FOREWORD

This shop manual contains the specifications, construction, operation, adjustment and service procedures of the Model D6B diesel engine for service mechanics engaged in servicing of the Hyundai diesel engines.

Please make the most of this shop manual to perform correct servicing and wasteless operations.

Note that some of the contents of this shop manual are subject to change owing to improvements, etc. that may be introduced after publication of the shop manual.

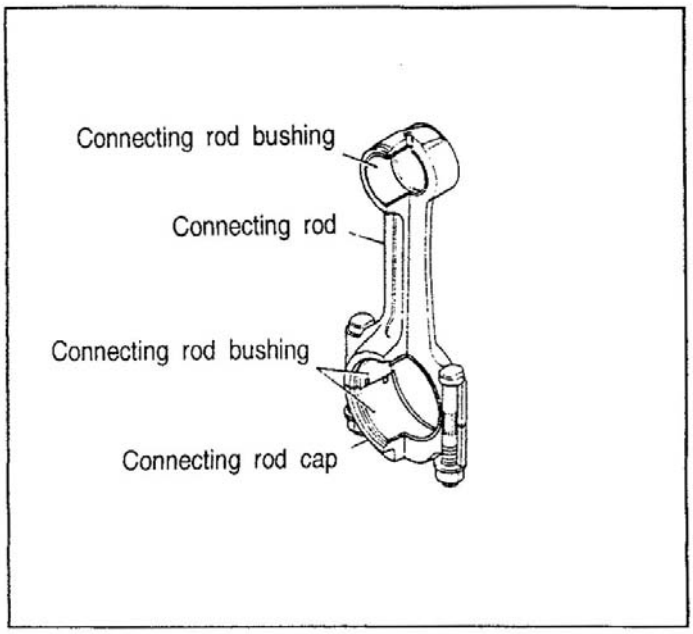
Printed in Korea

HYUNDAI MOTOR COMPANY
INDUSTRIAL ENGINE ENGINEERING DEP'T

Cooling

Item		Specification	
Cooling system		Water-cooled, forced circulation type	
Cooling water quantity (engine proper)		Approx. 13 lit.	
Water pump	Type	Centrifugal type	
	Drive system	V-belt drive	
V-belt	Type	Low edge cog B type	
	Quantity	2	
Thermostat	Type	Wax pellet bottom bypass type	
	Valve opening temperature	76.5℃	
Fan	Type	Polypropylene pusher type	[Option] Polypropylene suction type

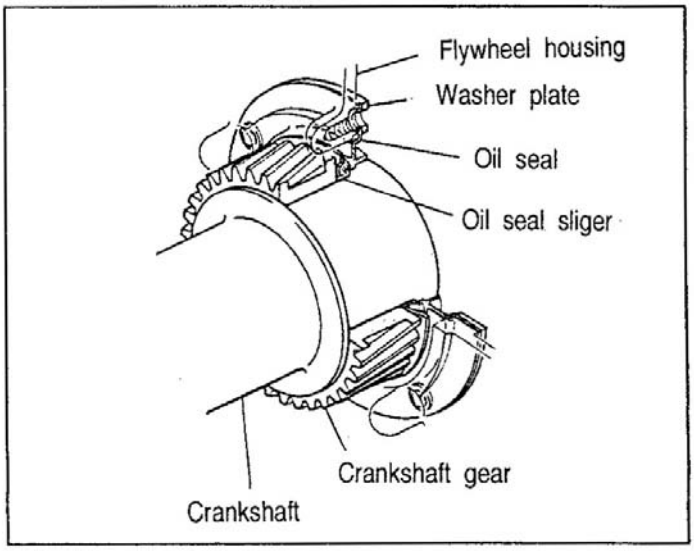
(5) Connecting Rod, Connecting Rod Bearing



The connecting rod is an I-section stamp forging ensuring high rigidity. A lead bronze bushing is press-fitted into the small end. the connecting rod bearing for the big end is a split-style plain bearing. This bearing is soft steel backed kelmet metal, the inside surface of which is plated with an alloy of lead, tin and copper. The whole bearing is then plated with tin.

(6) Crankshaft and Main Bearing

(a) Crankshaft



The crankshaft is a rigid die forging integral with the balance weight.

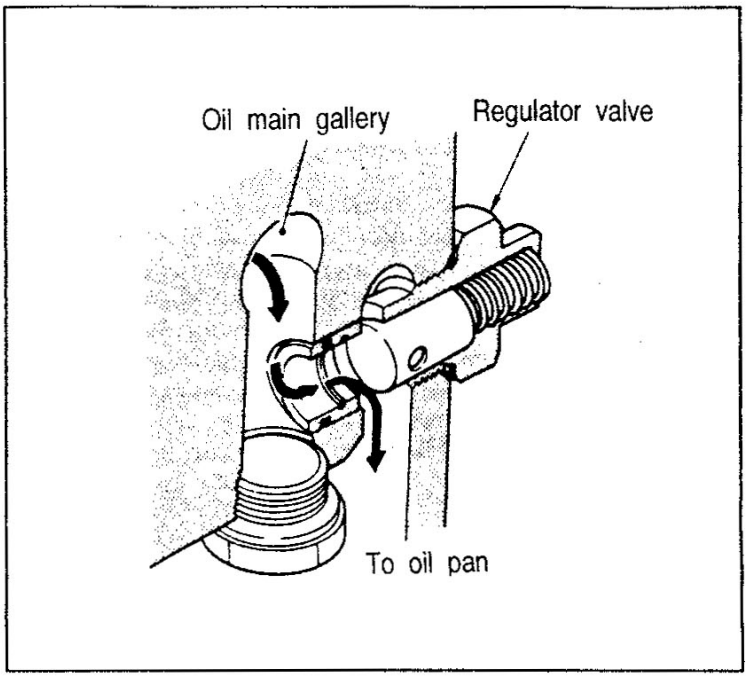
The pin and journal are induction hardened for higher resistance to wear. An oil hole in each journal is aligned with that in pin, feeding some of the main bearing lubricating oil to the pin for lubricatin of the connecting rod bearing

An oil seal is provided at the front and rear of the crankshaft. The one in the rear is the axial lip type.

(4) Regulator Valve

Located at the bottom of the injection pump on the left side of the crankcase, the regulator valve regulates the pressure of the engine oil which flows through the oil filter and oil cooler into the oil main gallery.

If the oil pressure of the oil main gallery exceeds specification, the valve of the regulator valve will open to return some of the engine oil to the oil pan.

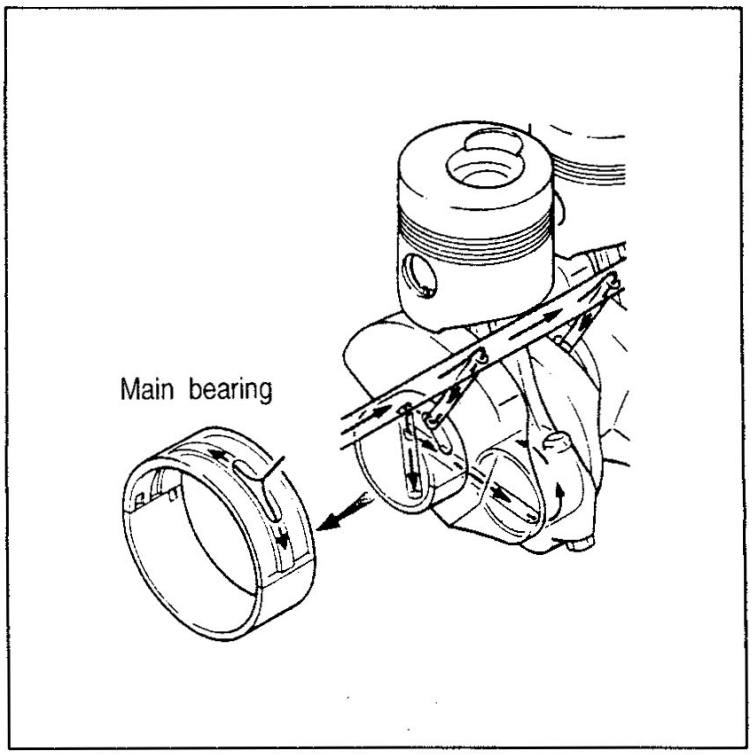


(5) Lubrication of Individual Parts

The engine oil forced to the oil main gallery lubricates the individual parts as described below.

(a) Main bearing and connecting rod bearing

The oil flows form the oil main gallery through the respective oil holes to lubricate the crankshaft main bearings. Part of this engine oil passes through the oil hole in the crankshaft to lubricate the connecting rod bearings.



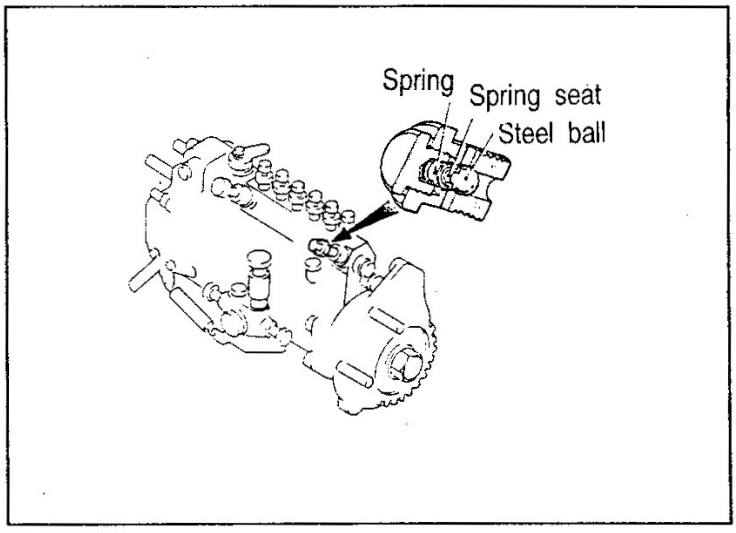
brought back to its original position by the pressure of the delivery valve spring to block the fuel path, thereby prebenting counter flow of the fuel.

The delivery valve is brought down further until the seat surface is held tight. During that stroke the fuel is drawn back from above to instantly lower the residual pressure between the delivery valve and nozzle. The draw-back effect improves the end break of an injection from the nozzle and prevents after-injection dripping.

A delivery valve stopper is provided on the top of the delivery valve spring. The stopper limits the lift of the delivery valve and prevents valve surging during high speed rotation. In addition, it reduces the dead volume between the delivery valve and nozzle, thereby stabilizing the injection amount.

(d) Overflow valve

When the fuel pressure in the injection pump exceeds a set level, the steel ball in the overflow valve goes up to let the fuel flow out of the injection pump and return to the fuel tank, thereby stabilizing the fuel temperature and temperature distribution in the injection pump and maintaining the injection rate into each cylinder constant.



The idling spring is mounted to the lower end of the tension lever to provide low speed control during driving. To the top of the governor, the engine stop lever is mounted which moves the control rack to non-injection position to stop the engine. A cancel spring is provided to protect the control rack from undue force when it is operated.

To the top of the governor cover, the start booster (spring capsule assembly) is mounted to incresase the amount of fuel injection and facilitate starting. This device also serves to reduce smoke emission during operation in practical full load low speed range.

The RFD type governor spring tension changes with the degree of inclination of the speed control lever so that this governor can be set to any speed.

Because of this construction, any speed can be achieved by operating the speed control lever with the load control lever fixed at the full load position.

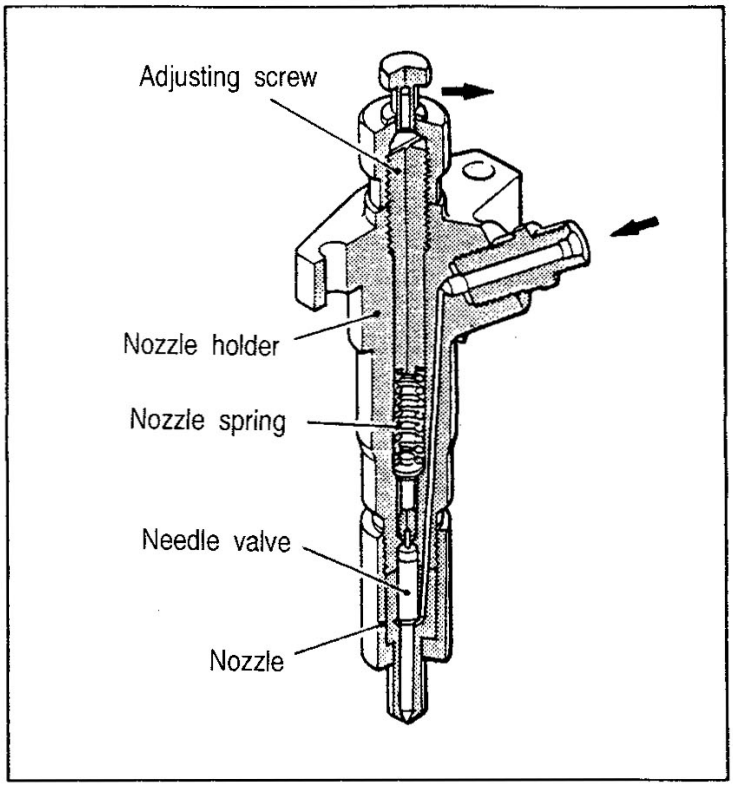
(5) Injection Nozzle

The injection nozzle is a hole type.

The fuel delivered from the injection pump enters the nozzle holder. When fuel reaches the specified pressure, it pushes the needle valve of the nozzle tip against the nozzle spring, so fuel is sprayed from the injection orifice at the end of the nozzle into the cylinder.

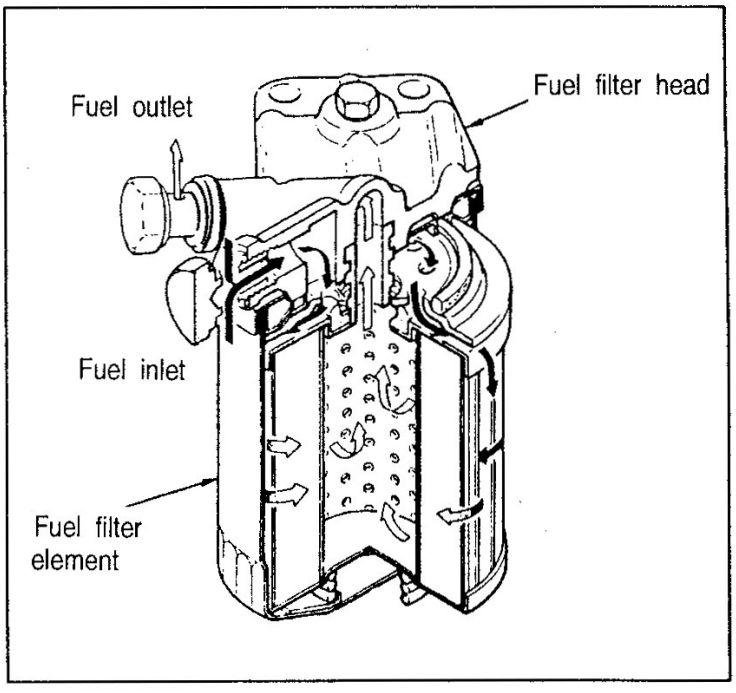
Some of the high pressure fuel lubricates the needle valve and returns through the fuel leak-off pipe to the fuel tank.

The injection pressure is adjustable with the adjusting screw.



(6) Fuel Filter

The fuel filter is a cartridge type designed for ease of element replacement.



Unit : mm

Description		Nominal value (Basic diameter in [ ])	Repair limit	Service limit	Remedy and remarks
Clerance between camshaft journal and bushing	No. 1	[57.75] 0.03 to 0.08	0.15		Replace bushing.
	No. 2	[58.00] 0.03 to 0.08			
	No. 3	[58.25] 0.03 to 0.08			
	No. 4	[58.50] 0.03 to 0.08			
Cam profile (Cam lobe height:)	Inlet	49.547		49.047	Replace.
	Exhaust	49.307		48.807	
Camshaft bend			0.04		Press correct or replace.
Fly-wheel	Friction surface distortion	0.05 or less	0.2		Correct or replace.
	Height up to friction surface	20		19	Replace.
	Runout of friction surface		0.2		Correct installation.
Eccentricity of flywheel			0.2		Correct installation.
Cylinder liner	Flange projction	0.03 to 0.10			replace crankcase and cylinder liner.
	I.D.	118.00 to 118.035		118.25	Replace

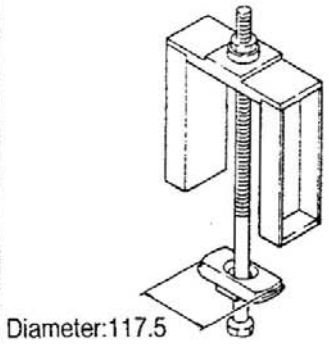
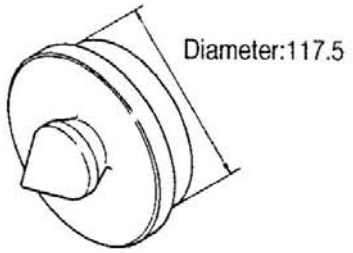
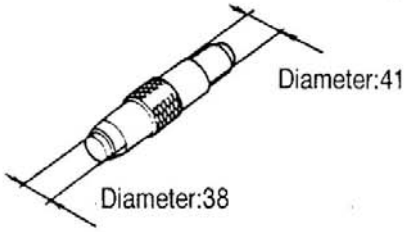
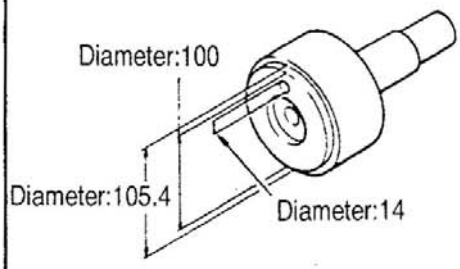
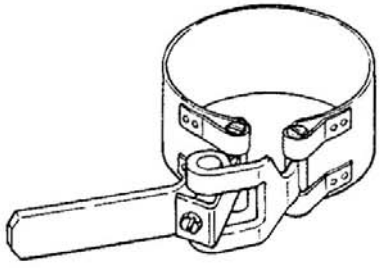
2-3 TIGHTENING TORQUE TABLE

2-3-1 Tightening Torque for Major Bolts and Nuts

Tightening torque unit : N m(kgf m)

Description		Thread size	torque	Remarks
Engine proper	Rocker cover bolt	M8×1.25	9.8(1.0)	
	Cylinder head bolt	M14×2.0	195 to 215 (20 to 22)	Wet
		M10×1.5	34(3.5)	
	Flywheel housing bolt	M10×1.5	44(4.5)	
	Rocker bracket bolt	M10×1.5	34(3.5)	
	Flywheel bolt	M14×1.5	175(18)	Wet
	Camshaft gear bolt	M20×1.5	175(18)	
	Idler gear No. 1 shaft bolt	M12×1.75	88(9)	
	Main bearing cap bolt	M14×2.0	175(18)	Wet
	Connecting rod nut	M13×1.25	115(12)	Wet
	Crankshaft pulley Bolt	M14×1.5		
	Torsional damper bolt	M10×1.5	44(4.5)	
Inlet and exhaust	Inlet manifold bolt	M8×1.25	19 to 27 (1.9 to 2.8)	
	Exhaust manifold nut	M10×1.25	41 to 45 (4.2 to 4.6)	

Unit : mm

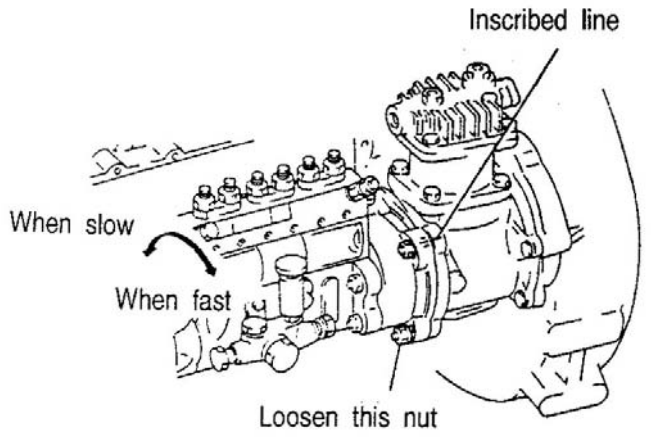
Tool name	Part No.	Shape	Use
Cylinder Liner Extractor	MH061761		Removal of cylinder liner
Cylinder Liner Installer	MH061771		Installation of cylinder liner
Connecting Rod Bushing Puller	MH061193		Replacement of connecting rod bushing
Oil Seal slinger Installer	MH061470		Installation of oil seal slinger
Piston Guide	MH061760		Insertion of piston
Piston Guide Lever	MH061658		

(7) Use Universal Extension (special tool, MH061099) to loosen the nuts.

(8) If the fuel injection timing is slow, push the injection pump toward the crankcase.

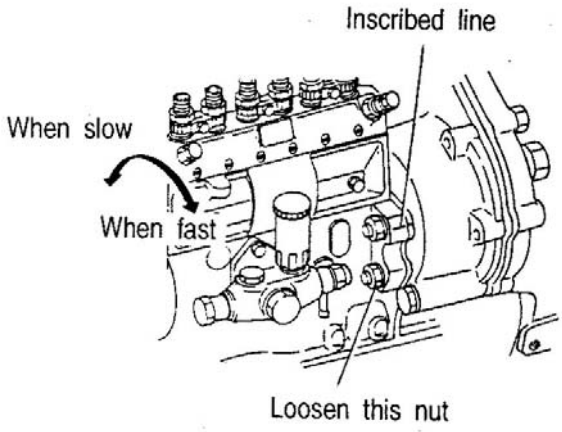
If the fuel injection timing is fast, push the injection pump in an opposite direction to the crankcase.

[With air compressor]



(9) Move the injection pump as required.
A shift of one part in the scale will vary the injecton timing by 6°.
Moving the injection pump 1° will advance or retard the injection timing about 2°.

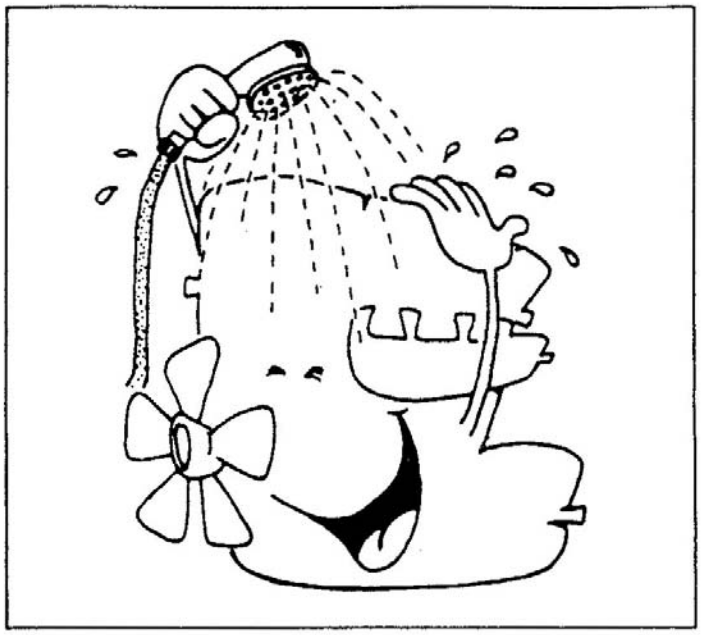
[Without air compressor]



(10) Tighten the injection pump attaching nuts and remeasure the fuel injection timing.

5-1-2 Cleaning of Engine

Oil, grease, dust, etc. are deposited on the engine. Therefore, use steam cleaner, engine cleaner, etc. to clean the engine.



Remove the electrical devices(alternator, starter, etc.), V-belt, rubber hose, wiring, etc. before cleaning the engine.

NOTE : Before disassembly and cleaning, isolate symptoms and possible causes of problem which are not easily detected after disassembly and cleaning.

5-2 REMOVAL AND INSTALLATION

5-2-1 Electrical

When electrical devices are to be removed, set the starter switch(battery switch) to OFF, then remove ⊖ (mimus) battery cable.

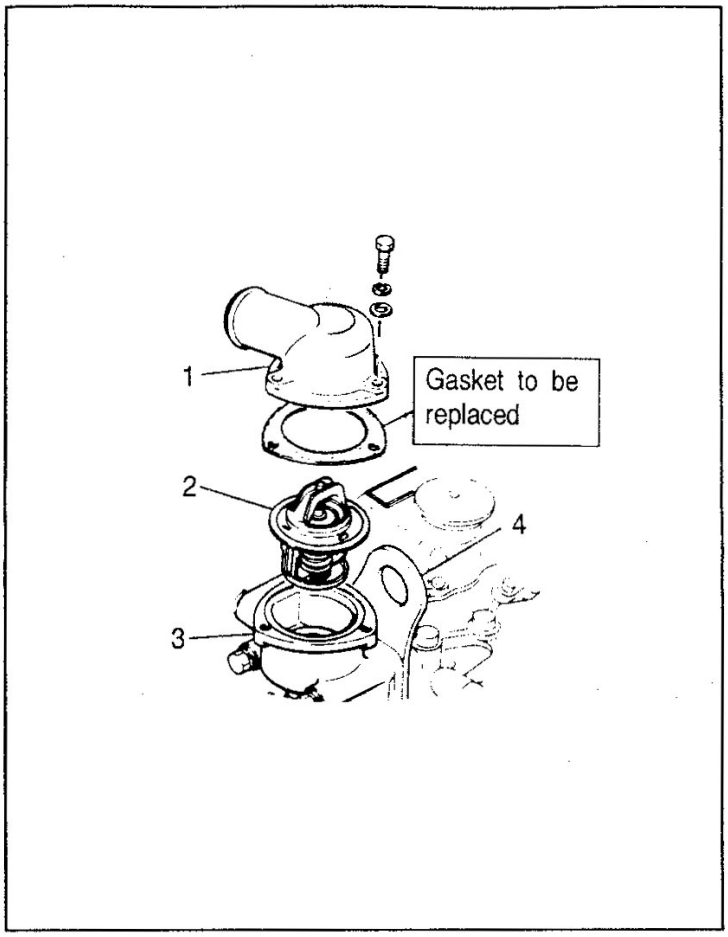
(1) Harness

In disconnecting engine harness terminals, mark each clamp as it is removed to prevent wrong wiring in reinstallation.

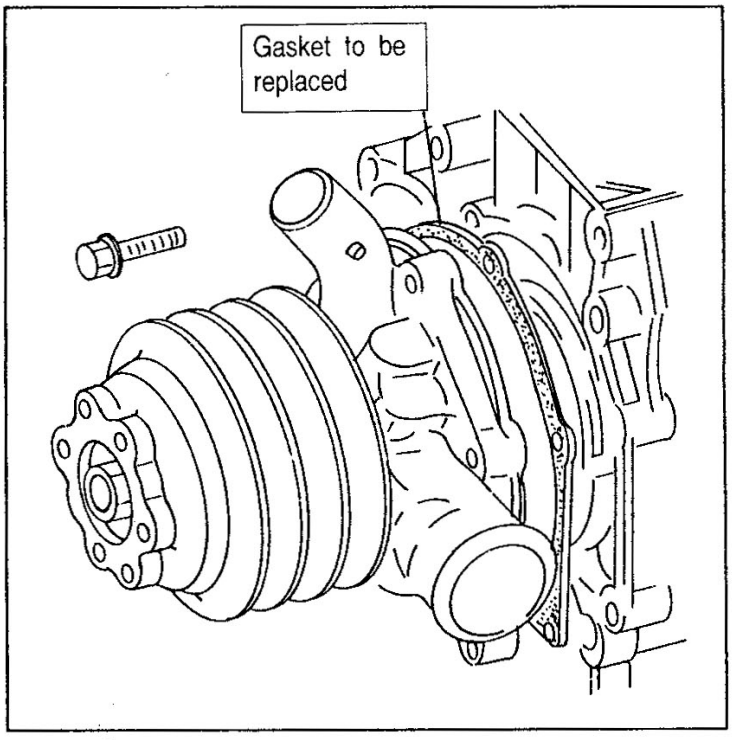
(2) Thermostat

1. Thermostat cover
2. Thermostat
3. Thermostat case
4. Front hanger

NOTE : Thermostat case and front hunger must not be replaced unless when checking for water leaks.

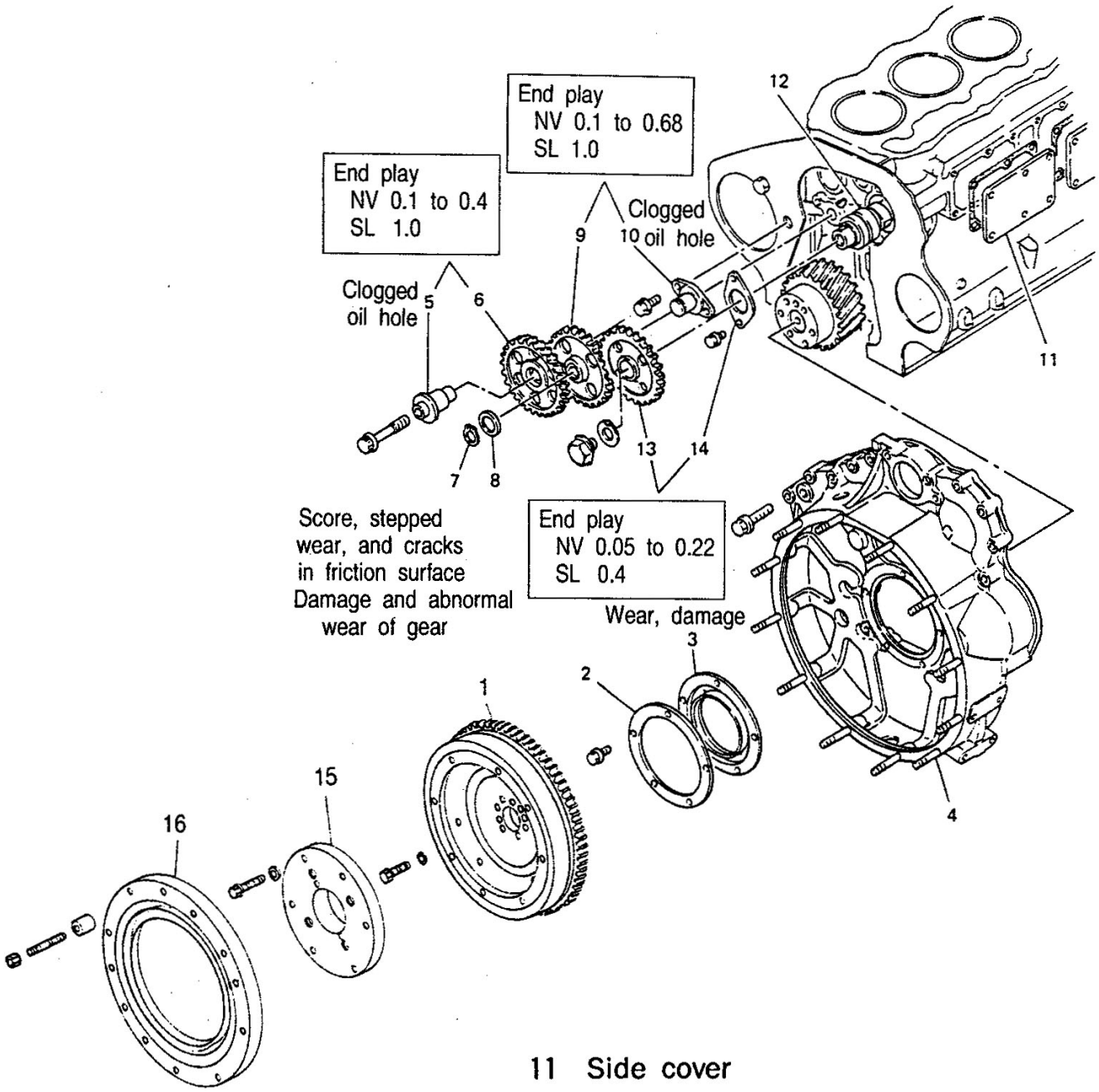


(3) Water Pump



6-1-2 Flywheel, Timing Gear and Camshaft

Crankshaft gear and idler gear No. 1 backlash NV 0.10 to 0.19 SL 0.35	Idler gear No, 1 and idler gear No. 2 backlash NV 0.11 to 0.24 SL 0.35
Idler gear No. 1 and injection pump gear (or air compressor gear) backlash NV 0.11 to 0.24 RL 0.35	Idler gear No. 2 and camshaft gear backlash NV 0.12 to 0.26 RL 0.35



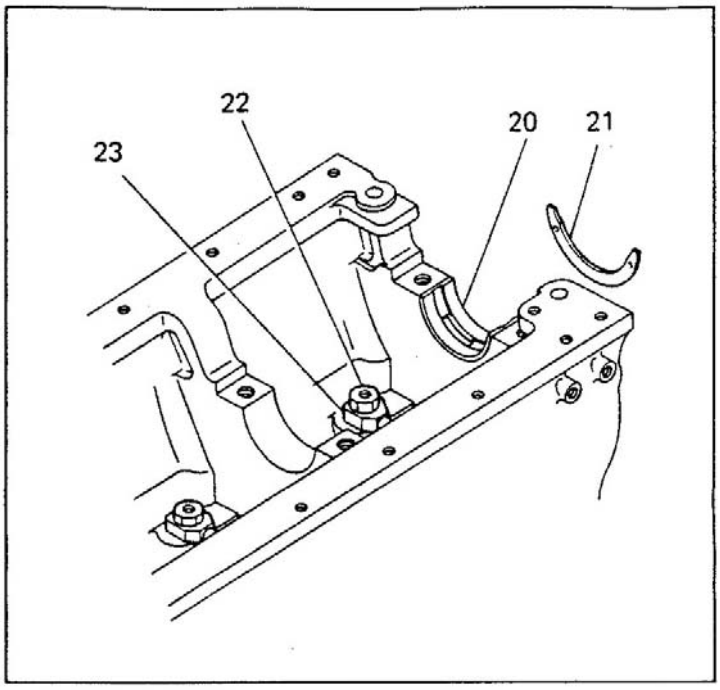
1 Flywheel
2 Washer plate
3 Oil seal
4 Flywheel housing
5 Idler shaft No. 1
6 Idler gear No. 1
7 Snap ring
8 Thrust washer
9 Idler gear No. 2
10 Idler shaft No. 2
11 Side cover
12 Camshaft
13 Camshaft gear
14 Thrust plate
15. Adaptor
16. Spacer

NV···Nominal Value
RL···Repair Limit
SL···Service Limit

(11) Remove the following parts.

19 Main bearing
20 Thrust plate

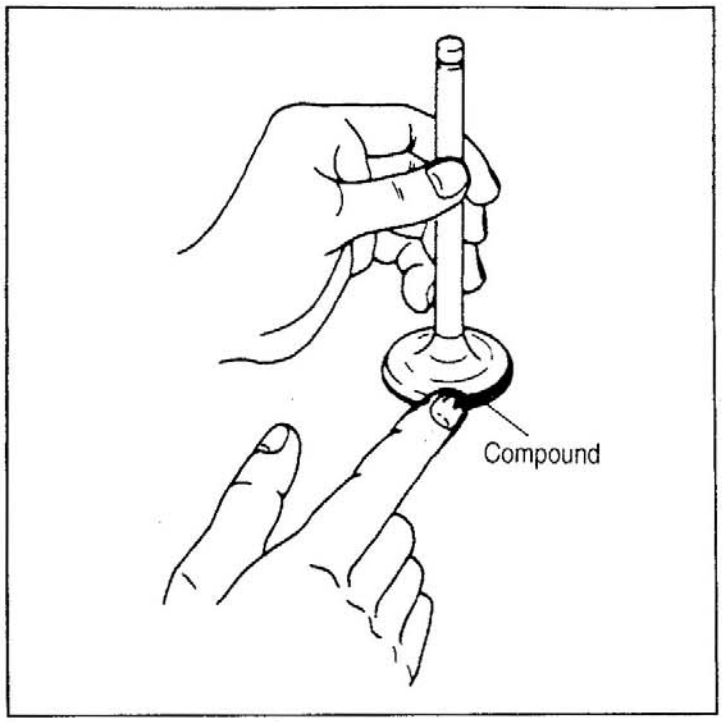
NOTE : Do not remove check valve 22 and oil jet 23 unless oil holes are clogged or other unusual conditions are evident.



(9) Lapping of Valve and Valve Seat

The valve and valve seat must be in even contact throughout. When the valve or valve seat was corrected or replaced, make sure that they are lapped.

(a) Apply a thin coat of lapping compound evenly to the seating surface of the valve.



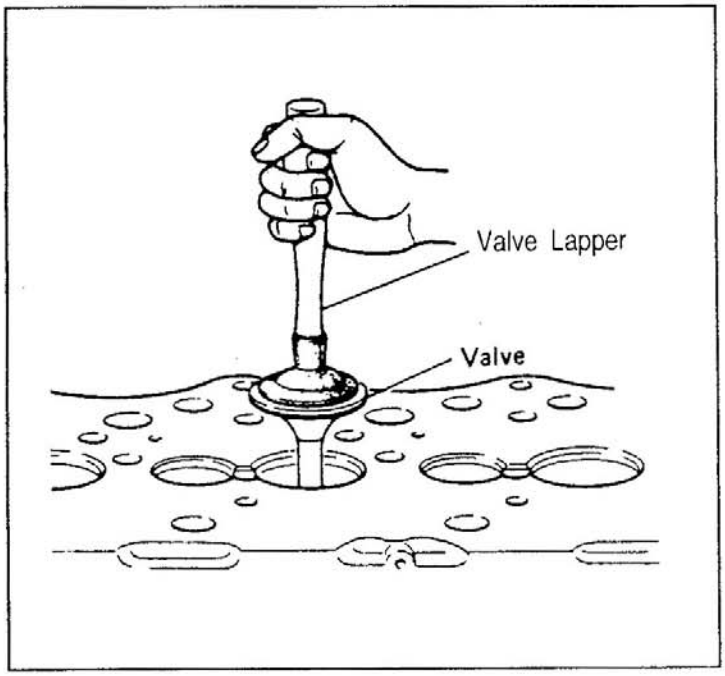
NOTE : 1. Make sure that no compound sticks to the stem of the valve.

2. Use intermediate mesh compound(120 to 150 meshes) first and then use fine mesh compound (200 meshes or more) for finishing.

3. If the compound is mixed with a small amount of engine oil, it can be evenly applied.

(b) Lap the valve and valve seat by using a Valve Lapper(special tool).

while turning the valve slightly at a time, strike it against the valve seat.

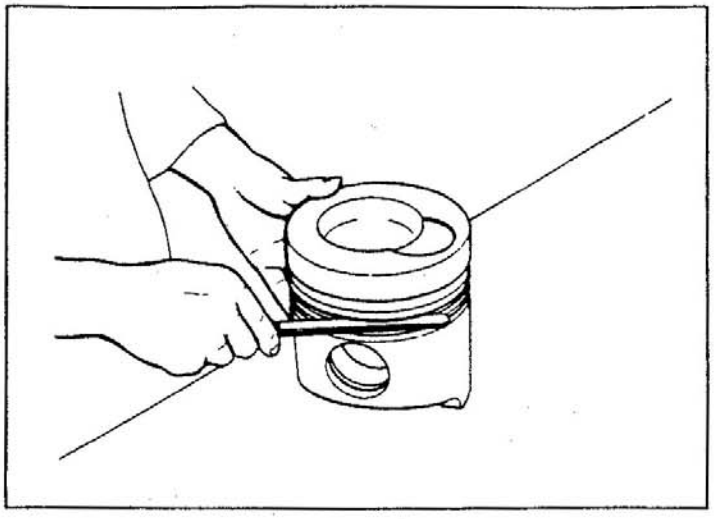


(c) Wash away the compound in gas oil, etc.

(d) Apply engine oil to the contacting surfaces to seat them with oil.

(e) Check to ensure that they are properly seated.

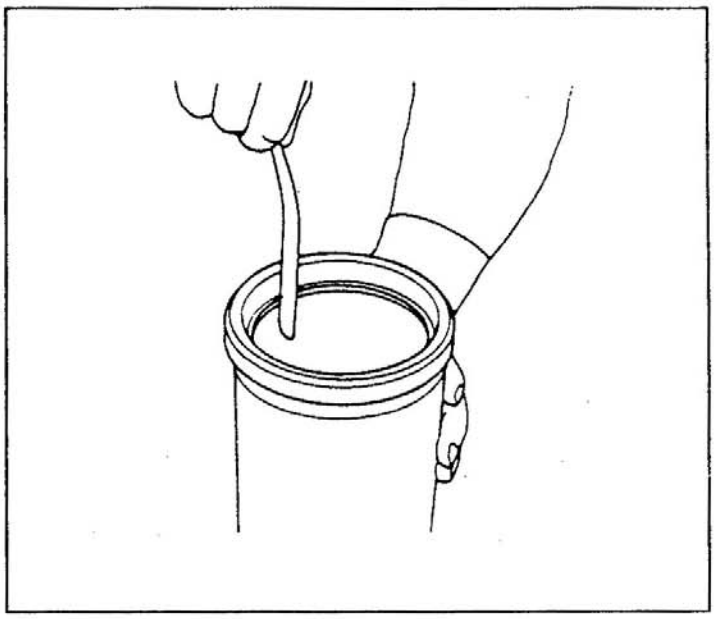
(3) Measure the clearance between the grooves in piston and piston rings. If the service limit is exceeded, replace the piston rings or piston.



NOTE : 1. After carbon has been removed, measure the clearance all around the piston.

2. Replace the piston ring as a set.

(4) Place the piston ring in a standard gauge or new cylinder liner to measure the open end gap.



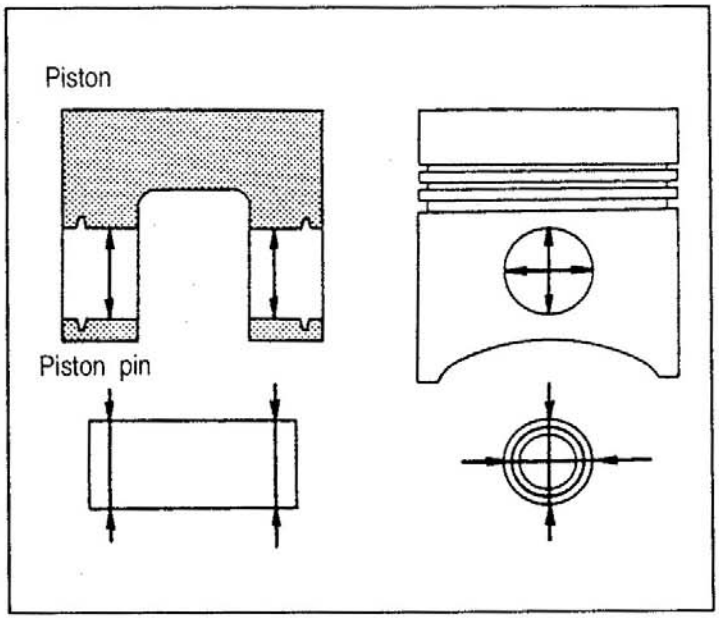
If the service limit is exceeded, replace.

Standard gauge I.D.

D6BR : 118 ± 0

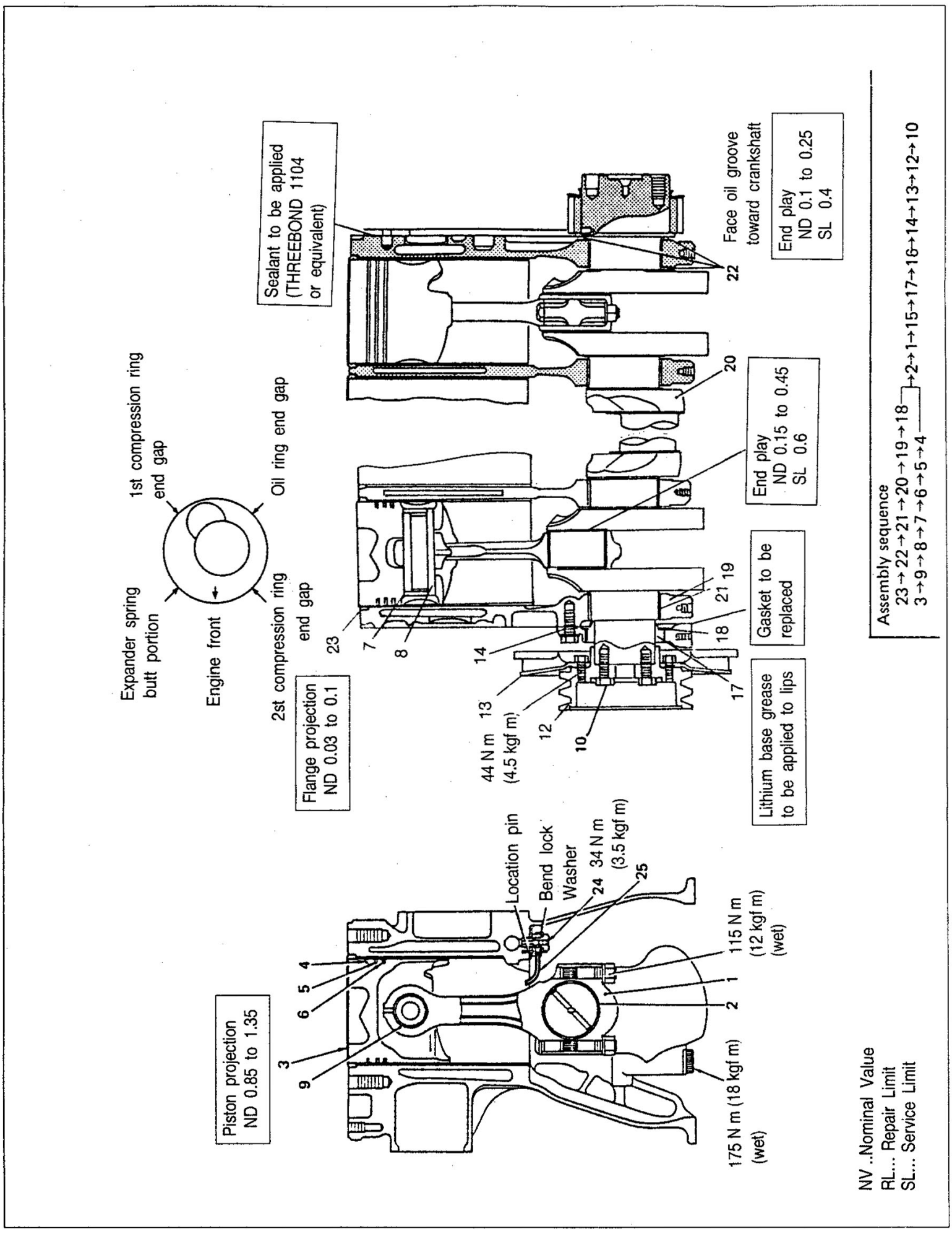
NOTE : For measurement, push the piston ring into the standard gauge with a piston to level its position.

(5) Calculate the clearance between the piston pin and its hole in piston by measuring their O.D. and I.D.



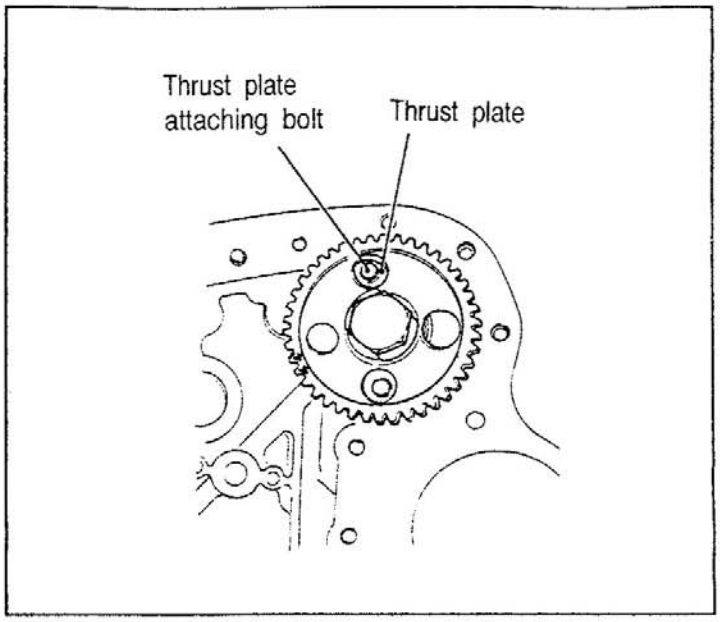
If the clearance is over the service limit, replace the piston pin or piston.

6-3-1 Crankcase and Main Moving Parts



(d) Insert the camshaft 12 into the crankcase and mount the thrust plate to the crankcase with bolt.

NOTE : When the camshaft is inserted, take care not to damage the bushing in the crankcase.

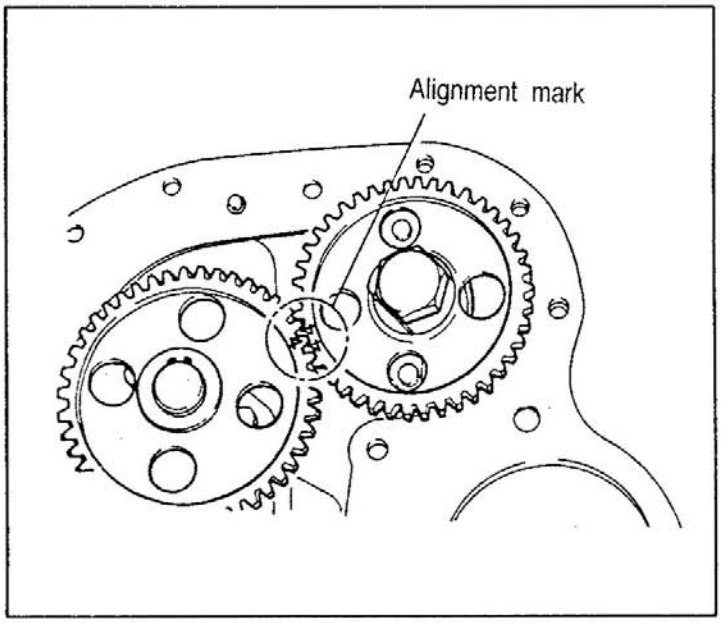


(2) Idler Gear No. 2

Install inthe following sequence.

10 Idler shaft No. 2
9 Idler gear No. 2
8 thrust washer
7 Snap ring

NOTE : Put the idler gear No. 2 and camshaft gear in mesh so that the same marks inscribed on the side of teeth will meet with each other.

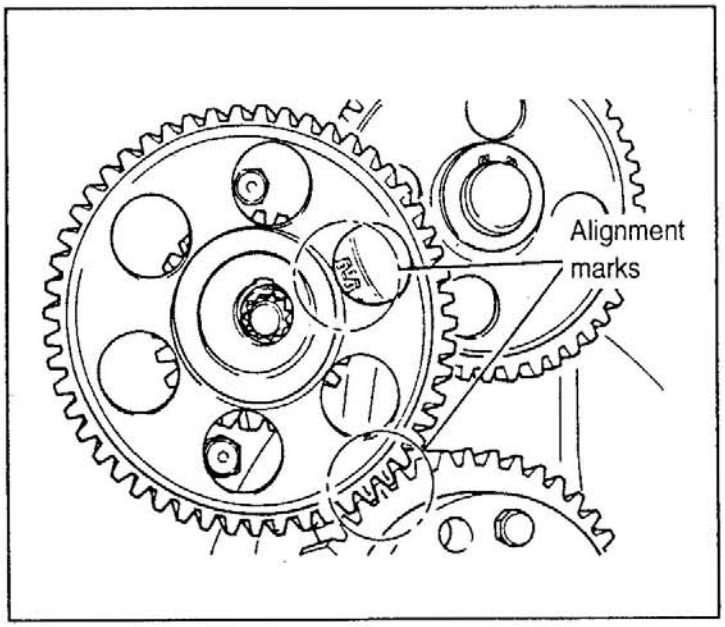


(3) Idler Gear No. 1

(a) Insert the idler shaft No. 1 8 into the idler gear No. 19.

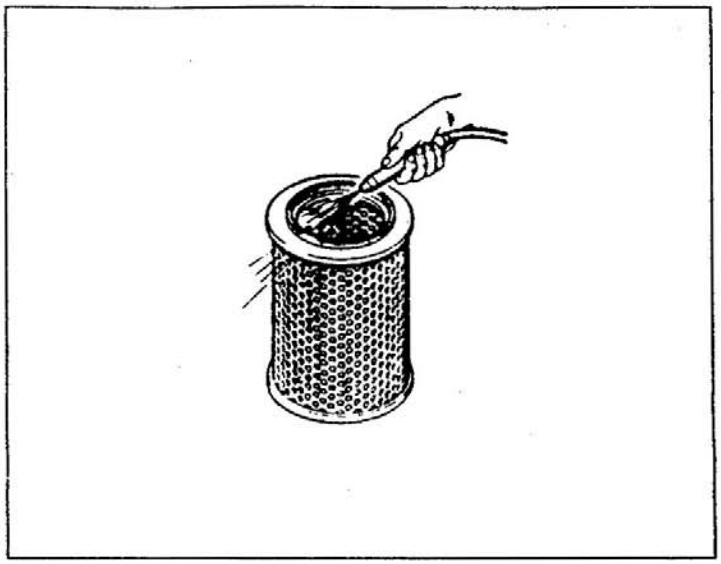
(b) Mount the idler shaft No. 1 to the crankcase together with the gear.

(c) Tighten the bolt to the specified torque.



7-2-2 Inspection and Cleaning

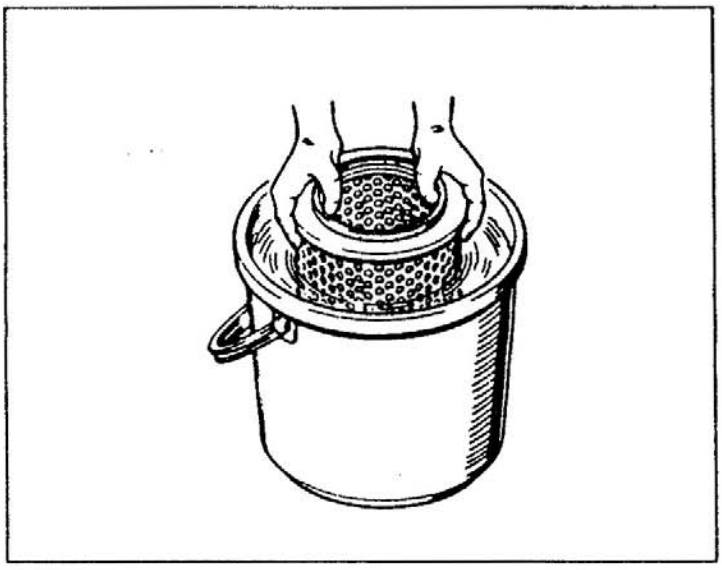
(1) Inspection and Cleaning of Filter Paper Type Element



(a) Whent there is dry dust on the element

Clean by blowing compressed air [less than 685 kPa (7kgf/ cm²)] against the element.
Blow compressed air from inside the element, moving the nozzle up and down along the filter paper frills, and clean the entire element.

NOTE : Avoid cleaning dust by striking the element or striking it against anything.



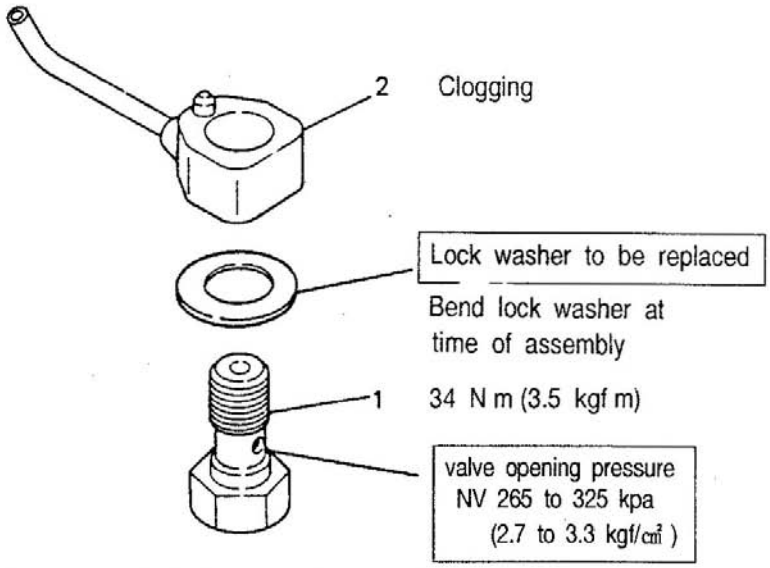
(b) When there is moist dust on the element.

When there is oil smoke or soot moistened dust on the element, clean the element using an element cleaner ND-1500.

Put 15g of the cleaner per liter of about 40℃ hot water, stir, and soak the element in the solution for about 30minutes, and clean.

After cleaning, rinse the element in water [water pressure less than 275 kPa(2.8kgf/ cm²)], and let dry in a well-ventilated place.

8-6 CHECK VALVE



NV ..Nominal Value

1 Check valve

2 Oil jet body

9-5 GAS LEAKAGE TEST

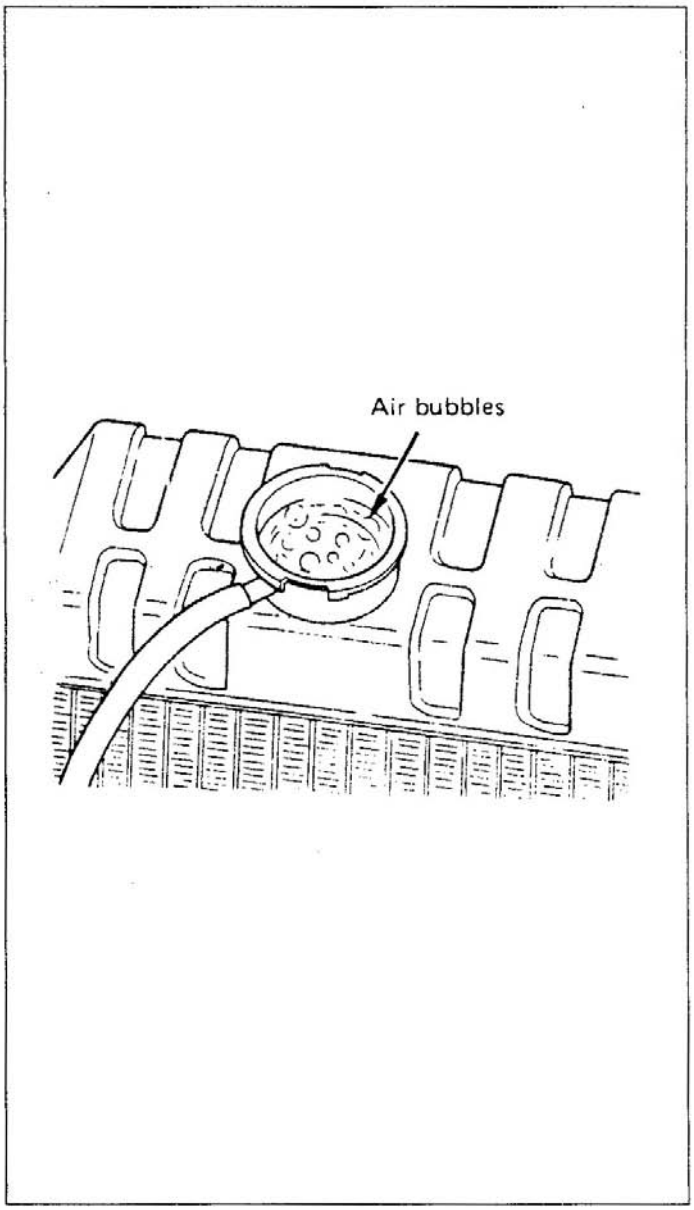
Presence of air or exhaust gas in the coolant will promote corrosion, rust formation and cavitation.

1) Inspection

(a) Remove the radiator cap.

(b) Operate the engine to raise the fluid temperature to about 90℃

(c) If air bubbles are continously produced in the coolant in this condition, it is evident that there is air or exhaust gas in the coolant.



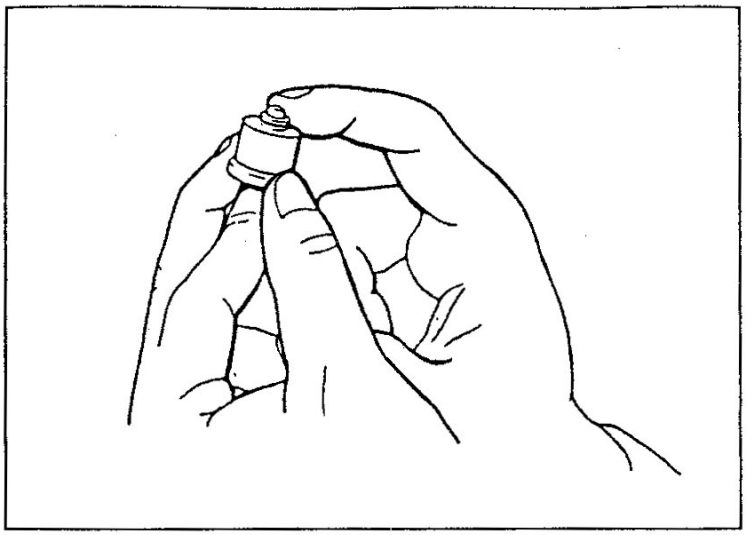
2) Cause

(a) If there is air in the coolant, check for loose cylinder head bolts, water pump attaching bolts and hose connection in addition to damaged hose.

(b) If there is exhaust gas in the coolant, check for damaged cylinder head gasket on nozzle tube end staked portion or cracked sylinder head.

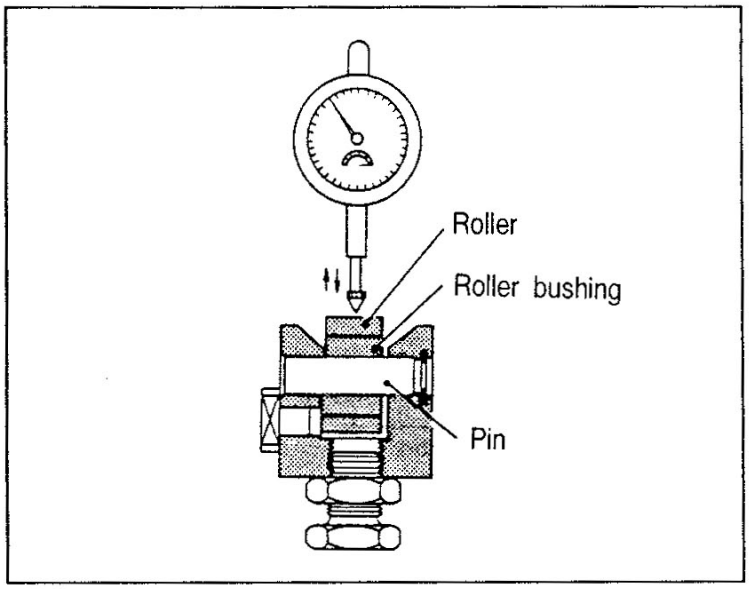
(b) Delivery valve

After washing the delivery valve section and valve seat in gas oil, check for wear. With the bottom of the valve seat closed with a finger, push the piston with another finger and then release. The valve is in good condition if the piston spring back.
Otherwise, replace the delivery valve as it is heavily worn.



(c) Tappet

Mount the dial gauge to the roller section of the tappet and move the roller up and down to check the total clearance.
It the total clearance exceeds the service limit, replace the tappet assembly.

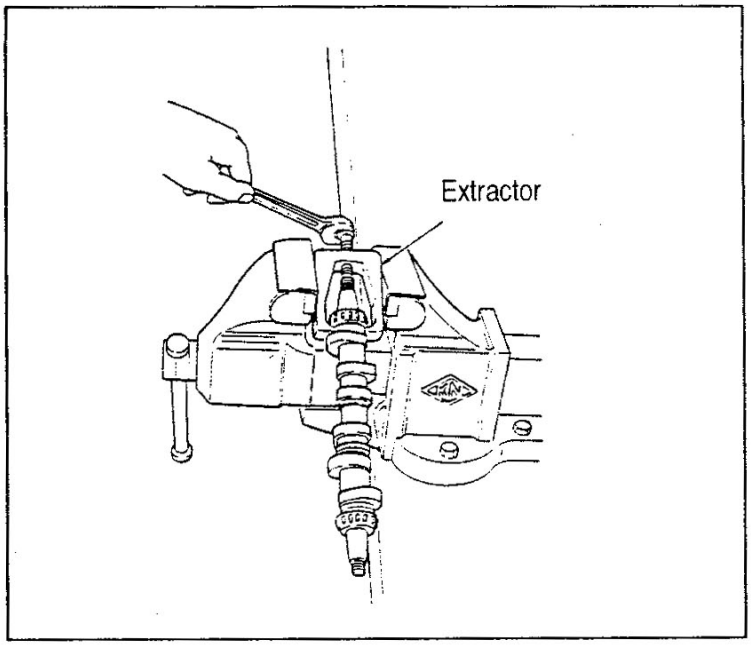


(d) Replacement of taper roller bearing

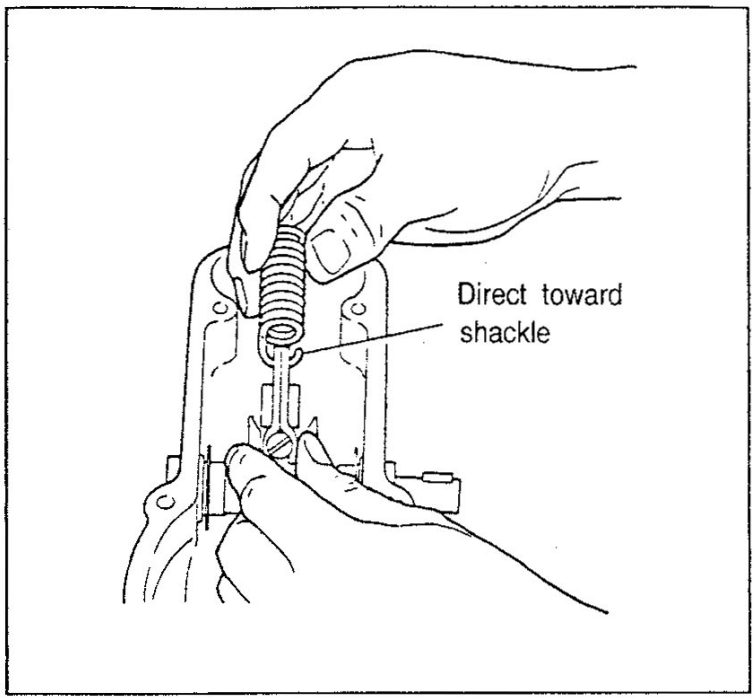
1) Inner race

Remove the taper roller bearing using Extractor (special tool). For installation, put ring and shim and then press-fit the taper roller bearing.

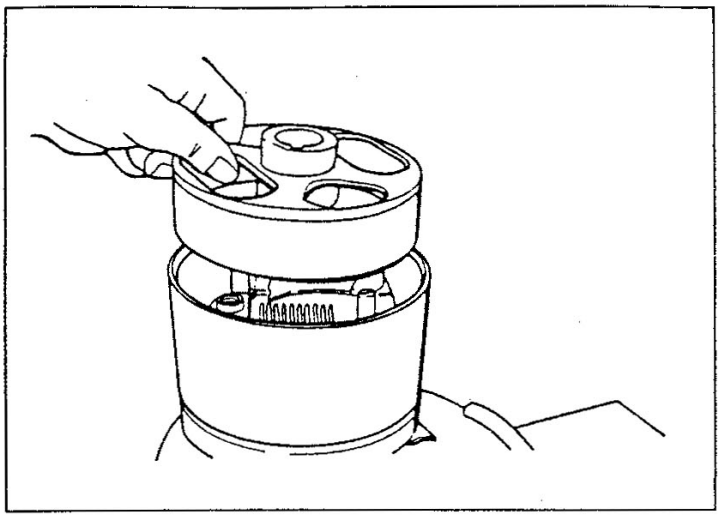
NOTE : Use shims of nearly the same thickness on both ends of the camshaft.



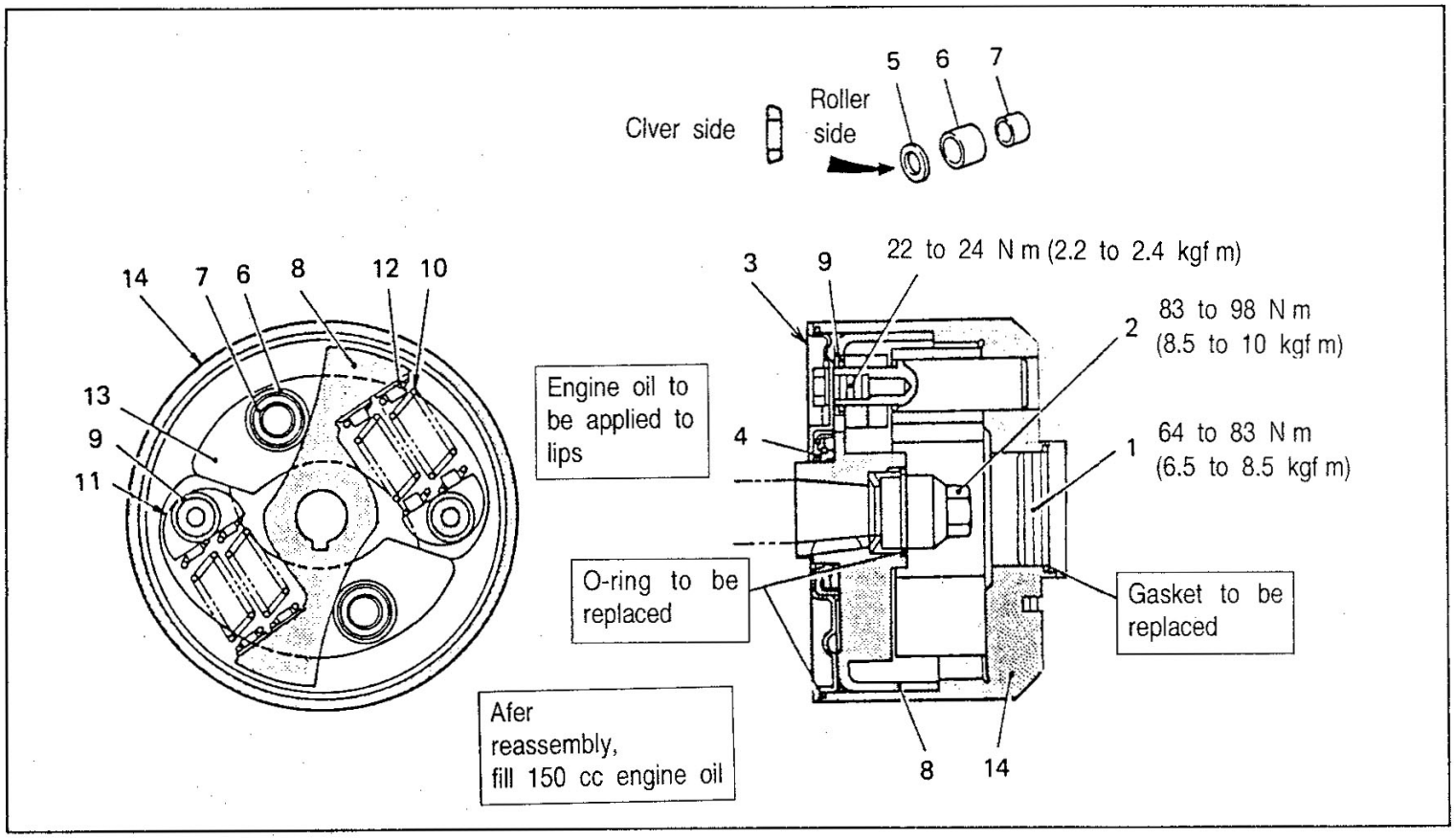
(h) When mounting the governor spring to the swivel lever, position the spring so that its end faces the shackle.



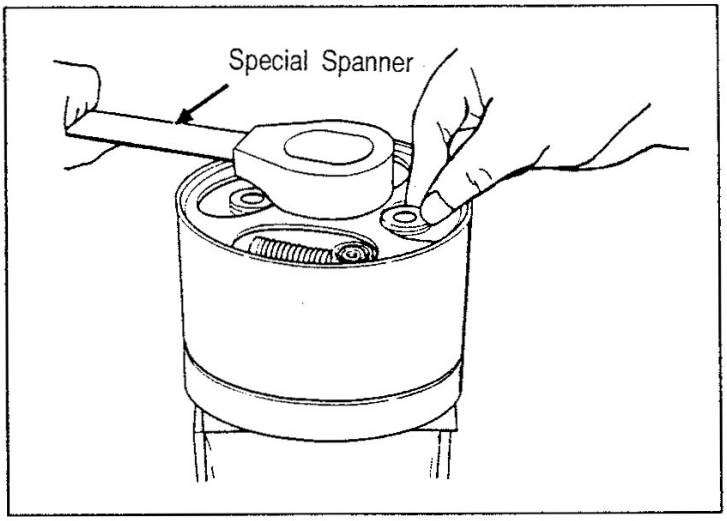
(g) Lift up and remove the flange 8. Then, remove the retainer 9, timer spring 10, spring seat 11 and shim 12. Finally remove the fly-weight 13.



(2) Assembly



(a) Mount Special Spanner (special tool) to the flange and mount the bushing 7, roller 6 and washer 5 while compressing the timer spring.

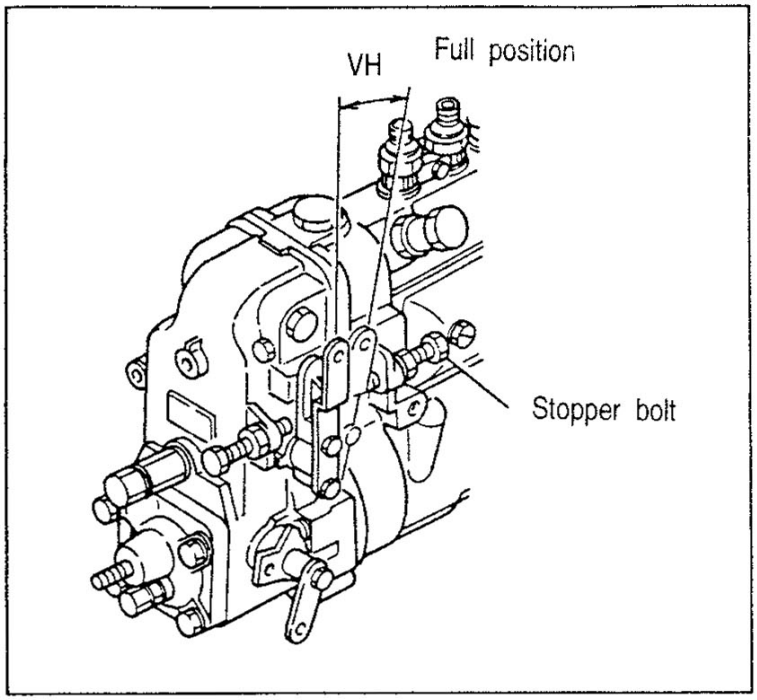


(f) Adjustment of high speed control

1) Adjustment of maximum speed stopper

Tilt the adjusting lever and set the maximum control speed of the governor.

Tilt the adjusting lever and adjust the maximum speed stopper so that the control rack is moved from the Rc position when the pump speed increased slowly from Nc reaches Nd.



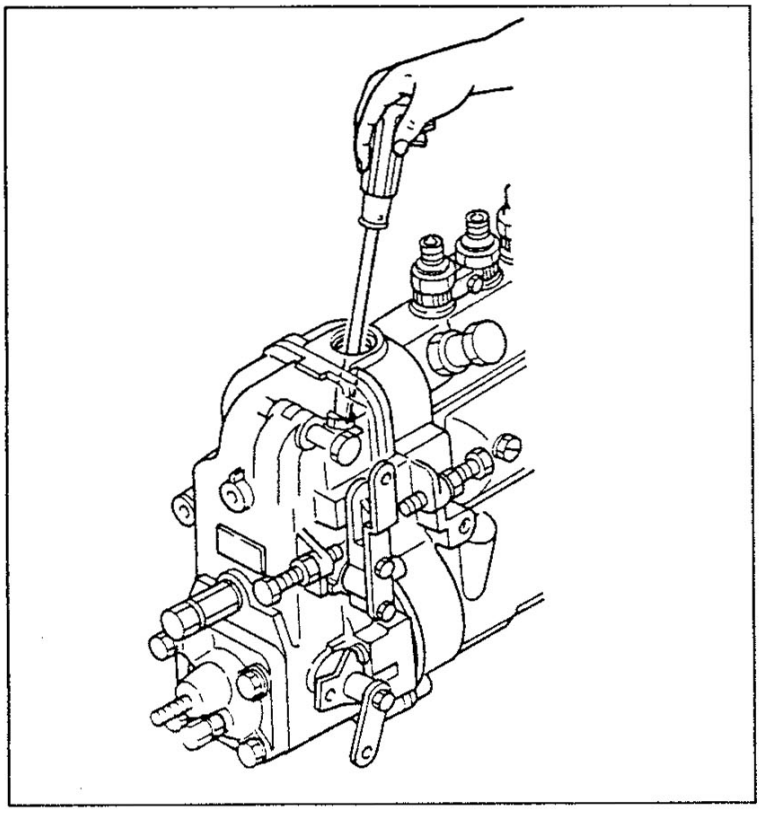
2) Adjustment of speed variation rate

Increase the pump speed from Nd and check to see that when the speed reaches Ne, the rack position is pulled back to Re.

If it is out of specification, adjust the amount the adjusting screw of the swivel lever is turned down.

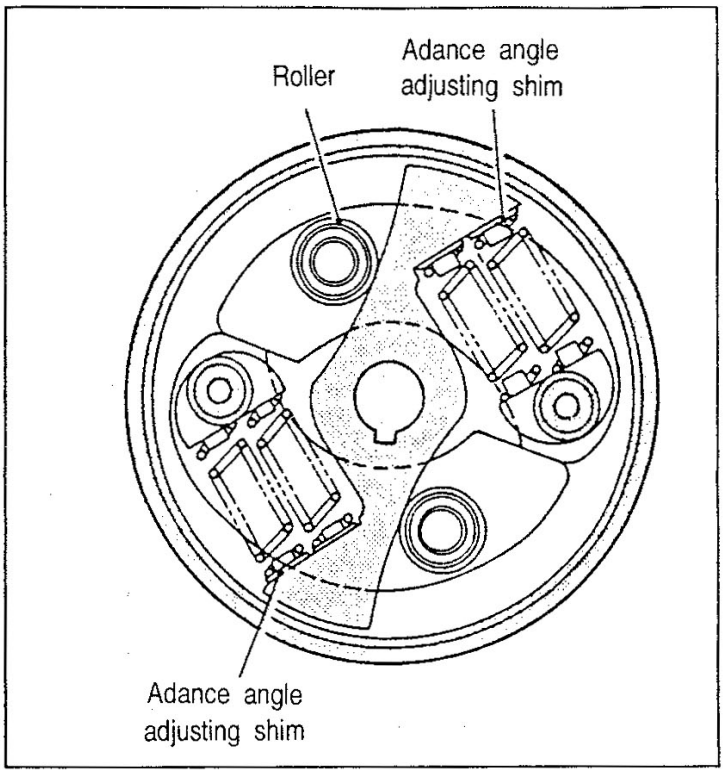
Tightening the screw will improve the speed variation rate.

Loosening it will worsen the speed variation rate.



$$\text{Speed varitation rate} = \frac{Ne - Nd}{Nd} \times 100(\%)$$

(5) SA, SA-D Type Automatic Timer



Advance angle characteristics

To adjust the advance angle characteristics, adjust the number of adjusting shims or replace the roller. Larger shim thickness reduces the advance angle.

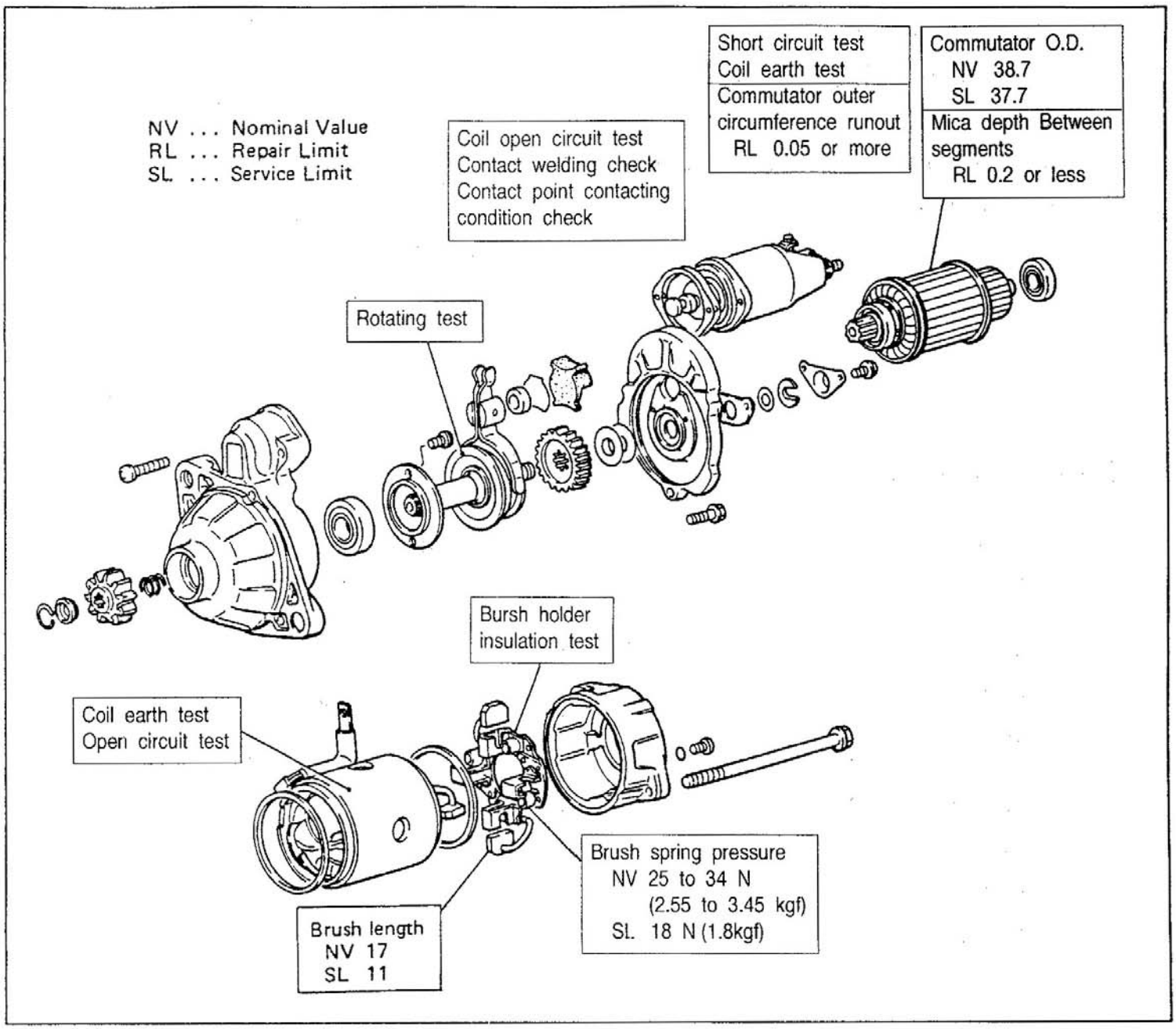
Shim thickness (11type)

0.1, 0.2, 0.25, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0

Roller O.D. (4 types)

17.9, 18.0, 18.1, 18.2mm

11-1-2 Inspection

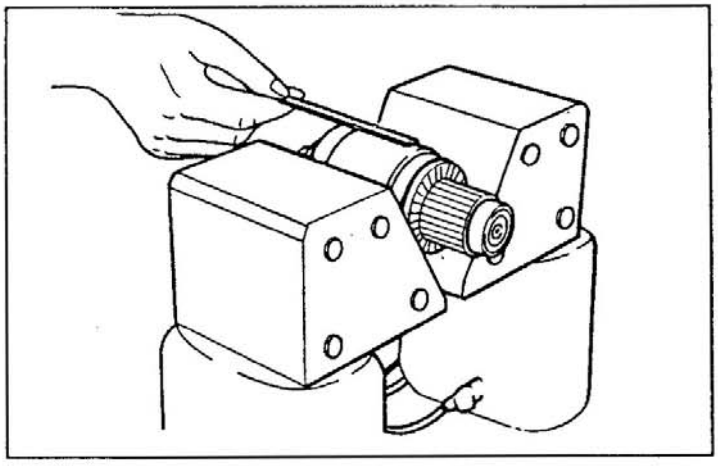


(1) Armature

(a) Coil short circuit test

Place the armature on the growler tester. Slowly turn the armature manually with armature core parallel to the armature. If the core is attracted or vibrates, it indicated coil short circuit.

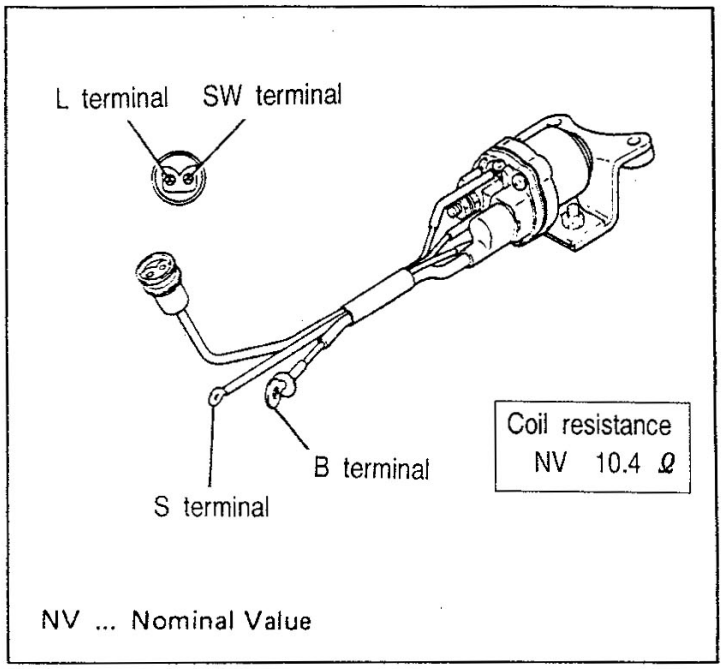
Then replace the armature.

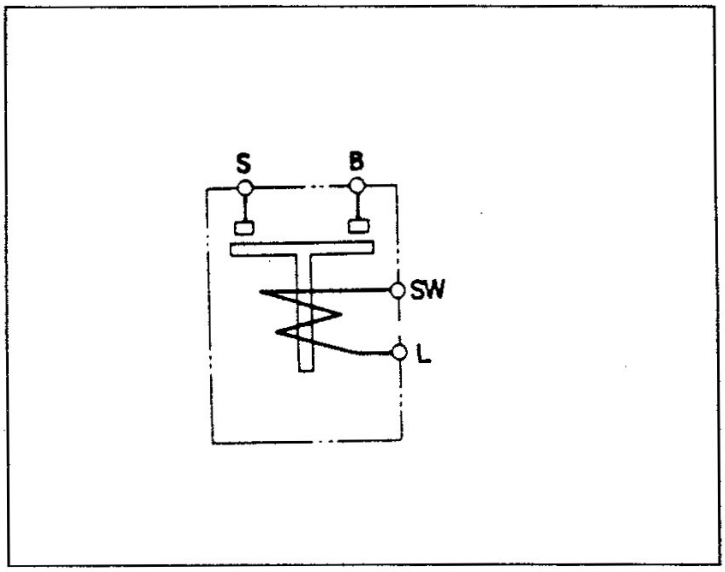


11-2 STARTER RELAY

(1) Check for continuity between the "SW" and "L" terminals and check to ensure that the coil resistance is up to specification

(2) Check to ensure that when the beattery voltage (24V or 12V) is applied across the "SW" and "L" terminals, there is continuity between the "B" and "S" terminals

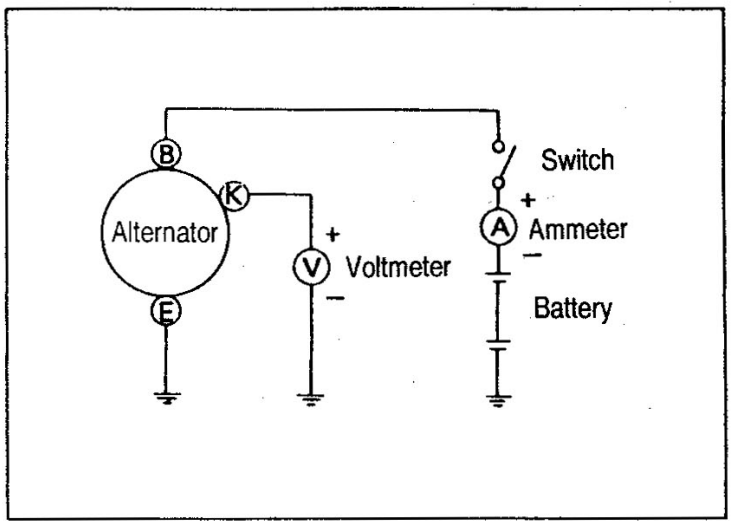




(d) IC regulator regulated voltage inspection (as mounted to engine)

1) Connect a voltmeter and an ammeter and provide a switch.

2) The regulator is normal if the voltmeter reads 0 when the swith is closed. If the voltmeter pointer deflects, the alternator or wiring is defective.



3) With the ammeter teminal shorted to prevent flow of the starter current throught it, start up the engine.

4) Increase the engine speed to approximately 2000rpm and read the regulator voltage value if the charge current is 5A or less.

If the charge current is 5A or more, continue charging for some time or replace with a fully charged battery. It is also acceptable to connect a 1/ 4 resistor (25W) in series to the battery to limit the charge current.

5) It is good if the regulator voltage is specified.

If not, replace the regulator assembly as the regulator voltage is not readjustable.