

LUBRICATION SYSTEM

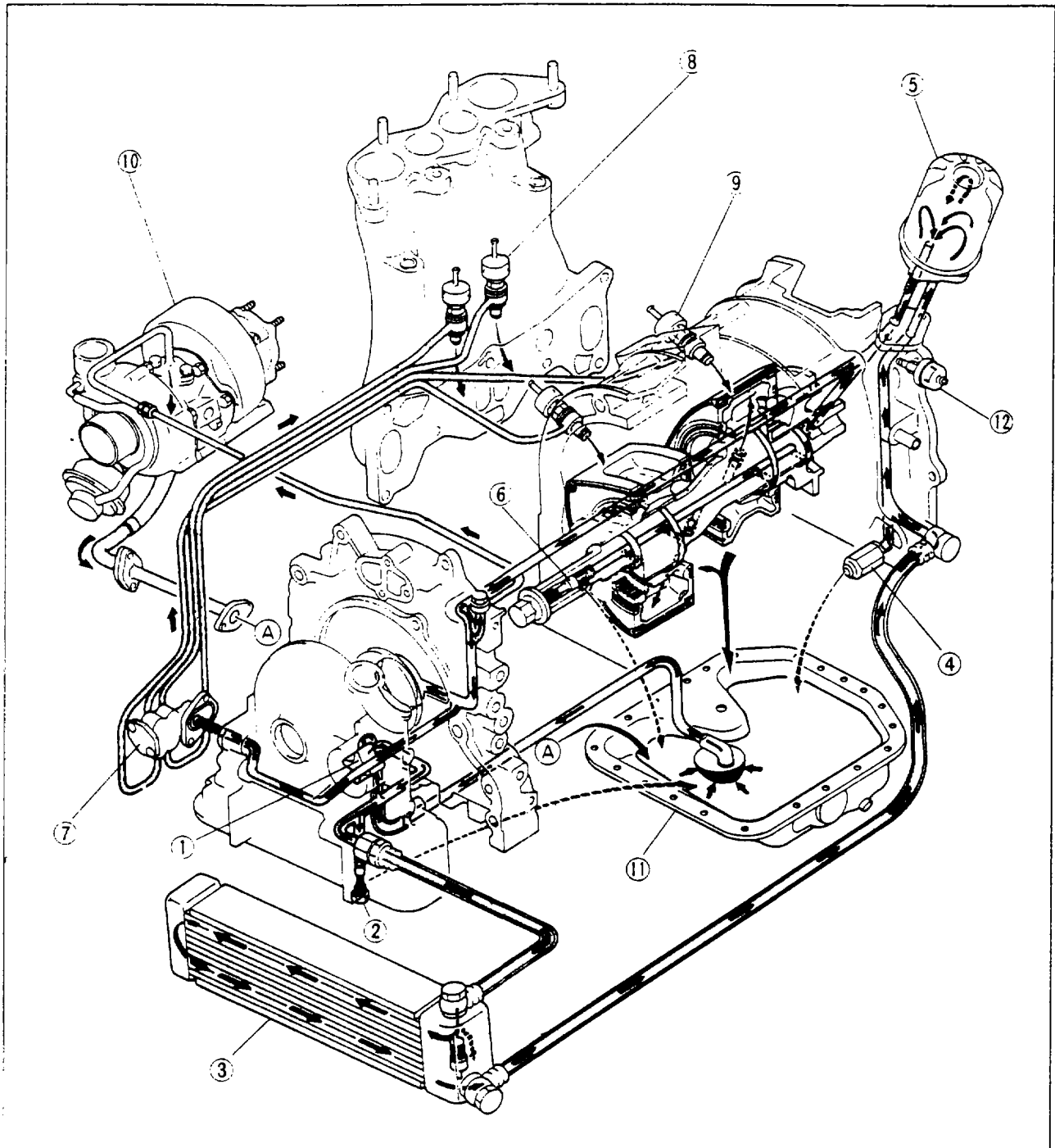
OUTLINE	2- 2
STRUCTURAL VIEW	2- 2
SPECIFICATIONS	2- 3
RECOMMENDED SAE VISCOSITY NUMBERS	2- 3
TROUBLESHOOTING GUIDE	2- 4
INSPECTION	2- 5
ENGINE OIL	2- 5
OIL PRESSURE	2- 5
METERING OIL PUMP	2- 6
OIL FILTER	2- 7
REPLACEMENT	2- 7
OIL PAN	2- 8
REMOVAL AND INSTALLATION	2- 8
INSPECTION	2-10
OIL PUMP	2-11
REMOVAL AND INSTALLATION	2-11
DISASSEMBLY AND ASSEMBLY	2-14
INSPECTION	2-15
OIL COOLER	2-16
REMOVAL AND INSTALLATION	2-16
INSPECTION	2-16
OIL PRESSURE CONTROL VALVE	2-17
REMOVAL AND INSTALLATION	2-17
INSPECTION	2-17
ECCENTRIC SHAFT BYPASS VALVE	2-17
REMOVAL AND INSTALLATION	2-17
INSPECTION	2-17

67U02X-001

2 OUTLINE

OUTLINE

STRUCTURAL VIEW



77U02X-101

- | | |
|---------------------------------|------------------------|
| 1. Oil pump | 7. Metering oil pump |
| 2. Oil pressure control valve | 8. Manifold oil nozzle |
| 3. Oil cooler | 9. Housing oil nozzle |
| 4. Oil pressure regulator valve | 10. Turbocharger |
| 5. Oil filter | 11. Oil pan |
| 6. Eccentric shaft bypass valve | 12. Oil pressure gauge |

SPECIFICATIONS

Items		Engine models	Turbo	Non-Turbo
Lubrication system			Forced-fed	
Oil pump	Type		Trochoid	
	Number of rotors		2	
	Diameter x width of rotor	mm (in)	50 x 17.5 (1.97 x 0.69)	50 x 12.5 (1.97 x 0.49)
Control valve relief pressure		kPa (kg/cm ² , psi)	1,080 (11.0, 156)	
Oil cooler	Type		Air cooled, with bypass valve	
	Relief temperature	°C (°F)	60—65 (140—149) or below	
	Relief pressure differential	kPa (kg/cm ² , psi)	349 (3.56, 50) at 60°C (140°F)	
Regulator valve relief pressure		kPa (kg/cm ² , psi)	490 (5.0, 71)	
Oil filter	Type		Full-flow, paper element	
	Relief pressure differential	kPa (kg/cm ² , psi)	98 (1.0, 14)	
Eccentric shaft bypass valve relief temperature		°C (°F)	60 (140) or below	
Oil capacity	Total (dry engine)	liters (US qt, Imp qt)	5.8 (6.1, 5.1)	
	Oil pan	liters (US qt, Imp qt)	4.4 (4.7, 3.9)	
	Oil cooler	liters (US qt, Imp qt)	0.8 (0.85, 0.70)	
	Oil filter	liters (US qt, Imp qt)	0.3 (0.32, 0.26)	
Engine oil grade (API service)			"Fuel efficient" SF (Do not use synthetic oil)	

67U02X-001

RECOMMENDED SAE VISCOSITY NUMBERS

Temperature	(°C)	-30	-20	-10	0	10	20	30	40	50	
	(°F)	-20	0	20	40	60	80	100	120		
Engine oil	5W - 30										
	10W - 30										
	10W - 40 10W - 50										
	20W - 40 20W - 50										

67U02X-004

Temperature range anticipated before next oil change, °C (°F)

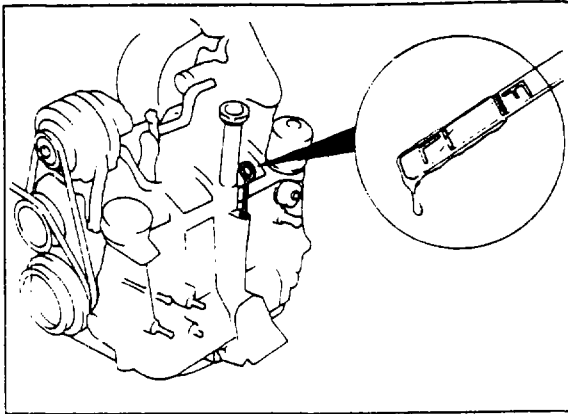
2 TROUBLESHOOTING GUIDE

TROUBLESHOOTING GUIDE

Problem	Possible Cause	Remedy	Page
Engine hard starting	Improper engine oil	Replace	2- 3
	Insufficient engine oil	Add oil	2- 5
Excessive oil consumption	Oil working up or working down Oil leak	Refer to Section 1 As described below	
Oil leakage	Loose drain plug or damaged washer	Tighten or replace	2-10
	Faulty seal at oil pan	Repair	2- 9
	Damaged front cover	Replace	—
	Loose front cover bolt or oil pan bolt	Tighten	—
	Damaged sealing rubber, "O" ring, or front cover gasket	Replace	—
	Malfunction of oil seal	Replace	—
	Loose oil filter	Tighten	2- 7
	Loose or damaged oil level sensor or oil pressure gauge	Tighten or replace	—
	Damaged oil cooler or oil cooler hose	Replace	2-16
Oil pressure drop*	Oil leak	As described above	
	Insufficient oil	Add oil	2- 5
	Worn or damaged oil pump gear	Replace	2-15
	Clogged oil strainer	Clean	—
	Malfunction of oil pressure control valve	Replace	2- 7
	Malfunction of oil cooler bypass valve	Replace	2-16
	Malfunction of oil pressure regulator valve	Replace	—
	Clogged oil filter	Replace	2- 7
	Malfunction of eccentric shaft bypass valve	Replace	2-17
	Excessive oil clearance between eccentric shaft and main bearing	Refer to Section 1	
Oil pressure gauge does not work	Oil pressure drop	As described above	
	Malfunction of oil pressure gauge unit	Refer to Section 15	
	Malfunction of electrical system	Refer to Section 15	
Oil level warning light illuminates when engine is running	Insufficient oil	Add oil	2- 5
	Malfunction of oil level sensor	Refer to Section 15	
	Malfunction of electrical system	Refer to Section 15	

87U02X-002

* Oil pressure becomes low when the engine is cold because the eccentric shaft bypass valve operates.

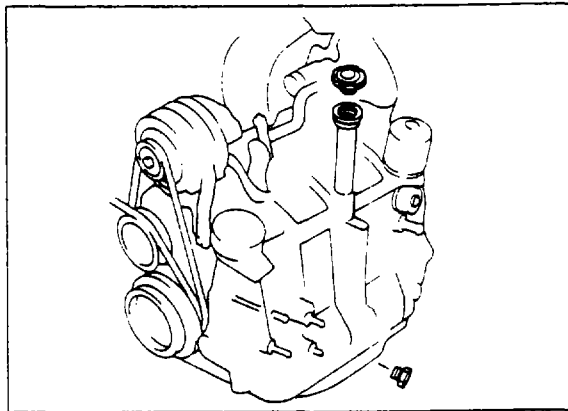


67U02X-006

INSPECTION

ENGINE OIL

1. Be sure the vehicle is on level ground.
2. Warm up the engine.
3. Wait for five minutes after turning off the engine.
4. Check the engine oil level and condition with the oil level gauge.
5. If necessary, add oil or replace.



67U02X-007

Replacement

1. Warm up the engine.
2. Remove the oil filler cap and remove the drain plug.

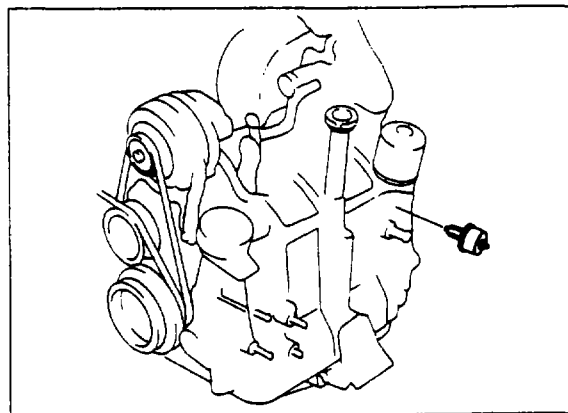
Warning

Wait a while if the engine is too hot. Use caution when draining.

3. Clean and install the drain plug with a new gasket.
4. Refill the engine with the specified oil to the "F" mark on the level gauge.
5. Refit the oil filler cap securely.

Oil pan capacity:

4.4 liters (4.7 US qt, 3.9 Imp qt)

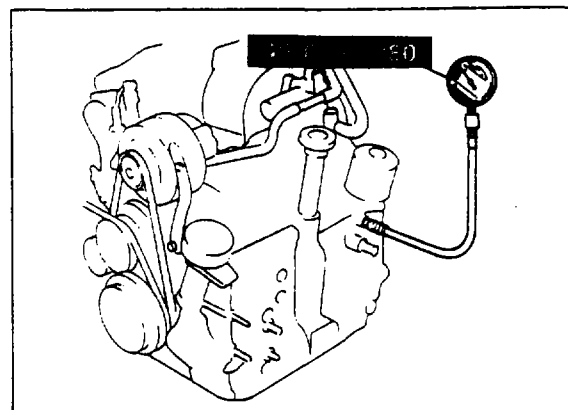


67U02X-008

6. Start the engine and check for leaks.
7. Stop the engine and recheck the level.

OIL PRESSURE

1. Remove the oil pressure gauge unit.
2. Install the **oil pressure gauge** (49 0187 280) tester.



67U02X-009

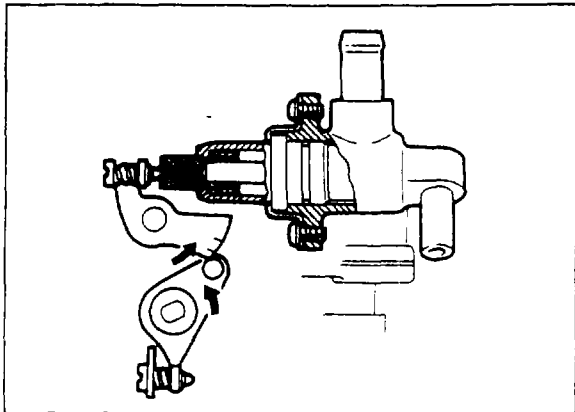
3. Start the engine and let it warm up to operating temperature.
4. Run the engine at **3,000 rpm** and note the gauge reading.

Standard oil pressure:

441—539 kPa (4.5—5.5 kg/cm², 64—78 psi)

5. If the pressure does not come up to the specified pressure, check for the cause, and repair. (Refer to Troubleshooting Guide.)

2 INSPECTION

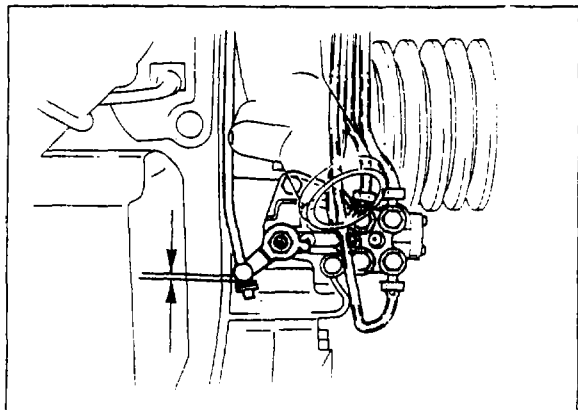


67U02X-010

METERING OIL PUMP

Rod Clearance

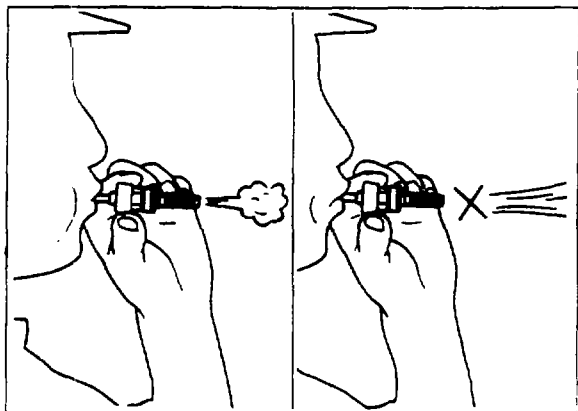
1. Rotate the fast-idle cam in the direction of the arrow to separate the cam and roller.



67U02X-011

2. Check the clearance of the rod and the lever. If necessary, adjust the clearance with washers.

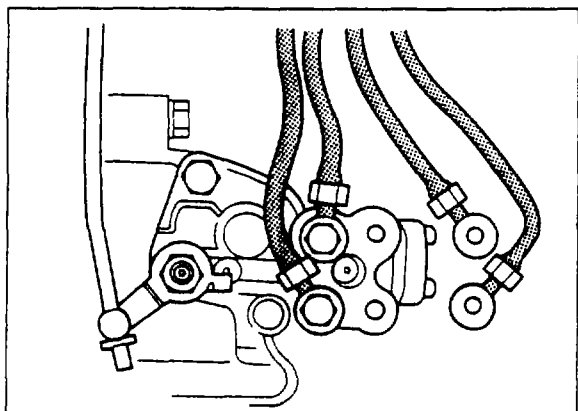
Clearance: 0—1 mm (0—0.04 in)



67U02X-012

Oil Nozzle

1. Remove the housing oil nozzles from the rotor housing and remove the manifold oil nozzle from the intake manifold.
2. Check that air passes in only one direction. If not so, replace the oil nozzle.



67U02X-013

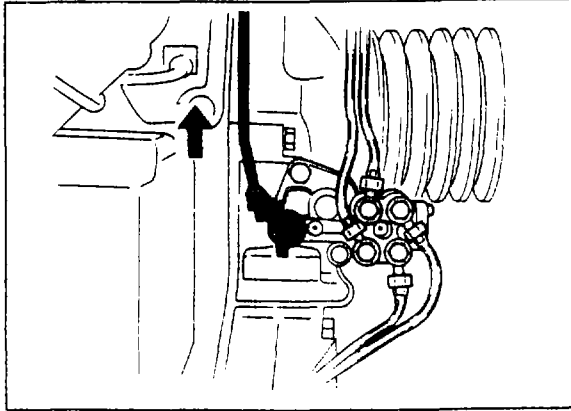
Oil Discharge

1. Warm up the engine.
2. Connect a tachometer to the engine.
3. Disconnect two housing oil hoses from the meter oil pump.

Caution

Only disconnect two hoses at one time.

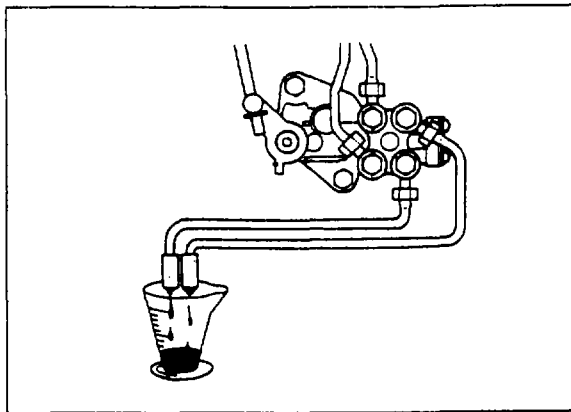
4. Connect suitable hoses to the metering oil pump for measurement.



67U02X-014

- Pull the metering oil pump rod up to its maximum.

Caution
Make sure to lift the rod fully while the engine is running.



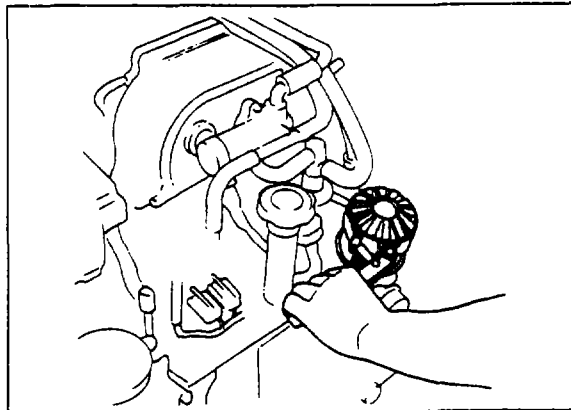
77U02X-103

- Run the engine at **2,000 rpm** and measure the amount of oil discharged in 5 minutes.
- Measure the manifold metering oil discharge in the same manner.

Standard discharge:

Turbo: 5.2—6.6 cc (0.32—0.40 cu in)
 /2,000 rpm—5 min.

Non-Turbo: 4.2—5.6 cc (0.26—0.34 cu in)
 /2,000 rpm—5 min.

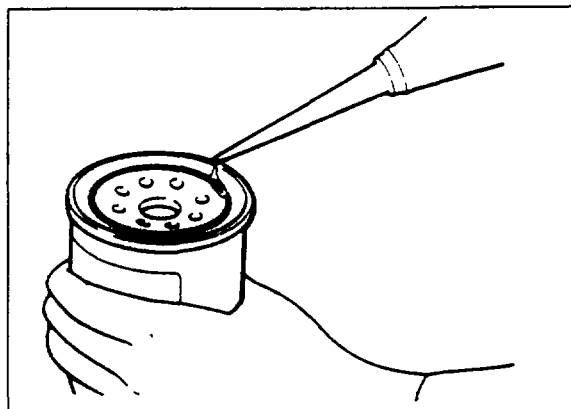


67U02X-016

OIL FILTER

REPLACEMENT

- Remove the oil filter with a suitable wrench.
- Clean the mounting surface.



67U02X-C17

- Apply a small amount of engine oil to the rubber seal of the new filter.
- Install the oil filter and tighten it thoroughly by hand only.
- Start the engine and check for leaks.
- Check the oil level.

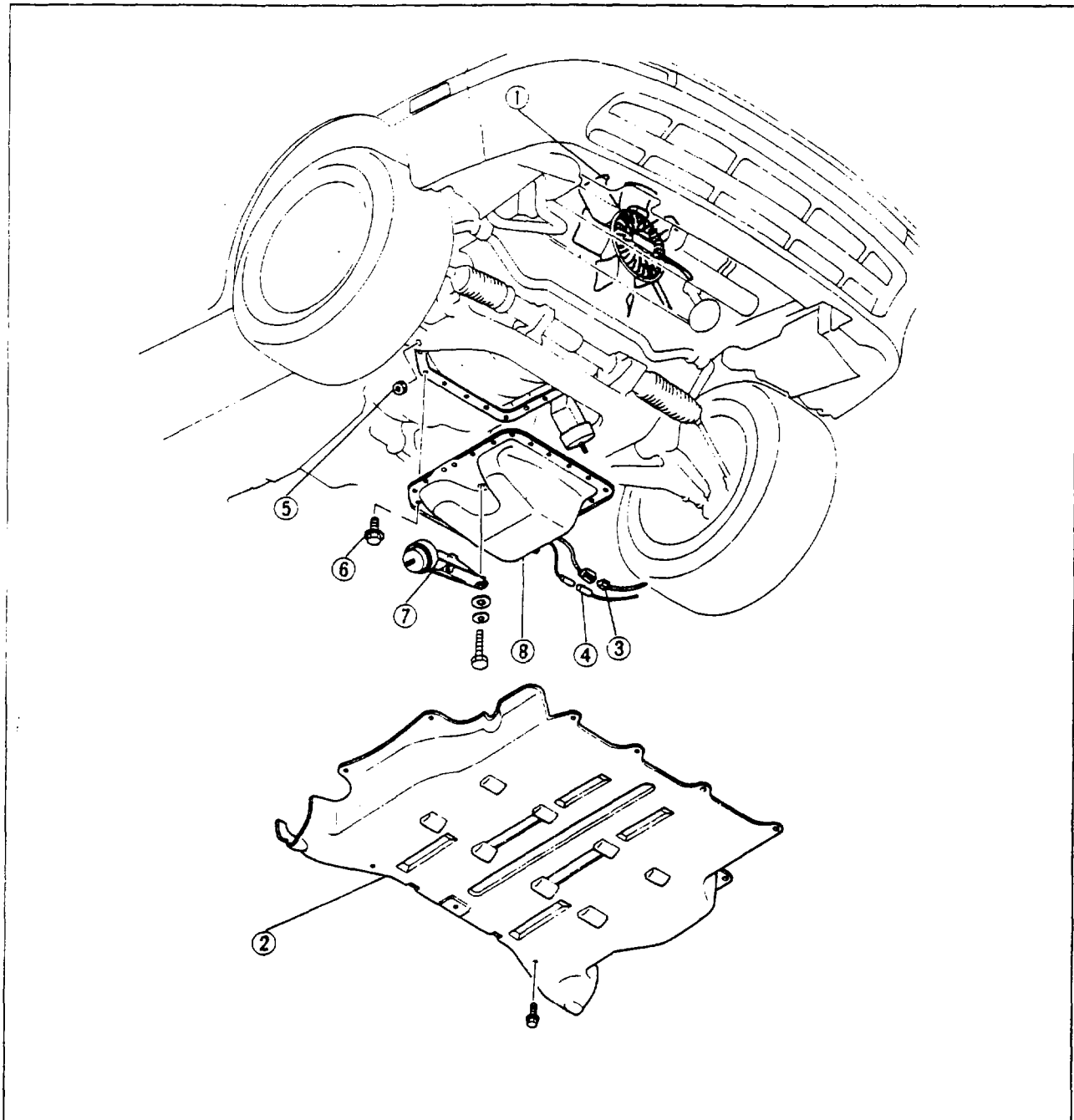
2 OIL PAN

OIL PAN

REMOVAL AND INSTALLATION

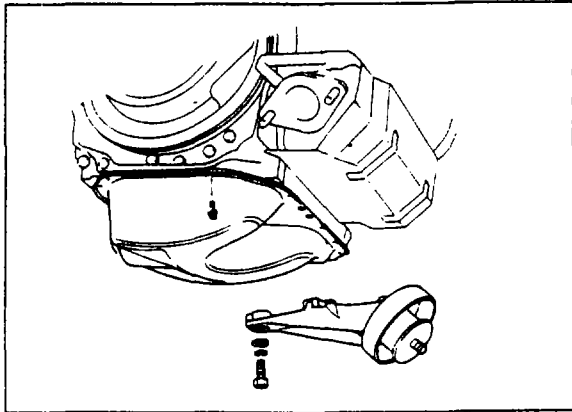
1. Disconnect the negative battery cable.
2. Drain the engine oil.
3. Remove in the sequence shown in the figure.
4. Install in the reverse order of removal.
5. Add the prescribed amount of oil.
6. Check the engine for oil leakage and level.

67U02X-018



67U02X-019

- | | |
|-------------------------------|--------------------------|
| 1. Cooling fan | 5. Engine mount nut |
| 2. Engine under cover | 6. Oil pan mounting bolt |
| 3. Oil level sensor connector | 7. Right engine mount |
| 4. Oil thermo unit connector | 8. Oil pan |



67U02X-020

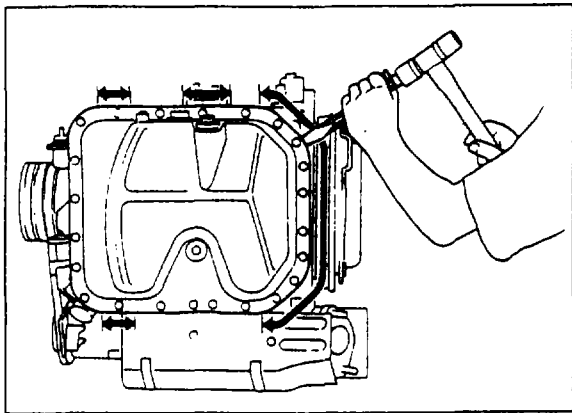
Removal Note

Oil pan attaching bolt

1. Remove the engine mounting nuts and lift the engine 40—60 mm (1.6—2.4 in).
2. Remove the oil pan attaching bolts.

Warning

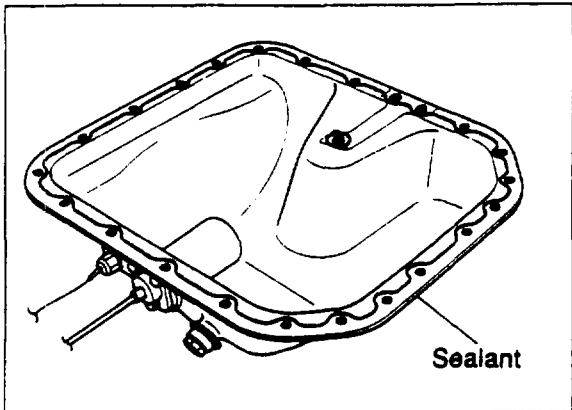
Be sure the vehicle is securely supported and the engine is securely hung.



67U02X-021

Oil pan

To separate the oil pan, insert a flat-tipped screw driver or a suitable tool into only the areas shown in the figure.

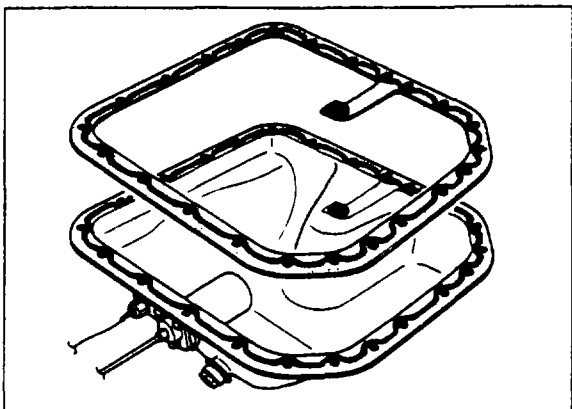


67U02X-022

Installation Note

Oil pan

1. Clean the mating surface of the housings and oil pan.
2. **(Without gasket)**
Apply a 4—6 mm (0.16—0.24 in) diameter bead of the sealant (8527 77 739) around the rim of the oil pan as shown in the figure. It should be continuously rimmed inside the bolt holes, and the ends should overlap.



67U02X-023

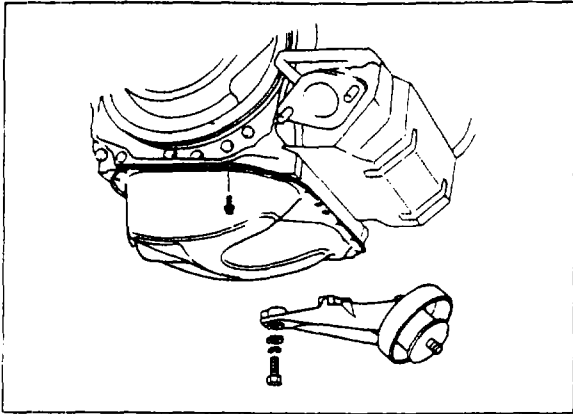
(With gasket)

Apply a 4—6 mm (0.16—0.24 in) diameter bead of sealant (8527 77 739, or suitable silicone base sealant) around the rim of the oil pan and the housing side of the new gasket. It should be continuously rimmed inside the bolt holes, and the ends should overlap.

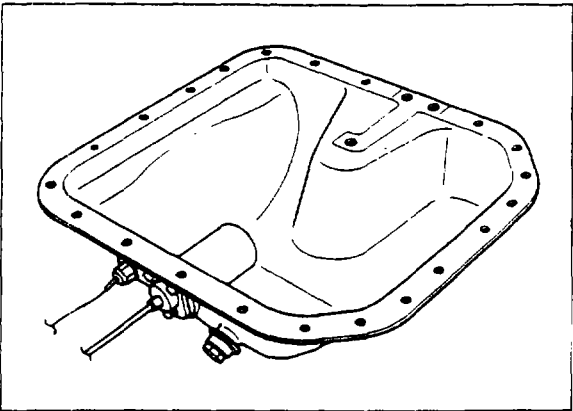
Caution

Install the oil pan within 30 minutes after the sealant is applied.

2 OIL PAN



67U02X-024



67U02X-025

3. Install the oil pan and the right engine mount together, and tighten the bolts gradually.

Oil pan bolt tightening torque:

8—11 N·m (0.8—1.1 m·kg, 69—95 in·lb)

Engine mount bolt tightening torque:

63—93 N·m (6.4—9.5 m, 46—69 ft·lb)

INSPECTION

Check the following points. Repair or replace if necessary.

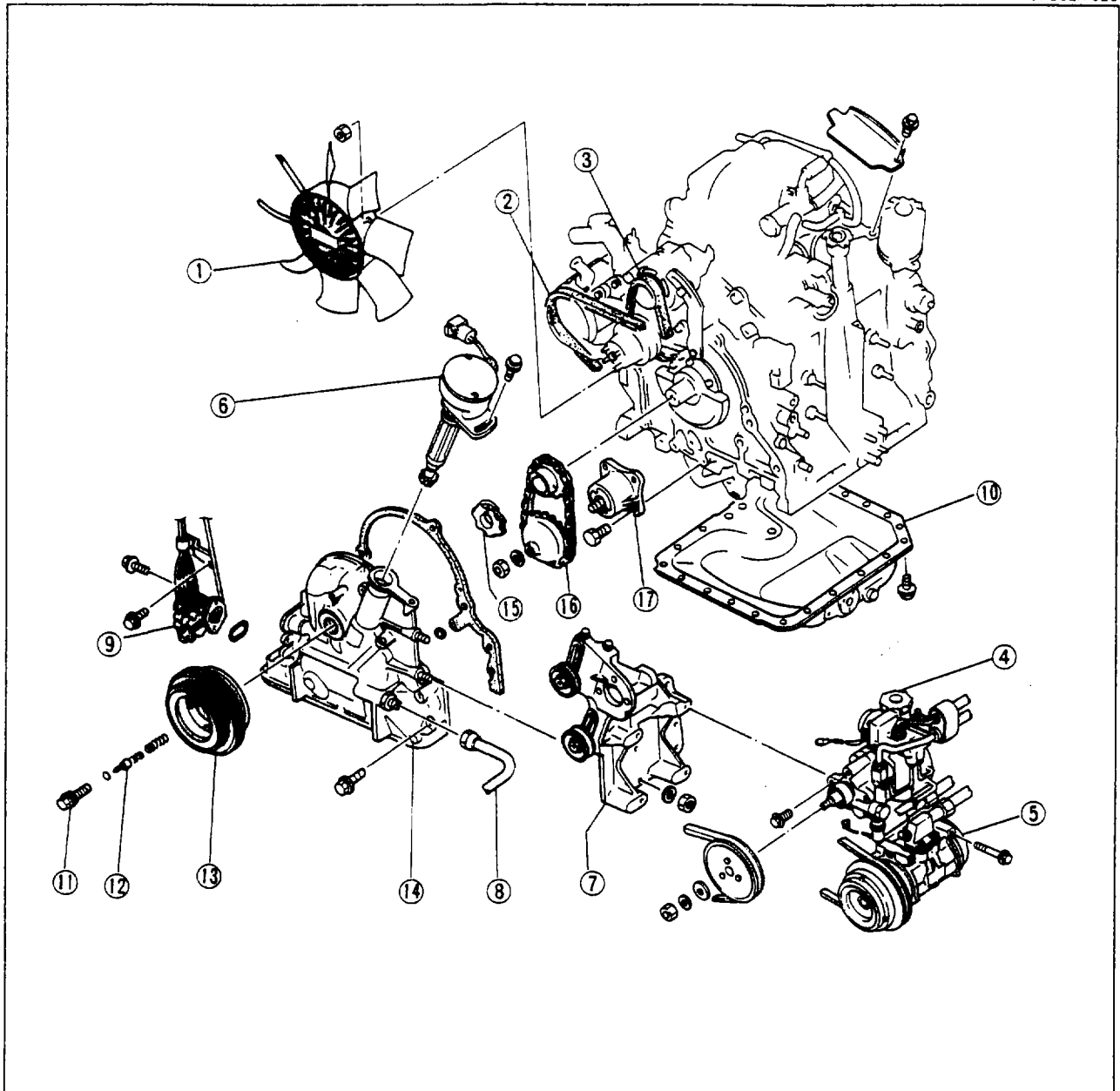
1. Cracks, distortion, damage
2. Damaged drain plug threads

OIL PUMP

REMOVAL AND INSTALLATION

1. Disconnect the negative battery cable.
2. Drain the engine oil.
3. Remove in the sequence shown in the figure.
4. Install in the reverse order of removal.

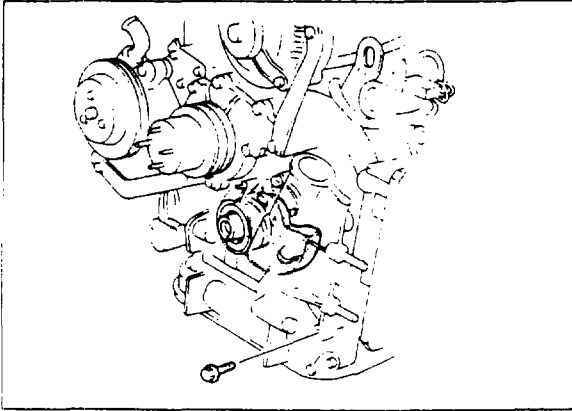
67U02X-026



67U02X-027

- | | |
|--------------------------------------|--|
| 1. Cooling fan | 10. Oil pan (Refer to page 2—8.) |
| 2. Air pump drive belt | 11. Eccentric shaft pulley lock bolt |
| 3. Alternator drive belt | 12. Eccentric shaft bypass valve and spring |
| 4. P/S pump and drive belt | 13. Eccentric shaft pulley |
| 5. A/C compressor and drive belt | 14. Front cover |
| 6. Crank angle sensor | 15. Distributor drive gear |
| 7. A/C compressor — P/S pump bracket | 16. Oil pump drive gear and driven gear, and chain |
| 8. Oil pipe | 17. Oil pump |
| 9. Metering oil pump | |

2 OIL PUMP

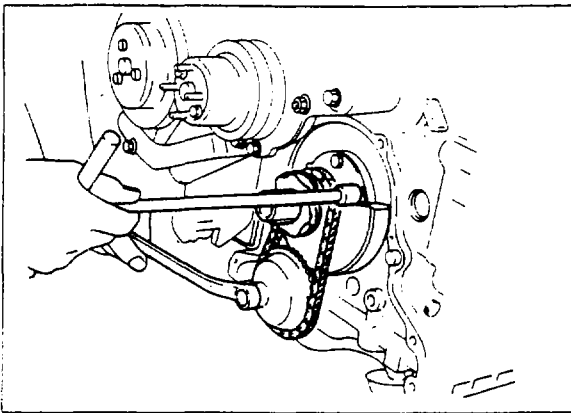


67U02X-028

Removal Note

Front cover

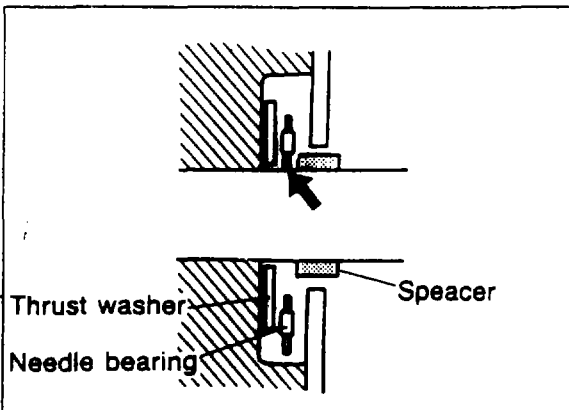
1. Turn the eccentric shaft so that the balance weight is in the lower position to provide clearance between the balance weight and water pump.
2. Remove the front cover.



67U02X-029

Oil pump lock nut

To loosen the oil pump lock nut, lock the balance weight.

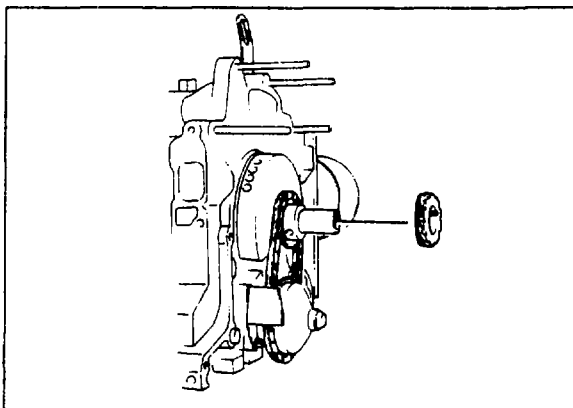


67U02X-051

Installation Note

Caution

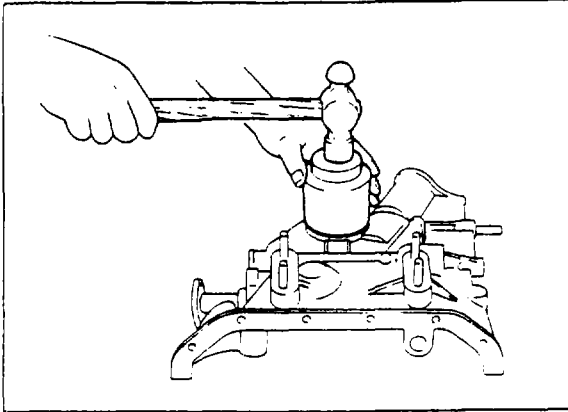
Before tightening the eccentric shaft lock bolt, do not move the eccentric shaft and the balance weight to prevent the needle bearing from being wedged by the spacer.



67U02X-030

Distributor drive gear

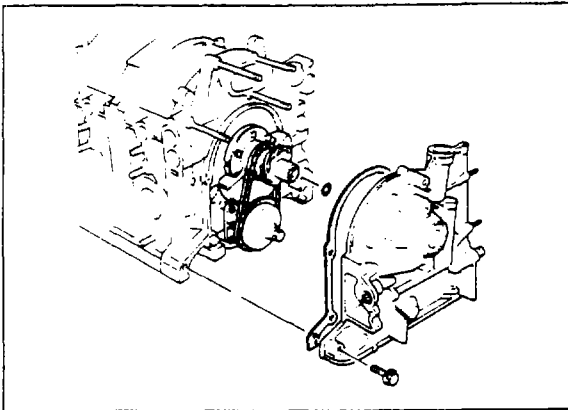
Install the distributor drive gear so that the chamfer surface faces the front housing.



67U02X-031

Front cover

1. Replace the front oil seal.
 - (1) Press out the oil seal.
 - (2) Apply engine oil to the front cover and new oil seal.
 - (3) Press the oil seal into the front cover.
 - (4) Apply engine oil to the oil seal lip.



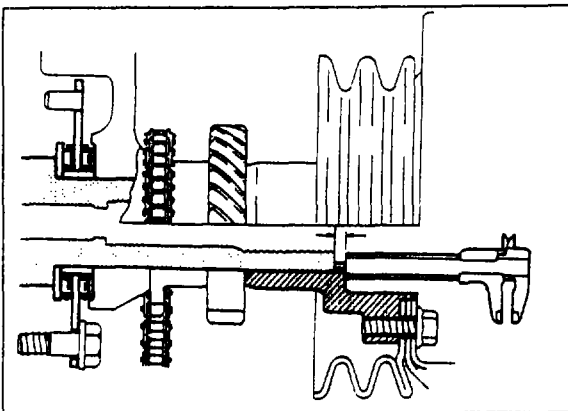
67U02X-032

2. Apply petroleum jelly to the new "O" ring and install it in the oil passage hole.
3. Install the front cover with a new gasket.

Tightening torque:

16—22 N·m (1.6—2.3 m·kg, 12—17 ft·lb)

4. Cut away the part of the gasket which projects out from the oil pan.

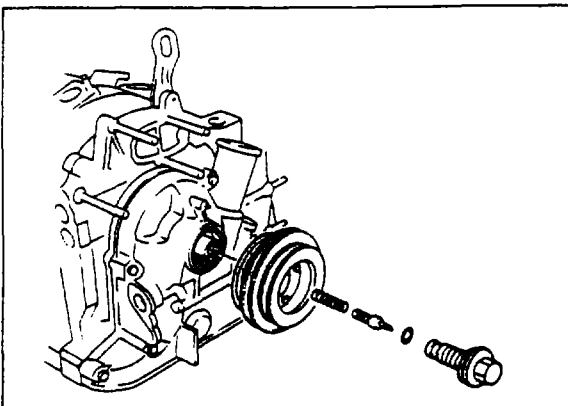


67U02X-052

Eccentric shaft pulley lock bolt

1. Check the pulley boss protrusion from the eccentric shaft end.
 - (1) Temporarily install the lock bolt, and tighten it by hand only.
 - (2) Remove the lock bolt, and measure the pulley boss protrusion. If it is over the limit, the needle bearing may be wedged by the spacer. Remove and reassemble the needle bearing correctly.

Protrusion limit: 2.44 mm (0.0961 in)



87U02X-003

2. Apply a sealing agent to the flange surface of the bolt.
3. Apply a tightening agent to the threads of the bolt.
4. Apply engine oil to the new "O" ring and install it on the bolt.
5. Install the new pulley lock bolt.

Tightening torque:

108—132 N·m

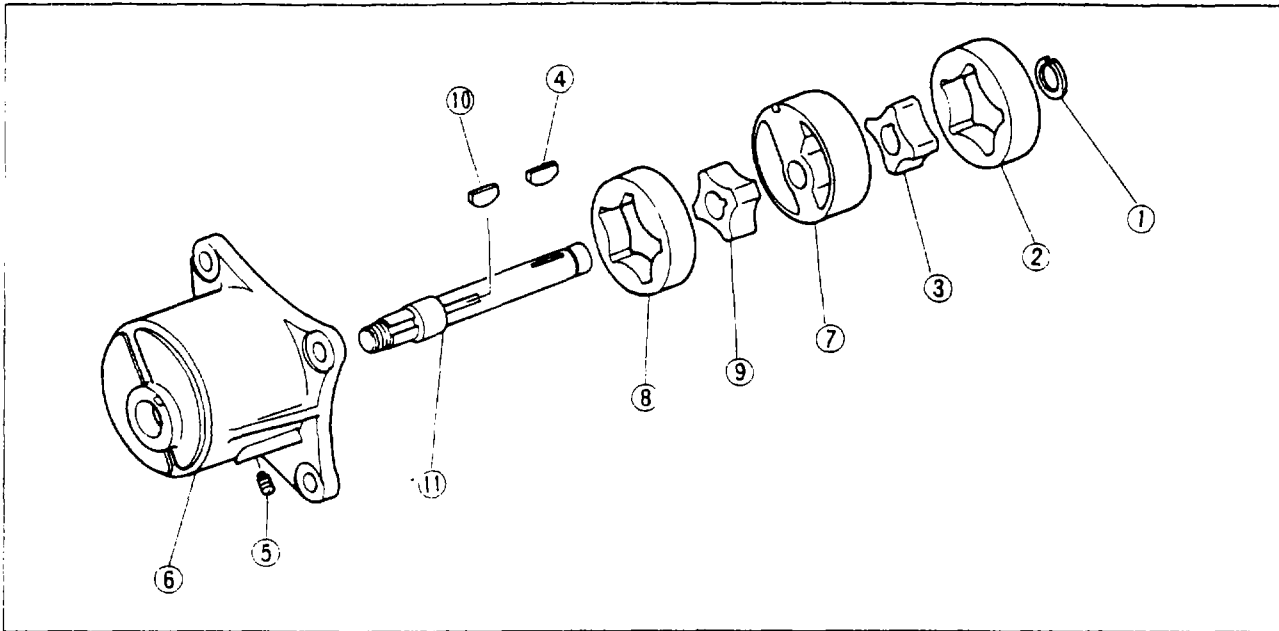
(11.0—13.5 m·kg, 80—98 ft·lb)

2 OIL PUMP

DISASSEMBLY AND ASSEMBLY

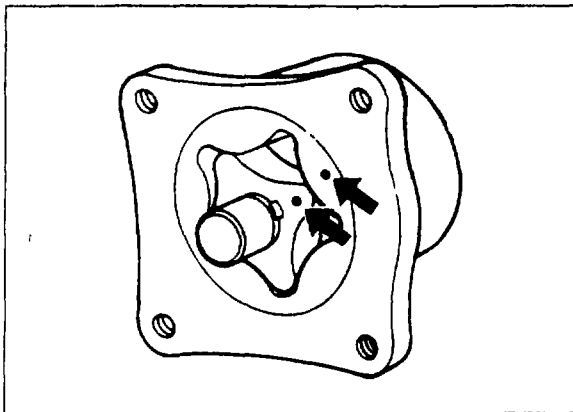
1. Disassemble in the sequence shown in the figure.
2. Assemble in the reverse order of disassembly.

67U02X-035



67U02X-036

- | | | |
|---------------------|----------------------|----------------------|
| 1. Snap ring | 5. Screw | 9. Front inner rotor |
| 2. Rear outer rotor | 6. Body | 10. Key |
| 3. Rear inner rotor | 7. Middle plate | 11. Shaft |
| 4. Key | 8. Front outer rotor | |



67U02X-037

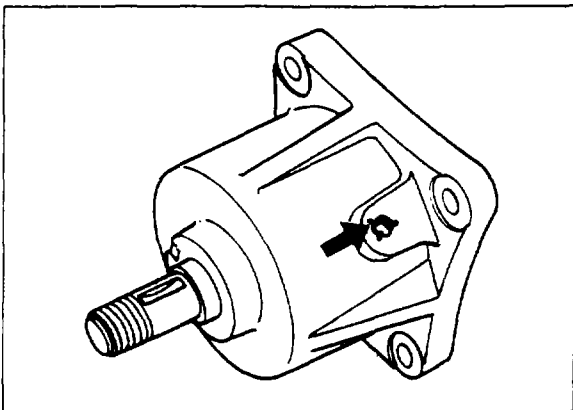
Caution

Do not confuse the front and rear rotors.

Assembly Note

Outer rotor and inner rotor

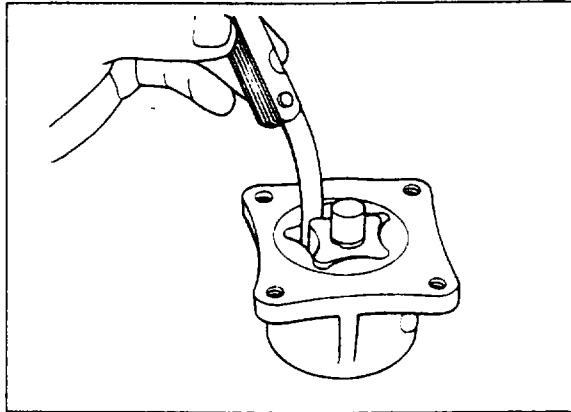
Install the outer and inner rotors at front and rear so that the tally marks on the rotors go toward the front housing.



67U02X-038

Screw

Crimp the screw after installing it.



67L02X-039

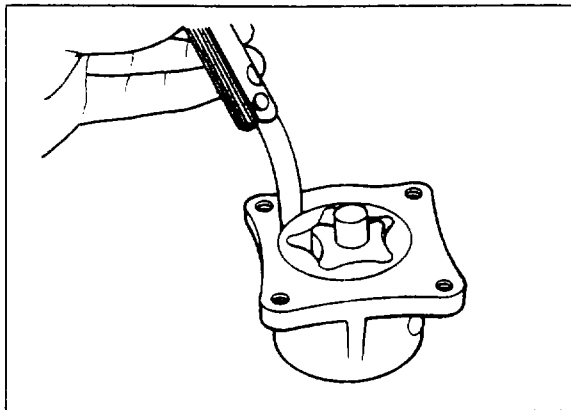
INSPECTION

1. Inspect the oil pump parts for wear or damage, and replace if necessary.
2. Measure the clearance between the lobes of rotors with a feeler gauge.

Standard clearance:

0.03—0.12 mm (0.0012—0.0047 in)

Clearance limit: 0.15 mm (0.0059 in)



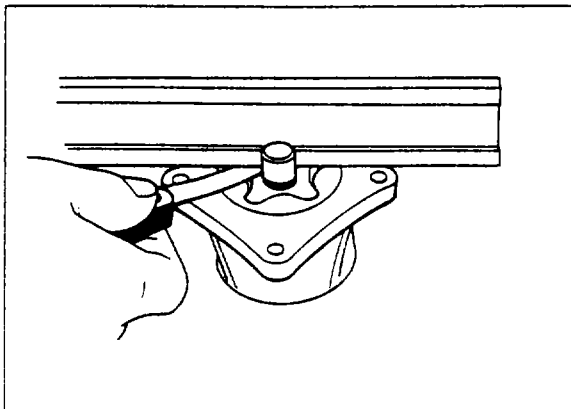
67U02X-040

3. Measure the clearance between the outer rotor and the pump body.

Standard clearance:

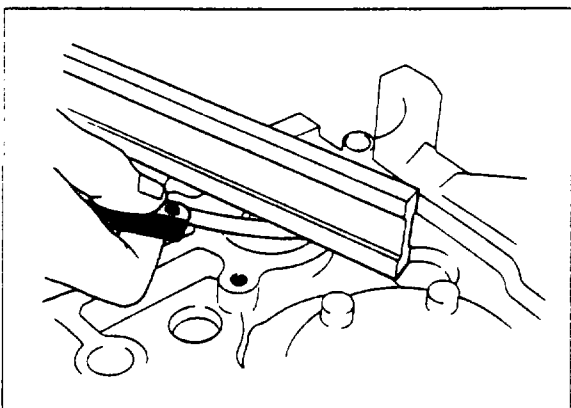
0.20—0.25 mm (0.0079—0.098 in)

Clearance limit: 0.30 mm (0.0118 in)



67U02X-041

4. Inspect the end float of the rotors.
 - (1) Measure the sinking of the rotor from the pump body.



67U02X-042

- (2) Measure the sinking of the rotor sliding surface from the pump mounting surface.
 - (3) Add the two sinking amounts. If necessary, grind the pump body, or replace it.

Standard end float:

0.03—0.13 mm (0.0012—0.0051 in)

End float limit: 0.15 mm (0.0059 in)

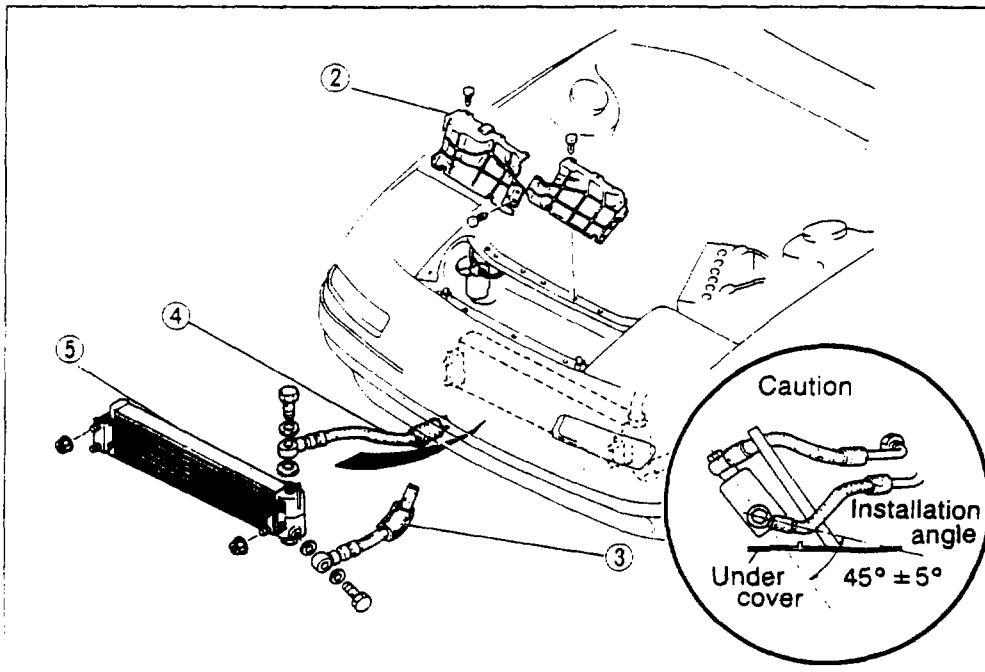
2 OIL COOLER

OIL COOLER

REMOVAL AND INSTALLATION

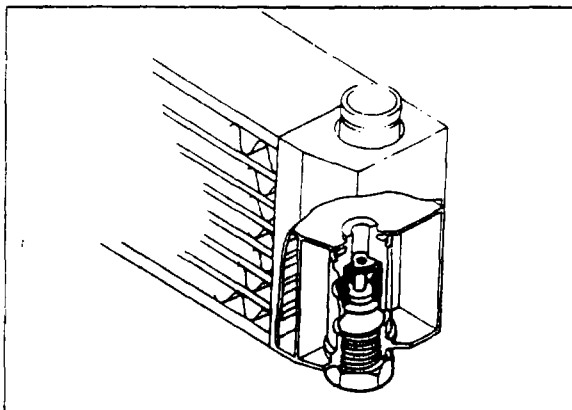
1. Remove in the sequence shown in the figure.
2. Install in the reverse order of removal.
3. Check the engine oil for leakage and level.

67U02X-043



1. Under cover
2. Radiator grill upper cover
3. Oil inlet hose
4. Oil outlet hose
5. Oil cooler

67U02X-044



67U02X-045

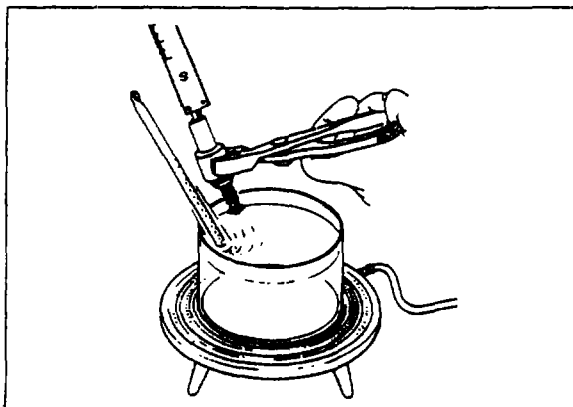
INSPECTION

Oil Cooler

Visually check the oil cooler for damage, cracks or leakage. Repair or replace if necessary.

Oil Cooler Bypass Valve

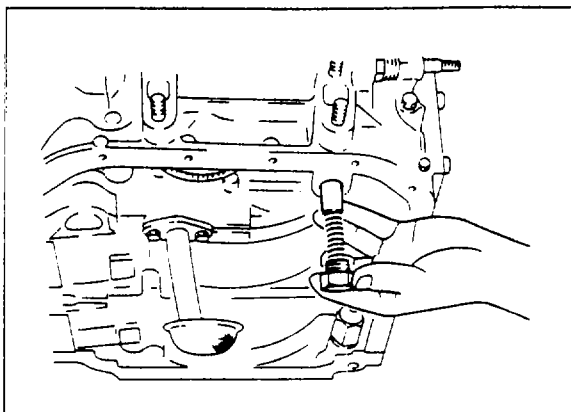
1. Remove the bypass valve from the bottom of the oil cooler.



67U02X-046

2. Place the bypass valve in oil and heat the oil gradually.
3. Check the protrusion of the valve at **65°C (149°F)**.

Protrusion: 5 mm (0.2 in) min.

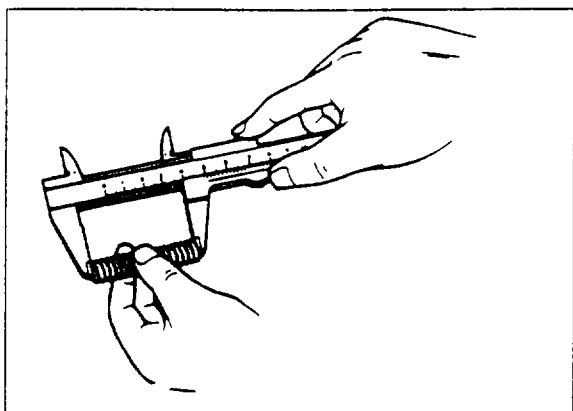


67U02X-047

OIL PRESSURE CONTROL VALVE

REMOVAL AND INSTALLATION

1. Remove the parts in the following order:
 - (1) Oil pan (Refer to page 2—8.)
 - (2) Cap bolt and spring
 - (3) Control plunger
2. Install in the reverse order.
3. Check the engine oil for leakage and level.

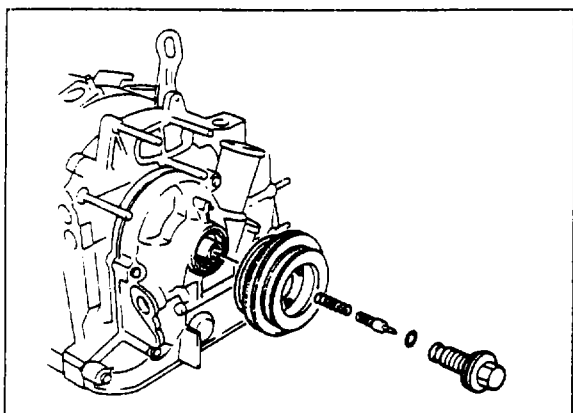


67U02X-048

INSPECTION

1. Check each part for damage or scoring. Replace if necessary.
2. Measure the free length of the spring, and if necessary, replace it.

Standard free length: 73.0 mm (2.87 in)

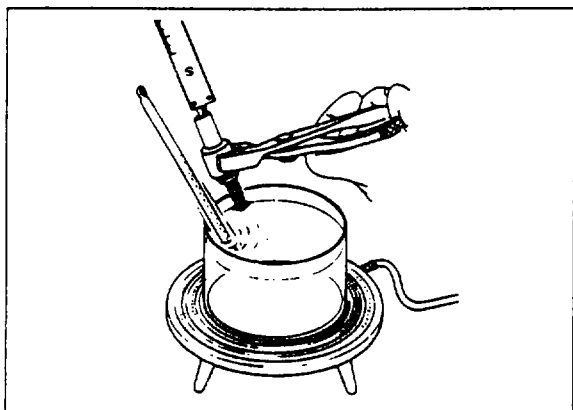


67U02X-049

ECCENTRIC SHAFT BYPASS VALVE

REMOVAL AND INSTALLATION

1. Remove the parts in the following order:
 - (1) Cooling fan
 - (2) Drive belts
 - (3) Eccentric shaft lock bolt
 - (4) Bypass valve and spring
2. Install in the reverse order. (Refer to page 2—13 when installing eccentric shaft pulley.)
3. Check the engine oil for leakage and level.



67U02X-050

INSPECTION

1. Place the eccentric shaft bypass valve in oil and heat up the oil gradually.
2. Check the protrusion of the valve at 60°C (140°F).

Protrusion: 6 mm (0.24 in) min.