# LUBRICATING SYSTEM


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## LUBRICATING SYSTEM

A two-rotor type pump supplies oil by forced circulation. The pump installed inside the front cover is driven by gears on the eccentric shaft.

A full-flow oil filter is provided on the rear housing of the engine. The metering oil pump delivers an adequate amount of oil into the float chamber of carburettor to lubricate seals.

An oil cooler is fixed beneath the radiator. When the oil temperature rises, a thermo-valve functions to cool the oil in the cooler.

## 2–A. LUBRICATING CIRCUIT

1. The oil enters the oil pump through an oil strainer and is discharged to the oil filter through the oil passage of the housing.
2. When the oil temperature exceeds 71°C (160°F), the thermo-valve in the front cover starts functioning to discharge the oil to the oil cooler from the oil pump.
3. The cooled oil passed through a hose from cooler is mixed with the uncooled oil passed through the passage of the housing, before the oil filter.
4. The filtered oil is discharged to the front main bearing through the tubular dowel and to the rear main bearing through the passage of the rear housing.
5. After lubricating the front and rear main bearings, the oil passes through the oil holes of the bearings and enters the oil passage provided in the eccentric shaft.
6. Stationary gears, internal gears and thrust bearings are lubricated with the oil discharged through the clearance between the main bearing and the shaft.
7. The oil circulating through the eccentric shaft passage lubricates the rotor bearings.
8. The eccentric shaft is equipped with two oil plug jets which are faced to front and rear rotor inner holes. The oil in the passage of the eccentric shaft is injected through the plug jets into the rotors and cools the rotors.
9. Oil passing through the tubular dowel is sent to the distributor and the metering oil pump.
10. From the metering oil pump the lubricant is discharged to the carburettor and is supplied into the combustion chambers together with the air-fuel mixture to lubricate the apex seal, corner seal, side seal and the housing.

## 2–B. PRESSURE REGULATOR

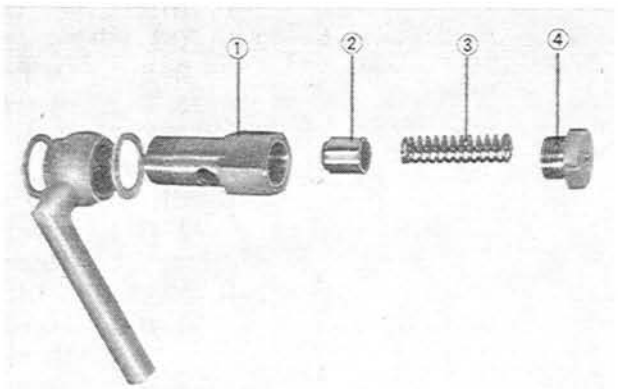


**Fig. 2–1**

1. Regulator body
2. Control plunger
3. Control spring
4. Plug

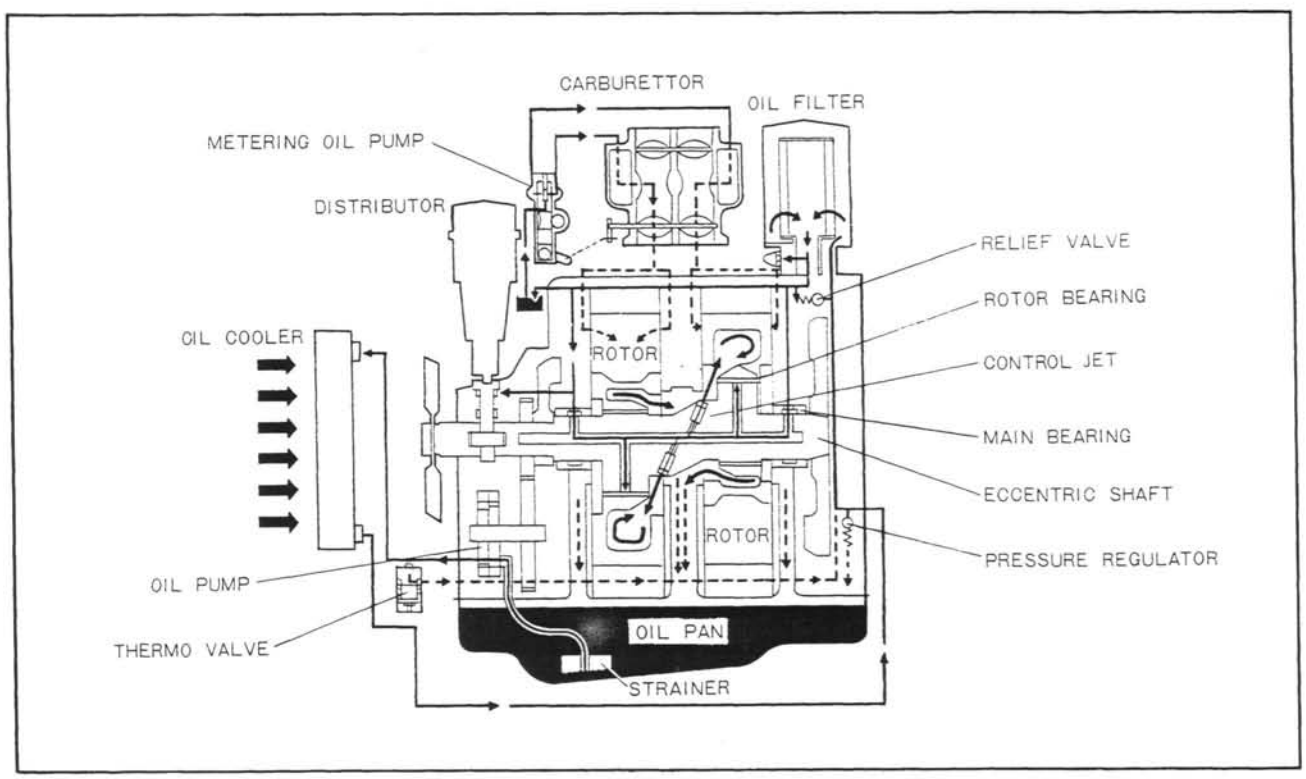


**Fig. 2–2** Lubricating circuit

## 2–B. OIL PRESSURE RELIEF VALVE

The oil pressure regulator valve is installed in the rear housing. The regulator valve opens when the number of engine revolutions increases and the oil pressure in the lubricating system rises. Then the oil pressure is relieved and excess oil is returned to the oil sump. By this function of the regulator valve, the oil pressure can be maintained at a maximum of 5.0 kg/cm² (71.1 lb/in²).

## 2–C. OIL PRESSURE SWITCH

The oil pressure switch is provided on the left side of the rear housing. This switch is connected to the warning lamp on the instrument panel. The normal pressure is 2.5 kg/cm² (35.6 lb/in²) during engine idling. If the oil pressure drops below 0.3 kg/cm² (4.3 lb/in²), the warning lamp lights up to indicate some troubles in the lubricating system. When the lamp comes on, immediate checks should be made.

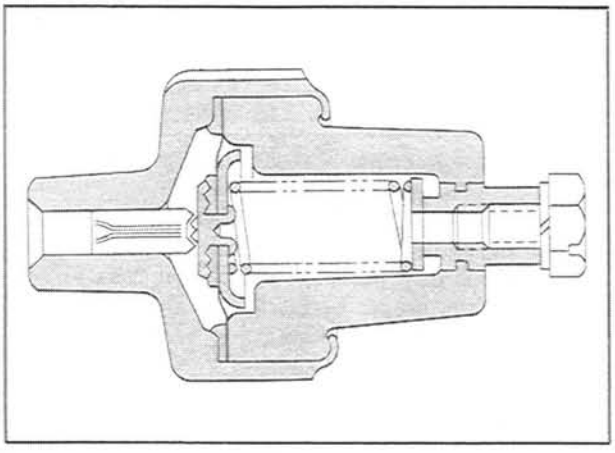

Fig. 2–3 Oil pressure switch

## 2–D. INSPECTING THE OIL PRESSURE

The oil pressure should be checked as follows:

1. Operate the engine until it is warmed up to the normal operating temperature.
2. Remove the oil pressure switch and connect an oil pressure gauge instead.
3. Operate the engine at 3,000 rpm and read the oil pressure gauge. The oil pressure should be 5.0 kg/cm² (71.1 lb/in²).

If the oil pressure is found extremely low, check the following points:

1) Make sure whether the oil level is between F and L on the dipstick gauge or not.
2) See if the oil filter is clogged. If clogged, replace the oil filter cartridge refer to 2–F.
3) Inspect the oil pump for defects, refer to 2–E.
4) Inspect the oil pressure relief valve and check plunger wear. If found defective, replace the valve. The specifications of the spring are in the following table.

| | |
|---|---|
| Free Length | 46.4 mm (1.827 in) |
| Set Length | 35.3 mm (1.390 in) |
| Set Load | 7.1 kg (15.6 lb.) |

## 2–E. OIL PUMP

The components of the trochoid rotor type oil pump are shown in Fig. 2–5.

The feeding capacity of the oil pump is 16 ~ 20 liters (34 ~ 42 U.S. pint, 28 ~ 35 Imp. pint) per minute at 6,000 rpm.

### 2–E–1. Oil Pump Inspection

For checking, proceed as follows:

1. Use a feeler gauge to check the clearance between the outer rotor and the inner rotor as shown in Fig. 2–4. The standard clearnace should be 0.01 ~ 0.09 mm (0.0004 ~ 0.0035 in).

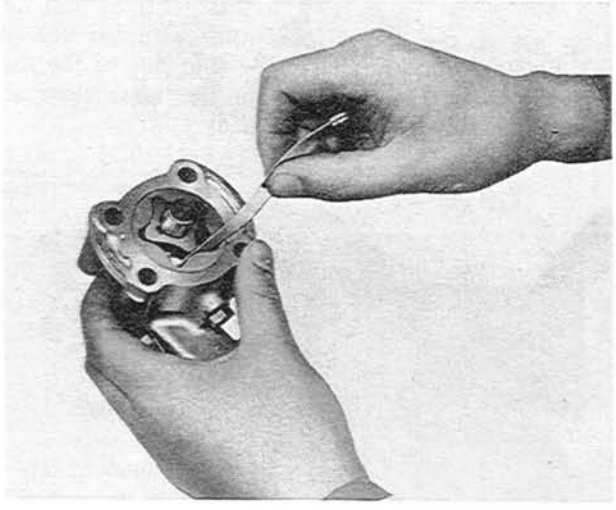

Fig. 2–4 Checking gap of rotors

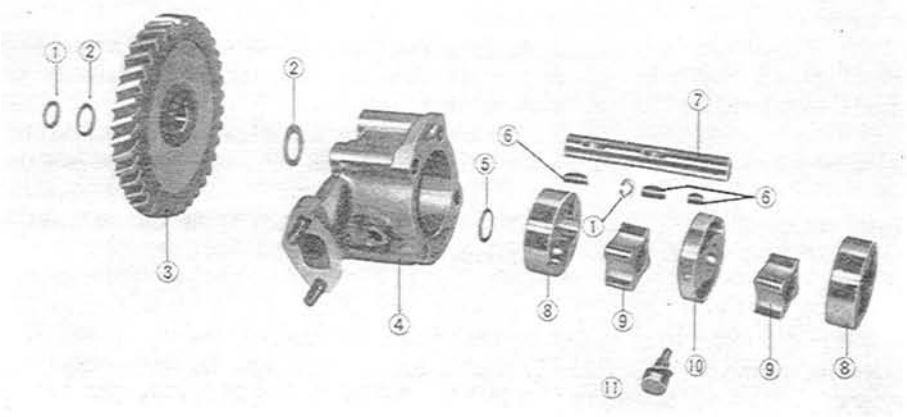

Fig. 2–5 Oil pump assembly

1. Snap ring
2. Adjusting washer
3. Oil pump driven gear
4. Oil pump body
5. Thrust washer
6. Woodruff key
7. Oil pump shaft
8. Outer rotor
9. Inner rotor
10. Intermediate plate
11. Set bolt & washer

2. Measure the clearance between the outer rotor and the pump body with the feeler gauge. The specified clearance is 0.20 ~ 0.25 mm (0.008 ~ 0.010 in).
3. Inspect the end float of the rotor with the feeler gauge as shown in Fig. 2–6. If the end float is too large, make corrections by scraping the pump body. The standard value of the end float is 0.10 ~ 0.20 mm (0.0014 ~ 0.008 in).

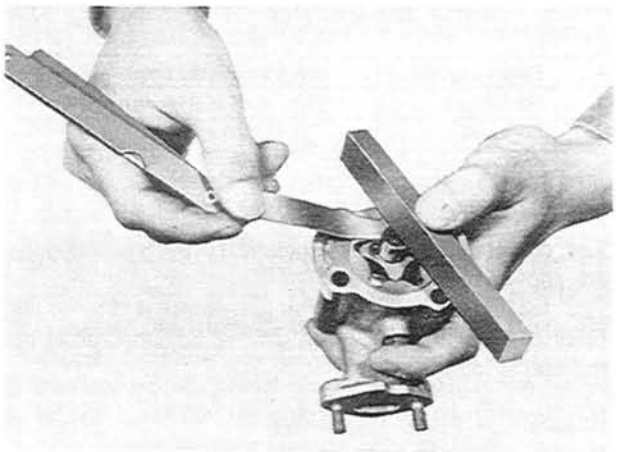

Fig. 2–6 Checking end float of rotors

### 2–E–2. Assembling the Oil Pump

1. Attach the stop ring and the key to the oil pump drive shaft.
2. Attach the inner rotor to the shaft by matching the key groove of the inner rotor with the key.
3. Fix the thrust washer to the stop ring of the shaft as shown in Fig. 2–7. Mount the inner rotor and shaft assembly to the pump body.

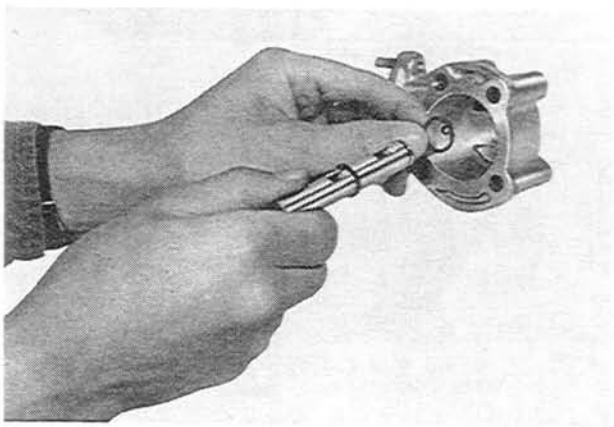

Fig. 2–7 Assembling oil pump

4. Apply oil to the outer rotor. Attach the outer rotor to the body with the chamfered side facing the driven gear.
5. Attach the intermediate plate to the body. Tighten the screw.
6. Fix the key to the key groove of the shaft.
7. Mount the inner rotor on the shaft with matching the key groove.
8. Mount the outer rotor
9. Mount the oil pump assembly on the front cover and fix it with the bolts. Rotate the drive shaft by hand to see whether it rotates smoothly.
10. Mount the thrust washer and driven gear on the shaft (insert the key).
11. Insert an available shims between the driven gear and the stop ring so that the clearance between the oil pump body and the driven gear is 0.1 ~ 0.2 mm (0.004 ~ 0.008 in ). The following three kinds of shims are available : 0.1 mm (0.004 in ), 0.3 mm (0.012 in ), 0.6 mm (0.024 in ).
12. Then fix the stop ring.

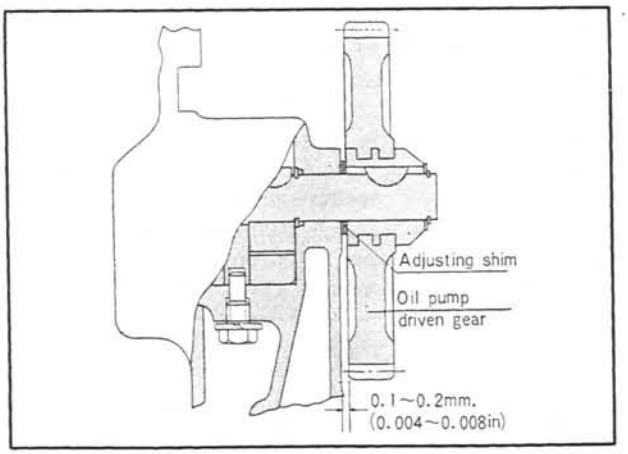


Fig. 2–8 Clearance of drive gear and body

### 2–E–3. Replacing the Oil Pump Gears

If the oil pump drive gear or the driven gear should be replaced, they must be replaced in pairs in order to obtain the proper backlash. The standard backlash is 0.08 ~ 0.12 mm (0.003 ~ 0.005 in ).

## 2–F. OIL FILTER

The oil filter is of the cartridge type. The element is sealed in its container as a unit.
The oil filter is equipped with a relief valve. When the filter-flow resistance exceeds 0.8 ~ 1.2 kg/cm² (11.4 ~ 17.1 lb/in²) on account of clogging and contamination of the element, the relief valve is opened by the oil pressure.
The oil is then discharged directly to the engine without passing through the oil filter. The oil filter element should be replaced in intervals of 12,000 km (8,000 miles).

1. Use the oil filter wrench to replace the oil filter cartridge.
2. Apply a small quantity of oil to the rubber packing of the new filter cartridge and fix the cartridge to the filter bracket.
3. Tighten the cartridge a farther 2/3 of a turn by hand after the oil seal contacts with the seal surface but absolutely no more.
4. Start the engine and check if the oil leaks from the joints.

## 2–G. OIL THERMO–VALVE

The oil thermo-valve is provided in the front cover and consists of a pellet, a sliding valve and a return

spring. The oil sent from the oil pump to the thermo-valve takes two courses thereafter depend upon oil temperature, one leading to the oil cooler, and the other bypassing the oil cooler and leading direct to the oil filter by way of the housing. The passage leading to the oil cooler is always opened. The passage leading to the housing is also fully opened when the oil temperature is low, and most oil takes this passage and proceeds direct to the oil filter via the housing as there is resistance in the oil cooler. When the oil temperature rises to over 71°C (160°F), the pellet starts functioning, and when the oil temperature reaches 78°C (172°F), the passage leading to the housing gets completely closed. During the condition of the temperature between 71° ~ 78°C (160° ~ 172°F), a part of oil is sent directly to the oil filter via housing and the rest is cooled in the cooler before being sent to the oil filter. After exceeding 78°C (172°F), as the oil passage to the housing is closed, all oil is sent to the oil filter through the cooler.

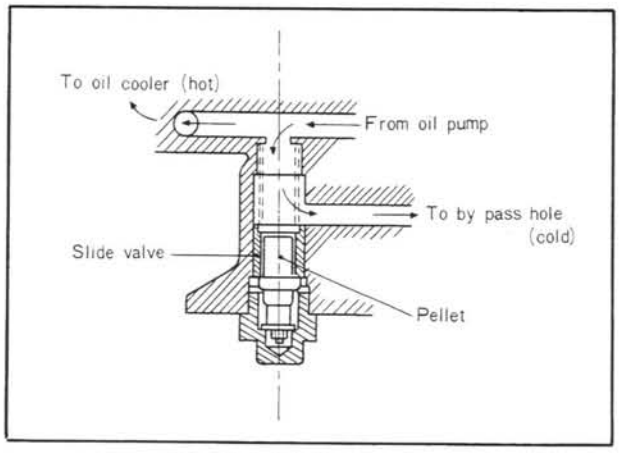


**Fig. 2–9** Oil thermo-valve

### 2–G–1. Inspecting the Oil Thermo-Valve

1. Inspect the sliding surface of the slide valve to see whether there is any damage.
2. Inspect the return spring for any damage or deterioration. If the deterioration is serious, replace the spring. The free length of the spring should be 43.8 mm (1.724 in).
3. Inspect the pellet by inserting it in water together with a thermometer. Stir the water and gradually heat it. Check whether the pellet begins to function at 71°C (160°F) and lifts by 6 mm (0.236 in) at 78°C (172°F).

## 2–H. METERING OIL PUMP

The plunger type metering oil pump is provided to send a proper amount of oil to the carburettor. The oil enters the combustion chamber together with the air fuel mixture. Thus the sliding faces of seals and housing are lubricated.

The supplied amount of oil is controlled by the engine revolutions and the load, in the following way: The control lever of the pump is interlocked with the throttle lever of the carburettor and moves the control pin. The control pin is cam-shaped shaft and is in contact with the cam-shaped tip of the plunger, and so the stroke of the plunger is controled with the opening angle of the throttle valve. When the opening of the throttle valve is small, the stroke of the plunger is only a little. Thus the stroke of the differential plunger which is turned and pushed together with the plunger is small to keep the oil discharge small.

When the opening of the throttle valve becomes large, the stroke of plunger becomes larger to increase the stroke of the differential plunger. Thus the supplied amount of oil becomes larger.

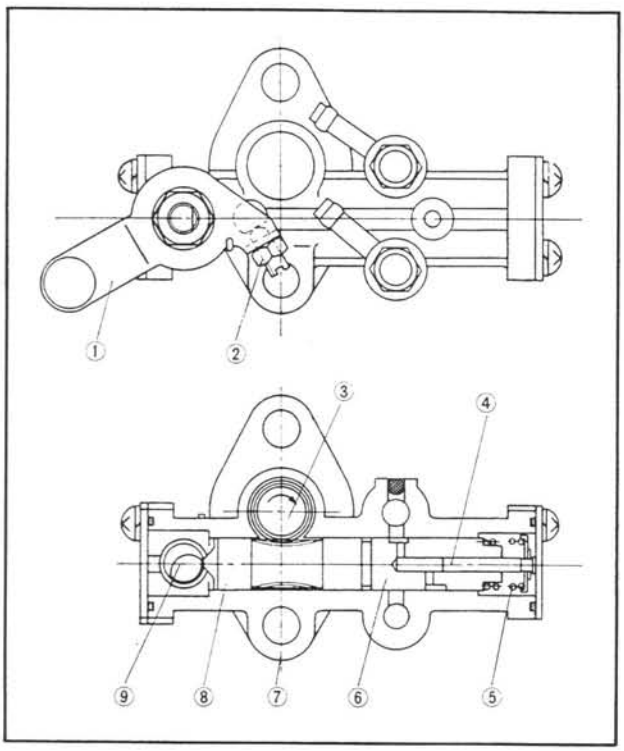


**Fig. 2–10** Metering oil pump

1. Control lever
2. Adjust screw
3. Driving worm
4. Sub-plunger
5. Plunger spring
6. Differential plunger
7. Pump body
8. Plunger
9. Control pin

### 2–H–1. Inspecting the Metering Oil Pump

The amount of oil discharge from the oil metering pump should be inspected as follows:

Disconnect the oil tubes, which are connected with the carburettor, at the carburettor side.

Disconnect the connecting rod of the oil metering pump at the carburettor side. Set the engine so as to revolve at 2,000 rpm. Check the amount of oil discharged from the oil tube of the oil metering pump and if it is 6.5 ±1 cc/10 min, discharge of oil is normal. Otherwise, adjust the oil metering pump.

### 2–H–2. Adjusting the Metering Oil Pump

For adjustment of the oil metering pump, the amount of oil discharge will be increased by turning the adjust screw clockwise and be decreased by turning it counterclockwise.