Component Procedures: Cylinder Head Assembly

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Component Procedures: Cylinder Head Assembly

Parts and Labor (itype_189)

Parts

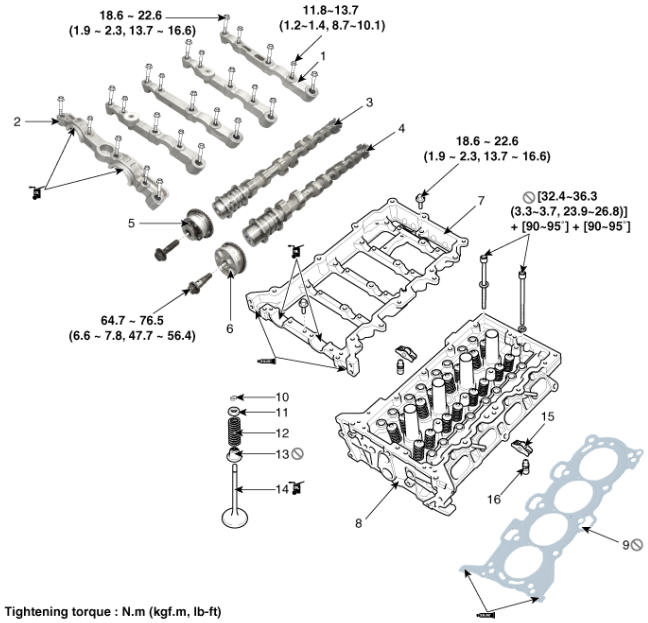
Qualifier	Part #	Name	Price	Note
Cylinder Head & Valves > Cyl?	5D0952EU00	1 - Korea Built	1252.42	
Cylinder Head & Valves > Cyl?	71ZN52EX00	1 - Us Built	1409.60	
Cylinder Head & Valves > Exh?	222122E000	6 - Exhaust Valve	15.24	
Cylinder Head & Valves > Hea?	223112E100	2 - Head Gasket	87.61	
Cylinder Head & Valves > Int?	222112E400	5 - Intake Valve	14.37	
Cylinder Head & Valves > Roc?	245512E010	33 - Rocker Arms	19.50	
Cylinder Head & Valves > Val?	224102E700	3 - Valve Cover	342.26	
Cylinder Head & Valves > Val?	224412E700	4 - Valve Cover Gasket	44.52	
Cylinder Head & Valves > Val?	222232G600	8 - Valve Keeper	2.26	
Cylinder Head & Valves > Val?	2461003000	11 - Valve Lifters	15.47	Order By Size.
Cylinder Head & Valves > Val?	222242G000	7 - Valve Seals	2.44	
Cylinder Head & Valves > Val?	222222E010	10 - Valve Spring Reta?	2.39	
Cylinder Head & Valves > Val?	222212E000	9 - Valve Springs	7.24	
Engine	209202EU13	Valve Grind Gasket Kit	302.40	

Labor

Operation	Qualifier Path	Skill	Std Hrs	Wty Hrs
Remove & Replace	Cylinder Head & Valves > Cylinder Head, R&R	A	11.8	0.0
Remove & Replace	Cylinder Head & Valves > Head Gasket, R&R	B	8.6	0.0
Remove & Replace	Cylinder Head & Valves > Rocker Arms, R&R > A?	B	4.9	0.0
Remove & Replace	Cylinder Head & Valves > Valve Cover Gasket, ?	B	2.7	0.0
Remove & Replace	Cylinder Head & Valves > Valve Lifters, R&R >?	B	5.2	0.0
Remove & Replace	Cylinder Head & Valves > Valve Seals, R&R > A?	B	10.2	0.0
Remove & Replace	Cylinder Head & Valves > Valve Springs, R&R >?	B	10.2	0.0
Grind	Cylinder Head & Valves > Valves, Grind > All ?	B	11.8	0.0
Grind	Cylinder Head & Valves > Valves, Grind > All ?		0.1	
Grind	Cylinder Head & Valves > Valves, Grind > All ?		0.2	
Grind	Cylinder Head & Valves > Valves, Grind > All ?		0.1	
Grind	Cylinder Head & Valves > Valves, Grind > All ?		0.2	
Grind	Cylinder Head & Valves > Valves, Grind > All ?		0.1	
Adjust	Cylinder Head & Valves > Valves, Adjust > All?	B	5.2	0.0

Cylinder Head - Components and Components Location (Article 45347)

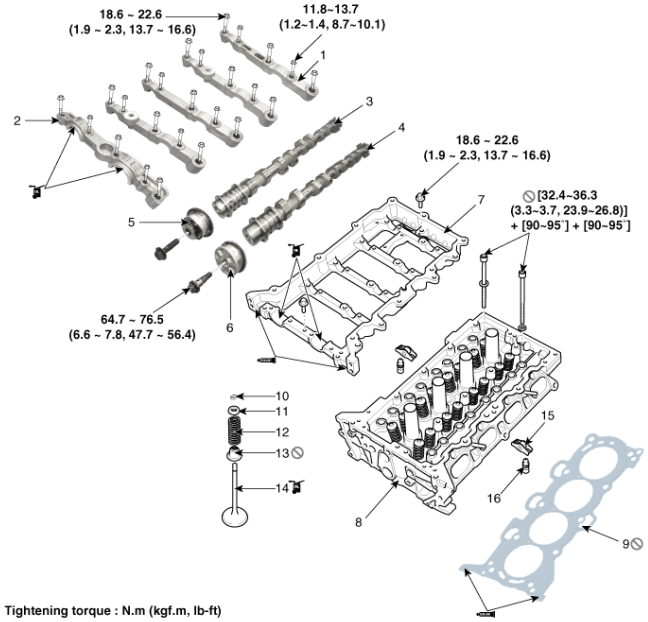
- Components



1. Camshaft bearing cap 2. Camshaft front bearing cap 3. Exhaust camshaft 4. Intake camshaft 5. Exhaust CVVT assembly 6. Intake CVVT assembly 7. Cam carrier 8. Cylinder head 9. Cylinder head gasket 10. Retainer lock 11. Retainer 12. Valve spring 13. Valve stem seal 14. Valve 15. Swing arm 16. Hydraulic lash adjuster (HLA)

Cylinder Head Assembly - Components and Components Location (Article 45338)

- Components



1. Camshaft bearing cap 2. Camshaft front bearing cap 3. Exhaust camshaft 4. Intake camshaft 5. Exhaust CVVT assembly 6. Intake CVVT assembly 7. Cam carrier 8. Cylinder head 9. Cylinder head gasket 10. Retainer lock 11. Retainer 12. Valve spring 13. Valve stem seal 14. Valve 15. Swing arm 16. Hydraulic lash adjuster (HLA)

Cylinder Head - Repair Procedures (Article 45348)

- Removal

Use fender covers to avoid damaging painted surfaces. To avoid damaging the cylinder head , wait until the engine coolant temperature drops below normal temperature (20°C [68°F]) 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.

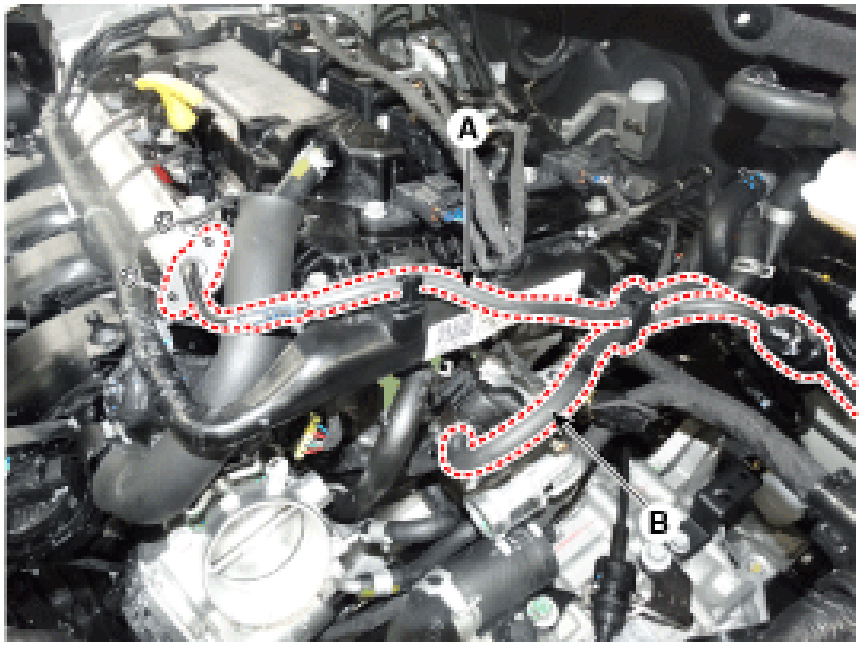
NOTICE

- Use fender covers to avoid damaging painted surfaces.
- To avoid damaging the cylinder head , wait until the engine coolant temperature drops below normal temperature (20°C [68°F]) 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.

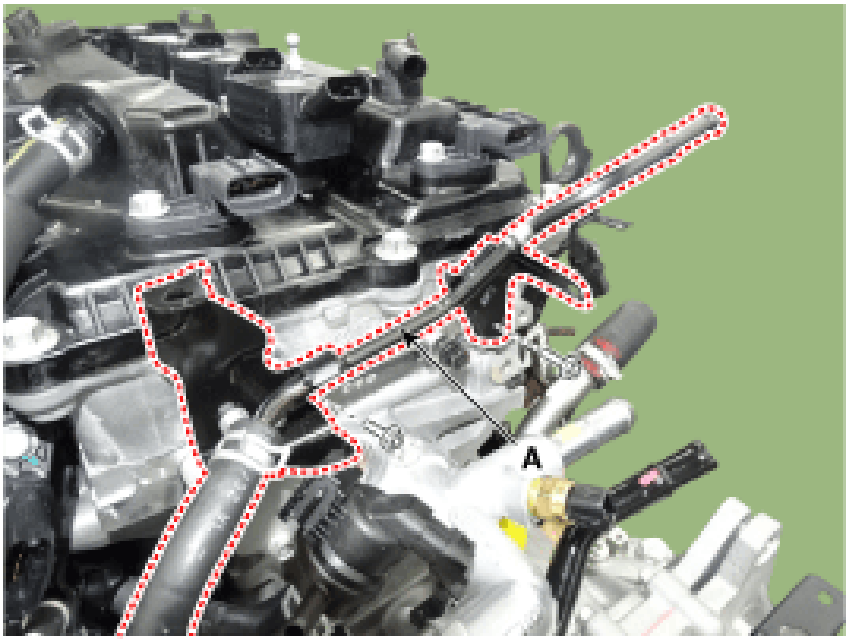
Mark all wiring and hoses to avoid misconnection. Turn the crankshaft pulley so that the No. 1 piston is at TDC (Top dead center).

Information

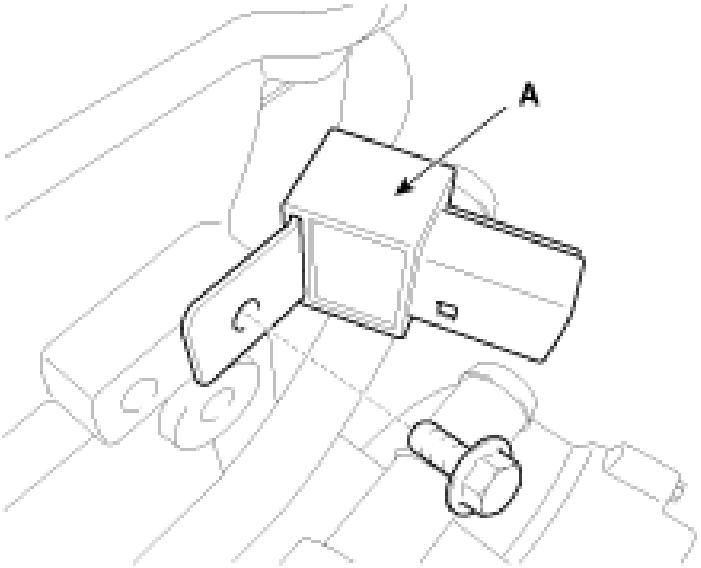
- Mark all wiring and hoses to avoid misconnection.
- Turn the crankshaft pulley so that the No. 1 piston is at TDC (Top dead center).
- Remove the engine cover . (Refer to Engine and Transaxle Assembly - "Engine Cover")
- Remove the air duct and air cleaner assembly . (Refer to Intake and Exhasut System - "Air Cleaner")
- Remove the battery. (Refer to Engine Electrical System - "Battery")
- Remove the ECM (Engine Control Module). (Refer to Engine Control / Fuel System - "Engine Control Module (ECM)")
- Remove the battery tray. (Refer to Engine Electrical System - "Battery")
- Remove the engine room under cover . (Refer to Engine and Transaxle Assembly - "Engine Room Under Cover")
- Drain the coolant. (Refer to Cooling System - "Coolant")
- Disconnect the fuel hose (A) and purge control solenoid valve (PCSV) hose (B).



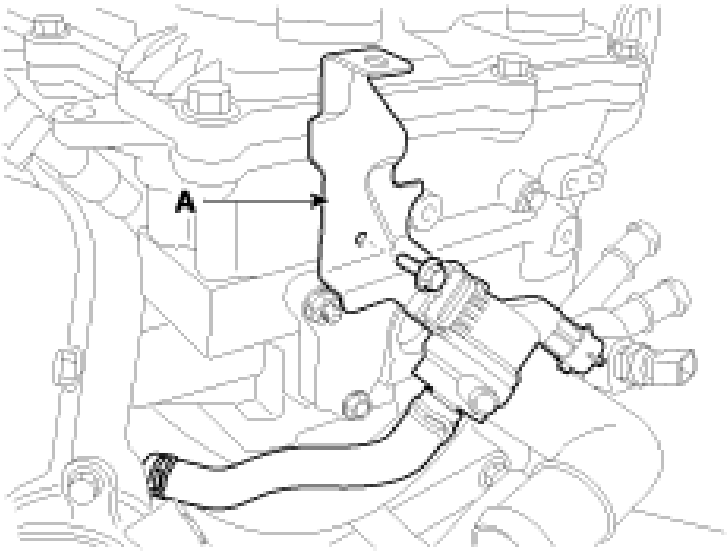
- Remove the vacuum pipe (A). Tightening torque : 9.8 - 11.8 N.m (1.0 - 1.2 kgf.m, 7.2 - 8.7 lb-ft)



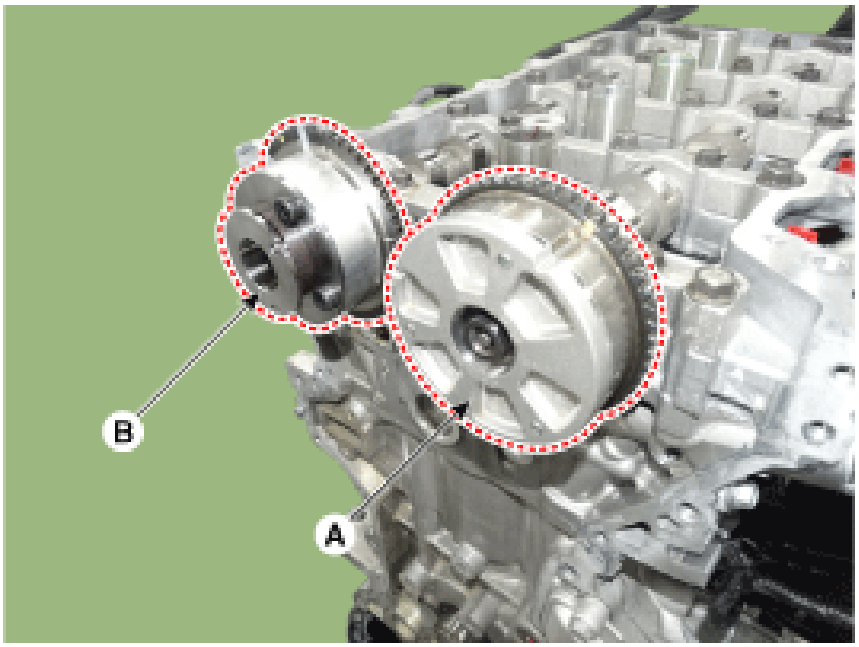
- Remove the condenser (A). Tightening torque : 9.8 - 11.8 N.m (1.0 - 1.2 kgf.m, 7.2 - 8.7 lb-ft)



- Remove the purge control solenoid valve (PCSV) bracket (A). Tightening torque : 9.8 - 11.8 N.m (1.0 - 1.2 kgf.m, 7.2 - 8.7 lb-ft)



- Remove the delivery pipe. (Refer to Engine Control/Fuel System - "Delivery Pipe")
- Remove the cylinder head cover . (Refer to Cylinder Head Assembly - "Cylinder Head Cover")
- Remove the timing chain . (Refer to Timing System - "Timing Chain")
- Remove the exhaust manifold . (Refer to Intake and Exhaust System - "Exhaust Manifold")
- Remove the intake manifold . (Refer to Intake and Exhaust System - "Intake Manifold")
- Remove the water temperature control assembly. (Refer to Cooling System - "Water Temperature Control Assembly")
- Remove the heater pipe . (Refer to Cooling System - "Thermostat")
- Remove the intake CVVT assembly (A) and exhaust CVVT assembly (B). When removing the CVVT assembly bolt, hold the camshaft with a wrench to prevent the camshaft from rotating.



When removing the CVVT assembly bolt, hold the camshaft with a wrench to prevent the camshaft from rotating.
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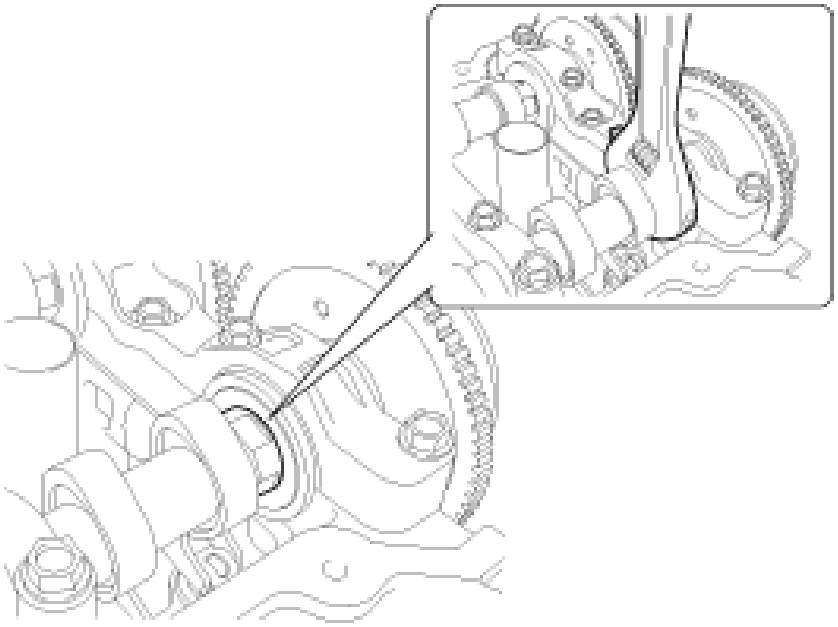
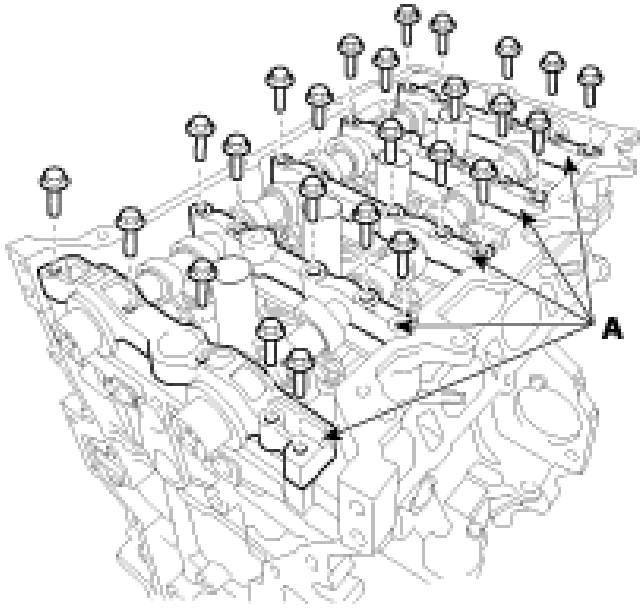
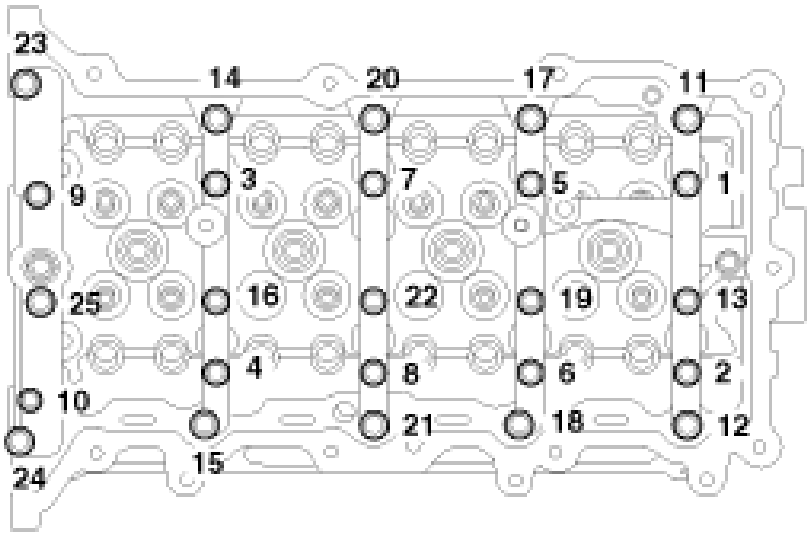
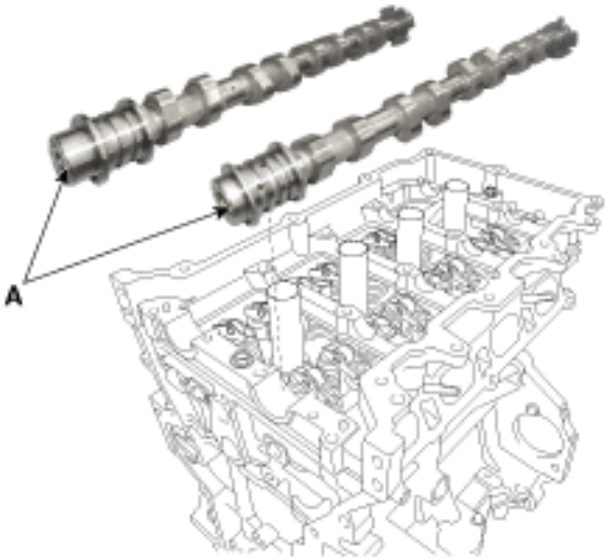


- Remove the camshaft. Remove the camshaft bearing cap (A) by loosening the bolts in the sequence as shown. Remove the camshafts (A).
- Remove the camshaft bearing cap (A) by loosening the bolts in the sequence as shown.

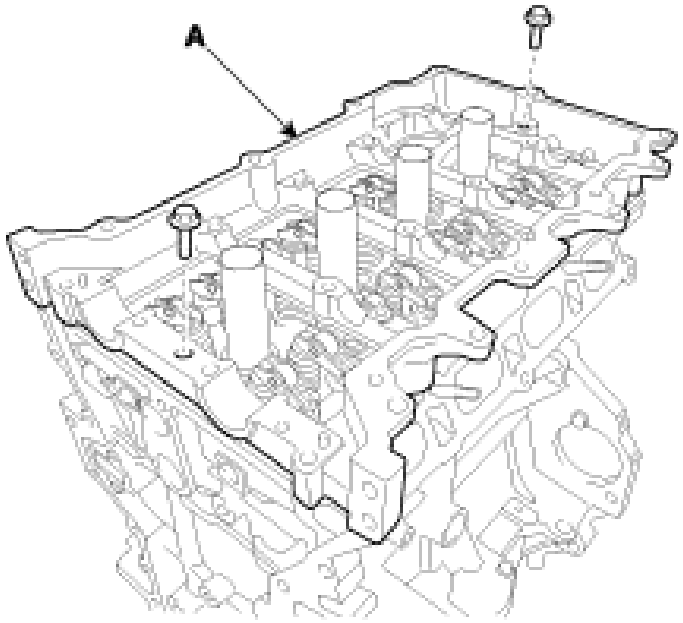




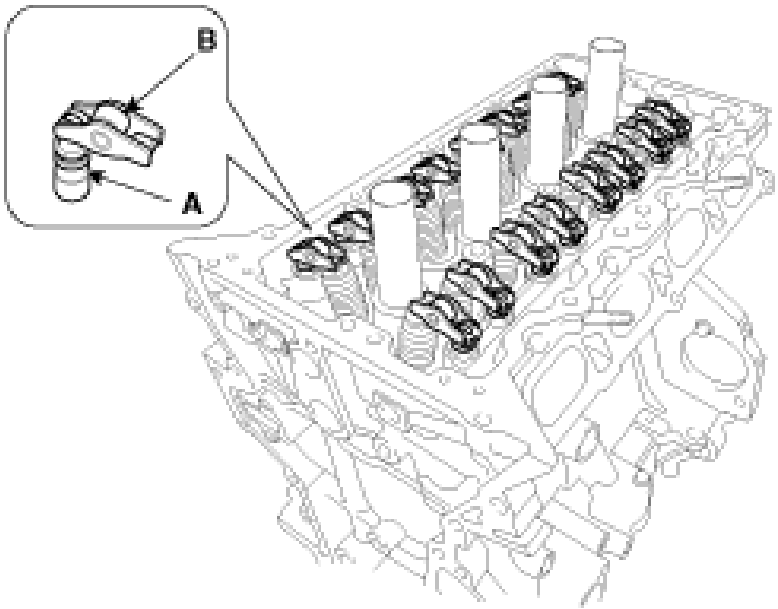
- Remove the camshafts (A).



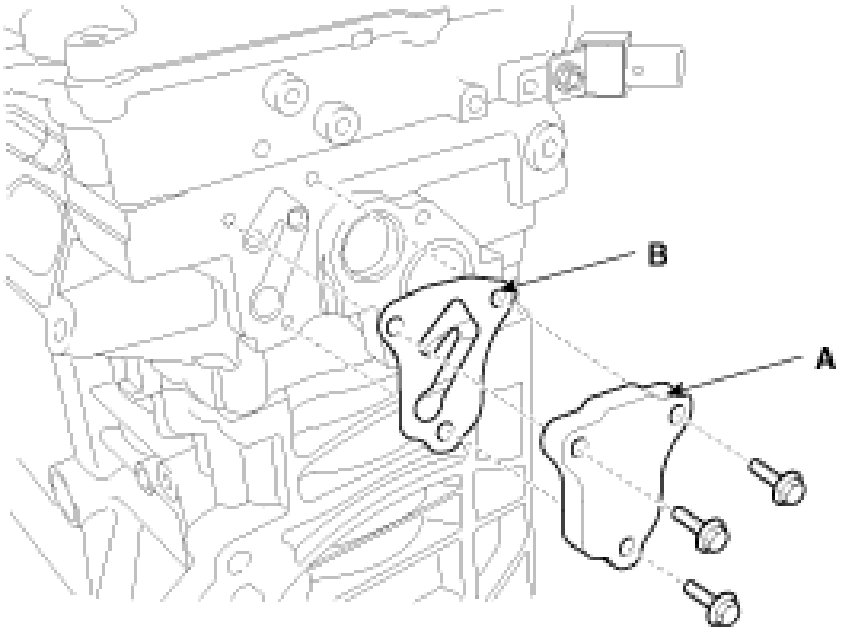
- Remove the cam carrier (A).



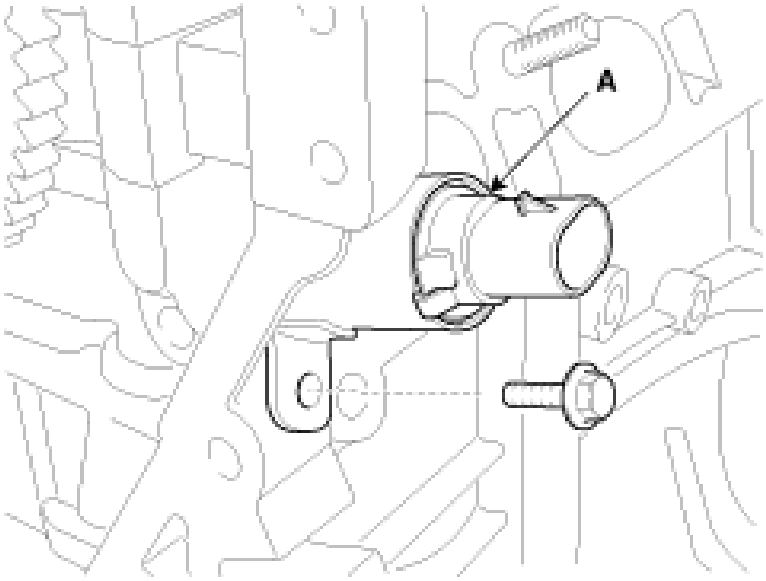
- Remove the hydraulic lash adjuster (HLA) (A) and the swing arm (B). The HLA and swing arm should be kept together as pairs during storage after removal and reinstallation.



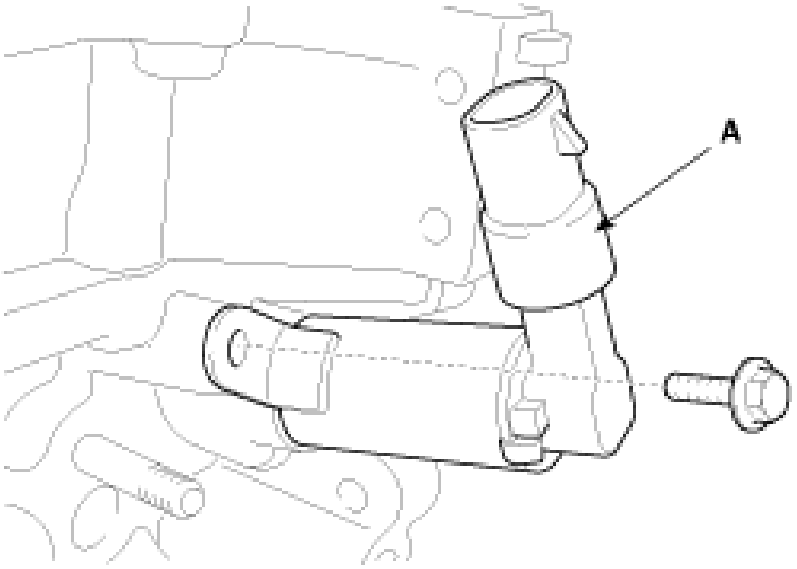
The HLA and swing arm should be kept together as pairs during storage after removal and reinstallation.
- The HLA and swing arm should be kept together as pairs during storage after removal and reinstallation.
- Remove the oil control adapter (A) with the gasket (B).



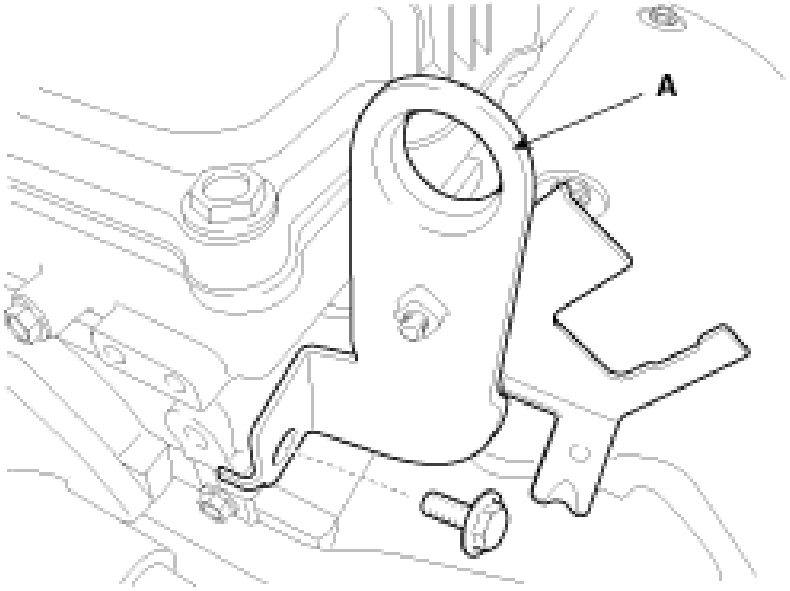
- Remove the intake oil control valve (OCV) (A).



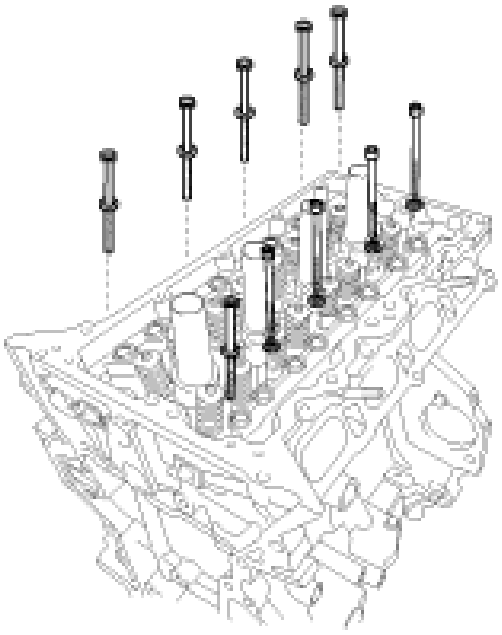
- Remove the exhaust oil control valve (OCV) (A).

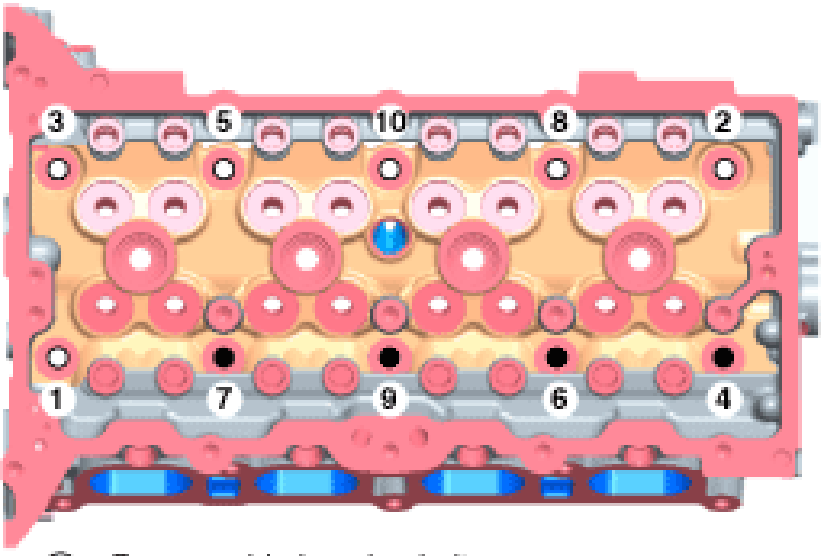


- Remove the rear engine hanger (A).



- Remove the spark plugs . (Refer to Engine Electrical System - "Spark Plug")
- Remove the cylinder head. Using bit socket (12PT), uniformly loosen and remove the cylinder head bolts, in several passes, in the sequence as shown. Head warpage or cracking could result from removing bolts in an incorrect order. Lift the cylinder head (A) from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench. Be careful not to damage the contact surfaces of the cylinder head and cylinder block. Remove the cylinder head gasket (B).
- Using bit socket (12PT), uniformly loosen and remove the cylinder head bolts, in several passes, in the sequence as shown. Head warpage or cracking could result from removing bolts in an incorrect order.





○ : Preassembled washer bolt
● : Non-preassembled washer bolt

Head warpage or cracking could result from removing bolts in an incorrect order.
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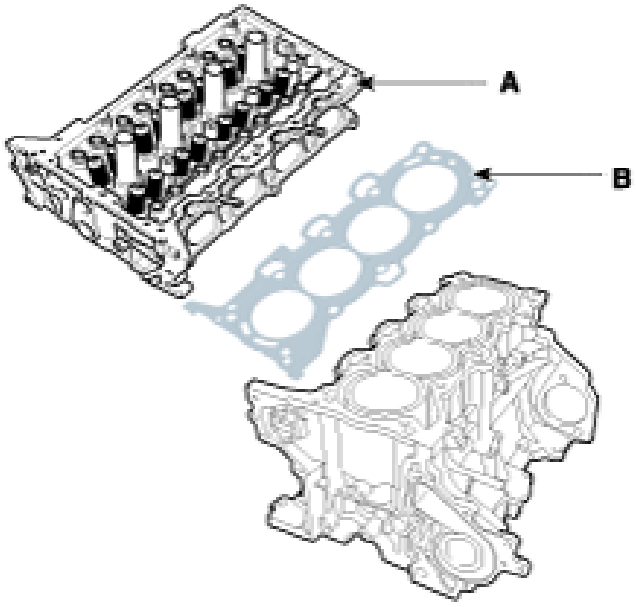
- Remove the cylinder head gasket (B).



- Disassembly

Identify, valves and valve spring s as they are removed so that each item can be reinstalled in its original position.

- Identify, valves and valve spring s as they are removed so that each item can be reinstalled in its original position.
- Remove the valves. Using the SST (09222-3K000, 09222-2A100), compress the valve spring and remove the retainer lock (A). When installing the SST, insert the front support (A) directly into the bolt hole on the cylinder head. Do not press valve retainer more than 12mm (0.47in.). Remove the spring retainer (B). Remove the valve spring (C). Remove the valve (D). Using needle-nose pliers, remove the valve stem seal (E). Do not reuse the valve stem seals.
- Using the SST (09222-3K000, 09222-2A100), compress the valve spring and remove the retainer lock (A). When installing the SST, insert the front support (A) directly into the bolt hole on the cylinder head. Do not press valve retainer more than 12mm (0.47in.).

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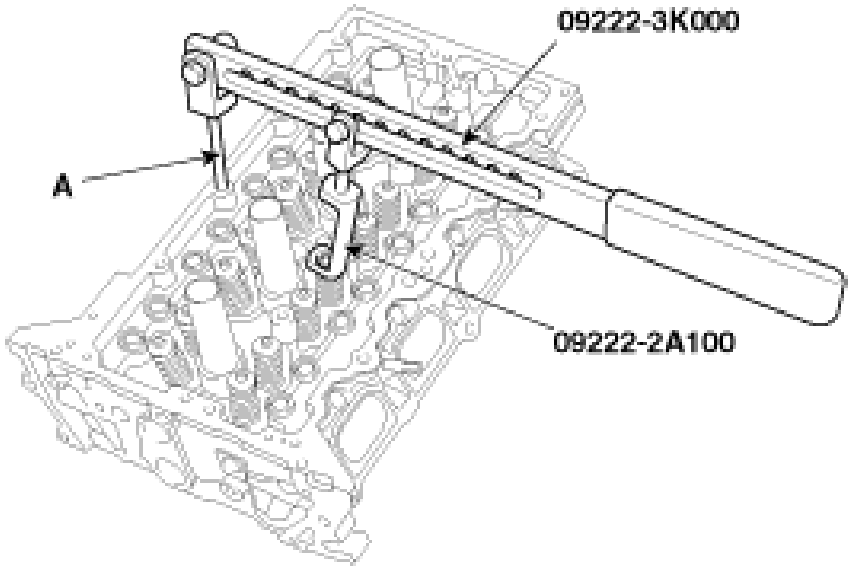
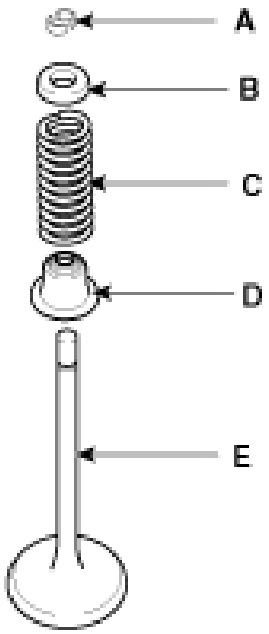


Do not press valve retainer more than 12mm (0.47in.).

- Do not press valve retainer more than 12mm (0.47in.).
- Remove the spring retainer (B).

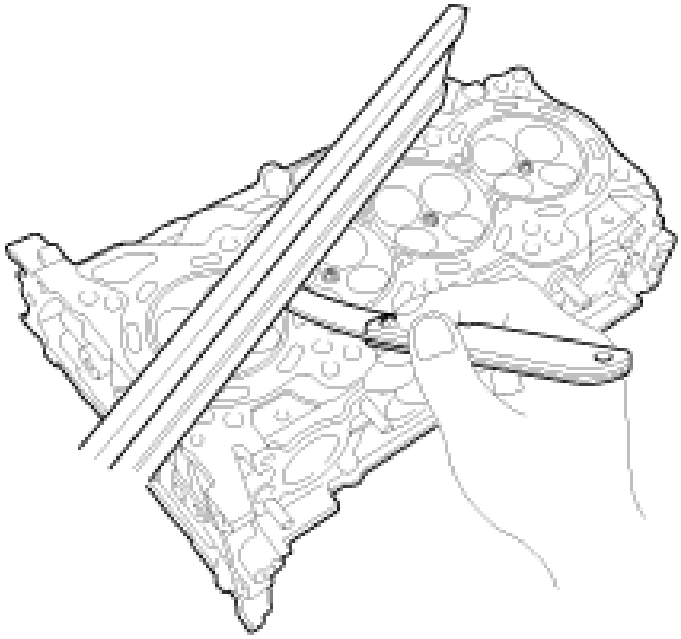
- Remove the valve spring (C).
- Remove the valve (D).
- Using needle-nose pliers, remove the valve stem seal (E). Do not reuse the valve stem seals.

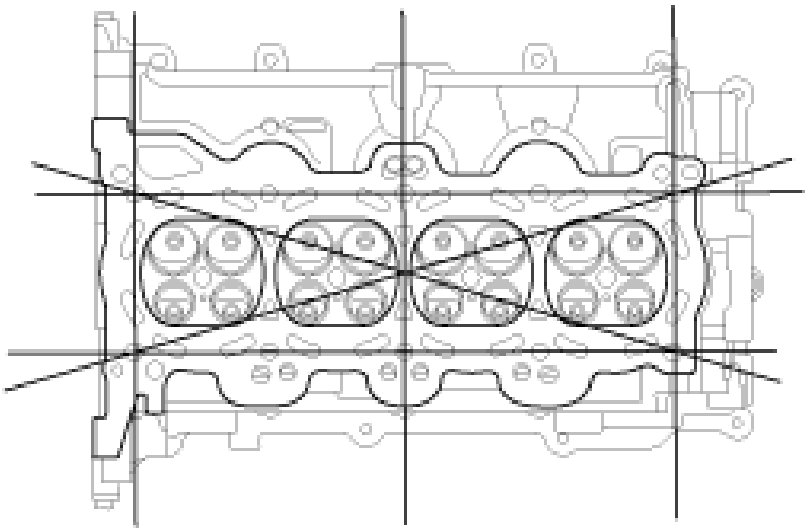


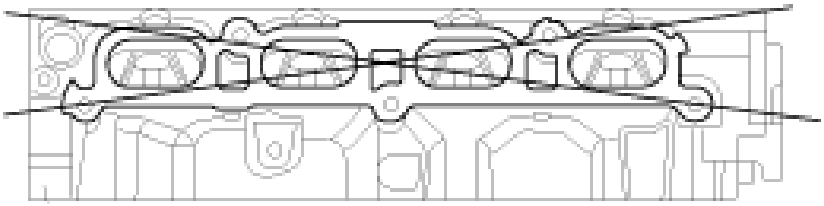
Do not reuse the valve stem seals.
- Do not reuse the valve stem seals.
- Inspection

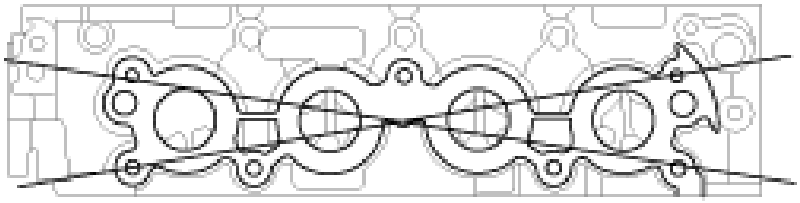
Cylinder Head

- Inspect for flatness. Using a precision straight edge and feeler gauge, measure the contacting surface of the cylinder block and the manifolds for warpage. Flatness of cylinder head gasket surface : Less than 0.05 mm (0.0020 in.) for total area Less than 0.02 mm (0.0008 in.) for a section of 100 mm (3.9370 in.) x 100 mm (3.9370 in.) Flatness of manifold mounting surface : Less than 0.10 mm (0.0039 in.)





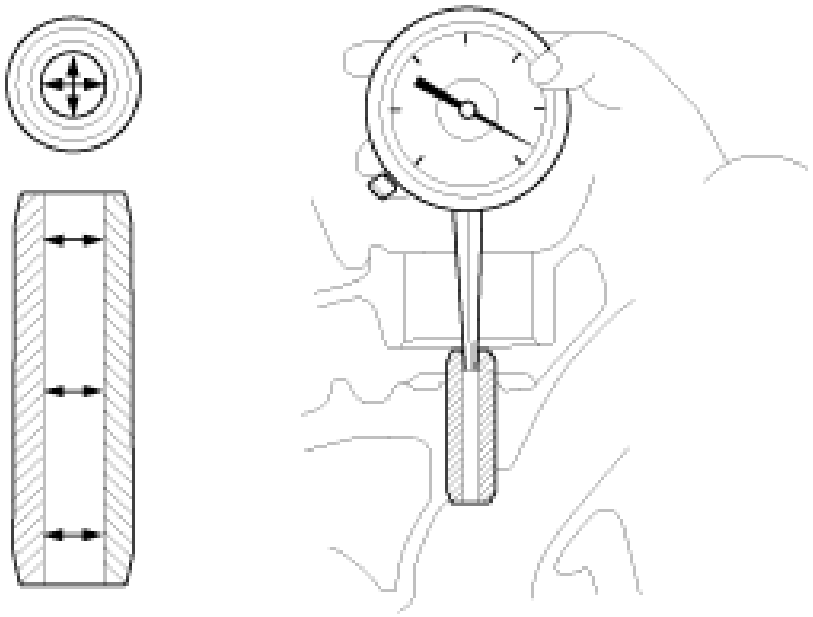




- Inspect for cracks. Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

Valve and Valve Spring

- Inspect valve stems and valve guides. Using a caliper gauge, measure the inside diameter of the valve guide. Valve guide inner diameter Intake : 5.500 - 5.512 mm (0.21654 - 0.21701 in.) Exhaust : 5.500 - 5.512 mm (0.21654 - 0.21701 in.) Using a micrometer, measure the diameter of the valve stem. Valve stem outer diameter Intake : 5.465 - 5.480 mm (0.21516 - 0.21575 in.) Exhaust : 5.458 - 5.470 mm (0.21488 - 0.21535 in.) Subtract the valve stem diameter measurement from the valve guide inside diameter measurement. If the clearance is greater than specification, replace the valve or the cylinder head. Valve stem-to-guide clearance [Standard] Intake : 0.020 - 0.047 mm (0.00079 - 0.00185 in.) Exhaust : 0.030 - 0.054 mm (0.00118 - 0.00213 in.)
- Using a caliper gauge, measure the inside diameter of the valve guide. Valve guide inner diameter Intake : 5.500 - 5.512 mm (0.21654 - 0.21701 in.) Exhaust : 5.500 - 5.512 mm (0.21654 - 0.21701 in.)



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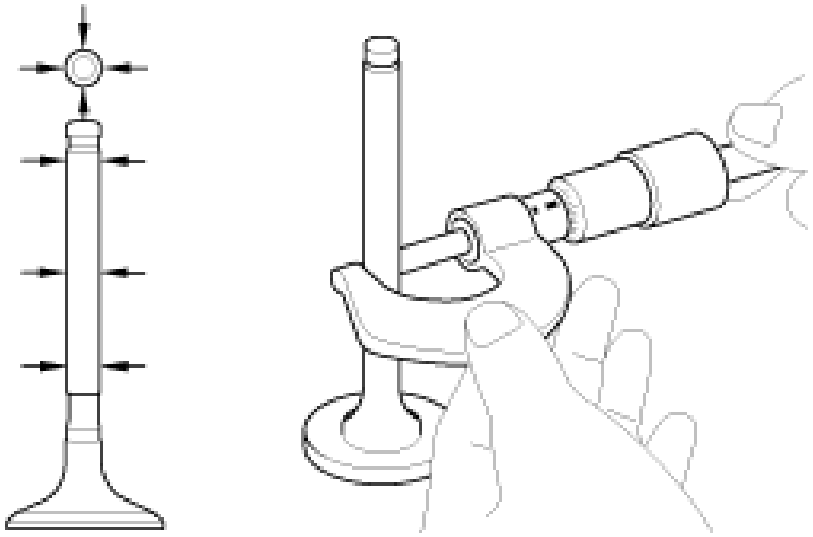

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- Inspect the valves. Check the valve is ground to the correct valve face angle. Check that the surface of the valve for wear. If the valve face is worn, replace the valve. Check the valve head margin thickness. If the margin thickness is less than specification, replace the valve. Margin [Standard] Intake : 1.30 mm (0.0512 in.) Exhaust : 1.26 mm (0.0496 in.) Check the valve length. Valve length [Standard] Intake : 102.22 mm (4.0244 in.) Exhaust : 104.04 mm (4.0961 in.) [Limit] Intake : 101.97 mm (4.0146 in.) Exhaust : 103.79 mm (4.0862 in.) Check the surface of the valve stem tip for wear. If the valve stem tip is worn, replace the valve.
- Check the valve is ground to the correct valve face angle.
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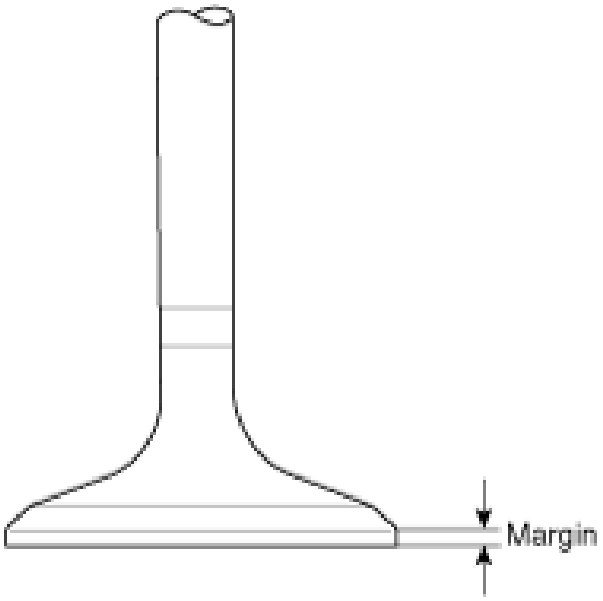
- Check the valve head margin thickness. If the margin thickness is less than specification, replace the valve. Margin [Standard] Intake : 1.30 mm (0.0512 in.) Exhaust : 1.26 mm (0.0496 in.)



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- Check the surface of the valve stem tip for wear. If the valve stem tip is worn, replace the valve.
- Inspect the valve seats and the valve guides. 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. Check the valve guide for wear.If the valve guide is worn, replace the cylinder head.
- 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.
- Check the valve guide for wear.If the valve guide is worn, replace the cylinder head.
- Inspect the valve springs. Using a steel square, measure the out-of-square of valve spring. Using a vernier calipers, measure the free length of valve spring. If the free length is not as specified, replace the valve spring. Valve spring [Standard] Free length : 45.93 mm (1.8083 in.) Load : 19.6 ± 1.0kg / 37.0mm (43.21 ± 2.20 lb / 1.4567 in) 45.7 ± 1.8kg / 27. 0mm (100.75 ± 3.97 lb / 1.0630 in) Out-of-square : Less than 1.5°
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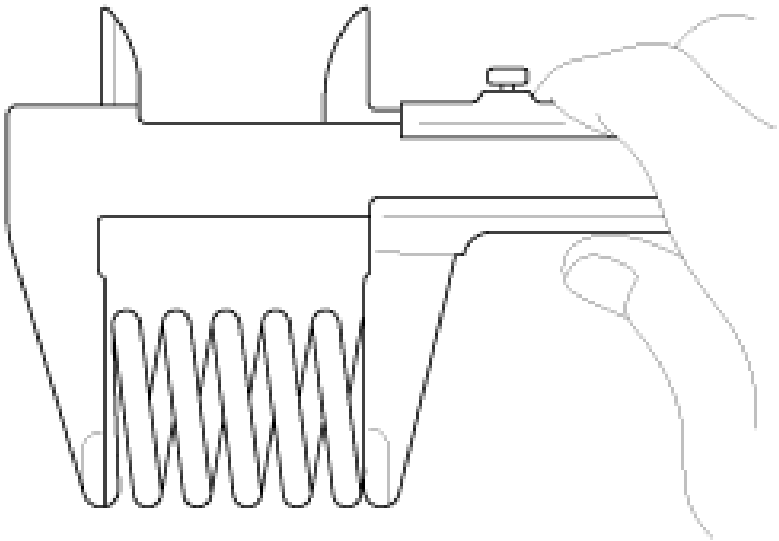
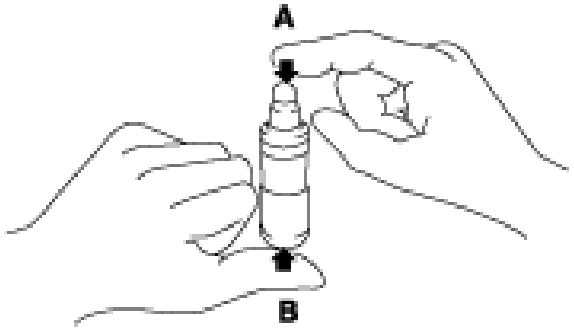


Hydraulic Lash Adjuster (HLA)



Problem Possible cause Action
1. Temporary noise when starting a cold engine Normal This noise will disappear after the oil in the engine reaches the normal pressure.
2. Continuous noise when the engine is started after parking more than 48 hours Oil leakage of the high pressure chamber on the HLA, allowing air to get in Noise will disappear within 15 minutes when engine runs at 2000-3000 rpm. If it doesn't disappear, refer to step 7 below.
3. Continuous noise when the engine is first started after rebuilding cylinder head Insufficient oil in cylinder head oil gallery
4. Continuous noise when the engine is started after excessively cranking the engine by the starter motor or band Oil leakage of the high-pressure chamber in the HLA, allowing air to get in Insufficient oil in the HLA
- Oil leakage of the high-pressure chamber in the HLA, allowing air to get in
- Insufficient oil in the HLA
5. Continuous noise when the engine is running after changing the HLA Do not run engine at a speed higher than 3000 rpm, as this may damage the HLA.
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6. Continuous noise during idle after high engine speed Engine oil level too high or too low Check oil level. Drain or add oil as necessary.
- Check oil level.
- Drain or add oil as necessary.
Excessive amount of air in the oil at high engine speed Check oil supply system.
Deteriorated oil Check oil quality. If deteriorated, replace with specified type.
7. Noise continues for more than 15 minutes Low oil pressure Check oil pressure and oil supply system of each part of engine.
Faulty HLA Remove the cylinder head cover and press HLA down by hand. If it moves, replace the HLA.
- Reassembly
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.
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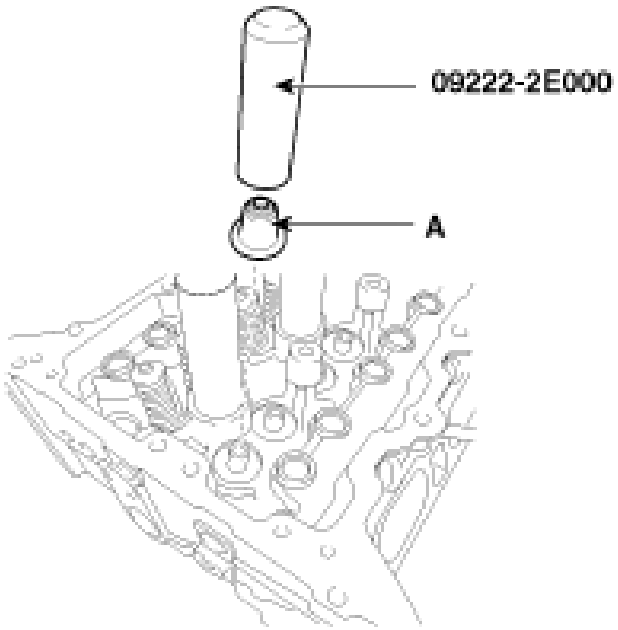
- Before installing the parts, apply fresh engine oil to all sliding and rotating surface.
- Replace oil seals with new ones.
- Install the valves. Using the SST (09222-2E000), push in a new stem seal (A). Do not reuse old valve stem seals. Incorrect installation of the seal could result in oil leakage past the valve guides. Install the valve, valve spring and spring retainer. Place the valve springs so that the side coated with enamel faces toward the valve spring retainer and then installs the retainer. Using the SST (09222-3K000, 09222-2A100), compress the spring and install the retainer locks. Before releasing the valve spring compressor, ensure that the retainer locks are correctly in place after pushing down and releasing the compressor handle 2-3 times. When installing the SST, insert the front support (A) directly into the bolt hole on the cylinder head. Do not

press valve retainer more than 12mm (0.47in.).
- Using the SST (09222-2E000), push in a new stem seal (A). Do not reuse old valve stem seals. Incorrect installation of the seal could result in oil leakage past the valve guides.



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- Installation

Thoroughly clean all parts to be assembled. Always use new cylinder head and manifold gaskets. Always use new cylinder head bolts. The cylinder head gasket is a metal gasket. Take care not to bend it. Rotate the crankshaft to set the No.1 piston at TDC (Top dead center) on compression stroke.
- Always use new cylinder head and manifold gaskets.
- Always use new cylinder head bolts.
- The cylinder head gasket is a metal gasket. Take care not to bend it.
- Rotate the crankshaft to set the No.1 piston at TDC (Top dead center) on compression stroke.
- Install the cylinder head gasket (B) on the cylinder block. Remove hardening sealant, oil, dust, moisture and harmful foreign materials from the cylinder block and the cylinder head. Apply liquid gasket on the edge of the cylinder block. Install the cylinder head gasket with the dowel pins of the cylinder block. Apply liquid gasket on the edge of the cylinder head gasket. Apply liquid gasket on the edge of the cylinder block and cylinder head gasket. Sealant : Threebond 1217H or equivalent Assemble the cylinder head gasket and the cylinder head within 5 minutes after applying sealant.
- Remove hardening sealant, oil, dust, moisture and harmful foreign materials from the cylinder block and the cylinder head.
- Apply liquid gasket on the edge of the cylinder block.
- Install the cylinder head gasket with the dowel pins of the cylinder block.
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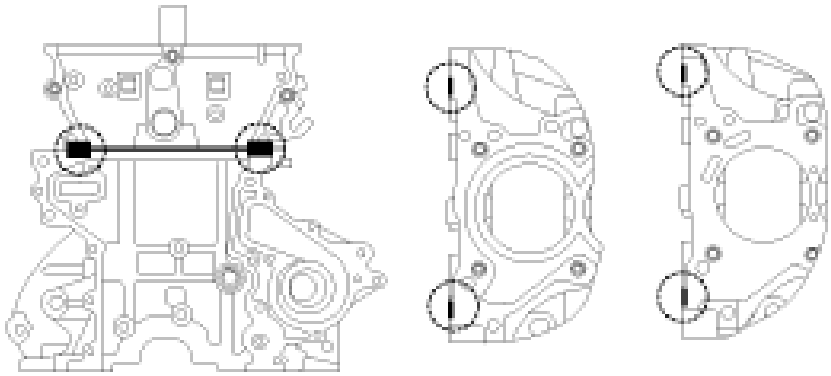
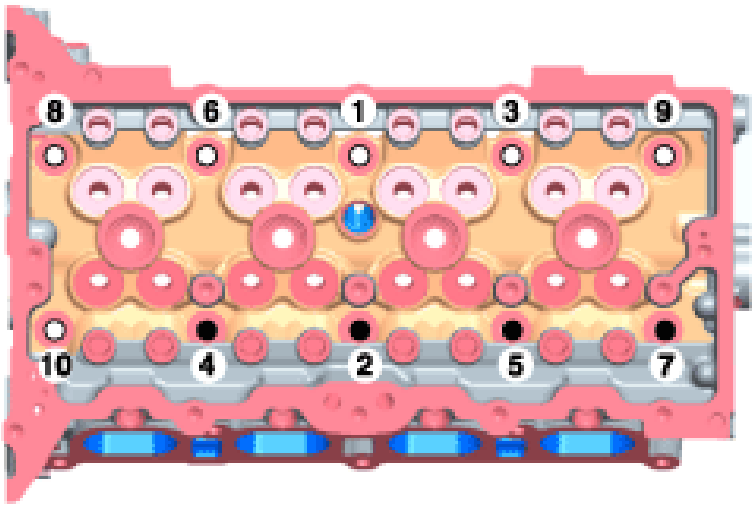


Assemble the cylinder head gasket and the cylinder head within 5 minutes after applying sealant.
- Assemble the cylinder head gasket and the cylinder head within 5 minutes after applying sealant.
- Place the cylinder head (A) carefully to protect damage to the head gasket during installation.
- Install the cylinder head bolts with washers. Using SST (09221-4A000), install and tighten the 10 cylinder head bolts, in several passes, in the sequence as shown. Tightening torque 1st step : 32.4 - 36.3 N.m (3.3 - 3.7 kgf.m, 23.9 - 26.8 lb-ft) 2nd step : 90-95° 3rd step : 90-95° Do not reuse the cylinder head bolts. Do not apply engine oil on the bolt threads to achieve correct torque. Remove the extruded sealant within 5 minutes after installing cylinder head bolts. The engine running or pressure test should not be performed within 30 minutes after installing cylinder head bolts. Be careful not to change the installing position of the preassembled washer bolts and non-preassembled washer bolts. When installing the washer of the non-preassembled washer bolts, the round and chamfer of washers should be faced up.



○ : Preassembled washer bolt
● : Non-preassembled washer bolt

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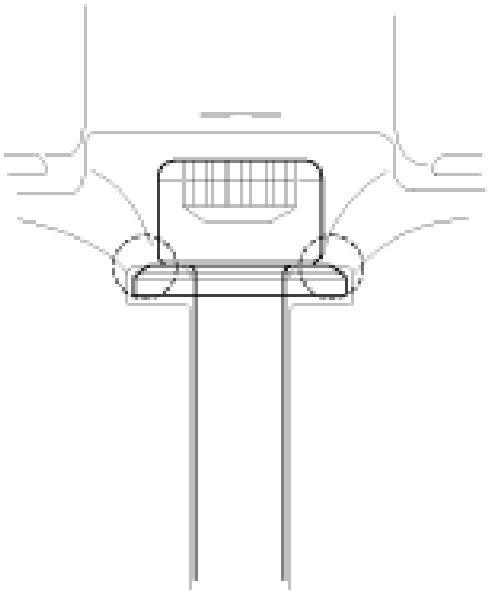

- Install the rear engine hanger (A). Tightening torque : 34.3 - 39.2 N.m (3.5 - 4.0 kgf.m, 25.3 - 28.9 lb-ft)
- Install the exhaust oil control valve (OCV) (A). Tightening torque : 9.8 - 11.8 N.m (1.0 - 1.2 kgf.m, 7.2 - 8.7 lb-ft)
- Install the intake oil control valve (OCV) (A). Tightening torque : 9.8 - 11.8 N.m (1.0 - 1.2 kgf.m, 7.2 - 8.7 lb-ft) Do not reuse the OCV when dropped. Keep the OCV filter clean. Do not hold the OCV sleeve (A) during servicing. When the OCV is installed on the engine, do not move the engine with holding the OCV yoke.
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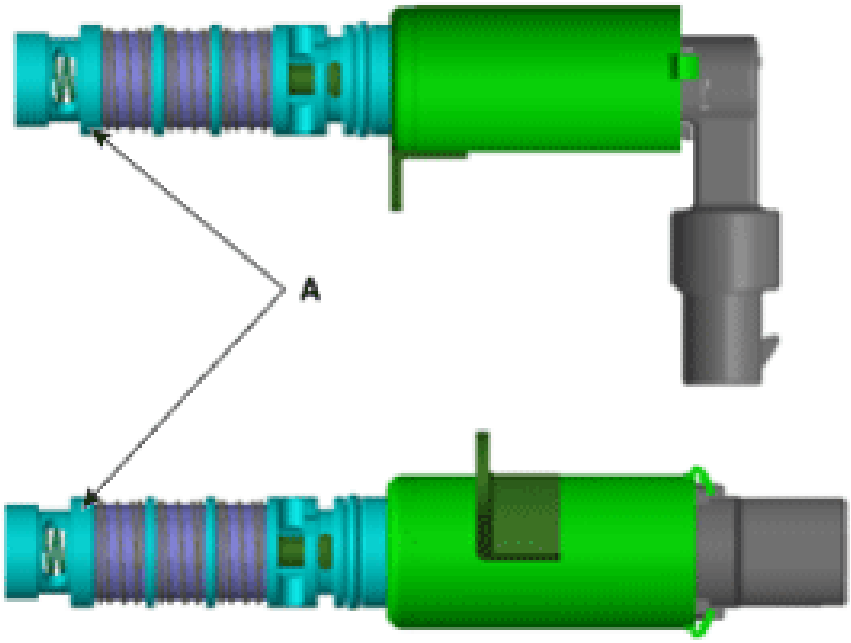
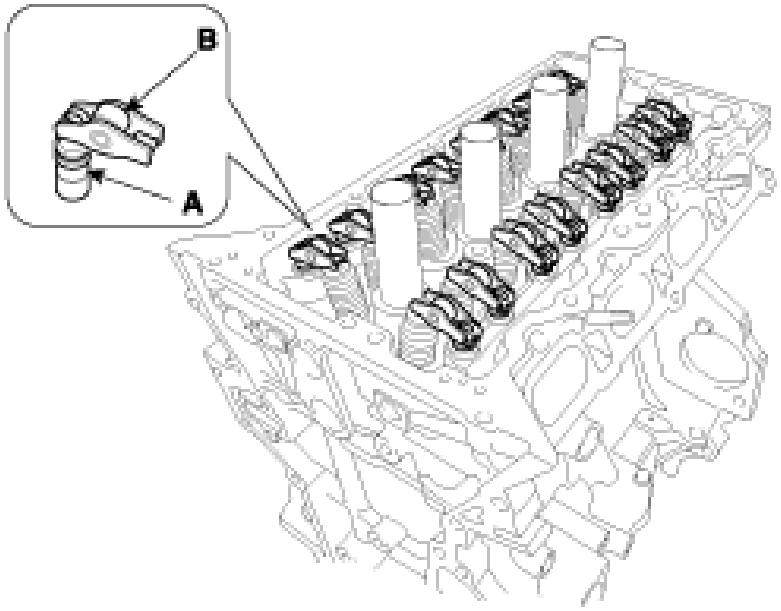


- Install the oil control adapter (A) with a new gasket (B). Tightening torque : 9.8 - 11.8 N.m (1.0 - 1.2 kgf.m, 7.2 - 8.7 lb-ft)
- Install the hydraulic lash adjuster (HLA) (A) and the swing arm (B). When installing HLA, it should be held upright so that engine oil in HLA may not spill and assured that dust does not adhere to HLA. HLA should be inserted carefully to the cylinder head not to spill engine oil. If engine oil has spilled out of the lash adjuster, HLA bleeding should be performed according to the below procedure. HLA bleeding procedure Stroke the lash adjuster in engine oil by pushing its cap 4 to 5 times while pushing the ball down slightly using a hard steel wire. Be careful not to give the ball a hard push because the ball weighs just several grams. If installing with engine oil spilling out of the lash adjuster and air in it, it might make an abnormal noise.



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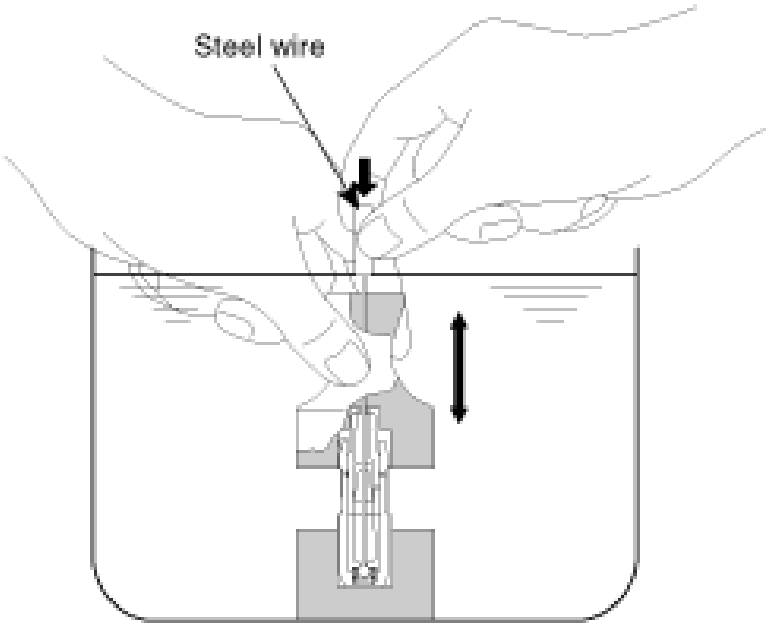

- Install the cam carrier. Using a gasket scraper, remove all the old packing material from the gasket surfaces. The sealant locations on the cam carrier and the cylinder head must be free of harmful foreign materials, oil, dust and moisture. Spray cleaner on the surface and wipe with a clean duster. After applying liquid sealant on the bottom surface of the cam carrier, assemble the cam carrier. Continuous bead of sealant should be applied to prevent any path from oil leakage. Bead width : 2.5 - 3.5 mm (0.10 - 0.14 in.) Sealant : Threebond 1217H or equivalent Place the cam carrier (A) on the cylinder head. The dowel pins on the cam carrier and holes on the cylinder head should be used as a reference in order to assemble the cam carrier in exact position. Fasten the cam carrier bolts. Tightening torque : 18.6 - 22.6 N.m (1.9 - 2.3 kgf.m, 13.7 - 16.6 lb-ft) Assemble the cam carrier within 5 minutes after applying sealant. Assemble the camshaft bearing cap within 5 minutes after assembling the cam carrier. The engine running or pressure test should not be performed within 30 minutes after assembling the cam carrier.
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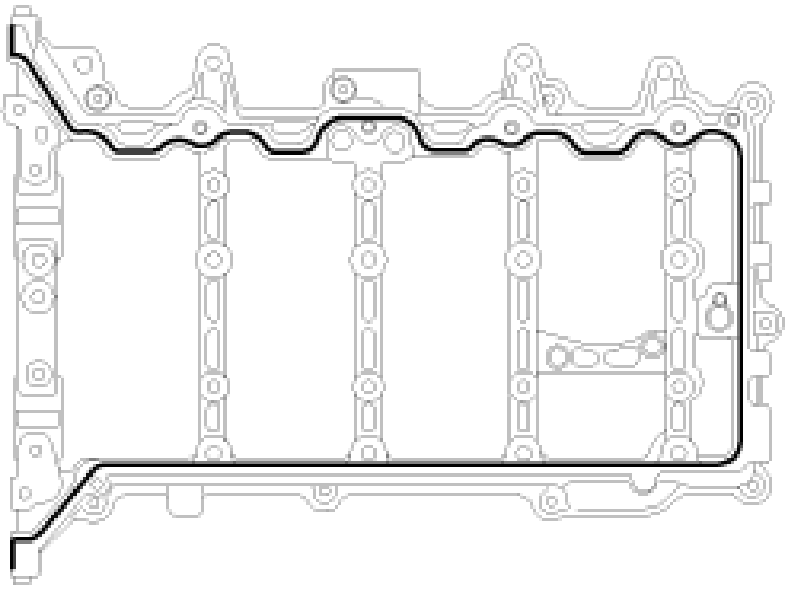

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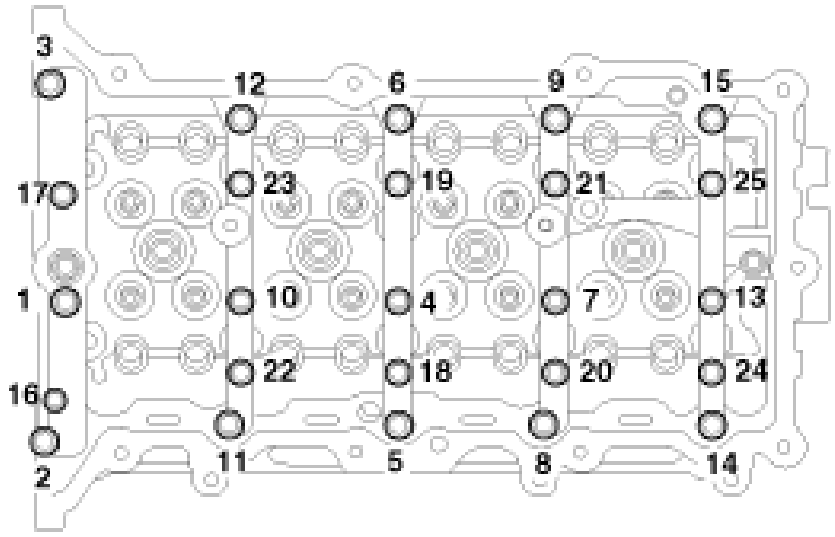
- The engine running or pressure test should not be performed within 30 minutes after assembling the cam carrier.
- Install the camshafts. Place the intake and exhaust camshaft s (A) on the cam carrier. Install the camshaft bearing cap (A). Tighten the bolts, in several passes, in the sequence as shown. Tightening torque M6 bolts : 11.8 - 13.7 N.m (1.2 - 1.4 kgf.m, 8.7 - 10.1 lb-ft) M8 bolts : 18.6 - 22.6 N.m (1.9 - 2.3 kgf.m, 13.7 - 16.6 lb-ft) Be careful not to change the position and direction of bearing caps.
- Place the intake and exhaust camshaft s (A) on the cam carrier.
- Install the camshaft bearing cap (A). Tighten the bolts, in several passes, in the sequence as shown. Tightening torque M6 bolts : 11.8 - 13.7 N.m (1.2 - 1.4 kgf.m, 8.7 - 10.1 lb-ft) M8 bolts : 18.6 - 22.6 N.m (1.9 - 2.3 kgf.m, 13.7 - 16.6 lb-ft) Be careful not to change the position and direction of bearing caps.



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- Install the intake CVVT assembly (A) and exhaust CVVT assembly (B). Tightening torque : 64.7 - 76.5 N.m (6.6 - 7.8 kgf.m, 47.7 - 56.4 lb-ft) When removing the CVVT assembly bolt, hold the camshaft with a wrench to prevent the camshaft from rotating.
- Install the other parts reverse order of removal.
- Add all the necessary fluids and check for leaks. Connect GDS. Check for codes, note, and clear. Recheck.
Refill engine with engine oil. Refill a radiator and a reservoir tank with engine coolant. Clean battery posts and cable terminals and assemble. Inspect for fuel leakage. After assembling the fuel line, turn on the ignition switch (do not operate the starter) so that the fuel pump runs for approximately two seconds and fuel line pressurizes. Repeat this operation two or three times, then check for fuel leakage at any point in the fuel line. Bleed air from the cooling system . (Refer to Cooling System - "Coolant")
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