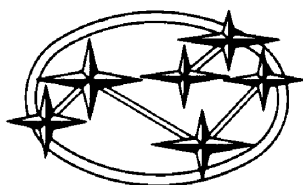


SUBARU

1988



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MECHANISM AND FUNCTION

General

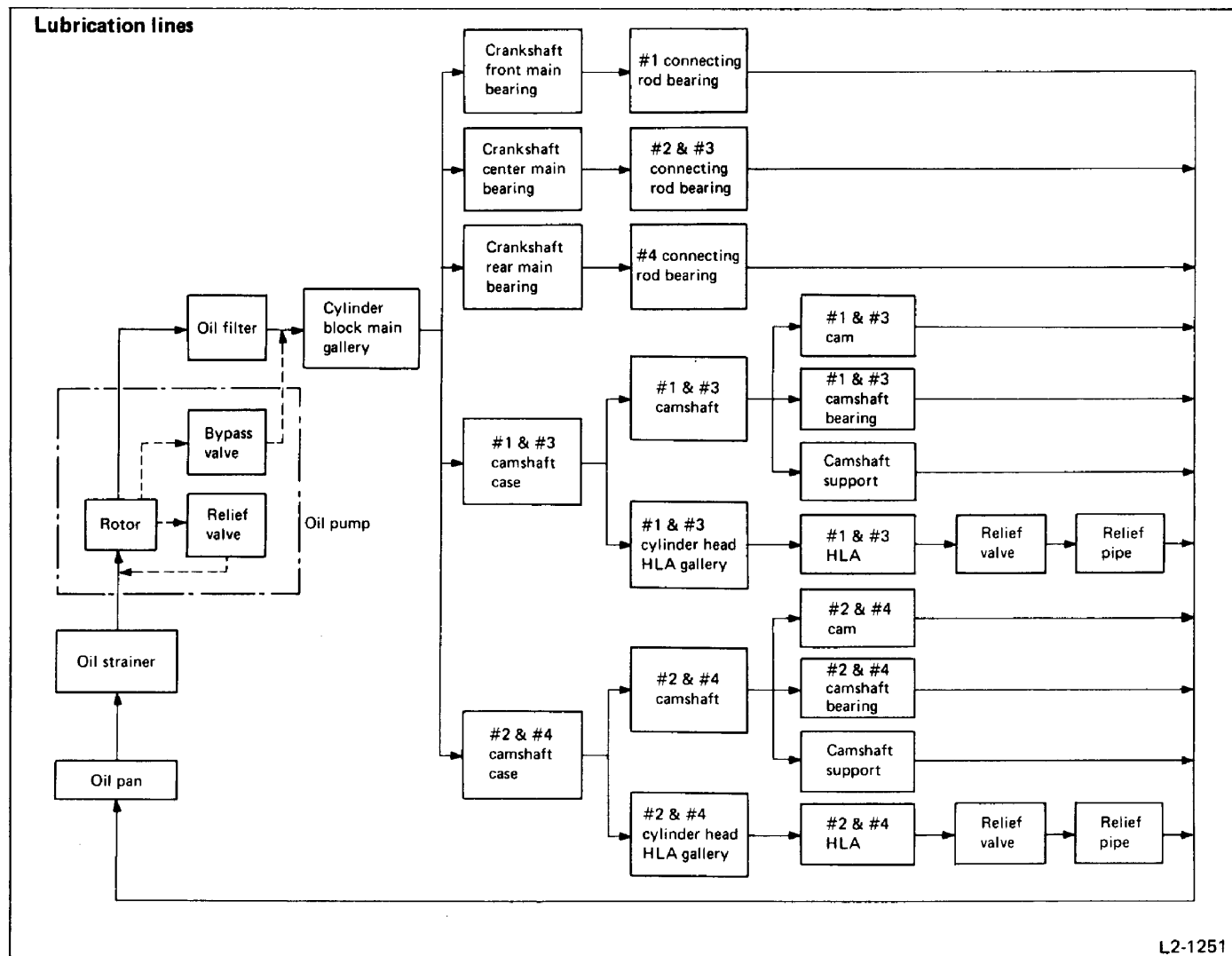
The engine lubrication system is a fully-pressurized full-flow filter type. The lubricating oil is pressurized by a trochoid oil pump with a built-in oil relief valve and oil bypass valve*. This oil pump is driven by the crankshaft at a speed ratio of 1:1 through a timing belt.

If the filtering capacity of the oil filter deteriorates, oil is sent directly to the main gallery through the oil bypass valve. If the oil pressure rises in the oil circuit, excess oil is returned to the oil pump through the oil relief valve.

*: The oil bypass valve is non-disassembling type.

Lubrication Lines

1800 cc Engine



L2-1251

Fig. 1

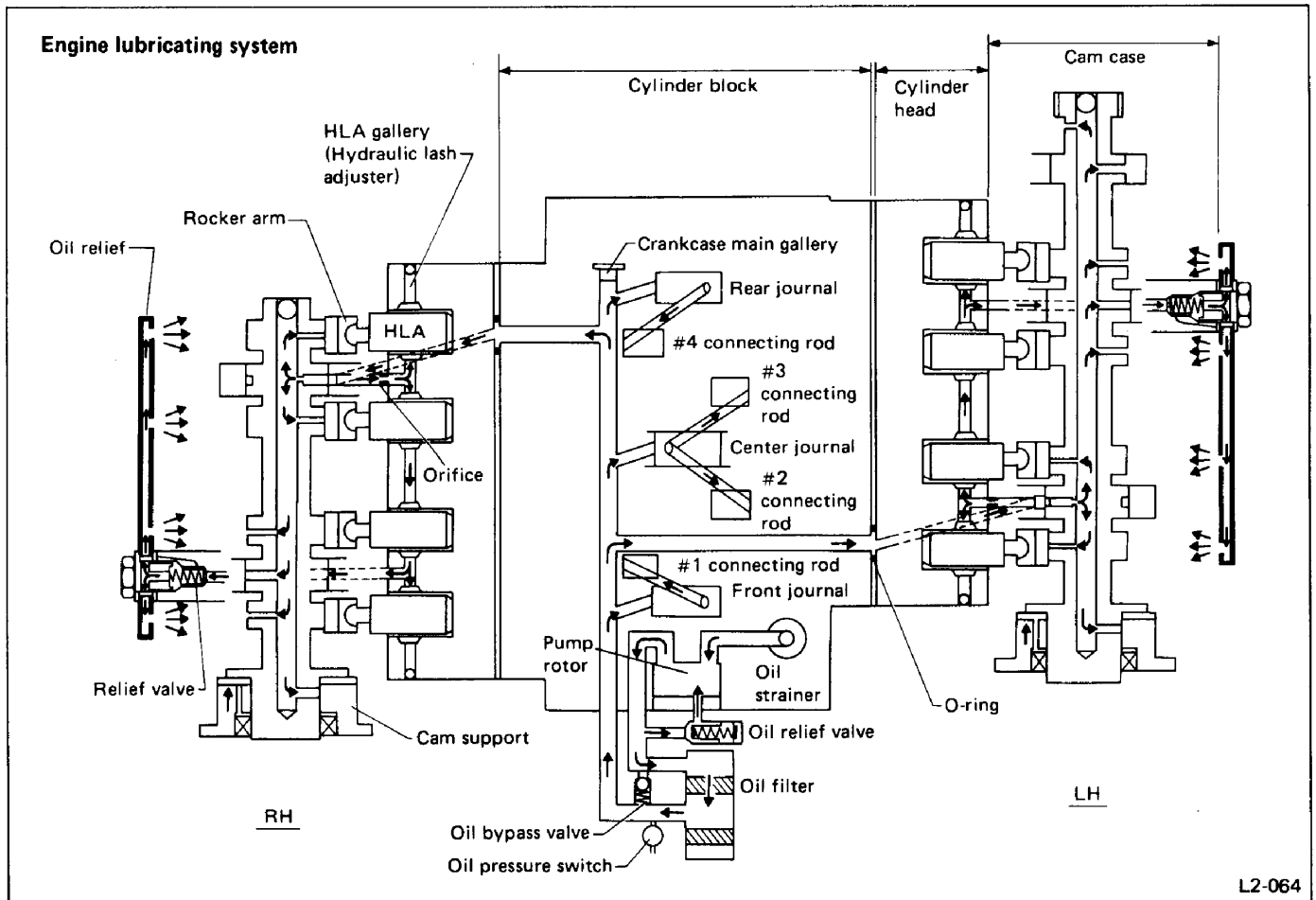
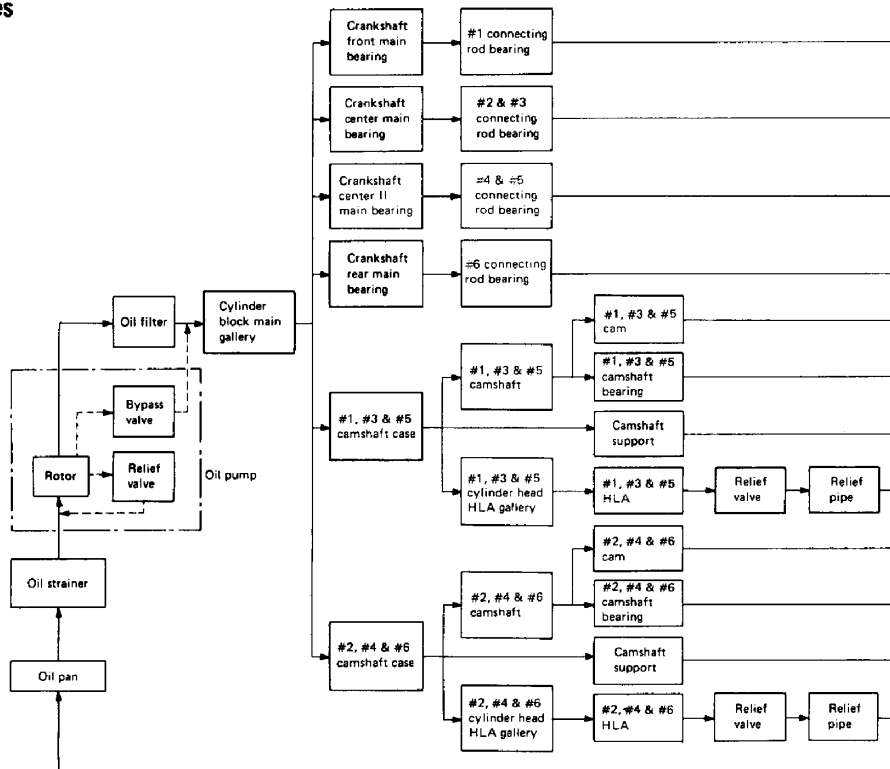


Fig. 2

2700 cc Engine

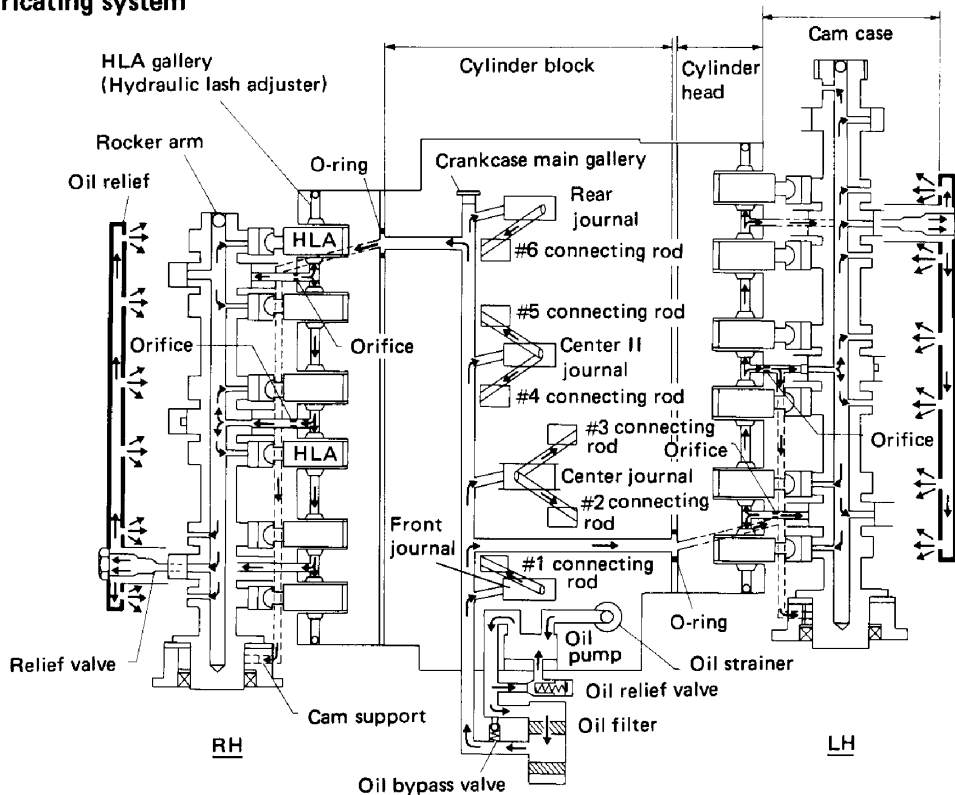
Lubrication lines



L2-1252

Fig. 3

Engine lubricating system



L2-1253

Fig. 4

Oil Pump

The oil pump is a small pump which sucks lubricant from the oil pan, and pressurizes it to send it to each section subjected to friction.

The trochoid pump consists of a pump casing with one lube oil inlet and one outlet, and an inner and outer rotor.

The inner rotor has four projections and the outer rotor has five depressions. As the inner rotor rotates inside the outer rotor, the clearance between the two rotors constantly varies. The oil is pumped in accordance with this clearance change. The trochoid pump is small and features a simple construction which experiences fewer problems.

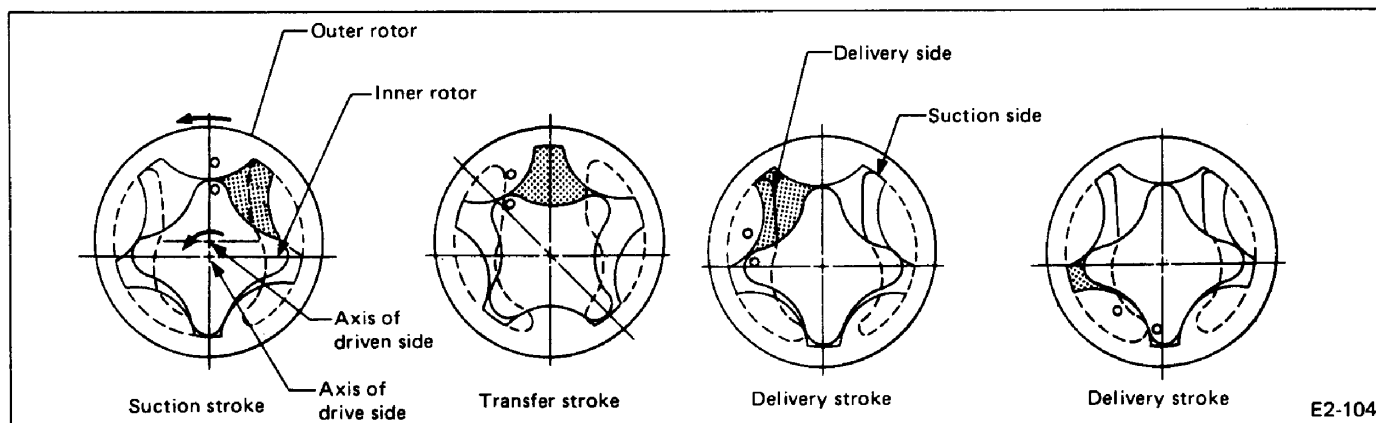


Fig. 5

Oil Pressure Switch

(Oil Pressure Indicator Light Equipped Model Only)

The oil pressure switch is attached to the oil pump case. It monitors the oil pressure and turns on or off the oil pressure indicator light in the combination meter.

The oil pressure switch consists of a diaphragm, which is operated by oil pressure, a set of contacts, which are opened or closed by diaphragm movement, and a spring, which determines when the contacts open depending on the oil pressure. It is enclosed by a housing similar in design to a hexagonal nut molded with phenol resin and a terminal.

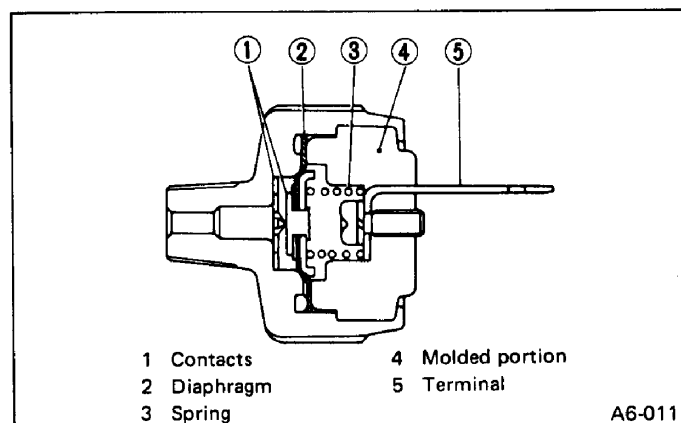


Fig. 6

Oil Pressure Gauge

Construction

GAUGE SECTION

The gauge section consists of a bimetal, pointer and scale plate. The bimetal is wound with heat wire. The pointer moves in response to bending of the bimetal.

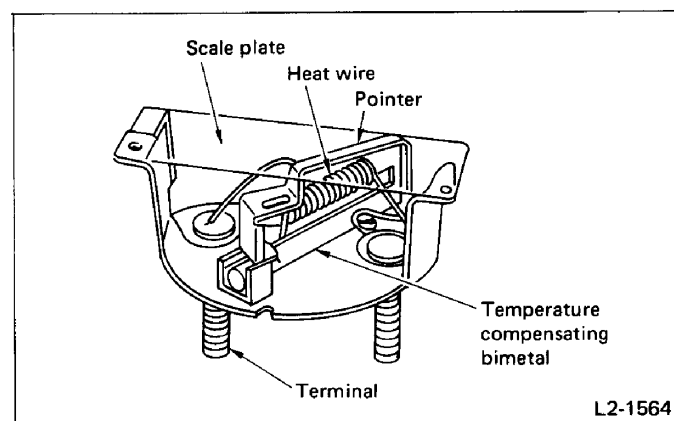


Fig. 7 Construction of the gauge section

SENDER SECTION

This section consists of a diaphragm, point arm, contact points and a heat-wire-wound bimetal. The diaphragm is displaced by oil pressure and the point arm conveys diaphragm displacement to the contacts.

It is completely enclosed by a cover equipped with a positive terminal.

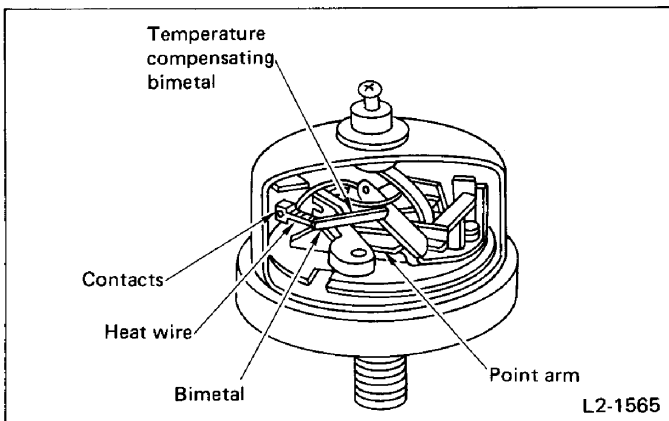


Fig. 8 Construction of the sender section

Operation

- 1) When no oil pressure is applied, contact points open slightly.

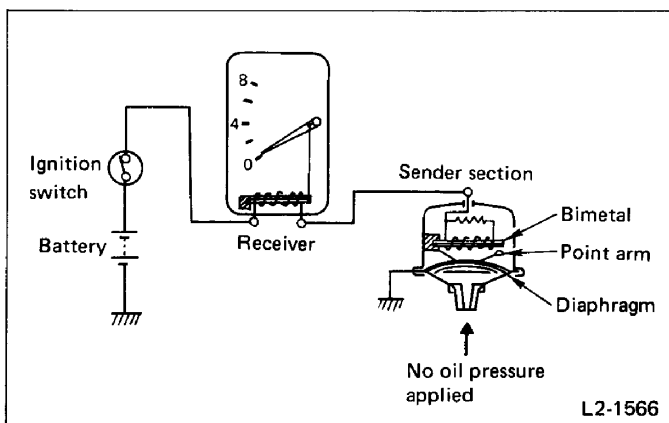


Fig. 9 No oil pressure applied

- 2) When oil pressure is low:

- (1) The point arm is held by the diaphragm and lightly contacts the contact point of the bimetal.
- (2) When the ignition switch is turned ON, current flows through the gauge section and heat wire of the sender section. Because of low point contact pressure, heat generated by low current allows the bimetal to bend so that the contact points open.
- (3) The contact points (on the sender side) open rapidly. Since the temperature of the bimetal (on the gauge side) does not increase, the bimetal hardly bends and the pointer does not move.

- 3) When oil pressure is applied:

- (1) The diaphragm expands in response to oil pressure so that it pushes up the point arm forcefully. The point arm then contacts the contact point (on the bimetal side).
- (2) At this point, when the ignition switch is turned ON to open the contact point, the bimetal bends considerably. In other words, current flows for a long period of time.
- (3) However, after current flows through the heat wire for a certain period of time (until the bimetal reaches a certain temperature), the point will open to interrupt the current flow. As the bimetal cools, the contact point closes again.
- (4) Thus, the contact point closes and opens in response to the temperature of the bimetal. That is, the temperature in relation to oil pressure. In other words, the bimetal maintains a certain temperature in response to oil pressure.
- (5) Similar to the bimetal of the sender section, the bimetal of the gauge section bends as its temperature increases. This causes the gauge pointer to deflect.

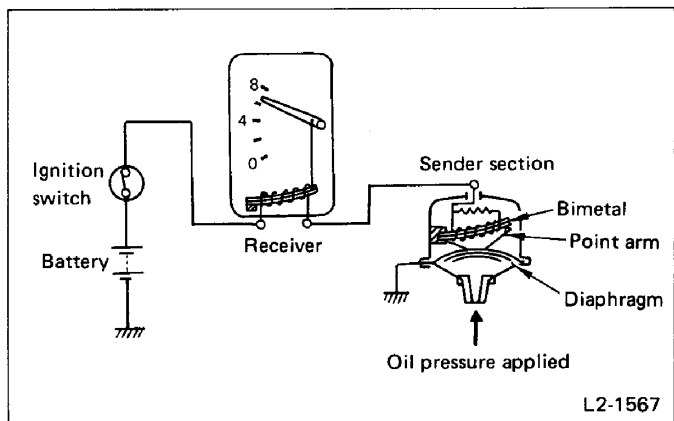


Fig. 10 Oil pressure applied

Operating precautions

- 1) Do not apply battery voltage directly to the gauge or sender section. Otherwise, the heat wire may burn or the bimetal twist.
- 2) Connect the terminals firmly.
If an erroneous indication is noted, check wiring for grounding, the terminal for looseness, and the gauge for operation.
- 3) Do not ground or short the midpoint of the wiring. Otherwise, problems similar to those indicated in 1) above may occur.
- 4) Do not drop the gauge/sender section and do not allow it to strike adjacent parts.

SPECIFICATIONS AND SERVICE DATA

SPECIFICATIONS

			1800 cc model	2700 cc model
Lubrication method			Forced feed, full flow filtration, splash type	
Oil pump	Pump type		Trochoid type	
	Discharge performance I	Discharge - Pressure	2.0 l/min (2.1 US qt/min, 1.8 Imp qt/min) - 98 kPa (1.0 kg/cm ² , 14 psi)	5.0 l/min (5.3 US qt/min, 4.4 Imp qt/min) - 98 kPa (1.0 kg/cm ² , 14 psi)
		Speed	550 rpm	
		Oil temperature	75 – 85°C (167 – 185°F)	
	Discharge performance II	Discharge - Pressure	31.2 l/min (8.24 US gal/min, 6.86 Imp gal/min) - 294 kPa (3.0 kg/cm ² , 43 psi)	40 l/min (10.6 US gal/min, 8.8 Imp gal/min) - 392 kPa (4.0 kg/cm ² , 57 psi)
		Speed	5,000 rpm	
		Oil temperature	75 – 85°C (167 – 185°F)	
	Oil relief valve	Pressure at which valve starts to open	392 – 441 kPa (4.0 – 4.5 kg/cm ² , 57 – 64 psi)	441 – 490 kPa (4.5 – 5.0 kg/cm ² , 64 – 71 psi)
	Oil bypass valve	Pressure at which valve starts to open	147 kPa (1.5 kg/cm ² , 21 psi)	
Oil filter		Type	Paper, cartridge type	
		Filtration area	0.137 m ² (1.47 sq ft)	
Engine oil capacity		Upper level	4.0 l (4.2 US qt, 3.5 Imp qt)	5.0 l (5.3 US qt, 4.4 Imp qt)
		Lower level	3.0 l (3.2 US qt, 2.6 Imp qt)	4.0 l (4.2 US qt, 3.5 Imp qt)
Oil pressure switch*		Type	Immersed contact point type	—
		Voltage	12V	—
		Warning light	12V - 3.4 W or less	—
		Pressure at which switch closes	14.7 – 24.5 kPa (0.15 – 0.25 kg/cm ² , 2.1 – 3.6 psi)	—
		Pressure at which switch opens	14.7 – 24.5 kPa (0.15 – 0.25 kg/cm ² , 2.1 – 3.6 psi)	—
		Proof pressure	981 kPa (10 kg/cm ² , 142 psi) or more	—
Oil pressure gauge		Type	Bimetal type	
		Voltage	12V	
		Pressure range	0 – 785 kPa (0 – 8 kg/cm ² , 0 – 114 psi)	

*Oil pressure indicator light equipped model only

SERVICE DATA

			1800 cc model	2700 cc model
Oil pump	Inner rotor outer diameter		35.65 – 35.70 mm (1.4035 – 1.4055 in)	
	Outer rotor outer diameter		49.95 – 50.00 mm (1.9665 – 1.9685 in)	
	Inner and outer rotor height	A	13.89 – 13.91 mm (0.5468 – 0.5476 in)	18.89 – 18.91 mm (0.7437 – 0.7445 in)
		B	13.90 – 13.92 mm (0.5472 – 0.5480 in)	18.90 – 18.92 mm (0.7441 – 0.7449 in)
		C	13.91 – 13.93 mm (0.5476 – 0.5484 in)	18.91 – 18.93 mm (0.7445 – 0.7453 in)
	Oil pump case projection height		7.97 – 8.00 mm (0.3138 – 0.3150 in)	2.97 – 3.00 mm (0.1169 – 0.1181 in)
	Rotor housing depth		21.96 – 22.04 mm (0.8646 – 0.8677 in)	
	Side clearance between inner or outer rotor and crankcase	STD	0.05 – 0.16 mm (0.0020 – 0.0063 in)	
		Limit	0.18 mm (0.0071 in)	
	Case clearance between outer rotor and crankcase	STD	0.10 – 0.18 mm (0.0039 – 0.0071 in)	
		Limit	0.22 mm (0.0087 in)	
	Relief valve spring	Free length	47.1 mm (1.854 in)	52.2 mm (2.055 in)
		Installed length	33.5 mm (1.319 in)	38.9 mm (1.531 in)
		Load when installed	3.88 – 4.28 kg (8.56 – 9.44 lb)	6.15 – 6.75 kg (13.56 – 14.88 lb)

Reference pressure with oil pump equipped on the engine is as follows:

Condition		1800 cc model	2700 cc model
Oil temperature		100°C (212°F)	
Cooling fan		OFF	
Engine oil		10W-30 (SAE)	
Engine speed	2,000 rpm	206 - 304 kPa (2.1 - 3.1 kg/cm ² , 30 - 44 psi)	382 – 490 kPa (3.9 – 5.0 kg/cm ² , 55.– 71 psi)
	4,000 rpm	353 - 441 kPa (3.6 - 4.5 kg/cm ² , 51 - 64 psi)	481 – 569 kPa (4.9 – 5.8 kg/cm ² , 70 – 82 psi)

COMPONENT PARTS

Oil Pump

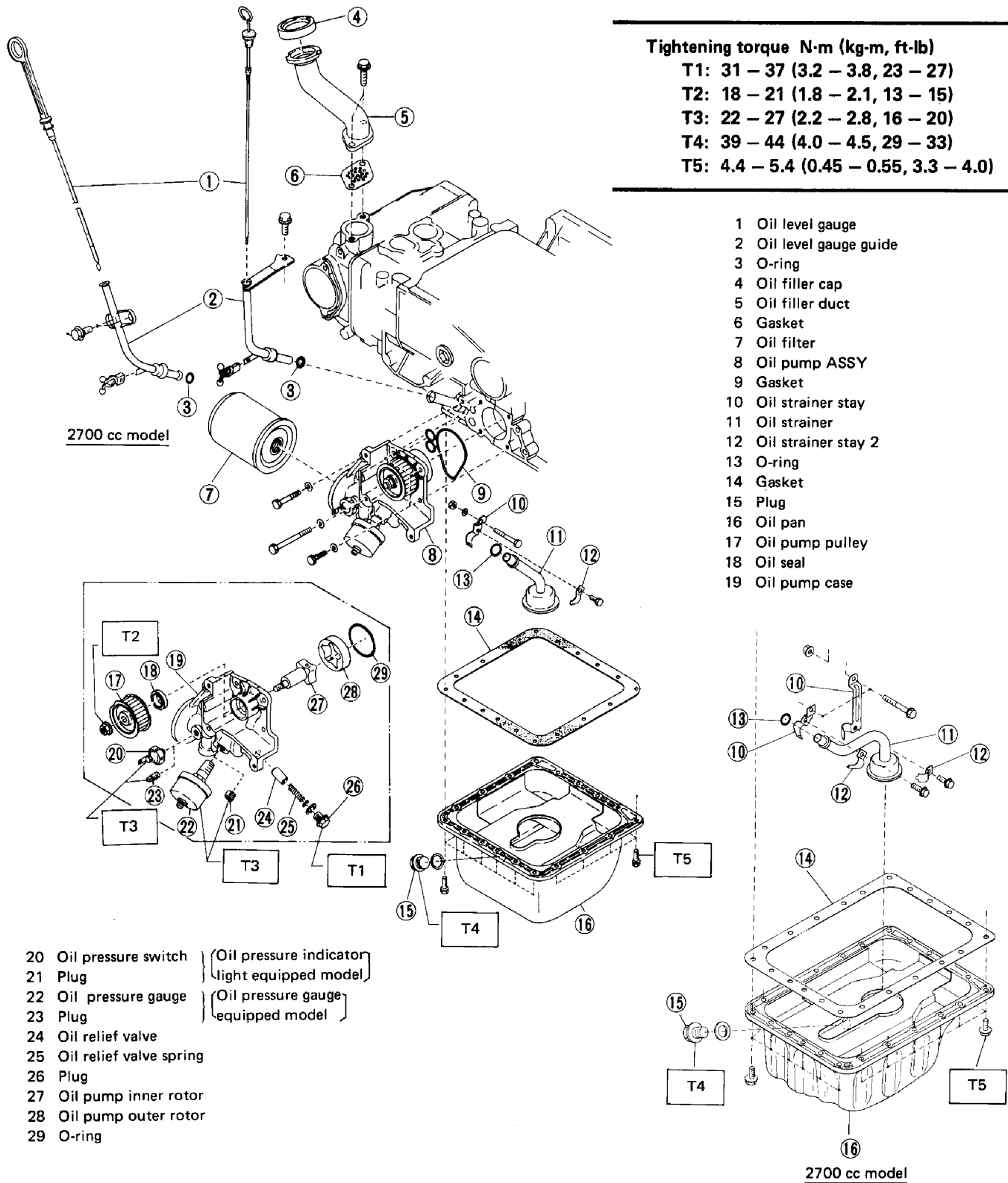


Fig. 11

L2-1254

SERVICE PROCEDURE

Oil Pump

REMOVAL

- 1) Drain engine oil.
- 2) Remove belt covers and camshaft drive belts. (See Section 2-3 "Engine".)

Before removing camshaft drive belts, be sure to loosen oil pump pulley mounting nut.

- 3) Remove oil pump mounting bolts, and detach oil pump together with oil filter from cylinder block.

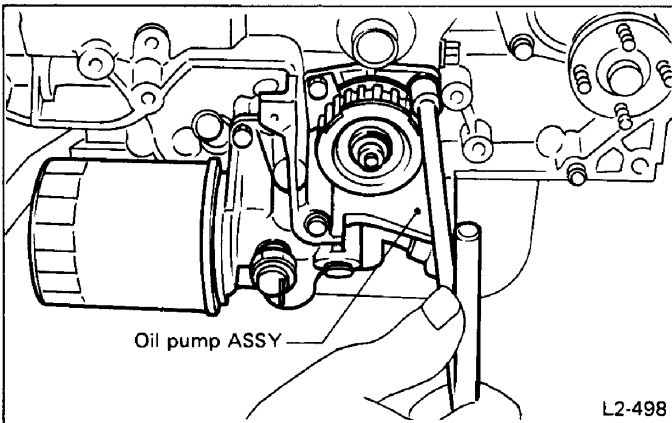


Fig. 12

- 4) Remove oil pump outer rotor from cylinder block.

DISASSEMBLY

- 1) Remove oil filter from oil pump.
- 2) Remove O-ring.
- 3) Remove oil pressure gauge or oil pressure switch.
- 4) Remove oil pump pulley, and draw out oil pump inner rotor.
- 5) Remove oil relief valve plug, and take out spring and ball.

INSPECTION

Wash the disassembled parts, check them for the following items, and repair or replace if defective.

INNER ROTOR

Check the outside diameter of the inner rotor shaft portion, and replace it if worn or damaged.

Outside diameter of inner rotor shaft portion:
35.65 – 35.70 mm (1.4035 – 1.4055 in)

OUTER ROTOR

Check the outer rotor, and replace if worn or damaged.

Outside diameter of outer rotor:
49.95 – 50.00 mm (1.9665 – 1.9685 in)

OIL PUMP CASE CLEARANCE

Measure the clearance between the outer rotor and the cylinder block rotor housing.

If the clearance exceeds the limit, replace the rotor.

Case clearance:
Standard
0.10 – 0.18 mm (0.0039 – 0.0071 in)
Limit
0.22 mm (0.0087 in)

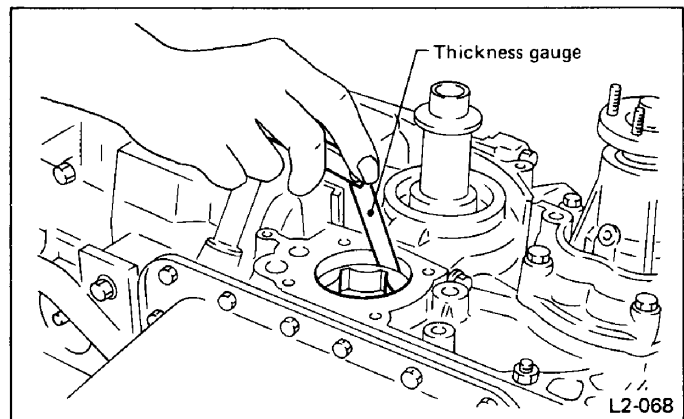


Fig. 13

OIL PUMP SIDE CLEARANCE

- 1) Measure total height of case projection (H1) plus oil pump inner and outer rotors (H2).

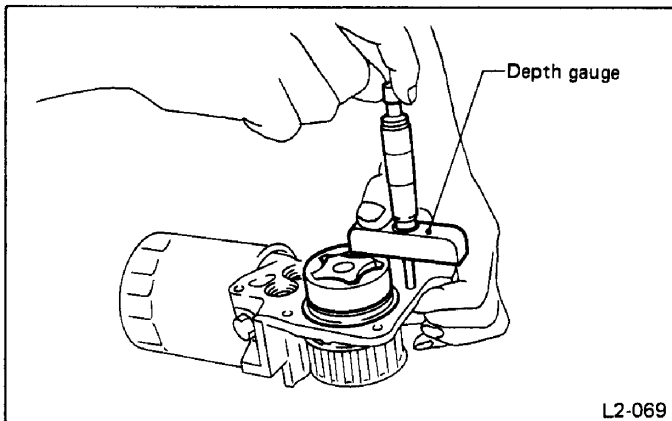


Fig. 14

2) Measure depth (L) of rotor housing bore in cylinder block.

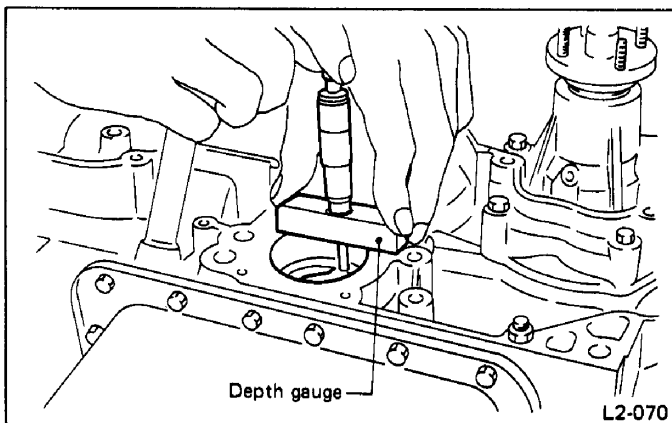


Fig. 15

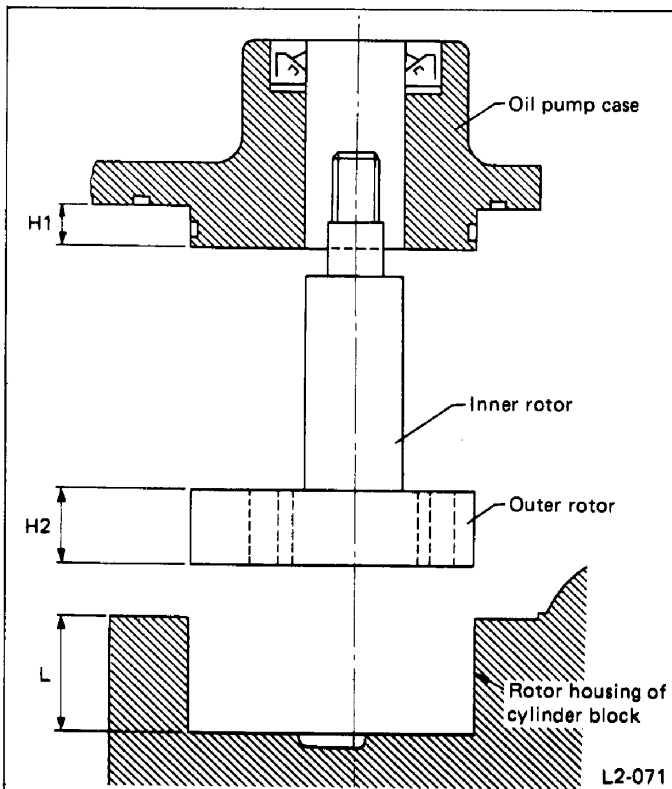


Fig. 16

- 3) Calculate side clearance (C) using the following equation:

$$C = L - (H1 + H2)$$

Side clearance: C

Standard

0.05 – 0.16 mm (0.0020 – 0.0063 in)

Limit

0.18 mm (0.0071 in)

- 4) If side clearance value (C) is larger than "Limit" shown below, replace pump inner and outer rotors with the suitable ones selected from following table.

Inner and Outer Rotor Height (H2)		
Marking	1800 cc	2700 cc
A	13.89 – 13.91 mm (0.5468 – 0.5476 in)	18.89 – 18.91 mm (0.7437 – 0.7445 in)
B	13.90 – 13.92 mm (0.5472 – 0.5480 in)	18.90 – 18.92 mm (0.7441 – 0.7449 in)
C	13.91 – 13.93 mm (0.5476 – 0.5484 in)	18.91 – 18.93 mm (0.7445 – 0.7453 in)

Height of case projection: H1

1800 cc model

7.97 – 8.00 mm (0.3138 – 0.3150 in)

2700 cc model

2.97 – 3.00 mm (0.1169 – 0.1181 in)

Depth of rotor housing: L

21.96 – 22.04 mm (0.8646 – 0.8677 in)

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

Free length

1800 cc model: 47.1 mm (1.854 in)

2700 cc model: 52.2 mm (2.055 in)

Installed length

1800 cc model: 33.5 mm (1.319 in)

2700 cc model: 38.9 mm (1.531 in)

Load when installed

1800 cc model:

3.88 – 4.28 kg (8.56 – 9.44 lb)

2700 cc model:

6.15 – 6.75 kg (13.56 – 14.88 lb)

OIL PUMP CASE

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

OIL SEAL

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

ASSEMBLY AND INSTALLATION

Assembly and installation is in the reverse order of removal procedure.

Observe the following:

- 1) Replace the O-ring and gaskets with a new one.
- 2) Coat rubber seal of oil filter with engine oil before installing the oil filter.
- 3) Tighten oil filter an extra 2/3 turn after rubber seal contacts pump case. Do not tighten excessively.

TROUBLESHOOTING

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

	Trouble	Possible cause		Corrective action
Oil pressure indicator light equipped model	1. Warning light remains on.	1) Oil pressure switch failure	Cracked diaphragm	Replace.
			Oil leakage within switch	Replace.
		2) Low oil pressure	Clogged oil filter	Replace.
			Malfunction of oil bypass valve	Clean or replace.
			Malfunction of oil relief valve	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 drive gear and rotor	Replace.
	2. Warning light does not go on.	1) Burnt-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)
Oil pressure gauge equipped model	4. Oil pressure gauge indication is erroneous.	1) Poor contact at terminals		Repair.
		2) Deformed bimetal		Replace.
		3) Binding of needle pointer		Repair.
		4) Contaminated points		Replace.
		5) Low oil pressure		Check for the same possible causes as listed in 1.—2)
	5. Oil pressure gauge does not deflect.	1) Needle pointer out of place		Repair.
		2) Heat wire disconnection		Replace.
		3) Disconnection of wiring		Repair.
		4) Cracked sensor diaphragm		Replace.
		5) Low oil pressure		Check for the same possible causes as listed in 1.—2)