LUBRICATION

LU(SOHC)

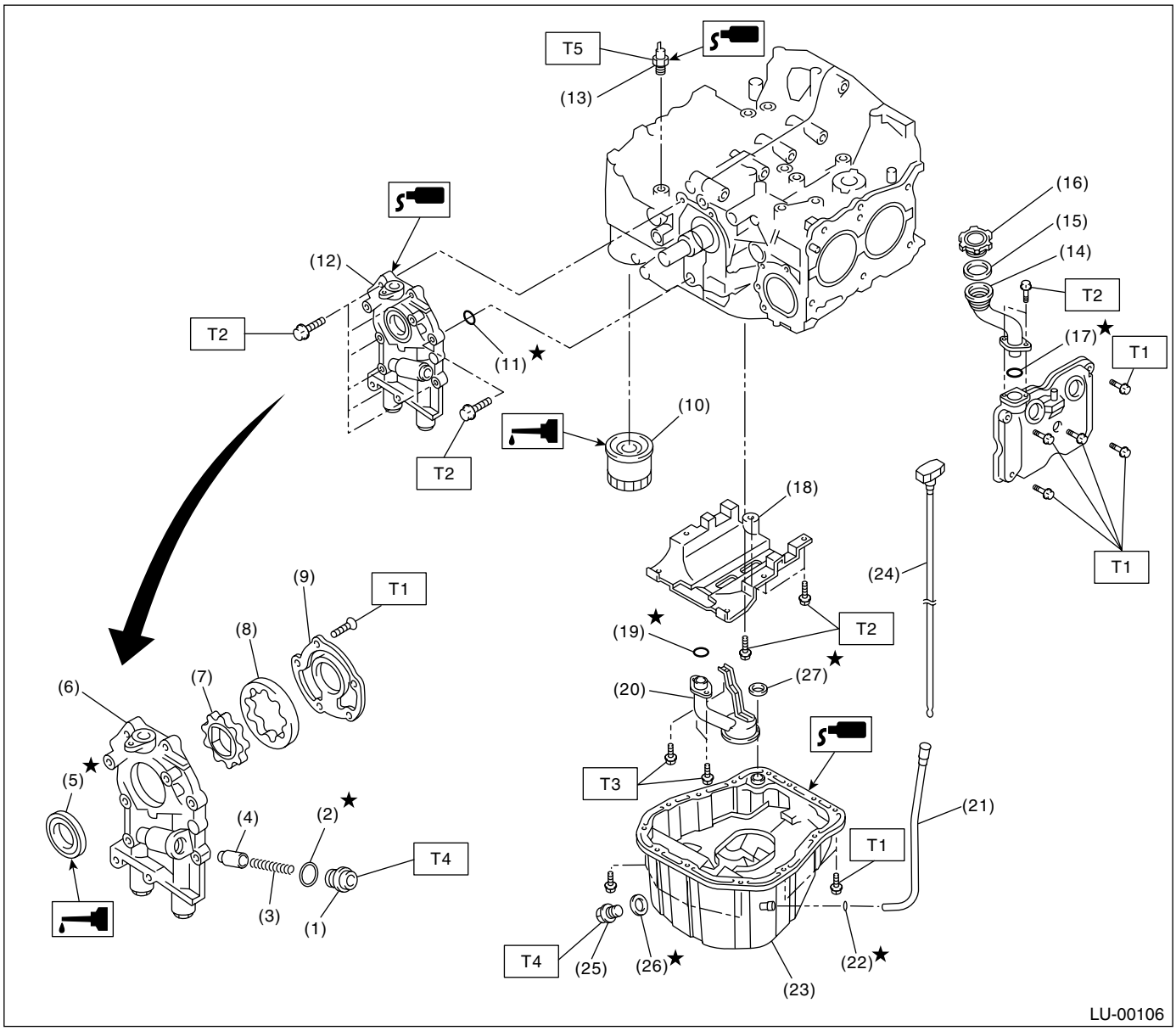
1. General Description

A: SPECIFICATIONS

Lubrication method					Forced lubrication
Oil pump	Pump type				Trochoid type
	Number of teeth		Inner rotor		9
			Outer rotor		10
	Outer rotor diameter × thickness		Non-turbo model		78 × 7 mm (3.07 × 0.28 in)
			Turbo model		78 × 10 mm (3.07 × 0.39 in)
	Tip clearance between inner and outer rotor			STANDARD	0.04 — 0.14 mm (0.0016 — 0.0055 in)
				LIMIT	0.18 mm (0.0071 in)
	Side clearance between inner rotor and pump case			STANDARD	0.02 — 0.07 mm (0.0008 — 0.0028 in)
				LIMIT	0.12 mm (0.0047 in)
	Case clearance between outer rotor and pump case			STANDARD	0.10 — 0.175 mm (0.0039 — 0.0069 in)
				LIMIT	0.20 mm (0.0079 in)
	Capacity at 80°C (176°F)	Non-turbo model	600 rpm	- Discharge pressure	98 kPa (1.0 kg/cm^2, 14 psi)
				- Discharge quantity	3.2 ℓ (3.4 US qt, 2.8 Imp qt)/min.
			5,000 rpm	- Discharge pressure	294 kPa (3.0 kg/cm^2, 43 psi)
				- Discharge quantity	32.6 ℓ (34.4 US qt, 28.7 Imp qt)/min.
		Turbo model	600 rpm	- Discharge pressure	98 kPa (1.0 kg/cm^2, 14 psi)
				- Discharge quantity	4.6 ℓ (4.9 US qt, 4.0 Imp qt)/min.
			5,000 rpm	- Discharge pressure	294 kPa (3.0 kg/cm^2, 43 psi)
				- Discharge quantity	47.0 ℓ (49.7 US qt, 41.4 Imp qt)/min.
	Relief valve operation pressure		Non-turbo model		490 kPa (5.0 kg/cm^2, 71 psi)
			Turbo model		588 kPa (6.0 kg/cm^2, 85 psi)
Oil filter	Type				Full-flow filter type
	Filtration area			Non-turbo	760 cm^2 (118 sq in)
				Turbo	800 cm^2 (124 sq in)
	By-pass valve opening pressure			Non-turbo	157 kPa (1.60 kg/cm^2, 22.8 psi)
				Turbo	160 kPa (1.63 kg/cm^2, 23.2 psi)
	Outer diameter × width			Non-turbo	80 × 70 mm (3.15 × 2.76 in)
				Turbo	68 × 65 mm (2.68 × 2.56 in)
	Oil filter to engine thread size				M 20 × 1.5
Oil pressure switch	Type				Immersed contact point type
	Working voltage — wattage				12 V — 3.4 W or less
	Warning light activation pressure				14.7 kPa (0.15 kg/cm^2, 2.1 psi)
	Proof pressure				More than 981 kPa (10 kg/cm^2, 142 psi)
Oil capacity (at replacement)			Non-turbo model		4.0 ℓ (4.2 US qt, 3.5 Imp qt)
			Turbo model		4.5 ℓ (4.8 US qt, 4.0 Imp qt)

B: COMPONENT

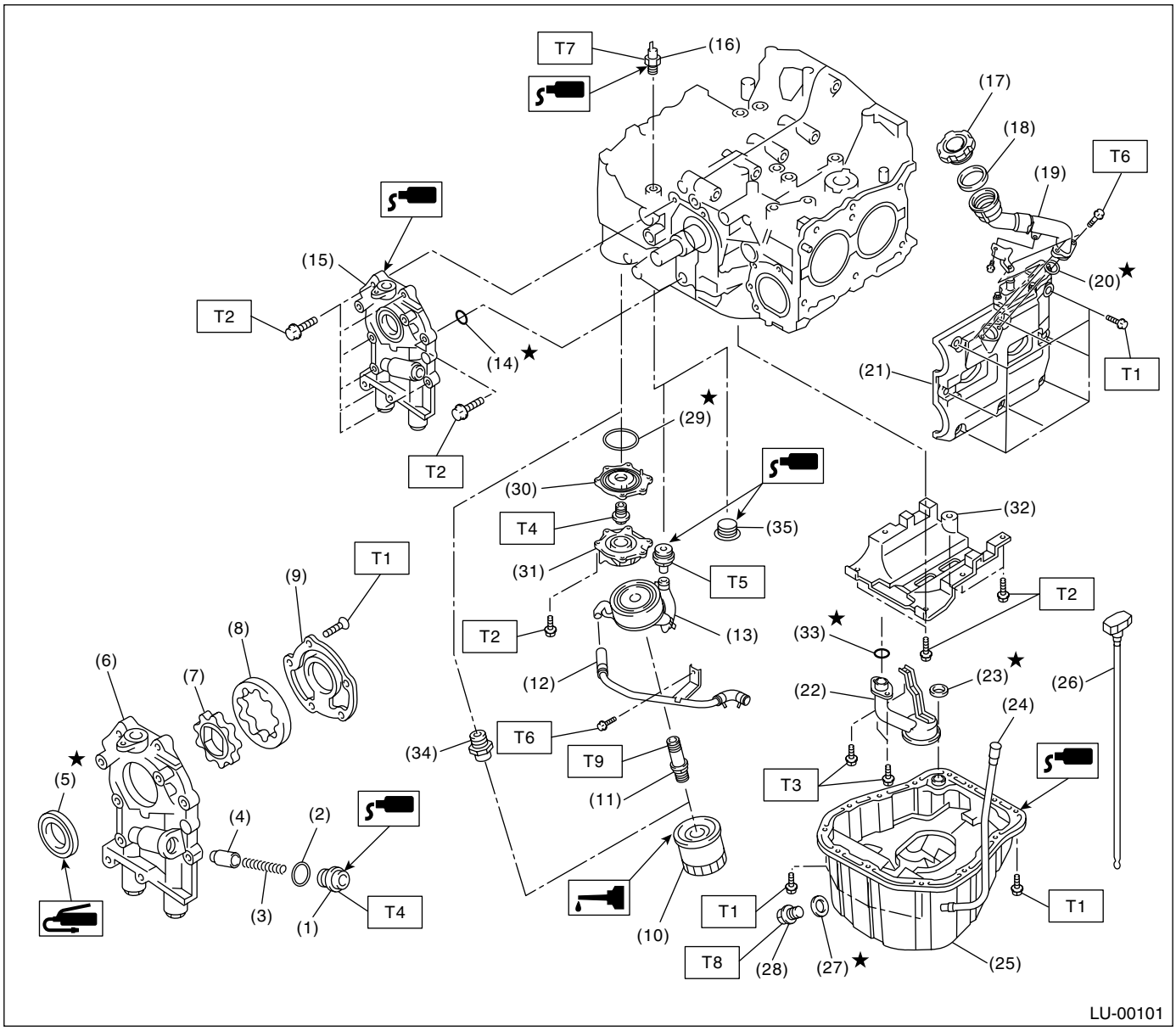
1. NON-TURBO MODEL



(1) Plug
(2) Gasket
(3) Relief valve spring
(4) Relief valve
(5) Oil seal
(6) Oil pump case
(7) Inner rotor
(8) Outer rotor
(9) Oil pump cover
(10) Oil filter
(11) O-ring
(12) Oil pump ASSY
(13) Oil pressure switch
(14) Oil filler duct
(15) O-ring
(16) Oil filler cap
(17) O-ring
(18) Baffle plate
(19) O-ring
(20) Oil strainer
(21) Oil level gauge guide
(22) O-ring
(23) Oil pan
(24) Oil level gauge
(25) Drain plug
(26) Metal gasket
(27) Gasket

Tightening torque: N·m (kgf-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 6.4 (0.65, 4.7)
T3: 10 (1.0, 7.2)
T4: 44 (4.5, 32.5)
T5: 25 (2.5, 18.1)

2. TURBO MODEL



(1) Plug
(2) Gasket
(3) Relief valve spring
(4) Relief valve
(5) Oil seal
(6) Oil pump case
(7) Inner rotor
(8) Outer rotor
(9) Oil pump cover
(10) Oil filter
(11) Oil cooler connector (with oil cooler)
(12) Water by-pass pipe (with oil cooler)
(13) Oil cooler (with oil cooler)
(14) O-ring
(15) Oil pump ASSY
(16) Oil pressure switch
(17) Oil filler cap
(18) O-ring
(19) Oil filler duct
(20) O-ring
(21) Rocker cover
(22) Oil strainer
(23) Gasket
(24) Oil level gauge guide
(25) Oil pan
(26) Oil level gauge
(27) Metal gasket
(28) Drain plug
(29) O-ring
(30) Adapter (1)
(31) Adapter (2)
(32) Baffle plate
(33) O-ring
(34) Oil filter connector (without oil cooler)
(35) Plug (without oil cooler)

Tightening torque: N·m (kgf-m, ft-lb)
T1: 5 (0.5, 3.6)
T2: 6.4 (0.65, 4.7)
T3: 10 (1.0, 7.0)
T4: 44 (4.5, 32.5)
T5: 69 (7.0, 50.9)
T6: 6.4 (0.65, 4.7)
T7: 25 (2.5, 18.1)
T8: 44 (4.5, 32.5)
T9: 54 (5.5, 40)

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 the ground cable from battery.

D: PREPARATION TOOL

1. SPECIAL TOOLS

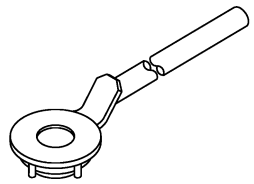
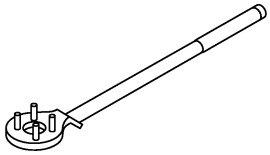
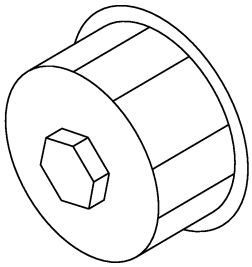
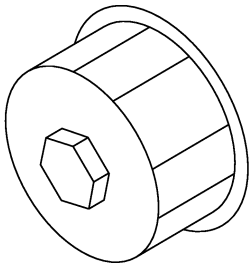
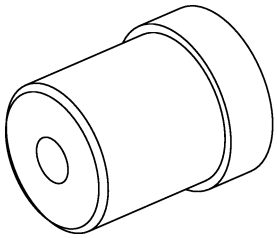
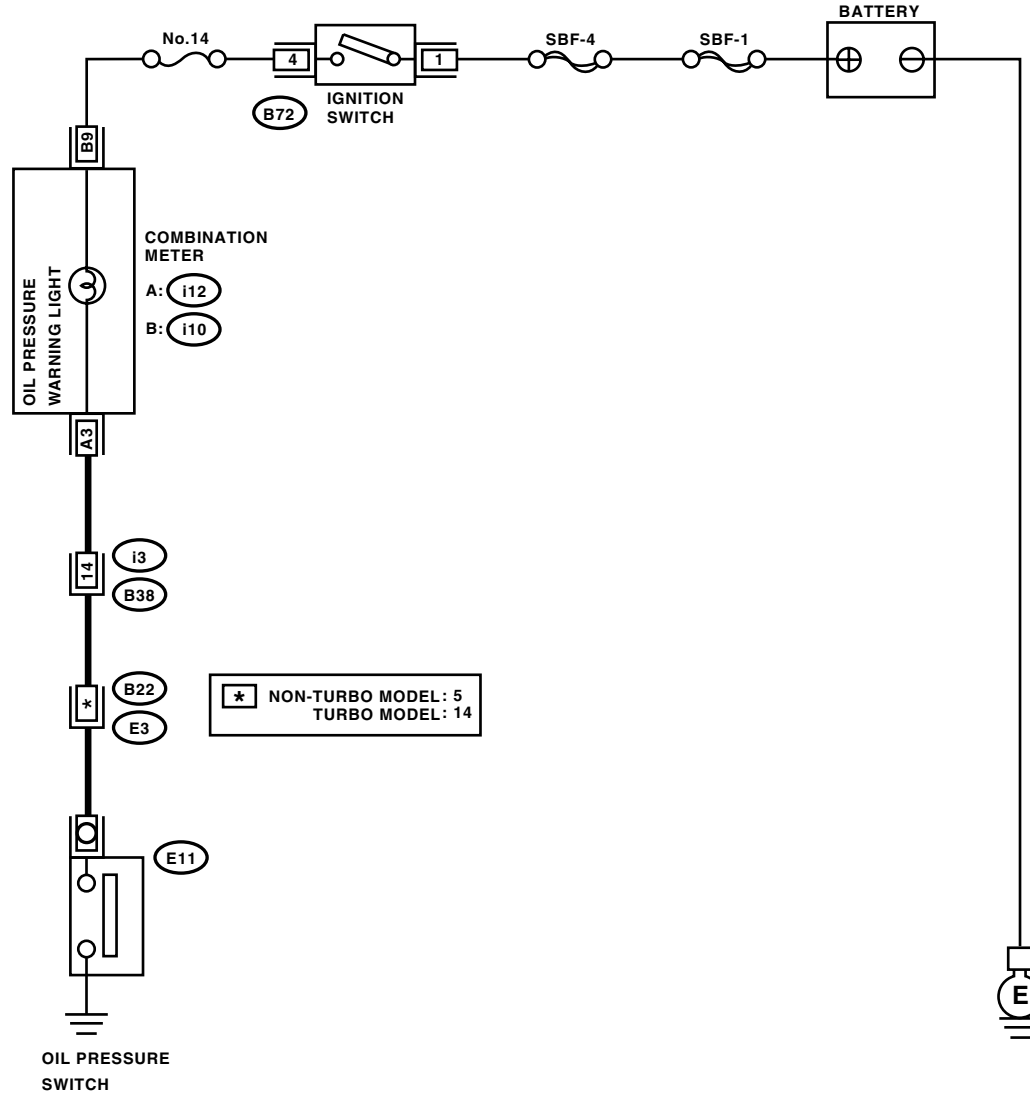
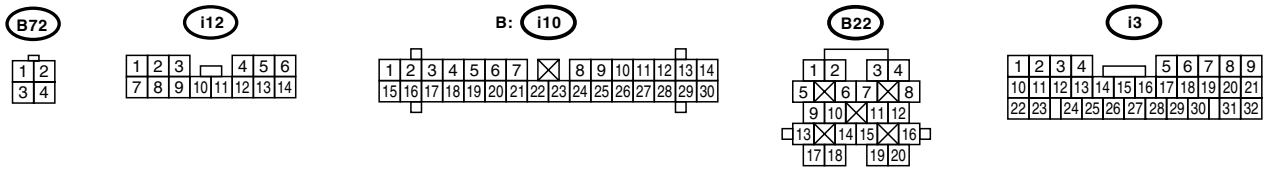
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977400	499977400 (2000 cc model)	CRANK PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt.
 ST-499977100	499977100 (2500 cc model)	CRANK PULLEY WRENCH	Used for stopping rotation of crankshaft pulley when loosening and tightening crankshaft pulley bolt.
 ST-498547000	498547000 (Non-turbo model)	OIL FILTER WRENCH	• Used for removing and installing oil filter.
 ST18332AA000	18332AA000 (Turbo model)	OIL FILTER WRENCH	• Used for removing and installing oil filter. • Tool for Turbo model is a general purpose tool from KTC (KYOTO TOOL CO., LTD.) in Japan. (KTC part No.: AVSA-067) For availability as same as Subaru genuine part, tool No. is established.

ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499587100	499587100	OIL SEAL INSTALLER	Used for installing oil pump oil seal.

2. Oil Pressure System

A: SCHEMATIC





LU-00102

B: INSPECTION

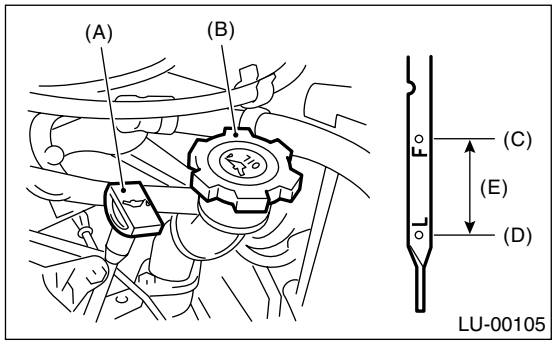
	Step	Value	Yes	No
1	**CHECK COMBINATION METER.** 1)Turn the ignition switch to ON. (engine OFF) 2)Check other warning lights. Does the warning lights go on?	Warning lights go on.	Go to step **2.**	Repair or replace the combination meter. <Ref. to IDI-4, INSPECTION, Combination Meter System.>
2	**CHECK HARNESS CONNECTOR BETWEEN COMBINATION METER AND OIL PRESSURE SWITCH.** 1)Turn the ignition switch to OFF. 2)Disconnect the connector from oil pressure switch. 3)Turn the ignition switch ON. 4)Measure the voltage of harness between the combination meter connector and chassis ground. ***Connector & terminal*** ***(E11) No. 1 (+) — Chassis ground (-):*** Is the measured value more than specified value?	10 V	Replace the oil pressure switch.	Go to step **3.**
3	**CHECK COMBINATION METER.** 1)Turn the ignition switch to OFF. 2)Remove the combination meter. 3)Measure the resistance of combination meter. ***Terminal*** ***No. B9 — No. A3:*** Is the measured value less than specified value?	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

A: INSPECTION

1) Park the vehicle on a level surface.
2) Remove the oil level gauge and wipe it clean.
3) Reinsert the level gauge all the way. Be sure that the level gauge is correctly inserted and 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 “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) Just after driving or while the engine is warm, engine oil level may show in the range between the “F” line and notch mark. This is caused by thermal expansion of the engine oil.

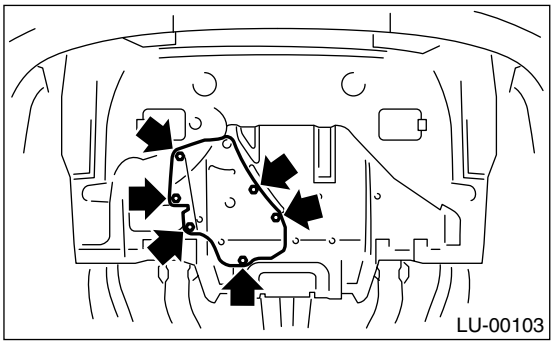
NOTE:
To prevent overfilling the engine oil, do not add oil above the “F” line when the engine is cold.



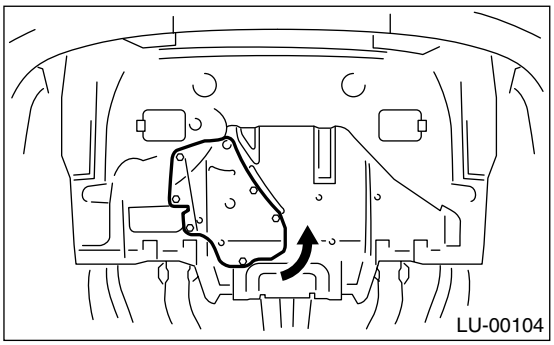
(A) Oil level gauge
(B) Engine oil filler cap
(C) Upper level
(D) Lower level
(E) Approx. 1.0 ℓ (1.1 Us qt, 0.9 Imp qt)

B: REPLACEMENT

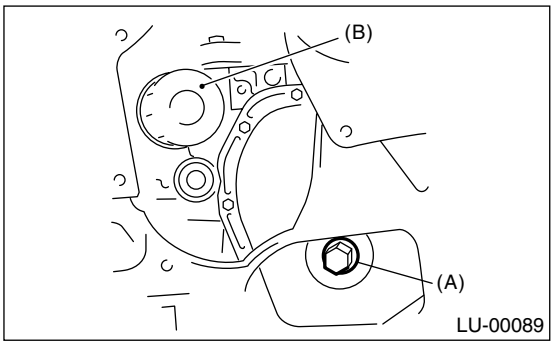
1) Open the engine oil filler cap for quick draining of the engine oil.
2) Remove six clips.



3) Turn the service hole cover counterclockwise.



4) Drain the engine oil by loosening the engine oil drain plug.

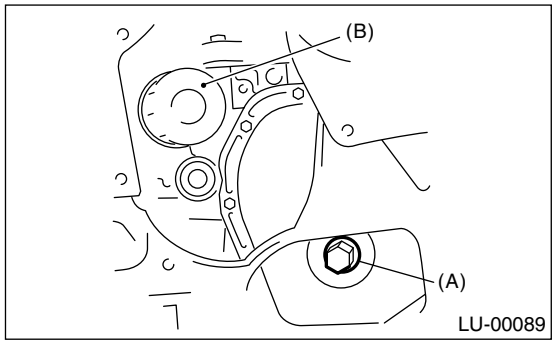


(A) Drain plug
(B) Oil filter

5) Replace the drain plug gasket.

6) Tighten the engine oil drain plug after draining engine oil.

Tightening torque:
44 N·m (4.5 kgf-m, 32.5 ft-lb)



(A) Drain plug
(B) Oil filter

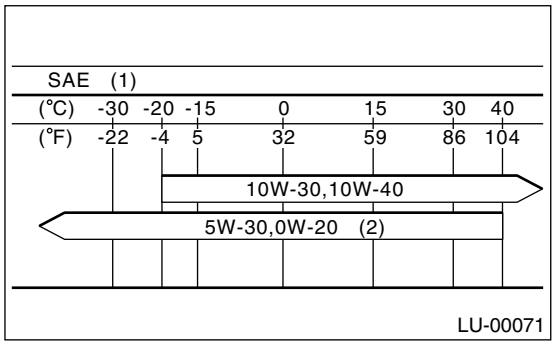
7) Install the service hole cover.
8) Fill engine oil through the filler pipe up to upper point on level gauge. Make sure that the vehicle is placed level when checking oil level. Use the engine oil of proper quality and viscosity, selected in accordance with the table in figure.

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

Engine oil capacity: (Non-turbo model)
Upper level
4.0 ℓ (4.2 US qt, 3.5 Imp qt)
Lower level
3.0 ℓ (3.2 US qt, 2.6 Imp qt)

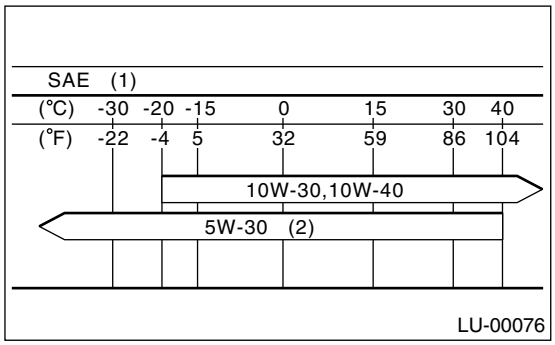
Engine oil capacity: (Turbo model)
Upper level
4.5 ℓ (4.8 US qt, 4.0 Imp qt)
Lower level
3.5 ℓ (3.7 US qt, 3.1 Imp qt)

- NON-TURBO MODEL



(1) SAE Viscosity No. and Applicable Temperature
(2) PREFERRED

- TURBO MODEL



(1) SAE Viscosity No. and Applicable Temperature
(2) PREFERRED

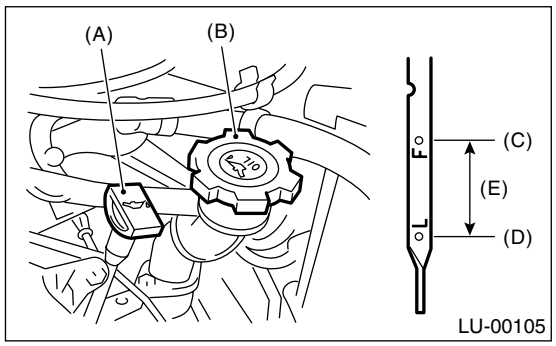
The proper viscosity helps vehicle get good cold and hot starting by reducing viscous friction and thus increasing cranking speed.

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

9) Close the engine oil filler cap.
10) Start the engine and warm it up for a time.

11) After the engine stops, recheck the oil level. If necessary, add engine oil up to the upper level on level gauge.

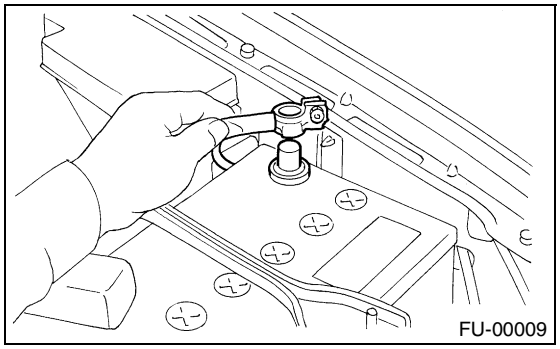


(A) Oil level gauge
(B) Engine oil filler cap
(C) Upper level
(D) Lower level
(E) Approx. 1.0 ℓ (1.1 Us qt, 0.9 Imp qt)

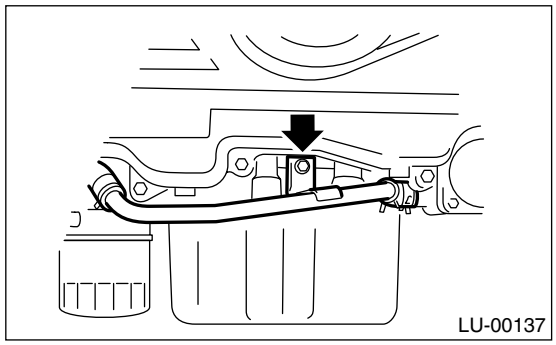
4. Oil Pump

A: REMOVAL

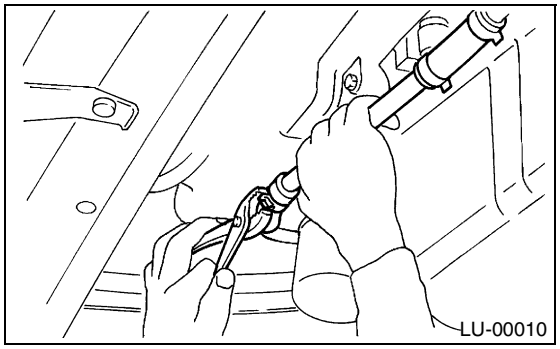
1) Disconnect the ground cable from battery.



2) Lift-up the vehicle.
3) Remove the under cover.
4) Remove the bolts which install water pipe of oil cooler to oil pump. (Turbo model)

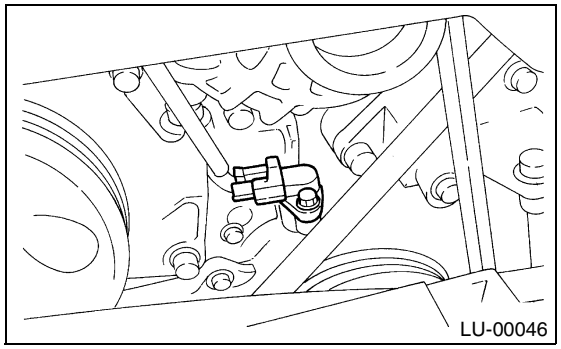


5) Remove the water pipe and hoses between oil cooler and water pump. (Turbo model)

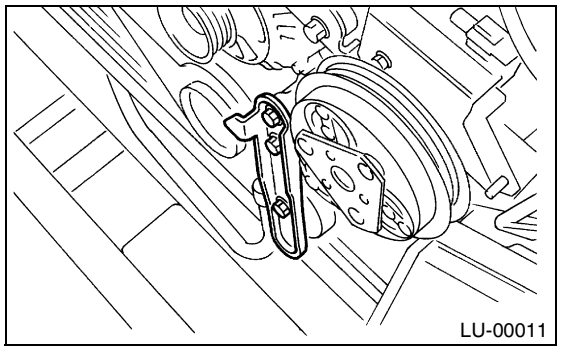


6) Remove the radiator. <Ref. to CO(SOHC)-27, REMOVAL, Radiator.>

7) Remove the crankshaft position sensor.

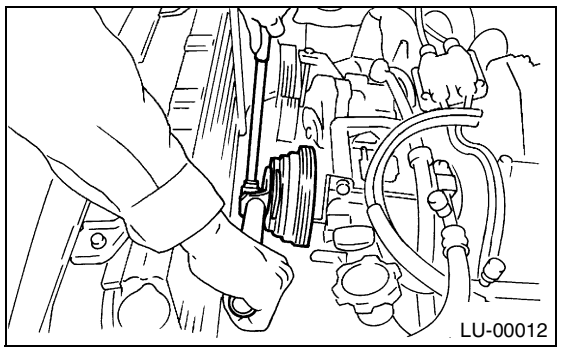


8) Remove the V-belts.
<Ref. to ME(SOHC)-41, REMOVAL, V-belt.> or <Ref. to ME(TURBO)-44, REMOVAL, V-belt.>
9) Remove the rear side V-belt tensioner.



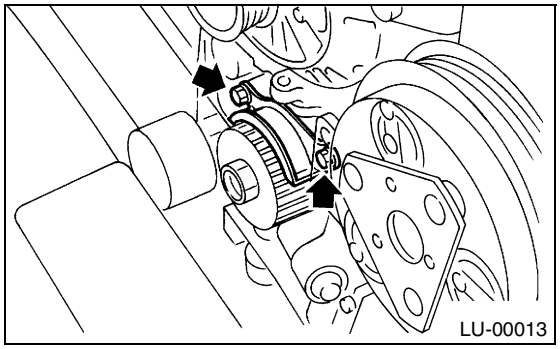
10) Remove the crankshaft pulley by using ST.

ST	499977400	CRANKSHAFT PULLEY WRENCH (2000 cc model)
ST	499977100	CRANKSHAFT PULLEY WRENCH (2500 cc model)

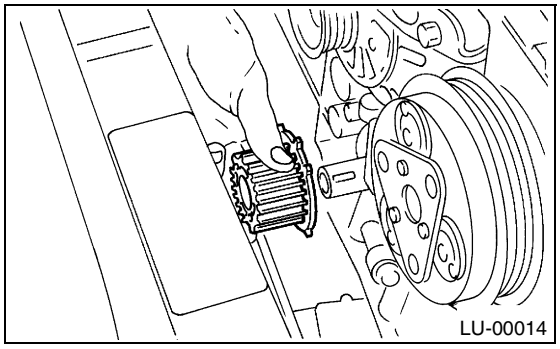


11) Remove the water pump. <Ref. to CO(SOHC)-20, REMOVAL, Water Pump.>

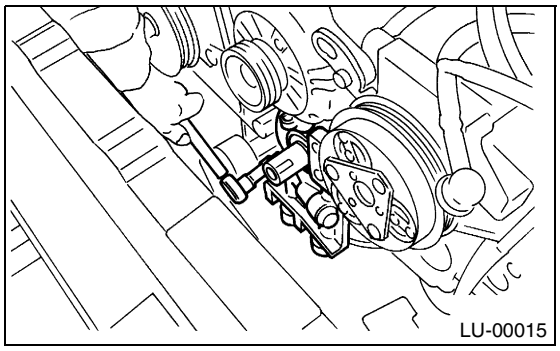
12) Remove the timing belt guide. (MT vehicles)



13) Remove the crankshaft sprocket.

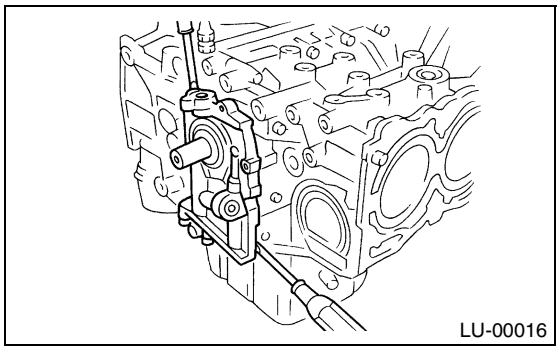


14) Remove the bolts which install oil pump onto cylinder block.



15) Remove the oil pump by using flat tip screwdriver.

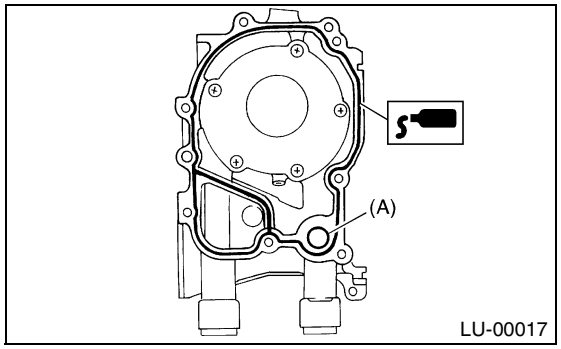
CAUTION:
Be careful not to scratch the mating surfaces of cylinder block and oil pump.



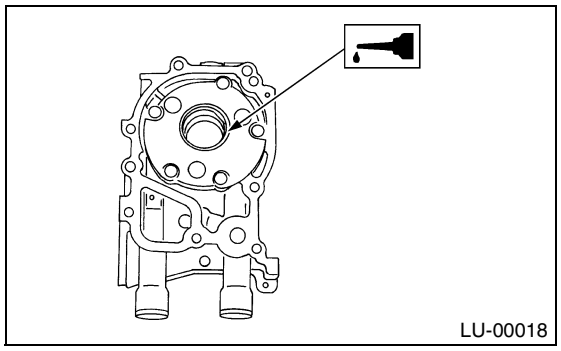
B: INSTALLATION

Install in the reverse order of removal.
Do the following:
1) Apply fluid packing to the matching surfaces of oil pump.

Fluid packing:
Part No. 004403007
THREE BOND 1215 or equivalent



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

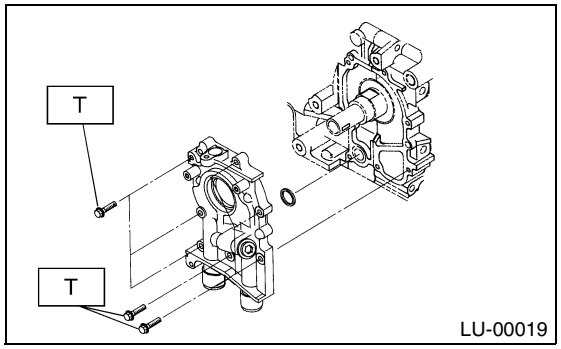


4) Be careful not to scratch the oil seal when installing oil pump on cylinder block.
5) Position the oil pump, aligning the notched area with crankshaft, and push the oil pump straight.

CAUTION:
Make sure the oil seal lip is not folded.

6) Install the oil pump.

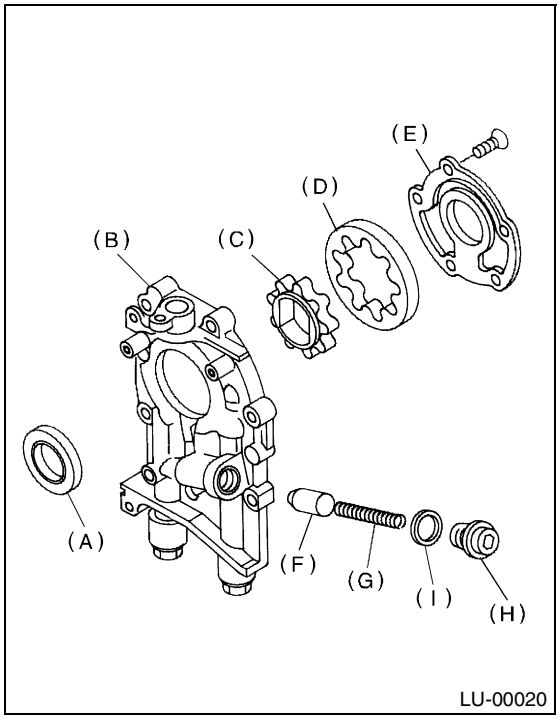
Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



C: DISASSEMBLY

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

CAUTION:
Before disassembling the oil pump, remove the relief valve.

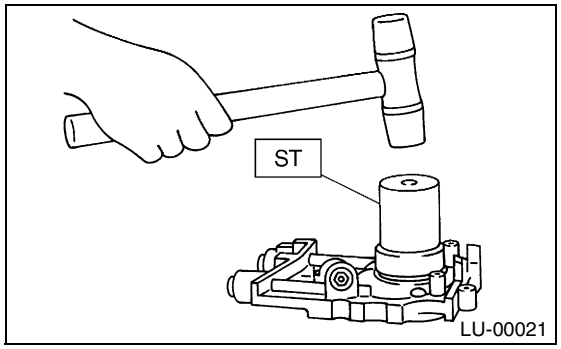


(A) Oil seal
(B) Pump case
(C) Inner rotor
(D) Outer rotor
(E) Pump cover
(F) Relief valve
(G) Relief valve spring
(H) Plug
(I) Gasket

D: ASSEMBLY

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

NOTE:
Use a new oil seal.

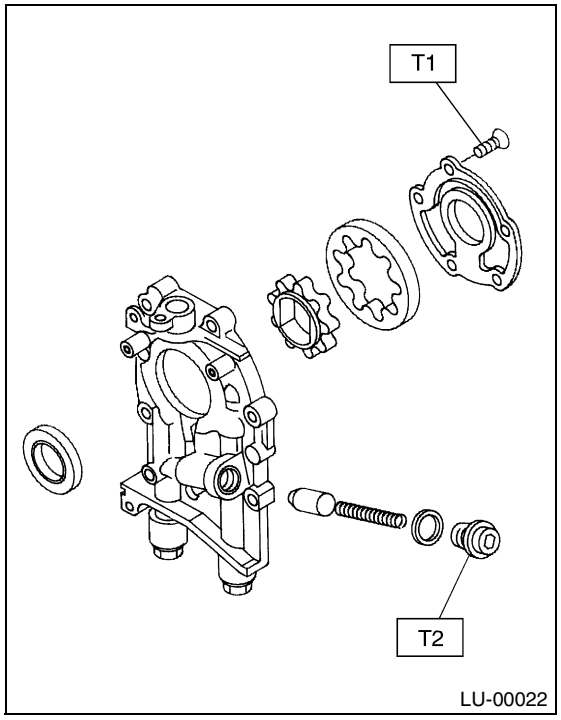


2) Apply a coat of engine oil to the inner and outer rotors.
3) Install the inner and outer rotors in their original positions.
4) Install the oil relief valve and relief valve spring and plug.

NOTE:
Use a new gasket.

5) Install the oil pump cover.

Tightening torque:
T1: 5 N·m (0.5 kgf-m, 3.6 ft-lb)
T2: 44 N·m (4.5 kgf-m, 32.5 ft-lb)

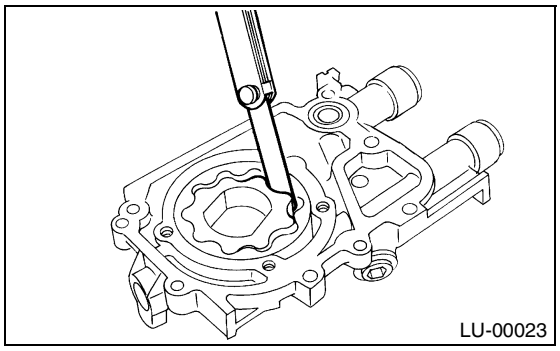


E: INSPECTION

1. TIP CLEARANCE

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

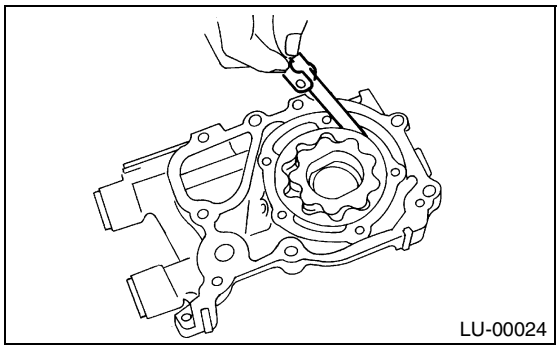
Tip clearance:
Standard
0.04 — 0.14 mm (0.0016 — 0.0055 in)
Limit
0.18 mm (0.0071 in)



2. CASE CLEARANCE

Measure the clearance between the outer rotor and oil pump rotor housing. If clearance exceeds the limit, replace the rotor.

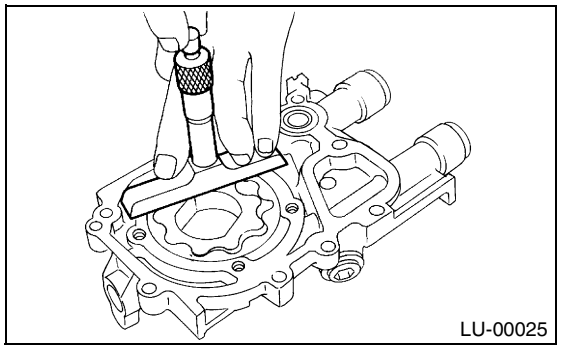
Case clearance:
Standard
0.10 — 0.175 mm (0.0039 — 0.0069 in)
Limit
0.20 mm (0.0079 in)



3. SIDE CLEARANCE

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

Side clearance:
Standard
0.02 — 0.07 mm (0.0008 — 0.0028 in)
Limit
0.12 mm (0.0047 in)



4. OIL RELIEF VALVE

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

Relief valve spring:
Non-turbo model
Free length
72.8 mm (2.866 in)
Installed length
54.7 mm (2.154 in)
Load when installed
81.3 N (8.29 kgf, 18.24 lb)
Turbo model
Free length
73.7 mm (2.902 in)
Installed length
54.7 mm (2.154 in)
Load when installed
93.1 N (9.49 kgf, 20.88 lb)

5. OIL PUMP CASE

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

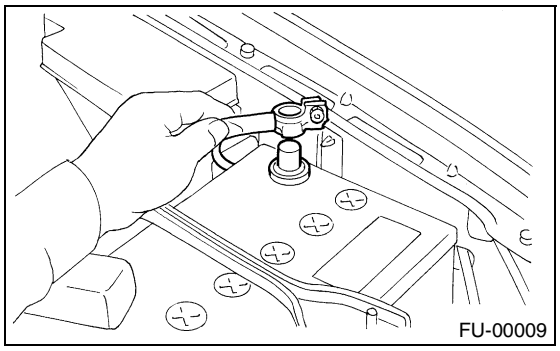
6. OIL SEAL

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

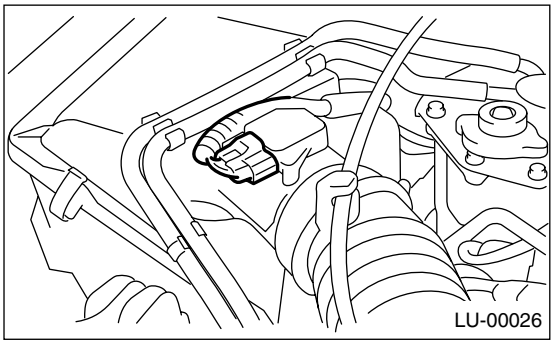
5. Oil Pan and Strainer

A: REMOVAL

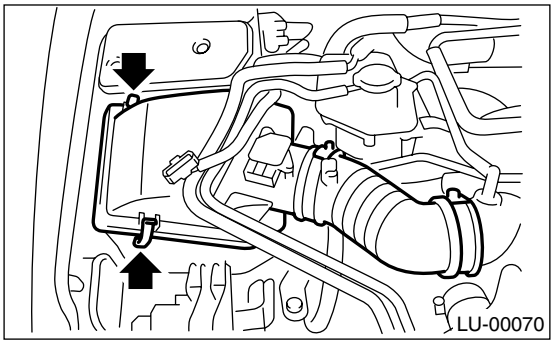
1) Set the vehicle on lift arms.
2) Remove the front wheels.
3) Disconnect the ground cable from battery.



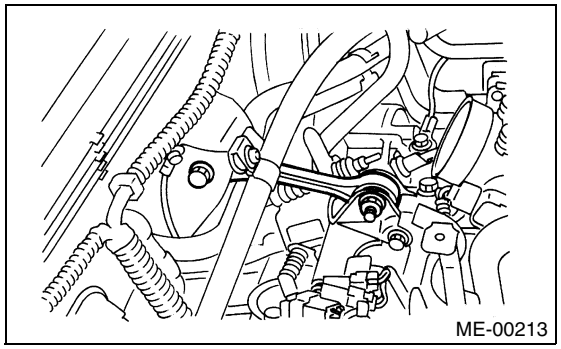
4) Remove the air intake duct and air cleaner case. (Non-turbo model) <Ref. to IN(SOHC)-7, REMOVAL, Air Intake Duct.> and <Ref. to IN(SOHC)-6, REMOVAL, Air Cleaner Case.>
5) Disconnect the connector from mass air flow sensor. (Turbo model)



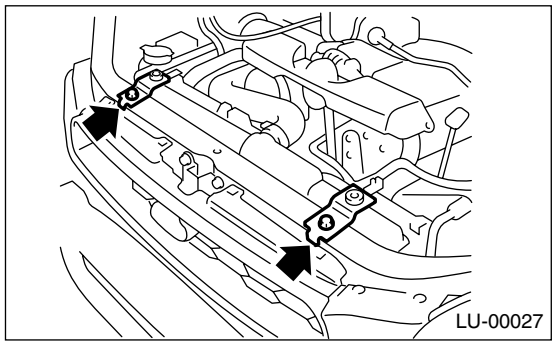
6) Remove the air intake boot and air cleaner upper cover. (Turbo model)



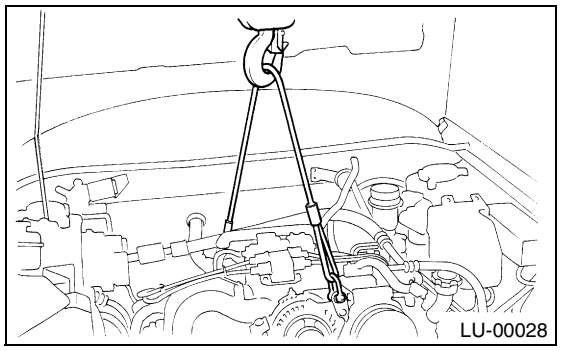
7) Remove the intercooler (Turbo model) <Ref. to IN(TURBO)-10, REMOVAL, Intercooler.>
8) Remove the pitching stopper.



9) Remove the radiator upper brackets.



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

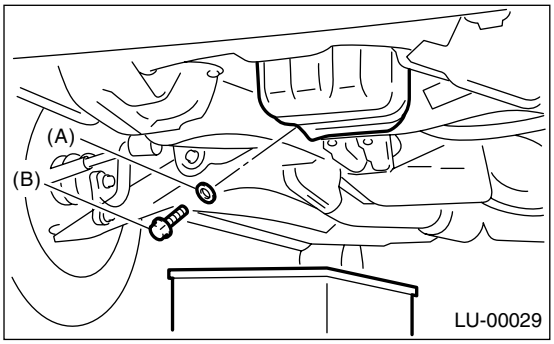


11) Lift-up the vehicle.

CAUTION:
When lifting up the vehicle, rise up the wire rope together.

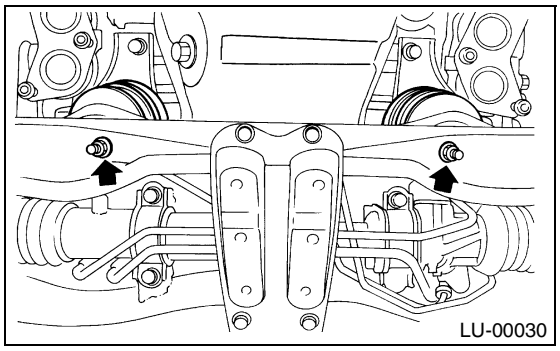
12) Remove the under cover.

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



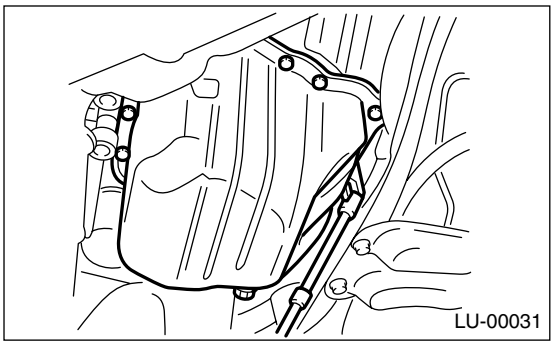
(A) Gasket
(B) Drain plug

14) Remove the front and center exhaust pipes. (Non-turbo model) <Ref. to EX(SOHC)-7, REMOVAL, Front Exhaust Pipe.>
15) Remove the nuts which install front cushion rubber onto front crossmember.

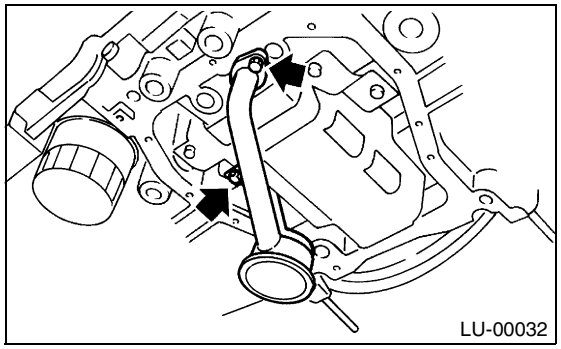


16) Remove the bolts which install oil pan on cylinder block while raising up engine.
17) Insert the oil pan cutter blade between the cylinder block-to-oil pan clearance.

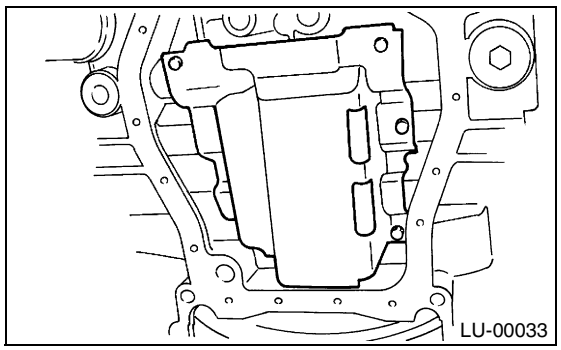
CAUTION:
Do not use a screwdriver or similar tool in place of oil pan cutter.



18) Remove the oil strainer.



19) Remove the baffle plate.

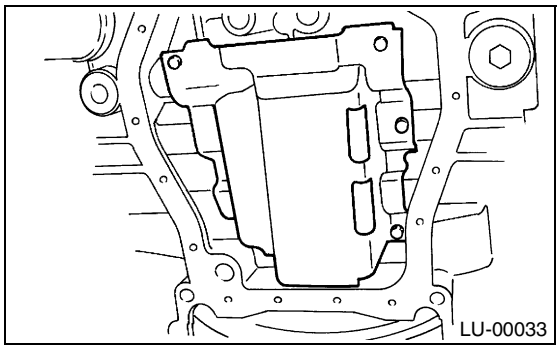


B: INSTALLATION

CAUTION:
Before installing the oil pan, clean sealant from oil pan and engine block.

1) Install the baffle plate.

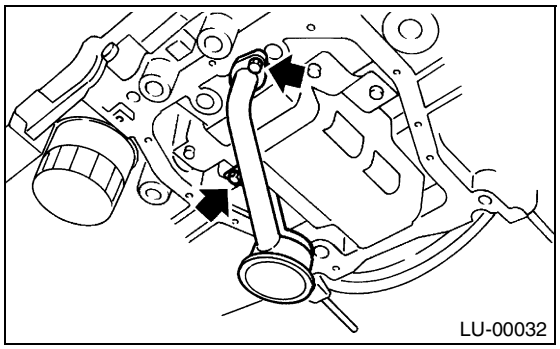
Tightening torque:
6.4 N·m (0.65 kgf-m, 4.7 ft-lb)



2) Install the oil strainer onto baffle plate.

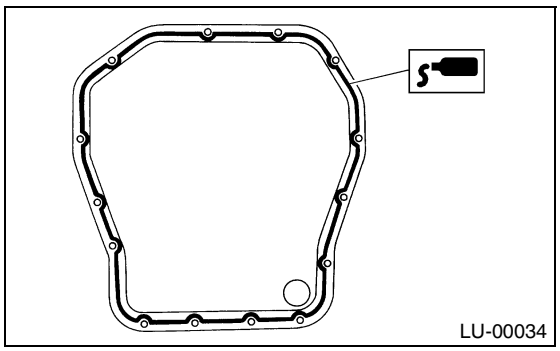
NOTE:
Replace the O-ring with a new one.

Tightening torque:
10 N·m (1.0 kgf-m, 7.2 ft-lb)



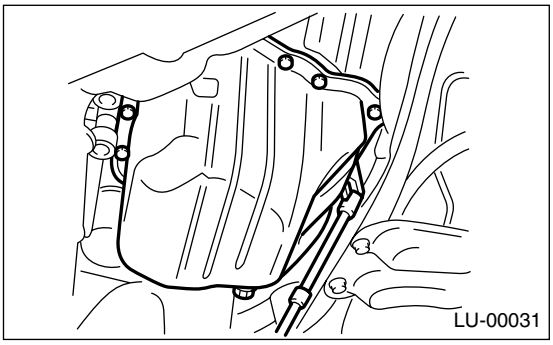
3) Apply fluid packing to the mating surfaces and install oil pan.

Fluid packing:
Part No. 004403007
THREE BOND 1215 or equivalent



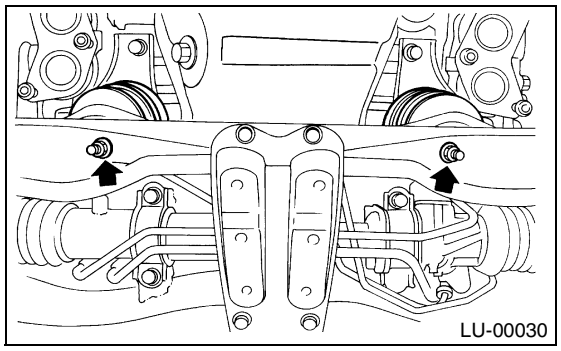
4) Tighten the bolts which install the oil pan onto engine block.

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



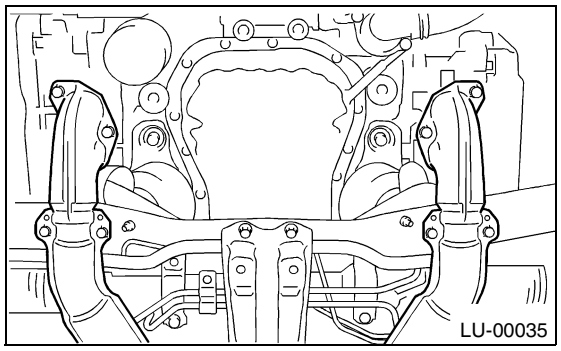
5) Lower the engine onto front crossmember.
6) Tighten the nuts which install front cushion rubber onto front crossmember.

Tightening torque:
69 N·m (7.0 kgf-m, 50.9 ft-lb)



7) Install the front and center exhaust pipes. (Non-Turbo model) <Ref. to EX(SOHC)-8, INSTALLATION, Front Exhaust Pipe.>

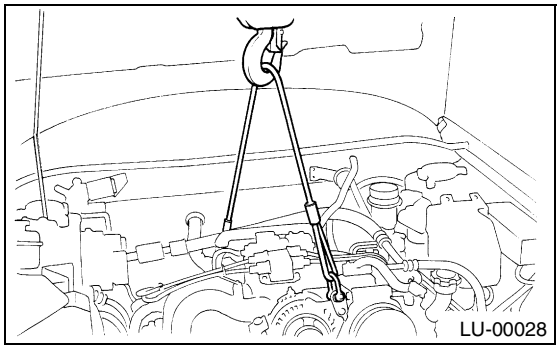
NOTE:
Always use new gaskets.



8) Install the under cover.
9) Lower the vehicle.

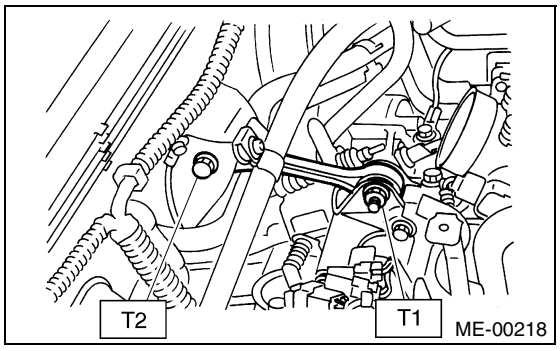
CAUTION:
When lowering the vehicle, lower the lifting device and wire rope together.

10) Remove the lifting device and steel cables.

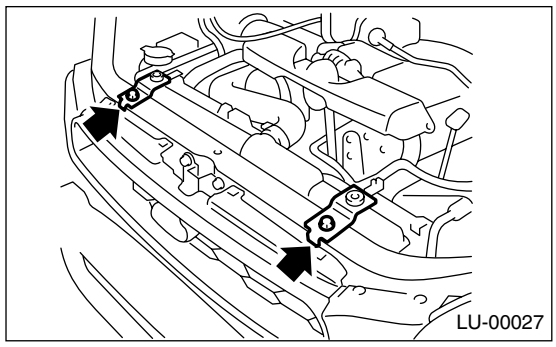


11) Install the pitching stopper.

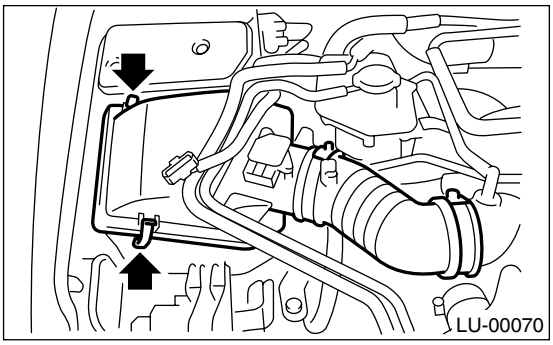
Tightening torque:
T1: 50 N·m (5.1 kgf-m, 36.9 ft-lb)
T2: 58 N·m (5.9 kgf-m, 42.8 ft-lb)



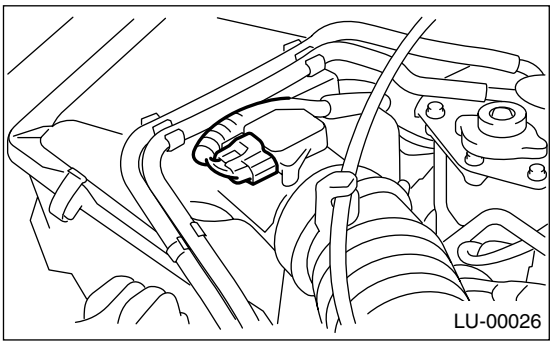
12) Install the radiator upper brackets.



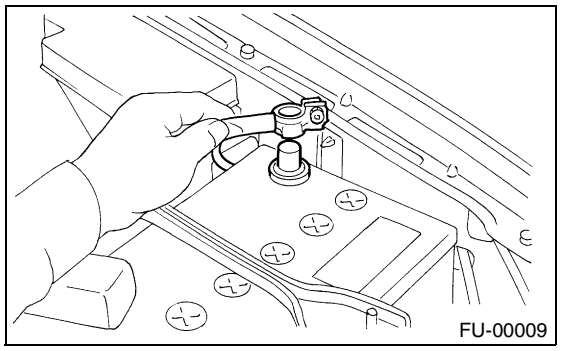
13) Install the air intake duct and air cleaner case. (Non-turbo model) <Ref. to IN(SOHC)-7, INSTALLATION, Air Intake Duct.> and <Ref. to IN(SOHC)-6, INSTALLATION, Air Cleaner Case.>
14) Install the intercooler. (Turbo model) <Ref. to IN(TURBO)-11, INSTALLATION, Intercooler.>
15) Install the air intake boot and air cleaner upper cover. (Turbo model)



16) Connect the connector to mass air flow sensor. (Turbo model)



17) Install the front wheels.
18) Connect the battery ground cable to battery.



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

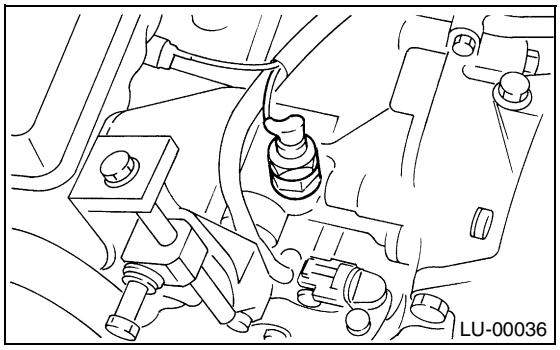
C: INSPECTION

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

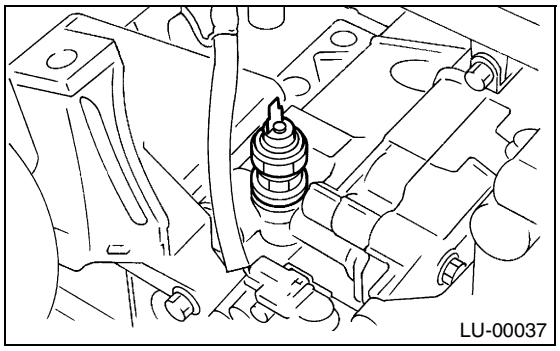
6. Oil Pressure Switch

A: REMOVAL

1) Remove the generator from bracket. <Ref. to SC(SOHC)-15, REMOVAL, Generator.>
2) Disconnect the terminal from oil pressure switch.



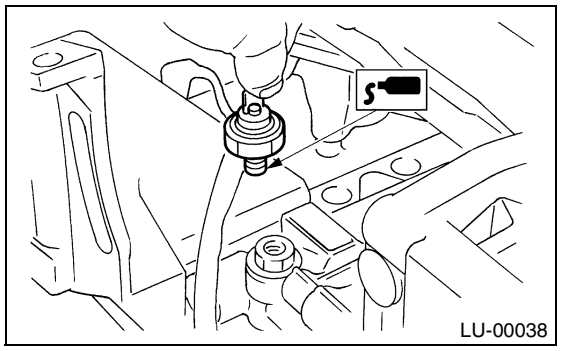
3) Remove the oil pressure switch.



B: INSTALLATION

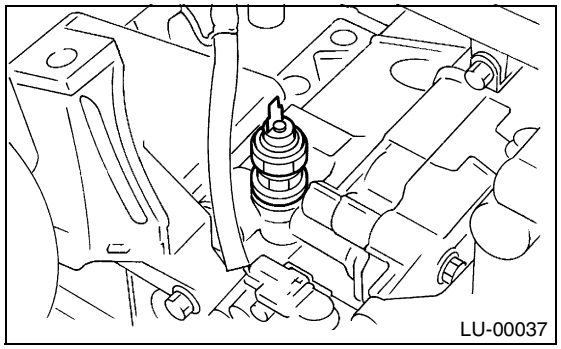
1) Apply fluid packing to the oil pressure switch threads.

Fluid packing:
Part No. 004403007
THREE BOND 1324 or equivalent

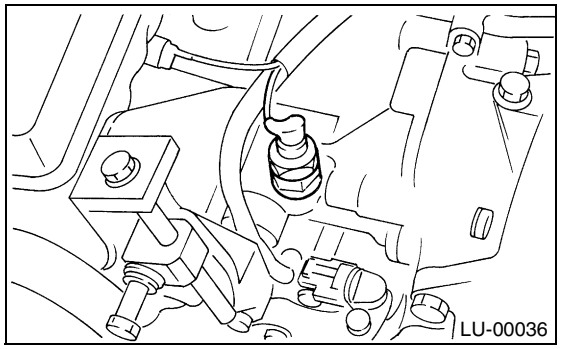


2) Install the oil pressure switch onto engine block.

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



3) Connect the terminal of oil pressure switch.



4) Install the generator on bracket. <Ref. to SC(SOHC)-15, INSTALLATION, Generator.>

C: INSPECTION

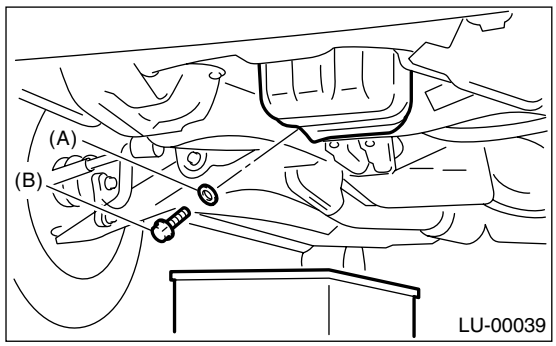
Make sure oil does not leak or seep from where the oil pressure switch is installed.

7. Engine Oil Cooler

A: REMOVAL

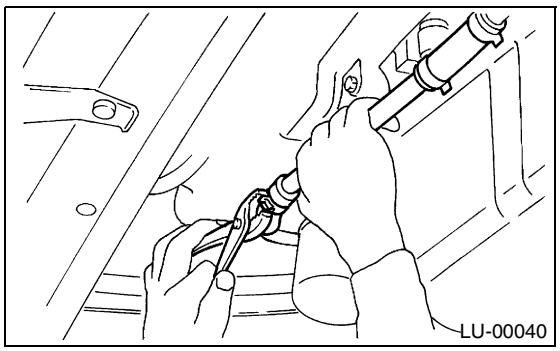
NOTE:
Engine oil cooler is equipped with turbo model only.

1) Lift-up the vehicle.
2) Remove the under cover.
3) Drain the engine oil.
Set a container under the vehicle, and remove the drain plug from oil pan.

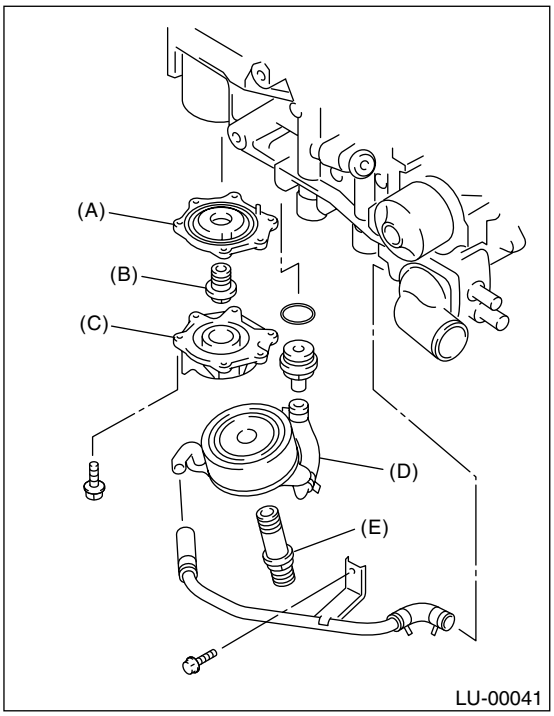


(A) Gasket
(B) Drain plug

4) Drain the engine coolant.
5) Remove the water by-pass pipe between oil cooler and water pump.



6) Remove the engine oil filter. <Ref. to LU(SOHC)-24, REMOVAL, Engine Oil Filter.>
7) Remove the connector and remove oil cooler.
8) Remove the adapters (1) and (2).

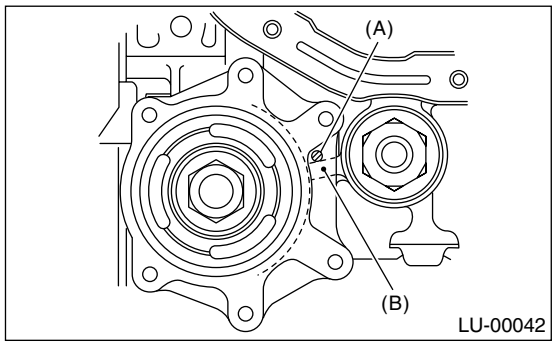


(A) Adapter (1)
(B) Adapter connector
(C) Adapter (2)
(D) Oil cooler
(E) Oil cooler connector

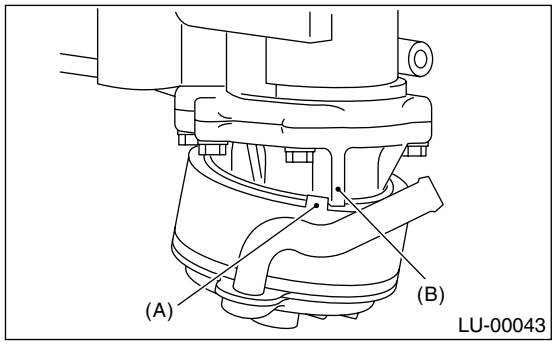
B: INSTALLATION

NOTE:
Engine oil cooler is equipped with turbo model only.

1) Install in the reverse order of removal.
2) Contact the knock pin (A) of adapter (1) to cylinder block rib to install adapter (1).

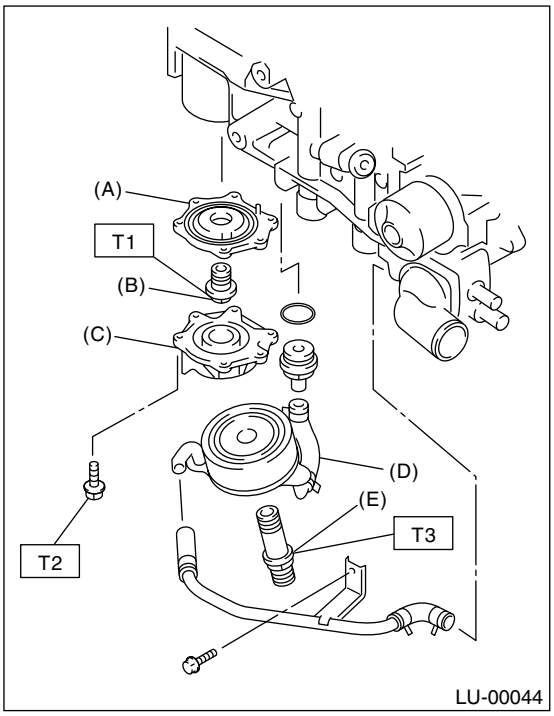


3) Install the adapter (2).
4) Contact the engine oil cooler stopper (A) to adapter (2) rib to install engine oil cooler.



Tightening torque:
T1: 6.4 N·m (0.7 kgf-m, 5.1 ft-lb)
T2: 44 N·m (4.5 kgf-m, 33 ft-lb)
T3: 54 N·m (5.5 kgf-m, 40 ft-lb)

NOTE:
Always use a new O-ring.



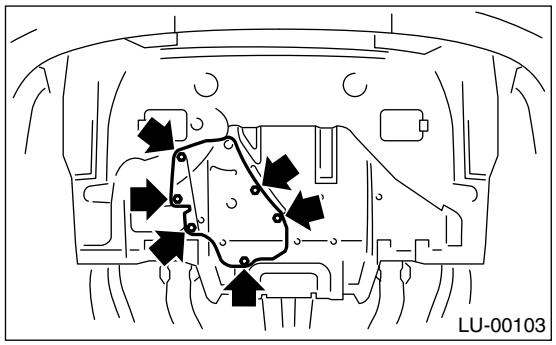
C: INSPECTION

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

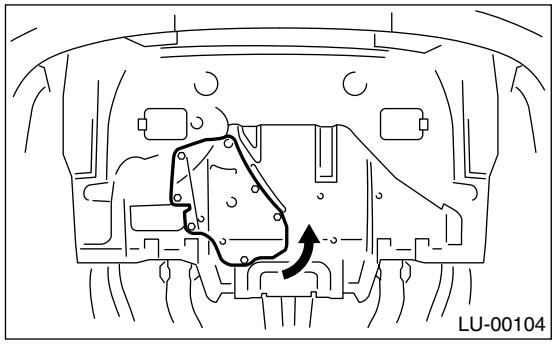
8. Engine Oil Filter

A: REMOVAL

1) Remove six clips on the under cover.

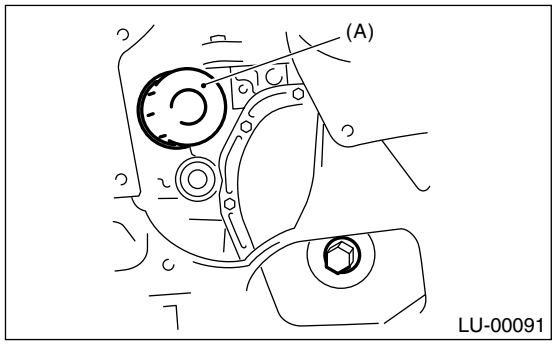


2) Turn the service hole cover counterclockwise.



3) Remove the oil filter with ST.

ST	498547000	OIL FILTER WRENCH (Non-trbo model)
ST	18332AA000	OIL FILTER WRENCH (Turbo model)



B: INSTALLATION

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

C: INSPECTION

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

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

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

9. Engine Lubrication System Trouble in General

A: INSPECTION

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).