

Note:

- **When the valve is replaced, lap the valve. Refer to “VALVE SEAT” for lapping.  Ref. to [MECHANICAL\(H4DO\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)**
- **If the valve shim has to be replaced, check the cam clearance and replace with the suitable valve shim.  Ref. to [MECHANICAL\(H4DO\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)**

Clearance between valve and valve shim:

Intake

Standard

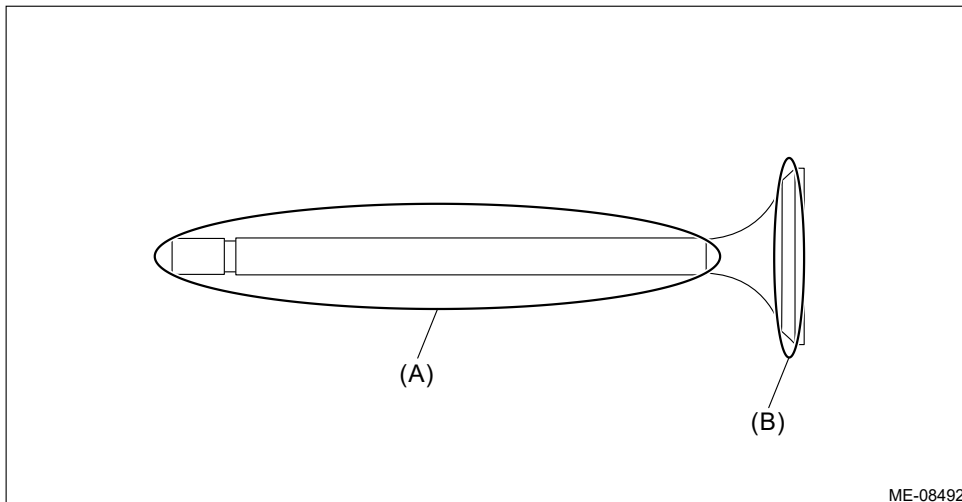
0.030—0.105 mm (0.0012—0.0041 in)

**Exhaust
Standard**

0.040—0.115 mm (0.0016—0.0045 in)

4. VALVE SEAT

1. Check the valve seat for damage and deformation.
2. Check the seating width and seating position between valve and valve seat for the intake valve seat and exhaust valve seat.
 - (1) Clean the valve and valve seat.
 - (2) Coat the stem (A) of the valve lightly with engine oil and apply red dye evenly on the valve face (B).



- (3) Using the valve lapper, slowly insert the valve with red dye applied into the valve guide. Lightly press the valve against the valve seat without turning the valve, and then slowly pull out the valve.
- (4) Check the seating width "W" of valve seat as shown in the figure, using a caliper gauge. Check the seating width "W" between valve and valve seat by measuring the width of red dye on the seating surface of valve seat. If the seating width "W" between valve and valve seat is out of the standard, correct the seating surface of valve seat using the valve seat cutter. For correcting procedures of the valve seat seating surface, refer to step 3).

Note:

- **When the red dye does not appear seamlessly on the valve seat seating surface, lap the valve. For lapping procedure, refer to step 4).**
- **When the red dye does not appear seamlessly on the valve seat seating surface even after lapping the valve, correct the valve seat seating surface using the valve seat cutter. For correcting procedures of the valve seat seating surface, refer to step 3).**

Seating width W between valve and valve seat:

Intake

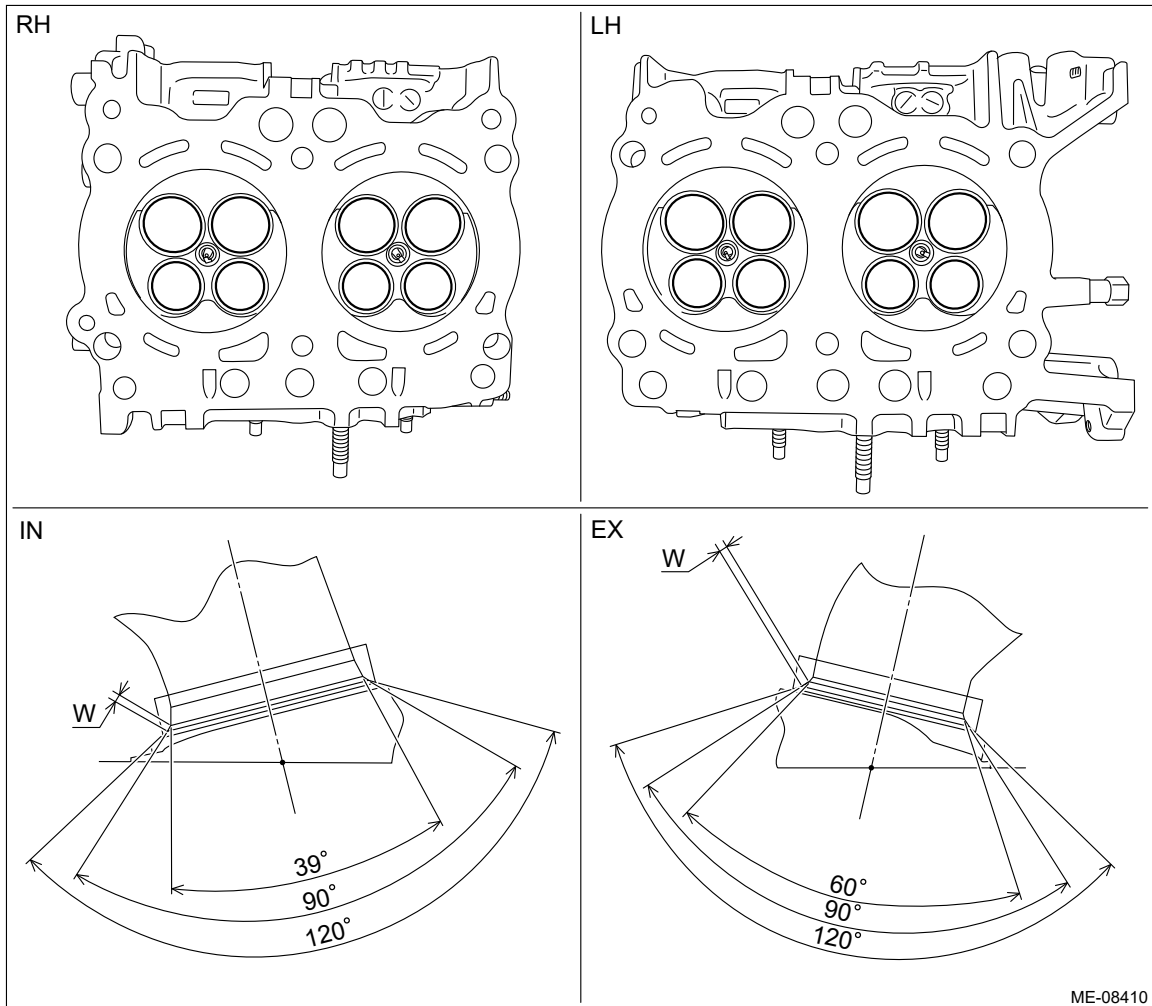
Standard

0.8—1.6 mm (0.031—0.063 in)

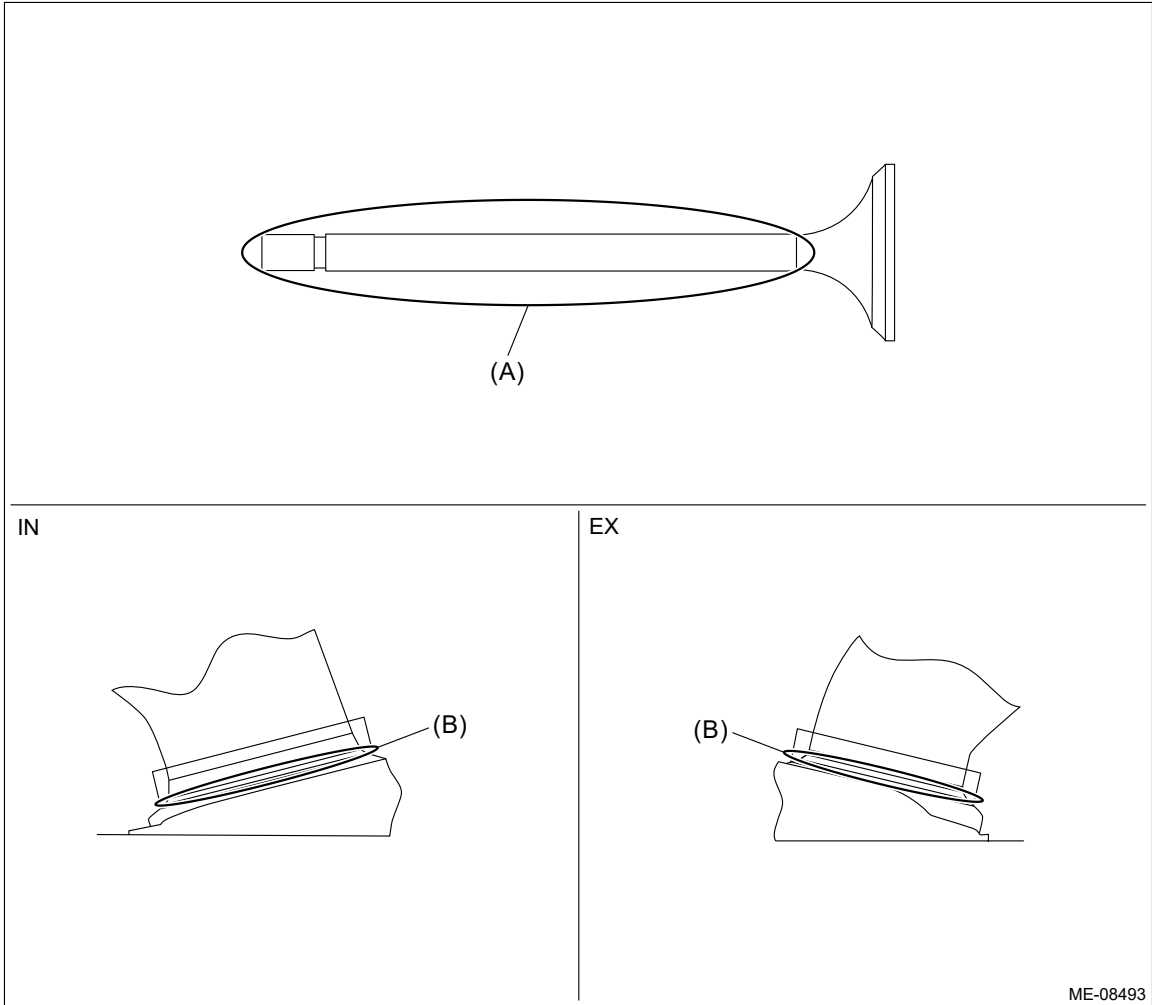
Exhaust

Standard

1.1—1.7 mm (0.043—0.067 in)



- (5) Wipe off the red dye on the valve and valve seat completely.
- (6) Coat the stem (A) of the valve lightly with engine oil and apply red dye evenly on the seating surface (B) between valve and valve seat.

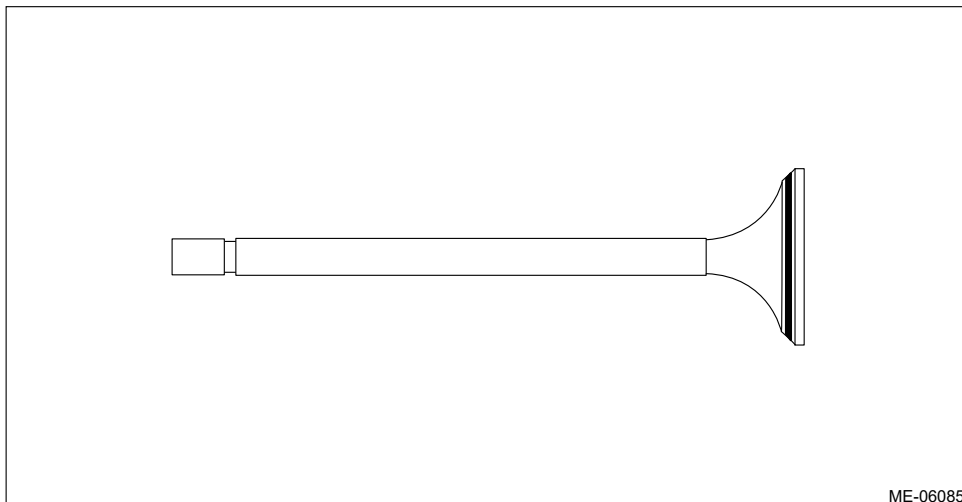


ME-08493

- (7) Using the valve lapper, slowly insert the valve into the valve guide. Lightly press the valve against the valve seat without turning the valve, and then slowly pull out the valve.
- (8) Check the seating position between valve and valve seat. Check the seating position between valve and valve seat by checking the position of red dye on the valve face. If the seating position between valve and valve seat is not at the center of valve face, correct the seating surface of valve seat using the valve seat cutter. For correcting procedures of the valve seat seating surface, refer to step 3).

Seating position between valve and valve seat:

Valve face center



ME-06085

(9) After inspection, wipe off the red dye completely.

3. When correcting the seating surfaces of valve seat

(1) Correct the seating angle between valve and valve seat using the 45° valve seat cutter.

Note:

- Select the size of the valve seat cutter by referring to the outer diameters of the intake valve head and exhaust valve head.

Valve head outer diameter:

Intake

Standard

35.9–36.1 mm (1.413–1.421 in)

Exhaust

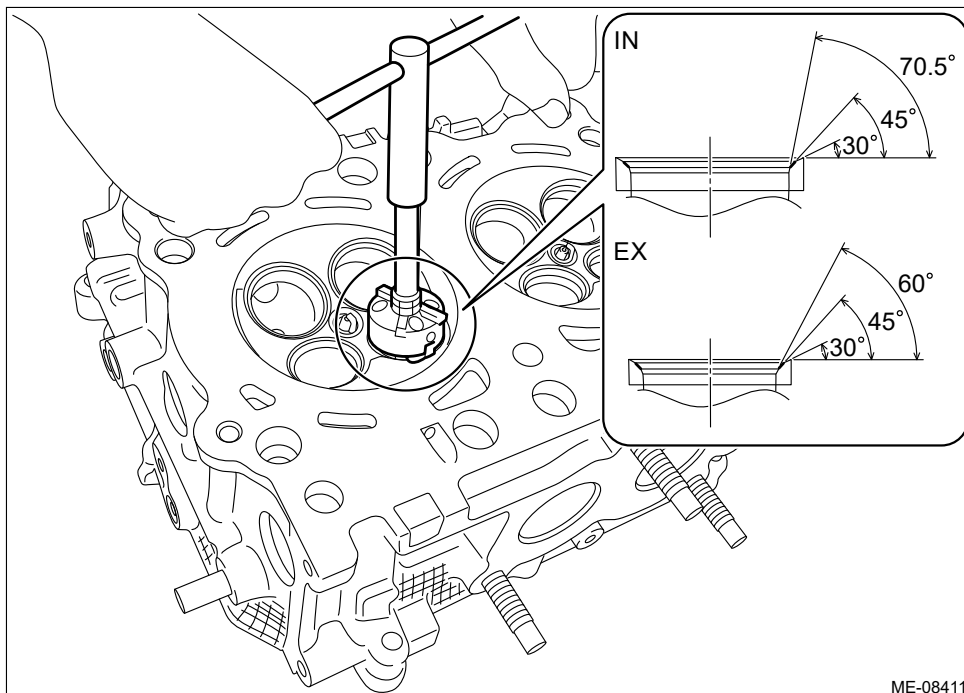
Standard

27.9–28.1 mm (1.098–1.106 in)

- Grind the seating surface so that the seating width between valve and valve seat becomes slightly larger than the standard value.
- Gradually reduce pressure at the end of grinding process in order to avoid creating a gap on the valve seat correcting surface.

Seating angle between valve and valve seat:

45°



(2) Lap the valve. For lapping procedure of the valve, refer to step 4).

(3) Check the seating position between valve and valve seat. For inspection of the seating position between valve and valve seat, refer to step 2).

Note:

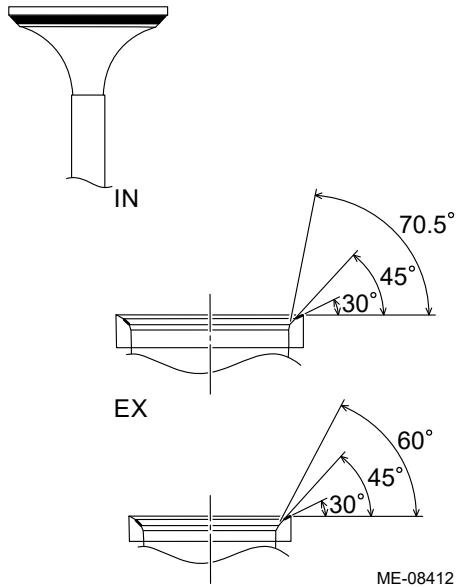
This procedure is necessary to select a seat cutter to be used in step (4).

(4) Using a seat cutter, correct the valve seat so that the seating width between valve and valve seat becomes the standard value.

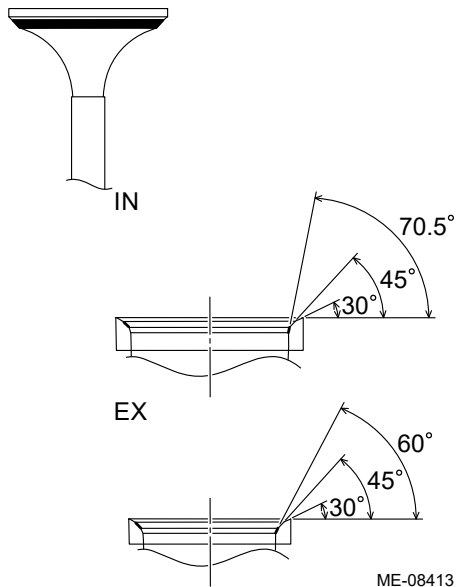
Note:

- Select a proper valve seat cutter according to the following table.

| Seating position between valve and valve seat | Seat cutter selection |
|---|---|
| | When the seating position of valve face is high, grind the surface using the 30° seat cutter until seating width between valve and valve seat becomes the standard value. |



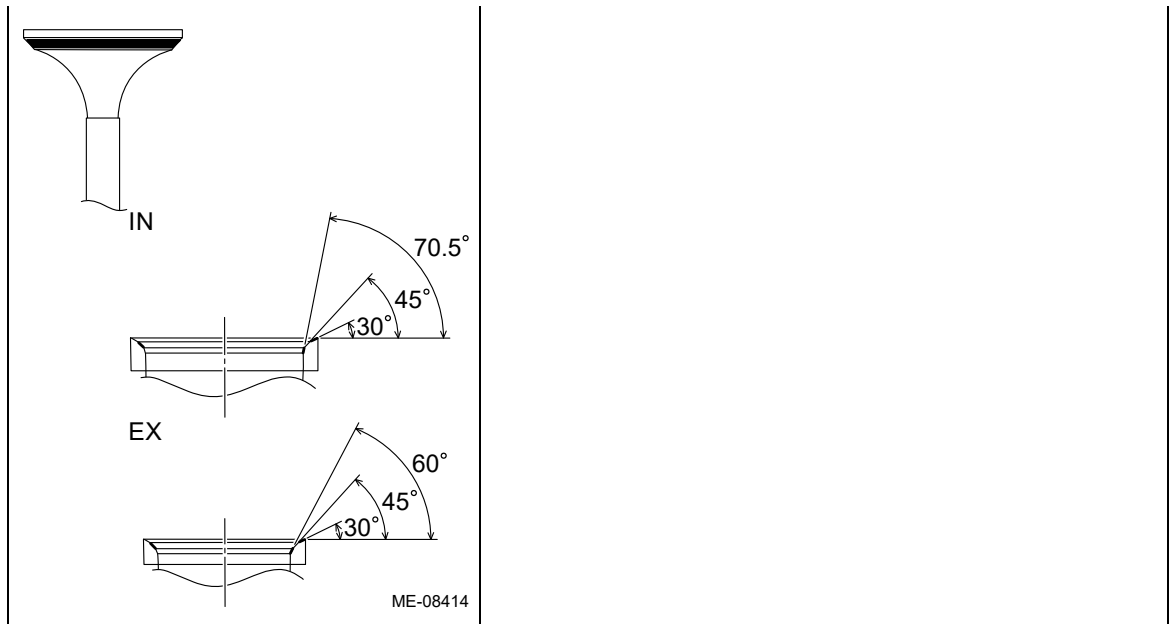
ME-08412



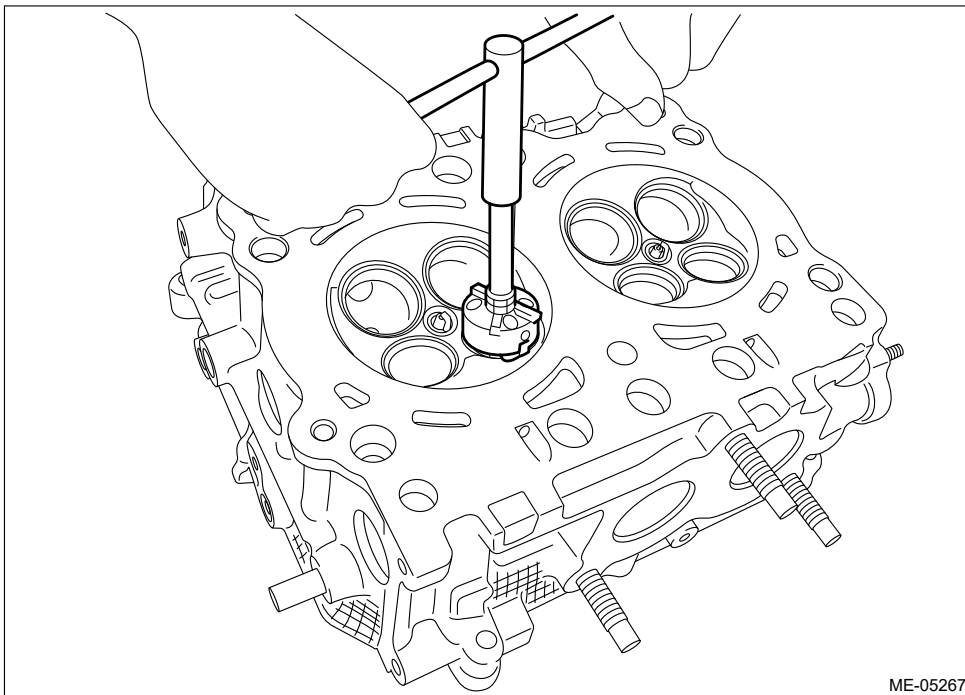
ME-08413

When the seating position of valve face is low, grind the surface using the 70.5° (IN) or 60° (EX) seat cutter until seating width between valve and valve seat reaches the standard value.

When the seating position of valve face is at center, grind the surface evenly using the 30° and 70.5° (IN) or 60° (EX) seat cutters until seating width between valve and valve seat reaches the standard value.



- Gradually reduce pressure at the end of grinding process in order to avoid creating a gap on the valve seat correcting surface.



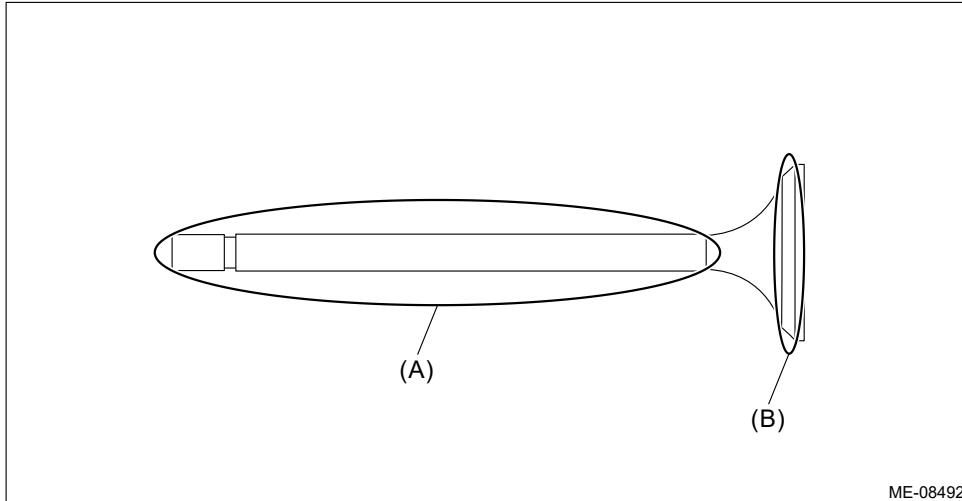
(5) Lap the valve. For lapping procedure of the valve, refer to step 4).

4. When lapping the valve

- (1) Coat the stem (A) of the valve lightly with engine oil and put a small amount of valve compound evenly on the valve face (B).

Note:

- Be careful not to put the valve compound more than necessary.
- To avoid damaging the valve guide and valve stem, be careful not to let the valve compound contact the valve stem.



- (2) Using the valve lapper, slowly insert the valve with the valve compound applied into the valve guide, and lap the seating surface between valve and valve seat. First, lift the valve and strike it against the valve seat twice, and then slightly turn the valve once. Repeat these steps as one set.

Note:

- To prevent the seating width between valve and valve seat from exceeding the standard value, be careful not to keep turning the valve while pressing it against the valve seat during lapping.
- Be careful not to lift the valve too far during lapping in order to prevent the valve from coming off the valve guide.

- (3) Wipe off the valve compound on the valve and valve seat completely after lapping.

Note:

Be careful not to leave any valve compound in order to avoid malfunction.

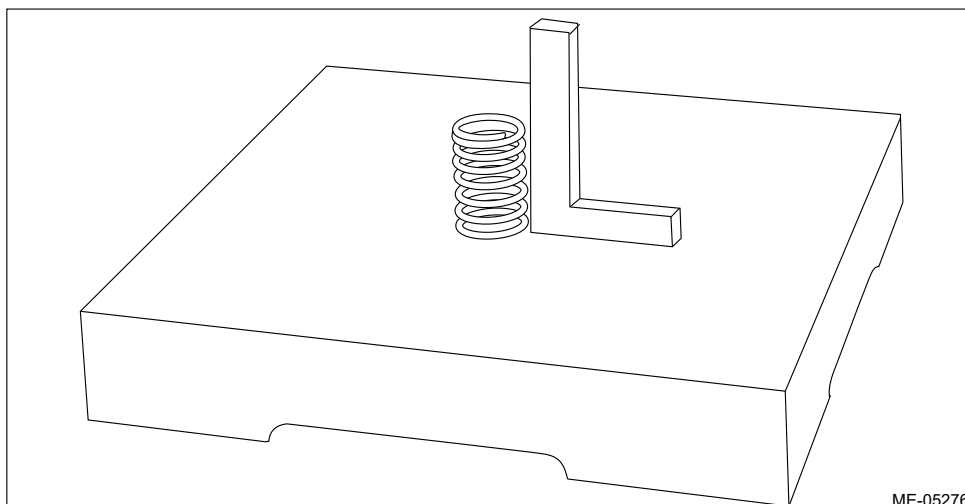
- (4) Check the seating width and seating position between valve and valve seat.

5. VALVE SPRING

1. Check the valve spring for damage and deformation.
2. Using a caliper gauge, valve spring tester, surface plate and try square, check the valve spring free length, tension/spring height and squareness. If it is not within the standard, replace the valve spring.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- To check the squareness of the valve spring, stand the valve spring on a surface plate and check its deflection at the top of the valve spring using a try square.



Valve spring free length:

CVT model**Standard**

41.68 mm (1.641 in)

MT model**Standard**

41.06 mm (1.617 in)

Valve spring tension/spring height:**CVT model**

Set

Standard

182 — 210 N (18.56—21.41 kgf, 40.92—47.22 lbf)/33.0 mm (1.299 in)

Lift

Standard

502 — 554 N (51.19—56.49 kgf, 112.87—124.56 lbf)/22.0 mm (0.866 in)

MT model

Set

Standard

182 — 210 N (18.56—21.41 kgf, 40.92—47.22 lbf)/33.0 mm (1.299 in)

Lift

Standard

552 — 610 N (56.29—62.20 kgf, 124.11—137.15 lbf)/22.0 mm (0.866 in)

Valve spring squareness:**Standard**

2.5°, 1.8 mm (0.071 in) or less

INSTALLATION

1. CYLINDER HEAD RH

- 1. Clean the bolt holes in the cylinder block RH.

Caution:

To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

- 2. Apply liquid gasket to both sides of the cylinder head gasket RH as shown in the figure.

Note:

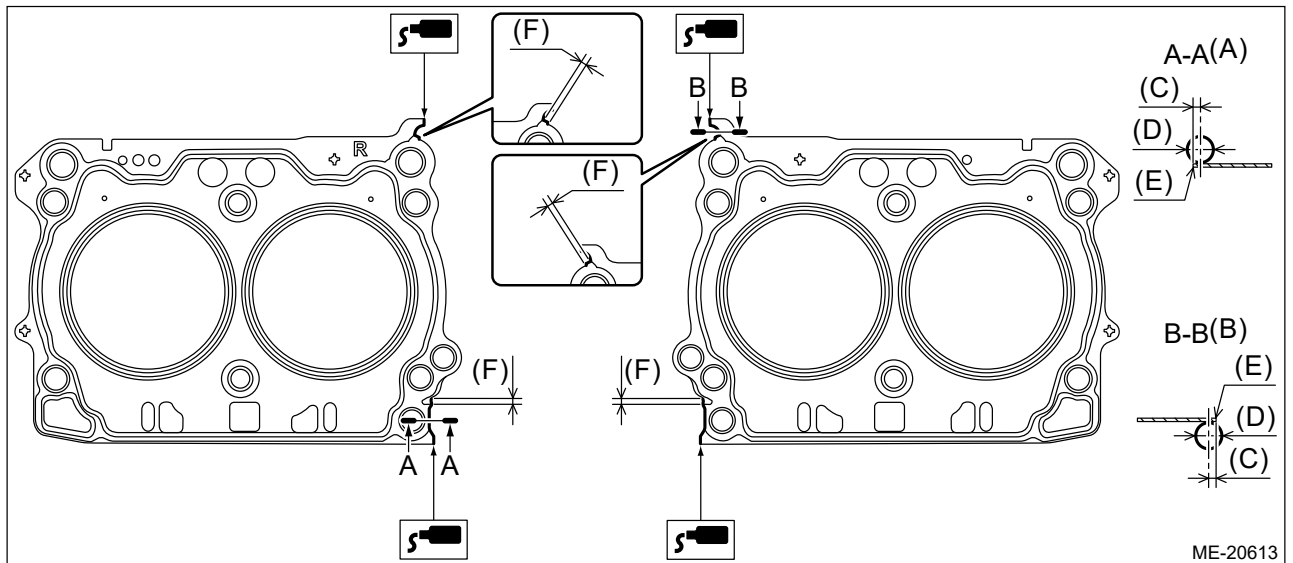
- Use a new cylinder head gasket RH.
- Before applying liquid gasket, degrease the mating surface of cylinder blocks RH and cylinder head RH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3±1 mm (0.1181±0.0394 in)



- | | | |
|--|---|--|
| (A) Liquid gasket applying position to the cylinder head side | (C) Within 1 mm (0.0394 in) | (E) Cylinder head gasket edge |
| (B) Liquid gasket applying position to the cylinder block side | (D) $\varnothing 3 \pm 1$ mm (0.1181±0.0394 in) | (F) Overlap margin of bead end and liquid gasket: 3 – 10 mm (0.1181 – 0.3937 in) |

- 3. Attach the cylinder head gasket RH.

Note:

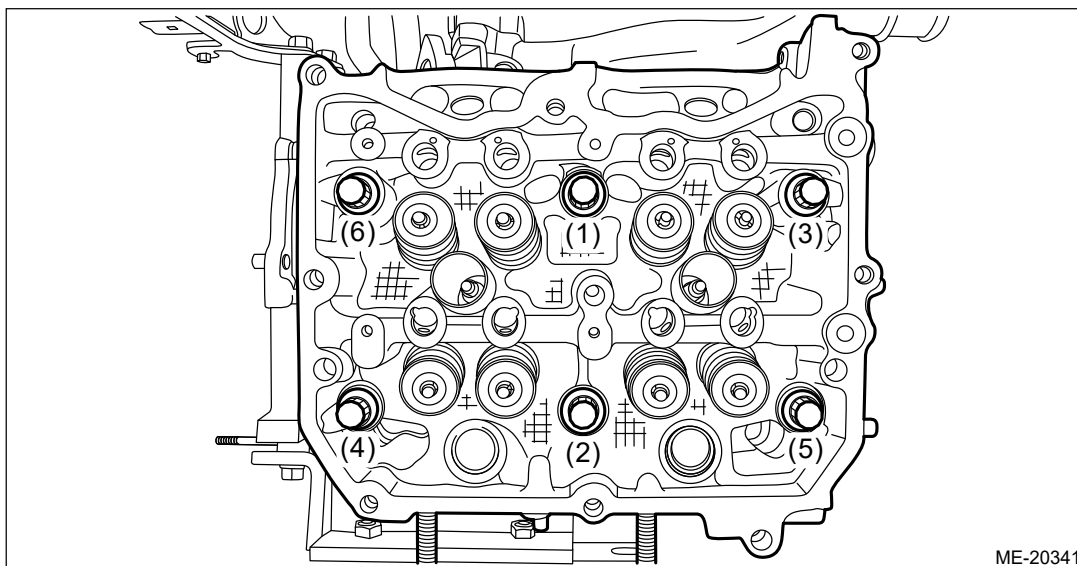
Check that liquid gasket RH is squeezed out from the cylinder head gasket.

- 4. Install the cylinder head RH to the cylinder block RH.

Caution:

Be careful not to scratch the mating surface of cylinder head RH and cylinder block RH.

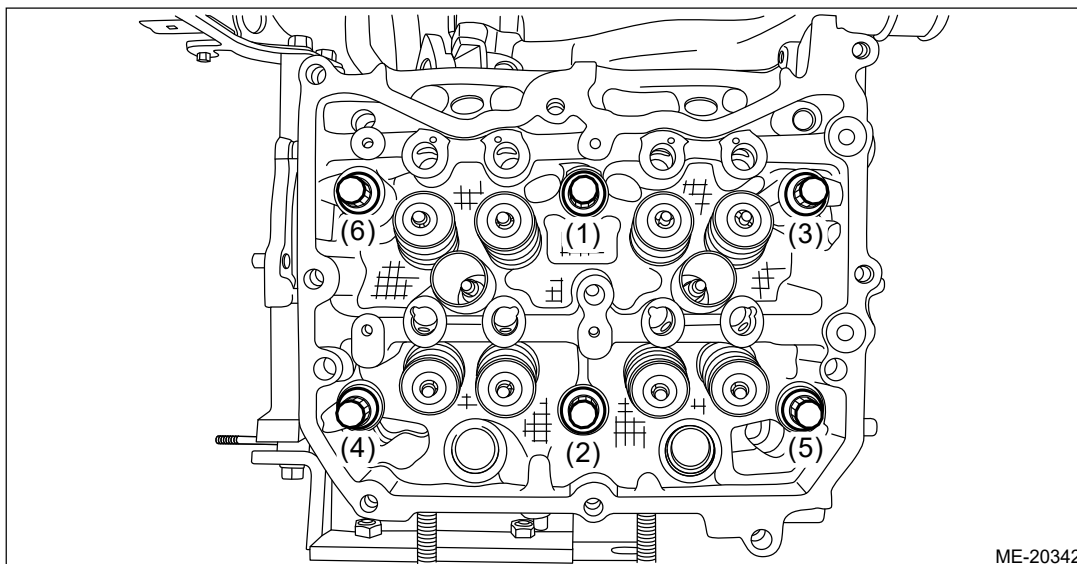
- (1) Clean the cylinder head bolt threads and apply sufficient engine oil to the washer and cylinder head bolts threads.
- (2) Mount the cylinder head RH onto the cylinder block RH, and tighten all bolts with a torque of 29 N·m (3.0 kgf-m, 21.4 ft-lb) in numerical order as shown in the figure.



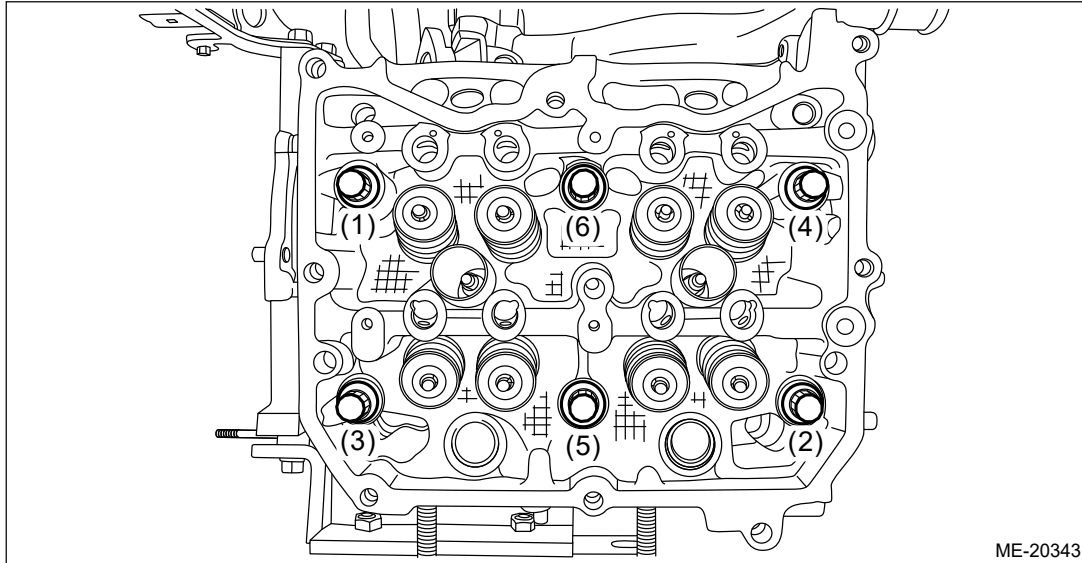
- (3) Tighten all cylinder head bolts further with a torque of 100 N·m (10.2 kgf-m, 73.8 ft-lb) in numerical order as shown in the figure.

Caution:

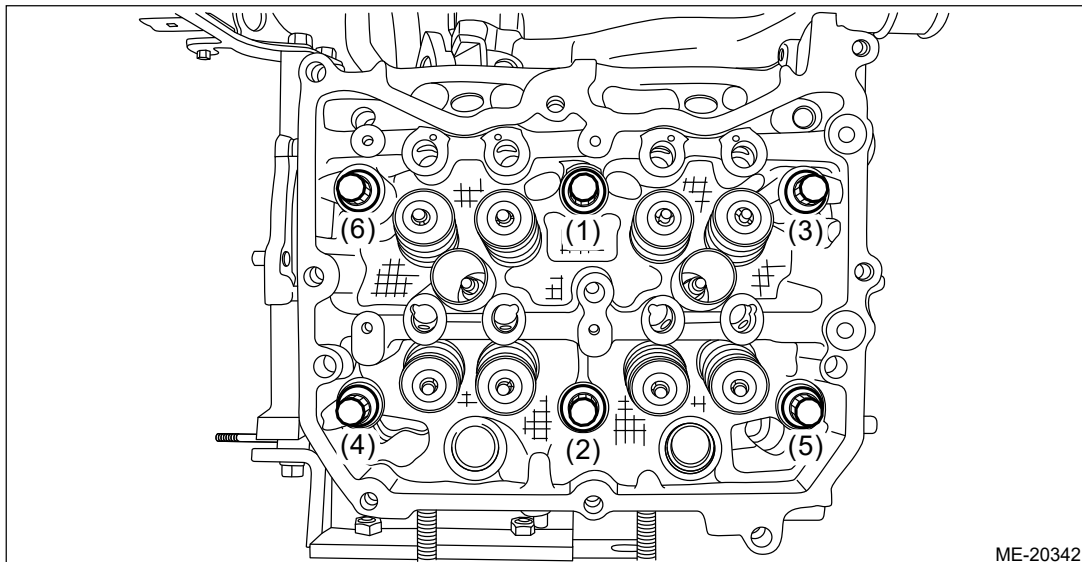
If the bolt makes stick-slip sound during tightening, repeat the procedure from step 1). In that case, the cylinder head gasket RH can be reused. But it is necessary to remove liquid gasket completely from cylinder block RH, cylinder head RH and cylinder head gasket RH and re-apply to them.



- (4) Loosen all cylinder head bolts 180° in numerical order as shown in the figure, and then loosen all cylinder head bolts 180° further in numerical order as shown in the figure.



- (5) Tighten all cylinder head bolts with a torque of 42 N·m (4.3 kgf-m, 31.0 ft-lb) in numerical order as shown in the figure.

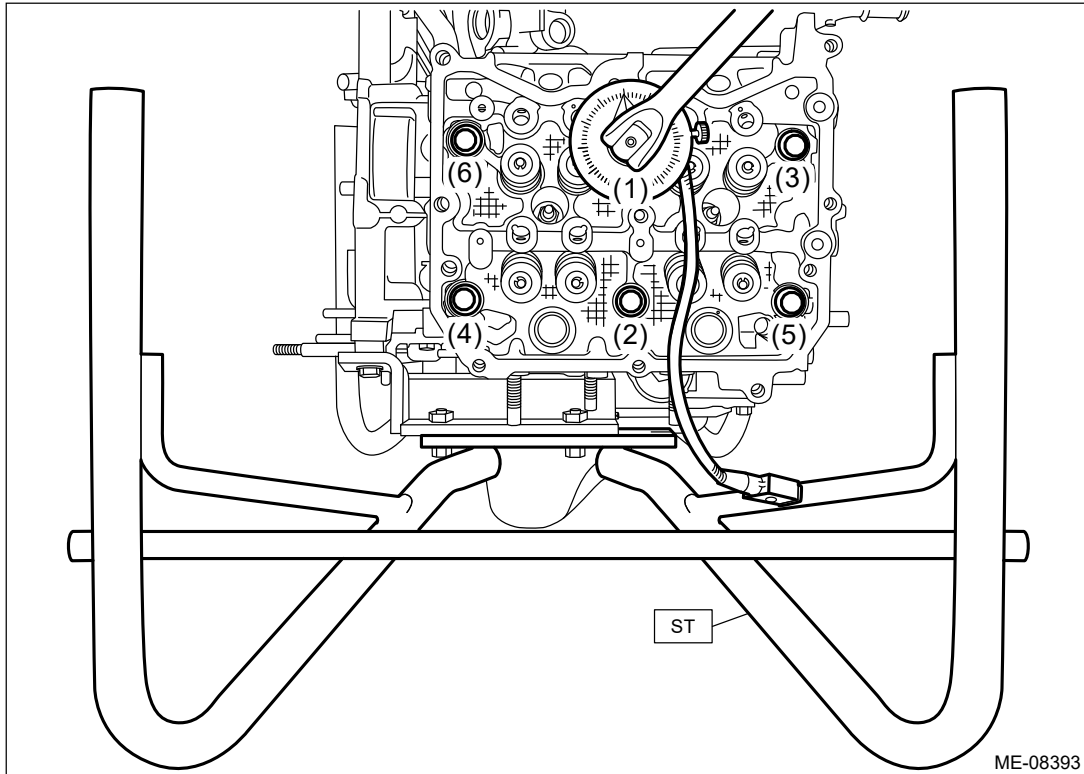


- (6) Using angle gauge, tighten all cylinder head bolts with specified angle in numerical order as shown in the figure.

ST 499817100 ENGINE STAND

Tightening angle:

$80^{\circ} \pm 2^{\circ}$



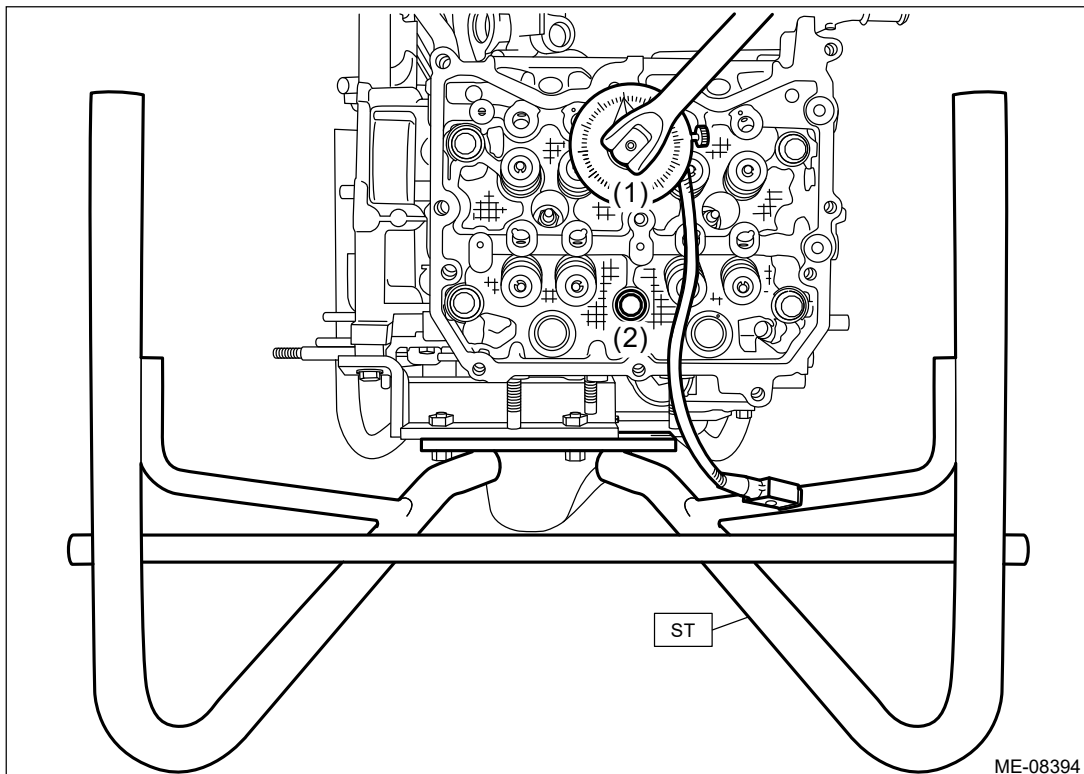
ME-08393

- (7) Using angle gauge, tighten the cylinder head bolts (2 places) with specified angle in numerical order as shown in the figure.

ST 499817100 ENGINE STAND

Tightening angle:

$75^{\circ} \pm 2^{\circ}$



ME-08394

- (8) Using angle gauge, tighten the cylinder head bolts (4 places) with specified angle in numerical order as shown in the figure.

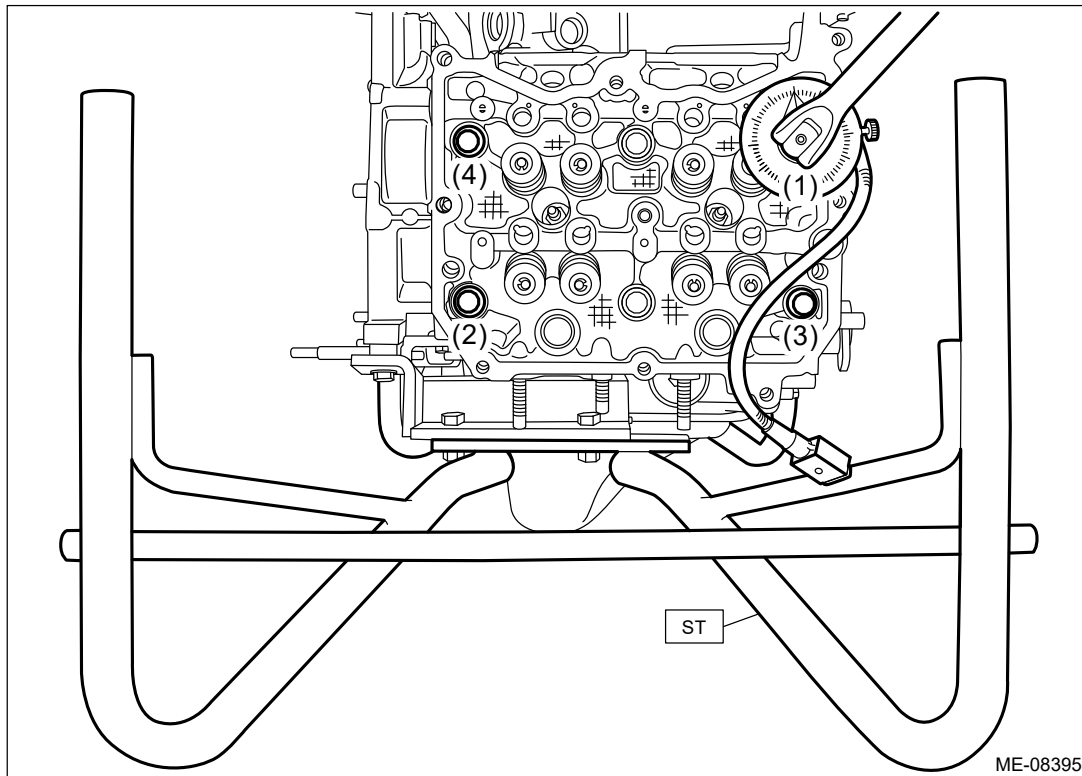
Note:








After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

ST 499817100 ENGINE STAND

Tightening angle:

$30^{\circ} \pm 2^{\circ}$



- 5.** Install the EGR cooler.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DO\)>EGR Cooler>INSTALLATION.](#)
- 6.** Install the cam carrier RH.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>INSTALLATION > CAM CARRIER RH.](#)
- 7.** Install the rocker cover RH.  [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>INSTALLATION > ROCKER COVER RH.](#)
- 8.** Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)
- 9.** Install the engine wiring harness.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Wiring Harness>INSTALLATION.](#)
- 10.** Install the intake manifold assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>INSTALLATION.](#)
- 11.** Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>INSTALLATION.](#)

2. CYLINDER HEAD LH

- 1.** Clean the bolt holes in the cylinder block LH.

Caution:

To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

2. Apply liquid gasket to both sides of the cylinder head gasket LH as shown in the figure.

Note:

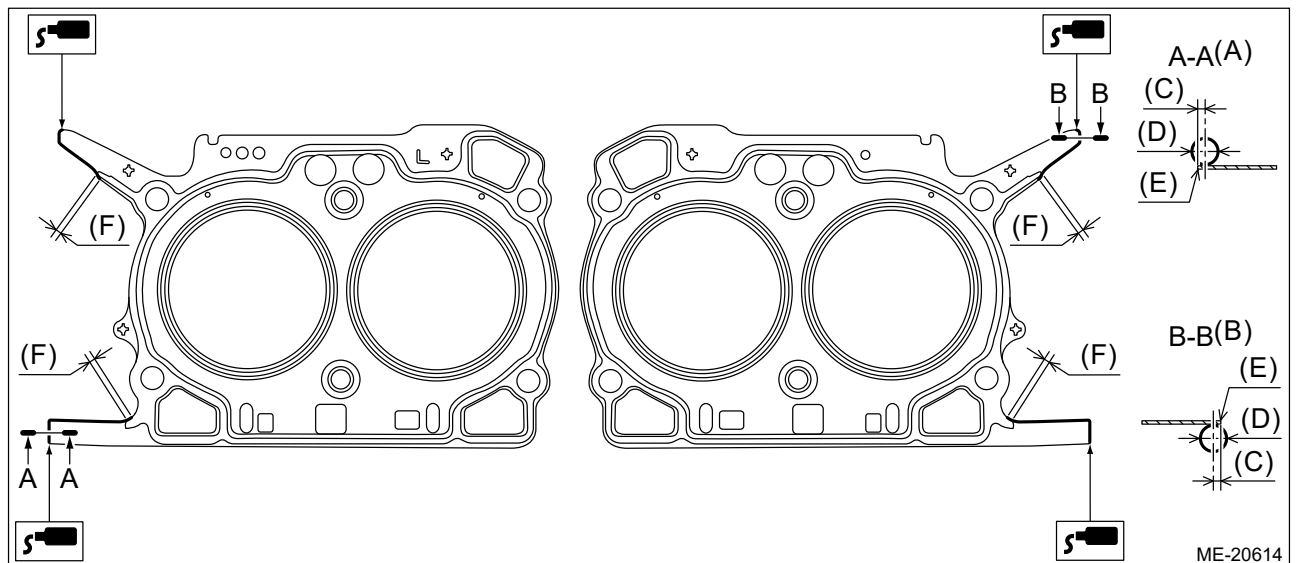
- Use a new cylinder head gasket LH.
- Before applying liquid gasket, degrease the mating surface of cylinder blocks LH and cylinder head LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3±1 mm (0.1181±0.0394 in)



(A) Liquid gasket applying position to the cylinder head side

(C) Within 1 mm (0.0394 in)

(E) Cylinder head gasket edge

(B) Liquid gasket applying position to the cylinder block side

(D) $\varnothing 3\pm 1$ mm (0.1181±0.0394 in)

(F) Overlap margin of bead end and liquid gasket: 3 – 10 mm (0.1181 – 0.3937 in)

3. Attach the cylinder head gasket LH.

Note:

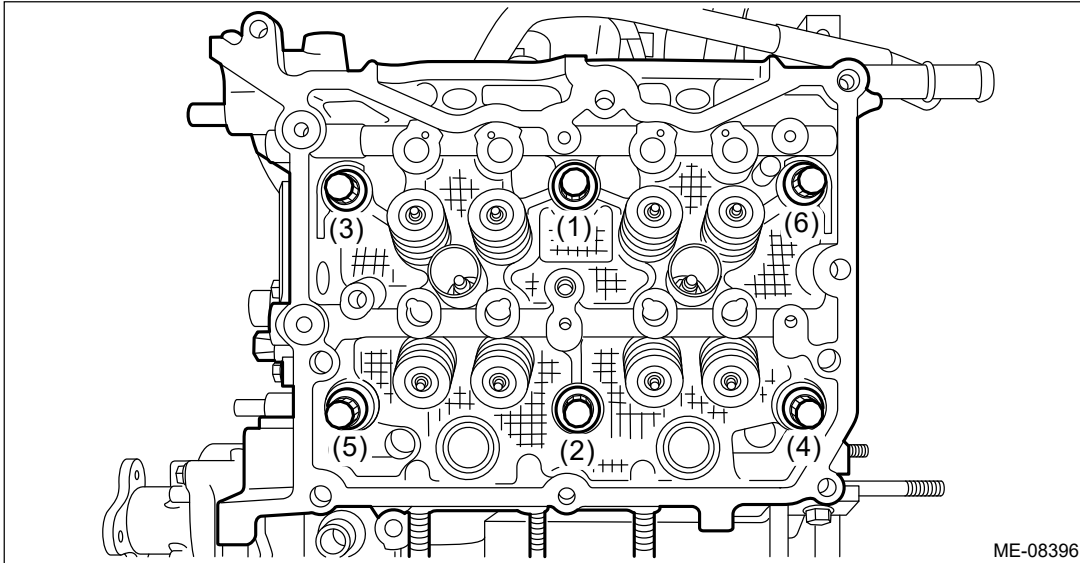
Check that liquid gasket is squeezed out from the cylinder head gasket LH.

4. Install the cylinder head LH to the cylinder block LH.

Caution:

Be careful not to scratch the mating surface of cylinder head LH and cylinder block LH.

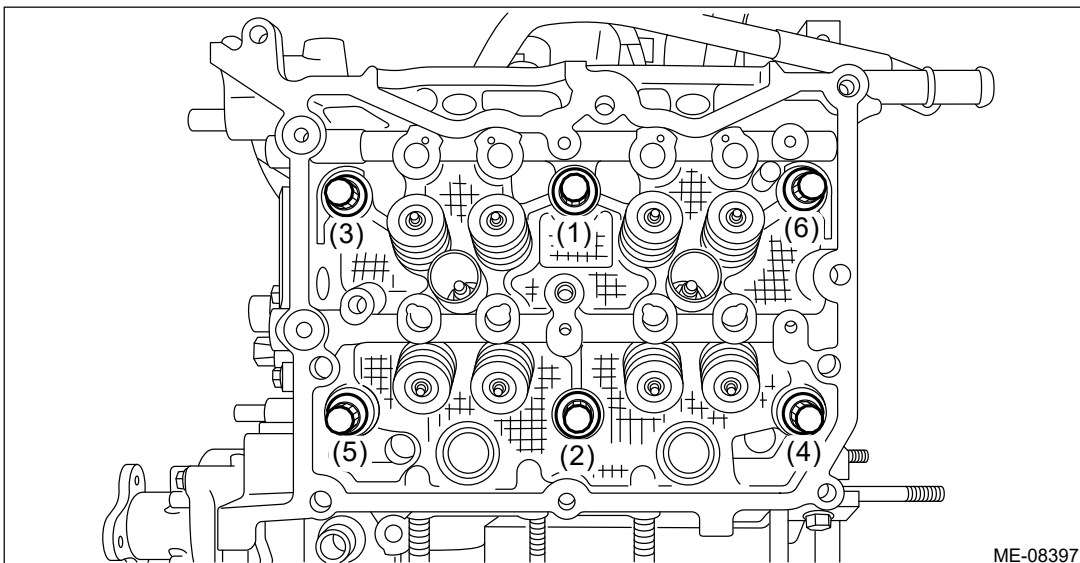
- (1) Clean the cylinder head bolt threads and apply sufficient engine oil to the washer and cylinder head bolts threads.
- (2) Mount the cylinder head LH onto the cylinder block LH, and tighten all bolts with a torque of 29 N·m (3.0 kgf-m, 21.4 ft-lb) in numerical order as shown in the figure.



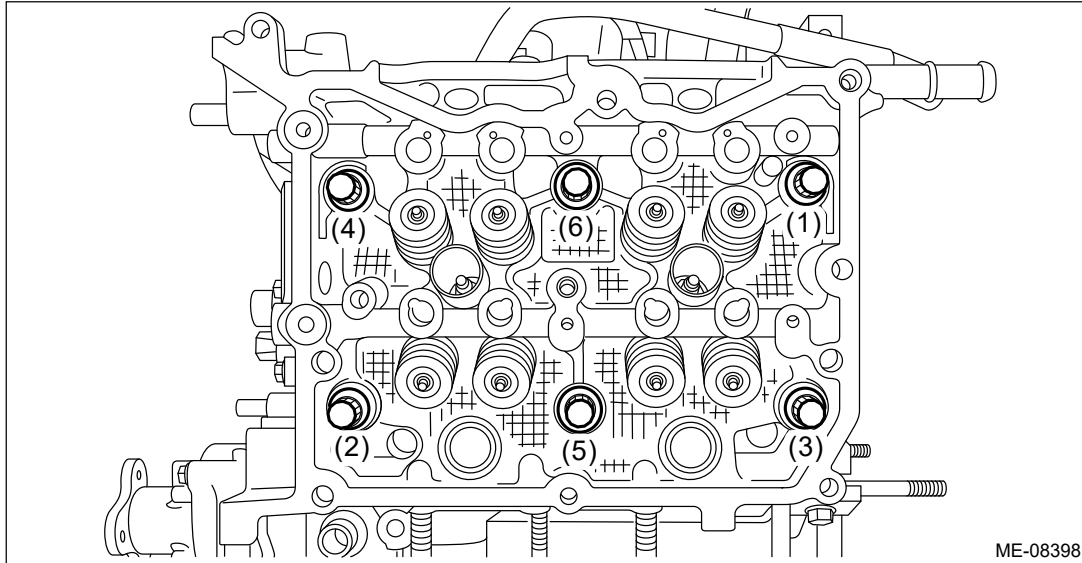
- (3) Tighten all cylinder head bolts further with a torque of 100 N·m (10.2 kgf-m, 73.8 ft-lb) in numerical order as shown in the figure.

Caution:

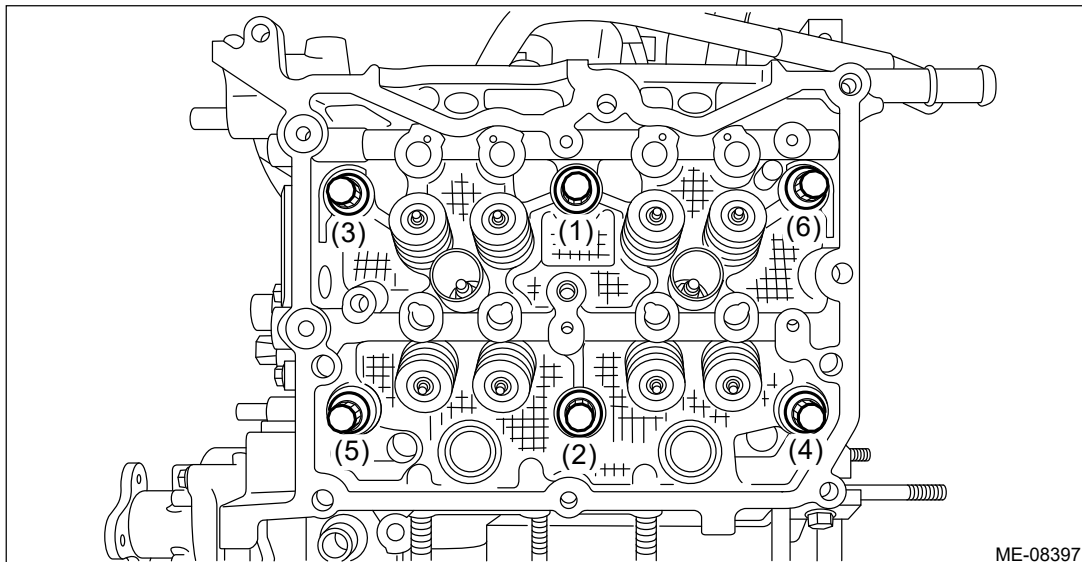
If the bolt makes stick-slip sound during tightening, repeat the procedure from step 1). In that case, the cylinder head gasket LH can be reused. But it is necessary to remove liquid gasket completely from cylinder block LH, cylinder head LH and cylinder head gasket LH and re-apply to them.



- (4) Loosen all cylinder head bolts 180° in numerical order as shown in the figure, and then loosen all cylinder head bolts 180° further in numerical order as shown in the figure.



(5) Tighten all cylinder head bolts with a torque of 42 N·m (4.3 kgf-m, 31.0 ft-lb) in numerical order as shown in the figure.

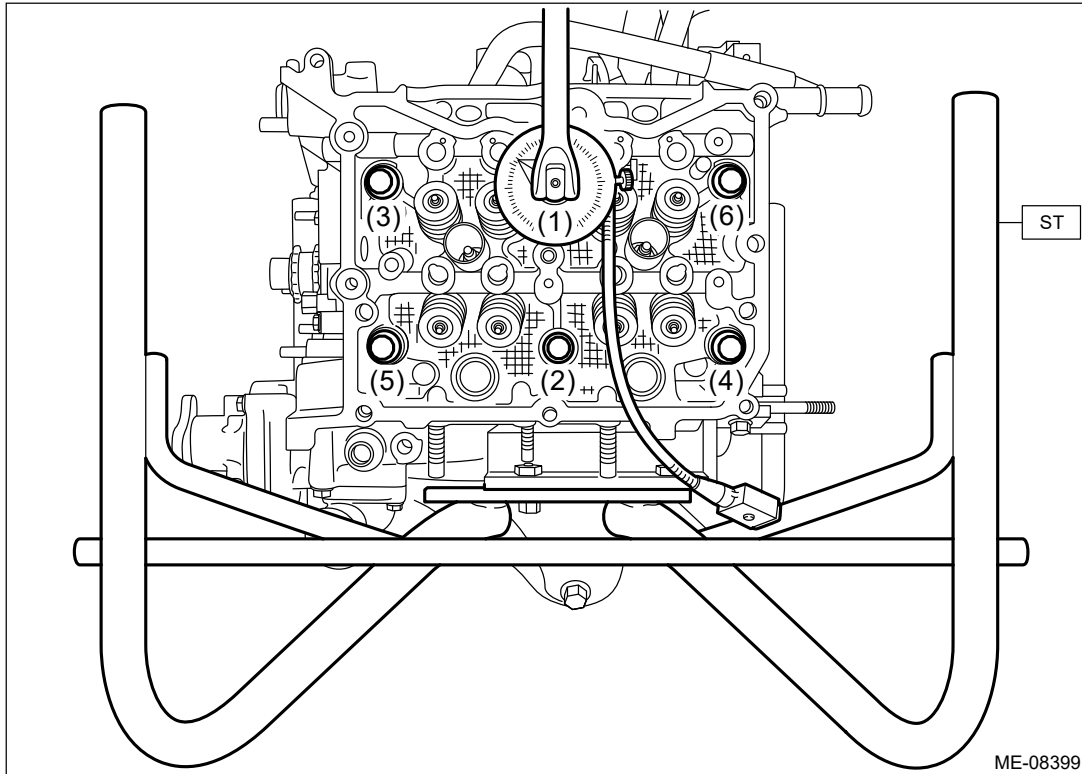


(6) Using angle gauge, tighten all cylinder head bolts with specified angle in numerical order as shown in the figure.

ST 499817100 ENGINE STAND

Tightening angle:

$80^{\circ} \pm 2^{\circ}$

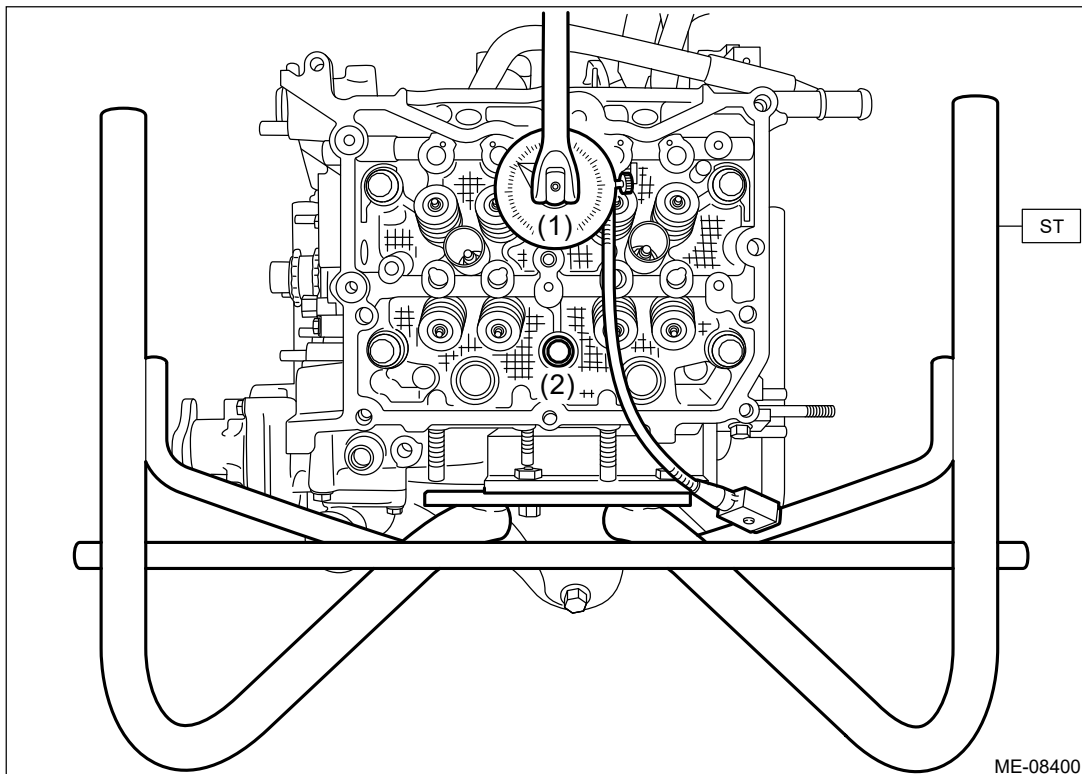


- (7) Using angle gauge, tighten the cylinder head bolts (2 places) with specified angle in numerical order as shown in the figure.

ST 499817100 ENGINE STAND

Tightening angle:

$75^{\circ} \pm 2^{\circ}$



- (8) Using angle gauge, tighten the cylinder head bolts (4 places) with specified angle in numerical order as shown in the figure.

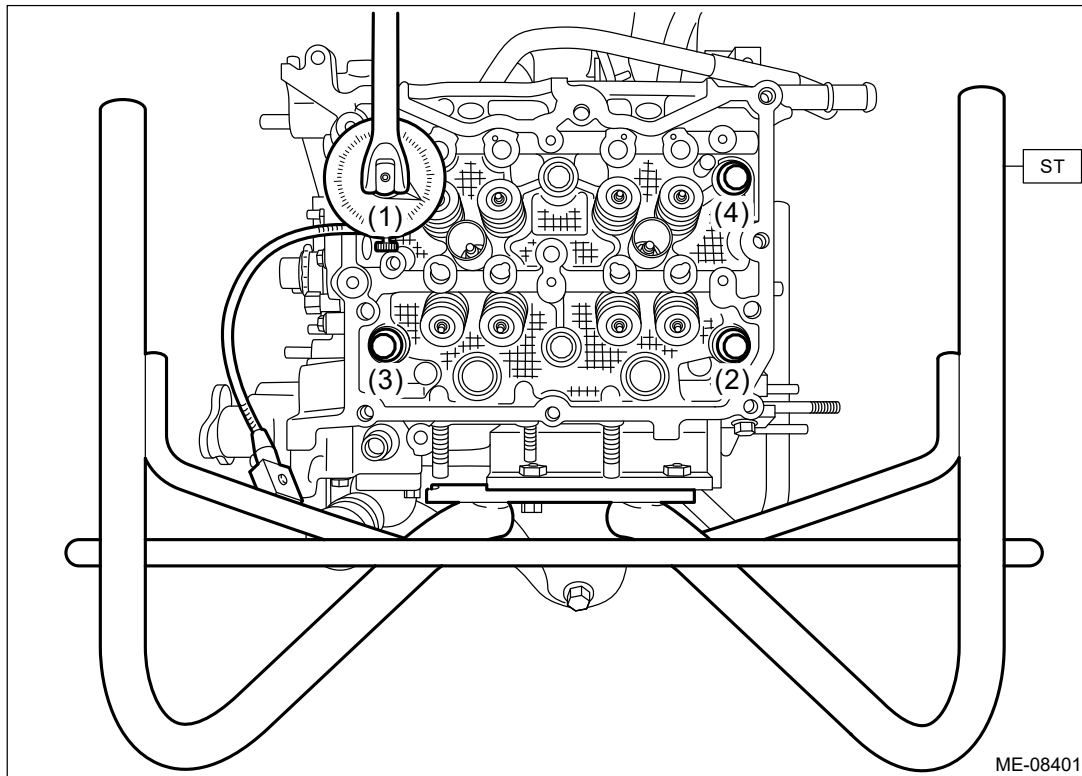
Note:








After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

ST 499817100 ENGINE STAND

Tightening angle:

$30^{\circ} \pm 2^{\circ}$



- 5.** Install the A/C compressor.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Compressor>INSTALLATION.](#)
- 6.** Install the cam carrier LH.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>INSTALLATION > CAM CARRIER LH.](#)
- 7.** Install the rocker cover LH.  [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>INSTALLATION > ROCKER COVER LH.](#)
- 8.** Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)
- 9.** Install the engine wiring harness.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Engine Wiring Harness>INSTALLATION.](#)
- 10.** Install the intake manifold assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Intake Manifold Assembly>INSTALLATION.](#)
- 11.** Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>INSTALLATION.](#)

MECHANICAL(H4DO) > Cylinder Head

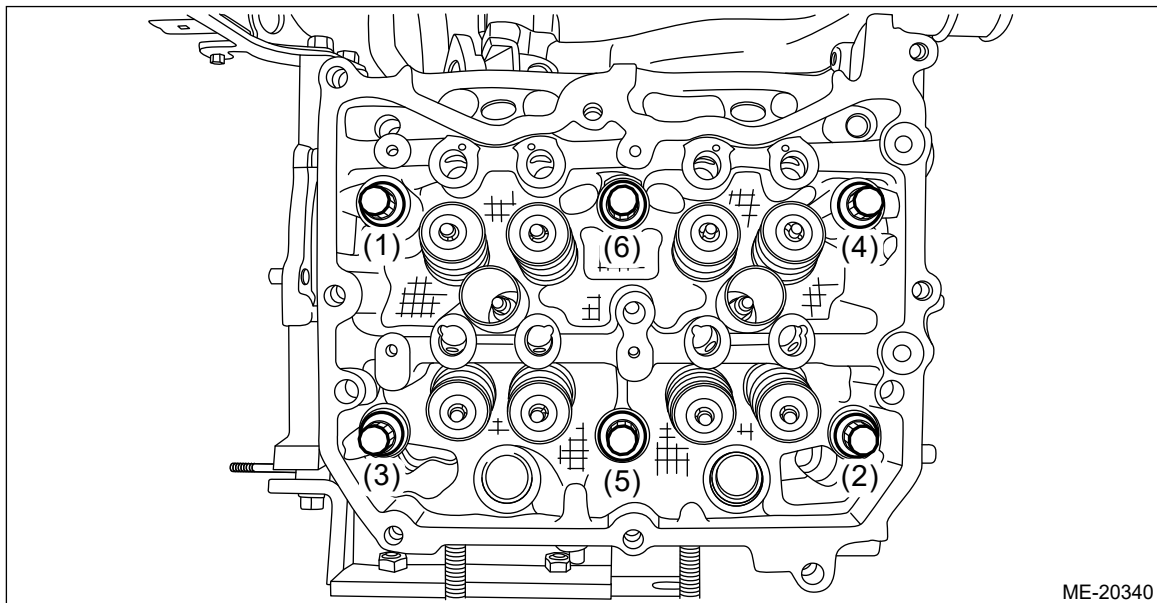
REMOVAL

1. CYLINDER HEAD RH

1. Remove the engine from the vehicle. [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>REMOVAL.](#)
2. Remove the intake manifold assembly. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DO\)>Intake Manifold Assembly>REMOVAL.](#)
3. Remove the engine wiring harness. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DO\)>Engine Wiring Harness>REMOVAL.](#)
4. Remove the chain cover. [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
5. Remove the rocker cover RH. [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>REMOVAL > ROCKER COVER RH.](#)
6. Remove the cam carrier RH. [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>REMOVAL > CAM CARRIER RH.](#)
7. Remove the EGR cooler. [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DO\)>EGR Cooler>REMOVAL.](#)
8. Loosen the bolts holding the cylinder head RH equally, a little at a time in numerical sequence as shown in the figure, and while leaving the cylinder head bolts (1) and (4) engaged by three or four threads, remove the other cylinder head bolts.

Note:

Leaving the cylinder head bolts (1) and (4) engaged by three or four threads prevents the cylinder head RH from falling.










9. While tapping the cylinder head RH with a plastic hammer, separate it from cylinder block RH.
10. Remove the bolts (1) and (4) to remove cylinder head RH.
11. Remove the cylinder head gasket RH.

Caution:

Be careful not to scratch the mating surface of cylinder head and cylinder block.

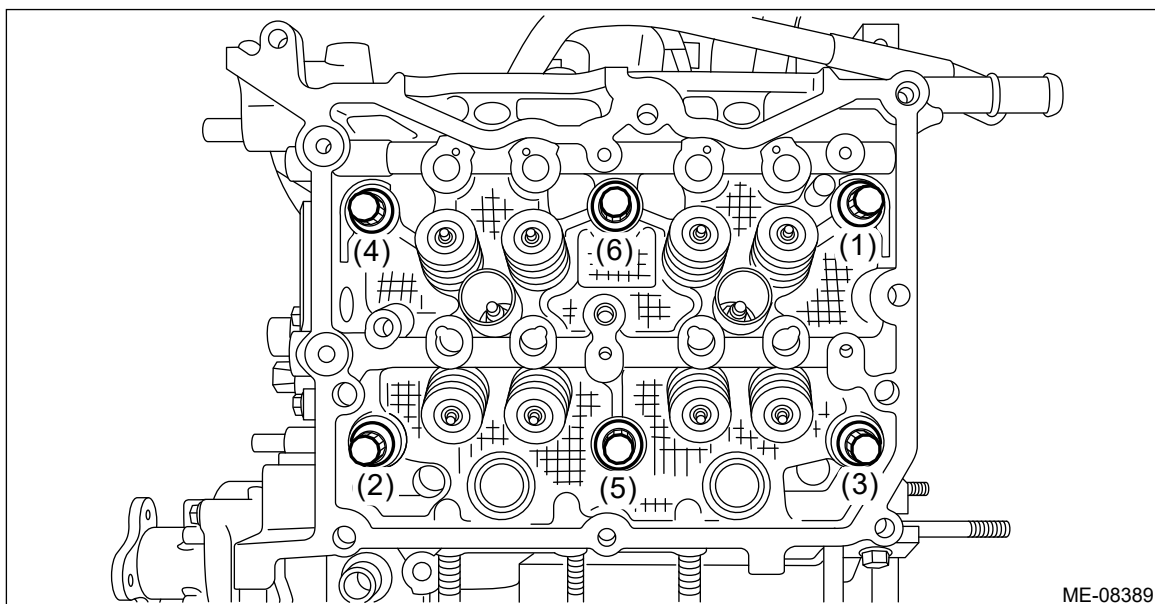
12. Remove the liquid gasket from cylinder head RH and cam carrier RH.

2. CYLINDER HEAD LH

1. Remove the engine from the vehicle.  [Ref. to MECHANICAL\(H4DO\)>Engine Assembly>REMOVAL.](#)
2. Remove the intake manifold assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DO\)>Intake Manifold Assembly>REMOVAL.](#)
3. Remove the engine wiring harness.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DO\)>Engine Wiring Harness>REMOVAL.](#)
4. Remove the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>REMOVAL.](#)
5. Remove the rocker cover LH.  [Ref. to MECHANICAL\(H4DO\)>Rocker Cover>REMOVAL > ROCKER COVER LH.](#)
6. Remove the cam carrier LH.  [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>REMOVAL > CAM CARRIER LH.](#)
7. Remove the A/C compressor.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Compressor>REMOVAL.](#)
8. Loosen the bolts holding the cylinder head LH equally, a little at a time in numerical sequence as shown in the figure, and while leaving the cylinder head bolts (1) and (4) engaged by three or four threads, remove the other cylinder head bolts.

Note:

Leaving the cylinder head bolts (1) and (4) engaged by three or four threads prevents the cylinder head LH from falling.



9. While tapping the cylinder head LH with a plastic hammer, separate it from cylinder block LH.
10. Remove the cylinder head bolts (1) and (4) to remove cylinder head LH.
11. Remove the cylinder head gasket LH.

Caution:

Be careful not to scratch the mating surface of cylinder head and cylinder block.

12. Remove the liquid gasket from cylinder head LH and cam carrier LH.

MECHANICAL(H4DO) > Engine Assembly

INSPECTION

- 1.** Check that pipes, hoses, connectors and clamps are installed firmly.
- 2.** Check the engine coolant is at specified level.
- 3.** Start the engine and check for exhaust gas, engine coolant, leaks of fuel, etc. Also check for noise and vibrations.

MECHANICAL(H4DO) > Engine Assembly

INSTALLATION

1. Install the engine mounting onto the engine.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)

2. Apply a small amount of grease to splines of main shaft. (MT model)

Grease:

NICHIMOLY N-130 or equivalent

3. Position the engine in engine compartment and align it with transmission.

Note:

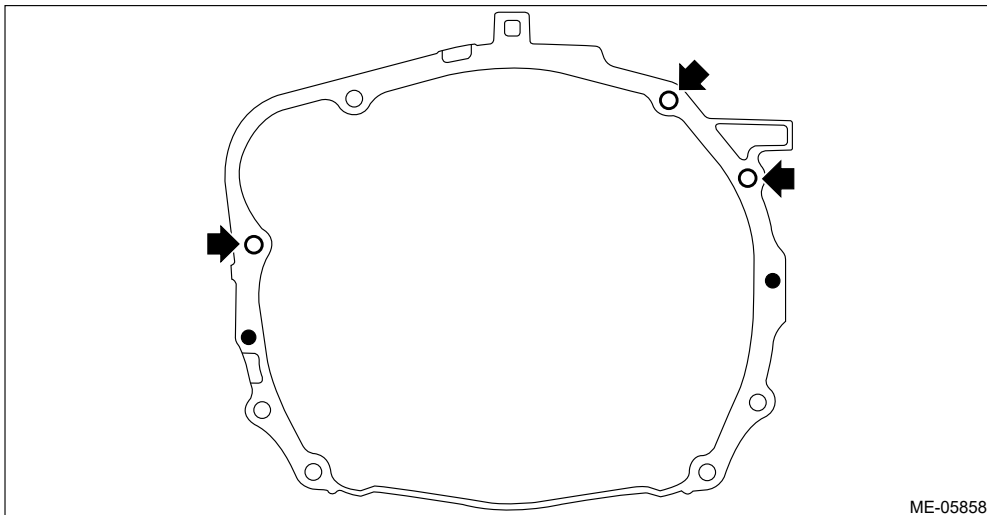
Be careful not to damage adjacent parts or body panels with crank pulley, oil level gauge, etc.

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

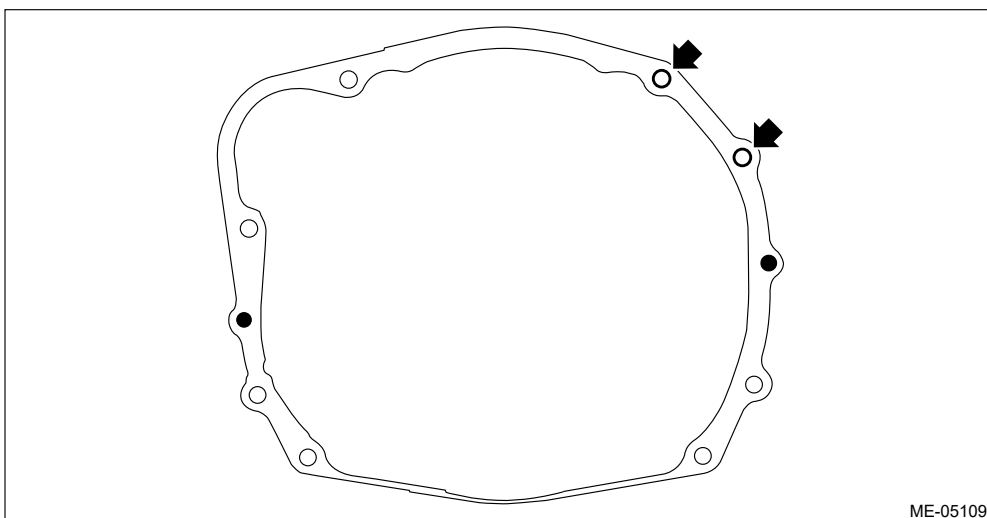
Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)

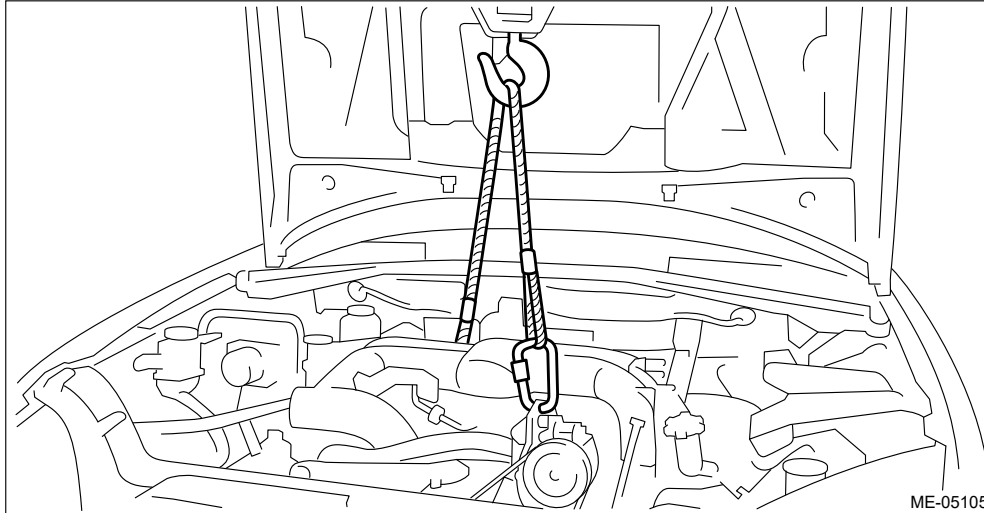
- CVT model



- MT model



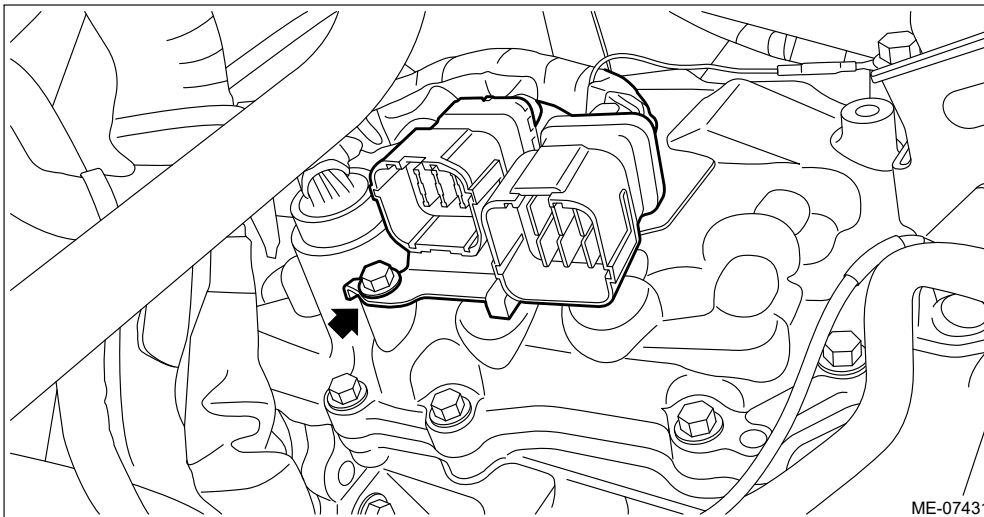
5. Remove the lifting device and wire ropes.



6. Remove the garage jack.
7. Install the transmission harness stay. (CVT model)

Tightening torque:

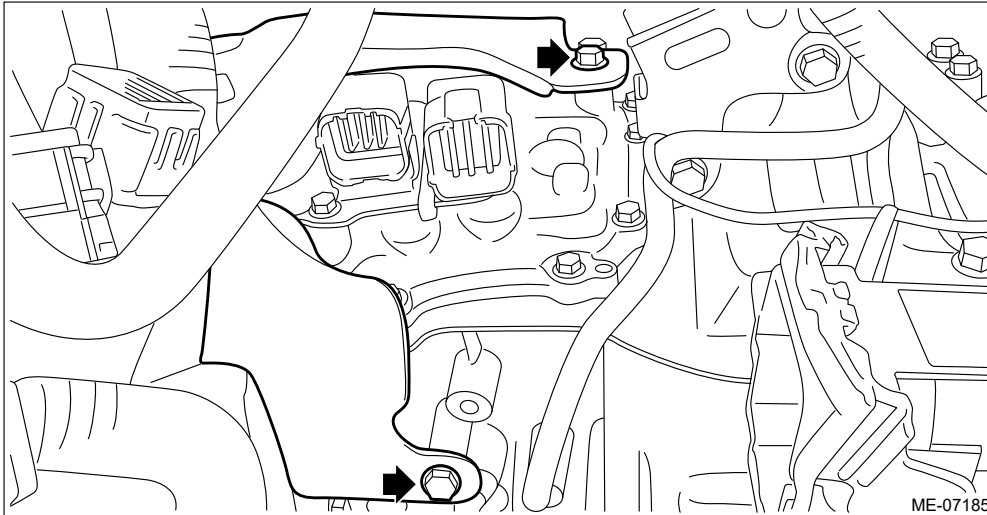
7 N·m (0.7 kgf-m, 5.2 ft-lb)



8. Install the transmission case cover. (CVT model)

Tightening torque:

8 N·m (0.8 kgf-m, 5.9 ft-lb)

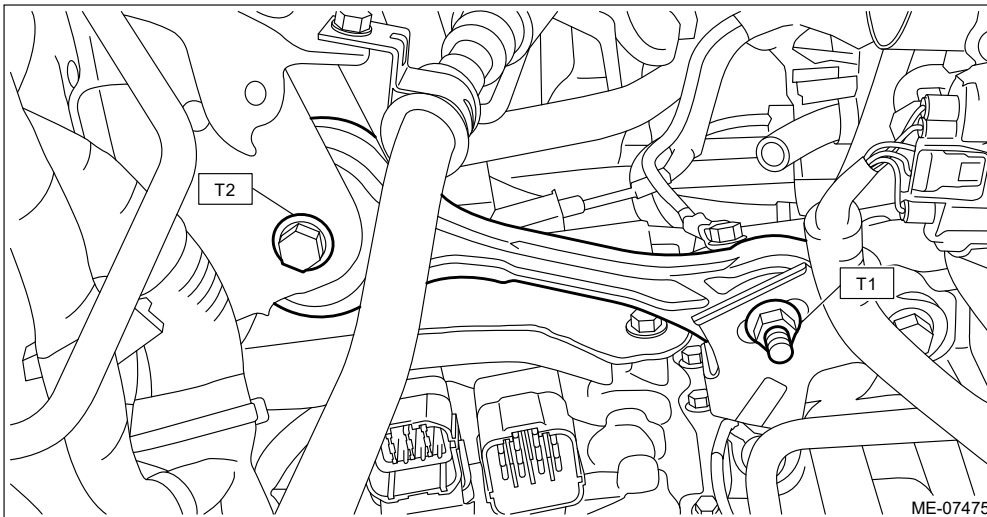


- 9.** Install the pitching stopper.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

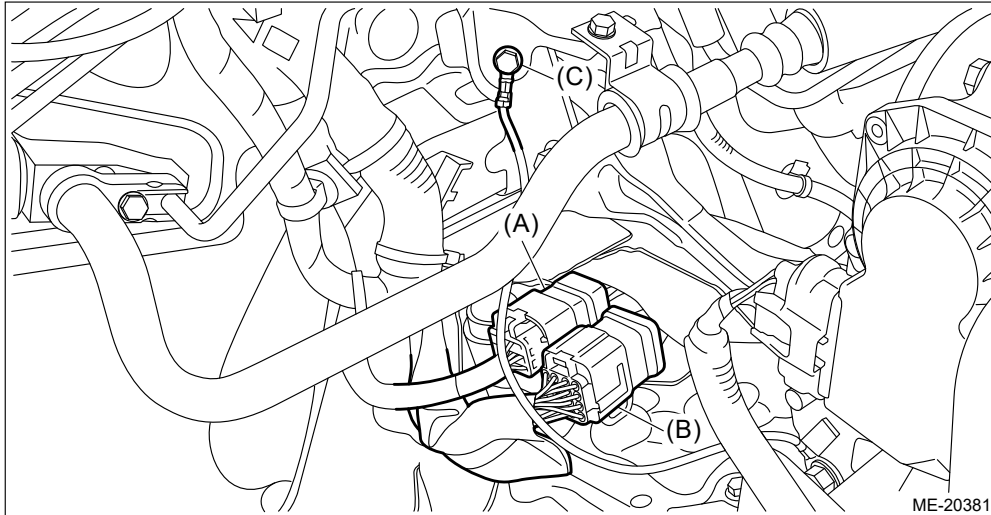
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



- 10.** Connect the transmission radio ground terminal (C) to the vehicle body, and connect the bulkhead harness connector to the transmission harness connector (A) and the inhibitor harness connector (B). (CVT model)

Tightening torque:

13 N·m (1.3 kgf-m, 9.6 ft-lb)

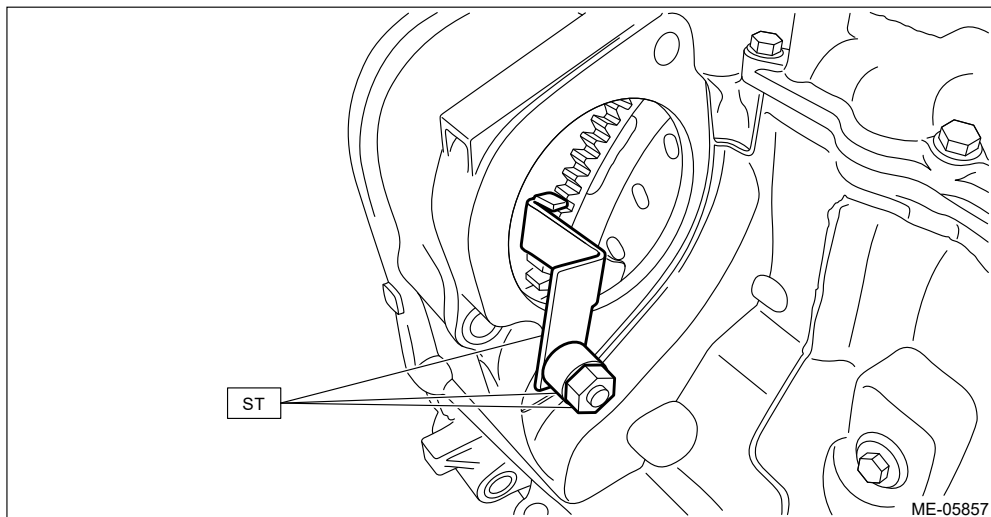


11. Remove the ST from torque converter clutch case. (CVT model)

Note:

Be careful not to drop the ST into the torque converter clutch case when removing the ST.

ST 498277200 STOPPER SET



12. Install the torque converter clutch to drive plate. (CVT model)

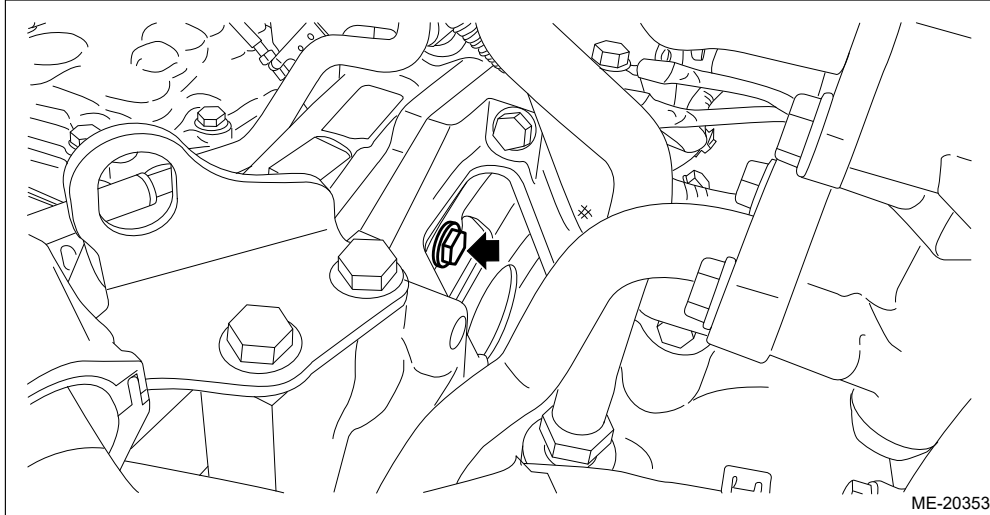
(1) Insert the wrench into the crank pulley bolt and rotate the crank pulley to install the bolts which hold torque converter clutch to drive plate.

Note:

Be careful not to drop bolts into the torque converter clutch case.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)



(2) Fit the plug to service hole.

13. Install the starter.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Starter>INSTALLATION.](#)

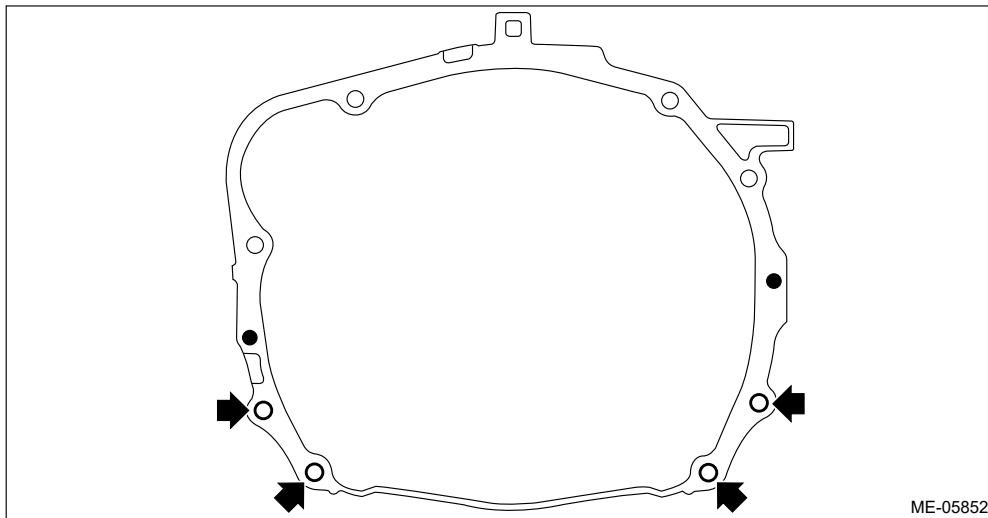
14. Lift up the vehicle.

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

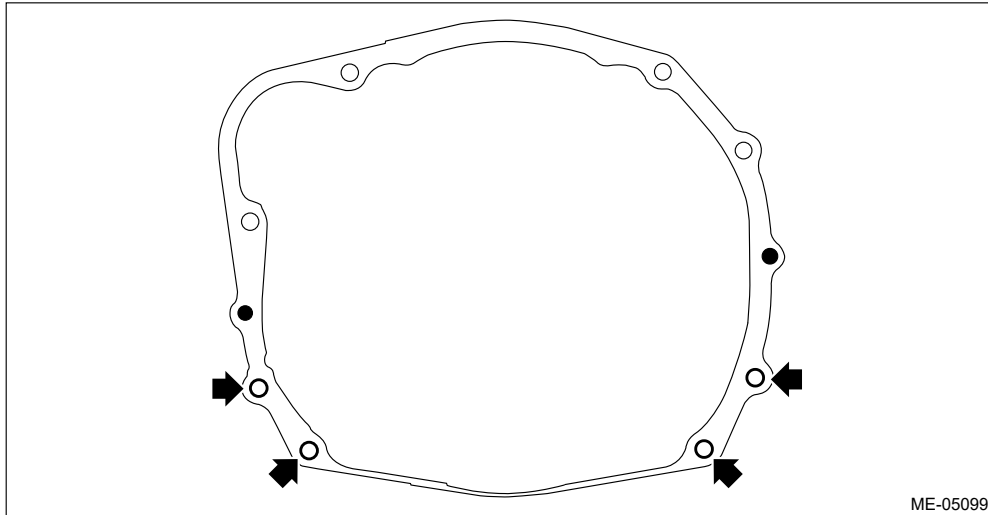
Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)

- CVT model



- MT model



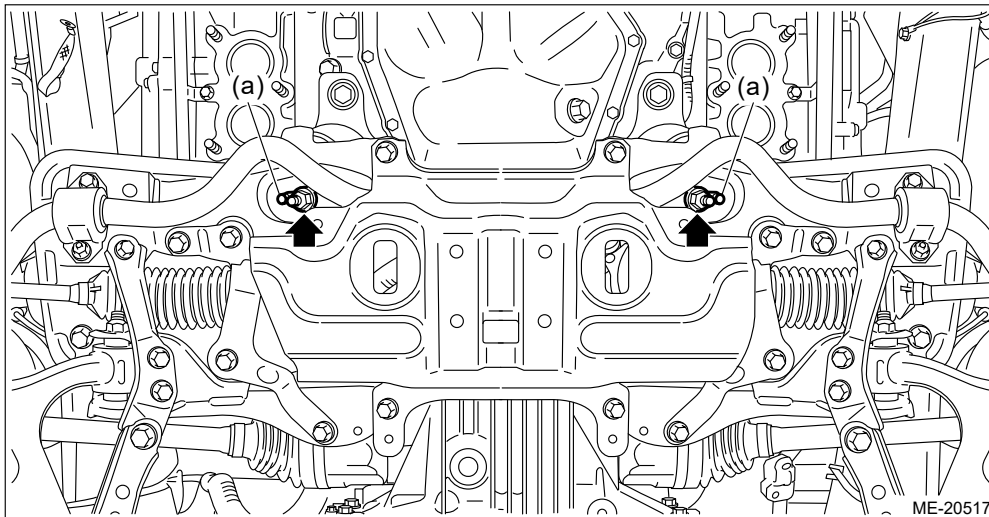
16. Install the nuts which hold the engine mounting to the front crossmember. (CVT model)

Note:

- Make sure that locators (a) of the engine mounting are securely inserted.
- Use a new nut.

Tightening torque:

60 N·m (6.1 kgf-m, 44.3 ft-lb)



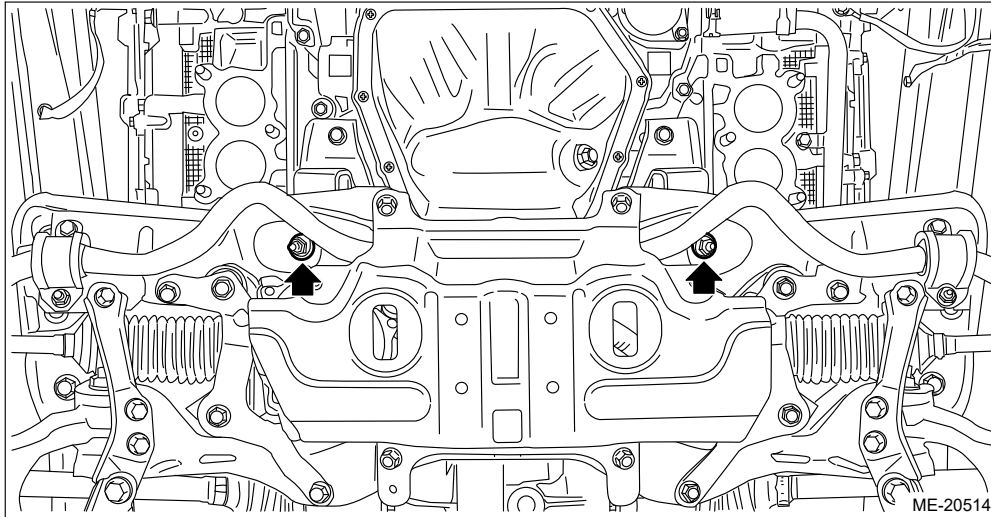
17. Install the nuts which hold the engine mounting to the crossmember. (MT model)

Note:

- Use a new nut.

Tightening torque:

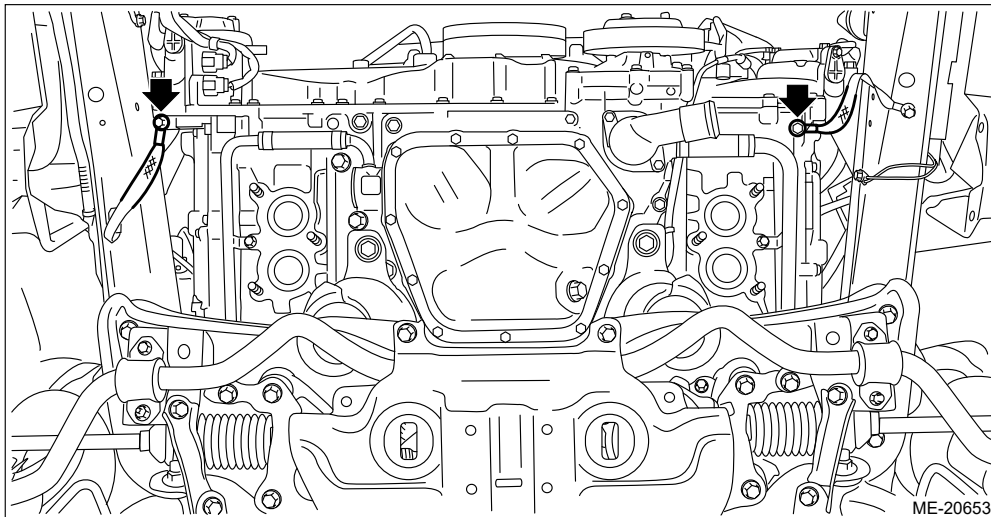
60 N·m (6.1 kgf-m, 44.3 ft-lb)



18. Connect the ground cable.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)



19. Install the under cover front - transmission.  [Ref. to EXTERIOR/INTERIOR TRIM>General Description>COMPONENT > FLOOR UNDER PROTECTOR.](#)

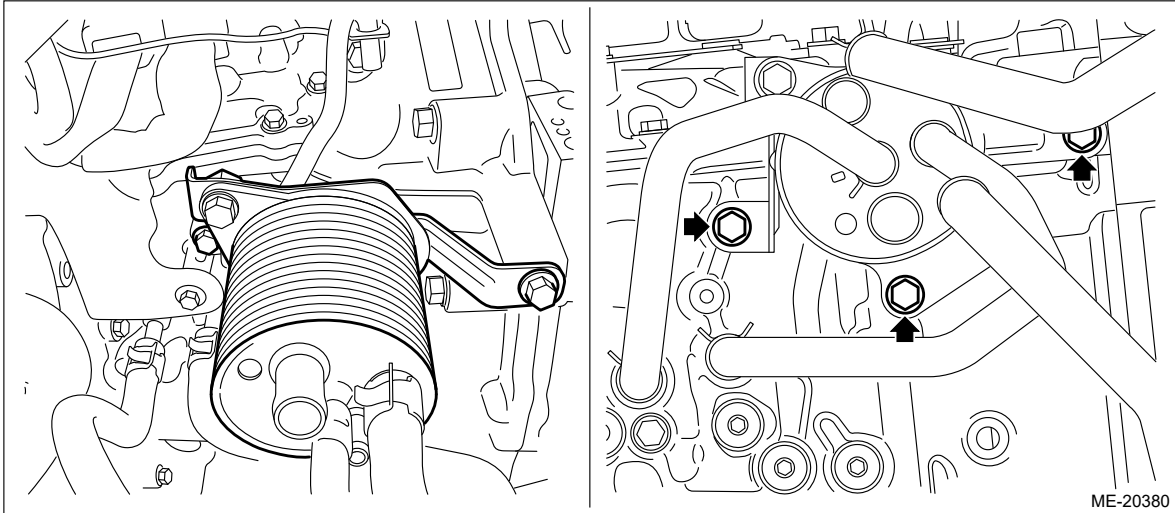
20. Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>INSTALLATION.](#)

21. Lower the vehicle.

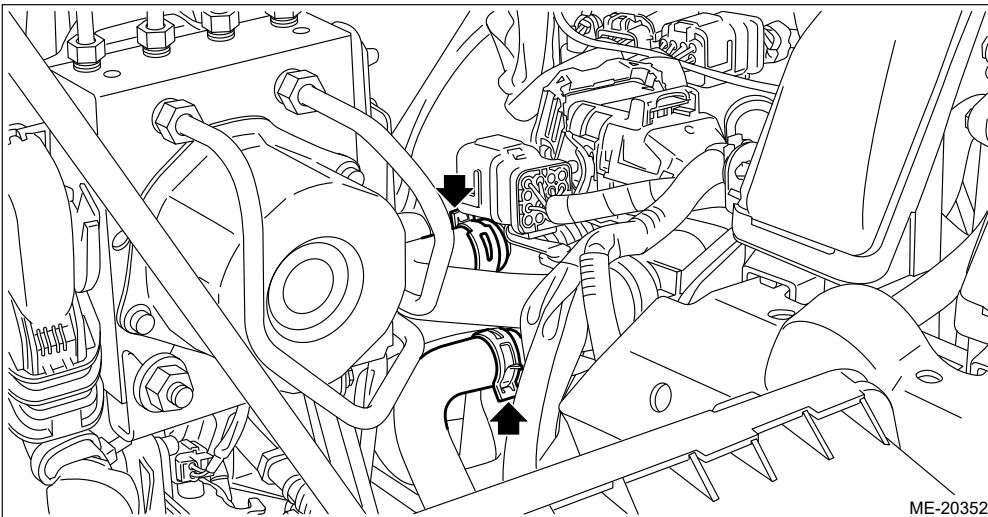
22. Install the CVTF cooler (with warmer feature) to the transmission. (CVT model)

Tightening torque:

23 N·m (2.3 kgf-m, 17.0 ft-lb)

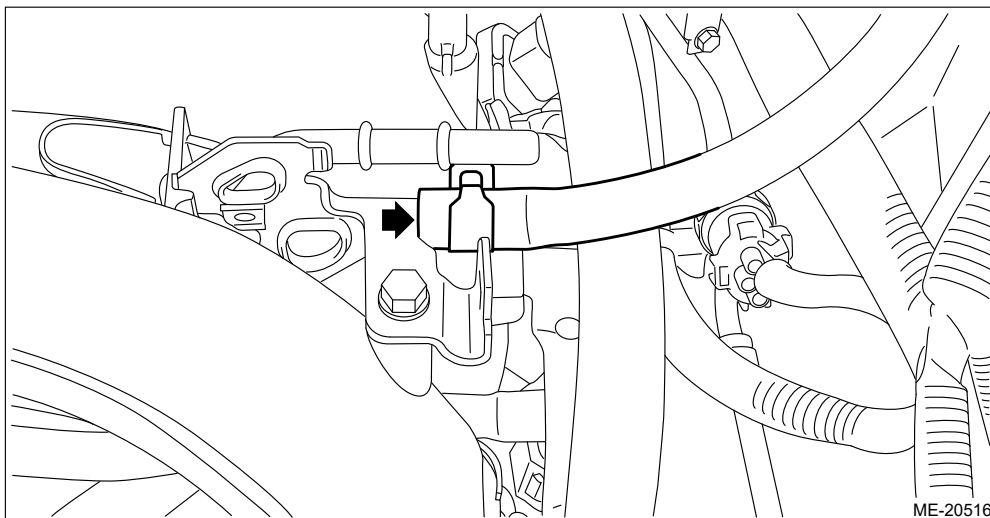


23. Connect the water hose to the CVTF cooler (with warmer feature). (CVT model)



24. Connect the fuel delivery tube and evaporation hose.

(1) Connect the evaporation hose to fuel pipe assembly.



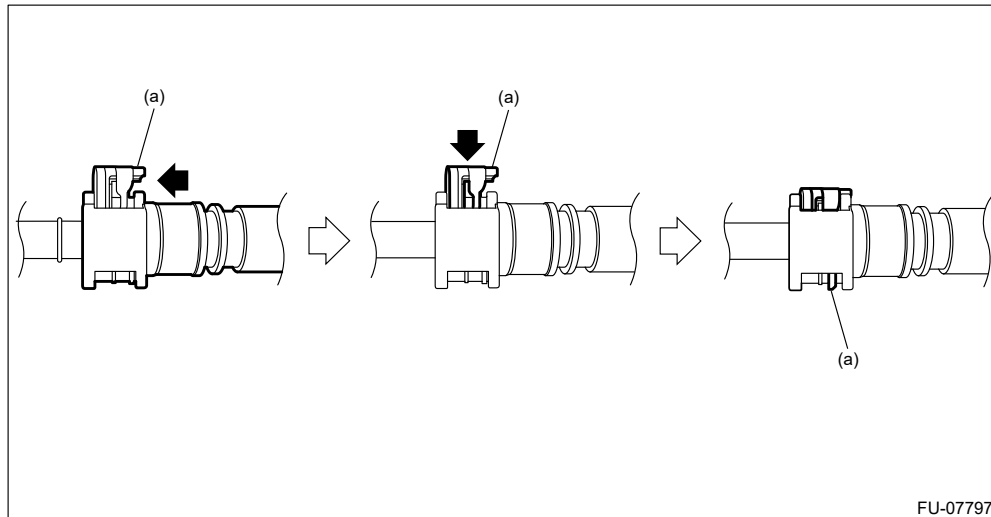
(2) Connect the quick connector on the fuel delivery tube to the fuel pipe assembly, and fix the fuel delivery tube using clip (A).

Caution:

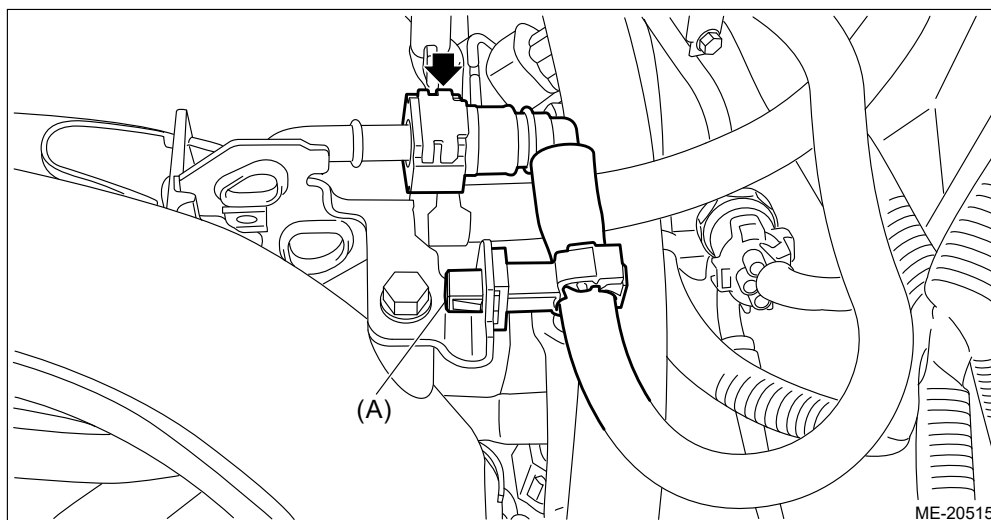
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



(a) Slider

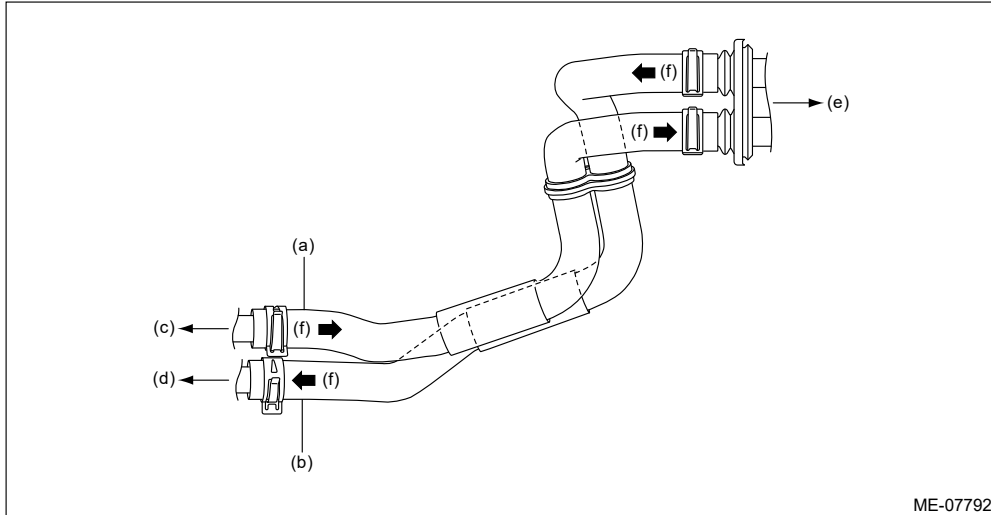


25. Connect the following hoses.

- (1) Heater inlet hose and heater outlet hose


Note:

Be careful not to mix up the heater inlet hose and the heater outlet hose when connecting them.



- | | | |
|------------------------|------------------------|-------------------------|
| (a) Heater inlet hose | (c) To water pipe ASSY | (e) To heater core ASSY |
| (b) Heater outlet hose | (d) To water pipe LH | (f) Engine coolant flow |

(2) Brake booster vacuum hose

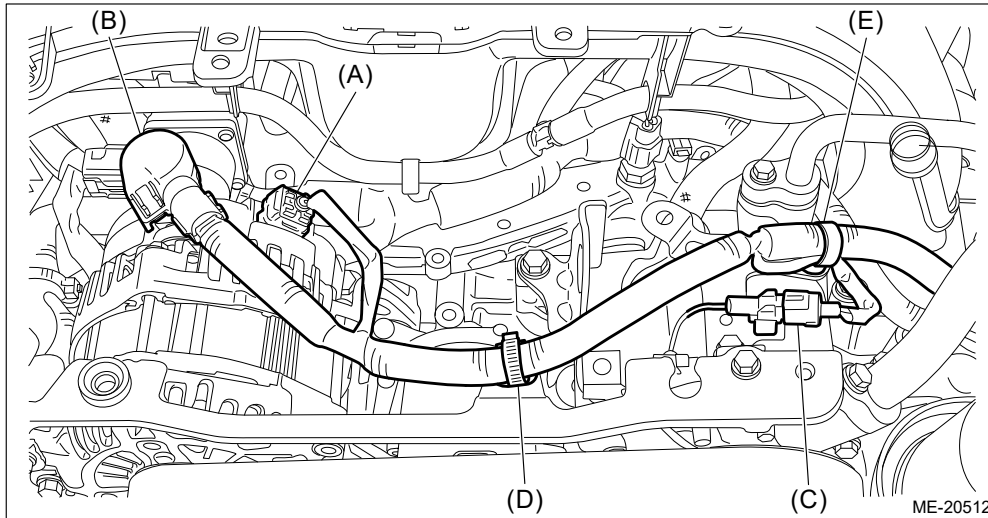
26. Connect the A/C pressure hose to A/C compressor.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Hose and Pipe>INSTALLATION.](#)

27. Place the generator code and install the generator cord to the clip (D) and clip (E).

28. Connect the connector (A) and terminal (B) to the generator, and connect the connector (C) to the A/C compressor.

Tightening torque:

15 N·m (1.5 kgf-m, 11.1 ft-lb)



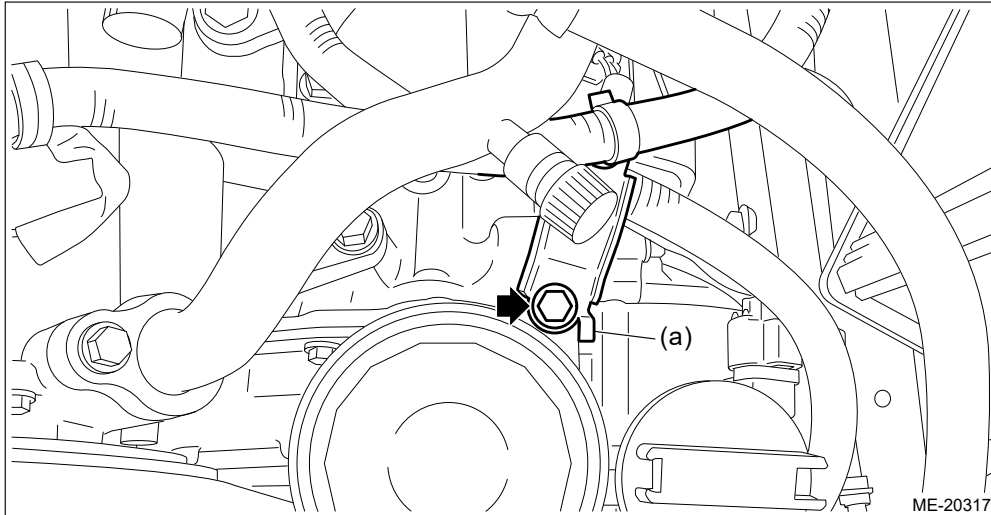
29. Install the generator cord stay A to the chain cover.

Note:

Install the generator cord stay so that the folded end (a) touches the chain cover boss.

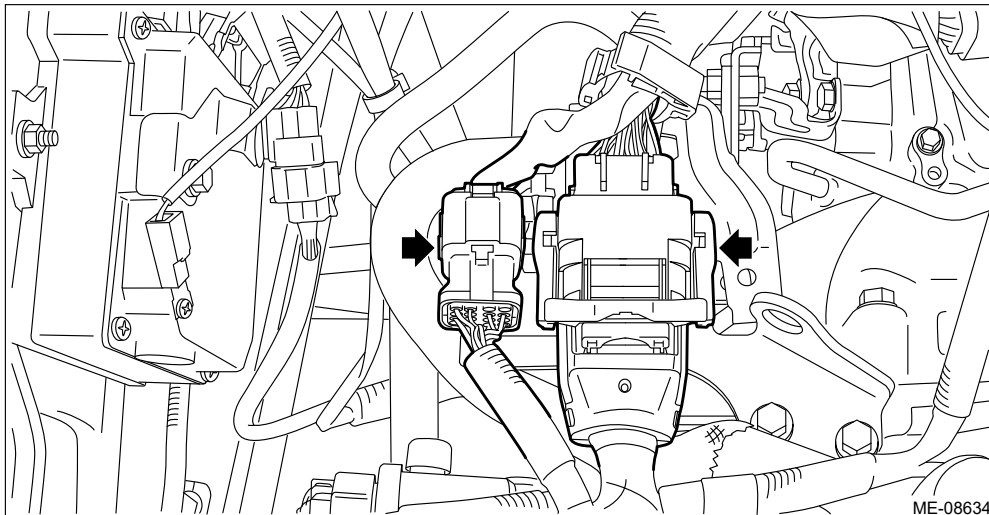
Tightening torque:

8 N·m (0.8 kgf-m, 5.9 ft-lb)



30. Connect the engine harness connector.

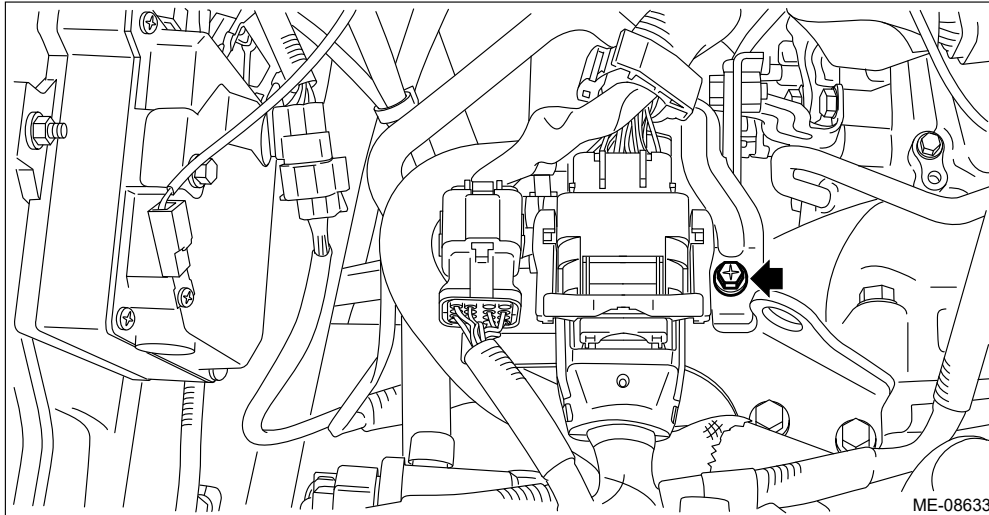
- (1) Connect the bulkhead harness connector to the engine harness connector (black) and engine harness connector (brown).





- (2) Install the bolt which secures the bulkhead harness connector bracket.

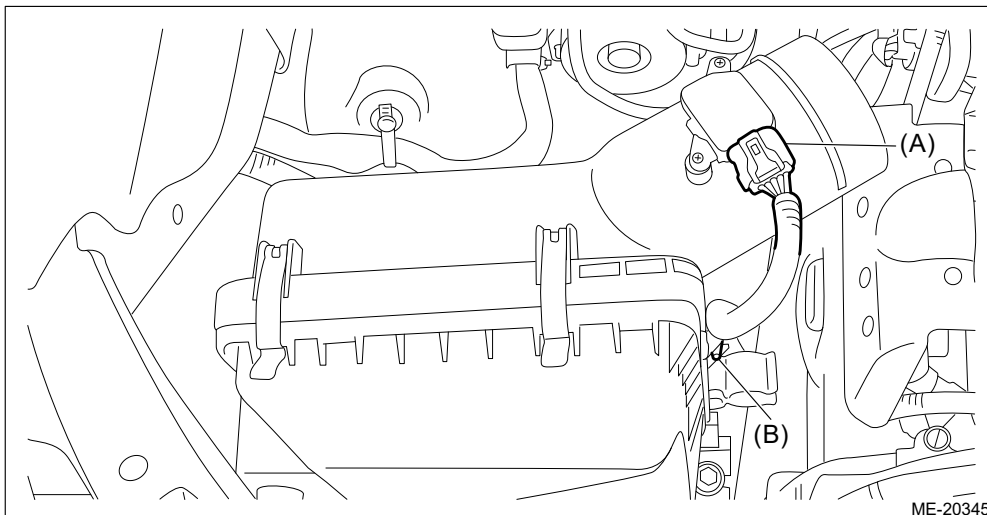
Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)








ME-08633

31. Install the radiator.  [Ref. to COOLING\(H4DO\)>Radiator>INSTALLATION.](#)
32. Install the air cleaner case (rear) together with the air cleaner element.  [Ref. to INTAKE \(INDUCTION\) \(H4DO\)>Air Cleaner Case>INSTALLATION.](#)
33. Secure the bulkhead wiring harness with clip (B) and connect the connector (A) to the mass air flow and intake air temperature sensor.

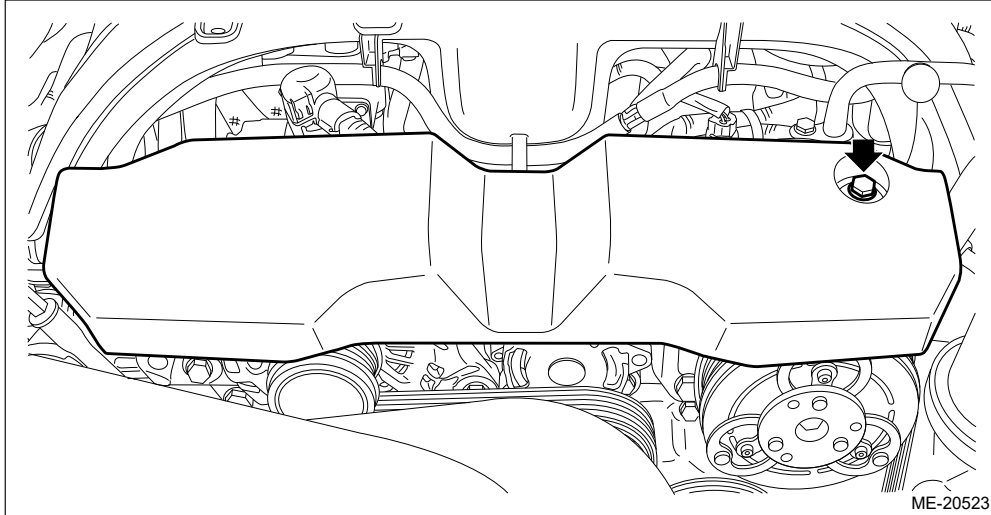


ME-20345

34. Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)
35. Install the air intake duct.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>INSTALLATION.](#)
36. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
37. Charge the A/C system with refrigerant.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Refrigerant Charging Procedure>PROCEDURE.](#)
38. Fill engine coolant.  [Ref. to COOLING\(H4DO\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
39. Install the V-belt cover.

Tightening torque:

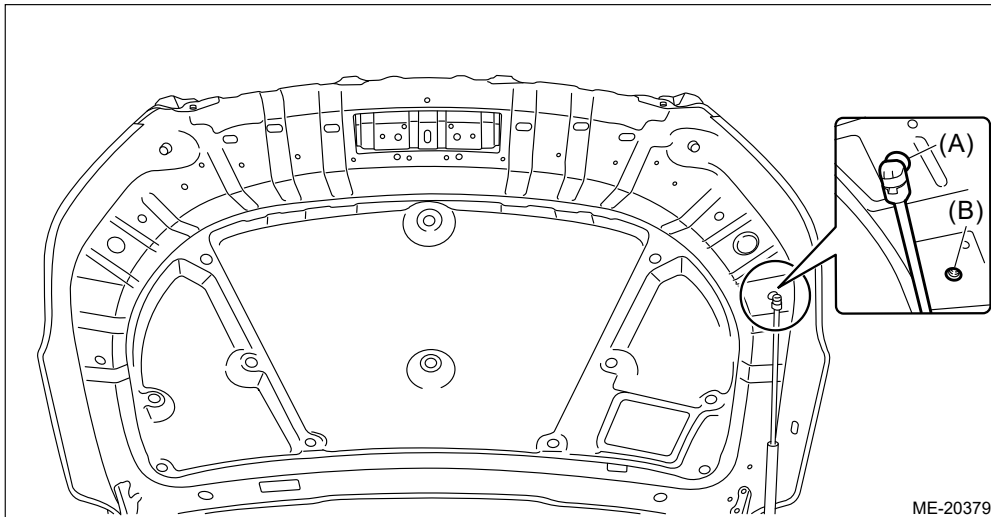
7 N·m (0.7 kgf·m, 5.2 ft·lb)



40. Change the installation position of the front hood damper from (B) to (A).

Tightening torque:

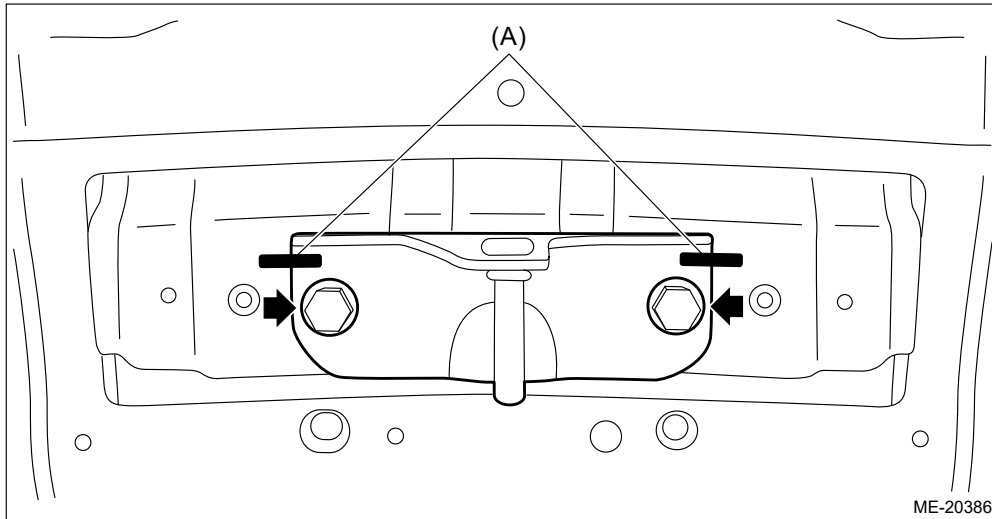
20 N·m (2.0 kgf-m, 14.8 ft-lb)




41. Align the alignment marks (A), and install the front hood striker to the front hood.

Tightening torque:


33 N·m (3.4 kgf-m, 24.3 ft-lb)

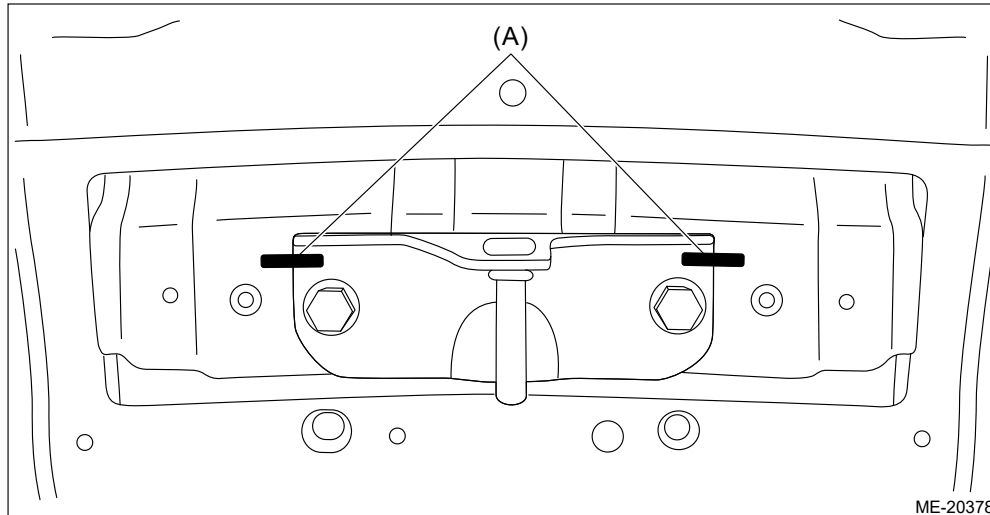


42. Install the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>INSTALLATION.](#)

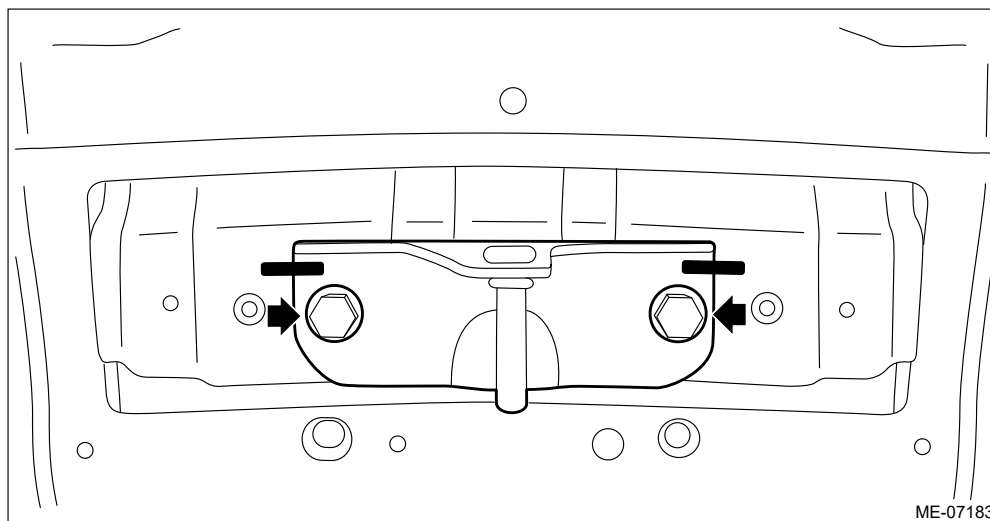
MECHANICAL(H4DO) > Engine Assembly

REMOVAL

1. Remove the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>REMOVAL > FRONT GRILLE UPPER.](#)
2. Using a marker pen, make alignment marks (A) on both the front hood and the front hood striker.



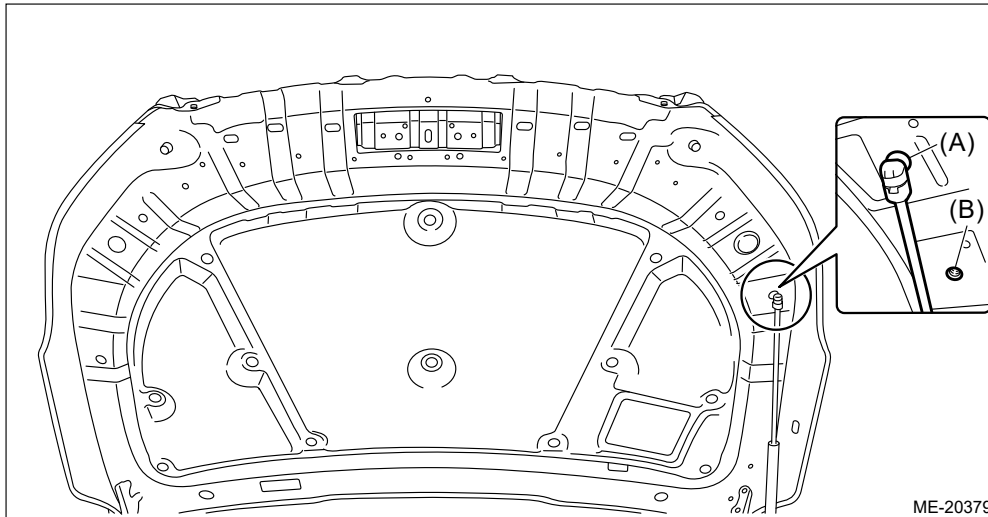
3. Remove the front hood striker from the front hood.



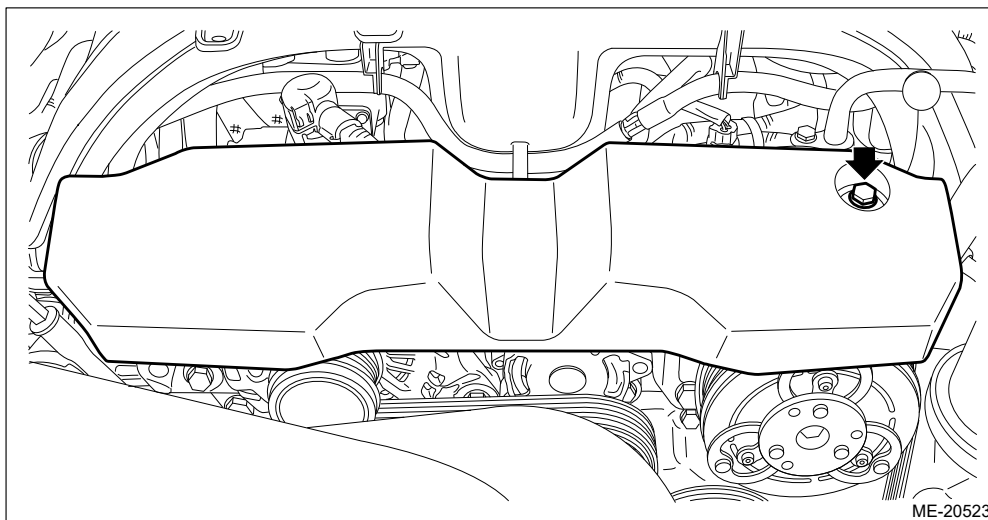
4. Change the front hood damper mounting position from (A) to (B), and completely open the front hood.

Tightening torque:

20 N·m (2.0 kgf-m, 14.8 ft-lb)



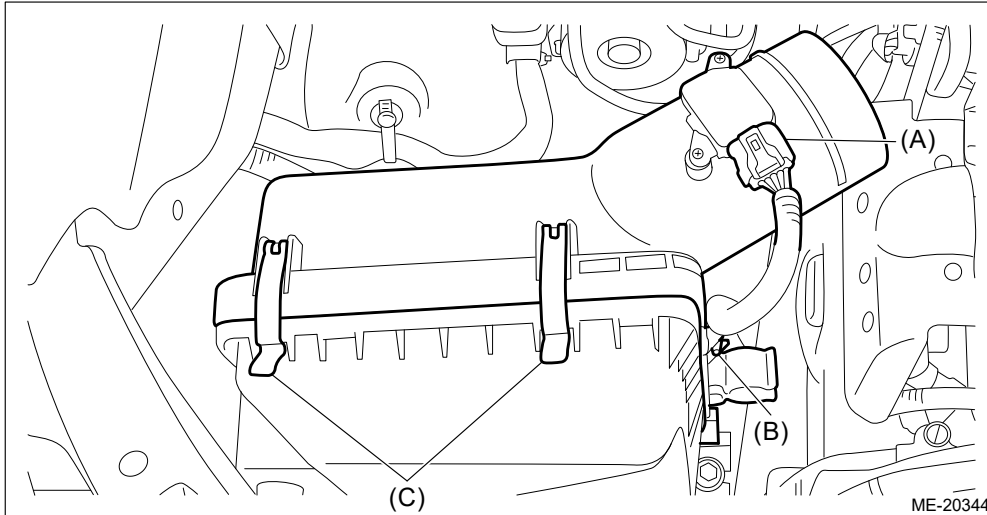
5. Remove the V-belt covers.




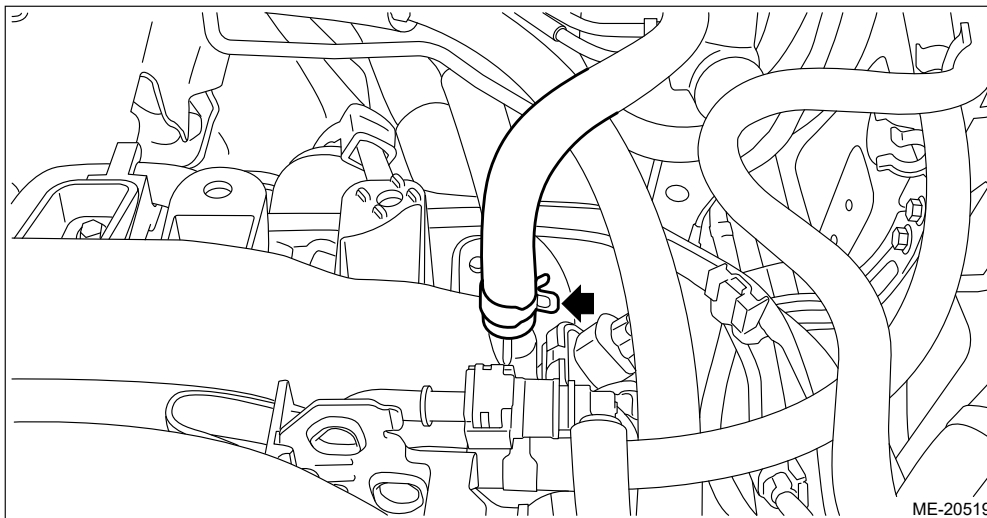
6. Collect the refrigerant from A/C system. [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Refrigerant Recovery Procedure.](#)
7. Release the fuel pressure. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)
8. Open the fuel filler lid and remove the fuel filler cap.

Note:

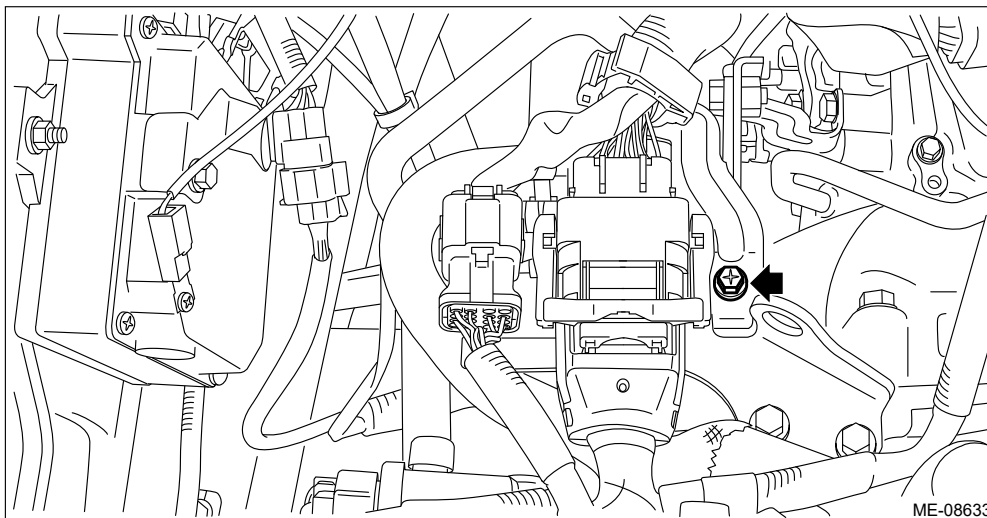
This operation is required to release the inner pressure of the fuel tank.
9. Disconnect the ground terminal from battery sensor. [Ref. to NOTE>NOTE > BATTERY.](#)
10. Remove the air intake duct. [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
11. Remove the air intake boot. [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>REMOVAL.](#)
12. Disconnect the connector (A) from the mass air flow and intake air temperature sensor, and remove the clip (B) securing the bulkhead wiring harness.
13. Remove the clip (C), and the air cleaner case (rear) together with the air cleaner element.



- 14.** Remove the radiator.  Ref. to [COOLING\(H4DO\)>Radiator>REMOVAL](#).
- 15.** Disconnect the brake booster vacuum hose from the intake manifold.

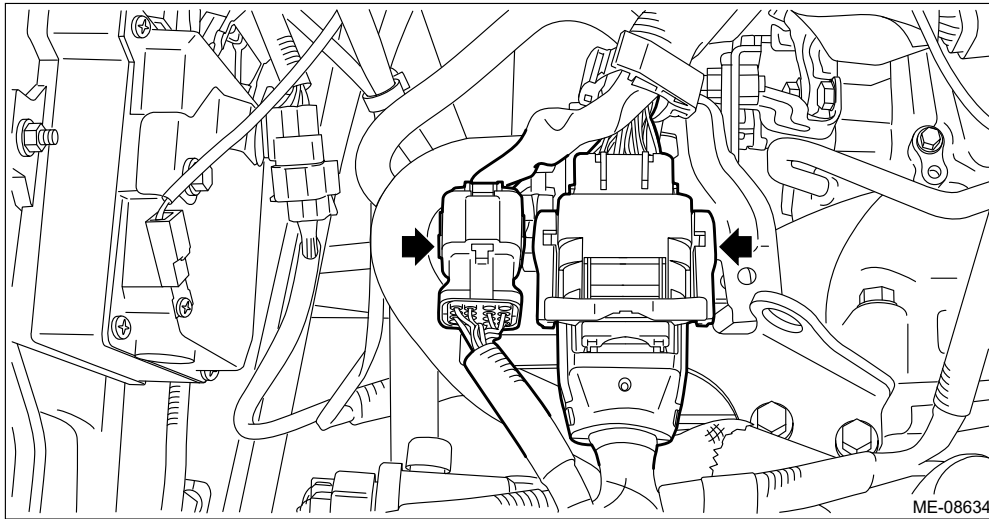


- 16.** Disconnect the engine harness connector.
- (1) Remove the bolt securing the bulkhead harness connector bracket.

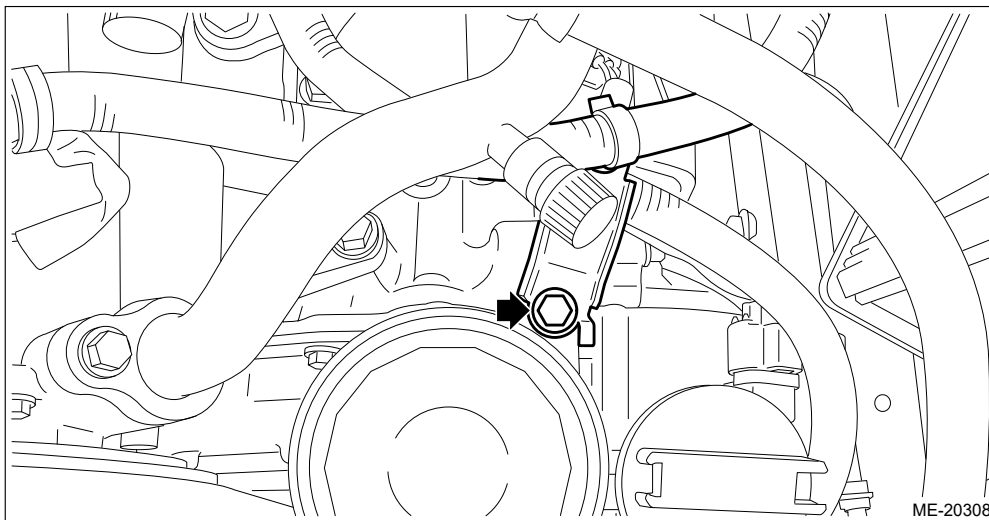


- (2) Disconnect the bulkhead harness connector from the engine harness connector (black) and engine

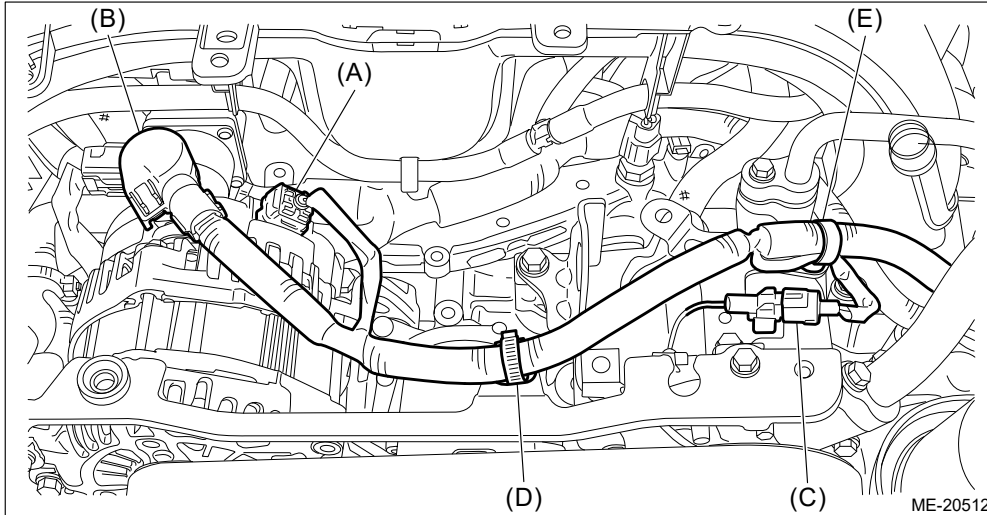
harness connector (brown).




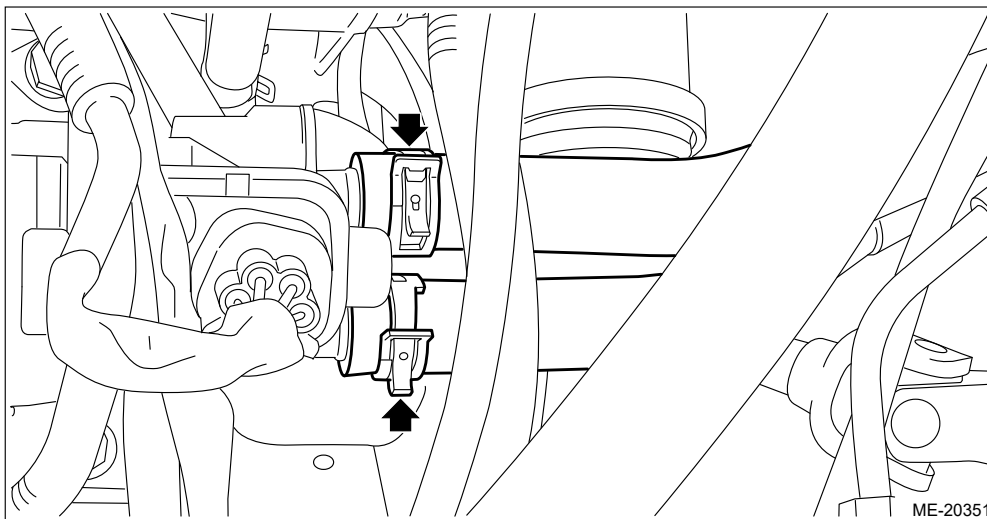
17. Remove the bolt which secures the generator cord stay A to the chain cover.



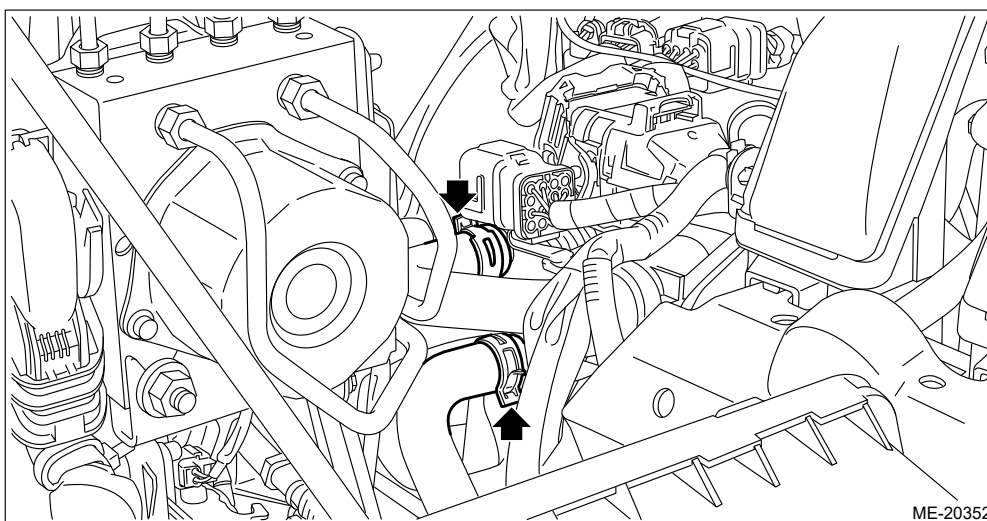
18. Disconnect connector (A) and terminal (B) from the generator, and disconnect connector (C) from A/C compressor.
19. Remove the generator cord from the clip (D) and clip (E), and move the generator cord aside so that it does not interfere with the work.



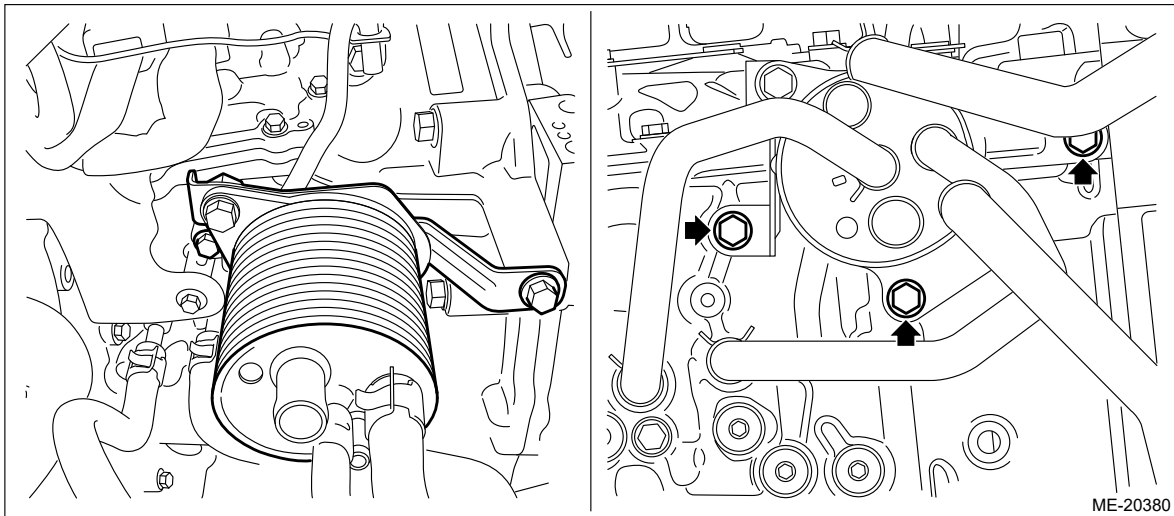
- 20. Disconnect the A/C pressure hoses from A/C compressor.  Ref. to [HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Hose and Pipe>REMOVAL](#).
- 21. Disconnect the heater inlet hose and the heater outlet hose from the water pipe assembly and water pipe assembly LH.





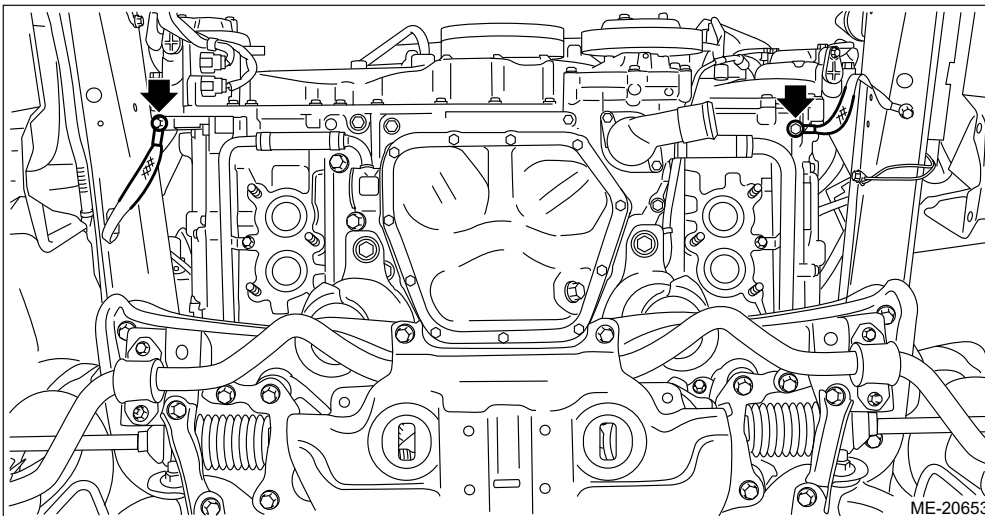
- 22. Disconnect the water hose from CVTF cooler (with warmer feature). (CVT model)



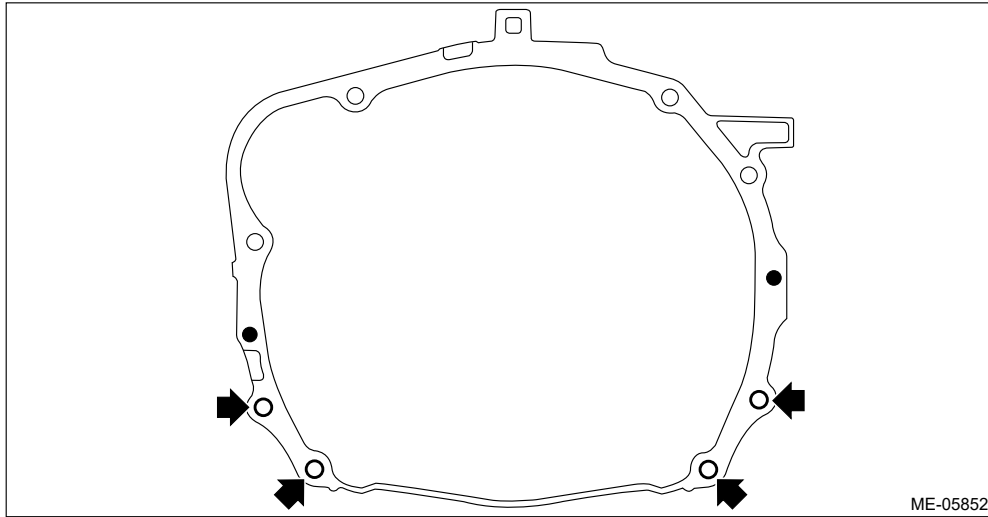
- 23.** Remove the bolt securing the CVTF cooler (with warmer feature) to the transmission, and move the CVTF cooler (with warmer feature) to the location where it does not interfere with the work. (CVT model)



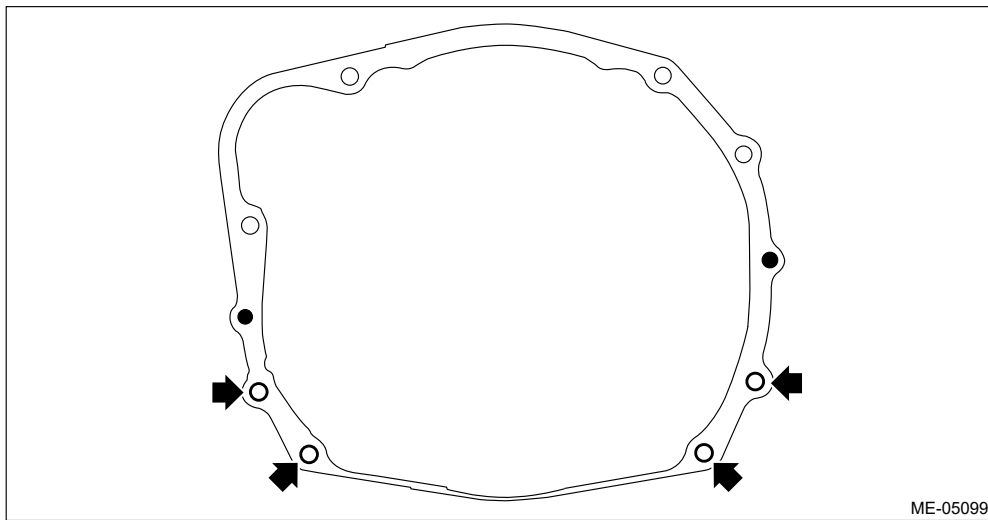
- 24.** Lift up the vehicle.
- 25.** Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)
- 26.** Remove the under cover front - transmission.  [Ref. to EXTERIOR/INTERIOR TRIM>General Description>COMPONENT > FLOOR UNDER PROTECTOR.](#)
- 27.** Disconnect the ground cable on the engine side.



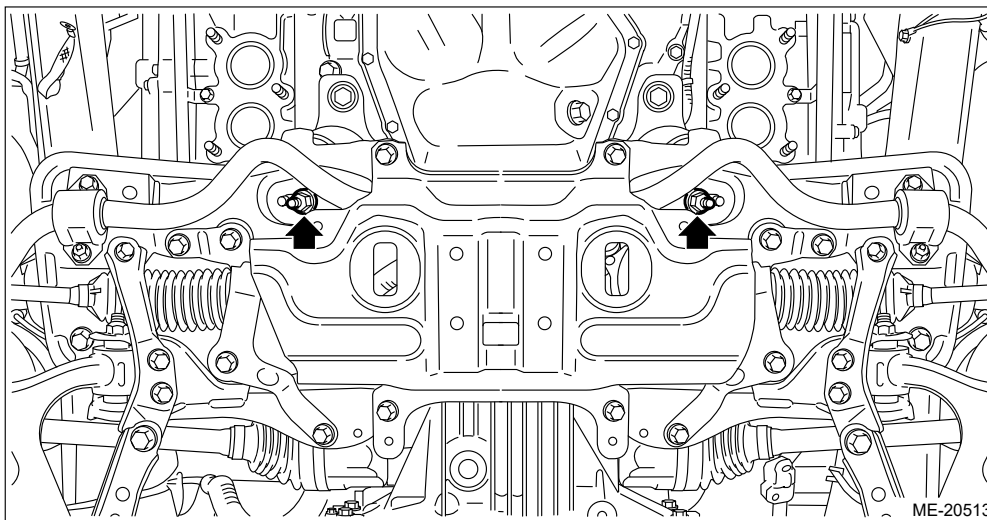
- 28.** Remove the bolts and nuts which hold the lower side of transmission to the engine.
- CVT model



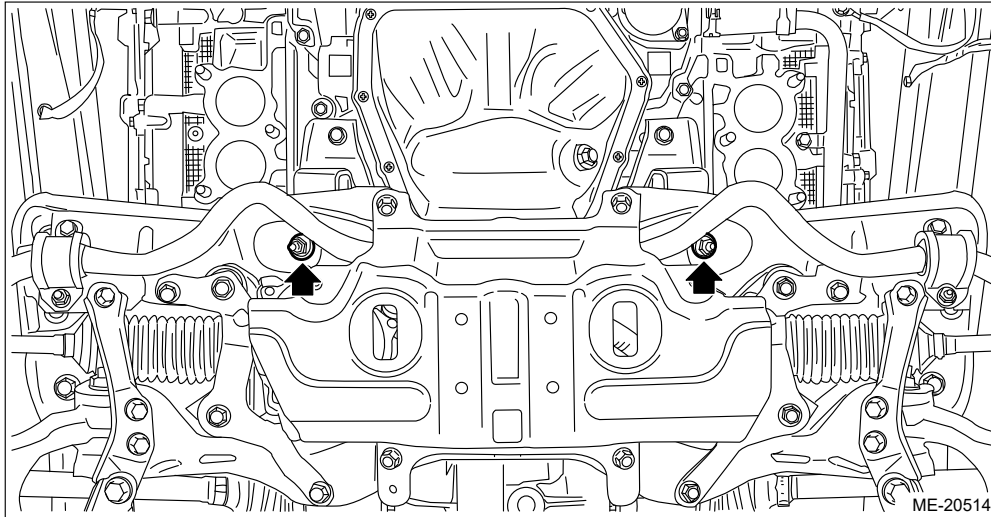
- MT model



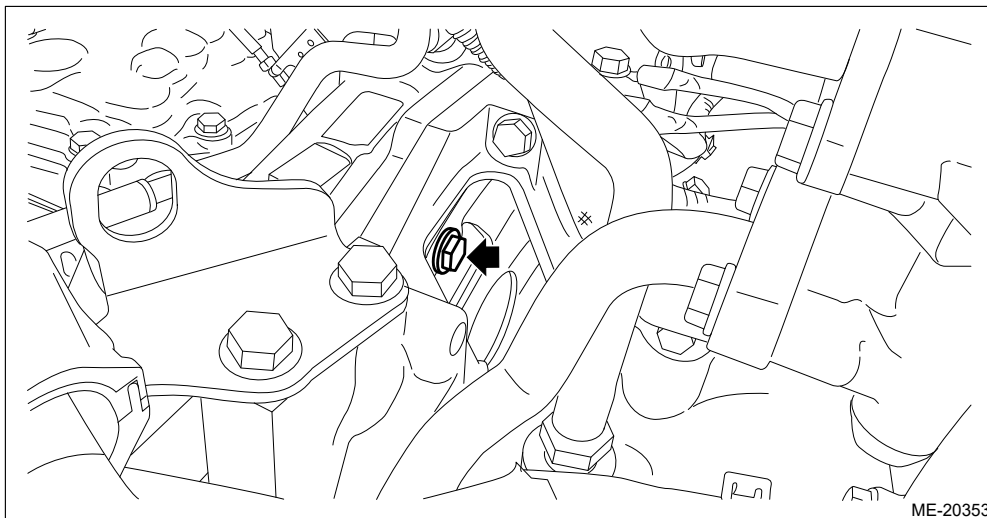
29. Remove the nuts which secure the engine mounting to the front crossmember. (CVT model)



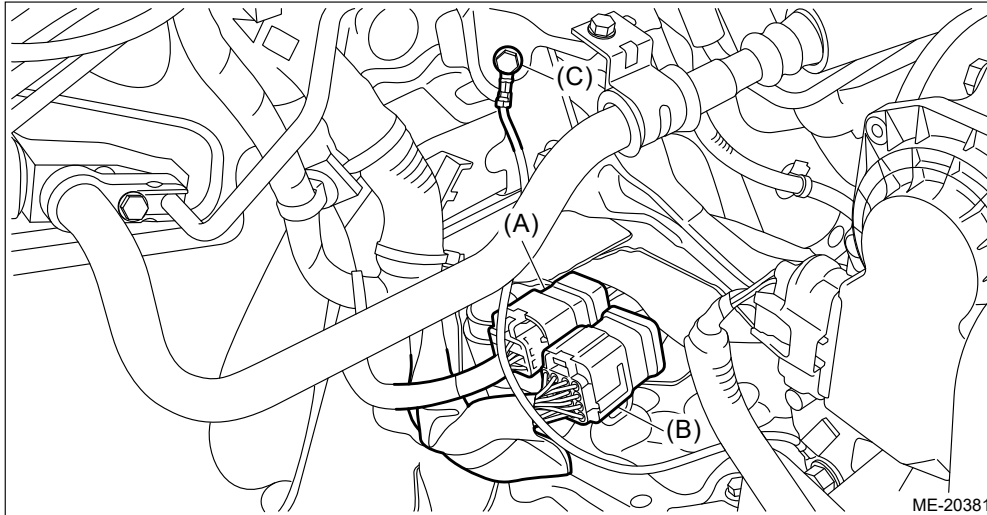
30. Remove the nuts which secure the engine mounting to the front crossmember. (MT model)



- 31.** Lower the vehicle.
- 32.** Separate the torque converter clutch from the drive plate. (CVT model)
 - (1) Remove the service hole plug.
 - (2) Insert the wrench into the crank pulley bolt and rotate the crank pulley to remove the bolts which hold torque converter clutch to drive plate.

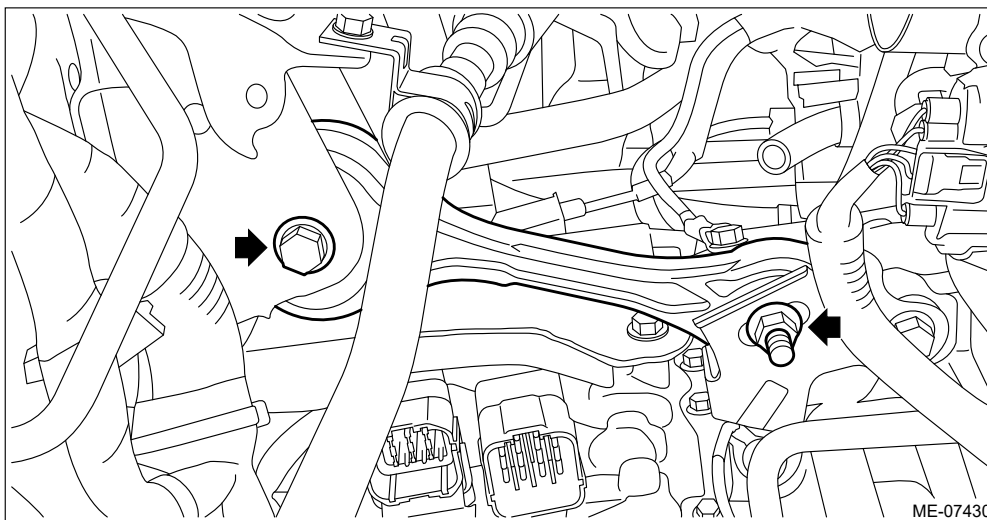


- 33.** Disconnect the bulkhead harness connector from the transmission harness connector (A) and the inhibitor harness connector (B), and disconnect the transmission radio ground terminal (C) from the vehicle body.



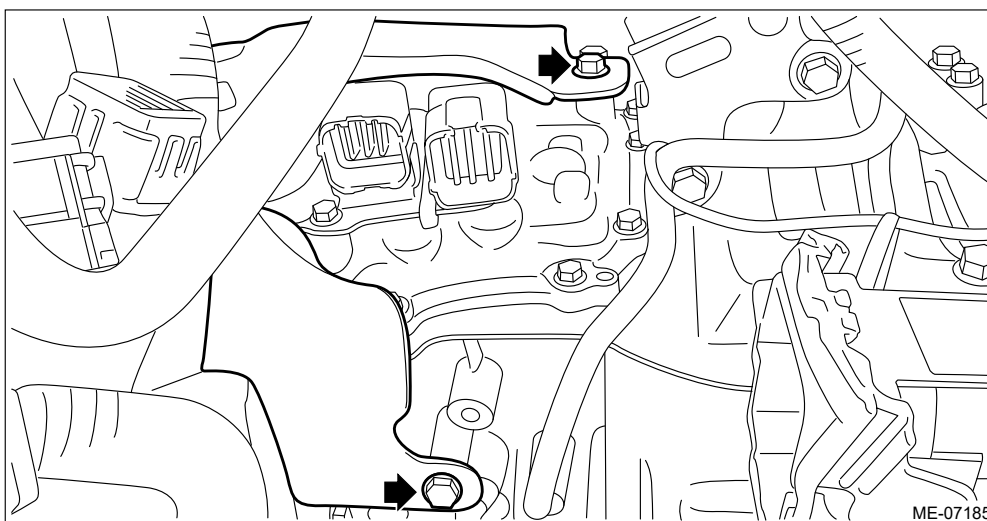
ME-20381

34. Remove the pitching stopper.



ME-07430

35. Remove the transmission case cover. (CVT model)

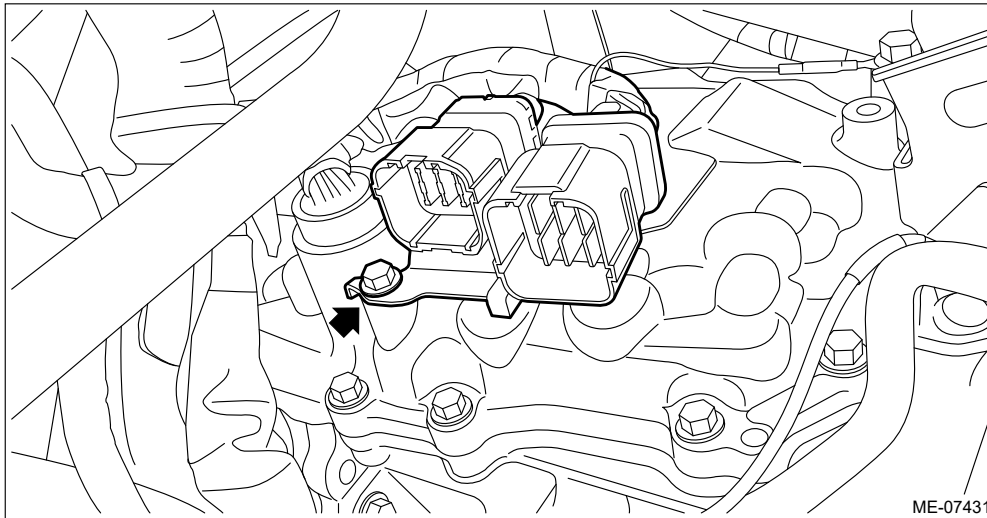


ME-07185

36. Remove the transmission harness stay and move to the engine side. (CVT model)

Note:

This procedure is required to prevent the transmission connector from touching the A/C pressure hose during engine removal/installation.



37. Disconnect the fuel delivery tube and evaporation hose.

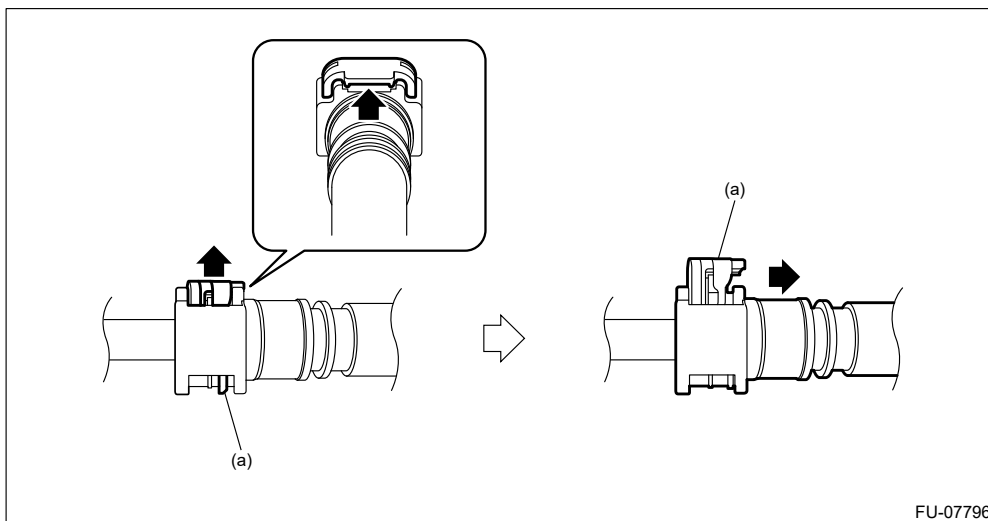
Caution:

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

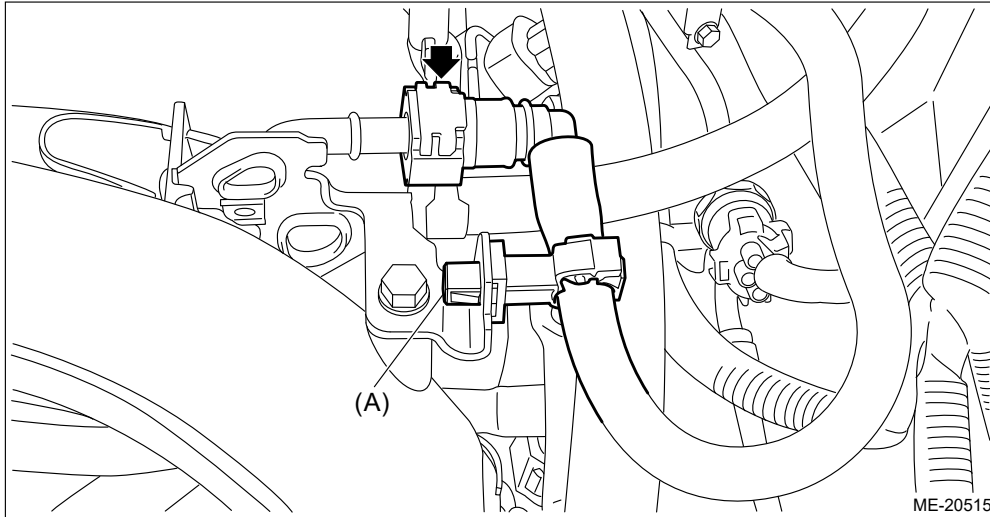
(1) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube.

Note:

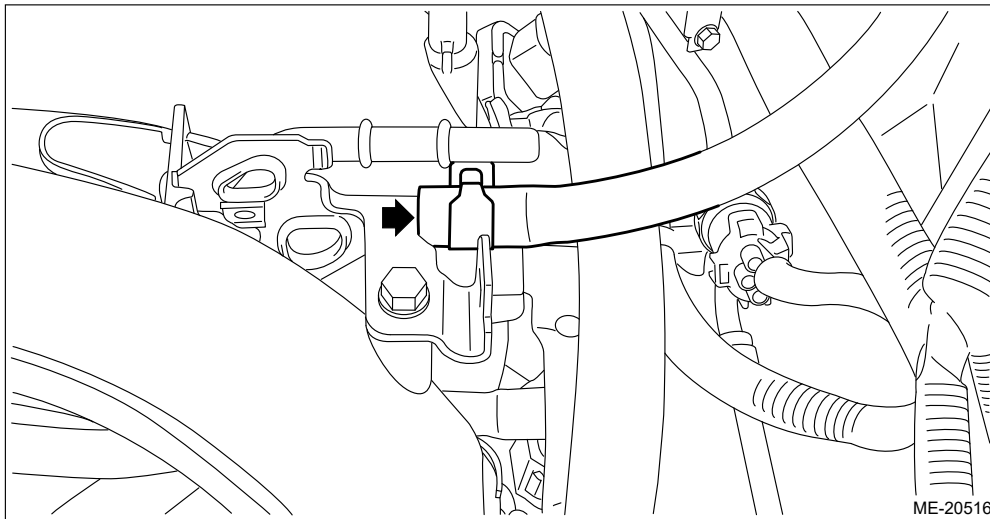
Disconnect the quick connector as shown in the figure.



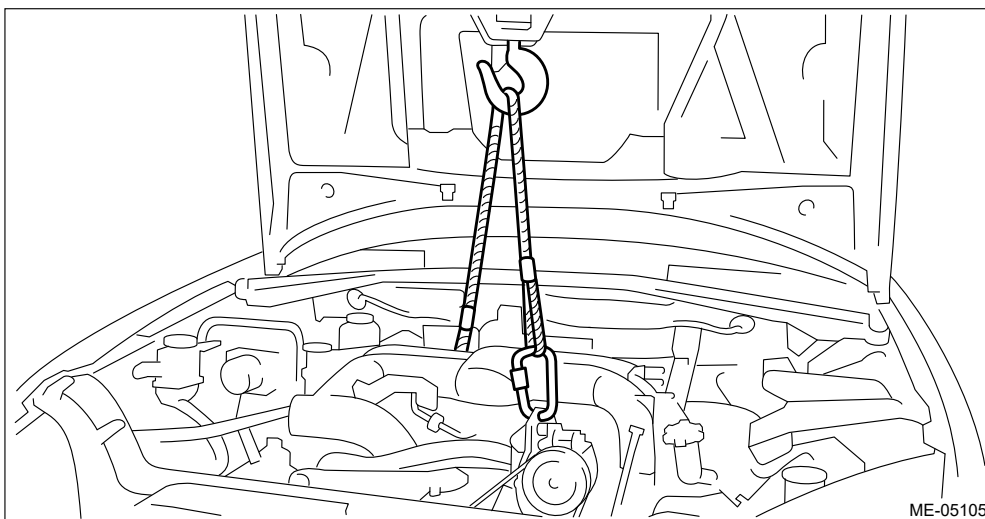
(a) Slider



(2) Disconnect the evaporation hose from the fuel pipe assembly.



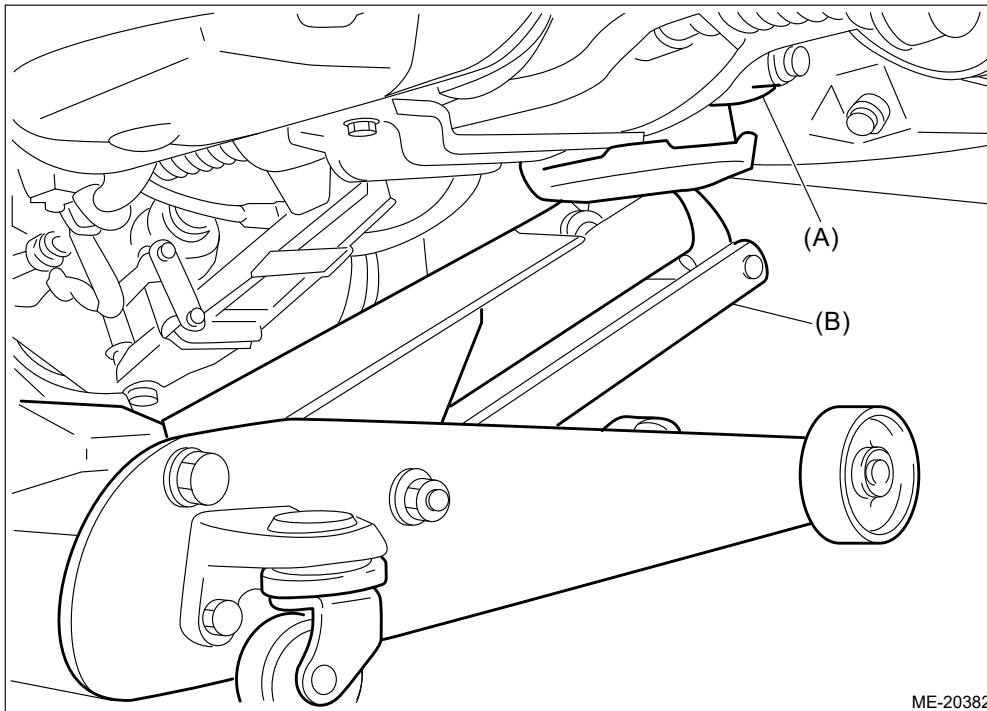
38. Support the engine with a lifting device and wire ropes.



39. Support the transmission with a garage jack.

Caution:

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




(A) Transmission

(B) Garage jack

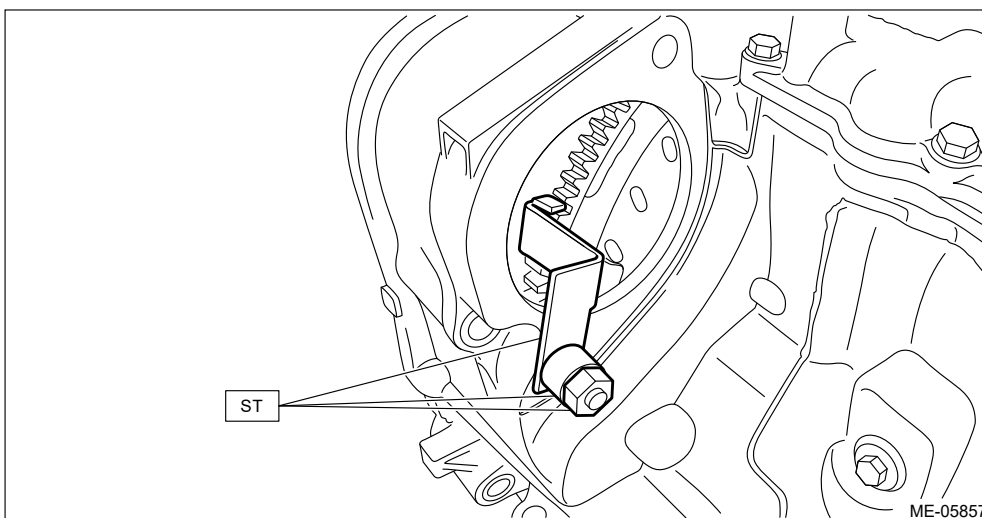
40. Separate the engine and transmission.

Caution:

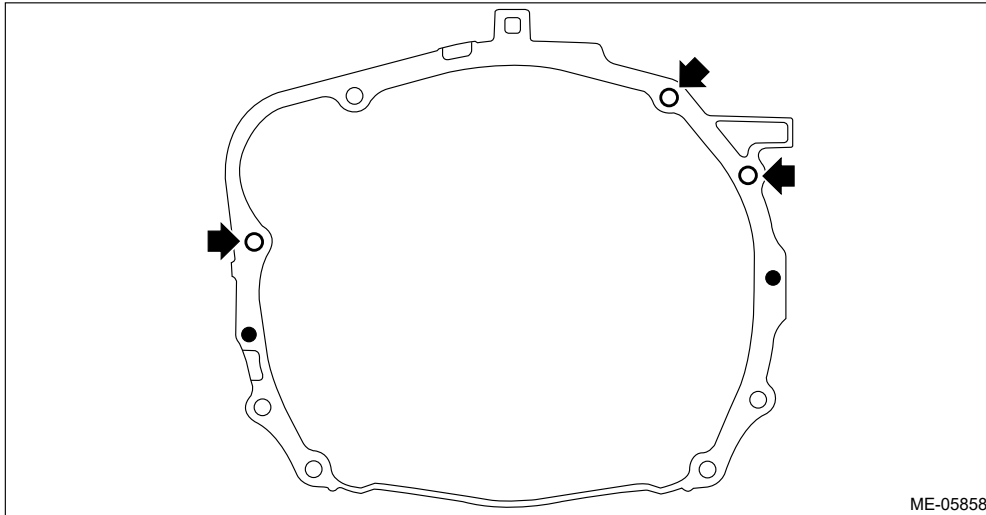
Before removing the engine away from transmission, check to be sure no work has been overlooked.

- (1) Remove the starter.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Starter>REMOVAL.](#)
- (2) Attach the ST to the torque converter clutch case. (CVT model)

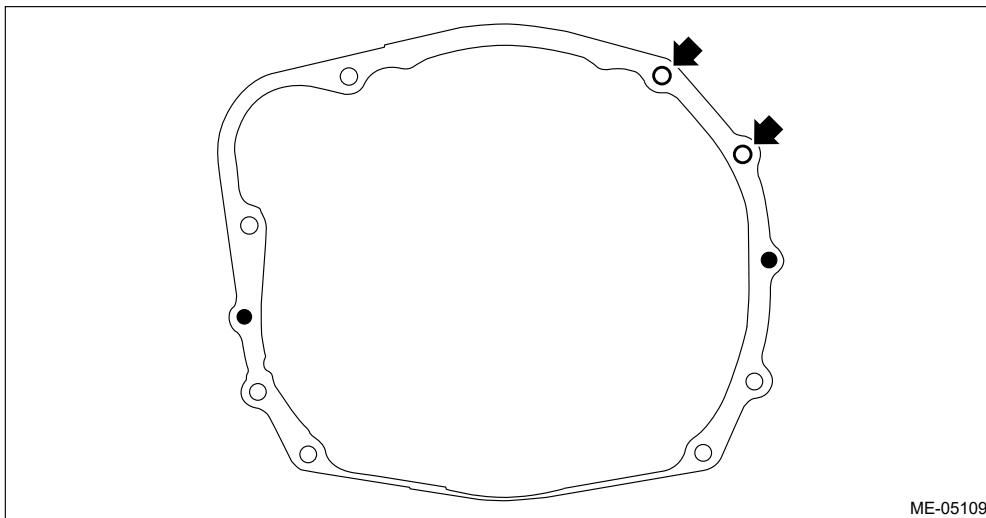
ST 498277200 STOPPER SET



- (3) Remove the bolts which hold the upper side of the transmission to the engine.
 - CVT model



- MT model



41. Remove the engine from the vehicle.

Note:

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

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

42. Remove the engine mounting from the engine.

MECHANICAL(H4DO) > Engine Mounting

INSPECTION

Make sure that there are no cracks or other damages.

MECHANICAL(H4DO) > Engine Mounting

INSTALLATION


Install in the reverse order of removal.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)

MECHANICAL(H4DO) > Engine Mounting

REMOVAL

- 1.** Remove the front crossmember.  [Ref. to FRONT SUSPENSION>Front Crossmember>REMOVAL.](#)
- 2.** Remove the engine mounting from the engine.



MECHANICAL(H4DO) > Engine Noise

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 cam clearance • Worn camshaft • Broken valve spring • Defective valve shim |
| Heavy and dull clank | Oil pressure is low. | <ul style="list-style-type: none"> • Worn crankshaft bearing • Worn connecting rod bearing |
| | Oil pressure is normal. | <ul style="list-style-type: none"> • Loosened flywheel mounting bolt • Damaged engine mounting |
| High-pitched clank | Sound is noticeable when accelerating with an overload condition. | <ul style="list-style-type: none"> • Ignition timing advanced • Accumulation of carbon inside combustion chamber • Wrong heat range of spark plug • Improper octane value gasoline |
| Clank noise when engine speed is (1,000 – 2,000 r/min) | Noise is reduced when fuel injector connector of noisy cylinder is disconnected.* | <ul style="list-style-type: none"> • Worn crankshaft bearing • Worn connecting rod bearing |
| Knocking sound when engine is operating under idling speed and engine is warm | Noise is reduced when fuel injector connector of noisy cylinder is disconnected.* | <ul style="list-style-type: none"> • Worn cylinder liner and piston ring • Broken or stuck piston ring • Worn piston pin and piston pin hole of piston |
| | Sound is not reduced if each fuel injector connector is disconnected in turn.* | <ul style="list-style-type: none"> • Unusually worn valve rocker • Unusually worn valve shim • Worn cam sprocket • Worn journal of cam carrier and camshaft cap |
| Squeaky sound | — | <ul style="list-style-type: none"> • Insufficient generator lubrication |
| Rubbing sound | — | <ul style="list-style-type: none"> • Poor contact of generator brush and rotor |
| 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"> • Defective V-belt tensioner assembly (loose V-belt) • Defective water pump shaft |
| Hissing sound | — | <ul style="list-style-type: none"> • Insufficient compression • Air leakage in air intake system, hose, connection or manifold |
| Timing chain noise | — | <ul style="list-style-type: none"> • Loose timing chain • Timing chain contacting with adjacent part |
| | | |

| | | |
|-------------|---|---------------------------|
| Valve noise | — | • Incorrect cam clearance |
|-------------|---|---------------------------|

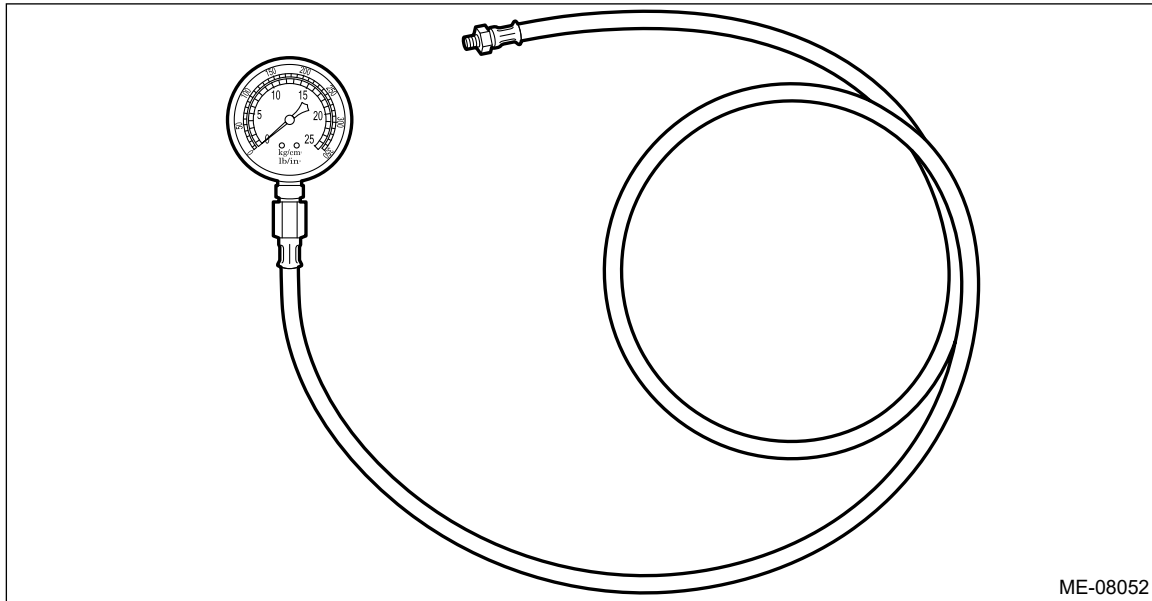
*When disconnecting the fuel injector connector, the malfunction indicator light illuminates and DTC is stored in ECM memory.

Therefore, after connecting the fuel injector connector, execute Clear Memory Mode  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Clear Memory Mode>OPERATION.](#) and Inspection Mode  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Inspection Mode>PROCEDURE.](#)

MECHANICAL(H4DO) > Engine Oil Pressure

INSPECTION

1. Disconnect the ground terminal from battery sensor. [🔗 Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the oil pressure switch. [🔗 Ref. to LUBRICATION\(H4DO\)>Oil Pressure Switch>REMOVAL.](#)
3. Install the oil pressure gauge to the installation area for the oil pressure switch of the chain cover.



4. Connect the ground terminal to battery sensor. [🔗 Ref. to NOTE>NOTE > BATTERY.](#)
5. Start the engine, and check the oil pressure.

Note:

- Standard value is based on an engine oil temperature of 80°C (176°F).
- If the oil pressure is out of specification, check oil pump, oil filter and lubrication line. [🔗 Ref. to LUBRICATION\(H4DO\)>Engine Lubrication System Trouble in General>INSPECTION.](#)
- If the oil pressure warning light is ON and oil pressure is within standard, check the oil pressure switch. [🔗 Ref. to LUBRICATION\(H4DO\)>Engine Lubrication System Trouble in General>INSPECTION.](#)

Engine oil pressure:

CVT model

While idling (no load and select lever in "P" or "N" range)

Standard

71 kPa (0.7 kg/cm², 10 psi) or more

At 3,000 r/min

Standard

206 kPa (2.1 kg/cm², 30 psi) or more

MT model

While idling (no load and gear shift lever in neutral position)

Standard

69 kPa (0.7 kg/cm², 10 psi) or more

At 3,000 r/min


Standard

206 kPa (2.1 kg/cm², 30 psi) or more

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

MECHANICAL(H4DO) > Fuel Pressure

INSPECTION

1. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DO\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)

2. Open the fuel filler lid and remove the fuel filler cap.

Note:

This operation is required to release the inner pressure of the fuel tank.

3. Disconnect the fuel delivery tube from the fuel pipe assembly, and connect the fuel pressure gauge.

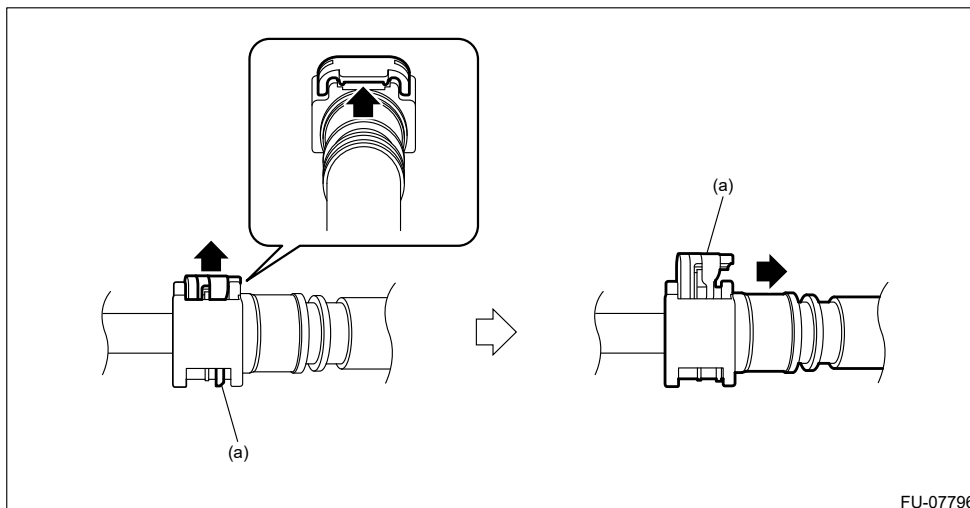
Caution:

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

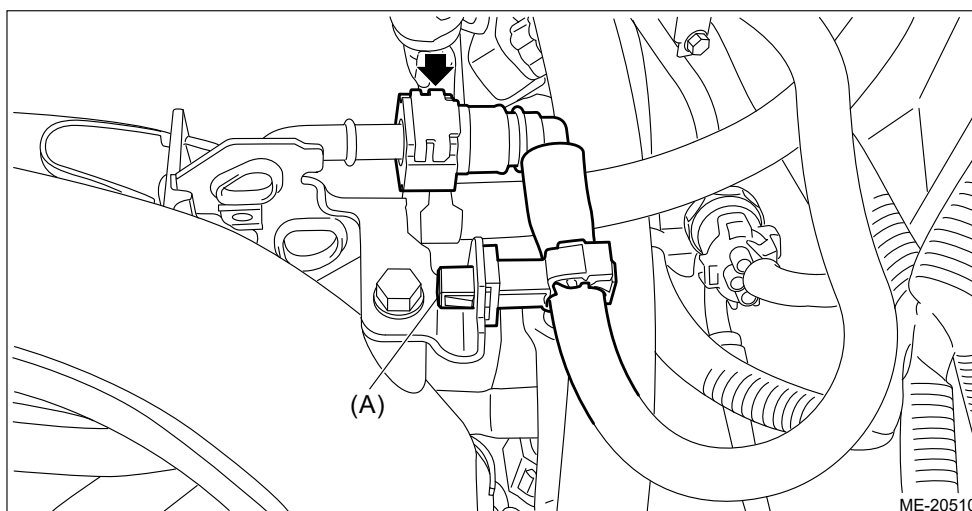
- (1) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube to the fuel pipe assembly.

Note:

Disconnect the quick connector as shown in the figure.



(a) Slider



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

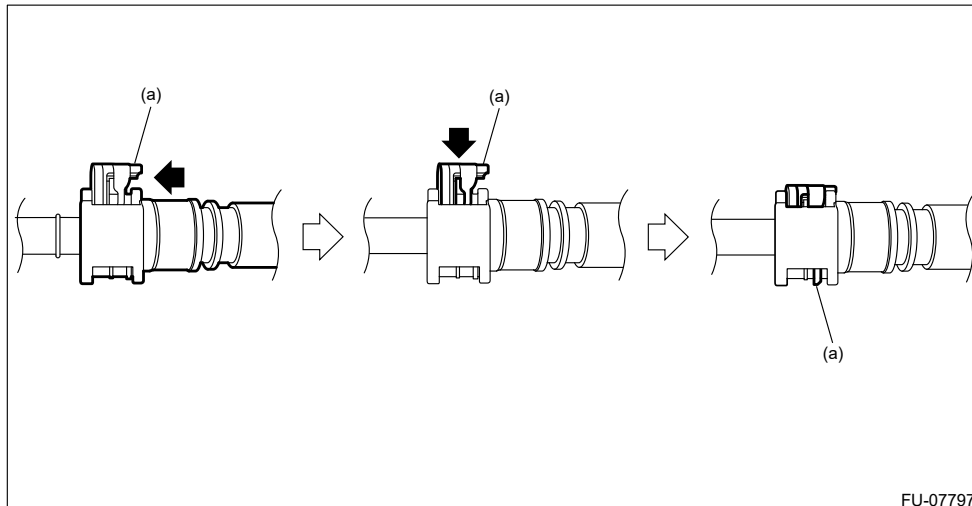
Caution:

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

- When connecting the quick connector with slider, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

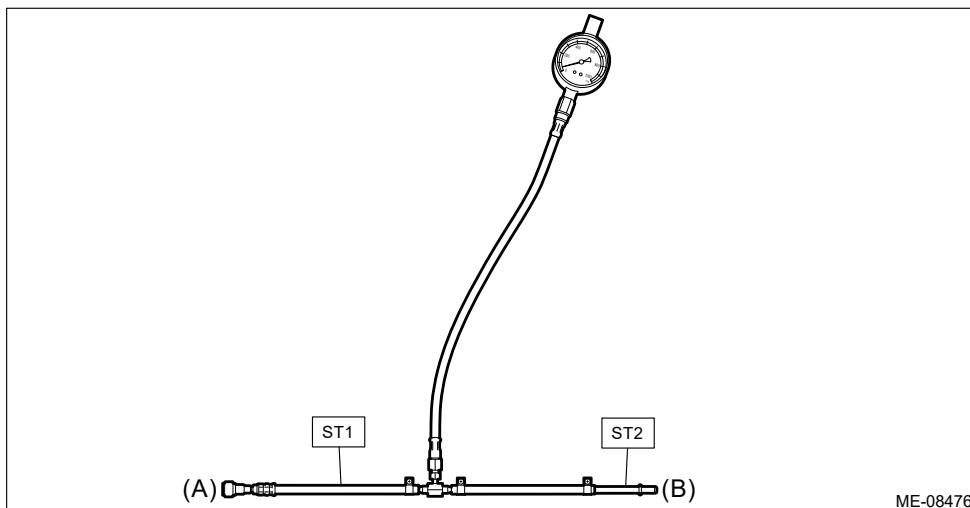
Note:

- ST1 is a SUBARU genuine part.
- When connecting the ST2 to the quick connector on the fuel delivery tube, connect as shown in the figure.



(a) Slider

- | | | |
|------------|-------------------|--------------------------|
| ST1 | 42075AG690 | FUEL HOSE |
| ST2 | 18471AA000 | FUEL PIPE ADAPTER |



(A) Fuel pipe ASSY side

(B) Fuel delivery tube side

4. Start the engine.
5. Check the fuel pressure after warming up the engine.

Note:

- The fuel pressure gauge readings becomes 10 – 20 kPa (0.1 – 0.2 kg/cm², 1 – 3 psi) higher than standard values during high-altitude operations.
- Check or replace the fuel pump and fuel delivery line if the fuel pressure is out of the standard.

Fuel pressure:

Standard

340 – 400 kPa (3.5 – 4.1 kg/cm², 49 – 58 psi)

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

Caution:

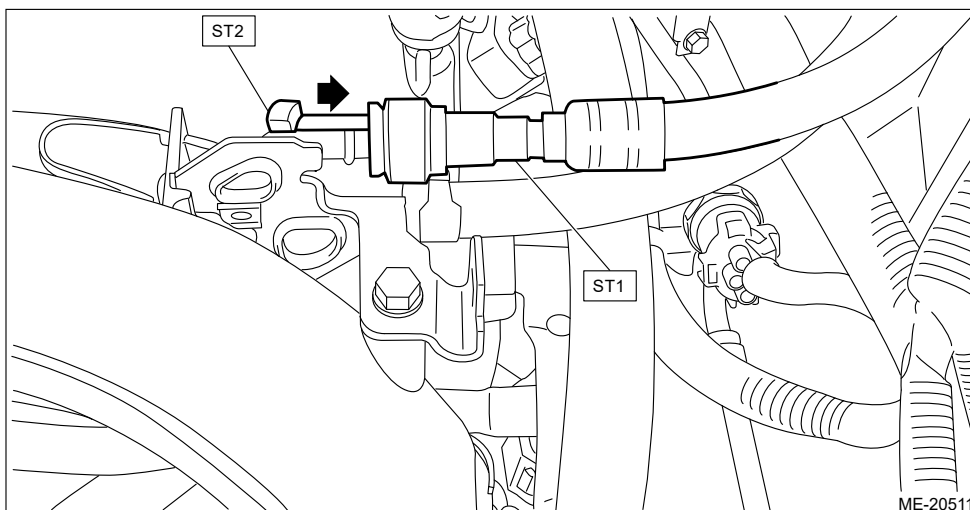
- Before removing the fuel pressure gauge, release the fuel pressure.
- Be careful not to spill fuel.
- Catch the fuel from hoses and tubes using a container or cloth.
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector with slider, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

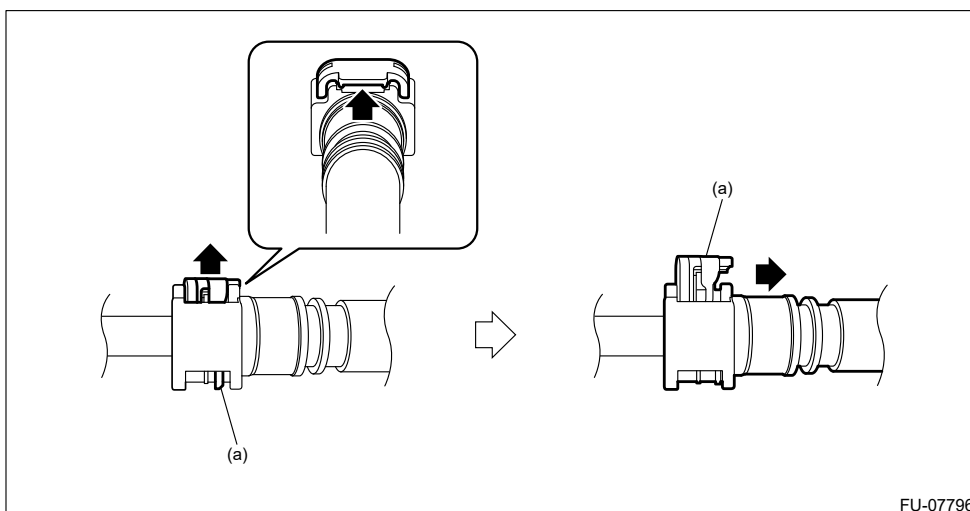
- When disconnecting the ST1, install the ST2 to the fuel pipe assembly, and press the ST2 in the direction of arrow to disconnect the quick connector on the ST1.

ST1 42075AG690 FUEL HOSE

ST2 42099AE000 QUICK CONNECTOR RELEASE

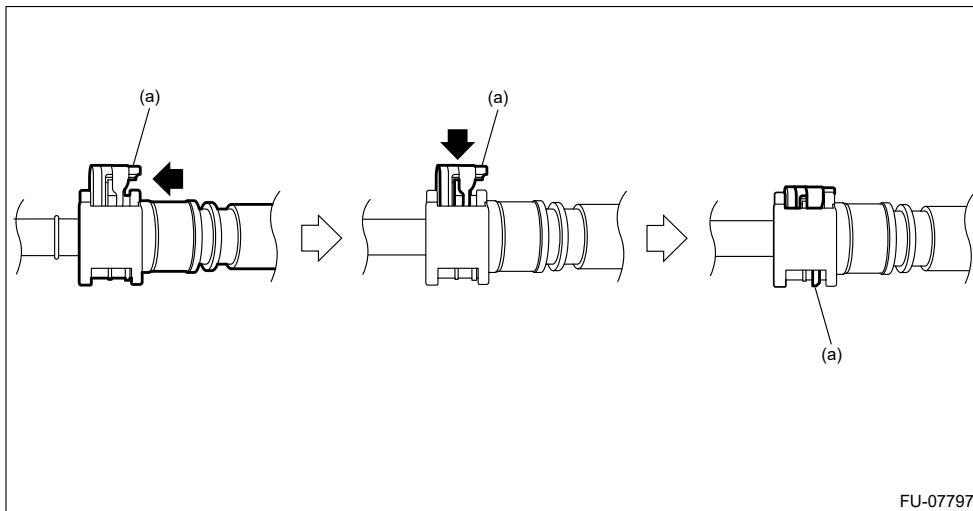


- Disconnect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

- Connect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

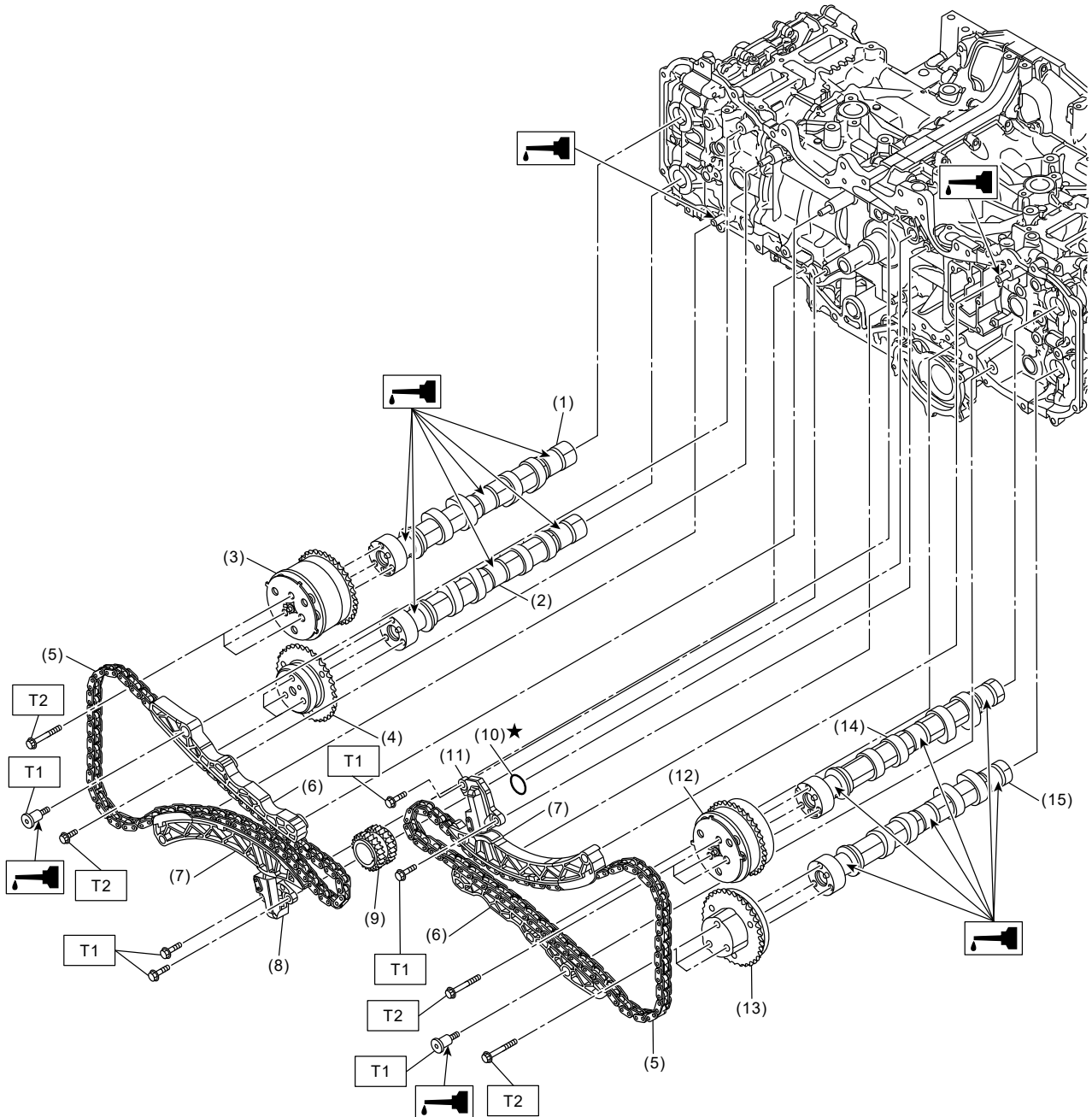
MECHANICAL(H4DO) > General Description

CAUTION

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

COMPONENT

1. TIMING CHAIN AND CAMSHAFT



ME-08170

- | | | |
|-----------------------------|-------------------------|--------------------------|
| (1) Intake camshaft RH | (8) Chain tensioner RH | (14) Intake camshaft LH |
| (2) Exhaust camshaft RH | (9) Crank sprocket | (15) Exhaust camshaft LH |
| (3) Intake cam sprocket RH | (10) O-ring | |
| (4) Exhaust cam sprocket RH | (11) Chain tensioner LH | |

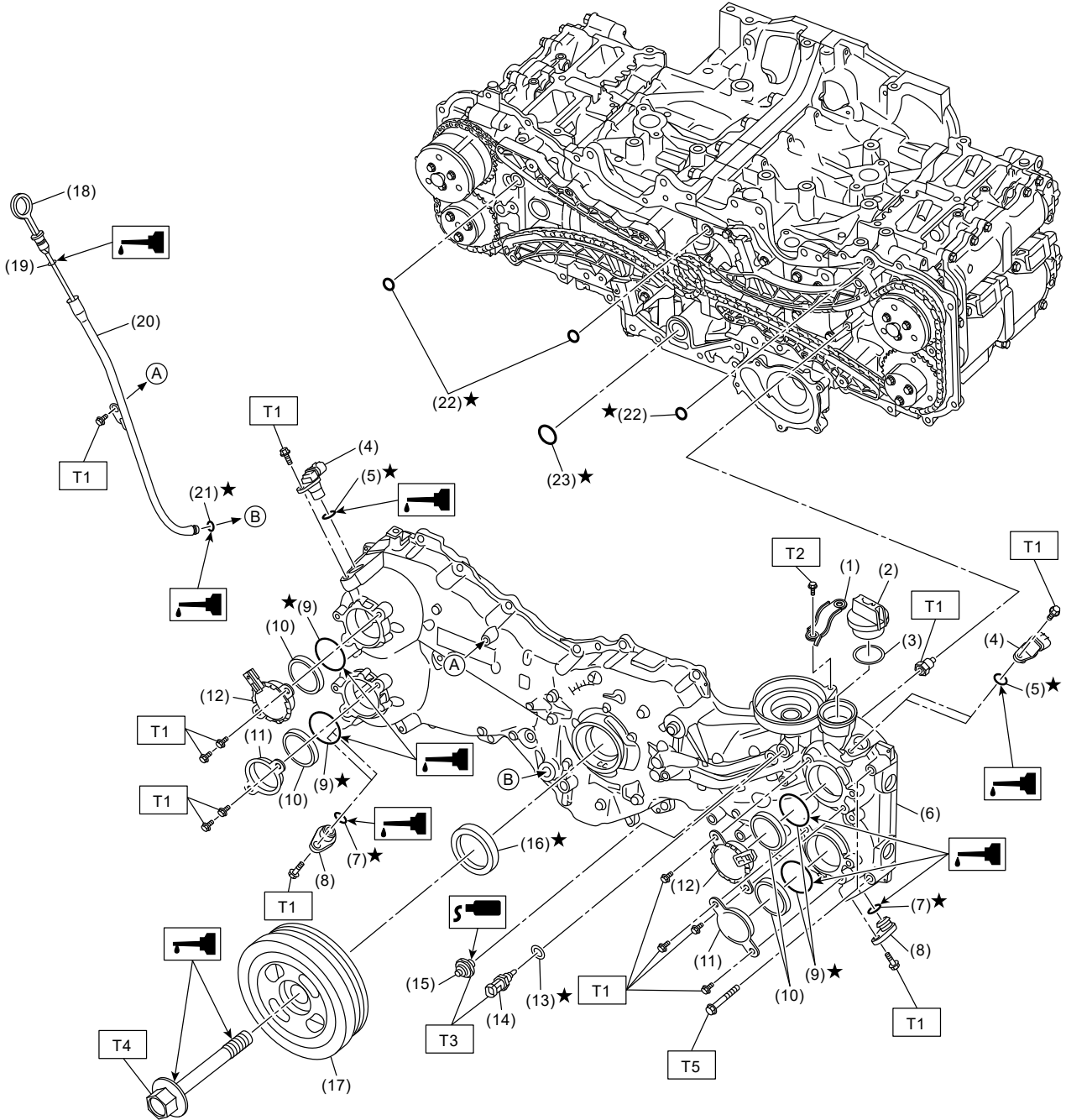
Tightening torque: N·m (kgf·m, ft·lb)

- (5) Timing chain
- (6) Chain guide
- (7) Chain tension lever

- (12) Intake cam sprocket LH
- (13) Exhaust cam sprocket LH

- T1: 6.4 (0.7, 4.7)**
- T2: 18 (1.8, 13.3)**

2. CHAIN COVER



- (1) Generator cord stay
- (2) Oil filler cap
- (3) Gasket
- (4) Camshaft position sensor
- (5) O-ring
- (11) Actuator cover
- (12) Oil control solenoid
- (13) Gasket
- (14) Engine oil temperature sensor
- (15) Oil pressure switch

- (21) O-ring
- (22) O-ring
- (23) O-ring

Tightening torque: N·m (kgf·m,


- (6) Chain cover
- (7) O-ring
- (8) Sensor cover
- (9) O-ring
- (10) Back-up ring
- (16) Front oil seal
- (17) Crank pulley
- (18) Oil level gauge
- (19) O-ring
- (20) Oil level gauge guide


ft-lb)

T1: 6.4 (0.7, 4.7)

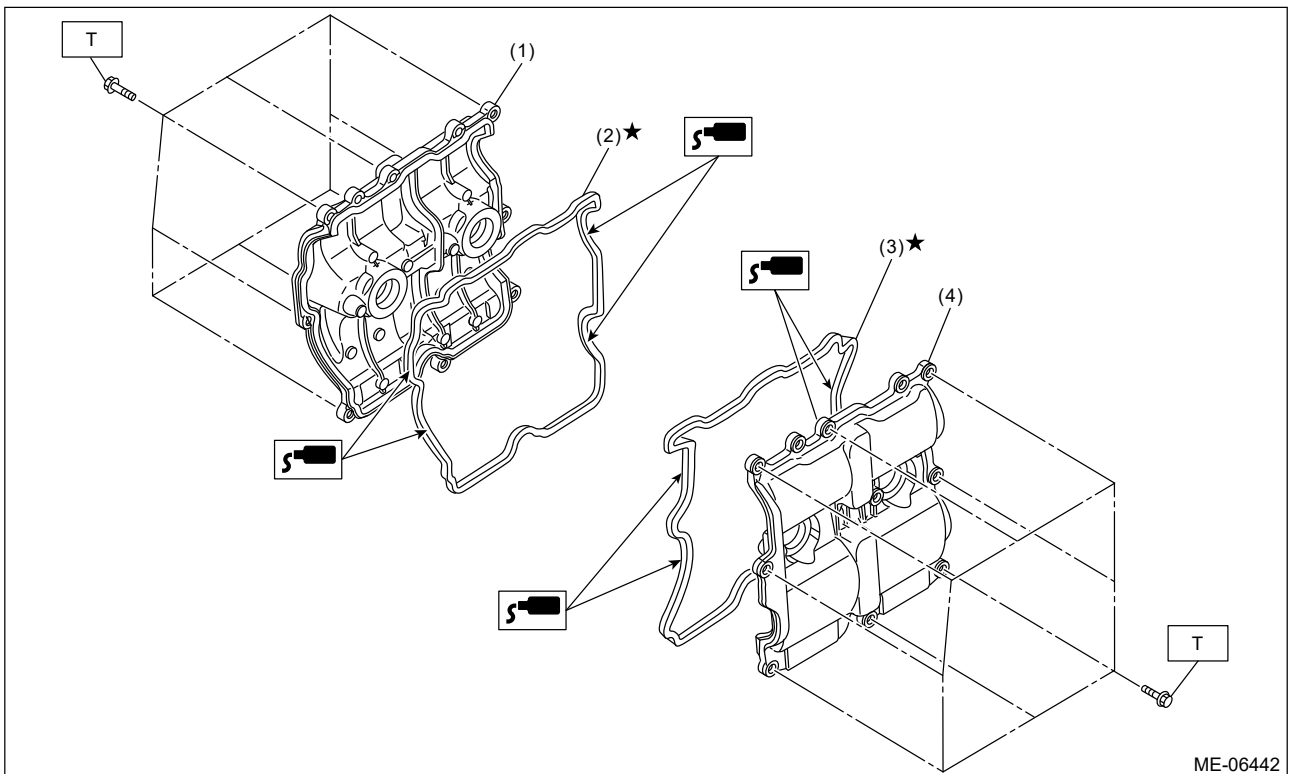
T2: 8 (0.8, 5.9)

T3: 18 (1.8, 13.3)

T4:  **Ref. to**
MECHANICAL(H4DO)>Crank Pulley>INSTALLATION.

T5:  **Ref. to**
MECHANICAL(H4DO)>Chain Cover>INSTALLATION.

3. ROCKER COVER




(1) Rocker cover RH

(3) Rocker cover gasket LH

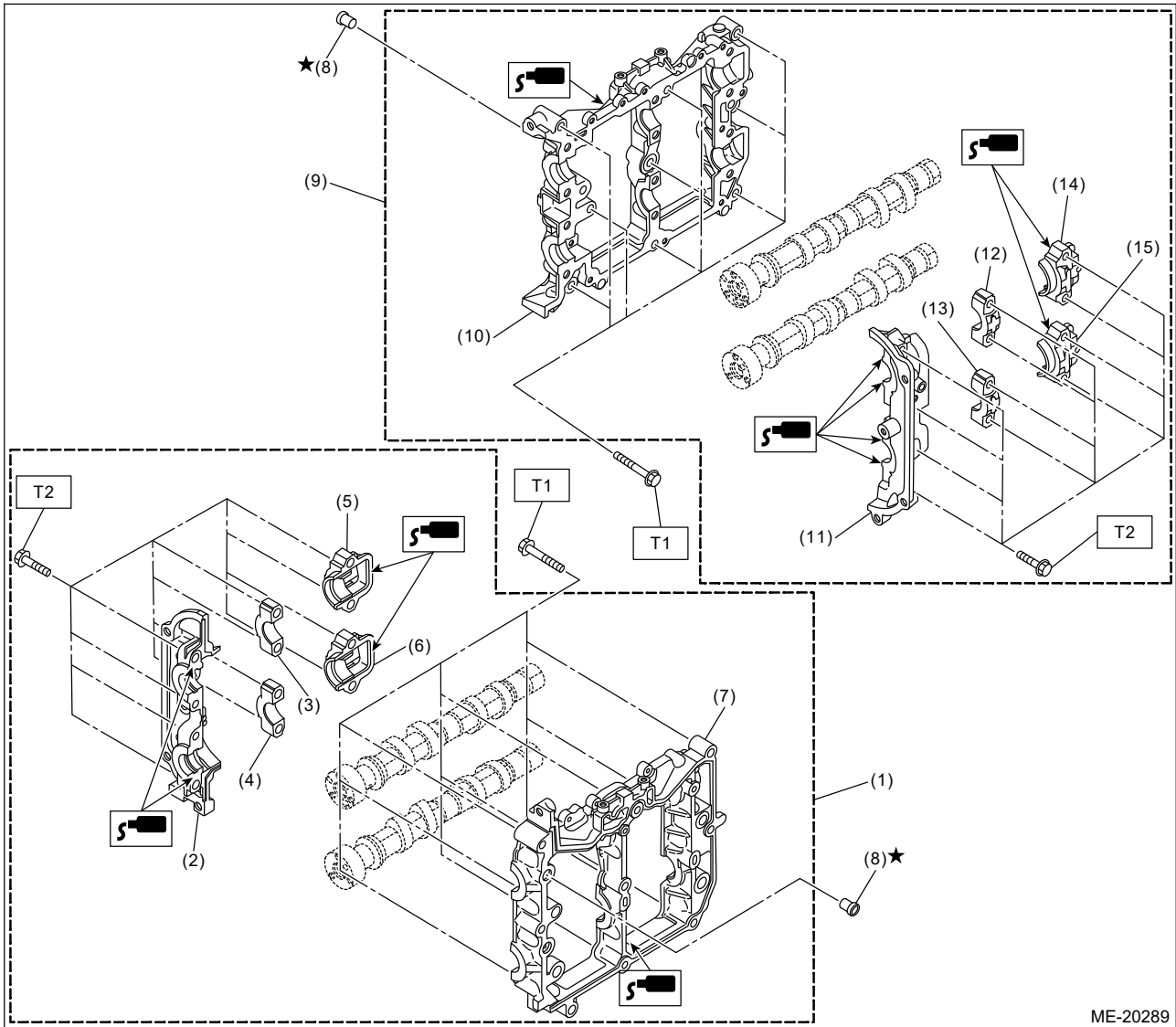
Tightening torque: N·m (kgf-m, ft-lb)

(2) Rocker cover gasket RH

(4) Rocker cover LH

T:  **Ref. to**
MECHANICAL(H4DO)>Rocker Cover>INSTALLATION.

4. CAM CARRIER



ME-20289

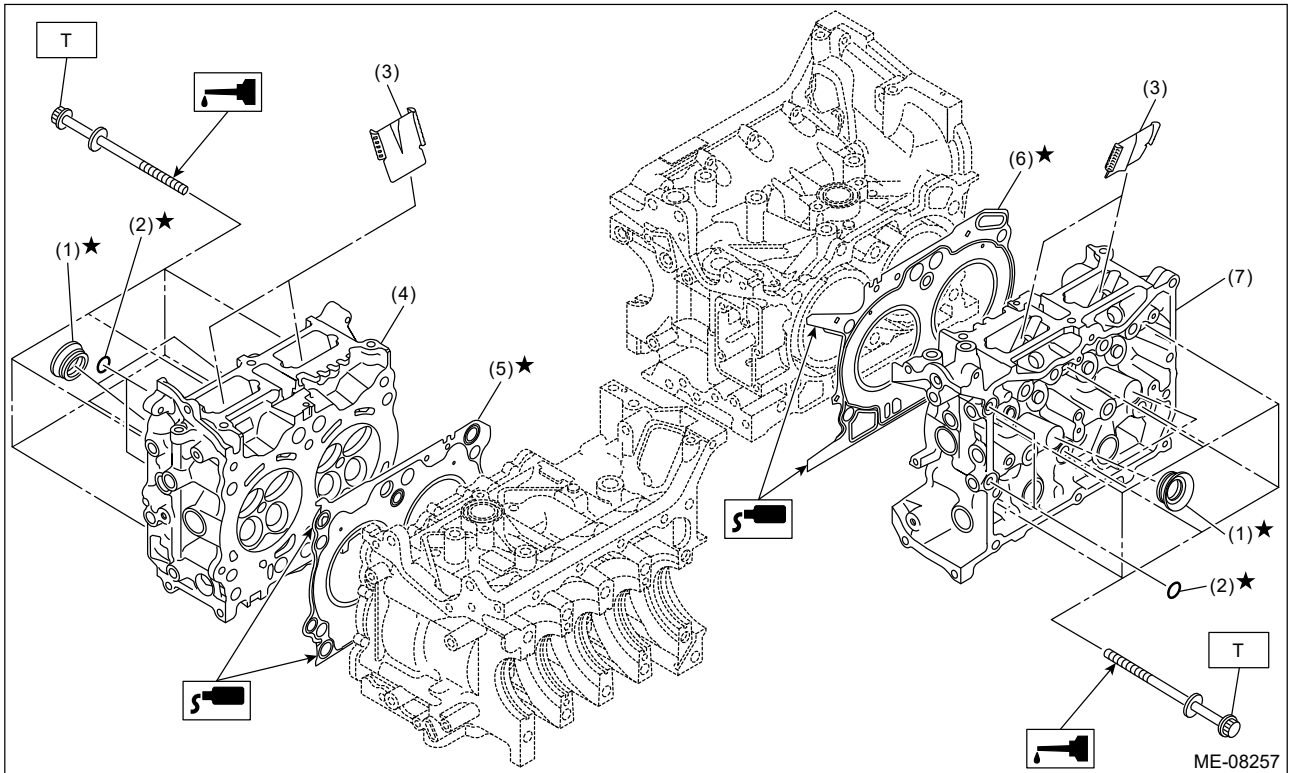
- | | | |
|------------------------------------|-------------------------------------|-----------------------------------|
| (1) Cam carrier ASSY RH | (8) Filter | (14) Intake rear camshaft cap LH |
| (2) Front camshaft cap RH | (9) Cam carrier ASSY LH | (15) Exhaust rear camshaft cap LH |
| (3) Intake center camshaft cap RH | (10) Cam carrier LH | |
| (4) Exhaust center camshaft cap RH | (11) Front camshaft cap LH | |
| (5) Intake rear camshaft cap RH | (12) Intake center camshaft cap LH | |
| (6) Exhaust rear camshaft cap RH | (13) Exhaust center camshaft cap LH | |
| (7) Cam carrier RH | | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>INSTALLATION.](#)

T2: [Ref. to MECHANICAL\(H4DO\)>Cam Carrier>ASSEMBLY.](#)

5. CYLINDER HEAD




(1) Spark plug pipe gasket

(5) Cylinder head gasket RH

Tightening torque: N·m (kgf-m, ft-lb)

(2) O-ring

(6) Cylinder head gasket LH

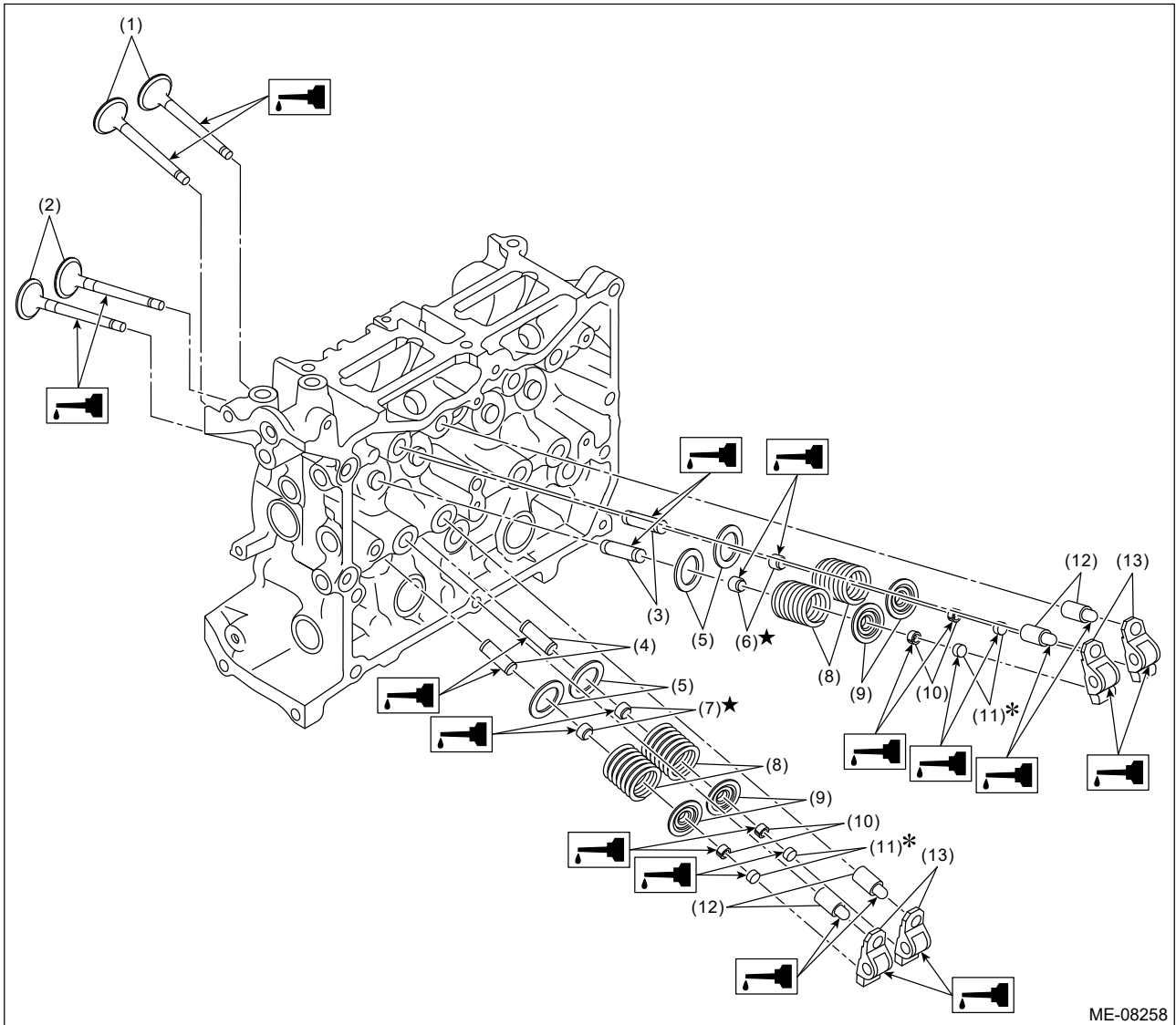
T:  Ref. to
MECHANICAL(H4DO)>Cylinder Head>INSTALLATION.

(3) Cylinder head plate

(7) Cylinder head LH

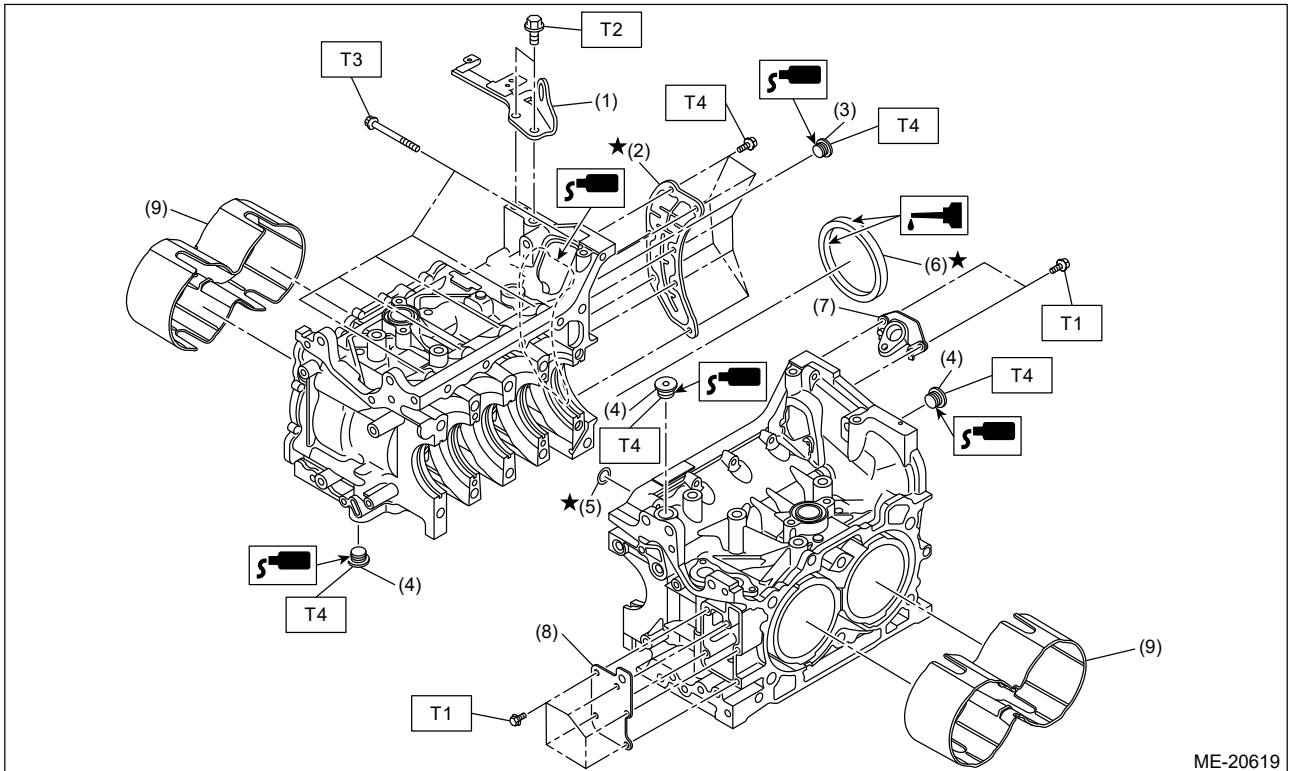
(4) Cylinder head RH

6. VALVE ASSY



- | | | |
|-------------------------|----------------------------|------------------------------|
| (1) Exhaust valve | (6) Intake valve oil seal | (11) Valve shim |
| (2) Intake valve | (7) Exhaust valve oil seal | (12) Roller rocker arm pivot |
| (3) Intake valve guide | (8) Valve spring | (13) Roller rocker arm |
| (4) Exhaust valve guide | (9) Valve spring retainer | |
| (5) Valve spring seat | (10) Valve collet | |

7. CYLINDER BLOCK 1



ME-20619

(1) Engine rear hanger

(6) Rear oil seal

Tightening torque: N·m (kgf·m, ft·lb)

(2) Oil separator cover

(7) Crankshaft position sensor holder

T1: 6.4 (0.7, 4.7)

(3) Cylinder block plug

(8) CYLINDER BLOCK PLATE

T2: 21 (2.1, 15.5)

(4) Main gallery plug

(9) Water jacket spacer

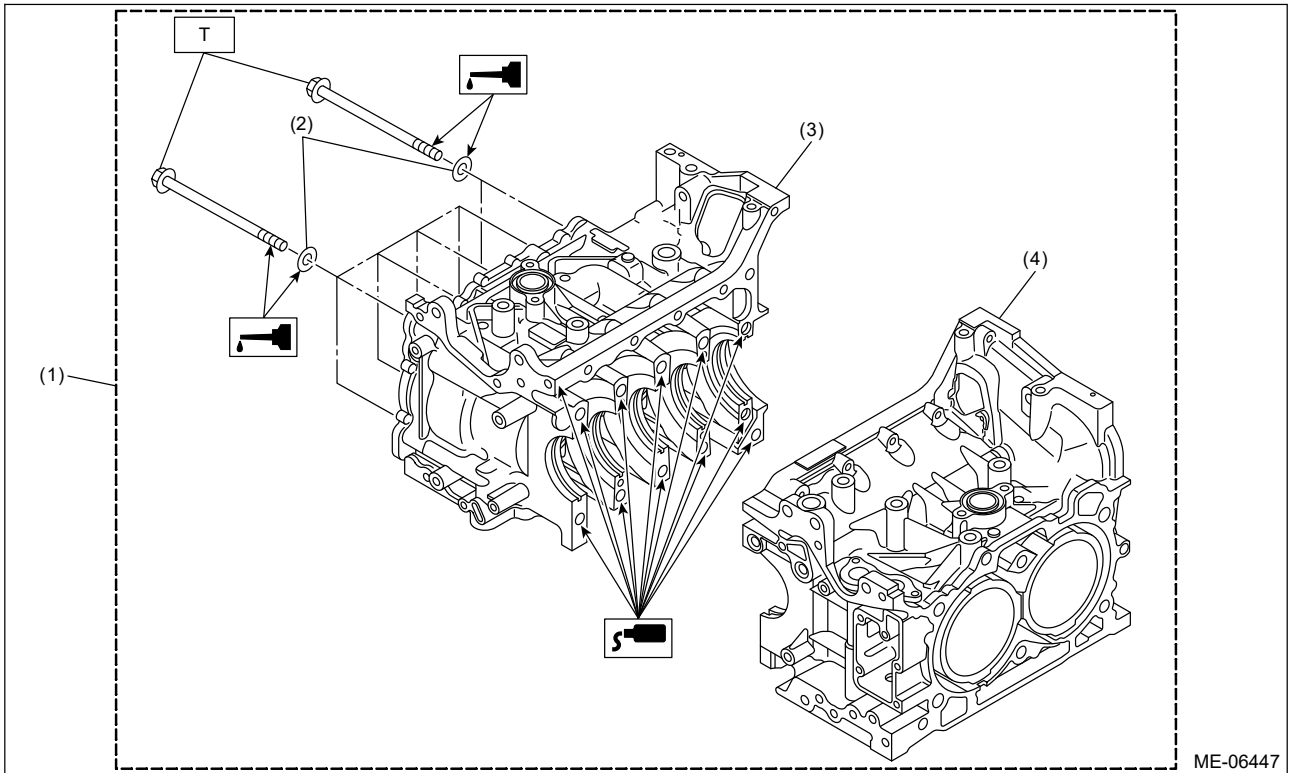
T3: 25 (2.5, 18.4)

(5) O-ring

T4:  Ref. to

[MECHANICAL\(H4DO\)>Cylinder Block>ASSEMBLY > CYLINDER BLOCK.](#)

8. CYLINDER BLOCK 2




(1) Cylinder block ASSY

(3) Cylinder block RH

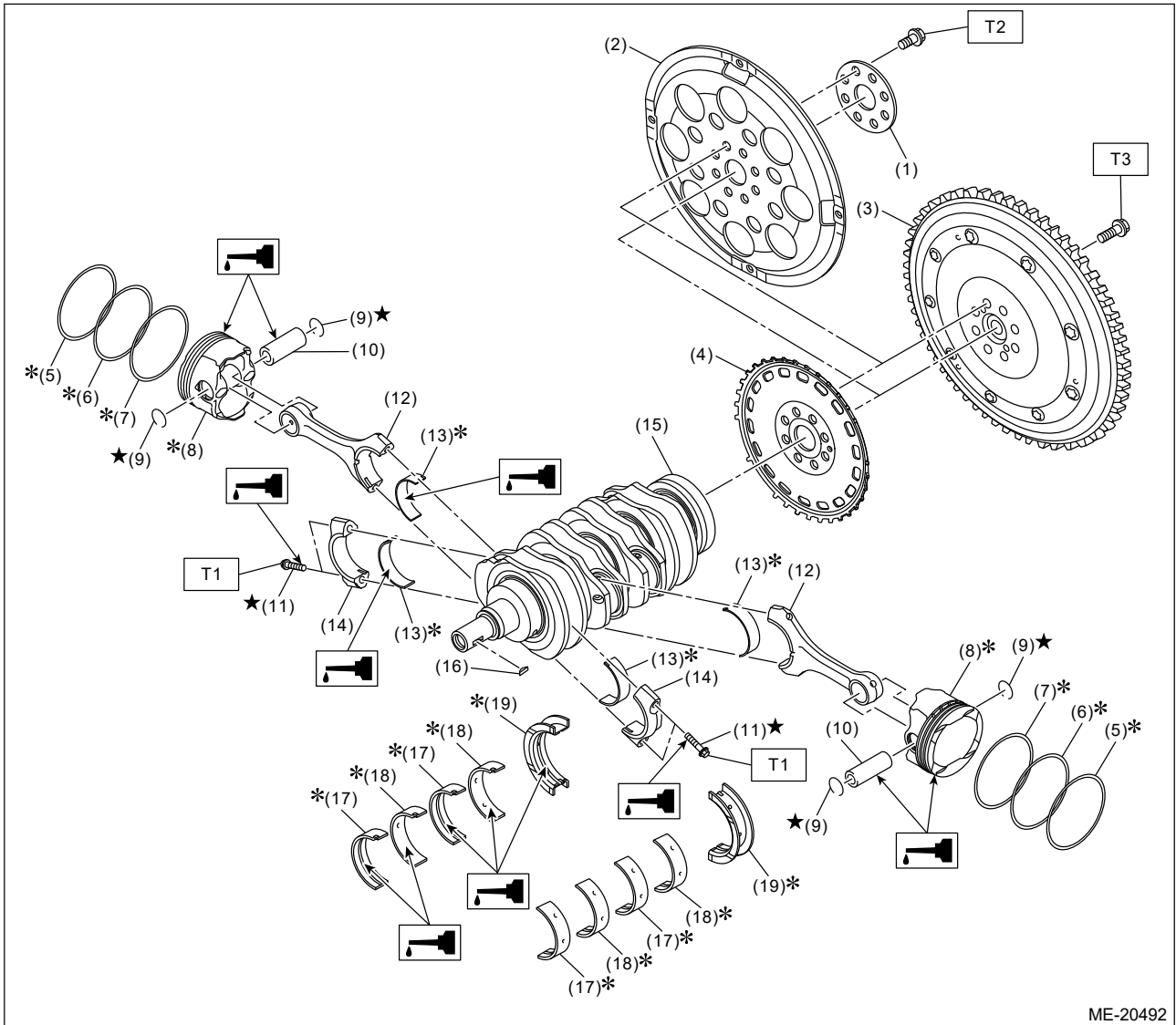
Tightening torque: N·m (kgf-m, ft-lb)

(2) Washer

(4) Cylinder block LH

T:  **Ref. to**
MECHANICAL(H4DO)>Cylinder
Block>INSTALLATION.

9. CRANKSHAFT AND PISTON



ME-20492

- | | | |
|---|------------------------------|--------------------------------|
| (1) Reinforcement drive plate (CVT model) | (9) Circlip | (17) Crankshaft bearing #1, #3 |
| (2) Drive plate (CVT model) | (10) Piston pin | (18) Crankshaft bearing #2, #4 |
| (3) Flywheel (MT model) | (11) Connecting rod cap bolt | (19) Crankshaft bearing #5 |
| (4) Crankshaft position sensor plate | (12) Connecting rod | |
| (5) Top ring | (13) Connecting rod bearing | |
| (6) Second ring | (14) Connecting rod cap | |
| (7) Oil ring | (15) Crankshaft | |
| (8) Piston | (16) Woodruff key | |

Tightening torque: N·m (kgf·m, ft·lb)

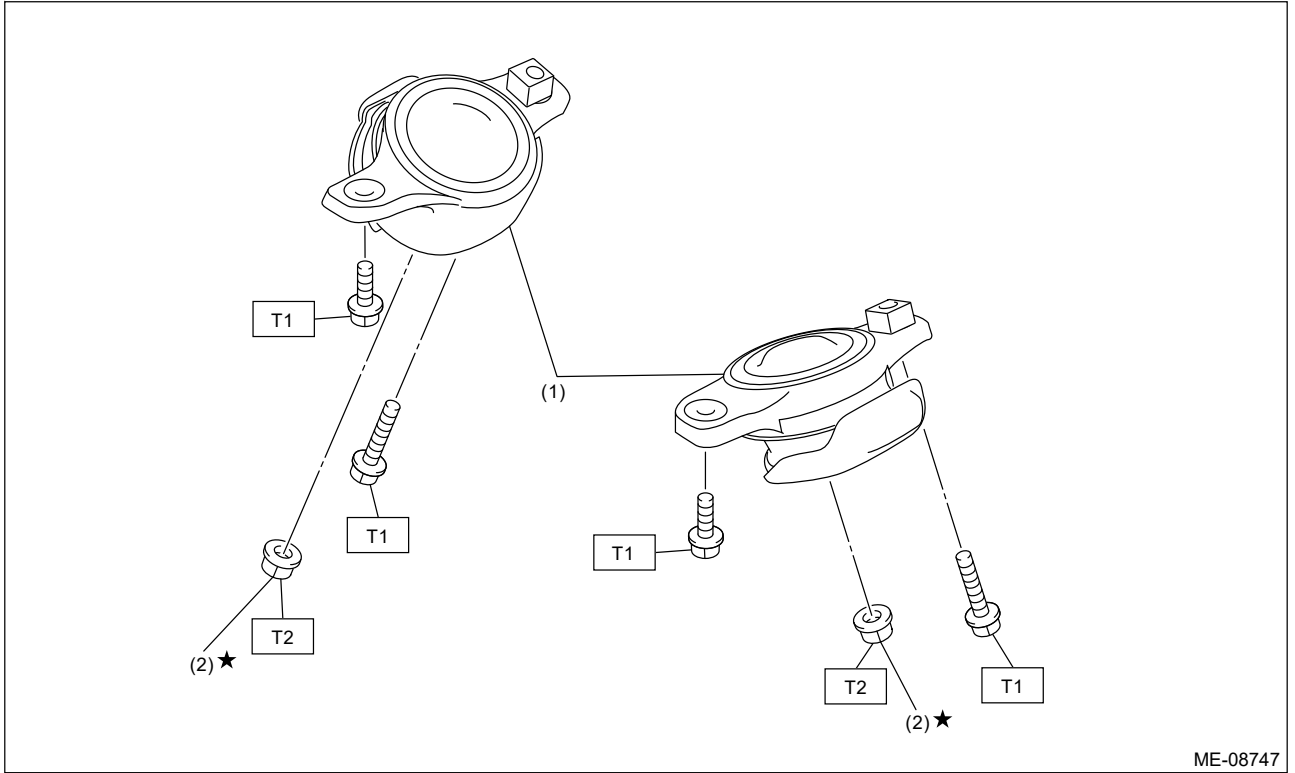
T1: [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>INSTALLATION.](#)

T2: [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR580\)>Drive Plate>INSTALLATION.](#)

T3: [Ref. to CLUTCH SYSTEM>Flywheel>INSTAL](#)

10. ENGINE MOUNTING

- CVT model



(1) Front cushion rubber

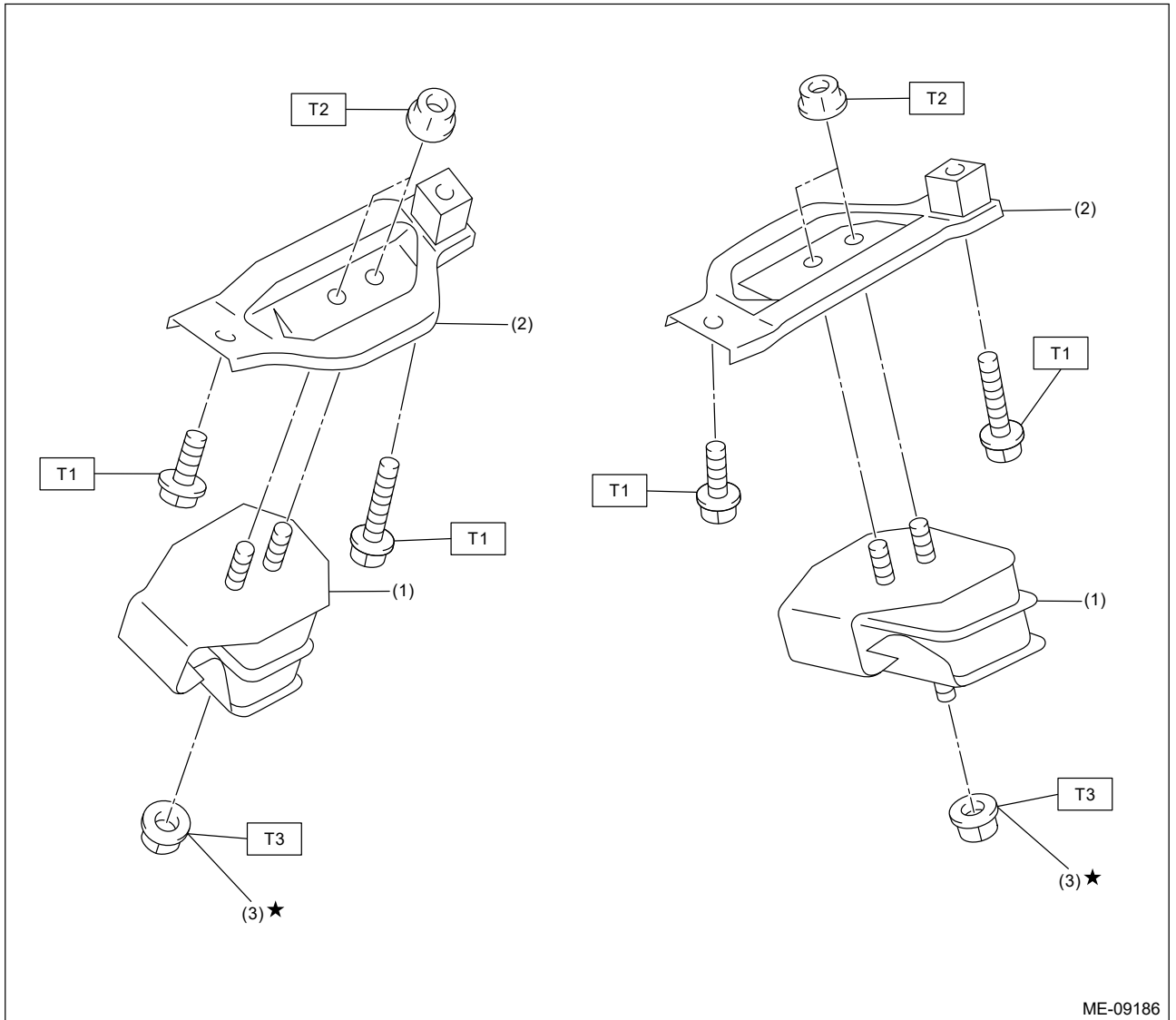
(2) Nut

Tightening torque: N·m (kgf-m, ft-lb)

T1: 35 (3.6, 25.8)

T2: 60 (6.1, 44.3)

- MT model



(1) Front cushion rubber (3) Nut

(2) Front engine mounting
bracket

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

T1: 35 (3.6, 25.8)

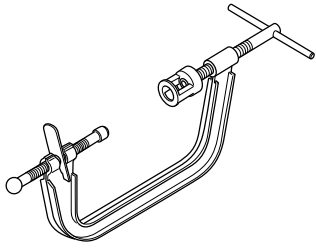
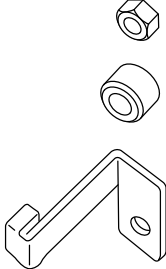
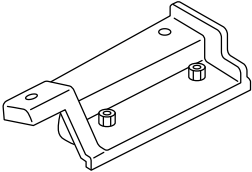
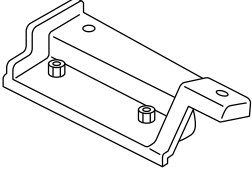
T2: 42 (4.3, 31.0)

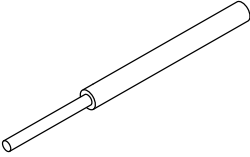
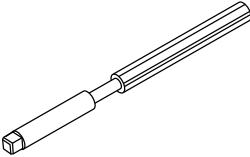
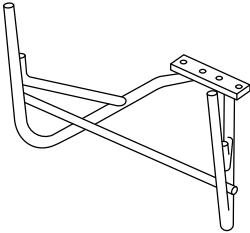
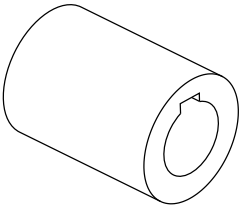
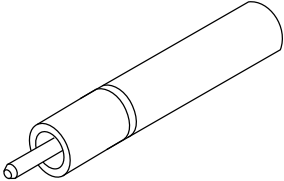
T3: 60 (6.1, 44.3)

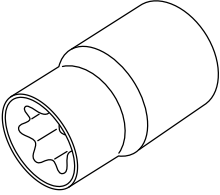
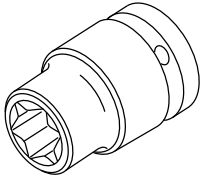
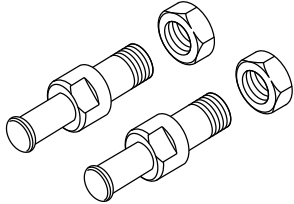
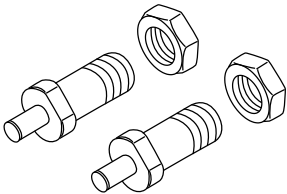
MECHANICAL(H4DO) > General Description

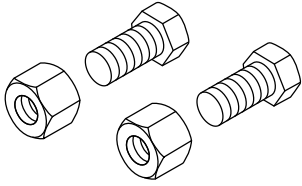
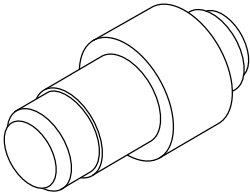
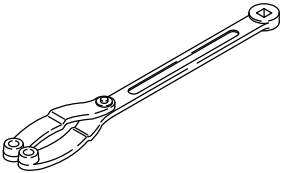
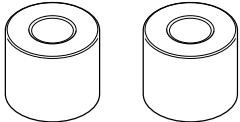
PREPARATION TOOL

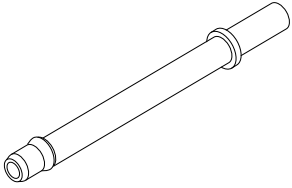
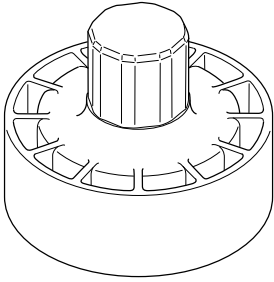
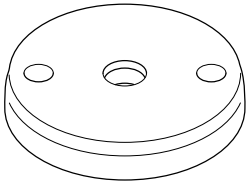
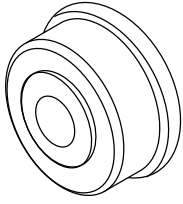
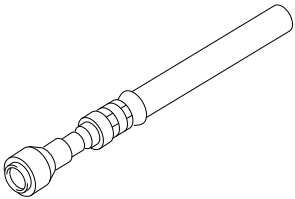
1. SPECIAL TOOL

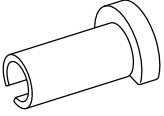

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---------------|-----------------------------------|--|
|  <p>ST0920287002000</p> | 0920287002000 | REMOVER AND REPLACER | Used for removing and installing valve spring. |
|  <p>ST-498277200</p> | 498277200 | STOPPER SET | Used for preventing the torque converter from falling when removing and installing the engine. (CVT model) |
|  <p>ST-498457000</p> | 498457000 | ENGINE STAND ADAPTER RH | <ul style="list-style-type: none"> • Used for disassembling and assembling engine. • Used together with ENGINE STAND (499817100) and ADAPTER (18362AA020). |
|  <p>ST-498457100</p> | 498457100 | ENGINE STAND ADAPTER LH | <ul style="list-style-type: none"> • Used for disassembling and assembling engine. • Used together with ENGINE STAND (499817100) and ADAPTER (18362AA020). |
| | 499765700 | VALVE GUIDE REMOVER AND INSTALLER | Used for removing and installing valve guide. |

| | | | |
|---|------------|----------------------|---|
|  <p>ST-499765700</p> | | | |
|  <p>ST-499765900</p> | 499765900 | VALVE GUIDE REAMER | Used for reaming valve guides. |
|  <p>ST-499817100</p> | 499817100 | ENGINE STAND | <ul style="list-style-type: none"> • Used for disassembling and assembling engine. • Used together with ADAPTER (18362AA020), ENGINE STAND ADAPTER RH (498457000) and LH (498457100). |
|  <p>ST18252AA000</p> | 18252AA000 | CRANKSHAFT SOCKET | Used for rotating crankshaft. |
|  <p>ST18261AA010</p> | 18261AA010 | VALVE OIL SEAL GUIDE | Used for press-fitting of intake valve guide stem seals and exhaust valve guide stem seals. |

| | | | |
|---|------------|-----------------------------|--|
|  <p>ST18270AA020</p> | 18270AA020 | SOCKET | Used for removing and installing connecting rod. |
|  <p>ST18270KA010</p> | 18270KA010 | SOCKET | Used for installing and removing cam sprocket. |
|  <p>ST18334AA000</p> | 18334AA000 | PULLEY WRENCH PIN SET | <ul style="list-style-type: none"> • Used for removing and installing the crank pulley. • Used together with PULLEY WRENCH (18355AA000). |
|  <p>ST18334AA020</p> | 18334AA020 | PULLEY WRENCH PIN SET | <ul style="list-style-type: none"> • Used for rotating the intake cam sprocket LH. • Used for removing and installing cam sprocket. • Used together with PULLEY WRENCH (18355AA000). • Used with the PULLEY WRENCH PIN SET (18334AA040) when removing and installing the exhaust cam sprocket. |
| | 18334AA040 | PULLEY WRENCH PIN SET | <ul style="list-style-type: none"> • Used for removing and installing exhaust cam sprocket. • Used together with PULLEY WRENCH (18355AA000) and PULLEY WRENCH PIN SET (18334AA020). |

| | | | |
|---|------------|--|--|
|  <p>ST18334AA040</p> | | | |
|  <p>ST18350AA000</p> | 18350AA000 | CONNECTING ROD BUSHING REMOVER AND INSTALLER | Used for removing and installing the connecting rod bushing at connecting rod small end. |
|  <p>ST18355AA000</p> | 18355AA000 | PULLEY WRENCH | <ul style="list-style-type: none"> • Used for removing and installing the crank pulley. • Used for rotating the intake cam sprocket LH. • Used for removing and installing cam sprocket. • Used together with PULLEY WRENCH PIN SET (18334AA000) or PULLEY WRENCH PIN SET (18334AA020). • Used with the PULLEY WRENCH PIN SET (18334AA040) when removing and installing the exhaust cam sprocket. |
|  <p>ST18362AA020</p> | 18362AA020 | ADAPTER | <ul style="list-style-type: none"> • Used for disassembling and assembling engine. • Used together with STAND (499817100), ENGINE STAND ADAPTER RH (498457000) and LH (498457100). • Bolt used: M10 × 50 (SUBARU genuine Part No.: 010410500) |
| | 18471AA000 | FUEL PIPE ADAPTER | Used for inspecting the fuel pressure. |

| | | | |
|---|------------|--------------------|---|
|  <p>ST18471AA000</p> | | | |
|  <p>ST18657AA030</p> | 18657AA030 | OIL SEAL INSTALLER | <ul style="list-style-type: none"> • Used for installing the rear oil seal of engine. • Used together with OIL SEAL GUIDE (18671AA020). |
|  <p>ST18671AA020</p> | 18671AA020 | OIL SEAL GUIDE | <ul style="list-style-type: none"> • Used for installing the rear oil seal of engine. • Used together with OIL SEAL INSTALLER (18657AA030). |
|  <p>ST41399FG020</p> | 41399FG020 | SPECIAL TOOL B | Used for installing the front oil seal of engine. |
|  <p>ST42075AG690</p> | 42075AG690 | FUEL HOSE | Used for inspecting the fuel pressure. Note: This is the SUBARU genuine part. |

| | | | |
|---|-----------------------------------|--------------------------------|---|
|  <p>ST42099AE000</p> | <p>42099AE000</p> | <p>QUICK CONNECTOR RELEASE</p> | <p>Used for removing FUEL HOSE (42075AG690).</p> <p>Note: FUEL HOSE (42075AG690) is used for checking the fuel pressure.</p> |
|  <p>STSSM4</p> | <p>— (Newly adopted tool)</p> | <p>SUBARU SELECT MONITOR 4</p> | <p>Used for setting of each function and troubleshooting for electrical system.</p> <p>Note: For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".</p> |

2. GENERAL TOOL

| TOOL NAME | REMARKS |
|------------------------|---|
| Compression gauge | Used for measuring compression. |
| Vacuum gauge | Used for measuring intake manifold vacuum. |
| Oil pressure gauge | Used for measuring engine oil pressure. |
| Fuel pressure gauge | Used for measuring fuel pressure. |
| Thickness gauge | Used for various inspections. |
| Angle gauge | Used for angle tightening. |
| Piston ring compressor | Used for installing the piston into the cylinder block. |
| DST-i | Used together with Subaru Select Monitor 4. |

MECHANICAL(H4DO) > General Description

SPECIFICATION

| | | | | |
|---|---|--------------------------------|--------------|---|
| Engine | Model | | | 2.5 L |
| | Cylinder arrangement | | | Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine |
| | Valve system mechanism | | | Chain driven, double overhead camshaft, 4-valve/cylinder |
| | Bore × Stroke | mm (in) | | 94.0 × 90.0 (3.70 × 3.54) |
| | Displacement | cm ³ (cu in) | | 2,498 (152) |
| | Compression ratio | | | 10.3 |
| | Compression pressure (at 200 – 300 r/min) | kPa (kg/cm ² , psi) | Standard | 1,050 – 1,400 (11 – 14, 152 – 203) |
| | Number of piston rings | | | Compression ring: 2 Oil ring: 1 |
| Intake valve timing | | Open | Max. retard | ATDC 16° |
| | | | Min. advance | BTDC 39° |
| | | Close | Max. retard | ABDC 80° |
| | | | Min. advance | ABDC 25° |
| Exhaust valve timing | | Open | BBDC 37° | |
| | | Close | ATDC 11° | |
| Cam clearance | mm (in) | Intake | Standard | 0.13 ^{+0.02} _{-0.03} (0.0051 ^{+0.0008} _{-0.0012}) |
| | | Exhaust | Standard | 0.22±0.02 (0.0087±0.0008) |
| Idle speed (For CVT model, select lever in "P" or "N" range. For MT model, gear shift lever in neutral position.) | r/min | No load | Standard | CVT model: 675±100 MT model: 650±100 |
| | | A/C ON | Standard | 800 – 900±100 |
| | Ignition order | | | 1 → 3 → 2 → 4 |

| | | | |
|-----------------|--------------|----------|------------------------|
| Ignition timing | BTDC/{r/min} | Standard | CVT model: 11°±10°/675 |
| | | | MT model: 6°±10°/650 |

Note:

OS: Oversize US: Undersize

| | | | | | |
|-------------------------------|--|---------|----------|---------------------------------|-----------------------------------|
| Camshaft | Bending | | mm (in) | Limit | 0.020 (0.0008) |
| | Cam lobe height | mm (in) | Intake | Standard | 40.34 — 40.44 (1.588 — 1.592) |
| | | | Exhaust | Standard | 39.66 — 39.76 (1.561 — 1.565) |
| | Cam base circle diameter | | mm (in) | Standard | 34.0 (1.339) |
| | Journal outer diameter | | mm (in) | Standard | 25.946 — 25.963 (1.0215 — 1.0222) |
| | Thrust clearance | | mm (in) | Standard | 0.068 — 0.116 (0.0027 — 0.0047) |
| | Oil clearance | | mm (in) | Standard | 0.037 — 0.072 (0.0015 — 0.0028) |
| Cylinder head | Warpage (mating surface with cylinder block) | | mm (in) | Limit | 0.020 (0.0008) |
| | Grinding limit | | mm (in) | | 98.4 (3.874) or less |
| | Height | | mm (in) | Standard | 98.5 (3.878) |
| Valve & valve guide | Valve overall length | | mm (in) | Intake | 104.95 (4.132) |
| | | | | Exhaust | 96.5 (3.799) |
| | Valve head edge thickness | mm (in) | Intake | Standard | 0.8 — 1.2 (0.031 — 0.047) |
| | | | Exhaust | Standard | 1.0 — 1.4 (0.039 — 0.055) |
| | Valve stem outer diameter | mm (in) | Intake | Standard | 5.455 — 5.470 (0.2148 — 0.2154) |
| | | | Exhaust | Standard | 5.445 — 5.460 (0.2144 — 0.2150) |
| | Valve guide inner diameter | | mm (in) | Standard | 5.500 — 5.512 (0.2165 — 0.2170) |
| | Clearance between valve and valve guide | mm (in) | Intake | Standard | 0.030 — 0.057 (0.0012 — 0.0022) |
| Exhaust | | | Standard | 0.040 — 0.067 (0.0016 — 0.0026) | |
| Valve guide protrusion amount | | mm (in) | Standard | 11.4 — 11.8 (0.449 — 0.465) | |
| Valve & | Valve stem end outer diameter | mm | Intake | Standard | 5.455 — 5.470 (0.2148 — |

| | | | | | |
|-------------------------|--|---------------------|---|---------------------------------|---|
| valve shim | | (in) | | Standard | 0.2154 |
| | | | Exhaust | Standard | 5.445 — 5.460 (0.2148 — 0.2150) |
| | Valve shim inner diameter | | mm (in) | Standard | 5.500 — 5.560 (0.2165 — 0.2189) |
| | Clearance between valve and valve shim | mm (in) | Intake | Standard | 0.030 — 0.105 (0.0012 — 0.0041) |
| Exhaust | | | Standard | 0.040 — 0.115 (0.0016 — 0.0045) | |
| Valve seat | Seating width between valve and valve seat | mm (in) | Intake | Standard | 0.8 — 1.6 (0.031 — 0.063) |
| | | | Exhaust | Standard | 1.1 — 1.7 (0.043 — 0.067) |
| | Seating angle between valve and valve seat | | | | 45° |
| | Seating position between valve and valve seat | | | | Valve face center |
| Valve spring | Free length | | mm (in) | Standard | CVT model: 41.68 (1.641) |
| | | | | | MT model: 41.06 (1.617) |
| | Tension/spring height | N (kgf, lb)/mm (in) | Set | Standard | 182 — 210 (18.56 — 21.41, 40.92 — 47.22)/33.0 (1.299) |
| | | | | | Lift |
| | | | MT model: 552 — 610 (56.29 — 62.20, 124.11 — 137.15)/22.0 (0.866) | | |
| Squareness | | | Standard | 2.5°, 1.8 mm (0.071 in) or less | |
| Cylinder block & piston | Cylinder block warpage (Mating surface with cylinder head) | | mm (in) | Limit | 0.025 (0.0010) |
| | Grinding limit of cylinder block | | mm (in) | | 204.9 (8.067) or less |
| | Height of cylinder block | | mm (in) | Standard | 205.0 (8.071) |
| | Inner diameter of cylinder liner | mm (in) | Cylinder bore size mark A | Standard | 94.005 — 94.015 (3.7010 — 3.7014) |
| | | | Cylinder bore size mark B | Standard | 93.995 — 94.005 (3.7006 — 3.7010) |
| | Cylindricity of cylinder liner | | mm (in) | Limit | 0.030 (0.0012) |
| | Out-of-roundness of cylinder liner | | mm (in) | Limit | 0.030 (0.0012) |


| | | | | | | | |
|--|---|------------------|--------------------------------------|----------|--|---------------------------------|---------------------------------|
| | Piston grade point | | | mm (in) | | 13.3 (0.52) | |
| Piston outer diameter | mm (in) | Standard size | Grade A | Standard | 93.980 — 93.990 (3.7000 — 3.7004) | | |
| | | | Grade B | Standard | 93.970 — 93.980 (3.6996 — 3.7000) | | |
| | | 0.25 (0.0098) OS | | Standard | 94.220 — 94.240 (3.7094 — 3.7102) | | |
| | | 0.50 (0.0197) OS | | Standard | 94.470 — 94.490 (3.7193 — 3.7201) | | |
| Clearance between cylinder liner and piston | | | mm (in) | Standard | 0.015 — 0.035 (0.0006 — 0.0014) | | |
| Inner diameter of cylinder liner boring limit (diameter) | | | | mm (in) | 94.505 (3.7207) or less | | |
| Piston and piston pin | Degree of fit | | | | Piston pin must be fitted into position with thumb at 20°C (68°F). | | |
| | Clearance between piston and piston pin | | | mm (in) | Standard | 0.004 — 0.008 (0.0002 — 0.0003) | |
| Piston ring | Closed gap | mm (in) | Compression ring | | Top ring | Standard | 0.20 — 0.25 (0.0079 — 0.0098) |
| | | | | | Second ring | Standard | 0.25 — 0.35 (0.0098 — 0.0138) |
| | | | Oil ring (upper rail and lower rail) | | | | Standard |
| | Clearance between compression ring and piston | | mm (in) | Top ring | | Standard | 0.040 — 0.080 (0.0016 — 0.0031) |
| | | Second ring | | Standard | 0.030 — 0.070 (0.0012 — 0.0028) | | |
| Connecting rod and connecting rod bearing | Bend or twist per 100 mm (3.94 in) in length | | | mm (in) | Limit | 0.10 (0.0039) | |
| | Thrust clearance | | | mm (in) | Standard | 0.070 — 0.330 (0.0028 — 0.0130) | |
| | Connecting rod bearing thickness (at center) | mm (in) | Standard size | | Standard | 1.492 — 1.508 (0.0587 — 0.0594) | |
| | | | 0.03 (0.0012) US | | Standard | 1.511 — 1.515 (0.0595 — 0.0596) | |
| | | | 0.05 (0.0020) US | | Standard | 1.521 — 1.525 (0.0599 — 0.0600) | |
| | | | 0.25 (0.0098) US | | Standard | 1.621 — 1.625 (0.0638 — 0.0640) | |
| Oil clearance | | | mm (in) | Standard | 0.017 — 0.047 (0.0007 — 0.0019) | | |
| Piston | Clearance between piston pin and | | | mm | Stan | 0.004 — 0.026 (0.0002 — | |

| | | | | | |
|--|-----------------------------------|-----------------------|------------------|----------|-----------------------------------|
| pin & connecting rod bushing | connecting rod bushing | (in) | Standard | 0.0010 | |
| Crankshaft and crankshaft bearing | Bending | | mm (in) | Limit | 0.035 (0.0014) |
| | Crankshaft pin | Cylindricality | mm (in) | Limit | 0.006 (0.0002) |
| | | Out-of-roundness | mm (in) | Limit | 0.005 (0.0002) |
| | | Grinding limit (dia.) | | mm (in) | 47.726 (1.8790) or less |
| | Crankshaft journal | Cylindricality | mm (in) | Limit | 0.006 (0.0002) |
| | | Out-of-roundness | mm (in) | Limit | 0.005 (0.0002) |
| | | Grinding limit (dia.) | | mm (in) | 67.735 (2.6667) or less |
| | Crankshaft pin outer diameter | mm (in) | Standard size | Standard | 47.976 — 48.000 (1.8888 — 1.8898) |
| | | | 0.03 (0.0012) US | Standard | 47.946 — 47.970 (1.8876 — 1.8886) |
| | | | 0.05 (0.0020) US | Standard | 47.926 — 47.950 (1.8868 — 1.8878) |
| | | | 0.25 (0.0098) US | Standard | 47.726 — 47.750 (1.8790 — 1.8799) |
| | Crankshaft journal outer diameter | mm (in) | Standard size | Standard | 67.985 — 68.003 (2.6766 — 2.6773) |
| | | | 0.03 (0.0012) US | Standard | 67.955 — 67.979 (2.6754 — 2.6763) |
| | | | 0.05 (0.0020) US | Standard | 67.935 — 67.959 (2.6746 — 2.6755) |
| | | | 0.25 (0.0098) US | Standard | 67.735 — 67.759 (2.6667 — 2.6677) |
| Crankshaft bearing thickness (at center) | mm (in) | #1, #2, #3, #4 | Standard size | Standard | 2.498 — 2.513 (0.0983 — 0.0989) |
| | | | 0.03 (0.0012) US | Standard | 2.519 — 2.522 (0.0992 — 0.0993) |
| | | | 0.05 (0.0020) US | Standard | 2.529 — 2.532 (0.0996 — 0.0997) |
| | | | 0.25 (0.0098) US | Standard | 2.629 — 2.632 (0.1035 — 0.1036) |
| | | | #5 | Standard | Standard |


| | | | | | |
|------------------|--|--|---------------------|--------------|------------------------------------|
| | | | size | dard | 0.0989) |
| | | | 0.03 (0.0012) US | Stan dard | 2.517 – 2.520 (0.0991 – 0.0992) |
| | | | 0.05 (0.0020) US | Stan dard | 2.527 – 2.530 (0.0995 – 0.0996) |
| | | | 0.25 (0.0098) US | Stan dard | 2.627 – 2.630 (0.1034 – 0.1035) |
| Thrust clearance | | | mm (in) | Stan dard | 0.130 – 0.308 (0.0051 – 0.0121) |
| Oil clearance | | | mm (in) | Stan dard | 0.013 – 0.031 (0.0005 – 0.0012) |

MECHANICAL(H4DO) > Idle Speed

INSPECTION

1. Before checking the idle speed, check the following item:
 - (1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.
 - (2) Check the malfunction indicator light does not illuminate.
2. Warm up the engine.
3. Read the engine idle speed using Subaru Select Monitor.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Note:


- **Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted.**
 - **If idle speed is out of standard, refer to the General Diagnosis Table under "Engine Control System".**  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Basic Diagnostic Procedure.](#)
- (1) Check the idle speed when no-loaded. (Headlight, blower fan, rear defroster, radiator fan, A/C and etc. are OFF)
Idle speed (No load, and for CVT model, select lever in "P" or "N" range, for MT model, gear shift lever in neutral position.):
Standard
 - 675±100 r/min (CVT model)
 - 650±100 r/min (MT model)
 - (2) Check the idle speed when loaded. (Turn the A/C switch to ON and operate the compressor for at least one minute before measurement.)
Idle speed (A/C on, and for CVT model, select lever in "P" or "N" range, for MT model, gear shift lever in neutral position.):
Standard
 - 800 — 900±100 r/min

MECHANICAL(H4DO) > Ignition Timing


INSPECTION

Caution:

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

- 1.** Before checking the ignition timing, check the following item:
 - (1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
 - (2) Check the malfunction indicator light does not illuminate.
- 2.** Warm up the engine.
- 3.** Read the ignition timing using Subaru Select Monitor.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Note:

If ignition timing is out of standard, check the ignition control system. Refer to "Engine Control System".  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DO\)>Basic Diagnostic Procedure.](#)

Ignition timing [BTDC/{r/min}]:

Standard





11°±10°/675 (CVT model)

6°±10°/650 (MT model)

MECHANICAL(H4DO) > Intake and Exhaust Valve

SPECIFICATION

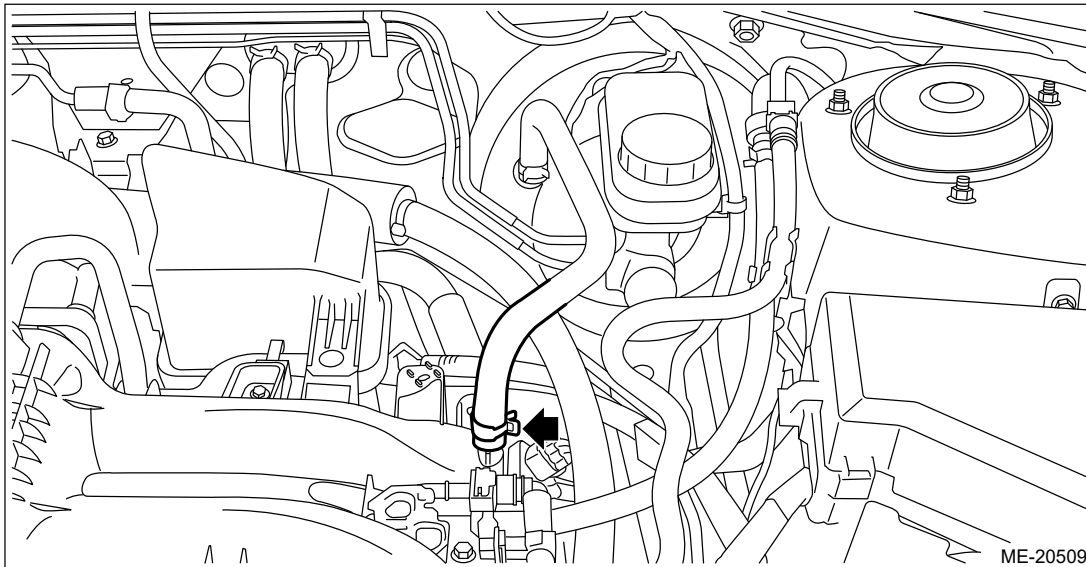
Refer to "Cylinder Head" for removal and installation procedures of the intake and exhaust valves.

 [Ref. to MECHANICAL\(H4DO\)>Cylinder Head>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Head>INSTALLATION.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Head>DISASSEMBLY.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Head>ASSEMBLY.](#)

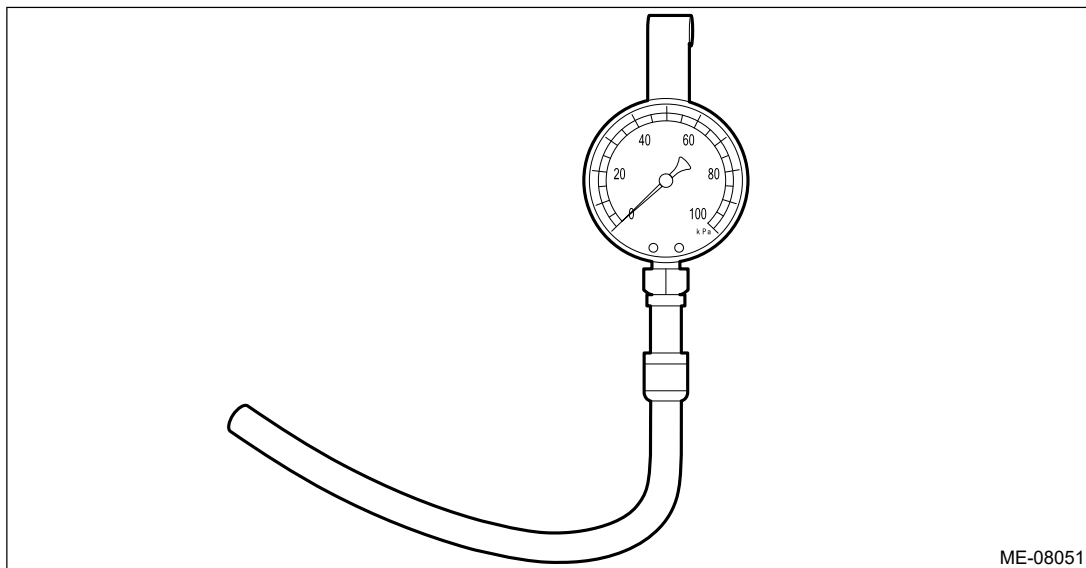
MECHANICAL(H4DO) > Intake Manifold Vacuum

INSPECTION

1. Warm up the engine.
2. Disconnect the brake booster vacuum hose from the intake manifold assembly.



3. Connect the vacuum gauge to the installation area for the brake booster vacuum hose of the intake manifold assembly.



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

Note:

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

Intake manifold vacuum (at idling, A/C OFF):

Standard

-60.0 kPa (-450 mmHg, -17.72 inHg) or more

| Diagnosis of engine condition by inspection of intake manifold vacuum | |
|---|---------------------------|
| Vacuum gauge needle behavior | Possible engine condition |
| | |





| | |
|---|---|
| 1. Needle is steady but lower than standard value. This tendency becomes more evident as engine temperature rises. | Leakage around intake manifold gasket, disconnection or damage of vacuum hose |
| 2. Needle intermittently drops to position lower than standard value. | Leakage around cylinder |
| 3. Needle drops suddenly and intermittently from standard value. | Sticky valve |
| 4. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases. | Weak or broken valve springs |
| 5. Needle vibrates above and below standard value in narrow range. | Defective ignition system |

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

MECHANICAL(H4DO) > Piston

SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of pistons.

 [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>INSTALLATION.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>DISASSEMBLY > PISTON AND CONNECTING ROD.](#)  [Ref. to MECHANICAL\(H4DO\)>Cylinder Block>ASSEMBLY > PISTON AND CONNECTING ROD.](#)

MECHANICAL(H4DO) > Preparation for Overhaul

PROCEDURE

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

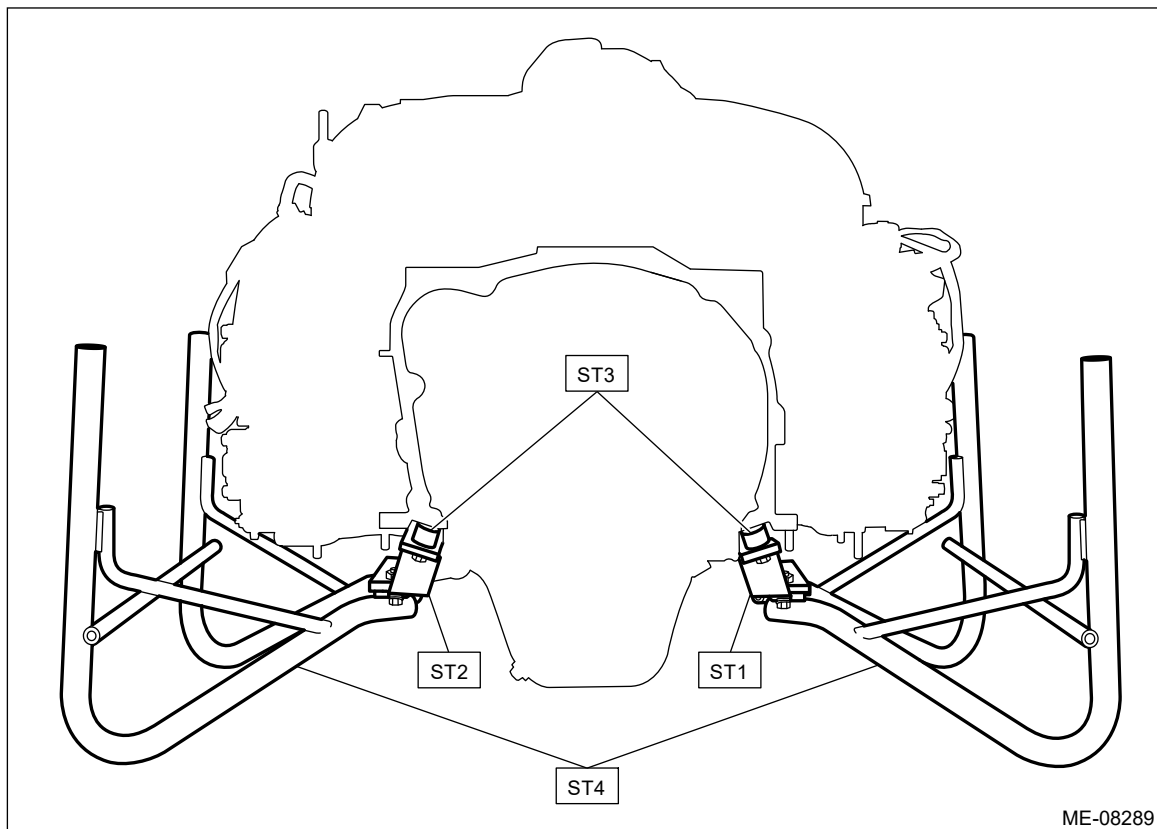
Note:

When using a commercially sold engine stand, follow the instructions of engine stand used.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)

| | | |
|------------|-------------------|--------------------------------|
| ST1 | 498457000 | ENGINE STAND ADAPTER RH |
| ST2 | 498457100 | ENGINE STAND ADAPTER LH |
| ST3 | 18362AA020 | ADAPTER |
| ST4 | 499817100 | ENGINE STAND |



2. In this section the procedures described under each index are all connected and stated in order. The procedure for overhauling of the engine will be completed when you go through all steps in the process.
Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

MECHANICAL(H4DO) > Rocker Cover

INSPECTION

Check that the rocker cover does not have deformation, cracks and any other damage.

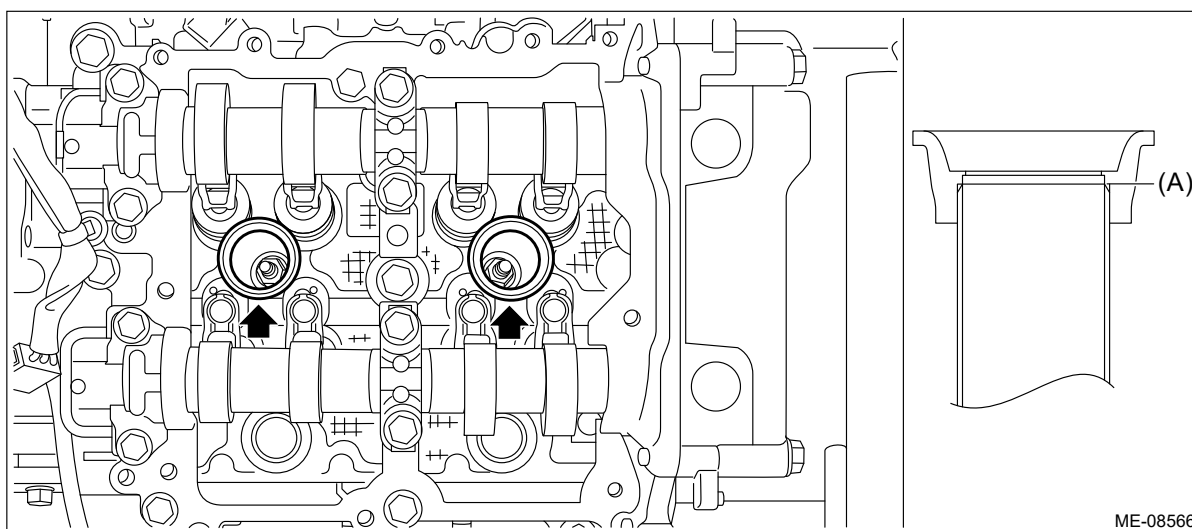
INSTALLATION

1. ROCKER COVER RH

1. Install the #1 spark plug pipe gasket and #3 spark plug pipe gasket to the #1 spark plug pipe and #3 spark plug pipe.

Note:

- Use a new #1 spark plug pipe gasket and #3 spark plug pipe gasket.
- Apply a light coat of engine oil to the #1 spark plug pipe gasket and #3 spark plug pipe gasket, and insert them onto the spark plug pipe edge (A).



2. Install the rocker cover gasket RH to the rocker cover RH.

Note:

Use a new rocker cover gasket RH.

3. Apply liquid gasket to the mating surface of rocker cover RH as shown in the figure.

Note:

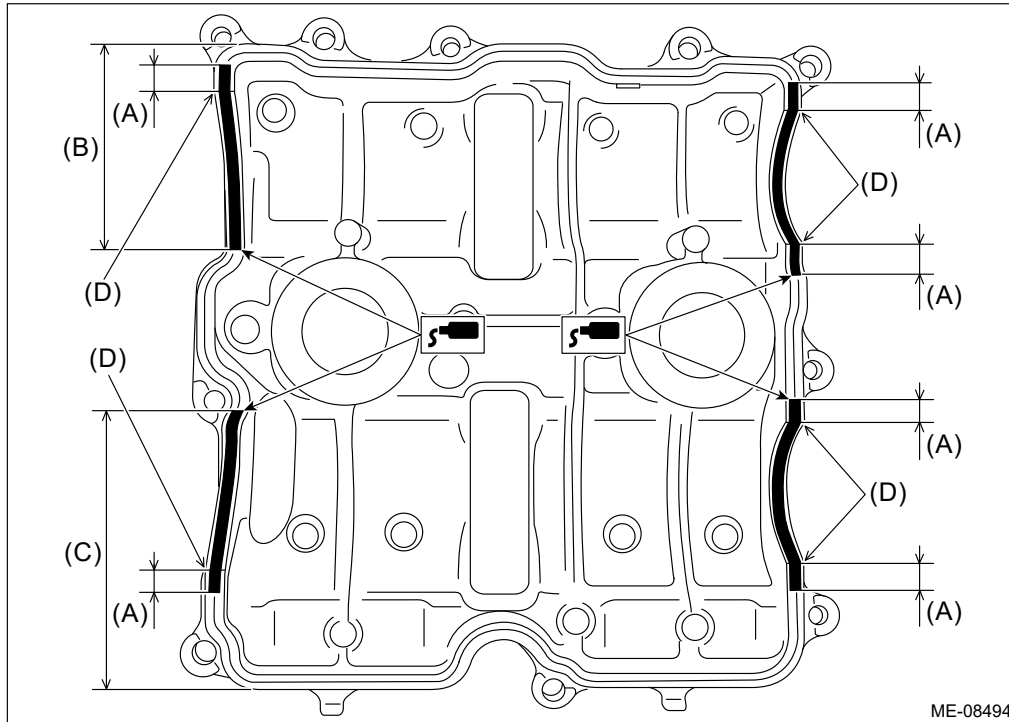
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the engine.
- Be careful not to allow liquid gasket to be squeezed out from rocker cover RH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3.5±0.5 mm (0.1378±0.0197 in)

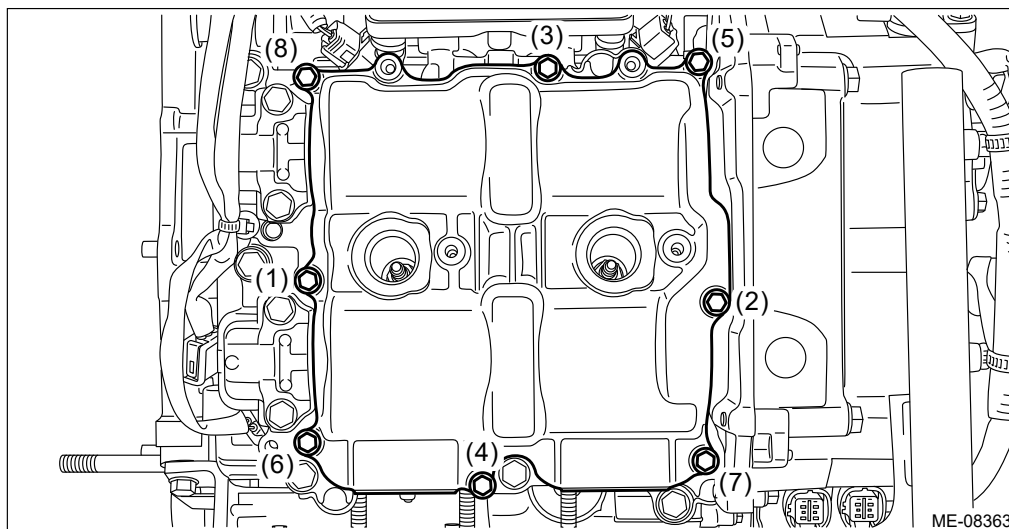


- (A) 10 mm (0.394 in) or more (C) 89 mm (3.504 in) or more (D) Arch starting point
 (B) 68 mm (2.677 in) or more

4. Set the rocker cover RH, and tighten the bolts in numerical order as shown in the figure.

Tightening torque:

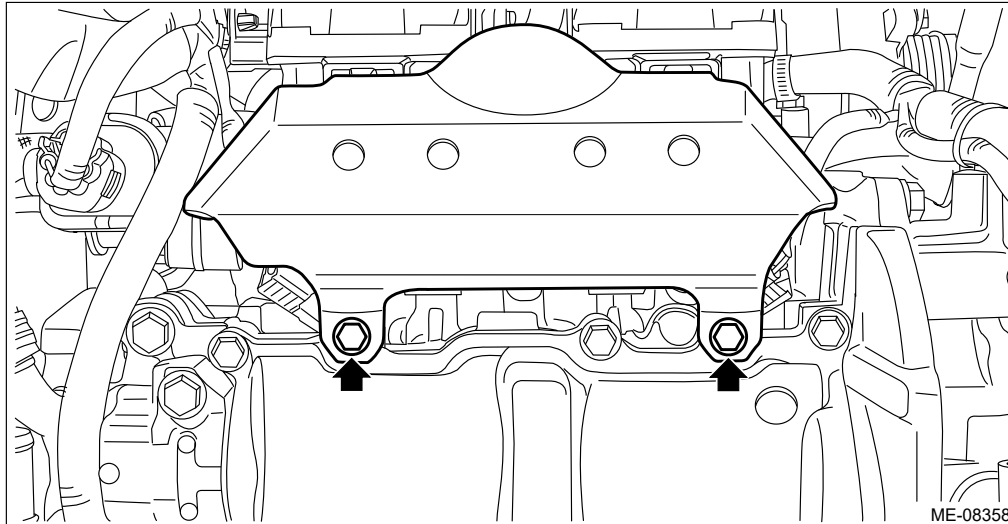
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)




5. Install the intake manifold protector RH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)






6. Install the #1 ignition coil and the #3 ignition coil.  [Ref. to IGNITION\(H4DO\)>Ignition Coil>INSTALLATION.](#)

7. When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

- (1) Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>INSTALLATION.](#)
- (2) Install the air cleaner case.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Cleaner Case>INSTALLATION.](#)
- (3) Install the air intake boot.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Boot>INSTALLATION.](#)

2. ROCKER COVER LH

1. When working on the vehicle

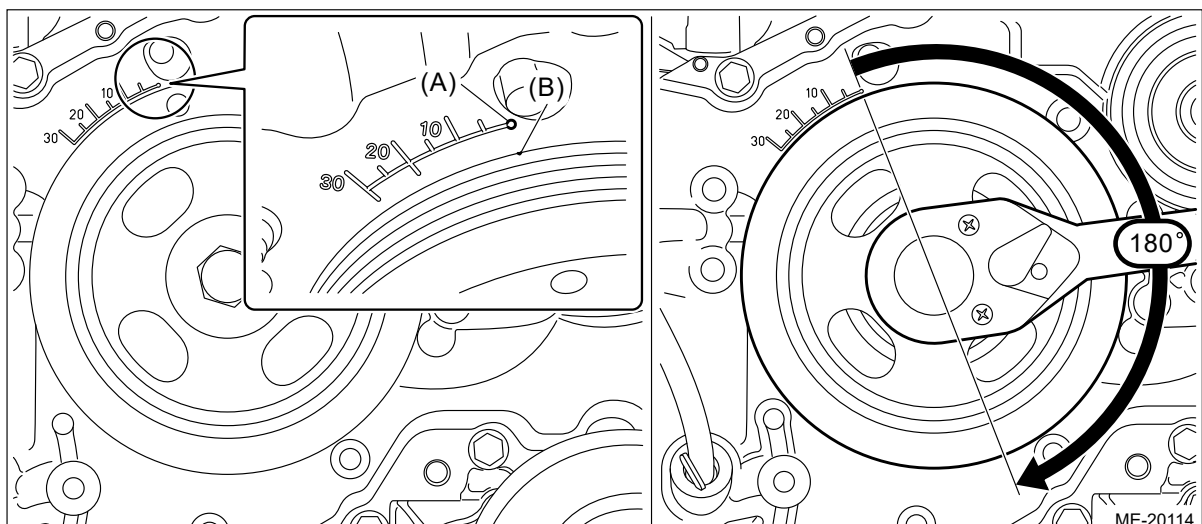
Note:

When working on the vehicle, perform the following steps also.

- (1) Align the timing mark (B) on crank pulley to the 0° in timing gauge (A) on chain cover as shown in the figure, and turn the crankshaft by 180° clockwise from that position.

Note:

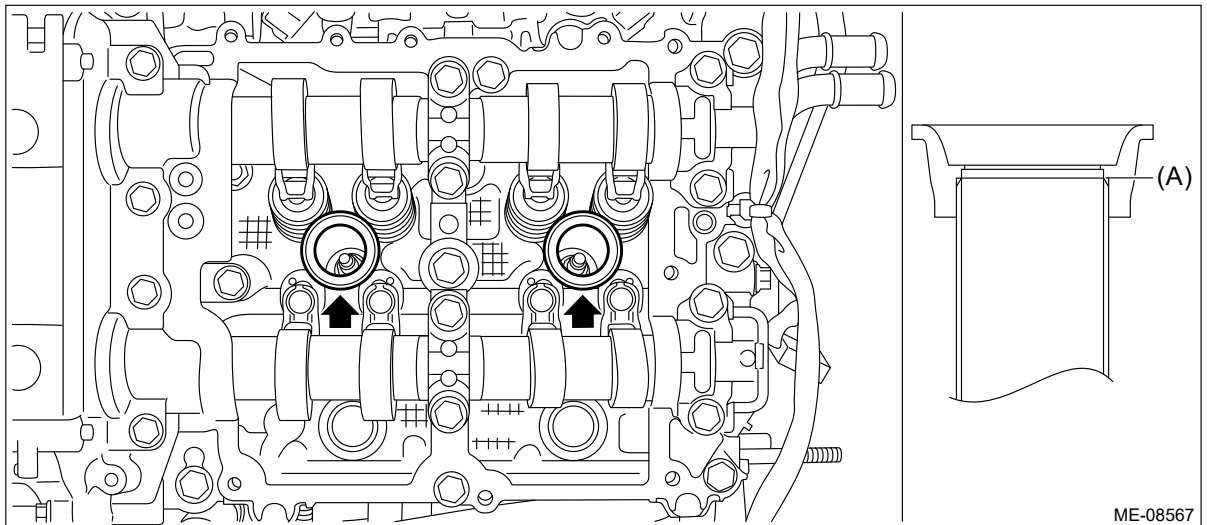
This procedure is required to prevent the rocker cover LH and the cam lobe of camshaft LH contacting with each other when installing the rocker cover LH.



2. Install the #2 spark plug pipe gasket and #4 spark plug pipe gasket to the #2 spark plug pipe and #4 spark plug pipe.

Note:

- Use a new #2 spark plug pipe gasket and #4 spark plug pipe gasket.
- Apply a light coat of engine oil to the #2 spark plug pipe gasket and #4 spark plug pipe gasket, and insert them onto the spark plug pipe edge (A).



- 3.** Install the rocker cover gasket LH to the rocker cover LH.

Note:

Use a new rocker cover gasket LH.

- 4.** Apply liquid gasket to the mating surface of rocker cover LH as shown in the figure.

Note:

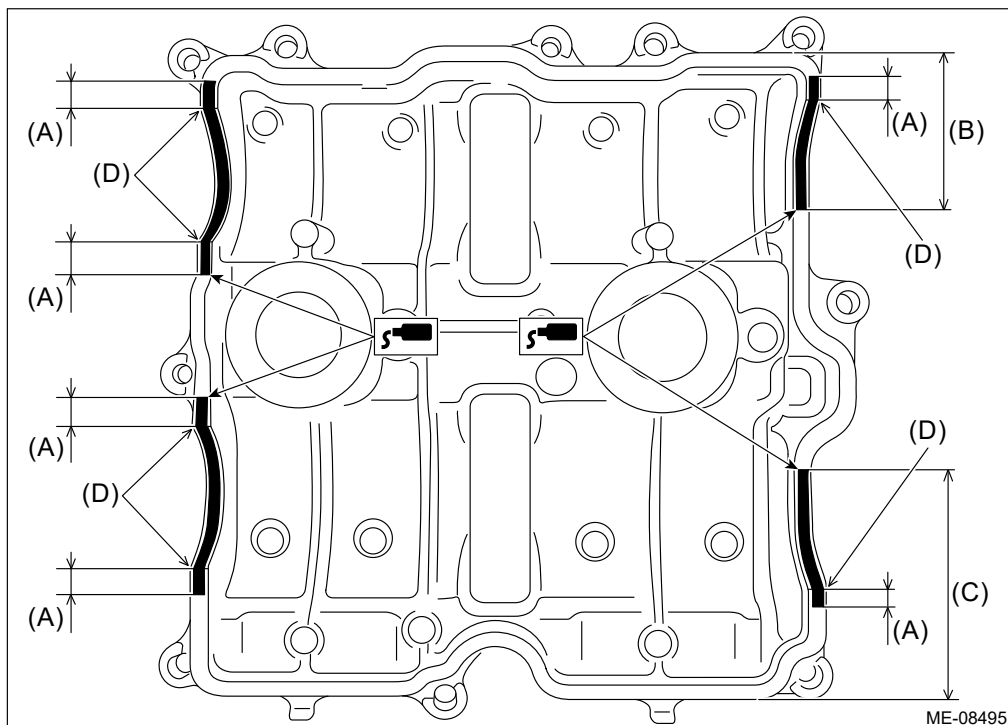
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the engine.
- Be careful not to allow liquid gasket to be squeezed out from rocker cover LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3.5±0.5 mm (0.1378±0.0197 in)

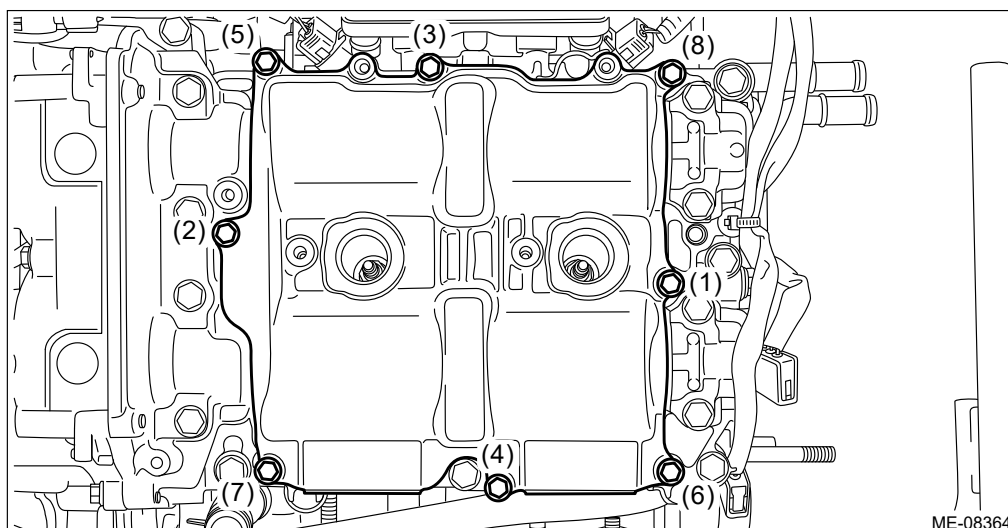


- (A) 10 mm (0.394 in) or more (C) 73 mm (2.874 in) or more (D) Arch starting point
 (B) 51 mm (2.008 in) or more

5. Set the rocker cover LH, and tighten the bolts in numerical order as shown in the figure.

Tightening torque:

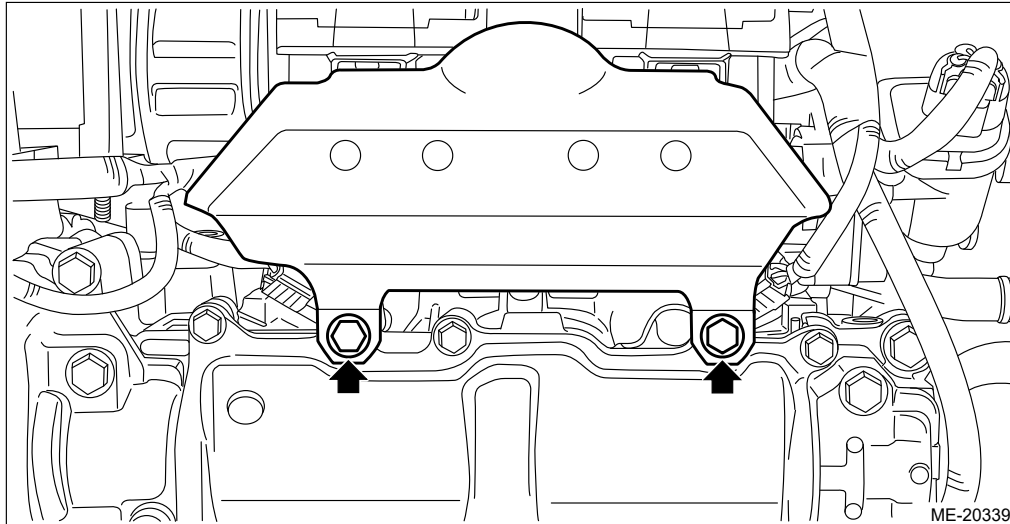
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



6. Install the intake manifold protector LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



7. Install the #2 ignition coil and the #4 ignition coil. [Ref. to IGNITION\(H4DQ\)>Ignition Coil>INSTALLATION.](#)

8. When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

- (1) Install the V-belts. [Ref. to MECHANICAL\(H4DQ\)>V-belt>INSTALLATION > V-BELT.](#)
- (2) Install the air intake duct (rear). [Ref. to INTAKE \(INDUCTION\)\(H4DQ\)>Air Intake Duct>INSTALLATION.](#)
- (3) Install the battery. [Ref. to STARTING/CHARGING SYSTEMS\(H4DQ\)>Battery>INSTALLATION.](#)

REMOVAL

1. ROCKER COVER RH

Note:

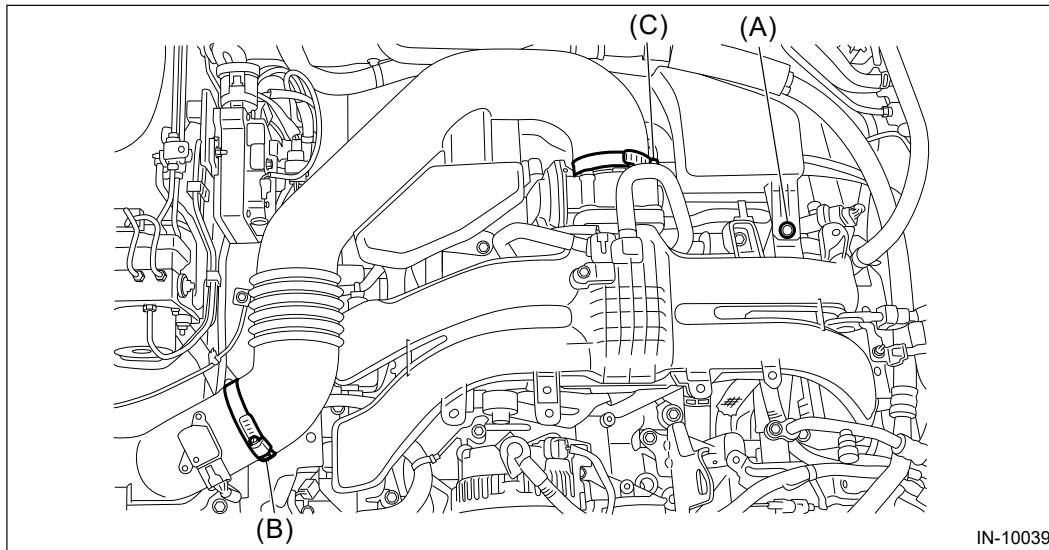
When replacing a single part, perform the work with the engine assembly installed to body.

1. When working on the vehicle

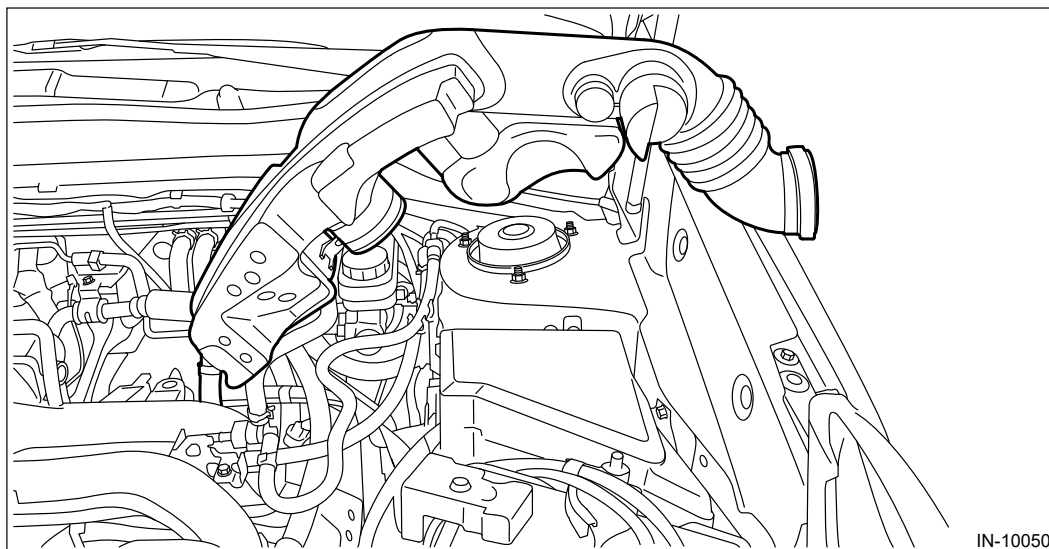
Note:



When working on the vehicle, perform the following steps also.


- (1) Remove the clip (A), and loosen the clamp (B) and the clamp (C) securing the air intake boot.



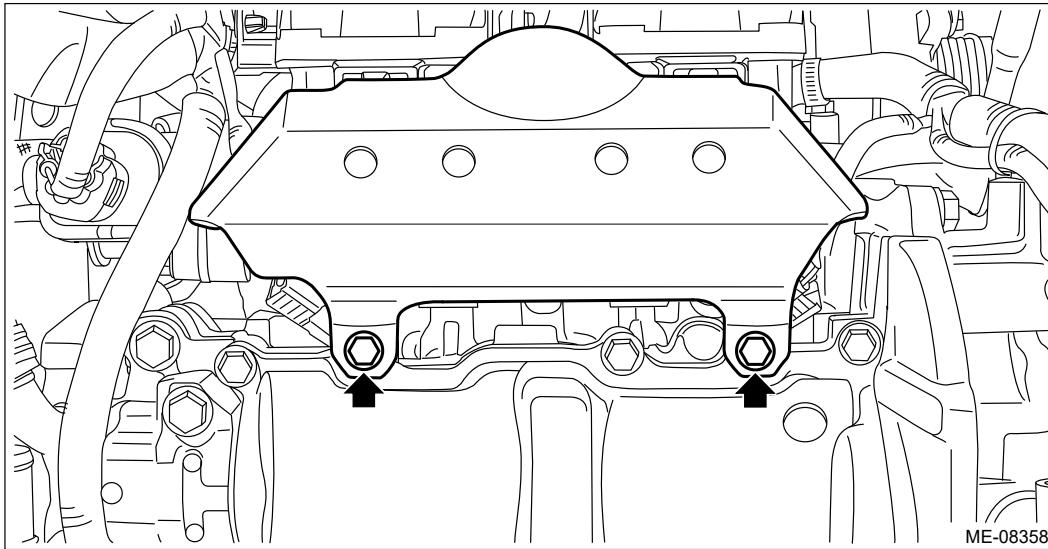
- (2) Remove the air intake boot from the air cleaner case (rear) and throttle body, and place the air intake boot aside so that it does not interfere with the work.



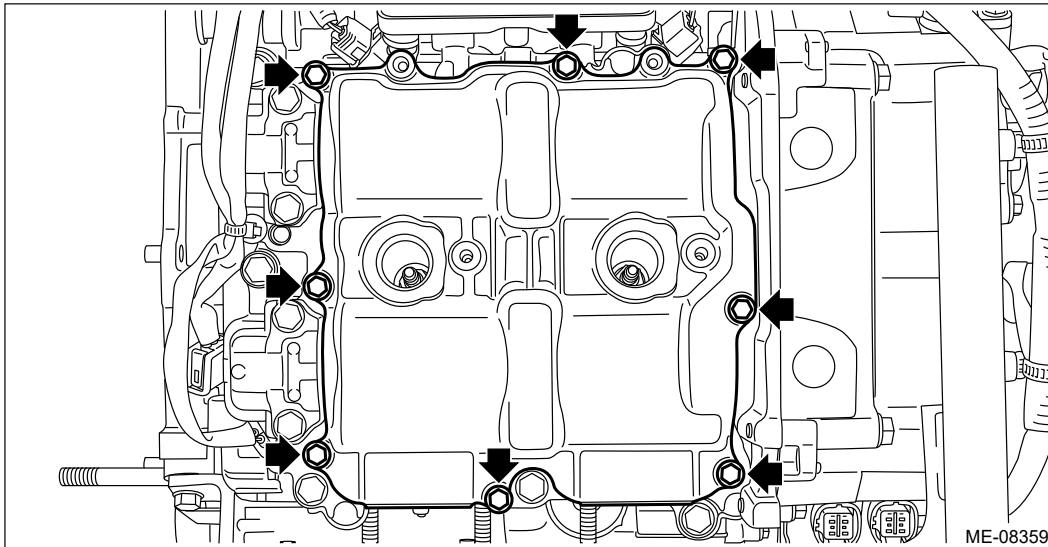
- (3) Remove the air cleaner case.  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Cleaner Case>REMOVAL.](#)
(4) Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DO\)>Front Exhaust Pipe>REMOVAL.](#)

2. Remove the #1 ignition coil and the #3 ignition coil.  [Ref. to IGNITION\(H4DO\)>Ignition Coil>REMOVAL.](#)

3. Remove the intake manifold protector RH.



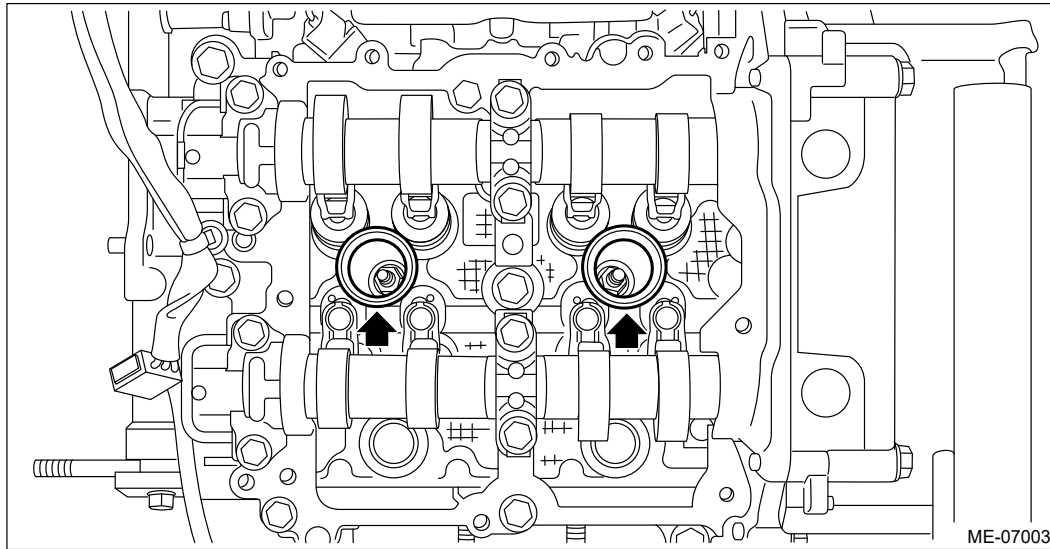
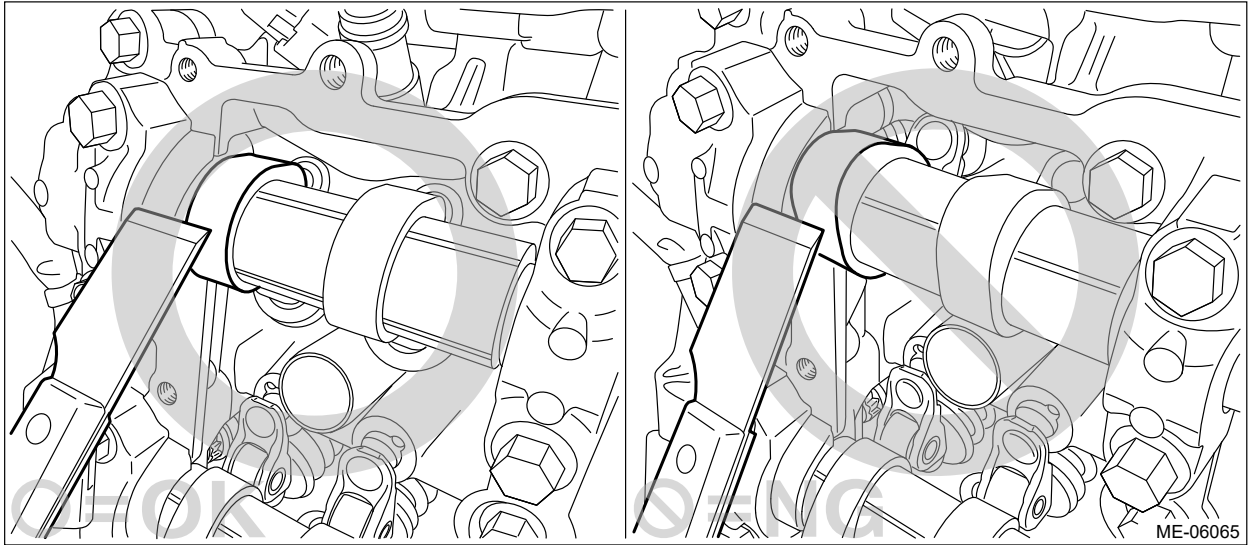
4. Remove the rocker cover RH.



5. Remove the rocker cover gasket RH, #1 spark plug pipe gasket and #3 spark plug pipe gasket, and remove the liquid gasket.

Caution:

- **When removing the liquid gasket from engine unit using scraper, use special care not to damage the cam lobe of camshaft RH.**
- **If the cam lobe of camshaft RH interferes, turn the crankshaft to the position where the scraper does not touch.**



2. ROCKER COVER LH




Note:

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

1. When working on the vehicle

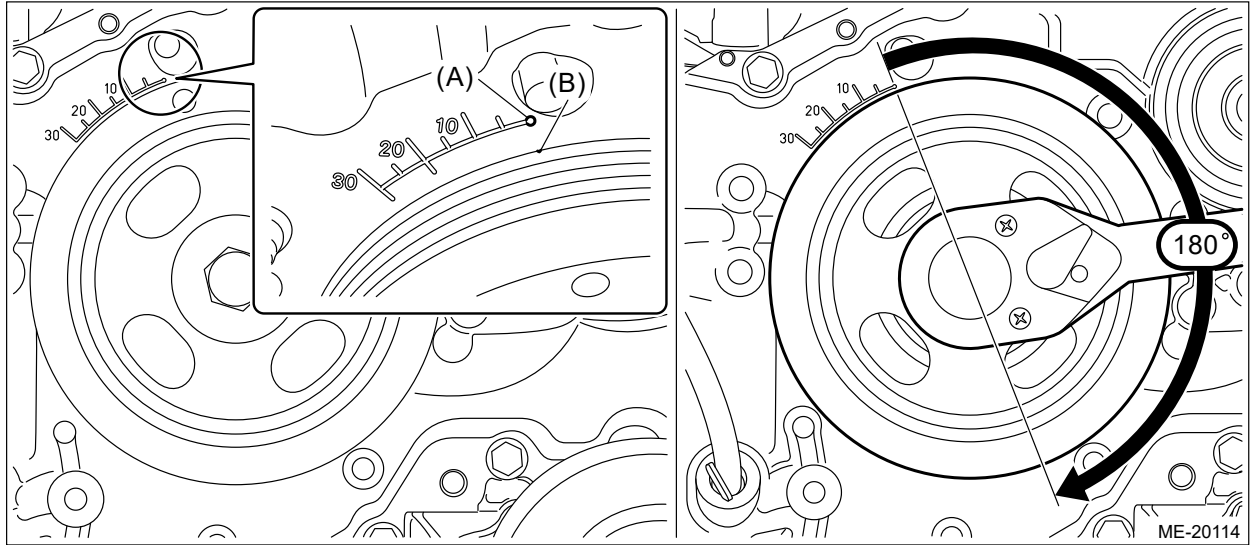
Note:


When working on the vehicle, perform the following steps also.

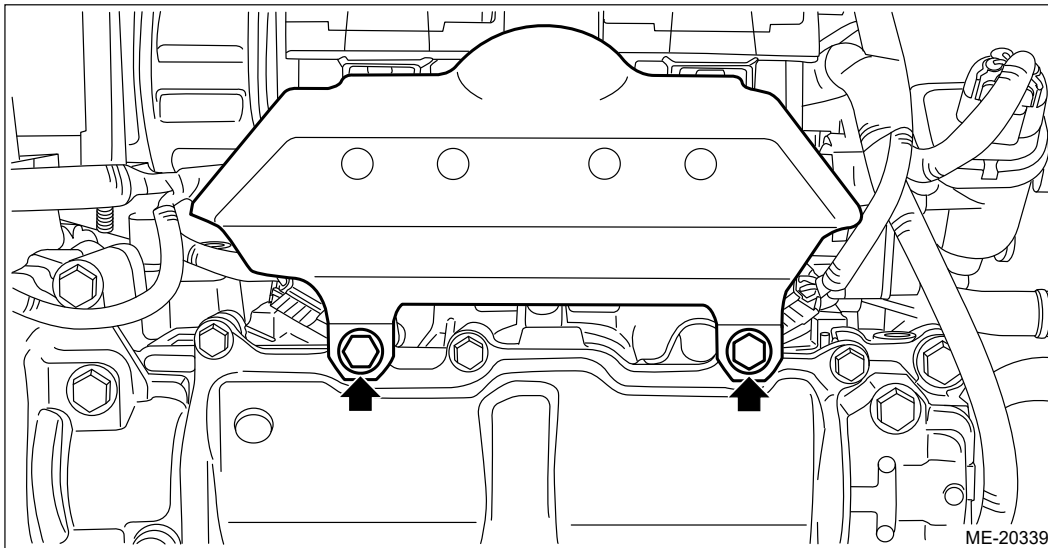
- (1) Remove the battery.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Battery>REMOVAL.](#)
- (2) Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DO\)>Air Intake Duct>REMOVAL.](#)
- (3) Remove the V-belts.  [Ref. to MECHANICAL\(H4DO\)>V-belt>REMOVAL > V-BELT.](#)
- (4) Align the timing mark (B) on crank pulley to the 0° in timing gauge (A) on chain cover as shown in the figure, and turn the crankshaft by 180° clockwise from that position.

Note:

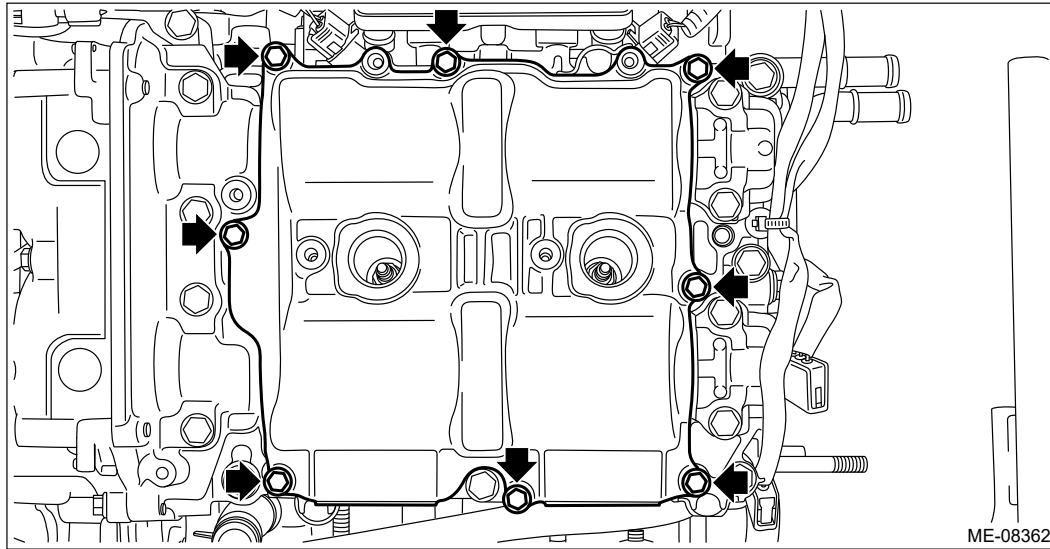
This procedure is required to prevent the rocker cover LH and the cam lobe of camshaft LH contacting with each other when removing the rocker cover LH.



2. Remove the #2 ignition coil and the #4 ignition coil.  [Ref. to IGNITION\(H4DO\)>Ignition Coil>REMOVAL.](#)
3. Remove the intake manifold protector LH.



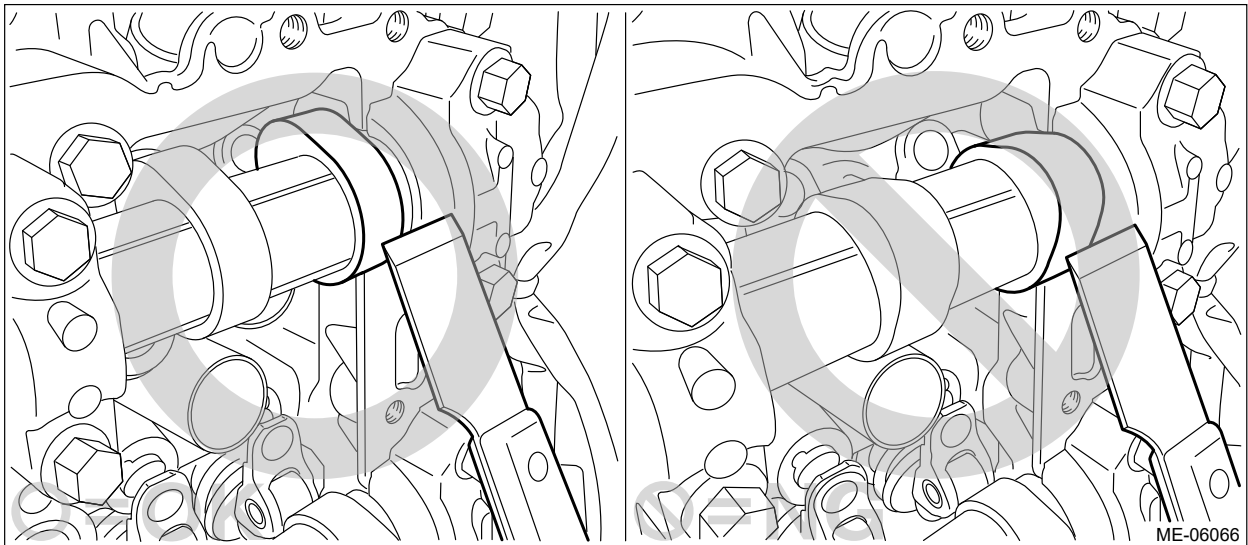
4. Remove the rocker cover LH.

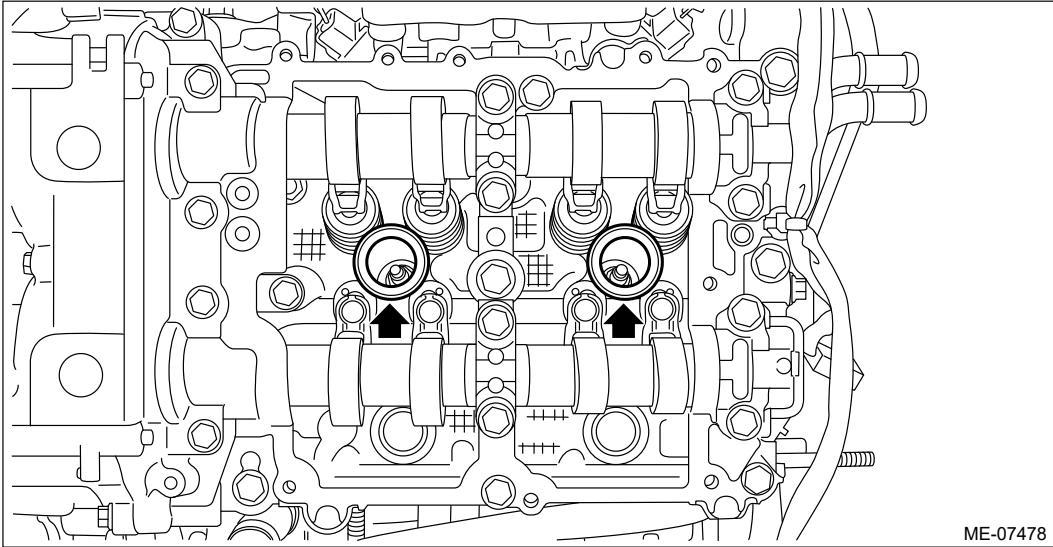


5. Remove the rocker cover gasket LH, #2 spark plug pipe gasket and #4 spark plug pipe gasket, and remove the liquid gasket.

Caution:

- When removing the liquid gasket from engine unit using scraper, use special care not to damage the cam lobe of camshaft LH.
- If the cam lobe of camshaft LH interferes, turn the crankshaft to the position where the scraper does not touch.





ME-07478

MECHANICAL(H4DO) > Symptoms and causes

INSPECTION



Note:



The "RANK" shown in the chart shows the possibilities of the cause of trouble in order from "Very often" to "Rarely".



A – Very often


B – Sometimes




C – Rarely



| Symptoms | Problem parts etc. | Possible cause | RANK |
|---|--|---|------|
| 1. Engine does not start. | | | |
| 1) Starter does not turn. | Starter | Defective battery-to-starter harness | B |
| | | Defective starter switch | C |
| | | Defective relay | C |
| | | Defective inhibitor switch | C |
| | | Defective starter | B |
| | Battery | Improper connection of terminal | A |
| | | Run-down battery | A |
| | | Defective charging system | B |
| | Friction | Seizure of crankshaft and connecting rod bearing | C |
| | | Seized camshaft | C |
| Seized or stuck piston and cylinder | | C | |
| Immobilizer system  Ref. to IMMOBILIZER (DIAGNOSTICS)>Basic Diagnostic Procedure. | | A | |
| 2) Initial combustion does not occur. | Starter | Defective starter | C |
| | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DO)>Basic Diagnostic Procedure. | | A |
| | Fuel line | Defective fuel pump and relay | A |
| | | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing chain | Trouble | B |
| | | Defective timing | B |
| | Compression | Incorrect cam clearance | C |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| Worn or broken valve spring | | B | |

| | | | |
|--|--|---|---|
| | | Worn or stuck piston rings, cylinder liner and piston | C |
| | | Incorrect valve timing | B |
| | | Improper engine oil (low viscosity) | B |
| 3) Initial combustion occurs. | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DO)>Basic Diagnostic Procedure. | | A |
| | Intake system | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | Fuel line | Defective fuel pump and relay | C |
| | | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing chain | Trouble | B |
| | | Defective timing | B |
| | Compression | Incorrect cam clearance | C |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder liner and piston | C |
| Incorrect valve timing | | B | |
| Improper engine oil (low viscosity) | B | | |
| 4) Engine stalls after initial combustion. | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DO)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened or cracked intake duct | B |
| | | Loosened or cracked PCV hose | C |
| | | Loosened or cracked vacuum hose | C |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Dirty air cleaner element | C |
| | Fuel line | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing chain | Trouble | B |
| | | Defective timing | B |
| | Compression | Incorrect cam clearance | C |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |

| | | | |
|---|--|---|---|
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | B |
| | | Improper engine oil (low viscosity) | B |
| 2. Rough idle and engine stall | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DO)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened or cracked intake duct | A |
| | | Loosened or cracked PCV hose | A |
| | | Loosened or cracked vacuum hose | A |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Defective PCV valve | C |
| | | Loosened oil filler cap | B |
| | | Dirty air cleaner element | C |
| | Fuel line | Defective fuel pump and relay | C |
| | | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing chain | Defective timing | C |
| | Compression | Incorrect cam clearance | B |
| | | Loosened spark plug or defective gasket | B |
| | | Loosened cylinder head bolt or defective cylinder head gasket | B |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | B |
| | | Incorrect valve timing | A |
| | | Improper engine oil (low viscosity) | B |
| | Lubrication system | Incorrect oil pressure | B |
| | | Defective rocker cover gasket | C |
| | Cooling system | Over-heating | C |
| | Other | Evaporative emission control system malfunction | A |
| | | Stuck or damaged throttle valve | B |
| 3. Low output, hesitation and poor acceleration | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DO)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened or cracked intake duct | A |
| | | Loosened or cracked PCV hose | A |

| | | | |
|------------|--|---|---|
| | | Loosened or cracked vacuum hose | B |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | B |
| | | Dirty air cleaner element | A |
| | Fuel line | Defective fuel pump and relay | B |
| | | Clogged fuel line | B |
| | | Lack of fuel or insufficient fuel | C |
| | Timing chain | Defective timing | B |
| | Compression | Incorrect cam clearance | B |
| | | Loosened spark plug or defective gasket | B |
| | | Loosened cylinder head bolt or defective cylinder head gasket | B |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | A |
| | | Improper engine oil (low viscosity) | B |
| | Lubrication system | Incorrect oil pressure | B |
| | Cooling system | Over-heating | C |
| | | Over-cooling | C |
| | Other | Evaporative emission control system malfunction | A |
| 4. Surging | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DO)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened or cracked intake duct | A |
| | | Loosened or cracked PCV hose | A |
| | | Loosened or cracked vacuum hose | A |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | B |
| | | Dirty air cleaner element | B |
| | Fuel line | Defective fuel pump and relay | B |
| | | Clogged fuel line | B |
| | | Lack of fuel or insufficient fuel | C |
| | Timing chain | Defective timing | B |

| | | | |
|---|--|---|---|
| | Compression | Incorrect cam clearance | B |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | C |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | A |
| | | Improper engine oil (low viscosity) | B |
| | Cooling system | Over-heating | B |
| Other | Evaporative emission control system malfunction | C | |
| 5. Engine does not return to idle. | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DO)>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 ENGINE (DIAGNOSTICS) (H4DO)>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 ENGINE (DIAGNOSTICS) (H4DO)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened or cracked intake duct | C |
| | | Loosened or cracked PCV hose | C |
| | | Loosened or cracked vacuum hose | B |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | C |
| | Timing chain | Defective timing | B |
| | Compression | Incorrect cam clearance | B |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | C |
| Worn or stuck piston rings, cylinder and piston | | C | |
| Incorrect valve timing | A | | |

| | | | |
|-------------------------------------|--|---|---|
| | Lubrication system | Incorrect oil pressure | C |
| | Cooling system | Over-cooling | C |
| | Other | Evaporative emission control system malfunction | C |
| 8. Knocking | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DO)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened oil filler cap | B |
| | Timing chain | Defective timing | B |
| | Compression | Incorrect cam 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 chain cover attaching bolts and defective gasket | B |
| | | Defective oil filter gasket | B |
| | | Defective crankshaft oil seal | B |
| | | Defective rocker cover gasket | B |
| | | Loosened oil drain plug or defective gasket | B |
| | Loosened oil pan mounting bolt or defective oil pan | B | |
| 10. Excessive fuel consumption | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DO)>Basic Diagnostic Procedure. | | A |
| | Intake system | Dirty air cleaner element | A |
| | Timing chain | Defective timing | B |
| | Compression | Incorrect cam clearance | B |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder 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 | |

MECHANICAL(H4DO) > Timing Chain Assembly

INSPECTION

- 1.** Check the timing chain, chain guide, chain tensioner lever and chain tensioner for deformation, cracks or other damages.
- 2.** Check the chain guide and chain tensioner lever for abnormal wear.

INSTALLATION

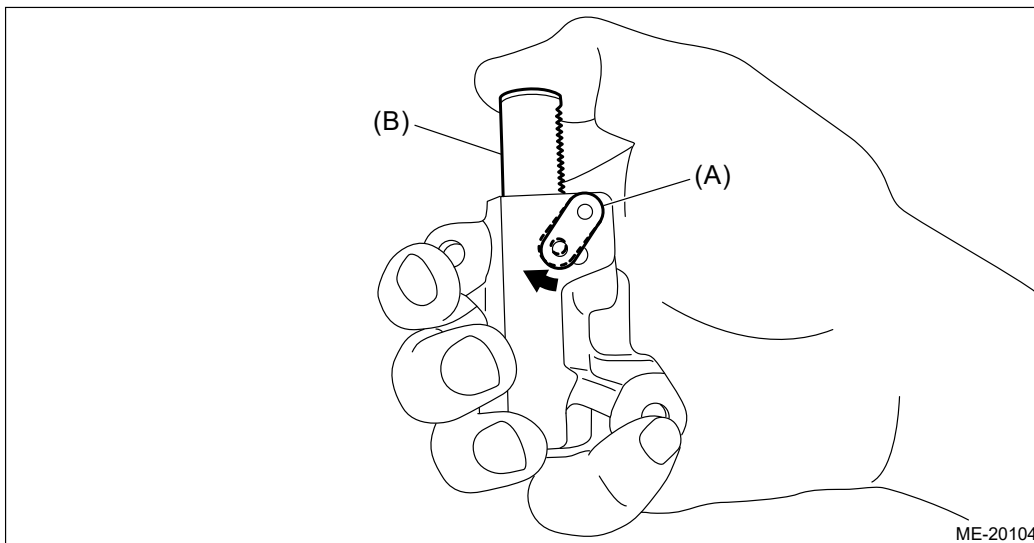
1. TIMING CHAIN LH

Note:

- Be careful that the foreign matter is not into or onto the assembled component during installation.
- Apply engine oil to all component parts of the timing chain.

1. Prepare to attach the chain tensioner LH.

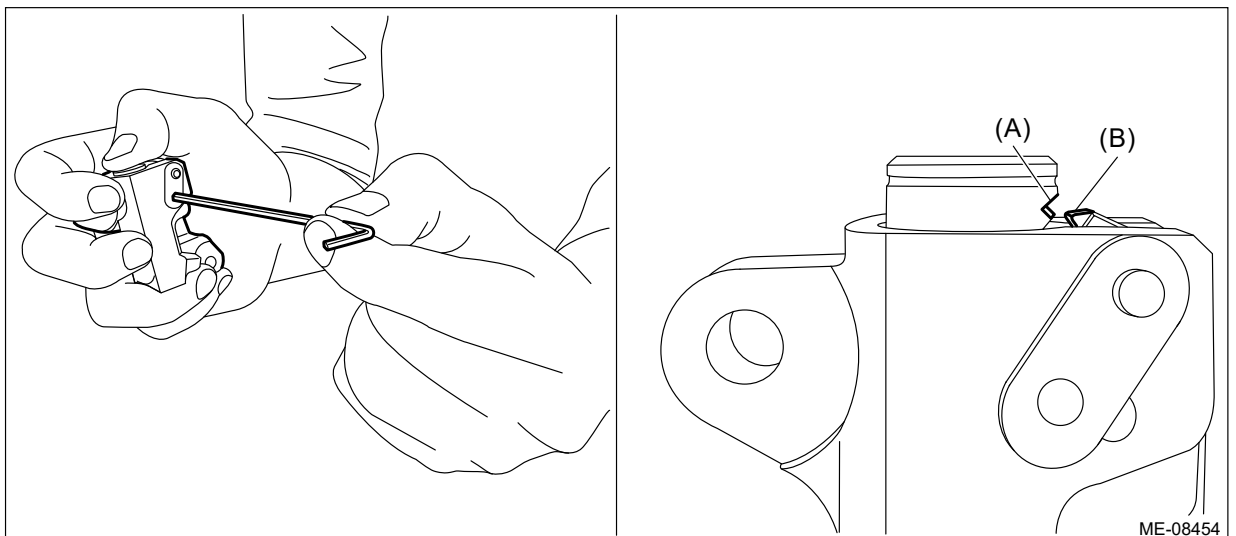
- (1) Move the link plate (A) in the direction of arrow to press in the plunger (B).



- (2) In order to secure the plunger, insert a stopper pin with a diameter of 1.3 mm (0.05 in) or a hex wrench with a diameter of 1.3 mm into the stopper pin hole.

Note:

If the stopper pin hole on the link plate and the stopper pin hole on the chain tensioner are not aligned, check that the first notch of plunger rack (A) is engaged with the stopper tooth (B). If not engaged, retract the plunger a little so that the first notch of plunger rack (A) is engaged with the stopper tooth (B).

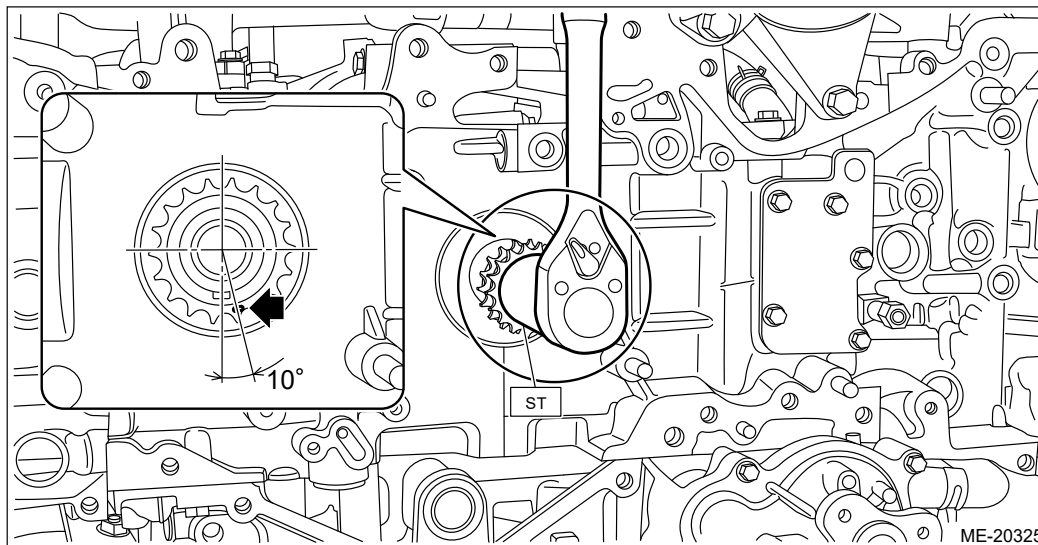


2. Check that the crank sprocket is located at the position shown in the figure. If not aligned, using ST turn the crankshaft to align the crank sprocket alignment mark to the position shown in the figure.

Note:

This procedure is required to prevent the valve and piston contacting with each other in the next step.

ST 18252AA000 CRANKSHAFT SOCKET



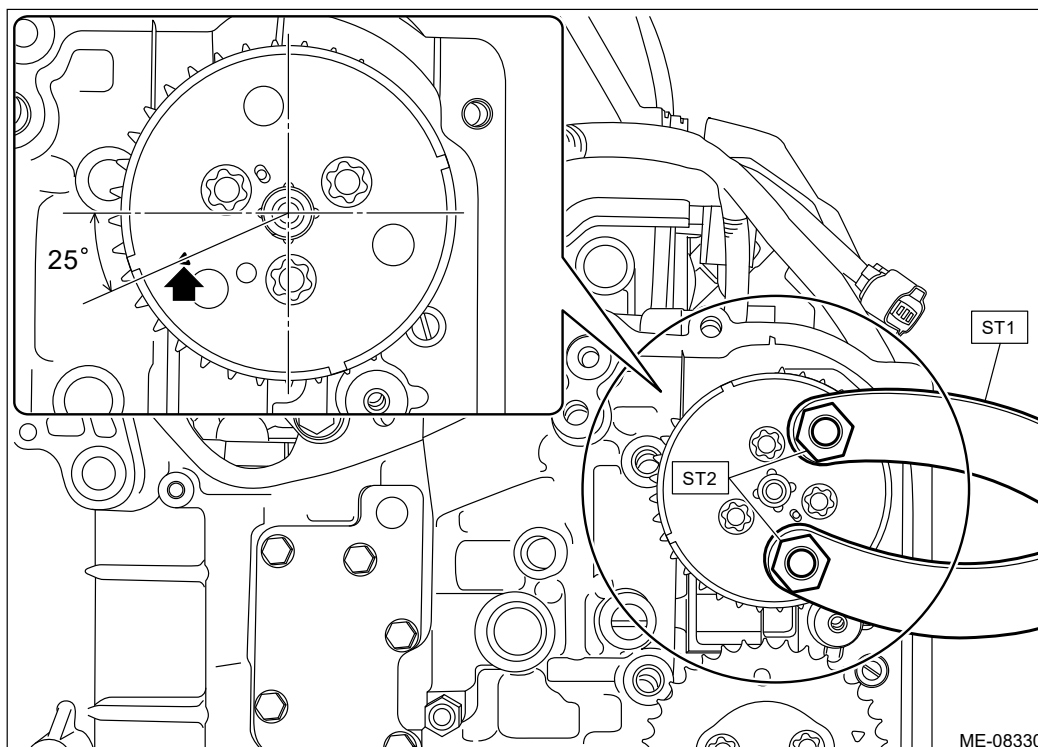
3. Using ST and by turning the intake cam sprocket LH, align the alignment marks to the positions as shown in the figure.

Caution:

- **When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn the exhaust camshaft LH.**
- **Perform the operation carefully since the ST comes off easily.**

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA020 PULLEY WRENCH PIN SET

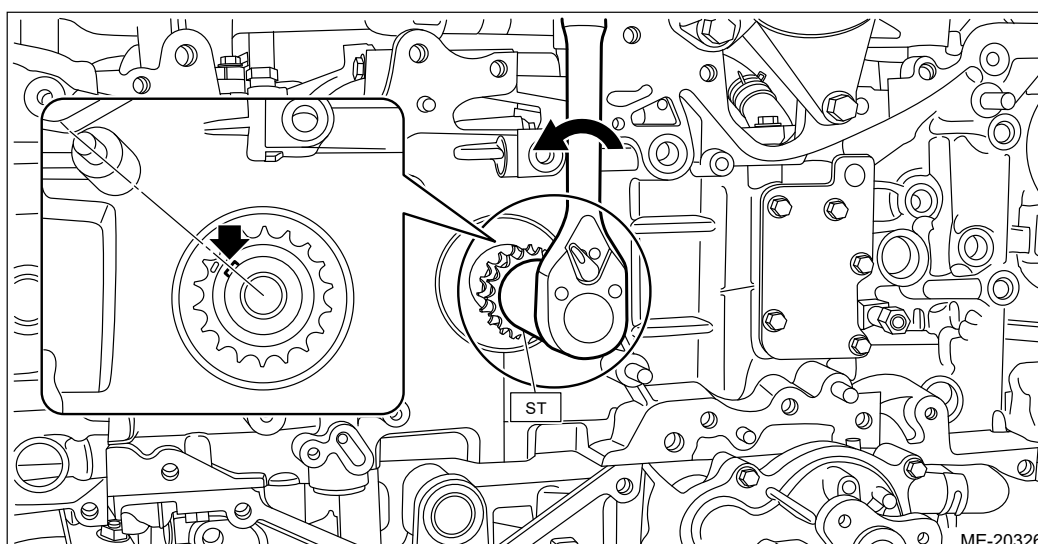


4. Using ST and by turning the crankshaft approximately 200° counterclockwise, align the alignment marks of crankshaft key to the positions as shown in the figure.

Caution:

Never turn clockwise because the valve and piston may contact. Clockwise turn is allowed only when adjusting the key position precisely, after turning the crankshaft counterclockwise to bring the key near the position as shown in the figure.

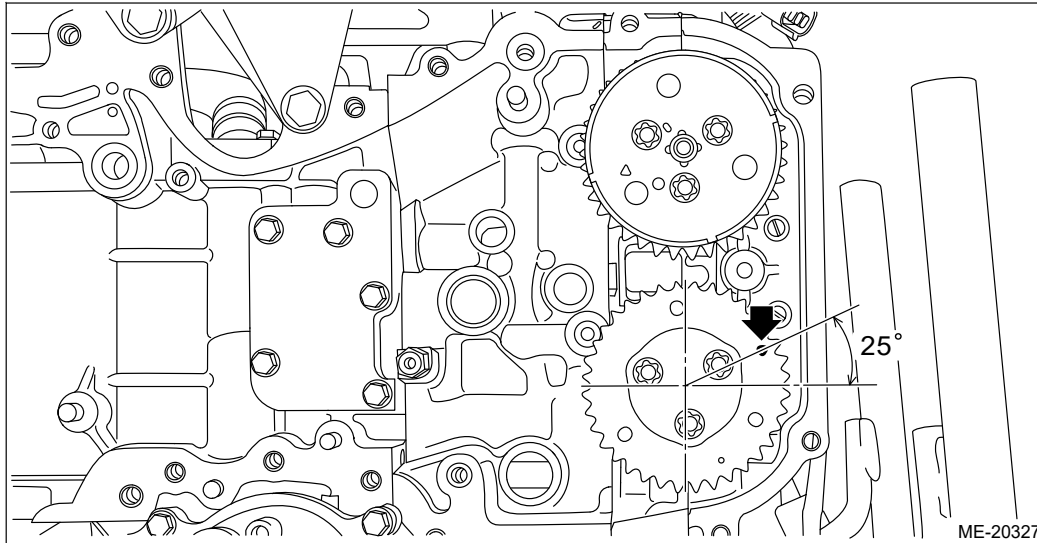
ST 18252AA000 CRANKSHAFT SOCKET



5. Align the alignment mark of exhaust cam sprocket LH to the position shown in the figure.

Caution:

To prevent valve damage, turn the exhaust cam sprocket LH only within the range of zero-lift (in range where it can be turned lightly by hand).

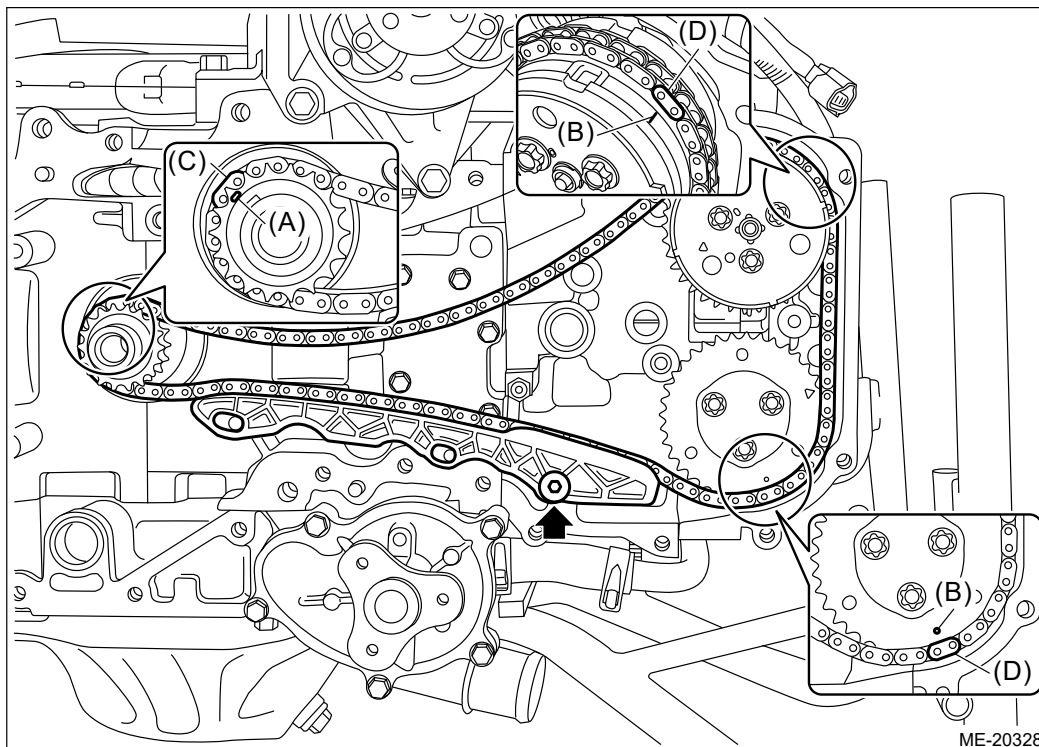


6. Install the timing chain LH and the timing chain guide LH.

- (1) Match the timing chain mark (blue) to the alignment mark of the crank sprocket.
- (2) Match the timing chain mark (pink) to the timing mark position of the intake cam sprocket LH.
- (3) Match the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket LH.
- (4) Install timing chain guide LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(A) Alignment mark

(C) Blue

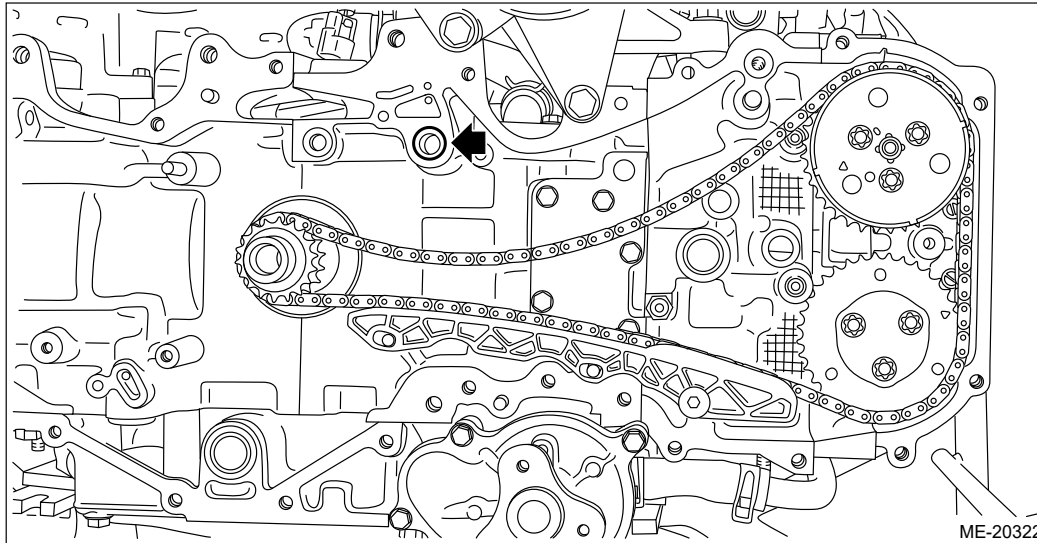
(D) Pink

(B) Timing mark

7. Install O-rings to the cylinder block LH.

Note:

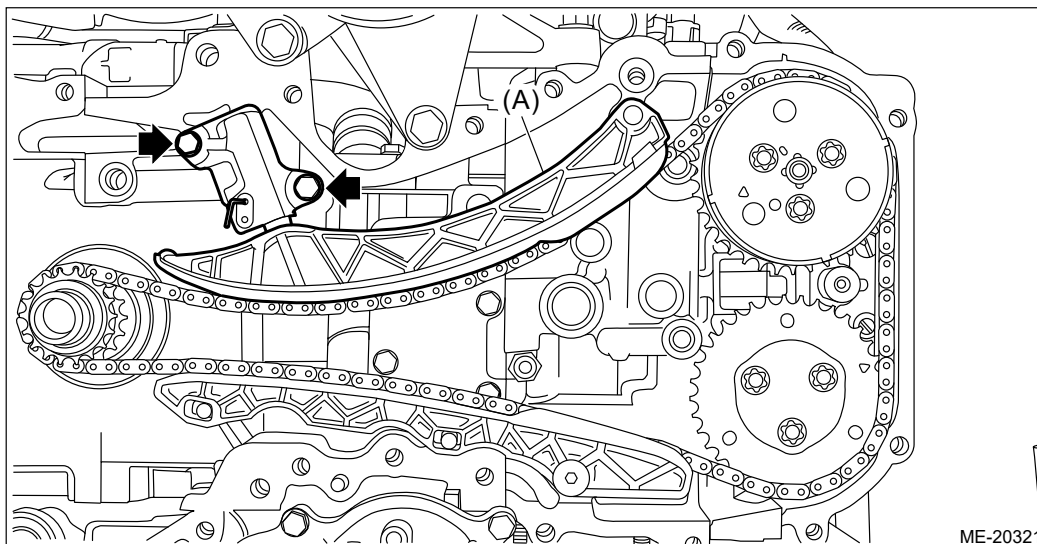
Use new O-rings.



8. Install the chain tensioner lever LH (A) and chain tensioner LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



9. Pull out the stopper pin from the chain tensioner LH.

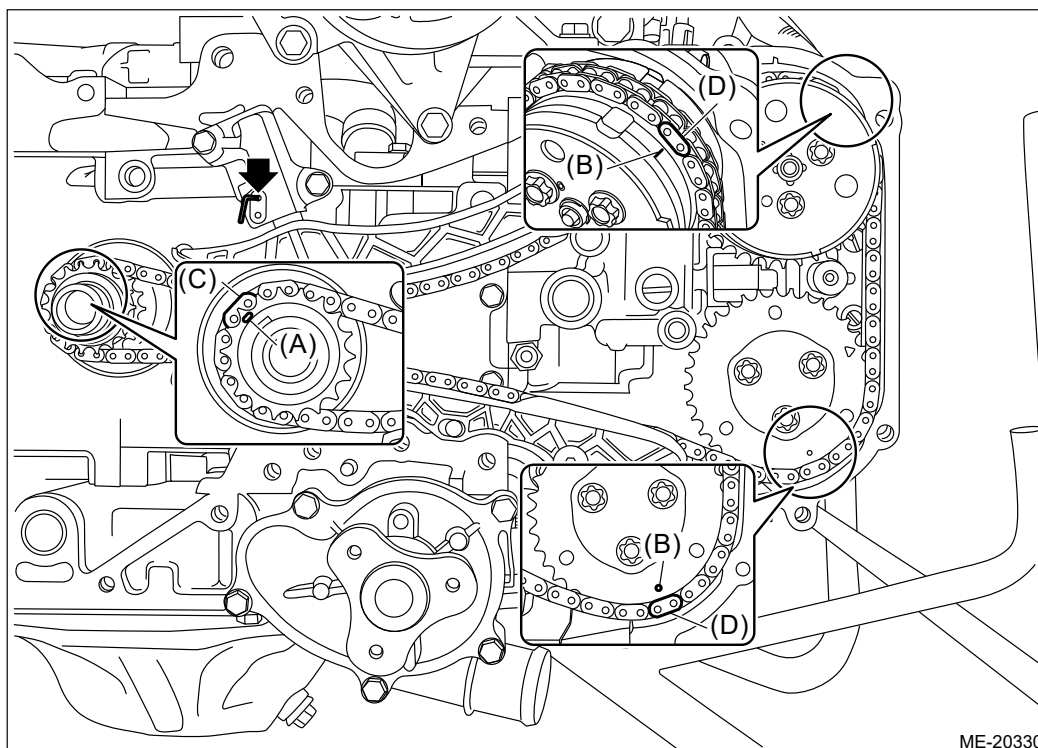
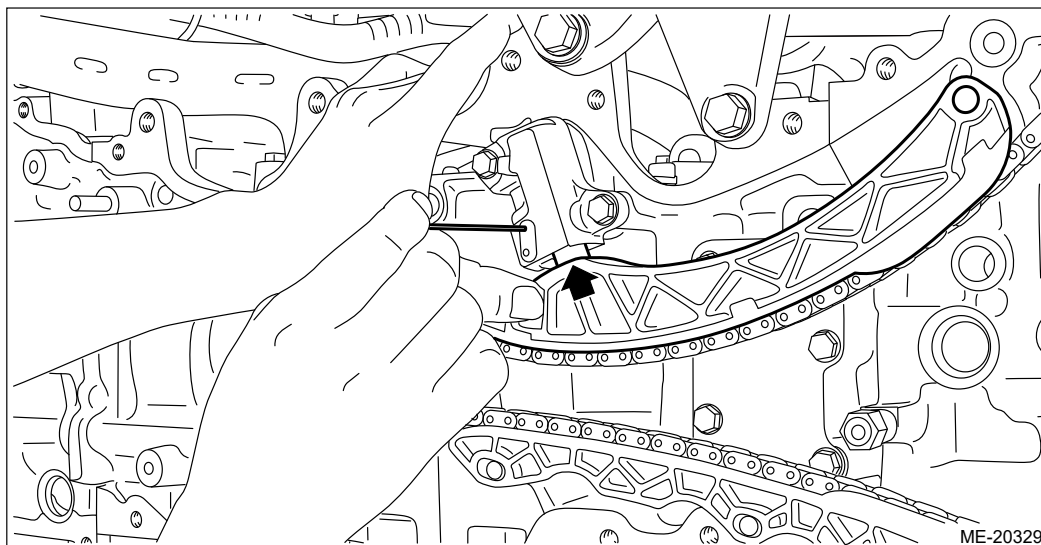
Caution:

Confirm the following before pulling out the stopper pin.

- **Matching of the timing chain mark (blue) to the alignment mark of the crank sprocket.**
- **Matching of the timing chain mark (pink) to the timing mark position of the intake cam sprocket LH.**
- **Matching of the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket LH.**

Note:

If the stopper pin cannot be removed, lift the chain tension lever LH to remove as shown in the figure.



(A) Alignment mark

(C) Blue

(D) Pink

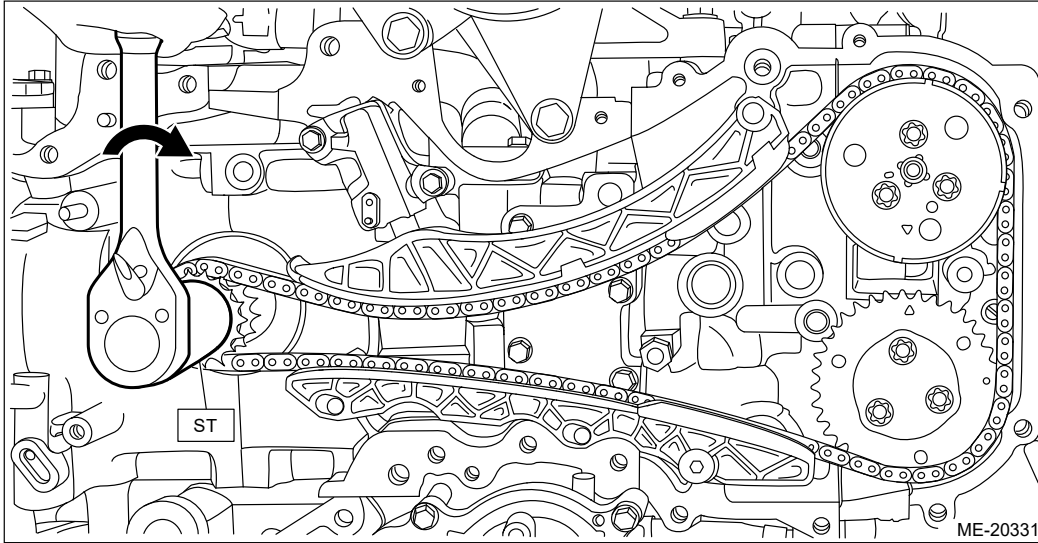
(B) Timing mark

10. Using the ST, turn the crankshaft clockwise, and make sure that there are no abnormal conditions.

Caution:

Always make sure to perform this confirmation.

ST 18252AA000 CRANKSHAFT SOCKET

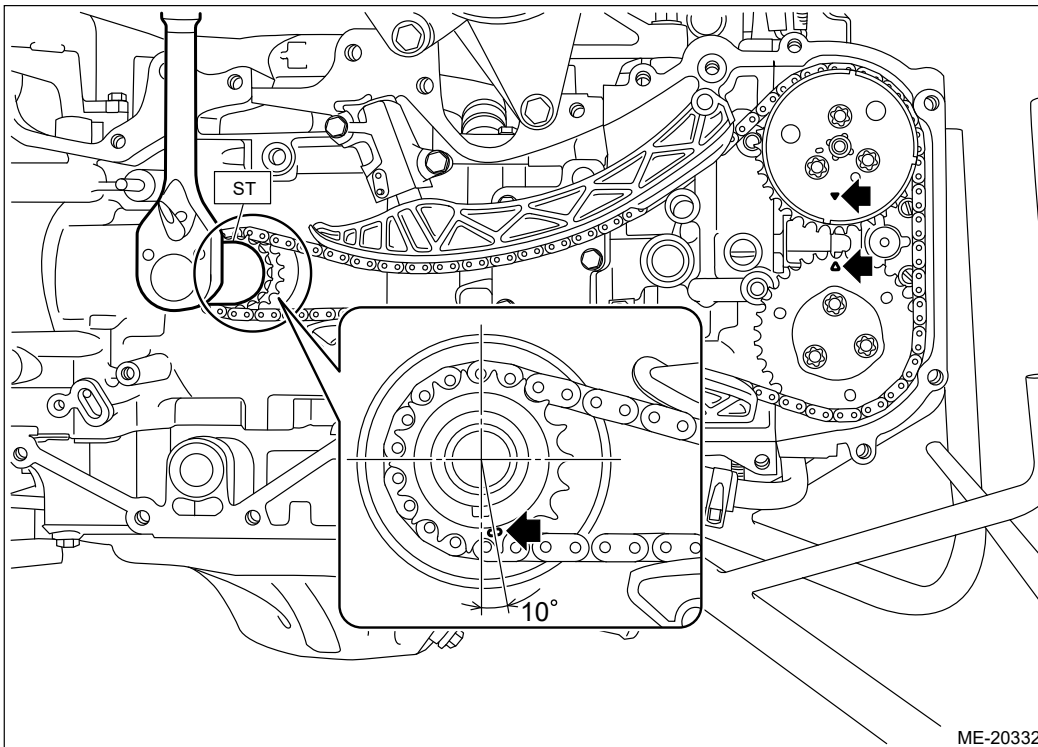


- 11.** Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket LH and exhaust cam sprocket LH to the positions as shown in the figure.

Note:

If the alignment marks are aligned to the positions as shown in the figure, the crankshaft key is located at six o'clock position.

ST 18252AA000 CRANKSHAFT SOCKET




- 12.** Install the timing chain RH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN RH.](#)

2. TIMING CHAIN RH

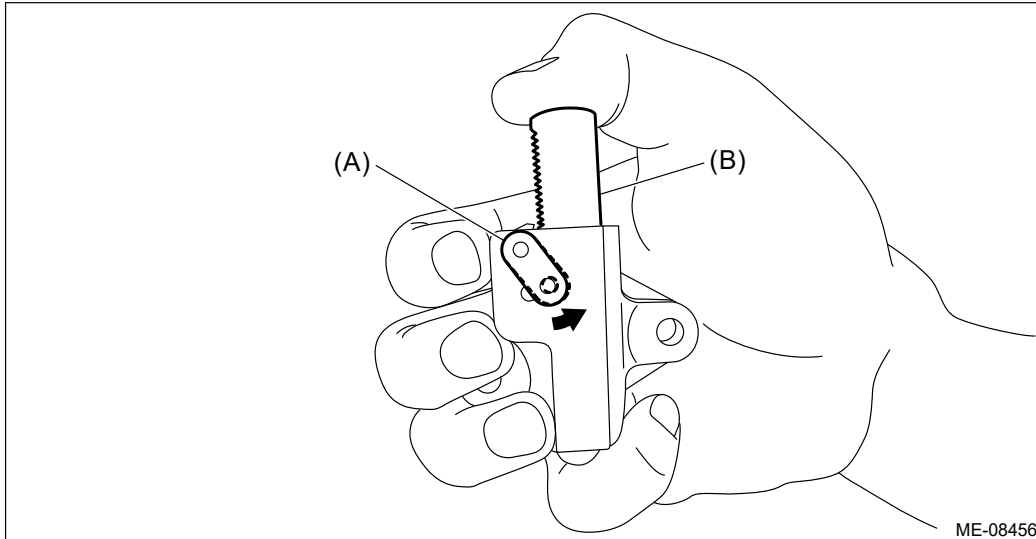
Note:

- **Be careful that the foreign matter is not into or onto the assembled component during installation.**
- **Apply engine oil to all component parts of the timing chain.**

1. Install timing chain LH.  [Ref. to MECHANICAL\(H4DO\)>Timing_Chain_Assembly>INSTALLATION > TIMING CHAIN LH.](#)

2. Prepare to attach the chain tensioner RH.

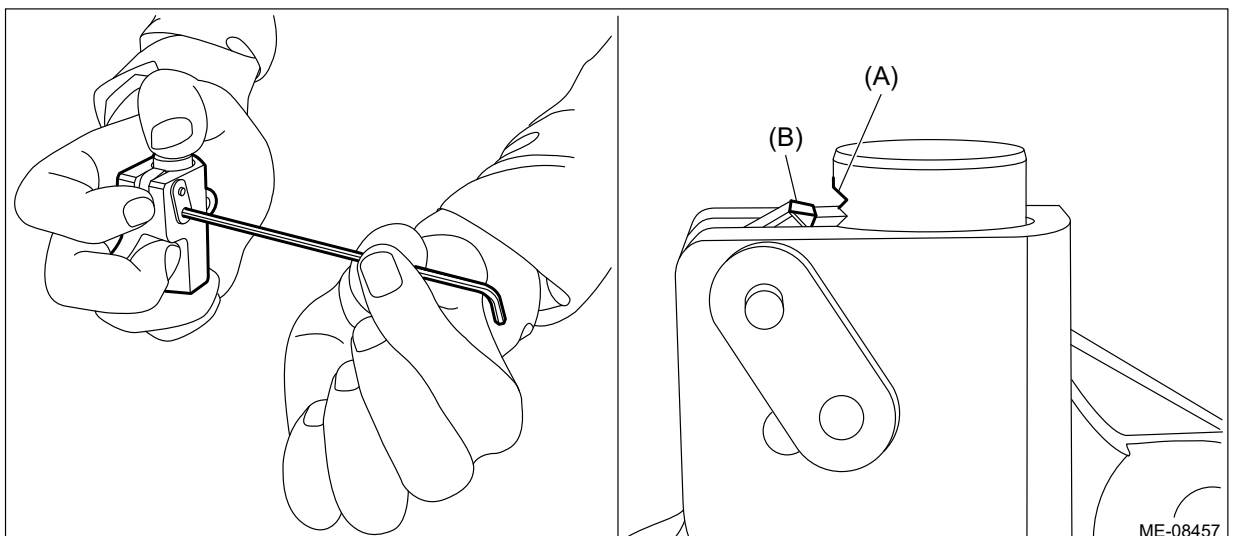
(1) Move the link plate (A) in the direction of arrow to press in the plunger (B).



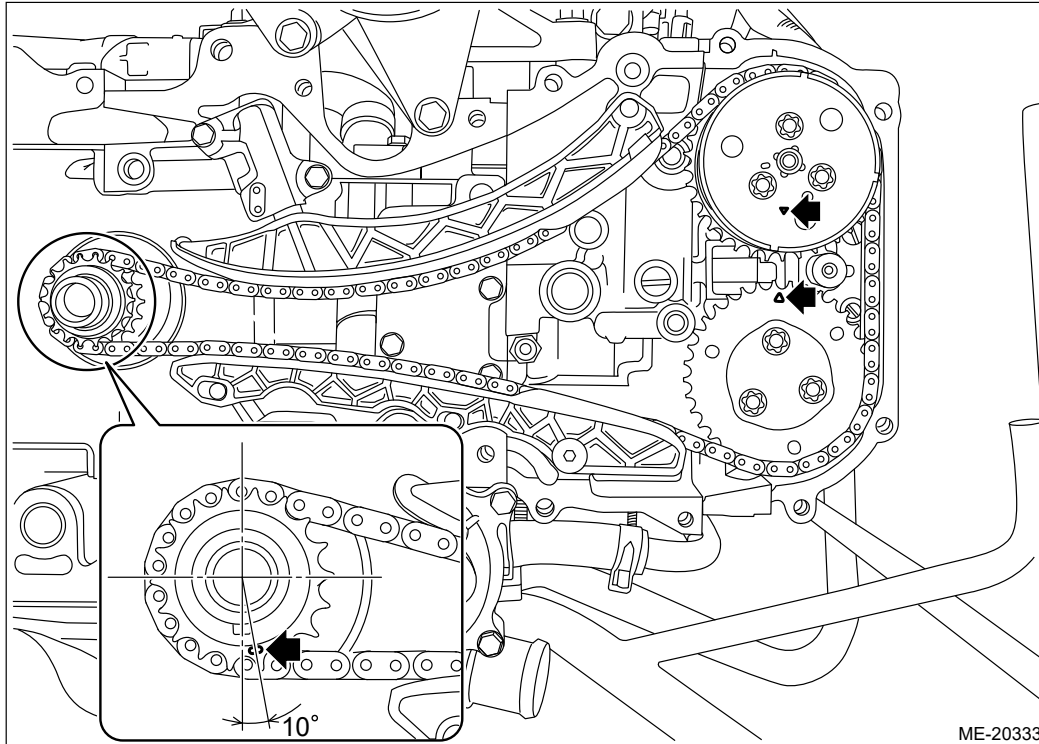
(2) In order to secure the plunger, insert a stopper pin with a diameter of 2.5 mm (0.098 in) or a hex wrench with a diameter of 2.5 mm into the stopper pin hole.

Note:

If the stopper pin hole on the link plate and the stopper pin hole on the chain tensioner are not aligned, check that the first notch of plunger rack (A) is engaged with the stopper tooth (B). If not engaged, retract the plunger a little so that the first notch of plunger rack (A) is engaged with the stopper tooth (B).



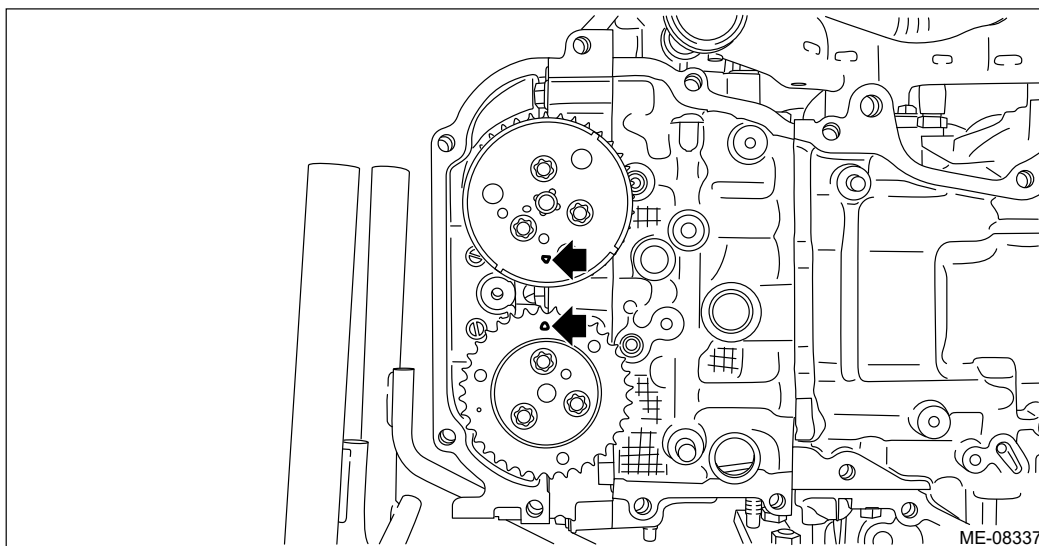
3. Make sure that the alignment marks of the crank sprocket, intake cam sprocket LH and exhaust cam sprocket LH are aligned to the positions as shown in the figure.



4. Align the alignment marks of intake cam sprocket RH and exhaust cam sprocket RH to the positions as shown in the figure.

Caution:

To prevent valve damage, turn the intake cam sprocket RH and exhaust cam sprocket RH only within the range of zero-lift (in range where it can be turned lightly by hand).

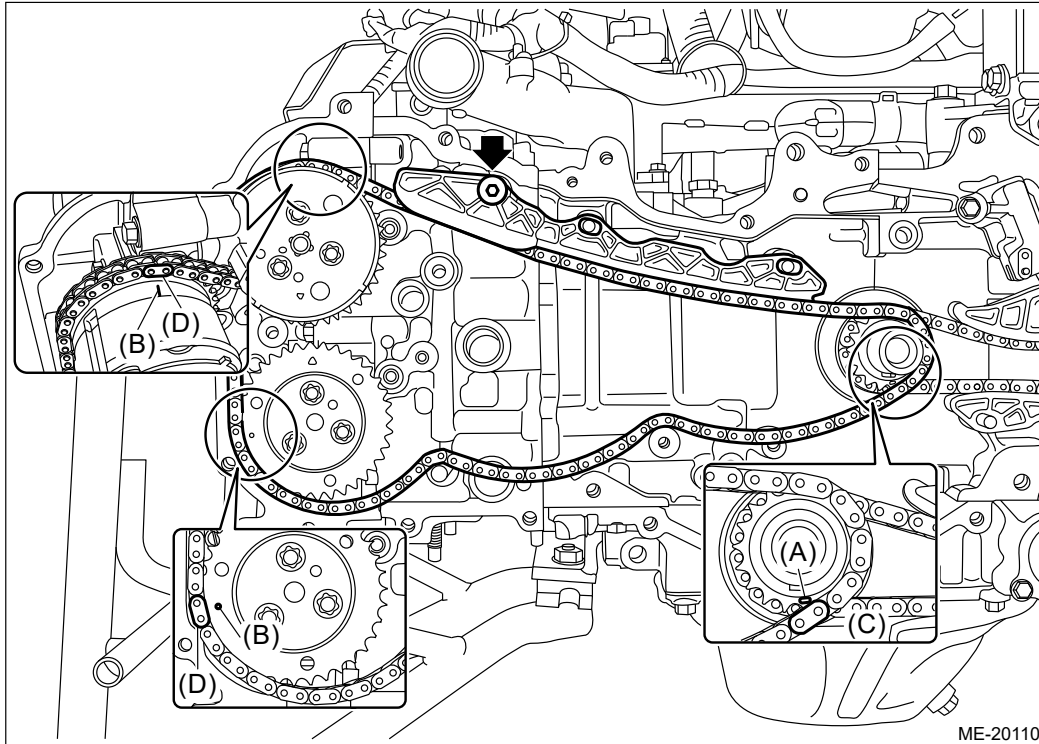


5. Install the timing chain RH and the timing chain guide RH.

- (1) Match the timing chain mark (blue) to the alignment mark of the crank sprocket.
- (2) Match the timing chain mark (pink) to the timing mark position of the intake cam sprocket RH.
- (3) Match the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket RH.
- (4) Install the timing chain guide RH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



ME-20110

(A) Alignment mark

(C) Blue

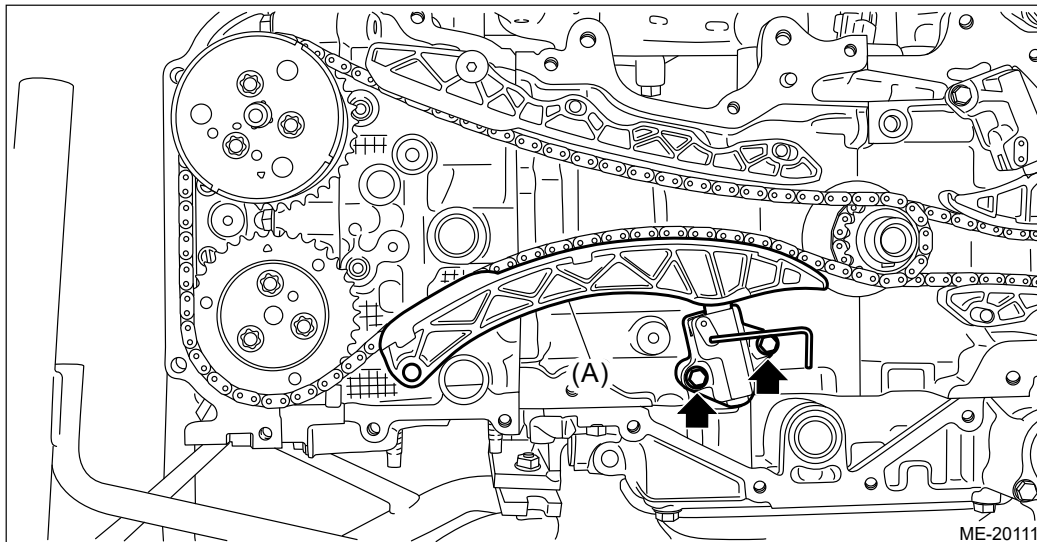
(D) Pink

(B) Timing mark

6. Install the chain tensioner lever RH (A) and chain tensioner RH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



ME-20111

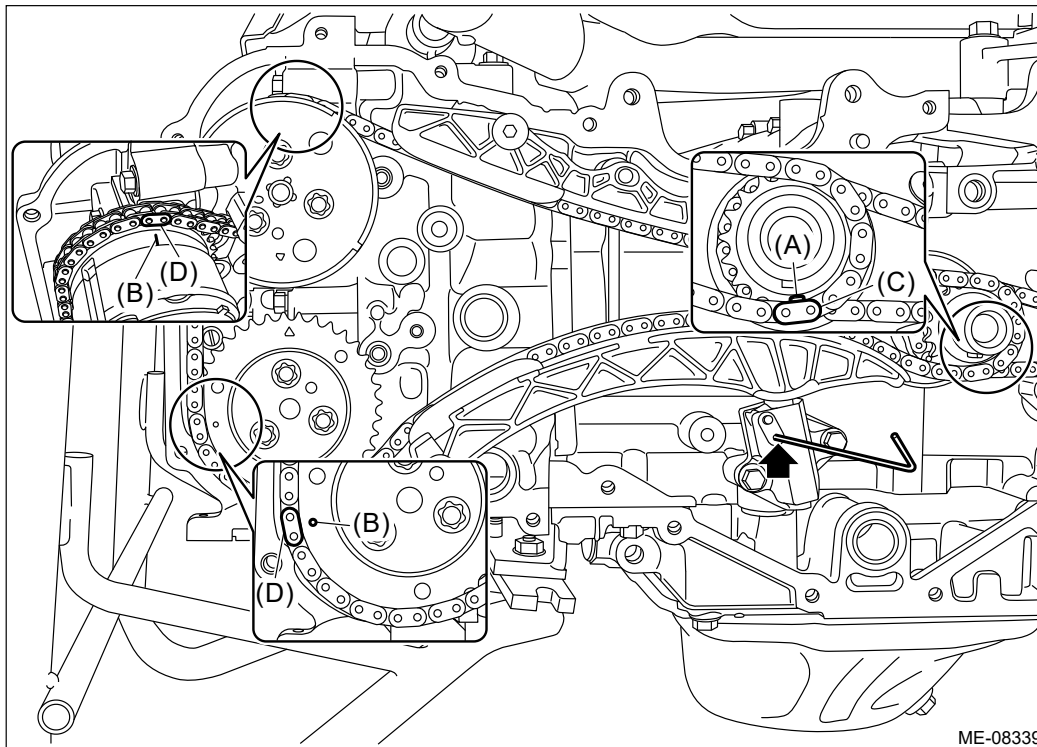
7. Pull out the stopper pin from the chain tensioner RH.

Caution:

Confirm the following before pulling out the stopper pin.

- **Matching of the timing chain mark (blue) to the alignment mark of the crank sprocket.**
- **Matching of the timing chain mark (pink) to the timing mark position of the intake cam sprocket RH.**

- **Matching of the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket RH.**



ME-08339

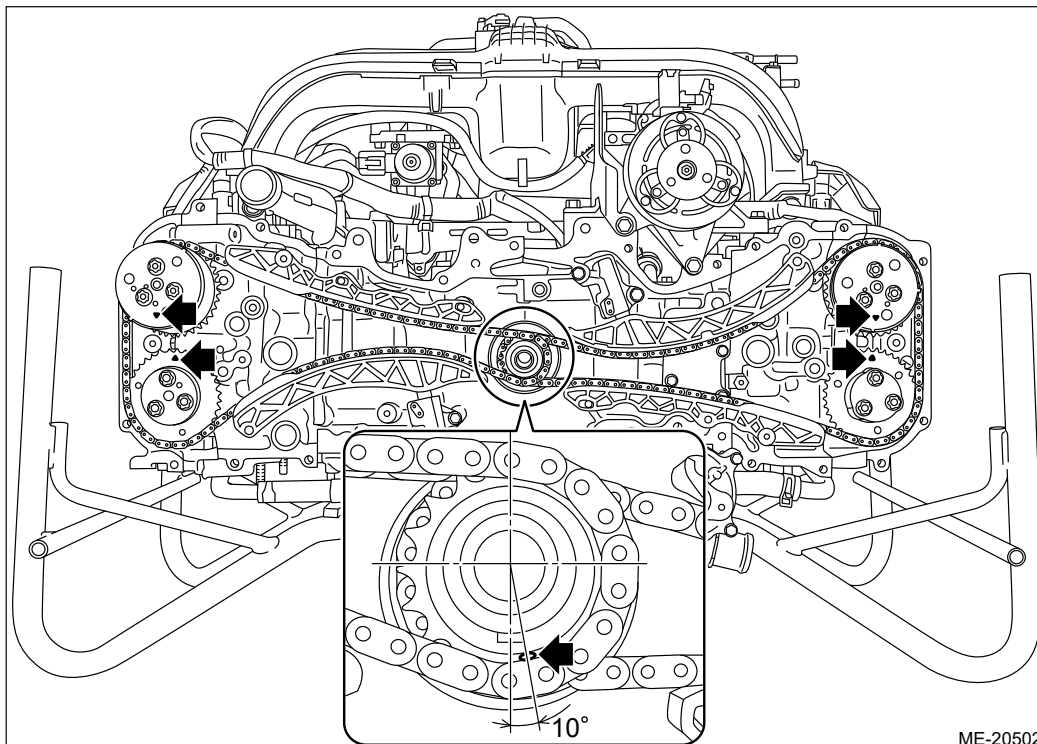
(A) Alignment mark

(C) Blue

(D) Pink

(B) Timing mark

8. Make sure that the alignment marks of the cam sprocket and crank sprocket are aligned to the positions as shown in the figure.



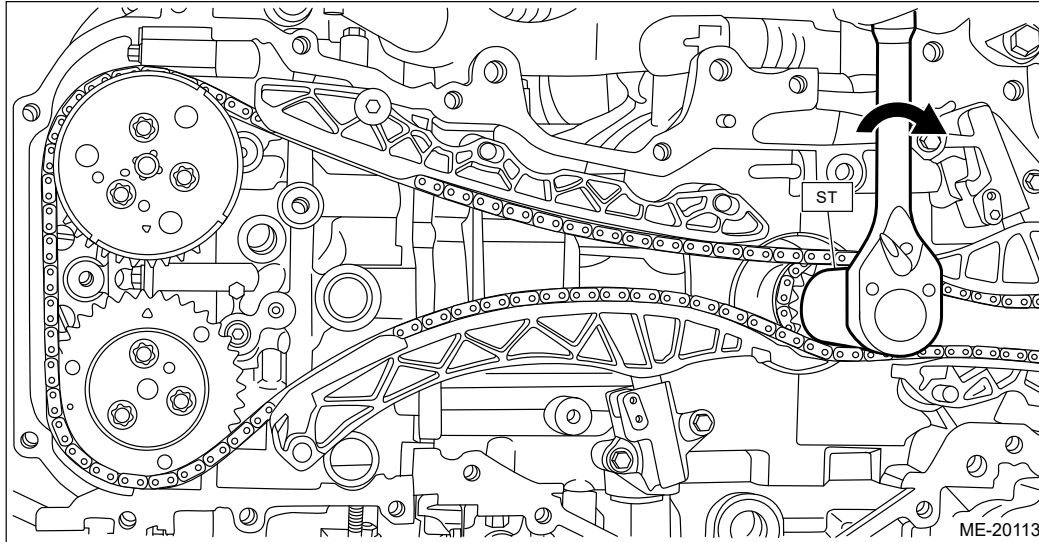
ME-20502

9. Using the ST, turn the crankshaft clockwise, and make sure that there are no abnormal conditions.

Caution:

Always make sure to perform this confirmation.

ST 18252AA000 CRANKSHAFT SOCKET




10. Install the chain cover.  [Ref. to MECHANICAL\(H4DO\)>Chain Cover>INSTALLATION.](#)

REMOVAL

1. TIMING CHAIN RH

Note:

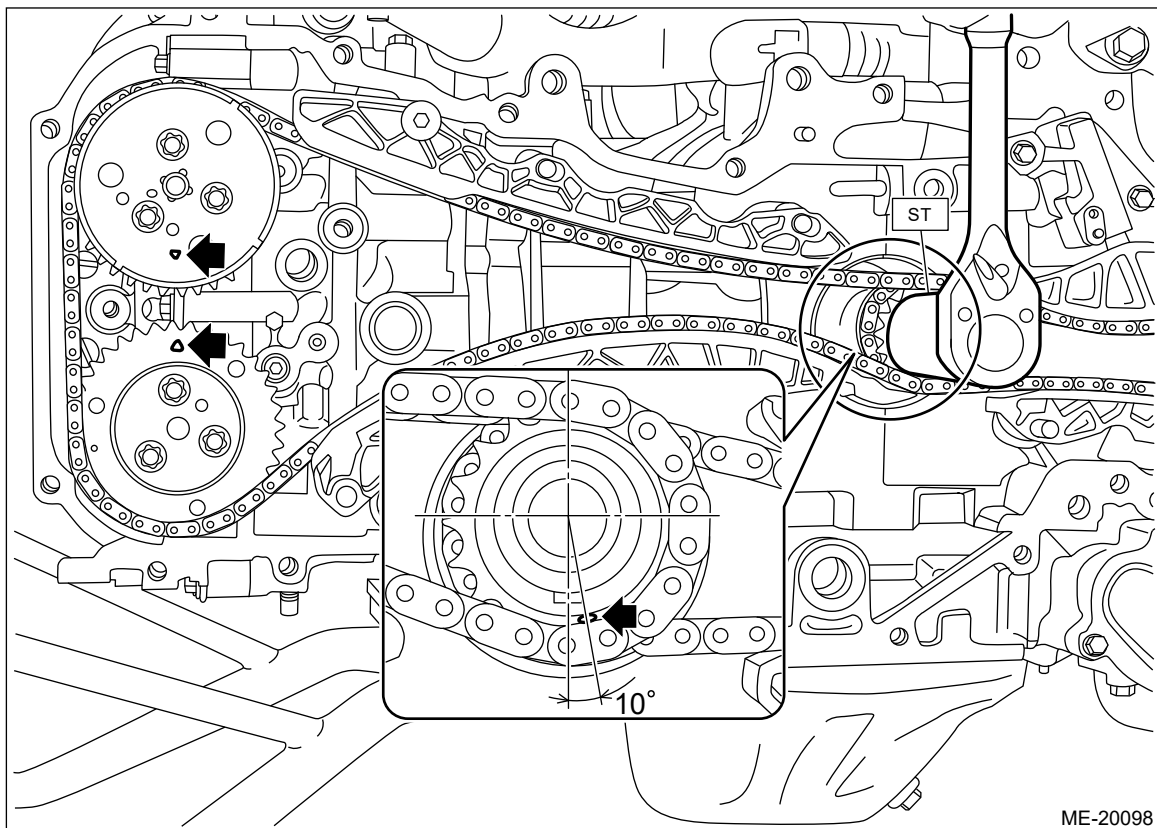
When replacing a single part, perform the work with the engine assembly installed to body.

- 1. Remove the chain cover.  Ref. to [MECHANICAL\(H4DO\)>Chain Cover>REMOVAL](#).
- 2. Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket RH and exhaust cam sprocket RH to the positions as shown in the figure.

Note:

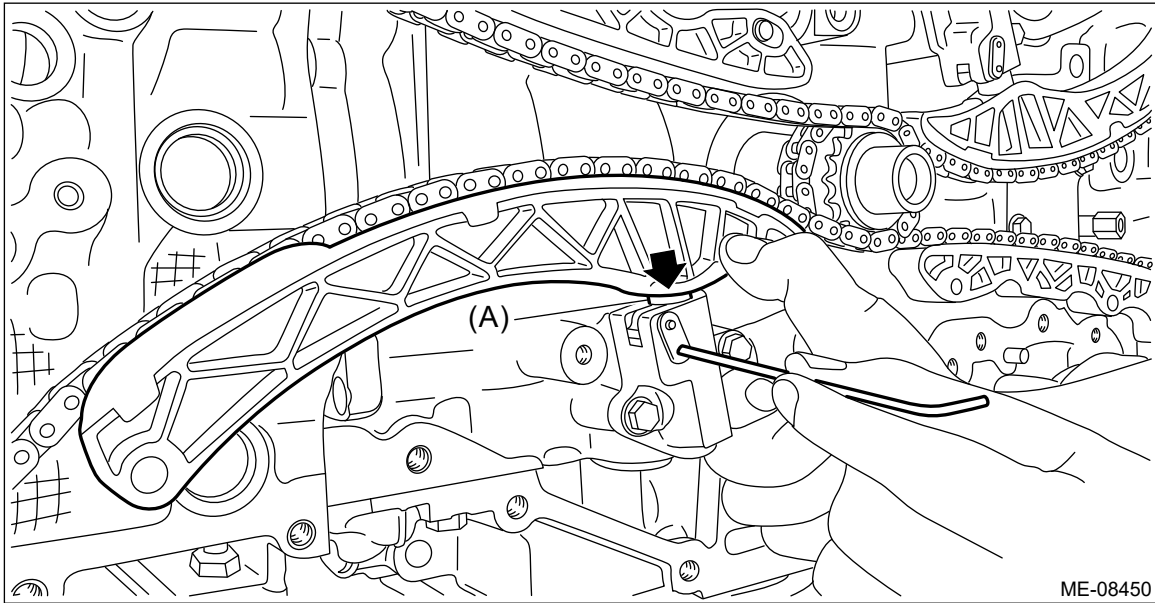
If the alignment marks are aligned to the positions as shown in the figure, the crankshaft key is located at six o'clock position.

ST 18252AA000 CRANKSHAFT SOCKET

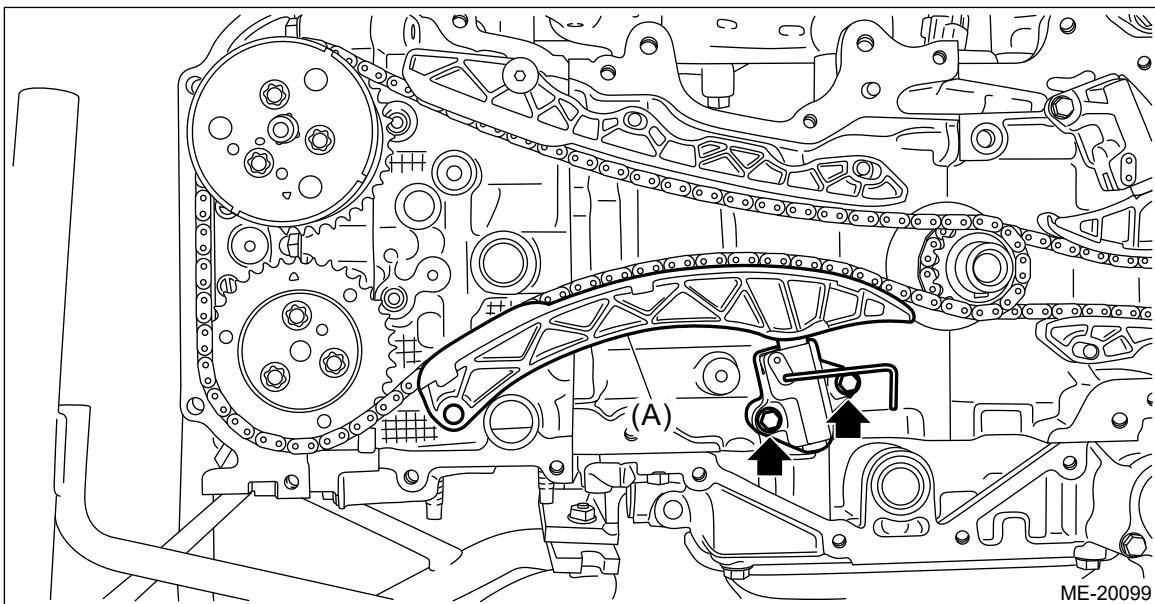


ME-20098

- 3. Push down the chain tensioner lever RH as shown in the figure, and insert a 2.5 mm (0.098 in) dia. stopper pin or a 2.5 mm dia. hex wrench into the stopper pin hole in the chain tensioner RH to secure the plunger (A).



4. Remove the chain tensioner RH, and remove the chain tensioner lever RH (A).



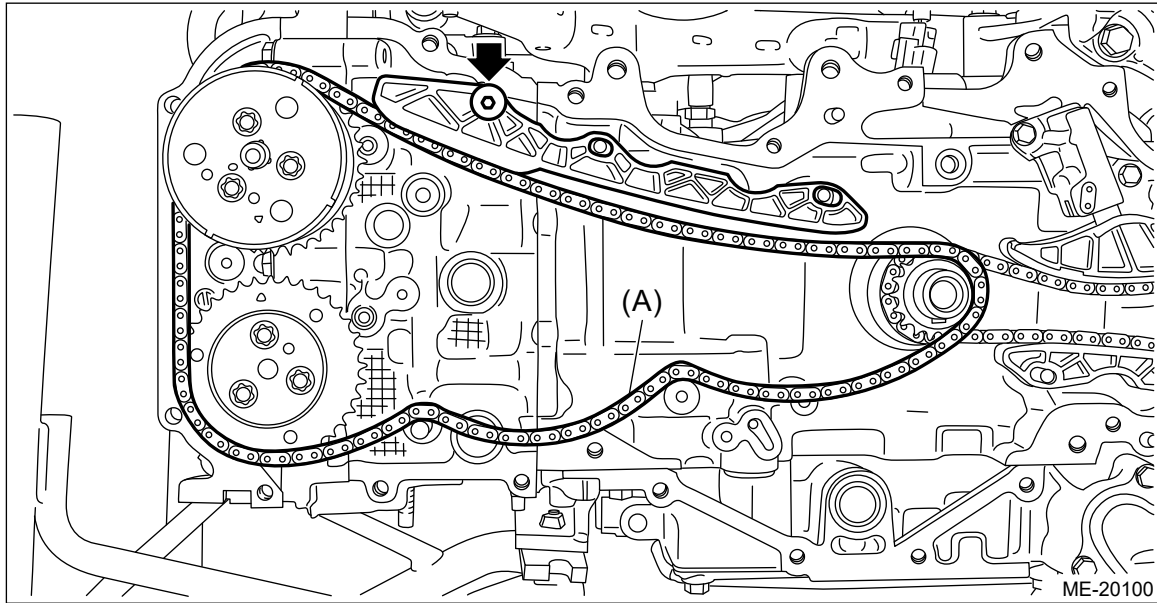
5. Remove the chain guide RH, and remove the timing chain RH (A).

Caution:


- If the timing chain RH is not installed, the intake camshaft RH and exhaust camshaft RH are kept at zero-lift position. All cams on the camshaft are not pressing down the roller rocker arm (intake valve and exhaust valve). (Under this condition, all valves remain unlifted.)
- Intake camshaft RH and exhaust camshaft RH can be independently rotated with the timing chain RH removed. When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn it to the outside of range of zero-lift (in range where it can be turned lightly by hand).

Note:

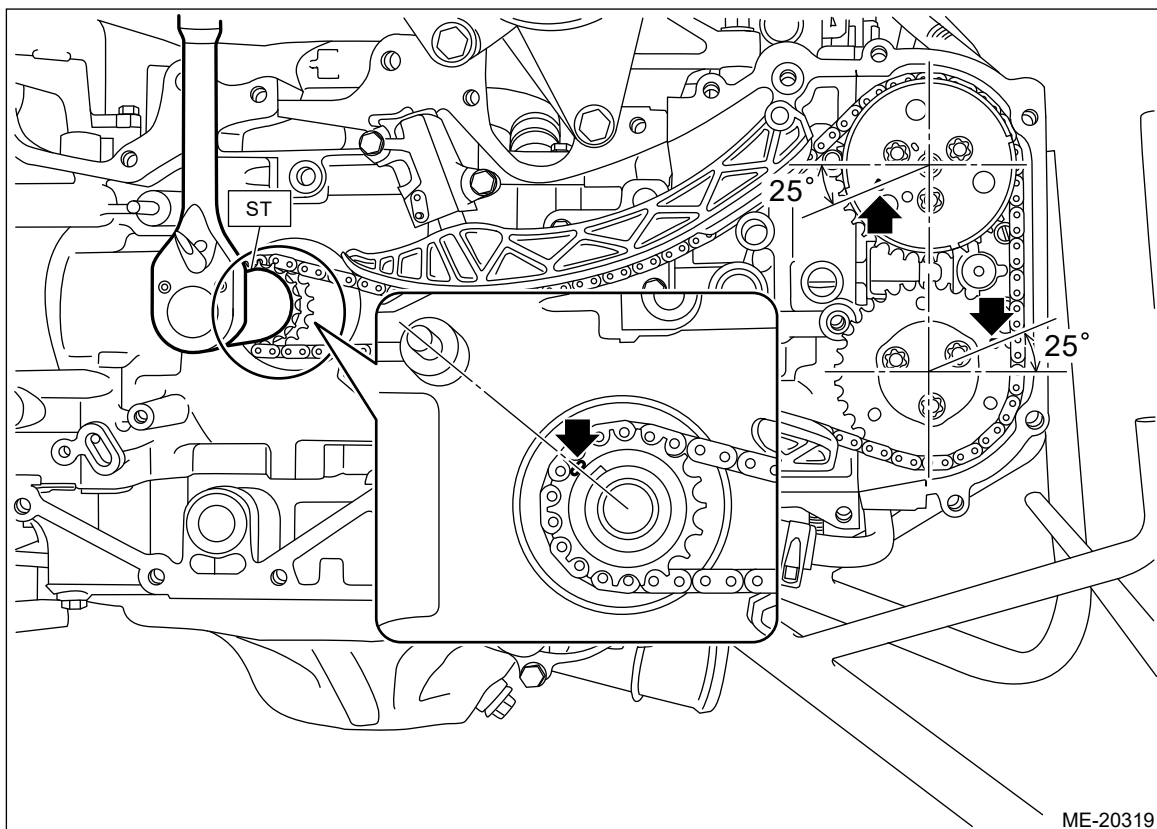
To avoid mixing with LH side, keep the removed part in order.



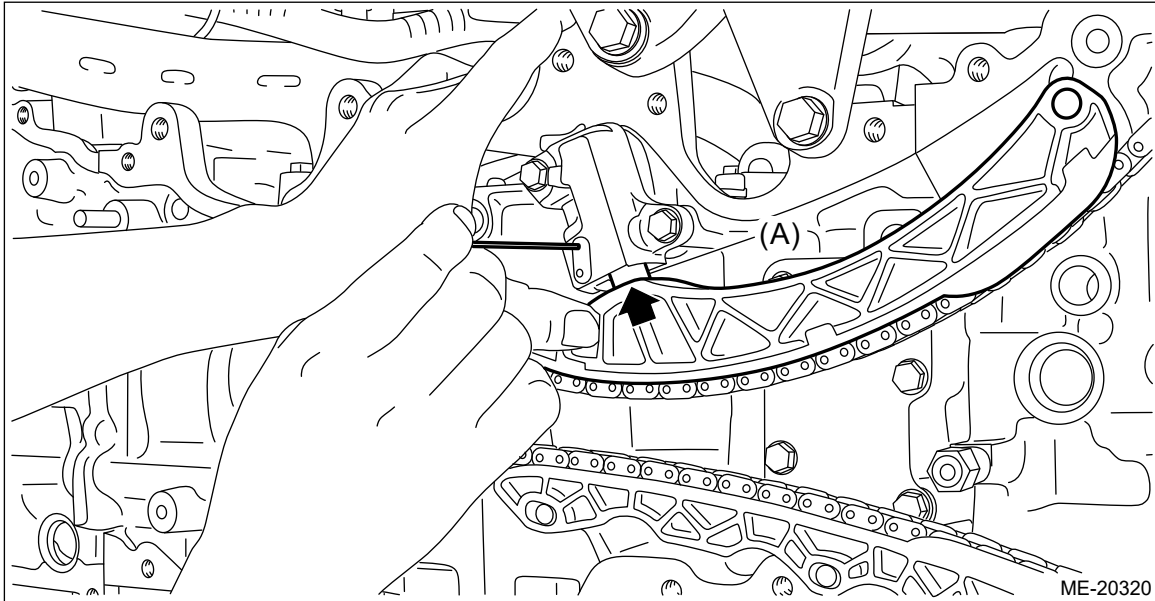
2. TIMING CHAIN LH

1. Remove the timing chain RH.  [Ref. to MECHANICAL\(H4DO\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
2. Using ST and by turning the crankshaft, align the alignment marks of crankshaft key, intake cam sprocket LH and exhaust cam sprocket LH to the positions as shown in the figure.

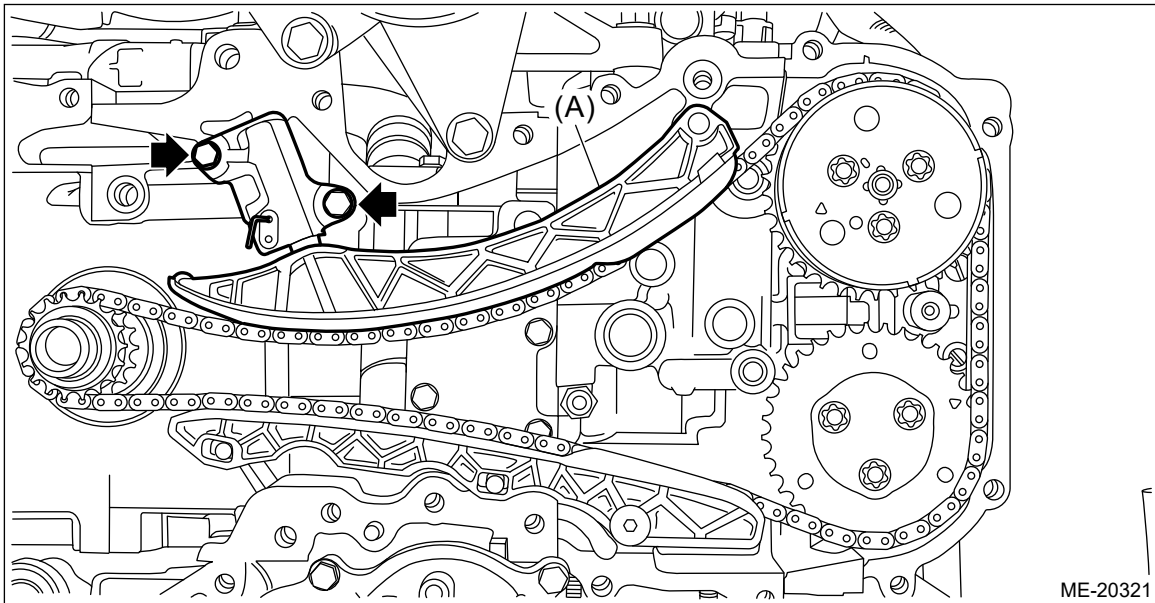
ST 18252AA000 CRANKSHAFT SOCKET



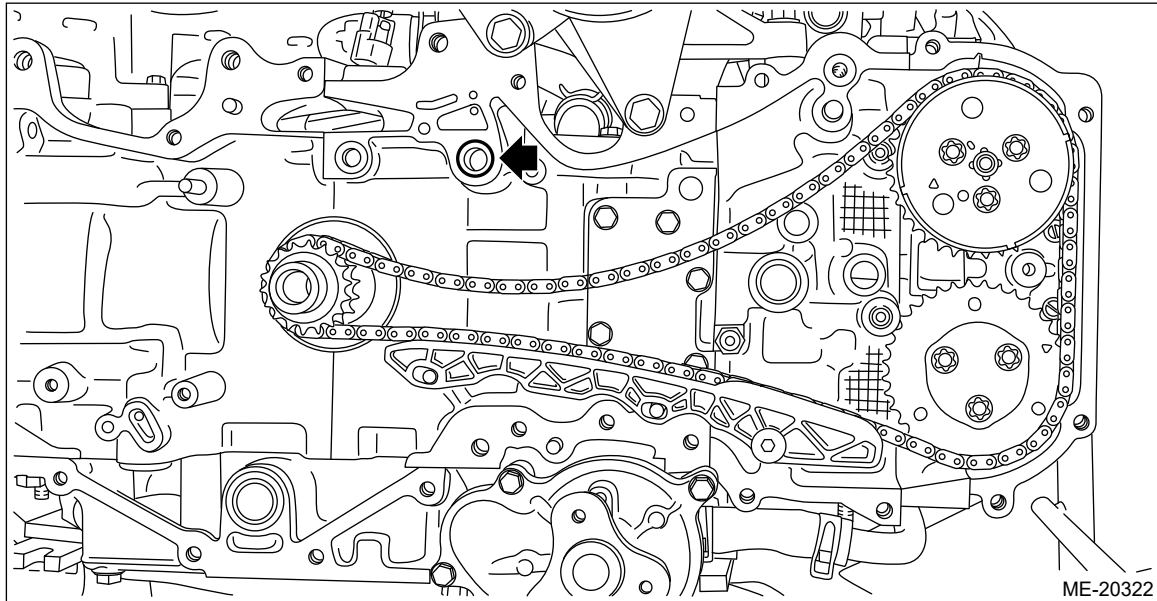
- 3.** Push up the chain tensioner lever LH as shown in the figure, and secure the plunger (A) by inserting a 1.3 mm (0.05 in) dia. stopper pin or a 1.3 mm dia. hex wrench into the stopper pin hole in the chain tensioner LH.



- 4.** Remove the chain tensioner LH, and remove the chain tensioner lever LH (A).



- 5.** Remove the O-ring from the cylinder block LH.



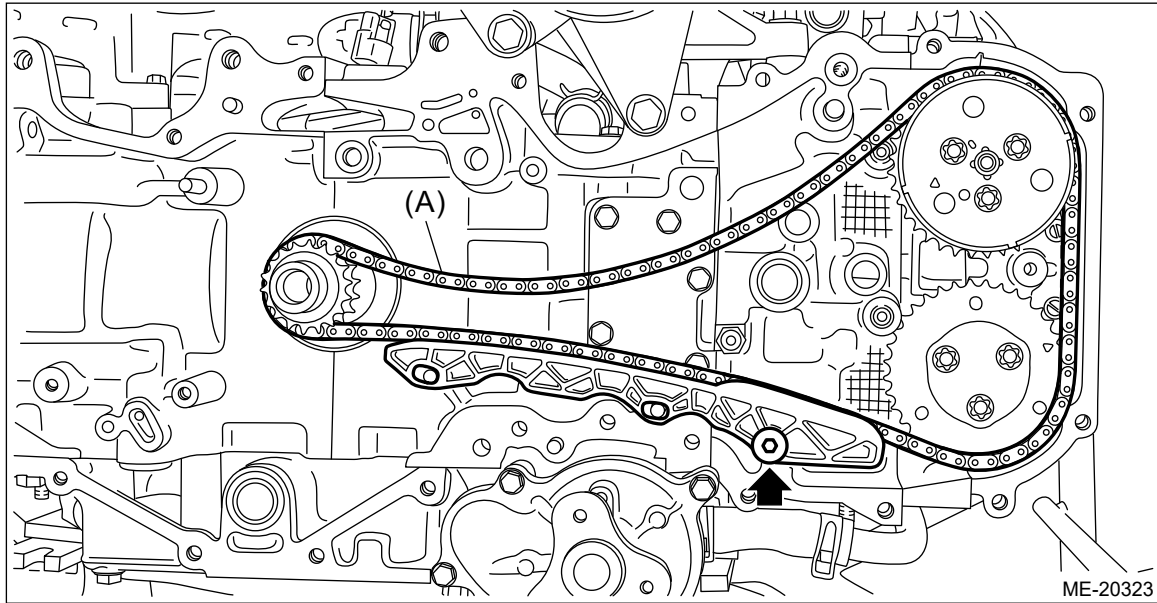
6. Remove the chain guide LH, and remove the timing chain LH (A).

Caution:

- If the timing chain LH is not installed, the exhaust camshaft LH is kept at zero-lift position. All cams on the exhaust camshaft LH are not pressing down the roller rocker arm (exhaust valve). (Under this condition, exhaust valves remain unlifted.)
- Intake camshaft LH is kept at lift position. All cams on the intake camshaft LH are pressing down the roller rocker arm (intake valve). (Under this condition, intake valves remain lifted.)
- Intake camshaft LH and exhaust camshaft RH can be independently rotated with the timing chain LH removed. When the exhaust camshaft LH is turned, the valve heads contact each other and valve stem may bend as described in above. Do not turn the exhaust camshaft LH to the outside of range of zero-lift (in range where it can be turned lightly by hand).
- #1 piston and #4 piston are located near TDC. If the intake camshaft LH is turned, the valve and the piston may contact and valve stem may bend. Do not turn the intake camshaft LH at this time.

Note:

To avoid mixing with RH side, keep the removed part in order.

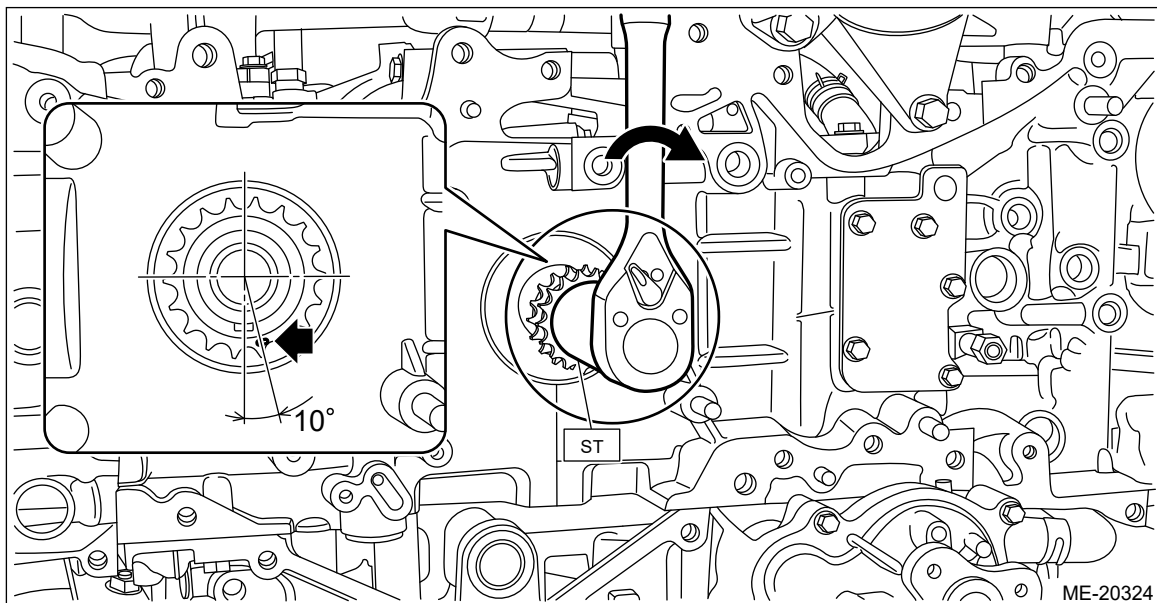


7. Using ST and by turning the crankshaft approximately 200° clockwise, align the alignment marks of crank sprocket to the positions as shown in the figure.

Caution:

- This procedure is required to prevent the valve and piston contacting with each other, by moving the all pistons to the middle of the cylinders.
- Never turn counterclockwise because the valve and piston may contact. Counterclockwise turn is allowed only when adjusting precisely the alignment marks, after turning the crank sprocket alignment mark clockwise near the position as shown in the figure.

ST 18252AA000 CRANKSHAFT SOCKET



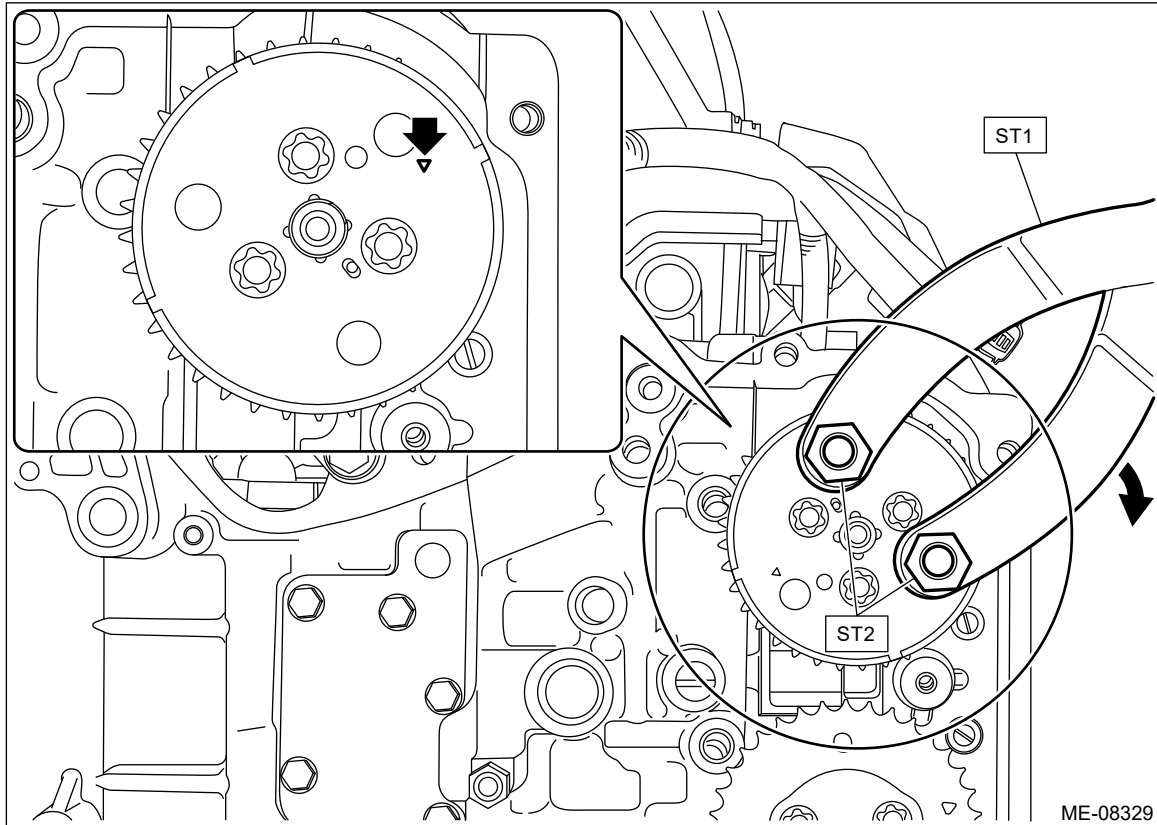
8. Using ST and by turning the intake cam sprocket LH approximately 180° clockwise, align the alignment marks of intake cam sprocket LH to the positions (zero-lift position) as shown in the figure.

Caution:

- After this work, when the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn the intake camshaft LH and exhaust camshaft LH to the outside of range of zero-lift (in range where it can be turned lightly by hand).
- Perform the operation carefully since the ST comes off easily.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA020 PULLEY WRENCH PIN SET

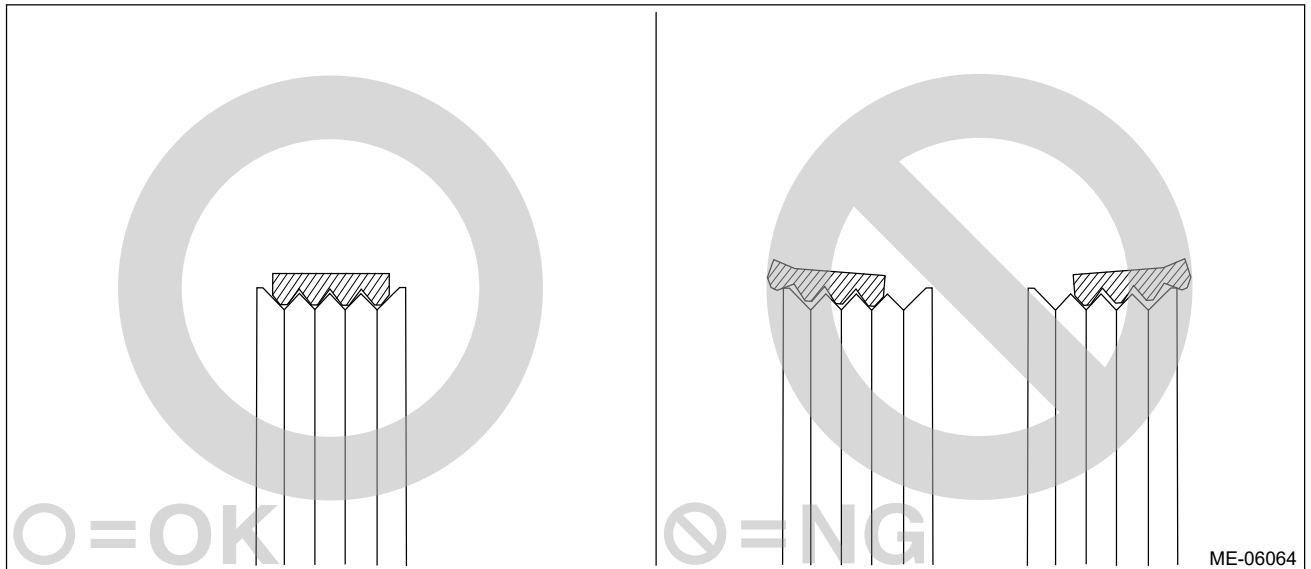


ME-08329

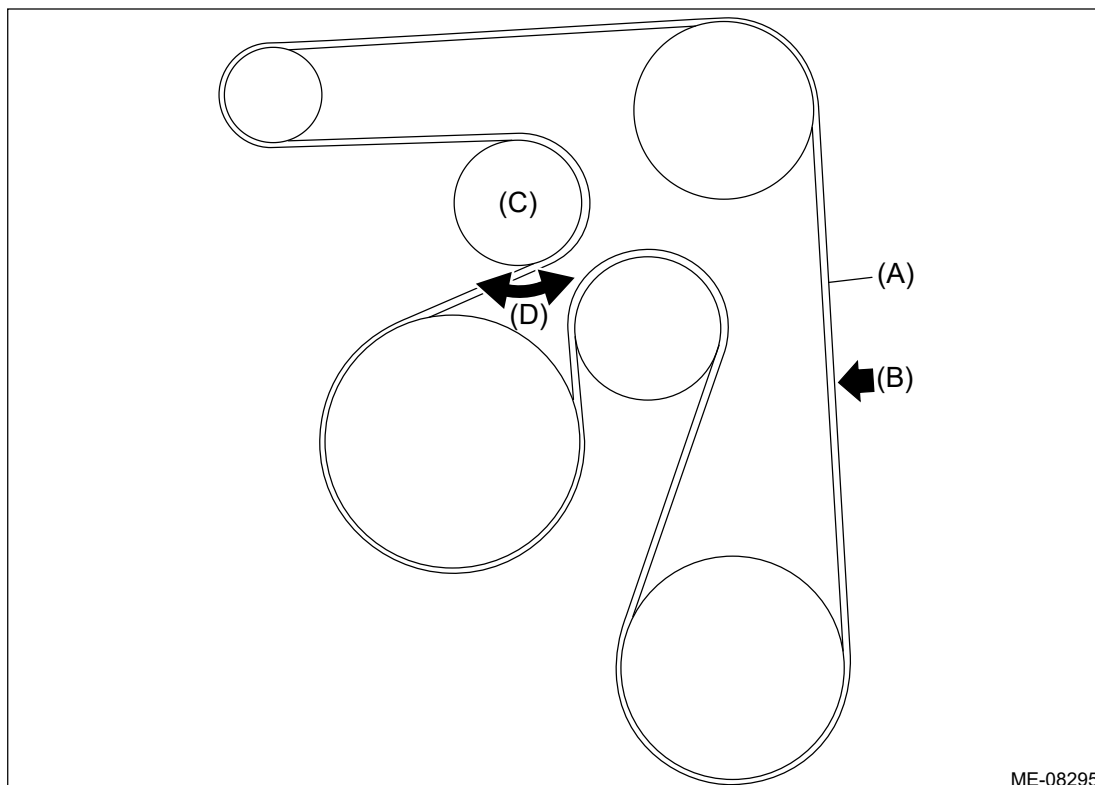
MECHANICAL(H4DO) > V-belt

INSPECTION

1. Check the V-belt for cracks, tear or wear.
2. Check the V-belt tensioner assembly and idler pulley for deformation, cracks or other damages.
3. Check that the V-belt ribs are securely placed on the rib grooves for each pulley.



4. Check that the V-belt tensioner assembly (C) moves in the direction of arrow (D), when the V-belt (A) is pushed and released by the area indicated by the arrow (B).



5. Start the engine and confirm that the V-belt rotates smoothly and no abnormal noise is emitted.

MECHANICAL(H4DO) > V-belt

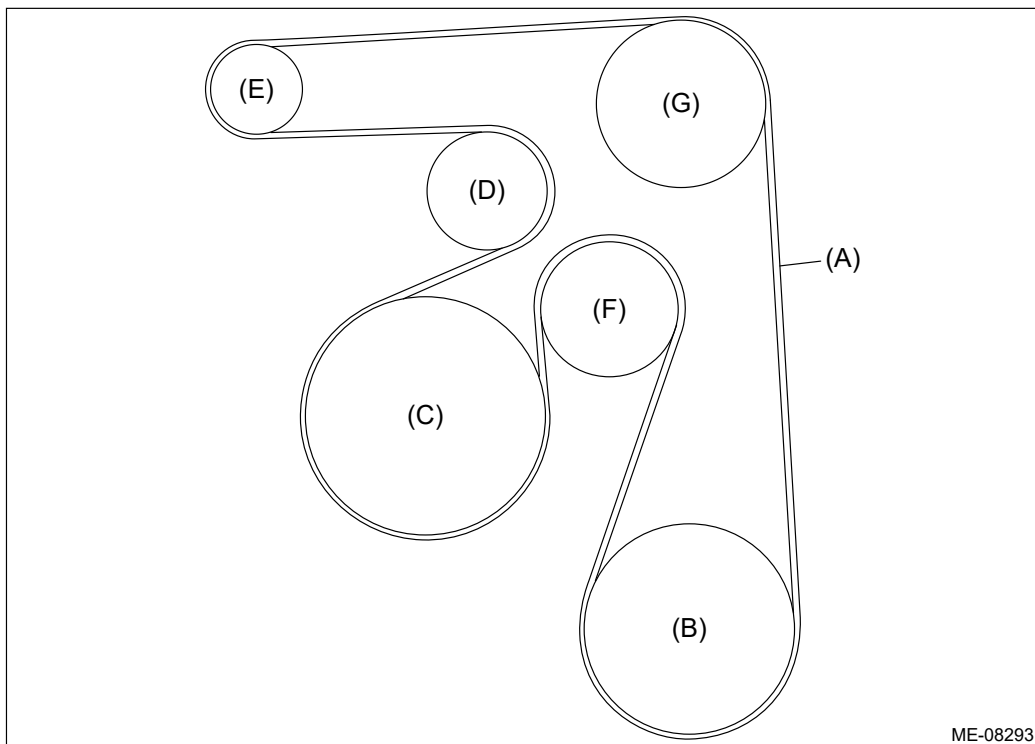
INSTALLATION

1. V-BELT

1. Attach the tool to the V-belt tensioner assembly, and rotate the tool clockwise to remove the V-belt as shown in the figure.

Caution:

- When reusing the V-belt, wipe off dust and water with cloth.
- Do not use the V-belt if there is any oil, grease or coolant on the belt.
- Be careful not to rub the V-belt end surface with bare hands; exposed core may cause injury.
- Wipe off any dust, oil and water on the groove of each pulley with cloth.



- | | | |
|-----------------------|---------------------------|---------------------------|
| (A) V-belt | (D) V-belt tensioner ASSY | (G) A/C compressor pulley |
| (B) Water pump pulley | (E) Generator pulley | |
| (C) Crank pulley | (F) Idler pulley | |

2. When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

- (1) Install the V-belt cover.

Tightening torque:

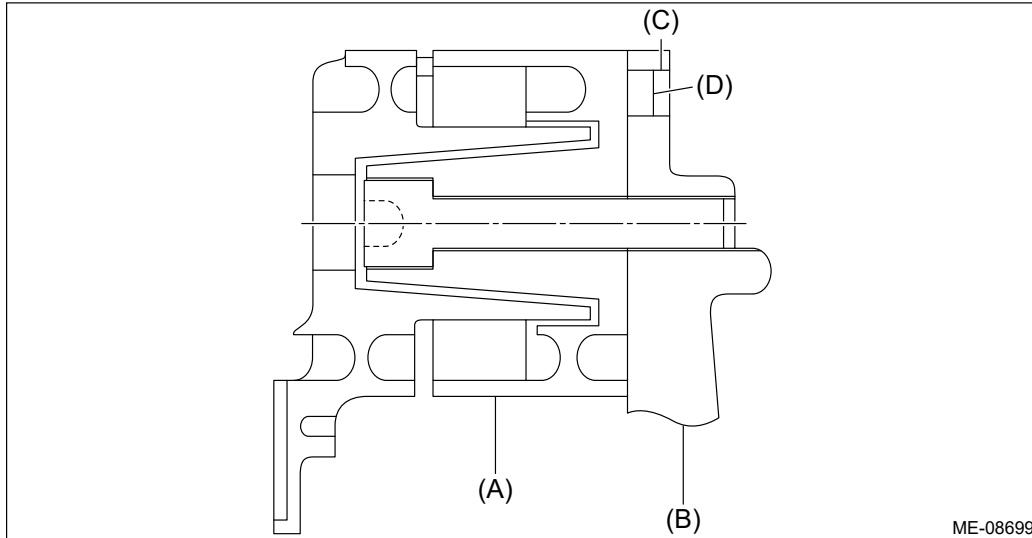
7 N·m (0.7 kgf-m, 5.2 ft-lb)

2. V-BELT TENSIONER ASSEMBLY

1. Install the V-belt tensioner assembly.

Note:


When installing the V-belt tensioner assembly, insert the protrusion of V-belt tensioner assembly into the hole for preventing rotation at the generator bracket.



- (A) V-belt tensioner ASSY (C) Hole to prevent rotation (D) Protrusion portion
 (B) Generator bracket

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)

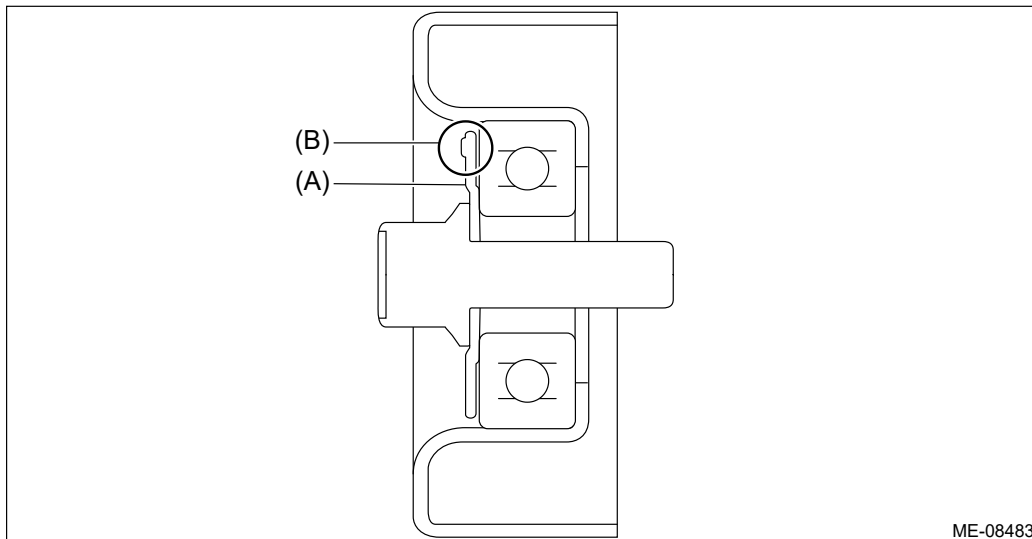
2. Install the cap to the V-belt tensioner assembly.
3. Install the V-belts.  [Ref. to MECHANICAL\(H4DO\)>V-belt>INSTALLATION > V-BELT.](#)

3. IDLER PULLEY

1. Install the idler pulley.

Note:

When installing the idler pulley, be careful of the idler pulley cover direction.



- (A) Idler pulley cover (B) Protrusion (3 places)

Tightening torque:

36 N·m (3.7 kgf-m, 26.6 ft-lb)

2. Install the V-belts.  [Ref. to MECHANICAL\(H4DO\)>V-belt>INSTALLATION > V-BELT.](#)

MECHANICAL(H4DO) > V-belt

REMOVAL

Note:

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

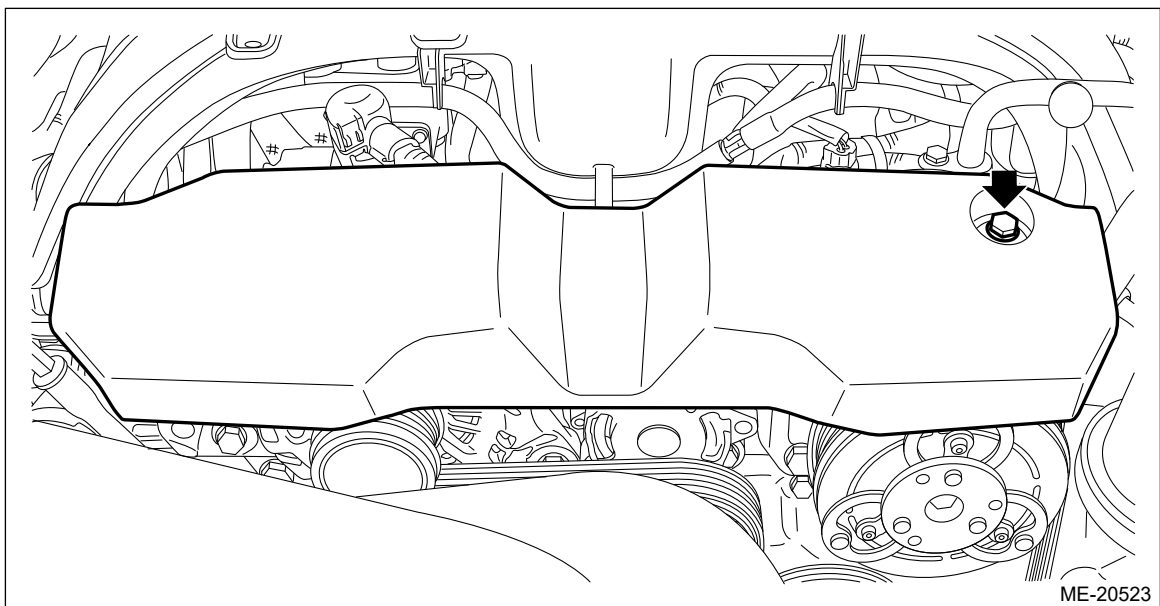
1. V-BELT

1. When working on the vehicle

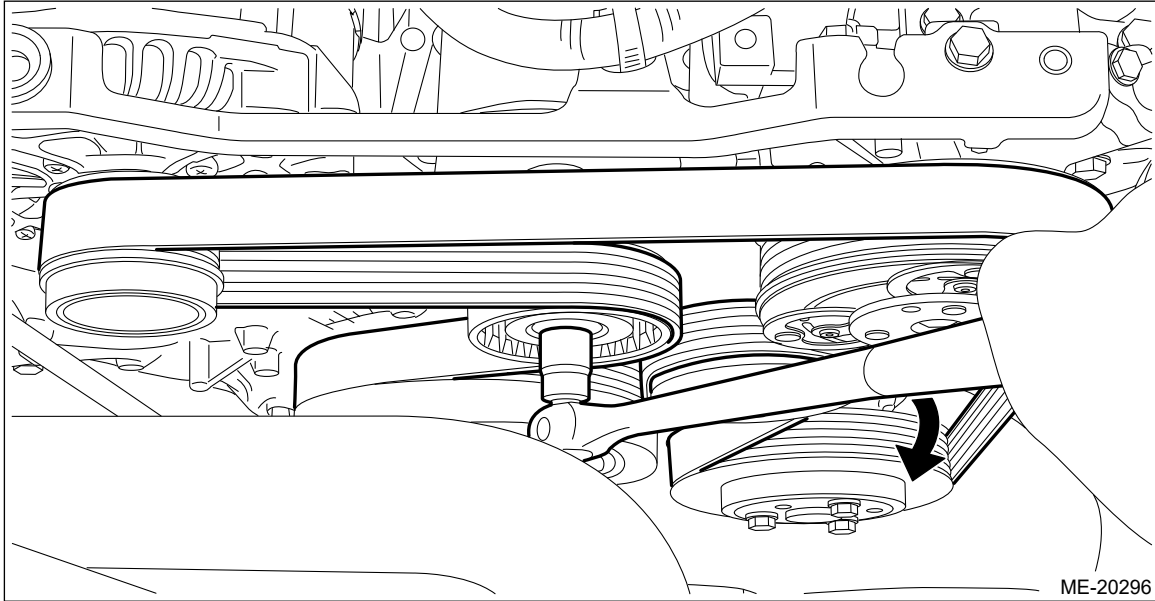
Note:

When working on the vehicle, perform the following steps also.


- (1) Remove the V-belt covers.

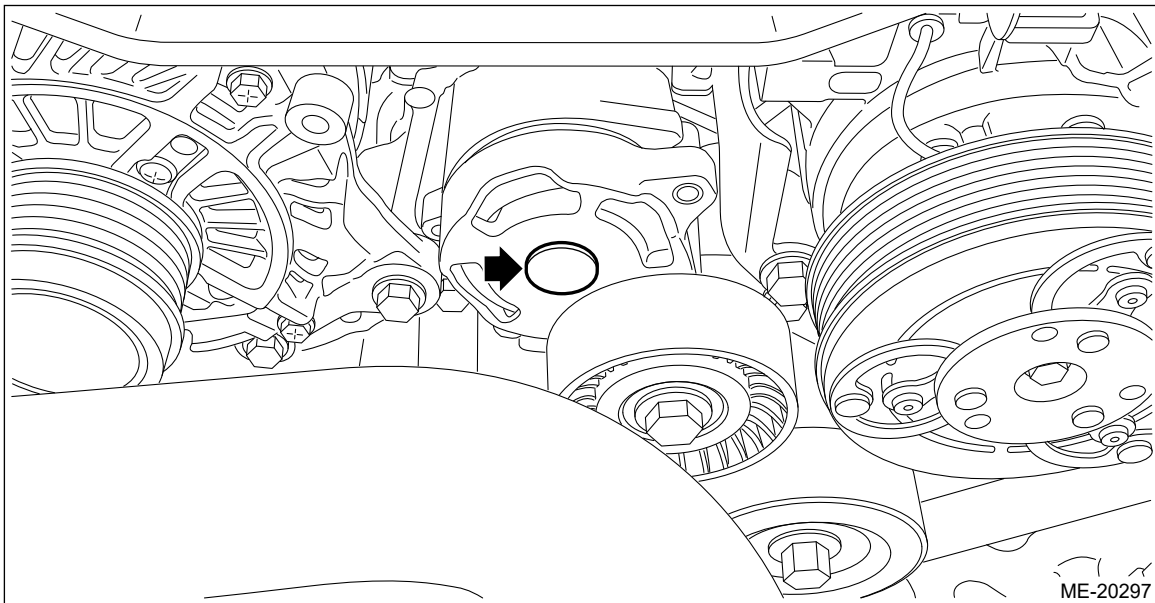


2. Attach the tool to the V-belt tensioner assembly, and rotate the tool clockwise to loosen and remove the V-belt.

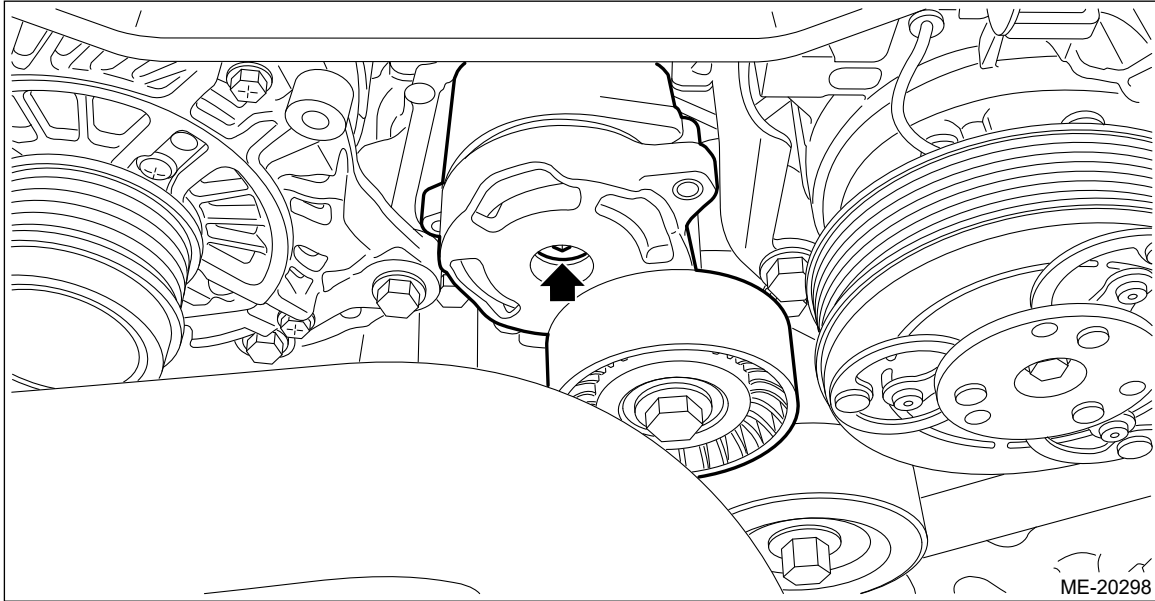


2. V-BELT TENSIONER ASSEMBLY

1. Remove the V-belts.  [Ref. to MECHANICAL\(H4DO\)>V-belt>REMOVAL > V-BELT.](#)
2. Remove the cap from V-belt tensioner assembly.

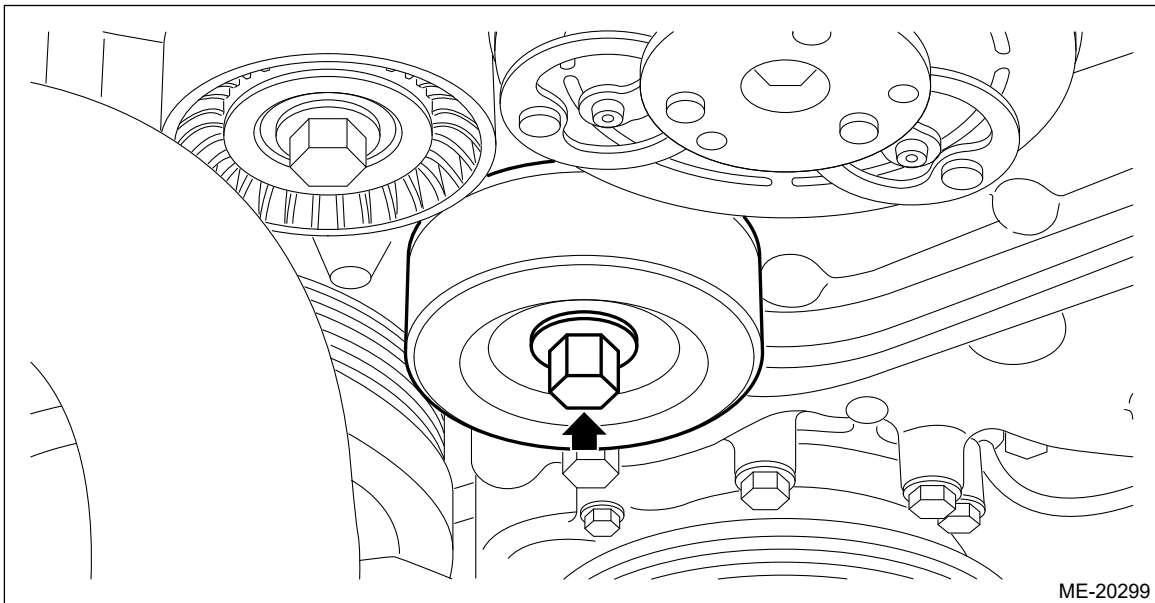


3. Remove the V-belt tensioner assembly.



3. IDLER PULLEY

1. Remove the V-belts.  [Ref. to MECHANICAL\(H4DO\)>V-belt>REMOVAL > V-BELT.](#)
2. Remove the idler pulley.



ASSEMBLY

1. CAM CARRIER RH

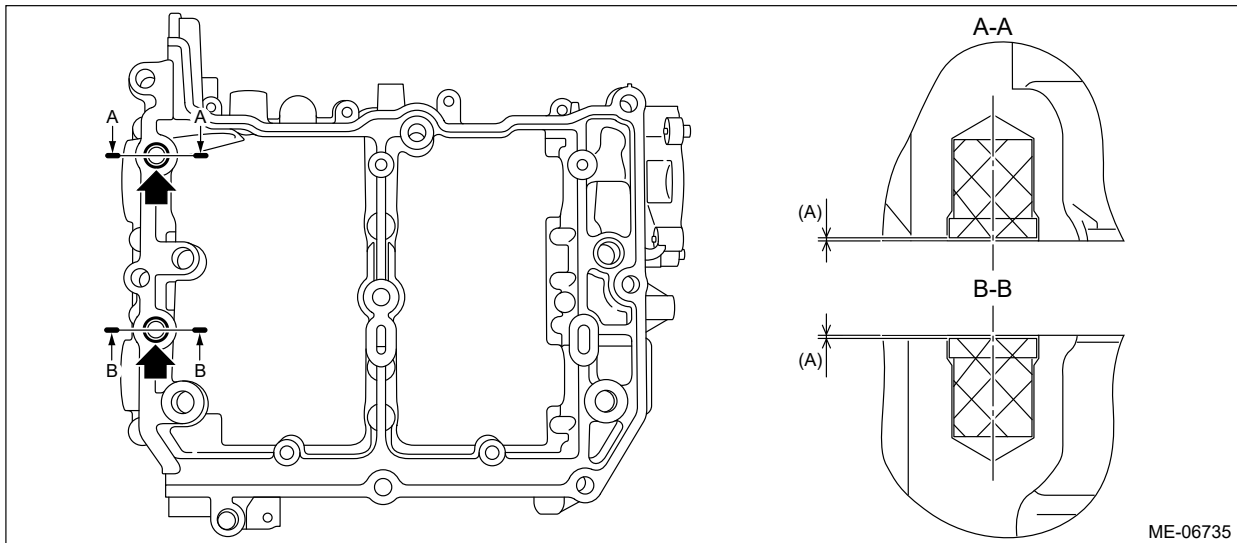
1. Install the filter to the cam carrier RH.

Note:

Use a new filter.

Filter insert position:

$0^{+0}_{-0.5}$ mm ($+0_{-0.0197}$ in) position from cam carrier RH end face



(A) $0 - 0.5$ mm ($0 - 0.0197$ in)

2. Set the intake camshaft RH and the exhaust camshaft RH to the cam carrier RH.

Note:

Apply engine oil to the journals of cam carrier RH before setting the intake camshaft RH and exhaust camshaft RH.

3. Install the front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH and exhaust rear camshaft cap RH.

- (1) Apply liquid gasket to the mating surface of front camshaft cap RH, intake rear camshaft cap RH and exhaust rear camshaft cap RH as shown in the figure.

Caution:

- **Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to flow toward camshaft journal, resulting in engine seizure.**
- **Do not apply liquid gasket excessively to the intake center camshaft cap RH and exhaust center camshaft cap RH.**

Note:

- **Before applying liquid gasket, degrease the old liquid gasket seal surface of the front camshaft cap RH, intake rear camshaft cap RH, exhaust rear camshaft cap RH, and cam carrier RH.**
- **Install within 5 min. after applying liquid gasket.**

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

Mating surfaces other than ranges A and B

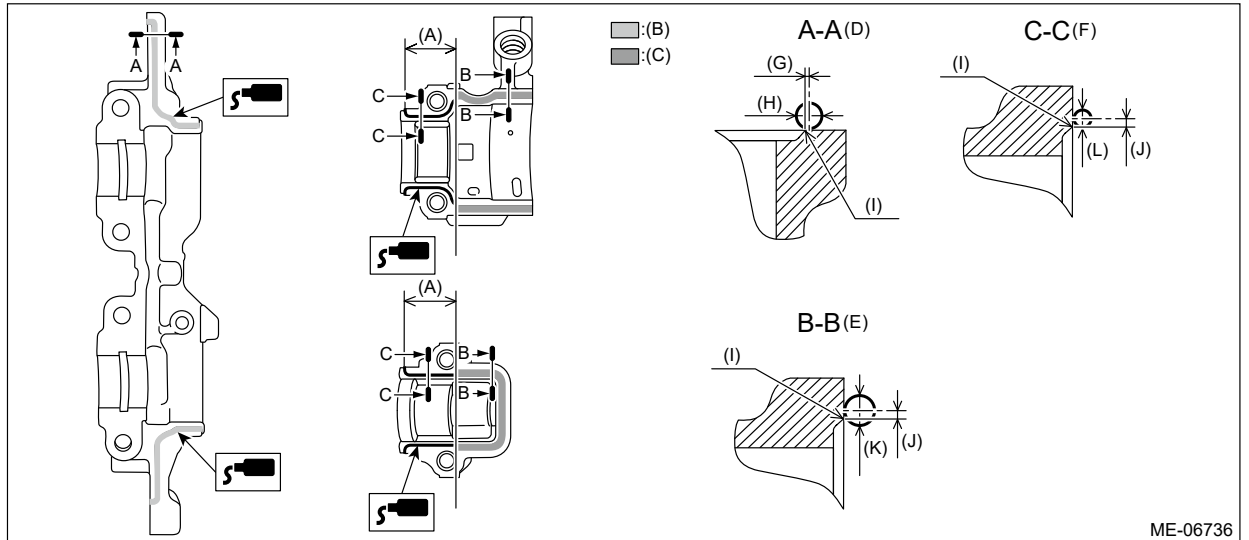
2±0.5 mm (0.0787±0.0197 in)

Mating surfaces of range A

3⁺¹_{-0.5} mm (0.1181^{+0.0394}_{-0.0197} in)

Mating surfaces of range B

3.5±0.5 mm (0.1378±0.0197 in)



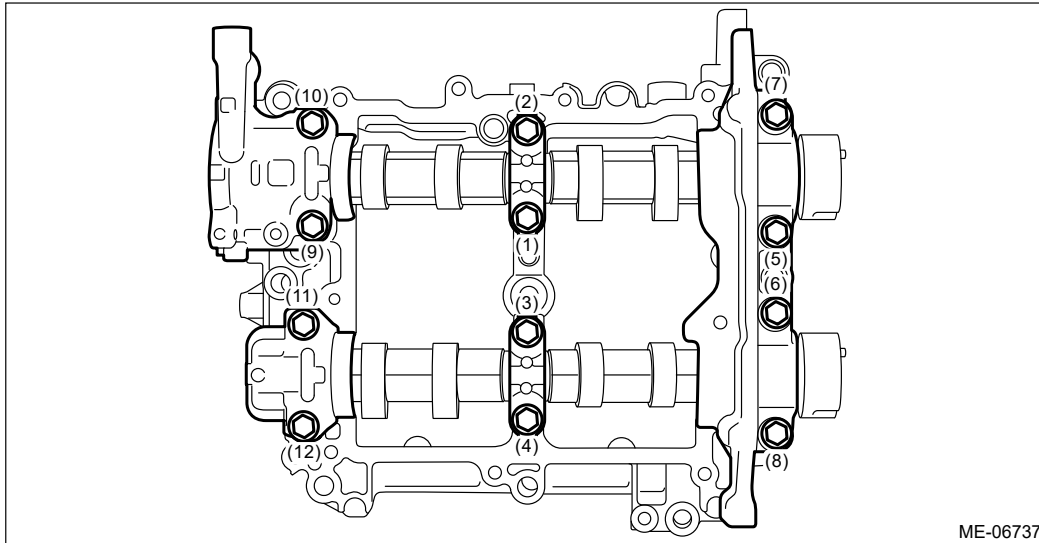
ME-06736

- | | | |
|---|---|---|
| (A) 28.5 mm (1.122 in) | (E) Liquid gasket applying position of mating surfaces of range B | (I) Chamfer edge |
| (B) Range A | (F) Liquid gasket applying position of mating surfaces other than range A and range B | (J) Within 1 mm (0.0394 in) |
| (C) Range B | (G) 0.5 mm (0.0197 in) | (K) $\varnothing 3.5 \pm 0.5$ mm (0.1378±0.0197 in) |
| (D) Liquid gasket applying position of mating surfaces of range A | (H) $\varnothing 3^{+1}_{-0.5}$ mm (0.1181 ^{+0.0394} _{-0.0197} in) | (L) $\varnothing 2 \pm 0.5$ mm (0.0787±0.0197 in) |

- (2) Apply engine oil to the journals of each camshaft cap before setting the camshaft cap.
- (3) Tighten the bolts which secure front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH and exhaust rear camshaft cap RH in numerical order as shown in the figure.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



(4) Remove the liquid gasket from the installation area of scavenge pump.

Note:

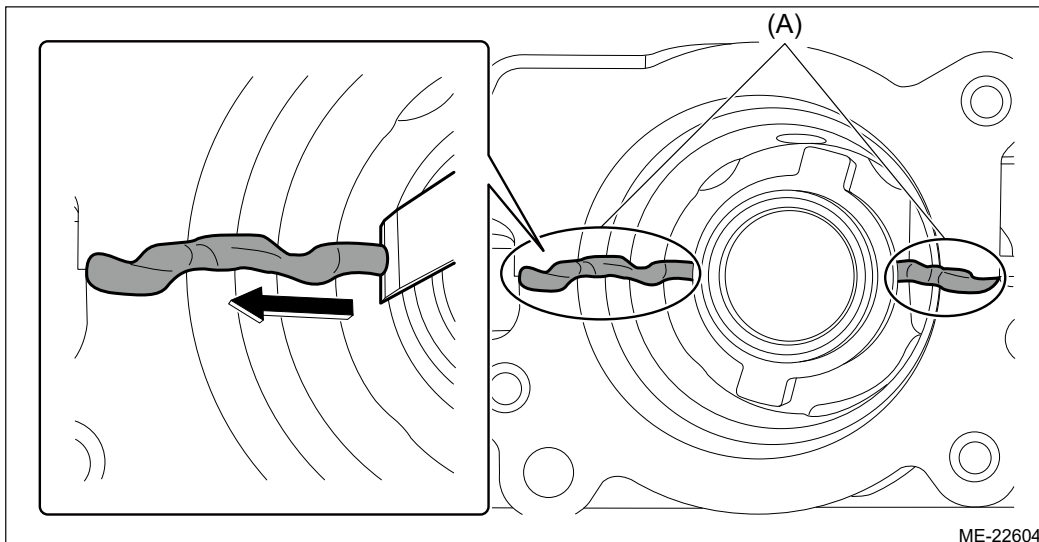
This procedure is required to prevent the coupling of scavenge pump and liquid gasket contacting with each other resulting in poor sealing.

1. Remove the liquid gasket in portions (A) in the arrowed direction (from inside to outside) shown in figure using a scraper.

Caution:

To avoid poor sealing, pay special attention to the following:

- **Remove the liquid gasket within five minutes after installing the camshaft cap.**
- **Do not use cloth when removing the liquid gasket.**
- **Do not remove liquid gasket in the opposite direction from arrow (from outside to inside).**

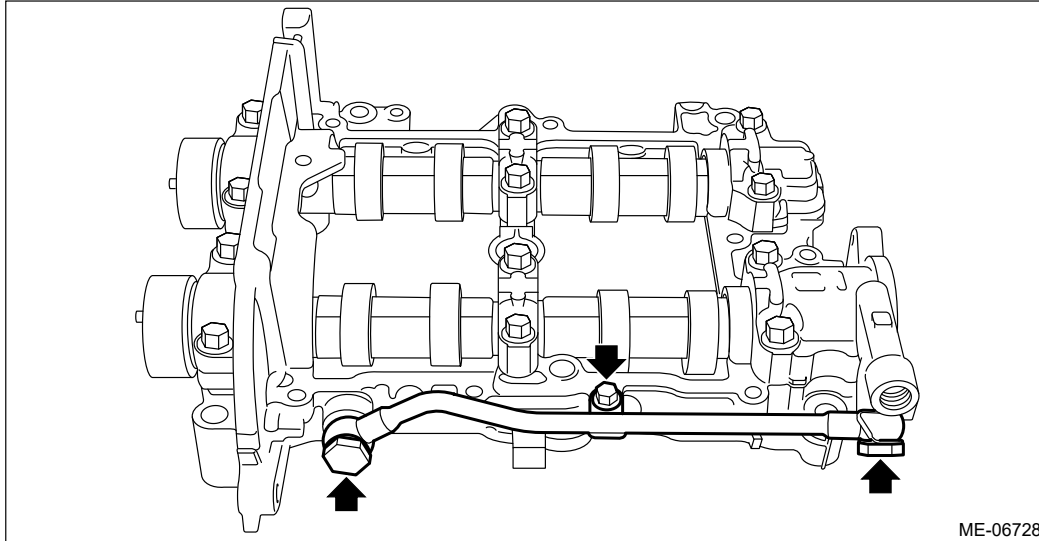


4. Install the oil pipe to the cam carrier RH.

(1) Set the oil pipe to the cam carrier RH, and temporarily tighten the bolts which secure the oil pipe to the cam carrier RH.

Note:

Use a new gasket.

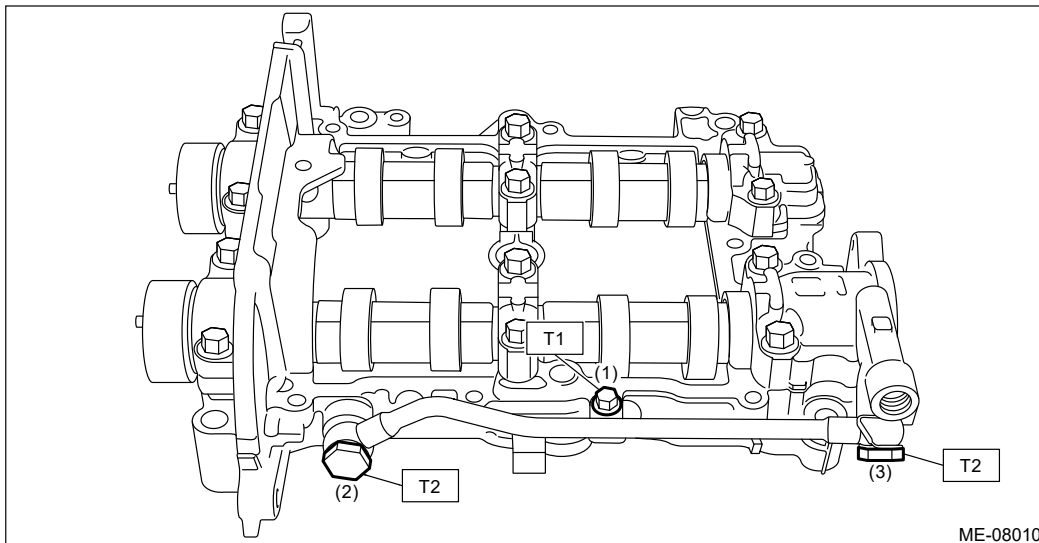


(2) Tighten the bolts which secures the oil pipe to the cam carrier RH in numerical order as shown in the figure.

Tightening torque:

T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

T2: 31 N·m (3.2 kgf-m, 22.9 ft-lb)



2. CAM CARRIER LH

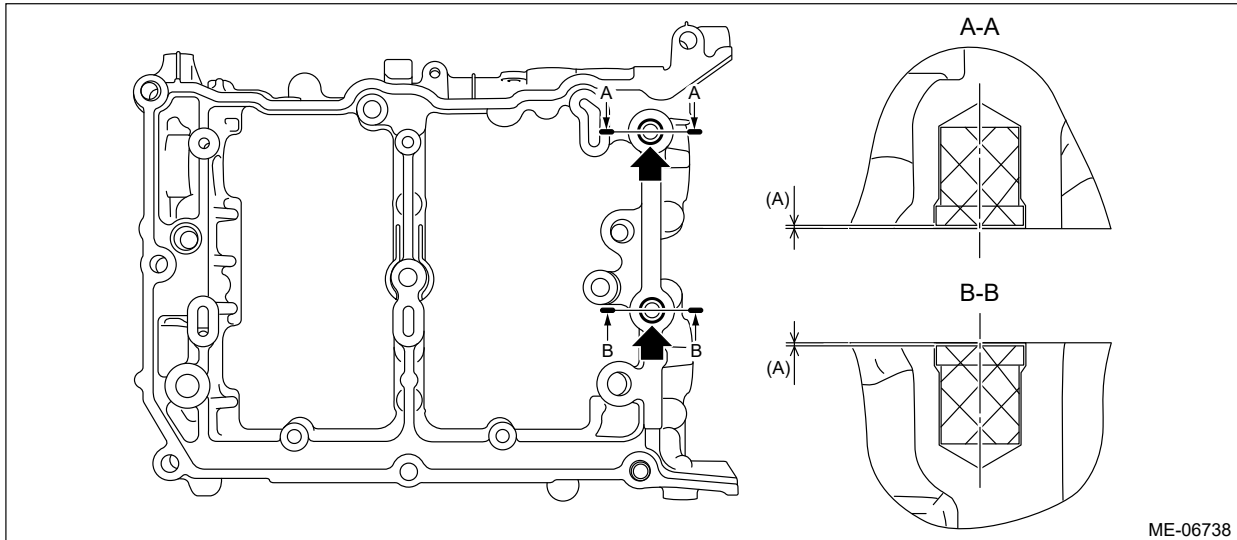
1. Install the filter to the cam carrier LH.

Note:

Use a new filter.

Filter insert position:

$0^{+0}_{-0.5}$ mm ($^{+0}_{-0.0197}$ in) position from cam carrier LH end face



(A) $0 - 0.5 \text{ mm}$ ($0 - 0.0197 \text{ in}$)

2. Set the intake camshaft LH and the exhaust camshaft LH to the cam carrier LH.

Note:

Apply engine oil to the journals of cam carrier LH before setting the intake camshaft LH and exhaust camshaft LH.

3. Install the front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH.
 - (1) Apply liquid gasket to the mating surface of front camshaft cap LH, intake rear camshaft cap LH and exhaust rear camshaft cap LH as shown in the figure.

Caution:

- **Do not apply liquid gasket excessively. Applying excessively may cause excess gasket to flow toward camshaft journal, resulting in engine seizure.**
- **Do not apply liquid gasket excessively to the intake center camshaft cap LH and exhaust center camshaft cap LH.**

Note:

- **Before applying liquid gasket, degrease the old liquid gasket seal surface of the front camshaft cap LH, intake rear camshaft cap LH, exhaust rear camshaft cap LH, and cam carrier LH.**
- **Install within 5 min. after applying liquid gasket.**

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

Mating surfaces other than ranges A, B and C

$2 \pm 0.5 \text{ mm}$ ($0.0787 \pm 0.0197 \text{ in}$)

Mating surfaces of range A

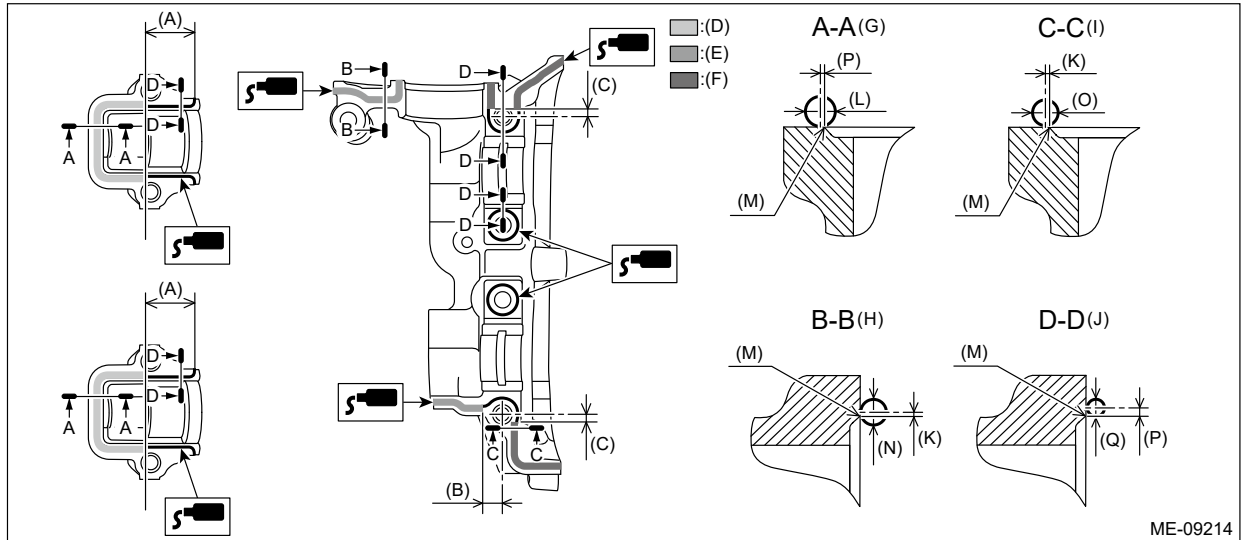
$3.5 \pm 0.5 \text{ mm}$ ($0.1378 \pm 0.0197 \text{ in}$)

Mating surfaces of range B

$3 \pm 0.5 \text{ mm}$ ($0.1181 \pm 0.0197 \text{ in}$)

Mating surfaces of range C

$3^{+1}_{-0.5} \text{ mm}$ ($0.1181^{+0.0394}_{-0.0197} \text{ in}$)

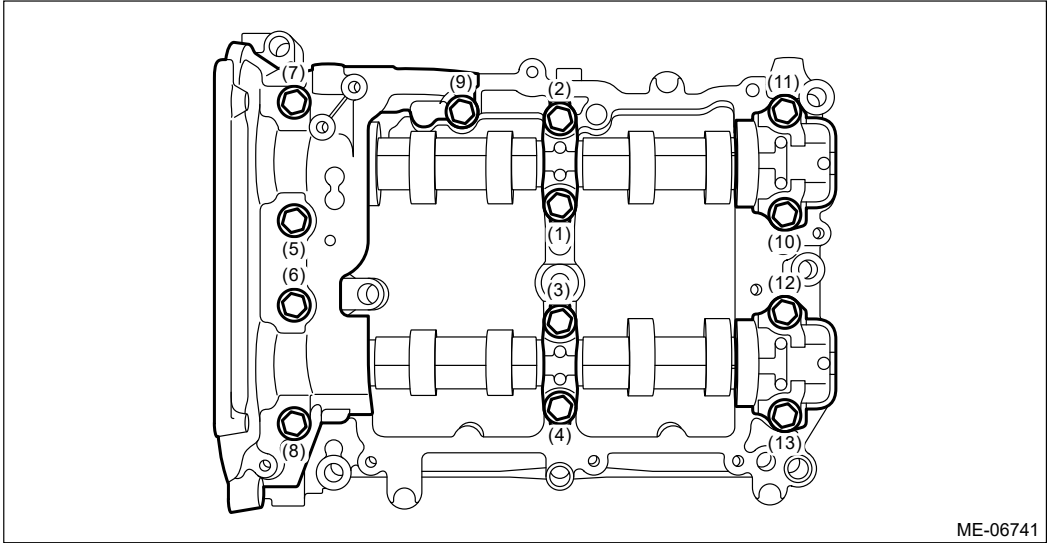


| | | |
|-------------------------|--|--|
| (A) 28.5 mm (1.122 in) | (G) Liquid gasket applying position of mating surfaces of range A | (M) Chamfer edge |
| (B) 11.6 mm (0.4567 in) | (H) Liquid gasket applying position of mating surfaces of range B | (N) $\varnothing 3 \pm 0.5$ mm (0.1181 \pm 0.0197 in) |
| (C) 5.1 mm (0.2008 in) | (I) Liquid gasket applying position of mating surfaces of range C | (O) $\varnothing 3^{+1}_{-0.5}$ mm (0.1181 \pm +0.0394 -0.0197 in) |
| (D) Range A | (J) Liquid gasket applying position of mating surfaces other than range A, range B and range C | (P) Within 1 mm (0.0394 in) |
| (E) Range B | (K) 0.5 mm (0.0197 in) | (Q) $\varnothing 2 \pm 0.5$ mm (0.0787 \pm 0.0197 in) |
| (F) Range C | (L) $\varnothing 3.5 \pm 0.5$ mm (0.1378 \pm 0.0197 in) | |

- (2) Apply engine oil to the journals of each camshaft cap before setting the camshaft cap.
- (3) Tighten the bolts which secure front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH in numerical order as shown in the figure.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)

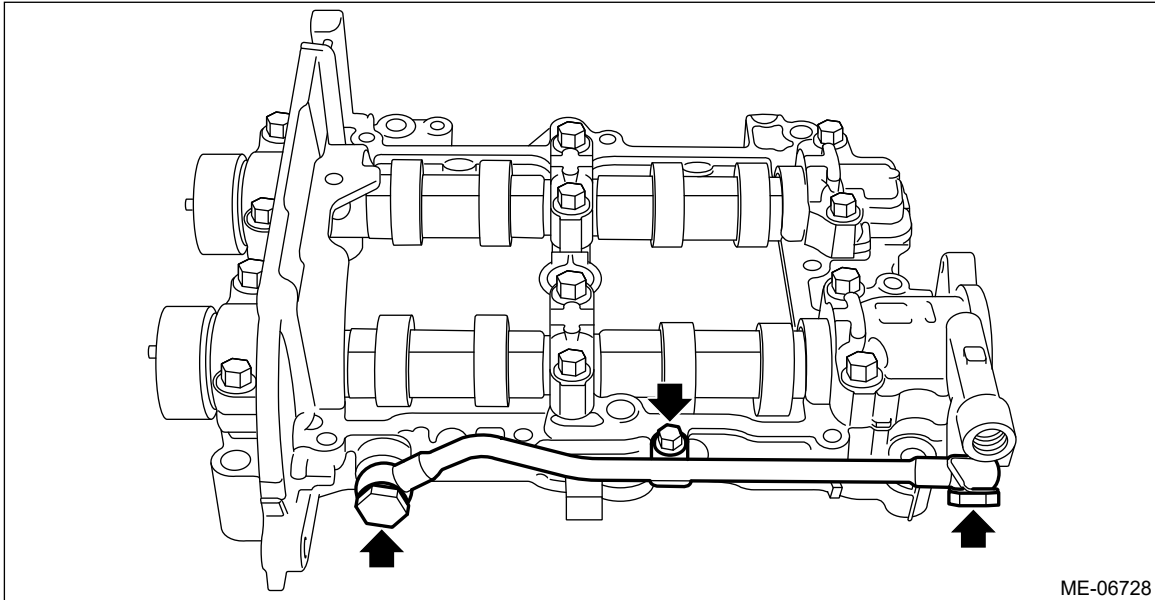


ME-06741

DISASSEMBLY

1. CAM CARRIER RH

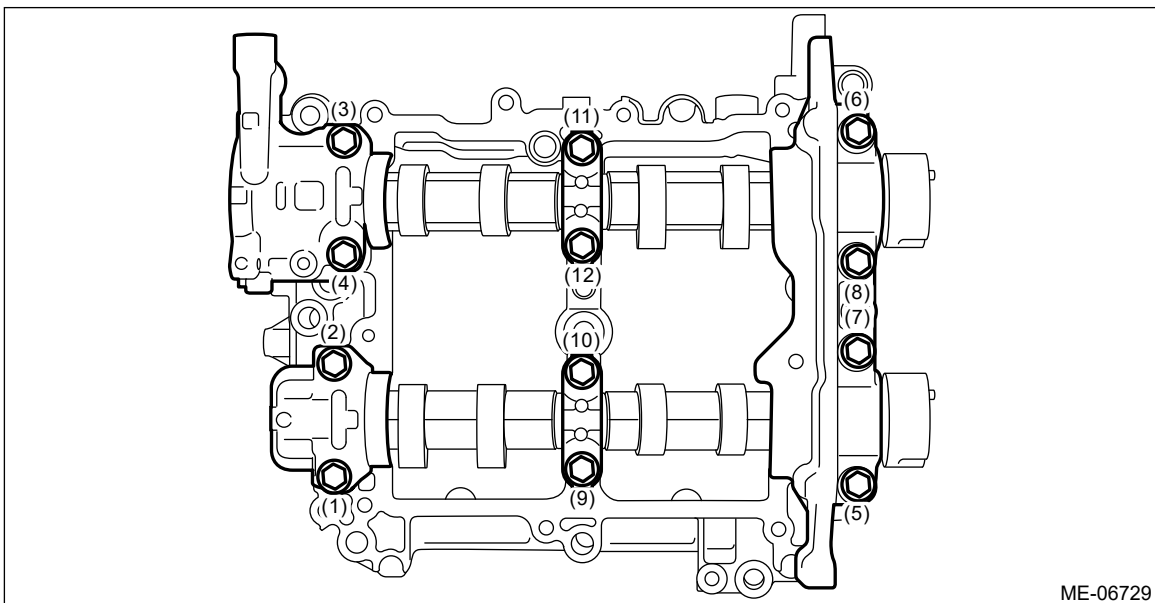
1. Remove the oil pipe from cam carrier RH.



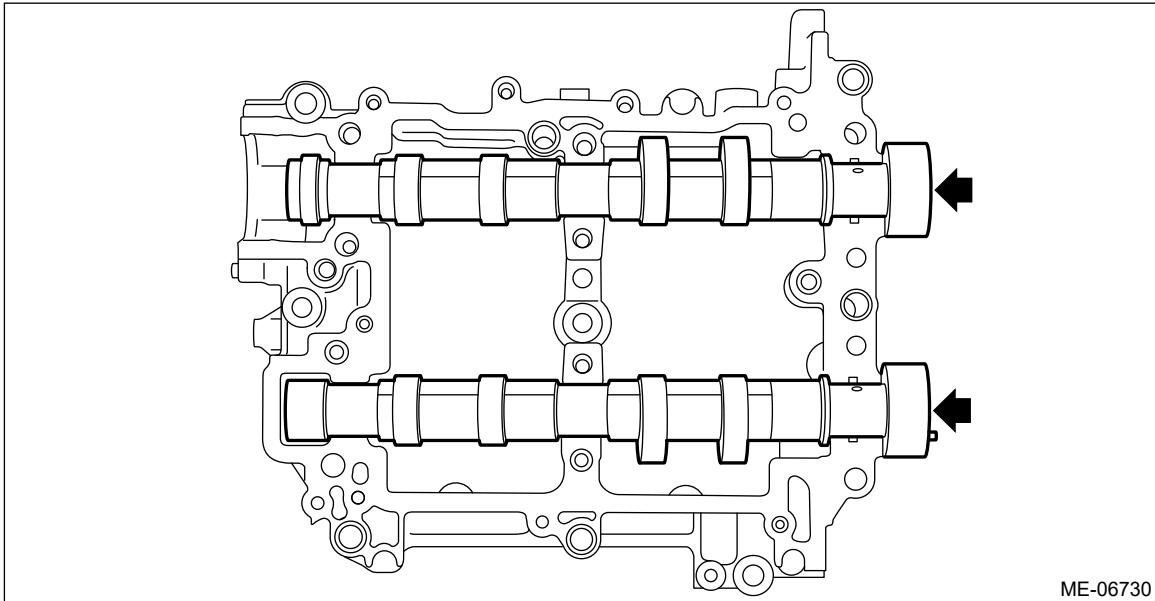
2. Loosen the bolts (front camshaft cap RH, intake center camshaft cap RH, intake rear camshaft cap RH, exhaust center camshaft cap RH, and exhaust rear camshaft cap RH) equally, a little at a time in numerical sequence as shown in the figure, and remove each camshaft cap.

Note:

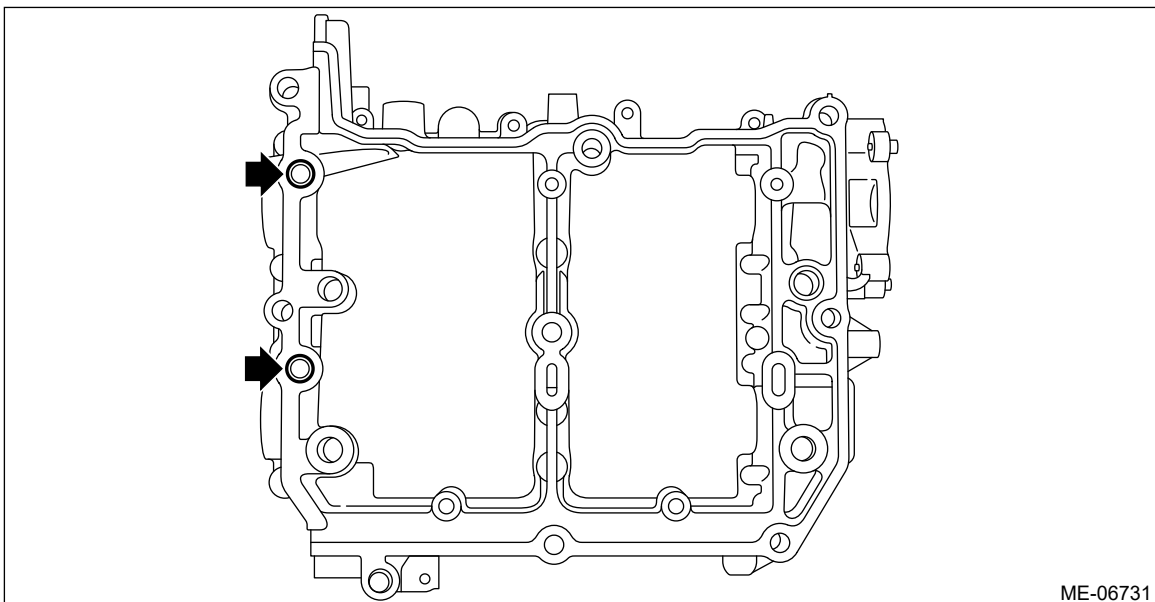
Arrange camshaft caps in order so that they can be installed in their original positions.



3. Remove the intake camshaft RH and the exhaust camshaft RH from cam carrier RH.



4. Remove the filter from cam carrier RH.



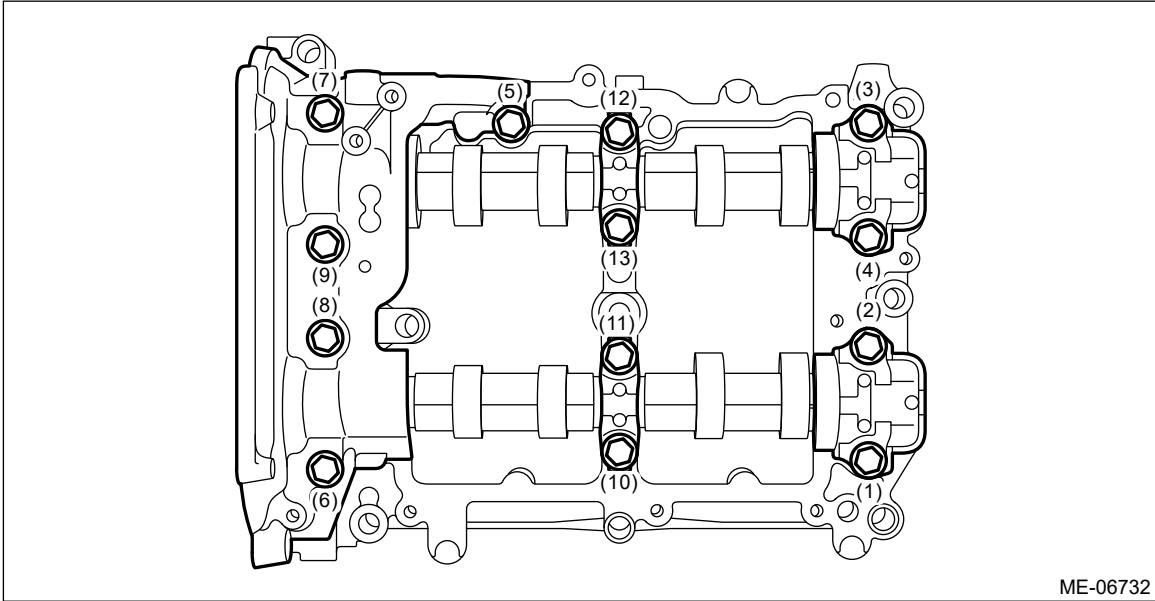
5. Remove the liquid gasket from cam carrier RH and front camshaft cap RH, intake rear camshaft cap RH and exhaust rear camshaft cap RH.

2. CAM CARRIER LH

1. Loosen the bolts (front camshaft cap LH, intake center camshaft cap LH, intake rear camshaft cap LH, exhaust center camshaft cap LH and exhaust rear camshaft cap LH) equally, a little at a time in numerical sequence as shown in the figure, and remove each camshaft cap.

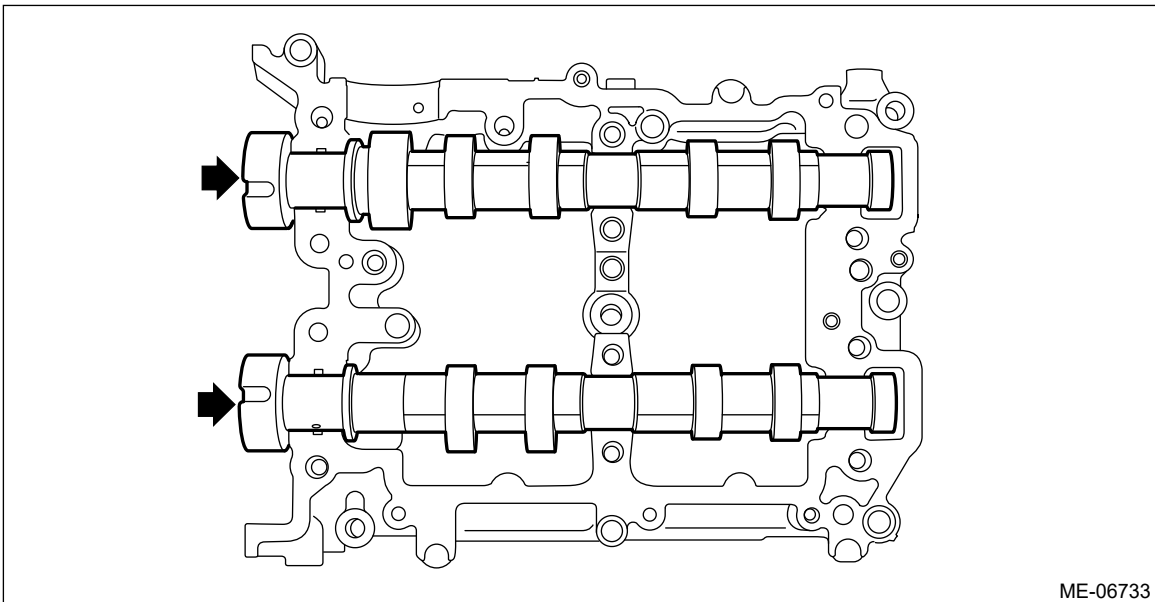
Note:

Arrange camshaft caps in order so that they can be installed in their original positions.



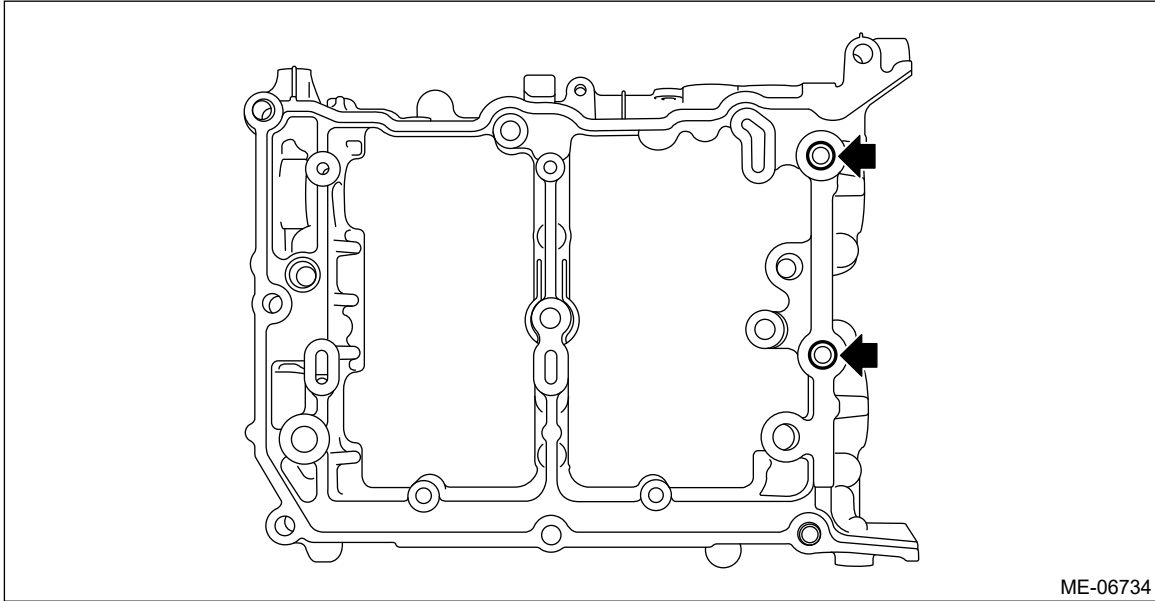
ME-06732

2. Remove the intake camshaft LH and the exhaust camshaft LH from cam carrier LH.



ME-06733

3. Remove the filter from cam carrier LH.



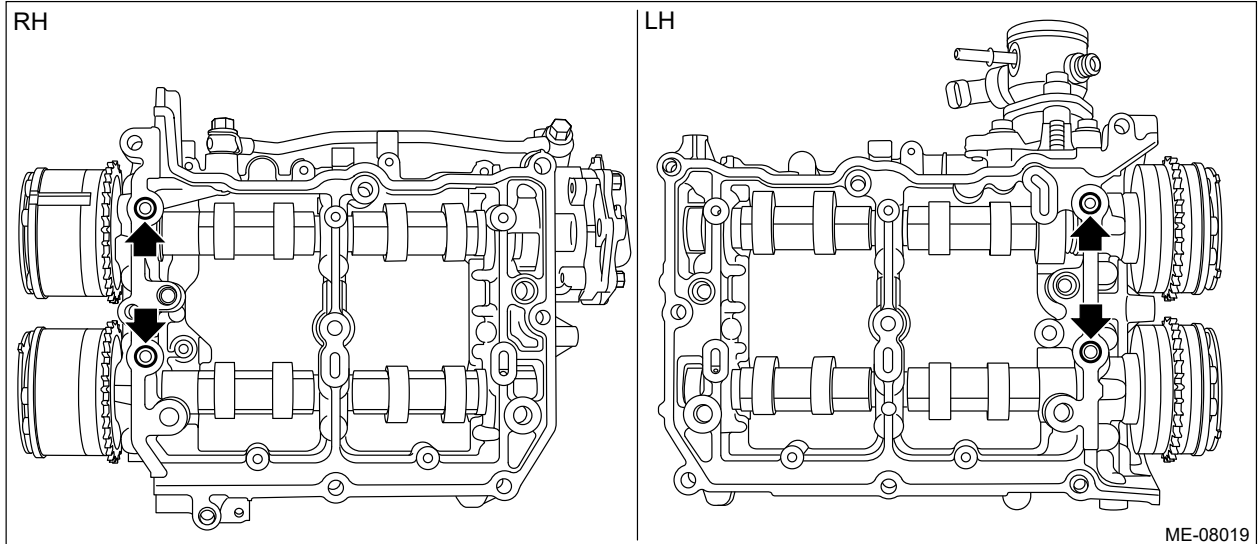
ME-06734

4. Remove the liquid gasket from cam carrier LH and front camshaft cap LH, intake rear camshaft cap LH and exhaust rear camshaft cap LH.

MECHANICAL(H4DOTC) > Cam Carrier

INSPECTION

1. Visually check the cam carrier filter, and if clogging is found, replace with a new part.



2. Check the camshaft journals for damage and wear. Replace the camshaft if faulty.
3. Check the cam face condition of camshaft, and remove the minor faults by grinding with oil stone. Replace the camshaft if uneven wear is found.
4. Using a dial gauge, check the camshaft bend. If it exceeds the limit, replace the camshaft.

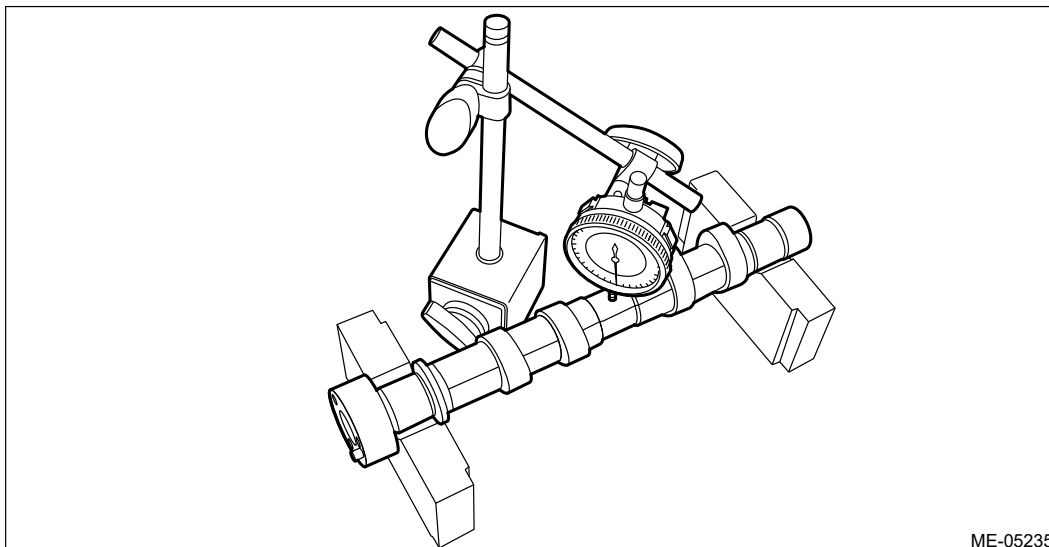
Note:

Measurement should be performed at a temperature of 20°C (68°F).

Camshaft bend:

Limit

0.020 mm (0.0008 in)



5. Check the cam lobe height "H" and cam base circle diameter "A" of camshaft as shown in the figure, using micrometer. If it is not within the standard, replace the camshaft.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Perform measurement of cam lobe height for fuel pump drive section at three points.**

Camshaft cam lobe overall height H:

Intake

Valve drive section

Standard

40.34 – 40.44 mm (1.588 – 1.592 in)

Fuel pump drive section

Standard

41.95 – 42.05 mm (1.652 – 1.656 in)

Exhaust

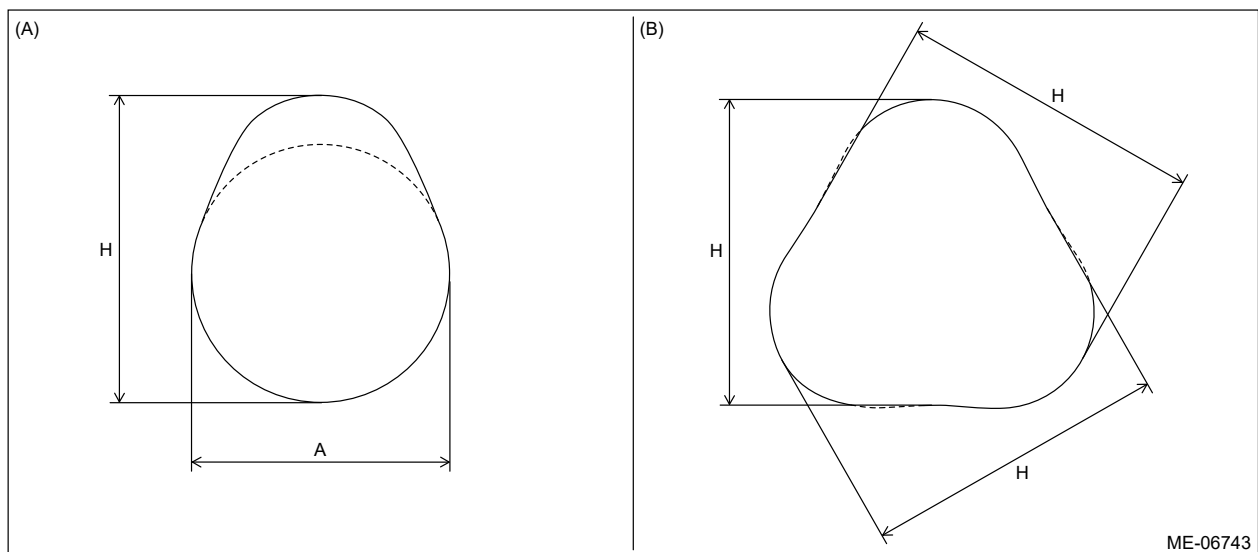
Standard

40.20 – 40.30 mm (1.583 – 1.587 in)

Camshaft cam base circle diameter A:

Standard

34.0 mm (1.339 in)



(A) Valve drive section

(B) Fuel pump drive section

6. Check the camshaft journal outer diameter using micrometer. If it is not within the standard, replace the camshaft.

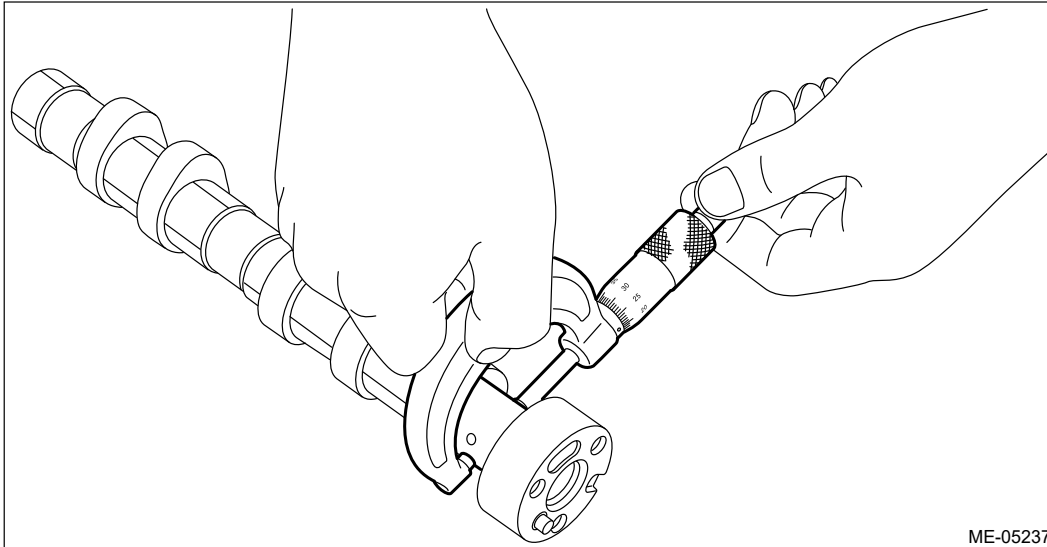
Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Measure outer diameter of each journal at several points, and read the value of most worn location.**

Camshaft journal outer diameter:

Standard

25.946 – 25.963 mm (1.0215 – 1.0222 in)



- 7.** Using a dial gauge, check the thrust clearance of the camshaft. If it is not within the standard or if uneven wear is found, replace each camshaft cap and cam carrier as a set. If necessary replace the camshaft.

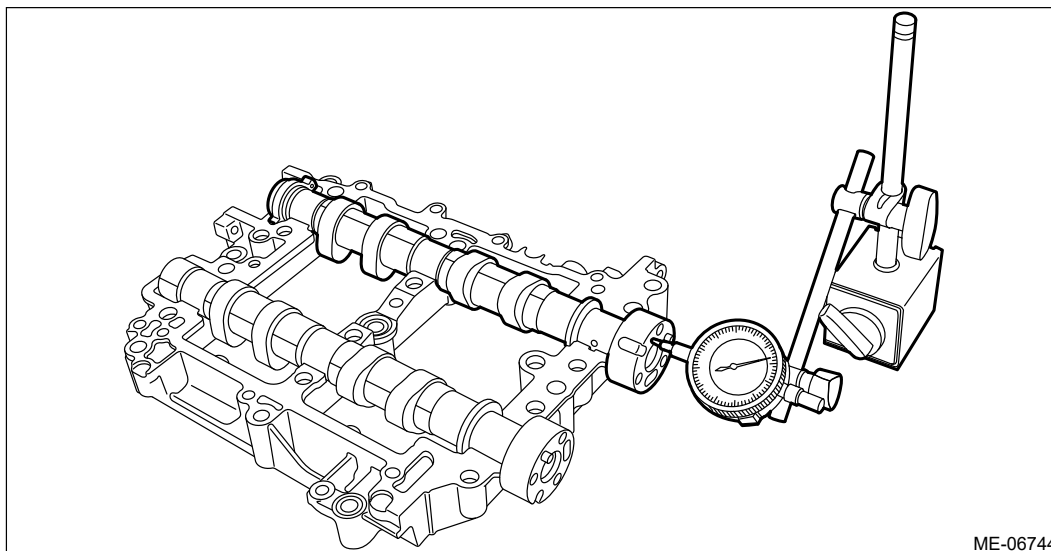
Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Set the dial gauge at end surface of camshaft.**

Camshaft thrust clearance:

Standard

0.068 — 0.116 mm (0.0027 — 0.0047 in)



- 8.** Check the oil clearance on the camshaft using a plastigauge.

Note:

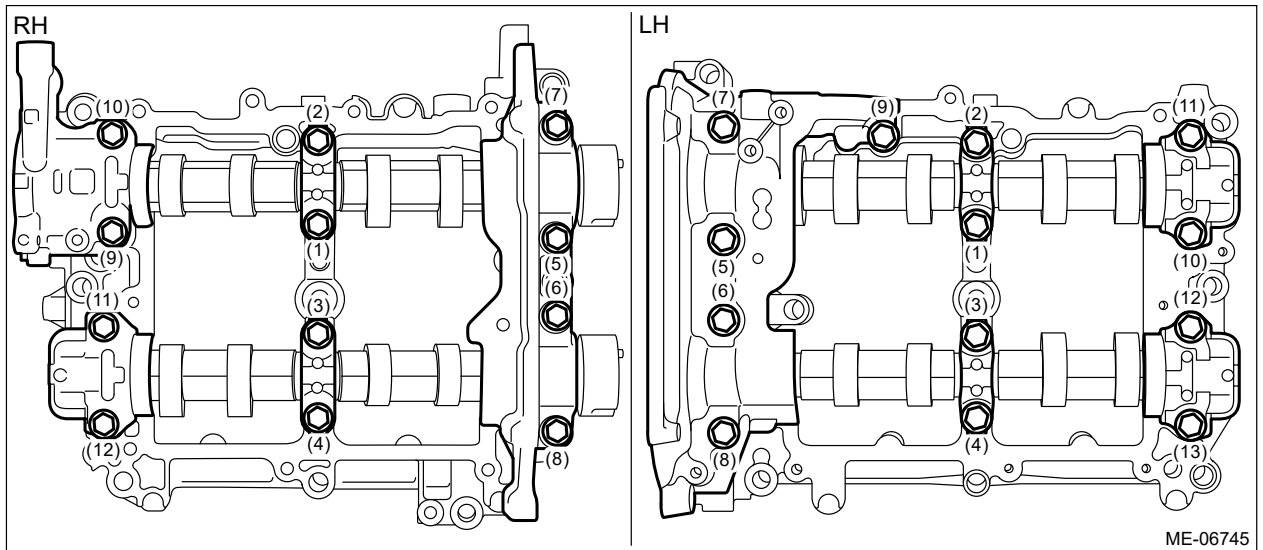
Measurement should be performed at a temperature of 20°C (68°F).

- (1) Remove the liquid gasket from cam carrier and front camshaft cap, intake rear camshaft cap and exhaust rear camshaft cap.
- (2) Clean each camshaft cap and cam carrier journals.
- (3) Set the camshaft to the cam carrier.
- (4) Place a plastigauge across the camshaft journals of each camshaft and set the camshaft caps.
- (5) Tighten the bolts which secure front camshaft cap, intake center camshaft cap, intake rear camshaft

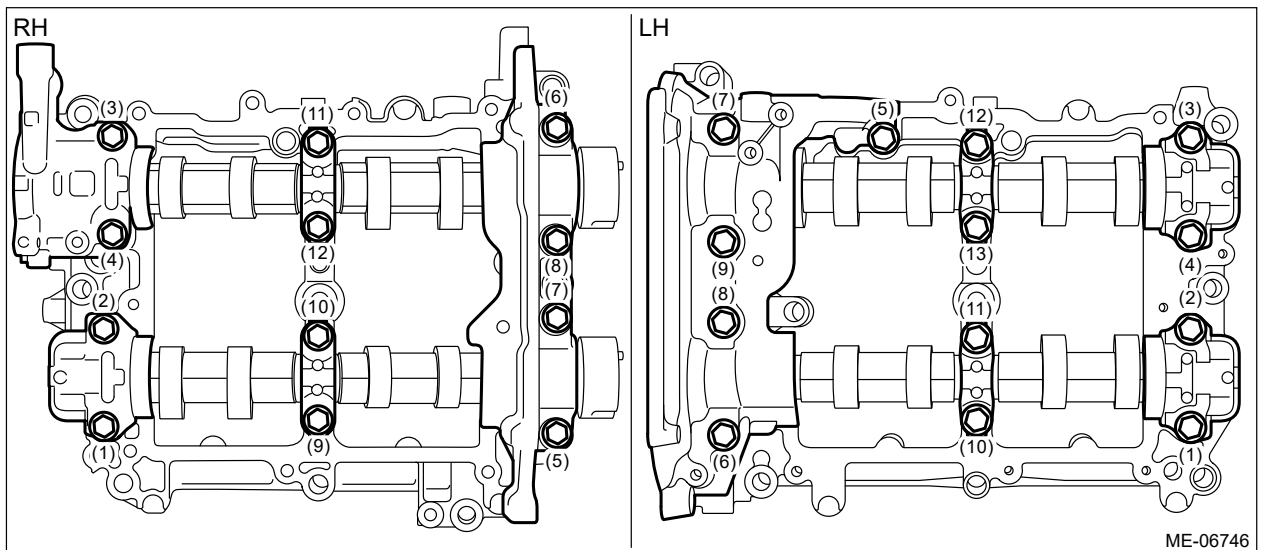
cap, exhaust center camshaft cap and exhaust rear camshaft cap in numerical order as shown in the figure.

Tightening torque:

18 N·m (1.8 kgf-m, 13.3 ft-lb)



- (6) Loosen the bolts (front camshaft cap, intake center camshaft cap, intake rear camshaft cap, exhaust center camshaft cap and exhaust rear camshaft cap) equally, a little at a time in numerical sequence as shown in the figure, and remove each camshaft cap.

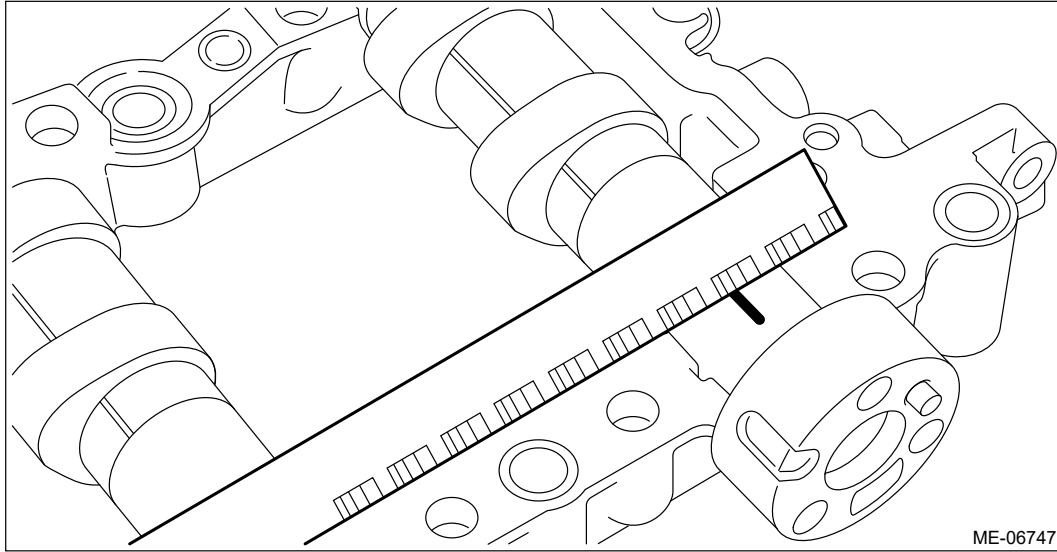


- (7) Determine camshaft oil clearance by matching the widest point of plastigauge on each journal against scale printed on a package of plastigauge. If it is not within the standard, replace each camshaft cap and cam carrier as a set. If necessary replace the camshaft.

Camshaft oil clearance:

Standard

0.037 – 0.072 mm (0.0015 – 0.0028 in)



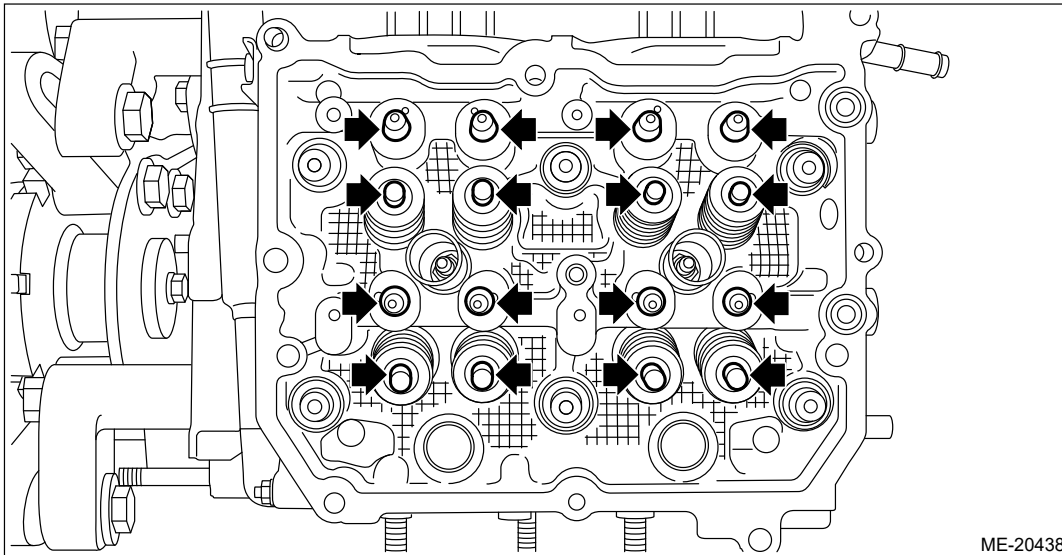
ME-06747

(8) Completely remove the plastigauge.

INSTALLATION

1. CAM CARRIER RH

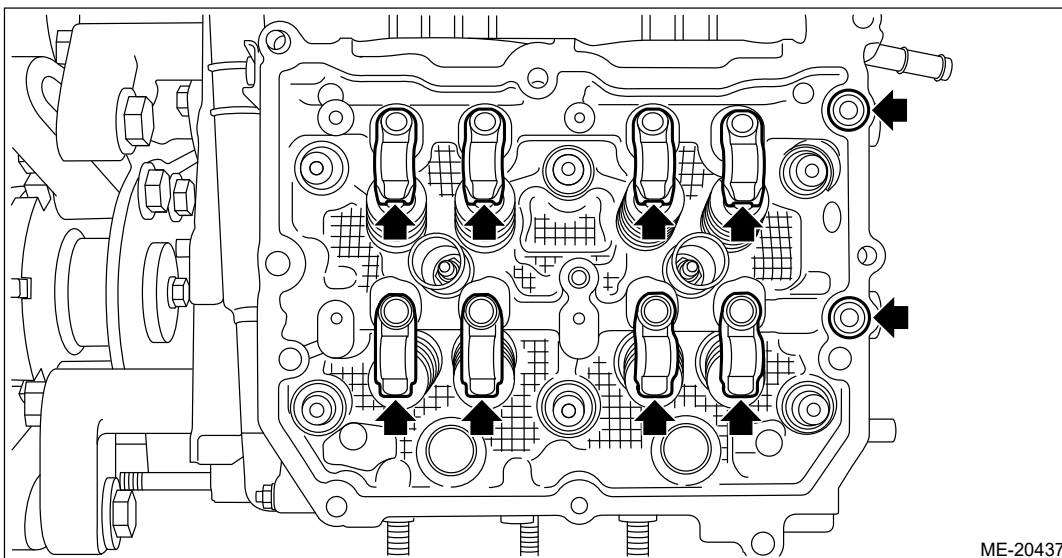
1. Set the part so that the cylinder head RH is on the upper side.
2. Apply engine oil to the valve shim and the roller rocker arm pivot, and install the valve shim and the roller rocker arm pivot to the cylinder head RH.



3. Apply engine oil to the O-ring and the roller rocker arm, and install the O-ring and the roller rocker arm to the cylinder head RH.

Note:

Use new O-rings.



4. Apply liquid gasket to the mating surface of cam carrier RH as shown in the figure.

Note:

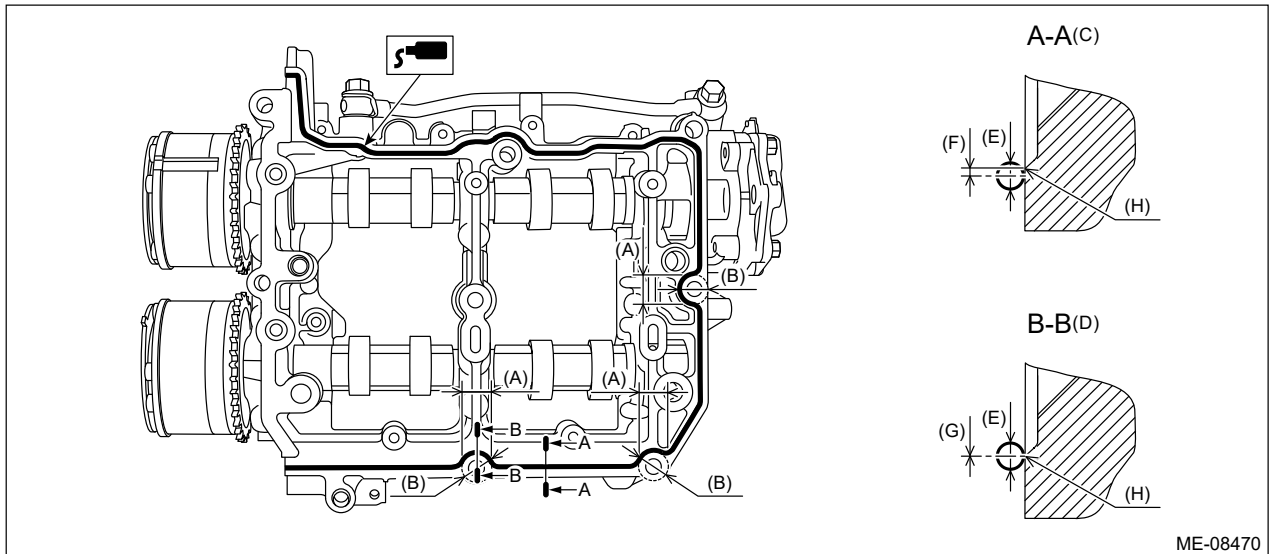
- **Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder head RH and cam carrier RH.**
- **Install within 5 min. after applying liquid gasket.**

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3 ± 0.5 mm (0.1181 ± 0.0197 in)



ME-08470

(A) Range A

(D) Liquid gasket applying position of mating surfaces of range A

(G) 0 ± 0.5 mm (0 ± 0.0197 in)

(B) $\varnothing 18$ mm (0.7087 in)

(E) $\varnothing 3\pm 0.5$ mm (0.1181 ± 0.0197 in)

(H) Chamfer edge

(C) Liquid gasket applying position of mating surfaces other than range A

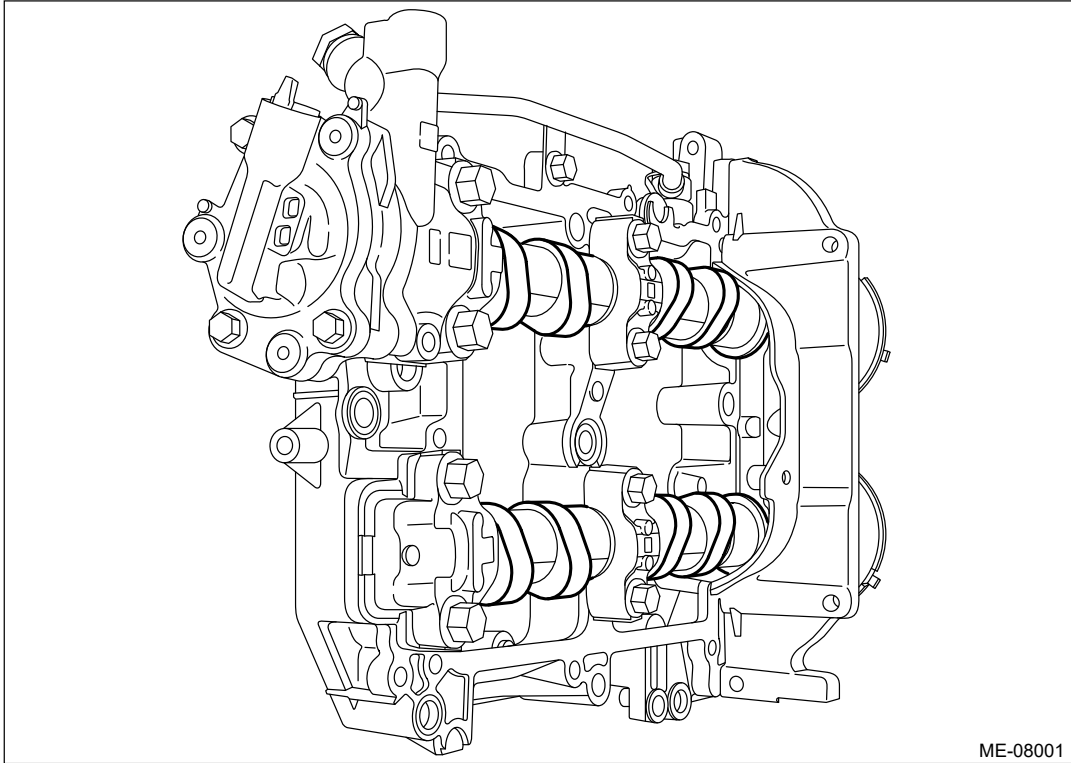
(F) Within 1 mm (0.0394 in)

5. Install the cam carrier RH to the cylinder head RH.

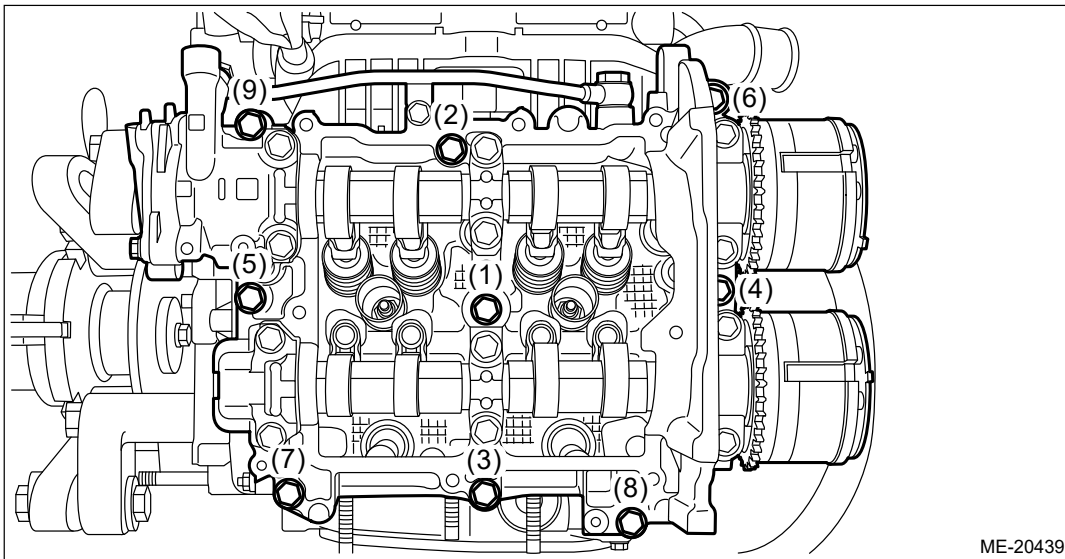
(1) Mount the cam carrier RH, then tighten all bolts with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

Note:

Set the intake camshaft RH and the exhaust camshaft RH to the zero-lift position as shown in the figure.

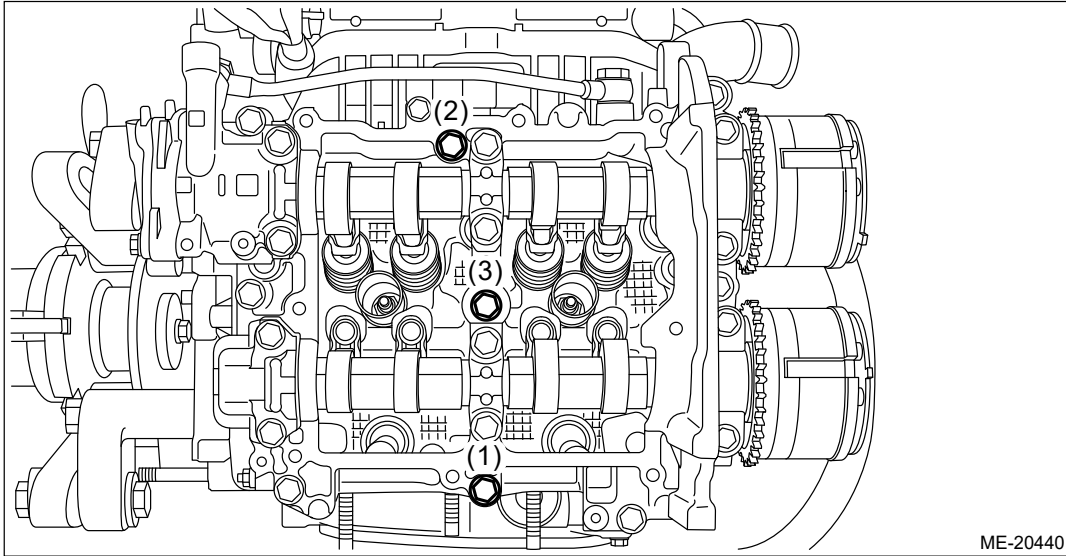


ME-08001

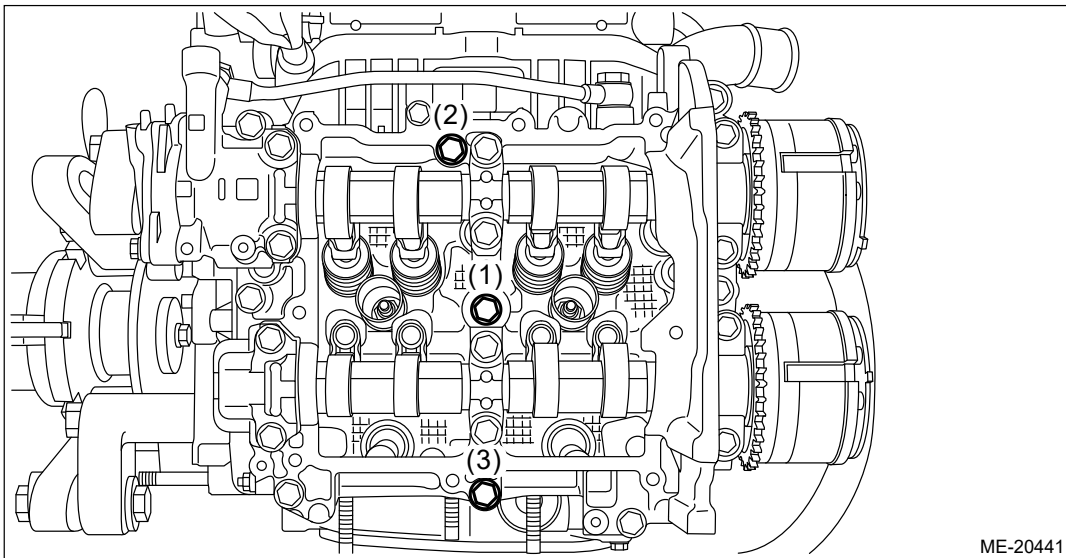


ME-20439

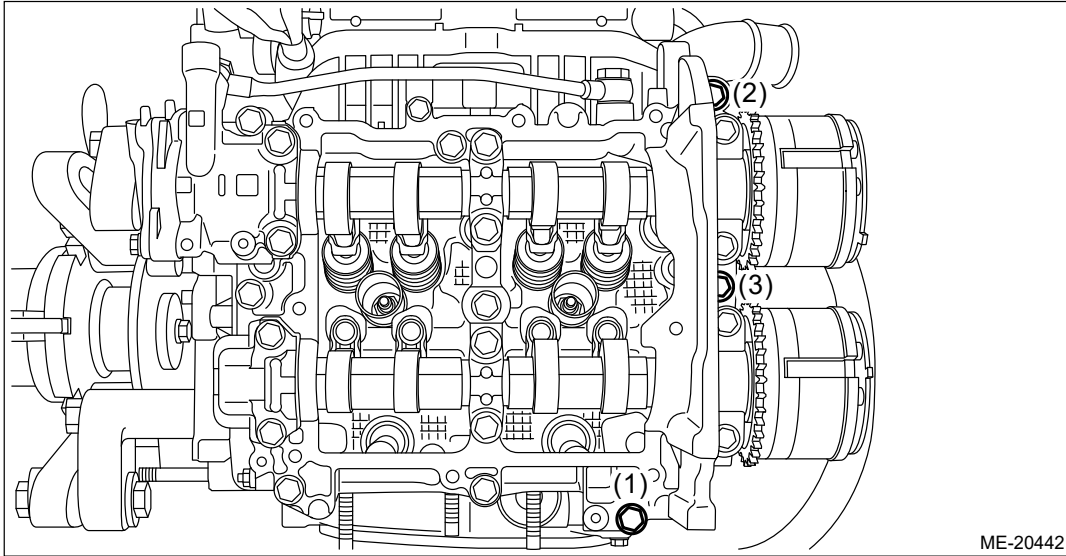
(2) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



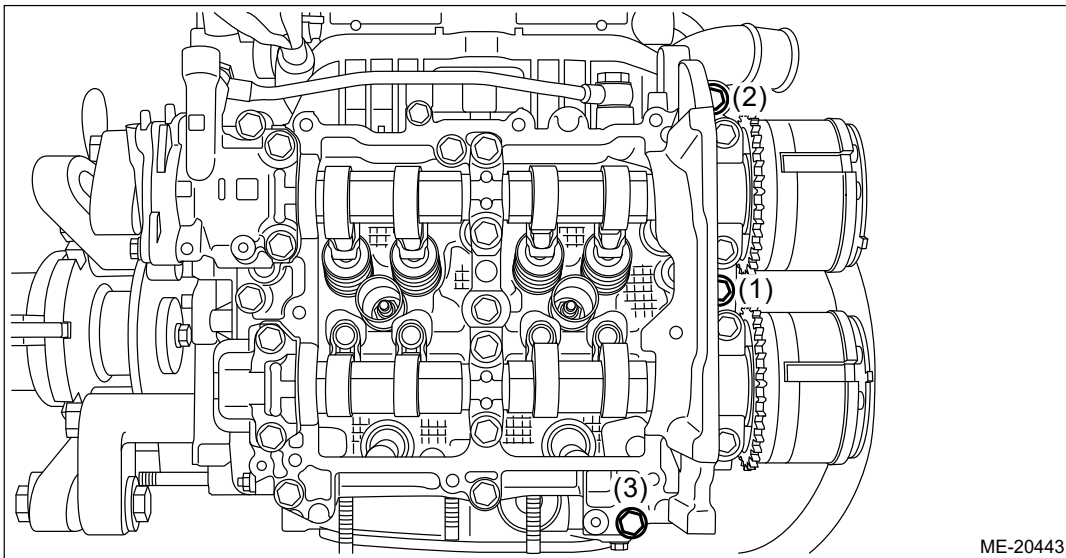
(3) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



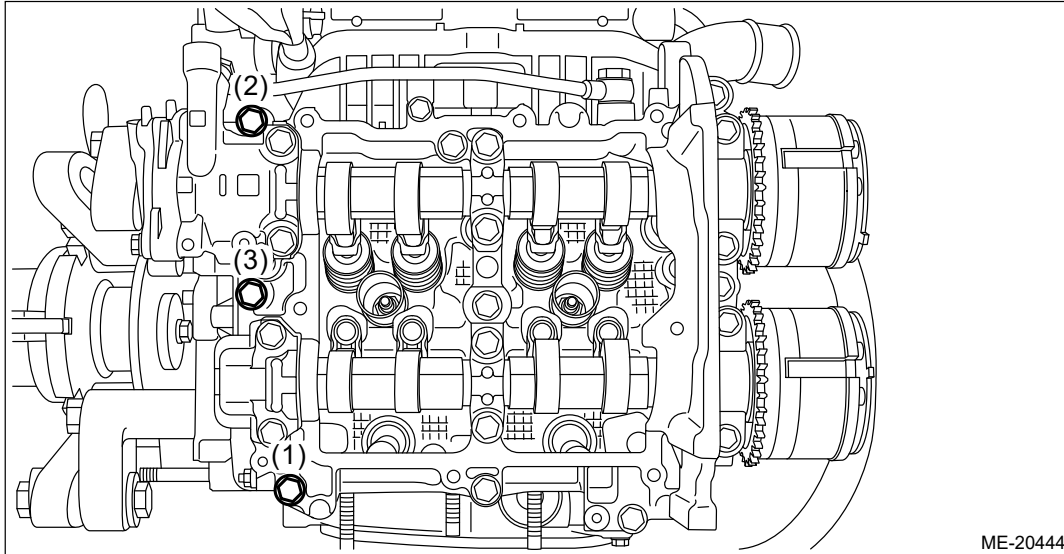
(4) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



(5) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



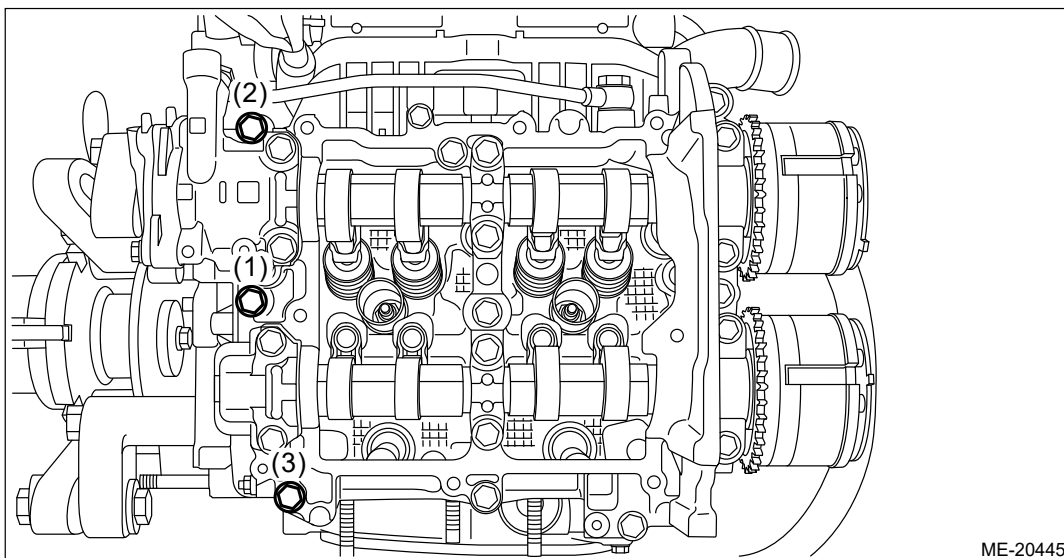
(6) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



- (7) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

Note:



After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.



6. Set the part so that the intake manifold is on the upper side.
 7. When the cam carrier RH has been disassembled


Note:

When the cam carrier RH has been disassembled, perform the following steps also.

- (1) Install the cam sprocket RH.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Sprocket>INSTALLATION > CAM SPROCKET RH.](#)
 (2) Install the scavenge pump.  [Ref. to LUBRICATION\(H4DO\)>Scavenge Pump>INSTALLATION.](#)

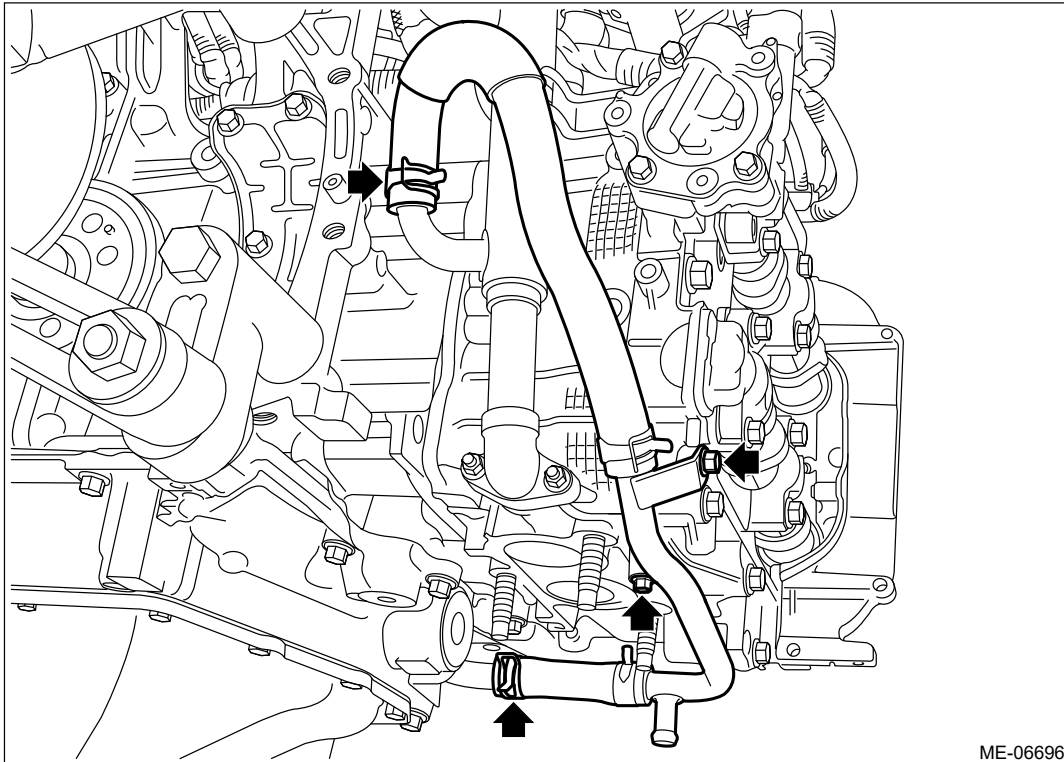
Note:

When installing the scavenge pump, do not turn the intake camshaft RH to the outside of range of zero-lift (in range where it can be turned lightly by hand).

8. Check the cam clearance.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)
 9. Connect the water pipe hose to oil pan upper and EGR cooler, and install the water pipe assembly.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

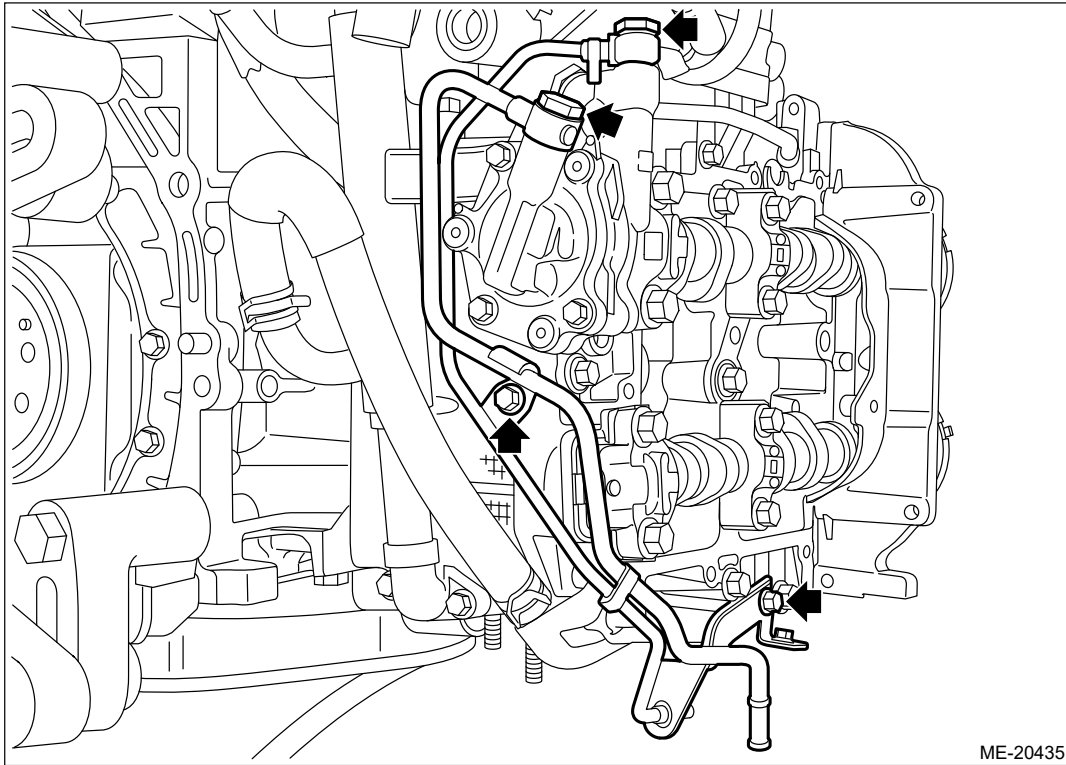


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- 10.** Install the oil pipe assembly to the scavenge pump and cam carrier RH.
 - (1) Set the oil pipe assembly to the scavenge pump and cam carrier RH, and temporarily tighten the bolts which secure the oil pipe assembly to the scavenge pump and cam carrier RH.

Note:

Use a new gasket.



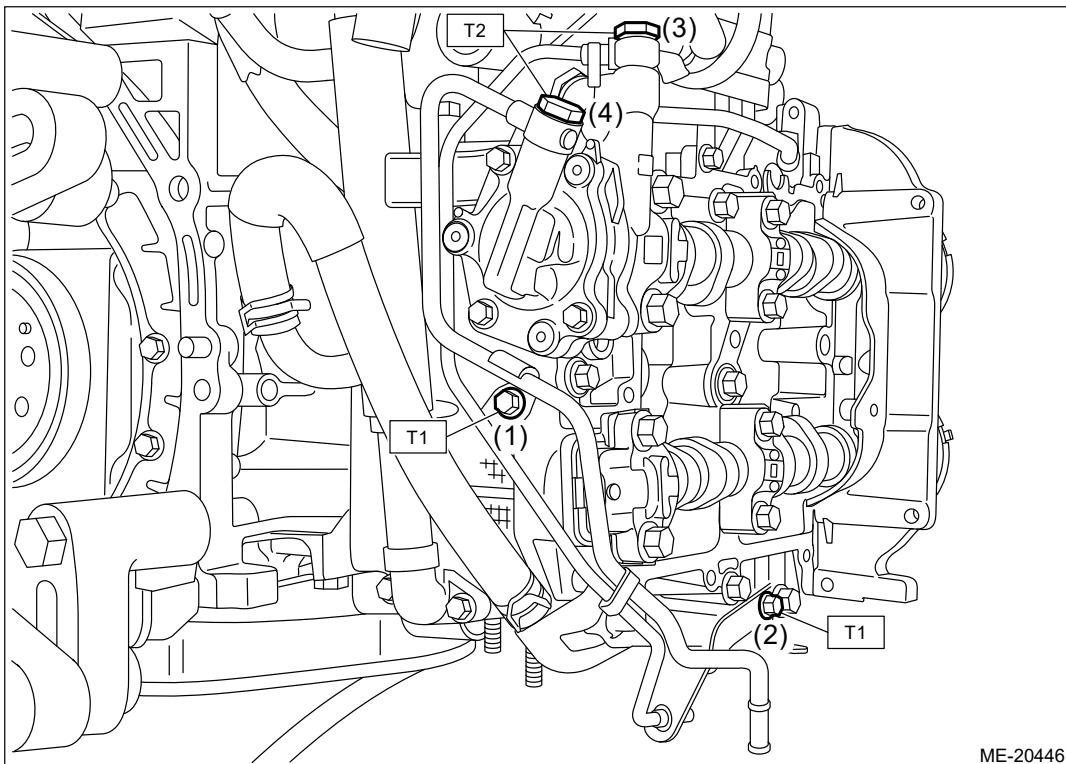
ME-20435

- (2) Tighten the bolts which secure the oil pipe assembly to the scavenge pump and cam carrier RH in numerical order as shown in the figure.

Tightening torque:

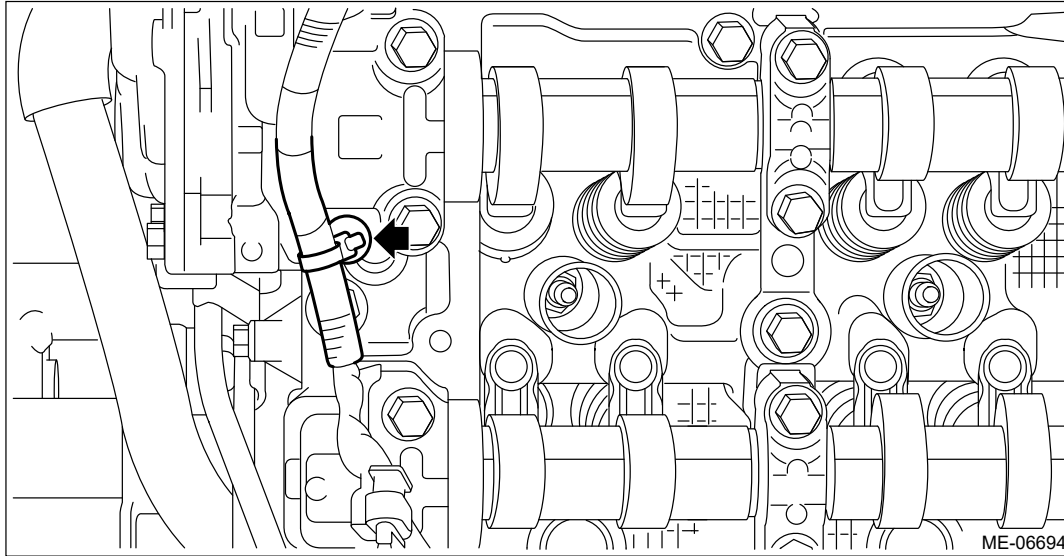
T1: 6.8 N·m (0.7 kgf-m, 5.0 ft-lb)





T2: 31.5 N·m (3.2 kgf-m, 23.2 ft-lb)



ME-20446

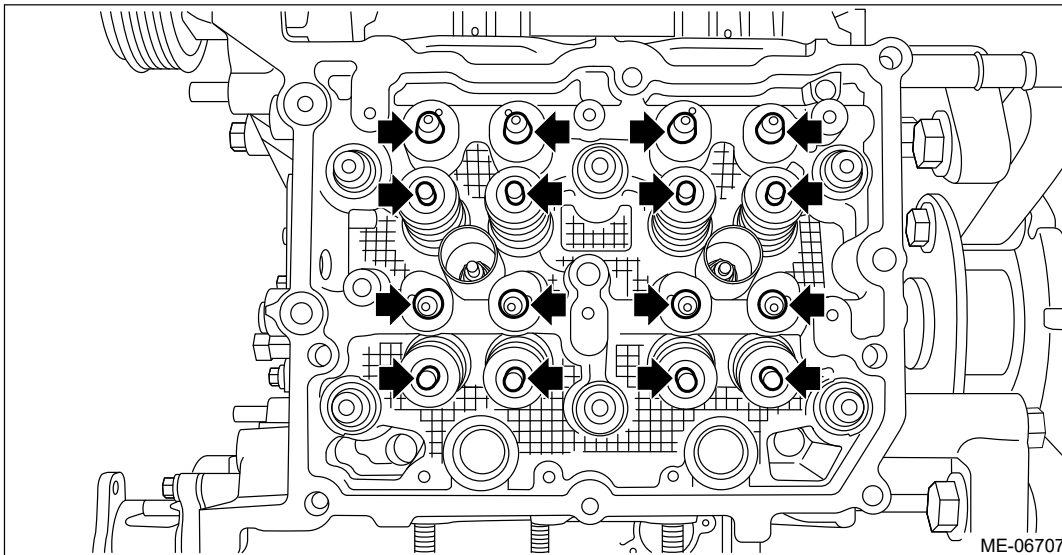
- 11.** Secure the engine harness to the cam carrier RH with a clip.



- 12.** Install the rocker cover RH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>INSTALLATION > ROCKER COVER RH.](#)
- 13.** Install the timing chain RH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN RH.](#)
- 14.** Install the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)
- 15.** Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>INSTALLATION.](#)

2. CAM CARRIER LH

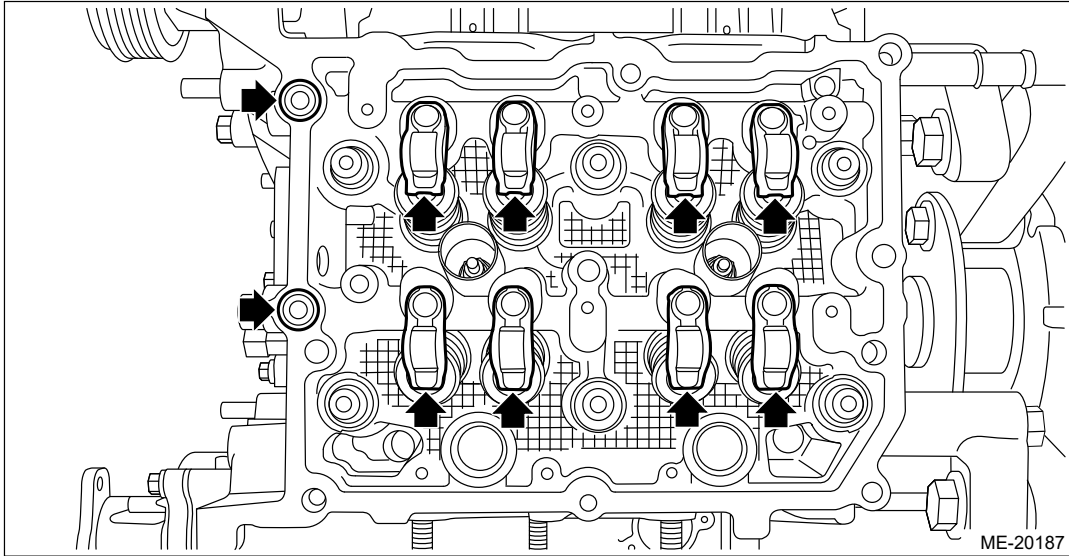
- 1.** Set the part so that the cylinder head LH is on the upper side.
- 2.** Apply engine oil to the valve shim and the roller rocker arm pivot, and install the valve shim and the roller rocker arm pivot to the cylinder head LH.



- 3.** Apply engine oil to the O-ring and the roller rocker arm, and install the O-ring and the roller rocker arm to the cylinder head LH.

Note:

Use new O-rings.



4. Apply liquid gasket to the mating surface of cam carrier LH as shown in the figure.

Note:

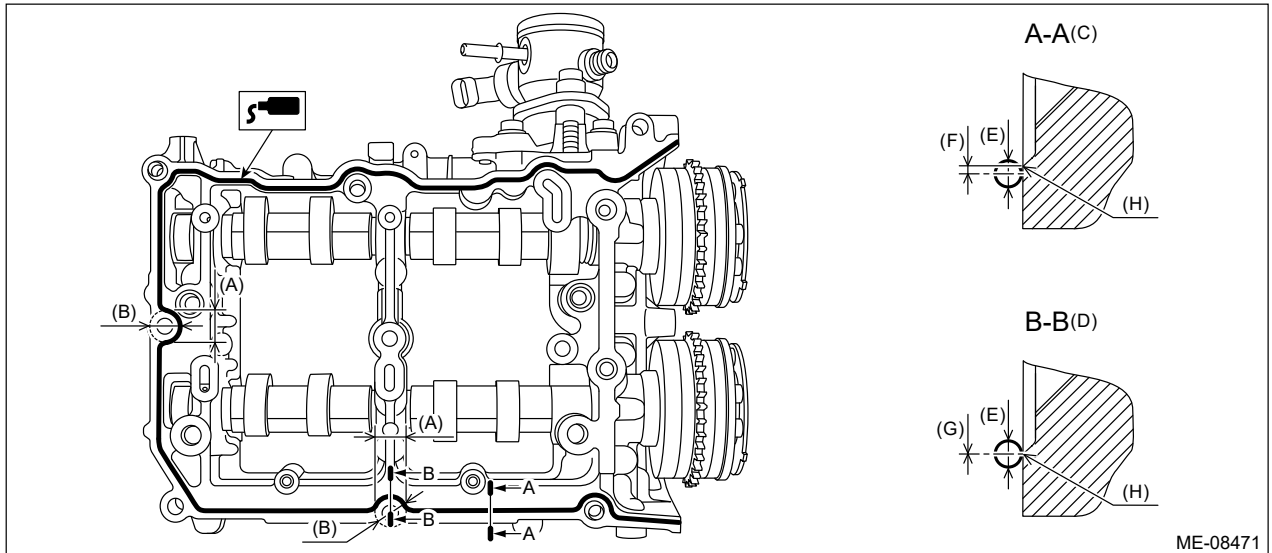
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder head LH and cam carrier LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3 ± 0.5 mm (0.1181 ± 0.0197 in)



(A) Range A

(B) $\varnothing 18$ mm (0.7087 in)

(C) Liquid gasket applying position of mating surfaces other than range A

(D) Liquid gasket applying position of mating surfaces of range A

(E) $\varnothing 3 \pm 0.5$ mm (0.1181 ± 0.0197 in)

(F) Within 1 mm (0.0394 in)

(G) 0 ± 0.5 mm (0 ± 0.0197 in)

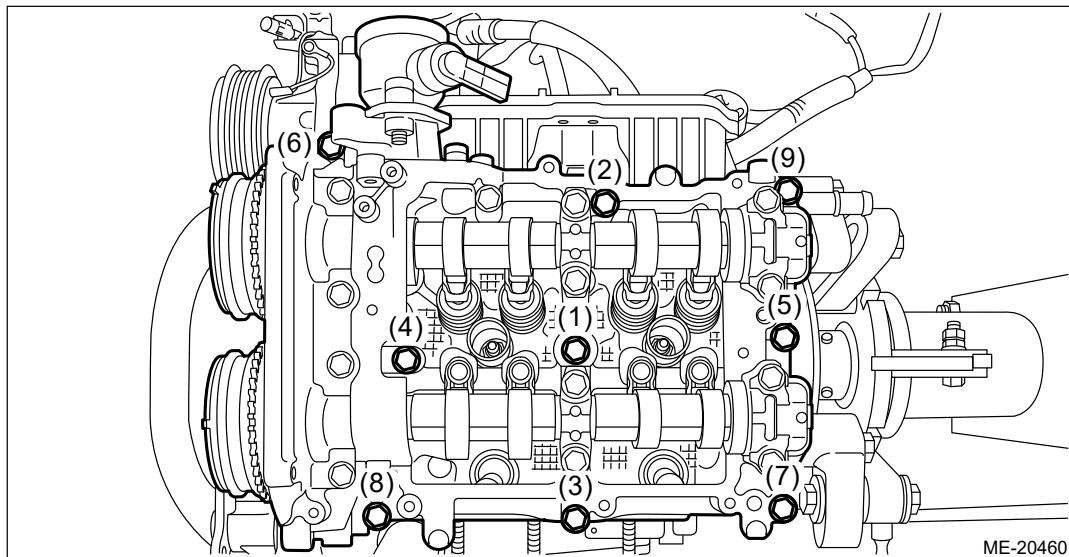
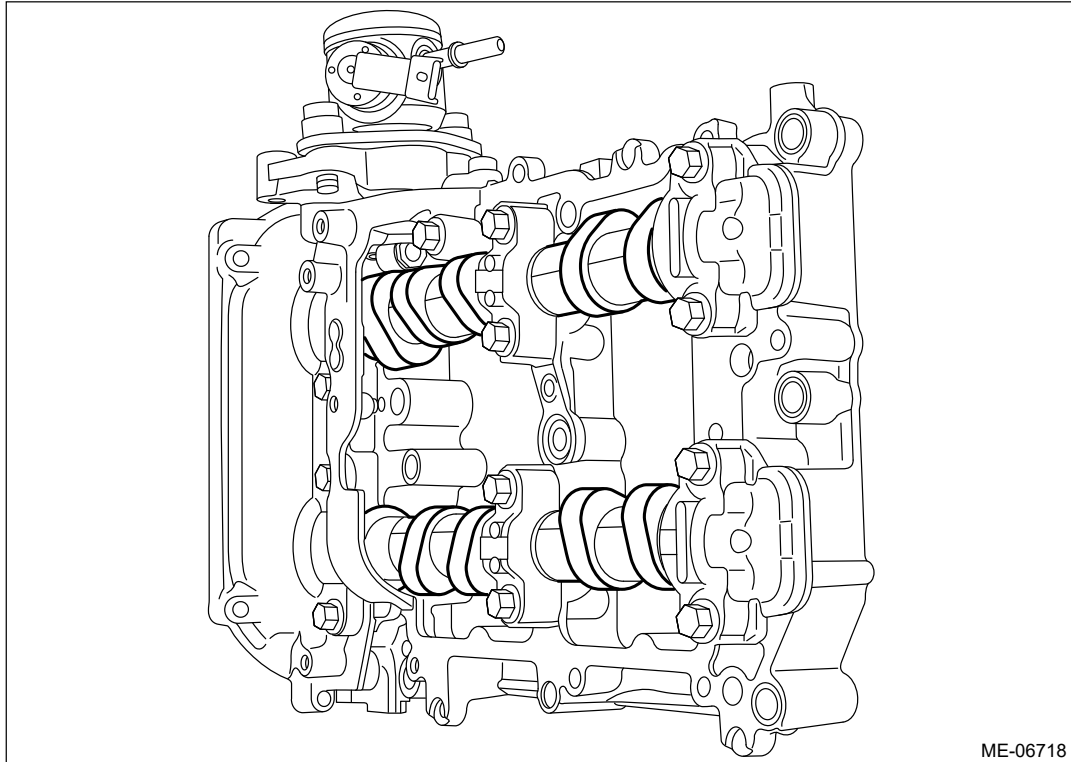
(H) Chamfer edge

5. Install the cam carrier LH to the cylinder head LH.

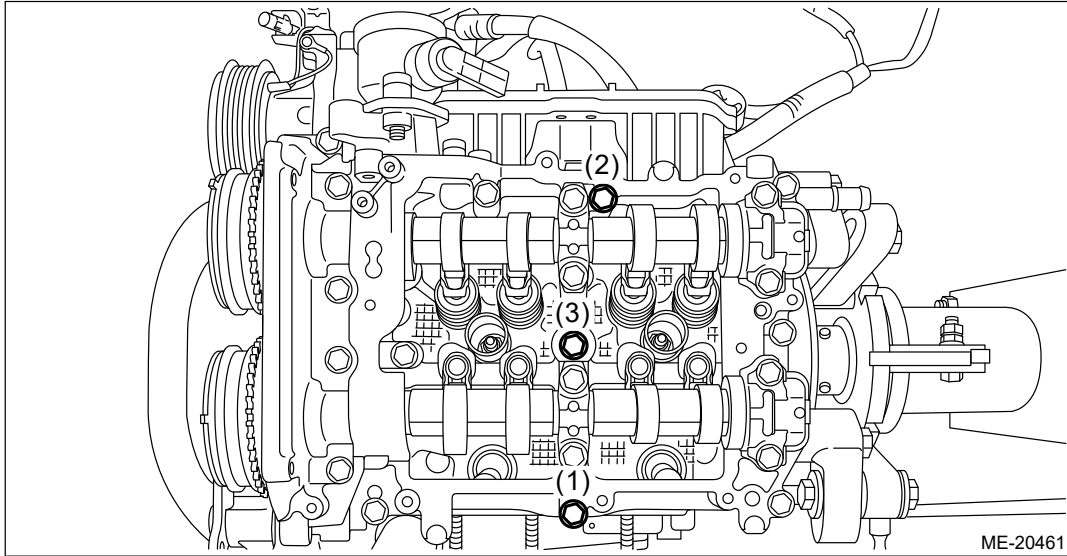
- (1) Mount the cam carrier LH, then tighten all bolts with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

Note:

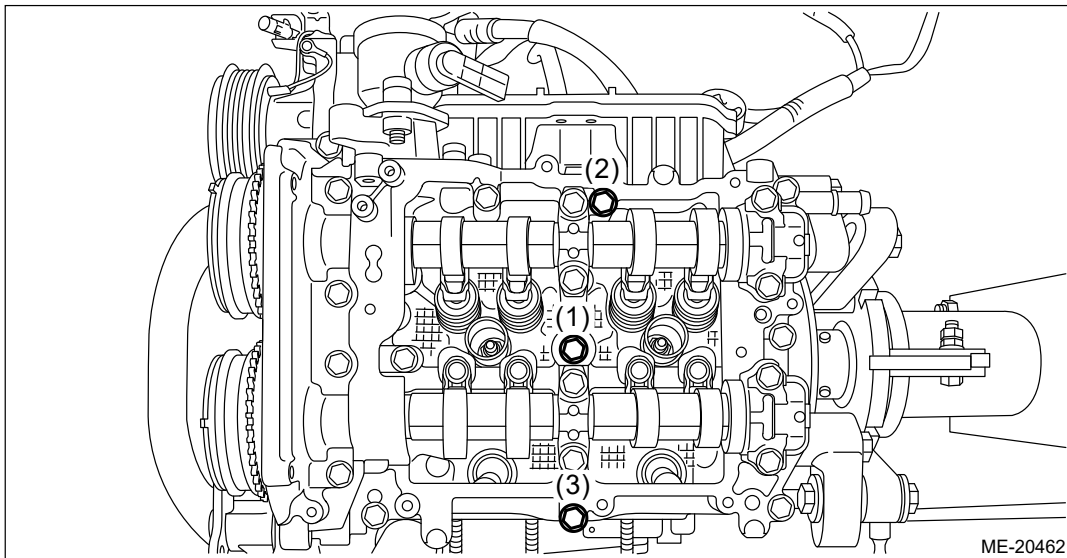
Set the intake camshaft LH and the exhaust camshaft LH to the zero-lift position as shown in the figure.



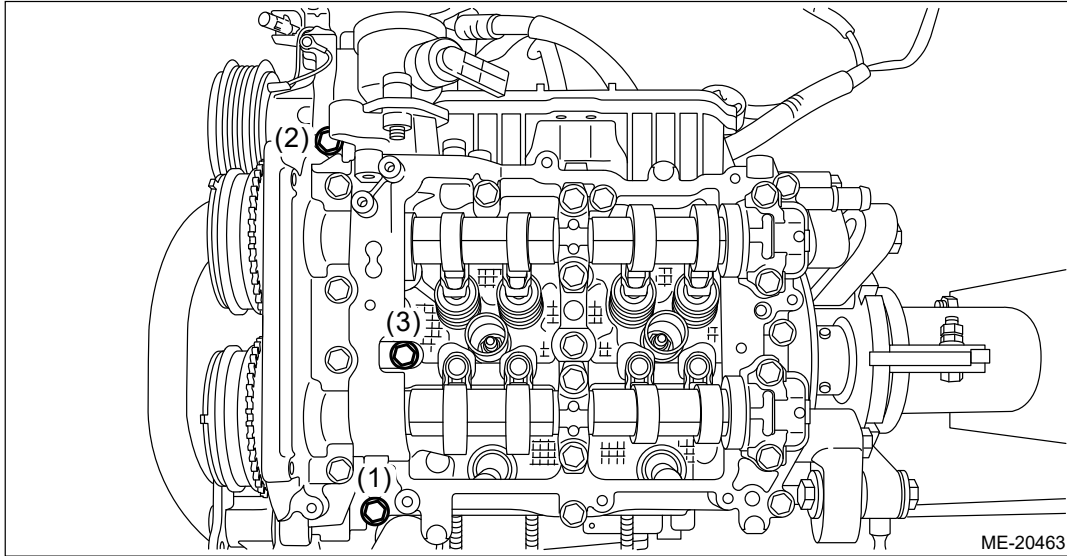
- (2) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



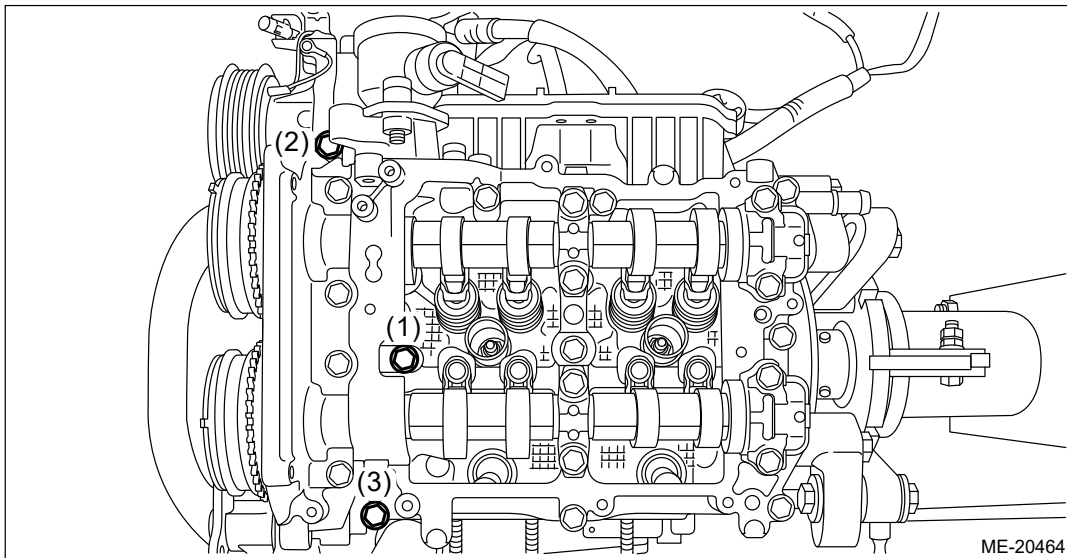
(3) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



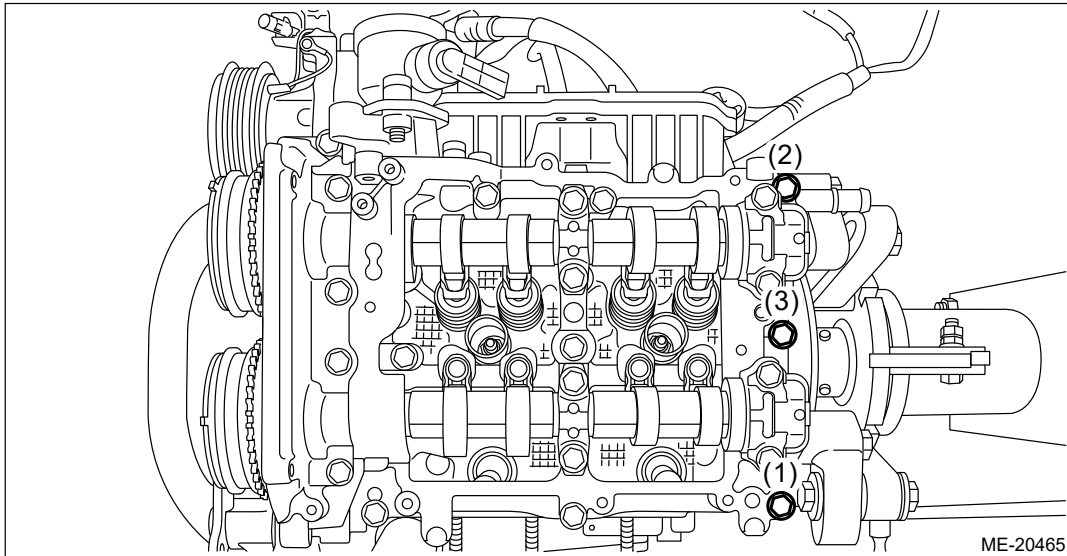
(4) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



(5) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.



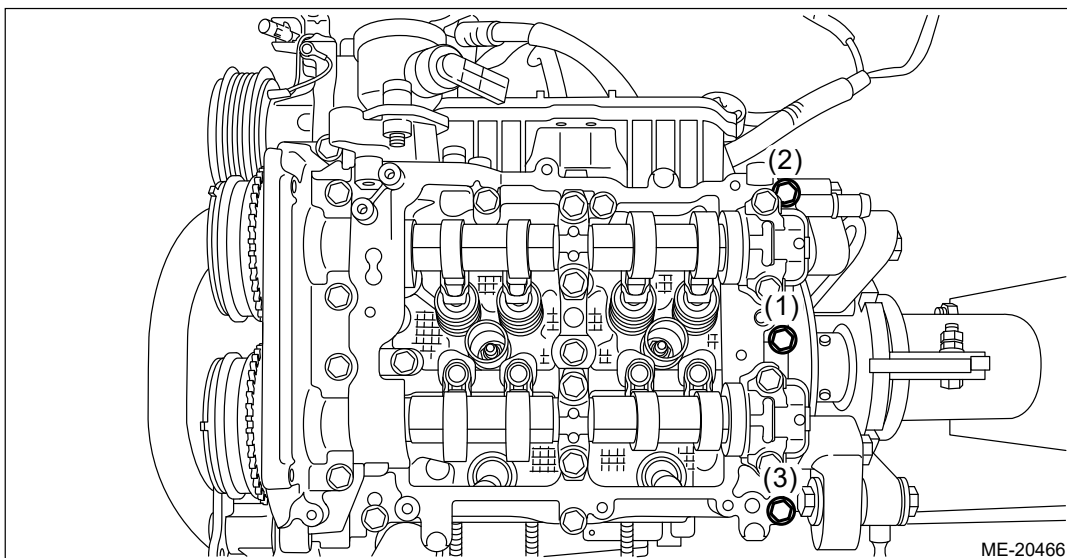
(6) Loosen the bolts (3 places) by 180° in numerical order as shown in the figure.



(7) Tighten the bolts (3 places) with a torque of 18 N·m (1.8 kgf-m, 13.3 ft-lb) in numerical order as shown in the figure.

Note:

After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.





6. Set the part so that the installation surface of the intake manifold is on the upper side.

7. When the cam carrier LH has been disassembled

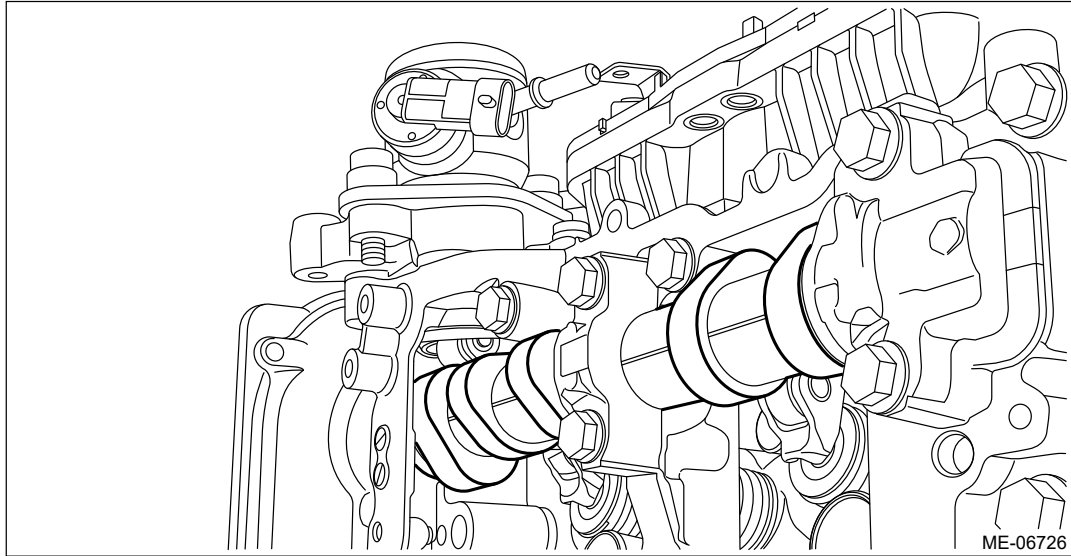
Note:

When the cam carrier LH has been disassembled, perform the following steps also.

- (1) Install the cam sprocket LH.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Sprocket>INSTALLATION > CAM SPROCKET LH.](#)
- (2) Install the high-pressure fuel pump.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>High Pressure Fuel Pump>INSTALLATION.](#)

Note:

Install the high-pressure fuel pump so that the cam lobes on the intake camshaft LH are positioned as shown in the figure. Perform adjustment within the range of zero-lift (in range where it can be turned lightly by hand).

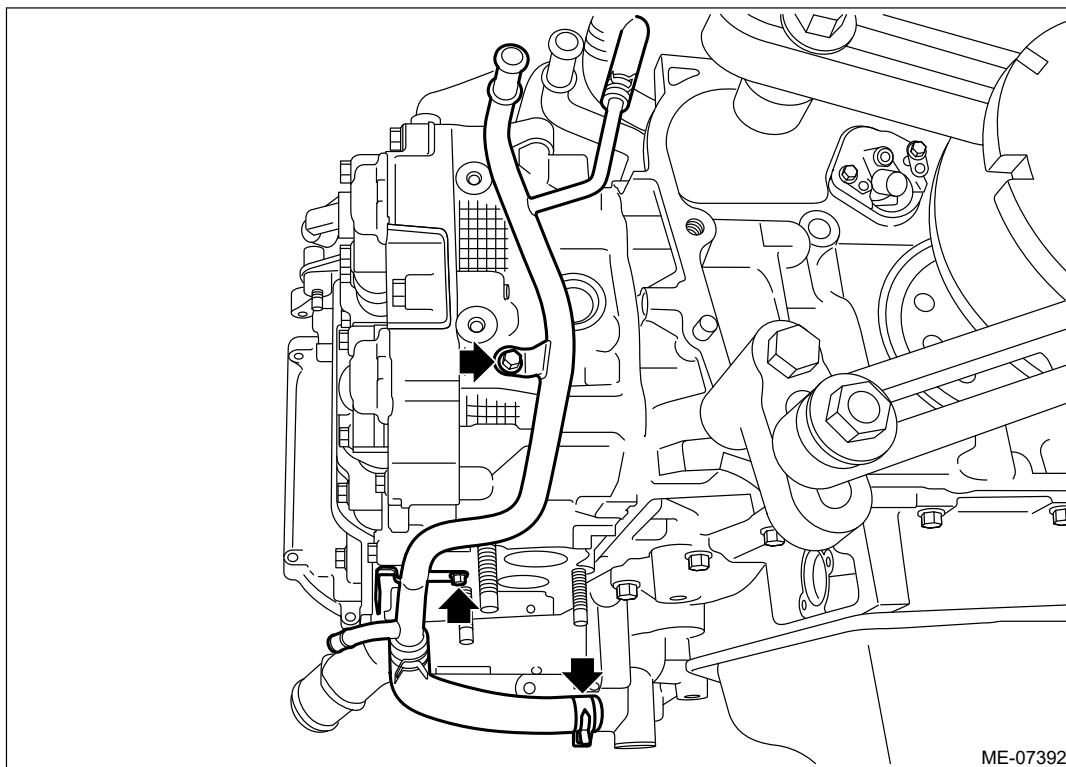


8. Check the cam clearance.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)

9. Connect the water pipe hose to oil pan upper, and install the water pipe assembly.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



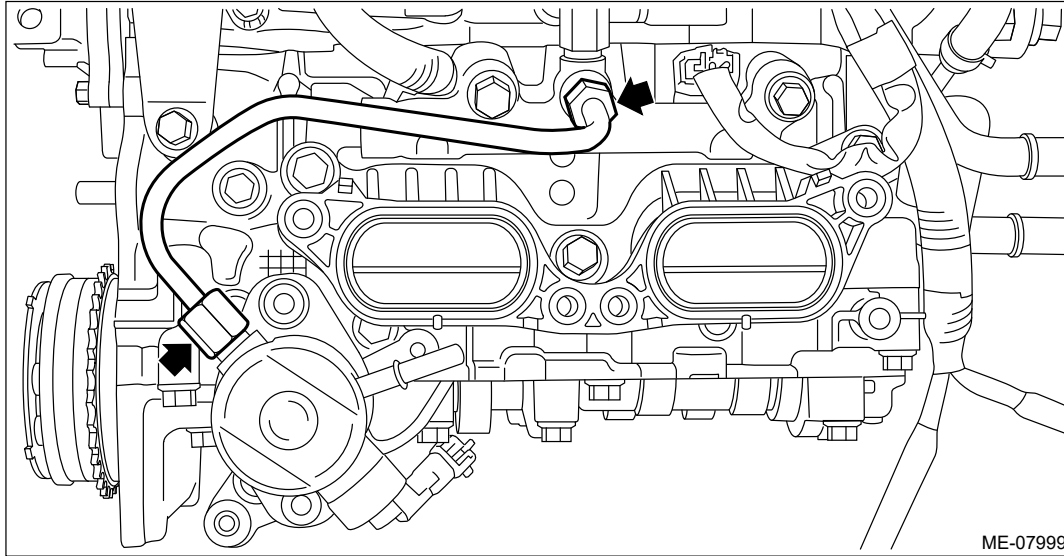
10. Temporarily tighten the flare nuts of the high-pressure fuel delivery pipe to the high-pressure fuel pump and fuel injector pipe by hand until they are seated, and then tighten the flare nuts.

Caution:

Always use a new fuel delivery pipe.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)



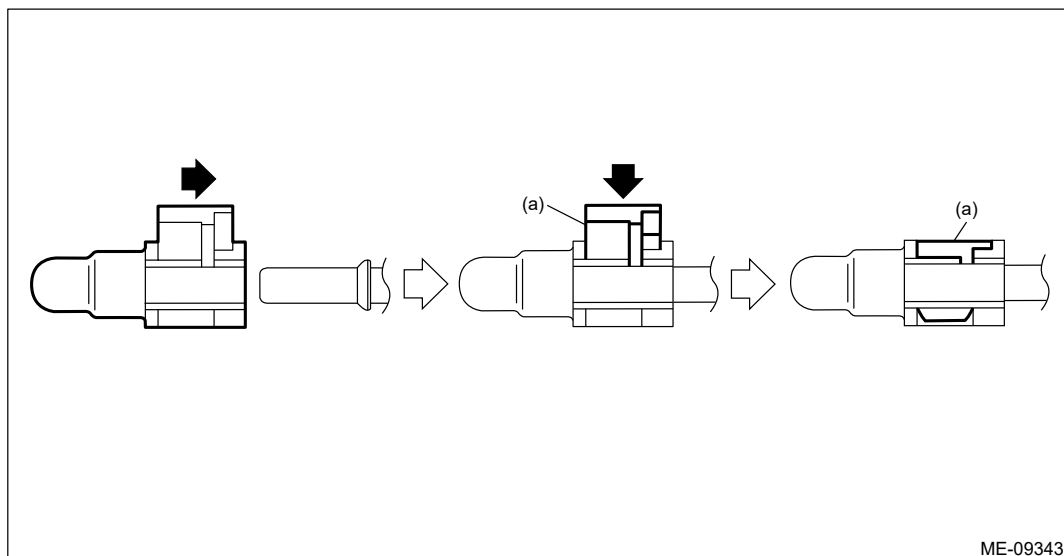
11. Install the fuel delivery pipe to the high-pressure fuel pump, and connect the connector (A) to the high-pressure fuel pump.

Caution:

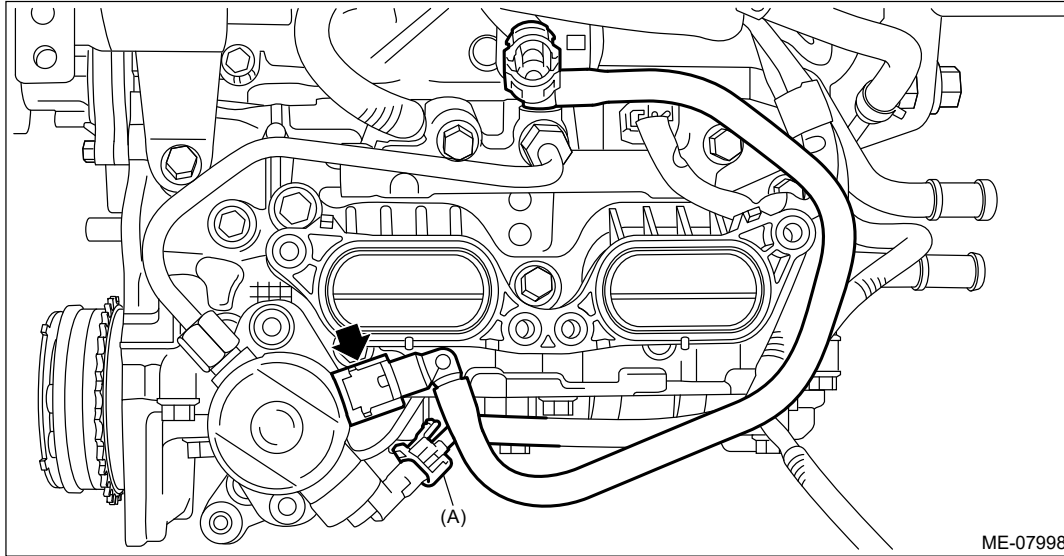
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

Connect the quick connector as shown in the figure.



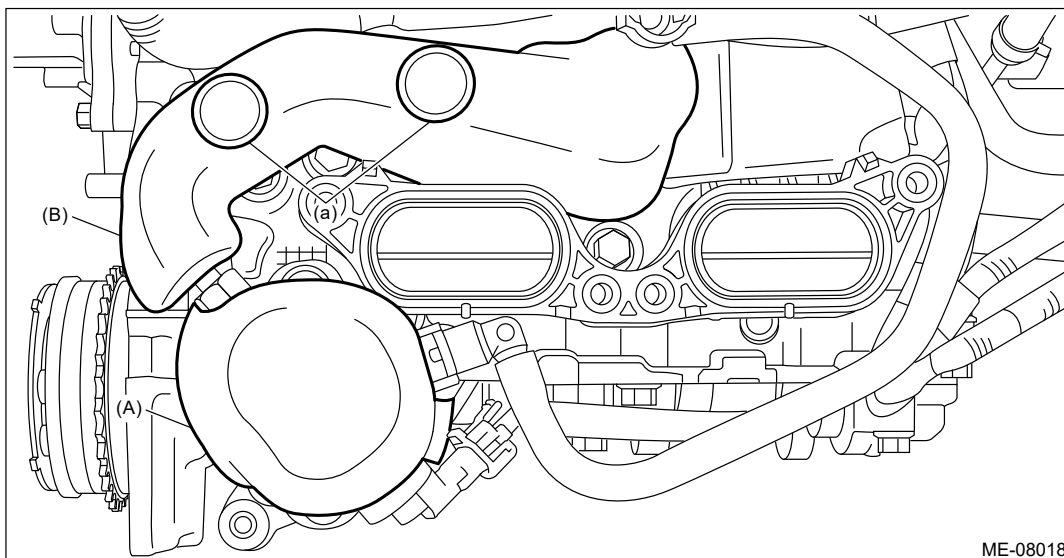
(a) Slider



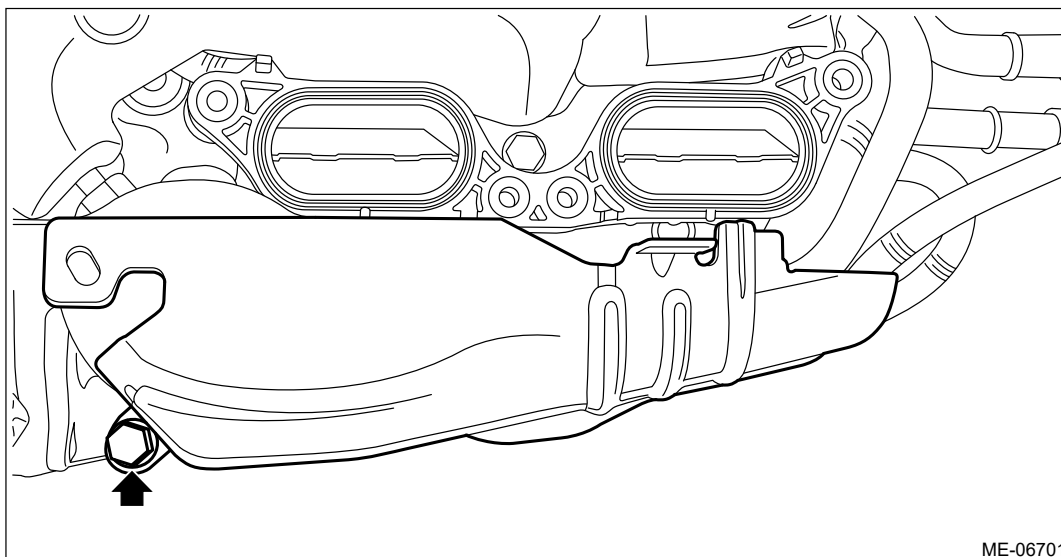
- 12.** Install the fuel pump insulator (A) to the high-pressure fuel pump, and then install the fuel pipe insulator No. 1 (B) to the high-pressure fuel delivery pipe.

Note:

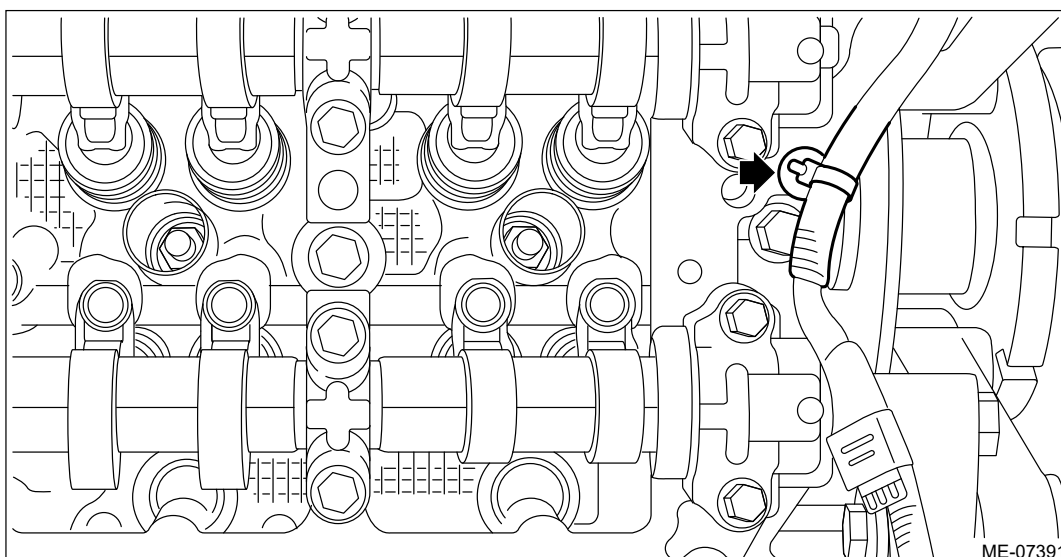
By pushing the sections (a) shown in the figure, fix the fuel pipe insulator No. 1 (B) to the high-pressure fuel delivery pipe.





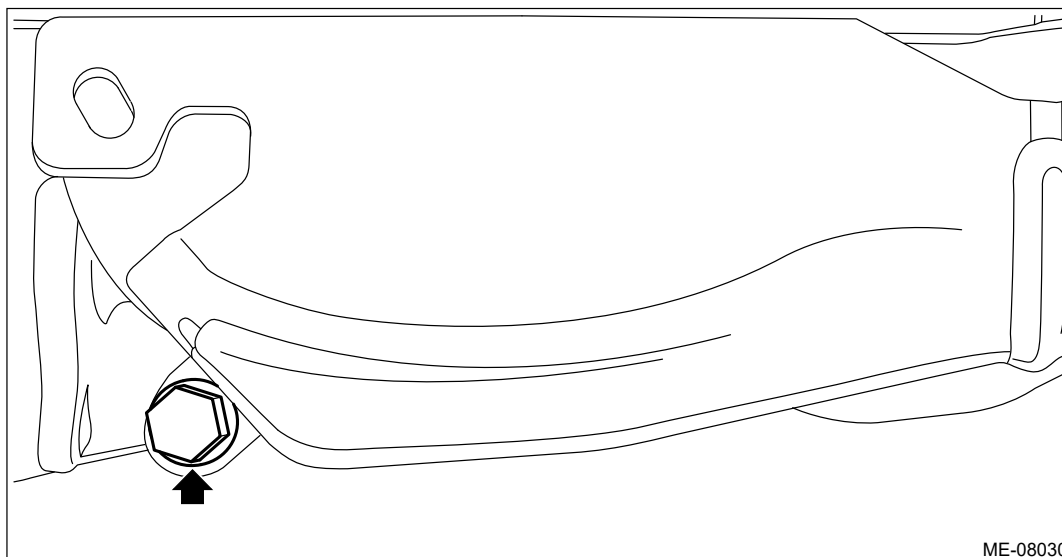
- 13.** Temporarily tighten the bolts securing the fuel pipe protector to the high-pressure fuel pump case.






- 14.** Secure the engine harness to the cam carrier LH with a clip.



- 15.** Install the rocker cover LH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>INSTALLATION >ROCKER COVER LH.](#)
- 16.** Install the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>INSTALLATION.](#)
- 17.** Tighten the bolts securing the fuel pipe protector to the high-pressure fuel pump case.
- Tightening torque:**
19 N·m (1.9 kgf-m, 14.0 ft-lb)







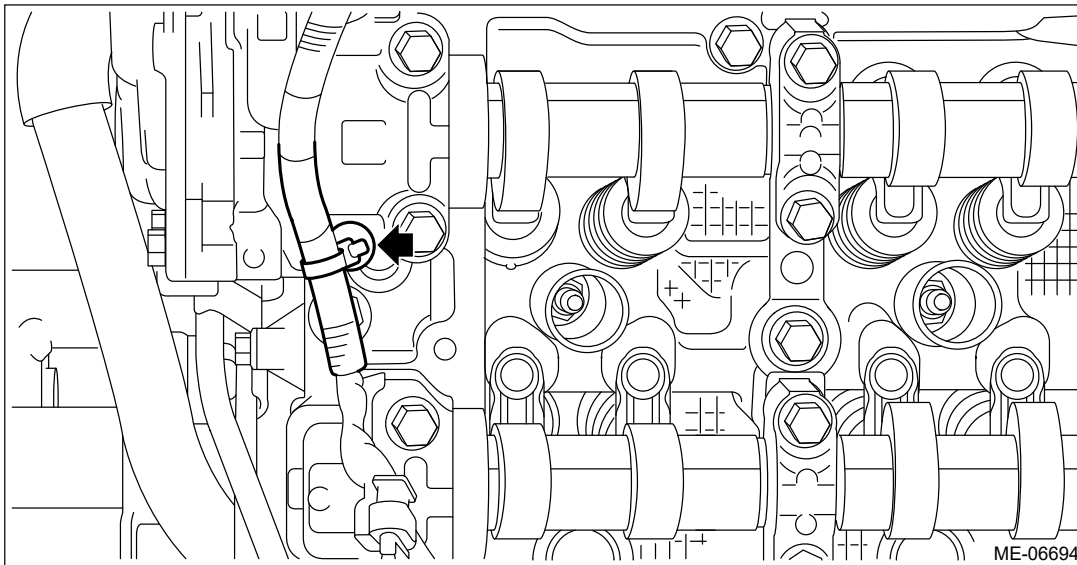
- 18.** Install timing chain LH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN LH.](#)
- 19.** Install the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)
- 20.** Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>INSTALLATION.](#)

MECHANICAL(H4DOTC) > Cam Carrier

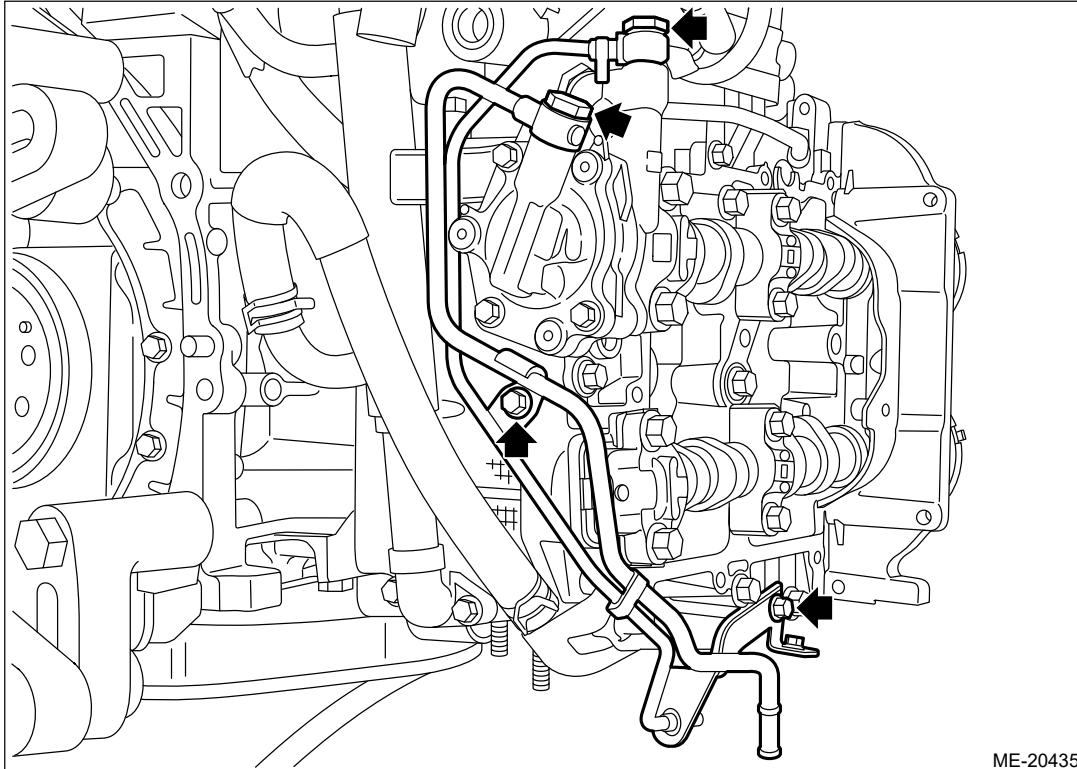
REMOVAL

1. CAM CARRIER RH

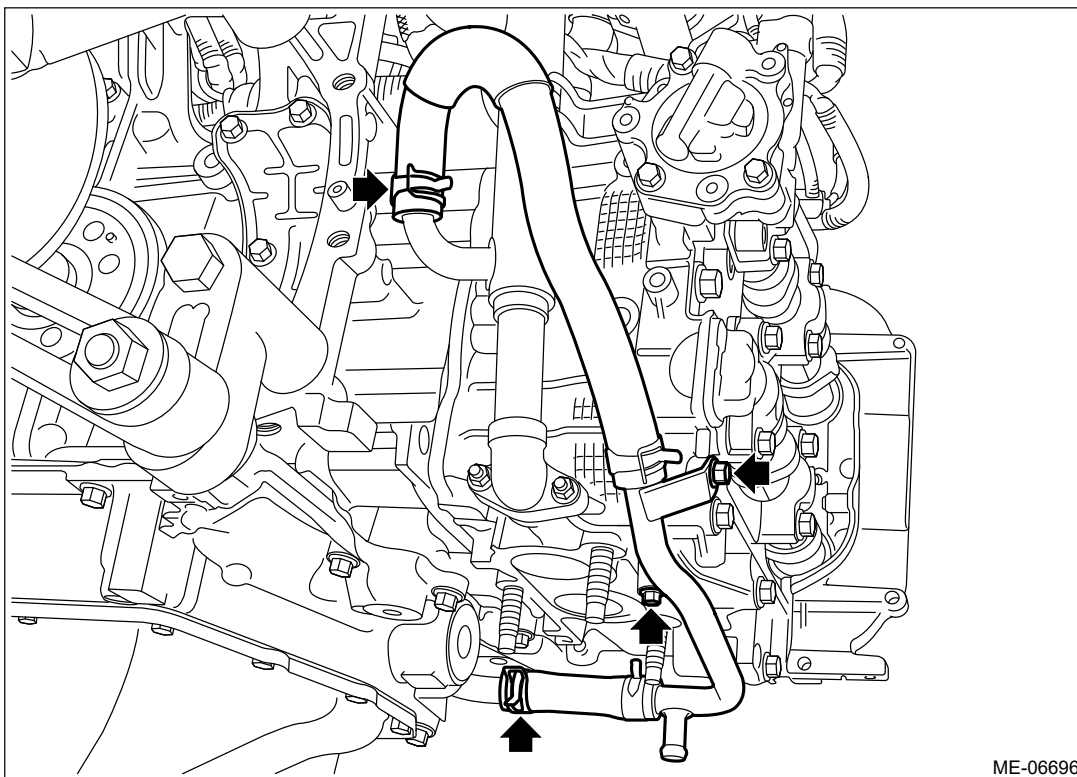
1. Remove the engine from the vehicle.  [Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>REMOVAL.](#)
2. Remove the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
3. Remove the timing chain RH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
4. Remove the rocker cover RH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>REMOVAL > ROCKER COVER RH.](#)
5. Remove the clip holding the engine harness from cam carrier RH.



6. Remove the oil pipe assembly from the scavenge pump and cam carrier RH.



7. Disconnect the water pipe hose from oil pan upper and EGR cooler, and remove the water pipe assembly.



8. When disassembling the cam carrier RH

Note:

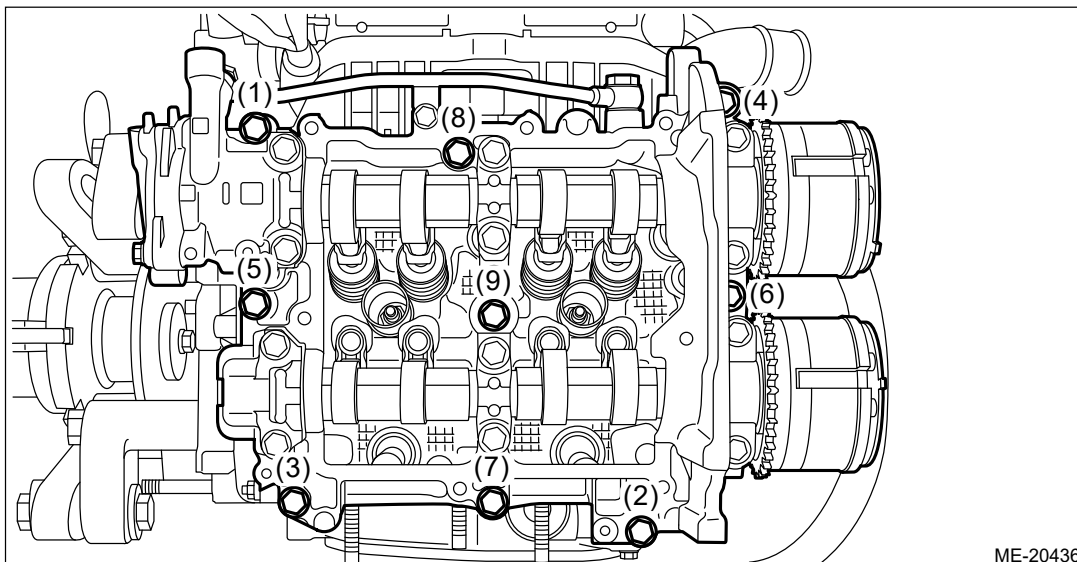
When disassembling the cam carrier RH, perform the following steps also.

- (1) Remove the scavenge pump.  [Ref. to LUBRICATION\(H4DO\)>Scavenge Pump>REMOVAL.](#)

(2) Remove the cam sprocket RH.  Ref. to [MECHANICAL\(H4DOTC\)>Cam Sprocket>REMOVAL > CAM SPROCKET RH.](#)

9. Set the part so that the cam carrier RH is on the upper side.

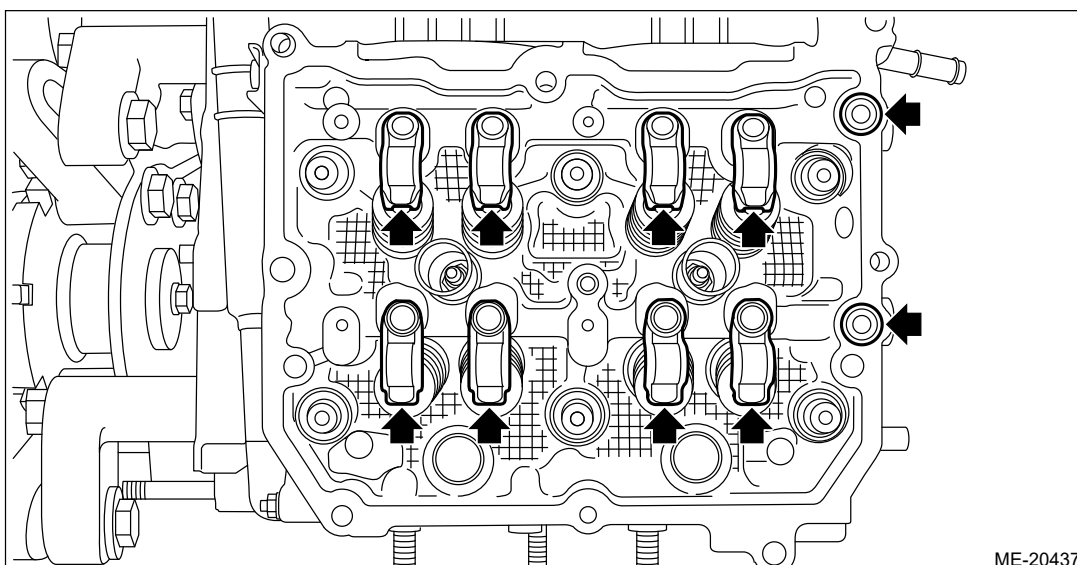
10. Loosen the bolts holding the cam carrier RH equally, a little at a time in numerical sequence as shown in the figure and remove the cam carrier RH.



11. Remove the O-ring and the roller rocker arm from cylinder head RH.

Note:

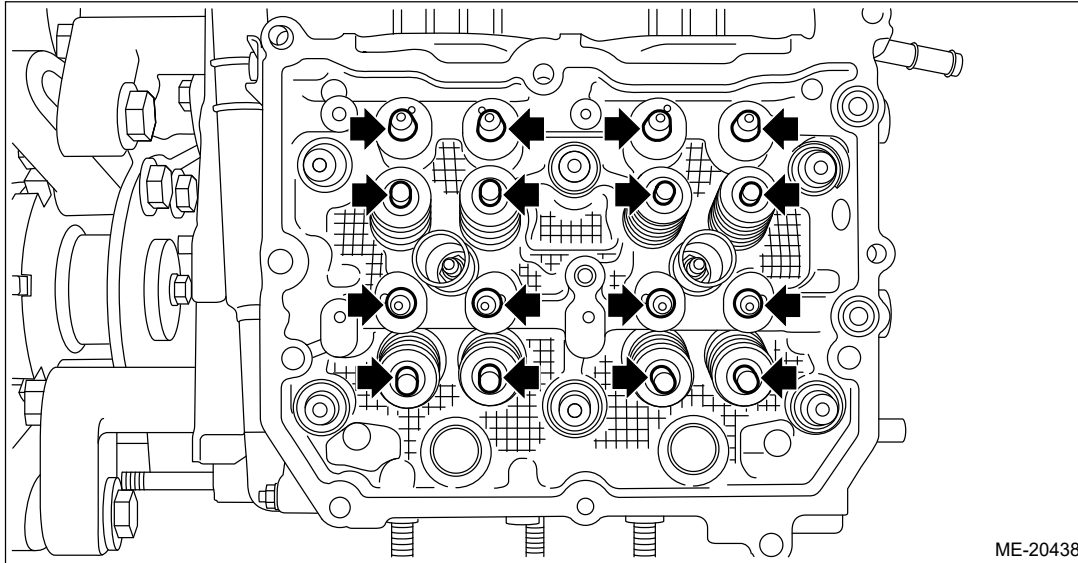
Be careful not to confuse the roller rocker arms.



12. Remove the valve shim and the roller rocker arm pivot from cylinder head RH.






Note:

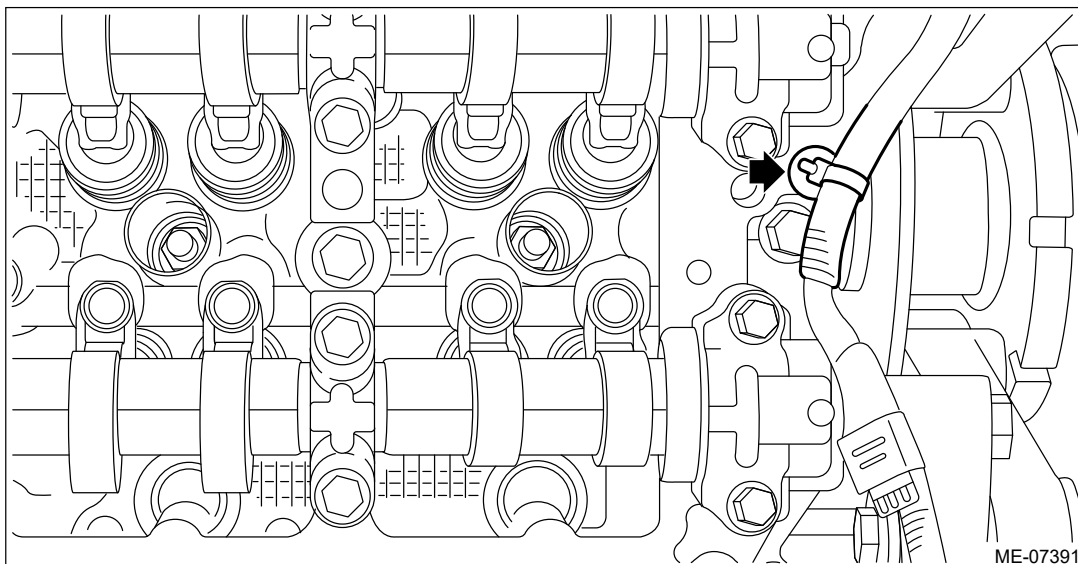
Be careful not to confuse the valve shim and the roller rocker arm pivot.



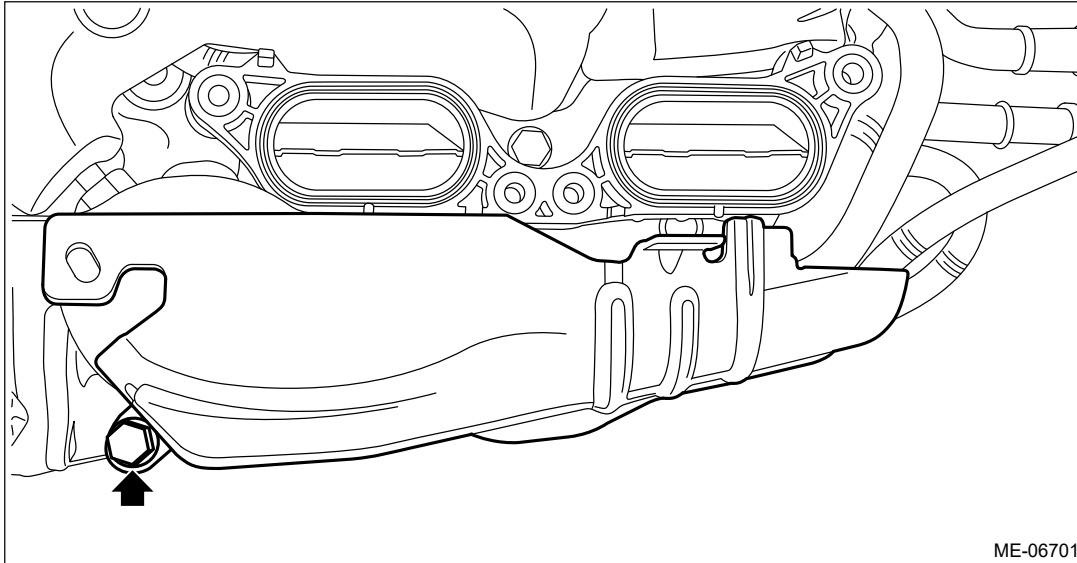
13. Remove the liquid gasket from cam carrier RH and cylinder head RH.

2. CAM CARRIER LH

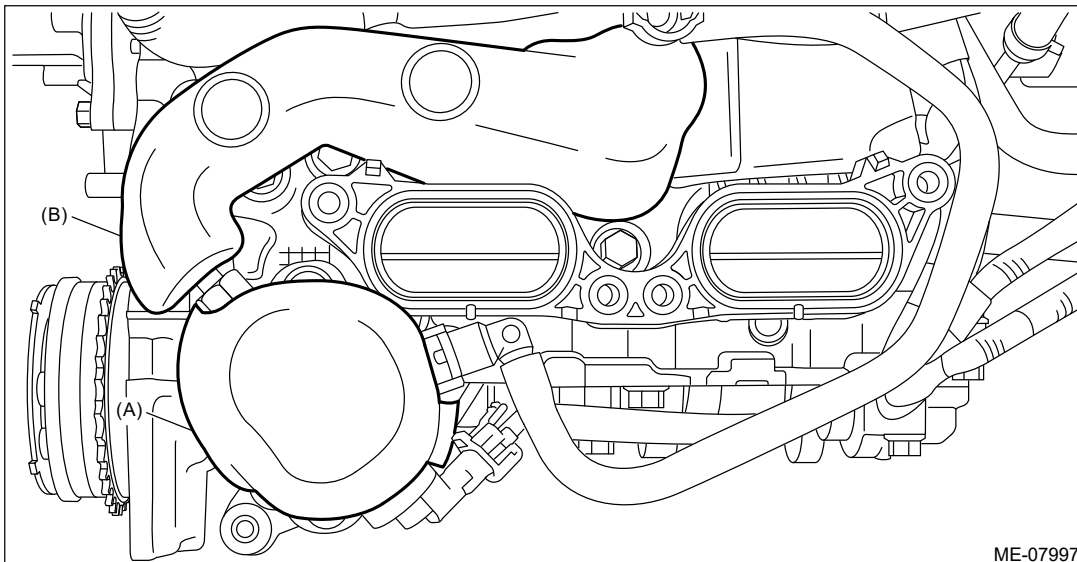
- 1.** Remove the engine from the vehicle.  [Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>REMOVAL.](#)
- 2.** Remove the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
- 3.** Remove the timing chain LH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN LH.](#)
- 4.** Remove the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
- 5.** Remove the rocker cover LH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>REMOVAL > ROCKER COVER LH.](#)
- 6.** Remove the clip holding the engine harness from cam carrier LH.



7. Remove the fuel pipe protector from the high-pressure fuel pump case.



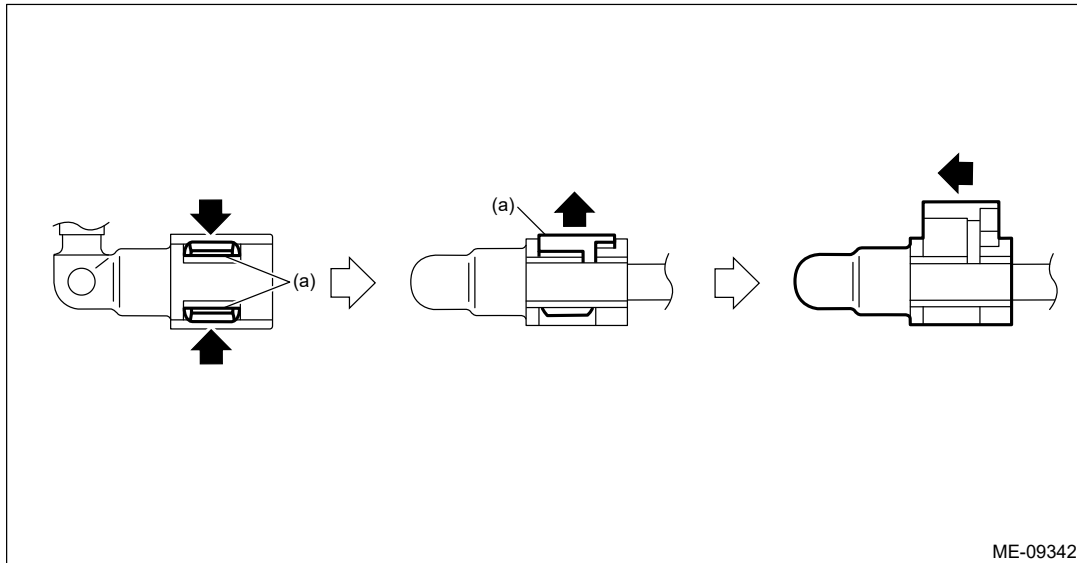
8. Remove the fuel pump insulator (A) from the high-pressure fuel pump, and then remove the fuel pipe insulator No. 1 (B) from the high-pressure fuel delivery pipe.



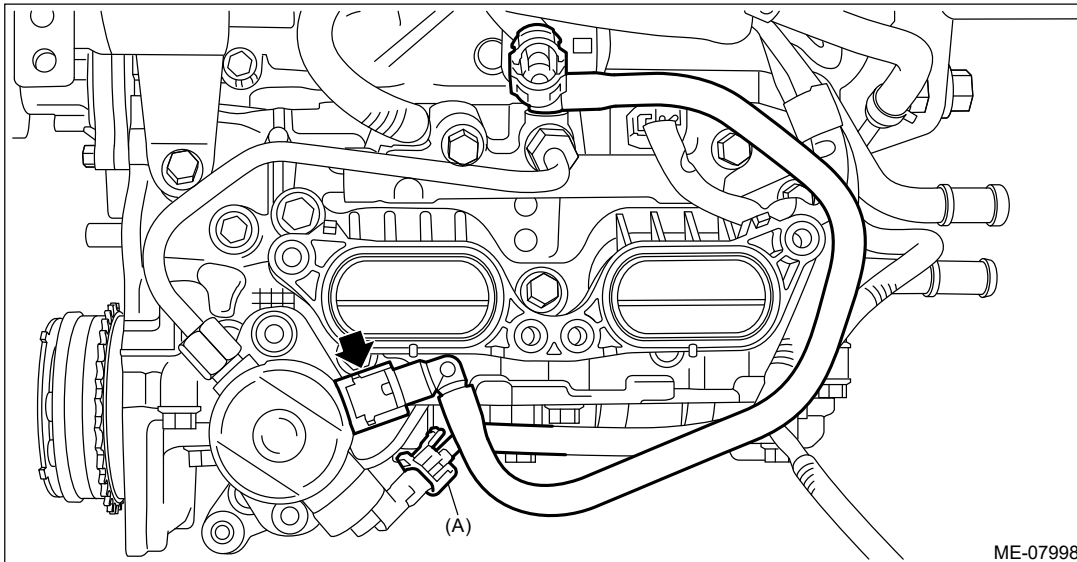
9. Disconnect the connector (A) from the high-pressure fuel pump, and remove the fuel delivery pipe from the high-pressure fuel pump.

Note:

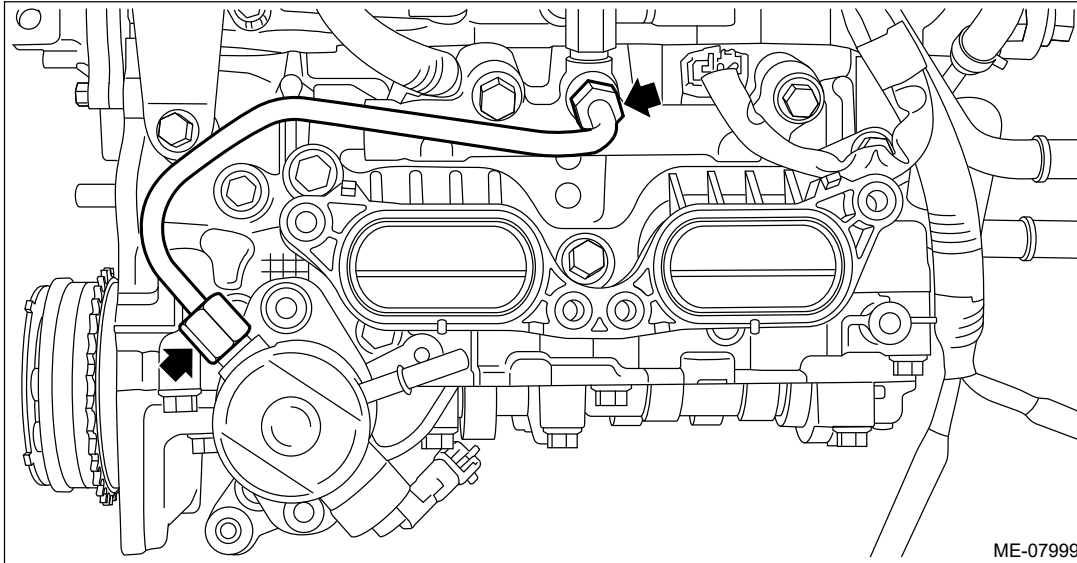
Disconnect the quick connector as shown in the figure.



(a) Slider

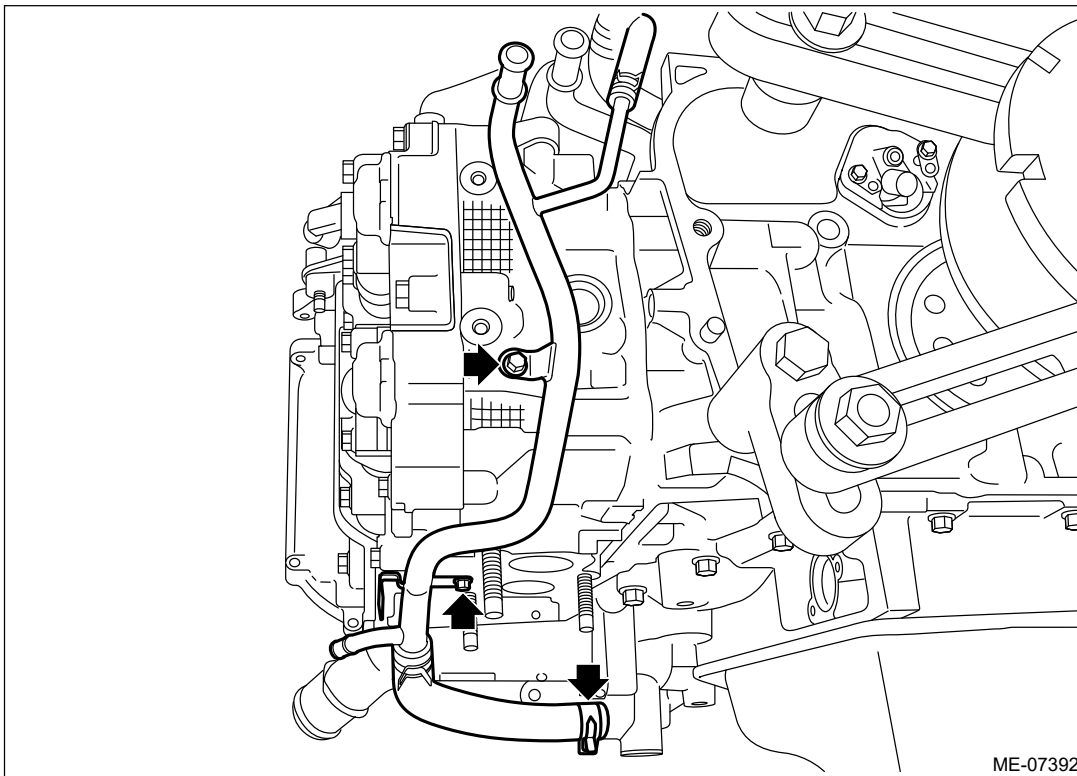


10. Remove the high-pressure fuel delivery pipe from the high-pressure fuel pump and fuel injector pipe.



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- 11.** Disconnect the water pipe hose from oil pan upper, and remove the water pipe assembly.





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- 12.** When disassembling the cam carrier LH

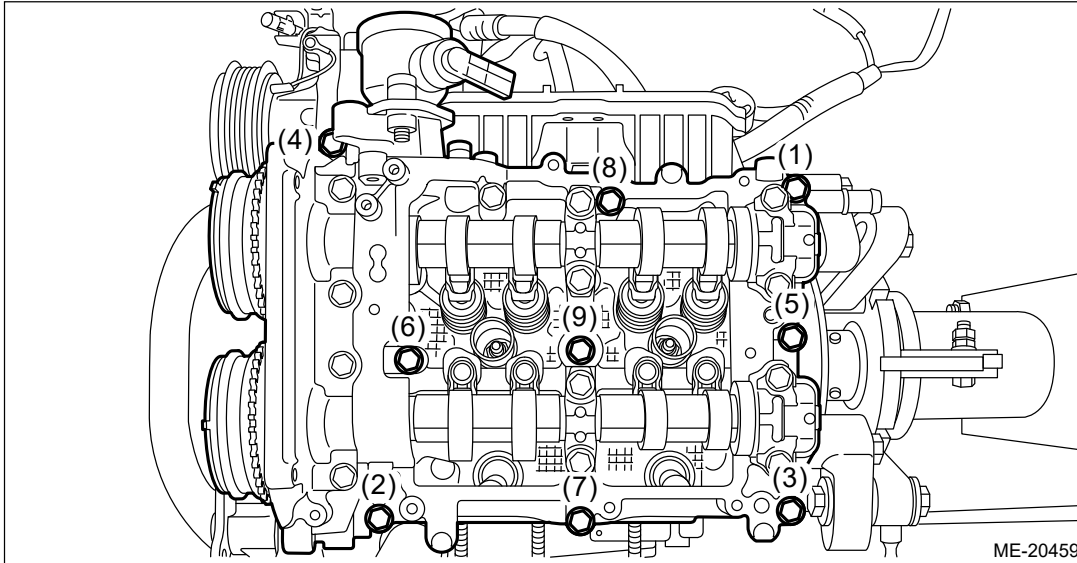
Note:

When disassembling the cam carrier LH, perform the following steps also.

- (1) Remove the high-pressure fuel pump.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>High Pressure Fuel Pump>REMOVAL.](#)
- (2) Remove the cam sprocket LH.  Ref. to [MECHANICAL\(H4DOTC\)>Cam Sprocket>REMOVAL > CAM SPROCKET LH.](#)

- 13.** Set the part so that the cam carrier LH is on the upper side.

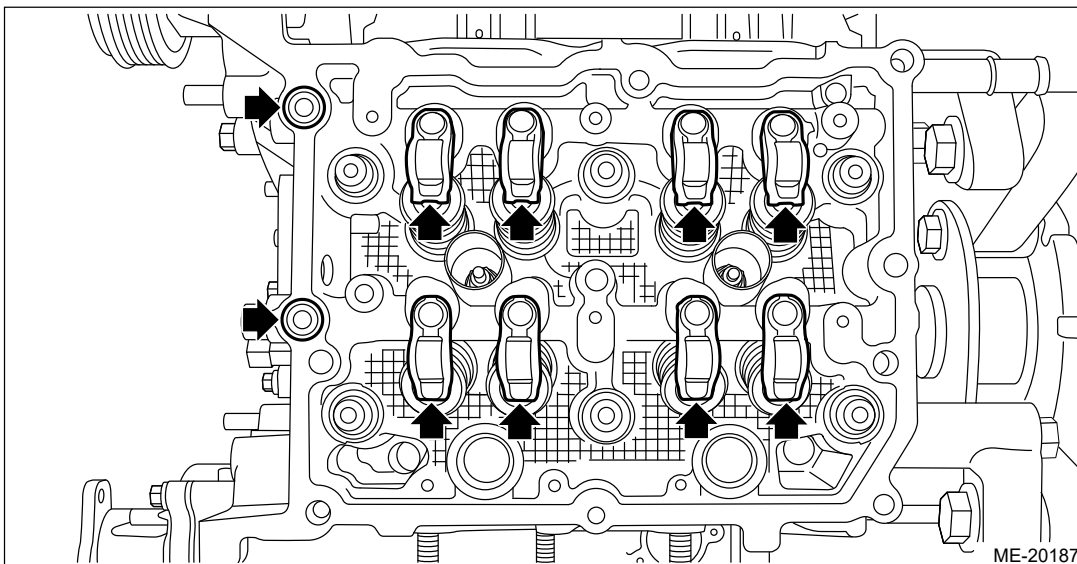
- 14.** Loosen the bolts holding the cam carrier LH equally, a little at a time in numerical sequence as shown in the figure and remove the cam carrier LH.



15. Remove the O-ring and the roller rocker arm from cylinder head LH.

Note:

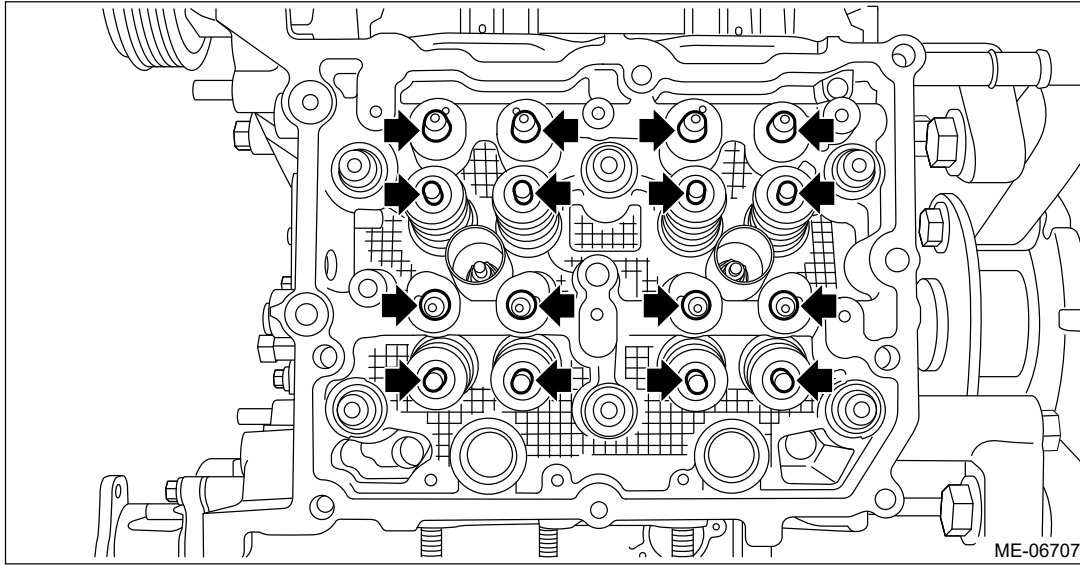
Be careful not to confuse the roller rocker arms.



16. Remove the valve shim and the roller rocker arm pivot from cylinder head LH.

Note:

Be careful not to confuse the valve shim and the roller rocker arm pivot.



17. Remove the liquid gasket from cam carrier LH and cylinder head LH.

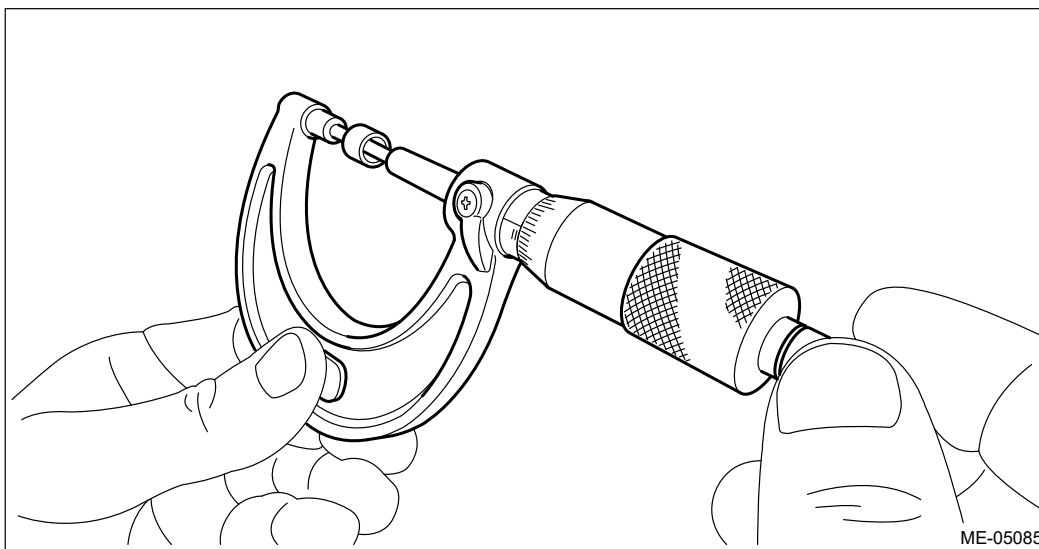
MECHANICAL(H4DOTC) > Cam Clearance

ADJUSTMENT

1. Remove the engine from the vehicle. [🔗 Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>REMOVAL.](#)
2. Remove the chain cover. [🔗 Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
3. When adjusting #1 and #3 cylinders
 - (1) Remove the timing chain RH. [🔗 Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
 - (2) Remove the cam carrier RH. [🔗 Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>REMOVAL > CAM CARRIER RH.](#)
 - (3) Measure the thickness of valve shim using micrometer.

Note:

Measurement should be performed at a temperature of 20°C (68°F).



- (4) Select a valve shim of suitable thickness using the measured cam clearance and valve shim thickness.

Note:

Use a new valve shim.

Intake side: $S = T + 1.69 \times (V - 0.13 \text{ mm (0.0051 in)})$

Exhaust side: $S = T + 1.87 \times (V - 0.22 \text{ mm (0.0087 in)})$

S: Valve shim thickness required

V: Measured cam clearance

T: Current valve shim thickness

- (5) Install the cam carrier RH. [🔗 Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>INSTALLATION > CAM CARRIER RH.](#)
- (6) Check all the cam clearance of RH side at this time. If the cam clearance is not within the standard value, repeat the procedure over again from step 2).

Note:

When the removing/installing of cam carrier RH has been performed, cam clearance may be outside the standard value. Checking of all cam clearance of RH side is necessary. Refer to INSPECTION of "Cam Clearance" for the cam clearance inspection.
[🔗 Ref. to MECHANICAL\(H4DOTC\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)

Cam clearance:

Intake

Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

Exhaust

Standard

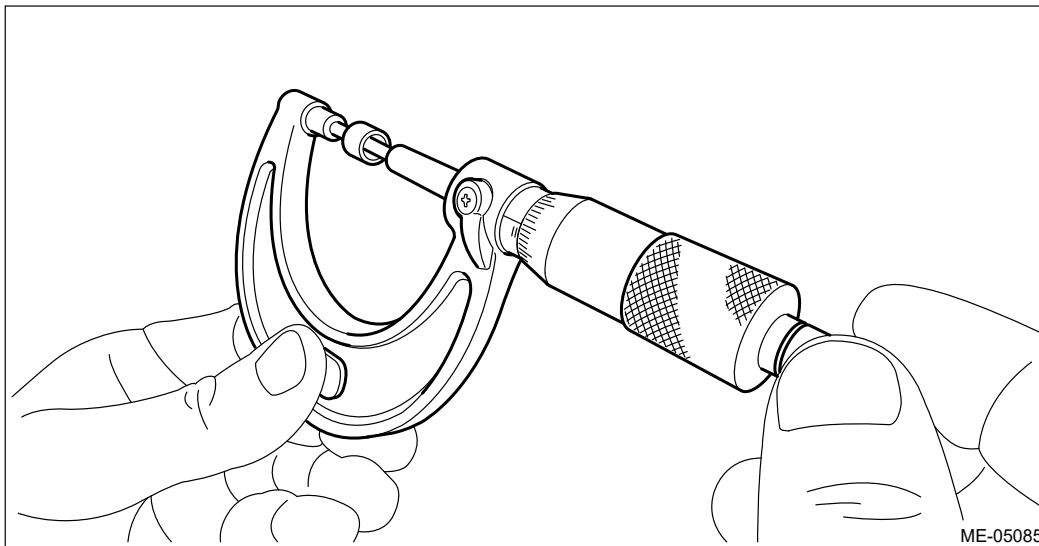
0.22 ± 0.02 mm (0.0087 ± 0.0008 in)

4. When adjusting #2 and #4 cylinders

- (1) Remove the timing chain LH. [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN LH.](#)
- (2) Remove the intake manifold. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
- (3) Remove the cam carrier LH. [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>REMOVAL > CAM CARRIER LH.](#)
- (4) Measure the thickness of valve shim using micrometer.

Note:

Measurement should be performed at a temperature of 20°C (68°F).



- (5) Select a valve shim of suitable thickness using the measured cam clearance and valve shim thickness.

Note:

Use a new valve shim.

| |
|---|
| Intake side: $S = T + 1.69 \times (V - 0.13 \text{ mm (0.0051 in)})$ |
| Exhaust side: $S = T + 1.87 \times (V - 0.22 \text{ mm (0.0087 in)})$ |
| S: Valve shim thickness required |
| V: Measured cam clearance |
| T: Current valve shim thickness |

- (6) Install the cam carrier LH. [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>INSTALLATION > CAM CARRIER LH.](#)
- (7) Check all the cam clearance of LH side at this time. If the cam clearance is not within the standard value, repeat the procedure over again from step 3).

Note:

When the removing/installing of cam carrier LH has been performed, cam clearance may be outside the standard value. Checking of all cam clearance of LH side is necessary. Refer to INSPECTION of "Cam Clearance" for the cam clearance inspection.
[Ref. to MECHANICAL\(H4DOTC\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)

Cam clearance:

Intake

Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

Exhaust

Standard

0.22 ± 0.02 mm (0.0087 ± 0.0008 in)

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

INSPECTION

1. WHEN TIMING CHAIN ASSEMBLY IS NOT REMOVED

Caution:

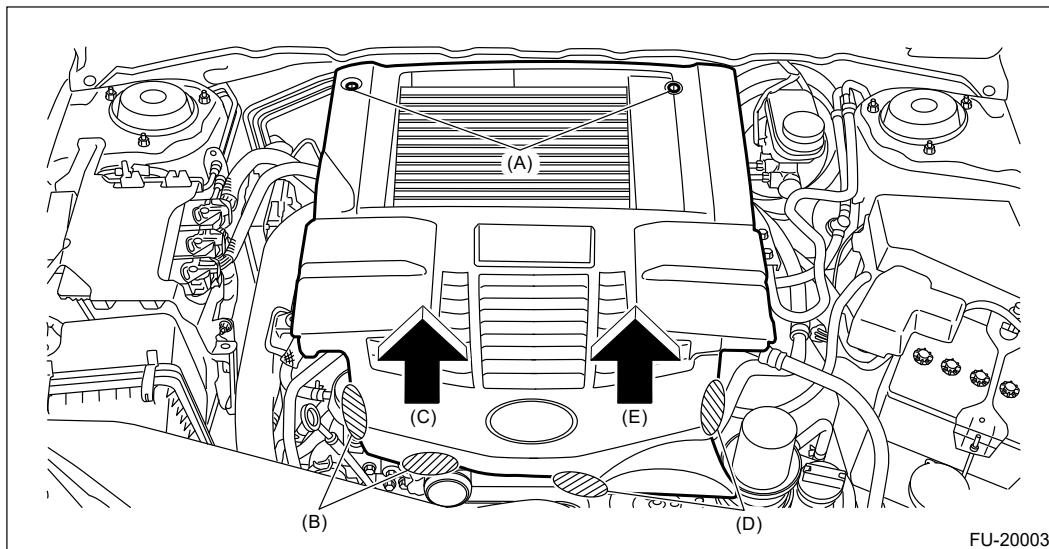
When working on the vehicle, if engine oil is spilt onto the exhaust pipe, wipe it off with cloth to avoid emission of smoke or causing a fire.

Note:

- Inspection of cam clearance should be performed while engine is cold.
- If the engine is removed from vehicle, performing the steps 1) to 2) is not necessary.

1. Remove the collector cover.

- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)

3. Remove the V-belts.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>REMOVAL.](#)

4. When inspecting #1 and #3 cylinders

- (1) Remove the rocker cover RH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>REMOVAL > ROCKER COVER RH.](#)

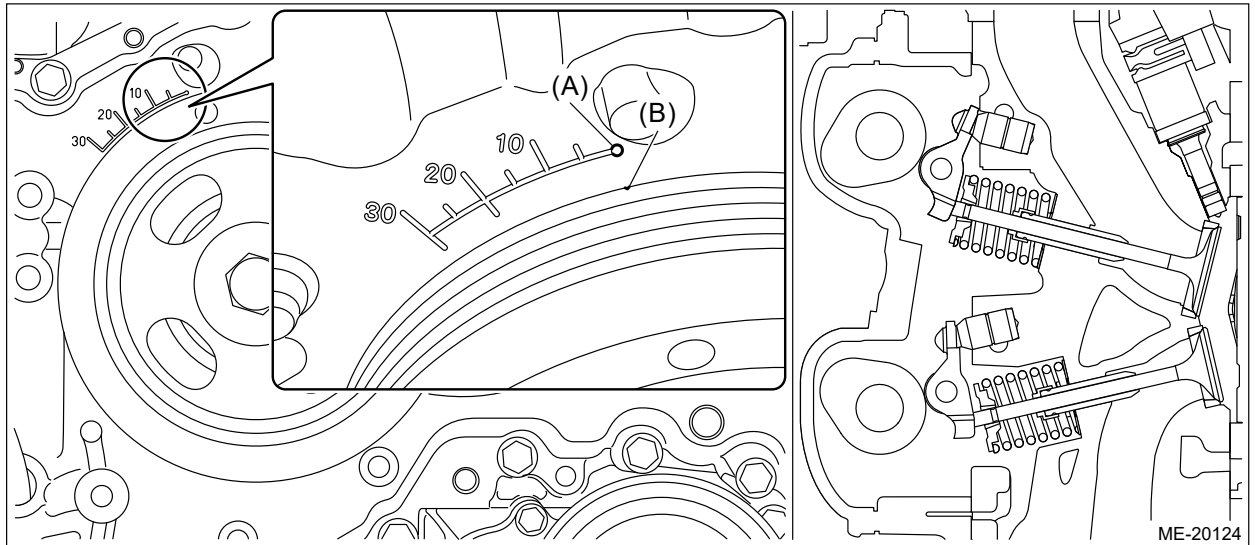
Note:

When working on the vehicle, place a suitable container under the vehicle.

- (2) Set #1 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

Note:

When the timing mark (B) on crank pulley is aligned to the 0° in timing gauge (A) on chain cover as shown in the figure, the #1 cylinder piston is located at TDC of compression stroke if the intake camshaft and exhaust camshaft does not depress the #1 cylinder intake side roller rocker arm (intake valve) and exhaust side roller rocker arm (exhaust valve). If roller rocker arm (valve) is depressed, turn the crank pulley by 360° in order to make #1 cylinder piston at TDC of compression stroke.



(3) Check the cam clearance for #1 cylinder intake, #1 cylinder exhaust and #3 cylinder exhaust.

Note:

- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Intake

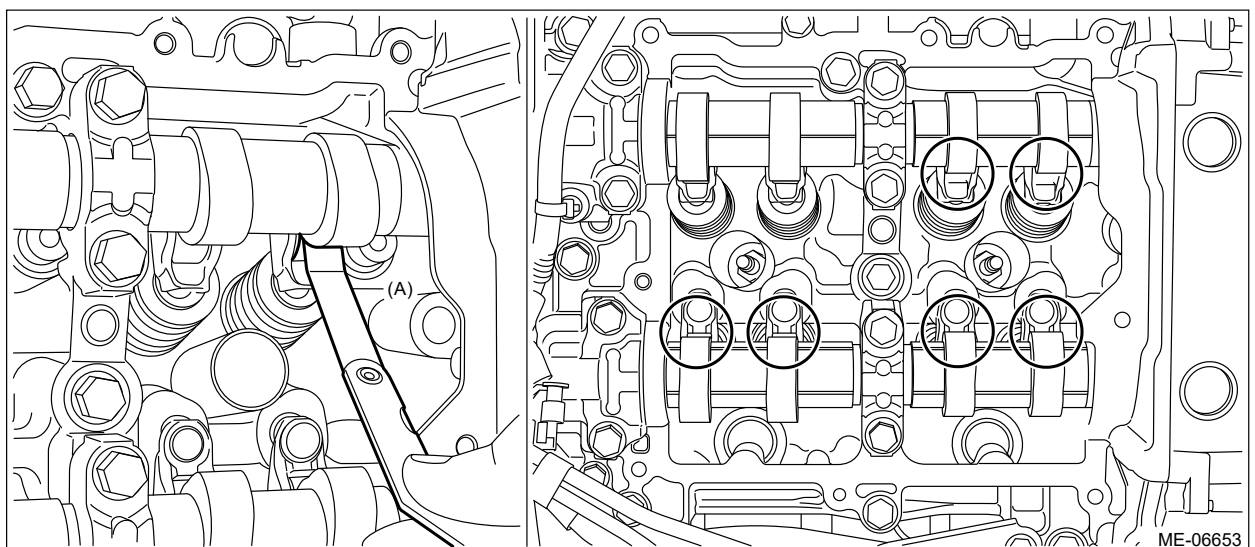
Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

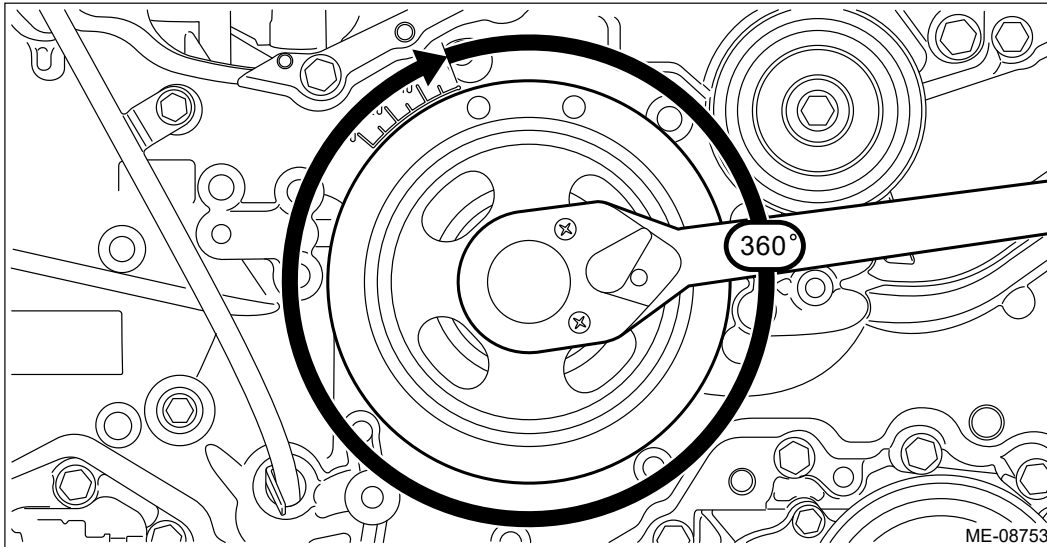
Exhaust

Standard

0.22 ± 0.02 mm (0.0087 ± 0.0008 in)



(4) Turn the crank pulley by 360°.



(5) Check the cam clearance of #3 cylinder intake.

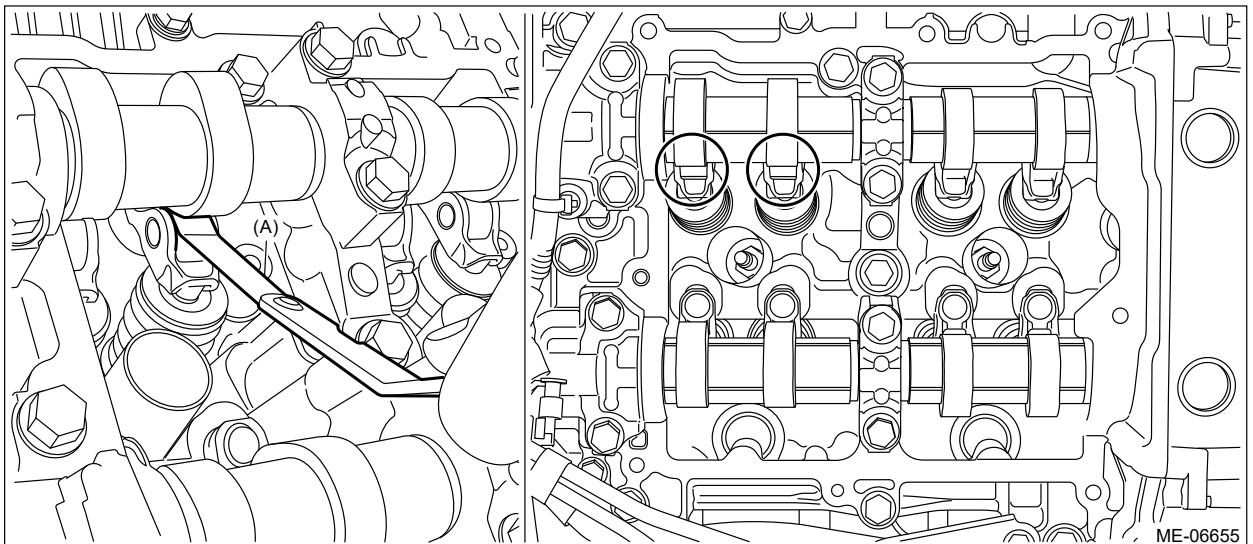
Note:

- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Standard

$$0.13^{+0.02}_{-0.03} \text{ mm } (0.0051^{+0.0008}_{-0.0012} \text{ in})$$



5. When inspecting #2 and #4 cylinders

(1) Remove the rocker cover LH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>REMOVAL >ROCKER COVER LH.](#)

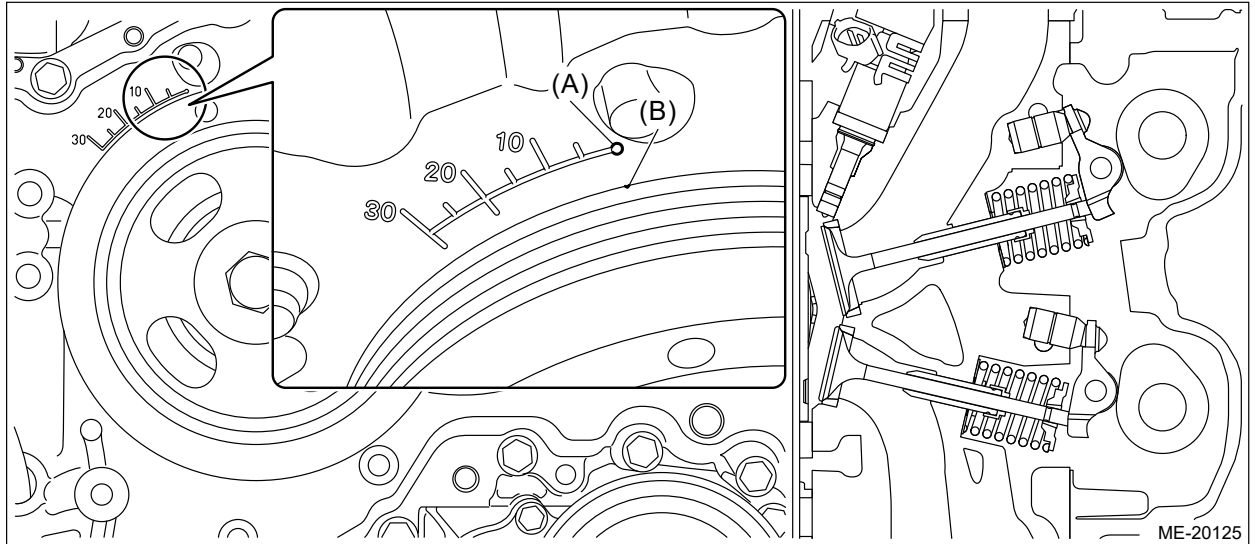
Note:

When working on the vehicle, place a suitable container under the vehicle.

(2) Set #2 cylinder piston to top dead center of compression stroke by rotating the crank pulley clockwise using the socket wrench.

Note:

When the timing mark (B) on crank pulley is aligned to the 0° in timing gauge (A) on chain cover as shown in the figure, the #2 cylinder piston is located at TDC of compression stroke if the intake camshaft and exhaust camshaft does not depress the #2 cylinder intake side roller rocker arm (intake valve) and exhaust side roller rocker arm (exhaust valve). If roller rocker arm (valve) is depressed, turn the crank pulley by 360° in order to make #2 cylinder piston at TDC of compression stroke.



- (3) Check the cam clearance for #2 cylinder intake, #2 cylinder exhaust and #4 cylinder exhaust.

Note:

- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Intake

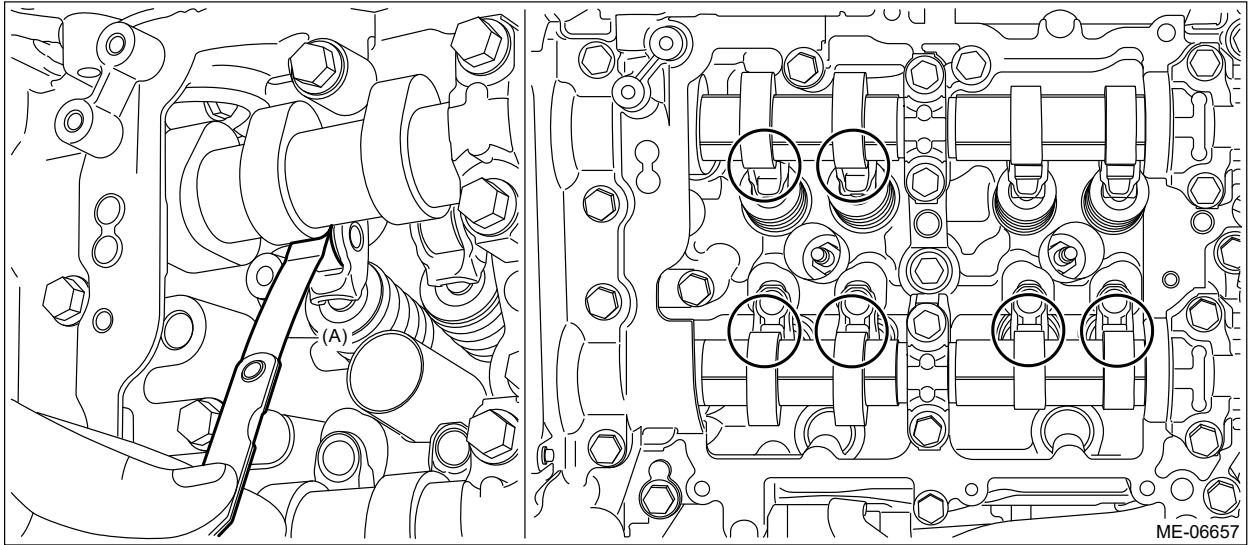
Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

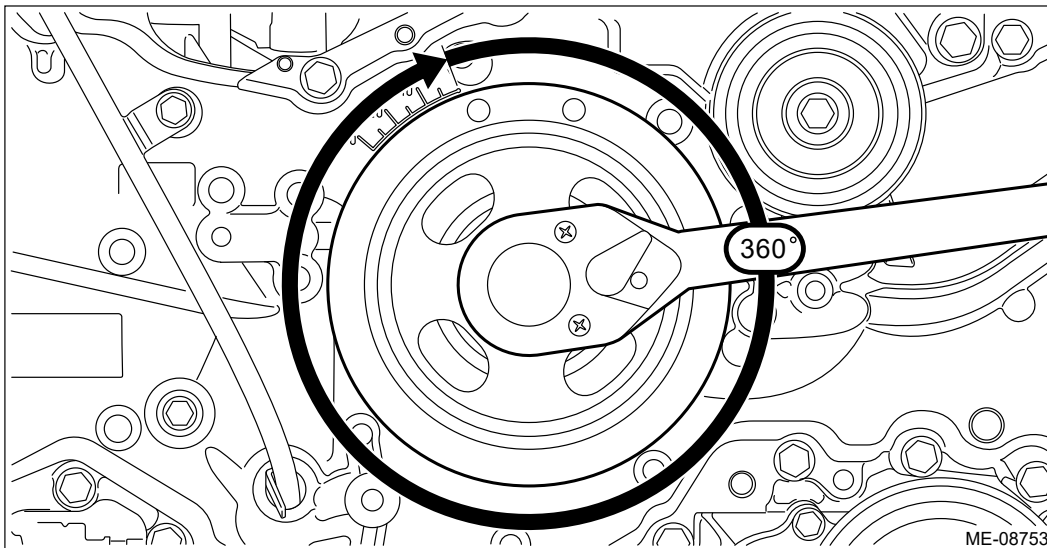
Exhaust

Standard

0.22 ± 0.02 mm (0.0087 ± 0.0008 in)



(4) Turn the crank pulley by 360°.



(5) Check the cam clearance of #4 cylinder intake.

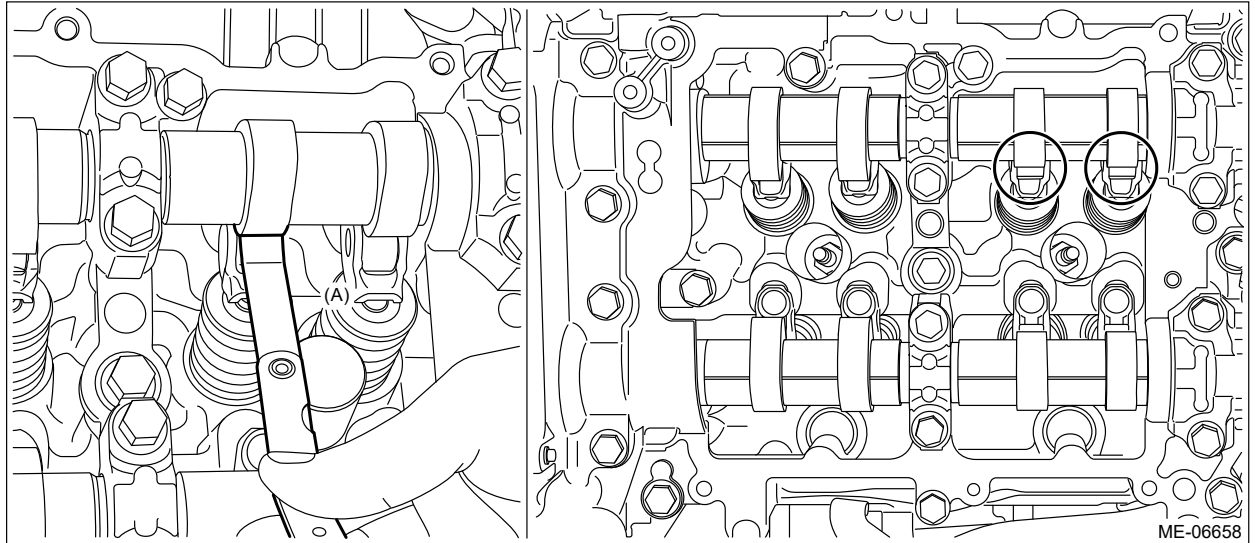
Note:


- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)



6. If necessary, adjust the cam clearance.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Clearance>ADJUSTMENT.](#)
7. After inspection, install the related parts in the reverse order of removal.

2. WHEN TIMING CHAIN ASSEMBLY IS REMOVED

Note:

Inspection of cam clearance should be performed while engine is cold.

1. When inspecting #1 and #3 cylinders

- (1) Remove the rocker cover RH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>REMOVAL >ROCKER COVER RH.](#)

Note:

When working on the vehicle, place a suitable container under the vehicle.

- (2) Check the #1 and #3 cylinder cam clearance.

Caution:

Intake and exhaust camshafts can be independently rotated with the timing chain removed. When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn it to the outside of range of zero lift (cam base circle position) (in range where it can be turned lightly by hand).

Note:

- For cam clearance inspection, adjust the cam base circle position so that the thickness gauge (A) can be inserted easily by hand turning the camshaft (cam sprocket) to be measured.
- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Intake

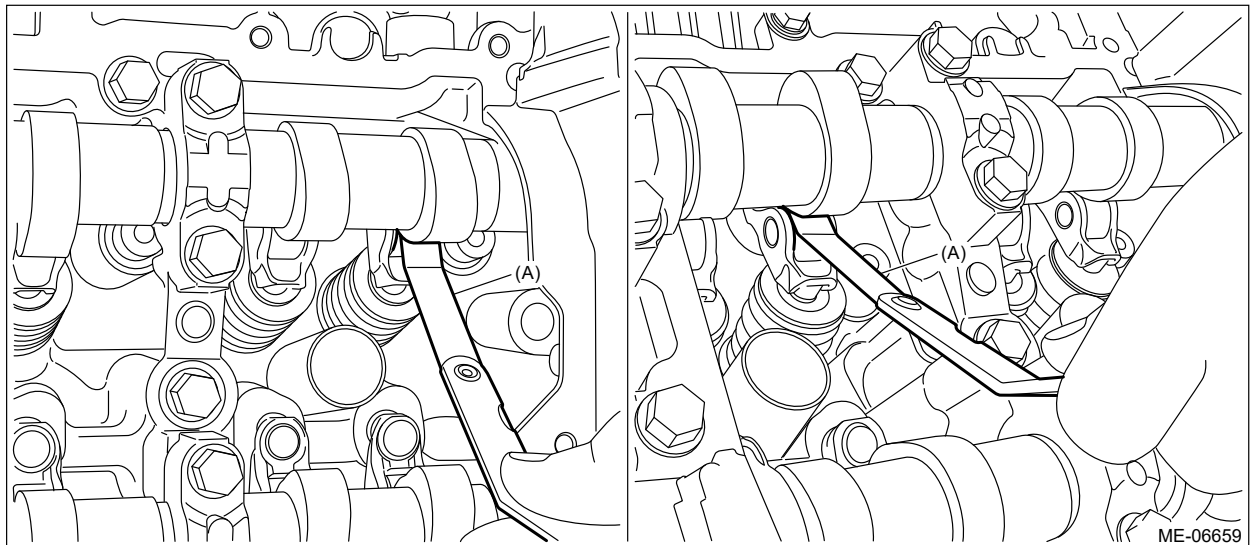
Standard

$0.13^{+0.02}_{-0.03}$ mm ($0.0051^{+0.0008}_{-0.0012}$ in)

Exhaust

Standard

0.22±0.02 mm (0.0087±0.0008 in)



2. When inspecting #2 and #4 cylinders

- (1) Remove the rocker cover LH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>REMOVAL >ROCKER COVER LH.](#)

Note:

When working on the vehicle, place a suitable container under the vehicle.

- (2) Check the #2 and #4 cylinder cam clearance.

Caution:

Intake and exhaust camshafts can be independently rotated with the timing chain removed. When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn it to the outside of range of zero lift (cam base circle position) (in range where it can be turned lightly by hand).

Note:

- Because the intake camshaft is pressurized by the high-pressure fuel pump, it is almost impossible to turn the intake camshaft lightly by hand. Since the zero-lift position is adjusted at the removal of the timing chain LH, measure the cam clearance at that position.
- For cam clearance inspection on exhaust side, adjust the cam base circle position so that the thickness gauge (A) can be inserted easily by hand turning the exhaust camshaft (cam sprocket).
- Measure the roller surface of cam base circle and roller rocker arm using thickness gauge (A).
- If the measured value is out of standard, take notes of the value in order to adjust the cam clearance later on.

Cam clearance:

Intake

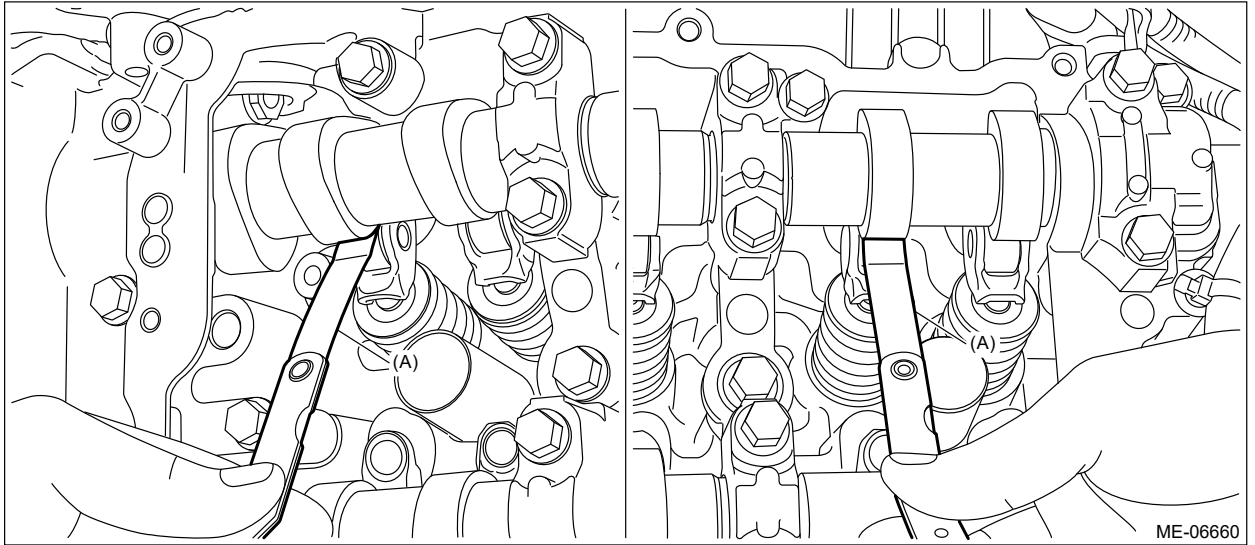
Standard


0.13^{+0.02}_{-0.03} mm (0.0051^{+0.0008}_{-0.0012} in)

Exhaust

Standard

0.22±0.02 mm (0.0087±0.0008 in)



3. If necessary, adjust the cam clearance.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Clearance>ADJUSTMENT.](#)
4. After inspection, install the related parts in the reverse order of removal.

MECHANICAL(H4DOTC) > Cam Sprocket

INSPECTION

Check the cam sprocket teeth for abnormal wear and scratches.

INSTALLATION

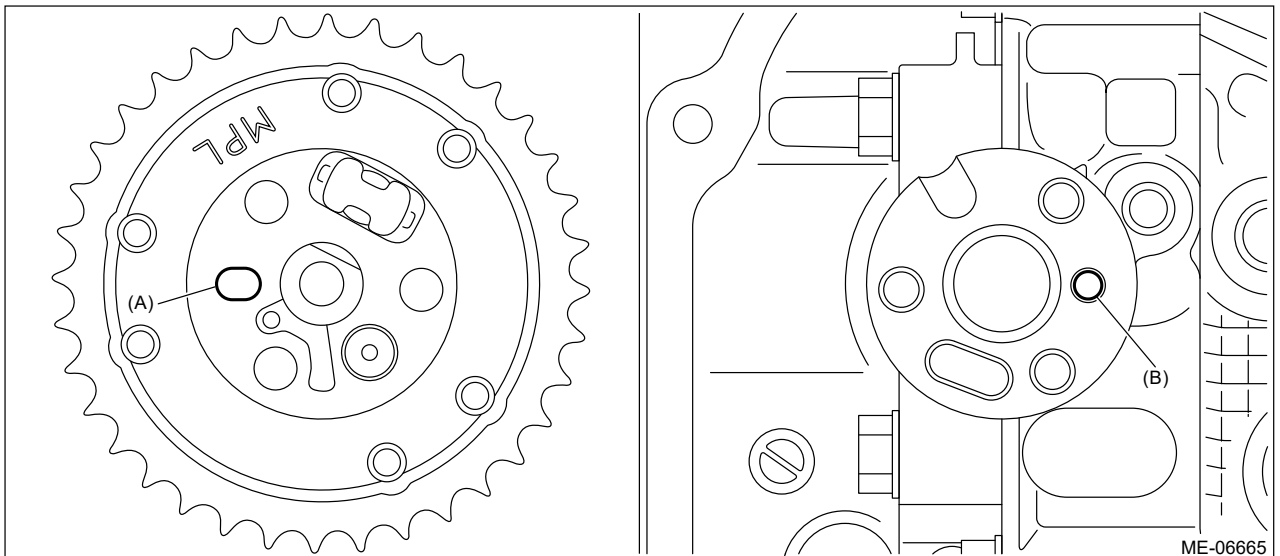
1. CAM SPROCKET RH

• INTAKE CAM SPROCKET RH

1. Install the intake cam sprocket RH by aligning the knock hole (A) of intake cam sprocket RH and the knock pin (B) of intake camshaft RH.

Note:

Before installation, check that there is no foreign matter on the intake cam sprocket RH and intake camshaft RH.



2. Hold the intake cam sprocket RH using the ST1 and ST2, and install the bolts using the ST3.

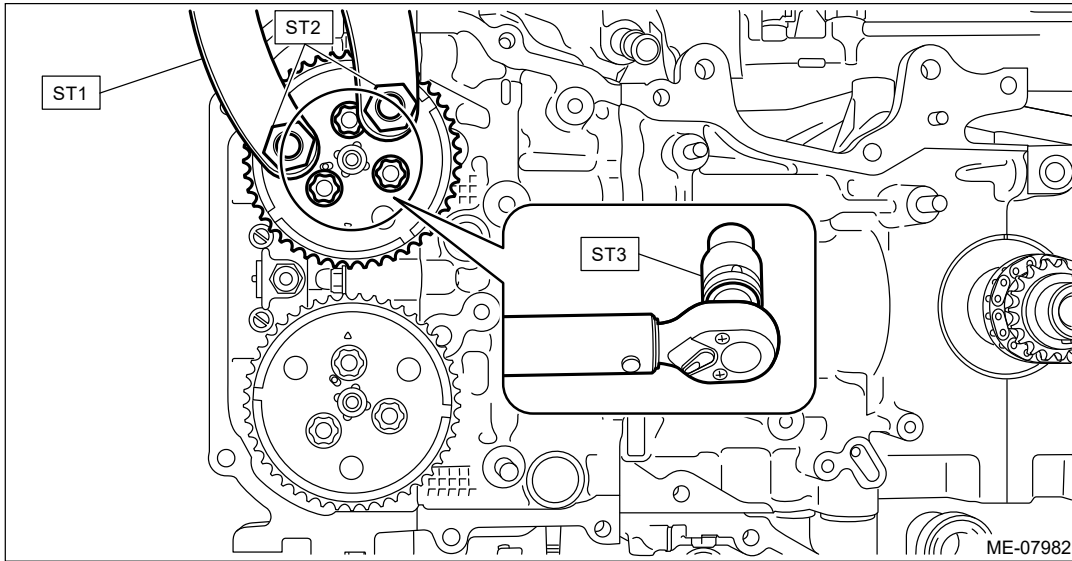
Caution:



Perform the operation carefully since the ST comes off easily.

| | | |
|------------|-------------------|------------------------------|
| ST1 | 18355AA000 | PULLEY WRENCH |
| ST2 | 18334AA020 | PULLEY WRENCH PIN SET |
| ST3 | 18270KA010 | SOCKET (E16) |

Tightening torque:

18 N•m (1.8 kgf-m, 13.3 ft-lb)



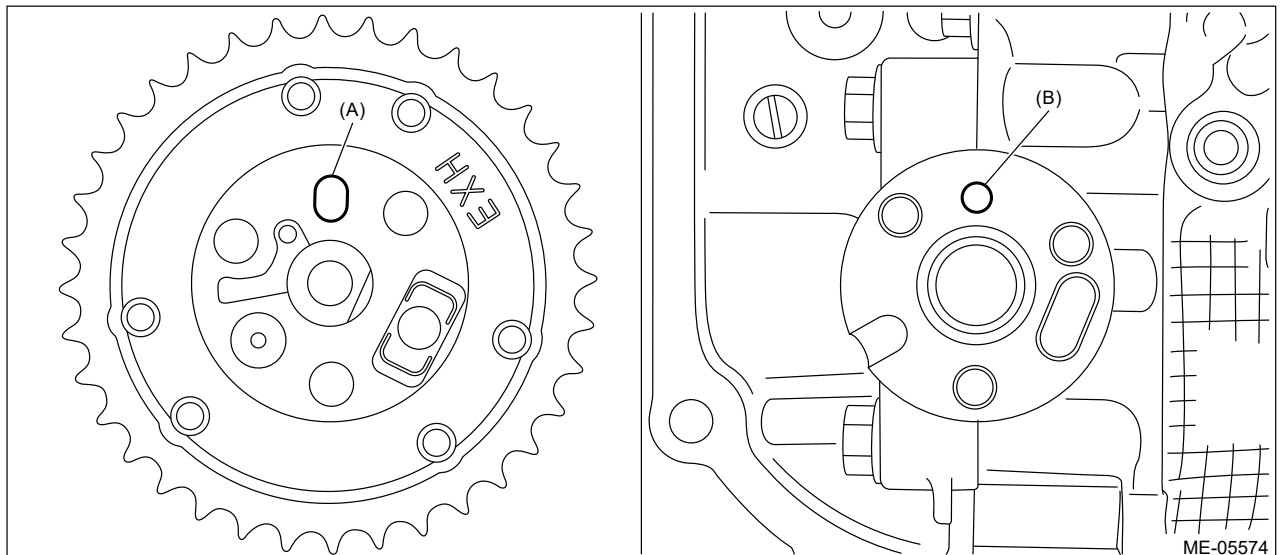
3. Install the timing chain RH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN RH.](#)
4. Install the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)

● **EXHAUST CAM SPROCKET RH**

1. Install the exhaust cam sprocket RH by aligning the knock hole (A) of exhaust cam sprocket RH and the knock pin (B) of exhaust camshaft RH.

Note:

Before installation, check that there is no foreign matter on the exhaust cam sprocket RH and exhaust camshaft RH.



2. Hold the exhaust cam sprocket RH using ST1 and ST2, and install the bolts using ST3.

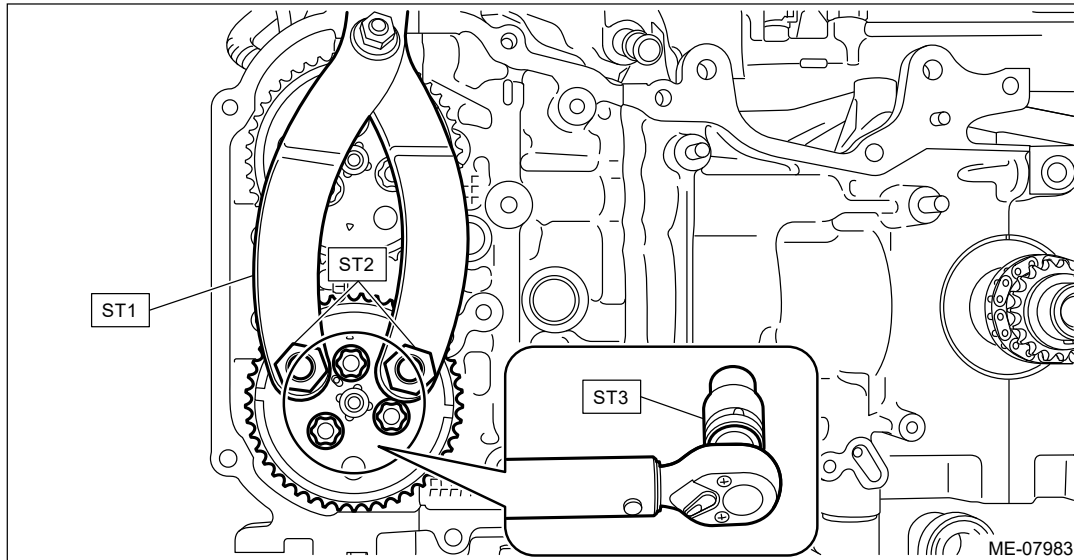
Caution:



Perform the operation carefully since the ST comes off easily.

| | | |
|------------|-------------------|------------------------------|
| ST1 | 18355AA000 | PULLEY WRENCH |
| ST2 | 18334AA020 | PULLEY WRENCH PIN SET |
| ST3 | 18270KA010 | SOCKET (E16) |

Tightening torque:

18 N•m (1.8 kgf-m, 13.3 ft-lb)



3. Install the timing chain RH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing_Chain Assembly>INSTALLATION > TIMING CHAIN RH.](#)
4. Install the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)

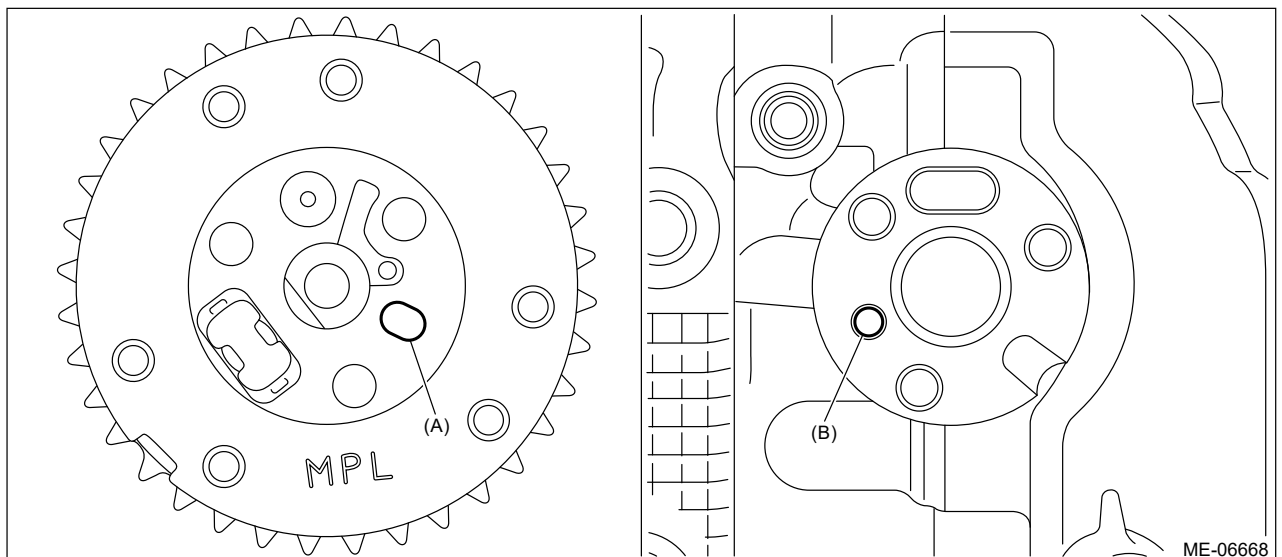
2. CAM SPROCKET LH

• INTAKE CAM SPROCKET LH

1. Install the intake cam sprocket LH by aligning the knock hole (A) of intake cam sprocket LH and the knock pin (B) of intake camshaft LH.

Note:

Before installation, check that there is no foreign matter on the intake cam sprocket LH and intake camshaft LH.



2. Hold the intake cam sprocket LH using the ST1 and ST2, and install the bolts using the ST3.

Caution:

Perform the operation carefully since the ST comes off easily.

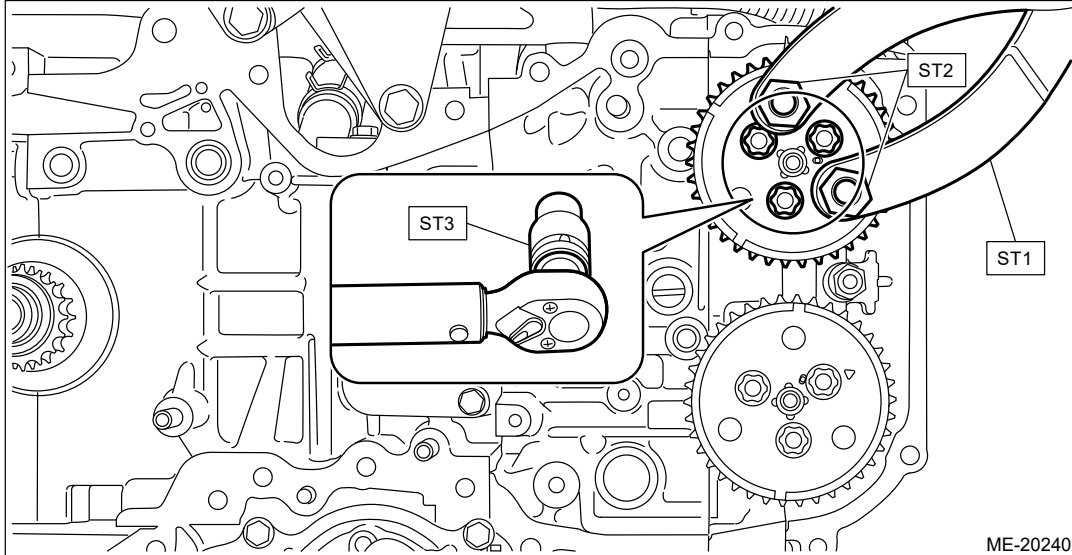
ST1 18355AA000 PULLEY WRENCH


ST2 18334AA020 PULLEY WRENCH PIN SET

ST3 18270KA010 SOCKET (E16)

Tightening torque:

18 N•m (1.8 kgf-m, 13.3 ft-lb)



3. Install timing chain LH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN LH.](#)

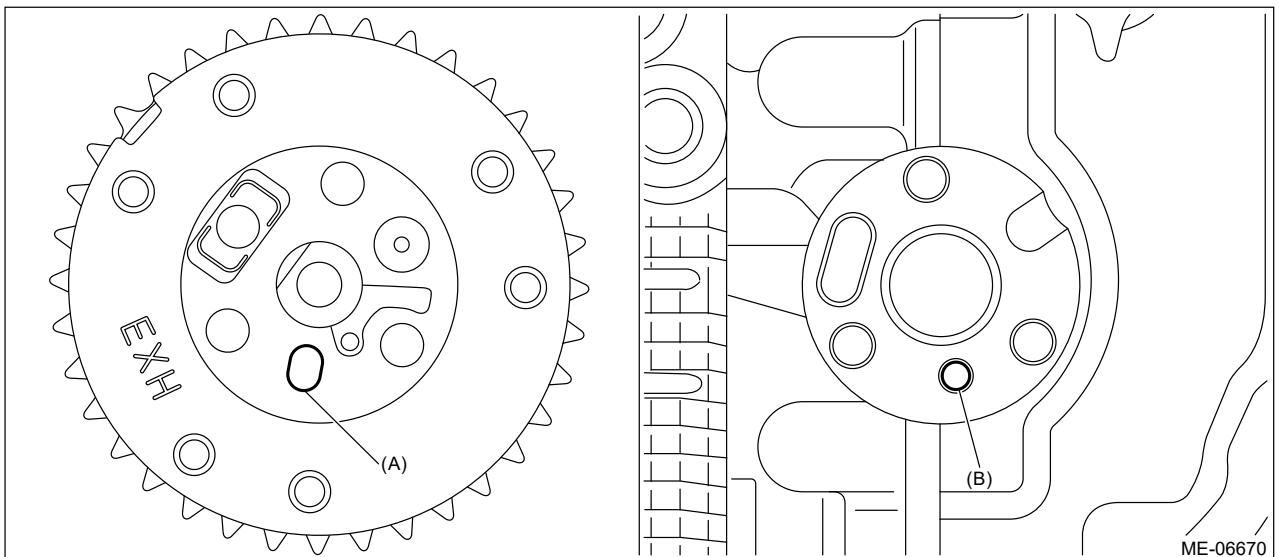
4. Install the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)

● **EXHAUST CAM SPROCKET LH**

1. Install the exhaust cam sprocket LH by aligning the knock hole (A) of exhaust cam sprocket LH and the knock pin (B) of exhaust camshaft LH.

Note:

Before installation, check that there is no foreign matter on the exhaust cam sprocket LH and exhaust camshaft LH.



2. Hold the exhaust cam sprocket LH using the ST1 and ST2, and install the bolts using the ST3.

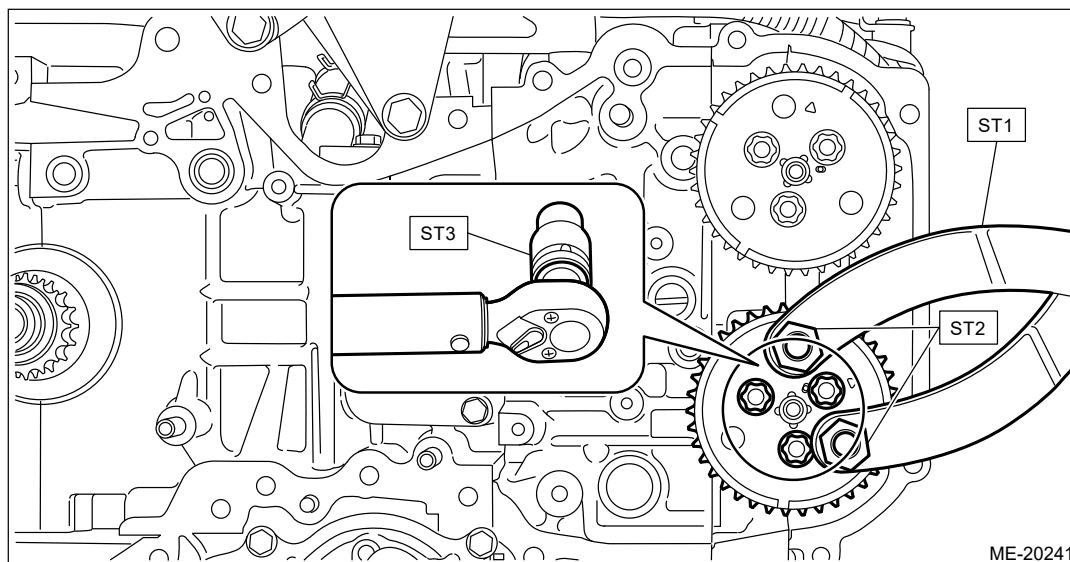
Caution:



Perform the operation carefully since the ST comes off easily.

- ST1 18355AA000 PULLEY WRENCH**
- ST2 18334AA020 PULLEY WRENCH PIN SET**
- ST3 18270KA010 SOCKET (E16)**

Tightening torque:

18 N•m (1.8 kgf-m, 13.3 ft-lb)



3. Install timing chain LH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN LH.](#)
4. Install the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)



REMOVAL

1. CAM SPROCKET RH

Note:

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

● **INTAKE CAM SPROCKET RH**

1. Remove the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain RH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
3. Hold the intake cam sprocket RH using the ST1 and ST2, and remove the bolts using the ST3.

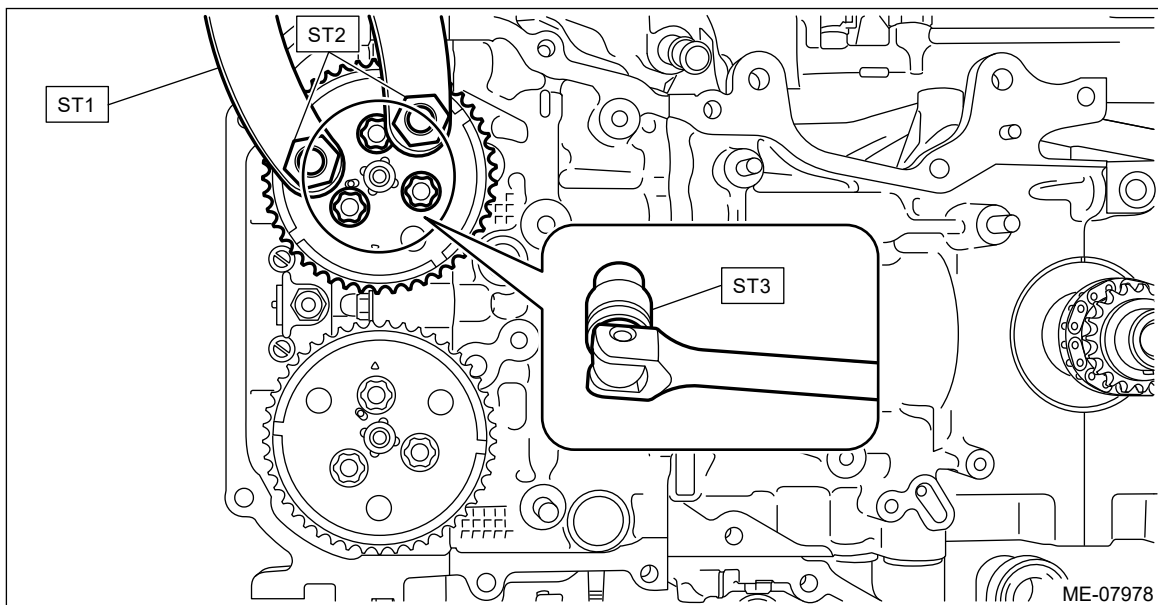
Caution:

Perform the operation carefully since the ST comes off easily.

ST1 18355AA000 PULLEY WRENCH



ST2 18334AA020 PULLEY WRENCH PIN SET

ST3 18270KA010 SOCKET (E16)



4. Remove the intake cam sprocket RH.

● **EXHAUST CAM SPROCKET RH**

1. Remove the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain RH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
3. Hold the exhaust cam sprocket RH using the ST1 and ST2, and remove the bolts using the ST3.

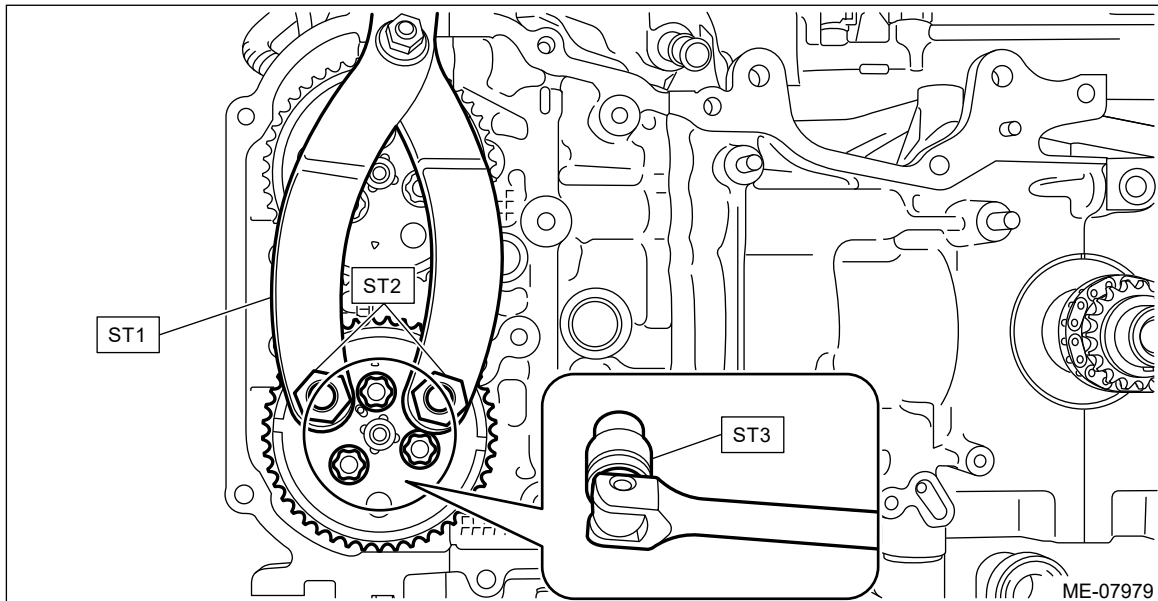
Caution:

Perform the operation carefully since the ST comes off easily.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA020 PULLEY WRENCH PIN SET

ST3 18270KA010 SOCKET (E16)





4. Remove the exhaust cam sprocket RH.

2. CAM SPROCKET LH

Note:

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

● INTAKE CAM SPROCKET LH

1. Remove the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain LH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN LH.](#)
3. Hold the intake cam sprocket LH using the ST1 and ST2, and remove the bolts using the ST3.

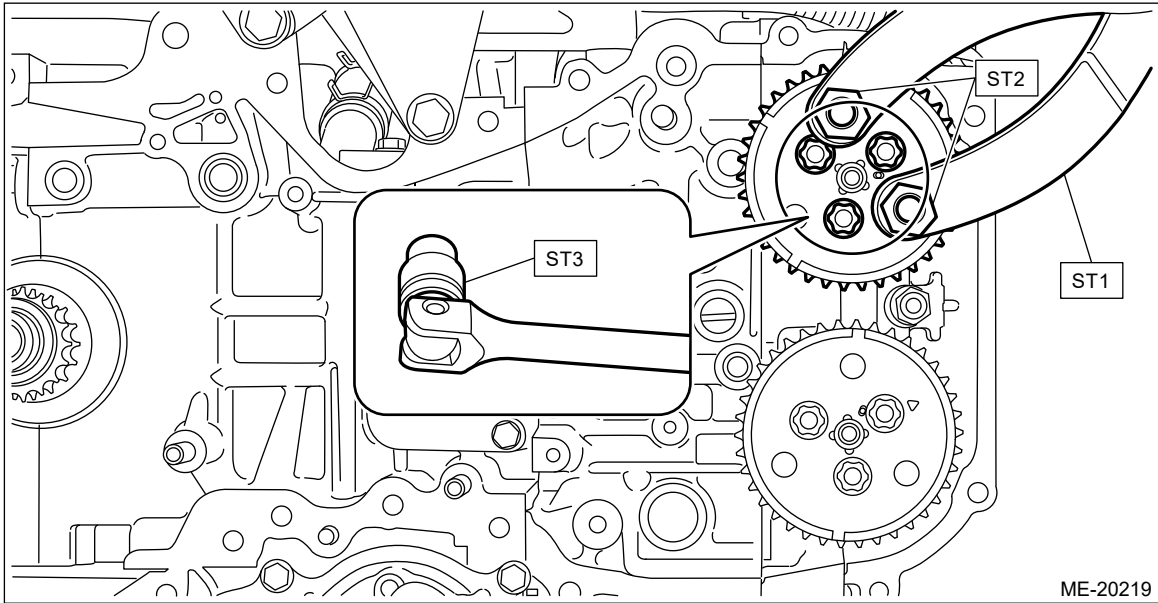
Caution:

Perform the operation carefully since the ST comes off easily.

ST1 18355AA000 PULLEY WRENCH



ST2 18334AA020 PULLEY WRENCH PIN SET

ST3 18270KA010 SOCKET (E16)



4. Remove the intake cam sprocket LH.

● **EXHAUST CAM SPROCKET LH**

1. Remove the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain LH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>REMOVAL > TIMING CHAIN LH.](#)
3. Hold the exhaust cam sprocket LH using the ST1 and ST2, and remove the bolts using the ST3.

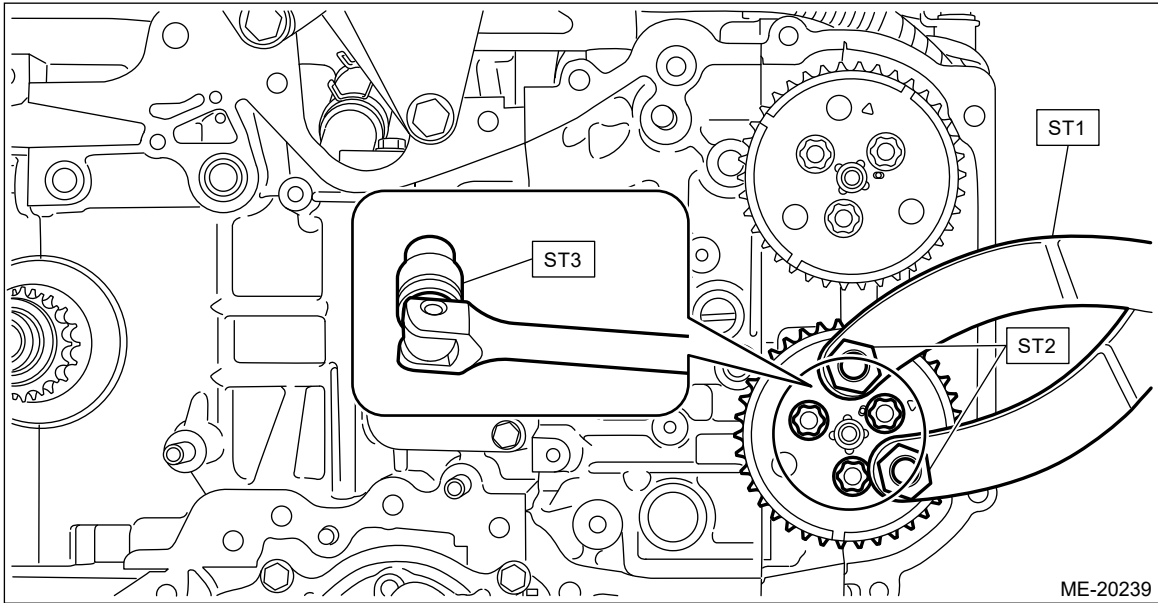
Caution:

Perform the operation carefully since the ST comes off easily.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA020 PULLEY WRENCH PIN SET

ST3 18270KA010 SOCKET (E16)





4. Remove the exhaust cam sprocket LH.



MECHANICAL(H4DOTC) > Camshaft

INSTALLATION

1. CAMSHAFT RH

The camshaft RH and cam carrier are designed as installing as a unit. Refer to "Cam Carrier" for installation procedures of camshaft RH.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>ASSEMBLY > CAM CARRIER RH.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>INSTALLATION > CAM CARRIER RH.](#)



2. CAMSHAFT LH

The camshaft LH and cam carrier are designed as installing as a unit. Refer to "Cam Carrier" for installation procedures of camshaft LH.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>ASSEMBLY > CAM CARRIER LH.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>INSTALLATION > CAM CARRIER LH.](#)



MECHANICAL(H4DOTC) > Camshaft

REMOVAL

1. CAMSHAFT RH






The camshaft RH and cam carrier are designed as removing as a unit. Refer to "Cam Carrier" for removal procedures of camshaft RH.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>REMOVAL > CAM CARRIER RH.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>DISASSEMBLY > CAM CARRIER RH.](#)

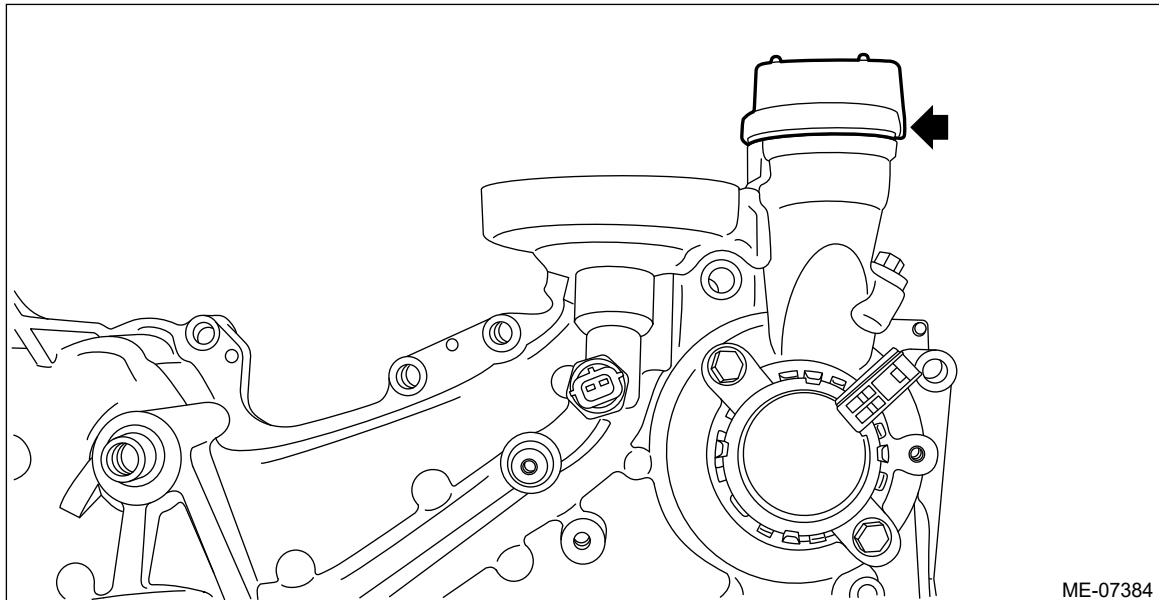
2. CAMSHAFT LH

The camshaft LH and cam carrier are designed as removing as a unit. Refer to "Cam Carrier" for removal procedures of camshaft LH.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>REMOVAL > CAM CARRIER LH.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>DISASSEMBLY > CAM CARRIER LH.](#)

MECHANICAL(H4DOTC) > Chain Cover

ASSEMBLY

1. Install the camshaft position sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Camshaft Position Sensor>INSTALLATION.](#)
2. Install the oil control solenoid.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Oil Control Solenoid>INSTALLATION.](#)
3. Install the engine oil temperature sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Oil Temperature Sensor>INSTALLATION.](#)
4. Install the oil pressure switch.  [Ref. to LUBRICATION\(H4DO\)>Oil Pressure Switch>INSTALLATION.](#)
5. Install the PCV hose assembly No. 1.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>PCV Hose Assembly>REPLACEMENT > PCV HOSE ASSEMBLY NO.1.](#)
6. Install the oil filler cap.

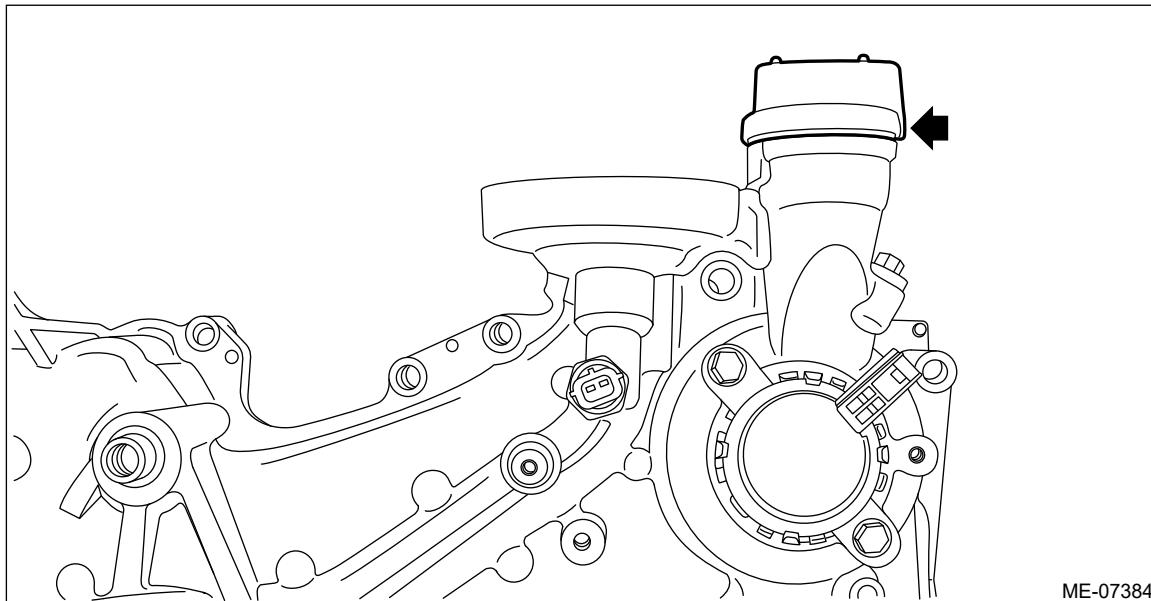







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MECHANICAL(H4DOTC) > Chain Cover

DISASSEMBLY

1. Remove the oil filler cap.



2. Remove the PCV hose assembly No. 1.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>PCV Hose Assembly>REPLACEMENT > PCV HOSE ASSEMBLY NO.1.](#)
3. Remove the oil pressure switch.  [Ref. to LUBRICATION\(H4DO\)>Oil Pressure Switch>REMOVAL.](#)
4. Remove the engine oil temperature sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Oil Temperature Sensor>REMOVAL.](#)
5. Remove the oil control solenoid.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Oil Control Solenoid>REMOVAL.](#)
6. Remove the camshaft position sensor.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Camshaft Position Sensor>REMOVAL.](#)

MECHANICAL(H4DOTC) > Chain Cover

INSPECTION

Check that the chain cover does not have deformation, cracks and any other damage.

MECHANICAL(H4DOTC) > Chain Cover

INSTALLATION

1. Decrease the press-fit section for the chain cover front oil seal, and install the front oil seal to the chain cover using ST.

Caution:

Do not apply fluid such as engine oil to the front oil seal and the chain cover; otherwise engine oil leakage may occur.

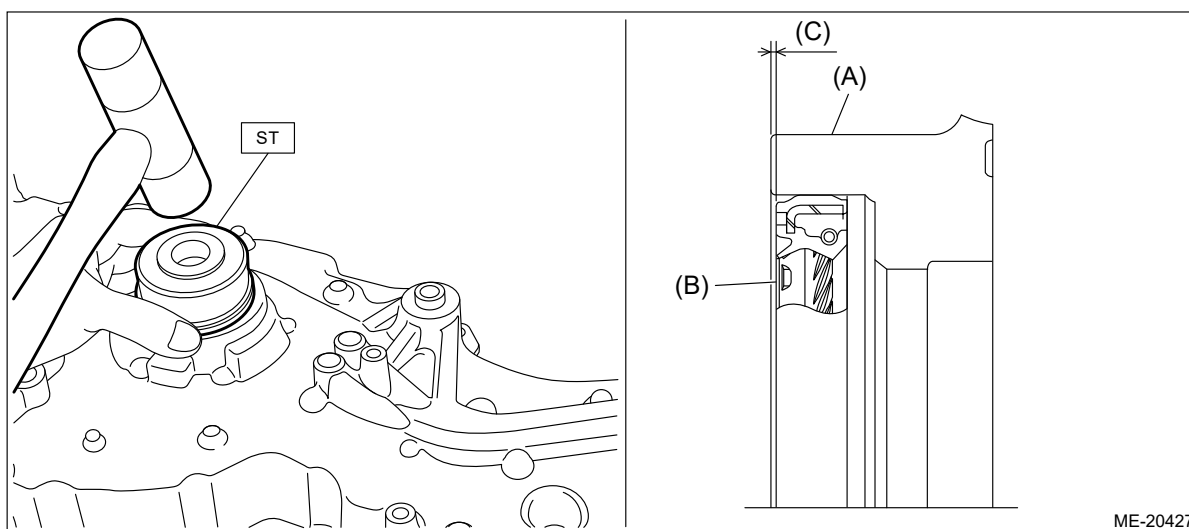
Note:

Use a new front oil seal.

ST 41399FG020 SPECIAL TOOL B

Front oil seal press-fit position:

1^{+0}_{-1} mm ($0.0039^{+0}_{-0.0039}$ in) position from chain cover end face



(A) Chain cover

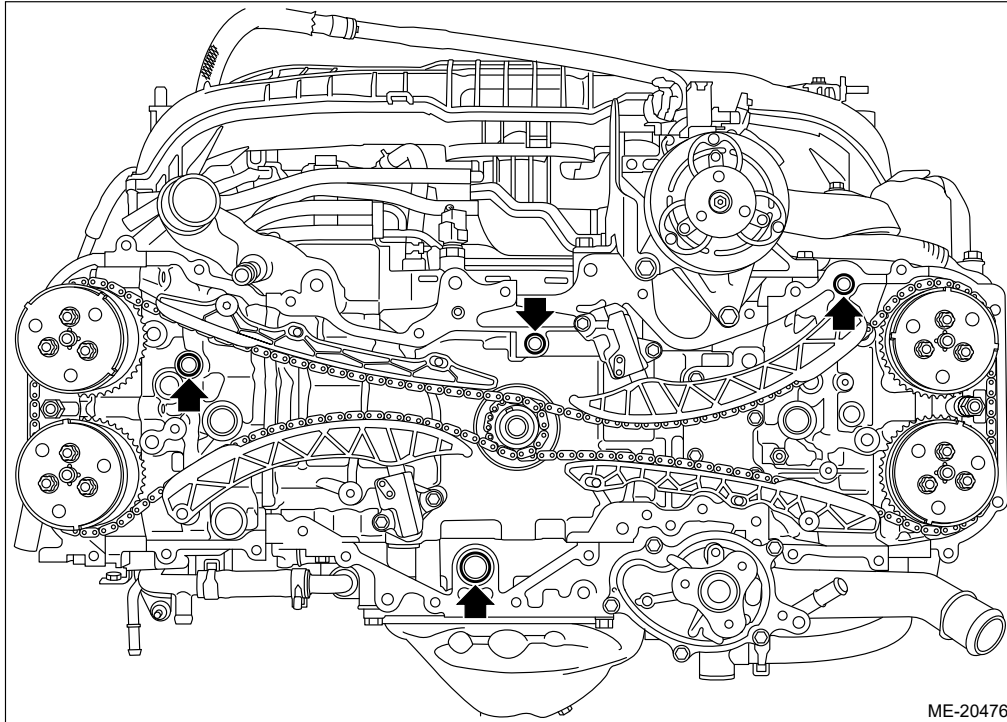
(B) Oil seal

(C) Front oil seal press-fit position
 1^{+0}_{-1} mm
 $(0.0039^{+0}_{-0.0039}$ in) position
from chain cover end face

2. Install the O-rings to cylinder head RH, cylinder head LH, cylinder block LH and oil pan upper.

Note:

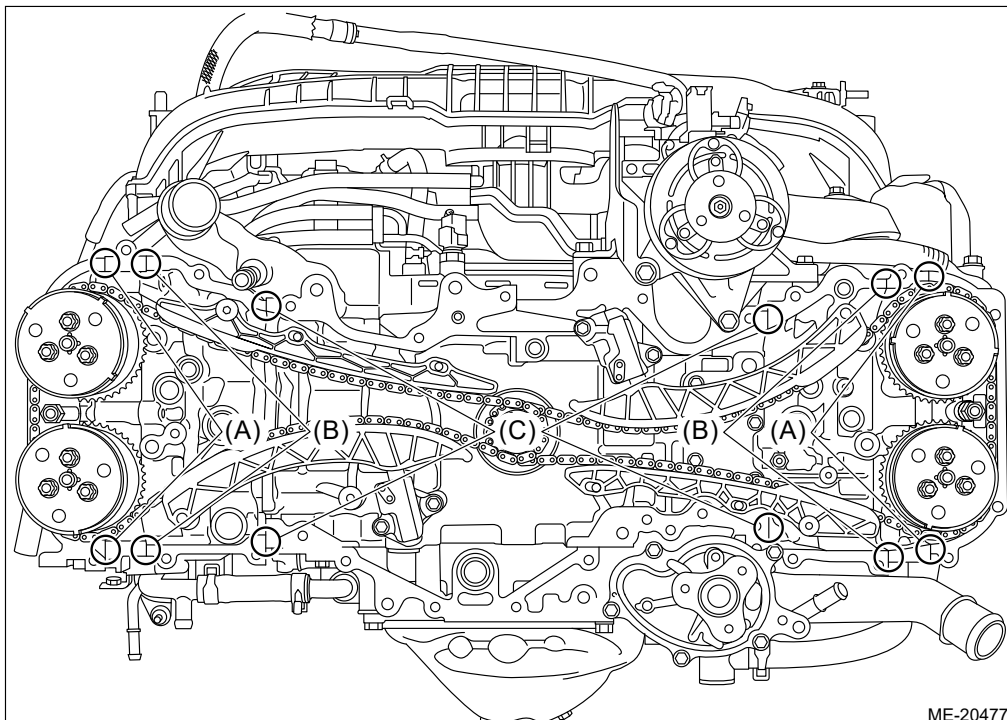
- Use new O-rings.
- Apply a coat of engine oil to the O-rings.



3. Apply liquid gasket if there are gaps between front camshaft cap and cam carrier (A), cam carrier and cylinder head (B), and cylinder head and cylinder block (C) as shown in the figure.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent



4. Apply liquid gasket to the chain cover mating surface and center boss (5 places) as shown in the figure.

Note:

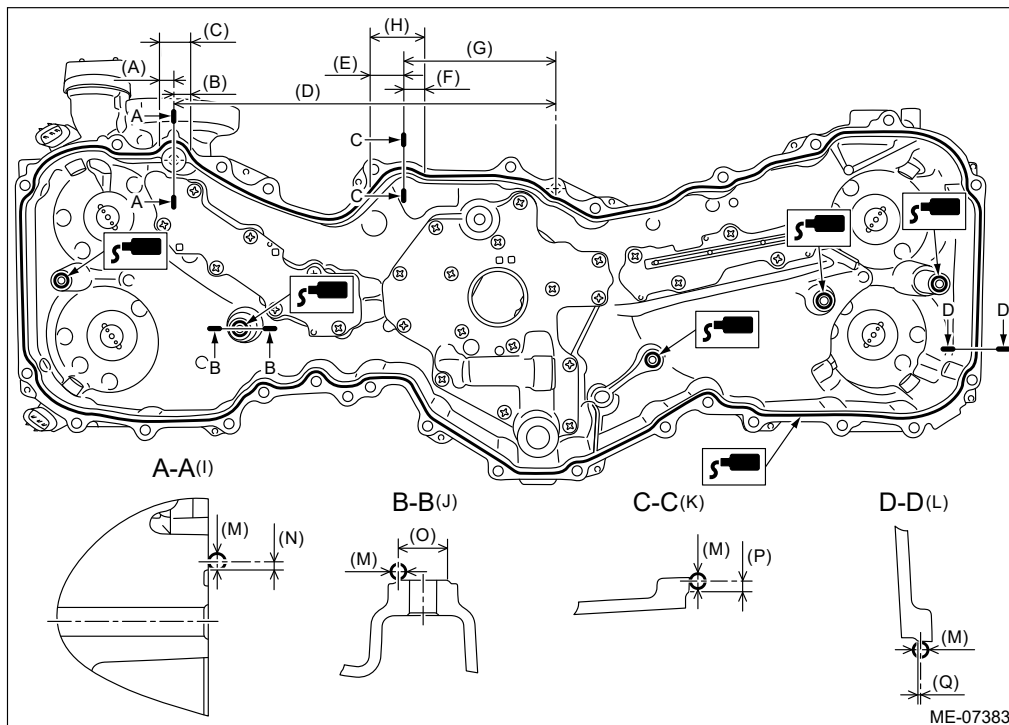
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the engine and chain cover.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

4±0.5 mm (0.1575±0.0197 in)

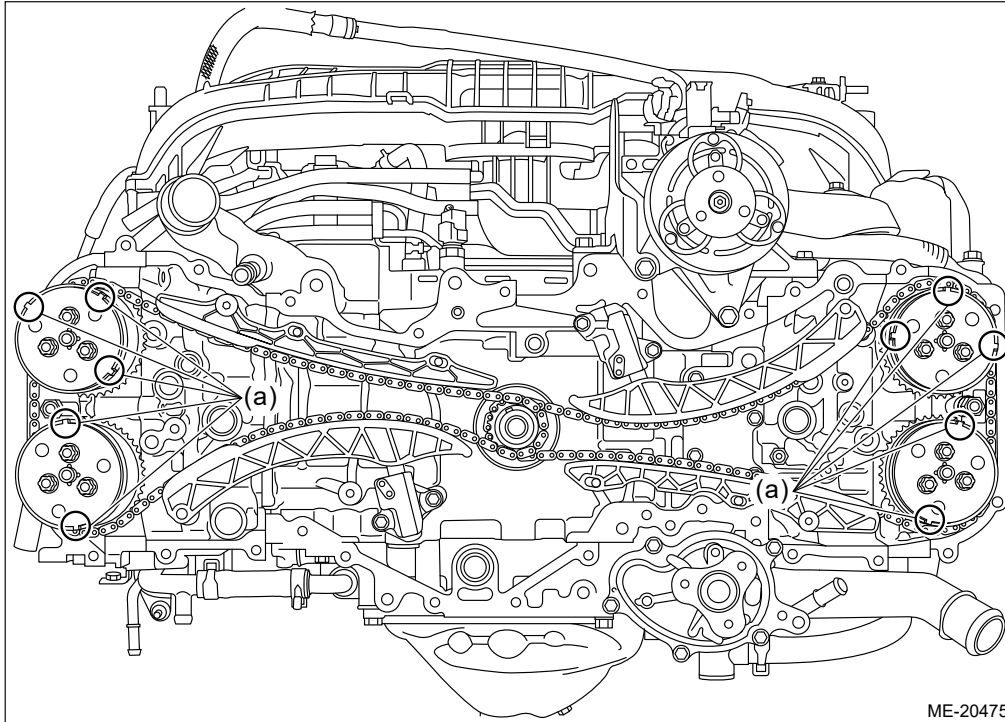


| | | |
|---------------------------|--|--|
| (A) 14.5 mm (0.5709 in) | (G) 127 mm (5.0000 in) | (M) $\varnothing 4 \pm 0.5$ mm (0.1575±0.0197 in) |
| (B) 17.5 mm (0.6890 in) | (H) Range B | (N) 2 mm (0.0787 in) |
| (C) Range A | (I) Liquid gasket applying position of mating surfaces of range A | (O) $\varnothing 12$ mm (0.4724 in) |
| (D) 316.2 mm (12.4488 in) | (J) Liquid gasket applying position of center boss (5 places) | (P) 2.5 mm (0.0984 in) |
| (E) 24.5 mm (0.9646 in) | (K) Liquid gasket applying position of mating surfaces of range B | (Q) 0.5 mm (0.0197 in) |
| (F) 18.5 mm (0.7283 in) | (L) Liquid gasket applying position of mating surfaces other than range A and range B | |

5. Set the chain cover, and tighten the bolts in numerical order as shown in the figure.

Caution:

The chain cover may contact the protrusion (a) of cam sprocket sensor plate and cause damage. When setting the chain cover, move the chain cover horizontally and set it while taking care not to contact with the cam sprocket.

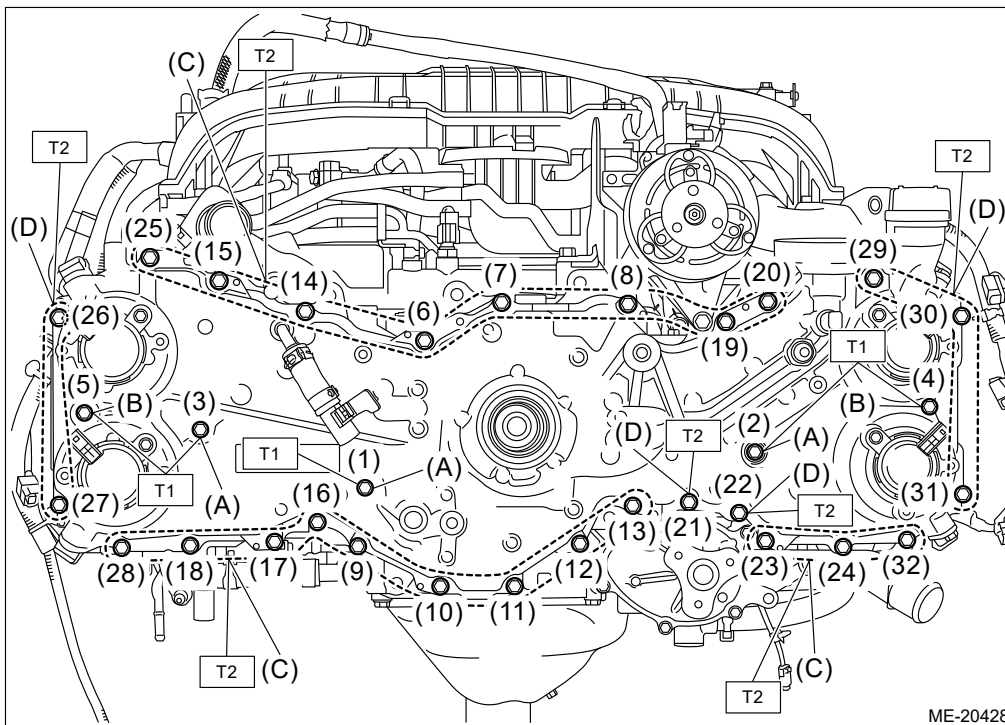


ME-20475

Tightening torque:

T1: 10 N·m (1.0 kgf·m, 7.4 ft·lb)

T2: 25 N·m (2.5 kgf·m, 18.4 ft·lb)



ME-20428

(A) M6 × 20

(C) M8 × 25

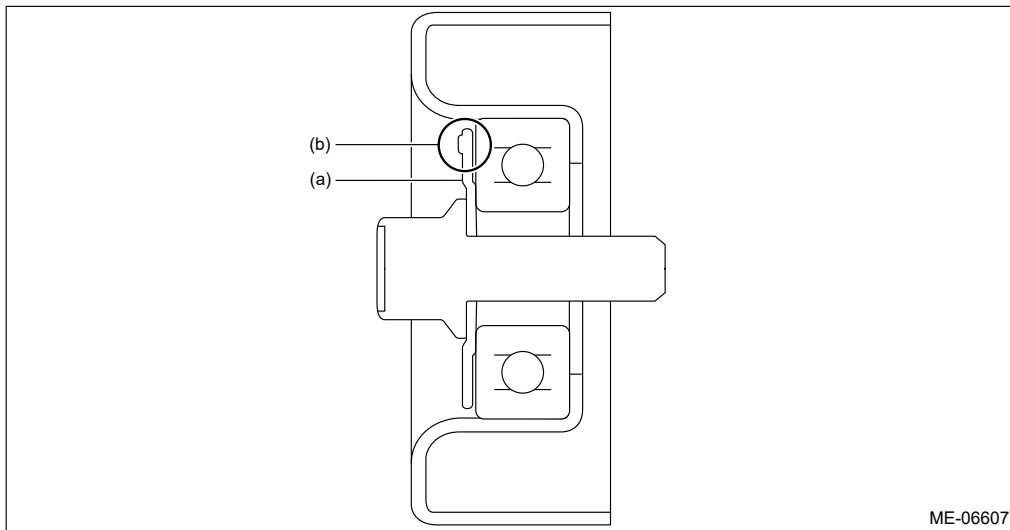
(D) M8 × 60

(B) M6 × 50

- 6.** Install the idler pulley (D), crank pulley boss (C) and oil level gauge guide (B), and insert the oil level gauge (A).

Note:

- When installing the idler pulley, be careful of the idler pulley cover direction.



(a) Idler pulley cover (b) Protrusion (3 places)

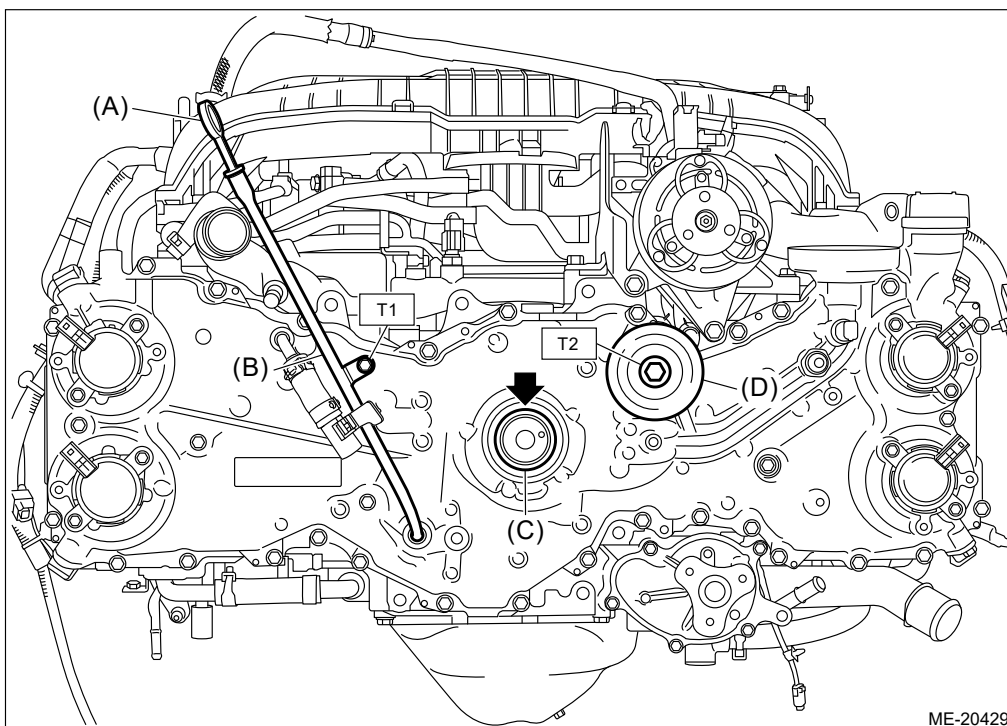
ME-06607

- Use a new O-ring to the oil level gauge guide.
- Apply a light coat of engine oil to the O-rings of the oil level gauge guide and the oil level gauge.

Tightening torque:

T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

T2: 36 N·m (3.7 kgf-m, 26.6 ft-lb)

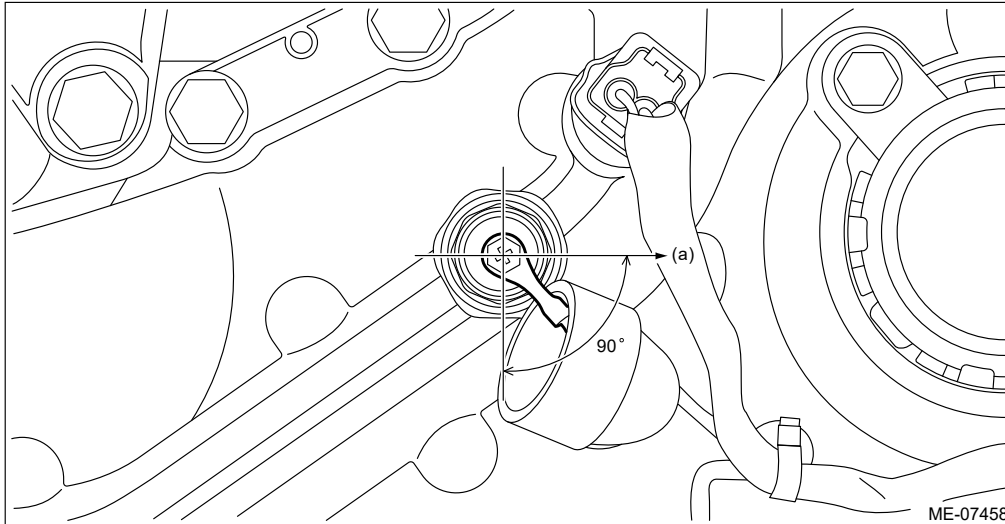


ME-20429

7. Connect the terminal (A) to the oil pressure switch, connector (B) to the engine oil temperature sensor, connector (C) to the intake oil control solenoid LH, connector (D) to the exhaust oil control solenoid LH, and the connector (E) to the intake camshaft position sensor LH, and fix the engine harness using the clip (F).

Note:

The oil pressure switch harness must be positioned toward the left lower side of the vehicle within the range of 90°.

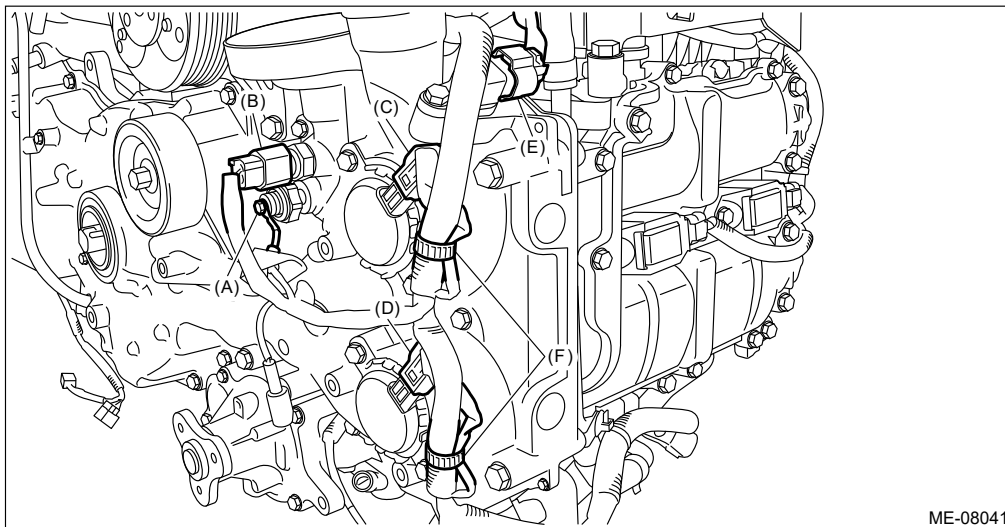


ME-07458

(a) Left side of vehicle

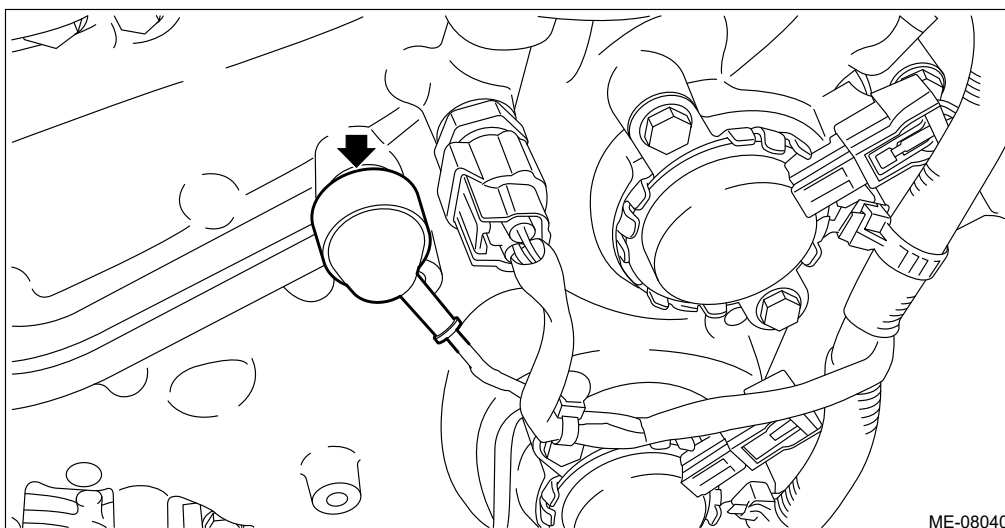
Tightening torque:

1.5 N·m (0.2 kgf-m, 1.1 ft-lb)



ME-08041

8. Attach the rubber cap to the oil pressure switch.

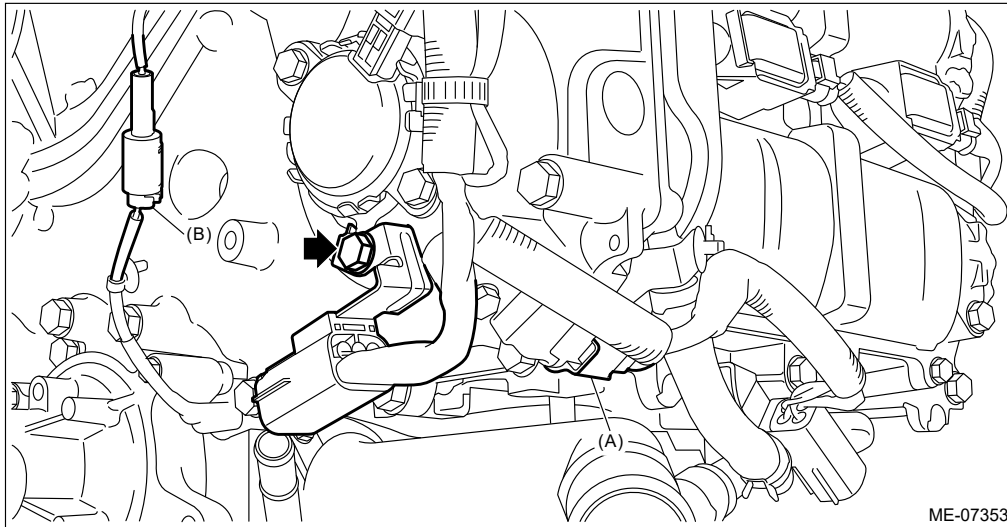


ME-08040

- 9.** Connect the connector (A) to the exhaust camshaft position sensor LH and the connector (B) to the oil level switch, and install the engine harness stay to the chain cover.

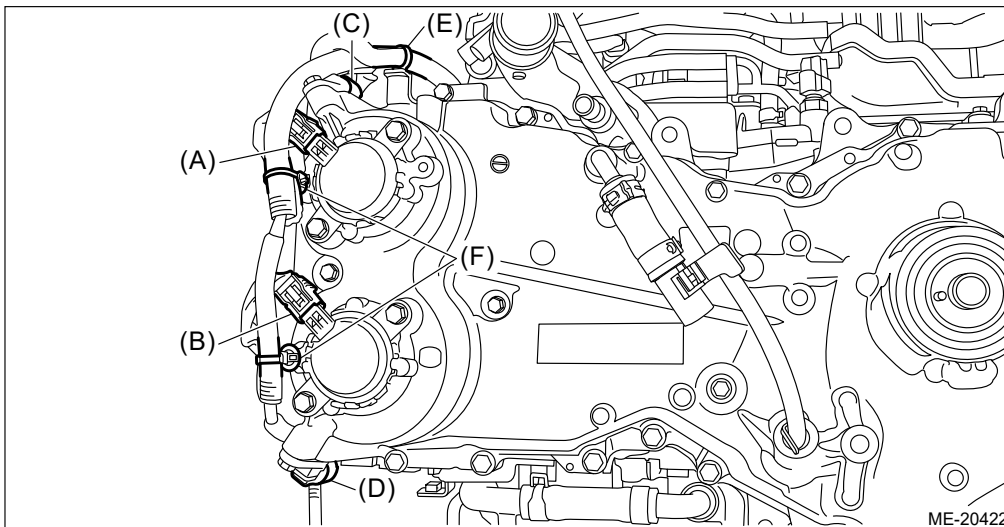
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



ME-07353

- 10.** Connect the connector (A) to the intake oil control solenoid RH, connector (B) to the exhaust oil control solenoid RH, connector (C) to the intake camshaft position sensor RH, and the connector (D) to the exhaust camshaft position sensor RH, and then fix the engine harness using the clips (E) and (F).



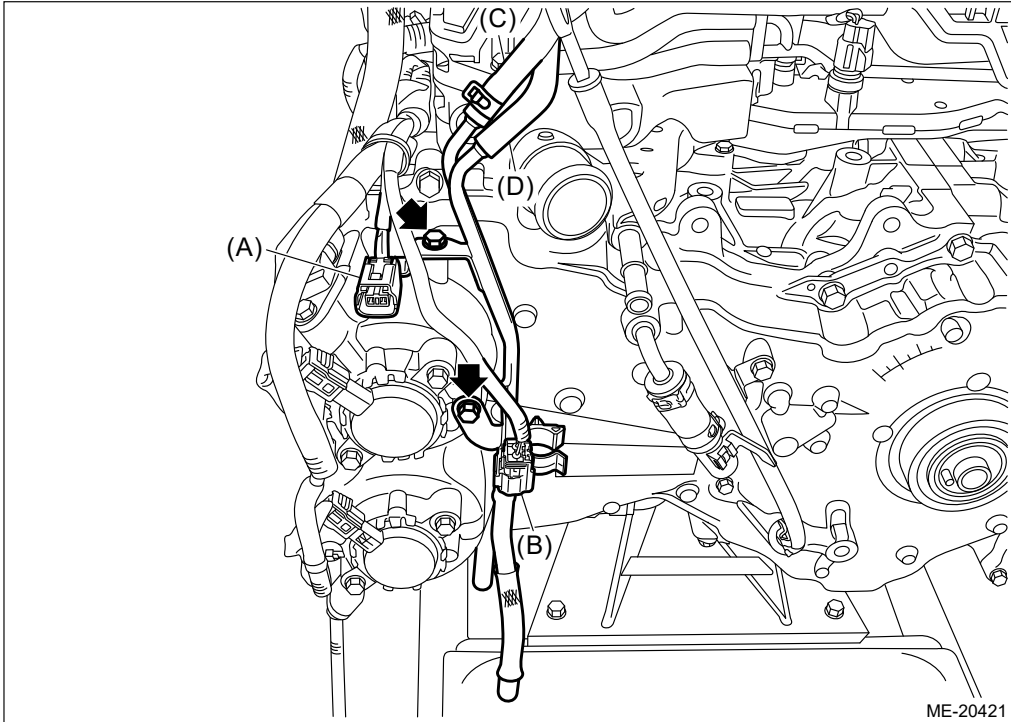
ME-20422

- 11.** Install the vacuum pipe assembly to the chain cover, and connect the vacuum control hose (C) and vacuum hose (D) to the vacuum pipe assembly.

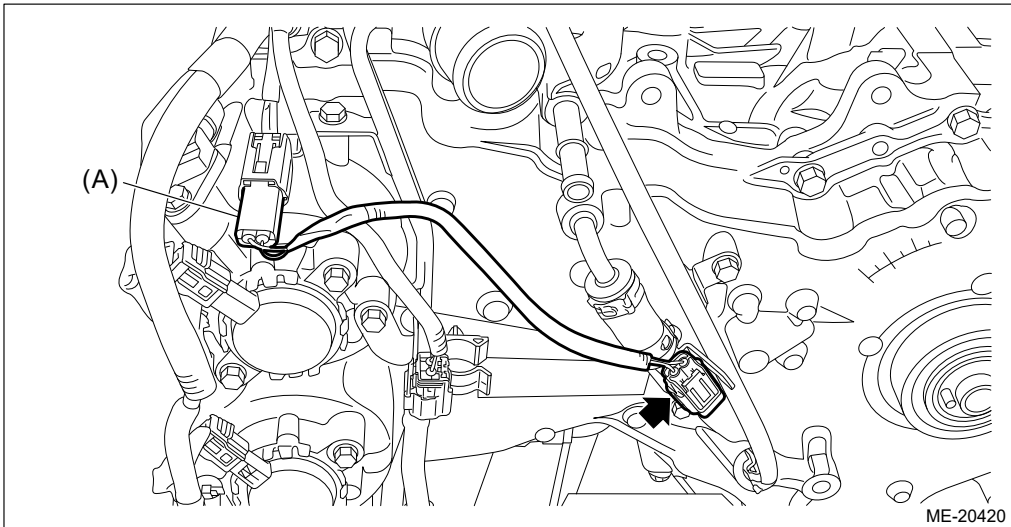
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

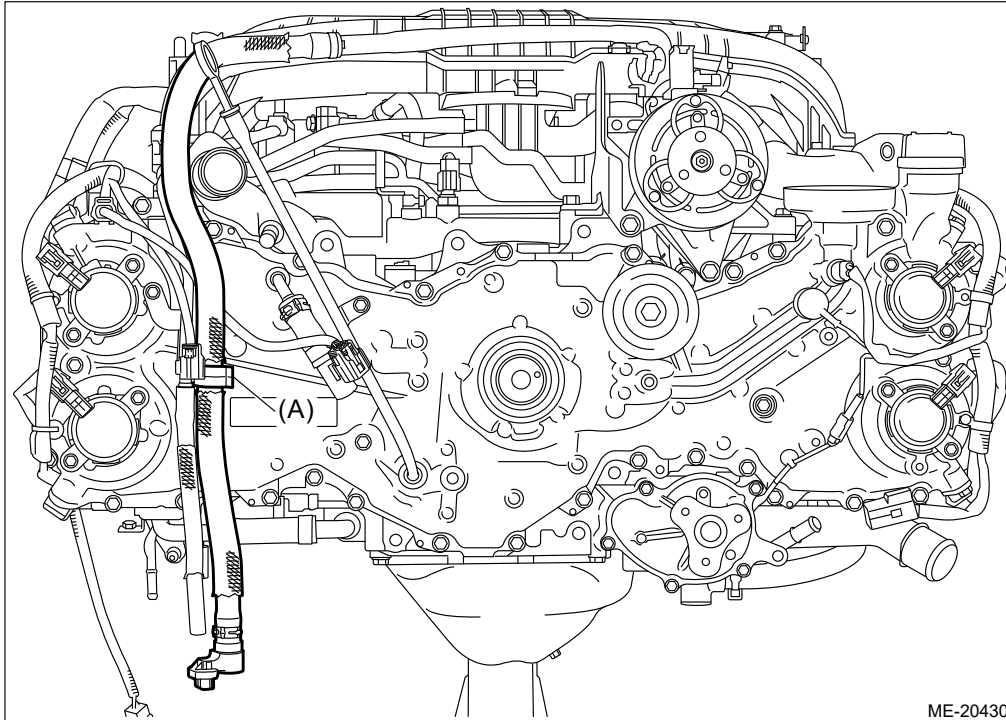
- 12.** Install the connector (A) and connector (B) to the vacuum pipe assembly.



- 13.** Install the blow-by diagnosis connector harness to the PCV hose assembly No. 1, and connect the connector (A) to the engine wiring harness.

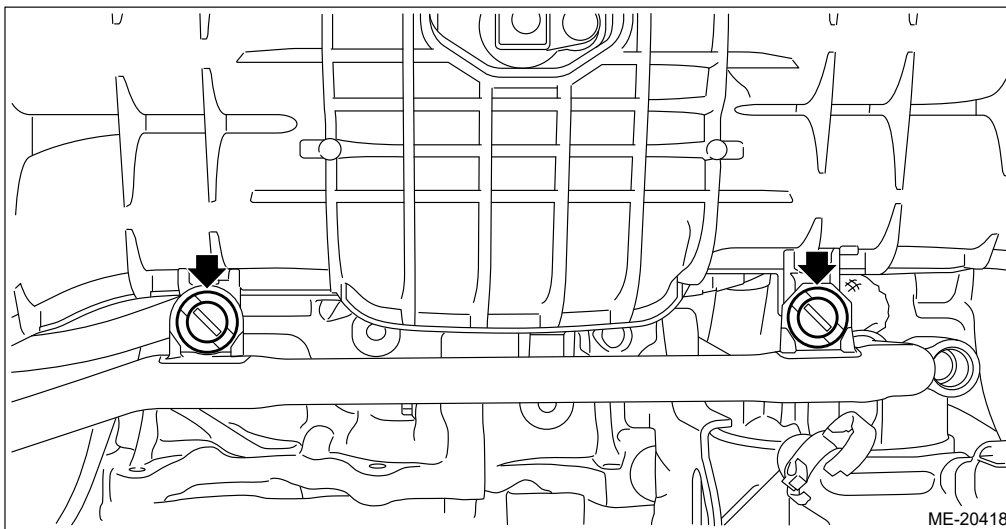


- 14.** Install the PCV pipe to the clip (A).



ME-20430

- 15.** Fix the PCV pipe to the intake manifold using the clip.




ME-20418

- 16.** Install the front engine oil cooler pipe assembly. [🔧 Ref. to LUBRICATION\(H4DO\)>Engine Oil Cooler Pipe>INSTALLATION > FRONT ENGINE OIL COOLER PIPE.](#)
- 17.** Attach the engine oil cooler. [🔧 Ref. to LUBRICATION\(H4DO\)>Engine Oil Cooler>INSTALLATION.](#)
- 18.** Install the crank pulley. [🔧 Ref. to MECHANICAL\(H4DOTC\)>Crank Pulley>INSTALLATION.](#)
- 19.** Install the water pump pulley. [🔧 Ref. to COOLING\(H4DOTC\)>Water Pump>INSTALLATION > WATER PUMP.](#)
- 20.** Install the generator. [🔧 Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Generator>INSTALLATION.](#)
- 21.** Install the V-belts. [🔧 Ref. to MECHANICAL\(H4DOTC\)>V-belt>INSTALLATION > V-BELT.](#)
- 22.** Fill engine oil. [🔧 Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
- 23.** When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

- (1) Install the front exhaust pipe. [🔧 Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)
- (2) Install the intake duct No. 1 and intake duct No. 2. [🔧 Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake](#)

[Duct>INSTALLATION > INTAKE DUCT NO. 1.](#)  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>INSTALLATION > INTAKE DUCT NO. 2.](#)

- (3) Install the radiator.  [Ref. to COOLING\(H4DOTC\)>Radiator>INSTALLATION.](#)

MECHANICAL(H4DOTC) > Chain Cover

REMOVAL

Note:

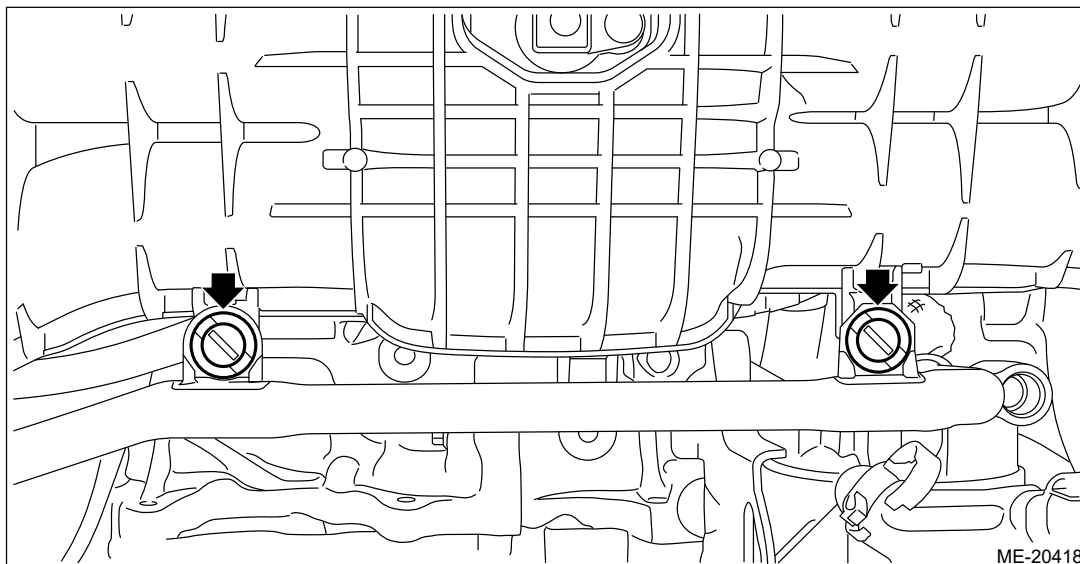
When replacing a single part, perform the work with the engine assembly installed to body.

1. When working on the vehicle

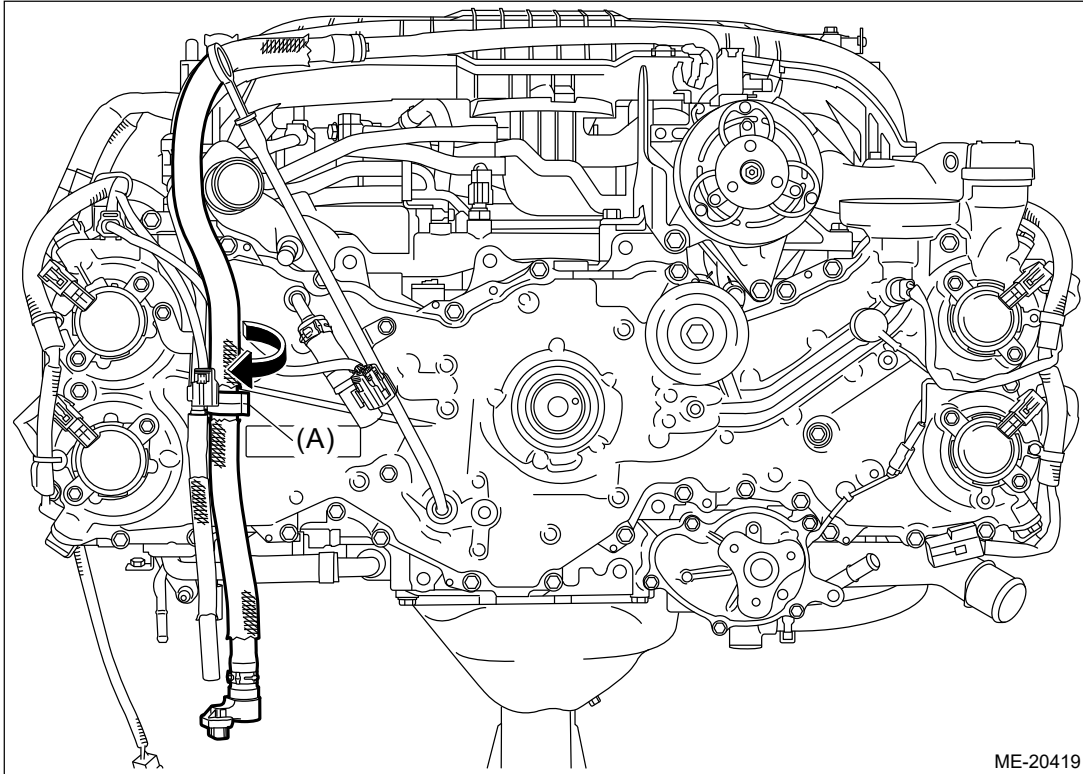
Note:

When working on the vehicle, perform the following steps also.

- (1) Remove the intercooler. [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
- (2) Remove the intake duct No. 1 and intake duct No. 2. [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 1.](#) [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 2.](#)
- (3) Remove the radiator. [Ref. to COOLING\(H4DOTC\)>Radiator>REMOVAL.](#)
- (4) Remove the front exhaust pipe. [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>REMOVAL.](#)
2. Drain the engine oil. [Ref. to LUBRICATION\(H4DO\)>Engine Oil>REPLACEMENT.](#)
3. Remove the V-belts. [Ref. to MECHANICAL\(H4DOTC\)>V-belt>REMOVAL > V-BELT.](#)
4. Remove the generator. [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Generator>REMOVAL.](#)
5. Remove the water pump pulley. [Ref. to COOLING\(H4DOTC\)>Water Pump>REMOVAL > WATER PUMP.](#)
6. Remove the crank pulley. [Ref. to MECHANICAL\(H4DOTC\)>Crank Pulley>REMOVAL.](#)
7. Remove the engine oil cooler. [Ref. to LUBRICATION\(H4DO\)>Engine Oil Cooler>REMOVAL.](#)
8. Remove the front engine oil cooler pipe assembly. [Ref. to LUBRICATION\(H4DO\)>Engine Oil Cooler Pipe>REMOVAL > FRONT ENGINE OIL COOLER PIPE.](#)
9. Remove the clip securing the PCV pipe to the intake manifold.

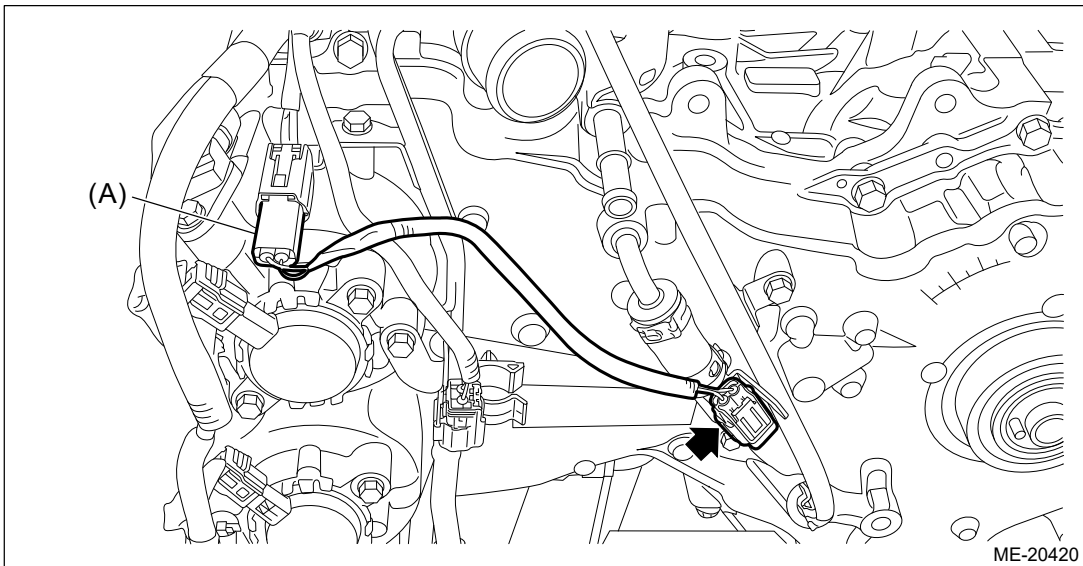


10. Remove the PCV pipe from the clip (A), and place the PCV pipe aside so that it does not interfere with the work.



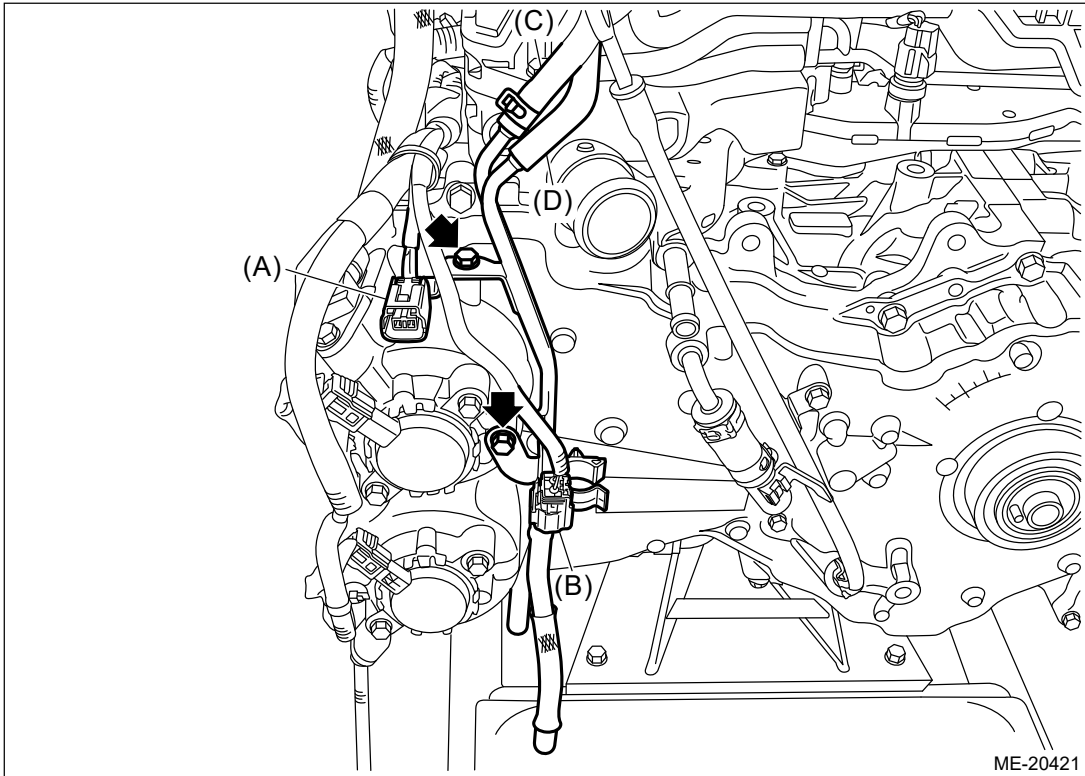
ME-20419

- 11.** Disconnect the connector (A) from the engine wiring harness, and remove the blow-by diagnosis connector harness from the PCV hose assembly No. 1.

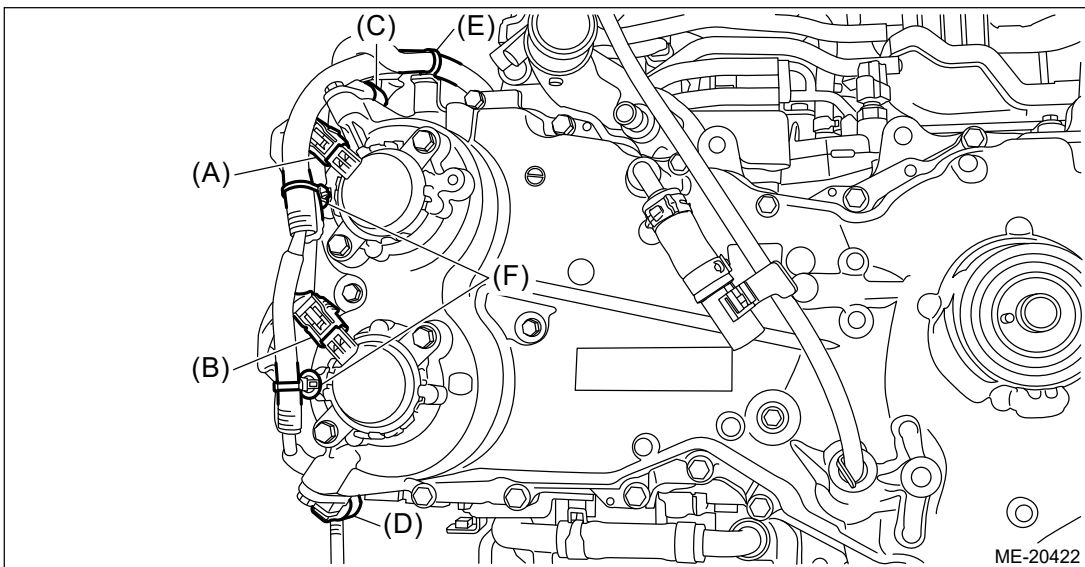


ME-20420

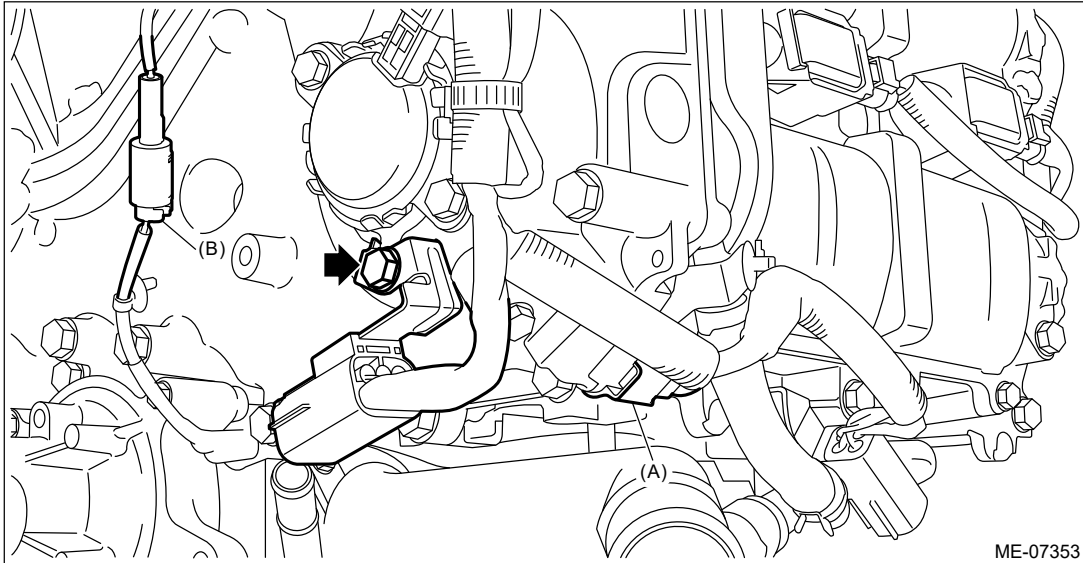
- 12.** Remove the connector (A) and connector (B) from the vacuum pipe assembly.
- 13.** Disconnect the vacuum control hose (C) and vacuum hose (D) from the vacuum pipe assembly, and remove the vacuum pipe assembly from the chain cover.



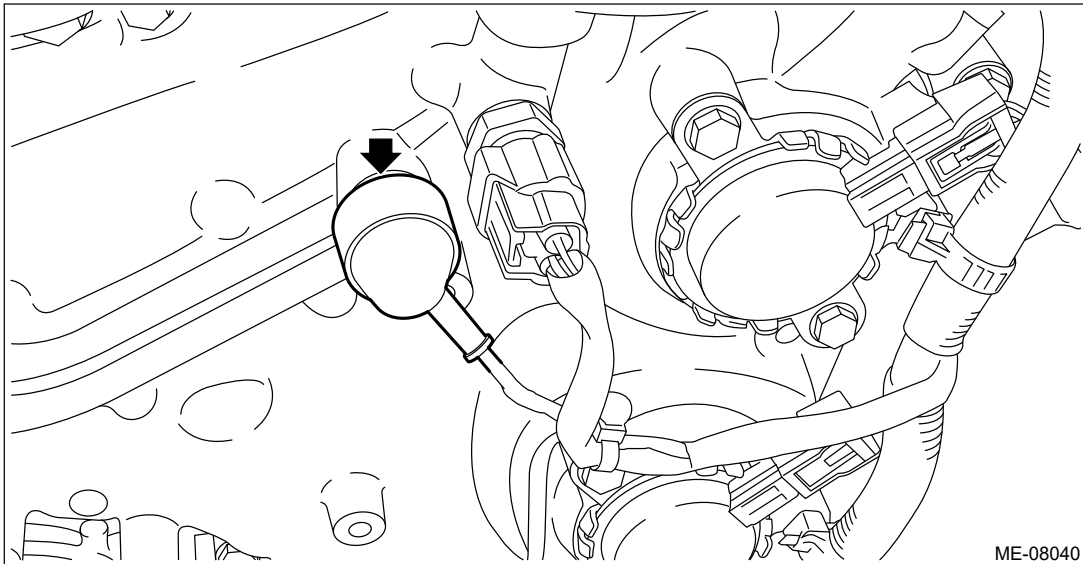
- 14.** Disconnect the connector (A) from the intake oil control solenoid RH, connector (B) from the exhaust oil control solenoid RH, connector (C) from the intake camshaft position sensor RH, and the connector (D) from the exhaust camshaft position sensor RH, and then remove the clips (E) and (F) securing the engine harness.



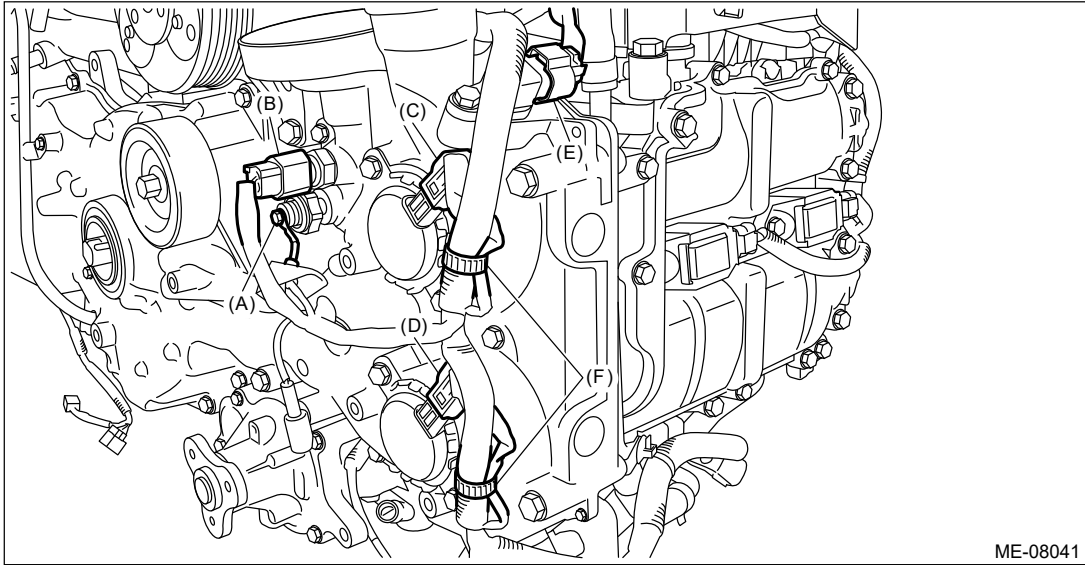
- 15.** Disconnect the connector (A) from the exhaust camshaft position sensor LH and the connector (B) from the oil level switch, and remove the engine harness stay from the chain cover.



- 16.** Remove the rubber cap from the oil pressure switch.

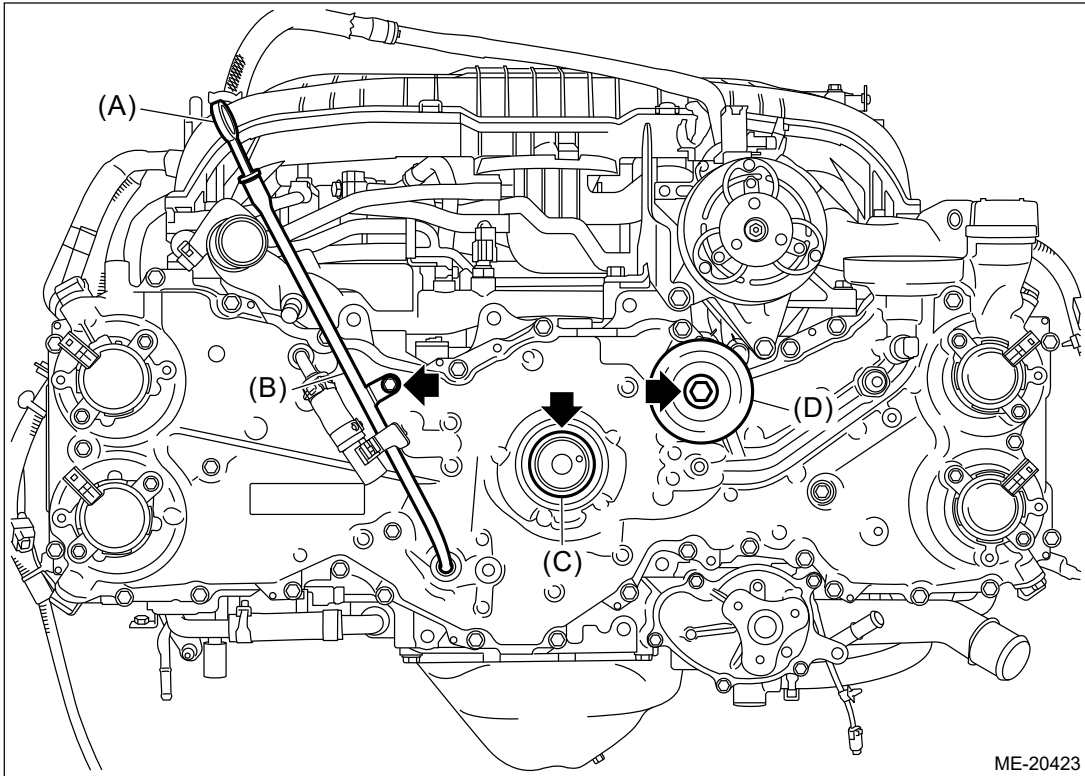


- 17.** Disconnect the terminal (A) from the oil pressure switch, connector (B) from the engine oil temperature sensor, connector (C) from the intake oil control solenoid LH, connector (D) from the exhaust oil control solenoid LH, and the connector (E) from the intake camshaft position sensor LH, and then remove the clip (F) securing the engine harness.



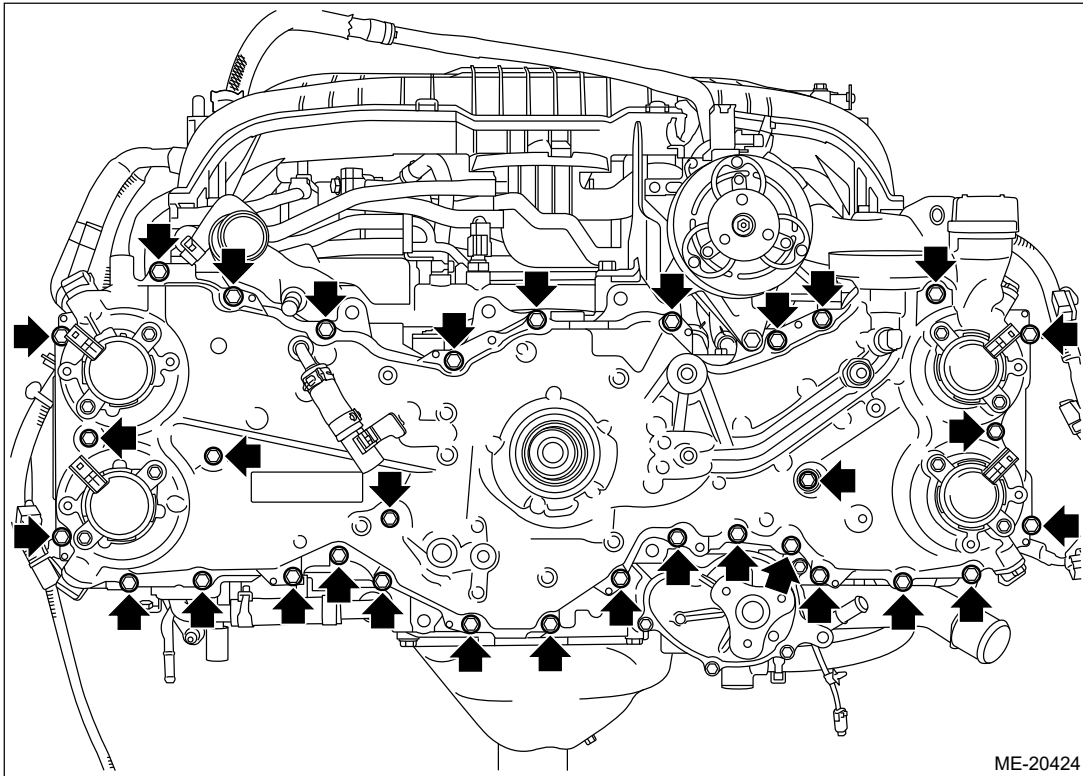
ME-08041

- 18.** Pull out the oil level gauge (A), and remove the oil level gauge guide (B), crank pulley boss (C), and idler pulley (D).



ME-20423

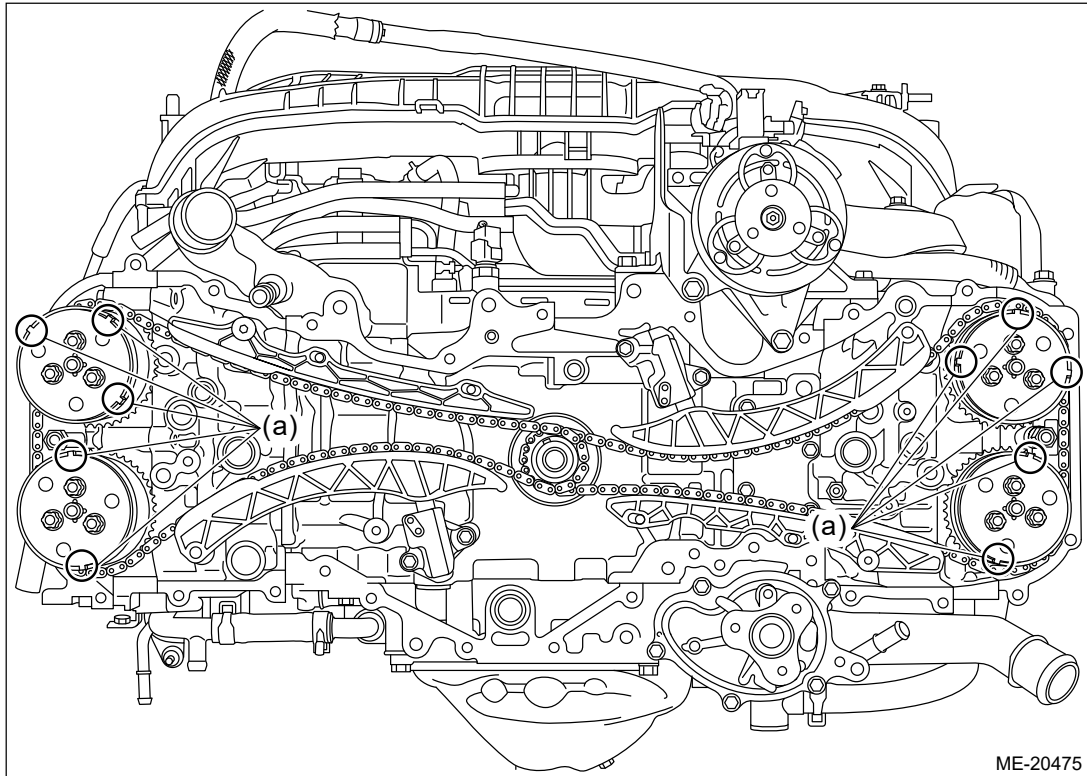
- 19.** Remove the bolts securing the chain cover to engine.



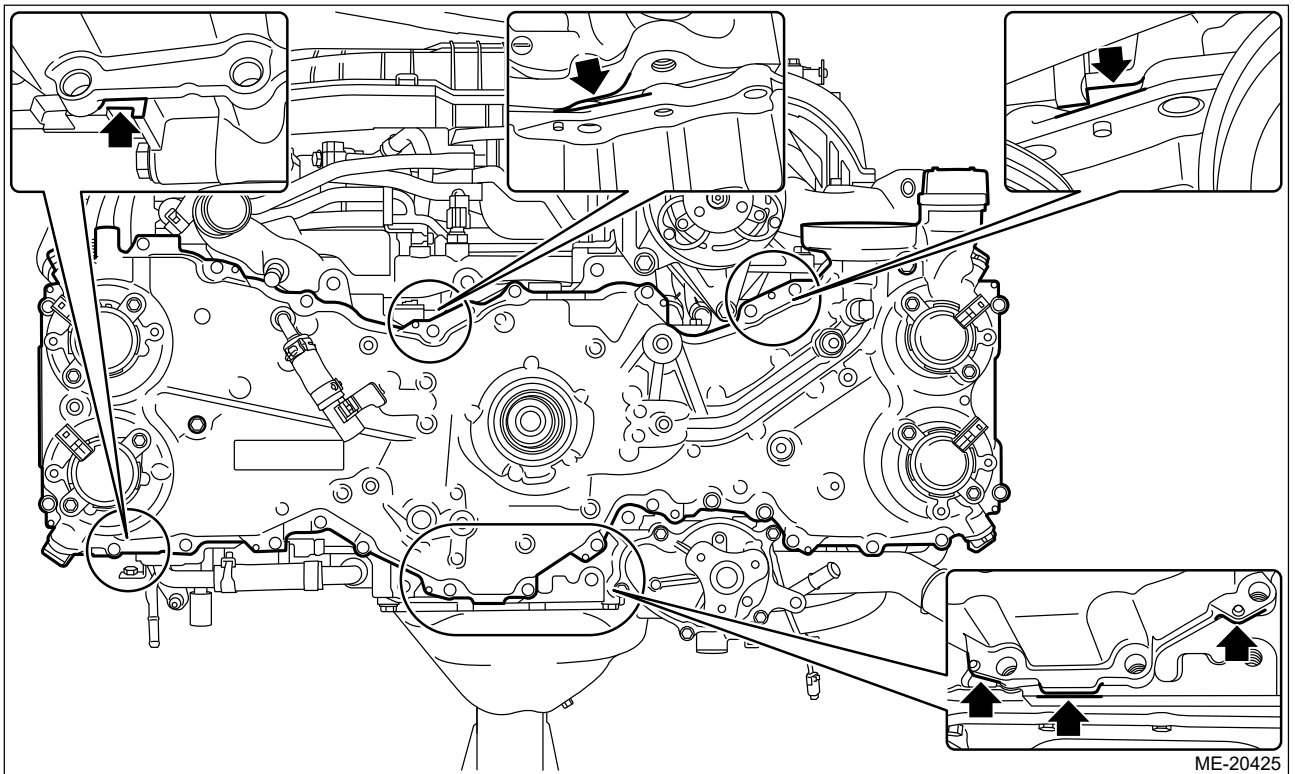
- 20.** Pry the points shown in the figure with a crowbar wrapped by protective tape, and then remove the chain cover from the engine.

Caution:

The chain cover may contact the protrusion (a) of cam sprocket sensor plate and cause damage. When removing the chain cover, move the chain cover horizontally until it cannot contact with the cam sprocket, and then remove it carefully.

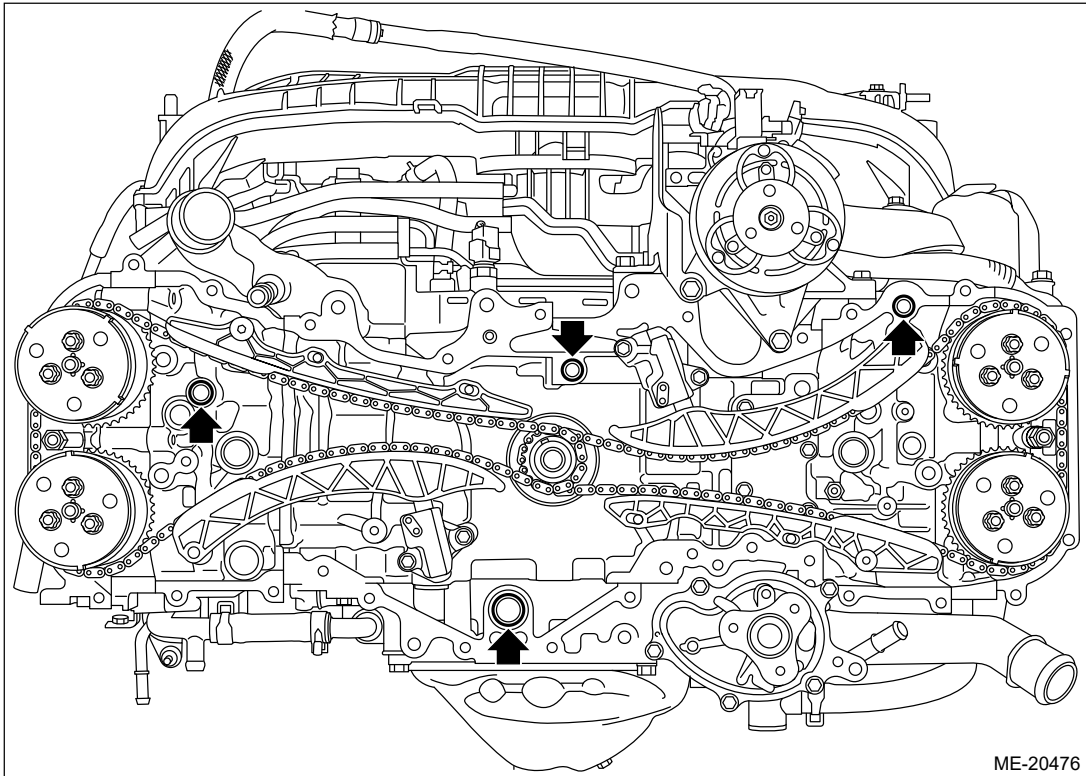


ME-20475

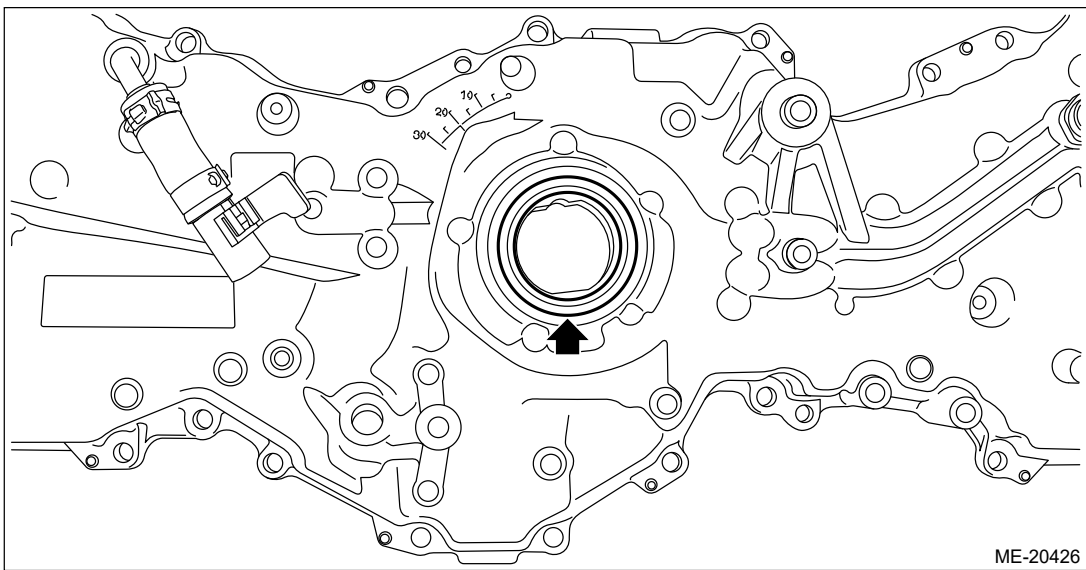


ME-20425

- 21.** Remove the O-rings from cylinder head RH, cylinder head LH, cylinder block LH and oil pan upper.



- 22.** Remove the liquid gasket from the chain cover and engine unit.
- 23.** Remove the front oil seal from the chain cover.



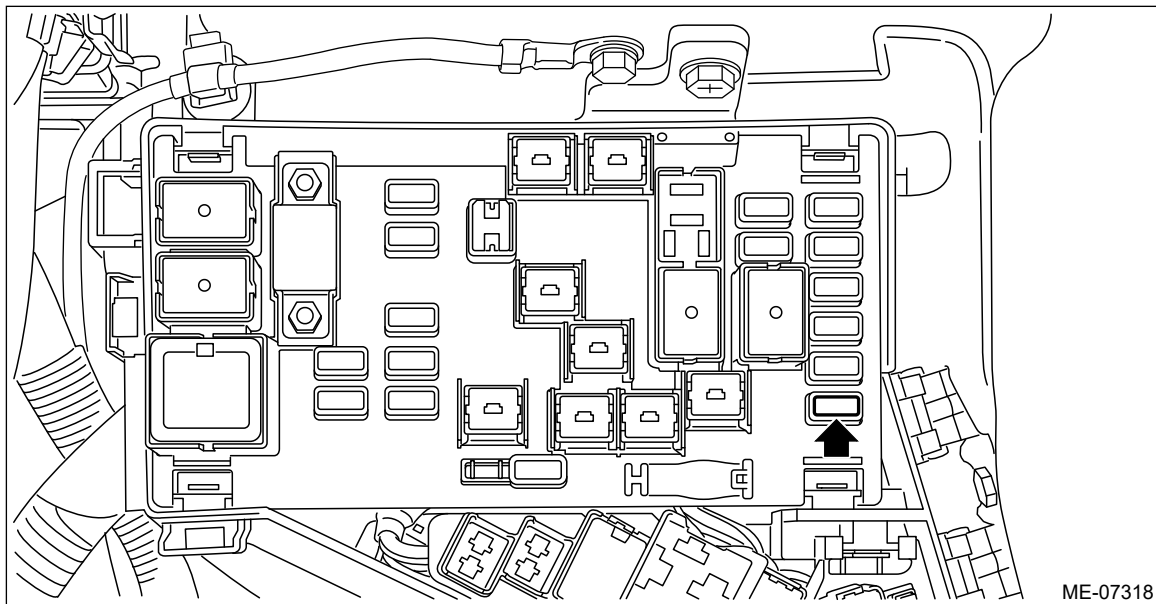
MECHANICAL(H4DOTC) > Compression

INSPECTION

Caution:

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

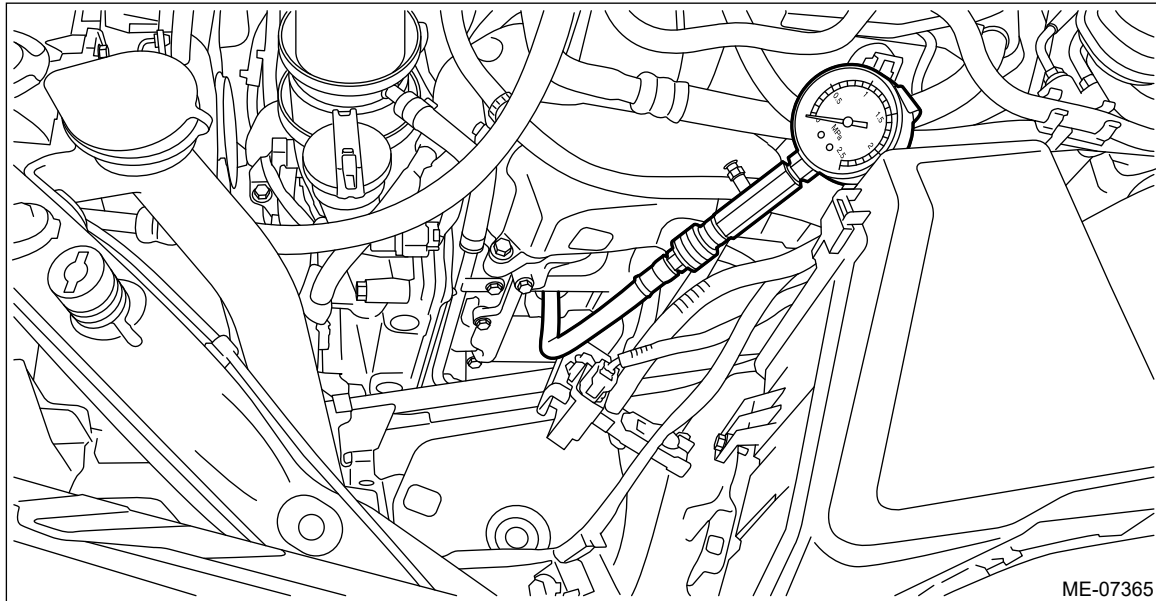
1. After warming-up the engine, turn the ignition switch to OFF.
2. Make sure that the battery is fully charged.
3. Check the starter motor for satisfactory performance and operation.
4. Remove the fuse of fuel pump from main fuse box.





5. Start the engine and run it until it stalls.
6. After the engine stalls, crank it for five more seconds.
7. Turn the ignition switch to OFF.
8. Remove all spark plugs. [🔗 Ref. to IGNITION\(H4DOTC\)>Spark Plug>REMOVAL.](#)
9. Install the compression gauge to the spark plug hole.

Note:

When using a screw-in type compression gauge, the screw should be less than 25 mm (0.98 in) long.



- 10.** Install the ECM.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Control Module \(ECM\)>INSTALLATION.](#)
- 11.** Install the battery.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Battery>INSTALLATION.](#)
- 12.** Turn the ignition switch to ON.
- 13.** Fully open the throttle valve.
- 14.** Crank the engine by starter motor and read the value when the needle of the compression gauge becomes stable.

Note:

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

Compression pressure (at 200 – 300 r/min):

Standard


1,350 – 1,750 kPa (14 – 18 kg/cm², 196 – 254 psi)

Difference between cylinders

100 kPa (1 kg/cm², 14 psi) or less

- 15.** After inspection, install the related parts in the reverse order of removal.





Note:

When compression pressure is checked, the malfunction indicator light illuminates and DTC (P0087) may be stored in ECM. When the malfunction indicator light has illuminated, perform the Clear Memory Mode.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Clear Memory Mode.](#)

MECHANICAL(H4DOTC) > Connecting Rod


SPECIFICATION

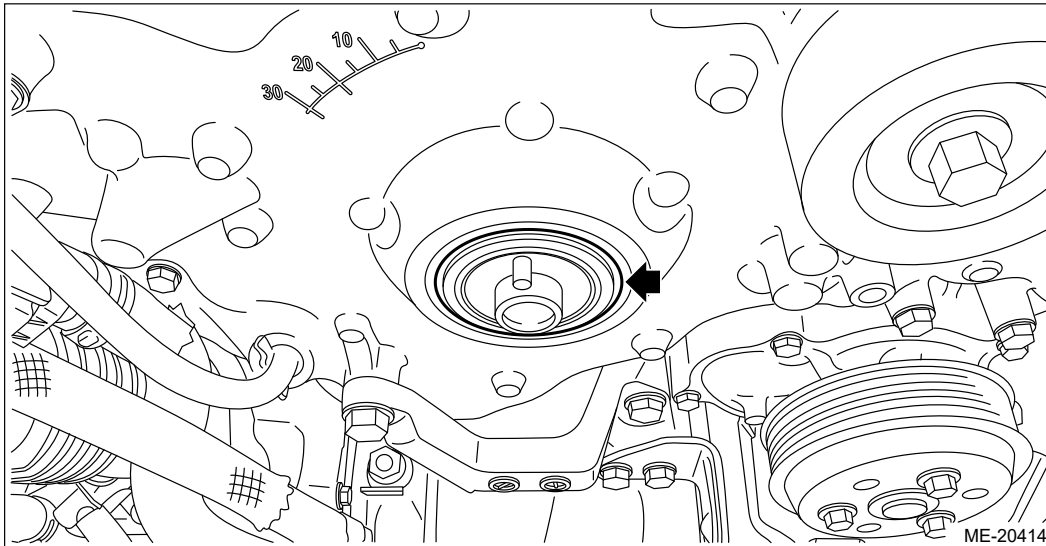
Refer to "Cylinder Block" for removal and installation procedures of connecting rod.

 [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>INSTALLATION.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>DISASSEMBLY > PISTON AND CONNECTING ROD.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>ASSEMBLY > PISTON AND CONNECTING ROD.](#)

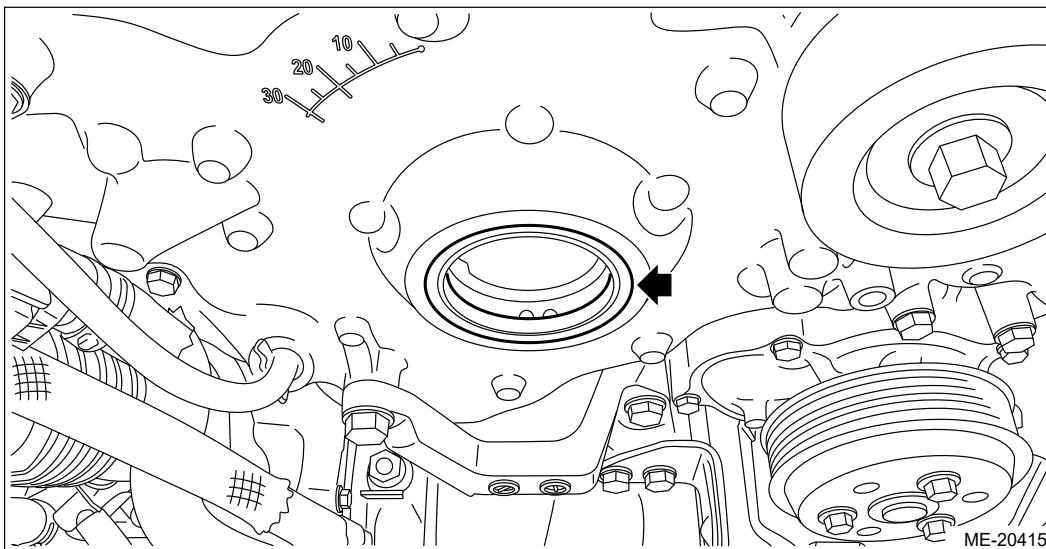
MECHANICAL(H4DOTC) > Crank Pulley

INSPECTION

1. Check that the crank pulley and crank pulley boss have no deformation, cracks or other damages.
2. Inspect for oil leakage from the front oil seal. If there is an oil leak, replace the front oil seal with a new part according to the following procedures.
 - (1) Remove the crank pulley.  Ref. to [MECHANICAL\(H4DOTC\)>Crank Pulley>REMOVAL](#).
 - (2) Remove the crank pulley boss from the chain cover.



- (3) Remove the front oil seal from the chain cover.



- (4) Degrease the press-fit section for the chain cover front oil seal, and install the front oil seal to the chain cover using ST.

Caution:

Do not apply fluid such as engine oil to the front oil seal and the chain cover; otherwise engine oil leakage may occur.

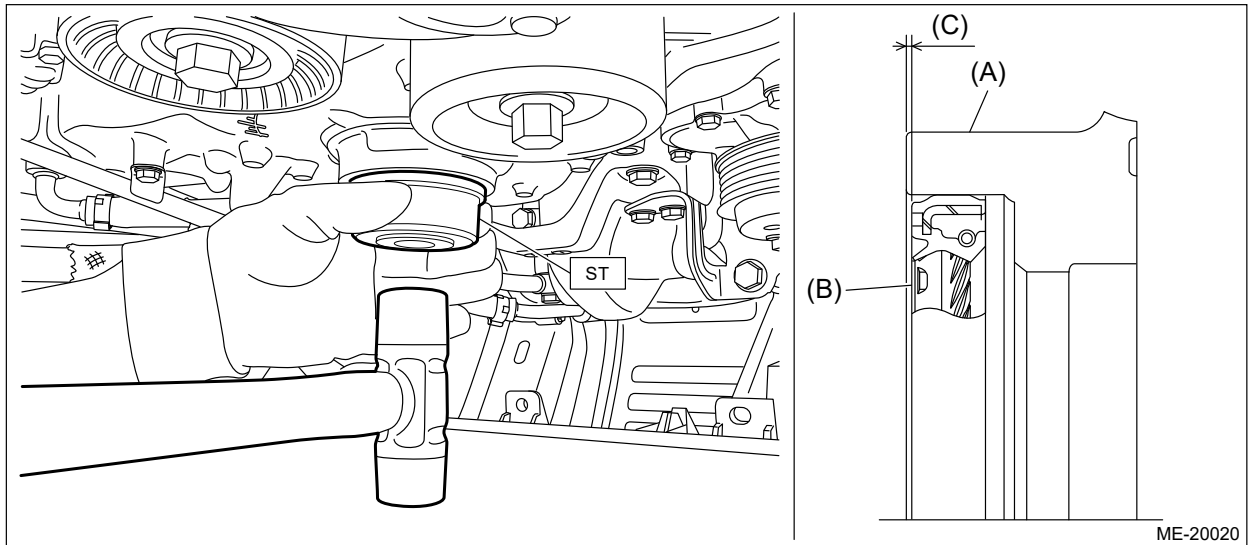
Note:

When tapping the front oil seal in, protect the radiator fin with cardboards etc. so as not to damage the radiator fin by the plastic hammer.

ST 41399FG020 SPECIAL TOOL B

Front oil seal press-fit position:

1^{+0}_{-1} mm ($0.0039^{+0}_{-0.0039}$ in) position from chain cover end face



(A) Chain cover

(B) Oil seal

(C) Front oil seal press-fit position
(1^{+0}_{-1} mm
($0.0039^{+0}_{-0.0039}$ in) position
from chain cover end face)

3. Install in the reverse order of removal after replacement.

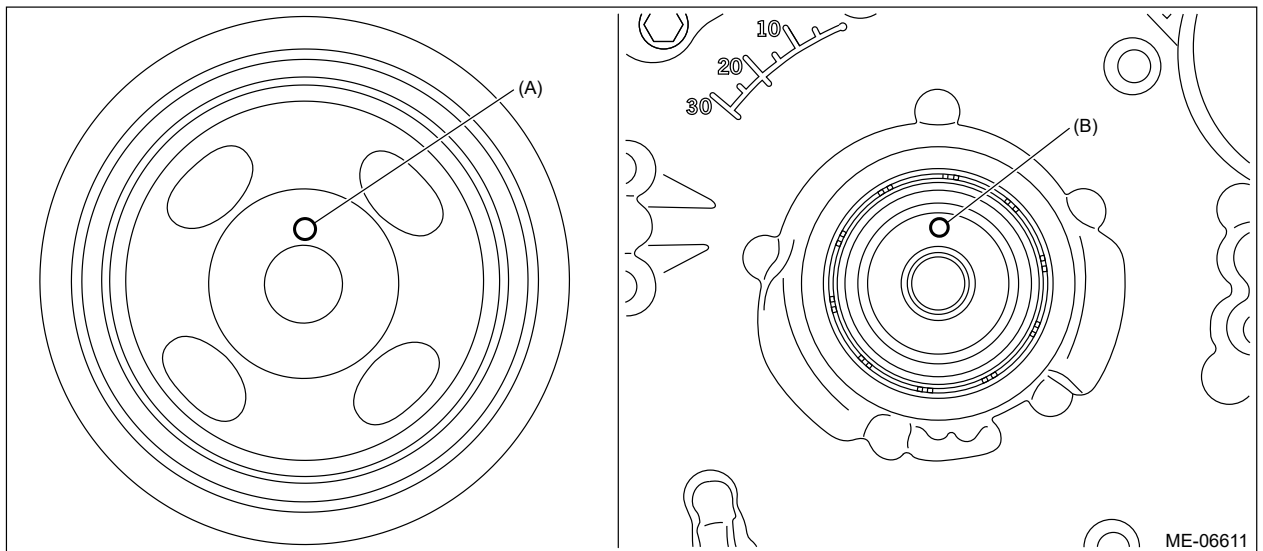
MECHANICAL(H4DOTC) > Crank Pulley

INSTALLATION

1. Clean the crankshaft thread using compressed air.
2. Apply engine oil to the crank pulley bolt seat and thread.
3. Install the crank pulley.
 - (1) Install the crank pulley to the crank pulley boss.

Note:

- Use new O-rings.
- Install the crank pulley by aligning the crank pulley knock hole (A) and crank pulley boss knock pin (B).



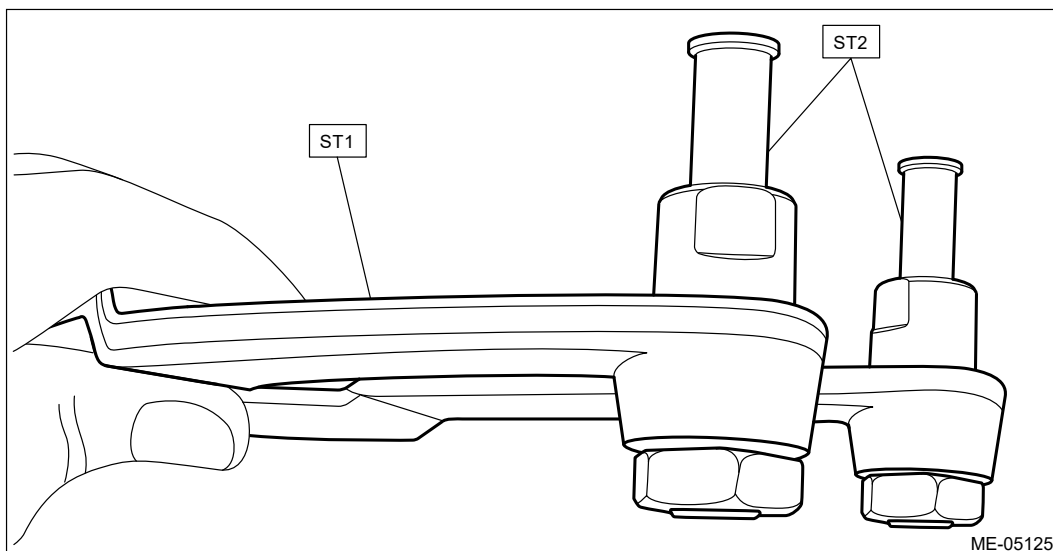
- (2) Use the ST to lock the crank pulley, and temporarily tighten the crank pulley bolt.

Note:

To prevent damaging ST1, attach the ST2 onto the ST1 as shown.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA000 PULLEY WRENCH PIN SET

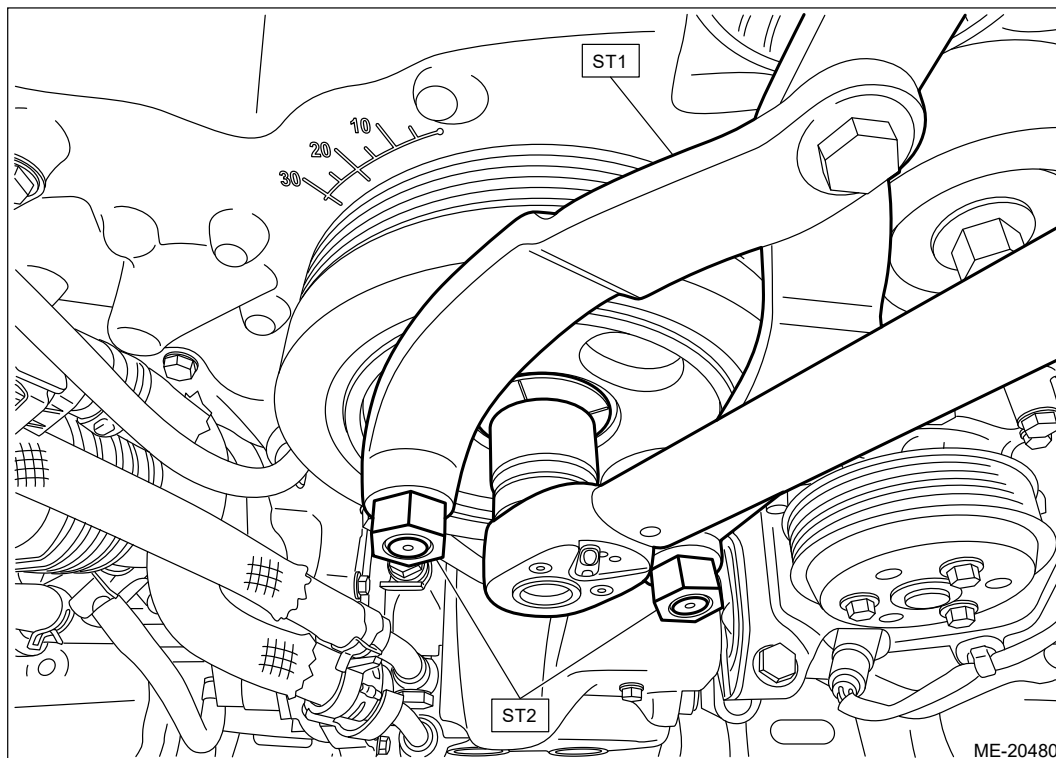


ST1 18355AA000 PULLEY WRENCH

ST2 18334AA000 PULLEY WRENCH PIN SET

Tightening torque:

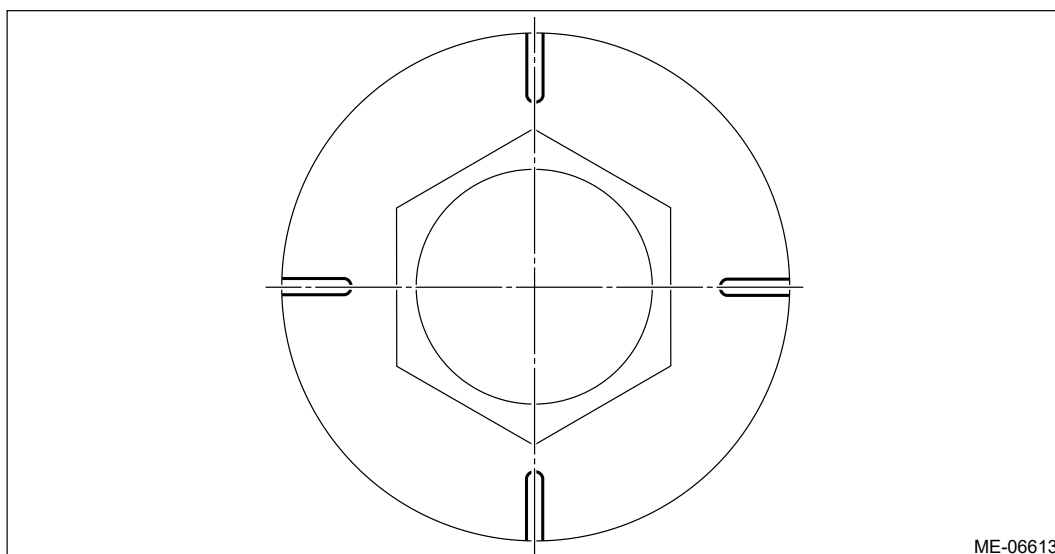
20 N·m (2.0 kgf-m, 14.8 ft-lb)



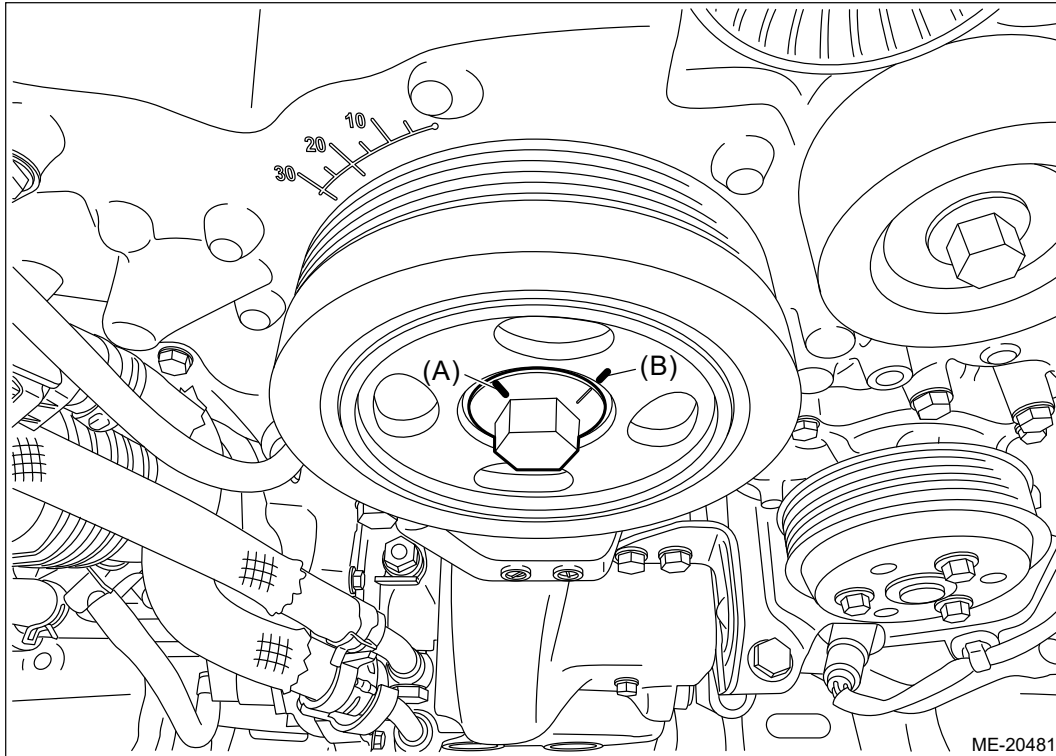
- (3) Use the marker as shown in the figure, draw the reference line (A) on the crank pulley bolt according to the indented line on the crank pulley bolt head, and draw the end line (B) on the crank pulley.

Note:

- Lines are indented by 90° on the crank pulley bolt head.



- Reference line is drawn for better visibility.



- (4) Use the ST to lock the crank pulley, and tighten the crank pulley bolt to the angle where reference line (A) and end line (B) are aligned.

Note:

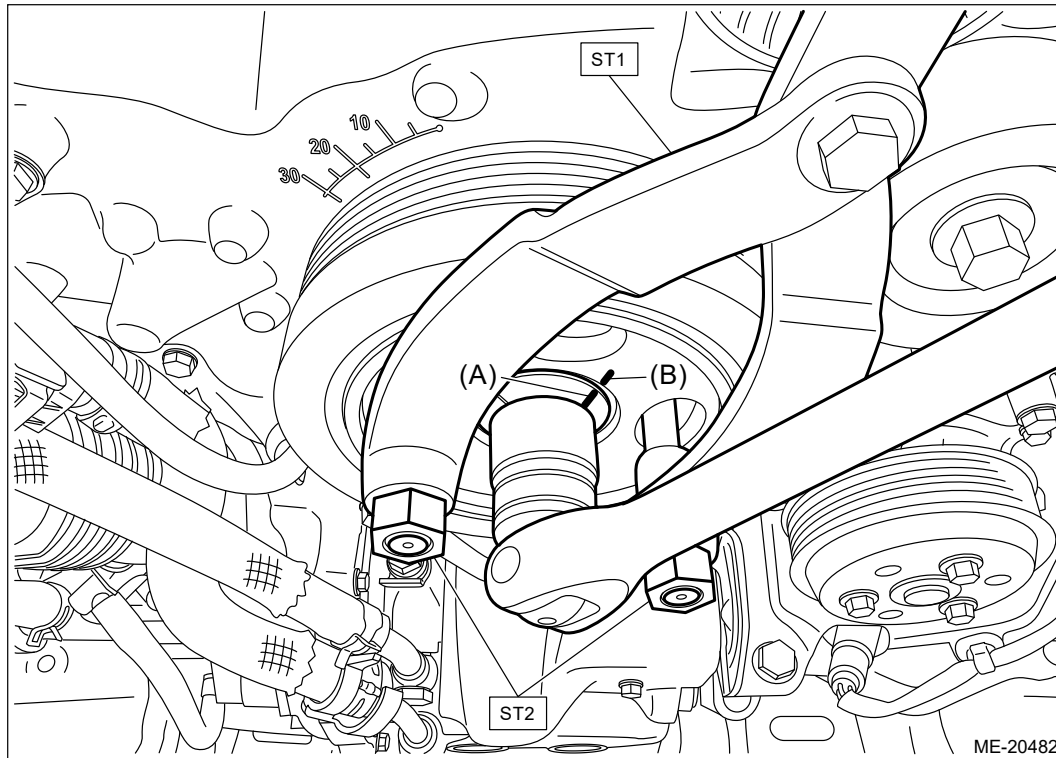
It should be approx. 90° when reference line (A) and end line (B) are aligned.


ST1 18355AA000 PULLEY WRENCH

ST2 18334AA000 PULLEY WRENCH PIN SET

Tightening angle:



90°±5°



4. Install the V-belts.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>INSTALLATION > V-BELT.](#)
5. When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

- (1) Install the radiator main fan & fan motor assembly and radiator sub fan & fan motor assembly.  [Ref. to COOLING\(H4DOTC\)>Radiator Main Fan and Fan Motor>INSTALLATION.](#)  [Ref. to COOLING\(H4DOTC\)>Radiator Sub Fan and Fan Motor>INSTALLATION.](#)

MECHANICAL(H4DOTC) > Crank Pulley

REMOVAL




Note:

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

1. When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

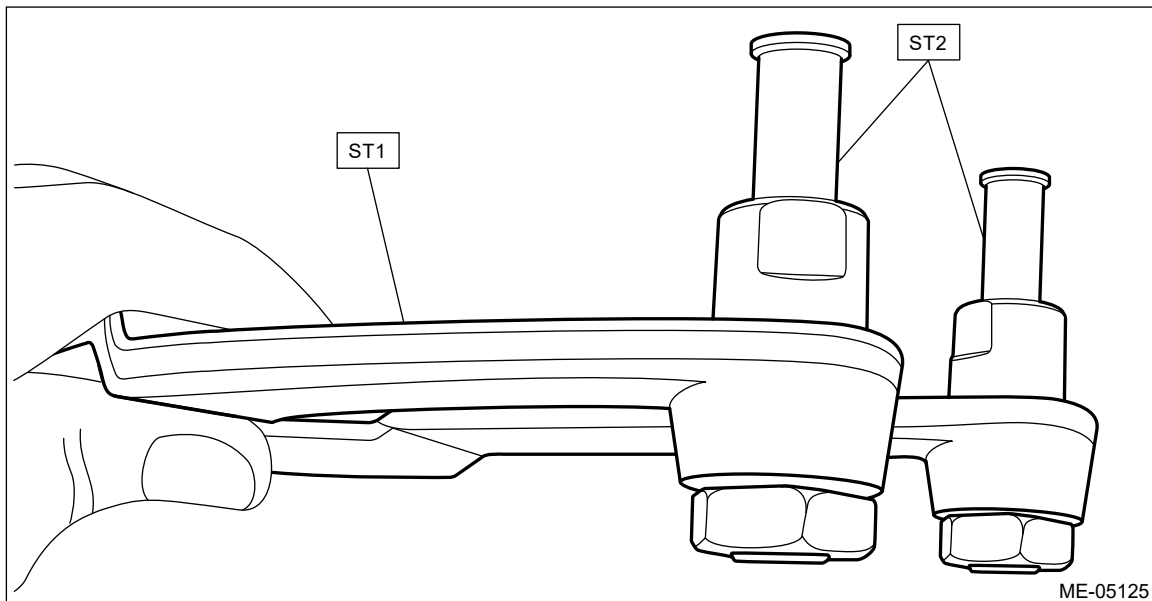
- (1) Remove the radiator main fan & fan motor assembly and radiator sub fan & fan motor assembly.  [Ref. to COOLING\(H4DOTC\)>Radiator Main Fan and Fan Motor>REMOVAL.](#)
 [Ref. to COOLING\(H4DOTC\)>Radiator Sub Fan and Fan Motor>REMOVAL.](#)
2. Remove the V-belts.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>REMOVAL > V-BELT.](#)
3. Use the ST to lock the crank pulley, and remove the crank pulley bolt.

Note:

To prevent damaging ST1, attach the ST2 onto the ST1 as shown.

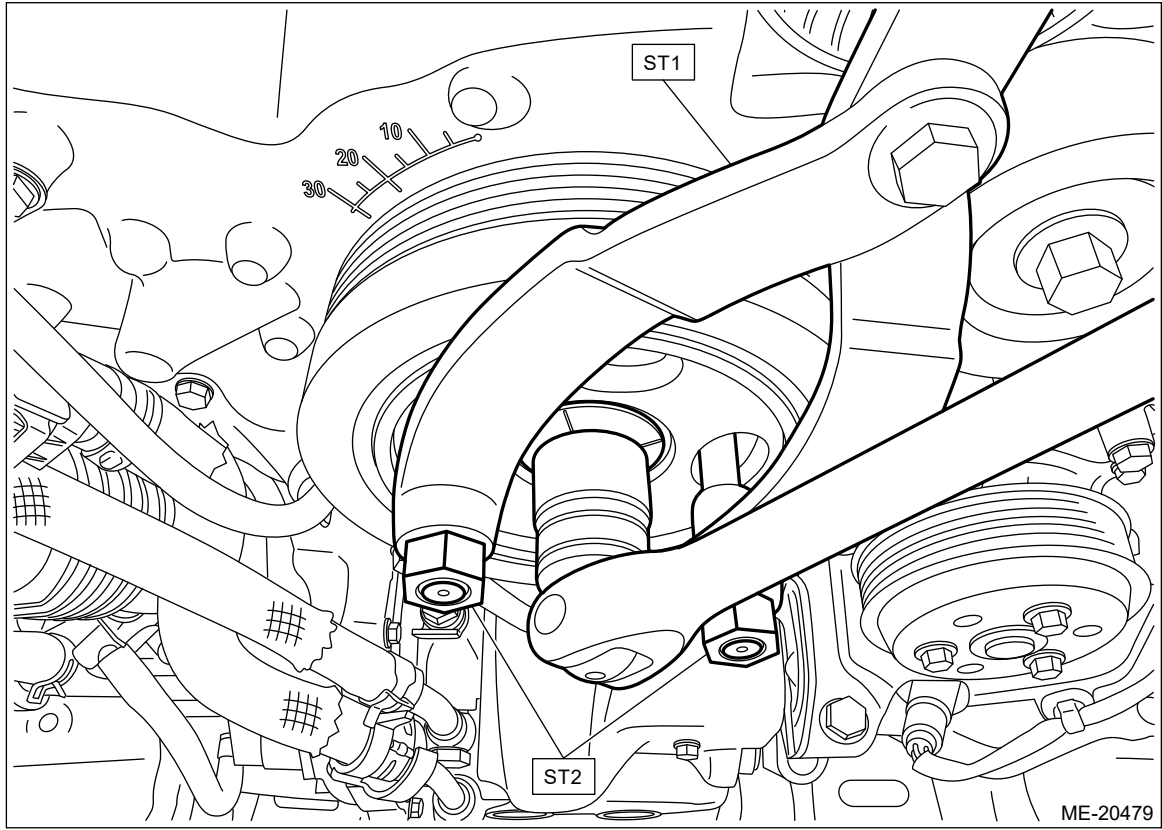
ST1 18355AA000 PULLEY WRENCH

ST2 18334AA000 PULLEY WRENCH PIN SET



ST1 18355AA000 PULLEY WRENCH

ST2 18334AA000 PULLEY WRENCH PIN SET



4. Remove the crank pulley.

ME-20479

MECHANICAL(H4DOTC) > Crank Sprocket

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.

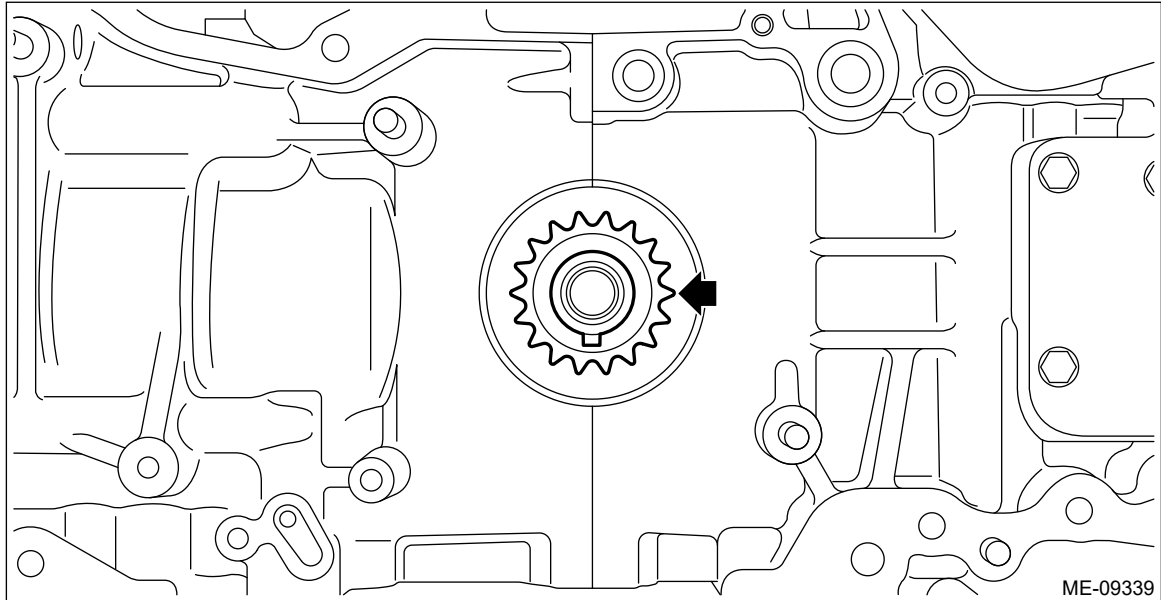
MECHANICAL(H4DOTC) > Crank Sprocket



INSTALLATION

1. Install the crank sprocket.

Note:

The direction of installation is not specified for the crank sprocket.





2. Install the timing chain.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>INSTALLATION.](#)
3. Install the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)

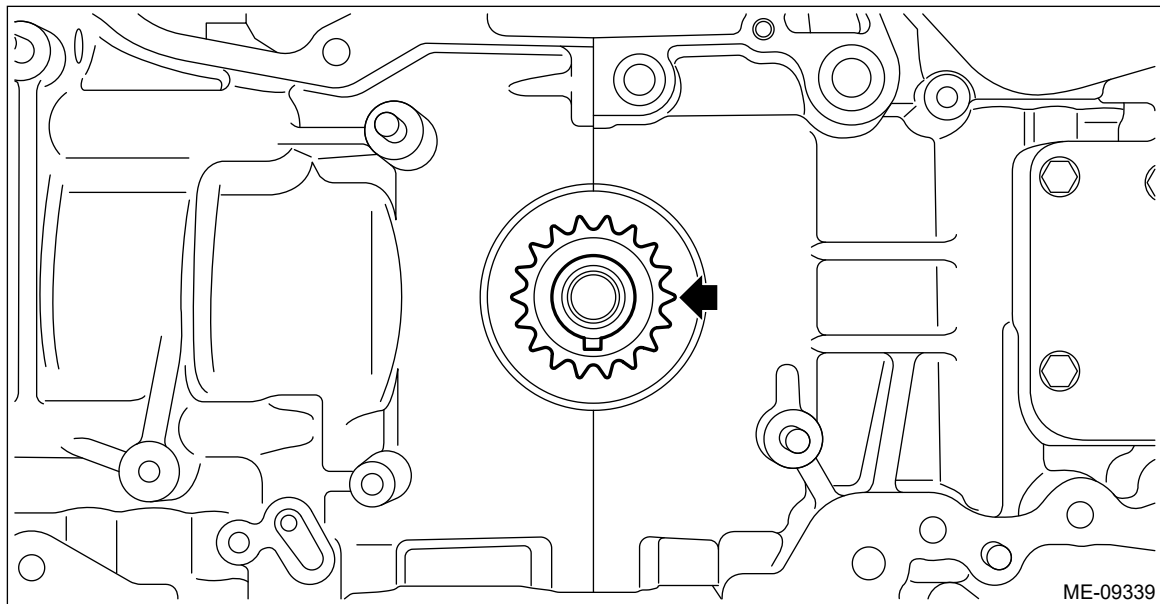
MECHANICAL(H4DOTC) > Crank Sprocket

REMOVAL

Note:

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



1. Remove the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
2. Remove the timing chain.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>REMOVAL.](#)
3. Remove the crank sprocket.



MECHANICAL(H4DOTC) > Crankshaft

SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of the crankshaft.

 [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>INSTALLATION.](#)

ASSEMBLY

1. CYLINDER BLOCK

1. Apply liquid gasket to the threaded portion of the main gallery plug, and install the main gallery plug to the cylinder block LH.

Note:

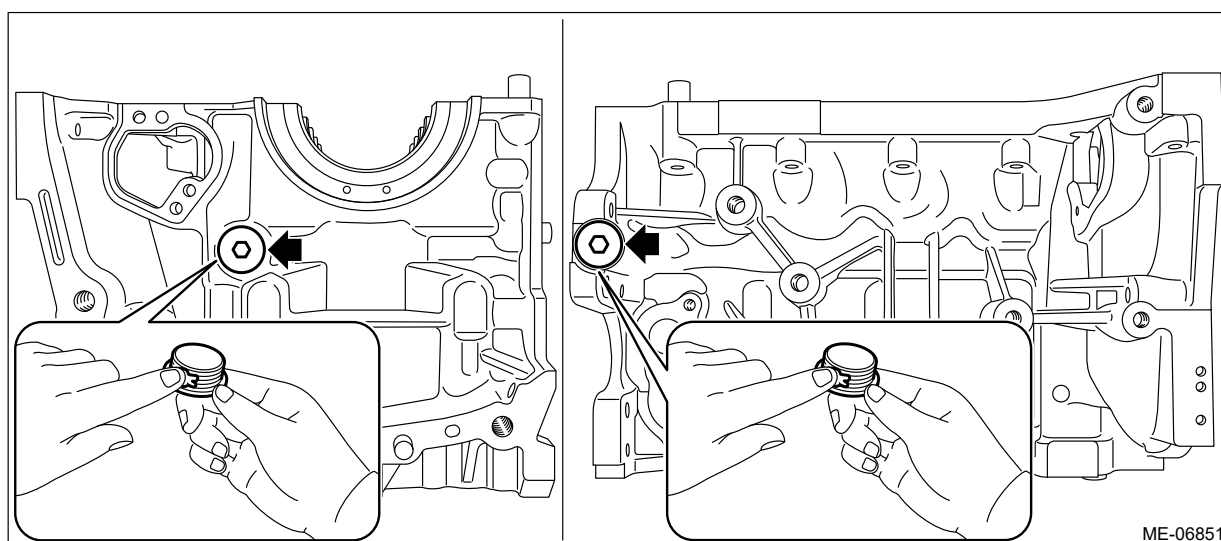
Before applying liquid gasket, degrease the thread holes of the cylinder block LH and main gallery plug.

Liquid gasket:

THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:

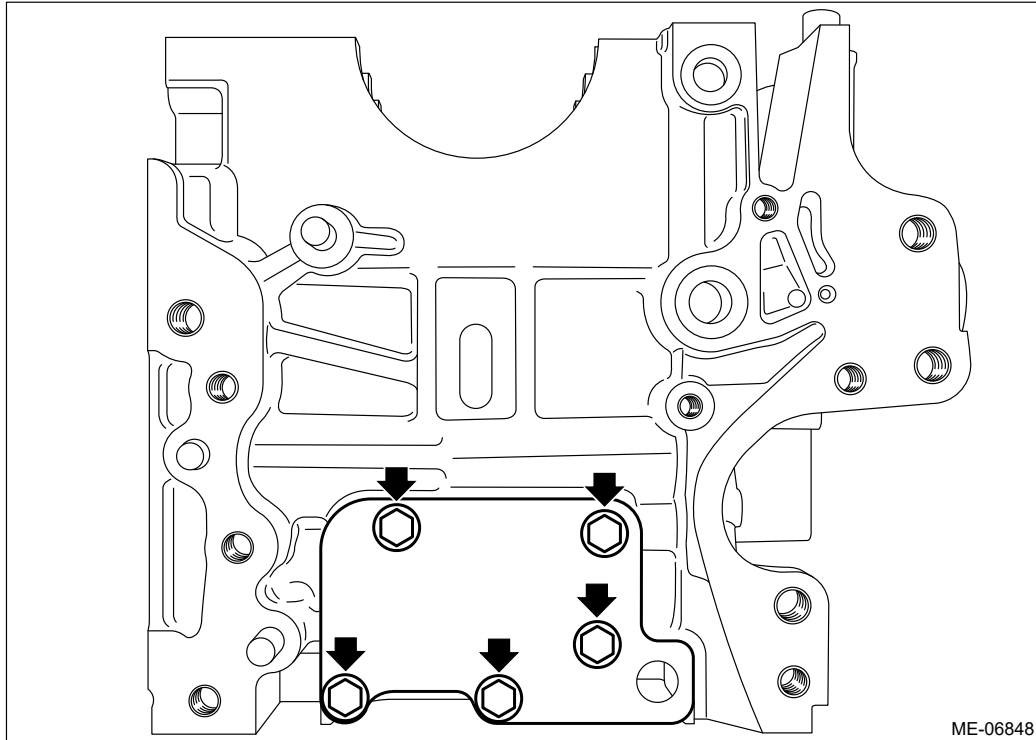
37 N·m (3.8 kgf-m, 27.3 ft-lb)



2. Install the cylinder block plate onto cylinder block LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



ME-06848

3. Apply liquid gasket to the threaded portions of cylinder block plug and main gallery plug, and install the cylinder block plug (A) and main gallery plug (B) to cylinder block RH.

Note:

Before applying liquid gasket, degrease the thread holes of the cylinder block RH, and the threaded portions of cylinder block plug and main gallery plug.

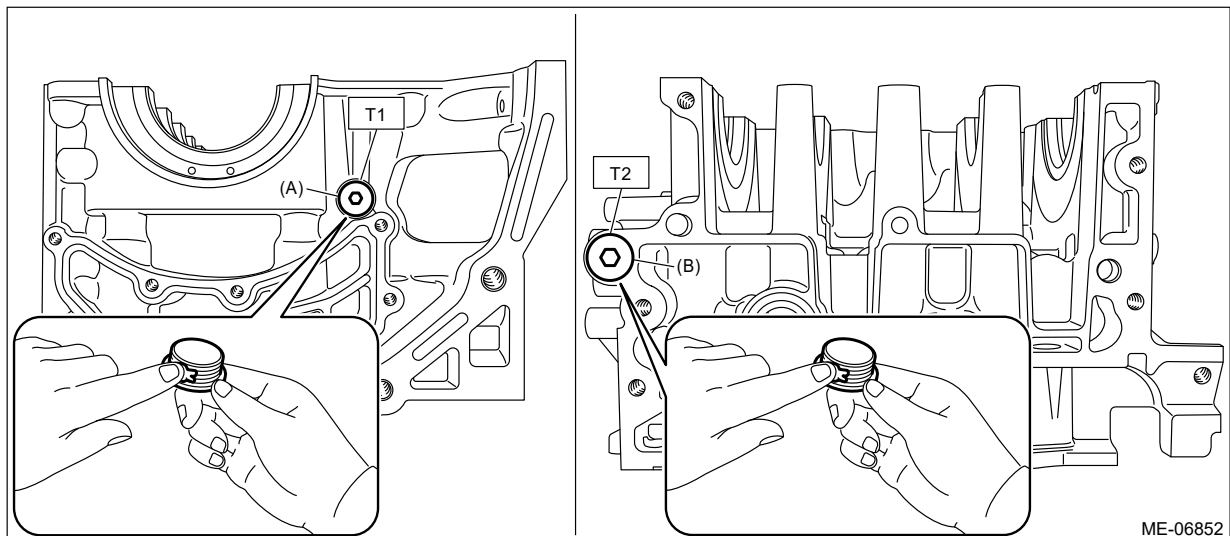
Liquid gasket:

THREE BOND 1105 (Part No. 004403010) or equivalent

Tightening torque:

T1: 16 N·m (1.6 kgf·m, 11.8 ft·lb)

T2: 37 N·m (3.8 kgf·m, 27.3 ft·lb)



ME-06852

4. Install the oil separator cover to the cylinder block RH.
 (1) Apply liquid gasket to the mating surfaces of oil separator cover.

Note:

- Use new oil separator cover.

- Before applying liquid gasket, degrease the old liquid gasket seal surface of cylinder block RH.
- Install within 5 min. after applying liquid gasket.

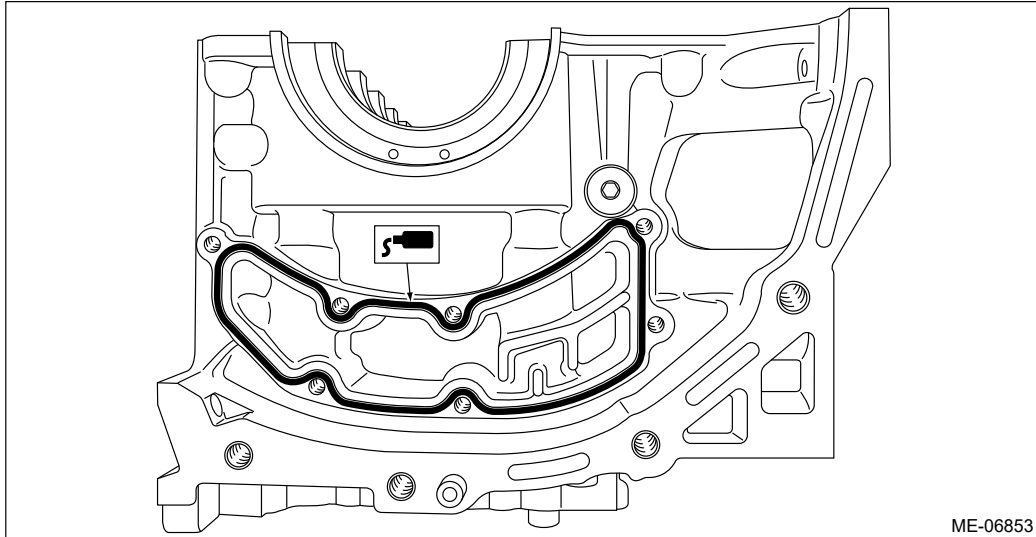
Liquid gasket:

Mating surface

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

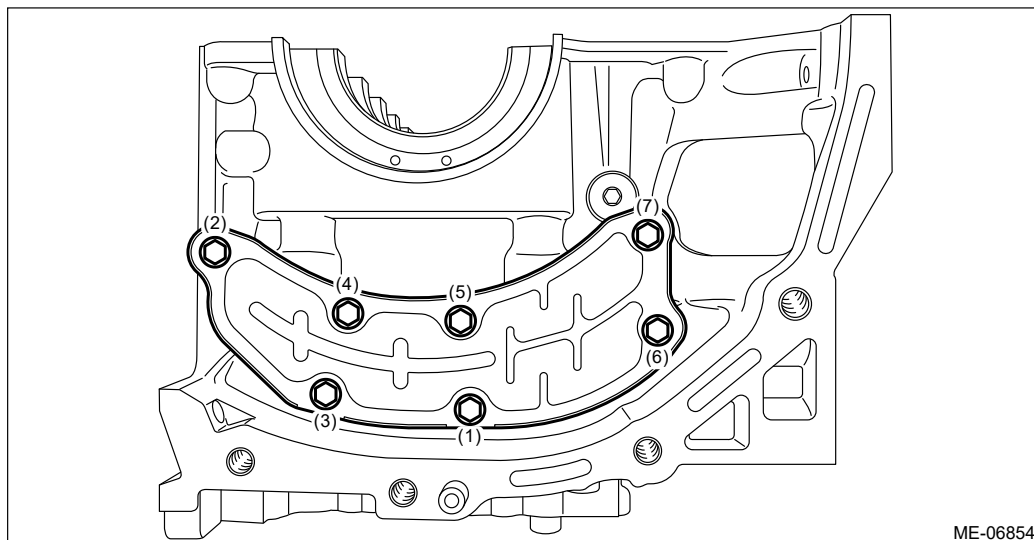
4±1 mm (0.1772±0.0394 in)



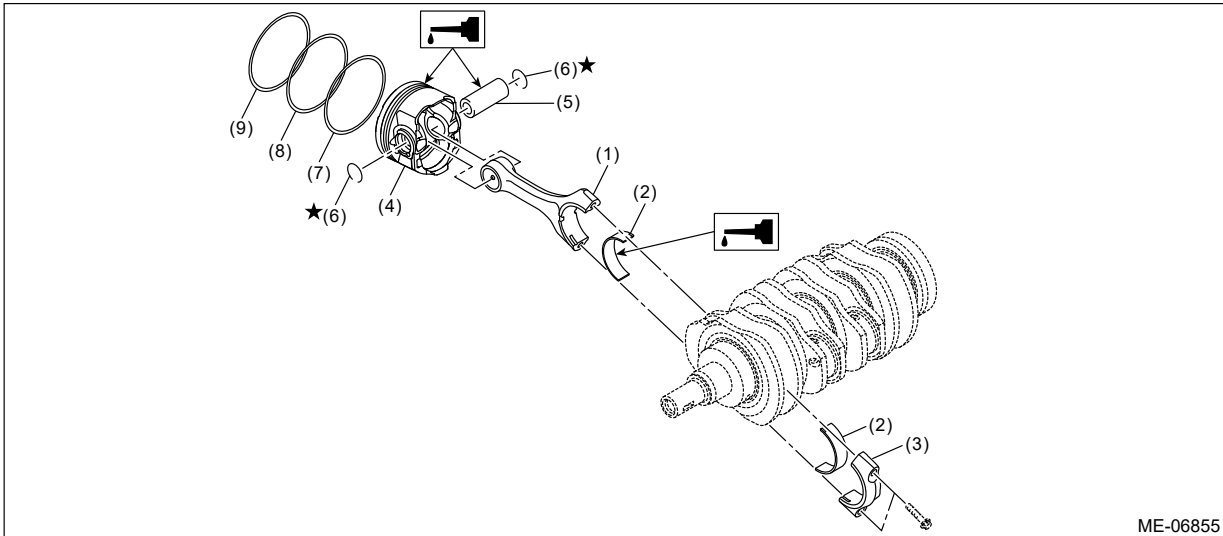
- (2) Install the oil separator cover to the cylinder block RH, and tighten the oil separator cover bolts in numerical order as shown in the figure.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



2. PISTON AND CONNECTING ROD

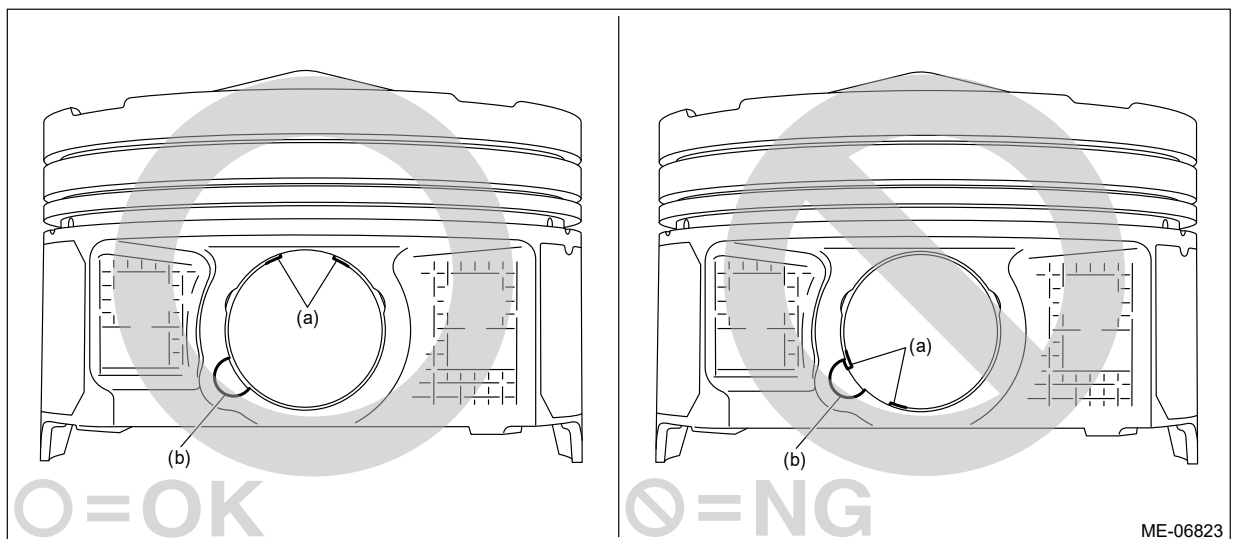


- | | | |
|----------------------------|----------------|-----------------|
| (1) Connecting rod | (4) Piston | (7) Oil ring |
| (2) Connecting rod bearing | (5) Piston pin | (8) Second ring |
| (3) Connecting rod cap | (6) Circlip | (9) Top ring |

1. Install the connecting rod bearing to the connecting rod and connecting rod cap.
2. Install the circlip on one end of the piston using a flat tip screwdriver.

Note:

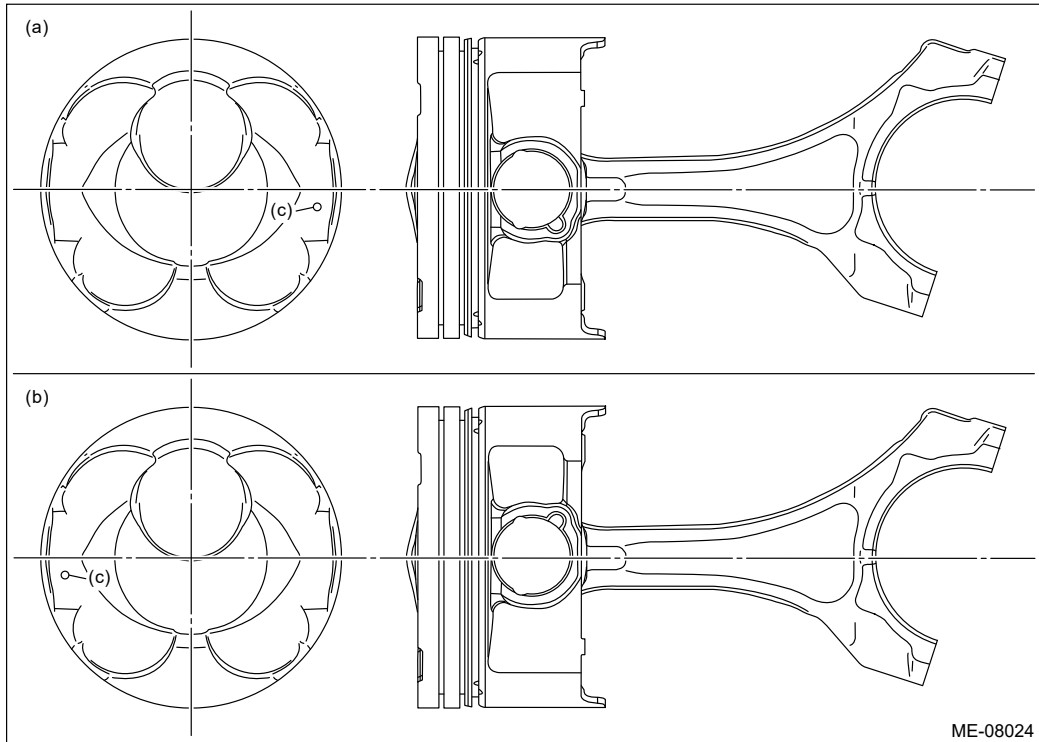
- Be careful not damage the piston, by wrapping the tip of flat tip screwdriver with tape.
- Make sure the circlip is firmly inserted into the circlip groove.
- After installing the circlip, rotate the circlip so that its end part (a) and the cutout portion of circlip groove (b) do not match.



3. Set the piston to the connecting rod.

Note:

Align the front mark of piston and the connecting rod direction correctly as shown in the figure.



(a) RH side (#1 and #3)

(b) LH side (#2 and #4)

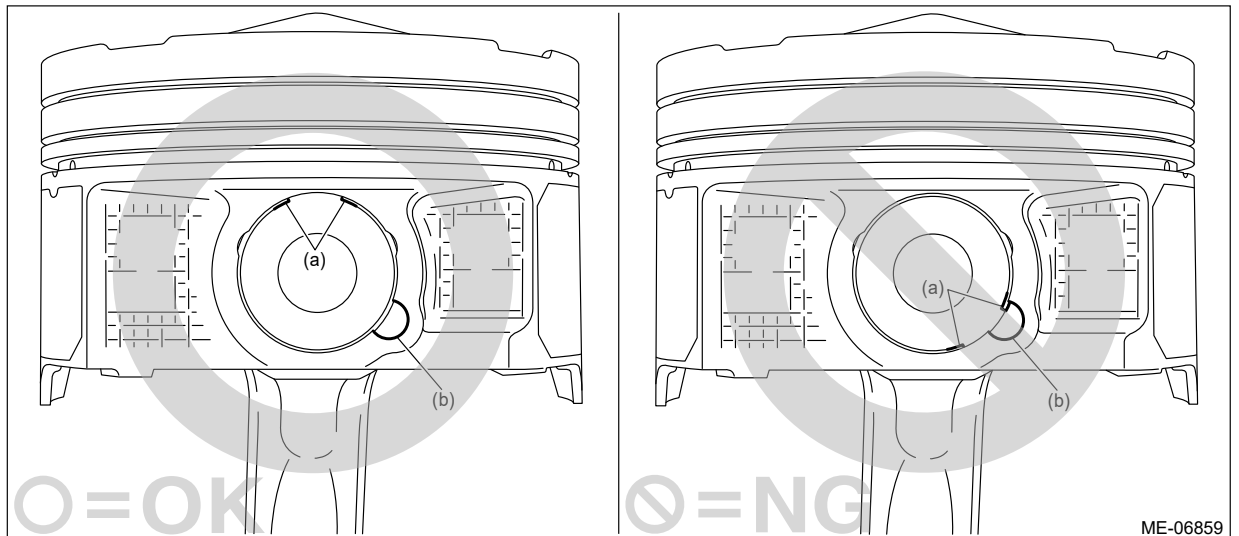
(c) Front mark

4. Apply engine oil to the piston pin, and attach the piston pin.

5. Install the circlip on the piston using a flat tip screwdriver.

Note:

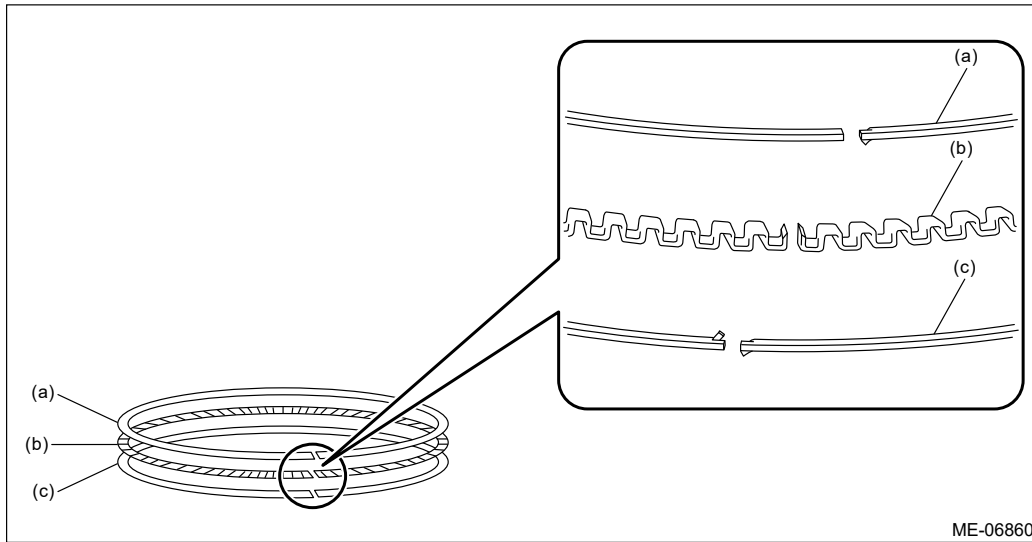
- **Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.**
- **Make sure the circlip is firmly inserted into the circlip groove.**
- **After installing the circlip, rotate the circlip so that its end part (a) and the cutout portion of circlip groove (b) do not match.**



6. Install the oil rings to the piston in the order of expander, lower rail and upper rail by hand.

Note:

Oil ring consists of the upper rail, expander and lower rail.

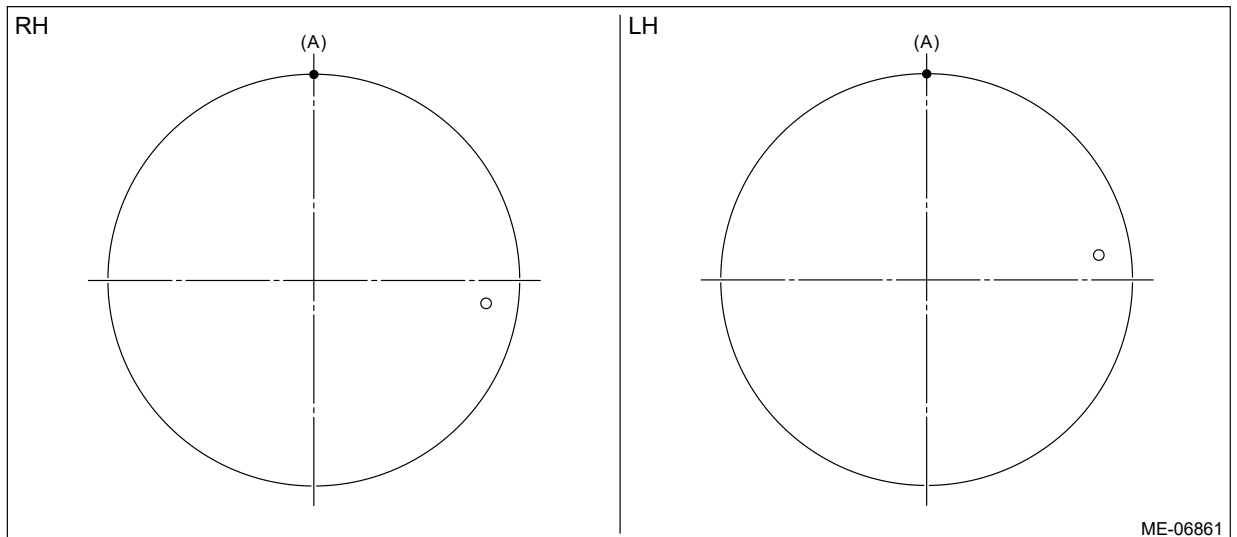


(a) Upper rail

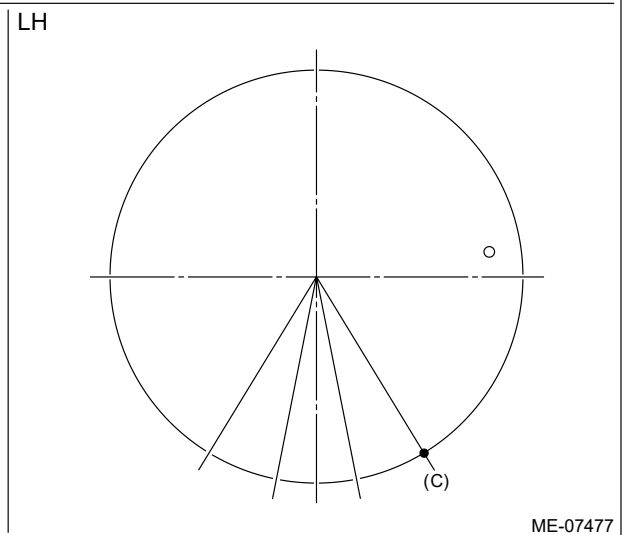
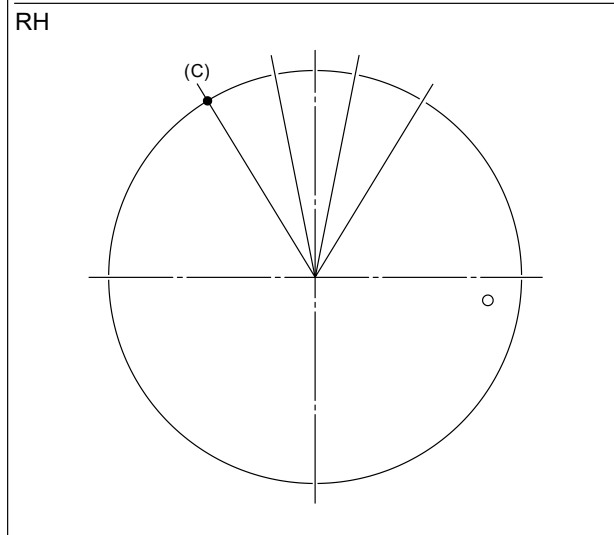
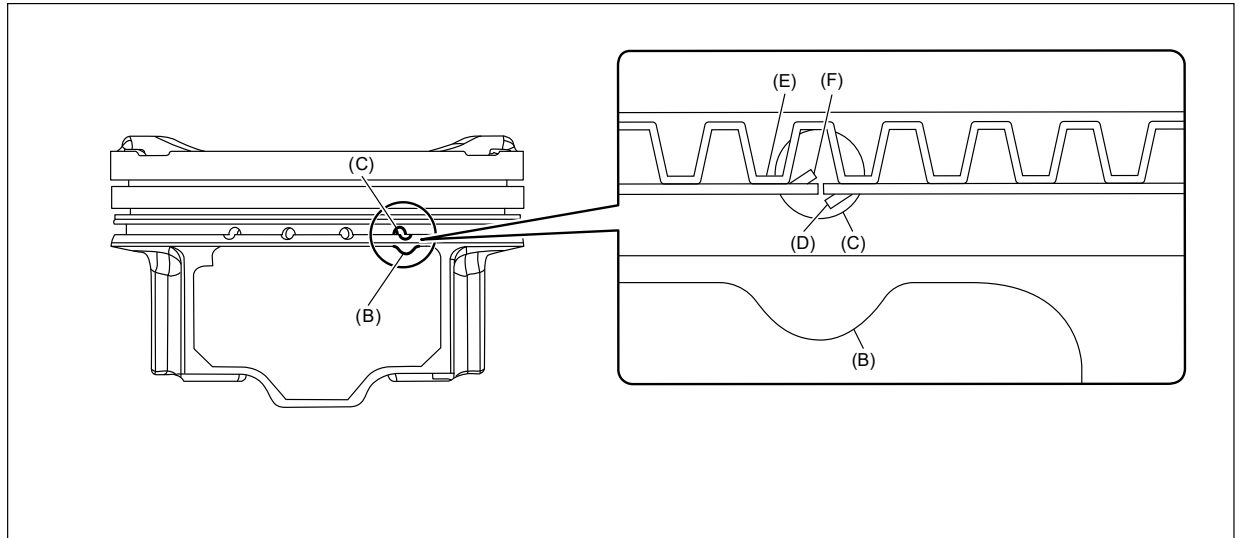
(b) Expander

(c) Lower rail

(1) Set the ring gap of the expander to the position (A).

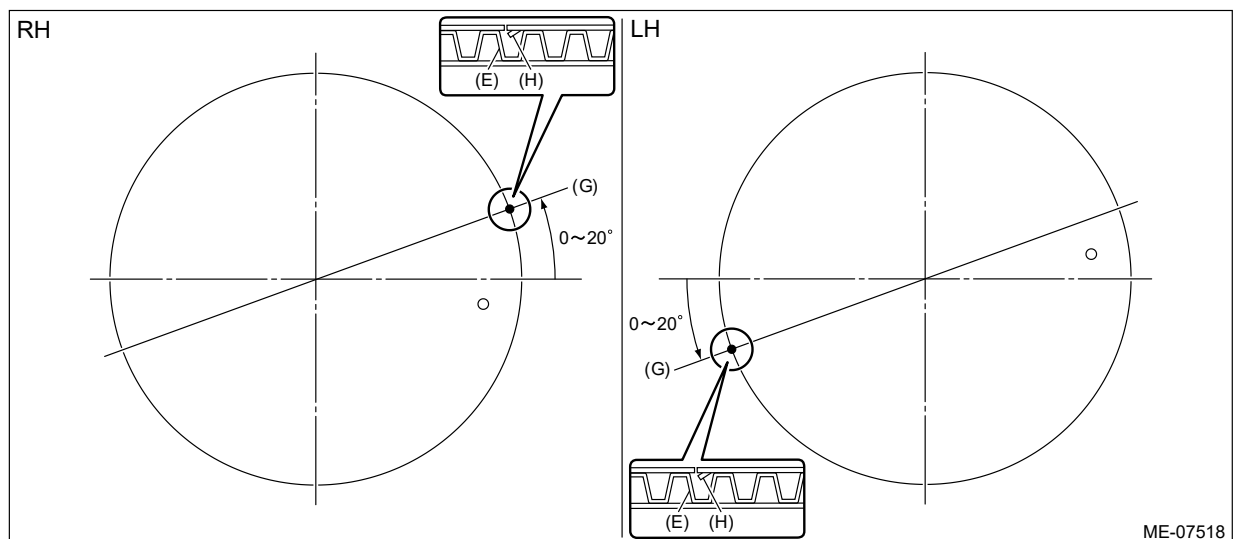


(2) Set the lower rail spin stopper (D) to the oil groove (C) located above the cutout portion (B) of the piston skirt coating, and hook the lower rail spin stopper (F) to the expander (E).



ME-07477

(3) Set the upper rail gap to the position (G), and hook the upper rail spin stopper (H) to the expander (E).



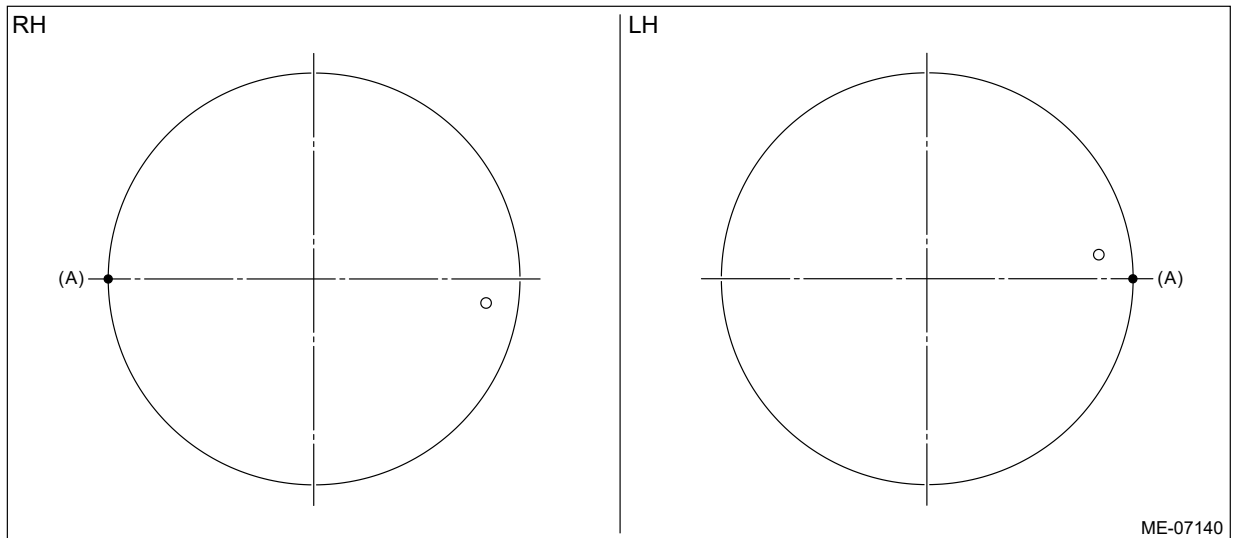
ME-07518

7. Install the compression rings to the piston in the order of second ring and top ring, using piston ring expander.

(1) Set the ring gap of the second ring to the position (A) in the figure.

Note:

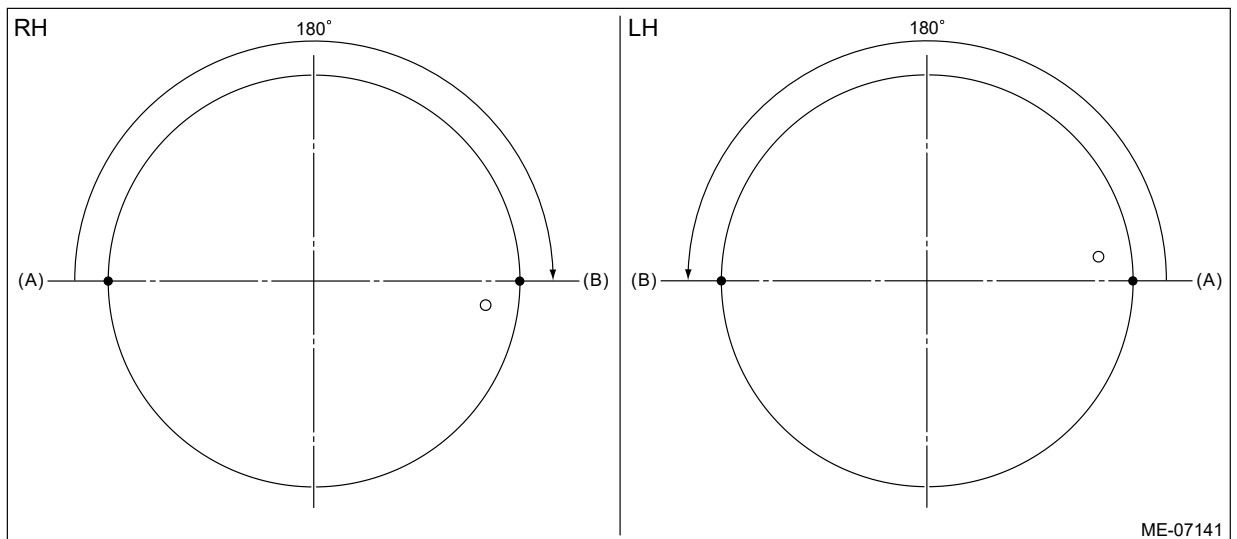
Install the second ring so that the ring mark (2N) faces the piston crown.



- (2) Set the ring gap of top ring at (B) in the figure on the 180° opposite direction of (A).

Note:

Install the top ring so that the ring mark (TN) faces the piston crown.

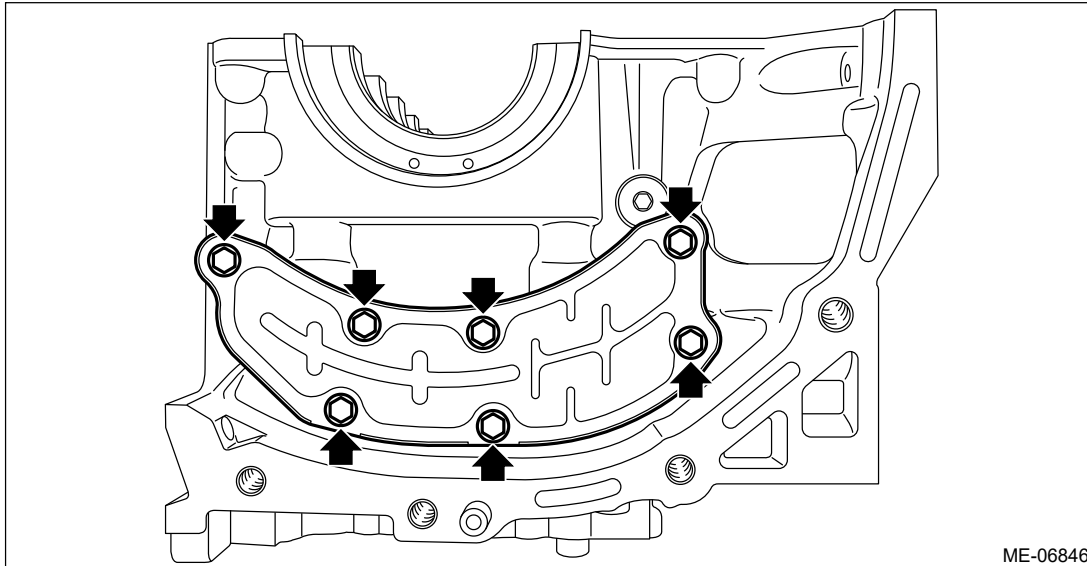


- 8.** Check that the piston ring is installed correctly.

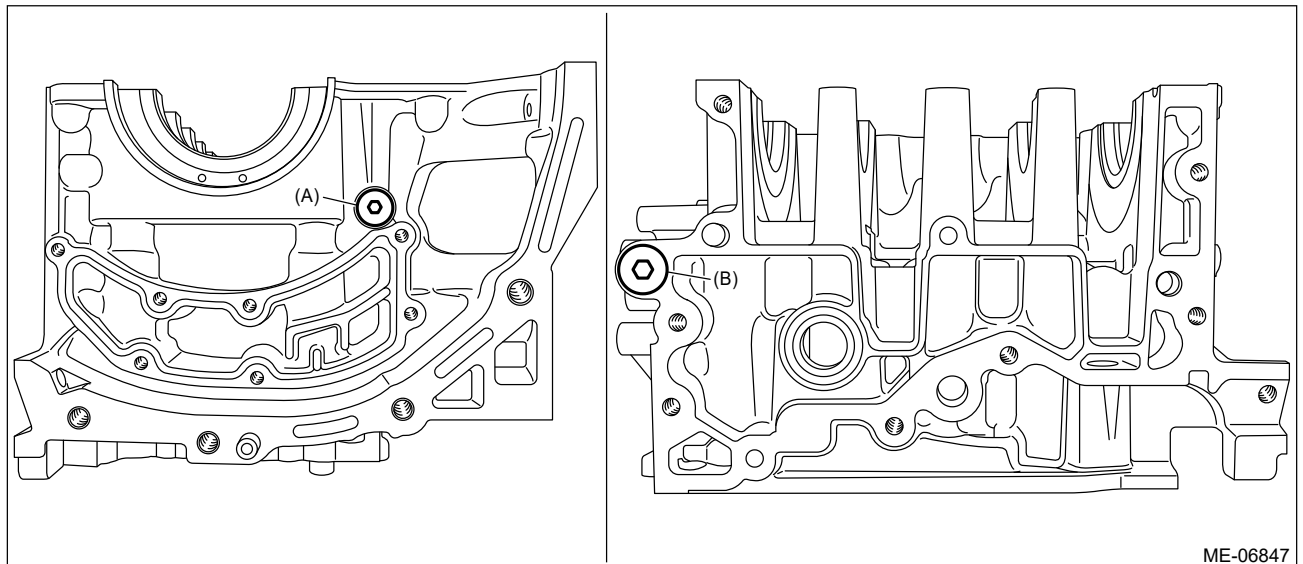
DISASSEMBLY

1. CYLINDER BLOCK

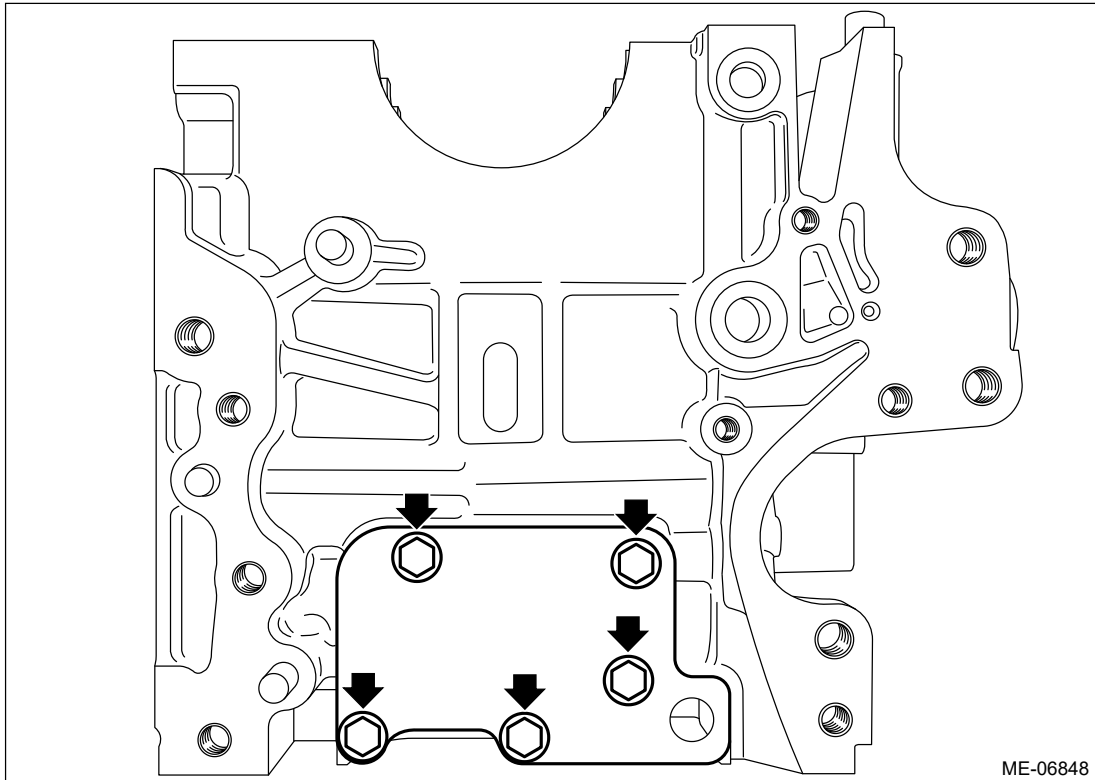
1. Remove the oil separator cover from cylinder block RH.



2. Remove the liquid gasket from cylinder block RH.
3. Remove the cylinder block plug (A) and the main gallery plug (B) from cylinder block RH.

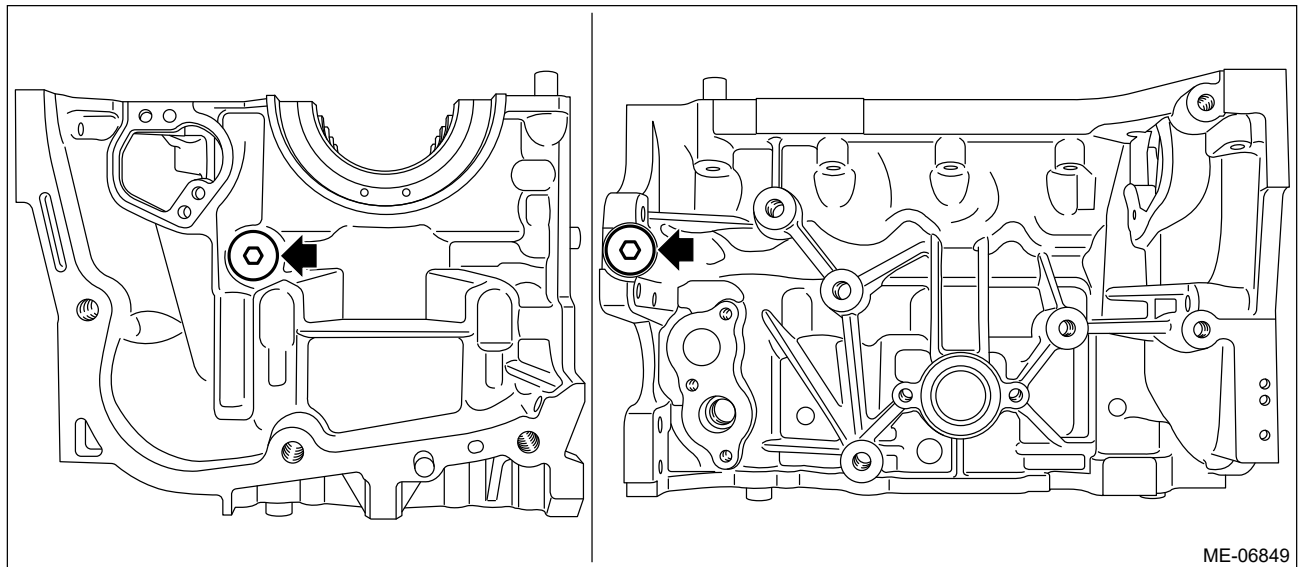


4. Remove the liquid gasket from the thread holes of the cylinder block RH, and from the threaded portions of cylinder block plug and main gallery plug.
5. Remove the cylinder block plate from cylinder block LH.



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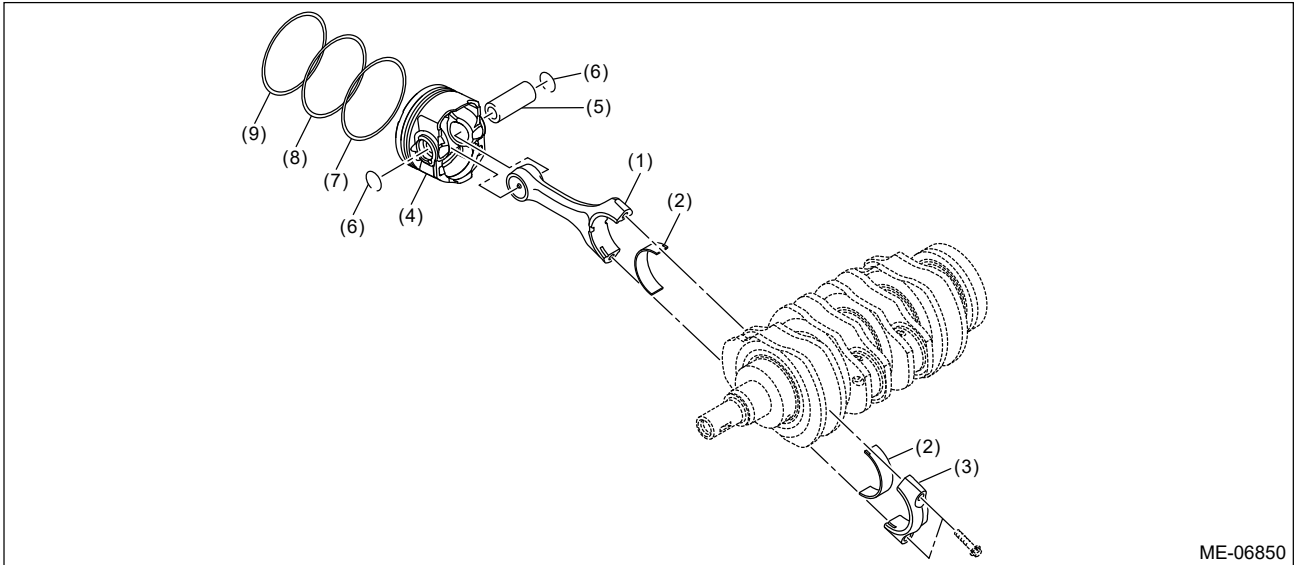
6. Remove the main gallery plug from cylinder block LH.



ME-06849

7. Remove the liquid gasket from the thread holes of the cylinder block LH and main gallery plug.

2. PISTON AND CONNECTING ROD



ME-06850

- | | | |
|----------------------------|----------------|-----------------|
| (1) Connecting rod | (4) Piston | (7) Oil ring |
| (2) Connecting rod bearing | (5) Piston pin | (8) Second ring |
| (3) Connecting rod cap | (6) Circlip | (9) Top ring |

Note:

To prevent confusion of various parts, mark each part.

1. Remove the connecting rod bearing from connecting rod and connecting rod cap.
2. Remove the piston rings from the piston.

Note:

Arrange the piston rings in order so that they can be installed in their original positions without confusion.

- (1) Remove the compression rings in the order of top ring and second ring, using piston ring expander.
- (2) Remove the oil rings in the order of upper rail, lower rail and expander by hand.
3. Remove the circlip on one end from the piston using a flat tip screwdriver.

Note:

Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.

4. Remove the piston pin from piston, and remove the connecting rod from piston.
5. Remove the circlip on other end from the piston using a flat tip screwdriver.

Note:

Be careful not damage the piston and piston pin, by wrapping the tip of flat tip screwdriver with tape.

INSPECTION

1. CYLINDER BLOCK & PISTON

1. Visually inspect to make sure that there are no cracks, scratches or other damage.
2. Use liquid penetrant tester on the important sections to check for fissures.
3. Check that there are no traces of gas leaking or water leaking on the gasket attachment surface.
4. Check the oil passages for clogging.
5. Check for warpage of mating surfaces of the cylinder block that contacts cylinder head using a straight edge and thickness gauge. If it exceeds the limit, correct the surface by grinding it with a surface grinder or replace the cylinder block.

Note:

Measurement should be performed at a temperature of 20°C (68°F).

Cylinder block warpage:

Limit

0.025 mm (0.0010 in)

Grinding limit of cylinder block:

204.9 mm (8.067 in) or less

Height of cylinder block:

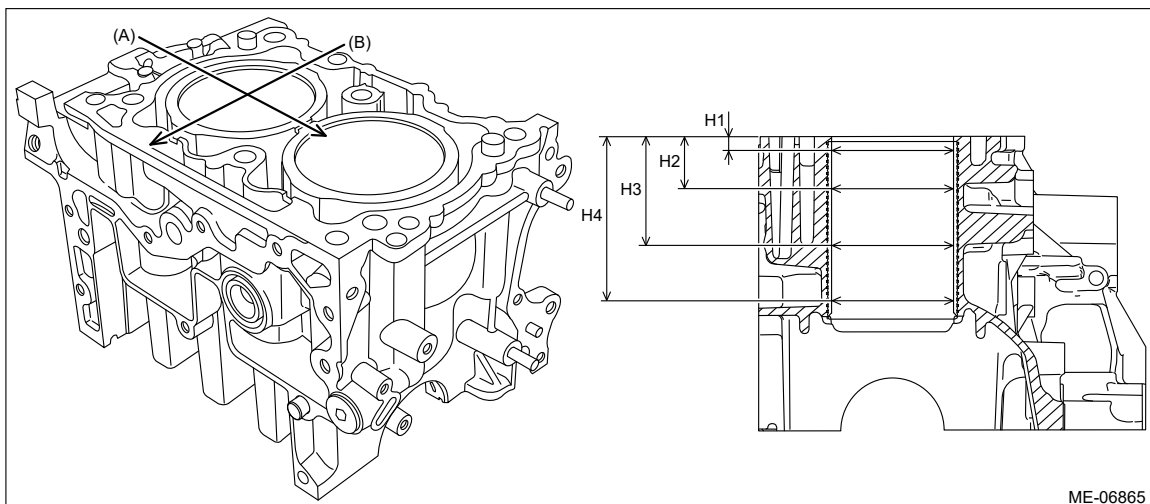
Standard

205.0 mm (8.071 in)

6. Using a cylinder bore gauge, check the cylindricity and out-of-roundness of cylinder liner. If it is not within the standard, perform reboring (including honing), or replace the cylinder block and piston as a set. For reboring and honing procedure, refer to step 8).

Note:

- Measure the cylinder liner with cylinder blocks separated (into cylinder block RH and cylinder block LH).
- Measurement should be performed at a temperature of 20°C (68°F).
- Write down all measurement values as the values are used in the next procedure.
- Measure the inner diameter of each cylinder liner in both the thrust and piston pin directions at the heights as shown in the figure.



(A) Piston pin direction

(B) Thrust direction

H1: 10 mm (0.3937 in)

H2: 45 mm (1.7717 in)

H3: 80 mm (3.1496 in)

H4: 105 mm (4.1339 in)

- Calculate the cylindricity of cylinder liner by using the following formula.

| |
|---------------------|
| Calculation formula |
|---------------------|

C = The larger value between the calculation values C' and C''

$C' = (D(a) - D(b)) / 2$

$C'' = (D(c) - D(d)) / 2$

C: Cylindricity of cylinder liner

D(a): The largest value of all the values obtained by measuring the cylinder liner inner diameter in the direction of the piston pin

D(b): The smallest value of all the values obtained by measuring the cylinder liner inner diameter in the direction of the piston pin

D(c): The largest value of all the values obtained by measuring the cylinder liner inner diameter in the thrust direction

D(d): The smallest value of all the values obtained by measuring the cylinder liner inner diameter in the thrust direction

- Calculate the out-of-roundness of cylinder liner at each measurement height by using the following formula.

Calculation formula

$R = (D(e) - D(f)) / 2$

R: Out-of-roundness of cylinder liner

D(e): The larger value between the measurement values in the piston pin direction and in the thrust direction of cylinder liner inner diameter

D(f): The smaller value between the measurement values in the piston pin direction and in the thrust direction of cylinder liner inner diameter

Cylindricity of cylinder liner:

Limit

0.030 mm (0.0012 in)

Out-of-roundness of cylinder liner:

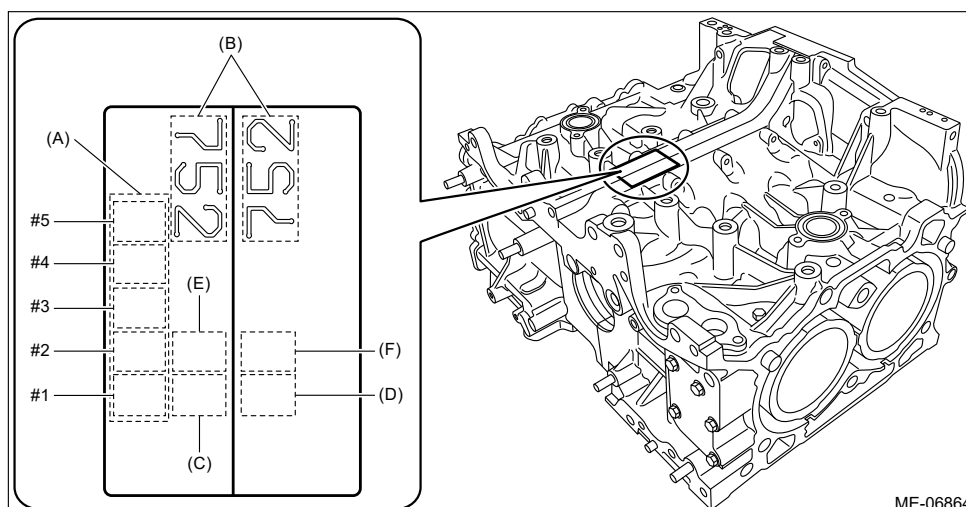
Limit

0.030 mm (0.0012 in)

7. Check the clearance between cylinder liner and piston. Check the clearance between cylinder liner and piston by measuring the inner diameter of cylinder liner and the outer diameter of piston respectively.
 - (1) Measure the inner diameter of cylinder liner. If it is not within the standard, perform reboring (including honing), or replace the cylinder block and piston as a set. For reboring and honing procedure, refer to step 8).

Note:

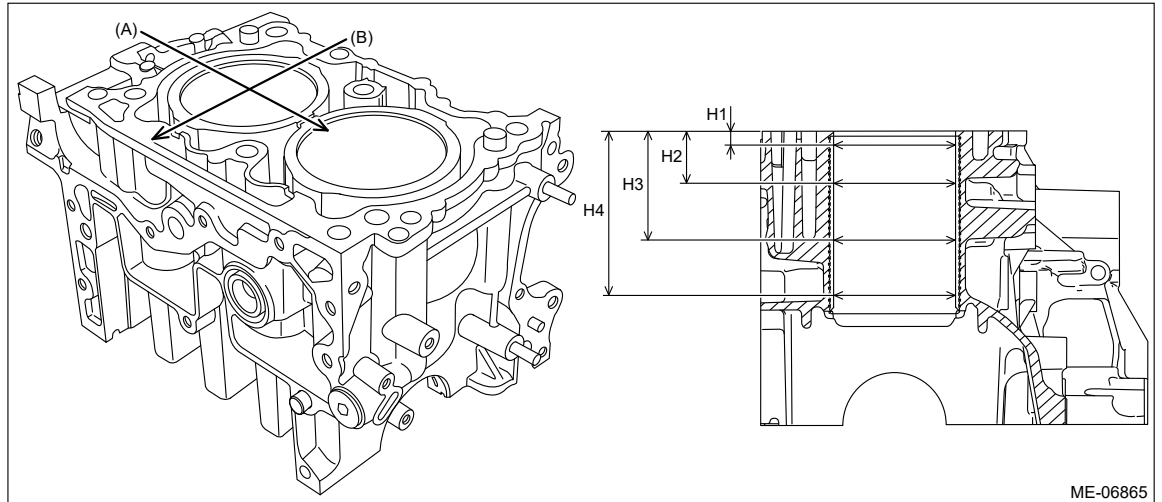
- Measure the cylinder liner with cylinder blocks separated (into cylinder block RH and cylinder block LH).
- Measurement should be performed at a temperature of 20°C (68°F).
- The cylinder bore size mark is stamped on the upper face of the cylinder block.



ME-06864

- (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

- **Measure the inner diameter of each cylinder liner in both the thrust and piston pin directions at the heights as shown in the figure and read the value of the most worn location.**



- (A) Piston pin direction
- (B) Thrust direction
- H1: 10 mm (0.3937 in)
- H2: 45 mm (1.7717 in)
- H3: 80 mm (3.1496 in)
- H4: 105 mm (4.1339 in)

Inner diameter of cylinder liner:

Cylinder bore size mark A

Standard

86.005 – 86.015 mm (3.3860 – 3.3864 in)

Cylinder bore size mark B

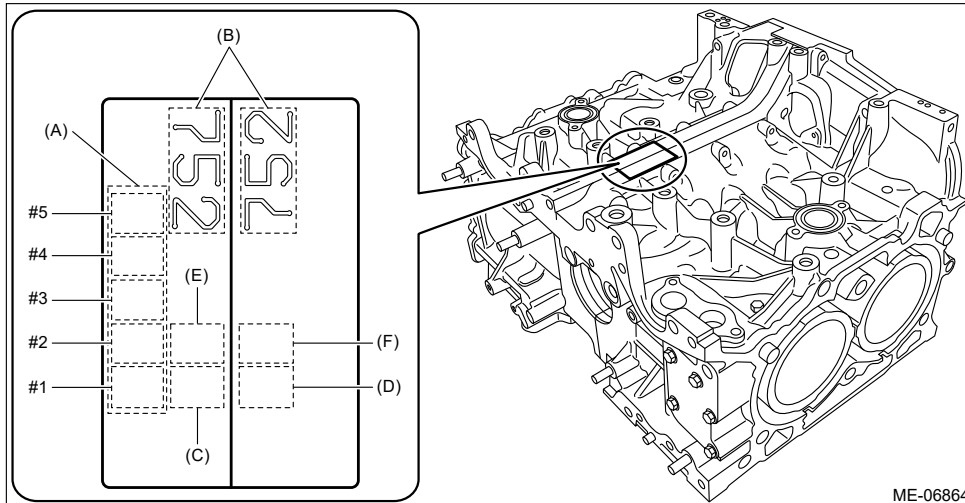
Standard

85.995 – 86.005 mm (3.3856 – 3.3860 in)

- (2) Check the outer diameter of piston with a micrometer. If it is not within the standard, replace the piston.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Measure the outer diameter of each piston in thrust direction at the height as shown in the figure.**
- **Standard sized pistons are classified into two grades, "A" and "B". These grades should be used as guide lines in selecting a standard piston.**
- **The grade can be judged by the stamp of cylinder bore size mark on the upper face of the cylinder block.**



- (A) Main journal size mark (C) #1 cylinder bore size mark (E) #3 cylinder bore size mark
 (B) Cylinder block (RH) - (LH) combination mark (D) #2 cylinder bore size mark (F) #4 cylinder bore size mark

- If the piston is replaced, check the clearance between cylinder liner and piston in the step (3), and select a suitable sized piston.

Piston grade point H:

40.0 mm (1.57 in)

Piston outer diameter:

Standard size (grade A = cylinder bore size mark A)

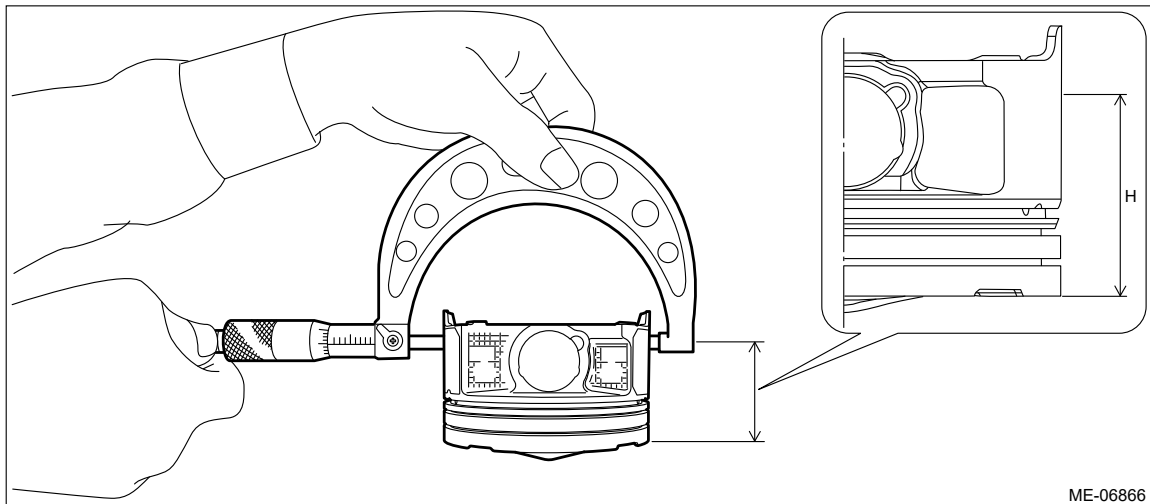
Standard

85.985 – 85.995 mm (3.3852 – 3.3856 in)

Standard size (grade B = cylinder bore size mark B)

Standard

85.975 – 85.985 mm (3.3848 – 3.3852 in)



- (3) Calculate the clearance between cylinder liner and piston. If it is not within the standard, perform reboring (including honing), or replace the cylinder block and piston as a set. For reboring and honing procedure, refer to step 8).

Note:

The clearance between cylinder liner and piston is decided by matching the cylinder block bore size mark and the grade of piston outer diameter (grade A or B).

Clearance between cylinder liner and piston:

Standard

0.010 — 0.030 mm (0.00039 — 0.00118 in)

8. Reboring and honing

- (1) If any of the cylindricality, out-of-roundness, inner diameter or clearance between cylinder liner and piston is out of standard or if there is any damage on the cylinder liner, perform reboring (including honing).

Caution:

When any of the cylinder liner needs reboring, all other cylinder liners must be rebored at the same time, and replaced with proper size pistons.

Oversize piston outer diameter:

0.25 mm (0.0098 in) oversize

Standard

86.225 — 86.245 mm (3.3947 — 3.3955 in)

0.50 mm (0.0197 in) oversize

Standard

86.475 — 86.495 mm (3.4045 — 3.4053 in)

- (2) If the inner diameter of cylinder liner exceeds the limit after reboring (including honing), replace the cylinder block and piston as a set.

Note:

- **Immediately after reboring (including honing), the inner diameter of cylinder liner may differ from its real diameter due to temperature rise. Thus, when measuring the inner diameter of cylinder liner, wait until the temperature has cooled to 20°C (68°F).**
- **For the measurement of the inner diameter of cylinder liner, refer to step 7).**

Inner diameter of cylinder liner boring limit (diameter):

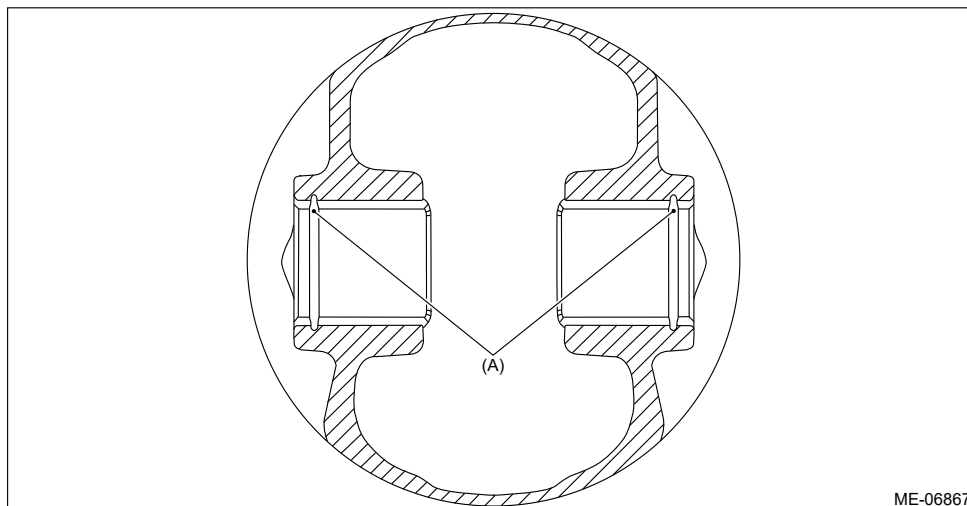
86.505 mm (3.4057 in) or less

2. PISTON AND PISTON PIN

1. Check the piston and piston pin for wear or crack.
2. Check the snap ring for distortion or wear.
3. Check the piston ring groove for damage.
4. Check the circlip groove (A) for burr.

Note:

If the burr is found, remove the burr from groove.

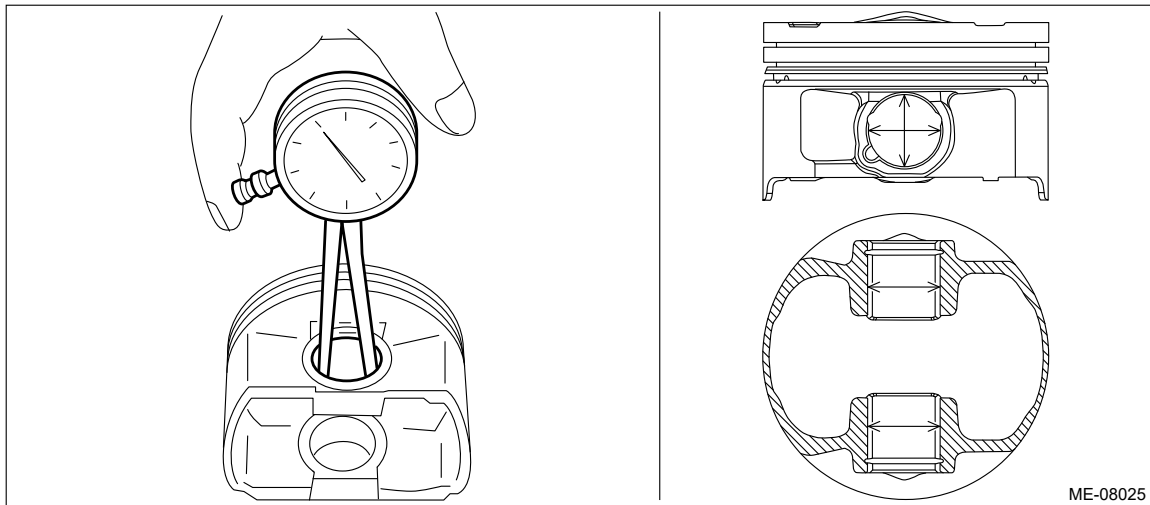


5. Check that the piston pin can be inserted into the piston with a thumb at 20°C (68°F).
6. Check the clearance between piston and piston pin. Check the clearance between piston and piston pin by measuring the inner diameter of piston pin hole and the outer diameter of piston pin respectively.
 - (1) Using a caliper gauge, measure the inner diameter of piston pin hole.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**

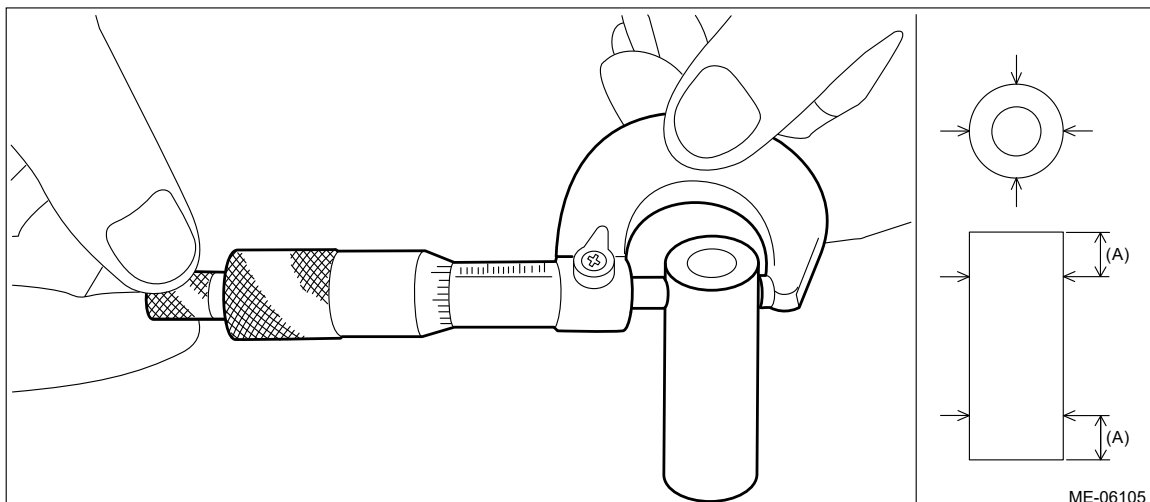
- Measure the inner diameter of the piston pin hole at the four locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(2) Measure the outer diameter of piston pin with a micrometer.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the piston pin at the four locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(A) 10 mm (0.394 in)

(3) Calculate the clearance between piston and piston pin. If it is not within the standard, replace the piston and piston pin as a set.

Clearance between piston and piston pin:

Standard

0.004 – 0.008 mm (0.0002 – 0.0003 in)

3. PISTON RING

1. Make sure the piston ring is not broken or damaged.
2. Using a cylindrical guide, insert the piston ring into the cylinder liner so that they are perpendicular to the cylinder wall, and check the piston ring gap using a thickness gauge. If it is not within the standard, replace the piston ring.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Use piston ring with same size as piston when replacing piston ring.**

Piston ring gap:

Compression ring (top ring)

Standard

0.20 – 0.25 mm (0.0079 – 0.0098 in)

Compression ring (second ring)

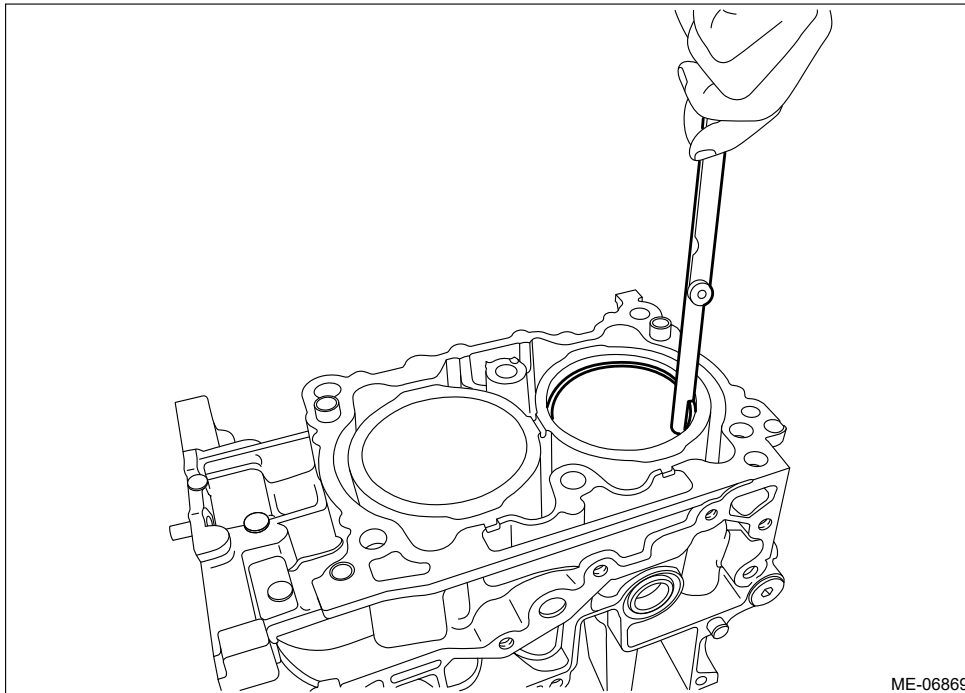
Standard

0.40 – 0.50 mm (0.0157 – 0.0197 in)

Oil ring (upper rail and lower rail)

Standard

0.10 – 0.35 mm (0.0039 – 0.0138 in)



3. Fit the compression ring straight into the piston ring groove, then check the clearance between compression ring and piston with a thickness gauge. If it is not within the standard, replace the compression ring.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Before inspecting the clearance, clean the piston ring groove and compression ring.**
- **Use compression ring with same size as piston when replacing compression ring.**

Clearance between compression ring and piston:

Top ring

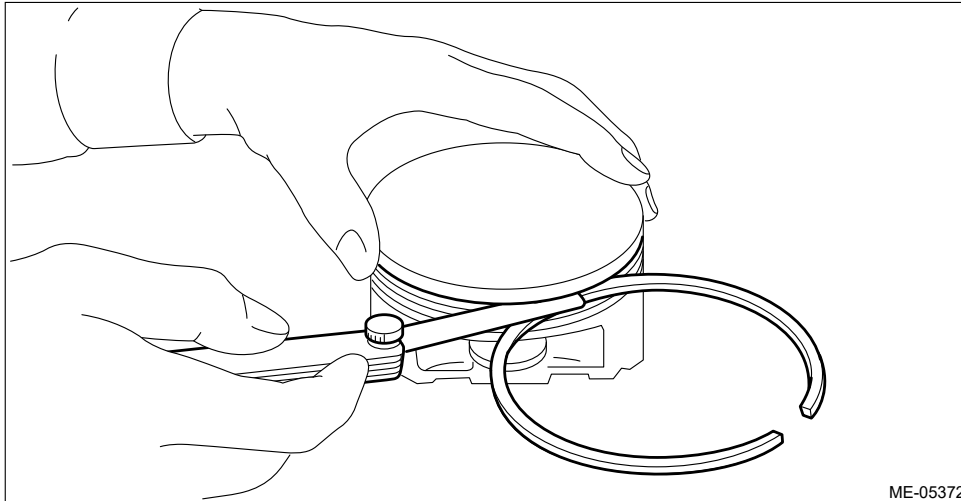
Standard

0.040 – 0.080 mm (0.0016 – 0.0031 in)

Second ring

Standard

0.045 – 0.085 mm (0.0018 – 0.0033 in)



ME-05372

4. CONNECTING ROD AND CONNECTING ROD BEARING

1. Check for bend or twist using a connecting rod aligner. If it exceeds the limit, replace the connecting rod.

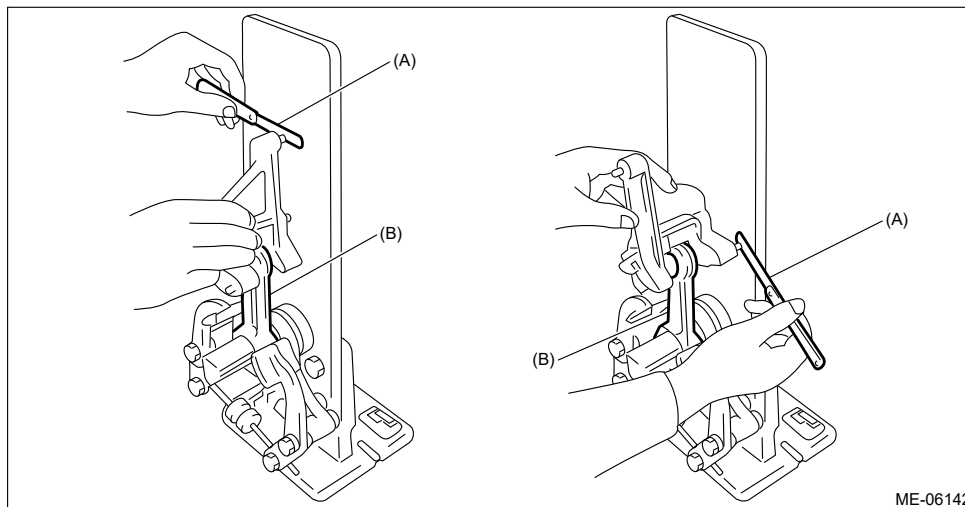
Note:

Measurement should be performed at a temperature of 20°C (68°F).

Bend or twist per 100 mm (3.94 in) in length:

Limit

0.10 mm (0.0039 in)



ME-06142

(A) Thickness gauge

(B) Connecting rod

2. Check that the large or small end thrust surface of each connecting rod is not damaged.
3. Check each connecting rod bearing for scar, peeling, seizure, melting or wear, etc.
4. Check the thrust clearance of each connecting rod using a thickness gauge.

Note:

Measurement should be performed at a temperature of 20°C (68°F).

- (1) Clean the #1 connecting rod bearing and the #1 pin of crankshaft, and apply engine oil to the #1 pin of crankshaft.
- (2) Set the #1 connecting rod bearing to the #1 connecting rod and #1 connecting rod cap.
- (3) Set the #1 connecting rod, #1 connecting rod cap and #1 connecting rod cap bolt to the #1 pin of crankshaft.

Note:

- **Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.**

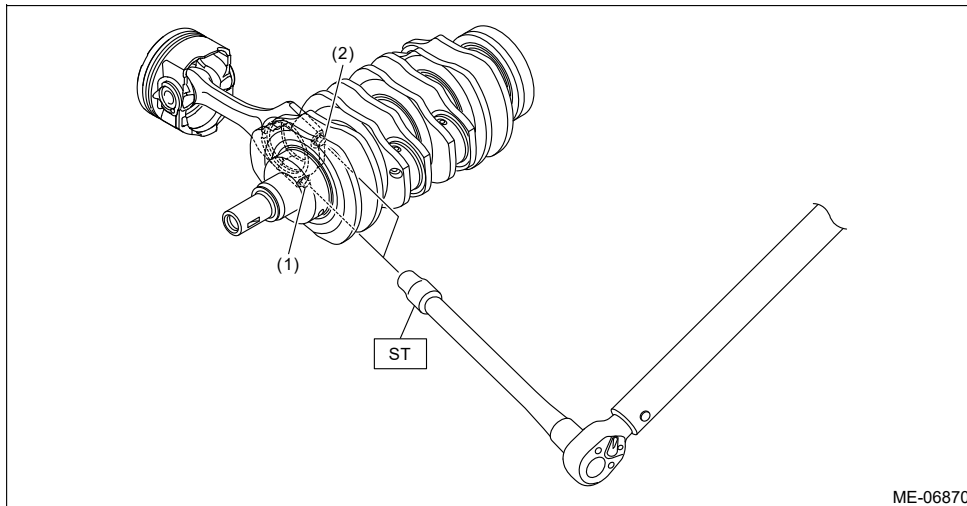
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #1 connecting rod cap bolt thread.

(4) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 25 N·m (2.5 kgf-m, 18.4 ft-lb) in numerical order as shown in the figure.

Caution:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.

ST 18270AA020 SOCKET



(5) Using ST and angle gauge, tighten the #1 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

Caution:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.

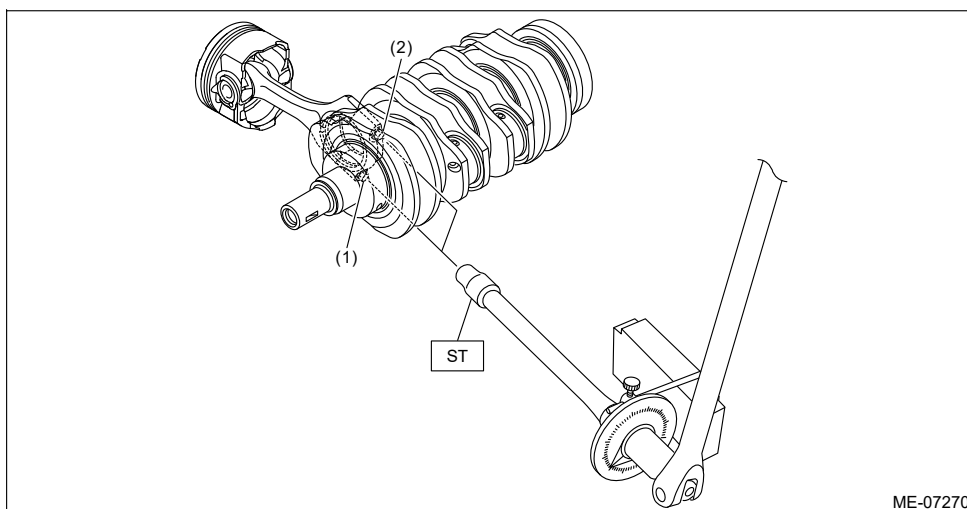
Note:

Prevent angle gauge from rotating using a V-block, etc.

ST 18270AA020 SOCKET

Tightening angle:

$$90^{\circ} + 5^{\circ} - 0^{\circ}$$



(6) In the same manner, install the #2, #3 and #4 connecting rods.

- (7) Check the thrust clearance of each connecting rod using a thickness gauge. If it is not within the standard, replace the connecting rod.

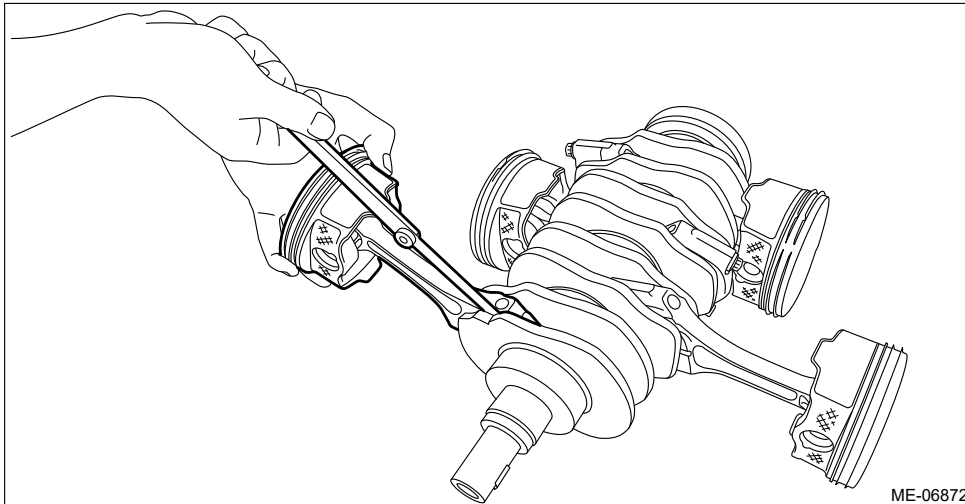
Note:

Measure the thrust clearance of each connecting rod at several points, and replace the connecting rod if there is uneven wear.

Connecting rod thrust clearance:

Standard

0.070 — 0.330 mm (0.0028 — 0.0130 in)



- 5.** Check the oil clearance on each connecting rod bearing using plastigauge.

Note:

Measurement should be performed at a temperature of 20°C (68°F).

- (1) Clean the #1 connecting rod bearing and the #1 pin of crankshaft.
- (2) Set the #1 connecting rod bearing to the #1 connecting rod and #1 connecting rod cap.
- (3) Place a plastigauge across the #1 pin of crankshaft, and set the #1 connecting rod, #1 connecting rod cap and #1 connecting rod cap bolt to the #1 pin of crankshaft.

Note:

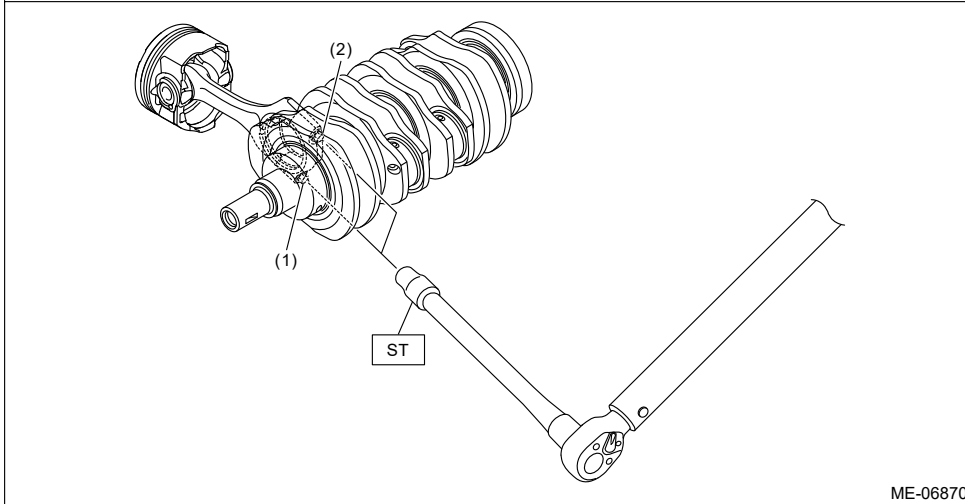
- **Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.**
- **Use a new connecting rod cap bolt.**
- **Apply a coat of engine oil to the #1 connecting rod cap bolt thread.**

- (4) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 25 N·m (2.5 kgf-m, 18.4 ft-lb) in numerical order as shown in the figure.

Caution:

- **Make sure to hold the crankshaft securely during work.**
- **When holding the crankshaft, be careful not to damage the crankshaft.**
- **During tightening, be careful not to move the #1 connecting rod and the #1 connecting rod cap.**

ST 18270AA020 SOCKET



- (5) Using ST and angle gauge, tighten the #1 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

Caution:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.
- During tightening, be careful not to move the #1 connecting rod and the #1 connecting rod cap.

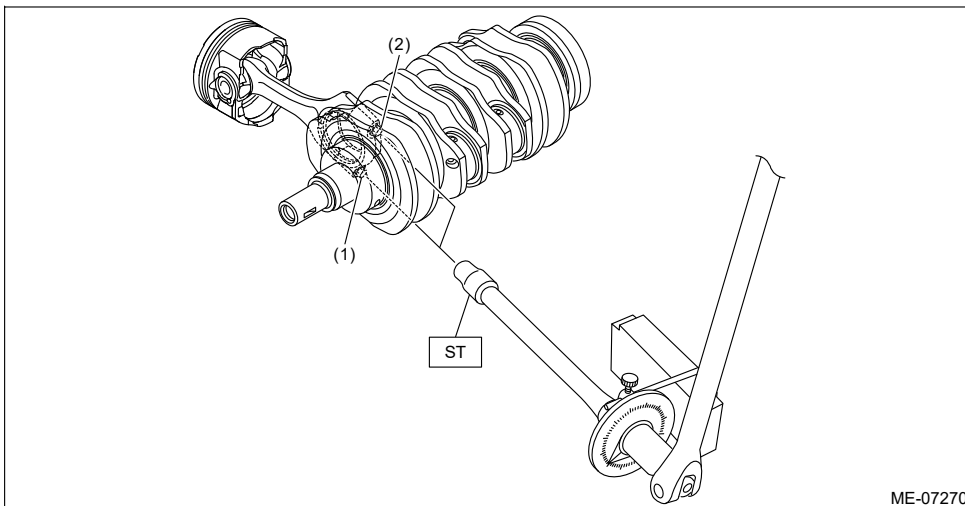
Note:

Prevent angle gauge from rotating using a V-block, etc.

ST 18270AA020 SOCKET

Tightening angle:

$$90^{\circ} + 5^{\circ} - 0^{\circ}$$

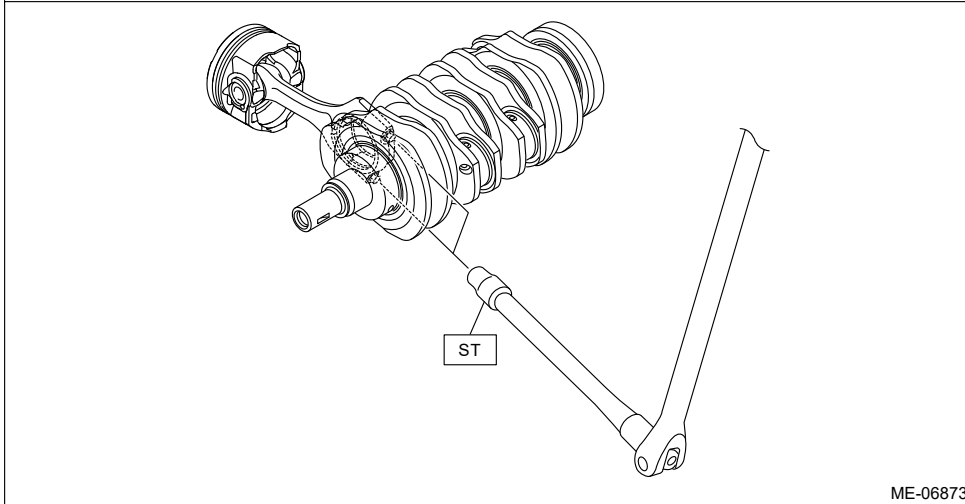


- (6) Using ST, loosen the #1 connecting rod cap bolt, and remove the #1 connecting rod cap bolt and #1 connecting rod cap.

Caution:

- Make sure to hold the crankshaft securely during work.
- When holding the crankshaft, be careful not to damage the crankshaft.
- During removal, be careful not to move the #1 connecting rod and the #1 connecting rod cap.

ST 18270AA020 SOCKET



- (7) Determine oil clearance of the #1 connecting rod bearing by matching the widest point of the plastigauge on #1 pin of crankshaft against scale printed on a package of the plastigauge. If it is not within the standard, replace the #1 connecting rod bearing.

Note:

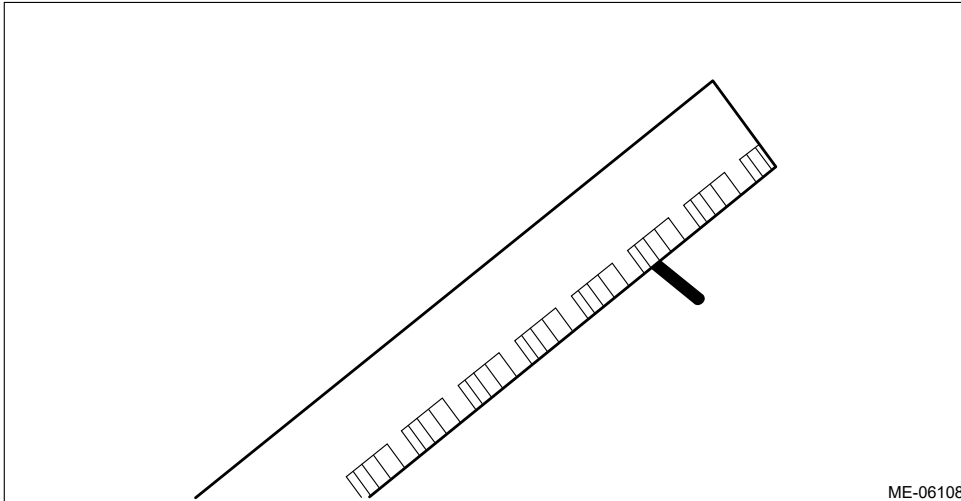
Measure the outer diameter of crankshaft pin using micrometer, and select the suitable size connecting rod bearing when replacing the connecting rod bearing.

| Unit: mm (in) | | |
|-------------------------------|--|--------------------------------------|
| Bearing | Connecting rod bearing thickness (at center) | Crankshaft pin outer diameter |
| | Standard | Standard |
| Standard size | 1.492 – 1.508 (0.0587 – 0.0594) | 49.976 – 50.000 (1.9676 – 1.9685) |
| 0.03 (0.0012) Undersize | 1.511 – 1.515 (0.0595 – 0.0596) | 49.946 – 49.970 (1.9664 – 1.9673) |
| 0.05 (0.0020) Undersize | 1.521 – 1.525 (0.0599 – 0.0600) | 49.926 – 49.950 (1.9656 – 1.9665) |
| 0.25 (0.0098) Undersize | 1.621 – 1.625 (0.0638 – 0.0640) | 49.726 – 49.750 (1.9577 – 1.9587) |

Connecting rod bearing oil clearance:

Standard

0.025 – 0.055 mm (0.0010 – 0.0022 in)



(8) Completely remove the plastigauge.

(9) In the same manner, check oil clearance of the #2, #3 and #4 connecting rod bearings.

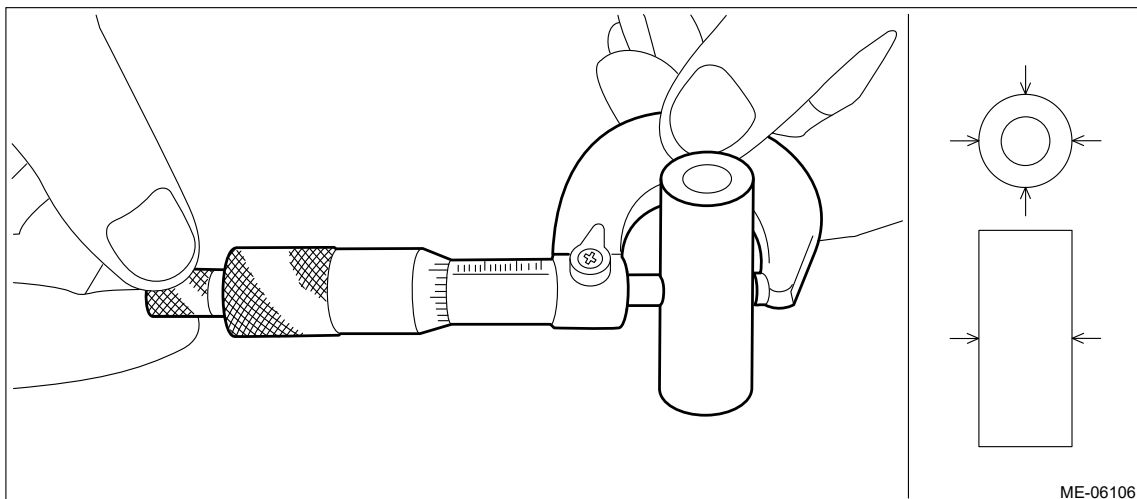
5. PISTON PIN & CONNECTING ROD BUSHING

1. Check that the connecting rod bushing is not damaged.
2. Check the clearance between piston pin and connecting rod bushing. Check the clearance between piston pin and connecting rod bushing by measuring the outer diameter of piston pin and the inner diameter of connecting rod bushing respectively.

(1) Measure the outer diameter of piston pin with a micrometer.

Note:

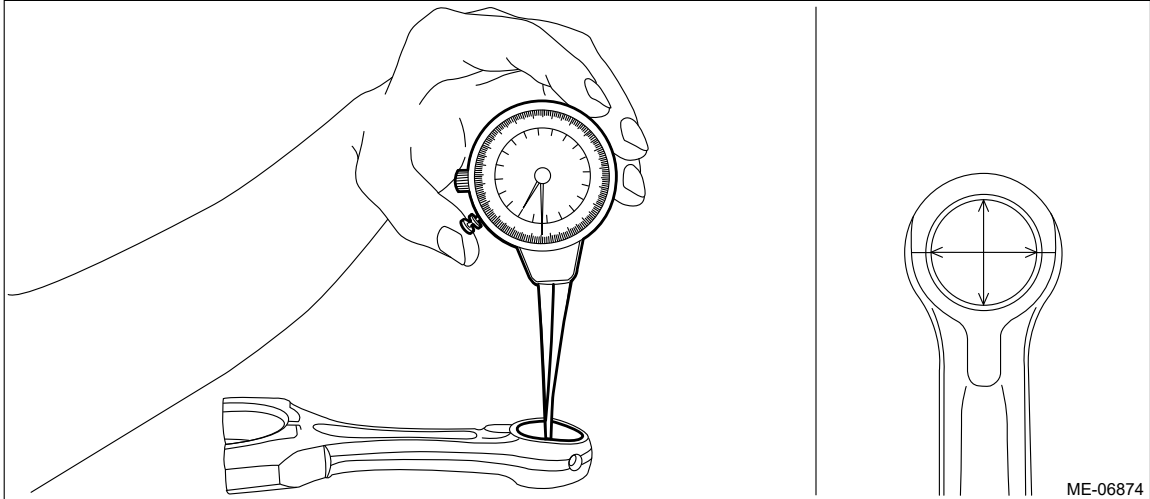
- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the piston pin at the two locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(2) Using a caliper gauge, measure the inner diameter of connecting rod bushing.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of the connecting rod bushing at the two locations as shown in the figure, and read the value of most worn location.
- Record the measured value.



(3) Calculate the clearance between piston pin and connecting rod bushing.

Clearance between piston pin and connecting rod bushing:

Standard

0.004 — 0.026 mm (0.0002 — 0.0010 in)

3. If the clearance between piston pin and connecting rod bushing is not within the standard, replace the connecting rod and piston pin as a set.

6. CRANKSHAFT AND CRANKSHAFT BEARING

1. Clean the crankshaft completely, and check it for cracks using liquid penetrant tester.
2. Using a dial gauge, check the crankshaft bend. If it exceeds the limit, grind to correct the crankshaft journal or replace the crankshaft.

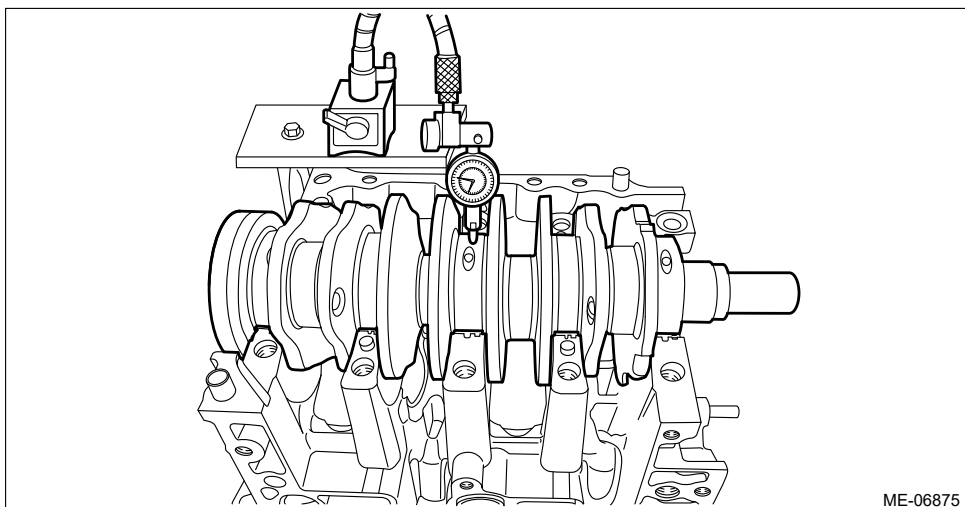
Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- If a suitable V-block is not available, using just the #1 and #5 crankshaft bearings on cylinder block, position the crankshaft on cylinder block. Then, measure the crankshaft bend using a dial gauge.
- When grinding to correct the crankshaft journal, refer to step 3).

Crankshaft bend:

Limit

0.035 mm (0.0014 in)



3. Using a micrometer, check the outer diameter of crankshaft pin, outer diameter of journal, cylindricity, and out-of-roundness. If it is not within the standard, replace the connecting rod bearing or crankshaft bearing, and grind to correct the crankshaft pin or journal or replace the crankshaft as required.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Select the suitable size connecting rod bearing or crankshaft bearing when replacing the connecting rod bearing or crankshaft bearing.
- When grinding to correct the crankshaft pin or journal, finish them to the suitable outer diameter as shown in the table below according to the undersize bearing to be used.

| Unit: mm (in) | | | | | |
|-------------------------|--|--------------------------------------|--|------------------------------------|--------------------------------------|
| Bearing | Connecting rod bearing thickness (at center) | Crankshaft pin outer diameter | Crankshaft bearing thickness (at center) | | Crankshaft journal outer diameter |
| | | | #1, #2, #3, #4 | #5 | |
| | Standard | Standard | Standard | Standard | Standard |
| Standard size | 1.492 – 1.508 (0.0587 – 0.0594) | 49.976 – 50.000 (1.9676 – 1.9685) | 2.498 – 2.513 (0.0983 – 0.0989) | 2.496 – 2.511 (0.0983 – 0.0989) | 67.985 – 68.003 (2.6766 – 2.6773) |
| 0.03 (0.0012) Undersize | 1.511 – 1.515 (0.0595 – 0.0596) | 49.946 – 49.970 (1.9664 – 1.9673) | 2.519 – 2.522 (0.0992 – 0.0993) | 2.517 – 2.520 (0.0991 – 0.0992) | 67.955 – 67.979 (2.6754 – 2.6763) |
| 0.05 (0.0020) Undersize | 1.521 – 1.525 (0.0599 – 0.0600) | 49.926 – 49.950 (1.9656 – 1.9665) | 2.529 – 2.532 (0.0996 – 0.0997) | 2.527 – 2.530 (0.0995 – 0.0996) | 67.935 – 67.959 (2.6746 – 2.6755) |
| 0.25 (0.0098) Undersize | 1.621 – 1.625 (0.0638 – 0.0640) | 49.726 – 49.750 (1.9577 – 1.9587) | 2.629 – 2.632 (0.1035 – 0.1036) | 2.627 – 2.630 (0.1034 – 0.1035) | 67.735 – 67.759 (2.6667 – 2.6677) |

Crankshaft pin:

Cylindricity

Limit

0.006 mm (0.0002 in)

Out-of-roundness

Limit

0.005 mm (0.0002 in)

Grinding limit (dia.)

49.726 mm (1.9577 in) or less

Crankshaft journal:

Cylindricity

Limit

0.006 mm (0.0002 in)

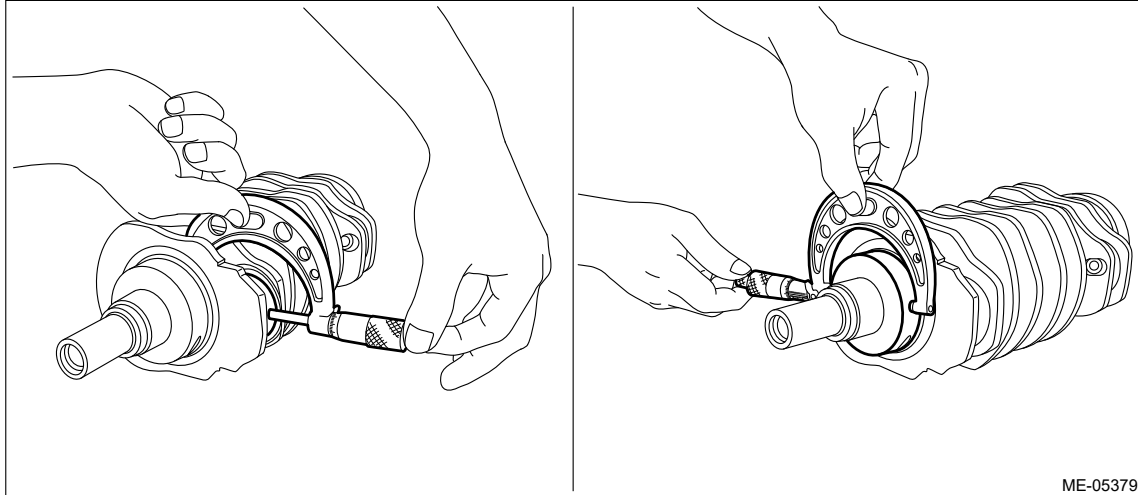
Out-of-roundness

Limit

0.005 mm (0.0002 in)

Grinding limit (dia.)

67.735 mm (2.6667 in) or less



ME-05379

4. Inspect the crankshaft bearing for scar, peeling, seizure, melting or wear, etc.
5. Use a thickness gauge to check the thrust clearance of crankshaft at thrust of #5 crankshaft bearing. If it is not within the standard, replace the #5 crankshaft bearing.

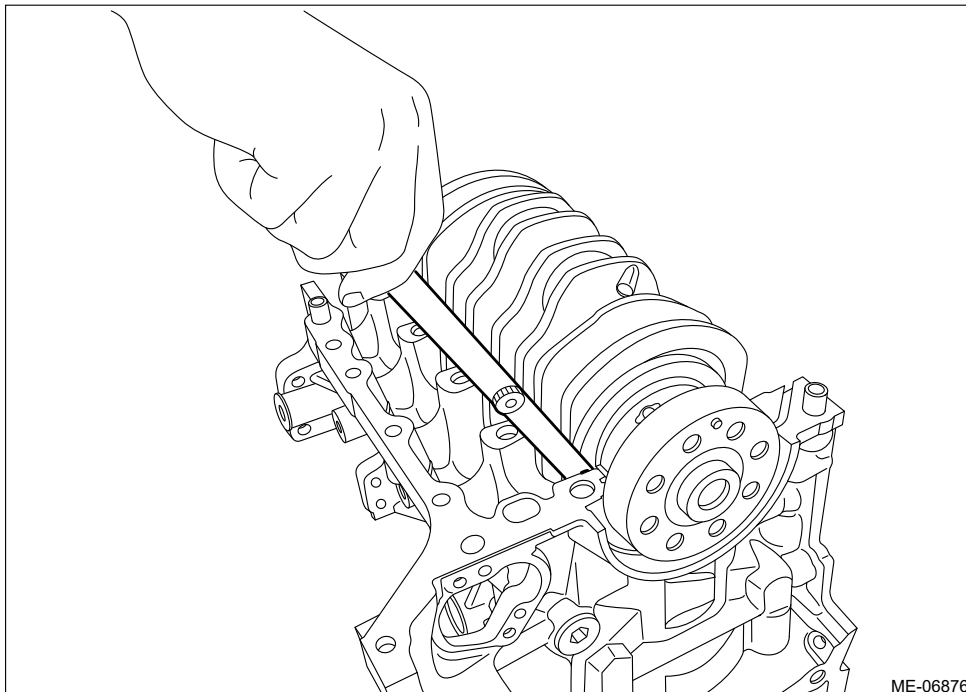
Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Set all the crankshaft bearings onto the cylinder block, then mount the crankshaft on the cylinder block, and use a thickness gauge to measure the thrust clearance of crankshaft.**
- **Select the #5 crankshaft bearing of suitable size by referring to step 3) when replacing #5 crankshaft bearing.**

Crankshaft thrust clearance:

Standard

0.130 — 0.308 mm (0.0051 — 0.0121 in)



ME-06876

6. Check the oil clearance on each crankshaft bearing using plastigauge.

Note:

Measurement should be performed at a temperature of 20°C (68°F).

- (1) Install the cylinder block LH to the engine stand.

Caution:

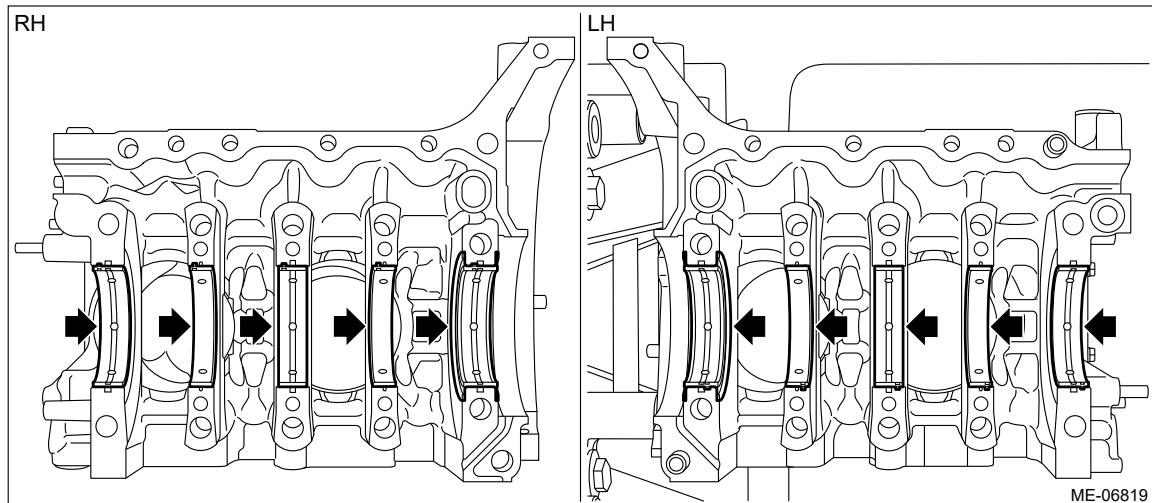
- **When the engine stand is not used, place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.**
- **Be careful not to scratch the mating surface of cylinder block during work.**

- (2) Remove the liquid gasket from cylinder block.
- (3) Clean each crankshaft bearing and crankshaft journal.
- (4) Set each crankshaft bearing to the cylinder block.

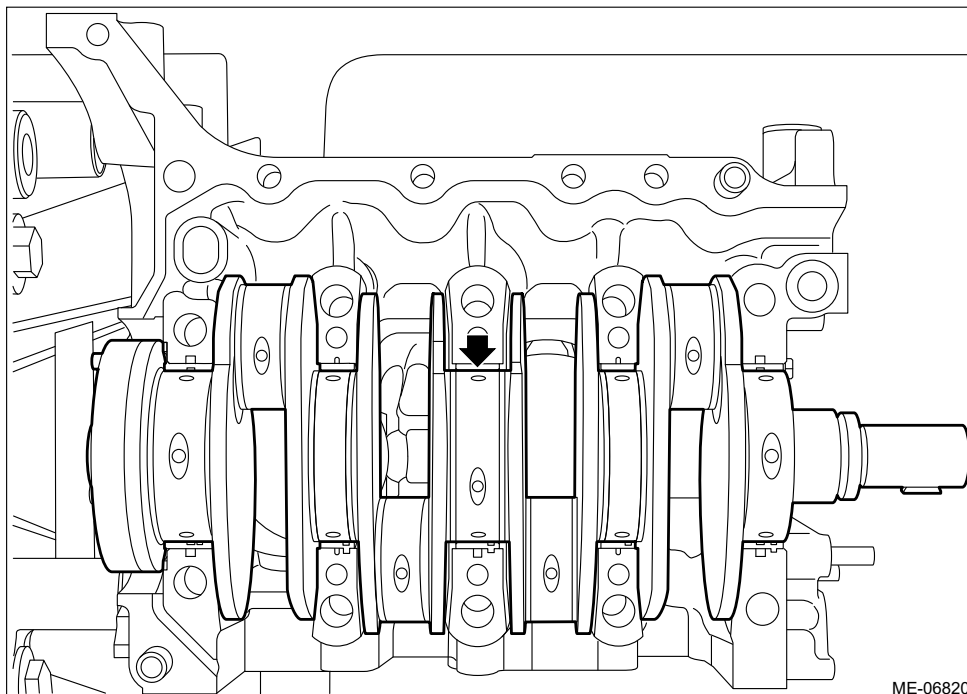
Caution:

When performing the operation of the cylinder block RH, be careful of the following.

- 1. Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.**
- 2. Be careful not to scratch the mating surface of cylinder block during work.**



- (5) Set the crankshaft to the cylinder block LH.



- (6) Place a plastigauge across the crankshaft journals and set the cylinder block RH to the cylinder block LH.
- (7) Apply a coat of engine oil to the washers and cylinder block mounting bolt threads.

Note:

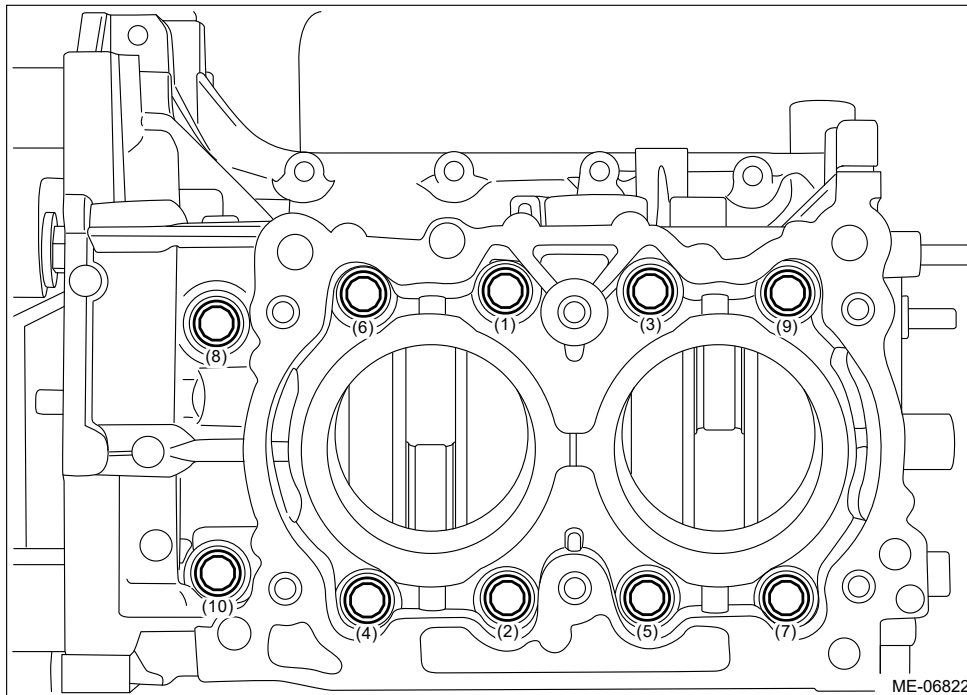
To prevent mixture of engine oil into the water jacket, do not apply a large amount.

- (8) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the

figure.

Caution:

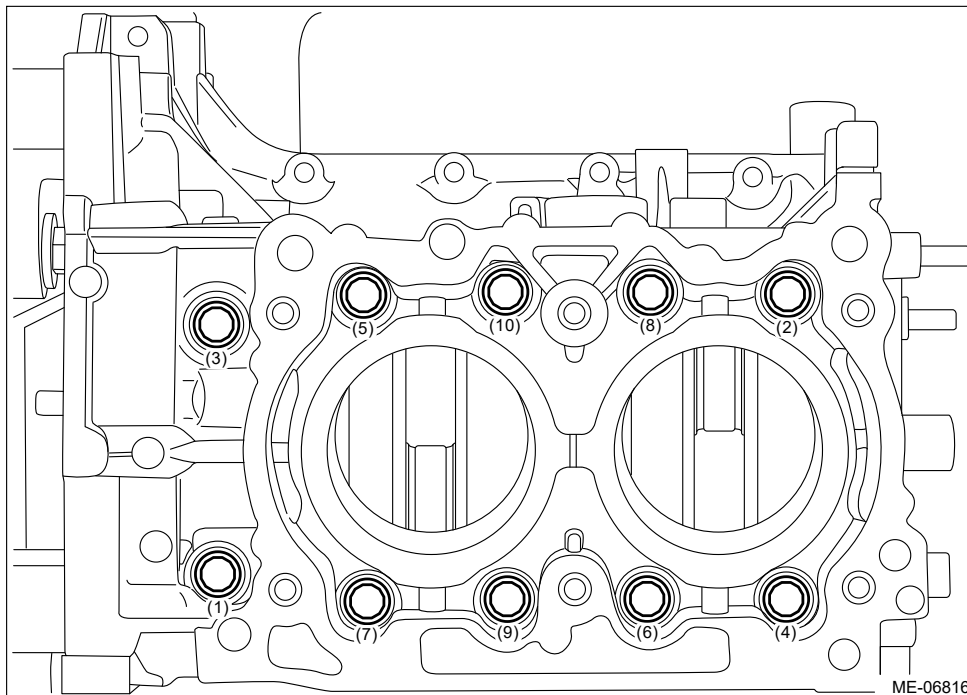
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



- (9) Loosen all mounting bolts by 180° in numerical order as shown in the figure.

Caution:

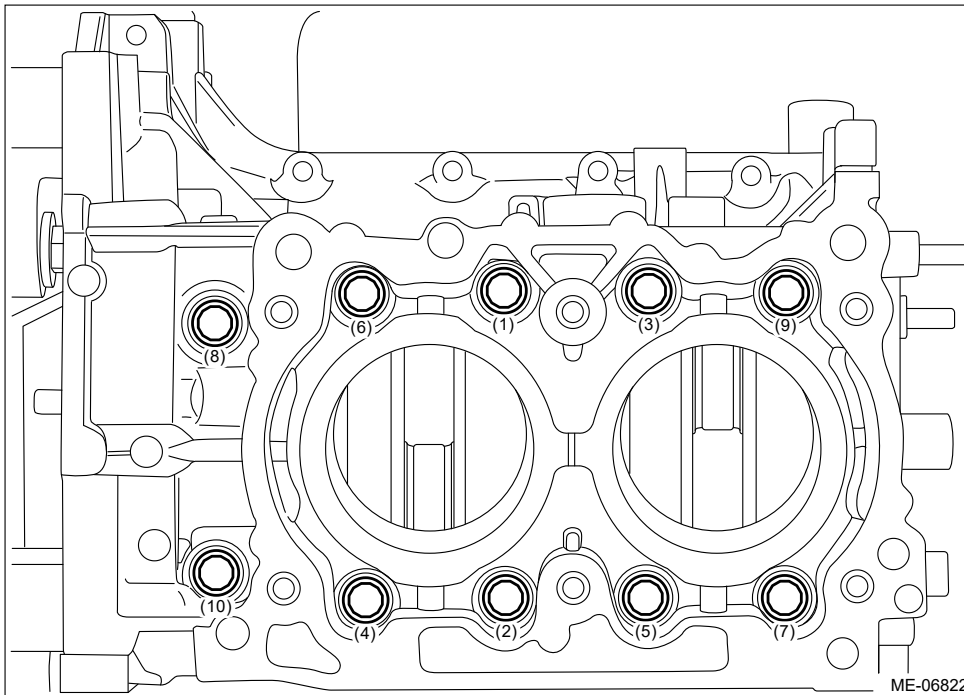
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



- (10) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf·m, 25.8 ft·lb) in numerical order as shown in the figure.

Caution:

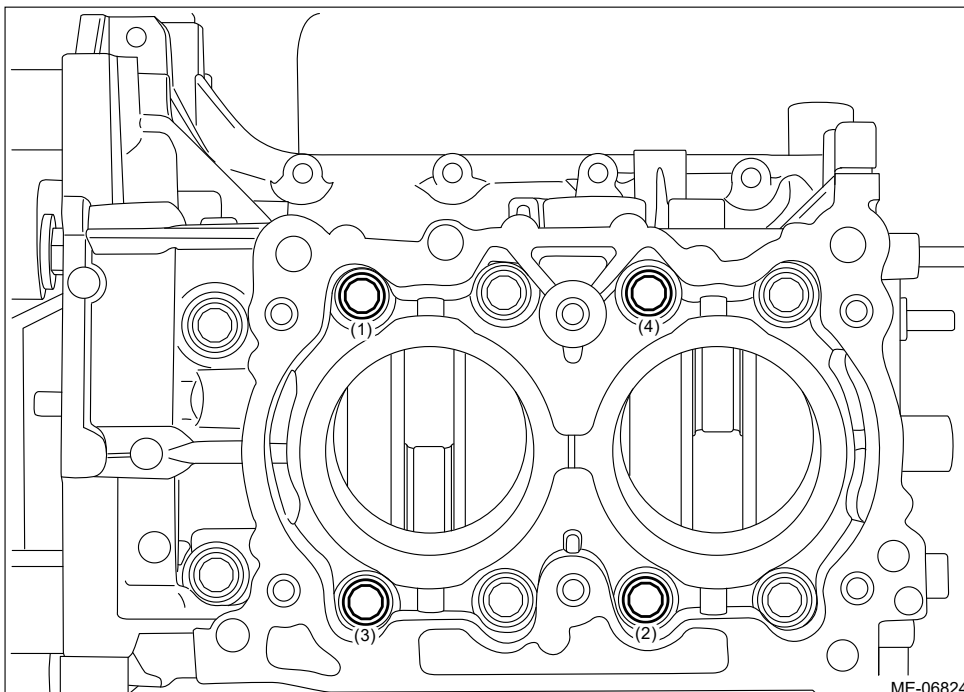
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(11) Loosen the mounting bolts (4 places) by 180° in numerical order as shown in the figure.

Caution:

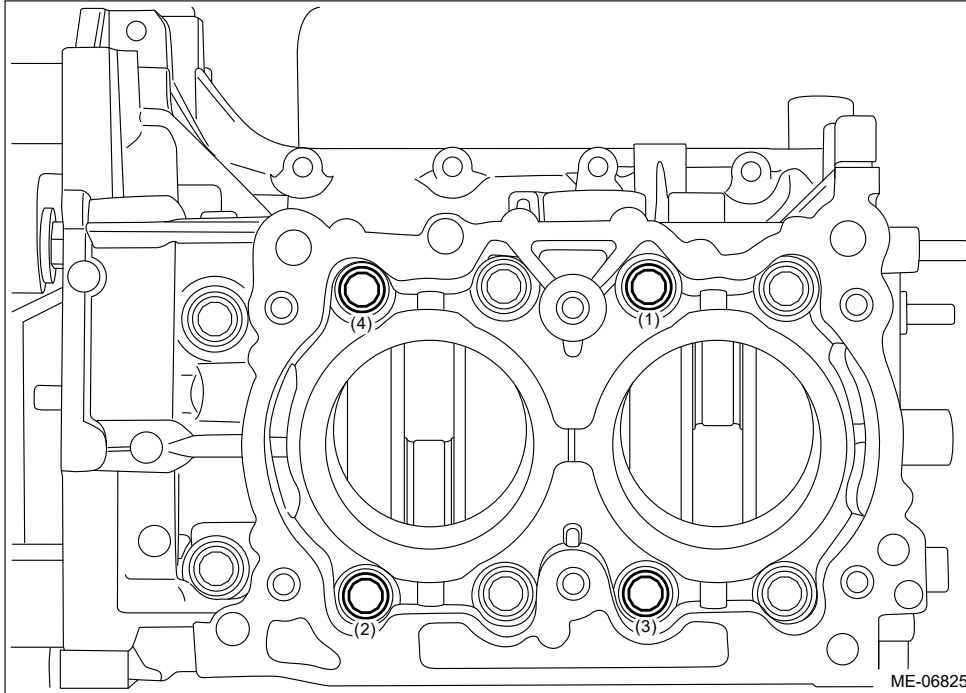
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(12) Tighten the mounting bolts (4 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



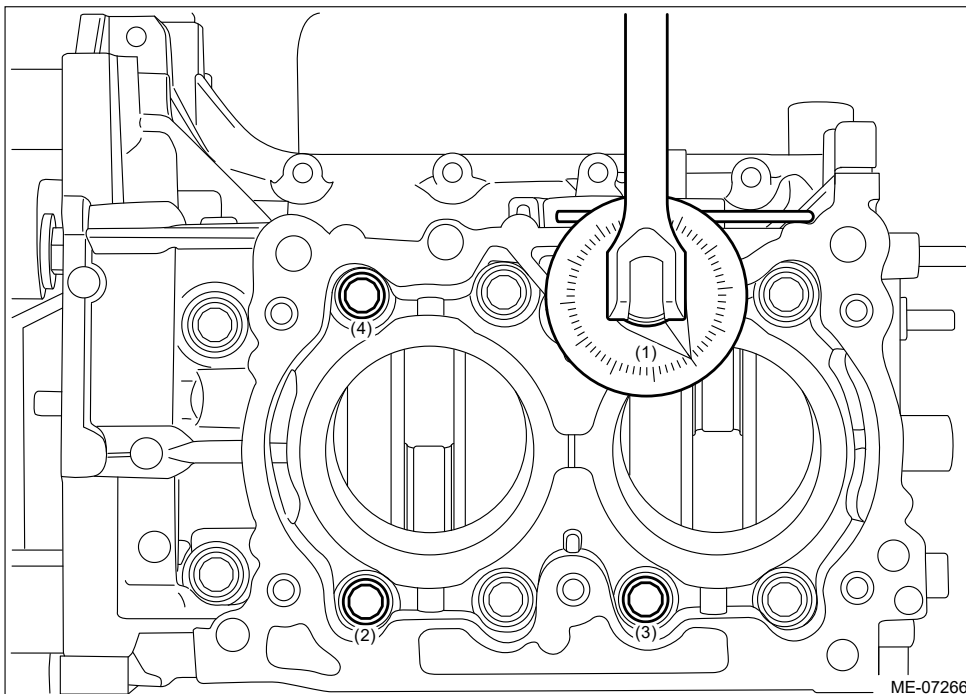
(13) Using angle gauge, tighten the mounting bolts (4 places) with specified angle in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:

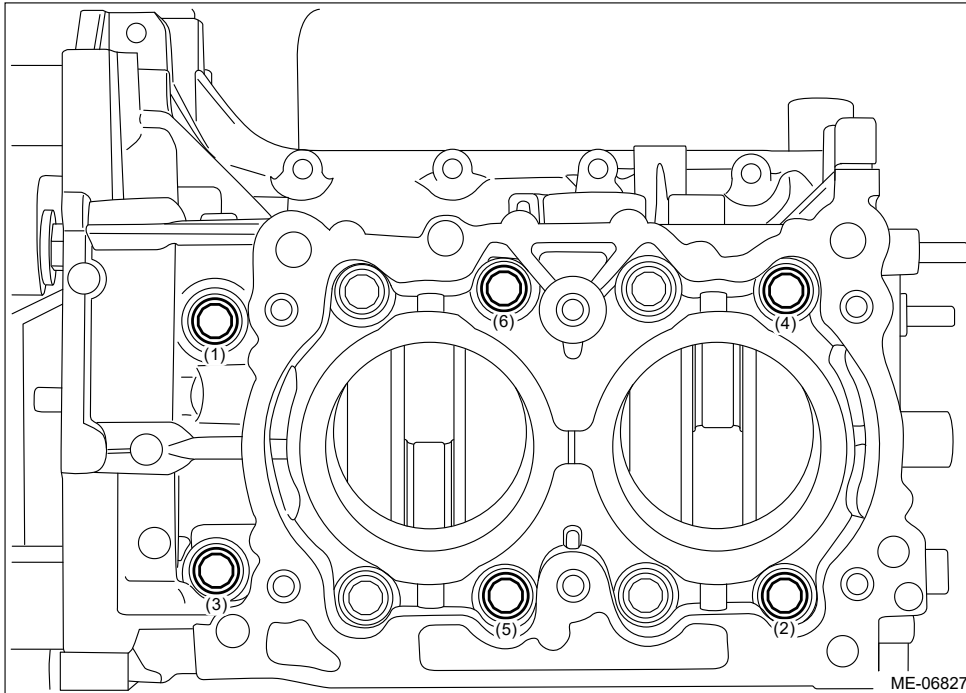
$60^{\circ} \pm 2^{\circ}$



(14) Loosen the mounting bolts (6 places) by 180° in numerical order as shown in the figure.

Caution:

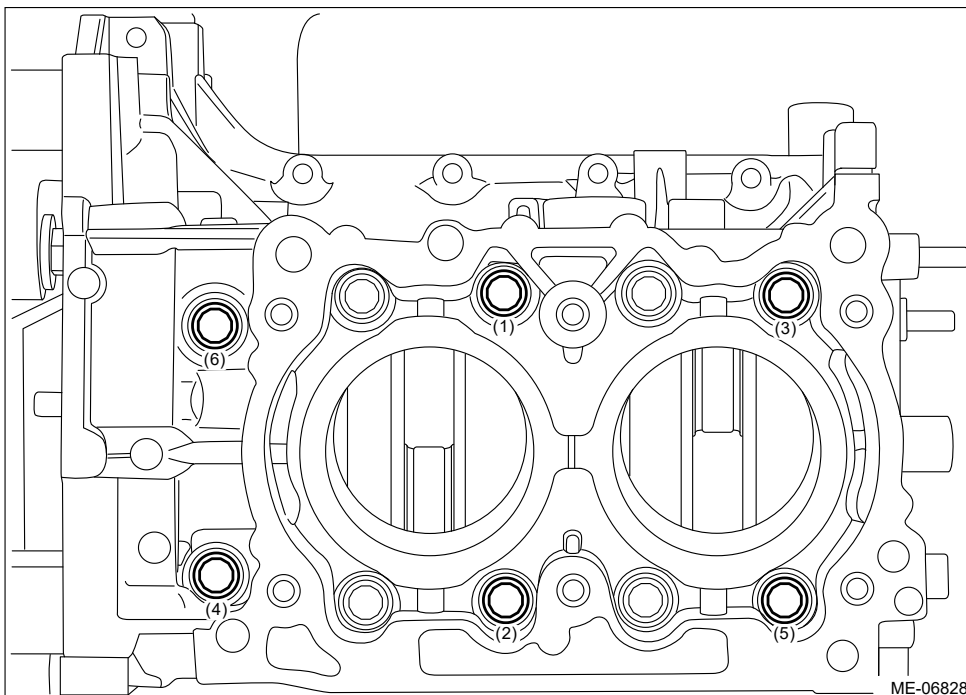
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



- (15) Tighten the mounting bolts (6 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



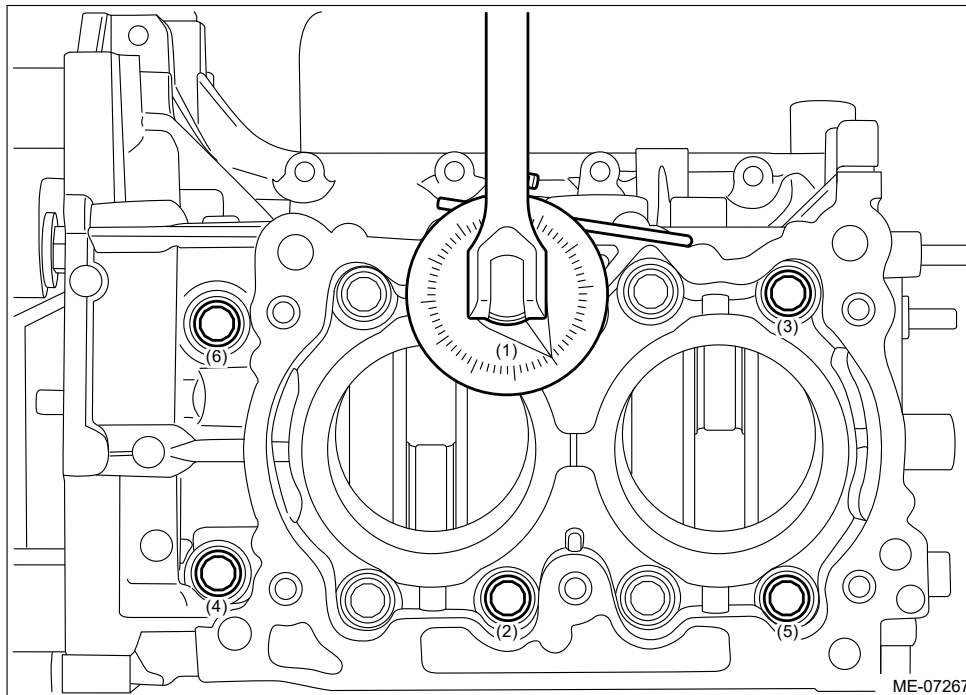
- (16) Using angle gauge, tighten the mounting bolts (6 places) with specified angle in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:

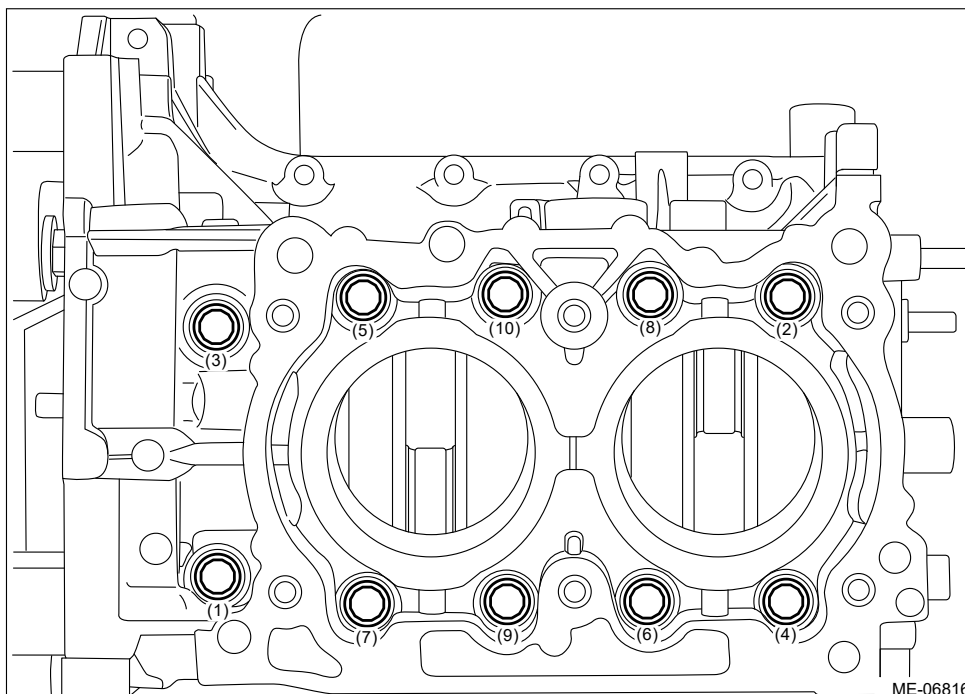
60°±2°



- (17) Loosen the cylinder block mounting bolts in numerical order as shown in the figure, and separate the cylinder block RH and LH.

Note:

Lift the cylinder block RH slightly, and confirm that the crankshaft is remaining in the cylinder block LH. If the cylinder block RH is lifted carelessly when separating, the crankshaft may stick to cylinder block RH, then fall off.



- (18) Determine the crankshaft oil clearance by matching the widest point of the plastigauge on each journal against scale printed on a package of the plastigauge. If it is not within the standard, replace the crankshaft bearing, and grind to correct the crankshaft journal or replace the crankshaft as required.

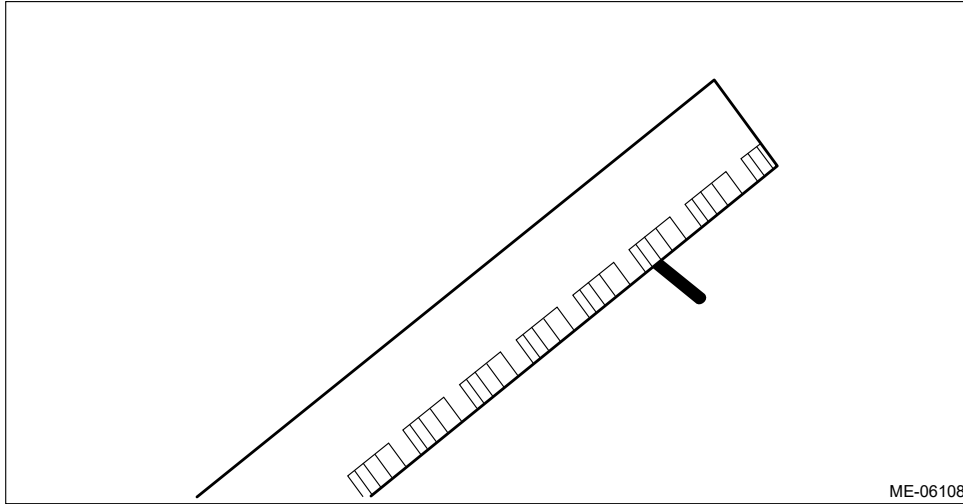
Note:

- **Select the crankshaft bearing of suitable size by referring to step 3) when replacing crankshaft bearing.**
- **When grinding to correct the crankshaft journal, finish it to the suitable outer diameter by referring to step 3) according to the undersize bearing to be used.**

Crankshaft oil clearance:

Standard

0.013 — 0.031 mm (0.0005 — 0.0012 in)



(19) Completely remove the plastigauge.

MECHANICAL(H4DOTC) > Cylinder Block

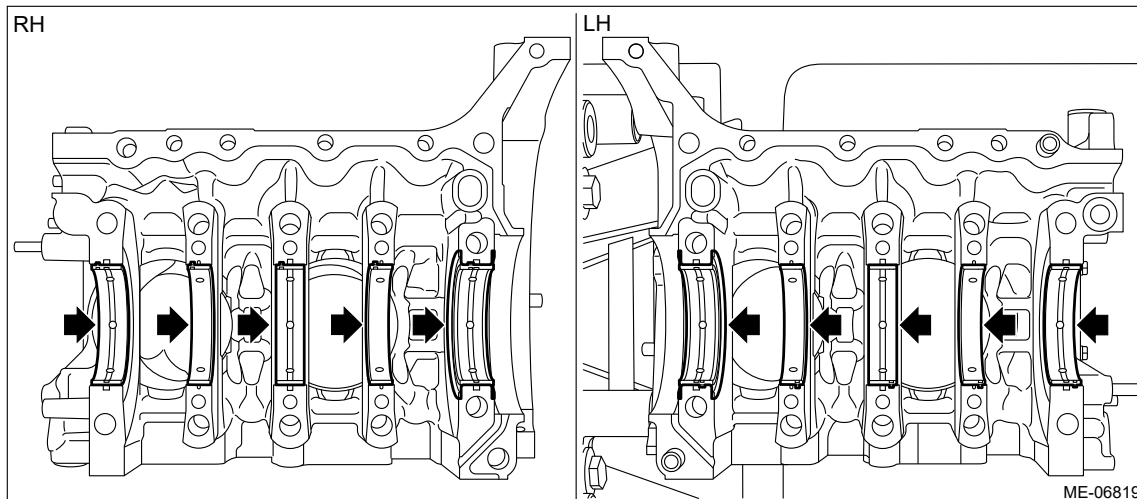
INSTALLATION

1. Install the cylinder block LH to the engine stand.
2. Apply engine oil to the crankshaft bearing, and install the crankshaft bearing to the cylinder block.

Caution:

When performing the operation of the cylinder block RH, be careful of the following.

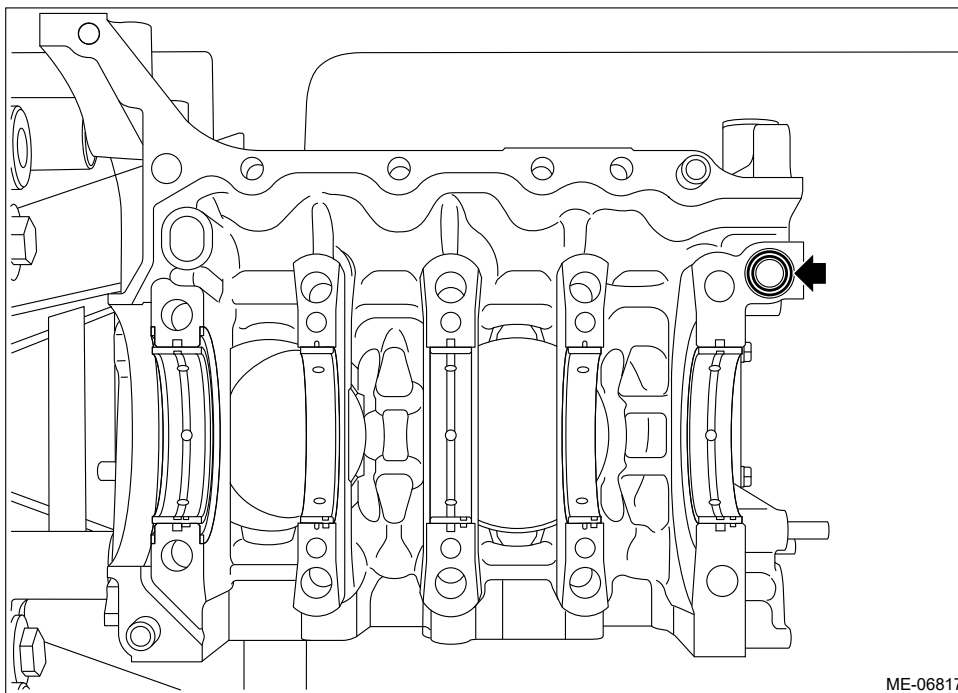
1. Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
2. Be careful not to scratch the mating surface of cylinder block during work.



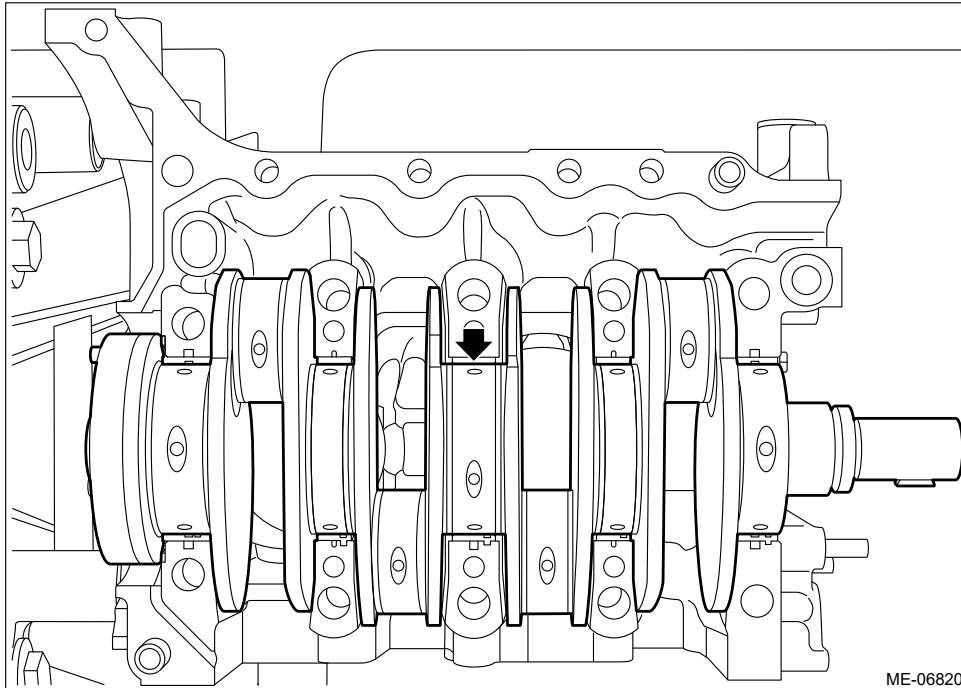
3. Install O-rings to the cylinder block LH.

Note:

Use new O-rings.



4. Apply engine oil to the crankshaft journal, and set the crankshaft to cylinder block LH.



5. Apply liquid gasket to the mating surface of cylinder block RH as shown in the figure.

Caution:

- Place a wood board wrapped with a waste cloth to prevent the knock pin damage and to stabilize the cylinder block before work.
- Be careful not to scratch the mating surface of cylinder block during work.
- Do not let the liquid gasket overflow to the oil passage and crankshaft bearing portions, because the engine seizure may result.

Note:

- Before applying liquid gasket, degrease the old liquid gasket seal surface of the cylinder block RH and cylinder block LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

Mating surfaces other than ranges A, B and C

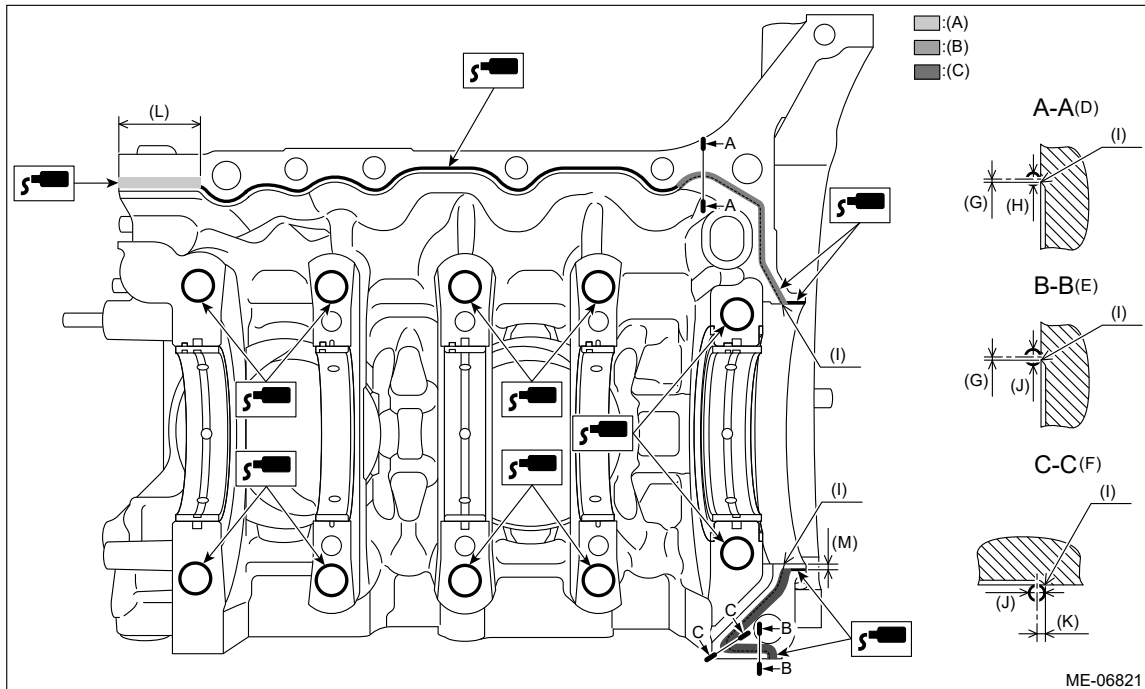
1±0.5 mm (0.0394±0.0197 in)

Mating surfaces of ranges A and C

4±0.5 mm (0.1575±0.0197 in)

Mating surfaces of range B

3.2±0.5 mm (0.1260±0.0197 in)



- | | | |
|---|--|------------------------|
| (A) Range A | (F) Liquid gasket applying position of mating surfaces (the edge) of range C | (K) 2 mm (0.0787 in) |
| (B) Range B | (G) Within 1 mm (0.0394 in) | (L) 36 mm (1.4173 in) |
| (C) Range C | (H) $\varnothing 3.2 \pm 0.5$ mm (0.1260 \pm 0.0197 in) | (M) 2.5 mm (0.0984 in) |
| (D) Liquid gasket applying position of mating surfaces of range B | (I) Chamfer edge | |
| (E) Liquid gasket applying position of mating surfaces (other than the edge) of range C | (J) $\varnothing 4 \pm 0.5$ mm (0.1575 \pm 0.0197 in) | |

6. Install the cylinder block RH to the cylinder block LH.

7. Join the cylinder blocks.

(1) Apply a coat of engine oil to the washers and cylinder block mounting bolt threads.

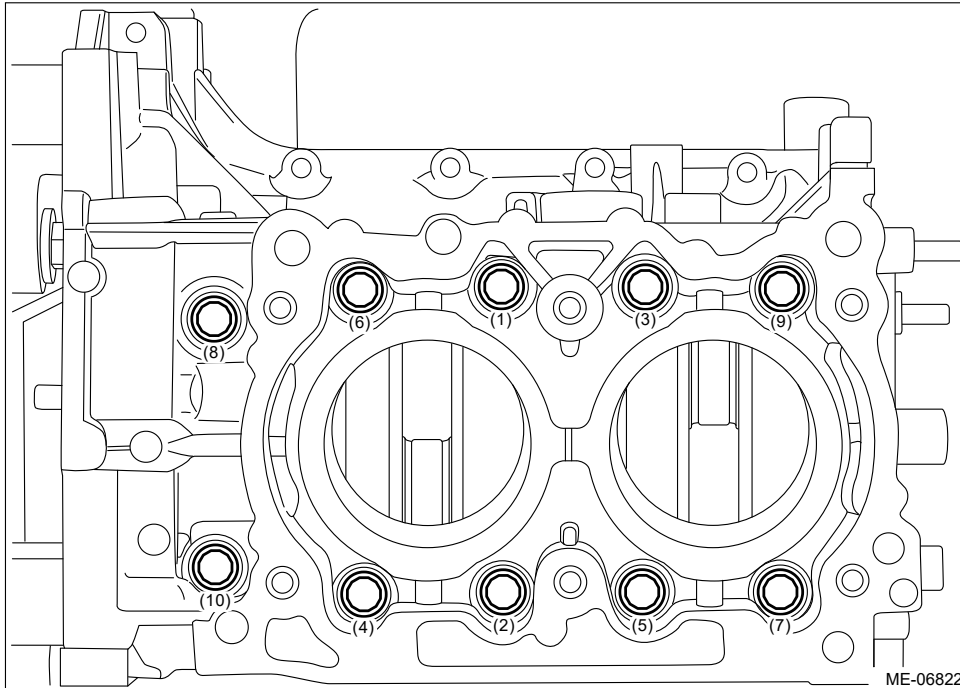
Note:

To prevent mixture of engine oil into the water jacket, do not apply a large amount.

(2) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf·m, 25.8 ft·lb) in numerical order as shown in the figure.

Caution:

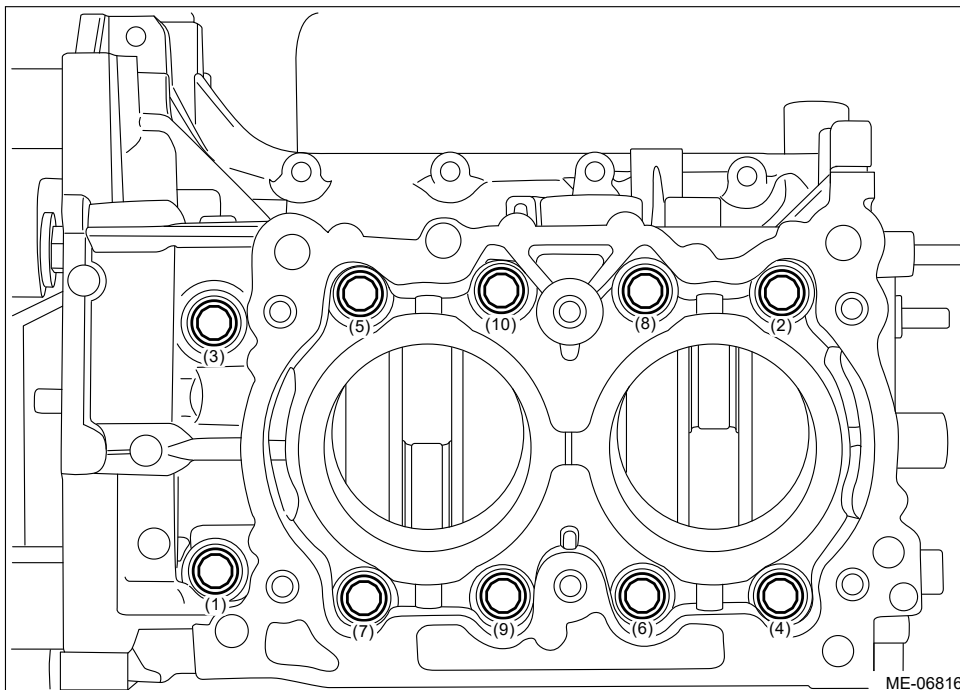
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(3) Loosen all mounting bolts by 180° in numerical order as shown in the figure.

Caution:

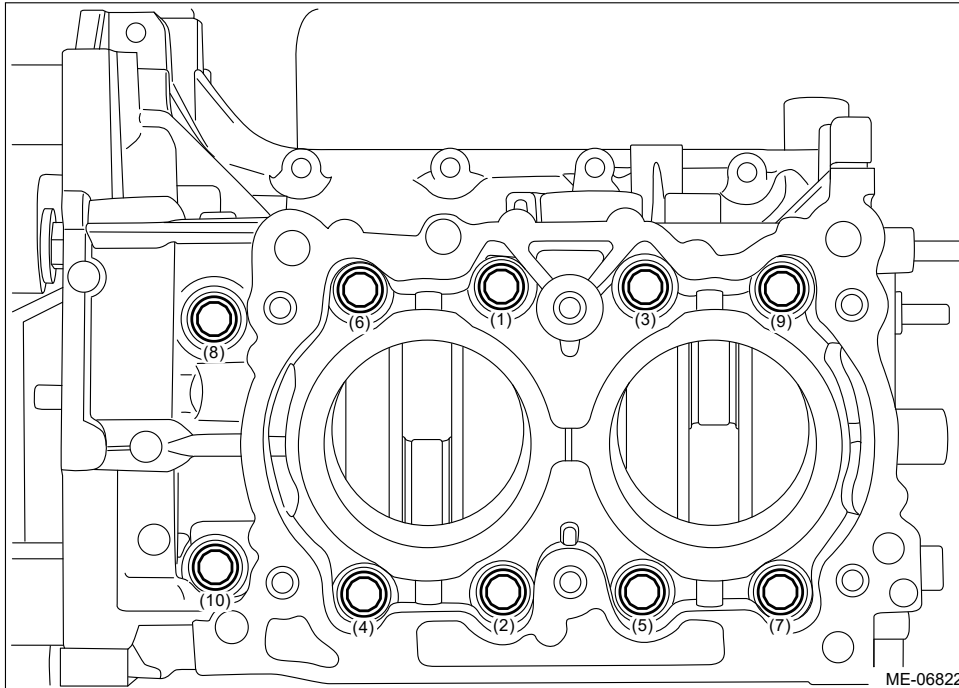
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(4) Tighten all mounting bolts with a torque of 35 N·m (3.6 kgf-m, 25.8 ft-lb) in numerical order as shown in the figure.

Caution:

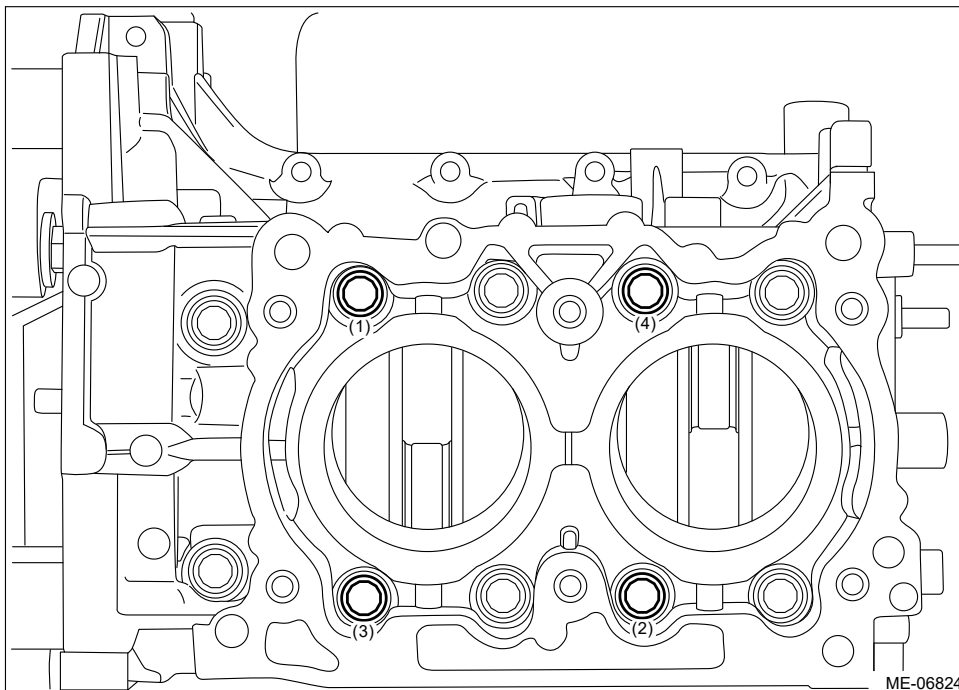
When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(5) Loosen the mounting bolts (4 places) by 180° in numerical order as shown in the figure.

Caution:

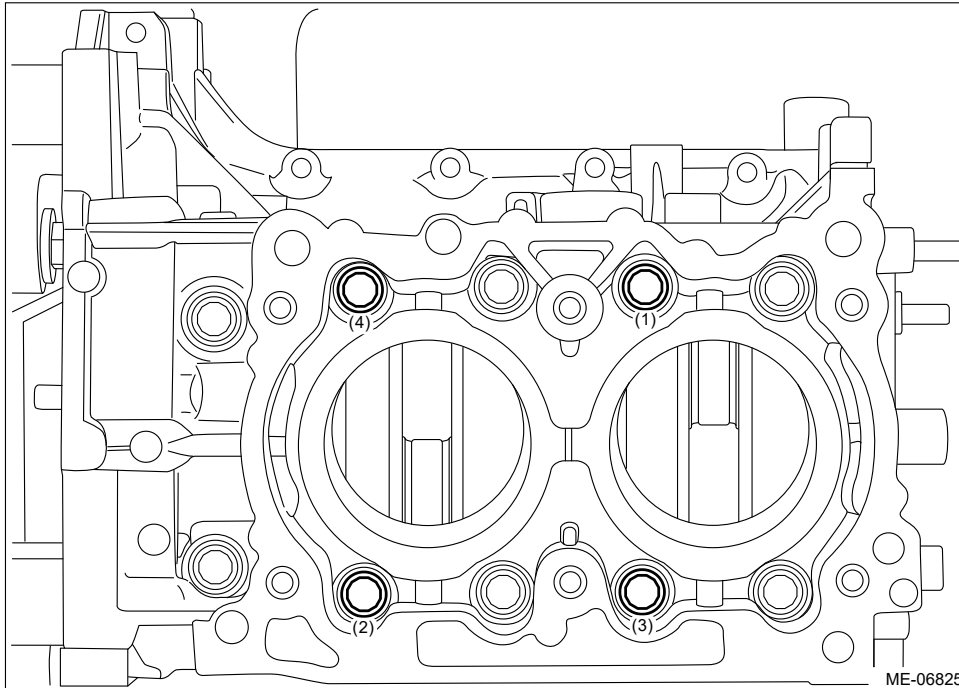
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(6) Tighten the mounting bolts (4 places) with a torque of 17 N·m (1.7 kgf·m, 12.5 ft·lb) in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



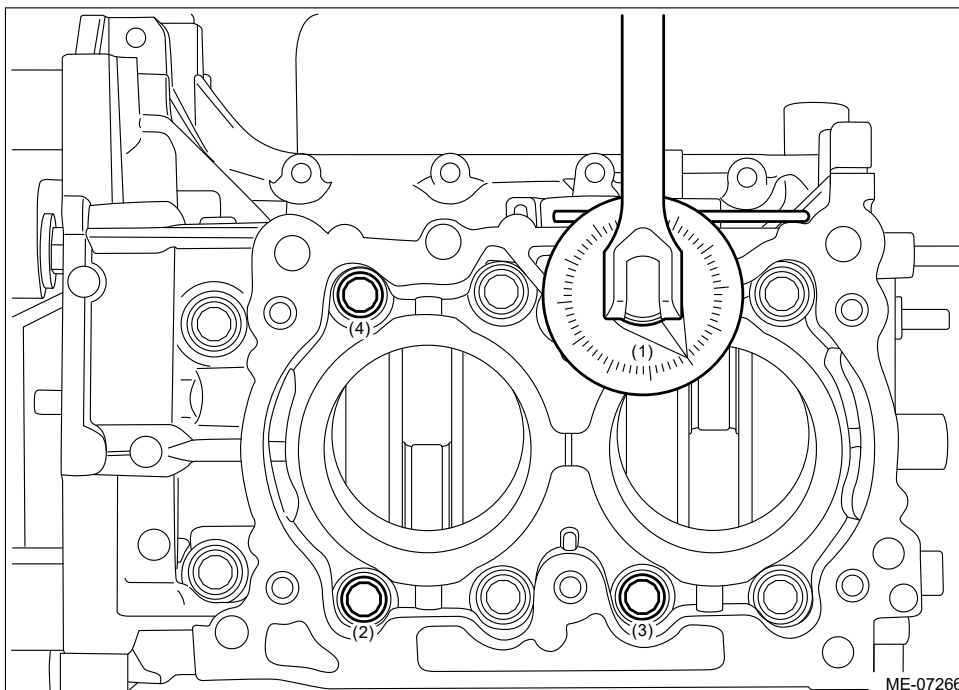
(7) Using angle gauge, tighten the mounting bolts (4 places) with specified angle in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:

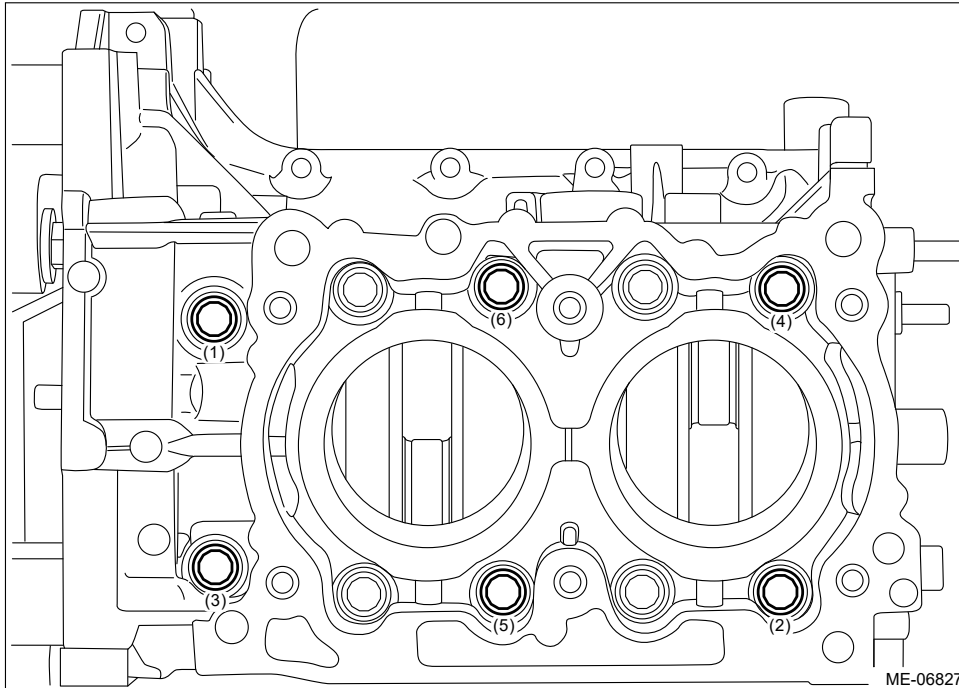
$60^{\circ} \pm 2^{\circ}$



(8) Loosen the mounting bolts (6 places) by 180° in numerical order as shown in the figure.

Caution:

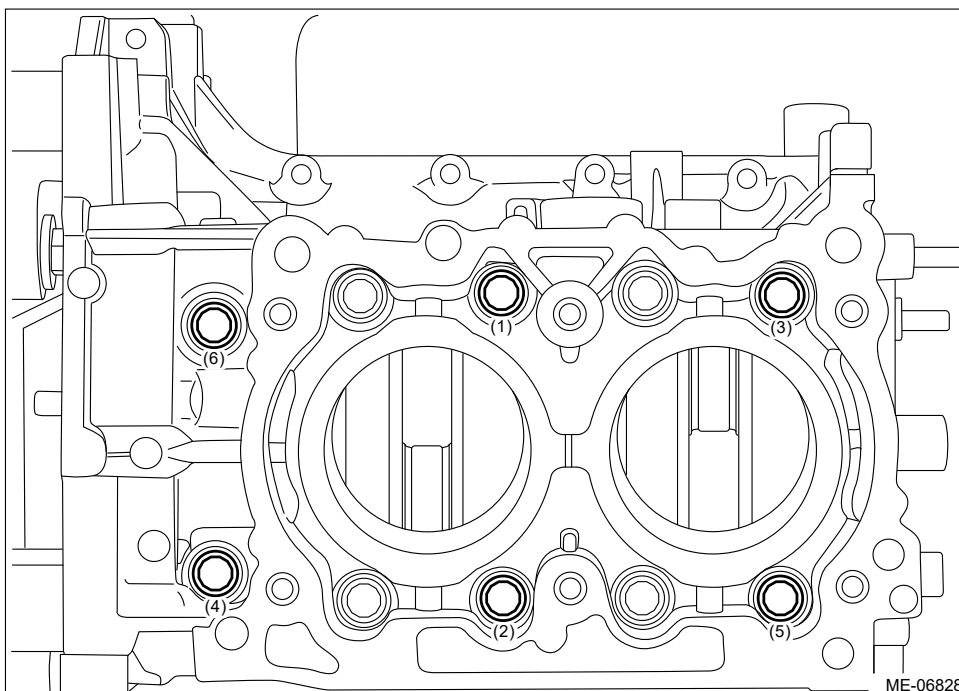
When loosening the mounting bolts, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



(9) Tighten the mounting bolts (6 places) with a torque of 17 N·m (1.7 kgf-m, 12.5 ft-lb) in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified torque, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.



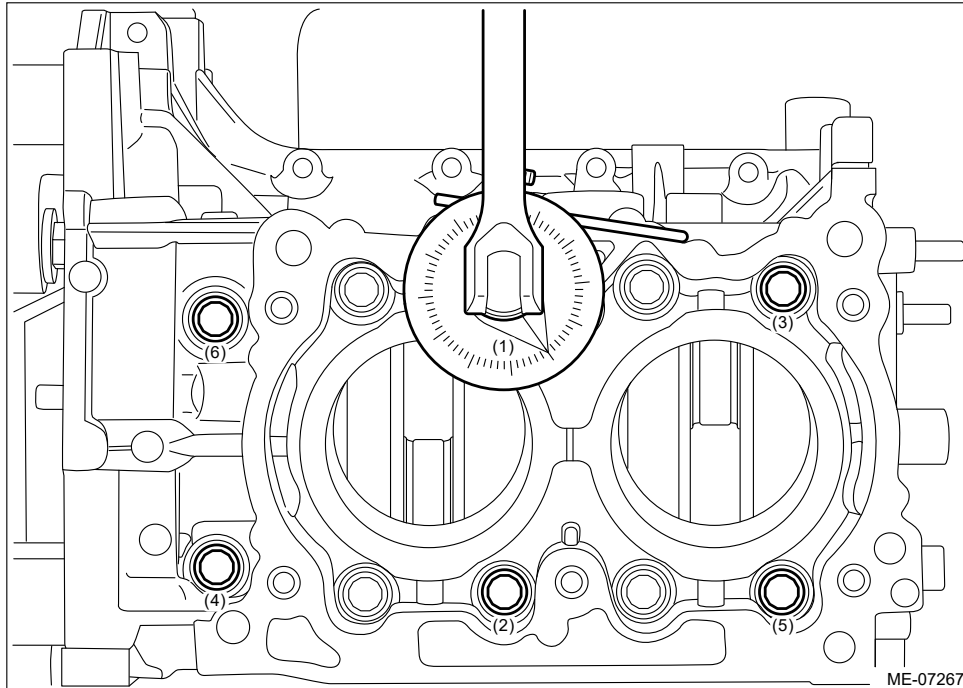
(10) Using angle gauge, tighten the mounting bolts (6 places) with specified angle in numerical order as shown in the figure.

Caution:

When tightening the mounting bolts with specified angle, hold the cylinder block LH while not holding the cylinder block RH to ensure the joint accuracy of the cylinder block.

Tightening angle:

$60^{\circ} \pm 2^{\circ}$



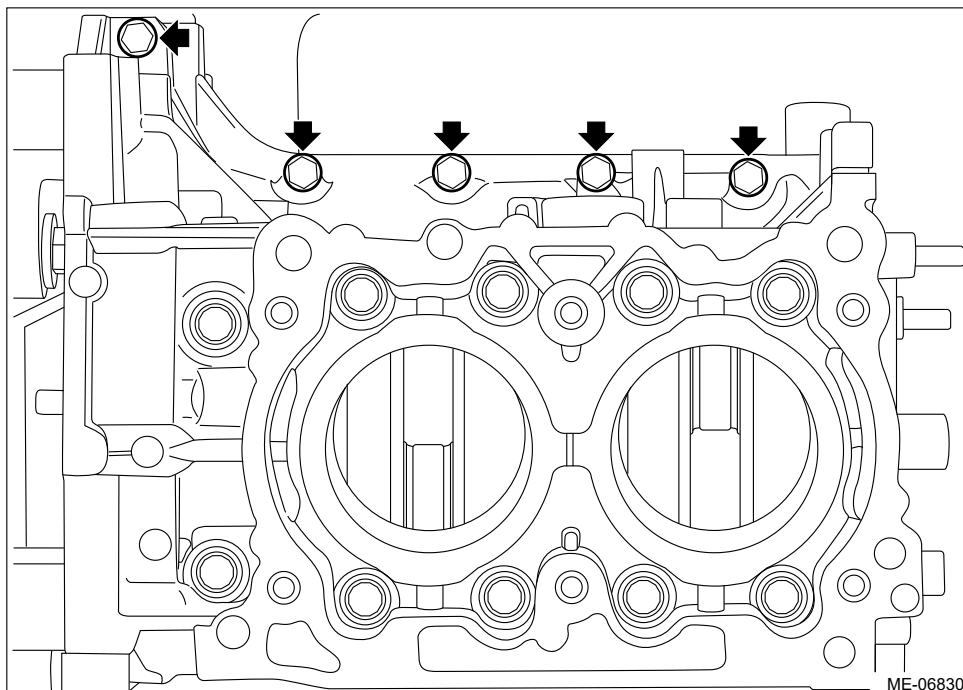
(11) Install the bolt shown in the figure.


Note:

After tightening, if the liquid gasket is squeezed out in the seal surface area of the chain cover and oil pan upper, completely remove any liquid gasket that is squeezed out. Any liquid gasket on the chamfer area, however, should not be removed.

Tightening torque:

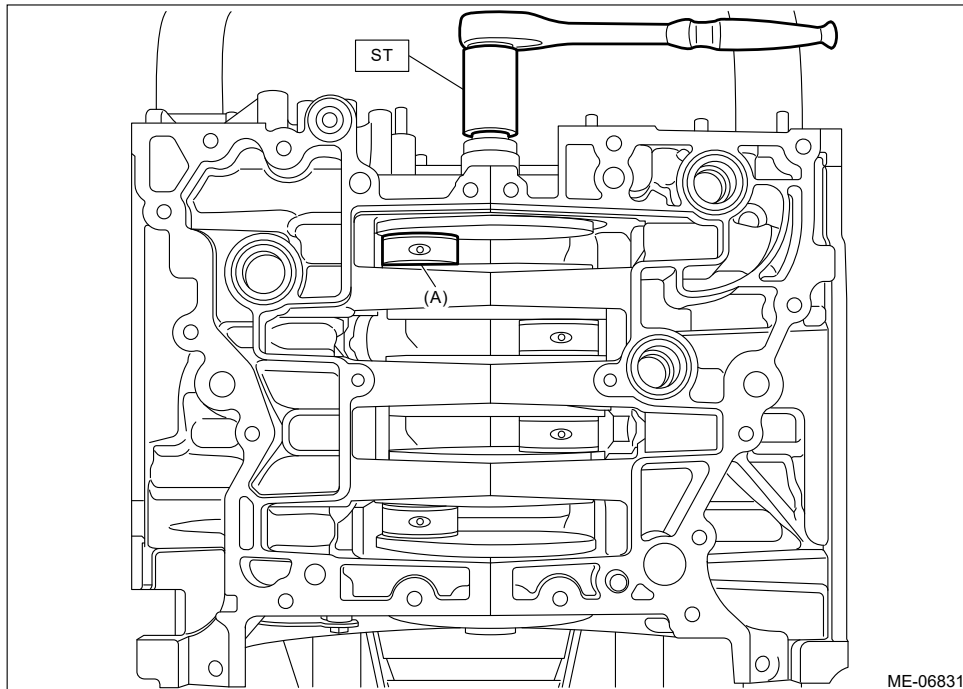
25 N·m (2.5 kgf-m, 18.4 ft-lb)



- 8.** Set the part so that the installation surface of the oil pan upper is on the upper side.
- 9.** Check that the piston ring gap for each piston is positioned correctly.  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>ASSEMBLY > PISTON AND CONNECTING ROD.](#)
- 10.** Install the piston and connecting rod to the cylinder block.
 - (1) Apply engine oil to the outer circumference of each piston, crankshaft pin, and in the cylinder block.

(2) Turn the crankshaft so that the #1 pin (A) of crankshaft is positioned at TDC using ST.

ST 18252AA000 CRANKSHAFT SOCKET



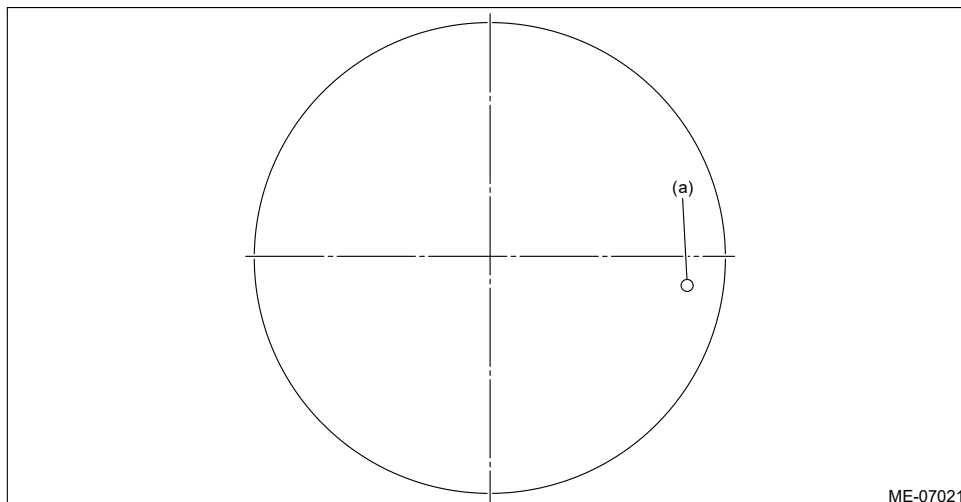
(3) Compress the piston ring using piston ring compressor, and insert the #1 connecting rod with #1 piston into cylinder block.

Caution:

- Be careful not to damage the cylinder liner and #1 pin of crankshaft by the #1 connecting rod large end.
- Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.

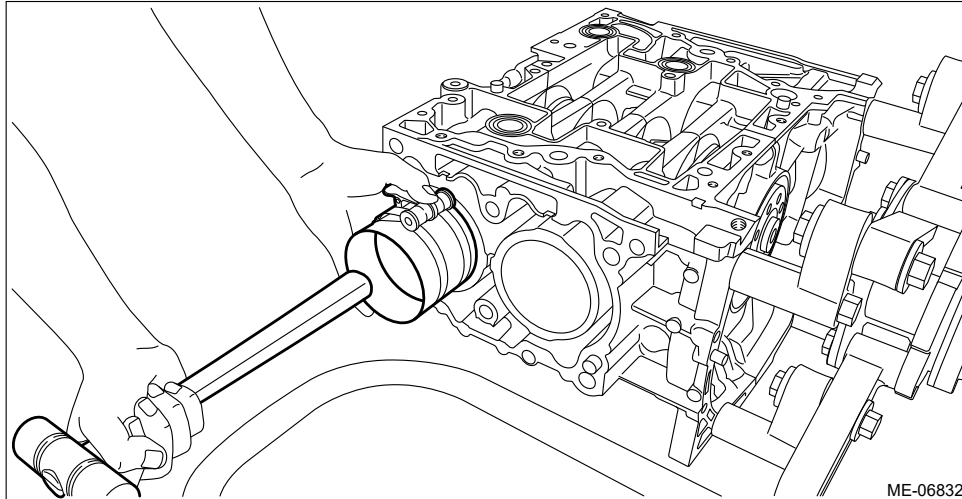
Note:

- Face the piston front mark (round mark) towards the front of the engine.



(a) Front mark

- Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.

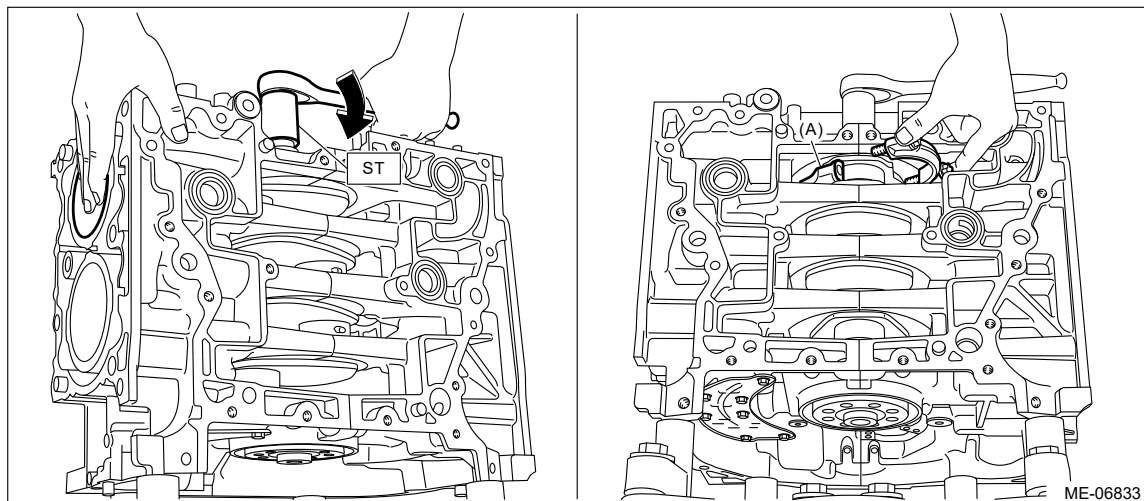


- (4) Turn the crankshaft counterclockwise so that the #1 pin of crankshaft and the large end (A) of #1 connecting rod are positioned as shown in the figure using ST, while pressing the #1 piston crown, and then set the #1 connecting rod cap and #1 connecting rod cap bolt.

Note:

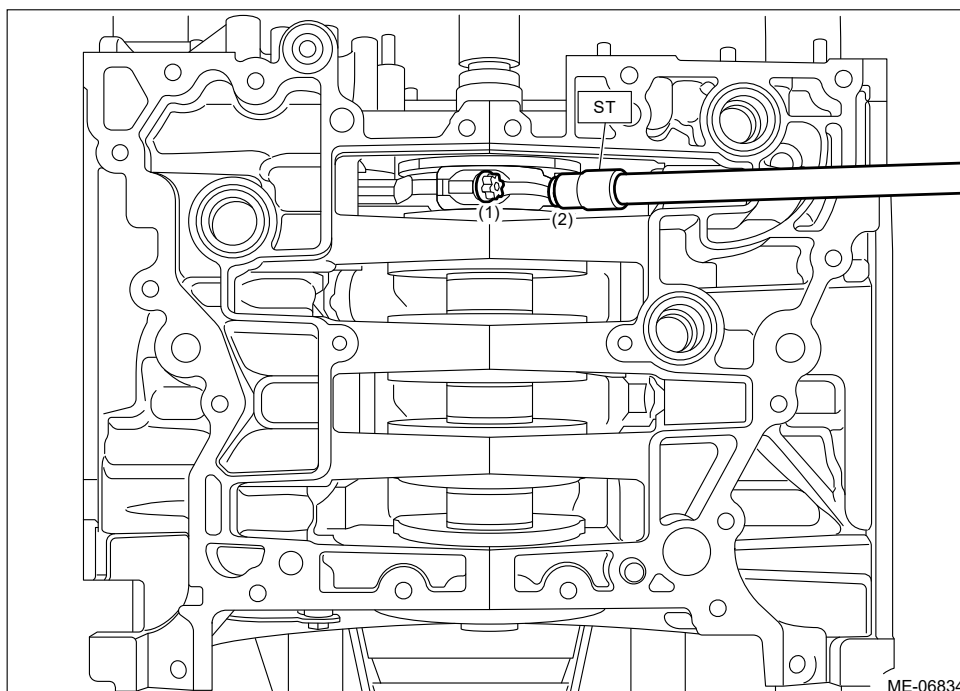
- Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.
- Use a new connecting rod cap bolt.
- Apply a coat of engine oil to the #1 connecting rod cap seat and the connecting rod cap bolt threads.

ST 18252AA000 CRANKSHAFT SOCKET



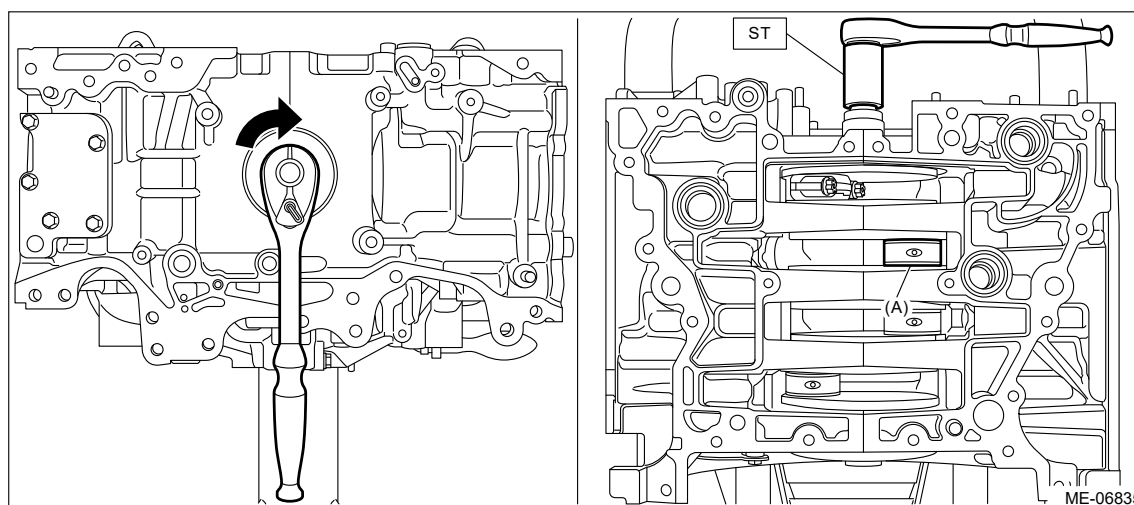
- (5) Using ST, tighten the #1 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 25 N·m (2.5 kgf-m, 18.4 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET



(6) Turn the crankshaft clockwise so that the #2 pin (A) of crankshaft is positioned at TDC using ST.

ST 18252AA000 CRANKSHAFT SOCKET



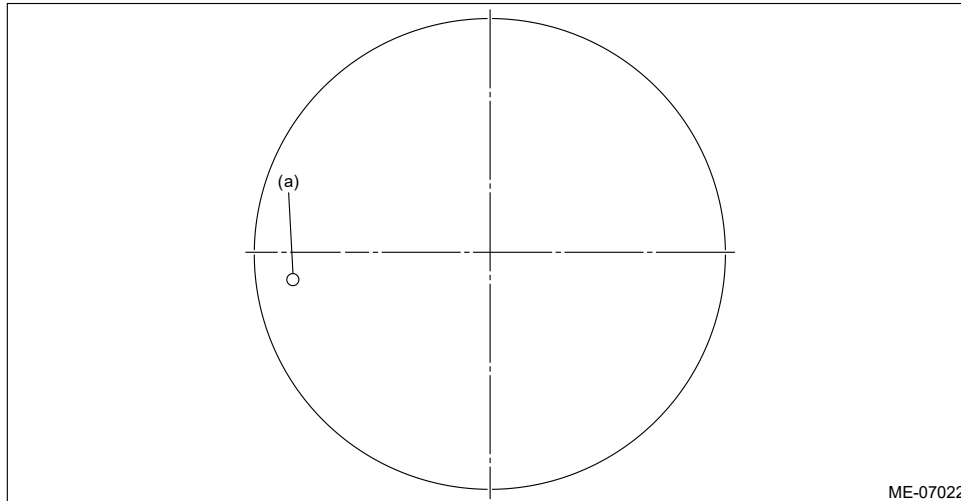
(7) Compress the piston ring using piston ring compressor, and insert the #2 connecting rod with #2 piston into cylinder block.

Caution:

- Be careful not to damage the cylinder liner and #2 pin of crankshaft by the #2 connecting rod large end.
- Be careful not to apply strong impact when inserting to prevent connecting rod bearing from falling off.

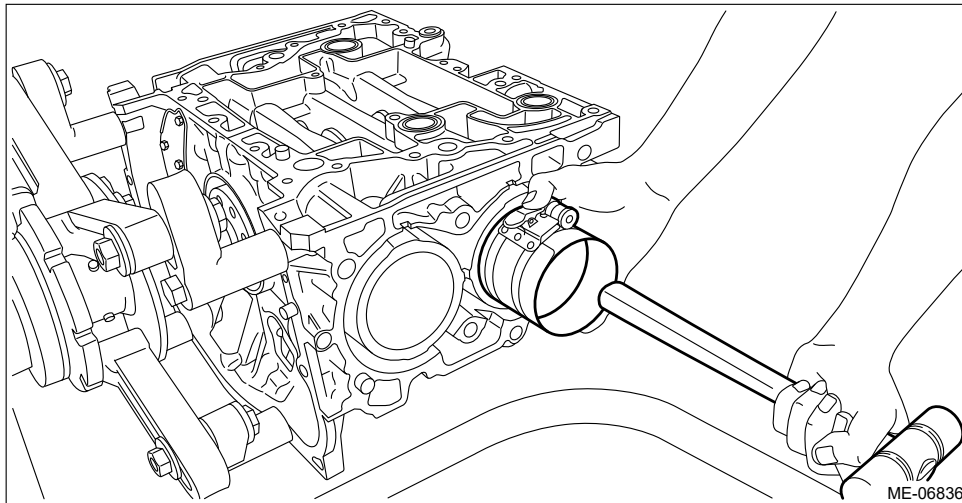
Note:

- Face the piston front mark (round mark) towards the front of the engine.



(a) Front mark

- **Insert while lightly tapping the crown of the piston with the handle of a plastic hammer.**

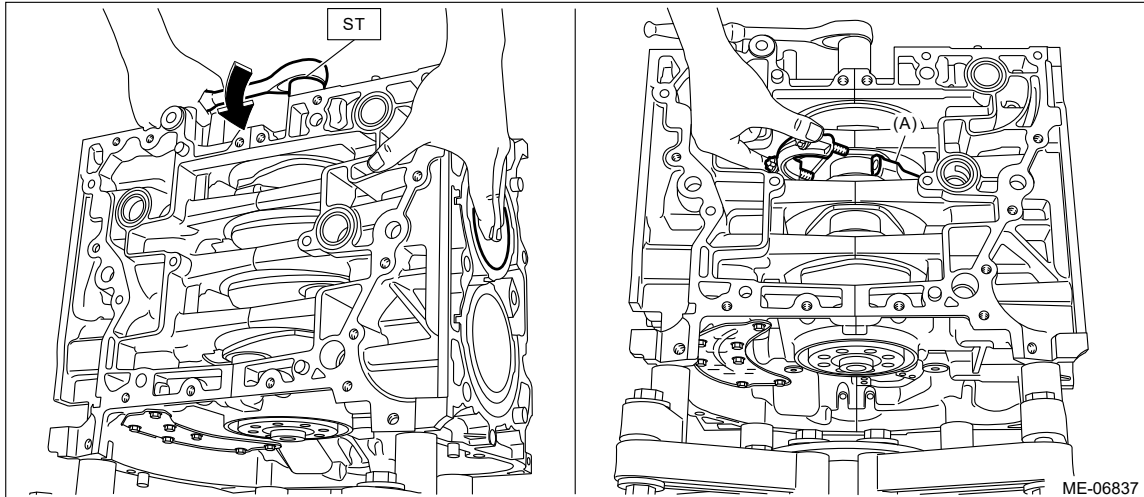


- (8) Turn the crankshaft clockwise so that the #2 pin of crankshaft and the large end (A) of #2 connecting rod are positioned as shown in the figure using ST, while pressing the #2 piston crown, and then set the #2 connecting rod cap and #2 connecting rod cap bolt.

Note:

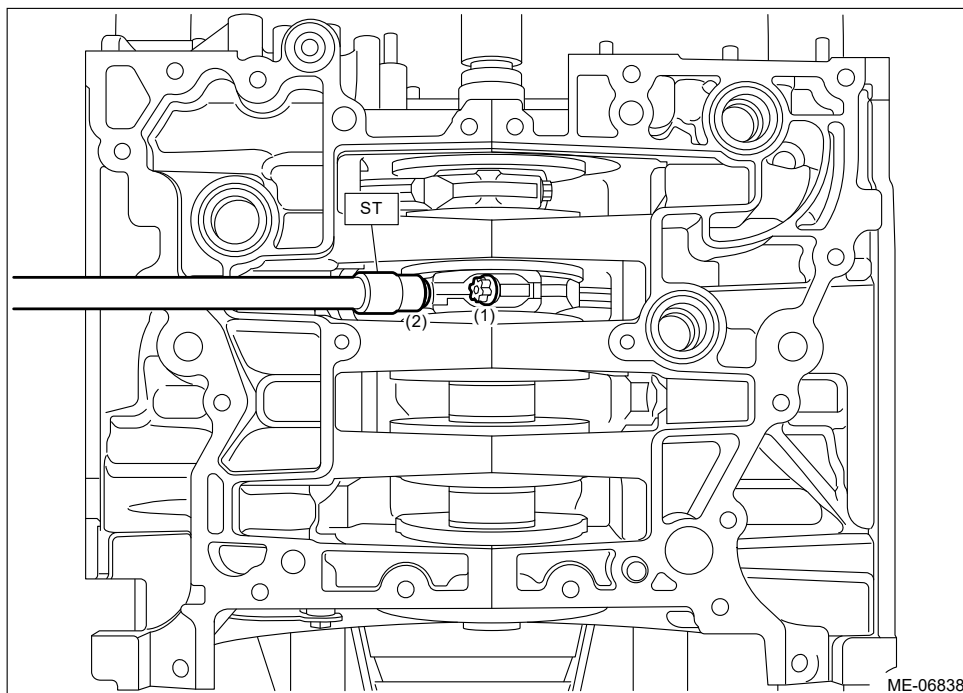
- **Each connecting rod has its own mating cap. Make sure that they are assembled correctly by checking their matching symbol.**
- **Use a new connecting rod cap bolt.**
- **Apply a coat of engine oil to the #2 connecting rod cap seat and the connecting rod cap bolt threads.**

ST 18252AA000 CRANKSHAFT SOCKET



- (9) Using ST, tighten the #2 connecting rod cap bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in numerical order as shown in the figure, then retighten the bolts to 25 N·m (2.5 kgf-m, 18.4 ft-lb) in numerical order as shown in the figure.

ST 18270AA020 SOCKET

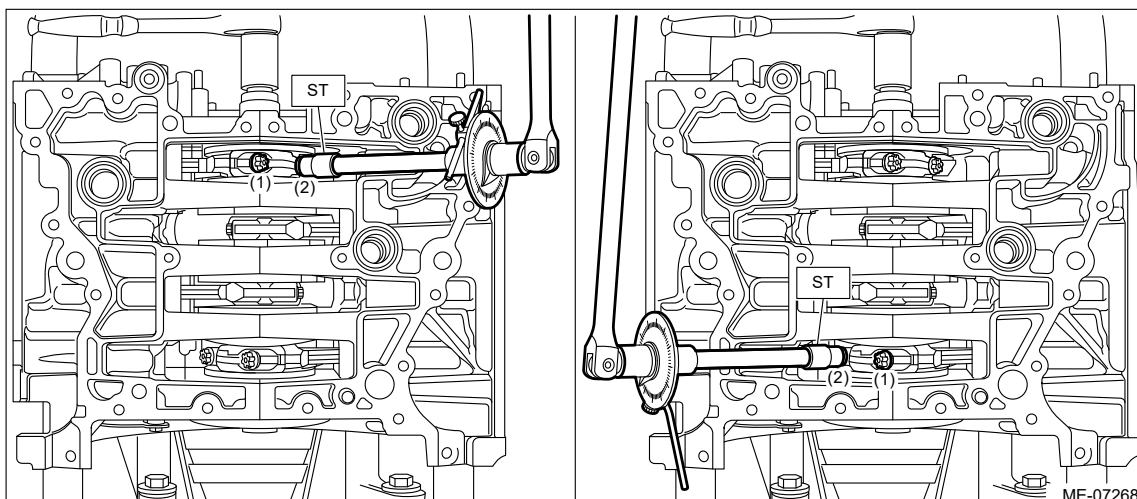


- (10) Install #3 and #4 pistons and ST connecting rod caps in the same installation procedure as #1 and #2 pistons and connecting rod caps.
- (11) Using ST and angle gauge, tighten the #1 connecting rod cap bolts and #4 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

ST 18270AA020 SOCKET

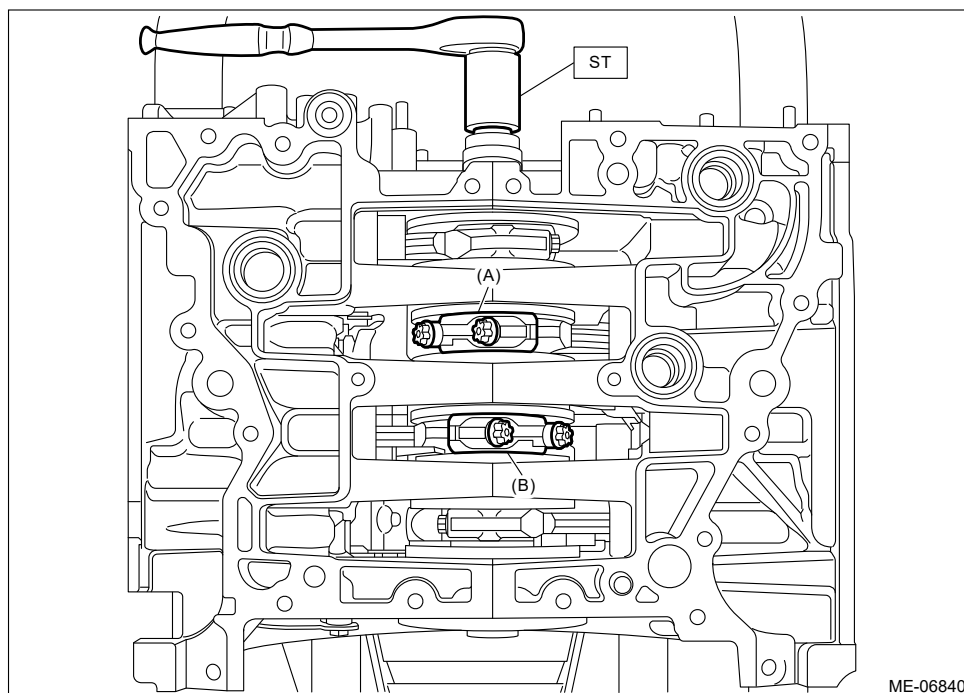
Tightening angle:

$90^{\circ}+5^{\circ}_{-0^{\circ}}$



(12) Turn the crankshaft so that the #2 connecting rod cap (A) and #3 connecting rod cap (B) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET

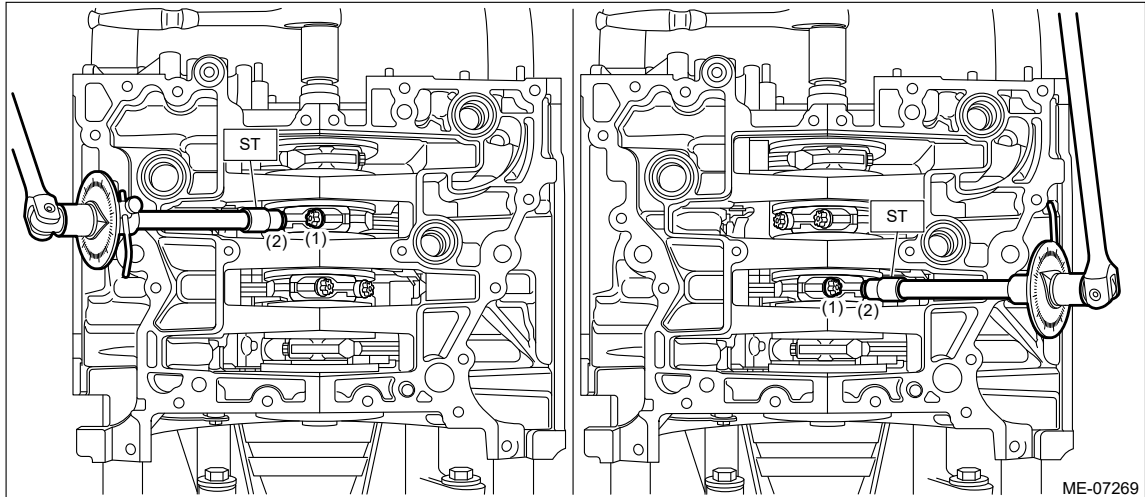



(13) Using ST and angle gauge, tighten the #2 connecting rod cap bolts and #3 connecting rod cap bolts with specified angle in numerical order as shown in the figure.

ST 18270AA020 SOCKET

Tightening angle:

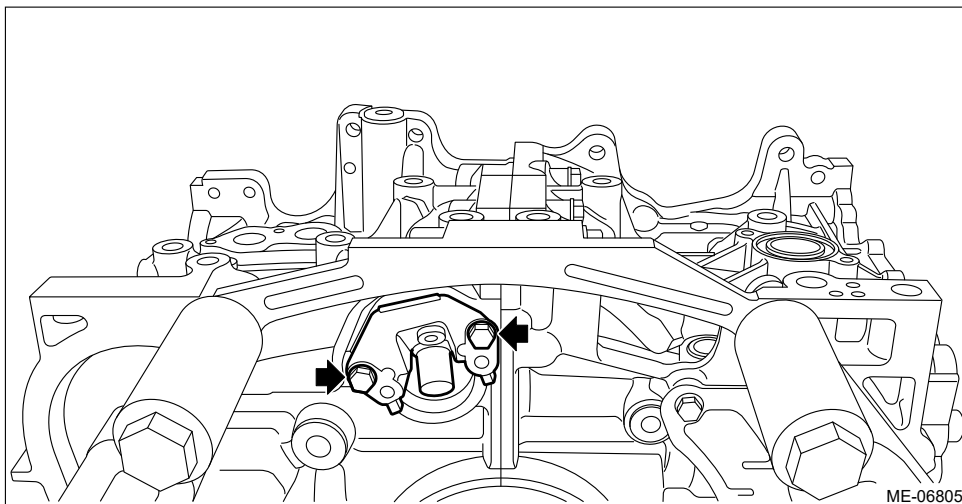
$90^{\circ} + 5^{\circ} - 0^{\circ}$



- 11.** Install the oil pan upper.  [Ref. to LUBRICATION\(H4DO\)>Oil Pan>INSTALLATION > OIL PAN UPPER.](#)
- 12.** Set the part so that the installation surface of the intake manifold is on the upper side.
- 13.** Install the crankshaft position sensor with crankshaft position sensor holder to the cylinder block LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



- 14.** Install the PCV valve onto the cylinder block RH.

Note:

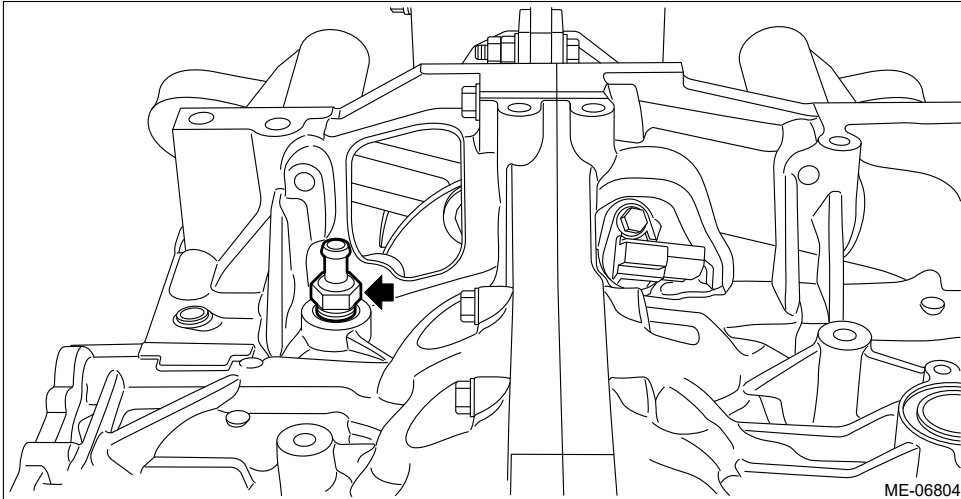
Apply liquid gasket to the bolt threads of PCV valve.

Liquid gasket:

THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:

23 N·m (2.3 kgf-m, 17.0 ft-lb)



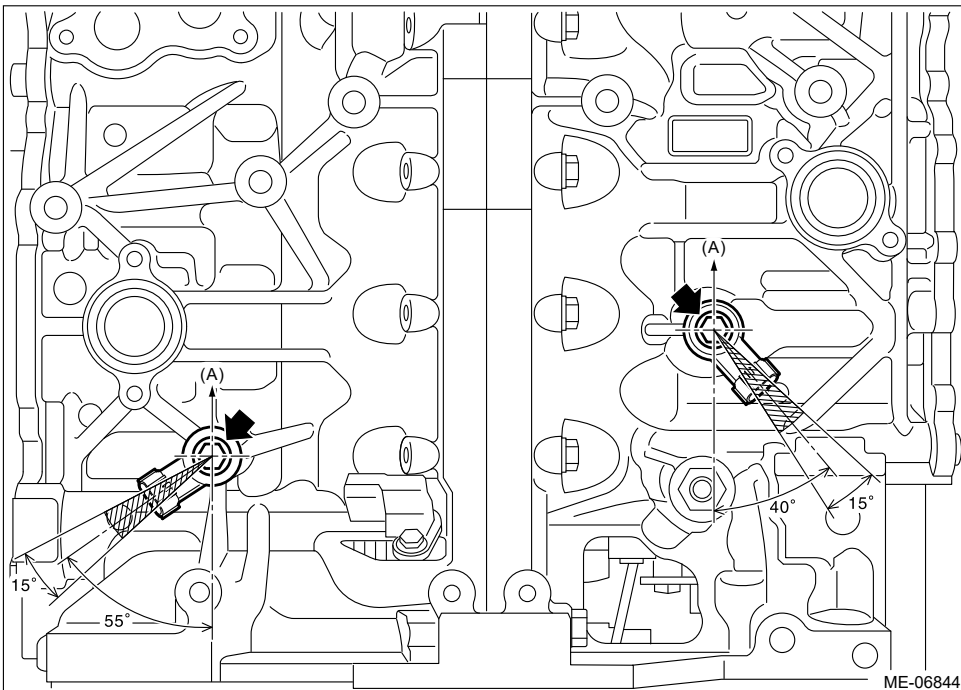
15. Install the knock sensor to the cylinder block LH.

Note:

Knock sensor must be positioned toward engine front so that the connector center position is within the range of shaded area shown in the figure.

Tightening torque:

24 N·m (2.4 kgf-m, 17.7 ft-lb)

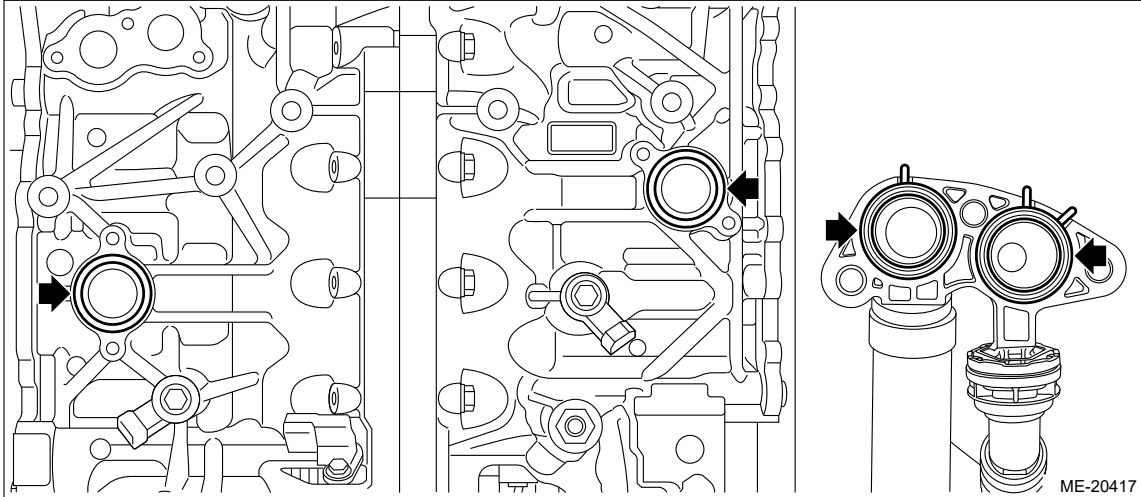


(A) Front of engine

16. Install the O-ring to the cylinder block and PCV connector.

Note:

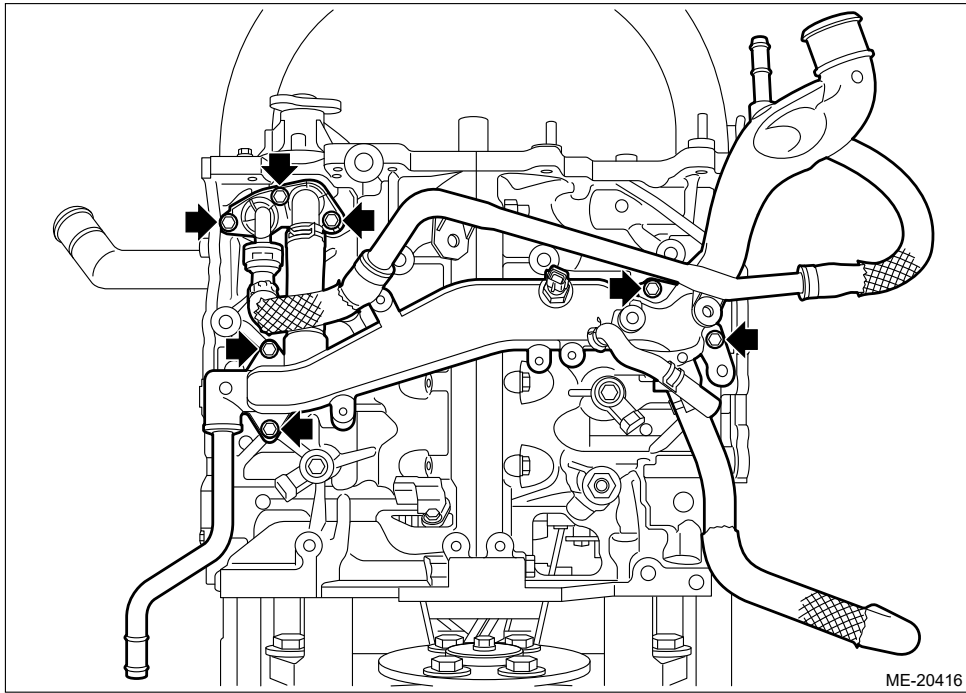
Use new O-rings.



17. Install the water pipe assembly and PCV connector to the cylinder block.

Tightening torque:

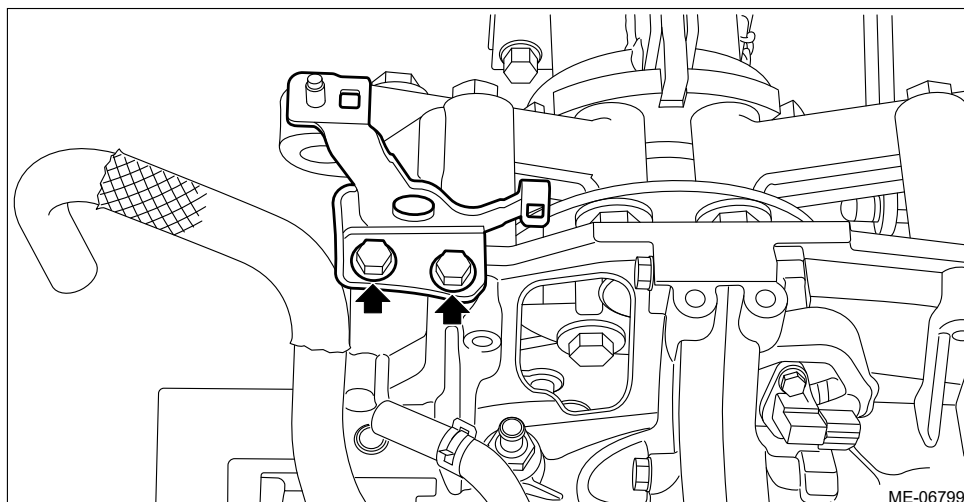
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



18. Install the engine rear hanger to the cylinder block RH.

Tightening torque:

21 N·m (2.1 kgf-m, 15.5 ft-lb)

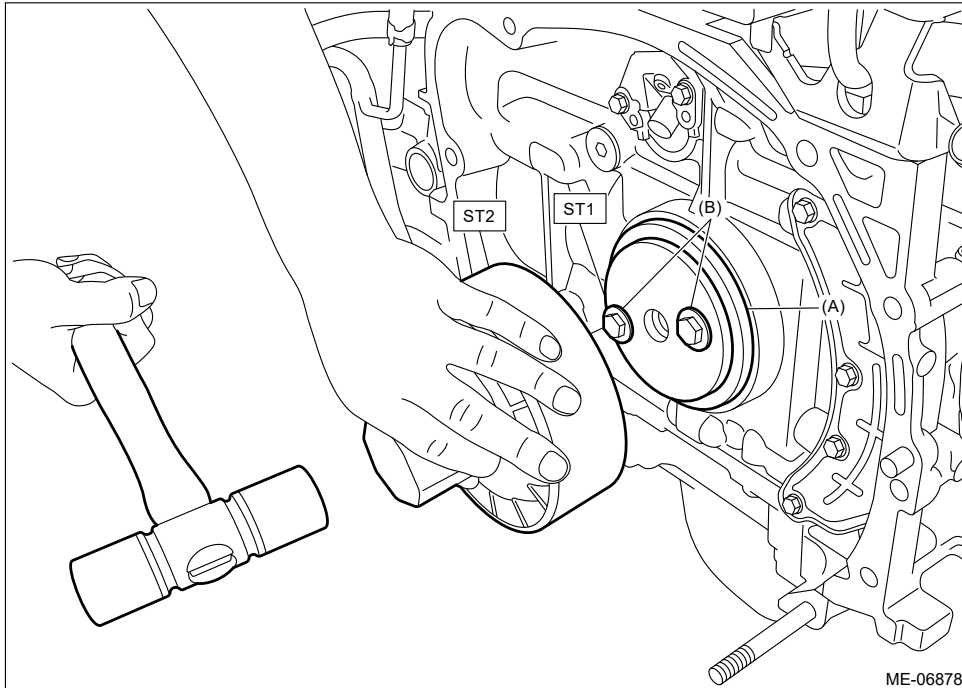


19. Install the crank sprocket. [Ref. to MECHANICAL\(H4DOTC\)>Crank Sprocket>INSTALLATION.](#)
20. Install the cylinder head. [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>INSTALLATION.](#)
21. Install the cam carrier. [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>INSTALLATION.](#)
22. Install the rocker cover. [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>INSTALLATION.](#)
23. Install the chain cover. [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)
24. Install the engine wiring harness. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Wiring Harness>INSTALLATION.](#)
25. Install the air intake adapter. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Tumble Generator Valve Assembly>INSTALLATION.](#)
26. Install the intake manifold. [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>INSTALLATION.](#)
27. Apply a coat of engine oil to the oil seal inner periphery and outer periphery, and install the rear oil seal using ST1 and ST2.

Note:


Use a new rear oil seal.

| | |
|-----------------------|---------------------------|
| ST1 18671AA020 | OIL SEAL GUIDE |
| ST2 18657AA030 | OIL SEAL INSTALLER |



(A) Rear oil seal











(B) Drive plate mounting bolt

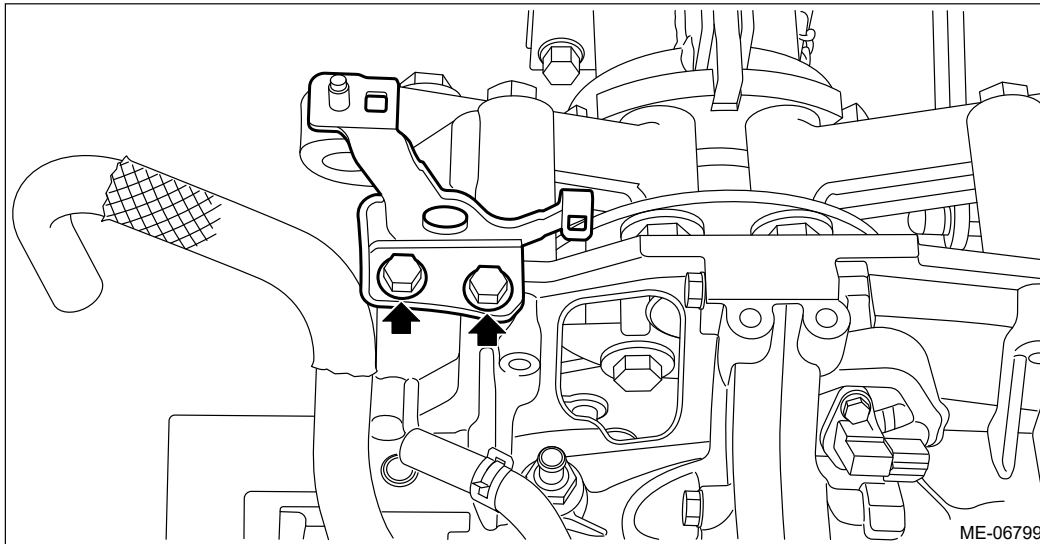
28. Install the crankshaft position sensor plate with drive plate.  [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR690\)>Drive Plate>INSTALLATION.](#)

29. Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>INSTALLATION.](#)

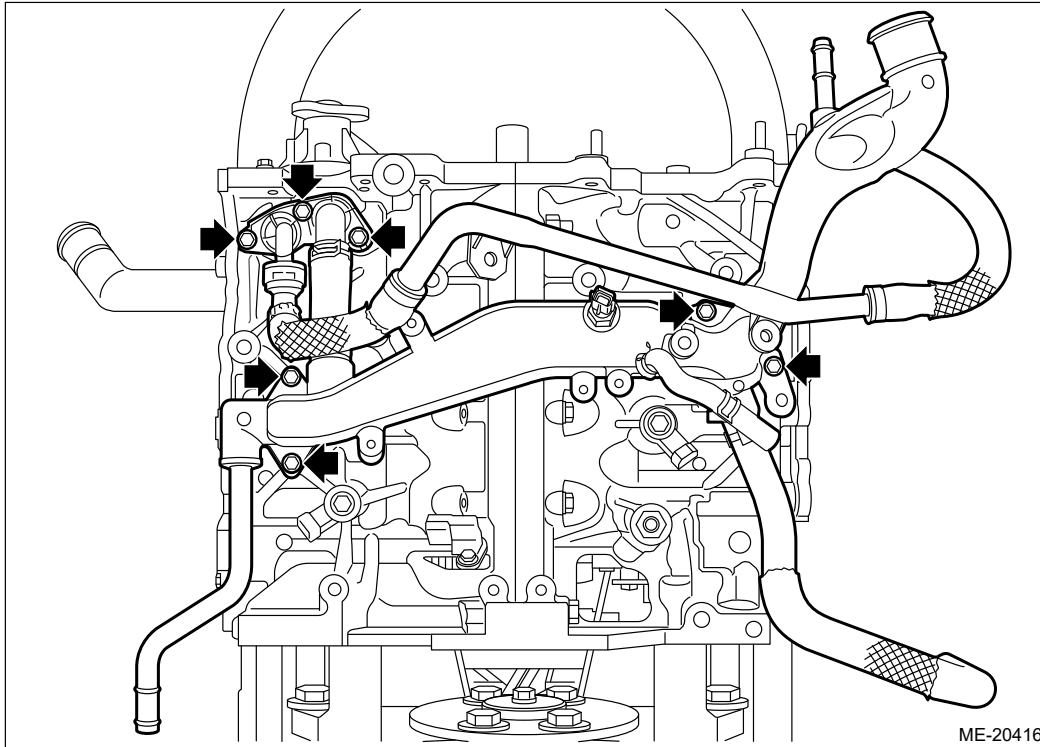
MECHANICAL(H4DOTC) > Cylinder Block

REMOVAL

1. Remove the engine from the vehicle.  [Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>REMOVAL.](#)
2. Remove the crankshaft position sensor plate with drive plate.  [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR690\)>Drive Plate>REMOVAL.](#)
3. Remove the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
4. Remove the air intake adapter.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Tumble Generator Valve Assembly>REMOVAL.](#)
5. Remove the engine wiring harness.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Wiring Harness>REMOVAL.](#)
6. Remove the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
7. Remove the rocker cover.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>REMOVAL.](#)
8. Remove the cam carrier.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>REMOVAL.](#)
9. Remove the cylinder head.  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>REMOVAL.](#)
10. Remove the crank sprocket.  [Ref. to MECHANICAL\(H4DOTC\)>Crank Sprocket>REMOVAL.](#)
11. Remove the engine rear hanger from cylinder block RH.

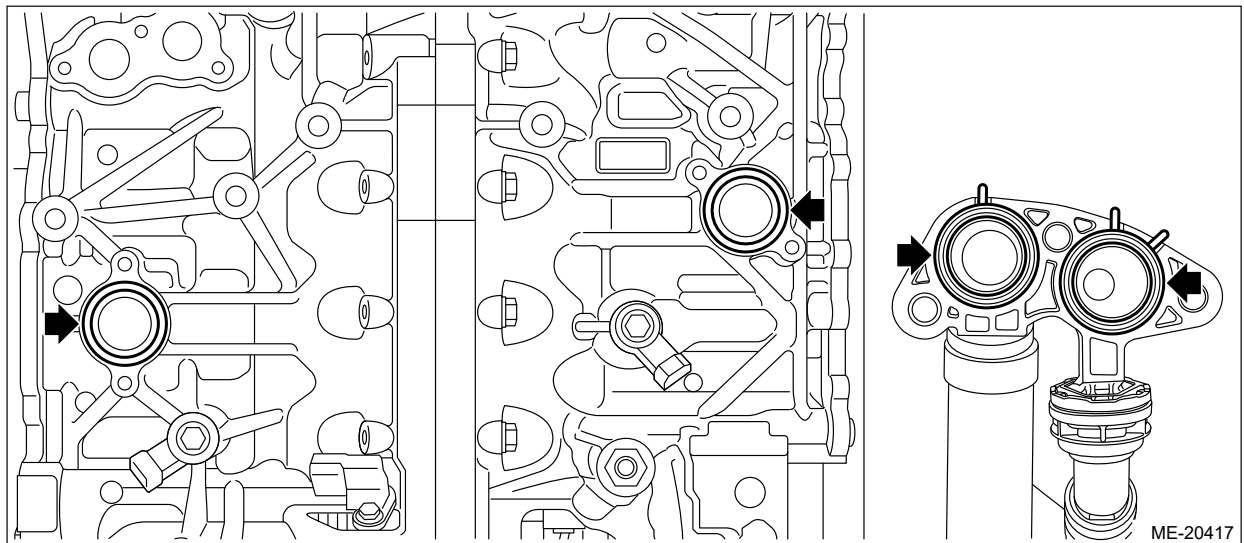


12. Remove the bolts securing the water pipe assembly and PCV connector to the cylinder block, and remove the water pipe assembly and PCV connector as a set from cylinder block.



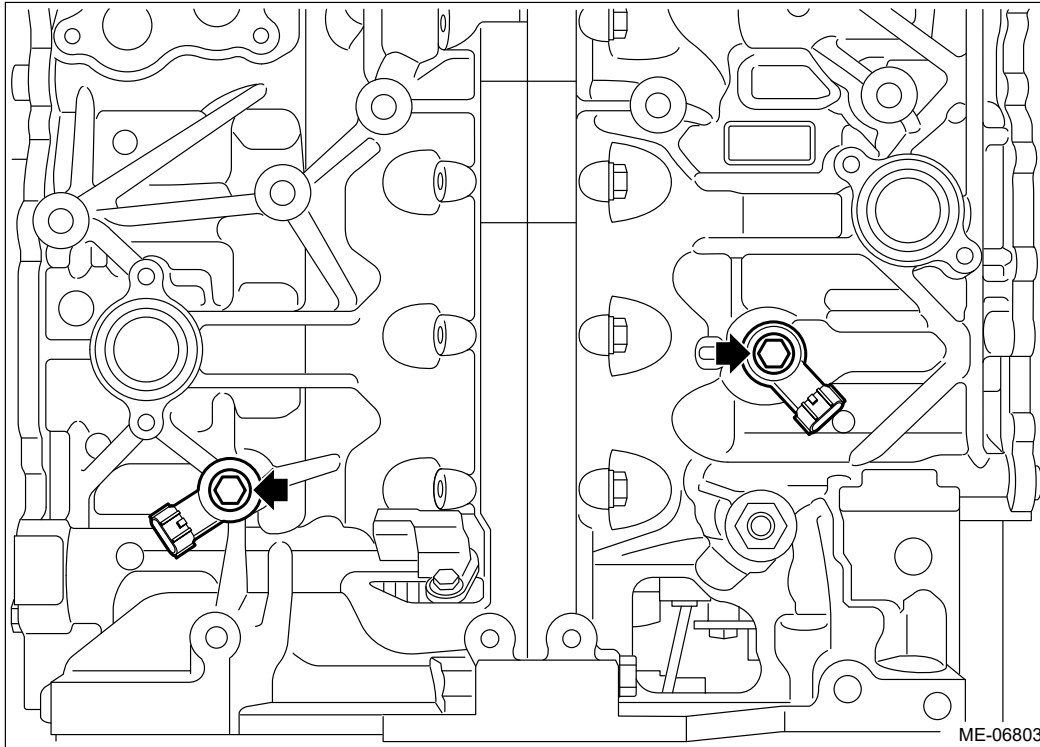
ME-20416

13. Remove the O-ring from the cylinder block and PCV connector.

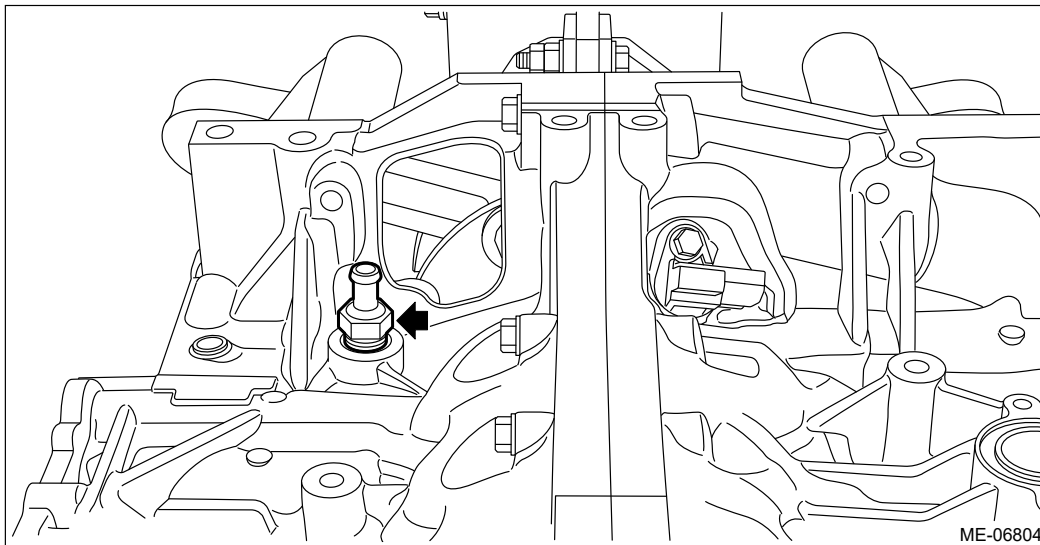


ME-20417

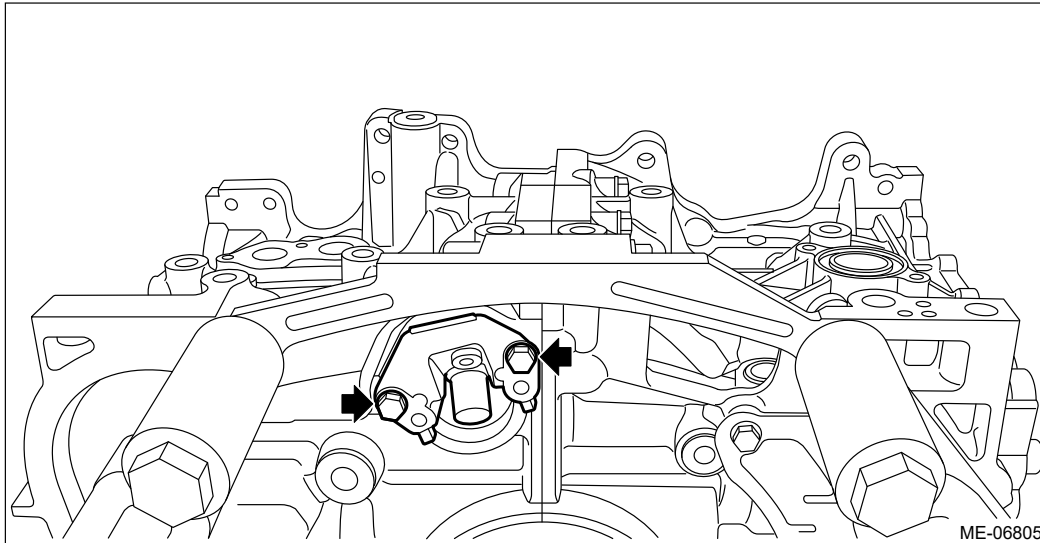
14. Remove the knock sensor from cylinder block LH.




15. Remove the PCV valve from the cylinder block RH.



16. Remove the bolts securing the crankshaft position sensor holder from the cylinder block LH, and remove the crankshaft position sensor with crankshaft position sensor holder.



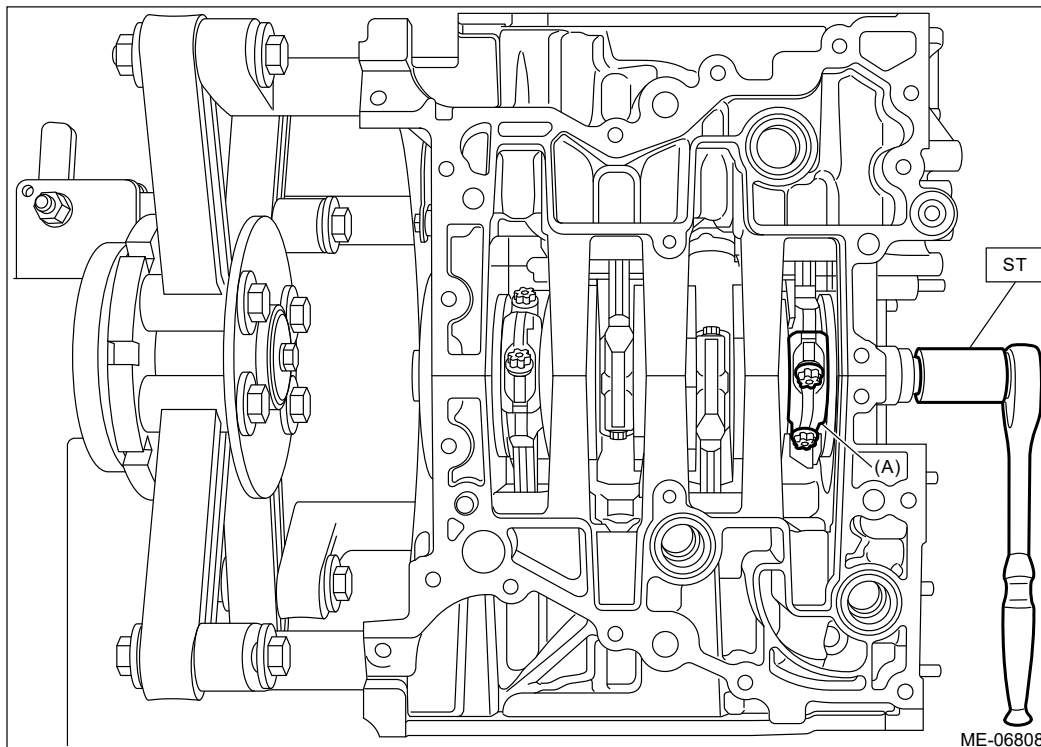
- 17.** Remove the oil pan upper.  [Ref. to LUBRICATION\(H4DO\)>Oil Pan>REMOVAL > OIL PAN UPPER.](#)
- 18.** Set the part so that the cylinder block RH is on the upper side.
- 19.** Remove the #1 and #3 connecting rod caps and pistons from the cylinder block.

Note:

Mark each connecting rod cap and piston with a cylinder number.

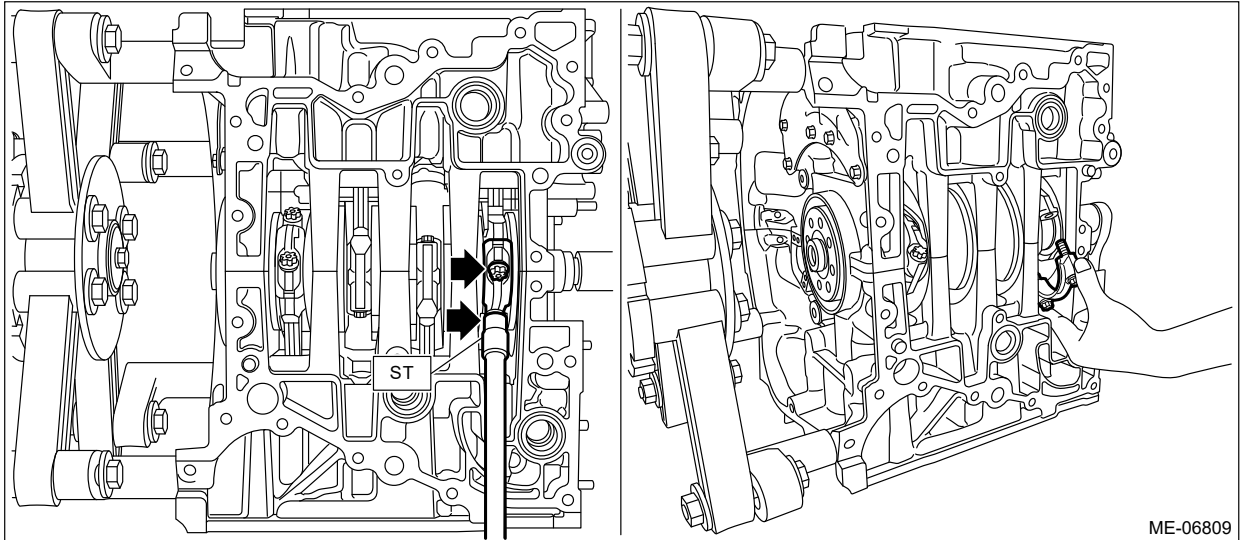
- (1) Turn the crankshaft so that the #1 connecting rod cap (A) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET



- (2) Using ST, loosen the #1 connecting rod cap bolt, and remove the #1 connecting rod cap bolt and #1 connecting rod cap.

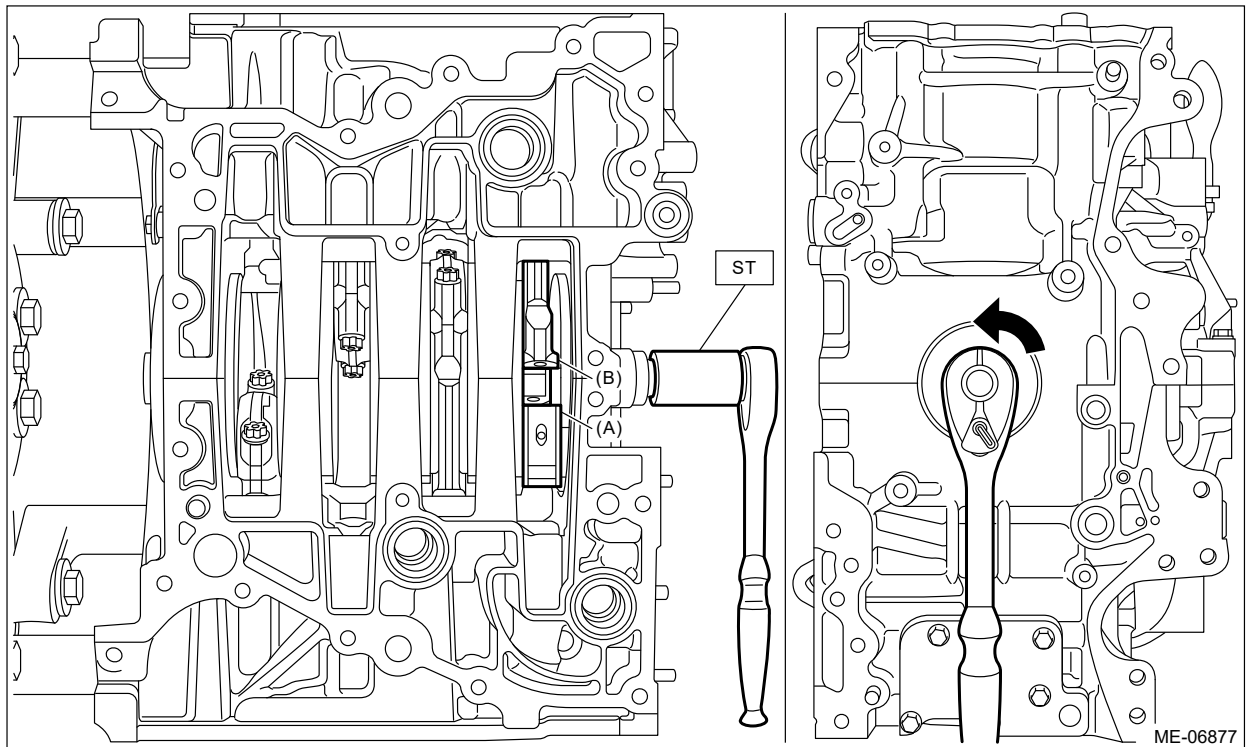
ST 18270AA020 SOCKET



ME-06809

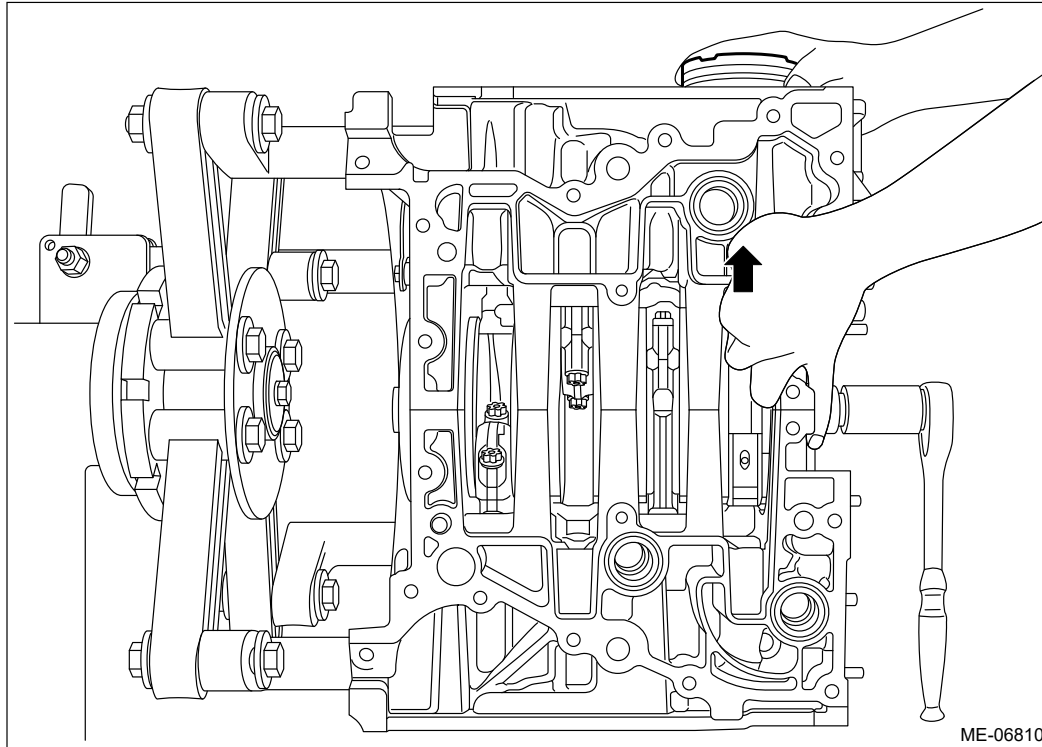
- (3) Using the ST, turn the crankshaft counterclockwise and separate the positions of the #1 pin (A) of crankshaft and the large end (B) of #1 connecting rod.

ST 18252AA000 CRANKSHAFT SOCKET



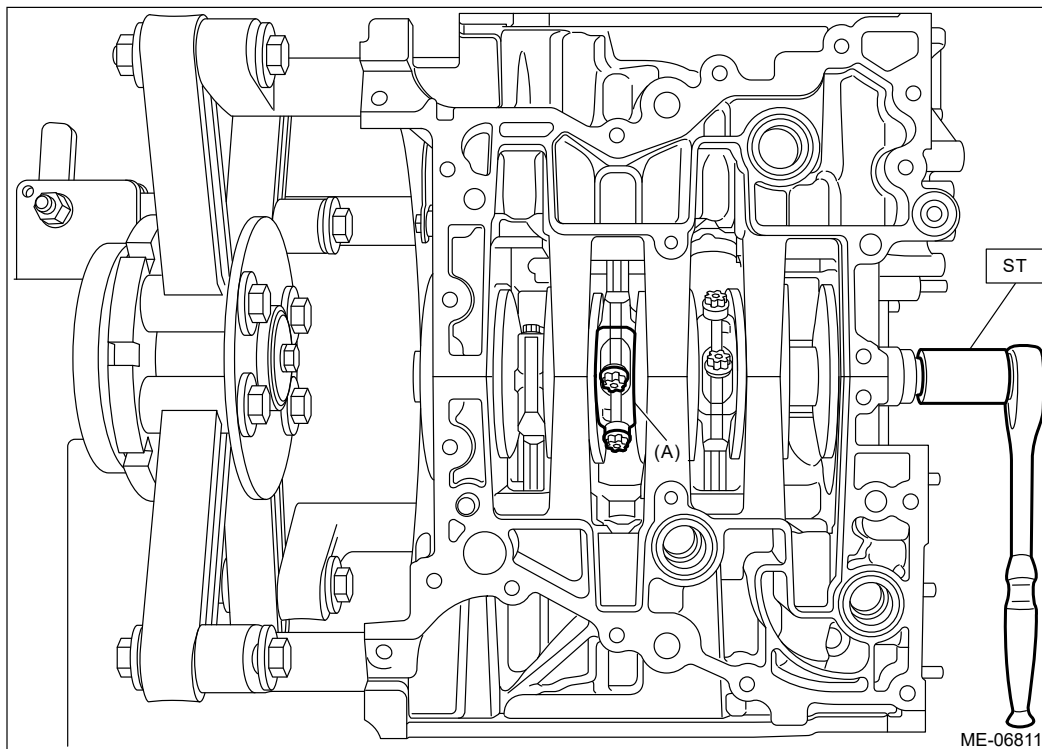
ME-06877

- (4) Push the #1 connecting rod in the direction of the arrow, and remove the #1 piston with #1 connecting rod from the cylinder block.



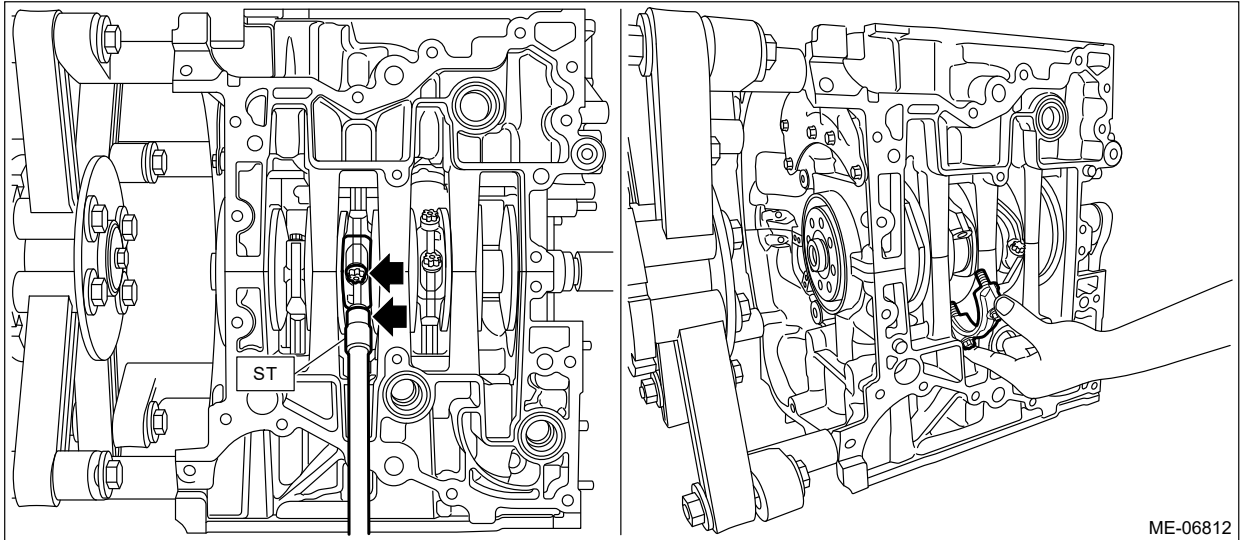
- (5) Turn the crankshaft so that the #3 connecting rod cap (A) is located at the position shown in the figure using ST.

ST 18252AA000 CRANKSHAFT SOCKET



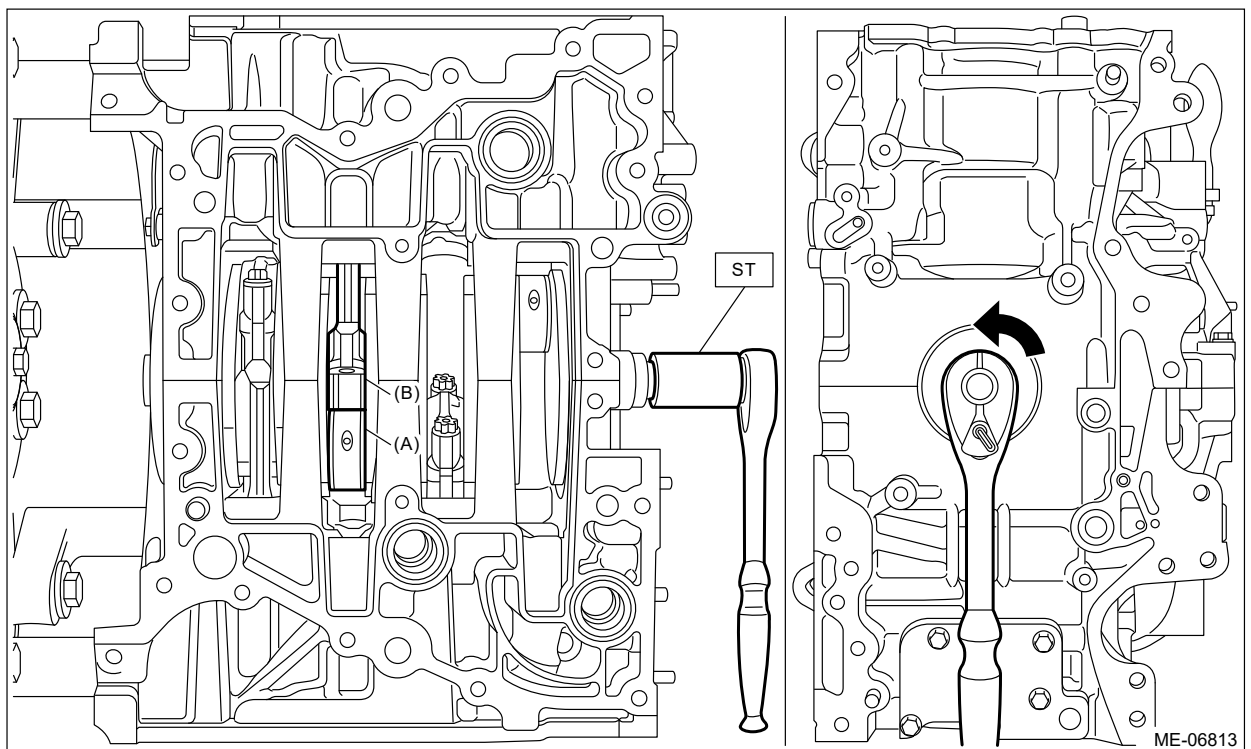
- (6) Using ST, loosen the #3 connecting rod cap bolt, and remove the #3 connecting rod cap bolt and #3 connecting rod cap.

ST 18270AA020 SOCKET

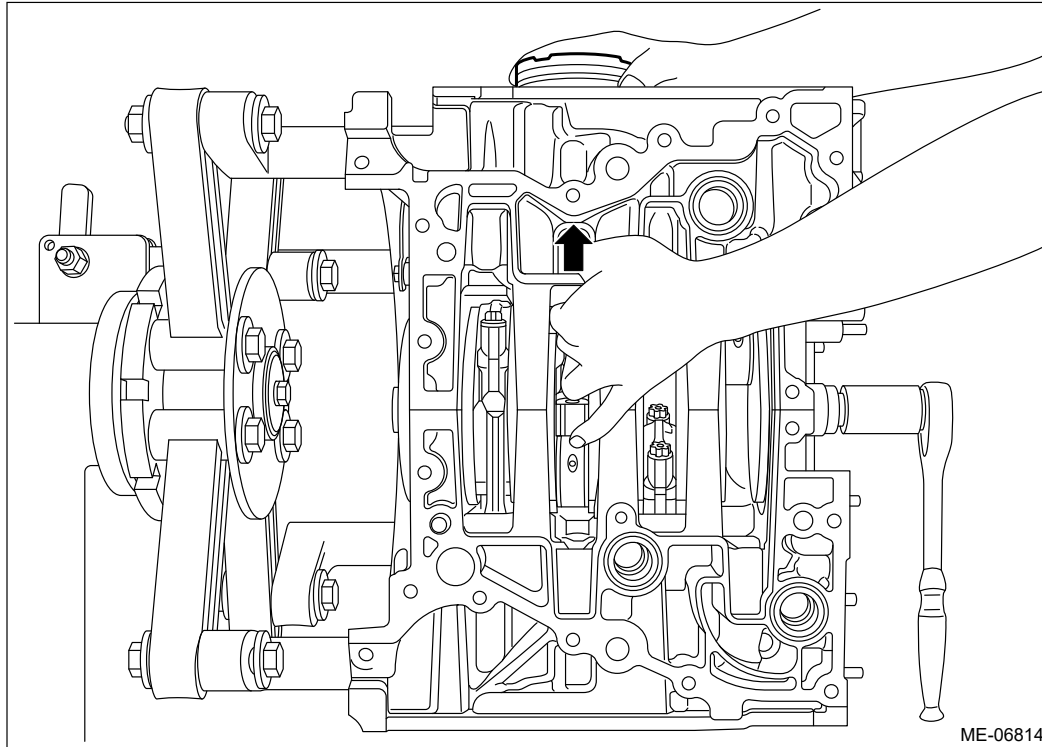


- (7) Using the ST, turn the crankshaft counterclockwise and separate the positions of the #3 pin (A) of crankshaft and the large end (B) of #3 connecting rod.

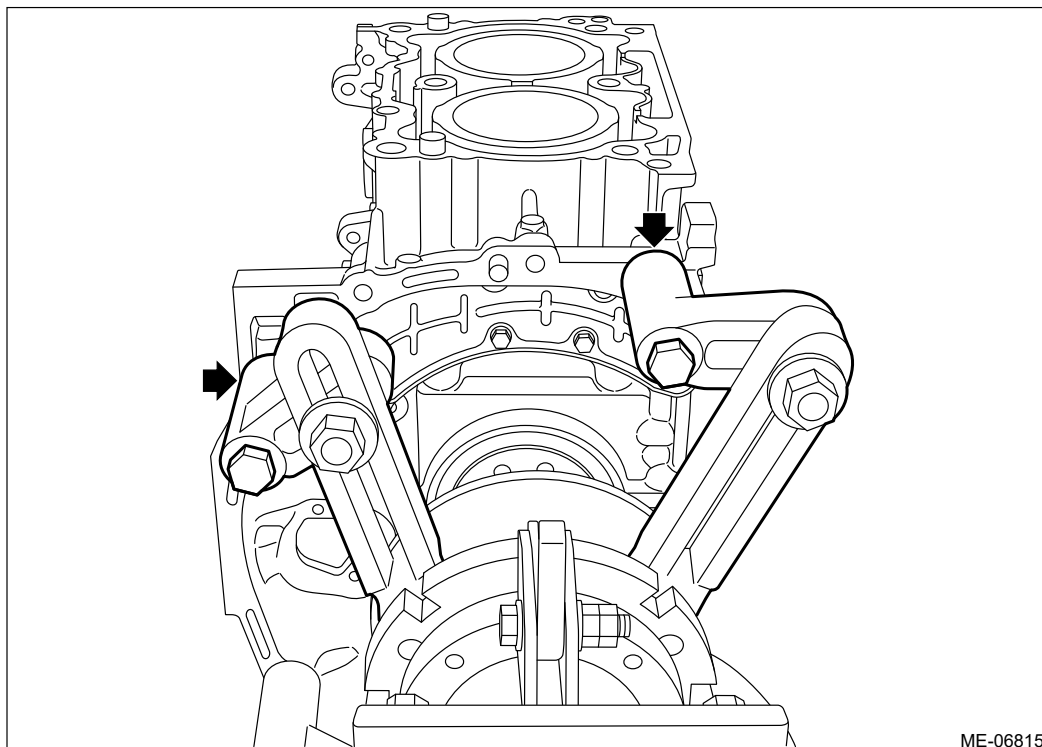
ST 18252AA000 CRANKSHAFT SOCKET



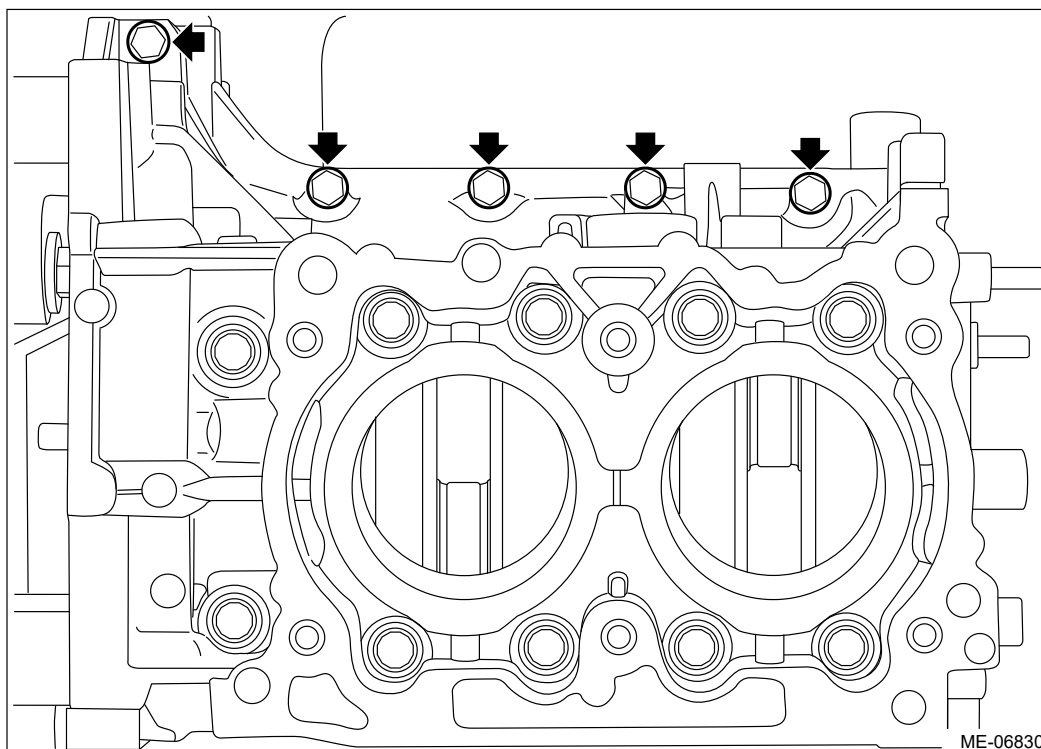
- (8) Push the #3 connecting rod in the direction of the arrow, and remove the #3 piston with #3 connecting rod from the cylinder block.



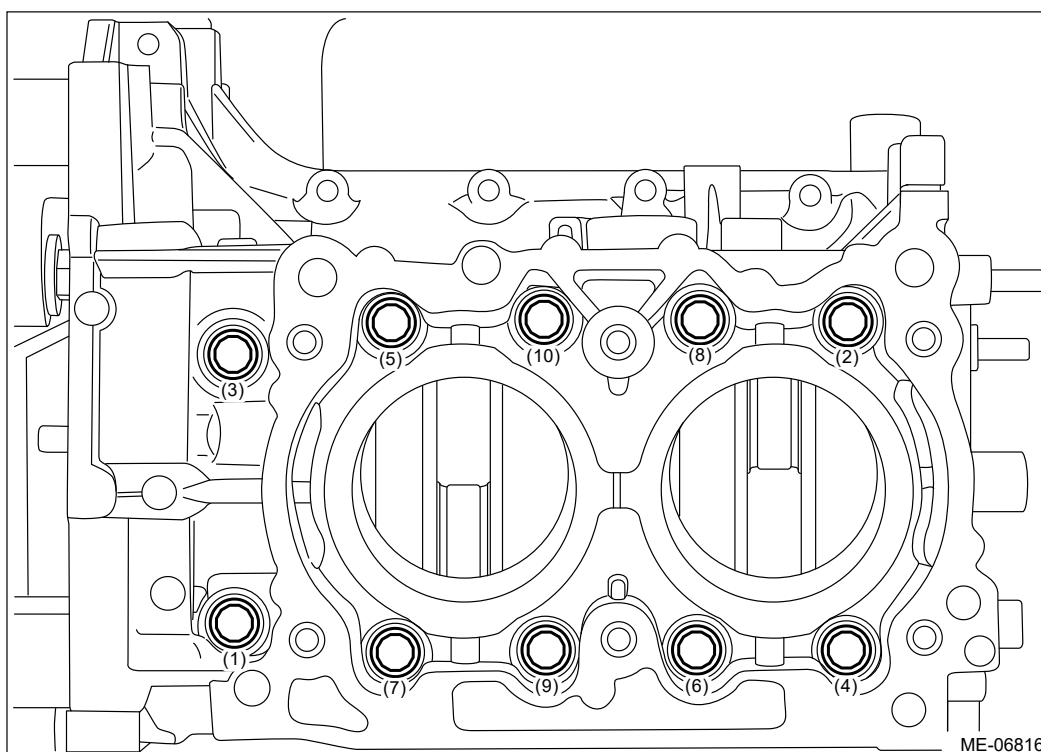
- 20.** Set the part so that the cylinder block LH is on the upper side.
- 21.** Remove #2 and #4 connecting rod caps and pistons in the same removal procedure as #1 and #3 connecting rod caps and pistons.
- 22.** Set the part so that the cylinder block RH is on the upper side, and separate the cylinder block.
 - (1) Remove the engine stand from the cylinder block RH.



- (2) Remove the bolt shown in the figure.



(3) Loosen the cylinder block mounting bolts in numerical order as shown in the figure.

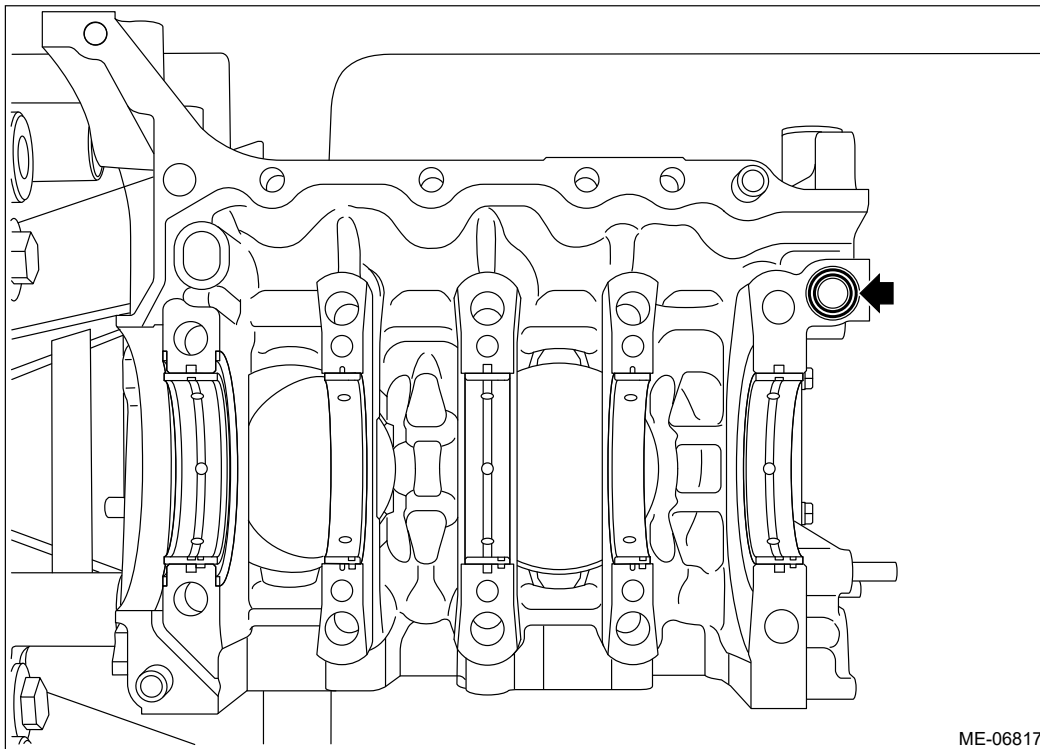


(4) While tapping the cylinder block RH with a plastic hammer, separate the cylinder block RH from the cylinder block LH.

Note:

Lift the cylinder block RH gradually, and confirm that the crankshaft is remaining in the cylinder block LH. If the cylinder block RH is lifted carelessly when separating, the crankshaft may stick to cylinder block RH, then fall off.

- 23.** Remove the crankshaft from cylinder block LH, and remove the rear oil seal.
- 24.** Remove the O-ring from the cylinder block LH.

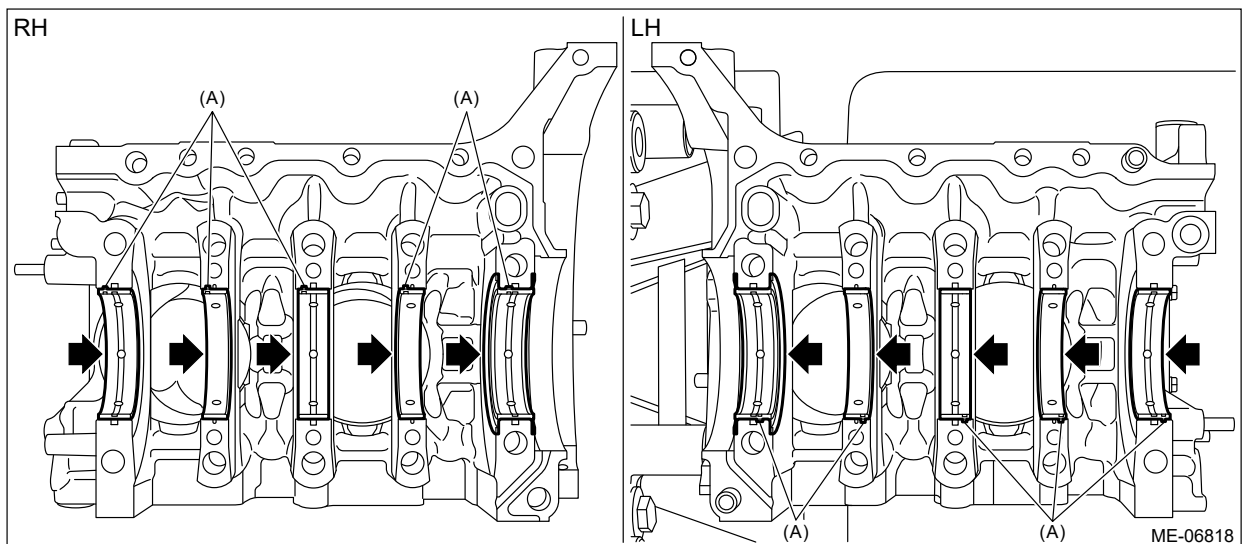


ME-06817

- 25.** Remove the crankshaft bearings from the cylinder block.

Note:

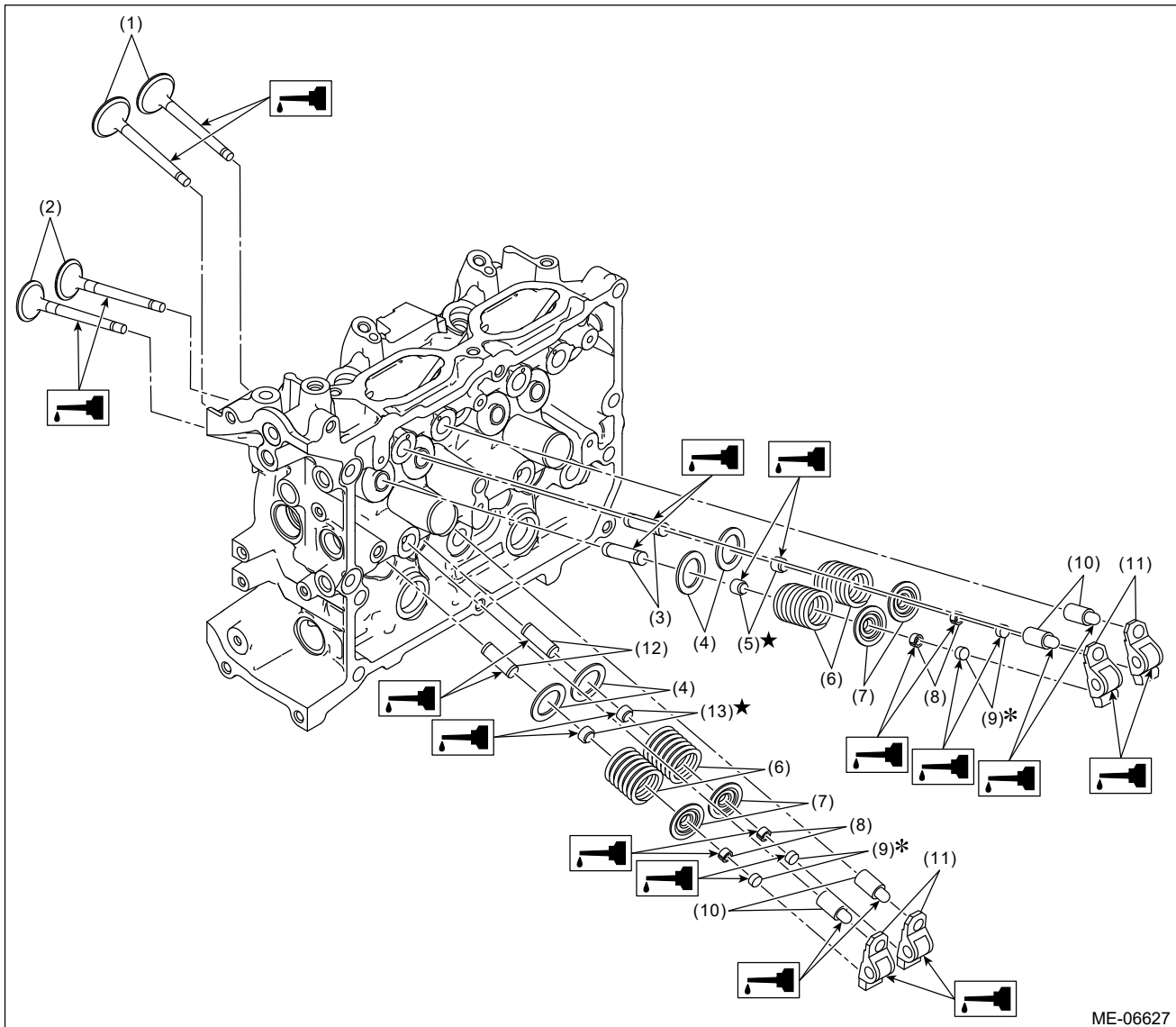
- **Be careful not to confuse the crankshaft bearing combination.**
- **Press the bearing at the end opposite to locking lip (A).**



ME-06818

- 26.** Remove the liquid gasket from cylinder block.
- 27.** Remove the cylinder block LH from the engine stand.

ASSEMBLY



- | | | |
|---------------------------|------------------------------|-----------------------------|
| (1) Exhaust valve | (6) Valve spring | (11) Roller rocker arm |
| (2) Intake valve | (7) Valve spring retainer | (12) Exhaust valve guide |
| (3) Intake valve guide | (8) Valve collet | (13) Exhaust valve oil seal |
| (4) Valve spring seat | (9) Valve shim | |
| (5) Intake valve oil seal | (10) Roller rocker arm pivot | |

1. Using the ST, install the valve oil seals to valve guides of cylinder head RH.

Caution:

- **During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.**
- **Use special care not to damage the cylinder head RH and guide during work.**
- **When installing the valve oil seal, press the ST with hands to install it and never drive the ST with a plastic hammer, otherwise the valve oil seal can be damaged.**

Note:

- Use a new valve oil seal.
- Apply engine oil to valve oil seal before installing.
- The intake valve oil seals and exhaust valve oil seals are distinguished by their colors.

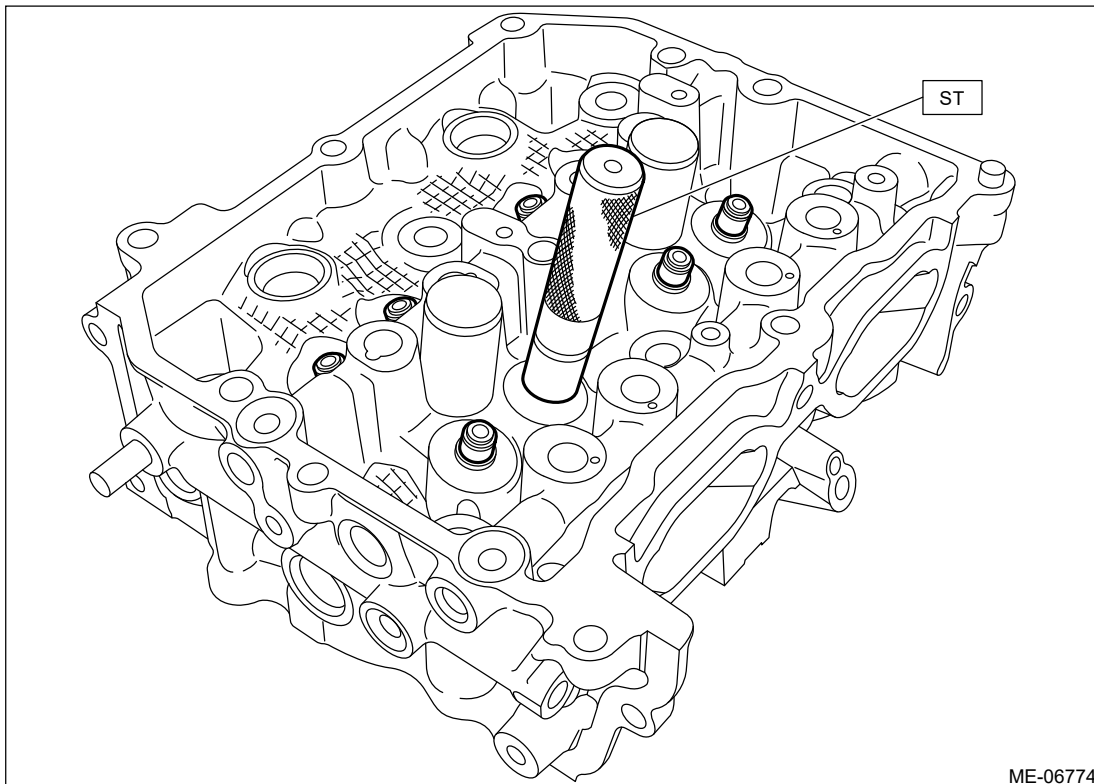
Identification colors:

Intake [Gray]

Exhaust [Green]

- For installation of valve guide, refer to INSPECTION.  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>INSPECTION > VALVE & VALVE GUIDE.](#)

ST 18261AA010 VALVE OIL SEAL GUIDE



2. For cylinder head LH, install the valve oil seal in the same manner.
3. Install the valve spring seat, valve spring, valve spring retainer, valve and valve collet to the cylinder head RH.

Caution:

During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.

- (1) Set the valve spring seat, valve spring and valve spring retainer onto the cylinder head RH.

Note:

Be sure to install the valve spring with its close-coiled end facing the cylinder head side.

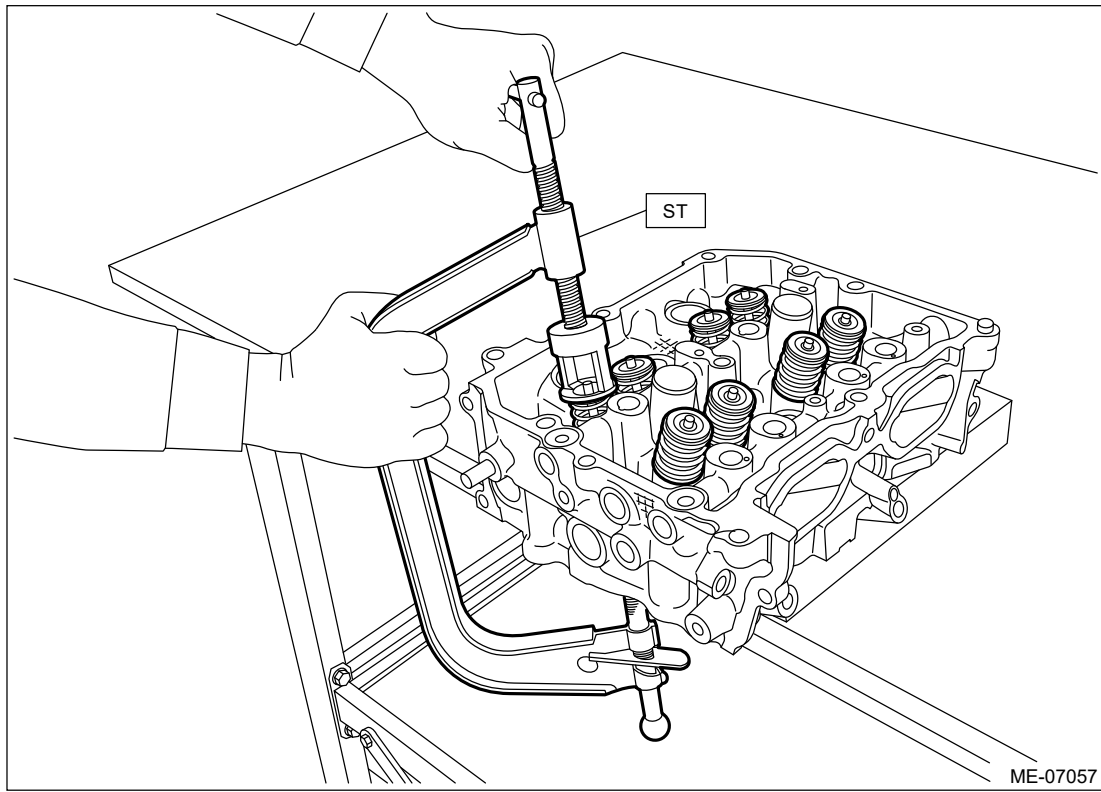
- (2) Coat the valve stem of each valve with engine oil and insert the valve into valve guide.

Note:

When inserting the valve into valve guide, use special care not to damage the oil seal lip.

(3) Compress the valve spring and install the valve collet using ST.

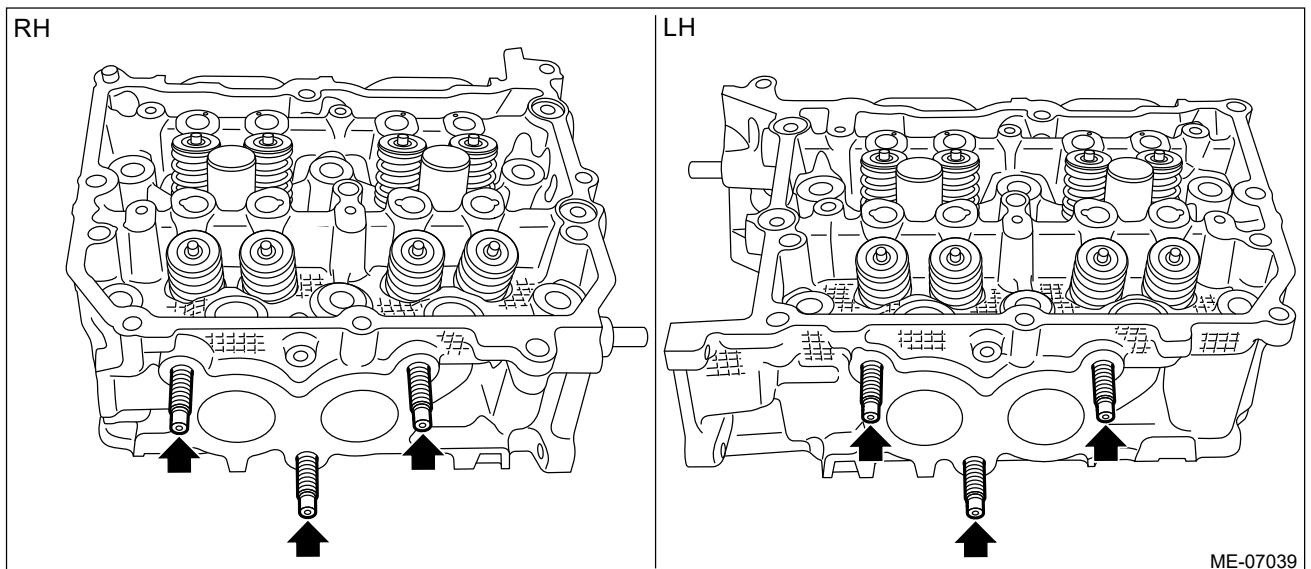
ST 0920287002000 REMOVER AND REPLACER



4. Install the valve spring seat, valve spring, valve spring retainer, valve and valve collet to the cylinder head LH.
5. Lightly tap the valve spring retainer with a plastic hammer, and make sure that the valve collet is securely attached.
6. Install the stud bolts onto cylinder heads.

Tightening torque:

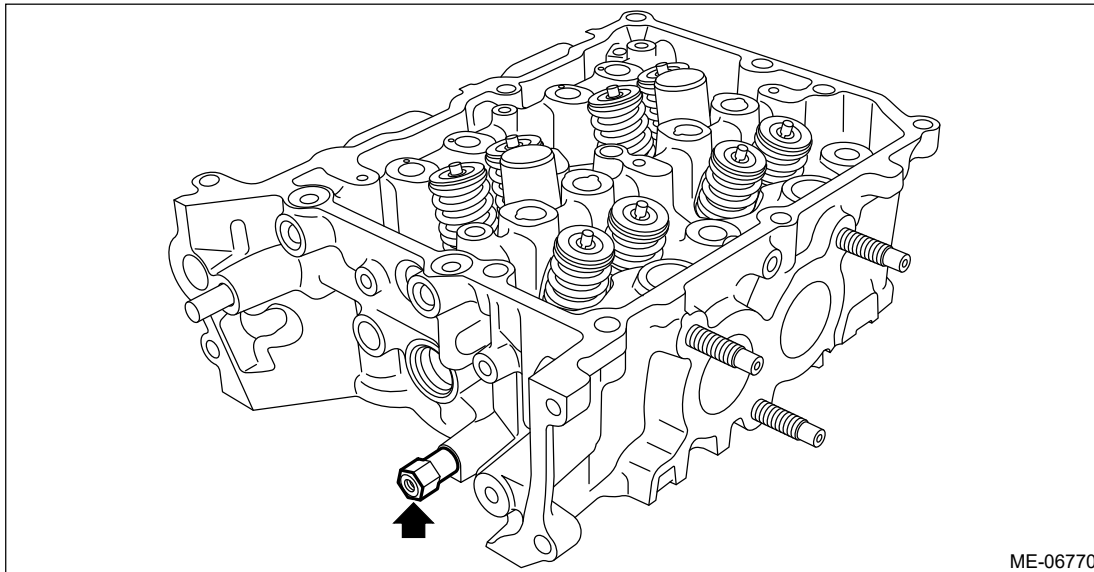
18 N·m (1.8 kgf-m, 13.3 ft-lb)



7. Install the chain cover securing bolt to the cylinder head LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

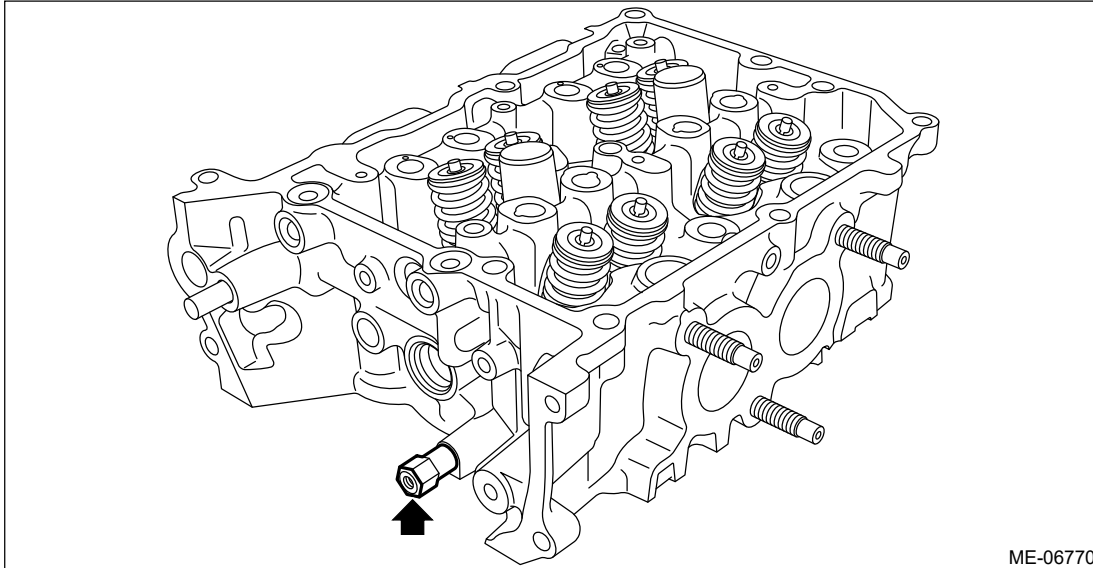


ME-06770

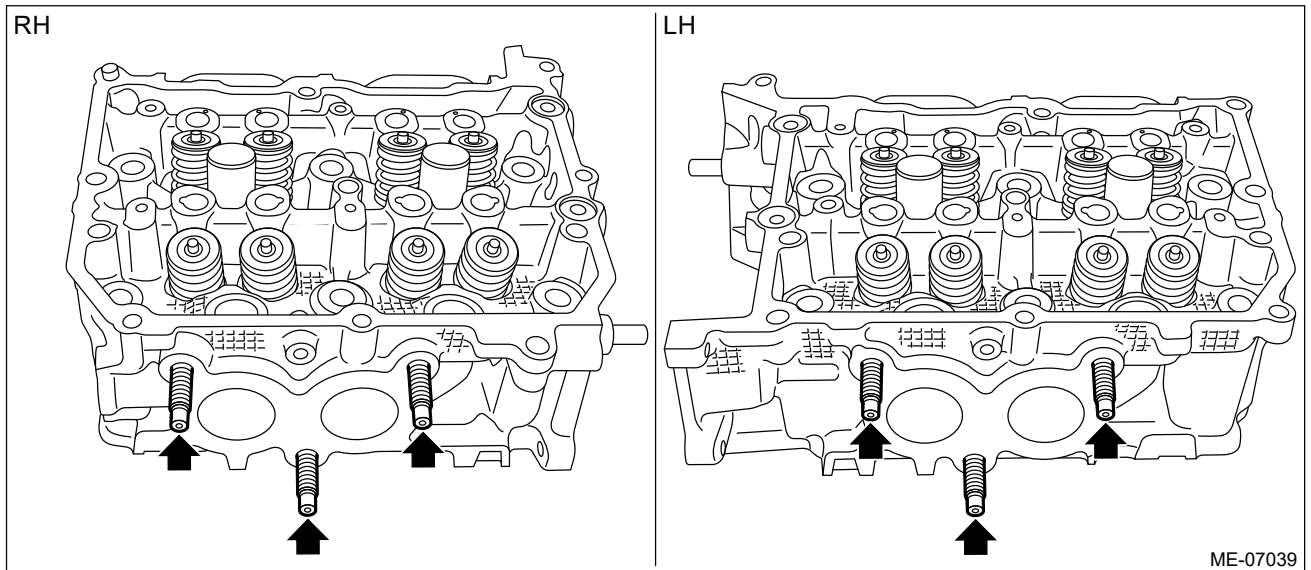
MECHANICAL(H4DOTC) > Cylinder Head

DISASSEMBLY

1. Remove the chain cover securing bolt from the cylinder head LH.




2. Remove the stud bolts from the cylinder head.



3. Remove the valve collet, valve, valve spring retainer, valve spring and valve spring seat from the cylinder head RH.

Warning:

Metallic sodium is encapsulated in the exhaust valve. Metallic sodium is a strong alkaline material and thus prone to serious chemical reaction. When handling or disposing of the valve, be sure to confirm "DISPOSAL".  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>DISPOSAL.](#)

Caution:

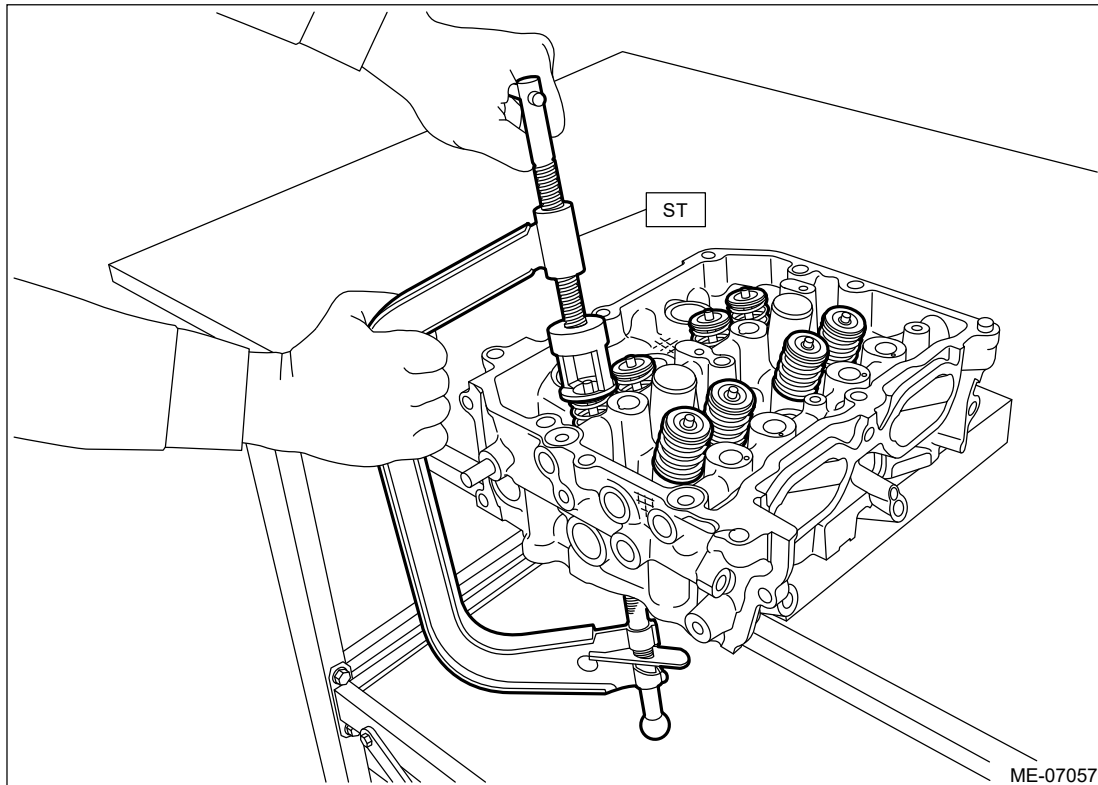
During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.

Note:

- **Mark each part to prevent confusion.**
- **Keep all the removed parts in order for re-installing in their original positions.**

(1) Compress the valve spring and remove the valve collet using ST.

ST 0920287002000 REMOVER AND REPLACER



(2) Remove valve, valve spring retainer, valve spring and valve spring seat.

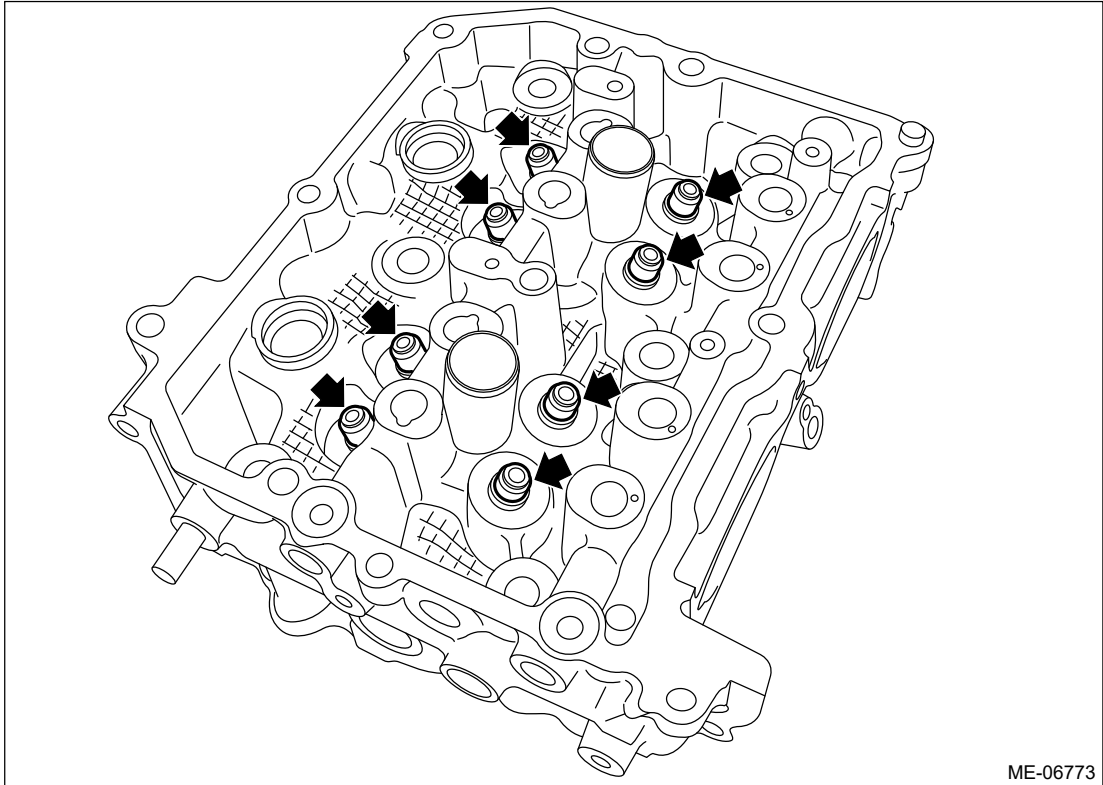
4. Remove the valve collet, valve, valve spring retainer, valve spring and valve spring seat from the cylinder head LH.
5. Remove the valve oil seals from valve guides of cylinder head RH.

Caution:

- **During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head RH.**
- **Use special care not to damage the cylinder head RH and guide during work.**

Note:

For removal of valve guide, refer to INSPECTION.  Ref. to [MECHANICAL\(H4DOTC\)>Cylinder Head>INSPECTION > VALVE & VALVE GUIDE.](#)



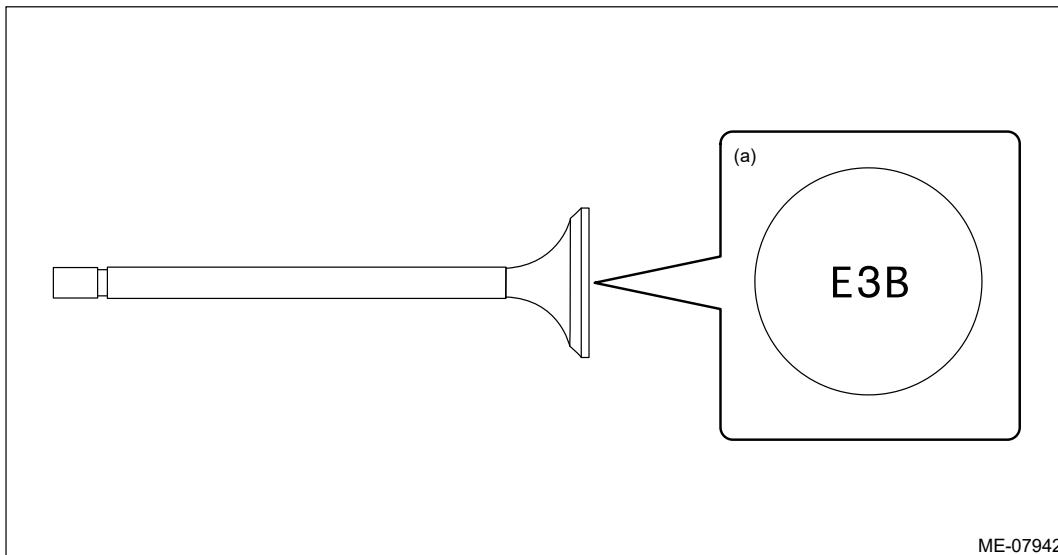
ME-06773

6. For cylinder head LH, remove the valve oil seal in the same manner.

DISPOSAL

Warning:

- **Metallic sodium is encapsulated in the exhaust valve. Metallic sodium is a strong alkaline material and poses a risk of causing a severe chemical reaction. Use great care when handling and disposing it.**
- **If the metallic sodium gets into your eyes, you may lose your sight. If it touches the skin, you may get burned severely or if it touches flame, fire may be caused by chemical reaction. Therefore, do not disassemble the exhaust valve.**
- **It is safe when the metallic sodium encapsulated in the exhaust valve is not exposed to the air.**
- **When the exhaust valve is broken, remove the broken exhaust valve, and dispose of the metallic sodium.**
- **Do not intentionally break the exhaust valve and take out the metallic sodium.**
- **Identify the exhaust valve in which the metallic sodium is encapsulated with the embossed mark.**



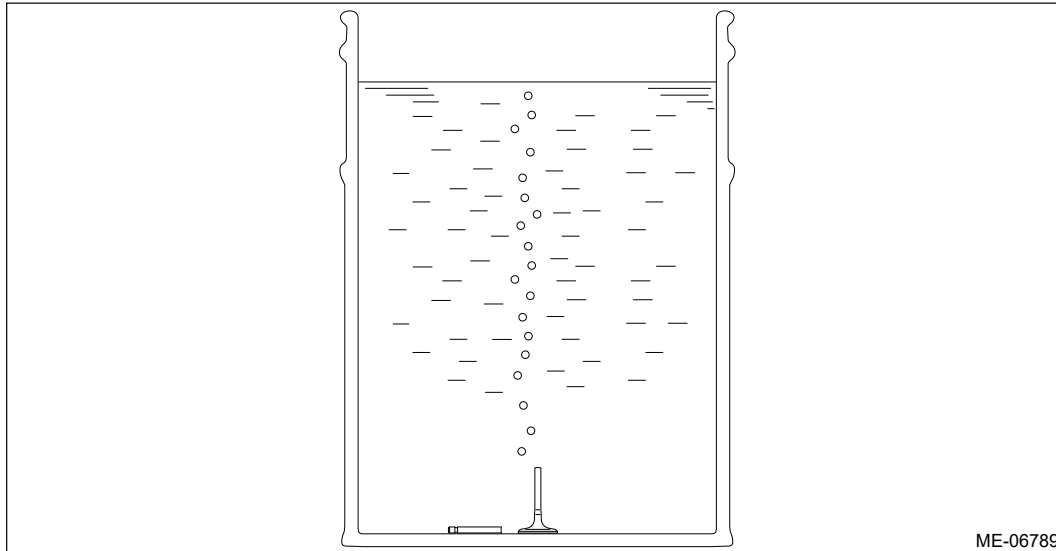
(a) Embossed mark
(Identification: E3B)

Caution:

- **When disposing of the exhaust valve that is not broken, entrust the disposal processing to the industrial waste disposer in charge of dissolution treatment.**
 - **When the exhaust valve is broken, remove it from the cylinder head, perform appropriate processing in the same manner as the general steel material.**
 - **When performing processing, be careful of the following.**
 - 1. Prepare the fire extinguisher nearby.**
 - 2. Wear the protective goggles.**
 - 3. Wear rubber gloves.**
- 1.** Wear rubber gloves and remove the broken exhaust valve from the cylinder head.
 - 2.** Prepare large container (bucket or oil can) in well-ventilated place, and fill the container with water (10 L or more).
 - 3.** Using a pair of large tweezers or pliers, immerse the broken exhaust valve in the water vertically.

Caution:

- **Completely immerse the broken exhaust valve in the water.**
- **Hydrogen gas is produced by the chemical reaction. Therefore, always keep the container away from open flames such as sparks.**
- **Because the severe chemical reaction is developed, keep at least 2 to 3 m away from the container.**



- 4.** After completion of chemical reaction (after the elapse of 4 to 5 hours), carefully take out the exhaust valve using a pair of large tweezers or pliers, and dispose of the exhaust valve according to the same disposal procedure as other parts.


Caution:

- **Concerning the liquid waste disposal of the liquid (sodium hydrate) produced in a chemical reaction, follow all governmental regulations and local regulations related to the liquid waste disposal.**
- **If the liquid produced in a chemical reaction (sodium hydrate) should touch the skin, immediately wash it away with plenty water.**

1. CYLINDER HEAD

1. Visually inspect to make sure that there are no cracks, scratches or other damage.
2. Use liquid penetrant tester on the important sections to check for fissures.
3. Check that there are no marks of gas leaking or water leaking on gasket attachment surface.
4. Check the warping of the cylinder head mating surface that mates with cylinder block at the locations shown in the figure using a straight edge (A) and thickness gauge (B). If it exceeds the limit, correct the surface by grinding it with a surface grinder or replace the cylinder head.

Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
 - **If there is warpage on the cylinder head mating surface, the cylinder head bolt tightening torque and angle tightening may be improper. When installing the cylinder head, make sure that tightening torque and angle tightening work is performed precisely according to the operation procedures.**
 - **When the cylinder head is replaced, lap each valve. Refer to "VALVE SEAT" for lapping. **
- [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)**

Cylinder head warpage:

Limit

0.020 mm (0.0008 in)

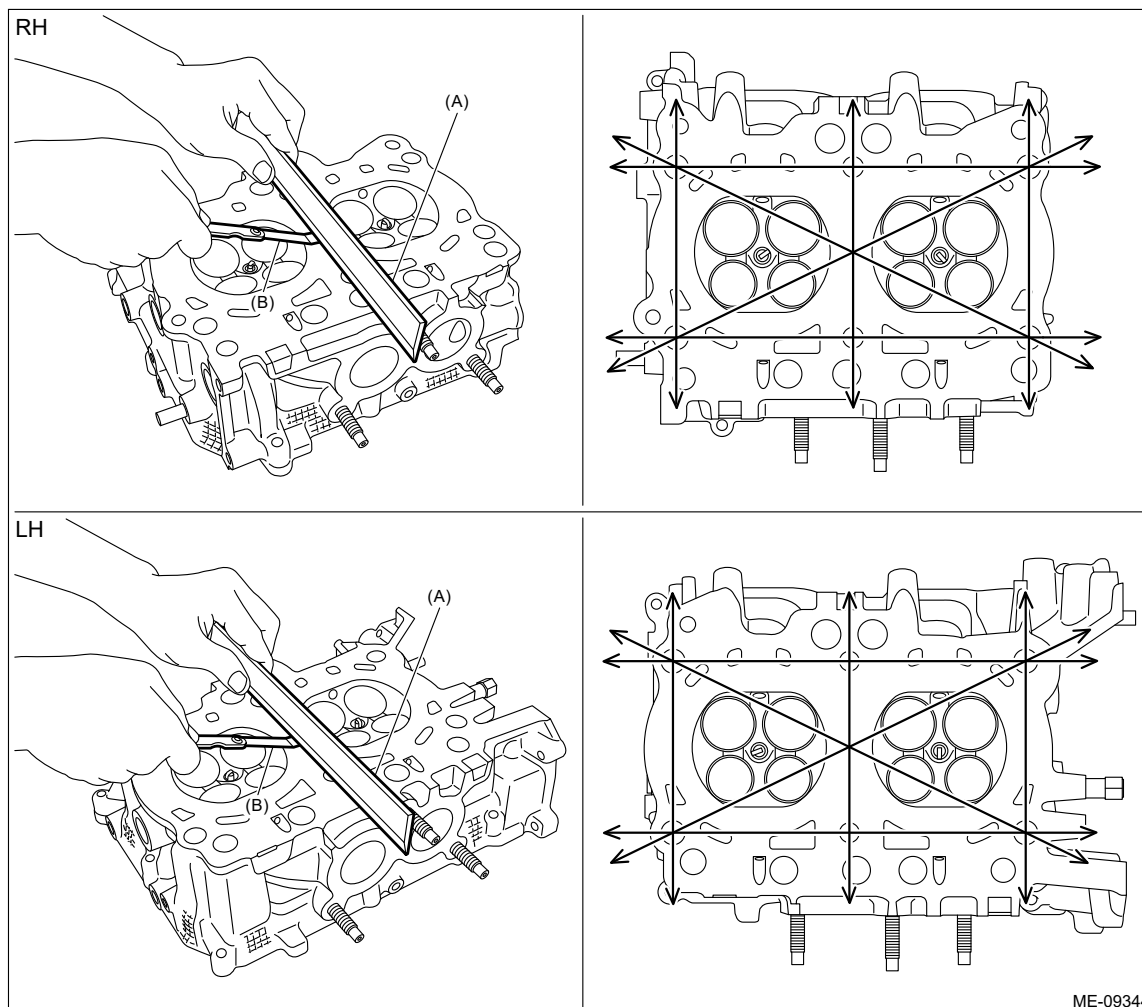
Cylinder head grinding limit:

98.4 mm (3.874 in) or less

Cylinder head height:

Standard


98.5 mm (3.878 in)



ME-09344

2. VALVE & VALVE GUIDE

Warning:

Metallic sodium is encapsulated in the exhaust valve. Metallic sodium is a strong alkaline material and thus prone to serious chemical reaction. When handling or disposing of the valve, be sure to confirm "DISPOSAL".  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>DISPOSAL.](#)

1. Check the valve flange and stem for damage, wear or deformation.
2. Measure the thickness "H" of valve head edge as shown in the figure using a caliper gauge. If it is not within the standard, replace the valve.

Note:

- It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

Valve overall length:

Intake

104.95 mm (4.132 in)

Exhaust

97.9 mm (3.854 in)

- When the valve is replaced, lap the valve. Refer to "VALVE SEAT" for lapping.  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

Valve head edge thickness H:

Intake (A)

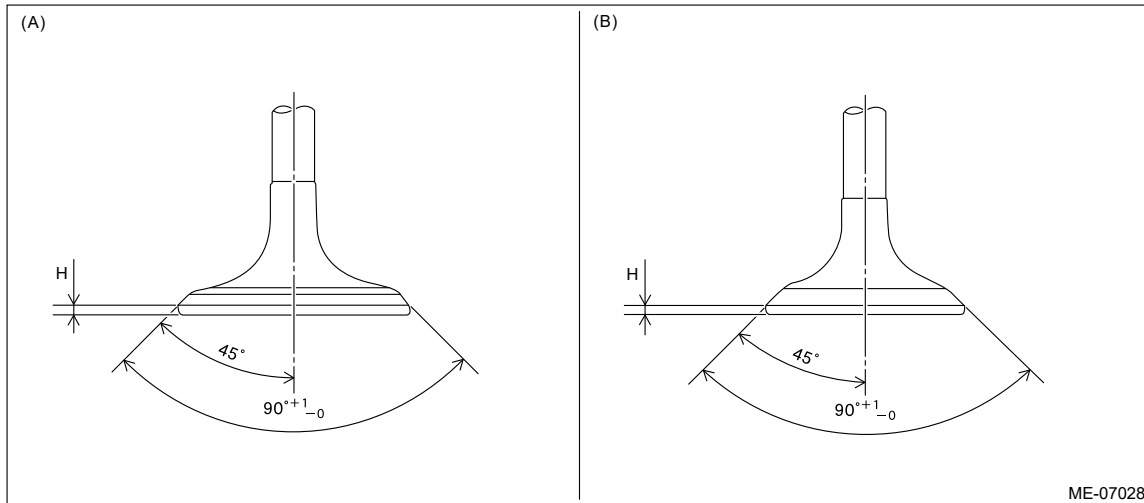
Standard

0.8—1.2 mm (0.031—0.047 in)

Exhaust (B)


Standard

1.0—1.4 mm (0.039—0.055 in)



3. Check the clearance between valve and valve guide. Check the clearance between valve and valve guide by measuring the outer diameter of valve stem and the inner diameter of valve guide respectively.
- (1) Measure the outer diameter of valve stem with a micrometer. If it is not within the standard, replace the valve.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the valve stem at the six locations as shown in the figure, and read the value of most worn location.
- When the valve is replaced, lap the valve. Refer to "VALVE SEAT" for lapping.  Ref. to [MECHANICAL\(H4DOTC\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

Valve stem outer diameter:

Intake

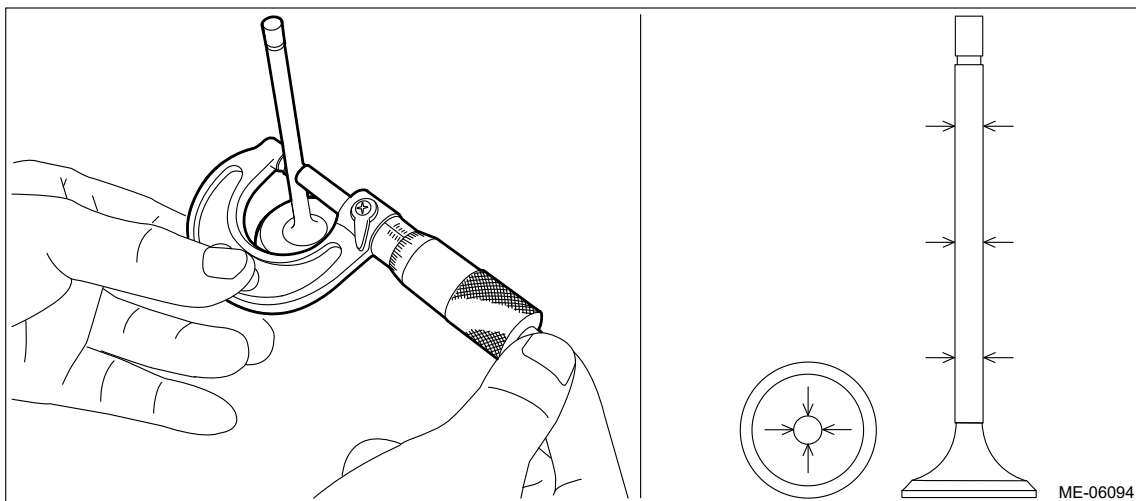
Standard

5.455—5.470 mm (0.2148—0.2154 in)

Exhaust

Standard

5.445—5.460 mm (0.2144—0.2150 in)



- (2) Using a caliper gauge, measure the inner diameter of valve guide. If it is not within the standard, replace the valve guide. For replacement procedure, refer to step 4).

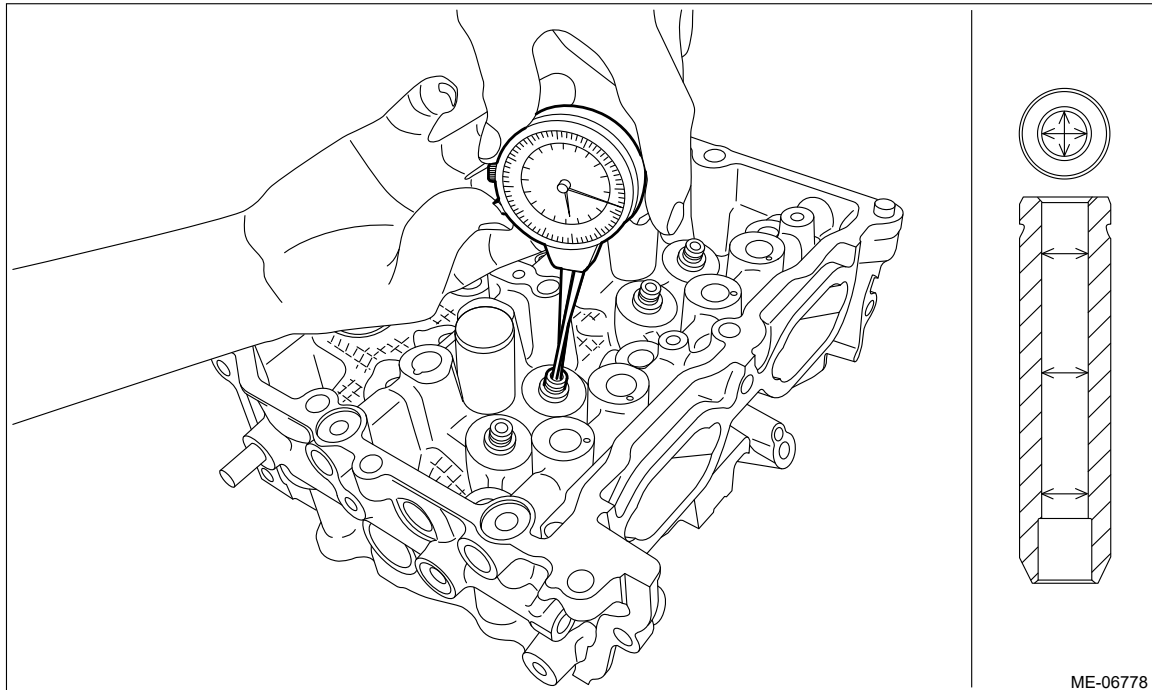
Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the inner diameter of the valve guide at the six locations as shown in the figure, and read the value of most worn location.

Valve guide inner diameter:

Standard

5.500—5.512 mm (0.2165—0.2170 in)



- (3) Calculate the clearance between valve and valve guide.

Clearance between valve and valve guide:

Intake

Standard

0.030—0.057 mm (0.0012—0.0022 in)

Exhaust

Standard

0.040—0.067 mm (0.0016—0.0026 in)

4. If the clearance between valve and valve guide exceeds the standard, replace the valve or valve guide, whichever shows the greater amount of wear or damage. For replacement procedure of valve guide, refer to the following.

Note:

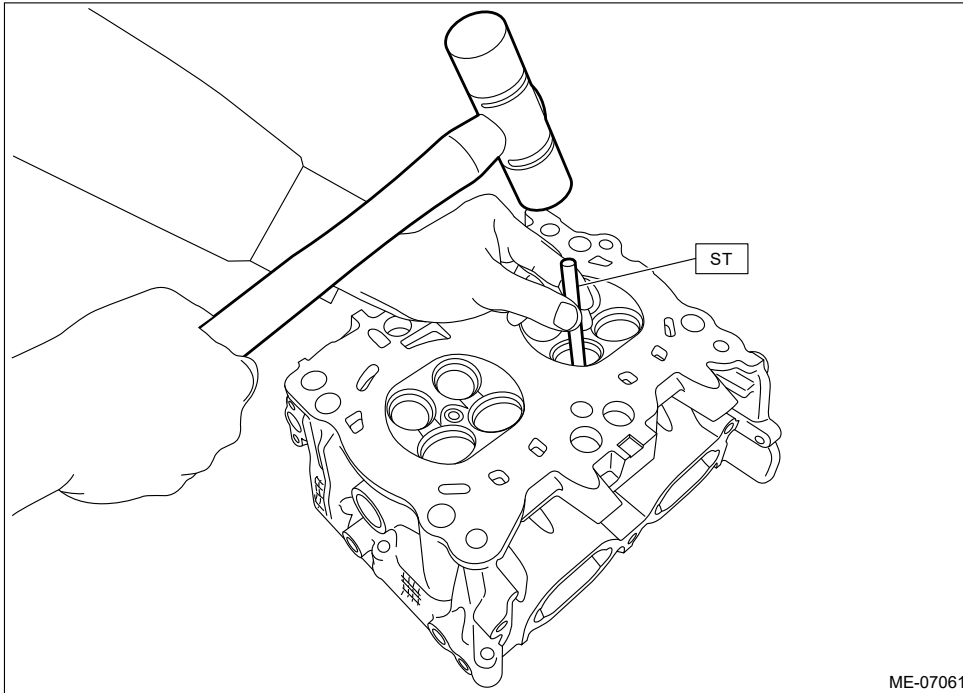
When the valve is replaced, lap the valve. Refer to "VALVE SEAT" for lapping.  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

- (1) Insert ST into the valve guide with the combustion chamber upward and remove the valve guide using plastic hammer.

Caution:

- Place a wood board wrapped with a waste cloth to stabilize the cylinder head before work.
- Use special care not to damage the cylinder head during work.
- Always strike the ST vertically with a plastic hammer. Otherwise, the ST can be damaged.

ST 499765700 VALVE GUIDE REMOVER AND INSTALLER



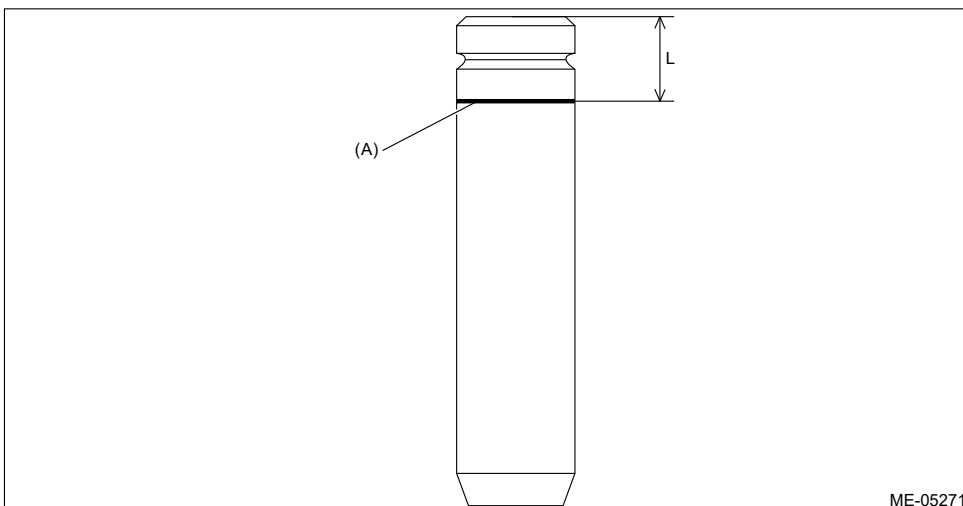
- (2) Before installing the valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide installation holes of cylinder head.
- (3) Draw a reference line (A) for insert on the valve guide using a marker as shown in the figure.

Note:

- Use a new valve guide.
- A reference line for insert is used as a guide when tapping-in the valve guide.

Valve guide inserting reference line position L:

15 mm (0.5906 in)

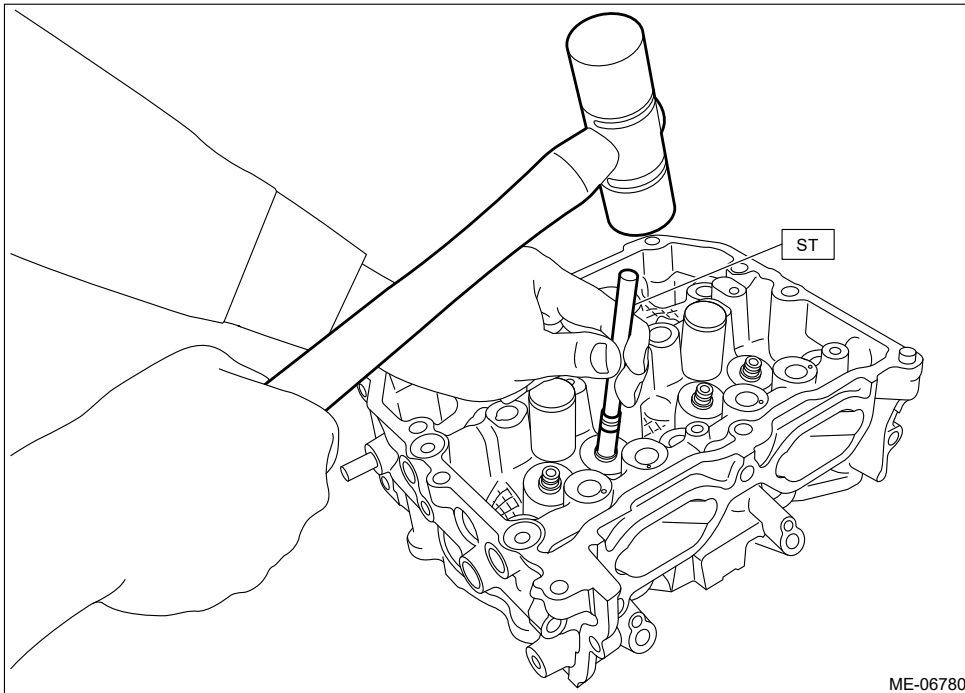


- (4) Apply a enough coat of engine oil to the valve guide, and set the valve guide on the cylinder head with the combustion chamber downward.
- (5) Insert the ST into the valve guide, and tap-in the valve guide to the reference line (A) for insert using plastic hammer.

Caution:

- During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head.
- Use special care not to damage the cylinder head during work.
- Always strike the ST vertically with a plastic hammer. Otherwise, the ST can be damaged.

ST 499765700 VALVE GUIDE REMOVER AND INSTALLER



- (6) Measure the valve guide protrusion amount "L" as shown in the figure using a caliper gauge. Insert the ST into the valve guide again, and tap-in the valve guide so that it is positioned within standard by referring to the measured value using plastic hammer.

Caution:

- During work, place a waste cloth, etc. to avoid scratching the mating surface of the cylinder head.
- Use special care not to damage the cylinder head during work.
- Always strike the ST vertically with a plastic hammer. Otherwise, the ST can be damaged.

Note:

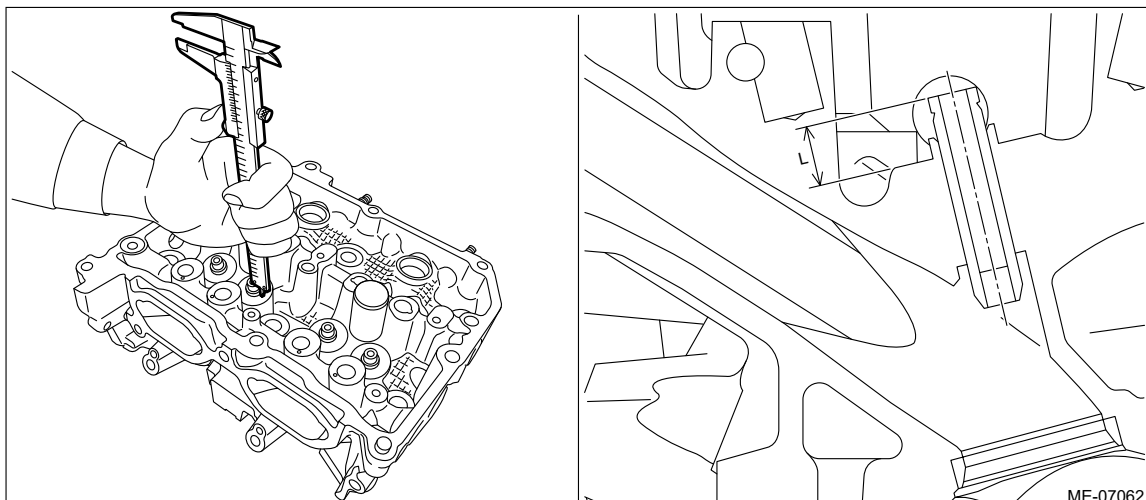
Be careful not to tap-in excessively by repeating the steps of Tapping-in → Measurement → Tapping-in → Measurement ... when installing the valve guide.

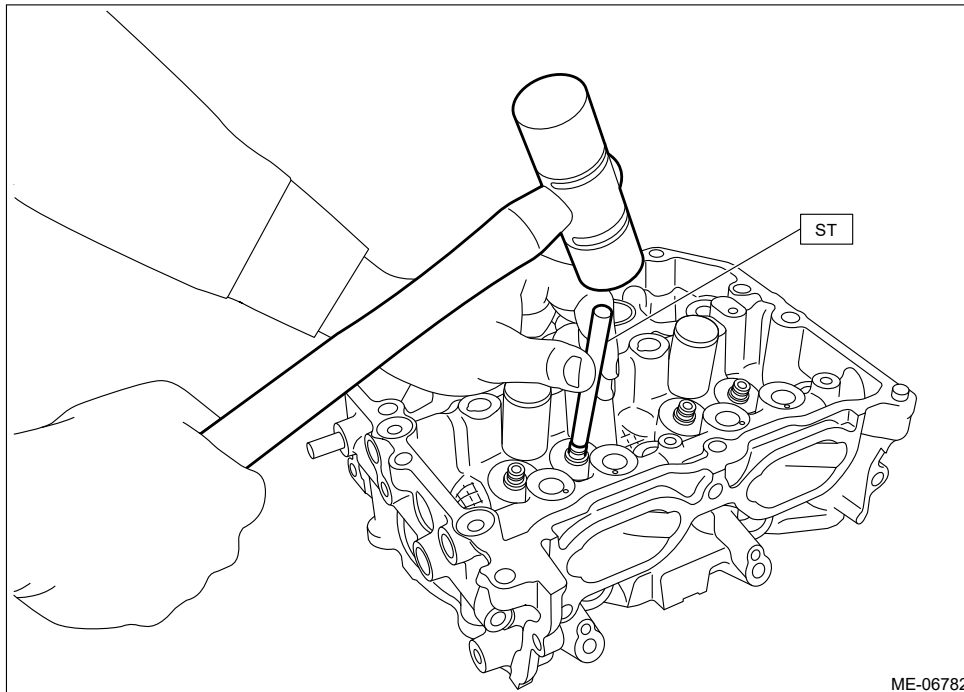
ST 499765700 VALVE GUIDE REMOVER AND INSTALLER

Valve guide protrusion amount L:

Standard

11.4–11.8 mm (0.449–0.465 in)





- (7) Ream the inside of valve guide with the combustion chamber upward using the ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

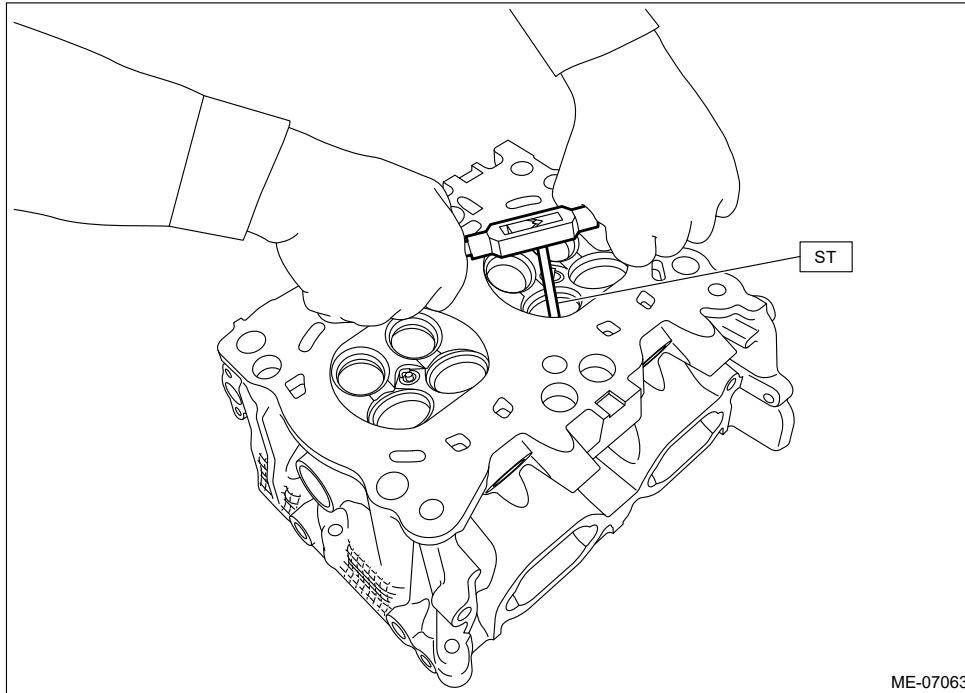
Caution:

- **Place a wood board wrapped with a waste cloth to stabilize the cylinder head before work.**
- **Use special care not to damage the cylinder head during work.**

Note:

- **Apply engine oil to the ST.**
- **If the inner surface of valve guide is damaged, the edge of ST should be slightly ground with oil stone.**
- **If the inner surface of valve guide becomes lustrous and the ST does not chip, use a new ST or remedy the ST.**

ST 499765900 VALVE GUIDE REAMER



- (8) After reaming, clean the valve guide to remove chips.
- (9) Check the seating width between valve and valve seat. [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

3. VALVE & VALVE SHIM

Warning:

Metallic sodium is encapsulated in the exhaust valve. Metallic sodium is a strong alkaline material and thus prone to serious chemical reaction. When handling or disposing of the valve, be sure to confirm "DISPOSAL". [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>DISPOSAL.](#)

1. Visually check the valve shim for damage.
2. Check the clearance between valve and valve shim. Check the clearance between valve and valve shim by measuring the outer diameter of valve stem end and the inner diameter of valve shim respectively.
 - (1) Measure the outer diameter of valve stem end with a micrometer. If it is not within the standard, replace the valve.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- Measure the outer diameter of the valve stem end at the two locations as shown in the figure, and read the value of most worn location.
- When the valve is replaced, lap the valve. Refer to "VALVE SEAT" for lapping. [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)

Valve stem end outer diameter:

Intake

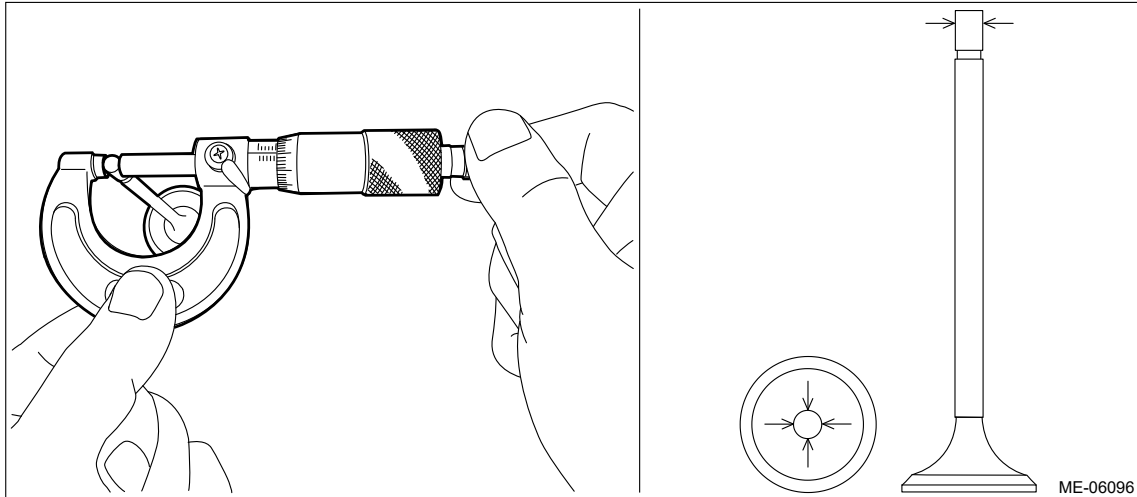
Standard

5.455–5.470 mm (0.2148–0.2154 in)

Exhaust


Standard

5.445–5.460 mm (0.2144–0.2150 in)



(2) Using a caliper gauge, measure the inner diameter of valve shim. If it is not within the standard, replace the valve shim.

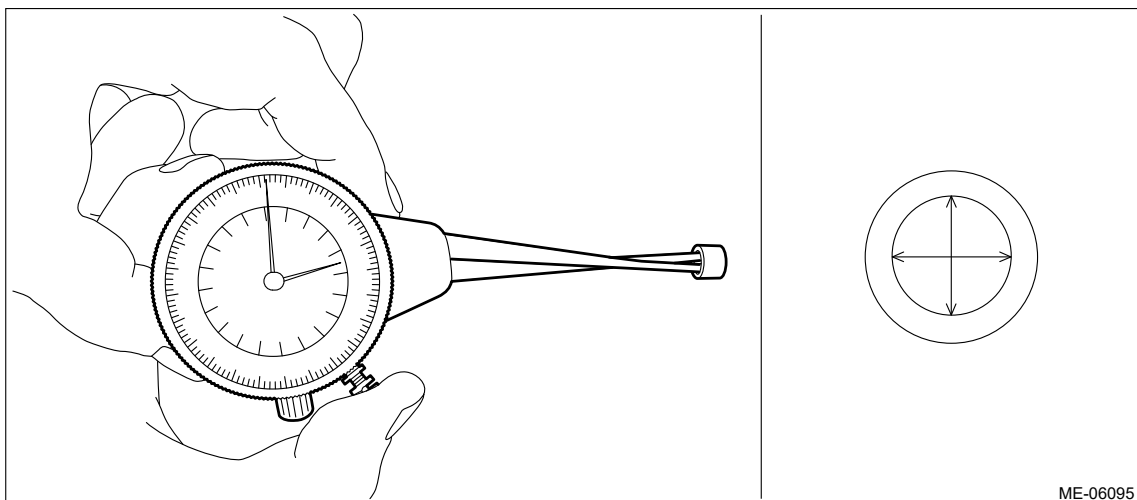
Note:

- **Measurement should be performed at a temperature of 20°C (68°F).**
- **Measure the inner diameter of the valve shim at the two locations as shown in the figure, and read the value of most worn location.**
- **If the valve shim has to be replaced, check the cam clearance and replace with the suitable valve shim.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)**

Valve shim inner diameter:



Standard

5.500—5.560 mm (0.2165—0.2189 in)



(3) Calculate the clearance between valve and valve shim. If the clearance exceeds the standard, replace the valve or valve shim, whichever shows the greater amount of wear or damage.

Note:

- **When the valve is replaced, lap the valve. Refer to “VALVE SEAT” for lapping.  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>INSPECTION > VALVE SEAT.](#)**
- **If the valve shim has to be replaced, check the cam clearance and replace with the suitable valve shim.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Clearance>INSPECTION > WHEN TIMING CHAIN ASSEMBLY IS REMOVED.](#)**

Clearance between valve and valve shim:

Intake

Standard

0.030—0.105 mm (0.0012—0.0041 in)

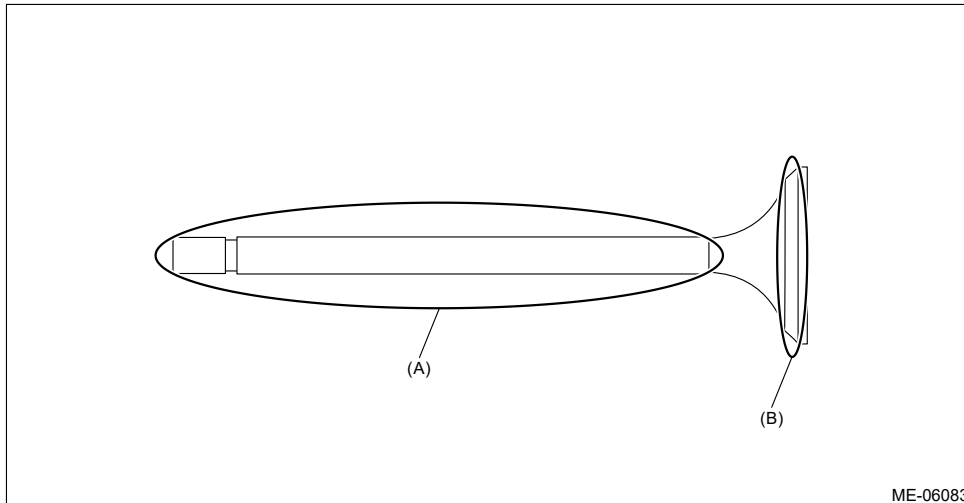
Exhaust

Standard

0.040—0.115 mm (0.0016—0.0045 in)

4. VALVE SEAT

1. Check the valve seat for damage and deformation.
2. Check the seating width and seating position between valve and valve seat for the intake valve seat and exhaust valve seat.
 - (1) Clean the valve and valve seat.
 - (2) Coat the stem (A) of the valve lightly with engine oil and apply red dye evenly on the valve face (B).



- (3) Using the valve lapper, slowly insert the valve with red dye applied into the valve guide. Lightly press the valve against the valve seat without turning the valve, and then slowly pull out the valve.
- (4) Check the seating width "W" of valve seat as shown in the figure, using a caliper gauge. Check the seating width "W" between valve and valve seat by measuring the width of red dye on the seating surface of valve seat. If the seating width "W" between valve and valve seat is out of the standard, correct the seating surface of valve seat using the valve seat cutter. For correcting procedures of the valve seat seating surface, refer to step 3).

Note:

- When the red dye does not appear seamlessly on the valve seat seating surface, lap the valve. For lapping procedure, refer to step 4).
- When the red dye does not appear seamlessly on the valve seat seating surface even after lapping the valve, correct the valve seat seating surface using the valve seat cutter. For correcting procedures of the valve seat seating surface, refer to step 3).

Seating width W between valve and valve seat:

Intake

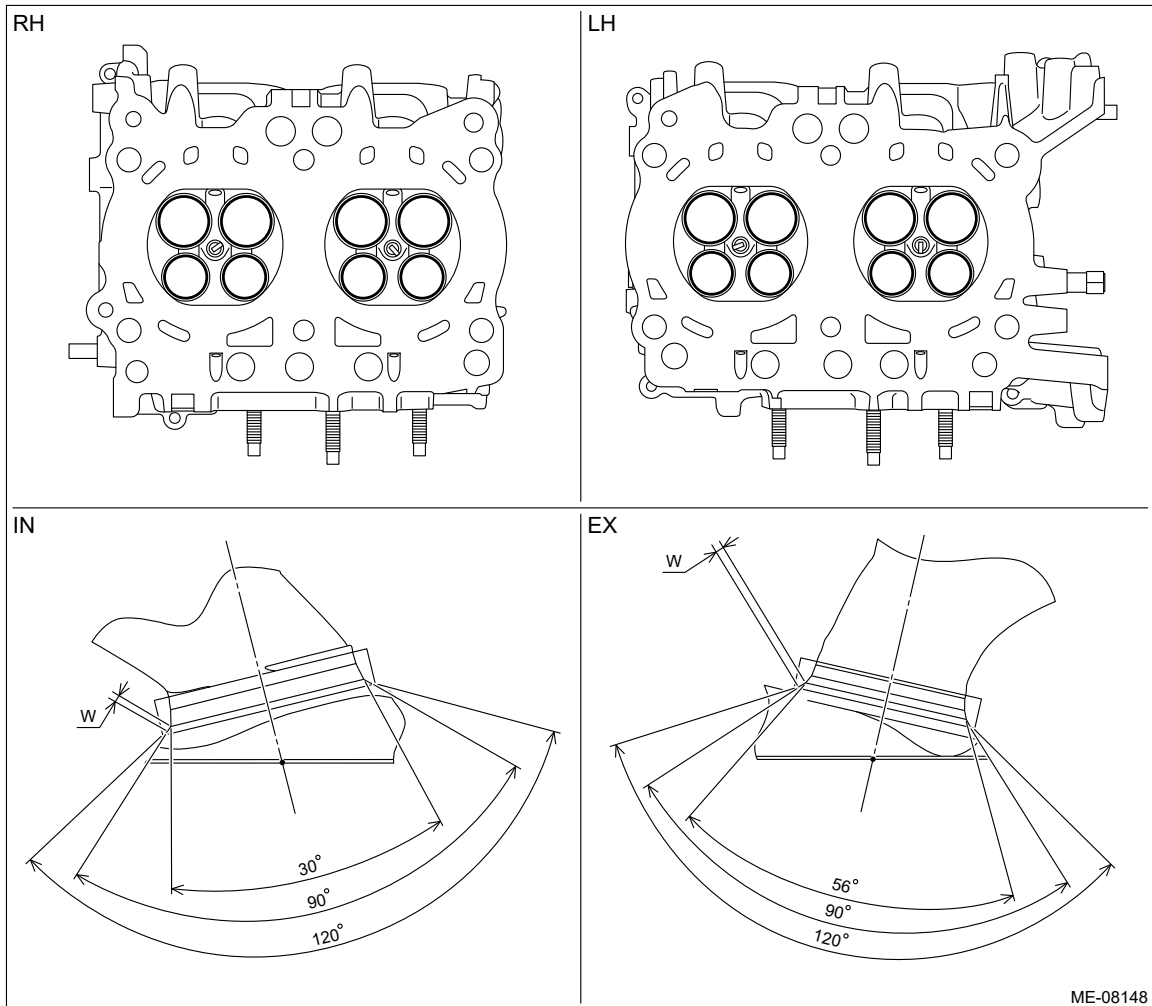
Standard

0.8—1.6 mm (0.031—0.063 in)

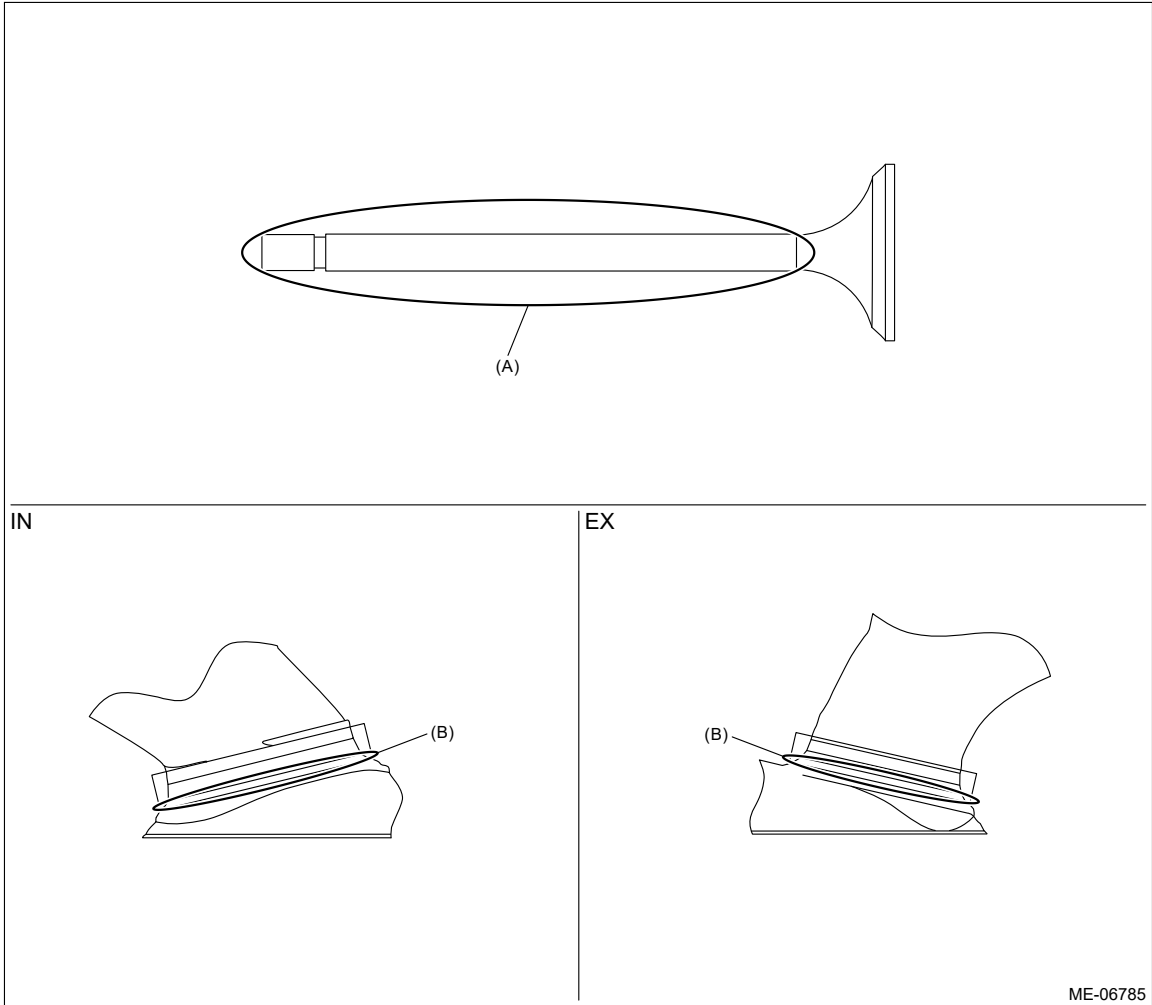
Exhaust

Standard

1.1—1.7 mm (0.043—0.067 in)



- (5) Wipe off the red dye on the valve and valve seat completely.
- (6) Coat the stem (A) of the valve lightly with engine oil and apply red dye evenly on the seating surface (B) between valve and valve seat.

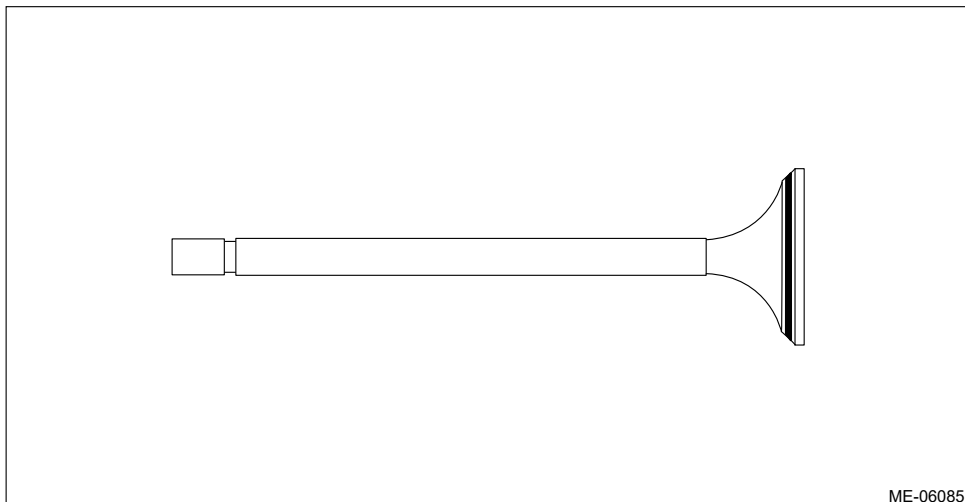


ME-06785

- (7) Using the valve lapper, slowly insert the valve into the valve guide. Lightly press the valve against the valve seat without turning the valve, and then slowly pull out the valve.
- (8) Check the seating position between valve and valve seat. Check the seating position between valve and valve seat by checking the position of red dye on the valve face. If the seating position between valve and valve seat is not at the center of valve face, correct the seating surface of valve seat using the valve seat cutter. For correcting procedures of the valve seat seating surface, refer to step 3).

Seating position between valve and valve seat:

Valve face center



ME-06085

(9) After inspection, wipe off the red dye completely.

3. When correcting the seating surfaces of valve seat

(1) Correct the seating angle between valve and valve seat using the 45° valve seat cutter.

Note:

- Select the size of the valve seat cutter by referring to the outer diameters of the intake valve and exhaust valve.

Valve outer diameter:

Intake

Standard

33.9—34.1 mm (1.335—1.343 in)

Exhaust

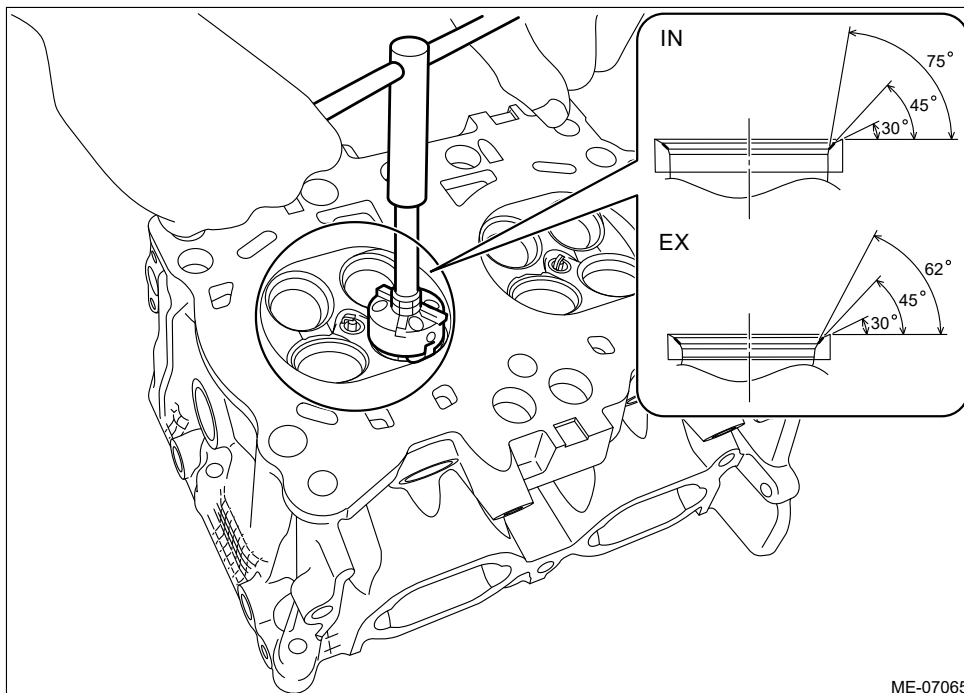
Standard

28.9—29.1 mm (1.138—1.146 in)

- Grind the seating surface so that the seating width between valve and valve seat becomes slightly larger than the standard value.
- Gradually reduce pressure at the end of grinding process in order to avoid creating a gap on the valve seat correcting surface.

Seating angle between valve and valve seat:

45°



(2) Lap the valve. For lapping procedure of the valve, refer to step 4).

(3) Check the seating position between valve and valve seat. For inspection of the seating position between valve and valve seat, refer to step 2).

Note:

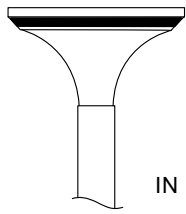
This procedure is necessary to select a seat cutter to be used in step (4).

(4) Using the 30°, 75° (IN) or 62° (EX) seat cutter, correct the valve seat so that the seating width between valve and valve seat becomes the standard value.

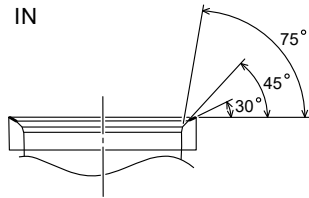
Note:

- Select a proper valve seat cutter according to the following table.

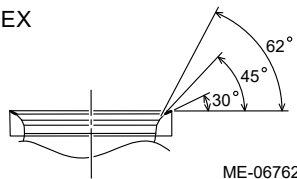
| Seating position between valve and valve seat | Seat cutter selection |
|---|---|
| | When the seating position of valve face is high, grind the surface using the 30° seat cutter until seating width between valve and valve seat becomes the standard value. |



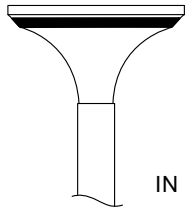
IN



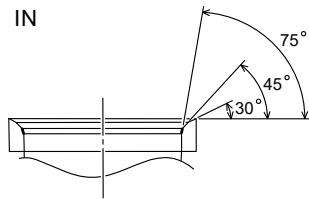
EX



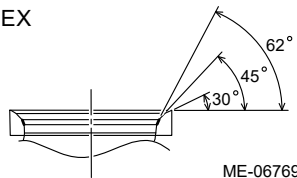
ME-06762



IN



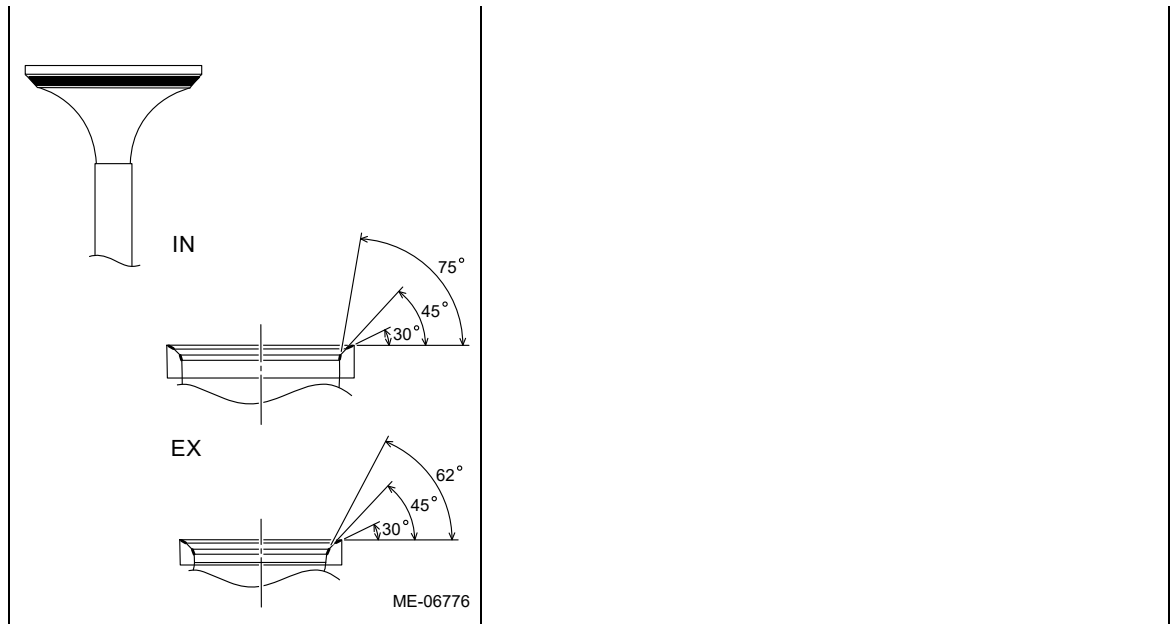
EX



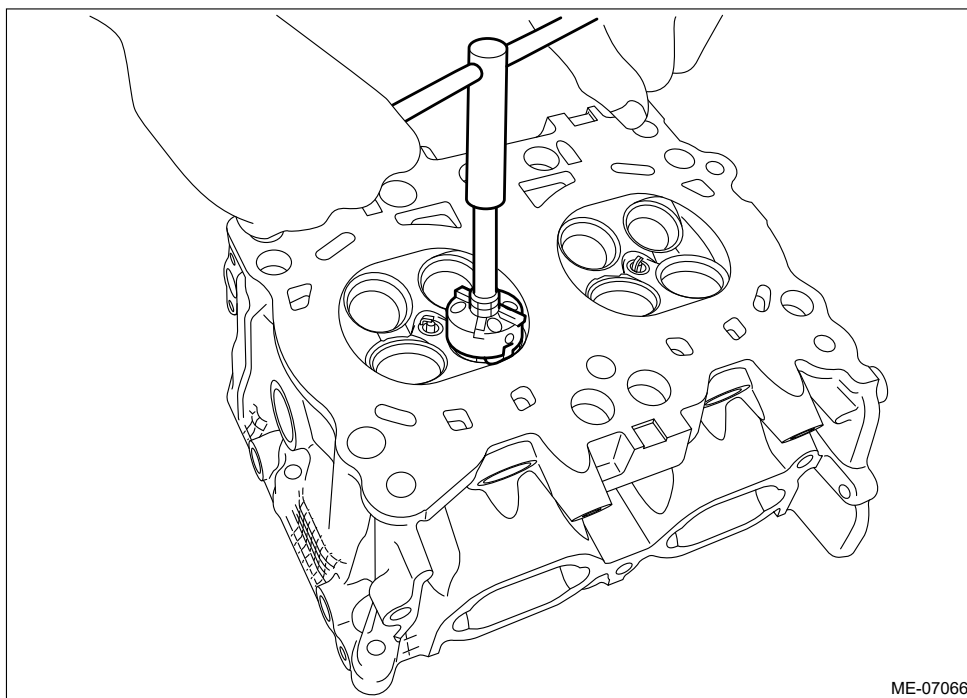
ME-06769

When the seating position of valve face is low, grind the surface using the 75° (IN) or 62° (EX) seat cutter until seating width between valve and valve seat becomes the standard value.

When the seating position of valve face is at center, grind the surface evenly using the 30° and 75° (IN) or 62° (EX) seat cutters until seating width between valve and valve seat becomes the standard value.



- Gradually reduce pressure at the end of grinding process in order to avoid creating a gap on the valve seat correcting surface.



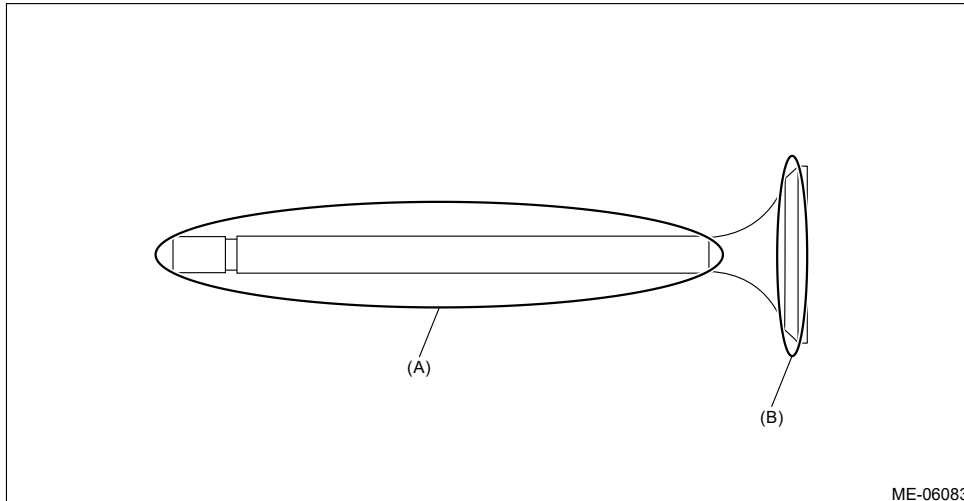
(5) Lap the valve. For lapping procedure of the valve, refer to step 4).

4. When lapping the valve

- (1) Coat the stem (A) of the valve lightly with engine oil and put a small amount of valve compound evenly on the valve face (B).

Note:

- Be careful not to put the valve compound more than necessary.
- To avoid damaging the valve guide and valve stem, be careful not to let the valve compound contact the valve stem.



ME-06083

- (2) Using the valve lapper, slowly insert the valve with the valve compound applied into the valve guide, and lap the seating surface between valve and valve seat. First, lift the valve and strike it against the valve seat twice, and then slightly turn the valve once. Repeat these steps as one set.

Note:

- To prevent the seating width between valve and valve seat from exceeding the standard value, be careful not to keep turning the valve while pressing it against the valve seat during lapping.
- Be careful not to lift the valve too far during lapping in order to prevent the valve from coming off the valve guide.

- (3) Wipe off the valve compound on the valve and valve seat completely after lapping.

Note:

Be careful not to leave any valve compound in order to avoid malfunction.

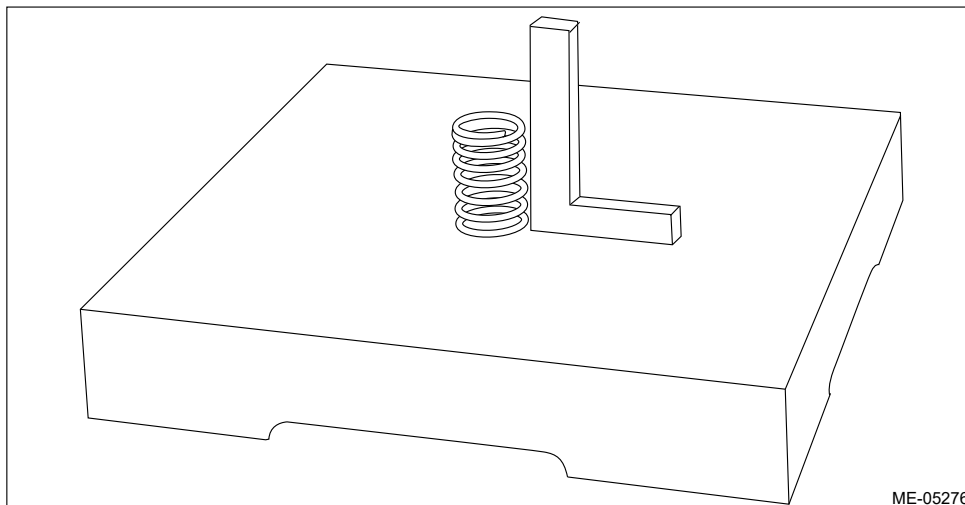
- (4) Check the seating width and seating position between valve and valve seat.

5. VALVE SPRING

1. Check the valve spring for damage and deformation.
2. Using a caliper gauge, valve spring tester, surface plate and try square, check the valve spring free length, tension/spring height and squareness. If it is not within the standard, replace the valve spring.

Note:

- Measurement should be performed at a temperature of 20°C (68°F).
- To check the squareness of the valve spring, stand the valve spring on a surface plate and check its deflection at the top of the valve spring using a try square.



ME-05276

Valve spring free length:

Standard

44.03 mm (1.733 in)

Valve spring tension/spring height:

Set

Standard

182 – 210 N (18.56–21.41 kgf, 40.92–47.22 lbf)/33.0 mm (1.299 in)

Lift

Standard

440 – 486 N (44.87–49.56 kgf, 98.93–109.27 lbf)/22.0 mm (0.866 in)

Valve spring squareness:

Standard

2.5°, 1.9 mm (0.075 in) or less

INSTALLATION

1. CYLINDER HEAD RH

1. Set the part so that the cylinder block RH is on the upper side.
2. Clean the bolt holes in the cylinder block RH.

Caution:

To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

3. Apply liquid gasket to both sides of the cylinder head gasket RH as shown in the figure.

Note:

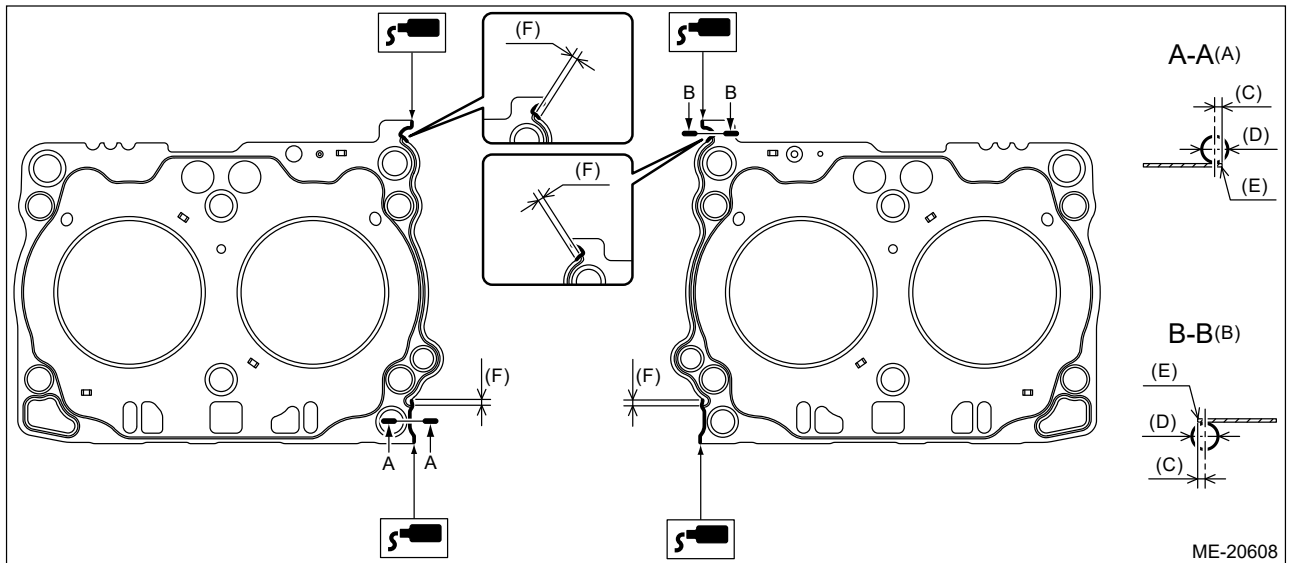
- Use a new cylinder head gasket RH.
- Before applying liquid gasket, degrease the mating surface of cylinder blocks RH and cylinder head RH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3±1 mm (0.1181±0.0394 in)



- | | | |
|--|---|--|
| (A) Liquid gasket applying position to the cylinder head side | (C) Within 1 mm (0.0394 in) | (E) Cylinder head gasket edge |
| (B) Liquid gasket applying position to the cylinder block side | (D) $\varnothing 3 \pm 1$ mm (0.1181±0.0394 in) | (F) Overlap margin of bead end and liquid gasket: 3 – 10 mm (0.1181 – 0.3937 in) |

4. Attach the cylinder head gasket RH.

Note:

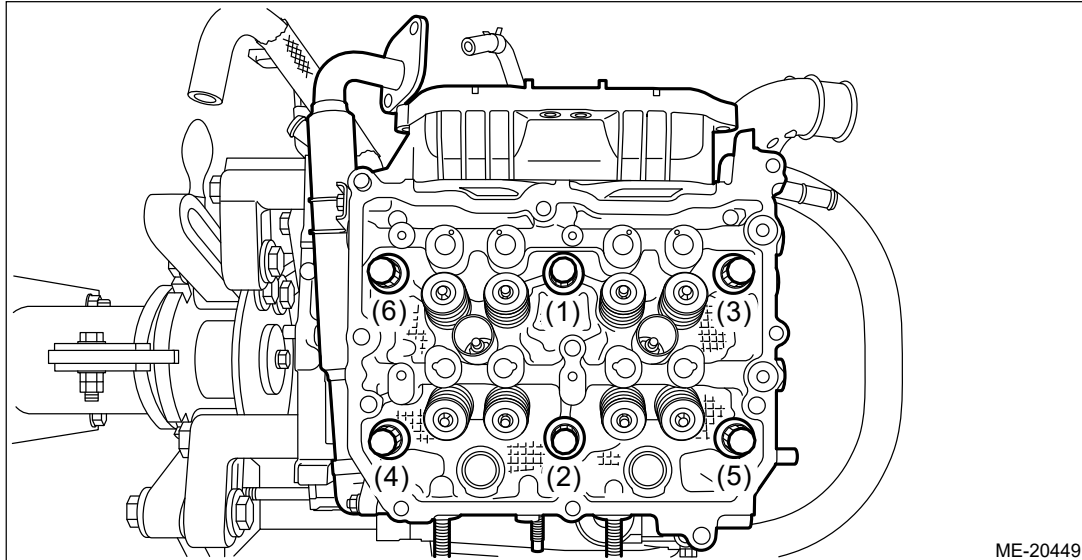
Check that liquid gasket RH is squeezed out from the cylinder head gasket.

5. Install the cylinder head RH to the cylinder block RH.

Caution:

Be careful not to scratch the mating surface of cylinder head RH and cylinder block RH.

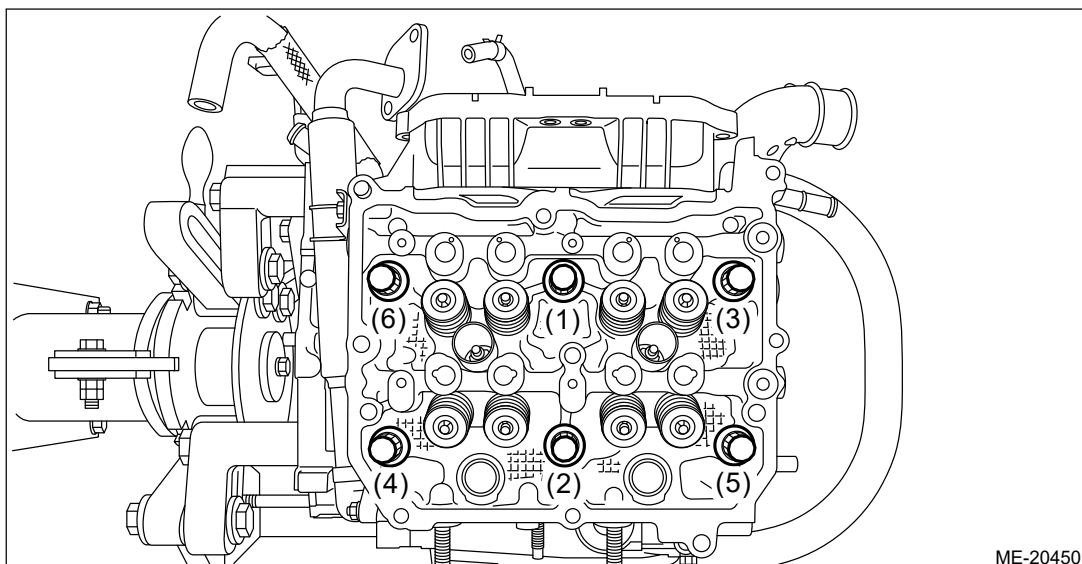
- (1) Clean the cylinder head bolt threads and apply sufficient engine oil to the washer and cylinder head bolts threads.
- (2) Mount the cylinder head RH onto the cylinder block RH, and tighten all bolts with a torque of 20 N·m (2.0 kgf-m, 14.8 ft-lb) in numerical order as shown in the figure.



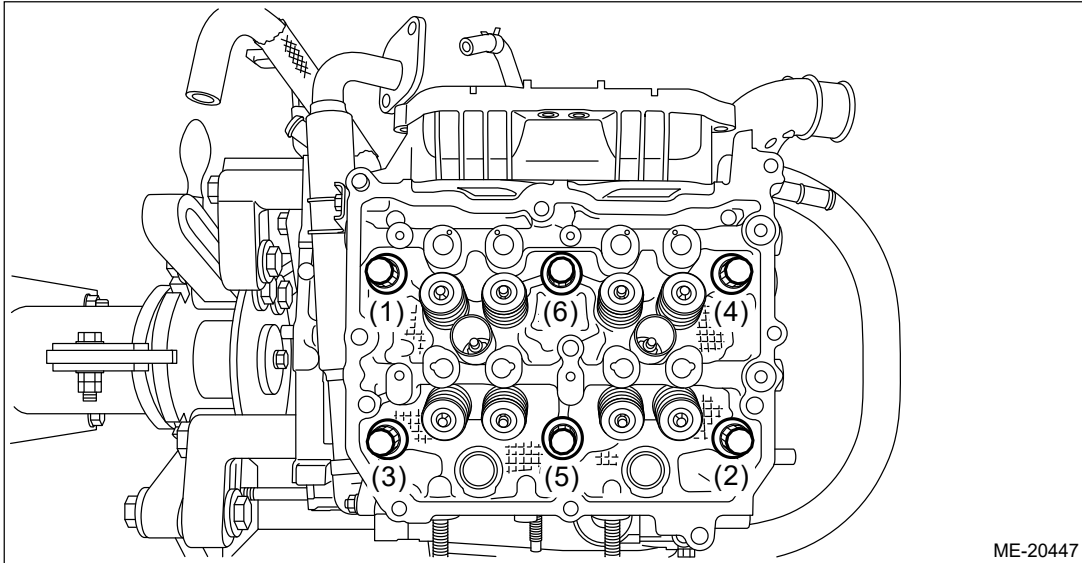
- (3) Tighten all cylinder head bolts further with a torque of 100 N·m (10.2 kgf-m, 73.8 ft-lb) in numerical order as shown in the figure.

Caution:

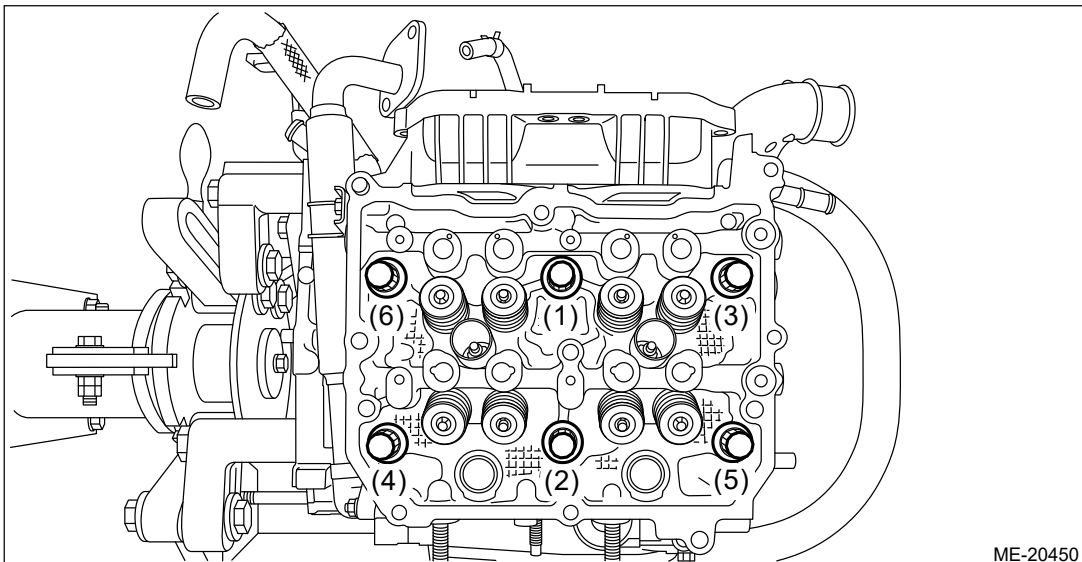
If the bolt makes stick-slip sound during tightening, repeat the procedure from step 1). In that case, the cylinder head gasket RH can be reused. But it is necessary to remove liquid gasket completely from cylinder block RH, cylinder head RH and cylinder head gasket RH and re-apply to them.



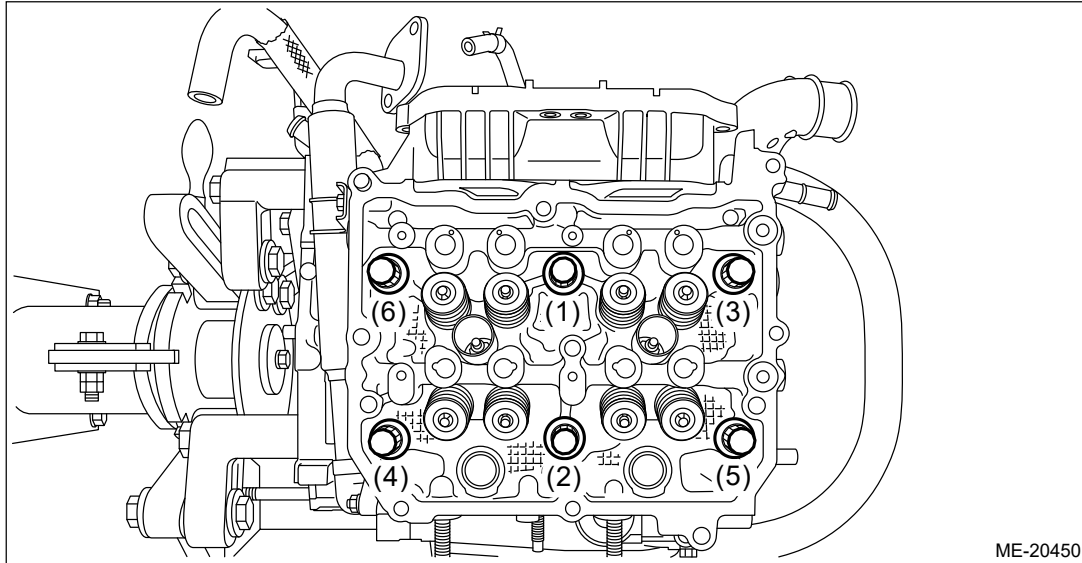
- (4) Loosen all cylinder head bolts by 360° in the numerical order as shown in the figure.



(5) Tighten all bolts with a torque of 20 N·m (2.0 kgf-m, 14.8 ft-lb) in numerical order as shown in the figure.



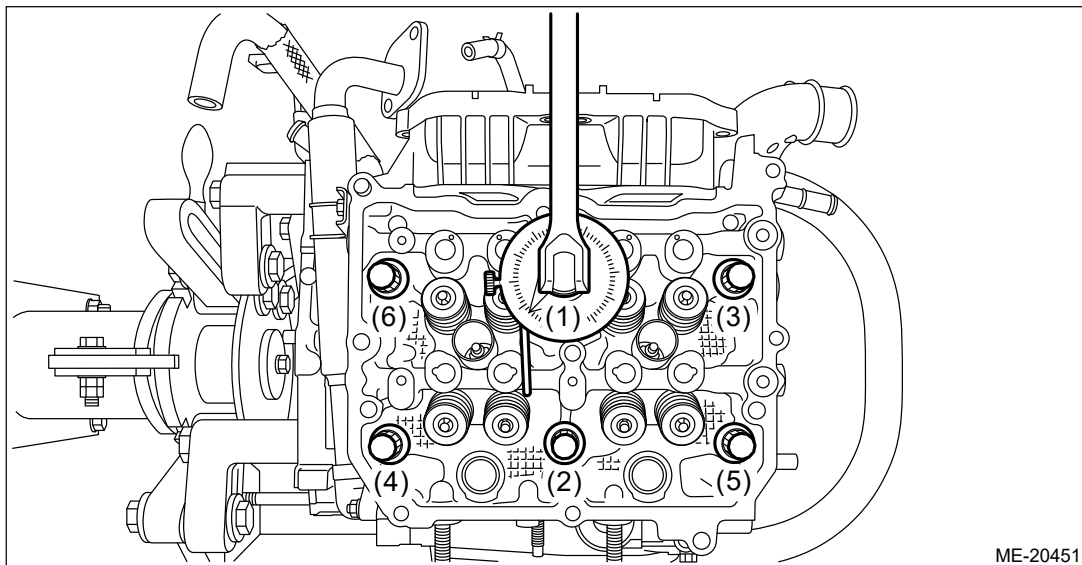
(6) Tighten all cylinder head bolts with a torque of 42 N·m (4.3 kgf-m, 31.0 ft-lb) in numerical order as shown in the figure.



(7) Using angle gauge, tighten all cylinder head bolts with specified angle in numerical order as shown in the figure.

Tightening angle:

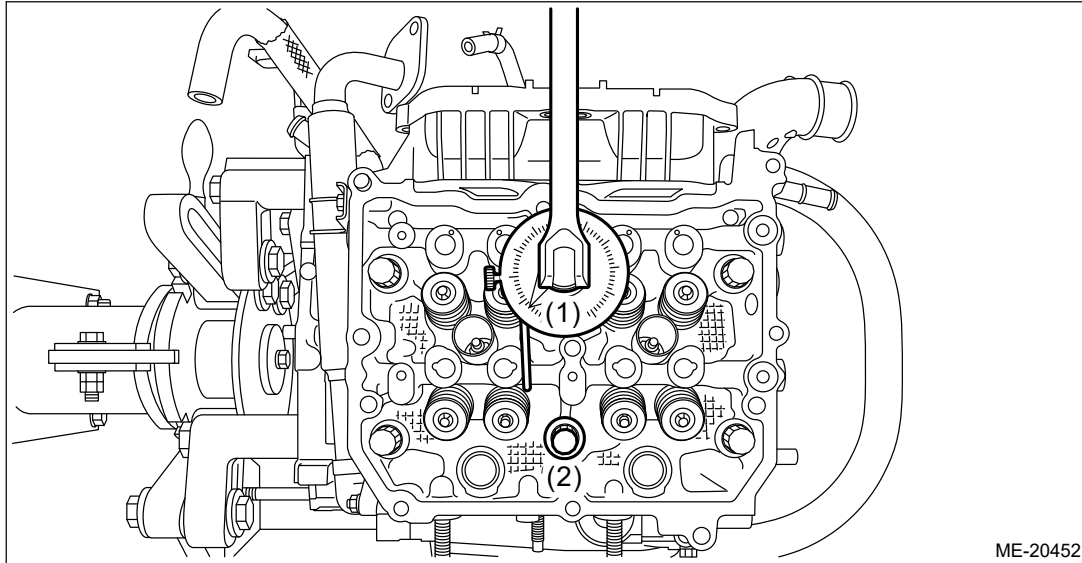
$100^{\circ} \pm 2^{\circ}$



(8) Using angle gauge, tighten the cylinder head bolts (2 places) with specified angle in numerical order as shown in the figure.

Tightening angle:

$100^{\circ} \pm 2^{\circ}$



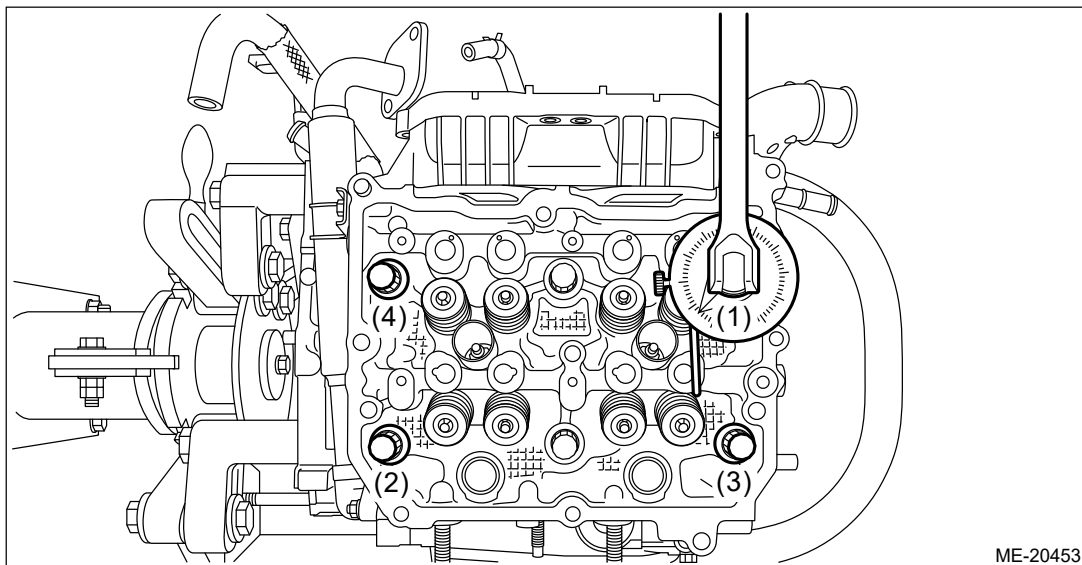
- (9) Using angle gauge, tighten the cylinder head bolts (4 places) with specified angle in numerical order as shown in the figure.

Note:

After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

Tightening angle:




$50^{\circ} \pm 2^{\circ}$










- 6.** Set the part so that the installation surface of the intake manifold is on the upper side.
7. When the cylinder head RH has been disassembled

Note:

When the cylinder head RH has been disassembled, perform the following steps also.

- (1) Install the EGR cooler.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\) \(H4DOTC\)>EGR Cooler>INSTALLATION.](#)
- (2) Install the fuel injector RH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Injector>INSTALLATION > FUEL INJECTOR RH.](#)
- (3) Install the air intake adapter RH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Tumble Generator Valve Assembly>INSTALLATION.](#)

8. Install the high-pressure fuel delivery pipe assembly.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>High Pressure Fuel Delivery Pipe>INSTALLATION > HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY.](#)
9. Install the cam carrier RH.  Ref. to [MECHANICAL\(H4DOTC\)>Cam Carrier>INSTALLATION > CAM CARRIER RH.](#)
10. Install the rocker cover RH.  Ref. to [MECHANICAL\(H4DOTC\)>Rocker Cover>INSTALLATION > ROCKER COVER RH.](#)
11. Install the chain cover.  Ref. to [MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)
12. Install the engine wiring harness.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Wiring Harness>INSTALLATION.](#)
13. Install the intake manifold.  Ref. to [FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>INSTALLATION.](#)
14. Install the engine to the vehicle.  Ref. to [MECHANICAL\(H4DOTC\)>Engine Assembly>INSTALLATION.](#)

2. CYLINDER HEAD LH

1. Set the part so that the cylinder block LH is on the upper side.
2. Clean the bolt holes in the cylinder block LH.

Caution:

To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

3. Apply liquid gasket to both sides of the cylinder head gasket LH as shown in the figure.

Note:

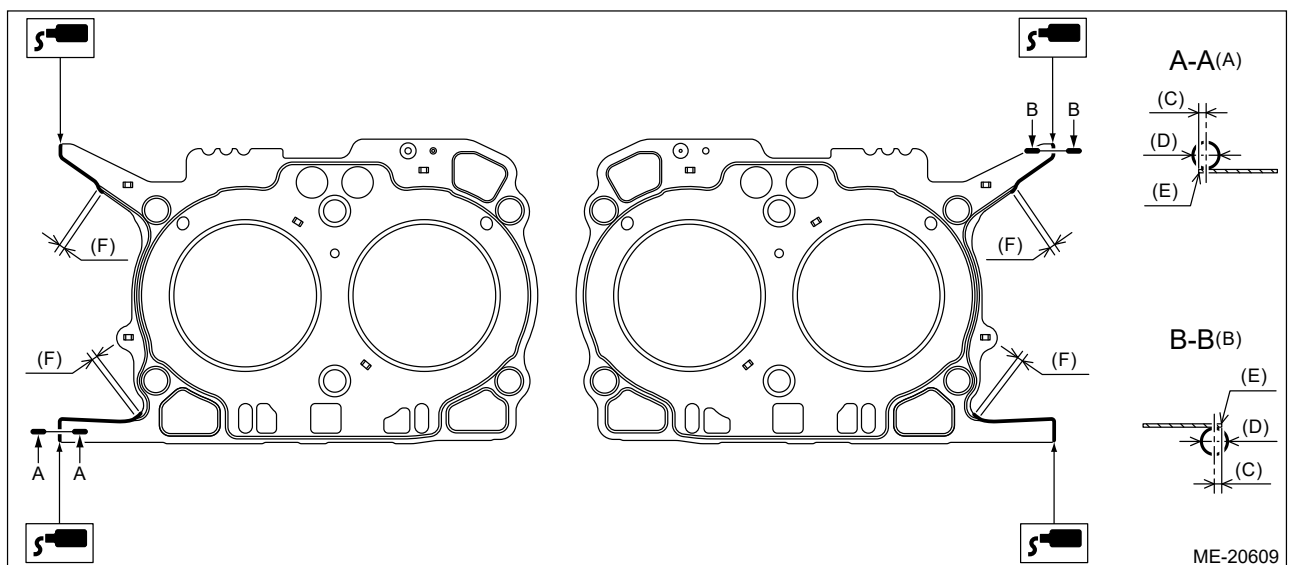
- Use a new cylinder head gasket LH.
- Before applying liquid gasket, degrease the mating surface of cylinder blocks LH and cylinder head LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3 ± 1 mm (0.1181 \pm 0.0394 in)



(A) Liquid gasket applying position to the cylinder head

(C) Within 1 mm (0.0394 in)

(E) Cylinder head gasket edge

side

(B) Liquid gasket applying
position to the cylinder block
side

(D) $\varnothing 3 \pm 1$ mm
(0.1181 \pm 0.0394 in)

(F) Overlap margin of bead end
and liquid gasket: 3 – 10 mm
(0.1181 – 0.3937 in)

4. Attach the cylinder head gasket LH.

Note:

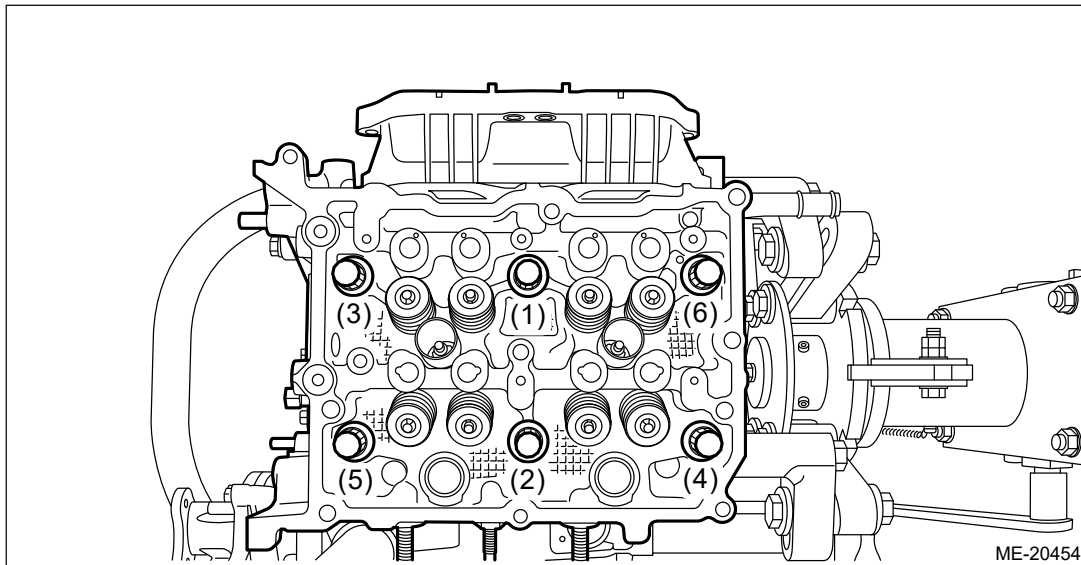
Check that liquid gasket is squeezed out from the cylinder head gasket LH.

5. Install the cylinder head LH to the cylinder block LH.

Caution:

Be careful not to scratch the mating surface of cylinder head LH and cylinder block LH.

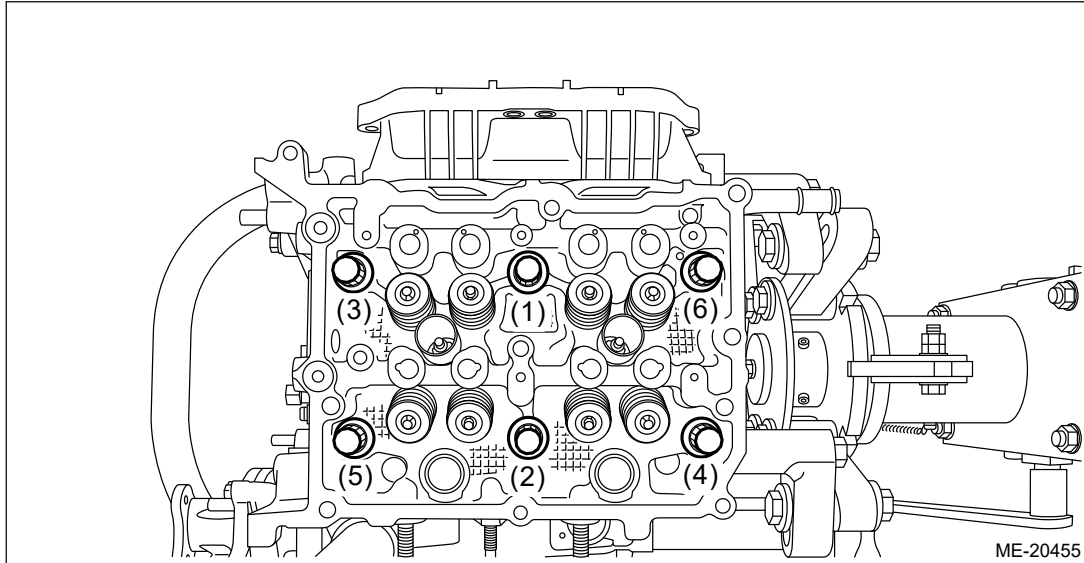
- (1) Clean the cylinder head bolt threads and apply sufficient engine oil to the washer and cylinder head bolts threads.
- (2) Mount the cylinder head LH onto the cylinder block LH, and tighten all bolts with a torque of 20 N·m (2.0 kgf-m, 14.8 ft-lb) in numerical order as shown in the figure.



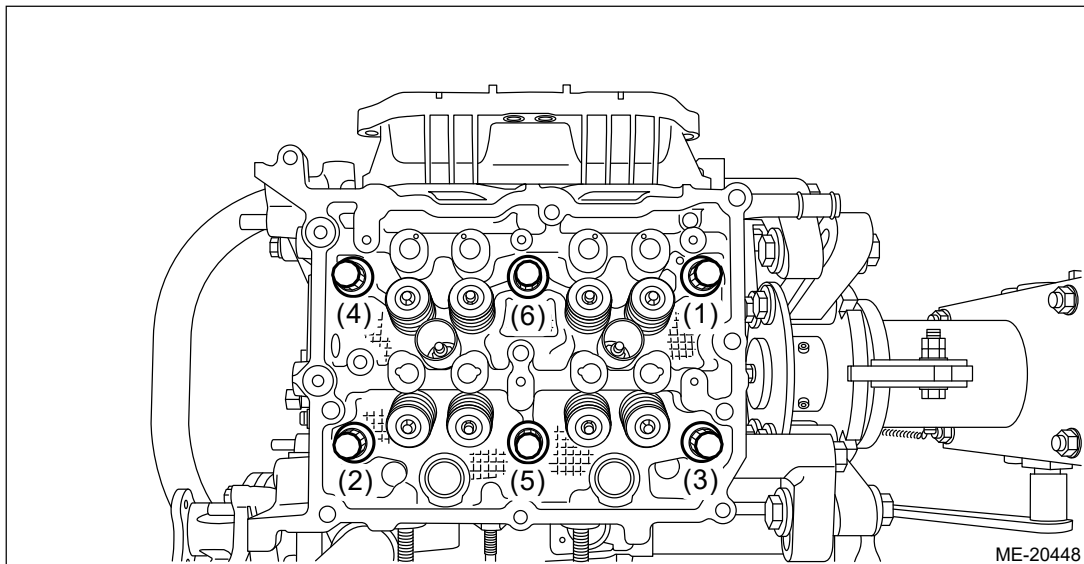
- (3) Tighten all cylinder head bolts further with a torque of 100 N·m (10.2 kgf-m, 73.8 ft-lb) in numerical order as shown in the figure.

Caution:

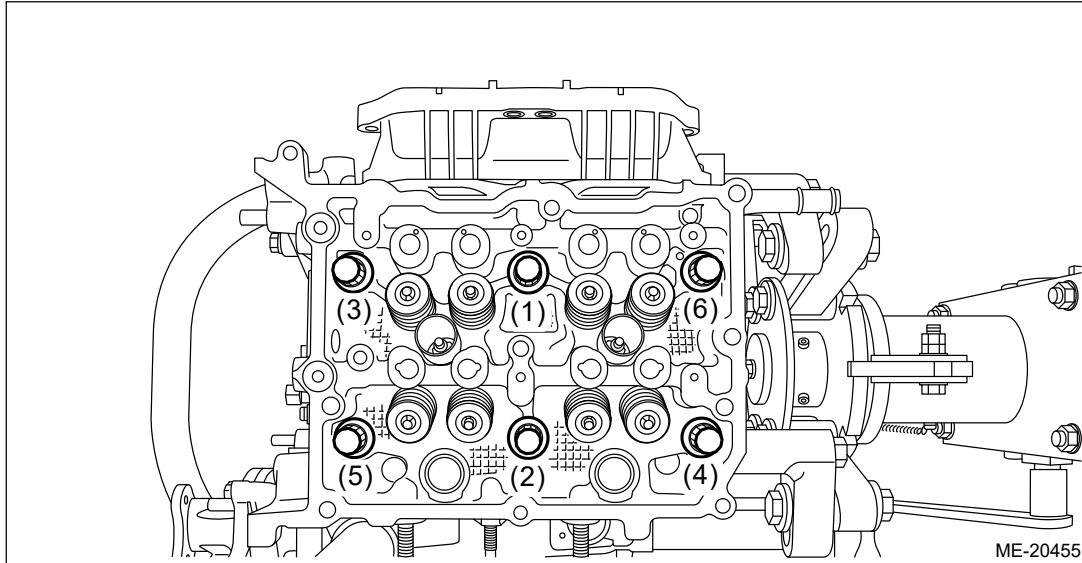
If the bolt makes stick-slip sound during tightening, repeat the procedure from step 1). In that case, the cylinder head gasket LH can be reused. But it is necessary to remove liquid gasket completely from cylinder block LH, cylinder head LH and cylinder head gasket LH and re-apply to them.



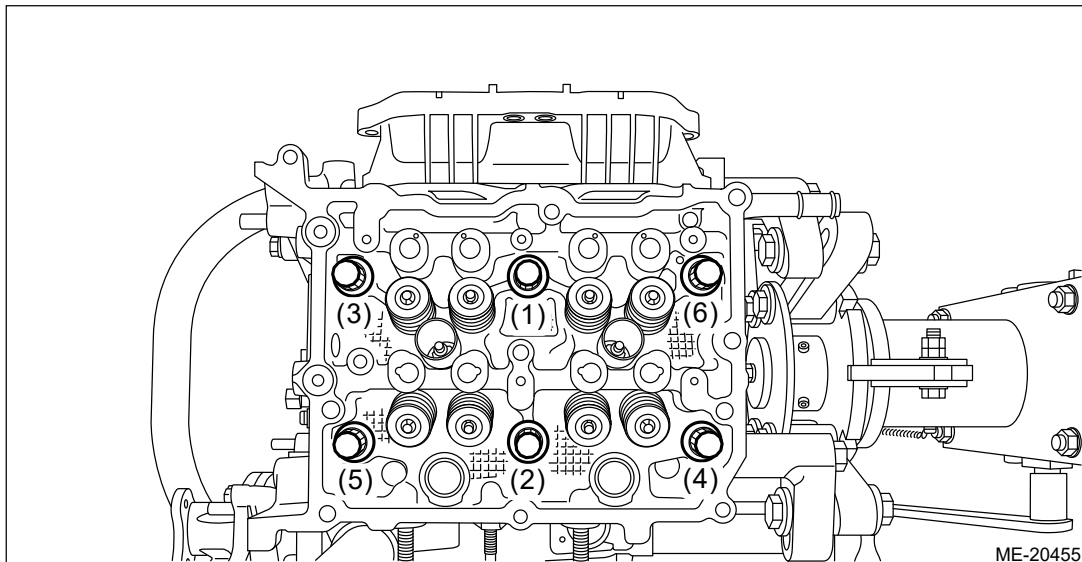
(4) Loosen all cylinder head bolts by 360° in the numerical order as shown in the figure.



(5) Tighten all bolts with a torque of 20 N·m (2.0 kgf-m, 14.8 ft-lb) in numerical order as shown in the figure.



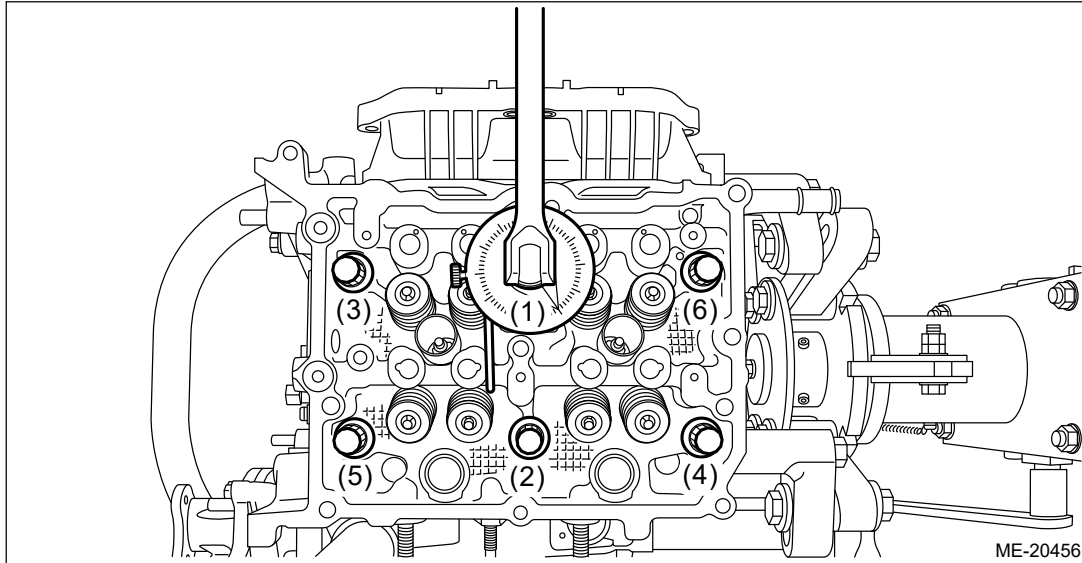
- (6) Tighten all cylinder head bolts with a torque of 42 N·m (4.3 kgf-m, 31.0 ft-lb) in numerical order as shown in the figure.



- (7) Using angle gauge, tighten all cylinder head bolts with specified angle in numerical order as shown in the figure.

Tightening angle:

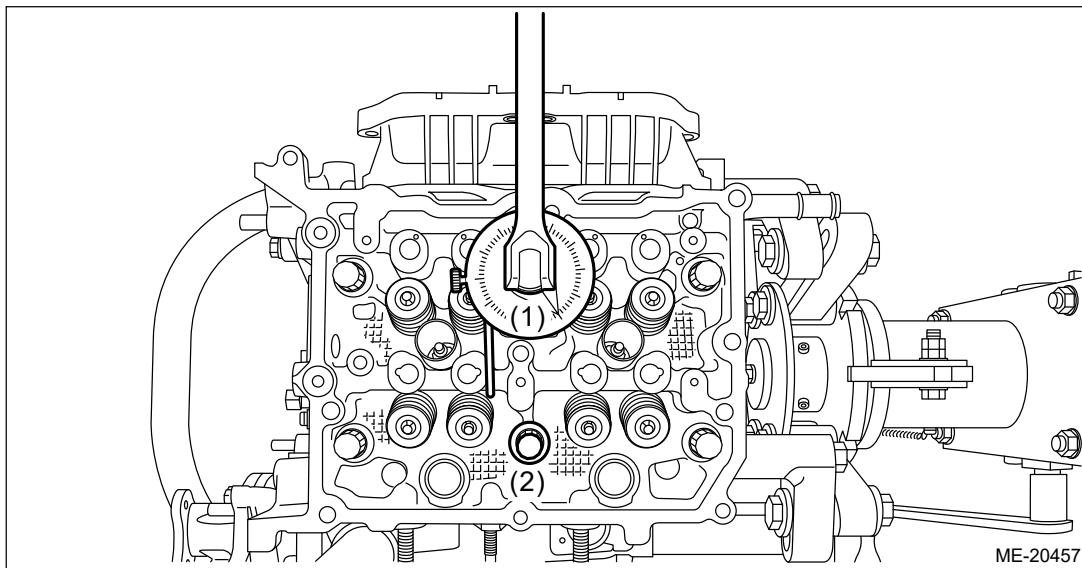
100°±2°



- (8) Using angle gauge, tighten the cylinder head bolts (2 places) with specified angle in numerical order as shown in the figure.

Tightening angle:

$100^{\circ} \pm 2^{\circ}$



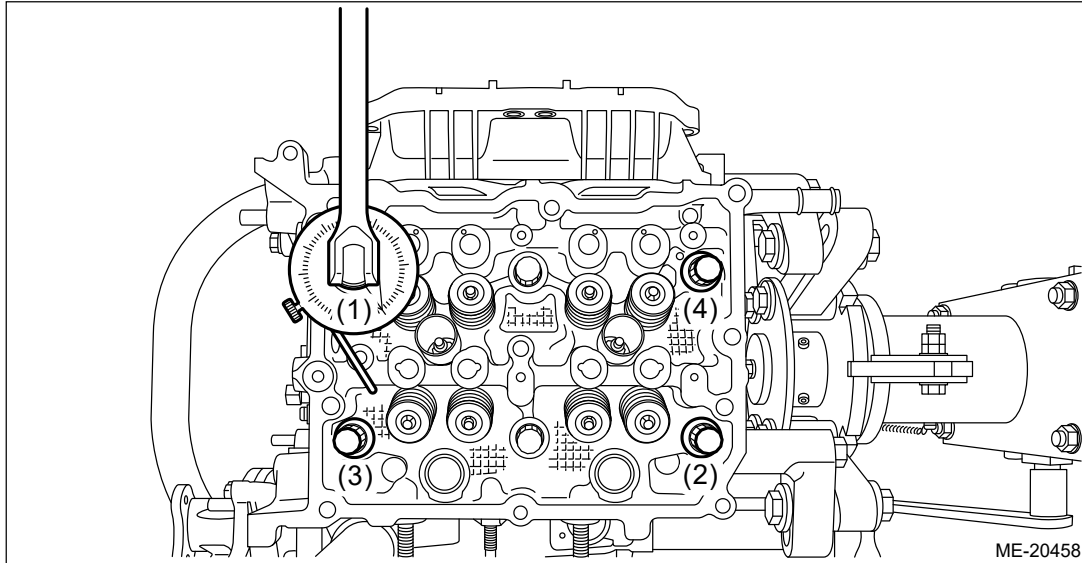
- (9) Using angle gauge, tighten the cylinder head bolts (4 places) with specified angle in numerical order as shown in the figure.

Note:

After tightening, if the liquid gasket is squeezed out onto the seal surface of the chain cover, completely remove any squeezed-out liquid gasket.

Tightening angle:











$50^{\circ} \pm 2^{\circ}$



6. Set the part so that the installation surface of the intake manifold is on the upper side.
7. When the cylinder head LH has been disassembled

Note:











When the cylinder head LH has been disassembled, perform the following steps also.

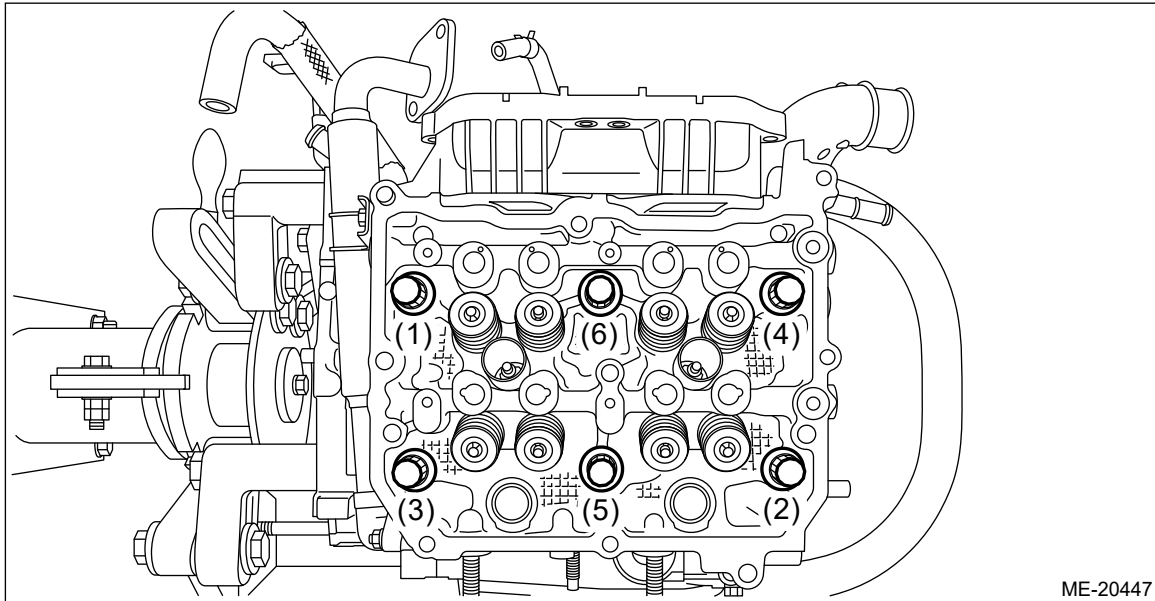
- (1) Install the fuel injector LH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Injector>INSTALLATION > FUEL INJECTOR LH.](#)
- (2) Install the air intake adapter LH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Tumble Generator Valve Assembly>INSTALLATION.](#)
8. Install the A/C compressor.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>INSTALLATION > CAM CARRIER LH.](#)
9. Install the high-pressure fuel delivery pipe assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>High Pressure Fuel Delivery Pipe>INSTALLATION > HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY.](#)
10. Install the cam carrier LH.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>INSTALLATION > CAM CARRIER LH.](#)
11. Install the rocker cover LH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>INSTALLATION > ROCKER COVER LH.](#)
12. Install the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)
13. Install the engine wiring harness.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Wiring Harness>INSTALLATION.](#)
14. Install the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>INSTALLATION.](#)
15. Install the engine to the vehicle.  [Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>INSTALLATION.](#)

MECHANICAL(H4DOTC) > Cylinder Head

REMOVAL

1. CYLINDER HEAD RH

1. Remove the engine from the vehicle.  [Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>REMOVAL.](#)
2. Remove the intake manifold.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
3. Remove the engine wiring harness.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Wiring Harness>REMOVAL.](#)
4. Remove the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
5. Remove the rocker cover RH.  [Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>REMOVAL > ROCKER COVER RH.](#)
6. Remove the cam carrier RH.  [Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>REMOVAL > CAM CARRIER RH.](#)
7. Remove the high-pressure fuel delivery pipe assembly.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>High Pressure Fuel Delivery Pipe>REMOVAL > HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY.](#)
8. When disassembling the cylinder head RH
Note:
When disassembling the cylinder head RH, perform the following steps also.
 - (1) Remove the air intake adapter RH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Tumble Generator Valve Assembly>REMOVAL.](#)
 - (2) Remove the fuel injector RH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel Injector>REMOVAL > FUEL INJECTOR RH.](#)
 - (3) Remove the EGR cooler.  [Ref. to EMISSION CONTROL \(AUX. EMISSION CONTROL DEVICES\)\(H4DOTC\)>EGR Cooler>REMOVAL.](#)
9. Set the part so that the cylinder head RH is on the upper side.
10. Loosen the bolts securing the cylinder head RH equally, a little at a time in numerical sequence as shown in the figure and remove the cylinder head bolt.



11. While tapping the cylinder head RH with a plastic hammer, separate to remove it from the cylinder block RH.
12. Remove the cylinder head gasket RH.


Caution:
Be careful not to scratch the mating surface of cylinder head and cylinder block.
13. Remove the liquid gasket from the cylinder head RH and cylinder block RH.

2. CYLINDER HEAD LH

1. Remove the engine from the vehicle. [🔧 Ref. to MECHANICAL\(H4DOTC\)>Engine Assembly>REMOVAL.](#)
2. Remove the intake manifold. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Intake Manifold>REMOVAL.](#)
3. Remove the engine wiring harness. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Engine Wiring Harness>REMOVAL.](#)
4. Remove the chain cover. [🔧 Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL.](#)
5. Remove the rocker cover LH. [🔧 Ref. to MECHANICAL\(H4DOTC\)>Rocker Cover>REMOVAL > ROCKER COVER LH.](#)
6. Remove the cam carrier LH. [🔧 Ref. to MECHANICAL\(H4DOTC\)>Cam Carrier>REMOVAL > CAM CARRIER LH.](#)
7. Remove the high-pressure fuel delivery pipe assembly. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>High Pressure Fuel Delivery Pipe>REMOVAL > HIGH-PRESSURE FUEL DELIVERY PIPE ASSEMBLY.](#)
8. Remove the A/C compressor. [🔧 Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Compressor>REMOVAL.](#)
9. When disassembling the cylinder head LH

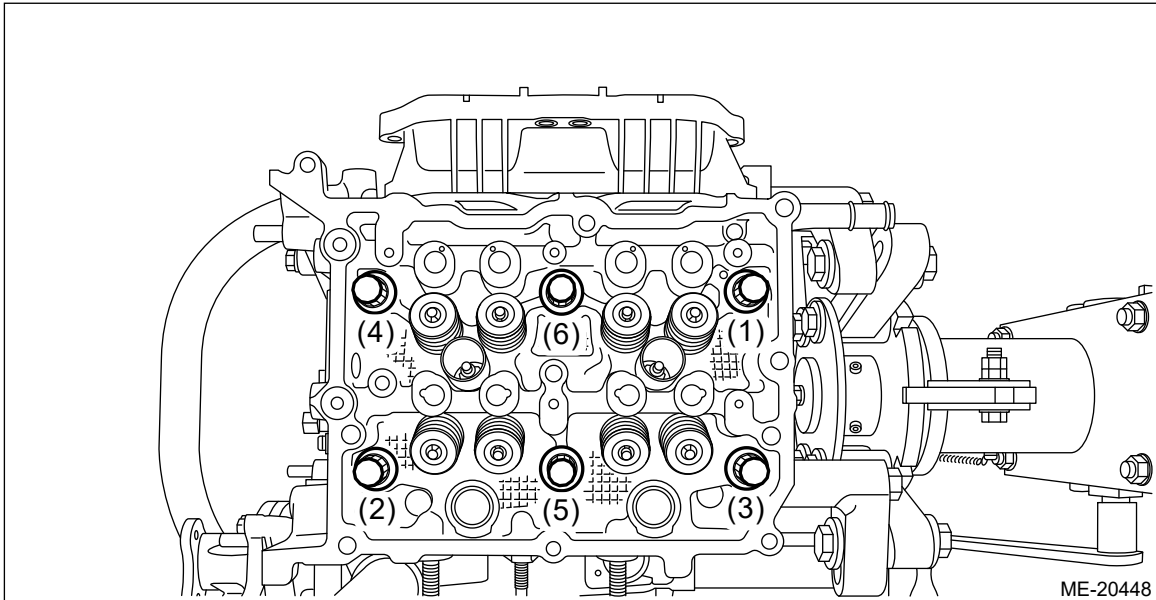
Note:
When disassembling the cylinder head LH, perform the following steps also.

 - (1) Remove the air intake adapter LH. [🔧 Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Tumble Generator Valve Assembly>REMOVAL.](#)

(2) Remove the fuel injector LH.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\) \(H4DOTC\)>Fuel Injector>REMOVAL > FUEL INJECTOR LH.](#)

10. Set the part so that the cylinder head LH is on the upper side.

11. Loosen the bolts securing the cylinder head LH equally, a little at a time in numerical sequence as shown in the figure and remove the cylinder head bolt.



12. While tapping the cylinder head LH with a plastic hammer, separate to remove it from the cylinder block LH.

13. Remove the cylinder head gasket LH.

Caution:

Be careful not to scratch the mating surface of cylinder head and cylinder block.

14. Remove the liquid gasket from cylinder head LH and cylinder block LH.

MECHANICAL(H4DOTC) > Engine Assembly

INSPECTION

- 1.** Check that pipes, hoses, connectors and clamps are installed firmly.
- 2.** Check the engine coolant is at specified level.
- 3.** Start the engine and check for exhaust gas, engine coolant, leaks of fuel, etc. Also check for noise and vibrations.

INSTALLATION

1. Install the engine mounting onto the engine.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)

2. Position the engine in engine compartment and align it with transmission.

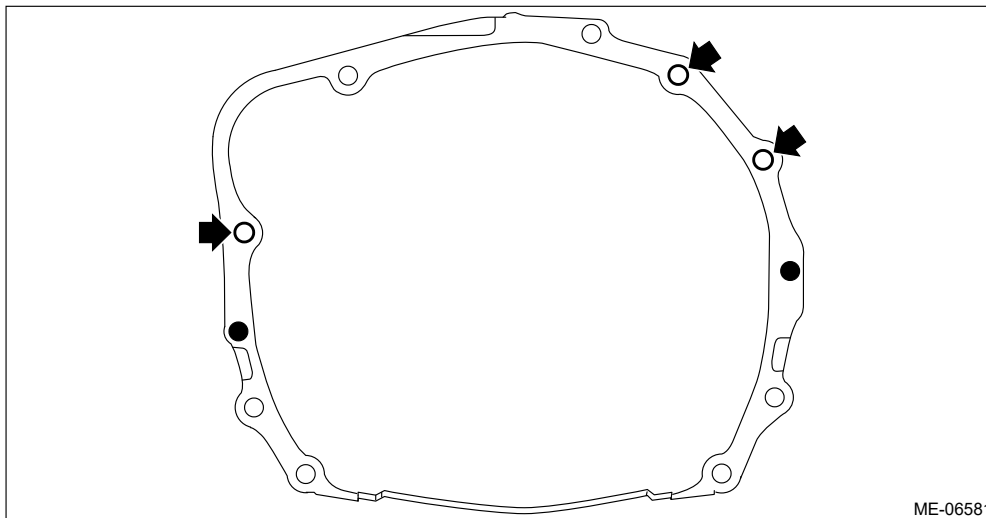
Note:

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

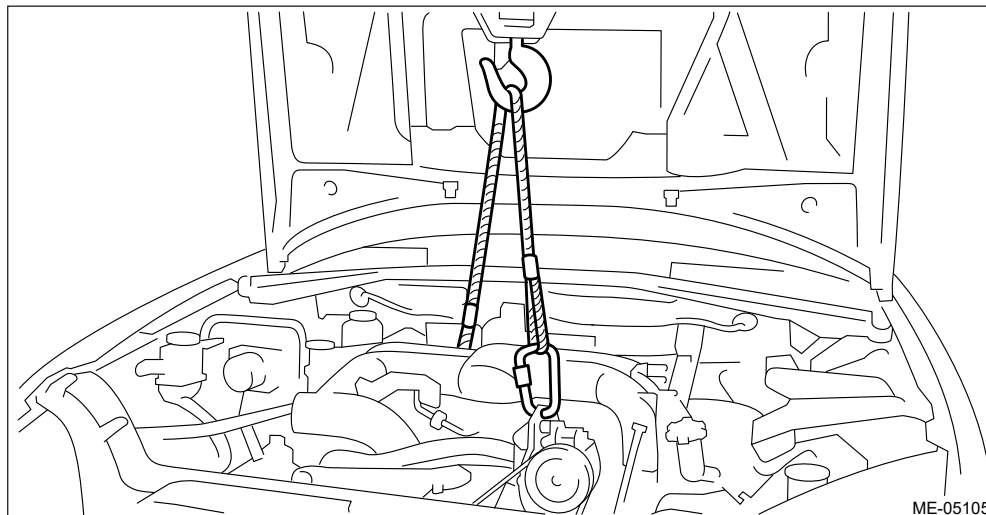
3. Install the bolts which hold upper side of transmission to engine.

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



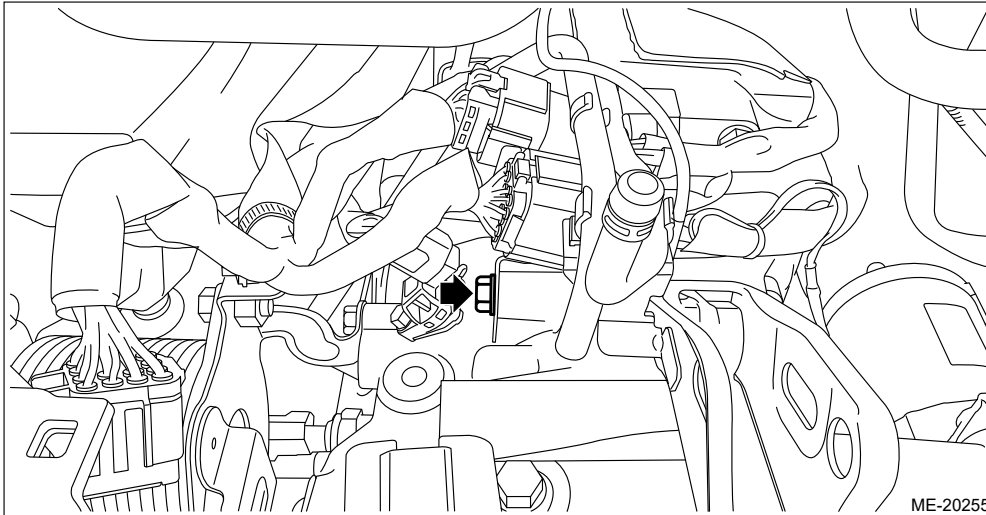
4. Remove the lifting device and wire ropes.



5. Remove the garage jack.
6. Install the bolt which secures the transmission harness stay to the CVT.

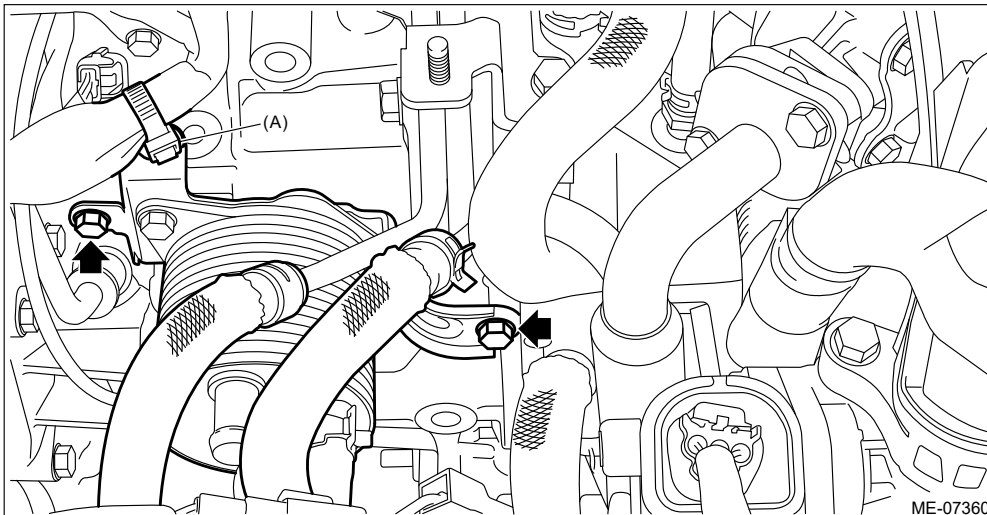
Tightening torque:

16 N·m (1.6 kgf-m, 11.8 ft-lb)



7. Install the CVTF cooler (with warmer feature) to the CVT.

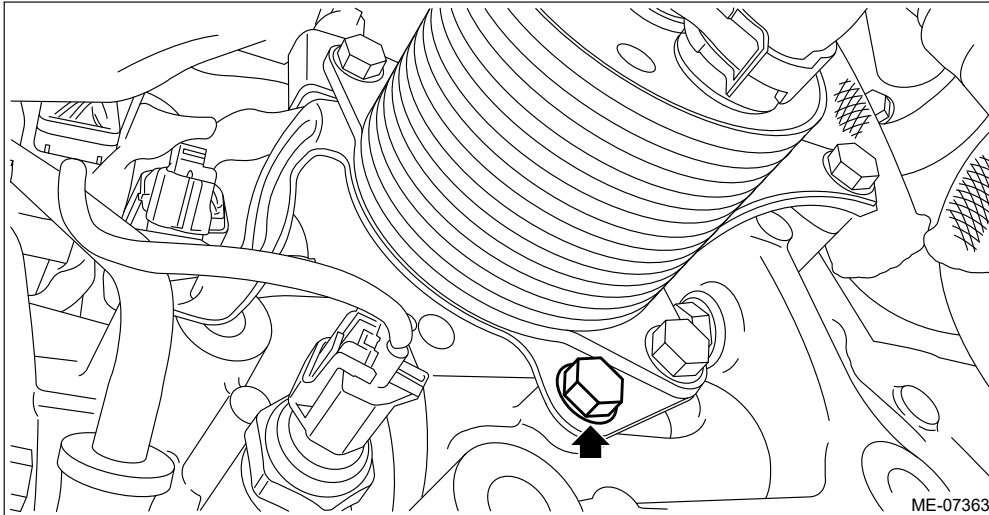
- (1) Temporarily tighten the upper bolt which secures the CVTF cooler (with warmer feature) to the CVT.
- (2) Using clip (A), fix the bulkhead harness to the CVTF cooler (with warmer feature).



- (3) Lift up the vehicle.
- (4) Install the lower bolt which secures CVTF cooler (with warmer feature) to the CVT.

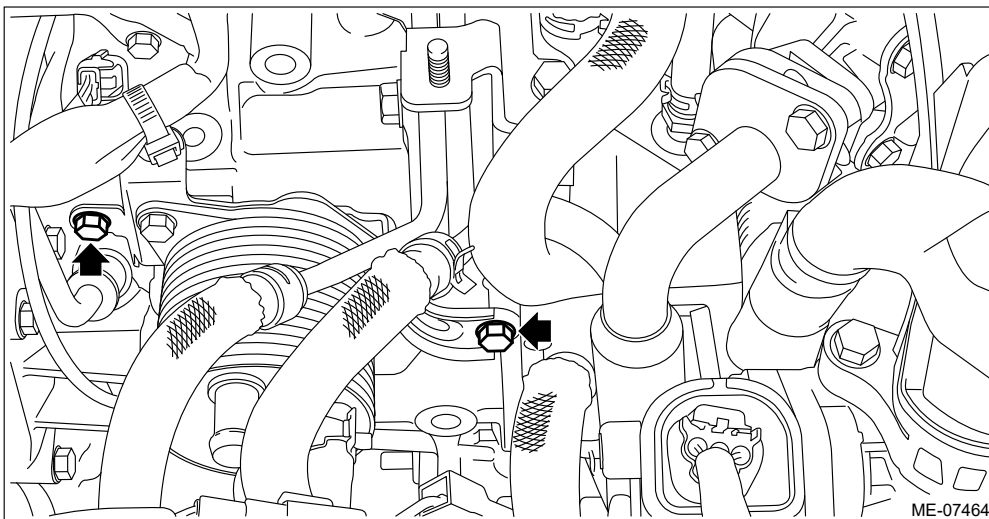
Tightening torque:

23 N·m (2.3 kgf-m, 17.0 ft-lb)



- (5) Lower the vehicle.
- (6) Tighten the upper bolt which secures the CVTF cooler (with warmer feature) to the CVT.

Tightening torque:
23 N·m (2.3 kgf-m, 17.0 ft-lb)

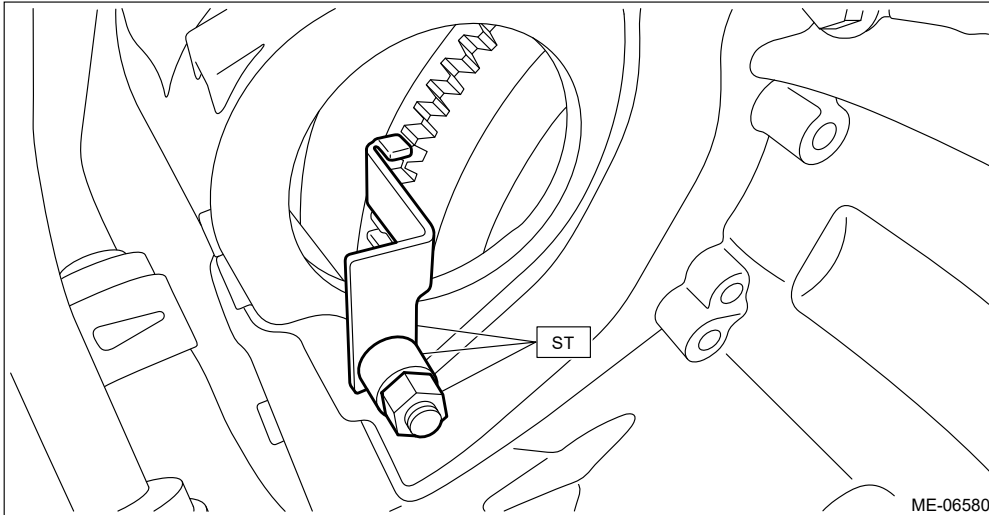


- 8.** Install the torque converter clutch to drive plate.
 - (1) Remove the ST from torque converter clutch case.

Note:

Be careful not to drop the ST into the torque converter clutch case when removing the ST.

ST 498277200 STOPPER SET



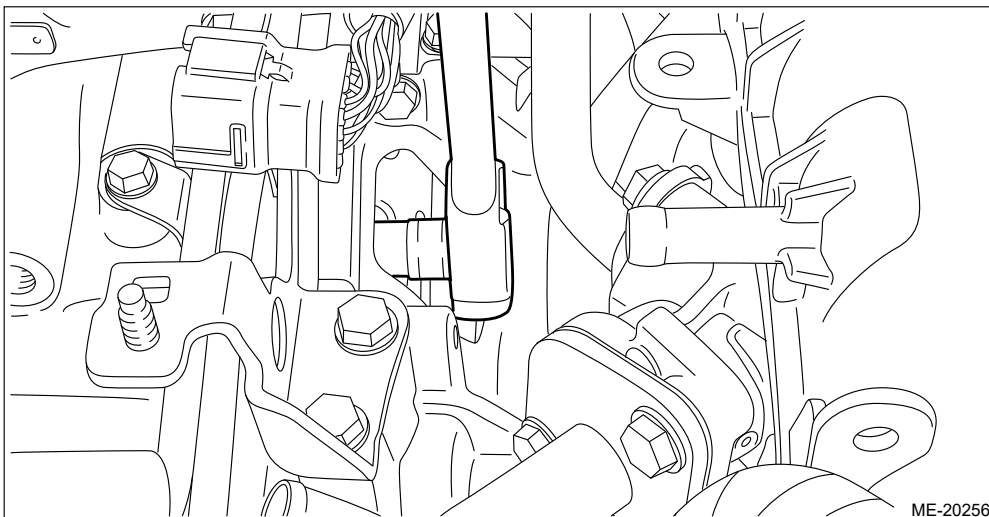
- (2) Insert the wrench into the crank pulley bolt and rotate the crank pulley to install the bolts which hold torque converter clutch to drive plate.

Note:

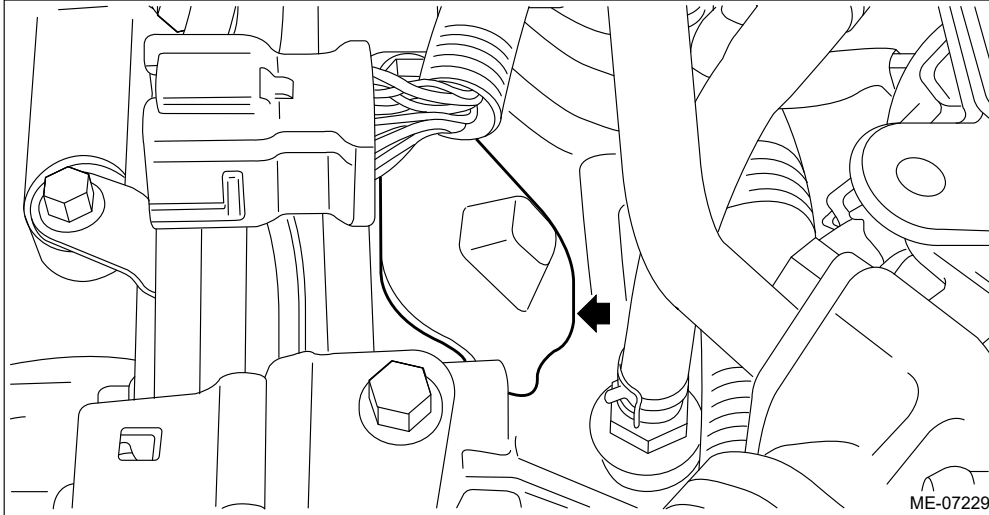
Be careful not to drop bolts into the torque converter clutch case.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)



- (3) Fit the plug to service hole.



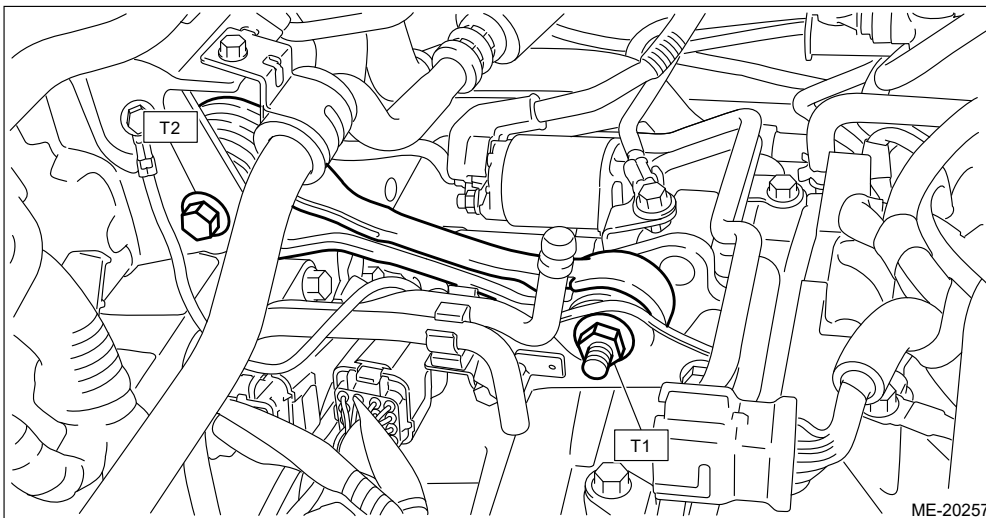
(4) Install the starter.  Ref. to [STARTING/CHARGING SYSTEMS\(H4DO\)>Starter>INSTALLATION](#).

9. 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)

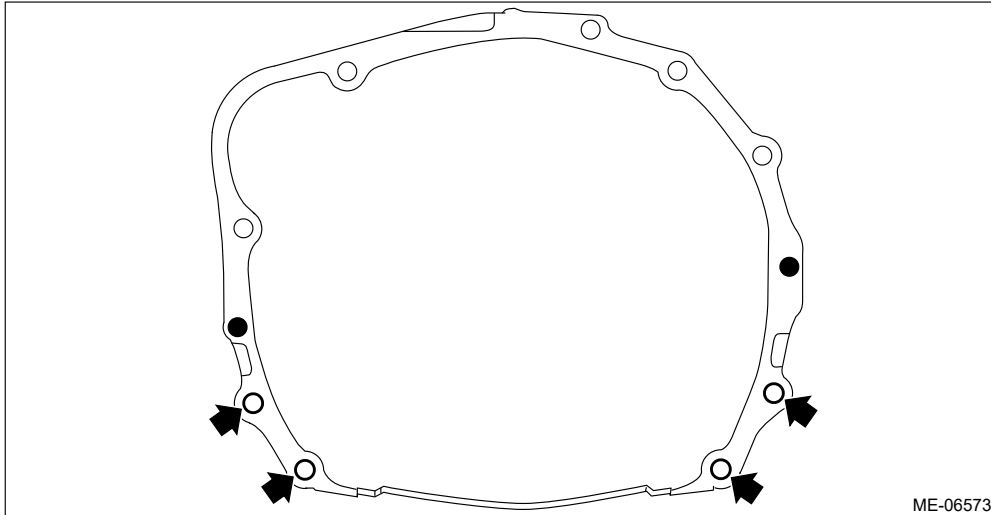


10. Lift up the vehicle.

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

Tightening torque:

50 N·m (5.1 kgf-m, 36.9 ft-lb)



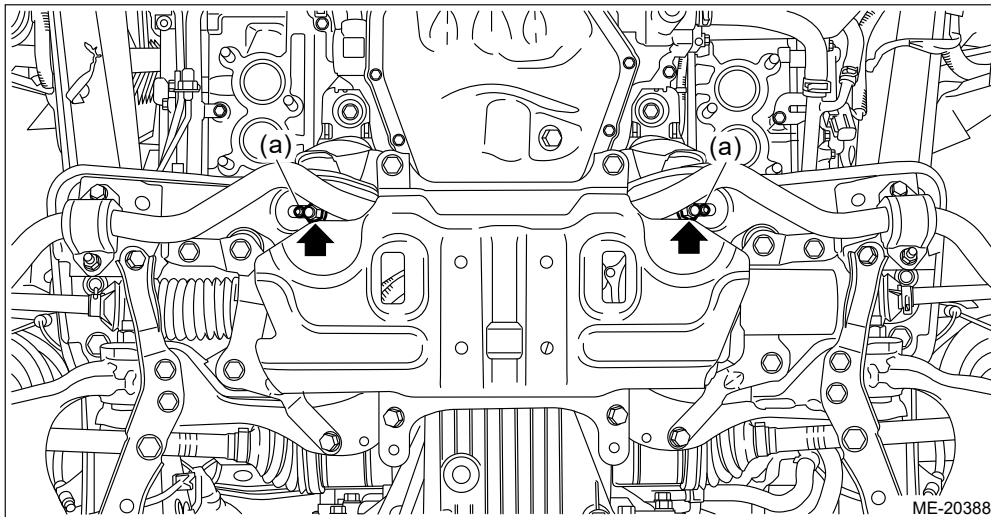
12. Install the nuts which hold the engine mounting to the front crossmember.

Note:

- Make sure that locators (a) of the engine mounting are securely inserted.
- Use a new nut.

Tightening torque:

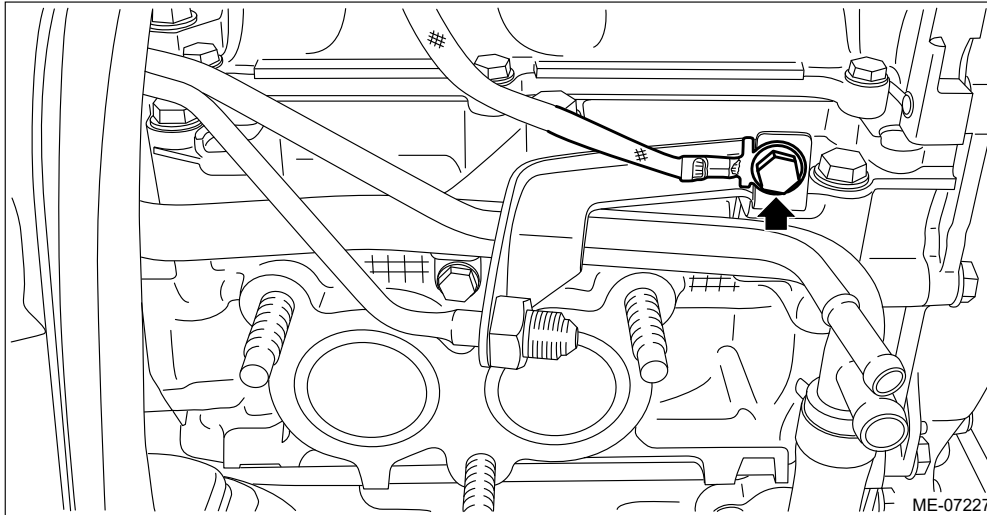
60 N·m (6.1 kgf-m, 44.3 ft-lb)



13. Connect the ground cable to the oil pipe assembly.

Tightening torque:

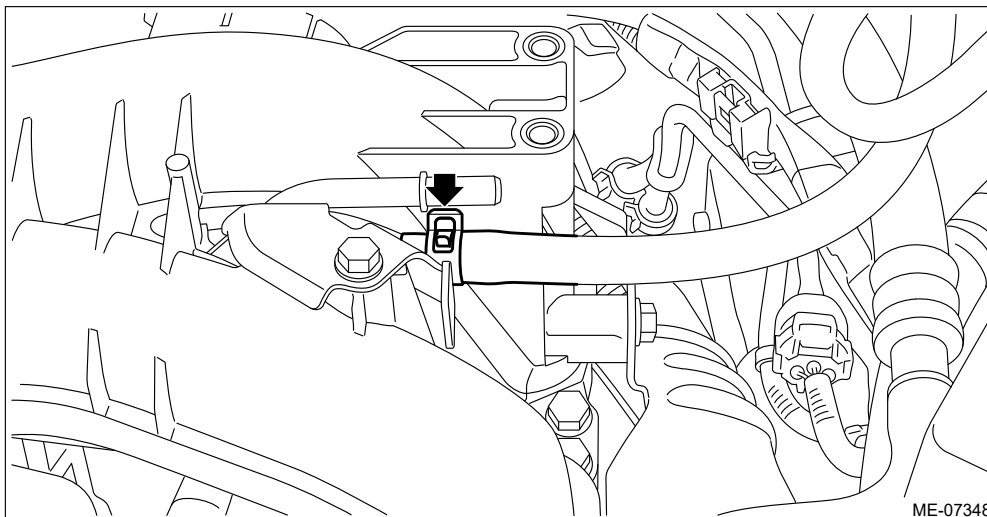
7 N·m (0.7 kgf-m, 5.2 ft-lb)



14. Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)

15. Connect the fuel delivery tube and evaporation hose.

(1) Connect the evaporation hose to fuel pipe assembly.



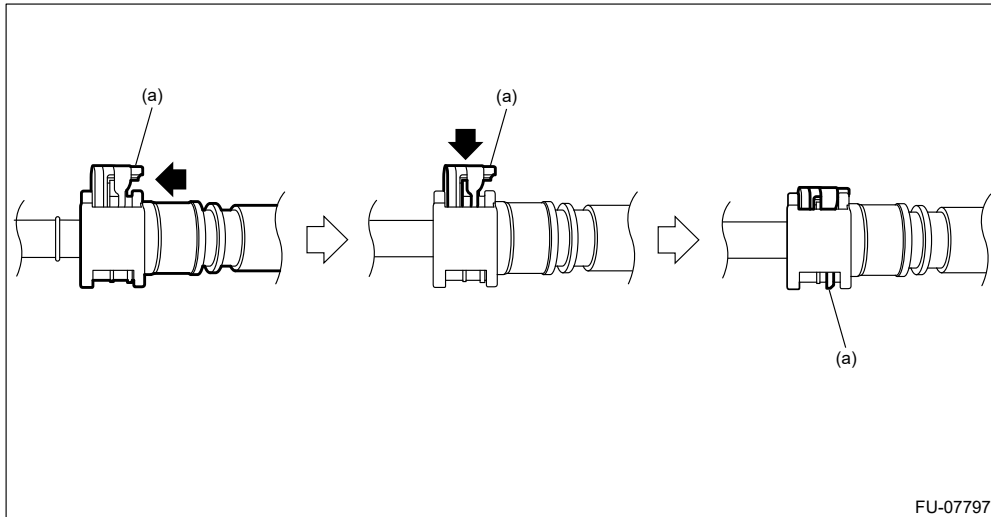
(2) Connect the quick connector on the fuel delivery tube to the fuel pipe assembly, and fix the fuel delivery tube using clip (A).

Caution:

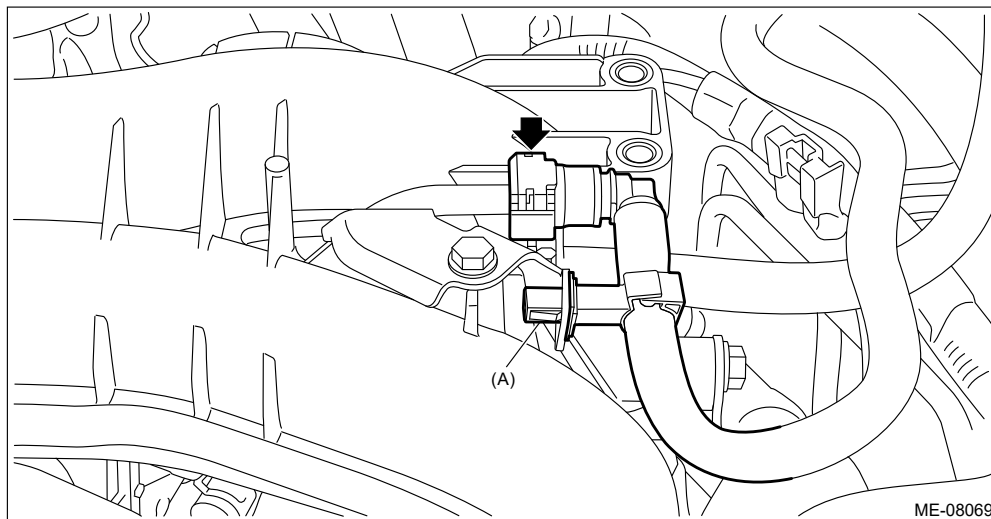
- **Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.**
- **When connecting the quick connector, make sure to insert it all the way in before locking the slider.**
- **When it is difficult to lock the slider, check that the connector is fully inserted.**
- **After locking the slider, check that the quick connector is securely connected.**

Note:

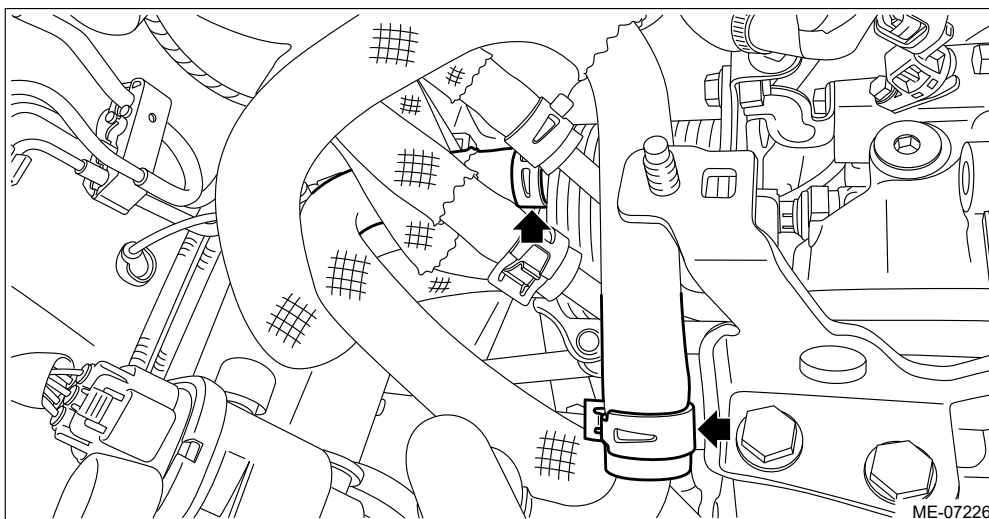
Connect the quick connector as shown in the figure.



(a) Slider



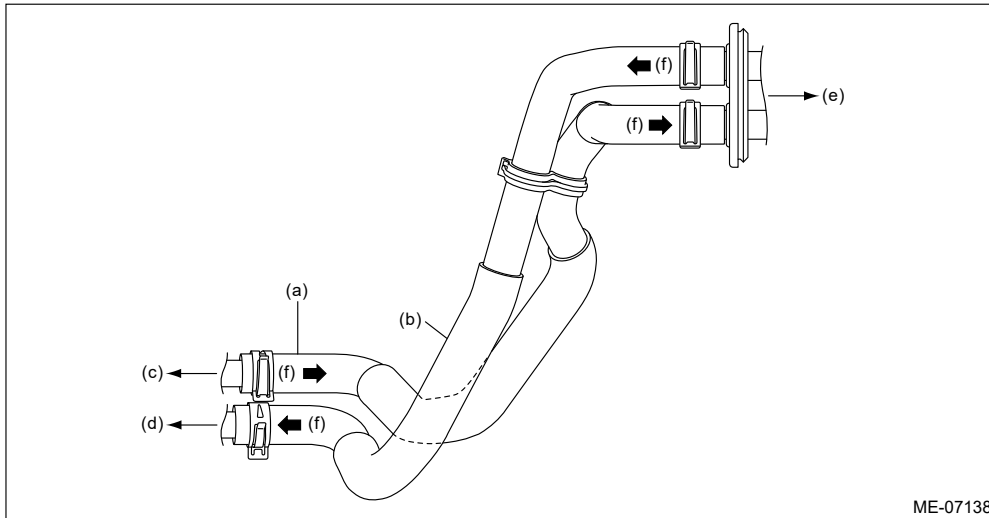
- 16.** Connect the engine coolant inlet hose and engine coolant outlet hose to the CVTF cooler (with warmer feature) and EGR cooler.



- 17.** Connect the heater inlet hose (A) to the water pipe assembly, and connect the heater outlet hose (B) to the water pipe LH.

Note:

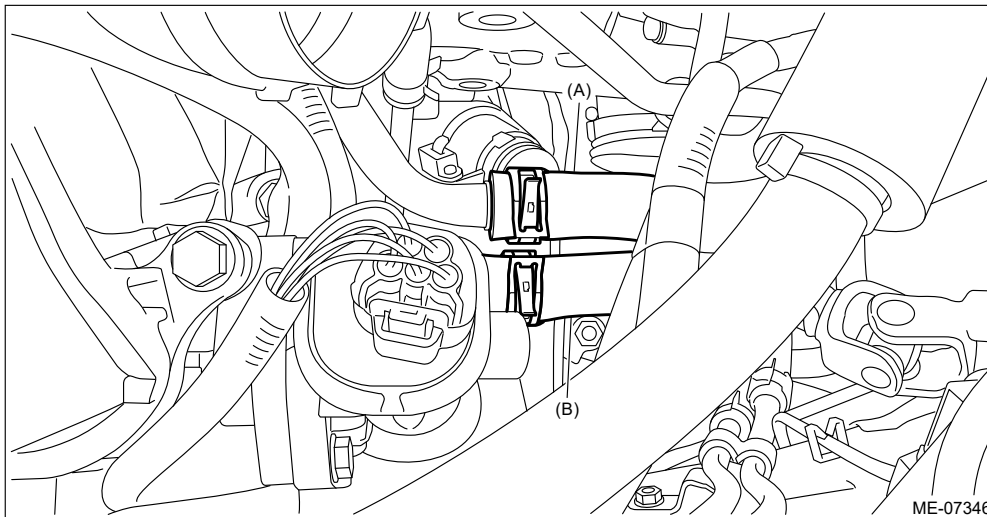
Be careful not to mix up the heater inlet hose and the heater outlet hose when connecting them.




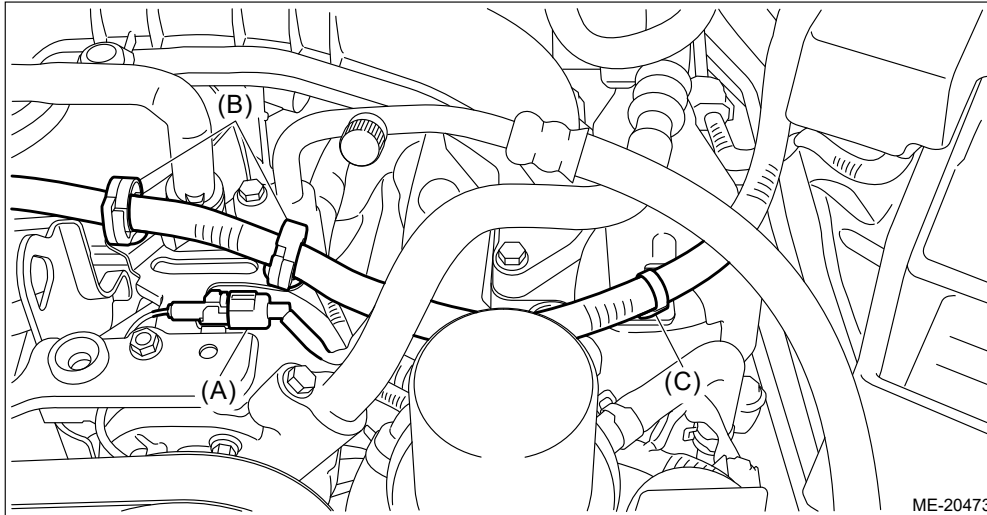
(a) Heater inlet hose
(b) Heater outlet hose

(c) To water pipe ASSY
(d) To water pipe LH

(e) To heater core ASSY
(f) Engine coolant flow



- 18.** Connect the A/C pressure hose to A/C compressor.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Hose and Pipe>INSTALLATION.](#)
- 19.** Set the generator cord, and fix the generator cord to the fuel pipe protector using clip (C).
- 20.** Install the generator cord to clip (B), and connect the connector (A) to A/C compressor.

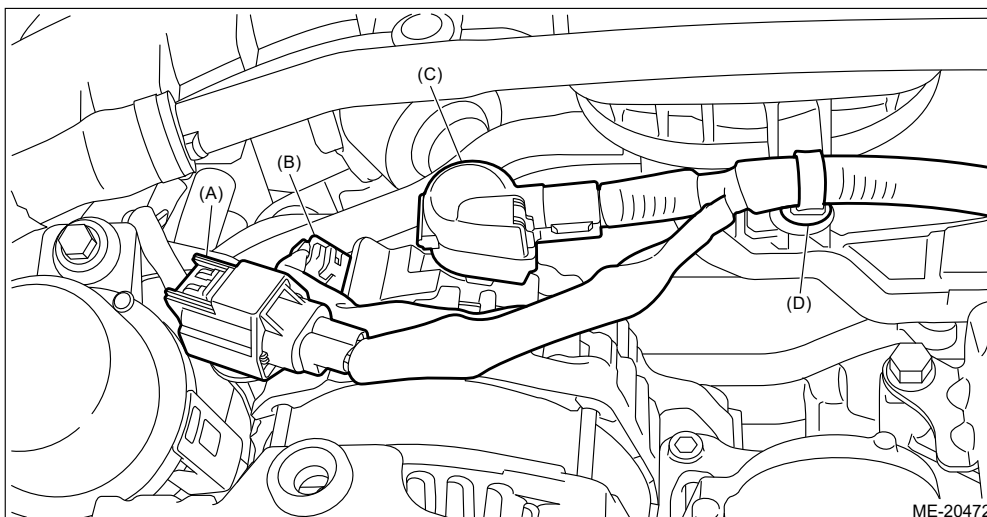


- 21.** Using clip (D), fix the generator cord to the generator cord stay, and connect the connector (B) and the terminal (C) to the generator.

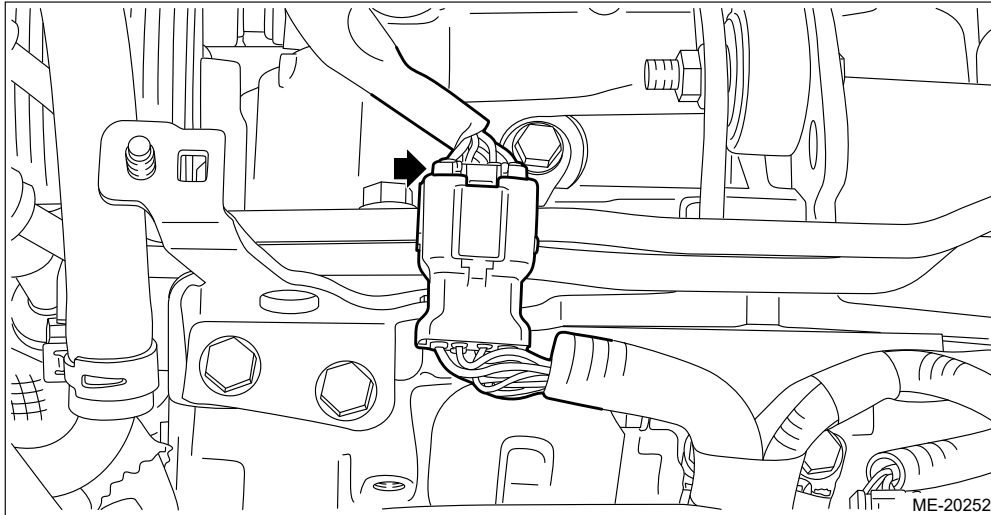
Tightening torque:

15 N·m (1.5 kgf-m, 11.1 ft-lb)

- 22.** Connect the connector (A) to the brake vacuum pump.



- 23.** Connect the bulkhead harness connector to the engine harness connector.

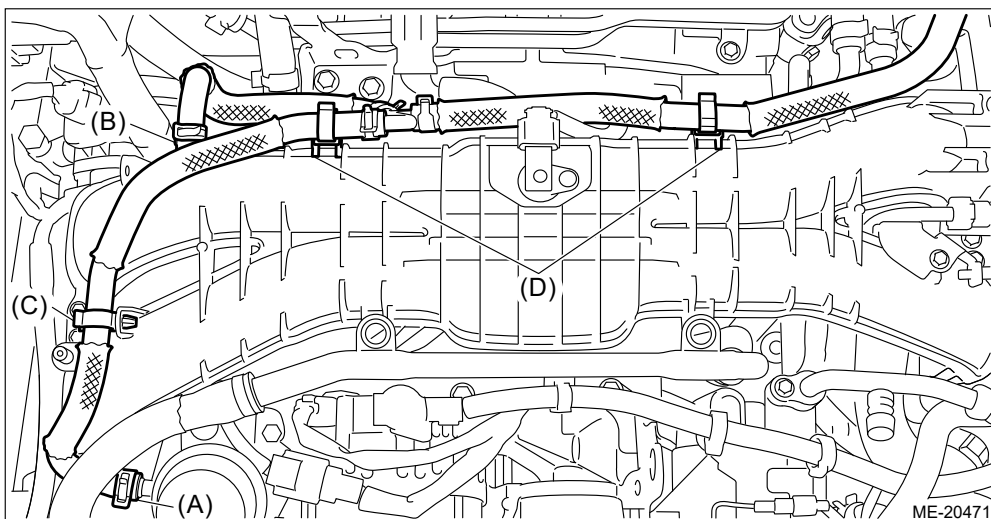


- 24.** Install the brake booster vacuum hose to the clip (D).

Note:

If the clip is removed from the intake manifold, install the clip to the position of alignment mark ▼ of intake manifold.

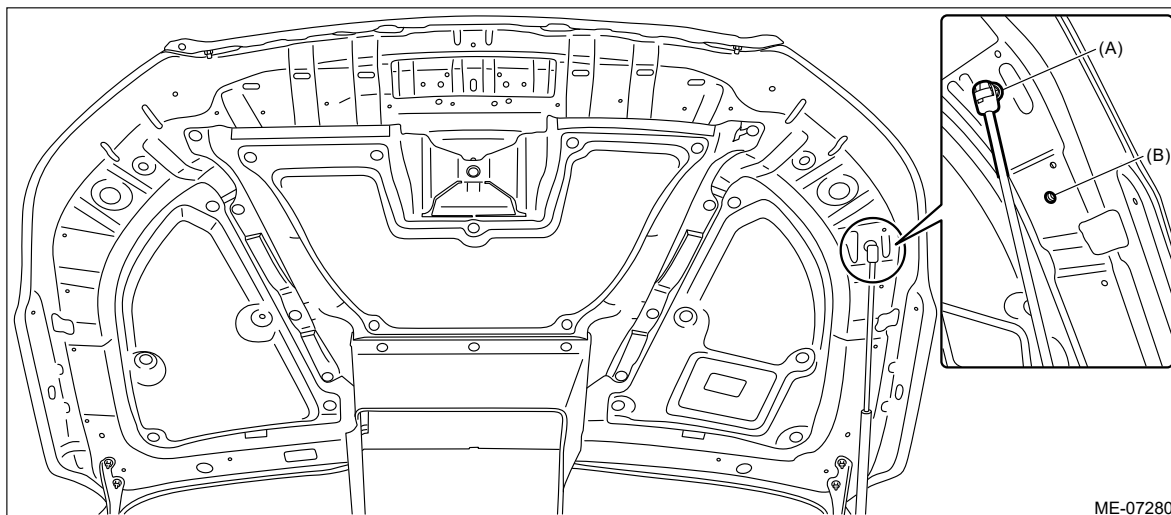
- 25.** Connect sections (A) and (B) of the brake booster vacuum hose to the brake vacuum pump and intake manifold, and install the brake booster vacuum hose to the clip (C).



- 26.** Install the radiator. [Ref. to COOLING\(H4DOTC\)>Radiator>INSTALLATION.](#)
- 27.** Install the intake duct No. 1 and intake duct No. 2. [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>INSTALLATION > INTAKE DUCT NO. 1.](#) [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>INSTALLATION > INTAKE DUCT NO. 2.](#)
- 28.** Install the intercooler. [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>INSTALLATION.](#)
- 29.** Install the air intake duct. [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
- 30.** Connect the battery ground terminal. [Ref. to NOTE>NOTE > BATTERY.](#)
- 31.** Charge the A/C system with refrigerant. [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Refrigerant Charging Procedure>PROCEDURE.](#)
- 32.** Fill engine coolant. [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
- 33.** Install the collector cover.
- 34.** Change the installation position of the front hood damper from (B) to (A).

Tightening torque:

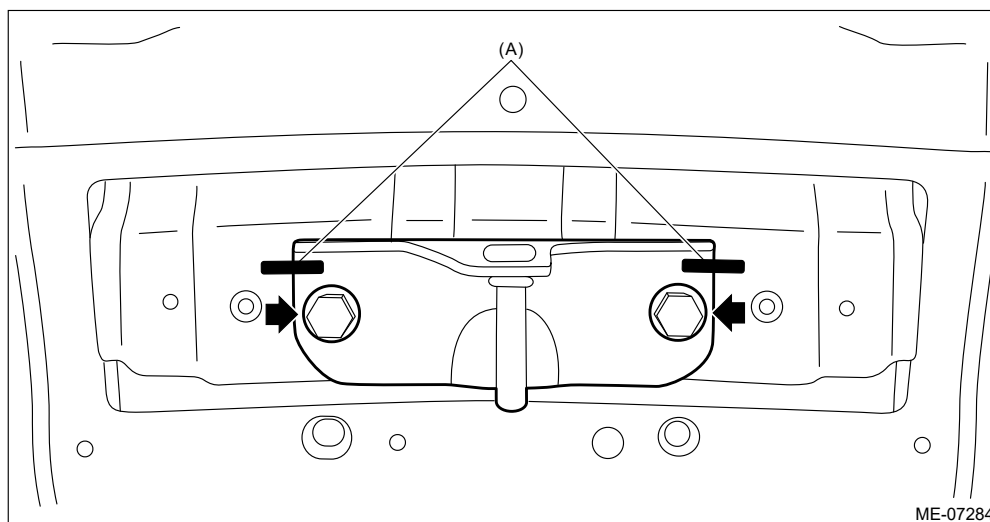
20 N·m (2.0 kgf·m, 14.8 ft·lb)




35. Align the alignment marks (A), and install the front hood striker to the front hood.

Tightening torque:


33 N·m (3.4 kgf-m, 24.3 ft-lb)

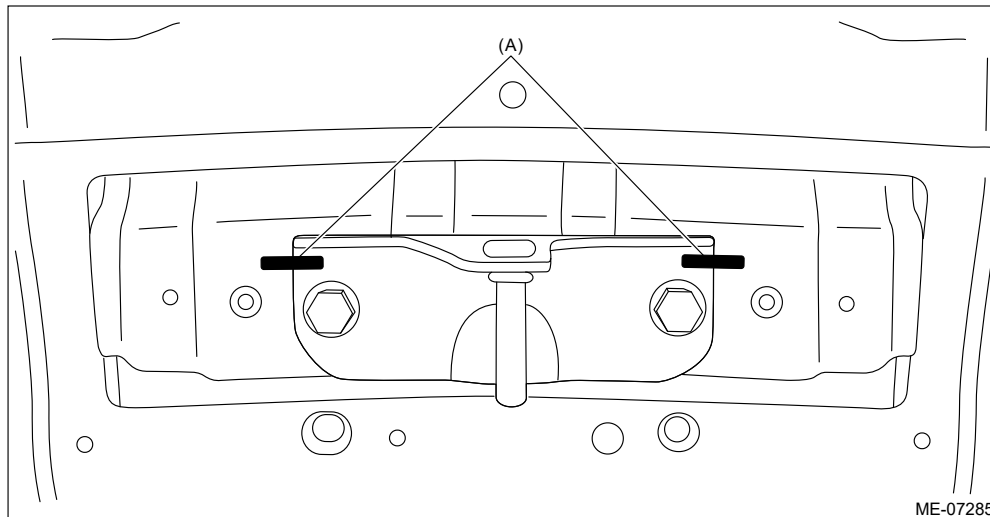


36. Install the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>INSTALLATION.](#)

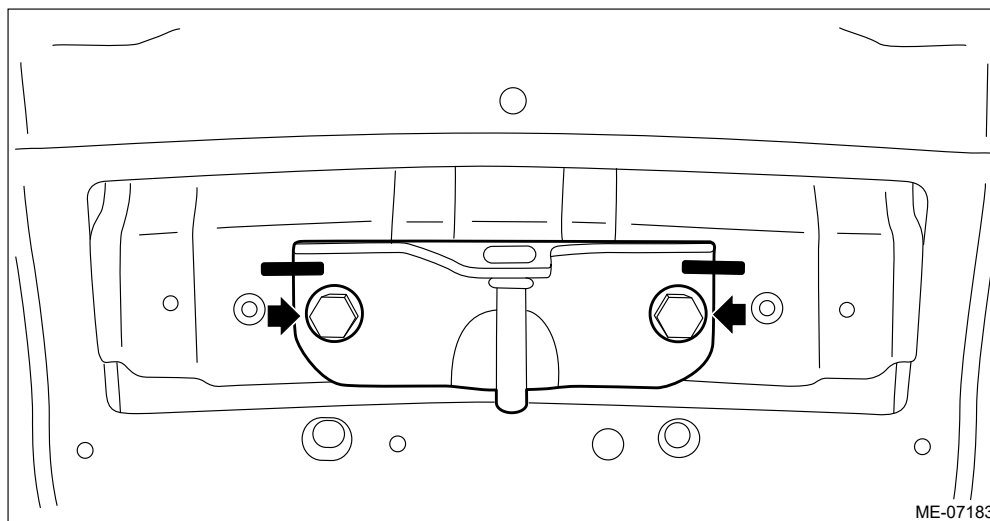
MECHANICAL(H4DOTC) > Engine Assembly

REMOVAL

1. Remove the bracket - grille UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>REMOVAL > FRONT GRILLE UPPER.](#)
2. Using a marker pen, make alignment marks (A) on both the front hood and the front hood striker.



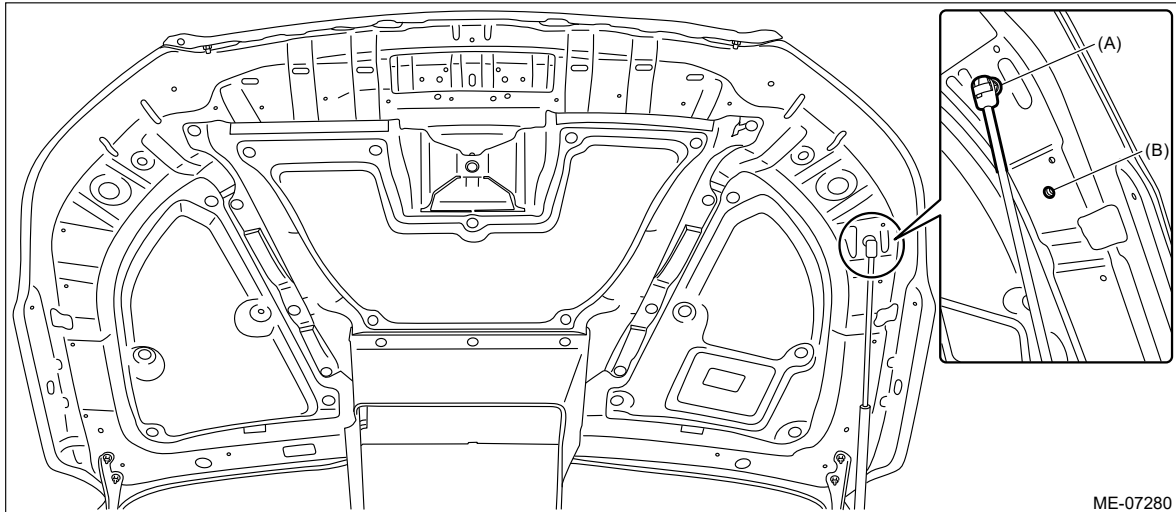
3. Remove the front hood striker from the front hood.



4. Change the front hood damper mounting position from (A) to (B), and completely open the front hood.

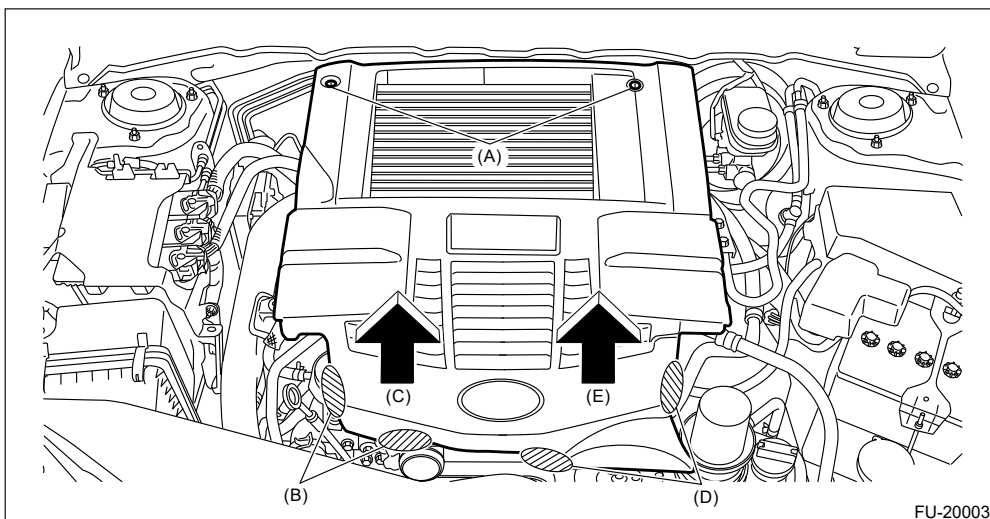
Tightening torque:

20 N·m (2.0 kgf-m, 14.8 ft-lb)




5. Remove the collector cover.

- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



6. Collect the refrigerant from A/C system.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Refrigerant Recovery Procedure.](#)

7. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)

8. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)



9. Open the fuel filler lid and remove the fuel filler cap.

Note:

This operation is required to release the inner pressure of the fuel tank.

10. Remove the air intake duct.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)

11. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)

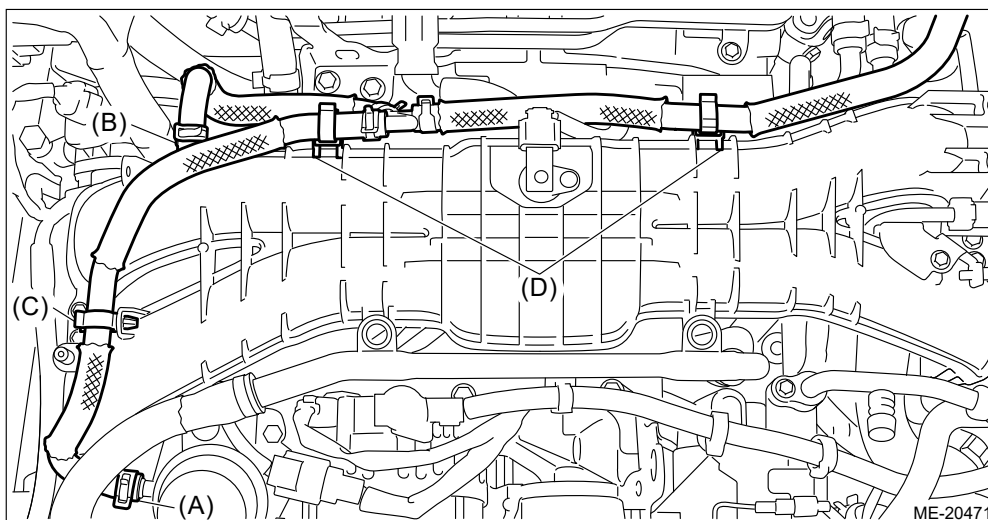
12. Remove the intake duct No. 1 and intake duct No. 2.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 1.](#)  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intake Duct>REMOVAL > INTAKE DUCT NO. 2.](#)

13. Remove the radiator.  [Ref. to COOLING\(H4DOTC\)>Radiator>REMOVAL.](#)

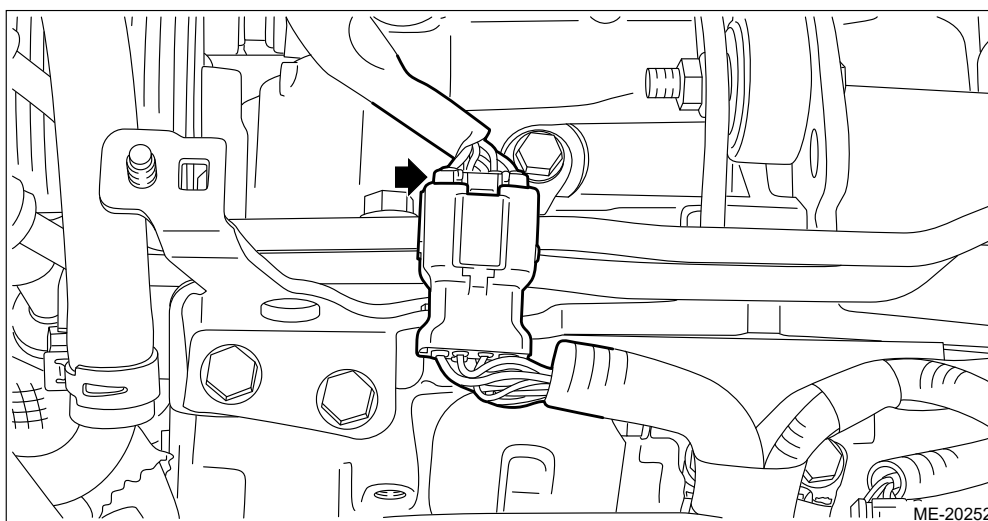
14. Disconnect sections (A) and (B) of the brake booster vacuum hose from the brake vacuum pump and intake manifold, and remove the brake booster vacuum hose from the clip (C).

15. Remove the brake booster vacuum hose from the clip (D), and place the brake booster vacuum hose aside so

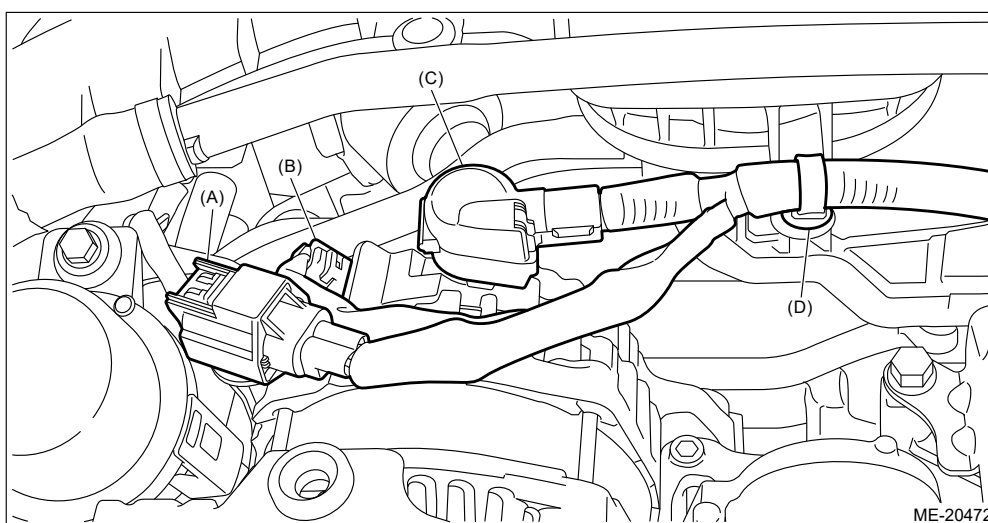
that it does not interfere with the work.



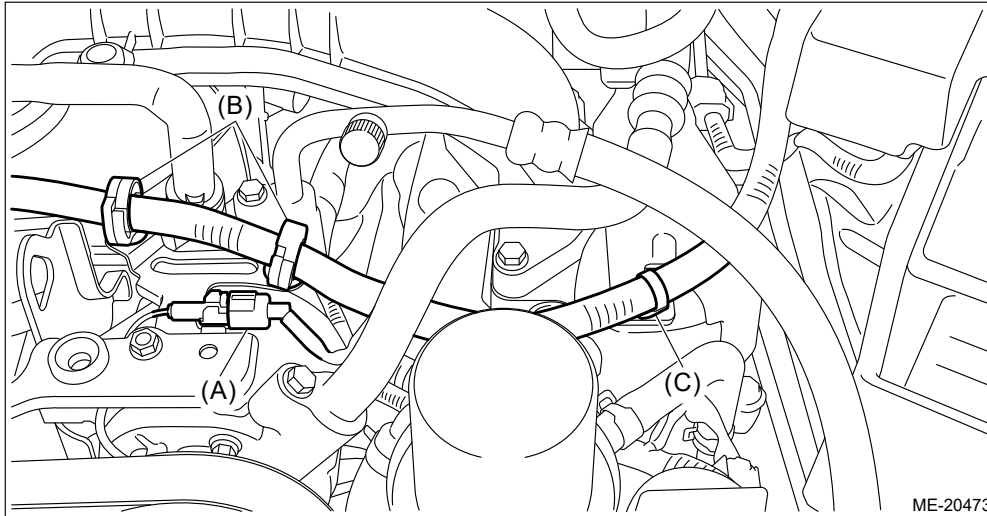
- 16. Disconnect the bulkhead harness connectors from the engine harness connectors.




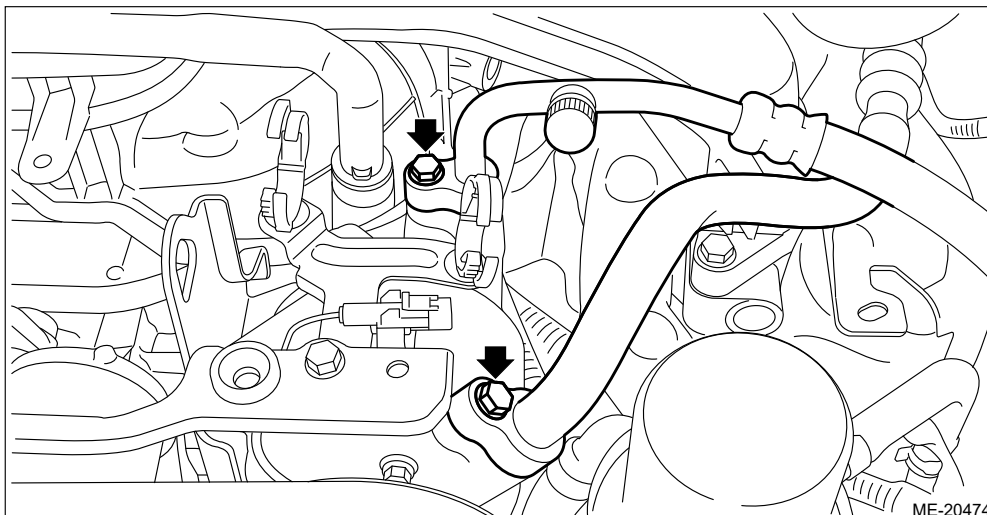
- 17. Disconnect the connector (A) from the brake vacuum pump.
- 18. Disconnect connector (B) and terminal (C) from the generator, and remove the clip (D) securing the generator cord to the intake manifold.



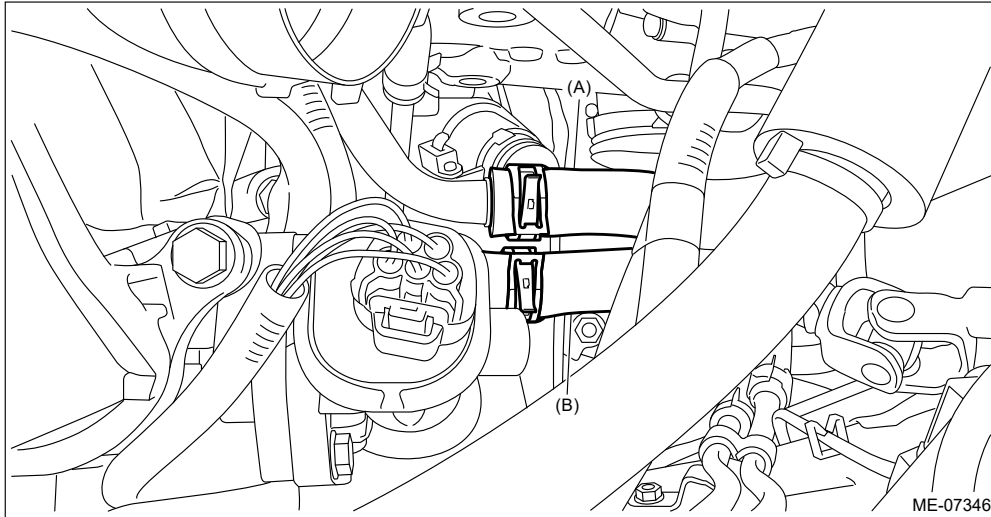
19. Disconnect connector (A) from A/C compressor, and remove the generator cord from clip (B).
20. Remove the clip (C) securing the generator cord to the fuel pipe protector, and move the generator cord aside so that it does not interfere with the work.



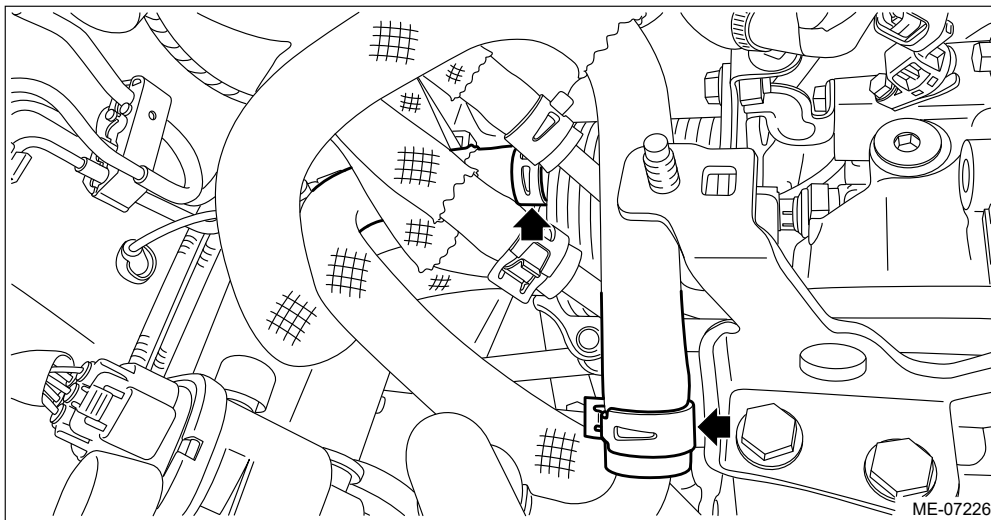
21. Disconnect the A/C pressure hoses from A/C compressor.  [Ref. to HVAC SYSTEM \(HEATER, VENTILATOR AND A/C\)>Hose and Pipe>REMOVAL.](#)




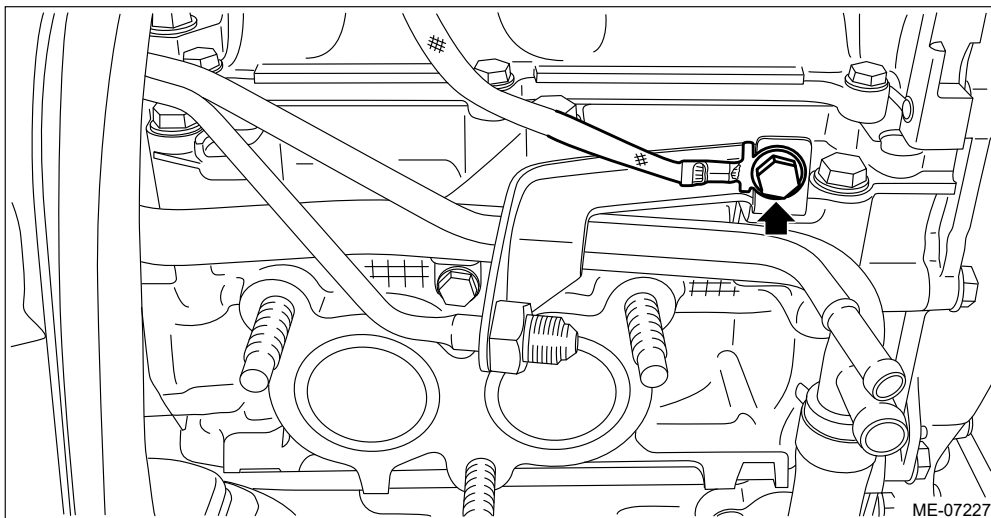
22. Disconnect the heater inlet hose (A) from the water pipe assembly, and disconnect the heater outlet hose (B) from the water pipe LH.



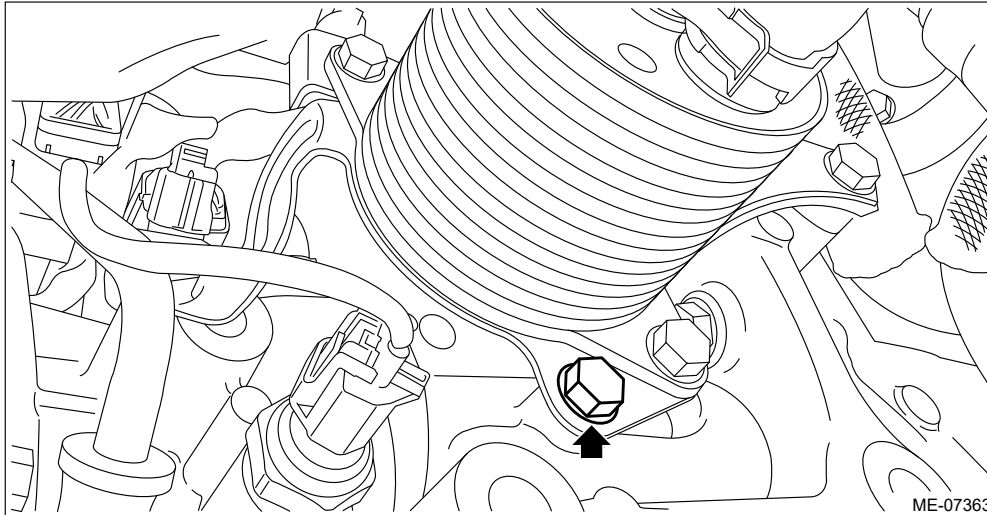
- 23.** Disconnect the engine coolant inlet hose and engine coolant outlet hose from the CVTF cooler (with warmer feature) and EGR cooler.



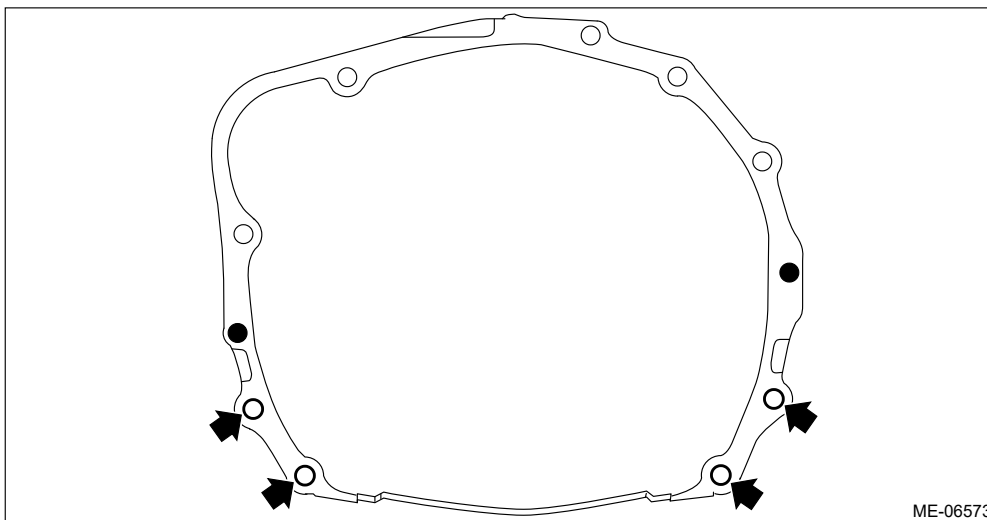
- 24.** Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>REMOVAL.](#)
- 25.** Disconnect the ground cable from the oil pipe assembly.



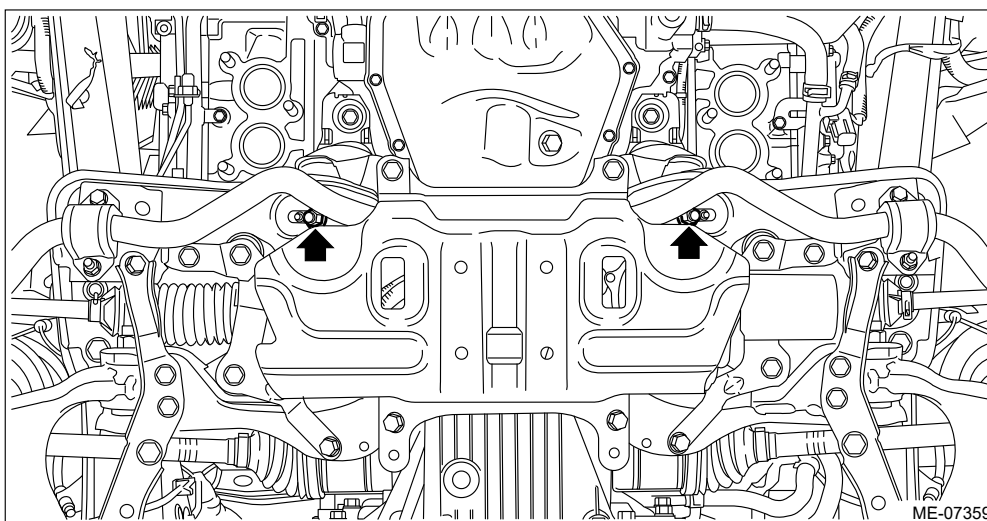
- 26.** Remove the lower bolt securing the CVTF cooler (with warmer feature) to the CVT.



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

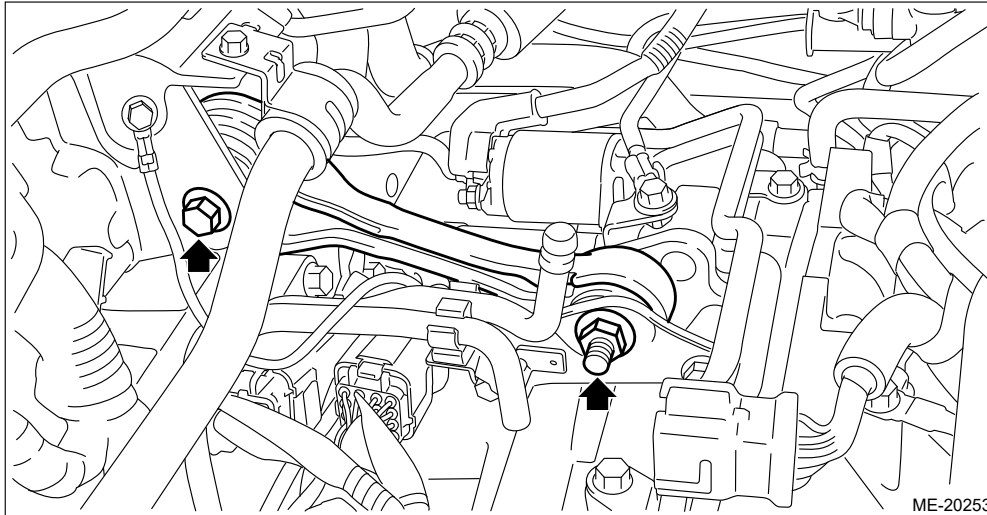


28. Remove the nuts which secure the engine mounting to the front crossmember.



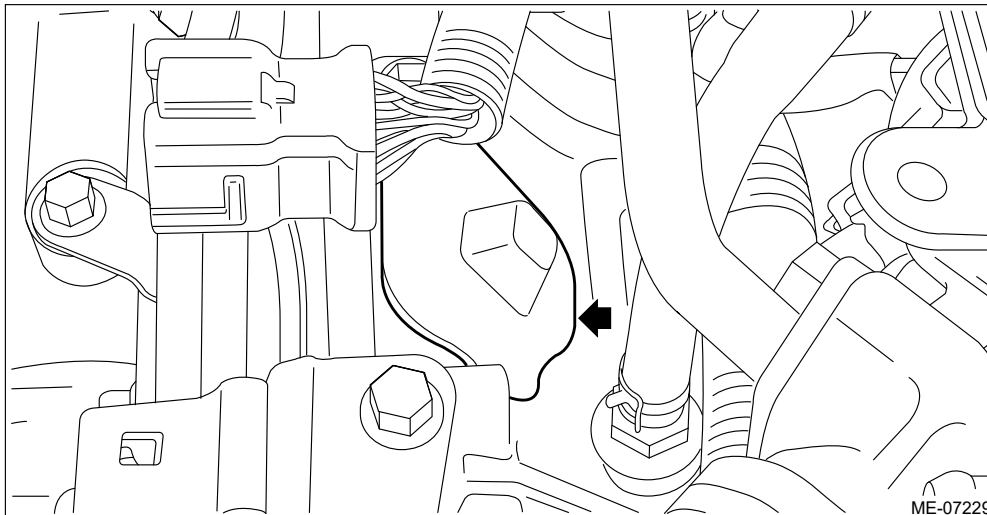
29. Lower the vehicle.

30. Remove the pitching stopper.

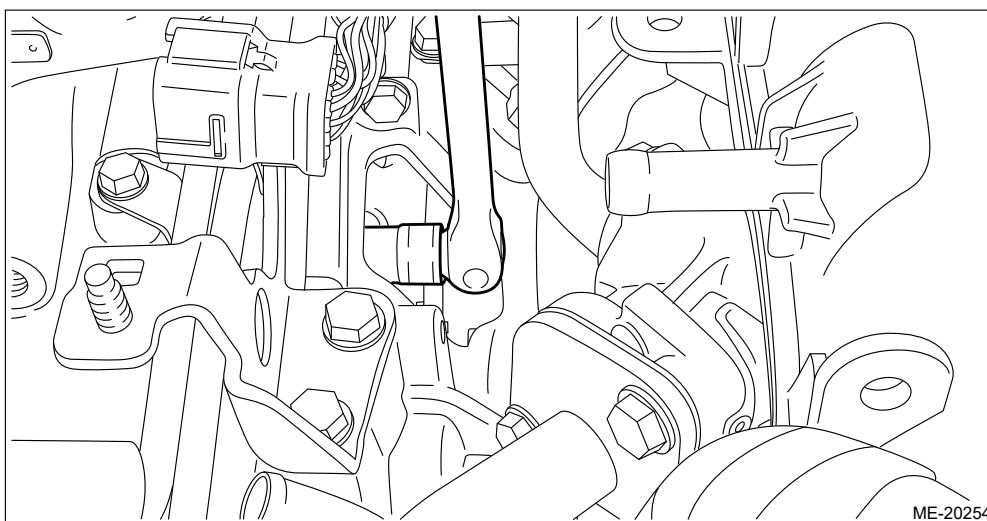


31. Separate the torque converter clutch from the drive plate.

- (1) Remove the starter.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Starter>REMOVAL.](#)
- (2) Remove the service hole plug.

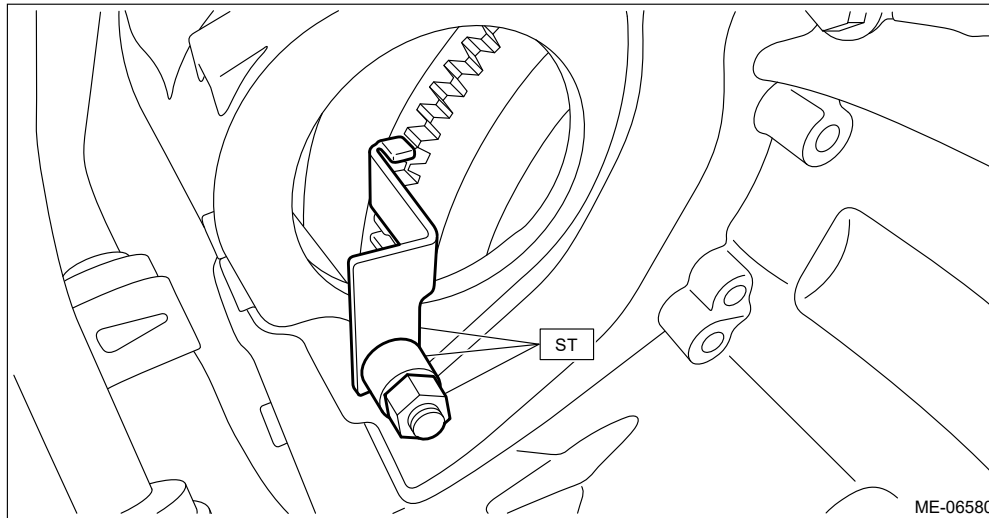


- (3) Insert the wrench into the crank pulley bolt and rotate the crank pulley to remove the bolts which hold torque converter clutch to drive plate.

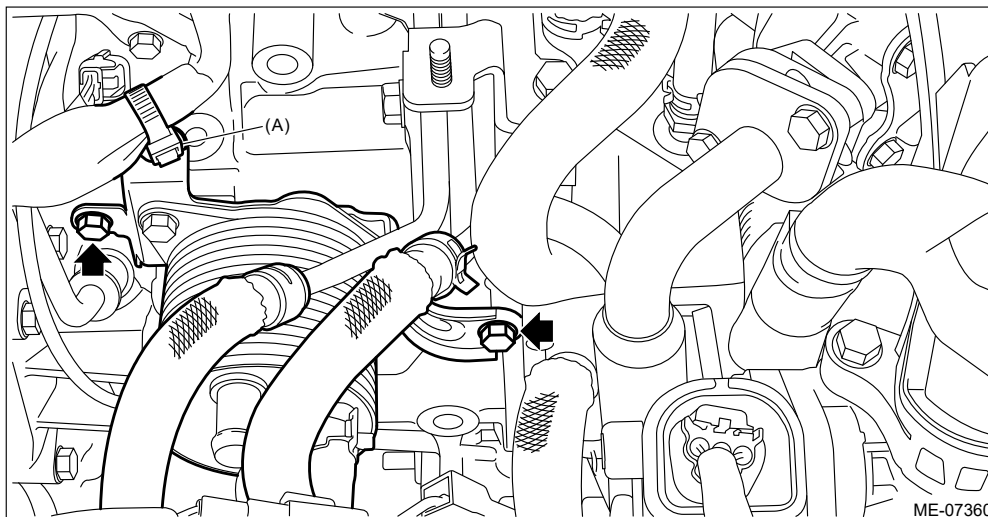


(4) Attach the ST to the torque converter clutch case.

ST 498277200 STOPPER SET



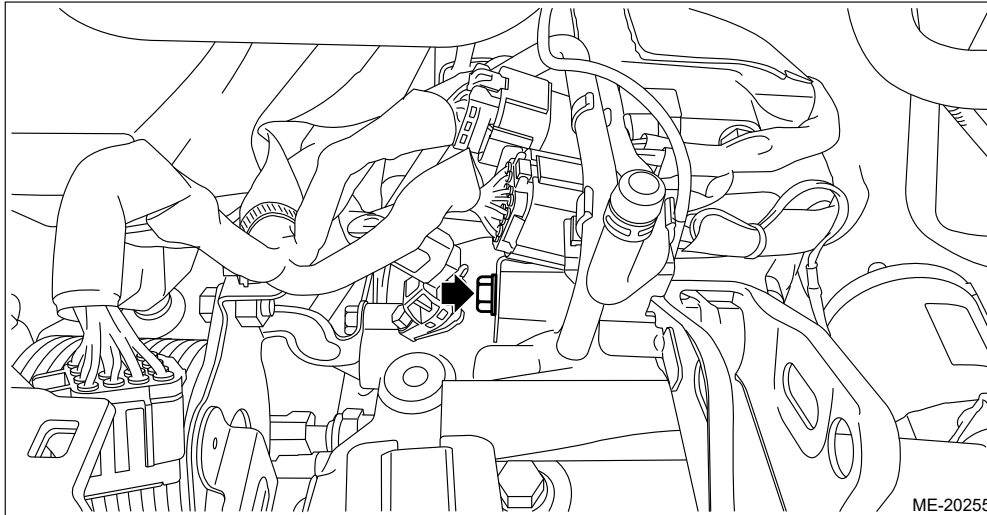
- 32.** Remove the clip (A) securing the bulkhead harness to the CVTF cooler (with warmer feature).
- 33.** Remove the upper bolt securing the CVTF cooler (with warmer feature) to the CVT, and move the CVTF cooler (with warmer feature) at the locations that do not interfere operation.



- 34.** Remove the bolt securing the transmission harness stay to the CVT.

Note:

This procedure is required to prevent the transmission connector from touching the A/C pressure hose during engine removal/installation.



35. Disconnect the fuel delivery tube and evaporation hose.

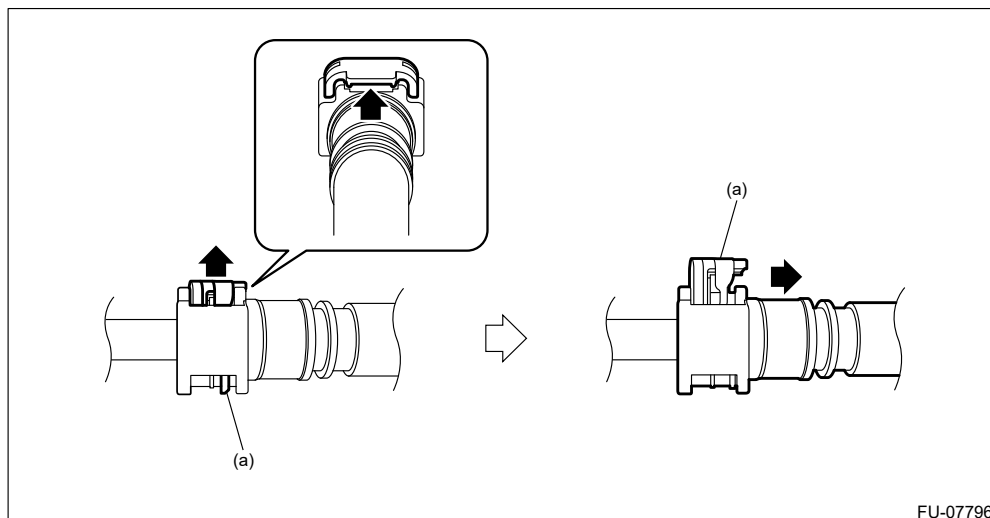
Caution:

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

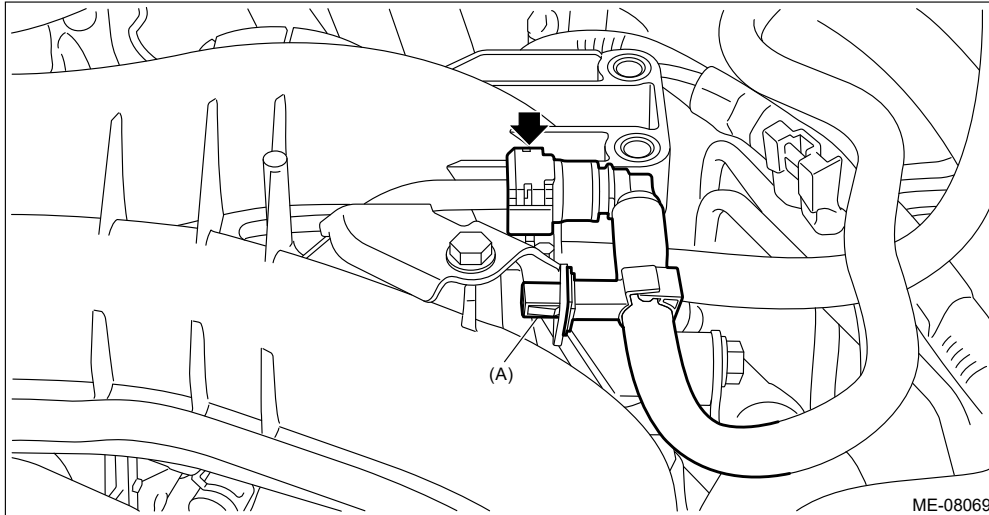
- (1) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube.

Note:

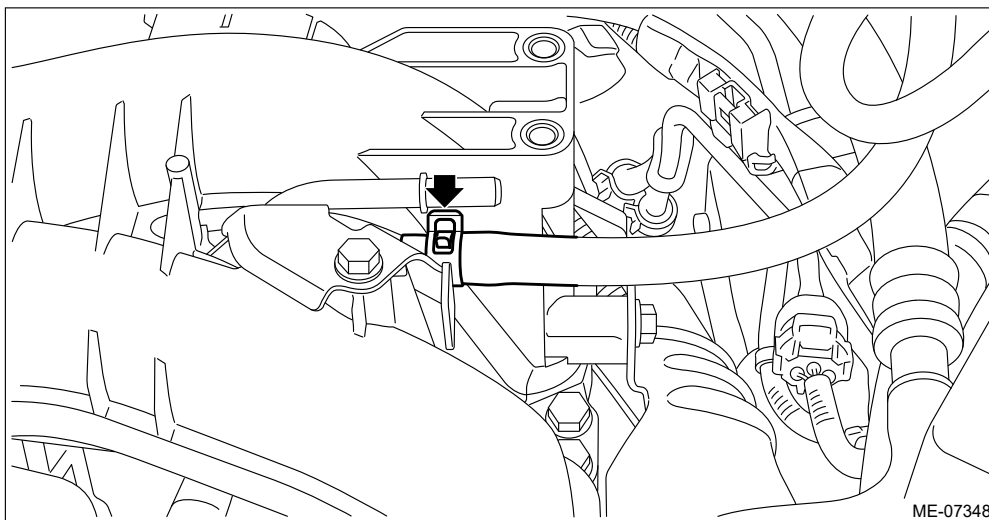
Disconnect the quick connector as shown in the figure.



(a) Slider



(2) Disconnect the evaporation hose from the fuel pipe assembly.

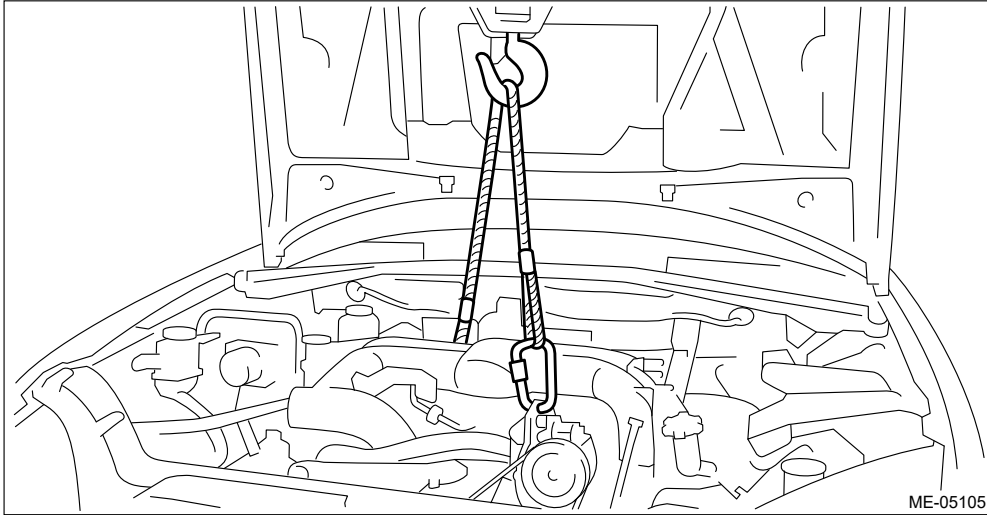


36. Separate the engine and transmission.

Caution:

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

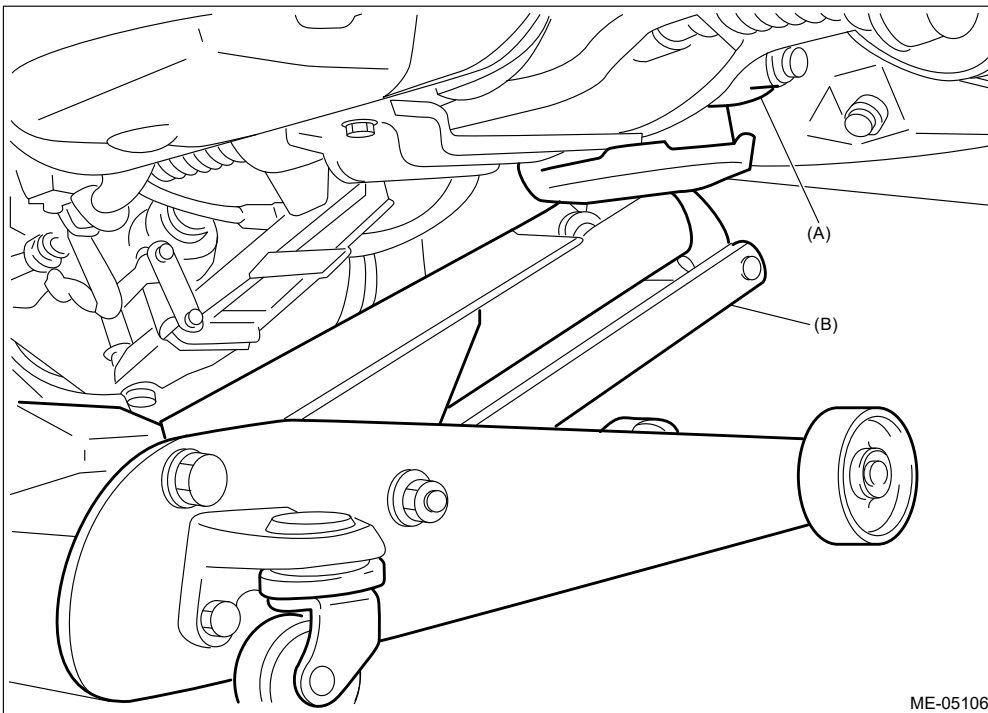
(1) Support the engine with a lifting device and wire ropes.



(2) Support the transmission with a garage jack.

Caution:

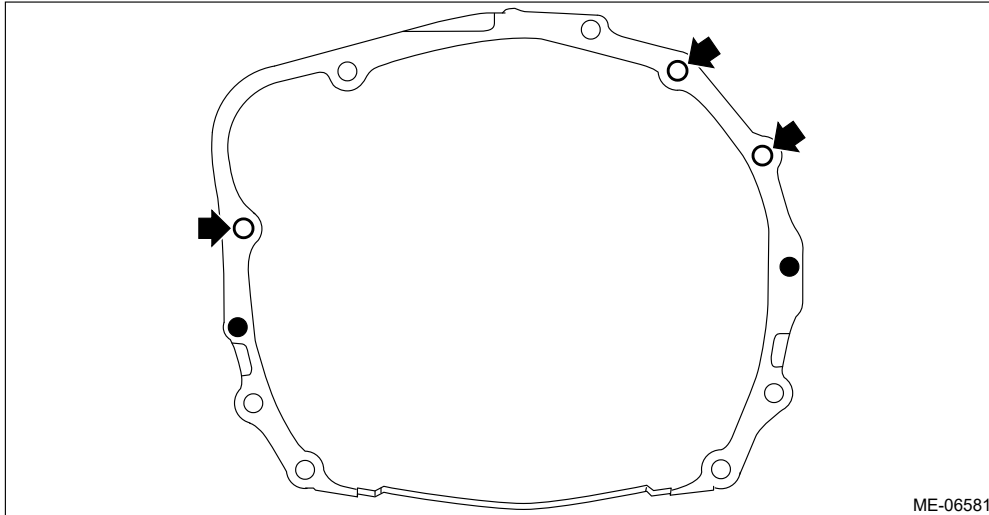
Be sure to perform this procedure to prevent the transmission from lowering by its own weight.



(A) Transmission

(B) Garage jack

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



ME-06581

37. Remove the engine from the vehicle.

Note:

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

- (1) Move the engine horizontally until engine is withdrawn from transmission.
- (2) Slowly move the engine away from engine compartment.

38. Remove the engine mounting from the engine.

MECHANICAL(H4DOTC) > Engine Mounting

INSPECTION

Make sure that there are no cracks or other damages.

MECHANICAL(H4DOTC) > Engine Mounting

INSTALLATION


Install in the reverse order of removal.

Tightening torque:

35 N·m (3.6 kgf-m, 25.8 ft-lb)

MECHANICAL(H4DOTC) > Engine Mounting


REMOVAL

1. Remove the front crossmember.  [Ref. to FRONT SUSPENSION>Front Crossmember>REMOVAL.](#)
2. Remove the engine mounting from the engine.

MECHANICAL(H4DOTC) > Engine Noise



INSPECTION

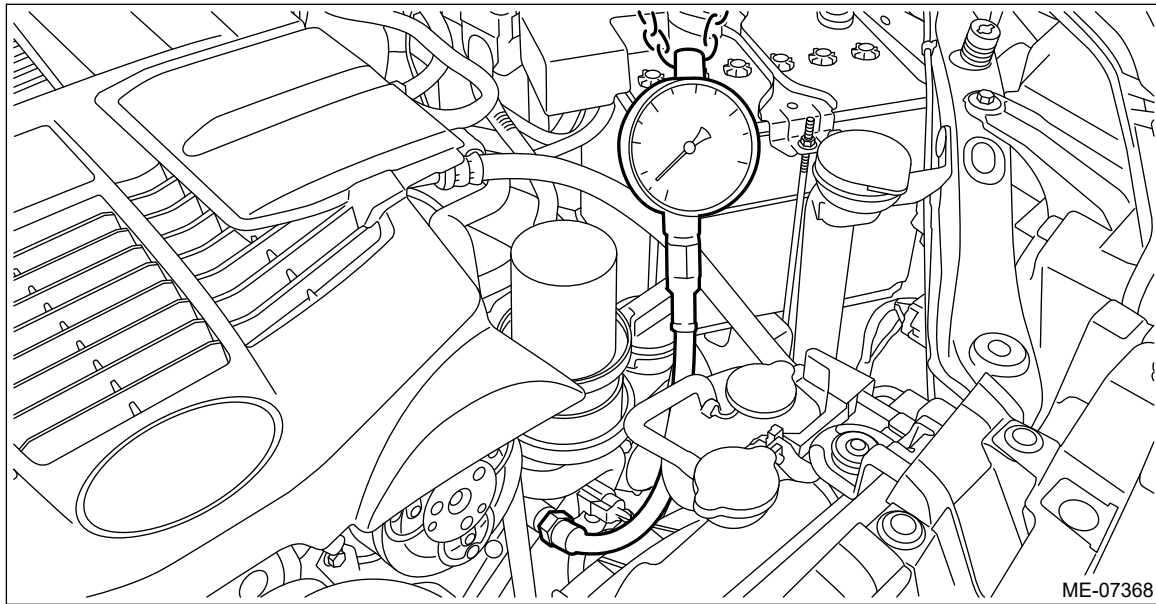
| Type of sound | Condition | Possible cause |
|---|--|--|
| Regular clicking sound | Sound increases as engine speed increases. | <ul style="list-style-type: none"> Valve mechanism is defective Incorrect cam clearance Worn camshaft Broken valve spring Defective valve shim |
| Heavy and dull clank | Oil pressure is low. | <ul style="list-style-type: none"> Worn crankshaft bearing Worn connecting rod bearing |
| | Oil pressure is normal. | <ul style="list-style-type: none"> Damaged engine mounting |
| High-pitched clank | Sound is noticeable when accelerating with an overload condition. | <ul style="list-style-type: none"> Ignition timing advanced Accumulation of carbon inside combustion chamber Wrong heat range of spark plug Improper octane value gasoline |
| Clank noise when engine speed is (1,000 – 2,000 r/min) | Sound is reduced when the fuel injector of the noisy cylinder is stopped.* | <ul style="list-style-type: none"> Worn crankshaft bearing Worn connecting rod bearing |
| Knocking sound when engine is operating under idling speed and engine is warm | Sound is reduced when the fuel injector of the noisy cylinder is stopped.* | <ul style="list-style-type: none"> Worn cylinder liner and piston ring Broken or stuck piston ring Worn piston pin and piston pin hole of piston |
| | Sound is not reduced if each fuel injector is stopped in turn.* | <ul style="list-style-type: none"> Unusually worn valve rocker Unusually worn valve shim Worn cam sprocket Worn journal of cam carrier and camshaft cap |
| Squeaky sound | — | <ul style="list-style-type: none"> Insufficient generator lubrication |
| Rubbing sound | — | <ul style="list-style-type: none"> Poor contact of generator brush and rotor |
| 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"> Defective V-belt tensioner assembly (loose V-belt) Defective water pump shaft |
| Hissing sound | — | <ul style="list-style-type: none"> Insufficient compression Air leakage in air intake system, hose, connection or manifold |
| Timing chain noise | — | <ul style="list-style-type: none"> Loose timing chain Timing chain contacting with adjacent part |
| Valve noise | — | <ul style="list-style-type: none"> Incorrect cam clearance |


* Fuel injector can be stopped using the Subaru Select Monitor.  [Ref. to ENGINE \(DIAGNOSTICS\) \(H4DOTC\)>Active Test>OPERATION.](#)

MECHANICAL(H4DOTC) > Engine Oil Pressure



INSPECTION

1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the oil pressure switch.  [Ref. to LUBRICATION\(H4DO\)>Oil Pressure Switch>REMOVAL.](#)
3. Install the oil pressure gauge to the chain cover.



4. Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
5. Start the engine, and check the oil pressure.

Note:

- Standard value is based on an engine oil temperature of 80°C (176°F).
- If the oil pressure is out of specification, check oil pump, oil filter and lubrication line.  [Ref. to LUBRICATION\(H4DO\)>Engine Lubrication System Trouble in General>INSPECTION.](#)
- If the oil pressure warning light is ON and oil pressure is within standard, check the oil pressure switch.  [Ref. to LUBRICATION\(H4DO\)>Engine Lubrication System Trouble in General>INSPECTION.](#)

Engine oil pressure:

While idling (no load and select lever in "P" or "N" range)

Standard

65 kPa (0.7 kg/cm², 9 psi) or more

At 3,000 r/min

Standard

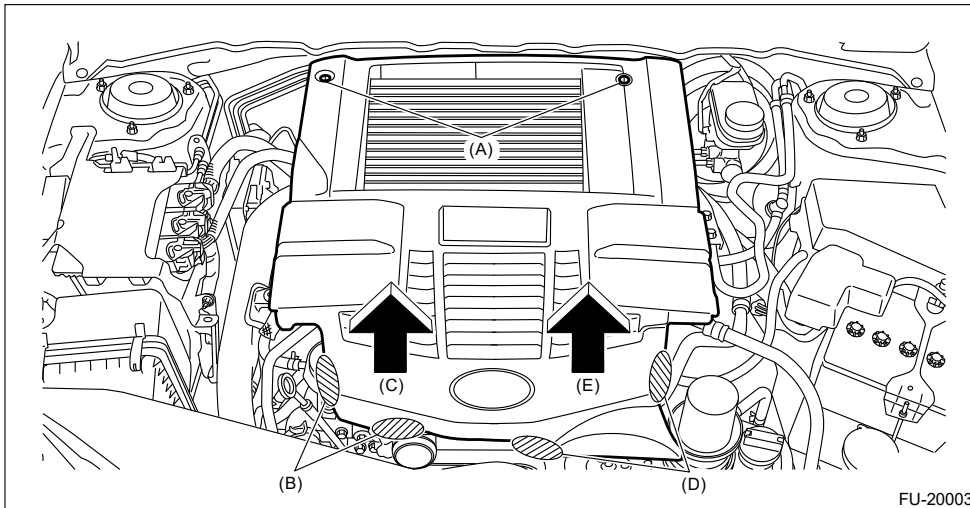
324 kPa (3.3 kg/cm², 47 psi) or more

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

MECHANICAL(H4DOTC) > Fuel Pressure

INSPECTION

1. Remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



2. Release the fuel pressure.  [Ref. to FUEL INJECTION \(FUEL SYSTEMS\)\(H4DOTC\)>Fuel>PROCEDURE > RELEASING OF FUEL PRESSURE.](#)

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

Note:

This operation is required to release the inner pressure of the fuel tank.

4. Disconnect the fuel delivery tube from the fuel delivery pipe, and connect the fuel pressure gauge.

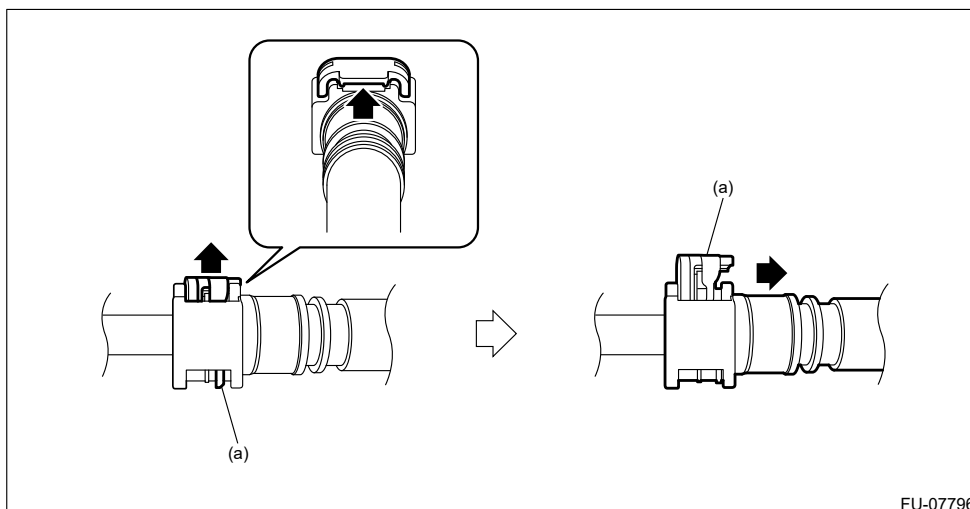
Caution:

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

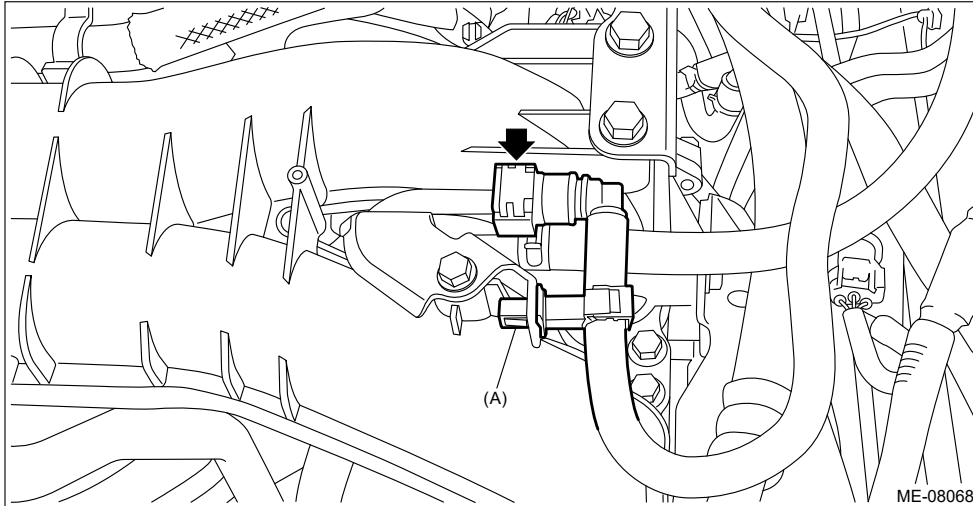
- (1) Disconnect the quick connector on the fuel delivery tube from the fuel pipe assembly, and remove the clip (A) securing the fuel delivery tube to the fuel pipe assembly.

Note:

Disconnect the quick connector as shown in the figure.



(a) Slider



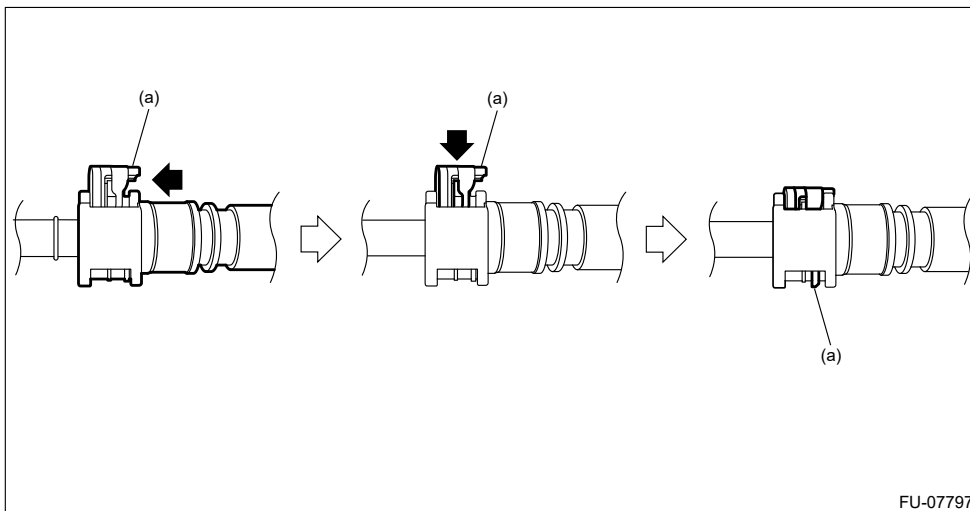
(2) Connect the fuel pressure gauge with ST1 and ST2.

Caution:

- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector with slider, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

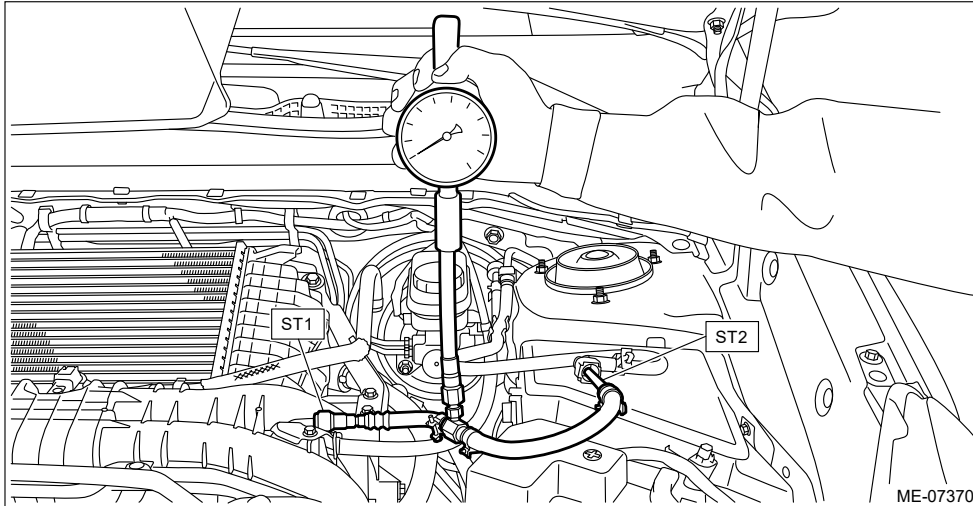
Note:

- ST1 is a SUBARU genuine part.
- When connecting the ST2 to the quick connector on the fuel delivery tube, connect as shown in the figure.



(a) Slider

- | | | |
|------------|-------------------|--------------------------|
| ST1 | 42075AG690 | FUEL HOSE |
| ST2 | 18471AA000 | FUEL PIPE ADAPTER |



5. Start the engine.
6. Check the fuel pressure after warming up the engine.

Note:

- The fuel pressure gauge readings becomes 10 – 20 kPa (0.1 – 0.2 kg/cm², 1 – 3 psi) higher than standard values during high-altitude operations.
- Check or replace the fuel pump and fuel delivery line if the fuel pressure is out of the standard.

Fuel pressure:

Standard

340 – 400 kPa (3.5 – 4.1 kg/cm², 49 – 58 psi)

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

Caution:

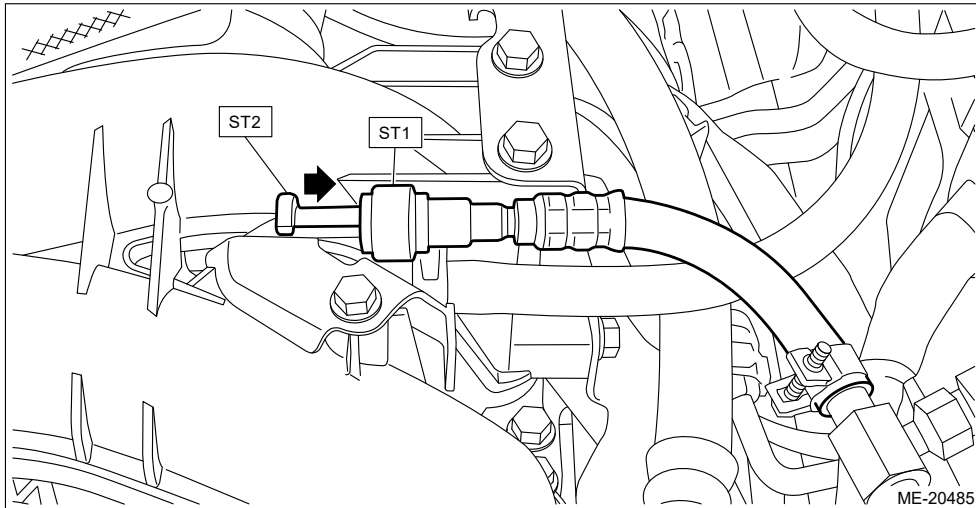
- Before removing the fuel pressure gauge, release the fuel pressure.
- Be careful not to spill fuel.
- Catch the fuel from hoses and tubes using a container or cloth.
- Check that there is no damage or dust on the quick connector. If necessary, clean the seal surface of the pipe.
- When connecting the quick connector with slider, make sure to insert it all the way in before locking the slider.
- When it is difficult to lock the slider, check that the connector is fully inserted.
- After locking the slider, check that the quick connector is securely connected.

Note:

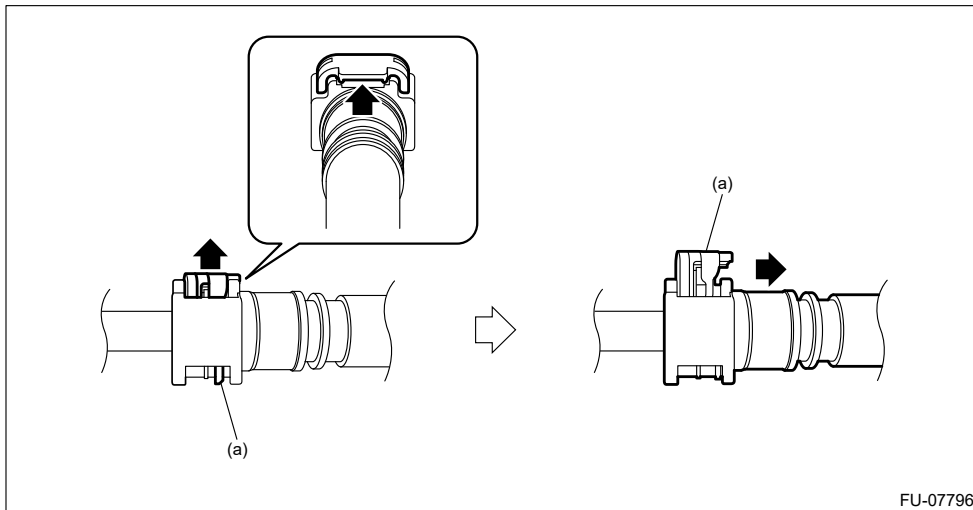
- When disconnecting the ST1, install the ST2 to the fuel pipe assembly, and press the ST2 in the direction of arrow to disconnect the quick connector on the ST1.

ST1 42075AG690 FUEL HOSE

ST2 42099AE000 QUICK CONNECTOR RELEASE

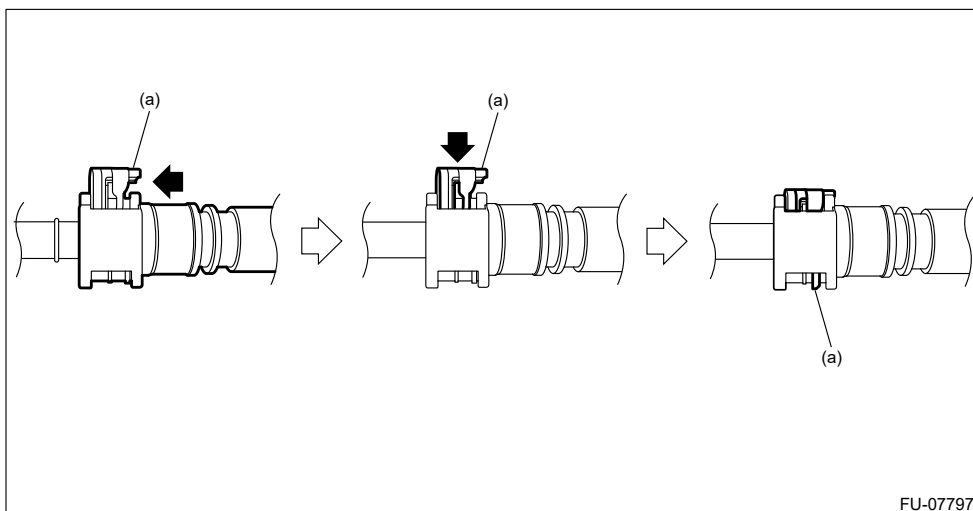


- Disconnect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

- Connect the quick connector on the fuel delivery tube as shown in the figure.



(a) Slider

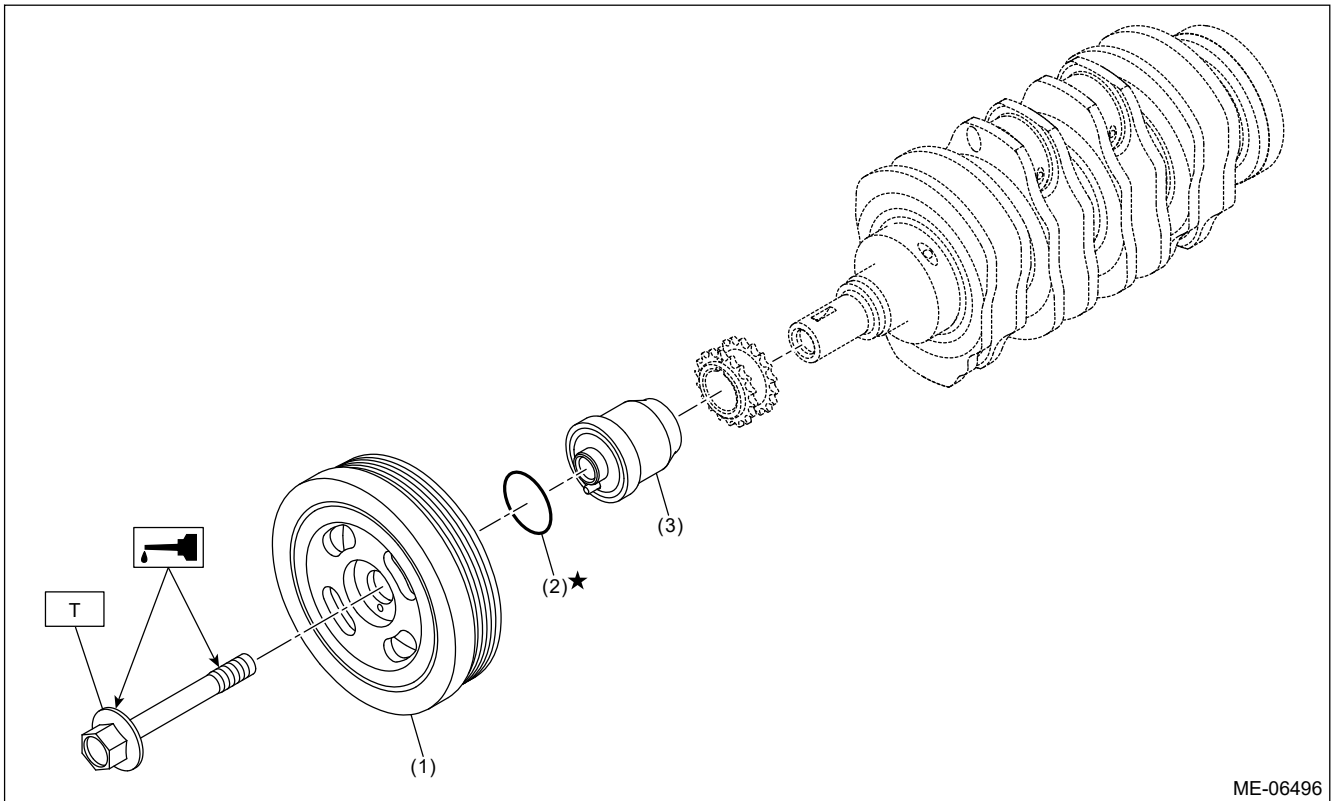
MECHANICAL(H4DOTC) > General Description

CAUTION

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

COMPONENT

1. CRANK PULLEY




(1) Crank pulley

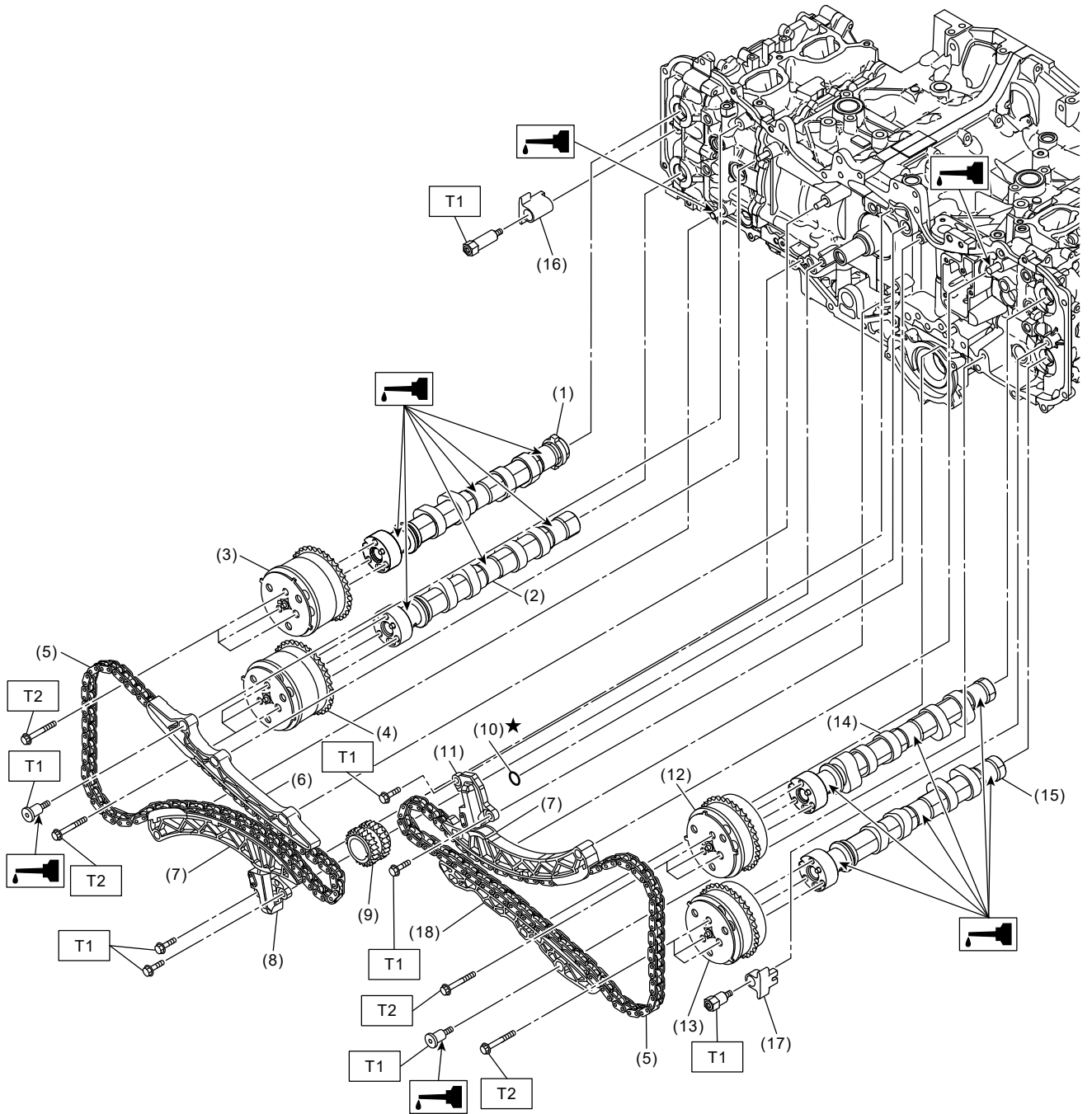
(3) Crank pulley boss

(2) O-ring

Tightening torque: N·m (kgf·m, ft·lb)

T:  **Ref. to**
[MECHANICAL\(H4DOTC\)>Crank Pulley>INSTALLATION.](#)

2. TIMING CHAIN & CAMSHAFT



ME-07893

- | | | |
|-----------------------------|------------------------------|--------------------|
| (1) Intake camshaft RH | (9) Crank sprocket | (17) Chain guide C |
| (2) Exhaust camshaft RH | (10) O-ring | (18) Chain guide D |
| (3) Intake cam sprocket RH | (11) Chain tensioner LH | |
| (4) Exhaust cam sprocket RH | (12) Intake cam sprocket LH | |
| (5) Timing chain | (13) Exhaust cam sprocket LH | |
| (6) Chain guide A | (14) Intake camshaft LH | |
| (7) Chain tension lever | (15) Exhaust camshaft LH | |

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

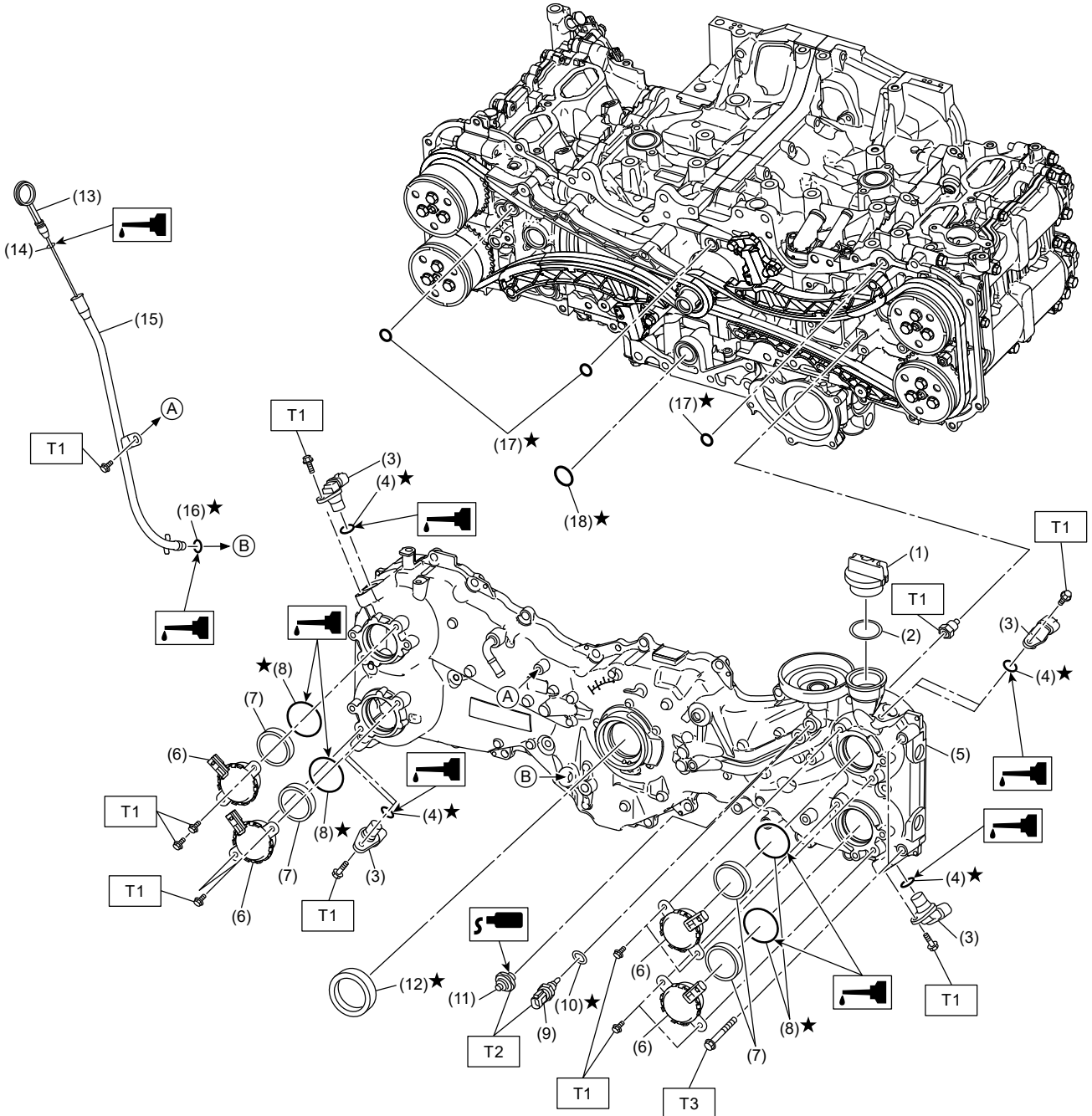
T1: 6.4 (0.7, 4.7)

T2: 18 (1.8, 13.3)

(8) Chain tensioner RH

(16) Chain guide B

3. CHAIN COVER



ME-20128

(1) Oil filler cap

(2) Gasket

(3) Camshaft position sensor

(4) O-ring

(9) Engine oil temperature sensor

(10) Gasket

(11) Oil pressure switch

(12) Front oil seal

(17) O-ring


(18) O-ring

Tightening torque: N·m (kgf·m, ft·lb)

- (5) Chain cover
- (6) Oil control solenoid
- (7) Back-up ring
- (13) Oil level gauge
- (14) O-ring
- (15) Oil level gauge guide

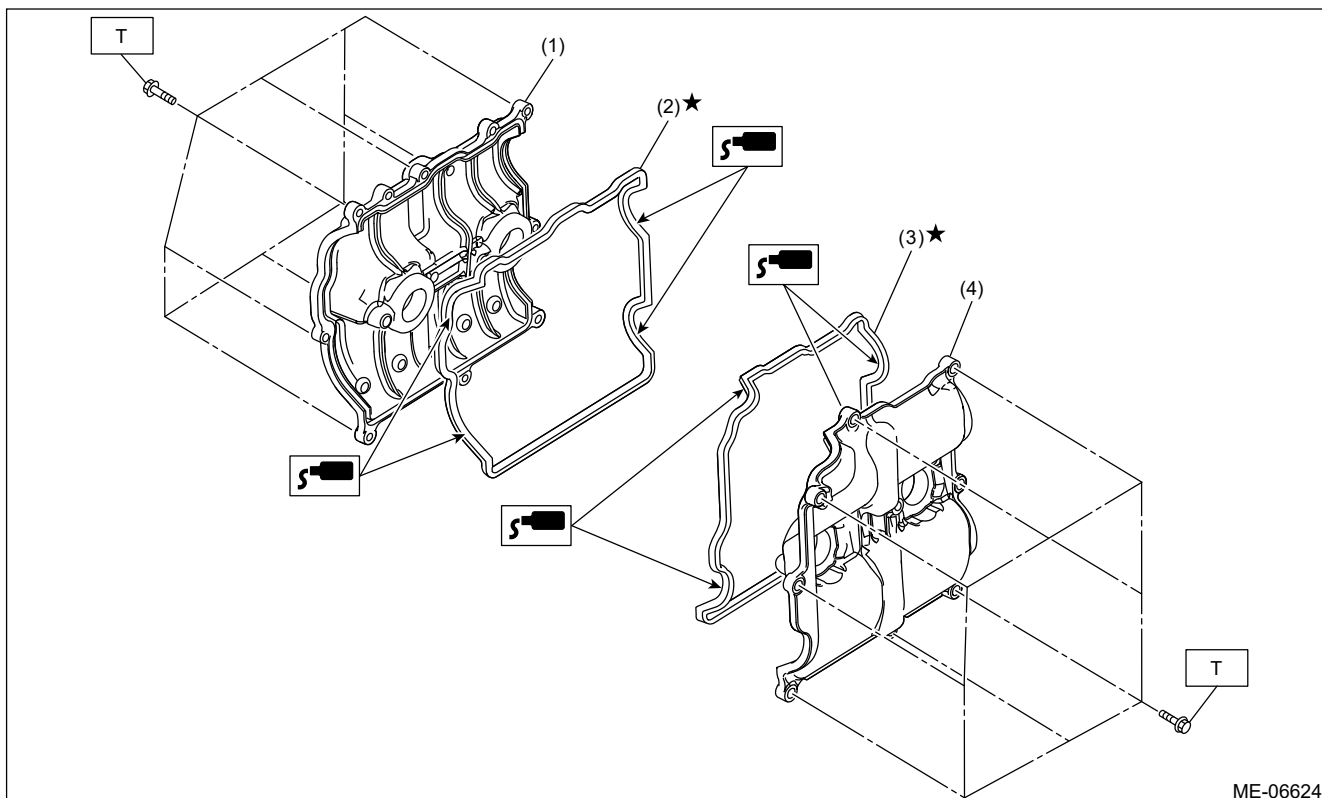
T1: 6.4 (0.7, 4.7)

T2: 18 (1.8, 13.3)

T3:  **Ref. to**
MECHANICAL(H4DOTC)>C
hain
Cover>INSTALLATION.

- (8) O-ring
- (16) O-ring

4. ROCKER COVER




(1) Rocker cover RH

(3) Rocker cover gasket LH

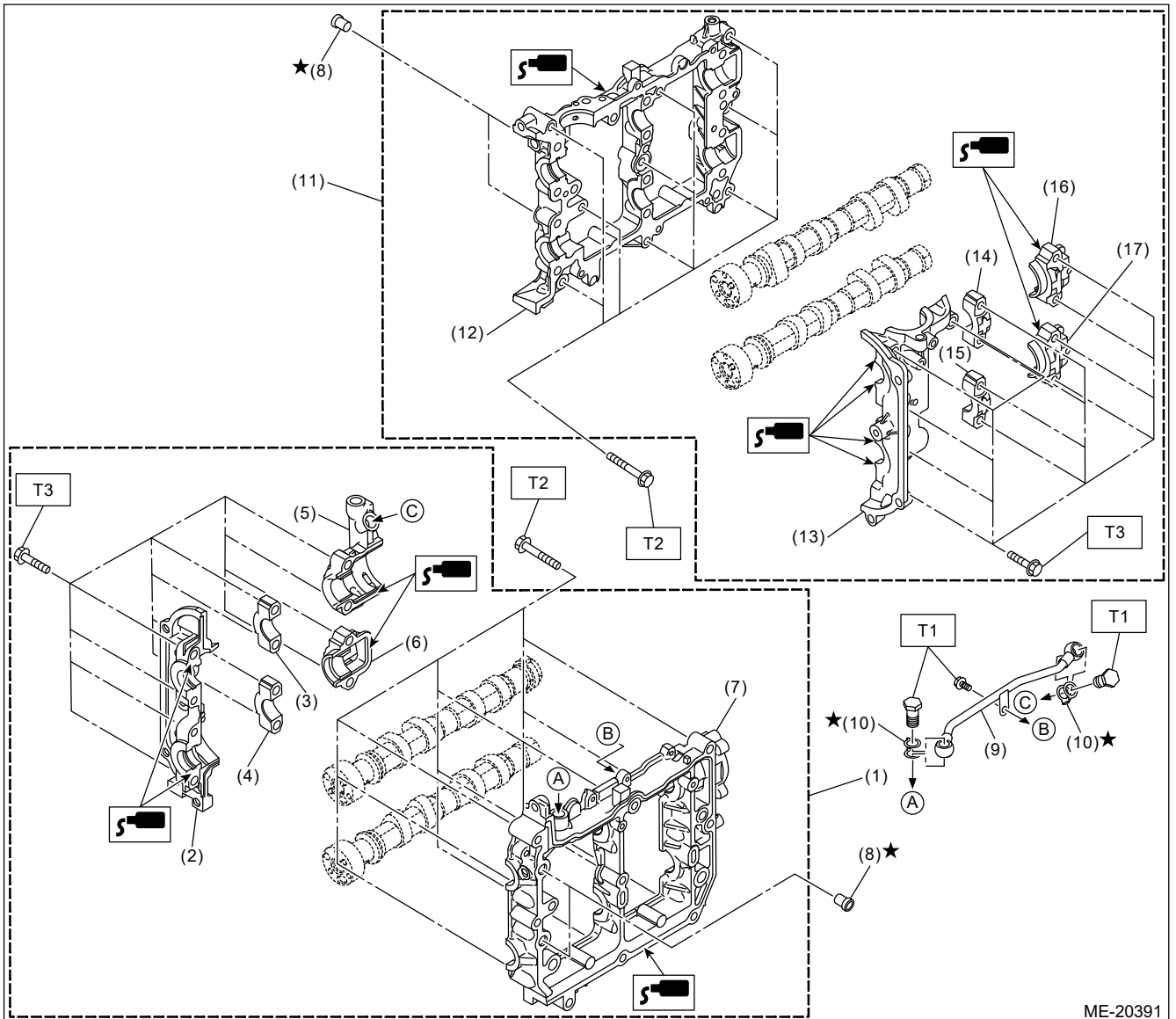
Tightening torque: N·m (kgf·m, ft·lb)

(2) Rocker cover gasket RH

(4) Rocker cover LH

T:  **Ref. to**
MECHANICAL(H4DOTC)>R
ocker
Cover>INSTALLATION.

5. CAM CARRIER



ME-20391

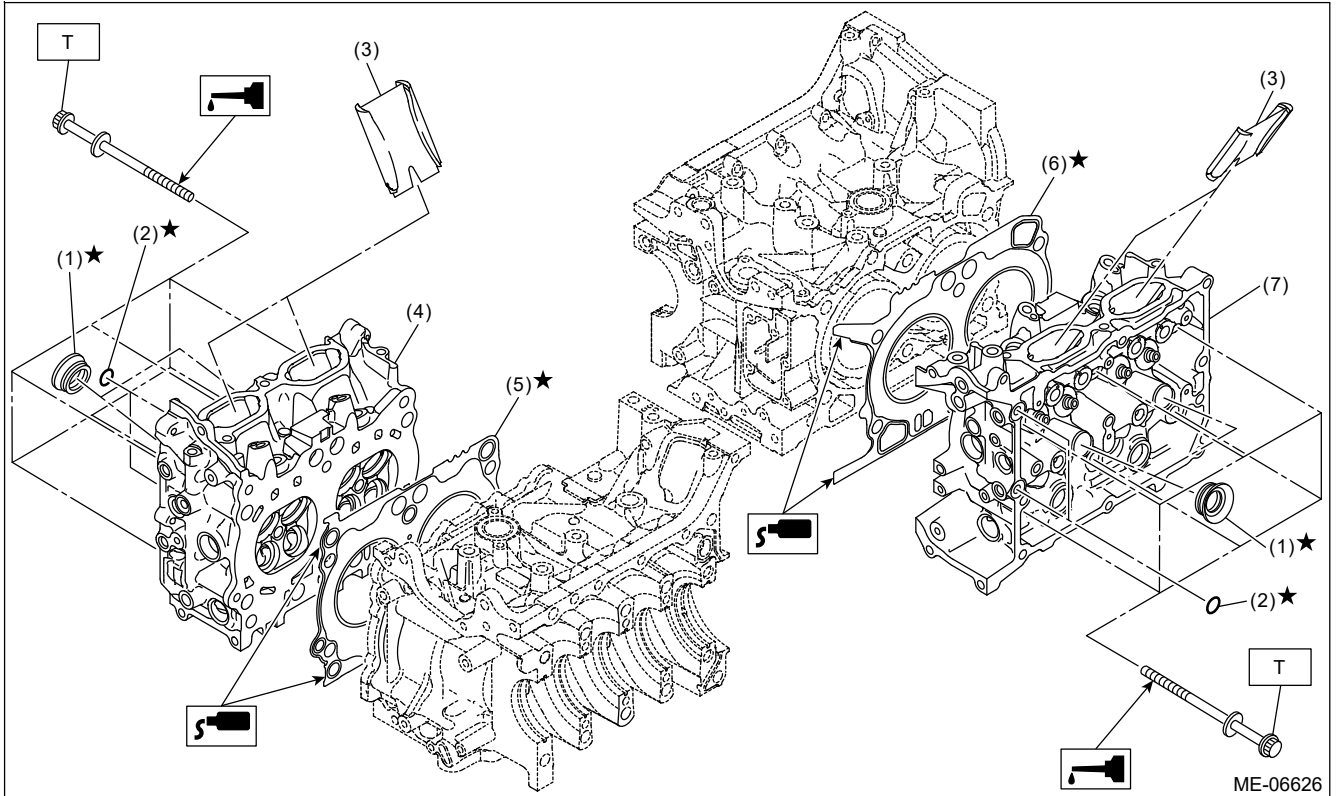
- | | | |
|------------------------------------|------------------------------------|---|
| (1) Cam carrier ASSY RH | (9) Oil pipe | (17) Exhaust rear camshaft cap LH |
| (2) Front camshaft cap RH | (10) Gasket | |
| (3) Intake center camshaft cap RH | (11) Cam carrier ASSY LH | Tightening torque: N·m (kgf·m, ft·lb) |
| (4) Exhaust center camshaft cap RH | (12) Cam carrier LH | T1: Ref. to MECHANICAL(H4DOTC)>Cam Carrier>ASSEMBLY > CAM CARRIER RH. |
| (5) Intake rear camshaft cap RH | (13) Front camshaft cap LH | T2: Ref. to MECHANICAL(H4DOTC)>Cam Carrier>INSTALLATION. |
| (6) Exhaust rear camshaft cap RH | (14) Intake center camshaft cap LH | T3: Ref. to MECHANICAL(H4DOTC)>Cam Carrier>ASSEMBLY. |
| (7) Cam carrier RH | (15) Exhaust center camshaft cap | |

LH

(8) Filter

(16) Intake rear camshaft cap LH

6. CYLINDER HEAD




(1) Spark plug pipe gasket

(5) Cylinder head gasket RH

Tightening torque: N·m (kgf-m, ft-lb)

(2) O-ring

(6) Cylinder head gasket LH

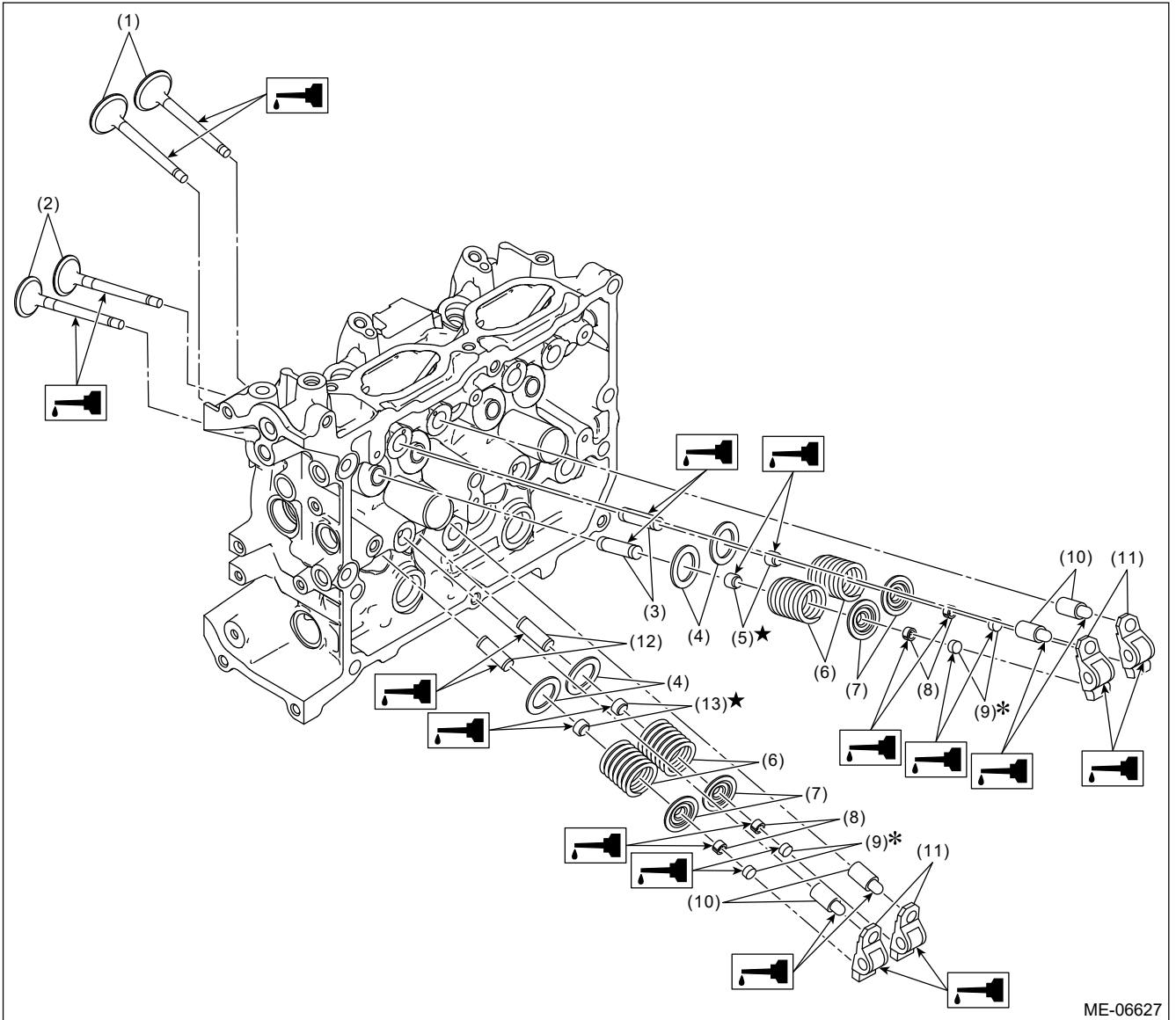
T:  **Ref. to**
MECHANICAL(H4DOTC)>C
ylinder
Head>INSTALLATION.

(3) Cylinder head plate

(7) Cylinder head LH

(4) Cylinder head RH

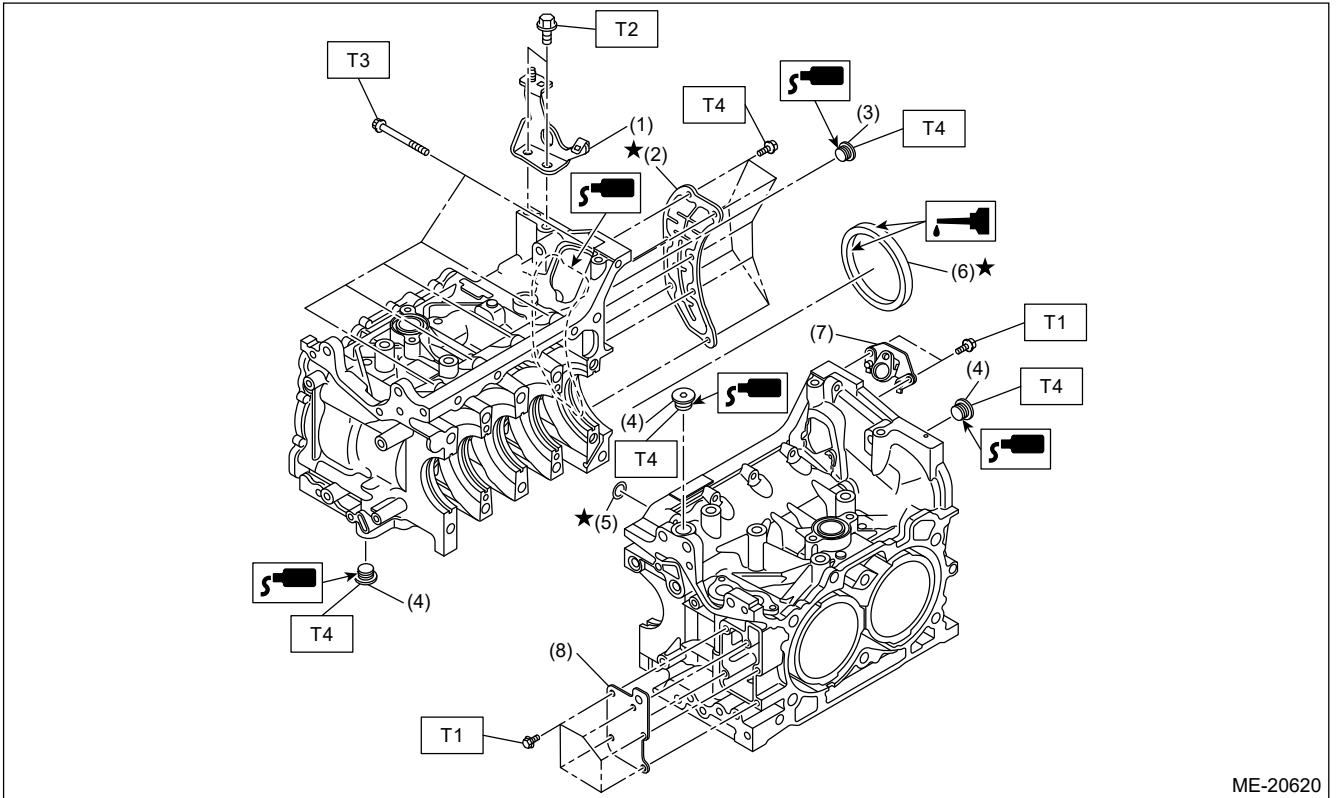
7. VALVE ASSEMBLY



ME-06627

- | | | |
|---------------------------|------------------------------|-----------------------------|
| (1) Exhaust valve | (6) Valve spring | (11) Roller rocker arm |
| (2) Intake valve | (7) Valve spring retainer | (12) Exhaust valve guide |
| (3) Intake valve guide | (8) Valve collet | (13) Exhaust valve oil seal |
| (4) Valve spring seat | (9) Valve shim | |
| (5) Intake valve oil seal | (10) Roller rocker arm pivot | |

8. CYLINDER BLOCK 1



ME-20620

(1) Engine rear hanger

(5) O-ring

Tightening torque: N·m (kgf-m, ft-lb)

(2) Oil separator cover

(6) Rear oil seal

T1: 6.4 (0.7, 4.7)

(3) Cylinder block plug

(7) Crankshaft position sensor holder

T2: 21 (2.1, 15.5)

(4) Main gallery plug

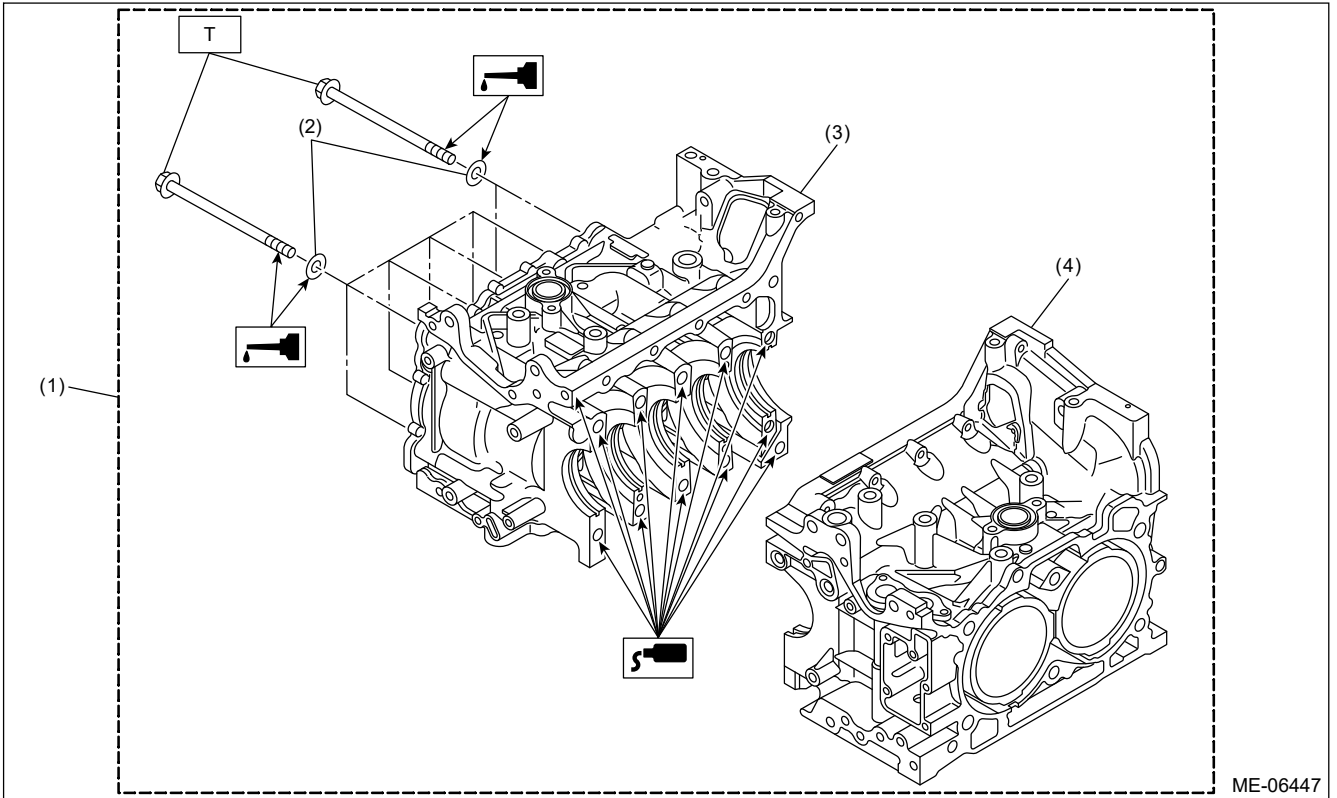
(8) CYLINDER BLOCK PLATE

T3: 25 (2.5, 18.4)

T4:  Ref. to

MECHANICAL(H4DOTC)>Cylinder Block>ASSEMBLY > CYLINDER BLOCK.

9. CYLINDER BLOCK 2




(1) Cylinder block ASSY

(3) Cylinder block RH

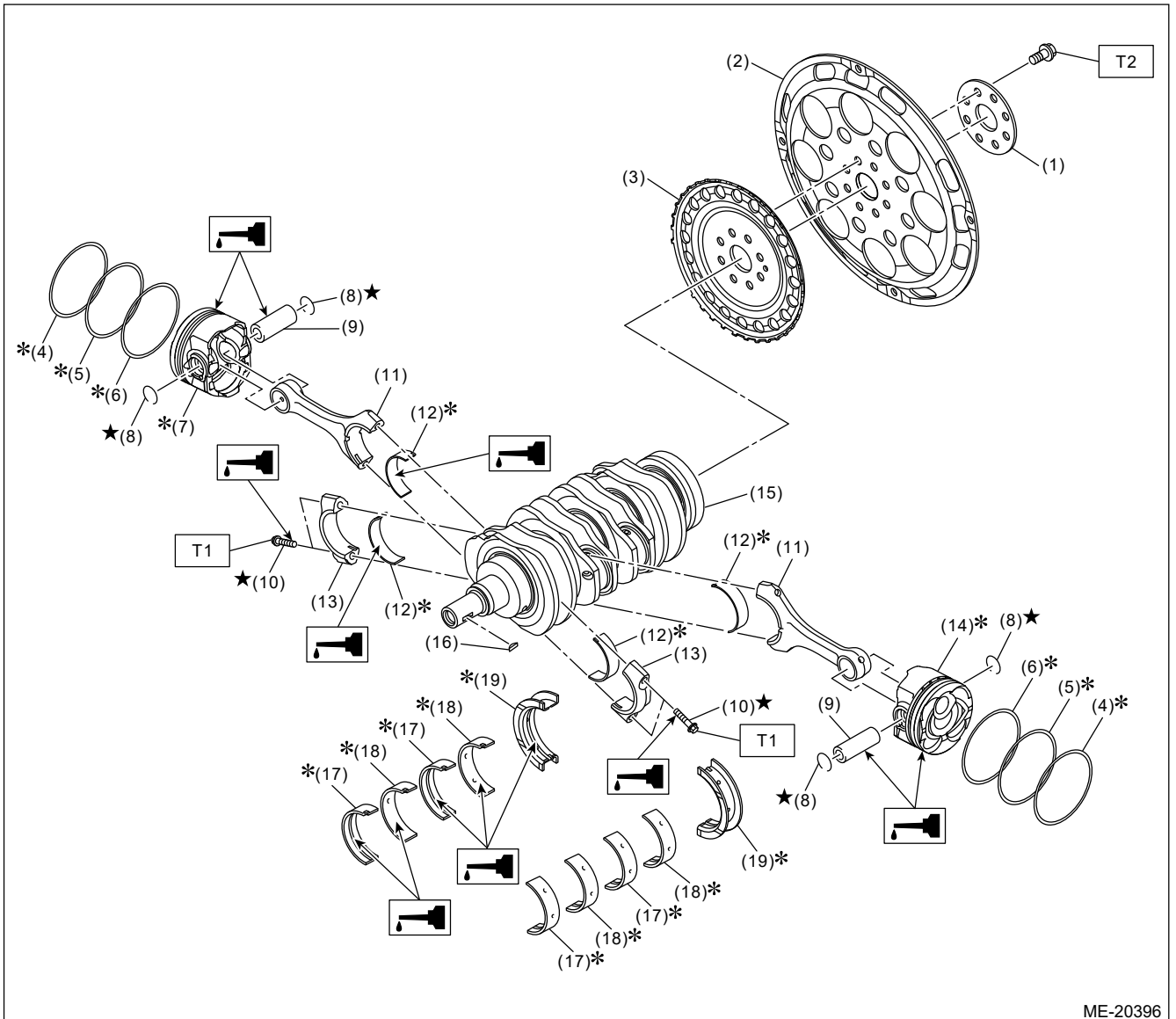
Tightening torque: N·m (kgf-m, ft-lb)

(2) Washer

(4) Cylinder block LH

T:  **Ref. to**
MECHANICAL(H4DOTC)>C
ylinder
Block>INSTALLATION.


10. CRANKSHAFT AND PISTON



ME-20396

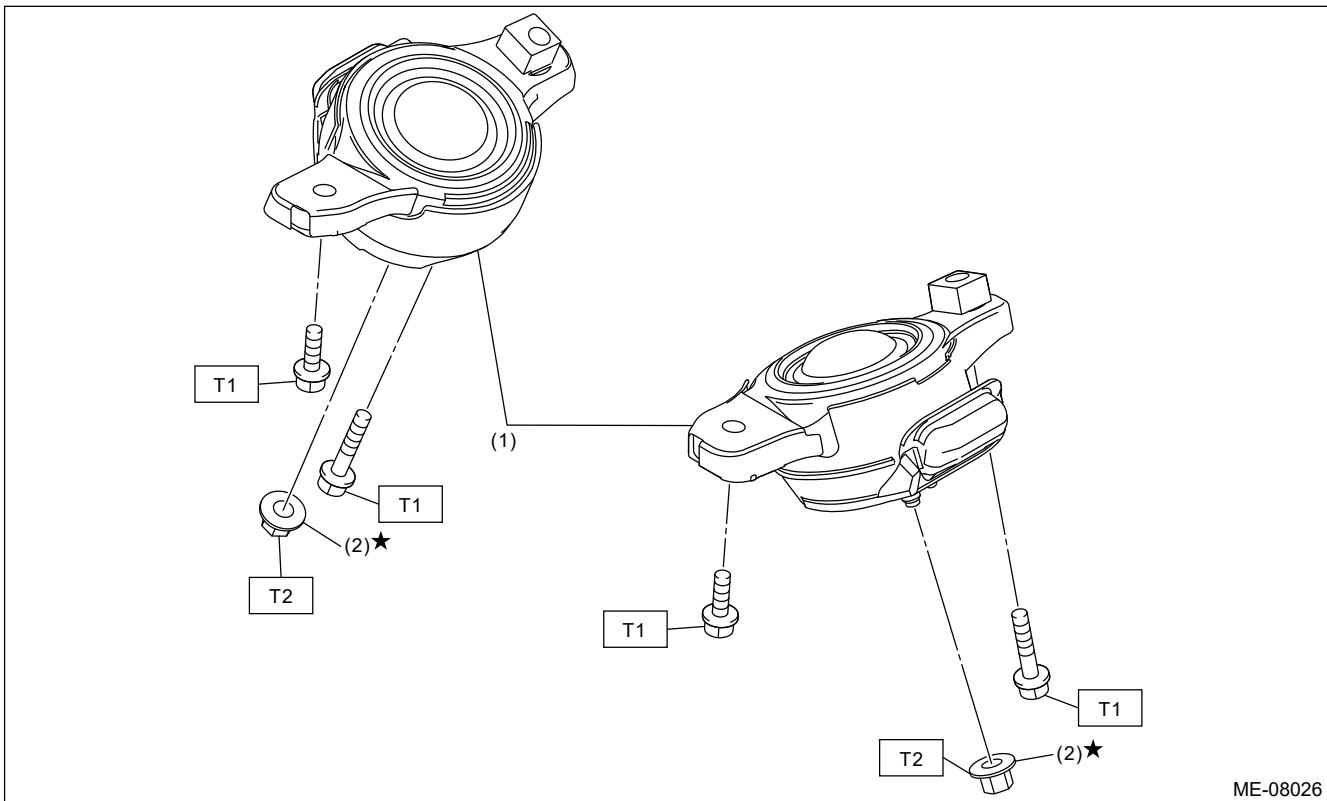
- | | | |
|--------------------------------------|------------------------------|--------------------------------|
| (1) Reinforcement drive plate | (9) Piston pin | (17) Crankshaft bearing #1, #3 |
| (2) Drive plate | (10) Connecting rod cap bolt | (18) Crankshaft bearing #2, #4 |
| (3) Crankshaft position sensor plate | (11) Connecting rod | (19) Crankshaft bearing #5 |
| (4) Top ring | (12) Connecting rod bearing | |
| (5) Second ring | (13) Connecting rod cap | |
| (6) Oil ring | (14) Piston LH | |
| (7) Piston RH | (15) Crankshaft | |
| (8) Circlip | (16) Woodruff key | |

Tightening torque: N·m (kgf·m, ft·lb)

T1:  **Ref. to**
MECHANICAL(H4DOTC)>C
ylinder
Block>INSTALLATION.

T2:  **Ref. to** **CONTINUOUSLY**
VARIABLE
TRANSMISSION(TR690)>D
rive Plate>INSTALLATION.

11. ENGINE MOUNTING



ME-08026

(1) Front cushion rubber

(2) Nut

Tightening torque: N·m (kgf-m, ft-lb)

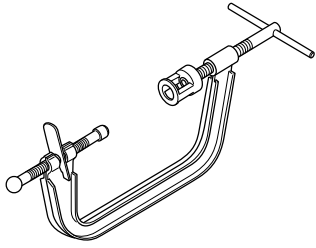
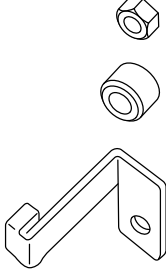
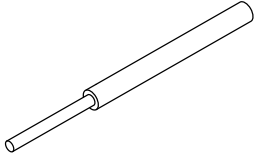
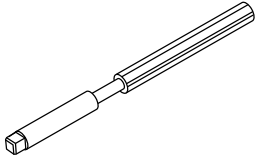
T1: 35 (3.6, 25.8)

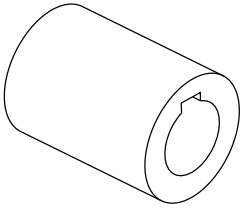
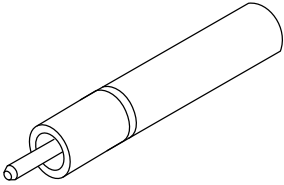
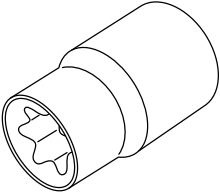
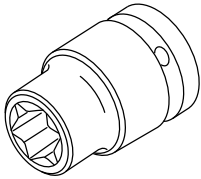
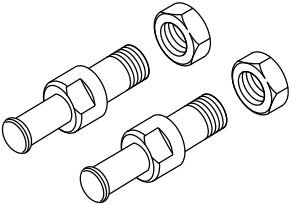
T2: 60 (6.1, 44.3)

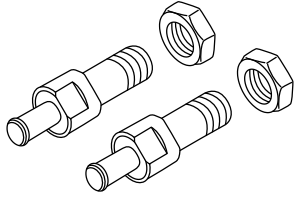
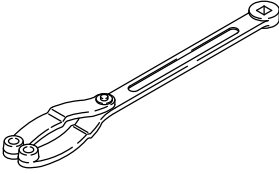
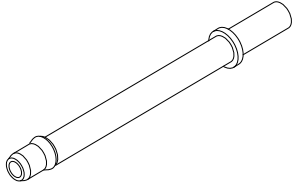
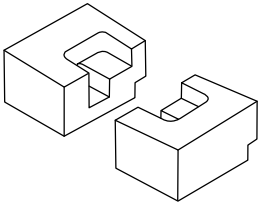
MECHANICAL(H4DOTC) > General Description

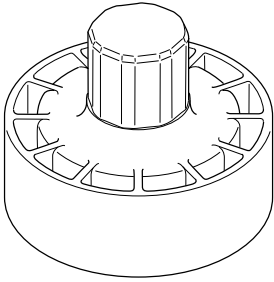
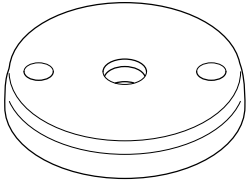
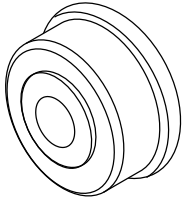
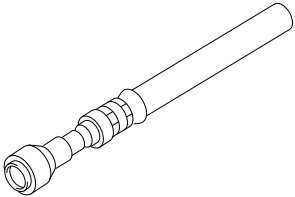
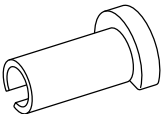
PREPARATION TOOL


1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|---|---------------|-----------------------------------|--|
|  <p>ST0920287002000</p> | 0920287002000 | REMOVER AND REPLACER | Used for removing and installing valve spring. |
|  <p>ST-498277200</p> | 498277200 | STOPPER SET | Used for preventing the torque converter from falling when removing and installing the engine. |
|  <p>ST-499765700</p> | 499765700 | VALVE GUIDE REMOVER AND INSTALLER | Used for removing and installing valve guide. |
|  <p>ST-499765900</p> | 499765900 | VALVE GUIDE REAMER | Used for reaming valve guides. |
| | 18252AA000 | CRANKSHAFT SOCKET | Used for rotating crankshaft. |

| | | | |
|---|------------|-----------------------|--|
|  <p>ST18252AA000</p> | | | |
|  <p>ST18261AA010</p> | 18261AA010 | VALVE OIL SEAL GUIDE | Used for press-fitting of intake valve oil seals and exhaust valve oil seals. |
|  <p>ST18270AA020</p> | 18270AA020 | SOCKET | Used for removing and installing connecting rod. |
|  <p>ST18270KA010</p> | 18270KA010 | SOCKET (E16) | Used for installing and removing cam sprocket. |
|  <p>ST18334AA000</p> | 18334AA000 | PULLEY WRENCH PIN SET | <ul style="list-style-type: none"> • Used for removing and installing the crank pulley. • Used together with PULLEY WRENCH (18355AA000). |

| | | | |
|---|------------|-----------------------------|---|
|  <p>ST18334AA030</p> | 18334AA020 | PULLEY WRENCH PIN SET | <ul style="list-style-type: none"> • Used for rotating the intake cam sprocket LH. • Used for removing and installing cam sprocket. • Used together with PULLEY WRENCH (18355AA000). |
|  <p>ST18355AA000</p> | 18355AA000 | PULLEY WRENCH | <ul style="list-style-type: none"> • Used for removing and installing the crank pulley. • Used for rotating the intake cam sprocket LH. • Used for removing and installing cam sprocket. • Used together with PULLEY WRENCH PIN SET (18334AA000) or PULLEY WRENCH PIN SET (18334AA030). |
|  <p>ST18471AA000</p> | 18471AA000 | FUEL PIPE ADAPTER | Used for inspecting the fuel pressure. |
|  <p>ST18632AA020</p> | 18632AA020 | STAND ASSY | Used for removing and installing rocker cover. |
| | 18657AA030 | OIL SEAL INSTALLER | <ul style="list-style-type: none"> • Used for installing the rear oil seal of engine. • Used together with OIL SEAL GUIDE (18671AA020). |

| | | | |
|---|------------|-------------------------|---|
|  <p>ST18657AA030</p> | | | |
|  <p>ST18671AA020</p> | 18671AA020 | OIL SEAL GUIDE | <ul style="list-style-type: none"> • Used for installing the rear oil seal of engine. • Used together with OIL SEAL INSTALLER (18657AA030). |
|  <p>ST41399FG020</p> | 41399FG020 | SPECIAL TOOL B | Used for installing the front oil seal of engine. |
|  <p>ST42075AG690</p> | 42075AG690 | FUEL HOSE | <p>Used for inspecting the fuel pressure.</p> <p>Note: This is the SUBARU genuine part.</p> |
|  <p>ST42099AE000</p> | 42099AE000 | QUICK CONNECTOR RELEASE | <p>Used for removing FUEL HOSE (42075AG690).</p> <p>Note: FUEL HOSE (42075AG690) is used for checking the fuel pressure.</p> |

| | | | |
|---|-----------------------------------|--|--|
|  <p>STSSM4</p> | <p>— (Newly adopted tool)</p> | <p>SUBARU SELECT MONITOR 4</p> | <p>Used for setting of each function and troubleshooting for electrical system. Note: For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help".</p> |
|---|-----------------------------------|--|--|

2. GENERAL TOOL

| TOOL NAME | REMARKS |
|------------------------|---|
| Compression gauge | Used for measuring compression. |
| Vacuum gauge | Used for measuring intake manifold vacuum. |
| Oil pressure gauge | Used for measuring engine oil pressure. |
| Fuel pressure gauge | Used for measuring fuel pressure. |
| Thickness gauge | Used for various inspections. |
| Engine stand | Used for disassembling and assembling engine. |
| Angle gauge | Used for angle tightening. |
| Piston ring compressor | Used for installing the piston into the cylinder block. |
| DST-i | Used together with Subaru Select Monitor 4. |

MECHANICAL(H4DOTC) > General Description

SPECIFICATION

| | | | | | |
|----------------------|---|--------------------------------|----------|---|----------|
| Engine | Model | | | 2.0 L | |
| | Cylinder arrangement | | | Horizontally opposed, liquid cooled, 4-cylinder, 4-stroke gasoline engine | |
| | Valve system mechanism | | | Chain driven, double overhead camshaft, 4-valve/cylinder | |
| | Bore × Stroke | mm (in) | | 86.0 × 86.0 (3.39 × 3.39) | |
| | Displacement | cm ³ (cu in) | | 1,998 (122) | |
| | Compression ratio | | | 10.6 | |
| | Compression pressure (at 200 – 300 r/min) | kPa (kg/cm ² , psi) | Standard | 1,350 – 1,750 (14 – 18, 196 – 254) | |
| | Number of piston rings | | | Compression ring: 2 Oil ring: 1 | |
| Intake valve timing | | | Opening | Max. retard | ATDC 26° |
| | | | | Min. advance | BTDC 42° |
| | | | Closing | Max. retard | ABDC 82° |
| | | | | Min. advance | ABDC 14° |
| Exhaust valve timing | | | Opening | Max. retard | BBDC 11° |
| | | | | Min. advance | BBDC 66° |
| | | | Closing | Max. retard | ATDC 55° |
| | | | | Min. advance | ATDC 0° |
| Cam clearance | mm (in) | Intake | Standard | 0.13 ^{+0.02} _{-0.03} (0.0051 ^{+0.0008} _{-0.0012}) | |

| | | | | | |
|---|--|--------------|----------|---------------------------|--------------|
| | | Exhaust | Standard | 0.22±0.02 (0.0087±0.0008) | |
| Idle rpm (select lever in "P" or "N" range) | | r/min | No load | Standard | 700±100 |
| | | | A/C ON | Standard | 775 — 865±50 |
| Ignition order | | | | 1 → 3 → 2 → 4 | |
| Ignition timing | | BTDC/{r/min} | Standard | 8°±10°/700 | |

Note:

OS: Oversize US: Undersize

| | | | | | | |
|---------------------|--|---------|----------|---------------------------------|---------------------------------|-----------------------------------|
| Camshaft | Bending | | | mm (in) | Limit | 0.020 (0.0008) |
| | Cam lobe height | mm (in) | Intake | Valve drive section | Standard | 40.34 — 40.44 (1.588 — 1.592) |
| | | | | Fuel pump drive section | Standard | 41.95 — 42.05 (1.652 — 1.656) |
| | | Exhaust | | | | Standard |
| | Cam base circle diameter | | | mm (in) | Standard | 34.0 (1.339) |
| | Journal outer diameter | | | mm (in) | Standard | 25.946 — 25.963 (1.0215 — 1.0222) |
| | Thrust clearance | | | mm (in) | Standard | 0.068 — 0.116 (0.0027 — 0.0047) |
| | Oil clearance | | | mm (in) | Standard | 0.037 — 0.072 (0.0015 — 0.0028) |
| Cylinder head | Warpage (mating surface with cylinder block) | | | mm (in) | Limit | 0.020 (0.0008) |
| | Grinding limit | | | mm (in) | | 98.4 (3.874) or less |
| | Height | | | mm (in) | Standard | 98.5 (3.878) |
| Valve & valve guide | Valve overall length | | mm (in) | Intake | | 104.95 (4.132) |
| | | | | Exhaust | | 97.9 (3.854) |
| | Valve head edge thickness | mm (in) | Intake | Standard | 0.8 — 1.2 (0.031 — 0.047) | |
| | | | Exhaust | Standard | 1.0 — 1.4 (0.039 — 0.055) | |
| | Valve stem outer diameter | mm (in) | Intake | Standard | 5.455 — 5.470 (0.2148 — 0.2154) | |
| Exhaust | | | Standard | 5.445 — 5.460 (0.2144 — 0.2150) | | |

| | | | | | |
|-------------------------|--|---------------------|---------------------------|---------------------------------|--|
| | Valve guide inner diameter | mm (in) | Standard | 5.500 — 5.512 (0.2165 — 0.2170) | |
| | Clearance between valve and valve guide | mm (in) | Intake | Standard | 0.030 — 0.057 (0.0012 — 0.0022) |
| | | | Exhaust | Standard | 0.040 — 0.067 (0.0016 — 0.0026) |
| | Valve guide protrusion amount | mm (in) | Standard | 11.4 — 11.8 (0.449 — 0.465) | |
| Valve & valve shim | Valve stem end outer diameter | mm (in) | Intake | Standard | 5.455 — 5.470 (0.2148 — 0.2154) |
| | | | Exhaust | Standard | 5.445 — 5.460 (0.2144 — 0.2150) |
| | Valve shim inner diameter | mm (in) | Standard | 5.500 — 5.560 (0.2165 — 0.2189) | |
| | Clearance between valve and valve shim | mm (in) | Intake | Standard | 0.030 — 0.105 (0.0012 — 0.0041) |
| Exhaust | | | Standard | 0.040 — 0.115 (0.0016 — 0.0045) | |
| Valve seat | Seating width between valve and valve seat | mm (in) | Intake | Standard | 0.8 — 1.6 (0.031 — 0.063) |
| | | | Exhaust | Standard | 1.1 — 1.7 (0.043 — 0.067) |
| | Seating angle between valve and valve seat | | | | 45° |
| | Seating position between valve and valve seat | | | | Valve face center |
| Valve spring | Free length | mm (in) | Standard | 44.03 (1.733) | |
| | Tension/spring height | N (kgf, lb)/mm (in) | Set | Standard | 182 — 210 (18.56 — 21.41, 40.92 — 47.22)/33.0 (1.299) |
| | | | Lift | Standard | 440 — 486 (44.87 — 49.56, 98.93 — 109.27)/22.0 (0.866) |
| | Squareness | | | Standard | 2.5°, 1.9 mm (0.075 in) or less |
| Cylinder block & piston | Cylinder block warpage (Mating surface with cylinder head) | mm (in) | Limit | 0.025 (0.0010) | |
| | Grinding limit of cylinder block | mm (in) | | 204.9 (8.067) or less | |
| | Height of cylinder block | mm (in) | Standard | 205.0 (8.071) | |
| | Inner diameter of cylinder liner | mm (in) | Cylinder bore size mark A | Standard | 86.005 — 86.015 (3.3860 — 3.3864) |
| Cylinder | | | Stan | 85.995 — 86.005 (3.3856 — | |


| | | | | | | | |
|---|--|------------------------|---|------------------|--|------------------------------------|------------------------------------|
| | | | bore size mark B | dard | 3.3860) | | |
| Cylindricity of cylinder liner | | | mm (in) | Limit | 0.030 (0.0012) | | |
| Out-of-roundness of cylinder liner | | | mm (in) | Limit | 0.030 (0.0012) | | |
| Piston grade point | | | mm (in) | | 40.0 (1.57) | | |
| Piston outer diameter | mm (in) | Stan dard Size | Grad e A | Stan dard | 85.985 — 85.995 (3.3852 — 3.3856) | | |
| | | | Grad e B | Stan dard | 85.975 — 85.985 (3.3848 — 3.3852) | | |
| | | 0.25 (0.0098) OS | | Stan dard | 86.225 — 86.245 (3.3947 — 3.3955) | | |
| | | 0.50 (0.0197) OS | | Stan dard | 86.475 — 86.495 (3.4045 — 3.4053) | | |
| Clearance between cylinder liner and piston | | | mm (in) | Stan dard | 0.010 — 0.030 (0.0004 — 0.0012) | | |
| Inner diameter of cylinder liner boring limit (diameter) | | | | mm (in) | 86.505 (3.4057) or less | | |
| Piston and piston pin | Degree of fit | | | | Piston pin must be fitted into position with thumb at 20°C (68°F). | | |
| | Clearance between piston and piston pin | | | mm (in) | Stan dard | 0.004 — 0.008 (0.0002 — 0.0003) | |
| Piston ring | Closed gap | mm (in) | Compression ring | | Top ring | Stan dard | 0.20 — 0.25 (0.0079 — 0.0098) |
| | | | | | Second ring | Stan dard | 0.40 — 0.50 (0.0157 — 0.0197) |
| | | | Oil ring (Upper rail and lower rail) | | Stan dard | 0.10 — 0.35 (0.0039 — 0.0138) | |
| | Clearance between compression ring and piston | | mm (in) | Top ring | | Stan dard | 0.040 — 0.080 (0.0016 — 0.0031) |
| | | Second ring | | Stan dard | 0.045 — 0.085 (0.0018 — 0.0033) | | |
| Connect ing rod and connect ing rod bearing | Bend or twist per 100 mm (3.94 in) in length | | | mm (in) | Limit | 0.10 (0.0039) | |
| | Thrust clearance | | | mm (in) | Stan dard | 0.070 — 0.330 (0.0028 — 0.0130) | |
| | Connecting rod bearing thickness (at center) | | mm (in) | Standard size | | Stan dard | 1.492 — 1.508 (0.0587 — 0.0594) |
| | | 0.03 | | Stan | 1.511 — 1.515 (0.0595 — | | |

| | | | | | |
|--|--|--------------------------|-------------------------|--------------------------------------|--------------------------------------|
| | | (0.0012) US | dard | 0.0596) | |
| | | 0.05 (0.0020) US | Stand ard | 1.521 — 1.525 (0.0599 — 0.0600) | |
| | | 0.25 (0.0098) US | Stand ard | 1.621 — 1.625 (0.0638 — 0.0640) | |
| | Oil clearance | | mm (in) Stan dard | 0.025 — 0.055 (0.0010 — 0.0022) | |
| Piston pin & connect ing rod bushing | Clearance between piston pin and connecting rod bushing | | mm (in) Stan dard | 0.004 — 0.026 (0.0002 — 0.0010) | |
| Cranksh aft and cranksh aft bearing | Bending | | mm (in) Limit | 0.035 (0.0014) | |
| | Crankshaft pin | Cylindricalit y | mm (in) Limit | 0.006 (0.0002) | |
| | | Out-of- roundness | mm (in) Limit | 0.005 (0.0002) | |
| | | Grinding limit (dia.) | mm (in) | 49.726 (1.9577) or less | |
| | Crankshaft journal | Cylindricalit y | mm (in) Limit | 0.006 (0.0002) | |
| | | Out-of- roundness | mm (in) Limit | 0.005 (0.0002) | |
| | | Grinding limit (dia.) | mm (in) | 67.735 (2.6667) or less | |
| | Crankshaft pin outer diameter | mm (in) | Standard size | Stan dard | 49.976 — 50.000 (1.9676 — 1.9685) |
| | | | 0.03 (0.0012) US | Stan dard | 49.946 — 49.970 (1.9664 — 1.9673) |
| | | | 0.05 (0.0020) US | Stan dard | 49.926 — 49.950 (1.9656 — 1.9665) |
| 0.25 (0.0098) US | | | Stan dard | 49.726 — 49.750 (1.9577 — 1.9587) | |
| Crankshaft journal outer diameter | mm (in) | Standard size | Stan dard | 67.985 — 68.003 (2.6766 — 2.6773) | |
| | | 0.03 | Stan | 67.955 — 67.979 (2.6754 — | |


| | | | | | |
|---|------------|-------------------------|------------------------|--------------|--------------------------------------|
| | | | (0.0012) US | dard | 2.6763) |
| | | | 0.05 (0.0020) US | Stan dard | 67.935 — 67.959 (2.6746 — 2.6755) |
| | | | 0.25 (0.0098) US | Stan dard | 67.735 — 67.759 (2.6667 — 2.6677) |
| Crankshaft bearing thickness (at center) | mm (in) | #1, #2, #3, #4 | Standard size | Stan dard | 2.498 — 2.513 (0.0983 — 0.0989) |
| | | | 0.03 (0.0012) US | Stan dard | 2.519 — 2.522 (0.0992 — 0.0993) |
| | | | 0.05 (0.0020) US | Stan dard | 2.529 — 2.532 (0.0996 — 0.0997) |
| | | | 0.25 (0.0098) US | Stan dard | 2.629 — 2.632 (0.1035 — 0.1036) |
| | | #5 | Standard size | Stan dard | 2.496 — 2.511 (0.0983 — 0.0989) |
| | | | 0.03 (0.0012) US | Stan dard | 2.517 — 2.520 (0.0991 — 0.0992) |
| | | | 0.05 (0.0020) US | Stan dard | 2.527 — 2.530 (0.0995 — 0.0996) |
| | | | 0.25 (0.0098) US | Stan dard | 2.627 — 2.630 (0.1034 — 0.1035) |
| Thrust clearance | | | mm (in) | Stan dard | 0.130 — 0.308 (0.0051 — 0.0121) |
| Oil clearance | | | mm (in) | Stan dard | 0.013 — 0.031 (0.0005 — 0.0012) |

MECHANICAL(H4DOTC) > Idle Speed

INSPECTION

1. Before checking the idle speed, check the following item:
 - (1) Check the air cleaner element is free from clogging, ignition timing is correct, spark plugs are in good condition, and hoses are connected properly.
 - (2) Check the malfunction indicator light does not illuminate.
2. Warm up the engine.
3. Read the engine idle speed using Subaru Select Monitor.  [Ref. to ENGINE \(DIAGNOSTICS\) \(H4DOTC\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Note:


- **Idle speed cannot be adjusted manually, because the idle speed is automatically adjusted.**
 - **If idle speed is out of standard, refer to the General Diagnosis Table under "Engine Control System".**  [Ref. to ENGINE \(DIAGNOSTICS\) \(H4DOTC\)>Basic Diagnostic Procedure.](#)
- (1) Check the idle speed when no-loaded. (Headlight, blower fan, rear defroster, radiator fan, A/C and etc. are OFF)
Idle rpm (no load and select lever in "P" or "N" range):
Standard
700±100 r/min
 - (2) Check the idle speed when loaded. (Turn the A/C switch to ON and operate the compressor for at least one minute before measurement.)
Idle speed (A/C ON and select lever in "P" or "N" range):
Standard
775 — 865±50 r/min

MECHANICAL(H4DOTC) > Ignition Timing


INSPECTION

Caution:

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

1. Before checking the ignition timing, check the following item:
 - (1) Check the air cleaner element is free from clogging, spark plugs are in good condition, and hoses are connected properly.
 - (2) Check the malfunction indicator light does not illuminate.
2. Warm up the engine.
3. Read the ignition timing using Subaru Select Monitor.  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

Note:

If ignition timing is out of standard, check the ignition control system. Refer to "Engine Control System".  [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Basic Diagnostic Procedure.](#)

Ignition timing [BTDC/{r/min}]:





Standard

8°±10°/700

MECHANICAL(H4DOTC) > Intake and Exhaust Valve

SPECIFICATION

Refer to "Cylinder Head" for removal and installation procedures of the intake and exhaust valves.

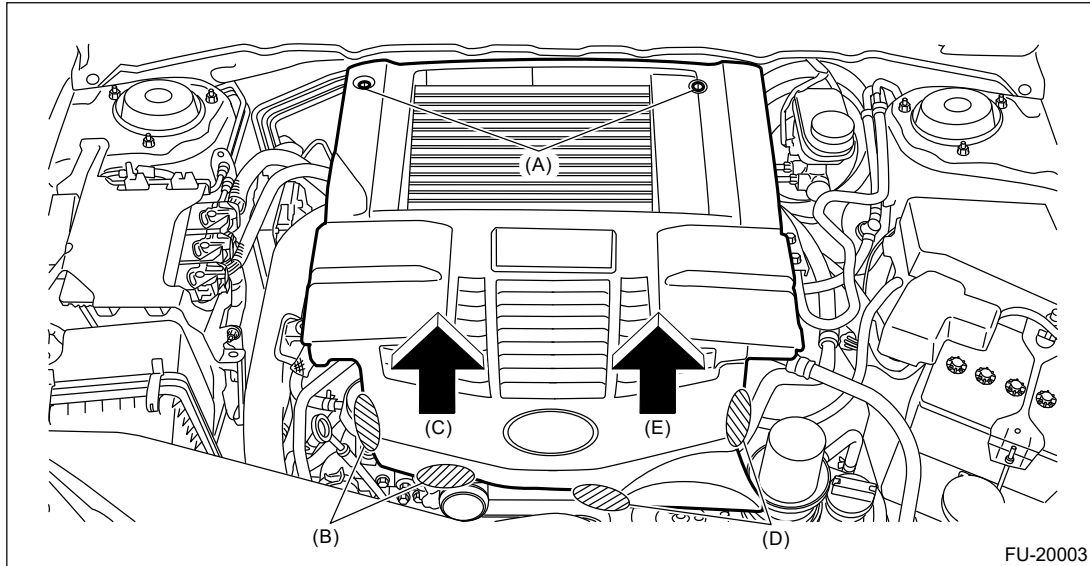
 [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>INSTALLATION.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>DISASSEMBLY.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Head>ASSEMBLY.](#)

MECHANICAL(H4DOTC) > Intake Manifold Vacuum

INSPECTION

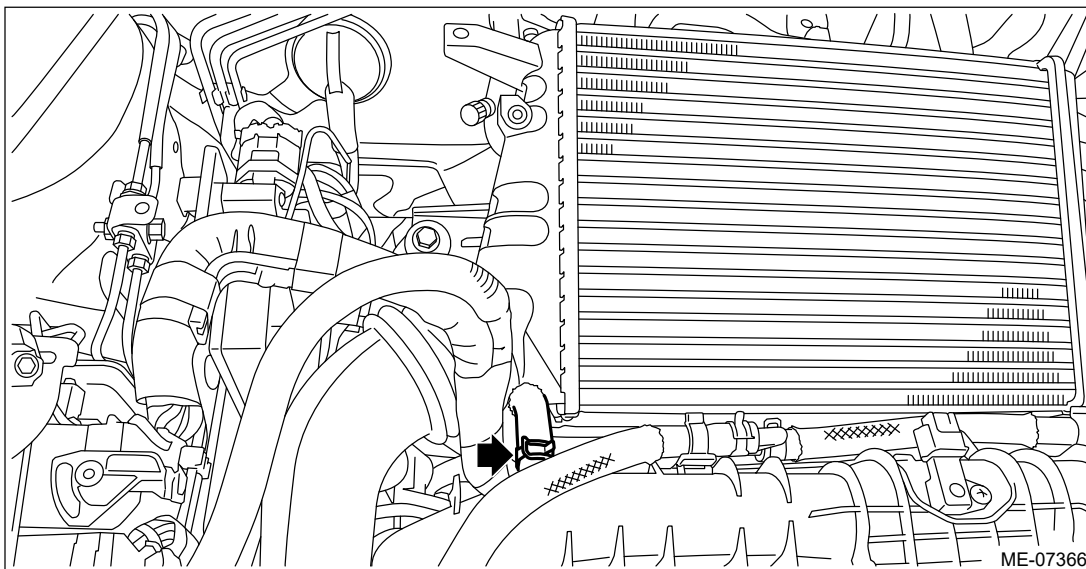
1. Remove the collector cover.

- (1) Remove the clip (A).
- (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
- (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.

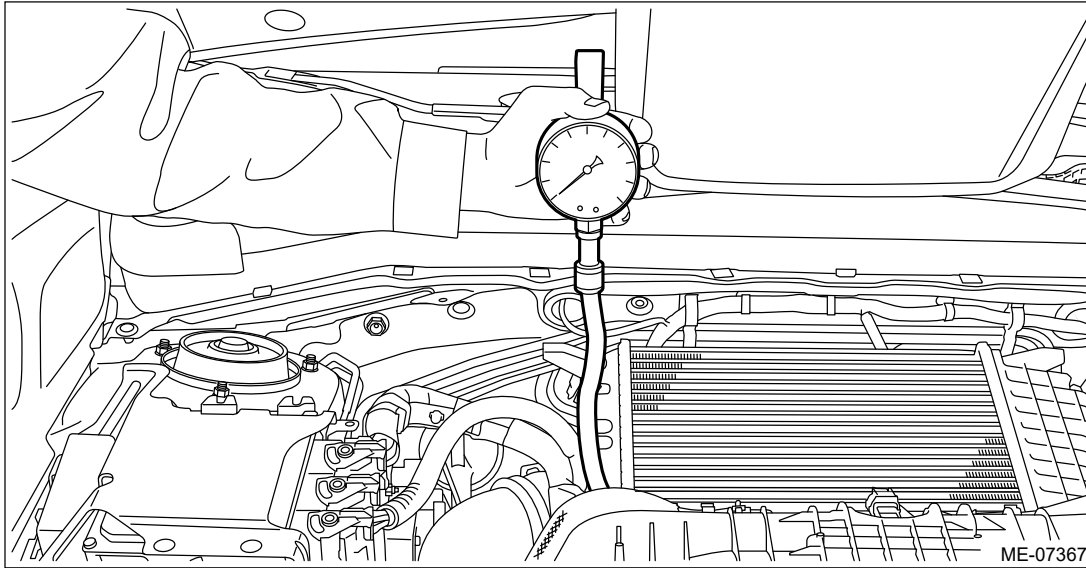


2. Warm up the engine.

3. Disconnect the brake booster vacuum hose from the intake manifold.



4. Connect the vacuum gauge to the intake manifold.



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

Note:

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

Intake manifold vacuum (at idling, A/C OFF):

Standard

-60.0 kPa (-450 mmHg, -17.72 inHg) or more





| Diagnosis of engine condition by inspection of intake manifold vacuum | |
|---|---|
| Vacuum gauge needle behavior | Possible engine condition |
| 1. Needle is steady but lower than standard value. This tendency becomes more evident as engine temperature rises. | Leakage around intake manifold gasket, disconnection or damage of vacuum hose |
| 2. Needle intermittently drops to position lower than standard value. | Leakage around cylinder |
| 3. Needle drops suddenly and intermittently from standard value. | Sticky valve |
| 4. When engine speed is gradually increased, needle begins to vibrate rapidly at certain speed, and then vibration increases as engine speed increases. | Weak or broken valve springs |
| 5. Needle vibrates above and below standard value in narrow range. | Defective ignition system |

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

MECHANICAL(H4DOTC) > Piston


SPECIFICATION

Refer to "Cylinder Block" for removal and installation procedures of pistons.

 [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>REMOVAL.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>INSTALLATION.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>DISASSEMBLY > PISTON AND CONNECTING ROD.](#)  [Ref. to MECHANICAL\(H4DOTC\)>Cylinder Block>ASSEMBLY > PISTON AND CONNECTING ROD.](#)

MECHANICAL(H4DOTC) > Preparation for Overhaul

PROCEDURE

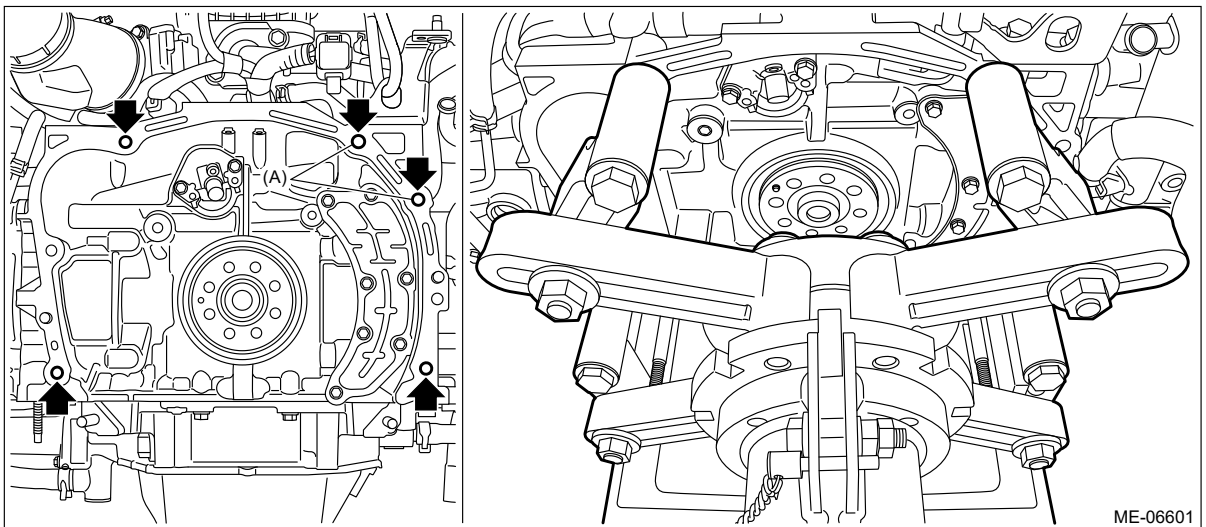
1. After engine has been removed from the vehicle, mount the engine to the engine stand while being careful of the following.
 - (1) When mounting the engine stand, follow the instructions of engine stand used.
 - (2) When disassembling the cylinder block, remove the crankshaft position sensor plate together with the drive plate first, and then mount the engine stand.  [Ref. to CONTINUOUSLY VARIABLE TRANSMISSION\(TR690\)>Drive Plate>REMOVAL.](#)
 - (3) Mount the engine stand using the points shown by the arrows in the figure.

Caution:

Be sure to mount the engine stand at four points. Otherwise, the engine damage may occur.

Note:

- For points (A), either of them can be used for mounting the engine stand.
- The engine stand shown in the figure is just for reference.



2. In this section the procedures described under each index are all connected and stated in order. The procedure for overhauling of the engine will be completed when you go through all steps in the process. Therefore, in this section, to conduct the particular procedure within the flow of a section, you need to go back and conduct the procedure described previously in order to do that particular procedure.

MECHANICAL(H4DOTC) > Rocker Cover

INSPECTION

Check that the rocker cover does not have deformation, cracks and any other damage.

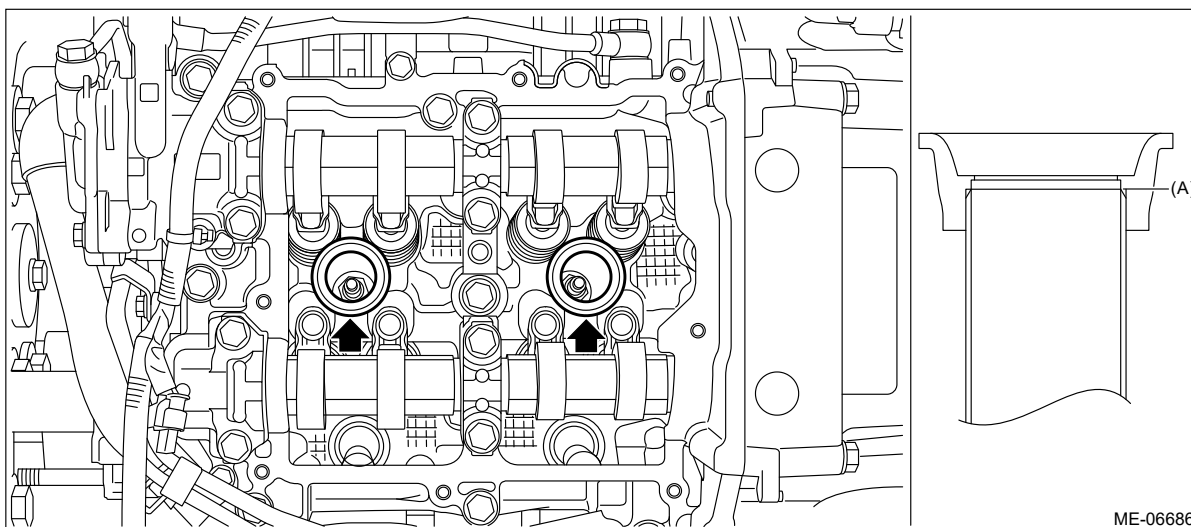
INSTALLATION

1. ROCKER COVER RH

1. Install the #1 spark plug pipe gasket and #3 spark plug pipe gasket to the #1 spark plug pipe and #3 spark plug pipe.

Note:

- Use a new #1 spark plug pipe gasket and #3 spark plug pipe gasket.
- Apply a light coat of engine oil to the #1 spark plug pipe gasket and #3 spark plug pipe gasket, and insert them onto the spark plug pipe edge (A).



2. Install the rocker cover gasket RH to the rocker cover RH.

Note:

Use a new rocker cover gasket RH.

3. Apply liquid gasket to the mating surface of rocker cover RH as shown in the figure.

Note:

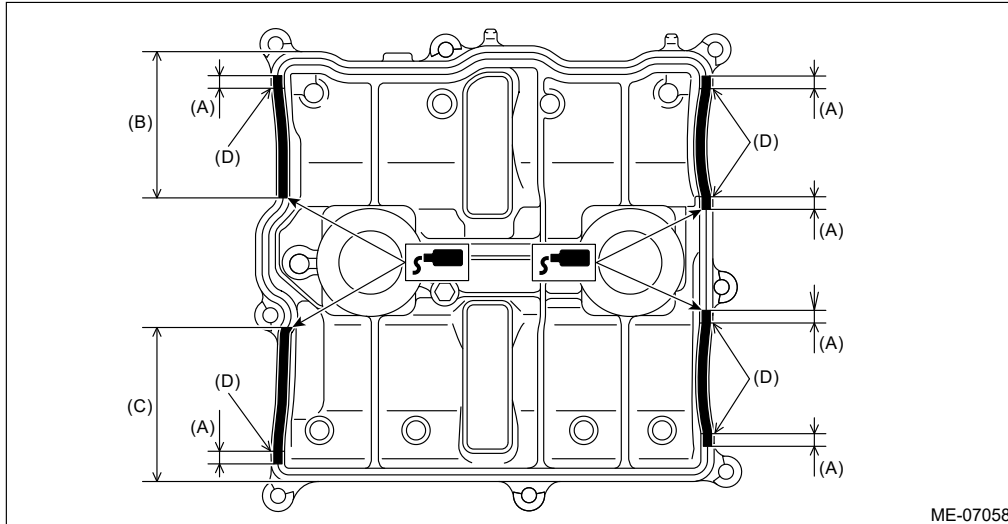
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the engine.
- Be careful not to allow liquid gasket to be squeezed out from rocker cover RH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3±1 mm (0.1181±0.0394 in)

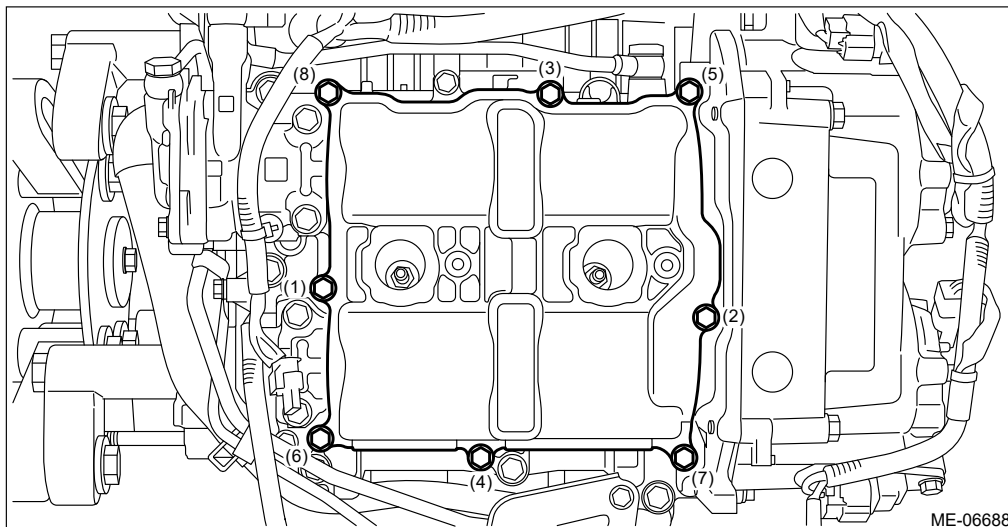



- (A) 10 mm (0.394 in) or more (C) 70.7 mm (2.783 in) or more (D) Arch starting point
 (B) 68 mm (2.677 in) or more

4. Set the rocker cover RH, and tighten the bolts in numerical order as shown in the figure.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



5. Install the #1 ignition coil and the #3 ignition coil.  [Ref. to IGNITION\(H4DOTC\)>Ignition Coil>INSTALLATION.](#)

6. When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

(1) Install the air cleaner case.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Cleaner Case>INSTALLATION.](#)

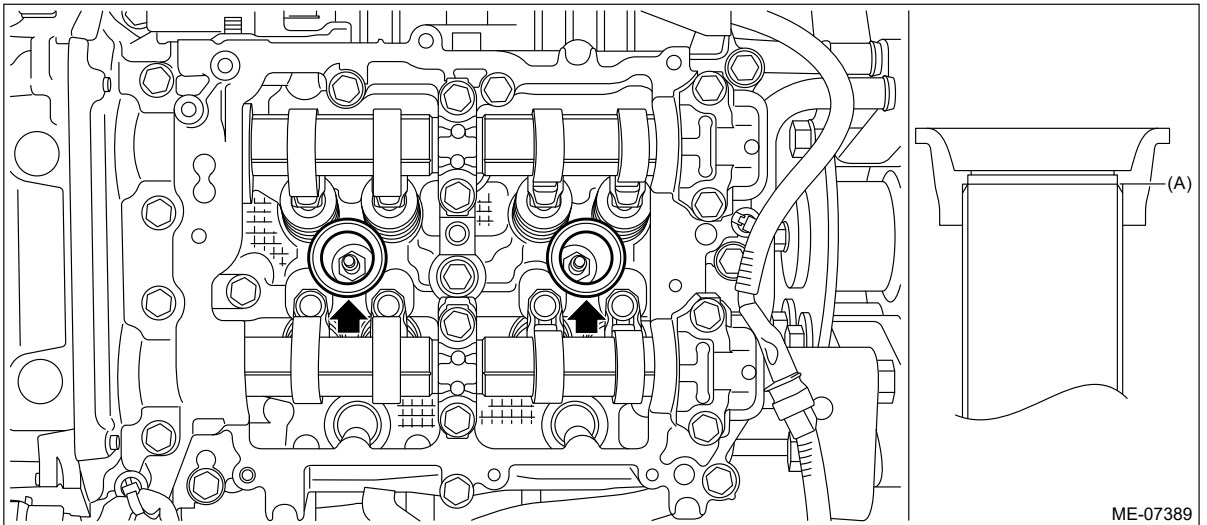
2. ROCKER COVER LH

1. Install the #2 spark plug pipe gasket and #4 spark plug pipe gasket to the #2 spark plug pipe and #4 spark plug pipe.

Note:

- Use a new #2 spark plug pipe gasket and #4 spark plug pipe gasket.

- Apply a light coat of engine oil to the #2 spark plug pipe gasket and #4 spark plug pipe gasket, and insert them onto the spark plug pipe edge (A).



ME-07389

2. Install the rocker cover gasket LH to the rocker cover LH.

Note:

Use a new rocker cover gasket LH.

3. Apply liquid gasket to the mating surface of rocker cover LH as shown in the figure.

Note:

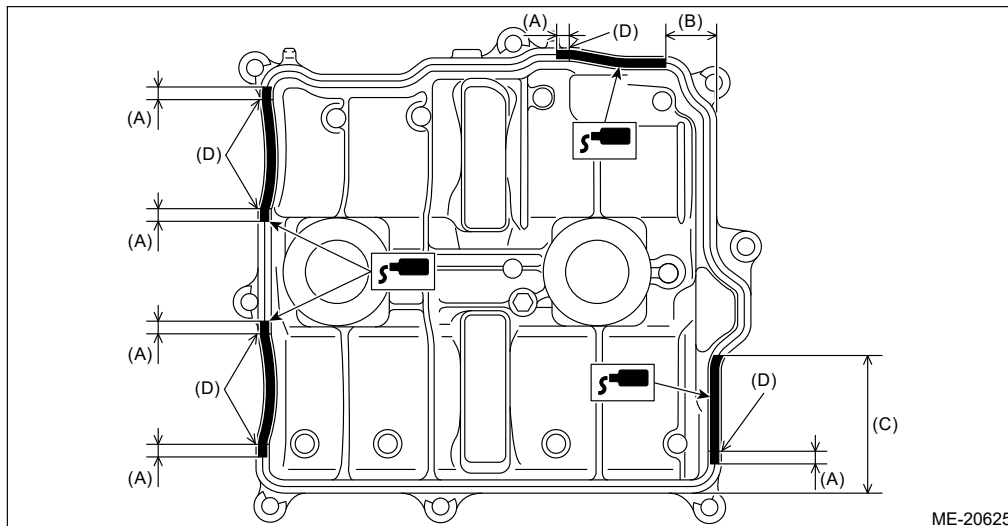
- Before applying liquid gasket, degrease the old liquid gasket seal surface of the engine.
- Be careful not to allow liquid gasket to be squeezed out from rocker cover LH.
- Install within 5 min. after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100), THREE BOND 1217H or equivalent

Liquid gasket applying diameter:

3±1 mm (0.1181±0.0394 in)



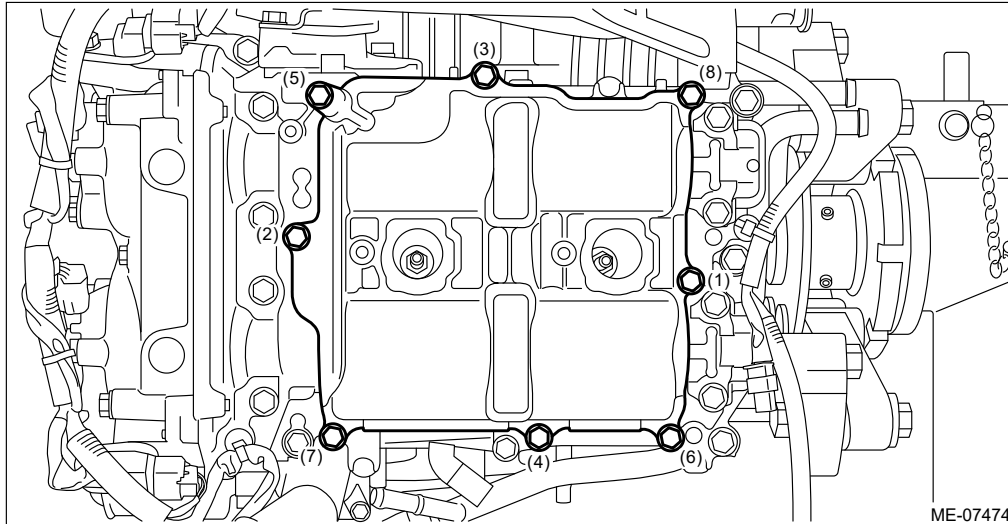
ME-20625

- (A) 10 mm (0.394 in) or more (C) 63 mm (2.480 in) or more (D) Arch starting point
 (B) 18.8 mm (0.7402 in) or less

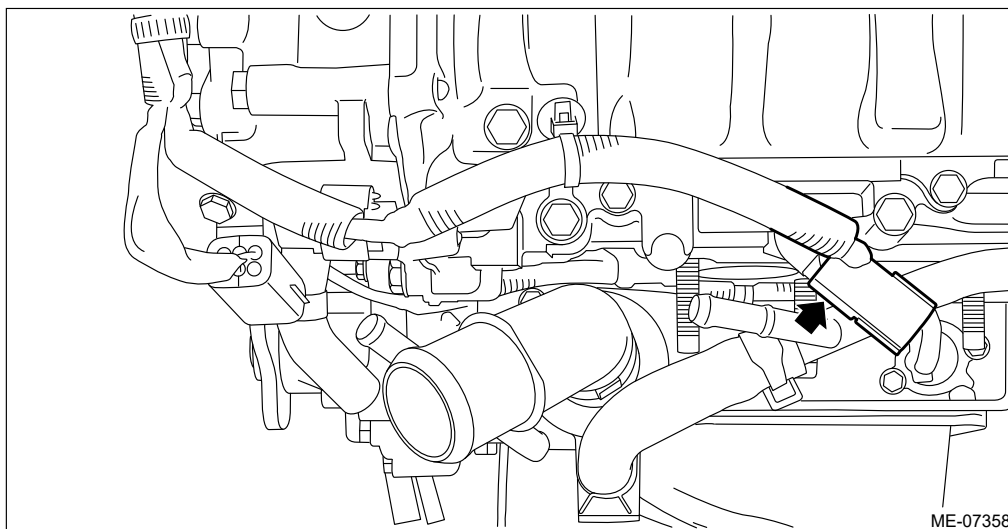
4. Set the rocker cover LH, and tighten the bolts in numerical order as shown in the figure.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



5. Connect the connector to the water pipe LH.

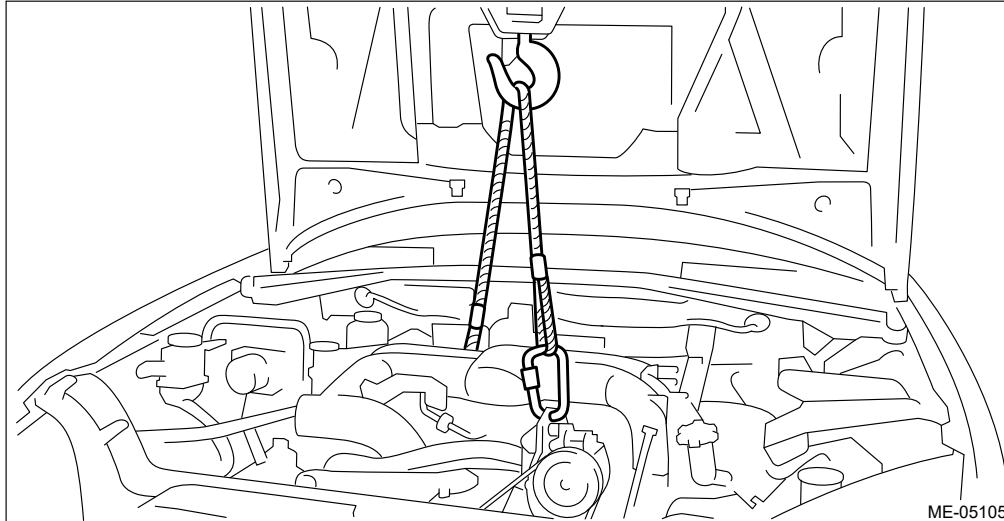


6. Install the #2 ignition coil and the #4 ignition coil. [📖 Ref. to IGNITION\(H4DOTC\)>Ignition Coil>INSTALLATION.](#)
7. Install the side engine oil cooler pipe assembly. [📖 Ref. to LUBRICATION\(H4DO\)>Engine Oil Cooler Pipe>INSTALLATION > SIDE ENGINE OIL COOLER PIPE.](#)
8. When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

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

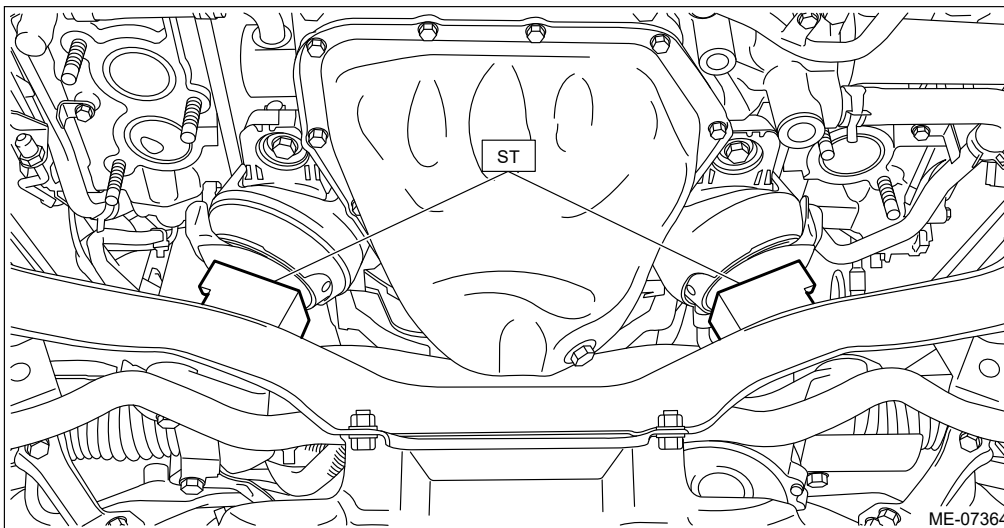


(2) Lift the engine, and remove the ST.

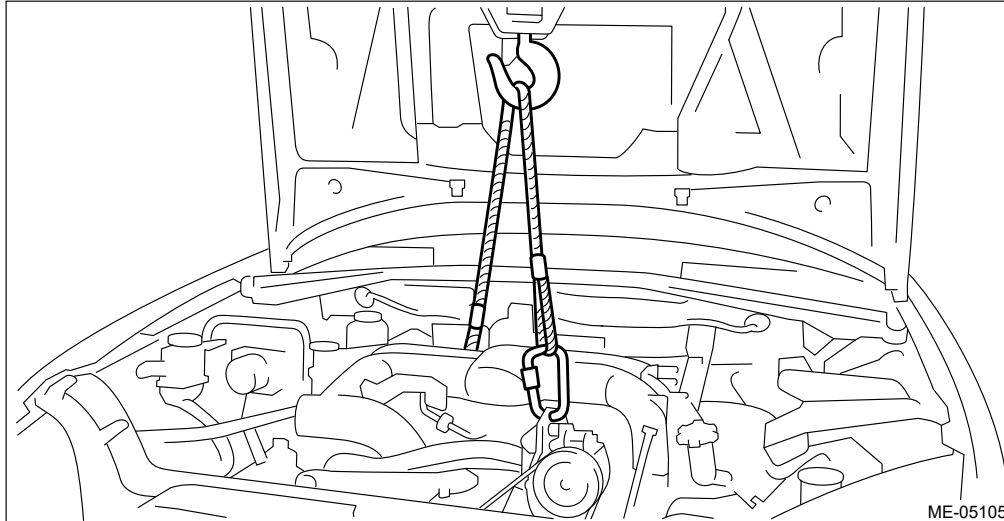
Caution:

When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.

ST 18632AA020 STAND ASSY



(3) Lower the engine and remove the lifting device and wire ropes.

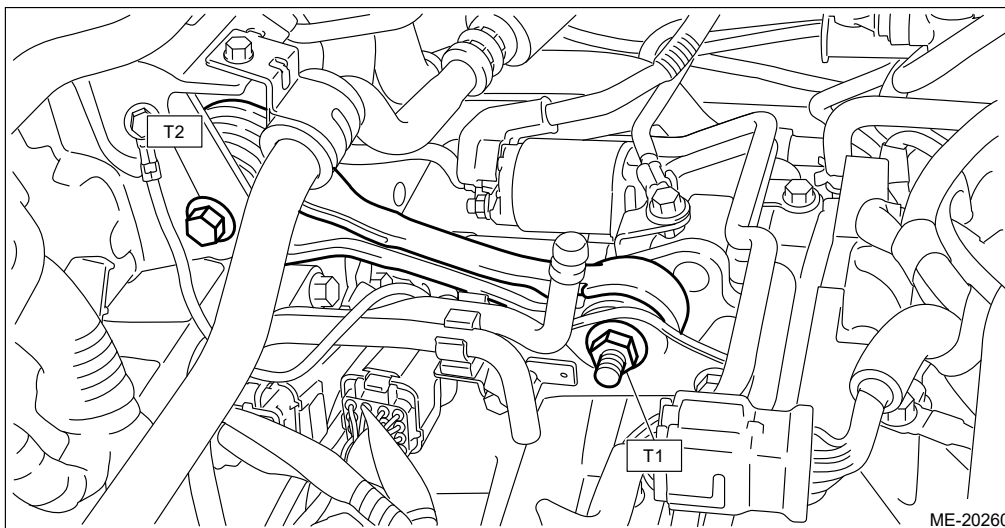


(4) Install the pitching stopper.

Tightening torque:

T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)

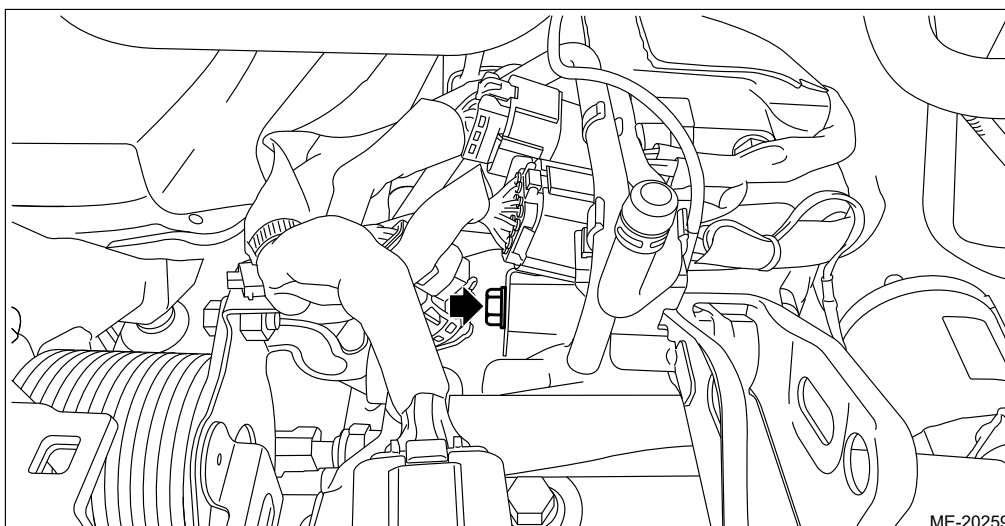
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



(5) Install the bolt which secures the transmission harness stay to the CVT.

Tightening torque:

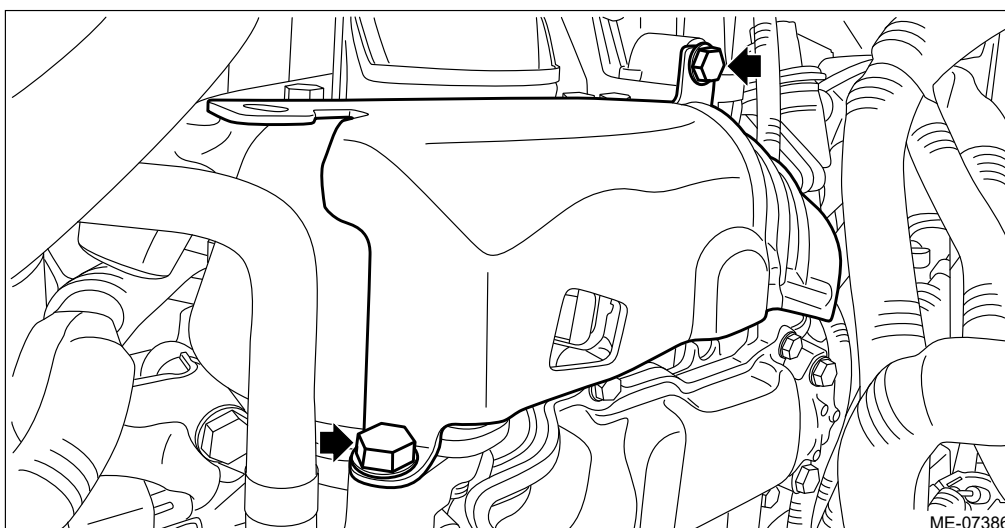
16 N·m (1.6 kgf-m, 11.8 ft-lb)



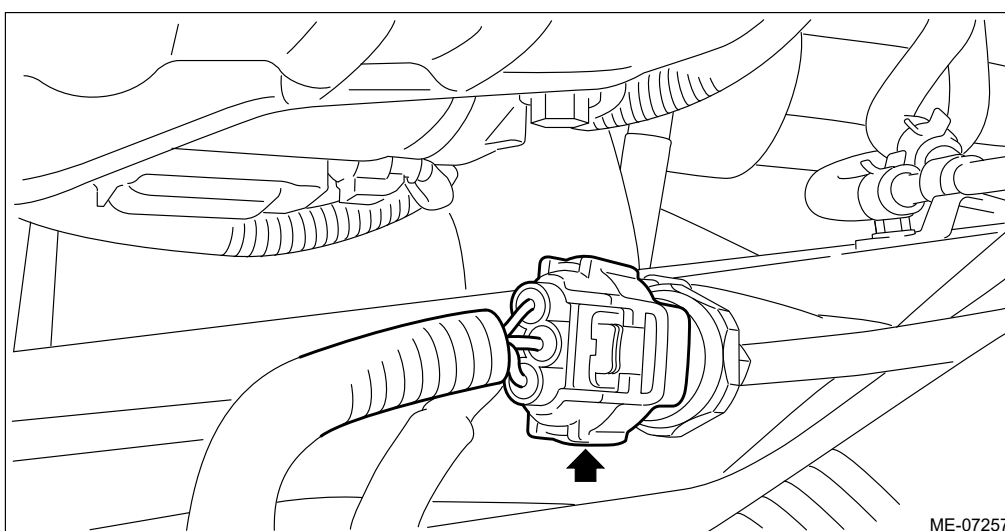
(6) Install the fuel pipe protector to the high-pressure fuel pump case and intake manifold.

Tightening torque:

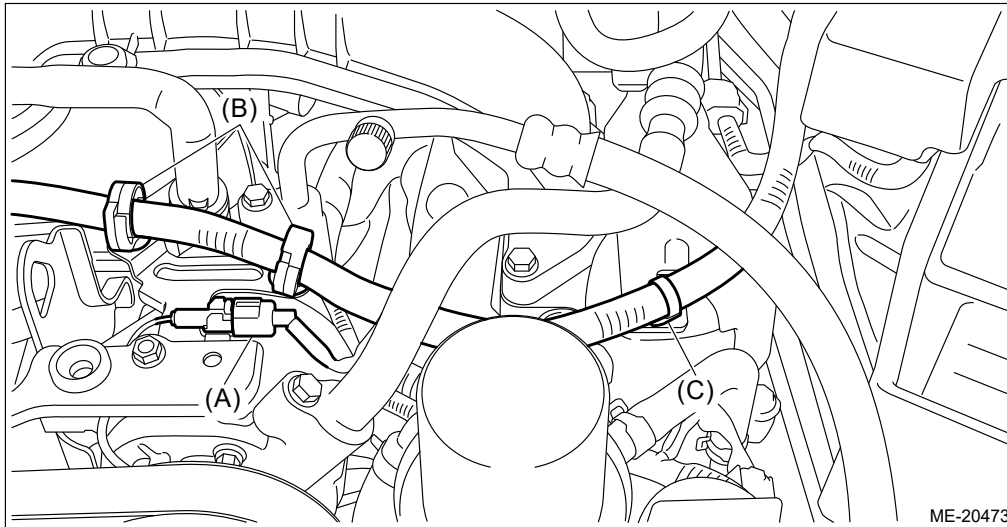
19 N·m (1.9 kgf-m, 14.0 ft-lb)



(7) Connect the connector to the pressure switch (triple pressure switch).



- (8) Set the generator cord, and fix the generator cord to the fuel pipe protector using clip (C).
- (9) Install the generator cord to clip (B), and connect the connector (A) to A/C compressor.

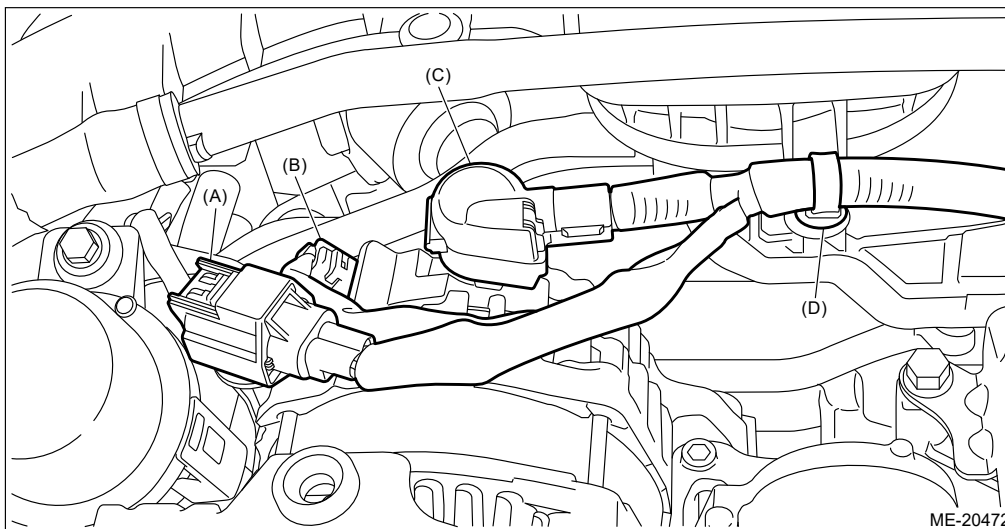


- (10) Using clip (D), fix the generator cord to the generator cord stay, and connect the connector (B) and the terminal (C) to the generator.

Tightening torque:

15 N·m (1.5 kgf-m, 11.1 ft-lb)

- (11) Connect the connector (A) to the brake vacuum pump.



- (12) Install the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>INSTALLATION.](#)

- (13) Lift up the vehicle.

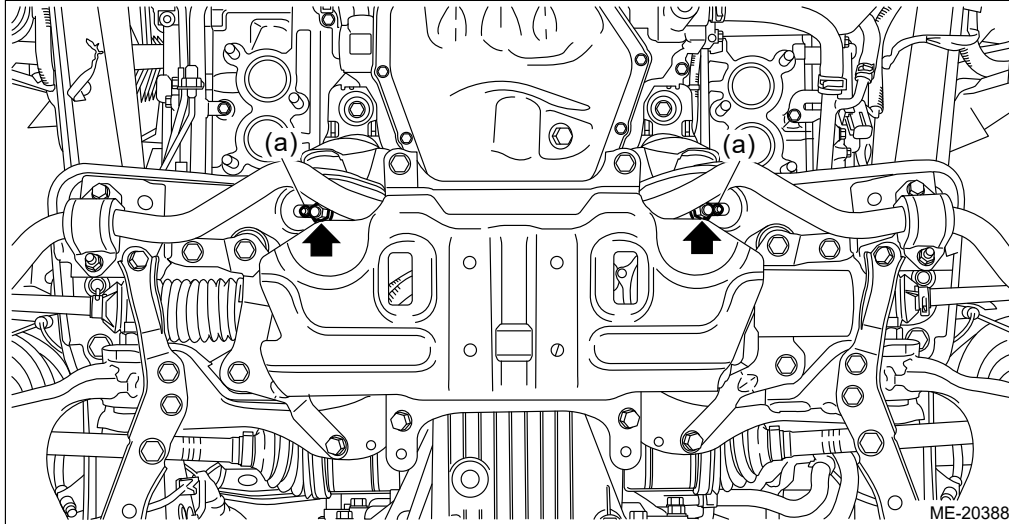
- (14) Install the nuts which hold the engine mounting to the crossmember.





Note:

- **Make sure that locators (a) of the engine mounting are securely inserted.**
- **Use a new nut.**

Tightening torque:

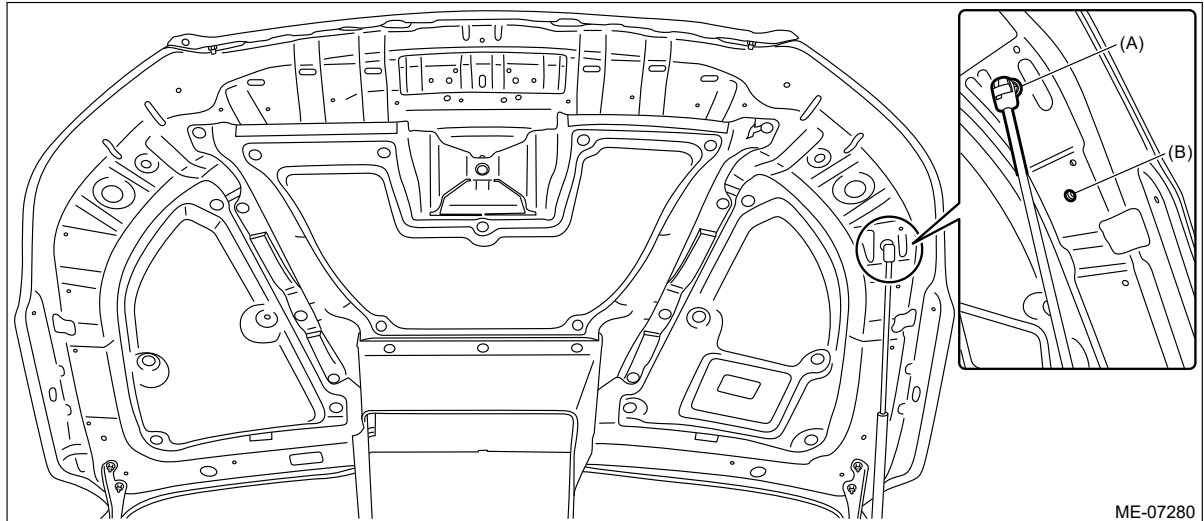
60 N·m (6.1 kgf-m, 44.3 ft-lb)



- (15) Install the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>INSTALLATION.](#)
- (16) Install the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>INSTALLATION.](#)
- (17) Install the battery.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Battery>INSTALLATION.](#)
- (18) Fill engine coolant.  [Ref. to COOLING\(H4DOTC\)>Engine Coolant>REPLACEMENT > FILLING OF ENGINE COOLANT.](#)
- (19) Install the collector cover.
- (20) Change the installation position of the front hood damper from (B) to (A).

Tightening torque:

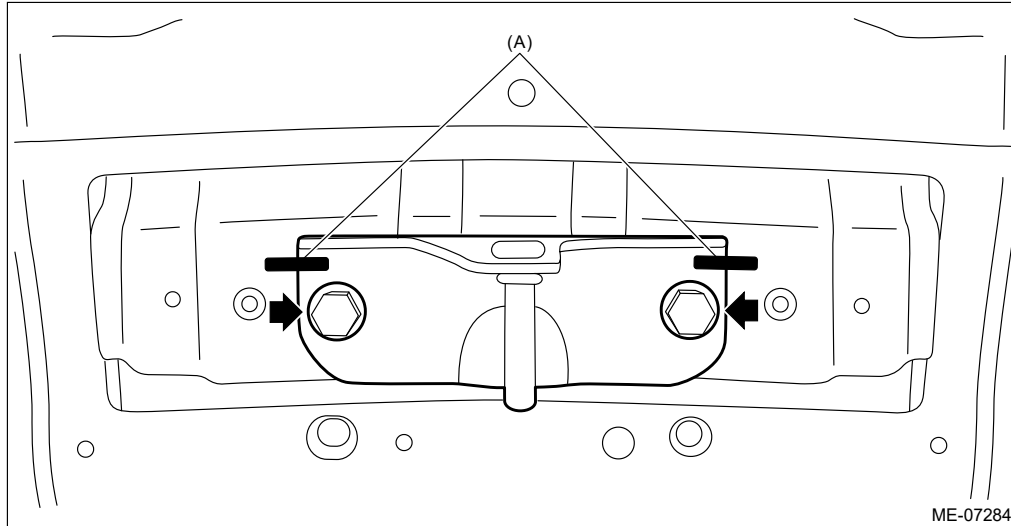
20 N·m (2.0 kgf-m, 14.8 ft-lb)




- (21) Align the alignment marks (A), and install the front hood striker to the front hood.

Tightening torque:

33 N·m (3.4 kgf-m, 24.3 ft-lb)



(22) Install the bracket grille - UPR, and the grille assembly - front CTR.  [Ref. to EXTERIOR/INTERIOR TRIM>Front Grille>INSTALLATION.](#)

REMOVAL

1. ROCKER COVER RH



Note:

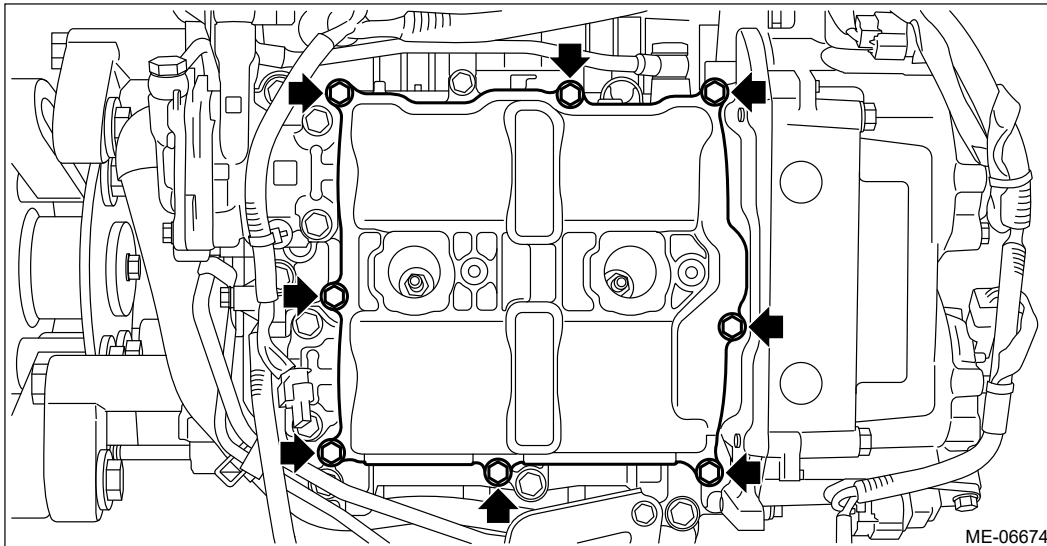
When replacing a single part, perform the work with the engine assembly installed to body.

1. When working on the vehicle

Note:

When working on the vehicle, perform the following steps also.

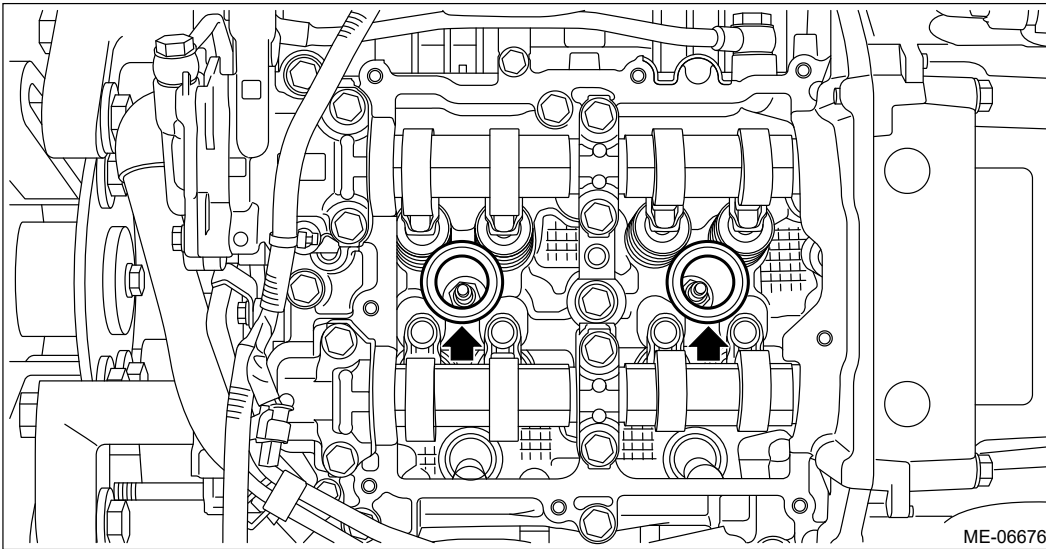
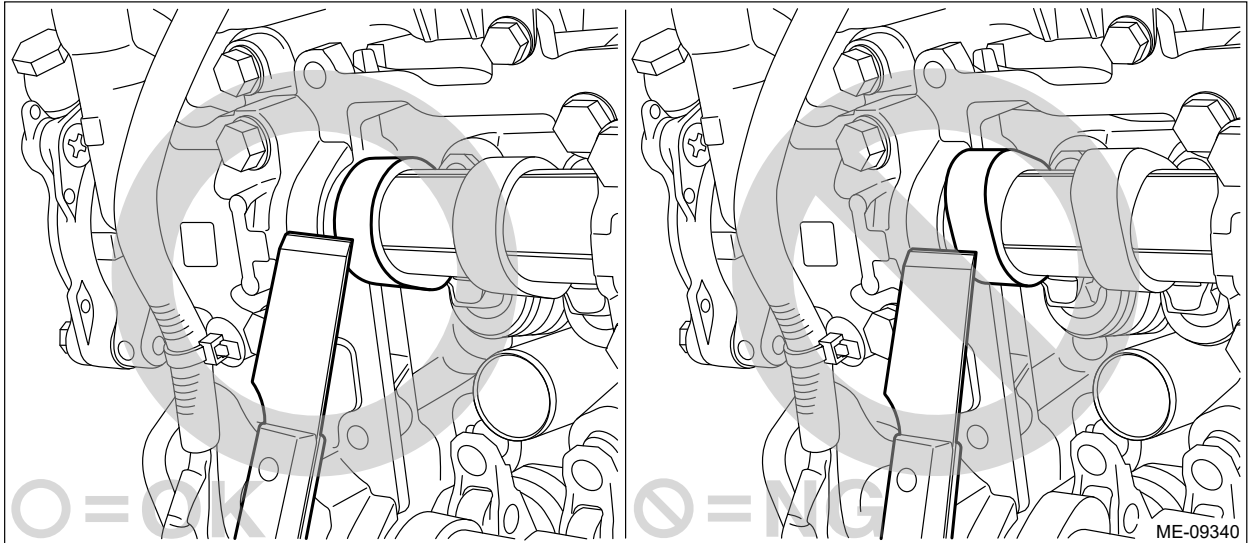
- (1) Remove the air cleaner case.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Cleaner Case>REMOVAL.](#)
2. Remove the #1 ignition coil and the #3 ignition coil.  [Ref. to IGNITION\(H4DOTC\)>Ignition Coil>REMOVAL.](#)
3. Remove the rocker cover RH.



4. Remove the rocker cover gasket RH, #1 spark plug pipe gasket and #3 spark plug pipe gasket, and remove the liquid gasket.

Caution:

- When removing the liquid gasket from engine unit using scraper, use special care not to damage the cam lobe of camshaft RH.
- If the cam lobe of camshaft RH interferes, turn the crankshaft to the position where the scraper does not touch.



2. ROCKER COVER LH


Note:

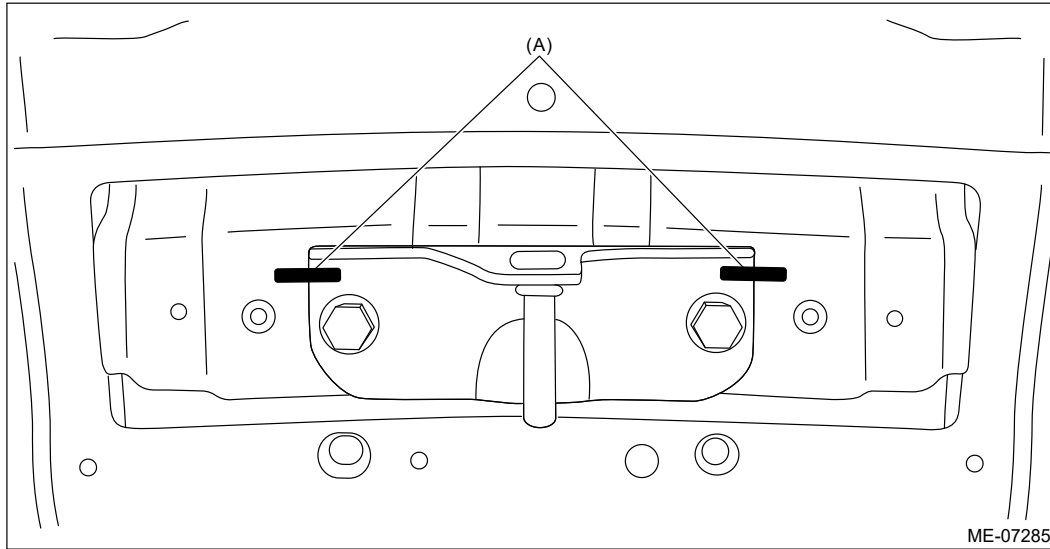
When replacing a single part, perform the work with the engine assembly installed to body.

1. When working on the vehicle

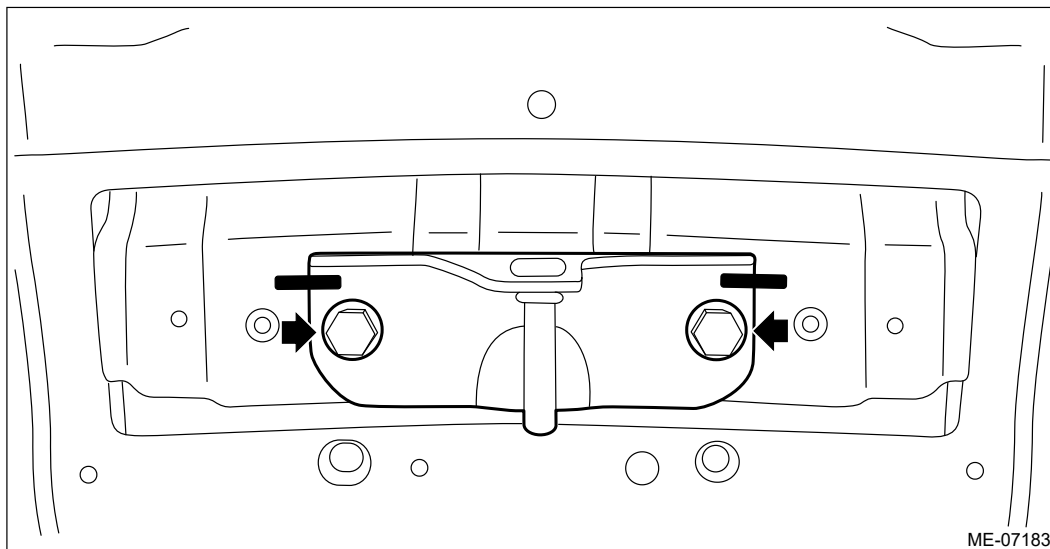
Note:

When working on the vehicle, perform the following steps also.

- (1) Remove the bracket - grille UPR, and the grille assembly - front CTR.  Ref. to [EXTERIOR/INTERIOR TRIM>Front Grille>REMOVAL > FRONT GRILLE UPPER.](#)
- (2) Using a marker pen, make alignment marks (A) on both the front hood and the front hood striker.



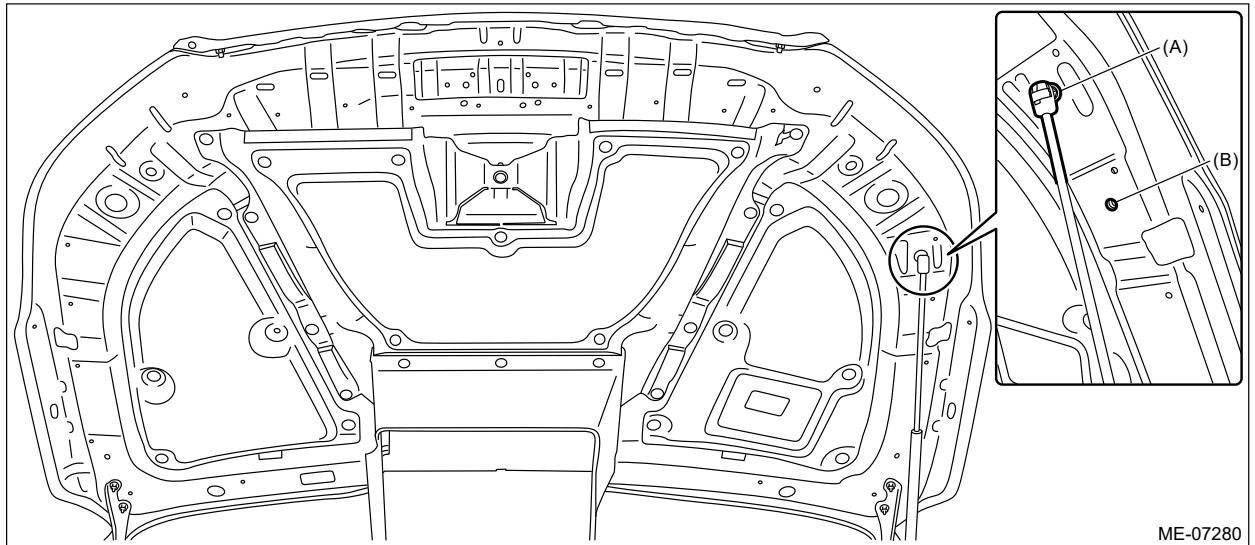
(3) Remove the front hood striker from the front hood.



(4) Change the front hood damper mounting position from (A) to (B), and completely open the front hood.

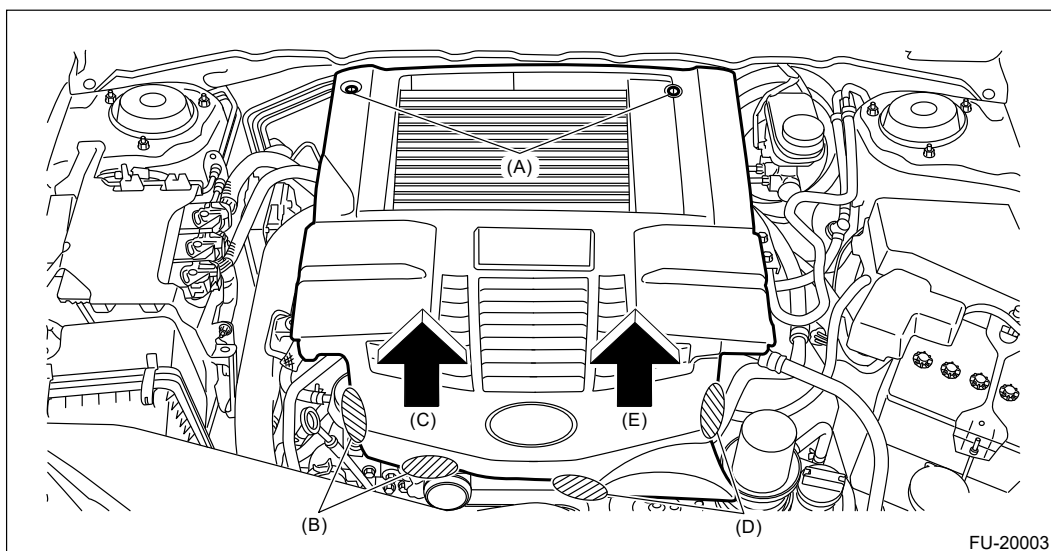
Tightening torque:




20 N·m (2.0 kgf-m, 14.8 ft-lb)

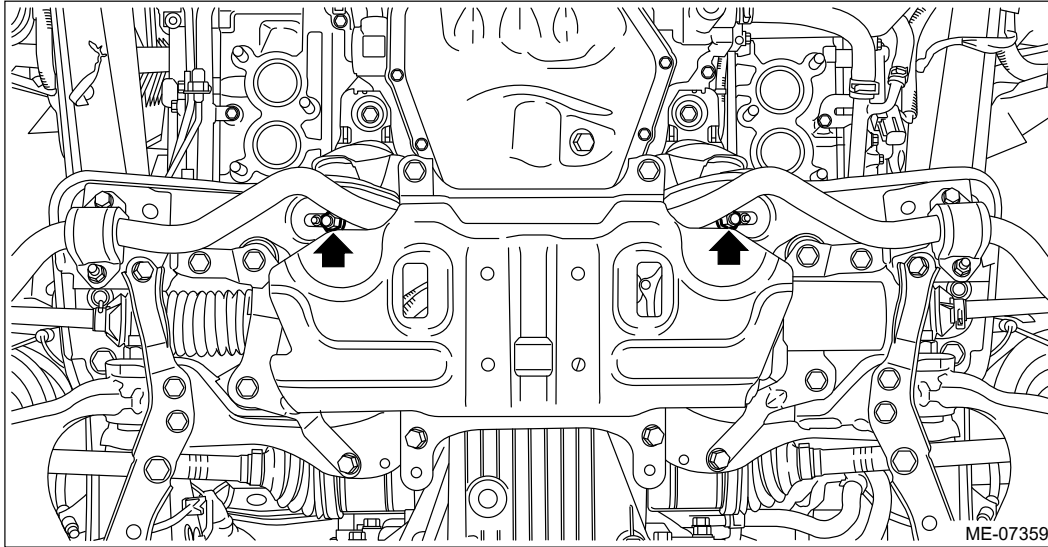



(5) Remove the collector cover.

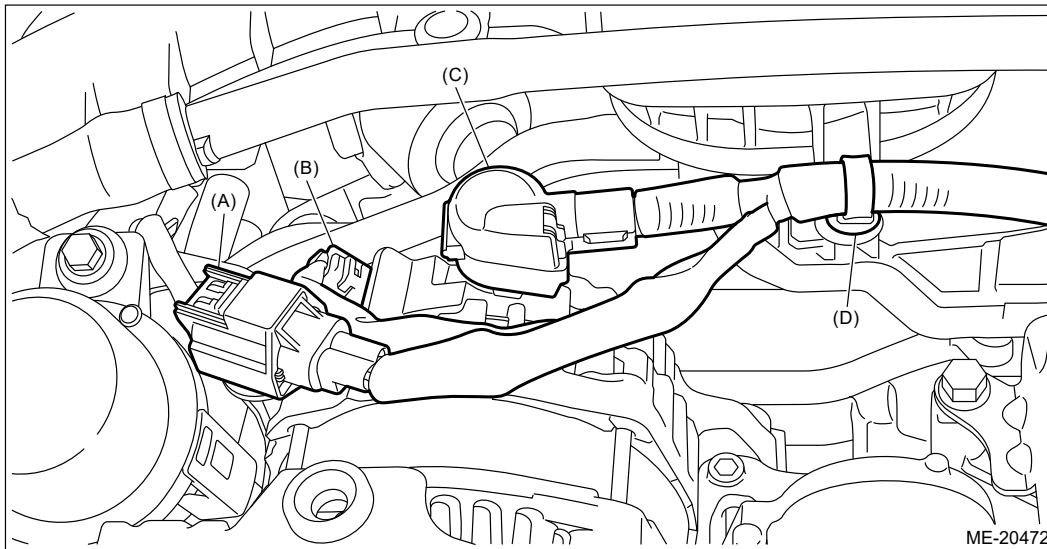
1. Remove the clip (A).
2. Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
3. Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



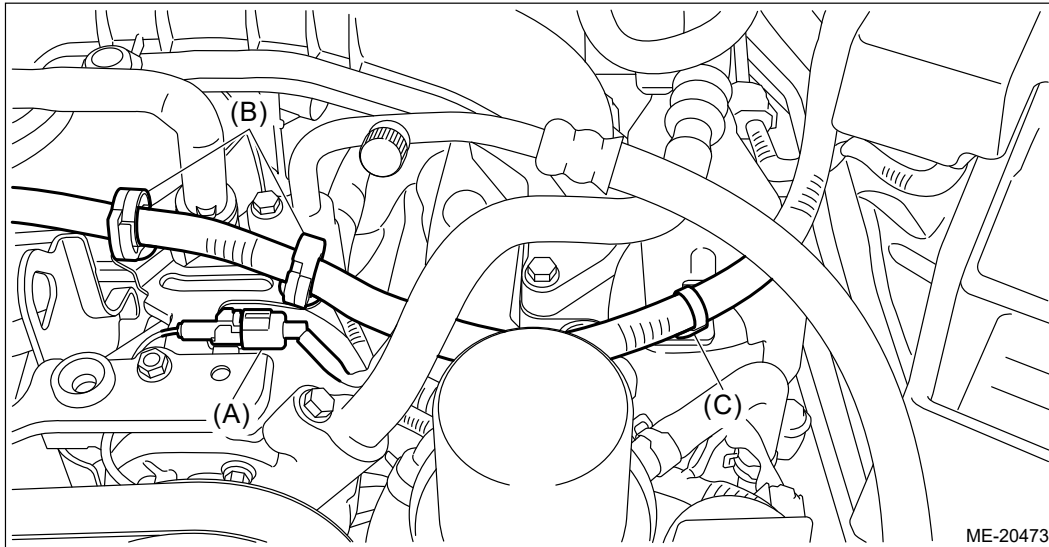
- (6) Remove the battery.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Battery>REMOVAL.](#)
- (7) Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)
- (8) Remove the front exhaust pipe.  [Ref. to EXHAUST\(H4DOTC\)>Front Exhaust Pipe>REMOVAL.](#)
- (9) Remove the nuts which secure the engine mounting to the front crossmember.



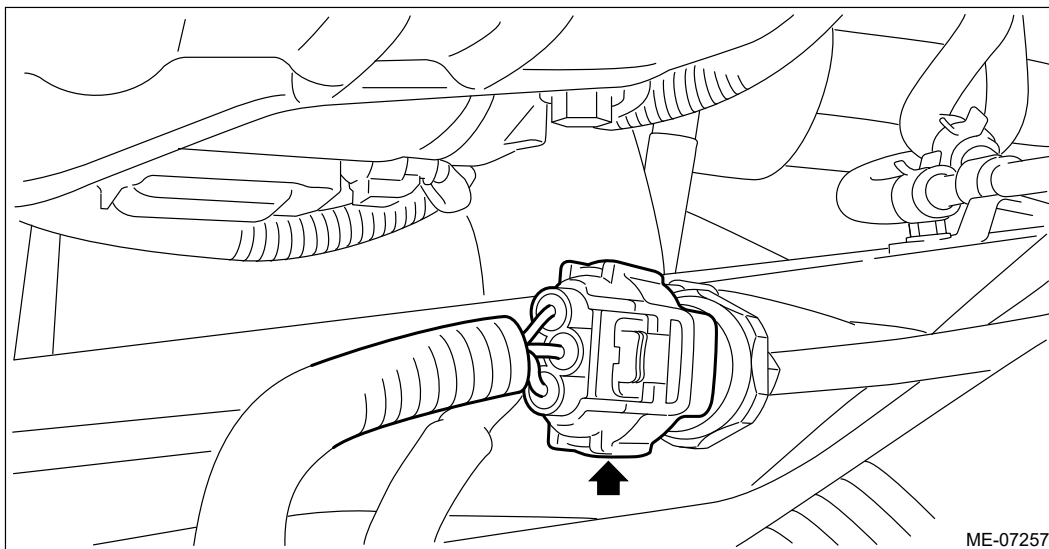
- (10) Lower the vehicle.
- (11) Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
- (12) Disconnect the connector (A) from the brake vacuum pump.
- (13) Disconnect connector (B) and terminal (C) from the generator, and remove the clip (D) securing the generator cord to the intake manifold.



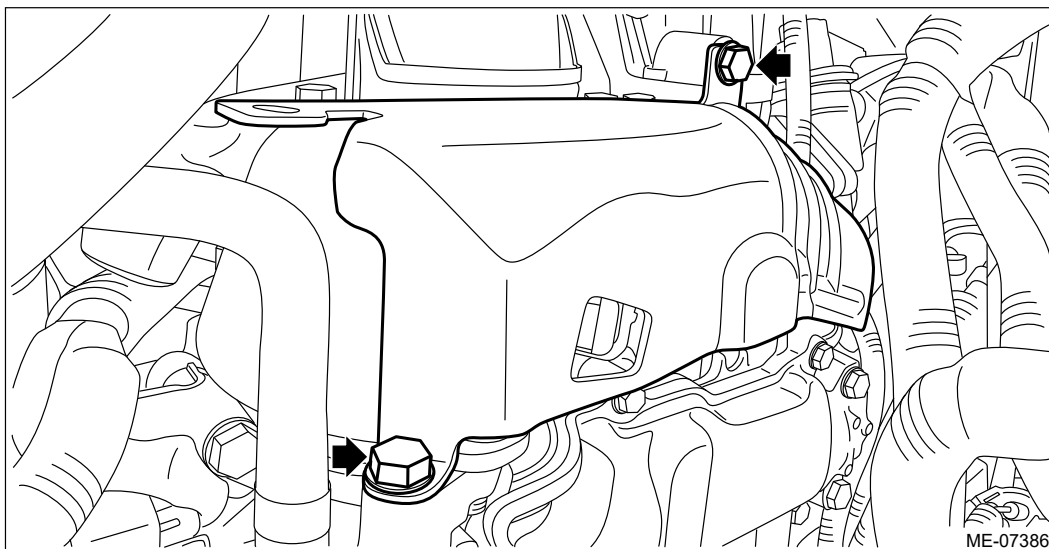
- (14) Disconnect connector (A) from A/C compressor, and remove the generator cord from clip (B).
- (15) Remove the clip (C) securing the generator cord to the fuel pipe protector, and move the generator cord aside so that it does not interfere with the work.



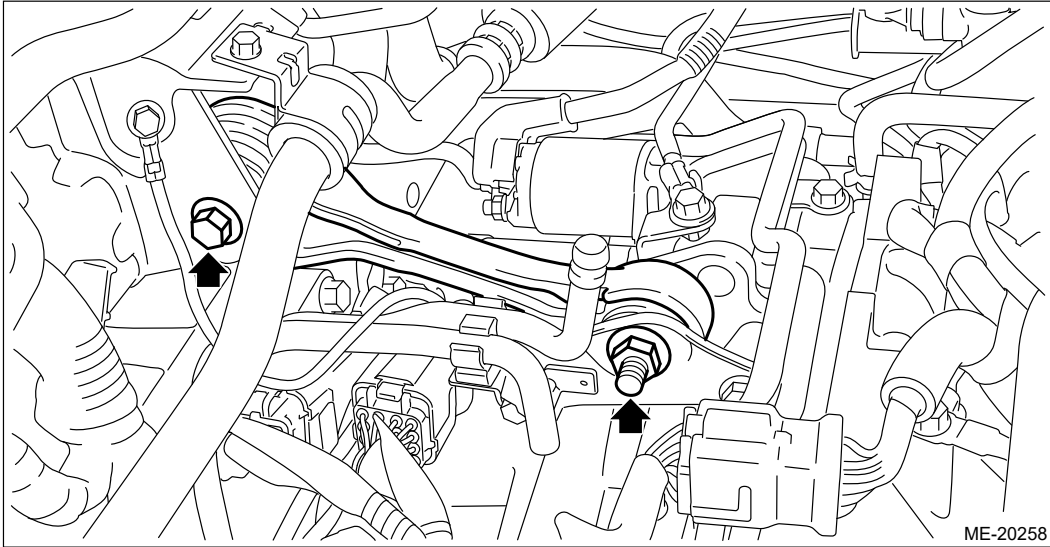
(16) Disconnect the connector from pressure switch (triple pressure switch).



(17) Remove the fuel pipe protector from the high-pressure fuel pump case and intake manifold.



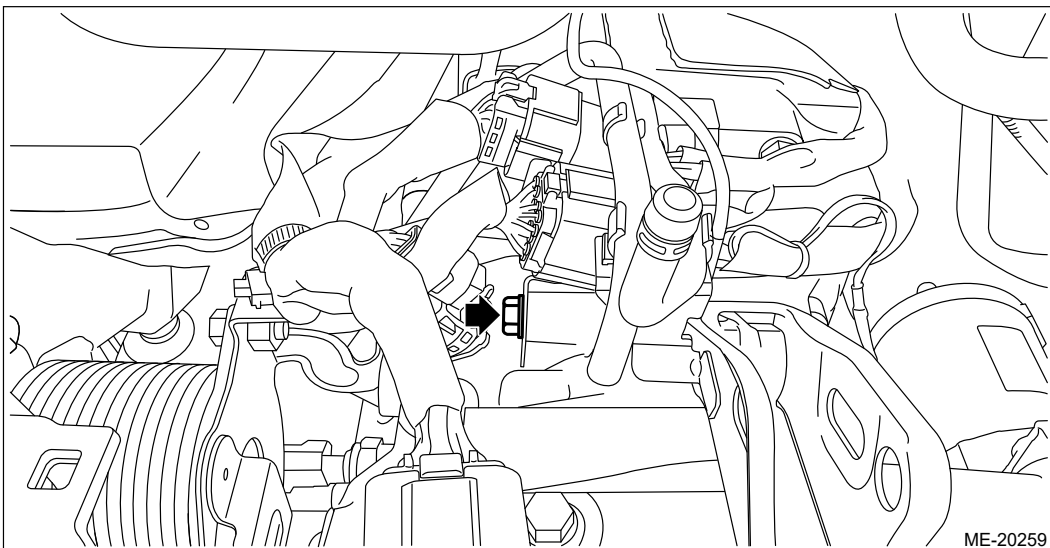
(18) Remove the pitching stopper.



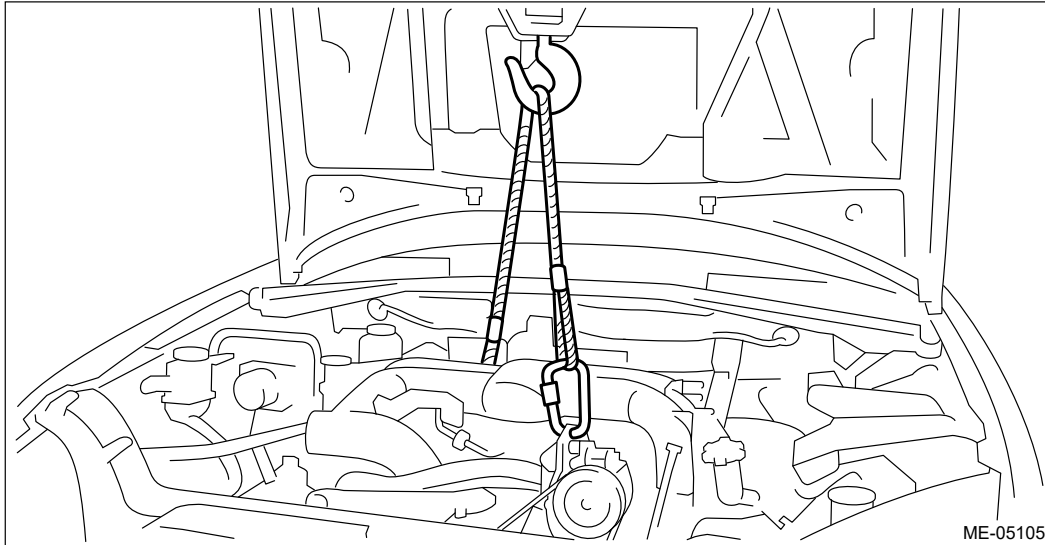
(19) Remove the bolt securing the transmission harness stay to the CVT.

Note:

This procedure is required to prevent the transmission connector from touching the A/C pressure hose during engine removal/installation.



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



- (21) Lift the engine high enough until the stud bolt of the engine mount is drawn out of the crossmember.

Caution:

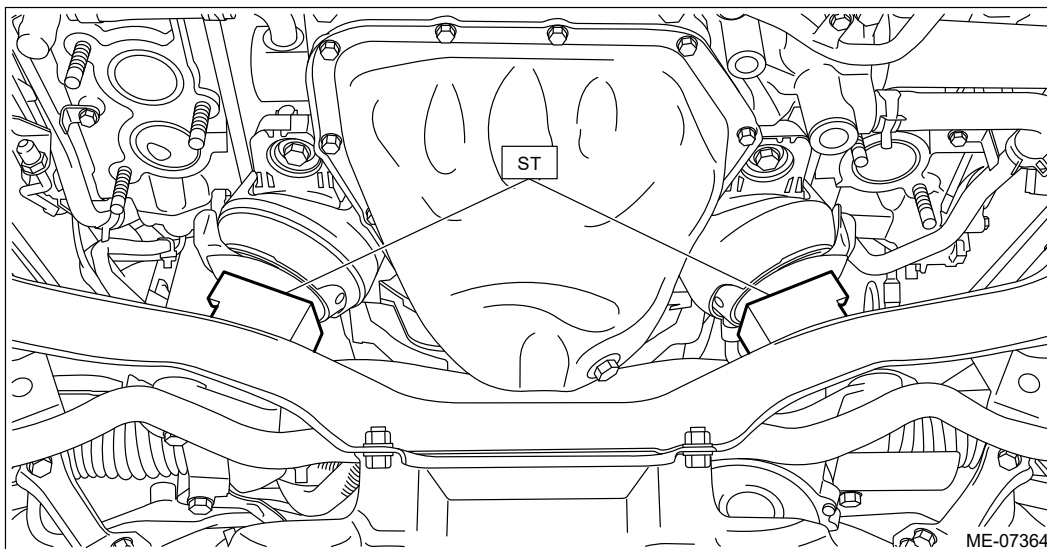
When lifting up the engine, pay attention to the clearance of each part and be careful not to lift the engine too much, in order to prevent damaging the vehicle.

- (22) Set the ST between the engine mount and crossmember, and slowly lower the engine.

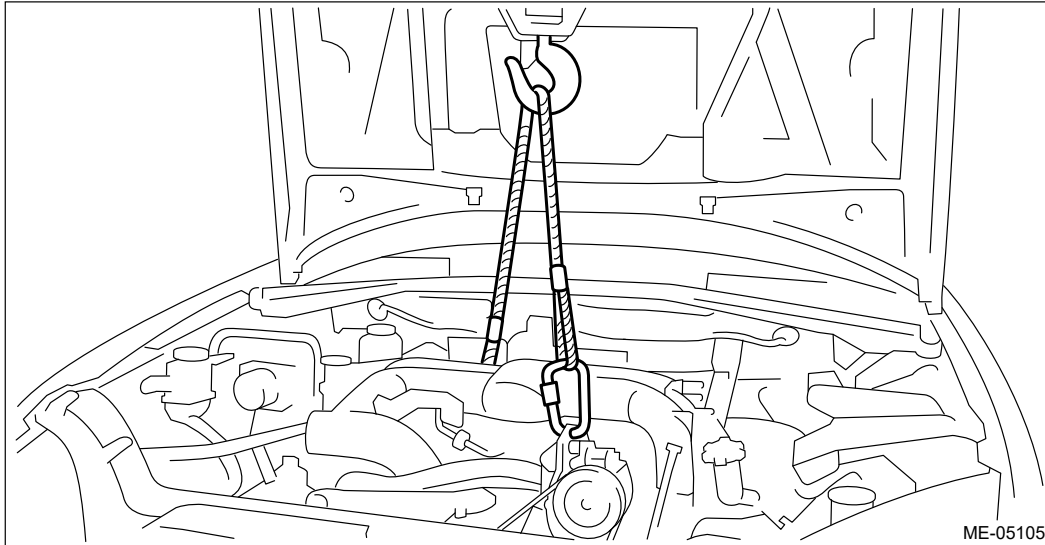
Caution:



After lowering the engine, check that the ST does not come off even if the engine is bounced.

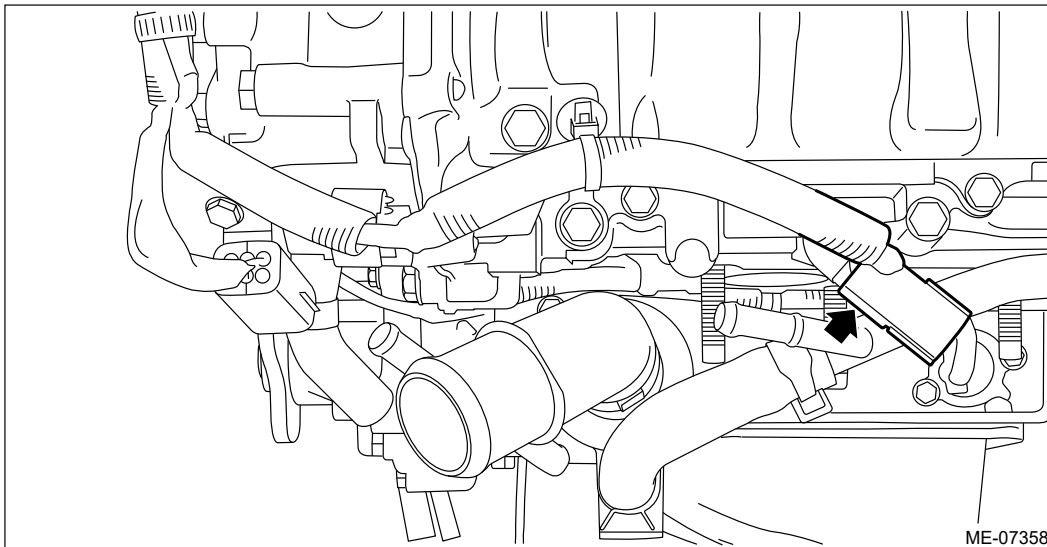
ST 18632AA020 STAND ASSY



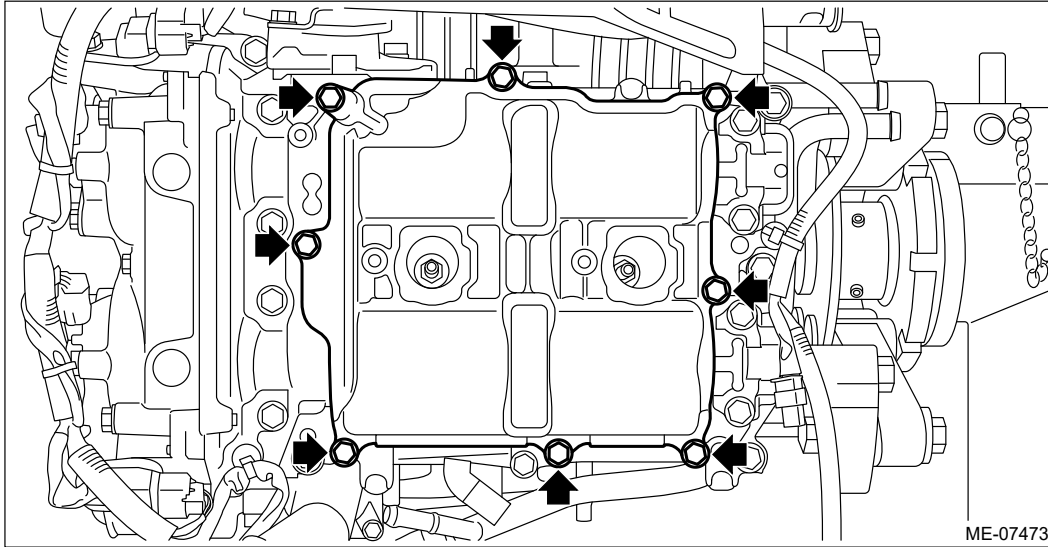
- (23) Remove the lifting device and wire ropes.



2. Remove the side engine oil cooler pipe assembly.  [Ref. to LUBRICATION\(H4DO\)>Engine Oil Cooler Pipe>REMOVAL > SIDE ENGINE OIL COOLER PIPE.](#)
3. Remove the #2 ignition coil and the #4 ignition coil.  [Ref. to IGNITION\(H4DOTC\)>Ignition Coil>REMOVAL.](#)
4. Remove the connector from the water pipe LH.



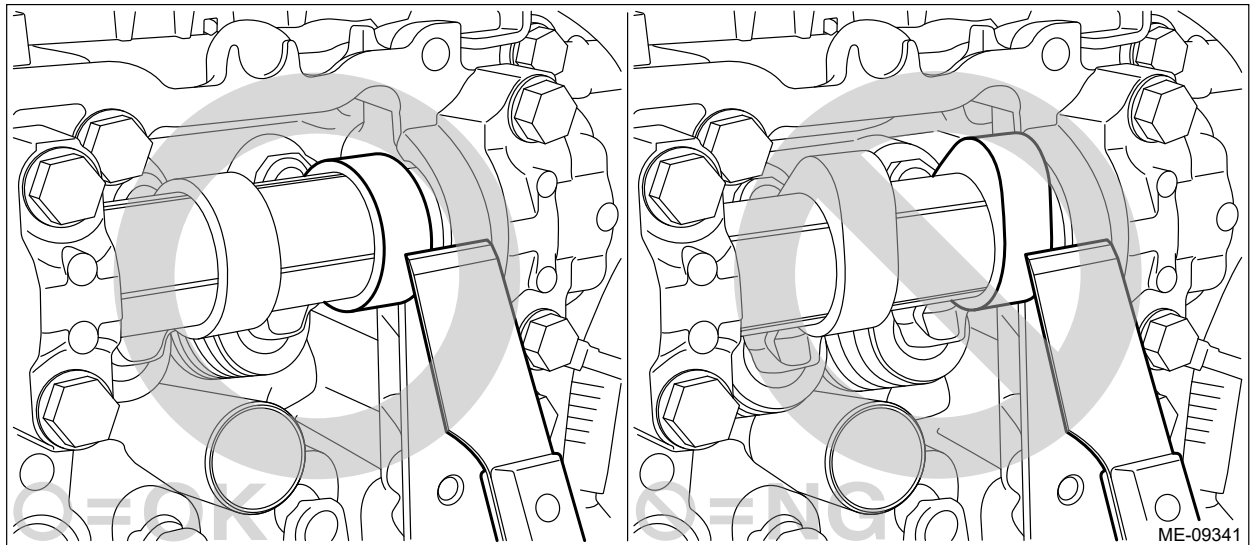
5. Remove the rocker cover LH.

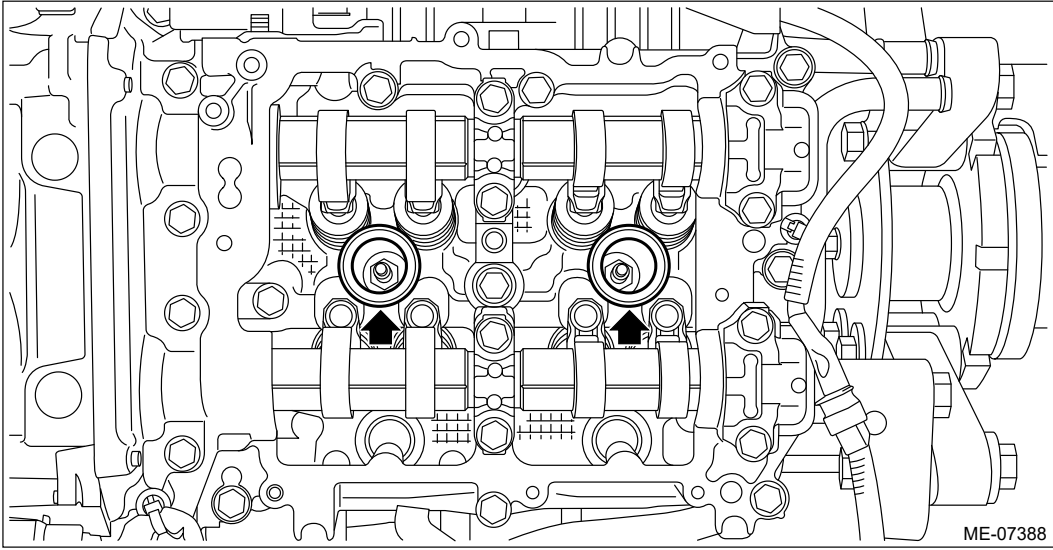


6. Remove the rocker cover gasket LH, #2 spark plug pipe gasket and #4 spark plug pipe gasket, and remove the liquid gasket.

Caution:

- When removing the liquid gasket from engine unit using scraper, use special care not to damage the cam lobe of camshaft LH.
- If the cam lobe of camshaft LH interferes, turn the crankshaft to the position where the scraper does not touch.





ME-07388

MECHANICAL(H4DOTC) > Symptoms and causes

INSPECTION



Note:



The "RANK" shown in the chart shows the possibilities of the cause of trouble in order from "Very often" to "Rarely".



A – Very often


B – Sometimes




C – Rarely



| Symptoms | Problem parts etc. | Possible cause | RANK |
|---|--|---|------|
| 1. Engine does not start. | | | |
| 1) Starter does not turn. | Starter | Defective battery-to-starter harness | B |
| | | Defective starter switch | C |
| | | Defective inhibitor switch | C |
| | | Defective starter | B |
| | Battery | Improper connection of terminal | A |
| | | Run-down battery | A |
| | | Defective charging system | B |
| | Friction | Seizure of crankshaft and connecting rod bearing | C |
| | | Seized camshaft | C |
| | | Seized or stuck piston and cylinder | C |
| Immobilizer system  Ref. to IMMOBILIZER (DIAGNOSTICS)>Basic Diagnostic Procedure. | | A | |
| 2) Initial combustion does not occur. | Starter | Defective starter | C |
| | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. | | A |
| | Fuel line | Defective fuel pump and relay | A |
| | | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing chain | Trouble | B |
| | | Defective timing | B |
| | Compression | Incorrect cam clearance | C |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| Worn or stuck piston rings, cylinder liner | | C | |

| | | | |
|--|--|---|---|
| | | and piston | |
| | | Incorrect valve timing | B |
| | | Improper engine oil (low viscosity) | B |
| 3) Initial combustion occurs. | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. | | A |
| | Intake system | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | Fuel line | Defective fuel pump and relay | C |
| | | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing chain | Trouble | B |
| | | Defective timing | B |
| | Compression | Incorrect cam clearance | C |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder liner and piston | C |
| | | Incorrect valve timing | B |
| | | Improper engine oil (low viscosity) | B |
| 4) Engine stalls after initial combustion. | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened or cracked intake duct | B |
| | | Loosened or cracked PCV hose | C |
| | | Loosened or cracked vacuum hose | C |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Dirty air cleaner element | C |
| | Fuel line | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing chain | Trouble | B |
| | | Defective timing | B |
| | Compression | Incorrect cam clearance | C |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |

| | | | |
|---|--|---|---|
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | B |
| | | Improper engine oil (low viscosity) | B |
| 2. Rough idle and engine stall | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened or cracked intake duct | A |
| | | Loosened or cracked PCV hose | A |
| | | Loosened or cracked vacuum hose | A |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Defective PCV valve | C |
| | | Loosened oil filler cap | B |
| | | Dirty air cleaner element | C |
| | Fuel line | Defective fuel pump and relay | C |
| | | Clogged fuel line | C |
| | | Lack of fuel or insufficient fuel | B |
| | Timing chain | Defective timing | C |
| | Compression | Incorrect cam clearance | B |
| | | Loosened spark plug or defective gasket | B |
| | | Loosened cylinder head bolt or defective cylinder head gasket | B |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | B |
| | | Incorrect valve timing | A |
| | | Improper engine oil (low viscosity) | B |
| | Lubrication system | Incorrect oil pressure | B |
| | | Defective rocker cover gasket | C |
| | Cooling system | Over-heating | C |
| | Other | Evaporative emission control system malfunction | A |
| | | Stuck or damaged throttle valve | B |
| 3. Low output, hesitation and poor acceleration | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened or cracked intake duct | A |
| | | Loosened or cracked PCV hose | A |
| | | Loosened or cracked vacuum hose | B |

| | | | |
|------------|-----------------------|--|---|
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | B |
| | | Dirty air cleaner element | A |
| | Fuel line | Defective fuel pump and relay | B |
| | | Clogged fuel line | B |
| | | Lack of fuel or insufficient fuel | C |
| | Timing chain | Defective timing | B |
| | Compression | Incorrect cam clearance | B |
| | | Loosened spark plug or defective gasket | B |
| | | Loosened cylinder head bolt or defective cylinder head gasket | B |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | B |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | A |
| | | Improper engine oil (low viscosity) | B |
| | Lubrication system | Incorrect oil pressure | B |
| | Cooling system | Over-heating | C |
| | | Over-cooling | C |
| | Other | Evaporative emission control system malfunction | A |
| 4. Surging | Engine control system |  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. | A |
| | Intake system | Loosened or cracked intake duct | A |
| | | Loosened or cracked PCV hose | A |
| | | Loosened or cracked vacuum hose | A |
| | | Defective intake manifold gasket | B |
| | | Defective throttle body gasket | B |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | B |
| | | Dirty air cleaner element | B |
| | Fuel line | Defective fuel pump and relay | B |
| | | Clogged fuel line | B |
| | | Lack of fuel or insufficient fuel | C |
| | Timing chain | Defective timing | B |
| | Compression | Incorrect cam clearance | B |

| | | | |
|------------------------------------|--|---|---|
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | C |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | C |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | A |
| | | Improper engine oil (low viscosity) | B |
| | Cooling system | Over-heating | B |
| | Other | Evaporative emission control system malfunction | C |
| 5. Engine does not return to idle. | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>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 ENGINE (DIAGNOSTICS) (H4DOTC)>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 ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened or cracked intake duct | C |
| | | Loosened or cracked PCV hose | C |
| | | Loosened or cracked vacuum hose | B |
| | | Defective PCV valve | B |
| | | Loosened oil filler cap | C |
| | Timing chain | Defective timing | B |
| | Compression | Incorrect cam clearance | B |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder head gasket | C |
| | | Improper valve sealing | B |
| | | Defective valve stem | C |
| | | Worn or broken valve spring | C |
| | | Worn or stuck piston rings, cylinder and piston | C |
| | | Incorrect valve timing | A |
| Lubrication system | Incorrect oil pressure | C | |

| | | | |
|-------------------------------------|--|---|---|
| | Cooling system | Over-cooling | C |
| | Other | Evaporative emission control system malfunction | C |
| 8. Knocking | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. | | A |
| | Intake system | Loosened oil filler cap | B |
| | Timing chain | Defective timing | B |
| | Compression | Incorrect cam 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 chain cover attaching bolts and defective gasket | B |
| | | Defective oil filter gasket | B |
| | | Defective crankshaft oil seal | B |
| | | Defective rocker cover gasket | B |
| | | Loosened oil drain plug or defective gasket | B |
| | | Loosened oil pan mounting bolt or defective oil pan | B |
| 10. Excessive fuel consumption | Engine control system  Ref. to ENGINE (DIAGNOSTICS) (H4DOTC)>Basic Diagnostic Procedure. | | A |
| | Intake system | Dirty air cleaner element | A |
| | Timing chain | Defective timing | B |
| | Compression | Incorrect cam clearance | B |
| | | Loosened spark plug or defective gasket | C |
| | | Loosened cylinder head bolt or defective cylinder 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 | |

MECHANICAL(H4DOTC) > Timing Chain Assembly

INSPECTION

- 1.** Check the timing chain, chain guide, chain tensioner lever and chain tensioner for deformation, cracks or other damages.
- 2.** Check the chain guide and chain tensioner lever for abnormal wear.

INSTALLATION

1. TIMING CHAIN LH

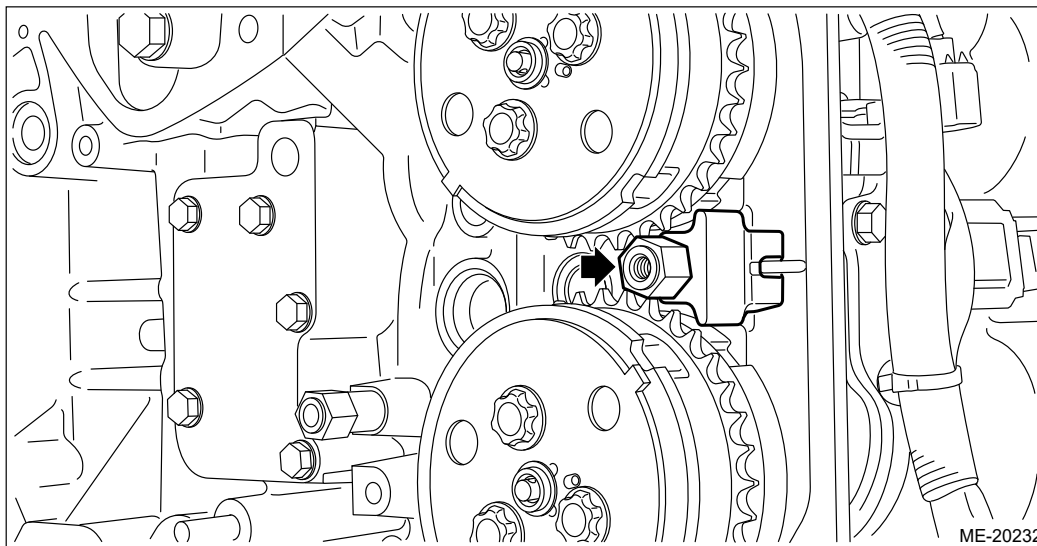
Note:

- Be careful that the foreign matter is not into or onto the assembled component during installation.
- Apply engine oil to all component parts of the timing chain.

1. Install the chain guide LH to the front camshaft cap LH.

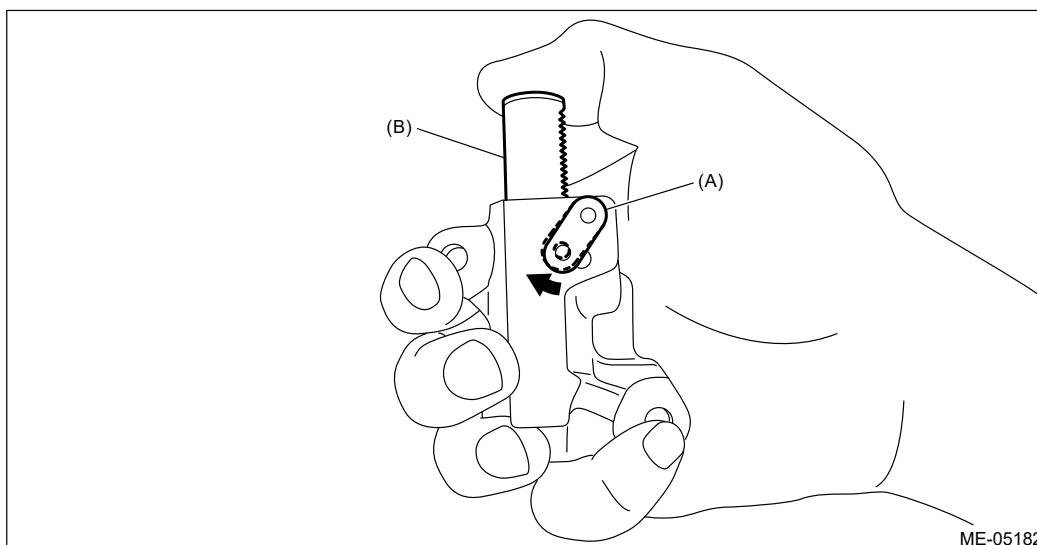
Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



2. Prepare to attach the chain tensioner LH.

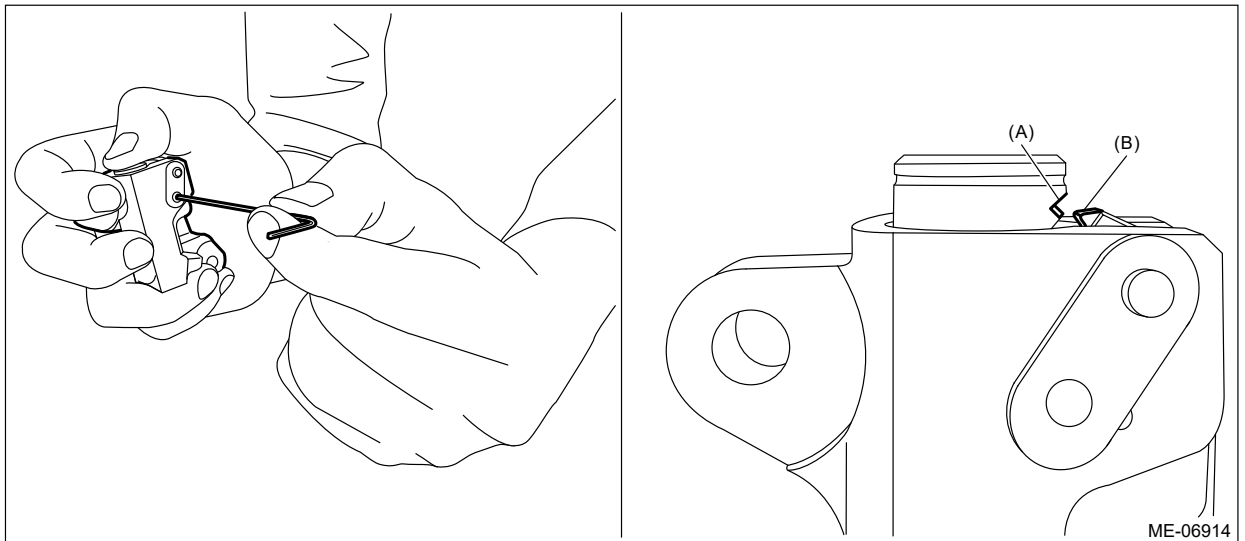
(1) Move the link plate (A) in the direction of arrow to press in the plunger (B).



(2) In order to secure the plunger, insert a stopper pin (clips, etc.) with a diameter of 1.3 mm (0.05 in) or less or a hex wrench with a diameter of 1.3 mm into the stopper pin hole.

Note:

If the stopper pin hole on the link plate and the stopper pin hole on the chain tensioner are not aligned, check that the first notch of plunger rack (A) is engaged with the stopper tooth (B). If not engaged, retract the plunger a little so that the first notch of plunger rack (A) is engaged with the stopper tooth (B).

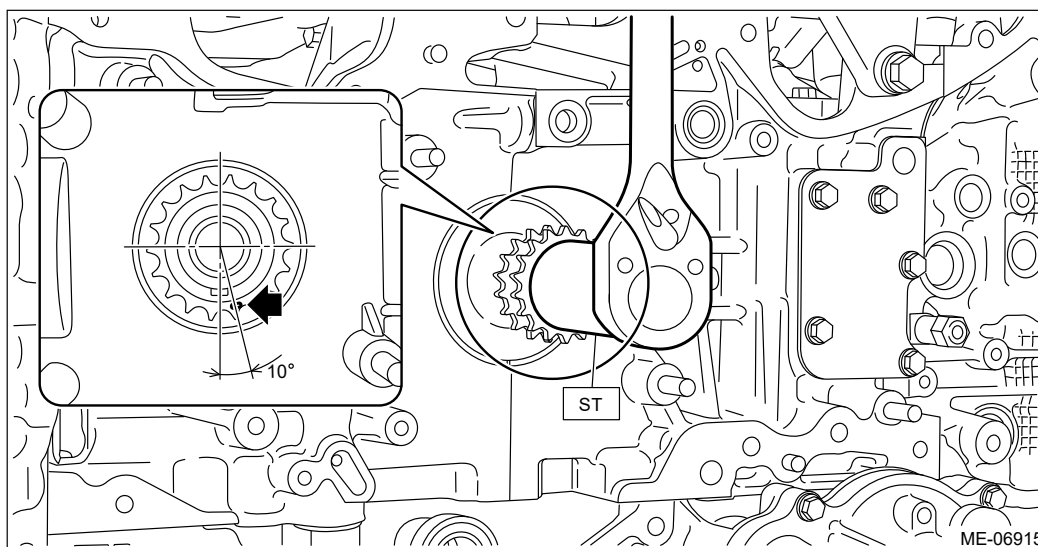


3. Check that the crank sprocket is located at the position shown in the figure. If not aligned, using ST turn the crankshaft to align the crank sprocket alignment mark to the position shown in the figure.

Note:

This procedure is required to prevent the valve and piston contacting with each other in the next step.

ST 18252AA000 CRANKSHAFT SOCKET



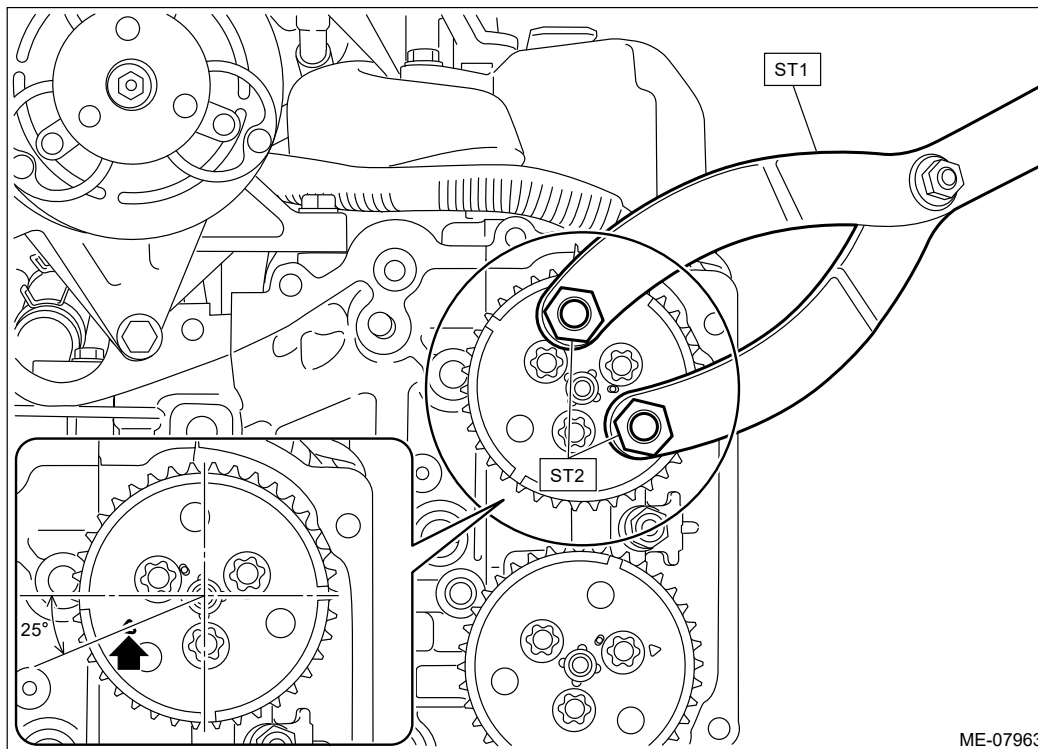
4. Using ST and by turning the intake cam sprocket LH, align the alignment marks to the positions as shown in the figure.

Caution:

- When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn the exhaust camshaft LH.
- Perform the operation carefully since the ST comes off easily.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA020 PULLEY WRENCH PIN SET

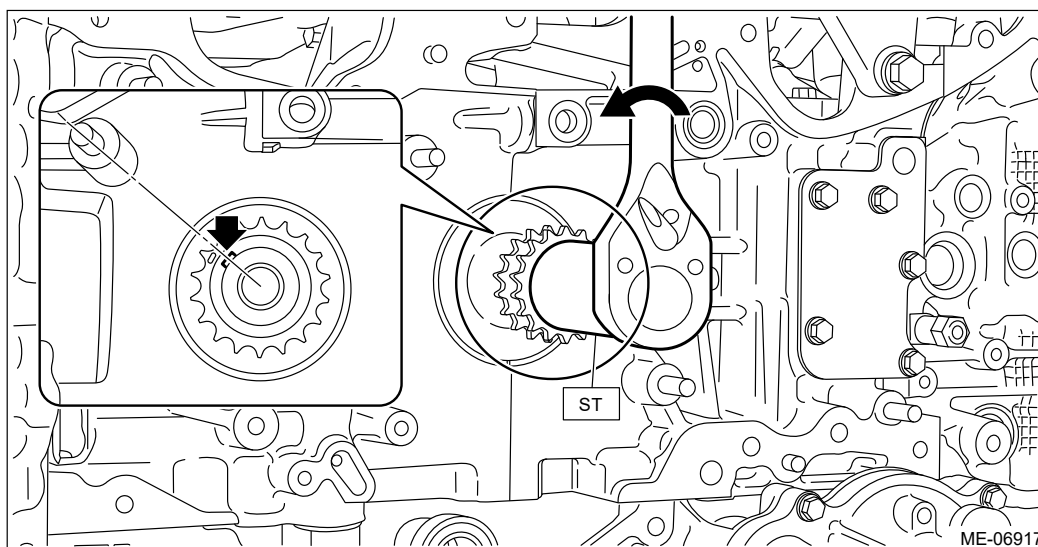


5. Using ST and by turning the crankshaft approximately 200° counterclockwise, align the alignment marks of crankshaft key to the positions as shown in the figure.

Caution:

Never turn clockwise because the valve and piston may contact. Clockwise turn is allowed only when adjusting the key position precisely, after turning the crankshaft counterclockwise to bring the key near the position as shown in the figure.

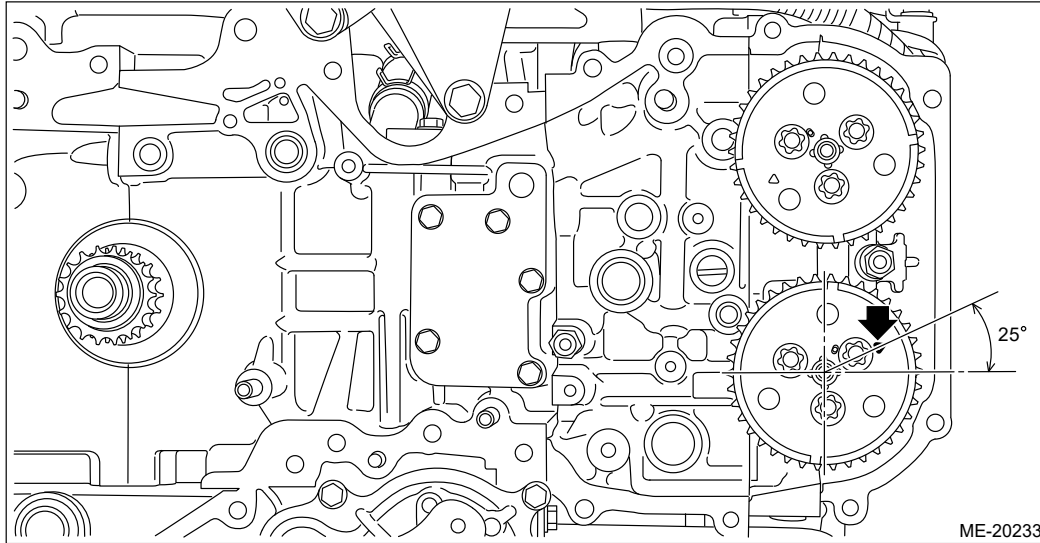
ST 18252AA000 CRANKSHAFT SOCKET



6. Align the alignment mark of exhaust cam sprocket LH to the position shown in the figure.

Caution:

To prevent valve damage, turn the exhaust cam sprocket LH only within the range of zero-lift (in range where it can be turned lightly by hand).

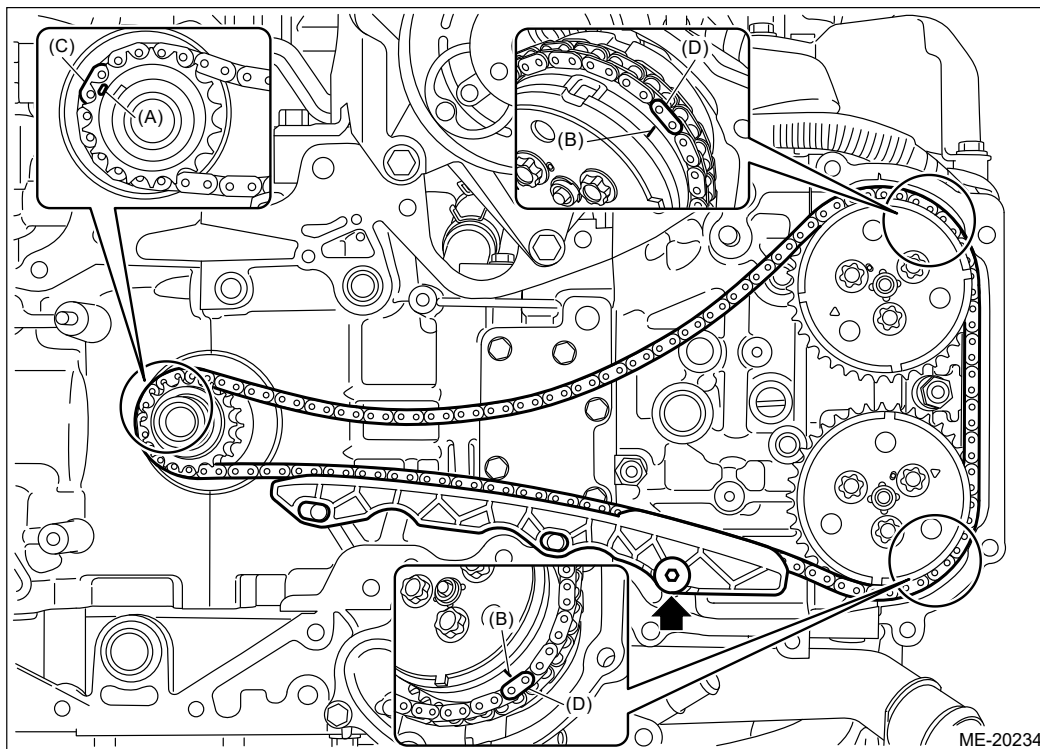


7. Install the timing chain LH and the timing chain guide LH.

- (1) Match the timing chain mark (blue) to the alignment mark of the crank sprocket.
- (2) Match the timing chain mark (pink) to the timing mark position of the intake cam sprocket LH.
- (3) Match the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket LH.
- (4) Install timing chain guide LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(A) Alignment mark

(C) Blue

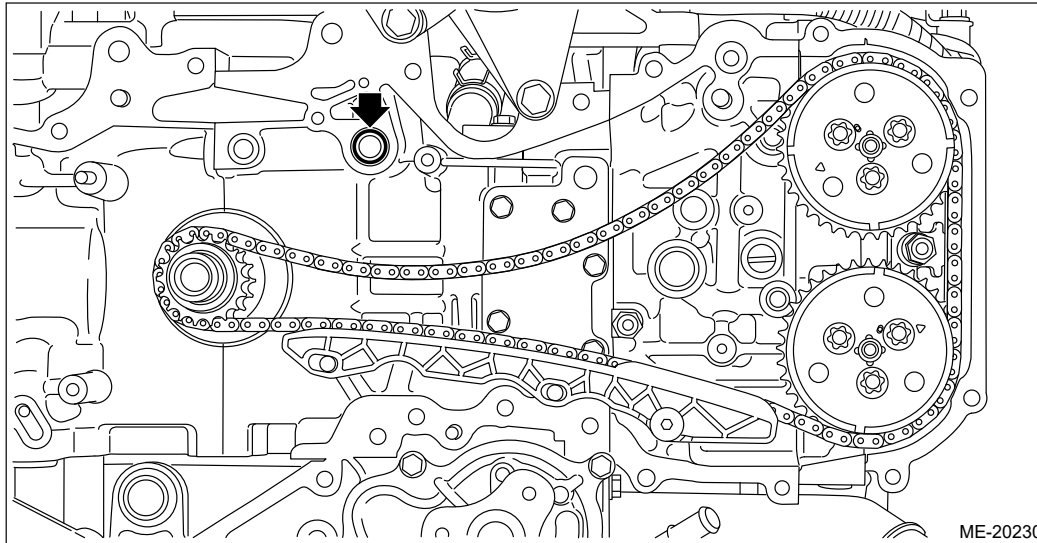
(D) Pink

(B) Timing mark

8. Install O-rings to the cylinder block LH.

Note:

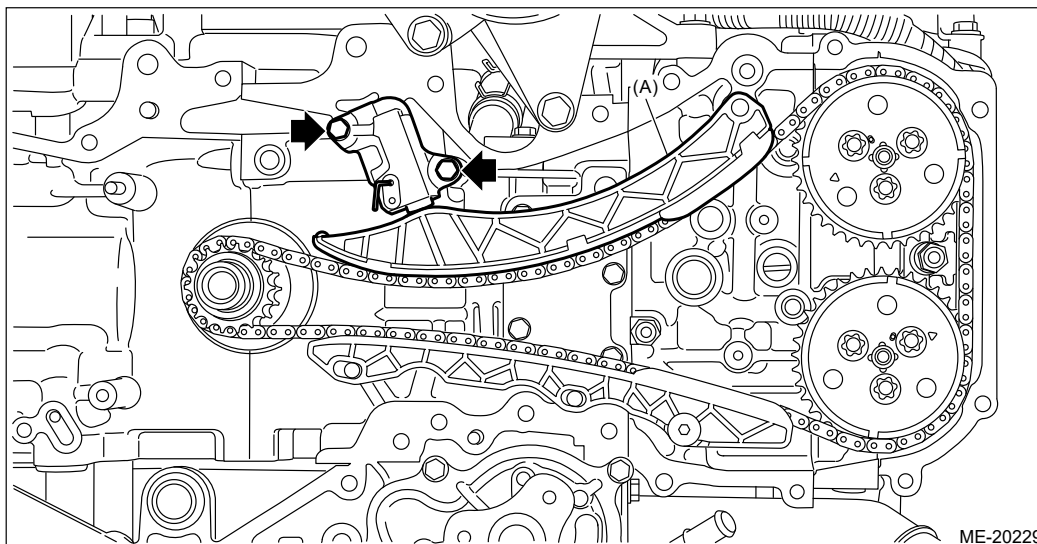
Use new O-rings.



9. Install the chain tensioner lever LH (A) and chain tensioner LH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



10. Pull out the stopper pin from the chain tensioner LH.

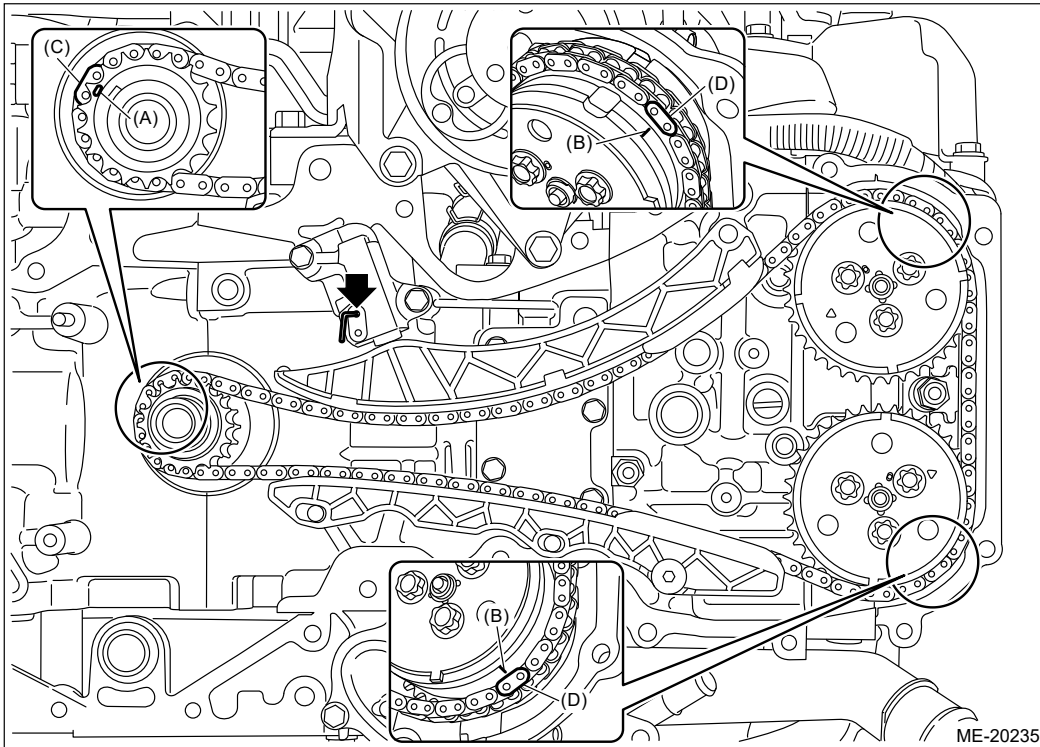
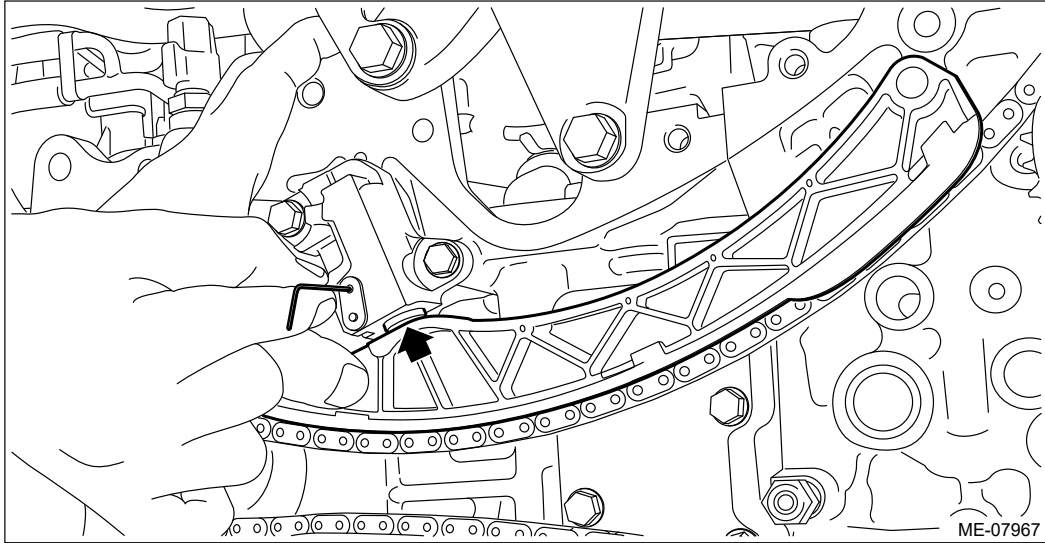
Caution:

Confirm the following before pulling out the stopper pin.

- **Matching of the timing chain mark (blue) to the alignment mark of the crank sprocket.**
- **Matching of the timing chain mark (pink) to the timing mark position of the intake cam sprocket LH.**
- **Matching of the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket LH.**

Note:

If the stopper pin cannot be removed, lift the chain tension lever LH to remove as shown in the figure.



(A) Alignment mark

(B) Timing mark

(C) Blue

(D) Pink

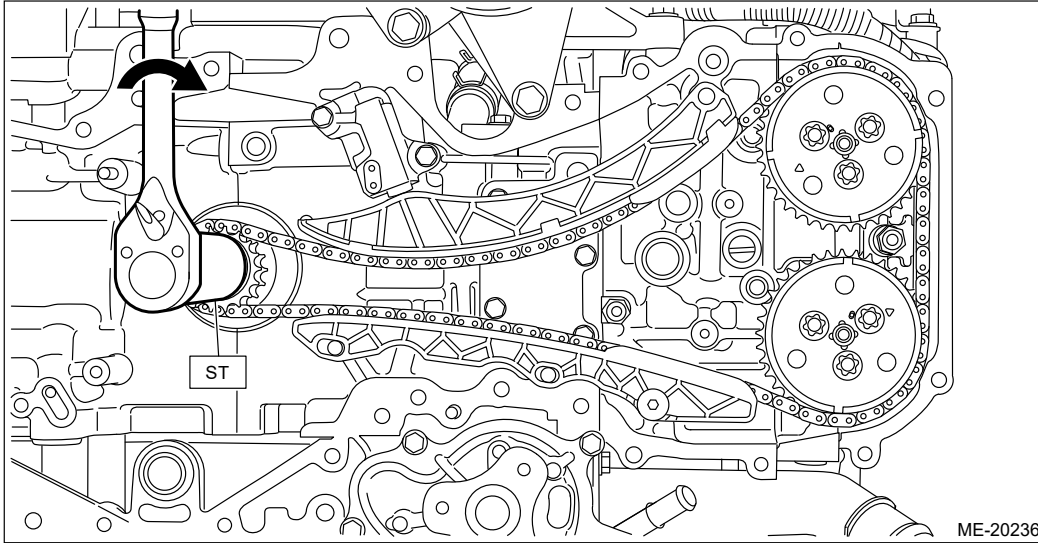
11. Using the ST, turn the crankshaft clockwise, and make sure that there are no abnormal conditions.

Caution:

Always make sure to perform this confirmation.

ST 18252AA000

CRANKSHAFT SOCKET

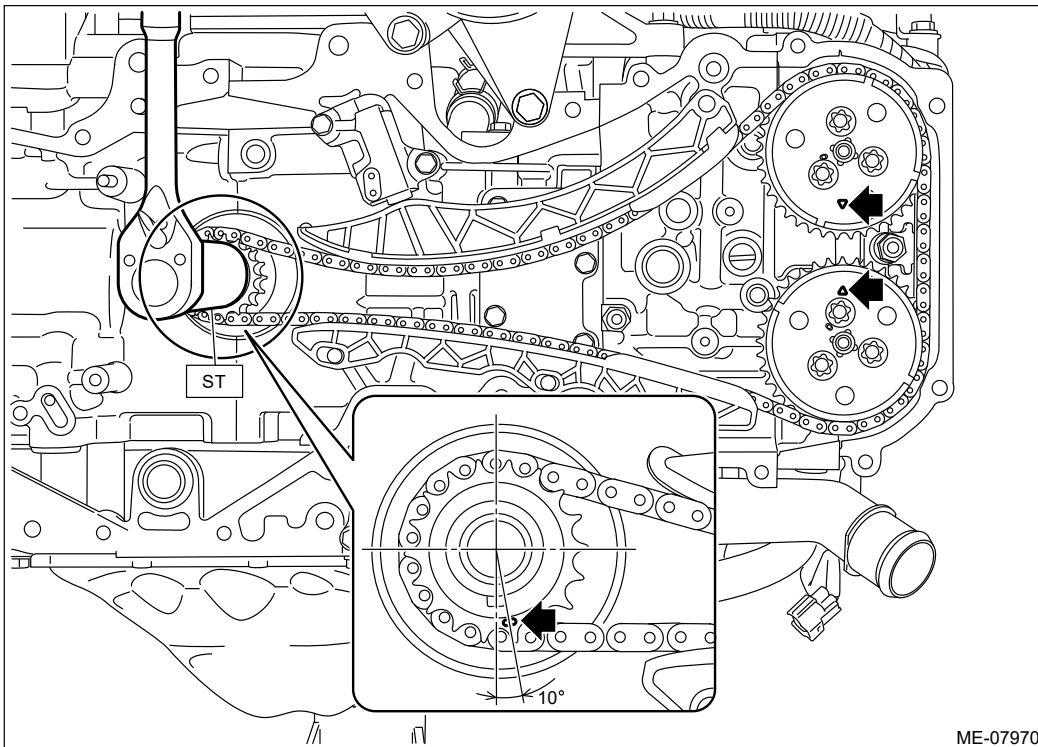


- 12.** Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket LH and exhaust cam sprocket LH to the positions as shown in the figure.

Note:

If the alignment marks are aligned to the positions as shown in the figure, the crankshaft key is located at six o'clock position.

ST 18252AA000 CRANKSHAFT SOCKET




- 13.** Install the timing chain RH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing Chain Assembly>INSTALLATION > TIMING CHAIN RH.](#)

2. TIMING CHAIN RH

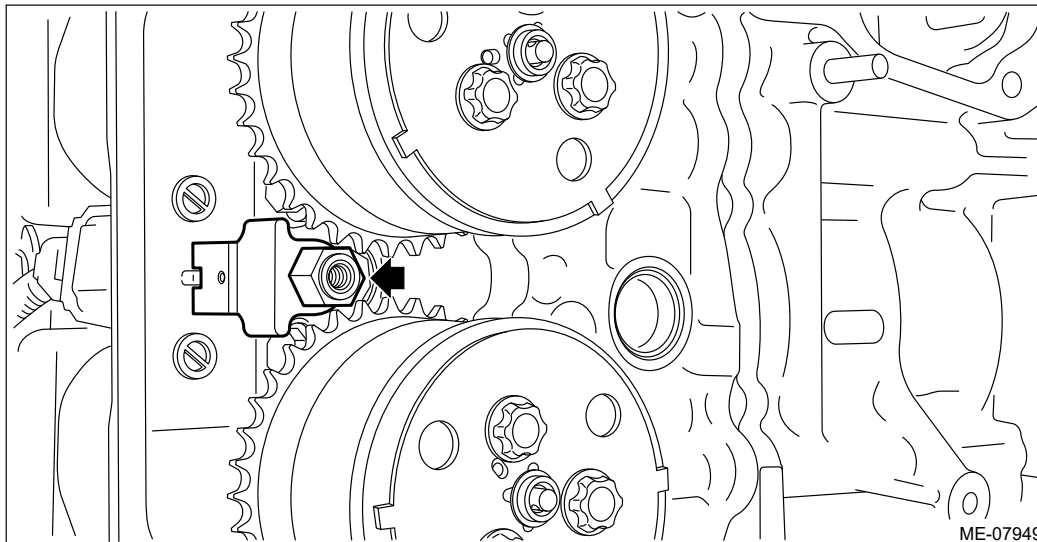
Note:

- Be careful that the foreign matter is not into or onto the assembled component during installation.
- Apply engine oil to all component parts of the timing chain.

1. Install timing chain LH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing_Chain_Assembly>INSTALLATION > TIMING CHAIN LH.](#)
2. Install the chain guide RH to the front camshaft cap RH.

Tightening torque:

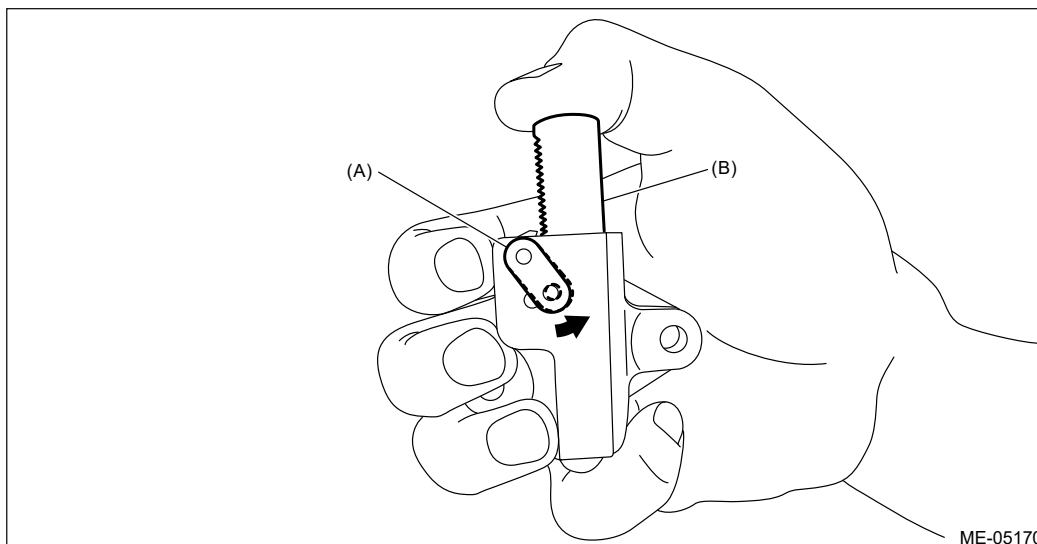
6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



ME-07949

3. Prepare to attach the chain tensioner RH.

(1) Move the link plate (A) in the direction of arrow to press in the plunger (B).

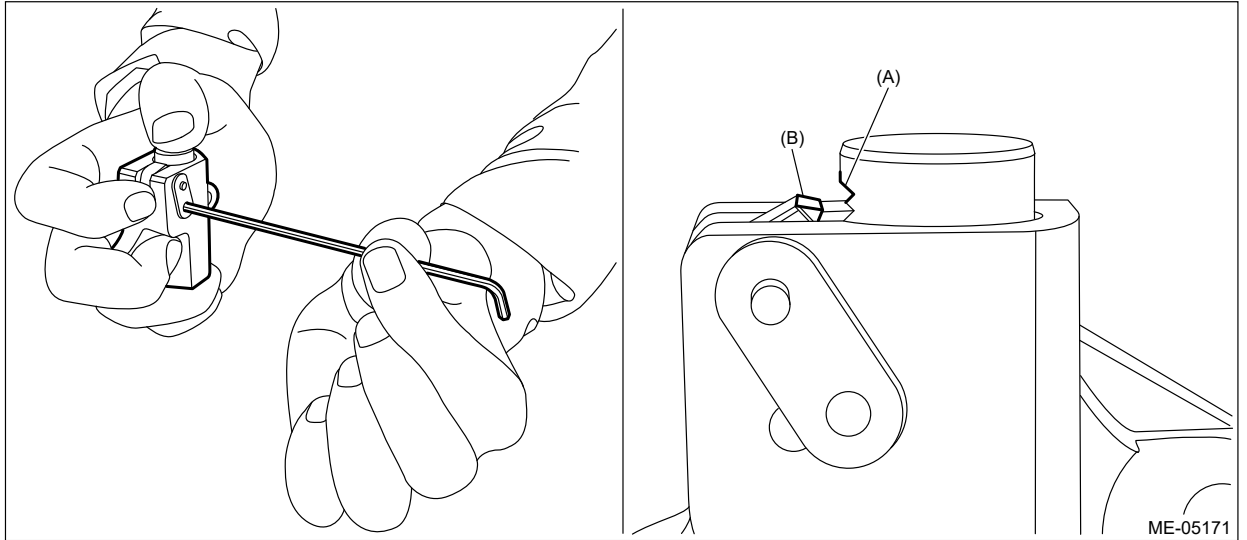


ME-05170

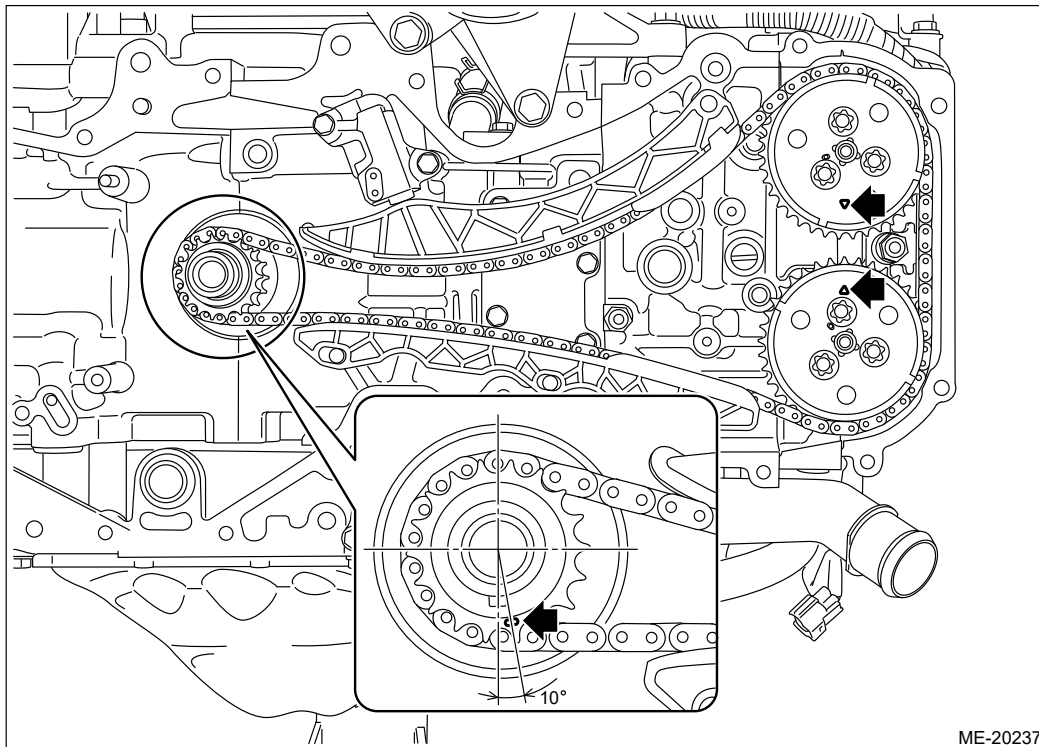
(2) In order to secure the plunger, insert a stopper pin with a diameter of 2.5 mm (0.098 in) or a hex wrench with a diameter of 2.5 mm into the stopper pin hole.

Note:

If the stopper pin hole on the link plate and the stopper pin hole on the chain tensioner are not aligned, check that the first notch of plunger rack (A) is engaged with the stopper tooth (B). If not engaged, retract the plunger a little so that the first notch of plunger rack (A) is engaged with the stopper tooth (B).



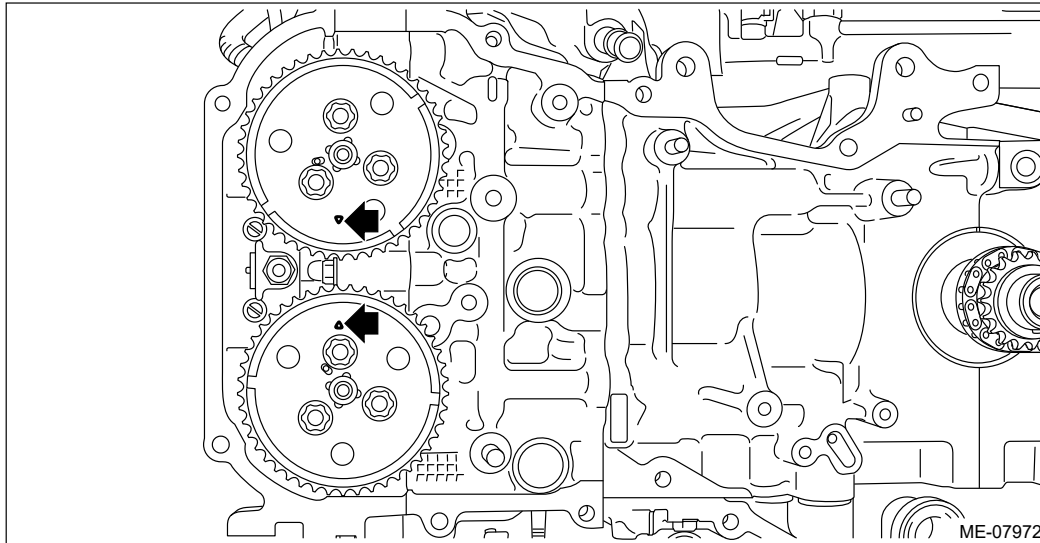
4. Make sure that the alignment marks of the crank sprocket, intake cam sprocket LH and exhaust cam sprocket LH are aligned to the positions as shown in the figure.



5. Align the alignment marks of intake cam sprocket RH and exhaust cam sprocket RH to the positions as shown in the figure.

Caution:

To prevent valve damage, turn the intake cam sprocket RH and exhaust cam sprocket RH only within the range of zero-lift (in range where it can be turned lightly by hand).

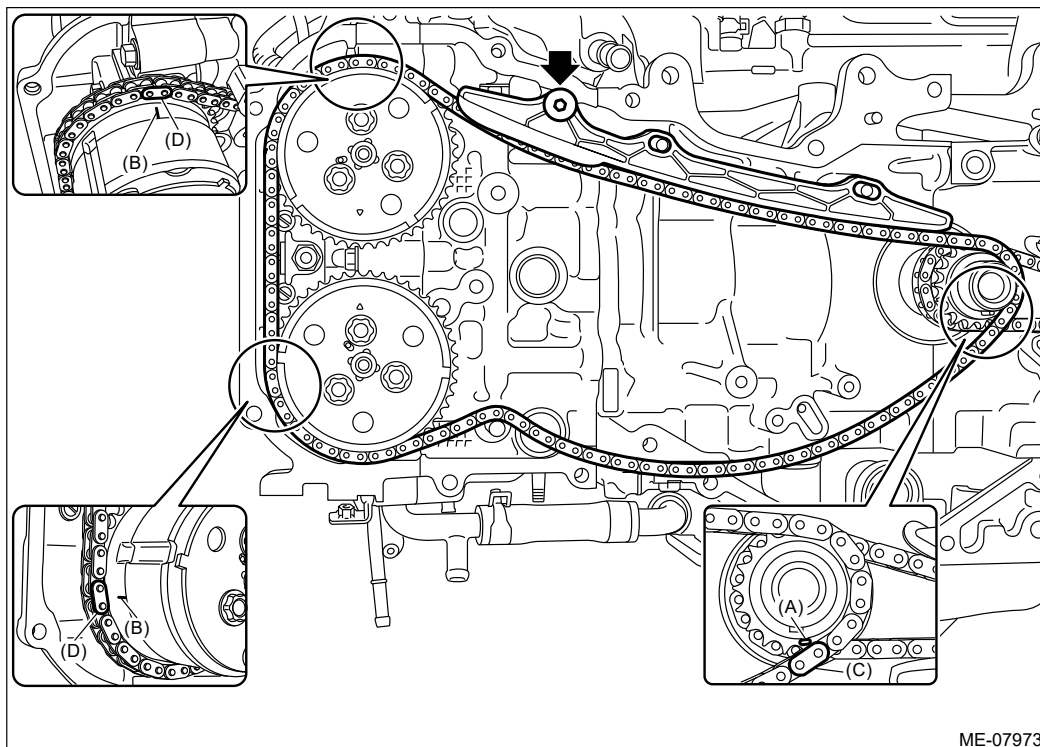


6. Install the timing chain RH and the timing chain guide RH.

- (1) Match the timing chain mark (blue) to the alignment mark of the crank sprocket.
- (2) Match the timing chain mark (pink) to the timing mark position of the intake cam sprocket RH.
- (3) Match the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket RH.
- (4) Install the timing chain guide RH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



(A) Alignment mark

(C) Blue

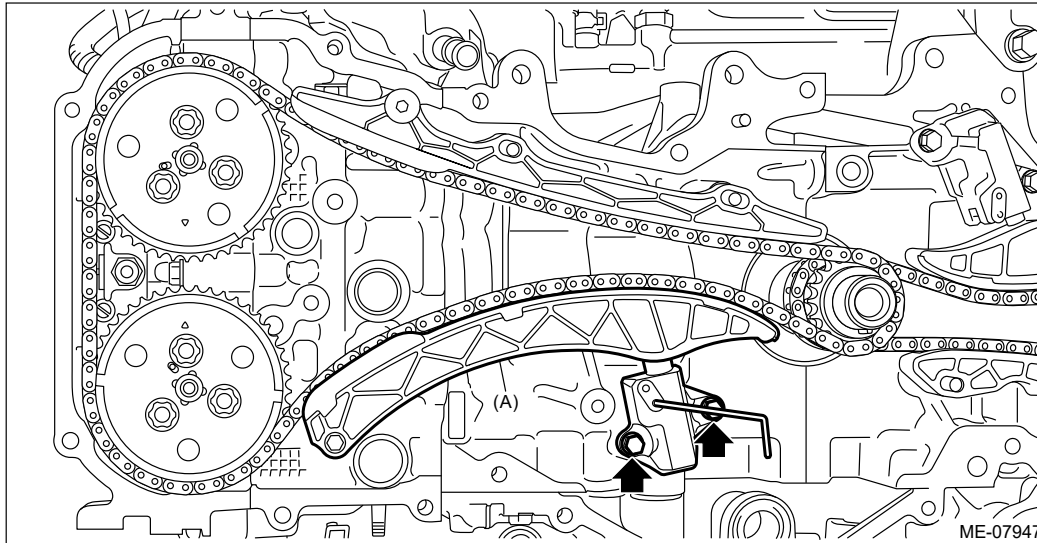
(D) Pink

(B) Timing mark

7. Install the chain tensioner lever RH (A) and chain tensioner RH.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

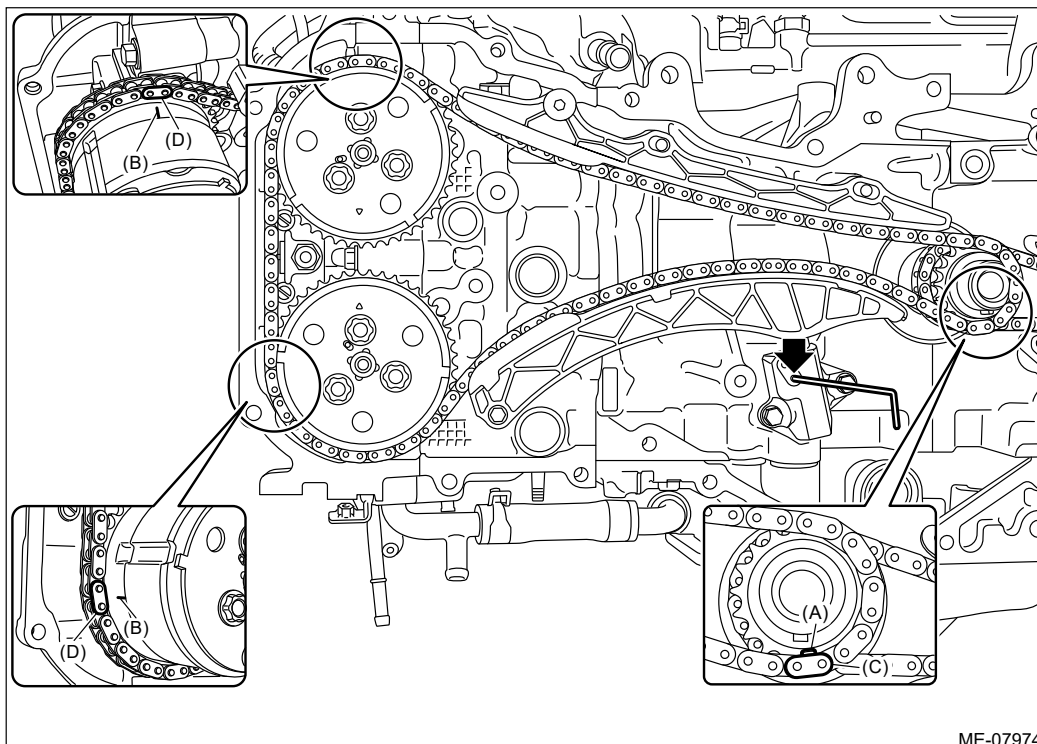


8. Pull out the stopper pin from the chain tensioner RH.

Caution:

Confirm the following before pulling out the stopper pin.

- **Matching of the timing chain mark (blue) to the alignment mark of the crank sprocket.**
- **Matching of the timing chain mark (pink) to the timing mark position of the intake cam sprocket RH.**
- **Matching of the timing chain mark (pink) to the timing mark position of the exhaust cam sprocket RH.**



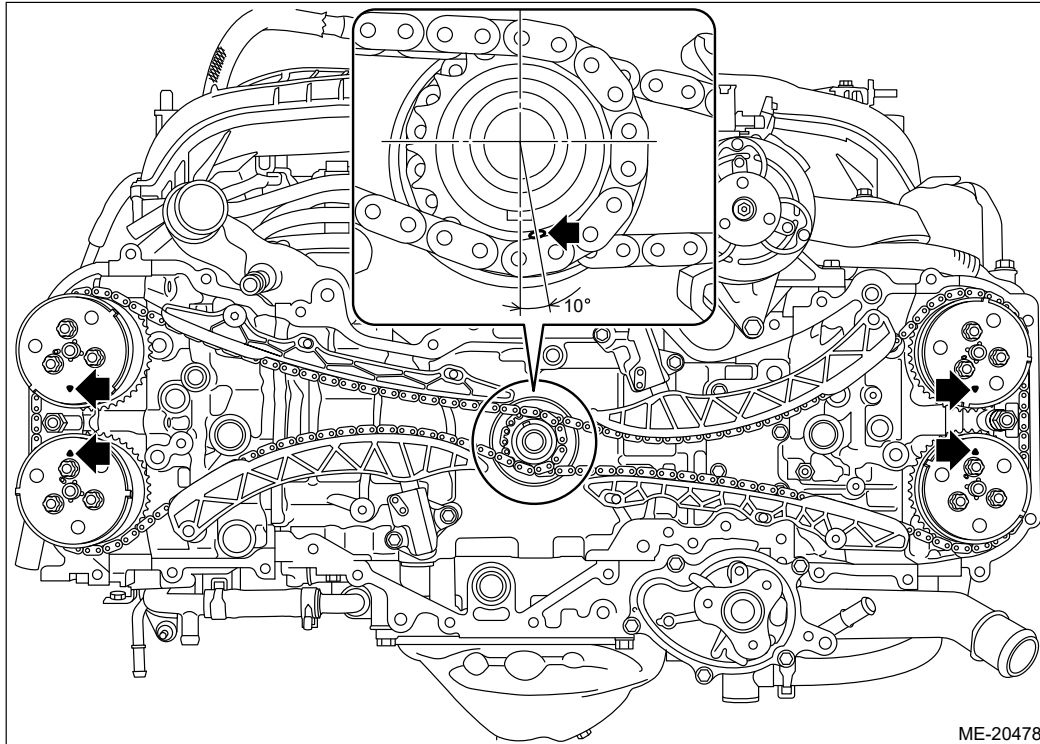
(A) Alignment mark

(C) Blue

(D) Pink

(B) Timing mark

9. Make sure that the alignment marks of the cam sprocket and crank sprocket are aligned to the positions as shown in the figure.



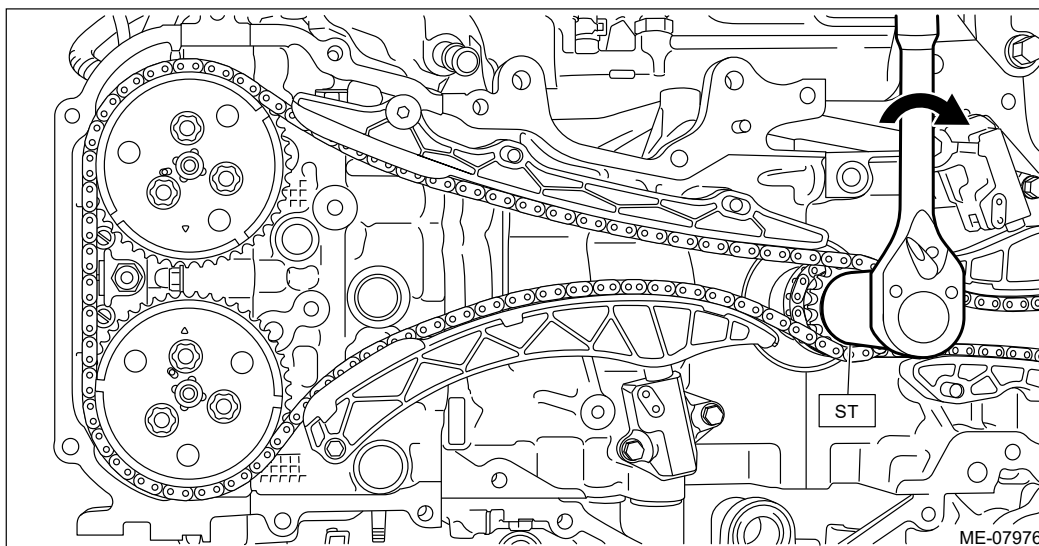
ME-20478

10. Using the ST, turn the crankshaft clockwise, and make sure that there are no abnormal conditions.

Caution:

Always make sure to perform this confirmation.

ST 18252AA000 CRANKSHAFT SOCKET



ME-07976


11. Install the chain cover.  [Ref. to MECHANICAL\(H4DOTC\)>Chain Cover>INSTALLATION.](#)

REMOVAL

1. TIMING CHAIN RH

Note:

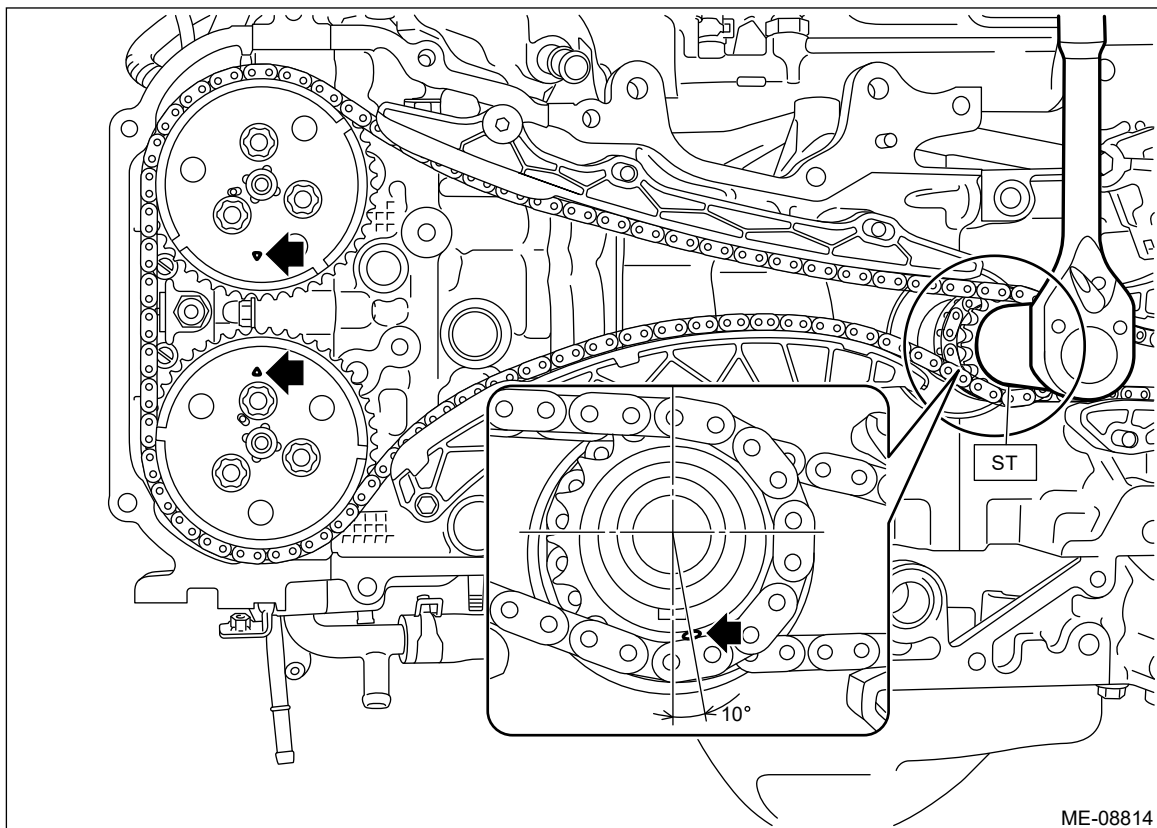
When replacing a single part, perform the work with the engine assembly installed to body.

- 1. Remove the chain cover.  Ref. to [MECHANICAL\(H4DOTC\)>Chain Cover>REMOVAL](#).
- 2. Using ST and by turning the crankshaft, align the alignment marks of crank sprocket, intake cam sprocket RH and exhaust cam sprocket RH to the positions as shown in the figure.

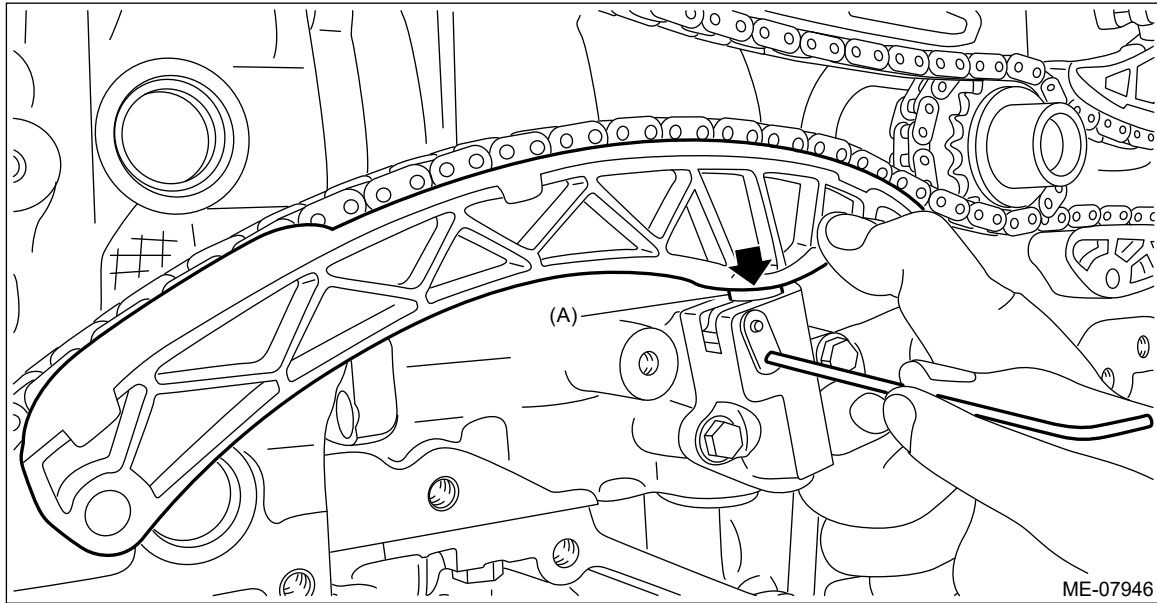
Note:

If the alignment marks are aligned to the positions as shown in the figure, the crankshaft key is located at six o'clock position.

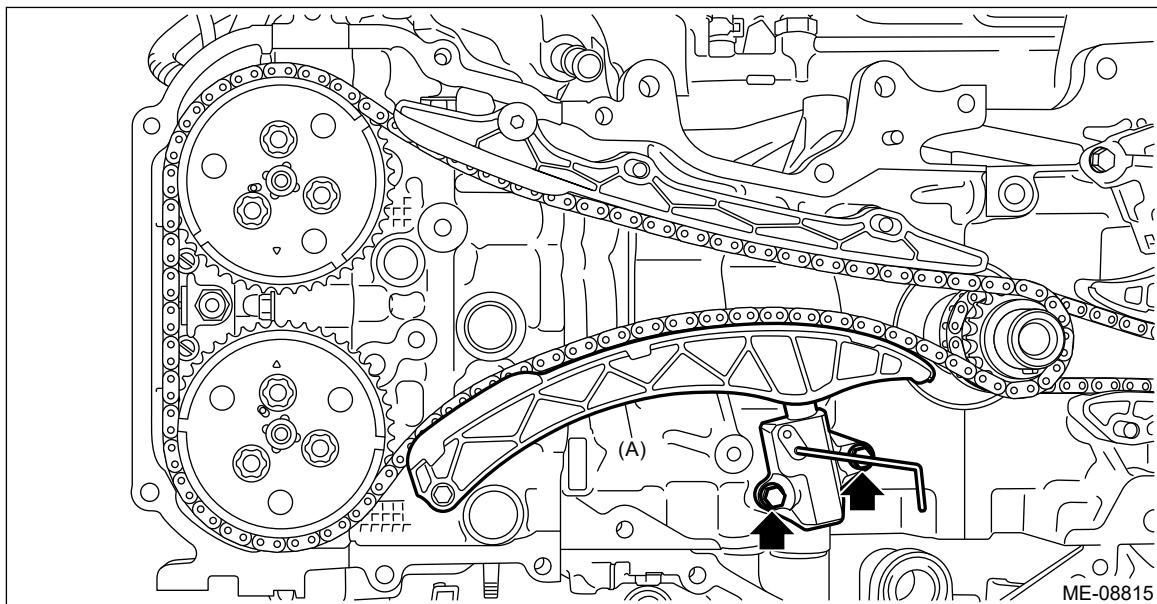
ST 18252AA000 CRANKSHAFT SOCKET



- 3. Push down the chain tensioner lever RH as shown in the figure, and insert a 2.5 mm (0.098 in) dia. stopper pin or a 2.5 mm dia. hex wrench into the stopper pin hole in the chain tensioner RH to secure the plunger (A).



4. Remove the chain tensioner RH, and remove the chain tensioner lever RH (A).



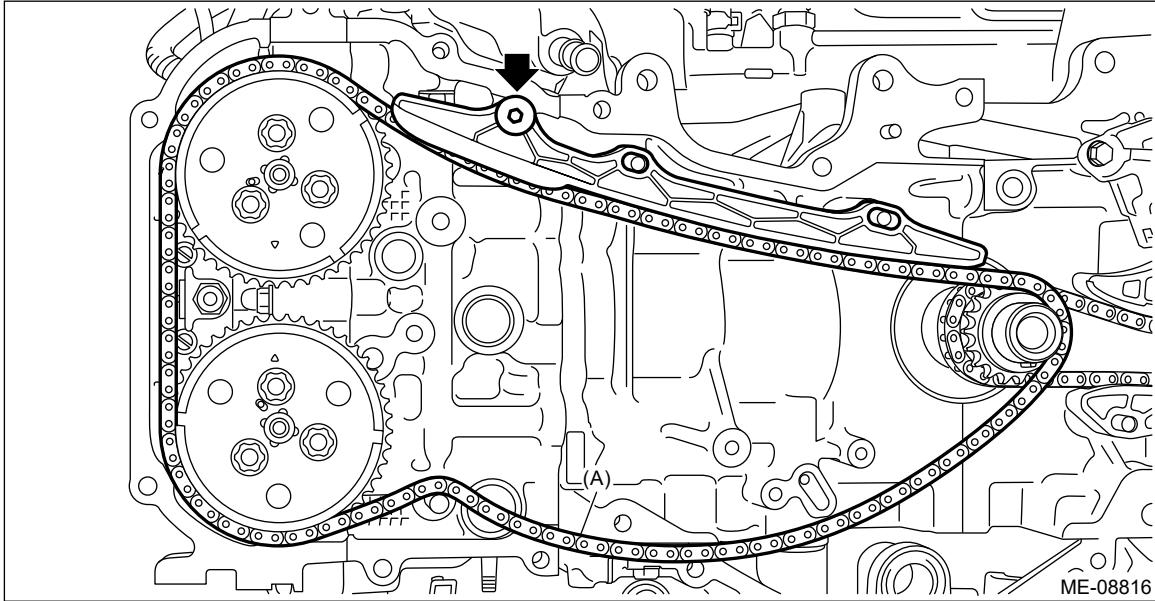
5. Remove the chain guide RH, and remove the timing chain RH (A).

Caution:

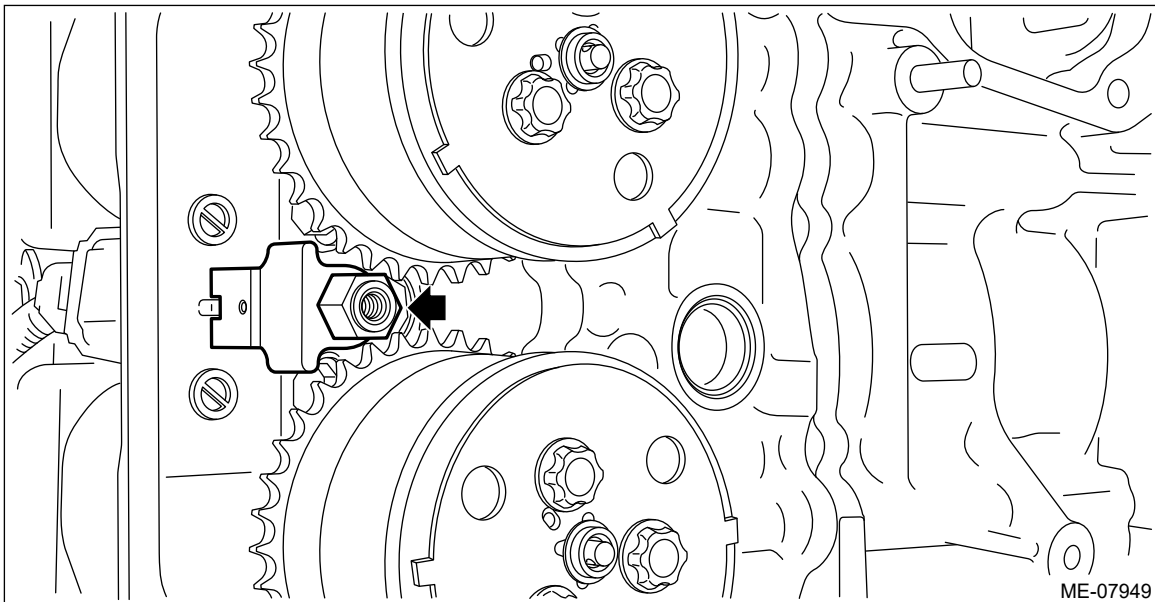
- If the timing chain RH is not installed, the intake camshaft RH and exhaust camshaft RH are kept at zero-lift position. All cams on the camshaft are not pressing down the roller rocker arm (intake valve and exhaust valve). (Under this condition, all valves remain unlifted.)
- Intake camshaft RH and exhaust camshaft RH can be independently rotated with the timing chain RH removed. When the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn it to the outside of range of zero-lift (in range where it can be turned lightly by hand).

Note:


To avoid mixing with LH side, keep the removed part in order.



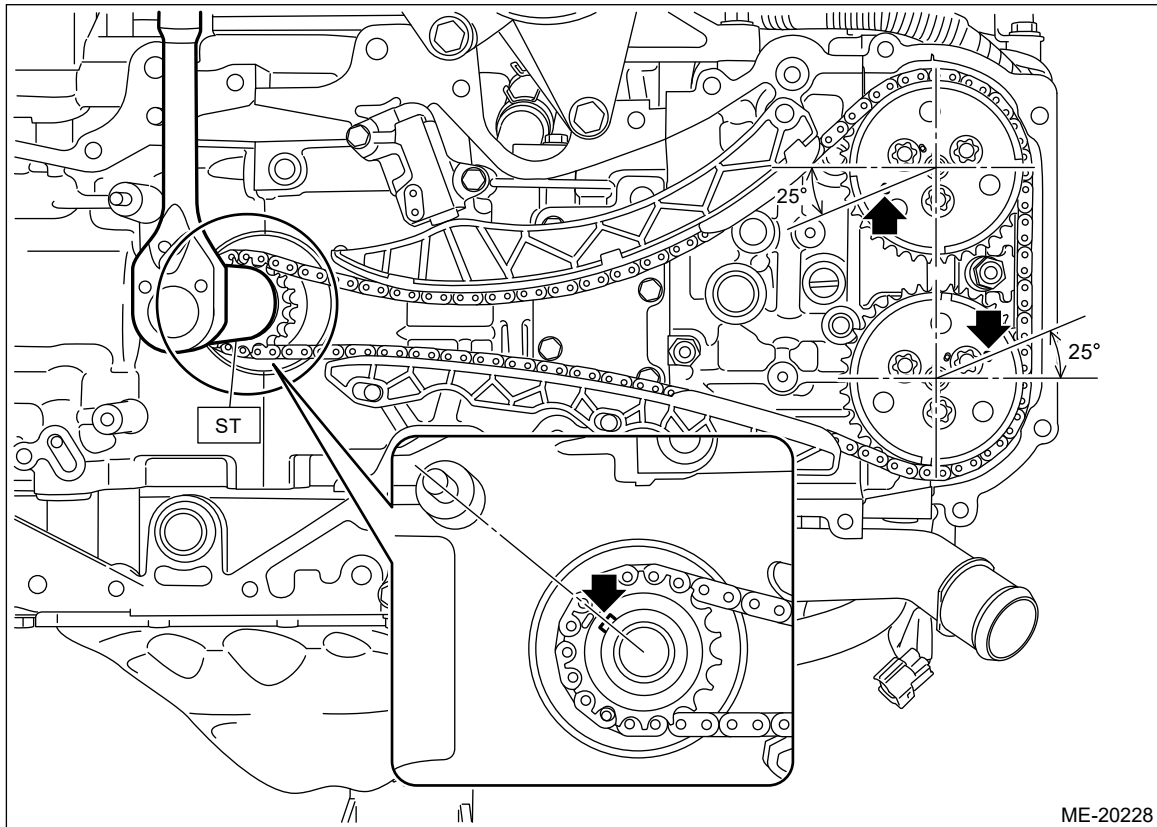
6. Remove the chain guide RH from the front camshaft cap RH.



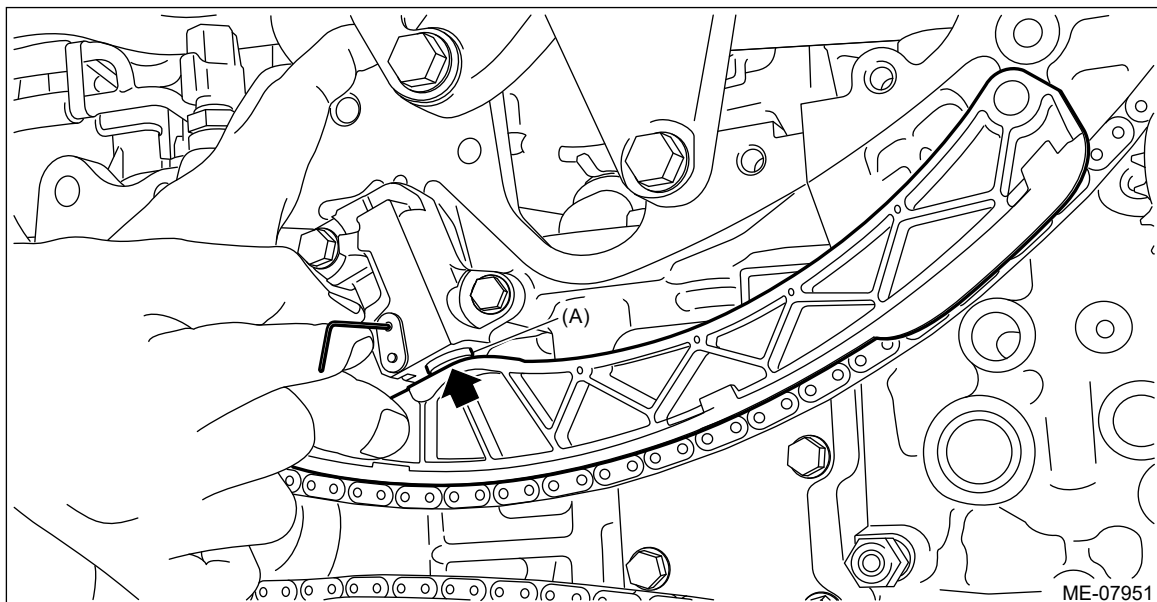
2. TIMING CHAIN LH

1. Remove the timing chain RH.  [Ref. to MECHANICAL\(H4DOTC\)>Timing_Chain Assembly>REMOVAL > TIMING CHAIN RH.](#)
2. Using ST and by turning the crankshaft, align the alignment marks of crankshaft key, intake cam sprocket LH and exhaust cam sprocket LH to the positions as shown in the figure.

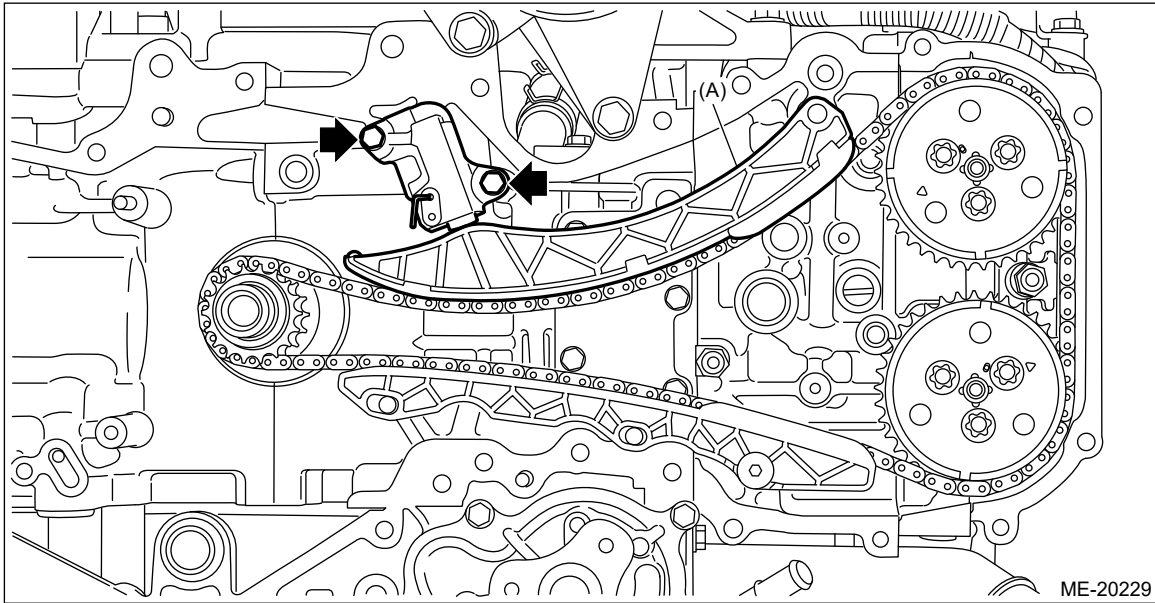
ST 18252AA000 CRANKSHAFT SOCKET



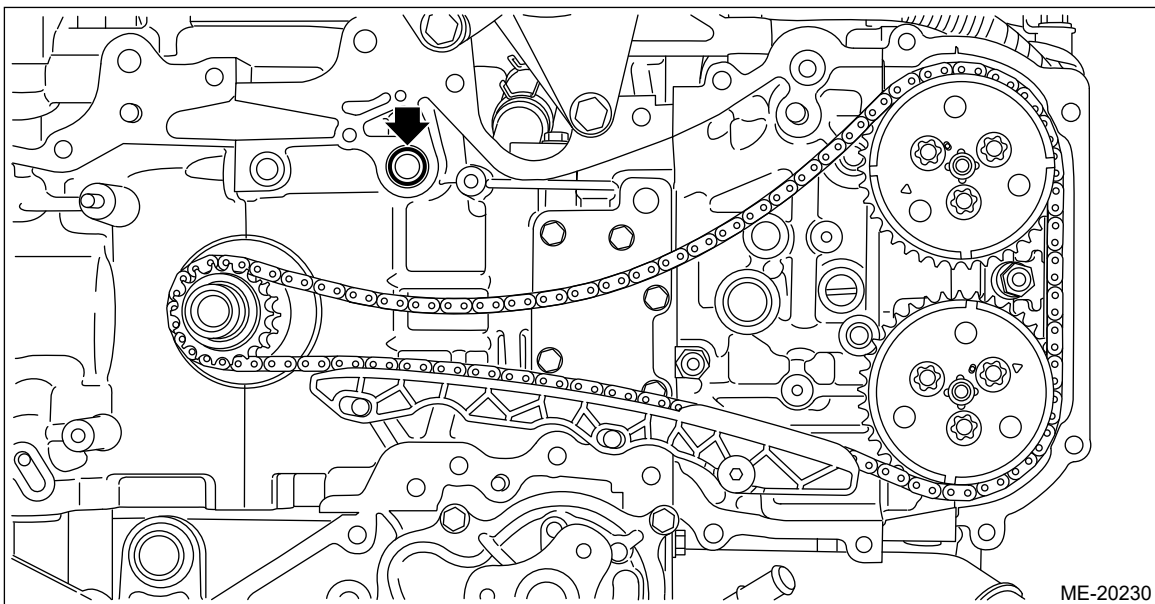
3. Push down the chain tensioner lever LH as shown in the figure, and insert a stopper pin (clips, etc.) with a diameter of 1.3 mm (0.05 in) or less or a hex wrench with a diameter of 1.3 mm into the stopper pin hole in the chain tensioner LH to secure the plunger (A).



4. Remove the chain tensioner LH, and remove the chain tensioner lever LH (A).



5. Remove the O-ring from the cylinder block LH.



6. Remove the chain guide LH, and remove the timing chain LH (A).

Caution:

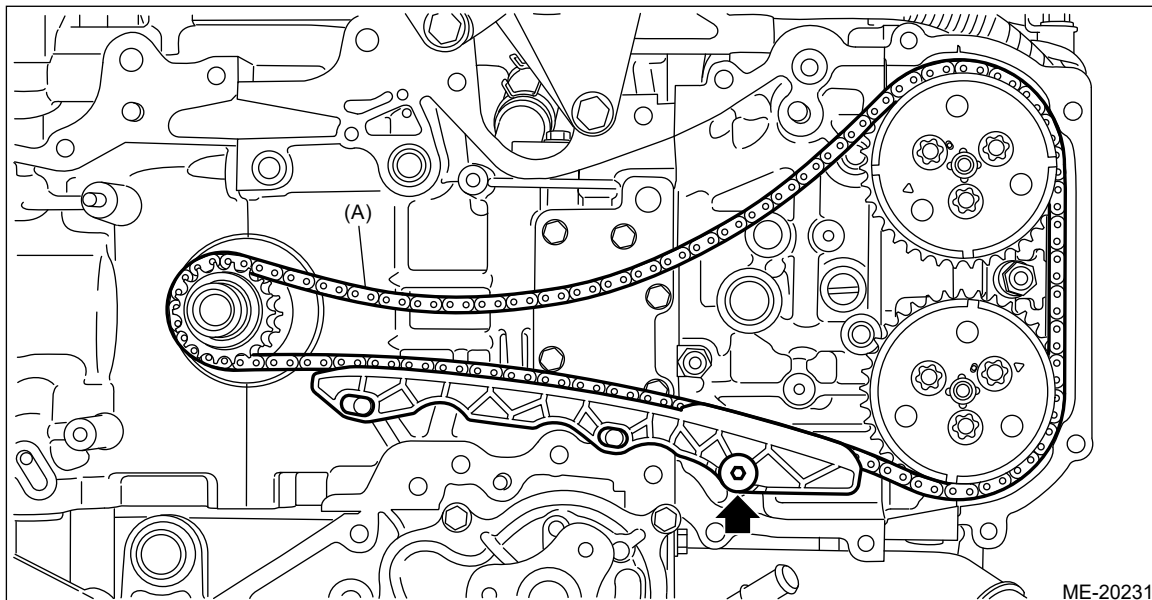
- If the timing chain LH is not installed, the exhaust camshaft LH is kept at zero-lift position. All cams on the exhaust camshaft LH are not pressing down the roller rocker arm (exhaust valve). (Under this condition, exhaust valves remain unlifted.)
- Intake camshaft LH is kept at lift position. All cams on the intake camshaft LH are pressing down the roller rocker arm (intake valve). (Under this condition, intake valves remain lifted.)
- Intake camshaft LH and exhaust camshaft RH can be independently rotated with the timing chain LH removed. When the exhaust camshaft LH is turned, the valve heads contact each other and valve stem may bend as described in

above. Do not turn the exhaust camshaft LH to the outside of range of zero-lift (in range where it can be turned lightly by hand).

- #1 piston and #4 piston are located near TDC. If the intake camshaft LH is turned, the valve and the piston may contact and valve stem may bend. Do not turn the intake camshaft LH at this time.

Note:

To avoid mixing with RH side, keep the removed part in order.

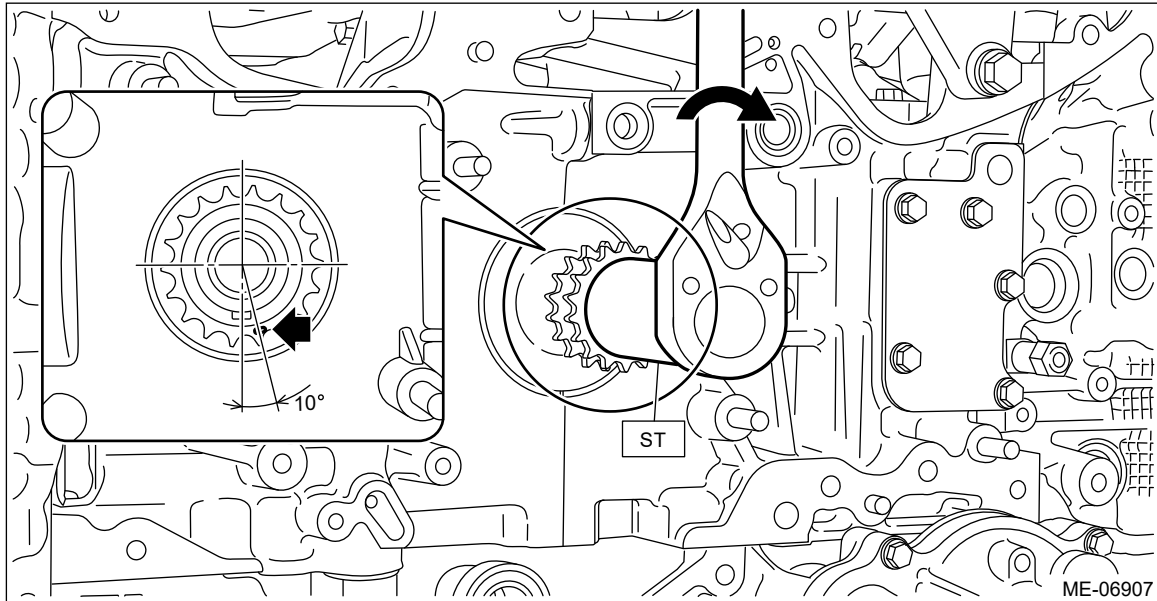


7. Using ST and by turning the crankshaft approximately 200° clockwise, align the alignment marks of crank sprocket to the positions as shown in the figure.

Caution:

- This procedure is required to prevent the valve and piston contacting with each other, by moving the all pistons to the middle of the cylinders.
- Never turn counterclockwise because the valve and piston may contact. Counterclockwise turn is allowed only when adjusting precisely the alignment marks, after turning the crank sprocket alignment mark clockwise near the position as shown in the figure.

ST 18252AA000 CRANKSHAFT SOCKET



- 8.** Using ST and by turning the intake cam sprocket LH approximately 130°, align the alignment marks of intake cam sprocket LH to the positions (zero-lift position) as shown in the figure.

Caution:

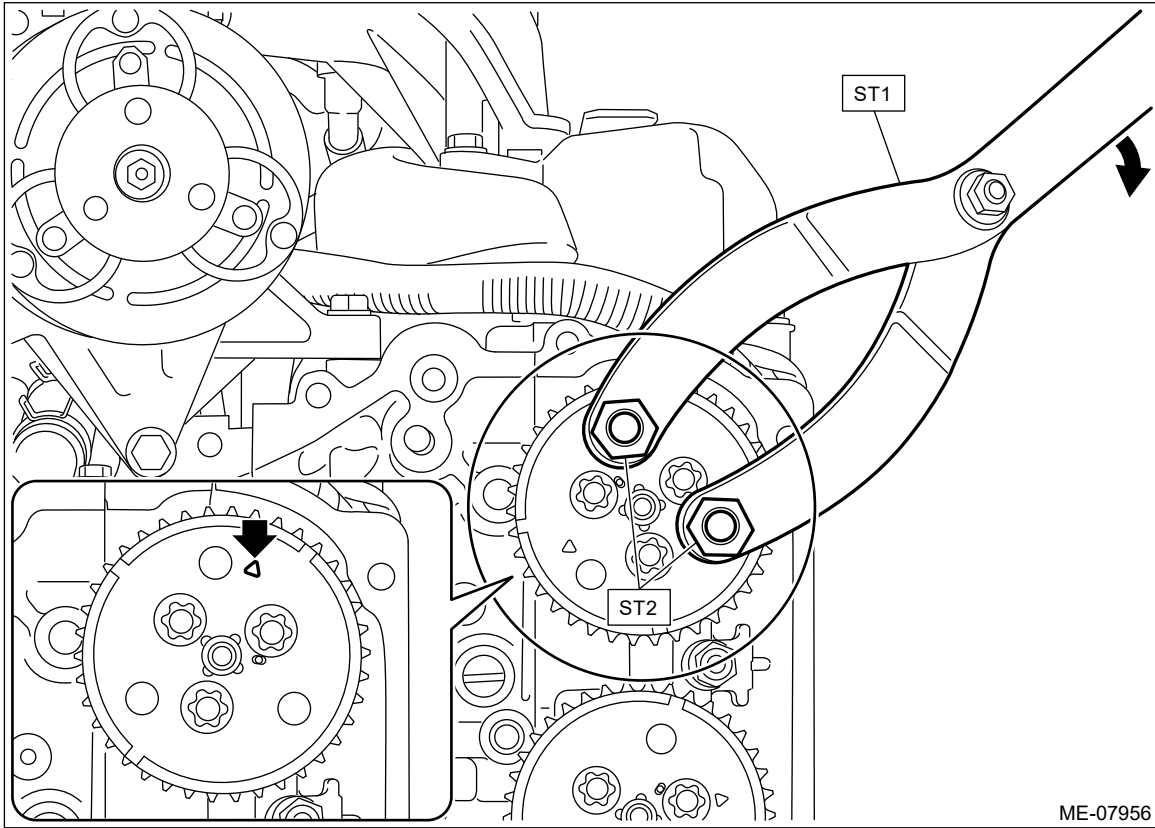
- After this work, when the intake valve and exhaust valve lift at the same time, the valve heads contact each other and valve stem may bend. Do not turn the intake camshaft LH and exhaust camshaft LH to the outside of range of zero-lift (in range where it can be turned lightly by hand).
- Perform the operation carefully since the ST comes off easily.

Note:

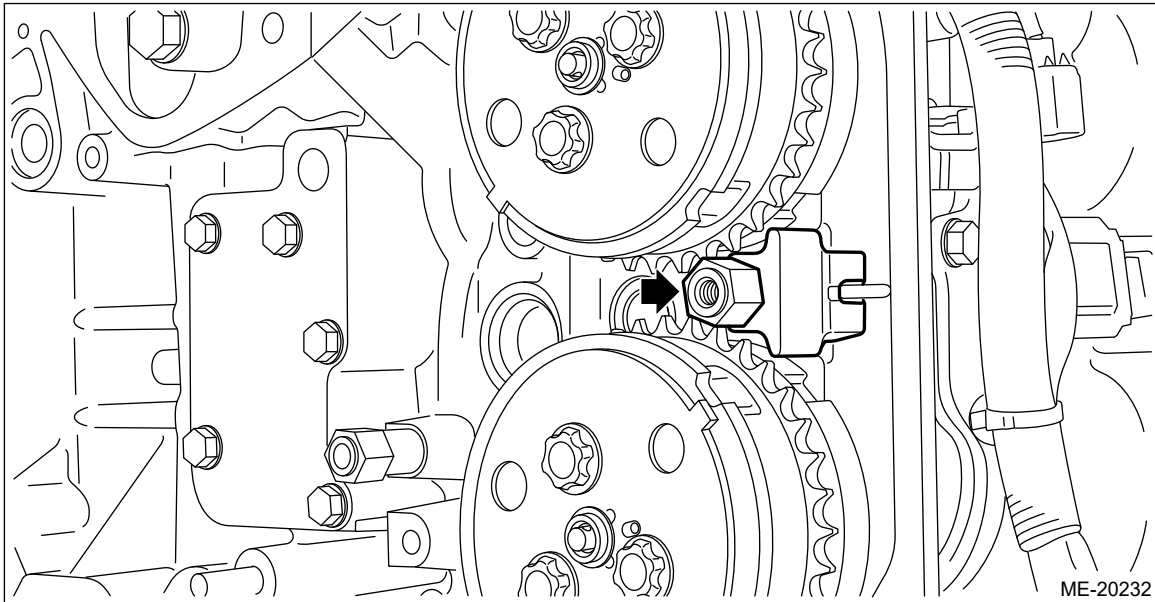
Intake camshaft LH has three peaks of drive sections for the high-pressure fuel pump. Therefore, there is little range where it can be turned lightly by hand in zero-lift position.

ST1 18355AA000 PULLEY WRENCH

ST2 18334AA020 PULLEY WRENCH PIN SET



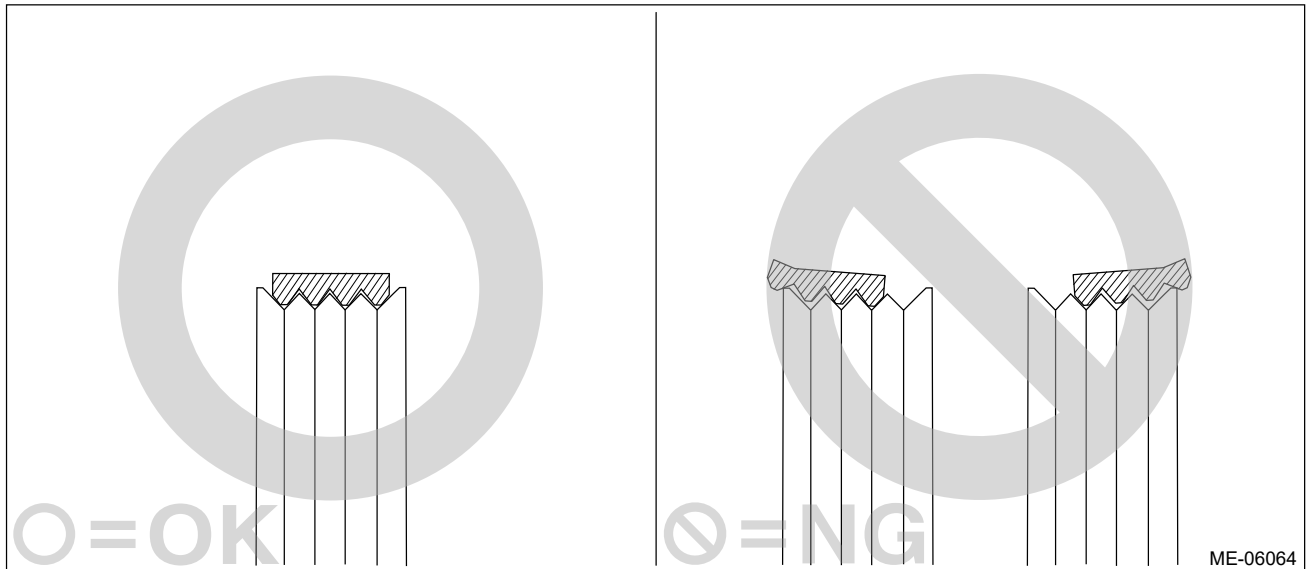
9. Remove the chain guide LH from the front camshaft cap LH.



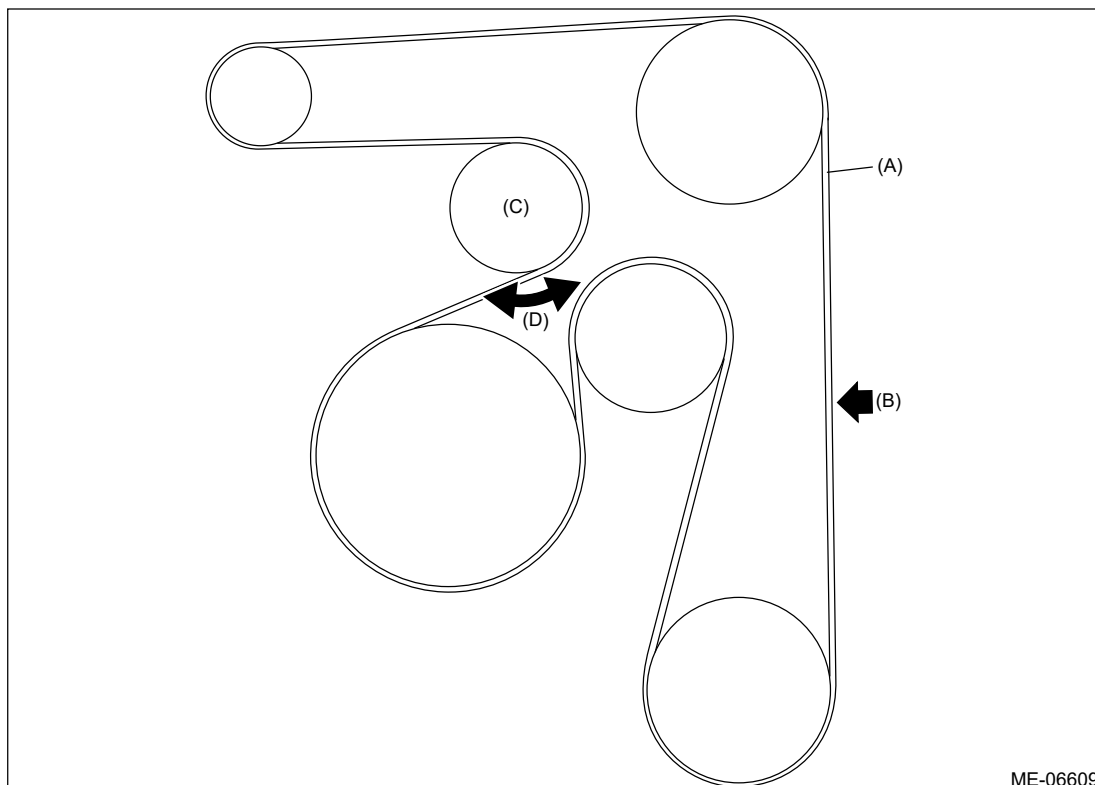
MECHANICAL(H4DOTC) > V-belt

INSPECTION

1. Check the V-belt for cracks, tear or wear.
2. Check the V-belt tensioner assembly and idler pulley for deformation, cracks or other damages.
3. Check that the V-belt ribs are securely placed on the rib grooves for each pulley.



4. Check that the V-belt tensioner assembly (C) moves in the direction of arrow (D), when the V-belt (A) is pushed and released by the area indicated by the arrow (B).



5. Start the engine and confirm that the V-belt rotates smoothly and no abnormal noise is emitted.

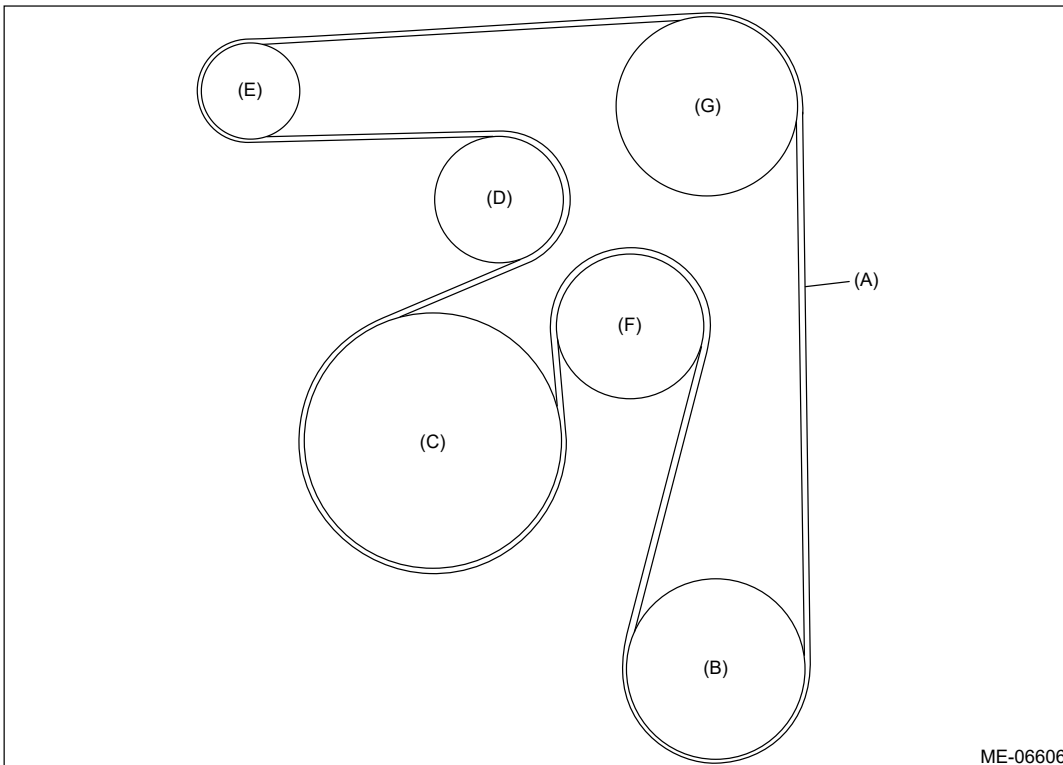
INSTALLATION

1. V-BELT

Install in the reverse order of removal.

Caution:

- When reusing the V-belt, wipe off dust and water with cloth.
- Do not use the V-belt if there is any oil, grease or coolant on the belt.
- Be careful not to rub the V-belt end surface with bare hands; exposed core may cause injury.
- Wipe off any dust, oil and water on the groove of each pulley with cloth.



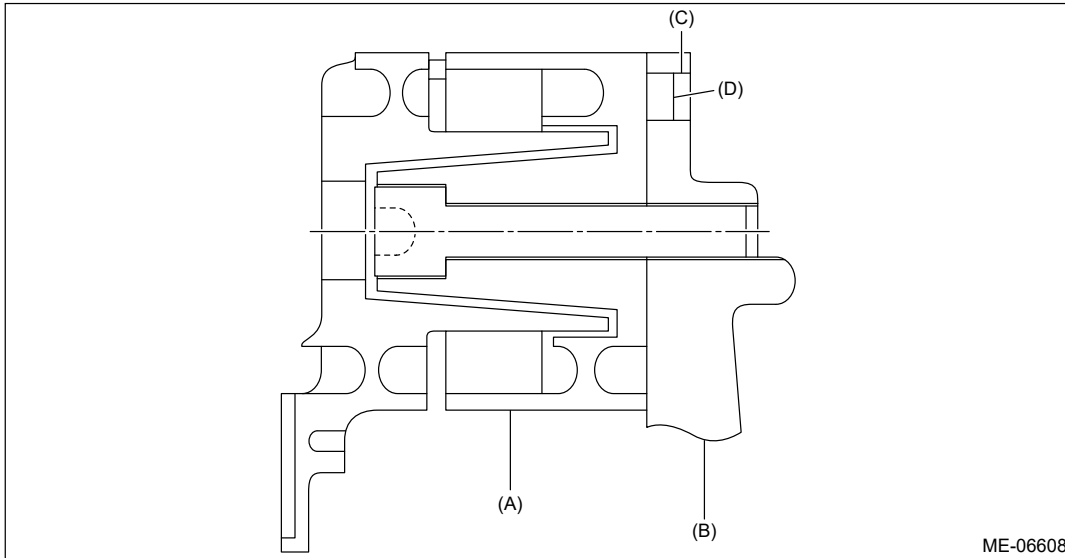
- | | | |
|-----------------------|---------------------------|---------------------------|
| (A) V-belt | (D) V-belt tensioner ASSY | (G) A/C compressor pulley |
| (B) Water pump pulley | (E) Generator pulley | |
| (C) Crank pulley | (F) Idler pulley | |

2. V-BELT TENSIONER ASSEMBLY

Install in the reverse order of removal.

Note:

When installing the V-belt tensioner assembly, insert the protrusion of V-belt tensioner assembly into the hole for preventing rotation at the generator bracket.



ME-06608

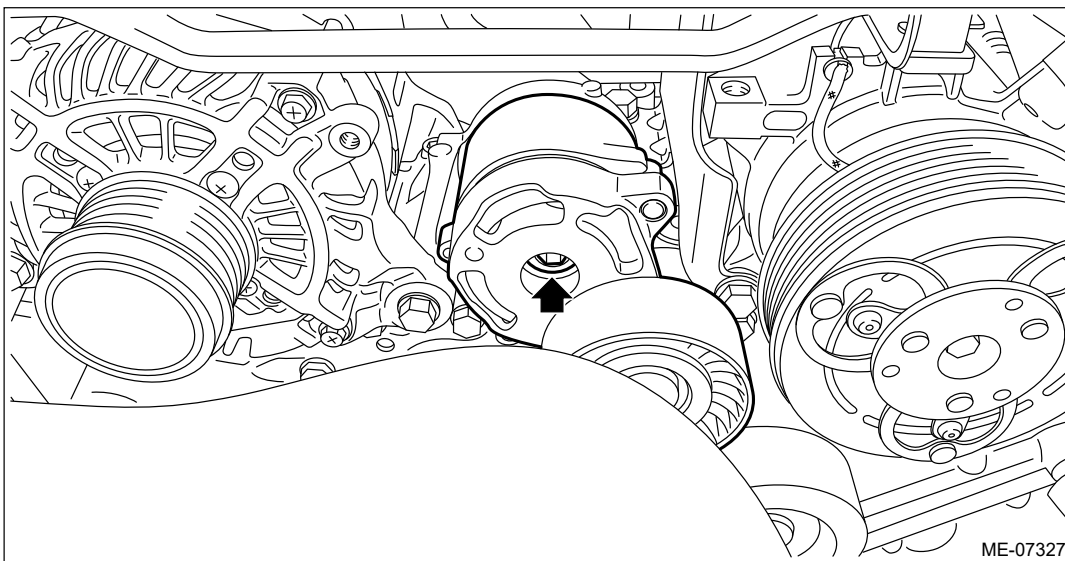
(A) V-belt tensioner ASSY
(B) Generator bracket

(C) Hole to prevent rotation

(D) Protrusion portion

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)



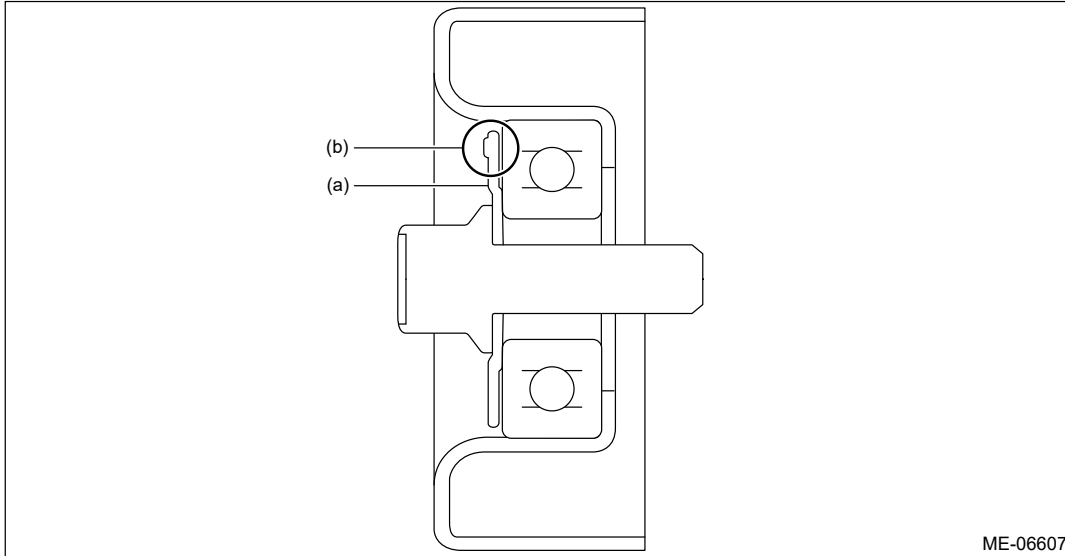
ME-07327

3. IDLER PULLEY

Install in the reverse order of removal.

Note:

When installing the idler pulley, be careful of the idler pulley cover direction.



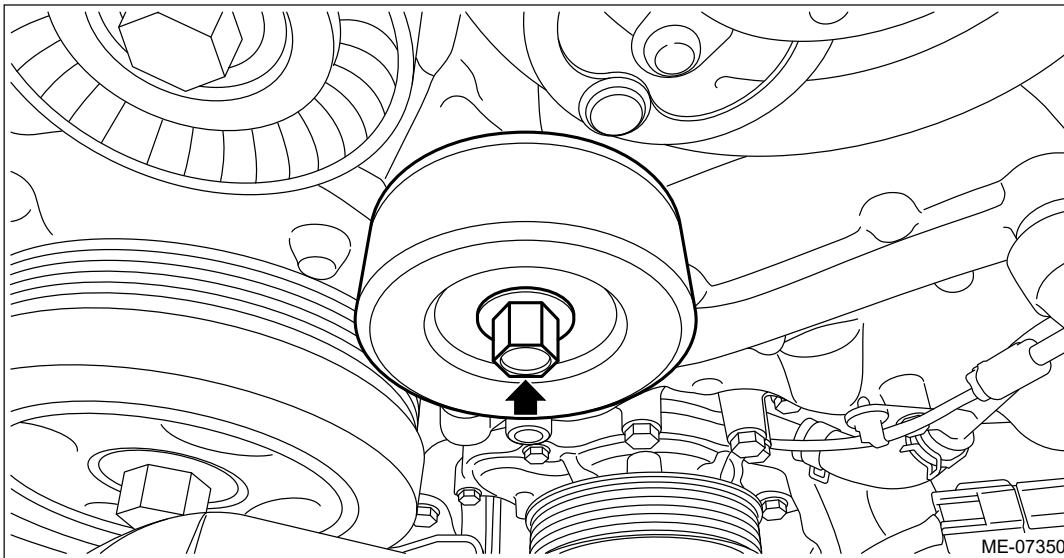
ME-06607

(a) Idler pulley cover

(b) Protrusion (3 places)

Tightening torque:

36 N·m (3.7 kgf-m, 26.6 ft-lb)



ME-07350

MECHANICAL(H4DOTC) > V-belt

REMOVAL

Note:

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

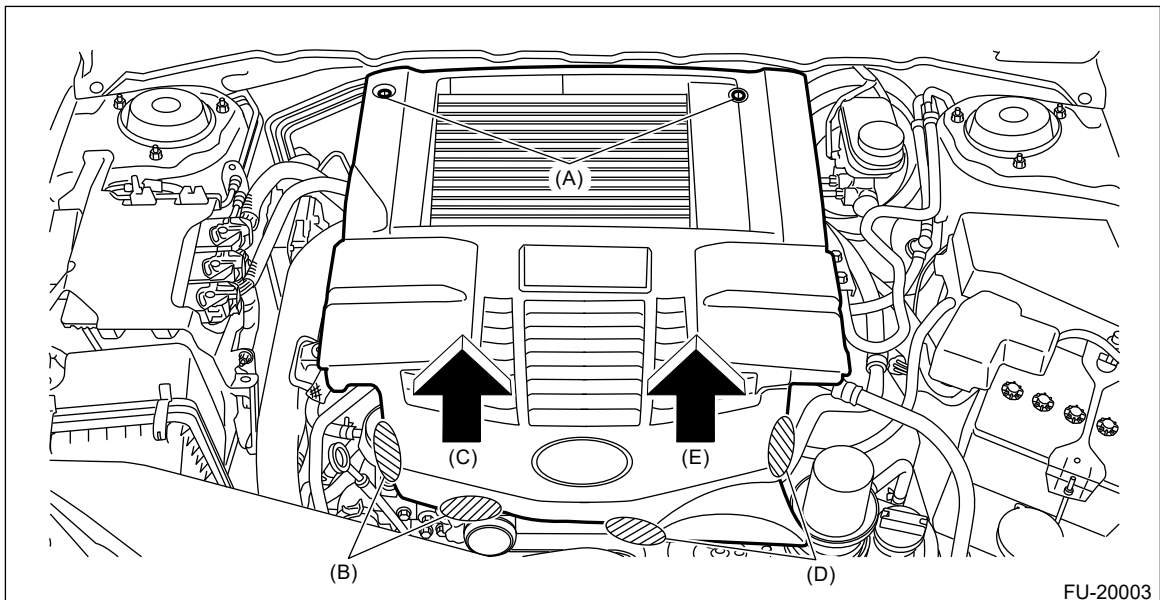
1. V-BELT


1. When working on the vehicle

Note:

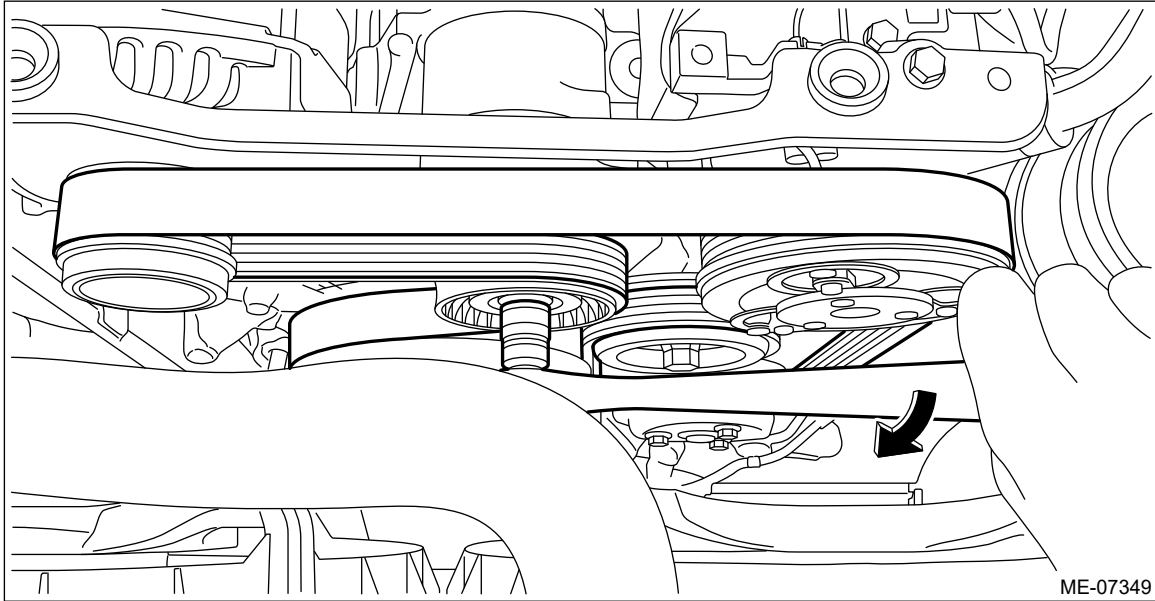
When working on the vehicle, perform the following steps also.

- (1) Remove the collector cover.
 1. Remove the clip (A).
 2. Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 3. Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.




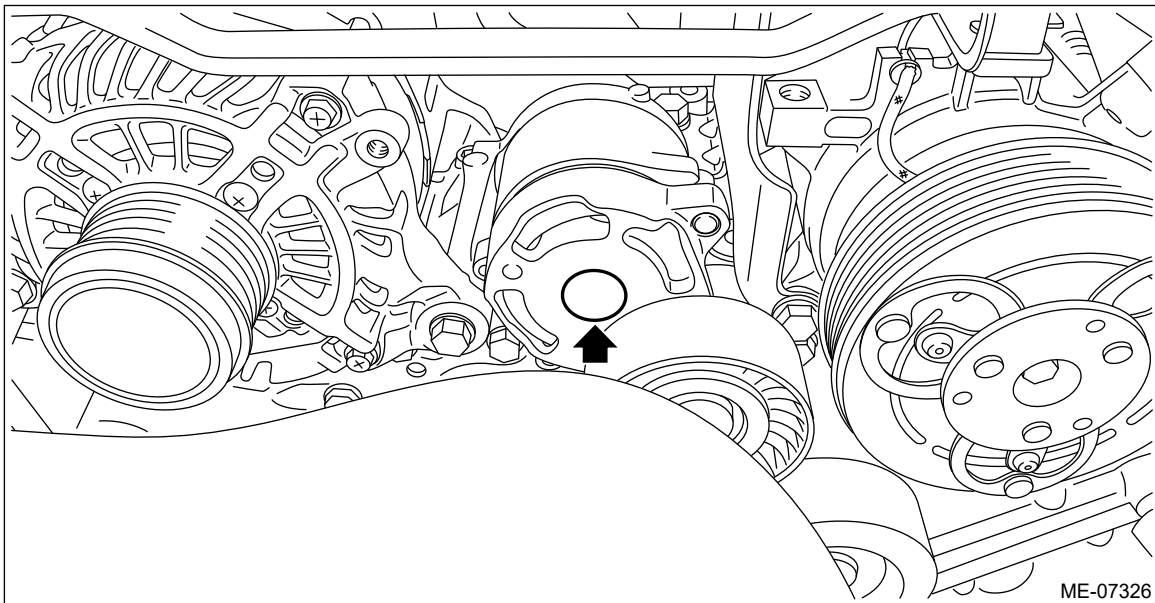
- (2) Remove the air intake duct (rear).  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Air Intake Duct>REMOVAL.](#)

2. Attach the tool to the V-belt tensioner assembly, and rotate the tool clockwise to loosen and remove the V-belt.

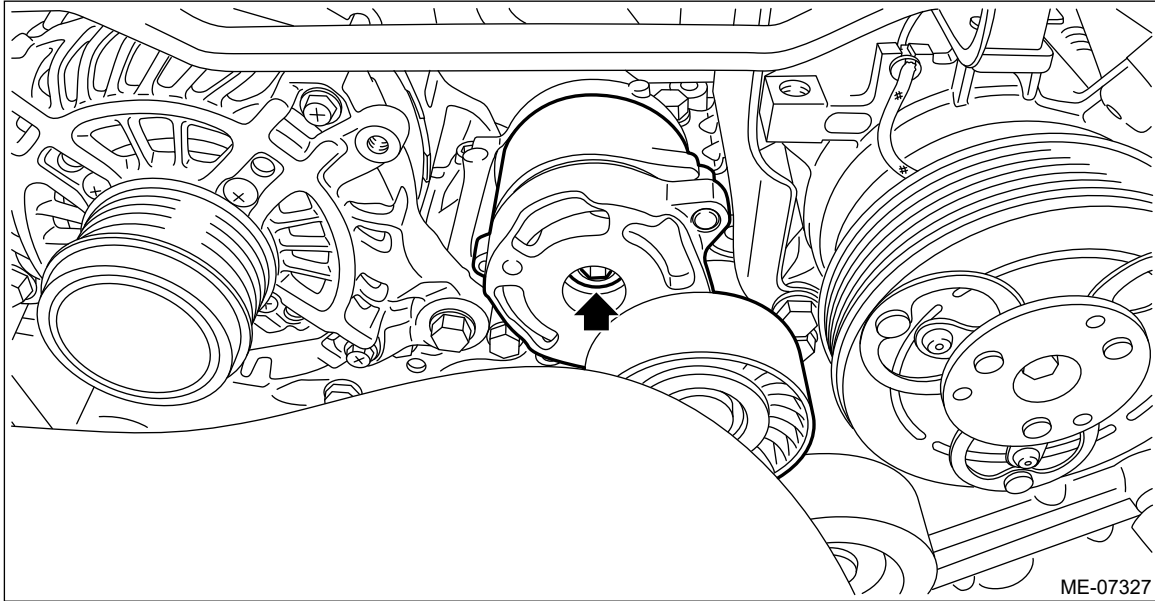


2. V-BELT TENSIONER ASSEMBLY

1. Remove the V-belts.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>REMOVAL > V-BELT.](#)
2. Remove the cap from V-belt tensioner assembly.




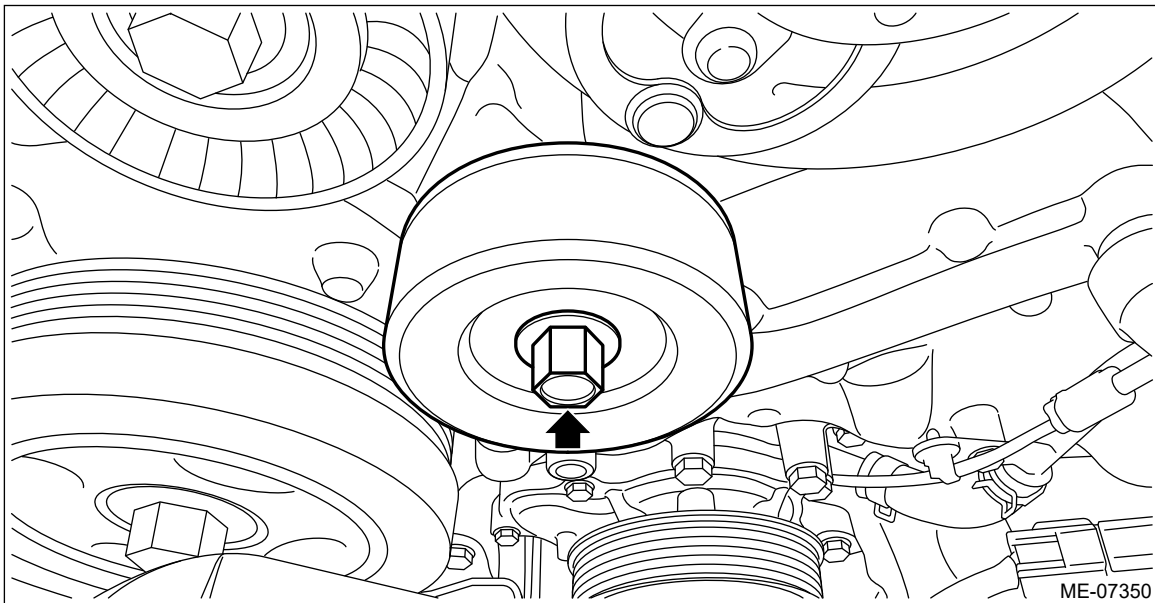
3. Remove the bolt securing the V-belt tensioner assembly to the generator bracket, and remove the V-belt tensioner assembly.



ME-07327

3. IDLER PULLEY

1. Remove the V-belts.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>REMOVAL > V-BELT.](#)
2. Remove the bolts which secure the idler pulley to the chain cover, and remove the idler pulley.



ME-07350

SPEED CONTROL SYSTEMS(H4DO) > Accelerator Pedal

DISASSEMBLY



Note:

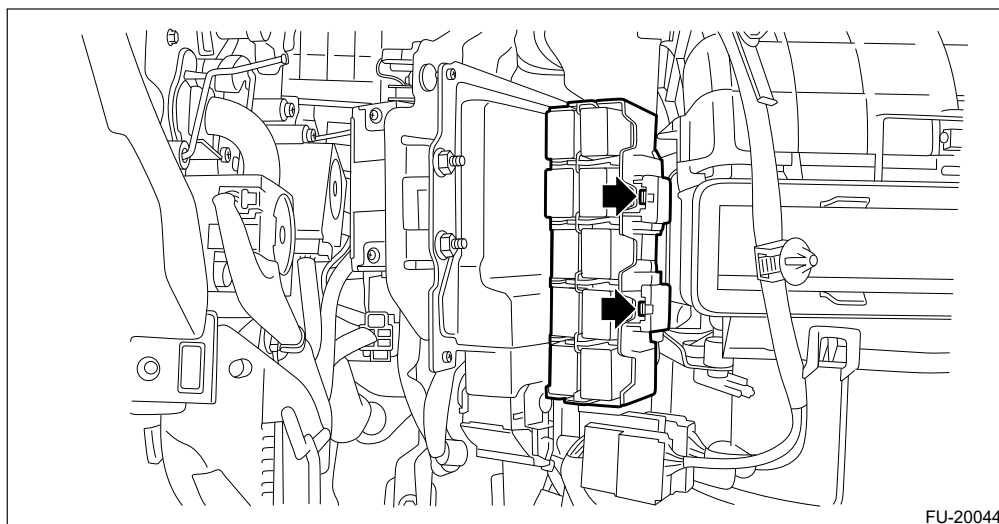
The accelerator pedal cannot be disassembled.

INSPECTION

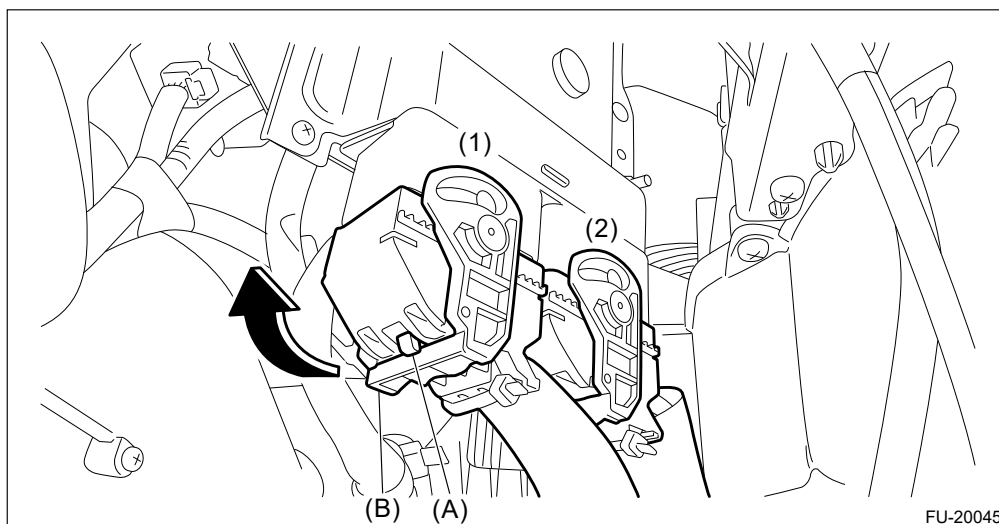
1. CHECK ACCELERATOR PEDAL SENSOR AREA (METHOD WITH CIRCUIT TESTER)


• **NON-TURBO MODEL**

1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the glove box.  [Ref. to EXTERIOR/INTERIOR TRIM>Glove Box>REMOVAL.](#)
3. Push down the claws, and remove the relay block.




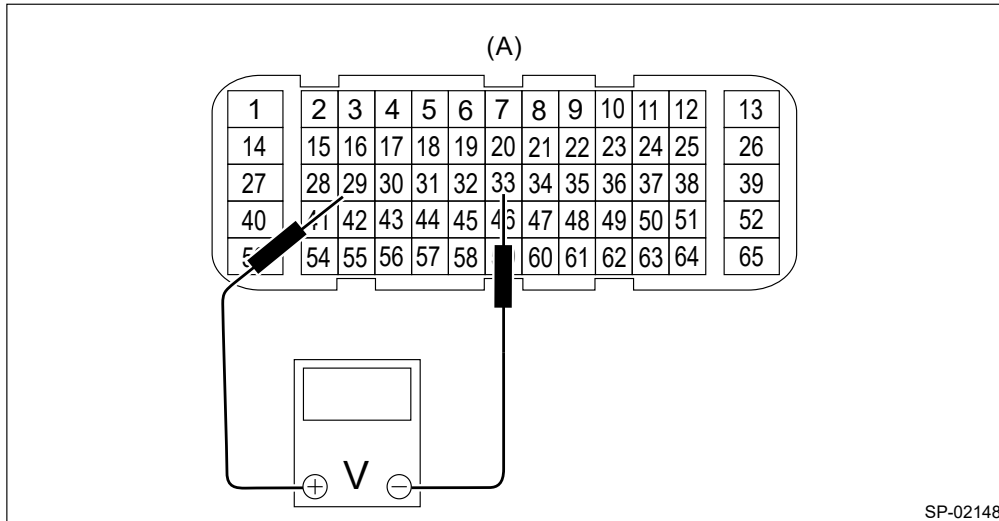
4. While pressing the section (A) shown in the figure, move the lock lever (B) in the direction of the arrow to disconnect the bulkhead harness connectors from the ECM in numerical order as shown in the figure.



5. Set the ST between the ECM and bulkhead harness connector.  [Ref. to ENGINE \(DIAGNOSTICS\) \(H4DO\)>General Description>CAUTION.](#)

ST 18460AA050 CHECK BOARD

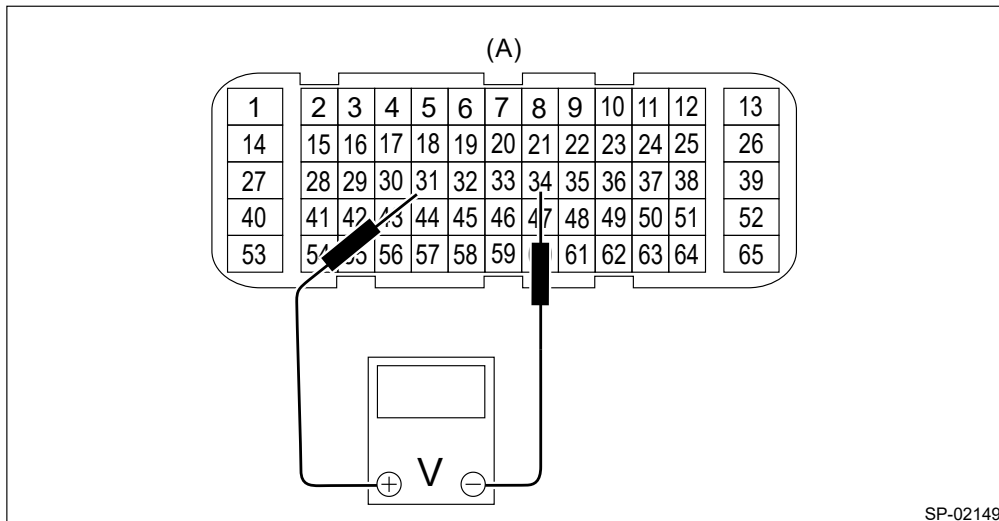
6. Connect the ground terminal to the battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
7. Turn the ignition switch to ON. (Engine OFF)
8. Measure the voltage between ECM connector terminals using ST.
 - Main sensor side



SP-02148

(A) To the check board connector
(ECM connector)

- Sub sensor side



SP-02149

(A) To the check board connector
(ECM connector)

| Accelerator pedal sensor | Accelerator pedal | Terminal No. | Standard |
|--------------------------|-----------------------------|-------------------|-------------|
| Main | Not depressed (full closed) | 29 (+) and 33 (-) | 0.3 – 1.1 V |
| | Depressed (full opened) | | 2.3 – 3.8 V |
| Sub | Not depressed (full closed) | 31 (+) and 34 (-) | 0.3 – 1.1 V |
| | Depressed (full opened) | | 2.3 – 3.8 V |

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

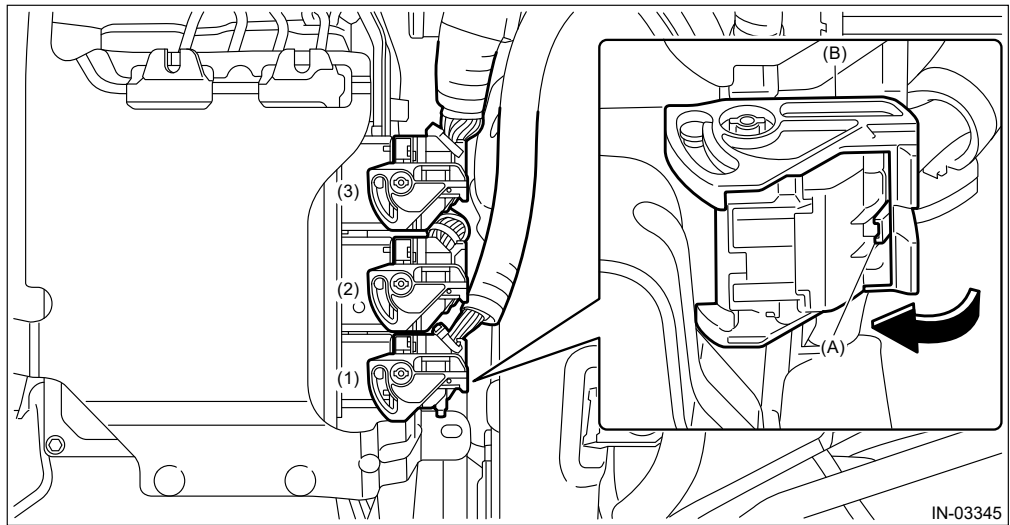
• **TURBO MODEL**

1. Disconnect the ground cable from battery.  Ref. to NOTE>NOTE > BATTERY.

Note:

For model with battery sensor, disconnect the ground terminal from battery sensor.

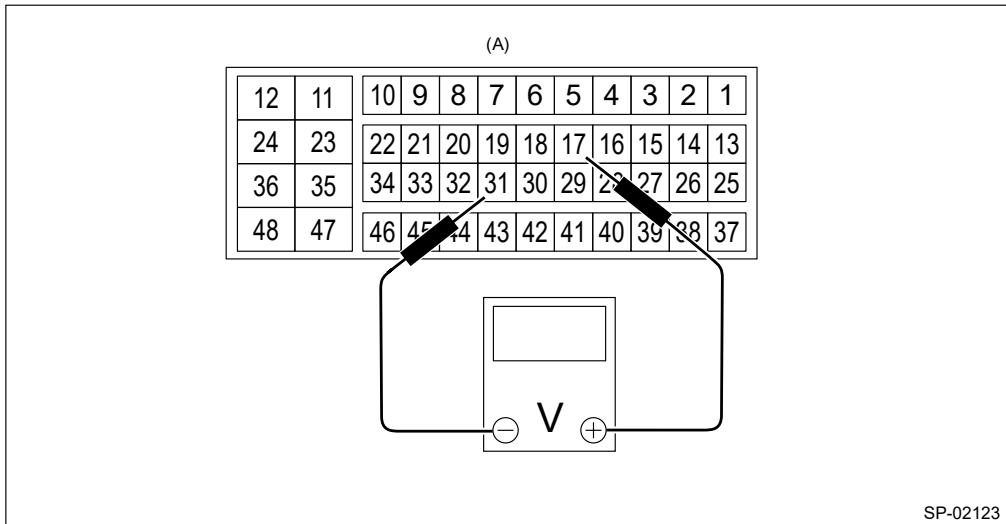
2. While pressing the section (A) shown in the figure, move the lock lever (B) in the direction of the arrow to disconnect the connectors from the ECM in numerical order as shown in the figure.



3. Install the special tool between the ECM and body harness and the engine harness. [Ref. to ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>General Description>CAUTION.](#)

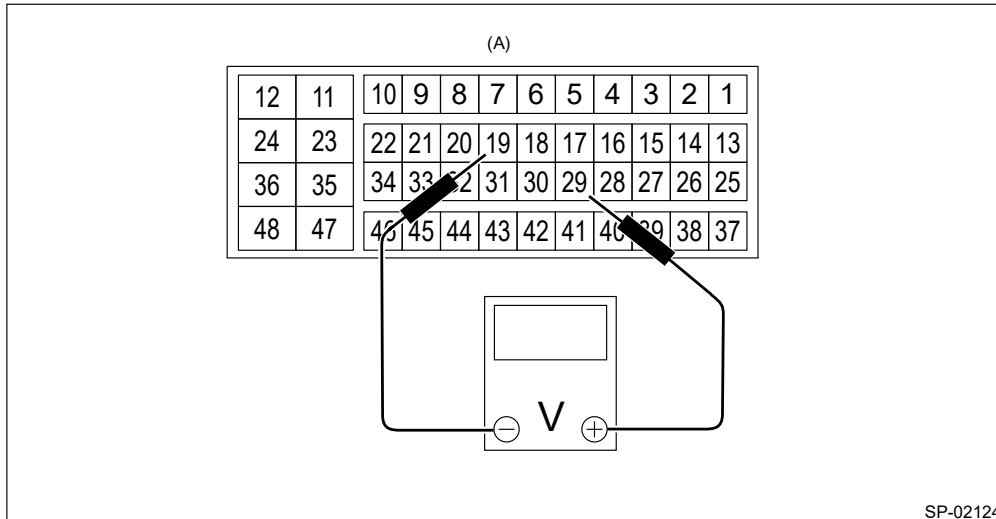
ST 18460AA030 CHECK BOARD

4. Connect the battery ground terminal. [Ref. to NOTE>NOTE > BATTERY.](#)
5. Turn the ignition switch to ON. (Engine OFF)
6. Measure the voltage between ECM connector terminals using ST.
 - Main sensor side



(A) To the check board connector (ECM connector)

- Sub sensor side



(A) To the check board connector
(ECM connector)

| Accelerator pedal sensor | Accelerator pedal | Terminal No. | Standard |
|--------------------------|-----------------------------|-------------------|-------------|
| Main | Not depressed (full closed) | 17 (+) and 31 (-) | 0.4 – 1.0 V |
| | Depressed (full opened) | | 2.4 – 3.7 V |
| Sub | Not depressed (full closed) | 29 (+) and 19 (-) | 0.4 – 1.0 V |
| | Depressed (full opened) | | 2.4 – 3.7 V |

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

2. CHECK ACCELERATOR PEDAL SENSOR AREA (METHOD WITH SUBARU SELECT MONITOR)

Note:

Individual difference of the accelerator pedal may not be corrected sufficiently on the ECM side after DTCs were cleared or the battery was removed and installed on the vehicle. Therefore, when the accelerator opening angle signal does not indicate 100%, repeat the ignition switch ON (engine OFF) and ignition switch OFF operations at intervals of three seconds or more, until the accelerator opening angle signal indicates 100%.

1. Turn the ignition switch to ON. (Engine OFF)
2. Read the accelerator pedal opening angle signal and voltage of accelerator pedal sensor using Subaru Select Monitor. Ref. to [ENGINE \(DIAGNOSTICS\)\(H4DO\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)
 Ref. to [ENGINE \(DIAGNOSTICS\)\(H4DOTC\)>Subaru Select Monitor>OPERATION > DATA MONITOR.](#)

- Non-turbo model

| Accelerator pedal sensor | Accelerator pedal opening angle signal | Standard |
|--------------------------|--|-------------|
| Main | 0.0% | 0.3 – 1.1 V |
| | 100.0% | 2.3 – 3.8 V |
| Sub | 0.0% | 0.3 – 1.1 V |
| | 100.0% | 2.3 – 3.8 V |

- Turbo model

| Accelerator pedal sensor | Accelerator pedal opening angle signal | Standard |
|---------------------------------|---|-----------------|
| Main | 0.0% | 0.4 – 1.0 V |
| | 100.0% | 2.4 – 3.7 V |
| Sub | 0.0% | 0.4 – 1.0 V |
| | 100.0% | 2.4 – 3.7 V |

3. OTHER INSPECTIONS

- 1.** Check that the accelerator pedal does not have deformation, cracks or damage.
- 2.** Check for smooth operation when the accelerator pedal is depressed.
- 3.** Check if the accelerator pedal returns to its original position smoothly when the pedal is released.

SPEED CONTROL SYSTEMS(H4DO) > Accelerator Pedal

INSTALLATION

Install in the reverse order of removal.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

SPEED CONTROL SYSTEMS(H4DO) > Accelerator Pedal

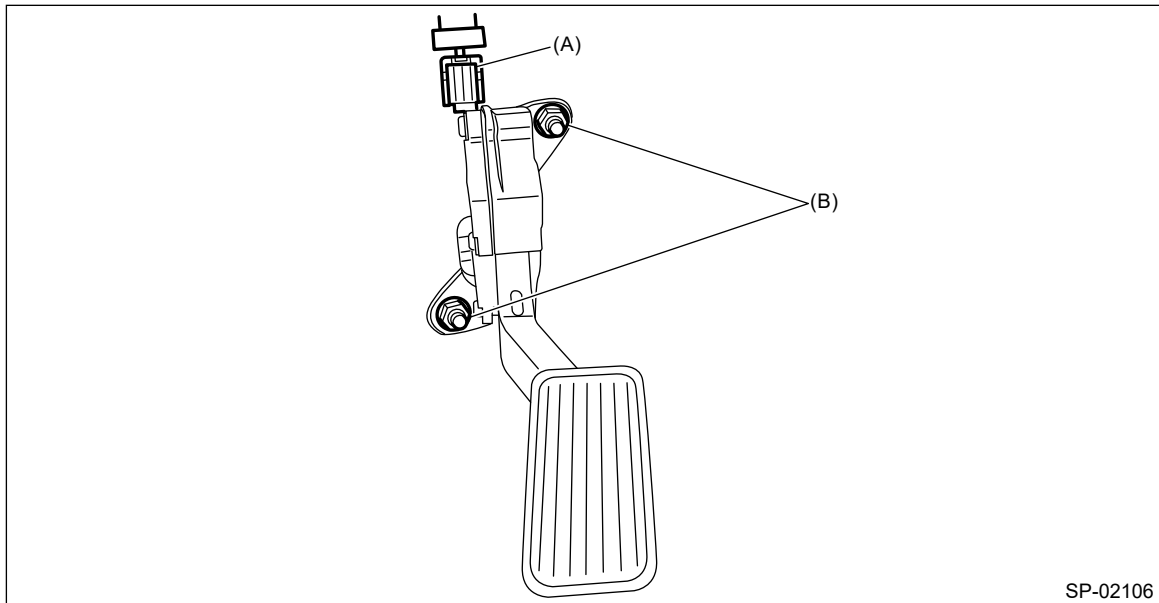
REMOVAL

1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)

Note:

For model with battery sensor, disconnect the ground terminal from battery sensor.

2. Disconnect the connector (A).
3. Remove the nut (B) securing accelerator pedal assembly, and remove the accelerator pedal assembly.



SP-02106

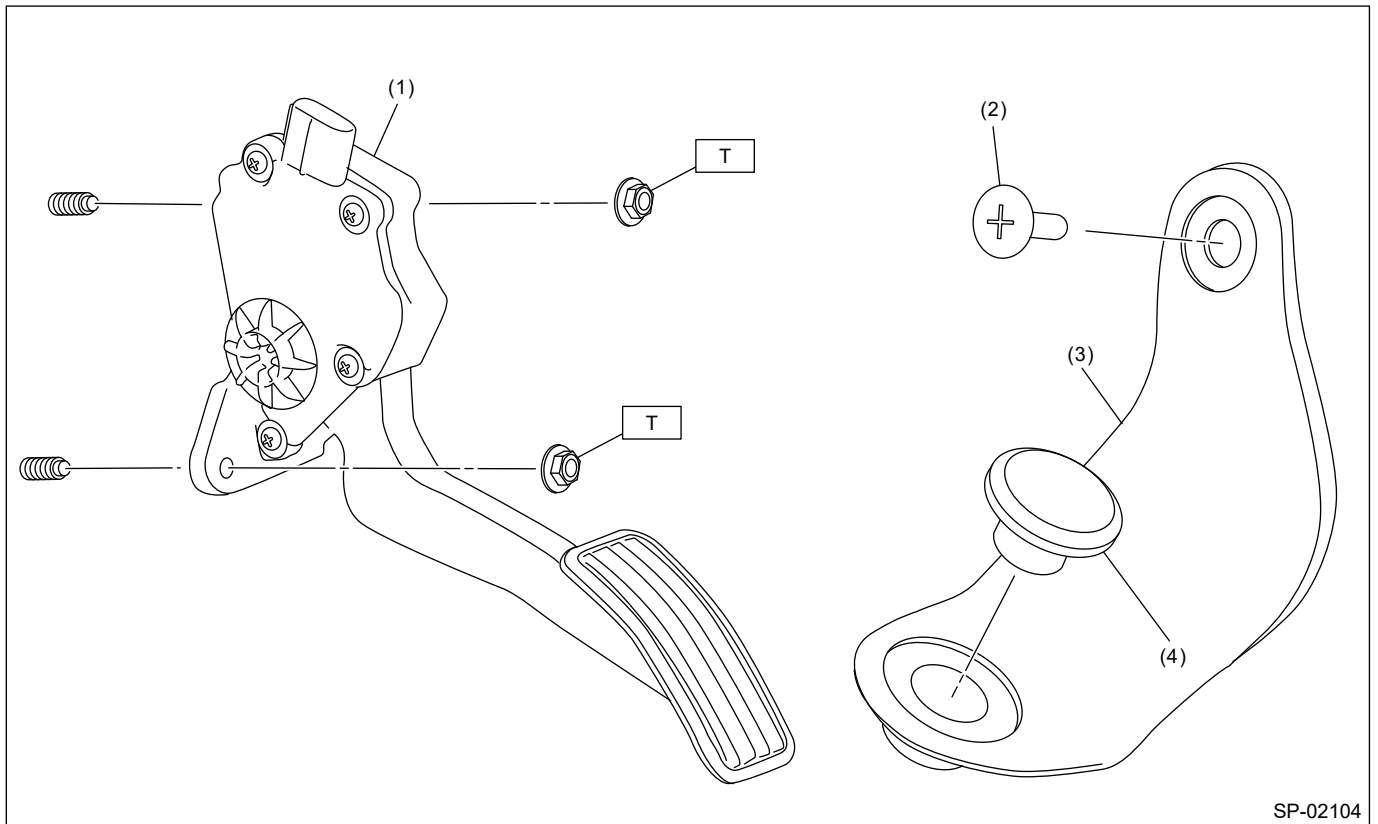
SPEED CONTROL SYSTEMS(H4DO) > General Description

CAUTION

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

SPEED CONTROL SYSTEMS(H4DO) > General Description

COMPONENT



(1) Accelerator pedal ASSY

(3) Accelerator plate

Tightening torque: N·m (kgf·m, ft·lb)

(2) Clip

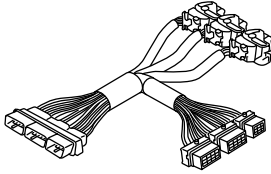
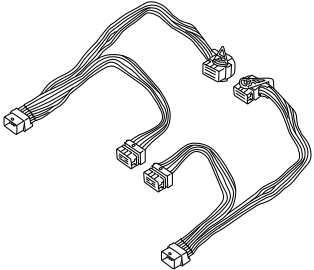

(4) Accelerator stopper

T: 7.5 (0.8, 5.5)

SPEED CONTROL SYSTEMS(H4DO) > General Description

PREPARATION TOOL

1. SPECIAL TOOL

| ILLUSTRATION | TOOL NUMBER | DESCRIPTION | REMARKS |
|--|---------------------------|-------------------------|---|
|  <p>ST18460AA030</p> | 18460AA030 | CHECK BOARD | Used for measuring voltage and resistance of ECM terminals. (Turbo model) |
|  <p>ST18460AA050</p> | 18460AA050 | CHECK BOARD | Used for measuring voltage and resistance of ECM terminals. (Non-turbo model) |
|  <p>STSSM4</p> | — (Newly adopted tool) | SUBARU SELECT MONITOR 4 | Used for setting of each function and troubleshooting for electrical system. Note: For detailed operation procedures of Subaru Select Monitor 4, refer to "Application help". |

2. GENERAL TOOL

| TOOL NAME | REMARKS |
|----------------|---|
| Circuit tester | Used for measuring resistance, voltage and current. |
| DST-i | Used together with Subaru Select Monitor 4. |


SPEED CONTROL SYSTEMS(H4DO) > General Description

SPECIFICATION

| | | | |
|-------------------|--------|--------------|---------------------------|
| Accelerator pedal | Stroke | At pedal pad | 50 – 59 mm (1.97–2.32 in) |
|-------------------|--------|--------------|---------------------------|

SPEED CONTROL SYSTEMS(H4DOTC) > General Description

SPECIFICATION

Specifications for the turbo model are included in the SP(H4DO) section.  [Ref. to SPEED CONTROL SYSTEMS\(H4DO\)>General Description.](#)

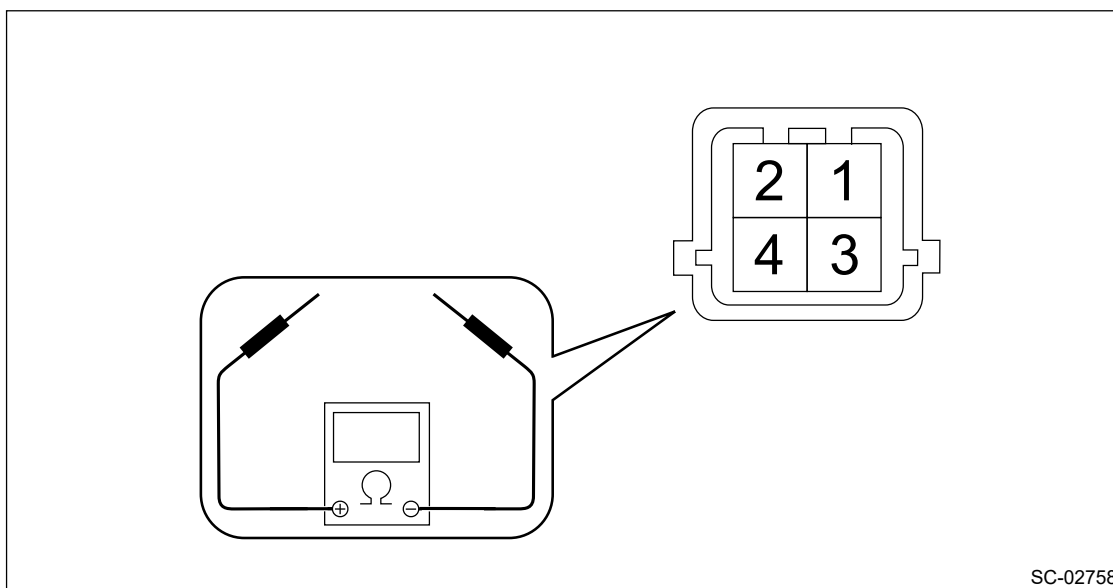
INSPECTION

1. CHECK BATTERY CURRENT SENSOR UNIT

Caution:

Pay attention to polarity when measuring the resistance in the battery current sensor.

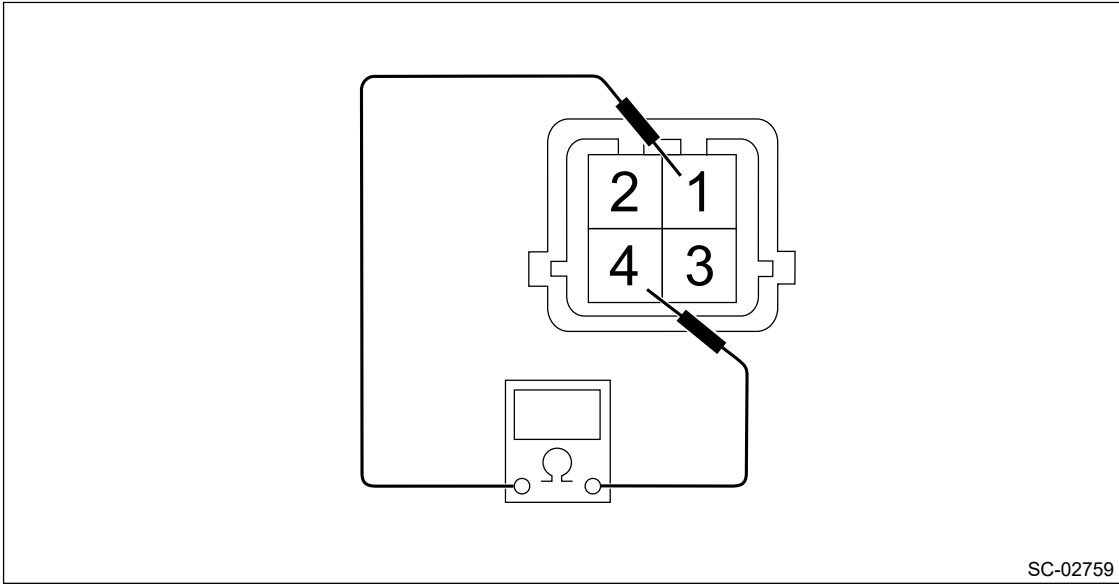
Check the resistance between the battery current sensor terminals.



| Terminal No. | Standard |
|-----------------|------------|
| 2 (+) and 3 (-) | 0 — 0.5 kΩ |
| 2 (+) and 4 (-) | 3 — 10 kΩ |
| 3 (+) and 4 (-) | 3 — 10 kΩ |

2. CHECK BATTERY TEMPERATURE SENSOR UNIT

Check the resistance between the battery temperature sensor terminals.



SC-02759

| Temperature | Terminal No. | Standard |
|-----------------------|--------------|------------|
| 20 — 30°C (68 — 86°F) | 1 and 4 | 1.3—3.2 kΩ |

3. OTHER INSPECTIONS

Check that the battery current & temperature sensor has no deformation, cracks or other damages.

STARTING/CHARGING SYSTEMS(H4DO) > Battery Current & Temperature Sensor

INSTALLATION

Install in the reverse order of removal.

Caution:


- **Hold the terminal bracket with your hand when tightening the nut to avoid deforming the bracket.**
- **Install the terminal bracket so that it is level to the battery.**
- **While working, be sure to protect metal parts with cloth.**

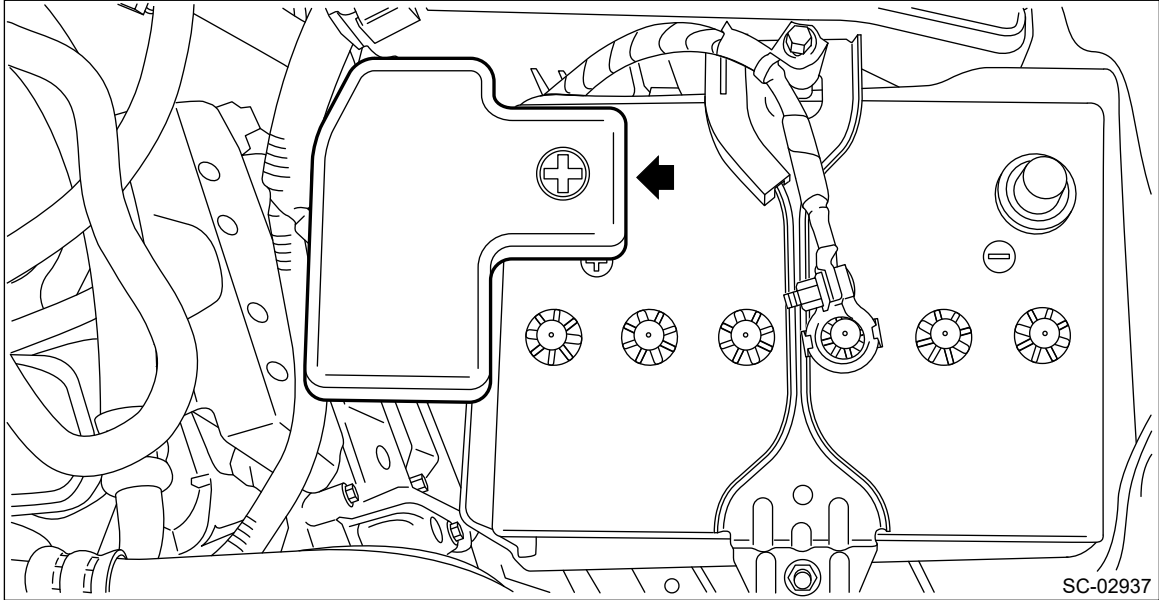
Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

STARTING/CHARGING SYSTEMS(H4DO) > Battery Current & Temperature Sensor

REMOVAL

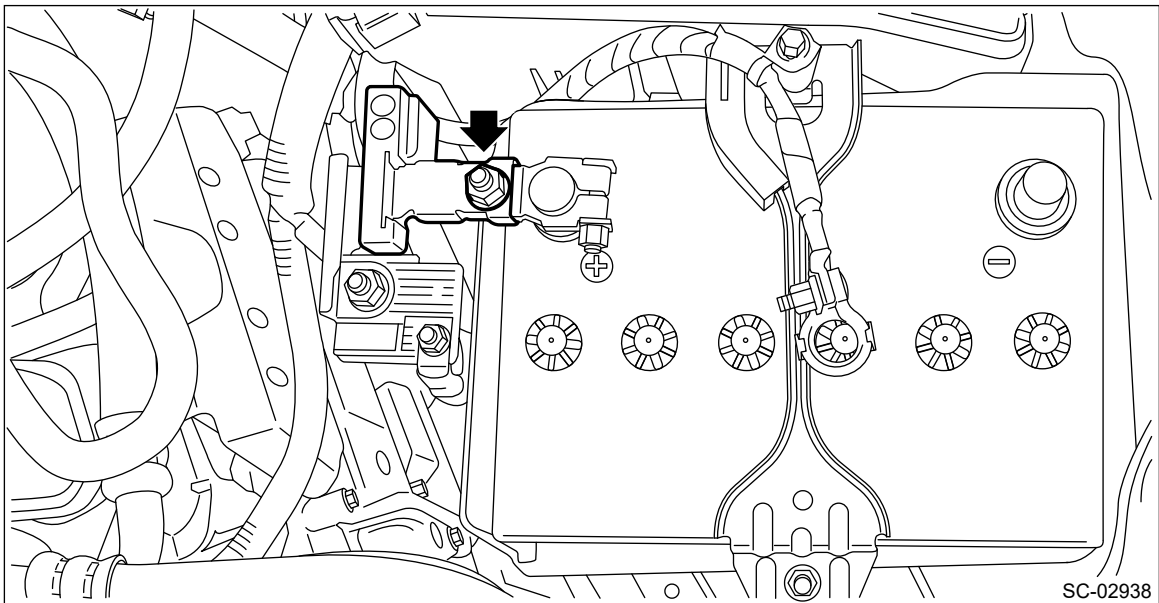
1. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Remove the battery terminal boot.



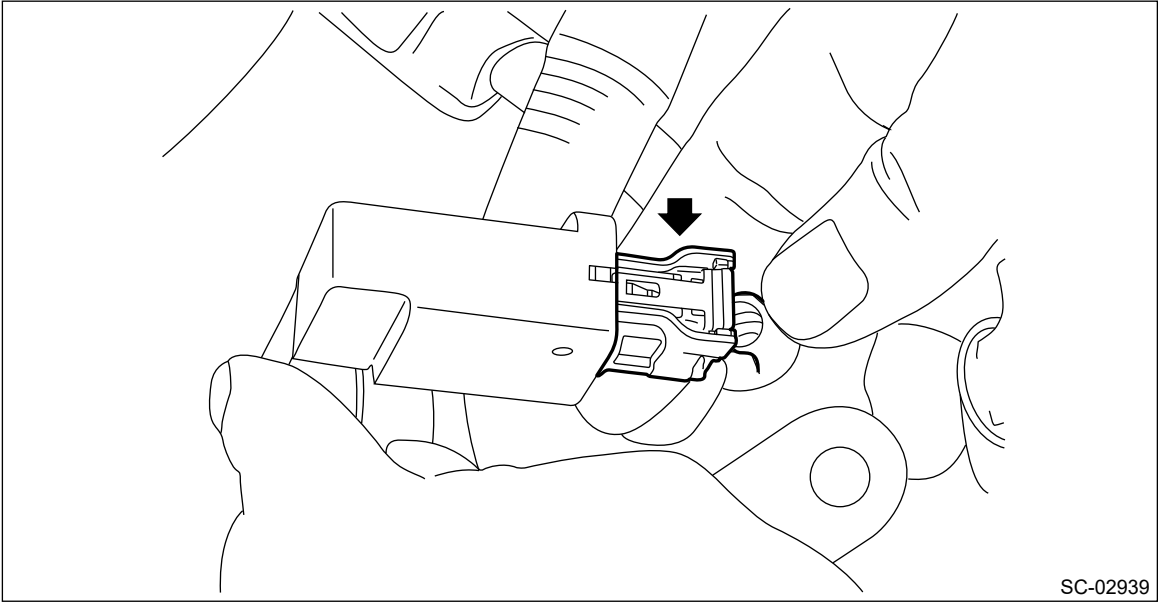
3. Remove the nut which holds the battery current & temperature sensor.

Caution:

- Hold the terminal bracket with your hand when loosening the nut to avoid deforming the bracket.
- While working, be sure to protect metal parts with cloth.



4. Disconnect the connectors from the battery current & temperature sensor.



SC-02939

STARTING/CHARGING SYSTEMS(H4DO) > Battery Sensor

INSPECTION

Check the battery sensor for deformation, cracks and any other damage.

STARTING/CHARGING SYSTEMS(H4DO) > Battery Sensor

INSTALLATION

Caution:

- If the battery terminal is worn and the terminal section is loose, replace it with a new battery.
- After connecting the ground terminal to the battery sensor, the initial diagnosis of the electronic throttle control is conducted by the vehicle. Therefore, wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.

Note:

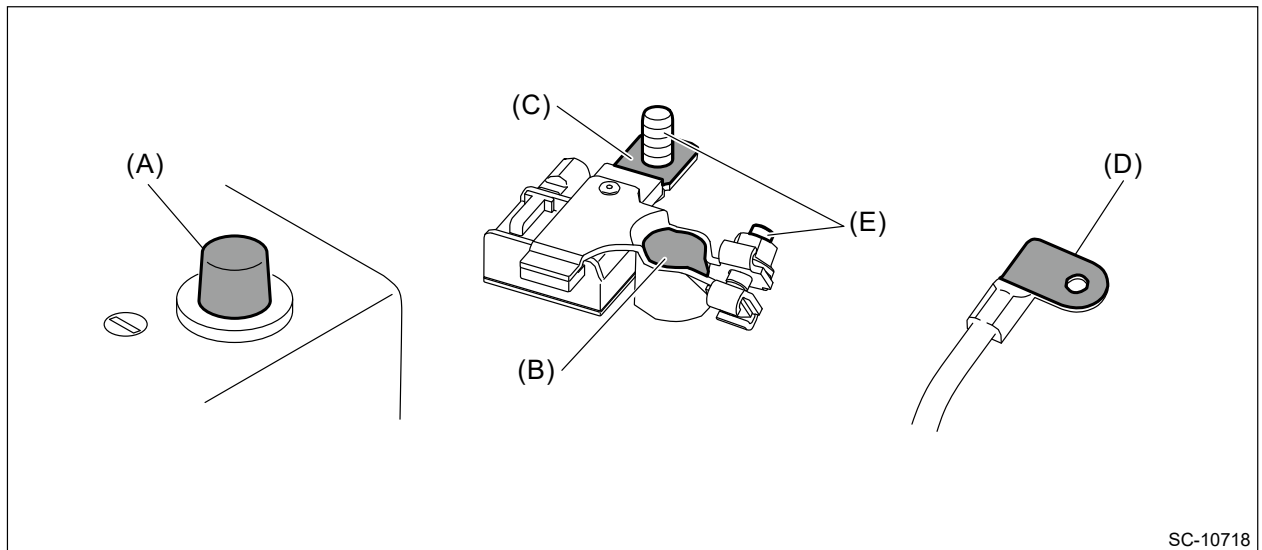
Install the battery sensor to the position where removal/installation of the vent plug is not interfered.

1. Install the battery sensor.

- (1) Clean and degrease the battery terminal, inside of the battery sensor terminal, ground terminal connecting area, and ground terminal.

Caution:

As residual grease on the bolt thread may cause overtorque, clean and degrease the thread if grease remains on it. Also, be careful to avoid battery sensor deformation and intrusion of grease into the inside of the connector when wiping.



(A) Battery terminal

(C) Ground terminal connecting area and ground terminal

(E) Bolt thread

(B) Inside of the battery sensor terminal

(D) Ground terminal

- (2) Loosen the battery sensor nut up to just before the crimp to make sure that the clamp is open.

Note:

This operation is required to firmly insert the battery sensor into the battery terminal.

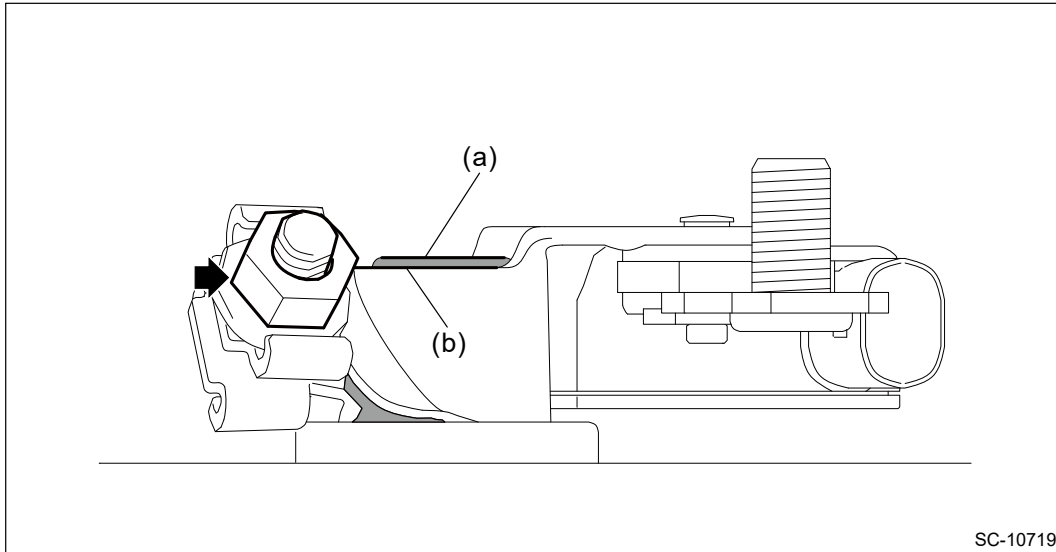
- (3) Set the battery sensor to the battery terminal, and tighten the nut.


Caution:

Insert until the battery terminal upper end (a) exceeds the height of the battery sensor terminal upper end (b).

Tightening torque:

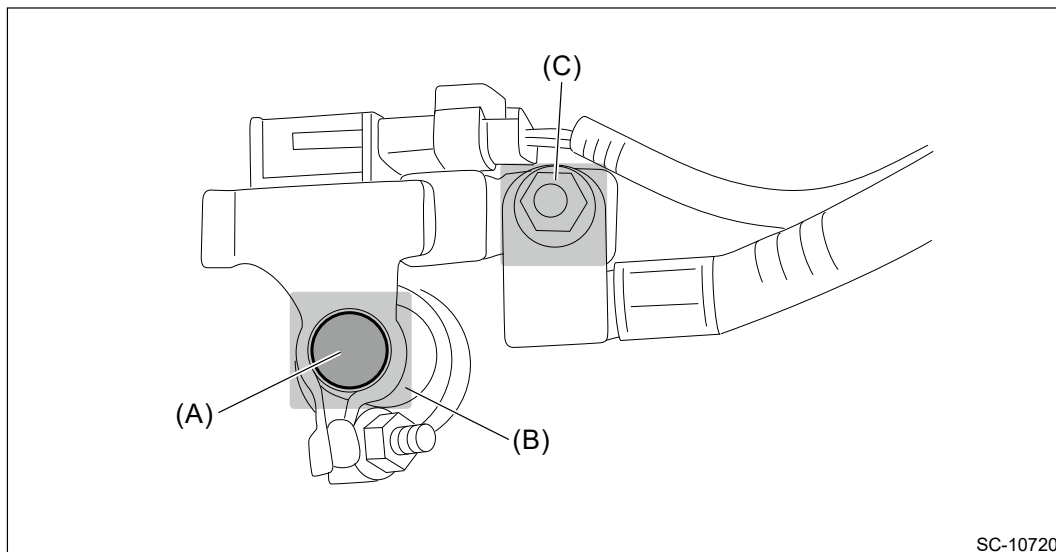
6 N·m (0.6 kgf-m, 4.4 ft-lb)



2. Connect the connector to the battery sensor.
3. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
4. Apply a thin coat of grease to cover the battery terminal surface (A), connection between the battery terminal and the battery sensor (B), and connection between the ground terminal and the battery sensor (C).


Caution:

This procedure is required to prevent rust and suppress sulfation. Be careful to avoid overgreasing as it causes insulation.



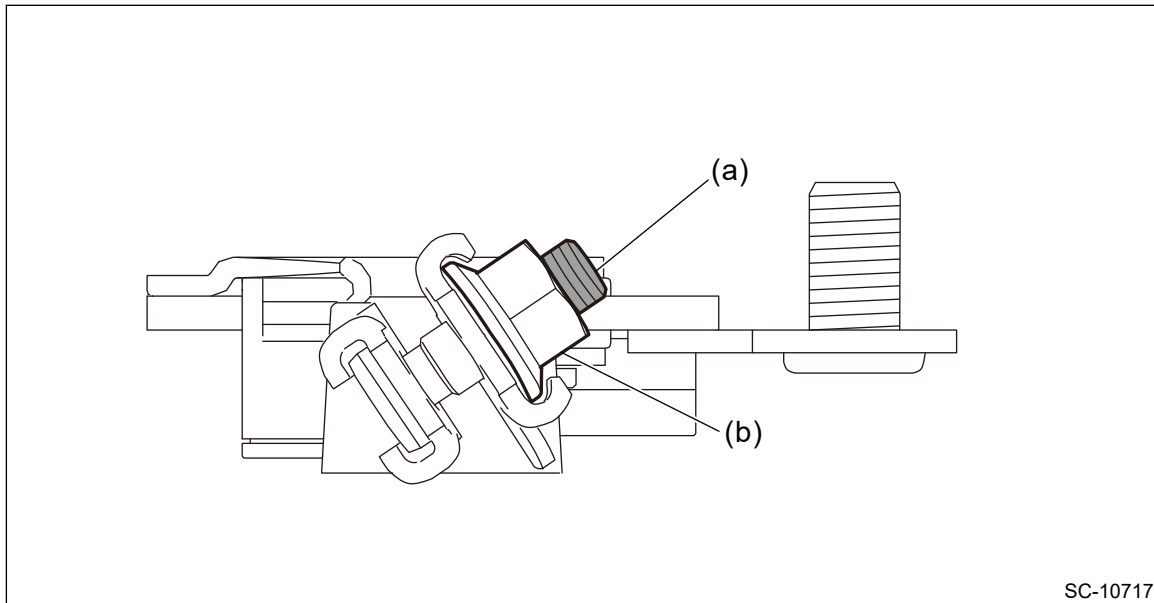
STARTING/CHARGING SYSTEMS(H4DO) > Battery Sensor

REMOVAL

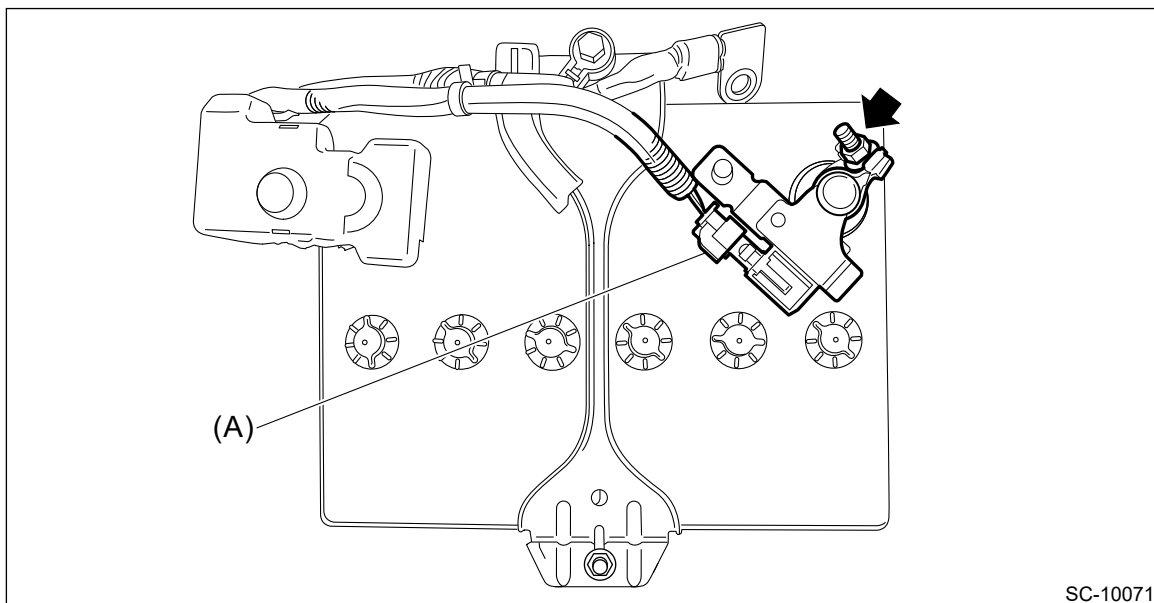
1. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
2. Disconnect the connector (A) from the battery sensor, and remove the battery sensor.

Caution:

The end of the bolt (a) of the battery sensor is crimped. Therefore, do not loosen the nut (b) to the crimped portion.



SC-10717



SC-10071

CHARGE

Warning:

Do not bring an open flame close to the battery when working.

Caution:

- **Prior to charging, corroded terminals should be cleaned with a brush and common caustic soda solution.**
- **Be careful while charging the battery because it produces flammable gases.**
- **Observe instructions when handling the battery charger.**
- **Before charging the battery on the vehicle, disconnect the battery ground terminal to prevent damage of generator diodes or other electrical units.**

1. NORMAL CHARGE (CONSTANT CURRENT CHARGE)

Charge the battery with the current value specified by manufacturer or with approximately 1/10 of battery's rating capacity. (See the table below.)

| Type | Charging current (A) | CCA (A) |
|--------|----------------------|---------|
| 55D23L | 4.0 – 5.0 | 390 |
| 75D23L | 5.0 – 6.0 | 470 |

Caution:

- **The charge control feature and specifications for judgment of charge completion depend on the device. Follow the instruction manual of the charger used.**
- **Keep the electrolyte temperature at 45°C (113°F) or less while charging. Stop charging when the temperature exceeds this value.**

Note:

The characteristics of typical charging methods are as follows.

- **Constant current charging**
This method makes it easy to charge to 100%, since the electrolyte is agitated by the gassing occurred at the end of charging. However, the time for charging is comparatively long because the current value is kept constant.
- **Constant voltage charging**
This method completes charging in a short period of time due to the large current. However, it is difficult to charge to 100% because no gassing occurred at the end of charging and the electrolyte is not agitated. Therefore, the combined use with the constant current charging is preferable.
- **Quasi-constant voltage charging**
This method is widely used for commercially available chargers. Compared to the constant voltage charging whose charging current at the beginning of charging becomes large, it reduces the charging current by lowering the voltage at the initial stage, resulting in battery load reduction. The time for charging is comparatively long. However, this type of chargers can be manufactured comparatively inexpensive due to the simple control circuit (or

manual settings). After the initial stage of charging is completed, it gradually raises the charging voltage so that the charging current is within the specification, until the battery is fully charged.

- **Constant voltage/current charging**

In addition to the constant voltage charging, this method controls the upper limit of the current.

The constant current charging is applied at the beginning of charging, and the constant voltage charging is applied at the end. This makes battery charge comparatively efficient in a short period of time. Charging by generators is similar to this method.

Judgment of charge completion

1. Specific gravity of electrolyte should be held within the specific range of 1.250 — 1.290 for one hour or more.
2. Voltage while charging should be held within the specified range of 15.0 — 16.8 V for one hour or more.
3. Gas is actively generated in all cells.
4. The amount of charge reaches 1.2 — 1.5 times of the amount of discharge.

Note:

The amount of discharge/charge can be calculated by the following formula.

Amount of discharge (Ah) = remaining capacity calculated by specific gravity (%) × 5 hour rate capacity (Ah)

Amount of charge (Ah) = Charging current value (A) × Time for charging

2. QUICK CHARGING

Charge the battery in a short period of time with a relatively large current by using a quick charger.

Charge the battery with the current value at approximately 1/2 of battery's rating capacity. (See the table below.)

Caution:

- **Quick charging is accompanied by a large amount of heat generation. Charging should be completed in up to 30 minutes regardless of battery size.**
- **Quick charging is used to recover the battery until it can start the vehicle. For full charging, use the normal charging method.**
- **Keep the electrolyte temperature at 55°C (131°F) or less while quick charging. Stop charging when the temperature exceeds this value.**

| Type | Charging current (A) | CCA (A) |
|--------|----------------------|---------|
| 55D23L | 20.0 — 25.0 | 390 |
| 75D23L | 24.0 — 29.0 | 470 |

STARTING/CHARGING SYSTEMS(H4DO) > Battery

INSPECTION

Warning:

- As batteries produce flammable gases, be careful not to bring an open flame close to the batteries.
- Ventilate sufficiently when using or charging battery in enclosed space.
- Electrolyte is corrosive acid, and has toxicity; be careful of handling the fluid.
- For safety, in case an explosion does occur, wear eye protection or shield your eyes when working near any battery. In addition, never lean over the battery.
- Be careful that the electrode does not come into contact with skin, eyes or clothing. Especially at contact with eyes, flush with water for 15 minutes and get prompt medical attention.
- Be careful not to let the electrode contact with the coated parts.
- Before starting work, remove rings, metal watch-bands, and other metal jewelry.
- Be careful not to let the metal tools contact the positive battery terminal and anything connected to it. When the operation using a metal tool to the positive terminal or anything connected to it is required, disconnect the battery ground terminal before starting the operation.

1. APPEARANCE

Check the battery case, top cover and terminal posts for dirt or cracks, and perform the following work as necessary.

- Clean the battery with water and wipe with a dry cloth.
- Apply a thin coat of grease on the terminal posts to prevent corrosion.

Check

- **Normal** → Go to the check item 2.
- **Abnormal** → Replace the battery.

2. ELECTROLYTE LEVEL

Check the electrolyte level in each cell.

Caution:

Do not fill beyond MAX level.

Note:

If the level is below the middle point between MIN level and MAX level, pour distilled water into the battery cell to bring the level to MAX.

Check

- **MAX level** → Go to the check item 3.
- **Below the middle point between MIN level and MAX level** → **Fill** → Go to the check item 3.

3. SPECIFIC GRAVITY OF ELECTROLYTE

Check the specific gravity of the electrolyte using a hydrometer and a thermometer.

Note:

- **Specific gravity varies with temperature of electrolyte so that it must be corrected at 20°C (68°F) using the following calculation:**

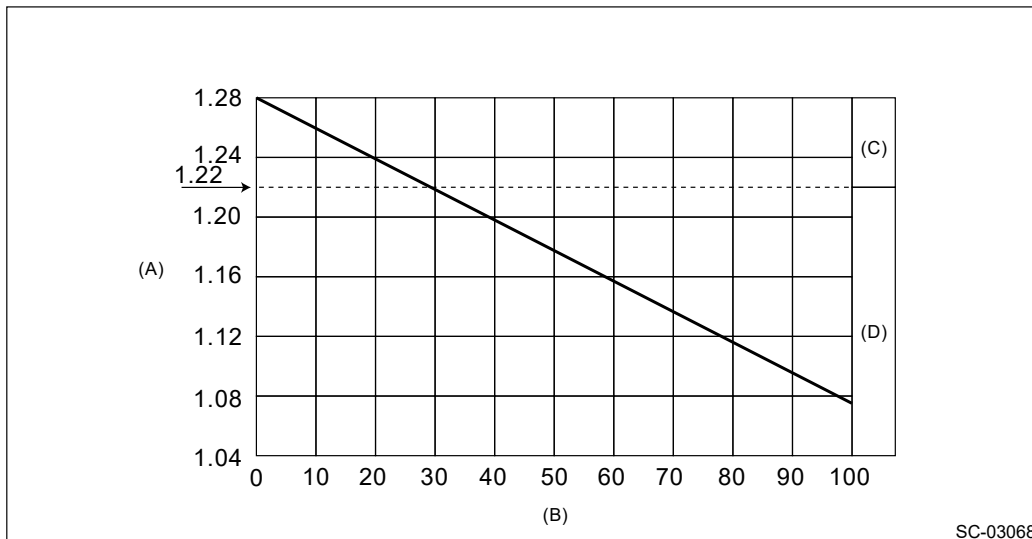
$$S_{20} = S_t + 0.0007 \times (t - 20)$$

S_{20} : Specific gravity corrected at electrolyte temperature of 20°C

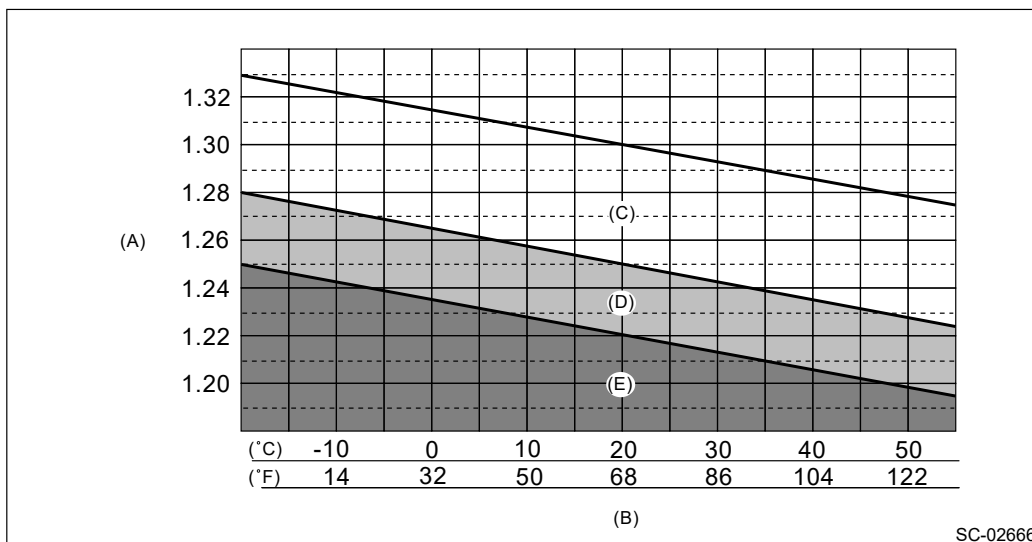
S_t : Measured specific gravity

t : Measured temperature (°C)

- When measuring in a simplified manner using the battery terminal voltage, calculate the specific gravity by the following formula.
Specific gravity = [0.187 × battery terminal voltage (V)] – 1.1
 Perform the steps 1) and 2) before measuring the voltage in order to stabilize the voltage.
 1) Turn the ignition switch to OFF and illuminate the headlight for 30 seconds.
 2) After turning off the headlight, leave the vehicle for one minute.
- 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.



(A) Specific gravity [20°C (68°F)] (B) Amount of discharge (%) (C) Good
 (D) Need to charge or replace



(A) Specific gravity [20°C (68°F)] (B) Electrolyte temperature (C) Good
 (D) [Note] (E) Need charging

Check

- **Specific gravity: 1.250 – 1.290, and difference between cells is 0.04 or less** → Battery is normal
- **Specific gravity: Less than 1.250, or difference between cells is 0.04 or more** → Battery needs to be charged or replaced





4. STANDBY CURRENT

1. Prepare the circuit tester which can measure down to 1 mA.

Note:


For model with keyless access function, the standby current changes regularly. Therefore, prepare the analog type circuit tester.

2. Using the circuit tester, check the standby current.

- (1) Check the battery.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Battery>INSPECTION > APPEARANCE.](#)  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Battery>INSPECTION > ELECTROLYTE LEVEL.](#)  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Battery>INSPECTION > SPECIFIC GRAVITY OF ELECTROLYTE.](#)  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>Battery>INSPECTION > STANDBY CURRENT.](#)

Note:

The standby current may be displayed lower than the actual value if the battery is weak, so be sure to check the battery. Charge or replace if necessary.

- (2) Check that the fuse is not blown out and is properly inserted.
- (3) When non-genuine electrical parts (including parts sold in authorized workshops) are installed, remove all parts except for genuine electrical parts.
- (4) Check that back-up fuse is inserted.  [Ref. to PRE-DELIVERY INSPECTION>PRE-DELIVERY INSPECTION \(PDI\) PROCEDURE > FUSE INSTALLATION.](#)
- (5) Start the engine, and set the switch positions for each system as shown in the following table.

Note:

Some of the listed systems are not equipped depending on the vehicle. Set only the systems equipped on the vehicle to the positions as shown.

| [System] | Position |
|---|-----------------|
| Headlight | ON or Auto |
| Fog light | [ON] |
| Wiper (front and rear) | ON or Low speed |
| Audio and navigation system | [ON] |
| Rear defogger | [ON] |
| Room light | DOOR |
| Luggage light | DOOR |
| Map light | [OFF] |
| Auto A/C | ON (AUTO) |
| Manual A/C | ON (Speed 1) |
| Electronic parking brake | [ON] |
| Electrical parts other than listed above (electrical parts that users can confirm the operation with the key removed) | [OFF] |

- (6) Turn the ignition switch to OFF.
- (7) Operate the front hood lock release lever to unlock the front hood.
- (8) Close all the doors (including rear gate and trunk lid) and then lock the doors. (Security alarm is in set condition)

Note:

For model with keyless access function, take the access key 1.5 m or more away from the vehicle after the door lock. And do not put the access key close to the vehicle while measuring the standby current.

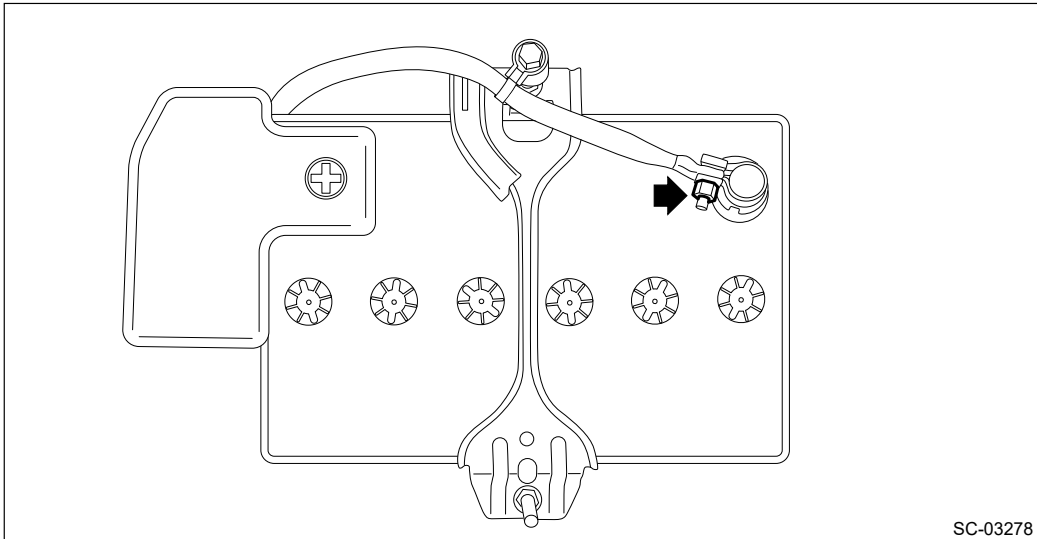
- (9) Wait for 5 minutes after door lock until the standby current stabilizes.
- (10) Loosen the nut which holds the negative terminal to the battery. (Model without battery sensor)

(11) Loosen the nut which holds the ground terminal to the battery sensor. (Model with battery sensor)

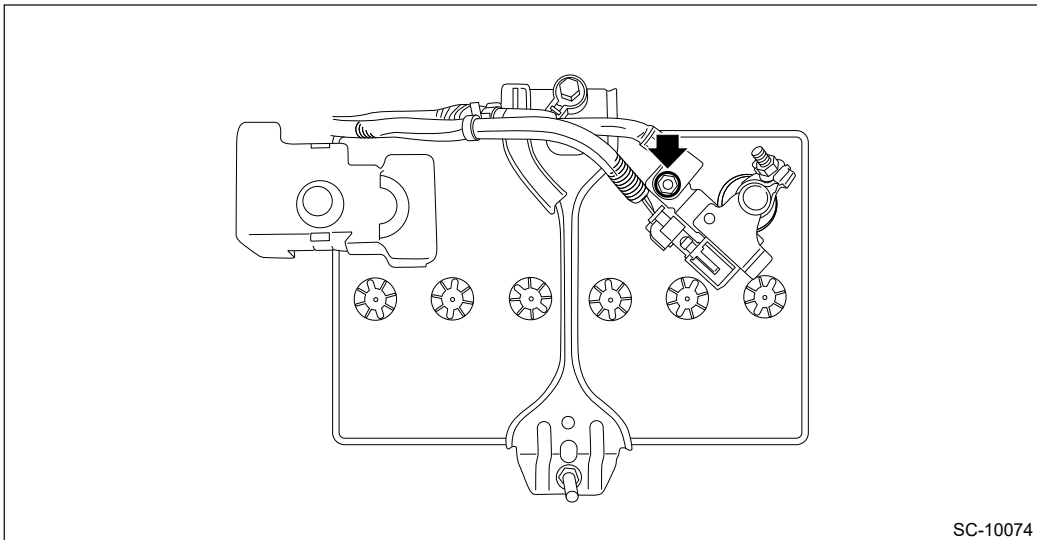
Note:

Do not disconnect the negative terminal or the ground terminal.

- Model without battery sensor



- Model with battery sensor



(12) Connect the circuit tester positive terminal to the negative terminal. (Model without battery sensor)

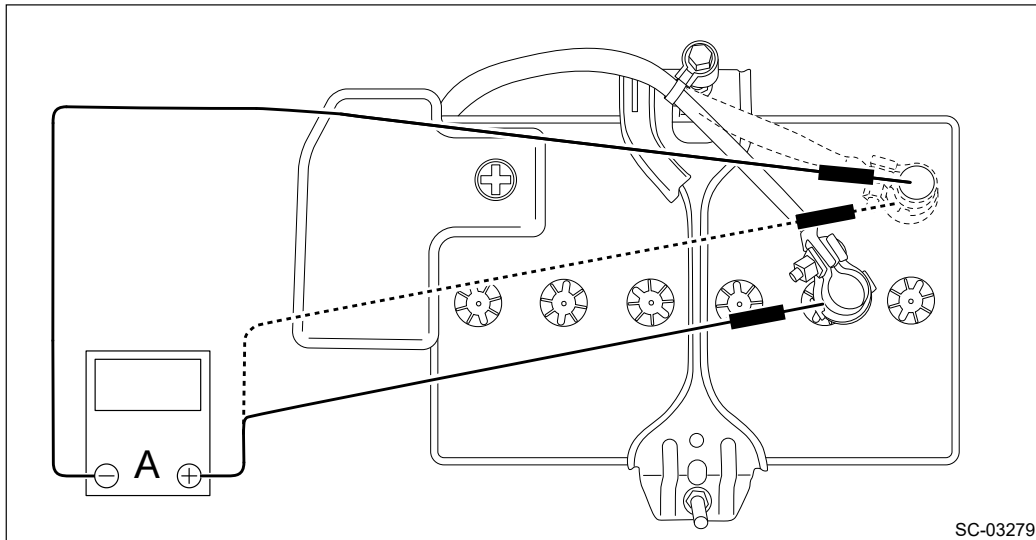
(13) Connect the circuit tester positive terminal to the ground terminal. (Model with battery sensor)

Note:

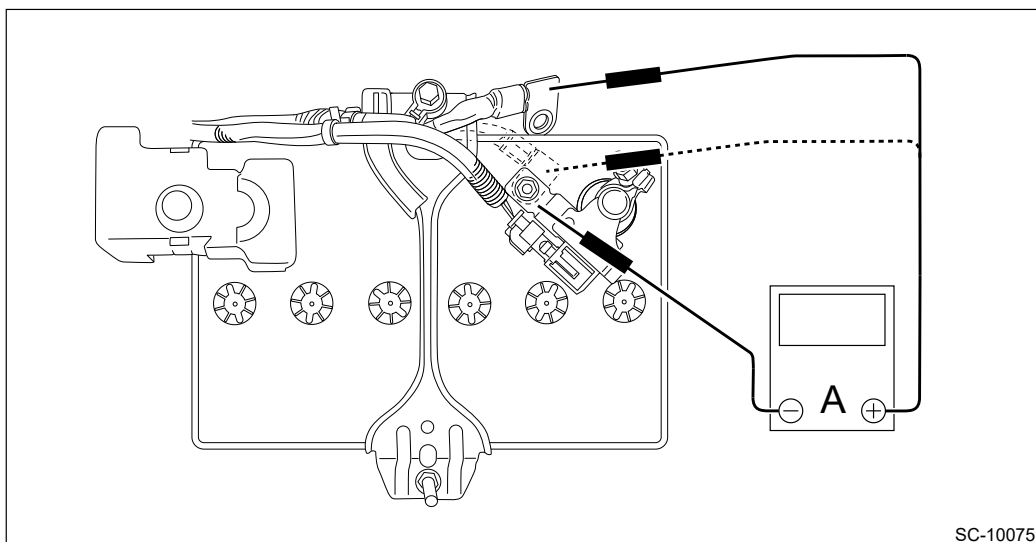
To prevent the damage to the circuit tester, set the circuit tester range to a large value first, then gradually change it to smaller values.

- (14) Connect the circuit tester negative terminal to the negative terminal installation part of the battery. (Model without battery sensor)
- (15) Connect the circuit tester negative terminal to the ground terminal installation part of the battery sensor. (Model with battery sensor)
- (16) While connecting the circuit tester positive terminal with the negative terminal as shown in the figure below, remove the negative terminal from the battery. (Model without battery sensor)
- (17) While connecting the circuit tester positive terminal with the ground terminal as shown in the figure below, remove the ground terminal from the battery sensor. (Model with battery sensor)

- Model without battery sensor



- Model with battery sensor




(18) Check the standby current.

Note:

- For model with keyless access function, the standby current changes periodically because the keyless access system continuously searches the access key (polling).
- When measuring the standby current, the reading of the circuit tester oscillates. Therefore, read the average value (median value).

Check

- When the maximum measurement value is less than 70 mA → Standby current is normal.
- When the maximum measurement value is 70 mA or more → Go to step (19).

(19) Remove all fuses one by one to identify which system changes the standby current value significantly.  Ref. to [WIRING SYSTEM>Power Supply Circuit](#).

(20) Check the harness and connector of the system whose standby current has changed significantly.

STARTING/CHARGING SYSTEMS(H4DO) > Battery

INSTALLATION

Install in the reverse order of removal.

Tightening torque:

3.5 N·m (0.4 kgf-m, 2.6 ft-lb)

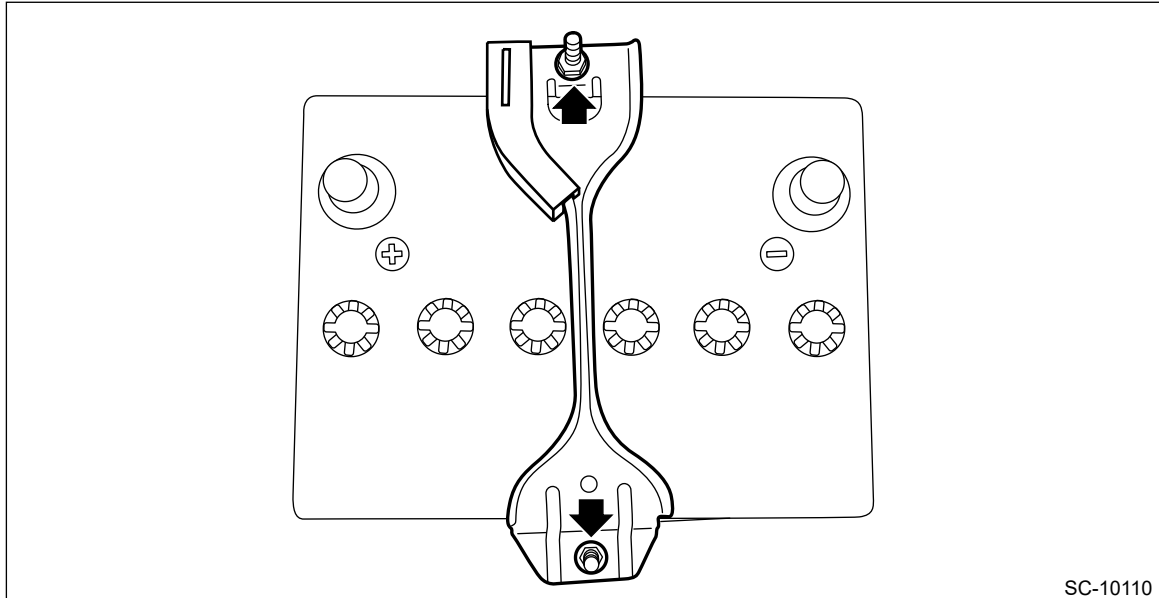
Note:

- **Clean the battery cable terminals and apply grease to retard the formation of corrosion.**
- **Connect the positive (+) terminal, and then connect the negative (–) terminal of the battery.**
- **After the battery is installed, initial diagnosis of the electronic throttle control is performed. Wait for 10 seconds or more after turning the ignition switch to ON, and then start the engine.**

STARTING/CHARGING SYSTEMS(H4DO) > Battery

REMOVAL

1. Disconnect the positive (+) terminal after disconnecting the negative (-) terminal of battery.
2. Remove the battery cable holder from the battery rod.
3. Remove the flange nut from battery rod and remove battery holder.



4. Remove the battery.

STARTING/CHARGING SYSTEMS(H4DO) > General Description

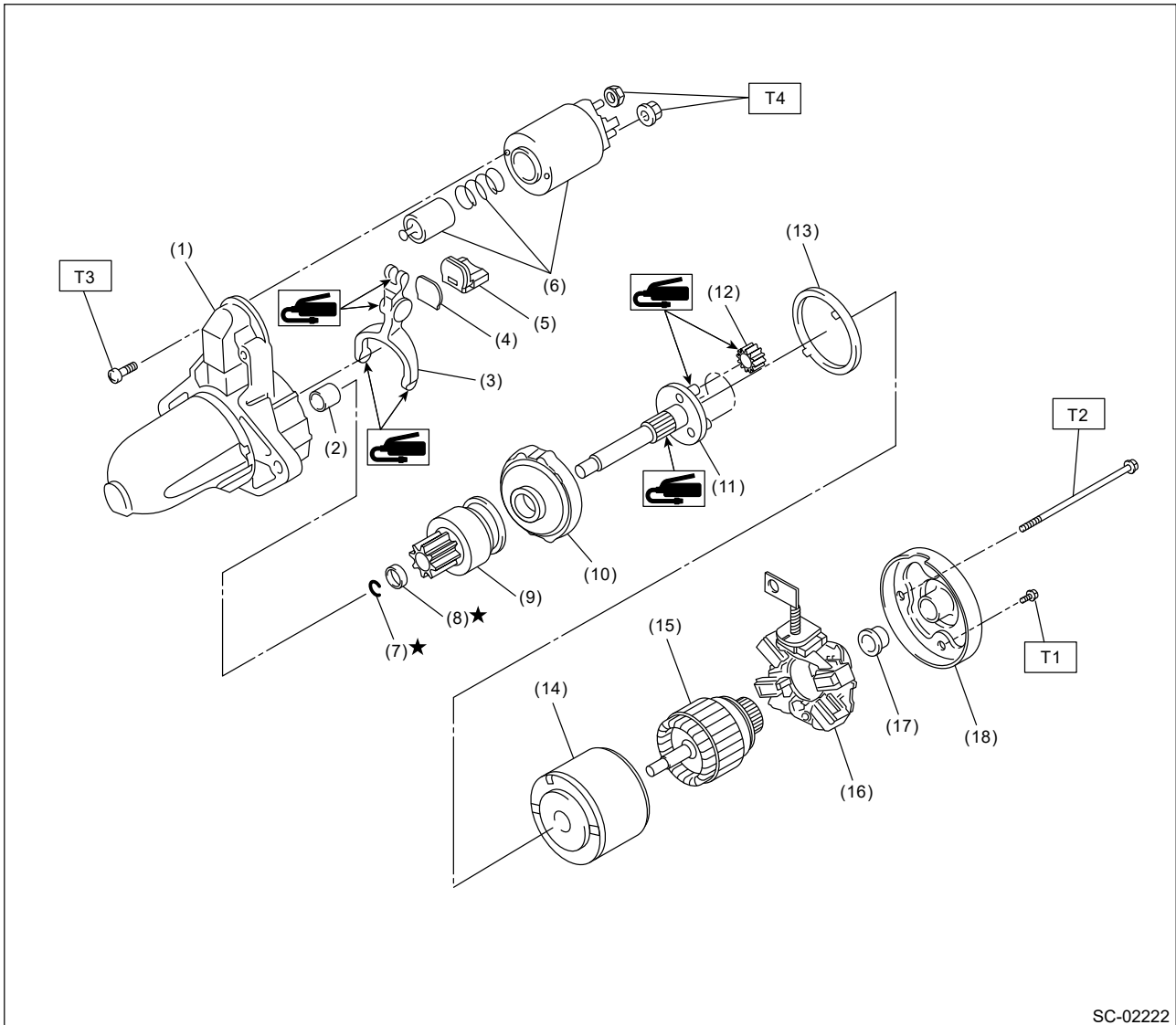
CAUTION

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

STARTING/CHARGING SYSTEMS(H4DO) > General Description

COMPONENT

1. STARTER



SC-02222

- | | | |
|--------------------------|-------------------------|-------------------------|
| (1) Starter housing ASSY | (9) Overrunning clutch | (17) Sleeve bearing |
| (2) Sleeve bearing | (10) Internal gear ASSY | (18) Starter cover ASSY |
| (3) Shift lever | (11) Shaft | |
| (4) PLATE | (12) Pinion gear | |
| (5) Seal rubber | (13) Seal rubber | |
| (6) Magnet switch ASSY | (14) Yoke ASSY | |
| (7) Snap ring | (15) Armature ASSY | |
| (8) STOPPER | (16) Brush holder ASSY | |

Tightening torque: N·m (kgf-m, ft-lb)

T1: 1.4 (0.1, 1.0)

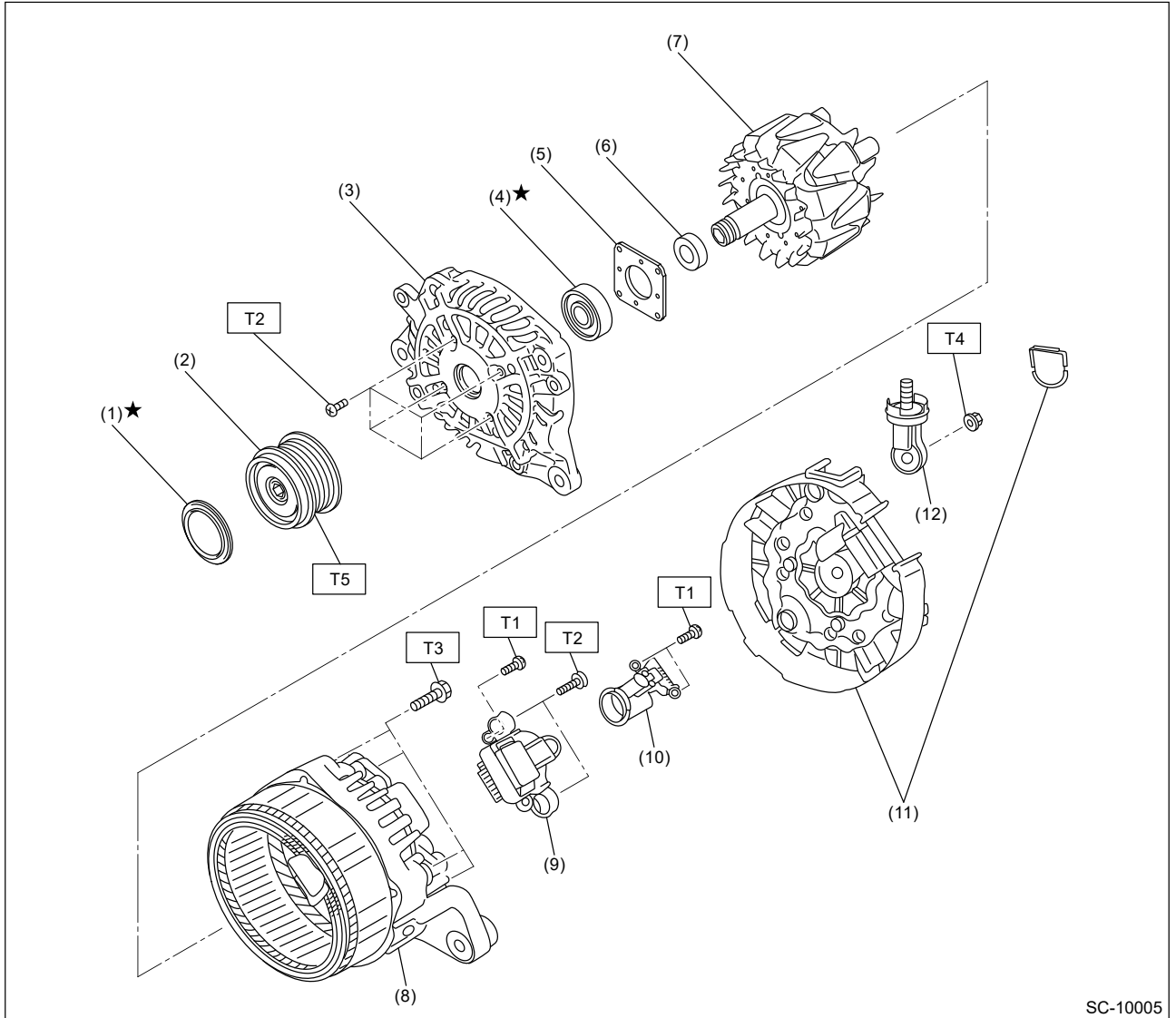
T2: 6 (0.6, 4.4)

T3: 7.5 (0.8, 5.5)

T4: 10 (1.0, 7.4)

2. GENERATOR

- Non-turbo model



SC-10005

(1) ★ Cap

(7) Rotor

Tightening torque: N·m (kgf-m, ft-lb)

(2) Pulley

(8) Rear cover ASSY

T1: 2 (0.2, 1.5)

(3) Front cover

(9) IC regulator

T2: 3.9 (0.4, 2.9)

(4) ★ Ball bearing

(10) Brush ASSY

T3: 4.4 (0.4, 3.2)

(5) ★ Bearing retainer

(11) Rear cover

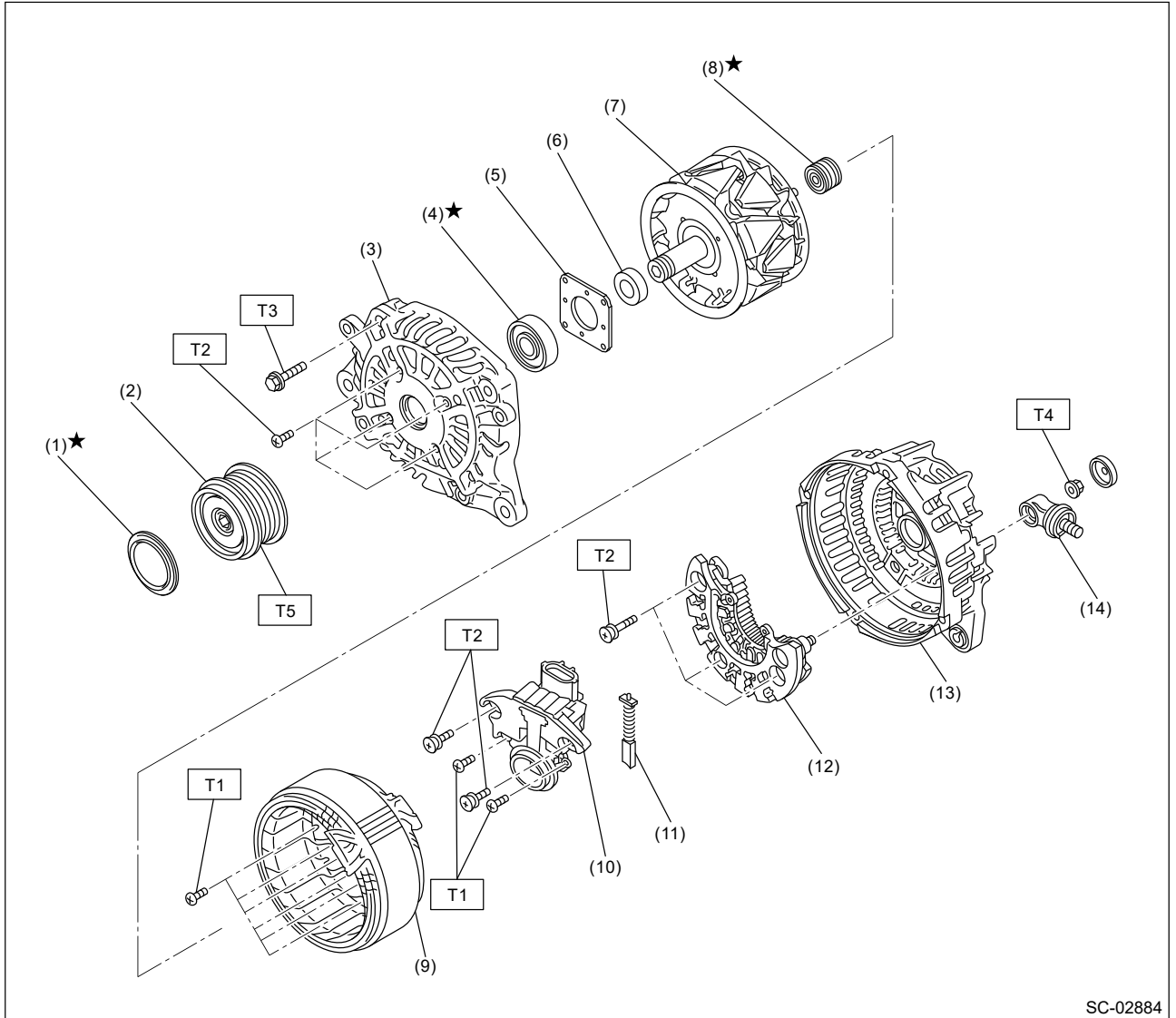
T4: 8.9 (0.9, 6.6)

(6) Spacer

(12) Terminal B

T5: 77.5 (7.9, 57.2)

- Turbo model



SC-02884

(1)★ Cap

(8) Bearing

Tightening torque: N·m (kgf·m, ft·lb)

(2) Pulley

(9) Stator coil

T1: 2 (0.2, 1.5)

(3) Front cover

(10) IC regulator

T2: 3.9 (0.4, 2.9)

(4)★ Ball bearing

(11) Brush

T3: 4.4 (0.4, 3.2)

(5) Bearing retainer

(12) Rectifier

T4: 8.9 (0.9, 6.6)

(6) Spacer

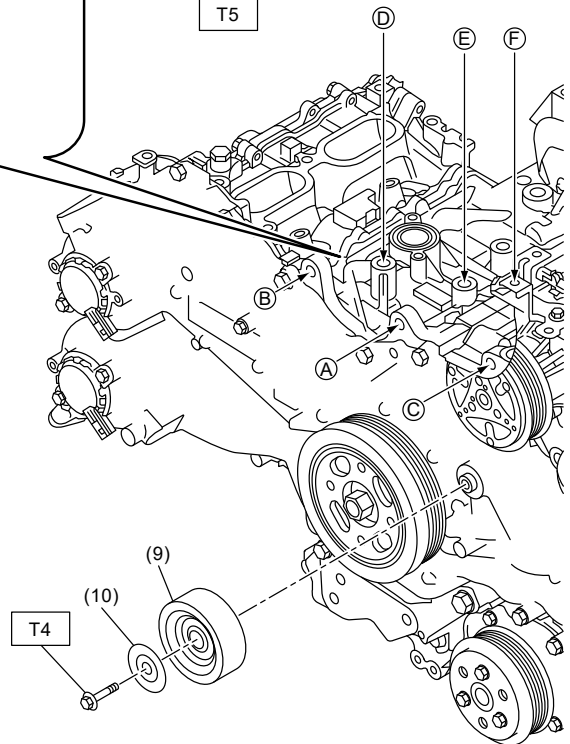
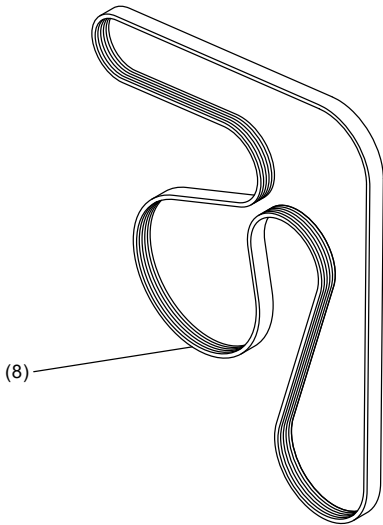
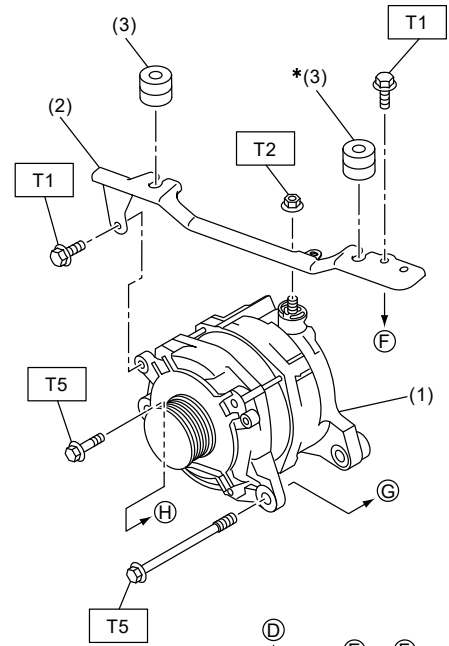
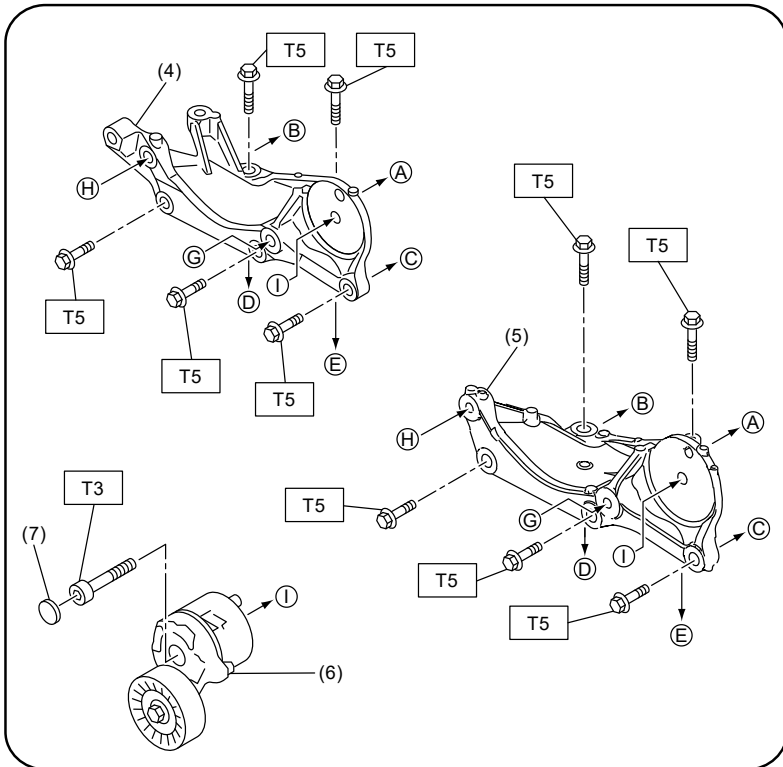
(13) Rear cover

T5: 108 (11.0, 79.8)

(7) Rotor

(14) Terminal B

3. GENERATOR BRACKET



SC-10072

- | | |
|--|-------------------------|
| (1) Generator | (7) Cap |
| (2) Collector cover bracket (V-belt cover bracket) | (8) V-belt |
| (3) Grommet | (9) Idler pulley |
| (4) Generator bracket (model with vacuum pump) | (10) Idler pulley cover |
| (5) Generator bracket (model without vacuum pump) | |
| (6) V-belt tensioner ASSY | |

Tightening torque: N·m (kgf·m, ft·lb)

T1: 6.4 (0.7, 4.7)

T2: 15 (1.5, 11.1)

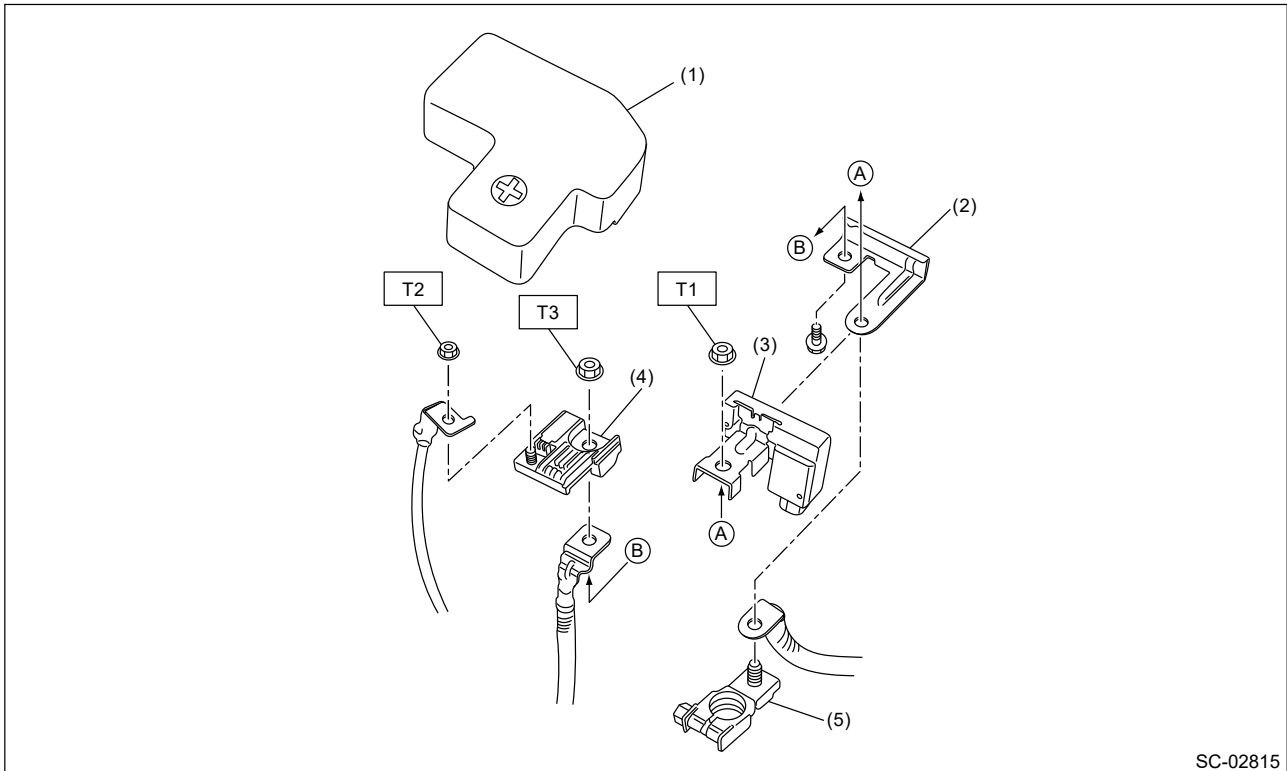
T3: 25 (2.5, 18.4)

T4: 36 (3.7, 26.6)

T5:  Ref. to

*Equipped only on turbo model.

4. BATTERY CURRENT & TEMPERATURE SENSOR



SC-02815

(1) Terminal boot

(4) Slow Blow Fuse

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

(2) Terminal bracket

(5) Terminal base

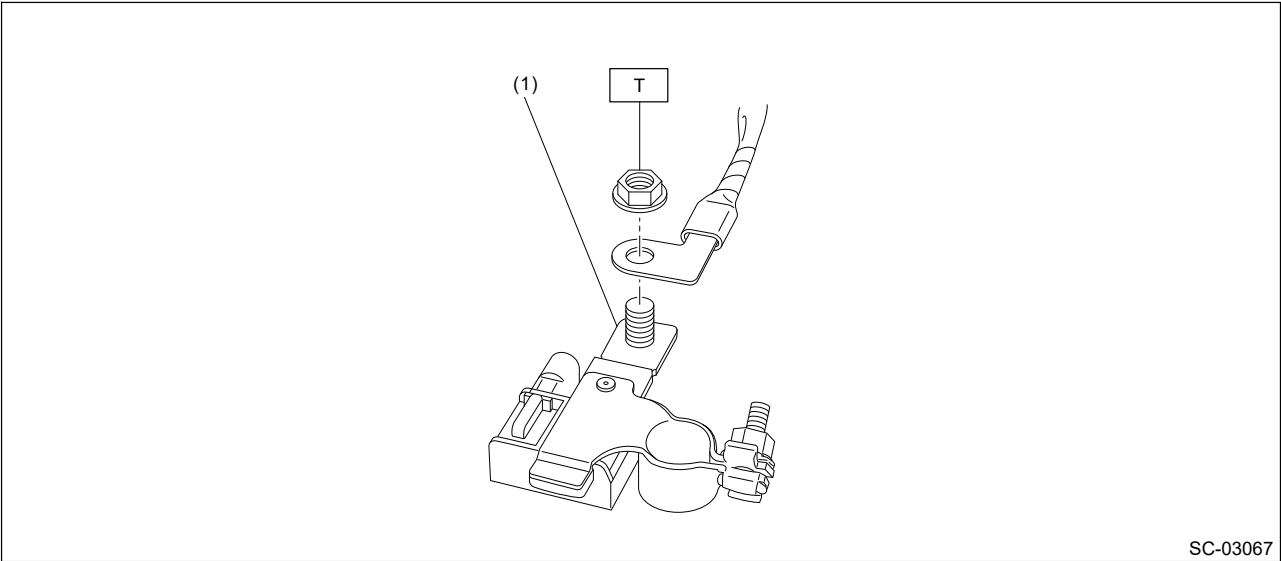
T1: 7.5 (0.8, 5.5)

(3) Battery current & temperature
sensor

T2: 9 (0.9, 6.6)

T3: 14 (1.4, 10.3)

5. BATTERY SENSOR



SC-03067

(1) Battery sensor

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

STARTING/CHARGING SYSTEMS(H4DO) > General Description

PREPARATION TOOL

1. GENERAL TOOL

| TOOL NAME | REMARKS |
|----------------|--|
| Circuit tester | Used for measuring resistance, voltage and current. Note: <ul style="list-style-type: none">• When measuring the standby current, prepare a circuit tester which can measure down to 1 mA.• When measuring the standby current for models with keyless access function, prepare an analog type. |

STARTING/CHARGING SYSTEMS(H4DO) > General Description

SPECIFICATION

- Non-turbo model

| Item | | Specifications | | |
|---------------|--------------------------------|---|--------------------|--|
| Vehicle model | | Non-turbo model | | |
| | | CVT | MT | |
| Starter | Type | Reduction type | | |
| | Model | M000T38571 | M000T33176 | |
| | Manufacturer | Mitsubishi Electric | | |
| | Voltage and output | 12 V —1.2 kW | 12 V —1.0 kW | |
| | Direction of rotation | Counterclockwise (when observed from pinion) | | |
| | Number of pinion teeth | 9 | 8 | |
| | No-load characteristics | Voltage | 11 V | |
| Current | | 90 A or less | 95 A or less | |
| Generator | Type | Rotating-field three-phase type, voltage regulator built-in type, with load response control system | | |
| | Model | A5TV0081 | | |
| | Manufacturer | Mitsubishi Electric | | |
| | Voltage and output | 12 V — 150 A | | |
| | Polarity on ground side | Negative | | |
| | Direction of rotation | Clockwise (when observed from pulley side) | | |
| | Stator connection | 3-phase Δ type | | |
| | Output current | 1,500 r/min— 44 A or more 2,500 r/min— 121 A or more 5,000 r/min— 148 A or more | | |
| | Regulated voltage | 14.0—14.6 V [20°C (68°F)] | | |
| | Rotor slip ring outer diameter | Standard | 22.7 mm (0.894 in) | |
| | | Limit | 22.1 mm (0.870 in) | |
| Brush length | Standard | 22.5 mm (0.886 in) | | |
| | Limit | 5.0 mm (0.197 in) | | |
| Battery | Type | 55D23L / 75D23L | | |
| | Nominal capacity | 5 HR: 40 Ah [25°C (77°F)] (55D23L) / 5 HR: 53 Ah [25°C (77°F)] (75D23L) | | |
| | Nominal voltage | 12 V | | |
| | CCA | 390 A (55D23L) / 470 A (75D23L) | | |

- Turbo model

| Item | Specifications |
|------|----------------|
|------|----------------|


| | | | | |
|-----------|--------------------------------|--------------|---|--|
| Starter | Type | | Reduction type | |
| | Model | | M000T20176 | |
| | Manufacturer | | Mitsubishi Electric | |
| | Voltage and output | | 12 V — 1.4 kW | |
| | Direction of rotation | | Counterclockwise (when observed from pinion) | |
| | Number of pinion teeth | | 9 | |
| | No-load characteristics | Voltage | 11 V | |
| Current | | 90 A or less | | |
| Generator | Type | | Rotating-field three-phase type, voltage regulator built-in type, with load response control system | |
| | Model | | A2TX3381 | |
| | Manufacturer | | Mitsubishi Electric | |
| | Voltage and output | | 12 V — 130 A | |
| | Polarity on ground side | | Negative | |
| | Direction of rotation | | Clockwise (when observed from pulley side) | |
| | Stator connection | | 3-phase Δ type | |
| | Output current | | 1,500 r/min — 50 A or more 2,500 r/min — 111 A or more 5,000 r/min — 133 A or more | |
| | Regulated voltage | | 14.1—14.8 V [20°C (68°F)] | |
| | Rotor slip ring outer diameter | Standard | 22.7 mm (0.894 in) | |
| | | Limit | 22.1 mm (0.870 in) | |
| | Brush length | Standard | 22.5 mm (0.886 in) | |
| | | Limit | 5.0 mm (0.197 in) | |
| Battery | Type | | 55D23L / 75D23L | |
| | Nominal capacity | | 5 HR: 40 Ah [25°C (77°F)] (55D23L) / 5 HR: 53 Ah [25°C (77°F)] (75D23L) | |
| | Nominal voltage | | 12 V | |
| | CCA | | 390 A (55D23L) / 470 A (75D23L) | |

ASSEMBLY

1. NON-TURBO MODEL

Assemble in the reverse order of disassembly.

Note:

- Refer to component for tightening torque of each part.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>General Description>COMPONENT > GENERATOR.](#)
- After assembling, manually turn the pulley to check that the rotor rotates smoothly.

1. Install the ball bearings.

- (1) Set the ball bearings in the front cover, then securely install an appropriate tool (such as a socket wrench of proper size) to the bearing outer race.
- (2) Using a press to press the ball bearings into the specified location.
- (3) Install the bearing retainer.


2. Push of the brush

When installing the brush assembly to the generator, push in the brush into the brush holder, and hold it with your fingers or a socket wrench of an appropriate size etc. until the installation is completed.

2. TURBO MODEL

Assemble in the reverse order of disassembly.

Note:

- Refer to component for tightening torque of each part.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>General Description>COMPONENT > GENERATOR.](#)
- After assembling, manually turn the pulley to check that the rotor rotates smoothly.

1. Assembling the rear cover and rectifier

Remove old silicone grease on the mating surface of rear cover and rectifier and apply new silicone grease.

Caution:

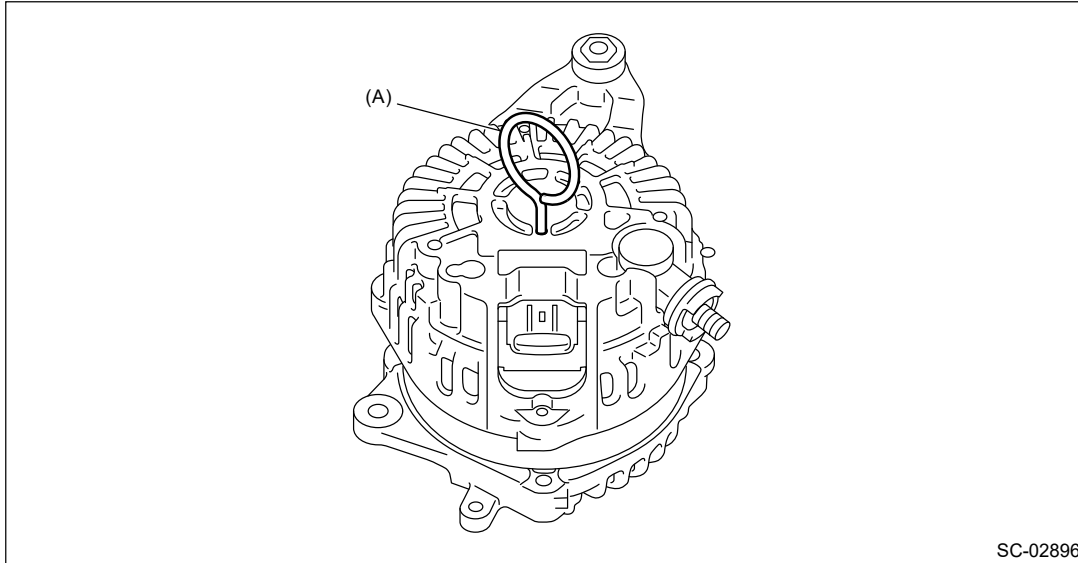
Do not apply silicone grease to the attachment threads of rectifier.

2. Push of the brush

Before assembling the front and rear parts, press the brush down into the brush holder, then fix the brush in that position by inserting a wire [1 mm (0.0394 in) dia., 40 — 50 mm (1.5748 — 1.9685 in) long] through the hole as shown in the figure.

Caution:

After assembling, remove the wire.



(A) Wire

3. Install the ball bearings.

- (1) Set the ball bearings in the front cover, then securely install an appropriate tool (such as a socket wrench of proper size) to the bearing outer race.
- (2) Using a press to press the ball bearings into the specified location.
- (3) Install the bearing retainer.

4. Install the bearings.

Caution:

Do not apply grease to the bearings. If there is any oil on the bearing box, remove it completely.

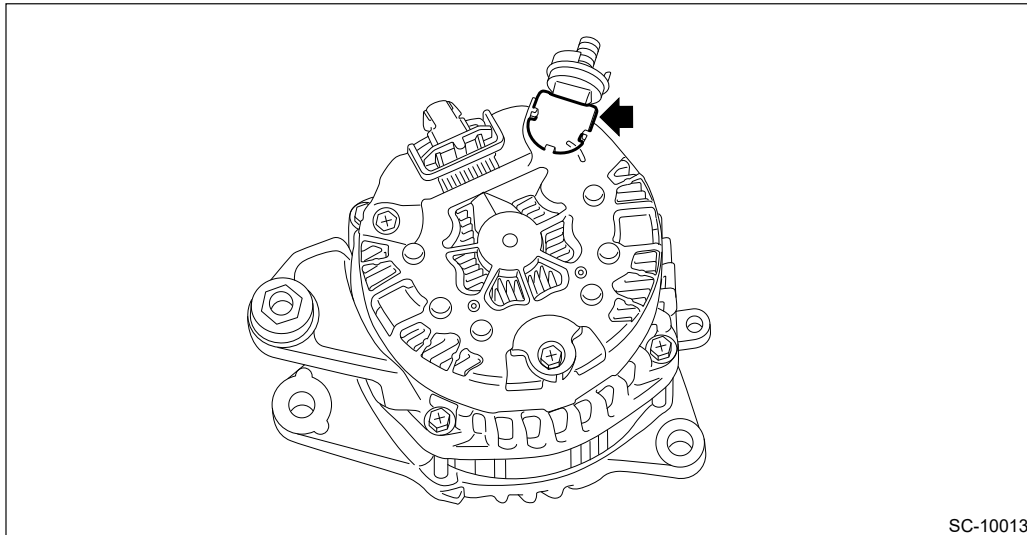
- (1) Use a press to install the bearings to the rotor shaft.
- (2) Heat the bearing box in rear cover at 50 — 60°C (122 — 140°F), and then press the bearing into rear cover.

STARTING/CHARGING SYSTEMS(H4DO) > Generator

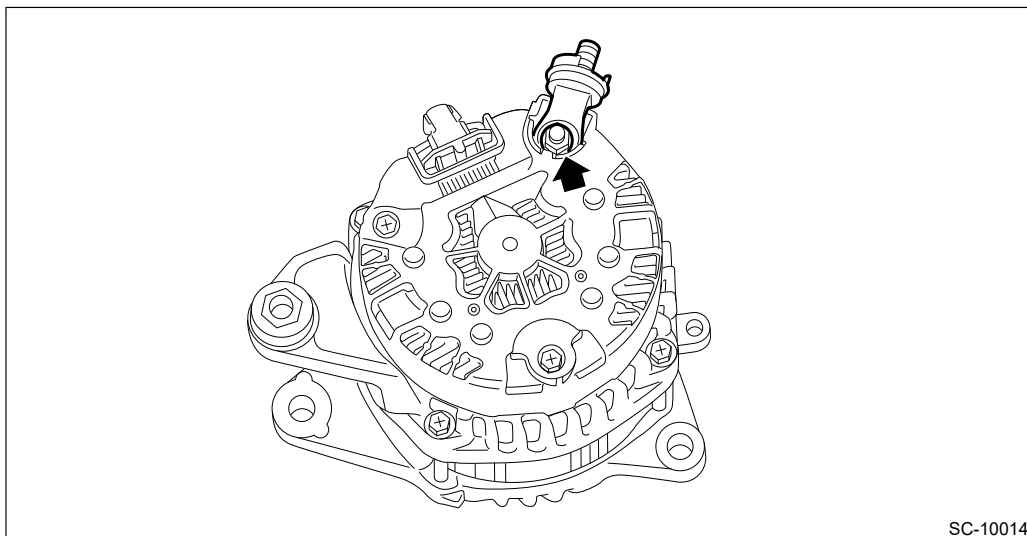
DISASSEMBLY

1. NON-TURBO MODEL

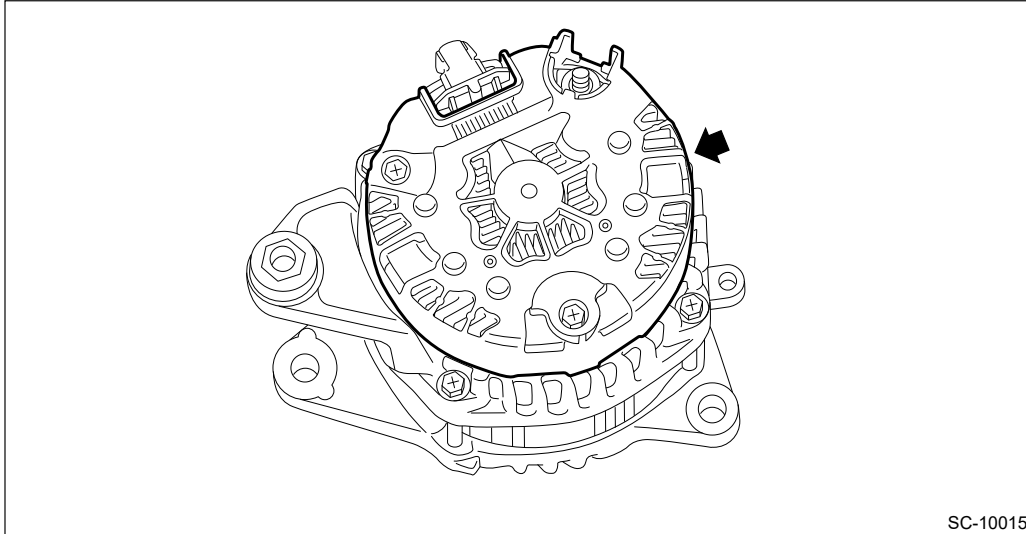
1. Remove the cover from the generator.



2. Remove the terminal B from the generator.



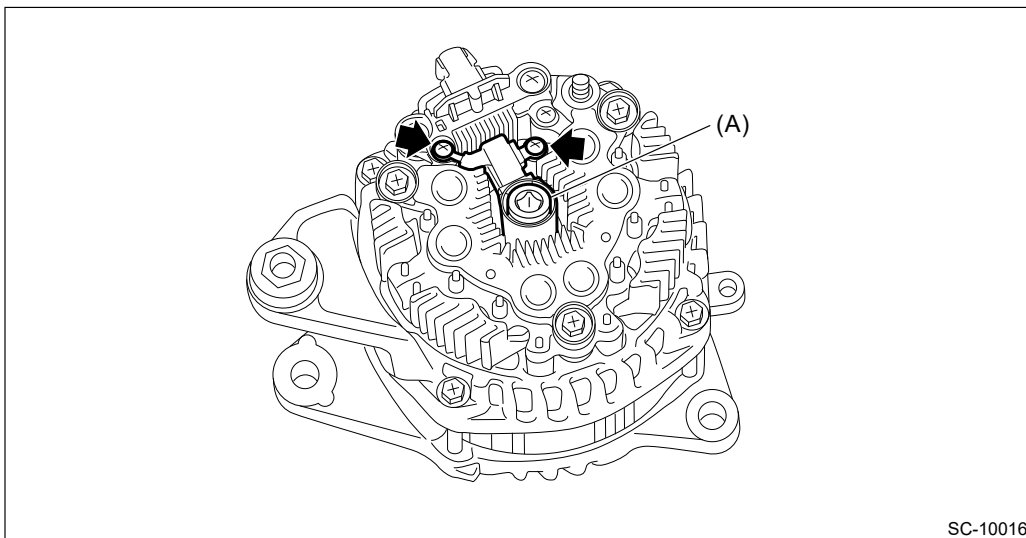
3. Remove the rear cover from the generator.



4. Remove the brush assembly from the generator.

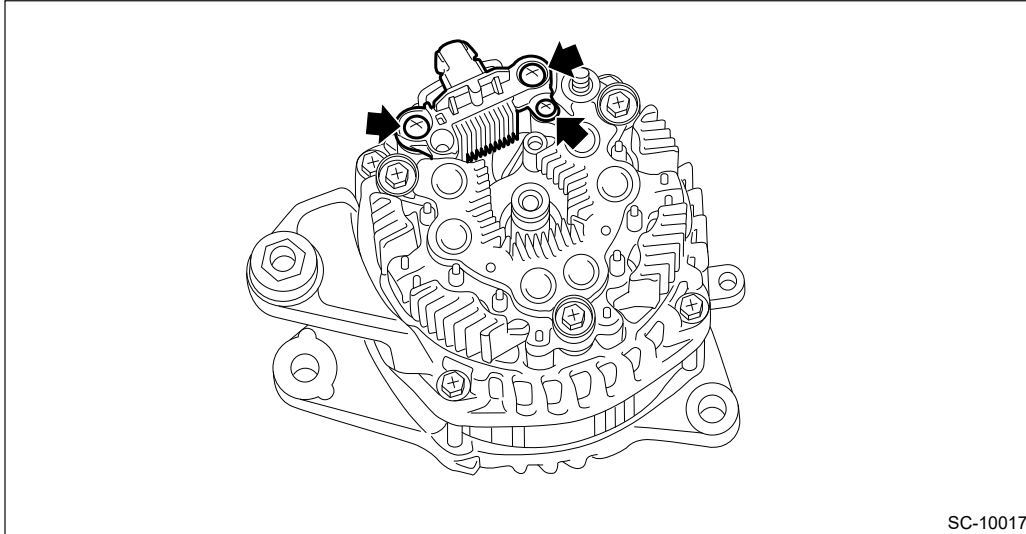
Note:

To prevent damage to the slip ring, set a socket wrench, etc. with an appropriate size between the brush and the slip ring.



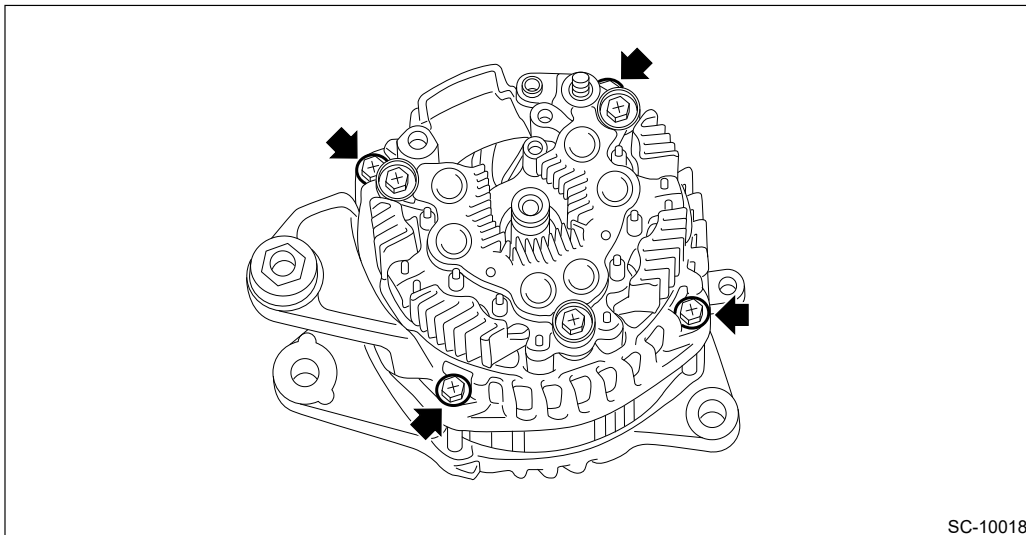
(A) Socket wrench

5. Remove the IC regulator from the generator.



SC-10017

6. Remove the through bolt from the generator.

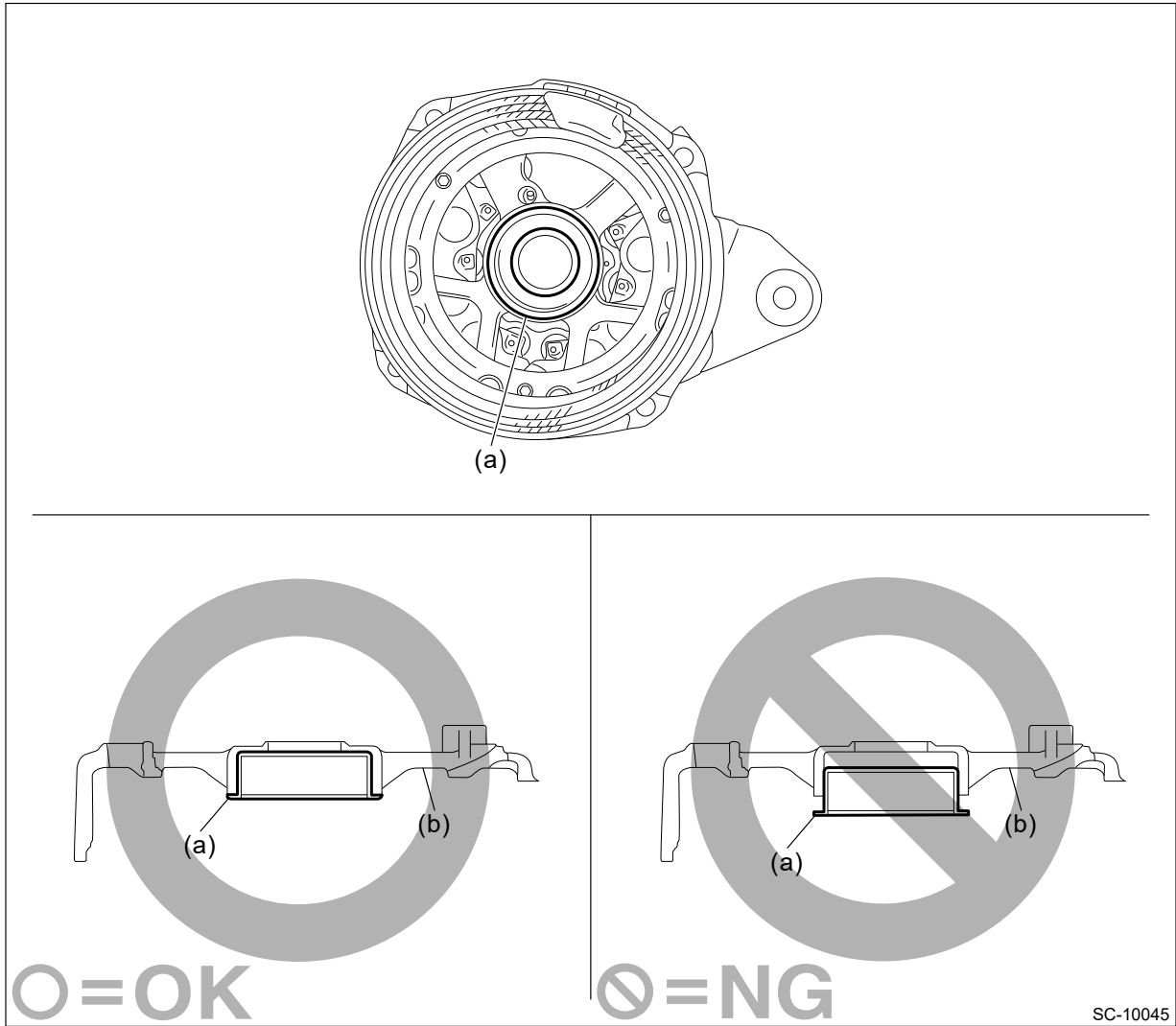


SC-10018

7. Insert a flat tip screwdriver or similar tool wrapped with protective tape into the gap between stator core and the front cover to disassemble.

Caution:

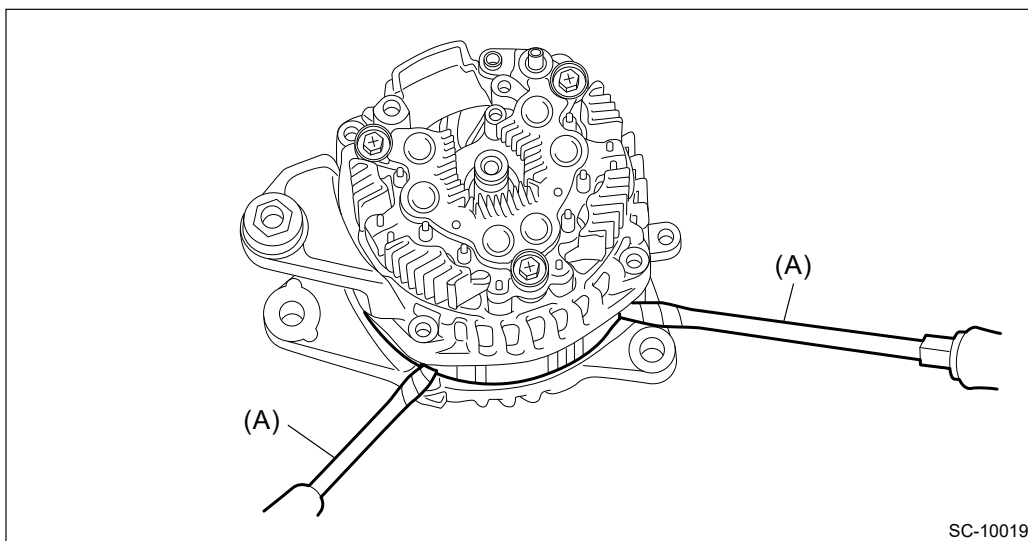
- **Do not remove the bearing cover from the rear cover assembly.**
- **If the bearing cover has been loosen or disengaged from the rear cover assembly, replace the rear cover assembly.**



SC-10045

(a) Bearing cover

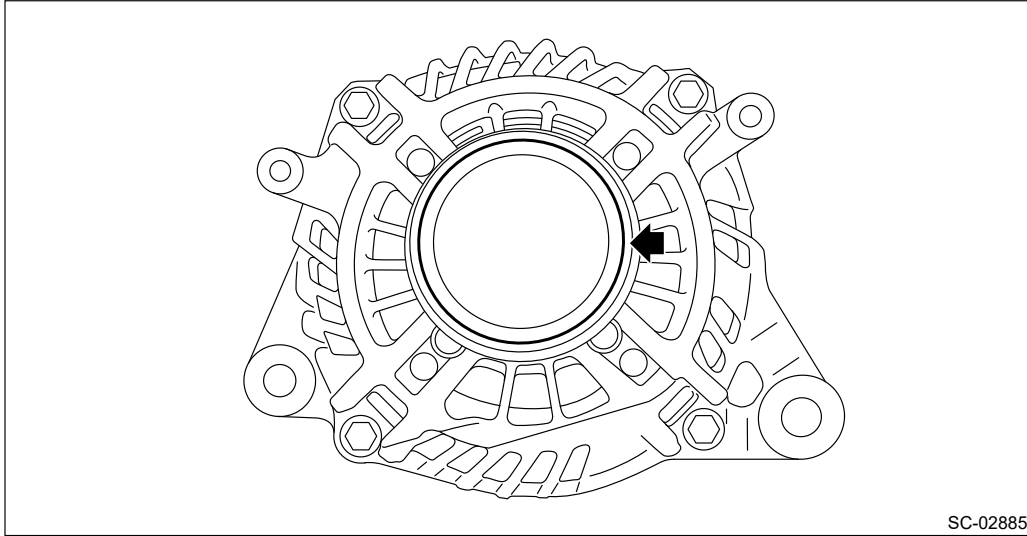
(b) Rear cover ASSY



SC-10019

(A) Flat tip screwdriver

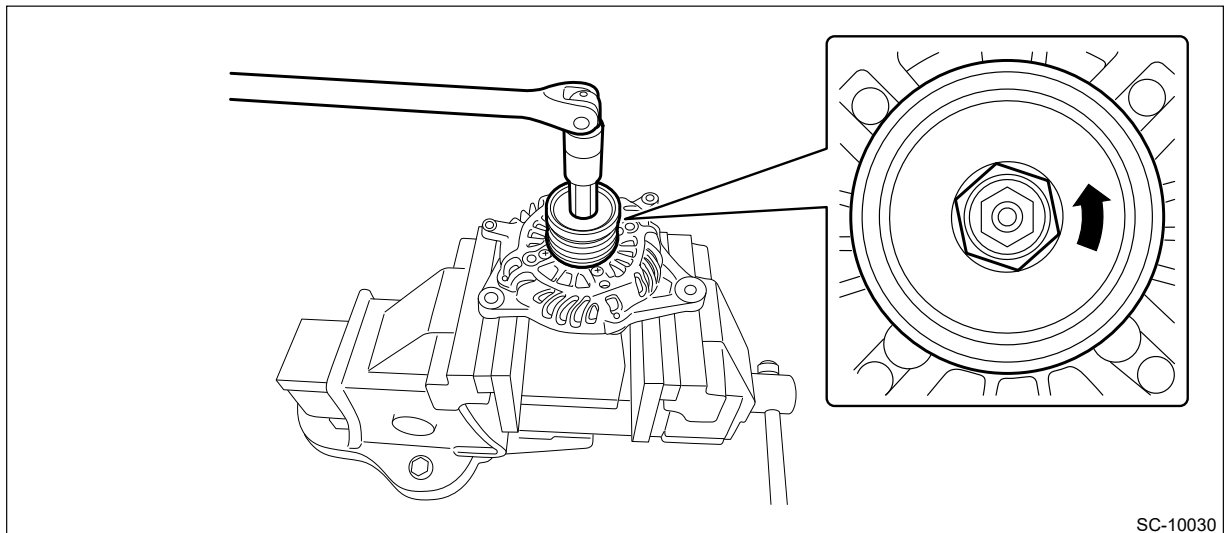
8. Remove the cap from the generator.



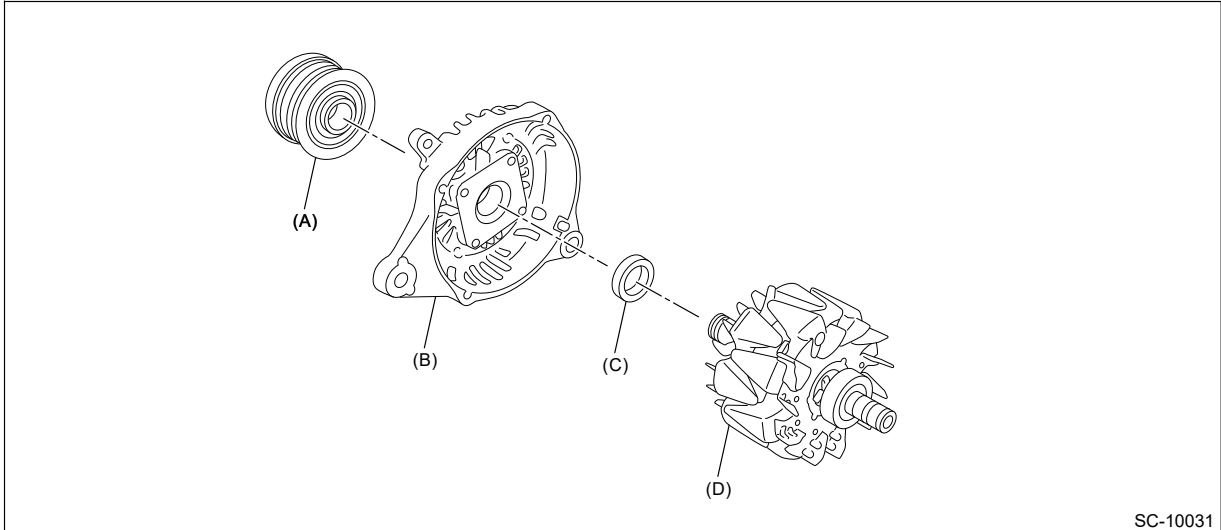
9. Hold the rotor on a vise and remove the pulley.

Caution:

When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.



10. Remove the rotor from the front cover.



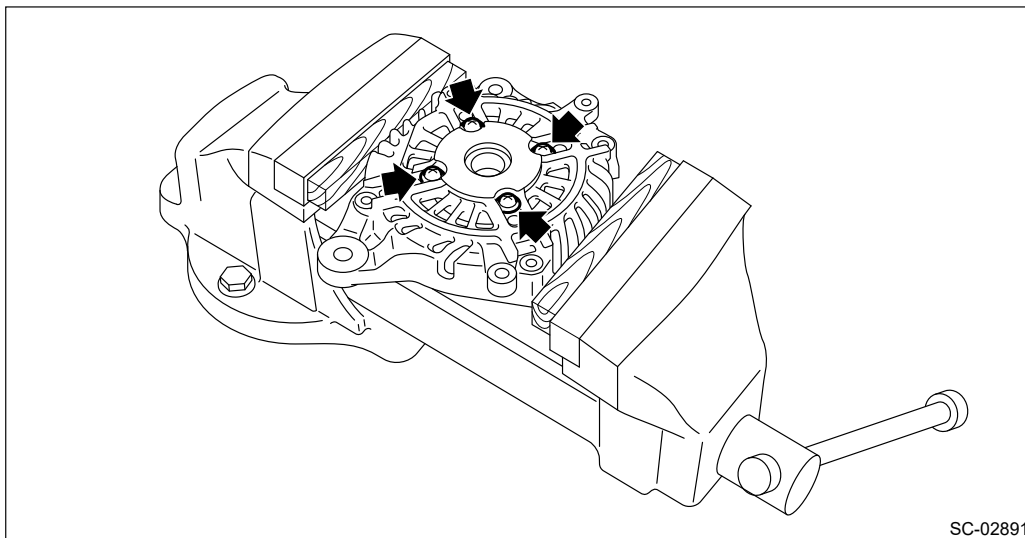
(A) Pulley

(B) Front cover

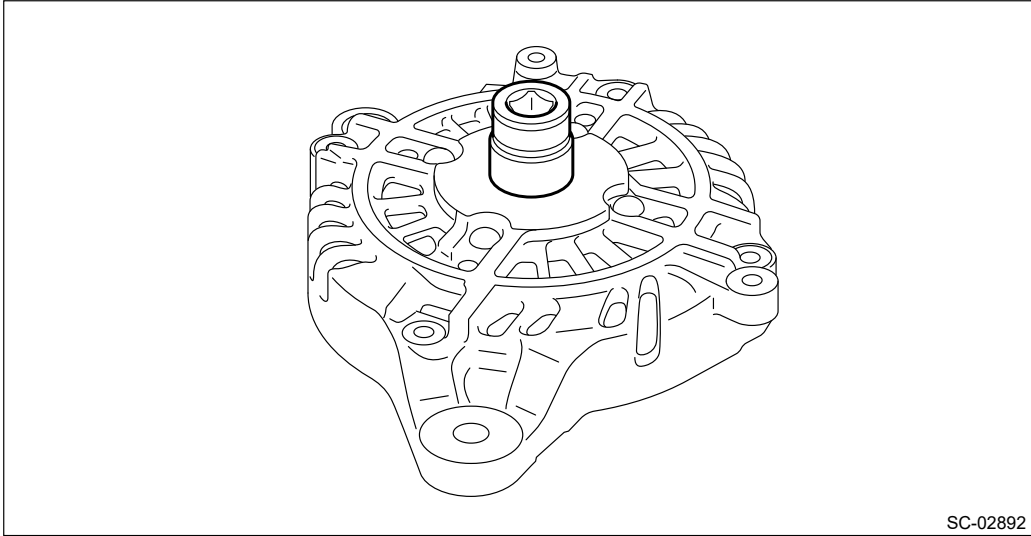
(C) Spacer

(D) Rotor

- 11.** Use the following procedures to remove the ball bearings.
- (1) Remove the bolt, and then detach the bearing retainer.



- (2) Firmly attach an appropriate tool (such as a correct size socket wrench) to the bearing inner race.

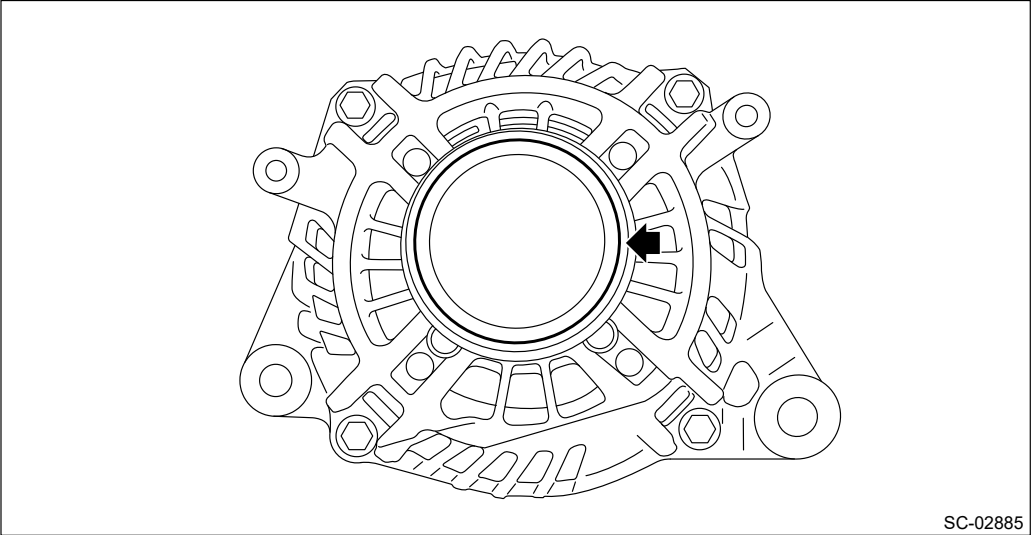


SC-02892

(3) Use the press to push the ball bearings out from the front cover.

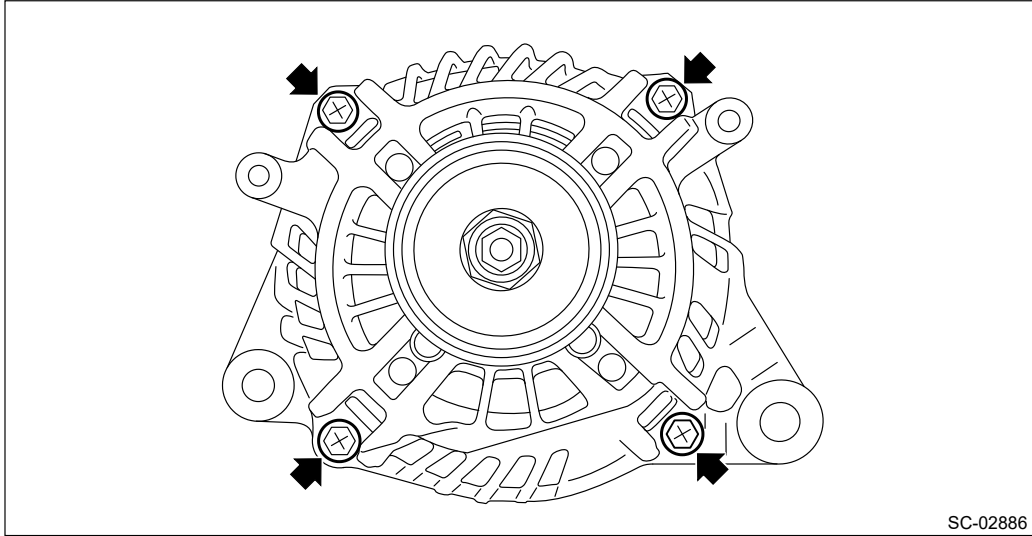
2. TURBO MODEL

1. Remove the cap from the generator.

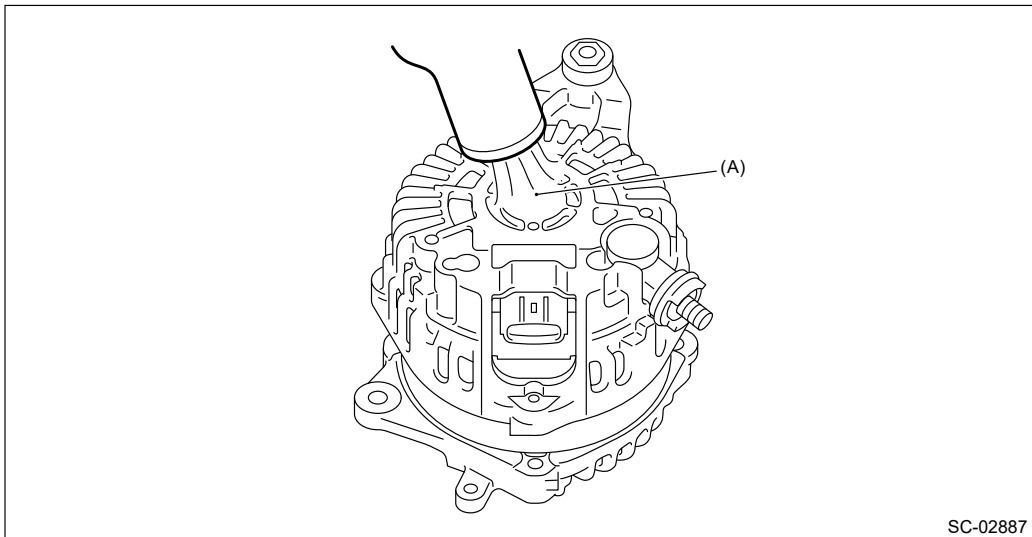


SC-02885

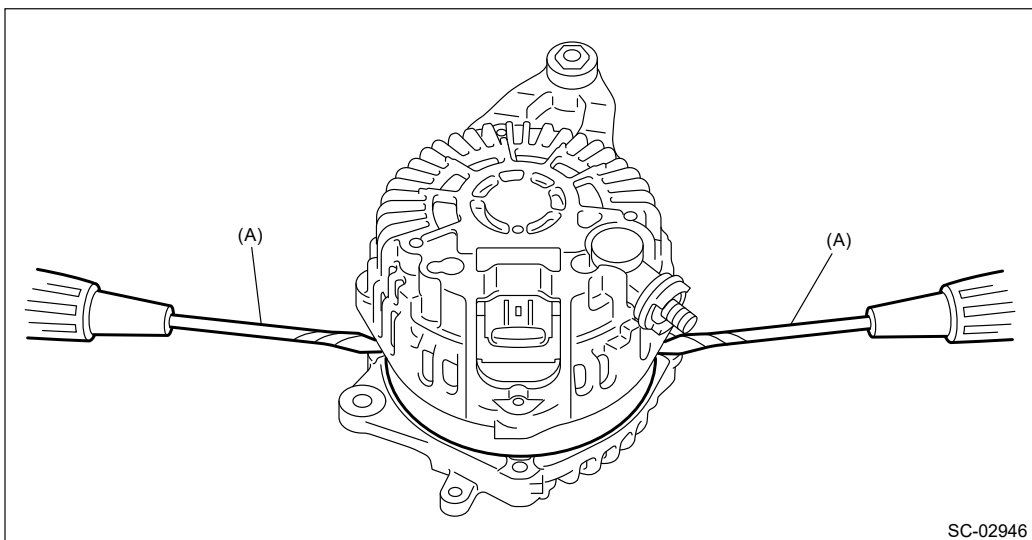
2. Remove the four through bolts.



3. Use a drier to heat the rear cover (A) portion to 50 – 60°C (122 – 140°F).



4. Insert a flat tip screwdriver or similar tool wrapped with protective tape into the gap between stator core and the front cover to disassemble.

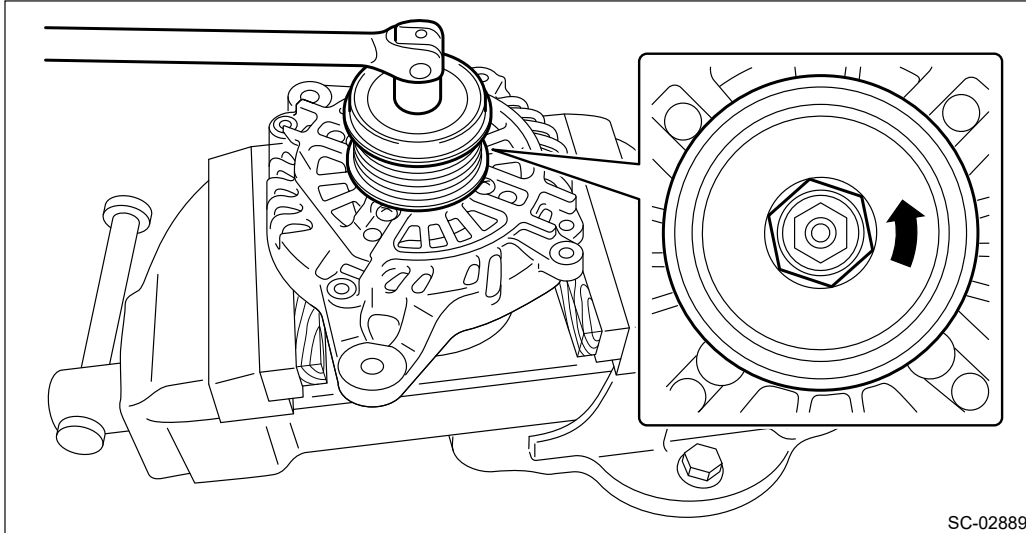


(A) Flat tip screwdriver

5. Hold the rotor on a vise and remove the pulley.

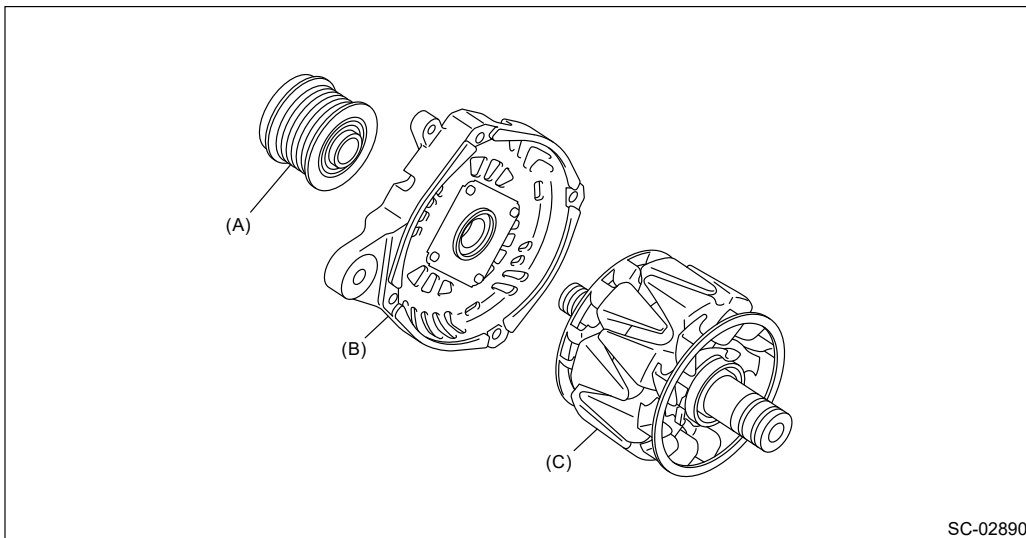
Caution:

When holding the rotor with a vise, place aluminum plates or wooden pieces on the vise jaws to prevent rotor from damage.



SC-02889

6. Remove the rotor from the front cover.



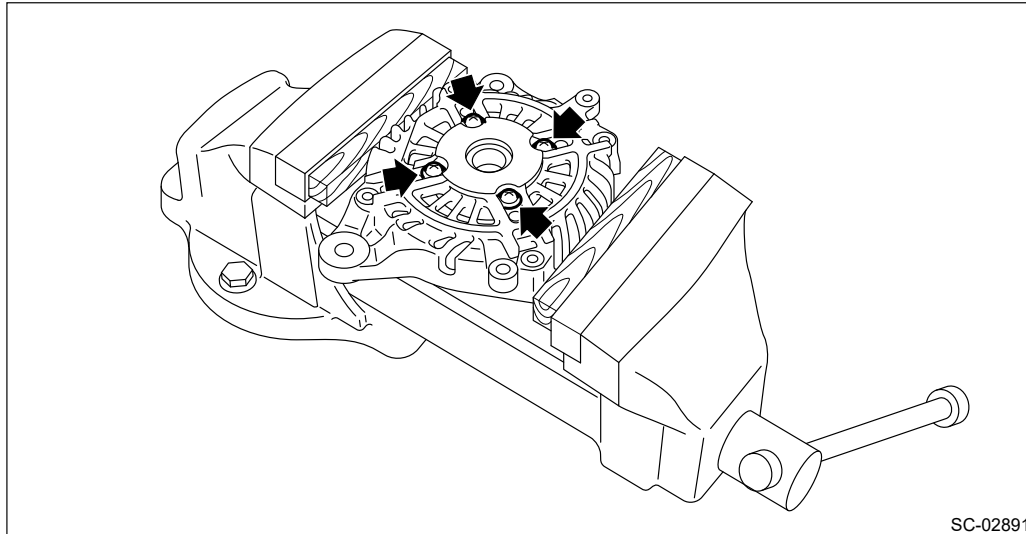
SC-02890

(A) Pulley

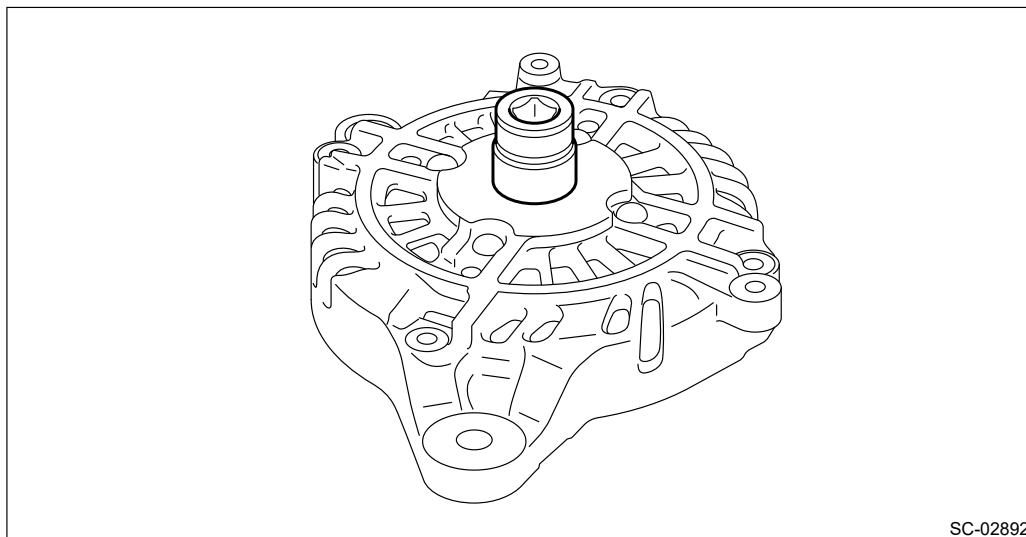
(B) Front cover

(C) Rotor

7. Use the following procedures to remove the ball bearings.
(1) Remove the bolt, and then detach the bearing retainer.

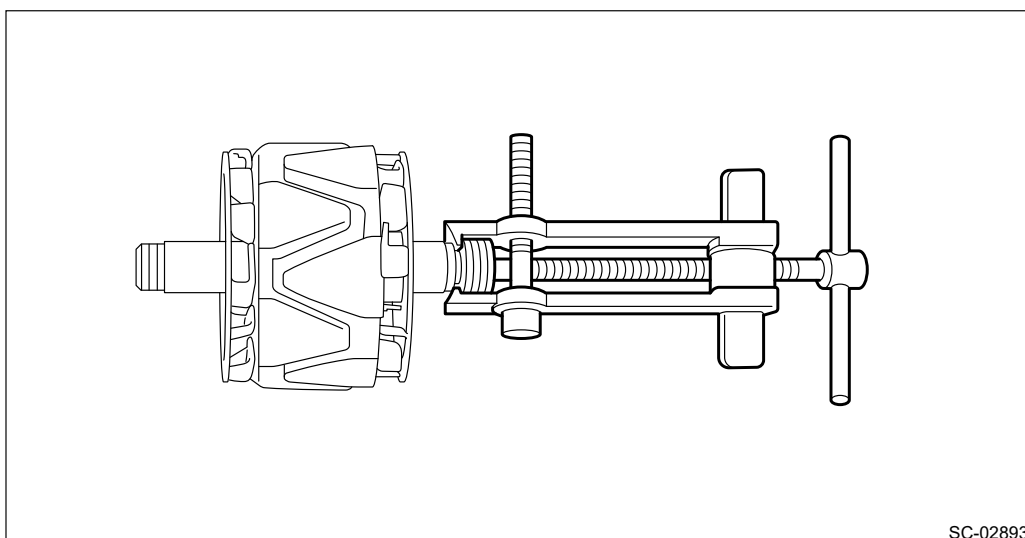


(2) Firmly attach an appropriate tool (such as a correct size socket wrench) to the bearing inner race.

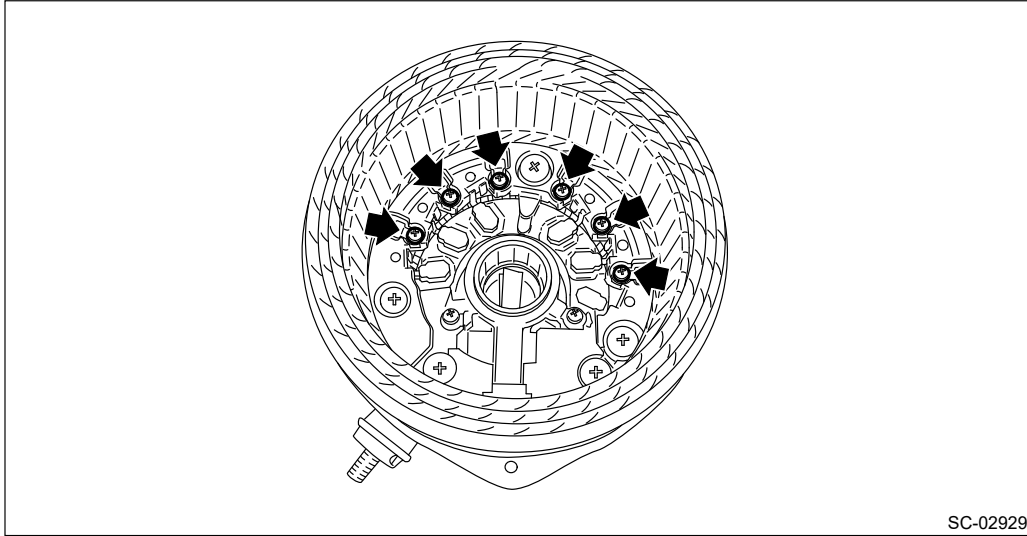


(3) Use the press to push the ball bearings out from the front cover.

8. Using the bearing puller, remove the bearings from the rotor.

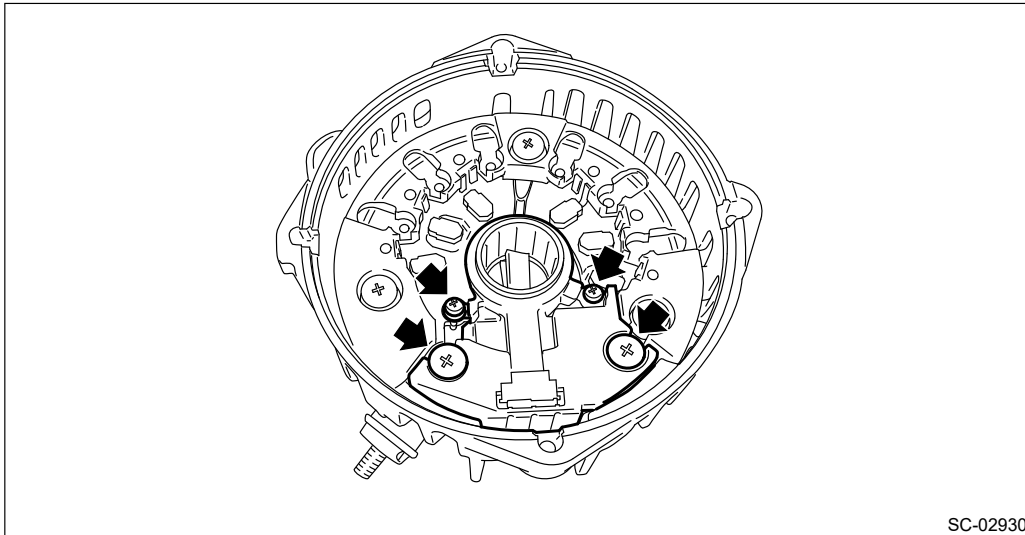


9. Remove six bolts which connect the rectifier and stator coil, then remove the stator coil.



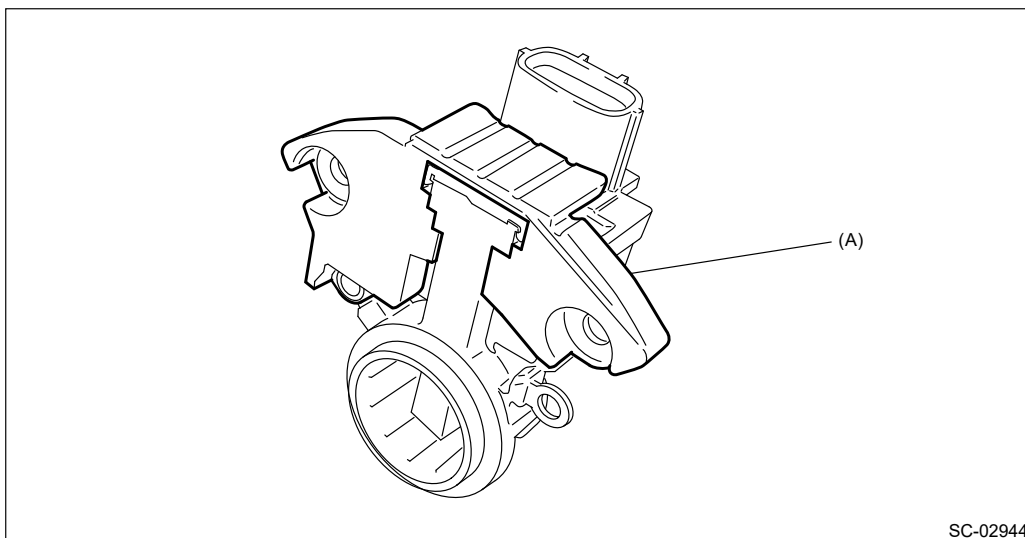
SC-02929

- 10.** Remove four screws which secure the IC regulator to the rear cover, then remove the IC regulator.



SC-02930

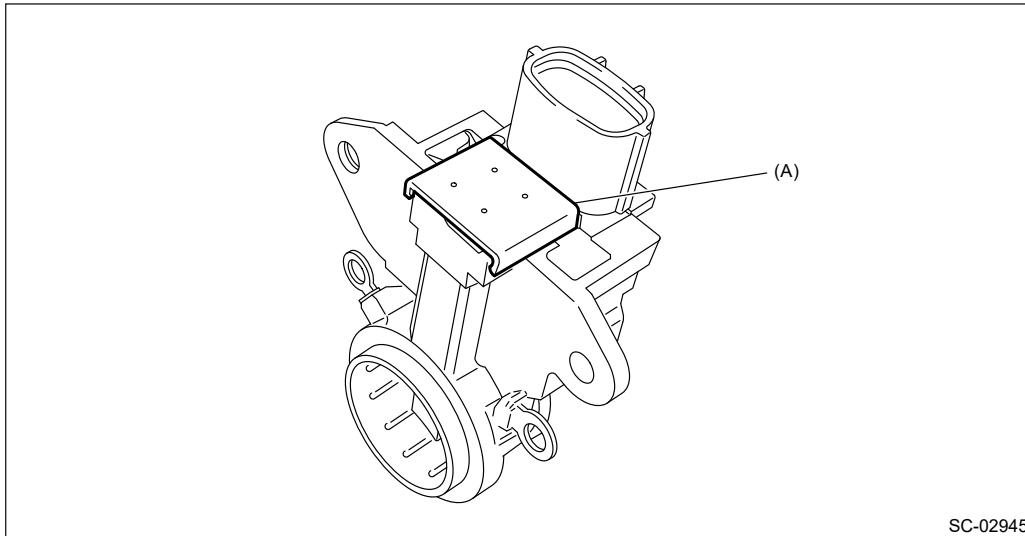
- 11.** Use the following procedures to remove the brush.
(1) Remove the cover A.



SC-02944

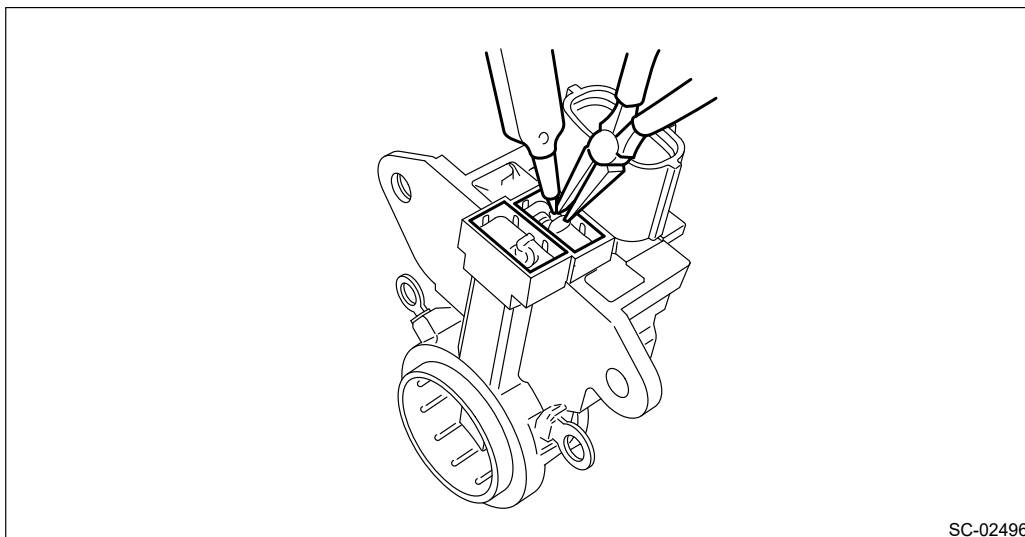
(A) Cover A

(2) Remove the cover B.



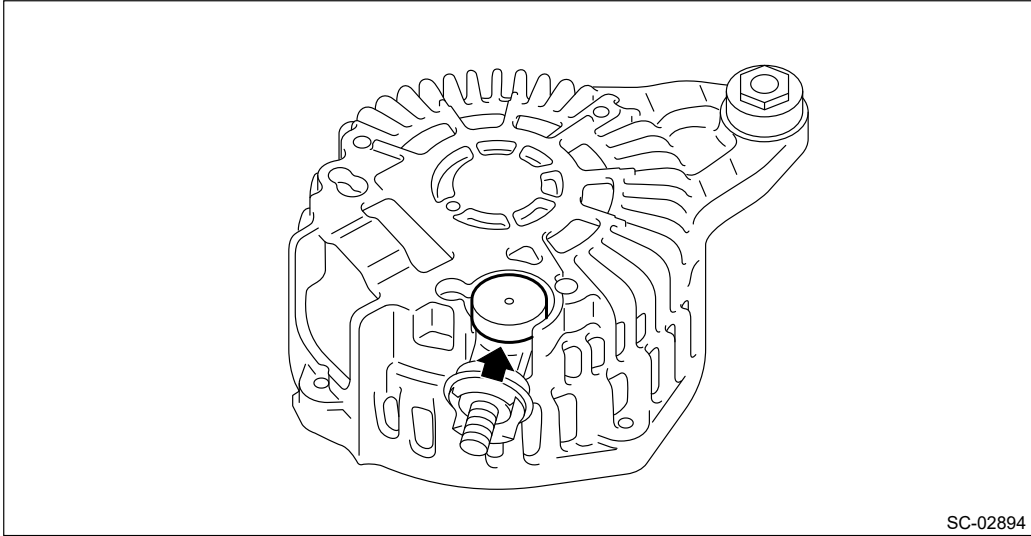
(A) Cover B

(3) Disconnect the connection and remove the brush.

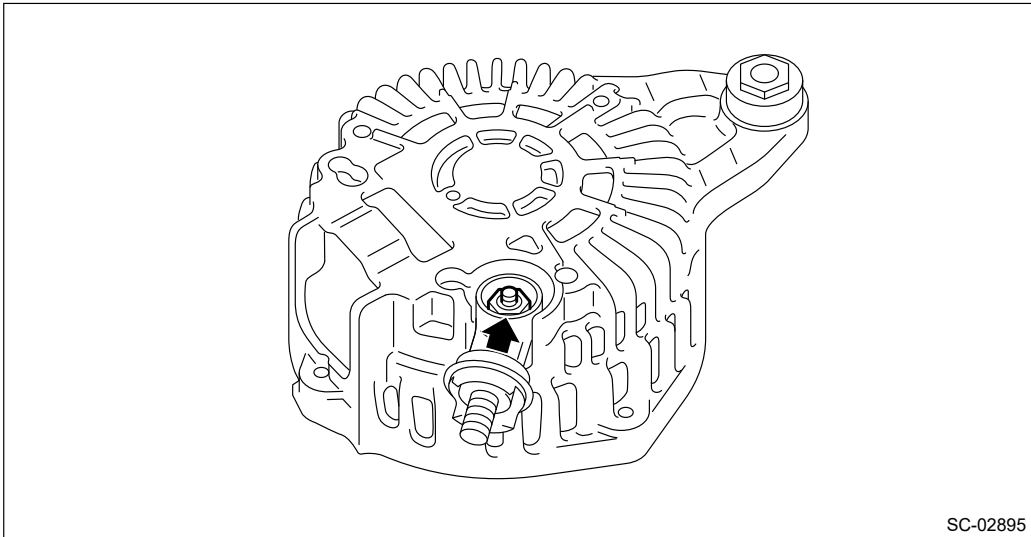


12. Remove the rectifier as follows.

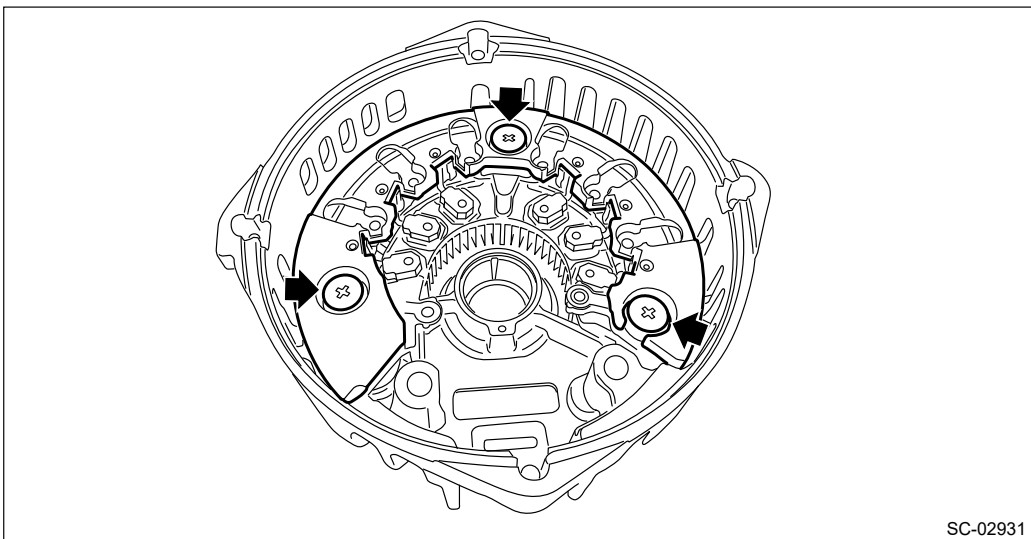
(1) Remove the cover on terminal B.



(2) Remove the nut on terminal B.



(3) Remove the bolts which secure the rectifier, and remove the rectifier.



INSPECTION

1. DIODE

Caution:

There is the possibility of damaging the diodes if a mega-tester (used to measure high voltages) or a similar measuring instrument is used. Never use a mega tester or equivalent for this test.

1. Check for continuity between the diode lead and terminal E or B. If continuity is not as shown in the table, replace the rectifier.

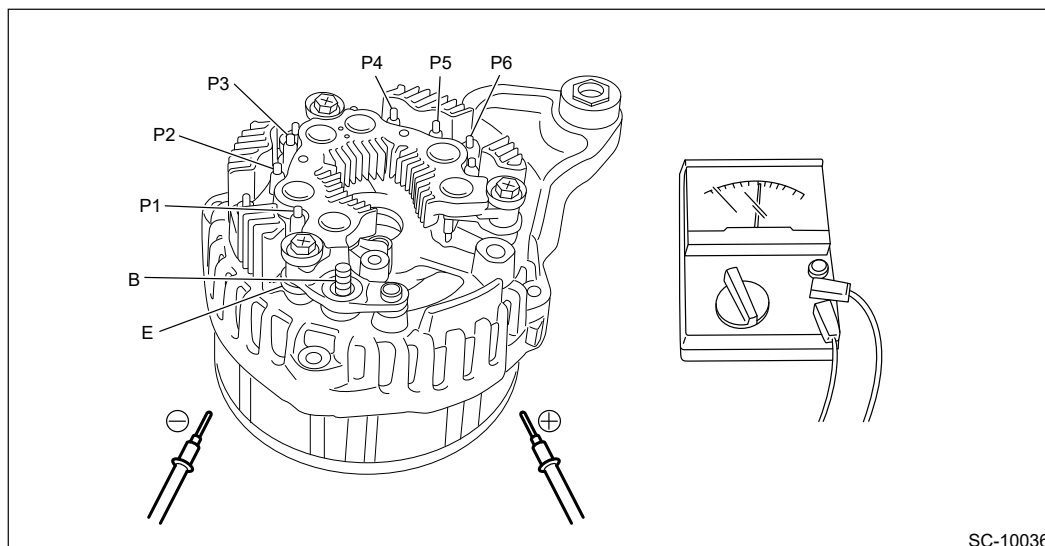
- At analog type tester

| Tester lead | | Continuity |
|------------------------|------------------------|------------|
| -lead | +lead | |
| E | P1, P2, P3, P4, P5, P6 | Yes |
| B | | No |
| P1, P2, P3, P4, P5, P6 | E | No |
| | B | Yes |

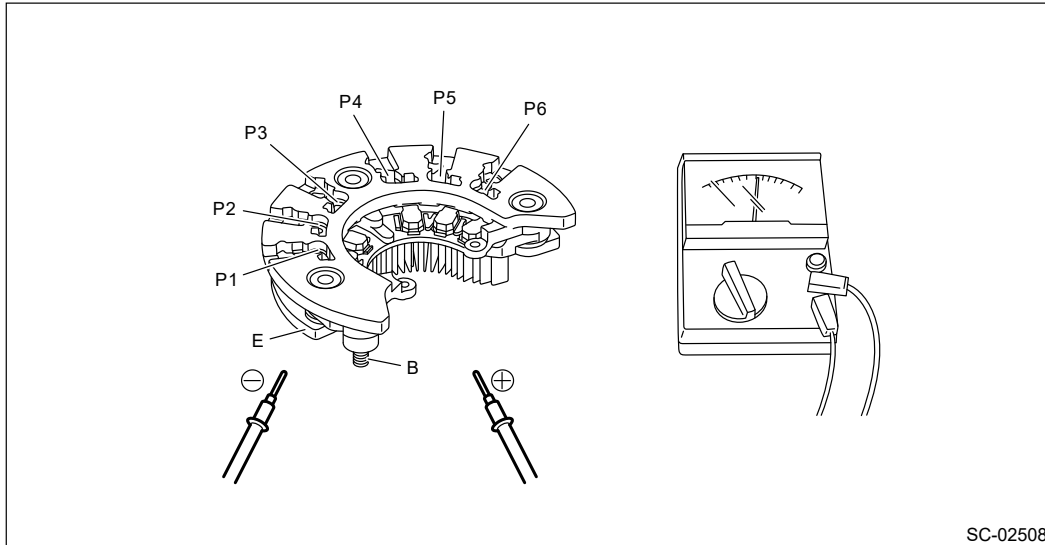
- At digital type tester

| Tester lead | | Continuity |
|------------------------|------------------------|------------|
| -lead | +lead | |
| E | P1, P2, P3, P4, P5, P6 | No |
| B | | Yes |
| P1, P2, P3, P4, P5, P6 | E | Yes |
| | B | No |

- Non-turbo model



- Turbo model



SC-02508

2. ROTOR

1. Slip ring surface

Inspect the slip rings for contamination or any roughness on the sliding surface. Repair the slip ring surface using a lathe or sand paper.

2. Slip ring outer diameter

Measure the slip ring outer diameter. Replace the rotor if the slip ring is worn.

Slip ring outer diameter:

Standard

22.7 mm (0.894 in)

Limit

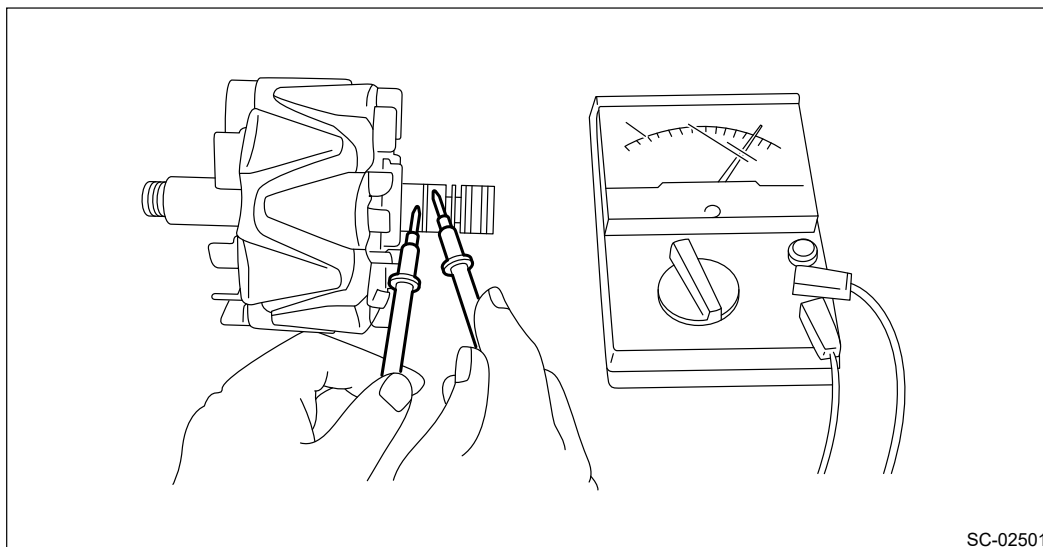
22.1 mm (0.870 in)

3. Continuity test

Using a circuit tester, check the resistance between slip rings. If the resistance is not within the standard, replace the rotor.

Standard:

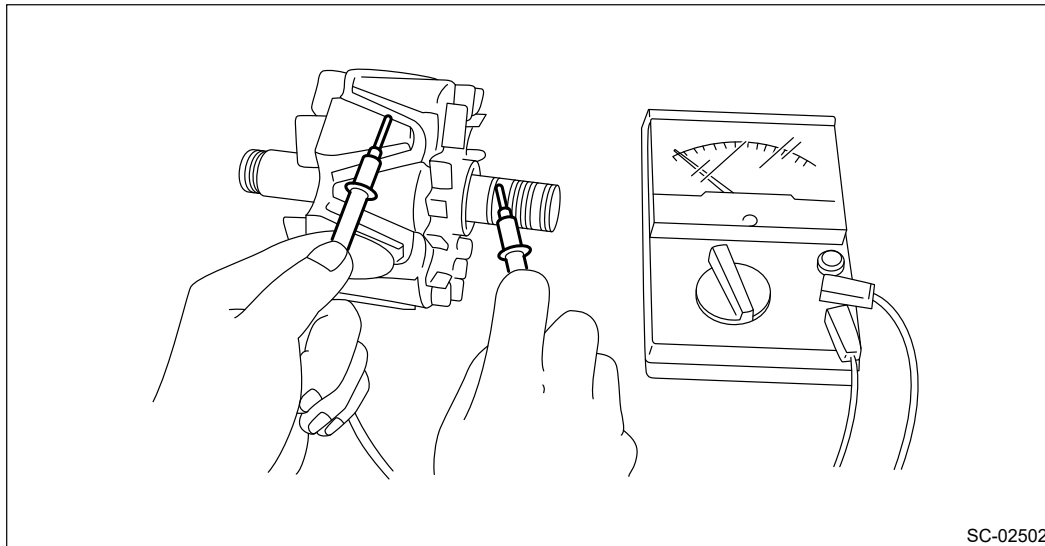
Approx. 2.0 – 2.4 Ω



SC-02501

4. Insulation test

Check the continuity between slip ring and rotor core or shaft. If there is continuity, replace the rotor because the rotor coil is grounded.



5. Bearing

Check the bearings. If there is any noise, or the rotor does not rotate smoothly, replace the bearings.

3. STATOR COIL

Note:

Perform this procedure only for the turbo model.

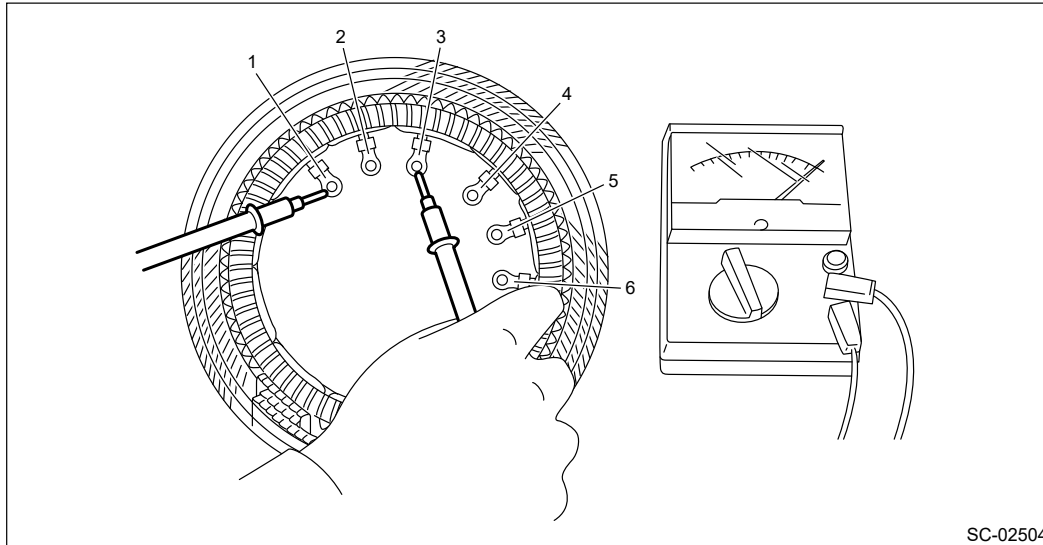
1. Continuity test

Inspect the continuity between the stator coil terminals. If continuity is not as shown in the table, replace the stator coil.

| (A) | | | | | | |
|-----|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | |
| ○ | — | ○ | | | | |
| ○ | — | — | ○ | | | |
| | | ○ | — | ○ | | |
| | | | ○ | — | ○ | |
| | | | ○ | — | — | ○ |
| | | | | ○ | — | ○ |

SC-02503

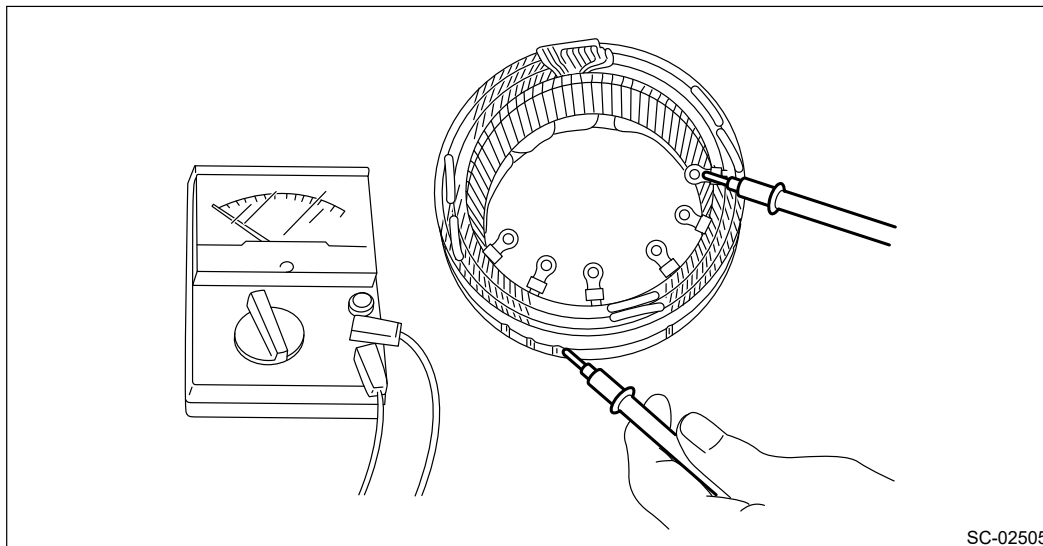
(A) Terminals



SC-02504

2. Insulation test

Inspect the continuity between the stator coil stator core and lead wire terminals. If there is continuity, replace the stator coil because the stator coil is grounded.



SC-02505

4. BRUSH

1. Measure the length of each brush. Replace the brush if wear exceeds service limits. There is a service limit mark (A) on each brush.

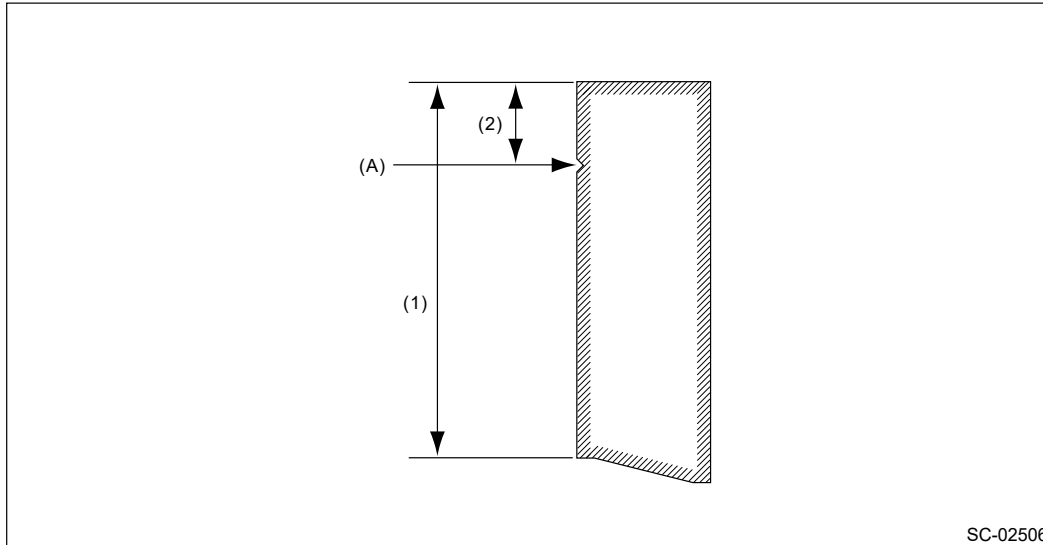
Brush length:

Standard (1)

22.5 mm (0.886 in)

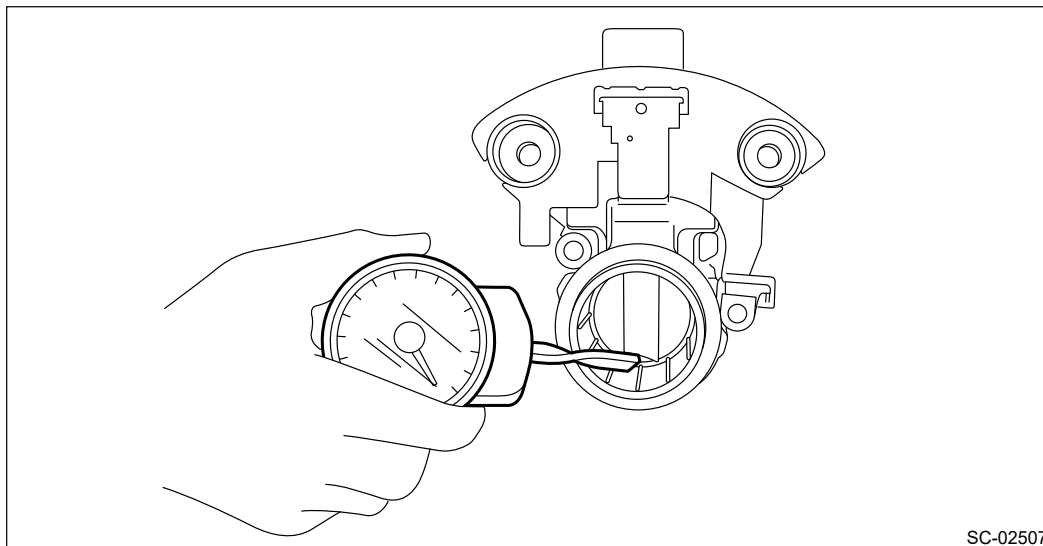
Limit (2)

5.0 mm (0.197 in)



SC-02506

2. Check that there is appropriate pressure on the brush spring. Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.0787 in). Then measure the pressure of brush spring. If the pressure is 1.7 N (173 gf, 6.11 ozf) or less, replace the brush spring. 4.1 — 5.3 N (418 — 540 gf, 14.75 — 19.06 ozf) pressure is required on the new spring.



SC-02507

5. BALL BEARING

Check the ball bearings. Replace the ball bearings if there is resistance in the rotation, or if there is any abnormal noise.

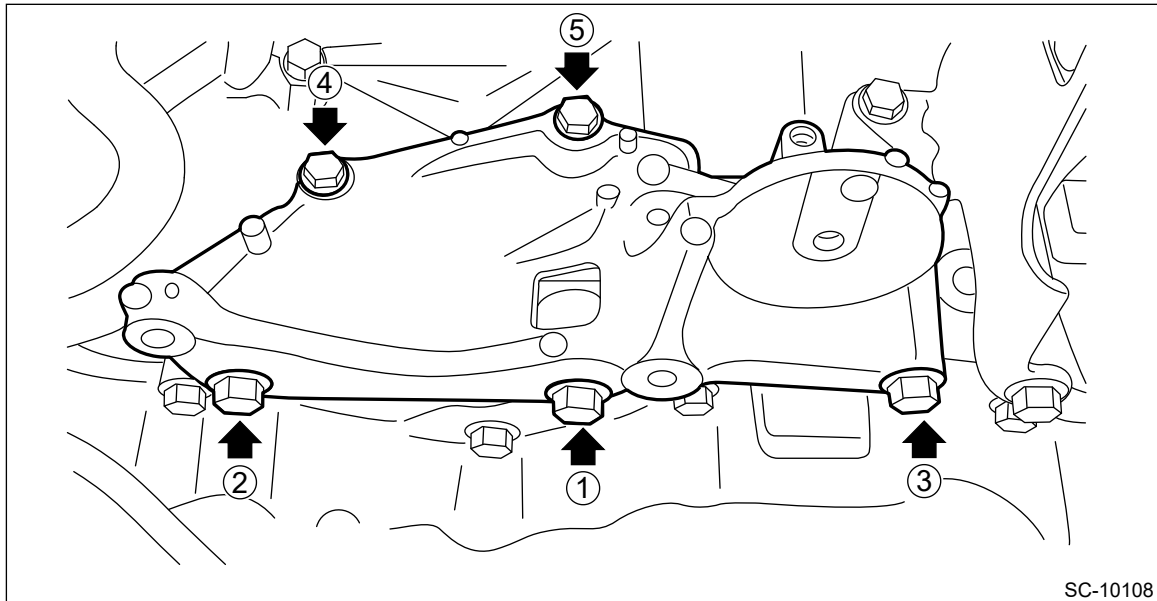
INSTALLATION

1. NON-TURBO MODEL

1. Temporarily install the generator bracket to the engine and tighten the bolts in the numerical order.

Tightening torque:

36 N·m (3.7 kgf-m, 26.6 ft-lb)

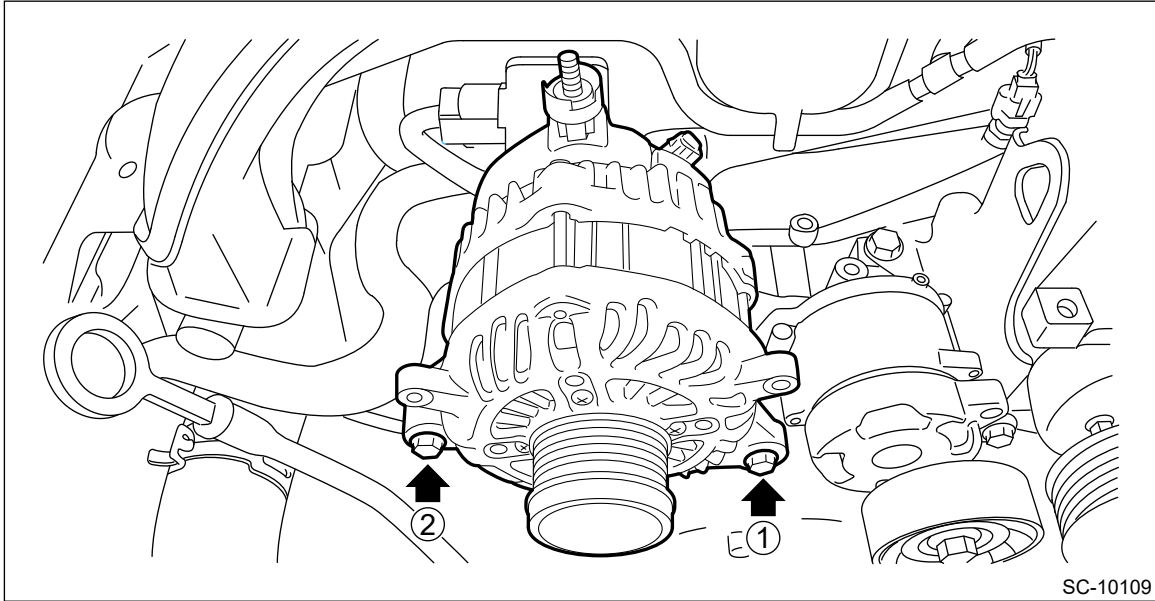


SC-10108

2. Install the V-belt tensioner assembly. [Ref. to MECHANICAL\(H4DO\)>V-belt>INSTALLATION > V-BELT TENSIONER ASSEMBLY.](#)
3. Temporarily install the generator bracket to the generator and tighten the bolts in the numerical order.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)



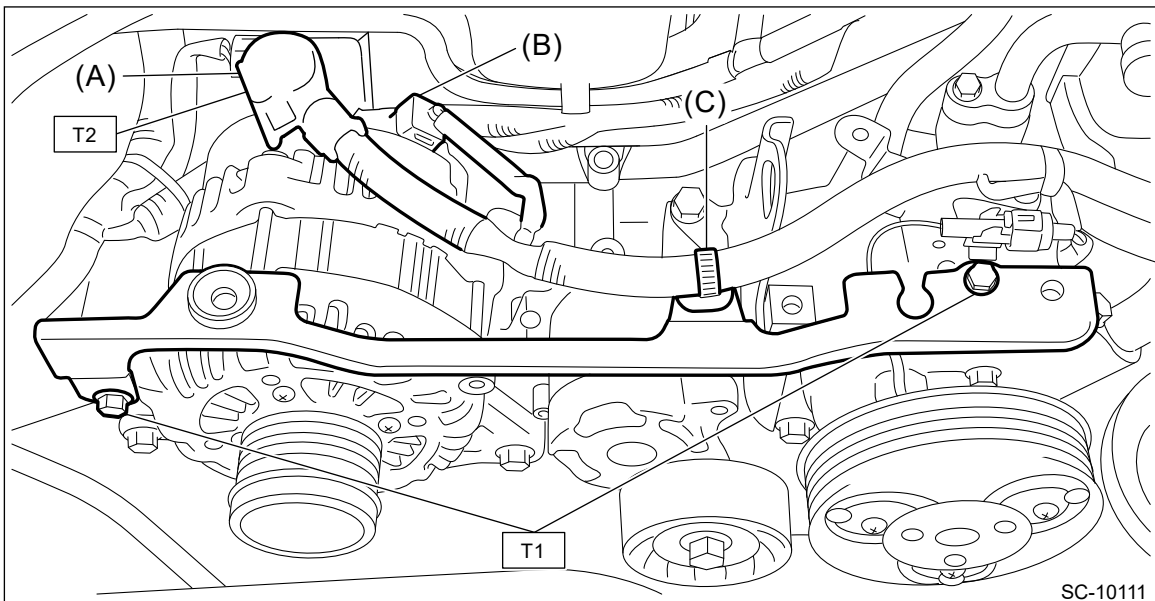
SC-10109

4. Install the V-belt cover bracket.
5. Connect the connector (A) and terminal (B) to the generator, and attach the clip (C).



Tightening torque:

T1: 6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

T2: 15 N·m (1.5 kgf-m, 11.1 ft-lb)

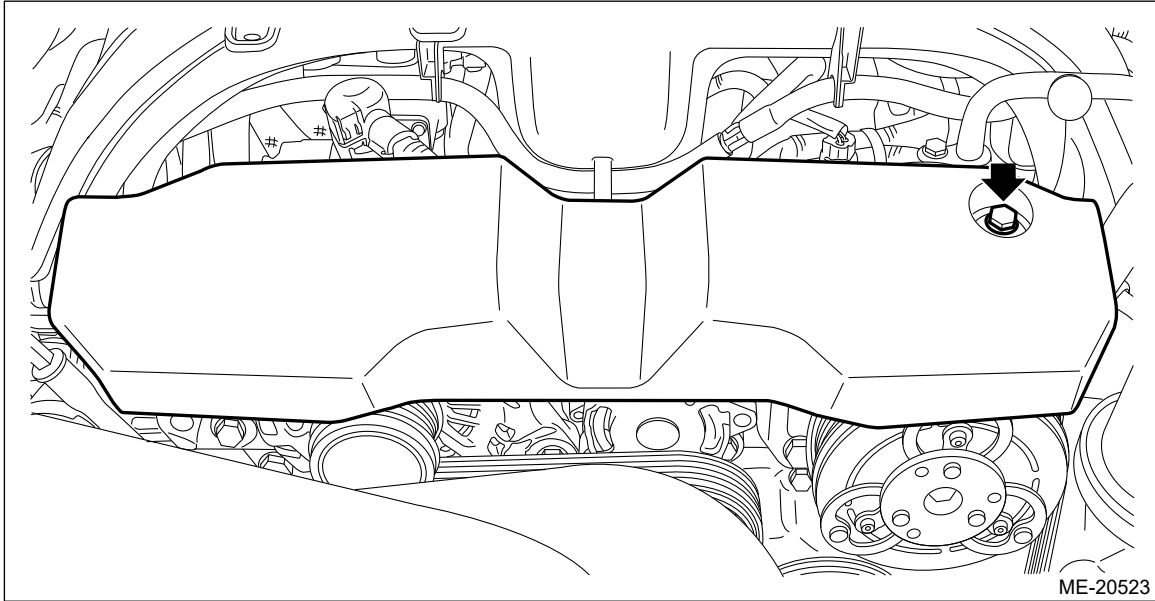


SC-10111

6. Install the V-belts.  [Ref. to MECHANICAL\(H4DQ\)>V-belt>INSTALLATION > V-BELT.](#)
7. Connect the ground terminal to battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
8. Install the V-belt cover.

Tightening torque:

7N·m (0.7 kgf-m, 5.2 ft-lb)

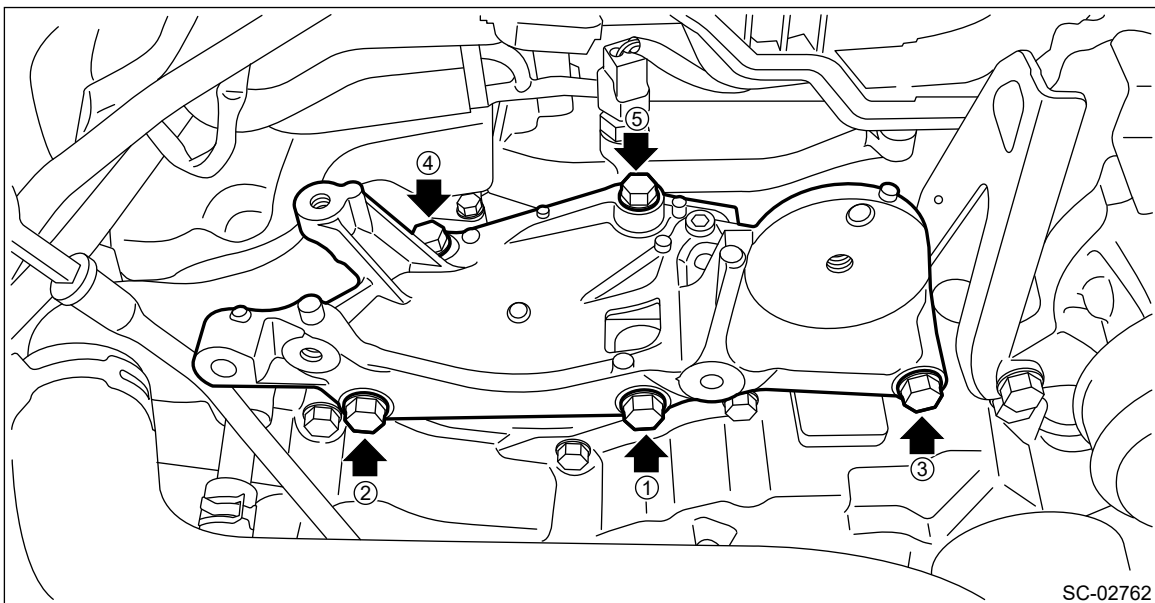


2. TURBO MODEL

1. Temporarily install the generator bracket to the engine and tighten the bolts in the numerical order.

Tightening torque:

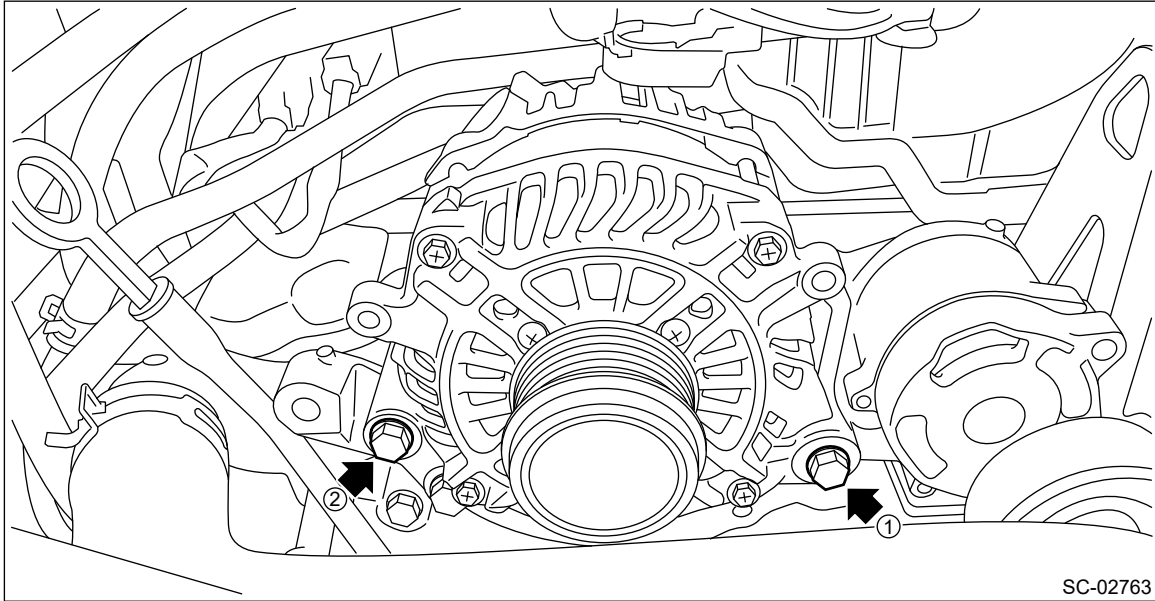
36 N·m (3.7 kgf-m, 26.6 ft-lb)



2. Install the V-belt tensioner assembly. [📄 Ref. to MECHANICAL\(H4DOTC\)>V-belt>INSTALLATION > V-BELT TENSIONER ASSEMBLY.](#)
3. Temporarily install the generator bracket to the generator and tighten the bolts in the numerical order.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)

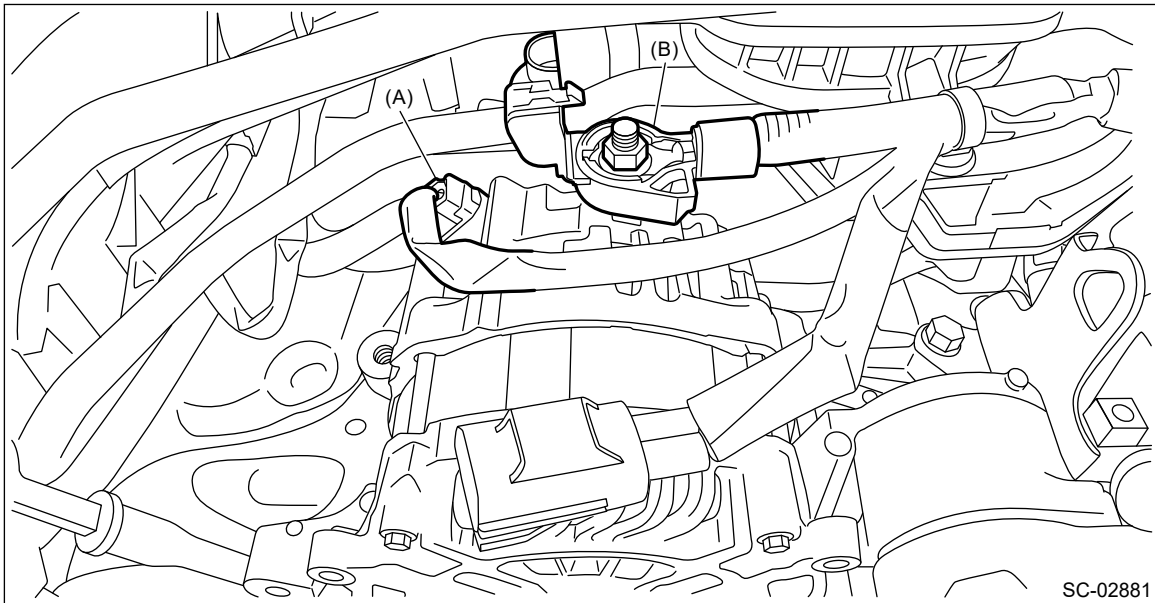


SC-02763

4. Connect the connector (A) and terminal (B) to the generator.

Tightening torque:

15 N·m (1.5 kgf-m, 11.1 ft-lb)

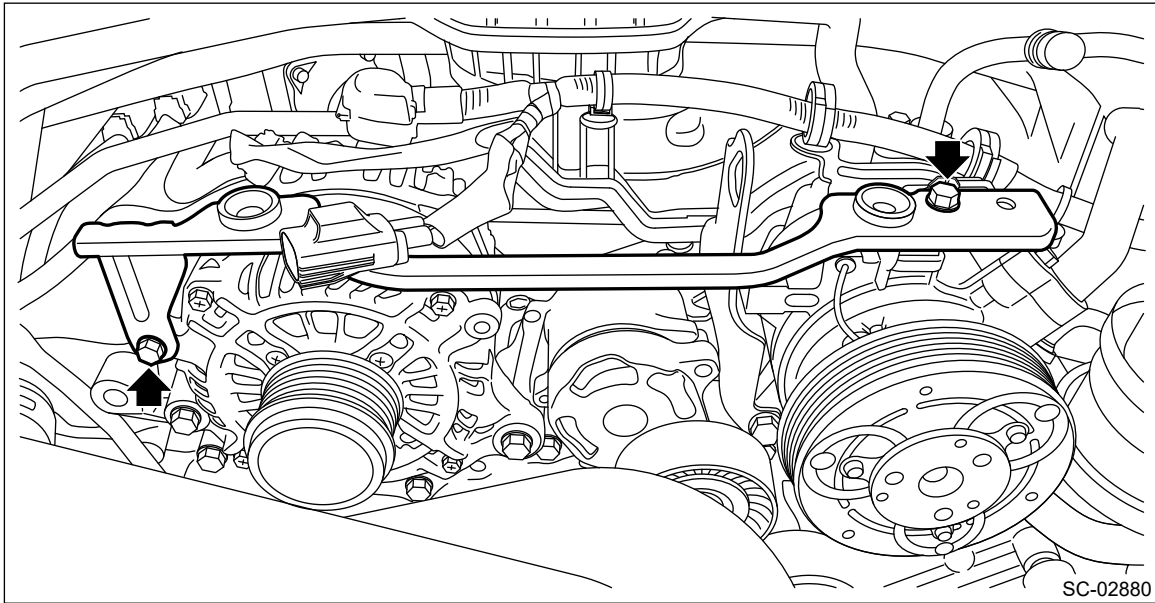





SC-02881

5. Install the collector cover bracket.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

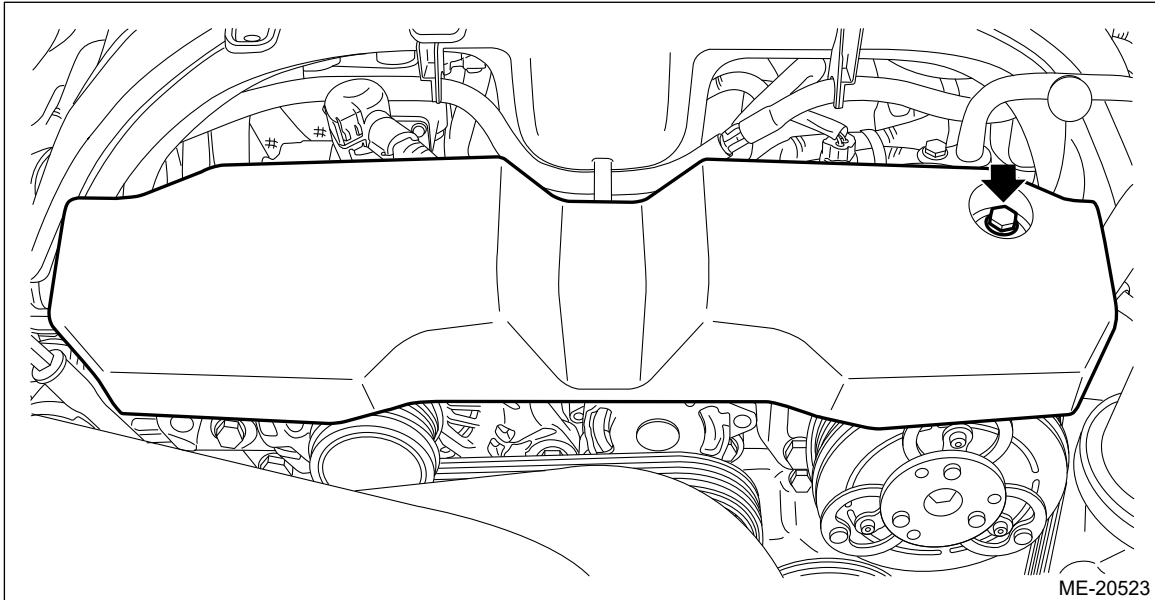




6. Install the V-belts.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>INSTALLATION > V-BELT.](#)
7. Install the brake vacuum pump.  [Ref. to BRAKE>Brake Vacuum Pump>INSTALLATION.](#)
8. Connect the battery ground terminal.  [Ref. to NOTE>NOTE > BATTERY.](#)
9. Install the collector cover.

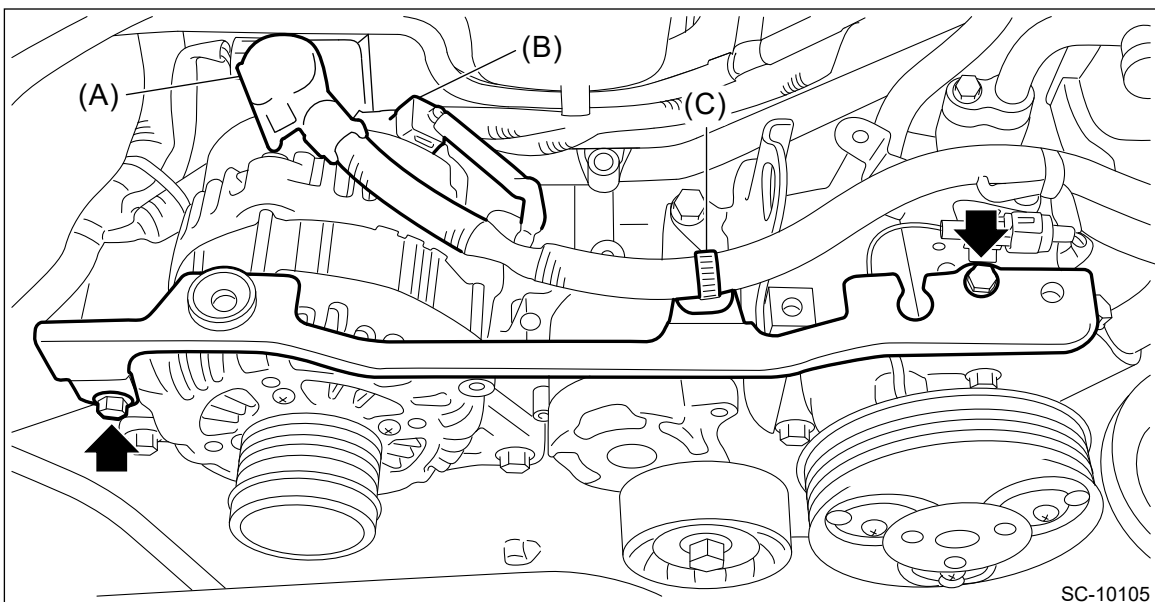
REMOVAL

1. NON-TURBO MODEL

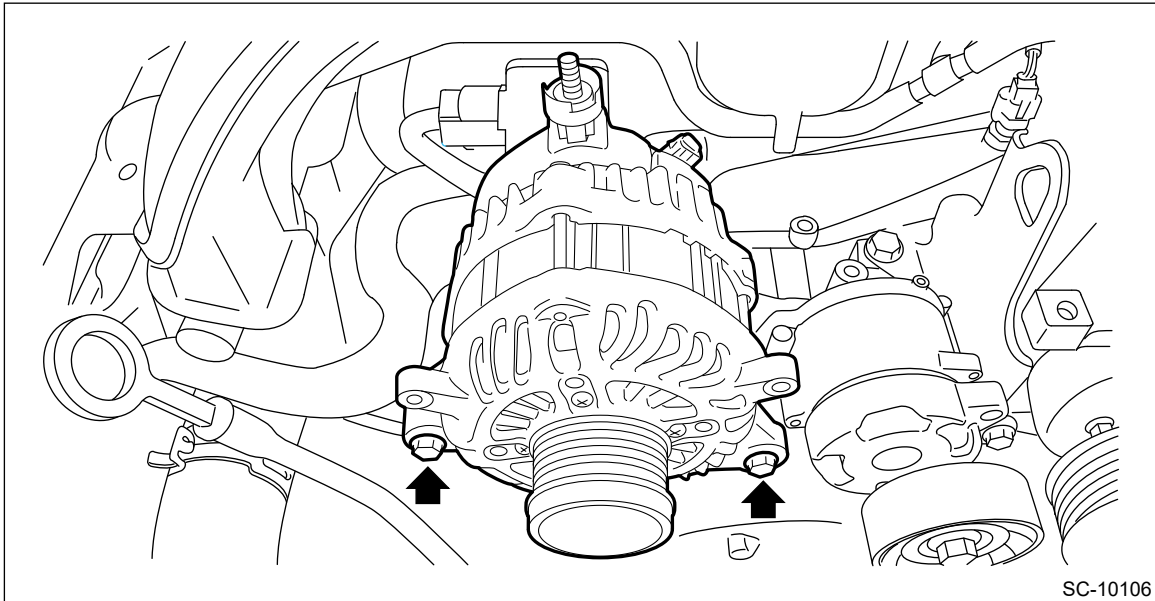
1. Remove the V-belt covers.




2. Disconnect the ground terminal from battery sensor.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Remove the V-belts.  [Ref. to MECHANICAL\(H4DO\)>V-belt>REMOVAL > V-BELT.](#)
4. Disconnect the connector (A) and terminal (B) from the generator, and remove the clip (C).
5. Remove the V-belt cover bracket.

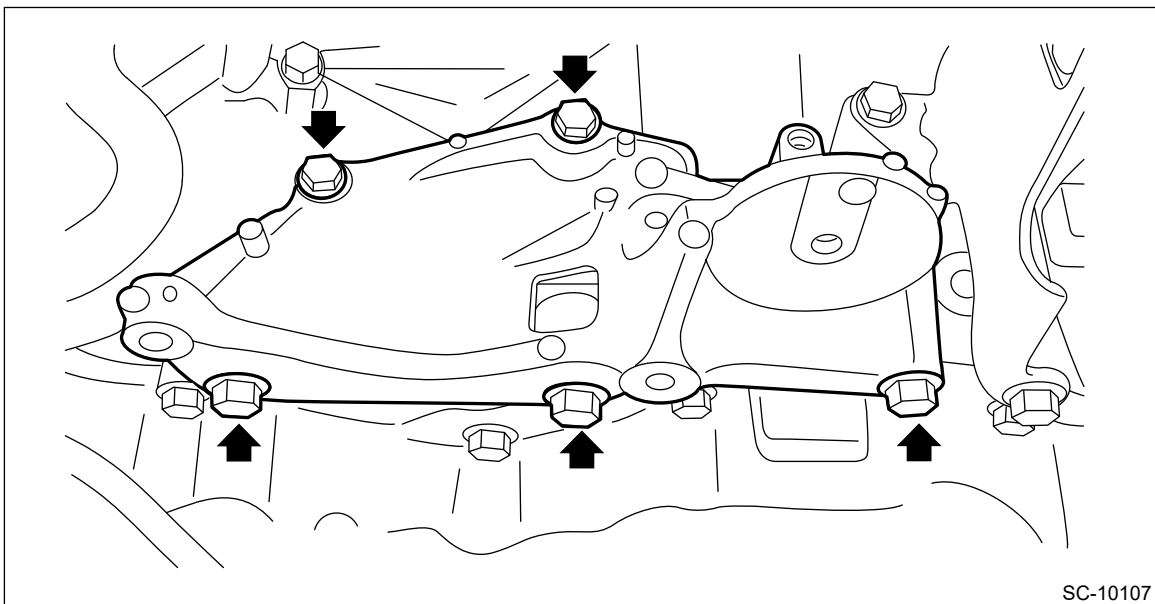


6. Remove the generator from the generator bracket.



SC-10106

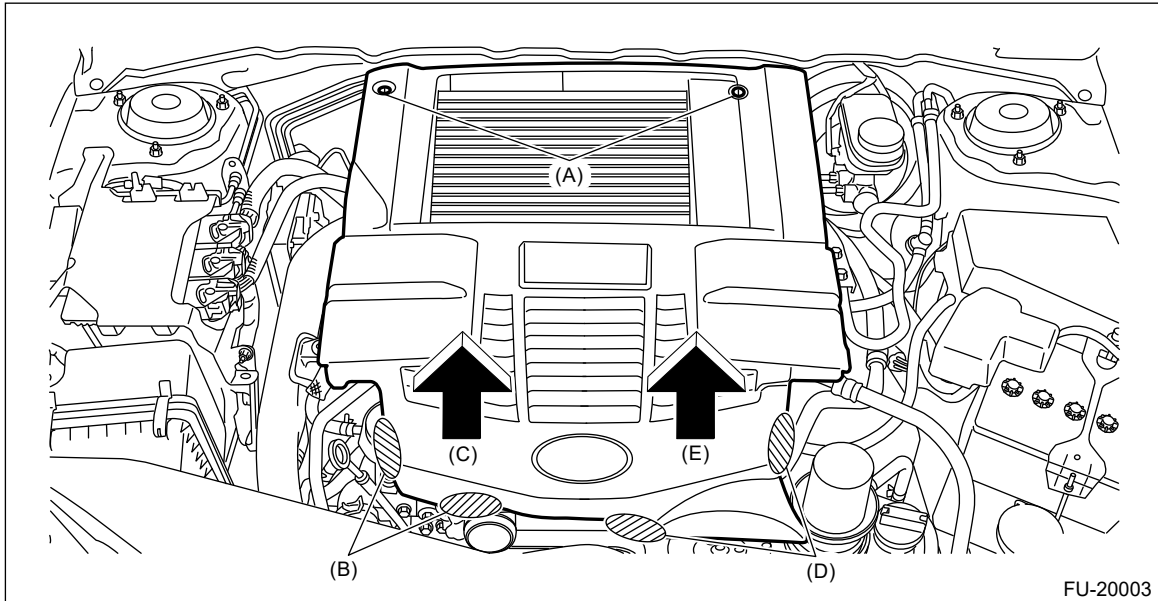
7. Remove the V-belt tensioner assembly.  [Ref. to MECHANICAL\(H4DO\)>V-belt>REMOVAL > V-BELT TENSIONER ASSEMBLY.](#)
8. Remove the generator bracket from the engine.






SC-10107

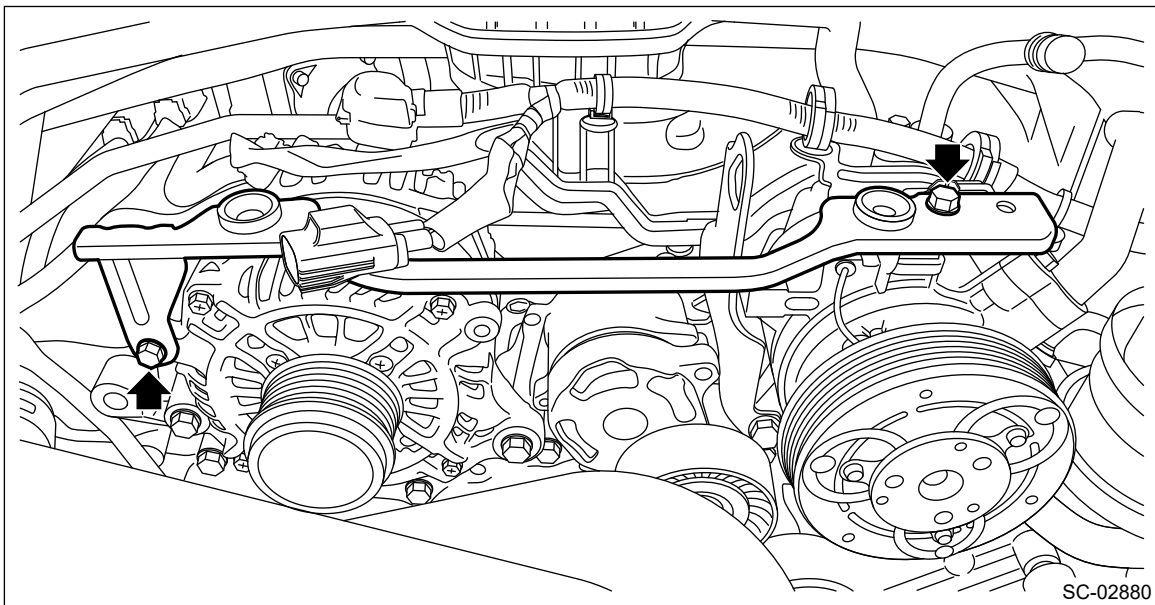
2. TURBO MODEL

1. Remove the clip (A), lift the front of the collector cover in the direction of arrow, and then remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.



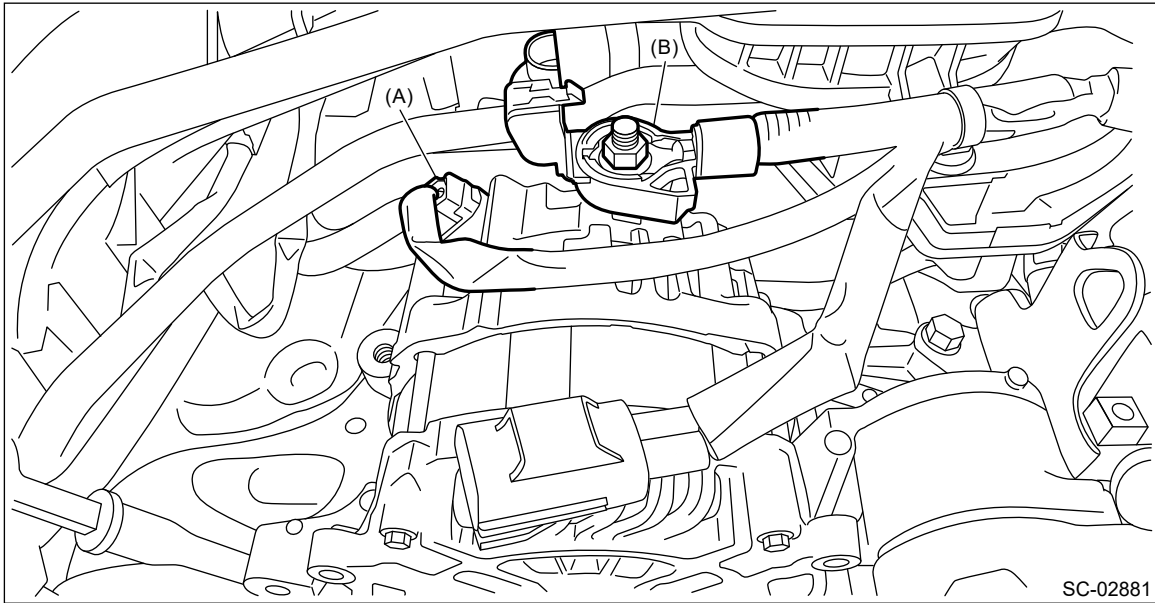
FU-20003

2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Remove the brake vacuum pump.  [Ref. to BRAKE>Brake Vacuum Pump>REMOVAL.](#)
4. Remove the V-belts.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>REMOVAL > V-BELT.](#)
5. Remove the collector cover bracket.

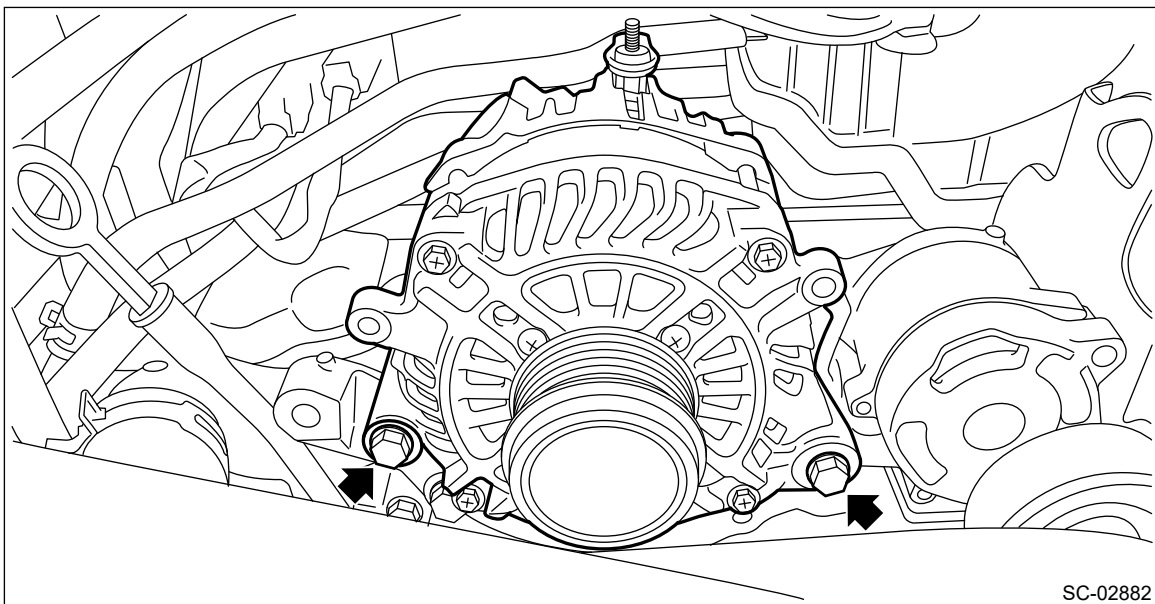



SC-02880

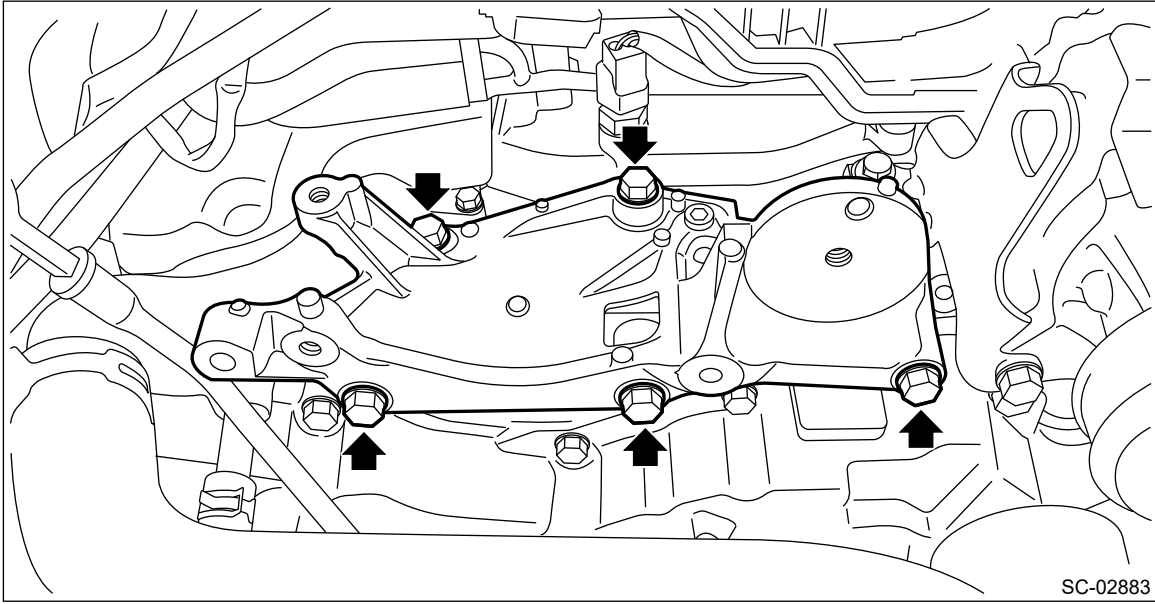
6. Disconnect the connector (A) and terminal (B) from the generator.



7. Remove the generator from the generator bracket.



8. Remove the V-belt tensioner assembly.  [Ref. to MECHANICAL\(H4DOTC\)>V-belt>REMOVAL > V-BELT TENSIONER ASSEMBLY.](#)
9. Remove the generator bracket from the engine.



SC-02883

STARTING/CHARGING SYSTEMS(H4DO) > Starter

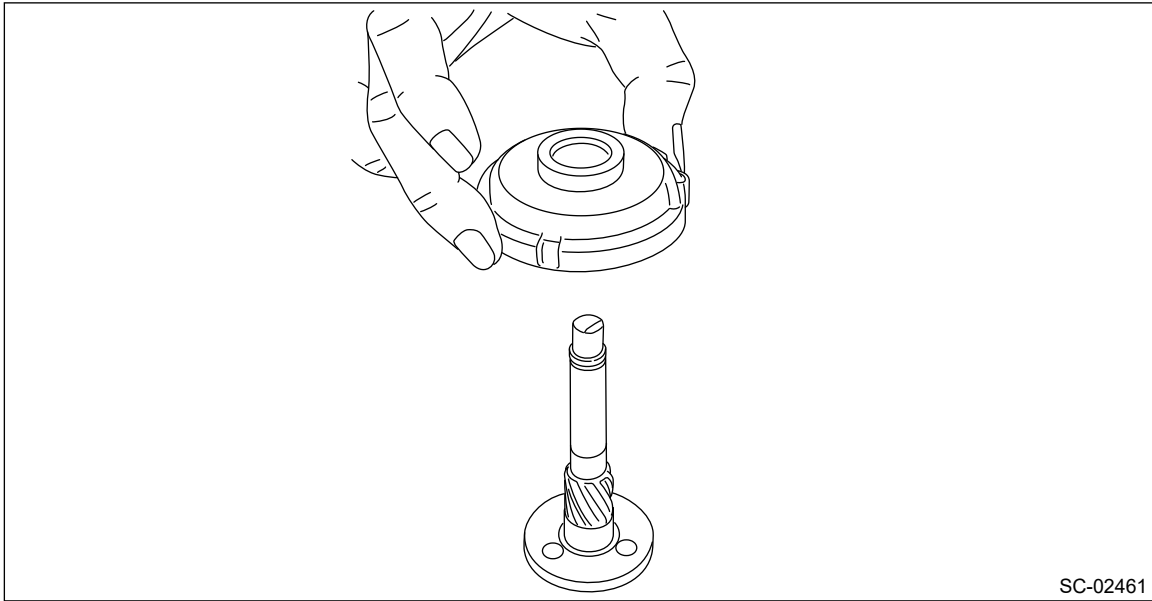
ASSEMBLY

1. Apply grease to the shaft sliding surfaces of the internal gear assembly.

Grease:

Multemp #6129 or equivalent

2. Assemble the shaft to the internal gear assembly.

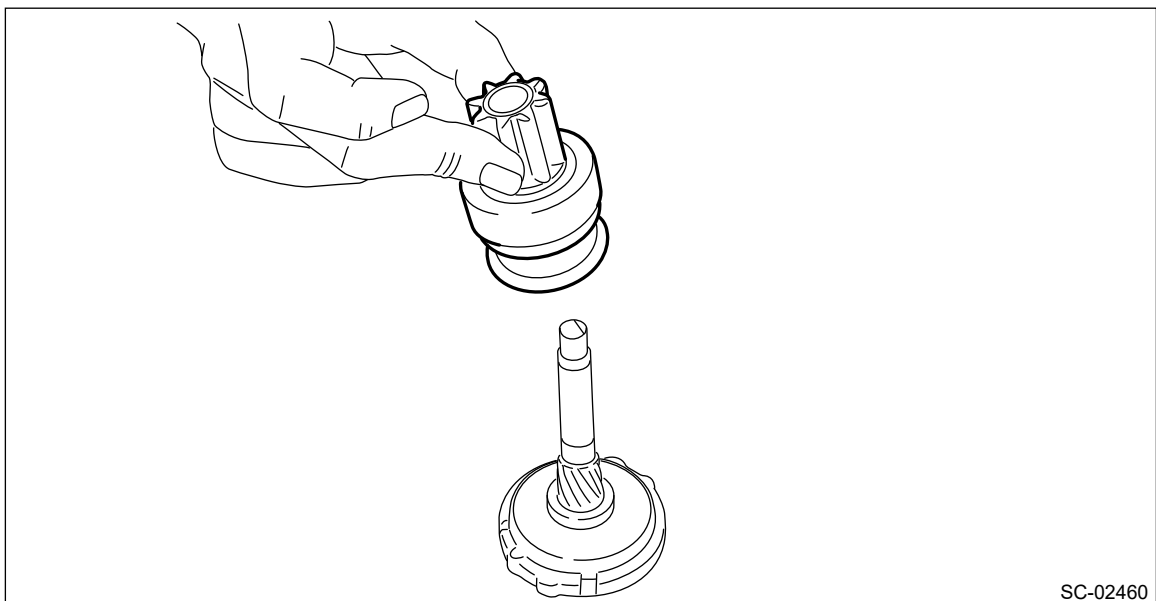


3. Assemble the overrunning clutch as follows:
 - (1) Apply grease to the spline portion of the shaft.

Grease:

Multemp #6129 or equivalent

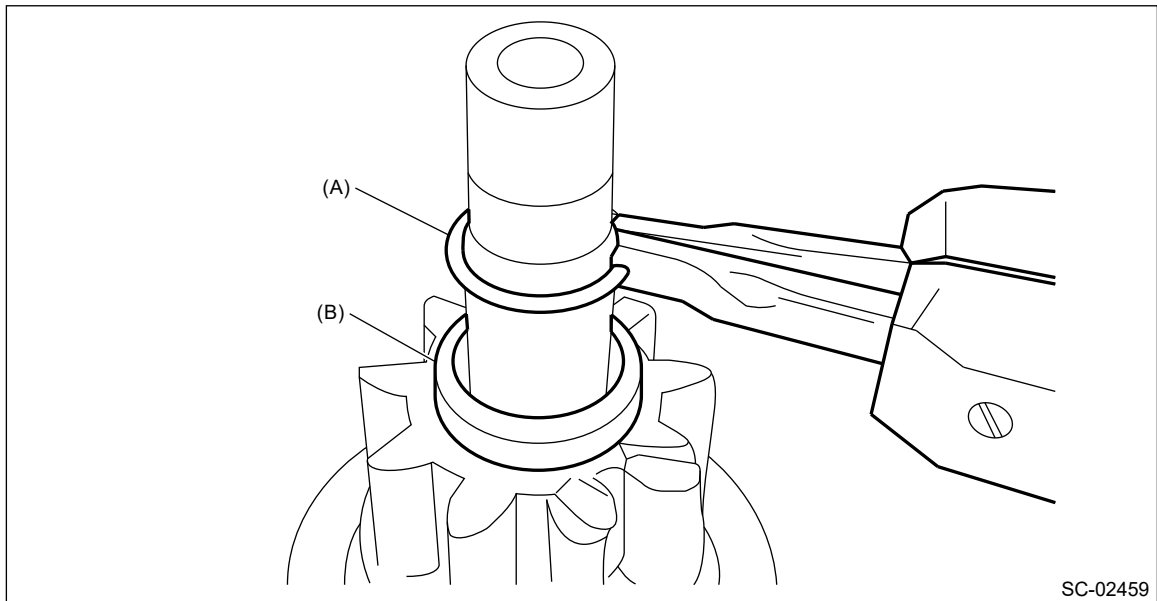
- (2) Install the overrunning clutch to shaft.



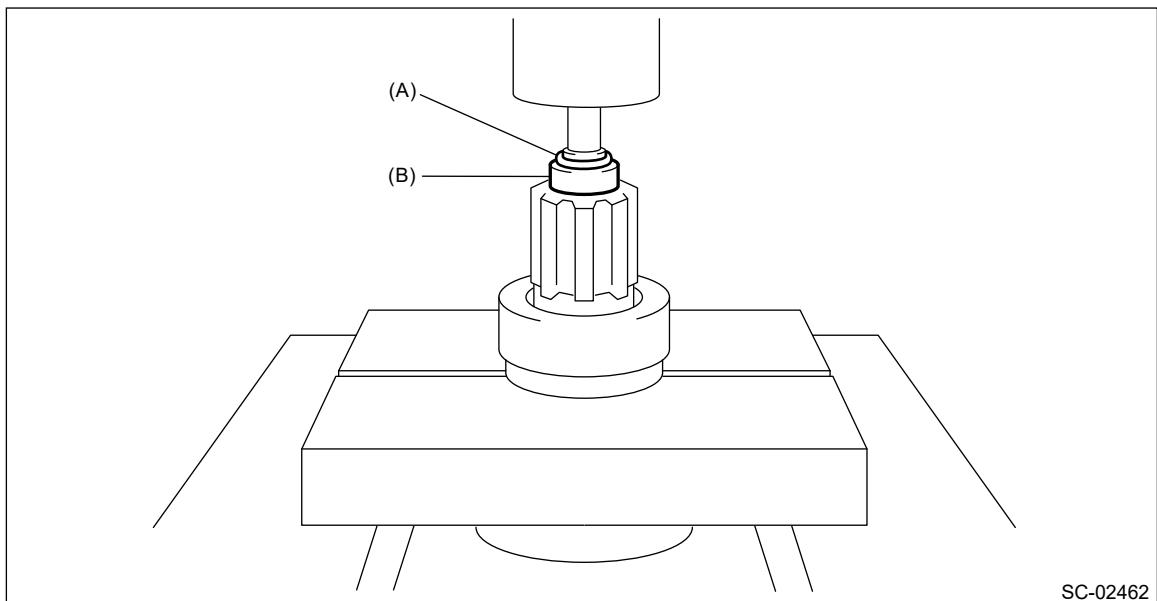
- (3) Pass stopper (B) through the shaft assembly, and attach snap ring (A).

Note:

Use new stoppers and snap rings.



(4) Using a press, pressure fit stopper (B) into snap ring (A).



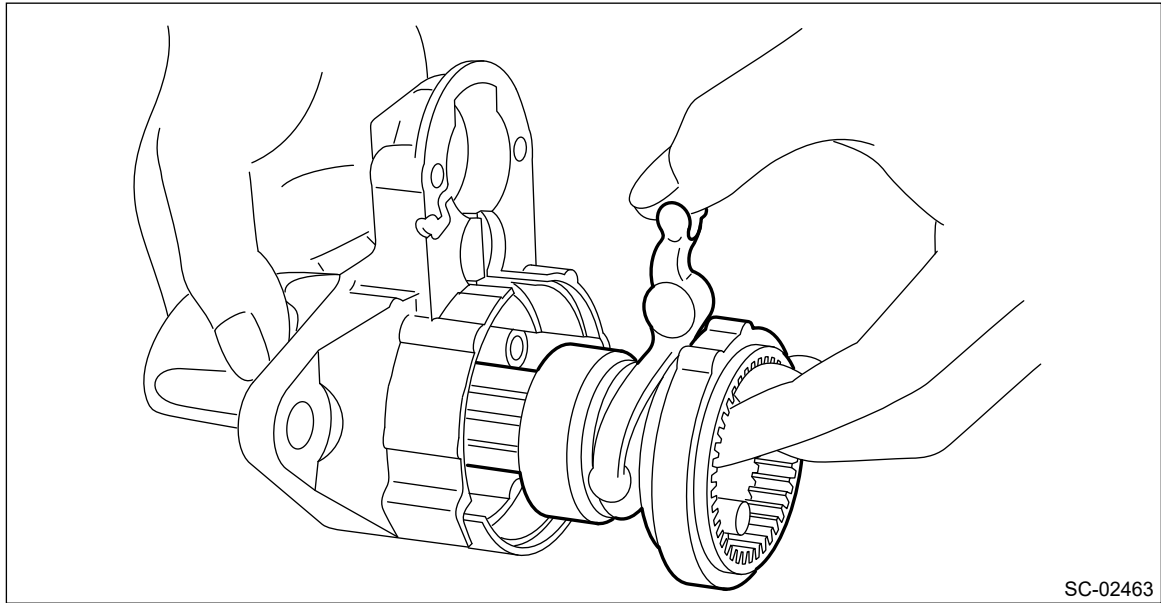
4. Assemble the overrunning clutch, internal gear assembly, shaft and shift lever as a single unit into the starter housing assembly.

Note:

Apply grease to the moving parts of the shift lever.

Grease:

Multemp #6129 or equivalent



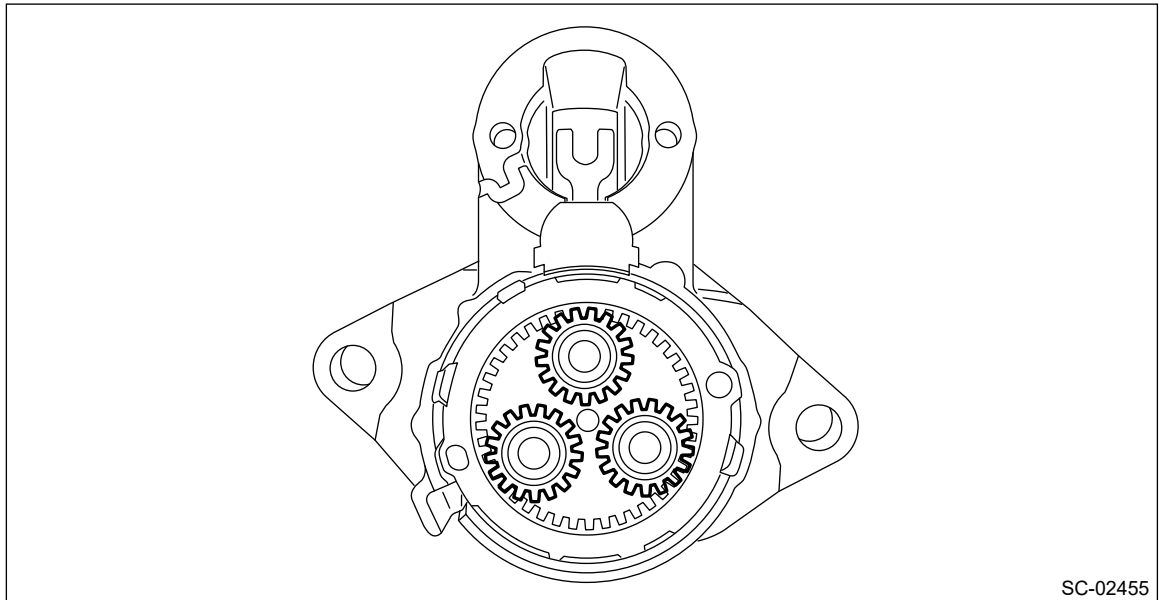
- 5.** Apply grease to the inside of the internal gear assembly and pinion gear, and attach the pinion gear to the internal gear assembly.

Note:

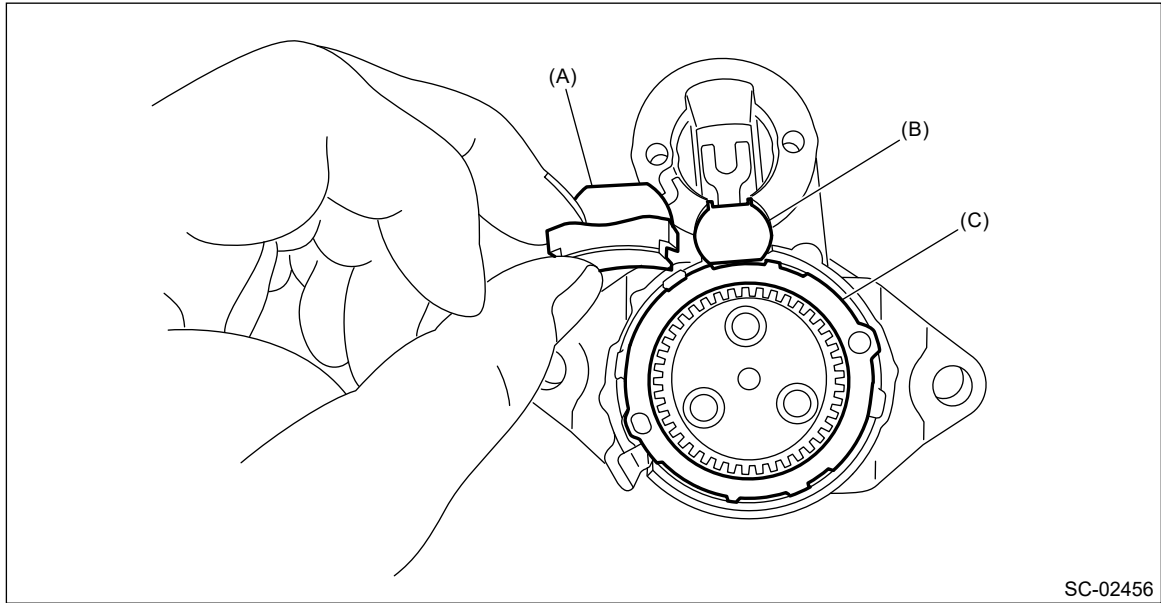
- **Apply grease evenly to the contact surfaces of each gear.**
- **Be careful that no debris becomes attached.**

Grease:

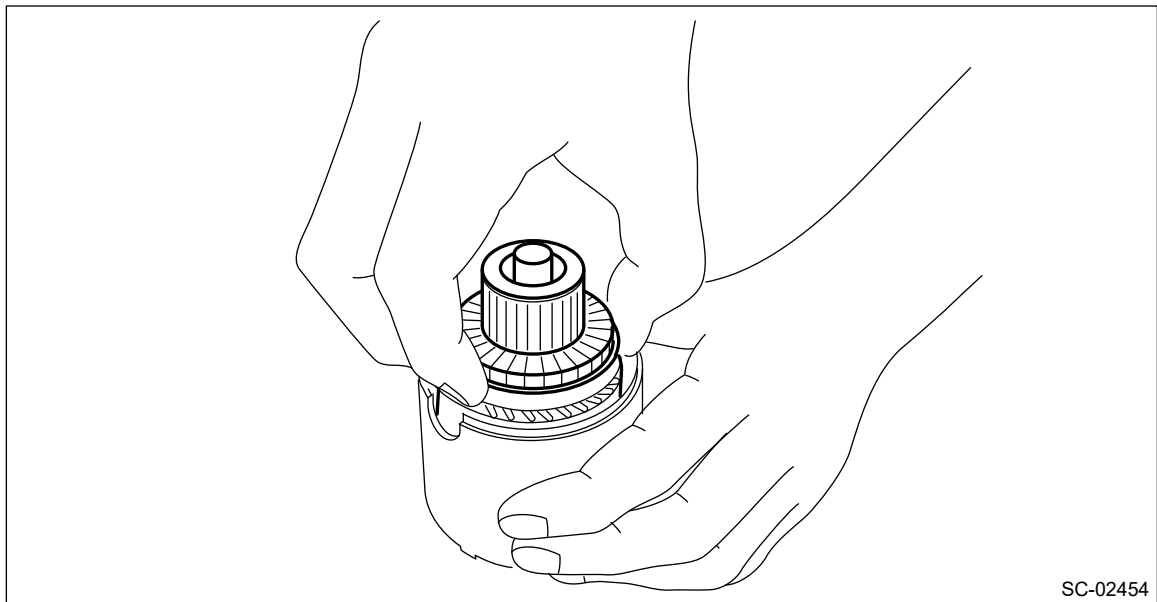
Molykote® AG650 or equivalent



- 6.** Install seal rubber (A), plate (B), and seal rubber (C).



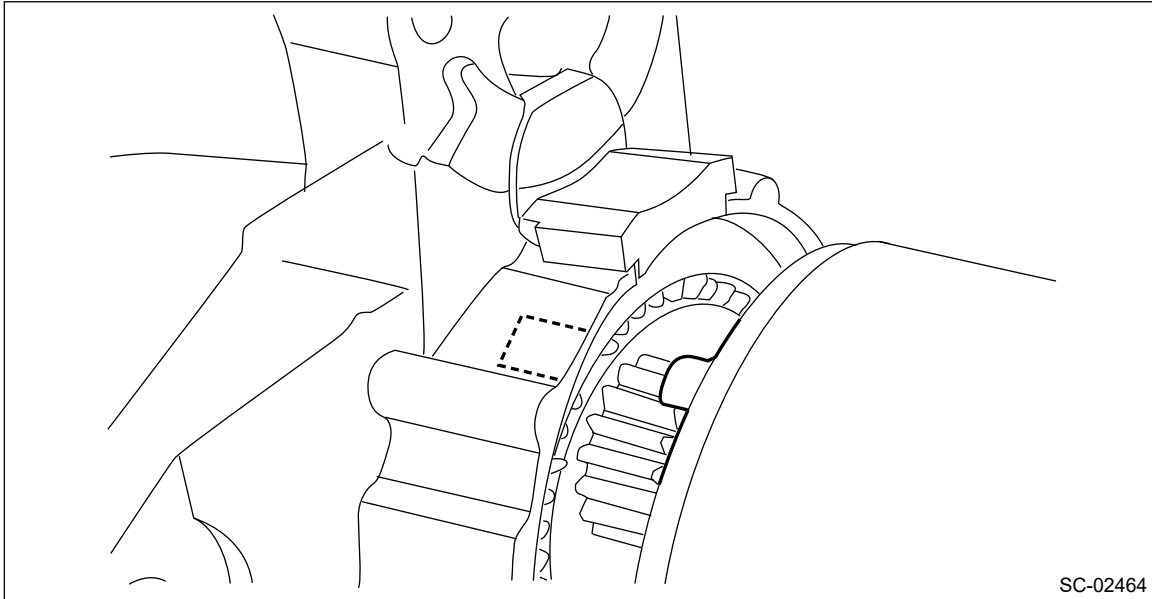
7. Assemble the armature assembly to the yoke assembly.



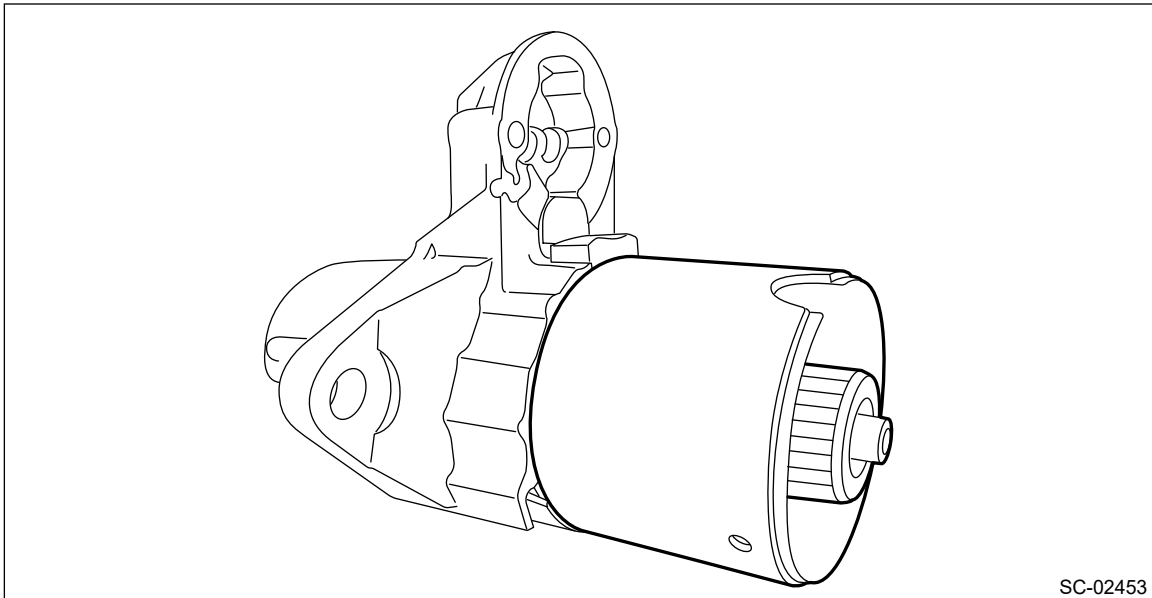
8. Attach the armature assembly and yoke assembly to the starter housing assembly together as a single unit.

Note:

As shown in the figure, match the protrusion of the yoke assembly to the cut out of the starter housing assembly.



SC-02464

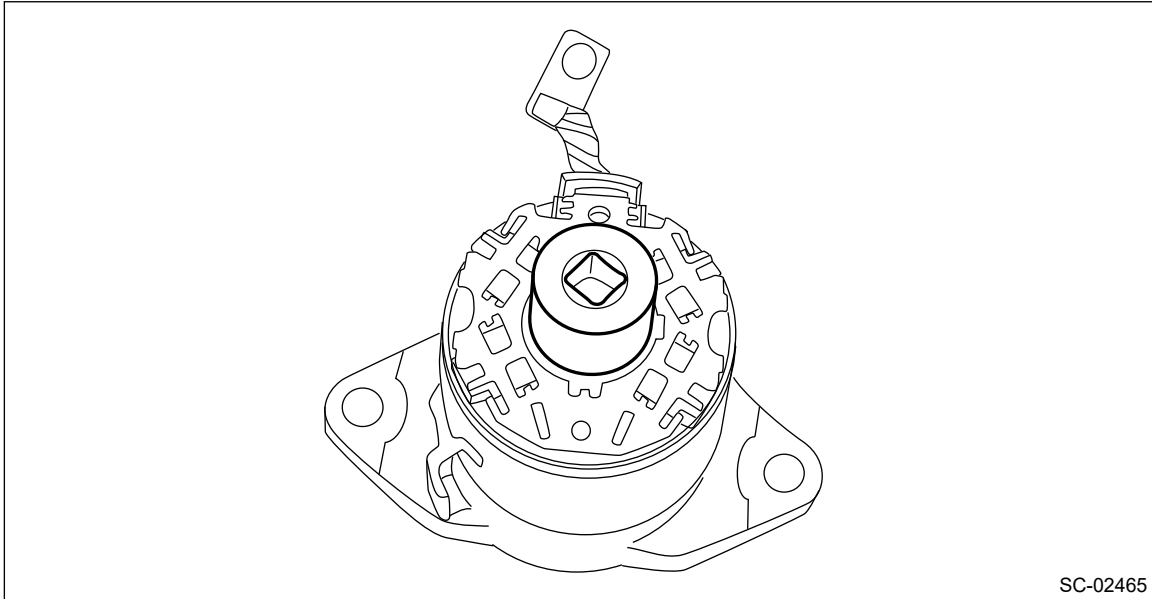


SC-02453

9. Use an appropriate tool (such as correctly sized socket wrenches) and attach the brush holder assembly to the armature assembly.

Note:

Be careful not to damage the brushes.



10. Secure starter cover assembly to the brush holder assembly with screws (A).

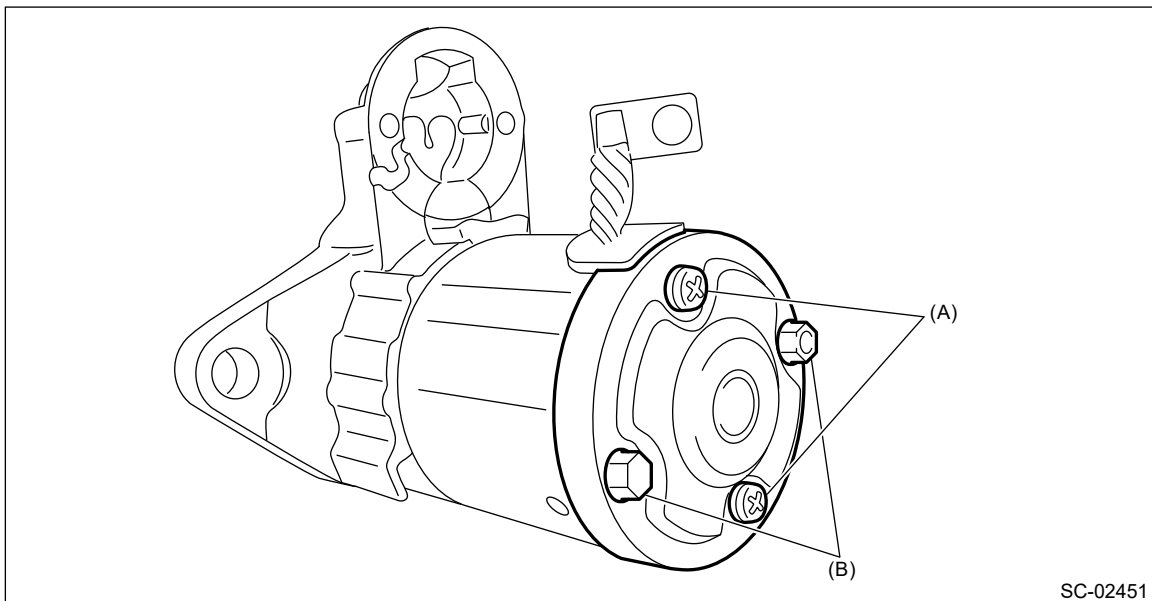
Tightening torque:

1.4 N·m (0.1 kgf-m, 1.0 ft-lb)

11. Tighten through bolts (B) on both sides.

Tightening torque:

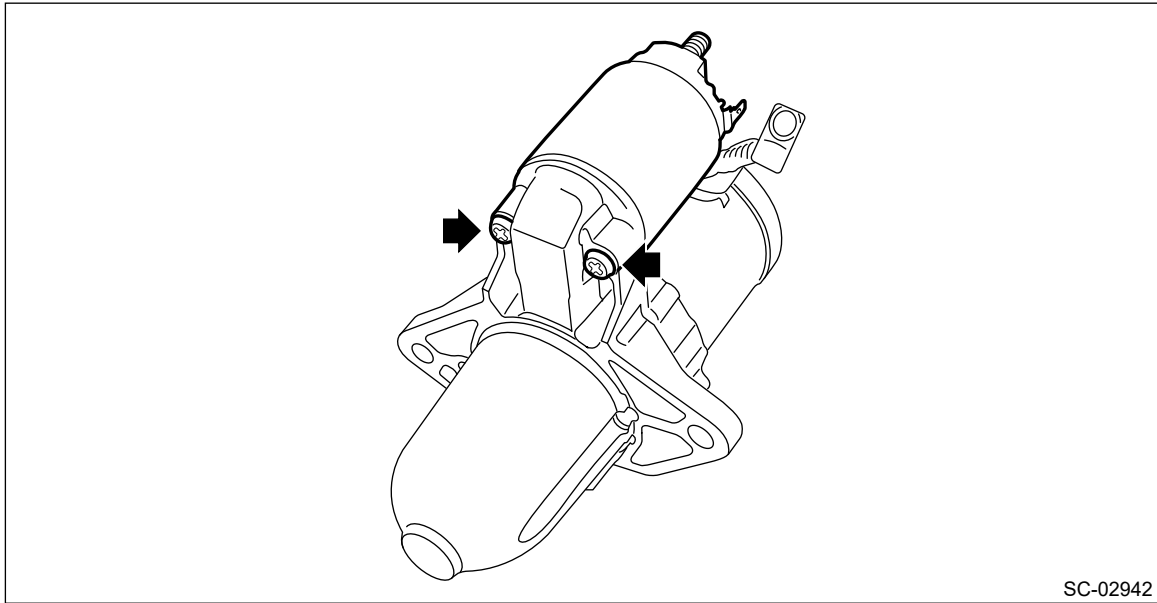
6 N·m (0.6 kgf-m, 4.4 ft-lb)



12. Attach the magnet switch assembly to the starter housing assembly.

Tightening torque:

7.5 N·m (0.8 kgf-m, 5.5 ft-lb)

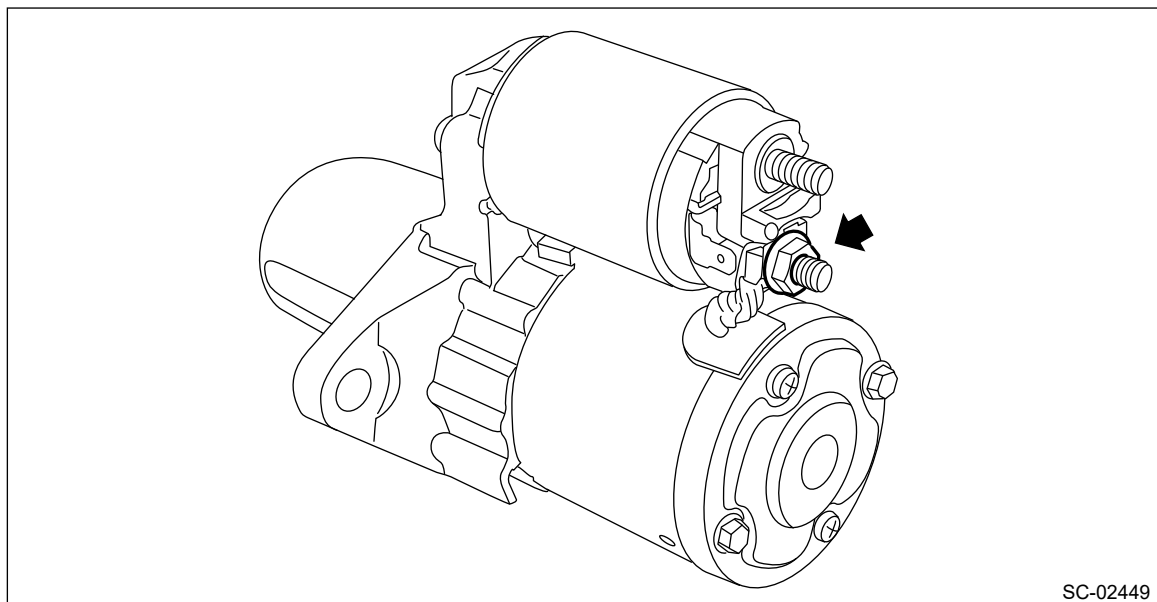


SC-02942

- 13.** Attach the cable to the terminal M of the magnet switch assembly, and secure with nuts.

Tightening torque:

10 N·m (1.0 kgf-m, 7.4 ft-lb)



SC-02449

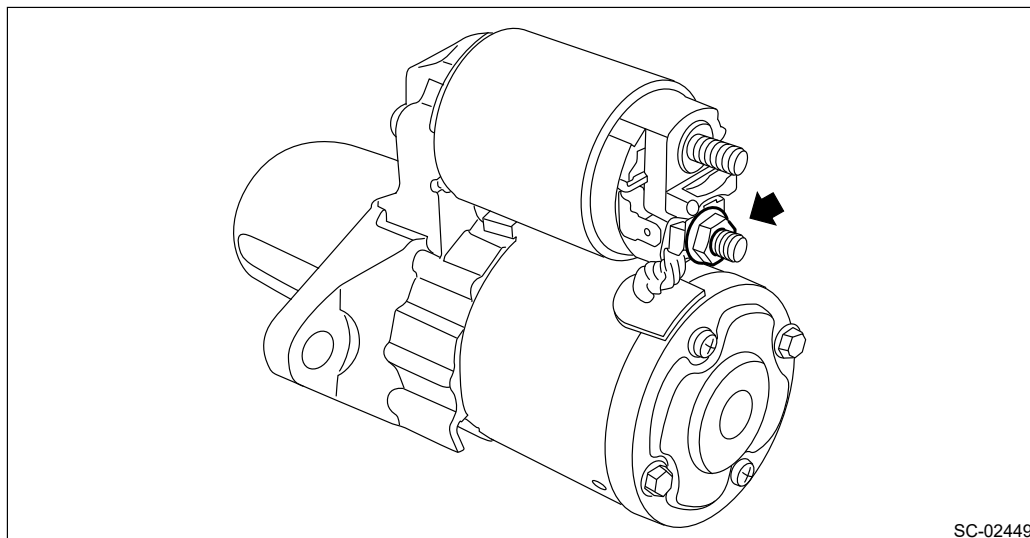
STARTING/CHARGING SYSTEMS(H4DO) > Starter

DISASSEMBLY

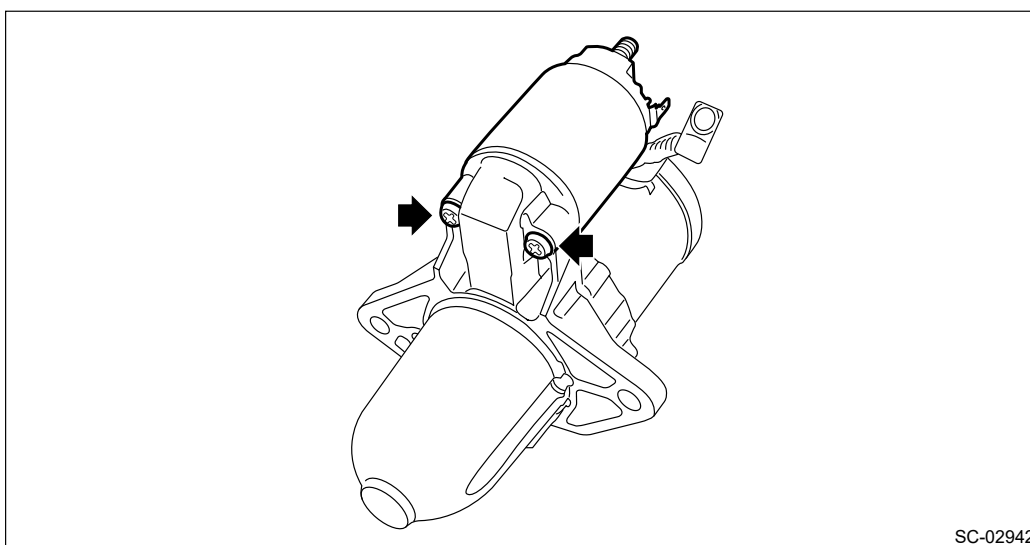
Caution:

The starter should be placed through a no-load test whenever it has been overhauled.

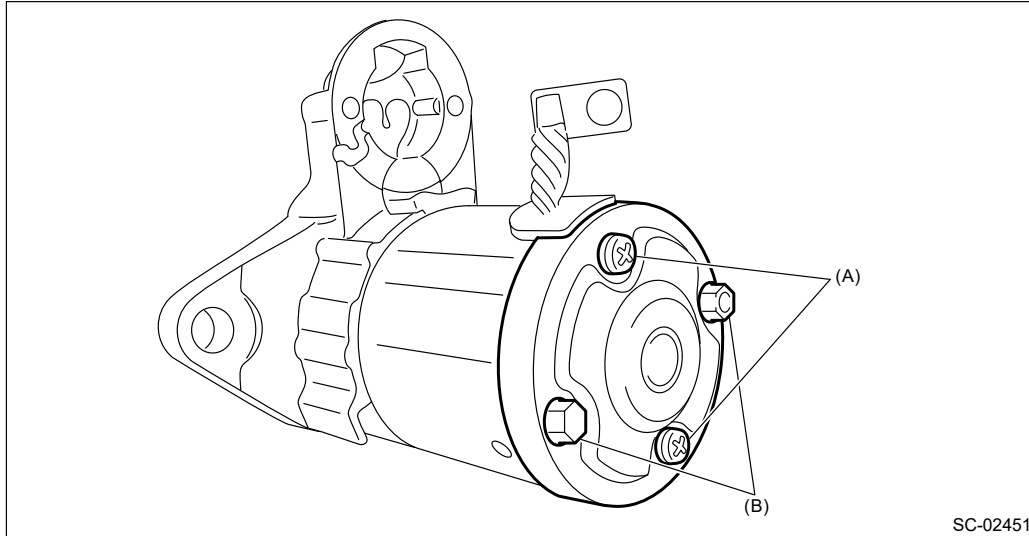
1. Disconnect the terminal M from the magnet switch assembly.



2. Remove the magnet switch assembly from the starter housing assembly.



3. Remove screws (A) of the brush holder assembly, and through bolts (B) on both sides, and remove the starter cover assembly.

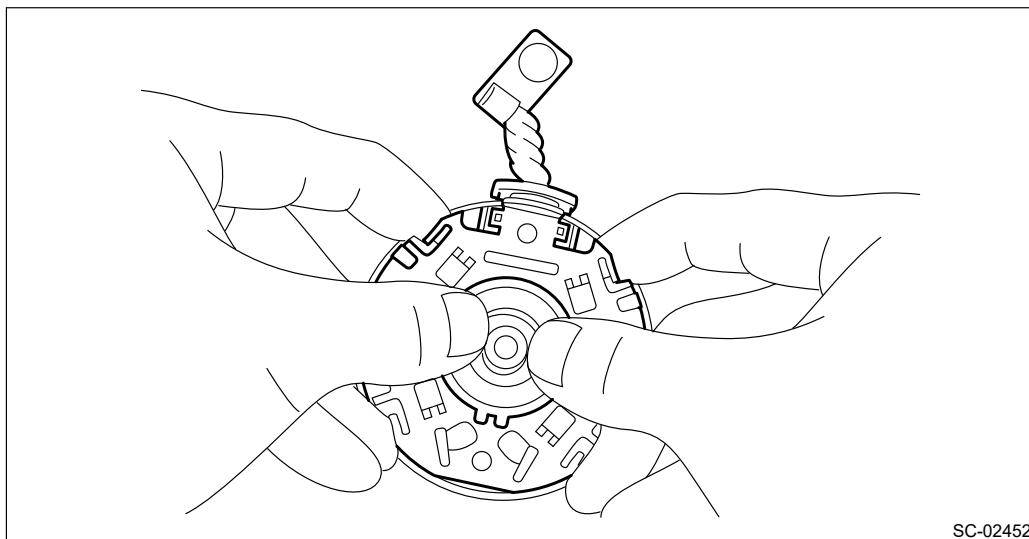


SC-02451

4. Remove the brush holder assembly from the armature assembly.

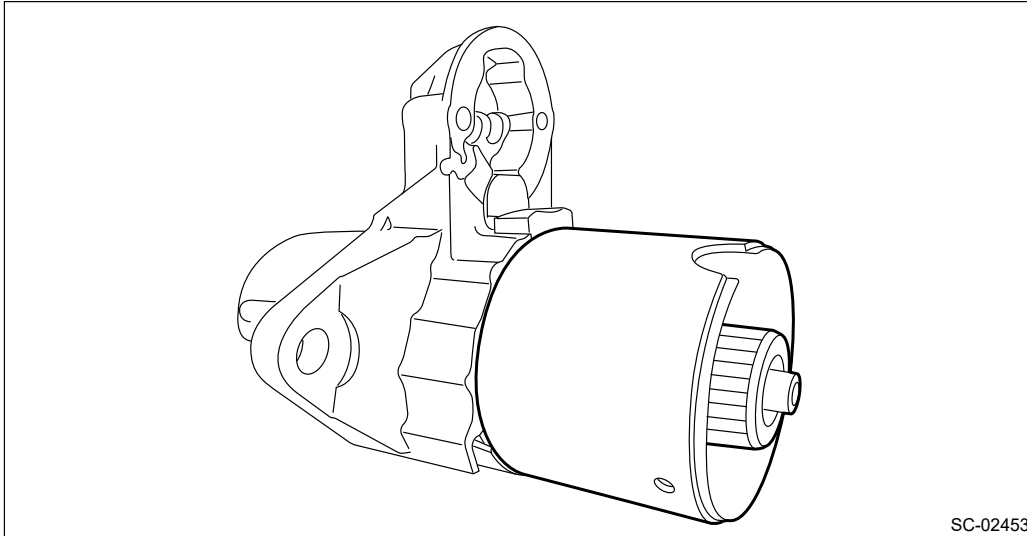
Note:

Hold the brush with your fingers so that the brush spring does not come flying out.

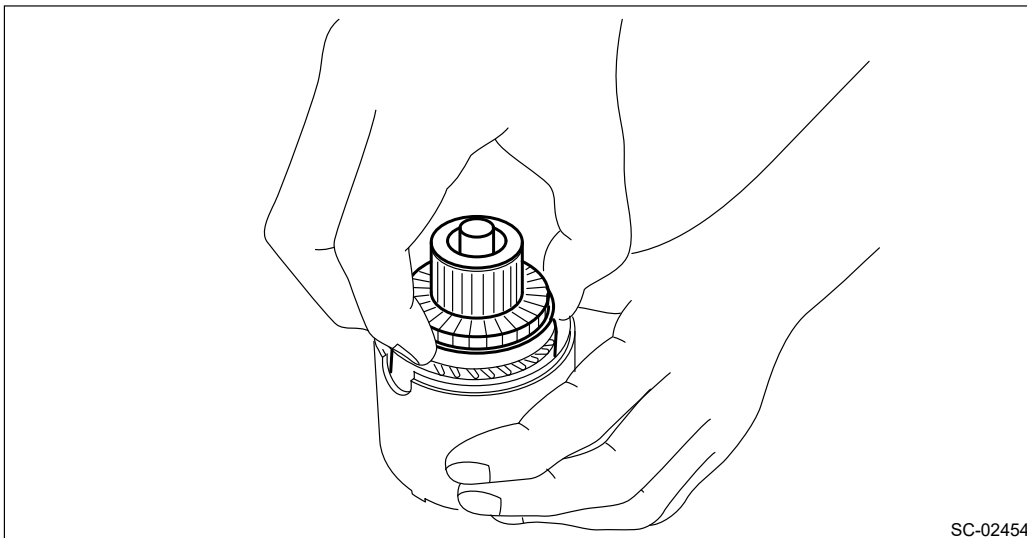


SC-02452

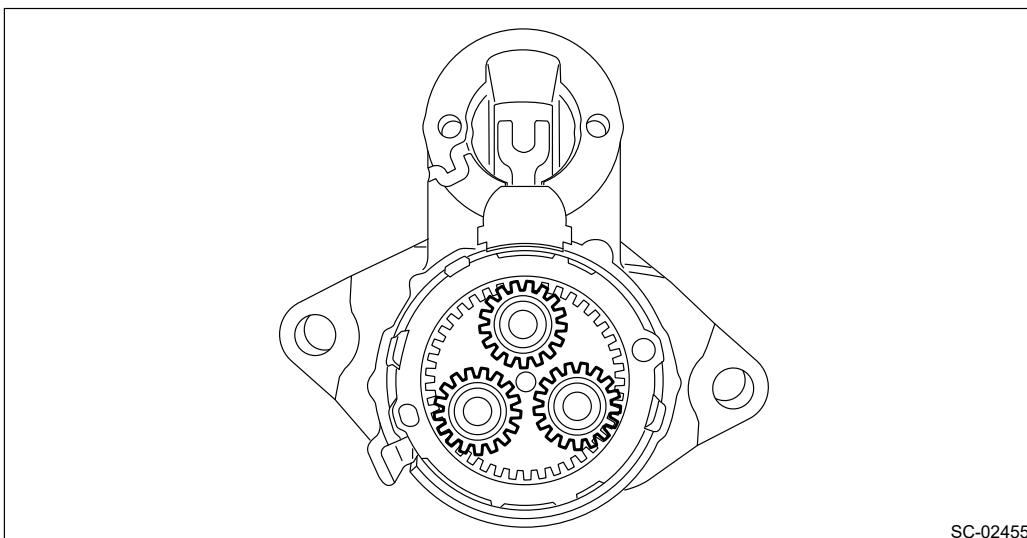
5. Remove the armature assembly and yoke assembly from the starter housing assembly together as a single unit.



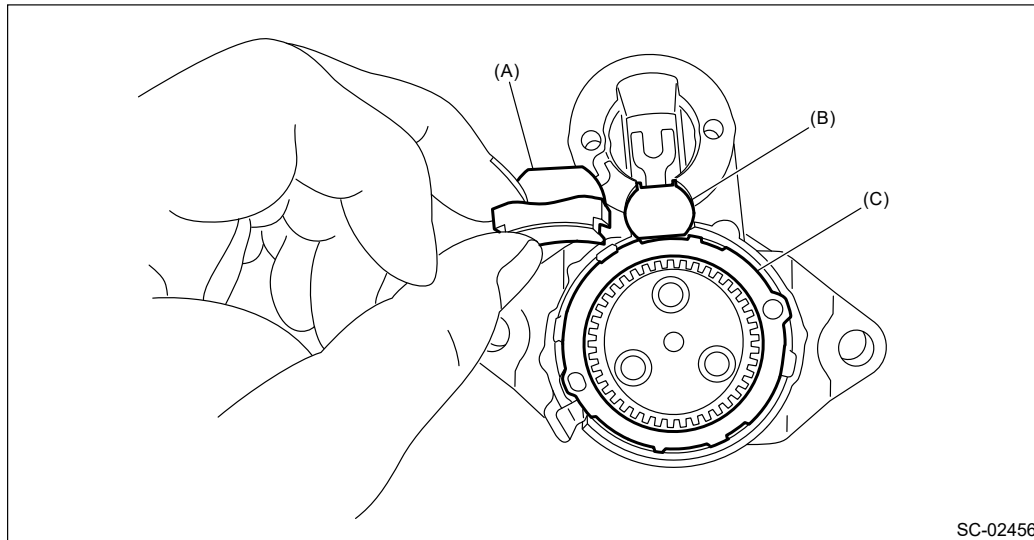
6. Separate the armature assembly and yoke assembly.



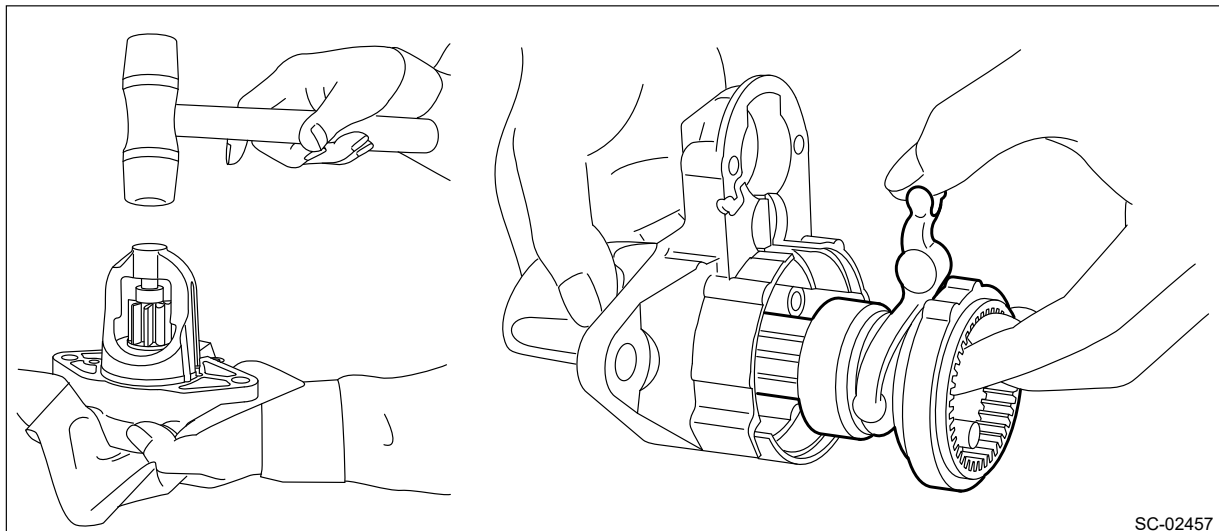
7. Remove the pinion gear from the internal gear assembly.



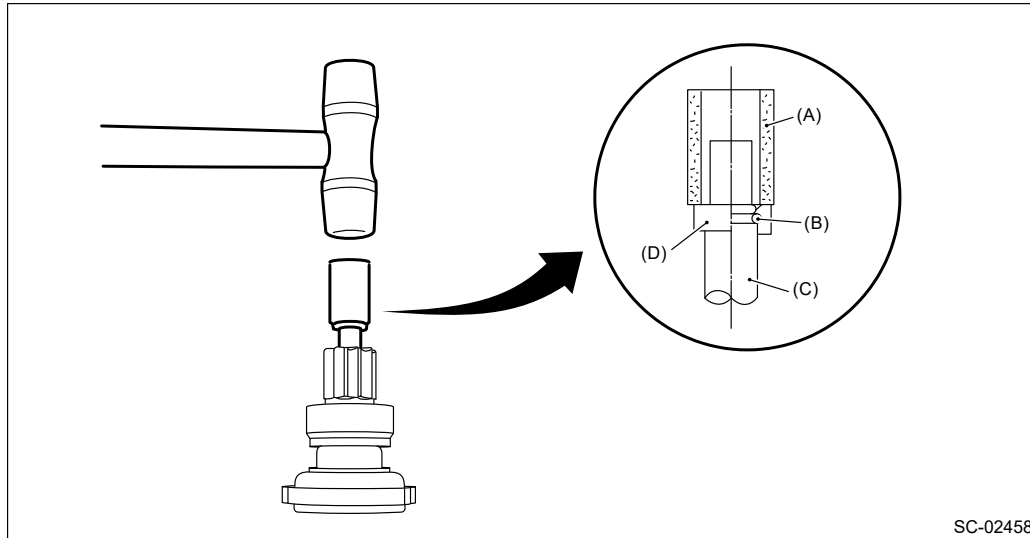
8. Remove seal rubber (A), plate (B), and seal rubber (C).



- 9.** Lightly tap the starter housing assembly with a plastic hammer as shown in the figure, and remove the overrunning clutch, internal gear assembly, shaft and shift lever together as one unit.



- 10.** Use the following procedures to remove the overrunning clutch from the shaft.
- (1) Use an appropriate tool (such as a fit socket wrench), and remove the stopper from snap ring by lightly tapping the stopper with a plastic hammer.

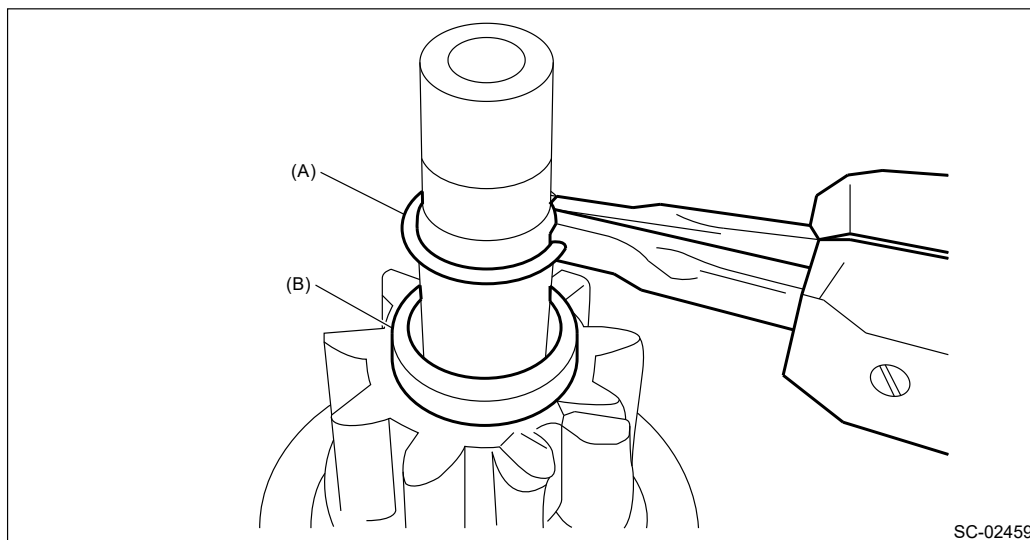


(A) Appropriate tool
(D) STOPPER

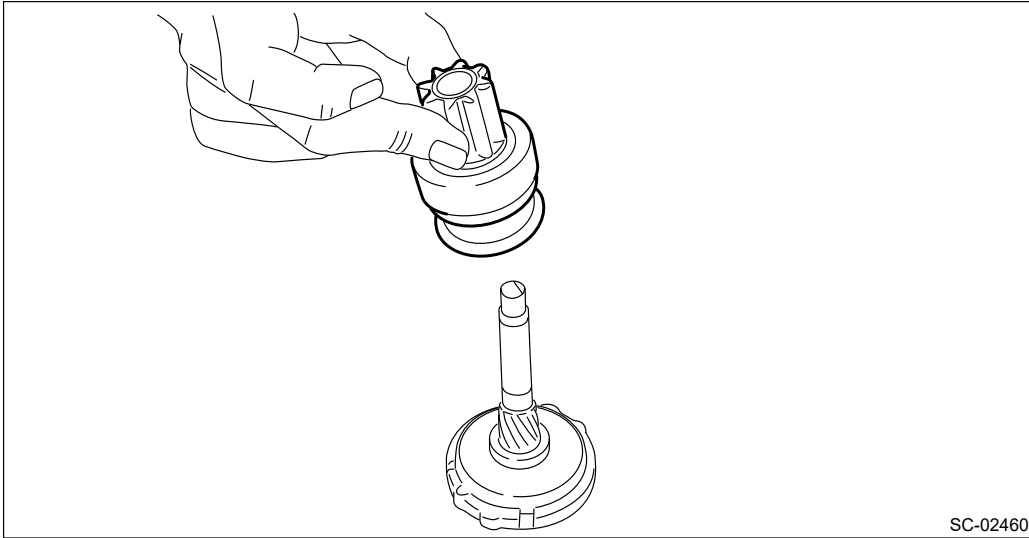
(B) Snap ring

(C) Shaft

(2) Remove snap ring (A) from the shaft, and remove stopper (B).

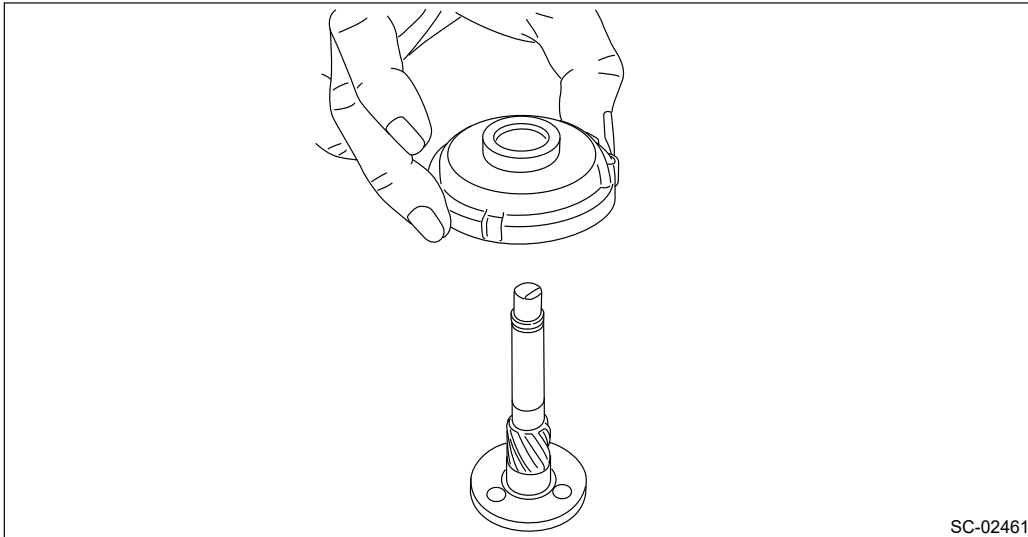


(3) Remove the overrunning clutch from the shaft.



SC-02460

11. Separate the internal gear assembly and shaft.




SC-02461

STARTING/CHARGING SYSTEMS(H4DO) > Starter

INSPECTION

Note:

- After the inspection, reinstall the disassembled or removed parts during the inspection in the reverse order of disassembly/removal procedure.
- Refer to component for tightening torque of each part.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>General Description>COMPONENT > STARTER.](#)

1. ARMATURE

1. Check the commutator for signs of seizure or stepped wear caused by roughness of the surface. If there is light wear, use sandpaper to repair.
2. Check for runout on the commutator. If excessive, replace the armature.

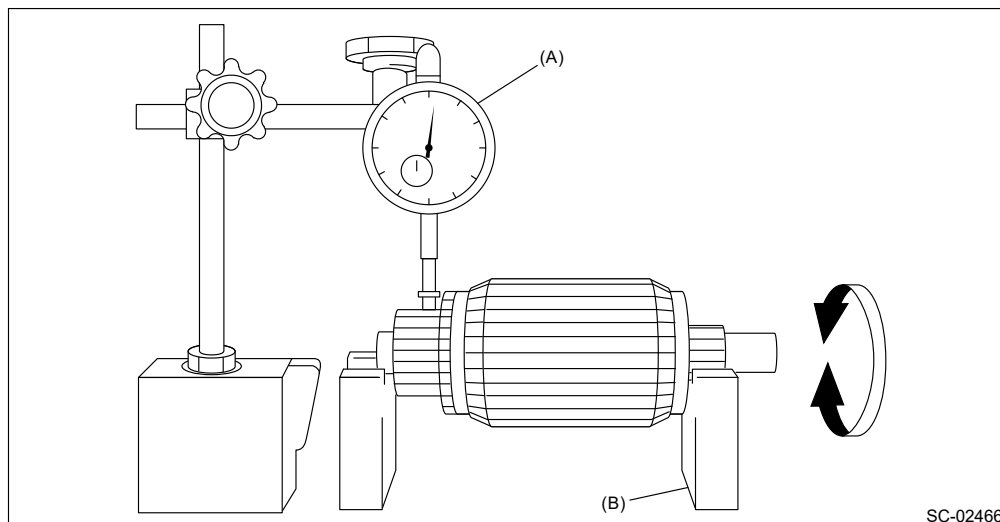
Commutator runout:

Standard

0.05 mm (0.0020 in)

Limit

0.10 mm (0.0039 in)



(A) DIAL GAUGE

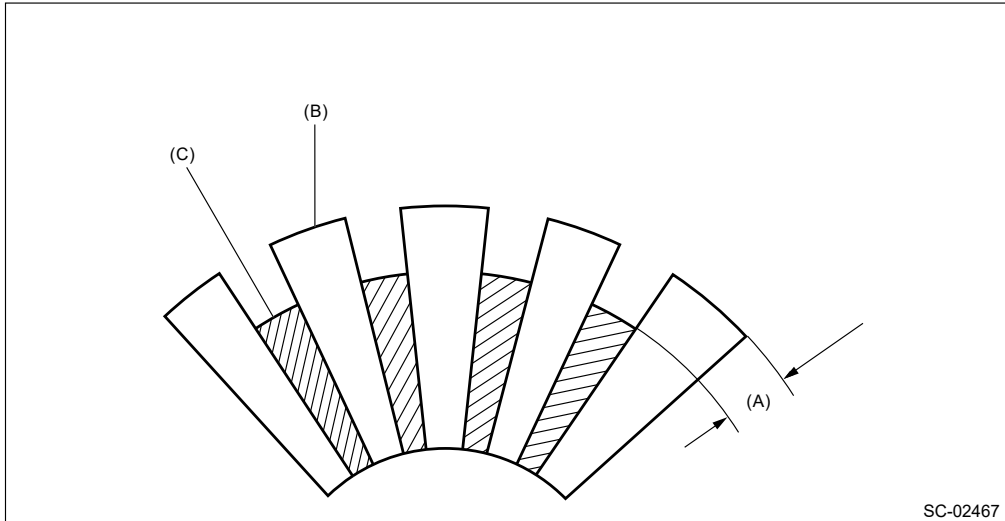
(B) V-block

3. Check the depth of the segment mold. If it is not within the standard, replace the armature.

Depth of segment mold:

Standard

0.50 mm (0.020 in)

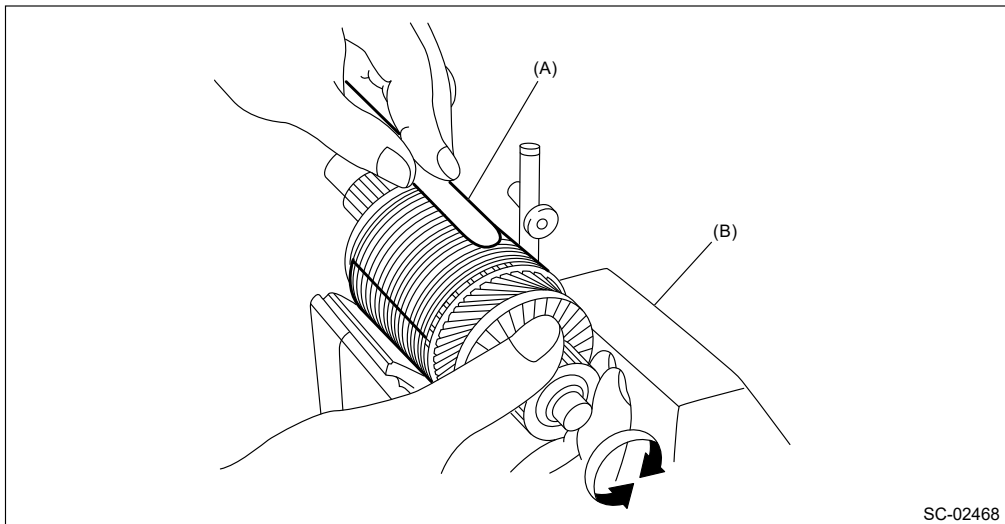


(A) Depth of mold

(B) Segment

(C) Mold

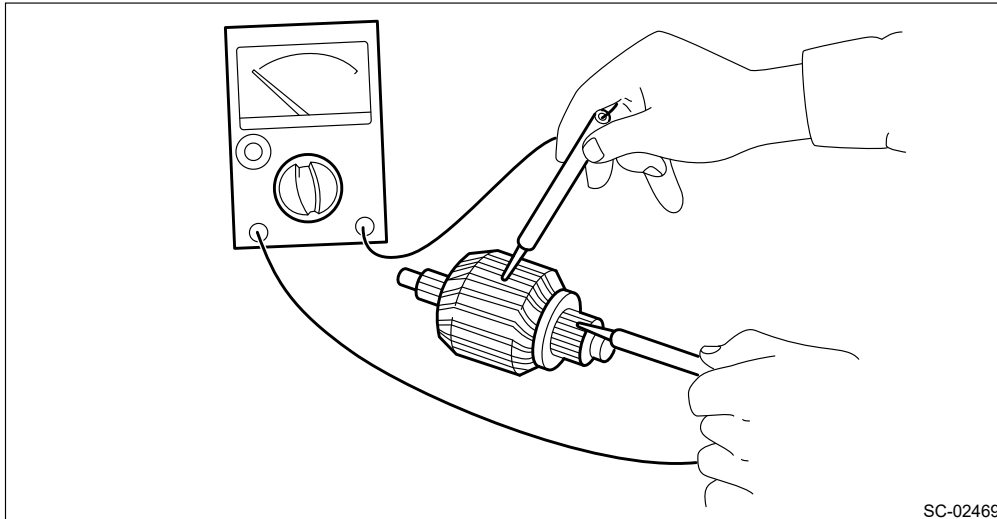
4. Place the armature on the growler tester to check for short circuits. While slowly turning the armature, support the steel sheet for the armature core. If the circuit of the armature is shorted, the steel sheet will vibrate, causing it to move towards the core. When the steel sheet has moved or vibrated, replace the armature.



(A) Steel sheet

(B) Growler tester

5. Use a circuit tester to touch the probe of one side to the commutator segment, and the other probe to the shaft. If there is continuity, replace the armature.



SC-02469

2. YOKE

Make sure that the pole is set at the predetermined position.

3. OVERRUNNING CLUTCH

Inspect the pinion, and if there is any wear or damage, replace the overrunning clutch. Also, check that the pinion rotates counterclockwise smoothly and does not rotate clockwise. If there is any fault, replace the overrunning clutch.

Caution:

To prevent spilling of grease, do not clean the overrunning clutch with oil.

4. BRUSH AND BRUSH HOLDER

1. Visually check the brush. If there is any abnormal wear or cracks, replace the brush.
2. Measure the length of the brush. If it exceeds service limits, replace the brush.

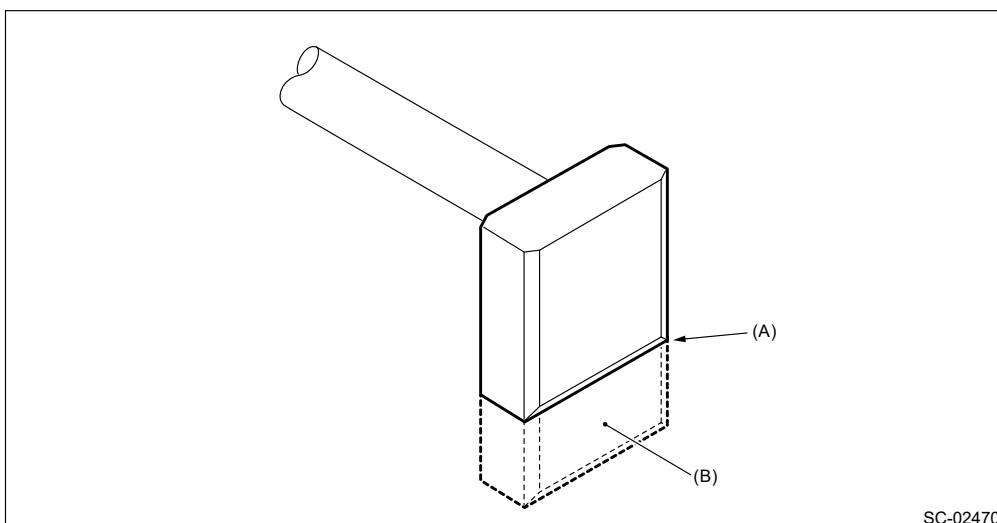
Brush length:

Standard

12.3 mm (0.484 in)

Limit

7.0 mm (0.276 in)



SC-02470

(A) Service limit line

(B) Brush

3. Check that the brush moves smoothly in the brush holder.
4. Measure the brush spring force with a spring scale. Replace the brush holder if below the service limit.

Brush spring force:

Standard

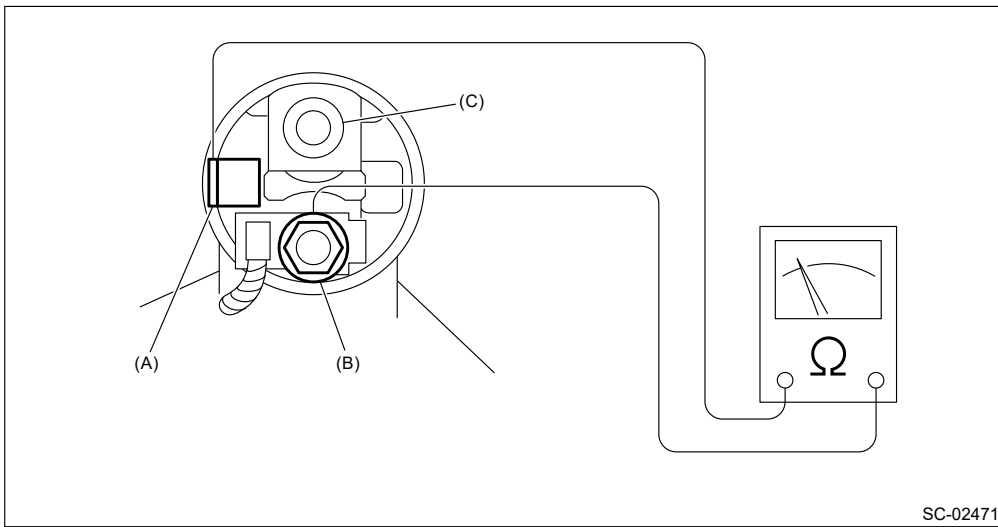
15.9 – 19.5 N (1.62 – 1.99 kgf, 3.57 – 4.38 lbf) (when new)

Limit

2.5 N (0.25 kgf, 0.56 lbf)

5. SWITCH ASSEMBLY

Using a circuit tester, check there is continuity between S terminal and M terminal, and between S terminal and ground. Also, check that there is no continuity between M terminal and B terminal.



(A) Terminal S

(B) Terminal M

(C) Terminal B

| Terminals | Standard |
|-------------------------|--------------|
| Terminal S – terminal M | 1 Ω or less |
| Terminal S – Ground | 1 Ω or less |
| Terminal M – terminal B | 1 MΩ or more |

6. SWITCH ASSEMBLY OPERATION

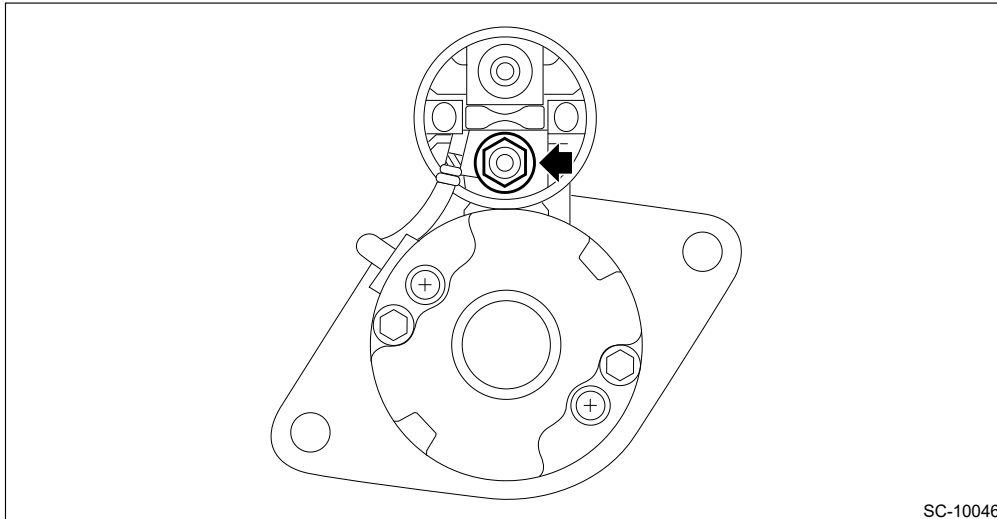
Caution:

Perform the inspection in a short period of time. (Within 3 to 5 seconds)

1. Loosen the nut which holds the M terminal to the starter body.

Note:

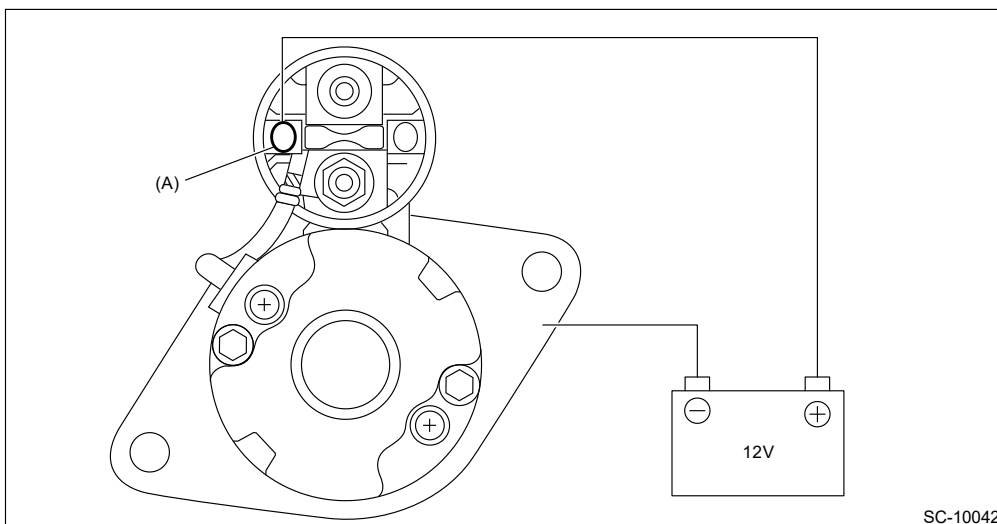
This procedure is required to facilitate the harness removal from the M terminal.



2. Connect the battery positive terminal to the switch assembly S terminal, and connect the battery negative terminal to the starter body. Then, if the pinion protrudes, it is normal.

Note:

The starter motor may rotate while the pinion protrudes. This occurs due to current that flows to the motor via pull-in coil. This is not a problem.



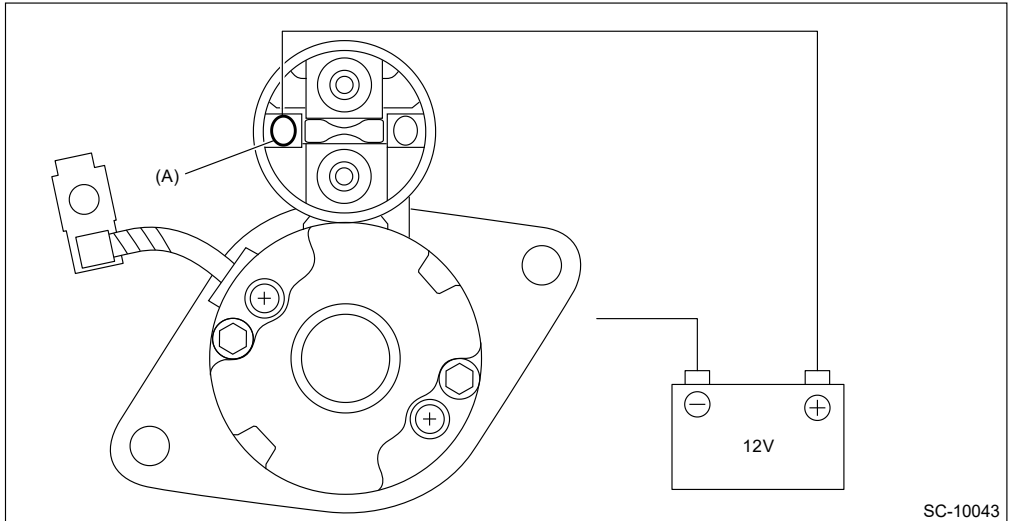
(A) Terminal S

3. Disconnect the harness from the M terminal. Check that the pinion is being protruded at this time.

Caution:

Hold the disconnected harness so that it does not contact the terminal or wiring.

4. Disconnect the battery negative terminal from the starter body. Then, if the pinion returns to its original position, it is normal.

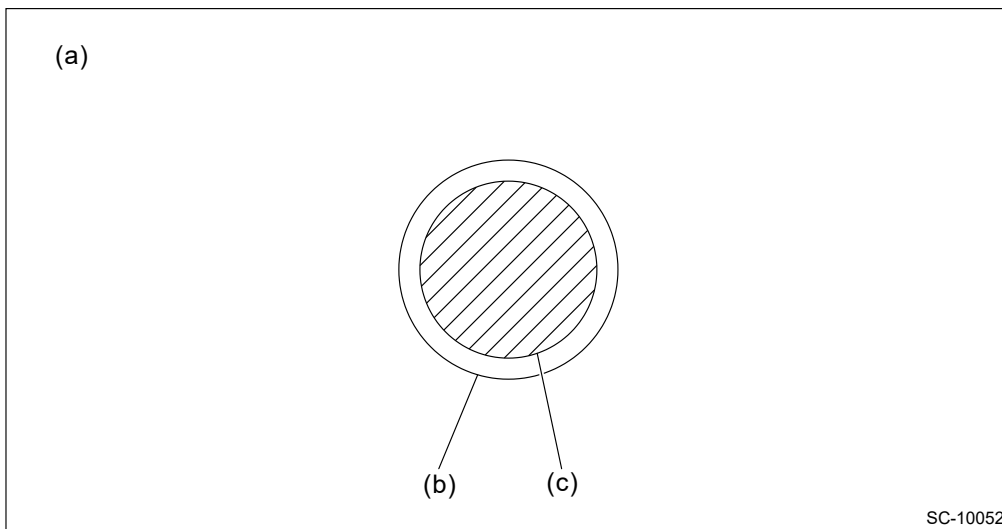


(A) Terminal S

7. NO-LOAD TEST

Caution:

- Use a thick cable due to large current flowing through the cable.
- For B terminal and ground, it is recommended that the cross-section area of continuity part (shaded part) should be 20 mm^2 (0.00310 sq in) or more. For S terminal, 1.25 mm^2 (0.00194 sq in) or more.



(a) Cable cross-section

(b) Cable shield part

(c) Cable continuity part

- It is possible to use a booster cable instead of wiring.
- Be careful not to burn yourself and cause a fire due to heat.
- Perform the no-load test in a short period of time. (Within 3 to 5 seconds)

Note:

For no-load test, use the circuit shown in figure.

INSTALLATION

1. NON-TURBO MODEL

Install in the reverse order of removal.

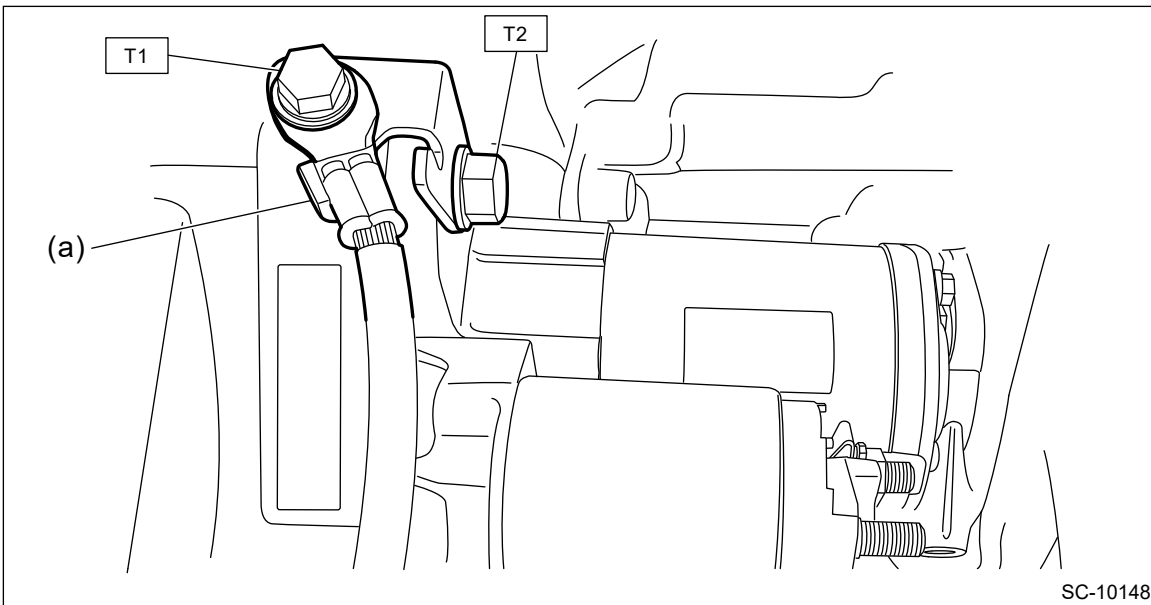
Note:

- Tighten the starter and cable stay (a) together using the upper bolt securing the starter.
- For the MT model, a bolt is used to the location (b).

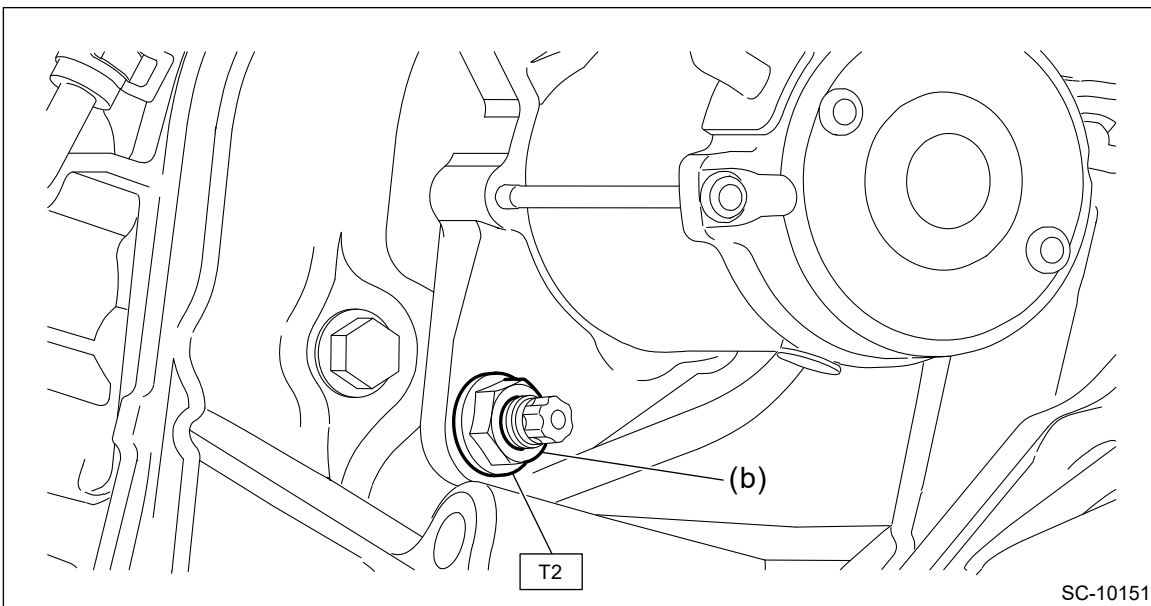
Tightening torque:

T1: 14 N•m (1.4 kgf-m, 10.3 ft-lb)

T2: 50 N•m (5.1 kgf-m, 36.9 ft-lb)



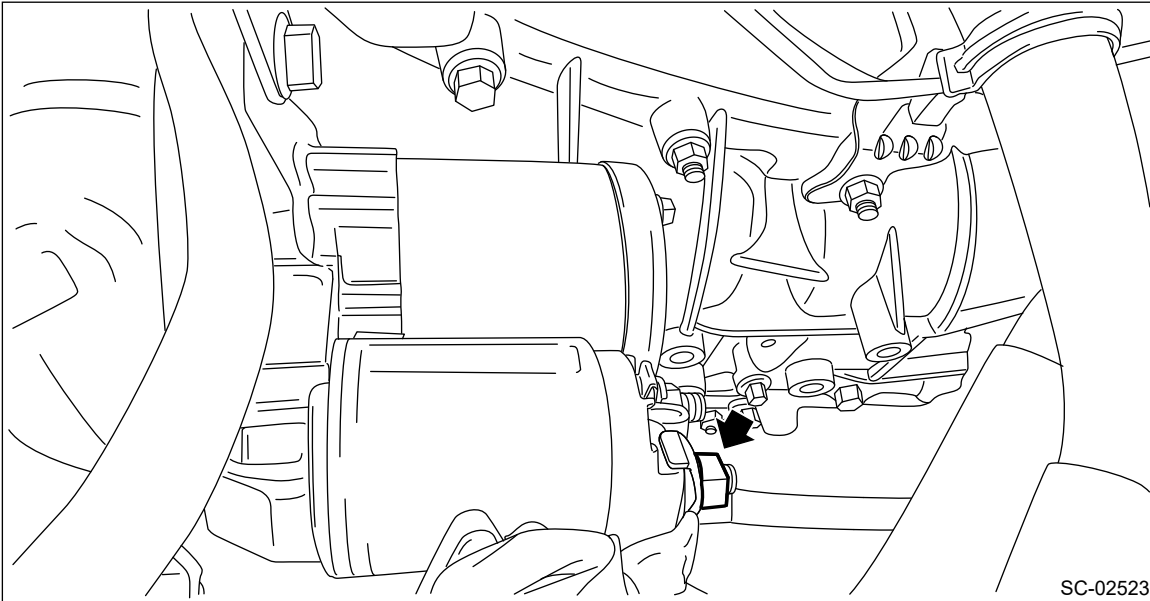
SC-10148



SC-10151

Tightening torque:

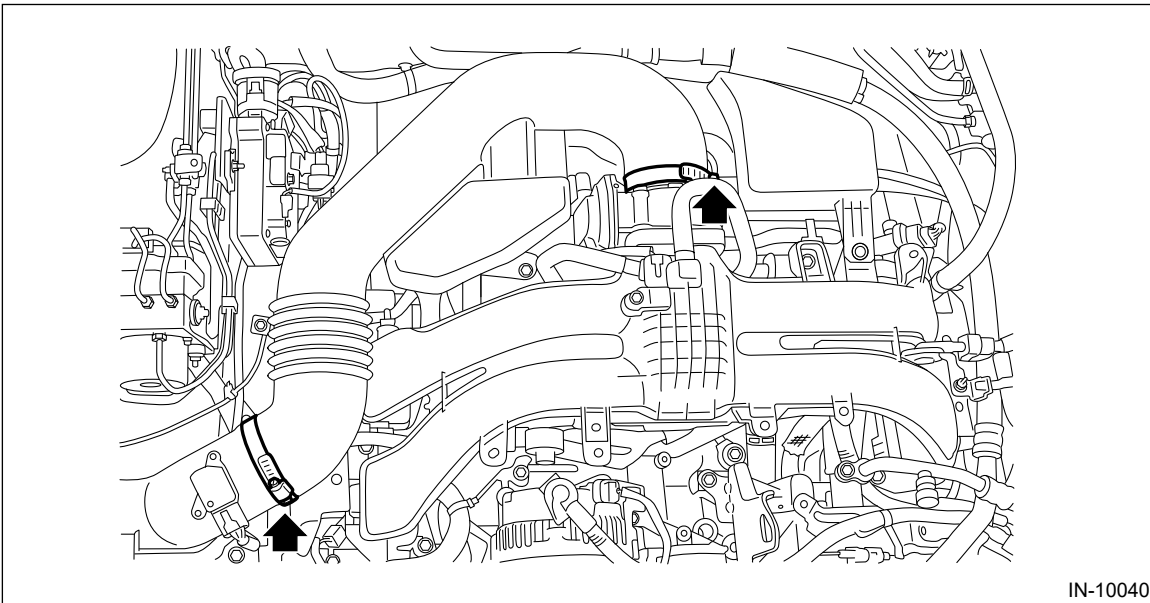
10 N•m (1.0 kgf-m, 7.4 ft-lb)



SC-02523

Tightening torque:

3 N•m (0.3 kgf-m, 2.2 ft-lb)



IN-10040

2. TURBO MODEL

Install in the reverse order of removal.

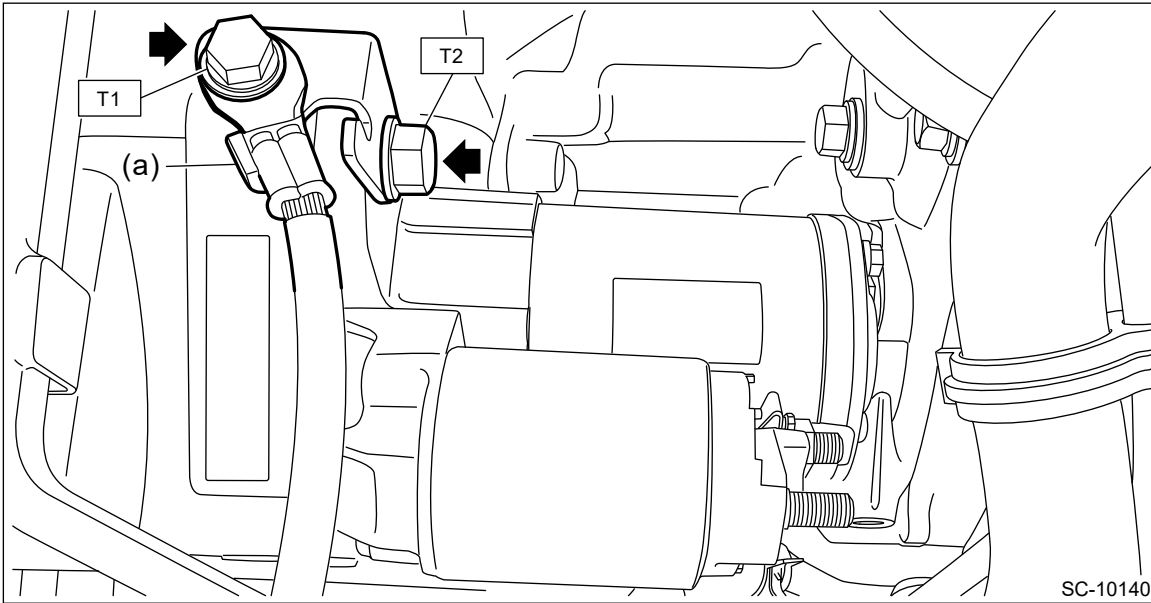
Note:

Tighten the starter and cable stay (a) together using the upper bolt securing the starter.

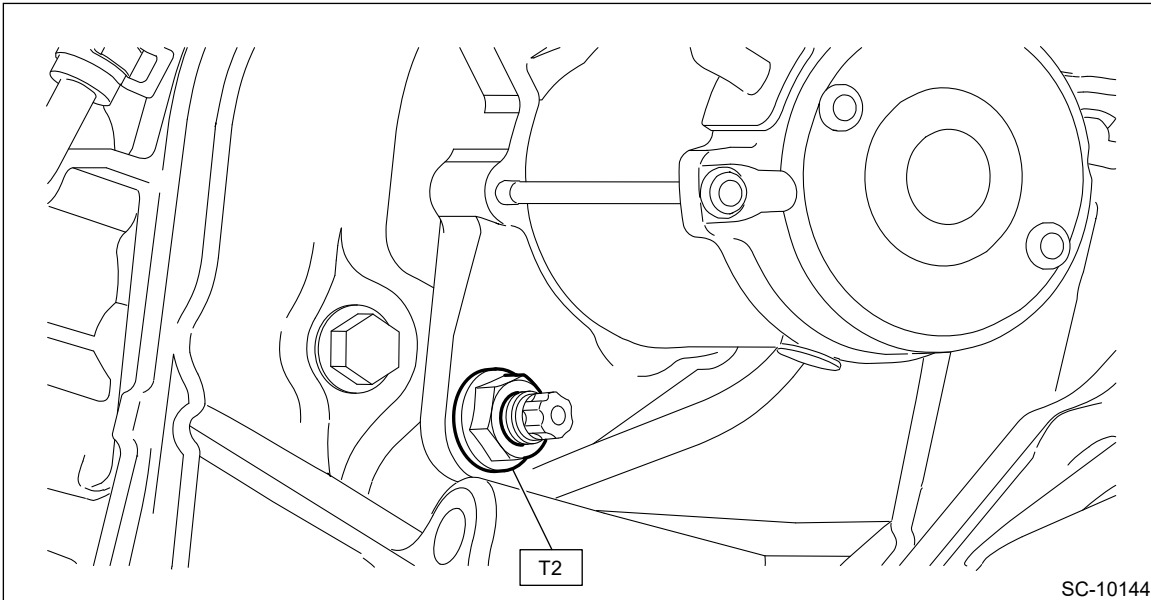
Tightening torque:

T1: 14 N•m (1.4 kgf-m, 10.3 ft-lb)

T2: 50 N•m (5.1 kgf-m, 36.9 ft-lb)



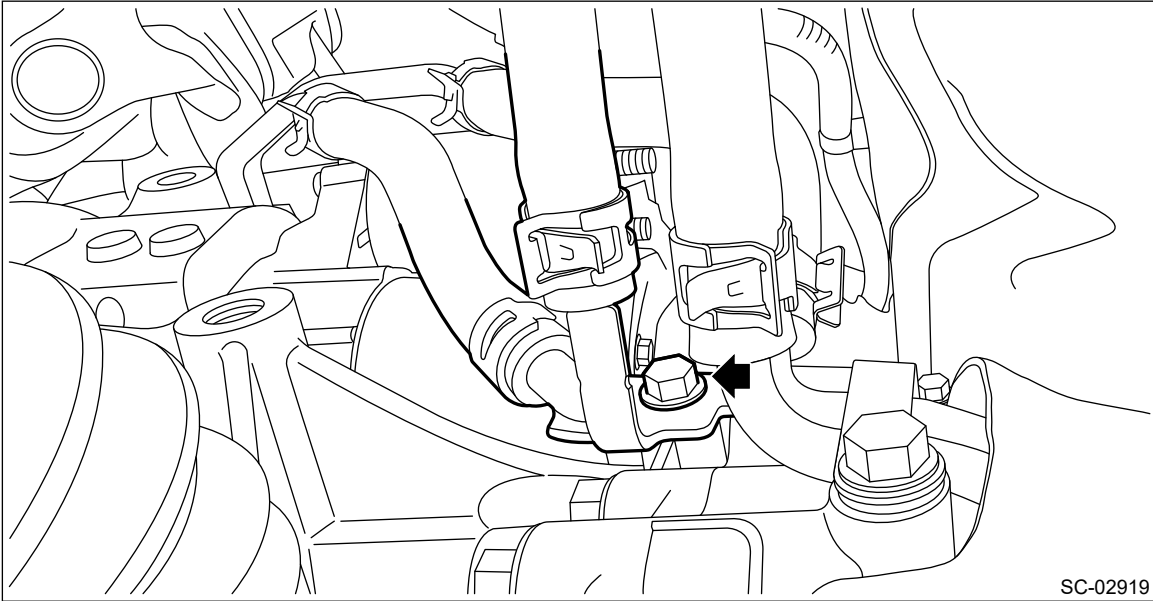
SC-10140



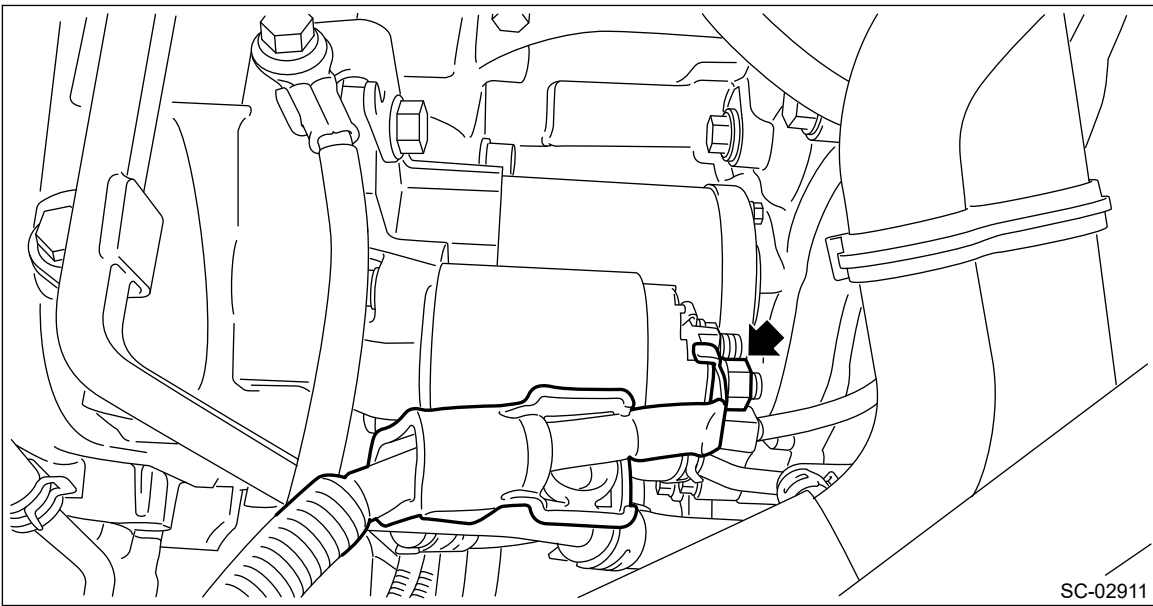
SC-10144

Tightening torque:

16 N•m (1.6 kgf-m, 11.8 ft-lb)




Tightening torque:
10 N•m (1.0 kgf-m, 7.4 ft-lb)

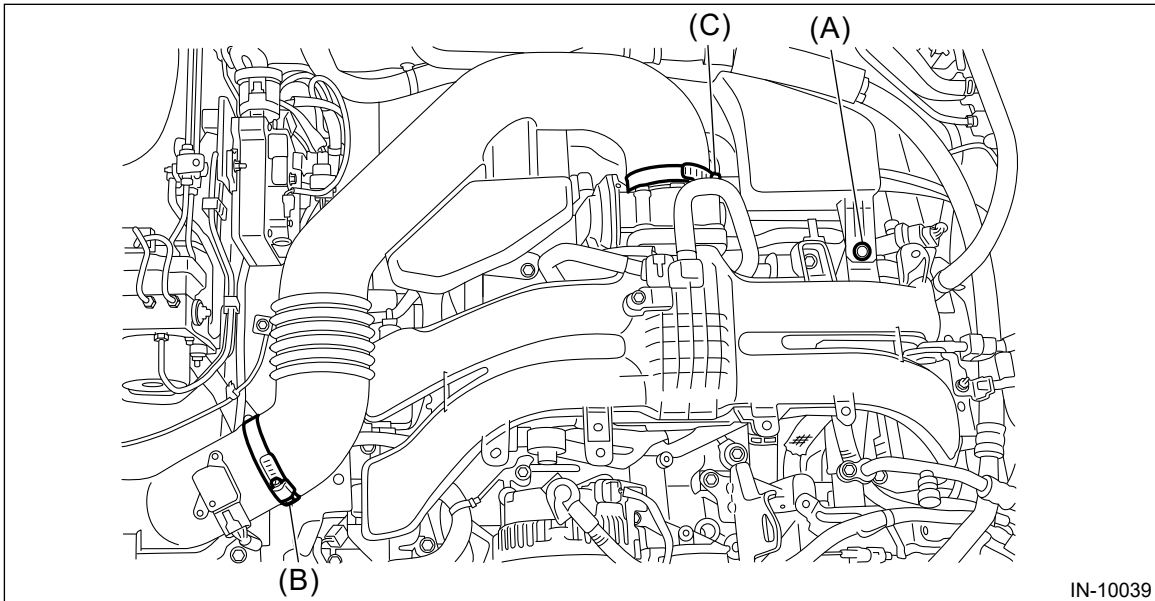


STARTING/CHARGING SYSTEMS(H4DO) > Starter

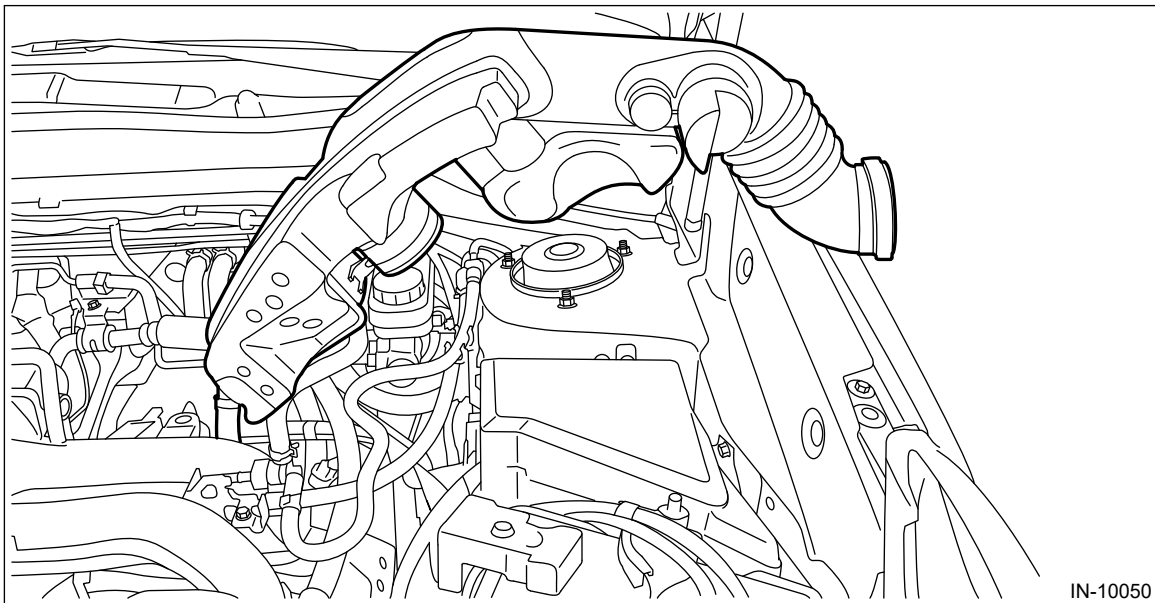
REMOVAL

1. NON-TURBO MODEL

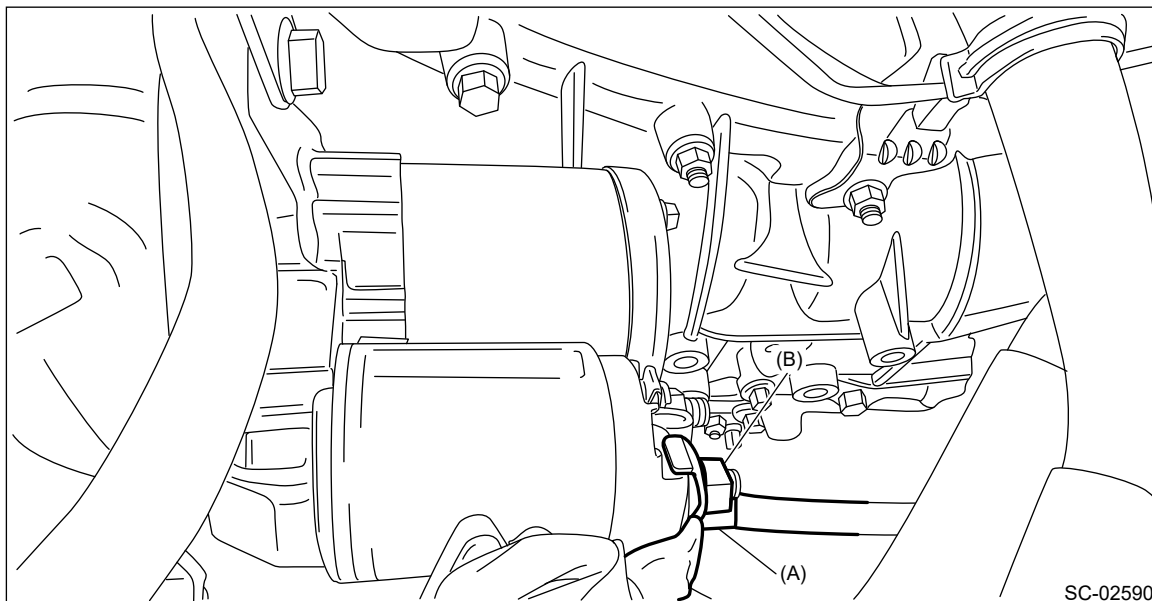
1. Disconnect the ground terminal from battery sensor.  Ref. to NOTE>NOTE > BATTERY.
2. Remove the clip (A) from the air intake boot.
3. Loosen the clamp (B) securing the air cleaner case (rear) to the air intake boot.
4. Loosen the clamp (C) which secures the throttle body to the air intake boot.



5. Remove the air intake boot from the throttle body, and place the air intake boot aside so that it does not interfere with the work.



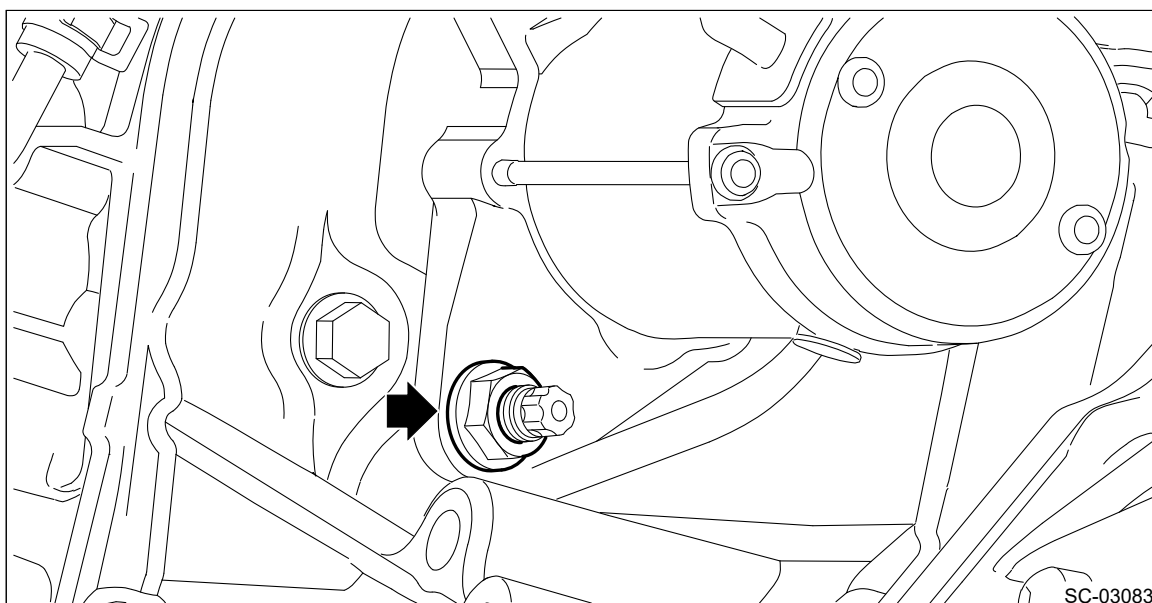
6. Disconnect the connector (A) and terminal (B) from starter.



7. Lift up the vehicle.
8. Remove the under cover front - transmission.  [Ref. to EXTERIOR/INTERIOR TRIM>General Description>COMPONENT > FLOOR UNDER PROTECTOR.](#)
9. Remove the starter lower nut.

Note:

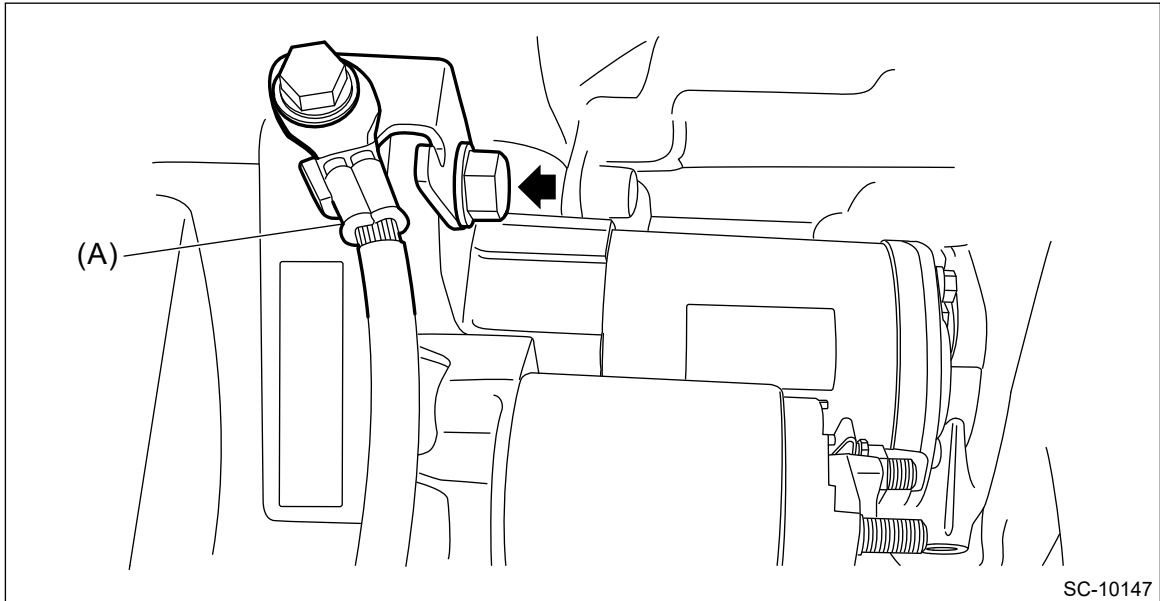
For the MT model, a bolt is used.



10. Lower the vehicle.
11. Disconnect the terminal (A) from the cable stay and remove the cable stay and starter from the transmission.

Caution:

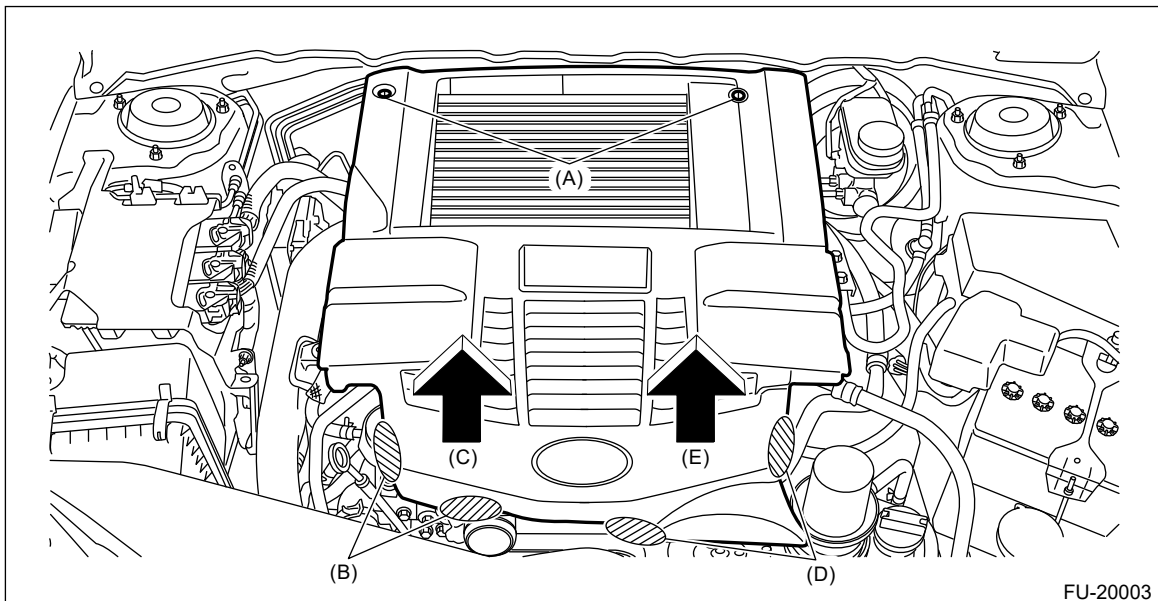
In order to prevent damaging the terminal (A), fix the terminal (A) when loosening the bolt, and avoid the part from rotating together while loosening the bolt.





SC-10147

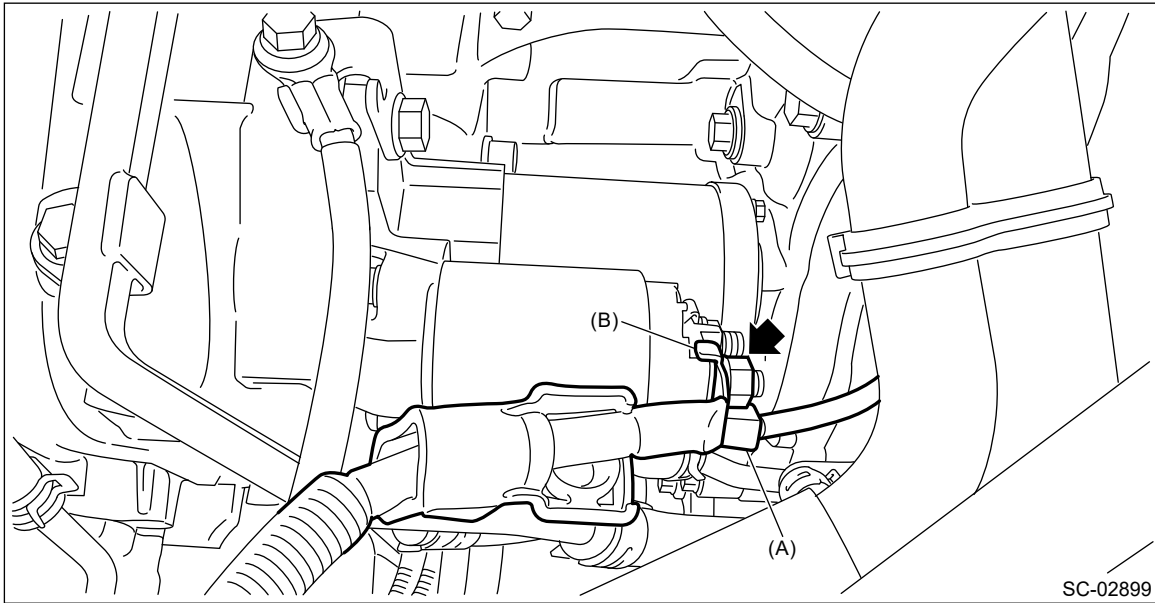
2. TURBO MODEL

1. Remove the clip (A), lift the front of the collector cover in the direction of arrow, and then remove the collector cover.
 - (1) Remove the clip (A).
 - (2) Hold the shaded area (B) by hand and carefully pull the RH side (C) upward.
 - (3) Hold the shaded area (D) by hand and carefully pull the LH side (E) upward.

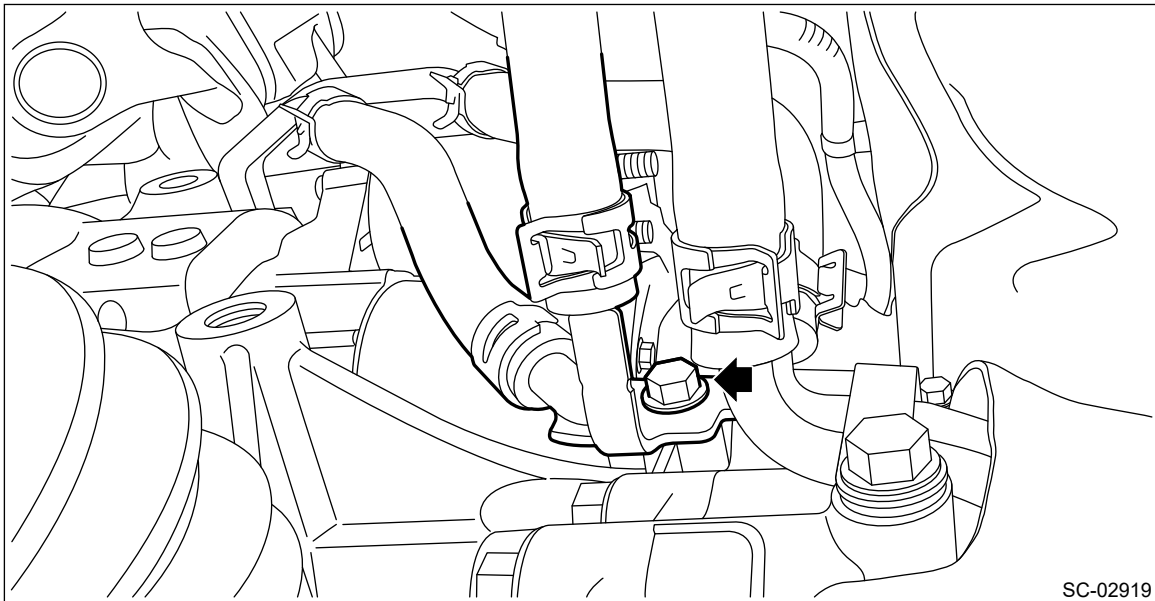


FU-20003

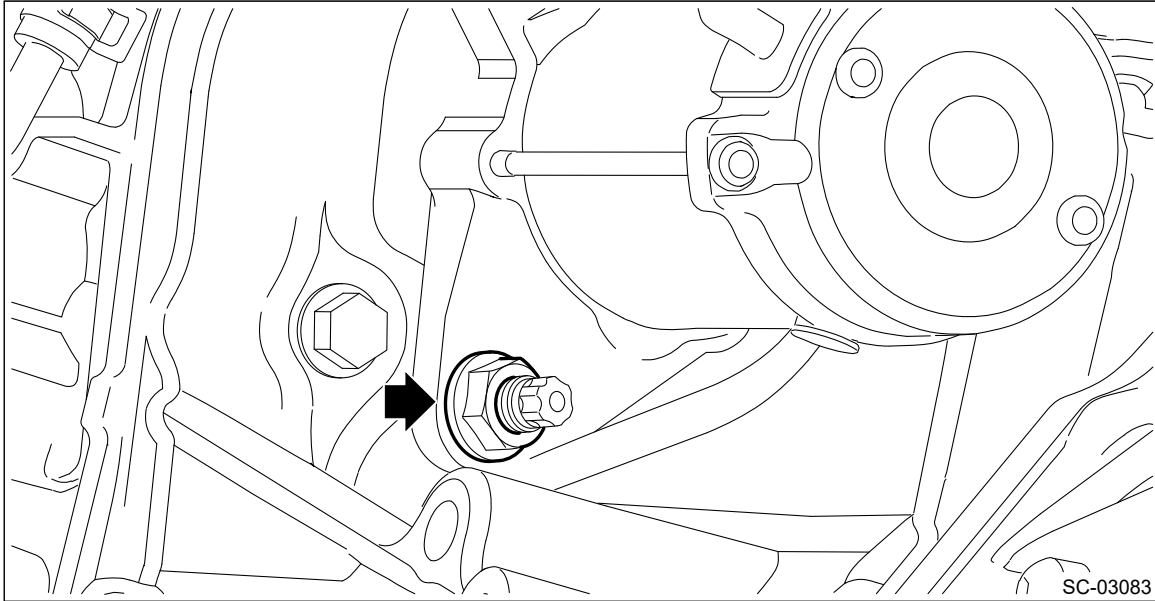
2. Disconnect the ground cable from battery.  [Ref. to NOTE>NOTE > BATTERY.](#)
3. Remove the intercooler.  [Ref. to INTAKE \(INDUCTION\)\(H4DOTC\)>Intercooler>REMOVAL.](#)
4. Disconnect the connector (A) and terminal (B) from starter.



5. Lift up the vehicle.
6. Remove the bolt which secures the CVTF cooler pipe to the transmission, and move the CVTF cooler pipe to the left side of the transmission.



7. Remove the nut at the bottom of the starter.

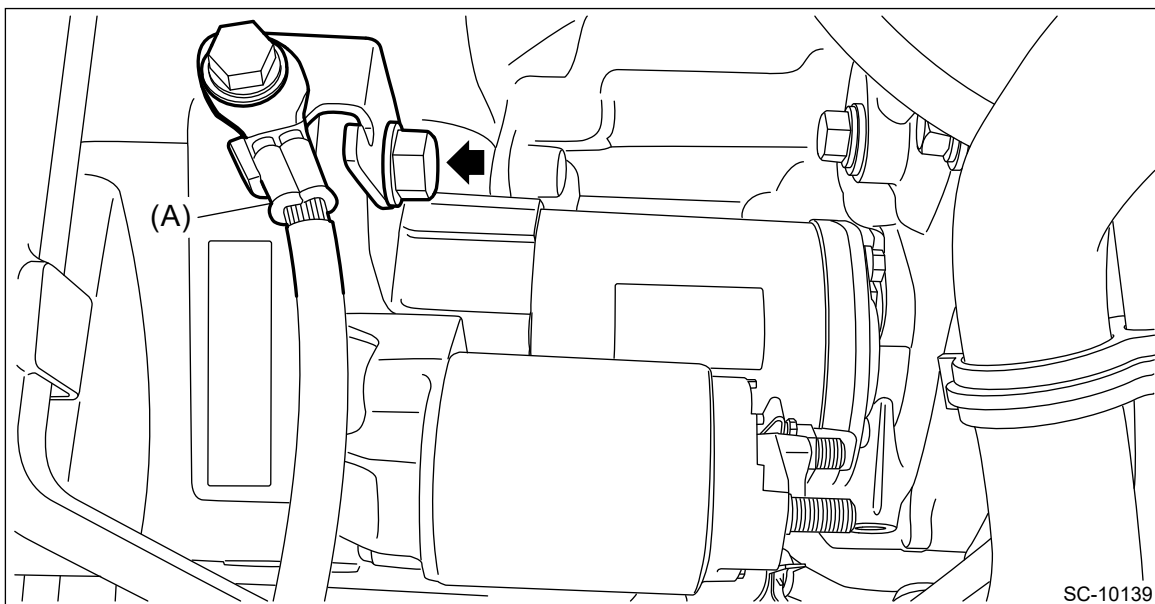


8. Lower the vehicle.
9. Disconnect the terminal (A) from the cable stay.

Caution:


In order to prevent damaging the terminal (A), fix the terminal (A) when loosening the bolt, and avoid the part from rotating together while loosening the bolt.

10. Remove the bolt (B) at the top of the starter, and remove the cable stay and starter from the transmission.



STARTING/CHARGING SYSTEMS(H4DOTC) > General Description

SPECIFICATION

Specifications for the turbo model are included in the SC(H4DO) section.  [Ref. to STARTING/CHARGING SYSTEMS\(H4DO\)>General Description.](#)

