



REMOVAL

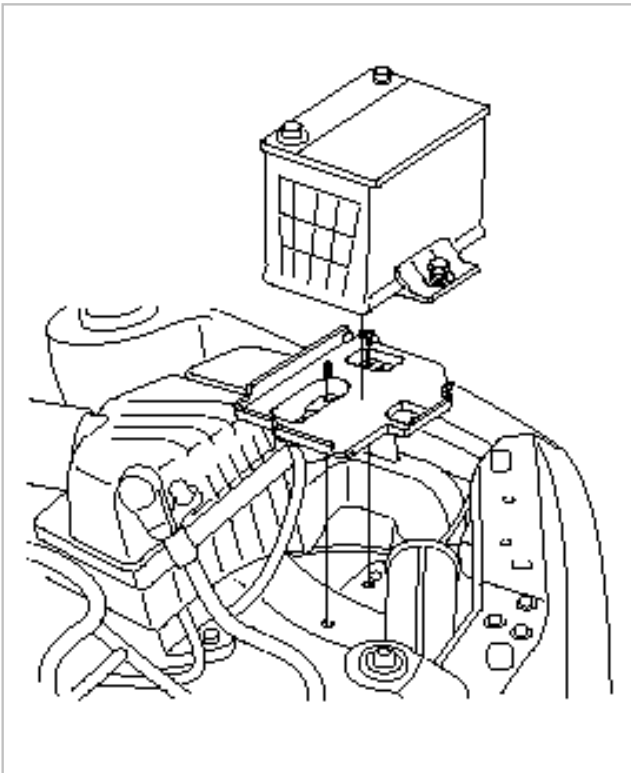
CAUTION

- Use fender covers 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.

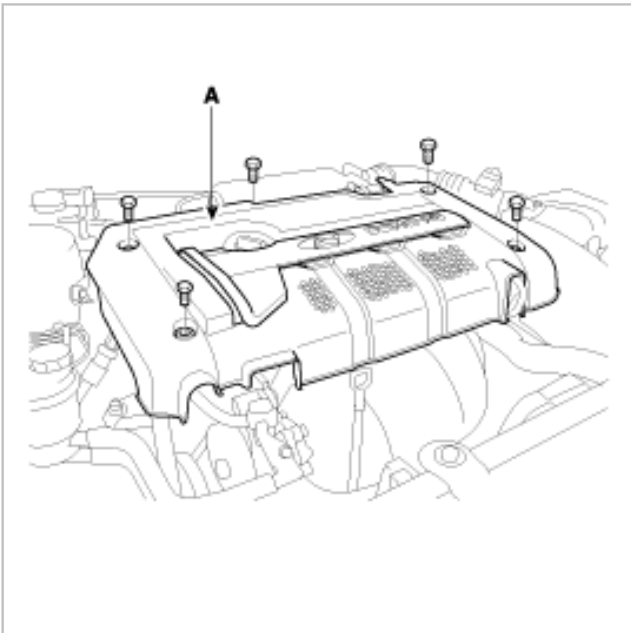
NOTE

- Mark all wiring and hoses to avoid misconnection.
- Inspect the timing belt before removing the cylinder head.
- Turn the crankshaft pulley so that the No. 1 piston is at top dead center.(see page-).

1. Disconnect the negative terminal from the battery.



2. Remove the engine cover (A).

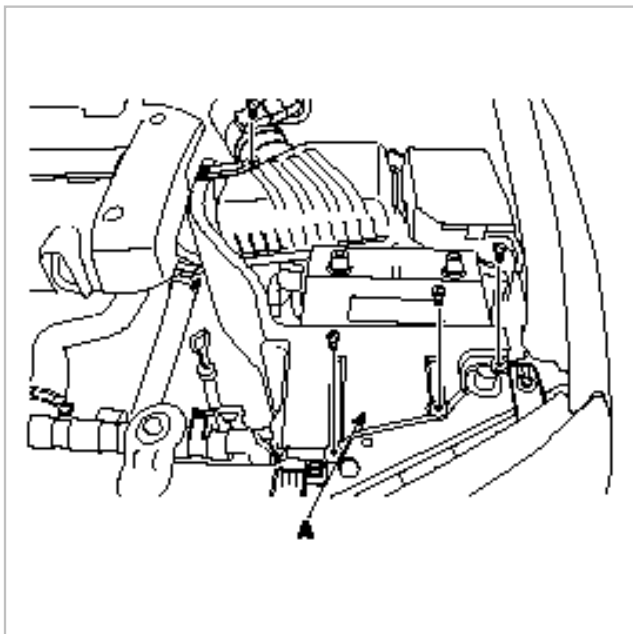


3. Drain the engine coolant(see page EM-97).

Remove the radiator cap to speed draining.

4. Remove the intake air hose and air cleaner assembly.

(1) Remove the heat shield (A).

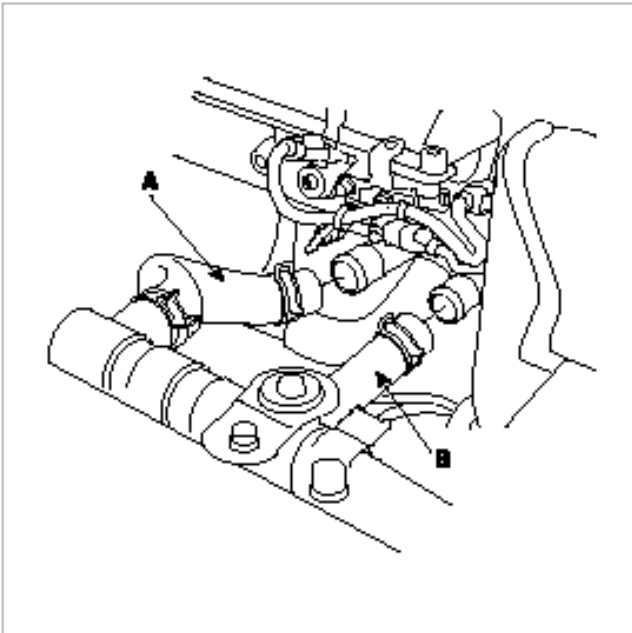


(2) Disconnect the AFS connector.

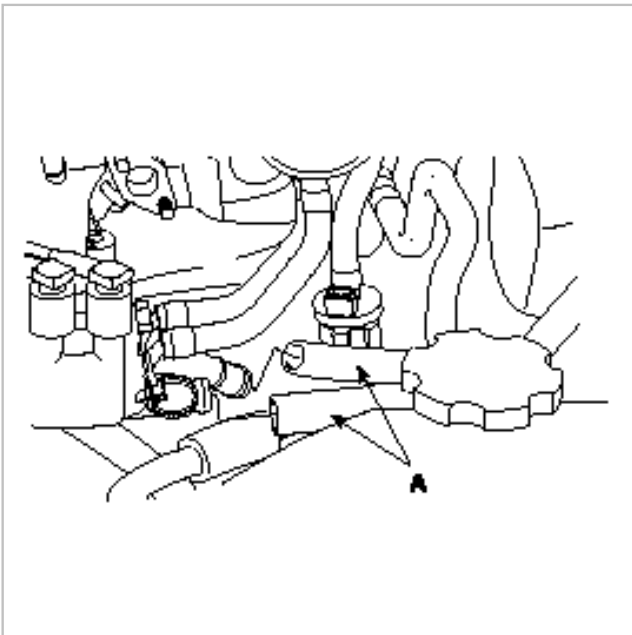
(3) Disconnect the breather hose from air cleaner hose.

(4) Remove the intake air hose and air cleaner assembly.

5. Remove the upper radiator hose(A) and lower radiator hose(B).



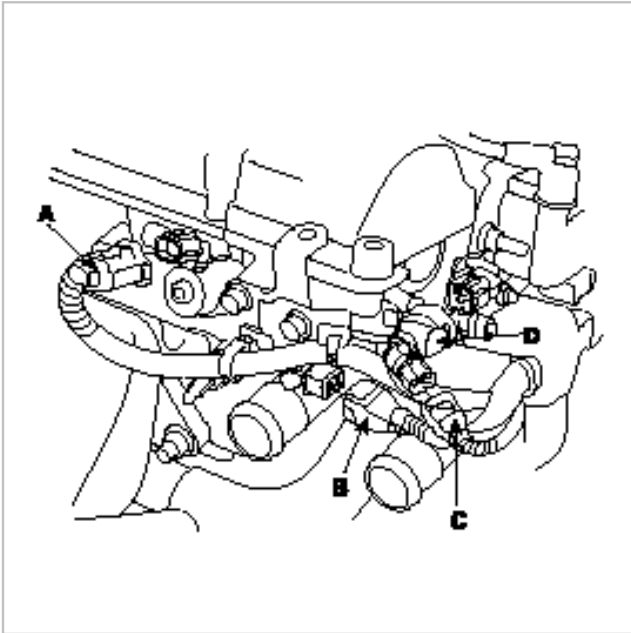
6. Remove the heater hoses (A).



7. Remove the engine wire harness connectors and wire harness clamps from the cylinder head and the intake manifold.

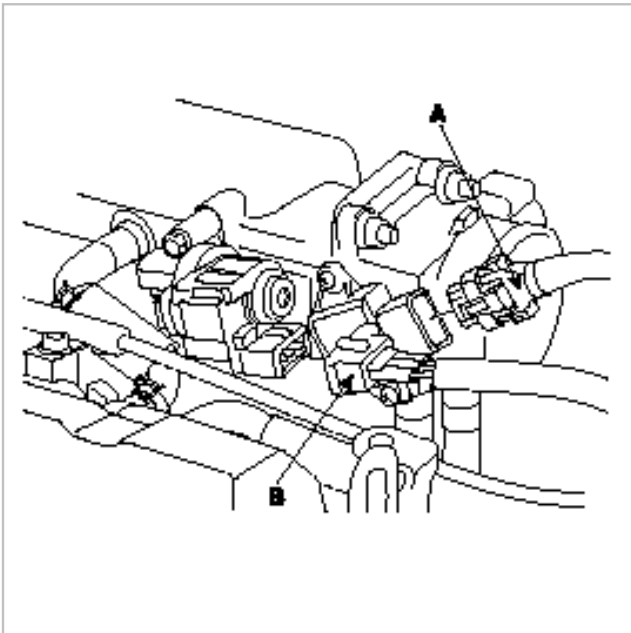
- (1) OCV(Oil control Valve) connector(A).
- (2) Oil temperature sensor connector(B).
- (3) ECT(Engine Coolant Temperature) sensor connector(C).

(4) Ignition coil connector(D).



(5) TPS(Throttle Position Sensor) connector(A).

(6) ISA(Idle Speed Actuator) connector(B).

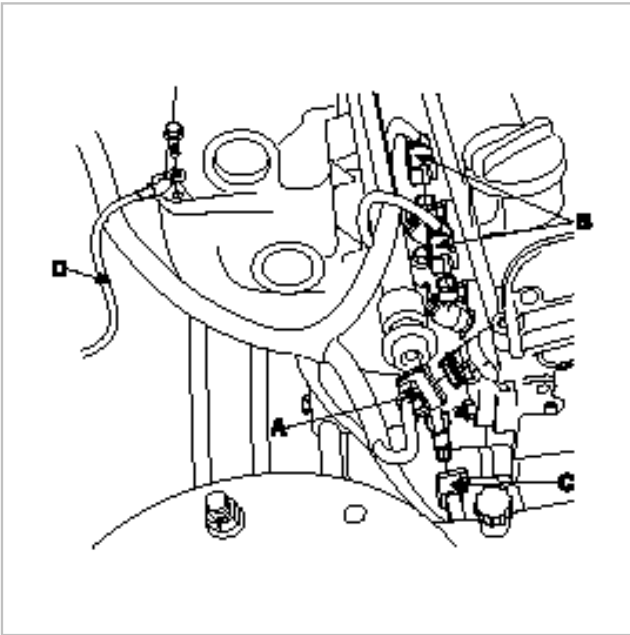


(7) CMP(Camshaft Position Sensor) connector(A).

(8) Four fuel injector connectors(B).

(9) Knock sensor connector(C).

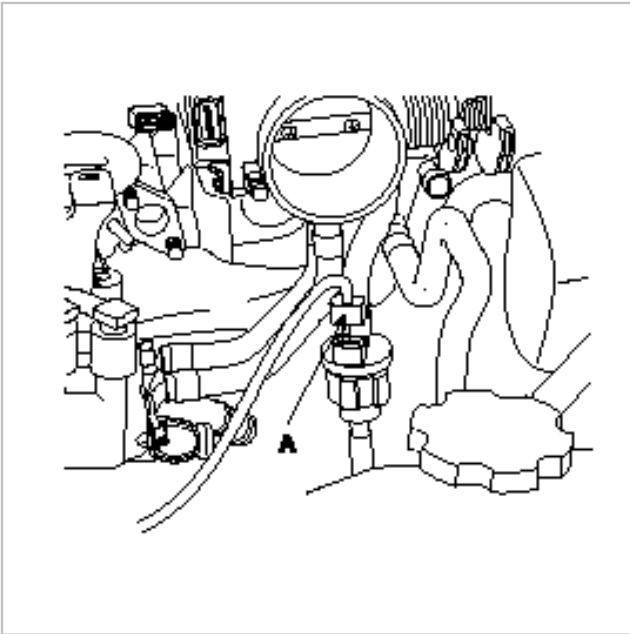
(10) Disconnect ground cable(D) from the intake manifold.



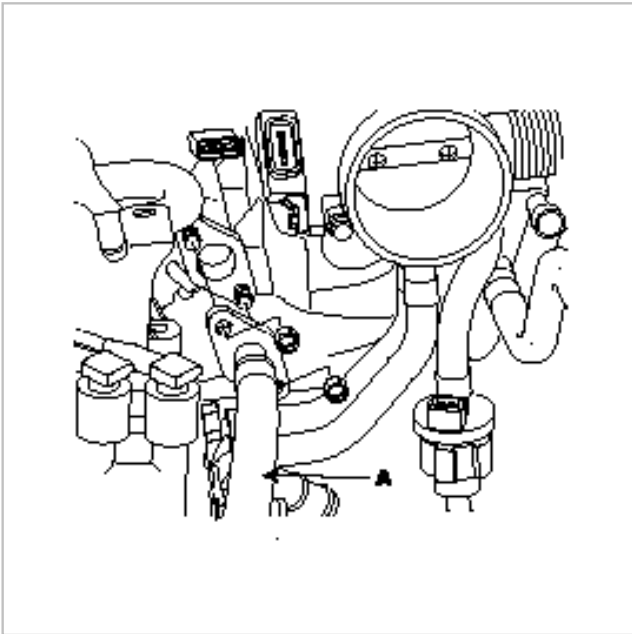
(11) Front heated oxygen sensor connector(A).



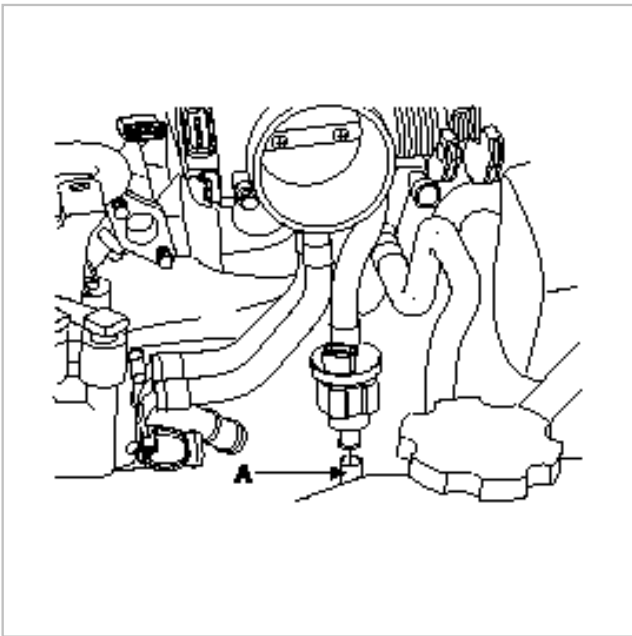
(12) PCSV(Purge Control Solenoid Valve) connector(A).



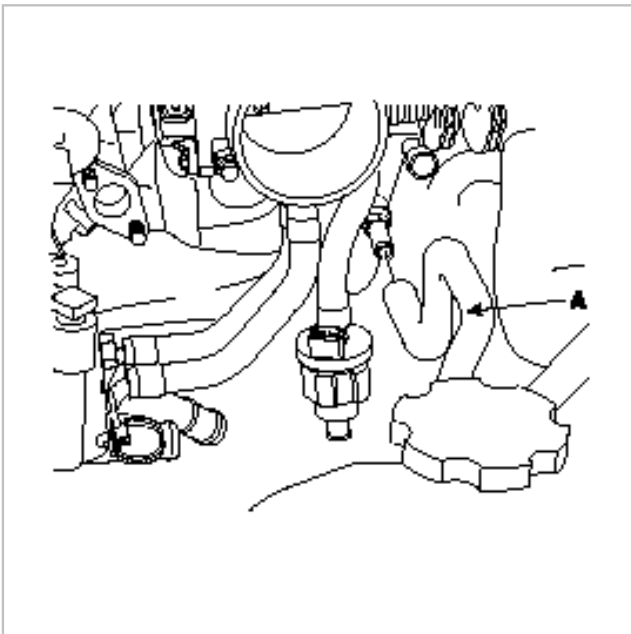
8. Remove the fuel inlet hose(A) from delivery pipe.



9. Remove the PCSV hose(A).



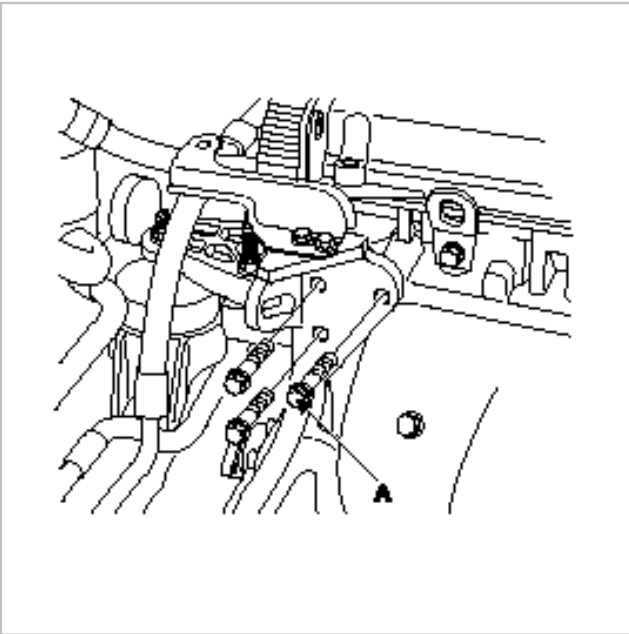
10. Remove the brake booster vacuum hose (A).



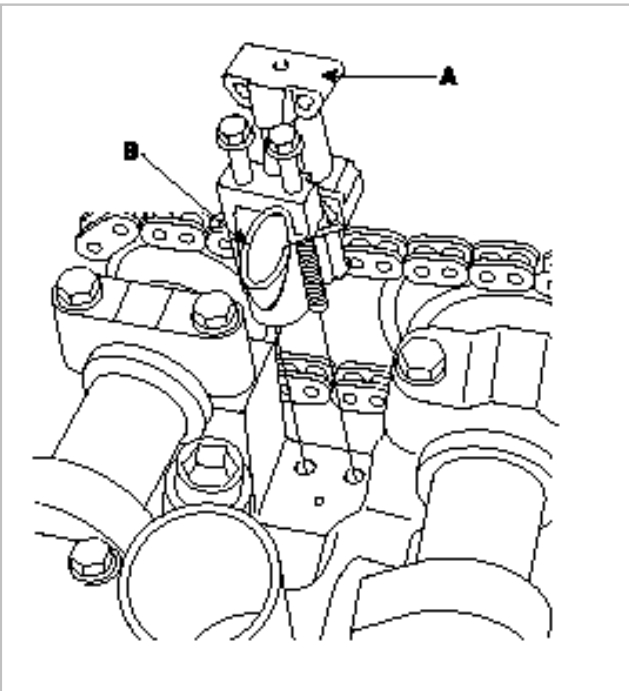
11. Remove the accelerator cable by loosening the locknut, then slip the cable end out of the throttle linkage.

12. Remove the power steering pump.(see ST group - power steering pump)

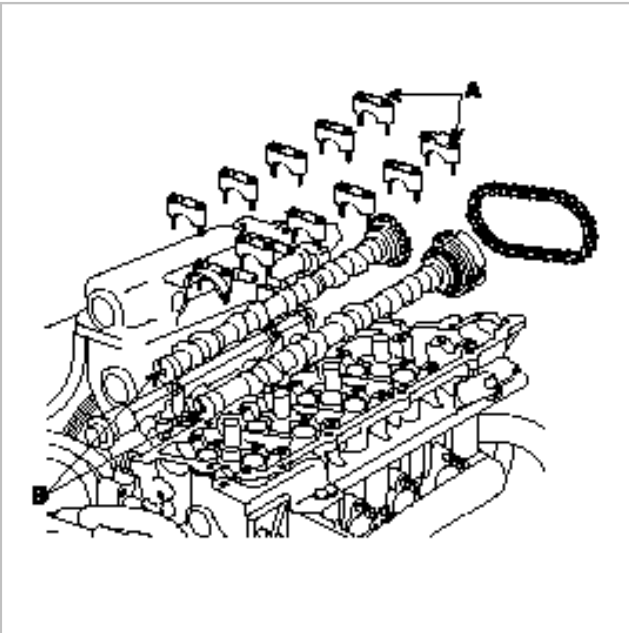
13. Remove the power steering pump bracket bolts.



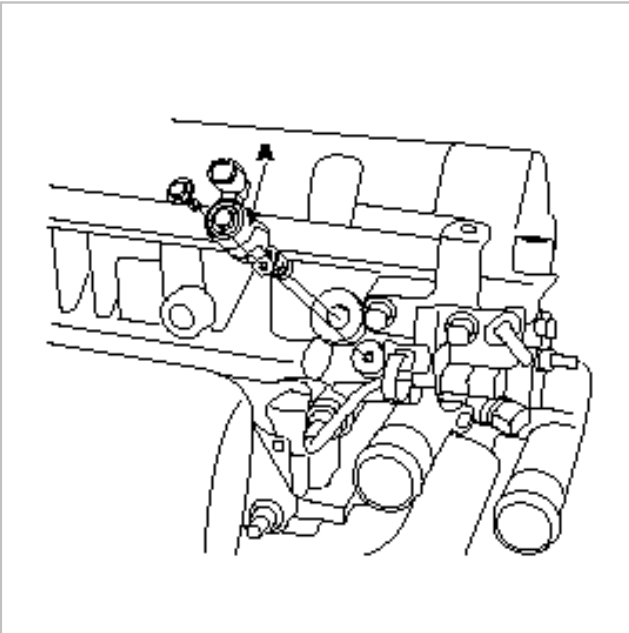
14. Remove the spark plug cable. (see EE group - ignition)
15. Remove the PCV hose. (see page EM-12)
16. Remove the cylinder head cover(see page EM-13).
17. Remove the timing belt(see page EM-25).
18. Remove the exhaust manifold(see page EM-117).
19. Remove the intake manifold.(see page EM-116).
20. Remove the camshaft sprocket.(see page EM-29).
21. Remove the timing chain auto tensioner.



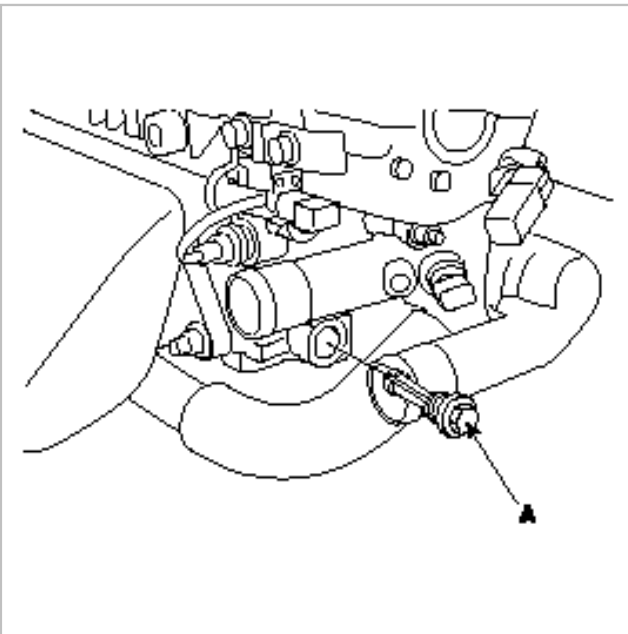
22. Remove the camshaft bearing caps(A) and camshafts(B).



23. Remove the OCV(oil control valve) (A).

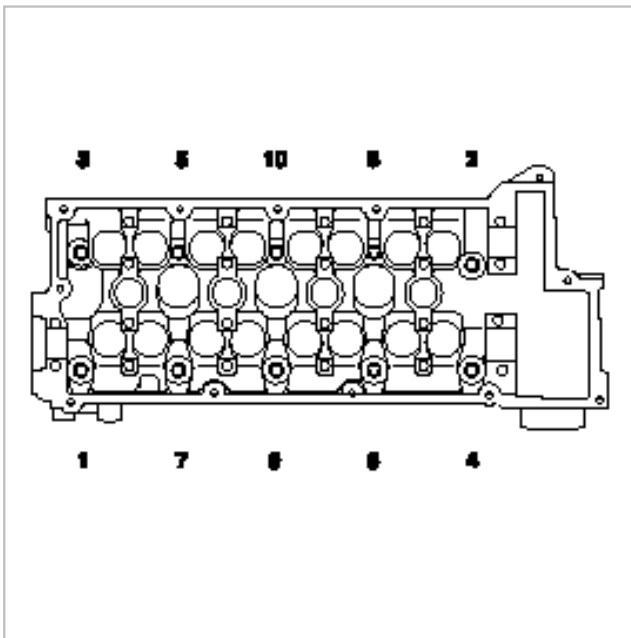


24. Remove the OCV(oil control valve) filter (A).



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

- (1) Using 8mm and 10mm hexagon wrench, uniformly loosen and remove the 10 cylinder head bolts, in several passes, in the sequence shown. Remove the 10 cylinder head bolts and plate washers.



CAUTION

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

- (2) Lift the cylinder head from the dowels on the cylinder block and replace the cylinder head on wooden blocks on a bench.

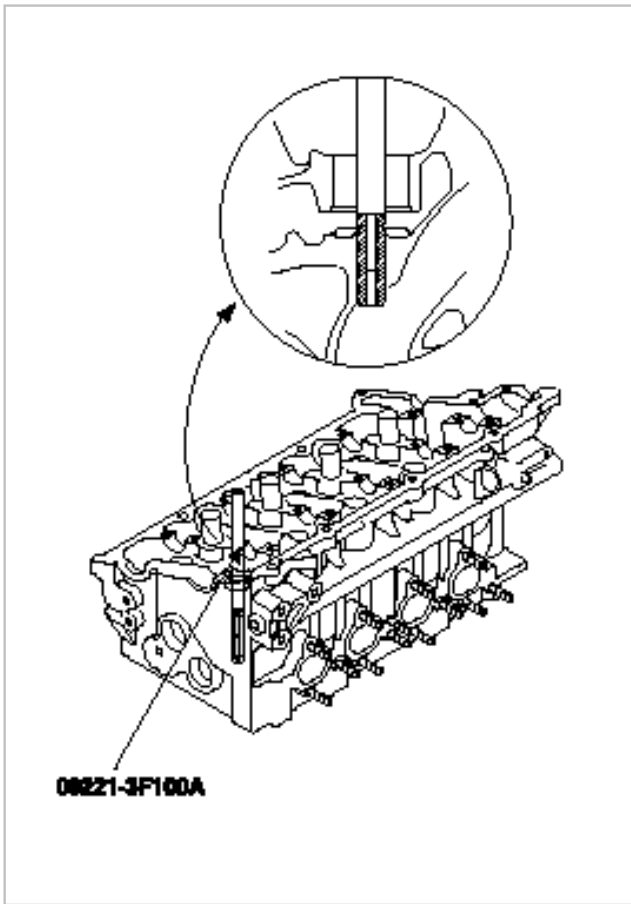
CAUTION

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

REPLACEMENT

VALVE GUIDE

1. Using the SST(service special tool: 09221-3F100A), withdraw the old valve guide toward the bottom of cylinder head.



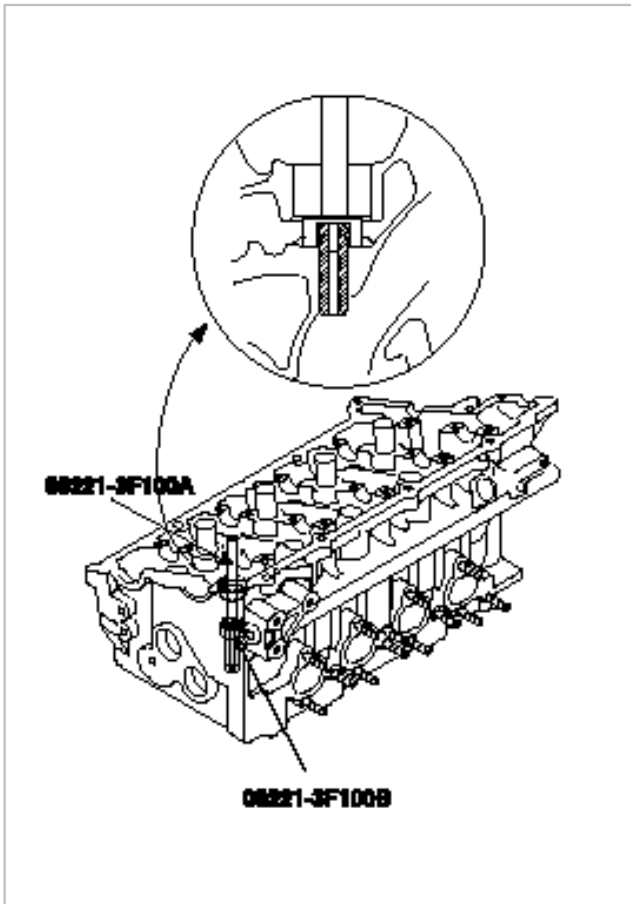
2. Recondition the valve guide hole so that it can match the newly press-fitted oversize valve guide.
3. Using the SST(service special tool: 09221-3F100A/B), press-fit the valve guide. The valve guide must be press-fitted from the upper side of the cylinder head. Keep in mind that the intake and exhaust valve guides are different in length.

Over size mm(in.)	Size mark	Oversize valve guide hole size mm(in.)
0.05 (0.002)	5	11.05 ~ 11.068 (0.4350 ~ 0.4357)
0.25 (0.010)	25	11.25 ~ 11.268 (0.4429 ~ 0.4436)
0.50 (0.020)	50	11.50 ~ 11.518 (0.4528 ~ 0.4535)

Valve guide length

Intake : 46mm (1.8in.)

Exhaust : 54.5mm (2.15in.)



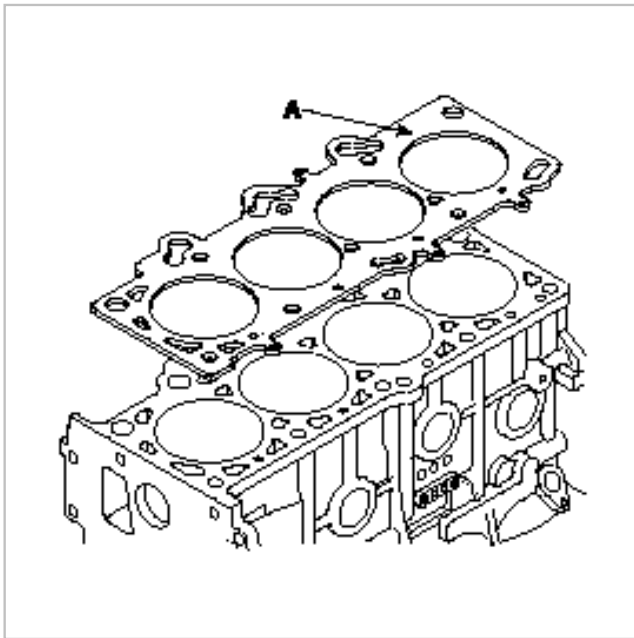
4. After the valve guide is press-fitted, insert a new valve and check for proper stem -to-guide clearance.
5. After the valve guide is replaced, check that the valve is seated properly. Recondition the valve seats as necessary.

INSTALLATION

NOTE

- Thoroughly clean all parts to be assembled.
- Always use a new head and manifold gasket.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft, set the No. 1 piston at TDC(see page-).

1. Install the cylinder head gasket (A) on the cylinder block.



NOTE

Be careful of the installation direction.

2. Place the cylinder head quietly in order not to damage the gasket with the bottom part of the end.
3. Install cylinder head bolts.
 - (1) Apply a light coat of engine oil on the threads and under the heads of the cylinder head bolts.
 - (2) Using 8mm and 10mm hexagon wrench, install and tighten the 10 cylinder head bolts and plate washers, in several passes, in the sequence shown.

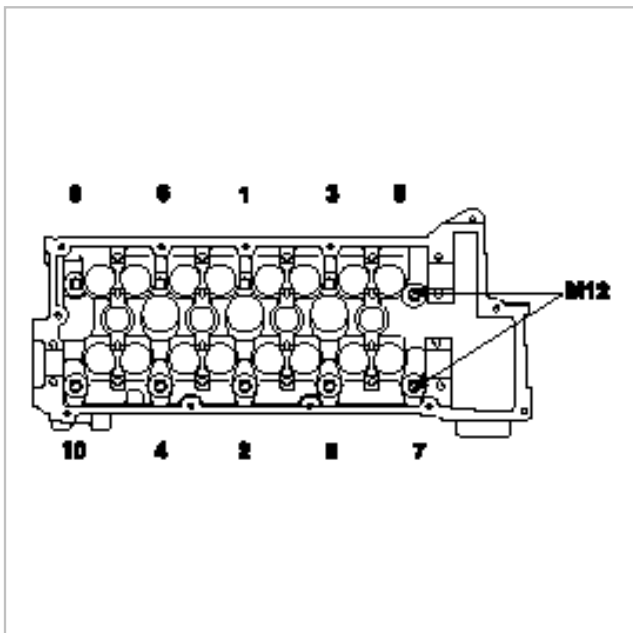
Tightening torque

M10 :

25Nm (250kgf.cm, 18lb.ft) + (60° ~ 65°) + (60° ~ 65°)

M12 :

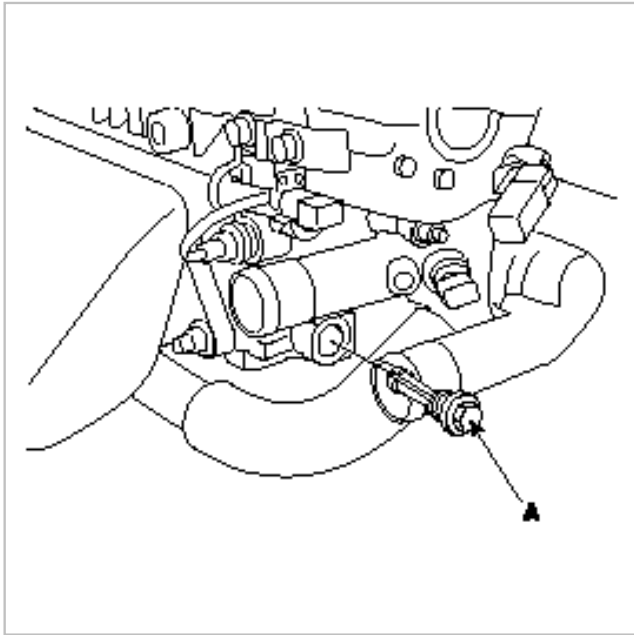
30Nm (300kgf.cm, 22lb.ft) + (60° ~ 65°) + (60° ~ 65°)



4. Install OCV filter (A).

Tightening torque

41 ~ 51Nm (410 ~ 510kgf.cm, 30 ~ 37.6lb.ft)



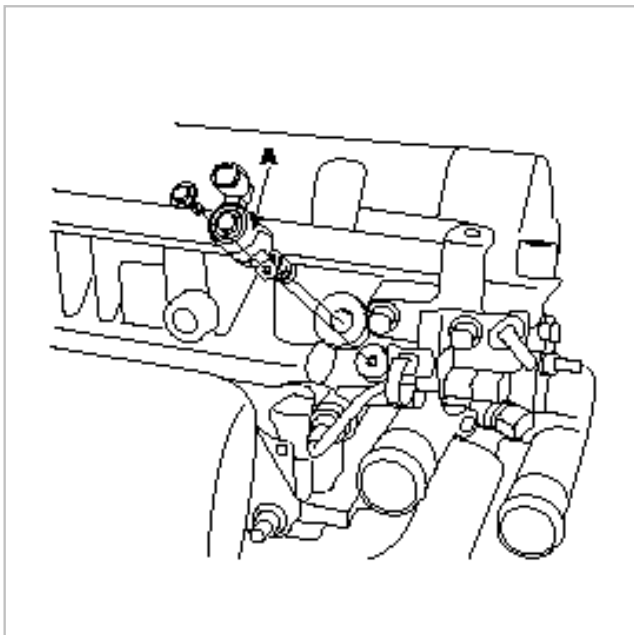
NOTE

Always use a new OCV filter gasket.
Keep clean the OCV filter.

5. Install OCV.

Tightening torque

10 ~ 12Nm(100 ~ 120kgf.cm, 7.3 ~ 8.8lb.ft)

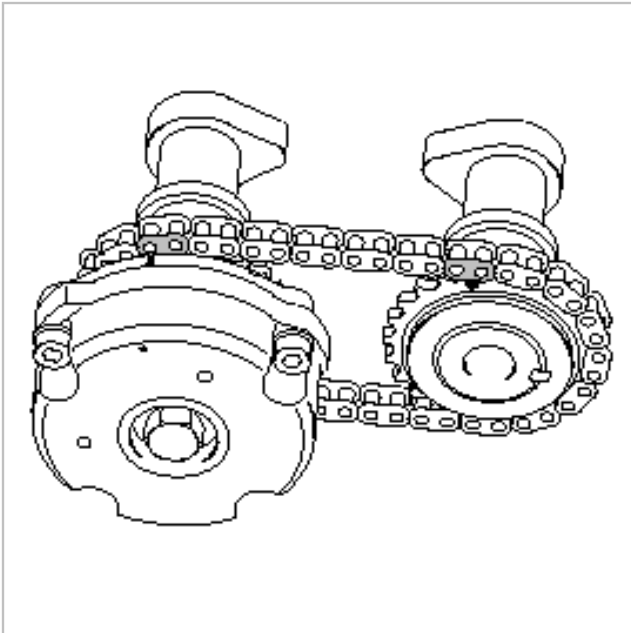


CAUTION

- Do not reuse the OCV when dropped.
- Keep clean the OCV.
- Do not hold the OCV sleeve during servicing.
- When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.

6. Install the camshafts.

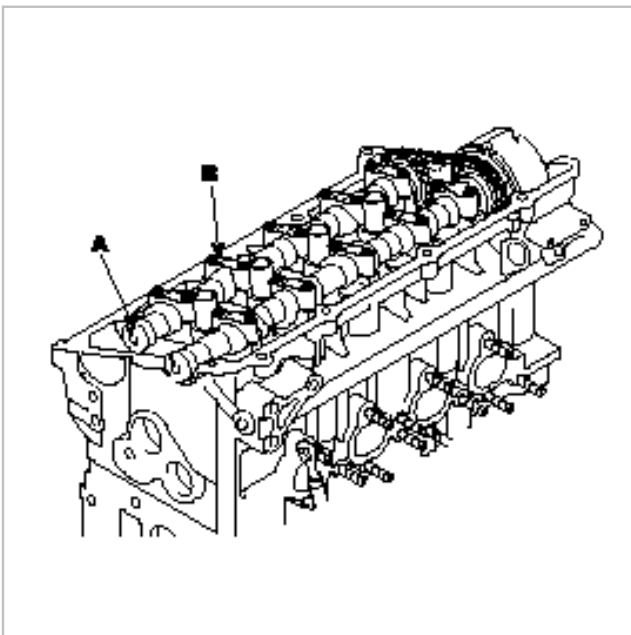
- (1) Align the camshaft timing chain with the intake timing chain sprocket and exhaust timing chain sprocket as shown.



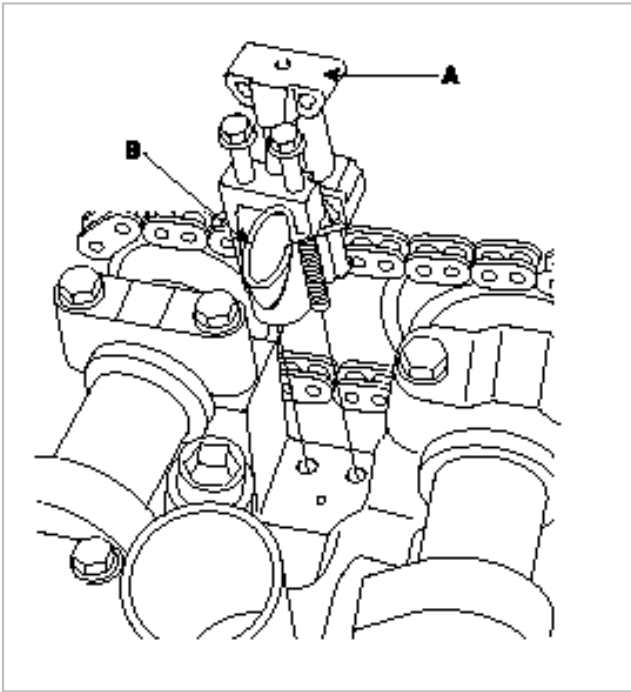
- (2) Install the camshafts and bearing caps.

Tightening torque

14 ~ 15Nm (140 ~ 150kgf.cm, 10 ~ 11lb.ft)



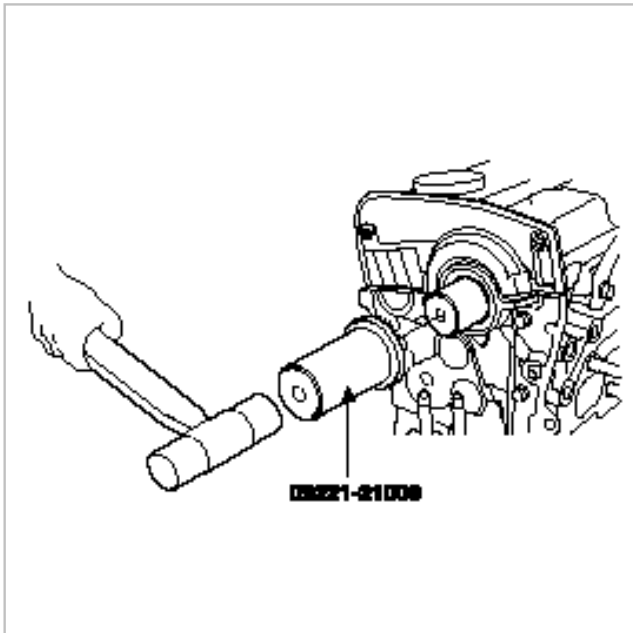
(3) Install the timing chain auto tensioner (A).



(4) Remove the auto tensioner stopper pin (B).

7. Check and adjust valve clearance.(see page EM-12).

8. Using the SST (09221-21000), install the camshaft bearing oil seal.

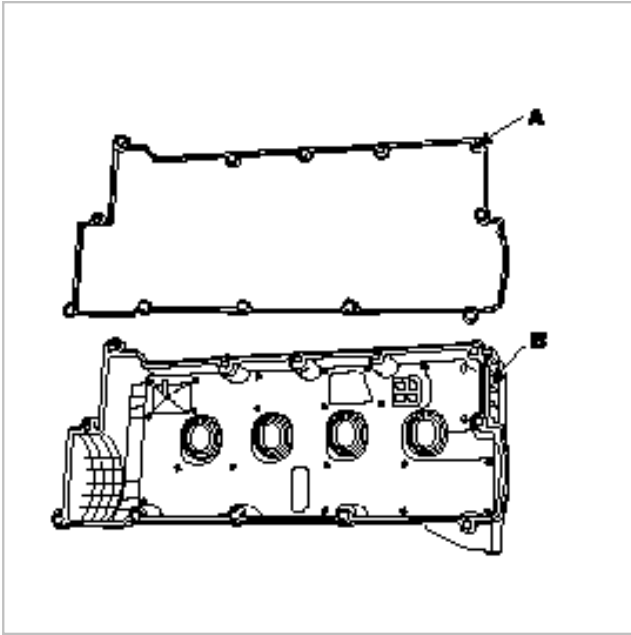


9. Install the camshaft sprocket.(see page EM-31).

10. Install the timing belt(see page EM-31).

11. Install the cylinder head cover.

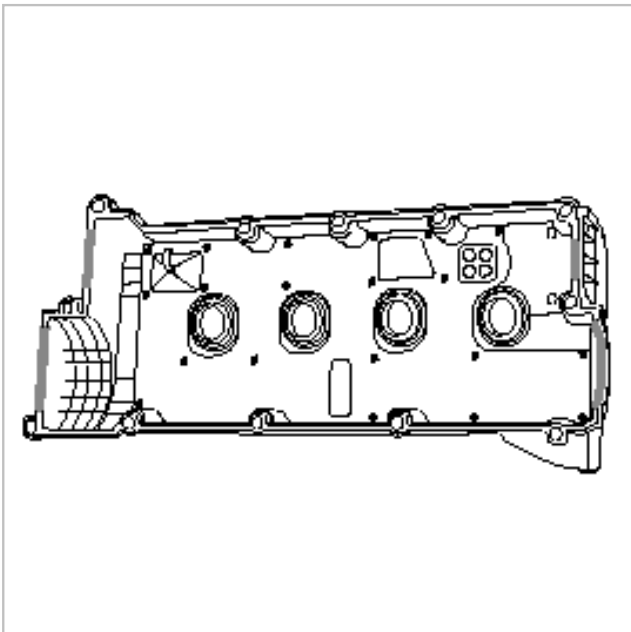
- (1) Install the cylinder head cover gasket in the groove of the cylinder head cover.



NOTE

- Before installing the head cover gasket, thoroughly clean the head cover gasket and the groove.
- When installing, make sure the head cover gasket is seated securely in the corners of the recesses with no gap.

- (2) Apply liquid gasket to the head cover gasket at the corners of the recess.



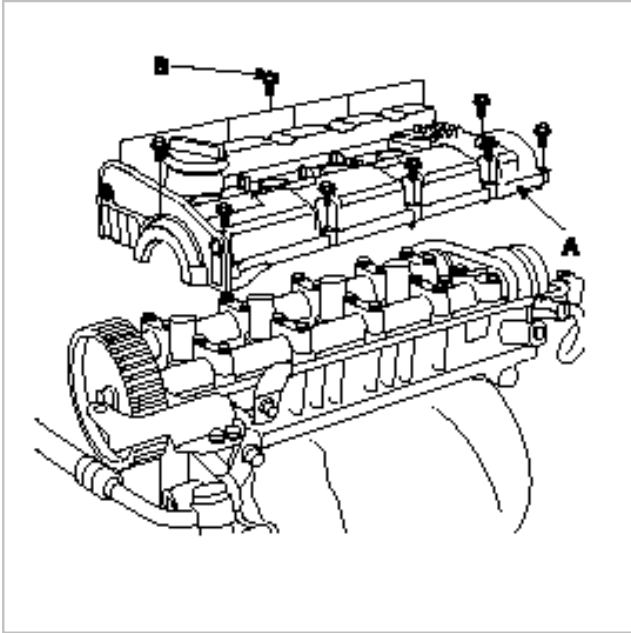
NOTE

- Use liquid gasket, loctite No. 5999.
- Check that the mating surfaces are clean and dry before applying liquid gasket
- After assembly, wait at least 30 minutes before filling the engine with oil.

(3) Install the cylinder head cover (A) with the 12bolts. Uniformly tighten the bolts in several passes.

Tightening torque

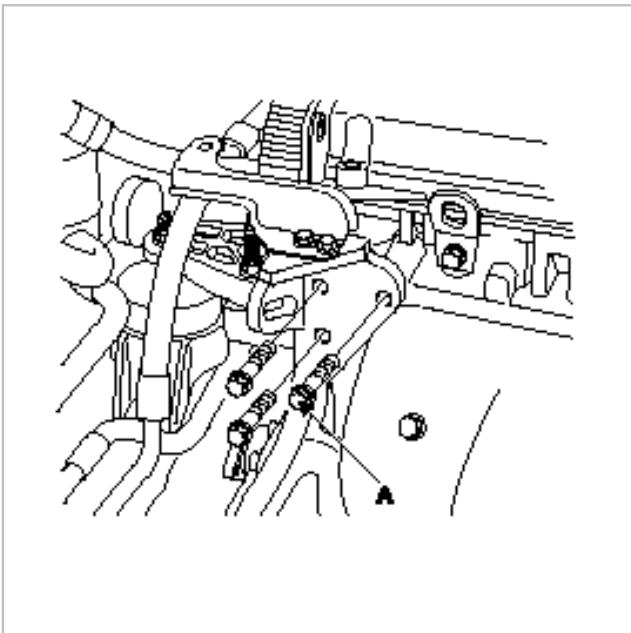
8 ~ 10N.m (80 ~ 100kgf.cm, 6 ~ 7.4 lb.ft)



12. Install the intake manifold. (see page EM-116)
13. Install the exhaust manifold. (see page EM-117)
14. Install the PCV. (see page EM-31)
15. Install the spark plug cable. (see EE group - ignition)
16. Install the power steering pump bracket bolts (A).

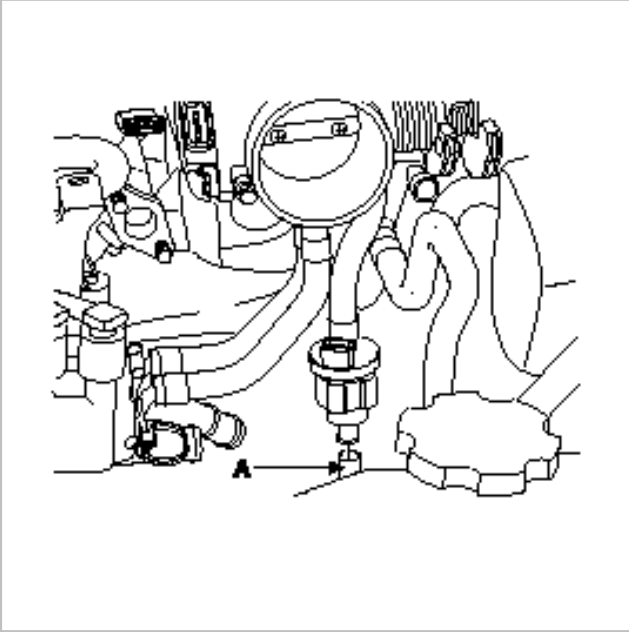
Tightening torque

35 ~ 50Nm (350 ~ 500kgf.cm, 26 ~ 37lb.ft)

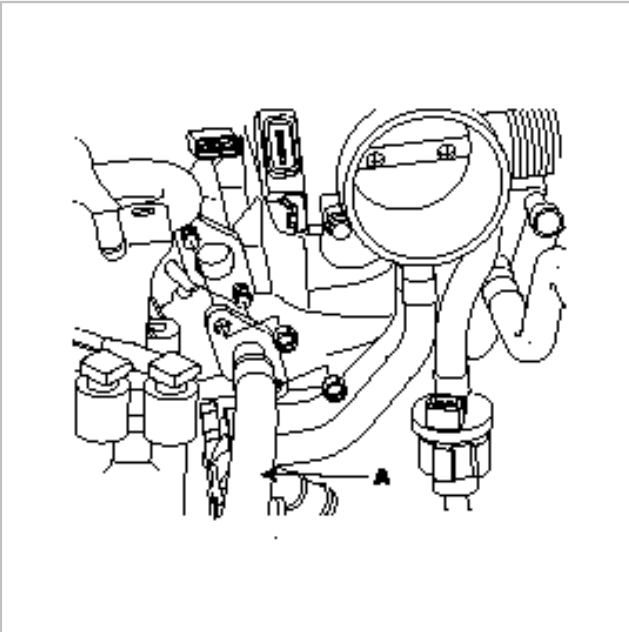


17. Install the power steering pump. (see ST group - power steering pump)

18. Install the accelerator cable.
19. Install the brake booster hose.
20. Install the PCSV hose (A).

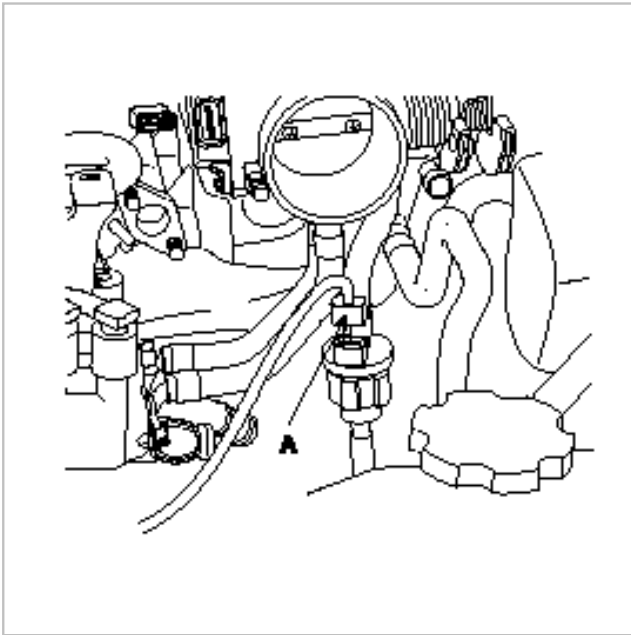


21. Install the fuel inlet hose (A).

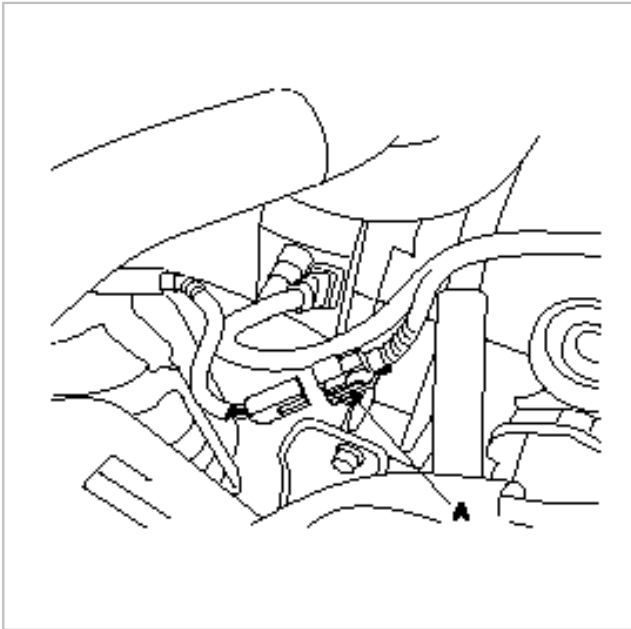


22. Install the engine wire harness connectors and wire harness clamps to the cylinder head and the intake manifold.

(1) PCSV connector (A).



(2) Front heated oxygen sensor connector (A).

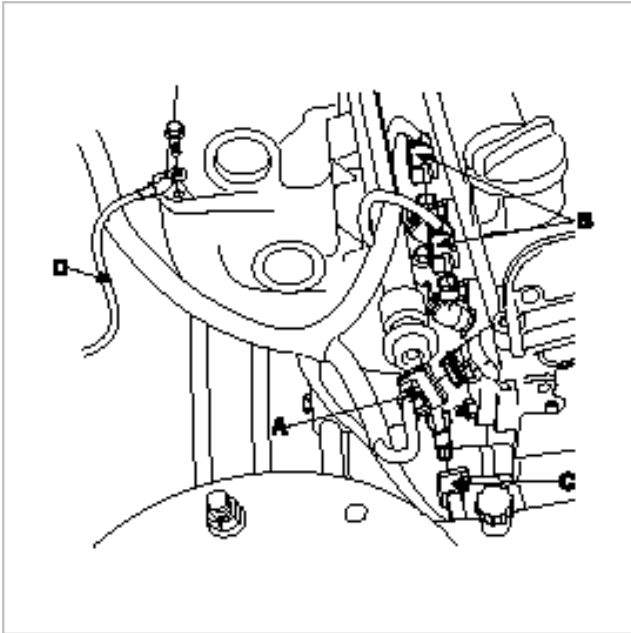


(3) Connect the ground cable to the intake manifold (D).

(4) Knock sensor connector (C).

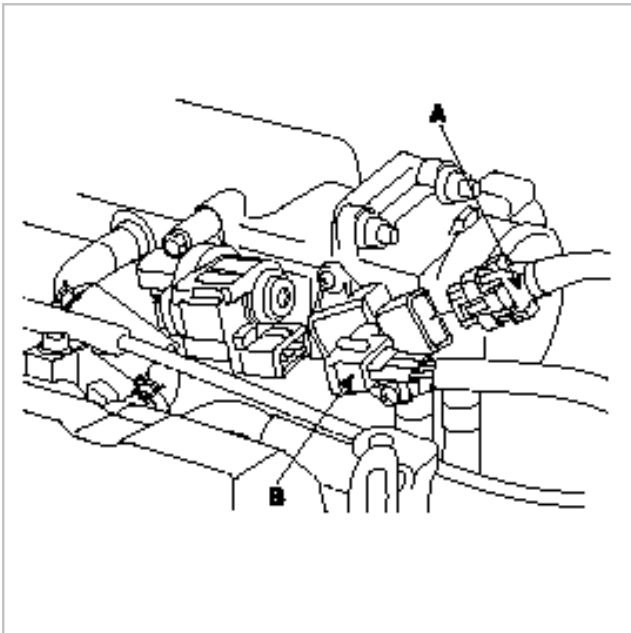
(5) Four fuel injector connectors (B).

(6) CMP connector (A).



(7) ISA connector (B).

(8) TPS connector (A).

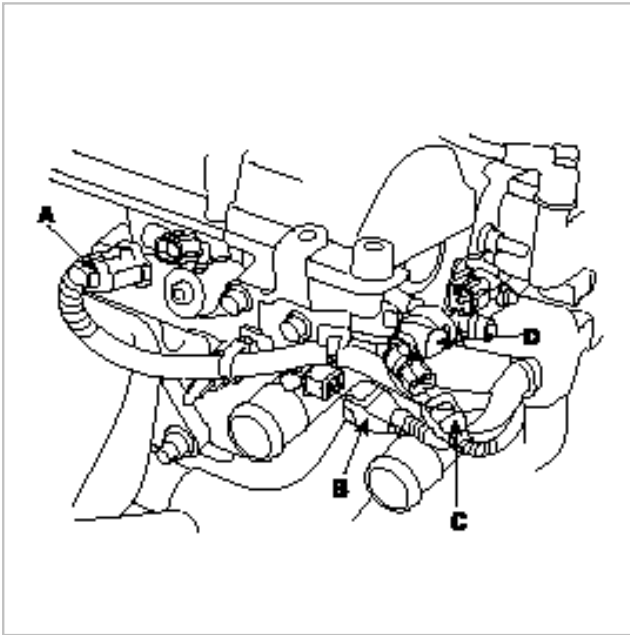


(9) Ignition coil connector (D).

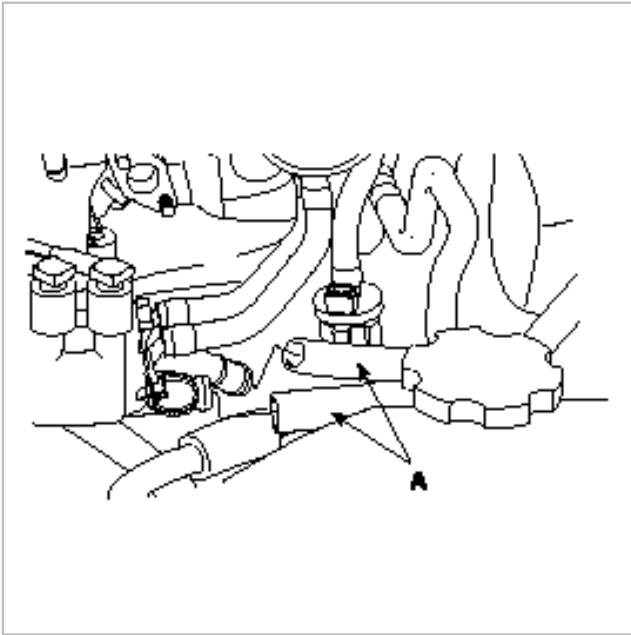
(10) ECT sensor connector (C).

(11) Oil temperature sensor connector (B).

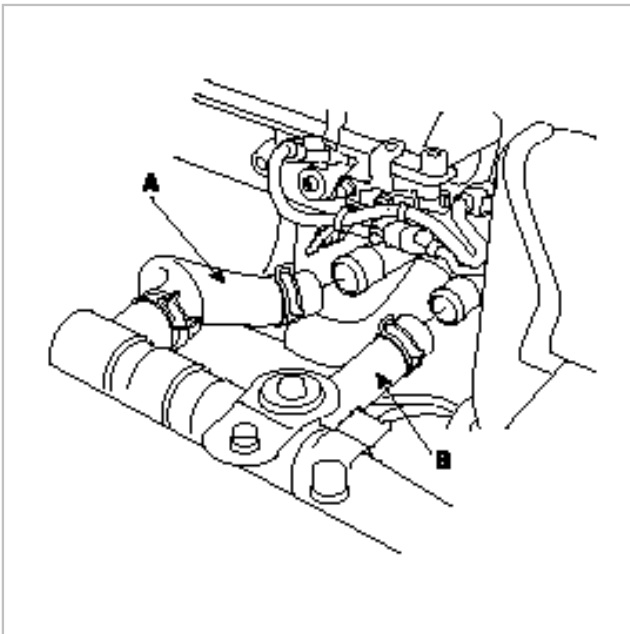
(12) OCV connector (A).



23. Install the heater hoses (A).

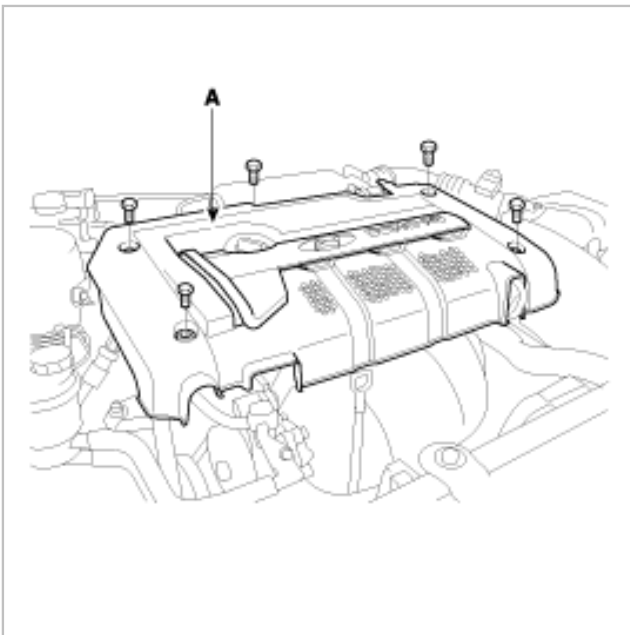


24. Install the upper radiator hose (A) and lower radiator hose (B).



25. Install the intake air hose and air cleaner assembly.

26. Install the engine cover (A).



27. Connect the negative terminal to the battery.

28. Fill with engine coolant.

29. Start the engine and check for leaks.

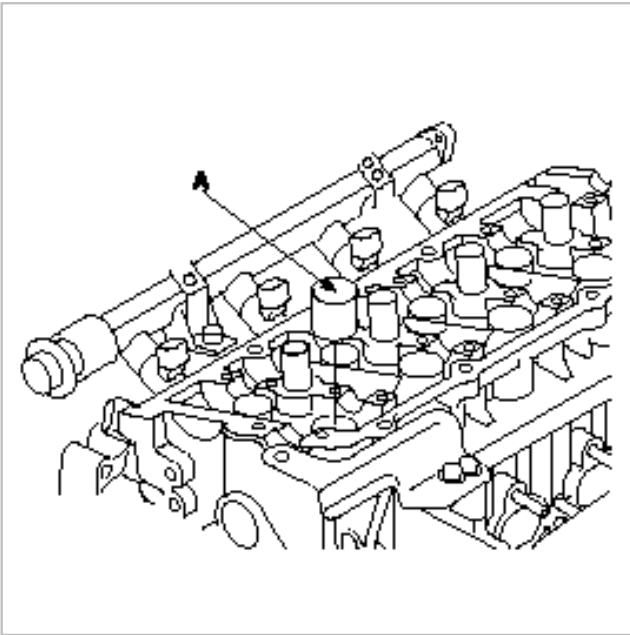
30. Recheck engine coolant level and oil level.

DISASSEMBLY

NOTE

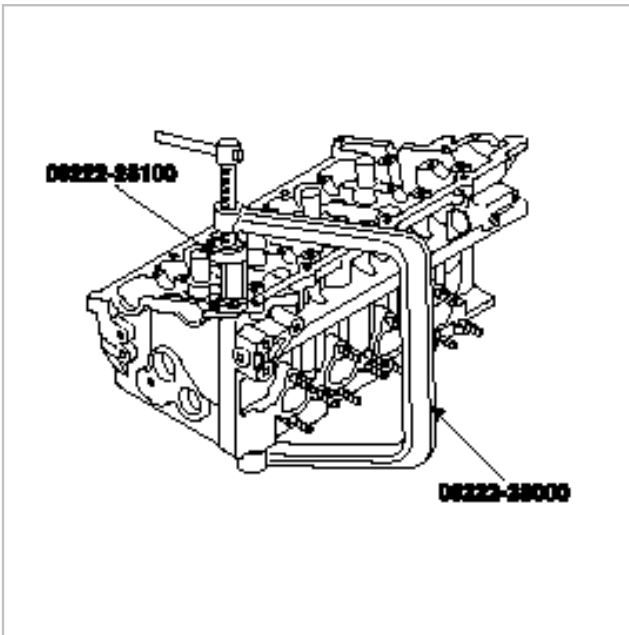
Identify MLA (Mechanical Lash Adjuster), valves, valve springs as they are removed so that each item can be reinstalled in its original position.

1. Remove MLAs (A).



2. Remove valves.

(1) Using SST(09222-28000, 09222-28100), compress the valve spring and remove retainer lock.



- (2) Remove the spring retainer.
- (3) Remove the valve spring.
- (4) Remove the valve.
- (5) Remove the using needle-nose pliers, remove the oil seal.
- (6) Using a magnetic finger, remove the spring seat.

INSPECTION

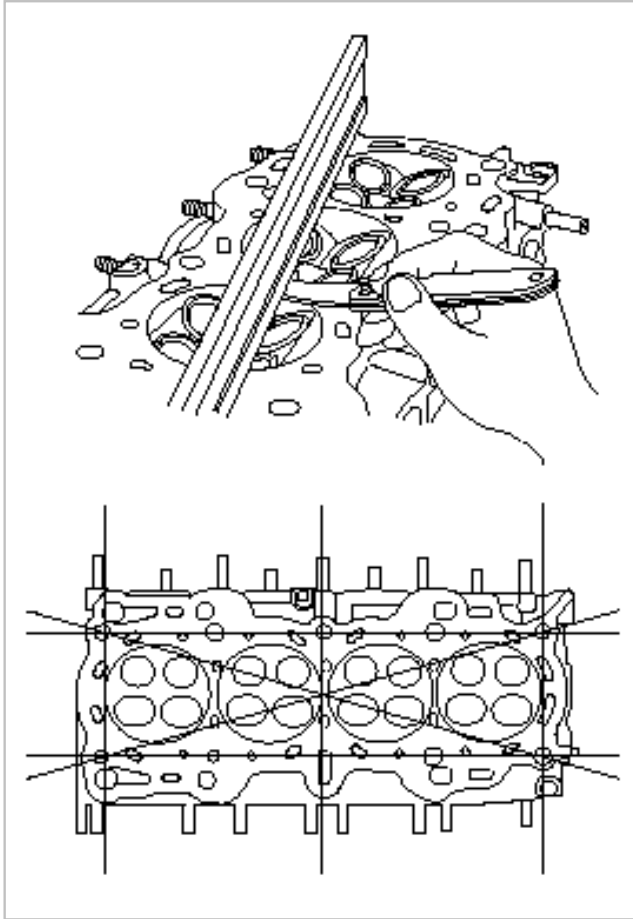
1. Inspect for flatness.

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

Flatness of cylinder head gasket surface

Standard : Less than 0.03mm(0.0012 in.)

Limit : 0.06 mm (0.0024 in.)



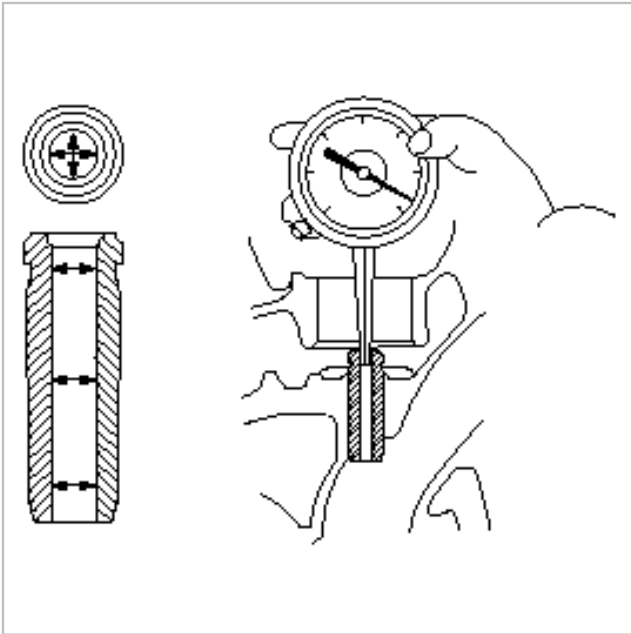
2. Inspect for cracks.

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

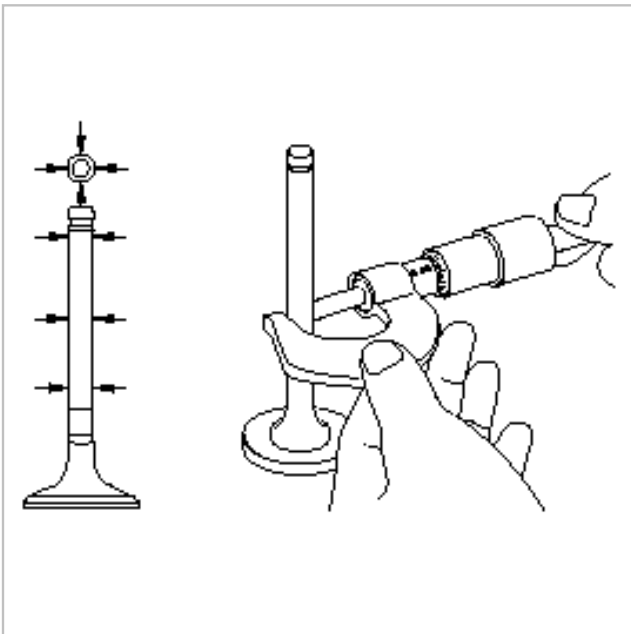
3. Inspect valve stems and valve guides.

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

Valve guide inside.



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



(3) Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.
Valve stem-to-guide clearance

[Standard]

Intake : 0.02 ~ 0.05mm (0.0008 ~ 0.0020in.)

Exhaust : 0.035 ~ 0.065mm (0.0014 ~ 0.0026in.)

[Limit]

Intake : 0.1mm (0.0040in.)

Exhaust : 0.13mm (0.0051in.)

If the clearance is greater than maximum, replace the valve and valve guide.

4. Inspect valves.

(1) Check the valve is ground to the correct valve face angle.

(2) Check that the surface of the 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]

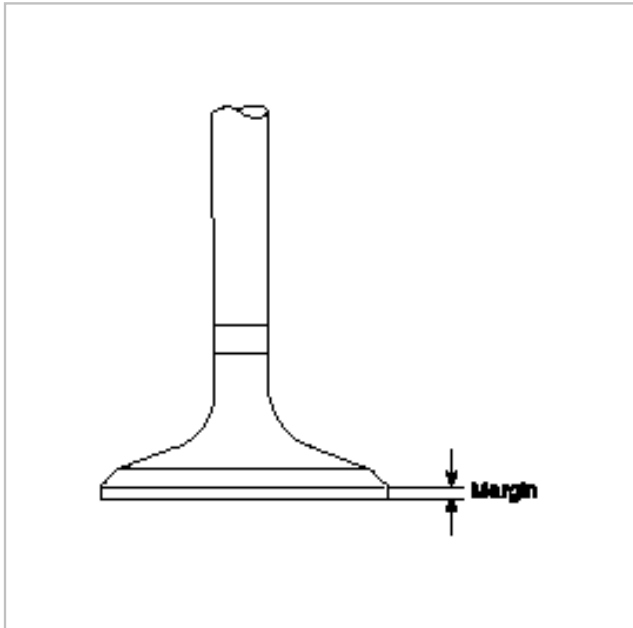
Intake : 1.15 mm(0.0453 in.)

Exhaust : 1.35 mm(0.0531 in.)

[Limit]

Intake : 0.8 mm(0.0315 in.)

Exhaust : 1.0mm(0.040 in.)



(4) Check the surface of the valve stem tip for wear.

If the valve stem tip is worn, replace the valve.

5. Inspect valve seats

Check the valve seat for evidence of overheating and improper contact with the valve face.

Replace the seat if necessary.

Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace it, then recondition the seat. Recondition the valve seat with a valve seat grinder or cutter. The valve seat contact width should be within specifications and centered on the valve face.

6. Inspect valve springs.

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

Valve spring

[Standard]

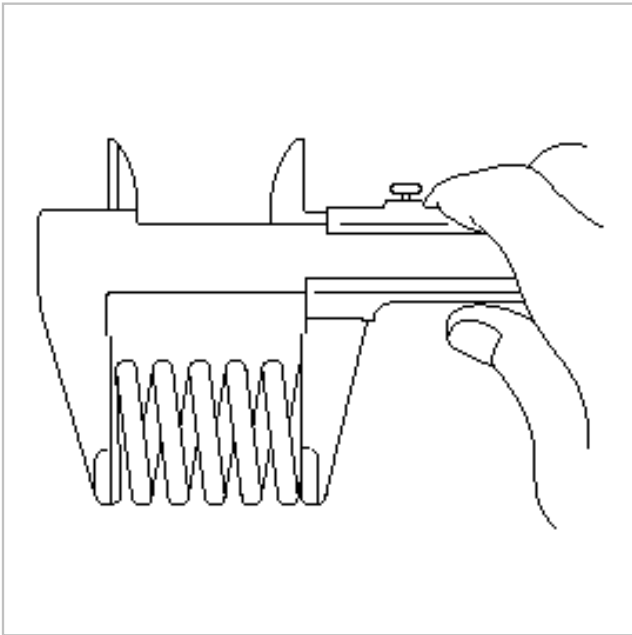
Free height : 48.86mm (1.9236 in.)

Load : 18.3kg / 39 mm (40.0 kg / 30.5mm)

[Limit]

Free height : -1.0 mm (-0.0394 in.)

Out-of-square : 3°



If the free length is not as specified, replace the valve spring.

7. Inspect camshaft for runout.

- (1) Place the camshaft on V-blocks.

If the circle runout is greater than maximum, replace the camshaft.

8. Inspect cam lobes.

Using a micrometer, measure the cam lobe height.

Cam height

W/O CVVT

[Standard value]

Intake : 44.820 mm (1.7646 in.)

Exhaust : 44.720 mm (1.7606 in.)

[Limit]

Intake : 44.720 mm (1.7606 in.)

Exhaust : 44.620 mm (1.7567 in.)

W/CVVT

[Standard value]

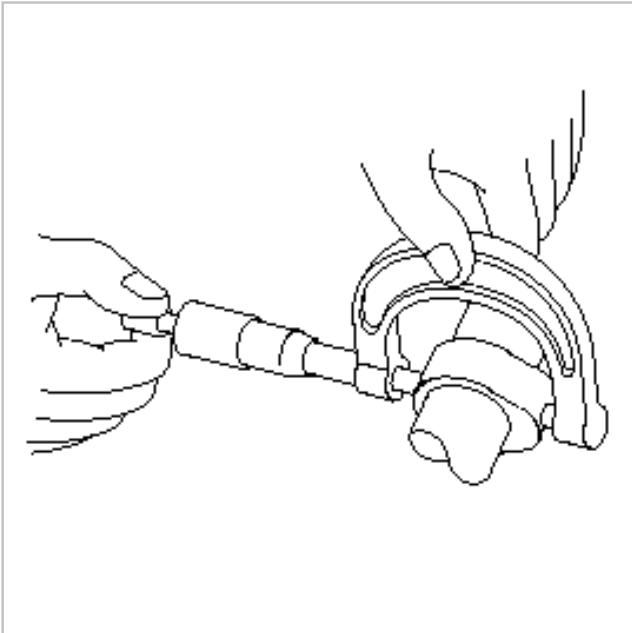
Intake : 44.618 mm (1.7566 in.)

Exhaust : 44.518 mm (1.7527 in.)

[Limit]

Intake : 44.518 mm (1.7527 in.)

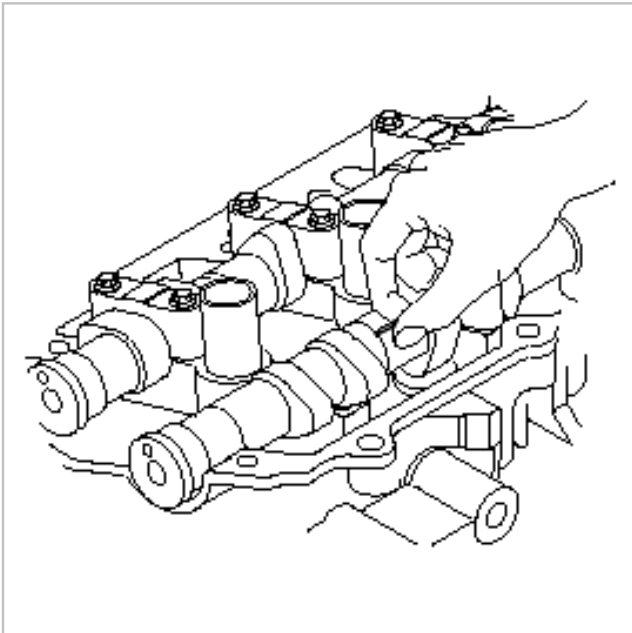
Exhaust : 44.418 mm (1.7487 in.)



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

9. Inspect 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.(see page-)

CAUTION

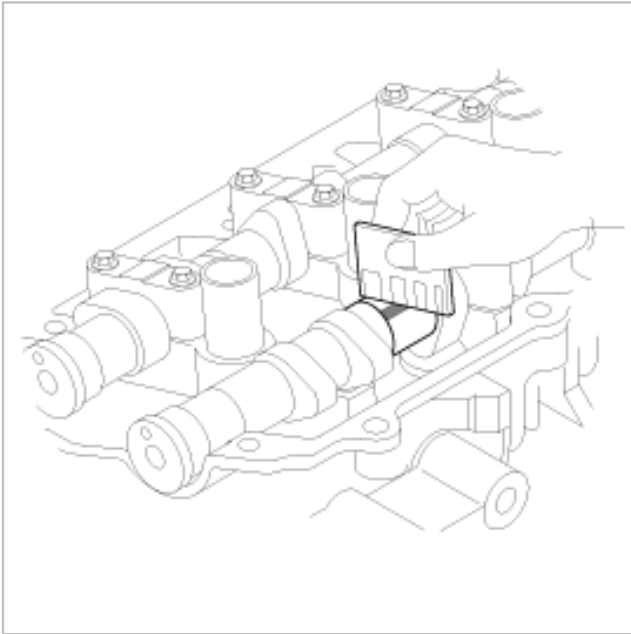
Do not turn the camshaft.

- (5) Remove the bearing caps.
- (6) Measure the plastigage at its widest point.

Bearing oil clearance :

[Standard value] : 0.02 ~ 0.061mm(0.0008 ~ 0.0024in.)

[Limit] : 0.1mm(0.0039in.)

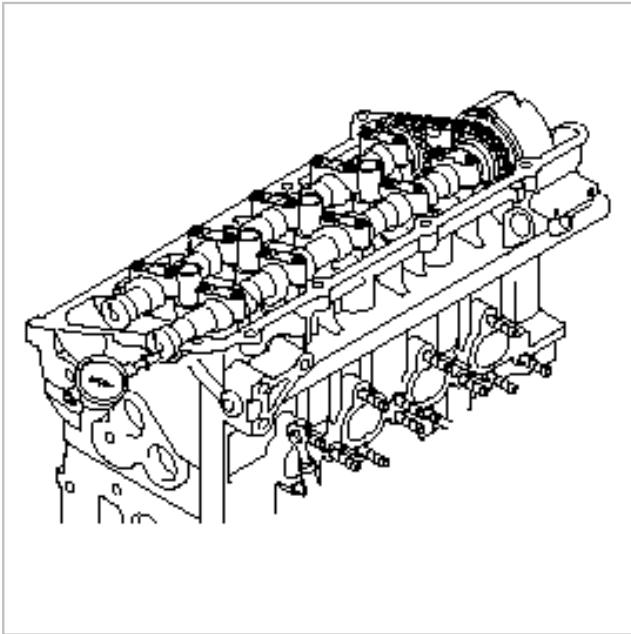


If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

- (7) Completely remove the plastigage.
 - (8) Remove the camshafts.
10. Inspect camshaft end play.
- (1) Install the camshafts.(see page-).
 - (2) Using a dial indicator, measure the end play while moving the camshaft back and forth.

Camshaft end play

[Standard value] : 0.1 ~ 0.2mm(0.004 ~ 0.008in.)



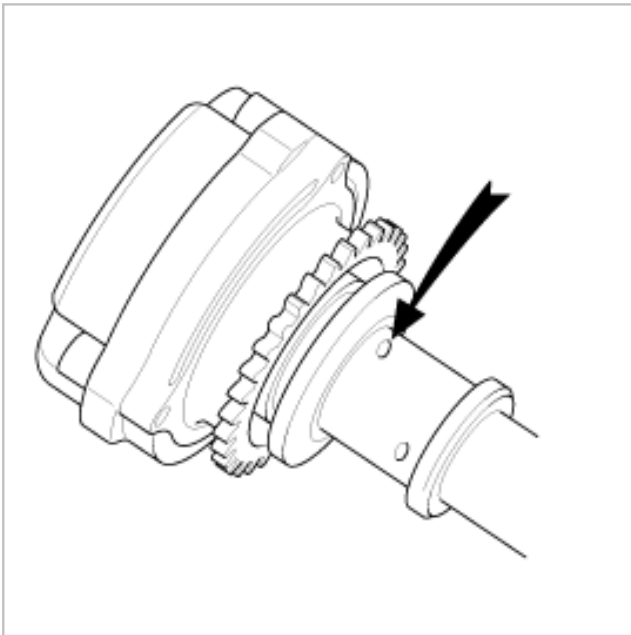
If the end play is greater than maximum, replace the camshaft. If necessary, replace the bearing caps and cylinder head as a set.

(3) Remove the camshafts.

11. Inspect CVVT assembly.

(1) Check that the CVVT assembly will not turn.

(2) Apply vinyl tape to all the parts except the one indicated by the arrow in the illustration.



(3) Wind tape around the tip of the air gun and apply air of approx. 100kpa(1kgf/cm², 14psi) to the port of the camshaft.

(Perform this order to release the lock pin for the maximum delay angle locking.)

NOTE

When the oil splashes, wipe it off with a shop rag and the likes.

(4) Under the condition of (3), turn the CVVT assembly to the advance angle side (the arrow marked direction in the illustration) with your hand.

Depending on the air pressure, the CVVT assembly will turn to the advance side without applying force by hand. 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.

(5) 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 20°

(6) Turn the CVVT assembly with your hand 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 surfaces.

Replace oil seals with new ones.

1. Install valves.

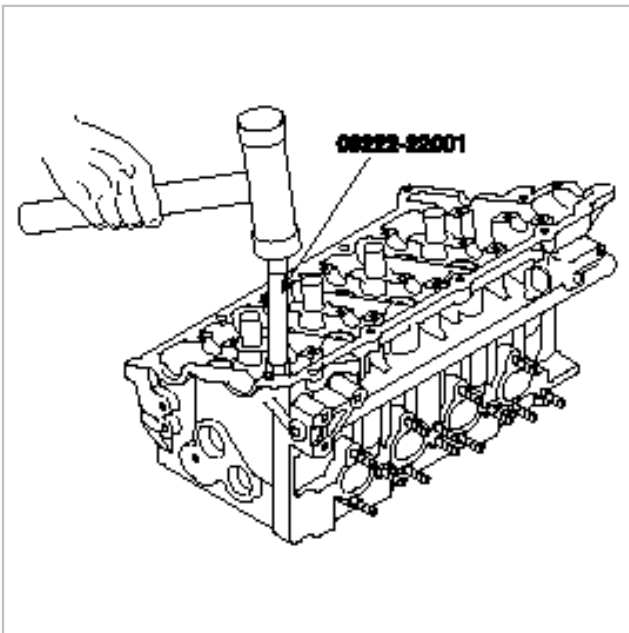
(1) Install the spring seats.

(2) Using SST(09222-22001), push in a new oil seal.

NOTE

Do not reuse old valve stem seals.

Incorrect installation of the seal could result in oil leakage past the valve guides.

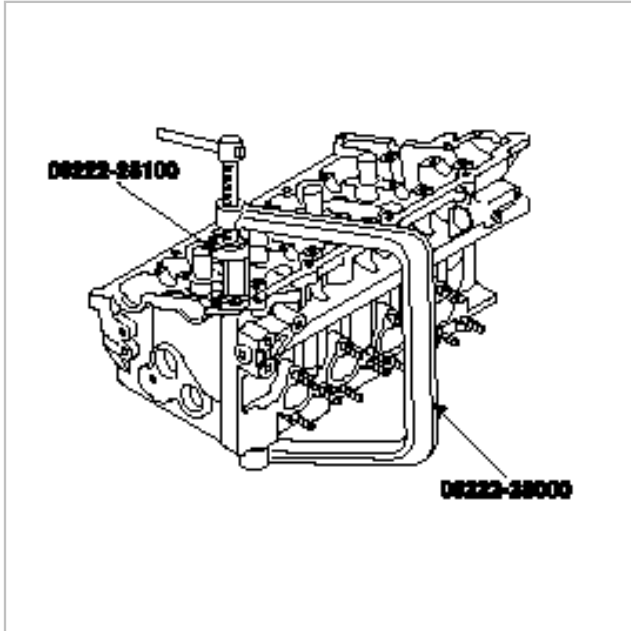


- (3) Install the valve, valve spring and spring retainer.

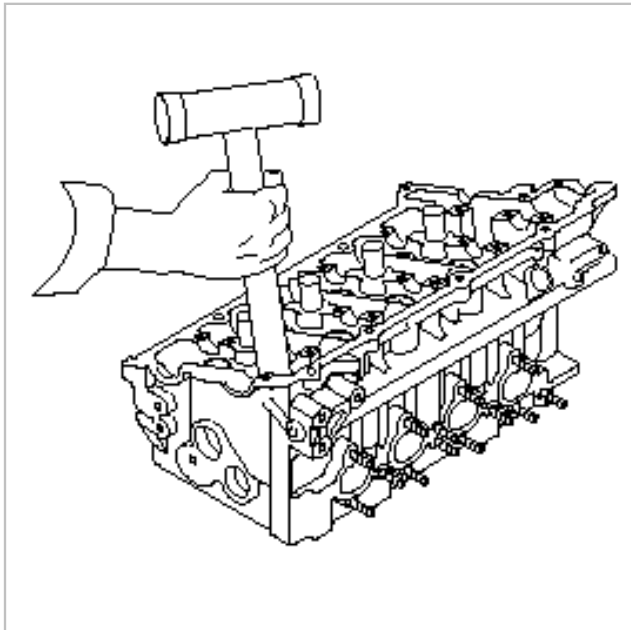
NOTE

Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer.

- (4) Using the SST(09222-28000,09222-28100), 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.



- (5) 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.



2. Install MLAs.

Check that the MLA rotates smoothly by hand.

