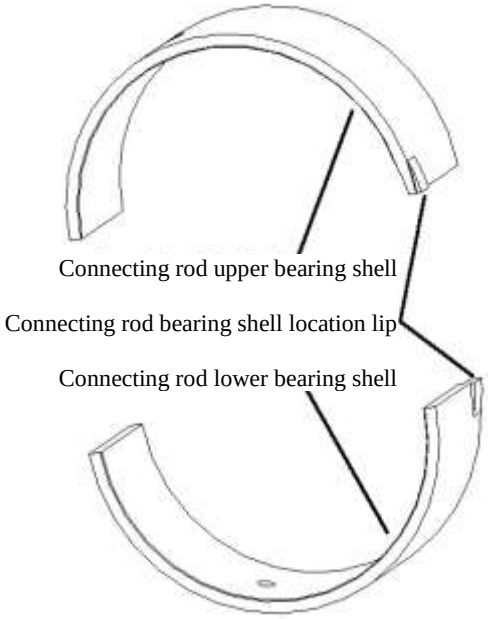
Contents

	Bent and deformed	Limit	0.03
	Connecting rod big end clearance	Standard	0.017~0.029
		Limit	0.046
	Connecting rod axial clearance	Standard	0.20~0.40
		Limit	0.50
Crankshaft	Main shaft diameter		
		Standard	φ46(0,-0.018)
		Enlarging 0.25mm type	φ45.75~φ45.57
		Enlarging 0.50mm type	φ45.5~φ45.32
	Main shaft diameter clearance		
		Standard	0.025~0.043
		Limit	0.068
	Connecting rod shaft diameter clearance		
		Standard	0.017~0.035
		Limit	0.052
	Crank pin diameter		
		Standard	φ44(0,-0.018)
		Enlarging 0.25mm type	φ39.75~φ39.57
		Enlarging 0.50mm type	φ39.50~φ39.32
Intake manifold	Seal groove depth		4±0.1mm
	Seal ring protruding height	Standard	2±0.1mm
		Limit	1.8mm
Exhaust manifold	Flange deformation		
		Standard	0.25
		Limit	0.40
Valve clearance	Cold state	intake valve	0.2±0.03mm
		Exhaust valve	0.3±0.03mm
Timing chain	Flexibility limit		4mm [with 127N applied]
Chain chamber cover	OCV Control valve hole diameter	Standard	φ18(+0.018,0)
		Limit	φ18.045
	Joint surface deformation	Standard	0.10
		Limit	0.25
Upper and lower connecting rod bearing shell	Shell width		14.5(0,-0.2)
	Free opening width		47(+1.5,+0.5)
	Central thickness		1.5(+0.009,-0.003)

Connecting rod bearing shell includes upper half and lower half. Upper half is installed on connecting rod body and lower half on connecting rod cap. Connecting rod bearing shell (upper and lower half) is divided into four groups within specified thickness tolerance. The bearing shell is colored on both ends. Connecting rod bearing positioning lip is on the side. When assembling, in order to ensure fit clearance, select and assemble according to grouping dimension of related parts.



Connecting rod bearing shell

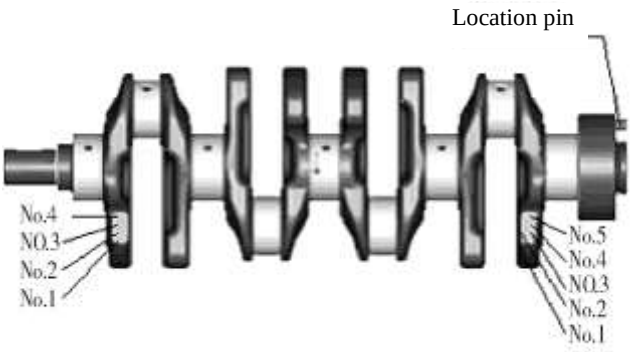
Crankshaft and bearing shell

Crankshaft is made of nodular cast iron, which consists of five main journals, eight pieces of balance weights, crank throw included angle 180 °, with symmetrical plane. It has dynamic balance itself. But it bears inner bending moment to make crankshaft reach inner balance. Two groups of different balance weights are prepared.

The third main journal bears axial thrust. Two thrust shims made of mock silver are installed on both sides of cylinder block supporting the third main journal.

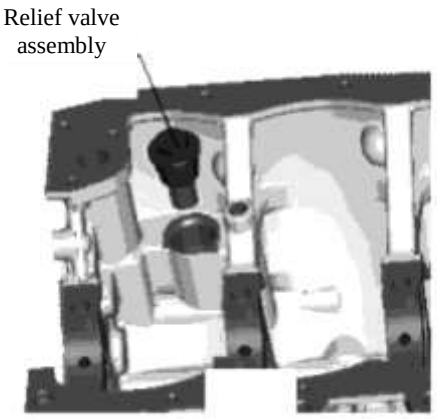
Balance weight removes all inherent vibration of the engine.

Connecting rod journal grouping code is stamped on the side of front balance weight. Main bearing journal grouping code is stamped on the side of rear balance weight.



Main bearing journal and connecting rod journal of crankshaft adopt rolling fillet to increase fatigue strength.

Main bearing journal diameter of crankshaft mm	46
Connecting rod journal diameter of crankshaft mm	44

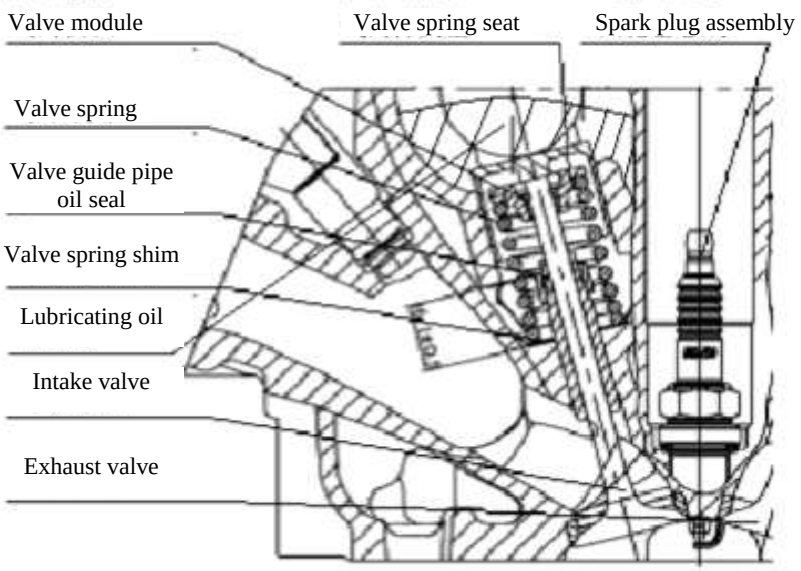


Engine oil pump sprocket tooth number

Tooth number of engine oil pump sprocket	Outer diameter of engine oil pump sprocket (mm)
25	48. 6

Lubrication for Valve Actuating Mechanism

Lubricating oil required for valve actuating mechanism goes through camshaft bearing support to submerge tappet and valve components in lubricating oil to ensure sufficient lubrication and heat dissipation.



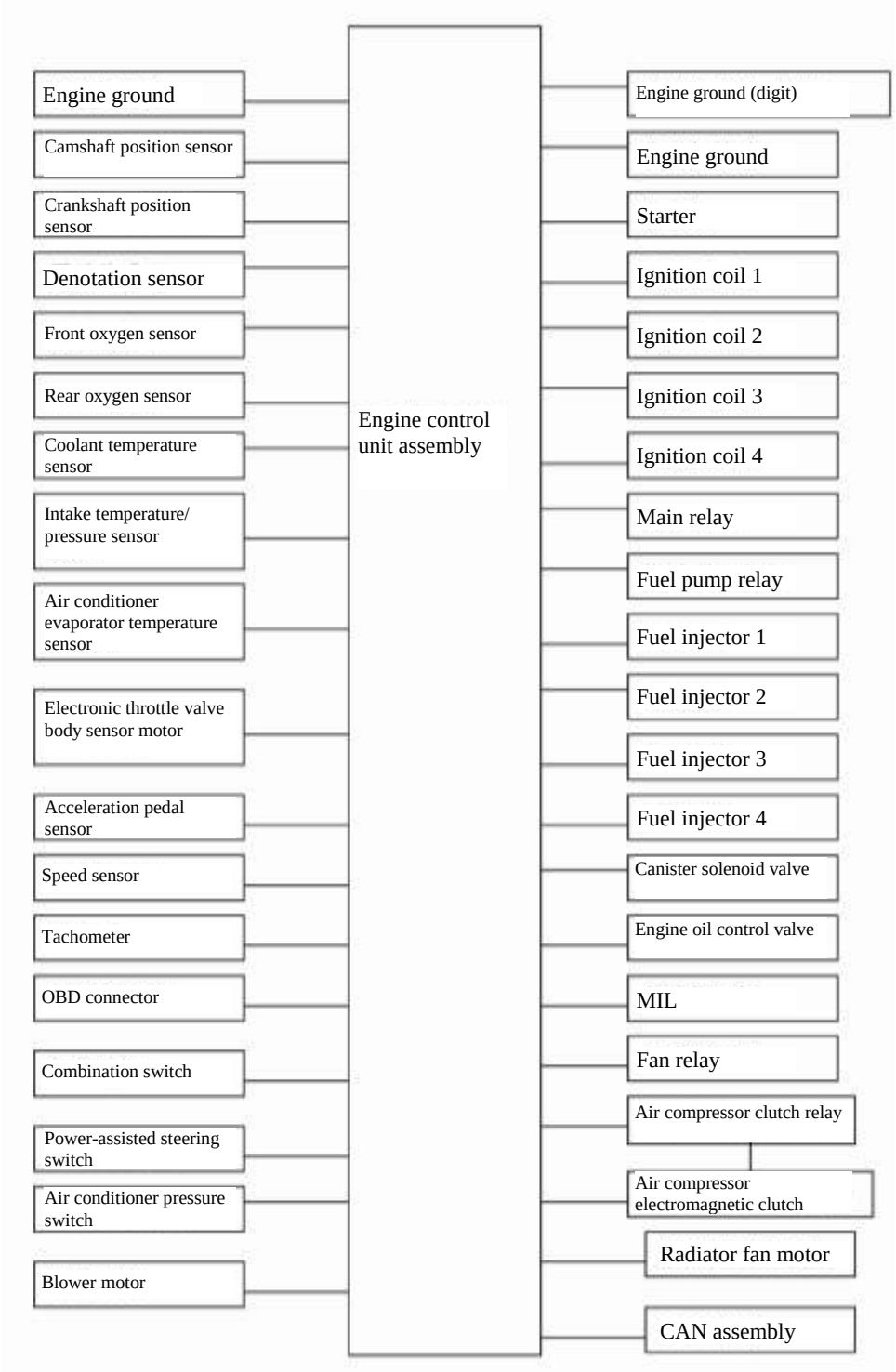
Valve actuating mechanism lubrication

Engine oil filter

Engine oil filter has an element. There is a relief valve in closed structure. When inlet/outlet pressure difference reaches the specified value, bypass valve is opened. At 2 MPa, engine oil filter shall not leak and be damaged within 2 minutes.

Engine oil filter

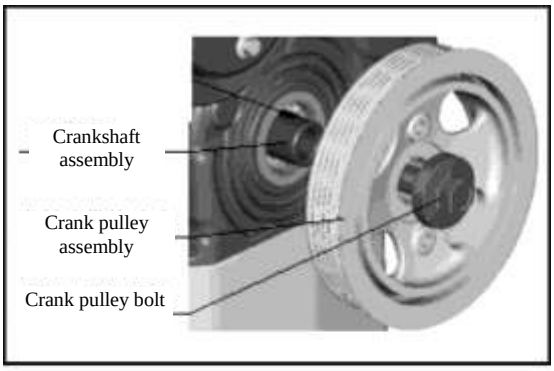
Filtering area	860 cm^2
Opening pressure of bypass-valve	0.1 ±0.02MPa(1.0 ±0.2 kgf/cm^2)



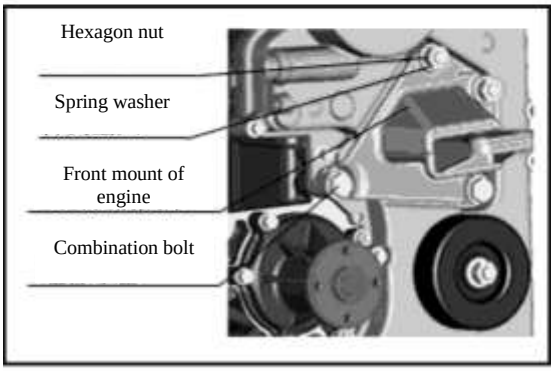
Functional block diagram for engine control unit assembly

11) Remove crank pulley.

Before loosening crank pulley bolt, use a screwdriver to lock crank pulley in order to prevent the crankshaft from rotating.



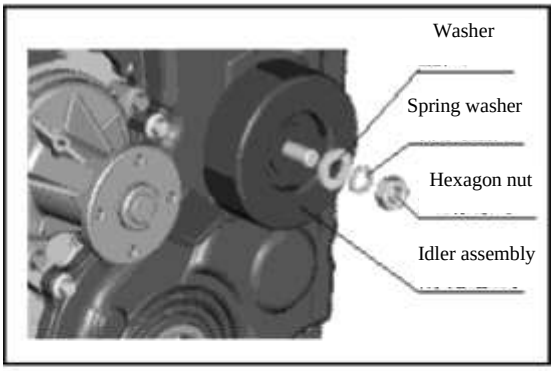
2) Remove front engine support.



13) Remove idler assembly.

Idler assembly is installed on the stud of cylinder block front end. Loosen hexagon nut and take down hexagon nut, spring washer and washer. Then take down idler assembly.

Note: keep all removed parts in a safe place to avoid them from being lost.



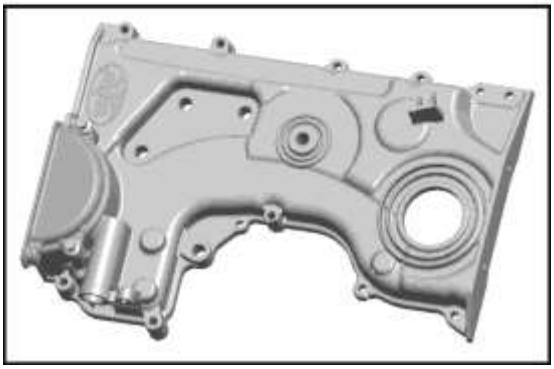
14) Remove bar type ignition coil assembly

Loosen hexagon head flange bolt and remove bar type ignition coil assembly.

Note: when removing bar type ignition coil assembly, it is not allowed to use a screwdriver to pry bar type ignition coil assembly to avoid bar type ignition coil assembly insulation sheath from being damaged.

15) Remove cylinder head cover assembly and engine oil filler cap.

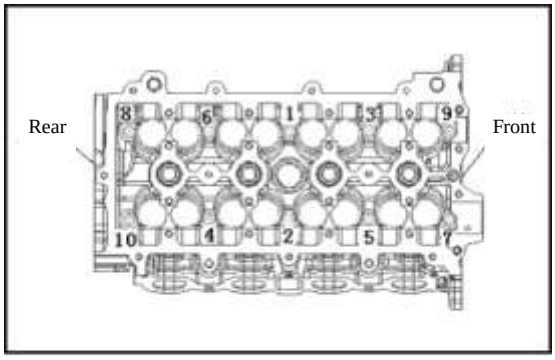
16) Remove chain chamber cover assembly



Align two pin holes of cylinder head gasket with locating ring on cylinder block and place it on cylinder block top surface.

(Note) Check cylinder head gasket thickness and if there is any defect. If necessary, replace with a new gasket.

Installation compression thickness of cylinder head gasket is more than 0.3mm.

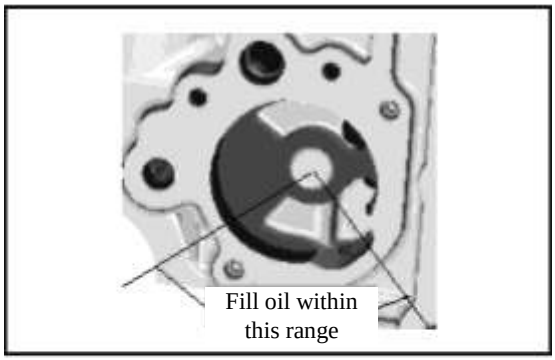


2) Install cylinder head assembly

① Clean cylinder head bottom and front end, align locating pin hole with locating ring on cylinder block and place it on cylinder head gasket carefully.

② Cylinder head bolt thread is applied by lubricating oil and then inserted into cylinder head bolt hole.

Tightening torque: 34±2N.m, then rotate by 120°.



2-5 Remove and install engine oil pump

After removing timing chain and water according to "Remove Timing Chain and Water Pump" section, remove engine oil pump.

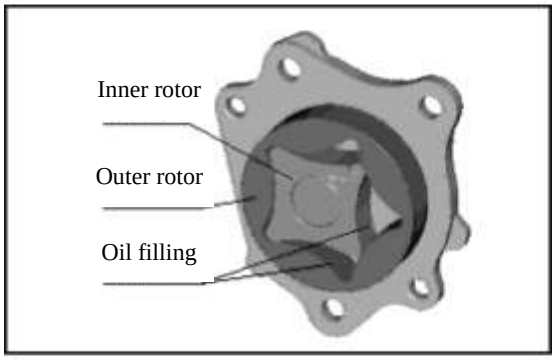
Remove engine oil pump

Loosen hexagon head flange bolt and remove engine oil pump. Check wear conditions of inner and outer rotors of engine oil pump.

Install engine oil pump

Fill lubricating oil into the clearance between inner and outer rotors of engine oil pump.

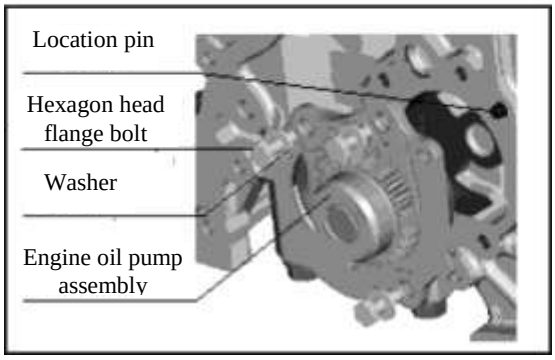
Fill lubricating oil from lower side of rotor mounting hole on cylinder block.



③ The mark on outer rotor faces to the outside of cylinder block.

④ Locate the bolt and washer with locating pin, and tighten them on front end of cylinder block. Tightening torque is 9±1.8N·m.

(Note) Rotate engine oil pump sprocket by at least one turn to lubricate the rotor completely and run flexibly.



Remove

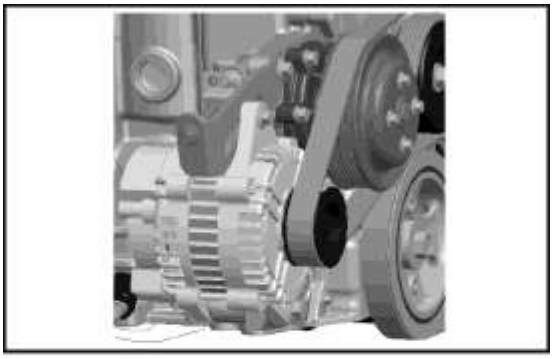
1) Remove V-belt

Loosen hexagon head flange bolt, but do not make it too loose.

Loosen adjusting bolt of the generator.

Remove V-belt.

Note: before removing, mark the running direction of V belt on the back of V belt with chalk (an arrow).



2) Remove water pump belt pulley.

Remove crank pulley

(1) When loosening crank pulley bolt, use a special maintenance tool to prevent the flywheel from rotating.

(2)Because tightening torque of crank pulley bolt is large, extended torque wrench can be used.

4) Remove engine front mounting bracket.

Loosen hexagon nut and combination bolt. Do not lose spring washer.

5) Remove idler assembly.

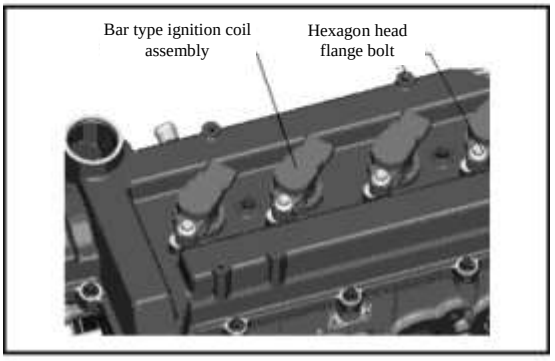
Remove hexagon nut. Do not lose washer and spring washer.

6) Remove engine oil filler cap assembly

7) Remove bar type ignition coil assembly

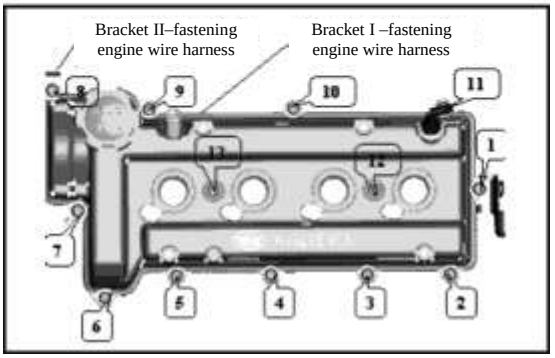
Loosen four hexagon head flange bolts and then take out bar type ignition coil assembly.

Note: When taking out bar type ignition coil assembly, if it is not easy to take out bar type ignition coil assembly, it is not allowed to use a screwdriver to pry bar type ignition coil assembly. Otherwise, bar type ignition coil assembly will be damaged.



8) Remove cylinder head cover assembly

Loosen hexagon head flange nut at (12) and (13) positions and bolts at ⑥ and ⑦ positions, and loosen bolts at other positions. Remove cylinder head cover assembly. (Note) put canister solenoid valve bracket (No. 1 position), engine wire harness bracket II (No. 8 position), engine wire harness bracket I (No. 7 position) and cylinder head cover gasket in a special container.



Remove

Remove bar type ignition coil assembly.

Remove spark plug.

Remove cylinder head cover assembly, liner and wire harness bracket I and II.

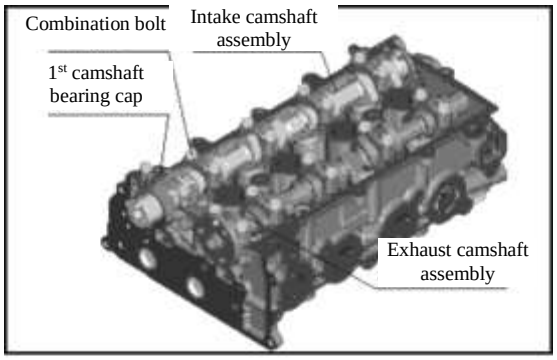
Remove canister solenoid valve bracket and canister solenoid valve.

Remove camshaft position sensor.

Remove 1st ~ 5th camshaft bearing caps. Loosen 20 bolts twice or three times uniformly and then remove them.

Loosening method as follows: 1. Loosen 1st camshaft bearing cap bolt. First loosen 2 bolts inside and then loosen other two bolts, remove 1st camshaft bearing cap.

2. Loosen other camshaft bearing caps. Loosening sequence of camshaft bearing cap is from outside to inside alternatively.



Note: 1. Do not lose location pin bush on camshaft bearing cap.

2. When removing camshaft bearing cap, do not knock or pry with a hard object. Otherwise, it may damage camshaft bearing cap.

3. After removing camshaft bearing cap, put it into the container in order.

7) Remove intake/exhaust camshaft

(1). Use S24 open spanner to hold exhaust or intake camshaft hexagon, rotate camshaft to keep camshaft peach away from tappet surface.

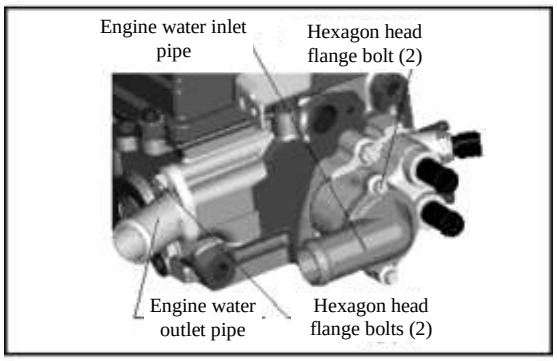
(2) Shake camshaft by hand to remove it.

(Note) 1. If camshaft can not be lifted straight, it is necessary to tighten 3rd camshaft bearing cap bolt again. Shake camshaft by hand to loosen it. Loosen 3rd camshaft bearing cap bolt again and remove camshaft.

2. Do not use a tool or other objects to pry camshaft or take it down forcedly. Otherwise, it may be broken.

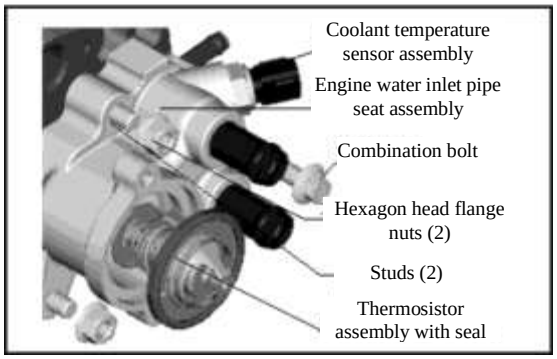
8) Remove valve tappet.

9) Loosen water inlet and outlet pipes.



10) Loosen water inlet seat, thermosistor and coolant temperature sensor.

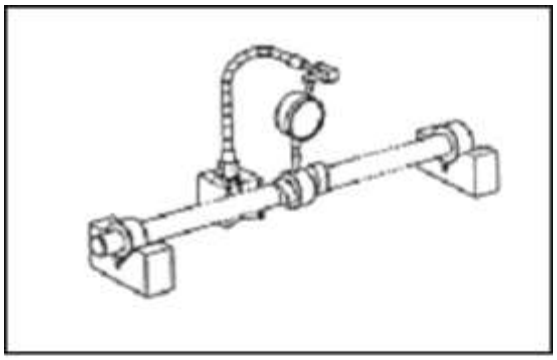
Use an open spanner to remove coolant temperature sensor. Do not use any impact tool.



3. Check radial runout of camshaft.

Use V block to support both ends of camshaft. Place dial gauge on the center of middle journal of camshaft, rotate camshaft by one turn to ensure camshaft does not move axially. When camshaft rotates, take down reading on dial gauge and calculate the maximum radial runout, i.e. the difference between the maximum reading and the minimum reading.

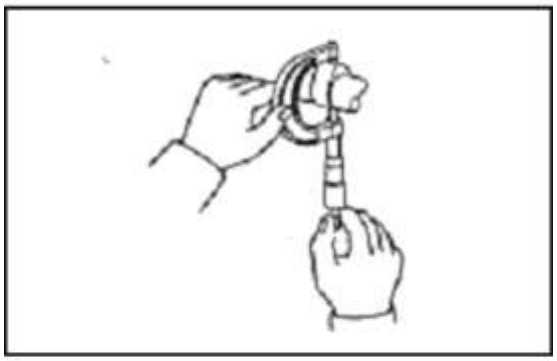
Maximum radial runout: 0.03mm



3. Check protruding height of cam.

Minimum limit: 39.45mm

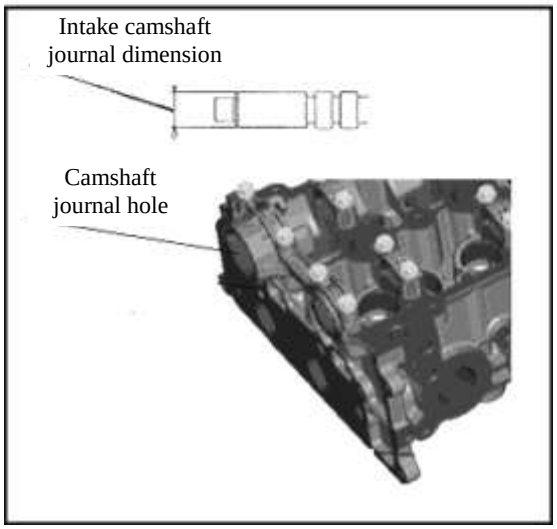
If the height measured is less than the minimum limit value, replace the camshaft.



4. Check the clearance between camshaft journal and cylinder head bearing hole.

① Measure outer diameter of camshaft journal.

② Measure inner diameter of five camshaft bearing seat holes on cylinder head. Measure each hole at two directions which are perpendicular to each other.



Clearance

1st camshaft bearing clearance	0.030~0.071mm
2nd ~5th camshaft bearing clearance	0.035~0.072 mm

19) Install engine oil filler cap.

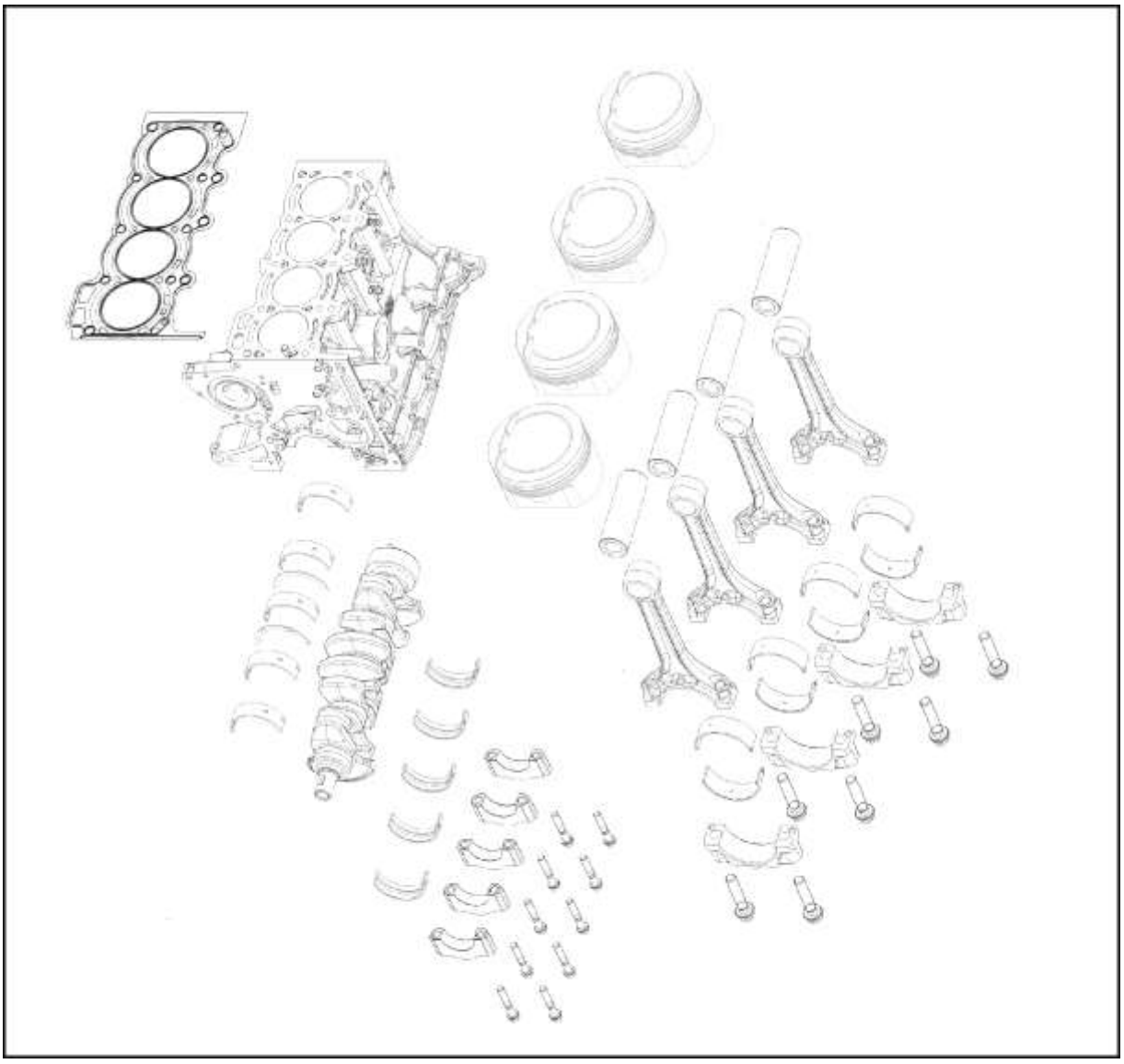
After applying lubricating oil on rubber seal ring of engine oil filler cap, install engine oil filler cap on cylinder head cover by rotating.

20) For installing spark plug assembly, refer to related section of ignition system.

21) For installing bar type ignition coil assembly, refer to related section of ignition system.

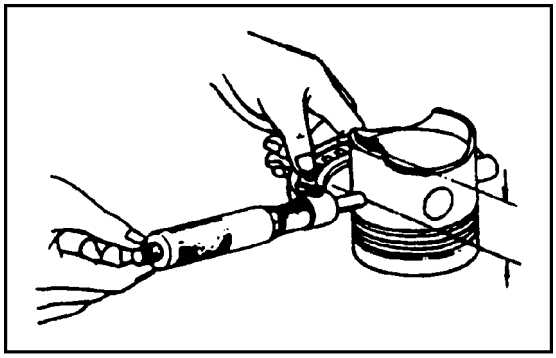
3.6 Cylinder block

Cylinder block composition



⑷Check if combination oil ring assembly is damaged.

Note: for one cylinder, if any of upper compression rings, middle compression ring and combination oil ring assembly are defective, replace piston ring as a whole group.



⑸ Measure outer diameter of the piston

Measure outer diameter of the piston at a distance from the lowest end of the piston

Measuring position for outer diameter of piston pin: 8mm away from lower end

Note: record measuring result. (When calculating the clearance between cylinder and piston, this measured result is required data.)

⑹Check piston pin clearance.

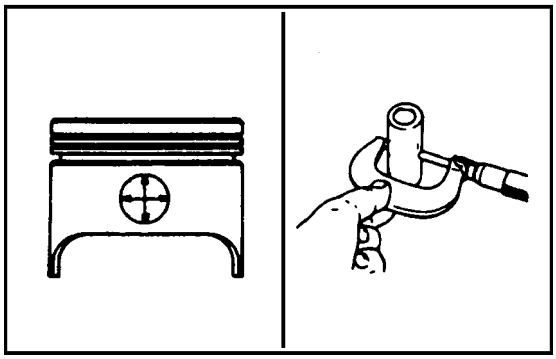
① Measure inner diameter of piston pin hole.

② Measure outer diameter of piston hole.

③ Calculate the clearance between piston pin hole and piston pin.

Allowable limit:

Note: If the clearance exceeds specified value, replace piston and piston rod in group.



⑺ Measure opening clearance of piston ring

After checking or repairing the cylinder, place piston ring into the cylinder until it is above 40mm from top installation surface of cylinder block. Measure piston ring opening clearance with a plug gauge.

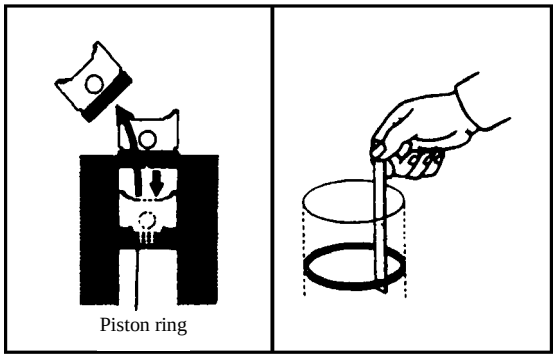
Lateral clearance between upper compression ring and ring groove: 0.04~0.09mm.

Lateral clearance between middle compression ring and ring groove: 0.02~0.06mm.

Backlash between oil ring and ring groove: 0.03~0.11mm.

Note: ①Before placing, apply lubricating oil on outside of piston ring.

②If opening clearance exceeds specified limit, replace piston ring in group.



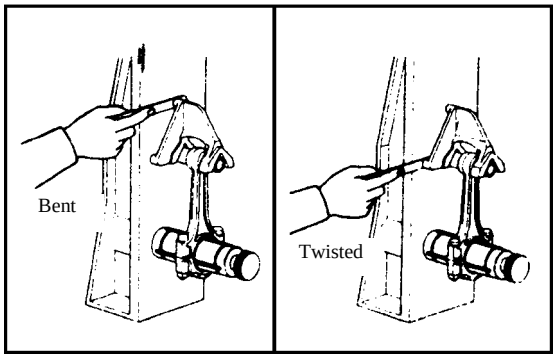
Check connecting rod

(1)Check if connecting rod is damaged or cracked.

(2)Check if connecting rod is bent and twisted.

Maximum bending limit: 0.03mm

Maximum torsion limit: 0.03mm



Grouping according to thickness of connecting rod bearing shell

Grouping No.	color mark.	Grouping size
4	Black	1.5
3	Dark brown	1.5
2	Green	1.5
1	Yellow	1.5

⑹Assembling relations of support hole, shaft hole, connecting rod journal

According to crankshaft connecting rod journal grouping code and connecting rod big end diameter grouping code, select appropriate connecting rod bearing shell.

Bearing shell code =6-(hole code + bearing code)

Table of assembling relation of support hole, bearing shell, connecting rod journal

support hole grouping / bearing shell grouping / main shaft split shaft	1		2	
	$\phi43^{+0.029}_{+0.023}$		$\phi43^{+0.023}_{+0.017}$	
1	Clearance	Bearing shell code	clearance	Bearing shell code
$\phi40^{-0.012}_{+0.018}$	0.017 0.035	04	0.017 0.035	03
2	Clearance	Bearing shell code	clearance	Bearing shell code
$\phi40^{-0.006}_{+0.012}$	0.017 0.035	03	0.017 0.035	02
3	Clearance	Bearing shell code	clearance	Bearing shell code
$\phi40^{-0}_{+0.006}$	0.017 0.035	02	0.017 0.035	01

Bearing shell =6-(Hole code +Bearing code

⑺ Install connecting rod upper/lower bearing shells

Install connecting rod upper bearing shell into connecting rod bearing shell seat hole, make location lip in corresponding slot of bearing shell seat and make shell back lean against connecting rod big end hole seat surface reliably.

Install connecting rod lower bearing shell into connecting rod bearing shell seat hole, make location lip in corresponding slot of bearing shell seat and make shell back lean against connecting rod big end hole seat surface reliably.

Note: ① Connecting rod upper bearing shell is provided with oil hole, but connecting rod lower bearing shell is not provided with oil hole.

② Oil or other foreign matters are forbidden between bearing shell back and connecting rod bearing support surface. Oil hole on the shell and oil hole on the support face shall be interlinked.

③ After bearing shell location lip is pressed into location slot of connecting rod bearing support, it will not become loose.

④ When installing, do not touch working surface and back face of connecting rod bearing shell, and installation surface of connecting rod bearing shell.

⑤ Wipe off lubricating oil on the back of each connecting rod bearing shell.