# Rotary Engine Overhaul Criteria and Criteria for Replacement of Parts

mazda

## FOREWORD

This book has been prepared for service personnel of Mazda authorized distributor and their dealers.

This book consists of the following two sections.

1. **ROTARY ENGINE OVERHAUL CRITERIA**
   In this section, criteria for judgement whether overhaul is necessary or not are explained.

2. **CRITERIA FOR REPLACEMENT OF PARTS**
   Measurement method and criteria for replacement of parts are fully described in this section.

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**4028-10-78E NN-X**

## Rotary Engine Overhaul Criteria

Contents

## RE Overhaul Criteria

The following mentioned items are either to be checked before overhauling the rotary engine, criteria for overhauling, or the items to be checked after overhauling. Based on this criteria, please make a correct judgement as to whether overhauling is required.

A point to be especially cautious about is that when overhauling is required, there are cases where the cause lies not in the engine itself, but in some engine accessories. It therefore is necessary to trace the cause before and after an overhaul, to replace the part which has been the cause, and to take other necessary measures to prevent the engine from being damaged once again. For example, when overheat occurs due to lack of coolant caused by breakage of the water hose and an overhaul becomes necessary, be sure to carry out not only an overhaul but change the water hose which was the cause of the overheat.

Roughly classified, there are three cases which require overhaul. How to decide whether overhaul is necessary is explained centering on these three cases.

**(1) High Oil Consumption**

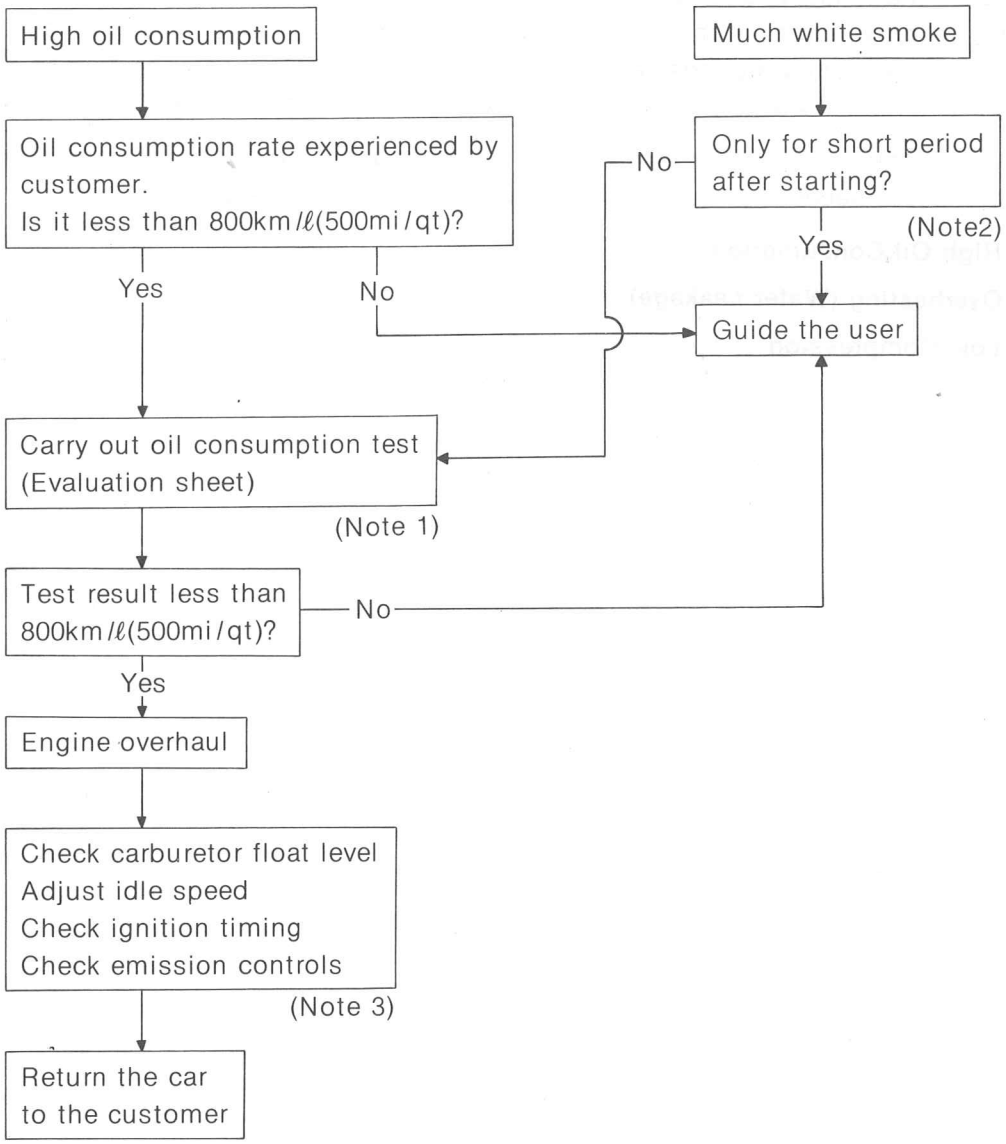
**(2) Overheating (Water Leakage)**

**(3) Low Compression**

## 1. High Oil Consumption

When a customer complains about high oil consumption or much white smoke, listen to his complaint carefully, and attempt to find if the cause is actually the engine, or due to one of the accessories or leakage. Perform our oil consumption test to determine the actual rate of oil consumption, and check for external leaks to prevent an unnecessary overhaul of the engine.

1-A. Checking procedure in case of oil consumption complaint



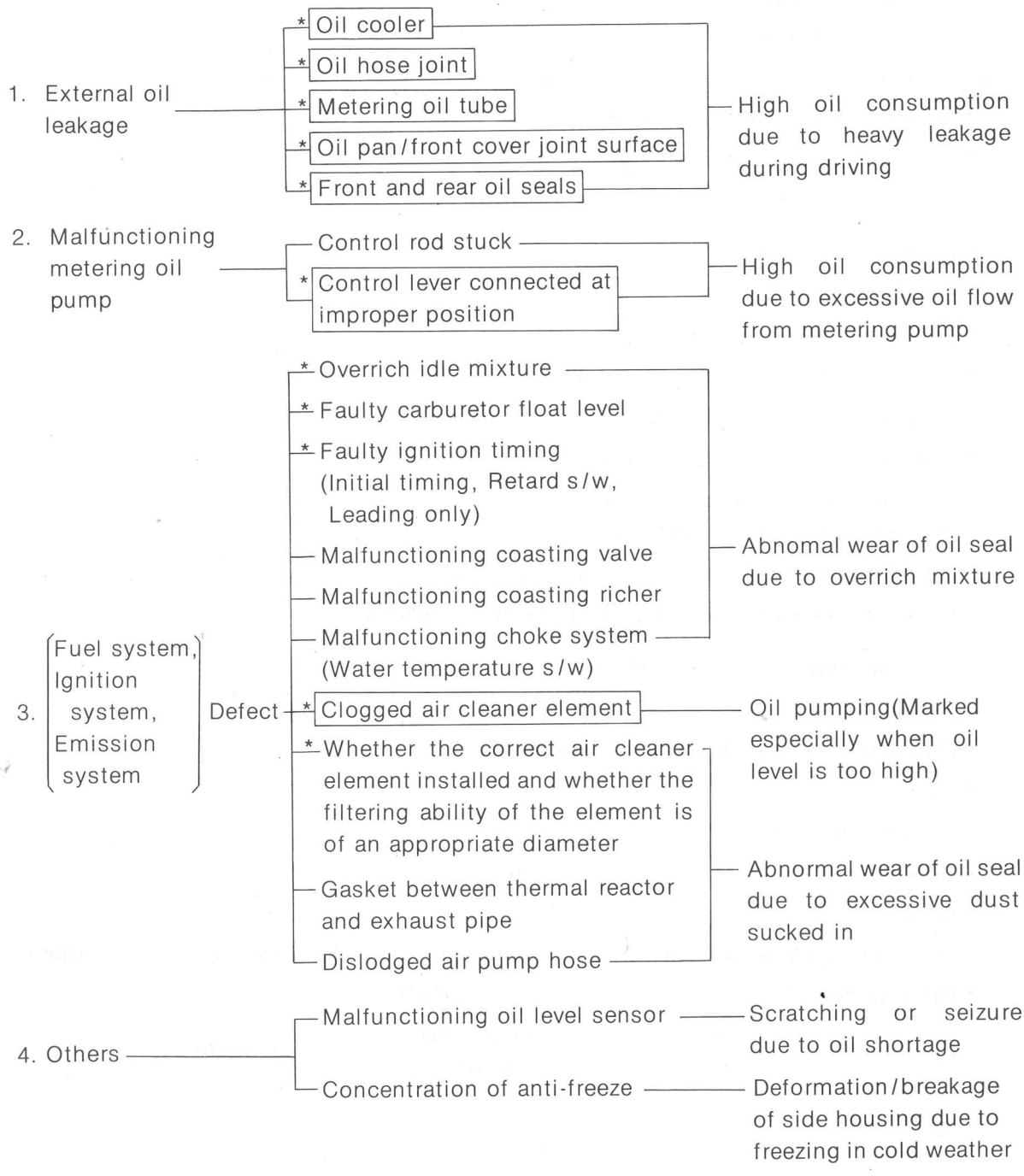

(Note 1) See PP. 1-4 and 1-5

(Note 2) See P. 1-6

(Note 3) See P. 1-3

## 1-B. Check points on high oil consumption

The check points relative to oil consumption are listed below. These factors should be considered on an engine with a high oil consumption complaint. Use them as a reference in checking both before and after an overhaul.
(*:Very important check points, □:Items to be checked before an overhaul)



1-C. An example of evaluation sheet

OIL CONSUMPTION RATE EVALUATION SHEET

Dealer:_____ Date:_____

Service man's name:_____

I. Customer Complaint

* Customer's name:_____ Car No.:_____
* Delivered on:_____ Distance covered:_____km(miles)
* Service record: good, fair, poor
* Other engine problems: no, yes (_____)
* Oil consumption rate:_____km/ℓ(mi/qt)

II. Inspection Record

1. Oil leakage from:
* Oil cooler: none, slight, much
* Metering oil tube: none, slight, much
* Oil pan: none, slight, much
* Front cover: none, slight, much
* Front oil seal: none, slight, much
* Rear oil seal: none, slight, much

2. Air cleaner element: normal, clean, replaced
3. Function of metering oil pump rod: normal, sticking

III. Oil Consumption Test Record

1. Before the test
* Odometer reading: A_____km(miles)
* Date:_____

2. After the test
* Odometer reading: B_____km(miles)
* Date:_____
* Oil replenished in the test: C_____ℓ(qt) at _____km(miles) on _____(date)
* Oil level "F"–_____mm(in) = D_____ℓ(qt)

3. Computation $= \frac{B-A}{C-D} = \frac{\text{km(miles)}}{\ell\ (qt)} =$ _____km/ℓ(mi/qt)

IV. Comment

## 1-D. Measurement method of oil consumption

1. When starting the test

   (1) Warm up the engine and park the car on a flat surface.

   (2) In order to stabilize the oil level, stop the engine and wait for about 5 minutes.

   (3) Add oil precisely to the "F" level.

   (4) Record the necessary items in the Evaluation Sheet and return the car to the customer.

   At this time the following request should be made to the user.

   Please bring back your car when you have covered approximately twice the distance of _____ ℓ/km(mi/qt) that you reported. When replenishing oil during the test, be sure to get a receipt and let us see it when you bring back your car. Also, record as much as possible the running conditions (average speed) during the test.

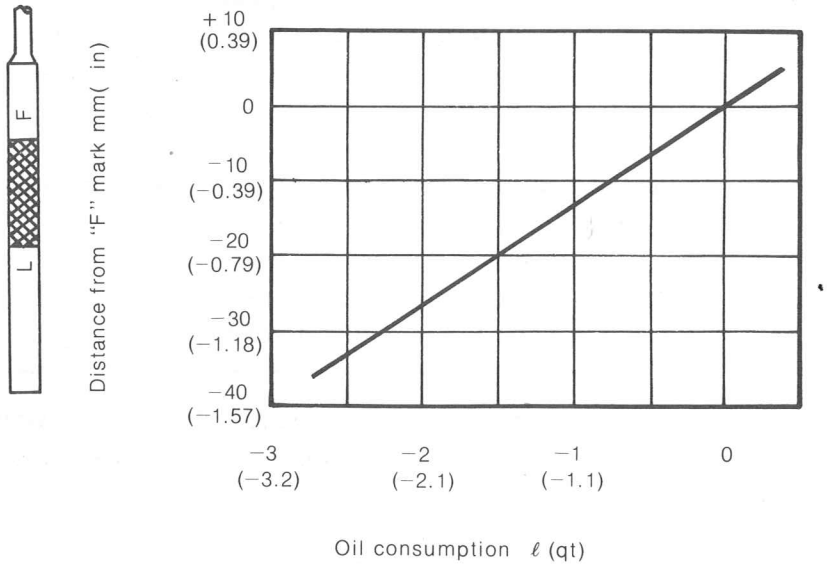
2. When completing the test

   (1) Warm up the engine and park the car on a flat surface.

   (2) Stop the engine and wait for about 5 minutes.

   (3) Measure the oil level.

   (4) Record the necessary items in the Evaluation Sheet and compute the oil consumption rate.



## 1-E. A suggested explanation to the customer on oil consumption

1. Oil consumption of rotary engine

* The rotary engine consumes oil for lubricating the seals. Because of its structural characteristics, the rotary engine supplies the oil metered by the metering oil pump (M. O.P.) from the carburetor into the engine's working chamber for seal lubrication. This metering oil pump controls the discharge amount according to engine rpm and load. The actual oil amount increases or decreases by 20-30% according to the load (gear used, air conditioning load, etc.), and oil seal performance.

* Oil seal break-in

Just like any other seal, the oil seal requires some break-in period until it becomes stabilized. For initial break-in,5,000 km(3,000 miles) will be necessary.

Measurement of oil consumption

The oil consumption level changes depending upon running conditions. Therefore, in order to get a stable oil consumption rate, ask the customer to obtain an average constant oil consumption rate by running long enough to use at least 2 ℓ(2 qts) of oil, and to measure the oil level under identical engine conditions (fully warmed up).

2. White smoke of rotary engine

When white smoke is emitted from the exhaust system, this is sometimes erroneously diagnosed immediately as "high oil consumption". Please fully understand the following before making a decision.

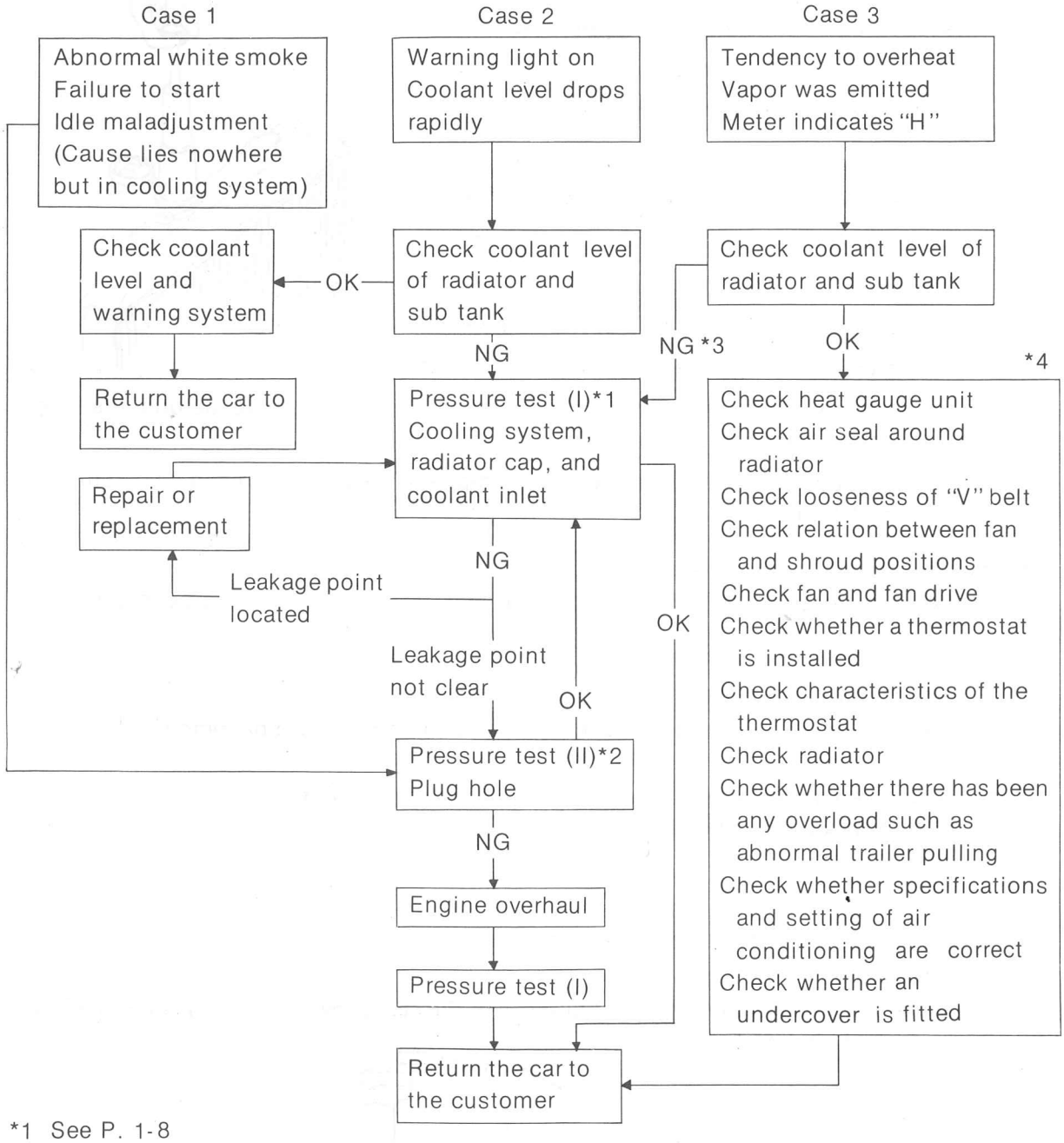
| | |
|---|---|
| White smoke after engine is warmed up | Not visible in case of a normal engine, but in case of an engine with high oil consumption (300-500 km/ℓ, 180-300 mile/qt), white-blue smoke is emitted. |
| White smoke immediately after starting (ambient temp: over 10°C, 50°F) | In case of a normal engine, a white-blue smoke appears on starting and after some 10 seconds disappears. In case of an engine with high oil consumption, thick white smoke appears immediately after starting, and white-blue smoke continues even after the engine is warmed up. |
| White smoke immediately after starting (ambient temp: below 5°C, 41°F) | In case of a normal engine, immediately after starting, because of an inadequately-functioning thermal reactor, unburned mixture components and vapor are emitted. They are condensed when emitted to the open air and become white smoke temporarily. This disappears when the temperature of the exhaust gas rises. |

Therefore, to claim high oil consumption, it is necessary to have thick white smoke emitted immediately after starting, and have white-blue smoke always emitted even after the engine is warmed up.

## 2. Overheat

When there is a complaint of overheat from a customer, be sure to check fully that the problem is not caused by some of the engine accessories. If the cause is in the engine accessories, overhauling often is not necessary. Therefore, check carefully in accordance with the procedure shown below. Also, even when overhauling is judged to be necessary, there are cases where the cause may lie in some engine accessories. So, pursue the cause and take necessary measures to correct the cause of the overheat in order to prevent the necessity of another overhaul.

2-A. Checking procedure when an overheat complaint is filed

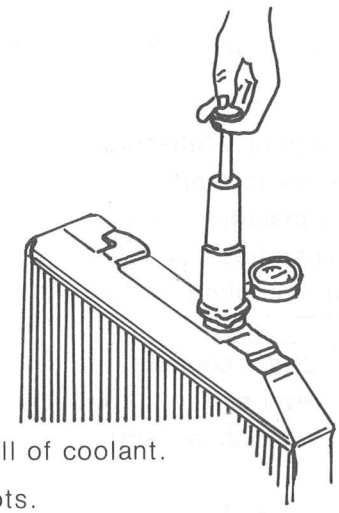



*1 See P. 1-8
*2 See P. 1-9
*3 Check *4 before returning the car to the customer.

## 2-B. Pressure test (I)

### 2-B-a. Check cooling system

1. Remove the radiator cap, fill the radiator with coolant, and attach the tester.
2. Warm up the engine.
3. Stop the engine and apply a pressure of 0.9 kg/cm² (12 - 13 lb/in²) with the tester. If the pressure holds for one minute, it is normal.
   Note: In case of a vehicle equipped with a sub tank with a pressure cap, apply the pressure from the sub tank.



   Check the following items.

   (a) Leakage from water hose joint areas
   (b) Leakage from the radiator
   (c) Leakage from level sensor area
   (d) Leakage from water pump
   (e) Leakage from inlet manifold gasket area
   (f) Leakage from heater hoses

   Caution:

   (a) Be sure to carry out the test with the radiator full of coolant.
   (b) Carefully wipe off water from the inspection spots.
   (c) When installing and removing the tester, be careful not to deform the inlet portion of the radiator.
   (d) When removing the tester the coolant blows off, so use a rag and be careful not to get burned.

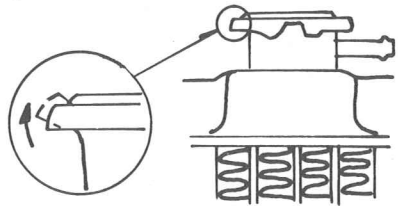
### 2-B-b. Inspection of radiator cap

(When a pressure cap is fitted to the sub tank, the cap should also be inspected.)

1. Crack for damage to the seal
2. Deformation and dents on the valve and valve seat
3. Deposits on the valve and between the valve and seat (Should be removed if there is any)
4. Install the cap tester and check the valve opening pressure.
   0.75 - 1.05 kg/cm²(10.66 - 17.77 lb/in²)

### 2-B-c. Inspection of the inlet

1. Deformation and dents on the seal surface
2. Deformation of edge area
   (When the inlet is deformed, the tightness of the cap is lowered and can be the cause for loss of coolant.)

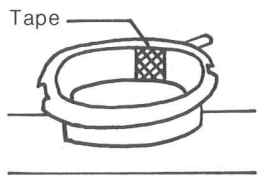


2-C. Pressure test (II) - Apply high pressure air to the plug hole
(Check damage on sealing rubber.)

1. Align the front rotor precisely on the TDC position. (This is to prevent the engine from rotating when air is applied.)

   Pull the parking brake and leave the shift lever in gear.

2. Remove the radiator cap and seal the hole of the pipe which extends to the sub tank with tape.




3. Remove only the trailing spark plug of the front rotor housing, install the attachment that fits this plug hole, and gradually feed compressed air (5 - 9 kg/cm$^2$, 71 - 128 lb/in$^2$) into the combustion chamber.

4. Check at the radiator filler neck whether the coolant level rises and whether air bubbles come up. (For about 3 minutes)

5. If the water rises, or bubbles are seen, it means there is damage in the sealing rubber, and an engine overhaul is necessary. If not, there is nothing abnormal about the sealing rubber.

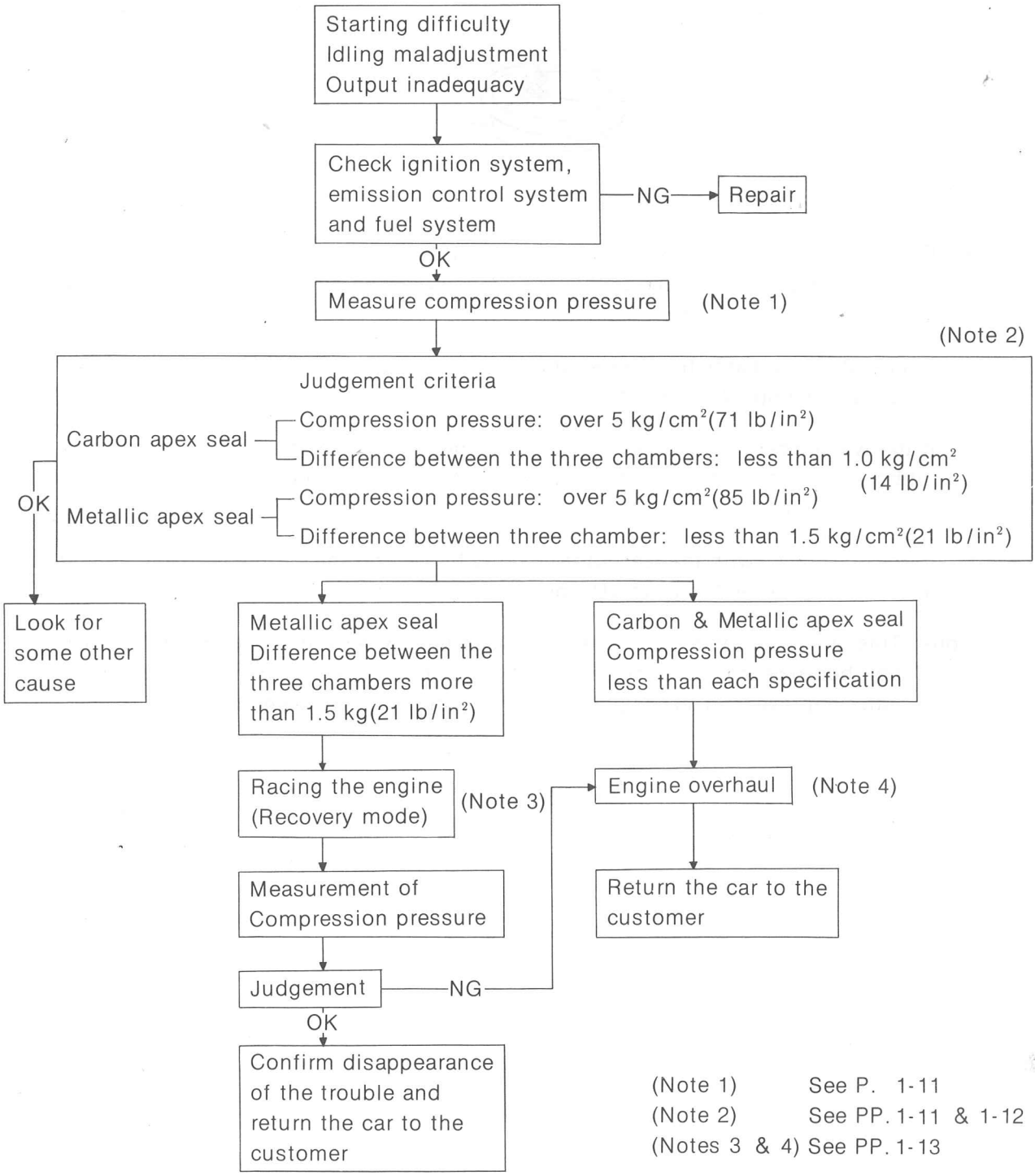
6. Proceed likewise with the rear rotor housing by turning the engine half-way around and aligning the rear rotor to TDC position.

Note: This checking should be carried out, as a rule, when the engine is cold. When hot, because of thermal expansion of rotor housing, etc., the sealing characteristics improve, and makes judgement more difficult than when cold.

### 3. Inadequate Compression Pressure

When the compression pressure is inadequate, complaints such as starting difficulty, idling maladjustment and inadequate power are made. The cause of these complaints, however, often lie in some other area. Therefore, check first the ignition system, emission control system, and fuel systems. If these prove normal, measure the compression pressure and judge whether overhaul is necessary.

3-A. Compression checking procedure




(Note 1) See P. 1-11
(Note 2) See PP. 1-11 & 1-12
(Notes 3 & 4) See PP. 1-13

## 3-B. Measurement method of compression pressure

1. Check that the battery is completely charged.
2. Warm up the engine.

   Note: Immediately after the engine is stopped, the temperature in the thermal reactor is still high. Since the mixture from the carburetor burns in the thermal reactor when cranking, it sometimes causes afterburning. In order to avoid this, leave the engine inoperative for about ten minutes after the engine is stopped, and then take the measurement. Also, in order to avoid danger in case of backfire, do not have the air cleaner cover removed.

3. Remove the trailing plug of the front rotor.

   Note: Do not remove the rear plugs. There will be a danger of catching fire as the mixture blows out of the rear plug holes when taking the measurement of the compression pressure on the front rotor.

4. Disconnect the primary coil wire on both trailing and leading coils.
5. Install the compression tester hose to the hole of the spark plug, and connect the wires to the battery.
6. Wait until the indicator gets warm, feed in the recording paper and have a 20-30mm (0.8-1.2in) line drawn at 0 position.
7. Have the throttle valve fully opened and crank the engine for 5-10 seconds to have the curve drawn.
8. Stop cranking, and at the same time stop feeding of the recording paper.
9. Install the trailing spark plug on the front side and take the measurement on the rear rotor in the same manner as on the front rotor.
10. Make judgement on the compression pressure.

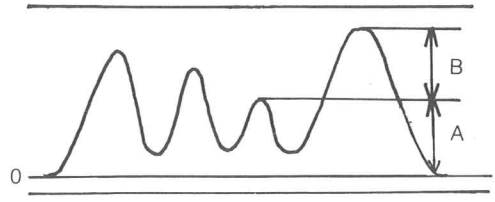
## 3-C. Judgement criteria of compression pressure

1. Measurement instrument

   Compression tester (TKK special tool No. 49 0820 280K, MMA No. 4908 20 280K)
   Recording paper (TKK special tool No. 49 0820 281, MMA No. 4908 20 2810)

2. Measurement items

   A: Minimum compression pressure
   B: Difference between maximum and minimum compression pressures

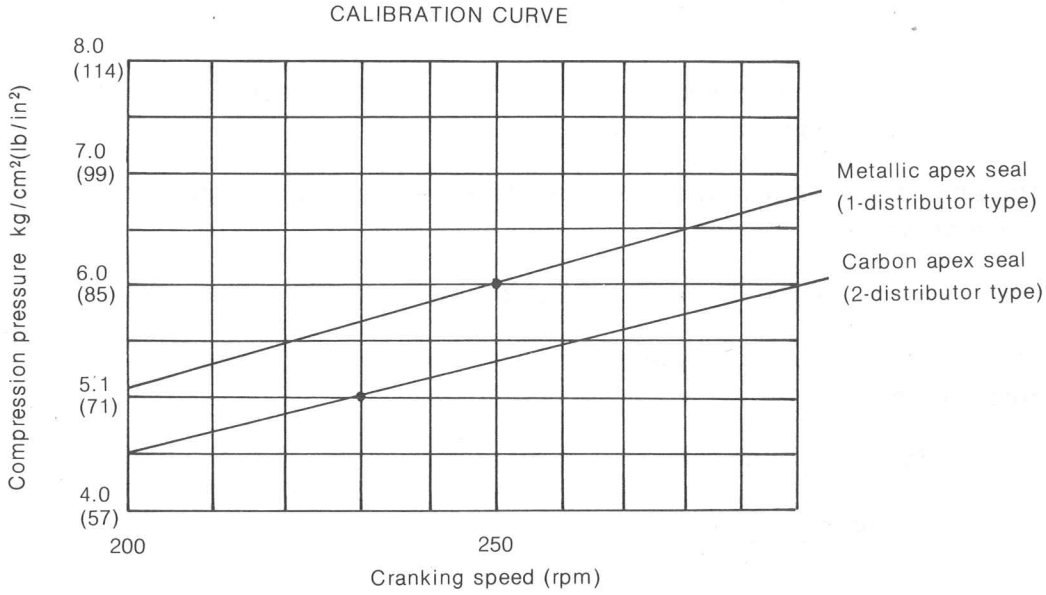


3. Judgement criteria

| | | Carbon apex seal 2-distributor type | Metallic apex seal 1-distributor type |
|---|---|---|---|
| A | Compression pressure | 5kg/cm² (71 lb/in²) | 6kg/cm² (85 lb/in²) |
| B | Difference between 3 chambers | 1.0kg/cm² (14 lb/in²) | 1.5kg/cm² (21 lb/in²) |
| Cranking speed | | 220 - 230 rpm | 240 - 250 rpm |

4. Correction of rpm

Depending upon the battery condition, starter and engine accessories, the cranking speed changes and so does the compression pressure. The graph below shows the relationship between the cranking speed and compression pressure.




Note: Cranking speed can be obtained by cranking the engine for 5 seconds and reading the number of peaks shown in the recording paper.

| Peaks | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|---|---|---|---|---|---|---|---|---|---|
| rpm | 204 | 216 | 228 | 240 | 252 | 264 | 276 | 288 | 300 |

3-D. Racing (Recovery Mode)

(A method to correct the drop in compression pressure caused by the side seal sticking to the rotor without disassembling the engine)

Run racing at 5000 rpm under no load 20 times.

3-E. Caution, when the engine is disassembled due to lack of compression pressure:

Of the gas seal clearance, △G (and carbon apex seal, △S) has a large additional influence upon compression pressures. It therefore requires extra attention when measuring these clearances, and correcting those clearances which are out of specified limits.

## Criteria for Replacement of Rotary Engine Parts

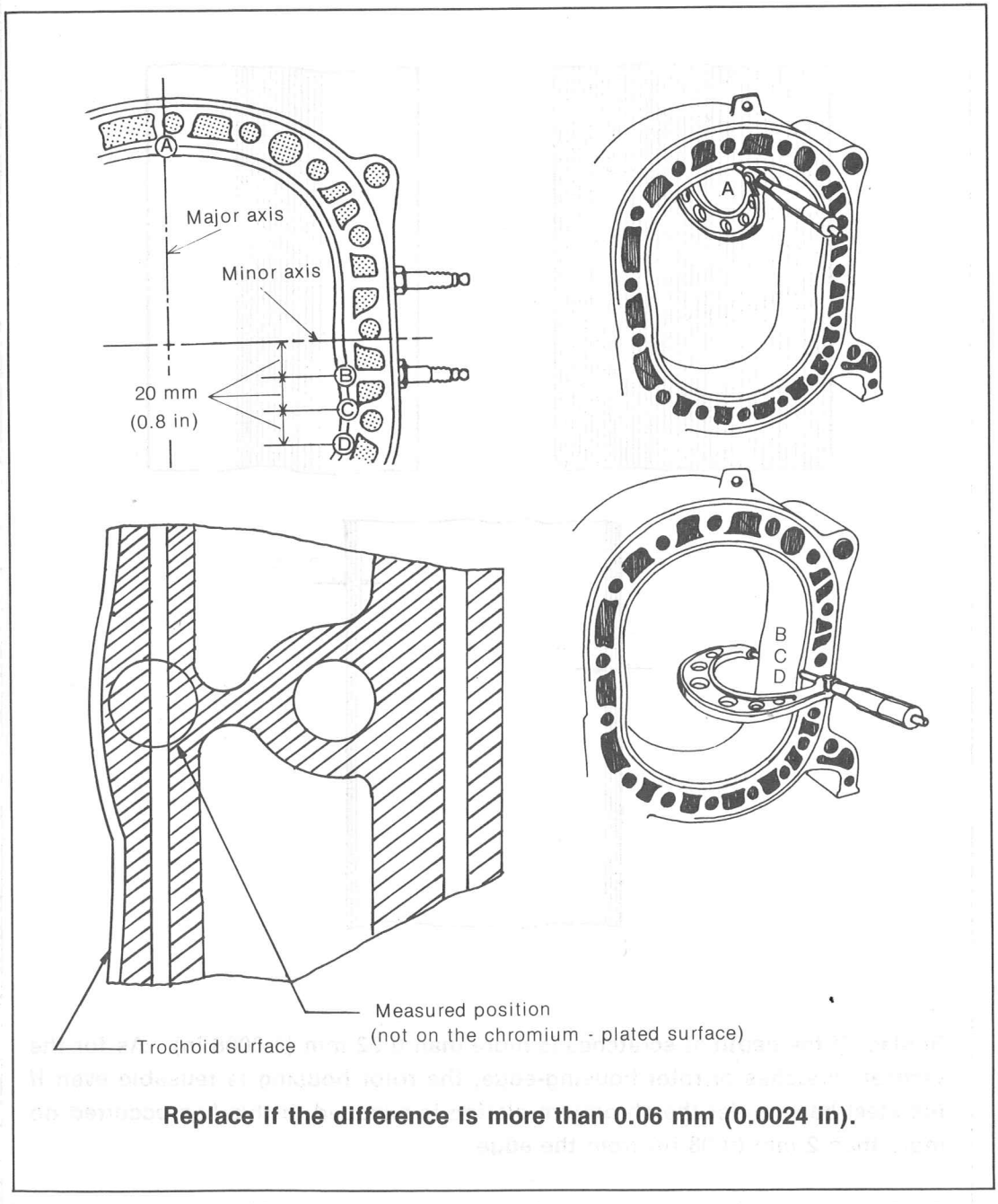
Contents

# 1. ROTOR HOUSING

## 1-A. Difference in width

1. Measuring tool required
   Micrometer (50 -75 mm) or (75 - 100 mm)

2. Measure the difference in width between
   A, and the smallest of either B, C, or D

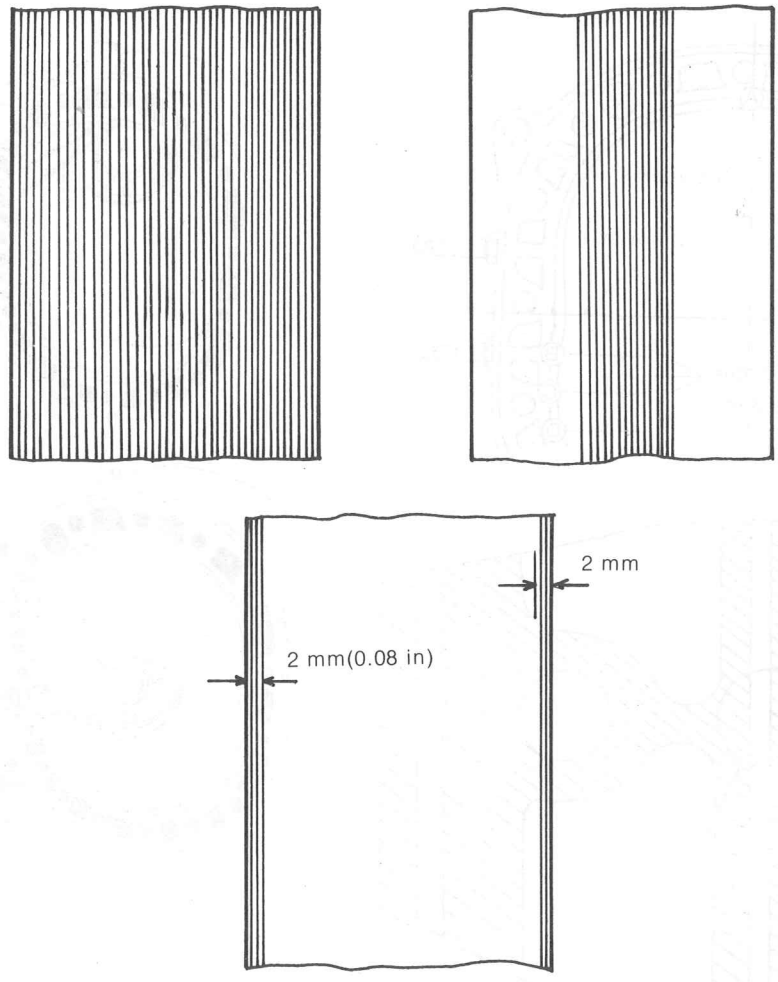



**Replace if the difference is more than 0.06 mm (0.0024 in).**

1-B. Damages on trochoid surface

1-B-a. Vertical scratches on trochoid surface

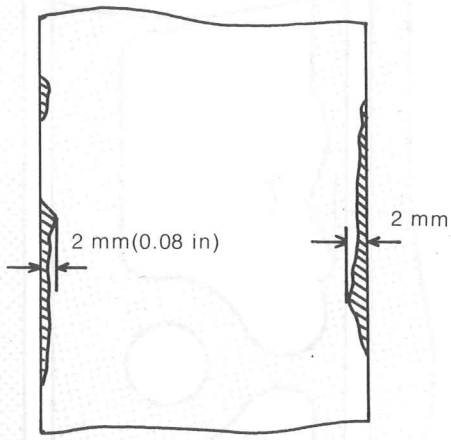
1. Inspection
   Visual and sensual inspection
2. Vertical scratches on trochoid surface




**Replace if the depth of scratches is more than 0.02 mm (0.0008 in). As for the vertical scratches or rotor housing-edge, the rotor housing is reusable even if the steel base under the chromium-plating is exposed, if this has occurred no more than 2 mm (0.08 in) from the edge.**

1-B-b. Chipping of chromium plated surface

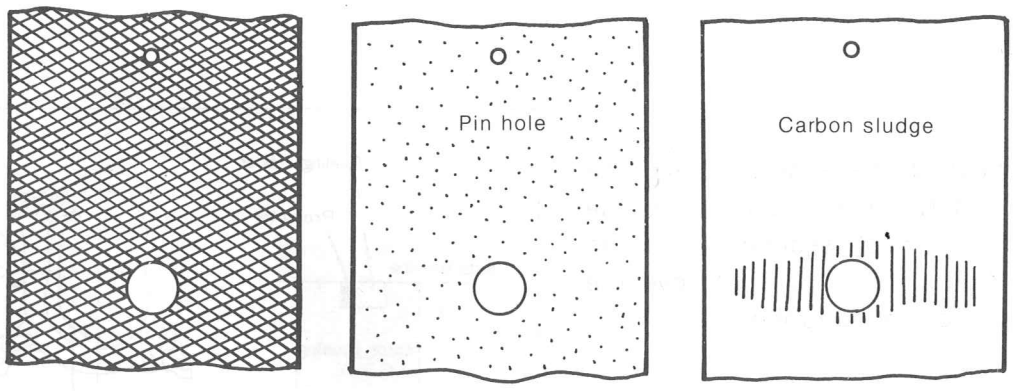
1. Measuring tool required:
   Vernier calipers or scale
2. Width of chips




**Replace if chipping extends inward more than 2 mm (0.08 in).**

1-B-c. Trochoid surface

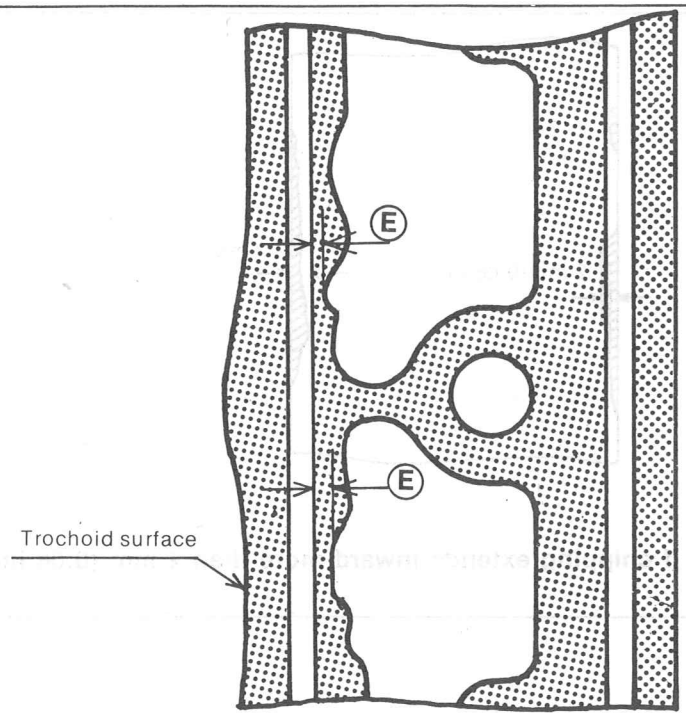
1. Inspection
   Visual inspection
2. Trochoid surface




**Reuse the housing if there is no other damage than that shown above.**

1-C. Corroded wear on the cooling jacket of rotor housing

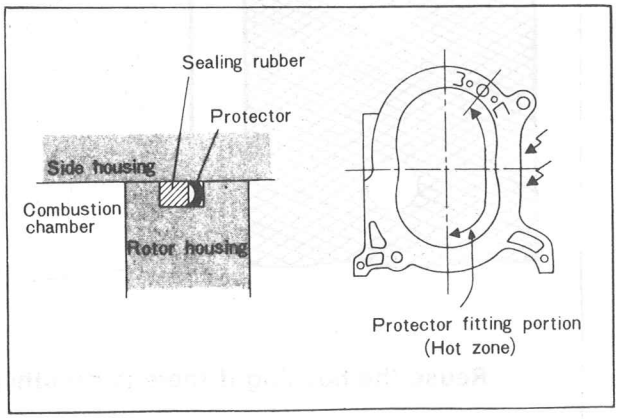
1. Measuring tool required
   Vernier calipers
2. Width of cooling jacket at E




**Replace if width E is less than 0.5mm(0.020 in).**

Note: Check the boss area around the spark plug hole and the inside wall of housing, because in rare cases there will be deep corrosion in that area.

Note:
When overhauling the engine, install the protector (Part No. 0866 23 0250) to the outside of the inner sealing rubber as shown in figure. This will improve the durability of the sealing rubber.



## 2. SIDE HOUSING (FRONT, INTERMEDIATE, REAR)

Note: Even if the side housings are out of the following criteria (2-A, 2-B, 2-C) they can be reused by regrinding them, unless they have extreme damage due to overheating, engine seizing, or cracking. However, the following required finish must be maintained if the housings are reground.

Grinding precision

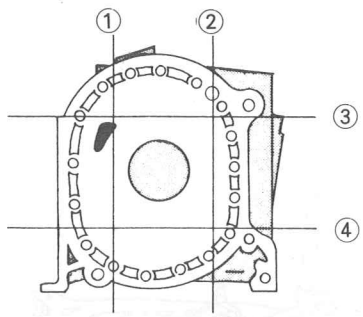
| | |
|---|---|
| Surface roughness | Between 0.007 - 0.0020 mm<br>(0.00003 - 0.00008 in) |
| Surface flatness | Within 0.02 mm (0.0008 in) |
| Regrinding amount | Less than 0.18 mm (0.007 in) * |

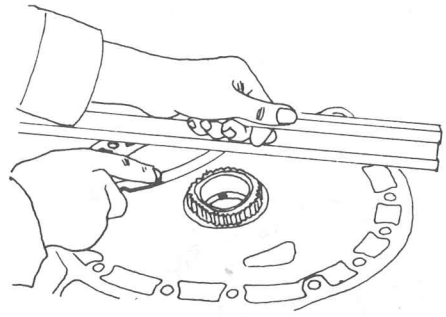
* Less than 0.10 mm (0.004 in)
in case with 80°C sprayed layer.

### 2-A. Side housing distortion

1. Measuring tools required:
   a) Straight edge (60 cm)
   b) Feeler gauge

2. Area of distortion 1, 2, 3 & 4



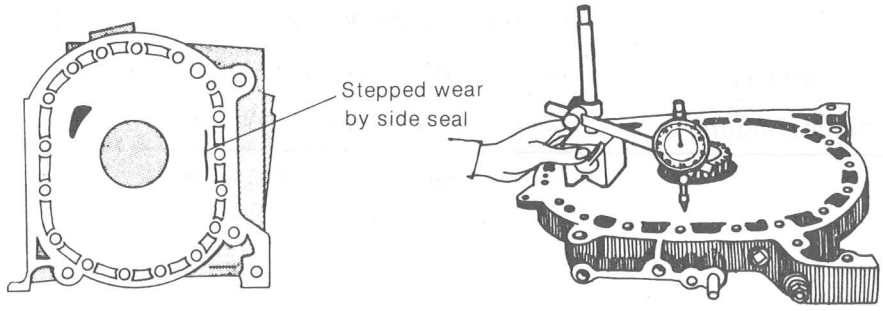



**Limit of distortion - 0.04 mm (0.0016 in)**

## 2-B. Side housing wear

### 2-B-a. Stepped wear by side seal (Vertical wear)

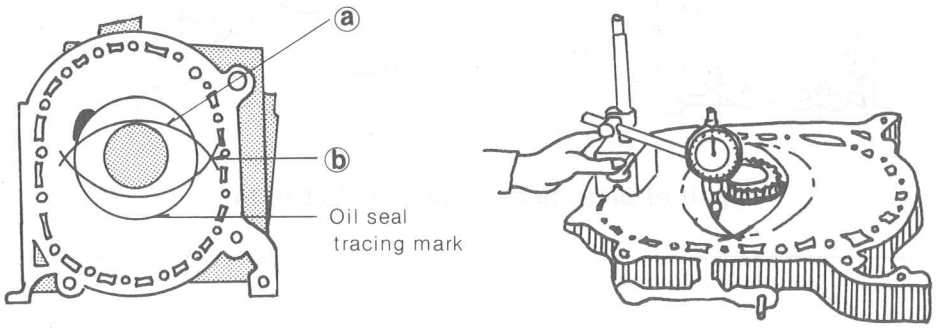
1. Measuring tools required
   a) Dial gauge
      (Sharpen the tip of dial gauge by grinding)
   b) Dial gauge stand
2. Stepped wear by side seal




**Limitation of wear - 0.10 mm (0.0039 in)**

### 2-B-b. Stepped wear by side seal

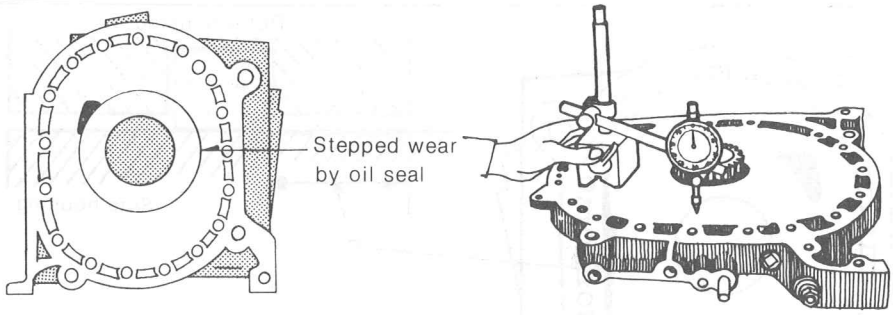
1. Measuring tools required
   a) Dial gauge
   b) Dial gauge stand
2. Stepped wear by side seal




**Limitation of wear**
**Inside of oil seal tracing mark ⓐ - 0.010 (0.0004 in)**
**Outside of oil seal tracing mark ⓑ - 0.10 (0.0039 in)**

2-B-c. Stepped wear by oil seal

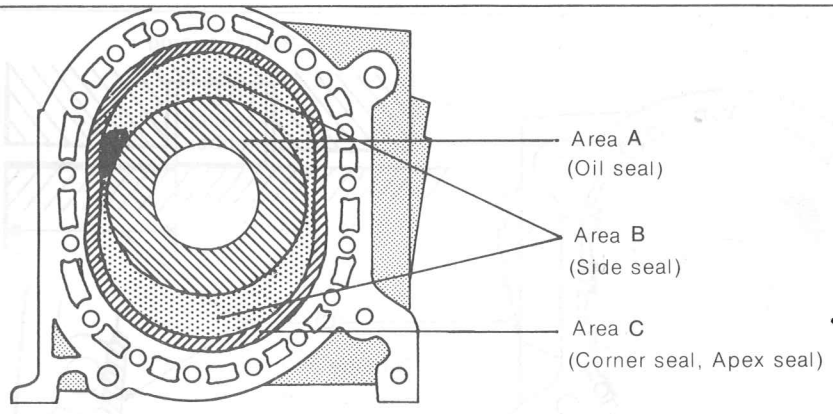
1. Measuring tools required
   a) Dial gauge
   b) Dial gauge stand
2. Stepped wear by oil seal




**Limitation of wear - 0.02 mm (0.0008 in)**

2-C. Scratches on the sliding surface

1. Measuring tools required
   a) Dial gauge
   b) Dial gauge stand
2. Scratch area A, B and C

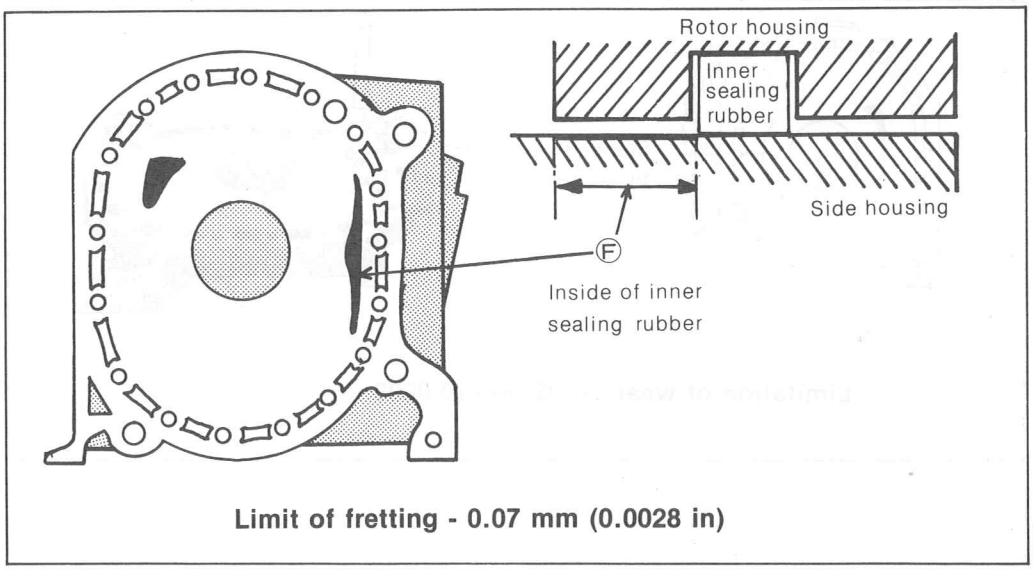



**Depth limit of scratches A - 0.01 mm (0.0004 in)**
**B - 0.1 mm (0.0039 in)**
**C - 0.1 mm (0.0039 in)**

## 2-D. Fretting and corrosion

### 2-D-a. Fretting

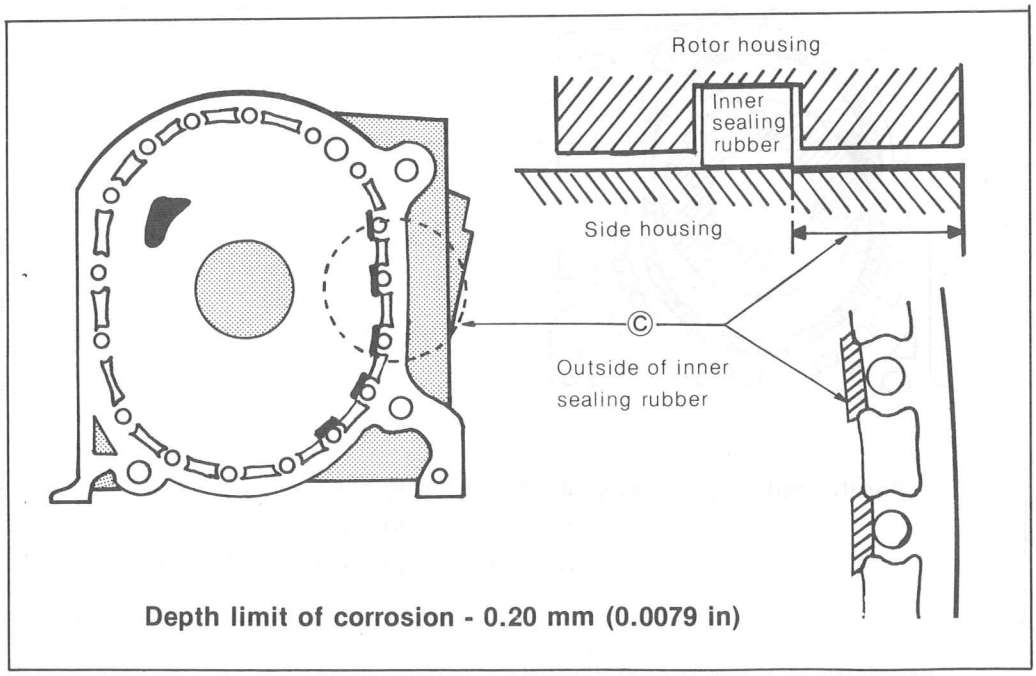
1. Measuring tools required
   a) Dial gauge
   b) Dial gauge stand
2. Fretting area F




**Limit of fretting - 0.07 mm (0.0028 in)**

### 2-D-b. Corrosion

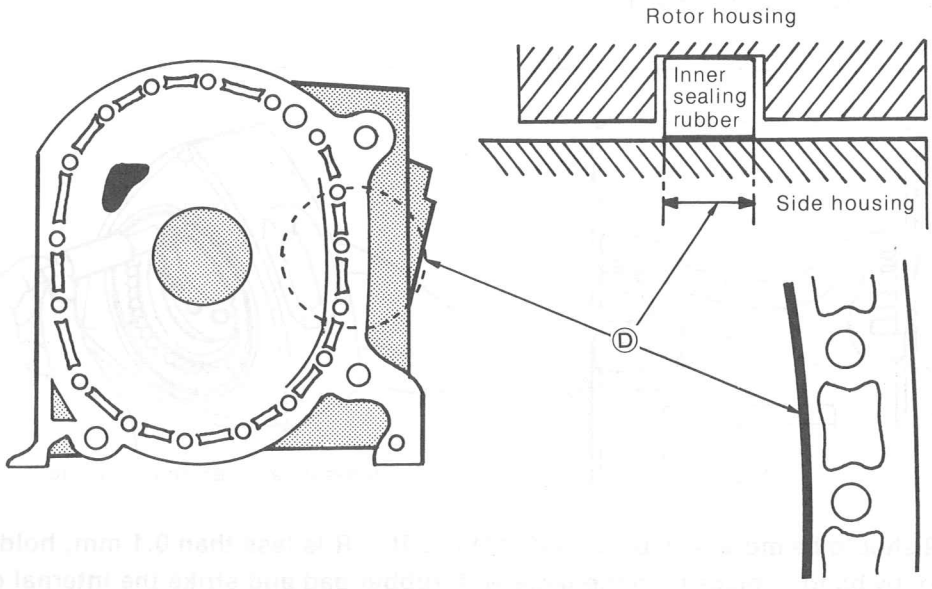
1. Measuring tools required
   a) Dial gauge
   b) Dial gauge stand
2. Corrosion area C




**Depth limit of corrosion - 0.20 mm (0.0079 in)**

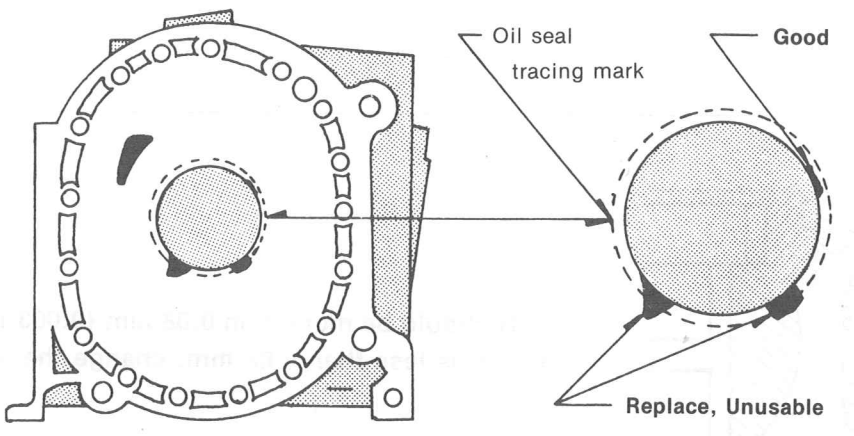
2-D-c. Corrosion (inner sealing rubber touching portion)

1. Measuring tools required
   a) Dial gauge
   b) Dial gauge stand
2. Corrosion area D




**Depth limit of corrosion - 0.07 mm (0.0028 in)**

2-E. Chips around eccentric shaft bore

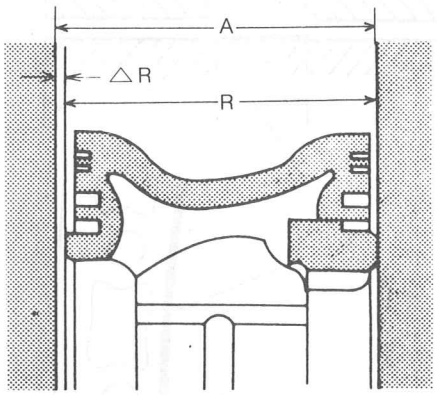


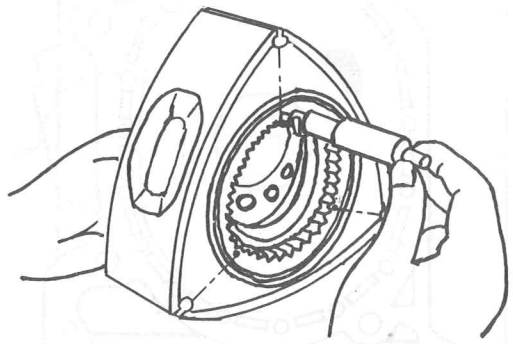

**Replace if chips are beyond oil seal tracing mark.**

3. ROTOR

3-A. Clearance related to rotor (△R)

1. Measuring tool required
   Micrometer (50 - 75 mm) or (75 - 100 mm)
2. Measurement of △R
   △R = Rotor housing width (A) on A point *— Maximum rotor width (R)
   *See "Note" on page 2-1



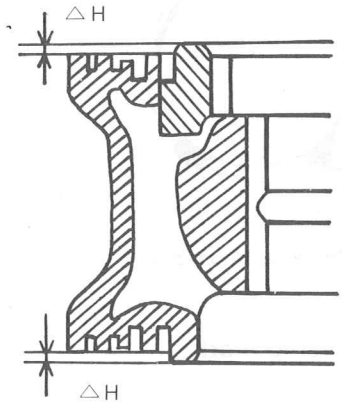



Measure at three points of rotor.

**△R should be more than 0.1 mm (0.004 in). If △R is less than 0.1 mm, hold the rotor by hand or place it on the table with rubber pad and strike the internal gear lightly with a plastic hammer, being careful not to damage the gear.**

3-B. Wear on the land of rotor (△H)

1. Measuring tools required
   a) Straight edge (30 cm)
   b) Feeler gauge (0.08 mm)
2. Measurement of △H

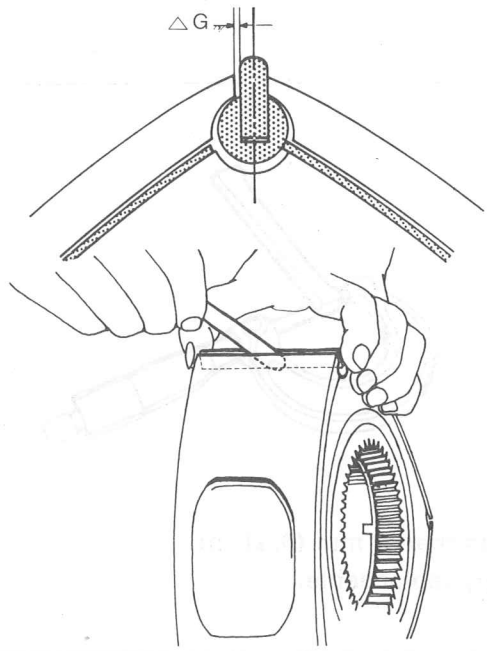


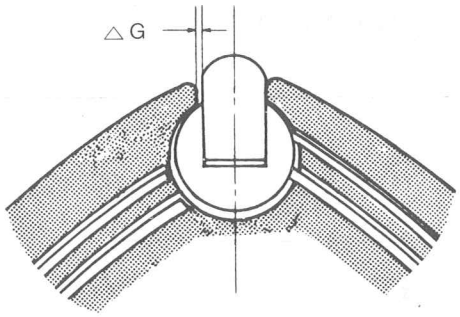

**△H should be more than 0.08 mm (0.003 in). If △H is less than 0.08 mm, change the rotor.**

3-C. Gap between apex seal and apex seal groove (△G)

1. Measuring tool required
   Feeler gauge (0.10 mm, 0.15 mm)

2. Measurement of △G

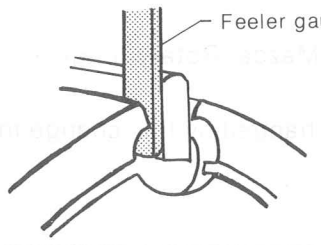



Lift the apex seal slightly (to operating position) to check △G.

| Carbon seal | Metallic seal |
|---|---|
| **Replace the rotor if △G is more than 0.1 mm (0.004 in) even if measured with new apex seal.** | **Replace the rotor if △G is more than 0.15 mm (0.006 in) even if measured with new apex seal.** |
| **Reuse the used apex seal if △G is within the limitation when measured with used apex seal unless there are no other damages.** | |

Rarely upper portion of apex seal groove is abnormally widened around the corner seal groove. In this case, measure the clearance by feeler gauge upon removing corner seal and installing new apex seal as shown below.




**If more than 0.2 mm (0.008 in), replace the rotor.**

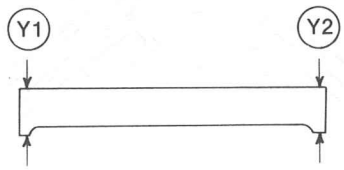
Notice: Check the air cleaner element because there is possibility of entering much dust into the engine.

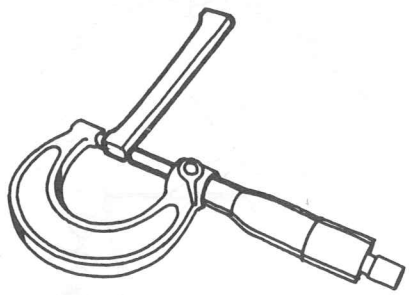
## 4. CARBON APEX SEAL

### 4-A. Measurement

4-A-a. Height of apex seal (Y)

1. Measuring tool required
   Micrometer (0 - 25 mm)
2. Measurement of Y1, Y2



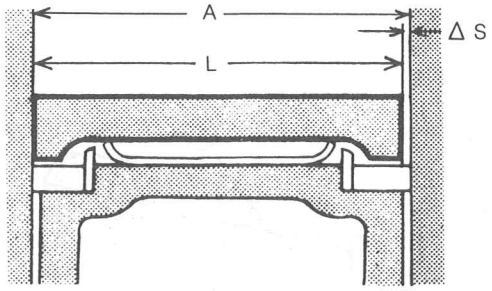



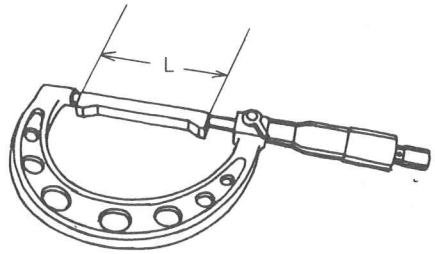
**Replace if Y1 or Y2 is less than 8 mm (0.31 in).**
**Apex seals are individually replaceable.**

4-A-b. Clearance between apex seal and rotor housing (△S)

1. Measuring tool required
   Micrometer (50 - 75 mm) or (75 - 100 mm)
2. Measurement of △S
   △S = Rotor housing width A on (A) point — Apex seal length (L)

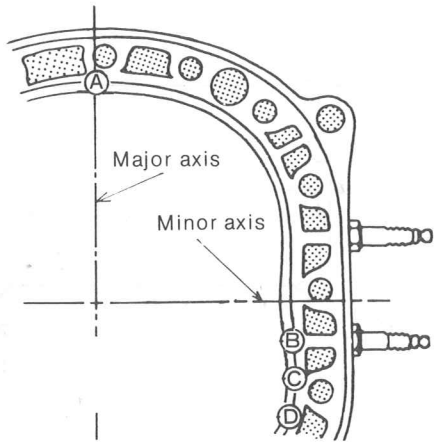
Note: In previous information, such as criteria book and workshop manual up to '75 models, the minimum rotor housing width (B, C or D) has been used as the rotor housing width for this measurement (△S, △R).
The measuring point has been changed as shown in this manual (A point) from September, 1975.
This change is also applicable for all Mazda Rotary Engine including previous products.
The specification, however, has not been changed by this change in measuring location.

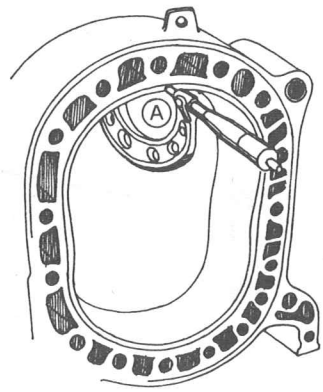



Notice: Measure the upper sides of apex seal end by micrometer, since upper sides are more worn than lower sides.

Micrometer measurement should be taken here.

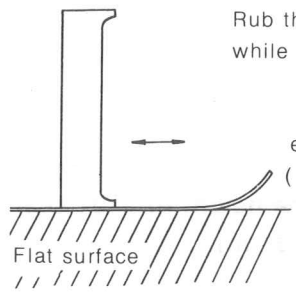



**Replace if more than 0.10 mm (0.004 in).**

3. Adjusting △S

Adjust the △S by grinding the apex seal end if △S is less than the lower limit of the standard △S in the criteria.

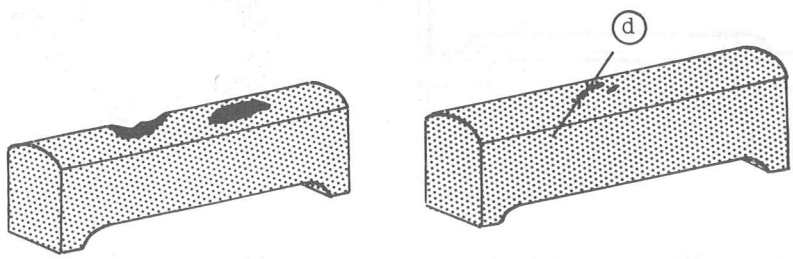



Rub the apex seal end on fine emery paper or emery powder while holding it vertically.

emery paper
( #500 ~ #1000)

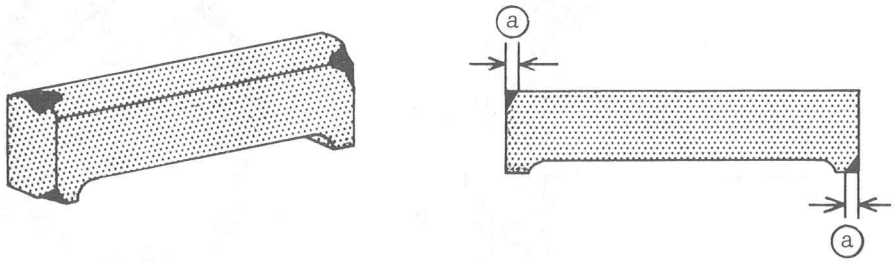
4-B. Apex seal inspection

4-B-a. Top of apex seal chipped or damaged



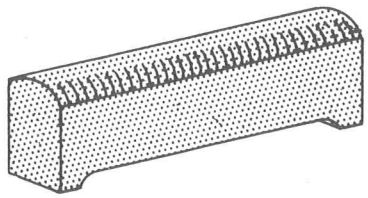

**Replace if ⓓ is more than 1.0 mm (0.040 in).**

4-B-b. End of apex seal chipped or damaged




**Replace if ⓐ is more than 1.0 mm (0.040 in).**

4-B-c. Vertical grooves on top of apex seal



**Reuse unless the height of apex seal is less than 8.0 mm (0.31 in).**

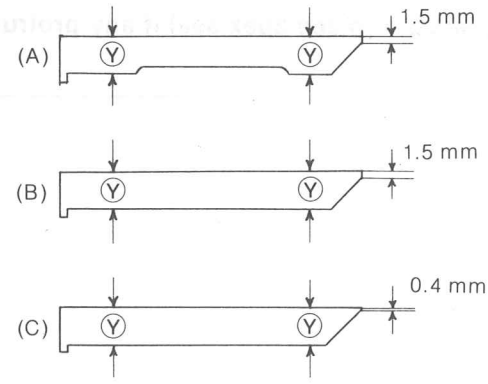
## 5. METAL APEX SEAL

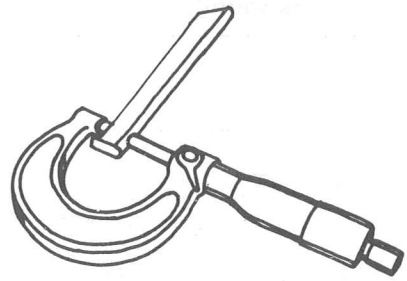
Note: When replacing the two piece type apex seal, replace them as a set (main piece and side piece).

### 5-A. Dimension

5-A-a. Height of apex seal (Y)

1. Measuring tool required
   Micrometer (0 - 25 mm)
2. Measurement of Y



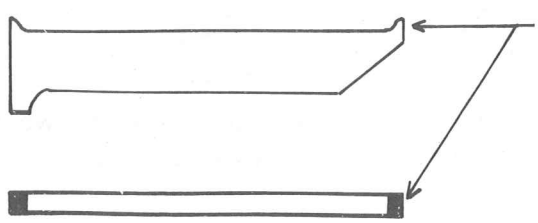



**Replace if Y is less than 7.0 mm (0.28 in).**
Note: Apex seals are individually replaceable.

5-A-b. Protrusion of apex seal end

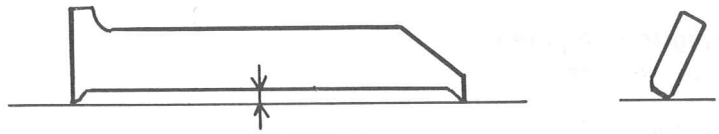
1. Measuring tool required
   a) Visual inspection
   b) Feeler gauge (0.03mm)
2. Measurement of protrusion

(1) Visual inspection:



If protrusion is found on its end, go to next process.

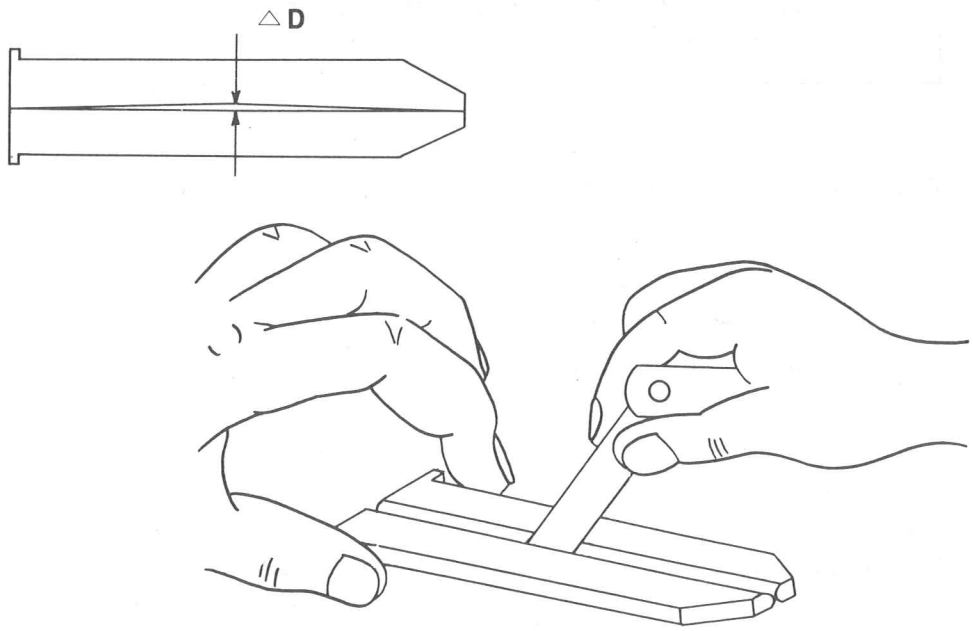
(2) Measurement by using feeler gauge:
Incline apex seal slightly to measure it, because protrusion is on side face rather than top.




**When the rotor housing is reused, reuse the apex seal if the clearance is less than 0.03 mm.**
**When the rotor housing is replaced, replace apex seal if any protrusion is found.**

5-A-c. Apex seal distortion (△D)

1. Measuring tool required
   Feeler gauge (0.05 mm)
2. Measurement of △D




Measure the gap between top surfaces of two apex seals picked from three seals on one rotor.

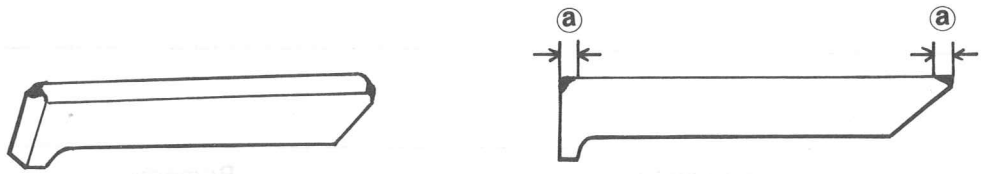
**Replace all three apex seals on a rotor if △D is more than 0.06 mm (0.0024 in).**

5-B. Apex seal inspection

5-B-a. Top of apex seal chipped or damaged

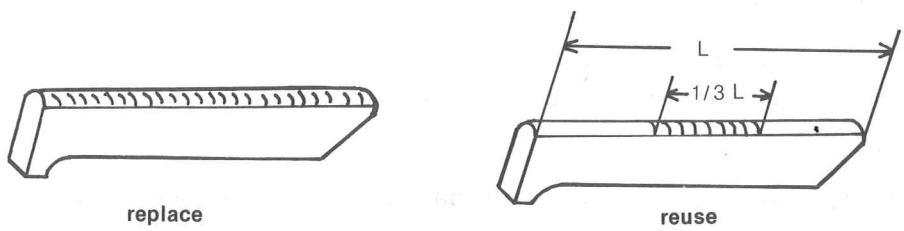

**Replace if ⓓ is more than 1.0 mm (0.040 in).**

5-B-b. End of apex seal chipped or damaged




**Replace if ⓐ is more than 1.0 mm (0.040 in).**

5-B-c. Vertical grooves on top of apex seal



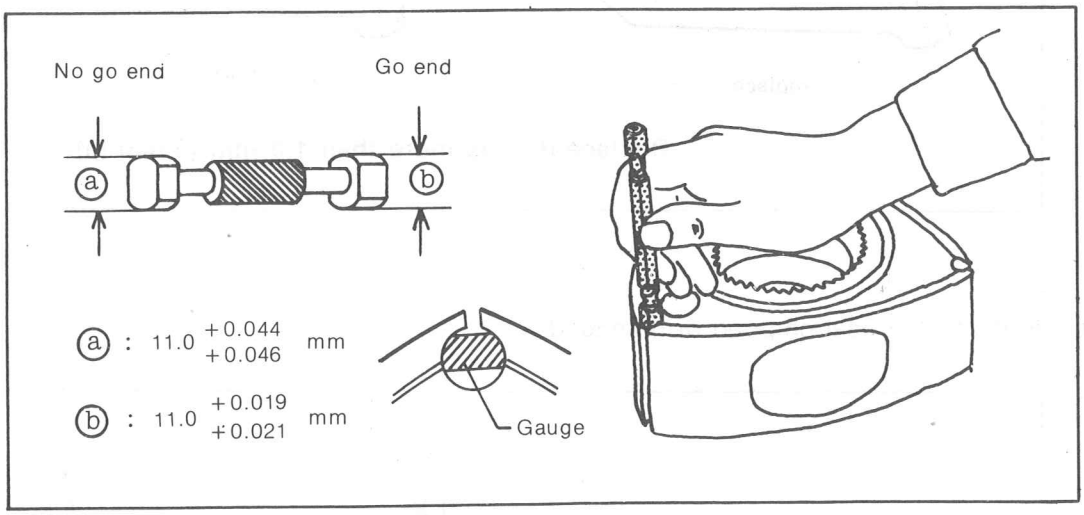

**Reuse if vertical groove area is less than 1/3 L.**

## 6. CORNER SEAL

### 6-A. Corner seal groove on rotor

The corner seal groove of the rotor shall be checked by the bar limit gauge (Go-No Go gauge) and classified into three conditions.

1. Measuring tool required
   Bar limit gauge (TKK special tool No. 49 0839 165, MMA No. 4908 39 1650)



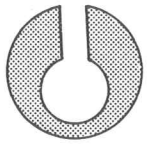

2. Classification

| Classification | Remedy |
|---|---|
| **a) Neither end of the gauge goes into the groove.** | **Use standard corner seal.** |
| **b) Go-end of the gauge go into the groove, no go-end does not.** | **Use 0.03 mm oversize corner seal. *** |
| **c) Both end of the gauge go into the groove.** | **Replace rotor.** |

3. Measuring method

   a) Do not force the gauge into the groove.
   b) Gauge should be vertically put into the groove.

*Note:
An oversize corner seal for the expansion type corner seal is not available. However, the standard size corner seal of the expansion type can be also used for class-"b"(go-end of the gauge can only go into the groove). If both ends of the gauge go into the groove(class-"c"), replace the rotor.



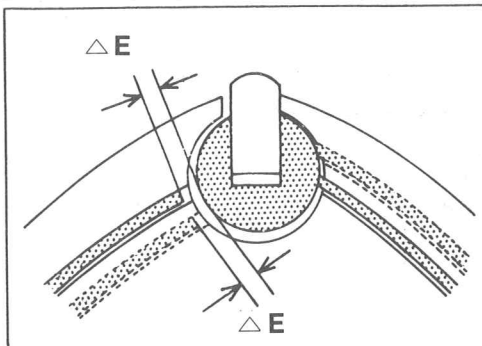
Expansion type corner seal

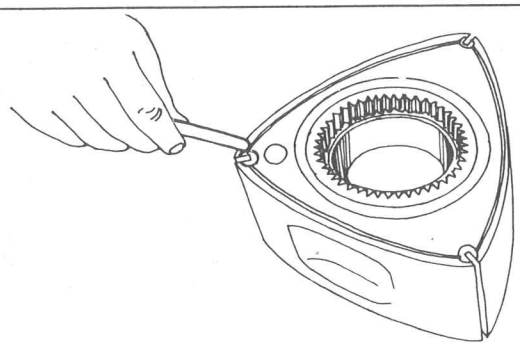
## 7. SIDE SEAL

### 7-A. Gap between side seal and corner seal (△E)

1. Measuring tool required
   Feeler gauge (0.05 and 0.04 mm)

2. Measurement of △E



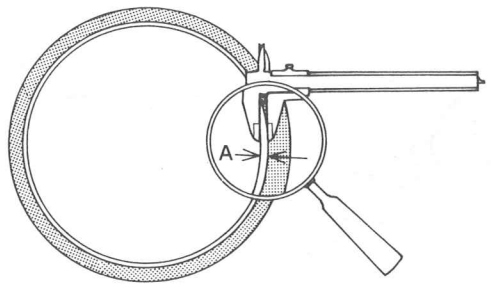
| | |
|---|---|
| **Standard** | **0.05 - 0.15 mm (0.002 - 0.006 in)** |
| **Limit** | **0.05 - 0.4 mm (0.002 - 0.016 in)**<br>**Replace if more than 0.4 mm.**<br>**File the end of side seal if △E is less than 0.05 mm.** |

## 8. OIL SEAL

### 8-A. Width of oil seal surface contacting side housing

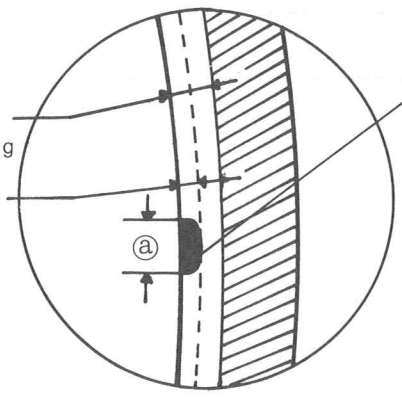
1. Measuring tools required
   a) Magnifying glass
   b) Vernier calipers (0 - 150 mm)

2. Measurement of A




**Replace if more than 0.5 mm (0.020 in).**

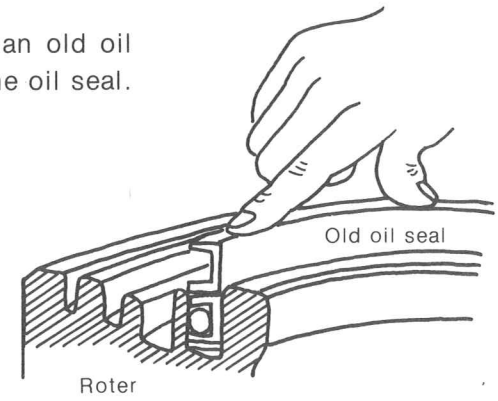
### 8-B. Chipping of chromium edge




**Replace if ⓐ is more than 2.5 mm (0.1 in) or the number of chippings are more than 10 pieces.**

Magnification of oil seal

Note: When installing the inner oil seal, utilize an old oil seal as shown in the figure to fully seat the oil seal.

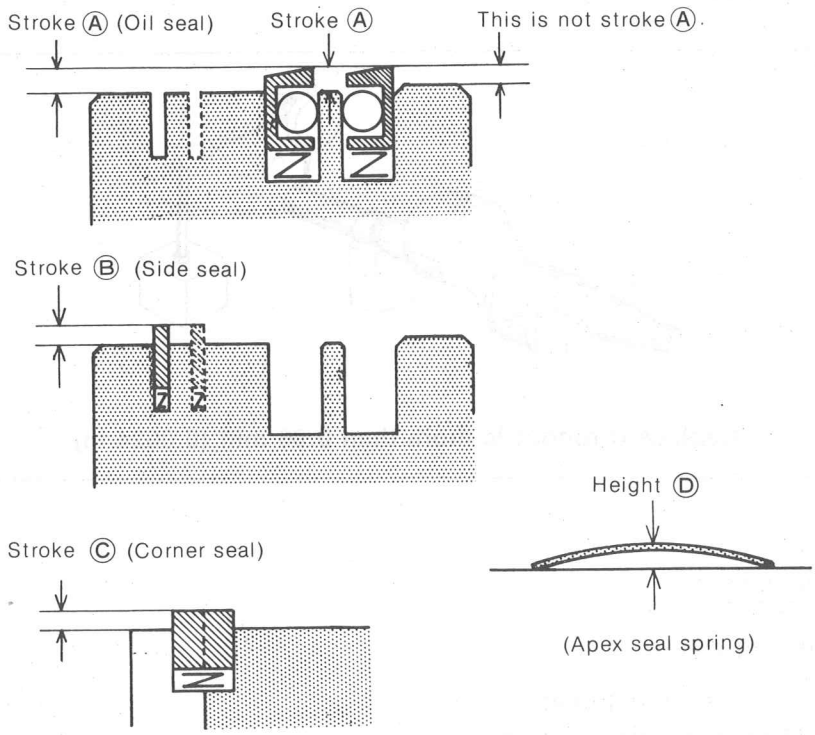


## 9. SEAL SPRING

### 9-A. Stroke of seal spring

1. Measuring tool required
   Vernier calipers (0 - 150 mm)

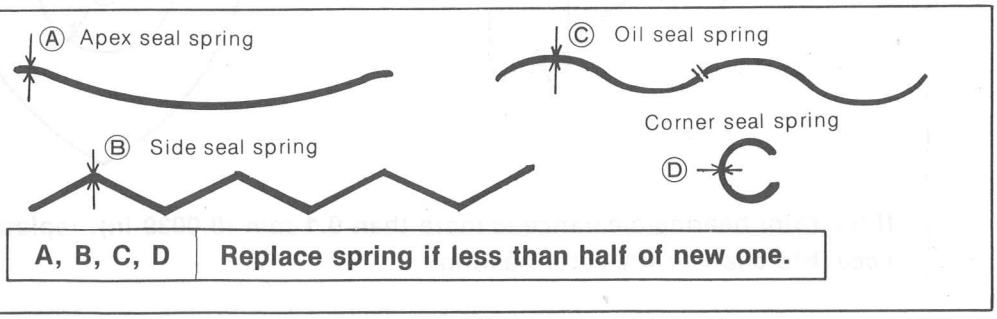
2. Measurement of stroke A, B, C and height D




| | | | |
|---|---|---|---|
| **A, B, C** | **Replace spring if less than 0.5 mm (0.02 in).** | | |
| **D** | **New engine (Metal apex seal)** | **13B** | **Replace less than 3.8 mm (0.15 in)** |
| | | **12A** | **Replace less than 5.5 mm (0.22 in)** |
| | **Previous engine (Carbon apex seal)** | **12A** | **Replace less than 4.6 mm (0.18 in)** |
| | | **10A** | **Replace less than 4.0 mm (0.16 in)** |

### 9-B. Thickness of seal spring

1. Inspection
   Visual inspection

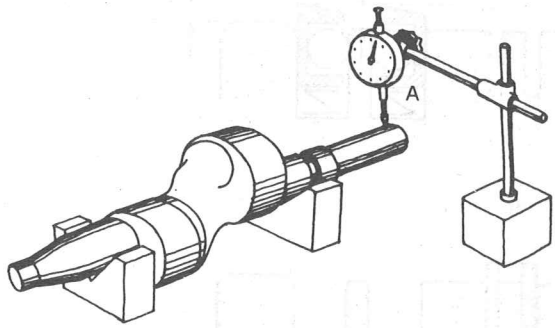



| | |
|---|---|
| **A, B, C, D** | **Replace spring if less than half of new one.** |

## 10. ECCENTRIC SHAFT

### 10-A. Eccentric shaft run out

1. Measuring tools required
   a) "V" blocks
   b) Dial gauge and stand
   c) Flat surface
2. Run out of point A

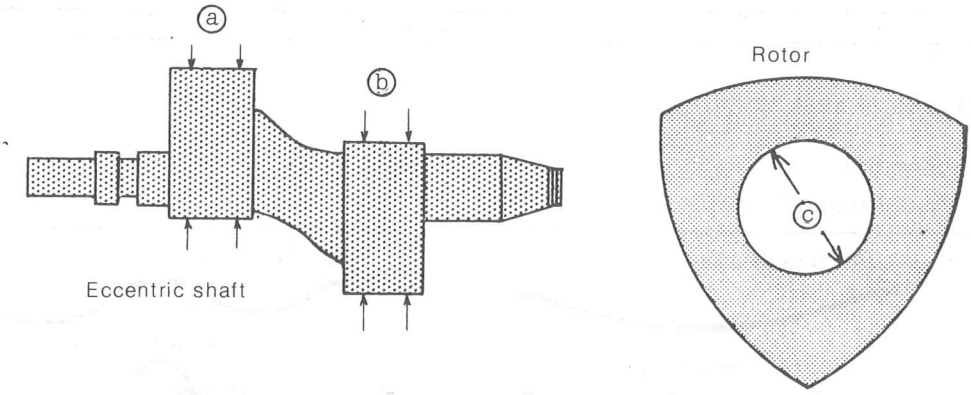



**Replace if runout is more than 0.06 mm (0.0024 in).**

### 10-B. Bearing clearances

#### 10-B-a. Rotor bearing clearances

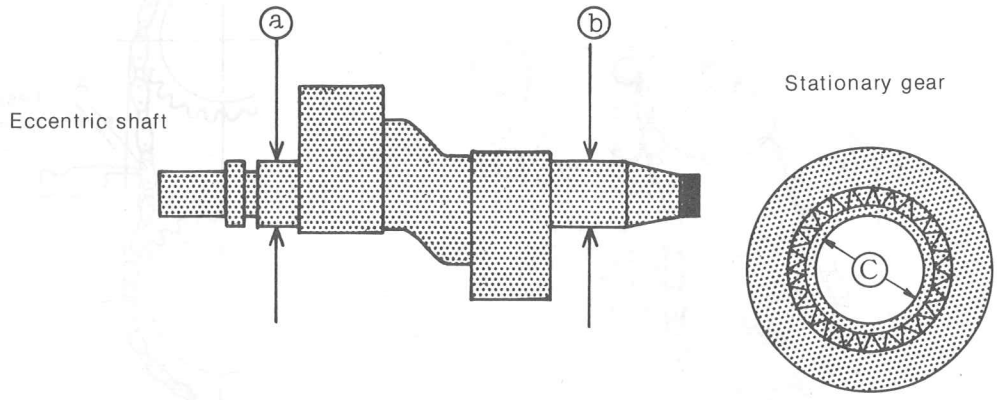
1. Measuring tools required
   a) Micrometer (50 - 75 mm)
   b) Inside micrometer (50 - 75 mm)
2. Measurement of a, b, and c
   Rotor bearing clearance = (c – a) or (c – b)




**If the rotor bearing clearance is more than 0.1 mm (0.0039 in), replace the eccentric shaft or the rotor bearing.**

10-B-b. Main bearing clearance

1. Measuring tools required
   a) Micrometer (25 - 50 mm)
   b) Inside micrometer (25 - 50 mm)
2. Measurement of a, b, and c
   Main bearing clearance = (c − a) or (c − b)




**If the main bearing clearance is more than 0.10 mm (0.0039 in), replace the eccentric shaft or main bearing.**

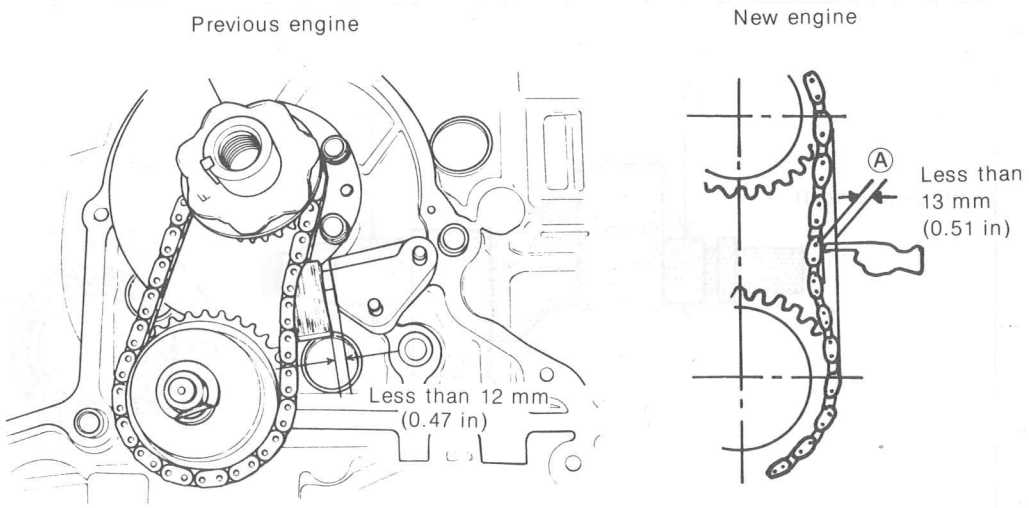
10-B-c. Journal surface of eccentric shaft

Eccentric shaft shall be reused except in the case of bearing seizing or heavy scratches, if the measurement is within limits. Refine the journal surface of the eccentric shaft carefully by using emery paper ( # 1000) with engine oil, if the journal surface is slightly seized or scratched.

## 11. OIL PUMP DRIVE CHAIN (CHAIN DRIVE TYPE ONLY)

### 11-A. Protrusion of chain adjuster

1. Measuring tool required
   Vernier calipers or scale
2. Measurement of protrusion



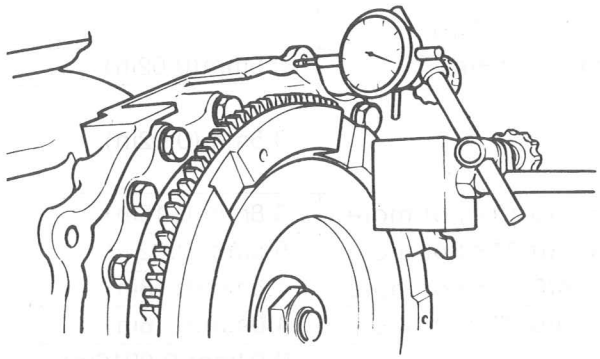

| | |
|---|---|
| **Previous engine (with chain adjuster)** | **Replace the chain (and sprockets if necessary) if the protrusion is more than 12 mm (0.47 in).** |
| **New engine (without chain adjuster)** | **Replace the chain (and sprockets if necessary) if A is more than 13 mm (0.51 in).** |

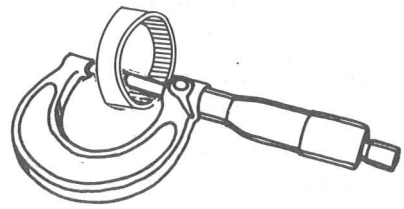
Note: Check the protrusion during disassembly to avoid wasting time when assembling the engine.

## 12. SPACER

### 12-A. Eccentric shaft end play

1. Measuring tools required
   a) Dial gauge and magnetic stand
   b) Micrometer (0 - 25 mm)
2. Measurement of end play





| | |
|---|---|
| **Standard end play** | **0.04 - 0.07 mm (0.0016 - 0.0028 in)** |
| **Limitation** | **0.09 mm (0.0035 in)**<br>**Replace the spacer if less than 0.04 mm (0.0016 in).**<br>**Grind the spacer if more than 0.09 mm (0.0035 in).** |

Note: (1) If the end play is small, spacer is small.
If the end play is big, spacer is big.
(2) The spacers are available in the following thicknesses.

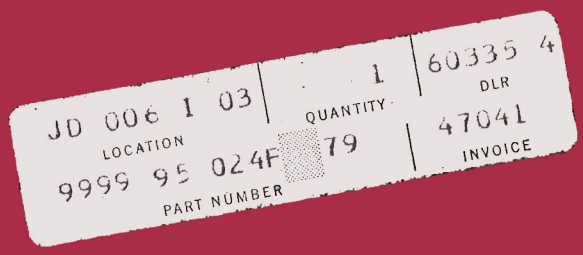
| Model | Mark | Thickness |
|---|---|---|
| R100 | | 6.05±0.01 mm(0.2382±0.0004 in) |
| 2 distributors engine except R100 | L | 9.08±0.01 mm(0.3574±0.0004 in) |
| | M | 9.04±0.01 mm(0.3559±0.0004 in) |
| | N | 9.00±0.01 mm(0.3543±0.0004 in) |
| 1 distributor engine | X | 8.08±0.01 mm(0.3181±0.0004 in) |
| | Y | 8.04±0.01 mm(0.3165±0.0004 in) |
| | V | 8.02±0.01 mm(0.3158±0.0004 in) |
| | Z | 8.00±0.01 mm(0.3150±0.0004 in) |

(3) Check the end play before overhaul and note the reading to have an easy job when assembling the engine.

TECHNICAL DATA

| | | | Standard | Limit | Ref. |
|---|---|---|---|---|---|
| Apex seal | Y | Metal seal | 8.5mm(0.33in) | 7.0mm(0.28in) | Page 2-15 |
| | | Carbon seal | 10.0mm(0.39in) | 8.0mm(0.31in) | 2-12 |
| | △S | Carbon seal | 0.05 - 0.07mm (0.0020 - 0.0028in) | 0.10mm(0.004in) | 2-13 |
| | △G | Metal seal | | 0.15mm(0.006in) | 2-11 |
| | | Carbon seal | | 0.10mm(0.004in) | |
| | △D | Metal seal | 0mm | 0.06mm(0.0024in) | 2-16 |
| Side seal | | △E | 0.05 - 0.15mm (0.002 - 0.006in) | 0.4mm(0.016in) | 2-19 |
| Oil seal lip | | | 0.2mm(0.008in) | 0.5mm(0.02in) | 2-20 |
| Seal stroke | | Corner seal<br>Side seal<br>Oil seal | | 0.5mm(0.02in) | 2-21 |
| Apex seal spring free height | | 13B | 4.7mm(0.19in) or more | 3.8mm(0.15in) | 2-21 |
| | | 12A(3mm Width) | 6.9mm(0.27in) or more | 5.5mm(0.22in) | |
| | | 12A(6mm Width) | 5.8mm(0.23in) or more | 4.6mm(0.18in) | |
| | | 10A | 5.0mm(0.20in) or more | 4.0mm(0.16in) | |
| Side housing | Distortion | | | 0.04mm(0.0016in) | 2- 5 |
| | Wear | Side seal (*1) | | 0.10mm(0.0039in) | 2- 6 |
| | | Side seal (*2) | | 0.010mm(0.0004in) | |
| | | Oil seal | | 0.02mm(0.0008in) | 2- 7 |
| | Fretting | | | 0.07mm(0.0028in) | 2- 8 |
| | Corrosion | | | 0.20mm(0.0079in) | 2- 8 |
| Rotor housing | Difference in width | | | 0.06mm(0.0024in) | 2- 1 |
| | Corrosion | | | 0.5mm(0.02in) | 2- 4 |
| Rotor | | △R | 0.12 - 0.21mm (0.0047 - 0.0083in) | 0.1mm(0.004in) | 2-10 |
| | | △H | 0.10 - 0.15mm (0.004 - 0.006in) | 0.08mm(0.003in) | 2-10 |
| Eccentric shaft | | Run out | | 0.06mm(0.0024in) | 2-22 |
| Bearing clearance | | Rotor | 0.04 - 0.08mm (0.0016 - 0.0031in) | 0.10mm(0.0039in) | 2-22 |
| | | Main | 0.04 - 0.07mm (0.0016 - 0.0028in) | 0.10mm(0.0039in) | 2-23 |
| End play | | | 0.04 - 0.07mm (0.0016 - 0.0028in) | 0.09mm(0.0035in) | 2-25 |
| Chain adjuster protrusion | | New engine | | 13mm(0.51in) | 2-24 |
| | | Previous | | 12mm(0.47in) | |
| Compression pressure | | New engine (1 Distributor) | 7 - 9kg/cm² (100 - 128 lb/in²) | 6kg/cm² (85 lb/in²) | 1-12 |
| | | Previous (2 Distributors) | 6 - 7kg/cm² (85 - 100 lb/in²) | 5kg/cm² (71 lb/in²) | |
| Oil consumption | | | | 800km/liter (500mile/U.S. Qt) | 1- 2 |

*1: Outside of oil seal tracing mark *2: Inside of oil seal tracing mark

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