

General Description

LUBRICATION

1. General Description

A: SPECIFICATION

Lubrication method			Forced lubrication
Oil pump	Pump type		Trochoid type
	Number of teeth	Inner rotor	7
		Outer rotor	8
	Outer rotor diameter × thickness mm (in)		86 × 13 (3.39 × 0.51)
	Tip clearance between inner and outer rotors mm (in)		0.04 — 0.14 (0.0016 — 0.0055)
	Side clearance between inner rotor and pump case mm (in)		0.020 — 0.046 (0.0008 — 0.0018)
	Case clearance between outer rotor and pump case mm (in)		0.110 — 0.175 (0.0043 — 0.0069)
Oil filter	Filter type		Full-flow filter type
	Filtration area cm ² (sq in)		1,300 (201.5)
	By-pass valve opening pressure kPa (kg/cm ² , psi)		160 (1.63, 23.2)
	Outer diameter × width mm (in)		80 × 75 (3.15 × 2.95)
	Installation screw specifications		M 20 × 1.5
Relief valve working pressure kPa (kg/cm ² , psi)		708 (7.22, 102.7)	
Oil pressure switch	Type		Immersed contact point type
	Operating voltage — power consumption		12 V — 3.4 W or less
	Warning light operating pressure kPa (kg/cm ² , psi)		15 (0.15, 2.2)
	Proof pressure kPa (kg/cm ² , psi)		980 (10.0, 142) or more
Engine oil	Total capacity (Overhaul) ℓ (US qt, Imp qt)		7.0 (7.4, 6.2)
	When replacing engine oil and oil filter ℓ (US qt, Imp qt)		5.7 (6.0, 5.0)
	When replacing engine oil only ℓ (US qt, Imp qt)		5.5 (5.8, 4.8)

Recommended oil:

Oil corresponding to either of the following standards.

- **For API standard, oil with SM “Energy Conserving” logo**
- **For ILSAC standard, oil with GF-4 “Star burst mark” label on the container**

SAE (1)						
(°C)	-30	-20	-15	0	15	30 40
(°F)	-22	-4	5	32	59	86 104
10W-30, 10W-40, 10W-50 5W-30 (2)						

LU-02329

- (1) SAE viscosity No. and applicable temperature
(2) Recommended

NOTE:

- The proper viscosity oil helps the engine maintain its ideal temperature, and cranking speed increased by reducing viscosity friction in hot condition.
- If the vehicle is used in regions of high temperatures or in other severe environments, use oil with the viscosities shown below.

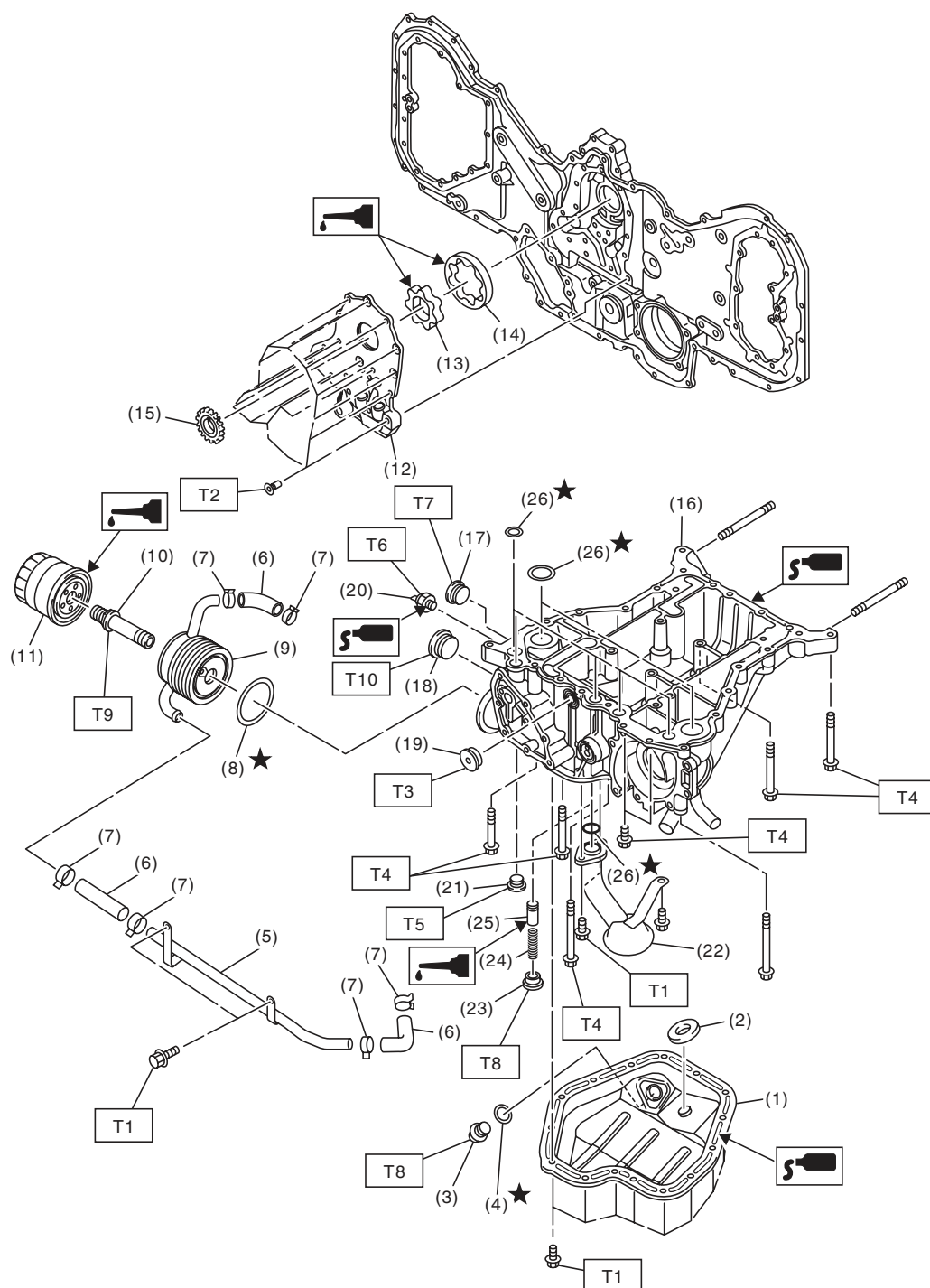
API standard: SM or SL

SAE viscosity No.: 30, 40, 10W-50, 20W-40, 20W-50

CAUTION:

It is acceptable to fill an engine with oil of another brand when replacing the oil, but make sure to use an oil with an API standard and SAE viscosity number specified by Subaru.

B: COMPONENT



LU-02368

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(1) Oil pan lower	(14) Outer rotor	<i>Tightening torque:N-m (kgf-m, ft-lb)</i>
(2) Magnet	(15) Crank sprocket	<i>T1: 6.4 (0.7, 4.7)</i>
(3) Drain plug	(16) Oil pan upper	<i>T2: <Ref. to LU(H6DO)-9, INSTAL-</i>
(4) Gasket	(17) Plug	<i>LATION, Oil Pump.></i>
(5) Engine oil cooler water pipe	(18) Plug	<i>T3: 16 (1.6, 11.8)</i>
(6) Water hose	(19) Plug	<i>T4: 18 (1.8, 13.3)</i>
(7) Clip	(20) Oil pressure switch	<i>T5: 23 (2.3, 17.0)</i>
(8) Gasket	(21) Plug	<i>T6: 25 (2.5, 18.4)</i>
(9) Oil cooler	(22) Oil strainer	<i>T7: 37 (3.8, 27.3)</i>
(10) Oil cooler connector	(23) Plug	<i>T8: 44 (4.5, 32.5)</i>
(11) Oil filter	(24) Relief valve spring	<i>T9: 54 (5.5, 39.8)</i>
(12) Oil pump cover	(25) Relief valve	<i>T10: 90 (9.2, 66.4)</i>
(13) Inner rotor	(26) O-ring	

General Description

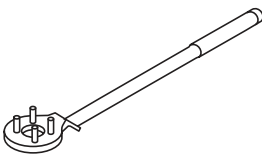
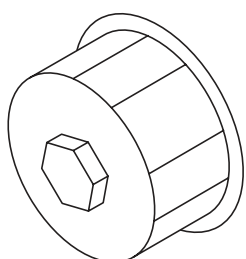
LUBRICATION

C: CAUTION

- Wear appropriate work clothing, including a cap, protective goggles and protective shoes when performing any work.
- Remove contamination including dirt and corrosion before removal, installation or disassembly.
- Keep the disassembled parts in order and protect them from dust and dirt.
- Before removal, installation or disassembly, be sure to clarify the failure. Avoid unnecessary removal, installation, disassembly and replacement.
- Vehicle components are extremely hot after driving. Be wary of receiving burns from heated parts.
- Be sure to tighten fasteners including bolts and nuts to the specified torque.
- Place shop jacks or rigid racks at the specified points.
- Before disconnecting connectors of sensors or units, be sure to disconnect the ground cable from battery.
- If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.
- Prepare a container and cloth to prevent scattering of oil when performing work where fuels can be spilled. If the fuel spills, wipe it off immediately to prevent from penetrating into floor or flowing out for environmental protection.
- Follow all government and local regulations concerning disposal of refuse when disposing oil.

D: PREPARATION TOOL

1. SPECIAL TOOL

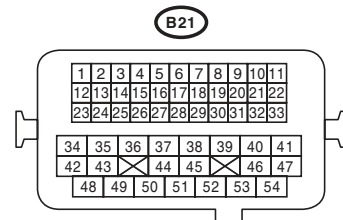
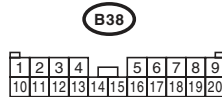
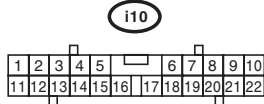
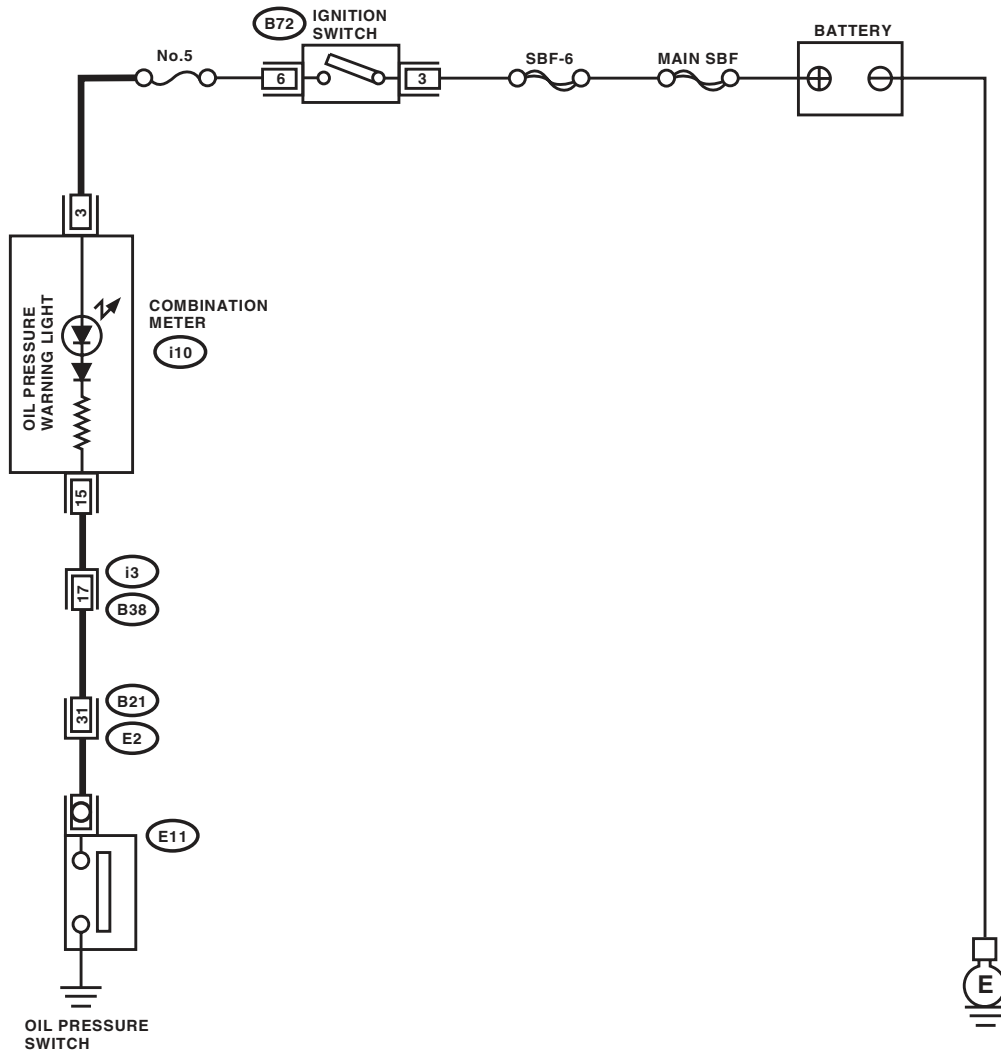
ILLUSTRATION	TOOL NUMBER	DESCRIPTION	REMARKS
 ST-499977100	499977100	CRANK PULLEY WRENCH	Used to stop rotation of the crank pulley when loosening or tightening crank pulley bolts.
 ST-498547000	498547000	OIL FILTER WRENCH	Used for removing and installing oil filter.

Oil Pressure System

LUBRICATION

2. Oil Pressure System

A: WIRING DIAGRAM



LU-02306

LU(H6DO)-6

Oil Pressure System

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B: INSPECTION

Step	Check	Yes	No
1 CHECK COMBINATION METER. 1) Turn the ignition switch to ON. (engine OFF) 2) Check the warning light of combination meter.	Does the warning light illuminate?	Go to step 2.	Repair or replace the combination meter. <Ref. to IDI-5, 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 to ON. 4) Measure the voltage between oil pressure switch connector and engine ground. Connector & terminal (E11) No. 1 (+) — Engine ground (-):	Is the voltage 10 V or more?	Replace the oil pressure switch. <Ref. to LU(H6DO)-15, 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. Terminals (i10) No. 3 — (i10) No. 15:	Is the resistance less than 10 Ω?	Repair the harness and connector. NOTE: In this case, repair the following item: • Open circuit of harness between combination meter and oil pressure switch • Poor contact in combination meter connector • Poor contact in oil pressure switch connector • Poor contact of coupling connector	Repair or replace the combination meter. <Ref. to IDI-5, INSPECTION, Combination Meter System.>

Engine Oil

LUBRICATION

3. Engine Oil

A: INSPECTION

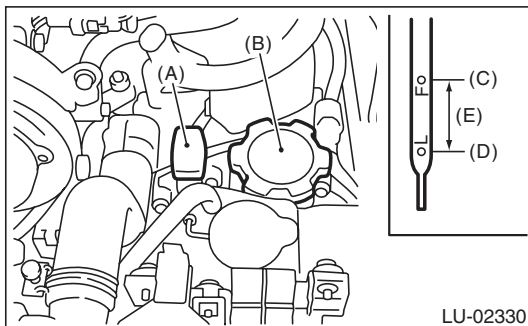
CAUTION:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

- 1) Park the vehicle on a level surface.
- 2) Remove the oil level gauge and wipe away the oil.
- 3) Reinsert the oil level gauge all the way. Be sure that the oil level gauge is correctly inserted and properly orientated.
- 4) Pull out the oil level gauge again, and check the oil level. If the engine oil level is below "L" line, make sure that there is no oil leakage from the engine, then add oil to rise the level up to the "F" line.
- 5) After turning off the engine, wait a few minutes for the oil to return to the oil pan before checking the oil level.

NOTE:

- Just after driving or while the engine is warm, engine oil level may over "F" line. This is caused by thermal expansion of engine oil.
- To prevent overfilling of engine oil, do not add oil above "F" line when the engine is cold.



- (A) Oil level gauge
(B) Engine oil filler cap
(C) "F" line
(D) "L" line
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

B: REPLACEMENT

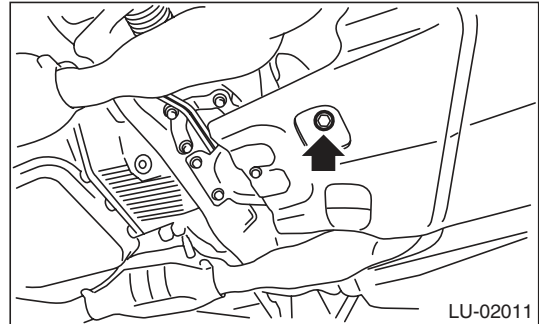
CAUTION:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

- 1) Set the vehicle on a lift.
- 2) Open the engine oil filler cap for quick draining of engine oil.
- 3) Lift up the vehicle.
- 4) Drain engine oil by loosening the engine oil drain plug.

NOTE:

Prepare the container for draining of engine oil.



- 5) Tighten the engine oil drain plug after draining engine oil.

NOTE:

Use a new drain plug gasket.

Tightening torque:

44 N·m (4.5 kgf-m, 32.5 ft-lb)

- 6) Lower the vehicle.
- 7) Using engine oil of proper quality and viscosity, fill engine oil through the oil filler duct to the "F" line on the level gauge. Make sure that the vehicle is parked on a level surface when checking oil level.

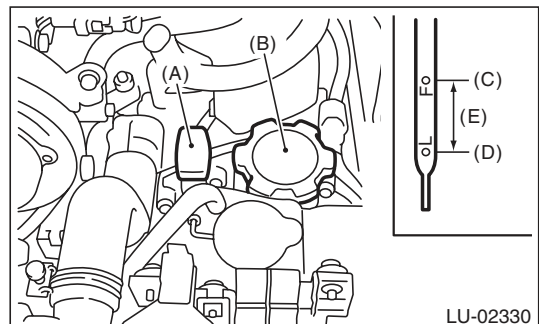
Recommended oil:

Refer to "SPECIFICATION" for the recommended oil. <Ref. to LU(H6DO)-2, SPECIFICATION, General Description.>

Engine oil capacity:

Refer to "SPECIFICATION" for the engine oil capacity. <Ref. to LU(H6DO)-2, SPECIFICATION, General Description.>

- 8) Close the engine oil filler cap.
- 9) Start the engine, and spreads the oil in engine room.
- 10) After stopping the engine, recheck the oil level. If necessary, add engine oil up to the "F" line on the level gauge.

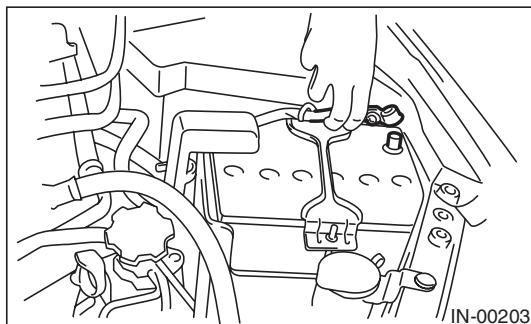


- (A) Oil level gauge
(B) Engine oil filler cap
(C) "F" line
(D) "L" line
(E) Approx. 1.0 ℓ (1.1 US qt, 0.9 Imp qt)

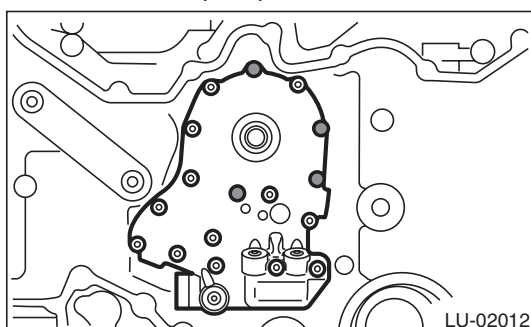
4. Oil Pump

A: REMOVAL

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



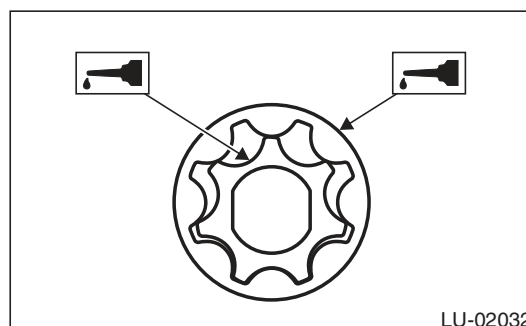
- 4) Lift up the vehicle.
- 5) Remove the under cover.
- 6) Drain engine coolant. <Ref. to CO(H6DO)-10, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 7) Lower the vehicle.
- 8) Remove the radiator. <Ref. to CO(H6DO)-15, REMOVAL, Radiator.>
- 9) Remove the V-belts. <Ref. to ME(H6DO)-42, REMOVAL, V-belt.>
- 10) Remove the front chain cover. <Ref. to ME(H6DO)-44, REMOVAL, Front Chain Cover.>
- 11) Remove the timing chain assembly. <Ref. to ME(H6DO)-46, REMOVAL, Timing Chain Assembly.>
- 12) Remove the crank sprocket.
- 13) Remove the oil pump cover.



- 14) Remove the inner rotor and outer rotor.

B: INSTALLATION

- 1) Apply a coat of engine oil to the whole area of inner rotor and outer rotor.



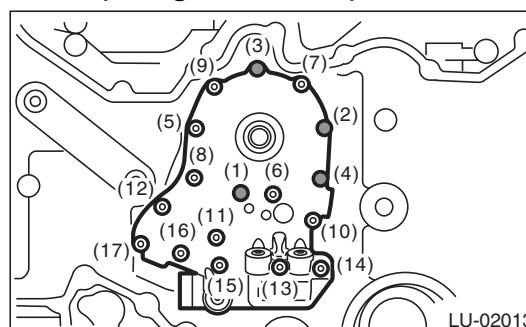
- 2) Install the inner rotor to crankshaft and assemble the outer rotor.
- 3) Install the oil pump cover.
- 4) Tighten the bolts in the numerical order as shown in the figure.

CAUTION:

Make sure that the bolt is installed in correct position.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



Bolt installing position	Bolt dimension
(1) and (3)	6 × 14 × 14
(2) and (4)	6 × 35 × 18
(5), (6), (7), (8), (9), (10) and (11)	6 × 35 × 15
(12), (15), (16) and (17)	6 × 16 × 16
(13) and (14)	6 × 26 × 15

- 5) Install the crank sprocket.
- 6) Install the timing chain assembly. <Ref. to ME(H6DO)-47, INSTALLATION, Timing Chain Assembly.>
- 7) Install the front chain cover. <Ref. to ME(H6DO)-44, INSTALLATION, Front Chain Cover.>
- 8) Install the V-belts. <Ref. to ME(H6DO)-42, INSTALLATION, V-belt.>
- 9) Install the radiator. <Ref. to CO(H6DO)-16, INSTALLATION, Radiator.>
- 10) Lift up the vehicle.
- 11) Install the under cover.
- 12) Lower the vehicle.

Oil Pump

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C: INSPECTION

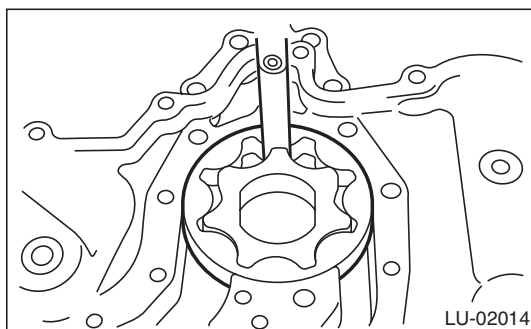
1. TIP CLEARANCE

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

Tip clearance:

Standard

0.04 — 0.14 mm (0.0016 — 0.0055 in)



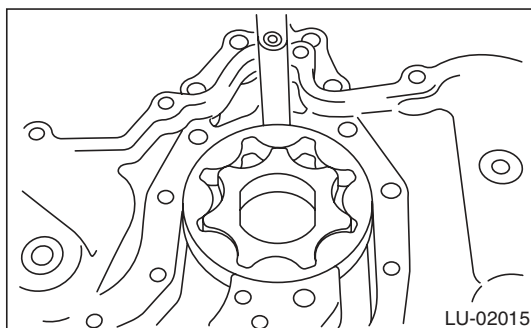
2. CASE CLEARANCE

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

Case clearance:

Standard

0.110 — 0.175 mm (0.0043 — 0.0069 in)



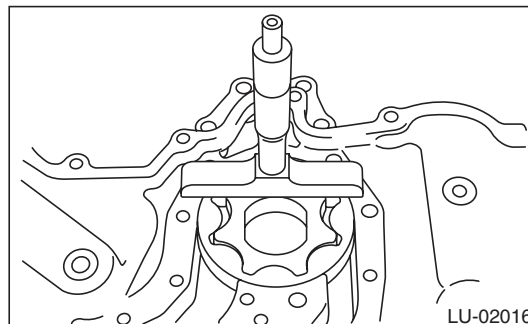
3. SIDE CLEARANCE

Measure the clearance between oil pump inner rotor and rear chain cover. If the clearance exceeds specification, replace the rotors as a matched set.

Side clearance:

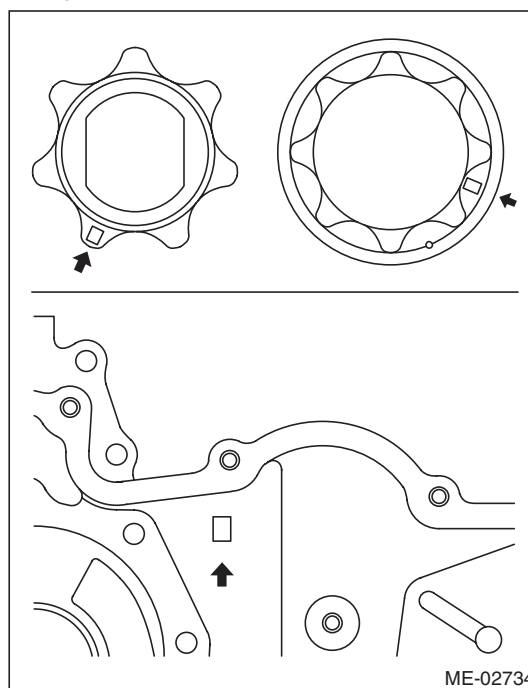
Specification

0.020 — 0.046 mm (0.0008 — 0.0018 in)



Perform the replacement part selection as follows.

- When replacing all of inner rotor, outer rotor and rear chain cover with new parts, use those with matching identification marks as there are identification marks on those parts in the locations shown on the figure.



Oil Pump

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- When replacing any of inner rotor, outer rotor and rear chain cover with a new part, select the suitable size from the following table so that side clearance is within the standard value.

Inner rotor

Identification	Part No.	Rotor thickness mm (in)
A	15015AA250	12.993 — 13.006 (0.51153 — 0.51205)
None	15015AA300	12.980 — 12.993 (0.51102 — 0.51153)
C	15015AA310	12.967 — 12.980 (0.51051 — 0.51102)

Outer rotor

Identification	Part No.	Rotor thickness mm (in)
A	15016AA250	12.993 — 13.006 (0.51153 — 0.51205)
None	15016AA300	12.980 — 12.993 (0.51102 — 0.51153)
C	15016AA310	12.967 — 12.980 (0.51051 — 0.51102)

Rear chain cover

Identification	Part No.	Rotor thickness mm (in)
A	13119AA020	13.026 — 13.039 (0.51295 — 0.51335)
B	13119AA050	13.013 — 13.026 (0.51232 — 0.51284)
C	13119AA060	13.000 — 13.013 (0.51181 — 0.51232)

4. OIL PUMP CASE

Check the worn shaft hole, clogged oil passage, crank and other parts for faults.

Oil Pump Relief Valve

LUBRICATION

5. Oil Pump Relief Valve

A: REMOVAL

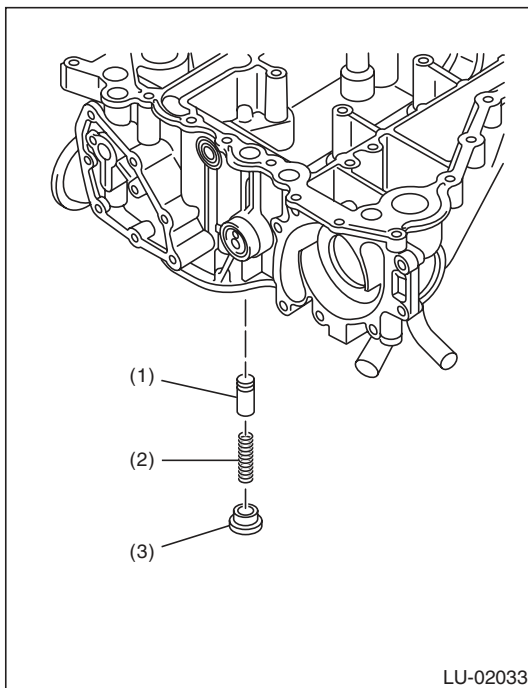
1. REAR CHAIN COVER SIDE

Oil pump relief valve is integrated into oil pump cover as one unit; therefore, refer to "Oil Pump" for removal procedure. <Ref. to LU(H6DO)-9, REMOVAL, Oil Pump.>

2. OIL PAN UPPER SIDE

1) Remove the oil pan. <Ref. to LU(H6DO)-13, REMOVAL, Oil Pan and Strainer.>

2) Remove the plug, relief valve spring and relief valve.



- (1) Relief valve
- (2) Relief valve spring
- (3) Plug

B: INSTALLATION

1. REAR CHAIN COVER SIDE

Oil pump relief valve is integrated into oil pump cover as one unit; therefore, refer to "Oil Pump" for installation procedure. <Ref. to LU(H6DO)-9, INSTALLATION, Oil Pump.>

2. OIL PAN UPPER SIDE

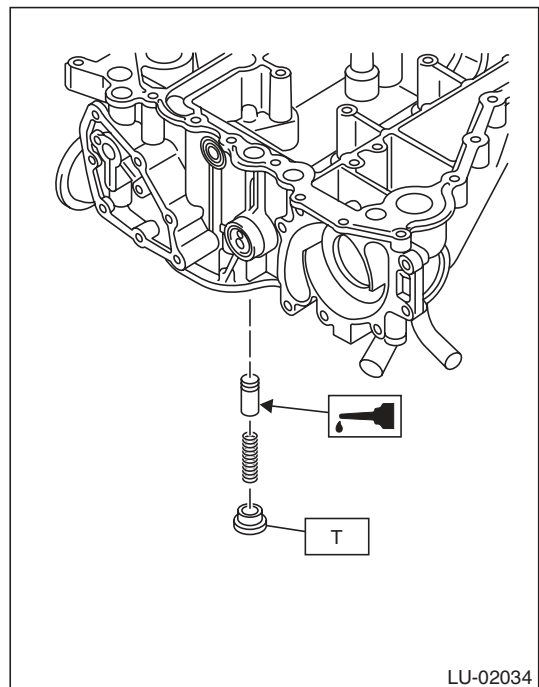
1) Install the relief valve, relief valve spring and plug.

NOTE:

Apply engine oil to the relief valve.

Tightening torque:

T: 44 N·m (4.5 kgf-m, 32.5 ft-lb)



2) Install the oil pan. <Ref. to LU(H6DO)-13, INSTALLATION, Oil Pan and Strainer.>

C: INSPECTION

Check the worn shaft hole of oil pump relief valve case, clogged oil passage, crank and other parts for faults.

6. Oil Pan and Strainer

A: REMOVAL

NOTE:

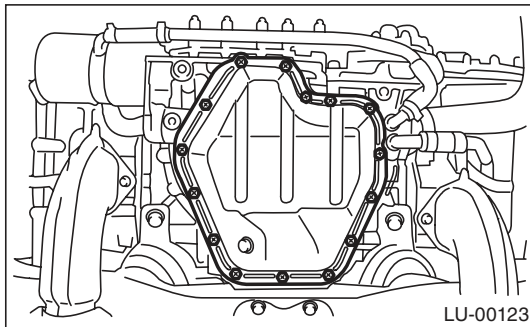
Before removing the oil pan upper, remove the engine from vehicle. <Ref. to ME(H6DO)-34, REMOVAL, Engine Assembly.> <Ref. to ME(H6DO)-64, REMOVAL, Cylinder Block.>

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain the engine oil. <Ref. to LU(H6DO)-8, REPLACEMENT, Engine Oil.>
- 5) Insert an oil pan cutter blade into the gap between oil pan upper and oil pan lower, and remove the oil pan.

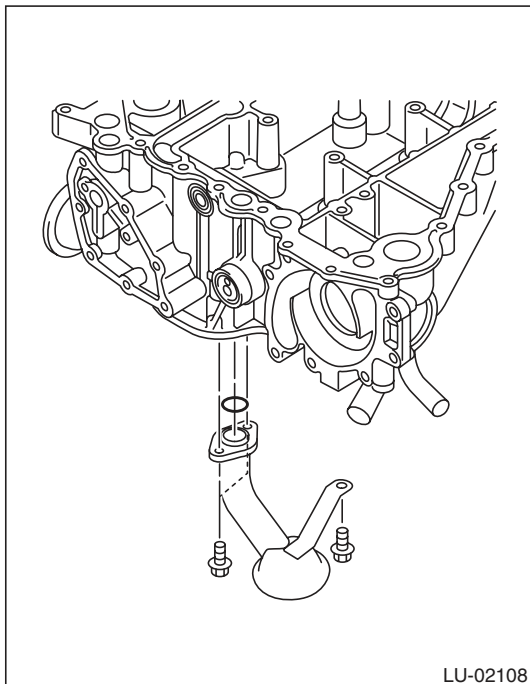
CAUTION:

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

- 6) Remove the oil pan lower.



- 7) Remove the oil strainer.



B: INSTALLATION

NOTE:

Before installing the oil pan, wipe and clean the mating surface of oil pan lower and oil pan upper.

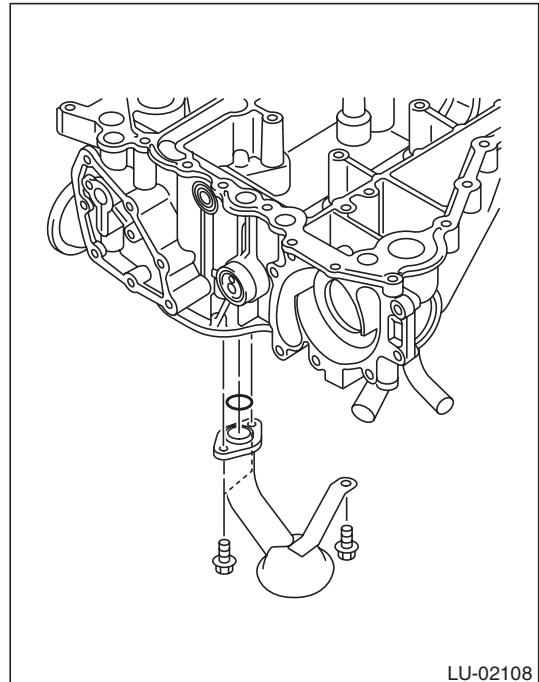
- 1) Install the oil strainer onto oil pan upper.

NOTE:

Use new O-rings.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



- 2) Apply liquid gasket to the mating surfaces of oil pan, and install the oil pan.

NOTE:

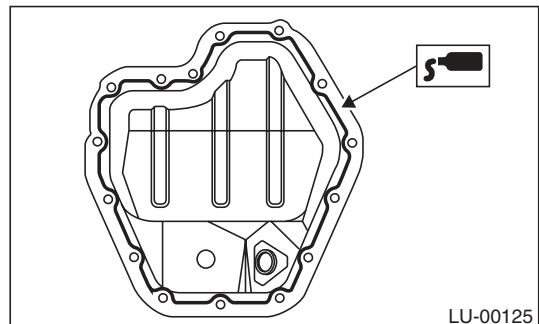
Install within 5 minutes after applying liquid gasket.

Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100) or equivalent

Applying liquid gasket diameter:

5.0±1.0 mm (0.197±0.039 in)



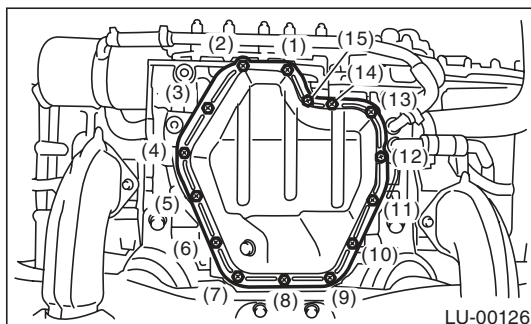
Oil Pan and Strainer

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3) Tighten the oil pan lower installing bolts in the numerical order as shown in the figure.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



4) Install the under cover.

5) Lower the vehicle.

6) Refill the engine oil. <Ref. to LU(H6DO)-8, INSPECTION, Engine Oil.>

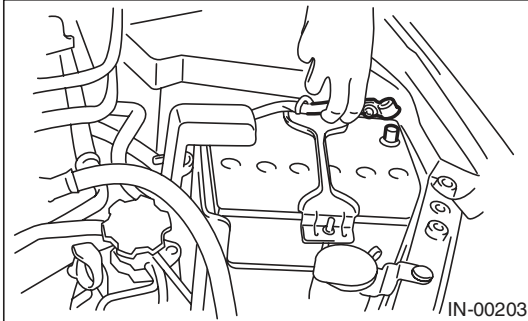
C: INSPECTION

Visually check that the oil pan, oil strainer and oil strainer stay are not damaged.

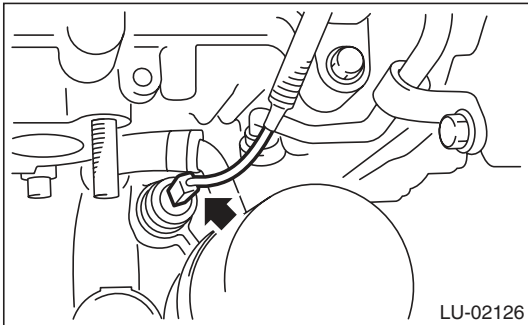
7. Oil Pressure Switch

A: REMOVAL

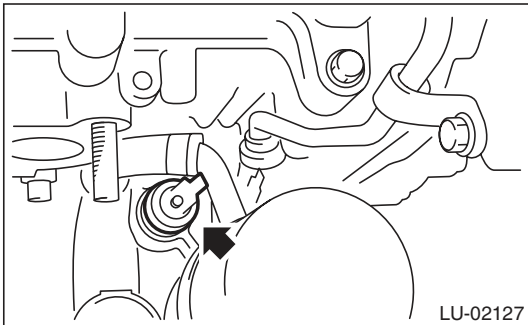
- 1) Set the vehicle on a lift.
- 2) Disconnect the ground cable from the battery.



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



- 6) Remove the oil pressure switch.

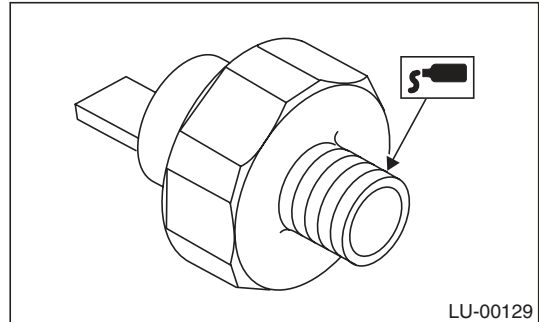


B: INSTALLATION

- 1) Apply liquid gasket to the oil pressure switch threads.

Liquid gasket:

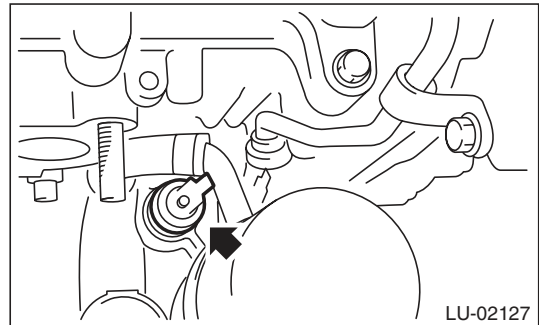
THREE BOND 1324 (Part No. 004403042) or equivalent



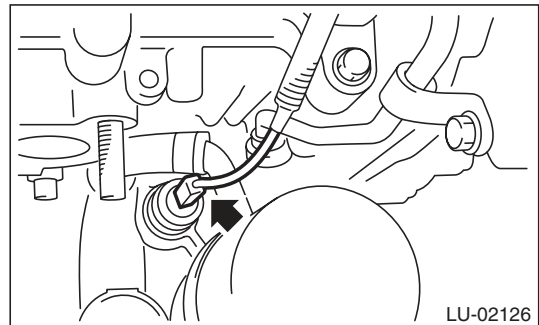
- 2) Install the oil pressure switch.

Tightening torque:

25 N·m (2.5 kgf-m, 18.4 ft-lb)



- 3) Connect the terminal of the oil pressure switch.



- 4) Install the under cover.

C: INSPECTION

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

8. Engine Oil Filter

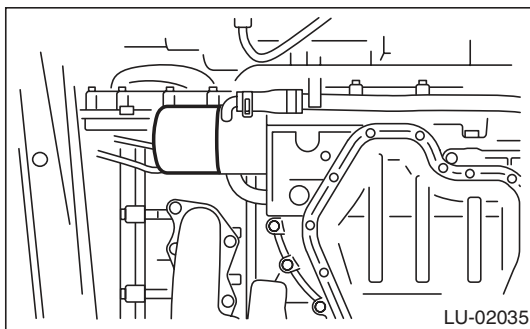
A: REMOVAL

CAUTION:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain the engine oil. <Ref. to LU(H6DO)-8, REPLACEMENT, Engine Oil.>
- 5) Remove the oil filter using ST.

ST 4985447000 OIL FILTER WRENCH



B: INSTALLATION

CAUTION:

Do not tighten excessively, or oil may leak.

- 1) Clean the oil filter installation surface of the oil cooler.
- 2) Obtain a new oil filter and apply a thin coat of engine oil to the seal rubber.
- 3) Install the oil filter turning it by hand, being careful not to damage the seal rubber.
- 4) Tighten more (approx. 3/4 turn) after the seal rubber contacts the oil cooler. When using a torque wrench, tighten to 14 N·m (1.4 kgf-m, 10.3 ft-lb).
- 5) Install the under cover.
- 6) Lower the vehicle.
- 7) Refill the engine oil. <Ref. to LU(H6DO)-8, INSPECTION, Engine Oil.>

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(H6DO)-8, INSPECTION, Engine Oil.>

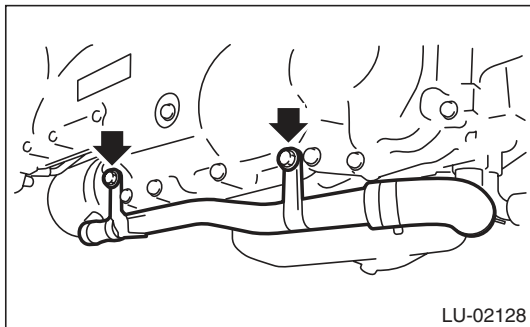
9. Oil Cooler

A: REMOVAL

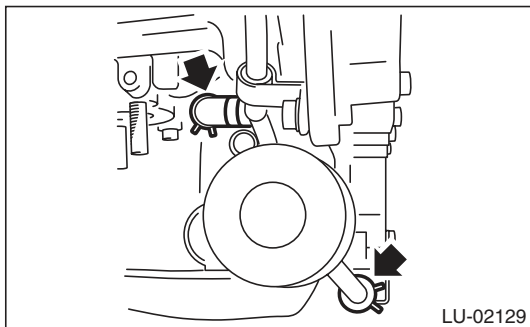
CAUTION:

If the engine oil is spilt over exhaust pipe or the under cover, wipe it off with cloth to avoid emitting smoke or causing a fire.

- 1) Set the vehicle on a lift.
- 2) Lift up the vehicle.
- 3) Remove the under cover.
- 4) Drain engine coolant. <Ref. to CO(H6DO)-10, DRAINING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>
- 5) Drain the engine oil. <Ref. to LU(H6DO)-8, REPLACEMENT, Engine Oil.>
- 6) Remove the bolts which hold the engine oil cooler water pipe to engine.

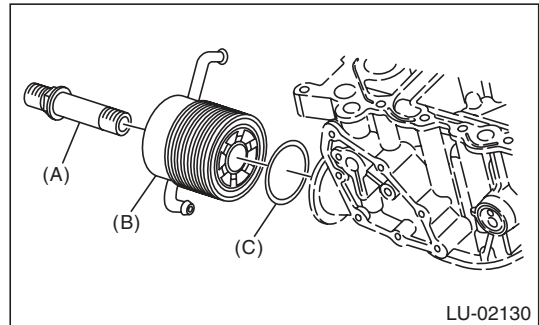


- 7) Disconnect the water hose from oil cooler.



- 8) Remove the oil filter using the ST. <Ref. to LU(H6DO)-16, REMOVAL, Engine Oil Filter.>

- 9) Remove the oil cooler connector and remove the oil cooler.



- (A) Oil cooler connector
- (B) Oil cooler
- (C) Gasket

Oil Cooler

LUBRICATION

B: INSTALLATION

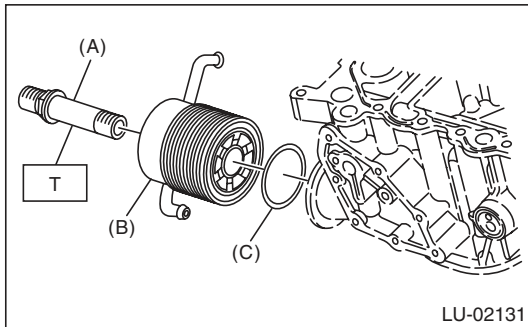
1) Install the oil cooler to oil pan upper with oil cooler connector.

NOTE:

Use a new gasket.

Tightening torque:

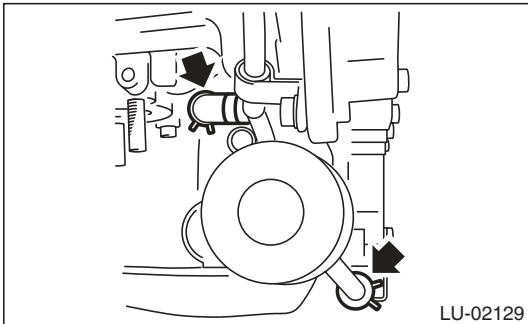
T: 54 N·m (5.5 kgf-m, 39.8 ft-lb)



- (A) Oil cooler connector
- (B) Oil cooler
- (C) Gasket

2) Install the oil filter. <Ref. to LU(H6DO)-16, INSTALLATION, Engine Oil Filter.>

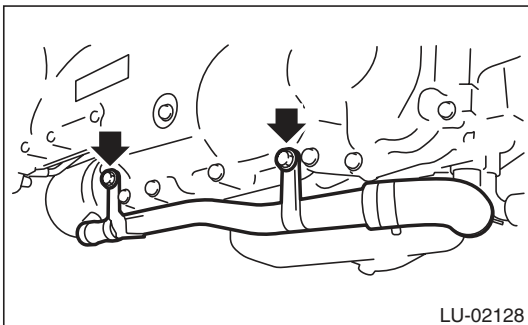
3) Connect the water hose.



4) Install the engine oil cooler water pipe onto engine.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



5) Lower the vehicle.

6) Refill the engine oil. <Ref. to LU(H6DO)-8, REPLACEMENT, Engine Oil.>

7) Fill engine coolant. <Ref. to CO(H6DO)-10, FILLING OF ENGINE COOLANT, REPLACEMENT, Engine Coolant.>

8) Check the engine oil level. <Ref. to LU(H6DO)-8, INSPECTION, Engine Oil.>

C: INSPECTION

1) Check that coolant passages are not clogged using an compressed air.

2) Check that the oil pan upper and O-ring installing surface of oil filter are not damaged.

Engine Lubrication System Trouble in General

LUBRICATION

10.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.

Symptom	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	Clogging of oil filter	Replace.
		Malfunction of oil by-pass valve in oil filter	Clean or replace.
		Malfunction of oil relief valve in 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 (including deterioration)	Replace.
		Broken pipe of oil strainer	Replace.
		Stuck oil pump rotor	Replace.
2. Warning light does not turn on.	1) Malfunction of combination meter		Replace.
	2) Poor contact of switch contact points		Replace.
	3) Disconnection of wiring		Repair.
3. Warning light flickers momentarily.	1) Poor contact of terminals		Repair.
	2) Defective wiring harness		Repair.
	3) Low oil pressure		Check for the same possible causes as listed 1. — 2).

Engine Lubrication System Trouble in General

LUBRICATION
