ENGINE 1 SECTION

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.

COOLING

CO

1. General Description

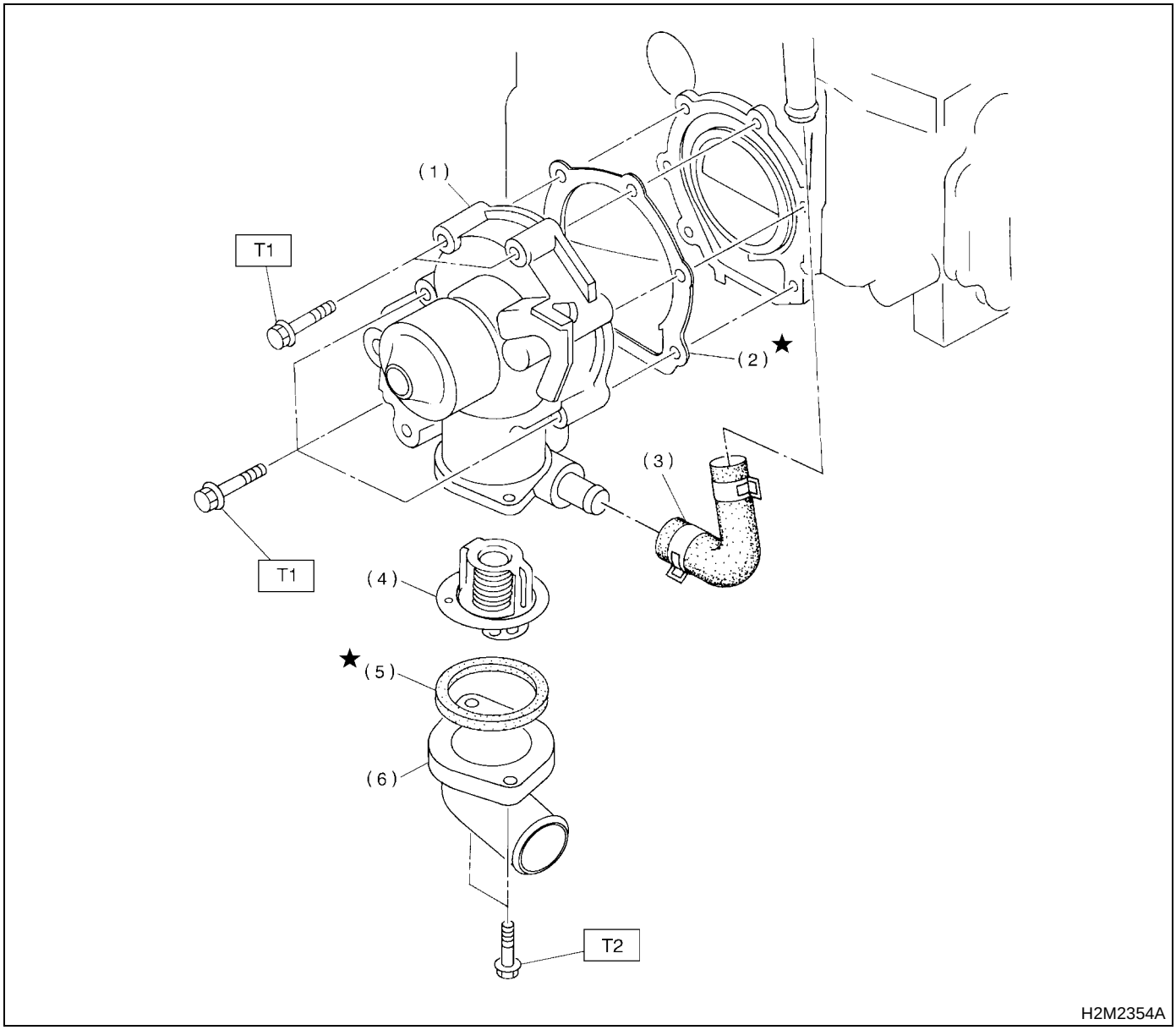
A: SPECIFICATIONS

Model			Non-turbo	Turbo
Cooling system			Electric fan + Forced engine coolant circulation system	
Total engine coolant capacity ℓ (US qt, Imp qt)			1.6AT: Approx. 7.3 (7.71, 6.42) 1.6MT: Approx. 7.4 (7.82, 6.51) 2.0AT: Approx. 6.9 (7.29, 6.07) 2.0MT: Approx. 7 (7.4, 6.2)	Approx. 7.7 (8.14, 6.78)
Water pump	Type		Centrifugal impeller type	
	Discharge performance I	Discharge	20 ℓ (5.3 US gal, 4.4 Imp gal)/min.	
		Pump speed—total engine coolant head	700 rpm — 0.3 mAq (1.0 ftAq)	
		Engine coolant temperature	85°C (185°F)	
	Discharge performance II	Discharge	100 ℓ (26.4 US gal, 22.0 Imp gal)/min.	
		Pump speed—total engine coolant head	3,000 rpm — 5.0 mAq (16.4 ftAq)	
		Engine coolant temperature	85°C (185°F)	
	Discharge performance III	Discharge	200 ℓ (52.8 US gal, 44.0 Imp gal)/min.	
		Pump speed—total engine coolant head	6,000 rpm — 23.0 mAq (75.5 ftAq)	
		Engine coolant temperature	85°C (185°F)	
	Impeller diameter		76 mm (2.99 in)	
	Number of impeller vanes		8	
	Pump pulley diameter		60 mm (2.36 in)	
	Clearance between impeller and case	Standard	0.5 — 0.7 mm (0.020 — 0.028 in)	
		Limit	1.0 mm (0.039 in)	
	"Thrust" runout of impeller end		0.5 mm (0.020 in)	
Thermostat	Type		Wax pellet type	
	Starts to open		76 — 80°C (169 — 176°F)	
	Fully opened		91°C (196°F)	
	Valve lift		9.0 mm (0.354 in) or more	
	Valve bore		35 mm (1.38 in)	
Radiator fan	Motor	Main fan	70 W	120 W
		Sub fan	70 W	120 W
	Fan diameter × Blade		320 mm (11.81 in) × 5 (main fan) 320 mm (11.81 in) × 7 (sub fan)	
Radiator	Type		Down flow, pressure type	
	Core dimensions		691.5 × 340 × 16 mm (27.22 × 13.39 × 0.63 in)	691.5 × 340 × 27 mm (27.22 × 13.39 × 1.06 in)
	Pressure range in which cap valve is open		Above: 108±15 kPa (1.1±0.15 kg/cm^2, 16±2 psi) Below: –1.0 to –4.9 kPa (–0.01 to –0.05 kg/cm^2, –0.1 to –0.7 psi)	
	Fins		Corrugated fin type	
Reservoir tank	Capacity		0.5 ℓ (0.5 US qt, 0.4 Imp qt)	

B: COMPONENT

1. WATER PUMP

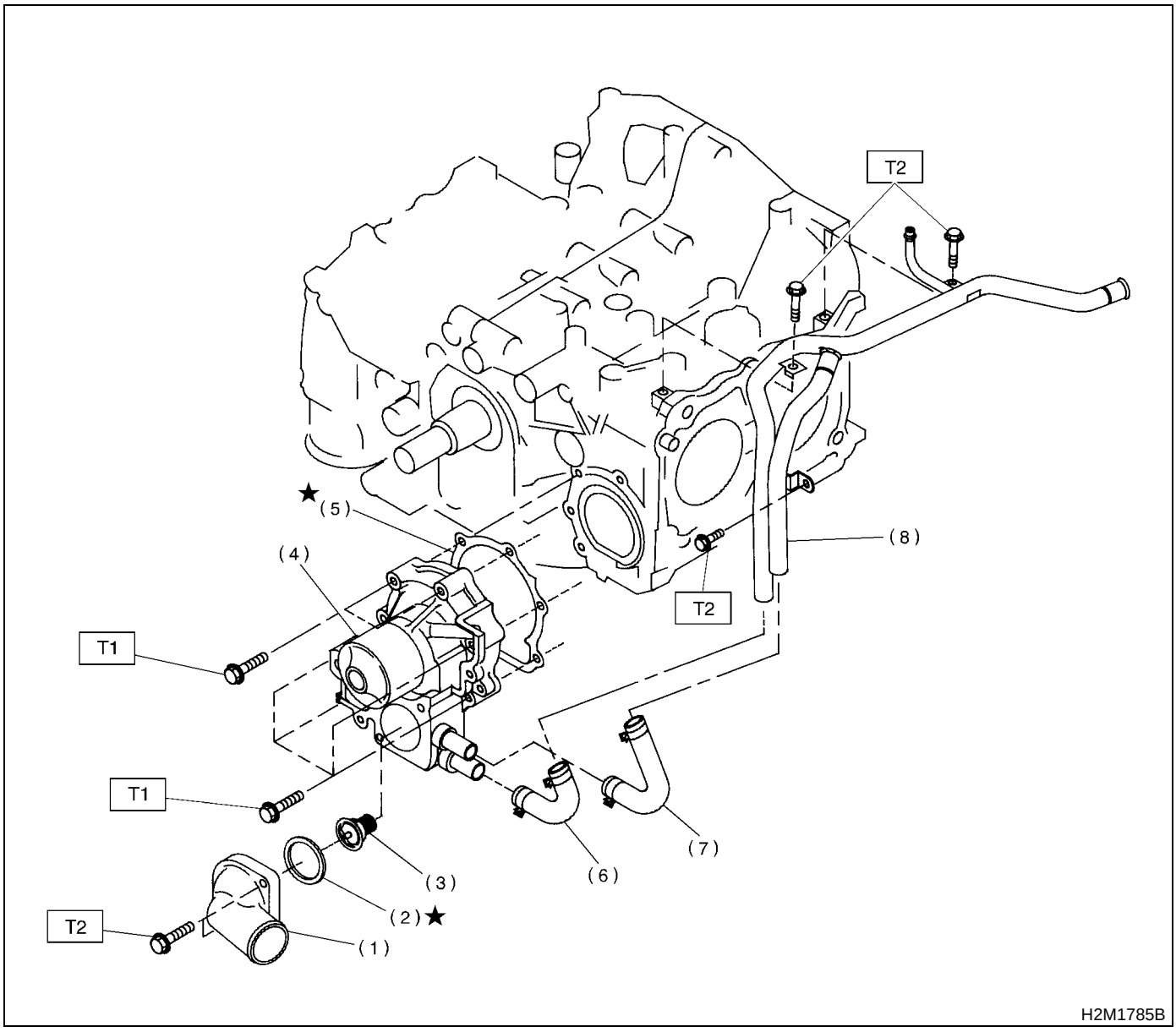
• NON-TURBO MODEL



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

Tightening torque: N·m (kgf-m, ft-lb)
T1: First 12 (1.2, 8.7)
Second 12 (1.2, 8.7)
T2: 6.4 (0.65, 4.7)

• TURBO MODEL

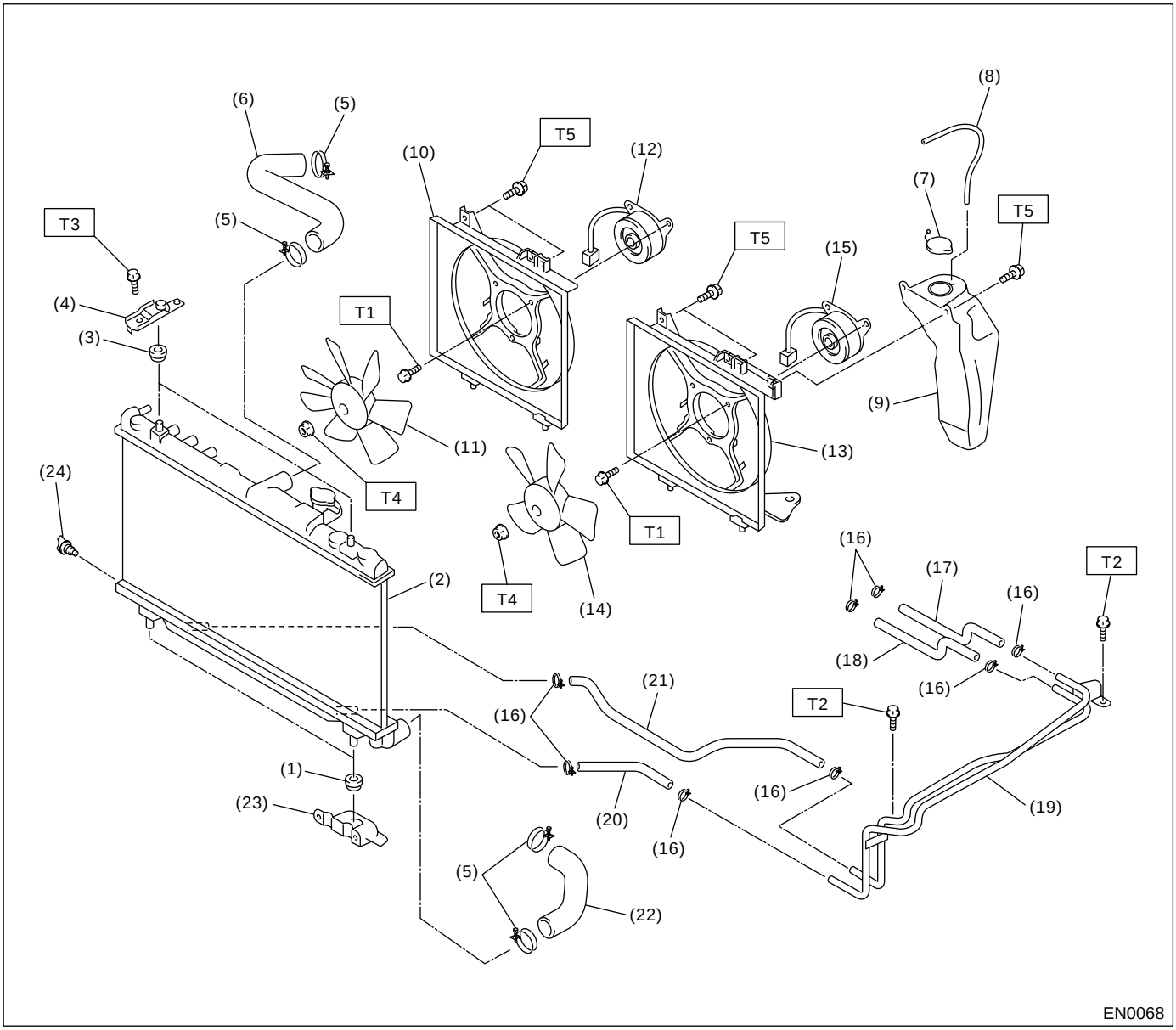


(1) Thermostat case
(2) Gasket
(3) Thermostat
(4) Water pump ASSY
(5) Gasket
(6) Header by-pass hose
(7) Coolant filler tank by-pass hose
(8) Water by-pass pipe

Tightening torque: N·m (kgf-m, ft-lb)
T1: First 12 (1.2, 8.7)
Second 12 (1.2, 8.7)
T2: 6.4 (0.65, 4.7)

2. RADIATOR AND RADIATOR FAN

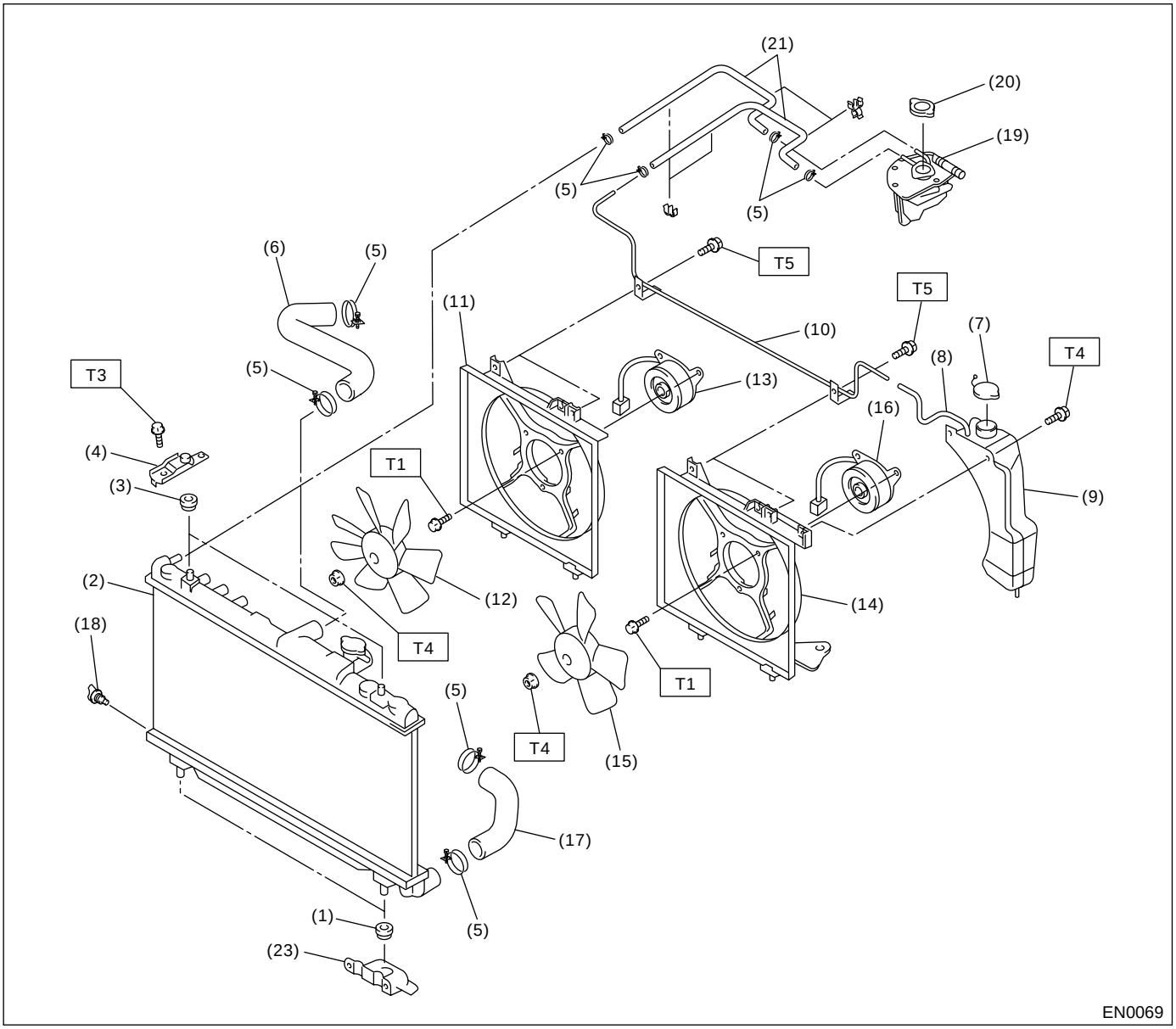
• NON-TURBO MODEL



(1)	Radiator lower cushion	(13)	Main fan shroud	(23)	Radiator lower bracket
(2)	Radiator	(14)	Radiator main fan	(24)	Radiator drain plug
(3)	Radiator upper cushion	(15)	Main fan motor		
(4)	Radiator upper bracket	(16)	ATF hose clamp (AT vehicles only)		
(5)	Clamp	(17)	ATF inlet hose A (AT vehicles only)		
(6)	Radiator inlet hose	(18)	ATF outlet hose A (AT vehicles only)		
(7)	Engine coolant reservoir tank cap				
(8)	Over flow hose	(19)	ATF pipe (AT vehicles only)		
(9)	Engine coolant reservoir tank	(20)	ATF inlet hose B (AT vehicles only)		
(10)	Sub fan shroud	(21)	ATF outlet hose B (AT vehicles only)		
(11)	Radiator sub fan				
(12)	Sub fan motor	(22)	Radiator outlet hose		

Tightening torque: N·m (kgf-m, ft-lb)	
T1:	***4.4 (0.45, 3.3)***
T2:	***12 (1.2, 8.7)***
T3:	***18 (1.8, 13.0)***
T4:	***3.4 (0.35, 2.5)***
T5:	***4.9 (0.50, 3.6)***

• TURBO MODEL



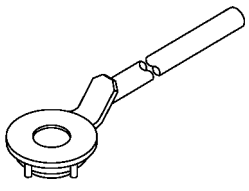
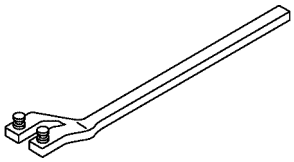
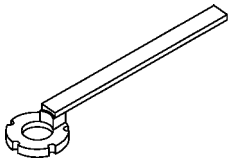
(1)	Radiator lower cushion	(10)	Over flow pipe	(19)	Engine coolant filler tank
(2)	Radiator	(11)	Sub fan shroud	(20)	Engine coolant filler tank cap
(3)	Radiator upper cushion	(12)	Radiator sub fan	(21)	Engine coolant hose
(4)	Radiator upper bracket	(13)	Radiator sub fan motor		
(5)	Clamp	(14)	Main fan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

Tightening torque: N·m (kgf-m, ft-lb)	
T1:	***4.4 (0.45, 3.3)***
T2:	***18 (1.8, 13.0)***
T3:	***3.4 (0.35, 2.5)***
T4:	***4.9 (0.50, 3.6)***

C: CAUTION

• Wear working 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 or dirt.
• Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly, and replacement.
• Be careful not to burn your hands, because each part in the vehicle is hot after running.
• Be sure to tighten fasteners including bolts and nuts to the specified torque.
• Place shop jacks or safety stands at the specified points.
• Before disconnecting electrical connectors of sensors or units, be sure to disconnect negative terminal from battery.

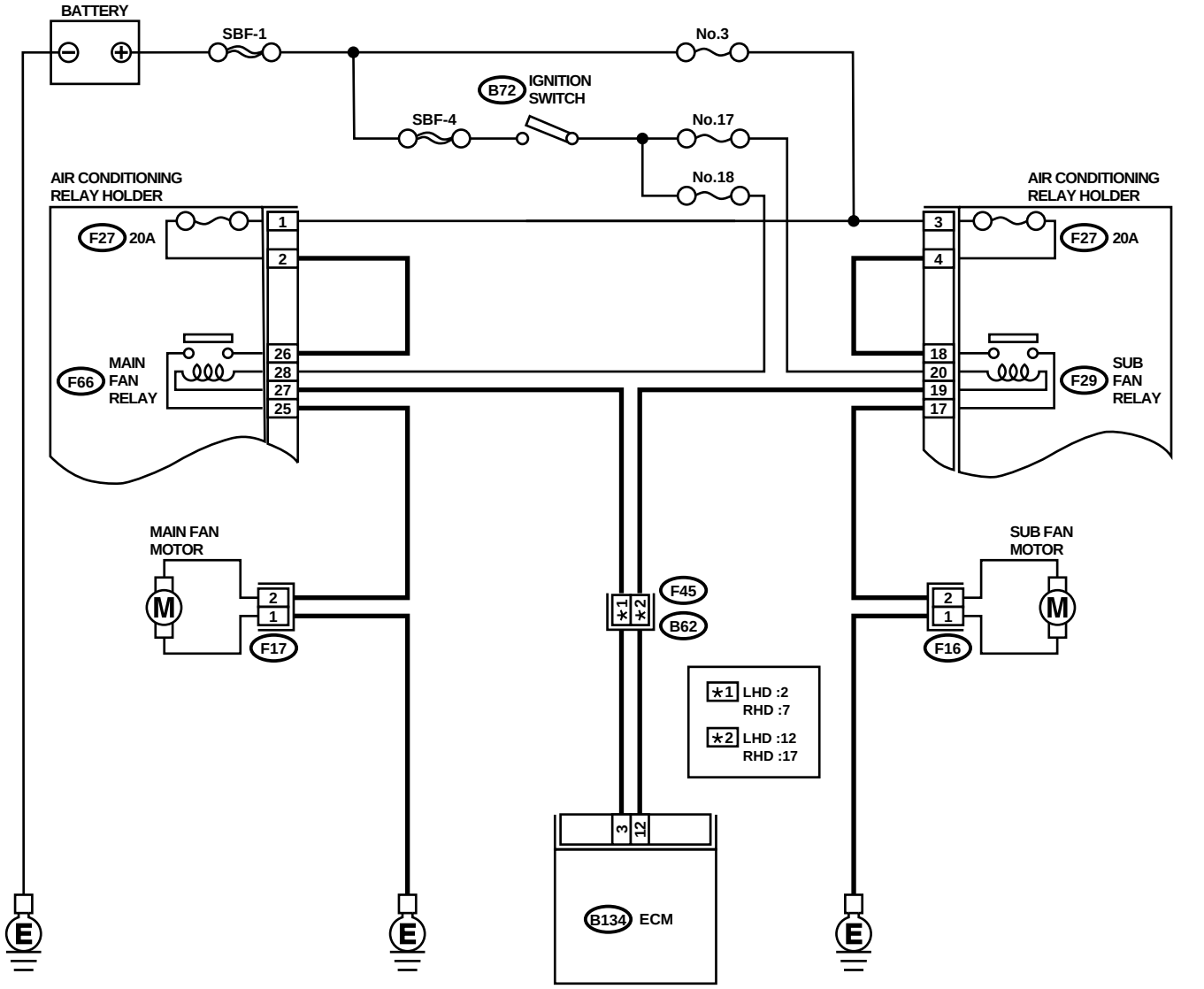
D: PREPARATION TOOL

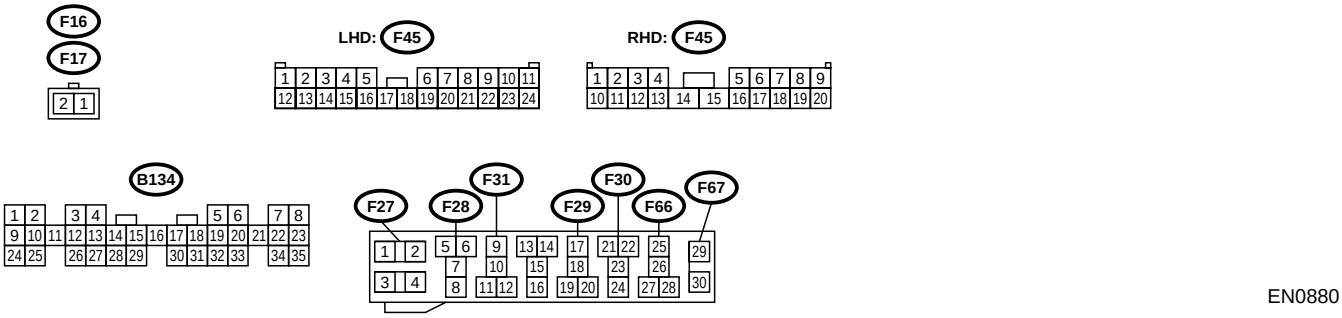
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M4157	499977300	CRANK PULLEY WRENCH	Used for stopping crankshaft pulley when loosening and tightening crankshaft pulley bolts.
 B2M3859	499207100	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket. (Non-turbo LH side only)
 B2M4158	499207400	CAMSHAFT SPROCKET WRENCH	Used for removing and installing camshaft sprocket.

2. Radiator Main Fan System

A: SCHEMATIC

1. NON-TURBO MODEL





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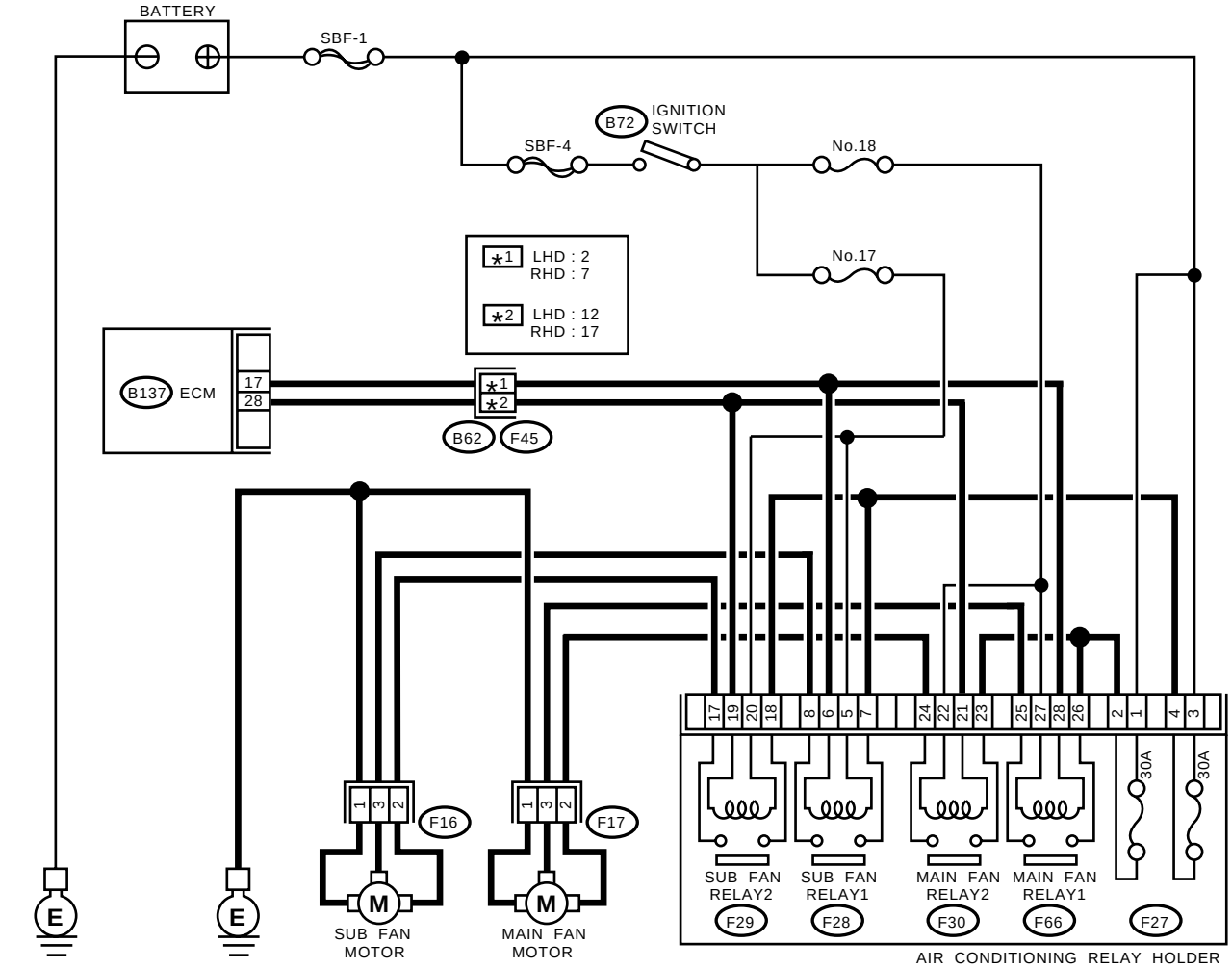
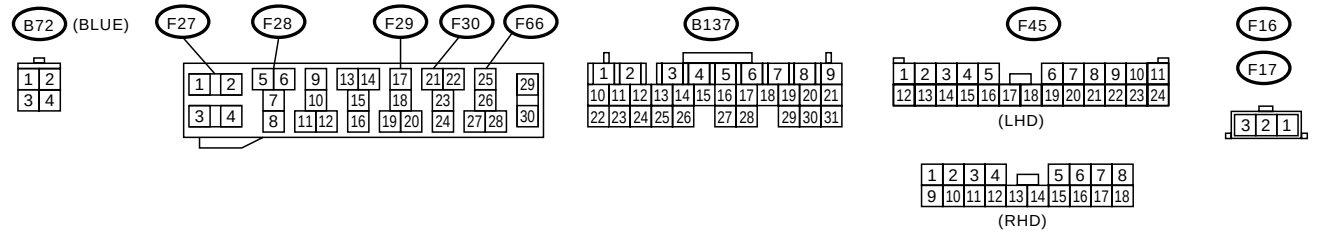
2. TURBO MODEL





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B: INSPECTION

1. NON-TURBO MODEL

DETECTING CONDITION:
Condition:
• Engine coolant temperature is above 95°C (203°F).
• Vehicle speed is below 19 km/h (12 MPH).
TROUBLE SYMPTOM:
• Radiator main fan does not rotate under the above conditions.

	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO MAIN FAN MOTOR.** **CAUTION:** **Be careful not to overheat engine during repair.** 1)Turn ignition switch to OFF. 2)Disconnect connector from main fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 95°C (203°F). 4)Stop the engine and turn ignition switch to ON. 5)Measure voltage between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 2 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **2.**	Go to step **5.**
2	**CHECK GROUND CIRCUIT OF MAIN FAN MOTOR.** 1)Turn ignition switch to OFF. 2)Measure resistance between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 1 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **3.**	Repair open circuit in harness between main fan motor connector and chassis ground.
3	**CHECK POOR CONTACT.** Check poor contact in main fan motor connector.	Is there poor contact in main fan motor connector?	Repair poor contact in main fan motor connector.	Go to step **4.**
4	**CHECK MAIN FAN MOTOR.** Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of main fan motor connector.	Does the main fan rotate?	Repair poor contact in main fan motor connector.	Replace main fan motor with a new one.
5	**CHECK POWER SUPPLY TO MAIN FAN RELAY.** 1)Turn ignition switch to OFF. 2)Remove main fan relay from A/C relay holder. 3)Measure voltage between main fan relay terminal and chassis ground. ***Connector & terminal*** ***(F66) No. 26 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **6.**	Go to step **7.**
6	**CHECK POWER SUPPLY TO MAIN FAN RELAY.** 1)Turn ignition switch to ON. 2)Measure voltage between main fan relay terminal and chassis ground. ***Connector & terminal*** ***(F66) No. 28 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **10.**	Go to step **9.**
7	**CHECK 20 A FUSE.** 1)Remove 20 A fuse from A/C relay holder. 2)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Go to step **8.**

	Step	Check	Yes	No
8	**CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL.** Measure voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 1 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Repair open circuit in harness between 20 A fuse and main fan relay terminal.	Repair open circuit in harness between main fuse box connector and 20 A fuse terminal.
9	**CHECK FUSE.** 1)Turn ignition switch to OFF. 2)Remove fuse No. 18 from joint box. 3)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Repair open circuit in harness between main fan relay and ignition switch.
10	**CHECK MAIN FAN RELAY.** 1)Turn ignition switch to OFF. 2)Remove main fan relay. 3)Measure resistance of main fan relay. ***Terminal*** ***No. 26 — No. 25:***	Is the resistance more than 1 MΩ?	Go to step **11.**	Replace main fan relay.
11	**CHECK MAIN FAN RELAY.** 1)Connect battery to terminals No. 27 and No. 28 of main fan relay. 2)Measure resistance of main fan relay. ***Terminal*** ***No. 26 — No. 25:***	Is the resistance less than 1 Ω?	Go to step **12.**	Replace main fan relay.
12	**CHECK HARNESS BETWEEN MAIN FAN RELAY TERMINAL AND MAIN FAN MOTOR CONNECTOR.** Measure resistance of harness between main fan motor connector and main fan relay terminal. ***Connector & terminal*** ***(F17) No. 2 — (F66) No. 25:***	Is the resistance less than 1 Ω?	Go to step **13.**	Repair open circuit in harness between main fan motor connector and main fan relay terminal.
13	**CHECK HARNESS BETWEEN MAIN FAN RELAY AND ECM.** 1)Turn ignition switch to OFF. 2)Disconnect connector from ECM. 3)Measure resistance of harness between main fan relay connector and ECM connector. ***Connector & terminal*** ***(F66) No. 27 — (B134) No. 3:***	Is the resistance less than 1 Ω?	Go to step **14.**	Repair open circuit in harness between main fan relay and ECM.
14	**CHECK POOR CONTACT.** Check poor contact in connector between main fan and ECM.	Is there poor contact in connector between main fan motor and ECM?	Repair poor contact connector.	Contact with your Subaru distributor.

NOTE:
Inspection by your Subaru distributor is required, because probable cause is deterioration of multiple parts.

2. TURBO MODEL

DETECTING CONDITION:
Condition:
• Engine coolant temperature is above 96°C (205°F).
• A/C compressor is rotated.
• Vehicle speed is below 19 km/h (12 MPH).

TROUBLE SYMPTOM:
• Radiator main fan does not rotate under the above conditions.
• Radiator main fan does not rotate at high speed when the following conditions are both met:
(1) Engine coolant temperature is above 90°C (194°F)
(2) A/C is ON

	Step	Check	Yes	No
1	**CHECK OPERATION OF RADIATOR.** 1)Run the engine at idle. (Vehicle stationary) 2)Turn the A/C switch to OFF. 3)Warm the engine coolant temperature over 96°C (205°F).	Does the main radiator fan rotate?	Go to step **2.**	Go to step **3.**
2	**CHECK OPERATION OF RADIATOR.** 1)Turn the A/C switch ON at condition of step 1.	Does the main radiator fan rotate faster when A/C compressor is operated?	Radiator main fan system is okay.	Go to step **17.**
3	**CHECK POWER SUPPLY TO MAIN FAN MOTOR.** **CAUTION:** **Be careful not to overheat engine during repair.** 1)Turn ignition switch to OFF. 2)Disconnect connector from main fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 96°C (205°F). 4)Stop the engine and turn ignition switch to ON. 5)Measure voltage between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 3 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **4.**	Go to step **7.**
4	**CHECK GROUND CIRCUIT OF MAIN FAN MOTOR.** 1)Turn ignition switch to OFF. 2)Measure resistance between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 1 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **5.**	Repair open circuit in harness between main fan motor connector and chassis ground.
5	**CHECK POOR CONTACT.** Check poor contact in main fan motor connector.	Is there poor contact in main fan motor connector?	Repair poor contact in main fan motor connector.	Go to step **6.**
6	**CHECK MAIN FAN MOTOR.** Connect battery positive (+) terminal to terminal No. 3, and negative (–) terminal to terminal No. 1 of main fan motor connector.	Does the main fan rotate?	Repair poor contact in main fan motor connector.	Replace main fan motor with a new one.
7	**CHECK POWER SUPPLY TO MAIN FAN RELAY1.** 1)Turn ignition switch to OFF. 2)Remove main fan relay1 from A/C relay holder. 3)Measure voltage between main fan relay1 terminal and chassis ground. ***Connector & terminal*** ***(F66) No. 26 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **8.**	Go to step **9.**

	Step	Check	Yes	No
8	**CHECK POWER SUPPLY TO MAIN FAN RELAY1.** 1)Turn ignition switch to ON. 2)Measure voltage between main fan relay1 terminal and chassis ground. ***Connector & terminal*** ***(F66) No. 27 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **12.**	Go to step **11.**
9	**CHECK 30 A FUSE.** 1)Remove 30 A fuse from A/C relay holder. 2)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Go to step **10.**
10	**CHECK POWER SUPPLY TO A/C RELAY HOLDER 30 A FUSE TERMINAL.** Measure voltage of harness between A/C relay holder 30 A fuse terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 1 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Repair open circuit in harness between 30 A fuse and main fan relay terminal.	Repair open circuit in harness between main fuse box connector and 30 A fuse terminal.
11	**CHECK FUSE.** 1)Turn ignition switch to OFF. 2)Remove fuse No. 18 from joint box. 3)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Repair open circuit in harness between main fan relay and ignition switch.
12	**CHECK MAIN FAN RELAY.** 1)Turn ignition switch to OFF. 2)Remove main fan relay1. 3)Measure resistance of main fan relay1. ***Terminal*** ***No. 26 — No. 25:***	Is the resistance more than 1 MΩ?	Go to step **13.**	Replace main fan relay.
13	**CHECK MAIN FAN RELAY.** 1)Connect battery to terminals No. 27 and No. 28 of main fan relay1. 2)Measure resistance of main fan relay1. ***Terminal*** ***No. 26 — No. 25:***	Is the resistance less than 1 Ω?	Go to step **14.**	Replace main fan relay.
14	**CHECK HARNESS BETWEEN MAIN FAN RELAY TERMINAL AND MAIN FAN MOTOR CONNECTOR.** Measure resistance of harness between main fan motor connector and main fan relay terminal. ***Connector & terminal*** ***(F17) No. 3 — (F66) No. 25:***	Is the resistance less than 1 Ω?	Go to step **15.**	Repair open circuit in harness between main fan motor connector and main fan relay terminal.
15	**CHECK HARNESS BETWEEN MAIN FAN RELAY AND ECM.** 1)Turn ignition switch to OFF. 2)Disconnect connector from ECM. 3)Measure resistance of harness between main fan relay connector and ECM connector. ***Connector & terminal*** ***(F66) No. 28 — (B137) No. 17:***	Is the resistance less than 1 Ω?	Go to step **16.**	Repair open circuit in harness between main fan relay and ECM.
16	**CHECK POOR CONTACT.** Check poor contact in connector between main fan and ECM.	Is there poor contact in connector between main fan motor and ECM?	Repair poor contact connector.	Contact with your Subaru distributor.

	Step	Check	Yes	No
17	**CHECK POWER SUPPLY TO MAIN FAN MOTOR.** **CAUTION:** **Be careful not to overheat engine during repair.** 1)Turn ignition switch to OFF. 2)Disconnect connector from main fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 96°C (205°F). 4)Turn the A/C switch ON. 5)Measure voltage while A/C compressor is rotating. 6)Measure voltage between main fan motor connector and chassis ground. ***Connector & terminal*** ***(F17) No. 2 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **18.**	Go to step **20.**
18	**CHECK POOR CONTACT.** Check poor contact in main fan motor connector.	Is there poor contact in main fan motor connector?	Repair poor contact in main fan motor connector.	Go to step **19.**
19	**CHECK MAIN FAN MOTOR.** Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of main fan motor connector.	Does the main fan rotate?	Repair poor contact in main fan motor connector.	Replace main fan motor with a new one.
20	**CHECK POWER SUPPLY TO MAIN FAN RELAY2.** 1)Turn ignition switch to OFF. 2)Remove main fan relay2 from A/C relay holder. 3)Measure voltage between main fan relay2 terminal and chassis ground. ***Connector & terminal*** ***(F30) No. 23 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **21.**	Go to step **22.**
21	**CHECK POWER SUPPLY TO MAIN FAN RELAY2.** 1)Turn ignition switch to ON. 2)Measure voltage between main fan relay2 terminal and chassis ground. ***Connector & terminal*** ***(F30) No. 22 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **25.**	Go to step **24.**
22	**CHECK 30 A FUSE.** 1)Remove 30 A fuse from A/C relay holder. 2)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Go to step **23.**
23	**CHECK POWER SUPPLY TO A/C RELAY HOLDER 30 A FUSE TERMINAL.** Measure voltage of harness between A/C relay holder 30 A fuse terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 1 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Repair open circuit in harness between 30 A fuse and main fan relay terminal.	Repair open circuit in harness between main fuse box connector and 30 A fuse terminal.
24	**CHECK FUSE.** 1)Turn ignition switch to OFF. 2)Remove fuse No. 18 from joint box. 3)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Repair open circuit in harness between main fan relay and ignition switch.

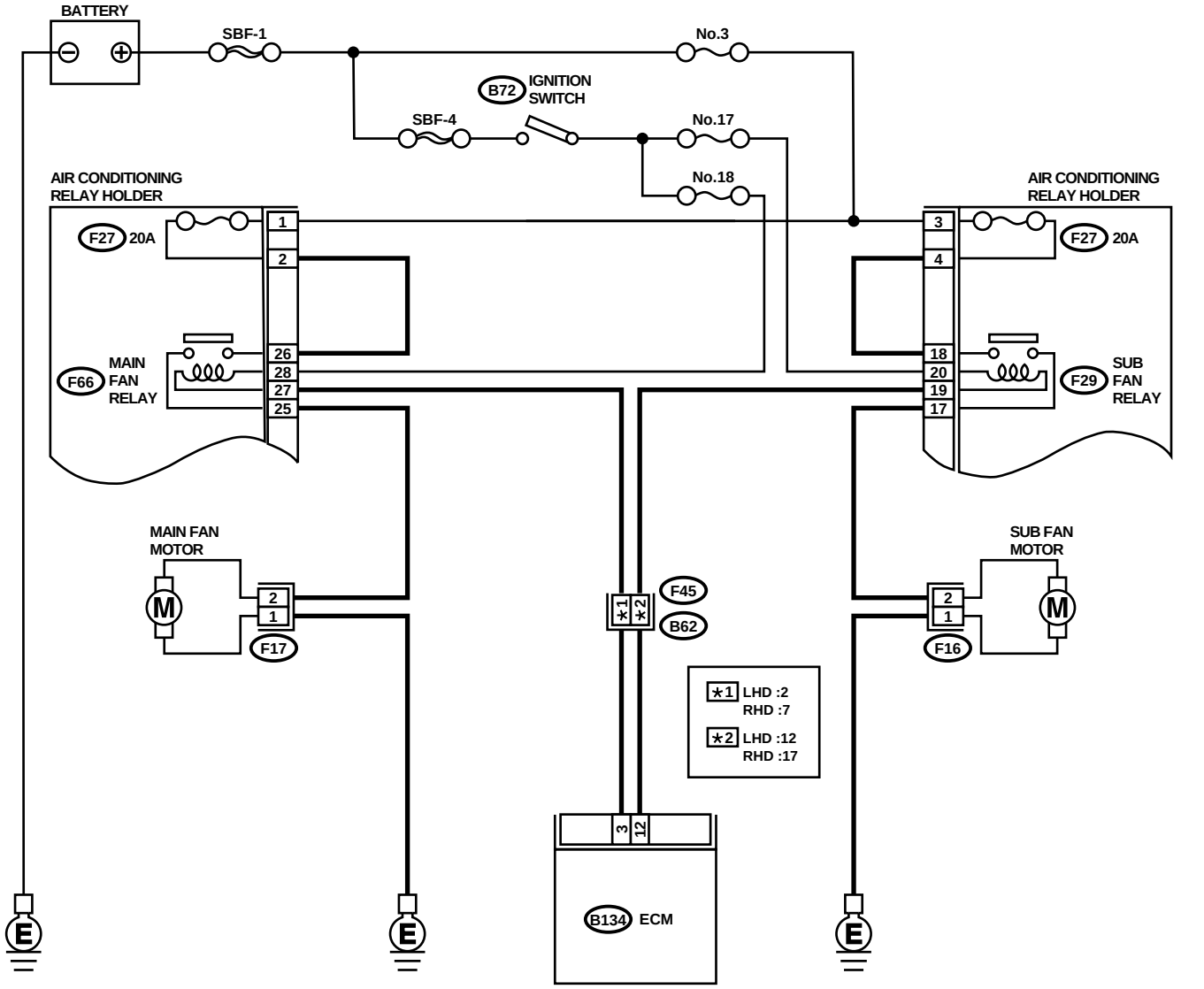
	Step	Check	Yes	No
25	**CHECK MAIN FAN RELAY.** 1)Turn ignition switch to OFF. 2)Remove main fan relay2. 3)Measure resistance of main fan relay2. ***Terminal*** ***No. 23 — No. 24:***	Is the resistance more than 1 MΩ?	Go to step **26.**	Replace main fan relay.
26	**CHECK MAIN FAN RELAY.** 1)Connect battery to terminals No. 21 and No. 22 of main fan relay1. 2)Measure resistance of main fan relay2. ***Terminal*** ***No. 23 — No. 24:***	Is the resistance less than 1 Ω?	Go to step **27.**	Replace main fan relay.
27	**CHECK HARNESS BETWEEN MAIN FAN RELAY TERMINAL AND MAIN FAN MOTOR CONNECTOR.** Measure resistance of harness between main fan motor connector and main fan relay terminal. ***Connector & terminal*** ***(F17) No. 2 — (F66) No. 24:***	Is the resistance less than 1 Ω?	Go to step **28.**	Repair open circuit in harness between main fan motor connector and main fan relay terminal.
28	**CHECK HARNESS BETWEEN MAIN FAN RELAY AND ECM.** 1)Turn ignition switch to OFF. 2)Disconnect connector from ECM. 3)Measure resistance of harness between main fan relay connector and ECM connector. ***Connector & terminal*** ***(F30) No. 21 — (B134) No. 28:***	Is the resistance less than 1 Ω?	Go to step **29.**	Repair open circuit in harness between main fan relay and ECM.
29	**CHECK POOR CONTACT.** Check poor contact in connector between main fan and ECM.	Is there poor contact in connector between main fan motor and ECM?	Repair poor contact connector.	Contact with your Subaru distributor.

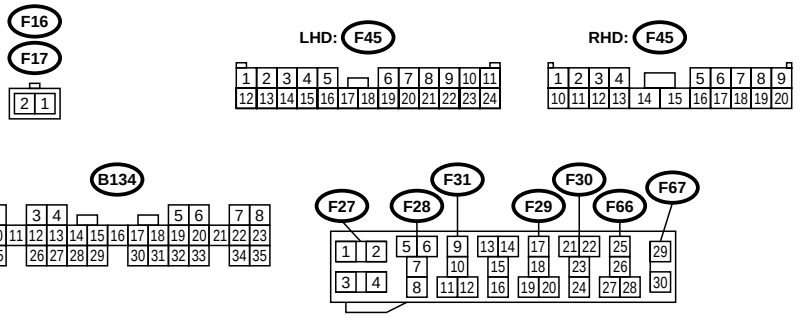
NOTE:
Inspection by your Subaru distributor is required, because probable cause is deterioration of multiple parts.

3. Radiator Sub Fan System

A: SCHEMATIC

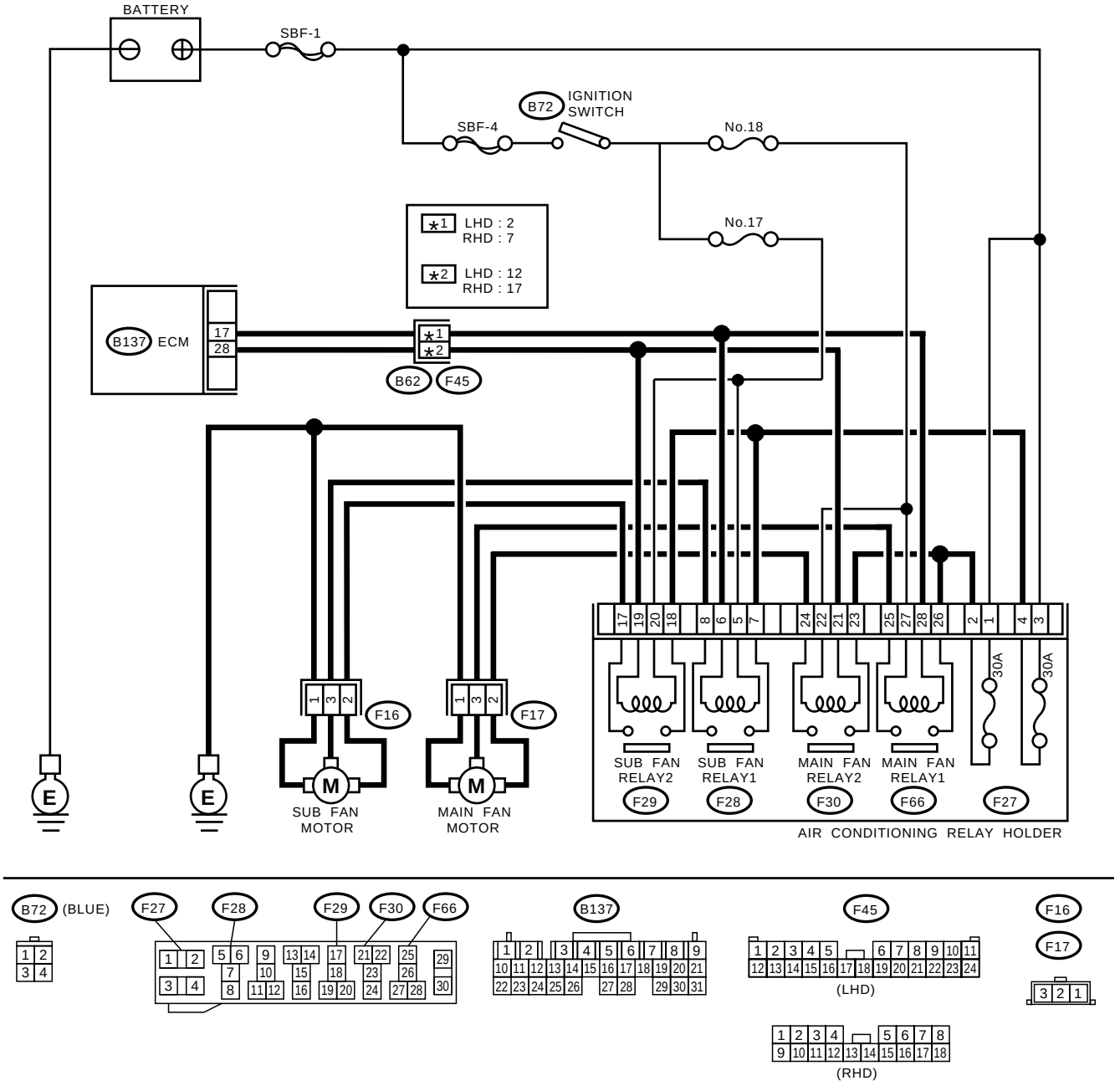
1. NON-TURBO MODEL





EN0880

2. TURBO MODEL



EN0260

B: INSPECTION

1. NON-TURBO MODEL

NOTE:
System for A/C equipped vehicles only.

DETECTING CONDITION:
Condition (1):
• Engine coolant temperature is below 95°C (203°F).
• A/C switch is turned ON.
• Vehicle speed is below 19 km/h (12 MPH).
Condition (2):
• Engine coolant temperature is above 100°C (212°F).
• A/C switch is turned OFF.
• Vehicle speed is below 19 km/h (12 MPH).
TROUBLE SYMPTOM:
• Radiator sub fan does not rotate under conditions (1) and (2) above.

	Step	Check	Yes	No
1	**CHECK POWER SUPPLY TO SUB FAN MOTOR.** **CAUTION:** **Be careful not to overheat engine during repair.** 1)Turn ignition switch to OFF. 2)Disconnect connector from sub fan motor and main fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 100°C (212°F). 4)Stop the engine and turn ignition switch to ON. 5)Measure voltage between sub fan motor connector and chassis ground. ***Connector & terminal*** ***(F16) No. 2 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **2.**	Go to step **5.**
2	**CHECK GROUND CIRCUIT OF SUB FAN MOTOR.** 1)Turn ignition switch to OFF. 2)Measure resistance between sub fan motor connector and chassis ground. ***Connector & terminal*** ***(F16) No. 1 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **3.**	Repair open circuit in harness between sub fan motor connector and chassis ground.
3	**CHECK POOR CONTACT.** Check poor contact in sub fan motor connector.	Is there poor contact in sub fan motor connector?	Repair poor contact in sub fan motor connector.	Go to step **4.**
4	**CHECK SUB FAN MOTOR.** Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of sub fan motor connector.	Does the sub fan rotate?	Repair poor contact in sub fan motor connector.	Replace sub fan motor with a new one.
5	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1)Turn ignition switch to OFF. 2)Remove sub fan relay from A/C relay holder. 3)Measure voltage between sub fan relay terminal and chassis ground. ***Connector & terminal*** ***(F28) No. 18 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **6.**	Go to step **7.**
6	**CHECK POWER SUPPLY TO SUB FAN RELAY.** 1)Turn ignition switch to ON. 2)Measure voltage between sub fan relay terminal and chassis ground. ***Connector & terminal*** ***(F28) No. 20 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **10.**	Go to step **9.**

	Step	Check	Yes	No
7	**CHECK 20 A FUSE.** 1)Remove 20 A fuse from A/C relay holder. 2)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Go to step **8.**
8	**CHECK POWER SUPPLY TO A/C RELAY HOLDER 20 A FUSE TERMINAL.** Measure voltage of harness between A/C relay holder 20 A fuse terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 3 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Repair open circuit in harness between 20 A fuse and sub fan relay terminal.	Repair open circuit in harness between main fuse box connector and 20 A fuse terminal.
9	**CHECK FUSE.** 1)Turn ignition switch to OFF. 2)Remove fuse No. 17 from joint box. 3)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Repair open circuit in harness between sub fan relay and ignition switch.
10	**CHECK SUB FAN RELAY.** 1)Turn ignition switch to OFF. 2)Measure resistance of sub fan relay. ***Terminal*** ***No. 17 — No. 18:***	Is the resistance more than 1 MΩ?	Go to step **11.**	Replace sub fan relay.
11	**CHECK SUB FAN RELAY.** 1)Connect battery to terminals No. 20 and No. 19 of sub fan relay. 2)Measure resistance of sub fan relay. ***Terminal*** ***No. 17 — No. 18:***	Is the resistance less than 1 Ω?	Go to step **12.**	Replace sub fan relay.
12	**CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.** Measure resistance of harness between sub fan motor connector and sub fan relay terminal. ***Connector & terminal*** ***(F16) No. 2 — (F28) No. 17:***	Is the resistance less than 1 Ω?	Go to step **13.**	Repair open circuit in harness between sub fan motor and sub fan relay connector.
13	**CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.** 1)Turn ignition switch to OFF. 2)Disconnect connector from ECM. 3)Measure resistance of harness between sub fan relay connector and ECM connector. ***Connector & terminal*** ***(F28) No. 19 — (B134) No. 12:***	Is the resistance less than 1 Ω?	Go to step **14.**	Repair open circuit in harness between sub fan relay and ECM.
14	**CHECK POOR CONTACT.** Check poor contact in connnector between sub fan and ECM.	Is there poor contact in connector between sub fan motor and ECM?	Repair poor contact connector.	Contact with your Subaru distributor.

NOTE:
Inspection by your Subaru distributor is required, because probable cause is deterioration of multiple parts.

2. TURBO MODEL

DETECTING CONDITION:
Condition:
• Engine coolant temperature is above 96°C (205°F).
• A/C compressor is rotated.
• Vehicle speed is below 19 km/h (12 MPH).

TROUBLE SYMPTOM:
• Radiator sub fan does not rotate under the above conditions.
• Radiator sub fan does not rotate at high speed when the following conditions are both met:
(1) Engine coolant temperature is above 90°C (194°F)
(2) A/C is ON

	Step	Check	Yes	No
1	**CHECK OPERATION OF RADIATOR.** 1)Run the engine at idle. (Vehicle stationary) 2)Turn the A/C switch to OFF. 3)Warm the engine coolant temperature over 96°C (205°F).	Does the radiator sub fan rotate?	Go to step **2.**	Go to step **3.**
2	**CHECK OPERATION OF RADIATOR.** 1)Turn the A/C switch ON at condition of step 1.	Does the radiator sub fan rotate faster when A/C compressor is operated?	Radiator main fan system is okay.	Go to step **17.**
3	**CHECK POWER SUPPLY TO SUB FAN MOTOR.** **CAUTION:** **Be careful not to overheat engine during repair.** 1)Turn ignition switch to OFF. 2)Disconnect connector from sub fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 96°C (205°F). 4)Stop the engine and turn ignition switch to ON. 5)Measure voltage between sub fan motor connector and chassis ground. ***Connector & terminal*** ***(F16) No. 3 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **4.**	Go to step **7.**
4	**CHECK GROUND CIRCUIT OF SUB FAN MOTOR.** 1)Turn ignition switch to OFF. 2)Measure resistance between sub fan motor connector and chassis ground. ***Connector & terminal*** ***(F16) No. 1 — Chassis ground:***	Is the resistance less than 5 Ω?	Go to step **5.**	Repair open circuit in harness between sub fan motor connector and chassis ground.
5	**CHECK POOR CONTACT.** Check poor contact in sub fan motor connector.	Is there poor contact in sub fan motor connector?	Repair poor contact in sub fan motor connector.	Go to step **6.**
6	**CHECK MAIN FAN MOTOR.** Connect battery positive (+) terminal to terminal No. 3, and negative (–) terminal to terminal No. 1 of sub fan motor connector.	Does the main fan rotate?	Repair poor contact in sub fan motor connector.	Replace sub fan motor with a new one.
7	**CHECK POWER SUPPLY TO SUB FAN RELAY1.** 1)Turn ignition switch to OFF. 2)Remove sub fan relay1 from A/C relay holder. 3)Measure voltage between sub fan relay1 terminal and chassis ground. ***Connector & terminal*** ***(F28) No. 7 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **8.**	Go to step **9.**

	Step	Check	Yes	No
8	**CHECK POWER SUPPLY TO SUB FAN RELAY1.** 1)Turn ignition switch to ON. 2)Measure voltage between sub fan relay1 terminal and chassis ground. ***Connector & terminal*** ***(F28) No. 5 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **12.**	Go to step **11.**
9	**CHECK 30 A FUSE.** 1)Remove 30 A fuse from A/C relay holder. 2)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Go to step **10.**
10	**CHECK POWER SUPPLY TO A/C RELAY HOLDER 30 A FUSE TERMINAL.** Measure voltage of harness between A/C relay holder 30 A fuse terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 3 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Repair open circuit in harness between 30 A fuse and sub fan relay terminal.	Repair open circuit in harness between sub fuse box connector and 30 A fuse terminal.
11	**CHECK FUSE.** 1)Turn ignition switch to OFF. 2)Remove fuse No. 17 from joint box. 3)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Repair open circuit in harness between sub fan relay and ignition switch.
12	**CHECK SUB FAN RELAY.** 1)Turn ignition switch to OFF. 2)Remove main fan relay1. 3)Measure resistance of sub fan relay1. ***Terminal*** ***No. 7 — No. 8:***	Is the resistance more than 1 MΩ?	Go to step **13.**	Replace sub fan relay.
13	**CHECK SUB FAN RELAY.** 1)Connect battery to terminals No. 6 and No. 5 of sub fan relay1. 2)Measure resistance of sub fan relay. ***Terminal*** ***No. 7 — No. 8:***	Is the resistance less than 1 Ω?	Go to step **14.**	Replace sub fan relay.
14	**CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.** Measure resistance of harness between sub fan motor connector and sub fan relay terminal. ***Connector & terminal*** ***(F16) No. 3 — (F28) No. 8:***	Is the resistance less than 1 Ω?	Go to step **15.**	Repair open circuit in harness between sub fan motor connector and sub fan relay terminal.
15	**CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.** 1)Turn ignition switch to OFF. 2)Disconnect connector from ECM. 3)Measure resistance of harness between sub fan relay connector and ECM connector. ***Connector & terminal*** ***(F28) No. 6 — (B137) No. 17:***	Is the resistance less than 1 Ω?	Go to step **16.**	Repair open circuit in harness between sub fan relay and ECM.
16	**CHECK POOR CONTACT.** Check poor contact in connector between sub fan and ECM.	Is there poor contact in connector between sub fan motor and ECM?	Repair poor contact connector.	Contact with your Subaru distributor.

	Step	Check	Yes	No
17	**CHECK POWER SUPPLY TO SUB FAN MOTOR.** **CAUTION:** **Be careful not to overheat engine during repair.** 1)Turn ignition switch to OFF. 2)Disconnect connector from sub fan motor. 3)Start the engine, and warm it up until engine coolant temperature increases over 96°C (205°F). 4)Turn the A/C switch ON. 5)Measure voltage while A/C compressor is rotating. 6)Measure voltage between sub fan motor connector and chassis ground. ***Connector & terminal*** ***(F16) No. 2 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **18.**	Go to step **20.**
18	**CHECK POOR CONTACT.** Check poor contact in sub fan motor connector.	Is there poor contact in sub fan motor connector?	Repair poor contact in sub fan motor connector.	Go to step **19.**
19	**CHECK SUB FAN MOTOR.** Connect battery positive (+) terminal to terminal No. 2, and negative (–) terminal to terminal No. 1 of sub fan motor connector.	Does the main fan rotate?	Repair poor contact in sub fan motor connector.	Replace sub fan motor with a new one.
20	**CHECK POWER SUPPLY TO SUB FAN RELAY2.** 1)Turn ignition switch to OFF. 2)Remove sub fan relay2 from A/C relay holder. 3)Measure voltage between sub fan relay2 terminal and chassis ground. ***Connector & terminal*** ***(F29) No. 18 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **21.**	Go to step **22.**
21	**CHECK POWER SUPPLY TO SUB FAN RELAY2.** 1)Turn ignition switch to ON. 2)Measure voltage between sub fan relay2 terminal and chassis ground. ***Connector & terminal*** ***(F29) No. 20 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Go to step **23.**	Go to step **24.**
22	**CHECK 30 A FUSE.** 1)Remove 30 A fuse from A/C relay holder. 2)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Go to step **23.**
23	**CHECK POWER SUPPLY TO A/C RELAY HOLDER 30 A FUSE TERMINAL.** Measure voltage of harness between A/C relay holder 30 A fuse terminal and chassis ground. ***Connector & terminal*** ***(F27) No. 3 (+) — Chassis ground (–):***	Is the voltage more than 10 V?	Repair open circuit in harness between 30 A fuse and sub fan relay terminal.	Repair open circuit in harness between sub fuse box connector and 30 A fuse terminal.
24	**CHECK FUSE.** 1)Turn ignition switch to OFF. 2)Remove fuse No. 17 from joint box. 3)Check condition of fuse.	Is the fuse blown-out?	Replace fuse.	Repair open circuit in harness between sub fan relay and ignition switch.

	Step	Check	Yes	No
25	**CHECK SUB FAN RELAY.** 1)Turn ignition switch to OFF. 2)Remove sub fan relay2. 3)Measure resistance of main fan relay2. ***Terminal*** ***No. 18 — No. 17:***	Is the resistance more than 1 MΩ?	Go to step **26.**	Replace sub fan relay.
26	**CHECK MAIN FAN RELAY.** 1)Connect battery to terminals No. 19 and No. 20 of sub fan relay2. 2)Measure resistance of main fan relay2. ***Terminal*** ***No. 18 — No. 17:***	Is the resistance less than 1 Ω?	Go to step **27.**	Replace sub fan relay.
27	**CHECK HARNESS BETWEEN SUB FAN RELAY TERMINAL AND SUB FAN MOTOR CONNECTOR.** Measure resistance of harness between sub fan motor connector and sub fan relay2 terminal. ***Connector & terminal*** ***(F16) No. 2 — (F29) No. 17:***	Is the resistance less than 1 Ω?	Go to step **28.**	Repair open circuit in harness between sub fan motor connector and sub fan relay terminal.
28	**CHECK HARNESS BETWEEN SUB FAN RELAY AND ECM.** 1)Turn ignition switch to OFF. 2)Disconnect connector from ECM. 3)Measure resistance of harness between sub fan relay connector and ECM connector. ***Connector & terminal*** ***(F29) No. 19 — (B137) No. 28:***	Is the resistance less than 1 Ω?	Go to step **29.**	Repair open circuit in harness between sub fan relay and ECM.
29	**CHECK POOR CONTACT.** Check poor contact in connector between sub fan and ECM.	Is there poor contact in connector between sub fan motor and ECM?	Repair poor contact connector.	Contact with your Subaru distributor.

NOTE:
Inspection by your Subaru distributor is required, because probable cause is deterioration of multiple parts.

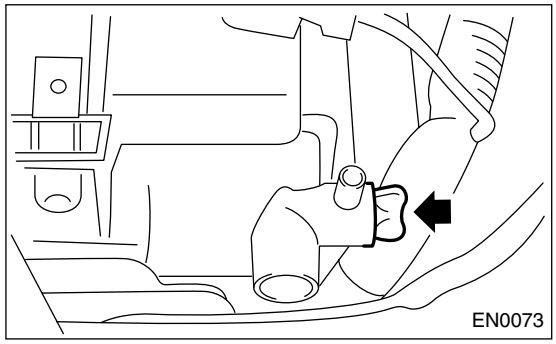
4. Engine Coolant

A: REPLACEMENT

1. DRAINING OF ENGINE COOLANT

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

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



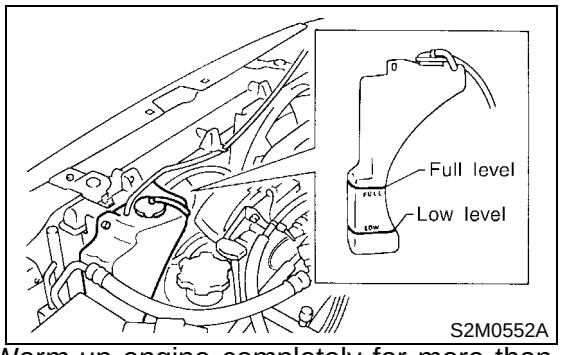
2. FILLING OF ENGINE COOLANT

1) Fill engine coolant into radiator up to filler neck position.

Coolant capacity (fill up to "FULL" level):
1.6 ℓ AT model
Approx. 7.3 ℓ (7.71 US qt, 6.42 Imp qt)
1.6 ℓ MT model
Approx. 7.4 ℓ (7.82 US qt, 6.51 Imp qt)
Non-turbo 2.0 ℓ AT model
Approx. 6.9 ℓ (7.29 US qt, 6.07 Imp qt)
Non-turbo 2.0 ℓ MT model
Approx. 7 ℓ (7.4US qt, 6.2 Imp qt)
Turbo model
Approx. 7.7 ℓ (8.14 US qt, 6.78 Imp qt)

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

2) Fill engine coolant into reservoir tank up to upper level.



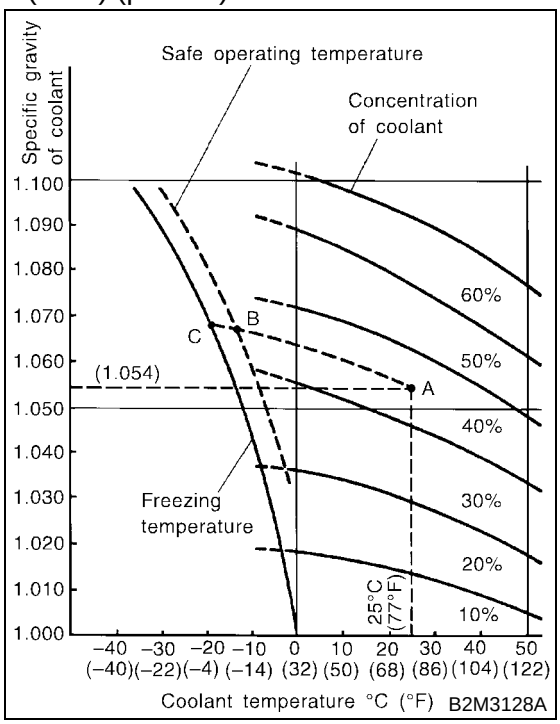
3) Warm-up engine completely for more than five minutes at 2,000 to 3,000 rpm.
4) If engine coolant level drops in radiator, add engine coolant to filler neck position.
5) If engine coolant level drops from upper level of reservoir tank, add engine coolant to upper level.
6) Attach radiator cap and reservoir tank cap properly.

B: INSPECTION

1. RELATIONSHIP OF SUBARU COOLANT CONCENTRATION AND FREEZING TEMPERATURE

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

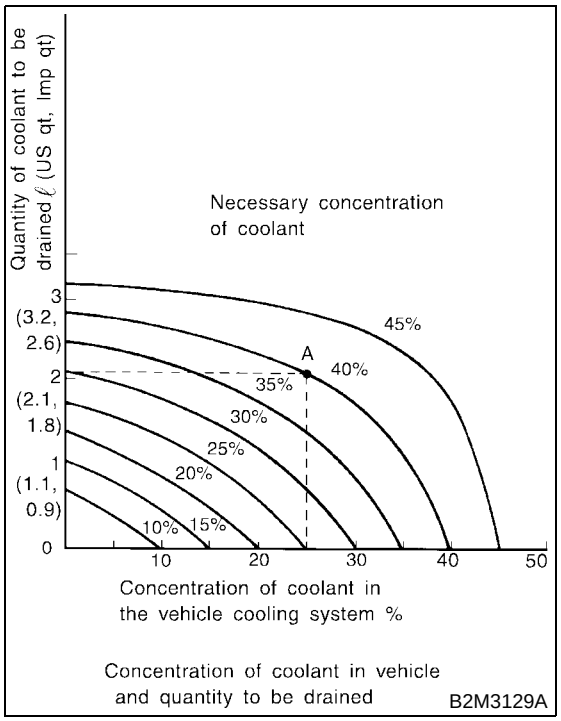
[Example]
If the coolant temperature is 25°C (77°F) and its specific gravity is 1.054, the concentration is 35% (point A), the safe operating temperature is –14°C (7°F) (point B), and the freezing temperature is –20°C (–4°F) (point C).



2. PROCEDURE TO ADJUST THE CONCENTRATION OF THE COOLANT

To adjust the concentration of the 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 liters (2.2 US qt, 1.8 Imp qt). Drain 2.1 liters (2.2 US qt, 1.8 Imp qt) of coolant from the cooling system and add 2.1 liters (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.

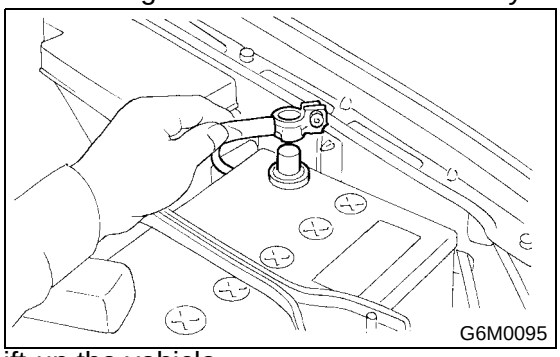


5. Water Pump

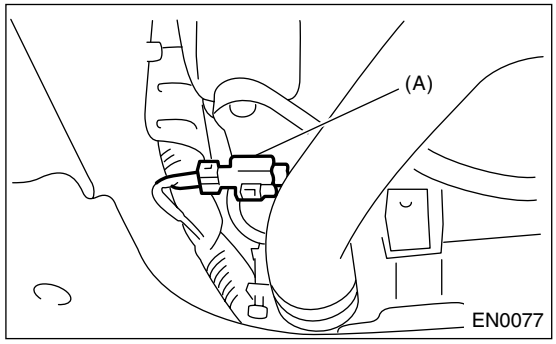
A: REMOVAL

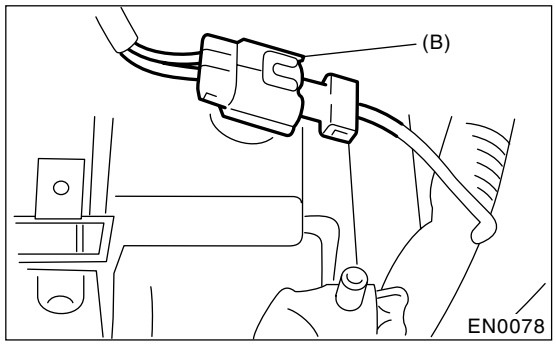
1. NON-TURBO MODEL

1) Disconnect ground cable from the battery.

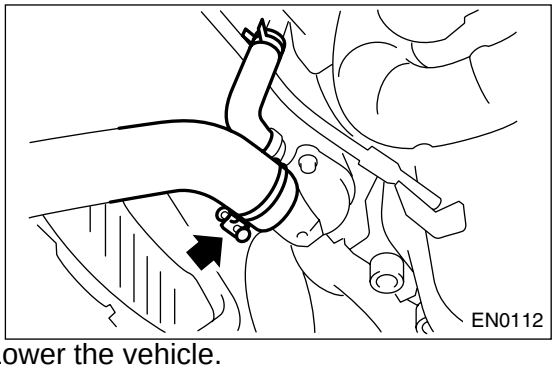


2) Lift-up the vehicle.
3) Remove under cover.
4) Drain engine coolant completely.
<Ref. to CO-25, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Disconnect connectors from radiator main fan (A) and sub fan (B) motors.

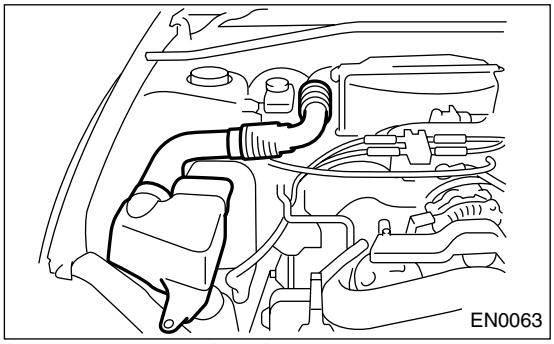




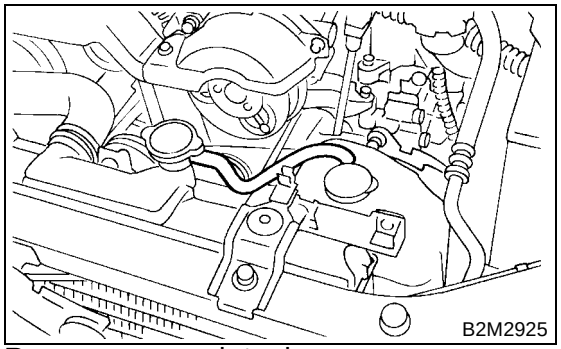
6) Disconnect radiator outlet hose and heater hose from water pump.



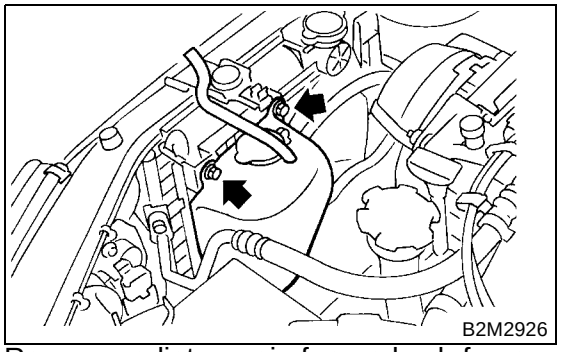
7) Lower the vehicle.
8) Remove air intake duct.



9) Disconnect over flow hose.

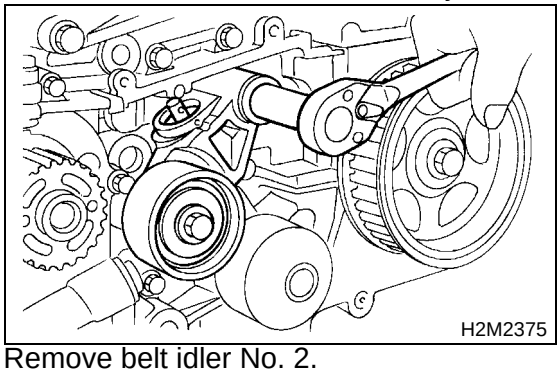


10) Remove reservoir tank.

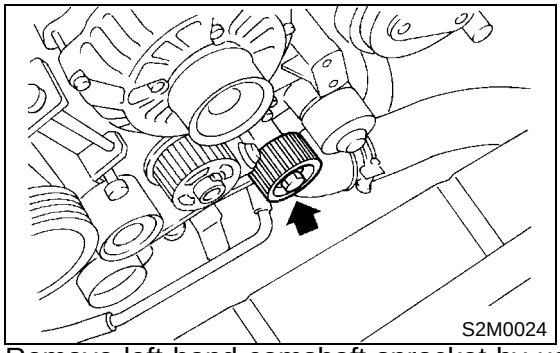


11) Remove radiator main fan and sub fan assemblies. <Ref. to CO-46, REMOVAL, Radiator Main Fan and Fan Motor.> and <Ref. to CO-48, REMOVAL, Radiator Sub Fan and Fan Motor.>
12) Remove V-belts.
<Ref. to ME(SOHC)-42, REMOVAL, V-belt.>

13) Remove timing belt.
<Ref. to ME(SOHC)-46, TIMING BELT, REMOVAL, Timing Belt Assembly.>
14) Remove automatic belt tension adjuster.

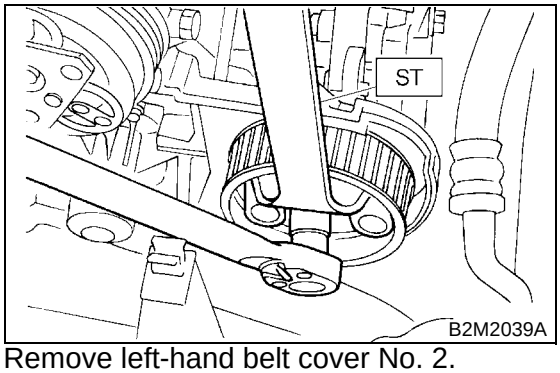

H2M2375

15) Remove belt idler No. 2.


S2M0024

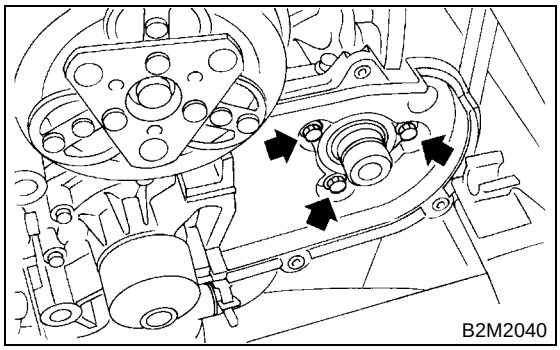
16) Remove left-hand camshaft sprocket by using ST.

ST 499207100 CAMSHAFT SPROCKET WRENCH

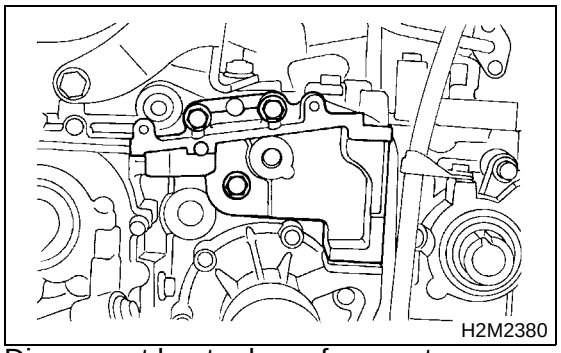


B2M2039A

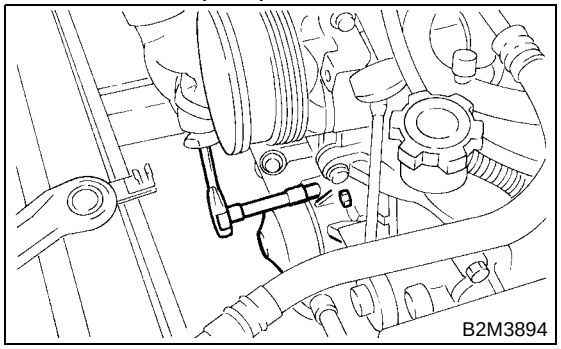
17) Remove left-hand belt cover No. 2.


B2M2040

18) Remove tensioner bracket.


H2M2380

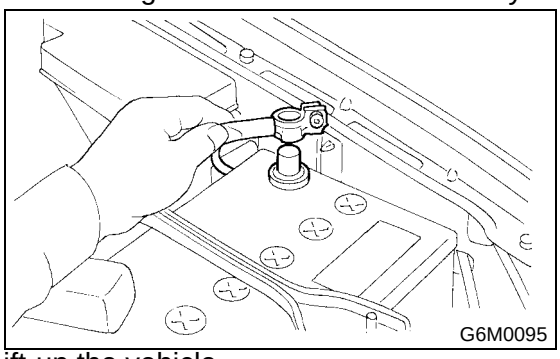
19) Disconnect heater hose from water pump.
20) Remove water pump.


B2M3894

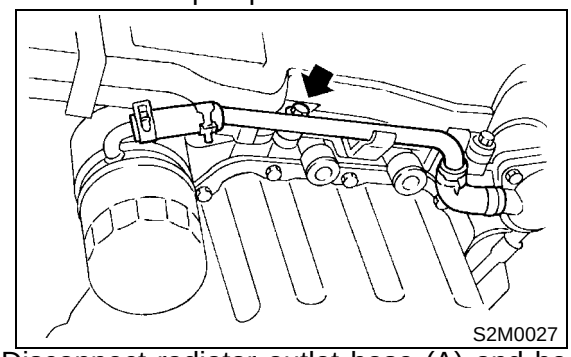
2. TURBO MODEL

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

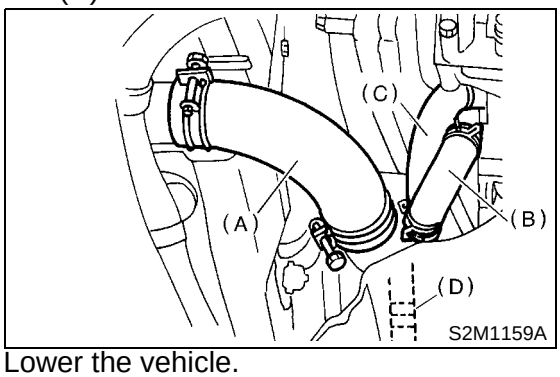
1) Set the vehicle on the lift.
2) Disconnect ground cable from the battery.


G6M0095

3) Lift-up the vehicle.
4) Remove under cover.
5) Drain engine coolant completely. <Ref. to CO-25, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
6) Disconnect connectors from radiator main fan and sub fan motors.
7) Remove bolt which installs water by-pass pipe of oil cooler onto oil pump.

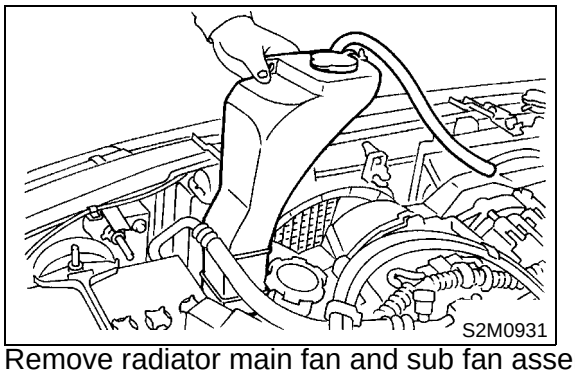

S2M0027

8) Disconnect radiator outlet hose (A) and heater hose (B) from water pump.
9) Disconnect water by-pass hose (C) and oil cooler hose (D).

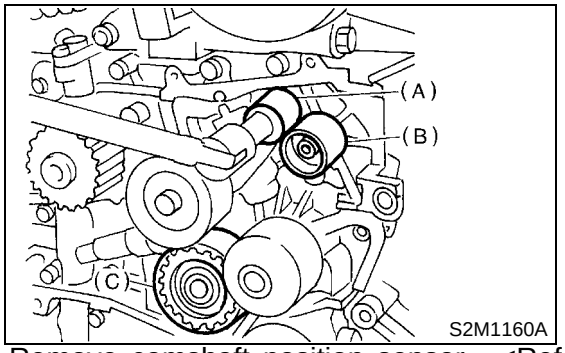


S2M1159A

10) Lower the vehicle.
11) Disconnect over flow hose.
12) Remove reservoir tank.


S2M0931

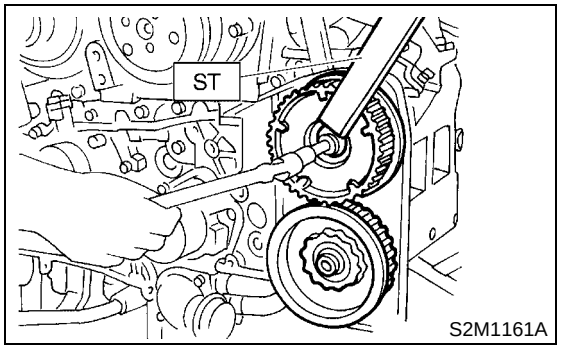
13) Remove radiator main fan and sub fan assemblies. <Ref. to CO-46, REMOVAL, Radiator Main Fan and Fan Motor.> and <Ref. to CO-48, REMOVAL, Radiator Sub Fan and Fan Motor.>
14) Remove V-belts. <Ref. to ME(DOHC TURBO)-43, REMOVAL, V-belt.>
15) Remove timing belt. <Ref. to ME(DOHC TURBO)-47, REMOVAL, Timing Belt Assembly.>
16) Remove automatic belt tension adjuster (A).
17) Remove belt idler (B).
18) Remove belt idler No. 2 (C).



S2M1160A

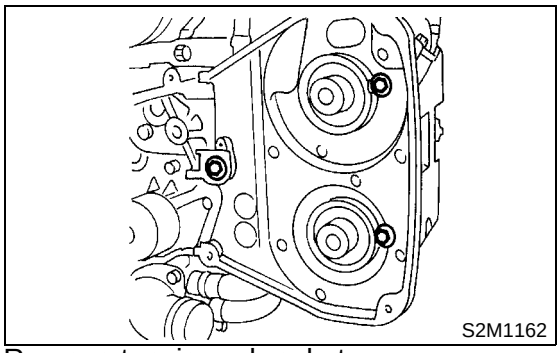
19) Remove camshaft position sensor. <Ref. to FU(DOHC TURBO)-29, REMOVAL, Camshaft Position Sensor.>
20) Remove left-hand camshaft sprockets by using ST.

ST 499207400 CAMSHAFT SPROCKET WRENCH

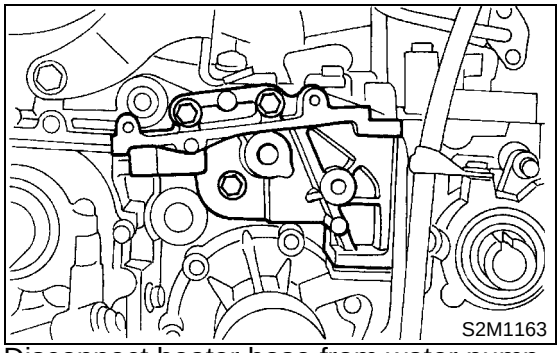


S2M1161A

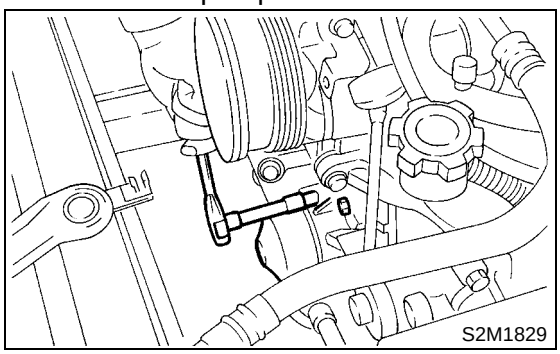
21) Remove left-hand belt cover No. 2.



22) Remove tensioner bracket.



23) Disconnect heater hose from water pump.
24) Remove water pump.



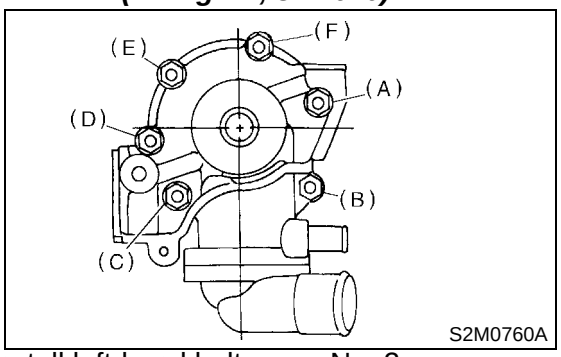
B: INSTALLATION

1. NON-TURBO MODEL

1) Install water pump onto left-hand cylinder head.

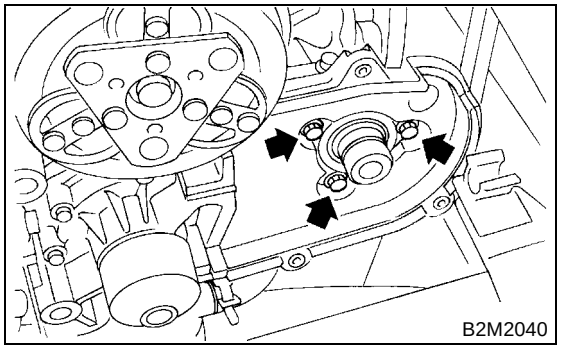
CAUTION:
- **Replace gasket with a new one.**
- **When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.**

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)



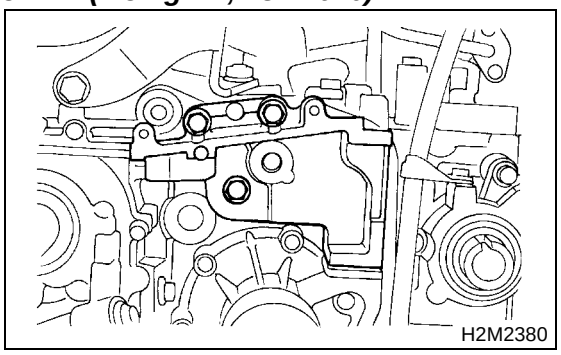
2) Install left-hand belt cover No. 2.

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



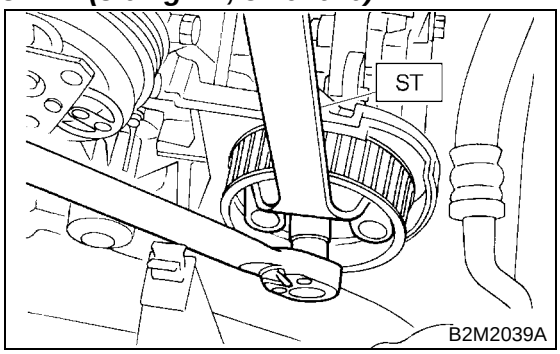
3) Install tensioner bracket.

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



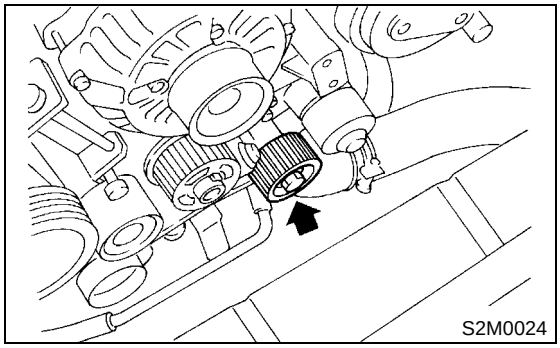
4) Install left-hand camshaft sprockets by using ST.
ST 4992707100 CAMSHAFT SPROCKET WRENCH

Tightening torque:
78 N·m (8.0 kgf-m, 57.9 ft-lb)

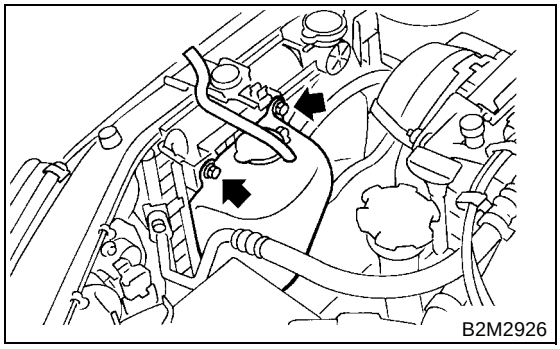


5) Install belt idler No. 2.

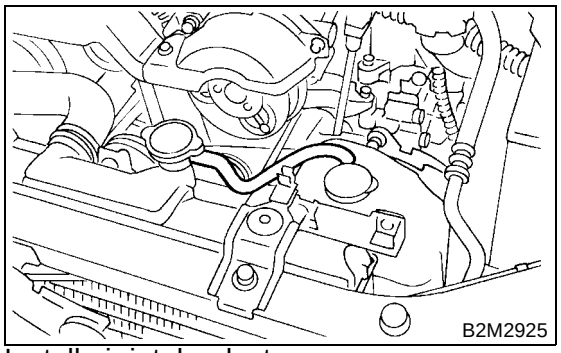
Tightening torque:
39 N·m (4.0 kgf-m, 28.9 ft-lb)



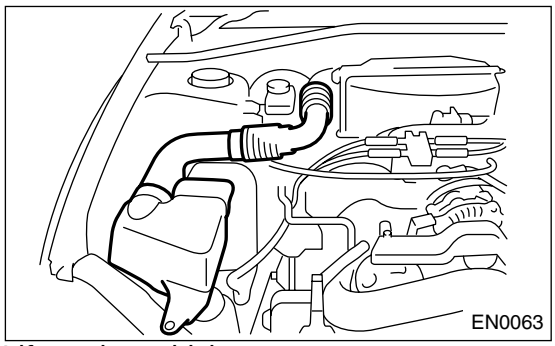
6) Install automatic belt tension adjuster which tension rod is holded with pin. <Ref. to ME(SOHC)-47, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt Assembly.>
7) Install timing belt. <Ref. to ME(SOHC)-48, TIMING BELT, INSTALLATION, Timing Belt Assembly.>
8) Install V-belts. <Ref. to ME(SOHC)-42, INSTALLATION, V-belt.>
9) Install radiator main fan and sub fan motor assemblies. <Ref. to CO-47, INSTALLATION, Radiator Main Fan and Fan Motor.> and <Ref. to CO-48, INSTALLATION, Radiator Sub Fan and Fan Motor.>
10) Install reservoir tank.



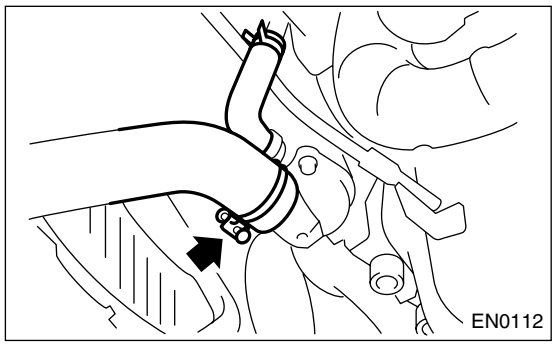
11) Connect over flow hose.



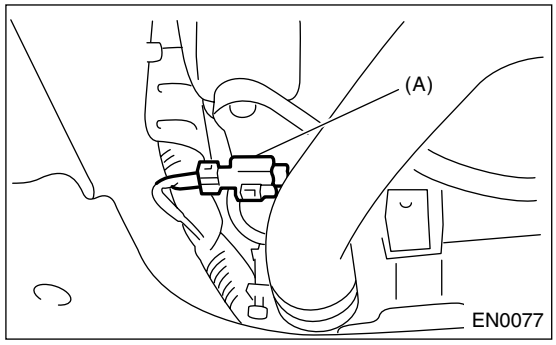
12) Install air intake duct.

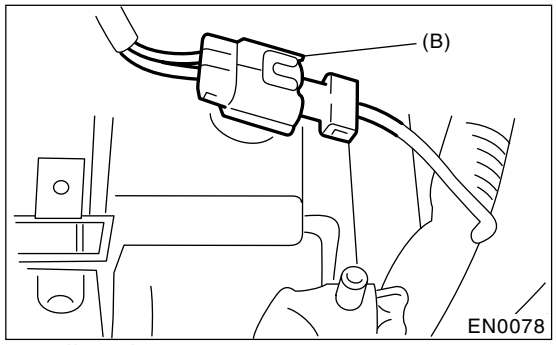


13) Lift-up the vehicle.
14) Connect radiator outlet hose and heater hose to water pump.

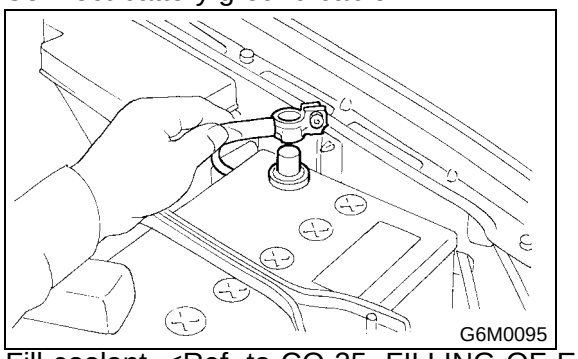


15) Connect connectors to radiator main fan (A) and sub fan (B) motors.





16) Install under cover.
17) Lower the vehicle.
18) Connect battery ground cable.



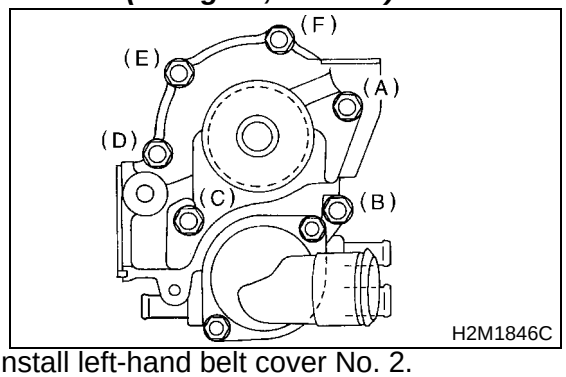
19) Fill coolant. <Ref. to CO-25, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

2. TURBO MODEL

1) Install water pump onto left-hand cylinder head.

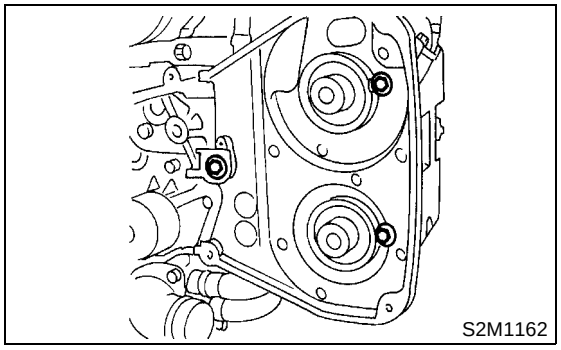
CAUTION:
• Replace gasket with a new one.
• When installing water pump, tighten bolts in two stages in alphabetical sequence as shown in figure.

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)



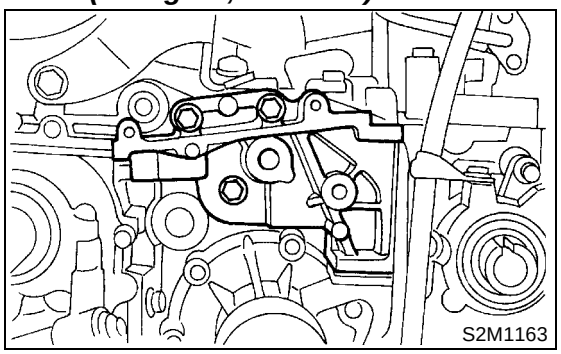
2) Install left-hand belt cover No. 2.

Tightening torque:
5 N·m (0.5 kgf-m, 3.6 ft-lb)



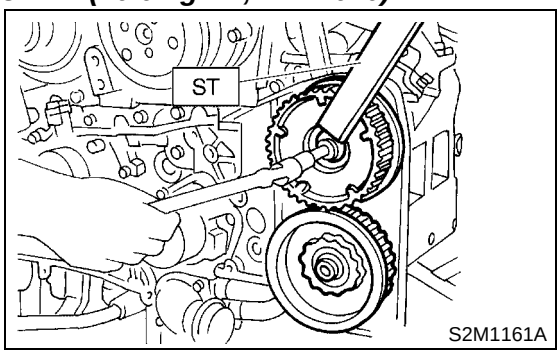
3) Install tensioner bracket.

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



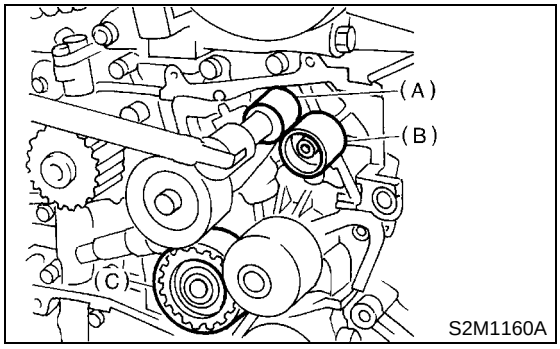
4) Install left-hand camshaft sprockets by using ST.
ST 499207400 CAMSHAFT SPROCKET WRENCH

Tightening torque:
98 N·m (10.0 kgf-m, 72.4 ft-lb)

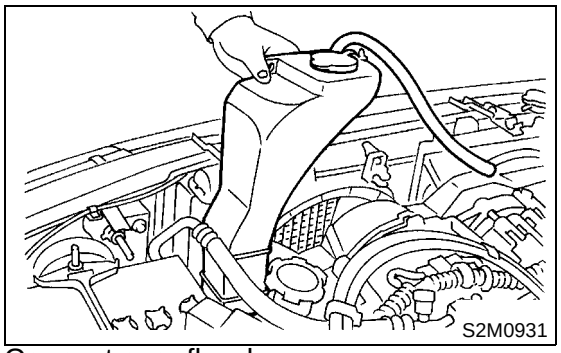


5) Install camshaft position sensor. <Ref. to FU(DOHC TURBO)-29, INSTALLATION, Camshaft Position Sensor.>
6) Install belt idler No. 2 (C).
7) Install belt idler (B).
8) Install automatic belt tension adjuster (A) which has a tension rod held by a pin. <Ref. to ME(DOHC TURBO)-48, AUTOMATIC BELT TENSION ADJUSTER ASSEMBLY AND BELT IDLER, INSTALLATION, Timing Belt Assembly.>

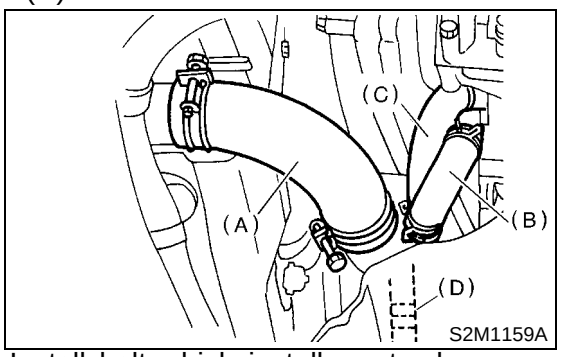
Tightening torque:
39.4 N·m (4.0 kgf-m, 28.9 ft-lb)



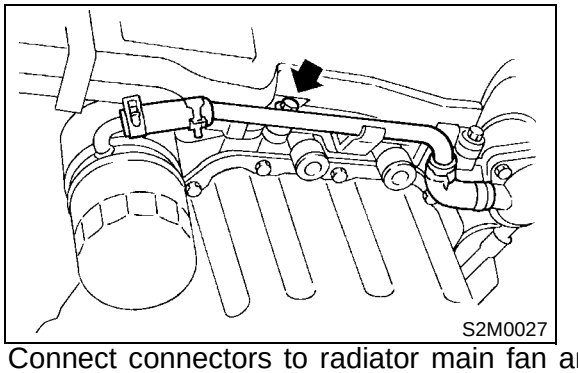
9) Install timing belt. <Ref. to ME(DOHC TURBO)-49, TIMING BELT, INSTALLATION, Timing Belt Assembly.>
10) Install V-belts. <Ref. to ME(DOHC TURBO)-43, INSTALLATION, V-belt.>
11) Install radiator main fan and sub fan motor assemblies. <Ref. to CO-47, INSTALLATION, Radiator Main Fan and Fan Motor.> and <Ref. to CO-48, INSTALLATION, Radiator Sub Fan and Fan Motor.>
12) Install reservoir tank.



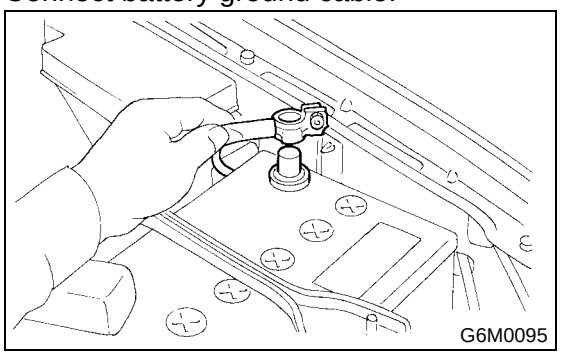
13) Connect over flow hose.
14) Lift-up the vehicle.
15) Connect radiator outlet hose (A) and heater hose (B) to water pump.
16) Connect water by-pass hose (C) and oil cooler hose (D).



17) Install bolt which installs water by-pass pipe onto oil pump.



18) Connect connectors to radiator main fan and sub fan motors.
19) Install under cover.
20) Lower the vehicle.
21) Connect battery ground cable.

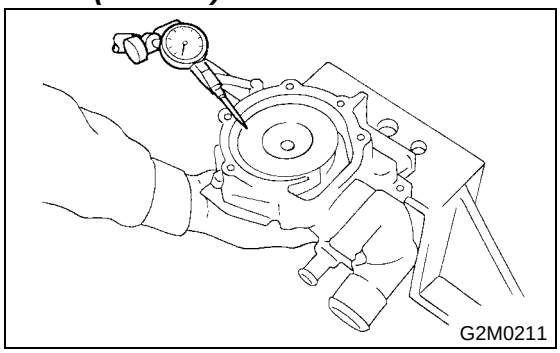


22) Fill coolant. <Ref. to CO-25, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

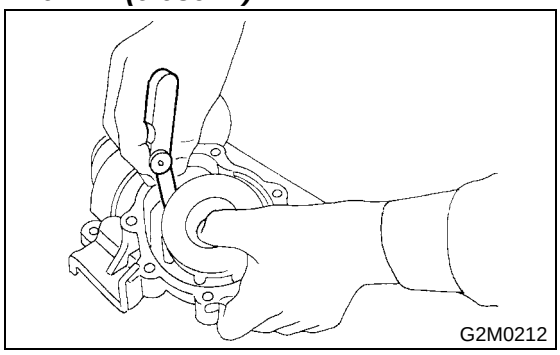
1) Check water pump bearing for smooth rotation.
2) Check water pump pulley for abnormalities.
3) Using a dial gauge, measure impeller runout in thrust direction while rotating the pulley.

"Thrust" runout limit:
0.5 mm (0.020 in)



4) Check clearance between impeller and pump case.

Clearance between impeller and pump case:
Standard
0.5 — 0.7 mm (0.020 — 0.028 in)
Limit
1.0 mm (0.039 in)

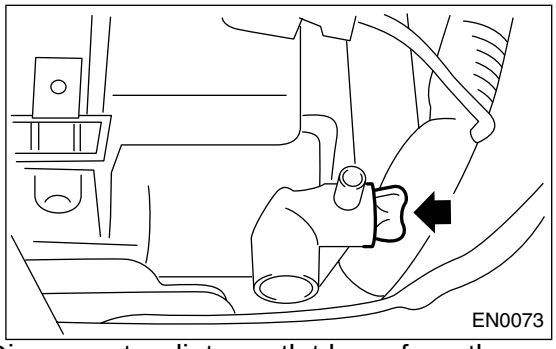


5) After water pump installation, check pulley shaft for engine coolant leaks. If leaks are noted, replace water pump assembly.

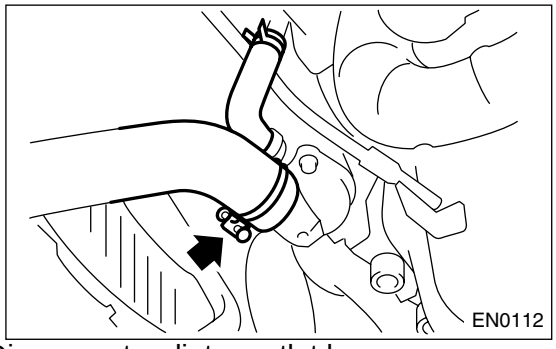
6. Thermostat

A: REMOVAL

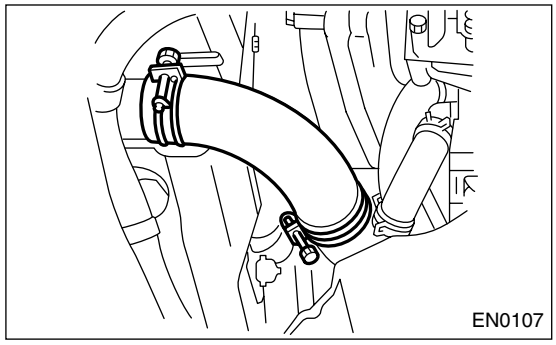
1) Lift-up the vehicle.
2) Remove under cover.
3) Drain engine coolant completely. <Ref. to CO-25, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>



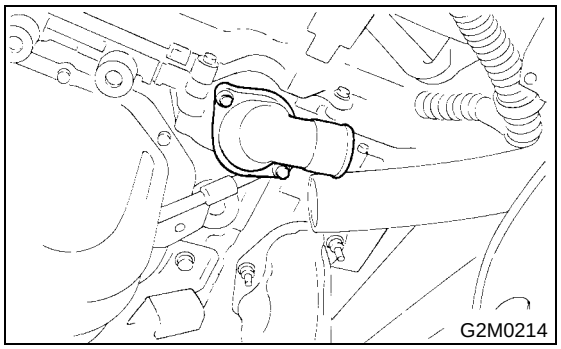
4) Disconnect radiator outlet hose from thermostat cover.
• Non-Turbo model



5) Disconnect radiator outlet hose.
• Turbo model



6) Remove thermostat cover and gasket, and pull out the thermostat.

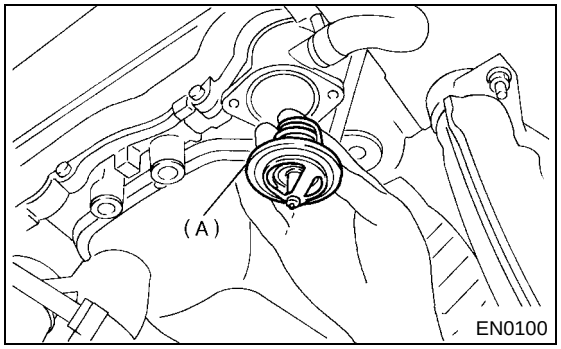


B: INSTALLATION

1) Install the thermostat in the water pump, and install the thermostat cover together with a gasket.

CAUTION:
• When reinstalling the thermostat, use a new gasket.
• The thermostat must be installed with the jiggle pin (A) facing to front side.
• At this time, set the jiggle pin of thermostat for front side.

Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



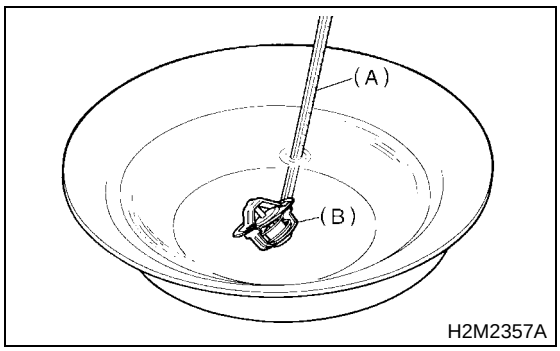
2) Fill coolant. <Ref. to CO-25, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION

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

Starts to open:
76 — 80°C (169 — 176°F)

Fully opens:
91°C (196°F)



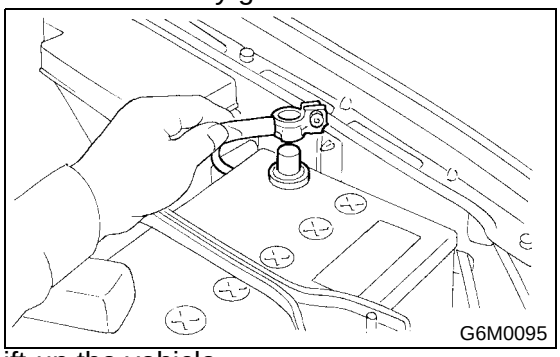
(A) Thermometer
(B) Thermostat

7. Radiator

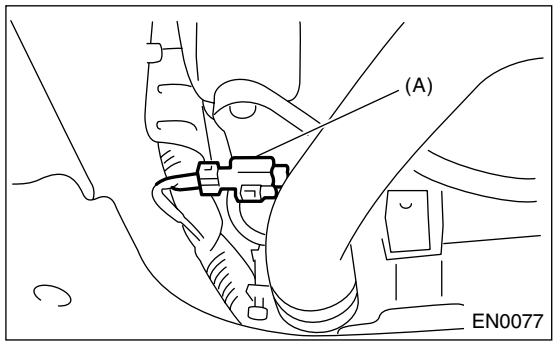
A: REMOVAL

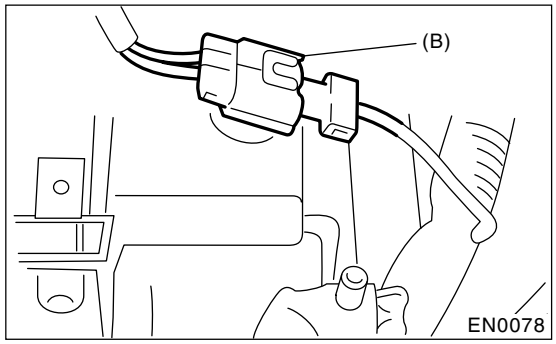
1. NON-TURBO MODEL

1) Disconnect battery ground cable.

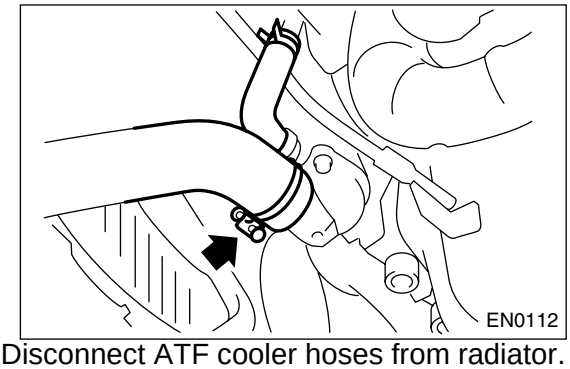


2) Lift-up the vehicle.
3) Drain engine coolant completely. <Ref. to CO-25, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Disconnect connectors of radiator main fan (A) and sub fan (B) motor.

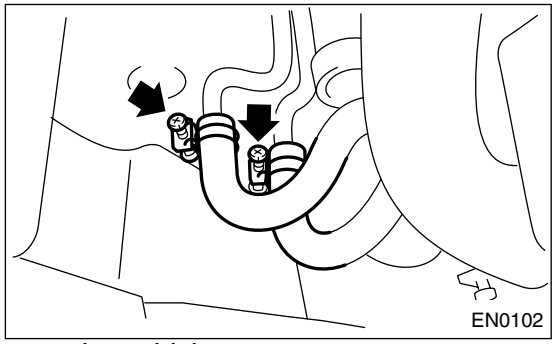




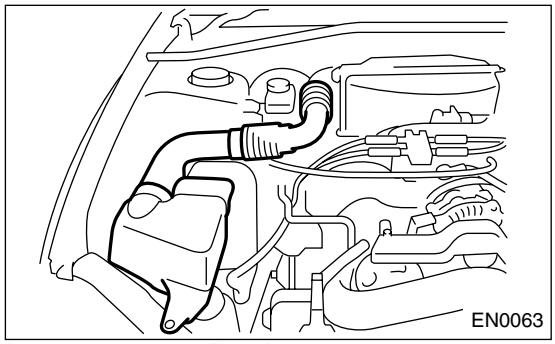
5) Disconnect radiator outlet hose from thermostat cover.



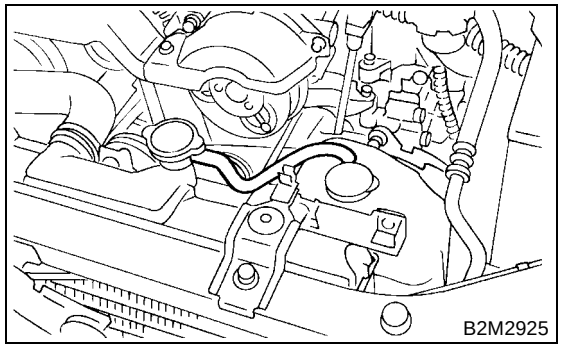
6) Disconnect ATF cooler hoses from radiator. (AT vehicles only)



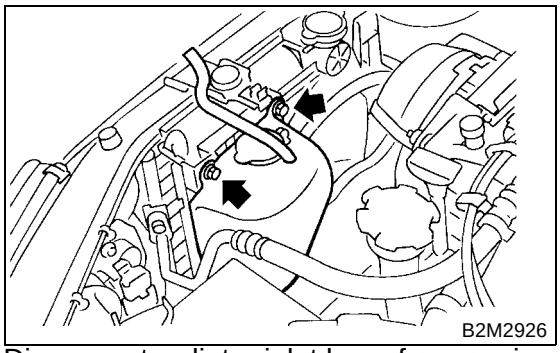
7) Lower the vehicle.
8) Remove air intake duct.



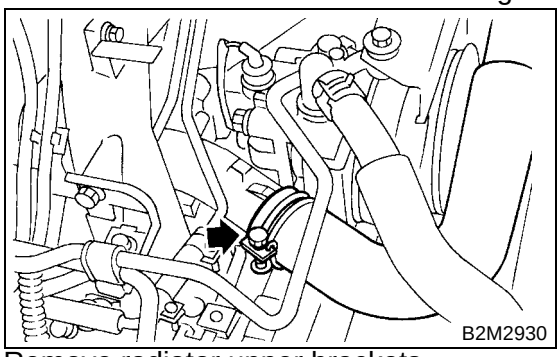
9) Disconnect over flow hose.



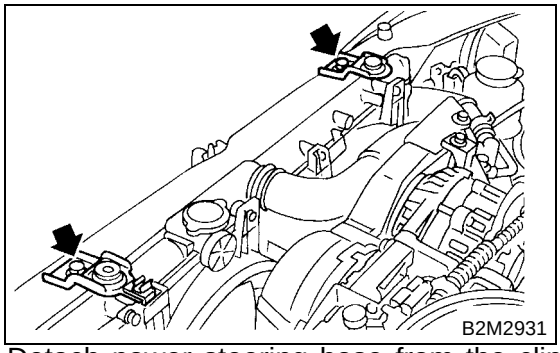
10) Remove reservoir tank.



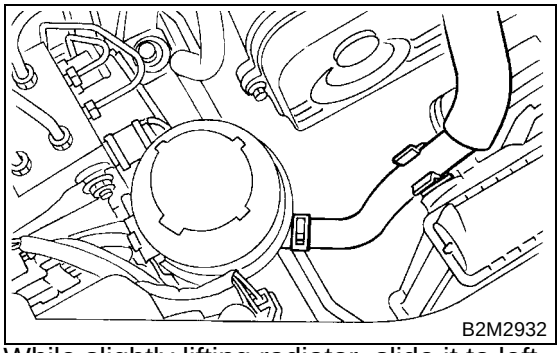
11) Disconnect radiator inlet hose from engine.



12) Remove radiator upper brackets.

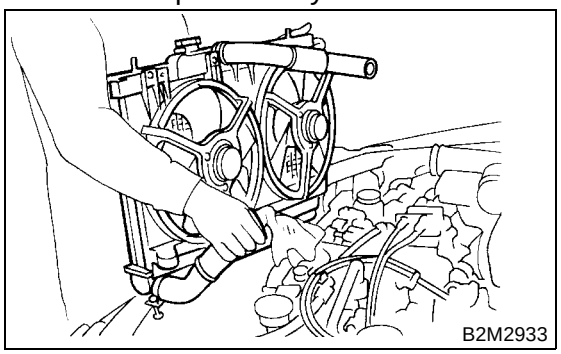


13) Detach power steering hose from the clip on the radiator.



14) While slightly lifting radiator, slide it to left.

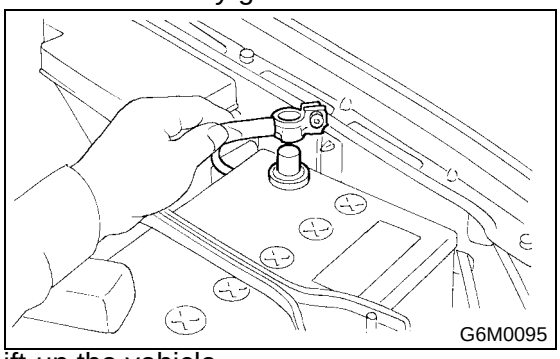
15) Lift radiator up and away from vehicle.



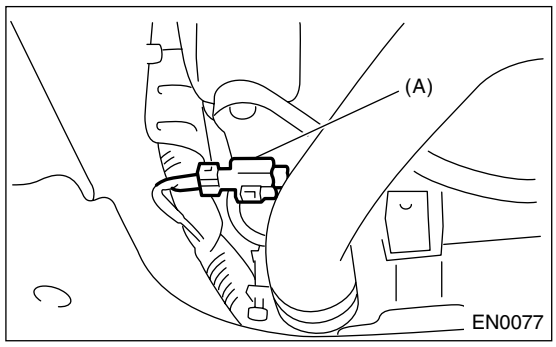
2. TURBO MODEL

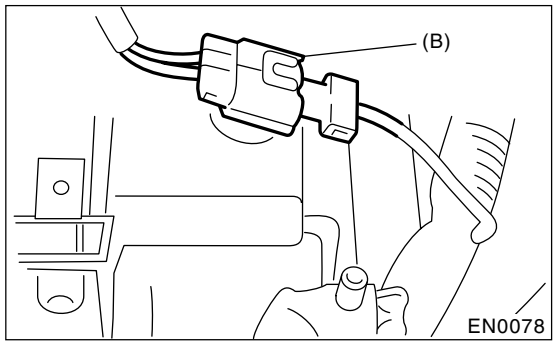
WARNING:
The radiator is pressurized. Wait until engine cools down before working on the radiator.

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

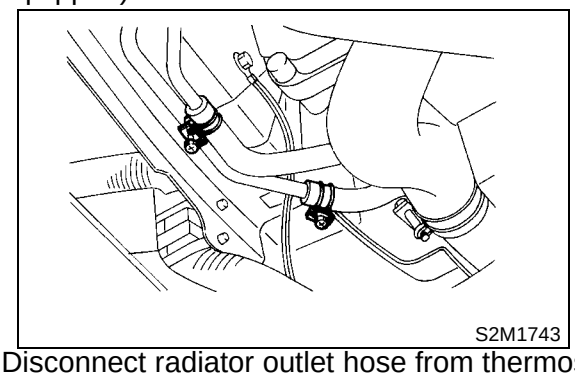


3) Lift-up the vehicle.
4) Remove under cover.
5) Drain engine coolant completely. <Ref. to CO-25, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
6) Disconnect connectors of radiator main fan (A) and sub fan motor (B).

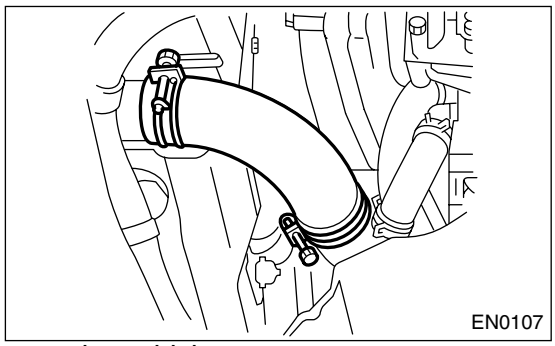




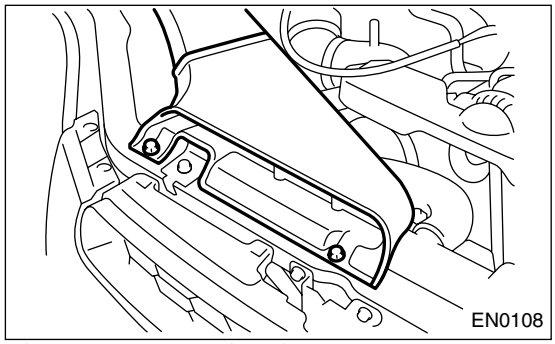
7) Disconnect oil cooler hoses from oil cooler pipes. (if equipped)



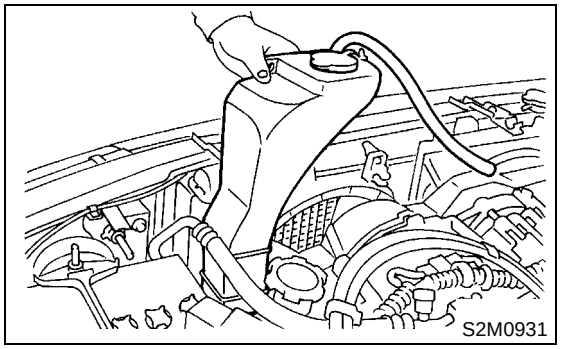
8) Disconnect radiator outlet hose from thermostat cover.



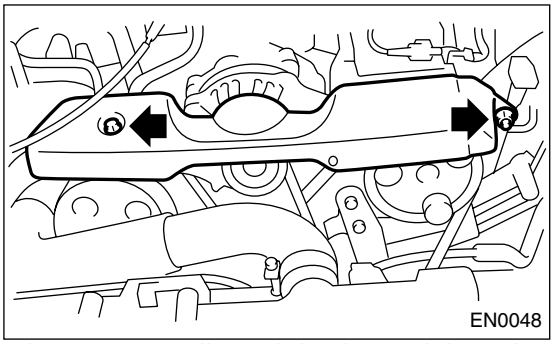
9) Lower the vehicle.
10) Remove air intake duct.



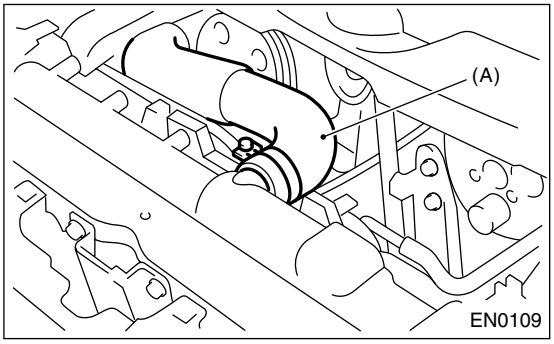
11) Disconnect over flow hose.
12) Remove reservoir tank.

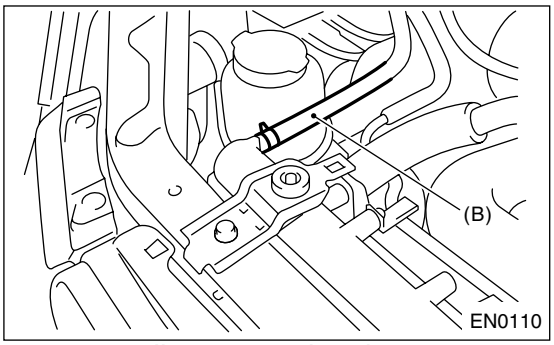


13) Remove V-belt covers.

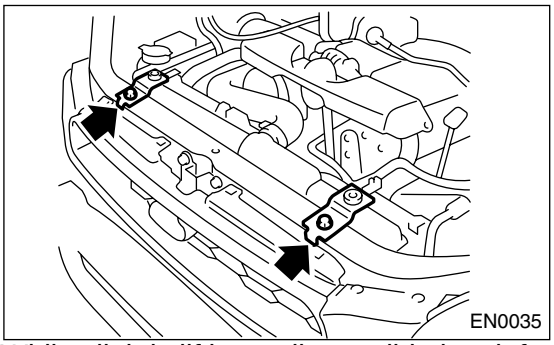


14) Disconnect radiator inlet hose (A) and water tank hose (B) from radiator.





15) Remove radiator upper brackets.

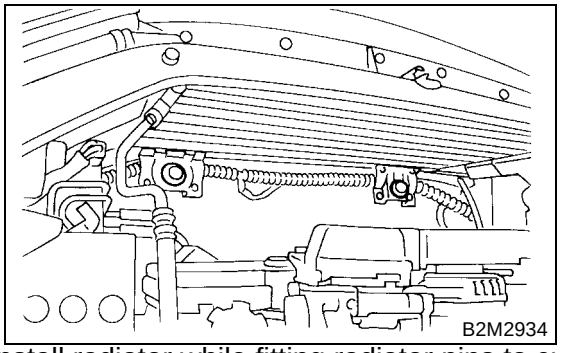


16) While slightly lifting radiator, slide it to left.
17) Lift radiator up and away from vehicle.

B: INSTALLATION

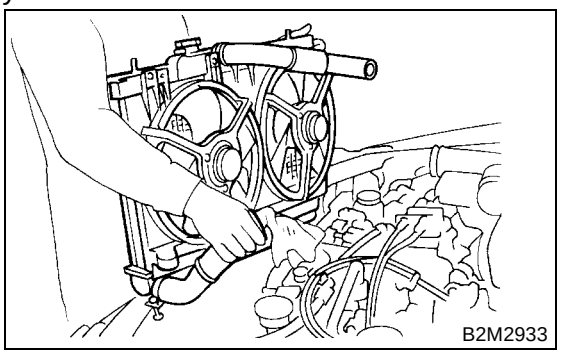
1. NON-TURBO MODEL

1) Attach radiator mounting cushions to holes on the vehicle.



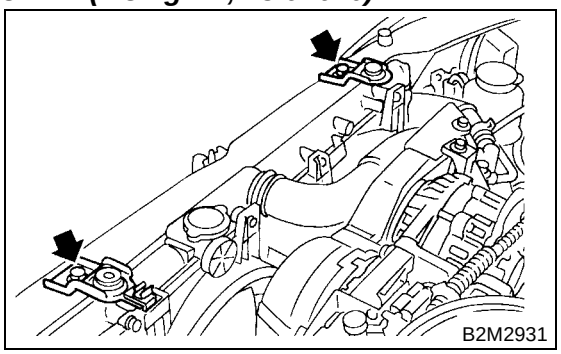
2) Install radiator while fitting radiator pins to cushions.

NOTE:
Fit pins on lower side of radiator into cushions on body side.

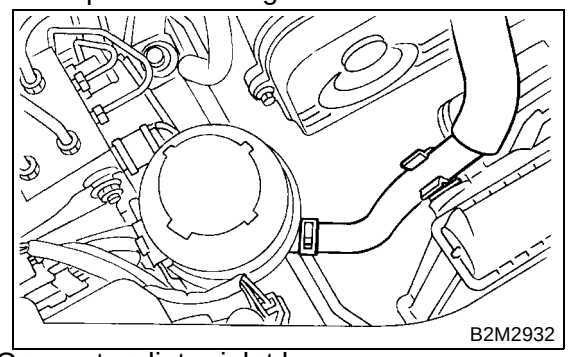


3) Install radiator brackets and tighten bolts.

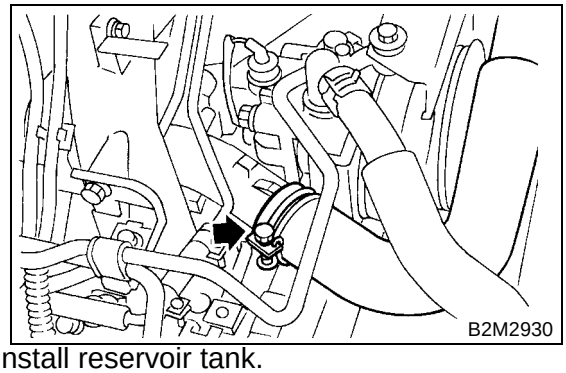
Tightening torque:
18 N·m (1.8 kgf-m, 13.0 ft-lb)



4) Attach power steering hose to the radiator.

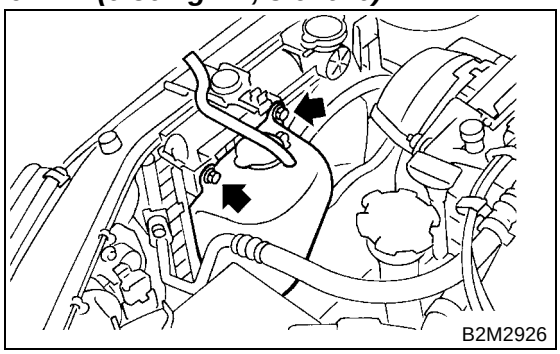


5) Connect radiator inlet hose.

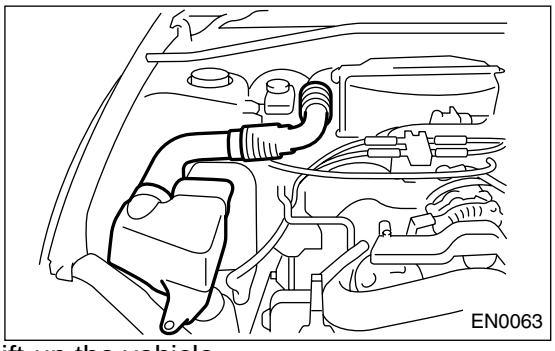


6) Install reservoir tank.

Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

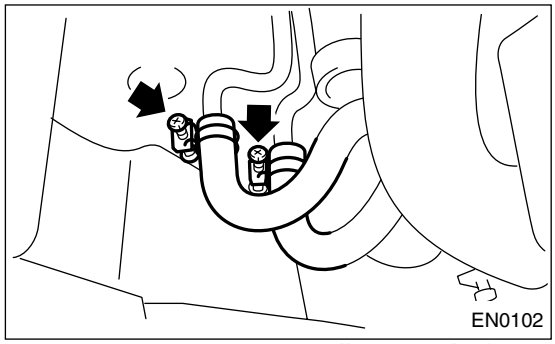


7) Install air intake duct.

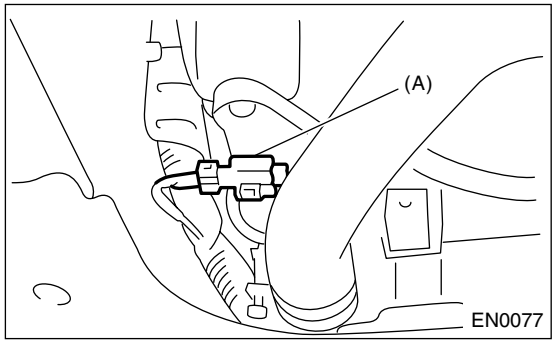


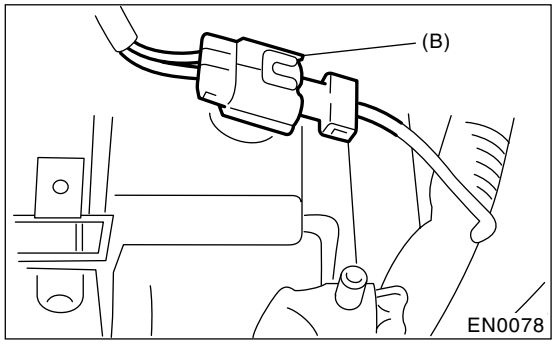
8) Lift-up the vehicle.

9) Connect ATF cooler hoses. (AT vehicles only)

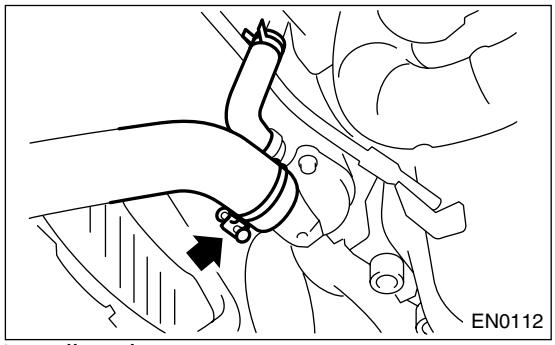


10) Connect connectors to radiator main fan motor (A) and sub fan motor (B).



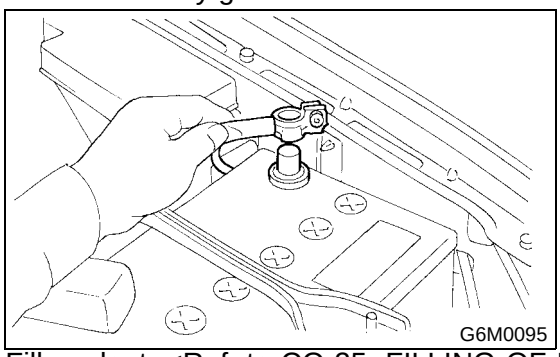


11) Connect radiator outlet hose.



12) Install under cover.
13) Lower the vehicle.

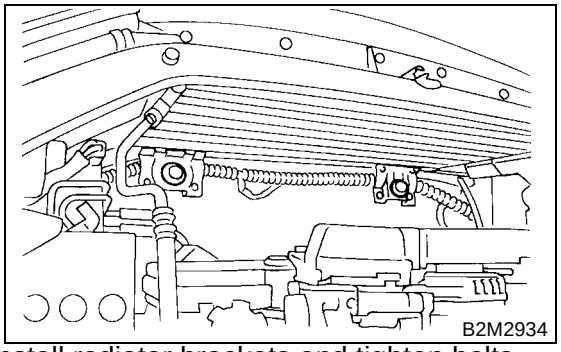
14) Connect battery ground cable.



15) Fill coolant. <Ref. to CO-25, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
16) Check ATF level. <Ref. to AT-9, INSPECTION, Automatic Transmission Fluid.>

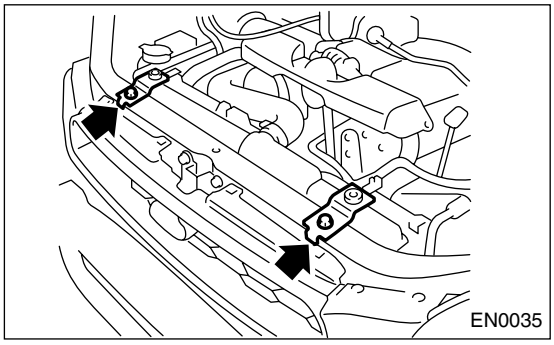
2. TURBO MODEL

1) Attach radiator mounting cushions to holes on the vehicle.

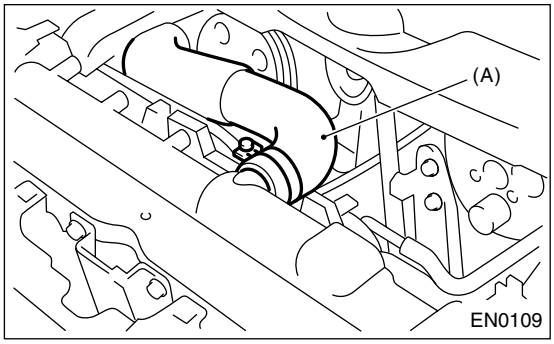


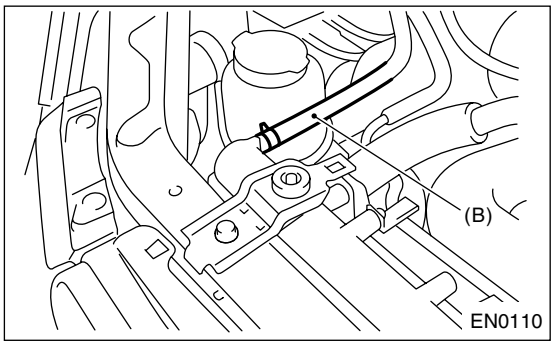
2) Install radiator brackets and tighten bolts.

Tightening torque:
18±5 N·m (1.8±0.5 kgf-m, 13.0±3.6 ft-lb)



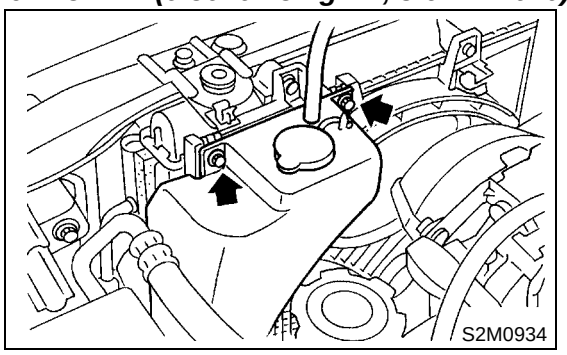
3) Connect radiator inlet hose (A) and water tank hose (B).



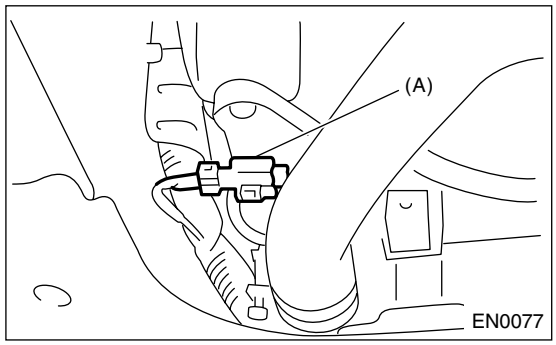


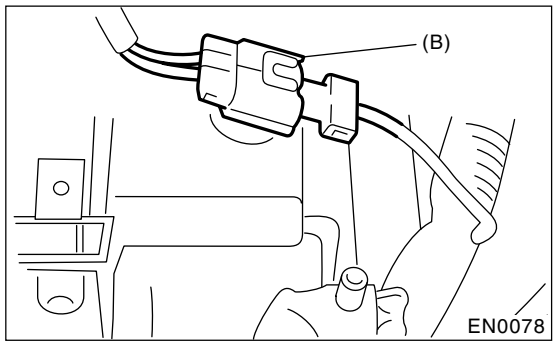
4) Install reservoir tank.

Tightening torque:
4.9±1.5 N·m (0.50±0.15 kgf-m, 3.6±1.1 ft-lb)

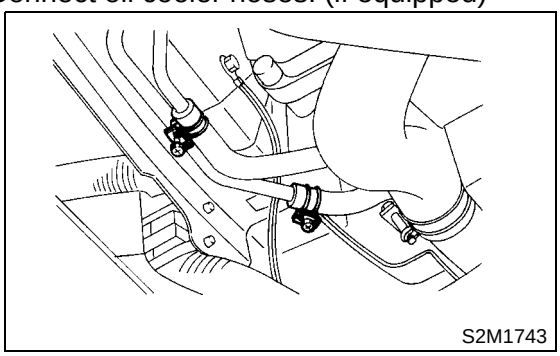


5) Connect over flow hose.
6) Lift-up the vehicle.
7) Connect connectors to radiator main fan motor(A) and sub fan motor(B).

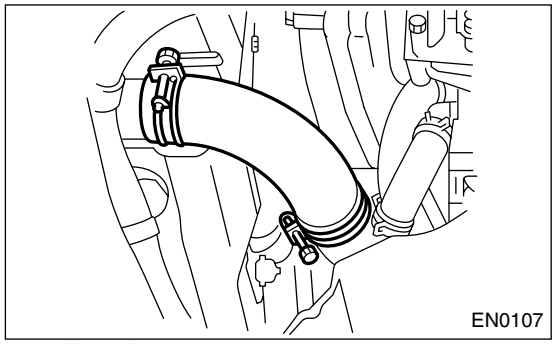




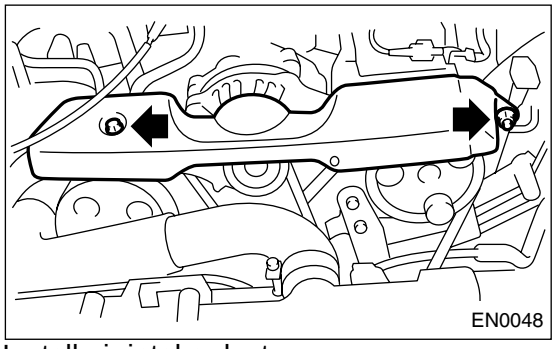
8) Connect oil cooler hoses. (if equipped)



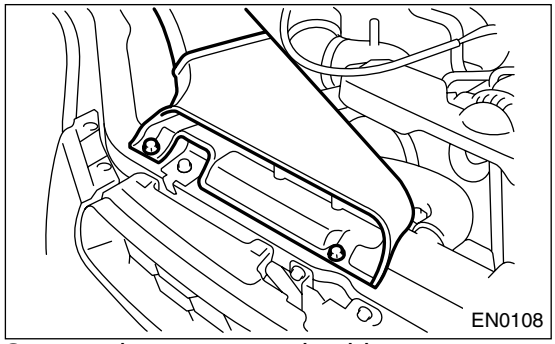
9) Connect radiator outlet hose.



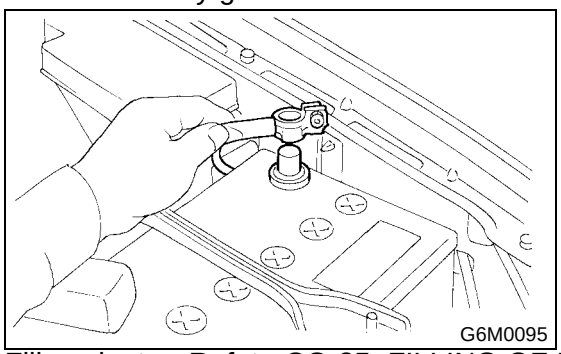
10) Install under cover.
11) Lower the vehicle.
12) Install V-belt covers.



13) Install air intake duct.



14) Connect battery ground cable.

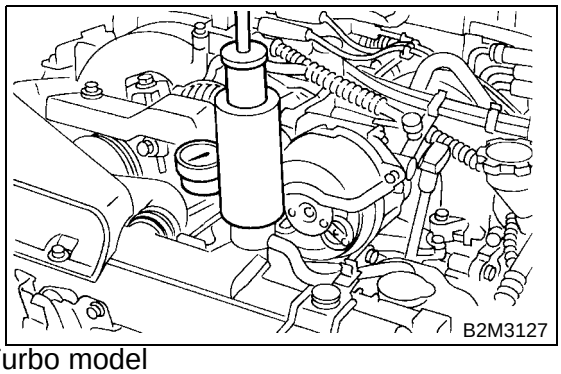


15) Fill coolant. <Ref. to CO-25, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

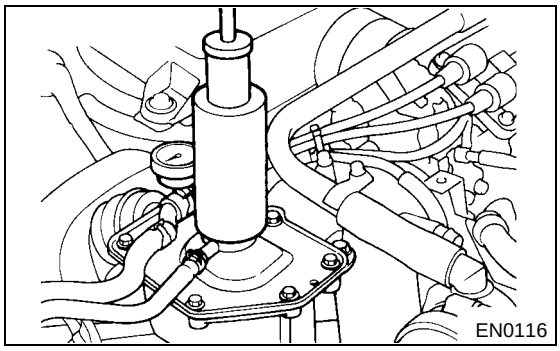
C: INSPECTION

1) Remove radiator cap, top off radiator, and attach tester to radiator in place of cap.

- Non-Turbo model



- Turbo model



2) Apply a pressure of 157 kPa (1.6 kg/cm^2, 23 psi) to radiator to check if:

(1) Engine coolant leaks at/around radiator.

(2) Engine coolant leaks at/around hoses or connections.

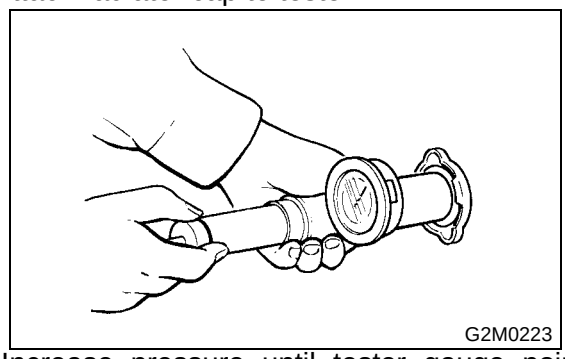
CAUTION:

- **Engine should be off.**
- **Wipe engine coolant from check points in advance.**
- **Be careful to prevent engine coolant from spurting out when removing tester.**
- **Be careful also not to deform filler neck of radiator when installing or removing tester.**

8. Radiator Cap

A: INSPECTION

1) Attach radiator cap to tester.



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

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

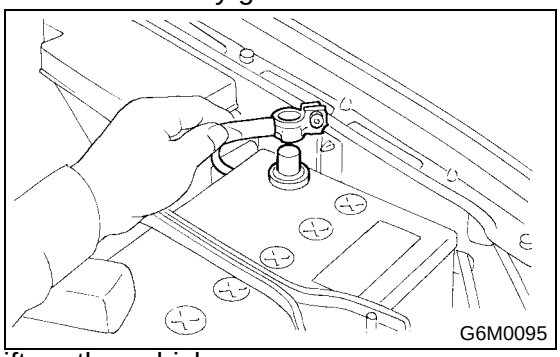
Service limit pressure:
83 kPa (0.85 kg/cm^2, 12 psi)

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

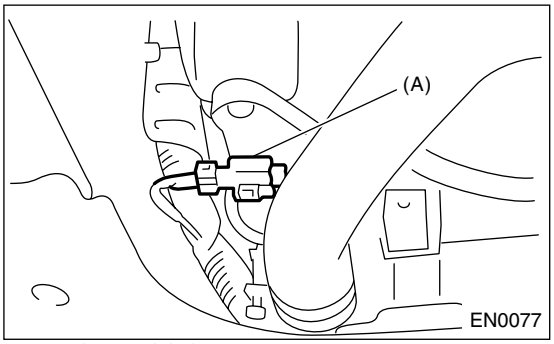
9. Radiator Main Fan and Fan Motor

A: REMOVAL

1) Disconnect battery ground cable.

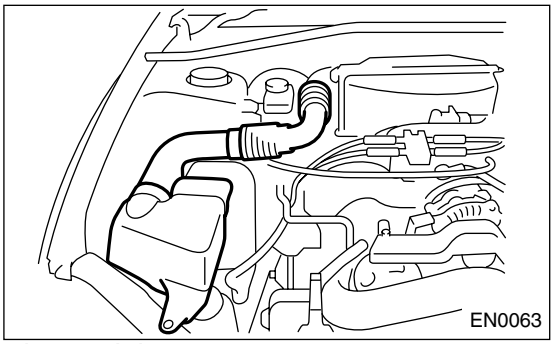


2) Lift-up the vehicle.
3) Remove under cover.
4) Disconnect connector of main fan motor (A).

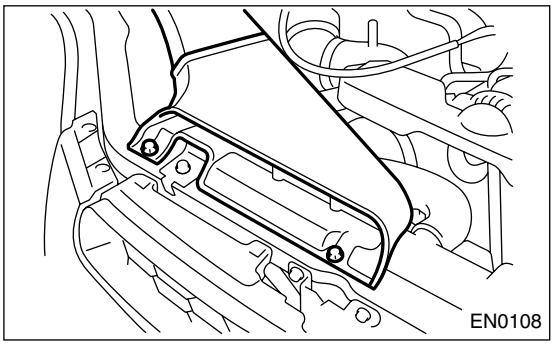


5) Lower the vehicle.
6) Remove air intake duct.

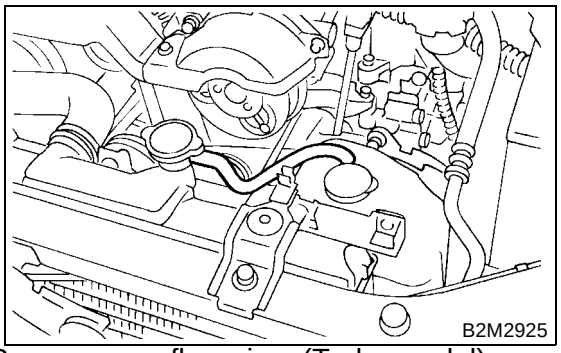
- Non-Turbo model



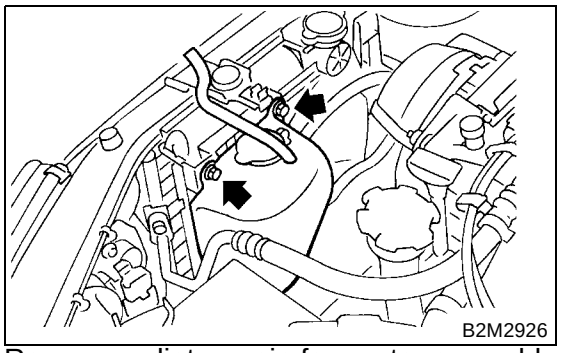
- Turbo model



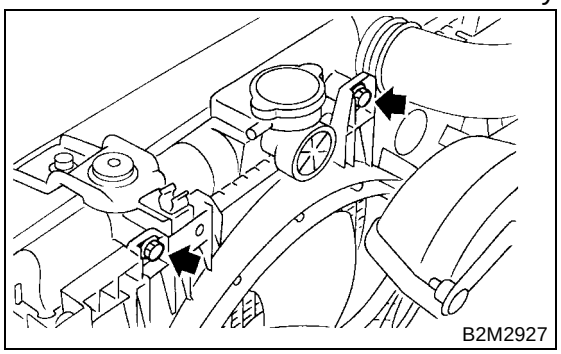
7) Disconnect over flow hose.



8) Remove over flow pipe. (Turbo model)
9) Remove reservoir tank.



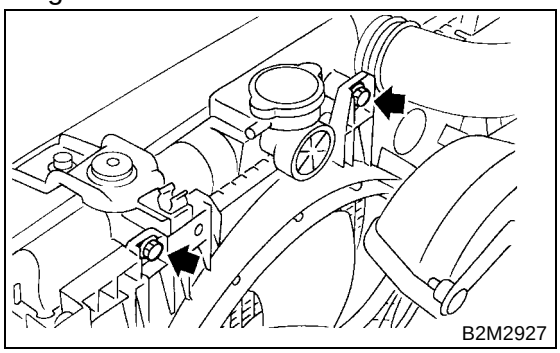
10) Remove radiator main fan motor assembly.



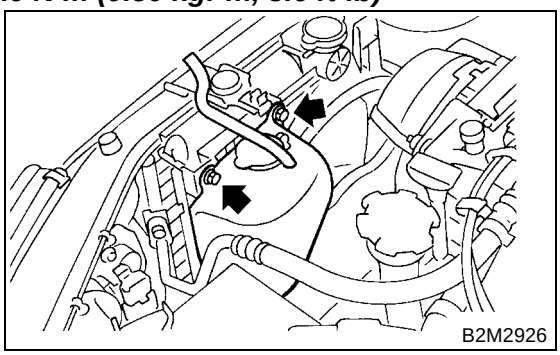
B: INSTALLATION

Install in the reverse order of removal.

NOTE:
When the main fan motor assembly cannot be installed as is, loosen the sub fan motor assembly securing bolts to install it.

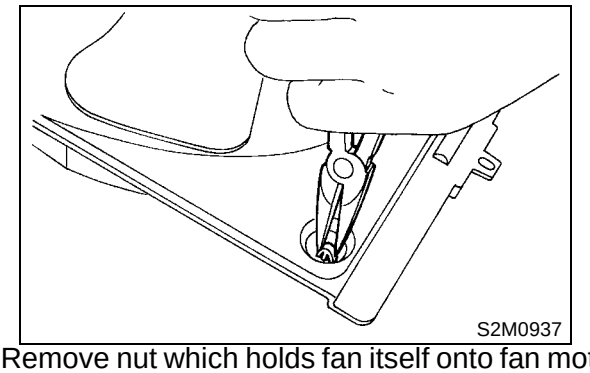


Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

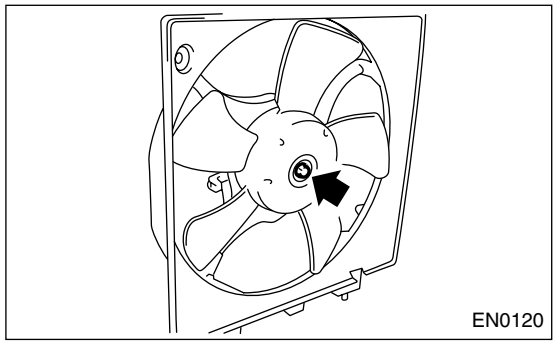


C: DISASSEMBLY

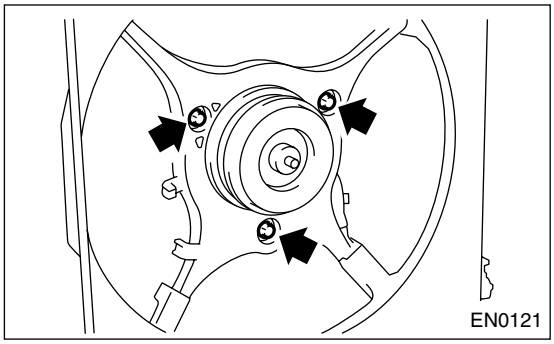
1) Remove clip which holds motor connector onto shroud.



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



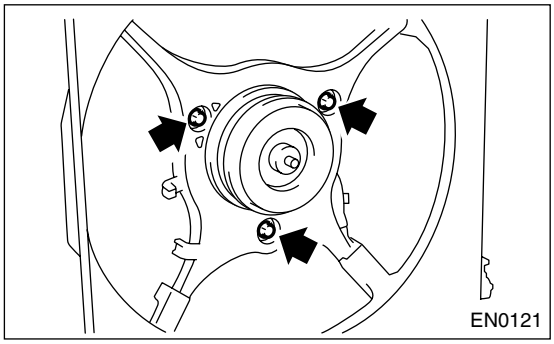
3) Remove bolts which install fan motor onto shroud.



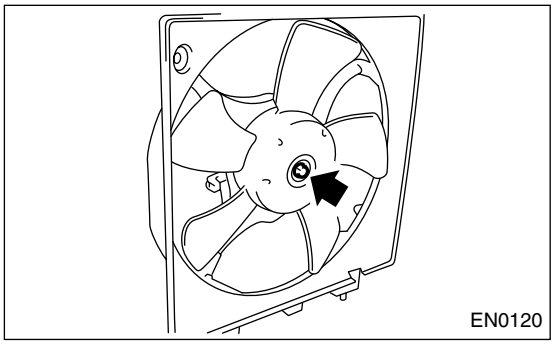
D: ASSEMBLY

Assemble in the reverse order of disassembly.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



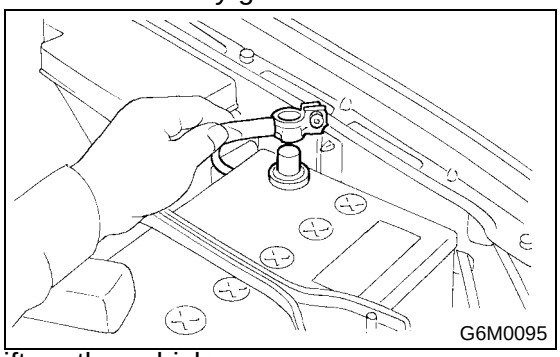
Tightening torque:
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



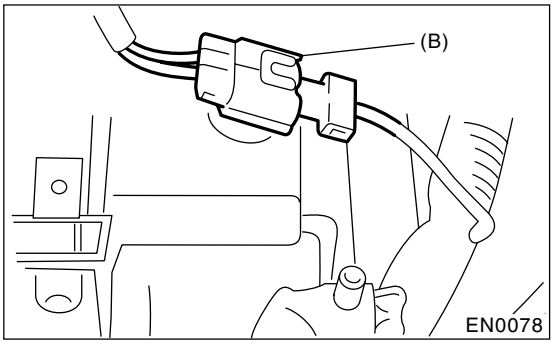
10. Radiator Sub Fan and Fan Motor

A: REMOVAL

1) Disconnect battery ground cable.

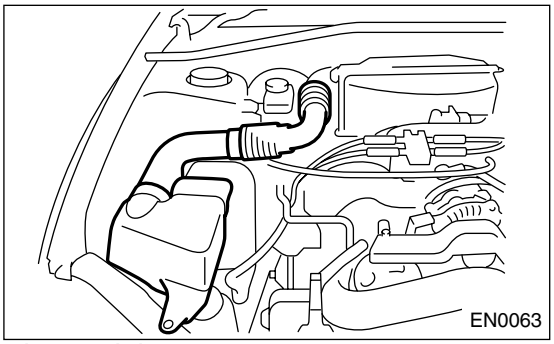


2) Lift-up the vehicle.
3) Remove under cover.
4) Disconnect connector of sub fan motor.

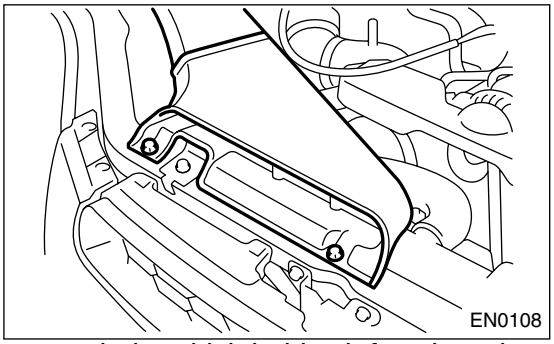


5) Lower the vehicle.
6) Remove air intake duct.

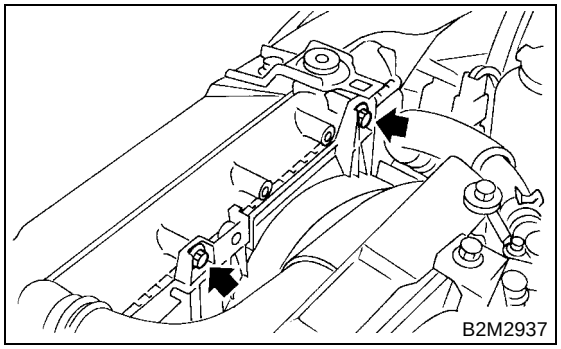
- Non-Turbo model



- Turbo model



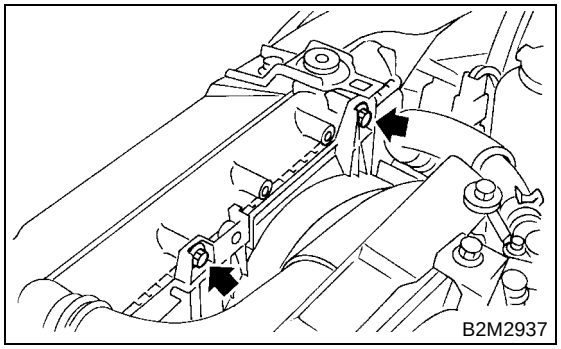
7) Remove bolts which hold sub fan shroud to radiator.
8) Remove over flow pipe. (Turbo model)
9) Remove radiator sub fan shroud through the under side of vehicle.



B: INSTALLATION

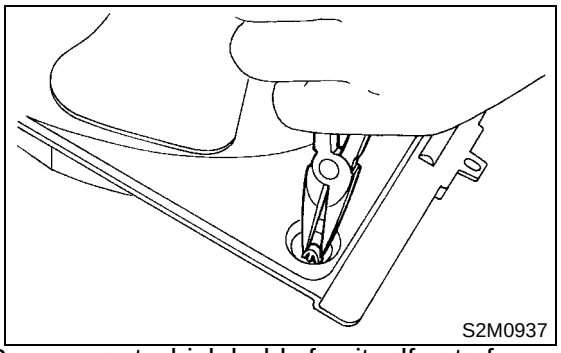
Install in the reverse order of removal.

Tightening torque:
4.9 N·m (0.50 kgf-m, 3.6 ft-lb)

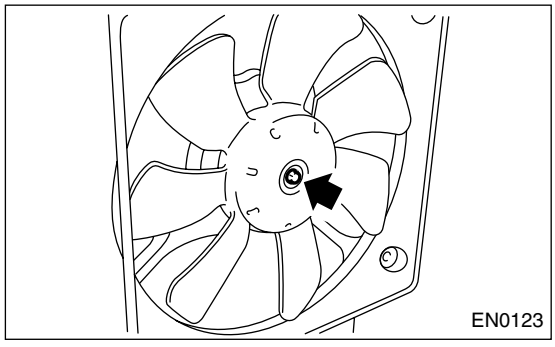


C: DISASSEMBLY

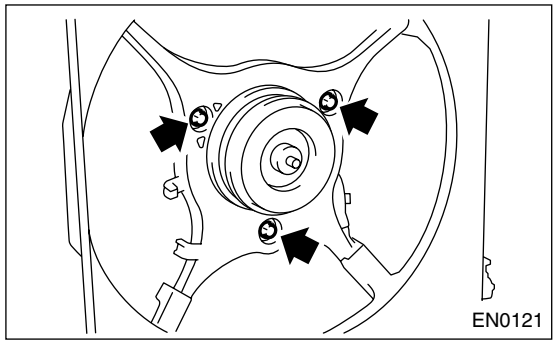
1) Remove clip which holds motor harness onto shroud.



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



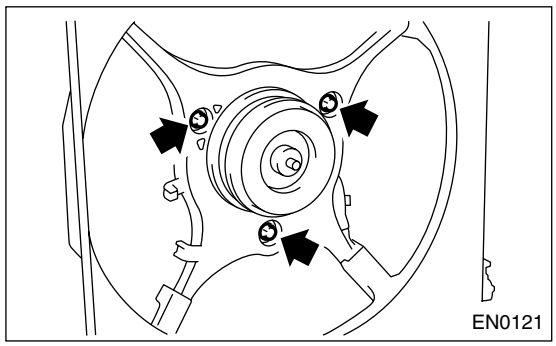
3) Remove bolts which install fan motor onto shroud.



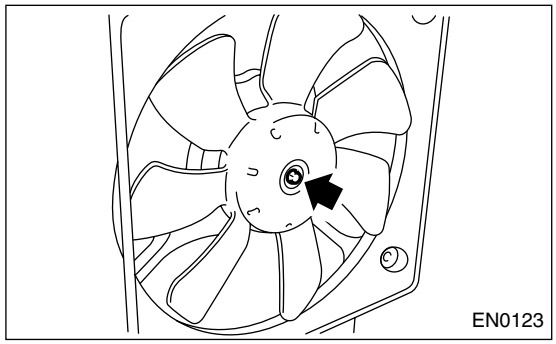
D: ASSEMBLY

Assemble in the reverse order of disasssembly.

Tightening torque:
4.4 N·m (0.45 kgf-m, 3.3 ft-lb)



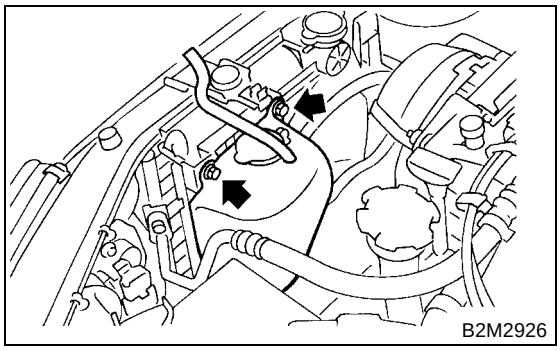
Tightening torque:
3.4 N·m (0.35 kgf-m, 2.5 ft-lb)



11.Reservoir Tank

A: REMOVAL

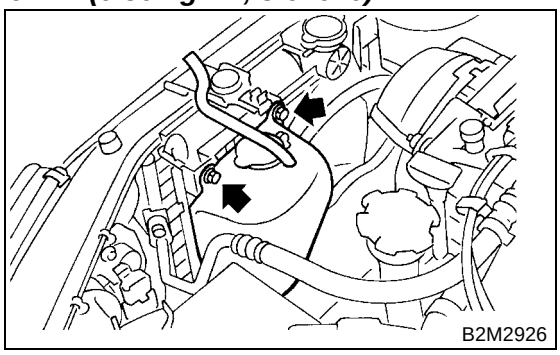
1) Disconnect over flow hose from radiator filler neck position.
2) Remove bolts which install reservoir tank onto radiator main fan shroud.
3) Remove reservoir tank.



B: INSTALLATION

Install in the reverse order of removal.

Tightening torque:
4.9N·m (0.50 kgf-m, 3.6 ft-lb)



C: INSPECTION

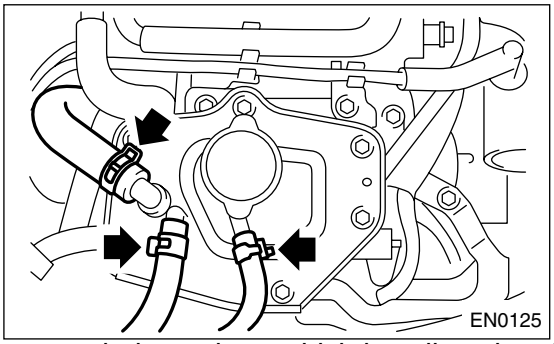
Make sure the engine coolant level is between full and low.

12.Coolant Filler Tank

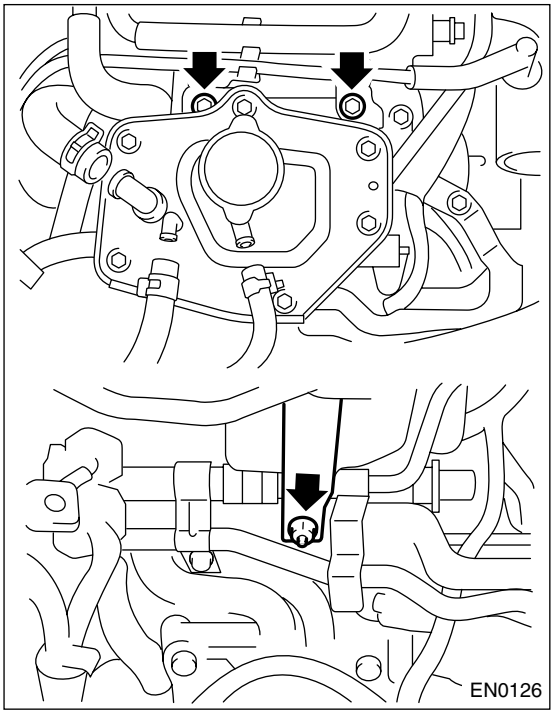
A: REMOVAL

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

1) Drain coolant about 3.0 (3.2 US qt, 2.6 lmp qt). <Ref. to CO-25, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
2) Remove air cleaner upper cover and air intake boot. <Ref. to IN(DOHC TURBO)-7, REMOVAL, Air Cleaner.>
3) Remove air cleaner element.
4) Disconnect engine coolant hoses from coolant filler tank.



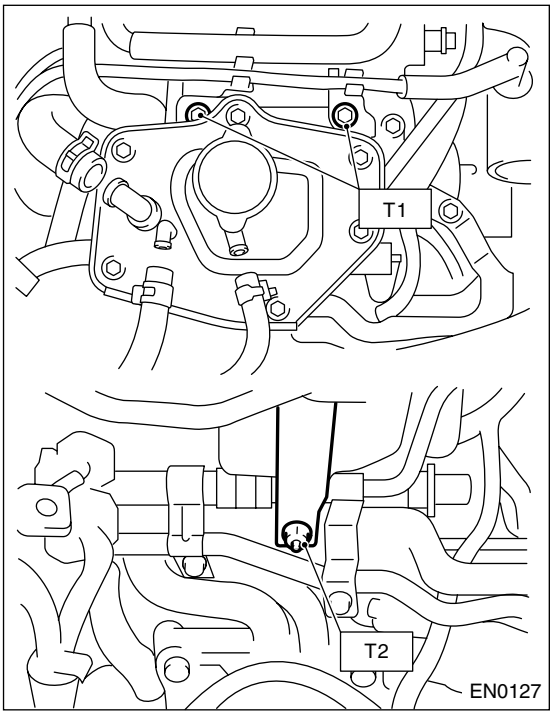
5) Remove bolts and nut which install coolant filler tank.
6) Disconnect engine coolant hose which connects the under side of coolant filler tank.
7) Remove coolant filler tank.



B: INSTALLATION

1) Install in the reverse order of removal.

Tightening torque:
T1: 19 N·m (1.9 kgf-m, 13.7 ft-lb)
T2: 21 N·m (2.1 kgf-m, 15.2 ft-lb)



2) Fill engine coolant. <Ref. to CO-25, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

13.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.
	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 ignition control system. <Ref. to EN(SOHC)-2, Basic Diagnostic Procedure.> or <Ref. to EN(SOHCw/oOBD)-2, Basic Diagnostic Procedure.> or <Ref. to EN(DOHC TURBO)-2, PROCEDURE, Basic Diagnostic Procedure.>
	h. Clogged or leaking radiator	Clean or repair, or replace.
	i. Improper engine oil in engine coolant	Replace engine coolant.
	j. Air/fuel mixture ratio too lean	Inspect and repair fuel injection system. <Ref. to EN(SOHC)-2, Basic Diagnostic Procedure.> or <Ref. to EN(SOHCw/oOBD)-2, Basic Diagnostic Procedure.> or <Ref. to EN(DOHC TURBO)-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	Adjust.
	o. Improper transmission oil	Replace.
	p. Defective thermostat	Replace.
	q. Malfunction of electric fan	Inspect radiator fan relay, engine coolant temperature sensor or radiator motor and replace there.
Over-cooling	a. Atmospheric 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.