

ENGINE

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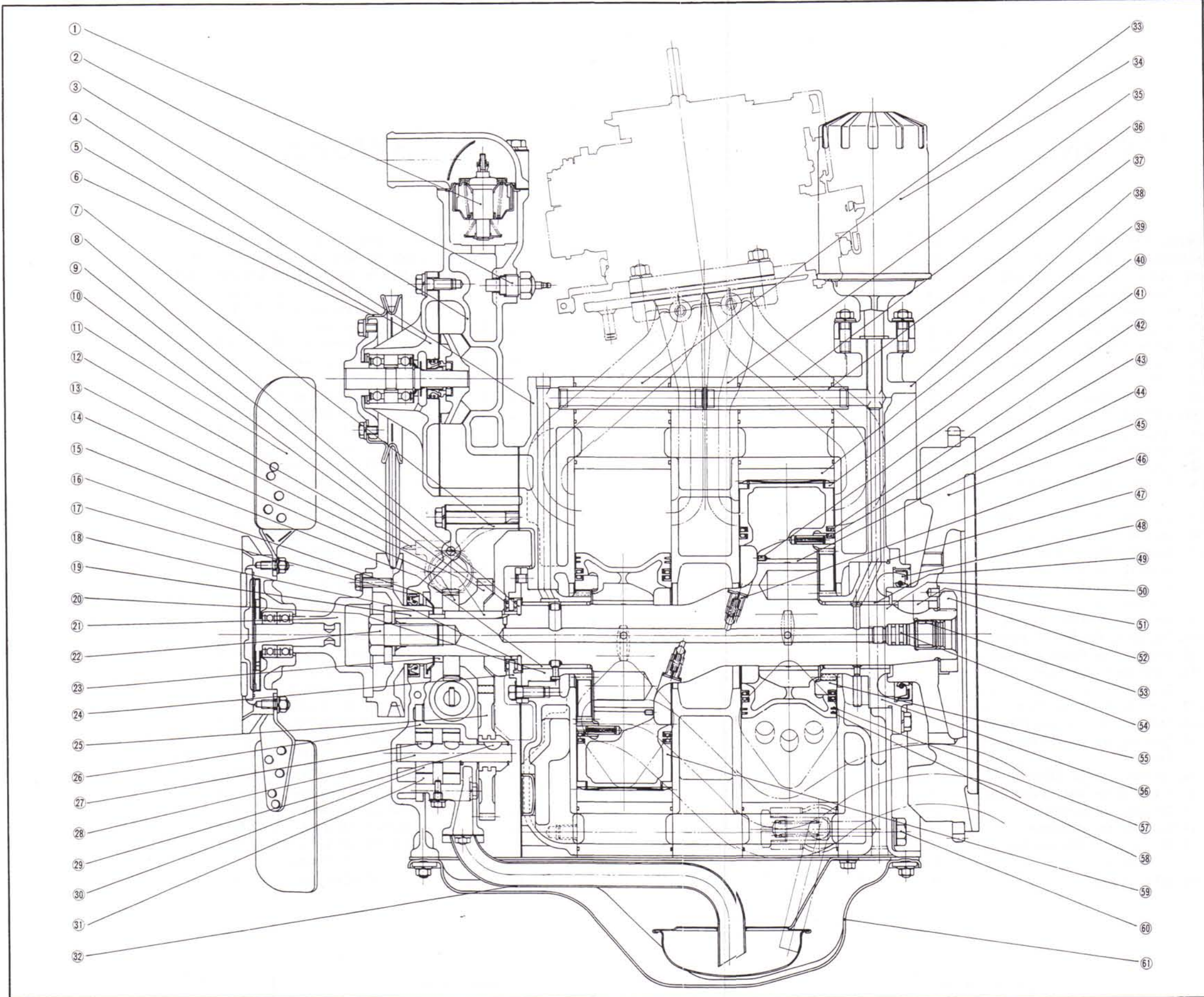


Fig. 1-1 Engine (1)

- 1. Thermostat
- 2. Heat Gauge Unit
- 3. Water Pump Casing Ass'y
- 4. Front Housing Ass'y
- 5. Pump Cover Ass'y
- 6. Water Pump Pulley
- 7. Front Cover Ass'y
- 8. Thrust Plate
- 9. Needle Bearing
- 10. Oil Pump Drive Gear
- 11. Cooling Fan
- 12. Indicator Pin
- 13. Key
- 14. Distributor Drive Gear
- 15. Main Bearing
- 16. Oil Baffle Plate
- 17. Oil Seal
- 18. Spacer
- 19. Key
- 20. Stationary Gear (front)
- 21. Fan Drive Ass'y
- 22. Bolt
- 23. Spacer
- 24. Thrust Bearing Housing
- 25. Oil Pump Drive Gear
- 26. Oil Pump Body
- 27. Key
- 28. Oil Pump Shaft
- 29. Key
- 30. Oil Pump Inner Rotor
- 31. Oil Pump Outer Rotor
- 32. Oil Strainer
- 33. Front Rotor Housing
- 34. Oil Filter
- 35. Intermediate Housing
- 36. Rear Rotor Housing
- 37. Tubular Dowel
- 38. Rear Housing
- 39. Apex Seal
- 40. Corner Seal
- 41. Set Screw
- 42. Oil Seal (outer)
- 43. Oil Seal (inner)
- 44. Rotor Bearing
- 45. Flywheel
- 46. Oil Jet Plug
- 47. "O" Ring
- 48. Oil Seal
- 49. Main Bearing
- 50. Eccentric Shaft
- 51. Key
- 52. Nut
- 53. Needle Bearing
- 54. Blind Plug
- 55. Internal Gear
- 56. Stationary Gear (rear)
- 57. Side Seal Inner
- 58. Side Seal Outer
- 59. Rotor Ass'y
- 60. Tension Bolt
- 61. Oil Pan

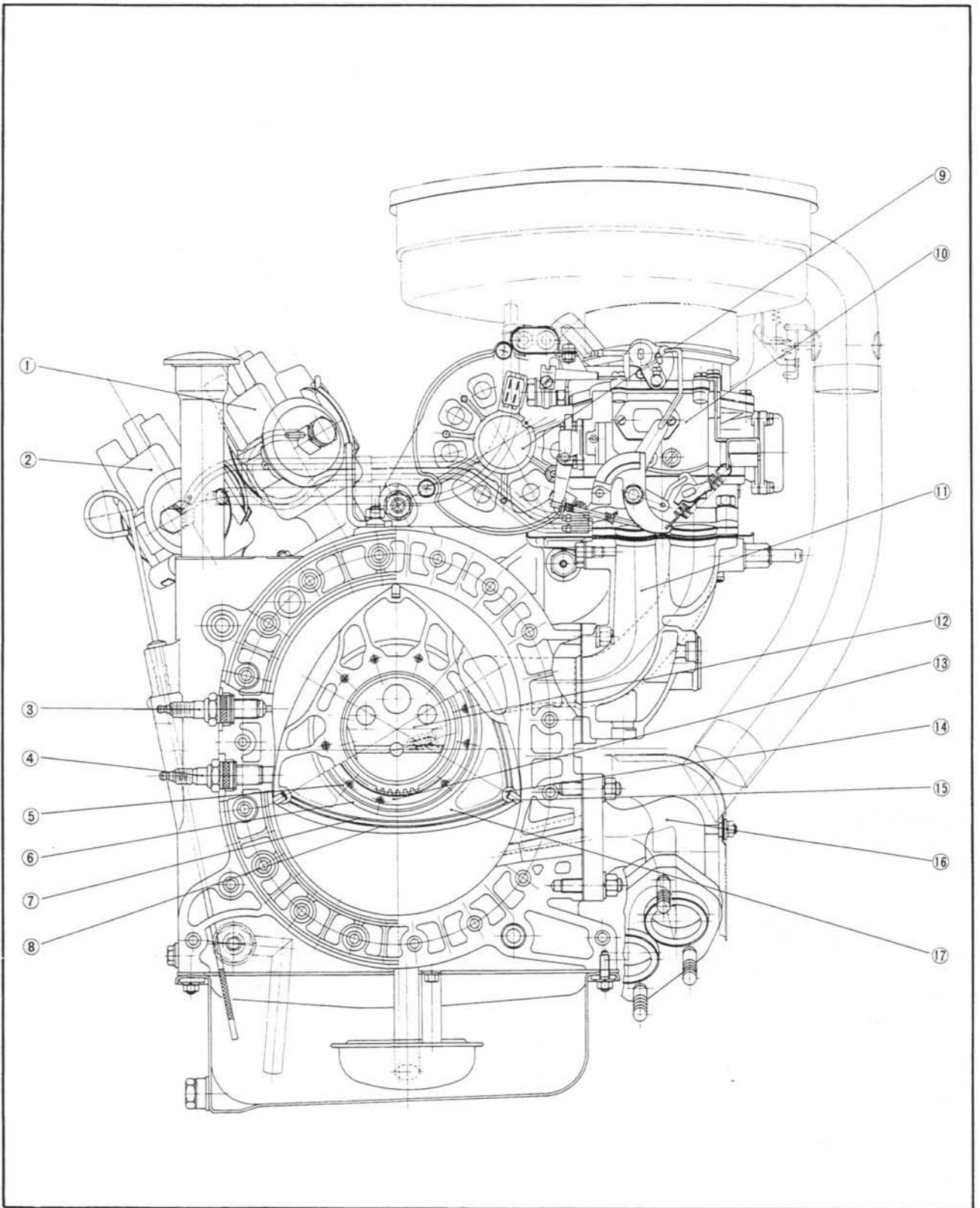


Fig. 1-2 Engine (2)

1. Trailing Distributor
2. Leading Distributor
3. Trailing Spark Plug
4. Leading Spark Plug
5. Inner Oil Seal
6. Outer Oil Seal

7. Inner Side Seal
8. Outer Side Seal
9. Alternator
10. Carburettor
11. Inlet Manifold
12. Eccentric Shaft

13. Internal Gear
14. Corner Seal
15. Apex Seal
16. Exhaust Manifold
17. Rotor

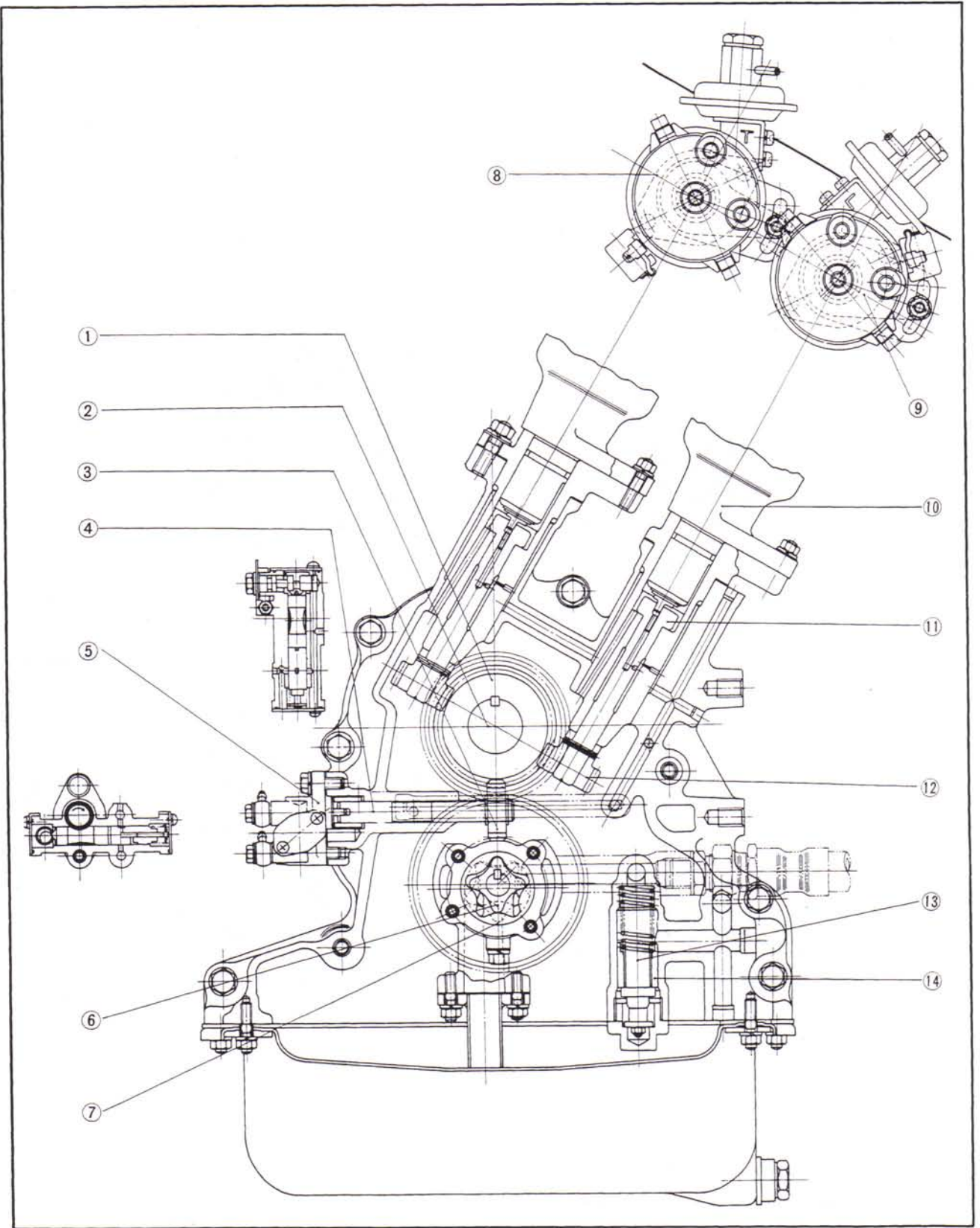


Fig. 1-3 Engine (3)

- 1. Distributor Drive Gear
- 2. Eccentric Shaft
- 3. Metering Pump Drive Gear
- 4. Metering Pump Drive Shaft
- 5. Metering Pump Ass'y

- 6. Oil Pump Inner Rotor
- 7. Oil Pump Outer Rotor
- 8. Trailing Distributor
- 9. Leading Distributor
- 10. Distributor Socket

- 11. Distributor Drive Shaft
- 12. Distributor Driven Gear
- 13. Pellet
- 14. Slide Valve

ENGINE

RX-2 is mounted with a 2-rotor type rotary piston engine of Toyo Kogyo's unique design. Its single chamber capacity is 573 cc (35.0 cu. in) and the compression ratio is 9.4 : 1. The performance is shown in Fig. 1-4.

The main component parts of the rotary piston engine are entirely different from those of the conventional reciprocating engine. The rotor which corresponds 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 the side housing 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 and is then produced as output through the flywheel.

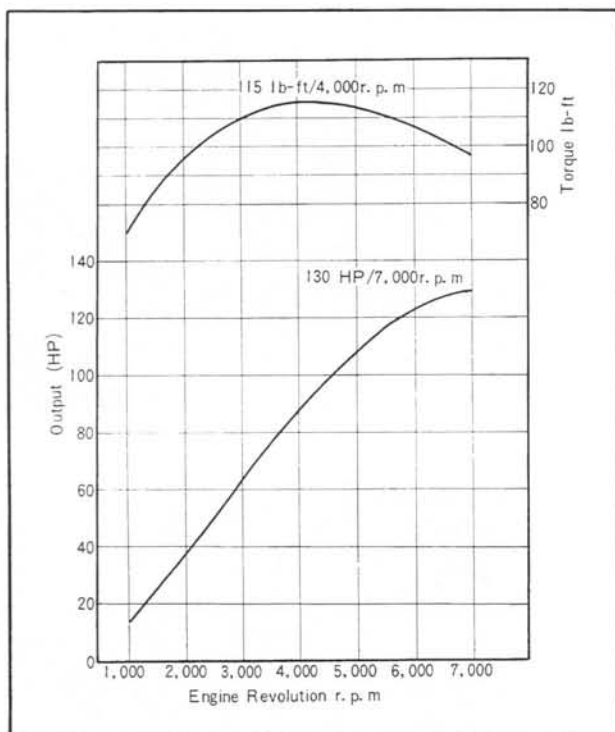


Fig. 1-4 Engine performance curve

1-A. REMOVING THE ENGINE

To remove the engine for overhauling, proceed as described in the following :

1. Remove the bonnet.
2. Protect the fender with a cover.
3. Drain the cooling water.
4. Drain the engine lubricating oil.
5. Remove the air-cleaner.
6. Remove the fuel pipe from the carburettor.
7. Disconnect the accelerator cable and the choke cable from the carburettor.
8. Disconnect the wiring from the starting motor.
9. Disconnect the wiring from the alternator and the water temperature gauge unit.
10. Disconnect the high-tension cables from the distributors and the spark plugs.
11. Disconnect the wire of the oil pressure switch.
12. Remove the water hoses from the engine.
13. Remove the heater hose from the engine.

14. Remove the oil hoses from the front cover and rear housing of the engine, and remove the oil hose clip on the engine mounting bracket.
15. Remove the radiator upper shroud.
16. Remove the alternator.

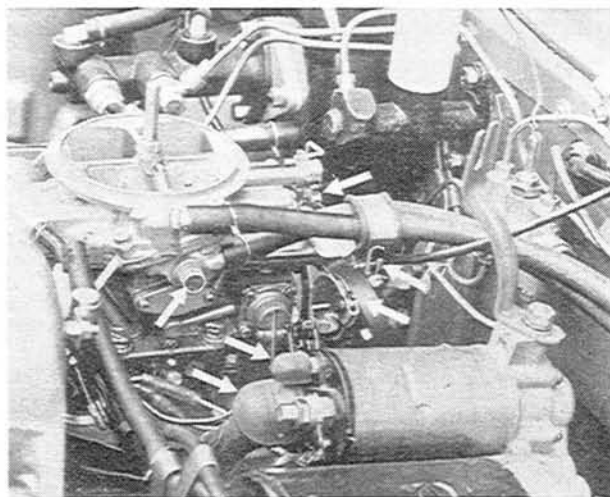


Fig. 1-5 Disconnecting pipes and cables

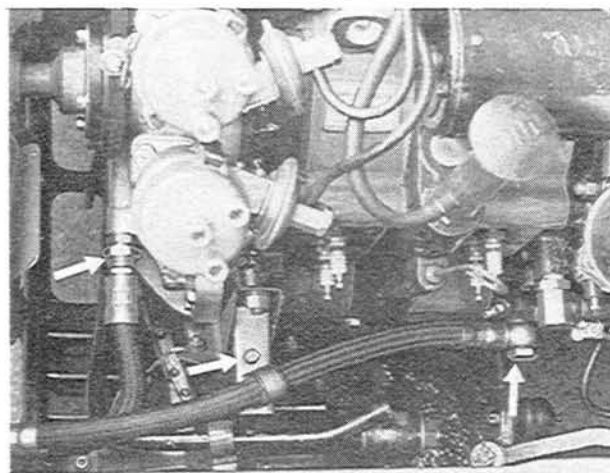


Fig. 1-6 Removing oil hoses

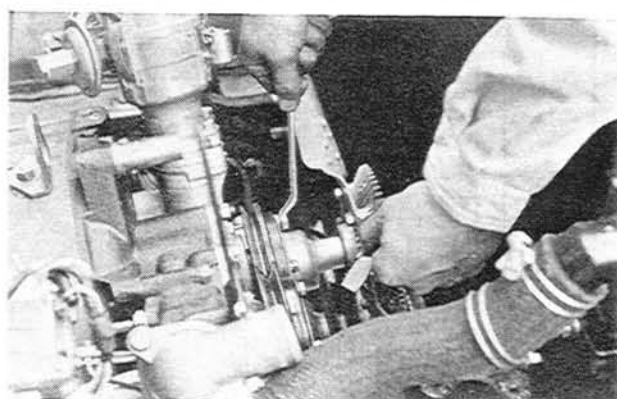


Fig. 1-7 Removing cooling fan



Fig. 1-8 Disconnecting exhaust pipe

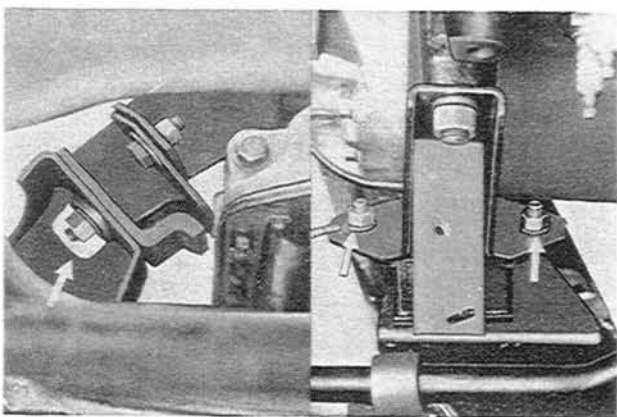


Fig. 1-9 Loosening mounting bolts



Fig. 1-10 Removing engine from vehicle

17. Remove the cooling fan from the eccentric shaft pulley.

18. Remove the starting motor.

19. Remove the clutch release cylinder and place it on the frame.

20. Disconnect the exhaust pipe from the manifold.

21. Remove the bolts securing the clutch housing to the rear housing of the engine.

22. Remove the hot air duct from the exhaust manifold.

23. Support the transmission with a suitable jack.

24. Remove the bolts from each engine mounting. For easy disconnection, it is recommendable to remove the two small bolts on left-hand side and a large nut on right-hand side as shown in Fig. 1-9.

25. Install a suitable lifting sling on the engine hanger bracket of the front rotor housing. Attach the sling to a hoist or other lifting device and take up all slack.

26. Pull the engine forward until it clears the clutch shaft. Then, lift the engine from the vehicle.

27. Disconnect the connecting rod of the oil metering pump at the carburettor side.

28. Remove the intake manifold, with carburettor and exhaust manifold.

29. Remove the engine bracket.

30. Mount the engine on the engine stand (49 0107 680A, 49 0813 005 and 49 0820 006).

1-B. DISASSEMBLING THE ENGINE

Engine overhaul should be done in the following order after dismounting the engine from the vehicle:

1. Remove the water pump pulley.
2. Remove the water pump.
3. Remove the distributors from the front cover.
4. Remove the spark plugs.
5. Remove the oil filter from the rear housing.

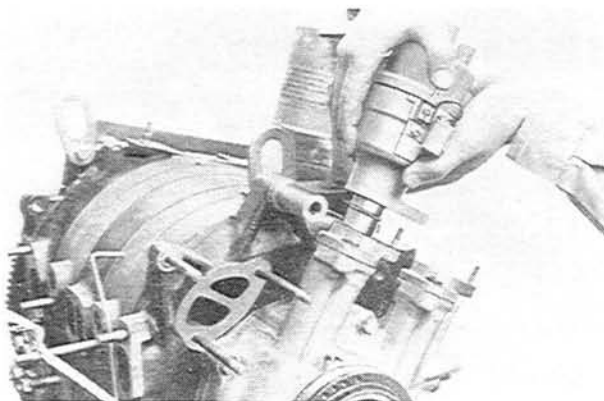


Fig. 1-11 Removing distributor

6. Attach the **ring gear brake** (49 0820 060) to the flywheel. Remove the eccentric shaft pulley with key.
7. Remove the clutch assembly and clutch disk.
8. Straighten the tab of the lockwasher and remove the flywheel nut using the **flywheel box wrench** (49 0820 035).

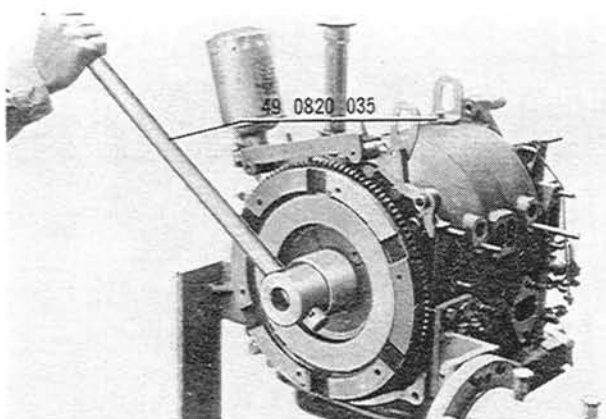


Fig. 1-12 Loosening flywheel nut

9. Remove the flywheel by using the **flywheel puller** (49 0823 300), turning the handle and lightly hitting the head of the puller.

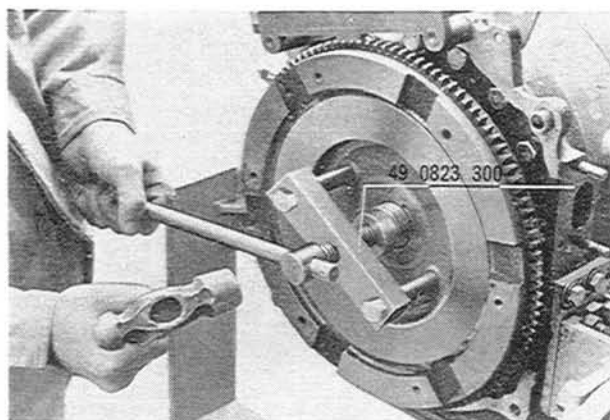


Fig. 1-13 Removing flywheel

10. Remove the oil pan.
11. Remove the oil strainer.

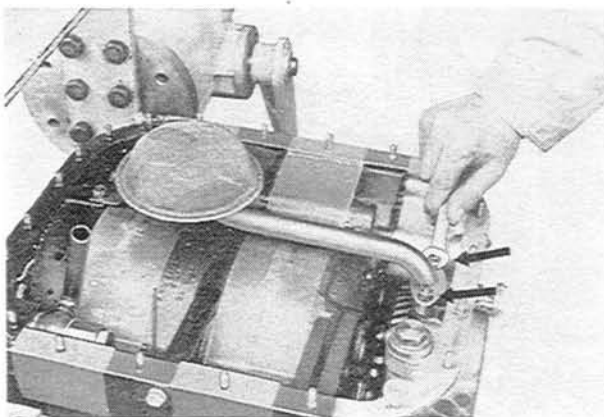


Fig. 1-14 Removing oil strainer

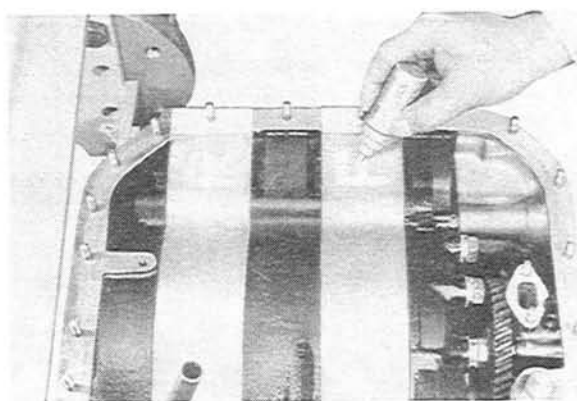


Fig. 1-15 Applying identification marks

Note: Apply identification marks on the front and rear rotor housings, which are common parts, so that they are fitted as they were, when reassembling the engine.

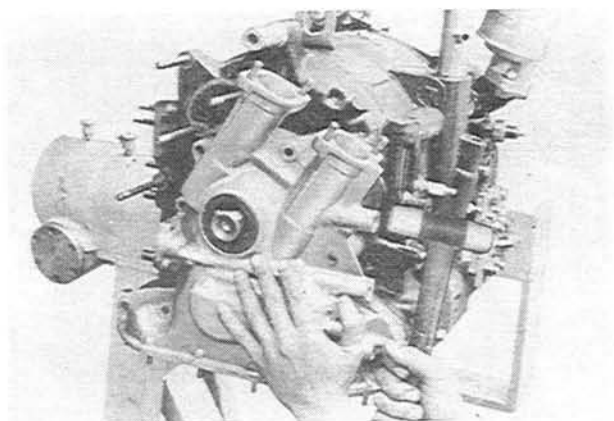


Fig. 1-16 Removing front cover

12. Remove the oil metering pump from the front cover.
13. Loosen the bolts attaching front cover and remove the cover.

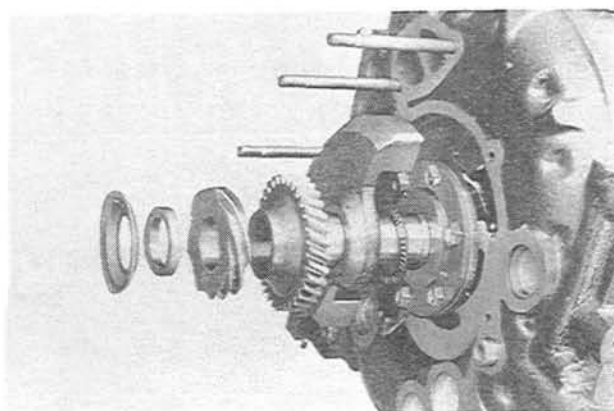


Fig. 1-17

14. Remove the spacer, distributor drive gear, oil pump drive gear, balance weight, thrust plate, and needle bearing in that order from the eccentric shaft.
15. Straighten the lockwashers of needle bearing housing tightened by six bolts and loosen the bolts. Remove the needle bearing housing, needle bearing and thrust washer.

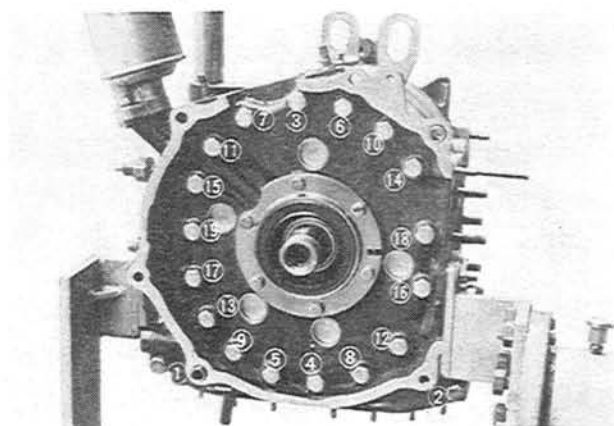


Fig. 1-18 Loosening order

16. Loosen the tension bolts in the order as shown in Fig. 1-18.

17. Remove the front housing.

18. Remove the corner seals with springs and the side seals with springs and place them in the **seal case** (49 0813 250) following the marks which are made at the nearest portion of each seal on the rotor side face.

These marks are made in order to prevent each seal from changing its original position when reassembling.

19. Remove the sealing rubbers and the "O" rings from between the front housing and the rotor housing.



Fig. 1-19 Removing front housing

20. Hold the rotor housing down by hand to prevent it from moving up, then pull the tubular dowels by using the **dowel puller** (49 0813 215).

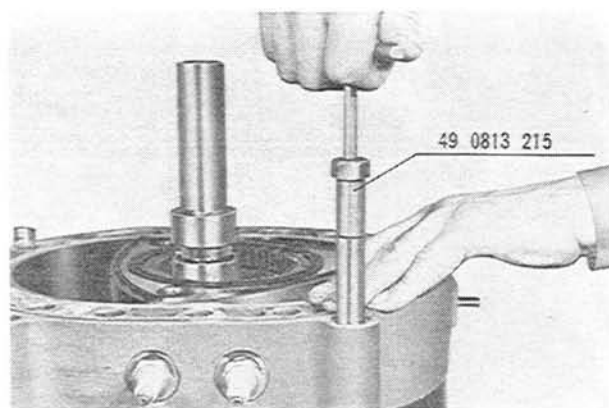


Fig. 1-20 Pulling tubular dowels

21. Install the **rotor clamp** (49 0813 230) by allowing the front rotor housing to move up to the required level so as not to damage the apex seals, then remove the front rotor housing.

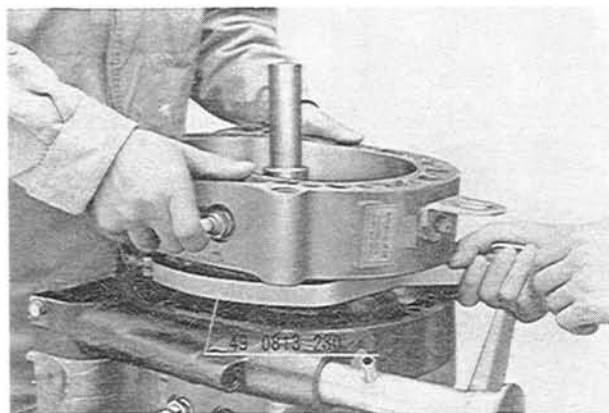


Fig. 1-21 Removing rotor housing

Note: The rotors are marked as shown in Fig. 1-22. "F" on the internal gear side indicates the front rotor, while "R" indicates the rear rotor. When assembling, be careful to these marks.

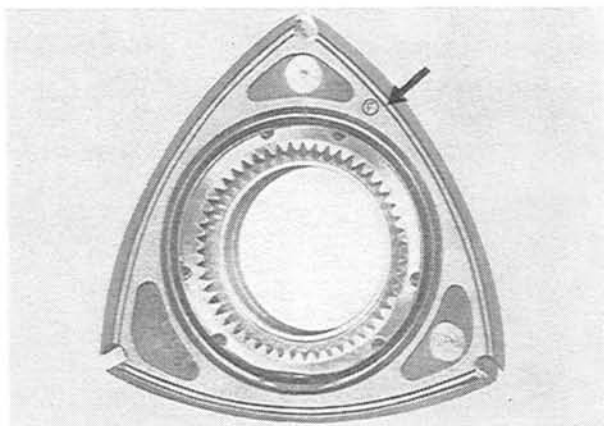


Fig. 1-22 Identification mark of rotor



Fig. 1-23 Putting identification mark

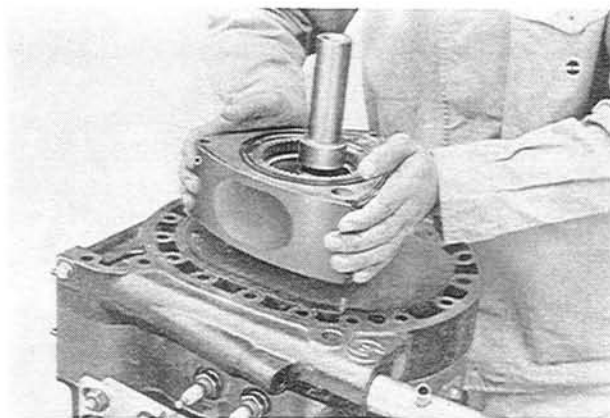


Fig. 1-24 Removing rotor

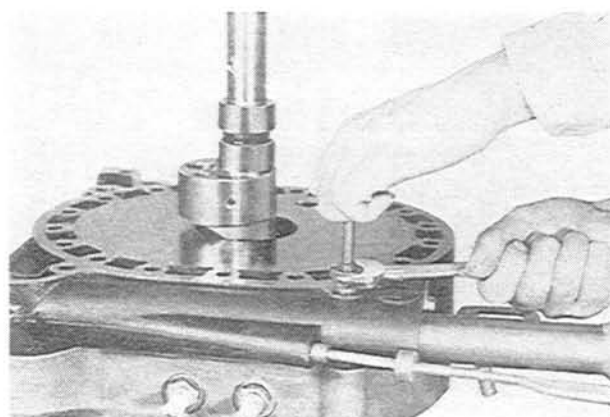


Fig. 1-25 Removing tubular dowels

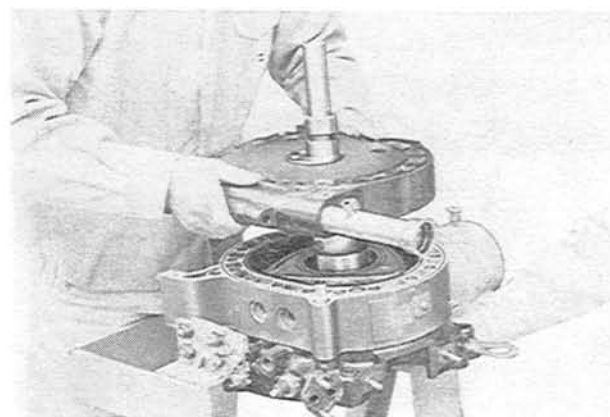


Fig. 1-26 Removing intermediate housing

22. Remove the apex seals and springs after removing the rotor clamp. When removing the apex seal, put an identification mark on the bottom of the apex seal so that, when reassembling the engine, the apex seal can be incorporated to the correct location and in the correct direction. Never put a mark with a punch, notch or the like.

23. Remove the rotor from the eccentric shaft and place it upside down on a clean cloth or rubber.

Note: If some seals drop, be careful not to change the original position of each seal on the reverse side of the rotor.

24. Remove the seals on the rear side of the rotor.

25. Extract the tubular dowels from the intermediate housing with the **dowel puller** (49 0813 215).

26. Remove the intermediate housing. Due to the eccentricity of the shaft at the journal portion, the intermediate housing must be removed by sliding it beyond the journal portion of the front rotor while holding the intermediate housing up and at the same time pushing up the eccentric shaft.

27. Remove the eccentric shaft.

28. Repeat the above procedure to remove the rear rotor housing and the rear rotor assembly.

1-C. ENGINE INSPECTION AND REPAIR

1-C-1. Front Housing

a. Inspection of front housing assembly

1. Check for traces of gas or water leakage.
2. Check for wear and damage on the surfaces contacting each seal.
3. Check for wear, cracks or broken teeth on the stationary gear.
4. Check for wear, scratching, flaking, and other damages to the main bearing.

b. Cleaning the front housing

It is recommended that the following steps are taken to remove carbon and sealing agent from the front housing.

1. Carbon Deposits

Use an extra-fine emery paper. When a carbon scraper is to be used, be careful not to damage the matching surfaces of the housing.

2. Sealing Agent

Use a cloth or a brush soaked in a solution of ketone or thinner.

c. Inspection of front housing for distortion

Place a straight edge on the housing surface as shown in Fig. 1-29 and measure the clearance between both with a feeler gauge.

The housing must be replaced if the distortion is found to be more than 0.04 mm (0.002 in).

d. Inspection of front housing for wear

Wear of the matching surfaces of the front housing and rotor should be measured with a dial indicator. The front housing must be replaced if the wear exceeds 0.1 mm (0.004 in).

There is a tendency of increased wear at both ends of the minor axis of the front housing. The effective depth of this wear is small.

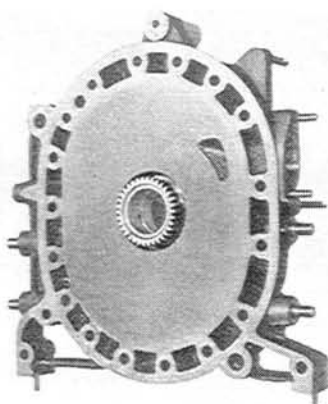


Fig. 1-27 Front housing

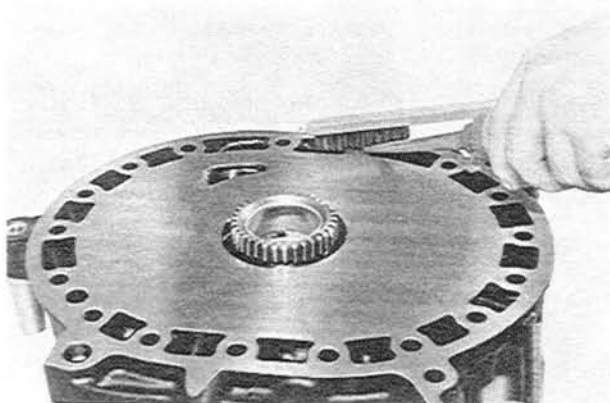


Fig. 1-28 Cleaning front housing

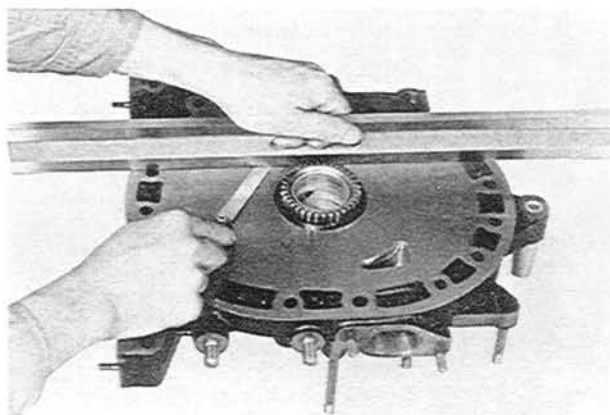


Fig. 1-29 Checking front housing distortion

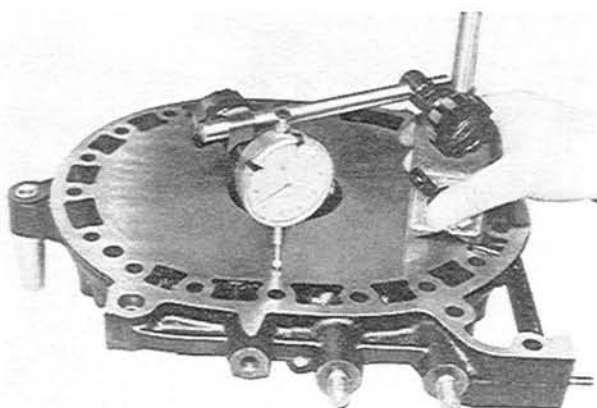


Fig. 1-30 Checking front housing wear

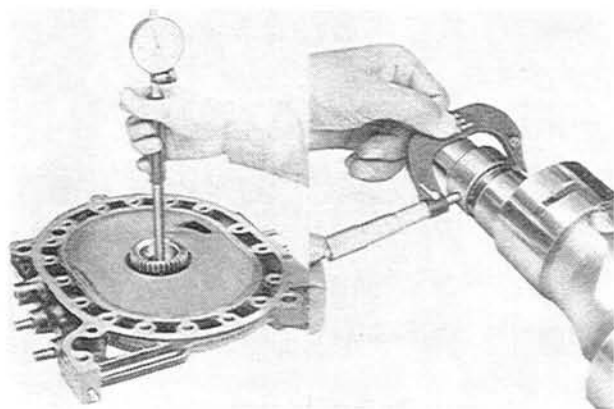


Fig. 1-31 Checking oil clearance

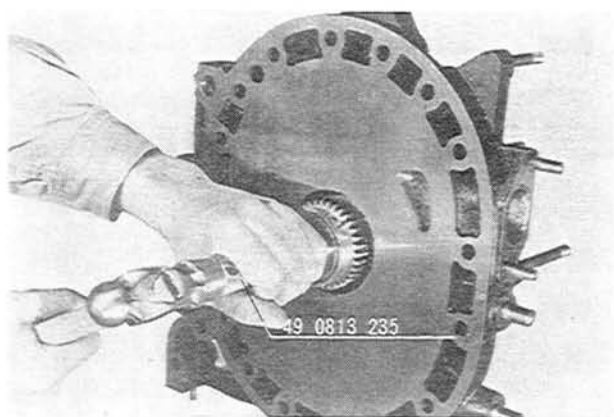


Fig. 1-32 Removing stationary gear

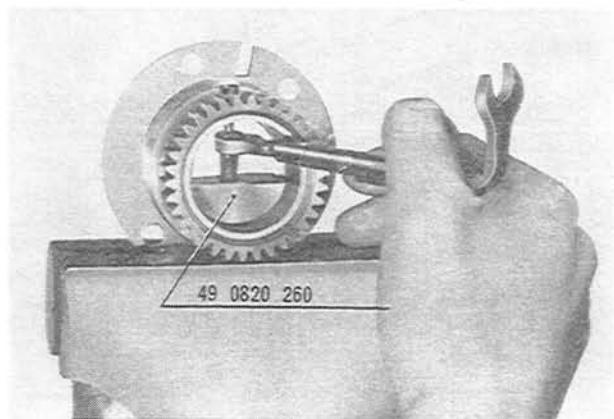


Fig. 1-33 Removing lock pin

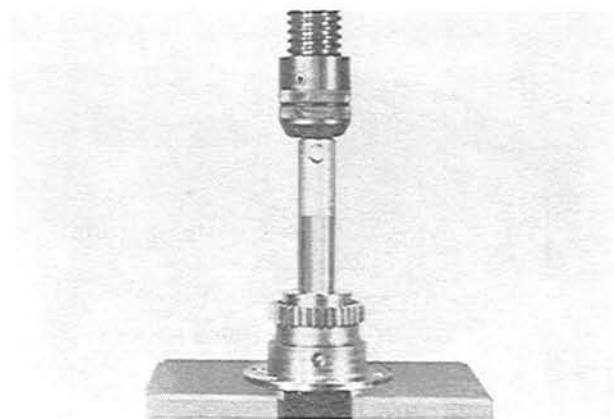


Fig. 1-34 Removing main bearing

e. Checking the main bearing clearance

The main bearing clearance is measured by checking the inner diameter of the main bearing and the outer diameter of the journal section of the eccentric shaft. The standard main bearing clearance is 0.04 ~ 0.07 mm (0.0016 ~ 0.0028 in), and the bearing must be replaced if the clearance becomes more than 0.10 mm (0.0039 in).

f. Removing and assembling the stationary gear and main bearing

When this work is required, proceed in the following steps.

1. Remove the bolts securing the stationary gear to the housing.
2. Press out the stationary gear with the **main bearing puller and installer** (49 0813 235).

3. Mount the stationary gear on a vise. Remove the bearing lock pin by using the **lock pin remover** (49 0820 260).

4. Remove the adapter from the **main bearing puller and installer** (49 0813 235) and use it to extract the main bearing as shown in Fig. 1-34.

5. Attach the adapter on the main bearing puller and installer and use it to press the bearing into the gear until the adapter touched the gear flange. Be sure to match the oil holes of bearing and gear, as shown in Fig. 1-35.

6. Insert the lock pin to prevent the bearing from turning.

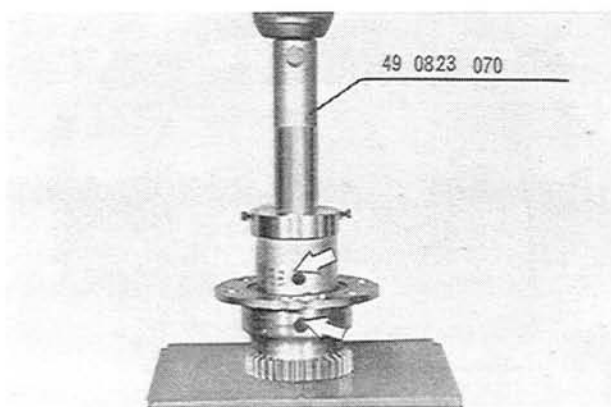


Fig. 1-35 Installing main bearing

7. Press in the stationary gear to the housing with **main bearing puller and installer** (49 0813 235), aligning the slot of the stationary gear flange and the dowel pin, as shown in Fig. 1-36.

8. Tighten the bolts attaching stationary gear.

Note: When replacing the stationary gear, refer to par 1-C-5, h.

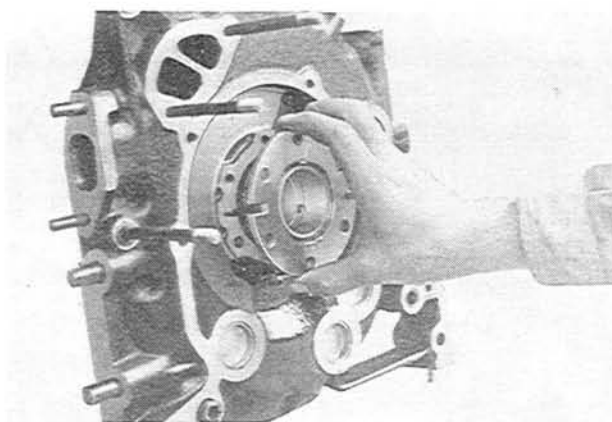


Fig. 1-36 Installing stationary gear

1-C-2. Intermediate Housing

Inspection for distortion or wear of the intermediate housing should be carried out in the same way as described for the front housing. Refer to par. 1-C-1.

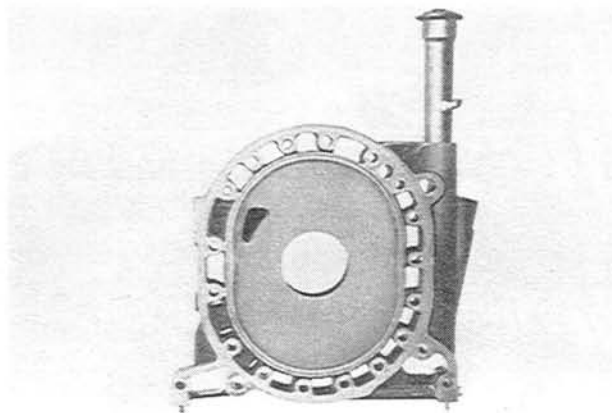


Fig. 1-37 Intermediate housing

1-C-3. Rear Housing

Inspection of the rear housing is carried out according to Par. 1-C-1, but the following point must be inspected as well.

a. Checking the oil seal

Check for wear and damage. If trace of oil leakage is found, replace the oil seal.

b. Replacing the stationary gear

1. Remove the bolts attaching the stationary gear to the rear housing.

2. Using the **main bearing puller and installer** (49 0813 235), extract the stationary gear.

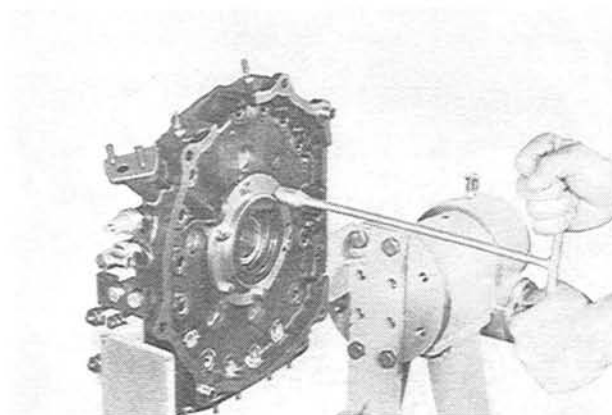


Fig. 1-38 Removing stationary gear

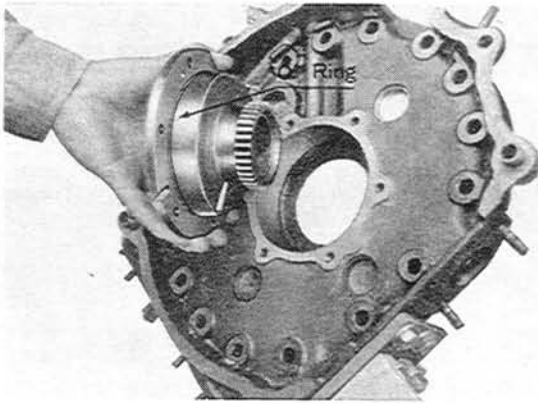


Fig. 1-39 Installing stationary gear

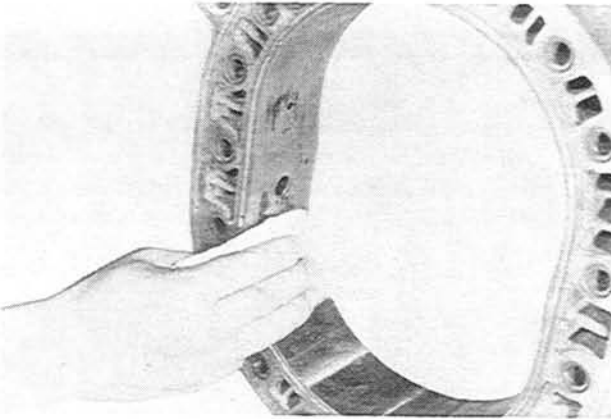


Fig. 1-40 Cleaning rotor housing

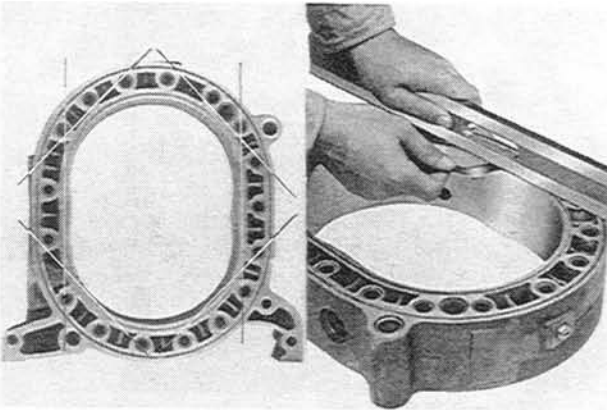


Fig. 1-41 Inspection rotor housing distortion

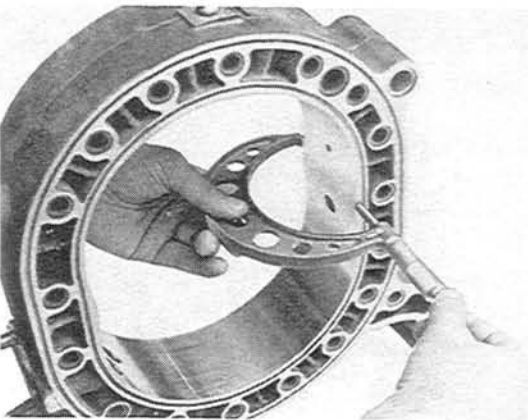


Fig. 1-42 Measuring rotor housing width

3. Put a thin film of grease on the "O" ring and place it in the groove of the stationary gear.
4. Apply sealing agent to the stationary gear flange.
5. Install the stationary gear on the rear housing while being careful not to damage the "O" ring and to match the slot of the stationary gear flange to the dowel pin of the rear housing.
- 6; Tighten the bolts attaching the stationary gear.

Note: Replace the "O" ring with new one whenever removing or replacing the stationary gear.

1-C-4. Rotor Housing

a. Checking the rotor housing

1. Check for exfoliation, damage or cracks on the chromium-plated surface. If any of these conditions is found, replace the rotor housing.
2. Check for traces of gas or water leakage along the inner margin of each side face of the rotor housing.

b. Cleaning the rotor housing

1. Remove the sealing agent by wiping with a cloth or brush soaked in a solution of ketone or thinner.
2. Remove carbon from the inner surface of the rotor housing by wiping with cloth. Soak the cloth in a solution of ketone or thinner when it is difficult to remove.
3. Remove deposits and rust from the cooling water passages.

c. Inspection of rotor housing distortion

Measure the distortion of the rotor housing surface at the position shown in Fig. 1-41, by using a straight edge and a feeler gauge. Replace the part with a new one if the distortion is found to be more than 0.04 mm (0.002 in).

Note: This operation should be done at any time when overhauling the engine.

d. Measuring the rotor housing width

Measure the width of the rotor housing at points close to the trochoid surface by using a micrometer. Measurements must be taken at least 8 points. If the difference between the maximum value and the minimum value exceeds 0.08 mm (0.0031 in), the rotor housing must be replaced with a new one, as there is a possibility of gas or water leakage. The standard width of the rotor is $70 \begin{smallmatrix} + 0 \\ - 0.02 \end{smallmatrix}$ mm ($2.7559 \begin{smallmatrix} + 0 \\ - 0.0008 \end{smallmatrix}$ in).

Note: This operation should be done when the trouble, such as overheating etc., has been occurred on engine.

1-C-5. Rotor

a. Inspection of combustion condition and gas leakage

1. 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 dismantled.
2. 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.

b. Oil seal inspection

1. Check for wear and damage of the oil seal lip contacted with the sliding surface of the side or intermediate housing. If the contact width is more than 0.8 mm (0.031 in), the oil seal should be replaced with new one.
2. Check the oil seal protrusion shown in Fig. 1-44. It should be more than 0.5 mm (0.02 in).

Note: Replace the "O" ring when overhauling the engine.

c. Removing the oil seal

1. Remove the oil seal by inserting the oil seal remover (49 0813 225) or a screw-driver in the slots of the rotor and prying it off.

Note: (1) Do not exert strong pressure at only one place to prevent deformation of the oil seal.
(2) Be careful not to damage the lip of the oil seal. Use a certain protector shown in Fig. 1-53.

2. Install the oil seal, referring to Par. 1-D-1.

d. Cleaning the rotor

Remove the carbon on the rotor by using a carbon remover or emery paper. Carbon in the grooves must be removed with a carbon remover taking care not to damage the grooves. Wash the rotor in cleaning solution and dry by blowing with compressed air.

e. Rotor inspection

Check the rotor for wear and damage. Check the internal gear for cracks, worn or chipped teeth.

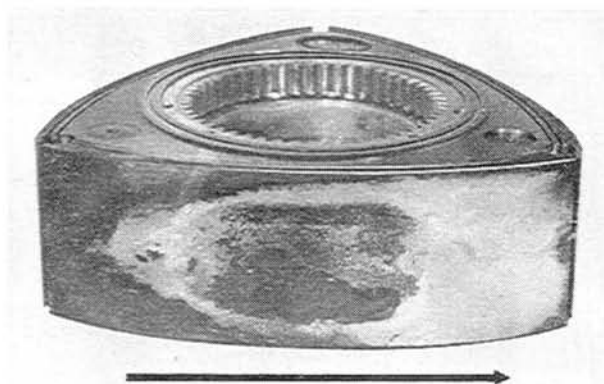


Fig. 1-43 Combustion condition

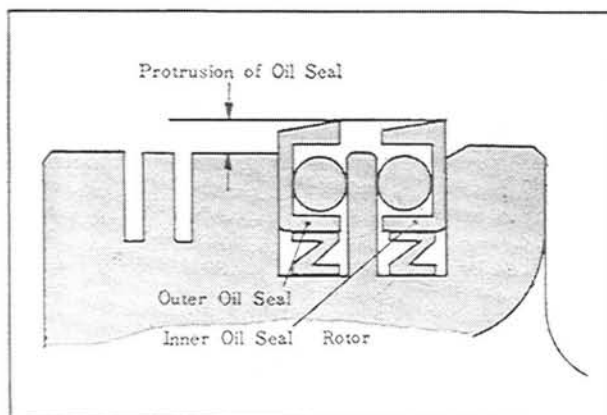


Fig. 1-44 Protrusion of oil seal

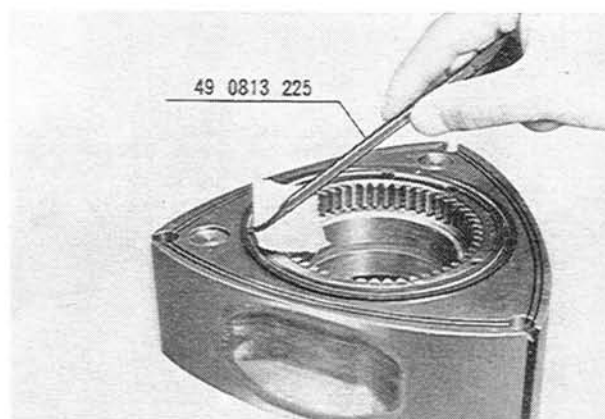


Fig. 1-45 Removing oil seals

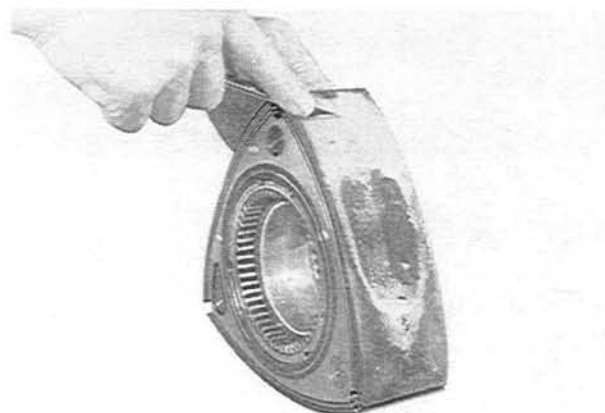


Fig. 1-46 Cleaning rotor

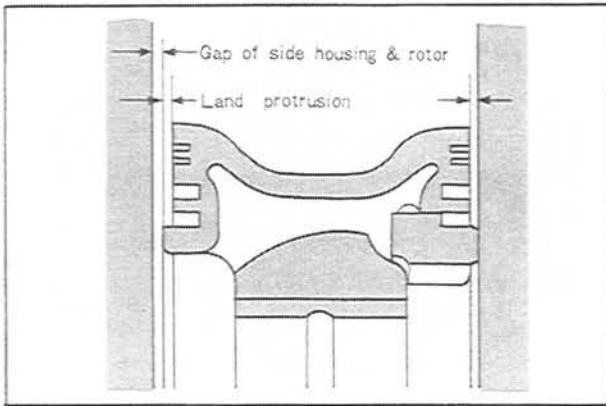


Fig. 1-47

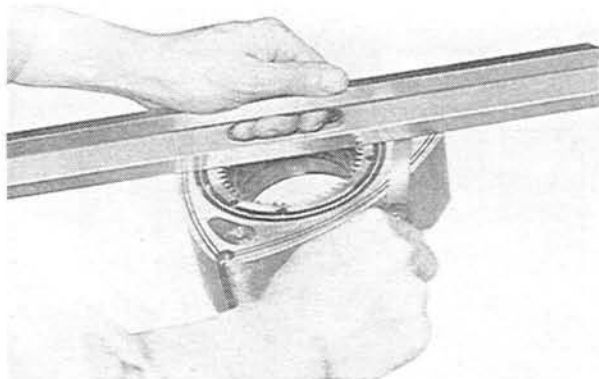


Fig. 1-48 Inspection land protrusion

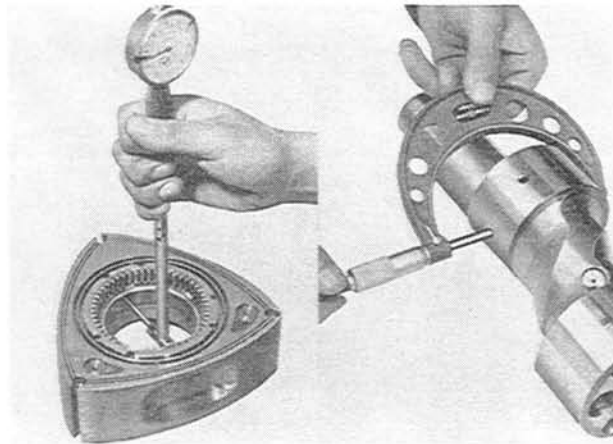


Fig. 1-49 Inspecting bearing clearance

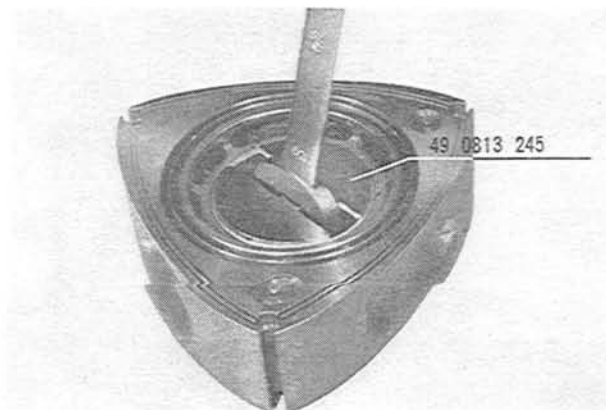


Fig. 1-50 Fitting expander

f. Inspecting the gap between side housing and rotor

The clearance can be measured by taking the width of the rotor housing and the width of the rotor. The standard clearance is 0.13 ~ 0.17 mm (0.0051 ~ 0.0067 in). If it is more than 0.17 mm (0.0067 in) replace the rotor and gear assembly. If the clearance is less than specification, there is a possibility that the internal gear locked with 6 double pins is loose.

g. Inspecting the land protrusion

Check the land protrusion of the rotor by placing a straight edge over the land and measuring the clearance between the rotor face and straight edge with a feeler gauge. It should be 0.10 ~ 0.15 mm (0.004 ~ 0.006 in). If it is less than specification, there is a possibility of the rotor touching the side housing at places other than the land, causing wear or damage.

h. Inspecting the rotor bearing

Check for wear, flaking or scratches on the bearing. If any of these conditions is found, replace the bearing. The bearing clearance can be measured by taking the inner diameter of the rotor bearing and the outer diameter of the eccentric shaft journal. The standard clearance is 0.05 ~ 0.09 mm (0.0020 ~ 0.0035 in). Replace the bearing if it is more than 0.10 mm (0.0039 in).

i. Replacing the rotor bearing

1. Insert the **expander** (49 0813 245) into the bearing to prevent the deformation of the rotor bearing when drilling a hole.

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



Fig. 1-51 Drilling hole

3. Place the rotor on the support so as to face the internal gear upward. Using the **rotor bearing puller and installer** (49 0813 240) without its adapter ring, press out the bearing, being careful not to damage the internal gear.

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

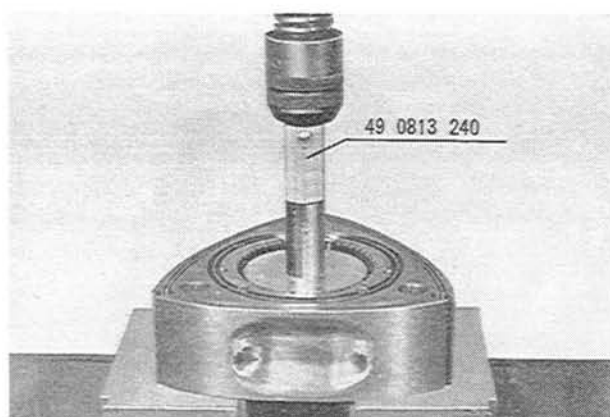


Fig. 1-52 Removing rotor bearing

5. Place the rotor on the support so as to face the internal gear upward. Press fit a new bearing using the **rotor bearing puller and installer** (49 0813 240) with its adapter removed screws until the oil hole of the bearing matches the oil hole on the apex side of the rotor, and the bearing and the boss become flush.

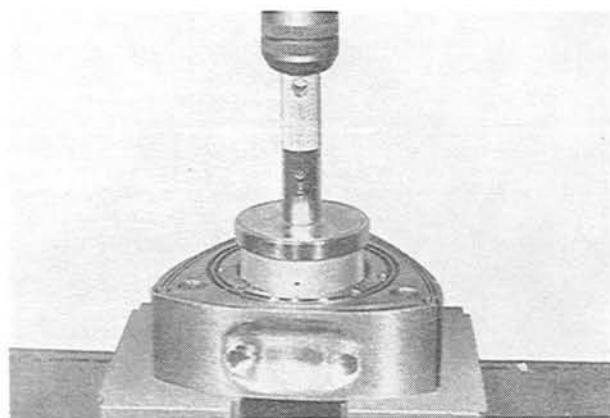


Fig. 1-53 Installing rotor bearing

6. Insert the **expander** (49 0813 254) into the bearing, and then drill a hole of 3.5 mm (0.14 in) diameter and about 7 mm (0.28 in) depth at approximately 7 mm (0.28 in) to the left or right from the original location of the locking screw hole. It must be made to the same direction from 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 an M4, P=0.70 mm tap.

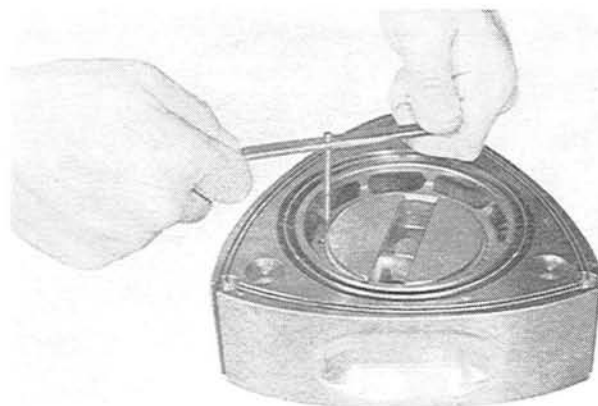


Fig. 1-54 Making thread



Fig. 1-55 Staking locking screws

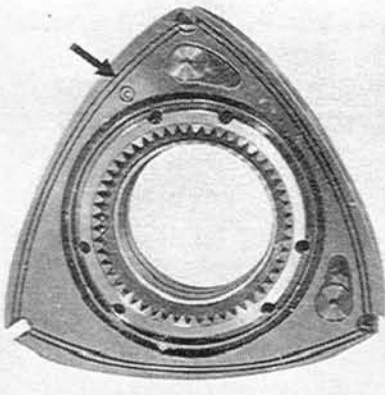


Fig. 1-56 Weight mark of rotor

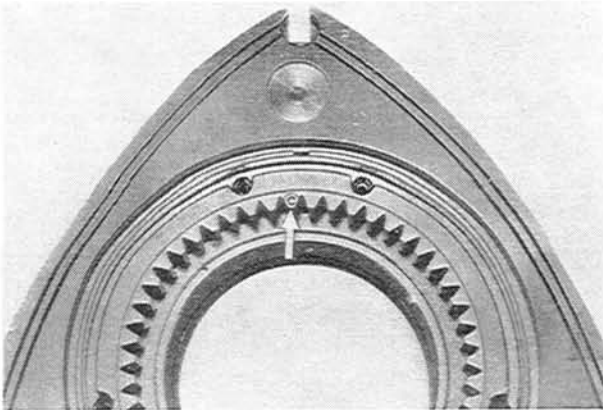


Fig. 1-57 Mark of internal gear

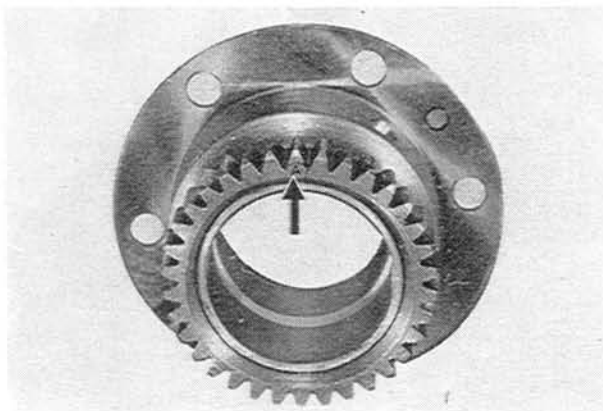


Fig. 1-58 Mark of stationary gear

8. Tighten the locking screws and stake them into positions with a punch to prevent them from working out.

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

j. Replacing the rotor

When replacing the rotor, note the following points.

1. Weight of rotor

Rotors are classified into 5 categories according to weight and marked a, b, c, d and e on the internal gear side.

In order to balance the front and rear rotors, the following combinations are adopted in the factory:

Combination of Markings

- a—a, b
- b—a, b, c
- c—b, c, d
- d—c, d, e
- e—d, e

Note: If it is necessary to replace a rotor, use a rotor marked with "c" in any case.

2. Internal and stationary gear backlash

The internal gears and stationary gears are classified into 3 categories, which are shown by embossing markings, A, no mark and C.

In order to obtain a proper backlash between the internal gear and the stationary gear, the identically marked gears are incorporated in the factory.

Note: When replacing a stationary gear at dealer, use a unmarked stationary gear in any case.

1-C-6. Seal and spring

a. Cleaning the seal and spring

1. Apex seal

Use a carbon remover to remove the carbon from both sides while being careful not to damage the apex seal. Wash with cleaning solution.

Note: A special carbon material is used for the apex seal. This is weaker and easier to damage than metal. Therefore, take extra care. Never use emery paper as it will damage the apex seal.

2. Corner seal and side seal

Clean with carbon remover and wash. Never use emery paper.

3. Seal spring

Remove carbon with the carbon remover and wash in cleaning solution.

b. Inspecting the apex seal

Check apex seal for wear, damage or cracks and replace if any of these conditions is found.

Measure the height of the apex seal with a micrometer. Replace if the height is less than 8.0 mm (0.315 in).

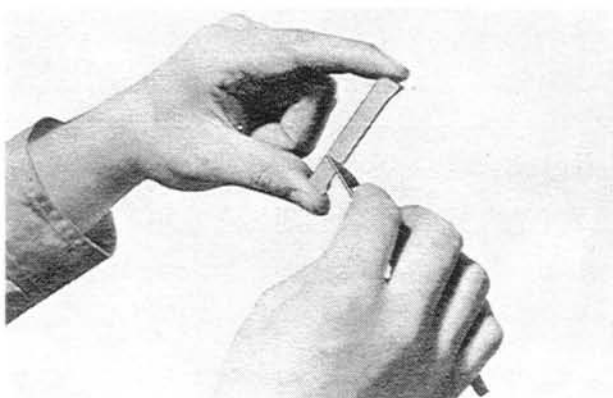


Fig. 1-59 Cleaning apex seal

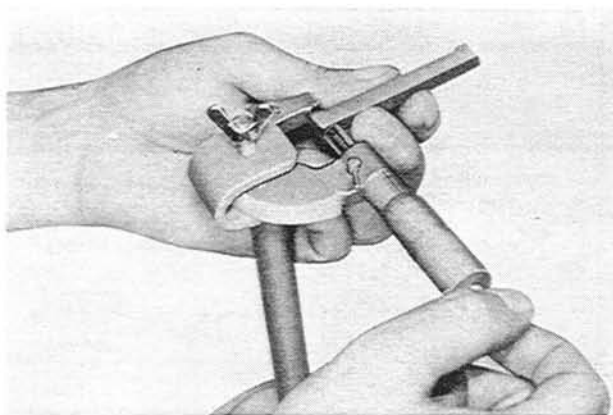


Fig. 1-60 Measuring apex seal height

c. Inspecting the gap between apex seal and groove

To measure the gap between apex seal and groove, place the apex seal in its respective rotor groove and use a feeler gauge to measure the gap. As shown in Fig. 1-61, the apex seal tends to wear unevenly and for this reason the feeler gauge should be inserted fully into the bottom of the groove. The standard value of this gap is 0.036 ~ 0.072 mm (0.0014 ~ 0.0028 in) and the apex seal must be replaced if the gap is more than 0.1 mm (0.0039 in).

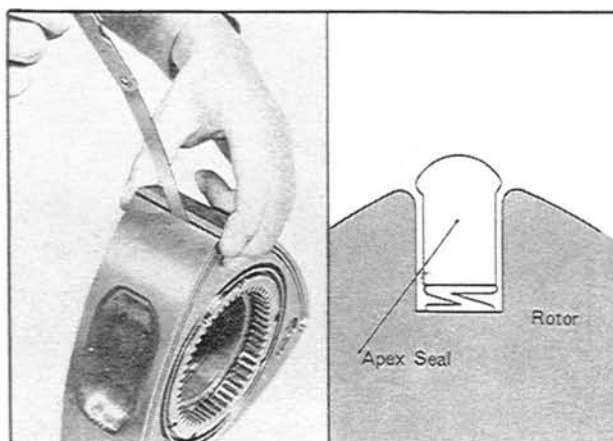


Fig. 1-61 Checking gap of apex seal and groove

d. Inspecting the gap between apex seal and side housing

Measure the length of the apex seal with a micrometer. Compare this measurement with the minimum value of the rotor housing width (Refer to Par. 1-C-4) to calculate the gap between the apex seal and side housing. The normal value of this gap is 0.01 ~ 0.05 mm (0.0004 ~ 0.0020 in), and the apex seal must be replaced if it is more than 0.15 mm (0.0059 in).

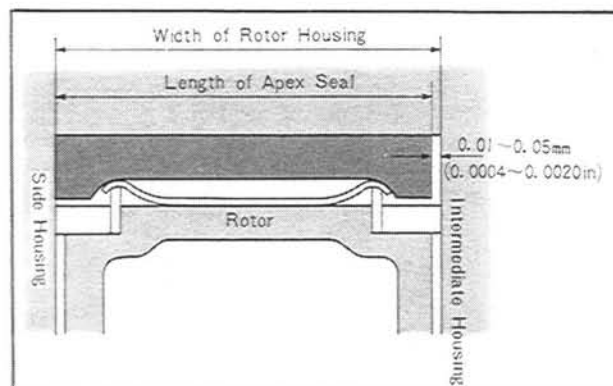


Fig. 1-62 Gap between apex seal and side housing



Fig. 1-63 Checking side seal gap

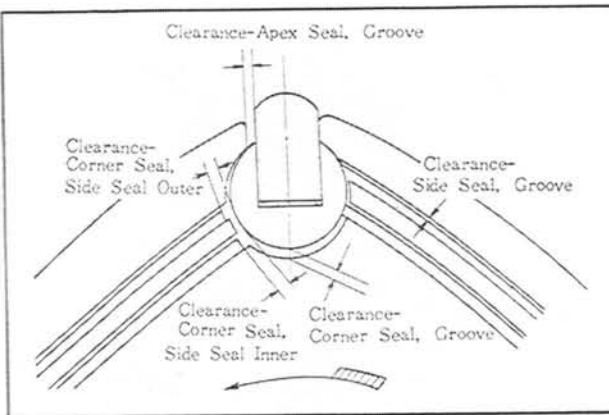


Fig. 1-64 Clearance of seals

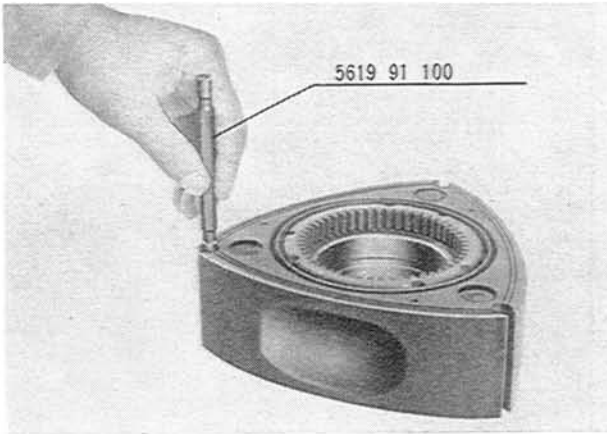


Fig. 1-65 Checking gap of corner seal and groove

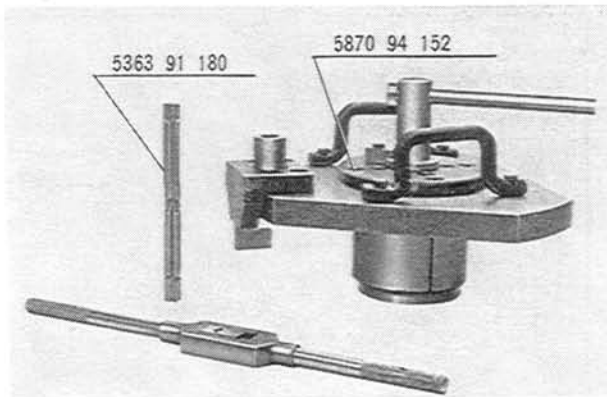


Fig. 1-66 Jig and reamer

e. Inspecting the gap between side seal and groove
Measure the gap with a feeler gauge. The standard clearance is 0.04 ~ 0.07 mm (0.0016 ~ 0.0028 in), and the side seal must be replaced if it exceeds 0.1 mm (0.0039 in).

f. Inspecting the gap between corner seal and 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 bore, which occurs 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 bore is determined by the **bar limit gauge** (5619 91 100) and classified into three conditions:

- (1) Neither end of the gauge does not go into the bore. This means that the gap conforms to the specifications.
- (2) While the go-end of the gauge goes into the bore, 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, leaving the rotor side as it is.
- (3) If the both ends of the gauge go into the bore, it means that the gap exceeds the limit of 0.08 mm (0.0031 in). Rework the corner seal bore with the **jig** (5870 94 152) and **reamer** (5363 91 180) to $11.2 + 0.008$ mm ($0.4410 + 0.0003$ in) diameter following the procedure in Par. 1-C-6, g, and fit a 0.2 mm (0.0079 in) oversize corner seal.

Note: (1) As the corner seal bore generally shows a heavy wear in the direction of the rotation, the side arcs on the gauge are partially cut off. Be sure to take measurement in the direction of the maximum wear of the bore.

(2) If the limit gauge is not available, a feeler gauge narrowed at the forward portion can be used for measuring the gap. According to a measurement thus obtained, the same corrective step as in the case of the limit gauge is applicable.

(3) The dimension of the outer diameter of the limit gauge is as follows:

Go-end	11.0	$+ 0.019$	mm	(0.4331	$+ 0.0007$	in)
		$+ 0.021$			$+ 0.0008$	
Not-go-end	11.0	$+ 0.044$	mm	(0.4331	$+ 0.0017$	in)
		$+ 0.046$			$+ 0.0018$	

g. Reboring corner seal groove

1. Remove carbon, rust and other deposits from the rotor surface especially the apex seal groove, being careful not to damage.
2. Install the **jig** (5870 94 152) the rotor and tighten the collect bar being careful not to damage the rotor bearing and apex seal groove.
3. Ream a hole with the **reamer** (5363 91 180) by hand applying sufficient engine oil as the coolant.

When feeding the reamer, it must be turned by about 20 rotations or over before the reaming work is accomplished completely.

4. Remove the reamer and jig from the rotor being careful not to damage the rotor.

Repeat the same manner as above to make other holes of the rotor.

5. Thoroughly clean the rotor, and check and confirm by visual inspection how the reaming hole of the corner seal is drilled through and if there is any damage to the rotor.

6. Fit a 200μ oversize corner seal of which surface is hard-chromium-plated. Check and confirm whether the gap between corner seal and groove is under specification.

Note: (1) When installing or removing the jig, be careful not to hit the rotor.

(2) If the reaming is carried out without applying oil, it will be difficult to obtain a proper surface roughness no matter how many time the reaming may be repeated.

(3) Avoid the two stage reaming, that is, with drawing the reamer halfway during the reaming work and then resuming the reaming, because chips may affect the surface roughness.

(4) Before starting the reaming work, it must be confirmed that the reamer diameter is under specifications, because the reamer might be worn less than the limit if it was used many time.

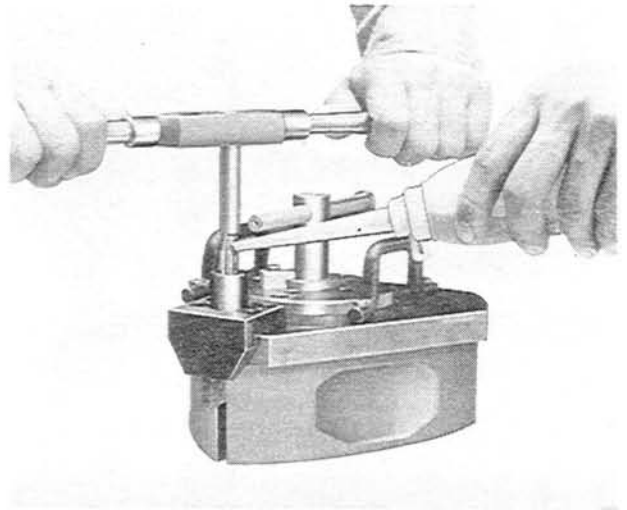


Fig. 1-67 Reboring corner seal groove

Reamer diameter	11.203 ~ 11.208 mm (0.4411 ~ 0.4413 in)
Rebored corner seal hole diameter	11.200 ~ 11.225 mm (0.4410 ~ 0.4419 in)
Oversize corner seal diameter	11.170 ~ 11.180 mm (0.4398 ~ 0.4402 in)

h. Inspecting the gap between side seal and corner seal

Check the gap with the side seal and corner seal installed on the rotor. Insert a feeler gauge between the rear of the side seal (against the turning direction of rotor) and the corner seal. When this clearance is too large, gas-sealing performance becomes poor.

The side seal must be replaced if the gap between the side seal and the corner seal exceeds 0.4 mm (0.016 in).

When a side seal is replaced, adjust the gap between side seal and corner seal by grinding the opposite end of the side seal to the rotor rotating direction along the round shape of corner seal with a fine file so that gap may be 0.05 ~ 0.15 mm (0.002 ~ 0.006 in).

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

i. Inspecting the seal spring

Check for wear or damage of the seal spring, especially the contacted portions with rotor or seal.

Note: When the corner seal, corner seal spring, side seal and side seal spring are installed onto the rotor, check the protrusion of each seal, referring to Par. 1-D-2.

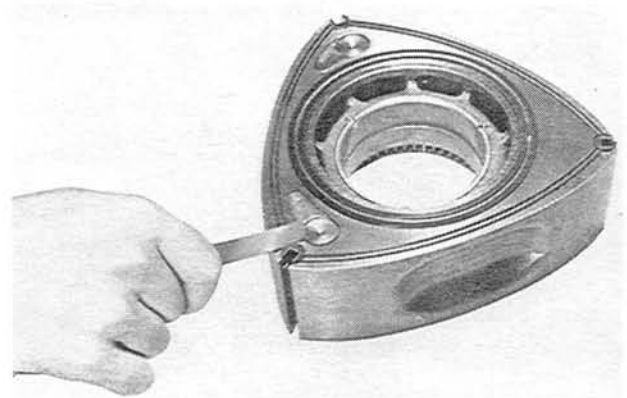


Fig. 1-68 Checking gap of corner seal and side seal

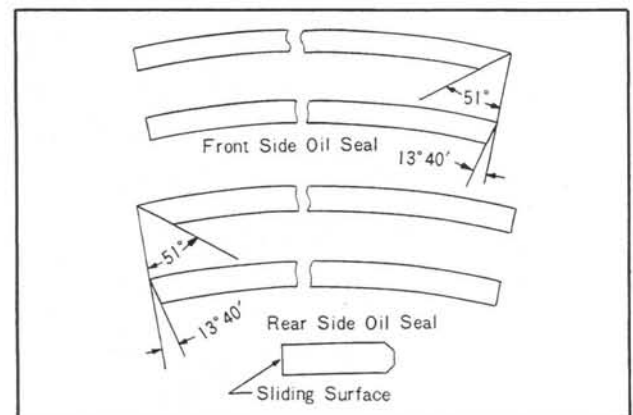


Fig. 1-69 Shape of side seal

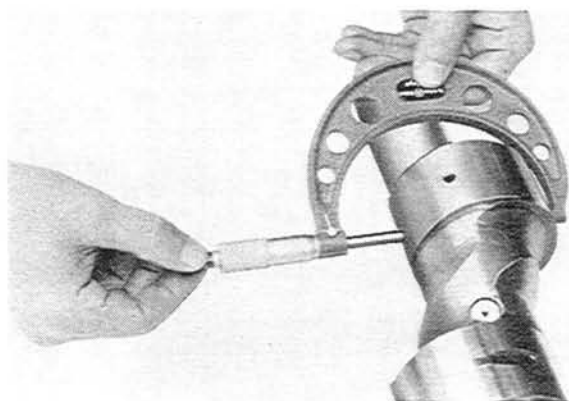


Fig. 1-70 Measuring journal diameter

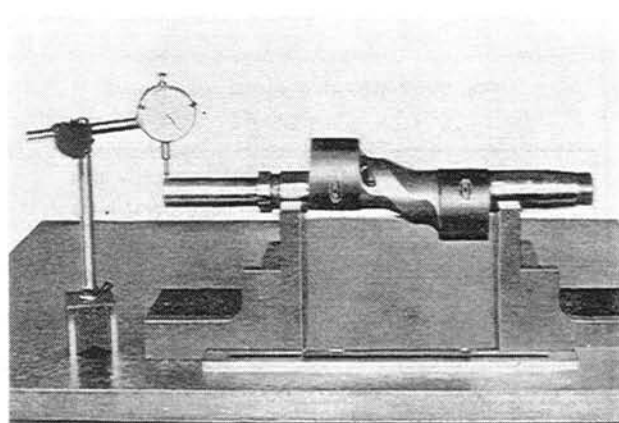


Fig. 1-71 Checking eccentric shaft run-out

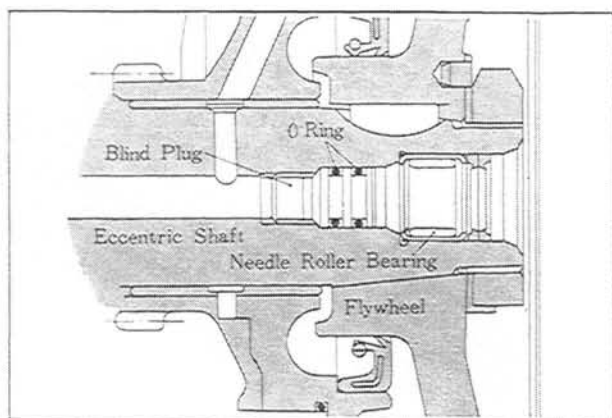


Fig. 1-72 Blind plug

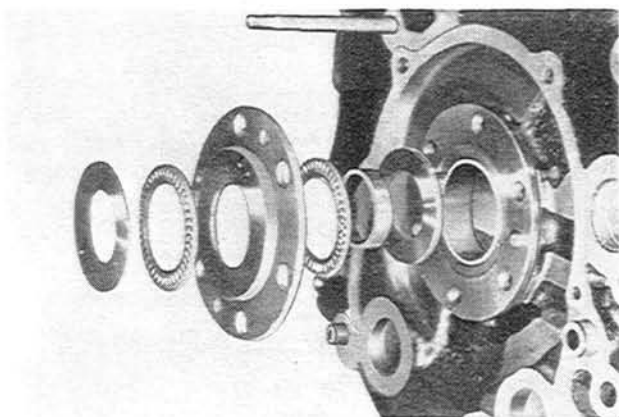


Fig. 1-73 Thrust bearings

1-C-7. Eccentric Shaft

a. Inspecting the eccentric shaft

Wash the shaft in a cleaning solution and blow the oil passage with compressed air. Check for cracks, scratches, wear or blockage of oil passages.

Measure the diameter of all journals of the eccentric shaft with a micrometer. Replace the shaft if the wear is excessive. The standard diameter of the main journal is $43 \begin{smallmatrix} +0 \\ -0.015 \end{smallmatrix}$ mm ($1.6929 \begin{smallmatrix} +0 \\ -0.0006 \end{smallmatrix}$ in), while that of the rotor journal is $74 \begin{smallmatrix} -0.015 \\ -0.030 \end{smallmatrix}$ mm ($2.9134 \begin{smallmatrix} -0.0006 \\ -0.0012 \end{smallmatrix}$ in).

b. Checking the eccentric shaft run-out

Mount the eccentric shaft on the "V" blocks. Turn the shaft slowly and measure the deflection at the front and rear with a dial gauge. If the deflection is more than 0.02 mm (0.0008 in), replace the shaft with a new one.

c. Inspecting the blind plug

An oil passage is provided inside of the eccentric shaft. The rear end is sealed with a blind plug for a pressure of 5 kg/cm² (71 lb/in²). Therefore, it is important to check for oil leakage or loose plug. If oil leakage is found, remove the blind plug with a hexagonal Allen key and replace the "O" ring.

d. Inspecting the needle roller bearing

Check for wear or damage to the needle roller bearing at the rear end of the eccentric shaft. Then insert the pilot part of the main drive shaft and check for smooth operation and proper clearance.

e. Inspecting the thrust bearings

The end thrust of the eccentric shaft is taken by the thrust bearings. Check the thrust bearing for wear or damage. Also inspect the bearing housing and thrust plate for wear.

1-D. ENGINE ASSEMBLY

The procedures for assembling the engine when the engine is to be completely overhauled are as follows:

1-D-1. Installing the Oil Seal

1. Place the rotor on a rubber pad or cloth to protect it from damage.
2. Fit the outer and inner oil seal springs in their respective grooves of the rotor so that the spring gap is located opposite each other as shown in Fig. 1-74.
3. Insert a new "O" ring in each oil seal.

Note: When replacing the oil seal, confirm smooth movement by placing the oil seal on the rotor groove before installing the "O" ring.

4. Apply the sufficient engine oil to the oil seal and groove.
5. Install the oil seal to the rotor groove pushing the head face of the oil seal with fingers slowly, carefully not to deform the oil seal as shown in Fig. 1-75.

Note:

- (1) When fitting the oil seal, confirm the head face of the oil seal so as not to mistake the head face (taper) for the bottom face (flat).
- (2) Install the oil seals on the both side of the rotor.

1-D-2. Installing the Seal

1. Place the rear rotor on a rubber pad or cloth so as to face the internal gear side upward.
2. Confirming the identification marks of the apex seal, place each apex seal on the rotor groove without the spring.
3. Install the corner seal springs and corner seals, and apply the engine oil.

Note: The top surface of the corner seal must 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. Fit the side seal springs to the rotor so as to face both ends of the side seal upward, and apply the engine oil.
5. Fit the side seals to their respective grooves.

Note: The side seal must protrude approx. 1.0 mm (0.04 in) from the rotor surface. Also check free movement by pressing manually.

6. Apply oil to the internal gear and seals of the rotor.
7. Install the **rotor clamp** (49 0813 230).



Fig. 1-74 Position of spring gap



Fig. 1-75 Installing oil seal

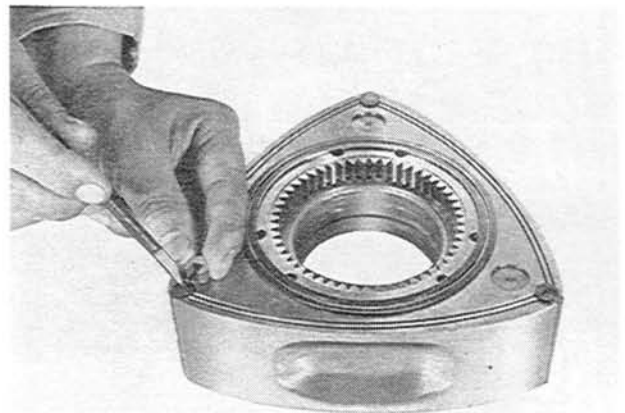


Fig. 1-76 Fitting corner seal

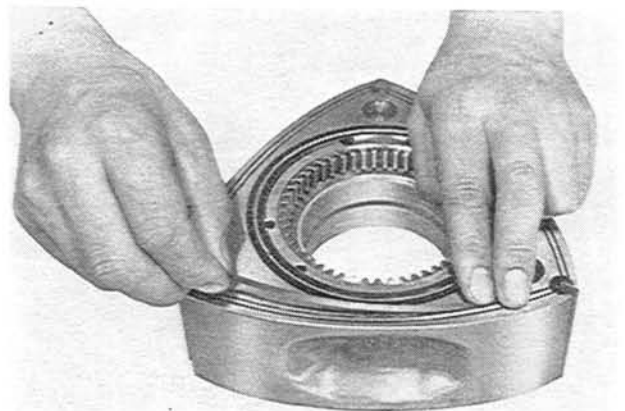


Fig. 1-77 Fitting side seal

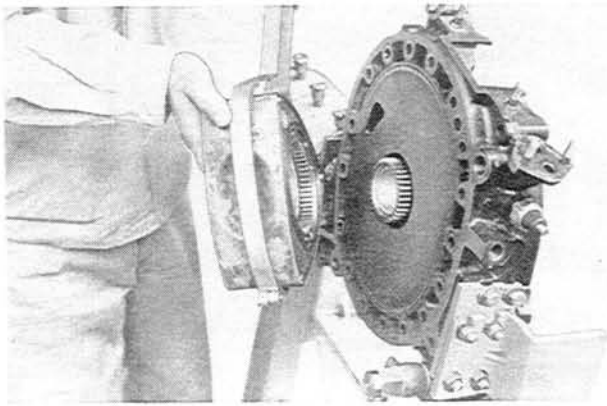


Fig. 1-78 Installing rear rotor assembly

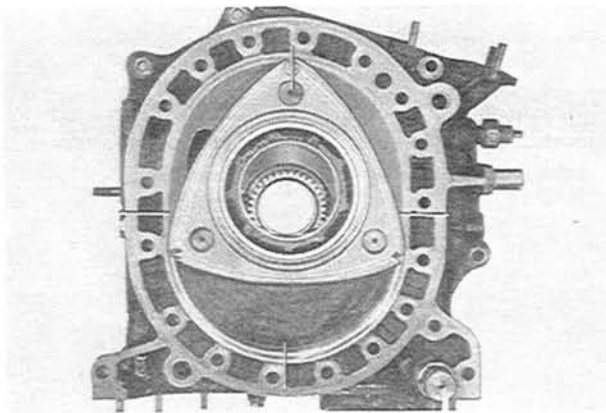


Fig. 1-79 Location of rotor apex

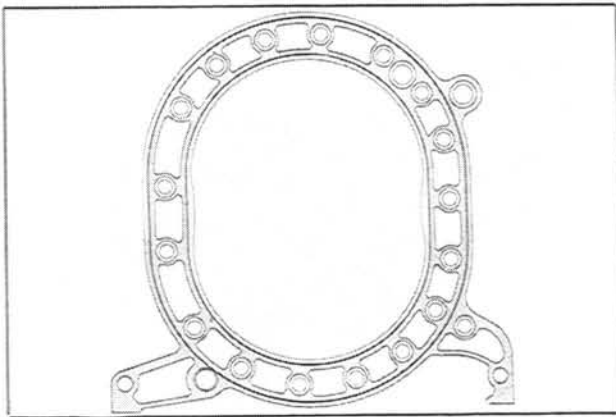


Fig. 1-80 Applying sealing agent

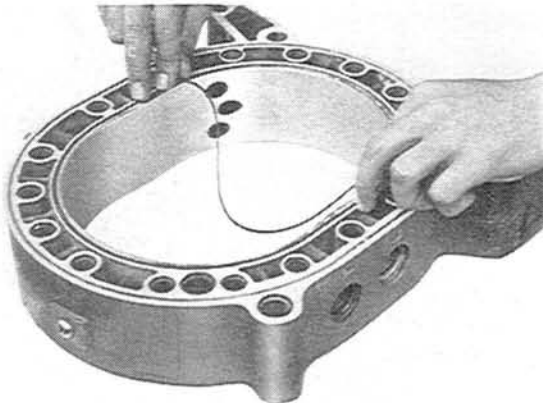


Fig. 1-81 Fitting sealing rubber

1-D-3. Installing the rear rotor

1. Mount the rear housing on the engine stand (49 0107 680A, 49 0813 005 and 49 0820 006), so that the rotor friction surface of the housing faces vertically.
2. Place the rotor on the rear housing taking care not to drop the seals, and turn the rear housing with rotor so as to be the sliding surface of the rear housing with rotor so as to be the sliding surface of the rear housing upward.

3. Mesh the internal gear and stationary gear so that one of the rotor apices is set to any one of the four places shown in Fig. 1-79.

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

4. Remove the rotor clamp and apex seals.

1-D-4. Installing the rear rotor housing

1. Apply sealing agent to the rear side of the rear rotor housing, as shown in Fig. 1-80. Be careful not to let the sealing agent penetrate into the cooling water or oil circuits.

2. Place the new "O" rings and sealing rubbers on the rear rotor housing.

Note: When installing the "O" rings and sealing rubbers on the rear rotor housing, slightly apply rubber grease to "O" rings and sealing rubbers to prevent them from coming off.

3. Reverse the rotor housing while taking care not to let the sealing rubbers and "O" rings drop out of the grooves, and mount it on the rear housing.

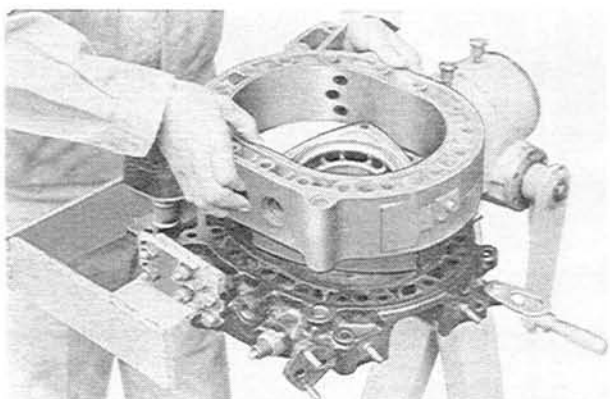


Fig. 1-82 Installing rear rotor housing

4. Insert the tubular dowels through the rear rotor housing holes to rear housing hole, after supplying a few drops of lubricant to the tubular dowels.

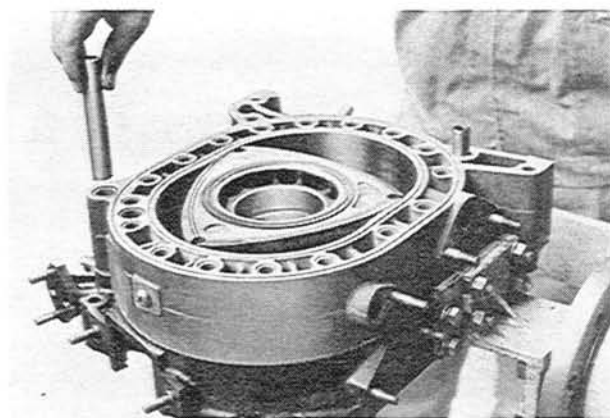


Fig. 1-83 Installing tubular dowels

1-D-5. Installing the eccentric shaft

1. Lubricate the journal sections.
2. Insert the eccentric shaft while being careful not to damage rotor bearing and main bearing.

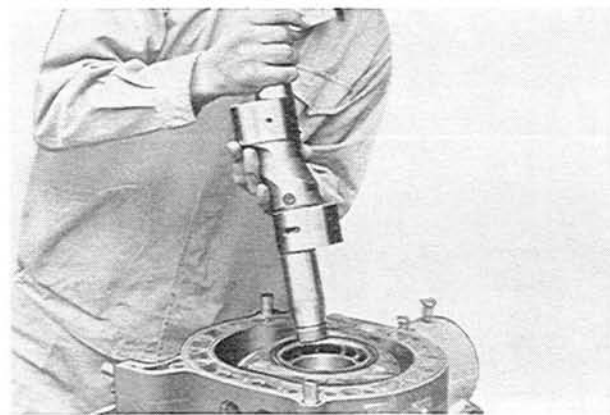


Fig. 1-84 Installing eccentric shaft

1-D-6. Installing the seals

1. Fit each apex seal to the rotor groove confirming the position and direction.
2. Install the each apex seal spring to the reverse side of the apex seal as shown in Fig. 1-85.
3. Fit the corner seals and side seals to their respective positions on the rotor. (Refer to step 3 and 4 in par 1-D-2.).
4. Apply some oil to the seals on the rotor and friction surface of the rear side housing.

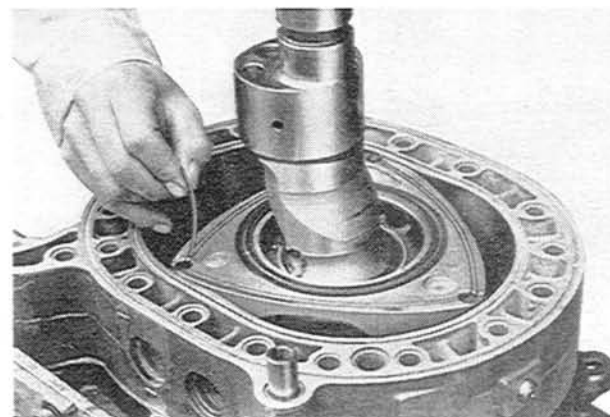


Fig. 1-85 Fitting apex seal spring

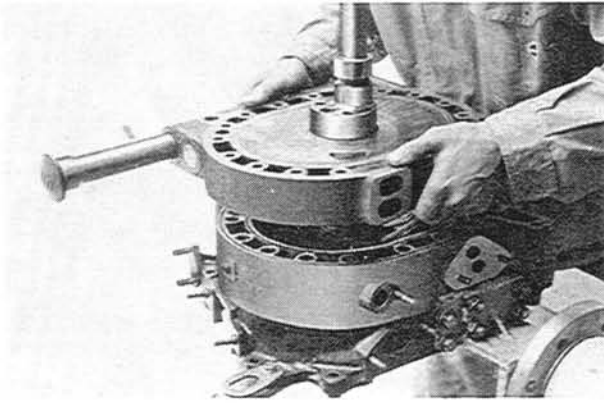


Fig. 1-86 Installing intermediate housing

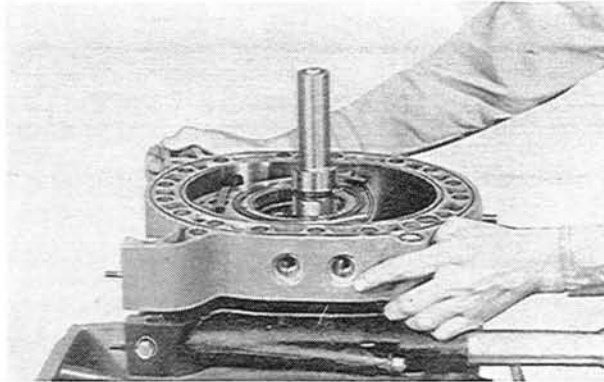


Fig. 1-87 Installing front rotor housing

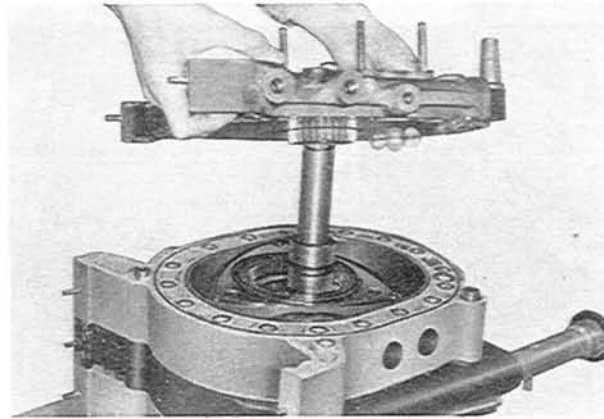


Fig. 1-88 Installing front housing

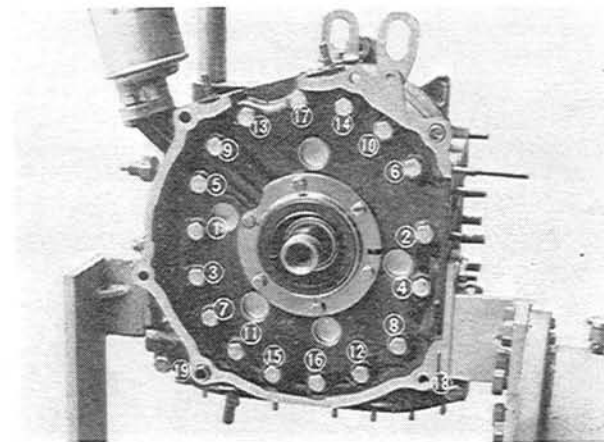


Fig. 1-89 Tightening order

1-D-7. Installing the Intermediate Housing

1. Apply sealing agent on the mating surface of the rear rotor housing.
2. Fit the new sealing rubbers and "O" rings on the rear rotor housing.
3. Make sure that the rotor housing is free from foreign matter.
4. While holding the rear end of the eccentric shaft up as high as it's rear journal portion does not exceed the rear rotor bearing, install the intermediate housing through the eccentric shaft.

1-D-8. Installing the Front Rotor and Housing

Refer to Par. 1-D-2, 3, 4 and 6, and assemble the front rotor and front rotor housing.

1-D-9. Installing the Front Housing

1. Apply sufficient engine oil to the stationary gear and the main bearing.
2. Install the front housing over the eccentric shaft. If necessary, turn the rotor slightly to engage the teeth of the front housing stationary gear and the front rotor internal gear.

1-D-10. Tightening the Tension Bolts

1. Fit the tension bolts.
2. Tighten the bolts gradually in the order shown in Fig. 1-89. The specified tightening torque is 2.5 m-kg (18 ft-lb).

Note: Attach the pulley bolt to the front end of the eccentric shaft and turn by means of a wrench to confirm smooth rotation.

1-D-11. Installing the Clutch Assembly

1. Apply grease to the oil seal of the rear housing.
2. Mount the flywheel to the rear end of the eccentric shaft through the key.
3. Apply sealing agent to the both faces of lock washer, apply the locking agent on the thread of the eccentric shaft and place the lock washer in position and install the lock nut.
4. Hold the flywheel with the **ring gear brake** (49 0820 060) and tighten the lock nut to a torque of 45 m-kg (320 ft-lb).
5. Bend the tab of the lock washer.

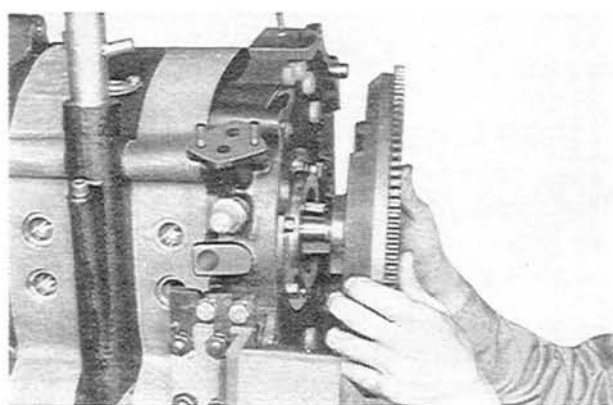


Fig. 1-90 Installing flywheel

6. Holding the clutch disk at the mounting position on the flywheel insert the **clutch disk centering tool** (49 0813 310) through the spline of the clutch disk into the needle bearing at the rear end of the eccentric shaft.
7. Mount the clutch cover and match the "O" mark on the clutch cover with the reamed hole of the flywheel and fit the securing bolts.
8. Tighten the bolts to a torque of 2.0 m-kg (15 ft-lb).

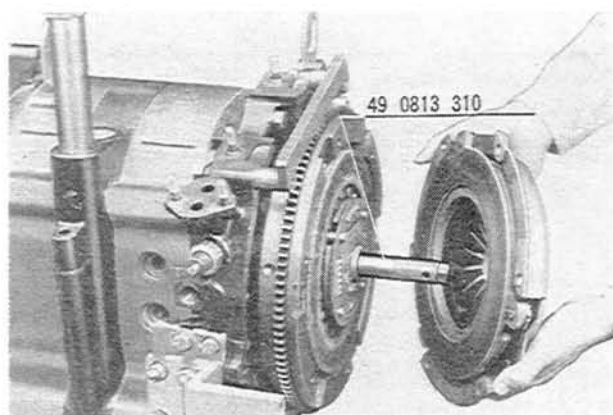


Fig. 1-91 Installing clutch assembly

1-D-12. Adjustment of Eccentric Shaft End Play

1. Turn the engine so as to place the front side of engine upward.
2. Fit the thrust plate, spacer and needle bearing on the eccentric shaft, and then apply sufficient engine oil to them.
3. Install the bearing housing on the front housing, and tighten the bolts and bend the tabs of the lock washers.

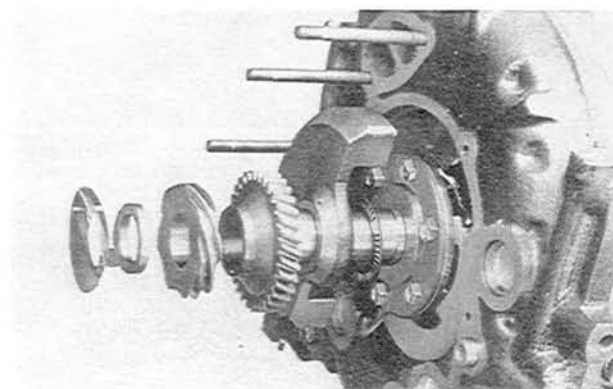


Fig. 1-92

4. Applying engine oil, install the needle bearing, thrust washer, balance weight, oil pump drive gear, distributor drive gear, key, spacer and beffle plate in that order on the eccentric shaft

Note: Before installing the thrust washer and balance weight, be sure that two needle bearing are in order along the center of the eccentric shaft.

5. Install the eccentric shaft pulley with key without front cover and tighten the bolt to 7.0 m-kg (50 ft-lb) holding the flywheel with the **ring gear brake** (49 0820 060).

6. Turn the engine assembly so as to place the eccentric shaft horizontally, and fit a dial indicator so that a feeler touches on the pulley.

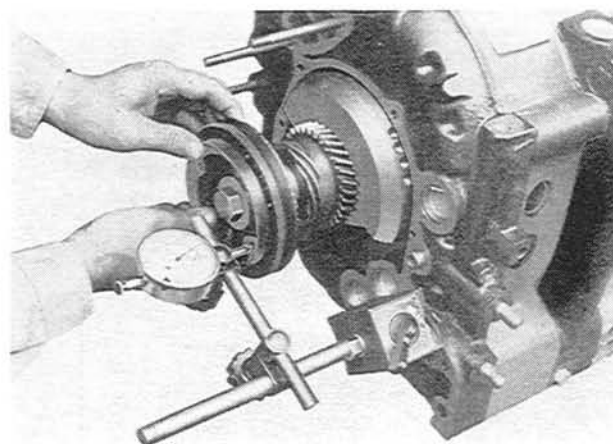


Fig. 1-93 Checking end play

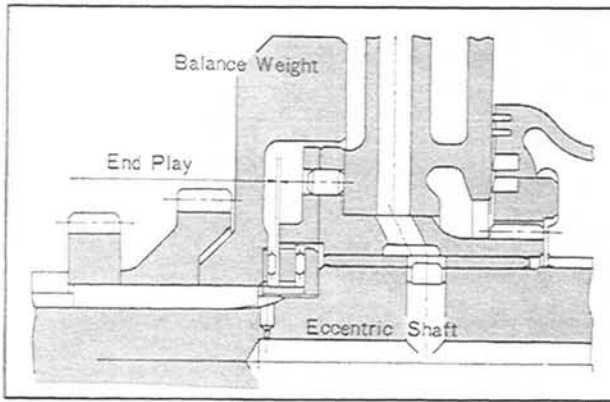


Fig. 1-94 End play of eccentric shaft

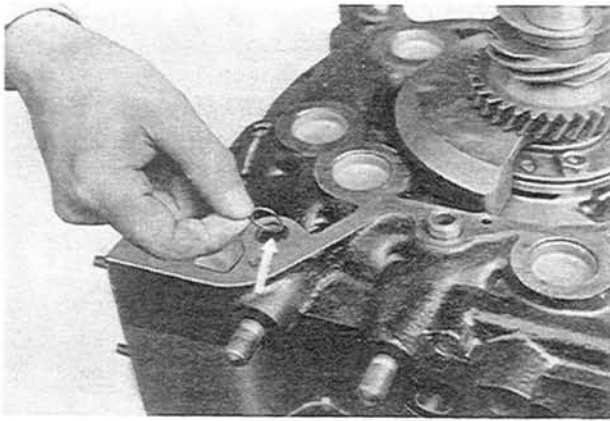


Fig. 1-95 Fitting "O" ring

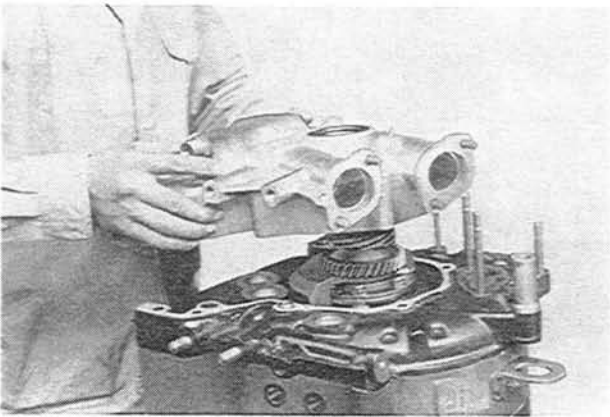


Fig. 1-96 Installing front cover

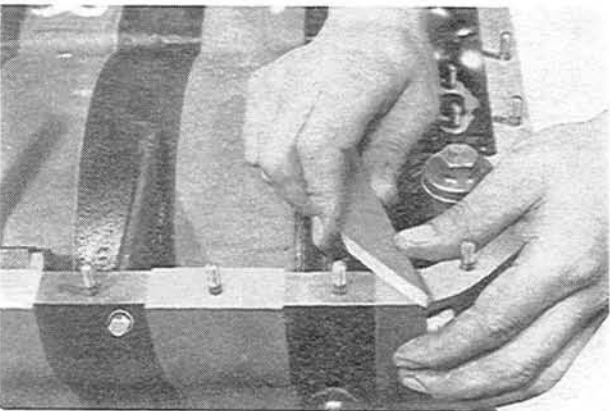


Fig. 1-97 Cutting excess gasket

7. Move the pulley fore and aft, and read the scale of dial indicator. The measured value should be $0.04 \sim 0.07$ mm ($0.0016 \sim 0.0018$ in). If it is not within the limit, adjust it by mean of grinding the spacer using the emery paper on the flat place, or by replacing the spacer. The following three kinds of spacer are available. Confirm the end play again. If the measurement is within standard, remove the eccentric shaft pulley and key, and take a next step to fit the front cover.

Mark	Thickness
N	9.00 ± 0.01 mm (0.3543 ± 0.0004 in)
M	9.04 ± 0.01 mm (0.3559 ± 0.0004 in)
L	9.08 ± 0.01 mm (0.3574 ± 0.0004 in)

1-D-13. Installing the Front Cover and Eccentric Shaft Pulley

1. Place the "O" ring on the oil passage of the front housing.

2. Apply grease to the oil seal of the front cover.

3. Place the gasket on the front housing and install the front cover.

4. Tighten the bolts mounting front cover to a torque of 2.0 m·kg (15 ft·lb).

5. Install the eccentric shaft pulley aligning the key grooves of the eccentric shaft and pulley.

6. Tighten nut mounting the eccentric shaft pulley to a torque of 7.0 m·kg (50 ft·lb).

7. Cut off surplus front cover gasket along mounting surface of the oil pan.

1-D-14. Installing the Metering Pump

Install the metering pump on the front cover.

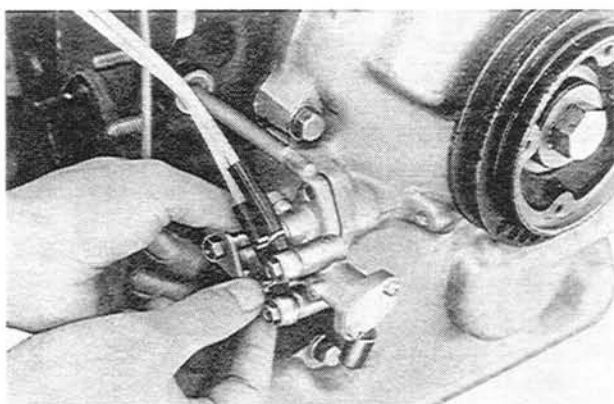


Fig. 1-98 Installing metering pump

1-D-15. Installing the Oil Strainer and Oil Pan

1. Place the gasket on the oil pump and install the oil strainer.
2. Fix the oil strainer stay with a bolt to the rear housing.
3. Apply sealing agent to the matching surface of the oil pan and each housing.
4. Install the oil pan with a gasket.
5. Install the nuts through the stiffeners.
6. Tighten the nuts diagonally until a torque of 0.6 m-kg (4.5 ft-lb) is attained.

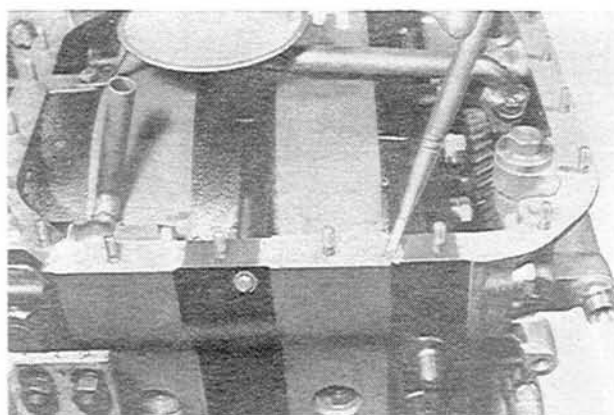


Fig. 1-99 Applying sealing agent

1-D-16. Installing the Oil Filter

Place the two "O" rings on the oil filter and install the unit to the rear housing.

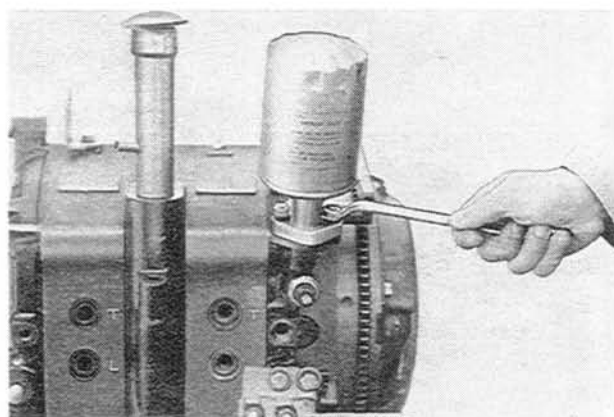


Fig. 1-100 Installing oil filter

1-D-17. Installing the Distributors

1. Turn the engine and stop when the white mark on the pulley matches the needle on the front housing.

Note: In case of the rotary engine, each rotor makes a 1/3 rotation as against one rotation of the eccentric shaft. That is, one combustion is obtained while the rotor makes a 1/3 rotation. Therefore, when the mark and the needle are aligned the front rotor is always located at T.D.C. in the compression stroke.



Fig. 1-101 Aligning for top dead center

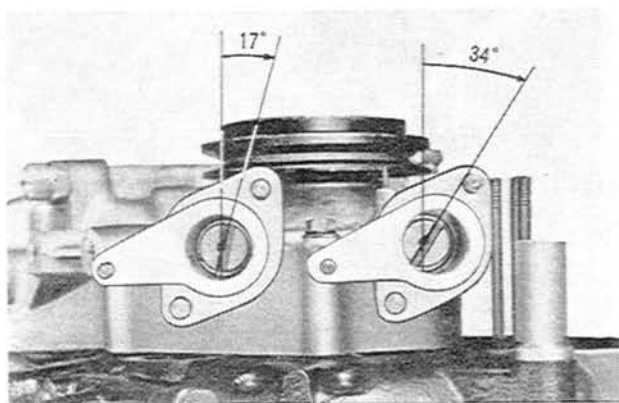


Fig. 1-102 Position of distributor socket

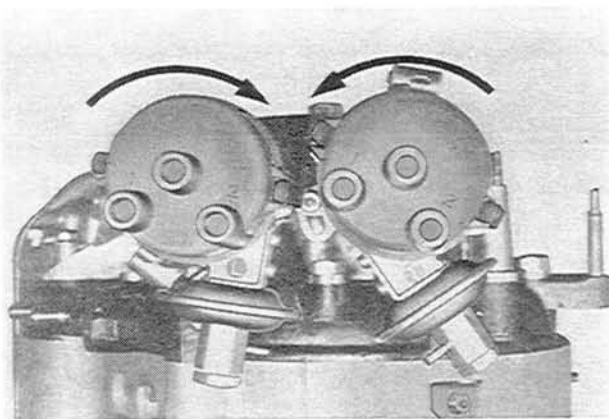


Fig. 1-103 Adjusting ignition timing

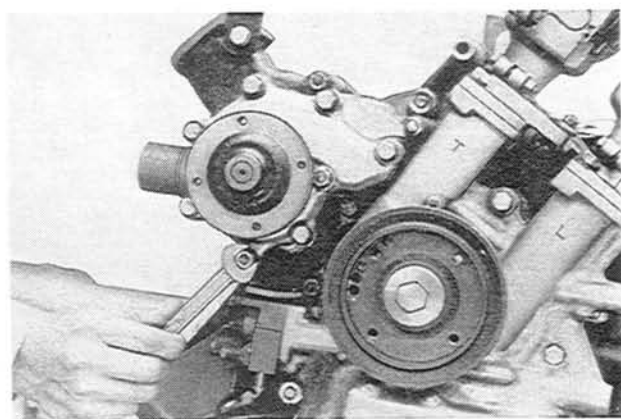


Fig. 1-104 Installing water pump

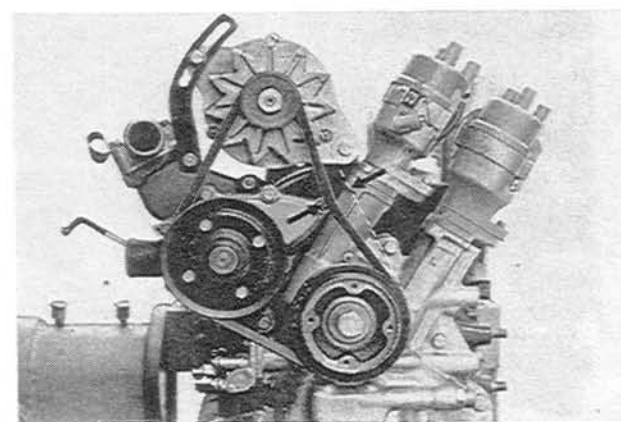


Fig. 1-105 Adjusting belt tension

2. 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 engine.

3. Install the leading side distributor socket through the gasket to the front housing so that the groove on the upper side of the drive shaft points about 17° to the right against the longitudinal axis of the engine, as shown in Fig. 1-102.

Note: The woodruff area at the upper part of the drive shaft varies with the left and right grooves, but this does not affect ignition timing even if it is 180° opposite.

4. Install each distributor on the socket so that the key of the distributor shaft matches the slot at the upper side of distributor drive shaft.

Note: The marks of the distributor and front cover, T and L, must be matched.

5. Turn the distributors as shown in Fig.1-103, until the contact point starts to open, Then tighten the lockplate.

1-D-18. Installing the Water Pump

1. Place the gasket on the front housing and install the water pump. Tighten the nuts.
2. Install the water pump pulley.

1-D-19. Installing the Alternator

1. Fix the alternator on the mounting bracket with bolt and nut.
2. Fit the V belt on the pulleys.
3. Attach the upper end of the alternator flange to the strap.
4. Adjust the belt tension so that the slack of the belt may be 15 ~ 17 mm (0.59 ~ 0.67 in) at the center point between alternator and eccentric shaft pulleys pushing the belt by about 10 kg (22 lb). For a new belt, it should be 11 ~ 13 mm (0.43 ~ 0.51 lb).
5. Tighten the bolts and nuts.

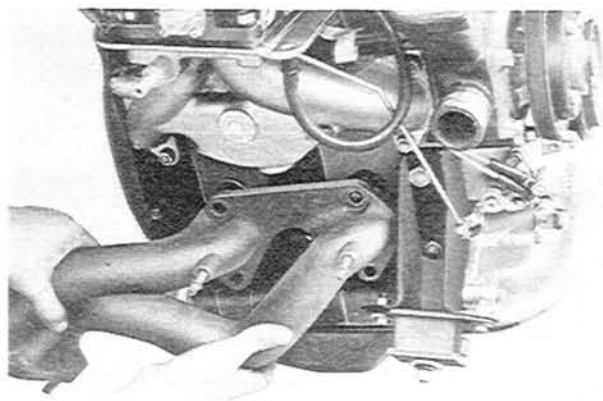


Fig. 106 Installing manifold

1-D-20. Installing the Manifold and Carburettor

1. Remove the engine from the engine stand.
2. Install the inlet manifold, exhaust manifold and carburettor with their gaskets.
3. Connect the carburettor and metering pump link.
4. Install the metering oil tube, and the distributor vacuum control tube.

1-E. ENGINE INSTALLATION

The engine is installed by reversing the removing procedures.

SPECIAL TOOLS

49 0107 680A	Engine stand
49 0813 005	Engine hanger
49 0820 006	Attachment, engine hanger
49 0813 215	Dowel puller
49 0813 240	Rotor bearing puller and installer
49 0813 245	Expander, rotor bearing
49 0813 225	Oil seal remover
49 0813 230	Rotor clamp
49 0813 250	Seal case
49 0813 235	Main bearing puller and installer
49 0820 260	Lock pin remover[
49 0820 060	Ring gear brake
49 0820 035	Box wrench, flywheel
49 0823 300	Flywheel puller
49 0813 310	Clutch disk centering tool
5619 91 100	Bar limit gauge, corner seal gloove
5870 94 152	Jig, corner seal gloove
5363 91 180	Reamer, corner seal gloove

