WORKSHOP MANUAL

MAZDA RX-3

ENGINE

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TOYO KOGYO CO., LTD.
HIROSHIMA, JAPAN

NOVEMBER, 1971

ENGINE

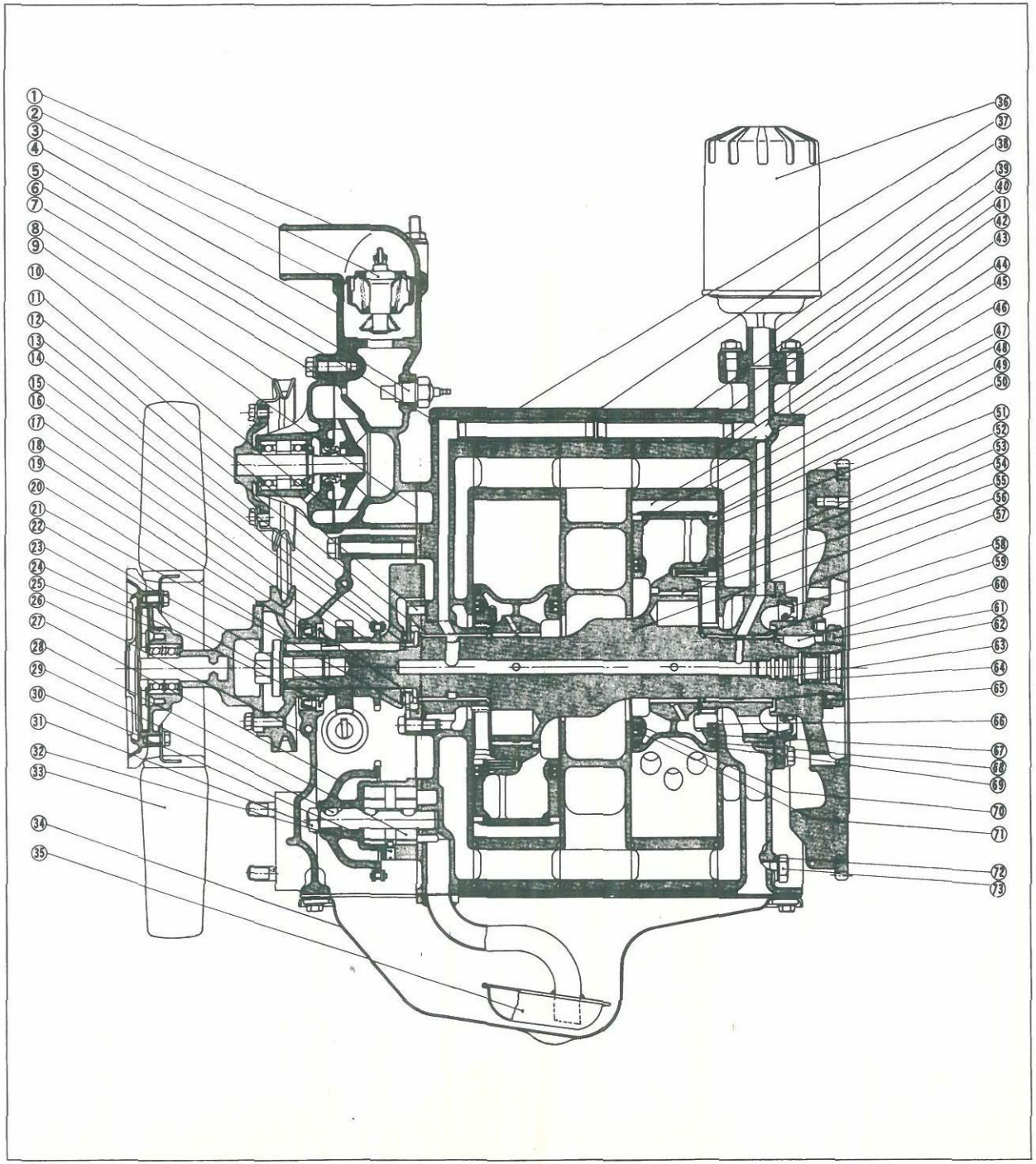


Fig. 1–1 Engine cross section (1)

1. Thermostat cover
2. Thermostat
3. Gasket
4. Water pump casing
5. Water thermometer unit
6. Front housing
7. Water pump body
8. Water pump pulley
9. Gasket
10. Gasket
11. Dowel pin
12. Bearing housing
13. Needle bearing
14. Spacer
15. Oil pump drive chain
16. Oil pump drive sprocket
17. Distributor drive gear
18. Thrust plate
19. Eccentric shaft front oil seal
20. Eccentric shaft pulley
21. Front stationary gear
22. Spacer
23. Eccentric shaft pulley bolt
24. Oil thrower
25. Fan drive
26. *Front cover*
27. Oil pump driven sprocket
28. Oil pump rotor
29. Key
30. Oil pump body
31. Oil pump drive sprocket nut
32. Oil pump middle plate attaching screw
33. *Cooling fan*
34. Oil pan
35. Oil strainer
36. Oil filter
37. Front rotor housing
38. Intermediate housing
39. Oil filter cover
40. Rear rotor housing
41. "O" ring
42. Tubular dowel
43. "O" ring
44. Sealing rubber (outer)
45. Rear housing
46. Apex seal
47. Apex seal spring
48. Sealing rubber (Inner)
49. Corner seal spring
50. Corner seal
51. Rear rotor
52. Oil seal (Outer)
53. Oil seal (Inner)
54. Flywheel
55. Rear rotor bearing
56. Eccentric shaft
57. Rear stationary gear
58. Eccentric shaft rear oil seal
59. Main bearing
60. Key
61. Flywheel nut
62. Needle bearing
63. "O" ring
64. *Grease seal*
65. Lock washer (Flywheel nut)
66. "O" ring (Inner oil seal)
67. "O" ring (Outer oil seal)
68. Side seal (Inner)
69. Side seal (Outer)
70. Oil seal spring (Inner)
71. Oil seal spring (Outer)
72. *Sealing washer*
73. Tension bolt

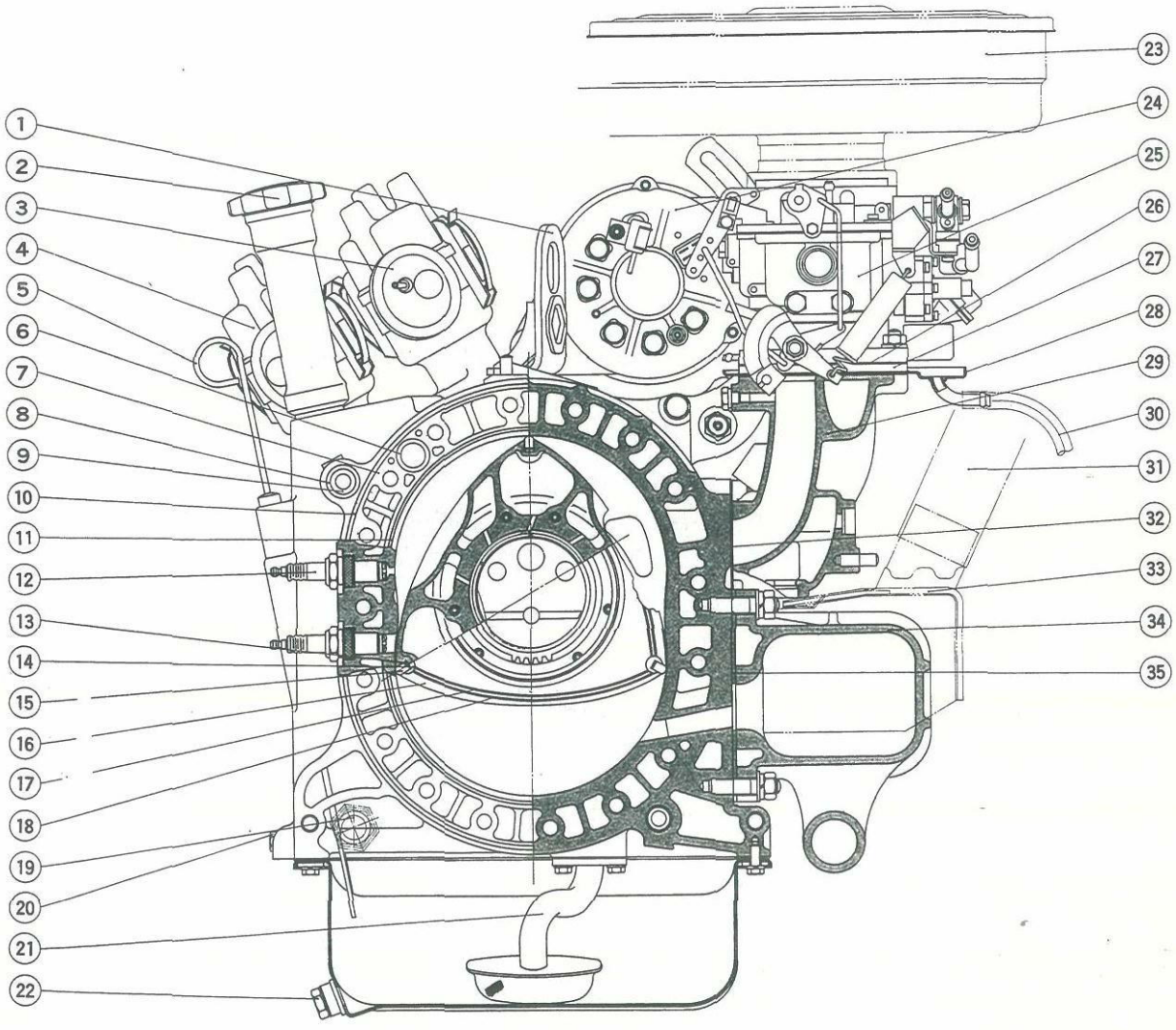


Fig. 1–2 Engine cross section (2)

1. Engine hanger bracket
2. Oil filler cap
3. Trailing distributor
4. Leading distributor
5. Dipstick gauge
6. "O" ring
7. Rotor housing
8. "O" ring
9. Tubular dowel
10. Sealing rubber (Outer)
11. Sealing rubber (Inner)
12. Spark plug
13. Apex seal spring
14. Corner seal
15. Apex seal
16. Rotor
17. Side seal (Inner)
18. Side seal (Outer)
19. Pressure regulator
20. Coolant drain plug
21. Oil filter
22. Oil drain plug
23. Air cleaner
24. Alternator
25. Carburetor
26. Gasket
27. Insulator
28. Carburetor tray
29. Intake manifold
30. Drain pipe
31. Air hose
32. Gasket
33. Hot air duct
34. Exhaust manifold
35. Gasket

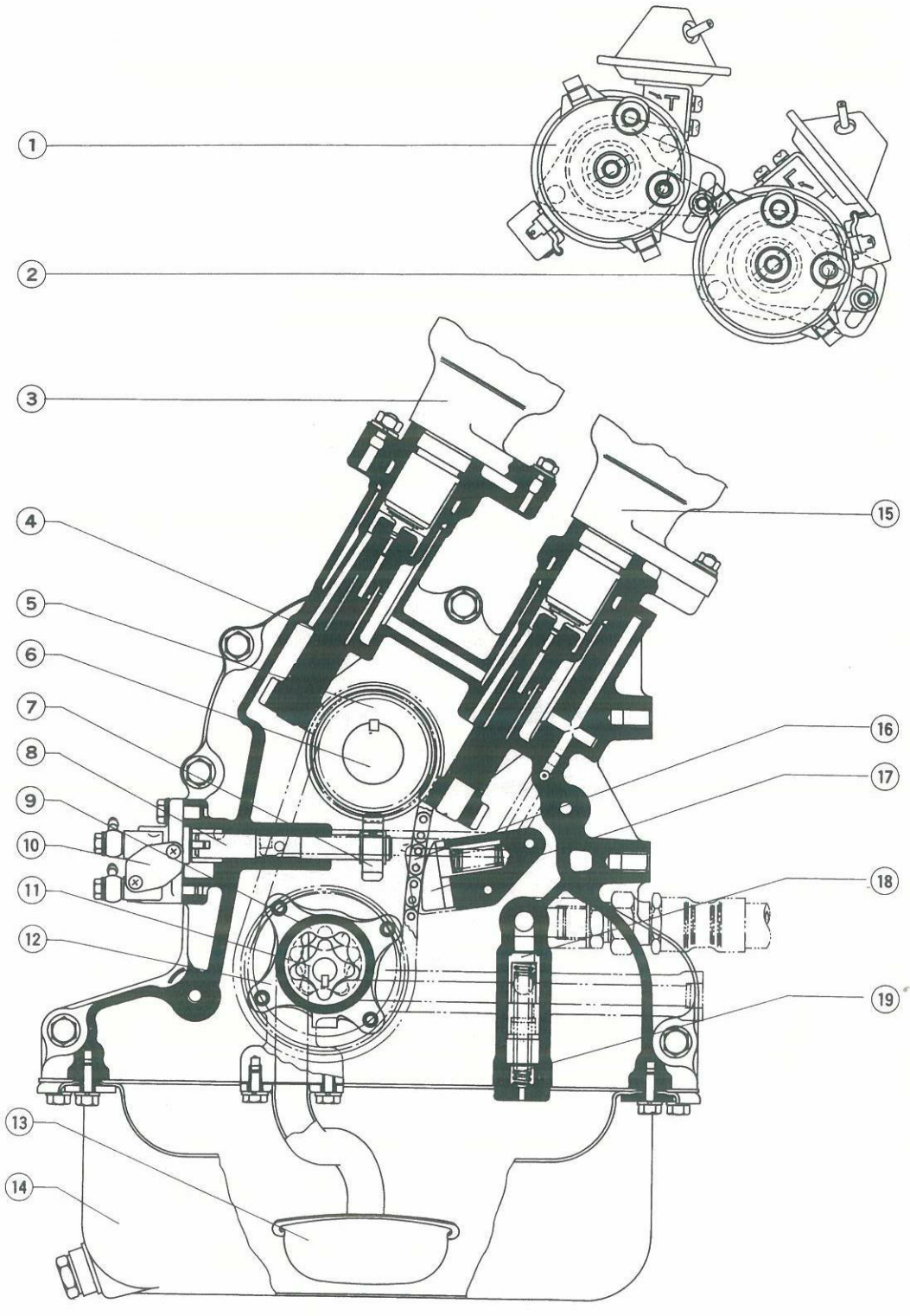


Fig. 1–3 Engine cross section (3)

1. Trailing distributor
2. Leading distributor
3. Trailing distributor socket
4. Distributor shaft
5. Distributor drive gear
6. Eccentric shaft
7. Metering oil pump driven gear
8. Metering oil pump shaft
9. Oil pump outer rotor
10. Metering oil pump
11. Oil pump inner rotor
12. Oil pump body
13. Oil strainer
14. Oil pan
15. Leading distributor socket
16. Oil pump chain
17. Oil pump chain adjuster
18. Pressure regulator
19. Spring

DESCRIPTION

RX-3 is mounted with a 2-rotor type rotary engine of Toyo Kogyo's unique design. Its single chamber capacity is 491 cc (30.0 cu. in) and the compression ratio is 9.4 : 1.

The main component parts of the rotary engine are entirely different from those of the conventional reciprocating engine. The rotor which correspond to the piston of the reciprocating engine makes a rotary motion due to the explosion pressure occurring in the chamber formed by the rotor housing and side housings which correspond to the cylinder of the reciprocating engine. This rotary motion of the rotor is converted into the rotary motion of the eccentric shaft, thereby producing the output.

1–A. ON CAR SERVICE

1–A–1. Eccentric Shaft Front Oil Seal

a. Removing of eccentric shaft front oil seal

1. Remove the screws and bolts attaching the radiator shroud, and remove the radiator shroud.
2. Remove the bolts that attach the cooling fan drive assembly onto the eccentric shaft pulley and remove the fan drive assembly.
3. Loosen the V-belt adjusting bar bolt and remove the V-belt.
4. Lock the flywheel from the service hole on the clutch housing with a suitable tool and remove the eccentric shaft pulley bolt. Then, remove the pulley.

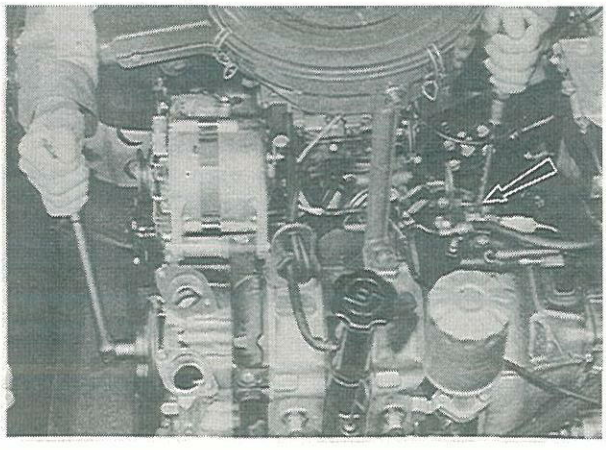


Fig. 1–4 Removing of eccentric shaft pulley

5. Remove the oil seal from the front cover with a suitable tool.

b. Installing of eccentric shaft front oil seal

Follow the removal procedures in the reverse order.

Note :

(a) Before installing the oil seal, apply lubricant onto the lip of the oil seal.

(b) Tighten the pulley bolt to **8.5 m-kg (60 ft-lb).**

(c) Adjust the V-belt deflection to **15 ~ 17 mm (0.59 ~ 0.67 in).**

1–A–2. Front Cover and Bearing Housing

a. Removing of front cover and bearing housing

1. Raise the front of the vehicle and support with stands.
2. Remove the bolts and screws attaching the engine under cover and remove the under cover.
3. Drain the lubricant by removing the drain plug. After draining, reinstall the drain plug.
4. Remove the bolts attaching the oil pan and remove the oil pan with gasket.
5. Remove the bolts attaching the oil strainer and remove the oil strainer.
6. Loosen the alternator adjusting bar bolt and remove the V-belt.
7. Remove the distributor caps.
8. Remove the nuts securing the distributors and lift the distributors out of the sockets.

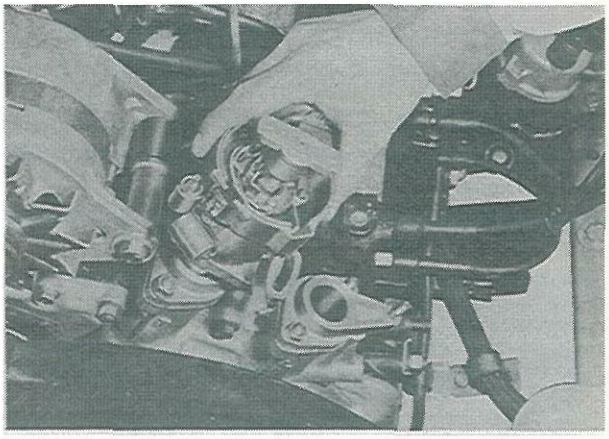


Fig. 1–5 Removing of distributor

9. Apply identification marks onto the distributor sockets and front cover for convenience in reassembly. Remove the nuts attaching the distributor sockets and remove the sockets.
10. Remove the screws and nuts attaching the radiator shroud and remove the shroud.
11. Remove the bolts that attach the cooling fan

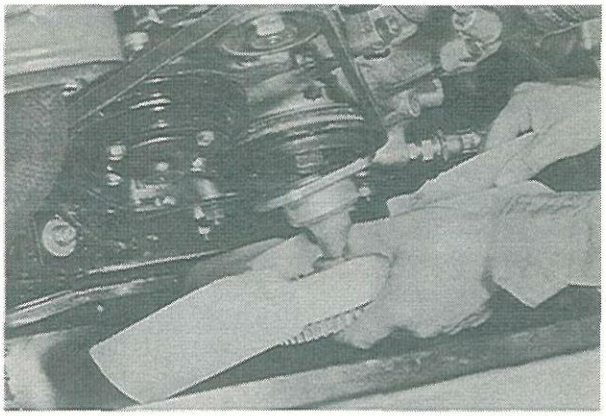


Fig. 1–6 Removing of cooling fan drive assembly

drive assembly onto the eccentric shaft pulley and remove the fan drive assembly.
12. Apply a dial indicator onto the eccentric shaft pulley as shown in Fig. 1–7. Move the pulley fore and aft, and take the reading of the indicator. The end play should be **0.04 ~ 0.07 mm (0.0016 ~ 0.0028 in)**. If it is not within the limits, adjust it by means of grinding the spacer using the emery paper on the surface plate, or by replacing the spacer.

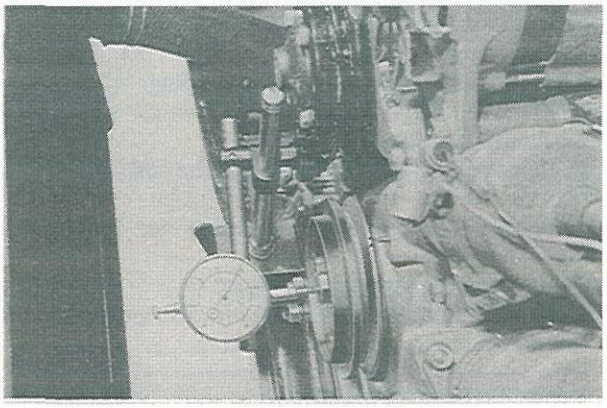


Fig. 1–7 Checking of eccentric shaft end play

13. Lock the flywheel from the service hole on the clutch housing and remove the eccentric shaft pulley bolt. Then, remove the pulley and key.
14. Disconnect the oil hose from the front cover as shown in Fig. 1–8.

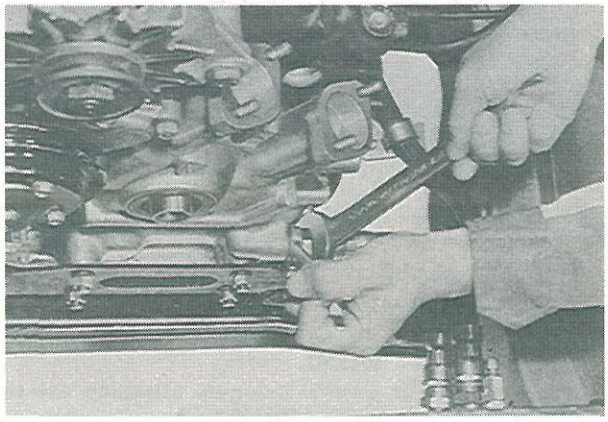


Fig. 1–8 Disconnecting of oil hose

15. Disconnect the oil tubes and connecting rod from the metering oil pump.
16. Place a jack under the intermediate housing, protecting the housing with a block of wood.
17. Remove the nuts attaching the engine mounting brackets and remove the brackets.
18. Remove the bolts attaching the front cover and remove the front cover.
19. Slide the oil thrower, spacer and distributor drive gear off the shaft.
20. Remove the nuts attaching the chain adjuster and remove the adjuster.
21. Remove the lock nut and washer for the oil pump driven sprocket. Slide the oil pump drive sprocket and driven sprocket together with the drive chain off

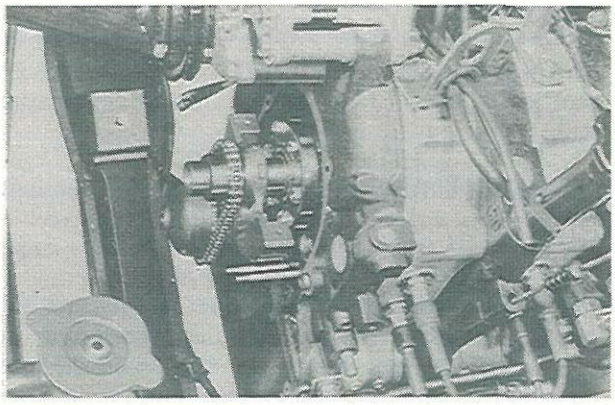


Fig. 1–9 Removing of sprockets and chain

the eccentric shaft and oil pump shaft simultaneously. Remove the key on the eccentric shaft.
22. Slide the balance weight, thrust washer and needle bearing off the shaft.
23. Remove the bolts attaching the bearing housing and slide the bearing housing, needle bearing, spacer and thrust plate off the shaft.

b. Checking of front cover and bearing housing
1. Replace the needle bearings that are worn or damaged.
2. Replace the bearing housing if there is any evidence of wear or damage.
3. Replace the thrust washer and thrust plate that are worn or damaged.
4. Replace the distributor drive gear if worn or scored.
5. Replace the chain adjuster, oil pump sprockets and drive chain if there is any evidence of wear or damage.
6. Replace the front cover that is cracked or damaged. Replace the oil seal in the cover if necessary.

c. Installing of front cover and bearing housing
1. Apply lubricant, and install the thrust plate and needle bearing onto the eccentric shaft.
2. Install the bearing housing onto the shaft, tighten the attaching bolts to 2.0 m-kg (15 ft-lb), and then bend the tabs of the lock washers.
3. Install the spacer, needle bearing and thrust washer onto the shaft and apply lubricant onto them.

Note :
Ensure that two needle bearings are placed in their proper position at the center of the shaft.

4. Install the balance weight onto the shaft.
5. Fit the keys onto the oil pump shaft and eccentric shaft. Engage the oil pump drive chain with the driven sprocket and drive sprocket, and install the sprockets with chain onto the eccentric shaft and oil pump shaft simultaneously.

Note :
When installing the chain, it should be engaged to the sprockets before installing the sprockets to the eccentric shaft and oil pump shaft.

6. Install the distributor drive gear, spacer and oil thrower onto the eccentric shaft.

Note:
The "F" mark on the gear must be faced to the front of the engine.

7. Fit the eccentric shaft pulley key onto the shaft and install the pulley onto the shaft so that the key way of the pulley aligns with the key. Tighten the pulley bolt to **8.5 m-kg (60 ft-lb).**
8. Check the eccentric shaft end play with a dial indicator. If the end play is not within **0.04 and 0.07 mm (0.0016 and 0.0028 in),** adjust it by grinding the spacer or replacing the spacer.
9. Remove the eccentric shaft pulley bolt and remove the pulley.
10. Install the chain adjuster and tighten the nuts.

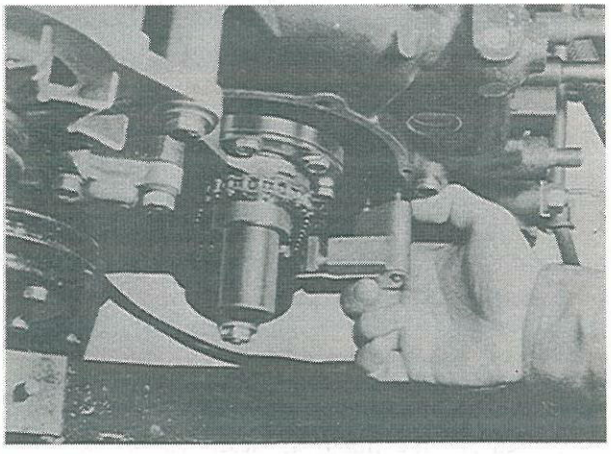


Fig. 1–10 Installing of chain adjuster

11. Tighten the oil pump driven sprocket nut to **3.5 m-kg (25 ft-lb)** and bend the tab of the lock washer.
12. Place the "O" ring on the oil passage of the front housing.

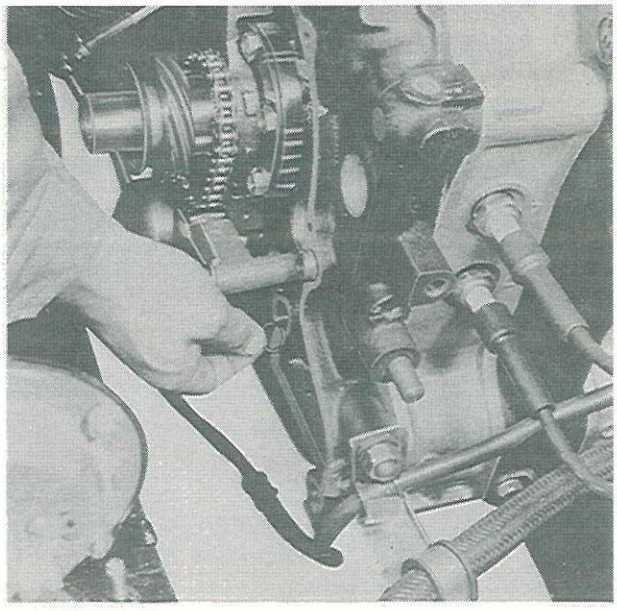


Fig. 1–11 Placing of "O" ring

13. Position the gasket and front cover onto the front housing and tighten the nuts to **2.0 m-kg (15 ft-lb).**

Note:
Cut off the excess gasket on the front cover along the mounting surface of the oil pan.

14. Secure the connecting rod to the metering oil pump with the cotter pin and connect the oil tubes with the metering oil pump.
15. Install the eccentric shaft pulley onto the shaft and tighten the pulley bolt to **8.5 m-kg (60 ft-lb).**
16. Place the gasket and oil strainer on the front housing and tighten the bolts.
17. Apply sealing agent onto the mating surfaces of the oil pan and each housing.
18. Place the gasket and oil pan in position and install the bolts through the stiffeners. Tighten the bolts **little by little in turn** until the torque becomes **1.0 m-kg (7.0 ft-lb) evenly.**
19. Rotate the eccentric shaft until the **yellow mark** on the pulley aligns with the needle on the front cover.

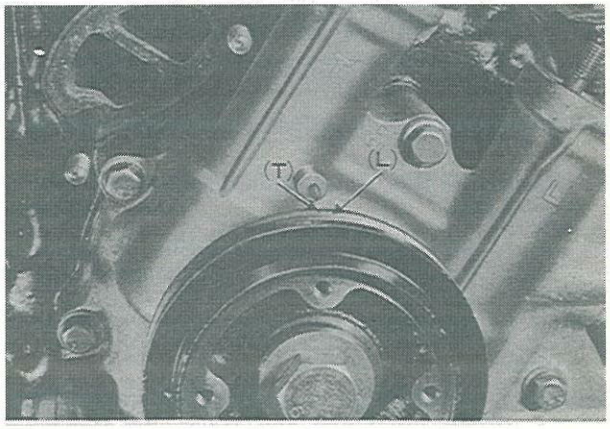


Fig. 1–12 Aligning of top dead center

20. Insert the trailing distributor socket through the gasket into the front cover so that the groove on the drive shaft is at an inclination of about 34° to the right against the longitudinal axis of the engine. Tighten the nuts attaching the socket.

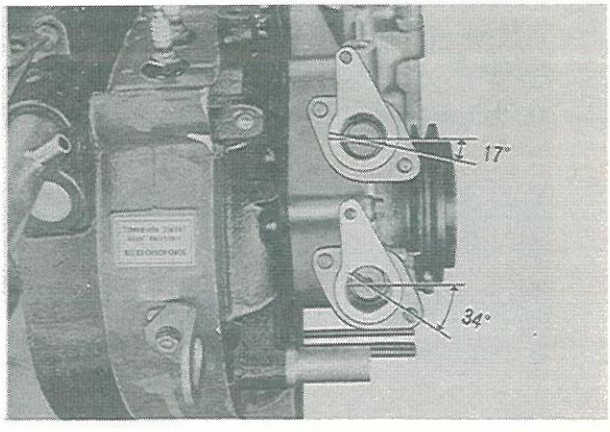


Fig. 1–13 Position of distributor sockets

21. The leading distributor socket is mounted at an inclination of 17° against the longitudinal axis of the engine.
22. Align the identification marks on each distributor housing and driven gear.
23. Insert the trailing and leading distributors into their respective sockets so that the tongue on the end of the distributor shaft fits into the groove on the drive shaft.

Note:
The marks on the distributor and front cover, "T" and "L", must be coincide with each other.

24. Rotate each distributor slightly in the direction shown in Fig. 1–14 and stop it when the contact points start to separate. Then, tighten the lock nut for each distributor.

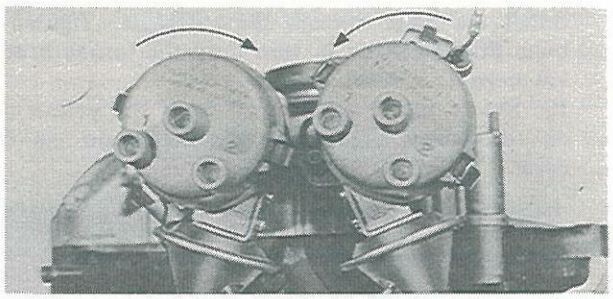


Fig. 1–14 Adjusting of ignition timing

25. Install the engine mounting brackets and tighten the nuts.
26. Connect the oil hose with the front cover.
27. Install the engine under cover, and tighten the bolts and screws.
28. Install the cooling fan drive assembly onto the eccentric shaft pulley and tighten the bolts.
29. Install the radiator shroud and tighten the bolts.
30. Install the V-belt and adjust the belt deflection to **15 ~ 17 mm (0.59 ~ 0.67 in).**
31. Fill the engine with lubricant.

1–A–3. Eccentric Shaft Rear Oil Seal

a. Replacing of eccentric shaft rear oil seal
1. Remove the clutch assembly as described in **Par. 6A–B–1.**

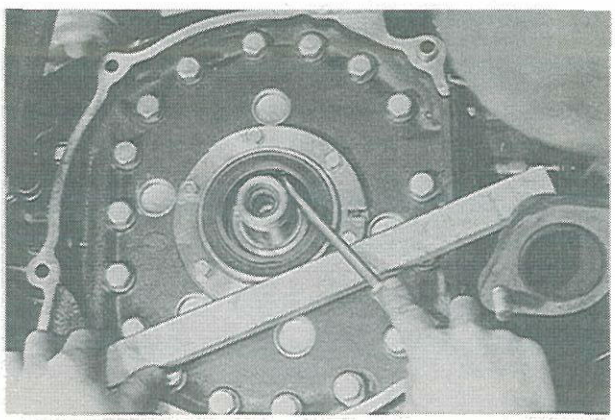


Fig. 1–15 Removing of oil seal

2. Remove the oil seal with a suitable tool, as shown in Fig. 1–15.
3. Apply lubricant onto the lip of the oil seal and install the oil seal using a plastic hammer, as shown in Fig. 1–16.

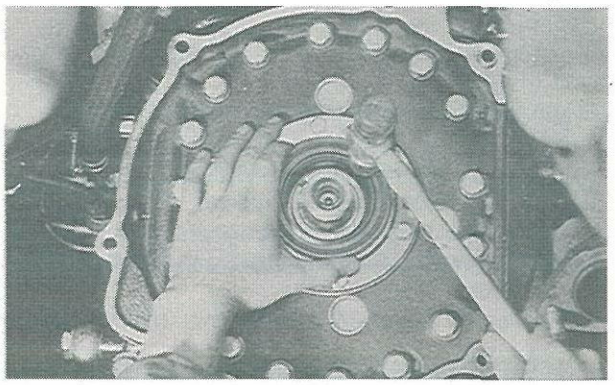


Fig. 1–16 Installing of oil seal

4. Install the clutch assembly.

1–B. MAJOR SERVICE

1–B–1. Engine Removal

The procedures for removing the engine from the vehicle for overhauling are as follows :
1. Remove the hood, as described in **Par. 14–A–1.**
2. Remove the engine under cover, and drain the coolant and the engine lubricant.
3. Disconnect the negative battery cable from the battery terminal.
4. Remove the air cleaner and support bracket.
5. Disconnect the choke cable and accelerator cable from the carburetor.
6. Disconnect the fuel pipes from the carburetor.
7. Remove the nuts attaching the thermostat cover and disconnect the engine earth cable from the thermostat cover. After disconnecting, install the attaching nuts.

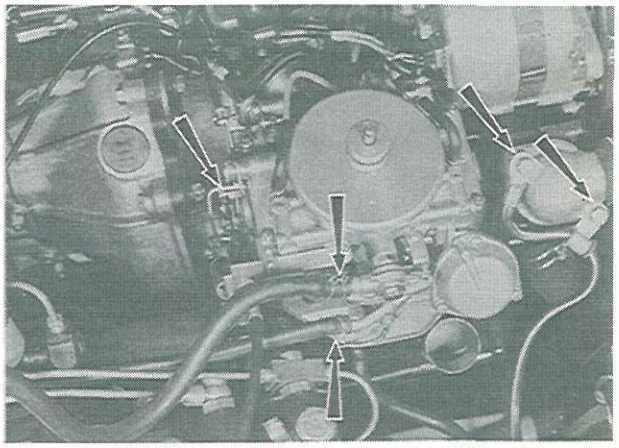


Fig. 1–17 Disconnecting of cables and pipes

8. Disconnect the vacuum hose for the power brake unit from the intake manifold.
9. Remove the bolts attaching the radiator shroud and remove the shroud.
10. Remove the bolts attaching the cooling fan drive assembly onto the eccentric shaft pulley and remove the fan drive assembly.
11. Loosen the water hose clamps, and remove the radiator upper and lower hoses.

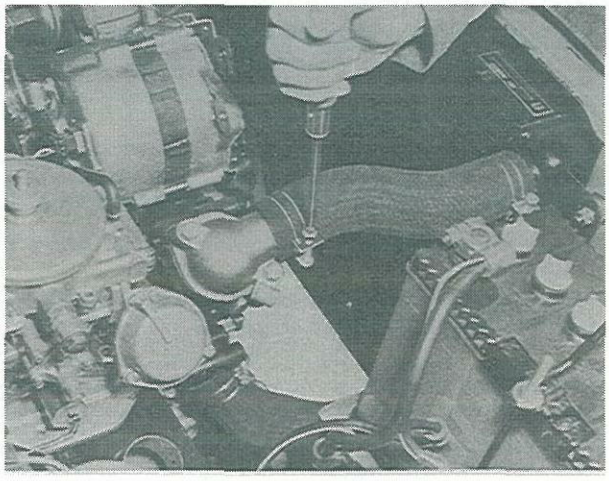


Fig. 1–18 Loosening of water hose clamps

12. Pull the high tension cables off the spark plugs.
13. Pull the primary wires off the distributors and remove the distributor caps.
14. Disconnect the wires at the alternator, water temperature gauge unit, oil pressure switch, carburetor coasting richer and starting motor.
15. Disconnect the heater hoses from the engine.
16. Disconnect the oil hoses from the engine front cover and rear housing.

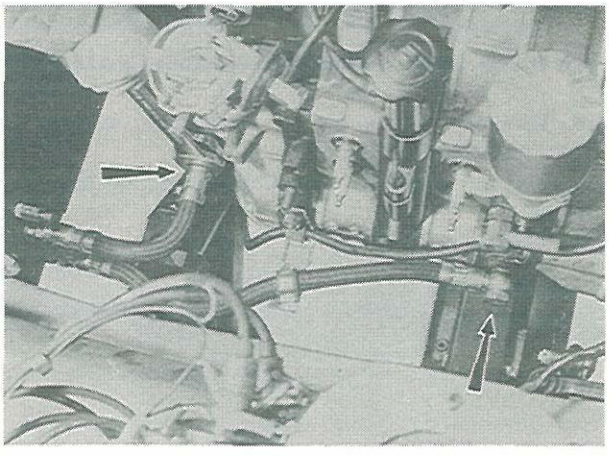


Fig. 1–19 Disconnecting of oil hoses

17. Disconnect the battery positive cable from the engine.
18. Remove the nuts attaching the clutch release cylinder. Then, remove the release cylinder from the clutch housing and wire it to the body to prevent damage.
19. Disconnect the exhaust pipe from the exhaust manifold.
20. Remove the bolts and nuts securing the clutch housing to the engine rear housing.
21. Support the transmission with a jack.
22. Remove the nuts from each engine mounting bracket.
23. Fit a suitable lifting sling to the engine hanger bracket on the engine rear housing. Attach the sling to a hoist or other lifting device and take up all slack.
24. Pull the engine forward until it clears the clutch shaft. Then, lift the engine from the vehicle. Take care not to damage the other components.
25. Remove the nuts attaching the hot air duct onto the exhaust manifold and remove the air duct.
26. Remove the nuts attaching the exhaust manifold, and remove the manifold and gaskets.

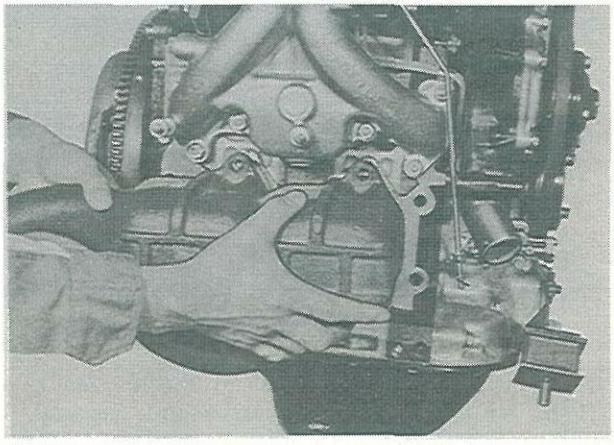


Fig. 1–20 Removing of exhaust manifold

27. Mount the engine on the **work stand** (Part Nos, 49 0839 000, 49 0813 005 and 49 0820 006).

1–B–2. Engine Disassembly

Engine disassembly should be done in the following order after removing the engine from the vehicle.
1. Disconnect the metering oil pump connecting rod, oil tubes and vacuum sensing tube from the carburetor.
2. Remove the nuts attaching the intake manifold, and remove the carburetor and intake manifold assembly.

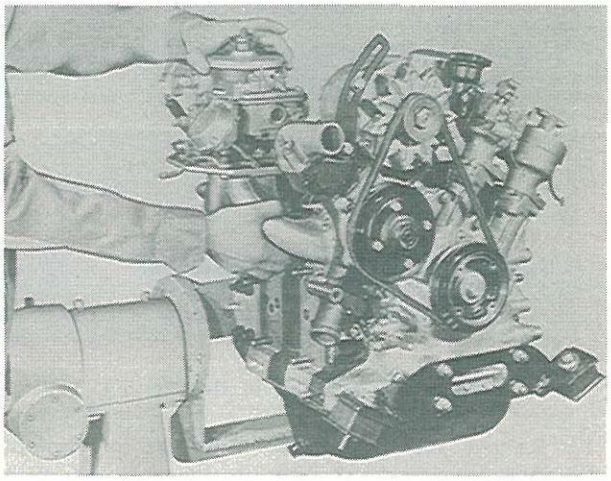


Fig. 1–21 Removing of intake manifold assembly

3. Remove the alternator adjusting bar bolt. **Do not** remove the adjusting bar.
4. Remove the bolt and nut attaching the alternator, and remove the alternator and V-belt.
5. Remove the bolts attaching the water pump pulley to the water pump and remove the pulley.
6. Remove the five nuts and two bolts attaching the water pump and remove the water pump.
7. Remove the nuts securing each distributor and lift the distributors out of the sockets.

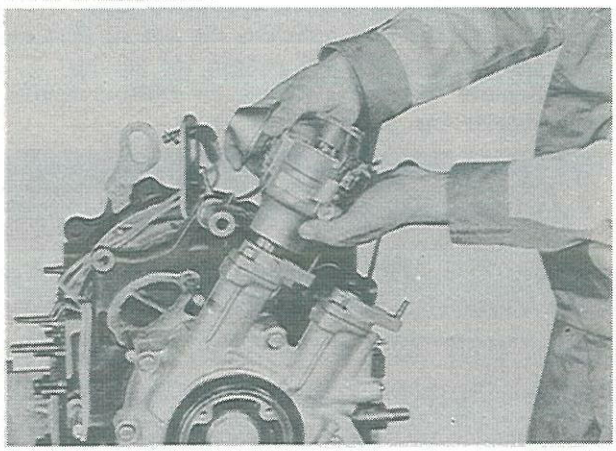


Fig. 1–22 Removing of distributors

8. Apply **identification marks** on the distributor sockets for convenience in reassembly. Remove the nuts securing each distributor socket and pull the sockets out of the front cover.
9. Attach the **ring gear brake** (Part No. 49 0820 060A) to the flywheel.
10. Remove the eccentric shaft pulley bolt and remove the pulley and key.
11. Remove the bolts attaching the clutch cover onto the flywheel, and remove the clutch cover and pressure plate assembly and clutch disc.
12. Straighten the tab of the lock washer and remove the flywheel nut using the **flywheel nut wrench** (Part No. 49 0820 035).

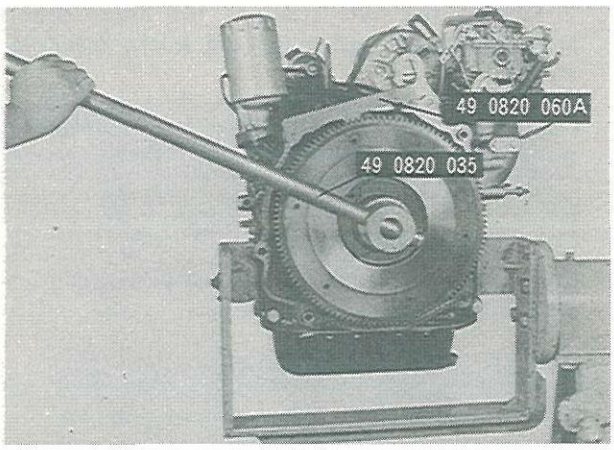


Fig. 1–23 Removing of flywheel nut

13. Remove the flywheel by using the **flywheel puller** (Part No. 49 0823 300), turning the handle of the puller and lightly hitting the head of the puller.

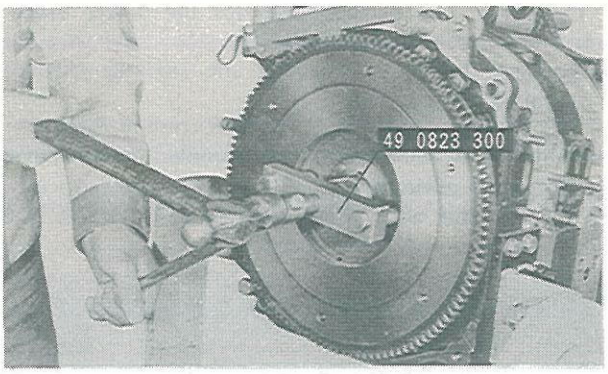


Fig. 1–24 Removing of flywheel

14. Invert the engine on the work stand.
15. Remove the bolts attaching the oil pan, and remove the oil pan and gasket.
16. Remove the bolts attaching the oil strainer, and remove the oil strainer and gasket.
17. Apply **identification marks** onto the front rotor housing and rear rotor housing, which are common parts, so that they will be as they were, when reassembling the engine.

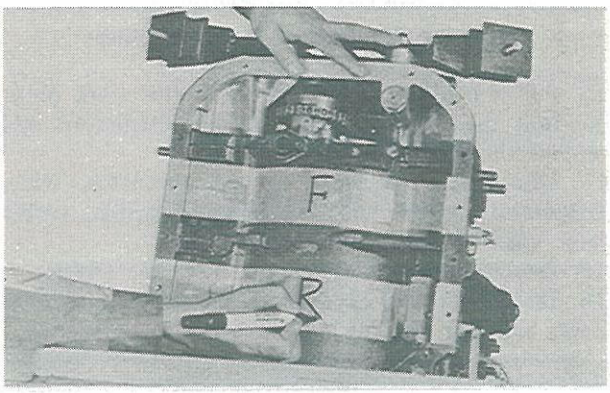


Fig. 1–25 Applying of identification marks

18. Turn the engine on the work stand so that the front end of the engine is up.
19. Remove the nuts attaching the engine mounting bracket to the front cover and remove the mounting bracket.
20. Remove the bolts attaching the front cover, and

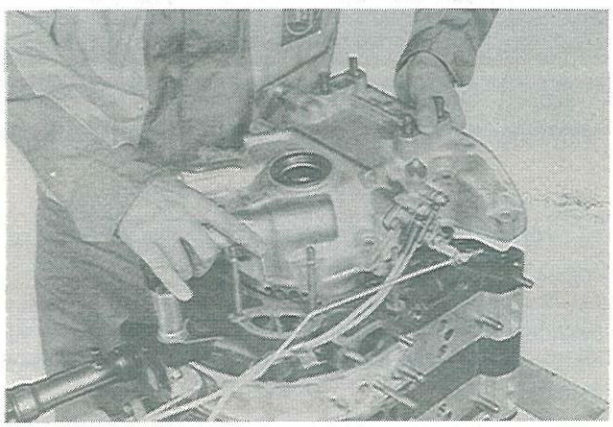


Fig. 1–26 Removing of front cover

remove the front cover and gasket.
21. Remove the "O" ring from the oil passage on the front housing.
22. Slide the oil thrower, spacer and distributor drive gear off the shaft.
23. Remove the nuts attaching the chain adjuster and remove the chain adjuster.
24. Remove the lock nut and washer for the oil pump driven sprocket.
25. Slide the oil pump drive sprocket and driven sprocket together with the drive chain off the eccentric shaft and oil pump shaft simultaneously. Remove the key on the eccentric shaft.
26. Slide the balance weight, thrust washer and needle bearing off the shaft.
27. Remove the bolts attaching the bearing housing, and slide the bearing housing, needle bearing, spacer and thrust plate off the shaft.

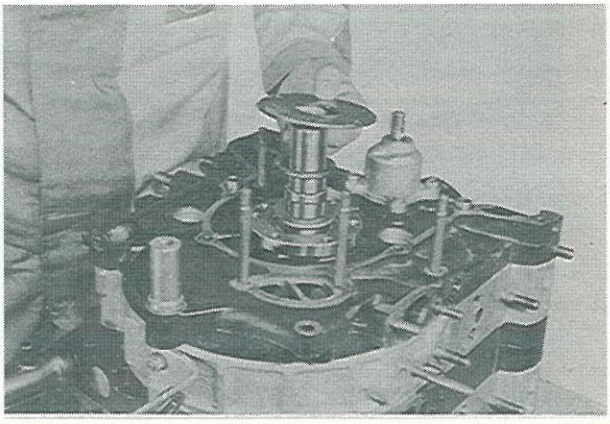


Fig. 1–27 Removing of bearing housing

28. Turn the engine on the work stand so that the top of the engine is up.
29. Loosen the tension bolts **in the reverse order of tightening,** and remove the tension bolts.

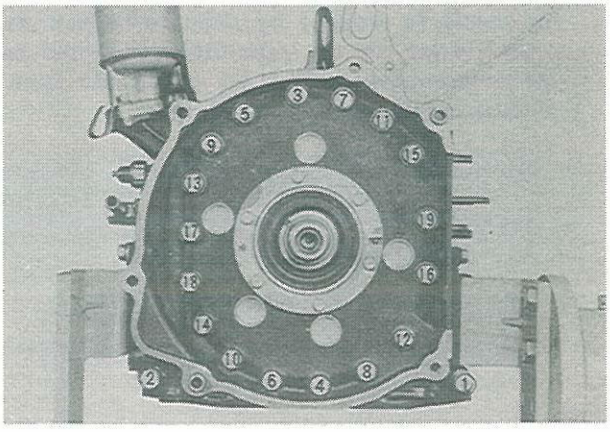


Fig. 1–28 Loosening order

Note :
Do not loosen the tension bolts at one time. Perform the removal in twice or three procedures.

30. Turn the engine on the work stand so that the front end of the engine is up.

31. Lift the front housing off the shaft.

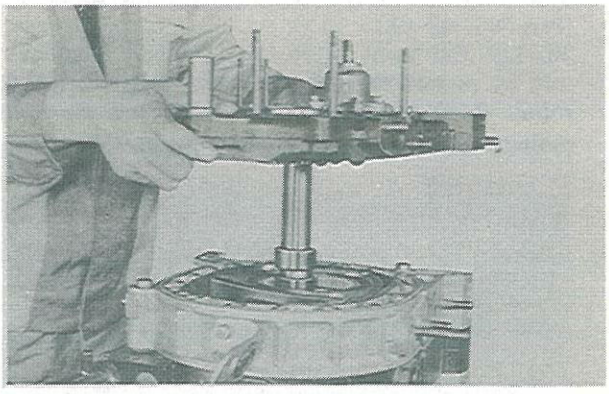


Fig. 1–29 Lifting of front housing

32. Remove any seals sticking to the rotor sliding surface of the front housing and place them back into their original position of each seal.

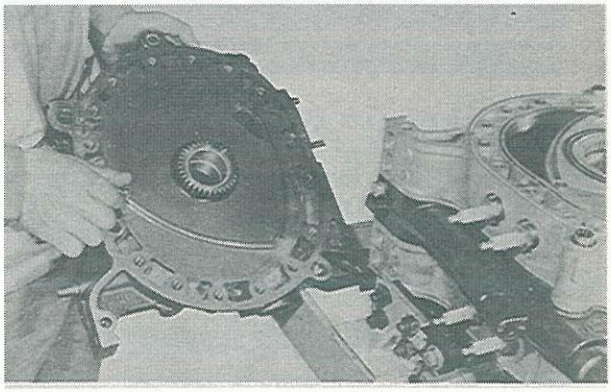


Fig. 1–30 Removing of seals

33. Remove the three corner seals, three corner seal springs, six side seals and six side seal springs from the front rotor, and place them in the **seal case** (Part No. 49 0813 250), in accordance with the marks which are applied on the side face of the rotor near each respective groove. These marks are made in order to prevent each seal from changing its original position when reassembling.
34. Remove the two sealing rubbers and two "O" rings from the front rotor housing.
35. Hold the front rotor housing down by hand

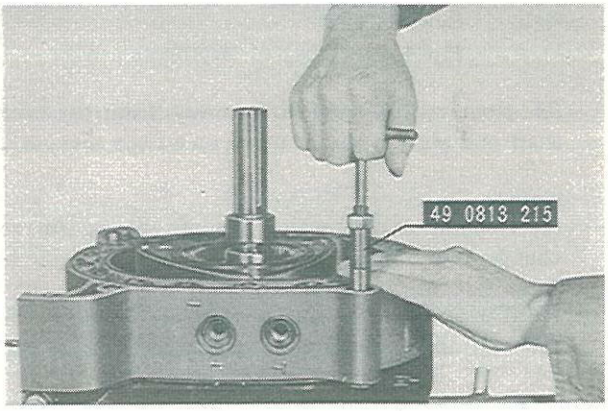


Fig. 1–31 Removing of tubular dowel

to prevent it from moving up, then pull the tubular dowels off the rotor housing with the **dowel puller** (Part No. 49 0813 215).
36. Lift the front rotor housing away from the rotor, so as not to drop the apex seals on the front rotor. Remove the two "O" rings and two sealing rubbers from the front rotor housing.

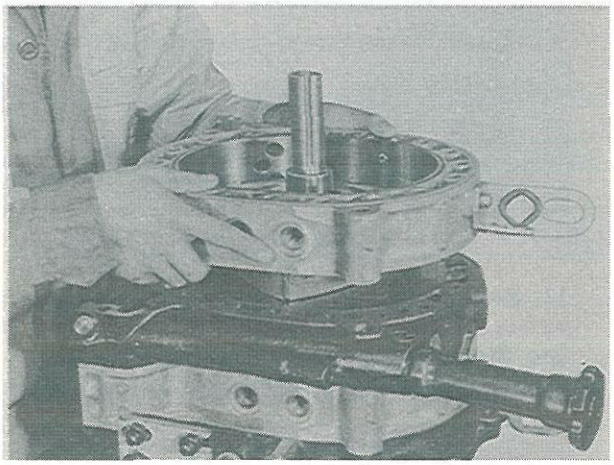


Fig. 1–32 Lifting of rotor housing

37. Remove the three apex seals and three springs from the front rotor and place them in the seal case. When removing the apex seal, put an **identification mark** on the bottom of the apex seal so that, when reassembling the engine, the apex seals can be installed in their correct locations and in the correct direction. **Never put** a mark with a punch.

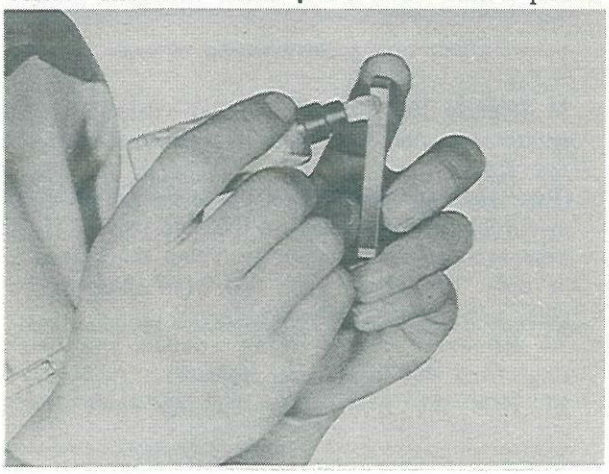


Fig. 1–33 Putting of identification mark

38. Remove the front rotor away from the eccentric shaft and place it upside down on a clean sheet of cloth.

Note :
(a) If some of the seals drop off, be careful not to change the original position of each seal on the reverse side of the rotor.
(b) The front and rear rotors are marked "F" or "R" on the internal gear side as shown in Fig. 1–34. "F" is the front rotor, while "R" is the rear rotor. When assembling, ensure that the front and rear rotors are correctly positioned.

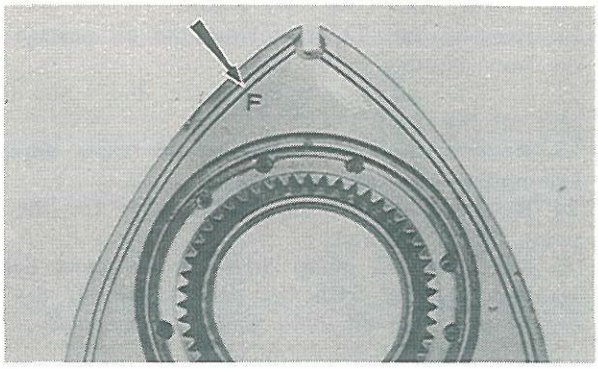


Fig. 1–34 Identification mark of rotor

39. Remove each seal and springs on the reverse side of the front rotor, and place them in the seal case.

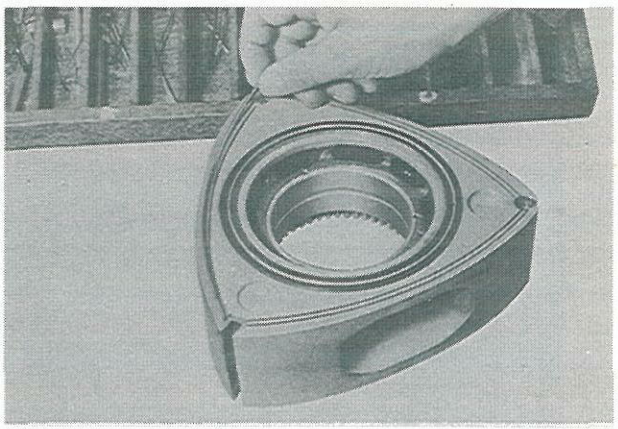


Fig. 1–35 Removing of seals

40. Hold the intermediate housing down by hand, and pull the tubular dowel off the intermediate housing using the **dowel puller** (Part No. 49 0813 215).
41. Lift the intermediate housing off the shaft so as not to damage the shaft. The intermediate housing should be removed by sliding it beyond the front rotor journal on the eccentric shaft while holding the intermediate housing up and at the same time pushing up the eccentric shaft.

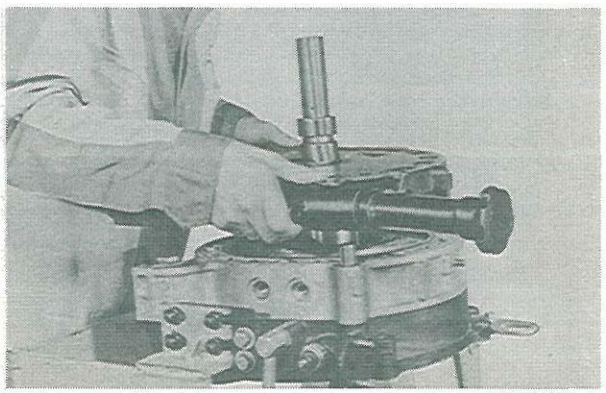


Fig. 1–36 Lifting of intermediate housing

42. Lift out the eccentric shaft.
43. Repeat the above procedures to remove the rear rotor housing and the rear rotor assembly.

1–B–3. Engine Inspection and Repair

a. Inspecting of front housing

1. Check the front housing for traces of gas or water leakage.
2. Remove all carbon on the housing with an extra-fine emery paper. When using a carbon scraper, be careful not to damage the mating surfaces of the housing.
3. Remove the sealing agent on the housing by using a cloth or a brush soaked in a solution of ketone or thinner.

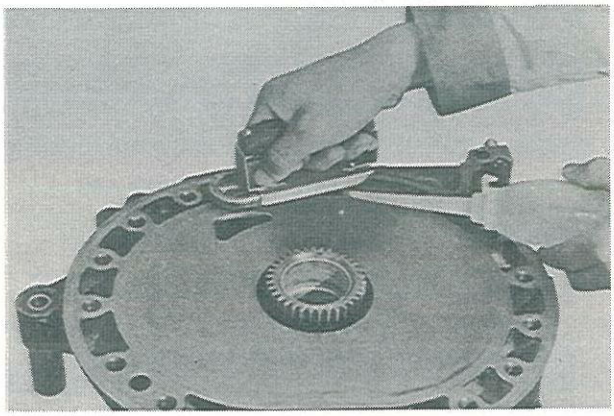


Fig. 1–37 Cleaning of front housing

4. Check for housing distortion by placing a straight edge on the housing surface. Measure the clearance between the straight edge and the housing surface with a feeler gauge, as shown in Fig. 1–38. If

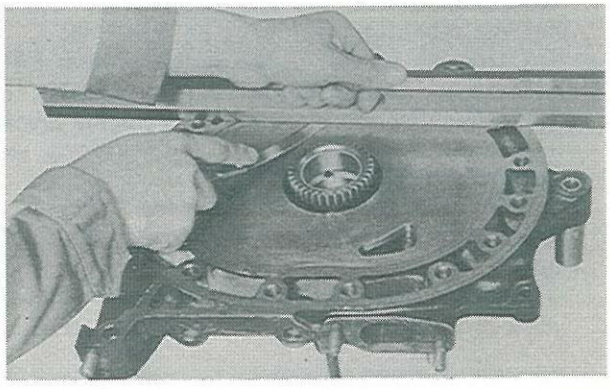


Fig. 1–38 Checking of front housing distortion

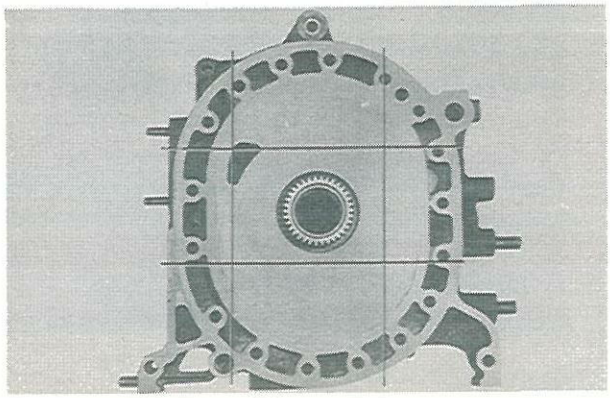


Fig. 1–39 Inspecting positions of housing distortion

the distortion exceeds **0.04 mm (0.002 in)**, replace the housing.
5. Check for wear on the rotor sliding surfaces of the housing with a dial indicator, as shown in Fig. 1–40. If the wear exceeds **0.10 mm (0.004 in)**, replace the housing.

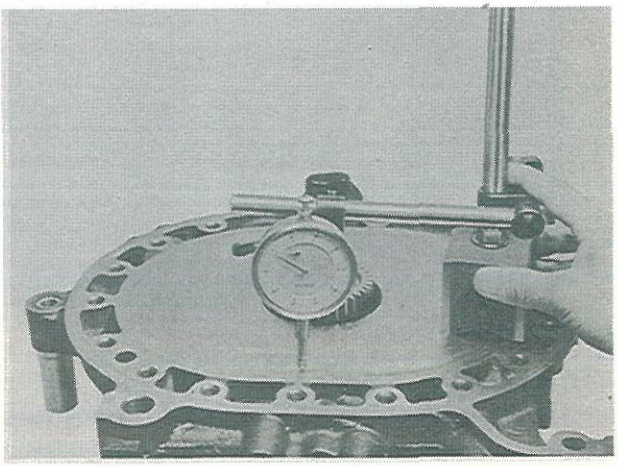


Fig. 1–40 Checking of front housing wear

There is a tendency of excessive wear occurring at both ends of the minor axis of the housing. However, width of this wear is small.

b. Inspecting of front stationary gear and main bearing

1. Check the teeth on the stationary gear for wear, crack or damage.
2. Check the main bearing for wear, scratching, flaking or other damages.
3. Check the clearance between the main bearing and eccentric shaft main journal by measuring the inner diameter of the main bearing and outer diameter of the eccentric shaft main journal.

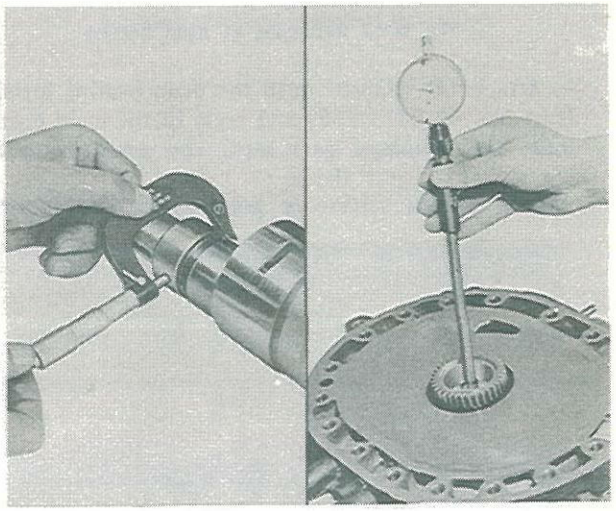


Fig. 1–41 Checking of main bearing clearance

The standard clearance is **0.04 ~ 0.07 mm (0.0016 ~ 0.0028 in)**. If the bearing clearance exceeds **0.10 mm (0.0039 in)**, replace the main bearing or eccentric shaft.
To replace the main bearing, proceed as follows :
1) Remove the stationary gear and main bearing as-

sembly from the housing, using the **main bearing remover** (Part No. 49 0813 235) shown in Fig. 1–42.

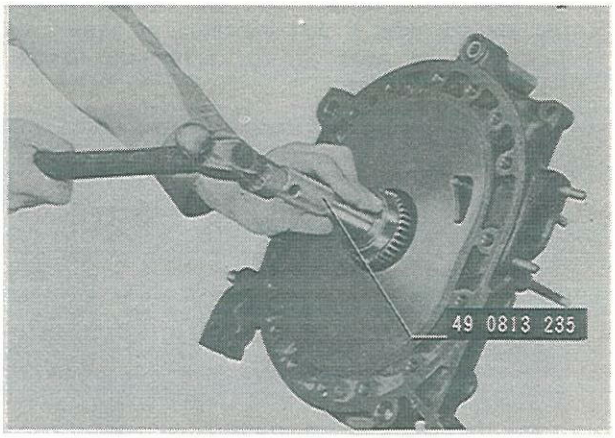


Fig. 1–42 Removing of stationary gear

2) Remove the adaptor on the main bearing remover and press the main bearing out of the stationary gear by using the main bearing remover (Part No. 49 0813 235), as shown in Fig. 1–43.

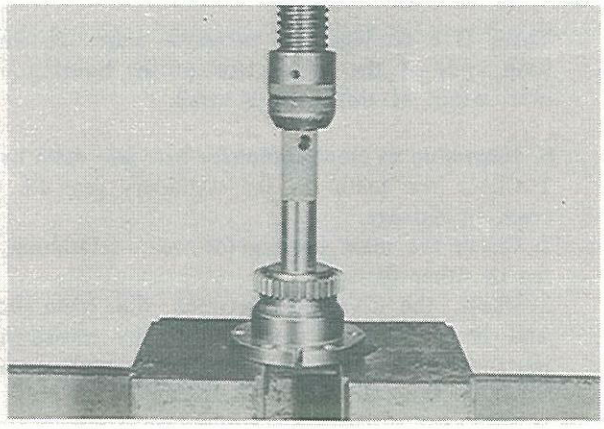


Fig. 1–43 Removing of main bearing

3) Attach the adaptor onto the **main bearing installer** (Part No. 49 0813 235) and press fit the main bearing into the stationary gear until the adaptor touches the stationary gear flange.
4) Press in the stationary gear to the housing with the main bearing installer (Part No. 49 0813 235), aligning the slot of the stationary gear flange and the dowel pin on the housing, as shown in Fig. 1–45.

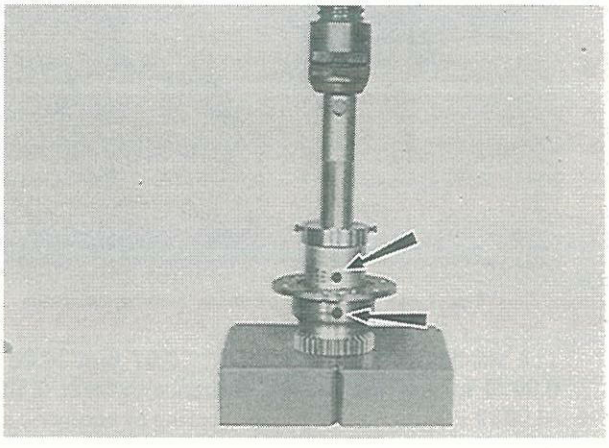


Fig. 1–44 Installing of main bearing

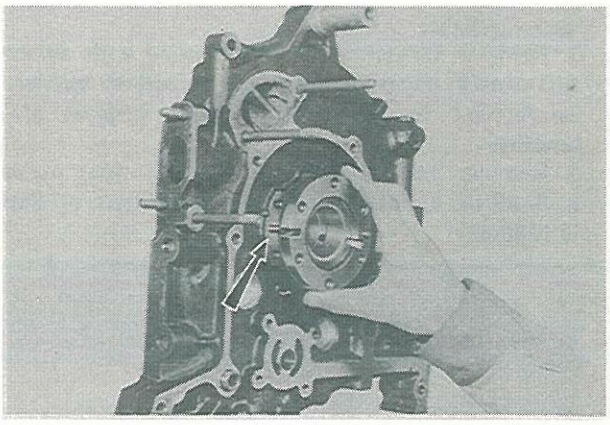


Fig. 1–45 Installing of stationary gear

Note:
When replacing the stationary gear, refer to **Par. 1–B–3, h.**

c. Inspecting of intermediate housing
Refer to **Par. 1–B–3. a,** and inspect the intermediate housing.

d. Inspecting of rear housing
Refer to **Par. 1–B–3. a,** and inspect the rear housing.

e. Inspecting of rear stationary gear and main bearing
Inspections of the rear stationary gear and main bearing are carried out according to **Par. 1–B–3. b,** but the following point must be inspected.
1. Check the oil seal in the stationary gear for wear or damage. Replace the oil seal if necessary.
To replace the stationary gear, proceed as follows:
1) Remove the bolts attaching the stationary gear to the rear housing.
2) Using the **main bearing remover** (Part No. 49 0813 235), remove the stationary gear from the rear housing.
3) Apply a thin coat of grease on the "O" ring and place it in the groove of the stationary gear.

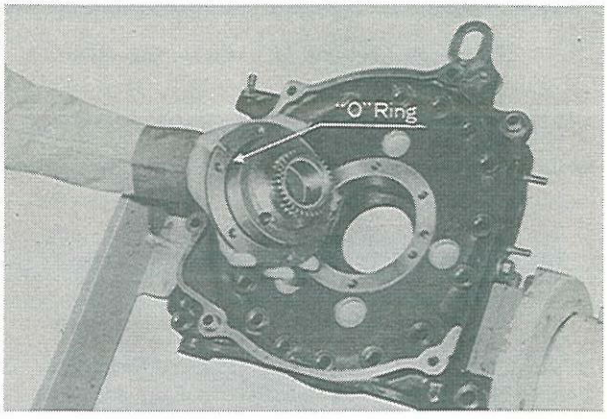


Fig. 1–46 Placing of "O" ring

4) Apply sealing agnet onto the stationary gear flange.

5) Install the stationary gear to the rear housing being careful to not damage the "O" ring and to align the slot of the stationary gear with the dowel pin on the rear housing.

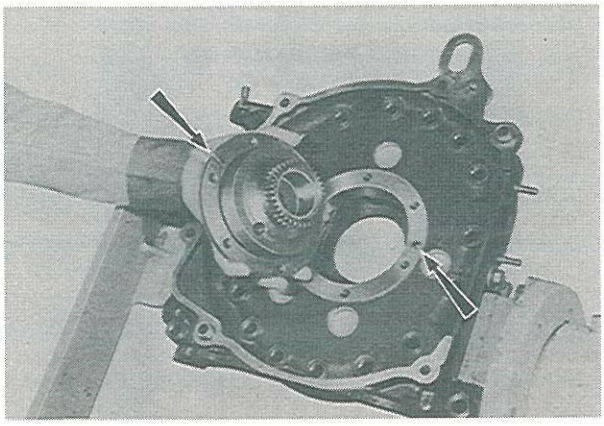


Fig. 1–47 Installing of stationary gear

6) Tighten the bolts attaching the stationary gear.

Note:
Replace the "O" ring with a new one whenever the stationary gear is removed.

f. Inspecting of rotor housing

1. Check for traces of gas or water leakage along the inner margin of each side face of the rotor housing.
2. Remove all carbon from the inner surface of the rotor housing by wiping with a cloth. Soak the cloth in a solution of ketone or thinner if the carbon is difficult to remove.

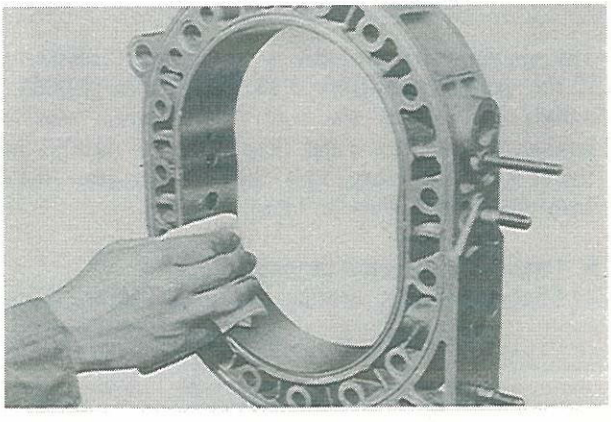


Fig. 1–48 Removing of carbon

3. Remove all deposits and rust from the cooling water passages on the housing.
4. Remove sealing agent by wiping with a cloth or brush soaked in a solution of ketone or thinner.
5. Check the chromium-plated surface on the rotor housing for scoring, flaking or any other damage.
If any of these condition exists, replace the rotor housing.
6. Check for rotor housing distortion by placing a straight edge in the position shown in Fig. 1–49.

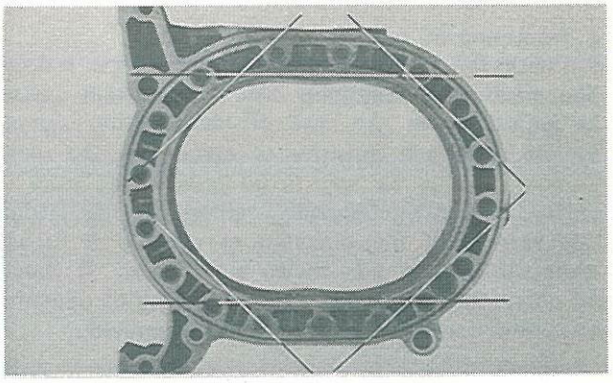


Fig. 1–49 Inspecting positions of housing distortion

Measure the clearance between the straight edge and rotor housing surface with a feeler gauge. If the distortion exceeds **0.04 mm (0.002 in)**, replace the rotor housing.

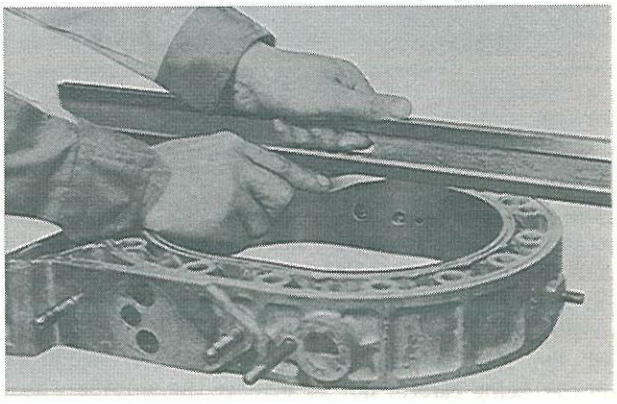


Fig. 1–50 Checking of rotor housing distortion

Note:
This check should be done whenever the engine is overhauled.

7. Check the rotor housing width **at points close to the trochoid surface** by using a micrometer. The measurements should be taken at 8 points at the least. If the difference between the maximum value and the minimum value exceeds **0.08 mm (0.0031 in)**, the rotor housing should be replaced with a new one, because there should be possibility of gas or water leakage. The standard width is **60 mm (2.3622 in)**.

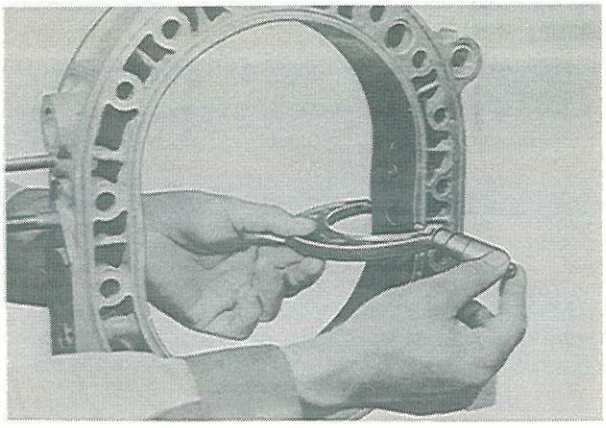


Fig. 1–51 Checking of rotor housing width

g. Inspecting of rotor

1. Check the combustion condition and gas leakage. The combustion condition can, to a certain extent, be judged as in the case of reciprocating engines by the color and quantity of carbon on the rotor. Combustion can be said to be good if the color of carbon is brown. Generally carbon on the leading side seen from the direction of rotation is brown, while the trailing side shows black color. It should be noted that this color varies according to operating conditions just before the engine is removed.

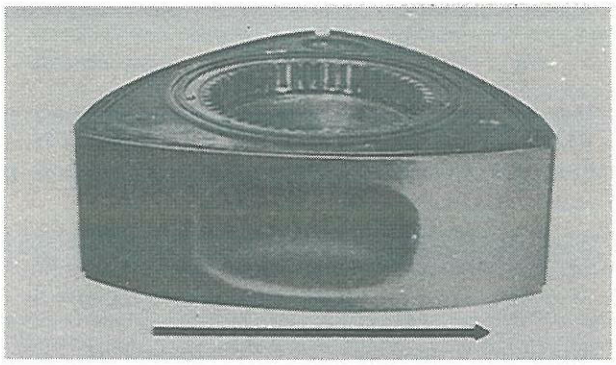


Fig. 1–52 Checking of combustion condition

The gas leakage can be judged by checking the color of the rotor side surface for blow-by traces originating from the side seals and corner seals.

2. Remove the carbon on the rotor by using a carbon remover or emery paper. Carbon in the seal grooves of the rotor should be removed with a carbon remover being careful not to damage the grooves. Wash the rotor in cleaning solution and dry by blowing with compressed air.

3. Carefully inspect the rotor and replace if it is severely worn or damaged.

4. Check the internal gear for cracks, worn or chipped teeth.

5. Remove the oil seals in the rotor as described in **Par. 1–B–3. i**, and check the land protrusion of the rotor by placing a straight edge on the land. Measure the clearance between the rotor and the straight edge with a feeler gauge as shown in Fig. 1–53. The standard protrusion is **0.10 ~ 0.15 mm (0.004 ~ 0.006 in)**. If the protrusion is less than the specification, there is a possibility of the rotor touching the side housing at places other than the land, causing wear or damage.

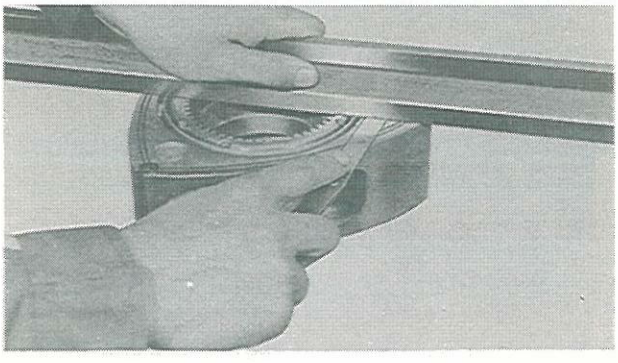


Fig. 1–53 Checking of land protrusion

6. Check the gap between the side housing and the rotor by measuring the rotor housing width and rotor width. The rotor width should be measured at the position shown in Fig. 1–55.

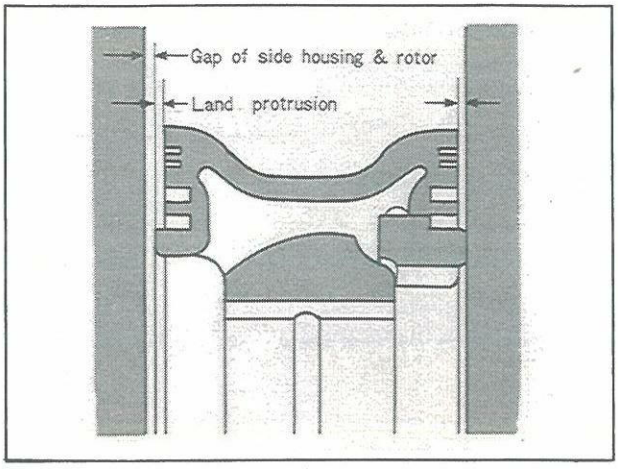


Fig. 1–54 Checking gap between side housing and rotor

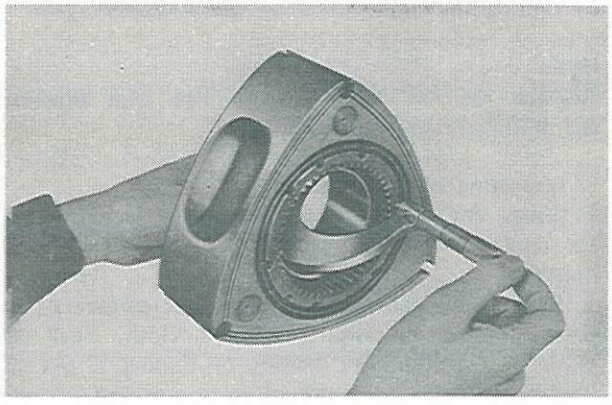


Fig. 1–55 Measuring of rotor width

The standard rotor width is **59.85 mm (2.3563 in)**. If the gap is not within **0.13 ~ 0.17 mm (0.0051 ~ 0.0067 in)**, replace the rotor and internal gear assembly. If the gap is less than 0.13 mm (0.0051 in), there is a possibility that the internal gear locked with six double pins is loose.

h. Inspecting of rotor bearing

1. Check the rotor bearing for wear, flaking, scoring

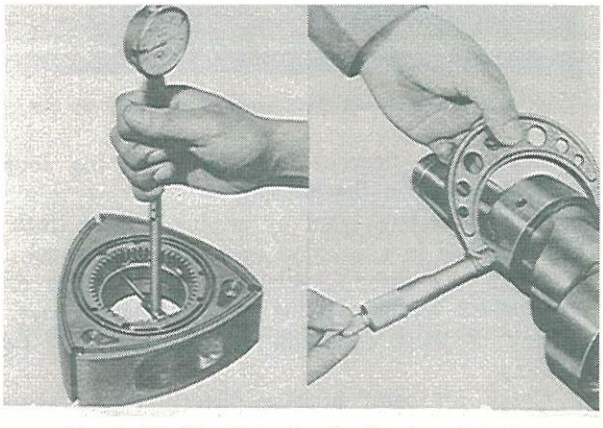


Fig. 1–56 Checking of rotor bearing clearance

or any damage. If any of these conditions is found, replace the bearing.

2. Check the rotor bearing clearance by measuring the inner diameter of the rotor bearing and outer diameter of the eccentric shaft rotor journal. The standard clearance is 0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in). Replace the bearing if it is more than **0.10 mm (0.0039 in)**.

To replace the rotor bearing, proceed as follows :

1) Insert the **expander** (Part No. 49 0813 245) into the rotor bearing to prevent any deformation of the bearing when drilling the hole.

Fig. 1–57 Inserting of expander

2) Drill a hole of 3.5 mm (0.14 in) diameter and about 7 mm (0.28 in) deep in the locking screw which holds the bearing on the rotor. And then, remove the expander.

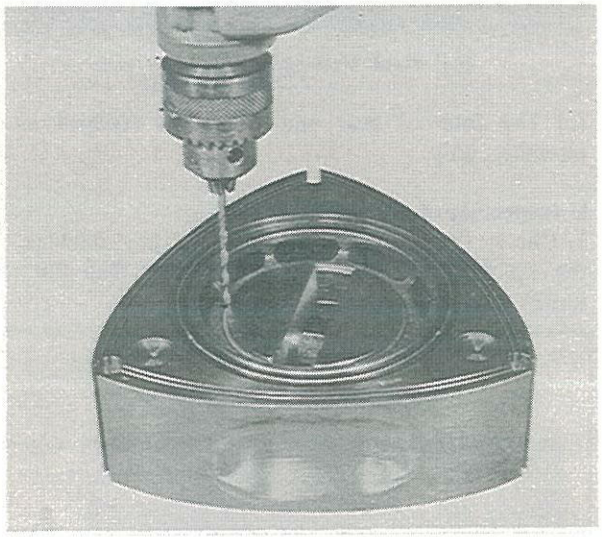


Fig. 1–58 Drilling of holes

3) Place the rotor on the support so that the internal gear is facing upward.

Using the **rotor bearing remover** (Part No. 49 0813 240) without the adaptor ring, press the bearing out of the rotor, being careful not to damage the internal gear.

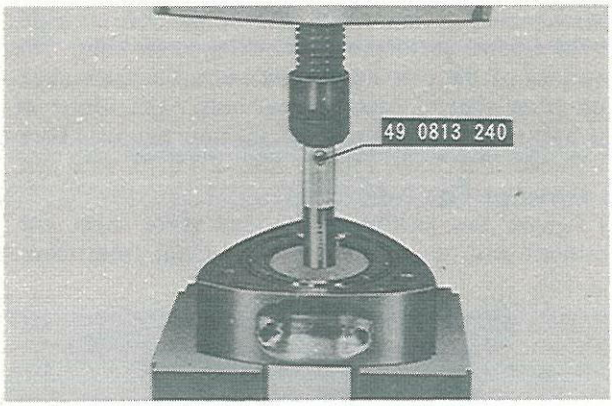


Fig. 1–59 Removing of rotor bearing

4) If the bearing bore in the rotor is damaged, finish the bore with emery paper and blow with compressed air.

5) Place the rotor on the support so that the internal gear is facing upward. Press fit a new bearing using the **rotor bearing installer** (Part No. 49 0813 240) with the adaptor screws of the installer removed so that the oil hole of the bearing is in line with the oil hole on the apex side of the rotor, and the bearing is flush with the rotor boss.

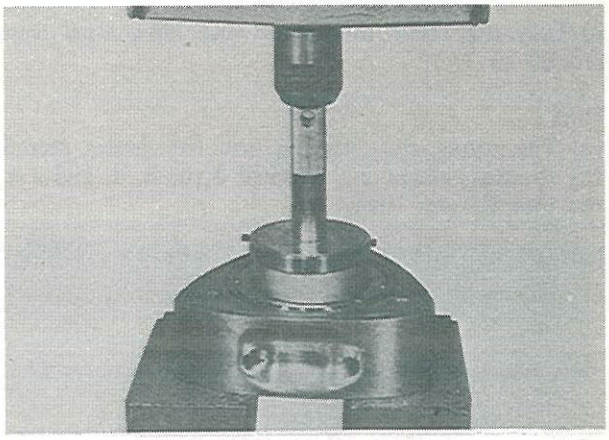


Fig. 1–60 Installing of rotor bearing

6) Insert the expander (Part No. 49 0813 245) into the bearing, and then drill a hole of 3.5 mm (0.14 in) diameter and about 7 mm (0.28 in) deep at

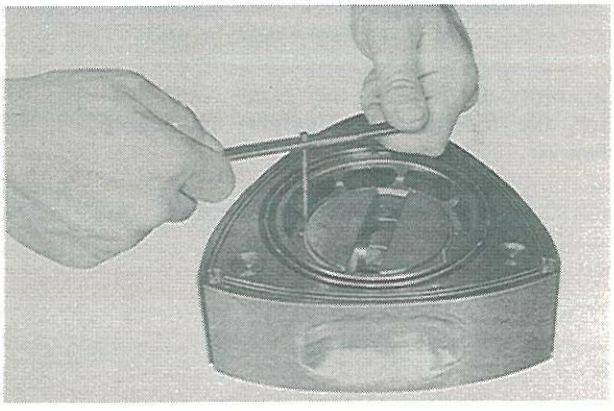


Fig. 1–61 Making of threads

approximately 7 mm (0.28 in) to the left or right of the original position of the locking screw hole. The positions of the new holes must be in the same direction from that of each original hole. The center of the hole must be 0.5 mm (0.02 in) from the rotor bore.
7) Thread the hole with a M4, P = 0.70 mm tap, as shown in Fig. 1–61.
8) Tighten the locking screws and stake them into positions with a punch to prevent them from working out.

Fig. 1–62 Staking of locking screws

9) Wash the rotor thoroughly and blow with compressed air.

Note :
(a) The rotors are classified into five grades according to their weight and marked a, b, c, d, and e on the internal gear side.

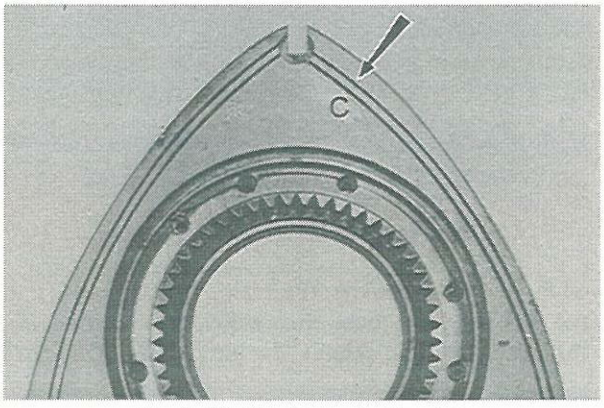


Fig. 1–63 Weight mark of rotor

In order to balance the front rotor and rear rotor, the following combinations are adopted in the factory.

Combination of rotor
a – b
b – a, b, c
c – b, c, d
d – c, d, e
e – d

If it becomes necessary to replace a rotor, use the rotor marked "C" in all cases.

(b) The internal gears and stationary gears are classified into three grades, by embossing markings, A, and C, also given no mark.
In order to obtain the proper backlash between the internal gear and the stationary gear, gears of the same marking are installed in the factory.
When replacing the stationary gear, there is no need to select the marking.

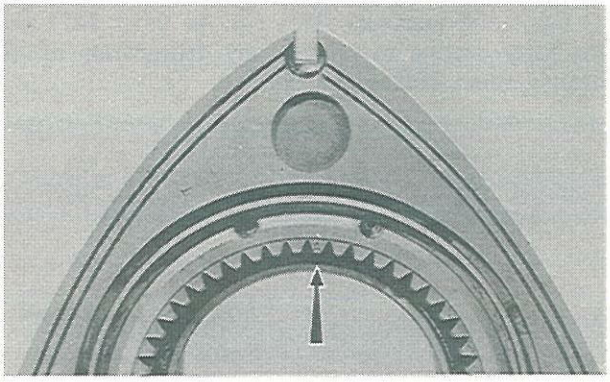


Fig. 1–64 Marking of internal gear

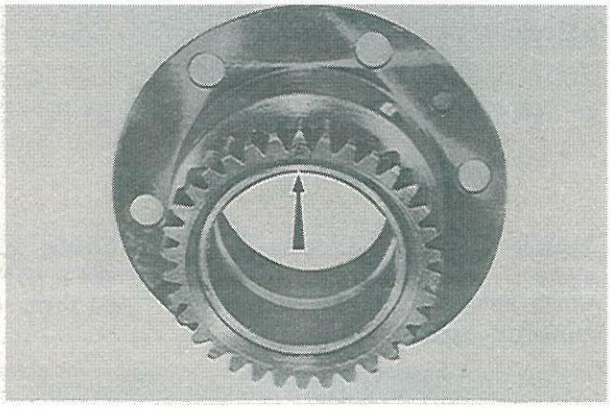


Fig. 1–65 Marking of stationary gear

(c) The internal gear and rotor are serviced as an assembly only.

i. Inspecting of oil seal in rotor
1. Check the oil seal for wear or any damage. If the lip width of the oil seal is more than **0.8 mm (0.031 in)**, replace the oil seal.

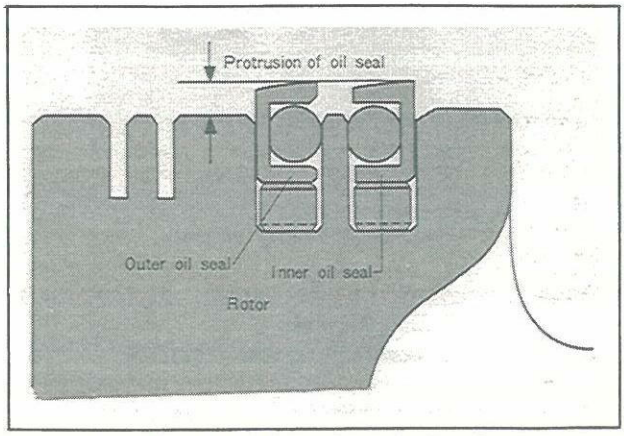


Fig. 1–66 Protrusion of oil seal

2. Check the oil seal protrusion shown in Fig. 1–66. The protrusion should be more than **0.5 mm (0.20 in)**.
If necessary, replace the oil seal as follows :
1) Remove the oil seal by inserting the **oil seal remover** (Part No. 49 0813 225) or a screwdriver in the slots of the rotor and prying the seal off.

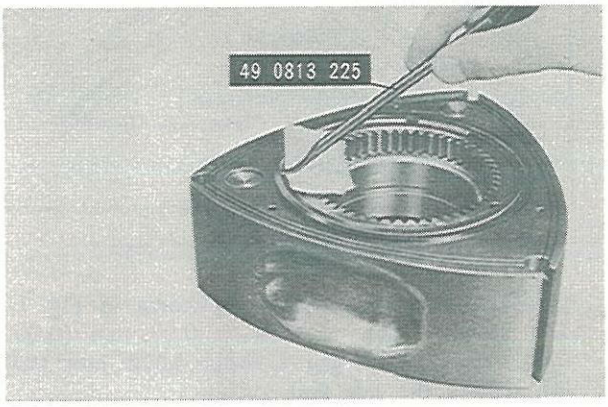


Fig. 1–67 Removing of oil seal

Note :
(a) **Do not** exert strong pressure at only one place to prevent deformation of the oil seal.
(b) Be careful not to damage the oil seal lip. Use a suitable protector shown in Fig. 1–67.
(c) Replace the "O" ring in the oil seal when the engine is overhauled.

2) Fit the outer and inner oil seal springs in their respective grooves on the rotor so that the ends of the spring are facing upward and the spring gaps are located opposite each other, as shown in Fig. 1–68.

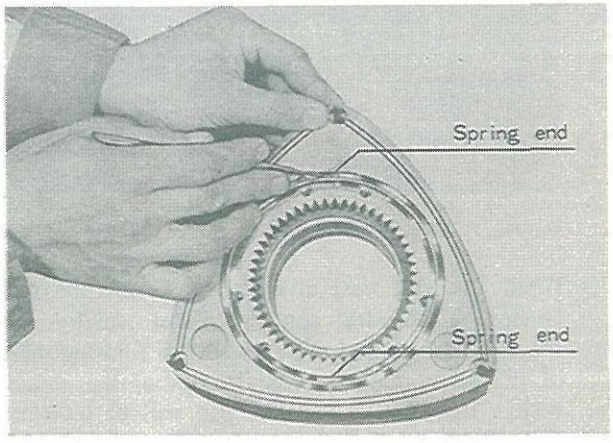


Fig. 1–68 Position of oil seal spring end

Note :
Before installing the "O" ring to the oil seal, confirm the smooth movement of each oil seal by placing the oil seal on the oil seal spring in the groove.

3) Insert new "O" ring in each oil seal.
4) Apply the sufficient engine lubricant onto the oil seal and oil seal groove.
5) Install the oil seal to the groove on the rotor

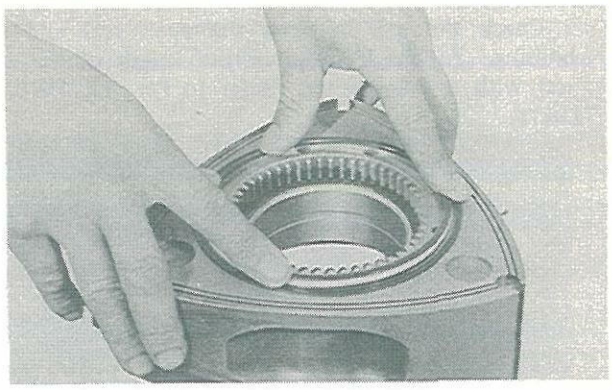


Fig. 1–69 Installing of oil seal

pushing the head of the oil seal with fingers slowly. Be careful not to deform the oil seal.

Note :
(a) As chamfering is performed and a white mark is applied on the bottom of the oil seal, confirm these before installing the oil seal so that the head (lip) of the oil seal may not be mistaken for the bottom.
(b) Install the oil seals on the both sides of the rotor.

J. Inspecting of apex seal
1. Remove all carbon from the apex seal and spring, being careful not to damage the apex seal. **Never use** emery paper as it will damage the apex seal. Wash them with cleaning solution.
2. Check the apex seal for wear, crack, or any damage. If any of these conditions is found, replace the apex seal. Check the spring for weakness.
3. Measure the height of the apex seal with a micrometer. Replace if the height is less than **10.0 mm (0.3937 in)**.
4. Check the gap between the apex seal and the groove. To check the gap, place the apex seal in its respective groove on the rotor and measure the gap between the apex seal and the groove with a feeler gauge. As shown in Fig. 1–70, the apex seal tends to wear unevenly and for this reason the feeler guage should be inserted until the tip of the gauge reaches the bottom of the groove. If the gap is more than **0.1 mm (0.004 in)**, replace the apex seal.

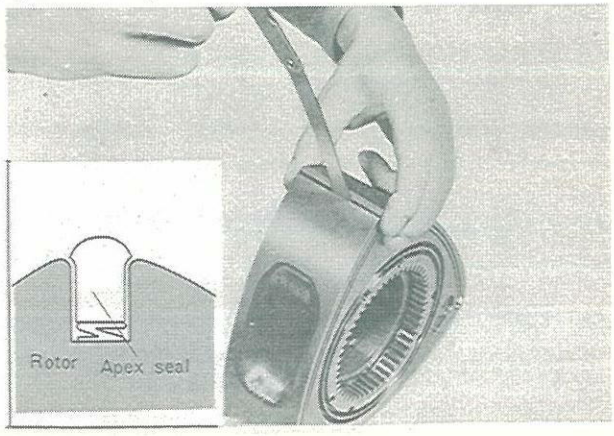


Fig. 1–70 Checking gap of apex seal and groove

5. Check the gap between the apex seal and side housing. To check, measure the length of the apex seal with a micrometer. Refer to **Par. TECHNICAL DATA.**

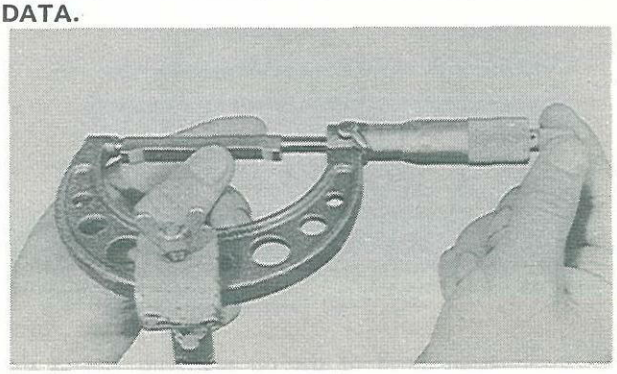


Fig. 1–71 Measuring of apex seal length

Compare the measured length with the minimum value of the rotor housing width to calculate the gap between the apex seal and side housing. If the gap is more than **0.15 mm (0.0059 in)**, replace the apex seal. If necessary, correct the apex seal length with emery paper.

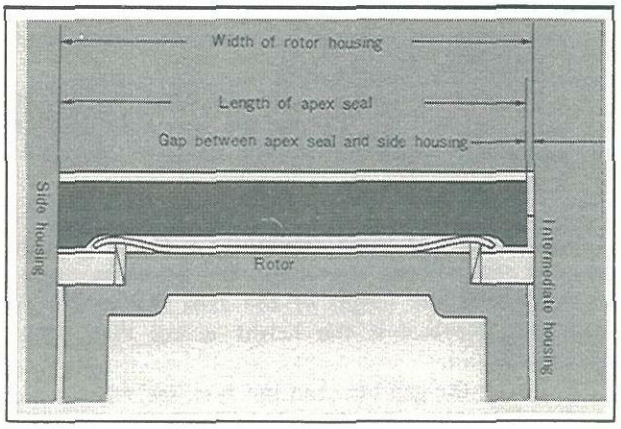


Fig. 1–72 Checking gap between apex seal and side housing

k. Inspecting of side seal

1. Remove all carbon from the side seal and spring with a carbon remover.
2. Check the side seal for wear, crack or any other damage and replace if any of these conditions is found.
3. Check the gap between the side seal and the

Fig. 1–73 Checking of side seal gap

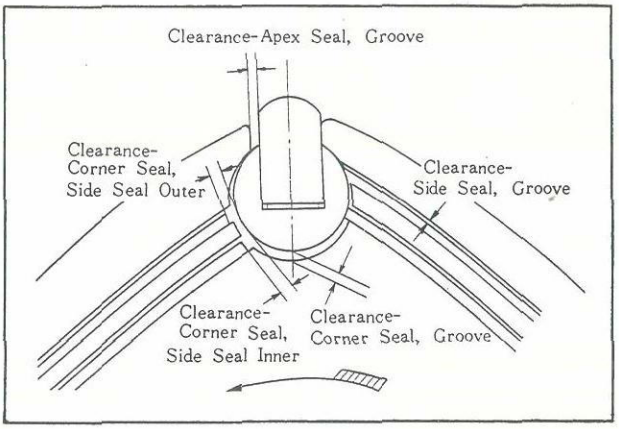


Fig. 1–74 Clearance of seals

groove with a feeler gauge as shown in Fig. 1–73. The standard gap is 0.04 ~ 0.07 mm (0.002 ~ 0.003 in). If the gap exceeds **0.078 mm (0.0031 in)**, replace the side seal.

4. Check the gap between the side seal and the corner seal with these seals installed on the rotor.

To check, insert a feeler gauge between the end of the side seal (against the rotating direction of rotor) and the corner seal. If the gap exceeds **0.4 mm (0.016 in)**, replace the side seal.

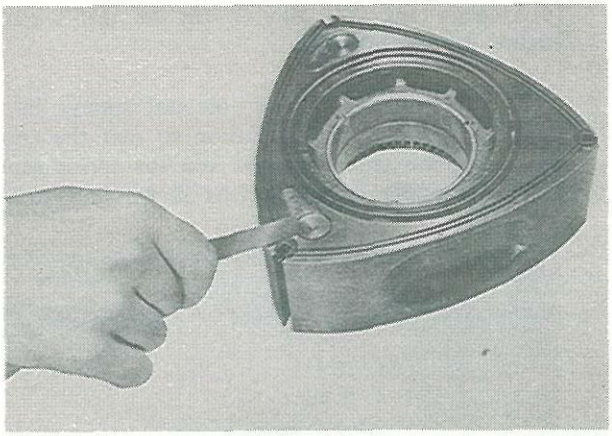


Fig. 1–75 Checking gap of corner seal and side seal

When the side seal is replaced, adjust the gap between the side seal and the corner seal by grinding the opposite end of the side seal in rotating direction of the rotor along the round shape of the corner seal with a fine file so that the gap will be **0.05 ~ 0.15 mm (0.002 ~ 0.006 in)**. If this gap is too large, gas-sealing performance will deteriorate.

Note :

Be sure to use the correct side seal when installing a new side seal as there are four different types, namely, the front inner, front outer, rear inner, and rear outer seal.

l. Inspecting of corner seal

1. Remove carbon from the corner seal.
2. Check the corner seal for wear or damage.

3. Check the gap between the corner seal and the corner seal groove. The standard gap is 0.020 ~ 0.048 mm (0.0008 ~ 0.0019 in) and the limit is **0.08 mm (0.0031 in)**. This gap enlargement shows uneven wear of the corner seal groove, which occur when the engine is operated with dust entering through a clogged element, damaged air cleaner or any other cause. When the wear is permitted to increase, the engine power will be reduced and the engine will become hard to start. The extent of wear of the corner seal groove is determined by the **bar limit gauge** (Part No. 49 0839 165) and classified into three conditions.

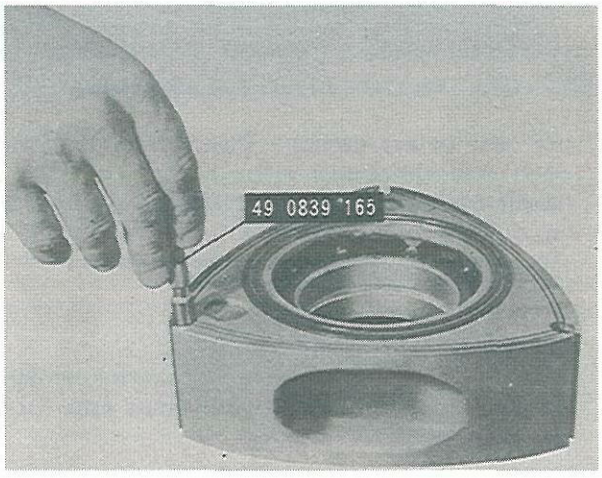


Fig. 1–76 Checking of corner seal groove

(1) Neither end of the gauge does not go into the groove. This means that the gap conforms to the specifications.
(2) While the go-end of the gauge goes into the groove, the not-go-end does not. This means the gap is more than standard dimension and less than the limit. In this case, replace the corner seal with a **0.03 mm (0.0012 in)** oversize one. **Do not** rebore the groove.
(3) If the both ends of the gauge go into the bore, it means that the gap exceeds the limit of 0.8 mm (0.0031 in). Rebore the corner seal groove with the **jig and reamer** (Part Nos. 2113 99 900 and 49 0839 170) to 11.2 mm (0.4410 in) diameter and use a **0.2 mm (0.0079 in)** oversizer corner seal.

Note:
(a) As the corner seal groove tends to show a heavy wear in the direction of the rotation, the side arcs on the gauge are partially cut off. Be sure to take the measurement in the direction of the maximum wear of the groove.
(b) If the gauge is not available, use a feeler gauge.
(c) The dimensions of the outer diameter of the gauge are as follows:

Go-end $11.0\ ^{+0.019}_{+0.021}$ mm $(0.4331\ ^{+0.0007}_{+0.0008}$ in)

Not-go-end $11.0\ ^{+0.044}_{+0.046}$ mm $(0.4331\ ^{+0.0017}_{+0.0018}$ in)

To rebore the corner seal groove, proceed as follows:
1) Remove carbon, rust and other deposits from the groove, being careful not to damage.
2) Install the **jig** (Part No. 2113 99 900) onto the rotor and tighten the correct bar being careful not to damage the rotor bearing and apex seal groove.

Fig. 1–77 Reaming of corner seal groove

3) Ream the groove with the **reamer** (Part No. 49 0839 170) by hand applying sufficient engine oil as a coolant. When feeding the reamer, it must be turned by about 20 rotations or over before the reaming work is accomplish completely.
4) Remove the reamer and jig from the rotor.
5) Repeat the same procedure when reaming the other grooves of the rotor.
6) Thoroughly clean the rotor, and check and confirm by visual inspection the condition of the reaming groove and to see if there is any damage to the rotor.
7) Fit a **0.2 mm (0.0079 in)** oversize corner seal into the groove, and check the gap between the corner seal and the groove. The standard gap is 0.02 ~ 0.048 mm (0.0008 ~ 0.0019 in).

Note:
(a) When installing or removing the jig, be careful not to hit the rotor.
(b) If the reaming is carried out without applying oil, it will be difficult to obtain the proper surface roughness no matter how many times the reaming may be repeated.
(c) Avoid two stage reaming, that is, drawing the reamer halfway during the reaming work and then resuming the reaming, because chips may affect the surface roughness.
(d) Before starting the reaming work, it must be confirmed that the reamer diameter is up to specifications, because the reamer could be worn in excess of the limit if it was used many times.

m. Inspecting of each seal spring
Check for weakness, wear or damage of the seal springs, especially the sections of the springs contacting the rotor or seal.

n. Inspecting of eccentric shaft
1. Wash the shaft in a cleaning solution and blow the oil passage with compressed air.
2. Check the shaft for cracks, scratches, wear or any other damage. Be sure that the oil passages are open.

3. Measure the diameter of the shaft journals with a micrometer. Replace the shaft if the wear is excessive. The standard diameter is **43 mm (1.6929 in)** on the main journal and **74 mm (2.9134 in)** on the rotor journal.

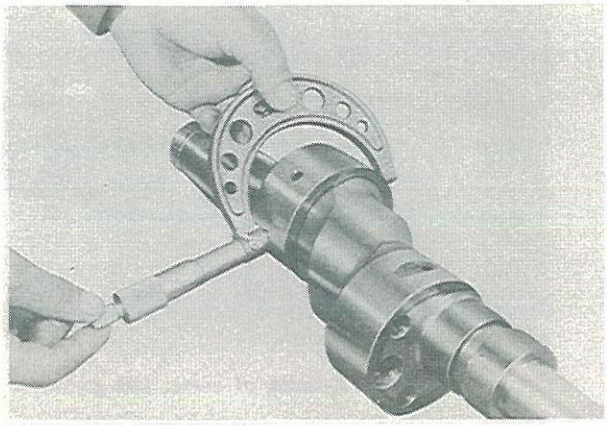


Fig. 1–78 Measuring of rotor journal diameter

4. Check the shaft run-out. To check, mount the shaft on "V"-blocks and apply a dial indicator. Slowly rotate the shaft and note the reading on the indicator. If the run-out is more than **0.02 mm (0.0008 in)**, replace the shaft with a new one.

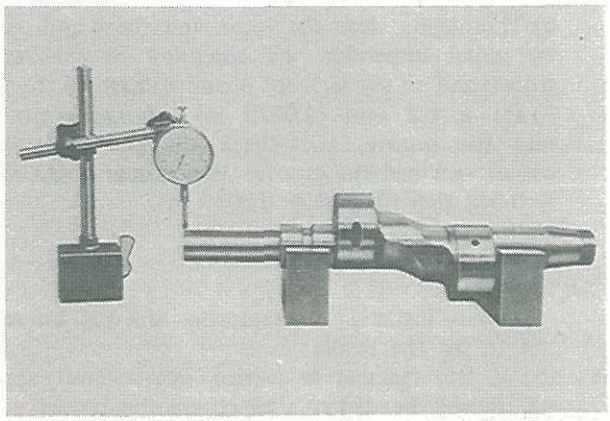


Fig. 1–79 Checking of eccentric shaft run-out

5. Check the blind plug in the shaft end for oil leakage or looseness. If any oil leakage is found, remove the blind plug with a hexagonal Allen key and replace the "O" ring.
6. Check the needle roller bearing in the shaft end

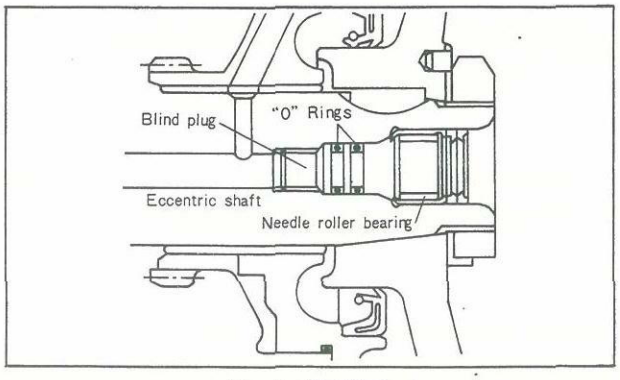


Fig. 1–80 Blind plug

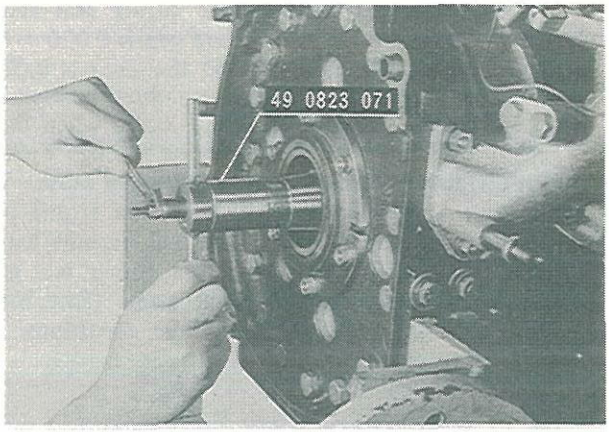


Fig. 1–81 Replacing of pilot bearing

for wear or any damage. Then insert the main drive shaft into the needle roller bearing and check the needle bearing for smooth operation and proper clearance.
To replace the bearing, use the **replacer** (Part Nos. 49 0823 071 and 49 0823 072).

o. Inspecting of needle bearing
Check the needle bearing for wear or damage. Inspect the bearing housing and thrust plate for wear or any damage.

1–B–4. Engine Assembly
The procedures for assembling the engine when the engine is to be completely overhauled are as follows:

a. Installing of oil seal
1. Place the rear rotor on a rubber pad or cloth.
2. Fit the outer and inner oil seal springs in their respective grooves on the rotor so that the spring gap is located opposite each other.
3. Insert a new "O" ring in each oil seal.

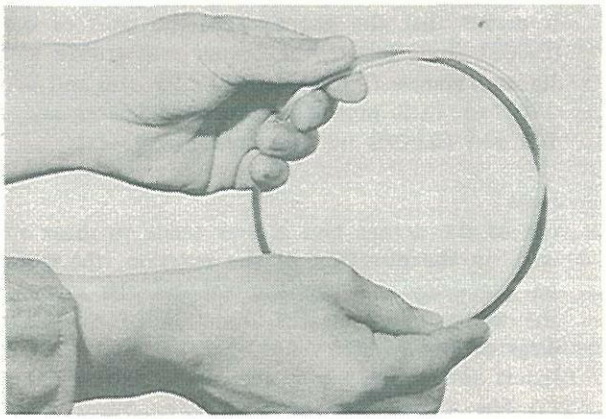


Fig. 1–82 Inserting of "O" ring

Note :
When replacing the oil seal, confirm the smooth movement of each oil seal by placing the oil seal on the oil seal spring in the groove before inserting the "O" ring.

4. Apply sufficient engine lubricant onto the oil seal and groove.

5. Install the oil seal to the groove on the rotor pushing the head of the oil seal slowly with fingers. Be careful not to deform the oil seal.

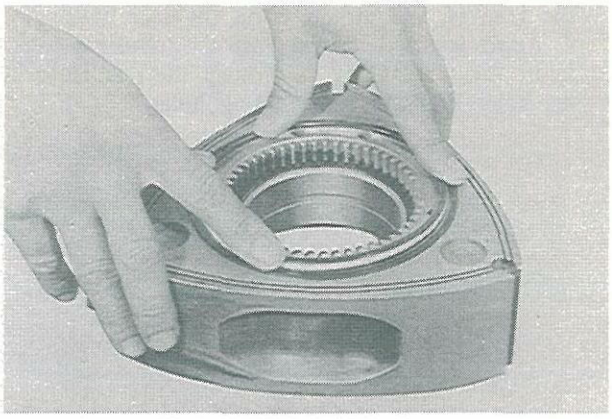


Fig. 1–83 Installing of oil seal

Note :
(a) As chamfering is performed and a white mark is applied on the bottom of the oil seal, confirm these before installing the oil seal so that the head (lip) of the oil seal will not be mistaken for the bottom.

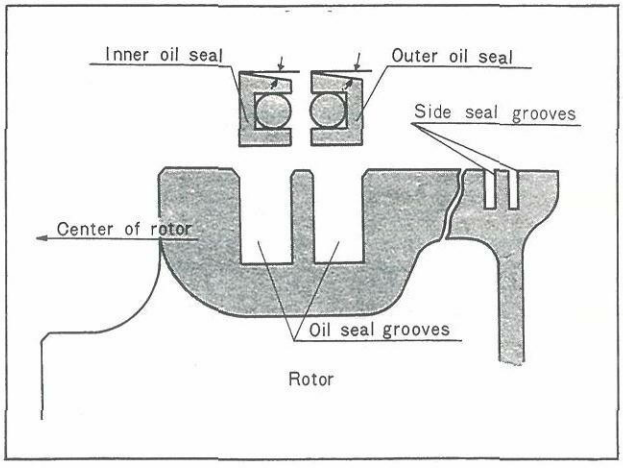


Fig. 1–84 Oil seal cross section

(b) Install the oil seals on both sides of the rotor.

b. Installing of each seal
1. Place the rear rotor on a rubber pad or cloth so that the teeth on the internal gear are facing upward.
2. Place each apex seal onto their respective grooves without the spring.
3. Place the corner seal springs and corner seals onto the grooves and apply engine lubricant onto them.

Note :
The top surface of the corner seal should be **1.3 ~ 1.5 mm (0.05 ~ 0.06 in)** higher than the rotor surface. It must also move freely, when pressed by finger.

4. Place the side seal springs on the side seal grooves of the rotor so as to face the both ends of the spring upward and apply engine lubricant onto them.

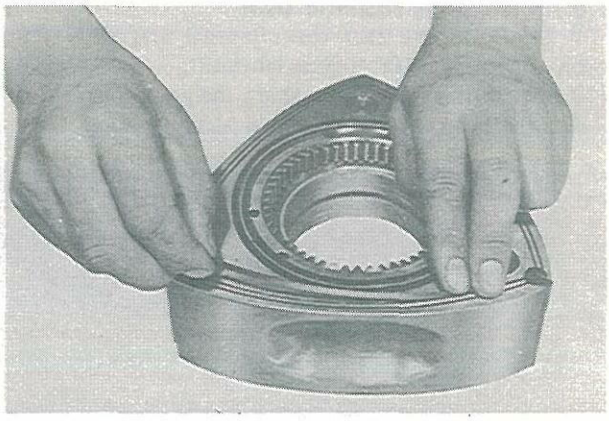


Fig. 1–85 Fitting of side seal

5. Fit the side seals into their respective grooves.

Note :
The side seal must protrude approximately **1.0 mm (0.04 in)** from the rotor surface. Also, check free movement by pressing with finger.

6. Apply engine lubricant onto each seal and internal gear of the rotor.

c. Installing of rear rotor
1. Mount the rear housing on the **work stand** (Part Nos. 49 0839 000, 49 0813 005 and 49 0820 006).
2. Turn the rear housing on the work stand so that the top of the housing is up.
3. Place the rotor on the rear housing taking care not to drop the seals, and turn the rear housing with the rotor so that the sliding surface of the rear housing faces upward.
4. Mesh the internal gear and stationary gear so that one of the rotor apexes is set to any one of the four places shown in Fig. 1–86.

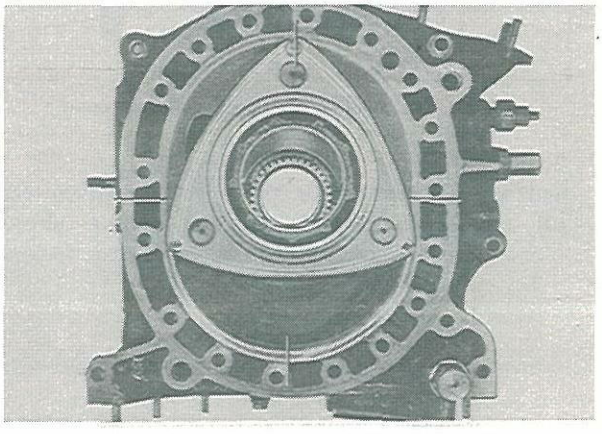


Fig. 1–86 Position of rotor apex

Note:
In this case, be careful not to drop the corner seal into the ports.

5. Remove the apex seals and place them on the flank of the rear rotor close to each of their respective original positions.

d. Installing of eccentric shaft

1. Lubricate the rear rotor journal and main journal on the shaft with engine lubricant.
2. Insert the eccentric shaft being careful not to damage the rotor bearing and main bearing.

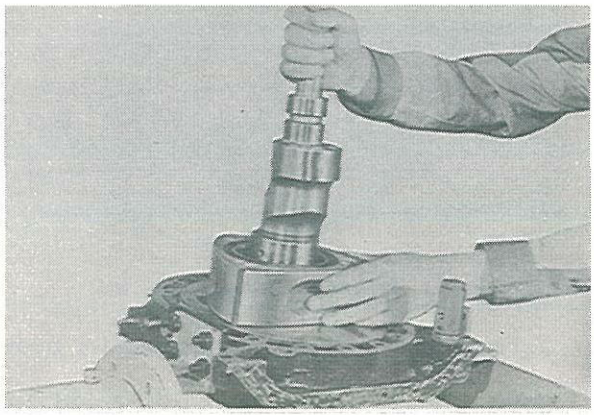


Fig. 1–87 Inserting of eccentric shaft

e. Installing of rear rotor housing

1. Apply sealing agent onto the rear side of the rear rotor housing, as shown in Fig. 1–88. Be careful not to let the sealing agent penetrate into the water passages or oil passages.

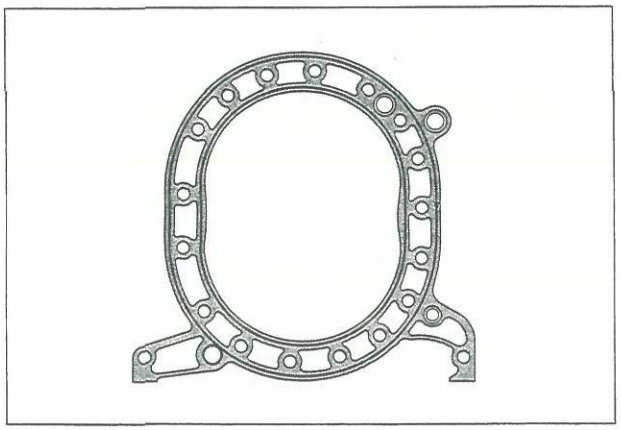


Fig. 1–88 Applying of sealing agent

2. Slightly apply rubber grease onto new "O" rings and sealing rubbers to prevent them from coming off, and place the "O" rings and sealing rubbers on the rear rotor housing.

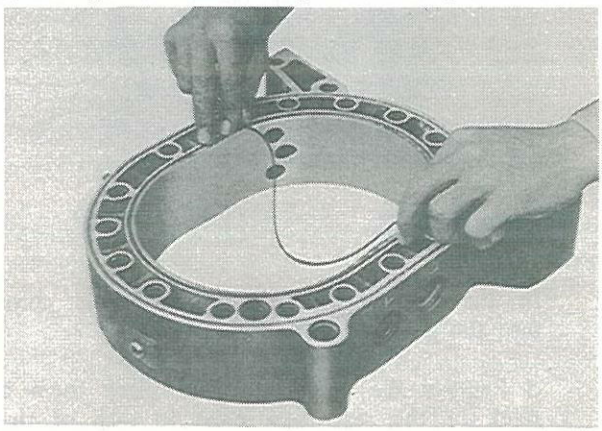


Fig. 1–89 Placing of sealing rubber

3. Invert the rear rotor housing being careful not to let the sealing rubbers and "O" rings drop out of the grooves, and mount it on the rear housing.
4. Apply engine lubricant onto the tubular dowels and insert the tubular dowels through the rear rotor housing holes into the rear housing holes.

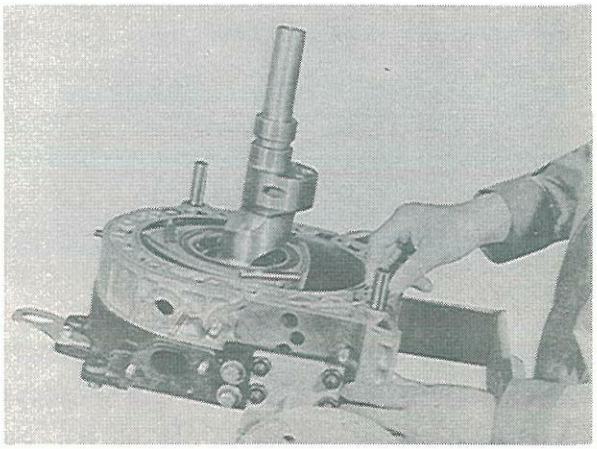


Fig. 1–90 Inserting of tubular dowel

f. Installing of seals

1. Fit each apex seal and springs into the grooves on the rear rotor, confirming their position and direction.

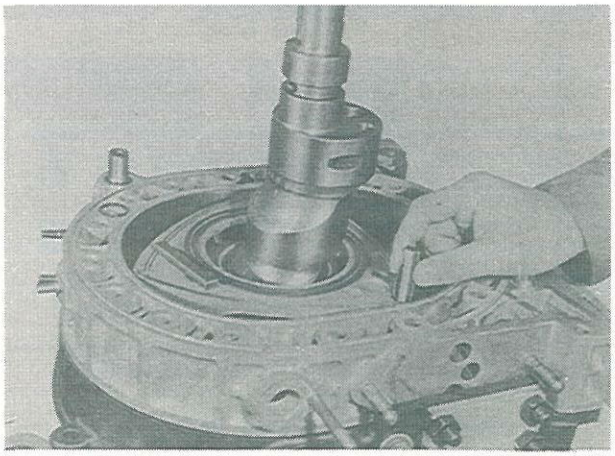


Fig. 1–91 Fitting of apex seal and spring

2. Fit the corner seals and side seals together with the springs to their respective grooves on the rear rotor (Refer to **step b in Par. 1–B–4**).
3. Apply some engine lubricant onto the seals on the rear rotor and sliding surface of the rear housing.

g. Installing of intermediate housing

1. Apply sealing agent onto the mating surface of the rear rotor housing.
2. Place new "O" rings and sealing rubbers on the rear rotor housing.
3. Make sure that the rear rotor housing is free from any foreign matter.
4. While holding the rear end of the eccentric shaft up to the extent that the front end of its rear rotor

journal does not come above the front end of the rear rotor bearing, place the intermediate housing on the rear rotor housing.

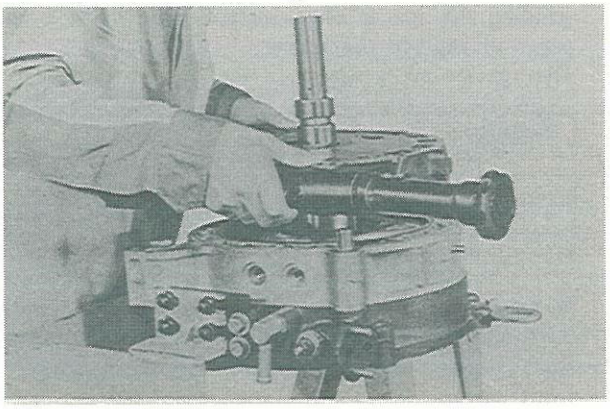


Fig. 1–92 Placing of intermediate housing

h. Installing of front rotor and front rotor housing
Refer to **steps a, b, c, e and f in Par. 1–B–4** and install the front rotor and front rotor housing.

i. Installing of front housing
1. Apply sufficient engine lubricant onto the stationary gear and main bearing.
2. Place the front housing on the front rotor housing. If necessary, turn the front rotor slightly to engage the teeth on the front housing stationary gear with these on the front rotor internal gear.

j. Tightening of tension bolts
1. Fit the tension bolts and apply 2 or 3 turns of each bolt.
2. Turn the engine on the work stand so that the top of the engine is up, and tighten the bolts gradually in the order shown in Fig. 1–93. The specified torque is **3.0 m-kg (22 ft-lb). Do not** tighten the tension bolts at one time.

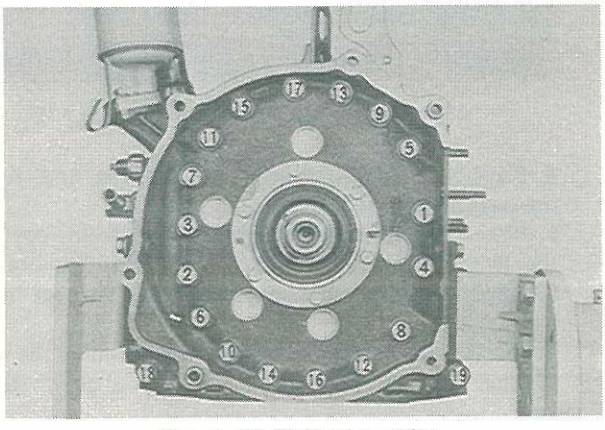


Fig. 1–93 Tightening order

3. Turn the eccentric shaft and make sure that the rotation is light and smooth.

k. Installing of flywheel
1. Apply lubricant to the oil seal in the rear housing and locking agent onto the thread of the eccentric shaft through the key.

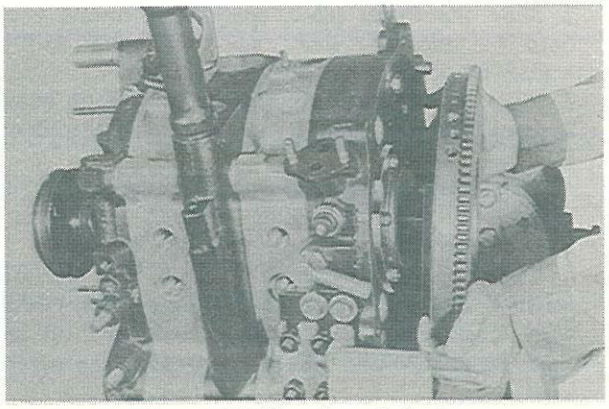


Fig. 1–94 Mounting of flywheel

2. Mount the flywheel to the rear end of the eccentric shaft so that the key fits into the keyway of the flywheel.
3. Apply sealing agent to both sides of the flywheel lock washer and place the lock washer in position.
4. Fit the flywheel lock nut by the fingers, and using the **flywheel nut wrench** (Part No. 49 0820 035) tighten the lock nut to **45.0 m-kg (350 ft-lb),** holding the flywheel with the **ring gear brake** (Part No. 49 0820 060A).

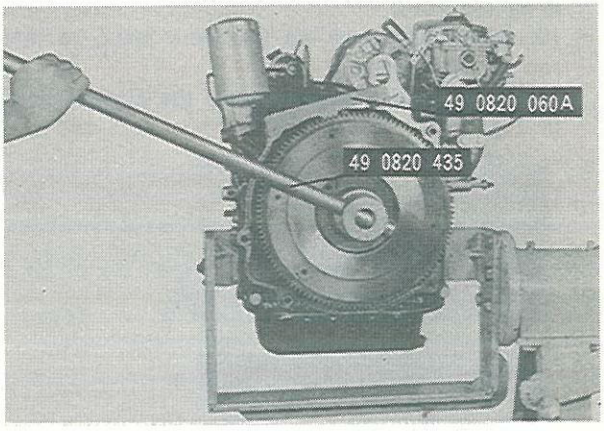


Fig. 1–95 Tightening of flywheel

l. Adjusting of eccentric shaft end play
1. Turn the engine on the work stand so that the front of the engine is up.

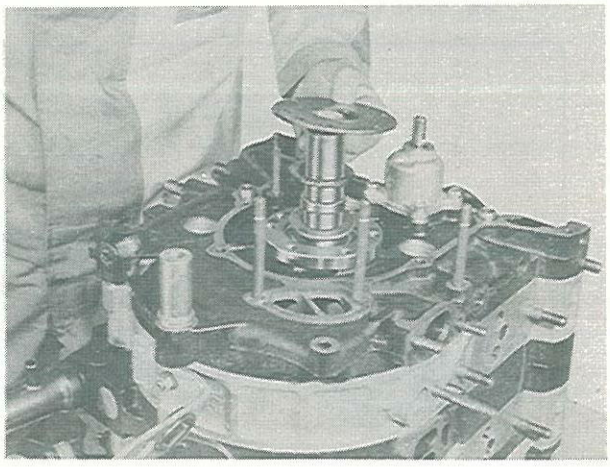


Fig. 1–96 Sliding of spacer and needle bearing

2. Slide the thrust plate, spacer and needle bearing onto the eccentric shaft, and then apply sufficient engine lubricant onto them.
3. Place the bearing housing on the front housing. Tighten the attaching bolts and bend the tabs of the lock washers.
4. Slide the needle bearing and thrust washer onto the shaft, and apply engine lubricant onto them.
5. Slide the balance weight onto the shaft.
6. Engage the oil pump drive chain with the driven sprocket and drive sprocket and slide the sprockets with chain onto the eccentric shaft and oil pump shaft simultaneously. Fit the key onto the eccentric shaft.

Note:
When installing the chain, it should be engaged to each sprocket before installing the sprockets to the eccentric shaft and oil pump shaft.

7. Slide the distributor drive gear, spacer and oil thrower onto the eccentric shaft.
8. Install the eccentric shaft pulley onto the shaft so that the keyway of the pulley aligns with the key.
9. Attach the **ring gear brake** (Part No. 49 0820 060A) to the flywheel, and tighten the pulley bolt to **8.5 m-kg (60 ft-lb).**
10. Turn the engine on the work stand so that the top of the engine is up.
11. Apply a dial indicator onto the flywheel as shown in Fig. 1–97. Move the flywheel fore and aft, and note the reading of the indicator. The standard end play is **0.04 ~ 0.07 mm (0.0016 ~ 0.0018 in).** If the end play is not within the limits, adjust it by grinding the spacer on a surface plate using a emery paper or replace the spacer.
The spacers are available in the following thicknesses:

Identification Mark	Thickness
X	8.08 ± 0.01 mm (0.3181 ± 0.0001 in)
Y	8.04 ± 0.01 mm (0.3166 ± 0.0001 in)
V	8.02 ± 0.01 mm (0.3158 ± 0.0001 in)
Z	8.00 ± 0.01 mm (0.3150 ± 0.0001 in)

Recheck the end play. If the end play is 0.04 ~ 0.07 mm (0.0016 ~ 0.0018 in), remove the eccentric shaft pulley, and proceed as follow to install the front cover:

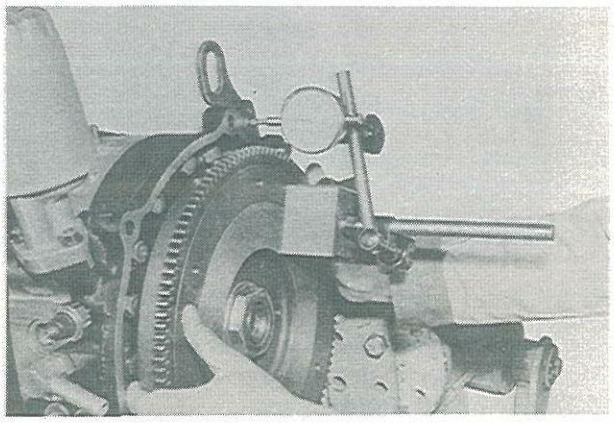


Fig. 1–97 Checking of eccentric shaft end play

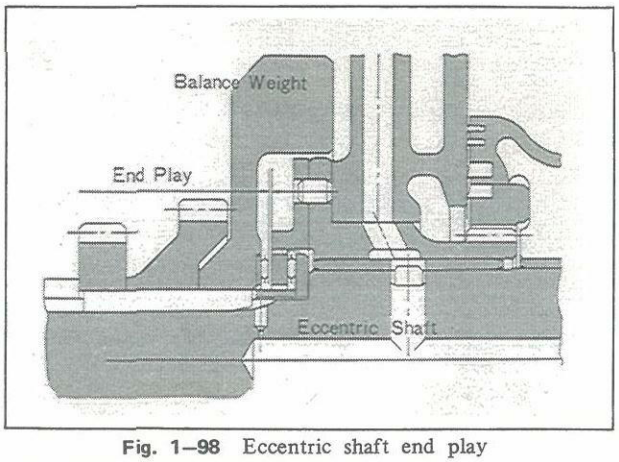


Fig. 1–98 Eccentric shaft end play

m. Installing of front cover and eccentric shaft pulley
1. Turn the engine on the work stand so that the front of the engine is up.
2. Tighten the oil pump driven sprocket nut and bend the tab of the lock washer.
3. Place a new "O" ring on the oil passage of the front cover.

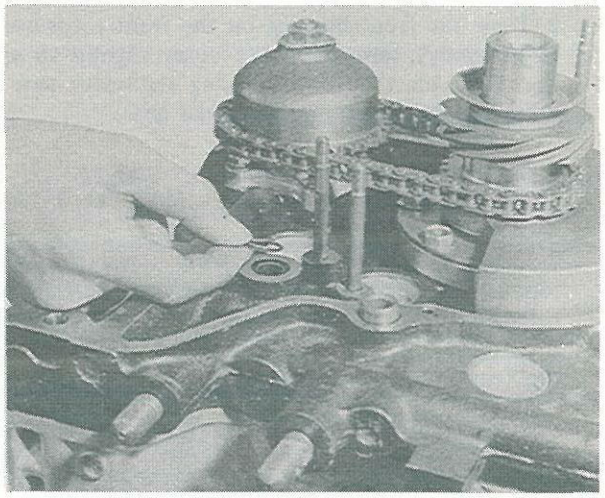


Fig. 1–99 Placing of "O" ring

4. Place the chain adjuster in position and tighten the attaching nuts.
5. Place the front cover gasket and front cover on the front housing and tighten the attaching bolts.
6. Apply engine lubricant onto the oil seal in the front cover.
7. Install the eccentric shaft pulley onto the shaft so that the keyway of the pulley aligns with the key.
8. Attach the ring gear brake to the flywheel and tighten the pulley bolt to **8.5 m-kg (60 ft-lb).**

n. Installing of clutch cover assembly
1. Hold the clutch disc in its mounting position with the **clutch disc arbor** (Part No. 49 0813 310). If the arbor is not available, use a spare main drive shaft.

2. Mount the clutch cover and pressure plate assembly on the flywheel, and **align the "O" mark** on the clutch cover with the **reamed hole of the flywheel**. Install the attaching bolts and tighten the bolts to 2.0 m-kg (15 ft-lb), using the **ring gear brake** (Part No. 49 0820 060A). Use the two reamer bolts in the reamed hole.

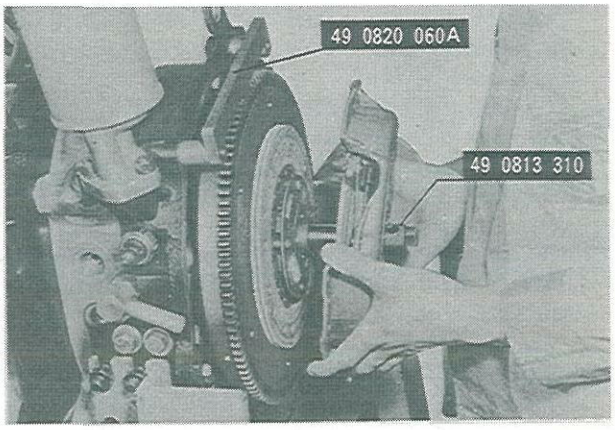


Fig. 1–100 Mounting of clutch cover

o. Installing of oil strainer and oil pan

1. Turn the engine on the work stand so that the bottom of the engine is up.
2. Cut off the excess gasket on the front cover along the mounting surface of the oil pan.

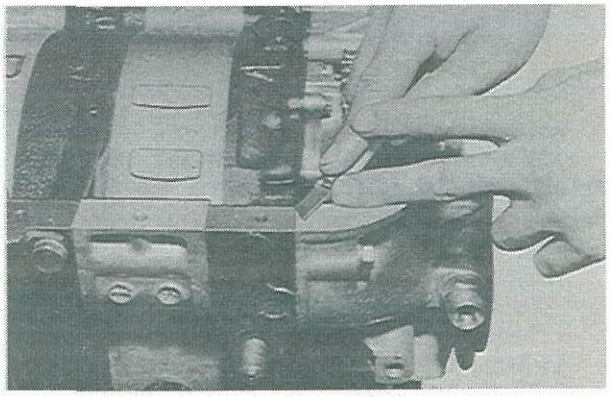


Fig. 1–101 Cutting of excess gasket

3. Place the oil strainer gasket and strainer on the front housing and tighten the attaching bolts.

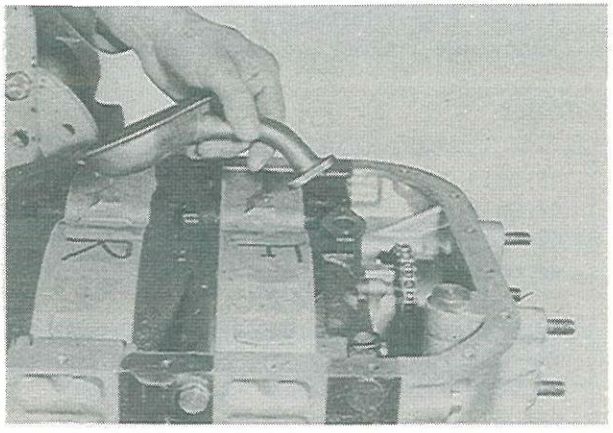


Fig. 1–102 Placing of oil strainer

4. Apply sealing agent onto the mating surfaces of the oil pan and each housing.

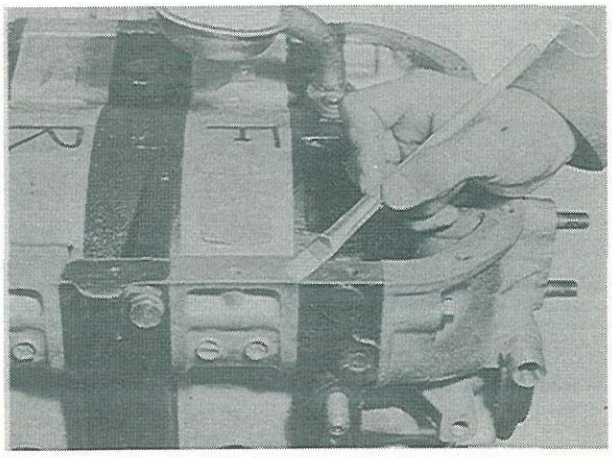


Fig. 1–103 Applying of sealing agent

5. Place the gasket and oil pan in position.
6. Insert the bolts through the stiffeners, and tighten the bolts **little by little in turn** until the torque becomes **1.0 m-kg (7.0 ft-lb) evenly**.

p. Installing of distributors

1. Invert the engine on the work stand.
2. Rotate the eccentric shaft until the white mark on the pulley aligns with the needle on the front cover.

Note :

On the rotary engine, each rotor makes a 1/3 rotation as against one rotation of the eccentric shaft. That is, a combustion is obtained at each 1/3 rotation of the rotor makes a 1/3 rotation. Therefore, when the white mark and needle are aligned, the front rotor is always located at top dead center in the compression stroke.

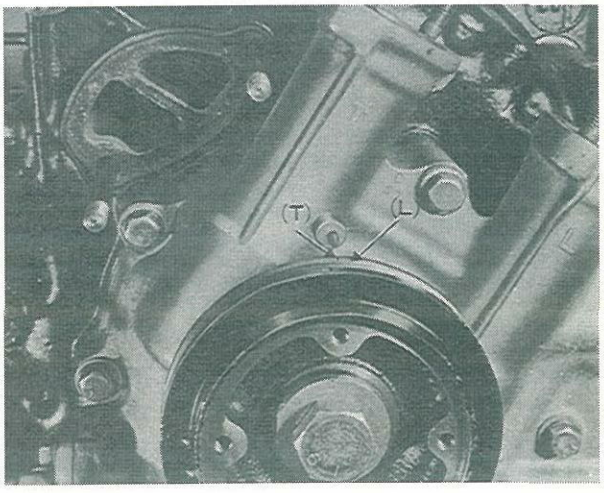


Fig. 1–104 Aligning of top dead center

3. Install the trailing distributor socket through the gasket so that the groove on the drive shaft is at an inclination of **about 34°** to the right against the longitudinal axis of the engine. Tighten the socket attaching nuts.

4. Install the leading distributor socket through the gasket onto the front housing so that the groove on the drive shaft is at an inclination of **about 17°** to the right against the longitudinal axis of the engine. Tighten the attaching nuts.

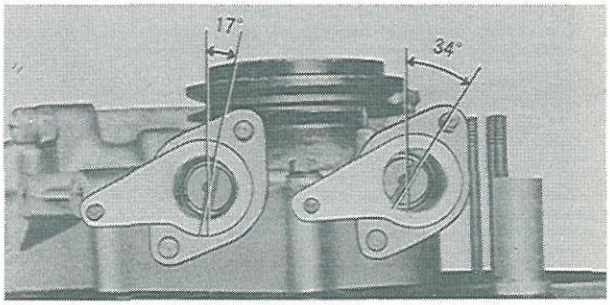


Fig. 1–105 Position of distributor socket

5. Align the identification marks on each distributor housing and driven gear. Insert each distributor into the socket so that the distributor driven shaft end fits into the groove on the drive shaft.

Note:
The marks of the distributor and front cover, "T" and "L", must be coincide with each other.

6. Rotate each distributor slightly in the direction shown in Fig. 1–106 and the contact points start to separate. Then, tighten the lock nut for each distributor.
7. Fit each distributor cap.

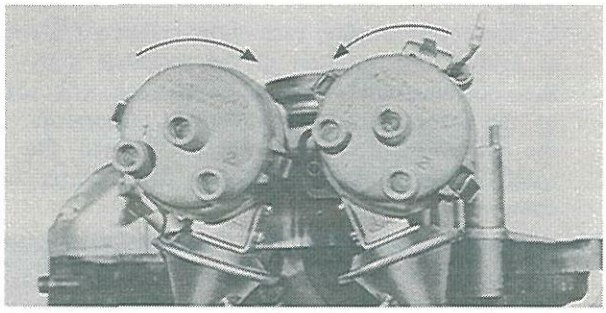


Fig. 1–106 Adjusting of ignition timing

q. Installing of water pump and engine mounting bracket

1. Place the gasket and water pump on the front housing, and tighten the attaching nuts.
2. Install the water pump pulley onto the water pump boss and tighten the bolts.
3. Install the engine mounting bracket onto the front cover and tighten the attaching nuts.

r. Installing of alternator

1. Install the alternator to the bracket with the bolt and nut.
2. Attach the upper end of the alternator flange to the adjusting bar.
3. Fit the "V"-belt.
4. Adjust the belt deflection.

The belt deflection should be **15 ~ 17 mm (0.59~ 0.67 in)** when thumb pressure of about 10 kg (22 lb) is applied to the middle of the belt between the alternator pulley and eccentric shaft pulley. On a new belt, the deflection should be **12 ~ 14 mm (0.47 ~ 0.55 in).** After adjusting, tighten the bolts and nuts.

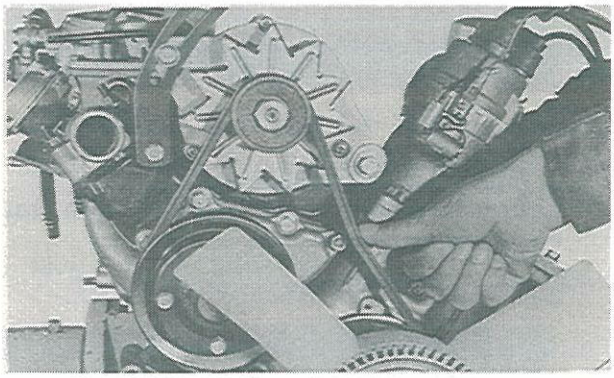


Fig. 1–107 Adjusting of "V" belt deflection

s. Installing of intake manifold and carburetor

1. Place the carburetor and intake manifold assembly with the gaskets in position and tighten the attaching nuts.
2. Connect the oil tubes, vacuum tube and metering oil pump connecting rod with the carburetor.

t. Installing of exhaust manifold

1. Remove the engine from the work stand.
2. Place the gaskets and exhaust manifold in position and tighten the attaching nuts.
3. Place the hot air duct in position and tighten the attaching nuts.

1–B–5. Engine Installation

Follow the removal procedures in the reverse order.

SPECIAL TOOLS

49 0839 000	Engine work stand	49 0813 245	Expander (For rotor bearing)
49 0813 005	Engine hanger	49 0813 240	Rotor bearing remover and installer
49 0820 006	Attachment (For engine hanger)	49 0813 225	Oil seal remover
49 0820 060A	Ring gear brake	49 0839 165	Bar limit gauge (For corner seal groove)
49 0820 035	Flywheel nut wrench		
49 0823 300	Flywheel puller	49 0839 170	Reamer (For corner seal groove)
49 0813 250	Seal case	2113 99 990	Jig (For corner seal groove)
49 0813 215	Tubular dowel puller	49 0823 071	Needle bearing remover
49 0813 235	Main bearing remover and installer	49 0823 072	Needle bearing installer
		49 0813 310	Clutch disc arbor

LUBRICATING SYSTEM

DESCRIPTION

Oil is circulated under pressure by a rotor type pump. The pump is driven by the eccentric shaft through the chain. A full-flow type oil filter is mounted on the rear housing. A metering oil pump delivers an adequate amount of oil into the float chamber of the carburetor to lubricate each seal. An oil cooler is fixed beneath the radiator.

2–A. LUBRICATING CIRCUIT

1. The oil pump which is driven by the eccentric shaft, draws up oil from the oil pan through the strainer and sends it to the oil cooler.
2. The oil that has been cooled through the oil cooler is forced to the oil filter.
3. The oil that has been filtered by the oil filter is forced to the front main bearing through the tubular dowel and to the rear main bearing through the passage of the rear housing.
4. 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.
5. Stationary gears, internal gears and needle bearings are lubricated by the oil forced through the clearance between the main bearing and shaft.
6. The oil circulating through the eccentric shaft passage lubricates the rotor bearings.
7. The oil passing through the tubular dowel is sent to the distributors and metering oil pump.
8. From the metering oil pump, the lubricant is forced to the carburetor and is supplied into the combustion chambers together with the air-fuel mixture to lubricate the apex seals, corner seals, side seals and housings.

2–B. OIL PUMP

The oil pump is of a rotor type based on a trochoid curve and consists of the parts as shown in Fig. 2–1. The feeding capacity is 6 liters/min. (12.7 U.S. pints/min., 10.6 Imp. pints/min.) at 1,000 rpm of engine revolution.

2–B–1. Oil Pump Removal

1. Remove the front cover as described in Par. **1–A–2.**
2. Remove the bolts attaching the oil pump to the front housing and remove the oil pump.

2–B–2. Oil Pump Disassembly

1. Remove the snap ring from the shaft, and remove the rear rotors and key.
2. Remove the middle plate attaching screw and remove the middle plate.
3. Remove the front rotors, and key from the shaft.

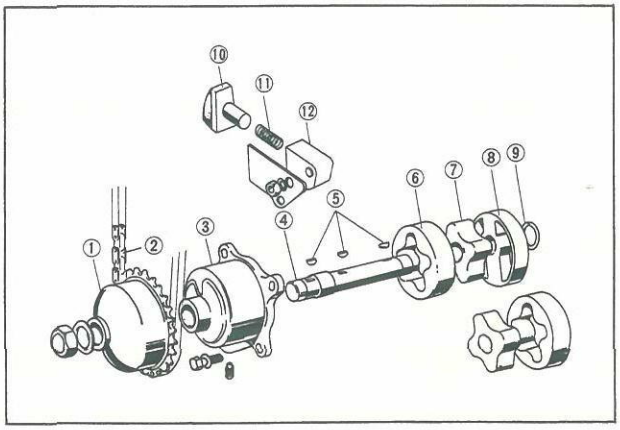


Fig. 2–1 Oil pump components

1. Oil pump driven sprocket
2. Oil pump chain
3. Pump body
4. Shaft
5. Keys
6. Outer rotor
7. Inner rotor
8. Middle plate
9. Snap ring
10. Slipper head
11. Spring
12. Body

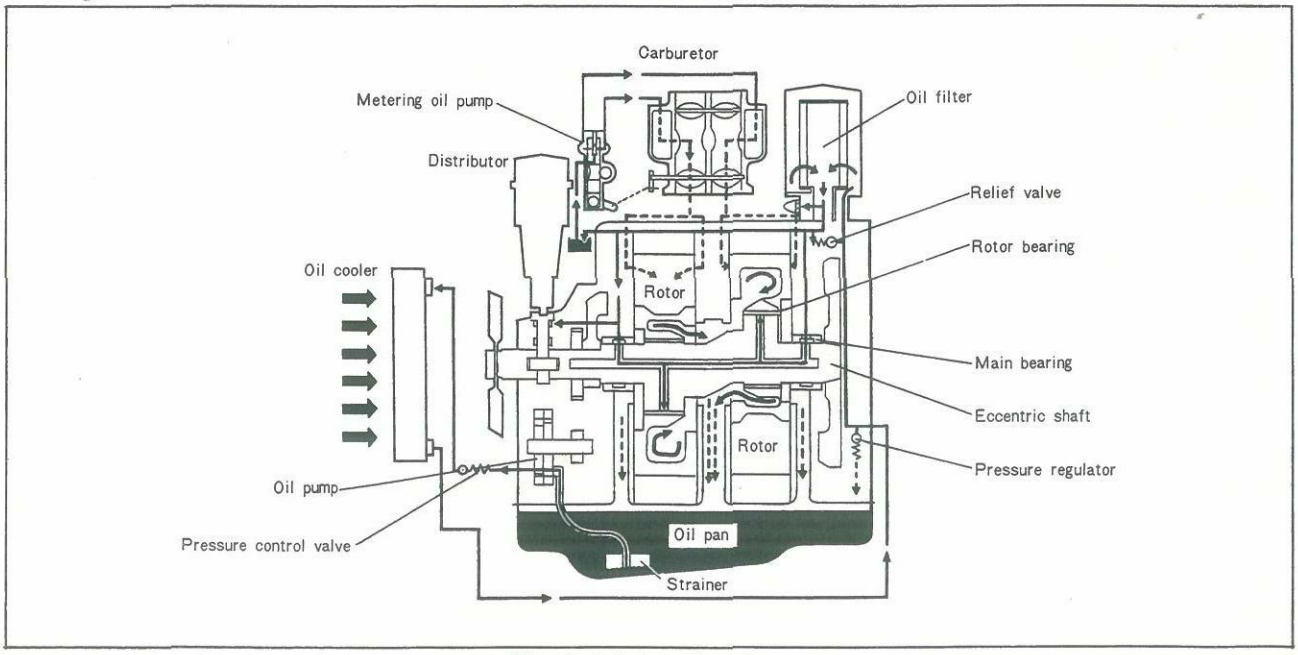


Fig. 2–2 Lubricating circuit

2–B–3. Oil Pump Inspection

1. Check the clearance between the lobes of the rotors with a feeler gauge, as shown in Fig. 2–3. The standard clearance should be 0.01 ~ 0.09 mm (0.0004 ~ 0.0035 in). If the clearance exceeds **0.15 mm (0.006 in)**, replace both rotors.

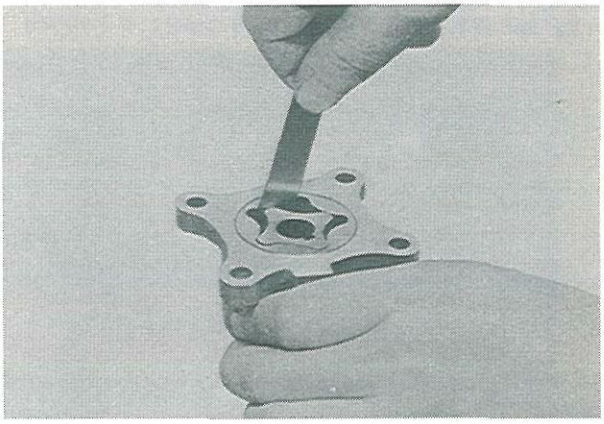


Fig. 2–3 Checking clearance between rotors

2. Check the clearance between the outer rotor and pump body with a feeler gauge as shown in Fig. 2–4. The specified clearance is 0.200 ~ 0.245 mm (0.008 ~ 0.010 in). If the clearance is more than **0.30 mm (0.012 in)**, replace both rotors.

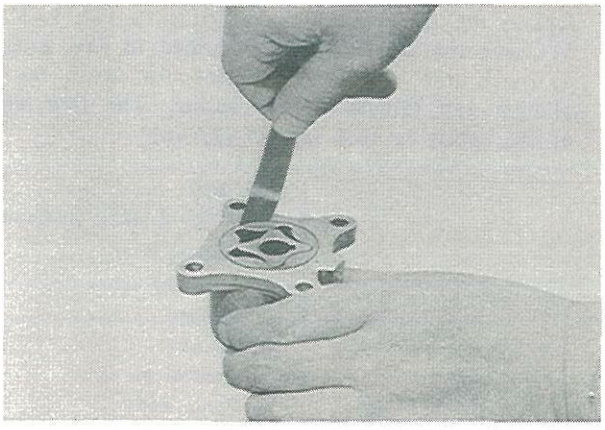


Fig. 2–4 Checking clearance of outer rotor and body

3. Check the end float of the rotors. Place a straight edge across the pump body and measure the clearance between the rotor and straight edge with a feeler gauge. The standard end float is 0.030 ~ 0.125 mm (0.001 ~ 0.005 in). If the end float exceeds **0.30 mm (0.012 in)**, correct the pump body or replace both rotors.

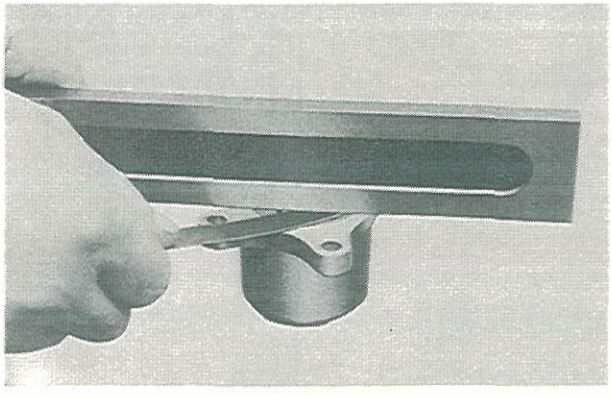


Fig. 2–5 Checking of end float

2–B–4. Oil Pump Assembly

Follow the disassembly procedures in the reverse order.

2–B–5. Oil Pump Installation

Follow the removal procedures in the reverse order.

2–C. CHAIN ADJUSTER

2–C–1. Chain Adjuster Removal

Refer to **Par. 1–A–2** and remove the chain adjuster.

2–C–2. Chain Adjuster Inspection

1. Check the amount of protrusion of the chain adjuster, as shown in Fig. 2–6. If the protrusion exceeds **12 mm (0.47 in)**, repalce the adjuster or chain.

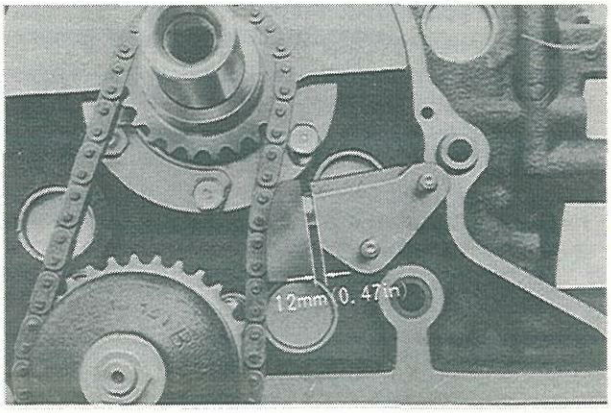


Fig. 2–6 Checking of chain adjuster protrusion

2. Check the rubber on the contacting surface of the chain adjuster for wear or damage and spring for weakness. If necessary, replace the chain adjuster.

2–C–3. Chain Adjuster Installation

Follow the removal procedures in the reverse order.

2–D. OIL PUMP CHAIN AND SPROCKET

2–D–1. Oil Pump Chain and Sprocket Removal

Refer to **Par. 1–A–2** and remove the oil pump chain and sprocket.

2–D–2. Oil Pump Chain and Sprocket Inspection

1. Check the chain for broken links.
2. Check the sprockets for cracks and worn or damaged teeth. If any defects are found, replace with new parts.

2–E. PRESSURE REGULATOR

The pressure regulator is provided on the rear housing. When the engine revolution becomes high and excessive oil pressure develops in the system, the pressure regulator opens to relieve the pressure and to send the excess oil to the oil pan. Thus, the oil pressure is maintained within the maximum pressure of **5 kg/cm² (71.1 ft-lb²)**.

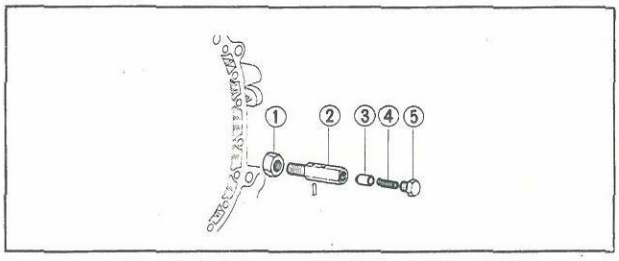


Fig. 2–7 Pressure regulator components
1. Lock nut
2. Regulator body
3. Plunger
4. Spring
5. Plug

2–F. OIL PRESSURE SWITCH

The oil pressure switch fitted to the rear housing is connected by the wiring to the oil pressure warning lamp. The safe minimum pressure is **0.3 kg/cm² (4.3 lb/in² at idle.** If the oil pressure drops below 0.3 kg/cm² (4.3 lb/in²) the warning lamp lights up to indicate a trouble in the lubricating system. Therefore, when the warning lamp goes on, the oil pressure should be checked immediately.

To check the oil pressure, proceed as follows:
1. Remove the oil pressure switch and install an oil pressure gauge in its place.
2. Warm up the engine to the normal operating temperature.
3. Run the engine at **3,000 rpm** and take a reading of the gauge. If the reading of the gauge is **5.0 kg/cm² (71.1 lb/in²)**, the oil pressure is normal.

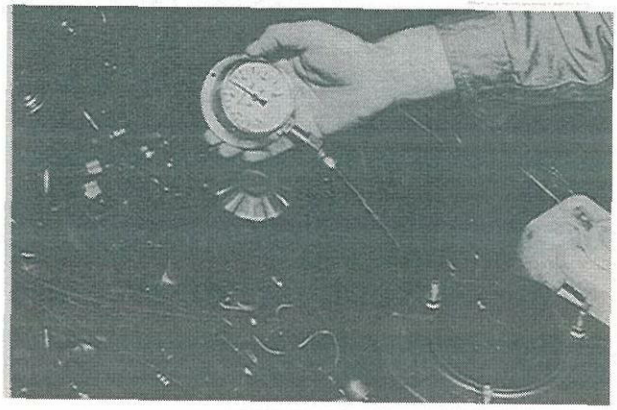


Fig. 2–8 *Checking of oil pressure*

If the oil pressure is extremely low, check the following points:
1) Ensure that the oil level is between the "F" and "L" marks of the dipstick gauge.
2) Check the oil filter for clogging. If it is clogged, replace the filter cartridge, referring to **Par. 2–K.**
3) Check the oil pump, as described in **Par. 2–B–3.**
4) Check the pressure regulator for wear on the plunger and fatigue on the spring. The free length of the spring is **46.4 mm (1.827 in).**

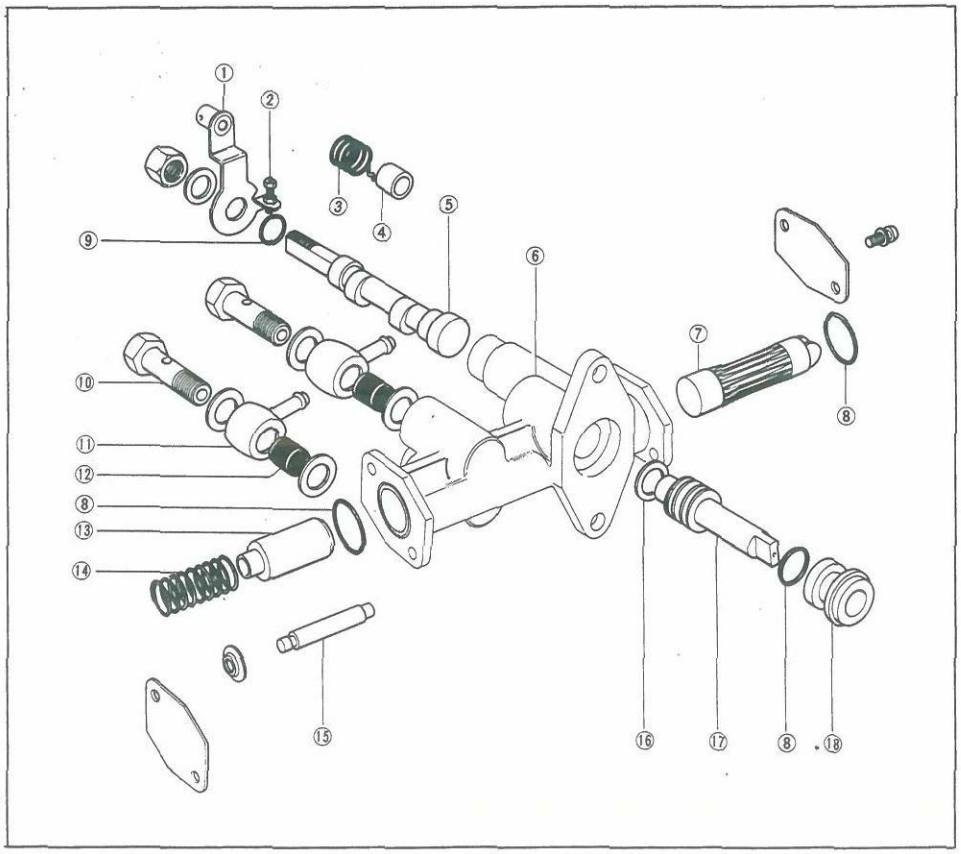


Fig. 2–9
Metering oil pump components
1. Control lever
2. Adjusting screw
3. Spring
4. Spacer
5. Control pin
6. Pump body
7. Plunger
8. "O" ring
9. "V" ring
10. Connecting bolt
11. Connector
12. Strainer
13. Differential plunger
14. Plunger spring
15. Sub plunger
16. Thrust washer
17. Worm gear
18. Worm bearing

2–G. METERING OIL PUMP

The plunger type metering oil pump is provided to send the proper amount of oil to the carburetor. The oil enters the combustion chamber together with the air-fuel mixture and lubricates the sliding surfaces of the seals and housings. The amount of oil supply 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 carburetor and moves the control pin. The control pin which is a cam-shaped shaft and is in contact with the cam-shaped tip of the plunger, and thus the stroke of the plunger is controlled by the opening angle of the throttle valve.

When the opening of the throttle valve is small, the stroke of the plunger is also small. Thus since the stroke of the differential plunger which is turned and pushed together with the plunger is small, the amount of oil discharge small is kept at a low level. As the opening of the throttle valve increases, the stroke of the plunger becomes larger, increasing the stroke of the differential plunger. Thus the amount of oil supply becomes larger.

2–G–1. Metering Oil Pump Removal

1. Disconnect the connecting rod from the control lever of the pump by removing the cotter pin.

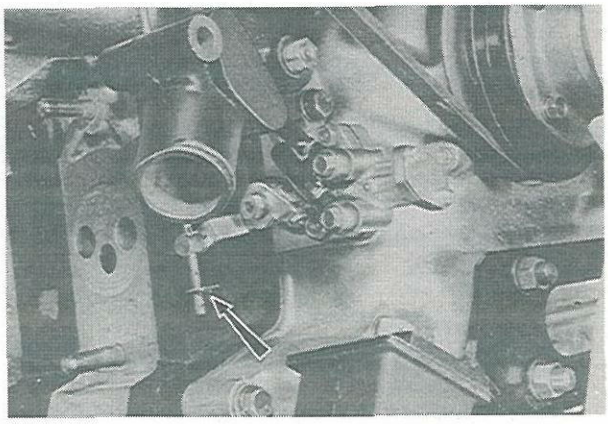


Fig. 2–10 Removing of cotter pin

2. Pull out the oil tubes at the carburetor.
3. Remove the bolts attaching the pump to the front cover and remove the pump.

2–G–2. Metering Oil Pump Disassembly

1. Remove the screws attaching the covers to the pump body and remove the covers from both sides of the body.
2. Remove the plunger, worm gear and spring.
3. Remove the front cover, as described in **Par. 1–A–2**, and remove the oil pump driven gear and shaft from the front cover.

To remove the driven gear, proceed as follows :

1) Remove the snap ring that secures the driven gear to the shaft and remove the shim and driven gear from the shaft.
2) Remove the shaft lock pin.
3) Remove the snap ring and remove the shaft from the front cover.

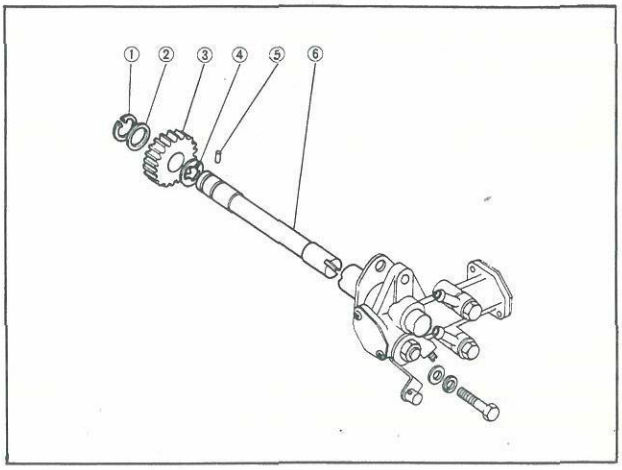


Fig. 2–11 Metering oil pump drive components

1. Snap ring	4. Snap ring
2. Shim	5. Lock pin
3. Driven gear	6. Pump shaft

2–G–3. Metering Oil Pump Inspection

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

1. Disconnect the oil tubes at the carburetor.
2. Disconnect the connecting rod of the metering oil pump at the carburetor.
3. Run the engine **at 2,000 rpm.**

Check the amount of oil discharged from the two oil tubes of the metering oil pump. If it is **2.4 ~ 2.9 cc/6 min.**, the discharge of oil is normal. If necessary, adjust the metering oil pump.

Fig. 2–12 Checking of oil discharge

2–G–4. Metering Oil Pump Adjustment

When adjusting the metering oil pump, the amount of oil discharge is increased by turning the adjusting screw clockwise and decreased by turning it counterclockwise.

2–G–5. Metering Oil Pump Assembly

Follow the disassembly procedures in the reverse order.

2–G–6. Metering Oil Pump Installation

Follow the removal procedures in the reverse order.

2–G–7. Adjusting of Metering Oil Pump Connecting Rod

At the ends of the pump connecting rod there are three holes which provide three changes in the pump discharge amount. Accordingly, select and use the hole according to the engine condition.

2–H. OIL COOLER

2–H–1. Oil Cooler Removal

1. Raise the vehicle and support with stands.
2. Drain the engine lubricant.
3. Remove the bolts and screws attaching the engine under cover, and remove the engine under cover.
4. Disconnect the oil hose from the oil cooler.
5. Remove the nuts attaching the oil cooler to the radiator and remove the oil cooler.

2–H–2. Oil Cooler Inspection

Examine the oil cooler carefully for leaks. If any leakage is found, however small it may be, repair completely by soldering, etc. Clean the exterior of the oil cooler core by blowing out with compressed air.

2–H–3. Oil Cooler Installation

Follow the removal procedures in the reverse order.

2–I. OIL PAN

2–I–1. Oil Pan Removal

1. Raise the vehicle and support with stands.
2. Drain the engine lubricant.
3. Remove the bolts and screws attaching the engine under cover, and remove the engine under cover.
4. Remove the bolts attaching the oil pan, and remove the oil pan and gasket.

2–I–2. Oil Pan Inspection

Scrape off any dirt or metal particles from the inside of the oil pan. Wash the oil pan in a solvent and dry it with compressed air.

Check the oil pan for any cracks and damaged drain plug threads. Inspect for damage (uneven surface) at the bolt holes caused by over-torqueing the bolts.

Straighten surfaces as required. Repair any damage, or replace the oil pan if repairs can not be made satisfactorily.

12–I–3. Oil Pan Installation

Follow the removal procedures in the reverse order.

2–J. OIL STRAINER

2–J–1. Oil Strainer Removal

1. Remove the oil pan, as described in **Par. 2–I–1.**
2. Remove the bolts attaching the oil strainer and remove the oil strainer.

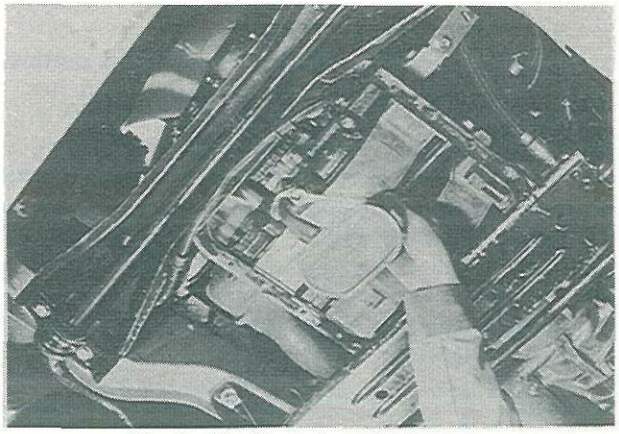


Fig. 2–13 Removing of oil strainer

2–J–2. Oil Strainer Installation

Follow the removal procedures in the reverse order.

2–K. OIL FILTER

The oil filter is of a cartridge type. The element of the filter is sealed in the container as a unit.

The oil filter is provided with a relief valve. If the oil filter is clogged by impurities in the oil and the filtering resistance reaches **1.2 kg/cm² (17.1 lb/in²)**, the oil can not pass through the element. In this case, the oil pushes the relief valve open and unfiltered oil is supplied to the engine.

The oil filter should be replaced **every 12,000 km (8,000 miles).**

To replace the oil filter, proceed as follows:

1. Remove the oil filter cartridge with a suitable oil filter wrench.
2. Apply oil onto the rubber gasket on the new filter cartridge.
3. Place the cartridge on the cover and screw in until it just touches the cover.
4. Tighten the cartridge a further 2/3 of a turn but absolutely no more.

Do not use the oil filter wrench.

5. Start the engine and check to see that the oil is not leaking from the joints. Top up with oil if necessary.

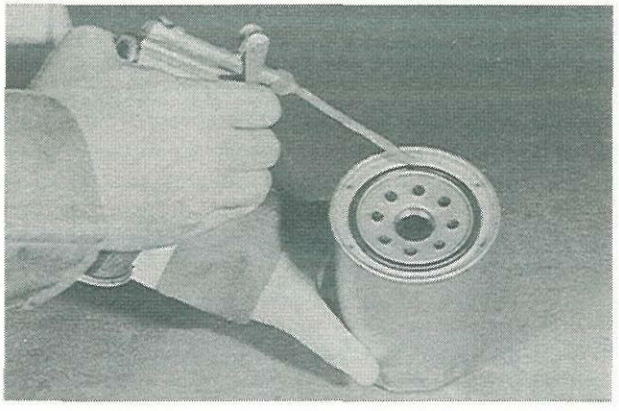


Fig. 2–14 Applying of oil

COOLING SYSTEM

DESCRIPTION

The completely sealed cooling system consists of a corrugated fin type radiator with sealed filler cap, expansion tank with pressure cap, centrifugal water pump, wax pellet type thermostat, and four-blade fan. The radiator and the expansion tank are connected by the hose. When the engine is overheated, the coolant in the radiator flows out and is let into the expansion tank through the hose. The coolant is then returned to the radiator by negative pressure which builds-up in the cooling system when the engine cools down. The coolant should be changed **every two years or every 48,000 km (32,000 miles).**

3–A. COOLANT CIRCUIT

The water pump is driven by the eccentric shaft pulley through a V-belt and discharges the cooling water to the front housing. The water circulates from the front housing through the water passage provided in each housing and flows to the rear housing. From the rear housing, the water is returned to the front housing. At low engine temperature, the thermostat is closed to keep the water from entering the radiator. The water then flows directly to the water pump where it is recirculated to each housing. As the thermostat opens when the engine is warmed up, the water flows into the radiator. The cooled water flows from the radiator to the water pump through the connecting hose and cools the engine by circulation.

3–B. FLUSHING OF COOLING SYSTEM

The cooling system should be flushed **every two years or 48,000 km (32,000 miles).**
The flushing procedures are as follows:
1. Open the drain plugs and drain the coolant.

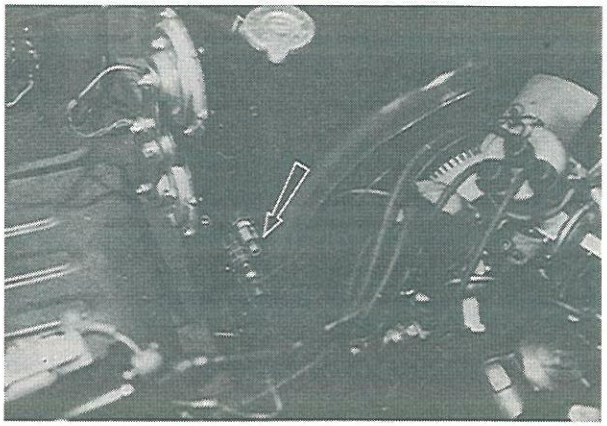


Fig. 3–1 Opening of drain plug

2. Close the drain plugs and supply clean soft water.

Note:
If necessary, use cleaning solution to loosen rust and scale, by following the instructions given by the maker of the cleaning solution.

3. Run the engine for about one hour, at the normal operating temperature.
4. Drain the water completely.
5. Fill with soft water (demineralized water) and genuine long life coolant, referring to **Par. 3–C.**

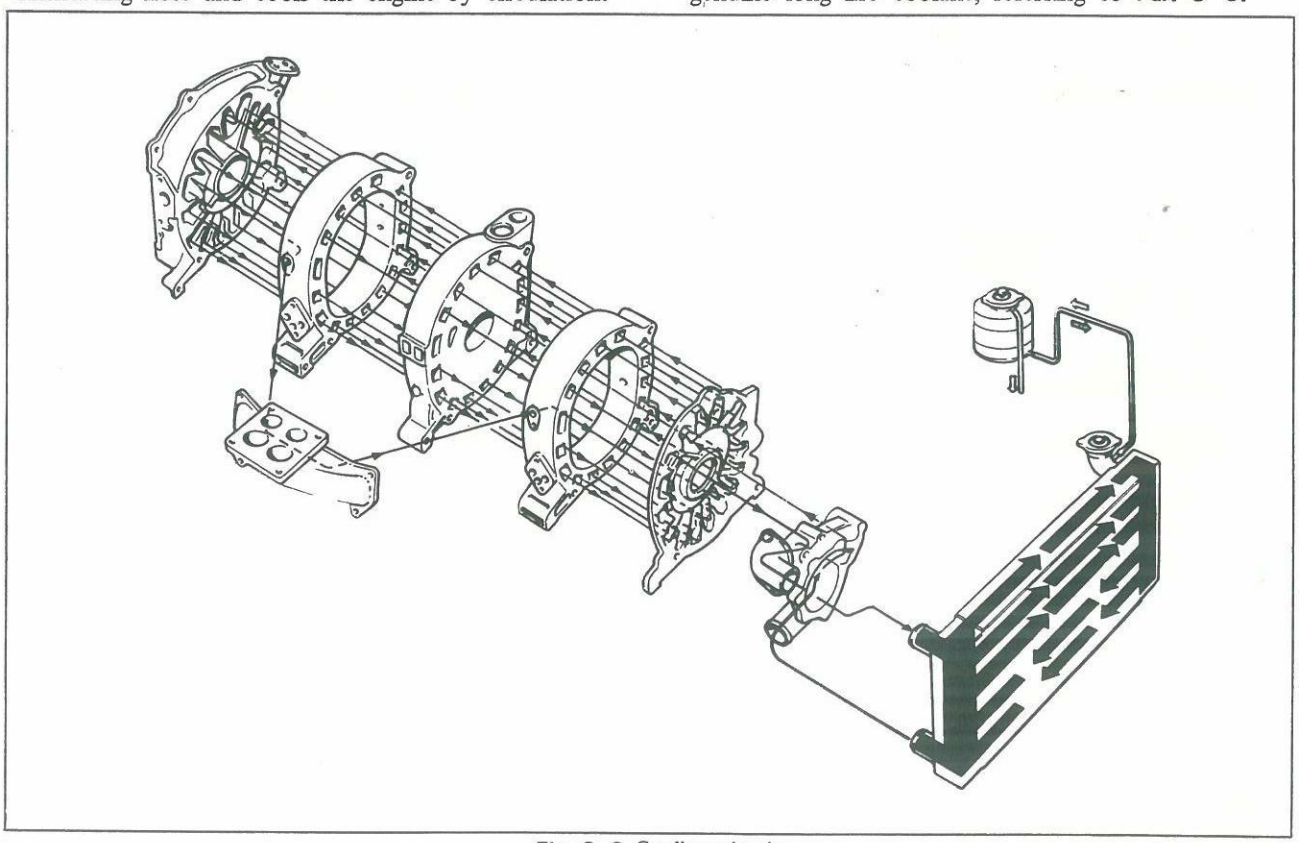


Fig. 3–2 Cooling circuit

3–C. GENUINE LONG LIFE COOLANT

Genuine long life coolant is used in the cooling system of RX-3. This coolant includes an anti-freeze solution and an anti-corrosive solution. The mixture ratio of water and genuine long life coolant is shown in the following table :

Freezing point	Mixture ratio		Specific gravity of mixture at 20°C (68°F)
	Coolant	Water	
–20°C(–4°F)	35	65	1.051
–45°C(–49°F)	55	45	1.078

Note :

(a) Always use soft water (demineralized water) in the cooling system.

(b) If genuine long life coolant is not available, add genuine anti-freeze solution or anti-corrosive according to the time of the year.

Freezing point		Mixture ratio %		Specific gravity of mixture at 20° C (68°F)
C	F	Antifreeze solution	Water	
– 6.3	20.7	15	85	1.022
– 9.3	15.3	20	80	1.029
–12.6	9.3	25	75	1.037
–16.2	2.8	30	70	1.044
–20.5	– 4.9	35	65	1.051
–25.2	–13.4	40	60	1.058
–31.2	–24.2	45	55	1.066
–37.6	–35.7	50	50	1.073
–45.2	–49.4	55	45	1.080

3–D. RADIATOR

The radiator is of the corrugated fin type with a sealed filler cap. The water capacity of the radiator is 1.9 liters (4.0 U.S. pints, 3.3 Imp. pints)

3–D–1. Radiator Removal

1. Drain the cooling system.
2. Remove the bolts and screws attaching the radiator shroud and remove the radiator shroud.
3. Disconnect each hose from the radiator.

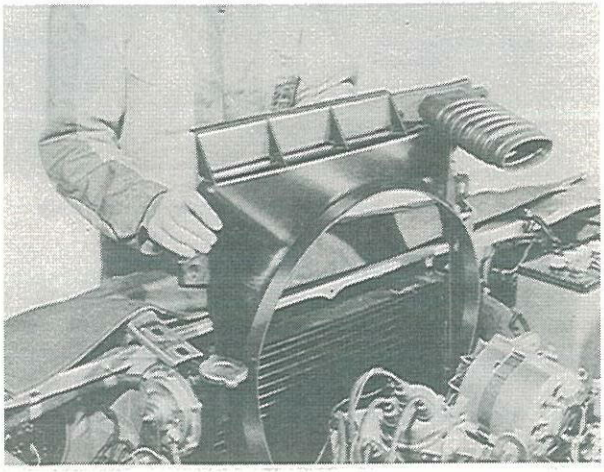


Fig. 3–3 Removing of radiator shroud

4. Remove the nuts attaching the radiator to the oil cooler and body, and remove the radiator.

3–D–2. Radiator Inspection

Check the radiator for leaks. Repair if necessary. Check the radiator core fin for clogging of the air passages. If necessary, repair the fins. If the clogging of the radiator core covers an area of more than 20 percent of the total radiator area, replace the radiator.

3–D–3. Radiator Installation

Follow the removal procedures in the reverse order.

3–E. EXPANSION TANK

The expansion tank has a pressure cap and is connected with the radiator by hose. The pressure in the cooling system raises the boiling point of the coolant, thus preventing overheating and reducing overflow loss. When the pressure in the cooling system exceeds 0.9 kg/cm² (12.8 lb/in²), the pressure valve opens. A vacuum release valve is employed to prevent undesirable vacuum build-up when the system cools down.

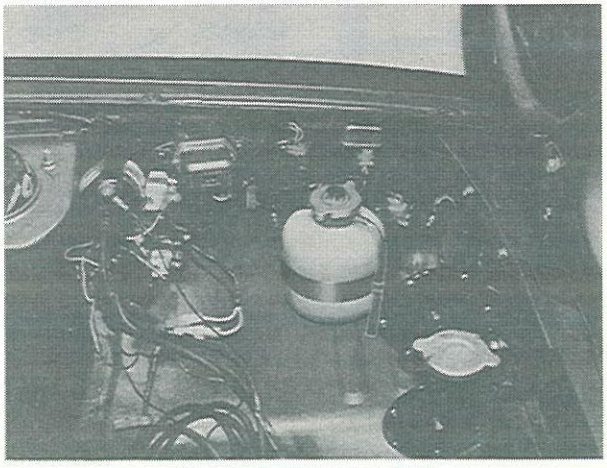


Fig. 3–4 Expansion tank

3–E–1. Expansion Tank Inspection

Check the function of the pressure cap. Many types of pressure gauges are available for use. Therefore, it is recommended that the gauge manufacturer's instructions be followed when performing the test. The specified pressure is **0.9 kg/cm² (12.8 lb/in²)**. Check the expansion tank for any crack or damage.

Note :

(a) The coolant should be filled full in the radiator and 1/3 full in the expansion tank.

(b) **To remove** the radiator sealed filler cap when the coolant temperature is high or at the boiling point, depress the push button on the expansion tank to release the pressure in the cooling system.

Then, turn the radiator cap further until it can be removed.

3–F. THERMOSTAT

The thermostat is of a wax type and also of a bottom bypass type which is superb in cooling efficiency. A bypass hole is provided beneath the thermostat, as shown in Fig. 3–5, and when the thermostat is completely closed, a large volume of cooling water flows through this hole so that localized rise in temperature can be prevented. On the other hand, when the thermostat is completely opened, the by-pass hole is closed by the thermostat valve and the entire amount of cooling water is circulated into the radiator, which will enable the radiator to work effectively. However, in case the thermostat is removed, a large volume of cooling water will flow through the bypass hole due to the larger bypass hole and the water circulating into the radiator will be decreased by half which will result in a rise in the temperature of the cooling water. Accordingly, be sure not to remove the thermostat nor to use any other type of thermostat.

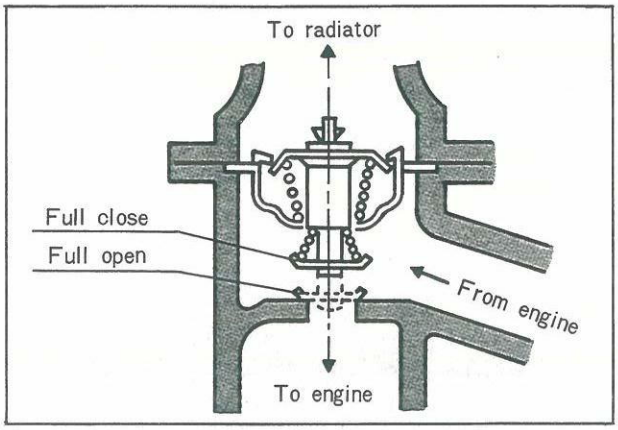


Fig. 3–5 Thermostat and by-pass hole

3–F–1. Thermostat Removal

1. Drain the cooling system.
2. Remove the bolts attaching the thermostat cover to the water pump and remove the cover.
3. Lift out the thermostat.

3–F–2. Thermostat Inspection

To inspect the thermostat, place it in water with a thermometer and gradually heat the water.

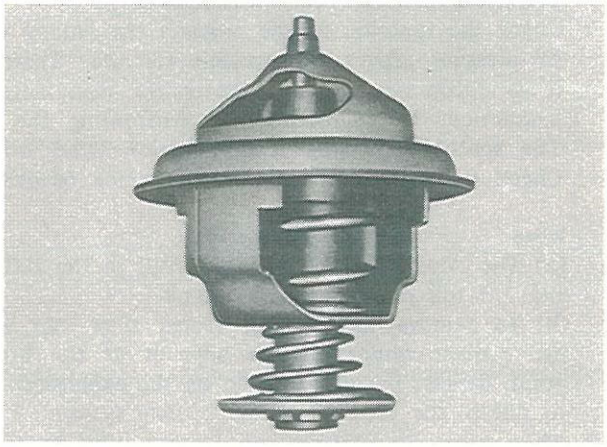


Fig. 3–6 Thermostat

Check the temperature when the thermostat starts to open and when it is fully opened, and also, measure the lift height when the thermostat is fully opened. If the reading shows a large difference from the standard specifications, replace the thermostat. The specifications of the thermostat are shown in the following table:

Starts to open	82°C (180°F)
Fully opens	95°C (203°F)
Lift height	8 mm (0.31 in)

3–F–3. Thermostat Installation

Follow the removal procedures in the reverse order.

3–G. COOLING FAN

A torque limit type fan drive has been adopted to drive the cooling fan for purpose of reducing the loss in horsepower at the high speeds under full load and preventing noises due to the fan. Furthermore the drive is so designed by using silicon oil as the medium for transmitting the torque that even the engine revolution increases, the revolution of the fan does not exceed a certain limit.

3–G–1. Cooling Fan Removal

1. Loosen the alternator adjusting bar bolt and disengage the V-belt.
2. Remove the bolts attaching the cooling fan to the eccentric shaft pulley and remove the cooling fan.
3. Remove the nuts attaching the fan to the fan drive and remove the fan.

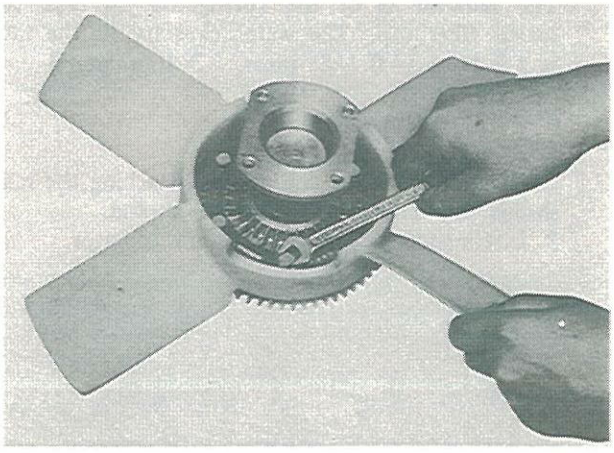


Fig. 3–7 Removing of cooling fan assembly

3–G–2. Checking of Fan Revolution

In case troubles, such as oil leakage should take place on the fan drive, the fan revolution will decrease. If the engine is apt to overheat, check the revolution of the fan in the following procedures:

1. Stick scotch tape on the fan drive shaft and fan as shown in Fig. 3–8.
2. Keep the engine revolution at **2,000 rpm** by using a photoelectrical revolution counter.

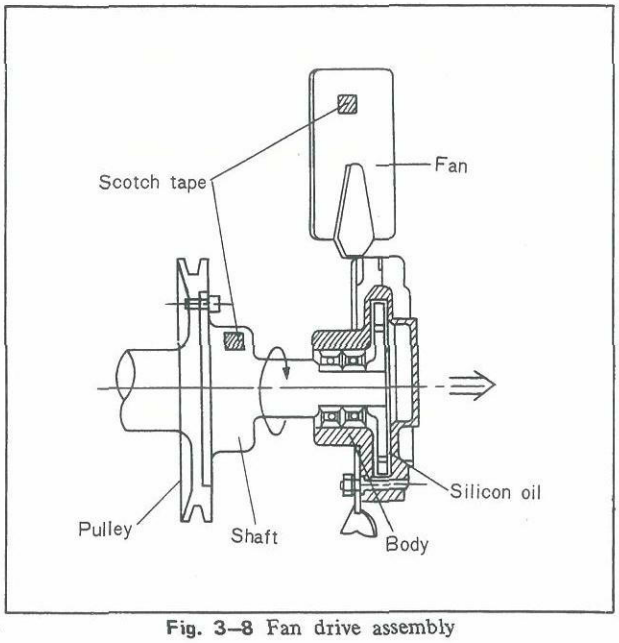


Fig. 3–8 Fan drive assembly

3. Facing the revolution counter toward the fan, read the revolution of the fan, and if it is less than the prescribed number of revolutions, replace the fan drive assembly. If it exceeds the prescribed number of revolutions, carry out the following check.
4. After warming-up the engine for 2 minutes at more than 2,000 rpm, keep the engine at 4,000 rpm by using a tachometer, and check to see if the revolution of the fan at that time is within the prescribed number of revolution.

Prescribed Revolution	
Engine	Fan
2,000 rpm	1,500 ~ 2,000 rpm
4,000 rpm	2,000 ~ 3,000 rpm

3–G–3. Cooling Fan Installation

Follow the removal procedures in the reverse order.

3–H. WATER PUMP

The water pump employs a centrifugal impeller. In the pump body, the shaft is supported by two bearings. The impeller is fitted to the rear end of the shaft. The seal assembly prevents water leakage.

3–H–1. Water Pump Inspection

Check the water pump for leaks and excessive end play or looseness of the shaft and bearings. If there is evidence of excessive play when the fan blades are manually moved up and down, this indicates that the bearings are rough. If water leaks from the hole located on the body, this is an indication of a defective seal necessitating overhaul of the pump and check of the seal and seat surface. If defective, replace the seal assembly.

3–H–2. Water Pump Removal

1. Drain the cooling system.
2. Remove the air cleaner.
3. Loosen the bolts attaching the water pump pulley to the water pump boss.
4. Loosen the alternator adjusting bar bolt and disengage the V-belt.
5. Remove the water pump pulley attaching bolts and then remove the pulley from the water pump.
6. Remove the bolts and nuts attaching the water pump to the front cover and remove the water pump.
7. Remove the bolts attaching the water pump body to the pump casing and remove the pump body.

3–H–3. Water Pump Disassembly

1. Using the **pulley boss support** (Part No. 49 0813 145A), press the shaft slowly, and remove the pulley boss and dust seal plate.

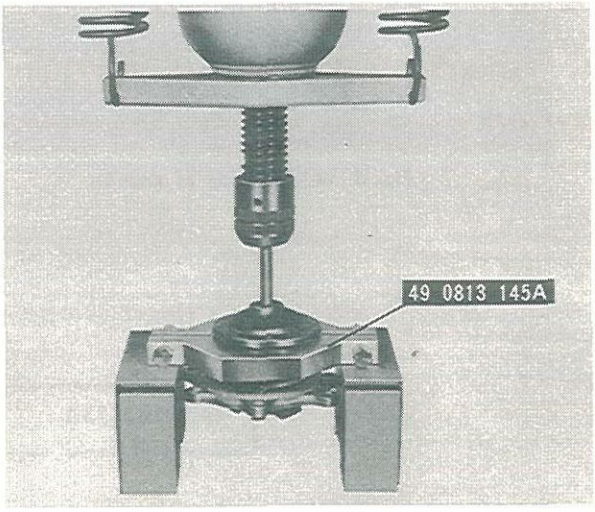


Fig. 3–9 Removing of water pump pulley boss

2. Remove the snap ring retaining the shaft and bearing assembly in the pump body.

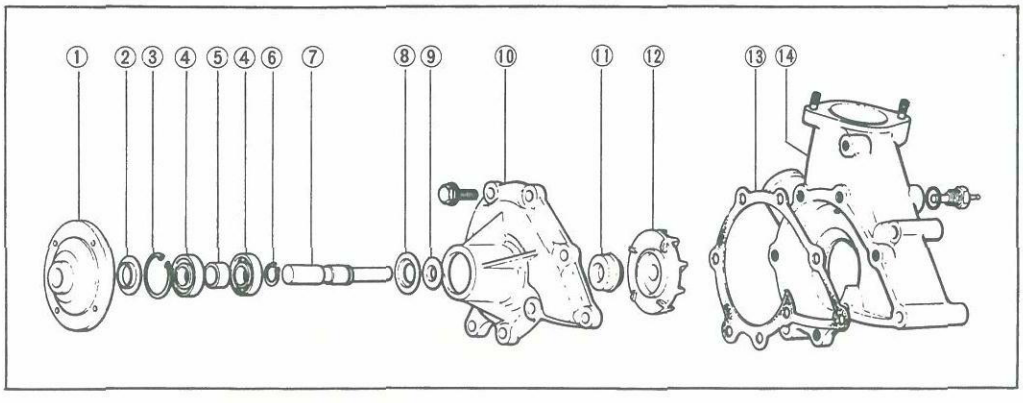


Fig. 3–10
Water pump components
1. Pulley boss
2. Dust seal plate
3. Snap ring
4. Bearing
5. Spacer
6. Stop ring
7. Shaft
8. Dust seal
9. Baffle plate
10. Pump body
11. Seal assembly
12. Impeller
13. Gasket
14. Casing

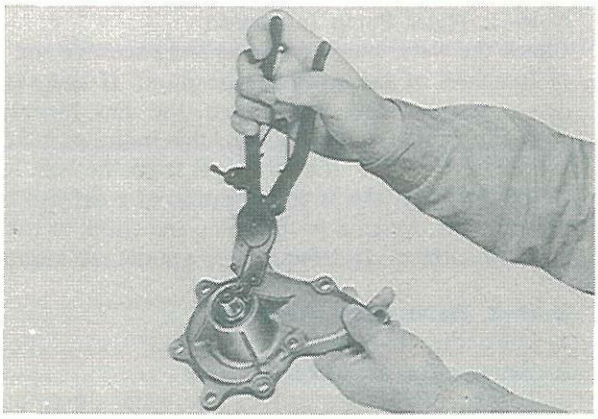


Fig. 3–11 Removing of snap ring

3. Place the front side of the pump body on the **support** (Part No. 49 0813 145A) and apply pressure to the rear end of the shaft to press the shaft and

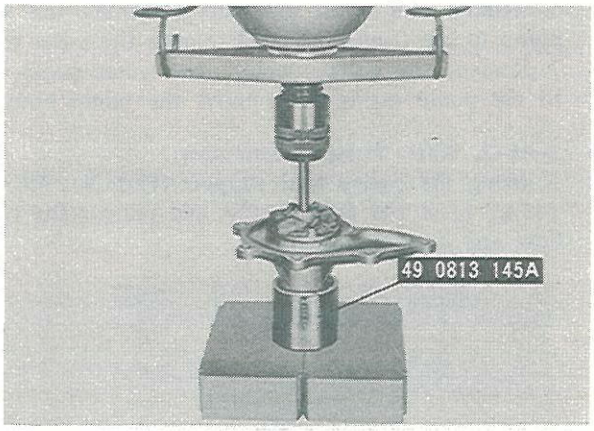


Fig. 3–12 Removing of impeller

remove the impeller from the shaft.
Then press the shaft and bearing assembly out of the pump body.
4. Remove the seal assembly from the pump body.
5. Slide the baffle plate and dust seal plate off the shaft.
6. Remove the bearing stop ring from the shaft.
7. Remove the bearings and spacer from the shaft.

3–H–4. Water Pump Assembly

1. Fit the bearing stop ring onto the groove of the shaft.
2. Slide the dust seal plate onto the shaft.
3. Slide the baffle plate onto the taper of the shaft.
4. Press fit the bearing onto the shaft with sealed side rearward.
5. Press the shaft and bearing into the pump body.
6. Slide the spacer onto the shaft and **fill 1/3 of the space** between the two bearings with grease.
7. Press fit the bearing onto the shaft with the sealed side forward until the snap ring can be installed.
8. Install the snap ring onto the groove of the pump body to retain the shaft and bearing assembly in position.
9. Slide the dust seal plate onto the shaft, and press the pulley boss onto the shaft until it is flush with the front end of the shaft.
10. Apply lubricant onto the seal assembly and install the seal assembly into the pump body.
11. Press the impeller onto the shaft until it is flush with the end of the shaft.

3–H–5. Water Pump Installation

Follow the removal procedures in the reverse order.

SPECIAL TOOL

49 0813 145A	Water pump pulley boss support

FUEL SYSTEM

DESCRIPTION

The fuel system consists of the carburetor, fuel pump, fuel filter, fuel tank, fuel line, accelerator linkage and air cleaner.

The fuel tank is installed in the luggage compartment. By the suction of the fuel pump, the fuel flows through the fuel line into the fuel filter. The fuel passes through the filter element from the outside to the inside of the element. During this fuel flow, the filter element cleans out all the dirt. The fuel pump is producing a constant controlled pressure, and the fuel volume required for engine operations. The fuel supplied by the fuel pump flows passing through the fuel hose into the carburetor.

The carburetor mixes the air and fuel in varying proportions for different operating conditions. As the air passes through the carburetor before entering the engine, fuel is supplied into the engine through the various circuits of the carburetor.

The air cleaner operates primarily to remove dust and dirt from the air which is drawn into the carburetor and then into the engine.

4–A. FUEL TANK

4–A–1. Fuel Tank Removal

1. Remove the drain plug from the bottom of the tank, and allow the fuel to drain from the fuel tank.
2. Open the luggage compartment, and remove the package trim by removing the two attaching screws.
3. Disconnect the fuel gauge wire from the unit.
4. Disconnect each hose from the fuel tank.
5. Remove the bolts attaching the fuel tank and remove the fuel tank.

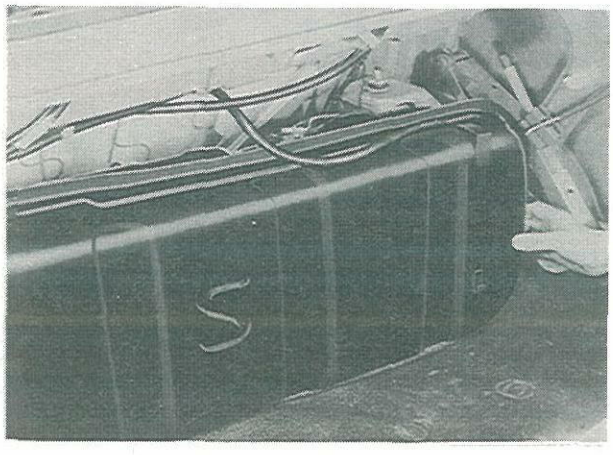


Fig. 4–1 Removing of fuel tank

6. Remove the screws attaching the fuel gauge unit to the tank and remove the fuel gauge unit.

4–A–2. Fuel Tank Inspection

Inspect the fuel tank for cracks and corrosion. If any defect is present, repair or replace as necessary.

Note :

Before repairing, clean the fuel tank thoroughly with steam and sufficiently to remove all explosive gas.

4–A–3. Fuel Tank Installation

Follow the removal procedures in the reverse order.

4–B. FUEL FILTER

The fuel filter is of a cartridge type. The element of the filter is sealed cartridge and should be replaced **every 12,000 km (8,000 miles).**

4–B–1. Fuel Filter Removal

1. Open the luggage compartment, and remove the package trim by removing the two attaching screws.
2. Disconnect the inlet hose and outlet hose from the filter.
3. Remove the filter from the retaining support.

4–B–2. Fuel Filter Installation

Follow the removal procedures in the reverse order.

4–C. FUEL PUMP

4–C–1. Fuel Pump Test

If the fuel pump does not supply the proper amount of fuel to the carburetor, the following tests should be made.

a. Pressure test

Connect a fuel pressure tester to the discharge port of the pump to test the fuel pressure. The feeding pressure should be **0.20 ~ 0.25 kg/cm² (2.8 ~ 3.6 lb/in²)**. If it is not to specifications, replace the fuel pump.

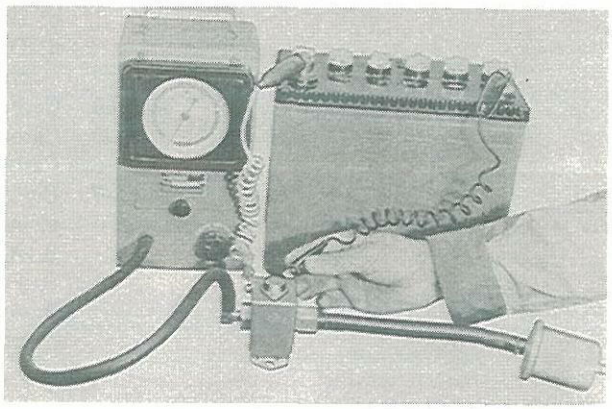


Fig. 4–2 Testing of fuel pressure

b. Volume test

Conduct a volume test of the fuel pump. The fuel pump should discharge a volume of **800 cc (0.21 U.S.**

gallon, 0.18 Imp. gallon) of fuel per minute. If defective, replace the fuel pump.

4–C–2. Fuel Pump Removal

1. Open the luggage compartment, and remove the package trim by removing the two attaching screws.
2. Disconnect the wire and hoses from the pump.
3. Remove the bolts attaching the pump and remove the pump.

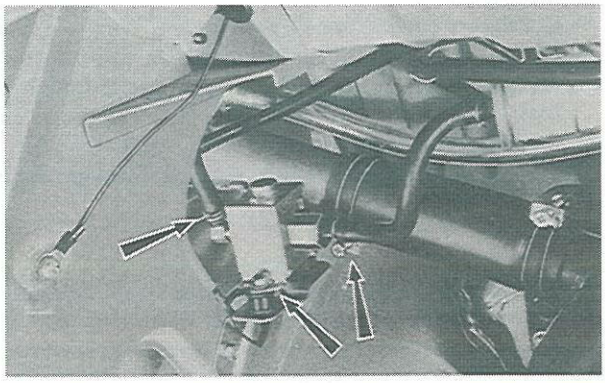


Fig. 4–3 Removing of fuel pump

4–C–3. Fuel Pump Installation

Follow the removal procedures in the reverse order.

4–D. FUEL LINES

Inspect the fuel lines for leaks and tighten the fuel line connections to prevent leakage. It is important that the fuel system be kept clean and free from water. If an excessive amount of dirt or water is found, drain the fuel from the tank and blow out the fuel lines with compressed air.

4–E. AIR CLEANER

The air cleaner is of a filter paper type. The element should be serviced as shown in the following table : To clean, blow the element with compressed air at low pressure.

	Clean	Replace
On dusty road	Every 1,500 km (1,000 miles)	Every 18,000 km (12,000 miles)
On paved road	Every 3,000 km (2,000 miles)	Every 36,000 km (24,000 miles)

4–F. ACCELERATOR LINKAGE

Inspect the accelerator linkage for proper installation. Remove the air cleaner and, with the accelerator fully depressed, observe the position of the carburetor throttle valves. They should be vertical (wide open position). Check the accelerator to ensure there is sticking or binding and for full return.

4–G. CARBURETOR

RX-3 is equipped with a 2-stage 4-barrel Zenith Stromberg carburetor. This carburetor comprises two sets each of primary barrels (for normal use) and a secondary barrels (for high output). In addition, a float circuit and a transfer system for the primary and secondary stages are attached. The primary barrel is equipped with a choke circuit, a low speed circuit, an auxiliary slow circuit and an accelerating circuit.

4–G–1. Carburetor Function

a. Fuel return circuit

This system incorporates a bimetal type fuel return valve to prevent percolation. When the fuel temperature reaches 55°C (131°F), the valve begins to open to return the fuel to the fuel tank.

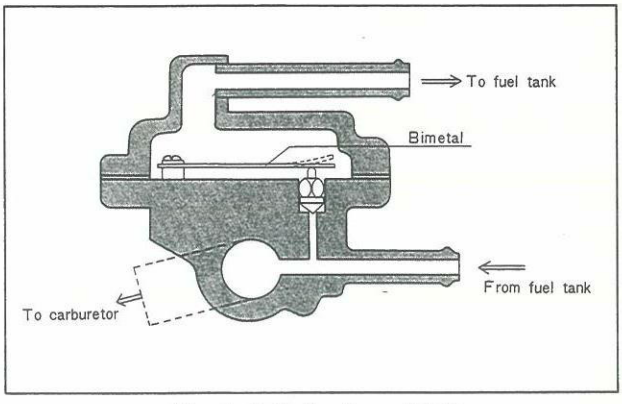


Fig. 4–4 Fuel return circuit

b. Float circuit

The float chamber is equipped with a float and a needle valve to keep the fuel level constant under all operating conditions.
A fuel level gauge is provided in the float chamber for easy inspection of the fuel level.
The ventilation system of the float chamber is of the inner circulation type.
Thus the fuel consumption is not influenced even if the air cleaner is clogged to a certain extent.

c. Low speed circuit

During idling and early part-throttle operation, the fuel is measured in the low speed circuit.
The fuel passes through the slow jet fitted in a branch passage of the main jet.
Then the fuel is mixed with air from the slow air bleed.
The air-fuel mixture then flows through the low speed passage and is ejected from the idle hole or the by-pass hole.

d. Auxiliary slow circuit

This circuit has been installed to prevent misfiring and knocking which are liable to occur at low load and high revolution due to lean mixture.

This is of the structure that a diaphragm responsive to the negative pressure of the secondary side is provided halfway on the circuit with its valve designed to open at a certain extent of the negative pressure, allowing the fuel led from the secondary step system to pass and proceed to the auxiliary slow jet and then finally the fuel is ejected through the auxiliary slow port to the primary venturi.

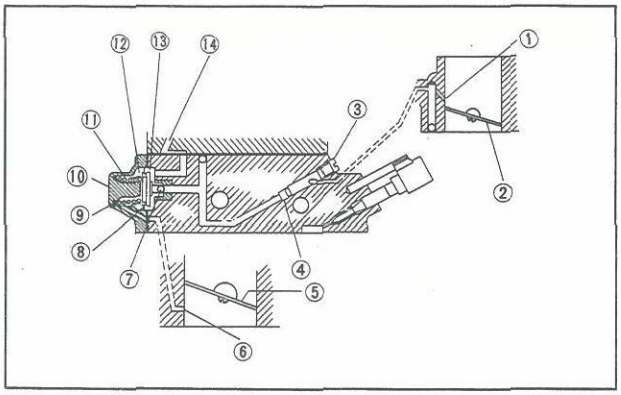


Fig. 4–5 Auxiliary slow circuit

1. Auxiliary slow hole
2. Primary throttle valve
3. Plug
4. Auxiliary slow jet
5. Secondary throttle valve
6. Vacuum hole
7. Ball valve
8. Diaphragm
9. Shim
10. Cover
11. Diaphragm spring
12. Vacuum chamber
13. Fuel chamber
14. From step circuit

e. Primary high speed circuit

During operation at part-throttle or full-throttle, the fuel is supplied through the high speed circuit. The fuel in the float chamber flows through the main jet, is mixed in the emulsion tube with the air from the main air bleed, and is sprayed through the main nozzle to the venturi.

f. Accelerating circuit

The accelerating circuit measures and supplies fuel for the rapid acceleration and smooth engine operation when the throttle valve is opened at lower speed. The accelerating piston rod is connected to the primary throttle valve by a link. When the primary throttle valve is closed, piston is raised.

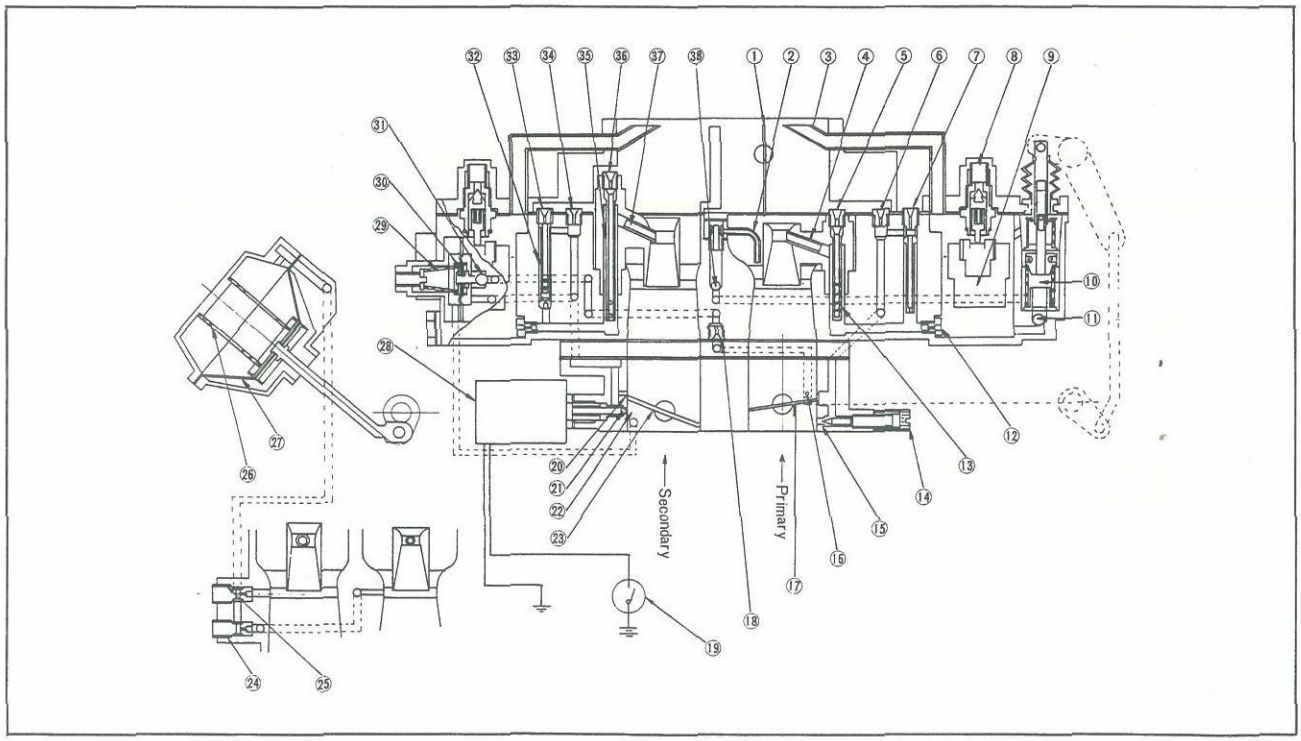


Fig. 4–6 Carburetor cross section

1. Choke valve
2. Pump nozzle
3. Air vent pipe
4. Primary main nozzle
5. Primary main air bleed
6. Primary No. 2 air bleed
7. Primary No. 1 air bleed
8. Fuel passage bolt filter
9. Float
10. Accelerating pump plunger
11. Pump inlet check valve
12. Primary main jet
13. Primary emultion tube
14. Idle adjust screw
15. Idle hole
16. Sub-slow hole
17. Primary throttle valve
18. Sub-slow jet
19. Vacuum switch
20. Secondary by-pass hole
21. Coasting richer valve
22. Coasting richer hole
23. Secondary throttle valve
24. Primary vacuum jet
25. Secondary vacuum jet
26. Diaphragm spring
27. Diaphragm
28. Coasting richer
29. Diaphragm spring
30. Sub-slow diaphragm
31. Sub-slow valve
32. Secondary emultion tube
33. Secondary slow jet
34. Secondary slow air bleed
35. Secondary emultion tube
36. Secondary main air bleed
37. Secondary main nozzle
38. Pump outlet check valve

Then the fuel in the float chamber is sucked up into the accelerating pump cylinder through the inlet check valve. With the primary throttle valve is open, the piston is lowered, the inlet check valve is closed, and the outlet check valve is opened. Then, the fuel in the accelerating pump is sprayed through the pump nozzle to the venturi.

g. Choke circuit

For easy starting and warming-up, the mixture ratio of air and fuel is controlled by the choke valve. The choke valve is an offset spring loaded type and prevents excessive choking.

When the choke valve is fully closed, the throttle valve is automatically opened to 15° by the choke connecting rod so as to obtain the most suitable mixture for starting-up of the engine.

h. Step circuit

The step circuit corresponds to the low speed circuit of the primary barrel and improves the connection between the primary and secondary barrels.

The fuel-flow in the secondary slow jet is mixed with air from the secondary slow air bleed, passes through the secondary low speed passage, and is ejected through a bore located near the fully-closed position of the secondary throttle valve.

i. Secondary high speed circuit

The secondary high speed circuit corresponds to the *primary high speed circuit.*

The secondary throttle valve is constructed so as to react to negative pressure in the venturi.

The vacuum jets are provided in the venturi sections of the primary and secondary stages. The average negative pressure of both jets acts in the diaphragm chamber and moves the diaphragm. The diaphragm and the secondary throttle valve are connected by a link to open the throttle valve according to the negative pressure.

However, the secondary throttle valve cannot be opened until the primary throttle valve is opened to 45° since the liable range of the secondary throttle valve to open or close is controlled with a connection between the lock-off lever installed on the primary shaft and the stopper on the secondary shaft.

When the opening of the primary throttle valve exceeds 45°, the secondary throttle valve opens in proportion to the negative pressure. Then the fuel from the main jet is mixed with air from the main air bleed and sprayed from the main nozzle into the venturi.

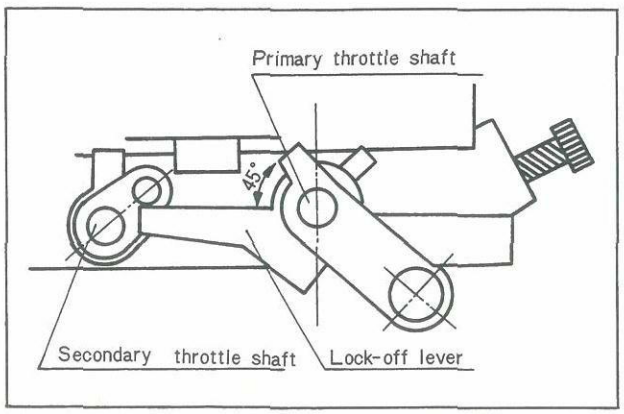


Fig. 4–7 Lock-off system

j. Coasting richer

The coasting richer prevents afterburning in the exhaust pipe which is liable to occur at sudden deceleration. The coasting richer opens the fuel passage to the secondary stage to supply an additional fuel so as to bring the lean mixture to an optimum air-fuel ratio, thereby improving its combustibility. The operation of the coasting richer is controlled by the vacuum switch. The vacuum switch closes the circuit to the coasting richer at intake manifold vacuum of over 630 mm-Hg and opens the circuit when the intake manifold vacuum is lowered to below 595 mm-Hg. The circuit to the coasting richer is as shown in Fig. 4–8.

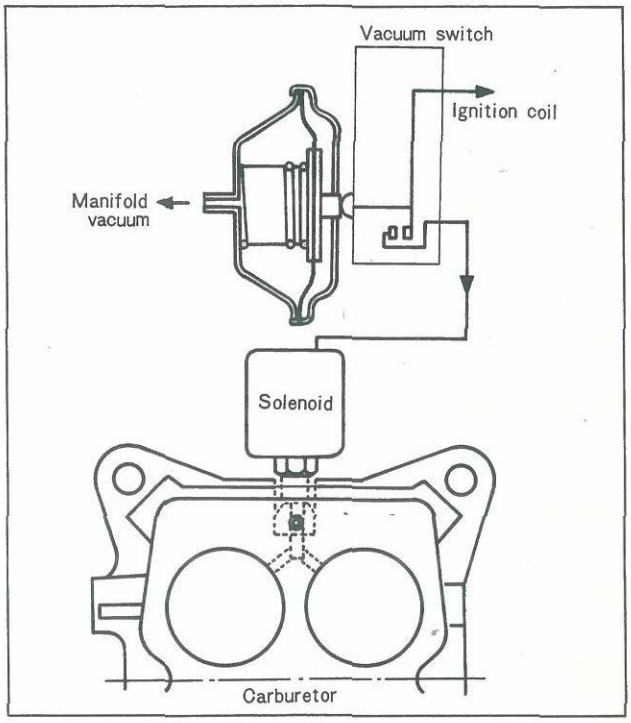


Fig. 4–8 Coasting richer

4–G–2. Carburetor Removal

1. Disconnect the negative battery cable from the battery terminal.
2. Remove the air cleaner.
3. Disconnect the choke cable and accelerator cable.
4. Disconnect the metering oil pump tubes and pump connecting rod.
5. Disconnect the fuel hoses and vacuum tube.
6. Remove the nuts attaching the carburetor to the intake manifold and remove the carburetor.

4–G–3. Carburetor Disassembly

a. Removing of air horn and throttle chamber

1. Remove the air horn attaching screws and air cleaner set bolt, and disconnect the pump connecting rod from the pump lever by removing the cotter pin.

2. Separate the air horn from the body, and disconnect the choke connecting rod from the fast idle lever. Then, remove the air horn from the body.

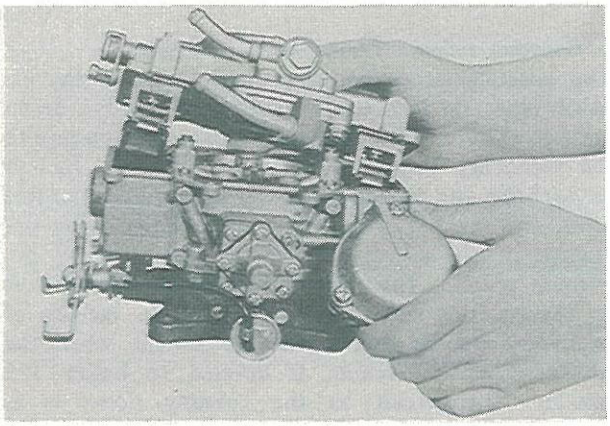


Fig. 4–9 Separating of air horn

3. Disconnect the vacuum control unit rod from the secondary throttle lever by removing the cotter pin.
4. Remove the vacuum control unit attaching screws and remove the cover, spring, diaphragm and unit body.

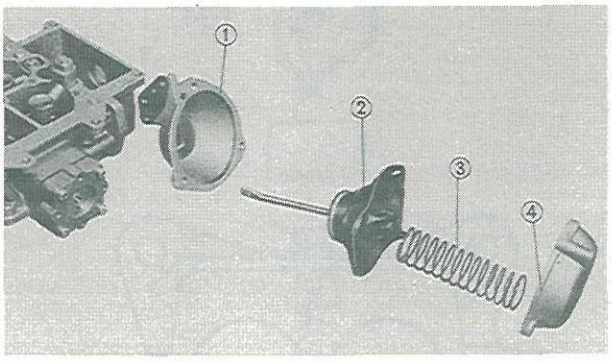


Fig. 4–10 Removing of vacuum control unit

1. Unit body
2. Diaphragm
3. Spring
4. Cover

5. Remove the screws attaching the body to the throttle chamber and remove the body.

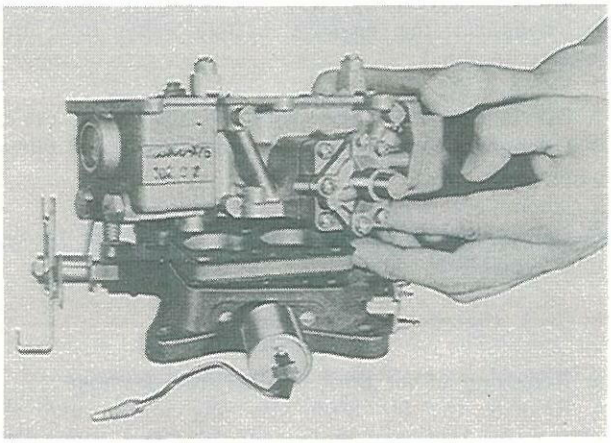


Fig. 4–11 Removing of throttle chamber

b. Disassembling of air horn

1. Remove the main passage bolt, filter and fuel return valve assembly.
2. Remove the accelerating pump lever and the pump plunger.
3. Remove the float retaining pin and remove the float.
4. Remove the clip, and take out the needle valve, spring and spring retainer. Then, remove the needle valve seat and filter.

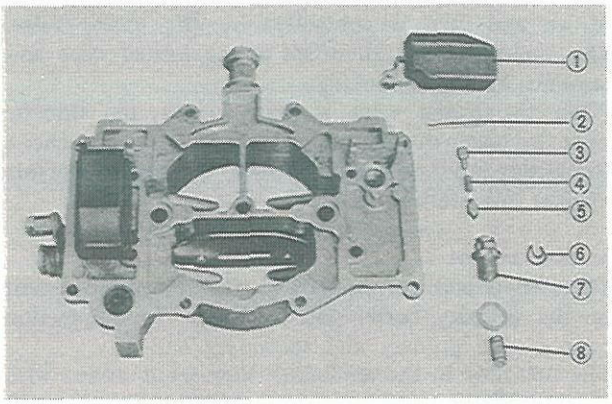


Fig. 4–12 Float and needle valve components

1. Float
2. Float retaining pin
3. Needle valve stem
4. Spring
5. Needle valve
6. Spring retainer
7. Fuel main passage bolt
8. Filter

c. Disassembling of body

1. Remove the accelerating pump nozzle from the body. Remove the outlet valve and inlet valve.
2. Remove the slow jets of the primary and secondary stages and all air bleeds from the body.
3. Remove the main jets by removing the plug from the body.
4. Remove the vacuum jets from the body.
5. Remove the screws attaching the sub-slow diaphragm cover and take out the diaphragm, return spring and washer. Remove the sub-slow jet by removing the plug.

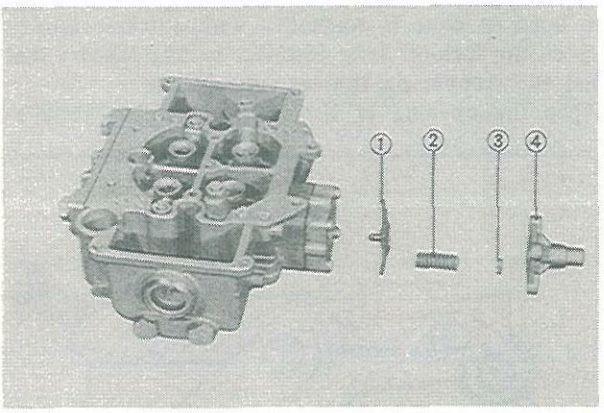


Fig. 4–13 Removing of sub-slow assembly

1. Diaphragm
2. Return spring
3. Washer
4. Diaphragm cover

6. Remove the venturi by tapping it from the bottom.

d. Disassembling of throttle chamber

1. Remove the lever by removing the attaching nut of the primary throttle lever on the shaft. Remove the throttle valve and shaft by removing screws attaching the throttle valve.
2. Remove the attaching screw of the secondary throttle valve and dismantle the secondary throttle valve and the shaft.

Note :

Do not dismangle the venturi, throttle valve and shaft, and the choke valve and shaft except when they have to be replaced because of wear or damage.

3. Remove the idle adjusting screw from the throttle chamber.

4–G–4. Carburetor Inspection

1. Wash all parts in clean gasoline and dry with compressed air. All passages of the carburetor must be blown very carefully. **Never use** a wire for cleaning the jets.
2. Inspect the air horn, body and body flange for cracks, nicks or burrs on their respective gasket surfaces.
3. Inspect the float for deformation, damaged tab and worn retaining pin bore.
4. Check the float needle valve for wear and for proper seating. To check the needle valve for proper seating, invert the air horn, assemble the needle valve and the float and then suck the fuel main passage. At this time, if any leakage is present, the valve seating is not satisfactory.
5. Inspect the filter for rust and damage.
6. Check the choke valve for proper choking, smooth movement and excessive play of choke shaft.
7. Check all jets and air bleeds for clog, damaged threads, damaged head slots and damaged holes.
8. Check the pump plunger for wear of sliding portion and smooth operation with the plunger bore. Check the spring for rust and weakness.
9. Check the idle adjusting screw for damaged thread and also seating surface. Check spring for weakness.
10. Check the primary and secondary throttle valves. If these close firmly or not, check them for smooth movement and excessive play of the shafts.

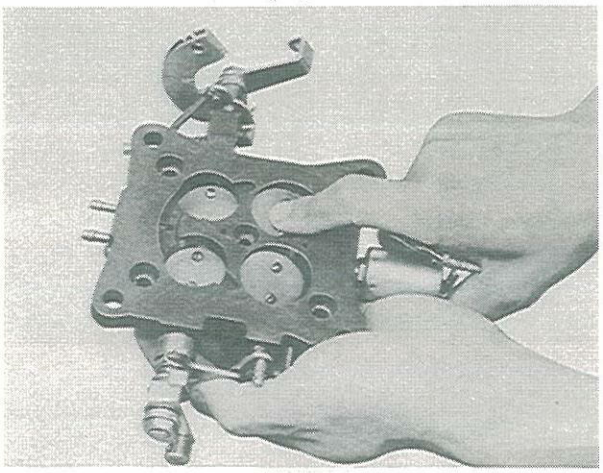


Fig. 4–14 Checking of throttle valves

Note :

Worn throttle valve shaft allows air to enter into the cylinder and air-fuel mixture at low speed becomes lean.

11. Check the diaphragm of vacuum control unit for damage. Check the spring for weakness.
12. Check whether the coasting richer is attracted when the solenoid wires are connected to the battery terminals as shown in Fig. 4–15.

Fig. 4–15 Checking of coasting richer

4–G–5. Carburetor Assembly

To assemble, follow the disassembly procedures in the reverse order with the following cautions.

1. Discard the old gaskets and use new ones.
2. Check that all parts are in good condition and clean.
3. Both the primary and secondary systems have their respective parts which are of the shape. Therefore, when installing, care should be taken so as not to mistake one for the other.
4. Adjust the primary and secondary throttle valves to close firmly at fully closed position.

4–G–6. Carburetor Installation

Follow the removal procedures in the reverse order.

4–G–7. Carburetor Adjustment

a. Adjusting of idle speed

1. Connect a tachometer onto the ignition coil and install a vacuum gauge onto the intake manifold.
2. Start the engine, and run it at idle speed.
3. Turn the throttle valve adjusting screw in or out until the engine operates smoothly without stalling at lowest possible revolution.
4. Turn the throttle valve adjusting screw, and the idle adjusting screw alternately to obtain a steady

and smooth engine operation at engine idle speed, which is indicated by steady reading on the gauge. The engine idle speed is **700 rpm.**

b. Adjusting of float level

Adjust the float level by bending the float lever seat so that the dimension **H** will be **18 mm (0.71 in)** when the float lever seat is in contact with the needle valve stem as shown in Fig. 4–16.

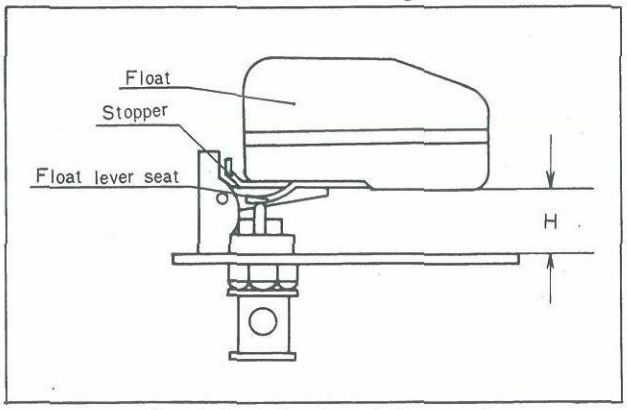


Fig. 4–16 Adjusting of float level

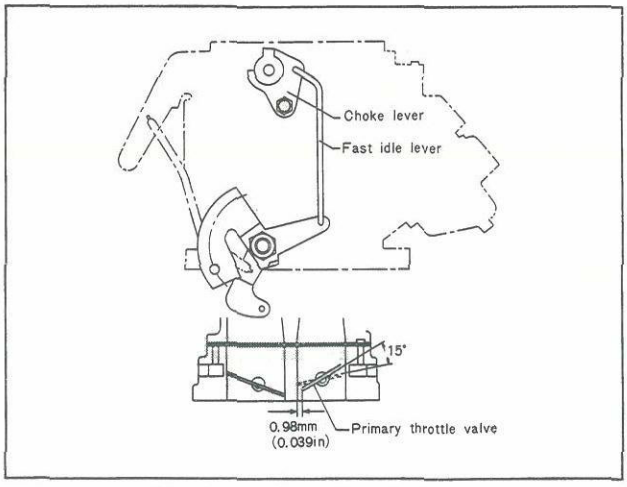


Fig. 4–17 Fast idle adjustment

c. Fast idle adjustment

When the carburetor is in choked position, the lip of fast idle lever contact with the fast throttle arm and the throttle valve is opened **slightly (15°)**. For this reason, the idle revolution is slightly higher (fast idle). When the choke valve is fully closed the clearance between the primary throttle valve and the bore should be **0.98 mm (0.039 in)**. Measure the clearance using a suitable wire gauge, and if necessary, adjust it by bending the fast idle lever. Check the choke valve for smooth movement.

d. Adjusting of accelerating pump stroke

At the ends of the pump lever there are four holes which provide four changes in the pump injection amount. When the pump lever connecting rod is placed in hole Ⓐ, the injection amount is smaller, whereas the injection amount is larger when the connecting rod is placed in hole Ⓑ. Accordingly, select and use a hole according to the engine condition, running condition and atmospheric temperature.

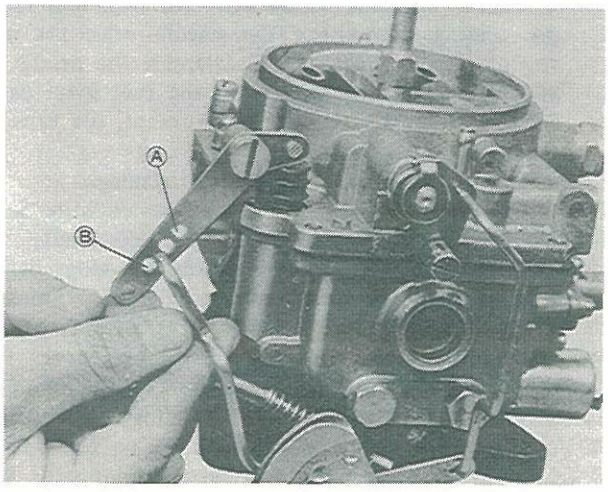


Fig. 4–18 Adjusting of accelerating pump stroke

ELECTRICAL SYSTEM

DESCRIPTION

The major electrical systems are the charging system, ignition system, starting system and lighting system. Service information for these systems are included in this section.

5–A. BATTERY

RX-3 is equipped with a 12 volt battery consisting of six cells. Its capacity is as follows:

NS60	45AH (20 hours rate)
NS70	65AH (20 hours rate)
N50Z	60AH (20 hours rate)

5–A–1. Checking of Battery

As the battery has many important functions to engine start, ignition and lighting, check the following points periodically and always keep the battery in perfect condition.

1. Check the electrolyte level in each cell of the battery, and add distilled water to maintain the solution **10 ~ 20 mm (0.4 ~ 0.8 in)** above the plates.
Do not overfill.
2. Check the specific gravity of the electrolyte with a hydrometer, as shown in Fig. 5–1.

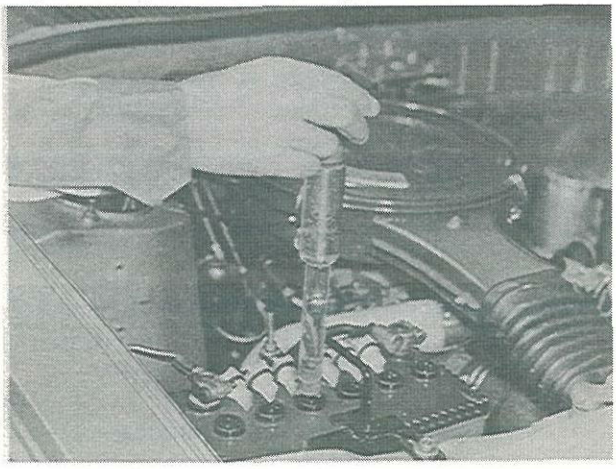


Fig. 5–1 Checking of specific gravity

If the reading is **1.26 or more,** it indicates that the battery is fully charged. If the reading is **below 1.20,** the battery requires recharging.

3. Check the tightness of the terminals to ensure good electrical connections. Clean the terminals and coat the terminals with grease.
4. Inspect for corroded or frayed battery cables.

5–A–2. Charging of Battery

a. Constant current charge

1. If the exterior of the battery is dirty with sulphuric acid or dust and dirt, wash these off with clean water and dry thoroughly before charging the battery.
2. Check the electrolyte level and add distilled water if necessary.

Note:
If addition of distilled water is neglected, the plates and separators will become exposed to air, causing a sulphation to occur on the plates.
Do not add dilute sulphuric acid unless the electrolyte has overflown or leaked out.

3. Connect the battery to the charger, ensuring that the polarities are correct.
4. To charge, apply an electric current of approximately 5A until the specific gravity of the electrolyte reaches 1.25 ~ 1.27.

b. Fast charge

As a fast charge causes both the temperature and the level of the electrolyte to rise suddenly, it does not have a favorable effect on the battery. Therefore, this should not be performed unless in the case of an emergency.
To charge with a fast charger, follow the instructions of the manufacture.

Note:
1. Ensure that the cables are removed from the battery terminals before the charge is applied. If this is neglected, it could cause a damage to the diodes on the alternator.
2. The battery should be kept by the use of cooling water to prevent the temperature of the electrolyte from exceeding 55°C (131°F), otherwise the charging should be discontinued temporarily when the temperature rises above this point.

5–B. SPARK PLUG

The two spark plug system is adopted on RX-3 for increasing the combustion efficiency. There are three kinds of heat range for genuine spark plugs as follows, so that they can be used under the driving area or running condition.

Manufacture	Hot type	Standard	Cold type
NGK	B–6EM	B–7EM	B–8EM
NIPPONDENSO	W20 EA	W22 EA	W25 EA

As these spark plugs are designed specially for RX-3, **do not** replace these with any of other types of spark plug.

5–B–1. Checking of Spark Plug

Check the spark plugs for burned and eroded electrode, black deposits, fouling, and cracked porcelain. Clean the spark plugs with a spark plug cleaner or a wire brush if they are fouled.
Replace the badly burned or eroded spark plugs.
Measure the electrode gap of each spark plug with a wire gauge, as shown in Fig. 5–2.
The standard gap is **0.8 ~ 0.9 mm (0.03 ~ 0.035 in).**
If the electrode gap exceeds more than 1.1 mm (0.043 in), replace the spark plug.

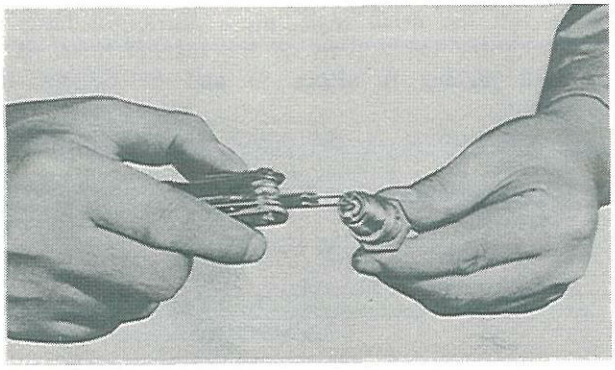


Fig. 5–2 Measuring of electrode gap

5–C. IGNITION COIL

Two types of ignition coil are equipped.
One is the leading ignition coil with external resistance which improves ignition performance and startability of the engine, and another is ordinary type, the trailing ignition coil.
When the ignition key is turned on to actuate the starting motor, the "S" and "R" terminals of the key switch are closed with the "B" terminal of the key switch and the "Ig" terminal is opened. In this case, current leads to the "S" terminal of the relay and magnetizes the relay coil. Thus, the "H" and "B" terminals of the relay are closed. Then, the primary current leads from the "R" terminal to the trailing ignition coil via the relay. And also, the primary current for leading one is led from the "R" terminal direct to the leading ignition coil by passing the external resistance.
When the ignition key is returned to the "Ig" position after starting the engine, only "Ig" terminal is closed with "B" terminal of the key switch. Therefore, the function of the relay is stopped and the primary current flows from the "Ig" terminal to the trailing ignition coil. And also, the current for leading one flows from the "Ig" terminal to the leading ignition coil by way of the external resistance.

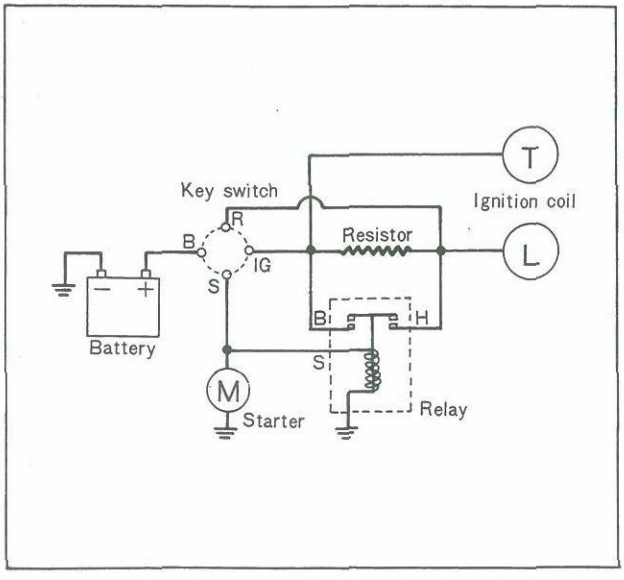


Fig. 5–3 Diagram of ignition coil

5–D. DISTRIBUTOR

RX-3 is equipped with two distributors, one for the spark plugs on the leading side and one for those on the trailing side.

5–D–1. Adjusting of Point Gap

Adjust the point gap of each distributor as follows :
1. Check the contact points alignment. If necessary, bend the stationary contact bracket so as to obtain contact in the center of the contact points.
2. Crank and stop the engine when the rubbing block on the contact arm just rests on the highest point of the cam.
3. Insert a feeler gauge of **0.45 mm (0.018 in)** between the contact points, loosen the two set screws and move the stationary contact point until the correct gap is obtained.

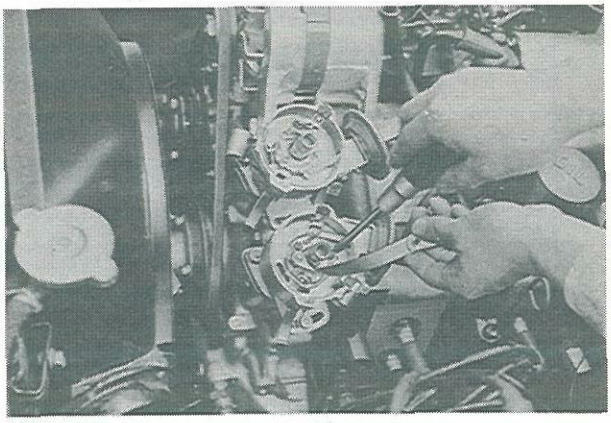


Fig. 5–4 Adjusting of point gap

4. Tighten the set screws and recheck the point gap.

5–D–2. Adjusting of Ignition Timing

To adjust, proceed as follows :
1. Connect a timing light to the high tension cord for leading spark plug of the front rotor housing.
2. Start the engine, and run it at idle speed of 700 rpm.
3. Aim the timing light at the timing indicator pin on the front cover.
4. Loosen the distributor locking nut, and rotate the leading distributor body until the timing mark on the eccentric shaft pulley aligns with the timing indicator pin on the front cover.

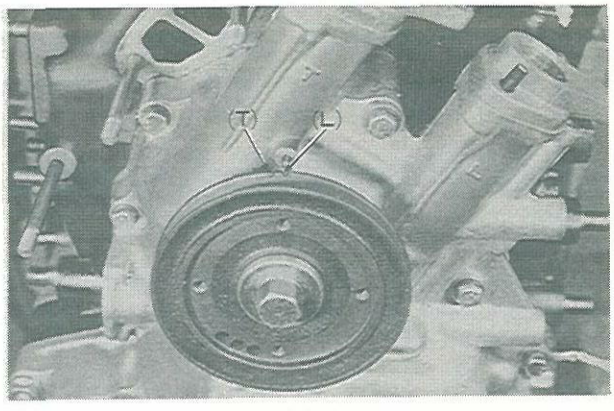


Fig. 5–5 Timing marks

5. Tighten the locking nut and recheck the timing.
6. Adjust the trailing distributor in the same way as above.

5–D–3. Testing of Distributor

a. Dwell angle test

The dwell angle also called cam angle is degrees of rotation through which the contact points remain closed.

To test the dwell angle, use a distributor tester following the instructions of the manufacturer. If the dwell reading is within 55 and 61 degrees, it is correct.

If the reading is not within the specifications, it indicates the following troubles.

1. Incorrect point gap
2. Worn cam
3. Worn rubbing block
4. Distorted contact arm

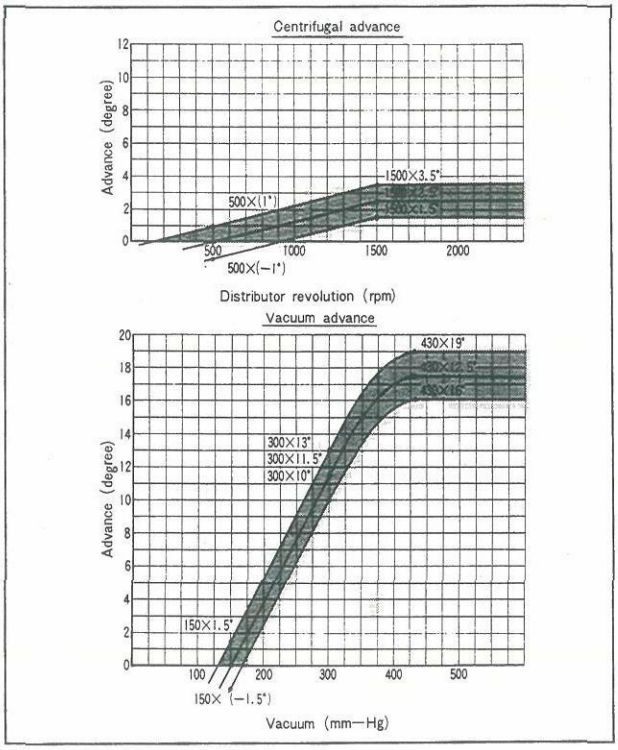


Fig. 5–6 Advancing characteristic (trailing side)

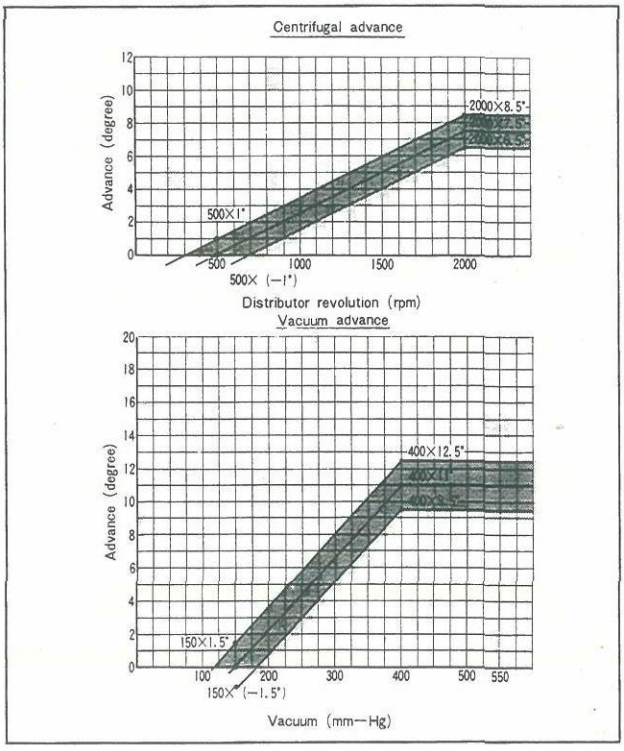


Fig. 5–7 Advancing characteristic (leading side)

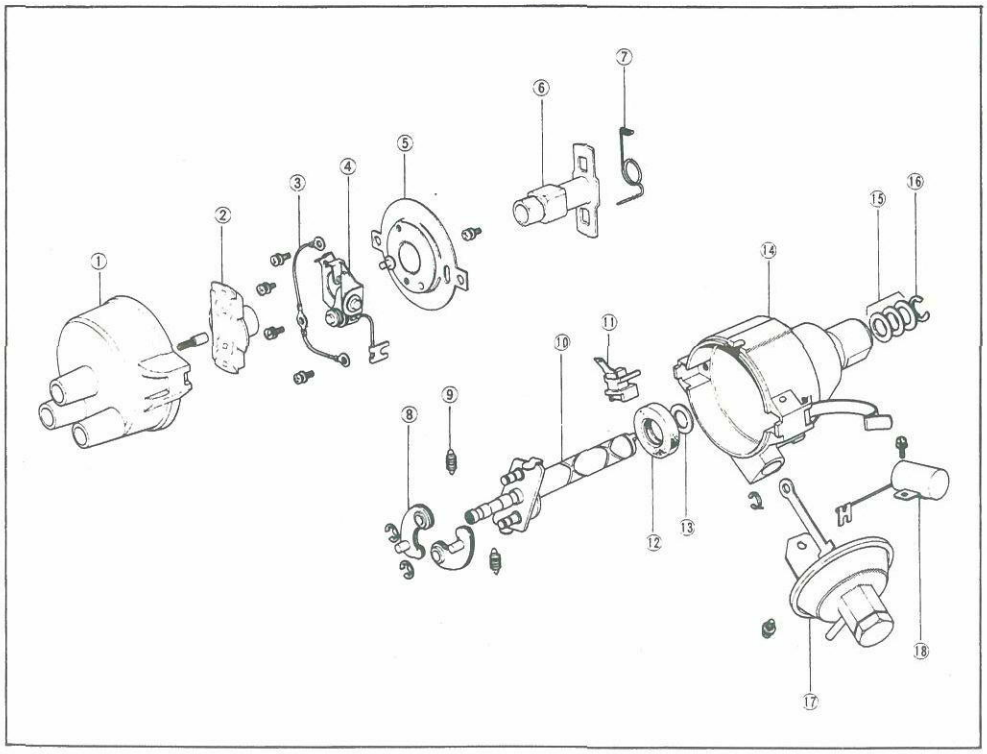


Fig. 5–8
Distributor components

1. Cap
2. Rotor
3. Earth wire
4. Contact point assembly
5. Breaker base assembly
6. Cam
7. Hair pin spring
8. Governor weight
9. Governor spring
10. Drive shaft
11. Terminal
12. Oil seal
13. Washer
14. Distributor body
15. Washer
16. Retaining clip
17. Vacuum control unit
18. Condenser

b. Advance Test
To test the ignition advancing characteristic of the distributor, use a distributor tester.
The advancing characteristic of each distributor should be **within the range** shown in Fig. 5–6 and 5–7.

5–D–4. Disassembling of Distributor
1. Loosen the cap retaining clips and lift off the cap.
2. Remove the rotor.
3. Remove the screws that attach the vacuum control unit and remove the clip holding the vacuum control unit rod. Remove the vacuum control unit.
4. Loosen the primary terminal screw and disconnect the lead. Remove the contact point assembly from the breaker base after removing the set screws.
5. Remove the primary terminal stud and insulator.
6. Remove the condenser.
7. Remove the screws that attach the breaker base and remove the breaker base.
8. Take off the felt and remove the cam set screw, then remove the cam.
9. Remove the distributor drive shaft retaining clip and washers. Remove the shaft in upward direction through the top of the distributor.
10. The governor can be removed by removing the governor spring and clip.

5–D–5. Distributor Inspection

a. Inspecting of distributor cap
Inspect the distributor cap for cracks, carbon runners and signs of arcing. Replace the cap if any of these are found.
Clean the high tension terminals.

b. Inspecting of rotor
Inspect the rotor for cracks or evidence of excessive burning at the end of the metal strip.

c. Inspecting of contact points
Inspect the points for wear, burning and pitting. If the points are affected only slightly, clean with stiff metal brush or oil stone. In case of severe damage, replace the points.

d. Checking of contact arm spring tension
For inspection, hook a spring scale on the contact arm and pull straight at a right angle to the contact arm.
Read the tension when the contact points start to separate. If the reading is **0.575 kg (1.27 lb) or less,** replace the contact point assembly.

e. Checking of condenser
If the condenser is leaky, it will cause a weak spark or burned contact points check the capacity of the condenser with a condenser tester.
The capacity is **0.27 ± 10%** microfarads. In the absence of a tester, check by substituting a new condenser.

5–D–6. Assembling of Distributor
Assemble the distributor in the reverse order of disassembling.

5–E. ALTERNATOR

5–E–1. Service Precautions
When servicing the charging system, observe the following precaution. If not followed, the result will be in serious damage of the system.
1. **Do not** short across or ground any of the terminals on the alternator.
2. **Never** operate the alternator on with an open circuit (with the field terminal connected and the armature terminal disconnected).
3. When installing a battery, always make sure that the negative post of the battery is attached securely to the ground strap.
4. **Never** reverse battery leads, not even for an instant, as reverse polarity current flow will damage the diodes in the alternator.
5. When charging the battery with a fast charger, disconnect the positive cable at the battery.

5–E–2. Checking of Charging System on Car
If the electrical system is not charging properly, it is advisable to determine whether the trouble is in the alternator or regulator prior to removing the alternator.
1. Disconnect the wire from "B" terminal of the alternator and connect the ammeter with the negative lead of the ammeter to the wire and the positive lead to the "B" terminal, as shown in Fig. 5–9.

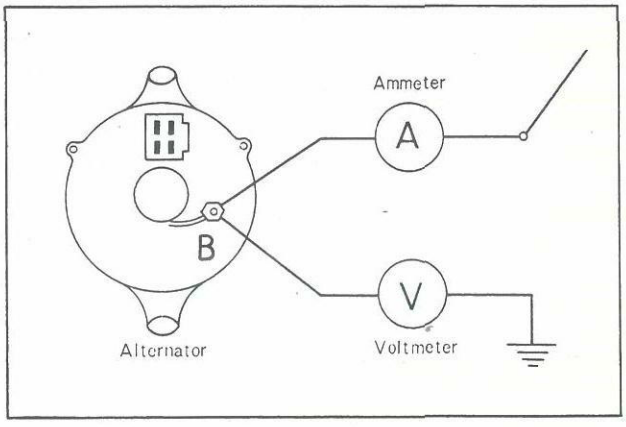


Fig. 5–9 Checking of alternator

2. Connect the positive lead of the voltmeter to the "B" terminal of the alternator and ground the negative lead of the voltmeter.
3. Switch the headlight on.
4. Start the engine and take the reading of the ammeter and voltmeter, holding the engine speed of 1,200 rpm (alternator speed: 2,500 rpm).
If the ammeter shows less than 32 ampares, the trouble is in the alternator and if the voltagemeter shows without the specifications it is in the regulator.

5–E–3. Disassembling of Alternator
1. Remove the front housing attaching bolts.
2. Separate the front housing by prying apart with a screwdriver at the slots of the front housing.
3. Remove the nut attaching the pulley to the shaft and remove the pulley, fan and spacer.

4. Remove the rotor from the front housing.
5. Remove the front bearing retainer attaching screw and remove the retainer. Support the front housing close to the bearing boss, and press out the old bearing from the housing, only if the bearing is defective.
6. Unsolder the diode leads and stator coil leads.
7. Remove the stator from the rear housing.
8. Remove the screws that attach the brush holder to the housing and remove the brush and holder, insulator and terminal.
9. Remove the screw attaching the diode holder and the two terminal screws, and remove the diode and holder assemblies from the rear housing.
10. Remove the nut attaching the radio noise suppression condenser and remove the condenser.

5–E–4. Alternator Inspection

a. Checking of stator coil

Check the stator coil for both open and grounded circuits with a tester.

To check for open, connect the prods to each of the two leads, as shown in Fig. 5–10. If there is no flow of current, the coil is open circuit and must be repaired or replaced.

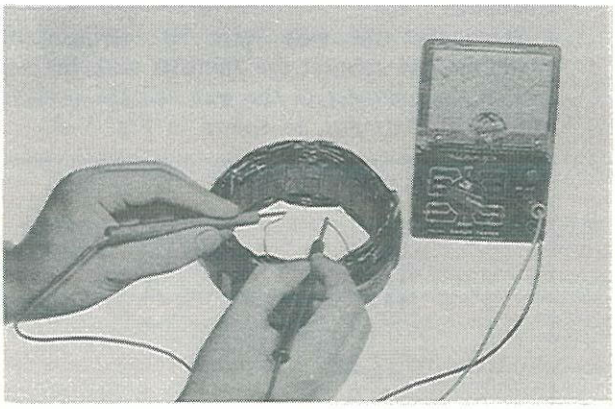


Fig. 5–10 Checking of stator coil for open

To check for ground, connect one prod to the core and the other to each lead wire, as shown in Fig. 5–11. If a ground is present the current will flow and the stator coil must be repaired or replaced.

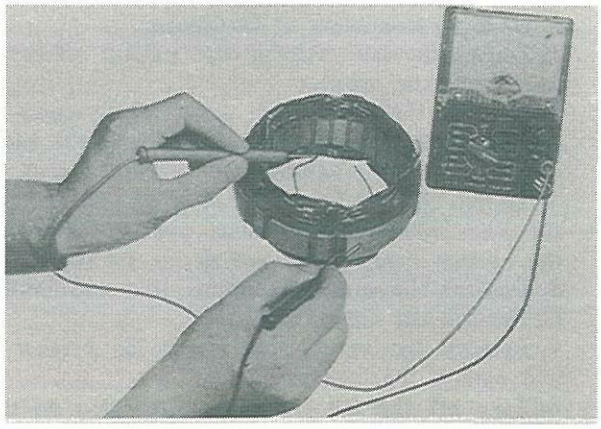


Fig. 5–11 Checking of stator coil for ground

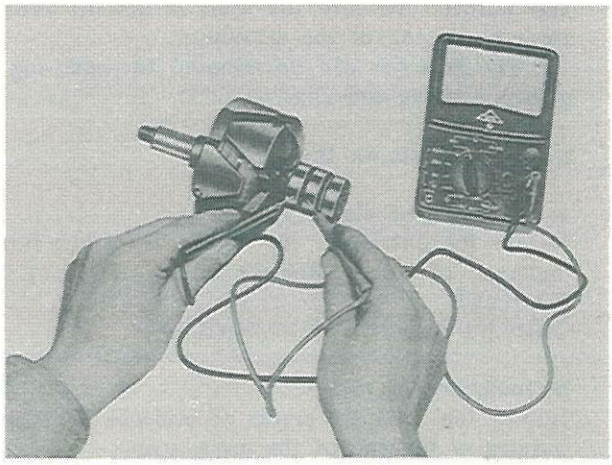


Fig. 5–12 Checking of rotor for open

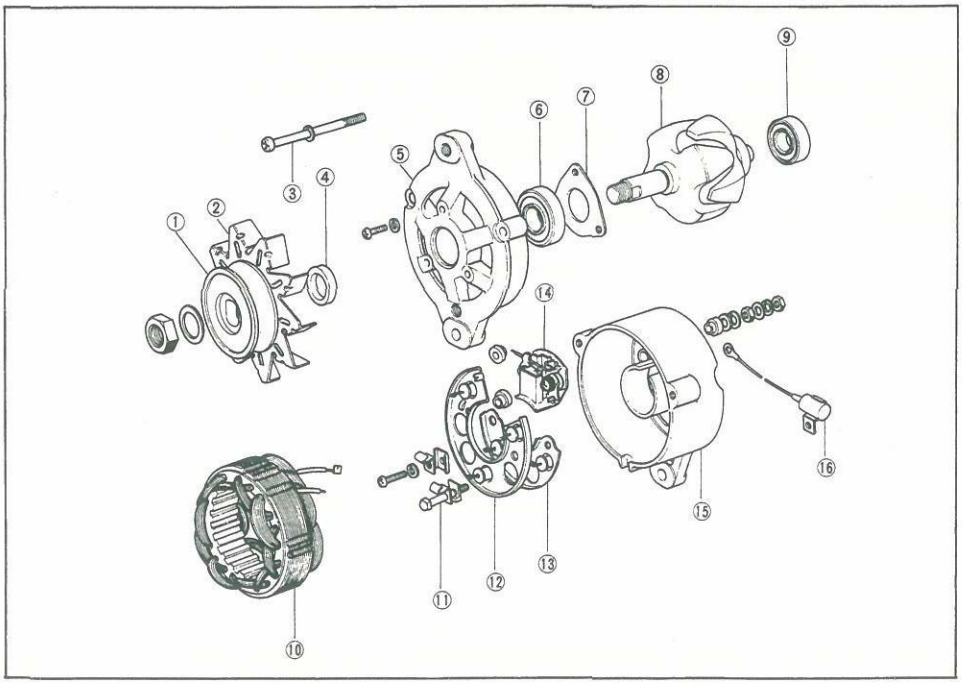


Fig. 5–13
Alternator components
1. Pulley
2. Fan
3. Bolt
4. Spacer
5. Front housing
6. Front bearing
7. Bearing retainer
8. Rotor
9. Rear bearing
10. Stator
11. Terminal bolt
12. Positive diode and holder
13. Negative diode and holder
14. Brush and holder
15. Rear housing
16. Condenser

b. Checking of rotor

To check for open circuit, place both prods of a tester on the slip rings, as shown in Fig. 5–12.
If the reading is 4 to 6 ohms, there is no trouble in the rotor.
To check for ground, connect one prod to the slip ring and other prod to the core. If the current flows the rotor must be repaired or replaced.

c. Checking of diodes

To check diodes, proceed as follows:
1. Positive diode open test
Connect the tester (+) lead on the diode holder and (–) lead on diode lead as shown in Fig. 5–14. Switch the tester to resistance check range, and check the resistance. Good diode will indicate no resistance, and if it indicates a high resistance, the diode is opened. The diode opened, should be replaced as a unit.

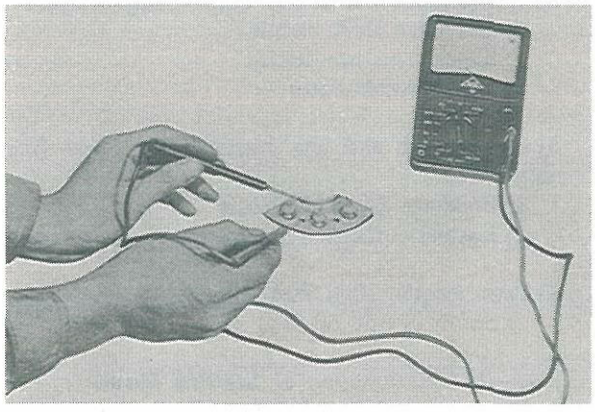


Fig. 5–14 Checking of positive diode

2. Negative diode open test
Connect the tester (–) lead on the diode holder, and (+) lead on the diode lead. Switch the tester to resistance check range, and check the resistance. Good diode will indicate no resistance, and if it indicates a high resistance, the diode is opened. Diode should be replaced as a unit.

d. Checking of brushes

The brush should be replaced when one third of its original length is worn. The standard length is 16 mm (0.630 in).
The standard tension of the brush spring is 390 gr (13.7 oz). If the tension is too low or if excessive corrosion exists, the spring must be replaced.

e. Checking of bearings

There is no need of lubricating as the bearing is prelubricated. In a long spell of use, when the bearing is worn or damaged, replace it with a new one.

5–E–5. Assembling of Alternator

Assemble the alternator in the reverse order of disassembling noting the following point.
1. When installing the rotor assembly to the rear housing and stator assembly, hold the brushes in position by inserting a piece of stiff wire into the hole of the brush through the rear housing as shown in Fig. 5–15.

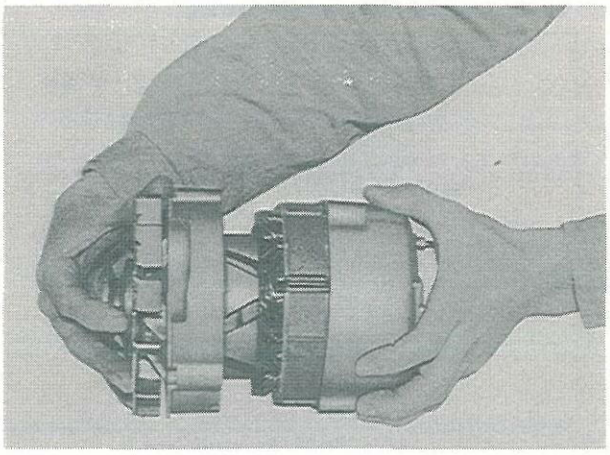


Fig. 5–15 Assembling of rotor assembly

2. The soldering of the diode leads should be performed in **less than twenty seconds** as the excessive heat may damage the diode.

5–F. REGULATOR

5–F–1. Checking of Constant Voltage Relay

To check, use an almost fully charged battery and connect a voltmeter between the (A) and (E) terminals of the regulator, as shown in Fig. 5–16.
Then, hold the alternator revolution to 4,000 rpm (engine revolution 2,000 rpm) and take a reading of the voltmeter. If the reading is from **13.5 ~ 14.5 volts,** it is in proper order. If it is not within the specifications, the voltage relay must be adjusted, as instructed in Par. 5–F–2.

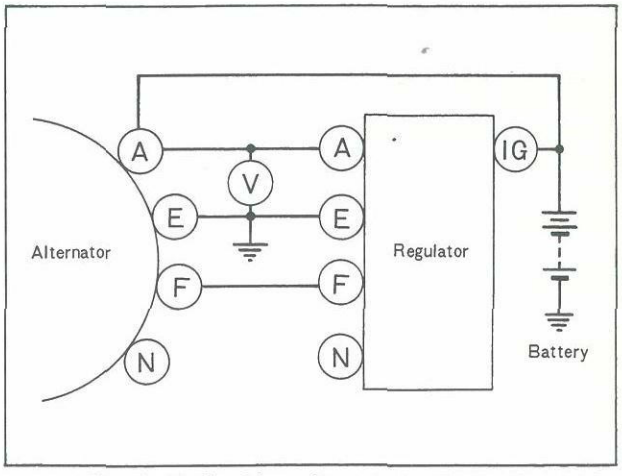


Fig. 5–16 Checking of constant voltage relay

5–F–2. Adjusting of Regulator

First, check the air gap, back gap and point gap with a wire gauge.
If they are not within the specifications, adjust by bending the stationary contact bracket. After correct gaps are obtained, adjust the voltage setting. Bend

the upper plate down to decrease the voltage setting, up to increase the voltage setting.

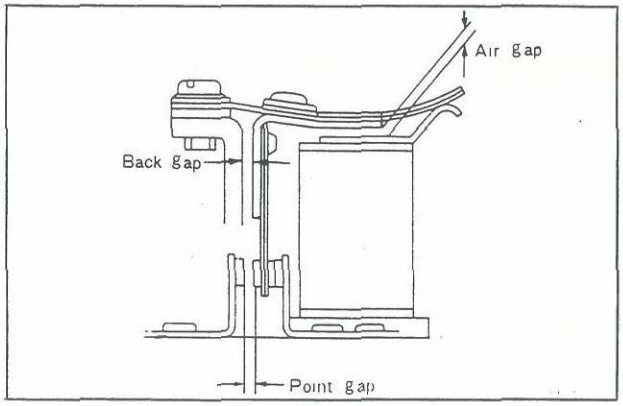


Fig. 5–17 Regulator gap

Constant voltage relay

Adjustment	Standard specification
Air gap	0.7 ~ 1.1 mm (0.028 ~ 0.043 in)
Point gap	0.3 ~ 0.4 mm (0.012 ~ 0.016 in)
Back gap	0.7 ~ 1.1 mm (0.028 ~ 0.043 in)
Voltage	14 ± 0.5V (Alternator 4,000 rpm)

5–G. STARTING MOTOR

5–G–1. Checking of Starting Circuit

When the starting motor fails to operate or does not satisfactorily operate, check the following points before removing the starting motor :

1. Weak battery
2. Corroded or loose battery terminal
3. Loose starting motor terminal
4. Broken or loose wires of the starting circuit
5. Faulty ignition switch

5–G–2. Testing of Starting Motor

a. Free running test

1. Place the starting motor in a vise equipped with soft jaws and connect a fully-charged 12 volts battery to the starting motor.

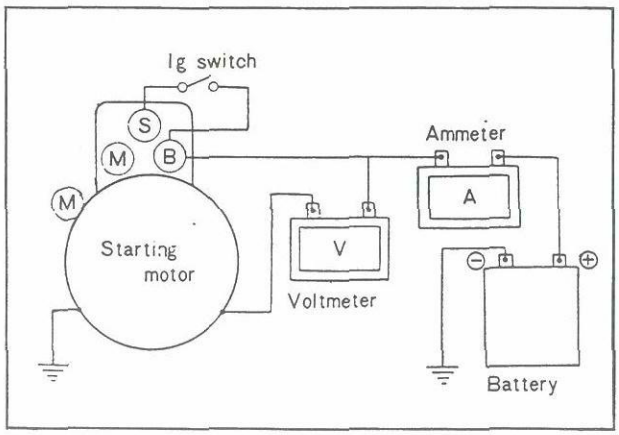


Fig. 5–18 Testing of circuit

2. Connect an ammeter between the (B) terminal of the starting motor and the battery.
3. Operate the starting motor and take a reading. Refer to **Par. TECHNICAL DATA.**

b. Lock resistance test

To test the lock resistance of the starting motor, follow the instructions of the test equipment manufacturer. Refer to **Par. TECHNICAL DATA.**

If the starting motor does not perform to the above test requirements repair it referring to the following list.

1) Starter rotates slowly with a large current at free running.
   a) Worn, dirty or defective bearings
   b) Short circuit of armature
   c) Grounded armature and field coil

2) Starter does not rotate with a large current
   a) Defective field circuit
   b) Short armature circuit
   c) Burnt commutator

3) Low torque and low current flow. Low free running speed.
   a) Breakage of field circuit
   b) Excessive internal resistance

4) Low torque. High free running speed.
   a) Short circuit of field coil

5–G–3. Disassembling of Starting Motor

1. Disconnect the field strap from the terminal on the magnetic switch.
2. Remove the magnetic switch attaching screws and remove the magnetic switch, spring and washers from the driving housing.

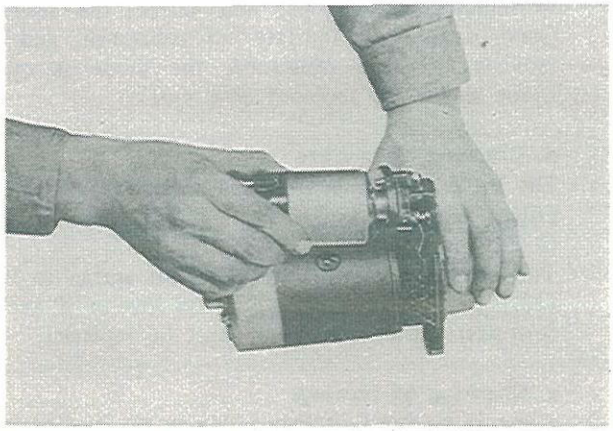


Fig. 5–19 Removing of magnetic switch

3. Remove the plunger from the driving lever.
4. Remove the bracket through bolts and brush holder attaching screws. Then, remove the rear bracket.
5. Remove the insulator and washer from the end of the armature shaft.
6. Remove the brush holder.
7. Separate the front bracket and the yoke.

8. Remove the armature from the yoke and remove the washers.
9. Loosen the screws attaching field coil, and separate the field coil assembly from the yoke.
10. Remove the driving lever, spring and spring seat.
11. Remove the over running clutch assembly from the armature shaft.

5–G–4. Starting Motor Inspection

a. Checking of armature

Check the armature for both grounding and short circuit. To check for grounding, touch one prod of a tester to each segment and the other prod to the core or shaft. If there is current flow, the coil of the corresponding segment is grounded.

To check for short circuit, use a growler tester. Place the armature against the core of the tester, and hold a steel strip on the armature. Then, rotate the armature slowly by hand. In case of short in the coil, the steel strip will become magnetized and vibrate.

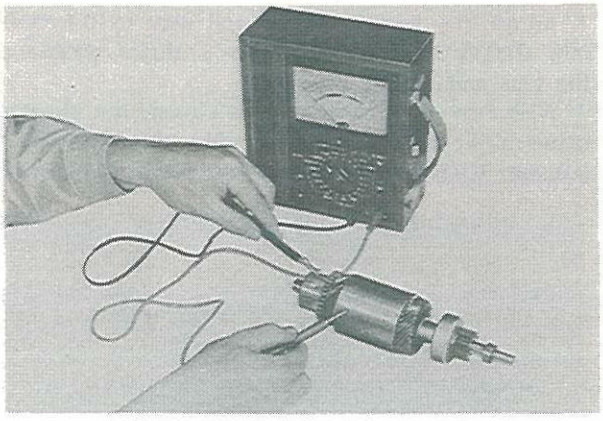


Fig. 5–20 Checking of armature

b. Checking of commutator

If the commutator is dirty, discolored or worn, clean it with emery paper and wash with clean solvent. After cleaning, undercut the mica between the segments to the depth of 0.5 ~ 0.8 mm (0.020 ~ 0.031 in). Refer Fig. 5–21.

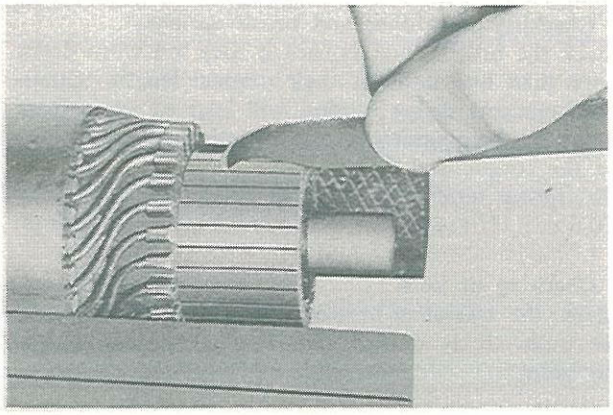


Fig. 5–21 Checking of commutator

c. Checking of field coil

To test the field coil for ground with a tester, place one prod on the yoke or pole core and the other prod to the field terminal. In case of grounding, there will be current flow and the field coil must be repaired or replaced. Refer Fig. 5–22.

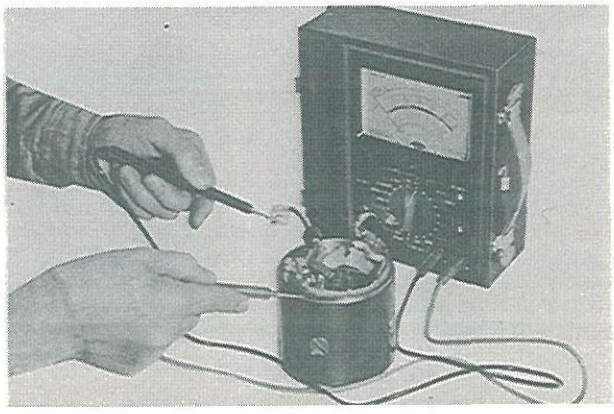


Fig. 5–22 Checking of field coil

d. Checking of brush holder

Check the brush holder for ground. Touch one prod of a tester to the brush holder and the other prod to the frame. Current flow indicates grounding. In that case replace the holder.

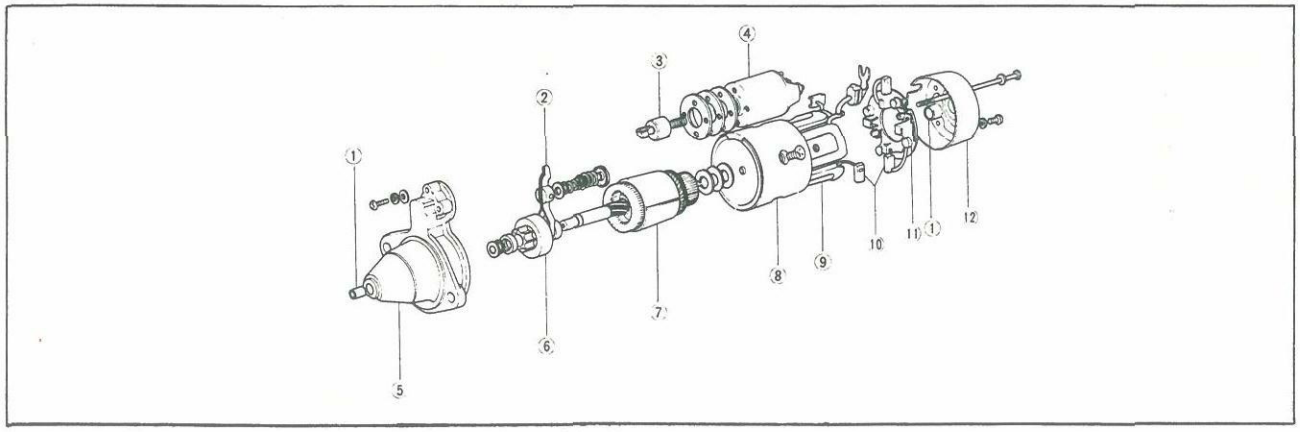


Fig. 5–23 Starting motor components

1. Bush
2. Driving lever
3. Plunger
4. Magnetic switch
5. Front bracket
6. Over running clutch assembly
7. Armature
8. Yoke
9. Field coil assembly
10. Brush
11. Brush holder
12. Rear bracket

e. Checking of brushes and brush springs
Check the brushes and replace if they are worn down more than one third of their original length. Otherwise, reduced spring tension will lead to an increase in the brush-commutator contact resistance. This lowers the torque and causes burnt commutator surface. The spring tension is 1.13 kg (40.0 oz) or 2.0 kg (70.5 oz). If the tension is too low, replace the springs.

f. Checking of bush
Check the clearance between the armature shaft and the bush. If it exceeds 0.2 mm (0.08 in), replace the bush.

5–G–5. Magnetic Switch Test

a. Pull-in coil test
Apply the specified voltage (8V) between the (S) terminal and (M) terminal. If the magnetic switch is forcefully attracted, the pull-in coil is in good condition.

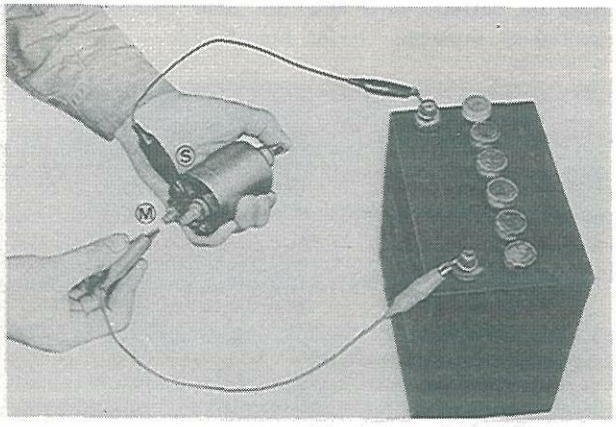


Fig. 5–24 Pull-in coil test

b. Holding coil test
Ground the (M) terminal to the magnetic switch body with a lead and apply the specified voltage (8V) to the terminal (S) to pull in the plunger. If the plunger remains attracted after disconnecting the lead from the (M) terminal, the coil functions properly.

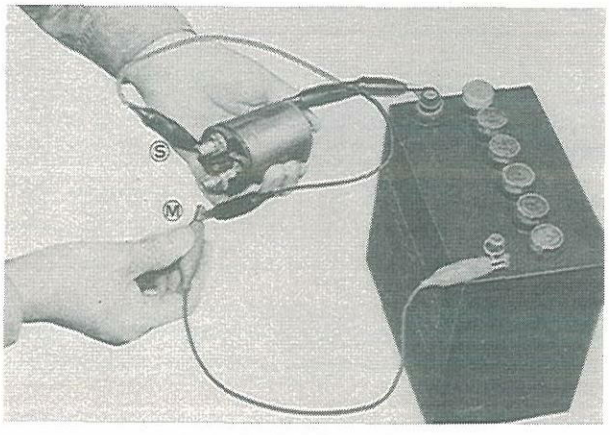


Fig. 5–25 Holding coil test

c. Return test
Push in the plunger by hand and apply the specified voltage (12V) between the (M) terminal and the magnetic switch body. If the plunger is not attracted, there is no trouble.

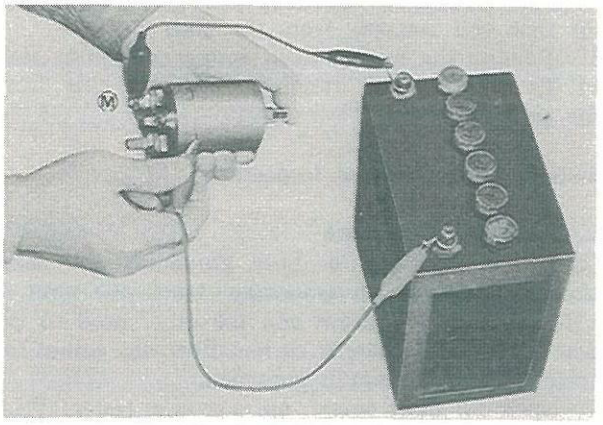


Fig. 5–26 Return test

5–G–6. Assembling of Starting Motor
To assemble the starting motor, reverse the procedure of **Par. 5–G–3**, noting the following points.
1. Adjust the armature shaft end play to 0.1 ~ 0.4 mm (0.004 ~ 0.015 in) with a thrust washer on the rear end of the shaft.
2. When the magnetic switch is closed, the clearance between the pinion and stop collar should be 0.5 ~ 2.0 mm (0.012 ~ 0.079).

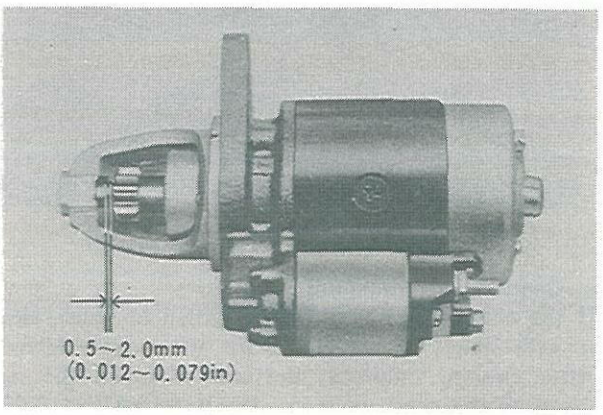


Fig. 5–27 Clearance of pinion and stop collar

5–H. LIGHTING SYSTEM
The wiring of the lighting systems is shown in the wiring diagrams. The wires in the various circuits are of different colors to aid when checking individual circuits.

5–H–1. Headlight Aim
Before adjusting the headlights, make sure that the tires are inflated uniformly to recommended pressure and the vehicle is on the level ground without load. To adjust the headlights, remove the head lamp frames and turn the three spring-loaded screws of the sealed beam unit until the headlights are aimed properly. When the high beam is amied 2.0 m (6.6

ft) straight ahead, the center of the high intensity should be 26.6 mm (1.47 in) lower than the horizontal lamp center line, as shown in Fig. 5–28.

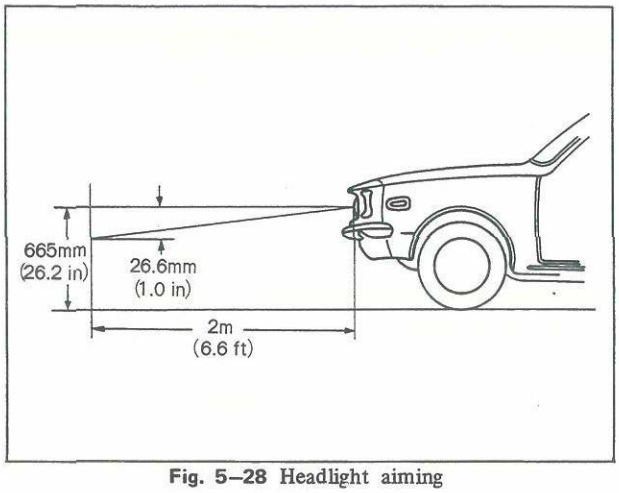


Fig. 5–28 Headlight aiming

5–H–2. Replacing of Bulbs

When replacing the bulbs, use the correct bulbs, referring the following table:

Head lamp	50W/37.5W or 45W/40W
Front turn signal and side lamp	21W/5W or 23W/8W
Rear turn signal lamp	23W/8W or 21W
Back-up lamp	23W or 10W
Stop and tail lamp	21W/5W
Licence lamp	8W or 5W
Side turn signal lamp	3.4W

5–I. METER PANEL

5–I–1. Fuel Gauge

RX-3 is equipped with an electric fuel gauge. The fuel gauge indicates the fuel quantity in the tank when the ignition switch is turned on. The fuel gauge circuit is composed of the fuel meter, mounted on the meter panel, and the fuel tank unit, connected by a single wire through the ignition switch.

Should the meter fail to register, check and repair the fuel meter circuit as follows:

1) Fuel gauge does not register with ignition "ON".
   a) Defective panel unit
   b) Faulty contact in "Ig" terminal of meter gauge
   c) Wiring to tank grounded
   d) Meter gauge improperly grounded
2) Fuel gauge shows "F" under all conditions.
   a) Open circuit in tank unit and meter gauge
   b) Break in wiring between tank unit and panel
3) Fuel gauge shows "E" under all conditions.
   a) Loose or faulty contact of terminals
   b) Short circuit in tank unit or meter gauge
   c) Break in P coil and S coil of meter gauge

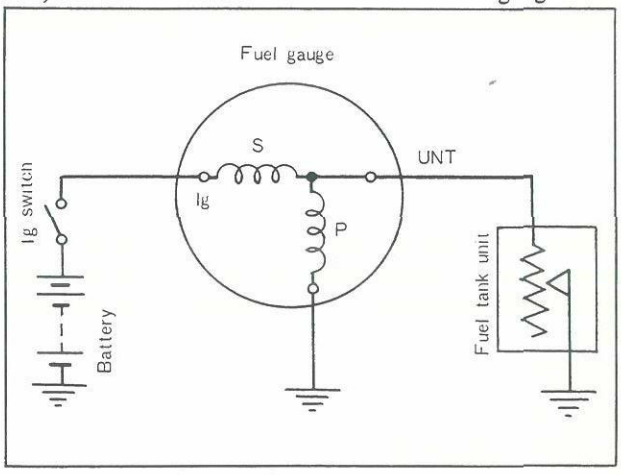


Fig. 5–29 Diagram of fuel gauge

5–I–2. Water Thermometer

The cooling water thermometer is operated electrically like the fuel gauge. The circuit consists of the water thermometer on the meter panel and the sending unit installed on the intake manifold. When the water thermometer registers improperly, check on the following points and refer to the wiring diagram for repair.

1) Pointer does not move when ignition switch is turned on.
   a) Defective panel unit
   b) Faulty contact in "Ig" terminal
2) Pointer shows "H" under all conditions.
   a) Open circuit in sending unit
   b) Break in wiring between both units.
   c) Loose or faulty contact in terminals
3) Pointer shows "C" under all conditions.
   a) Defective panel unit
   b) Short circuit in sending unit
   c) Panel unit improperly grounded

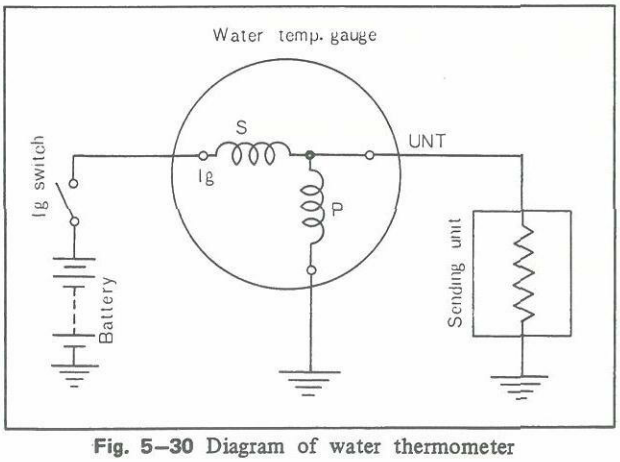
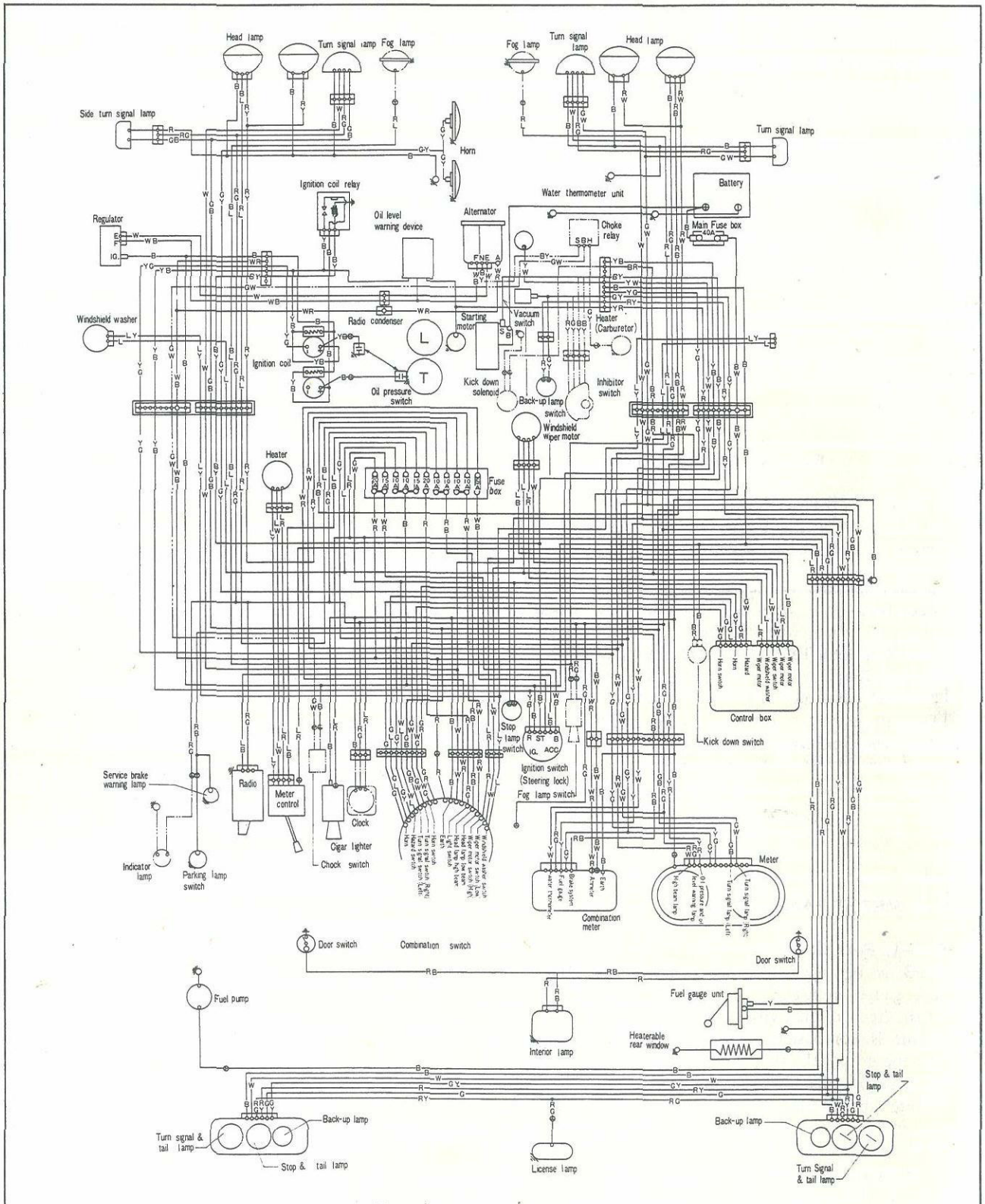


Fig. 5–30 Diagram of water thermometer



Wiring colour code
R : Red
G : Green
B : Black
L : Blue
Y : Yellow
W : Whith

Example

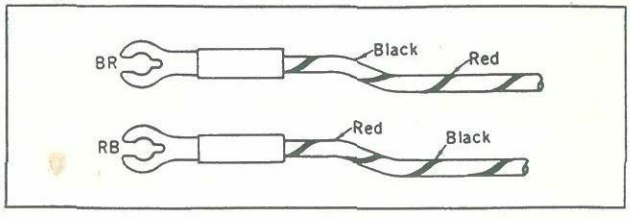


Fig. 5–31 Wiring diagram

TECHNICAL DATA

T

Engine (General Data)	
Type	Rotary engine, in line 2 rotors, water cooled
Displacement	491 cc x 2 rotors (30.0 cu. in x 2 rotors)
Compression ratio	9.4 : 1
Compression pressure	6.0 kg/cm² at 280 rpm (85 lb/in² at 280 rpm)
Max. Brake horsepower	110 HP/7,000 rpm (SAE)
Max. Torque	100 ft-lb/4,000 rpm (SAE)
Port timing :	
Intake opens	Primary : 32° A.T.D.C. Secondary : 32° A.T.D.C.
Intake closes	Primary : 40° A.B.D.C. Secondary : 40° A.B.D.C.
Exhaust opens	80° B.B.D.C.
Exhaust closes	48° A.T.D.C.

Engine	
Front and rear housing :	
Limit of distortion	0.04 mm (0.002 in)
Limit of wear	0.10 mm (0.004 in)
Rotor housing :	
Width	$60^{+0}_{-0.02}$ mm $(2.3622^{+0}_{-0.0008}$ in)
Limit of distortion	0.04 mm (0.002 in)
Intermediate housing :	
Width	50 ± 0.1 mm (1.9685 ± 0.0039 in)
Limit of distortion	0.04 mm (0.002 in)
Limit of wear	0.10 mm (0.004 in)
Rotor :	
Standard weight (with internal gear and bearing)	3.940 kg (8.686 lb)
Inside diameter	$80^{+0.019}_{-0}$ mm $(3.1497^{+0.0008}_{-0}$ in)
Gap of side housing and rotor	0.13 ~ 0.17 mm (0.0051 ~ 0.0067 in)
Protrusion of land	0.10 ~ 0.15 mm (0.004 ~ 0.006 in)
Permissible protrusion of land	Max. 0.2 mm (0.008 in) Min. 0.085 mm (0.003 in)
Width of apex seal gloove	6 ± 0.009 mm (0.2362 ± 0.0004 in)
Diameter of corner seal cave	$11^{+0.018}_{-0}$ mm $(0.4331^{+0.0007}_{-0}$ in)
Depth of corner seal cave	$8.0^{+0}_{-0.2}$ mm $(0.3150^{+0}_{-0.0079}$ in)
Width of side seal groove	$1.0^{+0.039}_{+0.014}$ mm $(0.0394^{+0.0015}_{+0.0006}$ in)
Depth of side seal groove	4.5 ± 1 mm (0.1772 ± 0.0039 in)
Width of oil seal groove	$3.5^{+0.06}_{+0.03}$ mm $(0.1378^{+0.0024}_{+0.0012}$ in)
Depth of oil seal groove	6.4 ± 0.1 mm (0.2520 ± 0.0039 in)
Apex seal :	
Length	$59.97^{+0}_{-0.025}$ mm (Arctic spec.) $(2.3611^{+0}_{-0.0010}$ in) $59.94^{+0}_{-0.020}$ mm $(2.3599^{+0}_{-0.0008}$ in)
Width	$6^{-0.043}_{-0.066}$ mm $(0.2362^{-0.0017}_{-0.0026}$ in)
Height	$10^{+0}_{-0.1}$ mm $(0.3937^{+0}_{-0.0039}$ in)
Limit of height	8.0 mm (0.3150 in)
Gap of apex seal and side housing :	
Standard	0.01 ~ 0.055 mm (0.0004 ~ 0.0020 in) } Arctic spec. 0.02 ~ 0.055 mm (0.0008 ~ 0.0020 in) } Arctic spec. 0.05 ~ 0.070 mm (0.0020 ~ 0.0028 in)
Limit	0.15 mm (0.0059 in)
Gap of apex seal and rotor groove :	
Standard	0.036 ~ 0.072 mm (0.0014 ~ 0.0028 in) 0.034 ~ 0.075 mm (Arctic spec.) (0.0013 ~ 0.0030 in)
Limit	0.10 mm (0.004 in)
Apex seal spring:	
Free height	5.0 mm (0.197 in)
Set height	2.0 mm (0.079 in)
Set load	2.9 ± 0.2 kg (6.4 ± 0.4 lb)
Spring constant	0.97 kg/mm (54.3 lb/in)
Corner seal:	
Outside diameter	$11^{-0.020}_{-0.030}$ mm $(0.4331^{-0.0008}_{-0.0012}$ in)
Width	$7^{+0}_{-0.2}$ mm $(0.2756^{+0}_{-0.0079}$ in)
Gap of corner seal and rotor groove:	
Standard	0.020 ~ 0.048 mm (0.0008 ~ 0.0019 in)
Limit	0.08 mm (0.0031 in)
Corner seal spring:	
Free height	2.7 mm (0.106 in)
Set height	1.0 mm (0.039 in)
Set load	1.3 ± 0.3 kg (2.9 ± 0.7 lb)
Spring constant	0.76 kg/mm (42.6 lb/in)
Side seal:	
Thickness	$1.0^{-0.014}_{-0.039}$ mm $(0.0394^{-0.0006}_{-0.0015}$ in)
Width	$3.5^{+0}_{-0.1}$ mm $(0.1378^{+0}_{-0.0039}$ in)
Gap of side seal and rotor groove:	
Standard	0.04 ~ 0.07 mm (0.002 ~ 0.003 in)
Limit	0.078 mm (0.0031 in)

Gap of side seal and corner seal:	
Standard	0.05 ~ 0.15 mm (0.002 ~ 0.006 in)
Limit	0.40 mm (0.016 in)
Side seal spring:	
Free height	1.9 mm (0.075 in)
Set height	1.0 mm (0.039 in)
Set load	4.0 ± 1.0 kg (8.8 ± 2.2 lb)
Spring constant	3.6 kg/mm (201.6 lb/in)
Oil seal:	
Thickness	$5.5\ ^{+\ 0.2}_{-\ 0}$ mm ($0.2165\ ^{+\ 0.0079}_{-\ 0}$ in)
Width	$3.35\ ^{+\ 0.05}_{-\ 0.15}$ mm ($0.1319\ ^{+\ 0.0020}_{-\ 0.0059}$ in)
Outside diameter of outer oil seal	$126\ ^{-\ 0.04}_{-\ 0.10}$ mm ($4.9607\ ^{-\ 0.0016}_{-\ 0.0039}$ in)
Outside diameter of inner oil seal	$116\ ^{-\ 0.03}_{-\ 0.09}$ mm ($4.5670\ ^{-\ 0.0012}_{-\ 0.0035}$ in)
Contact width of oil seal lip:	
Standard	0.2 mm (0.008 in)
Limit	0.8 mm (0.031 in)
Oil seal spring:	
Free height	Inner side: 2.7 mm (0.106 in) Outer side: 2.6 mm (0.102 in)
Set height	1.0 mm (0.039 in)
Set load	$13\ ^{+\ 3}_{-\ 0}$ kg ($28.7\ ^{+\ 6.6}_{-\ 0}$ lb)
Spring constant	Inner side : 7.5 kg/mm (419.6 lb/in) Outer side: 8.3 kg/mm (464.4 lb/in)
Main bearing:	
Inner diameter	$43\ ^{+\ 0.050}_{+\ 0.020}$ mm ($1.6929\ ^{+\ 0.0018}_{+\ 0.0008}$ in)
Main bearing clearance:	
Standard	0.04 ~ 0.07 mm (0.0016 ~ 0.0028 in)
Limit	0.10 mm (0.0039 in)
Rotor bearing:	
Inner diameter	$74\ ^{+\ 0.070}_{+\ 0.030}$ mm ($2.9134\ ^{+\ 0.0028}_{+\ 0.0012}$ in)
Rotor bearing clearance:	
Standard	0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in)
Limit	0.10 mm (0.0039 in)
Eccentric shaft:	
Eccentricity of rotor journal	$15\ ^{+\ 0}_{-\ 0.035}$ mm ($0.5906\ ^{+\ 0}_{-\ 0.0014}$ in)
Main journal diameter	$43\ ^{+\ 0.015}_{-\ 0.030}$ mm ($1.6929\ ^{+\ 0.0006}_{-\ 0.0012}$ in)
Rotor journal diameter	$74\ ^{-\ 0.015}_{-\ 0.030}$ mm ($2.9134\ ^{-\ 0.0006}_{-\ 0.0012}$ in)
Permissible run-out	Less than 0.02 mm (Less than 0.0008 in)
Eccentric shaft end play:	
Standard	0.04 ~ 0.07 mm (0.0016 ~ 0.0028 in)
Limit	0.09 mm (0.0035 in)
Internal gear:	
Number of teeth	51
Backlash of internal gear and stationary gear	0.06 ~ 0.08 mm (0.0024 ~ 0.0031 in)
Stationary gear:	
Number of teeth	34
Inner diameter	$47\ ^{+\ 0.016}_{-\ 0}$ mm ($1.8504\ ^{+\ 0.0006}_{-\ 0}$ in)

Lubricating system

Oil pump:	
Feeding capacity	6 liters/min (12.7 U.S. pints/min, 10.6 Imp. pints/min) at 1,000 rpm 22 liters/min (46.5 U.S. pints/min, 38.7 Imp. pints/min) at 7,000 rpm
Clearance of outer rotor and body	0.200 ~ 0.245 mm (0.008 ~ 0.010 in)
Clearance of outer rotor and inner rotor	0.01 ~ 0.09 mm (0.0004 ~ 0.0035 in)
Rotor end float	0.030 ~ 0.125 mm (0.001 ~ 0.005 in)
Oil pressure:	
Normal	5.0 kg/cm² (71.1 lb/in²) at 3,000 rpm 0.5 kg/cm² (7.1 lb/in²) at 700 rpm
Warning lamp lights	Less than 0.3 kg/cm² (4.3 lb/in²)
Pressure regulator control spring:	
Free length	46.4 mm (1.827 in)
Set length	35.3 mm (1.390 in)
Set load	7.1 kg (15.6 lb)
Relief valve opens:	
Regulated pressure	5.06 kg/cm² (72.0 lb/in²)
Oil metering pump feeding capacity	2.4 ~ 2.9 cc/6 min at 2,000 rpm
Oil capacity:	
Oil pan	4.8 liters (10.1 U.S. pints, 8.4 Imp. pints)
Full capacity	5.8 liters (12.3 U.S. pints, 10.2 Imp. pints)

Cooling system

Water pump:	
Type	Centrifugal
Feeding capacity	110 ~ 120 liters (233 ~ 254 U.S. pints, 194 ~ 211 Imp. pints/min)
Fan:	
Standard revolution	1,500 ~ 2,000 rpm at 2,000 rpm of engine
Fan diameter	380 mm (14.96 in)
Number of blades	4
Water pump pulley ratio	1.035 : 1
Thermostat:	
Starts to open	82 ± 1.5°C (180 ± 35°F)

Fully opens	95°C (203°F)
Lift	8^{+2}_{-0} mm ($0.31^{+0.079}_{-0}$ in) at 95°C (203°F)
Radiator :	
Type	Corrugated fin
Core area	7.15 m² (77.0 ft²) or 6.28 m² (67.6 ft²)
Relief valve pressure	0.9 ± 0.1 kg/cm² (12.8 ± 1.4 lb/in²)
Cooling capacity :	
With heater	7.3 liters (15.4 U.S. pints, 12.8 Imp. pints)
Without heater	6.8 liters (14.5 U.S. pints, 12.1 Imp. pints)

Fuel system

Fuel tank capacity	60.0 liters (15.6 U.S. gallons, 13.2 Imp. gallons)
Fuel filter	Paper element, cartridge type
Fuel pump :	
Type	Electrical (Transistor)
Rated terminal voltage	12 V
Min. operating voltage	Less than 10 V
Feeding pressure	0.20 ~ 0.25 kg/cm² (2.8 ~ 3.6 lb/in²)
Feeding capacity	More than 800 cc (0.21 U.S. gallon, 0.18 Imp. gallon/min)
Carburetor :	
Type	Down-draft, Zenith Stromberg
Throat diameter	Primary : 26 mm (1.0236 in)
	Secondary : 30 mm (1.1811 in)
Venturi diameter	Primary : 21 x 8 mm (0.8268 x 0.3150 in)
	Secondary : 28 x 10 mm (1.1024 x 0.3937 in)
Main jet	Primary : # 92
	Secondary : # 140
Main air bleed	Primary : # 100
	Primary : # 90 (Automatic transmission)
	Secondary : # 140
Slow jet	Primary : # 42
	Secondary : # 60
Slow air bleed	Primary : # 200
	Secondary : # 180
Pump nozzle	0.7 mm (0.028 in)

Electrical system

Battery :	
Voltage	12 V (NS60, NS70 or N50Z)
Capacity	45AH, 60AH or 65AH (20 hours rate)
Terminal ground	Negative
Specific gravity	Fully charged : 1.26
	Recharge at : 1.20
Distributor (T and L) :	
Contact point gap	0.45 ± 0.05 mm (0.018 ± 0.002 in)
Contact point pressure	0.575 ± 0.075 kg (1.27 ± 0.17 lb)
Condenser capacity	0.27 ± 0.027μF
Centrifugal advance :	
Trailing	Start : 0 ± 1° at 500 rpm of dis.
	Max. : 2.5 ± 1° at 1500 rpm of dis.
Leading	Start : 0 ± 1° at 500 rpm of dis.
	Max. : 7.5 ± 1° at 2,000 rpm of dis.
Vacuum advance :	
Trailing	Start : 0 ± 1.5° at 150 mmHg
	Max. : 17.5 ± 1° at 430 mmHg
Leading	Start : 0 ± 1° at 150 mmHg
	Max. : 11 ± 1.5° at 400 mmHg
Dwell angle	58 ± 3°
Firing order	1 – 2
Ignition timing	Trailing : 5° A.T.D.C.
	Leading : 0°
Marking location	Eccentric shaft pulley
Spark plug type and gap :	
Hot type	NGK B-6EM 0.8 ~ 0.9 mm (0.031 ~ 0.035 in)
	NIPPONDENSO W20EA (0.8 ~ 0.9 mm (0.031 ~ 0.035 in)
Standard type	NGK B-7EM 0.8 ~ 0.9 mm (0.031 ~ 0.035 in)
	NIPPONDENSO W22EA 0.8 ~ 0.9 mm (0.031 ~ 0.035 in)
Cold type	NGK B-8EM 0.8 ~ 0.9 mm (0.031 ~ 0.035 in)
	NIPPONDENSO W25EA 0.8 ~ 0.9 mm (0.031 ~ 0.035 in)
Starting motor :	
Capacity	1.0 KW
	2.0 KW (Arctic spec. or automatic transmission)
Free running test	Voltage : 11.5 V
	: 12 V (Automatic transmission)
	Current : Less than 70 A at 5,000 rpm or more
	: Less than 100 A at 5,400 rpm or more (Arctic spec.)
	: Less than 100 A at 1,700 rpm or more (Automatic transmission)
Lock test	Voltage : 5V
	: 4V (Arctic spec. or automatic transmission)
	Current : 800A or less
	: 1,000A or less (Arctic spec.)
	: 1,200A or less (Automatic tranmission)
	Torque : 0.9 m-kg or more (6.51 ft-lb or more)
	: 1.8 m-kg or more (13.02 ft-lb or more) (Arctic spec.)
	: 6.0 m-kg or more (43.40 ft-lb or more) (Automatic transmission)

Brush	4	Regulator:	
Brush spring tension	1.13 kg (40.0 oz) 2.0 kg (70.5 oz) (Arctic spec.)	Constant voltage relay	Air gap: 0.7 ~ 1.1 mm (0.028 ~ 0.043 in) Point gap: 0.3 ~ 0.4 mm (0.012 ~ 0.016 in) Back gap: 0.7 ~ 1.1 mm (0.028 ~ 0.043 in)
Magnetic switch operating Voltage	9V		
Alternator:			
Ground polarity	Negative	Regulated voltage, without load	14 ± 0.5V
No load test	Voltage: 14V at 1,050 rpm or less Current: 0A	Bulbs:	
		Head lamp	50W/37.5W or 45W/40W
		Front turn signal & side lamp	21W/5W or 23W/8W
Load test	Voltage: 14V at 2,500 rpm or less Current: 32A	Side turn signal lamp	3.4W
		Fog lamp	25W
		Interior lamp	5W
Brush spring pressure	390 gr (13.7 oz)	Rear turn signal lamp	21W or 23W/8W
Slip ring diameter	33 mm ± 0.2 (1.299 ± 0.008 in)	Stop, tail & back-up lamp	21W/5W/10W
		Licence lamp	8W, 10W or 5W
Ratio of alternator and eccentric shaft	2.02 : 1		

TIGHTENING TORQUE LIST

	m-kg	ft-lb		m-kg	ft-lb
Engine:			Coolant drain plug	2.0	15
Tension bolt	3.0	20	(Intermediate housing)		
Flywheel nut	45.0	350	Water pump	2.0	15
Eccentric shaft pulley	8.5	60	Water pump pulley	0.8	5
Front cover	2.0	15	Carburetor	2.0	15
Bearing housing	2.0	15	Intake manifold	2.0	15
Rear stationary gear	2.0	15	Exhaust manifold	5.0	40
Oil pan	1.0	7	Spark plug	1.5	10
Pressure regulator	3.5	25			
Oil drain plug	3.5	25	Standard bolts:		
Oil pump	0.8	5	6 mm P = 1.25	0.8	5
Oil pump driven sprocket nut	3.5	25	8 mm P = 1.25	2.0	15
Oil pressure switch	1.5	10	10 mm P = 1.25	4.0	30
Cooling fan	0.8	5	12 mm P = 1.5	7.0	50
Water thermometer gauge unit	1.0	7	14 mm P = 1.5	9.0	60