SUPPLEMENT FOR 6 CYLINDER ENGINE MODEL

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

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

FUJI HEAVY INDUSTRIES LTD.

G2281GE

SUPPLEMENT FOR 6 CYLINDER ENGINE MODEL

LUBRICATION

LU(H6)

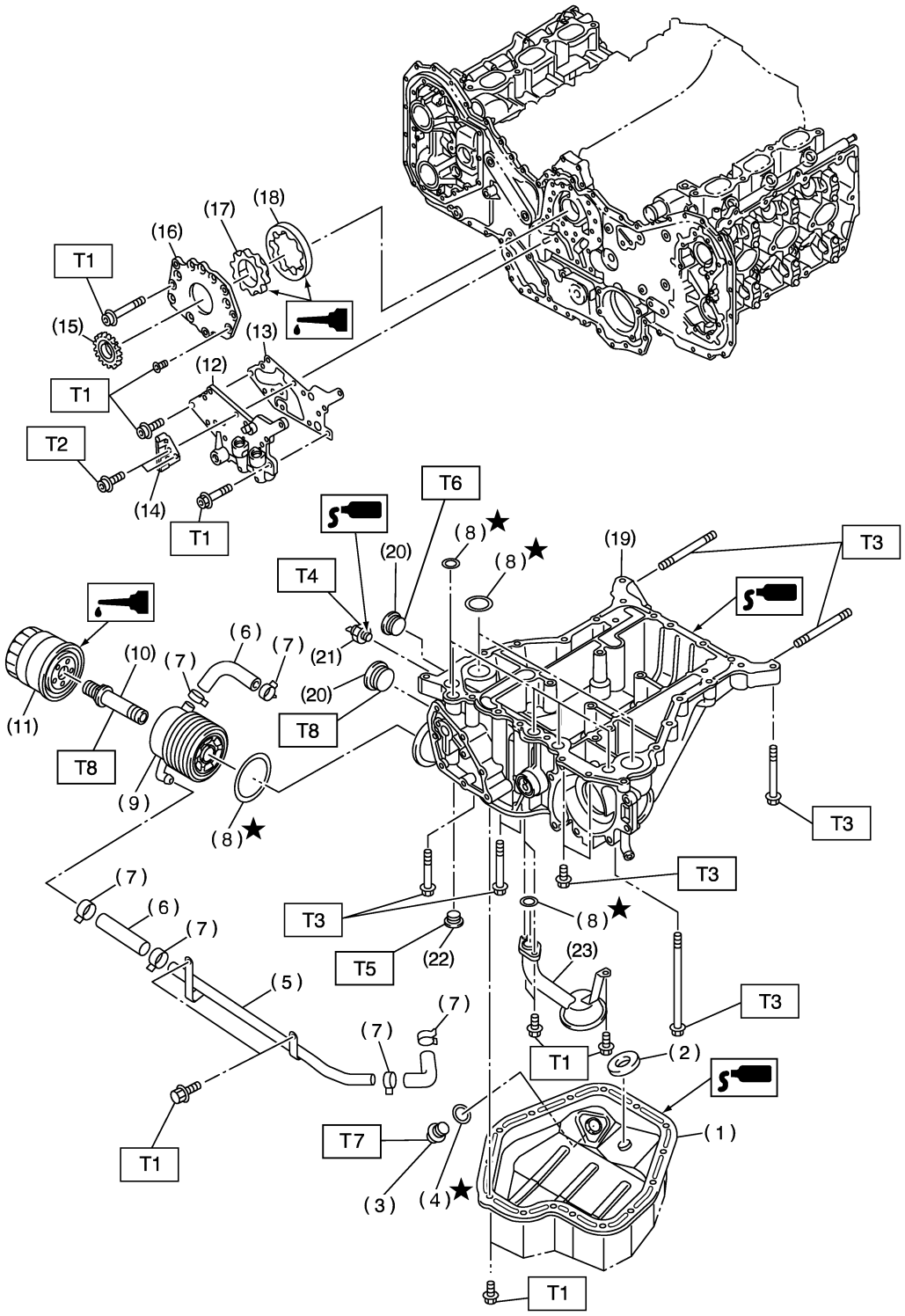
1. General Description S148001

A: SPECIFICATIONS S148001E49

Lubrication method				Forced lubrication
Oil pump	Pump type			Trochoid type
	Number of teeth	Inner rotor		9
		Outer rotor		10
	Outer rotor diameter × thickness			78 × 11 mm (3.07 × 0.43 in)
	Tip clearance between inner and outer rotor		STANDARD	0.04 — 0.14 mm (0.0016 — 0.0055 in)
			LIMIT	0.20 mm (0.0079 in)
	Side clearance between inner rotor and pump case		STANDARD	0.02 — 0.08 mm (0.0008 — 0.0031 in)
			LIMIT	0.15 mm (0.0059 in)
	Case clearance between outer rotor and pump case		STANDARD	0.11 — 0.18 mm (0.0043 — 0.0071 in)
			LIMIT	0.25 mm (0.0098 in)
Oil filter	Type			Full-flow filter type
	Filtration area			1,300 cm^2 (79 sq in)
	By-pass valve opening pressure			160 kPa (1.63 kg/cm^2, 23 psi)
	Outer diameter × width			80 × 75 mm (3.15 × 2.95 in)
	Oil filter to engine thread size			M 20 × 1.5
Relief valve peration pressure				588 kPa (6 kg/cm^2, 85 psi)
Oil pressure switch	Type			Immersed contact point type
	Working voltage — wattage			12 V — 3.4 W or less
	Warning light activation pressure			15 kPa (0.153 kg/cm^2, 2.18 psi)
	Proof pressure			More than 980 kPa (9.993 kg/cm^2, 142 psi)
Oil capacity (includes oil filter)				5.8 ℓ (6.1 US qt, 5.1 Imp qt)

MEMO:

B: COMPONENT S148001A05



B2M4533B

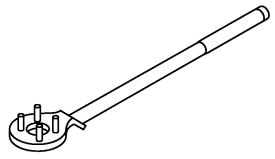
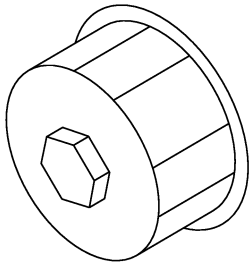
(1) Oil pan lower
(2) Magnet
(3) Drain plug
(4) Gasket
(5) Oil cooler pipe
(6) Hose
(7) Clamp
(8) O-ring
(9) Oil cooler
(10) Connector
(11) Oil filter
(12) Relief valve case
(13) Relief valve case gasket
(14) Chain guide (center)
(15) Crank sprocket
(16) Oil pump cover
(17) Inner rotor
(18) Outer rotor
(19) Oil pan upper
(20) Plug
(21) Oil pressure switch
(22) Plug
(23) Oil strainer

Tightening torque: N·m (kgf-m, ft-lb)
T1: 6.4 (0.65, 4.7)
T2: 7.8 (0.80, 5.8)
T3: 18 (1.8, 13)
T4: 25 (2.5, 18)
T5: 34 (3.5, 25)
T6: 37 (3.8, 27)
T7: 44 (4.5, 33)
T8: 90 (9.2, 67)

C: CAUTION S148001A03

- 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.

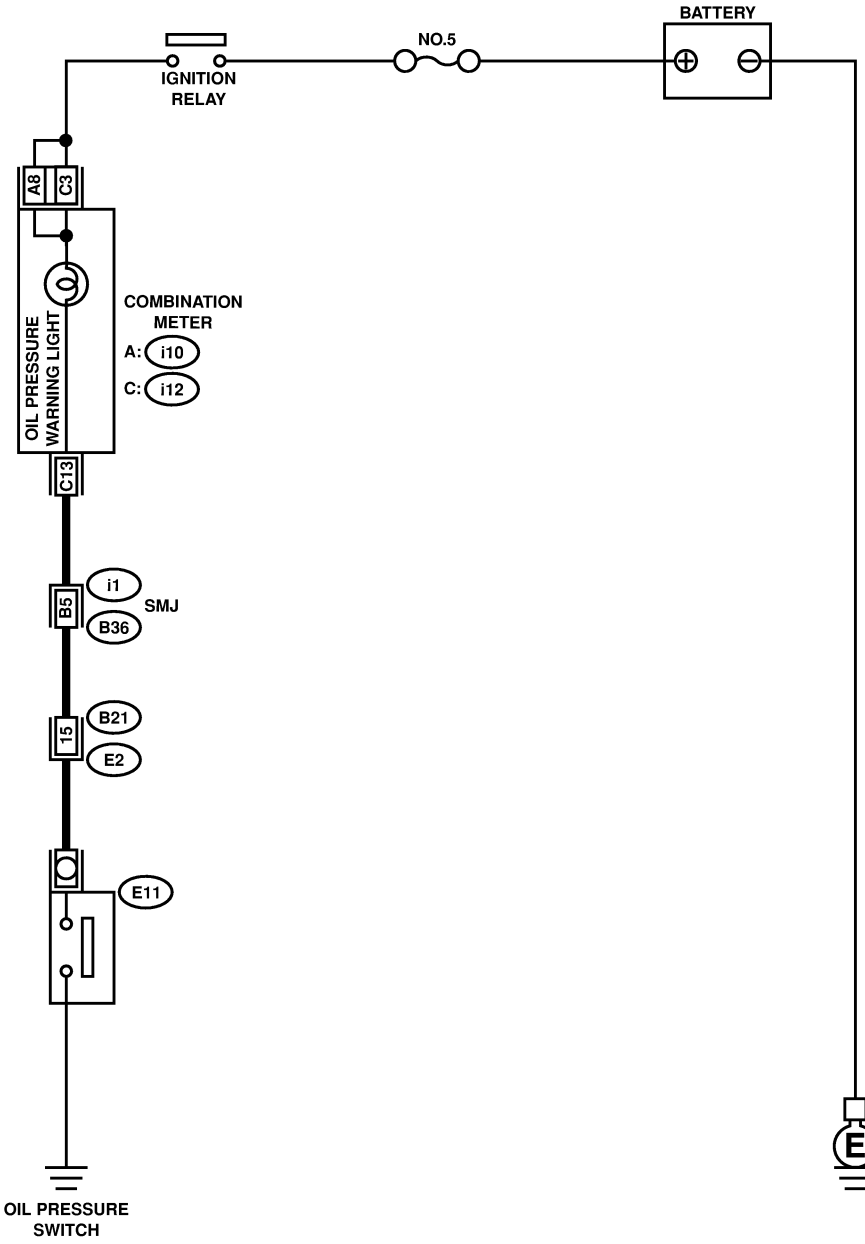
D: PREPARATION TOOL S148001A17

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 B2M3870	499977100	CRANK PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt.
 B2M3872	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.

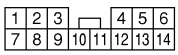
MEMO:

2. Oil Pressure System S148076

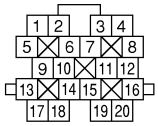
A: SCHEMATIC S148076A21



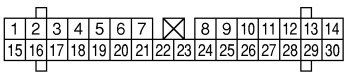
C: i12 (GREEN)



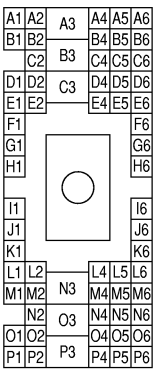
B21 (GRAY)



A: i10 (GREEN)



B36



B2M4573

B: INSPECTION S148076A10

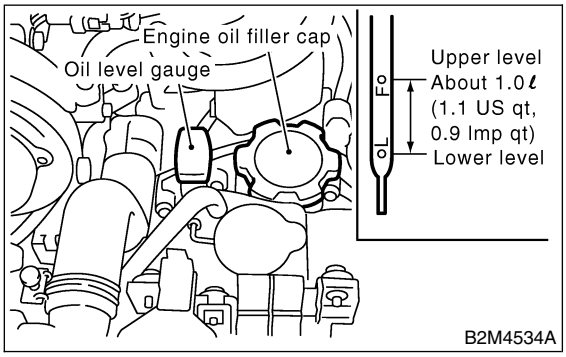
No.	Step	Check	Yes	No
1	**CHECK COMBINATION METER.** 1) Turn ignition switch to ON. (engine OFF) 2) Check other warning lights.	Does the warning lights go on?	Go to step **2**.	Repair or replace the combination meter. <Ref. to IDI-10 INSPECTION, Combination Meter System.>
2	**CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND OIL PRESSURE SWITCH.** 1) Turn ignition switch to OFF. 2) Disconnect connector from the oil pressure switch. 3) Turn ignition switch ON. 4) Measure the voltage of harness between the combination meter connector and chassis ground. ***Connector & terminal*** ***(E11) No. 1 — Chassis ground:***	Is the voltage more than 10 V?	Replace oil pressure switch.	Go to step **3**.
3	**CHECK COMBINATION METER.** 1) Turn ignition switch to OFF. 2) Remove the combination meter. 3) Measure the resistance of the combination meter. ***Terminals*** ***No. C13 — No. C3:*** ***No. C13 — No. A8:***	Is the resistance less than 10 Ω?	Replace the harness connector between combination meter and oil pressure switch.	Repair or replace the combination meter and the oil pressure switch warning light bulb.

3. Engine Oil S148077

A: INSPECTION S148077A10

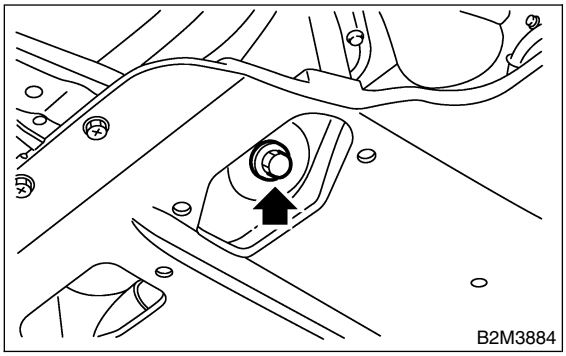
1) Park vehicle on a level surface.
2) Remove oil level gauge and wipe it clean.
3) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted and in the proper orientation.
4) Remove it again and note the reading. If the engine oil level is below the “L” line, add oil to bring the level up to the “F” line.
5) After turning off the engine, wait a few minutes for the oil to drain back into the oil pan before checking the level.
6) To prevent overfilling the engine oil, do not add oil above the “F” line when the engine is cold.

NOTE:
Just after driving or during warm-up, engine oil level may rise above the “F” mark.

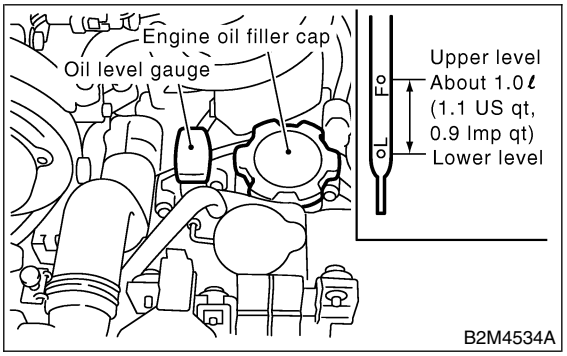


B: REPLACEMENT S148077A20

1) Drain engine oil by loosening engine oil drain plug.

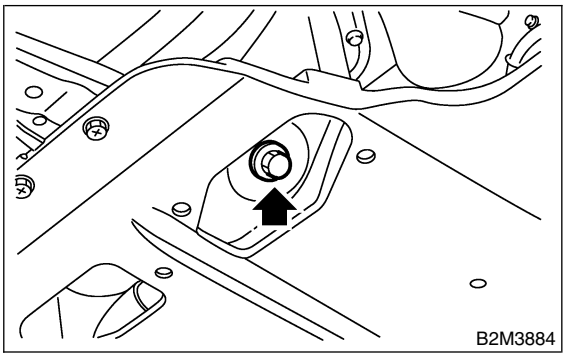


2) Open engine oil filler cap for quick draining of the engine oil.



3) Replace drain plug gasket.
4) Tighten engine oil drain plug after draining engine oil.

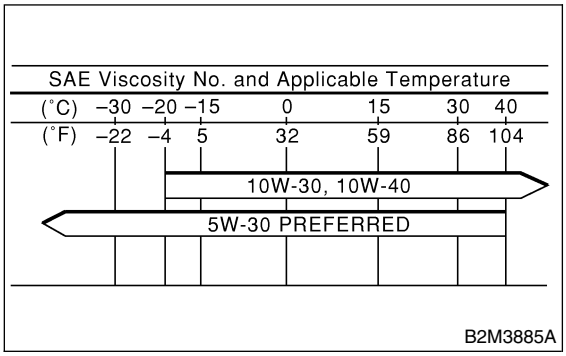
Tightening torque:
44 N·m (4.5 kgf-m, 33 ft-lb)



5) Fill engine oil through filler pipe up to upper point on level gauge. Make sure that vehicle is placed level when checking oil level. Use engine oil of proper quality and viscosity, selected in accordance with the table in figure.

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

Engine oil capacity (excludes oil filter):
Upper level
5.5 ℓ (5.8 US qt, 4.8 Imp qt)
Lower level
4.5 ℓ (4.8 US qt, 4.0 Imp qt)

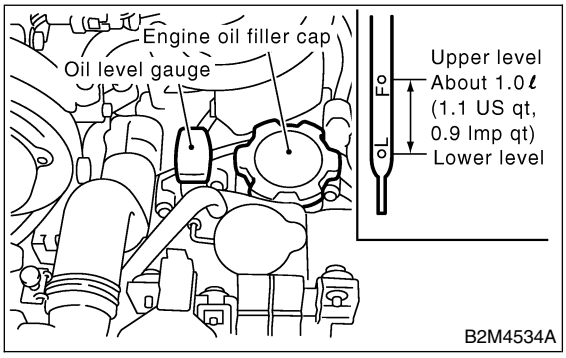


The proper viscosity helps vehicle get good cold and hot starting by reducing viscous friction and thus increasing cranking speed.

CAUTION:
When replenishing oil, it does not matter if the oil to be added is a different brand from that in the engine; however, use oil having the API classification and SAE viscosity No. designated by SUBARU.

NOTE:
If vehicle is used in desert areas with very high temperatures or for other heavy duty applications, the following viscosity oils may be used: API classification: SJ or SH
SAE Viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50.

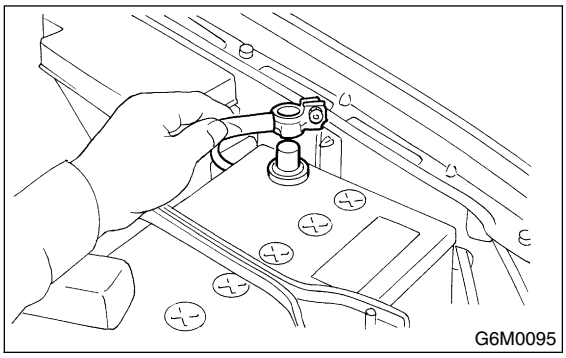
6) Close engine oil filler cap.
7) Start engine and warm it up for a time.
8) After engine stops, recheck the oil level. If necessary, add engine oil up to upper level on level gauge.



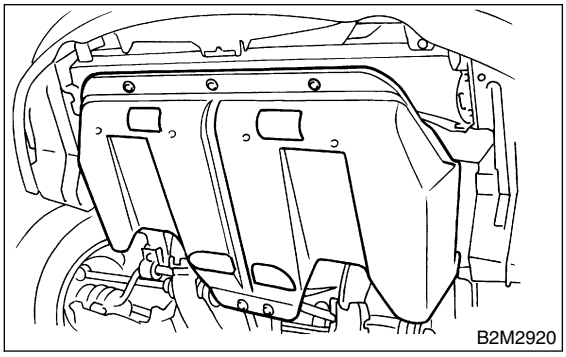
4. Oil Pump S148070

A: REMOVAL S148070A18

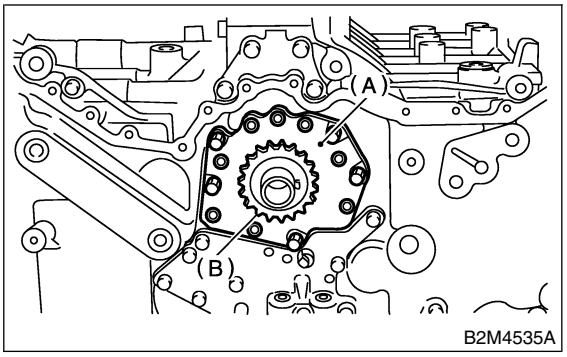
1) Disconnect battery ground cable.


G6M0095

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


B2M2920

4) Drain coolant. <Ref. to CO(H6)-18, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Lower the vehicle.
6) Remove radiator. <Ref. to CO(H6)-23, REMOVAL, Radiator.>
7) Remove V-belt. <Ref. to ME(H6)-31, REMOVAL, V-belt.>
8) Remove front chain cover. <Ref. to ME(H6)-42, REMOVAL, Front Chain Cover.>
9) Remove timing chain. <Ref. to ME(H6)-44, REMOVAL, Timing Chain.>
10) Remove oil pump cover and crankshaft sprocket.



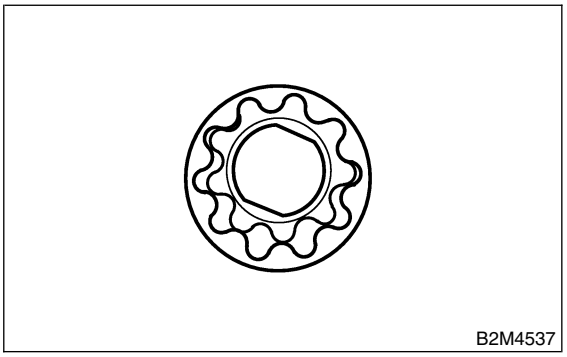
B2M4535A

(A) Oil pump cover
(B) Crankshaft sprocket

11) Remove inner rotor and outer rotor.

B: INSTALLATION S148070A11

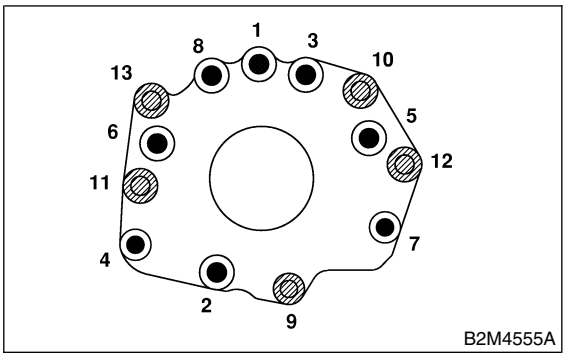
1) Apply engine oil to the entire surface area of both inner and outer rotor.


B2M4537

2) Install the inner rotor by fitting it into the groove on the crankshaft, and then assemble the outer rotor.
3) Install oil pump cover.
4) Tighten the bolts in the numerical sequence shown in the figure.

CAUTION:
Make sure that bolt mounting position is correct.

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



B2M4555A

5) Install crank sprocket.

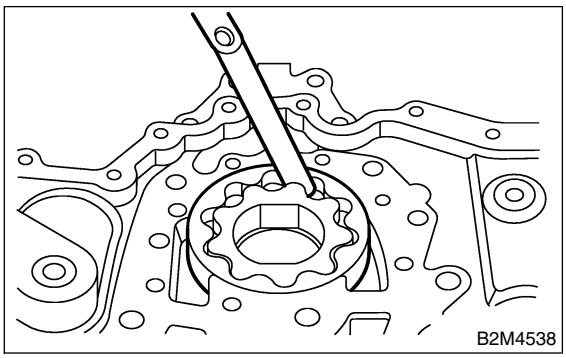
6) Install timing chain. <Ref. to ME(H6)-45, INSTALLATION, Timing Chain.>
7) Install front chain cover. <Ref. to ME(H6)-42, INSTALLATION, Front Chain Cover.>
8) Install V-belt. <Ref. to ME(H6)-31, INSTALLATION, V-belt.>
9) Install radiator. <Ref. to CO(H6)-24, INSTALLATION, Radiator.>
10) Fill coolant. <Ref. to CO(H6)-18, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION S148070A10

1. TIP CLEARANCE S148070A1001

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

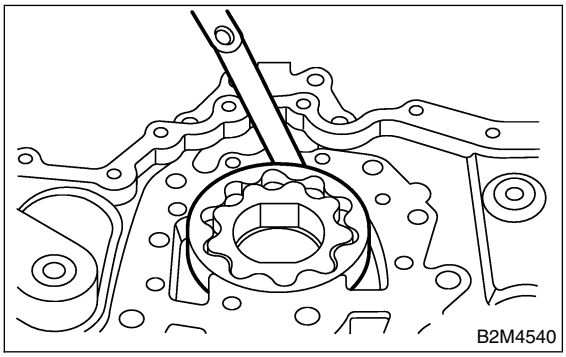
Tip clearance:
Standard
0.04 — 0.14 mm (0.0016 — 0.0055 in)
Limit
0.20 mm (0.0079 in)



2. CASE CLEARANCE S148070A1002

Measure the clearance between the outer rotor and the rear chain cover rotor housing. If the clearance exceeds the limit, replace the rotor.

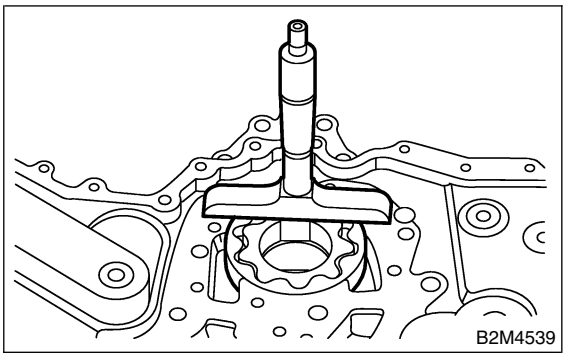
Case clearance:
Standard
0.11— 0.18 mm (0.0043 — 0.0071 in)
Limit
0.25 mm (0.0098 in)



3. SIDE CLEARANCE S148070A1003

Measure clearance between oil pump inner rotor and rear chain cover. If the clearance exceeds the limit, replace rotor or pump body.

Side clearance:
Standard
0.02 — 0.08 mm (0.0008 — 0.0031 in)
Limit
0.15 mm (0.0059 in)



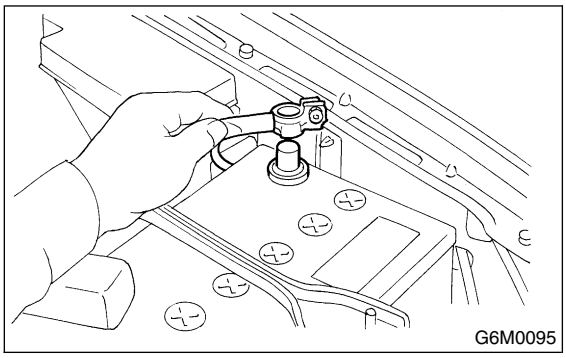
4. OIL PUMP CASE S148070A1004

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

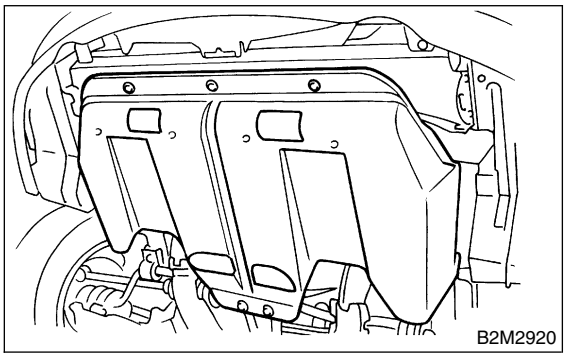
5. Oil Pump Relief Valve S148744

A: REMOVAL S148744A18

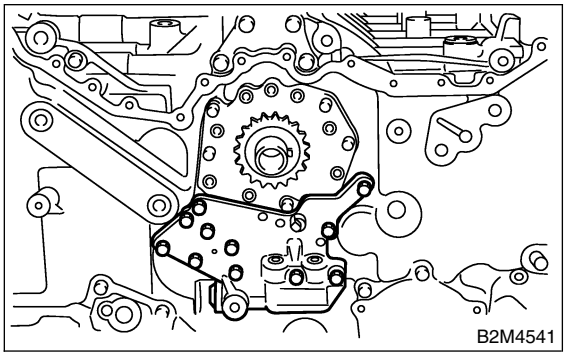
1) Disconnect battery ground cable.


G6M0095

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


B2M2920

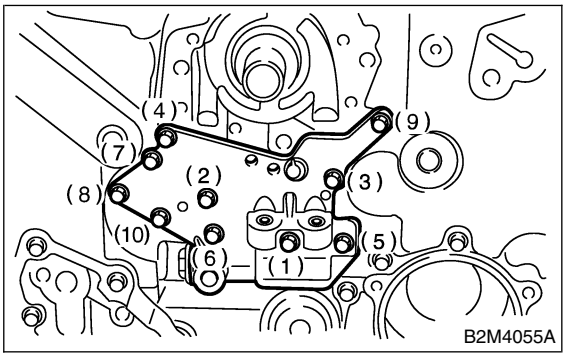
4) Drain coolant. <Ref. to CO(H6)-18 DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
5) Lower the vehicle.
6) Remove radiator. <Ref. to CO(H6)-23, REMOVAL, Radiator.>
7) Remove V-belt. <Ref. to ME(H6)-31, REMOVAL, V-belt.>
8) Remove front chain cover. <Ref. to ME(H6)-42, REMOVAL, Front Chain Cover.>
9) Remove timing chain assembly. <Ref. to ME(H6)-44, REMOVAL, Timing Chain Assembly.>
10) Remove oil pump relief valve.


B2M4541

B: INSTALLATION S148744A11

1) Install oil pump relief valve case and gasket
2) Tighten the bolts in the numerical sequence shown in the figure.

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



B2M4055A

Bolt installation position	Bolt dimension
(1) and (5)	6 x 26
(2), (3), (4) and (9)	6 x 35
(6), (7), (8) and (10)	6 x 16

3) Install timing chain assembly. <Ref. to ME(H6)-45, INSTALLATION, Timing Chain Assembly.>
4) Install front chain cover. <Ref. to ME(H6)-42, INSTALLATION, Front Chain Cover.>
5) Install V-belt. <Ref. to ME(H6)-31, INSTALLATION, V-belt.>
6) Install radiator. <Ref. to CO(H6)-24, INSTALLATION, Radiator.>
7) Fill coolant. <Ref. to CO(H6)-18, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

C: INSPECTION S148744A10

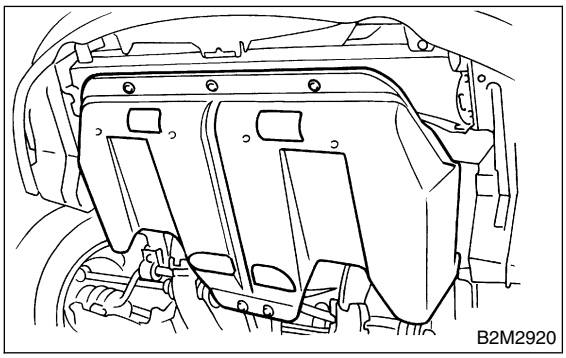
- Check the oil pump relief valve case for worn shaft hole, clogged oil passage, cracks and other faults.
- Make sure that there are no foreign materials on the gasket filter.

6. Oil Pan and Strainer S148071

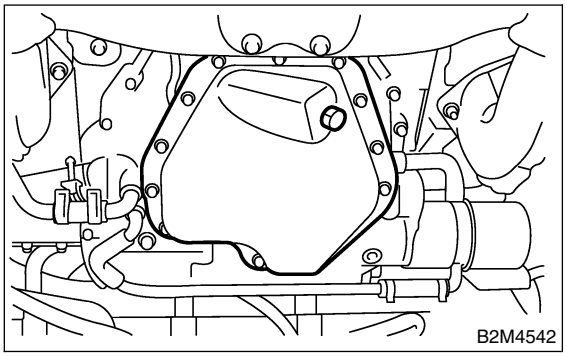
A: REMOVAL S148071A18

NOTE:
Oil pan upper cannot be removed from the normal vehicle position. The engine must be separated from the body prior to removal. <Ref. to ME(H6)-32, REMOVAL, Engine Assembly.>

1) Set the vehicle on lift arms.
2) Lift-up the vehicle.
3) Remove under cover.


B2M2920

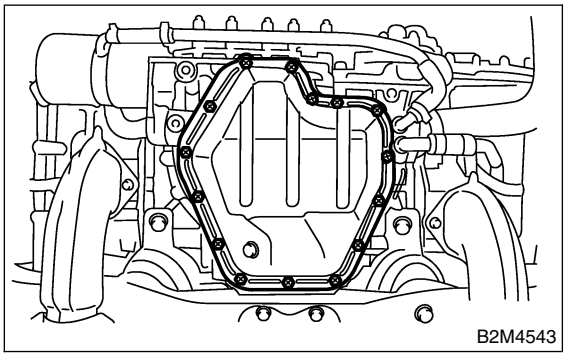
4) Drain engine oil.
Set container under the vehicle, and remove drain plug from oil pan.


B2M4542

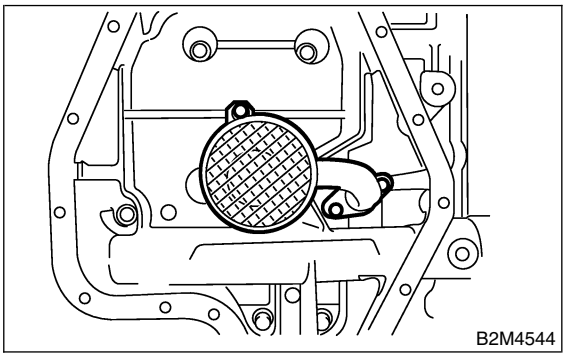
5) Insert oil pan cutter blade between upper and lower oil pans.

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

6) Remove oil pan.


B2M4543

7) Remove oil strainer.


B2M4544

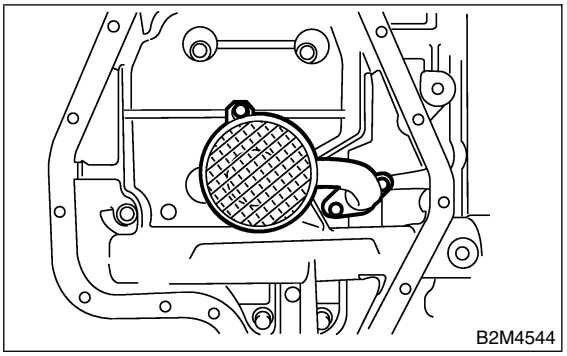
B: INSTALLATION S148071A11

CAUTION:
Before installing oil pan, clean sealant from lower oil pan and upper oil pan.

1) Install oil strainer onto baffle plate.

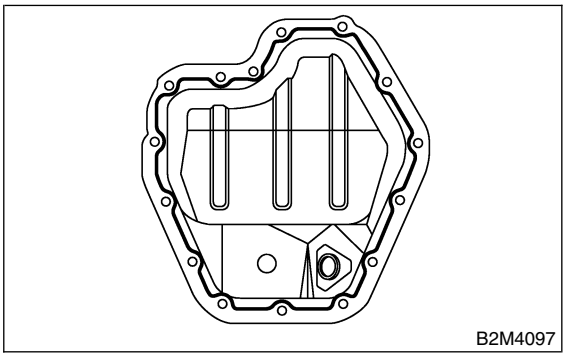
CAUTION:
Replace O-ring with a new one.

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


B2M4544

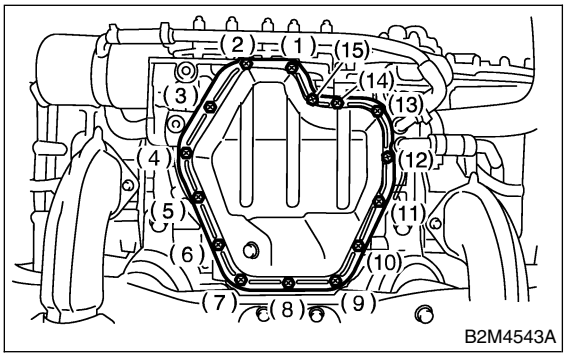
2) Apply fluid packing to mating surfaces and install oil pan.

Fluid packing:
THREE BOND 1280B

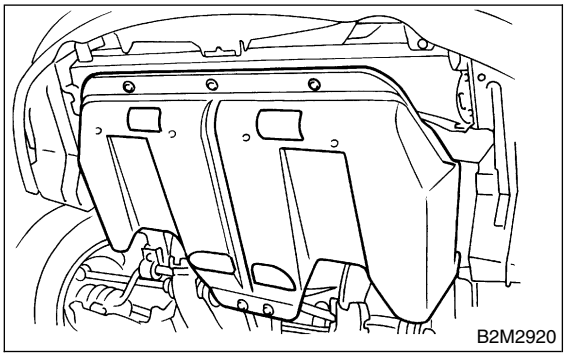

B2M4097

3) Tighten the lower oil pan mounting bolts in the numerical sequence shown in the figure.

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



4) Install under cover.



5) Fill engine oil. <Ref. to LU(H6)-10 INSPECTION, Engine Oil.>

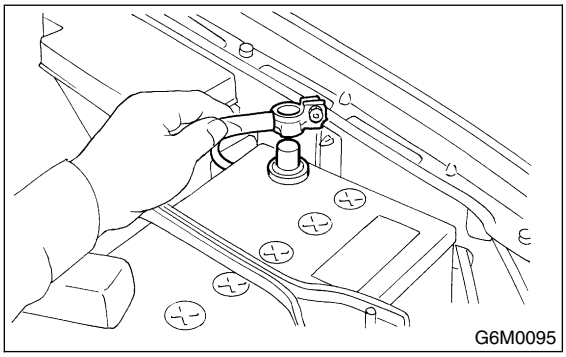
C: INSPECTION *S148071A10*

By visual check make sure oil pan, oil strainer and oil strainer stay are not damaged.

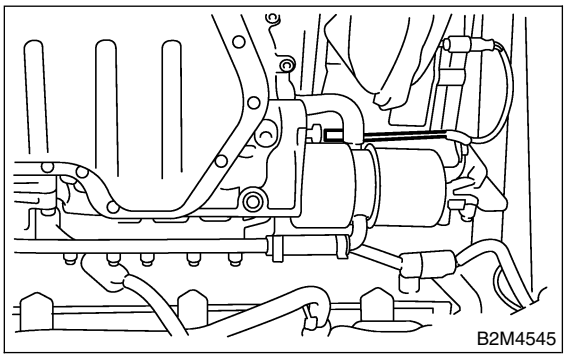
7. Oil Pressure Switch S148069

A: REMOVAL S148069A18

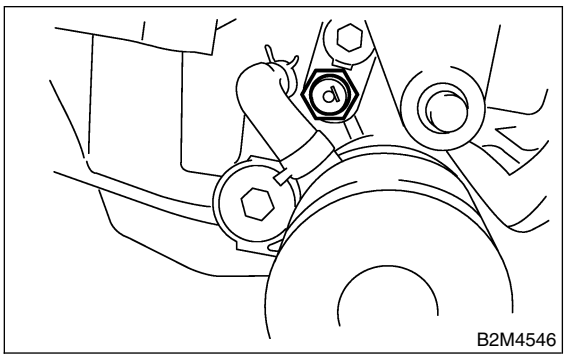
1) Set vehicle on the lift.
2) Disconnect battery ground cable.


G6M0095

3) Lift-up the vehicle.
4) Remove under cover.
5) Disconnect terminal from oil pressure switch.


B2M4545

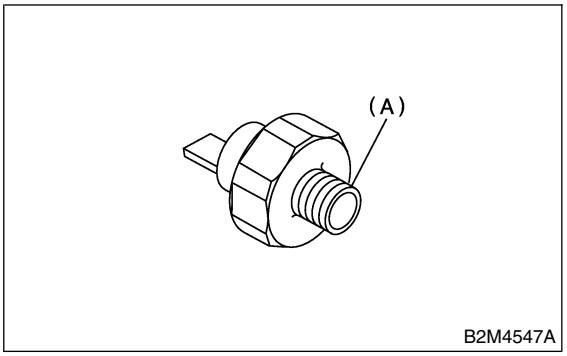
6) Remove oil pressure switch.


B2M4546

B: INSTALLATION S148069A11

1) Apply fluid packing to oil pressure switch threads.

Fluid packing:
THREE BOND 1324 or equivalent

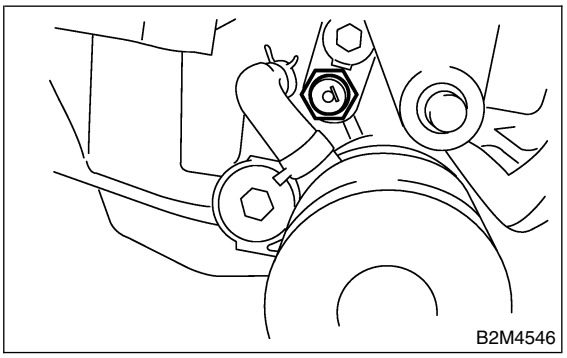


B2M4547A

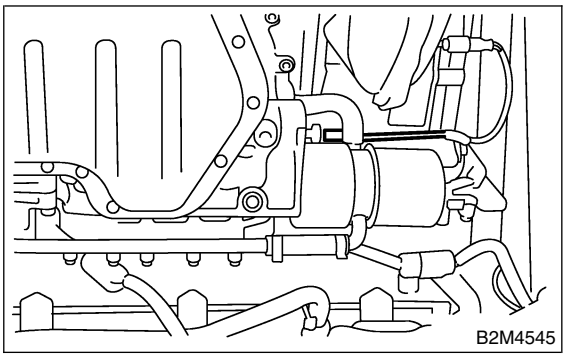
(A) Fluid packing

2) Install oil pressure switch.

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


B2M4546

3) Connect terminal of oil pressure switch.


B2M4545

4) Install under cover.

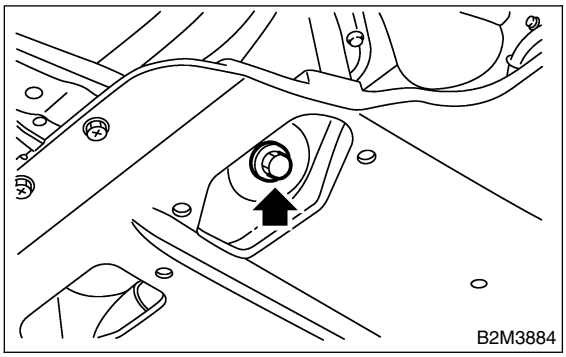
C: INSPECTION S148069A10

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

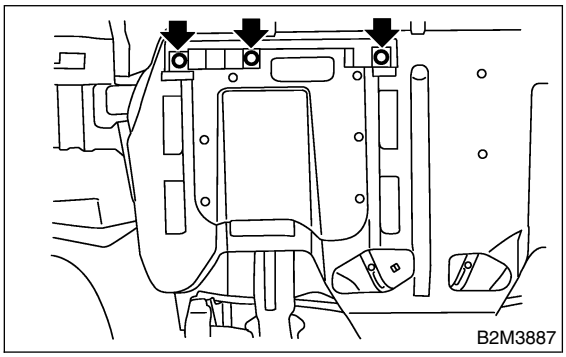
8. Engine Oil Filter S148585

A: REMOVAL S148585A18

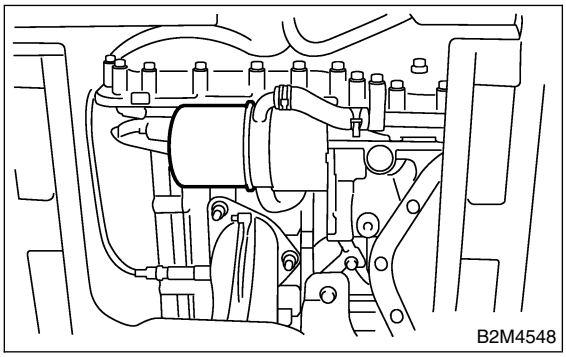
1) Drain engine oil by loosening engine oil drain plug.



2) Remove access lid.



3) Remove oil filter with ST.
ST 498547000 OIL FILTER WRENCH



B: INSTALLATION S148585A11

1) Get a new oil filter and apply a thin coat of engine oil to the rubber seal.
2) Install oil filter by turning it by hand, being careful not to damage rubber seal.
3) Tighten more (approximately 2/3 to 3/4 turn) after the rubber seal contacts the oil cooler. Do not tighten excessively, or oil may leak.

C: INSPECTION S148585A10

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

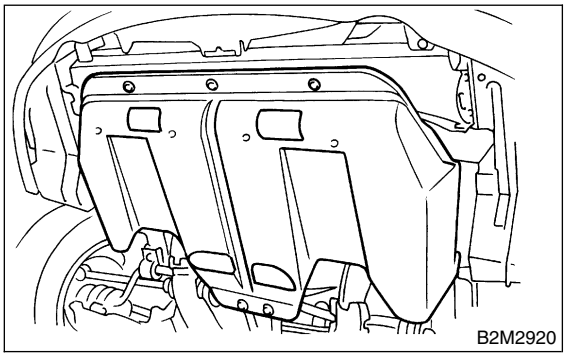
NOTE:
The filter element and filter case are permanently jointed; therefore, interior cleaning is not necessary.

2) Check the engine oil level. <Ref. to LU(H6)-10 INSPECTION, Engine Oil.>

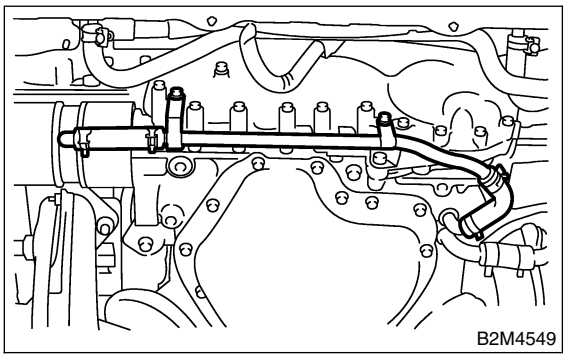
9. Oil Cooler S148073

A: REMOVAL S148073A18

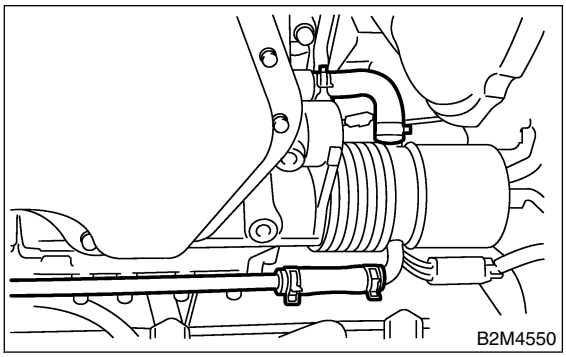
1) Lift-up the vehicle.
2) Remove under cover.


B2M2920

3) Drain engine coolant completely. <Ref. to CO(H6)-18, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
4) Drain engine oil. <Ref. to LU(H6)-10, REPLACEMENT, Engine Oil.>
5) Remove bolts which installs water pipe to engine.

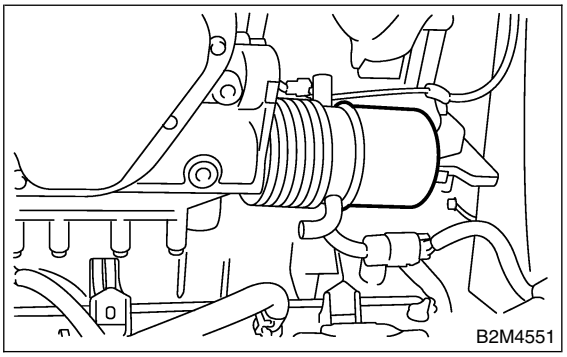

B2M4549

6) Disconnect water hoses from oil cooler.

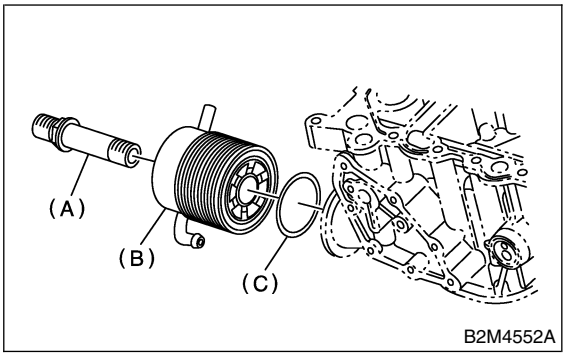

B2M4550

7) Remove oil filter using ST. <Ref. to LU(H6)-18, REMOVAL, Engine Oil Filter.>
ST 49854700 OIL FILTER WRENCH

NOTE:
Set container under the vehicle.


B2M4551

8) Remove connector and remove oil cooler.



B2M4552A

(A) Connector
(B) Oil cooler
(C) O-ring

B: INSPECTION S148073A10

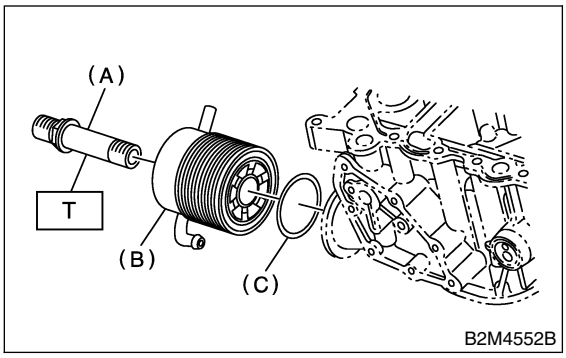
1) Check that coolant passages are not clogged using air blow method.
2) Check mating surfaces of upper oil pan, groove (O-ring installation groove) and oil filter for damage.

C: INSTALLATION S148073A11

1) Install oil cooler on upper oil pan with connector pipe.

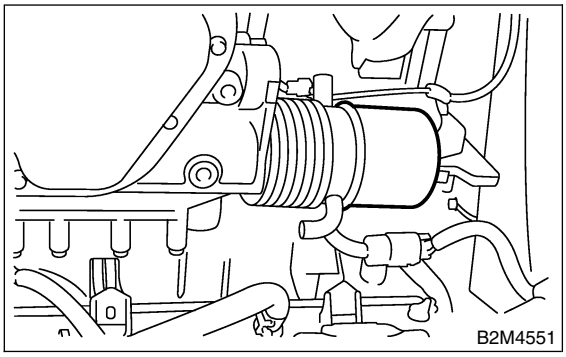
Tightening torque:
T: 54 N·m (5.5 kgf-m, 39.8 ft-lb)

CAUTION:
Always use a new gasket.

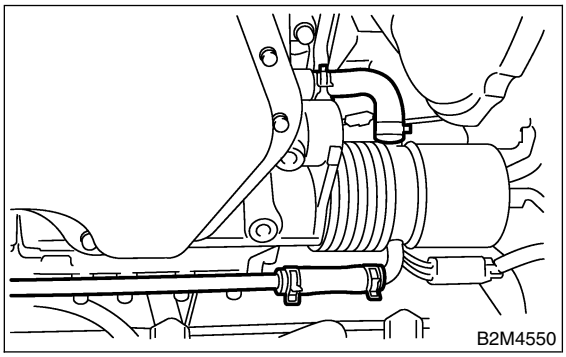


(A) Connector
(B) Oil cooler
(C) O-ring

2) Install oil filter using ST. <Ref. to LU(H6)-18, INSTALLATION, Engine Oil Filter.>
ST 49854700 OIL FILTER WRENCH

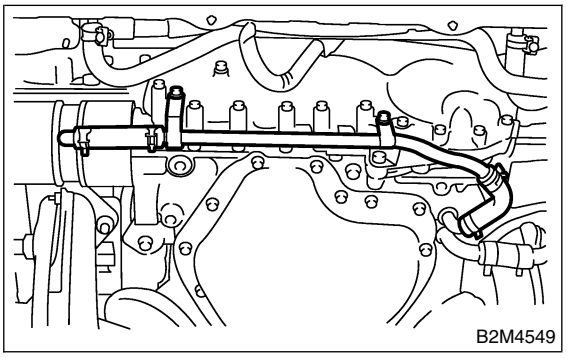


3) Install water hose.



4) Install water pipe to engine.

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



5) Fill engine oil. <Ref. to LU(H6)-10, REPLACEMENT, Engine Oil.>
6) Fill engine coolant. <Ref. to CO(H6)-18, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
7) Check the engine oil level. <Ref. to LU(H6)-10, INSPECTION, Engine Oil.>

10. Engine Lubrication System Trouble in General S148100

A: INSPECTION S148100A10

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

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

MEMO: