

SUBARU

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1992

	Page
M MECHANISM AND FUNCTION	2
1. General	2
2. Lubrication Lines	3
3. Oil Pump	4
4. Oil Filter	5
5. Oil Pan & Oil Strainer	5
6. Oil Pressure Switch	5
S SPECIFICATIONS AND SERVICE DATA	6
C COMPONENT PARTS	7
1. Oil Pump	7
2. Oil Pan	8
W SERVICE PROCEDURE	9
1. Oil Pump	9
2. Oil Pan	12
T TROUBLESHOOTING	14



M MECHANISM AND FUNCTION

1. General

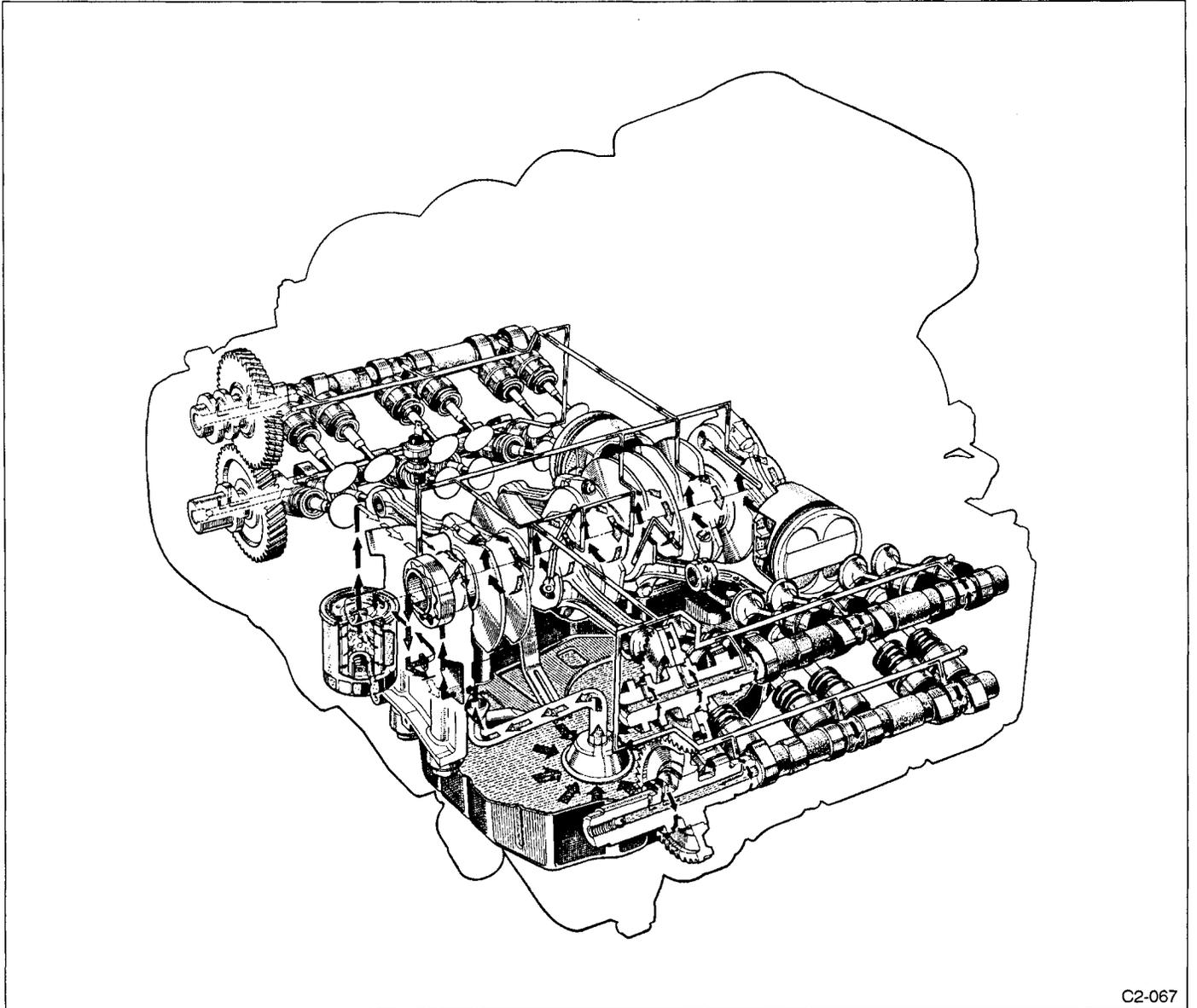
The lubrication system is a full-flow, filtering type. The oil pump utilizes a thin, large-diameter trochoid design to accommodate the high engine output. It is directly driven by the crankshaft.

Engine oil flow is regulated by the relief valve built into the oil pump. Then oil flows to the oil filter via the oil passage on the lower right side of cylinder block. After filtered the oil filter, engine oil delivered to the crank

journal bearings via the oil gallery on the cylinder block and then delivered to the connecting rod bearing via the crank journal.

Engine oil is also fed under pressure to the cylinder head valve mechanism after the flow is regulated by the orifice provided in the oil gallery.

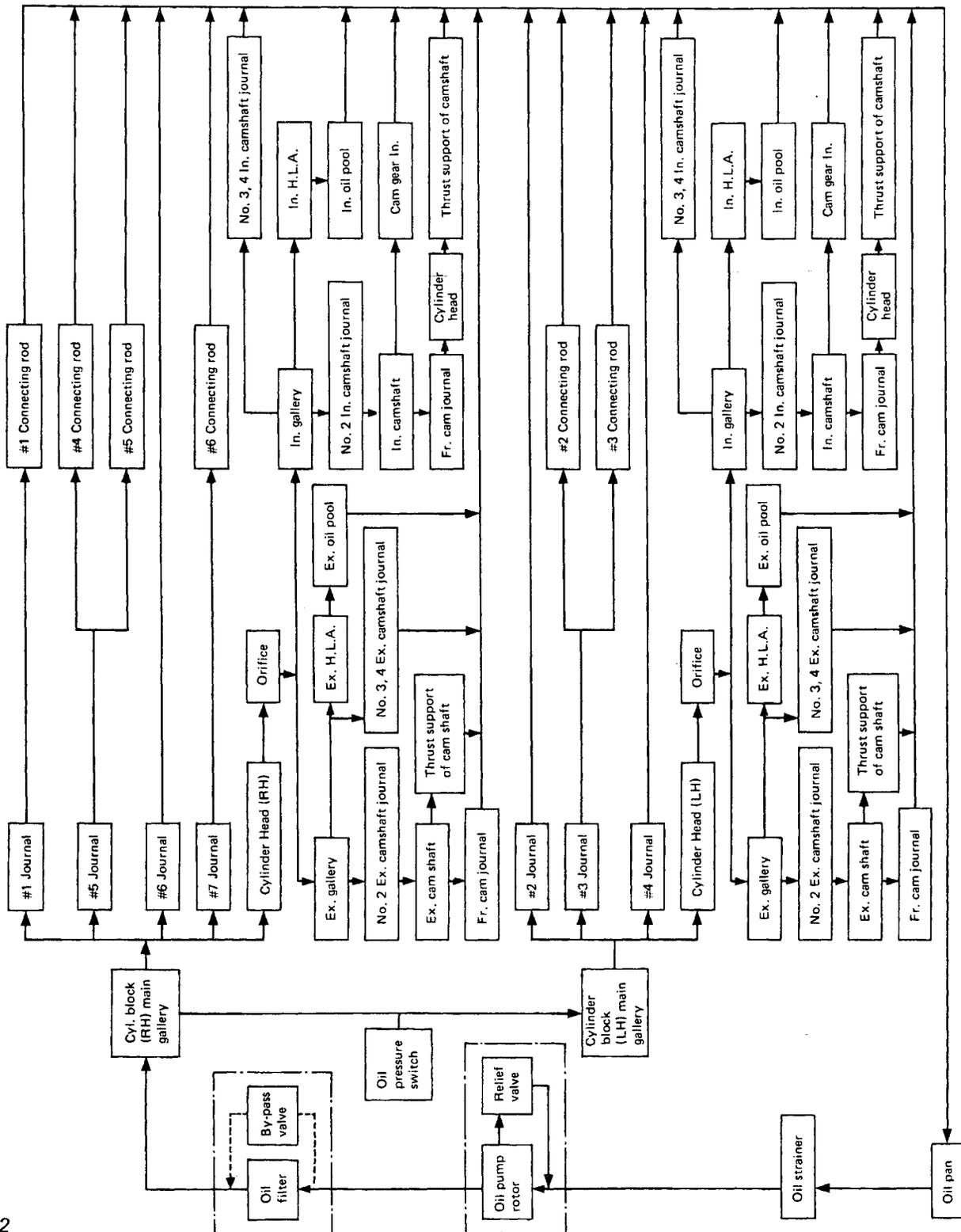
The oil pan is provided with baffle plates to eliminate the effect of oil suction caused by oil level variations during operation.



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Fig. 1

2. Lubrication Lines



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Fig. 2

3. Oil Pump

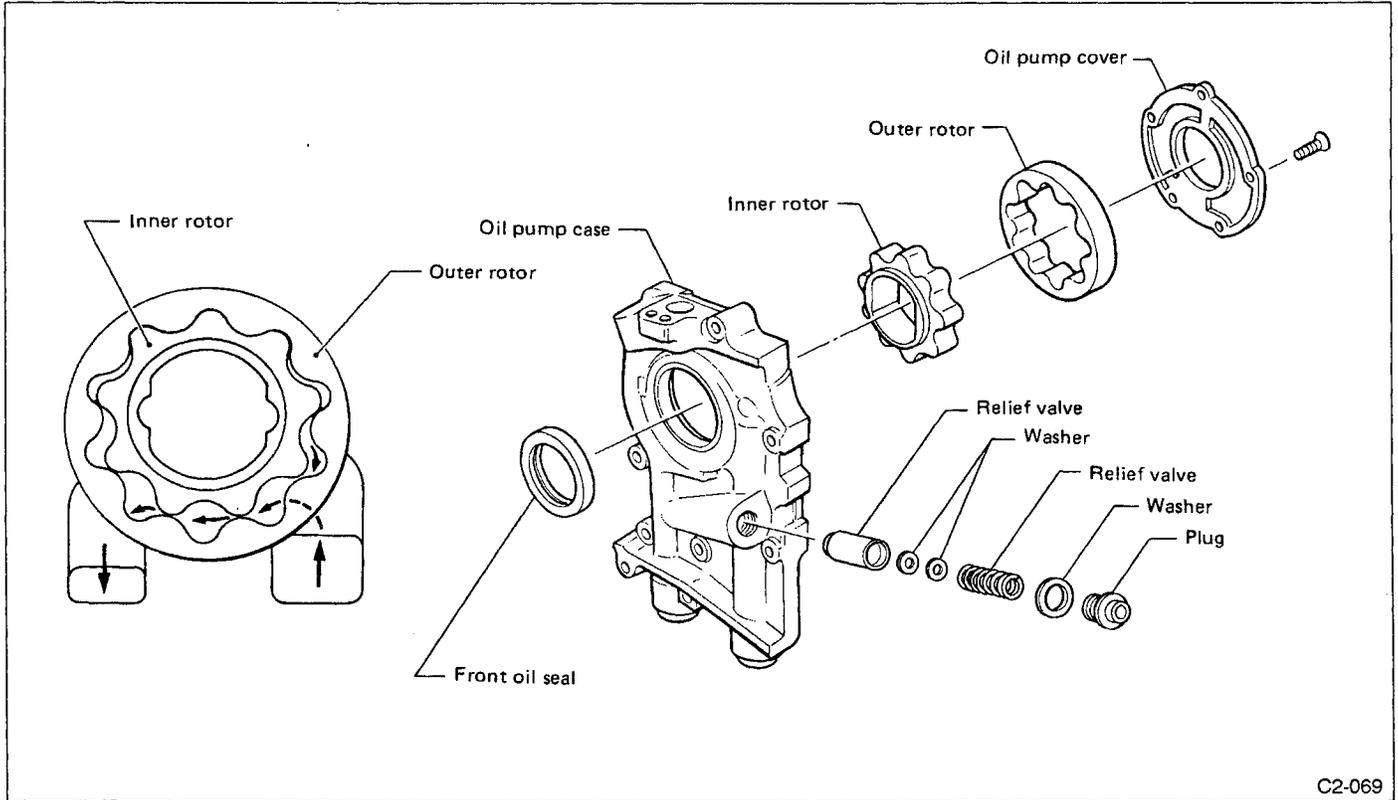
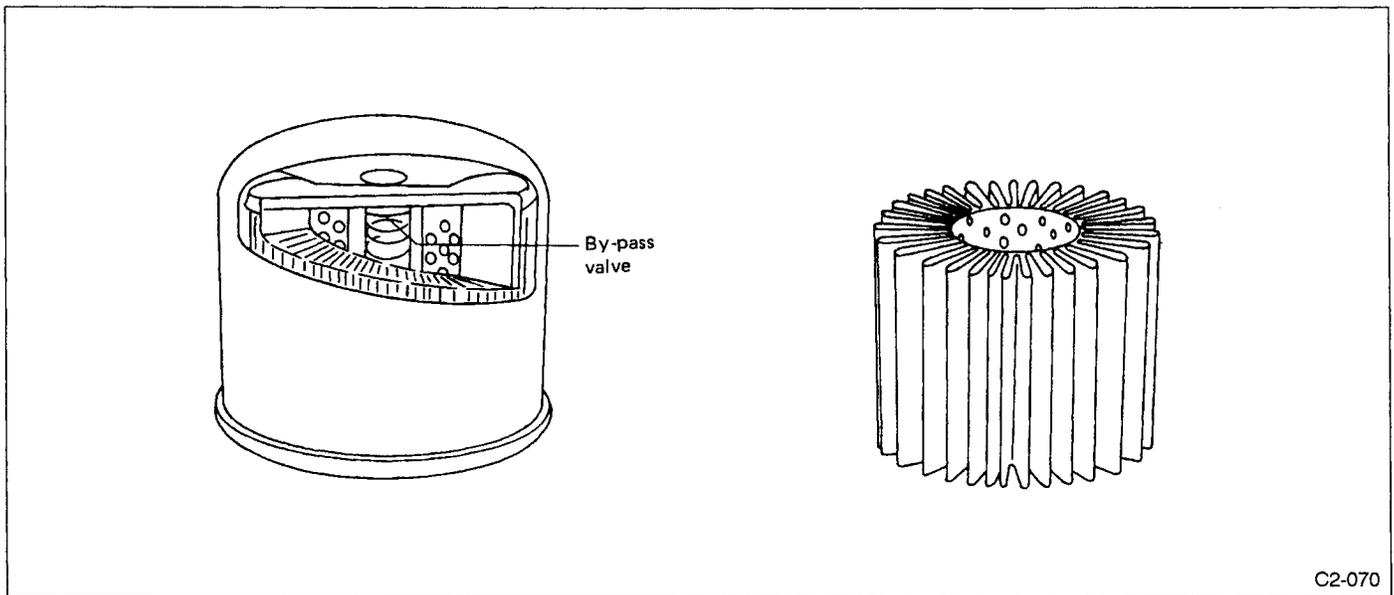


Fig. 3

The trochoid oil pump utilizes an internal oil circulation design which is accomplished by an inner rotor and outer rotor built into the pump body. When the inner rotor is driven by the crankshaft, the outer rotor is rotated, changing the size of the space between the two rotors (because of the different number of teeth used on the rotors).

Engine oil is sucked into the large space created near the inlet side. It is then carried over to the discharge port and discharged due to it being gradually pressurized as the space carrying it becomes smaller. Oil pressure is regulated by the relief valve located on the discharge side. Excess oil is directly returned to the suction port.

4. Oil Filter



C2-070

Fig. 4

The oil filter is a full-flow cartridge type that utilizes a paper element. It also has a built-in bypass valve. The filter element has a effective filtering area.

5. Oil Pan & Oil Strainer

The oil pan is joined to the cylinder block via liquid gasket. The oil strainer is a metal net type and removes large foreign particles from the engine oil. It is located in the middle of the oil pan. The pipe from the strainer is connected to the suction port on the left side of the cylinder block.

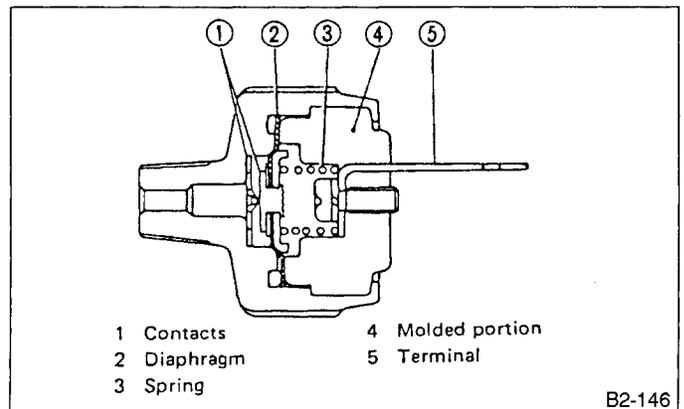
Baffle plates are placed in the oil pan and the lower side of the cylinder block to stabilize the oil level and strengthen the oil pan.

6. Oil Pressure Switch

A: CONSTRUCTION

The oil pressure switch is located on the front right upper portion of the cylinder block. The purpose of this switch is to monitor the operation of the oil pump as well as the lubricating oil pressure when the engine is running.

B: FUNCTION



B2-146

Fig. 5

1) When oil pressure does not build up (with ignition switch "ON"):

The diaphragm is pushed toward the cylinder block by spring force (equivalent to the specified oil pressure). This closes the contact point to illuminate the oil pilot lamp on the instrument panel.

2) When oil pressure reaches the specified value (after engine starts):

After oil pressure reaches the specified value of [14.7 kPa (0.15 kg/cm², 2.1 psi)], the diaphragm, pushed by oil pressure, overcomes the spring force. This opens the contact point to turn the oil pilot lamp off.

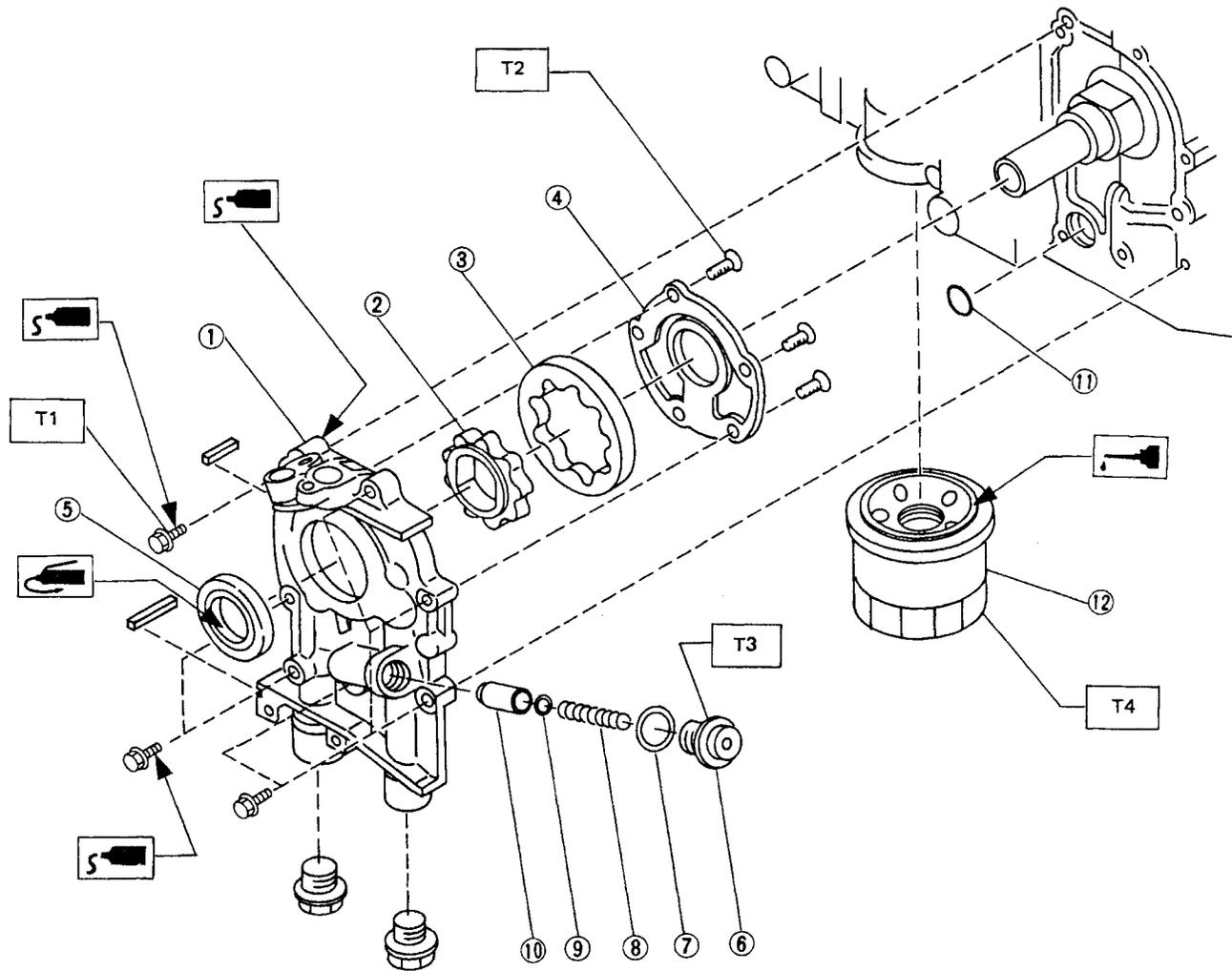
S SPECIFICATIONS AND SERVICE DATA

A: SPECIFICATIONS

Lubrication method				Forced lubrication	
Oil pump	Pump type			Trochoid type	
	Number of teeth	Inner rotor		9	
		Outer rotor		10	
	Outer rotor diameter x thickness			mm (in)	
				78 x 12 (3.07 x 0.47)	
	Tip clearance between inner and outer rotor			mm (in)	
				STD	
				0.04 — 0.14 (0.0016 — 0.0055)	
				LIM	
				0.18 (0.0071)	
	Side clearance between inner rotor and pump case			mm (in)	
STD					
			0.02 — 0.07 (0.0008 — 0.0028)		
			LIM		
			0.12 (0.0047)		
Case clearance between outer rotor and pump case			mm (in)		
			STD		
			0.10 — 0.175 (0.0039 — 0.0069)		
			LIM		
			0.20 (0.0079)		
Capacity 80°C (176°F)	600 rpm	Discharge	- pressure		
			98 kPa (1.0 kg/cm ² , 14 psi)		
			- quantity		
			5.5 ℓ (5.8 US qt, 4.8 Imp qt)/min.		
5,000 rpm	Discharge	- pressure			
		294 kPa (3.0 kg/cm ² , 43 psi)			
		- quantity			
		56 ℓ (14.8 US gal, 12.3 Imp gal)/min.			
Relief valve operation pressure				588 kPa (6 kg/cm ² , 85 psi)	
Oil filter	Type			Full-flow filter type	
	Filtration area			1,300 cm ² (202 sq in)	
	By-pass valve opening pressure			157 kPa (1.6 kg/cm ² , 23 psi)	
	Outer diameter x width			mm (in)	
				80 x 75 (3.15 x 2.95)	
Oil filter to engine thread size				M 20 x 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)				6.5 ℓ (6.9 US qt, 5.7 Imp qt)	

C COMPONENT PARTS

1. Oil Pump



- 1 Oil pump case
- 2 Inner rotor
- 3 Outer rotor
- 4 Oil pump cover
- 5 Front oil seal
- 6 Plug
- 7 Washer
- 8 Relief spring
- 9 Washer
- 10 Relief valve
- 11 O-ring
- 12 Oil filter

Tightening torque: N·m (kg·m, ft·lb)

T1: 6 – 7 (0.6 – 0.7, 4.3 – 5.1)

T2: 4 – 7 (0.4 – 0.7, 2.9 – 5.1)

T3: 40 – 48 (4.1 – 4.9, 30 – 35)

T4: 12 – 16 (1.2 – 1.6, 9 – 12)

Fig. 6

2. Oil Pan

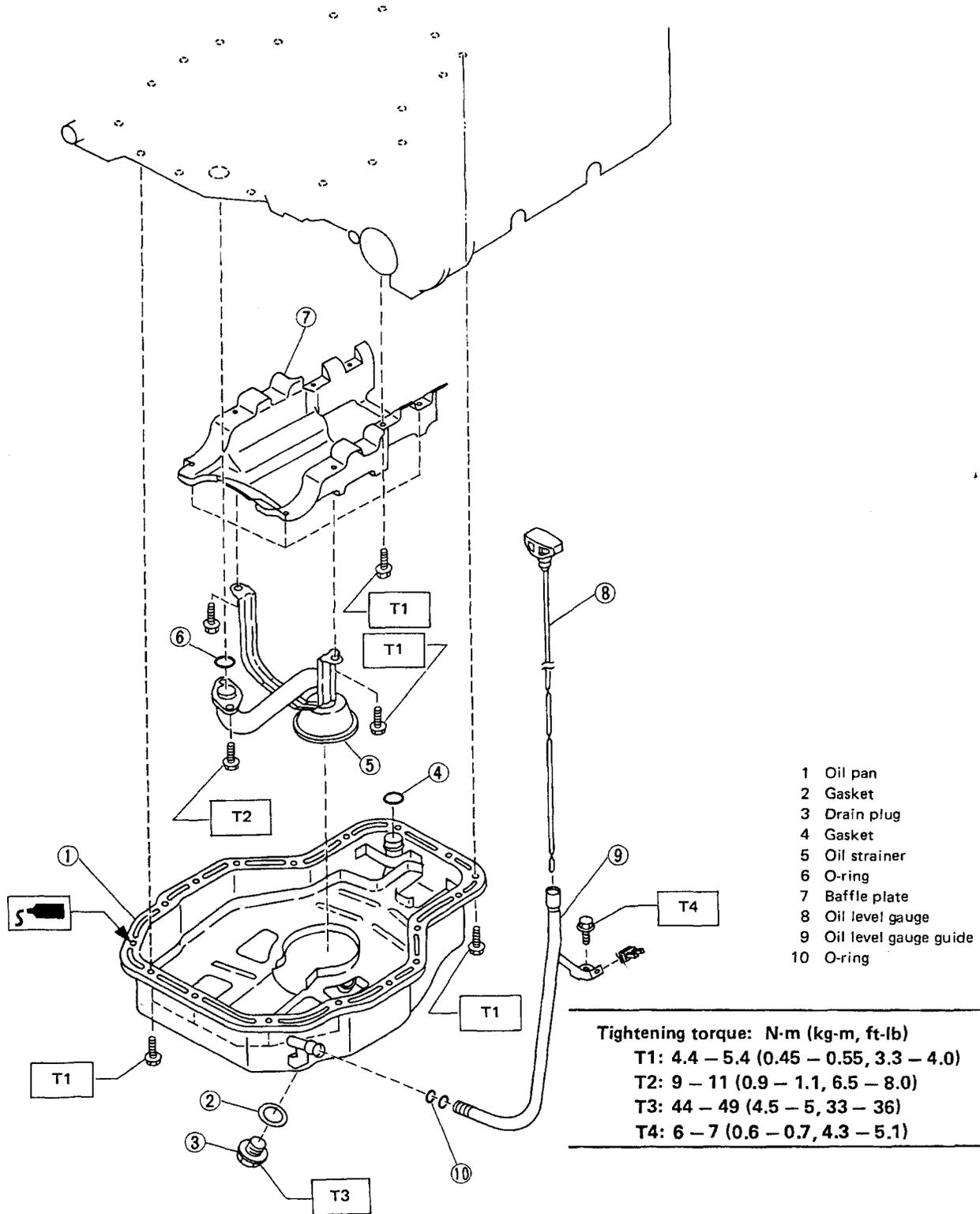


Fig. 7

W SERVICE PROCEDURE

1. Oil Pump

A: REMOVAL

- 1) Open the front hood.
- 2) Disconnect ground cable from the negative terminal of battery.
- 3) Drain engine oil.
- 4) Remove under cover.
- 5) Remove bolts which connect power steering oil cooler pipe ASSY to body.
(Do not remove power steering oil cooler pipe ASSY.)
- 6) Remove radiator fan motor ASSYs.
- 7) Remove drive belt cover and drive belts.
(Refer to 1-5 "Drive Belts [01A0]".)
- 8) Remove A/C belt idler pulley ASSY.
- 9) Remove power steering pump bracket.
(Do not remove power steering pump.)
- 10) Remove crank angle sensors.
- 11) Remove crank shaft pulley.
- 12) Remove timing belt covers, timing belt and related parts.
(Refer to 2-3 "Timing Belt [W2A0]".)
- 13) Remove crank shaft sprocket, belt idlers, belt tensioner and belt tensioner bracket.
(Refer to 2-3 "Timing Belt [W2A4]".)
- 14) Remove oil pump

Insert flat bladed screwdriver as shown in Figure.

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

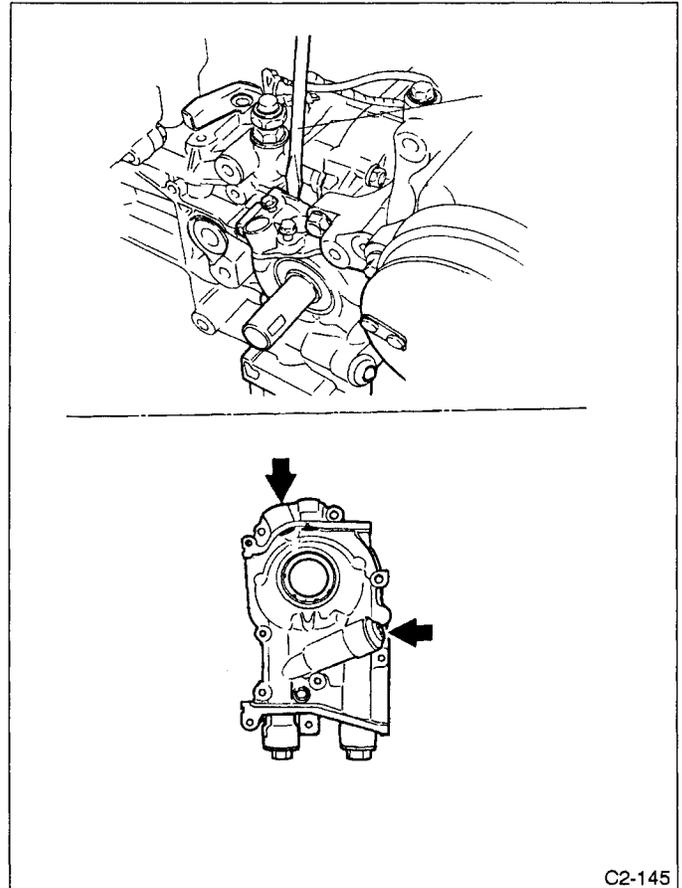
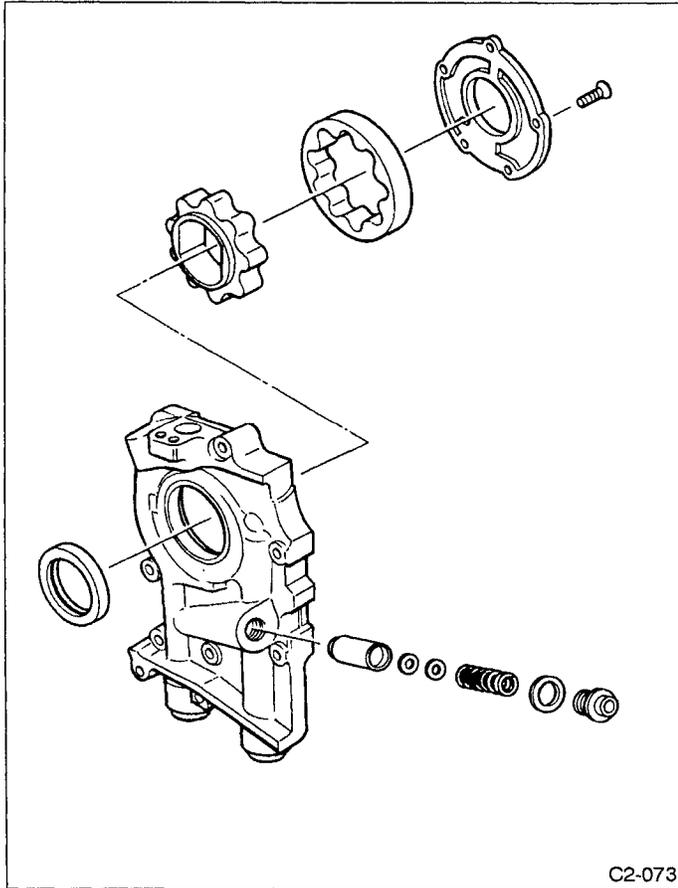


Fig. 8

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B: DISASSEMBLY

C2-073

Fig. 9

Remove screws which secure oil pump cover and disassemble oil pump.

Inscribe alignment marks on inner and outer rotors so that they can be replaced in their original positions during reassembly.

a. Before removing relief valve, loosen plug when removing oil pump from cylinder block.

b. The washer(s), which are placed between the relief valve and spring, prevent the relief valve from undergoing pressure variations. Replace the original number of washers during reassembly.

C: INSPECTION**1. TIP CLEARANCE**

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

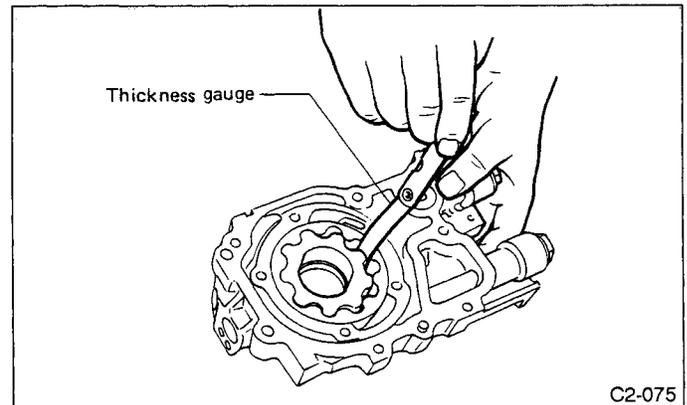
Tip clearance:

Standard

0.04 — 0.14 mm (0.0016 — 0.0055 in)

Limit

0.18 mm (0.0071 in)



C2-075

*Fig. 10***2. CASE CLEARANCE**

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

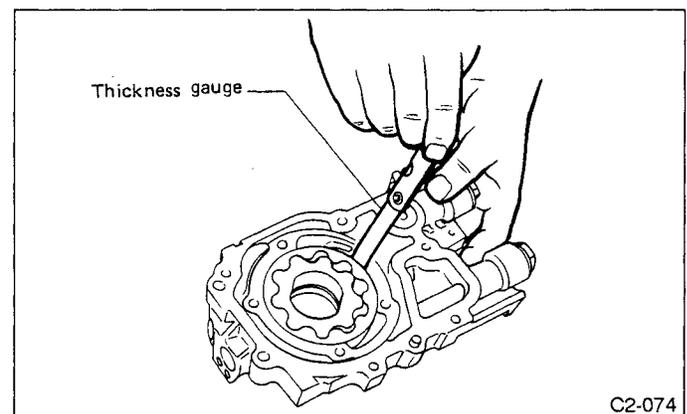
Case clearance:

Standard

0.10 — 0.175 mm (0.0039 — 0.0069 in)

Limit

0.20 mm (0.0079 in)



C2-074

Fig. 11

3. SIDE CLEARANCE

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

Side clearance:

Standard

0.02 — 0.07 mm (0.0008 — 0.0028 in)

Limit

0.12 mm (0.0047 in)

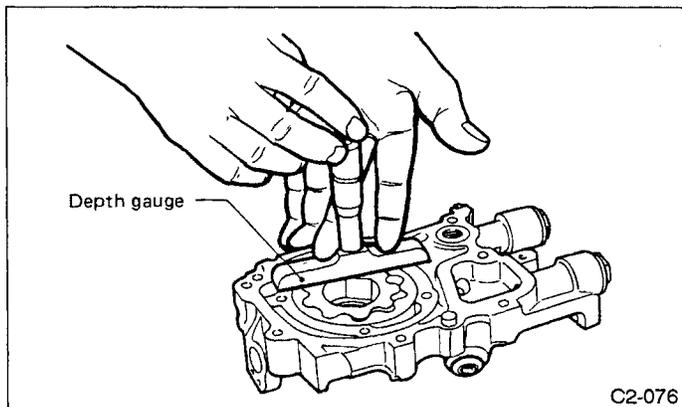


Fig. 12

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:

Free length

73.7 mm (2.902 in)

Installed length

54.7 mm (2.154 in)

Load when installed

93.2 N (9.5 kg, 20.9 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.

D: ASSEMBLY

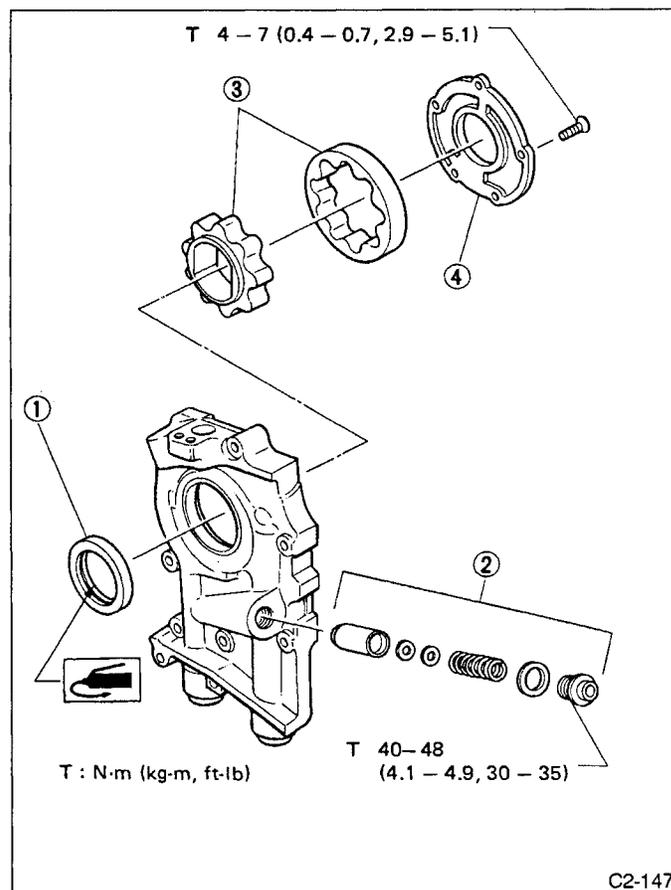


Fig. 13

1) Install front oil seal.

Use a new oil seal.

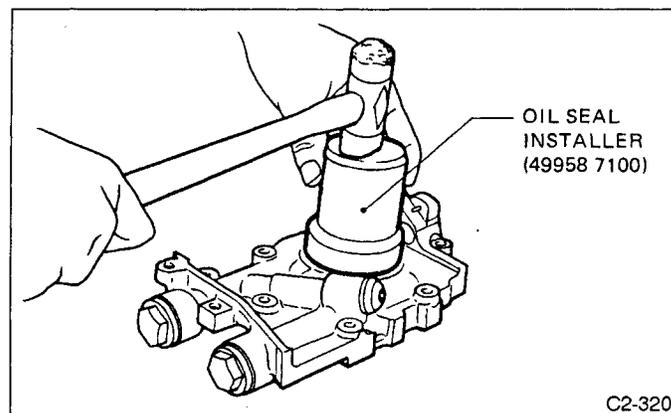


Fig. 14

2) Install oil relief valve and relief spring.

Always replace the original number of washers between the relief valve and spring during installation.

3) Install inner and outer rotors in their original positions.

4) Install oil pump cover.

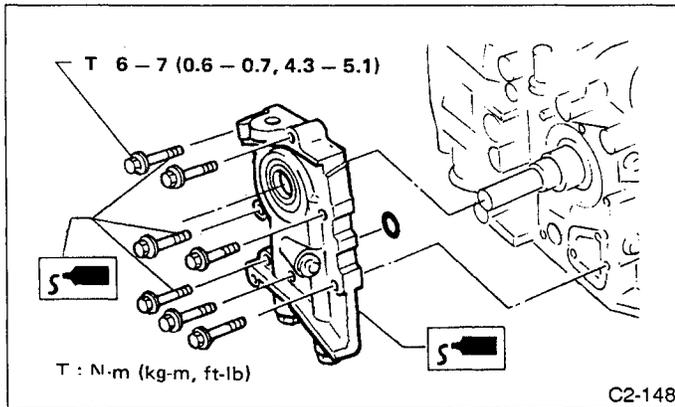
E: INSTALLATION

Fig. 15

Installation is in the reverse order of removal.
Observe the following:

- 1) Apply fluid packing to matching surfaces of oil pump.

Fluid packing:

Three bond 1215B or equivalent

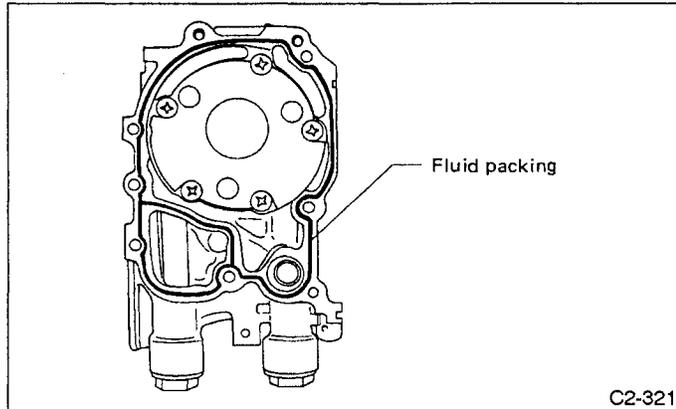


Fig. 16

- 2) Replace O-ring with a new one.
- 3) Be careful not to scratch oil seal when installing oil pump on cylinder block.
- 4) Apply fluid packing to thread portions of oil pump mounting bolts (3 places) shown in figure below.

Fluid packing:

Three bond 1344 or equivalent

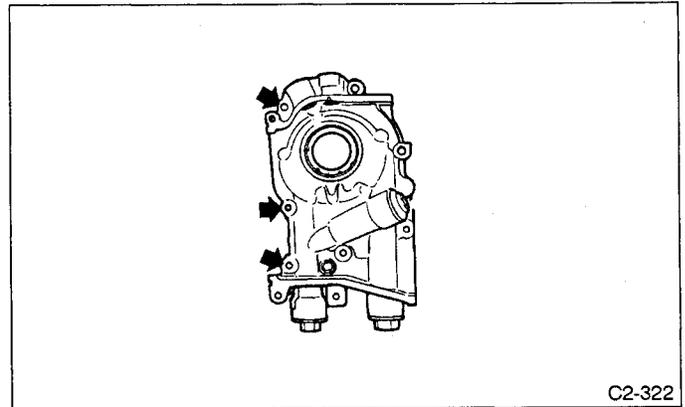


Fig. 17

Apply fluid packing to oil pressure switch threads before installation.

Fluid packing:

Three bond 1324 or equivalent

2. Oil Pan**A: REMOVAL**

- 1) Open the front hood.
- 2) Disconnect ground cable from the negative terminal of battery.
- 3) Disconnect left hand O₂ sensor connector.
- 4) Remove bolts which connect oil level gauge to cylinder head.
- 5) Drain engine oil.
- 6) Lift up the body.
- 7) Remove under cover.
- 8) Remove left-hand exhaust manifold cover, front exhaust pipe and exhaust manifold.
(Refer to "2-9 Exhaust Manifolds [W2A0]".)
- 9) Remove steering gear box clamps.
(Do not disconnect tie rod end from knuckle arm.)
- 10) Disconnect oil level gauge guide from oil pan.
- 11) Remove the bolts securing the oil pan to the cylinder block. To facilitate removal of the two rear oil pan mounting bolts, use a socket wrench with a universal joint.

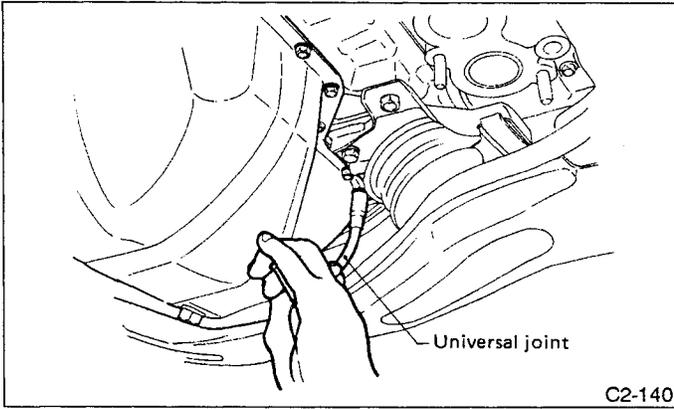


Fig. 18

12) Insert oil pan cutter blade between cylinder block-to-oil pan clearance, and remove oil pan.
Do not use a screwdriver or similar tool in place of oil pan cutter.

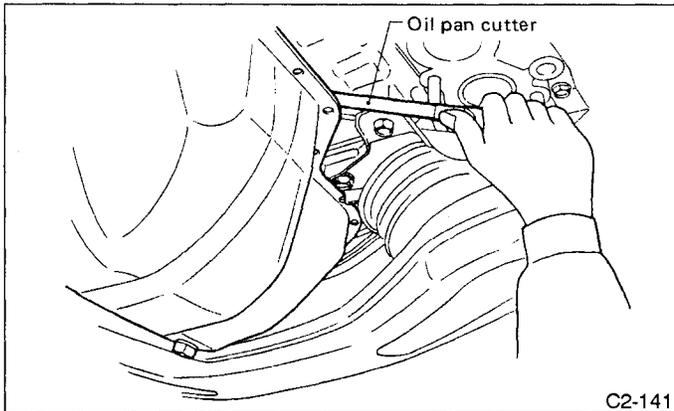


Fig. 19

13) Remove oil strainer.

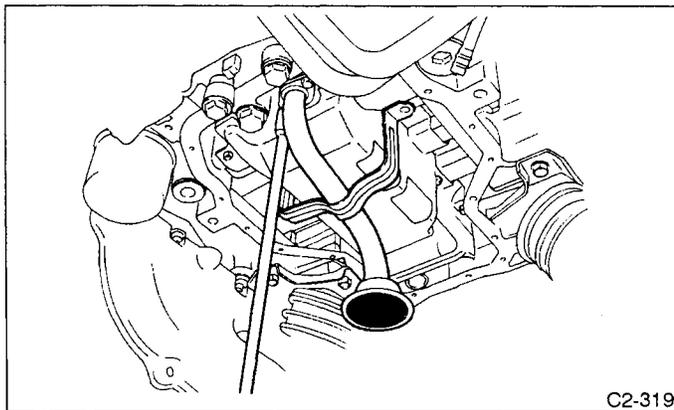


Fig. 20

14) Remove baffle plate.

B: INSTALLATION

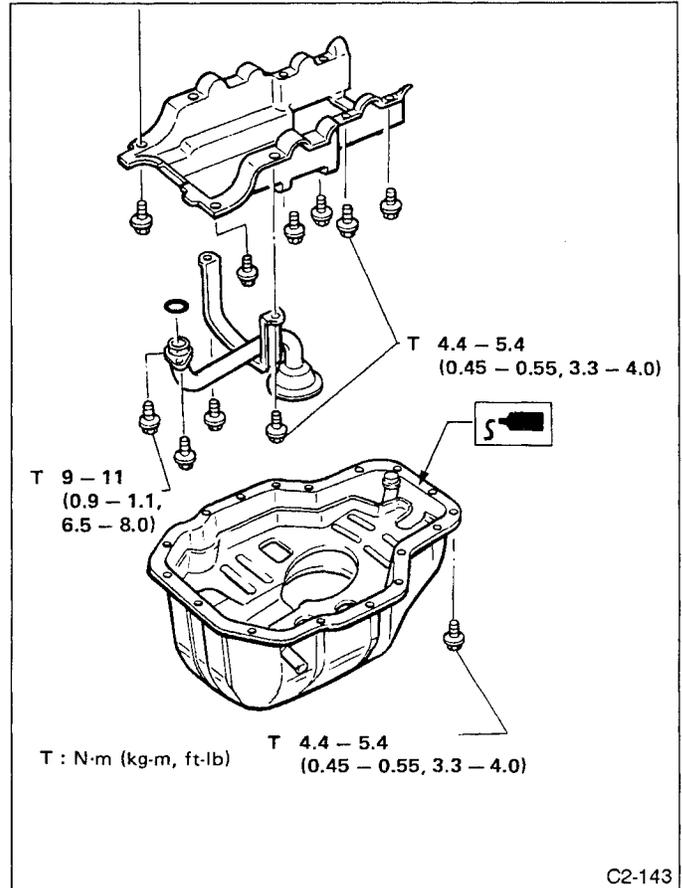


Fig. 21

Installation is in the reverse order of removal.

Observe the following:

- 1) Replace O-ring with a new one.
- 2) Apply fluid packing to mating surface of oil pan.

Fluid packing:

Three bond 1207F or equivalent

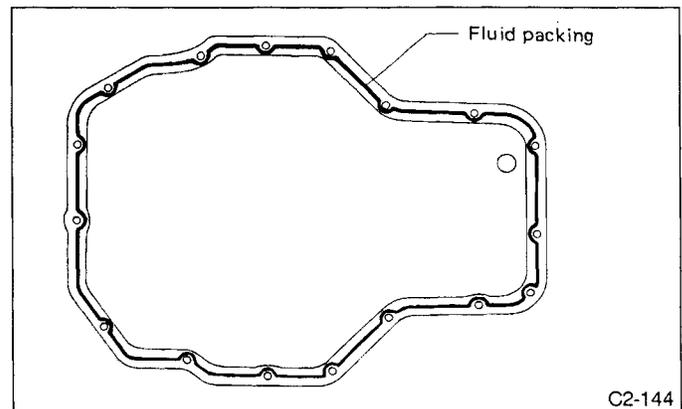


Fig. 22

T TROUBLESHOOTING

Before troubleshooting, 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)	