

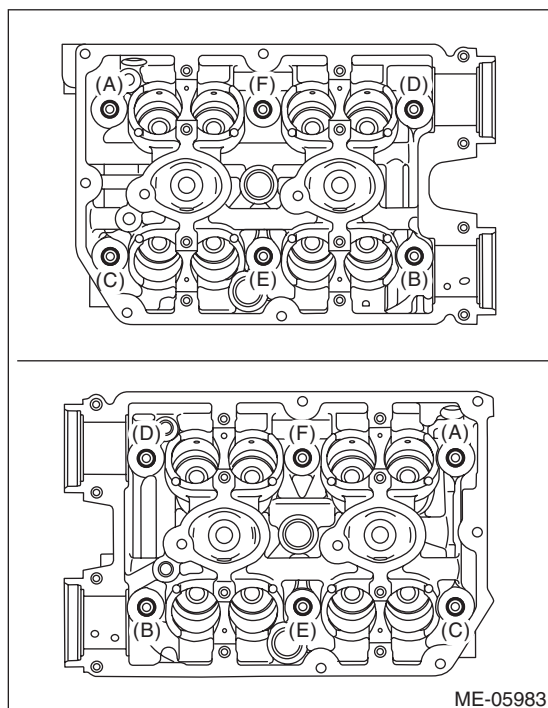
19. Cylinder Head

A: REMOVAL

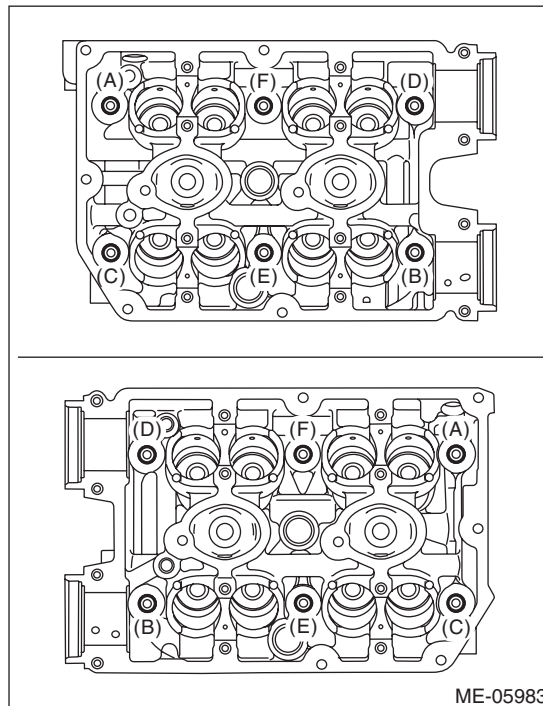
- 1) Remove the engine from the vehicle. <Ref. to ME(STI)-30, REMOVAL, Engine Assembly.>
- 2) Remove the rear side belt. <Ref. to ME(STI)-41, REAR SIDE BELT, REMOVAL, V-belt.>
- 3) Remove the intake manifold. <Ref. to FU(STI)-17, REMOVAL, Intake Manifold.>
- 4) Remove the crank pulley. <Ref. to ME(STI)-48, REMOVAL, Crank Pulley.>
- 5) Remove the timing belt cover. <Ref. to ME(STI)-50, REMOVAL, Timing Belt Cover.>
- 6) Remove the timing belt. <Ref. to ME(STI)-51, REMOVAL, Timing Belt.>
- 7) Remove the cam sprocket. <Ref. to ME(STI)-60, REMOVAL, Cam Sprocket.>
- 8) Remove the secondary air combination valve. <Ref. to EC(STI)-54, REMOVAL, Secondary Air Combination Valve.>
- 9) Remove the bolts which secure A/C compressor bracket to cylinder head.
- 10) Remove the oil pipe. <Ref. to LU(STI)-24, REMOVAL, Oil Pipe.>
- 11) Remove the camshaft. <Ref. to ME(STI)-62, REMOVAL, Camshaft.>
- 12) Remove the oil level gauge guide. (LH side only)
- 13) Remove the cylinder head bolts in alphabetical order shown in the figure.

NOTE:

Leave the bolts (A) and (D) engaged by three or four threads to prevent the cylinder head from falling.



- 14) While tapping the cylinder head with a plastic hammer, separate it from cylinder block. Remove the bolts (A) and (D) to remove cylinder head.



- 15) Remove the cylinder head gasket.

CAUTION:

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

B: INSTALLATION

- 1) Install the cylinder head to the cylinder block.

CAUTION:

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

NOTE:

Use a new cylinder head gasket.

- (1) Clean the bolt threads and the bolt holes in the cylinder block.

CAUTION:

To avoid erroneous tightening of the bolts, clean out the bolt holes sufficiently by blowing with compressed air to eliminate engine coolant etc.

- (2) Apply a sufficient coat of engine oil to the washer and bolt thread.
- (3) Tighten all bolts to 40 N·m (4.1 kgf-m, 29.5 ft-lb) in alphabetical order.

- (4) Retighten all bolts to 95 N·m (9.7 kgf-m, 70.1 ft-lb) in alphabetical order.

CAUTION:

If the bolt makes stick-slip sound during tightening, repeat the procedure from step (1). In this case, the cylinder head gasket can be re-used.

- (5) Loosen all the bolts by 180° in the reverse order of installing, and loosen them further by 180°.
 (6) Tighten all bolts to 10 N·m (1.0 kgf-m, 7.4 ft-lb) in alphabetical order.
 (7) Retighten all bolts to 30 N·m (3.1 kgf-m, 22.1 ft-lb) in alphabetical order.
 (8) Retighten all bolts to 70 N·m (7.1 kgf-m, 51.6 ft-lb) in alphabetical order.
 (9) Retighten all bolts by 80 — 90° in alphabetical order.
 (10) Retighten all bolts by 40 — 45° in alphabetical order.

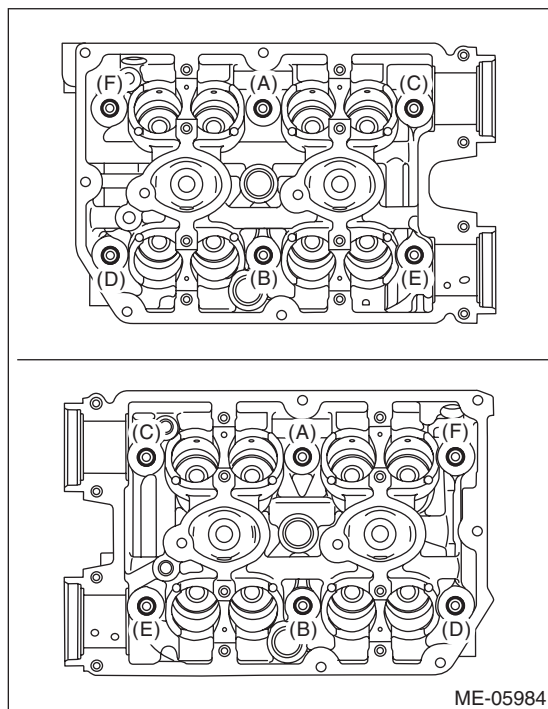
CAUTION:

The tightening angle of the bolt should not exceed 45°.

- (11) Retighten bolts (A) and (B) by 40 — 45°.

CAUTION:

Make sure the total “tightening angle” of steps (10) and (11) does not exceed 90°.



- 2) Install the oil level gauge guide. (LH side only)

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

- 3) Install the camshaft. <Ref. to ME(STI)-64, INSTALLATION, Camshaft.>

- 4) Install the oil pipe. <Ref. to LU(STI)-26, INSTALLATION, Oil Pipe.>

- 5) Install the A/C compressor bracket on cylinder head.

Tightening torque:

36 N·m (3.7 kgf-m, 26.6 ft-lb)

- 6) Install the secondary air combination valve. <Ref. to EC(STI)-54, INSTALLATION, Secondary Air Combination Valve.>

- 7) Install the cam sprocket. <Ref. to ME(STI)-60, INSTALLATION, Cam Sprocket.>

- 8) Install the timing belt. <Ref. to ME(STI)-53, INSTALLATION, Timing Belt.>

- 9) Adjust the valve clearance. <Ref. to ME(STI)-29, ADJUSTMENT, Valve Clearance.>

- 10) Install the rocker cover.

- (1) Install the rocker cover gasket to the rocker cover. (outer section and ignition coil section)

NOTE:

Use a new rocker cover gasket.

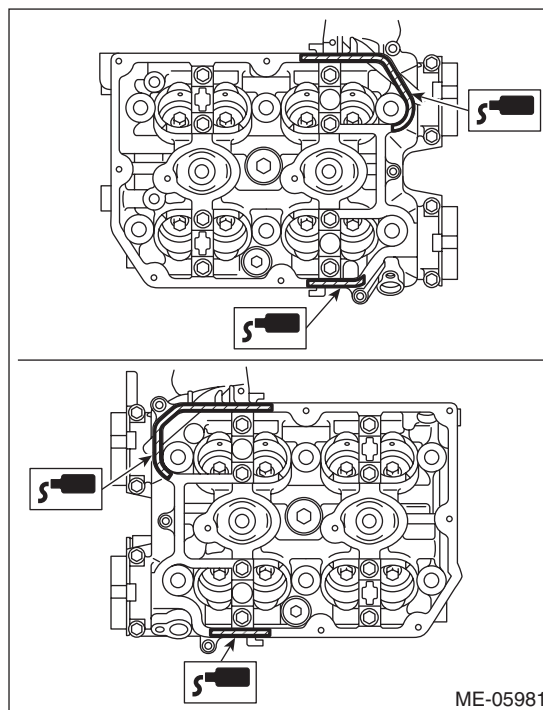
- (2) Apply liquid gasket to the specified point of the cylinder head.

NOTE:

Install within 5 min. after applying liquid gasket.

Liquid gasket:

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



- (3) Install the rocker cover onto cylinder heads. Ensure the gasket is properly positioned during installation.

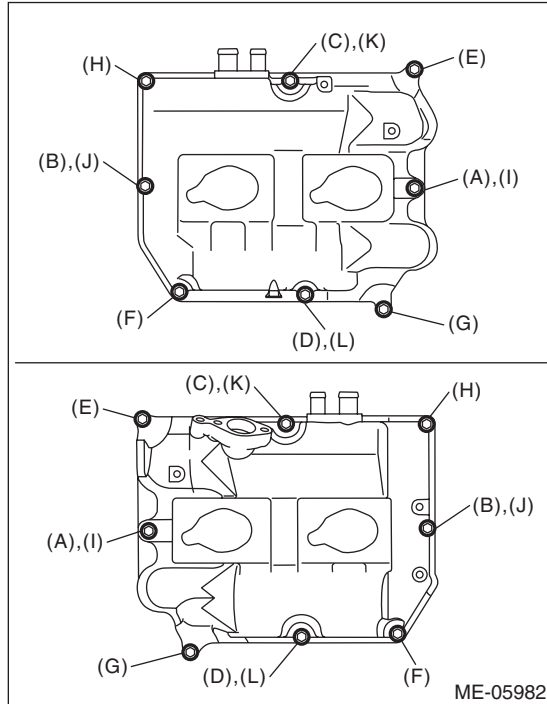
Cylinder Head

MECHANICAL

(4) Temporarily tighten the rocker cover bolts in alphabetical order shown in the figure, and then tighten to specified torque in alphabetical order.

Tightening torque:

6.4 N·m (0.7 kgf-m, 4.7 ft-lb)

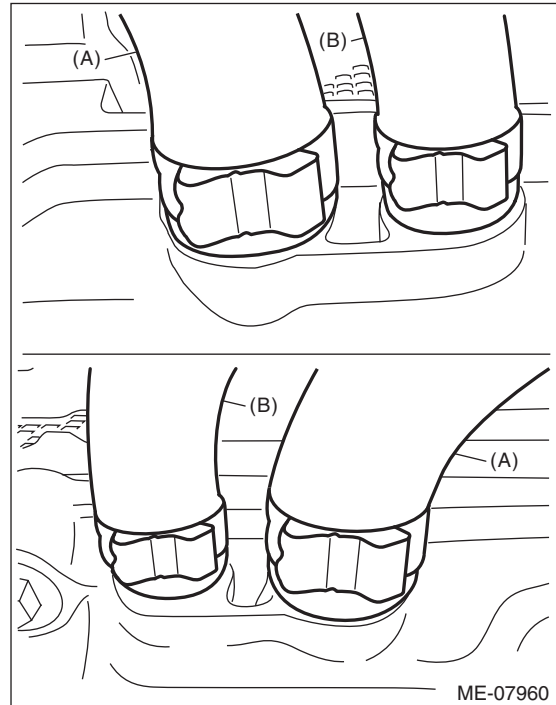
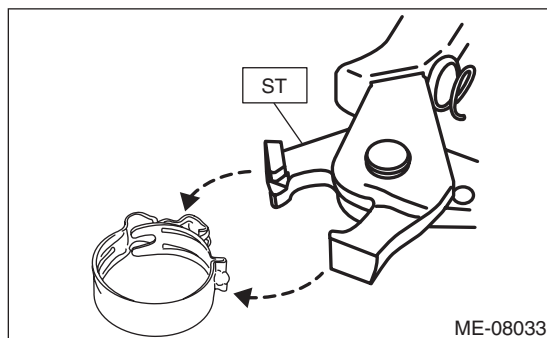


11) Connect the PCV hose (A) and vacuum hose (B) to the rocker cover.

NOTE:

Use a new clamp, fit the cut out in the ST with the protrusion on the clamp as shown in the figure, and lock the clamp.

ST 18353AA000 CLAMP PLIERS



12) Install the timing belt cover. <Ref. to ME(STI)-50, INSTALLATION, Timing Belt Cover.>

13) Install the crank pulley. <Ref. to ME(STI)-48, INSTALLATION, Crank Pulley.>

14) Install the intake manifold. <Ref. to FU(STI)-21, INSTALLATION, Intake Manifold.>

15) Install the rear side belt. <Ref. to ME(STI)-42, REAR SIDE BELT, INSTALLATION, V-belt.>

16) Install the engine to the vehicle. <Ref. to ME(STI)-34, INSTALLATION, Engine Assembly.>

C: DISASSEMBLY

1) Remove the valve lifter.

2) Place the cylinder head on ST1.

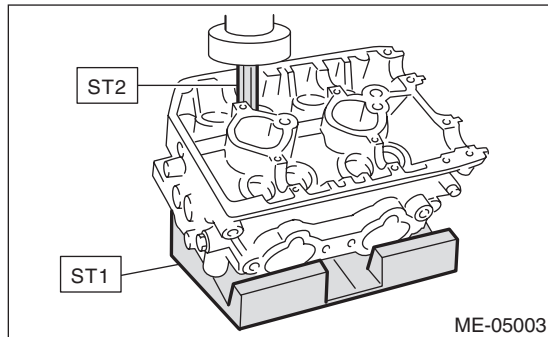
ST1 498267600 CYLINDER HEAD TABLE

3) Using ST2, compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.

ST2 499718000 VALVE SPRING REMOVER

NOTE:

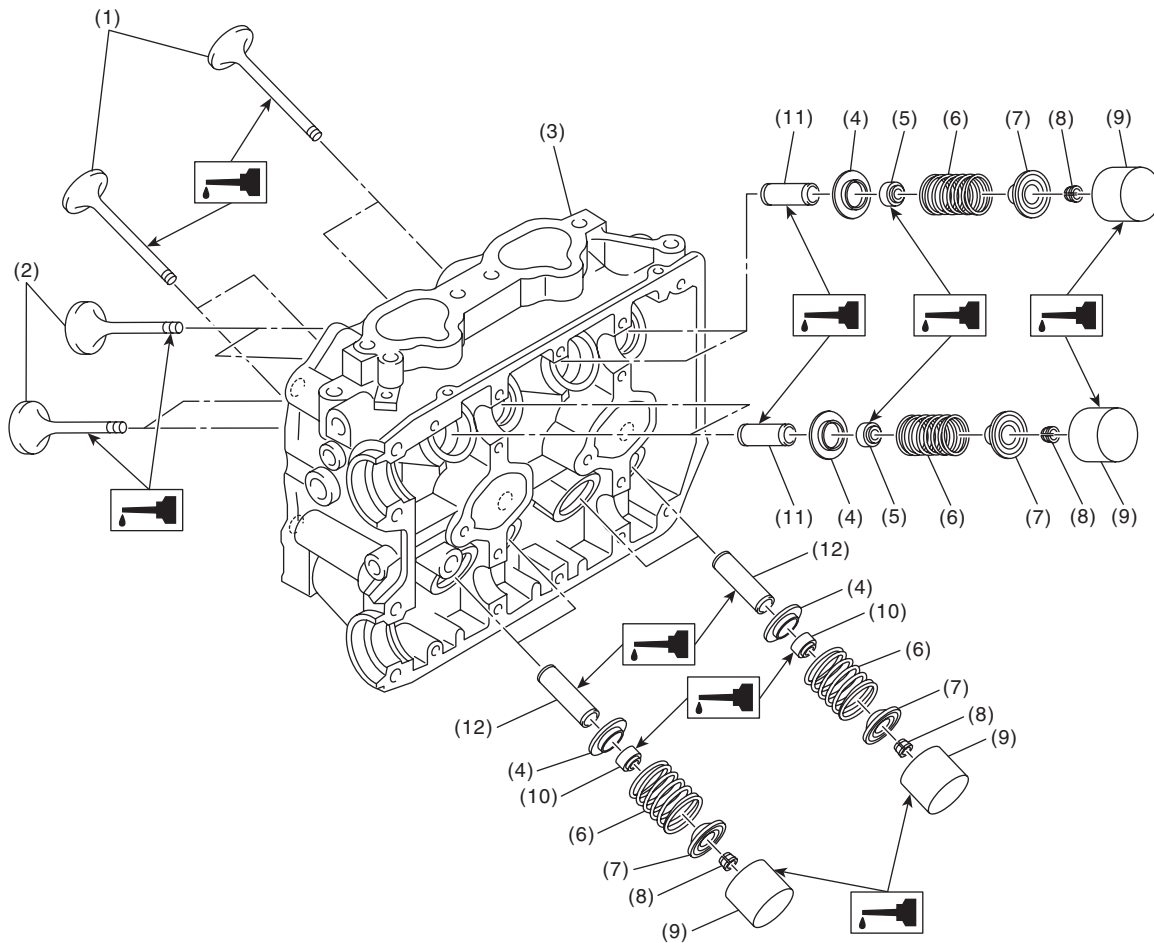
- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.
- Keep all the removed parts in order for re-installing in their original positions.
- For removal and installation procedures of the valve guide, intake valve oil seal and exhaust valve oil seal, refer to "INSPECTION". <Ref. to ME(STI)-76, VALVE GUIDE, INSPECTION, Cylinder Head.> <Ref. to ME(STI)-78, INTAKE AND EXHAUST VALVE OIL SEAL, INSPECTION, Cylinder Head.>



Cylinder Head

MECHANICAL

D: ASSEMBLY



ME-04990

- | | | |
|-----------------------|-------------------------------|-----------------------------|
| (1) Exhaust valve | (5) Intake valve oil seal | (9) Valve lifter |
| (2) Intake valve | (6) Valve spring | (10) Exhaust valve oil seal |
| (3) Cylinder head | (7) Valve spring retainer | (11) Intake valve guide |
| (4) Valve spring seat | (8) Valve spring retainer key | (12) Exhaust valve guide |

- 1) Install the valve spring and valve.
 - (1) Coat the valve 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.

- (2) Set the cylinder head on ST1.

ST1 498267600 CYLINDER HEAD TABLE

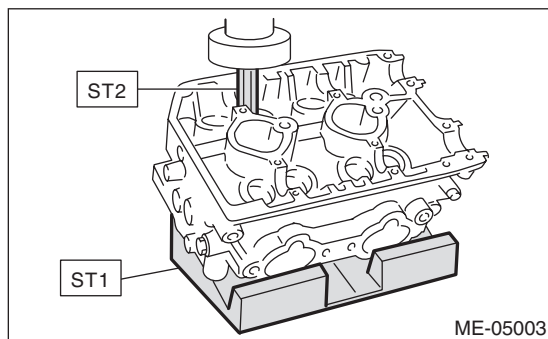
- (3) Install the valve spring and valve spring retainer.

NOTE:

Be sure to install the valve spring with its close-coiled end facing the cylinder head side.

- (4) Set the ST2 on valve spring.

ST2 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 plastic hammer for better seating.

- 2) Apply oil to the surface of valve lifter.
- 3) Install the valve lifter.

E: INSPECTION

1. CYLINDER HEAD

- 1) Check for cracks or damage. Use liquid penetrant tester on the important sections to check for fissures. Check that there are no marks of gas leaking or water leaking on gasket installing surface.

- 2) Measure the warping of the cylinder head surface that mates with cylinder block using a straight edge (A) and thickness gauge (B).

If the warping exceeds the limit, correct the surface by grinding it with a surface grinder.

Warping limit:

0.035 mm (0.0014 in)

Grinding limit:

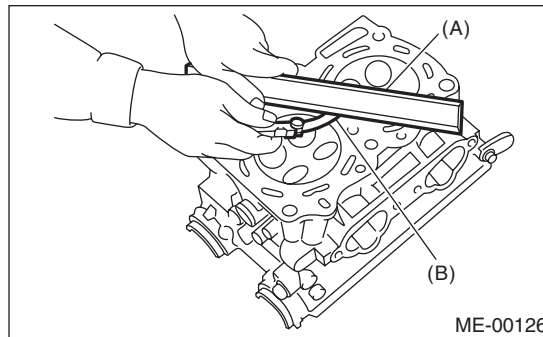
0.3 mm (0.012 in)

Standard height of cylinder head:

127.5 mm (5.02 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.

Contacting width *W* between valve and valve seat:

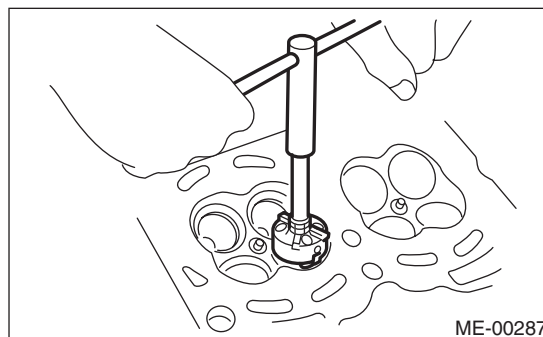
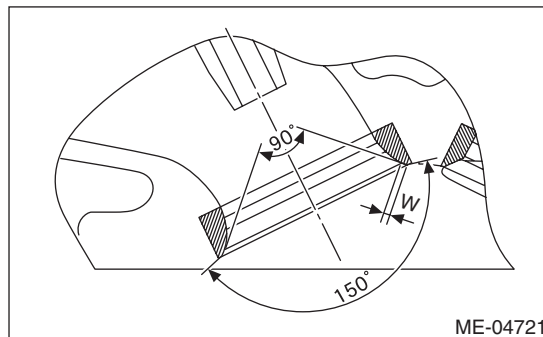
Standard

Intake

0.6 — 1.4 mm (0.024 — 0.055 in)

Exhaust

1.2 — 1.8 mm (0.047 — 0.071 in)



Cylinder Head

MECHANICAL

3. VALVE GUIDE

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

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 valve stem exceeds the standard, replace the valve guide or valve itself, whichever shows the greater amount of wear or damage. See the following procedure for valve guide replacement.

Valve guide inner diameter:

6.000 — 6.012 mm (0.2362 — 0.2367 in)

Valve stem outer diameters:

Intake

5.955 — 5.970 mm (0.2344 — 0.2350 in)

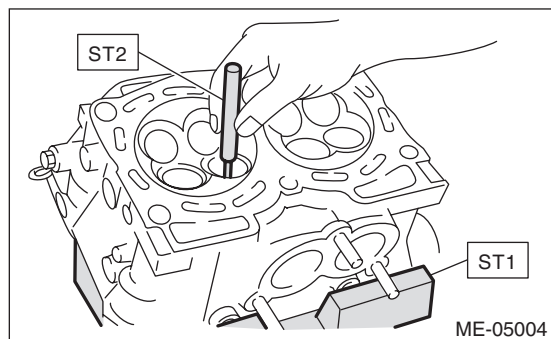
Exhaust

5.945 — 5.960 mm (0.2341 — 0.2346 in)

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

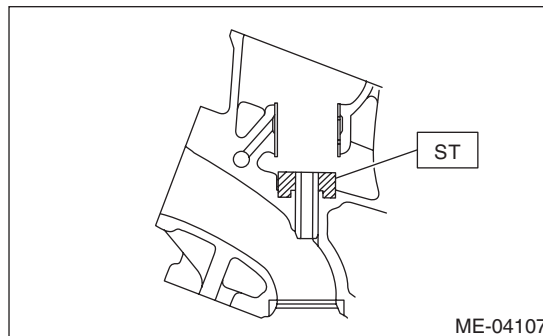
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

ST1 498267600 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



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

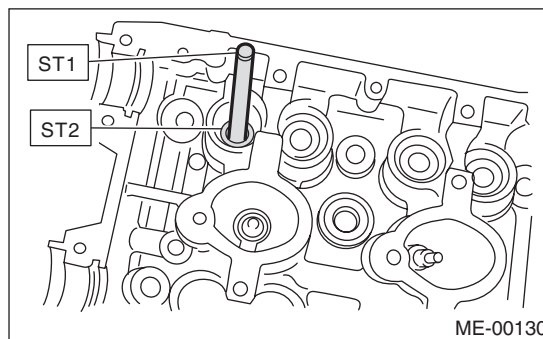
ST 18251AA020 VALVE GUIDE ADJUSTER



(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 the cylinder head, and insert the ST1 into valve guide. Press in until the valve guide upper end is flush with the upper surface of ST2.

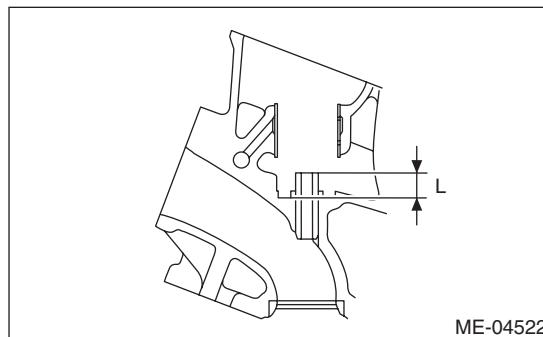
ST1 499767200 VALVE GUIDE REMOVER
ST2 18251AA020 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion amount "L".

Valve guide protrusion amount L:

15.8 — 16.2 mm (0.622 — 0.638 in)

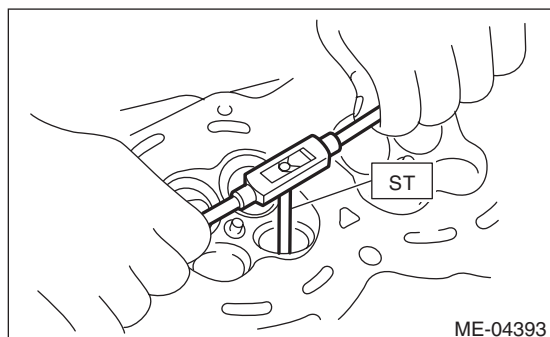


(7) Ream the inside of valve guide using ST. Put the ST in valve guide, and rotate the ST slowly clockwise while pushing it lightly. Bring the ST back while rotating it clockwise.

NOTE:

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

ST 499767400 VALVE GUIDE 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 of valve and valve stem, and replace the valve with a new part if damaged, worn, deformed, or if dimension "H" in the figure is outside of the specified limit.

Head edge thickness H:

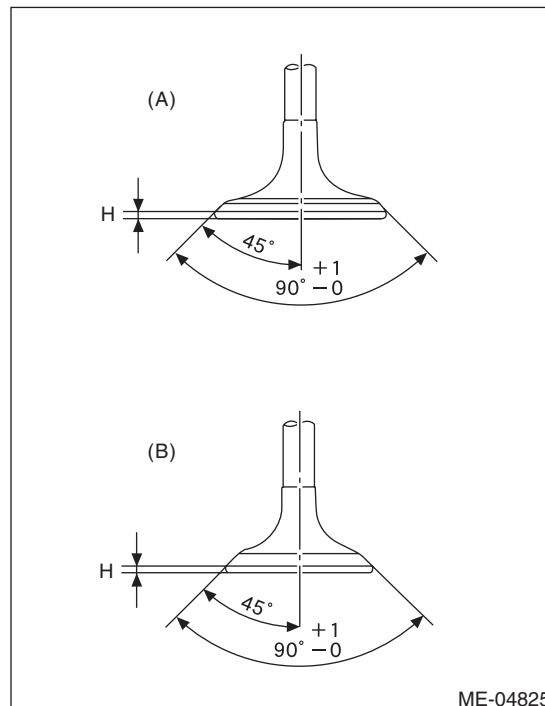
Standard

Intake (A)

1.0 — 1.4 mm (0.039 — 0.055 in)

Exhaust (B)

1.3 — 1.7 mm (0.051 — 0.067 in)



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

NOTE:

It is possible to differentiate between the intake valve and the exhaust valve by their overall length.

Valve overall length:

Intake

104.4 mm (4.110 in)

Exhaust

104.65 mm (4.1201 in)

Cylinder Head

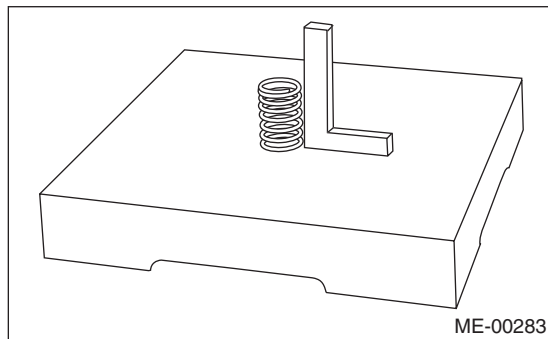
MECHANICAL

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.

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.

Free length	mm (in)	53.48 (2.106)
Tension/spring height N (kgf, lbf)/mm (in)	Set	204.6 — 235.4 (20.86 — 24.00, 46.00 — 52.93)/36.0 (1.417)
	Lift	363.5 — 401.7 (37.07 — 40.96, 81.73 — 90.32)/26.7 (1.051)
Squareness		2.5°, 2.3 mm (0.091 in) or less



6. INTAKE AND EXHAUST VALVE OIL SEAL

1) For the following, replace the oil seal with a new part. See the procedure 2) and subsequent for replacement procedures.

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

2) Place the cylinder head on ST1, and use ST2 to press-fit the oil seal.

ST1 498267600 CYLINDER HEAD TABLE

ST2 498857100 VALVE OIL SEAL GUIDE

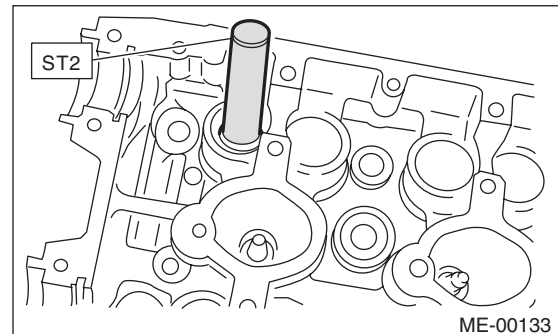
NOTE:

- Apply engine oil to oil seal before press-fitting.
- When press-fitting the oil seal, do not use a hammer to strike in.
- The intake valve oil seals and exhaust valve oil seals are distinguished by their colors.

Color of rubber part:

Intake [Gray]

Exhaust [Green]



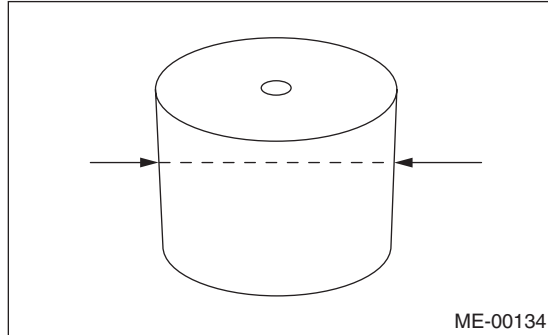
7. VALVE LIFTER

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

Outer diameter of valve lifter:

Standard

34.959 — 34.975 mm (1.3763 — 1.3770 in)

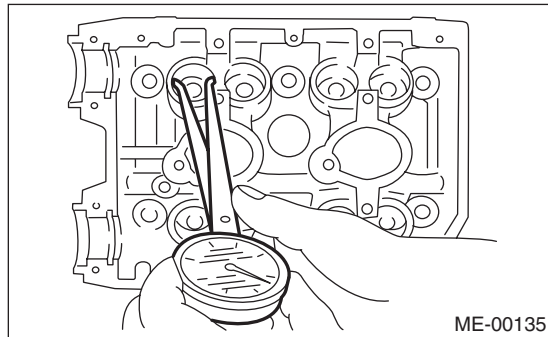


- 3) Measure the inner diameter of valve lifter mating surface on cylinder head.

Valve lifter mating surface inner diameter:

Standard

34.994 — 35.016 mm (1.3777 — 1.3786 in)



- 4) Check the clearance between valve lifter and valve lifter mating surface. The clearance can be checked by measuring the outer diameter of valve lifter and the inner diameter of valve lifter. If it exceeds the standard or offset wear occurs, replace the cylinder head.

Valve lifter and valve lifter mating surface clearance:

Standard

0.019 — 0.057 mm (0.0007 — 0.0022 in)