

**ENGINE SECTION 2**

This service manual has been prepared to provide SUBARU service personnel with the necessary information and data for the correct maintenance and repair of SUBARU vehicles. This manual includes the procedures for maintenance, disassembling, reassembling, inspection and adjustment of components and diagnostics for guidance of experienced mechanics. Please peruse and utilize this manual fully to ensure complete repair work for satisfying our customers by keeping their vehicle in optimum condition. When replacement of parts during repair work is needed, be sure to use SUBARU genuine parts.

All information, illustration and specifications contained in this manual are based on the latest product information available at the time of publication approval.

<b>FUEL INJECTION (FUEL SYSTEMS)</b>	<b>FU(H4DOTC)</b>
<b>EMISSION CONTROL (AUX. EMISSION CONTROL DEVICES)</b>	<b>EC(H4DOTC)</b>
<b>INTAKE (INDUCTION)</b>	<b>IN(H4DOTC)</b>
<b>MECHANICAL</b>	<b>ME(H4DOTC)</b>
<b>EXHAUST</b>	<b>EX(H4DOTC)</b>
<b>COOLING</b>	<b>CO(H4DOTC)</b>
<b>LUBRICATION</b>	<b>LU(H4DOTC)</b>
<b>SPEED CONTROL SYSTEMS</b>	<b>SP(H4DOTC)</b>
<b>IGNITION</b>	<b>IG(H4DOTC)</b>
<b>STARTING/CHARGING SYSTEMS</b>	<b>SC(H4DOTC)</b>
<b>ENGINE (DIAGNOSTICS)</b>	<b>EN(H4DOTC)(diag)</b>

# FUEL INJECTION (FUEL SYSTEMS)

# *FU(H4DOTC)*

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# COOLING

# CO(H4DOTC)

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# General Description

COOLING

## 1. General Description

### A: SPECIFICATION

Cooling system		Electric fan + Forced engine coolant circulation system		
Total engine coolant capacity		ℓ (US qt, Imp qt)		
		Approx. 7.3 (7.7, 6.4)		
Water pump	Type		Centrifugal impeller type	
	Discharge performance I	Discharge amount ℓ (US gal, Imp gal)/min	20 (5.3, 4.4)	
		Pump speed — Discharge pressure	760 rpm — 2.9 kPa (0.3 mAq)	
		Engine coolant temperature	85°C (185°F)	
	Discharge performance II	Discharge amount ℓ (US gal, Imp gal)/min	100 (26.4, 22.0)	
		Pump speed — Discharge pressure	3,000 rpm — 49.0 kPa (5.0 mAq)	
		Engine coolant temperature	85°C (185°F)	
	Discharge performance III	Discharge amount ℓ (US gal, Imp gal)/min	200 (52.8, 44.0)	
		Pump speed — Discharge pressure	6,000 rpm — 225.4 kPa (23.0 mAq)	
		Engine coolant temperature	85°C (185°F)	
	Impeller diameter		mm (in)	76 (2.99)
	Number of impeller vanes			8
Pump pulley diameter		mm (in)	60 (2.36)	
Clearance between impeller and case	Standard	mm (in)	0.5 — 1.5 (0.020 — 0.059)	
Thermostat	Type		Wax pellet type	
	Starting temperature to open		76 — 80°C (169 — 176°F)	
	Fully opens		91°C (196°F)	
	Valve lift	mm (in)	9.0 (0.354) or more	
	Valve bore	mm (in)	35 (1.38)	
Radiator fan	Motor input	Main fan	W 90	
		Sub fan	W 90	
	Fan diameter / Blades	Main fan	300 mm (11.8 in) /4	
		Sub fan	300 mm (11.8 in) /5	
Radiator	Type		Down flow	
	Core dimensions	Width × Height × Thickness mm (in)	687.4 × 340 × 16 (27.06 × 13.39 × 0.63)	
	Pressure range in which cap valve is open	Coolant filler tank side kPa (kg/cm <sup>2</sup> , psi)	Above: 108±15 (1.1±0.15, 16±2) Below: -1.0 — -4.9 (-0.01 — -0.05, -0.1 — -0.7)	
		Radiator side kPa (kg/cm <sup>2</sup> , psi)	Above only: 137±14.7 (1.40±0.15, 20±2.1)	
	Fins		Corrugated fin type	
Reservoir tank	Capacity	ℓ (US qt, Imp qt)	0.45 (0.48, 0.40)	

# General Description

COOLING

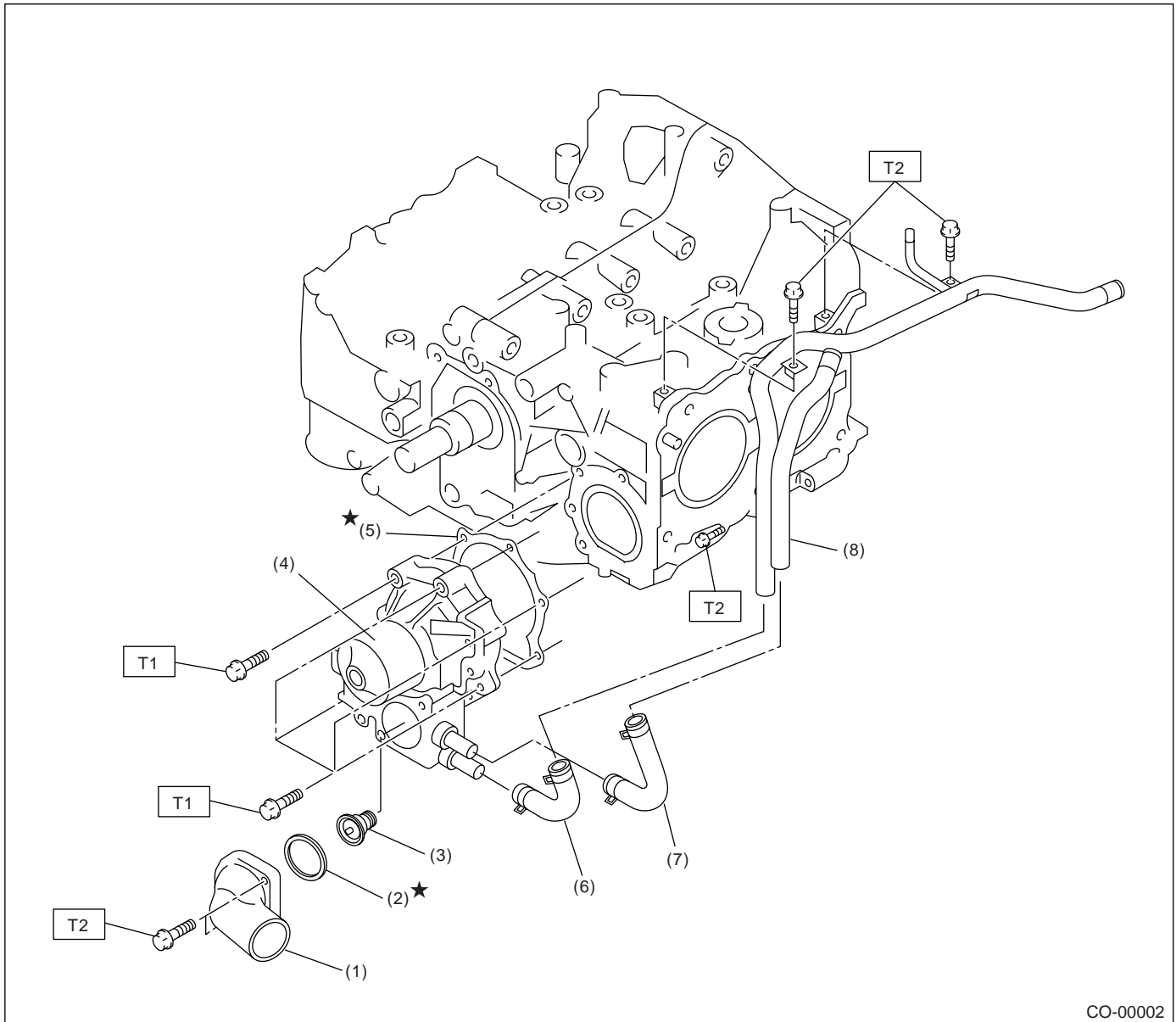
Vehicle speed	A/C compressor load	Engine coolant temperature		
		95°C (203°F) or less	96 — 99°C (205 — 210°F)	100°C (212°F) or more
		Operation of radiator fan	Operation of radiator fan	Operation of radiator fan
19 km/h (12 MPH) or less	OFF	OFF	Low-Speed	High-Speed
	Low	Low-Speed	Low-Speed	High-Speed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

# General Description

COOLING

## B: COMPONENT

### 1. WATER PUMP



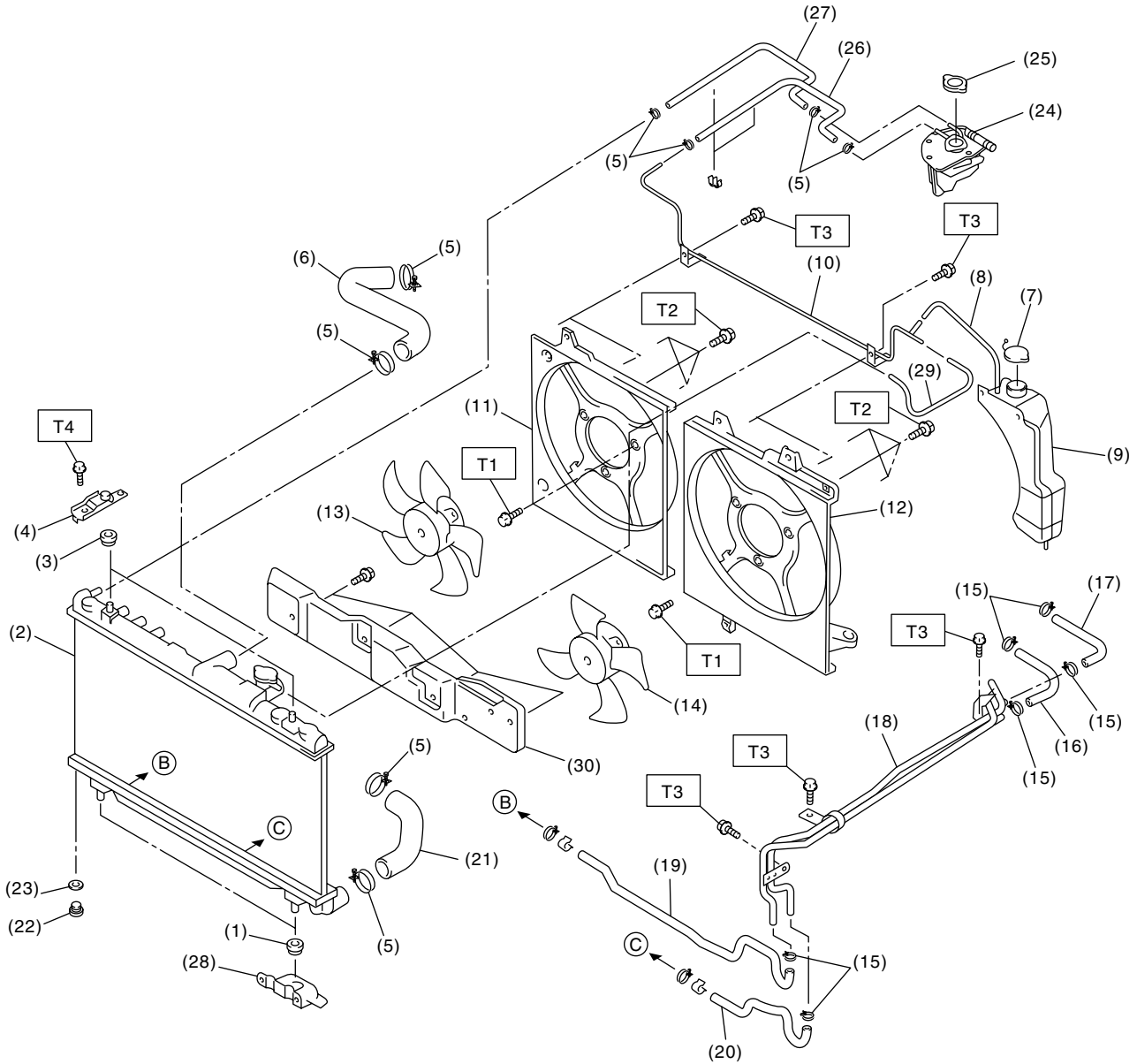
- |                      |                                 |
|----------------------|---------------------------------|
| (1) Thermostat cover | (5) Gasket                      |
| (2) Gasket           | (6) Heater by-pass hose         |
| (3) Thermostat       | (7) Coolant filler by-pass hose |
| (4)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

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

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

**T2: 12 (1.2, 8.7)**

## 2. RADIATOR AND RADIATOR FAN



CO-02004

# General Description

## COOLING

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

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

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### C: CAUTION

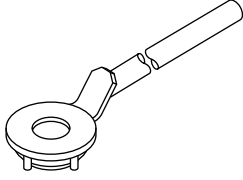
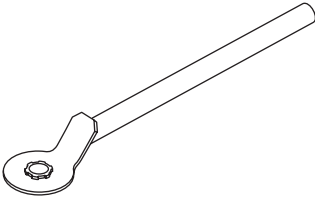
- Wear work clothing, including a cap, protective goggles, and protective shoes during operation.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation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



# General Description

COOLING

## D: PREPARATION TOOL

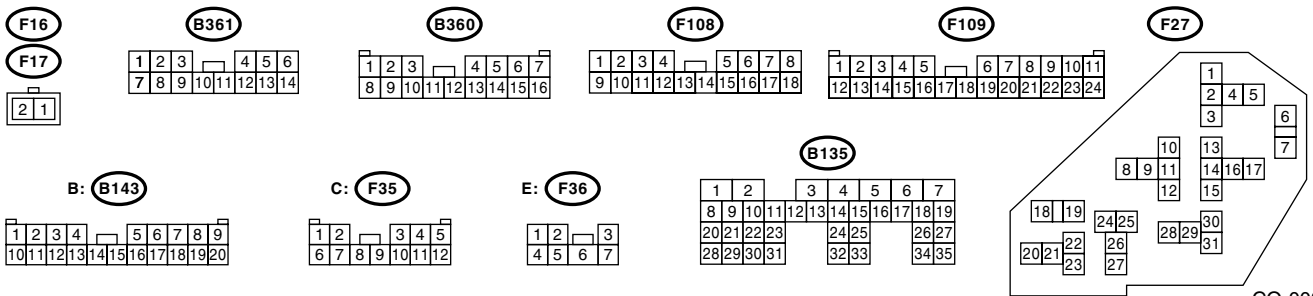
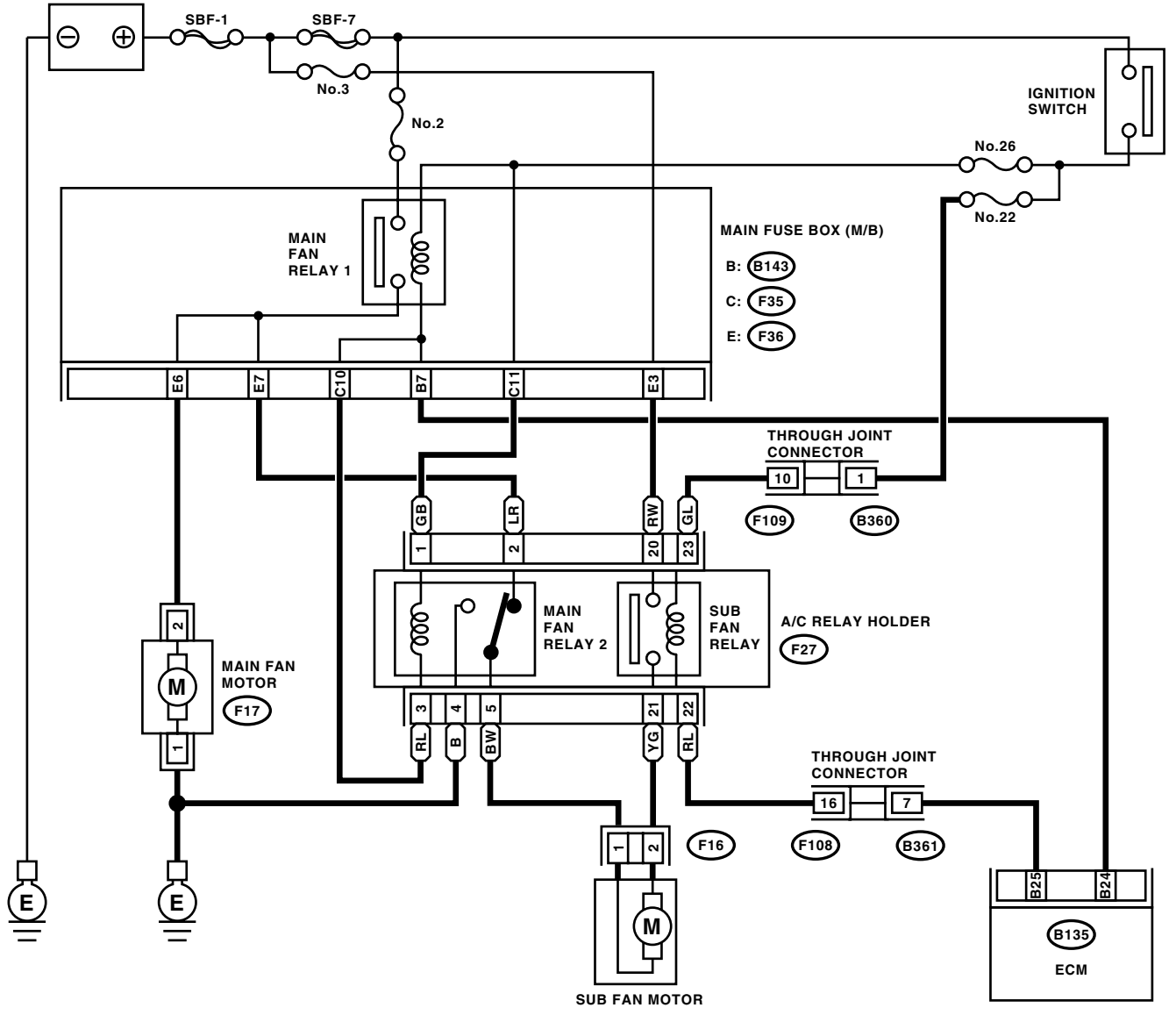
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 <p>ST-499977400</p>	499977400	CRANK PULLEY WRENCH	Used for stopping crank pulley when loosening and tightening crank pulley bolts.
 <p>ST-499977500</p>	499977500	CAM SPROCKET WRENCH	Used for removing and installing the intake and exhaust camshaft sprocket.

# Radiator Fan System

COOLING

## 2. Radiator Fan System

### A: WIRING DIAGRAM



CO-00298

## B: INSPECTION

### DETECTING CONDITION:

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

### TROUBLE SYMPTOMS:

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

Step	Check	Yes	No
<b>1 CHECK OPERATION OF RADIATOR FAN.</b> 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. NOTE: • When performing the compulsory operation check for the radiator fan relay using Subaru Select Monitor, the radiator main fan and sub fan will repeat such a operation as low speed revolution → high speed revolution → OFF in this order. • Refer to Compulsory Valve Operation Check Mode for more operation procedure. <Ref. to EN(H4DOTC)(diag)-31, Compulsory Valve Operation Check Mode.>	Do the radiator main fan and sub fan rotate at low speed?	Go to step 2.	Go to step 3.
<b>2 CHECK OPERATION OF RADIATOR FAN.</b> 1) Connect the test mode connector. 2) Turn the ignition switch to ON. 3) Perform the compulsory operation check for the radiator fan relay using Subaru Select Monitor. NOTE: • When performing the compulsory operation check for the radiator fan relay using Subaru Select Monitor, the radiator main fan and sub fan will repeat such a operation as low speed revolution → high speed revolution → OFF in this order. • Refer to Compulsory Valve Operation Check Mode for more operation procedure. <Ref. to EN(H4DOTC)(diag)-31, Compulsory Valve Operation Check Mode.>	Do the radiator main fan and sub fan rotate at high speed?	Radiator fan system is normal.	Go to step 27.
<b>3 CHECK POWER SUPPLY TO SUB FAN RELAY.</b> 1) Turn the ignition switch to OFF. 2) Remove the sub fan relay from A/C relay holder. 3) Measure the voltage between sub fan relay terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 20 (+) — Chassis ground (-):</b>	Is the voltage more than 10 V?	Go to step 4.	Go to step 5.
<b>4 CHECK POWER SUPPLY TO SUB FAN RELAY.</b> 1) Turn the ignition switch to ON. 2) Measure the voltage between sub fan relay terminal and chassis ground. <b>Connector &amp; terminal</b> <b>(F27) No. 23 (+) — Chassis ground (-):</b>	Is the voltage more than 10 V?	Go to step 7.	Go to step 6.

# Radiator Fan System

COOLING

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

# Radiator Fan System

COOLING

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

# Radiator Fan System

COOLING

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

## 3. Engine Coolant

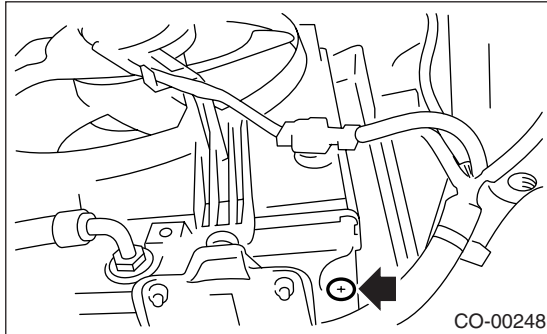
### A: REPLACEMENT

#### 1. DRAINING OF ENGINE COOLANT

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

**NOTE:**

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



- 4) Install the drain plug.

#### 2. FILLING OF ENGINE COOLANT

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

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

**Approx. 7.3 ℓ (7.7 US qt, 6.4 Imp qt)**

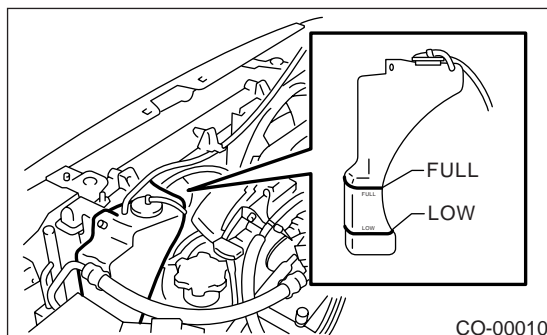
**CAUTION:**

**Do not confuse the cap of coolant filler tank and cap of radiator.**

**NOTE:**

- When pouring the engine coolant, the radiator side cap must not be removed.
- The SUBARU Genuine Coolant containing anti-freeze and anti-rust agents is especially made for SUBARU engine, which has an aluminum crank-case. Always use SUBARU Genuine Coolant, since other coolant may cause corrosion.

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



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

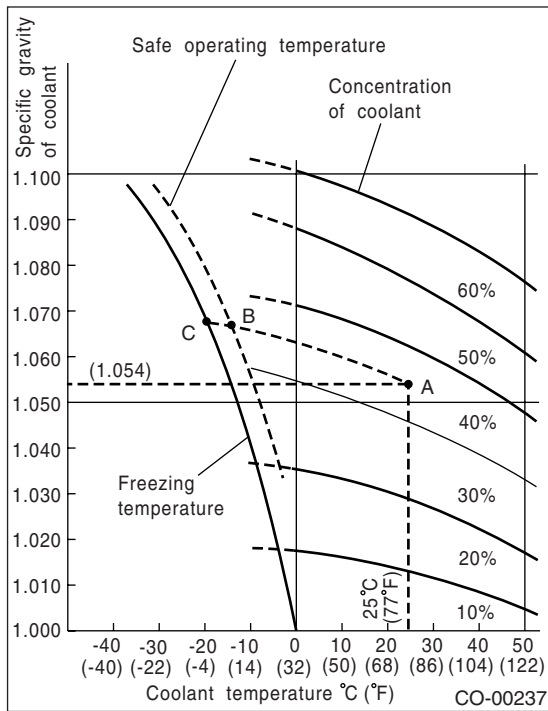
## B: INSPECTION

### 1. RERATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

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

[Example]

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



### 2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

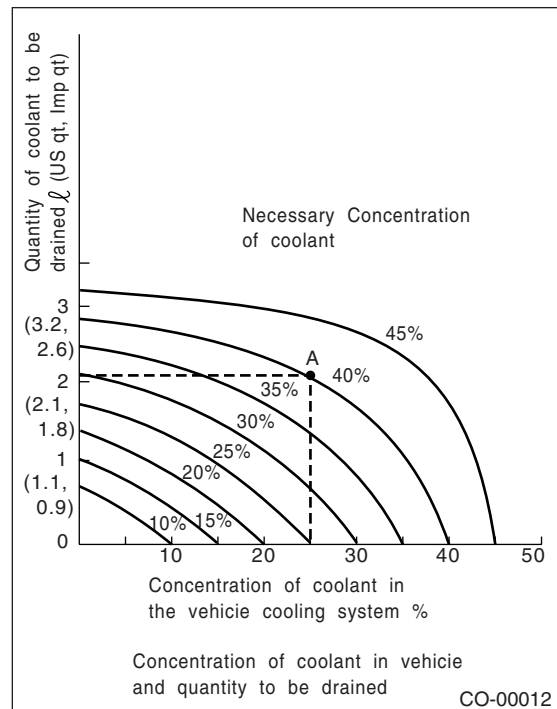
To adjust the concentration of coolant according to temperature, find the proper fluid concentration in the above diagram and replace the necessary amount of coolant with an undiluted solution of SUBARU genuine coolant (concentration 50%).

The amount of coolant that should be replaced can be determined using the diagram.

[Example]

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

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

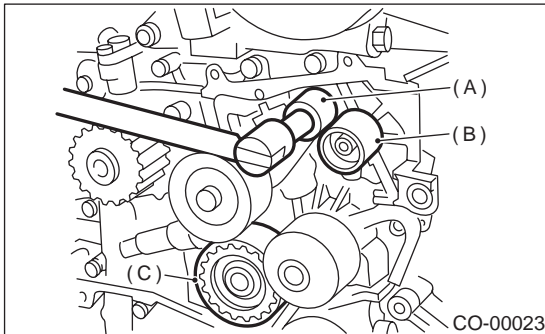




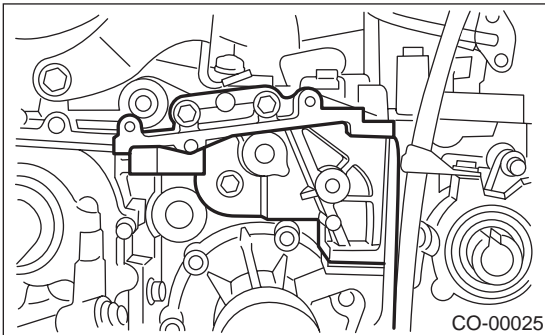
## 4. Water Pump

### A: REMOVAL

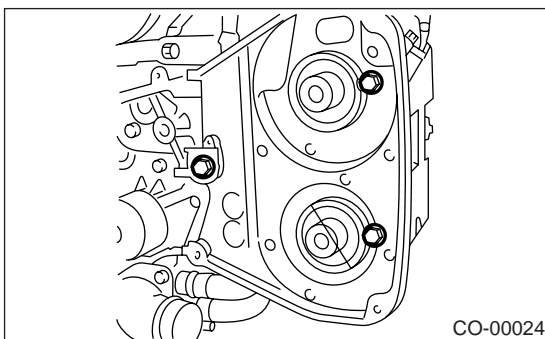
- 1) Remove the collector cover.
- 2) Remove the radiator. <Ref. to CO(H4DOTC)-19, REMOVAL, Radiator.>
- 3) Remove the V-belts. <Ref. to ME(H4DOTC)-39, REMOVAL, V-belt.>
- 4) Remove the timing belt. <Ref. to ME(H4DOTC)-43, REMOVAL, Timing Belt.>
- 5) Remove the automatic belt tension adjuster (A).
-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



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

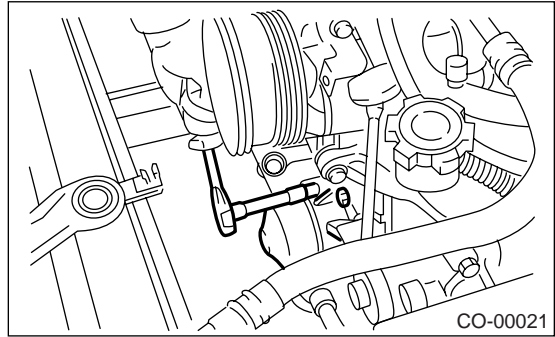


- 11) Remove the belt cover No. 2 (LH).



- 12) Disconnect the hose from water pump.

- 13) Remove the water pump.



### B: INSTALLATION

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

#### NOTE:

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

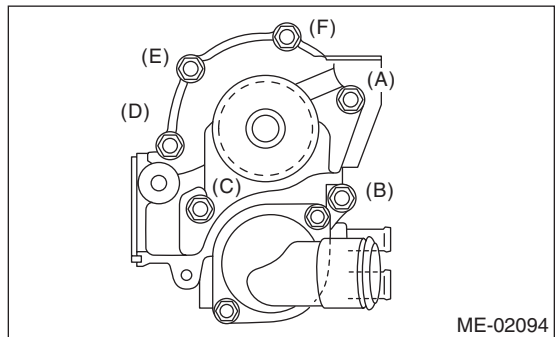
#### Tightening torque:

##### First:

**12 N·m (1.2 kgf-m, 8.7 ft-lb)**

##### Second:

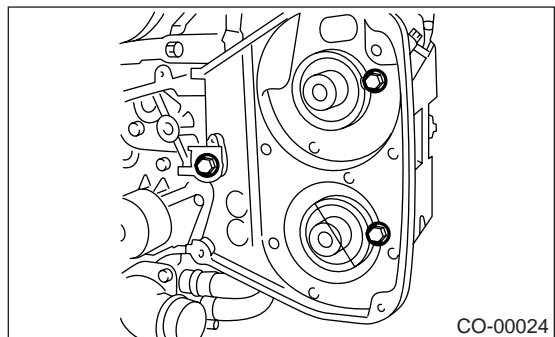
**12 N·m (1.2 kgf-m, 8.7 ft-lb)**



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

#### Tightening torque:

**5 N·m (0.5 kgf-m, 3.6 ft-lb)**



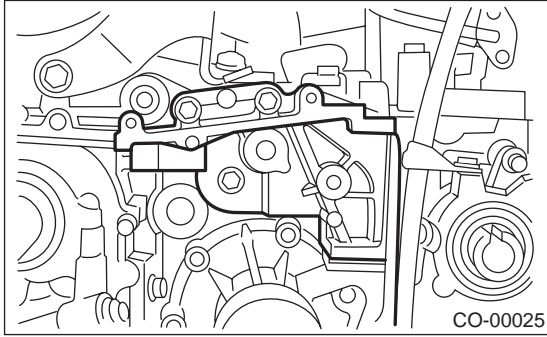
# Water Pump

## COOLING

4) Install the tensioner bracket.

**Tightening torque:**

**25 N·m (2.5 kgf·m, 18.1 ft-lb)**



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

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

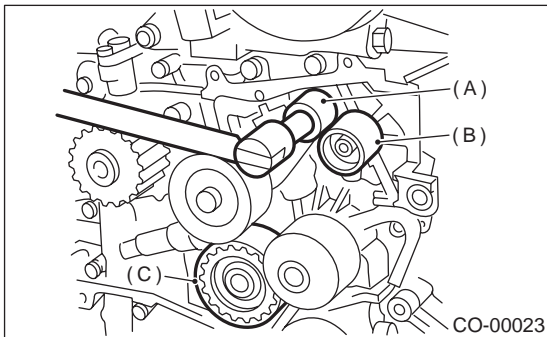
7) Install the belt idler No. 2 (C).

8) Install the belt idler (B).

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

**Tightening torque:**

**39 N·m (4.0 kgf·m, 28.9 ft-lb)**



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

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

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

13) Install the collector cover.

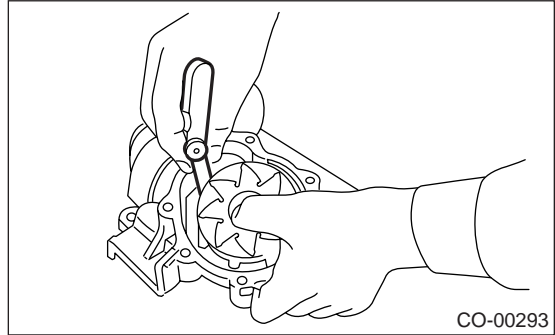
## C: INSPECTION

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

**Clearance between impeller and pump case:**

**Standard value**

**0.5 — 1.5 mm (0.020 — 0.059 in)**

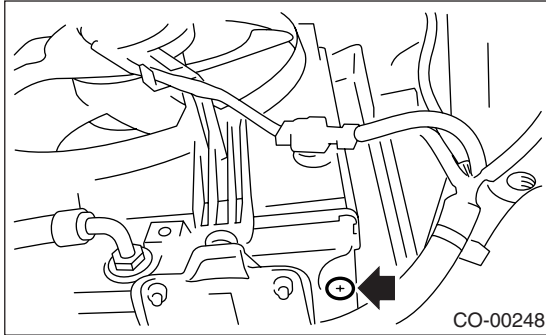


5) After water pump installation, check the pulley shaft for engine coolant leaks and noise. If leaks or noise are noted, replace the water pump assembly.

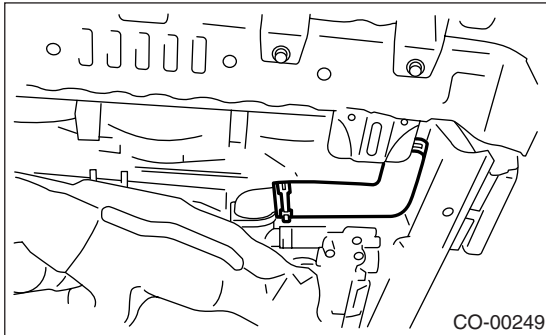
## 5. Thermostat

### A: REMOVAL

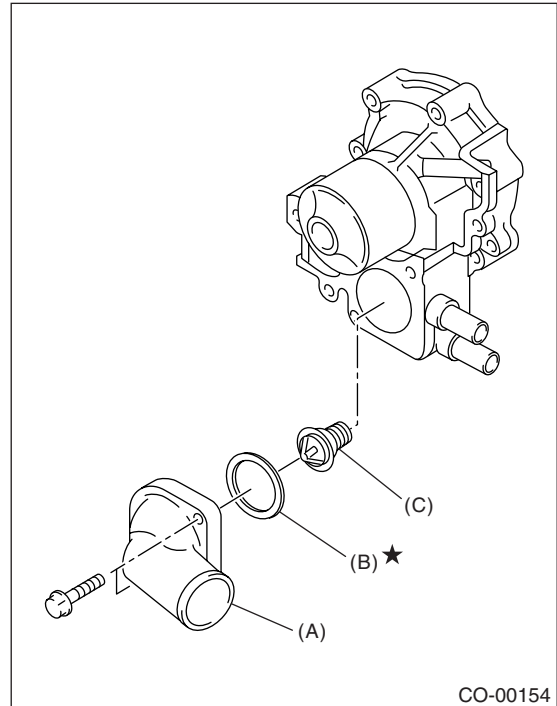
- 1) Set the vehicle on a lift.
- 2) Lift-up the vehicle.
- 3) Remove the under cover.
- 4) Drain engine coolant completely.  
<Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



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



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



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

### B: INSTALLATION

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

#### NOTE:

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

# Thermostat

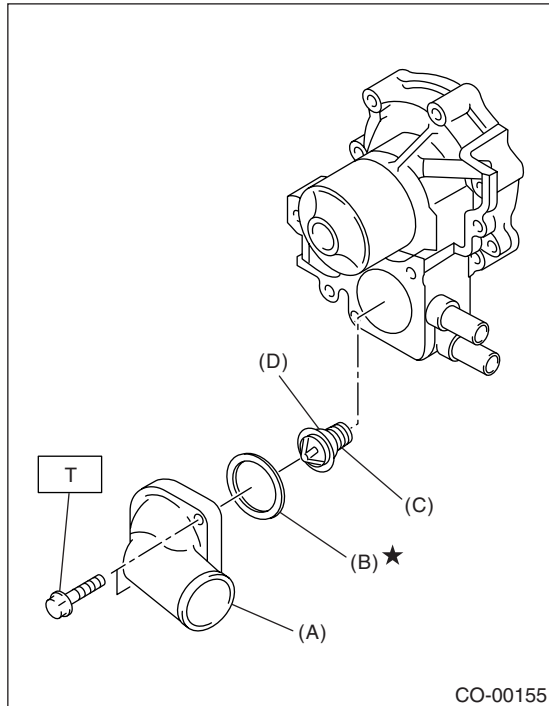
## COOLING

### Tightening torque:

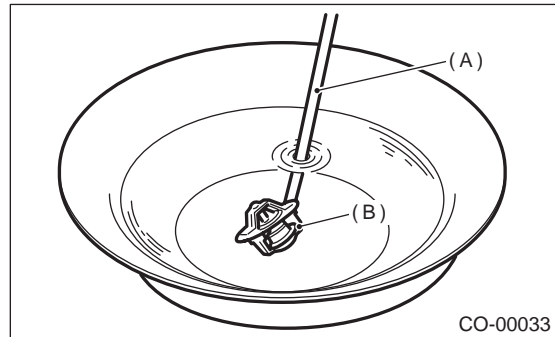
**12 N·m (1.2 kgf-m, 8.7 ft-lb)**

### Valve lift:

**9.0 mm (0.354 in) or more**



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



- (A) Thermometer
- (B) Thermostat

- 2) Connect the radiator outlet hose to thermostat cover.
- 3) Install the under cover.
- 4) Lower the vehicle.
- 5) Fill with engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

## C: INSPECTION

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

### • Inspection method

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

### Starting temperature to open:

**76 — 80°C (169 — 176°F)**

### Fully opens:

**91°C (196°F)**

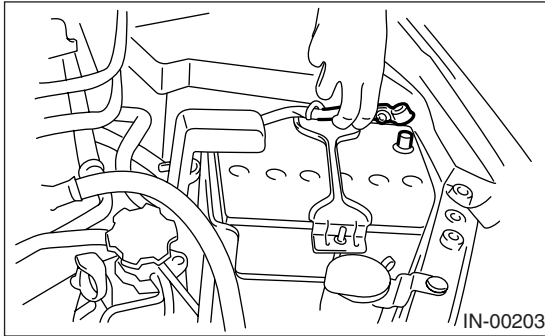
## 6. Radiator

### A: REMOVAL

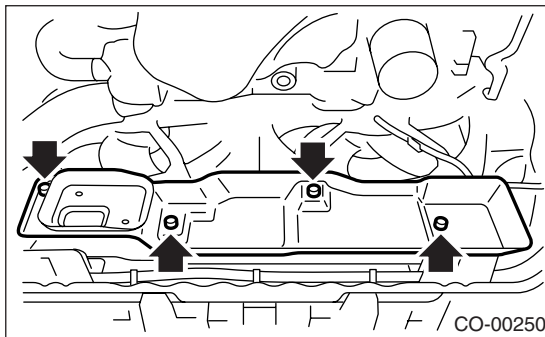
**WARNING:**

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

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

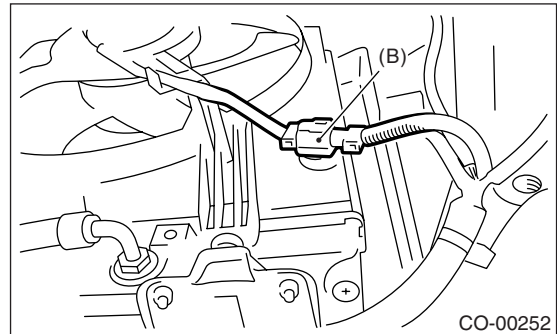
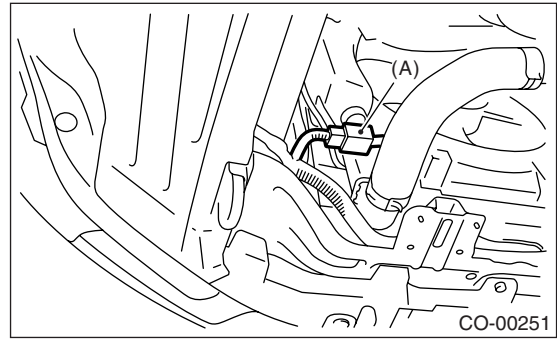


- 4) Lift-up the vehicle.
- 5) Remove the under cover.
- 6) Remove the heat shield cover from radiator.

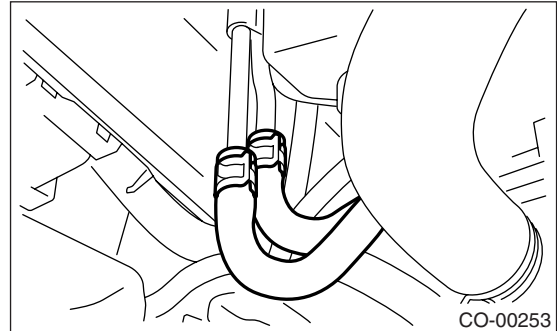


- 7) Drain engine coolant completely.  
<Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

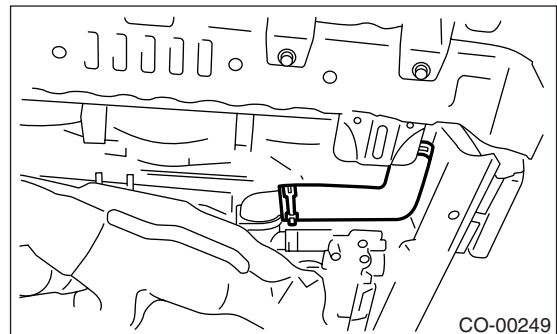
- 8) Disconnect the connectors of radiator main fan motor (A) and sub fan motor (B).



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



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

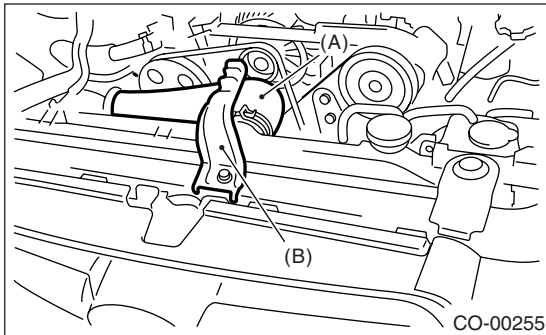


- 11) Lower the vehicle.
- 12) Remove the air intake duct. <Ref. to IN(H4DOTC)-9, REMOVAL, Air Intake Duct.>
- 13) Disconnect the over flow hose.

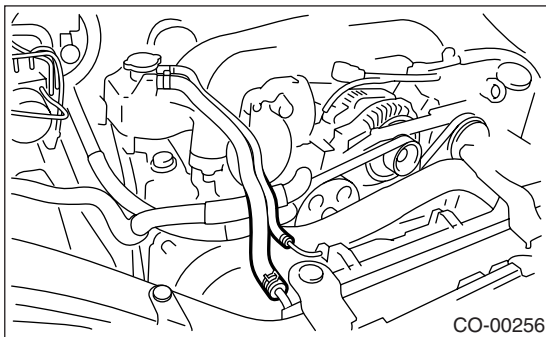
# Radiator

## COOLING

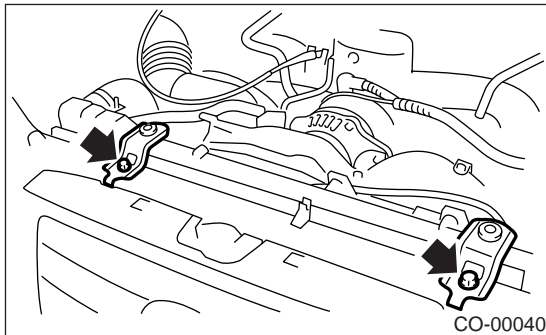
- 14) Remove the reservoir tank. <Ref. to CO(H4DOTC)-30, REMOVAL, Reservoir Tank.>
- 15) Disconnect the radiator inlet hose (A) from radiator.
- 16) Remove the hood stay holder (B).



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



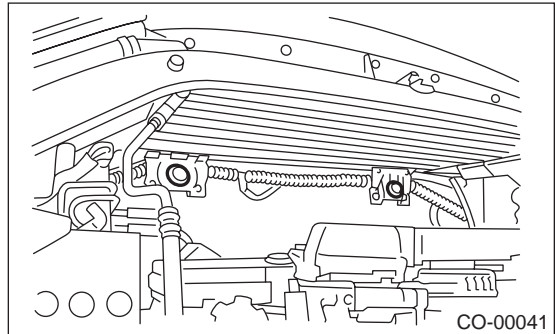
- 18) Remove the radiator upper brackets.



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

## B: INSTALLATION

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



- 2) Install the radiator to vehicle.

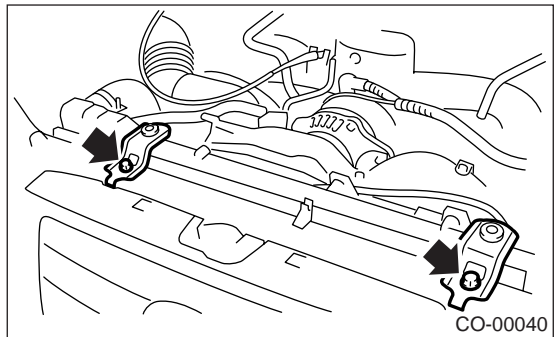
### NOTE:

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

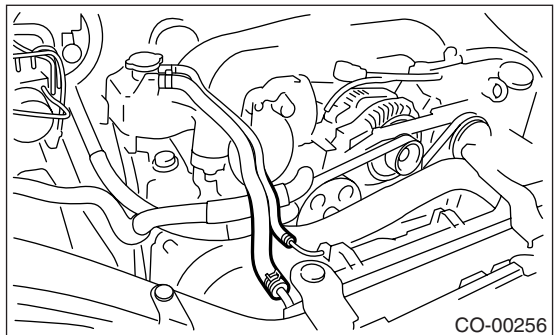
- 3) Install the radiator upper brackets and tighten the bolts.

### Tightening torque:

**18 N·m (1.8 kgf-m, 13.0 ft-lb)**



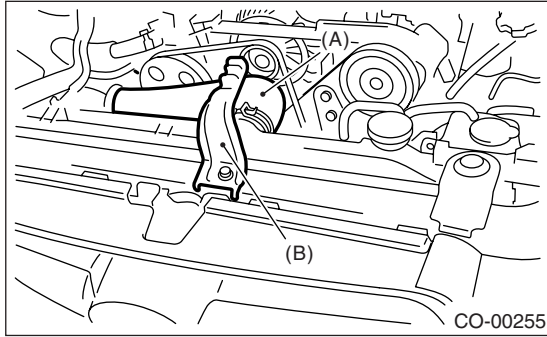
- 4) Connect the two coolant filler tank hoses to radiator.



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



6) Install the hood stay holder (B).



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

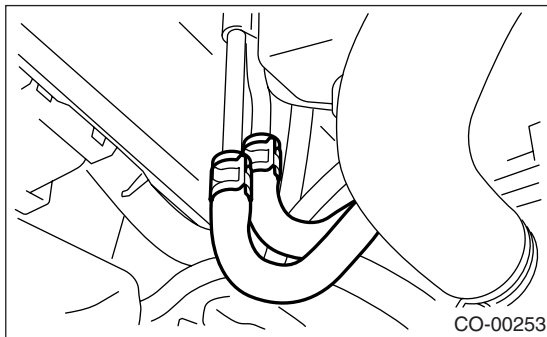
8) Connect the over flow hose.

9) Install the air intake duct.

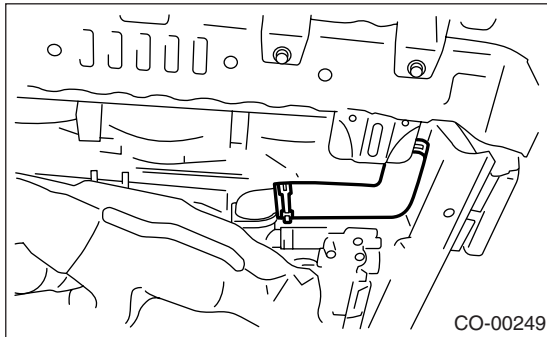
<Ref. to IN(H4DOTC)-9, INSTALLATION, Air Intake Duct.>

10) Lift-up the vehicle.

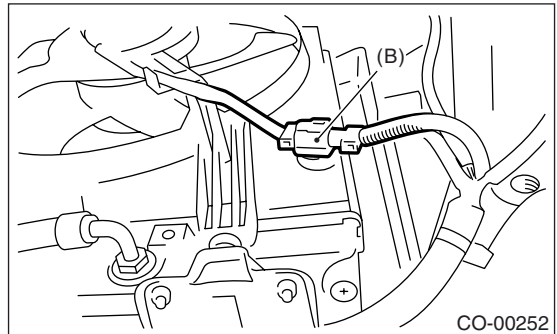
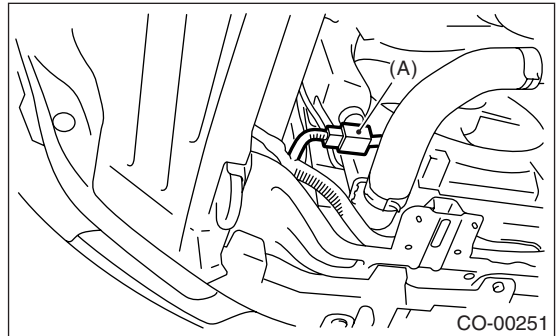
11) Connect the ATF cooler hoses.



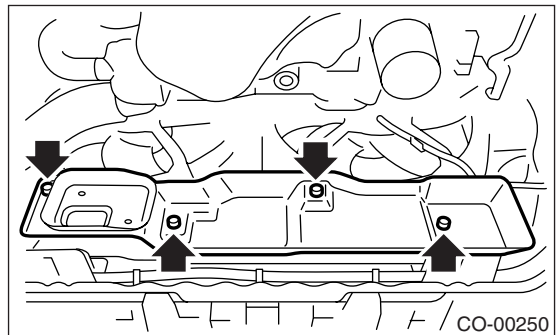
12) Connect the radiator outlet hose.



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



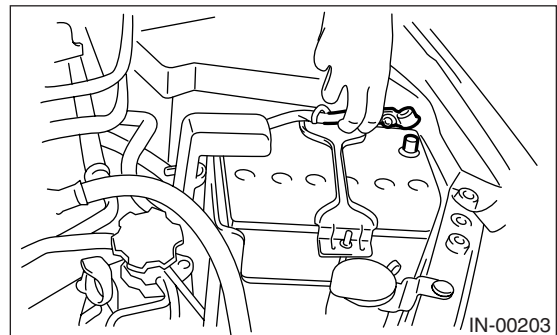
14) Install the heat shield cover.



15) Install the under cover.

16) Lower the vehicle.

17) Connect the battery ground cable to battery.



18) Fill engine coolant.

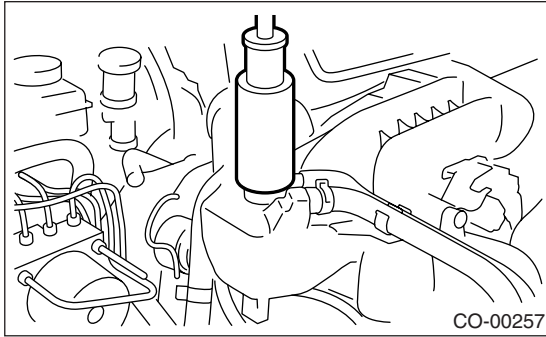
<Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

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

20) Install the collector cover.

### C: INSPECTION

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



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

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

#### **CAUTION:**

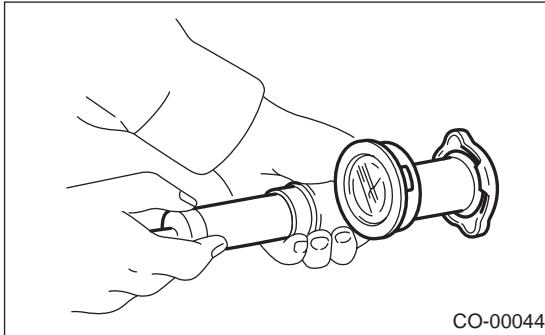
- Inspection must be carried out at the side of coolant filler tank, not at the side of radiator.
- Engine should be turned off.
- Wipe engine coolant from check points in advance.
- Be careful to prevent engine coolant from spurting out when removing tester.
- Be careful not to deform the filler neck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



## 7. Radiator Cap

### A: INSPECTION

1) Attach the radiator cap to tester.



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

#### **Coolant filler tank side**

##### **Standard pressure:**

**93 — 123 kPa (0.95 — 1.25 kg/cm<sup>2</sup>, 14 — 18 psi)**

##### **Service limit pressure:**

**83 kPa (0.85 kg/cm<sup>2</sup>, 12 psi)**

#### **Radiator side**

##### **Standard pressure:**

**122 — 152 kPa (1.24 — 1.55 kg/cm<sup>2</sup>, 18 — 22 psi)**

##### **Service limit pressure:**

**112 kPa (1.14 kg/cm<sup>2</sup>, 16 psi)**

#### **CAUTION:**

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

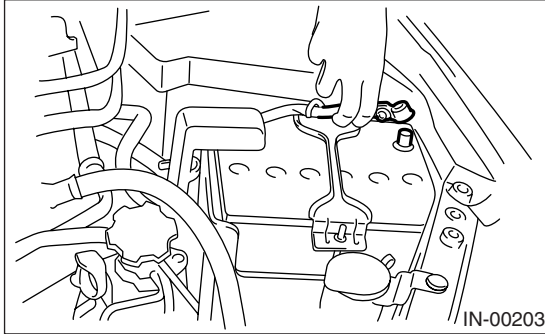
# Radiator Main Fan and Fan Motor

## COOLING

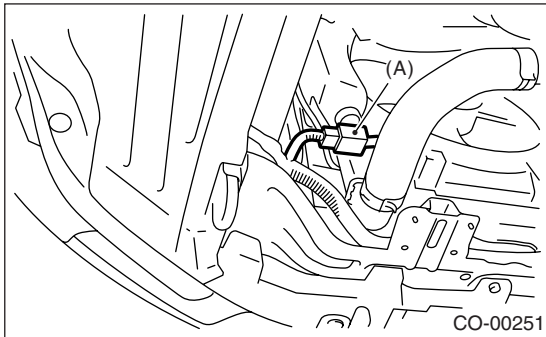
### 8. Radiator Main Fan and Fan Motor

#### A: REMOVAL

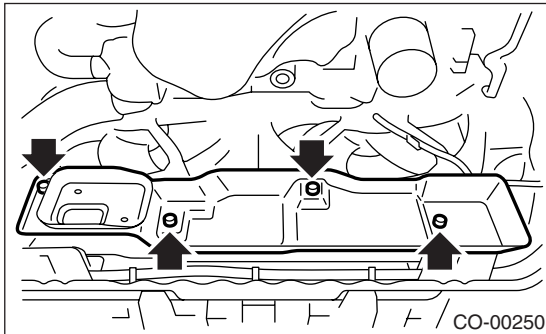
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



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

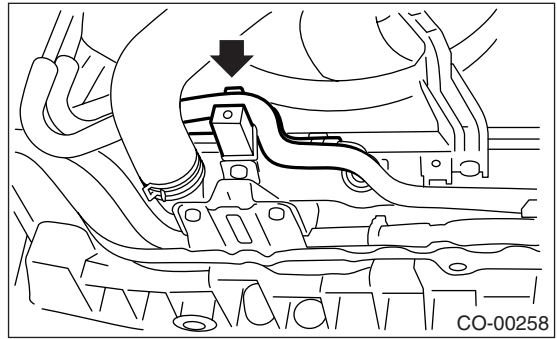


- 6) Remove the heat shield cover from radiator.

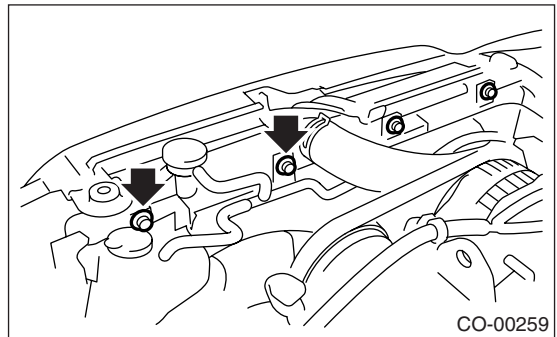


- 7) Drain the coolant about 1 ℓ (1.06 US qt, 0.88 Imp qt). <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

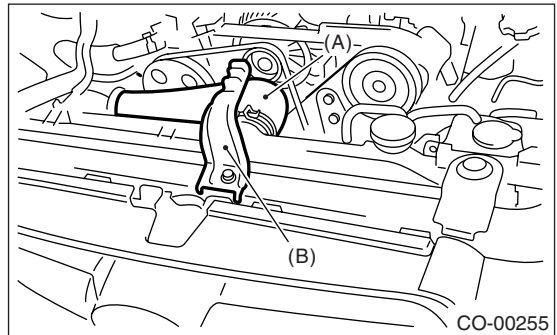
- 8) Remove the ATF hose from the clip of radiator main fan motor assembly.



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



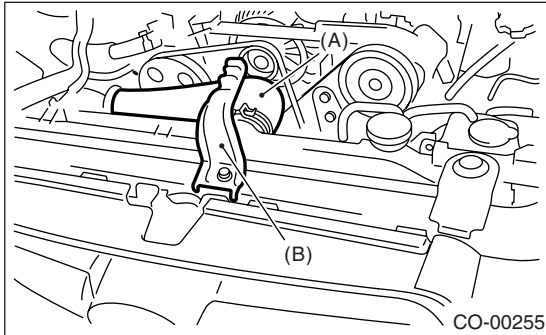
- 15) Disconnect the radiator inlet hose (A) from radiator.
- 16) Remove the hood stay holder (B).



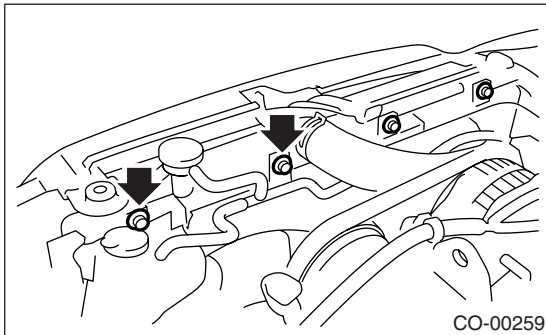
- 17) Remove the radiator main fan motor assembly from vehicle.

## B: INSTALLATION

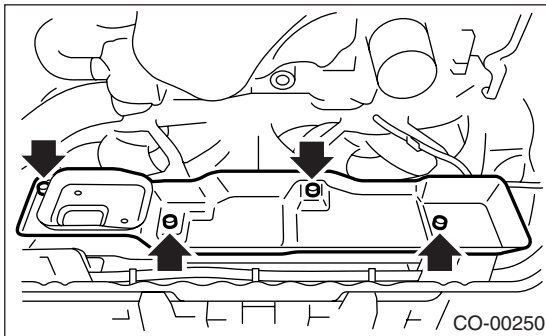
- 1) Install the radiator main fan motor assembly to vehicle.
- 2) Connect the radiator inlet hose (A) to radiator.
- 3) Install the hood stay holder (B).



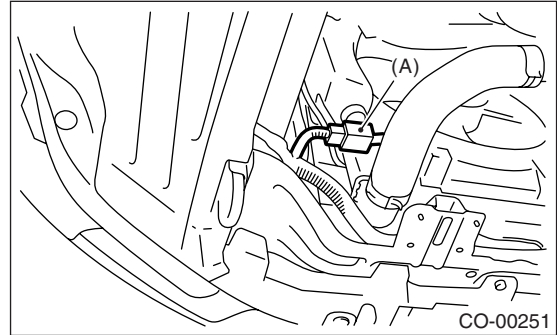
- 4) Install the mounting bolts of radiator main fan motor assembly.



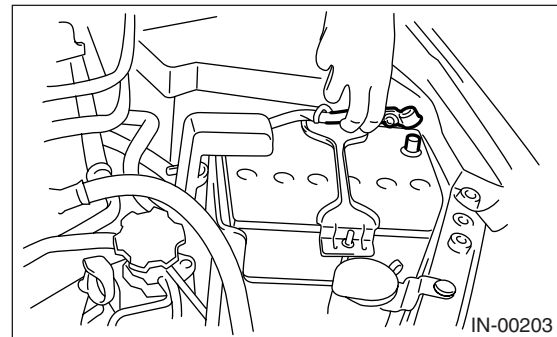
- 5) Install the reservoir tank. <Ref. to CO(H4DOTC)-30, INSTALLATION, Reservoir Tank.>
- 6) Install the over flow pipe.
- 7) Connect the over flow hose.
- 8) Install the air intake duct.
- 9) Lift-up the vehicle.
- 10) Attach the ATF hose to the clip of radiator main fan motor assembly.
- 11) Install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



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



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



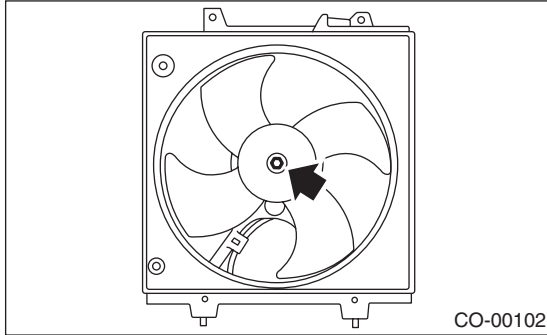
- 16) Fill engine coolant. <Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 17) Install the collector cover.

# Radiator Main Fan and Fan Motor

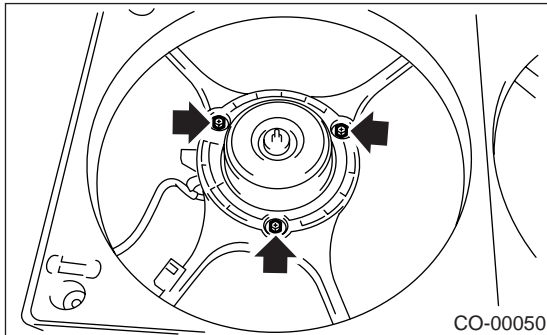
## COOLING

### C: DISASSEMBLY

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



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

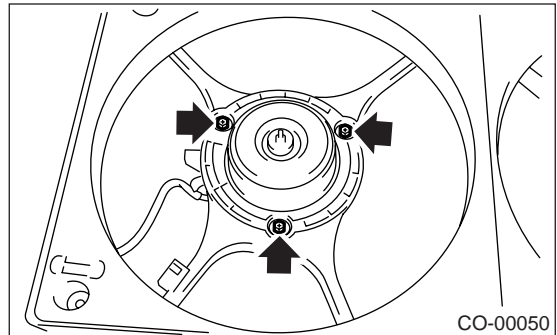


### D: ASSEMBLY

Assemble in the reverse order of disassembly.

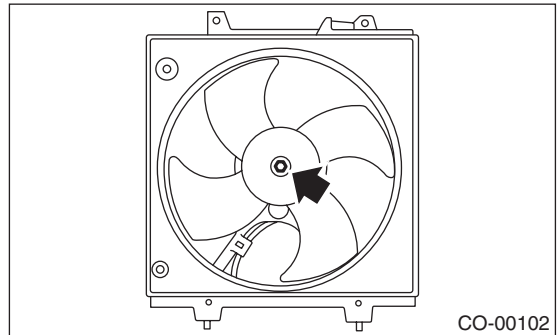
#### **Tightening torque:**

**4.4 N·m (0.45 kgf·m, 3.3 ft-lb)**



#### **Tightening torque:**

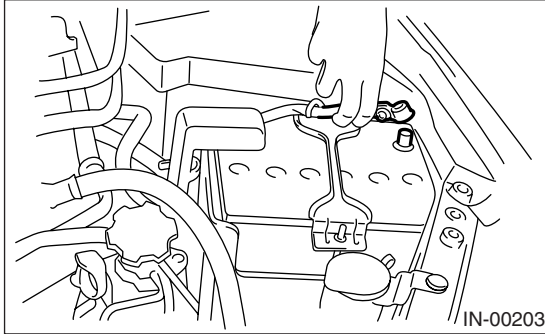
**3.4 N·m (0.35 kgf·m, 2.5 ft-lb)**



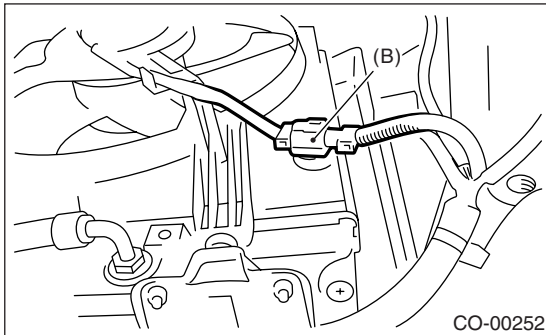
## 9. Radiator Sub Fan and Fan Motor

### A: REMOVAL

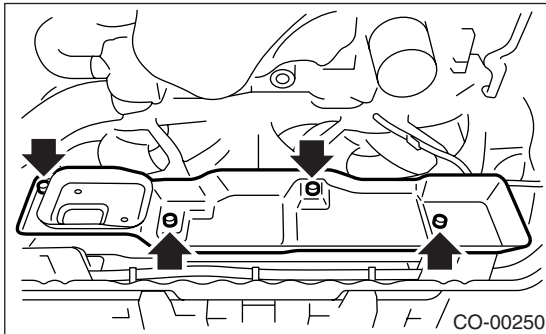
- 1) Remove the collector cover.
- 2) Disconnect the ground cable from battery.



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



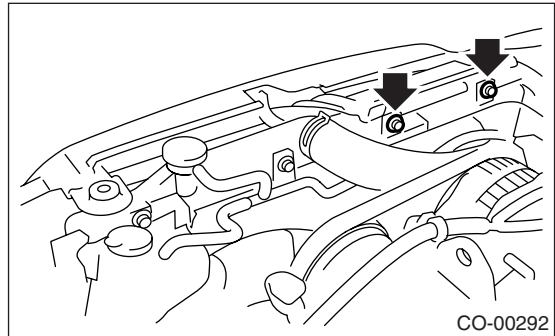
- 6) Remove the heat shield cover from radiator.



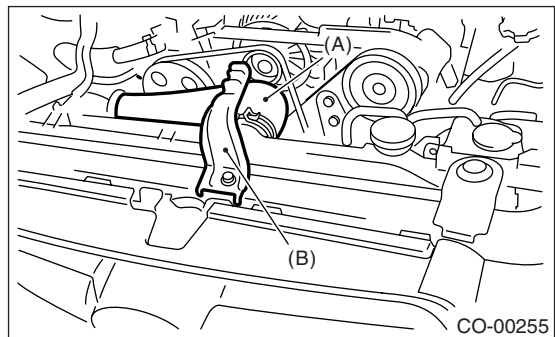
- 7) Drain the coolant about 1 ℓ (1.06 US qt, 0.88 Imp qt). <Ref. to CO(H4DOTC)-13, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

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

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



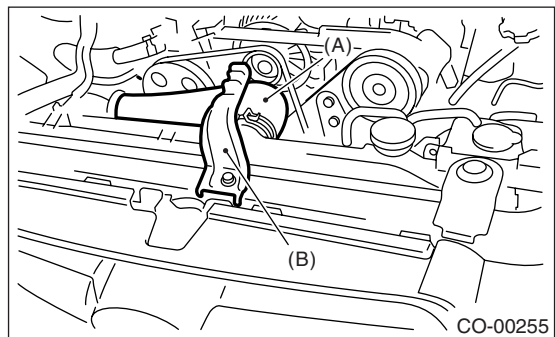
- 15) Disconnect the radiator inlet hose (A) from radiator.
- 16) Remove the hood stay holder (B).



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

### B: INSTALLATION

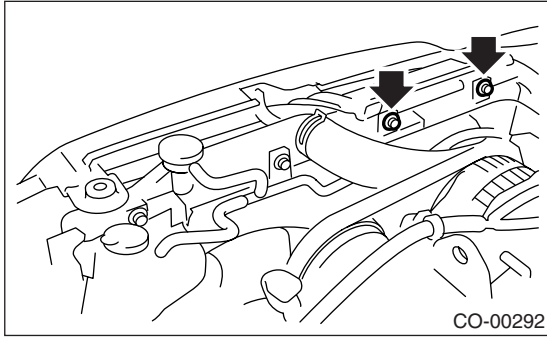
- 1) Install the radiator sub fan motor assembly to vehicle.
- 2) Connect the radiator inlet hose (A) to radiator.
- 3) Install the hood stay holder (B).



# Radiator Sub Fan and Fan Motor

## COOLING

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



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

6) Install the over flow pipe.

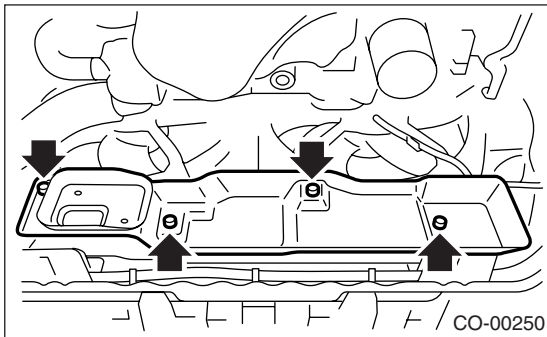
7) Connect the over flow hose.

8) Install the air intake duct.

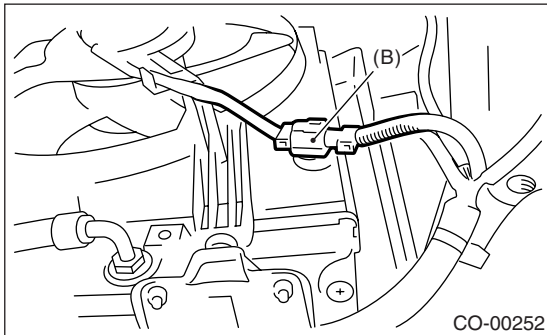
9) Lift-up the vehicle.

10) Attach the ATF hose to the clip of radiator sub fan motor assembly.

11) Install the heat shield cover to radiator.



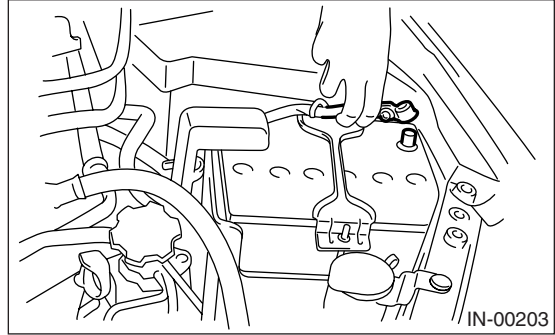
12) Connect the sub fan motor connector (B).



13) Install the under cover.

14) Lower the vehicle.

15) Connect the battery ground cable to battery.



16) Fill engine coolant.

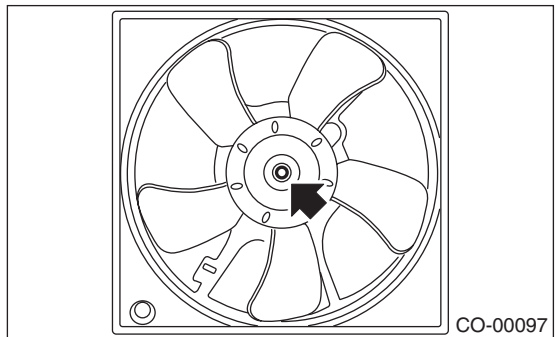
<Ref. to CO(H4DOTC)-13, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

17) Install the collector cover.

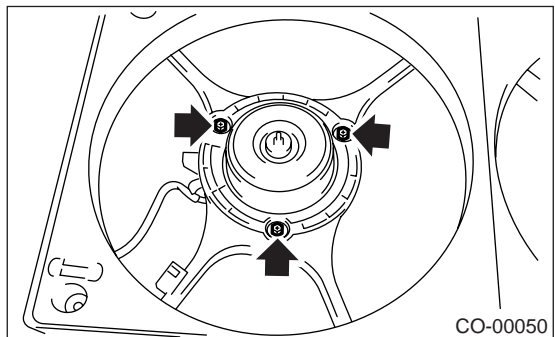
## C: DISASSEMBLY

1) Remove the clip which holds fan motor connector onto shroud.

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



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

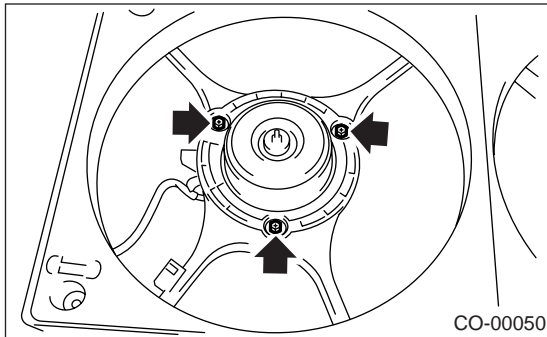


## D: ASSEMBLY

Assemble in the reverse order of disassembly.

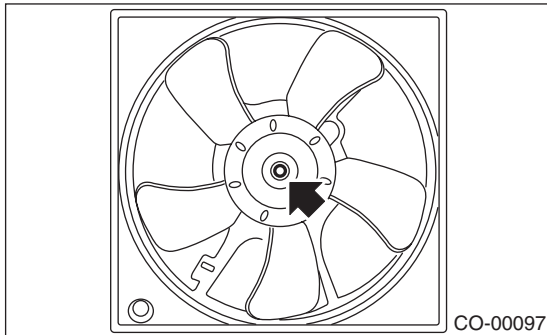
### *Tightening torque:*

**4.4 N·m (0.45 kgf-m, 3.3 ft-lb)**



### *Tightening torque:*

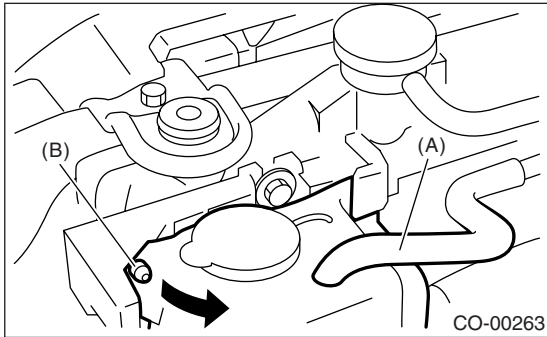
**3.4 N·m (0.35 kgf-m, 2.5 ft-lb)**



## 10. Reservoir Tank

### A: REMOVAL

- 1) Remove the collector cover.
- 2) Disconnect the over flow hose (A).
- 3) Pull out the reservoir tank to the arrow direction while pushing the claw (B).



### B: INSTALLATION

Install in the reverse order of removal.

### C: INSPECTION

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



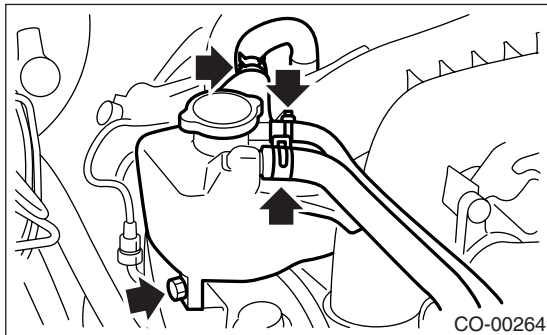
## 11. Coolant Filler Tank

### A: REMOVAL

#### WARNING:

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

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

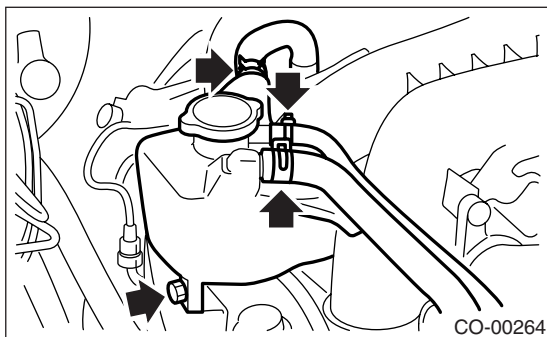


### B: INSTALLATION

- 1) Install in the reverse order of removal.

#### Tightening torque:

**16 N·m (1.6 kgf·m, 11.8 ft·lb)**



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

# Engine Cooling System Trouble in General

COOLING

## 12.Engine Cooling System Trouble in General

### A: INSPECTION

Trouble	Possible cause	Corrective action
Over-heating	a. Insufficient engine coolant	Replenish engine coolant, inspect for leakage, and repair it if necessary.
	b. Loose timing belt	Repair or replace timing belt tensioner.
	c. Oil on drive belt	Replace.
	d. Malfunction of thermostat	Replace.
	e. Malfunction of water pump	Replace.
	f. Clogged engine coolant passage	Clean.
	g. Improper ignition timing	Inspect and repair the ignition control system. <Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean, repair or replace.
	i. Improper engine oil in engine coolant	Replace engine coolant.
	j. Air/fuel mixture ratio too lean	Inspect and repair the fuel injection system. <Ref. to EN(H4DOTC)(diag)-2, PROCEDURE, Basic Diagnostic Procedure.>
	k. Excessive back pressure in exhaust system	Clean or replace.
	l. Insufficient clearance between piston and cylinder	Adjust or replace.
	m. Slipping clutch	Repair or replace.
	n. Dragging brake	Adjustment.
o. Defective radiator fan	Inspect radiator fan relay, engine coolant temperature sensor or radiator motor and replace there.	
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 gasket.
	e. Damaged or cracked cylinder head and crankcase	Repair or replace.
	f. Damaged or cracked thermostat case	Repair or replace.
	g. Leakage from radiator	Repair or replace.
Noise	a. Defective drive belt	Replace.
	b. Defective radiator fan	Replace.
	c. Defective water pump bearing	Replace water pump.
	d. Defective water pump mechanical seal	Replace water pump.