SHOP MANUAL

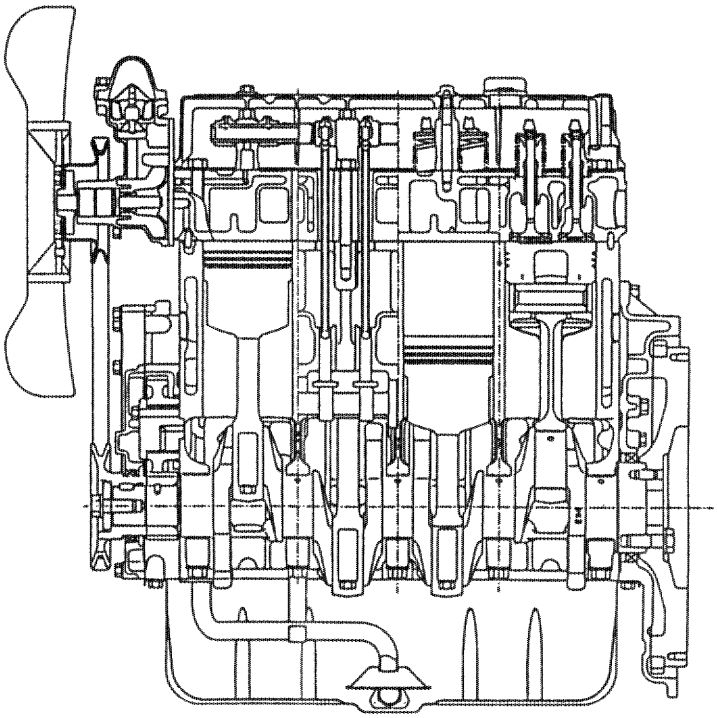
4D92E, 4D94E, 4D98E

DIESEL ENGINE

ENGINE MODEL	MACHINE MODEL	
4D92E	**FD10/14/15/18-16**	**622001 and up**
4D94E	**FD20/23/25/28/30-12**	**538001 and up**
4D98E	**FD20H/25H/30H-12**	**538001 and up**

0.3 Sectional View of Engine 2

Horizontal Sectional View of 4D92E/4D94E/4D98E Engine



1.5 Oversize pistons

The oversize pistons (including rings) in the sizes listed below are available for measuring cylinders and pistons during engine overhauling. (See 3.4, Cylinder Blocks.)

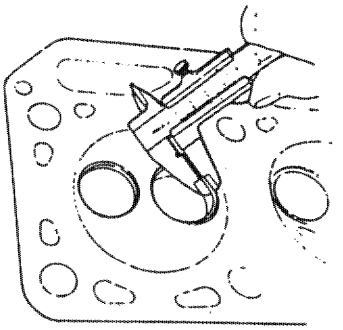
1. 4D92E	Standard	0.25S	0.50S	1.00S
Piston assembly	YM129904-22080	YM129904-22900	YM129904-22920	YM129904-22940
├ Piston	YM129904-22010	YM129904-22700	YM129904-22720	YM129904-22740
└ Ring assembly	YM129904-22050	YM129904-22950	YM129904-22970	YM129904-22990
├ 1st ring	YM129904-22100	YM129904-22750	YM129904-22850	YM129904-22650
├ 2nd ring	YM129904-22110	YM129904-22760	YM129904-22860	YM129904-22660
└ Oil ring	YM129904-22200	YM129904-22770	YM129904-22870	YM129904-22670
Applicable head gasket	YM129901-01331	YM129901-01331	YM129901-01331	YM129901-01331

2. 4D94E	Standard	0.25S	0.50S	1.00S
Piston assembly	YM129901-22080	YM129901-22900	YM129901-22920	YM129901-22940
├ Piston	YM129901-22010	YM129901-22700	YM129901-22720	YM129901-22740
└ Ring assembly	YM129901-22050	YM129901-22950	YM129901-22970	YM129901-22990
├ 1st ring	YM129901-22100	YM129901-22750	YM129901-22850	YM129901-22650
├ 2nd ring	YM129900-22110	YM129900-22760	YM129900-22860	YM129900-22660
└ Oil ring	YM129900-22160	YM129900-22770	YM129900-22870	YM129900-22670
Applicable head gasket	YM129901-01330 (Sandard)		YM129901-01340	

3. 4D98E	Standard	0.25S	0.50S	1.00S
Piston assembly	YM129903-22080	YM129903-22900	No setting specified	
├ Piston	YM129903-22010	YM129903-22700		
└ Ring assembly	YM129903-22050	YM129903-22950		
├ 1st ring	YM129902-22100	YM129903-22750		
├ 2nd ring	YM129902-22110	YM129902-22760		
└ Oil ring	YM129902-22160	YM129902-22770		
Applicable head gasket	YM129903-01330	YM129903-01330		

b) Measurement of seat width

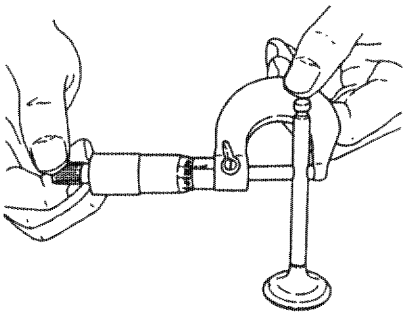
mm (in)		Standard	Limit
Width	Intake	**1.3 (0.051)**	**2.0 (0.079)**
	Exhaust	**2.2 (0.087)**	**3.0 (0.118)**

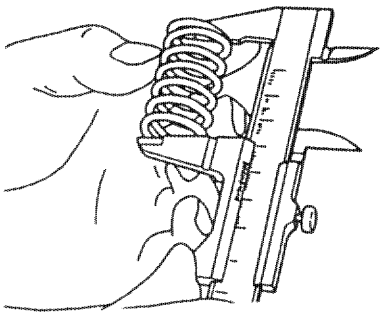


(ii) Intake/exhaust valve and valve guide

1) When the intake/exhaust valve shaft is bent or greatly worn, replace it together with the valve guide.
2) Measurement of the outer diameter of the valve shaft and inner diameter of the valve guide

mm (in)		Standard	Limit
Intake	Valve O.D.	**7.965 – 7.980 (0.3138 – 0.3144)**	**7.915 (0.312)**
	Guide I.D.	**8.015 – 8.030 (0.3158 – 0.3164)**	**8.100 (0.319)**
	Clearance	**0.035 – 0.065 (0.001 – 0.003)**	**0.185 (0.007)**
Exhaust	Valve O.D.	**7.955 – 7.970 (0.313 – 0.314)**	**7.905 (0.311)**
	Guide I.D.	**8.015 – 8.030 (0.3158 – 0.3164)**	**8.100 (0.319)**
	Clearance	**0.045 – 0.075 (0.002 – 0.003)**	**0.195 (0.008)**

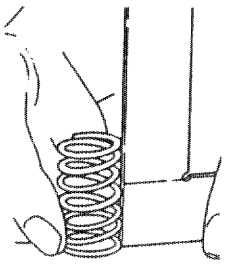


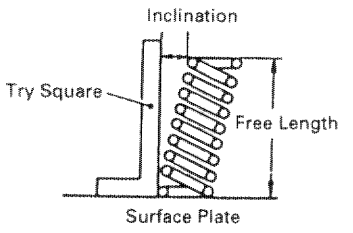


(iii) Valve spring

1) Replace it if it has any abnormality such as damage, corrosion.
2) Measurement of free length, inclination, and spring tension

	Standard	Limit
Free length mm (in)	**47.5 (1.872)**	–
Inclination mm (in)	–	**1.2 (0.047)**
1 mm (0.04 in) compression load N (kgf)<lb>	**22.1 (2.257)<4.977>**	–

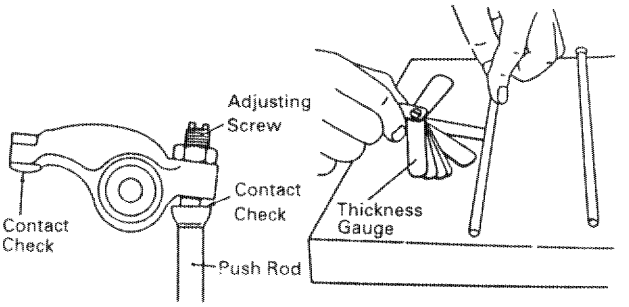




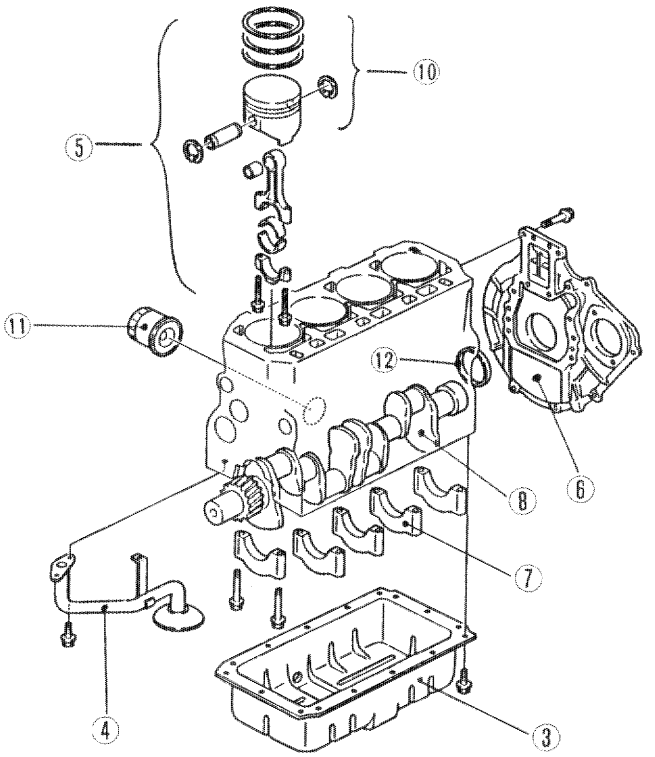
(iv) Locker arm, shaft, spring, push rod, valve head protector, and valve clearance adjusting screw

1) Replace them if they have any abnormality such as damage, corrosion. Pay additional attention to the contact area between the locker arm and valve head protector, corrosion and damage of the spring, bent of the push rod, and contact of both ends.

Bent of Push Rod	
Standard mm (in)	**0.03 (0.001) or less**



(2) Disassembly and Assembly of Cylinder Block



(3) Disassembly Procedure

Disassemble in order of the numbers shown in the drawing.

① Take the cylinder head disassembly procedural steps ① through⑪.
② Take the gear train disassembly procedural steps ① through ⑫.
③ Remove the oil pan. (Note 1)
④ Remove the lubricant suction pipe.
⑤ Remove the piston W/rod. (Note 2)
⑥ Remove the flywheel housing. (Note 3)
⑦ Remove the metal cap. (Note 4)
⑧ Remove the crank shaft. (Note 5)
⑨ Remove the tappet.
⑩ Remove the piston pin and ring. (Note 6)
⑪ Remove the oil filter assembly. (Note 7)
⑫ Remove the oil seal from the flywheel housing. (Note 8)

(4) Assembly Procedure

Assemble in the reverse order of disassembly.

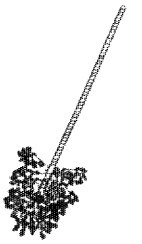
(6) Honing

1) When satisfactory repair cannot be done only by honing, judging from the conditions of local eccentric wear, damage, and so on, perform boring first.

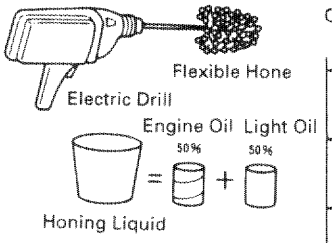
2) Prepare a flexible hone (code No. 129400-92430), electric drill, and honing liquid (mixed liquid of the engine oil and light oil).

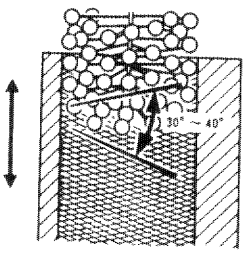
3) Apply the honing liquid to the flexible hone. Running the electric drill at 300 to 1,200 rpm, insert it into the cylinder bore and move up and down the flexible hone to hone the cylinder bore at 30 to 40°.

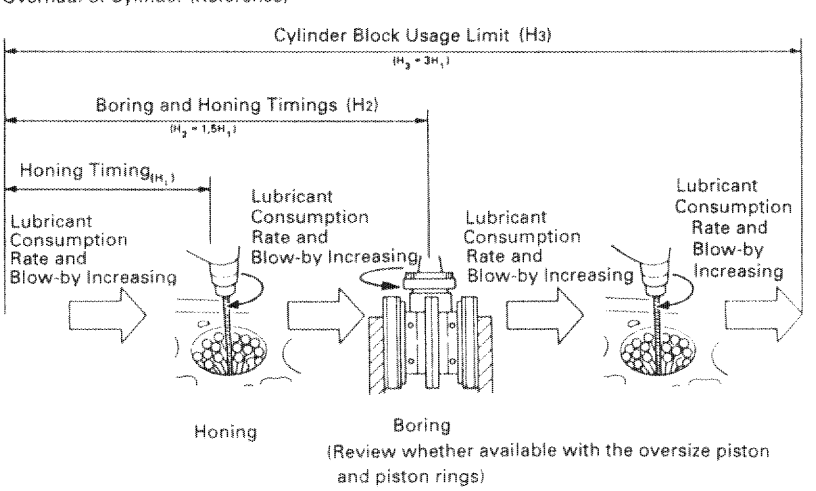
IMPORTANT 1) Do not run the drill at a higher rpm because it will lead to a breakage.
2) Do not put in/out the flexible hone in its stopping state.
The cylinder will be damaged.
3) Each grinding allowance should be about 1/1,000 mm (1/25,000 in).



Flexible Hone





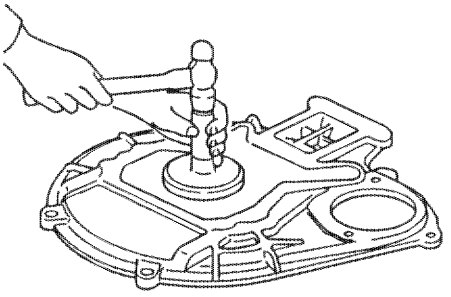


(7) Replacement of Cam Shaft Bushing and Connecting Rod Bushing

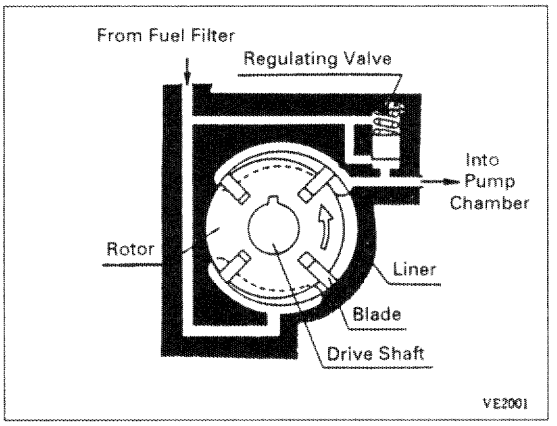
Replace them by using their respective special purpose tools.

(8) Replacement of Oil Seal

1) Draw out the used oil seal.
2) Use an oil seal inserting tool to set a new oil seal.
3) Apply lithium grease.

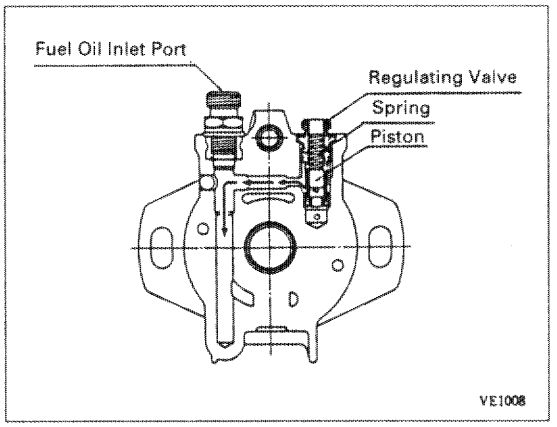


FUEL INJECTION/SPEED CONTROLLER SYSTEM



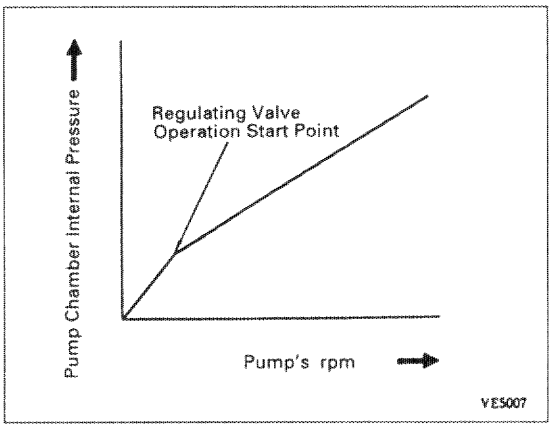
Feed Pump(Vane Type)

The feed pump is to pump up the fuel oil from the tank and feeds it into the pump chamber.
The feed pump consists of the rotor, blades, and liner. The rotor is driven by the drive shaft. The liner is set eccentrically to the rotation center of the rotor and there are four blades between the rotor and liner. When the rotor starts rotating, the blades are pushed against the inner wall of the liner by a centrifugal force and the volume of each chamber changes according to rotation.
Therefore, when the volume of this chamber increases, the fuel oil is pumped up from the fuel tank, and when it decreases, the fuel oil is compressed and fed into the pump chamber.



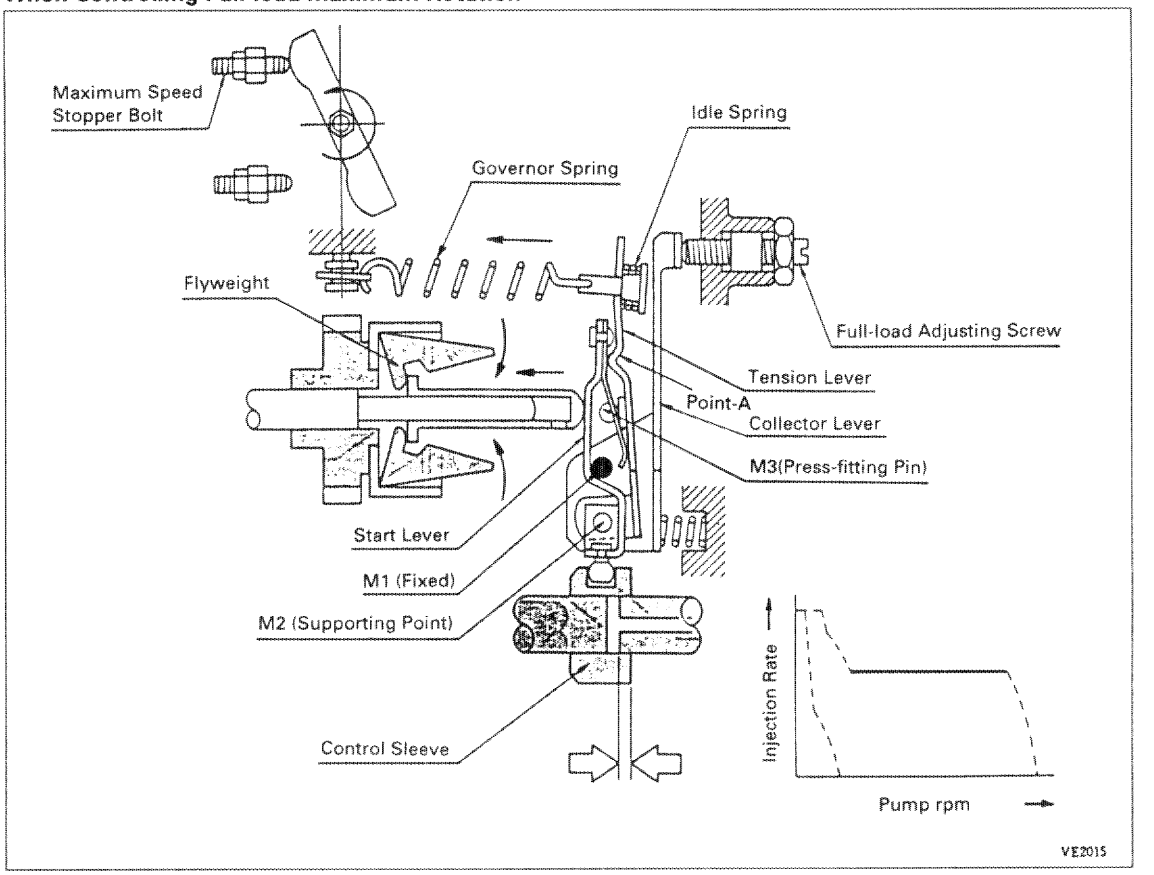
Regulating Valve

The regulating valve is to regulate the oil feed pressure of the feed pump so that the fuel oil pressure in the pump chamber will be always within a specified pressure range.
When the rpm of the injection pump increases and the oil feed pressure of the feed pump becomes higher, the fuel oil compresses the regulating valve spring to push up the piston. Then, the fuel oil is returned to the intake side of the feed pump as indicated by the arrows in the left figure.
Therefore, the pump chamber internal pressure can be regulated by changing the setting force of the regulating valve spring.



The left figure shows an example of the relations between the pump's rpm and pump chamber internal pressure. A hydraulic timer controls the injection timing by directly making use of this pump chamber internal pressure.

When Controlling Full-load Maximum Rotation



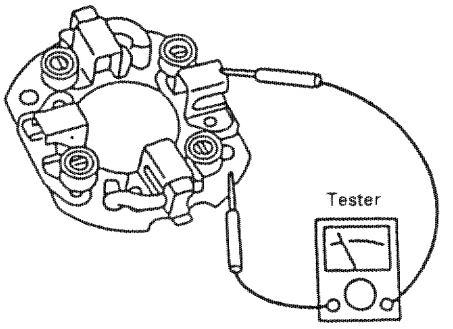
When the accelerator pedal is fully pressed and the control lever comes into contact with the maximum speed stopper bolt, the tension of the governor spring is maximized and the tension lever is fixed at a position where the press-fit pin M3 comes into contact with the pump housing.

When this is done, the idle spring is also completely contracted, the start lever and tension lever are integrated at the point-A, and the control sleeve is kept at a full-load position. At this time, the fly-weight is pushed by the governor sleeve and fully closed.

STARTING SYSTEM

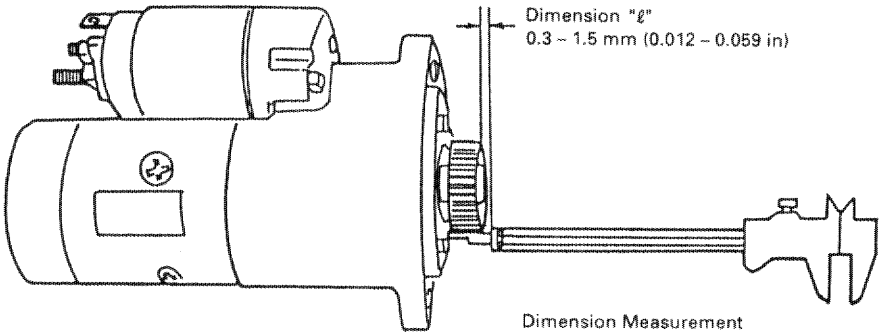
(c) Checking brush movement
When the brushes do not work properly, check whether or not the brush holder is bent or its slideway is dirty. If necessary, repair and clean.

(d) Checking for continuity between the brush holder and grounding.
Check for continuity between the insulated brush holder (⊕) and brush holder assembly base (⊖, grounding). If there is continuity, replace the brush holder, because it is grounded.



Brush Holder Grounding Test

7.5 Pinion Push-out Position by Magnetic Switch

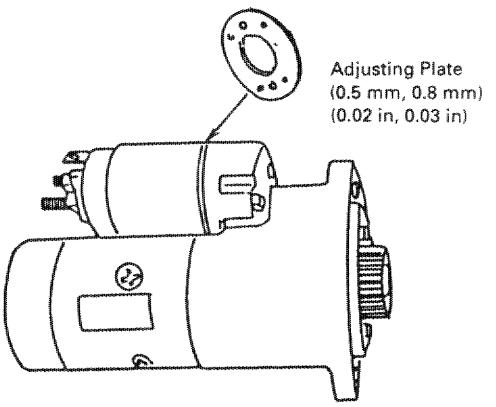


Dimension Measurement

ℓ=0.3 – 1.5 mm (0.012 – 0.059 in)

- When the pinion is pushed out by the magnetic switch, a pinion's stroke ℓ in the thrust direction (gap between a pinion stopper and clutch inner) is normally as mentioned above. Using slide calipers or depth gauge, measure the difference between the nose position of the pinion when the plunger is sucked in and the pinion is pushed out by the shift lever, and when the pinion is pulled out in the arrow-indicated direction by fingers. This becomes the dimension ℓ.

- When the dimension ℓ is beyond the above-mentioned limits, insert an adjusting plate to adjust as shown in the figure. There are two kinds of adjusting plates; 0.5 mm (0.02 in) and 0.8 mm (0.03 in) thick.



Adjusting Plate Inserting Position

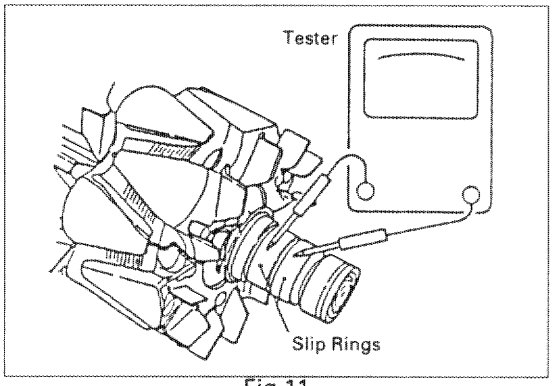


Fig.11

c) Rotor coil continuity test
Use a tester to check for continuity between the slip rings.

<When there is no continuity>
The rotor coil is disconnected.
Replace the rotor.
Rotor coil resistance: 3.45Ω at 20°C

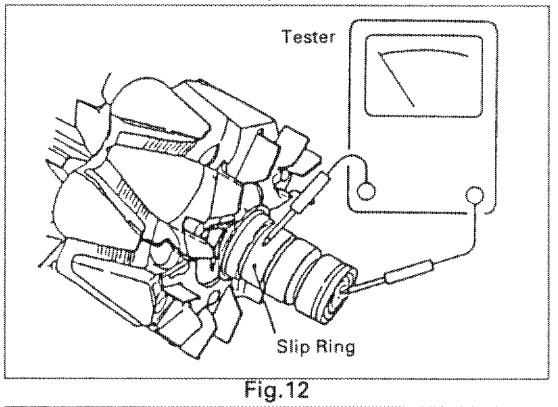


Fig.12

d) Rotor coil insulation test
Use a tester to check for continuity between the slip ring and rotor core or shaft.

<When there is continuity>
The rotor coil is short-circuited.
Replace the rotor.

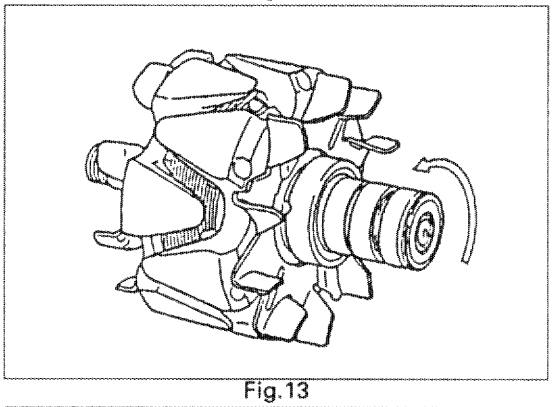


Fig.13

e) Checking the ball bearing
Check the ball bearing on the rear side. If it does not rotate smoothly or emits an abnormal sound, replace the ball bearing.

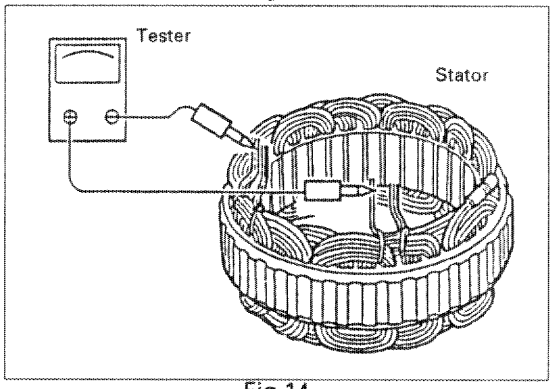
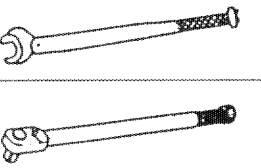
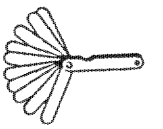
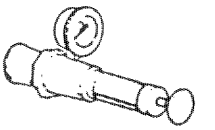
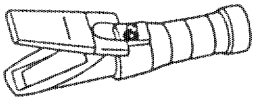
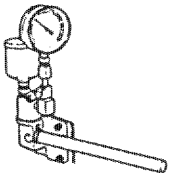
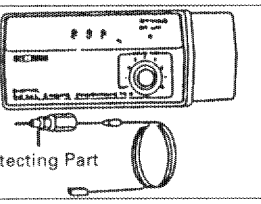
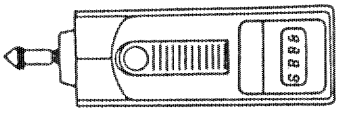
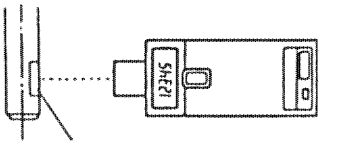


Fig.14

(3) Stator
a) Stator coil continuity test
Use a tester to check for continuity between each terminal of the stator coil.

<When there is no continuity>
The stator coil is disconnected.
Replace the stator.
Stator coil resistance:
0.108Ω/phase at 20°C
0.216Ω between U and V

No.	Tool Name		Application	Sketch
10	Torque wrench		This is used to tighten bolts and nuts by a specified torque.	
11	Thickness gauge		This is to measure a gap between a ring and a ring groove, that of a shaft joint, and so on.	
12	Cap tester		This is to check for a leak of pure water.	
13	Battery coolant tester		This is to check density of an antifreezing solution and the charging condition of battery liquid.	
14	Nozzle tester		This is to check the spraying condition and injection pressure of the fuel injection valve.	
15	Digital thermometer		This is to measure a temperature at each part.	 Detecting Part
16	Tachometer	Contact type	This is brought into contact with the mortise of the rotating shaft to measure rpm.	
		Photoelectric type	Affix a reflection mark to the outer circumference of the rotating part to measure rpm.	Rotating Part  Reflection Mark