



Removal

Engine removal is not required for this procedure.

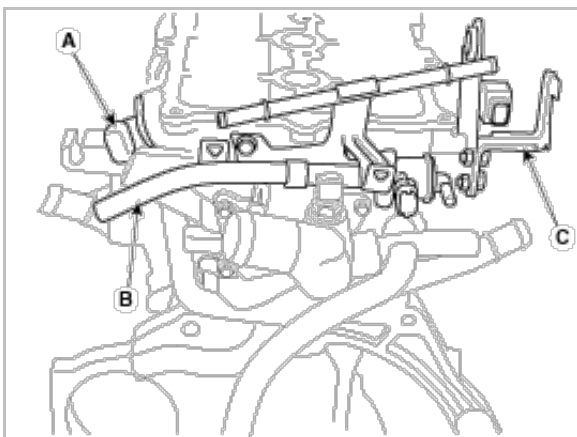
CAUTION

- Use Fender cover to avoid damaging painted surfaces.
- To avoid damaging the cylinder head, wait until the engine coolant temperature drops below normal temperature before removing it.
- When handling a metal gasket, take care not to fold the gasket or damage the contact surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

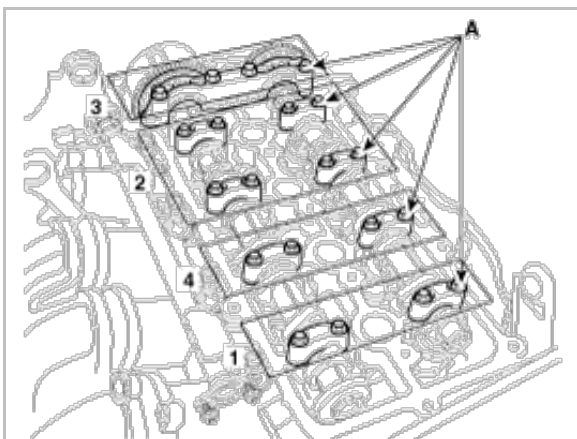
NOTE

- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.

1. Remove the timing chain.
(Refer to Timing system in this group)
2. Remove the exhaust manifold assembly. (Refer to Intake and exhaust system in this group)
3. Remove the intake manifold module assembly. (Refer to Intake and exhaust system in this group)
4. Disconnect the camshaft position sensor(CMP) connector (A) and remove the purge control solenoid valve(PCSV) bracket (B) and the module hanger bracket (C).



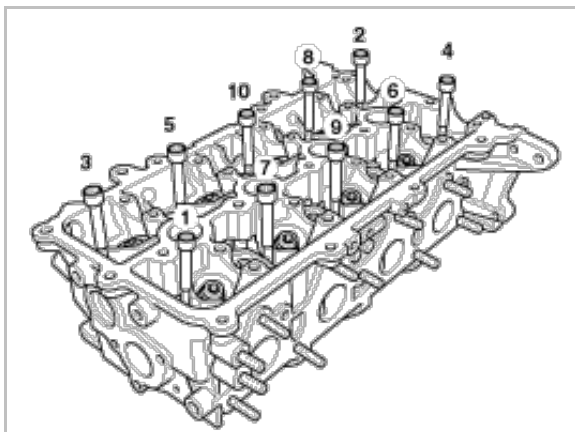
5. Remove the camshaft bearing caps (A) with the order below.



6. Remove the water temperature control assembly and the oil control valve(OCV).

7. Remove the cylinder head bolts, then remove the cylinder head.

(1) Uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown.



CAUTION

Head warpage or cracking could result from removing bolts in an incorrect order.

(2) Lift the cylinder head from the cylinder block and put the cylinder head on wooden blocks.

CAUTION

Be careful not to damage the contact surfaces of the cylinder head and cylinder block.

Disassembly

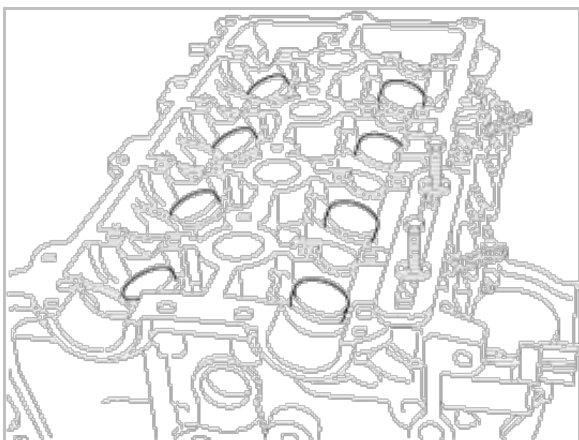
NOTE

Identify MLA(Mechanical lash adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove the MLAs (A).

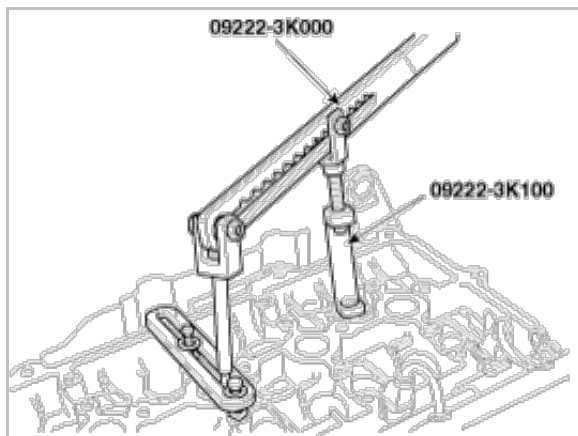
CAUTION

When removing MLAs, mark all the MLAs for their rearrangement.



2. Remove the valves.

(1) Using the SST (09222 - 3K000, 09222 - 3K100), compress the valve spring and remove the retainer lock.



- (2) Remove the spring retainer.
- (3) Remove the valve spring.
- (4) Remove the valve.
- (5) Remove the valve stem seal.
- (6) Using a magnetic finger, remove the spring seat.

CAUTION

Do not reuse the valve stem seals.

Inspection

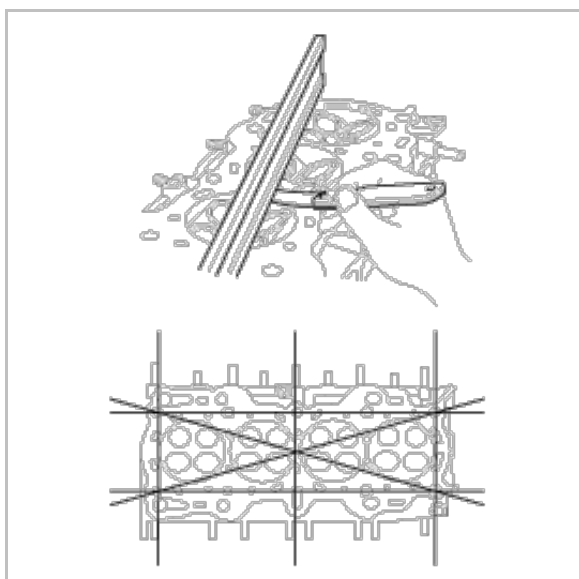
Cylinder Head

1. Inspect for flatness.

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder block and the manifolds for warpage.

Flatness of cylinder head gasket surface

Standard : Less than 0.05mm (0.0020in)



2. Inspect for cracks.

Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

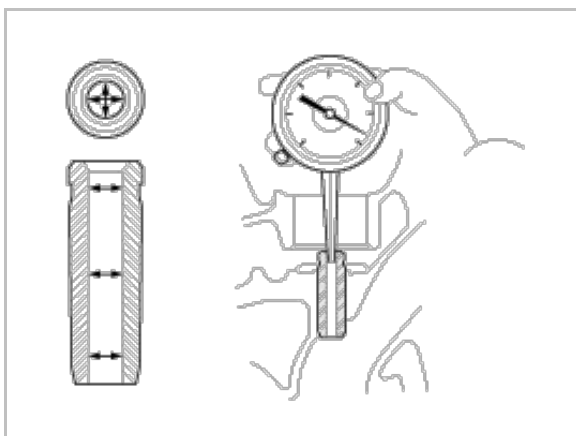
Valve And Valve Spring

1. Inspect the valve stems and valve guides.

- (1) Using a caliper gauge, measure the inner diameter of valve guide.

Valve guide inner diameter :

5.500 ~ 5.512mm (0.2165 ~ 0.2170in)

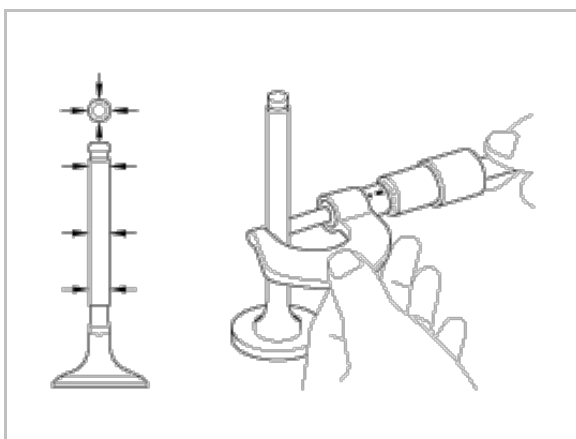


- (2) Using a micrometer, measure the outer diameter of valve stem.

Valve stem outer diameter

Intake : 5.465 ~ 5.480mm (0.2152 ~ 0.2157in)

Exhaust : 5.458 ~ 5.470mm (0.2149 ~ 0.2154in)



- (3) Subtract the valve stem outer diameter measurement from the valve guide inner diameter measurement.

Valve stem- to-guide clearance

Intake : 0.020 ~ 0.047mm (0.0008 ~ 0.0019in)

Exhaust : 0.030 ~ 0.054mm (0.0012 ~ 0.0021in)

If the clearance is greater than specification, replace the valve or the cylinder head.

2. Inspect the valves.

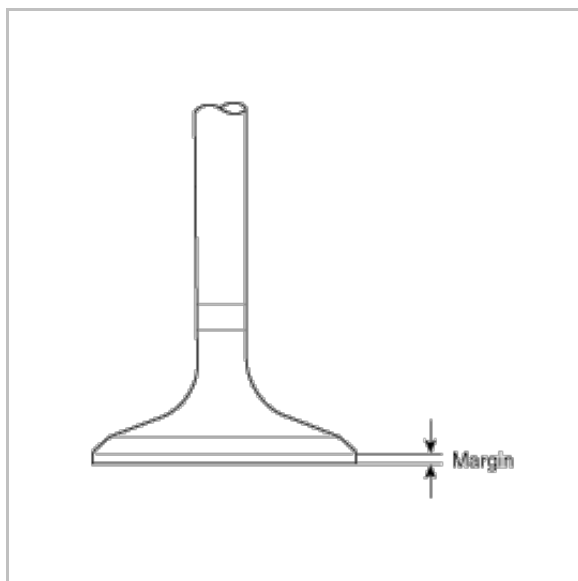
- (1) Check the valve is ground to the correct valve face angle.
 - (2) Check that the surface of valve for wear.
If the valve face is worn, replace the valve.
 - (3) Check the valve head margin thickness.
If the margin thickness is less than minimum, replace the valve.
-

Margin

Standard

Intake : 1.1mm (0.0433in)

Exhaust : 1.26mm (0.0496in)



- (4) Check the length of valve.

Valve length

Standard

Intake : 93.15mm (3.6673 in)

Exhaust : 92.60mm (3.6457 in)

- (5) Check the surface of valve stem tip for wear.
If the valve stem tip is worn, replace the valve.

3. Inspect the valve seats.

- (1) Check the valve seat for evidence of overheating and improper contact with the valve face. If the valve seat is worn, replace the cylinder head.
- (2) Check the valve guide for wear. If the valve guide is worn, replace the cylinder head.

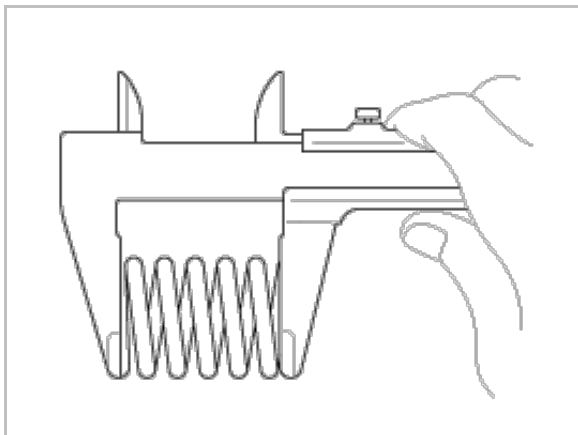
4. Inspect the valve springs.

- (1) Using a steel square, measure the out-of-square of valve spring.
- (2) Using a vernier calipers, measure the free length of valve spring.

Valve spring**Standard**

Free height : 45.1mm (1.7755in)

Out of square : Less than 1.5°



Camshaft

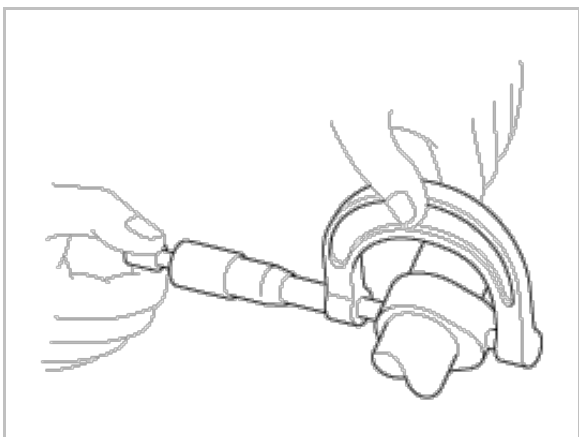
1. Inspect the cam height.

Using a micrometer, measure the cam height.

Cam height

Intake : 43.85mm (1.7264in)

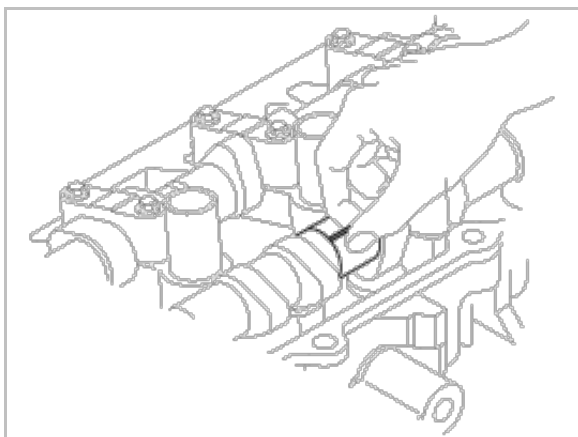
Exhaust : 42.85mm (1.6870in)



If the cam lobe height is less than specified, replace the camshaft.

2. Inspect the camshaft journal clearance.

- (1) Clean the bearing caps and camshaft journals.
- (2) Place the camshafts on the cylinder head.
- (3) Lay a strip of plastigage across each of the camshaft journal.



- (4) Install the bearing caps and tighten the bolts with specified torque.
-

Tightening torque :

M6 bolts :

11.8 ~ 13.7Nm (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)

M8 bolts :

18.6 ~ 22.6Nm (1.9 ~ 2.3 kgf.m, 13.7 ~ 16.6lb-ft)

CAUTION

Do not turn the camshaft.

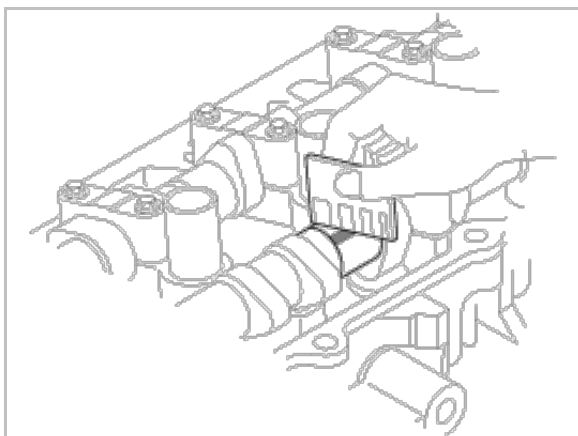
(5) Remove the bearing caps.

(6) Measure the plastigage at its widest point.

Bearing oil clearance

Standard : 0.027 ~ 0.058mm (0.0011 ~ 0.0023in)

Limit : 0.1mm (0.0039in)



If the oil clearance is greater than specified, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

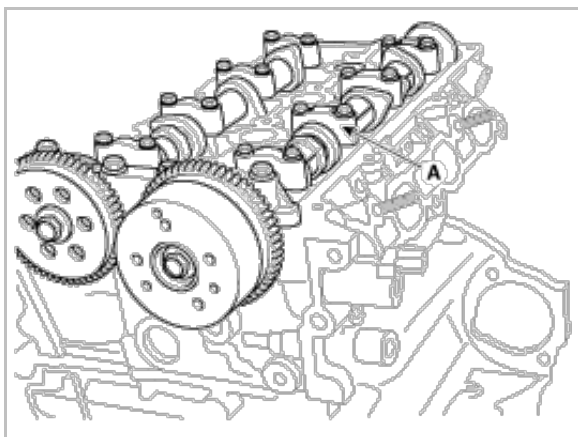
3. Inspect the camshaft end play.

(1) Install the camshafts.

(2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play

Standard : 0.1 ~ 0.2mm (0.0039 ~ 0.0079in)



If the end play is greater than specified, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- (3) Remove the camshafts.

Continuous Variable Valve Timing(CVVT) Assembly

1. Inspect the Continuous variable valve timing(CVVT) assembly.
 - (1) Fix the Continuous variable valve timing(CVVT) with its camshaft in a vice.
 - (2) Check that the CVVT assembly will not turn. If it is not turned, it is in normal condition.
 - (3) Apply vinyl tape to all the parts except the one hole.
 - (4) Using an air gun, apply the pressure, 147.10kpa (1.5kg/cm², 21.33psi) in the hole. This makes the lock pin in maximum retarded state released.

NOTE

- Wrap around it with a shop rag and the likes, because the oil splashes.
- After releasing the pin, you can turn the CVVT assembly for advance by hand.
- If there may be much air leakage, the pin can not be released.

- (5) Under the condition of 3), turn the CVVT assembly to the advance angle side with your hand.
 - A. Depending on the air pressure, the CVVT assembly will turn to the advance side.
 - B. Also, under the condition that the pressure can be hardly applied because of the air leakage from the port, there may be the case that the lock pin could be hardly released.
- (6) Except the position where the lock pin meets at the maximum delay angle, let the CVVT assembly turn back and forth and check the movable range and that there is no disturbance.

Standard : Movable smoothly in the range about 25°

- (7) Turn the CVVT assembly with your hand counterclockwise and lock it at the maximum delay angle position.

Reassembly

NOTE

- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surface.
- Replace oil seals with new ones.

1. Install the valves.
 - (1) Install the spring seats.
 - (2) Using the SST (09222 - 2B100), push in a new oil seal.

NOTE

Do not reuse old valve stem oil seals.
Incorrect installation of the seal could result in oil leakage past the valve guides.

CAUTION

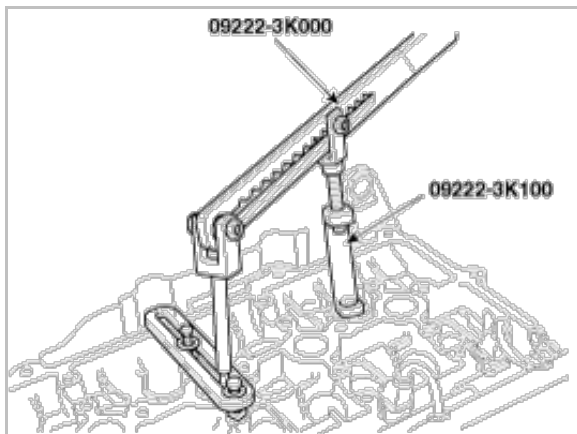
Intake valve stem seals are different from exhaust ones in type. Do not reassembly ones in the other's places.

- (3) Install the valve, valve spring and spring retainer, after applying engine oil at the end of each valve.
-

NOTE

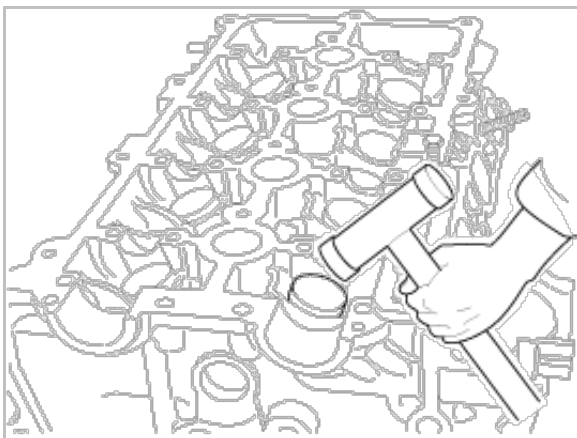
When installing valve springs, the enamel coated side should face the valve spring retainer.

2. Using the SST(09222 - 3K000, 09222 - 3K100), compress the spring and install the retainer locks. After installing the valves, ensure that the retainer locks are correctly in place before releasing the valve spring compressor.

**CAUTION**

When installing the SST, use the torque, 1.2kgf.m or less.

3. Lightly tap the end of each valve stem two or three times with the wooden handle of a hammer to ensure proper seating of the valve and retainer lock.



4. Install the MLA(Mechanical lash adjuster)s. Check that the MLA rotates smoothly by hand.

NOTE

All the MLAs should be installed in its original position.

Installation

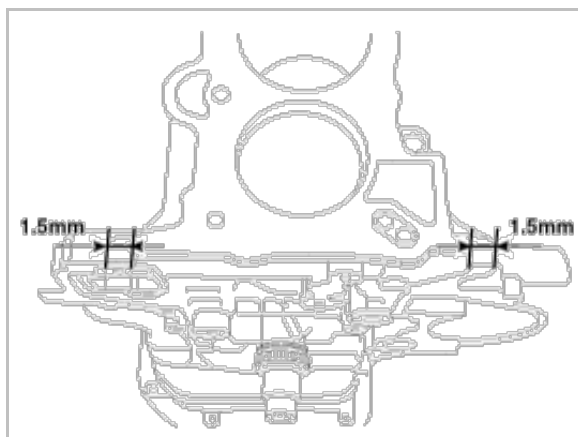
NOTE

- Thoroughly clean all parts to be assembled.
- Always use a new cylinder head and manifold gasket.
- Always use a new cylinder head bolt.
- The cylinder head gasket is a metal gasket. Take care not to bend it.

- Rotate the crankshaft, set the No.1 piston at TDC.

1. Install the cylinder head assembly.

- (1) Before installing, remove the hardened sealant from the cylinder block and cylinder head surface.
- (2) Before installing the cylinder head gasket, apply sealant on the upper surface of the cylinder block and reassemble the gasket within five minutes.



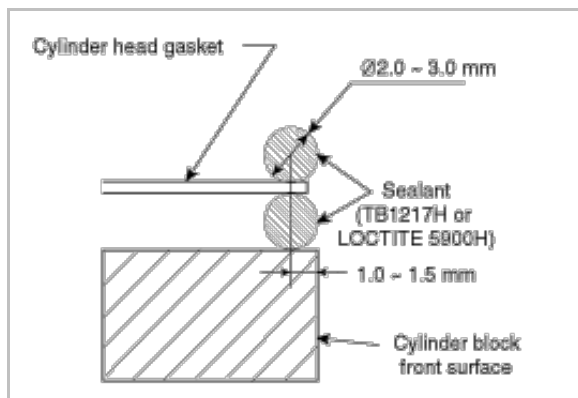
NOTE

Refer to the illustration for applying sealant.

Width : 2.0 ~ 3.0mm(0.0787~0.1181in.)

Position : 1.0 ~ 1.5mm(0.0394~0.0591in.)

Specification : TB 1217H or LOCTITE 5900H



- (3) After installing the cylinder head gasket on the cylinder block, apply sealant on the upper surface of the cylinder head gasket and reassemble in five minutes.

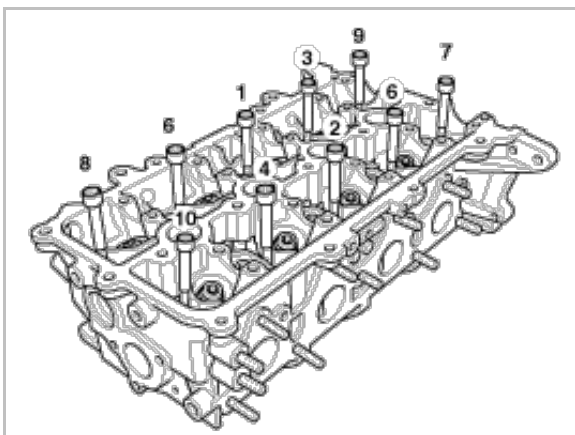
2. Place the cylinder head carefully not to damage the gasket.

3. Install the cylinder head bolts with washers.

- (1) Tighten the 10 cylinder head bolts, in several passes, in the sequence shown.

Tightening torque :

17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 90~95° + 100~105°

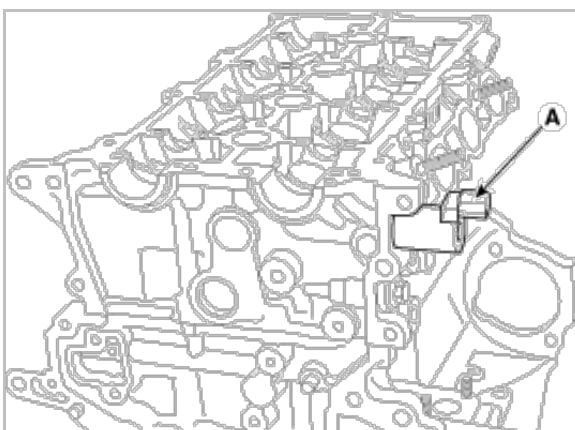

CAUTION

Always use new cylinder head bolts.

4. Install the oil control valve(OCV) (A).

Tightening torque :

9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

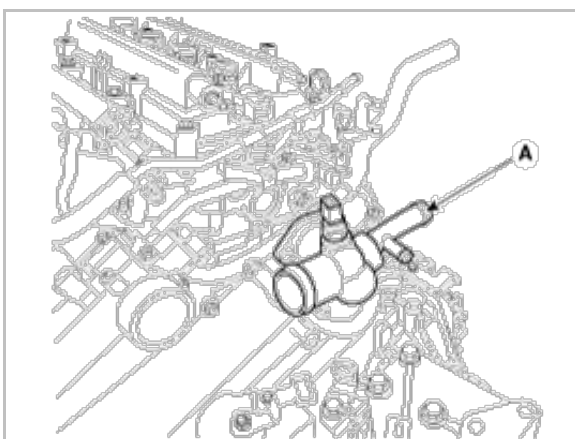


5. Tighten the mounting bolts for the water temperature control assembly (A) after installing the heater pipe.

Tightening torque :

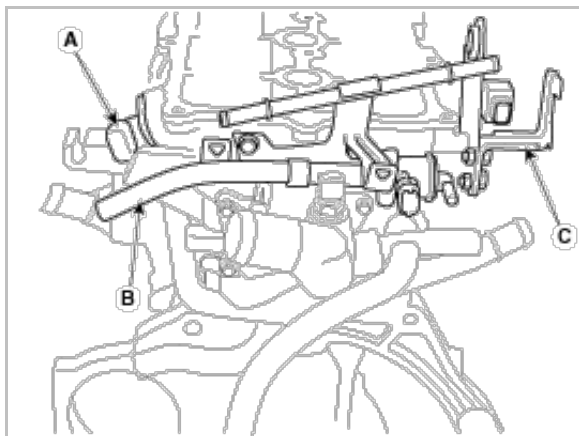
M6 bolts : 9.8 ~ 11.8N.m (1.0 ~ 1.2kgf.m, 7.2 ~ 8.7lb-ft)

M8 bolts : 18.6 ~ 23.5N.m (1.9 ~ 2.4kgf.m, 13.7 ~ 17.4lb-ft)



6. Connect the camshaft position sensor(CMP) connector (A) and install the purge control solenoid valve(PCSV) bracket (B) and the module hanger bracket (C)

(B) and the module hanger bracket (C).



7. Install the camshafts.

(1) Before installing, apply engine oil on journals.

CAUTION

Do not make oil flow down to the front side of the cylinder head.

(2) After installing, check the valve clearance.

8. Install the camshaft bearing caps with the order below.

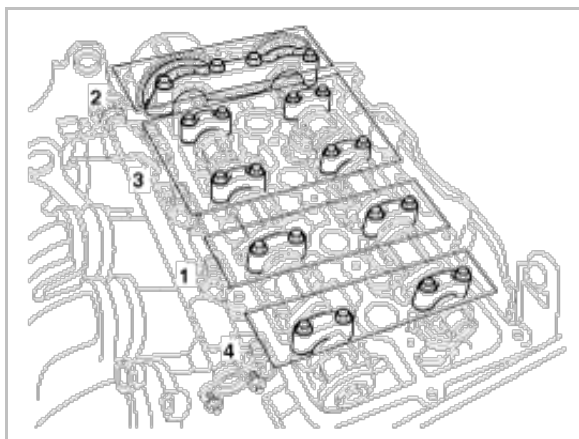
Tightening torque :

M6 bolts :

11.8 ~ 13.7N.m (1.2 ~ 1.4kgf.m, 8.7 ~ 10.1lb-ft)

M8 bolts :

18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



9. Install the intake and exhaust manifold.

(Refer to Intake and Exhaust system in this group)

10. Install the timing chain.

(Refer to Timing system in this group)