ENGINE

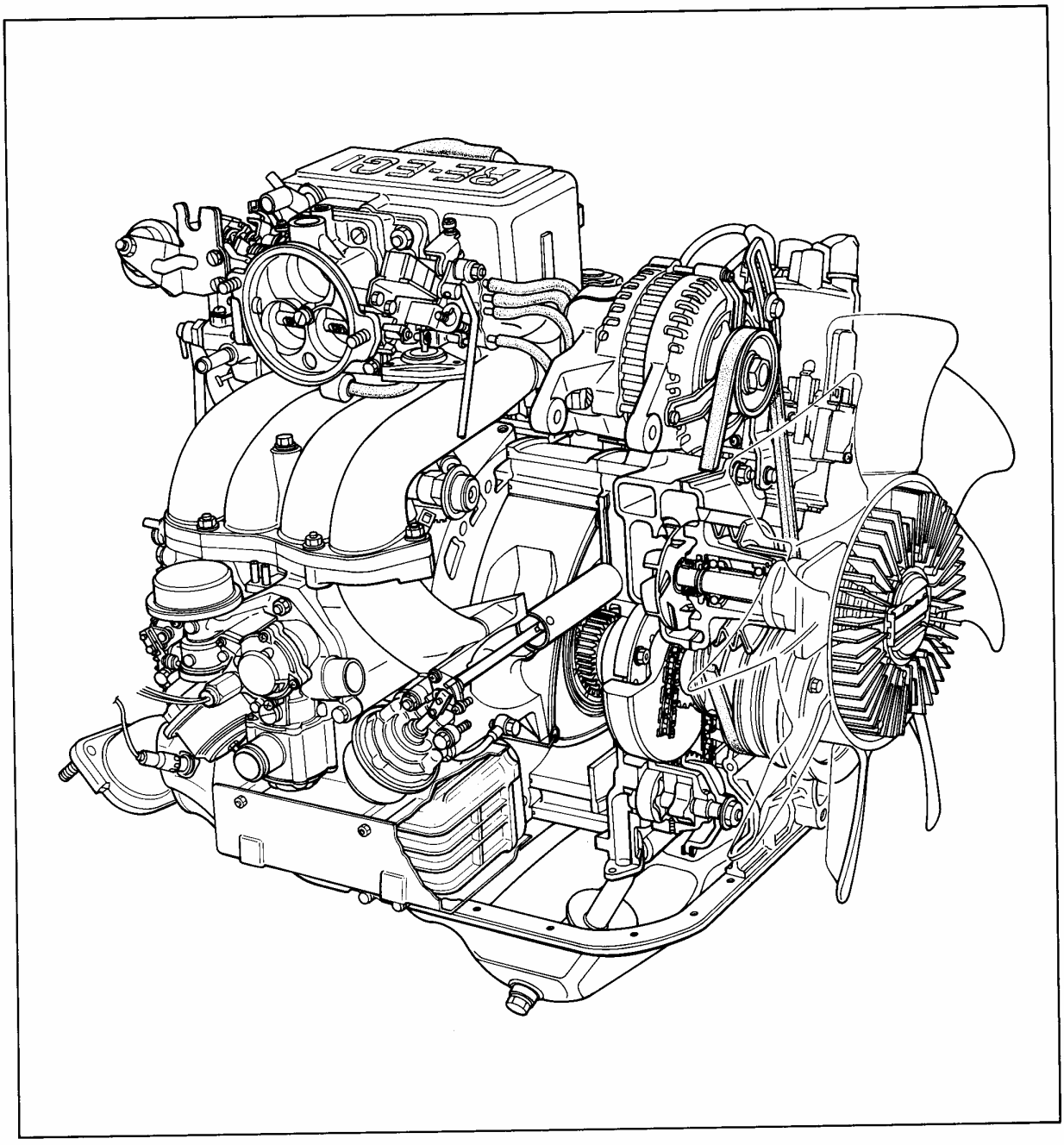
OUTLINE

OUTLINE OF CONSTRUCTION

- Two types of rotary engine have been equipped for the 1984 RX-7 models: the 13B and 12A engines.
- Ribs have been added to the rotor housing, and the plating of the rotor housing trochoid surface has been changed.
- The rotor has been coated with a special SM (soft material) seat.

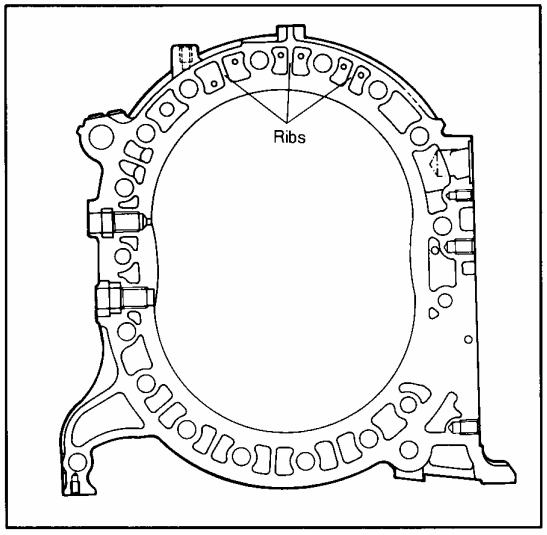
STRUCTURAL VIEW

13B engine



SPECIFICATIONS

Engine model				13B	12A
Type				Rotary engine	
Displacement cc (cu. in)				654 x 2 (40.0 x 2)	573 x 2 (35.0 x 2)
Number of cylinders and arrangement				2 rotors, longitudinal	
Combustion chamber type				Bath tub	
Compression ratio				9.4 : 1	9.4 : 1
Maximum power (HP/rpm)				135/6,000	101/6,000
Maximum torque (lb-ft/rpm)				133/2,750	107/4,000
Port timing	Intake	Open ATDC	Primary	32°	32°
			Secondary	32°	
			Auxiliary	45°	–
		Close ABDC	Primary	40°	40°
			Secondary	30°	
			Auxiliary	70°	–
	Exhaust	Open BBDC		71°	75°
		Close ATDC		48°	38°
Fuel supply system				EGI (Electronic gasoline injection)	Carburator
Ignition timing		Trailing		20° ATDC (RED)	20° ATDC (RED)
		Leading		5° ATDC (YELLOW)	0° TDC (YELLOW)
Idling rpm				800	750

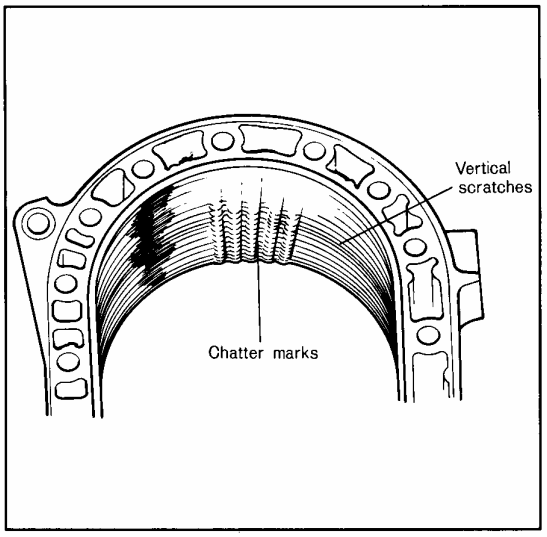


ROTOR HOUSING

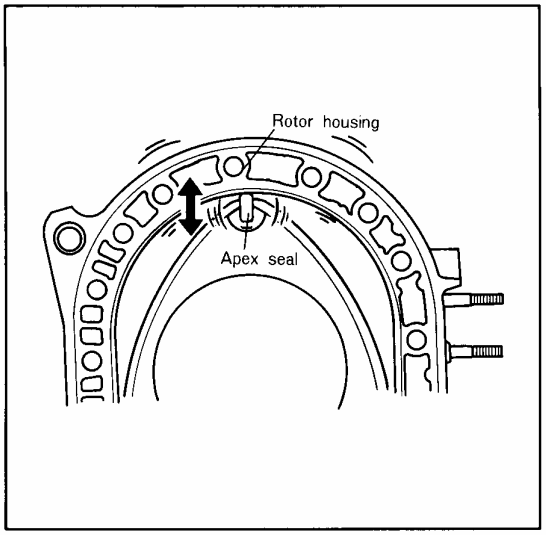
Addition of ribs (13B and 12A engines)

As shown in the figure at the left, ribs have been added at three places to the rotor housing.

The reason is to prevent vertical scratches and "chatter marks" on the rotor housing trochoid surface.



"Chatter marks" are the wavy, stepped wear which occurs on the rotor housing trochoid surface, and vertical scratches are, as their name indicates, scratches made by the apex seal in the rotor's direction of rotation.



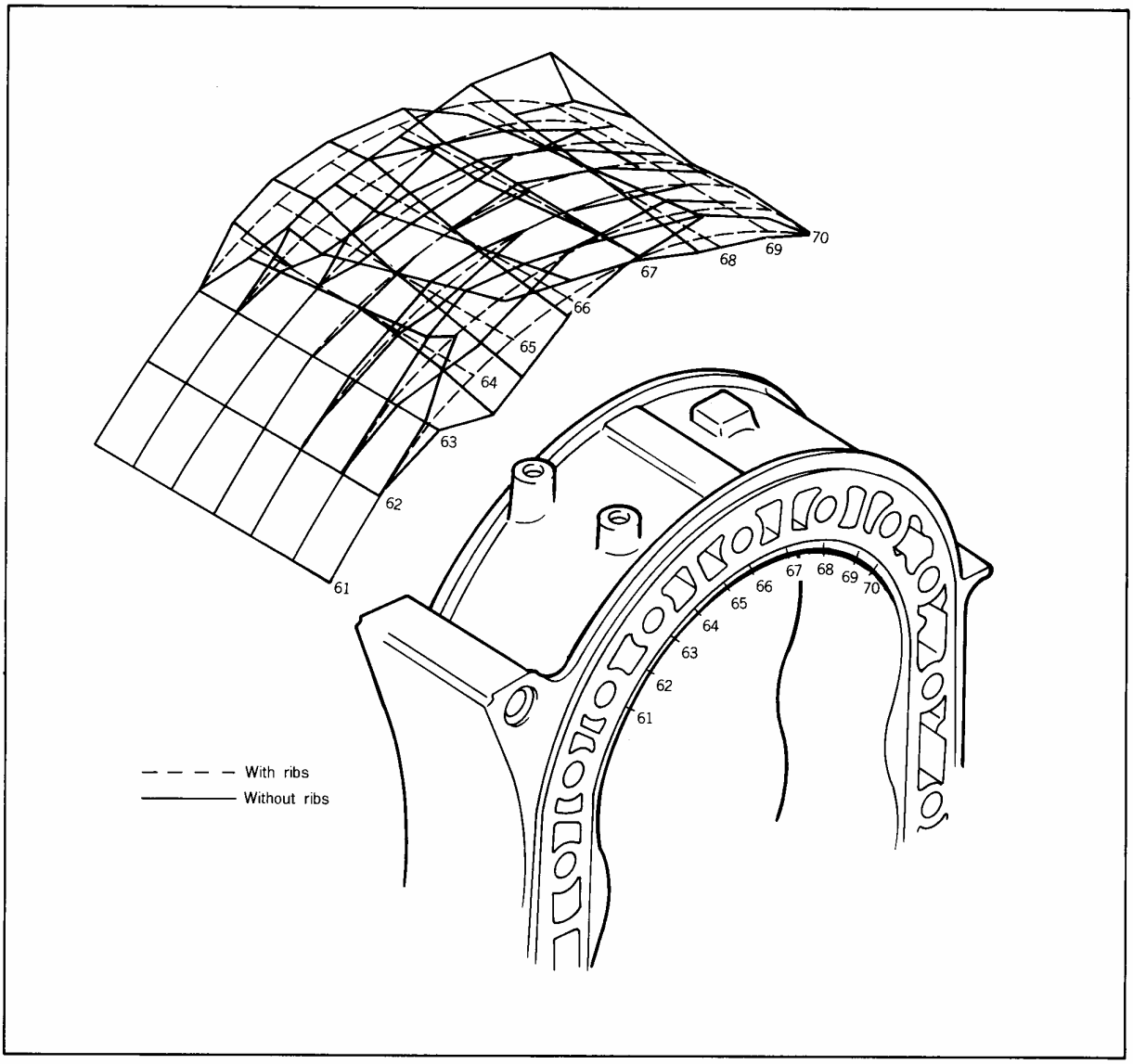
One of the primary causes of the chatter marks and vertical scratches, the sympathetic vibration (resonance) of the apex seal and rotor housing, was clarified by experiments.

This sympathetic vibration (resonance) is a result of the individual specific vibrations, which mutually amplify each other.

For the rotary engine, if there is resonance of the apex seal and the rotor housing, the apex seal beats against the rotor housing trochoid surface as it moves, with the result that such chatter marks and vertical scratches easily occur.

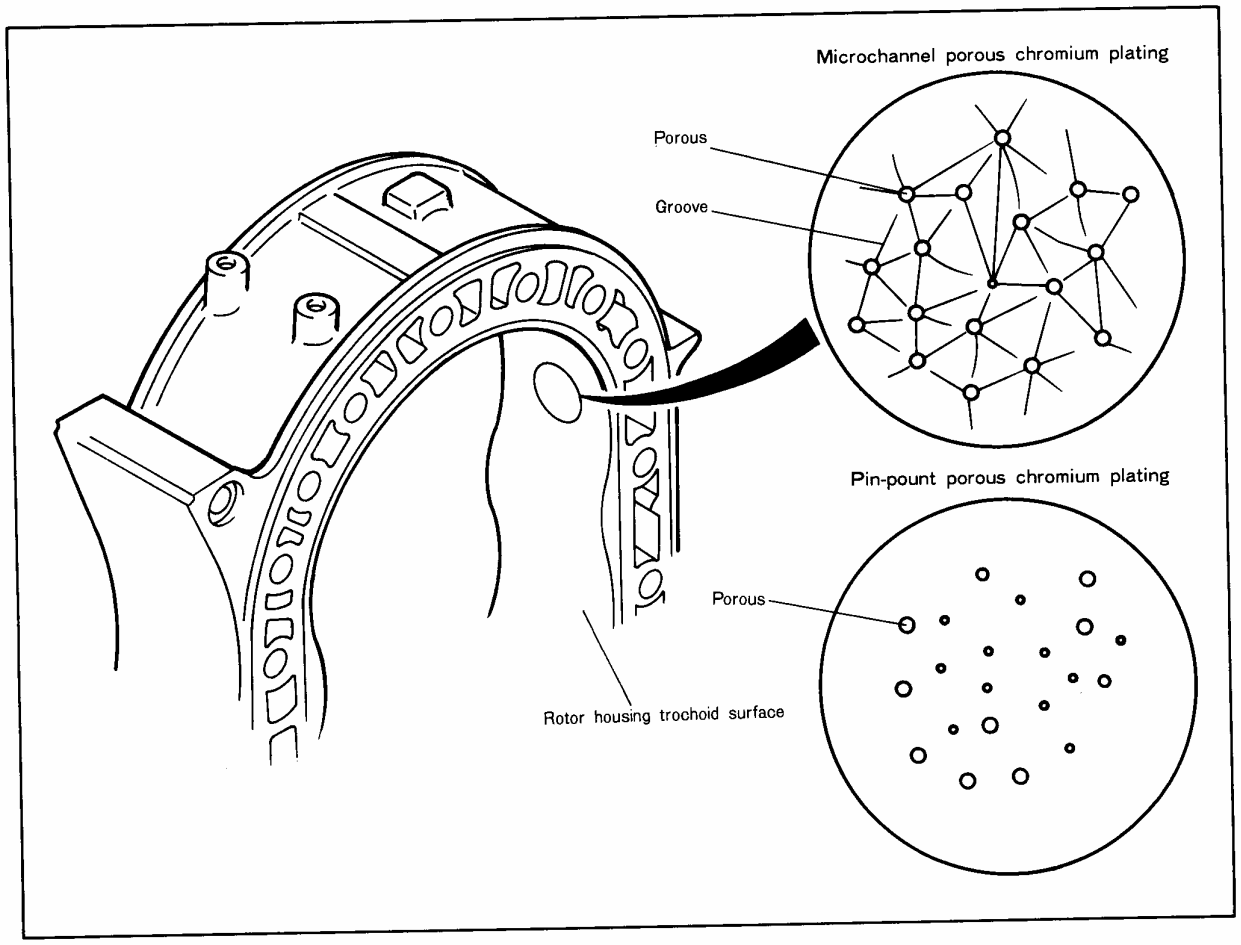
Structural analysis of the rotor housing

Thus, ribs have been added to the rotor housing and, by increasing the hardness, the specific vibration characteristic is changed, with the result that, during ordinary driving, resonance does not occur.
The figure below is an analysis of the construction of the rotor housing, with and without the ribs.
As can be clearly seen, there is little vibration for the rotor housing to which ribs have been added.

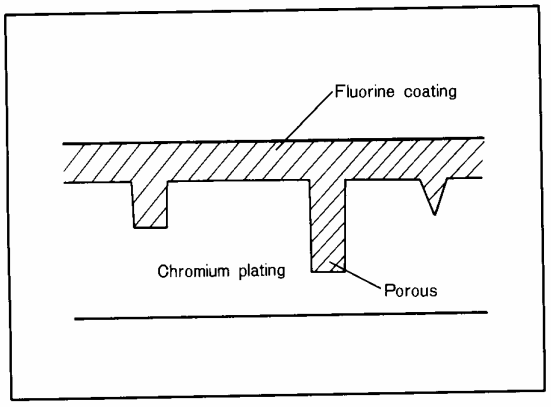


Plating changes of rotor housing trochoid surface (13B and 12A engines)

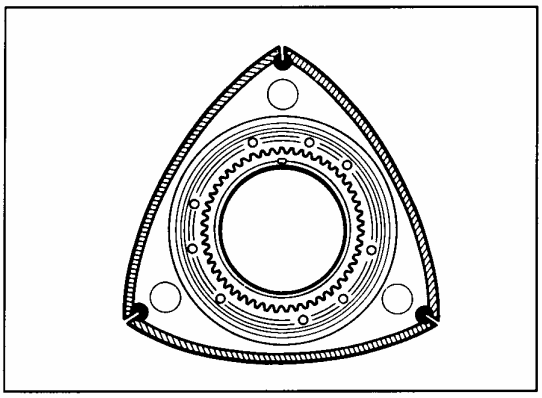
Microchannel porous chromium plating
The plating of the rotor housing trochoid surface has been changed from pin-point porous chromium plating to microchannel porous chromium plating.



The objectives of microchannel porous chromium plating are to improve the oil retention of the rotor housing trochoid surface and to prevent chatter marks and vertical scratches caused by the apex seal. And, in addition, the plating hardness is increased by 20%, thus improving the durability of the rotor housing.

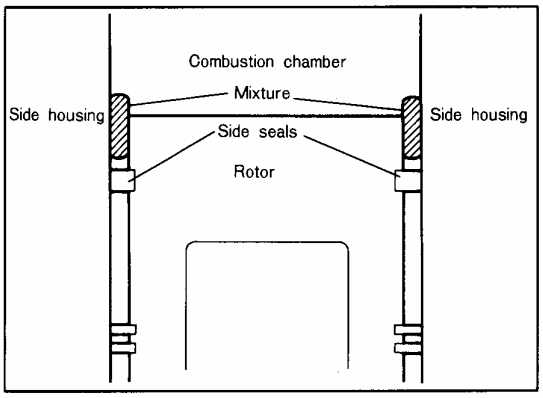


Fluorine coating (13B engine only)
For the 13B engine, a fluorine coating is applied to the rotor housing trochoid surface after the microchannel porous chromium plating process. This coating results in a great improvement in the initial seating between the apex seals and the rotor housing.

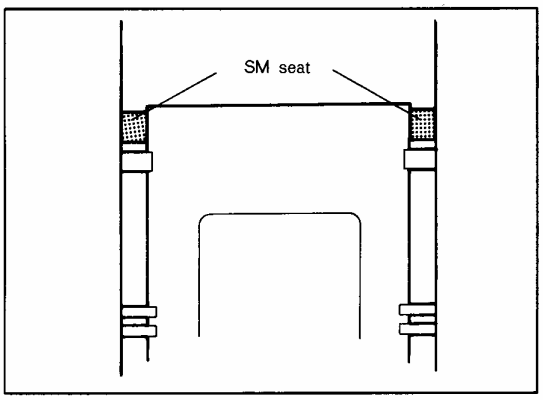


ROTOR

SM (soft material) seat (13B and 12A engines)
In order to reduce the amount of incombusted gases, a SM (soft material) seat is coated on the outer side of the rotor side seal (shown by the shaded area in the figure at the left). This SM (soft material) seat is made of a special resin, and is baked on at high temperature.



For the former rotor, the mixed gases (HC) in the shaded areas in the figure at the left were not completely burned, because of the low surrounding temperature, and were exhausted to the catalyst converter where they were oxidized.

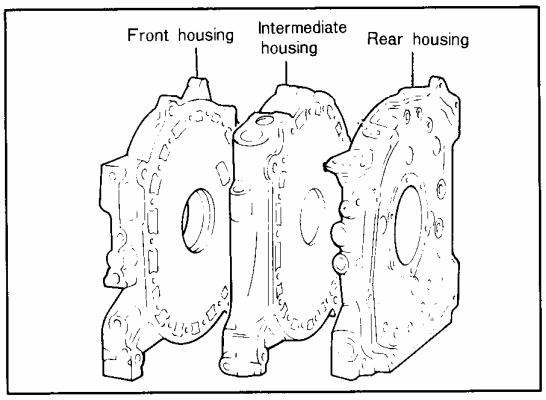


In order to even further improve the exhaust gas performance therefore, this SM (soft material) is coated, thus preventing mixture from reaching the zone where combustion is difficult, and thereby preventing the generation of incombusted gases.

Service point
Do not use a wire brush or similar tool for cleaning the SM (soft material) seat, because it will scrape off the coating.

ENGINE DEVELOPMENT

The RX-7 equipped with the 12A rotary engine was placed on sale in October of 1978. Its styling and driving safety, matched by its engine performance, soon won for it a high reputation, a reputation which is still just as high today.
To this model, the 13B EGI (Electronic Gasoline Injection) engine has been added for 1984.
We want to take this opportunity to briefly outline the development of the 12A rotary engine.
The following is the chronological order of that development.

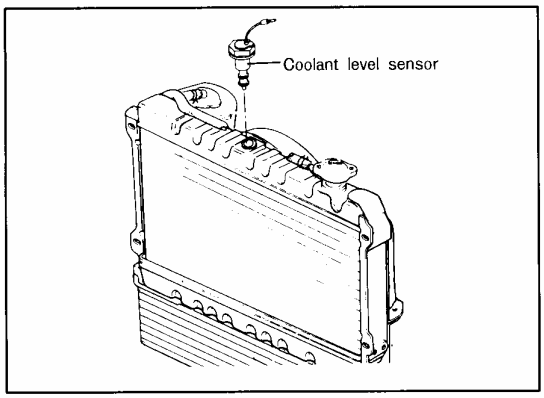


1979 MODELS

FRONT HOUSING, INTERMEDIATE HOUSING AND REAR HOUSING

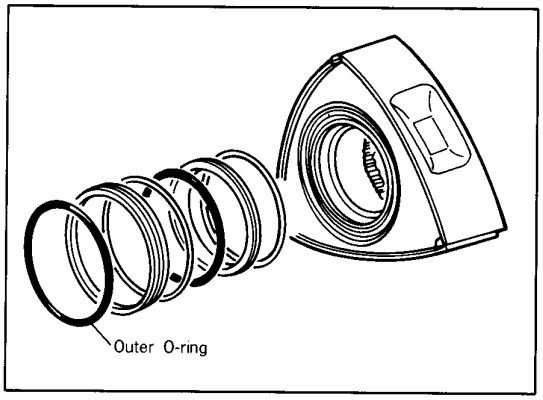
To prevent wear of the oil seal, corner seal and side seal, the REST (Rotary Engine Surface Treatment) process was used on the front housing, etc.

In the REST process, the surfaces of the front housing, etc., were subjected to nitrogen gas treatment in a special, high-temperature oven in order to harden these surfaces.



ENGINE COOLANT LEVEL SENSOR

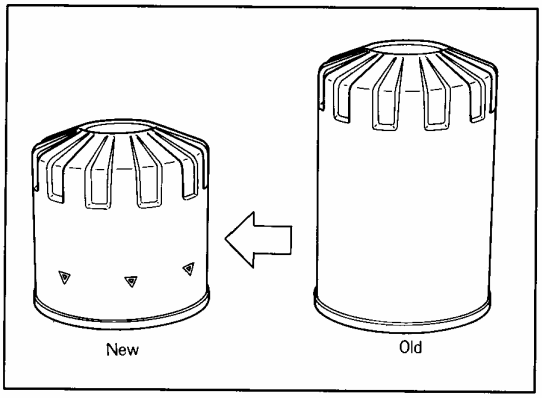
An engine coolant level sensor was equipped at the upper part of the radiator, and a warning light was installed in the instrument panel, in order to warn the driver of a drop in the amount of engine coolant and thus to prevent engine overheating.



1980 MODELS

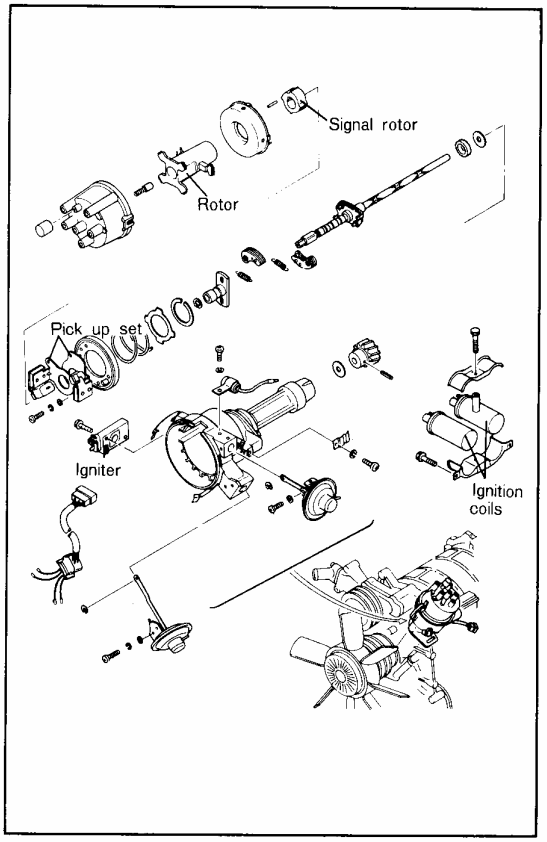
OUTER "O"-RING (rotor)

The material of the outer O-ring was changed from silicone rubber to a fluoric rubber with outstanding heat-resistance properties, thus improving the durability of the O-ring.



OIL FILTER CARTRIDGE

The length of the oil filter cartridge was changed from 120 mm to 80 mm, and the oil capacity was changed from 0.4 liters to 0.3 liters, thus reducing weight.

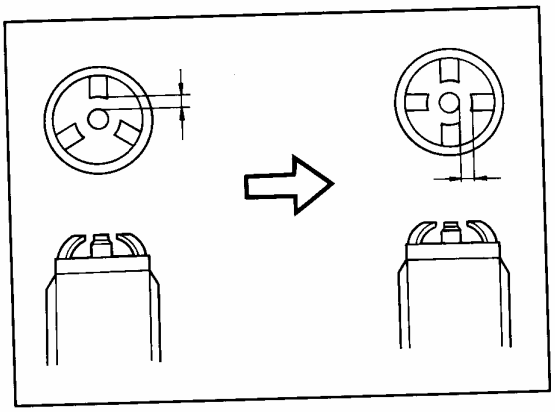


IGNITION SYSTEM

Distributor and Ignition Coil

The high energy ignition system is adopted to:
increase the ignition ability.
improve fuel economy.
improve starting ability.
improve reliability.

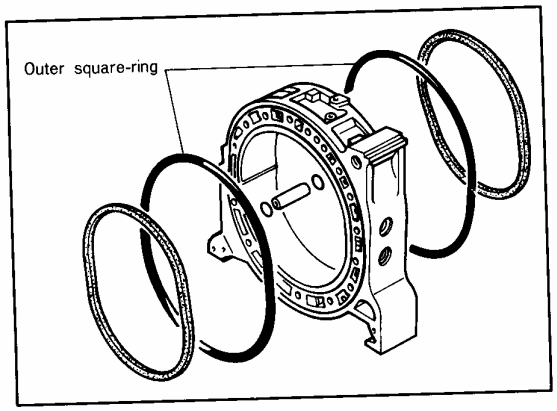
Item \ Model		1981	1980
Breaker type		Pointless (igniter)	Point
Ignition coil	Primary resistance	1.15 Ω	1.4 Ω
	Secondary resistance	10.2 kΩ	9.3 kΩ
	Resistor resistance	—	1.6 Ω



1981 MODELS

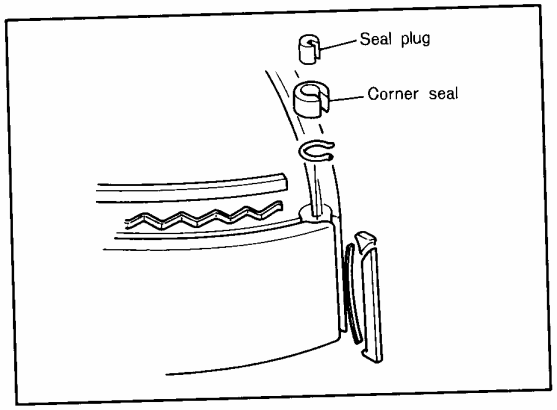
SPARK PLUGS

For easier sparking, the 4-pole ground electrode type of spark plugs were adopted, thereby reducing uncombusted gases and protecting the catalyst.



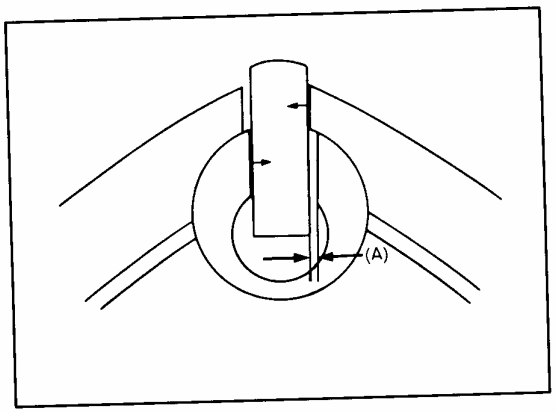
OUTER SQUARE RING (rotor housing)

The material of the outer square ring was changed from E619 to E680, thus improving the durability of the outer square ring.

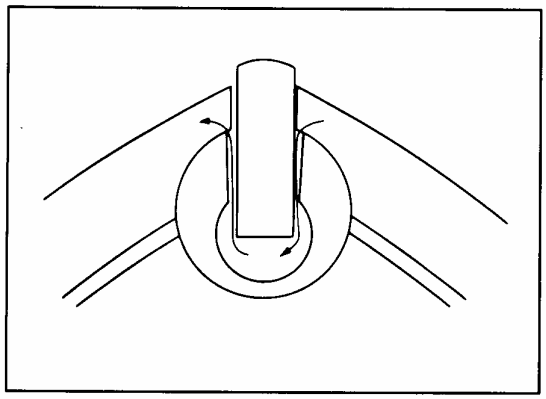


CORNER SEAL PLUG

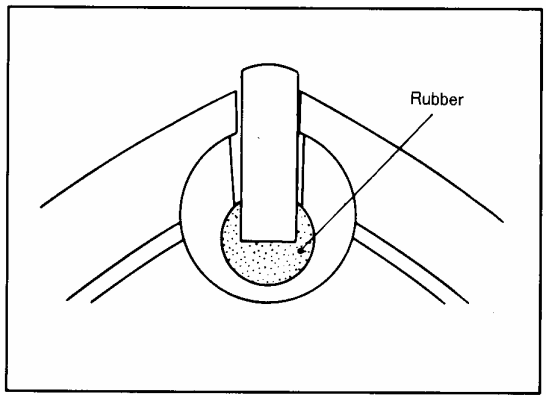
1. A corner seal plug was added inside the corner seal, thus reducing the gas leakage from the gap between the apex seal and the corner seal.



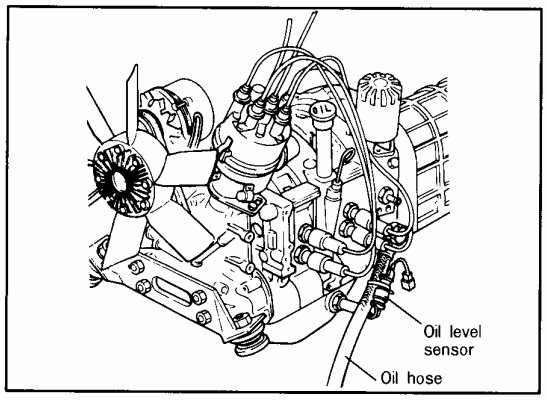
2. If the gap (A) between the apex seal and the corner seal is reduced to a certain value or less, the apex seal would be pressed on both the rotor groove and the corner seal, movement would be hindered, and the seal's performance would be reduced.



3. For that reason, it was necessary that the width of the groove of the apex seal used on the corner seal be greater than the groove in the rotor. But by doing so, a gap between the groove of the apex seal of the corner seal and the apex seal itself developed at both sides of the seal, and gases could easily escape from these gaps.

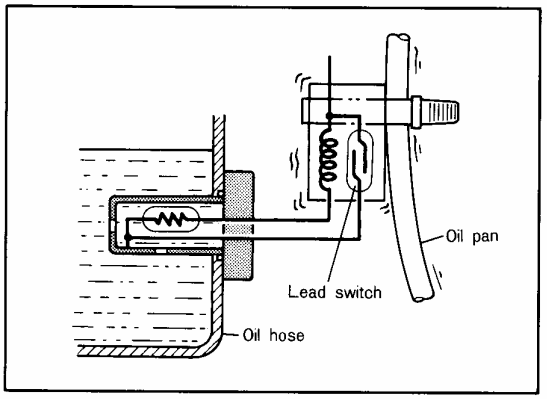


4. In order to prevent this, a rubber seal was added to the corner seal, as shown in the figure. This seal acted, without cramping the apex seal even if there was a slight manufacturing error of the groove width or the seal width, to maintain constant contact and to maintain airtightness. As a result, fluoric rubber, with outstanding resilience and excellent heat-resistance properties, is used.

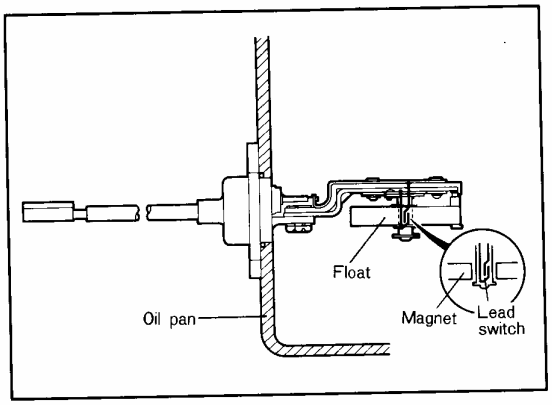


OIL LEVEL SENSOR

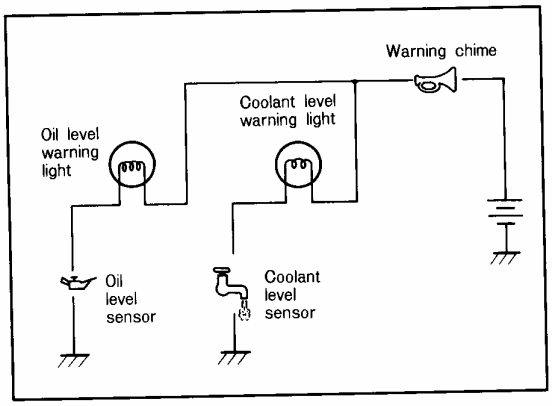
1. The oil level sensor was changed from the thermistor type to the float type, thus improving performance.



2. The lead switch of the thermistor type was clamped to the oil hose, with the result that engine vibrations were transmitted through the lead wiring to the lead switch, causing incorrect operation.



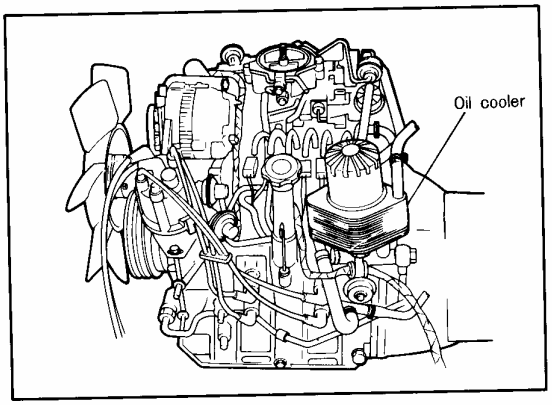
3. The float type has a magnet inside the lead switch, thus improving performance resulting from engine vibration.



1982 MODELS

ENGINE COOLANT LEVEL AND ENGINE OIL LEVEL WARNING CHIME

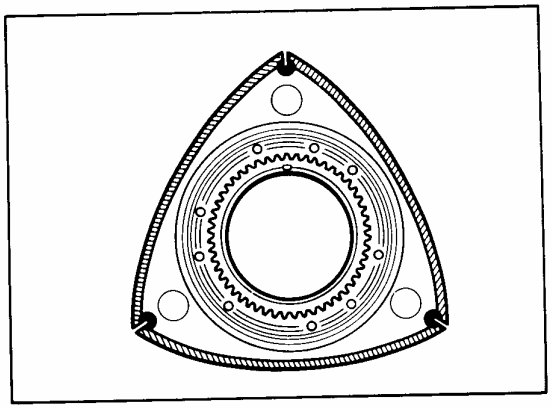
Formerly, a warning light was used, but a warning chime was added in order to increase the warning effect and capability.



1983 MODELS

OIL COOLER

A water-cooled oil cooler was adopted to reduce weight.



ROTOR

In order to reduce the amount of incombusted gases, a SM (soft material) seat is coated on the outer side of the rotor side seal (shown by the shaded area in the figure at the left). This SM (soft material) seat is made of a special resin, and is baked on at high temperature.