

# CYLINDER HEAD ASSEMBLY

MECHANICAL

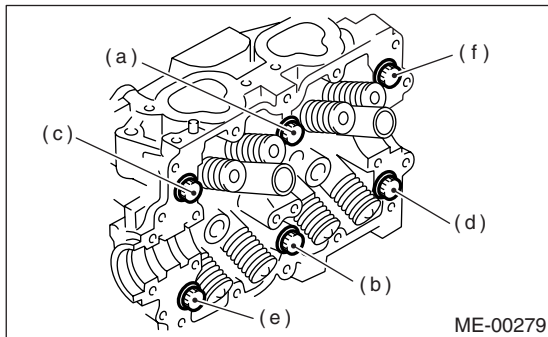
## 20. Cylinder Head Assembly

### A: REMOVAL

- 1) Remove the intake manifold. <Ref. to FU(H4SO)-14, REMOVAL, Intake Manifold.>
- 2) Remove the V-belt. <Ref. to ME(H4SO)-42, REMOVAL, V-belt.>
- 3) Remove the crank pulley. <Ref. to ME(H4SO)-44, REMOVAL, Crank Pulley.>
- 4) Remove the timing belt cover. <Ref. to ME(H4SO)-45, REMOVAL, Timing Belt Cover.>
- 5) Remove the timing belt assembly. <Ref. to ME(H4SO)-46, REMOVAL, Timing Belt Assembly.>
- 6) Remove the cam sprocket. <Ref. to ME(H4SO)-51, REMOVAL, Cam Sprocket.>
- 7) Remove the bolt which installs A/C compressor bracket on cylinder head.
- 8) Disconnect the PCV hose, then remove the rocker cover. <Ref. to ME(H4SO)-54, REMOVAL, Valve Rocker Assembly.>
- 9) Remove the valve rocker assembly. <Ref. to ME(H4SO)-54, REMOVAL, Valve Rocker Assembly.>
- 10) Remove the camshaft. <Ref. to ME(H4SO)-56, REMOVAL, Camshaft.>
- 11) Remove the cylinder head bolts in alphabetical sequence shown in the figure.

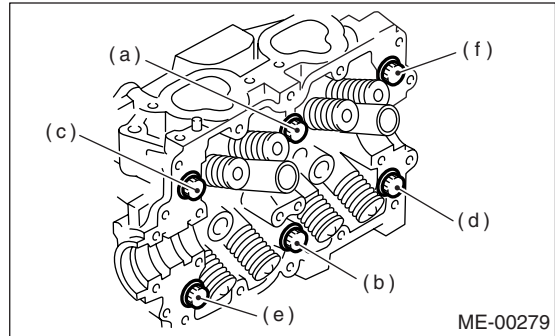
#### NOTE:

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



- 12) While tapping the cylinder head with a plastic hammer, separate it from cylinder block.

- 13) Remove the bolts (c) and (f) to remove cylinder head.



- 14) Remove the cylinder head gasket.

#### CAUTION:

**Do not scratch the mating surface of cylinder head and cylinder block.**

- 15) Similarly, remove the right side cylinder head.

### B: INSTALLATION

- 1) Install the cylinder head and gaskets on cylinder block.

#### CAUTION:

- Replace cylinder head gaskets with new ones.
- Be careful not to scratch the mating surface of cylinder block and cylinder head.

- 2) Tighten the cylinder head bolts.

- (1) Apply a coat of engine oil to the washers and bolt threads.
- (2) Tighten all bolts to 29 N·m (3.0 kgf-m, 22 ft-lb) in alphabetical sequence.
- (3) Tighten all bolts to 69 N·m (7.0 kgf-m, 51 ft-lb) in alphabetical sequence.
- (4) Back off all bolts in reverse order of assembly by 180° first; back them off by 180° again.
- (5) Tighten again all bolts 40° — 45° in alphabetical sequence.

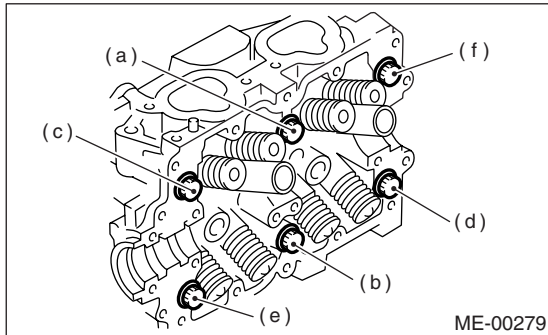
#### CAUTION:

**Do not tighten bolts more than 45°.**

(6) Tighten again the bolts (a) and (b) to 40° — 45°.

**CAUTION:**

**Do not tighten bolts more than 90° in total angle.**



3) Install the camshaft. <Ref. to ME(H4SO)-57, INSTALLATION, Camshaft.>

4) Install the valve rocker assembly. <Ref. to ME(H4SO)-54, INSTALLATION, Valve Rocker Assembly.>

5) Install the rocker cover and connect PCV hose. <Ref. to ME(H4SO)-54, INSTALLATION, Valve Rocker Assembly.>

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

7) Install the intake manifold. <Ref. to FU(H4SO)-16, INSTALLATION, Intake Manifold.>

8) Install the cam sprocket. <Ref. to ME(H4SO)-51, INSTALLATION, Cam Sprocket.>

9) Install the timing belt assembly. <Ref. to ME(H4SO)-47, INSTALLATION, Timing Belt Assembly.>

10) Install the timing belt cover. <Ref. to ME(H4SO)-45, INSTALLATION, Timing Belt Cover.>

11) Install the crank pulley. <Ref. to ME(H4SO)-44, INSTALLATION, Crank Pulley.>

12) Install the V-belt. <Ref. to ME(H4SO)-42, INSTALLATION, V-belt.>

**C: DISASSEMBLY**

1) Place the cylinder head on ST.

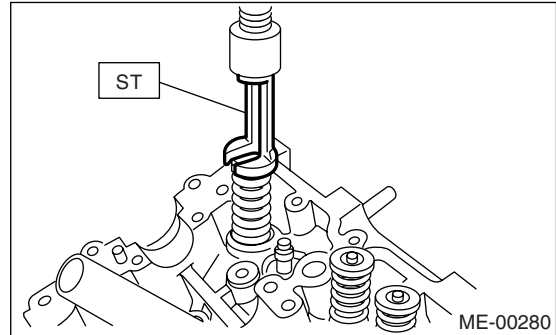
ST 498267800 CYLINDER HEAD TABLE

2) Set the ST on valve spring. Compress the valve spring, and then remove the valve spring retainer key. Remove each valve and valve spring.

ST 499718000 VALVE SPRING REMOVER

**CAUTION:**

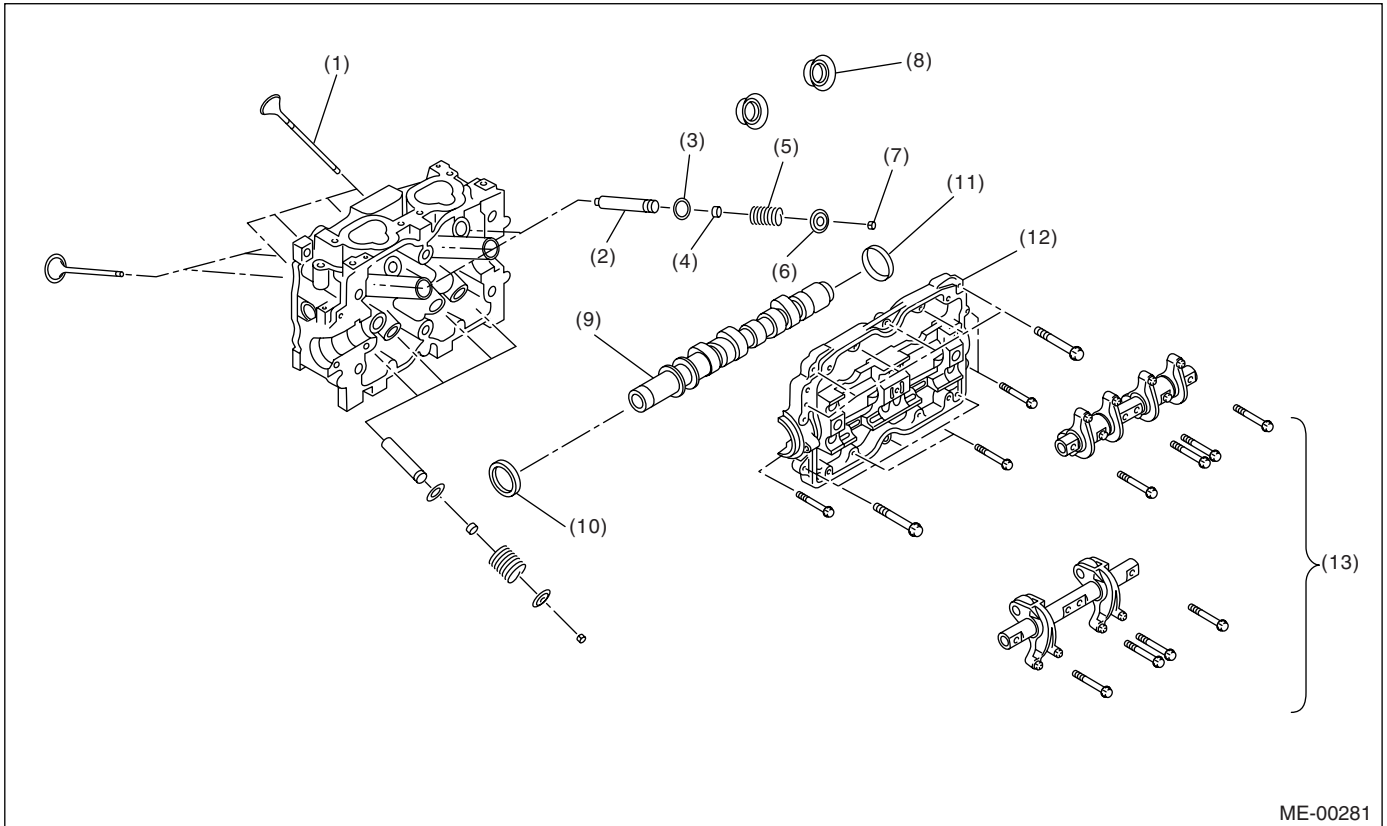
- Mark each valve to prevent confusion.
- Use extreme care not to damage the lips of intake valve oil seals and exhaust valve oil seals.



# CYLINDER HEAD ASSEMBLY

MECHANICAL

## D: ASSEMBLY



- |                       |                       |                        |
|-----------------------|-----------------------|------------------------|
| (1) Valve             | (6) Retainer          | (11) Plug              |
| (2) Valve guide       | (7) Collet (Valve)    | (12) Camshaft cap      |
| (3) Valve spring seat | (8) Spark plug gasket | (13) Valve rocker ASSY |
| (4) Oil seal          | (9) Camshaft          |                        |
| (5) Valve spring      | (10) Oil seal         |                        |

- 1) Place the cylinder head on ST.  
ST 498267800 CYLINDER HEAD TABLE
- 2) Coat the stem of each valve with engine oil and insert valve into valve guide.

**NOTE:**

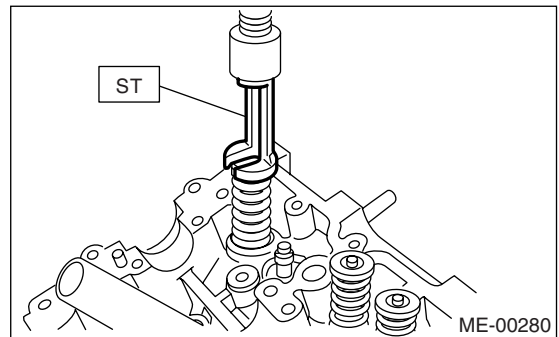
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

- 3) Install the valve spring and retainer.

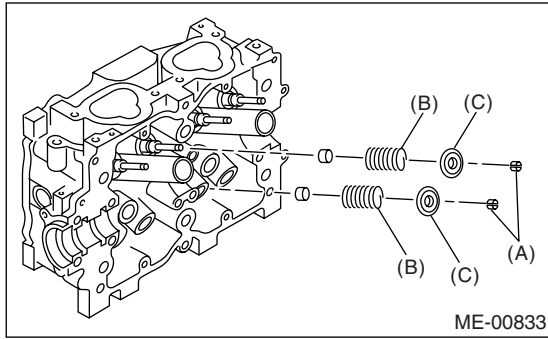
**NOTE:**

Be sure to install the valve springs with their close-coiled end facing the seat on the cylinder head.

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



5) Compress the valve spring, and then fit the valve spring collet (valve).



- (A) Collet (Valve)
- (B) Valve spring
- (C) Retainer

6) After installing, tap the valve spring retainers lightly with plastic hammer for better seating.

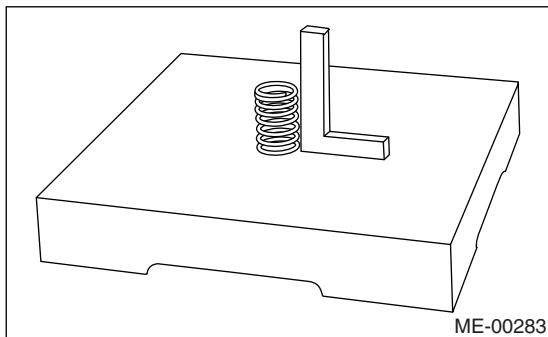
## E: INSPECTION

### 1. VALVE SPRING

1) Check the valve springs for damage, free length, and tension. Replace the valve spring if it is not to the specifications presented below.

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

Free length	54.30 mm (2.1378 in)
Squareness	2.5°, 2.4 mm (0.094 in)
Tension/ spring height	Set 214 — 246 N (21.8 — 25.1 kgf, 48.1 — 55.3 lb)/ 45.0 mm (1.772 in)
	Lift 526 — 582 N (53.6 — 59.3 kgf, 118.3 — 130.8 lb)/ 34.7 mm (1.366 in)



### 2. INTAKE AND EXHAUST VALVE OIL SEAL

1) Replace the oil seal with a new one in the following condition. Refer to procedure 2) to 4) for replacement procedure.

- Lip portion is damaged.
  - Spring is out of place.
  - Valve and valve seat are reconditioned.
  - Valve guide is replaced.
- 2) Using pliers, remove oil seal from valve guide.  
3) Place the cylinder head on ST1.  
4) Press-fit oil seal to the specified dimension indicated in the figure using ST2.

#### CAUTION:

- Apply engine oil to oil seal before press-fitting.
- When press-fitting oil seal, do not use hammer or strike in.
- Differentiate between intake valve oil seal and exhaust valve oil seal by noting their difference in color.

ST1 498267800 CYLINDER HEAD TABLE  
ST2 498857100 VALVE OIL SEAL GUIDE

#### Color of rubber part:

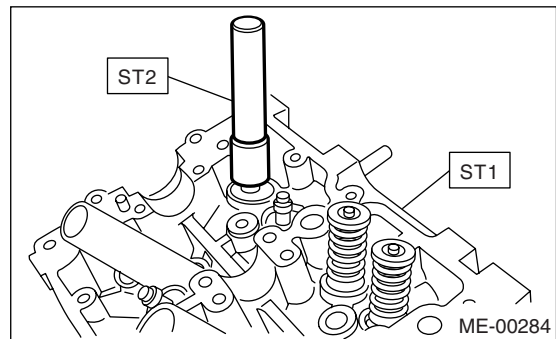
Intake [Black]

Exhaust [Brown]

#### Color of spring part:

Intake [Silver]

Exhaust [Silver]



### 3. CYLINDER HEAD

1) Make sure that no crack or other damage exists. In addition to visual inspection, inspect important areas by means of red lead check.

2) Make sure that gasket installing surface shows no trace of gas and water leaks.

3) Place the cylinder head on ST.

ST 498267800 CYLINDER HEAD TABLE

4) Measure the warping of the cylinder head surface that mates with crankcase using a straight edge and thickness gauge.

If the warping exceeds warping limit, regrind the surface with a surface grinder.

# CYLINDER HEAD ASSEMBLY

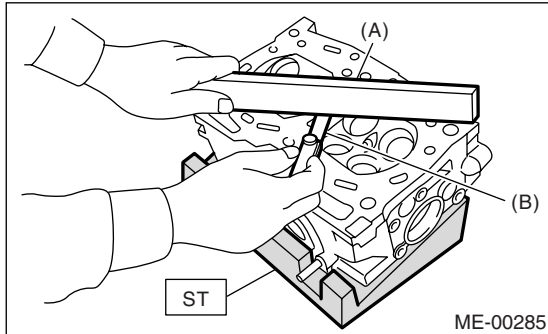
MECHANICAL

**Warping limit:**  
**0.05 mm (0.0020 in)**

**Grinding limit:**  
**0.1 mm (0.004 in)**

**Standard height of cylinder head:**  
**97.5 mm (3.839 in)**

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



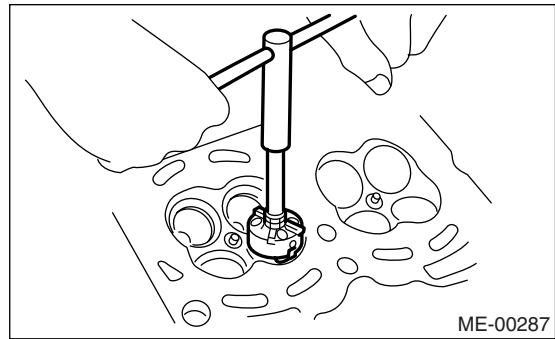
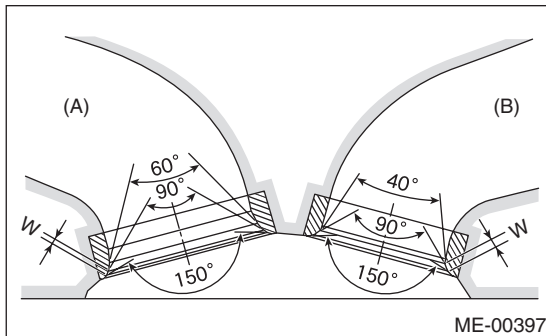
(A) Straight edge  
 (B) Thickness gauge

## 4. VALVE SEAT

- 1) Inspect the intake and exhaust valve seat.
- 2) Correct the contact surface with valve seat cutter if valve seat are defective or valve guides are replaced.

**Intake valve seat width: W (A)**  
**Standard: 1.1 mm (0.043 in)**  
**Limit: 1.8 mm (0.071 in)**

**Exhaust valve seat width: W (B)**  
**Standard: 1.5 mm (0.059 in)**  
**Limit: 2.2 mm (0.087 in)**



## 5. VALVE GUIDE

- 1) Check the clearance between valve guide and stem. The clearance can be checked by measuring the outside diameter of valve stem and the inside diameter of valve guide with outside and inside micrometers respectively.

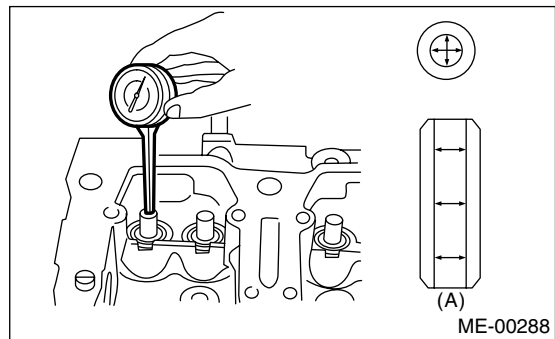
**Standard clearance between the valve guide and valve stem:**

**Intake**  
**0.035 — 0.062 mm (0.0014 — 0.0024 in)**

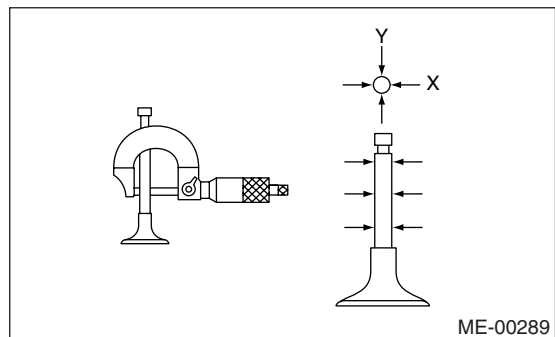
**Exhaust**  
**0.040 — 0.067 mm (0.0016 — 0.0026 in)**

**Limit clearance between the valve guide and valve stem:**

**Intake and Exhaust**  
**0.15 mm (0.0059 in)**



(A) Valve guide



# CYLINDER HEAD ASSEMBLY

MECHANICAL

2) If the clearance between valve guide and valve stem exceeds the limit, replace the valve guide or valve itself whichever shows greater amount of wear. 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

5.950 — 5.965 mm (0.2343 — 0.2348 in)

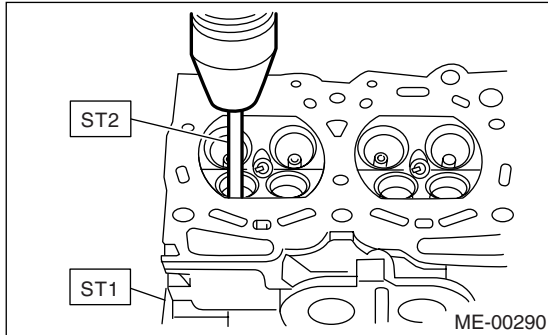
#### Exhaust

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 enter the holes in ST1.

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

ST1 498267800 CYLINDER HEAD TABLE  
ST2 499767200 VALVE GUIDE REMOVER



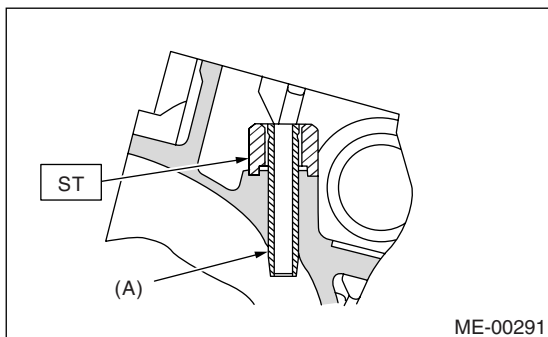
(3) Turn the cylinder head upside down and place ST as shown in the figure.

Intake side:

ST 499767700 VALVE GUIDE ADJUSTER

Exhaust side:

ST 499767800 VALVE GUIDE ADJUSTER



(A) New oversize valve guide

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

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

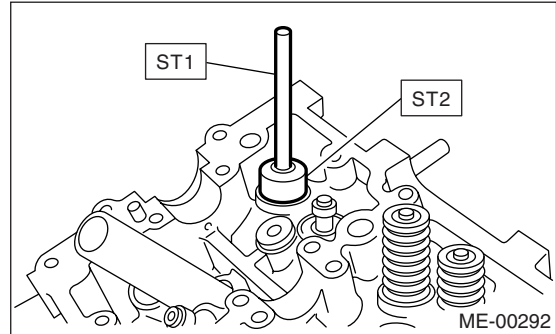
ST1 499767200 VALVE GUIDE REMOVER

Intake side:

ST2 499767700 VALVE GUIDE ADJUSTER

Exhaust side:

ST2 499767800 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

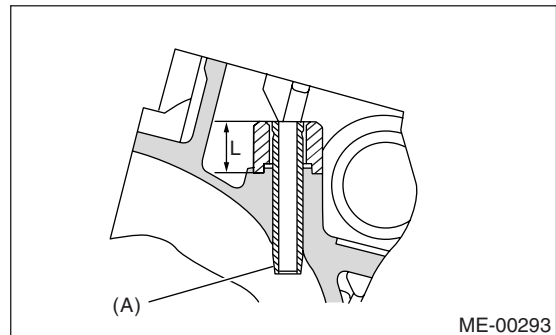
### Valve guide protrusion: L

#### Intake

20.0 — 20.5 mm (0.787 — 0.807 in)

#### Exhaust

16.5 — 17.0 mm (0.650 — 0.669 in)



(A) Valve guide

(7) Ream the inside of valve guide with ST. Gently rotate the reamer clockwise while pressing it lightly into valve guide, and return it also rotating clockwise.

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

### CAUTION:

Apply engine oil to the reamer when reaming.

### NOTE:

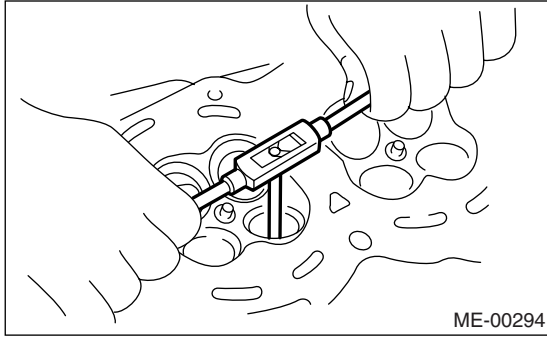
- If the inner surface of the valve guide is torn, the edge of the reamer should be slightly ground with an oil stone.

- If the inner surface of the valve guide becomes lustrous and the reamer does not chip, use a new reamer or remedy the reamer.

# CYLINDER HEAD ASSEMBLY

MECHANICAL

ST 499767400 VALVE GUIDE REAMER



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

NOTE:

Replace intake valve oil seal with a new one if the valve and seat are lapped.

**Valve overall length:**

**Intake**

**120.6 mm (4.75 in)**

**Exhaust**

**121.7 mm (4.79 in)**

## 6. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of valve, and replace if damaged, worn, or deformed, or if "H" is less than the specified limit.

**H:**

**Standard (intake)**

**1.0 mm (0.039 in)**

**Standard (exhaust)**

**1.2 mm (0.47 in)**

**Limit (intake and exhaust)**

**0.6 mm (0.024 in)**

2) Put a small amount of grinding compound on the seat surface and lap the valve and seat. <Ref. to ME(H4SO)-64, VALVE SEAT, INSPECTION, Cylinder Head Assembly.>

