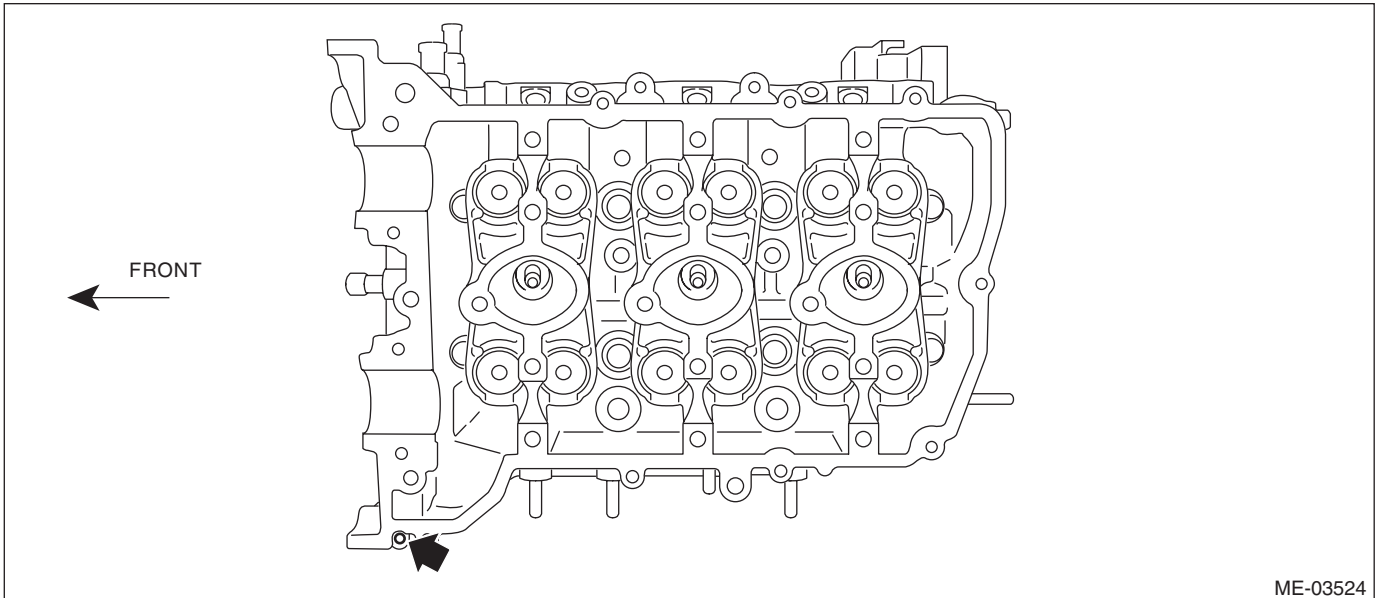


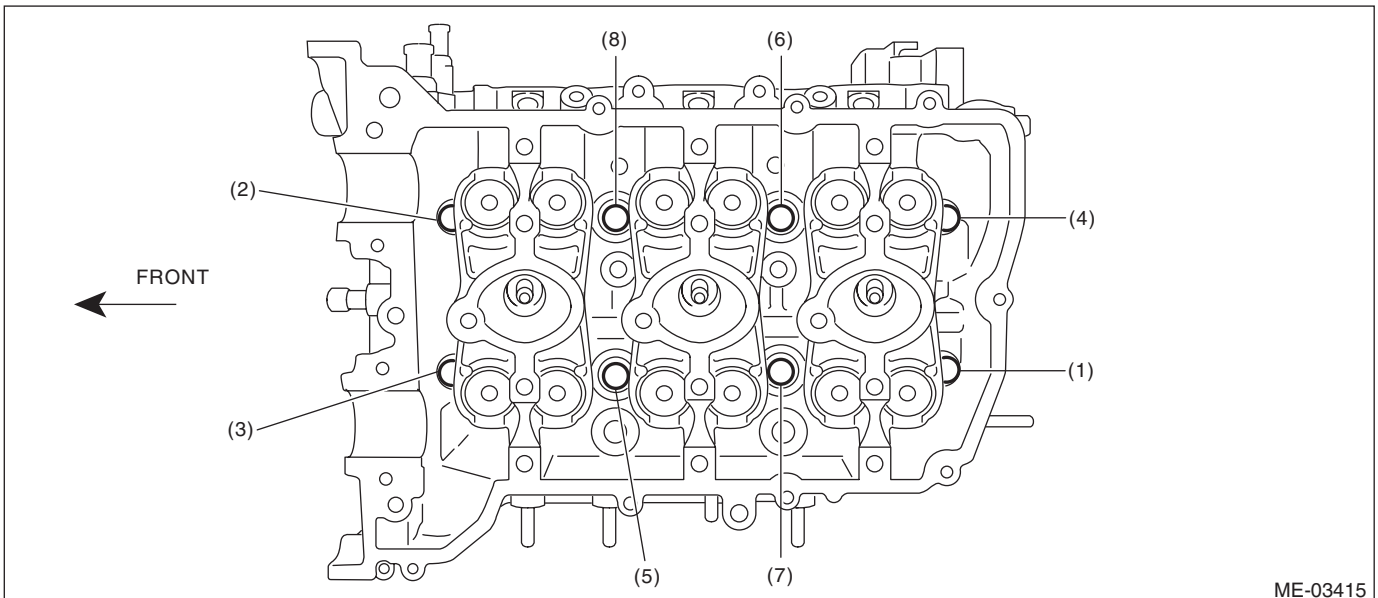
19. Cylinder Head

A: REMOVAL

- 1) Remove the engine from vehicle. <Ref. to ME(H6DO)-36, REMOVAL, Engine Assembly.>
- 2) Remove the crank pulley. <Ref. to ME(H6DO)-47, REMOVAL, Crank Pulley.>
- 3) Remove the chain cover. <Ref. to ME(H6DO)-48, REMOVAL, Chain Cover.>
- 4) Remove the timing chain assembly. <Ref. to ME(H6DO)-54, REMOVAL, Timing Chain Assembly.>
- 5) Remove the cam sprocket. <Ref. to ME(H6DO)-73, REMOVAL, Cam Sprocket.>
- 6) Remove the crank sprocket. <Ref. to ME(H6DO)-74, REMOVAL, Crank Sprocket.>
- 7) Remove the camshaft. <Ref. to ME(H6DO)-75, REMOVAL, Camshaft.>
- 8) Remove the seal bolts as shown in the figure.



- 9) Remove the cylinder head bolts in the numerical order as shown in the figure. Leave bolts (2) and (4) engaged by three or four threads to prevent the cylinder head from falling.



- 10) While tapping the cylinder head with a plastic hammer, separate it from cylinder block.
- 11) Remove the bolts (2) and (4) to remove cylinder head.
- 12) Remove the cylinder head gasket.

CAUTION:

Be careful not to scratch the mating surfaces of the cylinder head and cylinder block.

- 13) Similarly, remove the cylinder head (RH).

B: INSTALLATION

1) Apply liquid gasket to the mating surface of cylinder block as shown in the figure.

CAUTION:

Do not apply liquid gasket excessively. If applying excessively, remove the excess liquid gasket that flowed out.

NOTE:

Install within 5 minutes after applying liquid gasket.

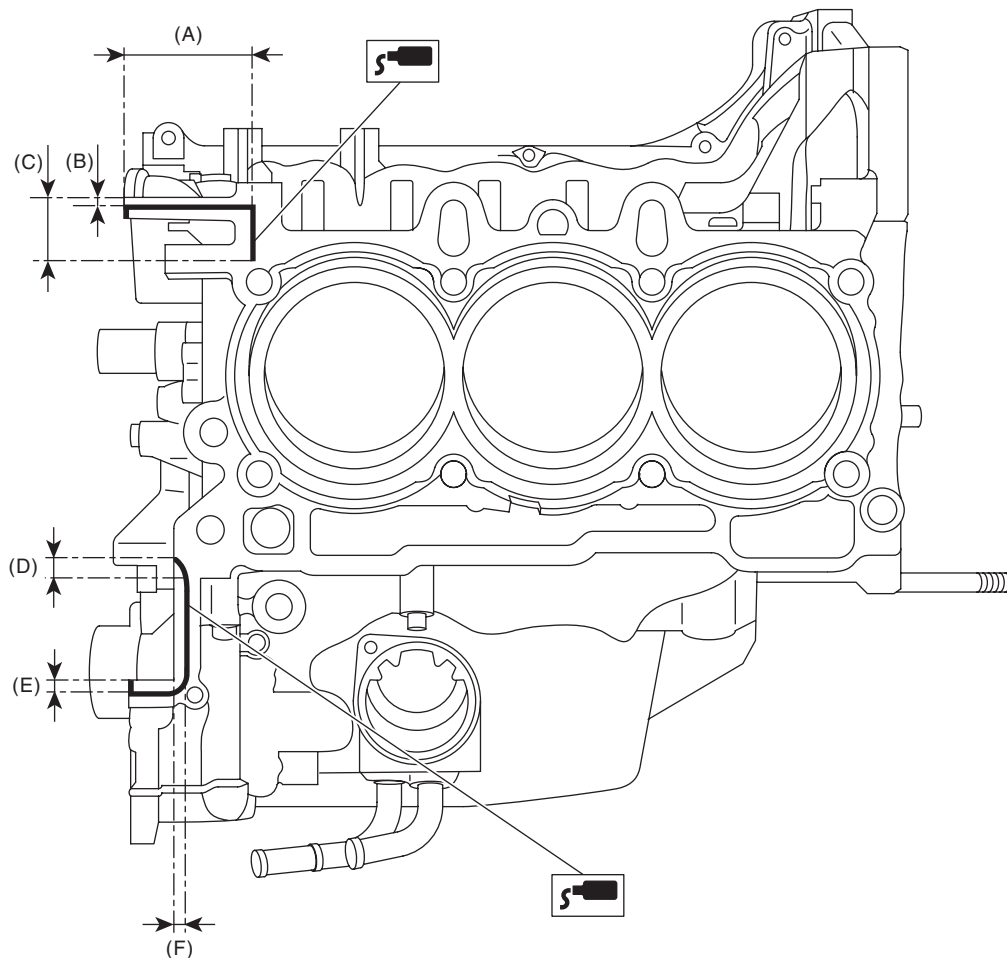
Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100) or equivalent

Applying liquid gasket diameter:

3.5 ± 1.0 mm (0.138 ± 0.039 in)

- LH side



ME-03416

(A) 59 mm (2.323 in)

(B) 2 mm (0.079 in)

(C) 20 mm (0.787 in)

(D) 7 mm (0.276 in)

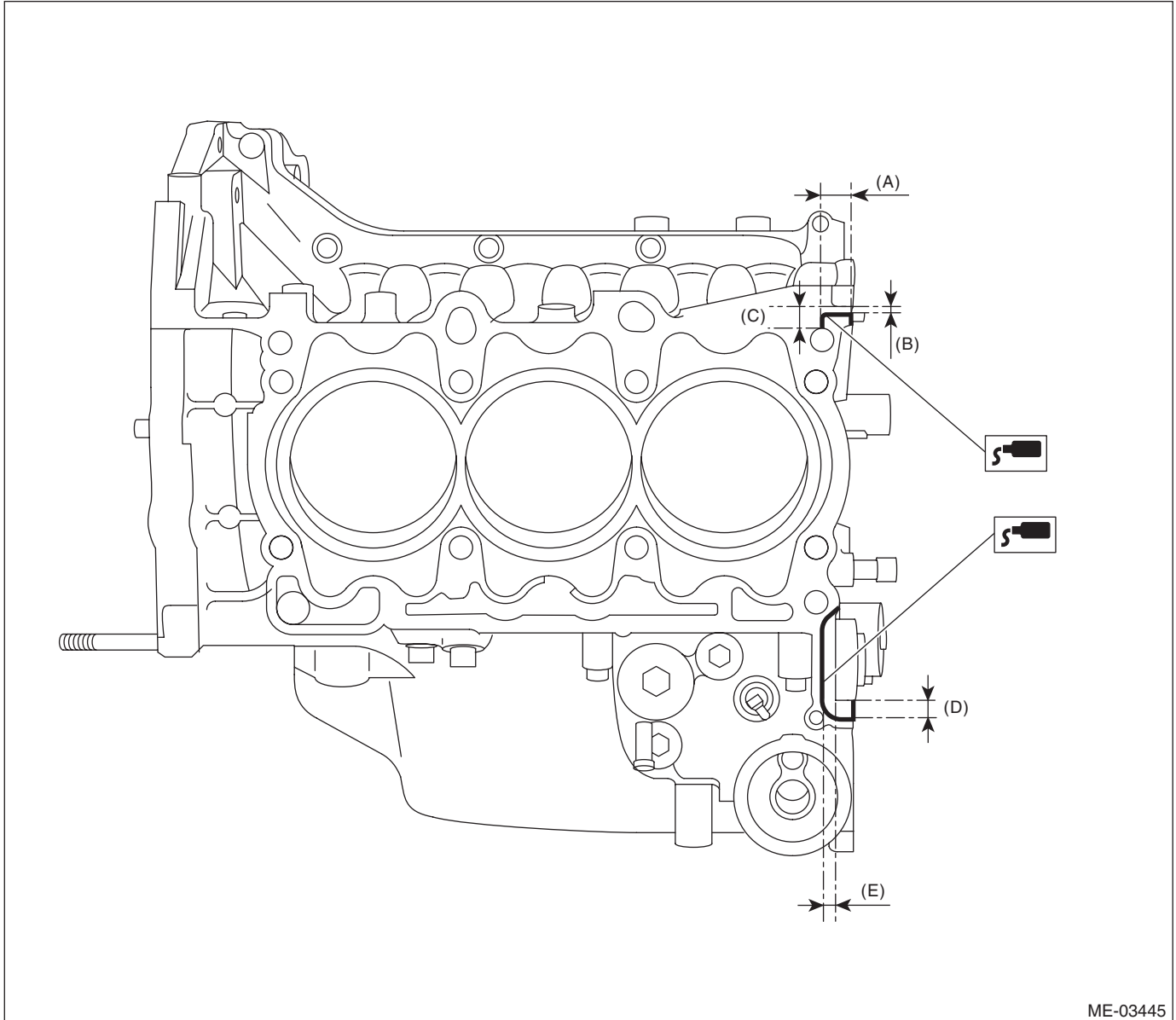
(E) 4 mm (0.157 in)

(F) 4 mm (0.157 in)

Cylinder Head

MECHANICAL

- RH side



ME-03445

(A) 17 mm (0.669 in)

(C) 9 mm (0.354 in)

(E) 4 mm (0.157 in)

(B) 2 mm (0.079 in)

(D) 4 mm (0.157 in)

2) Install the cylinder head gaskets (LH and RH) on cylinder blocks.

NOTE:

Use a new cylinder head gasket.

3) Apply liquid gasket to the mating surface of cylinder head gasket as shown in the figure.

CAUTION:

Do not apply liquid gasket excessively. If applying excessively, remove the excess liquid gasket that flowed out.

NOTE:

Install within 5 minutes after applying liquid gasket.

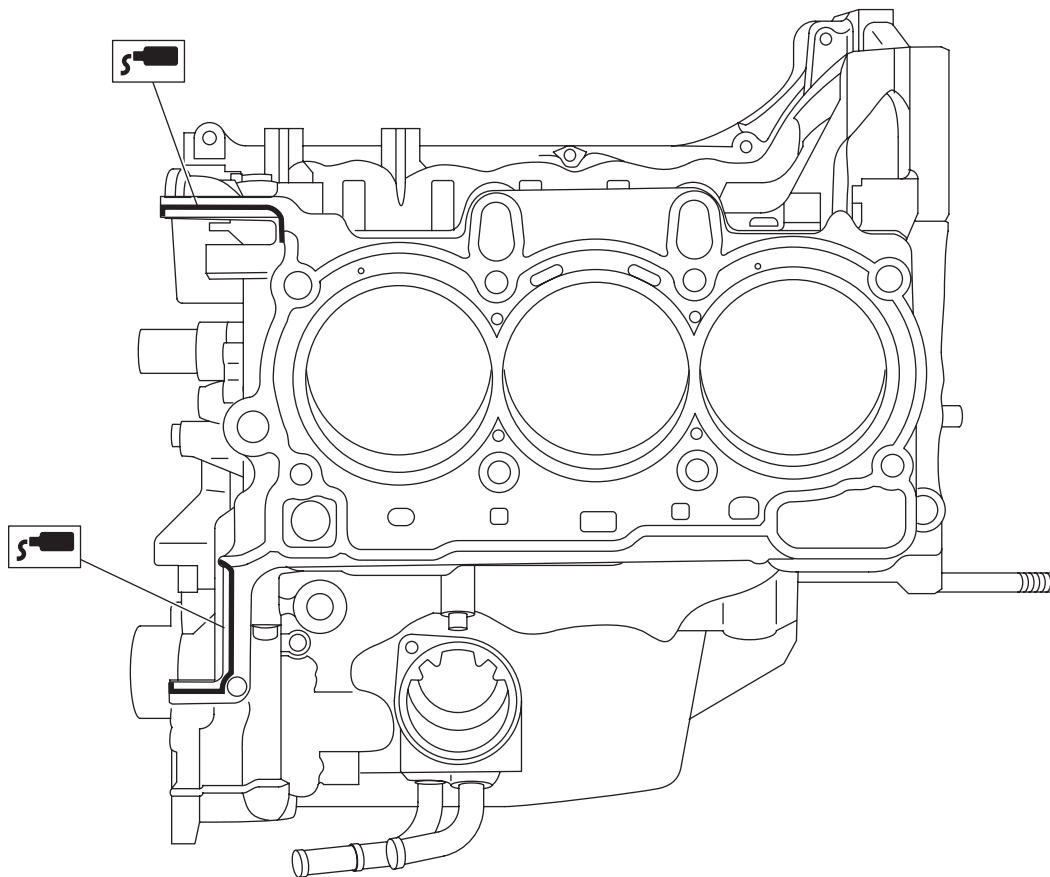
Liquid gasket:

THREE BOND 1217G (Part No. K0877Y0100) or equivalent

Applying liquid gasket diameter:

3.5 ± 1.0 mm (0.138 ± 0.039 in)

- LH side

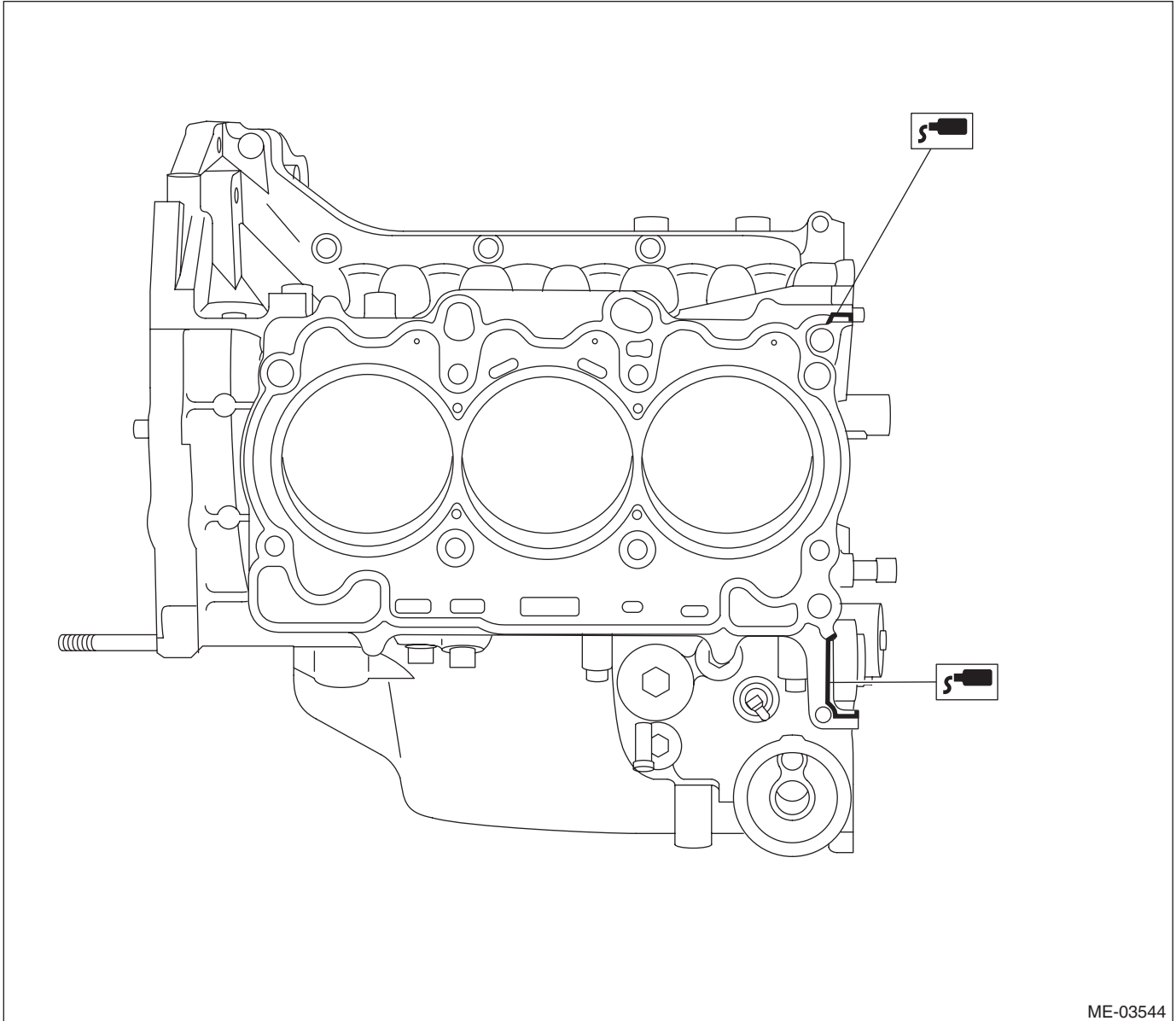


ME-03543

Cylinder Head

MECHANICAL

- RH side



4) Install the cylinder head to cylinder block.

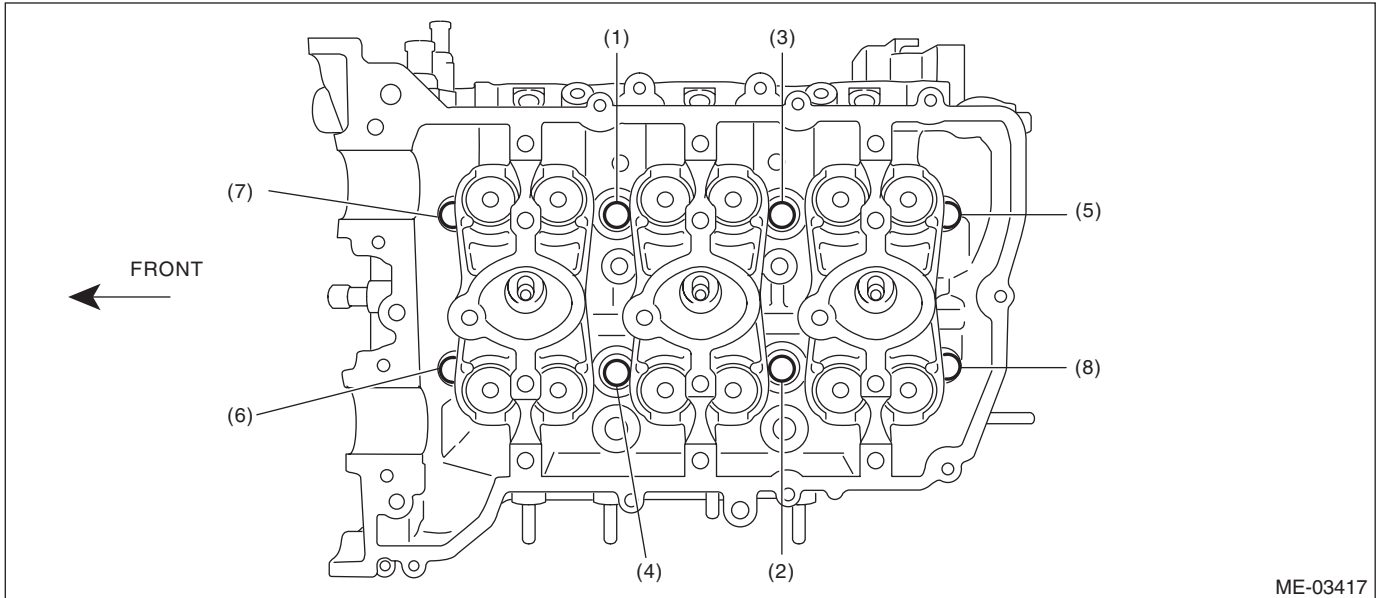
CAUTION:

Be careful not to scratch the mating surfaces of the cylinder head and cylinder block.

5) Tighten the cylinder head bolts.

- (1) Apply a coat of engine oil to washers and cylinder head bolt threads.
- (2) Install the cylinder head to cylinder block, and then tighten the bolts with torque of 20 N·m (2.0 kgf-m, 14.8 ft-lb) in numerical sequence as shown in the figure.
- (3) Tighten the bolts with torque of 50 N·m (5.1 kgf-m, 36.9 ft-lb) in numerical sequence as shown in the figure.
- (4) Loosen all the bolts by 180° in the reverse order of installing, and loosen them further by 180°.
- (5) Tighten the bolts with torque of 20 N·m (2.0 kgf-m, 14.8 ft-lb) in numerical sequence as shown in the figure.
- (6) Tighten the bolts (1) — (4) with torque of 48 N·m (4.9 kgf-m, 35.4 ft-lb) in numerical sequence.
- (7) Tighten the bolts (5) — (8) with torque of 44 N·m (4.5 kgf-m, 32.5 ft-lb) in numerical sequence.
- (8) Tighten all bolts 90° in the numerical order as shown in the figure.

(9) Tighten the bolt (1) — (4) by 45° in the numerical order.



6) Install the seal bolts as shown in the figure.

NOTE:

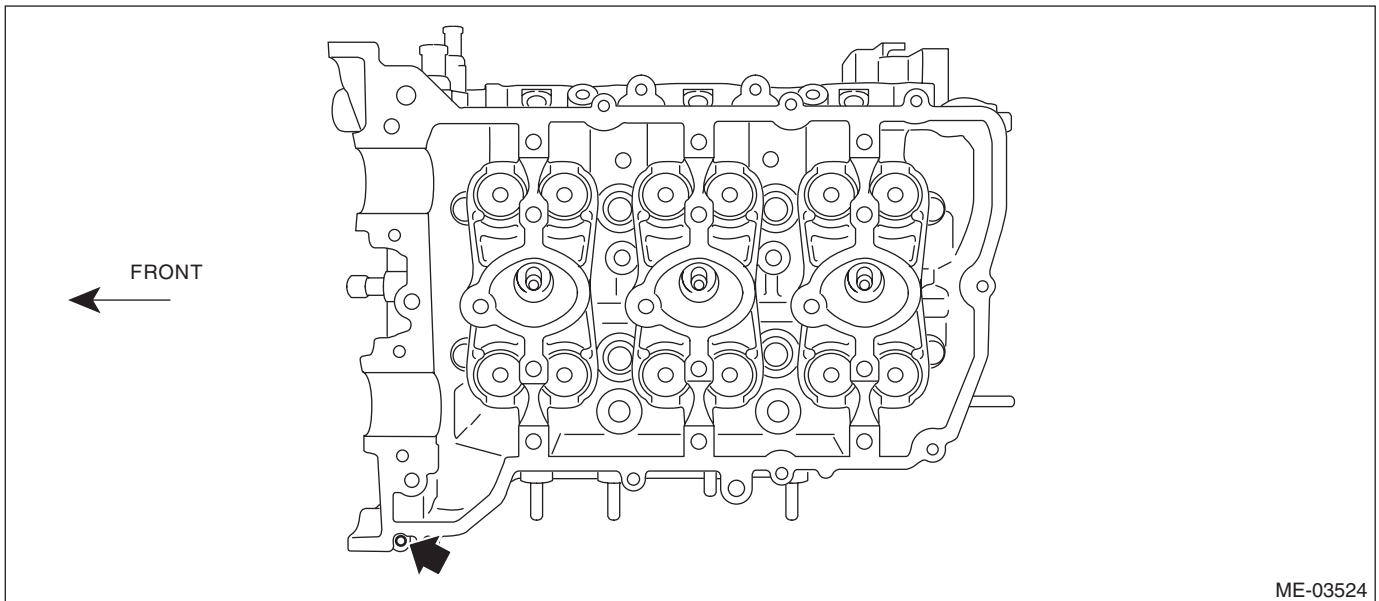
Apply seal material on the bolt threads before installing the seal bolts.

Seal material:

THREE BOND 1324 (Part No. 004403042) or equivalent

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)



7) Install the camshaft. <Ref. to ME(H6DO)-77, INSTALLATION, Camshaft.>

8) Install the crank sprocket. <Ref. to ME(H6DO)-74, INSTALLATION, Crank Sprocket.>

9) Install the cam sprocket. <Ref. to ME(H6DO)-73, INSTALLATION, Cam Sprocket.>

10) Install the timing chain assembly. <Ref. to ME(H6DO)-60, INSTALLATION, Timing Chain Assembly.>

11) Install the chain cover. <Ref. to ME(H6DO)-49, INSTALLATION, Chain Cover.>

12) Install the crank pulley. <Ref. to ME(H6DO)-47, INSTALLATION, Crank Pulley.>

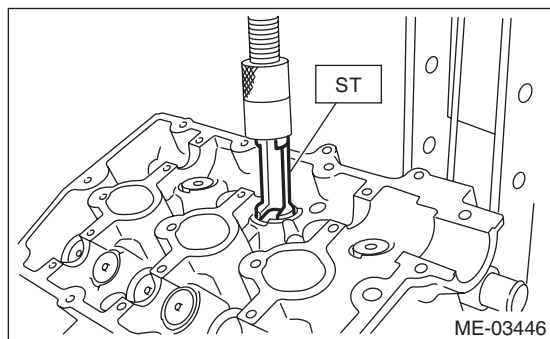
13) Install the engine to the vehicle. <Ref. to ME(H6DO)-40, INSTALLATION, Engine Assembly.>

C: DISASSEMBLY

- 1) Set the cylinder head on ST.
ST 18250AA010 CYLINDER HEAD TABLE
- 2) Remove the valve lifter.
- 3) Set the ST on valve spring retainer. Compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.
ST 499718000 VALVE SPRING REMOVER

NOTE:

- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.
- Keep all the removed parts in order for re-installing in their original positions.
- Refer to INSPECTION for removal and installation procedures of valve guide, intake valve oil seal and exhaust valve oil seal. <Ref. to ME(H6DO)-89, VALVE GUIDE, INSPECTION, Cylinder Head.>
<Ref. to ME(H6DO)-91, INTAKE AND EXHAUST VALVE OIL SEAL, INSPECTION, Cylinder Head.>



D: ASSEMBLY

- 1) Installation of valve spring and valve:
(1) Set the cylinder head on ST.
ST 18250AA010 CYLINDER HEAD TABLE
- (2) Coat the stem of each valve with engine oil and insert the valve into valve guide.

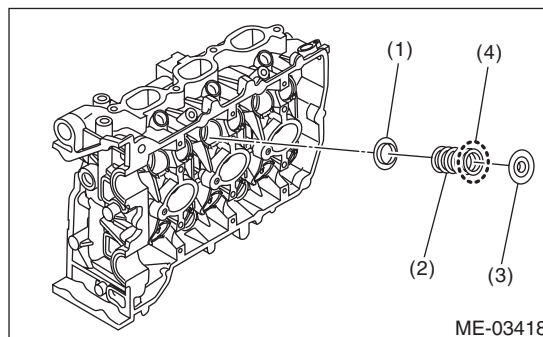
NOTE:

When inserting the valve into valve guide, use special care not to damage the oil seal lip.

- (3) Install the valve spring and retainer.

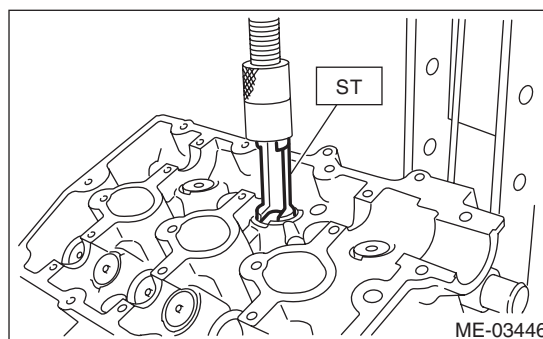
NOTE:

- Be sure to install the valve spring with its close-coiled end facing the seat on cylinder head.
- Install the valve spring with the painted side facing to retainer.



- (1) Seat
- (2) Valve spring
- (3) Retainer
- (4) Painted face

- (4) Set the ST on valve spring.
ST 499718000 VALVE SPRING REMOVER



- (5) Compress the valve spring and fit the valve spring retainer key.
- (6) After installing, tap the valve spring retainers lightly with a wooden hammer for better seating.
- 2) Apply oil to the surface of valve lifter.
- 3) Install the valve lifter.

E: INSPECTION

1. CYLINDER HEAD

1) Make sure that no crack or other damages do not exist. In addition to visual inspection, inspect important areas using liquid penetrant tester. Check that there are no marks of gas leaking or water leaking on gasket installing surface.

2) Set the cylinder head on ST.

ST 18250AA010 CYLINDER HEAD TABLE

3) Check for warpage at mating surface between the cylinder block and cylinder head using a straight edge (A) and thickness gauge (B). If the warpage exceeds limit, replace the cylinder head.

Surface warpage limit:

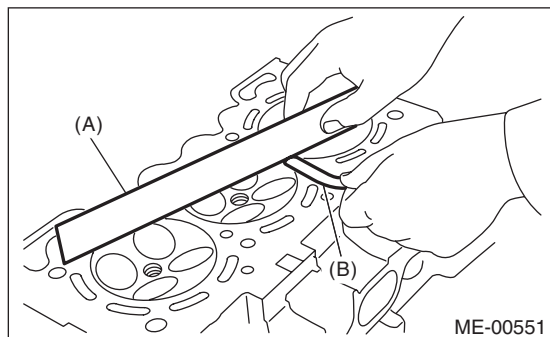
0.02 mm (0.0008 in)

Standard height of cylinder head:

124±0.05 mm (4.88±0.0020 in)

NOTE:

Uneven torque for the cylinder head bolts can cause warping. When reinstalling, pay special attention to the torque so as to tighten evenly.



2. VALVE SEAT

Inspect the intake and exhaust valve seats, and correct the contact surfaces with a valve seat cutter if they are defective or when valve guides are replaced.

Valve seat width W:

Intake:

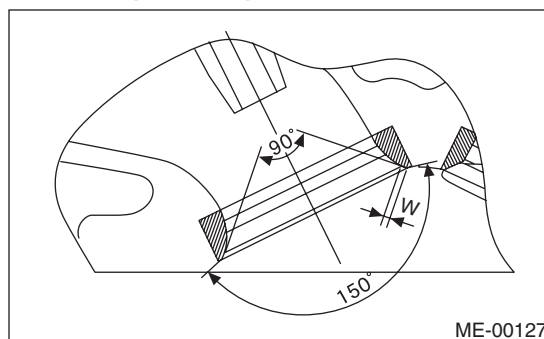
Standard:

1.0 mm (0.039 in)

Exhaust:

Standard:

1.5 mm (0.059 in)



3. VALVE GUIDE

1) Check the clearance between valve guide and stem. The clearance can be checked by measuring the valve stem outer diameter with a micrometer and valve guide inner diameter with a caliper gauge respectively.

Clearance between the valve guide and valve stem:

Standard:

Intake:

0.030 — 0.057 mm (0.0012 — 0.0022 in)

Exhaust:

0.040 — 0.067 mm (0.0016 — 0.0026 in)

2) If the clearance between valve guide and stem exceeds the standard, replace the valve guide or valve itself whichever shows greater amount of wear or damaged and etc. See the following procedure for valve guide replacement.

Valve guide inner diameter:

5.500 — 5.512 mm (0.2165 — 0.2170 in)

Valve stem outer diameters:

Intake:

5.455 — 5.470 mm (0.2148 — 0.2154 in)

Exhaust:

5.445 — 5.460 mm (0.2144 — 0.2150 in)

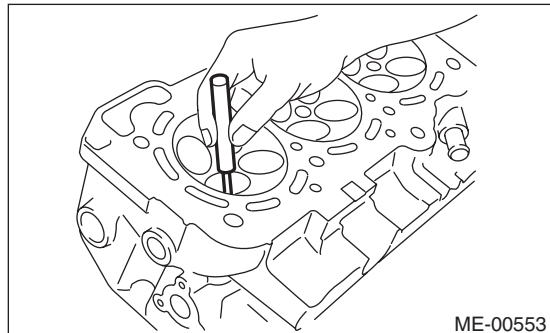
Cylinder Head

MECHANICAL

(1) Place the cylinder head on ST1 with the combustion chamber upward so that valve guides fit the holes in ST1.

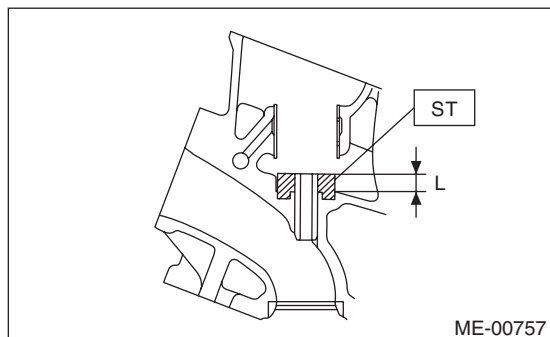
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 18250AA010 CYLINDER HEAD TABLE
ST2 499765700 VALVE GUIDE REMOVER



(3) Turn the cylinder head upside down and place the ST as shown in the figure.

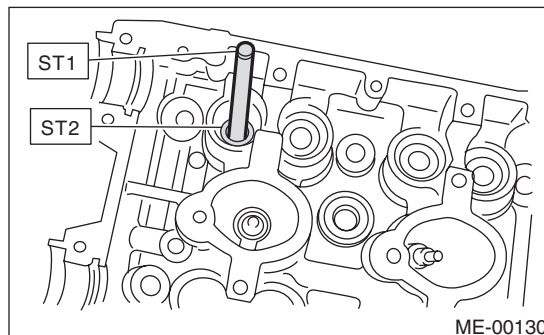
ST 18251AA050 VALVE GUIDE ADJUSTER
(Intake side)
ST 18251AA060 VALVE GUIDE ADJUSTER
(Exhaust side)



(4) Before installing a new valve guide, make sure that neither scratches nor damages exist on the inner surface of valve guide holes in cylinder head.

(5) Put a new valve guide, coated with sufficient oil, in cylinder, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

ST1 499765700 VALVE GUIDE REMOVER
ST2 18251AA050 VALVE GUIDE ADJUSTER
(Intake side)
ST2 18251AA060 VALVE GUIDE ADJUSTER
(Exhaust side)



(6) Check the valve guide protrusion.

Valve guide protrusion L:

Intake:

8.6 — 9.0 mm (0.3386 — 0.3543 in)

Exhaust:

10.7 — 11.1 mm (0.4213 — 0.4370 in)

(7) Ream the inside of valve guide using ST. Put the reamer in valve guide, and rotate the reamer slowly clockwise while pushing it lightly. Bring the reamer back while rotating it clockwise.

ST 499765900 VALVE GUIDE REAMER

NOTE:

- Apply engine oil to the reamer when reaming.
- If the inner surface of valve guide is damaged, the edge of reamer should be slightly ground with oil stone.
- If the inner surface of valve guide becomes lustrous and the reamer does not chip, use a new reamer or remedy the reamer.

(8) After reaming, clean the valve guide to remove chips.

(9) Recheck the contact condition between valve and valve seat after replacing the valve guide.

4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace if damaged, worn or deformed, or if dimension of "H" in the figure exceeds the standard, or if offset wear occurs.

Head edge thickness H:

Intake (A):

Standard

1.0 mm (0.039 in)

Exhaust (B):

Standard

1.2 mm (0.047 in)

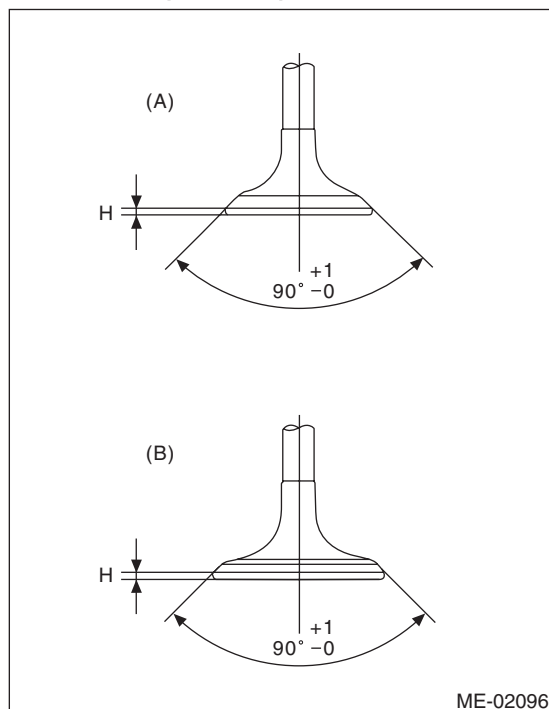
Valve overall length:

Intake (A):

103.5 mm (4.075 in)

Exhaust (B):

103.2 mm (4.063 in)



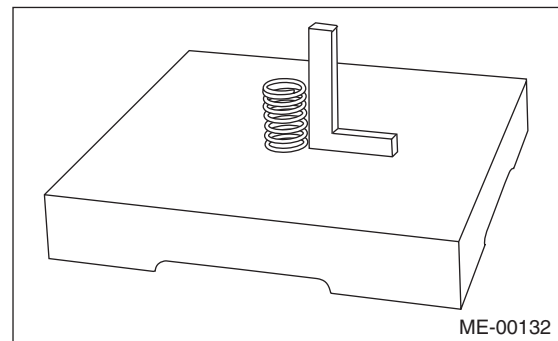
2) Put a small amount of grinding compound on the seat surface, and lap the valve and seat surface. Install a new valve oil seal after lapping.

5. VALVE SPRING

1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not within the standard value presented in the table.

Free length	mm (in)	Intake	41.51 (1.6342)
		Exhaust	41.51 (1.6342)
Squareness		Intake	2.5°, 1.8 mm (0.071 in)
		Exhaust	2.5°, 1.8 mm (0.071 in)

2) To measure the squareness of the valve spring, stand the valve spring on a surface plate and measure its deflection at the top of the valve spring using a try square.



6. INTAKE AND EXHAUST VALVE OIL SEAL

For the following, replace the oil seal with a new part.

- When the lip is damaged.
- When the spring is out of the specified position.
- When readjusting the surfaces of intake valve and valve seat.

- When replacing the intake valve guide.

1) Set the cylinder head on ST1.

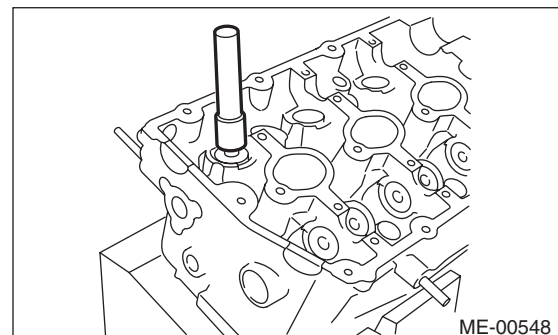
2) Using the ST2, press in the oil seal.

ST1 18250AA010 CYLINDER HEAD TABLE

ST2 499585500 VALVE OIL SEAL GUIDE

NOTE:

- Apply engine oil to oil seal before press-fitting.
- When press-fitting the oil seal, do not use a hammer to strike in.

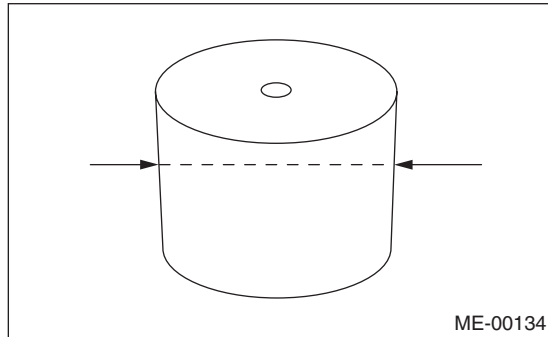


7. VALVE LIFTER

- 1) Check the valve lifter visually.
- 2) Measure the outer diameter of valve lifter.

Outer diameter:

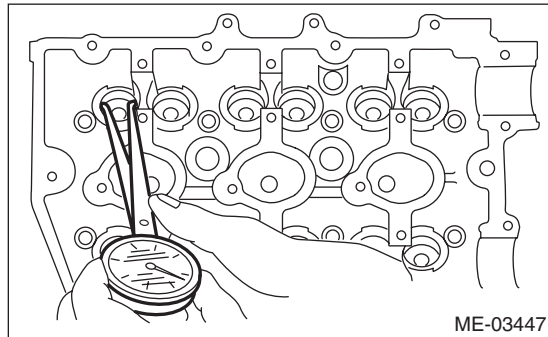
32.959 — 32.975 mm (1.2976 — 1.2982 in)



- 3) Measure the inner diameter of valve lifter hole of cylinder head.

Inner diameter:

32.994 — 33.016 mm (1.2990 — 1.2998 in)



NOTE:

If difference between outer diameter of valve lifter and inner diameter of valve lifter hole is out of the standard or offset wearing exists, replace the cylinder head.

Standard:

0.019 — 0.057 mm (0.0007 — 0.0022 in)