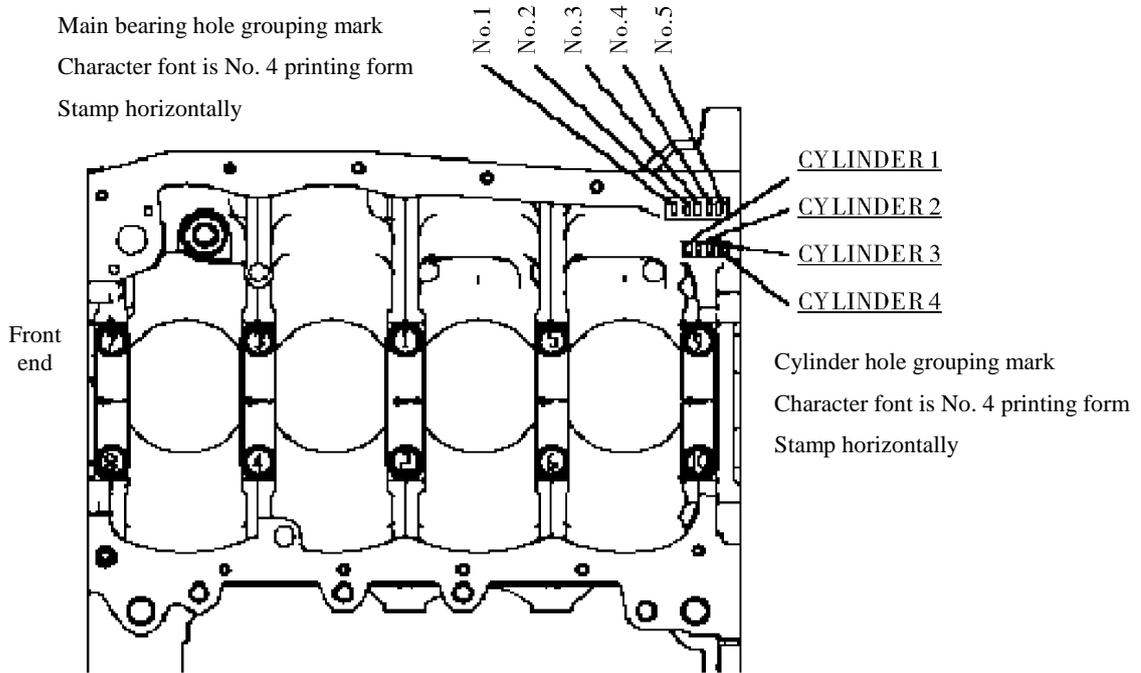


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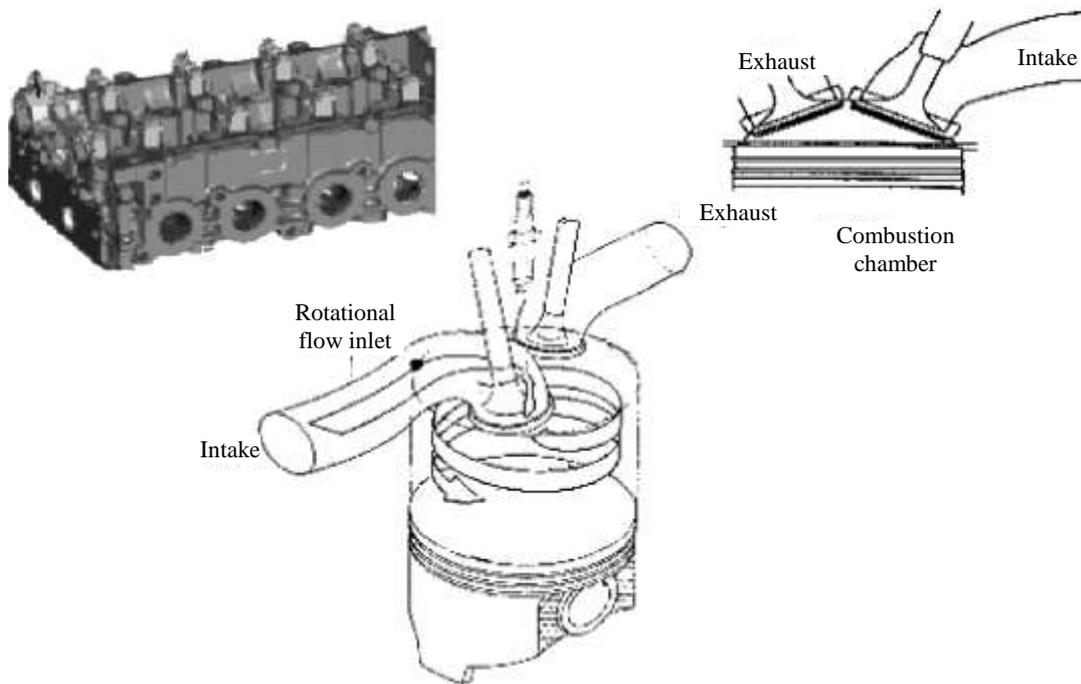
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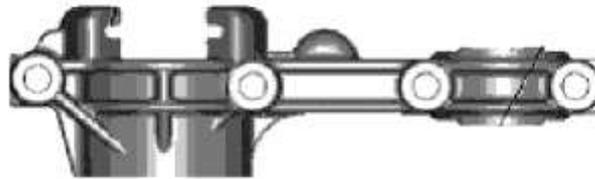
Cylinder head and combustion chamber

The cylinder head adopts aluminum alloy casting, double top-mounted camshaft structure and is provided with water jacket to cool cylinder head. Combustion chamber is like a roof ridge and spark plug is installed at the center of combustion chamber to keep flame spread uniform.

The valve seat opening is a little declined type The intake valve seat opening inclination is $14^{\circ}30'$ and exhaust valve seat opening inclination is $15^{\circ}12'$. The cylinder head is pressed into valve seat opening. There are two lines of camshaft bearing supports on the cylinder head. The first camshaft bearing support is combined. The cylinder head height is enlarged and rigidity is increased. Combined camshaft bearing support is provided with lubricating oil slot. The cylinder head bolt head seat is position in deep place. Fuel injector is installed on the cylinder head.



Cylinder head and combustion chamber

1st camshaft bearing support

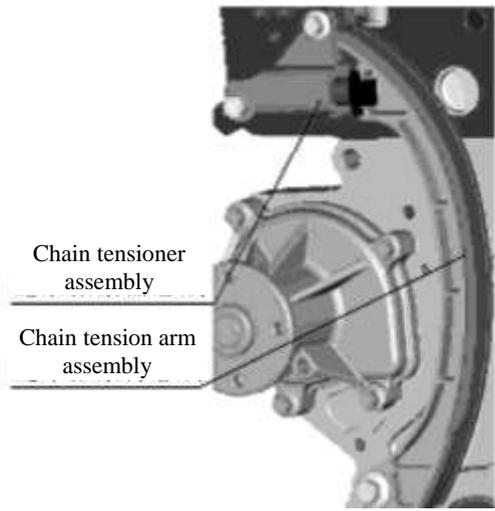
In order to increase combustion efficiency, air inlet adopts spiral-flow type to rotate gases in combustion chamber so as to increase the charging efficiency. The cylinder head is provided with longitudinal water channel.

Piston, piston rod and piston ring

Piston is made of aluminum casting alloy. There is a $\phi 60.4$ pit on the top (Note: piston top pit diameter of 1.3L engine is different from that of 1.5L engine) to enlarge combustion volume. There are two pits on the air intake side on the top of the piston to prevent it from colliding with intake valve. Piston is of three-ring short skirt type. Graphite coating is printed on the surface of piston. The first ring groove and some ring edges (including piston top) is oxidized to ensure safety and durability, resist heat load and mechanical load, and reduce the weight at the same time. Piston and cylinder block shall be matched to ensure fit clearance. The weight difference among four pistons of the same engine shall not be more than 6g. There is a forward mark (arrow) and piston outer diameter grouping number (A, B, C) printed on the top of the piston. Piston pin hole grouping adopts red and yellow. Piston skirt barrel line adopts hyperbolic cosine function. Barrel skirt and cylinder wall formed bidirectional wedge oil film make the skirt have higher bearing capacity and good lubrication. In addition, inclination in piston motion can avoid load on closed angle to reduce impact of the piston on cylinder wall.

In order to endure surface hardness of piston pin, inner and outer surfaces of the piston pin are carburized. Piston pin diameter adopts red and yellow marks on piston pin end face.

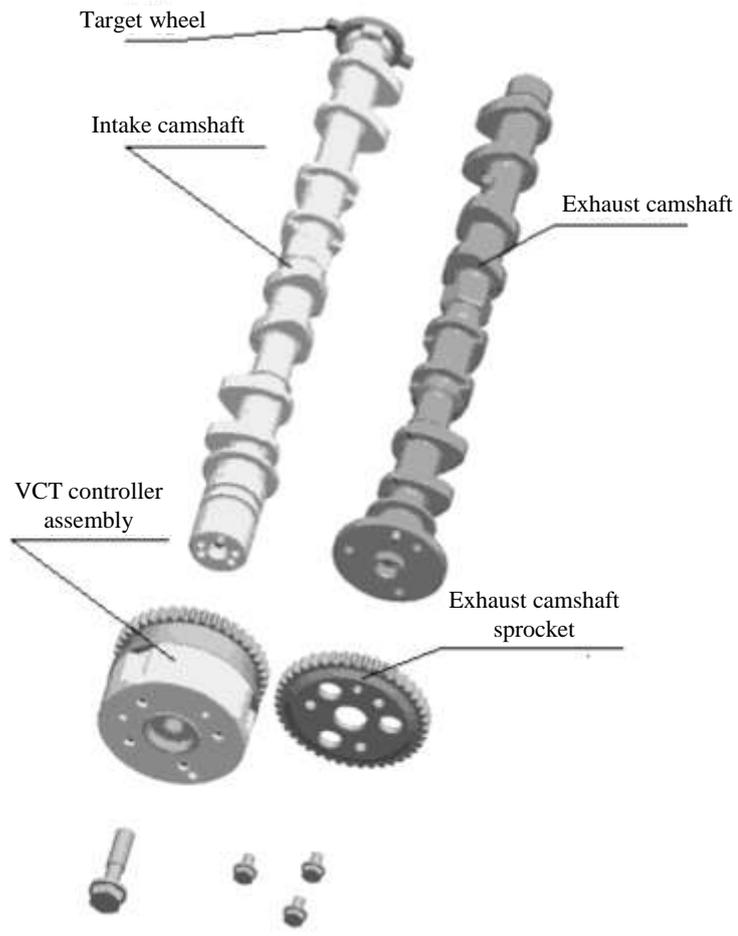
In order to reduce mechanical loss, 1st and 2nd piston rings shall be thin rings. Oil ring adopts two side rings and one grommet.



Chain tensioner assembly and chain tension arm assembly

Camshaft

Intake and exhaust camshaft are made of cold shock alloy cast iron. Cam included angle is 90°. Exhaust camshaft assembly drives intake camshaft assembly. The first journal of intake camshaft assembly has phase advance and delayed oil line.

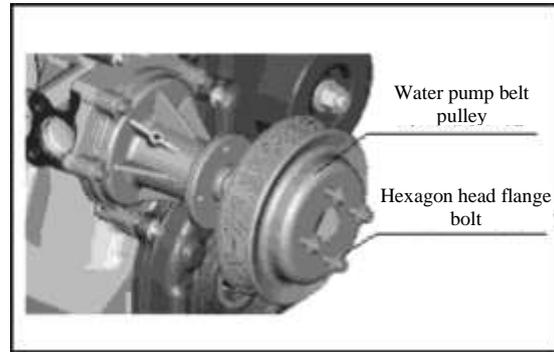


Intake and exhaust camshaft assembly



17) Install water pump belt pulley

Tightening torque of bolt: $11.5 \pm 2.5 \text{N.m}$

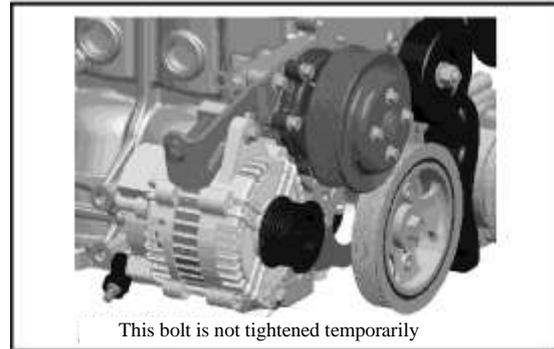


18) Install generator assembly and V-belt

Install generator assembly: it is installed on front end of cylinder block and adjusting bracket of the generator through bolts and nuts. Bolts are not tightened temporarily.

(2) Install V-belt. Install V-belt as shown in the Fig. Adjust adjusting bolt on the generator bracket to tension the belt and rotate crankshaft by more than two turns. Specified value of belt tensioning is $(650 \pm 50) \text{ N}$. Measuring position is at the arrow as shown in the Fig.

Tighten hexagon head flange bolt with tightening torque $23 \pm 4 \text{N m}$, tighten hexagon head bolt with tightening torque $50 \pm 10 \text{N m}$.



19) Install canister solenoid valve bracket and canister solenoid valve

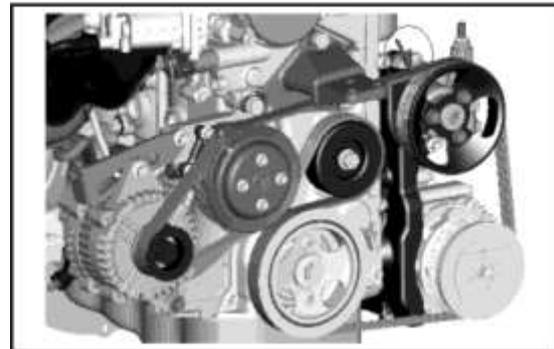
20) Install intake manifold and canister solenoid valve exhaust pipe; install connecting pipe from crankcase vent valve to intake manifold and fixing bolt of engine wire harness ground.

21) Install electronic throttle body bracket

22) Install each wire harness plug, actuator and sensor of the engine.

23) Install engine support and frame, and connect them. Tighten bolts and move out the jack under oil pan.

22) Fill cooling water.





3) Check chain guide rail assembly

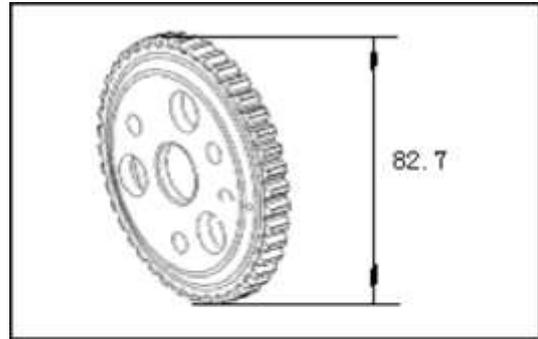
If deep scratch, groove and overlap occur on chain guide rail surface, replace chain guide rail assembly.

4) Check chain tension arm assembly

If deep scratch, groove and overlap occur on tension arm, replace chain tension arm assembly.

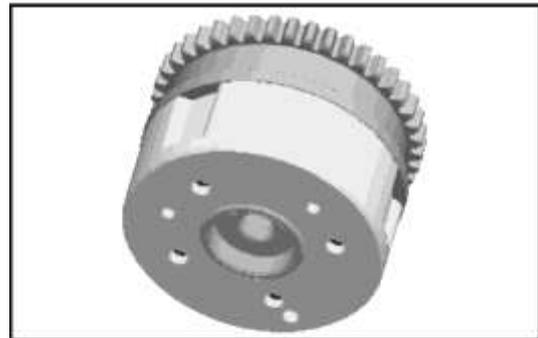
5) Check exhaust camshaft sprocket

Exhaust camshaft sprocket wear limit: 82.7mm.



6) Check VCT controller assembly sprocket

VCT controller assembly sprocket wear limit: 82.7mm.

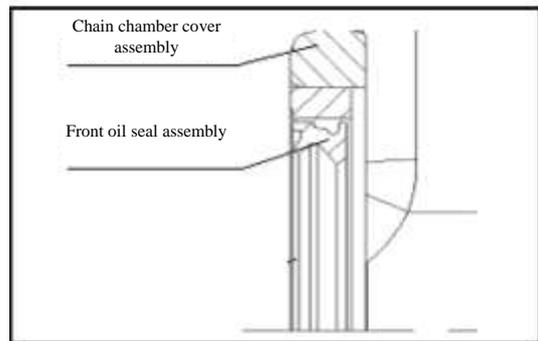


7) Check chain gear cover assembly

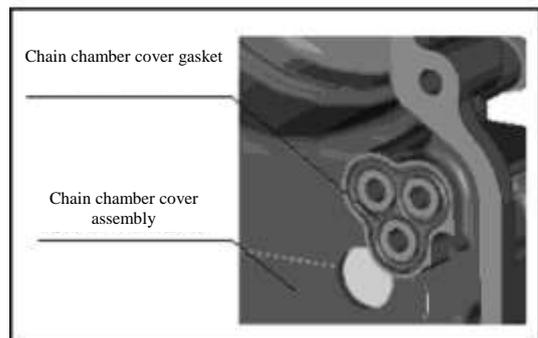
Check front oil seal assembly

Check front oil seal assembly lip. If any gap, wrinkle or crack occurs, replace front oil seal assembly.

Check front oil seal assembly spring. If breakage, extension and skipping occur, replace front oil seal assembly.



Replace it with new chain gear cover gasket



③ Check each seal surface of chain gear cover assembly is in



good state and has no crack, sand hole and warping. Otherwise, replace chain gear cover assembly.

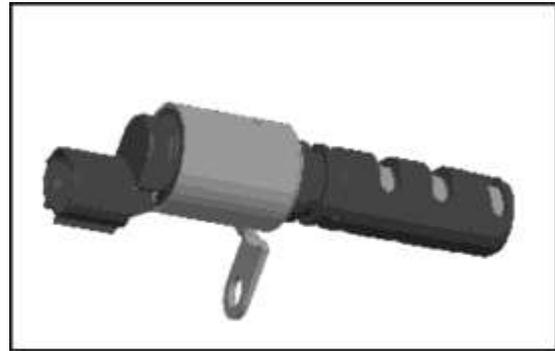
8) For checking V-belt, refer to 3.1.

9) Check OCV control valve assembly

Minimum valve diameter of OCV control valve assembly shall be larger than $\phi 17.7\text{mm}$. If the measured value is less than the minimum valve diameter, replace OCV control valve assembly.

② Check oil inlet duct hole, oil drainage duct hole, phase advance oil duct hole and phase delay oil duct hole of OCV control valve assembly. If scale formation occurs, replace OCV control valve assembly.

Note: For OCV control valve assembly in details, please refer to CA4GA1 Engine Maintenance Manual (electronic control).



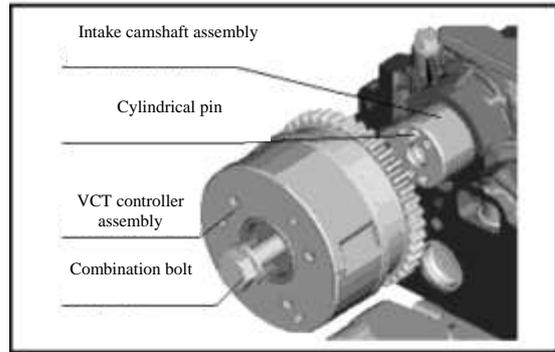
Install

1) Install VCT controller assembly

Fasten intake camshaft with a special tool, pour several drops of lubricating oil on the front end journal of intake camshaft, align pin hole of VCT controller assembly with cylindrical pin on camshaft.

After inserting, twist the sprocket slightly to check if location pin is inserted into location hole.

Tighten VCT controller assembly on camshaft with combination bolt. Tightening torque is: $47 \pm 7\text{N}$.

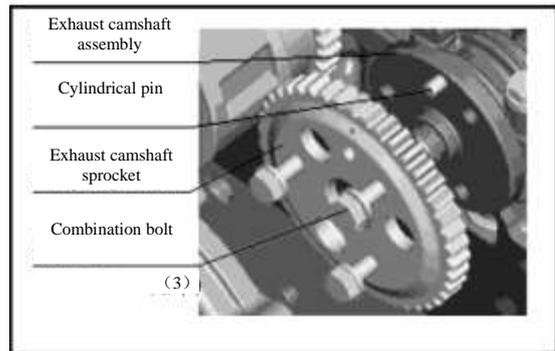


2) Install exhaust camshaft sprocket

① Use a special tool to fasten exhaust camshaft, align pin hole on exhaust camshaft sprocket with the pin on camshaft and place it on exhaust camshaft.

Note: After inserting, twist the sprocket slightly to check if location pin is inserted into location hole.

Tighten the sprocket on camshaft with combination bolt. Tightening torque is $8 \pm 1.6\text{N.m}$.



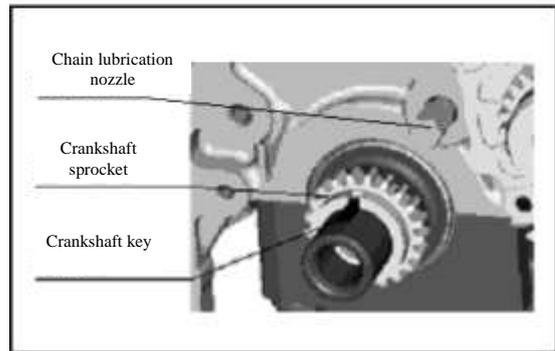
3) Install crankshaft sprocket

① Use a special tool to fasten crankshaft, keep crankshaft sprocket slot side outwards and make sprocket key slot and crankshaft key slot coincide.

② Install crankshaft key

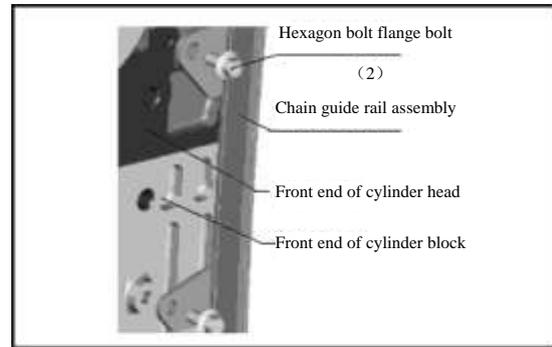
4) Install chain lubrication nozzle

Apply anaerobic sealant on threads of chain lubrication nozzle and install it on cylinder block front end, tighten it and keep injecting hole downwards.



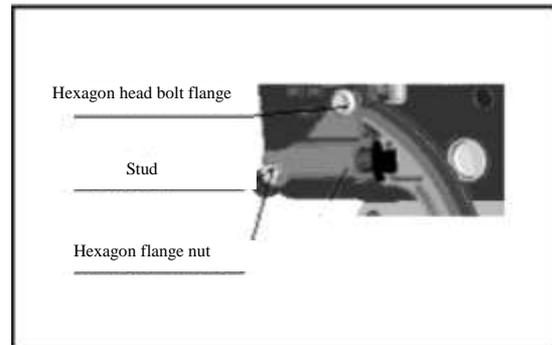
5) Install chain guide rail assembly

Install chain guide rail assembly on cylinder block and cylinder head front end. Tightening torque of bolts is $8 \pm 2 \text{N.m}$.


6) Install tensioner assembly

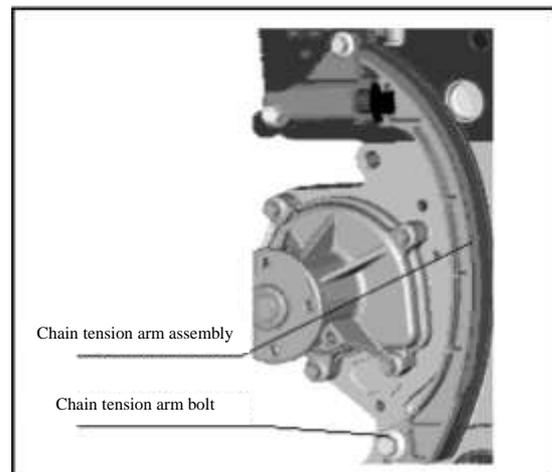
Stud is installed on cylinder head front end.

Tightening torque for installing chain tensioner assembly, stud and nut is $9 \pm 1.8 \text{N.m}$


7) Install chain tension arm

Chain tension arm assembly is installed on cylinder block and cylinder head block front end. Tightening torque of chain tension arm bolt is $19 \pm 3.8 \text{N.m}$.

Note: after tightening chain tension arm bolt, chain tension arm shall move flexibly.

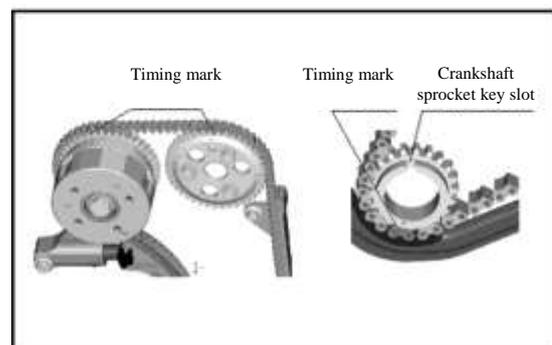

8) Install timing chain

Keep timing marks of VCT controller assembly sprocket and exhaust camshaft sprocket upwards, rotate crankshaft to make crankshaft sprocket key slot upwards.

Install timing chain and align timing mark (yellow leaf) with timing mark on the sprocket.

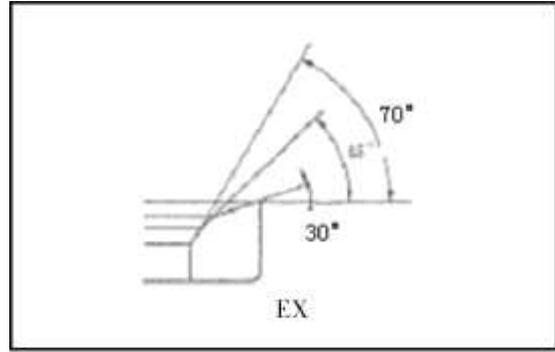
Note: If there is no timing mark on replaced timing chain, make timing mark according to the following requirements.

There are 14 teeth between timing mark of VCT controller assembly sprocket and timing mark of exhaust camshaft sprocket, 78 teeth between timing mark of VCT controller assembly sprocket and timing mark of crankshaft sprocket, and 78 teeth between timing mark of exhaust camshaft sprocket and timing mark of crankshaft sprocket.





Use 45° reamer to remove the burr generated during the course of repairing by 30° and 70° reamers



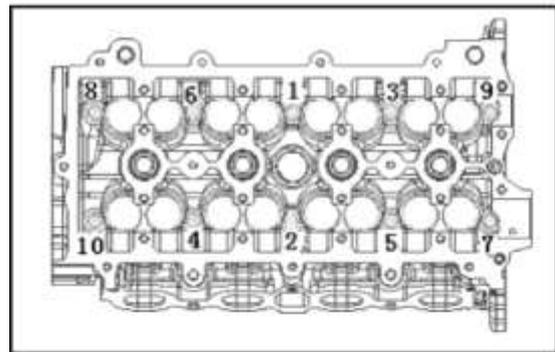
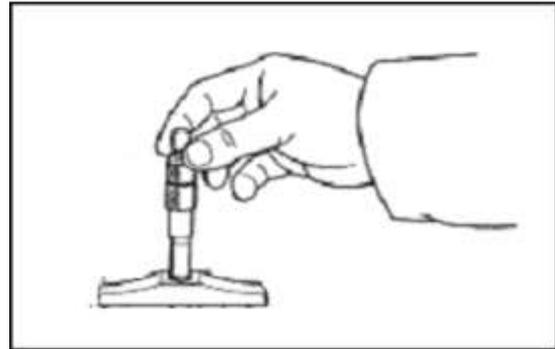
2. Check valve sinkage.

After repairing valve seat, place a new valve. Measure the distance between joint surface of cylinder block and cylinder head (contact surface of cylinder head gasket) and the highest of valve. Make sure the distance shall not exceed the following limit value.

Maximum limit value: Intake valve: 2.855 mm

Exhaust valve: 3.01 mm

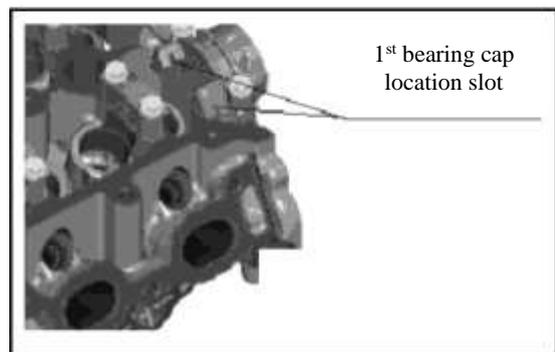
Note: if sinkage exceeds the maximum limit, replace cylinder head.



Check camshaft bearing cap.

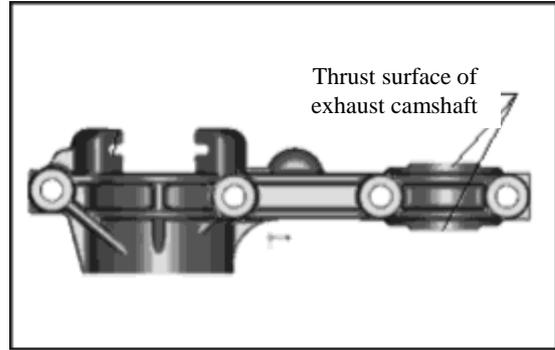
1. Check if camshaft bearing cap and camshaft bearing support are peeling off or burnt. If they are damaged, replace the complete set of camshaft bearing cap and cylinder head.

2. Check location slot width for 1st bearing cap intake camshaft side: 3~3.05mm. If it cannot meet the requirement, replace the complete set of cylinder head assembly.





3. Check thrust surface width of 1st bearing cap exhaust camshaft side: 21~21.05mm. If it cannot meet the requirement, replace the complete set of cylinder head assembly.



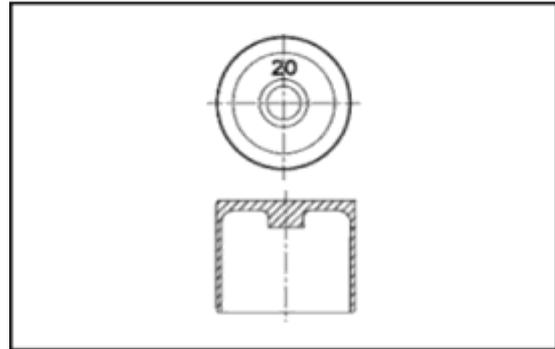
Check valve tappet.

1. Check if there is any slide mark on the top of valve tappet. If there is deep slide mark or sintering, replace the valve tappet.

2. Check if there is any slide mark on cylindrical surface of valve tappet. If there is deep slide mark or sintering, replace the valve tappet.

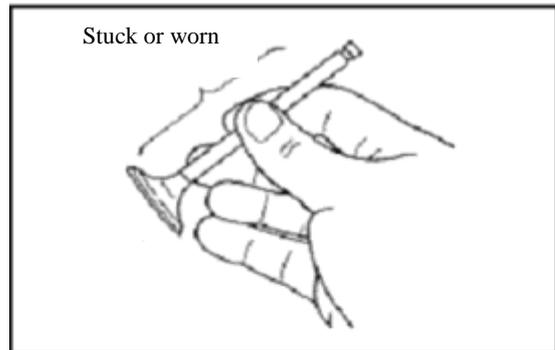
3. Check if valve tappet thickness is within 5.20~5.80mm. Otherwise, replace valve tappet.

Note: Make a mark on checked valve tappet and place them in a good order.



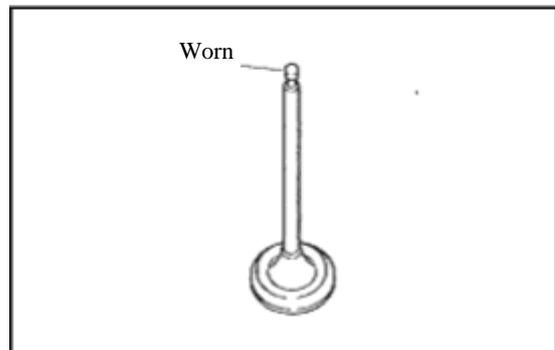
Check valve.

Check valve stem. Check if valve stem is stuck or damaged. If valve stem is damaged, replace the valve and valve guide pipe together.



Check valve stem tail.

Check if valve stem tail is worn abnormally.

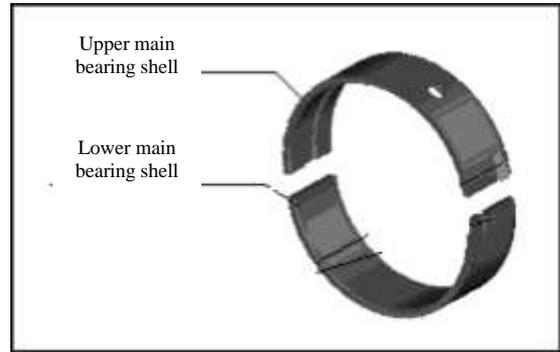




(5) Check axial clearance of crankshaft

① Install main bearing shell on main bearing and main bearing shell cover of cylinder block. During the course of checking, do not touch working surface and back face of main bearing shell, and installation surface of main bearing and main bearing shell cover of cylinder block.

Note: When operating, do not make upper main bearing shell and lower main bearing shell upside down. Upper main bearing shell (on cylinder block)..... is provided with oil groove and oil hole. Lower main bearing shell (on bearing cap)..... is not provided with oil groove and oil hole.

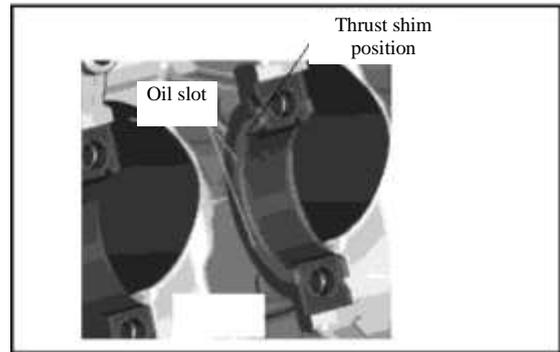


② Place crankshaft on cylinder block

Note: Be careful! Do not scratch crankshaft and main bearing shell.

③ Push two crankshaft thrust shims into two sides of 3rd main bearing support and keep oil groove outwards, i.e., oil groove is on the side of crankshaft.

Note: do not apply lubricating oil on crankshaft thrust shim.



④ Install main bearing cap, tighten it twice according to specified torque 60±5N.m.

⑤ Pry crankshaft balance block with a flat screwdriver to make crankshaft run out forwards, measure axial clearance of crankshaft with a dial gauge

Axial clearance: 0.04~0.20mm.

Note: record measured result.

⑥ If axial clearance exceeds specified value, you will determine which kind of thrust shim will be used or replace thrust shim according to the following calculation.

Measured axial clearance: A

The sum of crankshaft thrust shim thickness on the left and right: B

Specified axial clearance: C

Required crankshaft thrust shim thickness: $D = \{ (A+B) - C \} \div 2$

Based on calculated result of D value, select appropriate crankshaft thrust shim from the data in the following table.

Crankshaft thrust shim size	Crankshaft thrust shim thickness (mm)	Remark
Standard size	2.15~2.18	When the maximum of D ≤ 2.18
Enlarged size 0.125	2.275~2.305	When the maximum of D > 2.18
Enlarged size 0.250	2.40~2.43	When the maximum of D > 2.305

For example: measured axial clearance: A=0.53mm

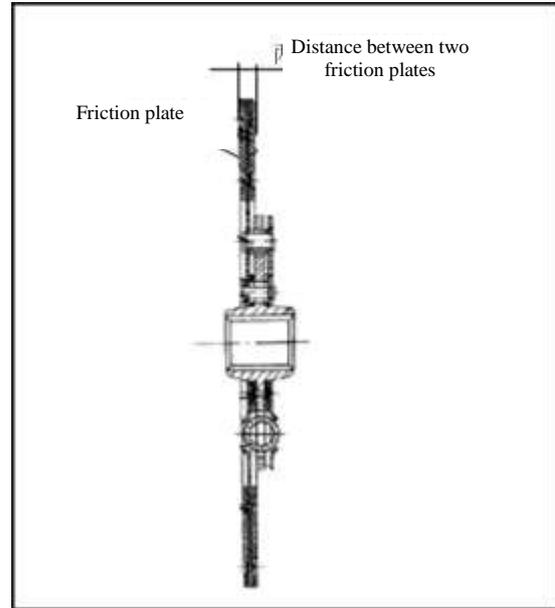
The sum of left and right crankshaft thrust shim thickness: B=4.2mm



6) Check clutch driven plate assembly

(1) Check average thickness of two friction surfaces for clutch driven plate assembly is 8.0~8.4mm. Average limit thickness of two friction surfaces is 7.8mm.

(2) Friction plate of clutch driven plate assembly shall not be broken, greasy and dirty.



7) Check flywheel gear ring assembly

(1) Confirm contact surface between gear ring of flywheel gear ring assembly and clutch plate is not worn and damaged.

(2) Check radial runout of flywheel gear ring assembly

Tighten flywheel bolt according to specified torque.

Tightening torque is 73.3~82.7N.m

Note: Before checking, tighten main bearing shell cover of crankshaft to specified torque.

Measure radial runout of flywheel gear ring assembly with dial gauge

Radial runout limit of flywheel gear ring assembly: 0.12mm

Note: if measured radial runout exceeds the limit, it is necessary to replace flywheel gear ring assembly.

8) For checking relief valve assembly, refer to “Lubrication System”

9) Check other parts

(1) Check if other parts are damaged or cracked. If necessary, replace them.

(2) For checking engine oil pump assembly, refer to “Lubrication System”

(3) For checking water pump assembly, refer to “cooling system”.

Install

(Notes)

(1) Clean all parts thoroughly.

(2) Before assembling, apply lubricating oil on all moving parts and rotating parts.

(3) Replace defective gasket to remove all sealant.

(4) If necessary, apply sealant to prevent water leakage and oil leakage.

(5) Use appropriate bolt, nut and shim. Tighten bolt and nut according to specified torque. Do not tighten stud on aluminum alloy parts too tightly.

