

## 19. Cylinder Head

### A: REMOVAL

1) Remove the V-belts. <Ref. to ME(H4DOTC)-36, REMOVAL, V-belt.>

2) Remove the crank pulley.

<Ref. to ME(H4DOTC)-39, REMOVAL, Crank Pulley.>

3) Remove the timing belt cover.

<Ref. to ME(H4DOTC)-41, REMOVAL, Timing Belt Cover.>

4) Remove the timing belt.

<Ref. to ME(H4DOTC)-42, REMOVAL, Timing Belt.>

5) Remove the cam sprocket.

<Ref. to ME(H4DOTC)-50, REMOVAL, Cam Sprocket.>

6) Remove the intake manifold.

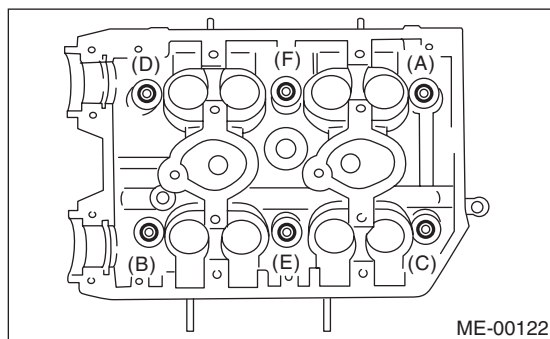
<Ref. to FU(H4DOTC)-11, REMOVAL, Intake Manifold.>

7) Remove the bolt which installs the A/C compressor bracket on cylinder head.

8) Remove the camshaft. <Ref. to ME(H4DOTC)-52, REMOVAL, Camshaft.>

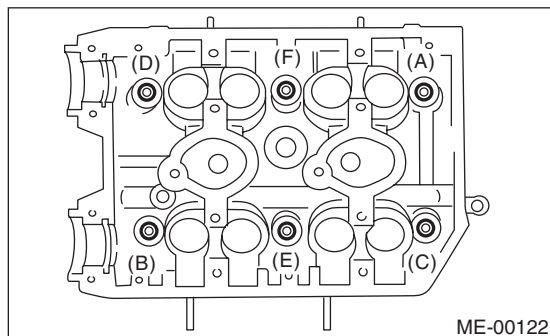
9) Remove the cylinder head bolts in alphabetical sequence shown in the figure.

Leave the bolts (A) and (D) 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.

Remove the bolts (A) and (D) to remove cylinder head.



11) Remove the cylinder head gasket.

### CAUTION:

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

12) Similarly, remove the cylinder head (RH).

### 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°.**

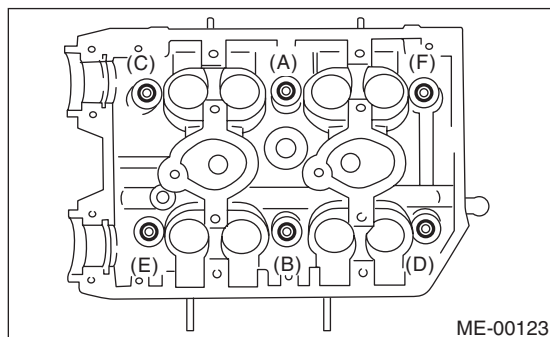
# Cylinder Head

## MECHANICAL

(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 camshaft. <Ref. to ME(H4DOTC)-53, INSTALLATION, Camshaft.>

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

4) Install the intake manifold.

<Ref. to FU(H4DOTC)-13, INSTALLATION, Intake Manifold.>

5) Install the cam sprocket.

<Ref. to ME(H4DOTC)-50, INSTALLATION, Cam Sprocket.>

6) Install the timing belt.

<Ref. to ME(H4DOTC)-44, INSTALLATION, Timing Belt.>

7) Install the timing belt cover.

<Ref. to ME(H4DOTC)-41, INSTALLATION, Timing Belt Cover.>

8) Install the crank pulley.

<Ref. to ME(H4DOTC)-39, INSTALLATION, Crank Pulley.>

9) Install the V-belts. <Ref. to ME(H4DOTC)-37, INSTALLATION, V-belt.>

## C: DISASSEMBLY

1) Remove the valve lifter.

2) Compress the valve spring and remove the valve spring retainer key. Remove each valve and valve spring.

ST1 498267600 CYLINDER HEAD TABLE

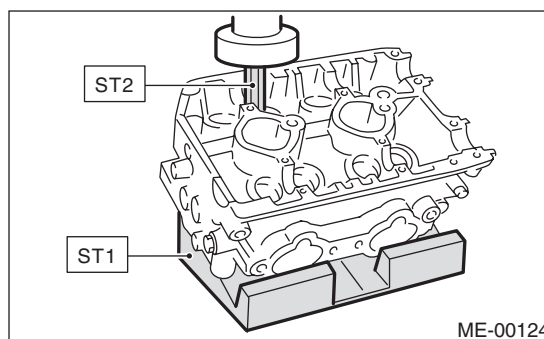
ST2 499718000 VALVE SPRING REMOVER

### NOTE:

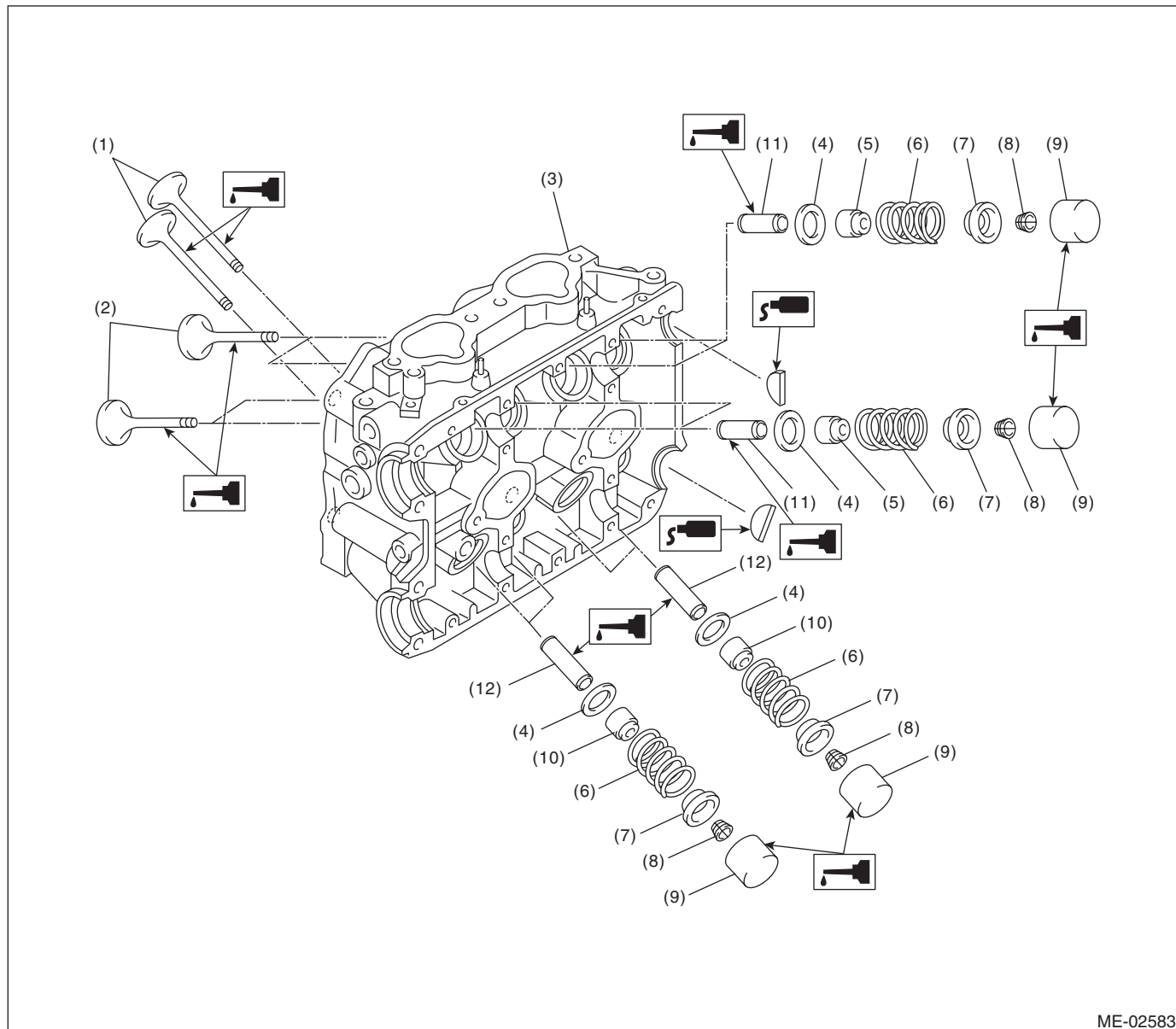
Keep all the removed parts in order for re-installing in their original positions.

### CAUTION:

- Mark each valve to prevent confusion.
- Pay careful attention not to damage the lips of intake valve oil seals and exhaust valve oil seals.



## D: ASSEMBLY



ME-02583

- |                       |                           |                             |
|-----------------------|---------------------------|-----------------------------|
| (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) Retainer              | (11) Intake valve guide     |
| (4) Valve spring seat | (8) Retainer key          | (12) Exhaust valve guide    |

# Cylinder Head

## MECHANICAL

- 1) Installation of valve spring and valve:
  - (1) Coat the stem of each valve with engine oil and insert the valve into valve guide.

### NOTE:

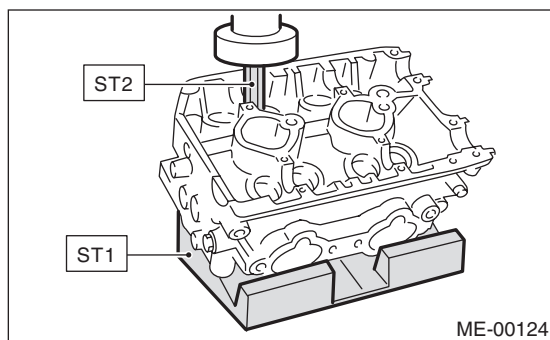
When inserting the valve into valve guide, use special care not to damage the oil seal lip.

- (2) Set the cylinder head on ST1.
- (3) Install the valve spring and retainer using ST2.

ST1 498267600 CYLINDER HEAD TABLE  
ST2 499718000 VALVE SPRING REMOVER

### NOTE:

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



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

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

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

#### Warp limit:

**0.035 mm (0.0014 in)**

#### Grinding limit:

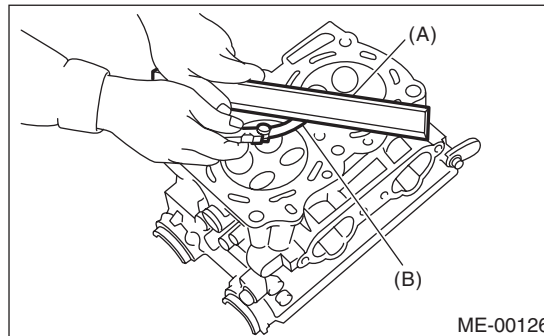
**0.3 mm (0.012 in)**

#### Standard height of cylinder head:

**127.5 mm (5.02 in)**

### NOTE:

Uneven torque for the cylinder head nuts 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

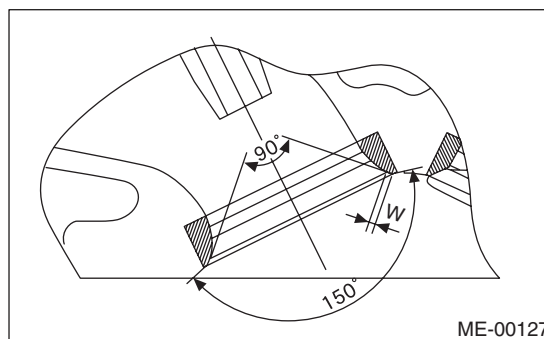
###### Standard

**0.6 — 1.4 mm (0.024 — 0.055 in)**

##### Exhaust

###### Standard

**1.2 — 1.8 mm (0.047 — 0.071 in)**



### 3. VALVE GUIDE

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

#### 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 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)**

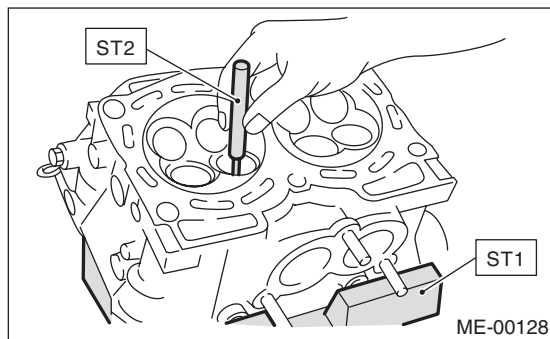
**Exhaust**

**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.

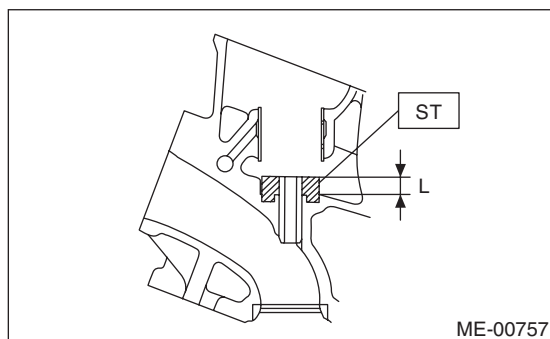
(2) Insert the ST2 into valve guide and press it down to remove the valve guide.

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.

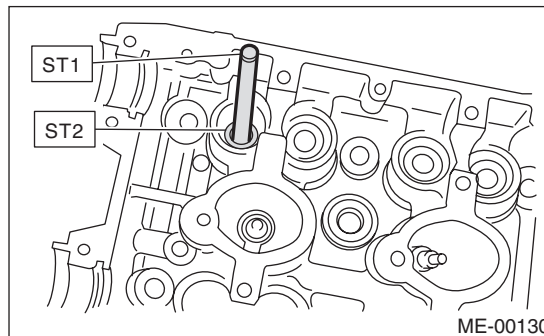
ST 18251AA020 VALVE GUIDE ADJUSTER



(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 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 499767200 VALVE GUIDE REMOVER  
ST2 18251AA020 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

**Valve guide protrusion L:**

**15.8 — 16.2 mm (0.622 — 0.638 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. After reaming, clean the valve guide to remove chips.

ST 499767400 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) Recheck the contact condition between valve and valve seat after replacing the valve guide.

# Cylinder Head

MECHANICAL

## 4. INTAKE AND EXHAUST VALVE

1) Inspect the flange and stem of the valve, and replace if damaged, worn or deformed, or if H exceeds the standard or there is uneven wear.

**H:**

**Standard (Intake)**

**1.0 — 1.4 mm (0.039 — 0.055 in)**

**Standard (Exhaust)**

**1.3 — 1.7 mm (0.051 — 0.067 in)**

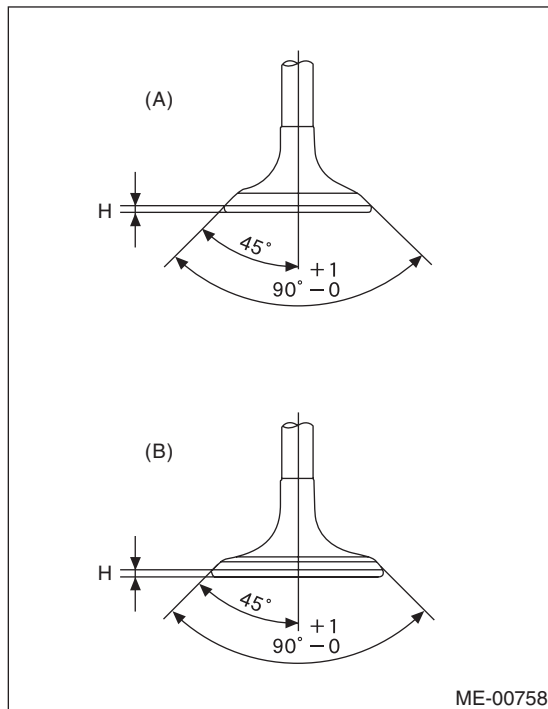
**Valve overall length:**

**Intake**

**104.4 mm (4.110 in)**

**Exhaust**

**104.65 mm (4.1201 in)**



(A) Intake

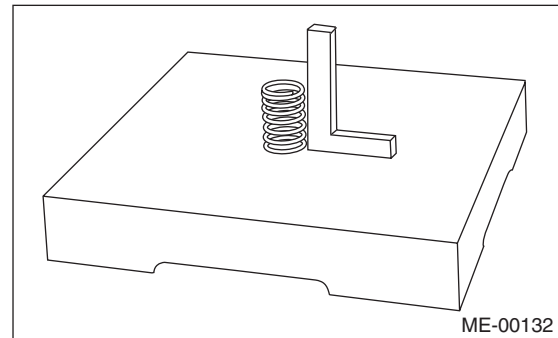
(B) Exhaust

## 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 spring on a surface plate and measure its deflection at the top of spring using a try square.

Free length	mm (in)	47.32 (1.863)
Tension/spring height N (kgf, lb)/mm (in)	Set	205 — 235 (20.9 — 24.0, 46.1 — 52.8)/36.0 (1.417)
	Lift	426 — 490 (43.4 — 50.0, 95.8 — 110)/26.50 (1.041)
Squareness		2.5°, 2.1 mm (0.083 in)



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

## 6. INTAKE AND EXHAUST VALVE OIL SEAL

In the following case, pinch and remove the oil seal from valve using pliers, and then replace it 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 sheet.
  - When replacing the intake valve guide.
- 1) Place the cylinder head on ST1.
  - 2) Using the ST2, press-fit the oil seal.

### NOTE:

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

ST1 498267600 CYLINDER HEAD TABLE  
ST2 498857100 VALVE OIL SEAL GUIDE

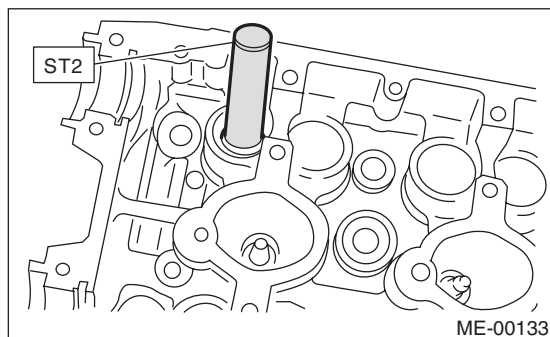
### CAUTION:

**Differentiate between the intake valve oil seal and exhaust valve oil seal by noting their difference in color.**

### Color of rubber part:

**Intake [Gray]**

**Exhaust [Green]**

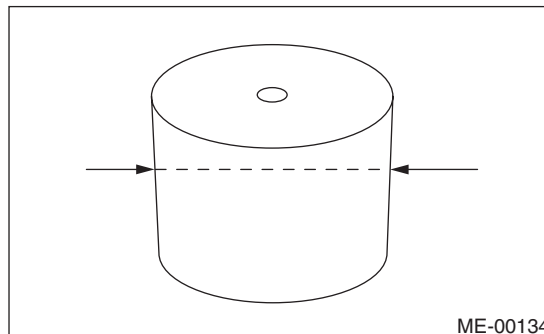


## 7. VALVE LIFTER

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

### Outer diameter:

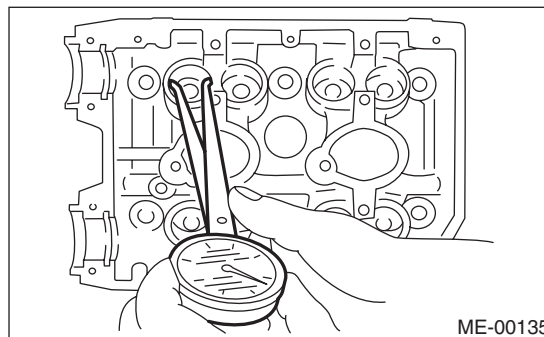
**34.959 — 34.975 mm (1.3763 — 1.3770 in)**



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

### Inner diameter:

**34.994 — 35.016 mm (1.3777 — 1.3786 in)**



### NOTE:

If difference between outer diameter of valve lifter and inner diameter of its mating surface is not within the standard or there is uneven wear, replace the cylinder head.

### Standard:

**0.019 — 0.057 mm (0.0007 — 0.0022 in)**

## F: DISPOSAL

### CAUTION:

- **Metallic sodium is enclosed in the exhaust valve. Metallic sodium is extremely alkaline and may produce severe chemical reactions. Full consideration must therefore be given to the following points when handling or disposing of the valve.**

- **Since metallic sodium may cause blindness if contacted with eyes, burns if contacted with the skin, and fire, do not deliberately take the valve apart.**

1) If the valve is damaged, remove the valve and neutralize it by immersing it in water, and dispose of it in the same way that general steel materials are disposed of. The disposal method is described in the following.

(1) Wearing rubber gloves, remove the damaged valve from the cylinder head.

(2) Prepare a large receptacle (bucket or other container) in a well ventilated location, and fill the receptacle with water. (at least 10 liters)

(3) Immerse the damaged valve in the receptacle.

### CAUTION:

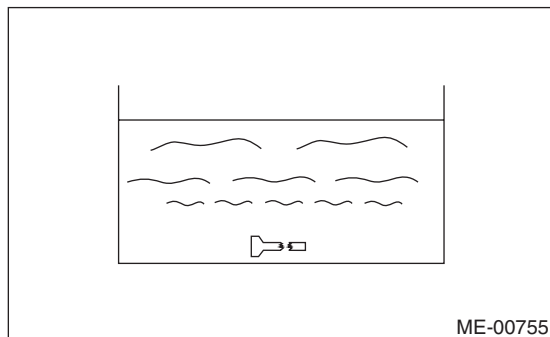
**A severe reaction may occur, so stand at least 2 — 3 m from the receptacle. Because the reaction will produce hydrogen gas, moreover, keep the receptacle away from sparks or flames.**

(4) Once the reaction is completed (about 4 — 5 hours have elapsed), carefully remove the valve using large pincers so that the reaction liquid does not contact your skin, and dispose of it with other parts that are being disposed of.

(5) The reaction liquid is a strong alkaline solution, so it must be disposed of in accordance with local regulations.

### CAUTION:

**Make sure the reaction liquid does not contact your skin. If contact with skin occurs, immediately wash the affected area with large quantities of water.**



ME-00755