REMOVAL

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, be careful not to fold the gasket or damage the contacting surface of the gasket.
- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

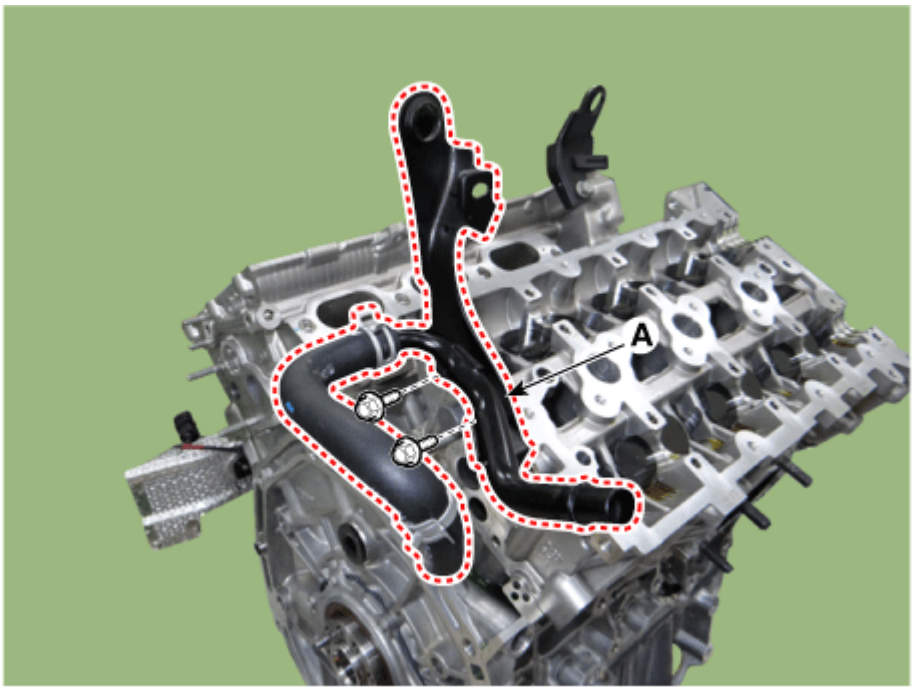
Information

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

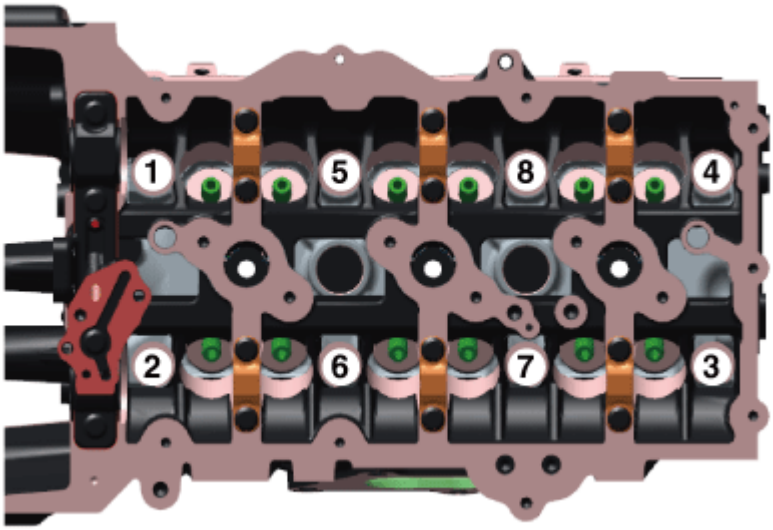
LH Cylinder Head

1. Remove the engine and transmission assembly.
   (Refer to Engine and Transmission Assembly - "Engine and Transmission Assembly")
2. Remove the surge tank.
   (Refer to Intake and Exhaust System - "Surge Tank")
3. Remove the intake manifold.
   (Refer to Intake and Exhaust System - "Intake Manifold")
4. Remove the delivery pipe.
   (Refer to Engine Control / Fuel System - "Delivery Pipe")
5. Remove the water temperature control assembly.
   (Refer to Cooling System - "Water Temperature Control Assembly")
6. Remove the LH turbo manifold module.
   (Refer to Intake and Exhaust System - "Turbo Manifold Module")
7. Remove the RH cylinder head cover.
   (Refer to Cylinder Head Assembly - "Cylinder Head Cover")
8. Remove the timing chain cover.
   (Refer to Timing System - "Timing Chain Cover")
9. Remove the oil level gauge & pipe.
   (Refer to Lubrication System - "Oil Level Gauge &e")
10. Remove the timing chain.
    (Refer to Timing System - "Timing Chain")
11. Remove the LH CVVT & camshaft assembly.
    (Refer to Cylinder Head Assembly - "CVVT &shaft")
12. Remove the RH engine hanger (A).
    Tightening torque :
    18.6 - 23.5 N·m (1.9 - 2.4 kgf·m, 13.7 - 17.4 lb·ft)

English

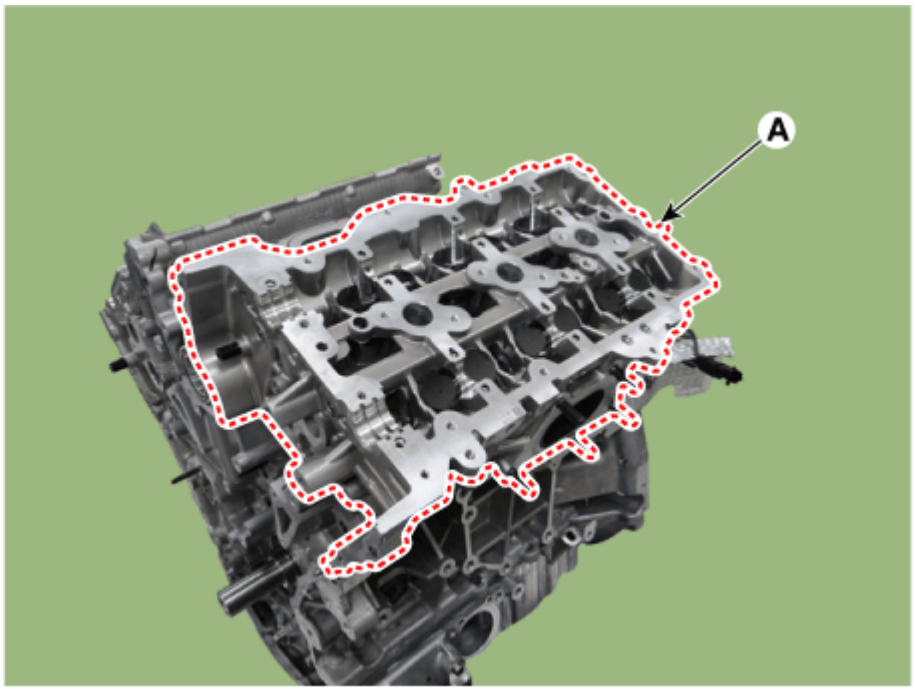


13. Remove the RH cylinder head.
    (1) Uniformly loosen and remove the cylinder head bolts, in several passes, in the sequence shown.

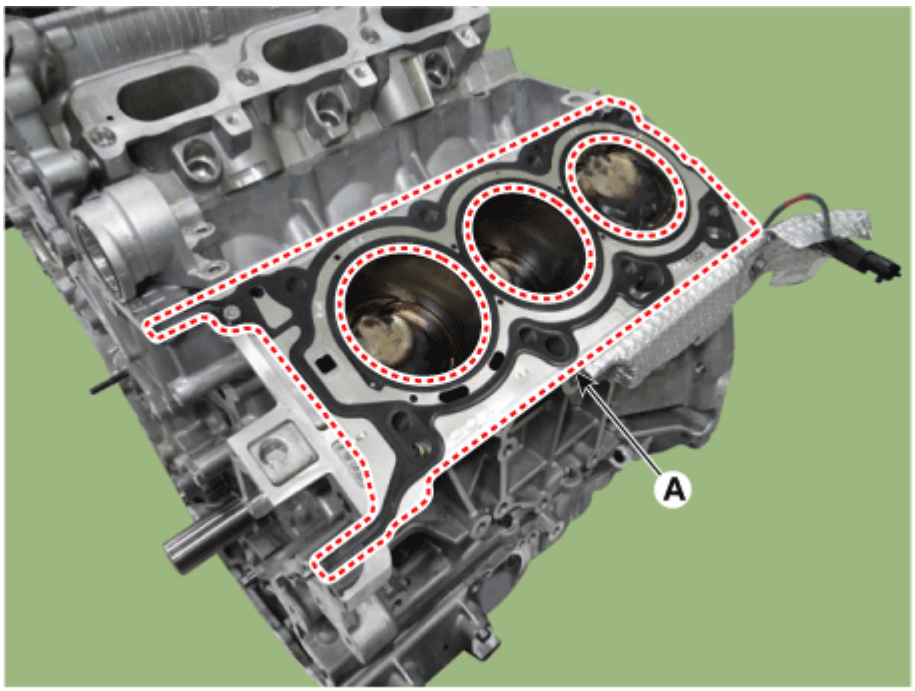


> **NOTICE**
>
> Removing bolts in an incorrect order may result in head warpage or crack.

    (2) Lift the RH cylinder head (A) from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.



(3) Remove the RH cylinder head gasket (A).



RH Cylinder Head

1. Remove the engine and transmission assembly.
   (Refer to Engine and Transmission Assembly - "Engine and Transmission Assembly")
2. Remove the surge tank.
   (Refer to Intake and Exhaust System - "Surge Tank")
3. Remove the intake manifold.
   (Refer to Intake and Exhaust System - "Intake Manifold")
4. Remove the delivery pipe.
   (Refer to Engine Control / Fuel System - "Delivery Pipe")
5. Remove the water temperature control assembly.
   (Refer to Cooling System - "Water Temperature Control Assembly")
6. Remove the RH turbo manifold module.
   (Refer to Intake and Exhaust System - "Turbo Manifold Module")

7. Remove the LH cylinder head cover.
   (Refer to Cylinder Head Assembly - "Cylinder Head Cover")

8. Remove the timing chain cover.
   (Refer to Timing System - "Timing Chain Cover")

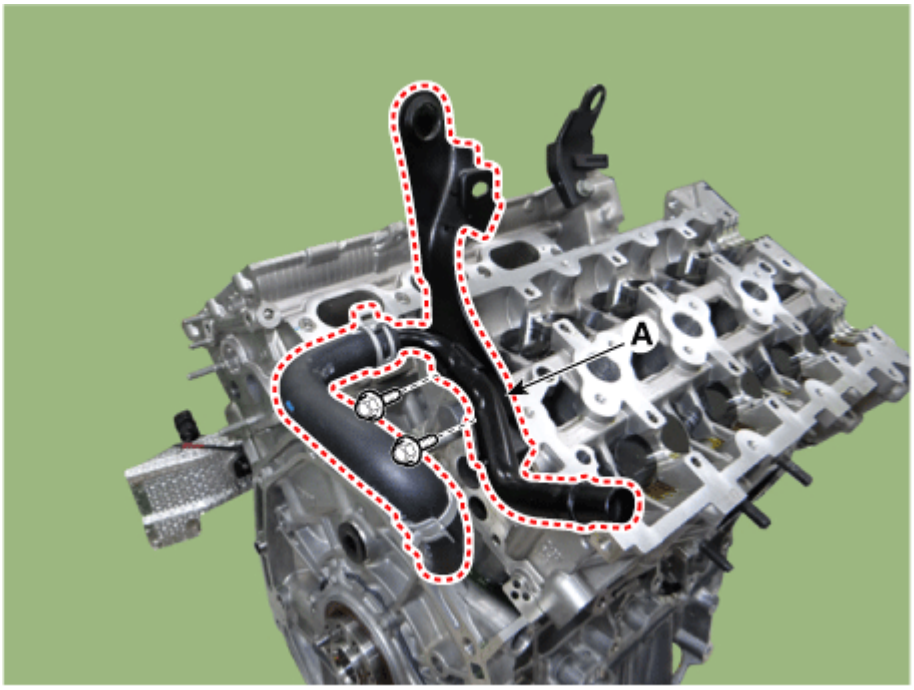
9. Remove the oil level gauge & pipe.
   (Refer to Lubrication System - "Oil Level Gauge &e")

10. Remove the timing chain.
    (Refer to Timing System - "Timing Chain")

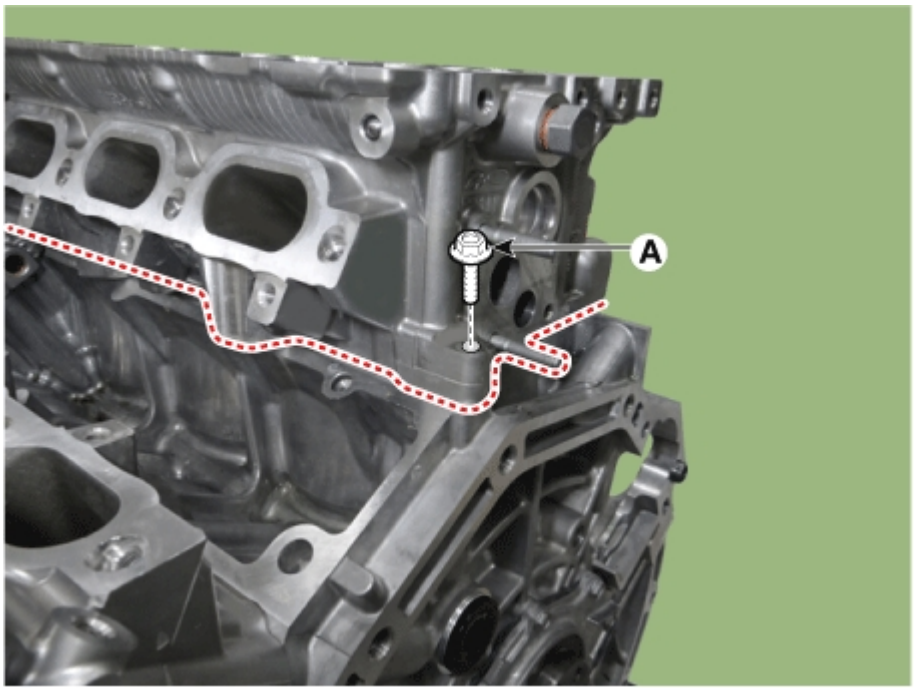
11. Remove the alternator.
    (Refer to Engine Electrical System - "Alternator")

12. Remove the RH CVVT & camshaft assembly.
    (Refer to Cylinder Head Assembly - "CVVT &shaft")

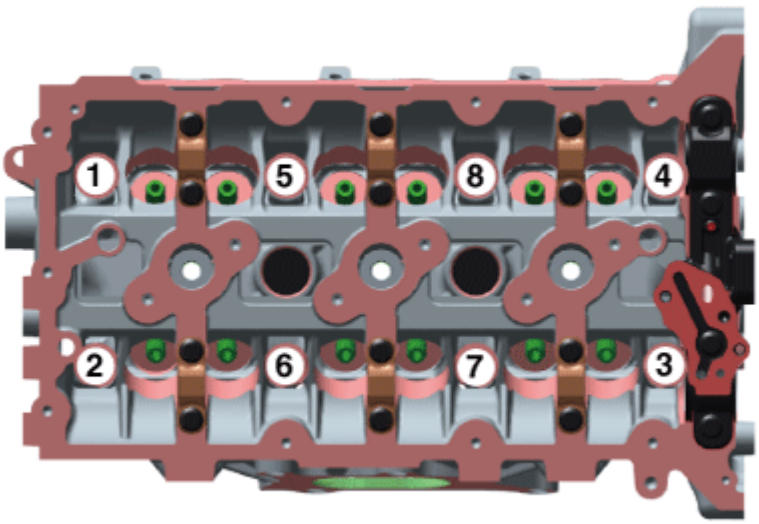
13. Remove the center engine hanger (A).
    Tightening torque :
    44.1 - 53.9 N·m (4.5 - 5.5 kgf·m, 32.5 - 39.8 lb·ft)



14. Remove the LH cylinder head.
    (1) Remove the RH cylinder head rear bolt (A).



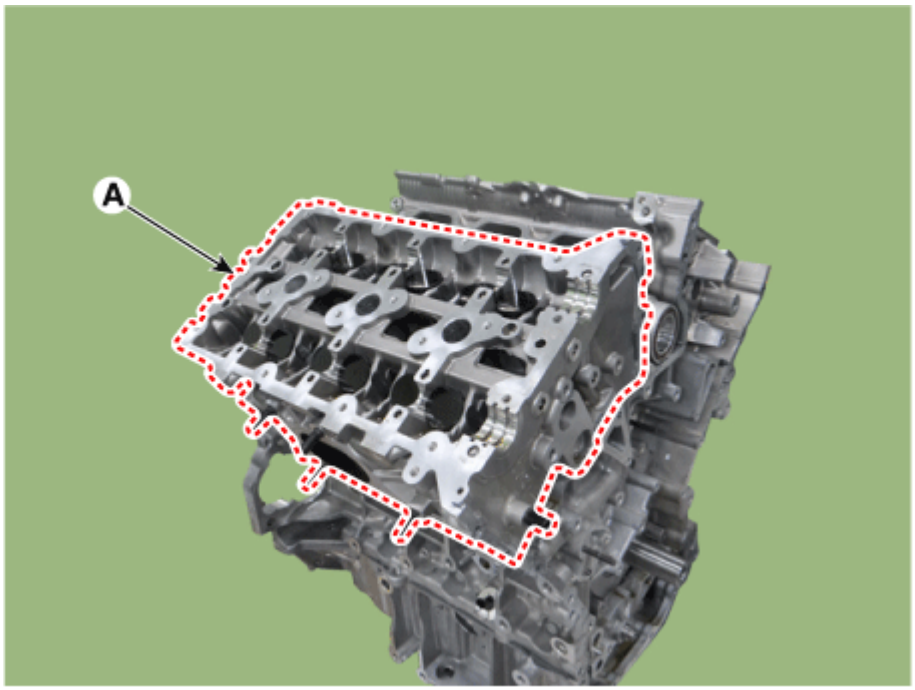
(2) Uniformly loosen and remove the cylinder head bolts, in several passes, in the sequence shown.



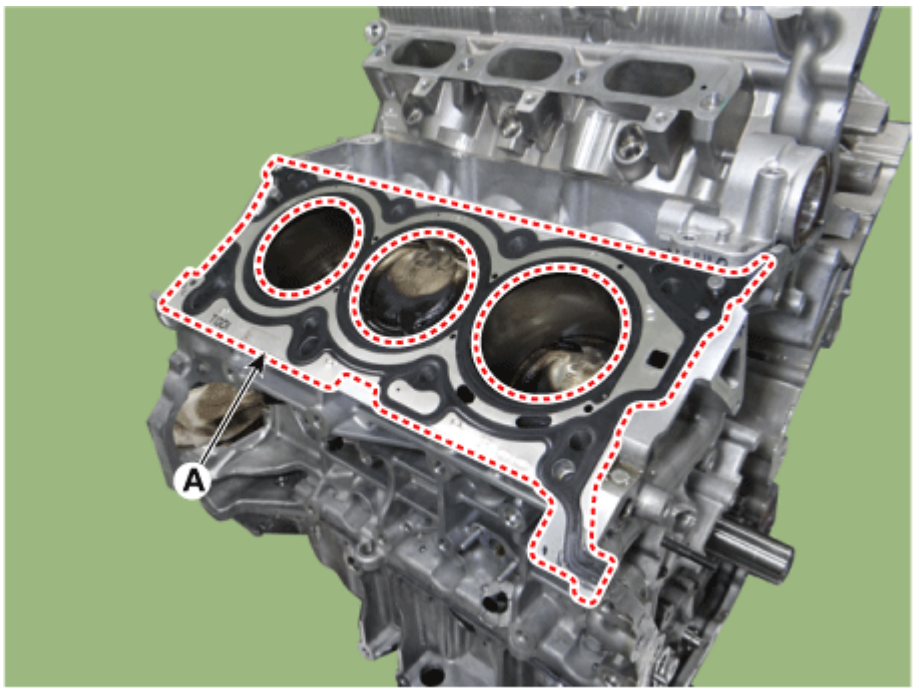
NOTICE

Removing bolts in an incorrect order may result in head warpage or crack.

(3) Lift the LH cylinder head (A) from the dowels on the cylinder block and place the cylinder head on wooden blocks on a bench.



(4) Remove the LH cylinder head gasket (A).

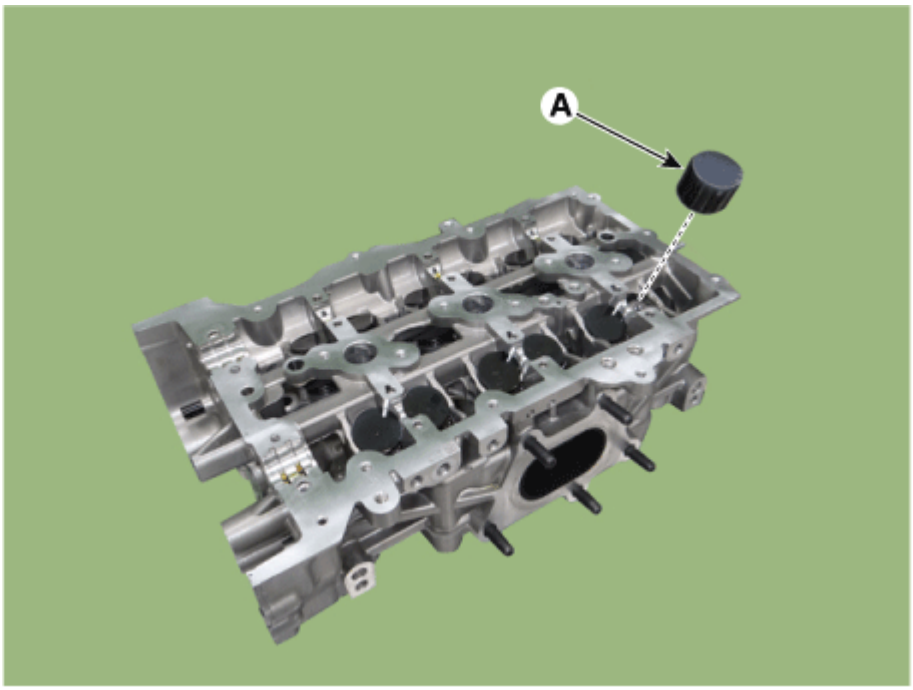


DISASSEMBLY

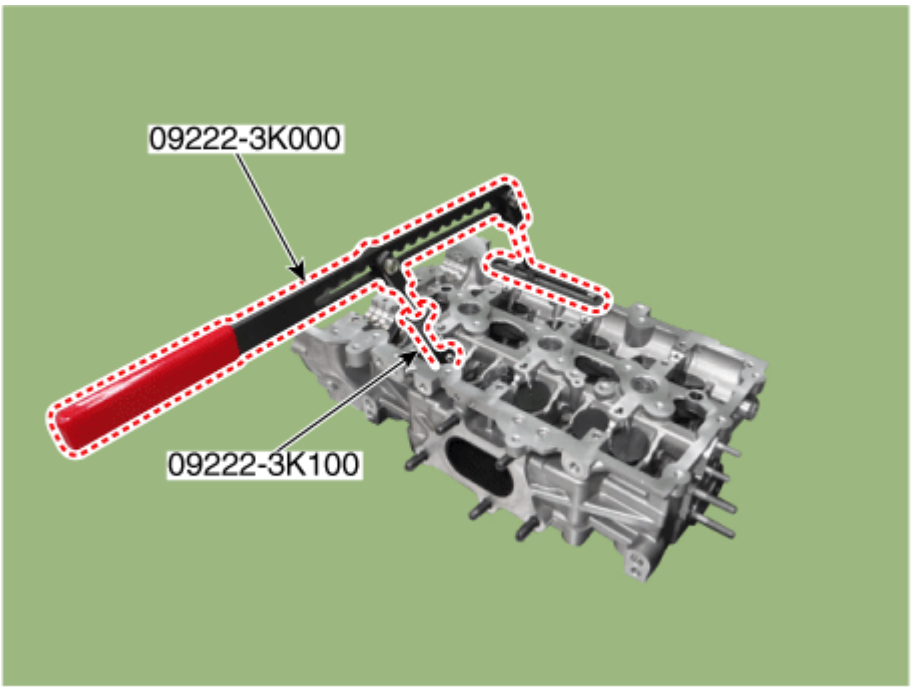
NOTICE

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

1. Remove the MLAs (A).



2. Remove the valves.
   (1) Using the SSTs (09222-3K000, 09222-3K100), 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 valve stem seal.

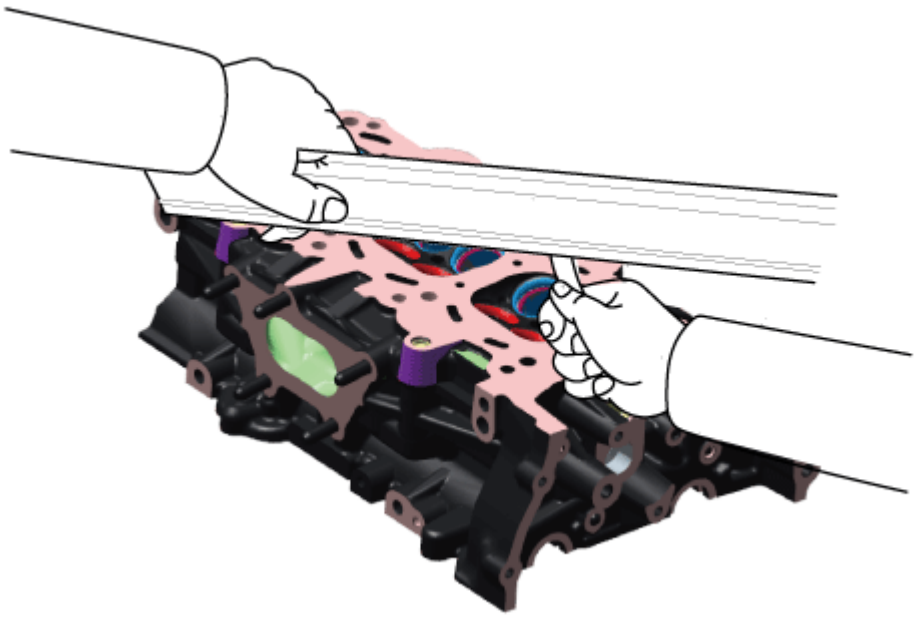
> **NOTICE**
>
> Do not reuse old valve stem seals.

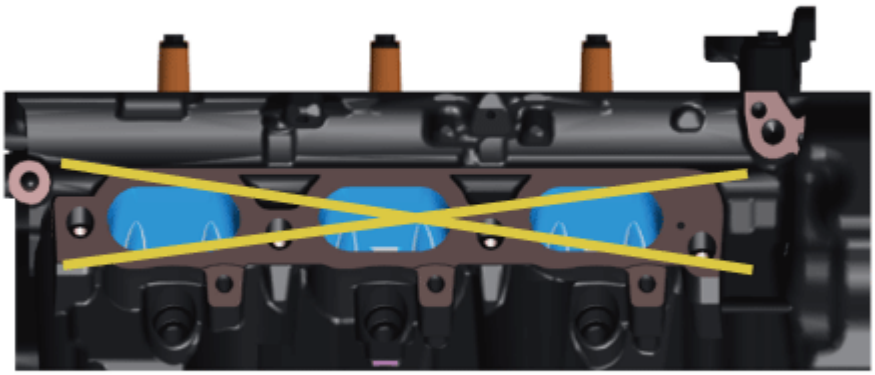
INSPECTION

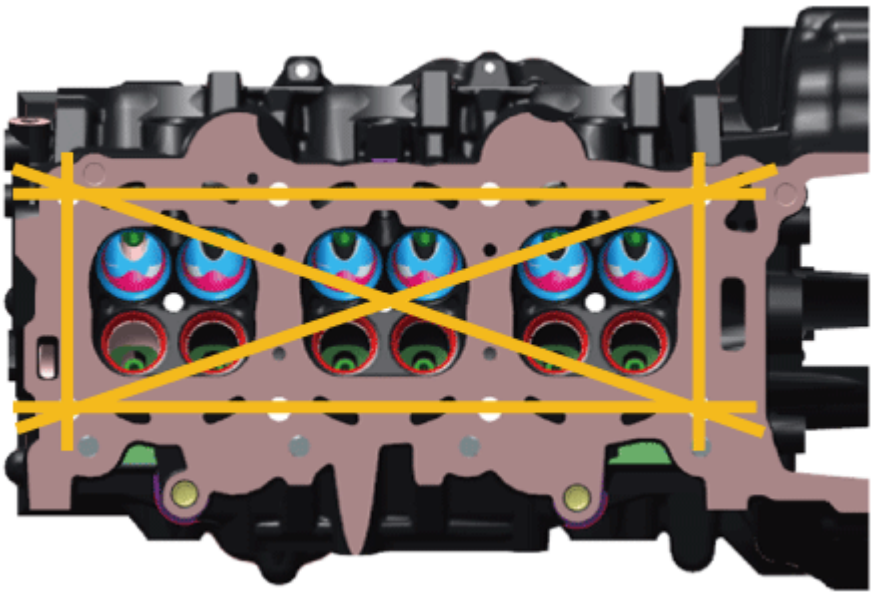
Cylinder Head

1. Inspect for flatness.
   Using a precision straight edge and feeler gauge, measure the warpage of the surface contacting with the cylinder block.
   If the flatness is greater than maximum, replace the cylinder head.

   Flatness of cylinder head gasket surface
   Standard : Less than 0.05 mm (0.002 in.)
   [Less than 0.02 mm(0.0008 in.) / 150x150]
   Flatness of manifold gasket surface
   Standard : Less than 0.01 mm (0.004 in) / 110x110



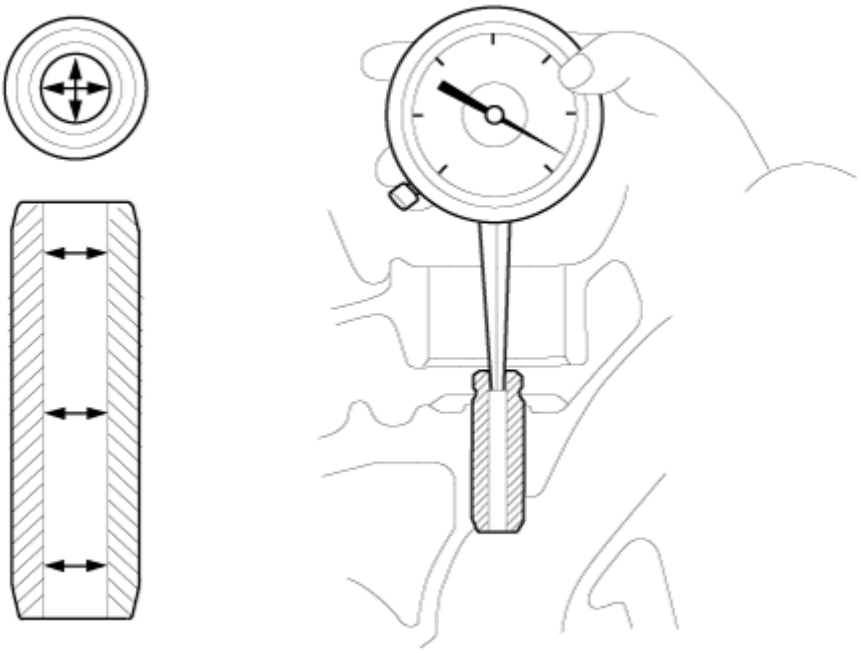




2. Inspect for cracks.
   Check the combustion chamber, intake ports, exhaust ports and cylinder block surface for cracks. If cracked, replace the cylinder head.

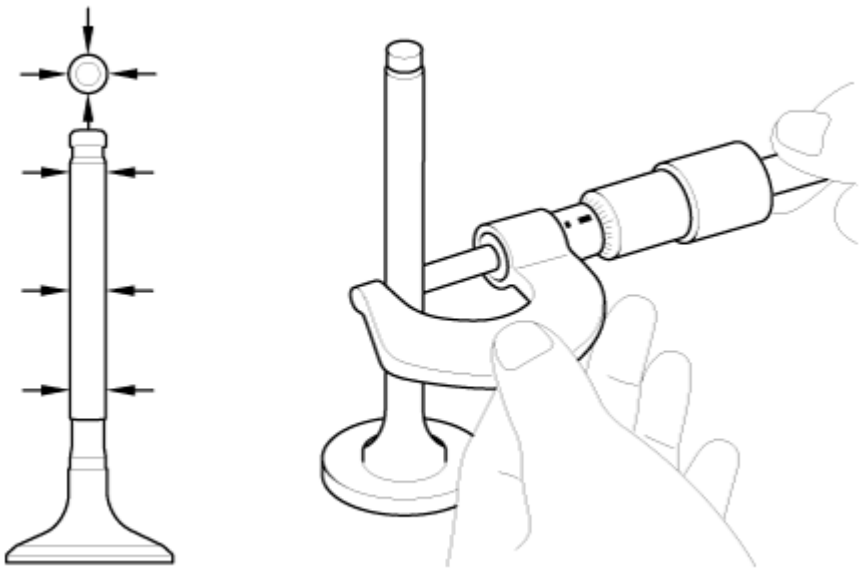
Valve And Valve Spring

1. Inspect valve stems and valve guides.
   (1) Using a caliper gauge, measure the inside diameter of the valve guide.
   Valve guide I.D.
   Intake / Exhaust : 5.500 - 5.512 mm (0.216 - 0.217 in.)



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

Valve stem O.D.
Intake : 5.465 - 5.480 mm (0.2152 - 0.2157 in.)
Exhaust : 5.458 - 5.470 mm (0.2149 - 0.2154 in.)



(3) Subtract the valve stem diameter measurement from the valve guide inside diameter measurement.

Valve stem-to-guide clearance
[Standard]
Intake : 0.020 - 0.047 mm (0.0008 - 0.0019 in.)
Exhaust : 0.030 - 0.054 mm (0.0012 - 0.0021 in.)

2. Inspect valves.

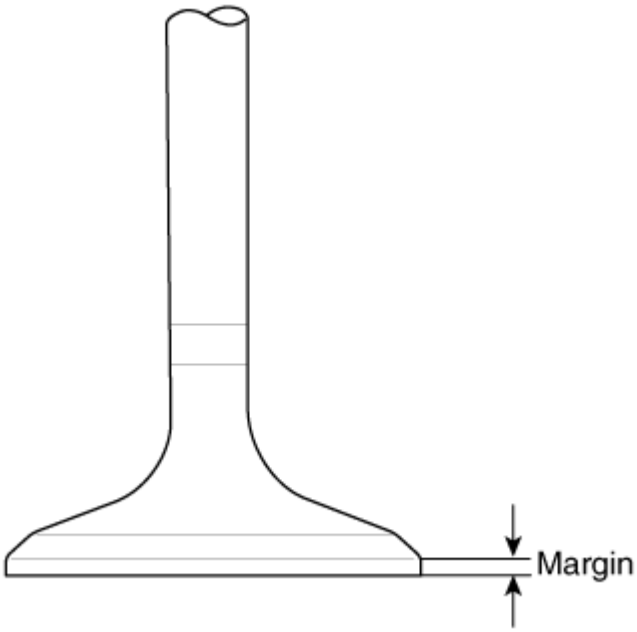
(1) Check that the valve is ground to the correct valve face angle.

(2) Check 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 below specification, replace the valve.

Margin

[Standard]
Intake : 1.0 mm (0.0402 in.)
Exhaust : 1.1 mm (0.0431 in.)



(4) Check the valve length.

Length
Intake : 105.27 mm (4.1445 in.)
Exhaust : 105.30 mm (4.1457 in.)

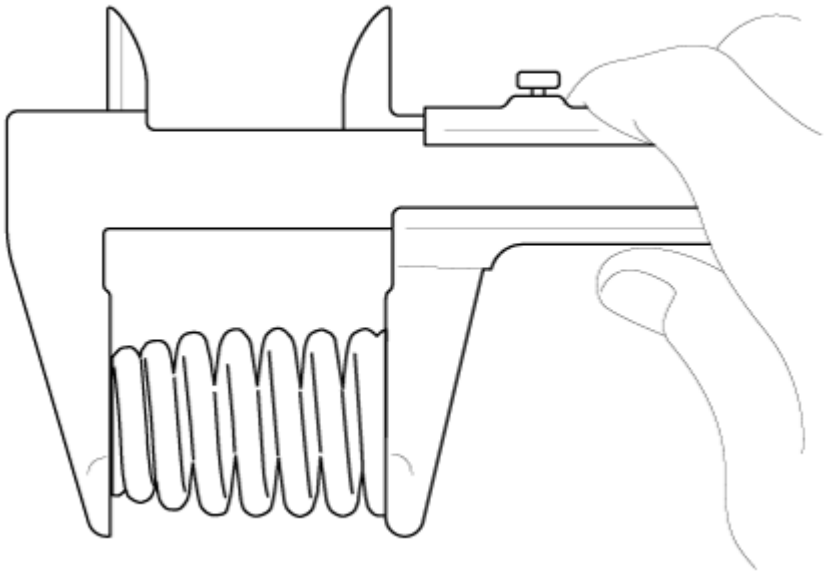
(5) Check the surface of the valve stem tip for wear.
If the valve stem tip is worn, replace the valve.

3. Inspect valve seats
Check the valve seat for evidence of overheating and improper contact with the valve face.
If the valve seat is worn, replace cylinder head.
Before reconditioning the seat, check the valve guide for wear. If the valve guide is worn, replace cylinder head.
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.

4. Inspect valve springs.
(1) Using a steel square, measure the out-of-square of the valve spring.

(2) Using vernier calipers, measure the free length of the valve spring.

Valve spring
Free height
Intake :
46.20 mm (1.8189 in.)
Exhaust :
54.91 mm (2.1618 in.)
Out-of-square : 1.5°



MLA

1. Inspect MLAs.
   Using a micrometer, measure the MLA outer diameter.
   MLA O.D.
   Intake/Exhaust :
   34.964 - 34.980 mm (1.3765 - 1.3772 in.)

2. Using a caliper gauge, measure MLA tappet bore inner diameter of cylinder head.
   Tappet bore I.D.
   Intake/Exhaust :
   35.000 - 35.025 mm (1.3779 - 1.3789 in.)

3. Subtract MLA outer diameter measurement from tappet bore inner diameter measurement.
   MLA to tappet bore clearance
   [Standard]
   Intake/Exhaust : 0.020 - 0.061 mm (0.0008 - 0.0024 in.)
   [Limit]
   Intake/Exhaust : 0.07 mm (0.0027 in.)

REASSEMBLY

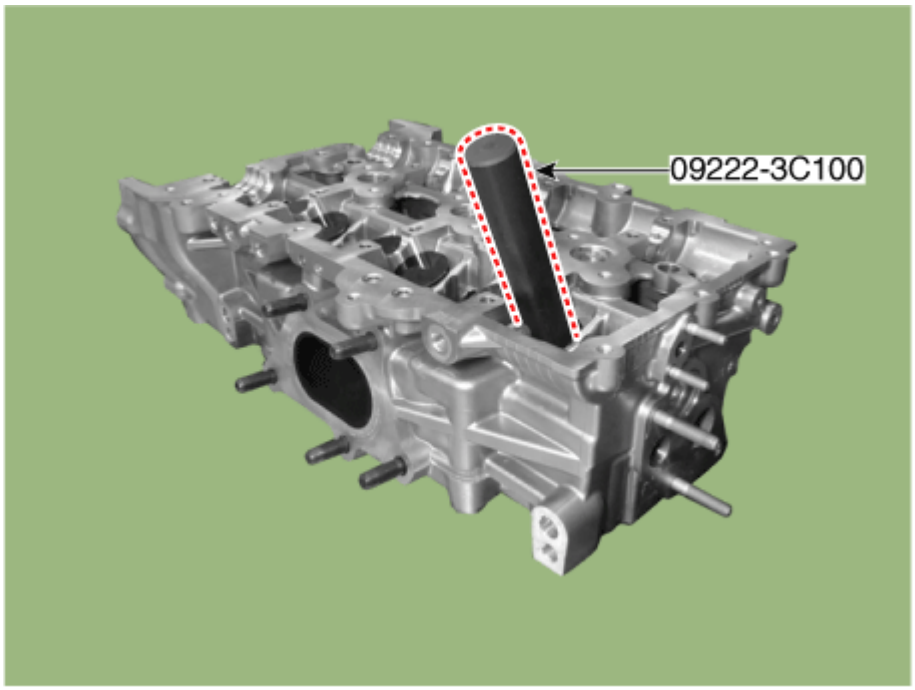
NOTICE

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 the valves.
   (1) Using the SST (09222-3C100), push in a new oil seal.

NOTICE

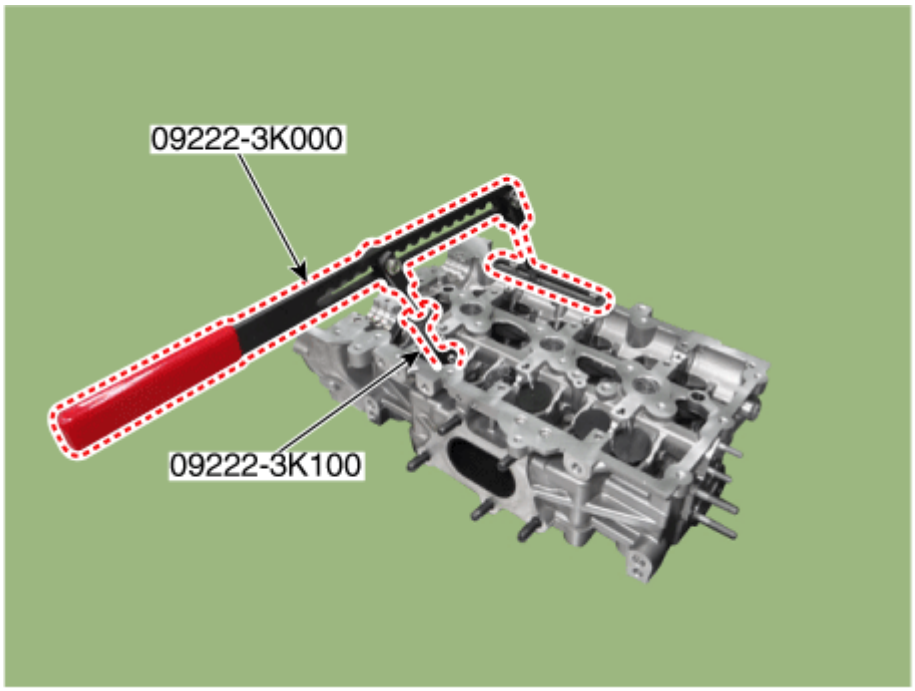
- Do not reuse old valve stem seals.
- Incorrect installation of the seal could result in oil leakage past the valve guides.



(2) Install the valve, valve spring and spring retainer.

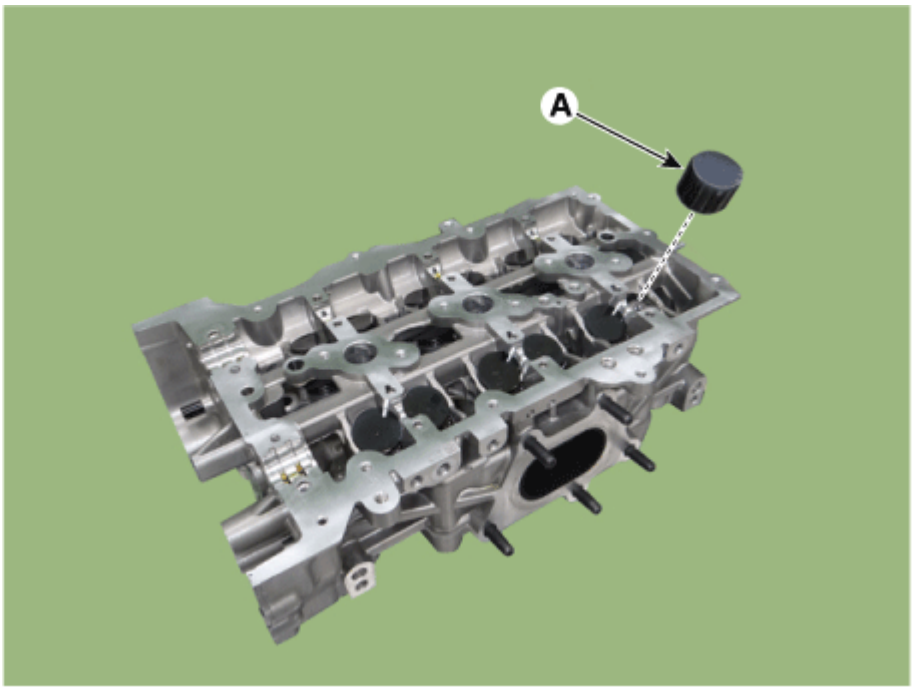
> **NOTICE**
>
> Place valve springs so that the side coated with enamel faces toward the valve spring retainer and then install the retainer.

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



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

2. Install the MLAs.
   Check by hand that the MLA rotates smoothly.



NOTICE

MLA can be reinstalled in its original position.
However, the valve lash clearances must be rechecked and adjusted accordingly before the cylinder head is installed on to the cylinder block.
Refer to valve clearance inspection and adjustment in cylinder head assembly section for Valve Clearance checking and adjustment procedure.

INSTALLATION

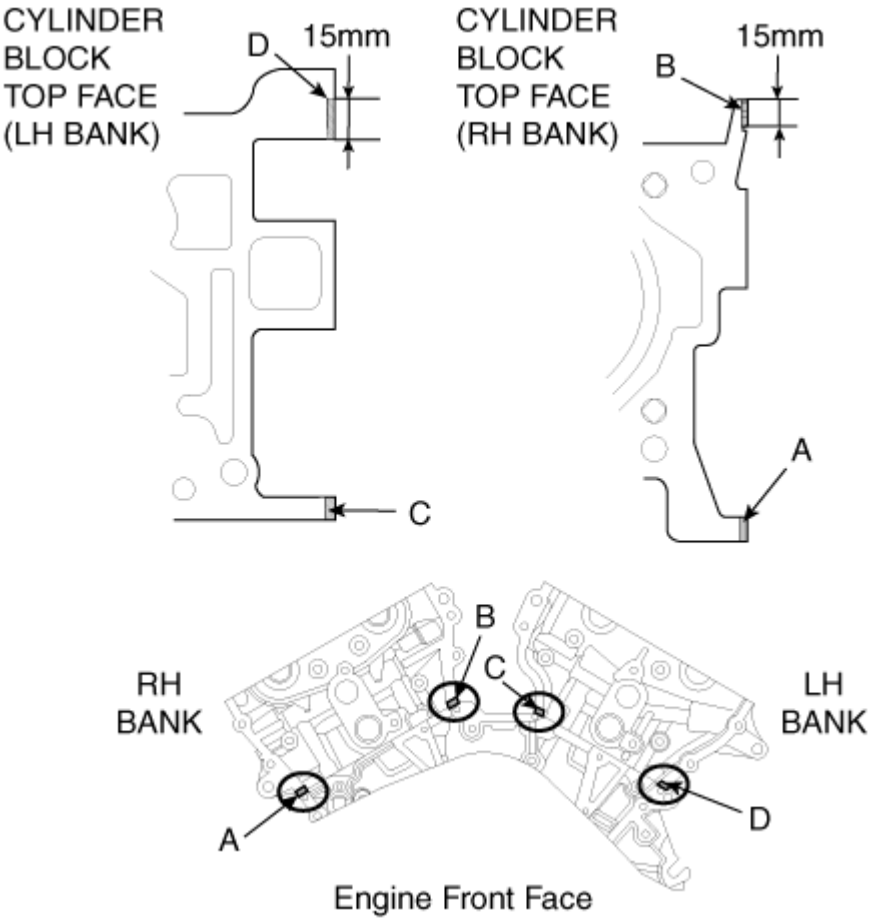
NOTICE

- Thoroughly clean all parts to be assembled.
- Always use a new head and manifold gasket.
- Always use new cylinder head bolts. Cylinder head bolts are torque-to-yield bolts designed to be permanently elongated beyond the state of elasticity when torqued, so if the bolts are removed and reused, it may cause the bolts to break or fail to maintain clamping force.
- The cylinder head gasket is a metal gasket. Be careful not to bend it.
- Rotate the crankshaft, and set the No.1 piston at TDC.

LH Cylinder Head

1. Install the LH cylinder head gasket.
   (1) The sealant locations on cylinder head gasket, cylinder block and timing chain cover must be free of engine oil and etc.

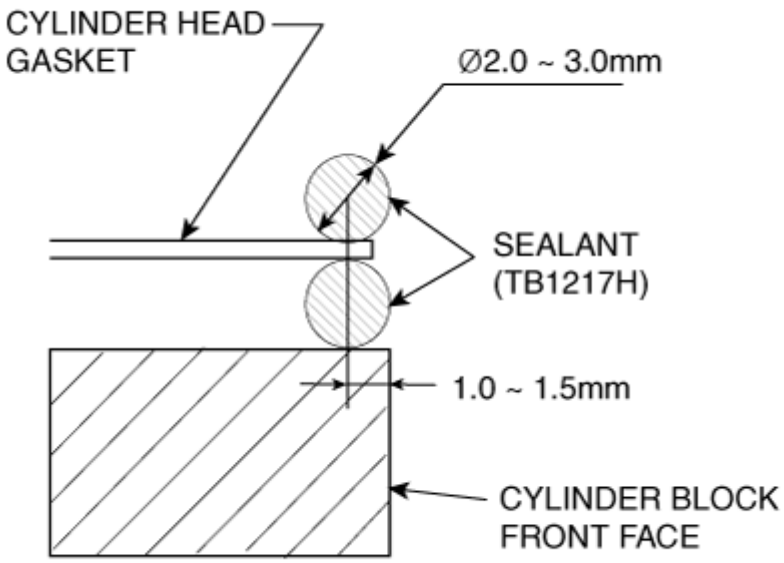
   (2) Apply sealant TB1217 or LT5900 on the cylinder block top surface (Refer to below illustration) before assembling the cylinder head gasket..
   Assemble the part within 5 minutes of applying sealant.



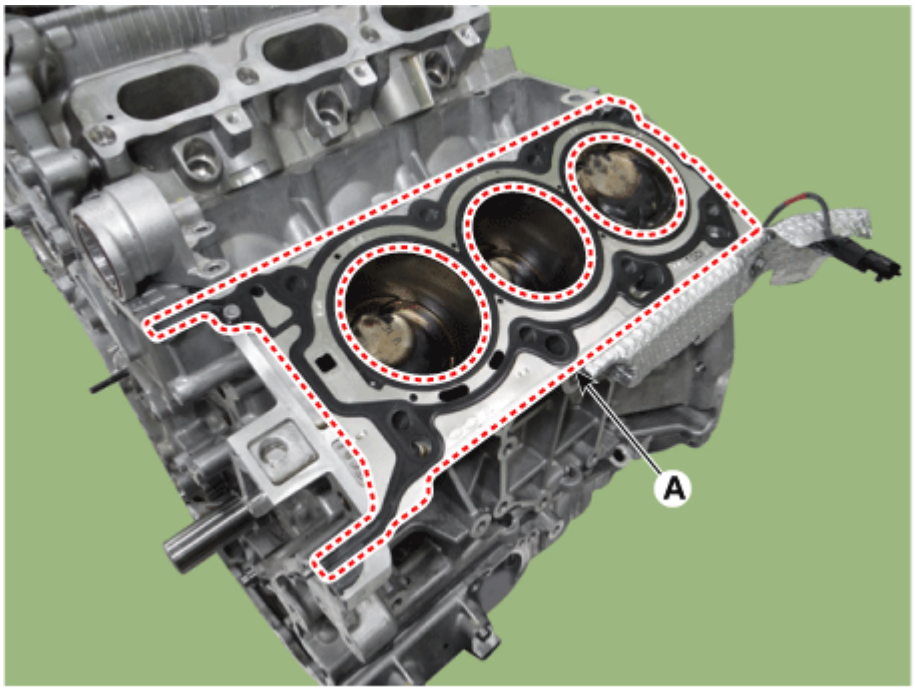
NOTICE

Apply sealant by referring to the following illustration.

Bead width :
2.0 - 3.0 mm (0.078 - 0.118 in.)
Sealant locations :
1.0 - 1.5 mm (0.039 - 0.059 in.) from block surface
Recommended sealant :
TB 1217H Liquid sealant

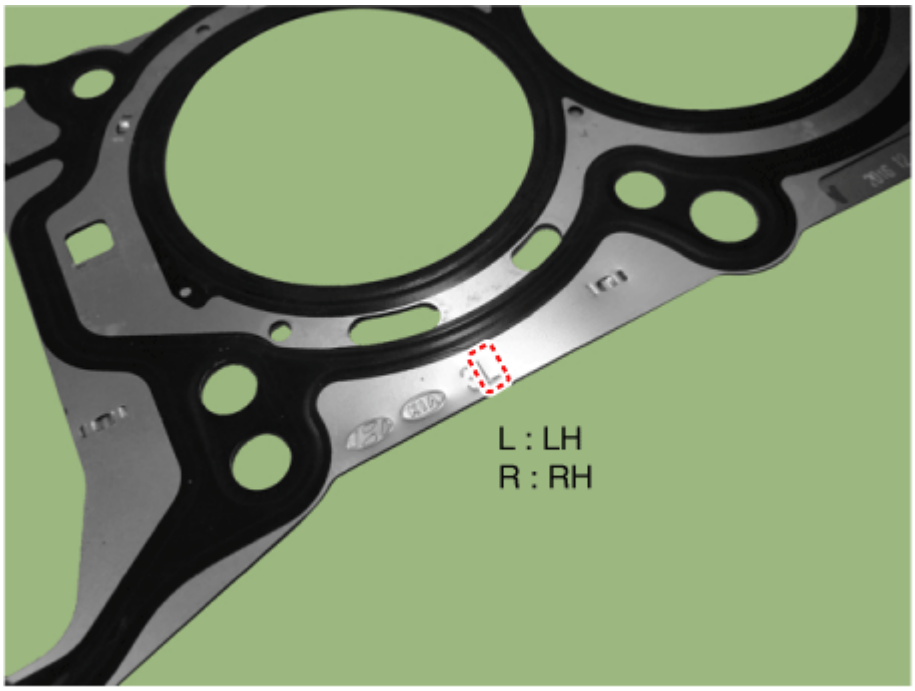


(3) Install the LH cylinder head gasket (A) on the cylinder block.

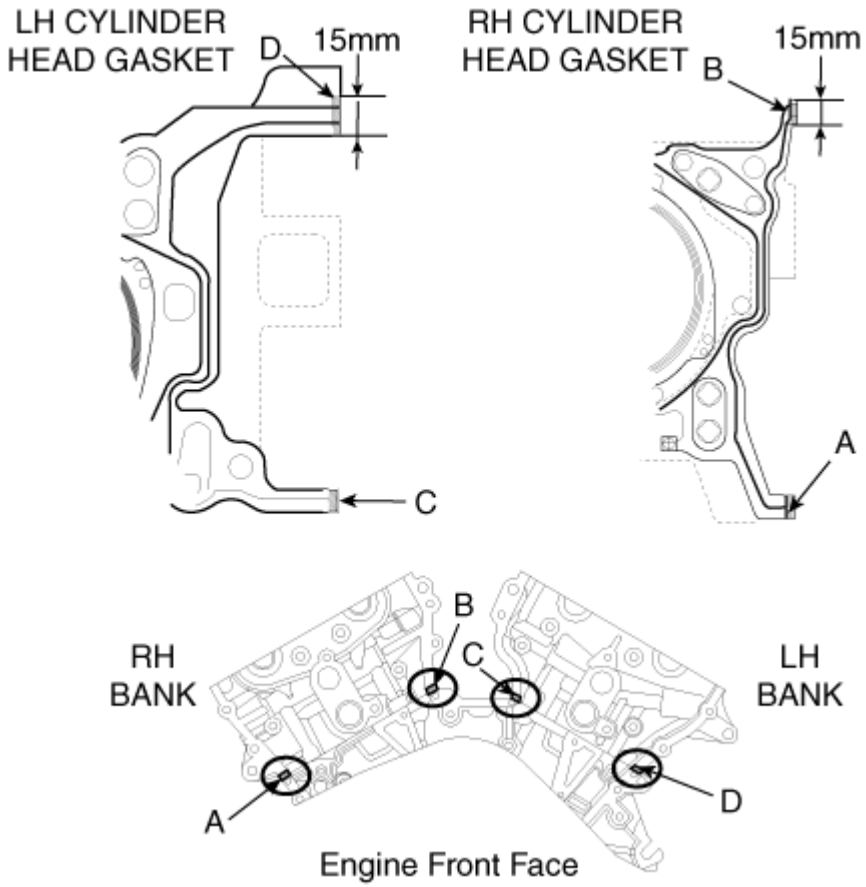


NOTICE

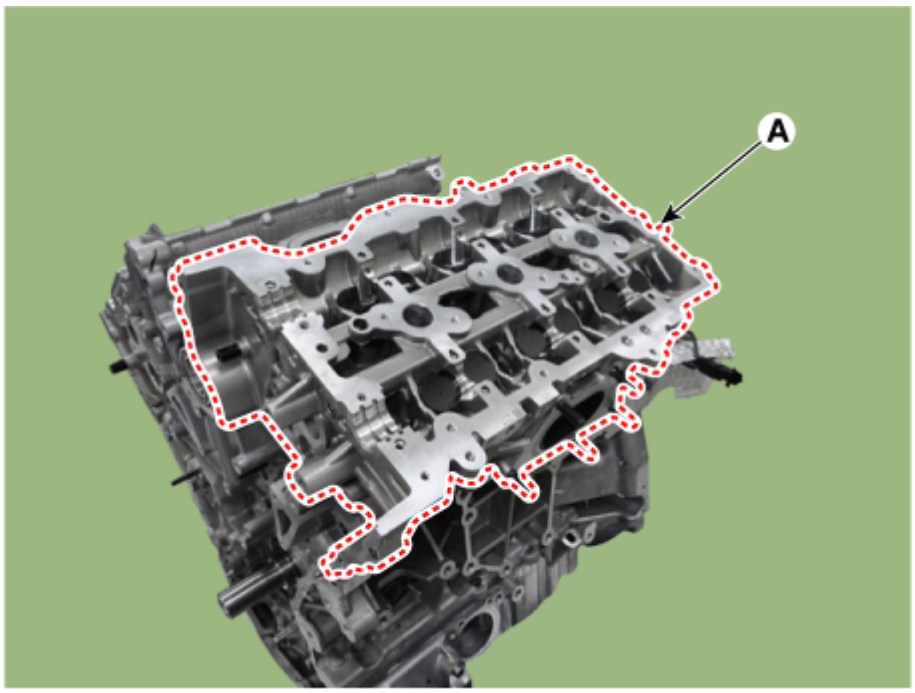
- Always use new cylinder head gasket.
- When install the cylinder head gasket, check the RH and LH mark on the cylinder head gasket.



(4) Apply sealant TB1217 or LT5900 on the cylinder head gasket top surface (Refer to below illustration) after assembling the cylinder head gasket.
Assemble the part within 5 minutes of applying sealant.

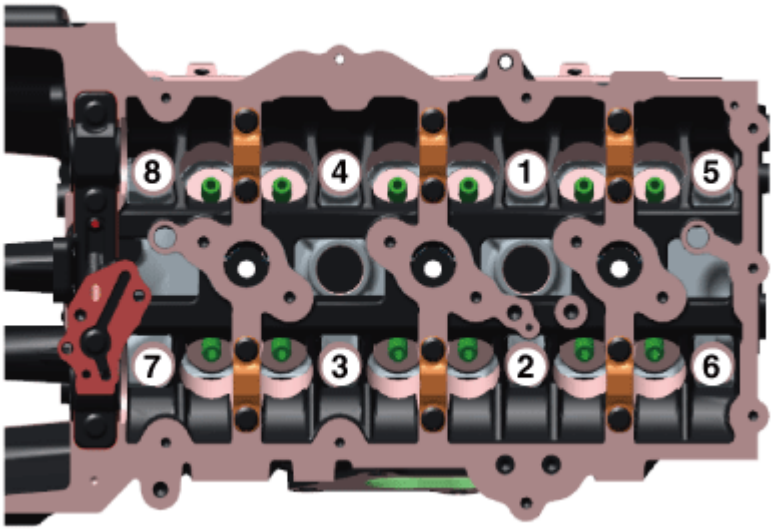


2. Install the LH cylinder head.
   (1) Place the LH cylinder head assembly (A) quietly in order not to damage the gasket with the bottom part of the end.



   (2) Tighten the LH cylinder head bolts and plate washers, in several passes, in the sequence shown.

   Tightening torque :
   37.3 - 41.2 N·m (3.8 - 4.2 kgf·m, 27.5 - 30.4 lb·ft) + (118 - 122°) + (88 - 92°)



NOTICE

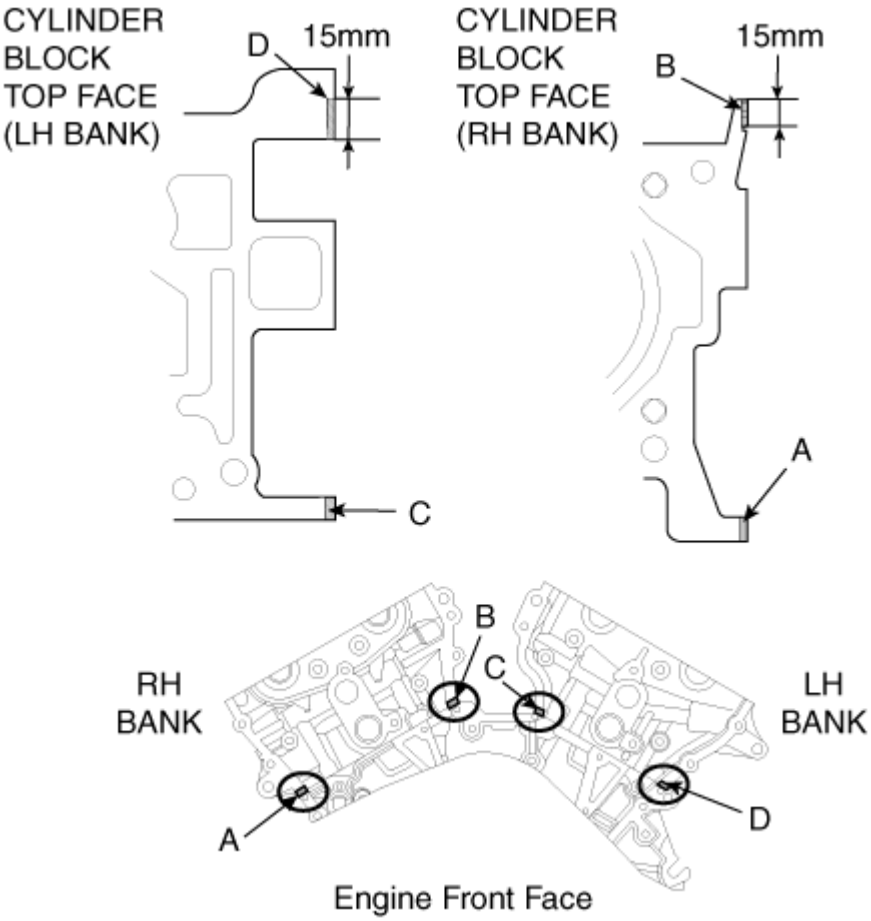
Always use new cylinder head bolts. Cylinder head bolts are torque-to-yield bolts designed to be permanently elongated beyond the state of elasticity when torqued, so if the bolts are removed and reused, it may cause the bolts to break or fail to maintain clamping force.

3. Install the other parts in the reverse order of removal.

RH Cylinder Head

1. Install the RH cylinder head gasket.
   (1) The sealant locations on cylinder head gasket, cylinder block and timing chain cover must be free of engine oil and etc.

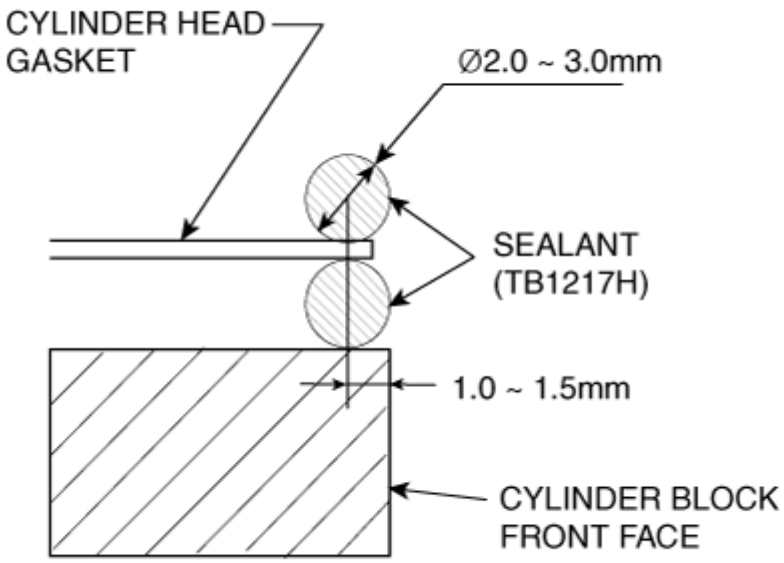
   (2) Apply sealant TB1217 or LT5900 on the cylinder block top surface (Refer to below illustration) before assembling the cylinder head gasket.
   Assemble the part within 5 minutes of applying sealant.



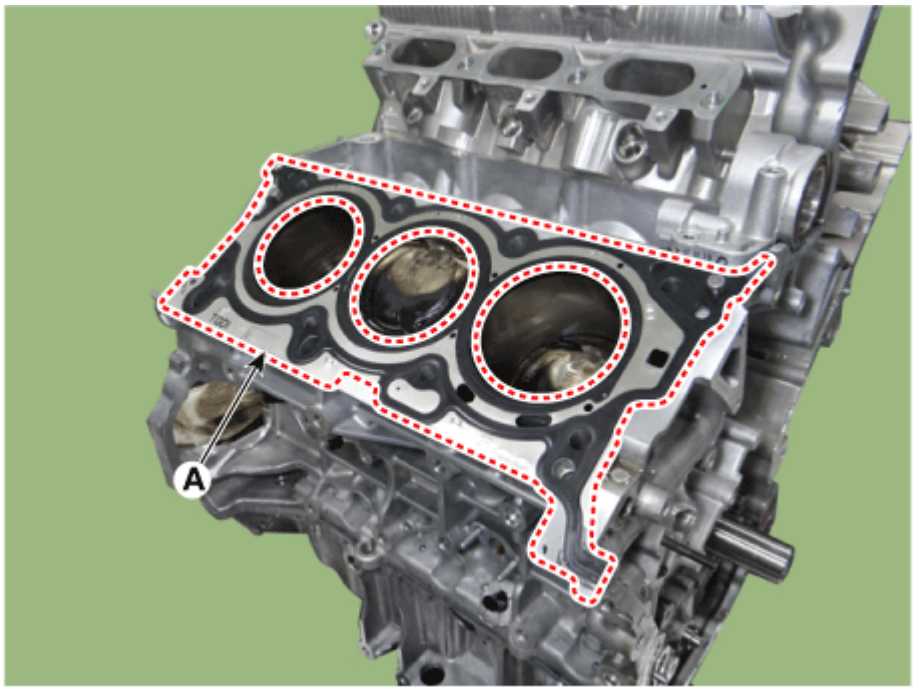
NOTICE

Apply sealant by referring to the following illustration.

Bead width :
2.0 - 3.0 mm (0.078 - 0.118 in.)
Sealant locations :
1.0 - 1.5 mm (0.039 - 0.059 in.) from block surface
Recommended sealant :
TB 1217H Liquid sealant

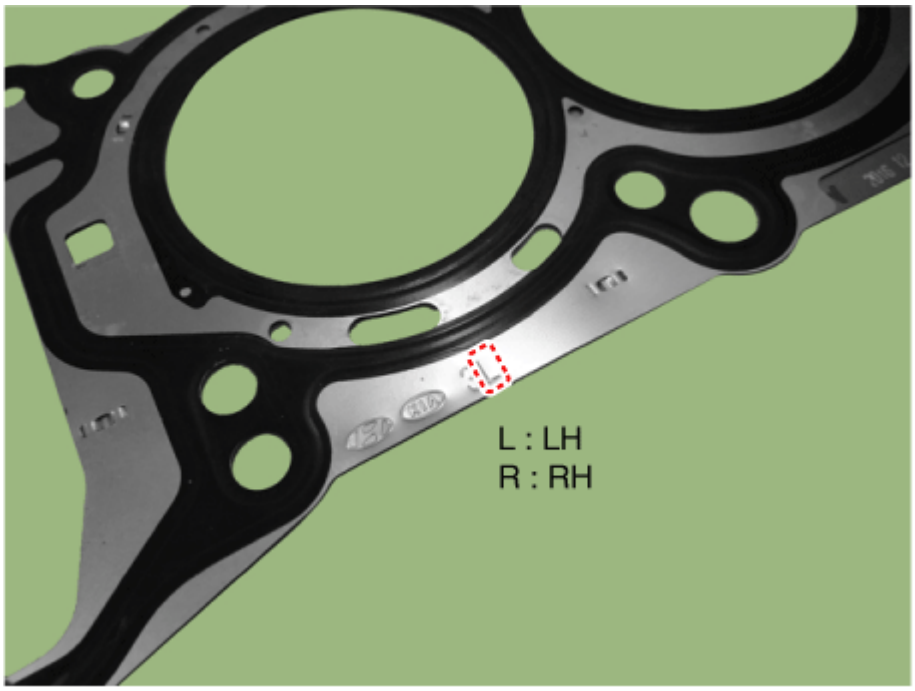


(3) Install the RH cylinder head gasket (A) on the cylinder block.

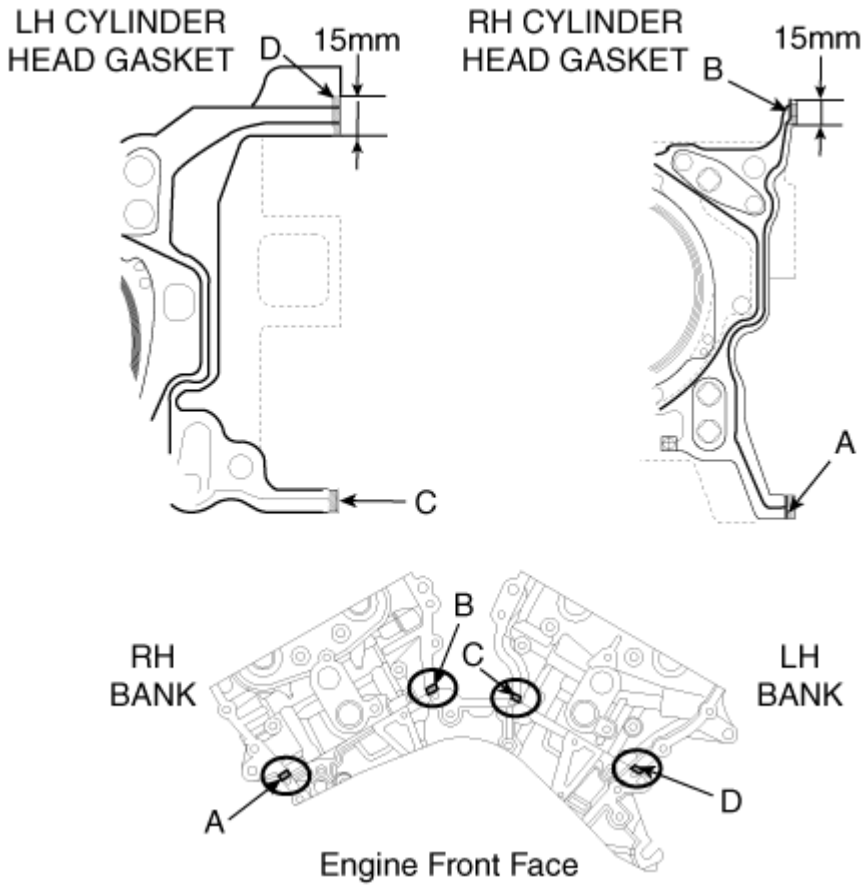


NOTICE

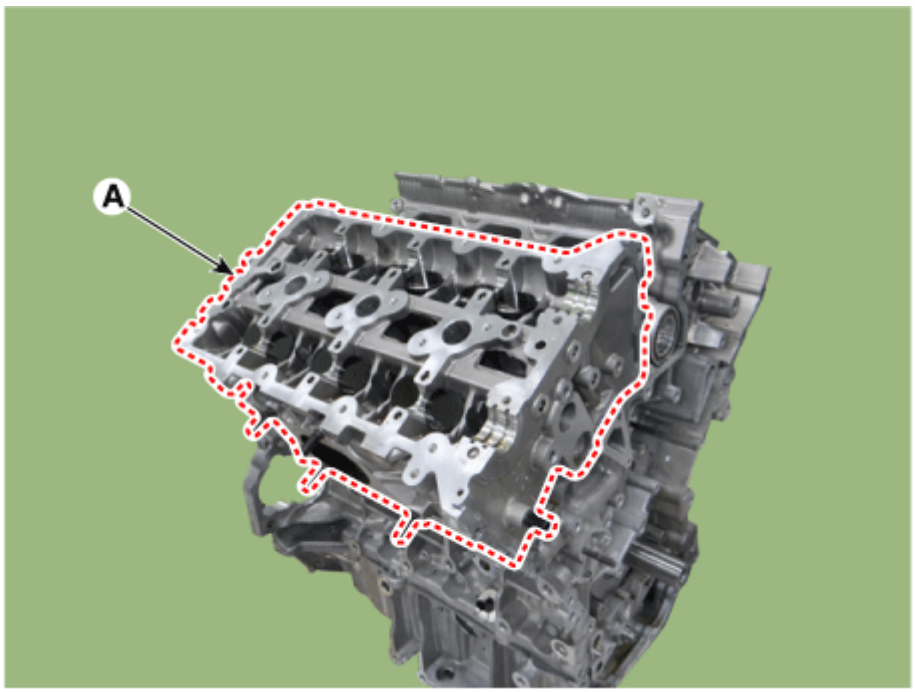
- Always use new cylinder head gasket.
- When install the cylinder head gasket, check the RH and LH mark on the cylinder head gasket.



(4) Apply sealant TB1217 or LT5900 on the cylinder head gasket top surface (Refer to below illustration) after assembling the cylinder head gasket.
Assemble the part within 5 minutes of applying sealant.

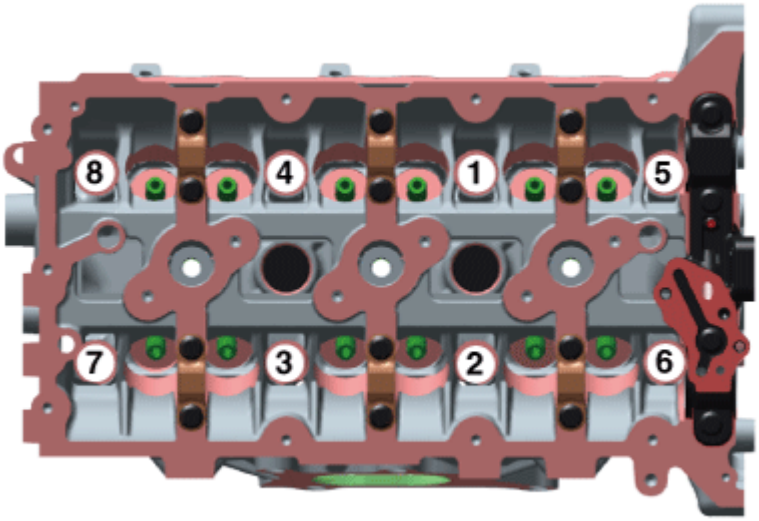


2. Install the RH cylinder head.
   (1) Place the RH cylinder head assembly (A) quietly in order not to damage the gasket with the bottom part of the end.



   (2) Tighten the RH cylinder head bolts and plate washers, in several passes, in the sequence shown.

   Tightening torque :
   37.3 - 41.2 N·m (3.8 - 4.2 kgf·m, 27.5 - 30.4 lb·ft) + (118 - 122°) + (88 - 92°)

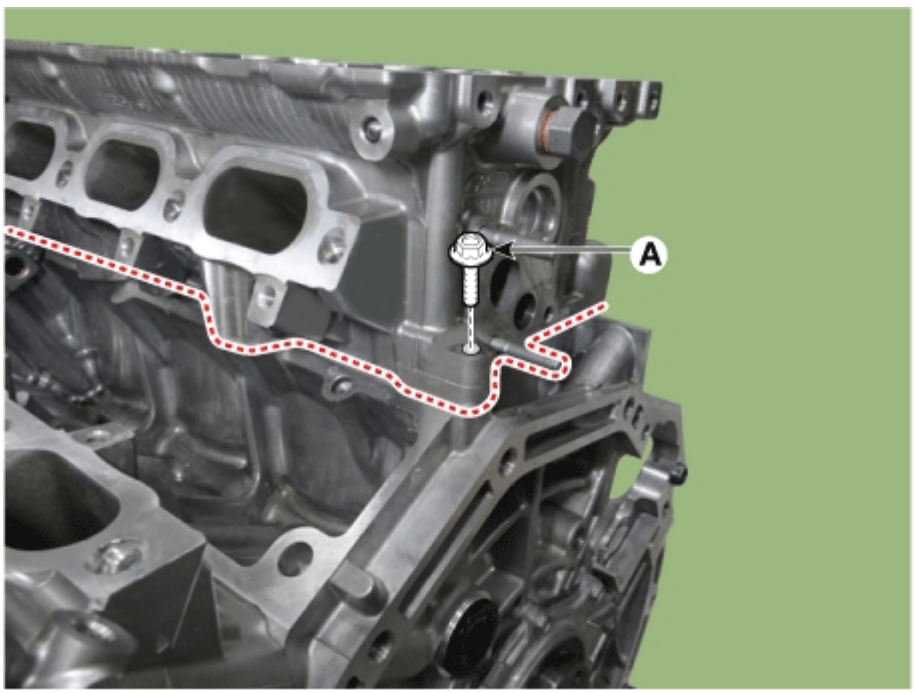


NOTICE

Always use new cylinder head bolts. Cylinder head bolts are torque-to-yield bolts designed to be permanently elongated beyond the state of elasticity when torqued, so if the bolts are removed and reused, it may cause the bolts to break or fail to maintain clamping force.

(3) Install the RH cylinder head rear bolt (A).

Tightening torque :
18.6 - 23.5 N·m (1.9 - 2.4 kgf·m, 13.7 - 17.4 lb·ft)



3. Install the other parts in the reverse order of removal.