

4. Cylinder Head

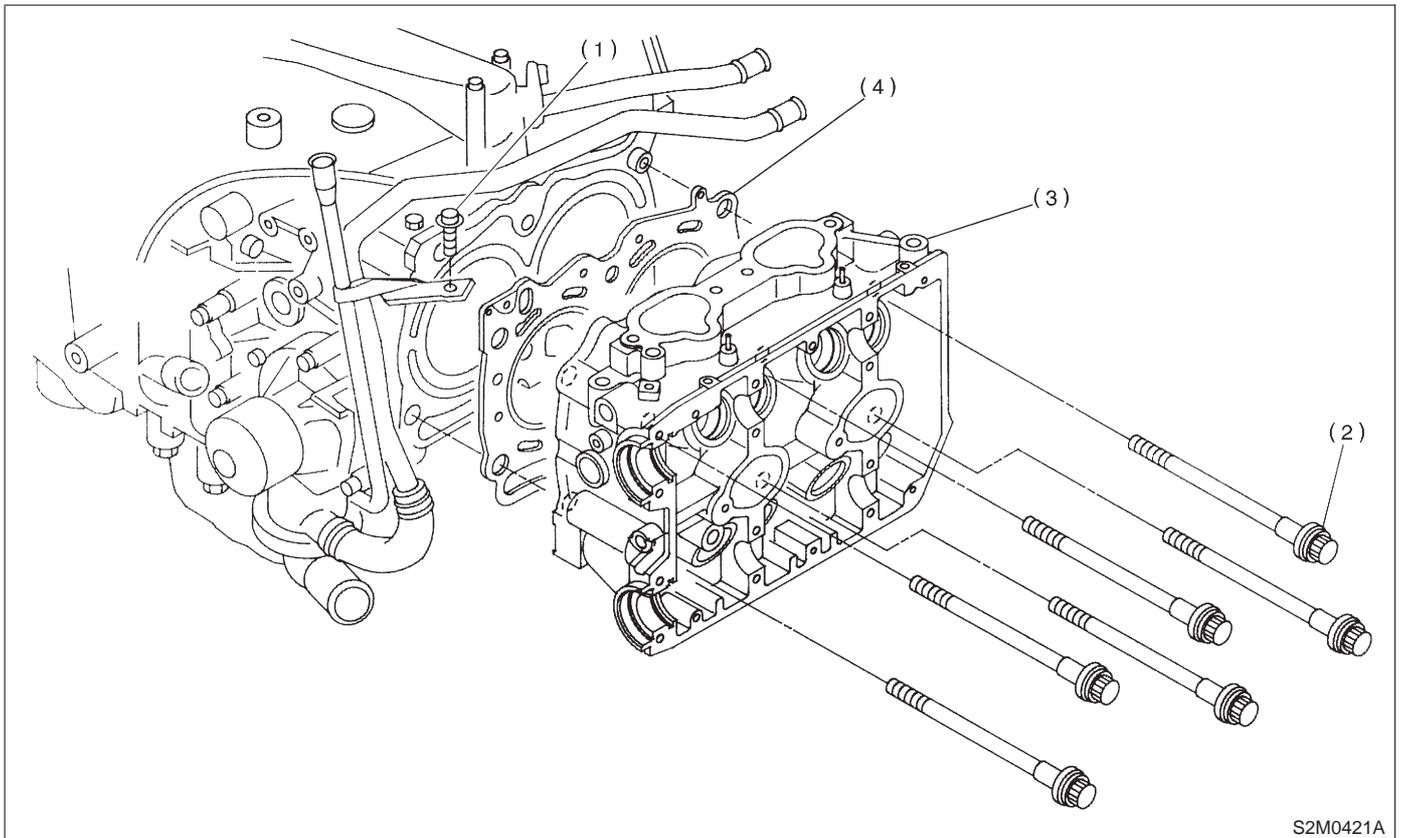
A: REMOVAL

1. RELATED PARTS

- 1) Remove V-belt.
- 2) Remove generator, air conditioner compressor and brackets.
- 3) Remove hoses and tubes from cylinder block.
- 4) Disconnect each connector and/or remove connector bracket.

- 5) Remove intake manifold assembly and gasket.
- 6) Remove camshaft position sensor.
- 7) Remove timing belt, camshaft sprockets and related parts.
<Ref. to 2-3b [W2A0].>
- 8) Remove rocker cover, camshafts and related parts.
<Ref. to 2-3b [W3A2].>

2. CYLINDER HEAD

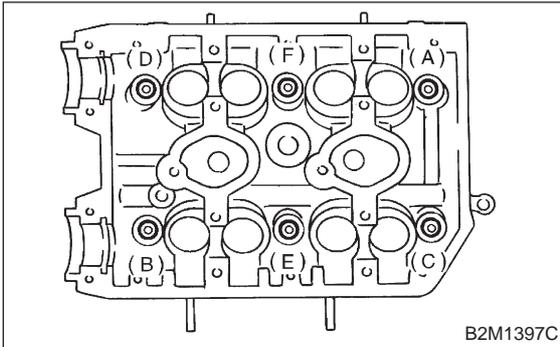


- | | |
|------------------------|--------------------------|
| (1) Bolt | (3) Cylinder head |
| (2) Cylinder head bolt | (4) Cylinder head gasket |

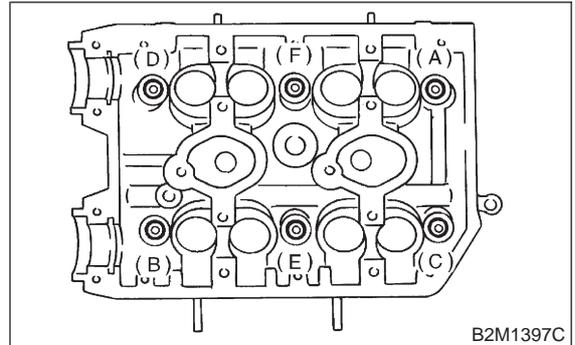
- 1) Remove oil level gauge guide attaching bolt (LH side only).

2) Remove cylinder head bolts in alphabetical sequence shown in figure.

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

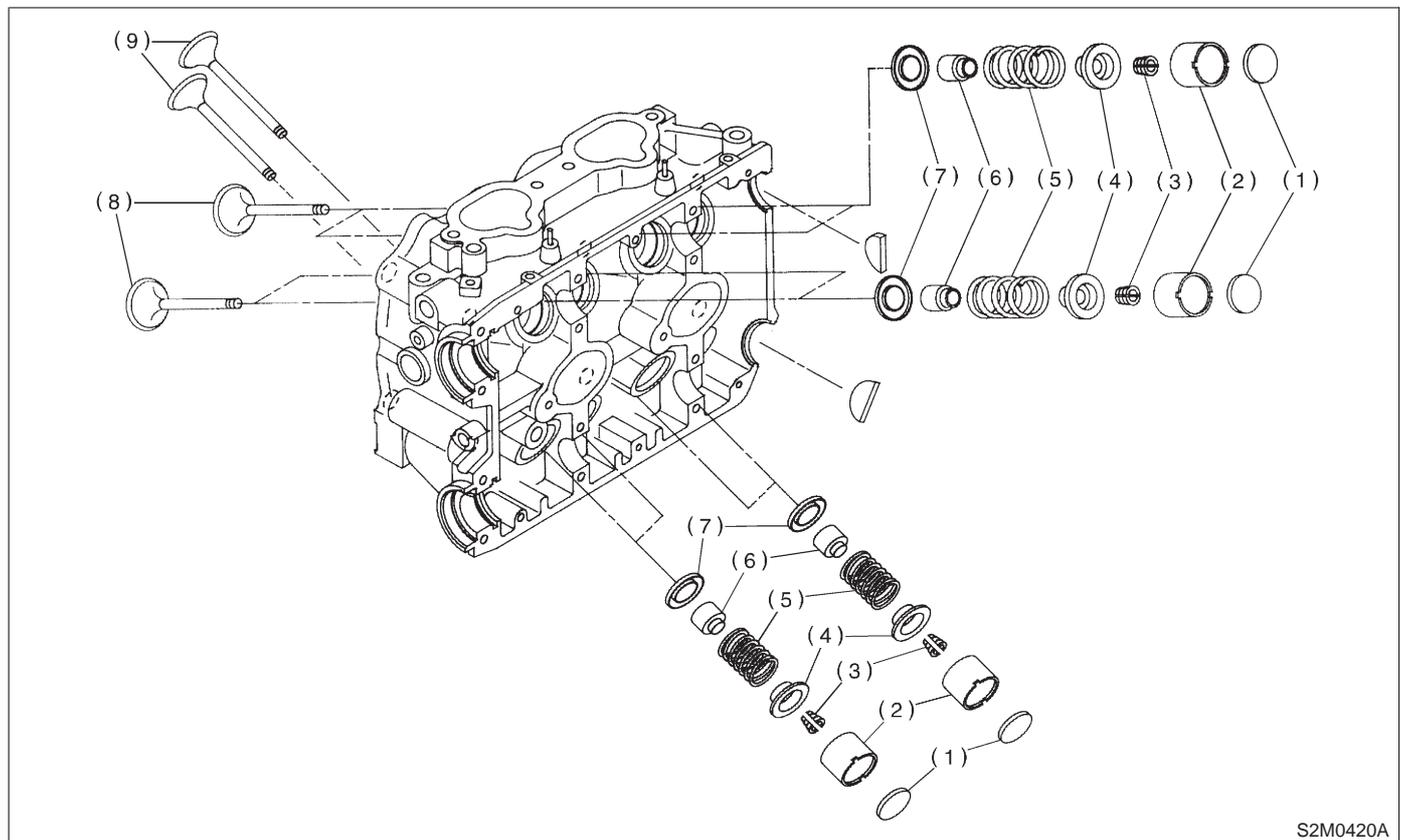


3) While tapping cylinder head with a plastic hammer, separate it from cylinder block.
Remove bolts (A) and (D) to remove cylinder head.



4) Remove cylinder head gasket.
5) Similarly, remove right-hand cylinder head.

B: DISASSEMBLY



- | | | |
|------------------------|--------------------|-----------------------|
| (1) Valve shim | (4) Valve retainer | (7) Valve spring seat |
| (2) Valve lifter | (5) Valve spring | (8) Intake valve |
| (3) Valve retainer key | (6) Valve oil seal | (9) Exhaust valve |

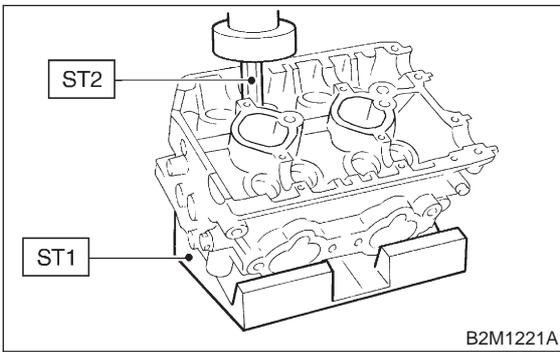
1) Remove valve shims and valve lifters.

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

CAUTION:

- Keep removed parts in order for re-installing in their original positions.
- Mark each valve to prevent confusion.
- Use extreme care not to damage the lips of the intake valve oil seals and exhaust valve oil seals.



C: INSPECTION

1. CYLINDER HEAD

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

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

If the warping exceeds 0.05 mm (0.0020 in), grind the surface with a surface grinder.

Warping limit:

0.05 mm (0.0020 in)

Grinding limit:

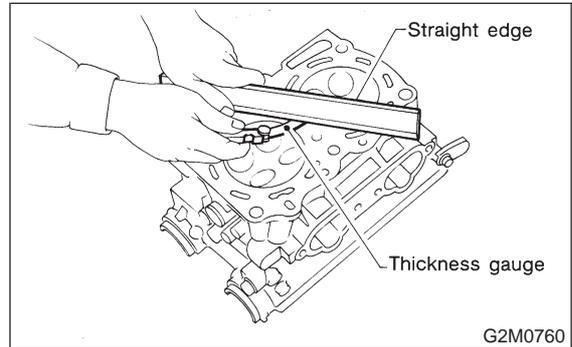
0.3 mm (0.012 in)

Standard height of cylinder head:

127.5 mm (5.02 in)

CAUTION:

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



2. VALVE SEAT

Inspect intake and exhaust valve seats, and correct the contact surfaces with 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)

Limit

1.7 mm (0.067 in)

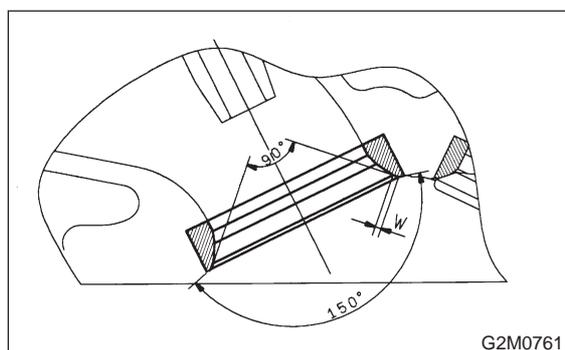
Exhaust

Standard

1.5 mm (0.059 in)

Limit

2.2 mm (0.087 in)



3. 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.

Clearance between the valve guide and valve stem:

Standard

Intake

0.035 — 0.062 mm (0.0014 — 0.0024 in)

Exhaust

0.040 — 0.067 mm (0.0016 — 0.0026 in)

Limit

0.15 mm (0.0059 in)

Valve guide inner diameter:

6.000 — 6.015 mm (0.2362 — 0.2368 in)

Valve stem outer diameter:

Intake

5.950 — 5.965 mm (0.2343 — 0.2348 in)

Exhaust

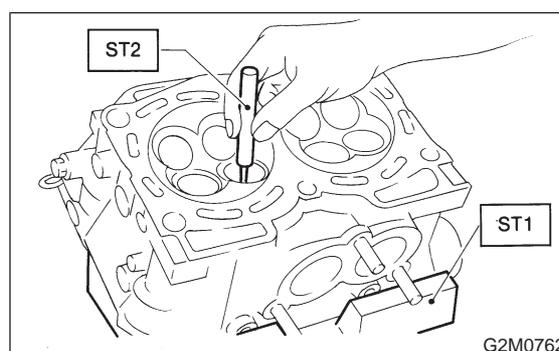
5.950 — 5.965 mm (0.2343 — 0.2348 in)

2) If the clearance between valve guide and stem exceeds the specification, replace guide as follows:

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

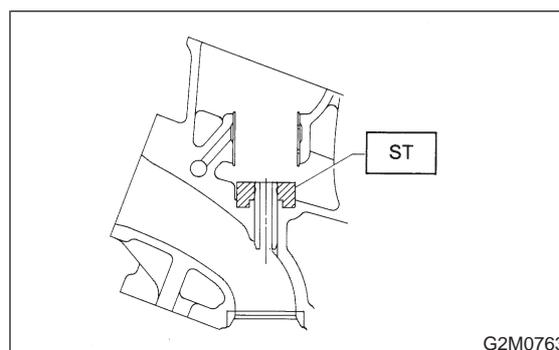
(2) Insert ST2 into valve guide and press it down to remove valve guide.

ST1 498267600 CYLINDER HEAD TABLE
ST2 499767200 VALVE GUIDE REMOVER



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

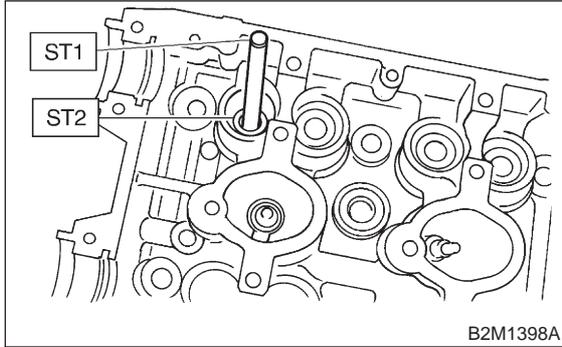
ST 498267700 VALVE GUIDE ADJUSTER



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

(5) Put new valve guide, coated with sufficient oil, in cylinder, and insert 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 498267700 VALVE GUIDE ADJUSTER



(6) Check the valve guide protrusion.

Valve guide protrusion: L
12.0 — 12.4 mm (0.472 — 0.488 in)

(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. After reaming, clean valve guide to remove chips.

ST 499767400 VALVE GUIDE REAMER

CAUTION:

- Apply engine oil to the reamer when reaming.
- 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 chips, use a new reamer or remedy the reamer.

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

4. 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:

Intake

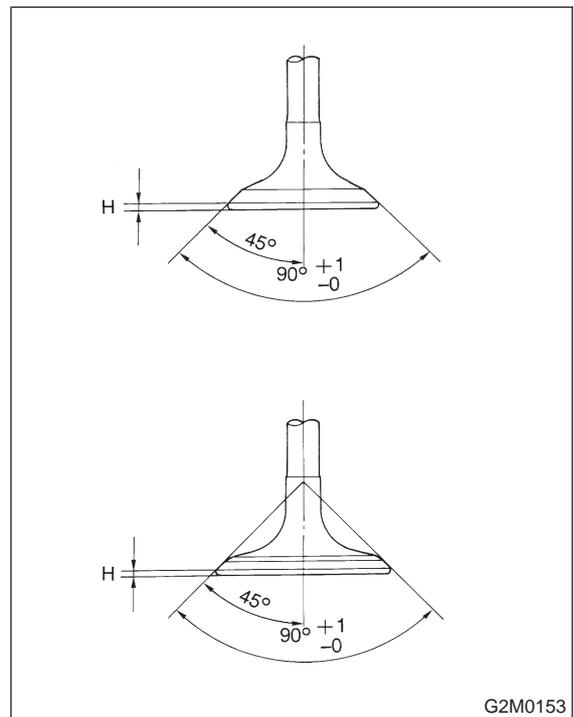
Standard
1.2 mm (0.047 in)
Limit
0.8 mm (0.031 in)

Exhaust

Standard
1.5 mm (0.059 in)
Limit
0.8 mm (0.031 in)

Valve overall length:

Intake
105.9 mm (4.169 in)
Exhaust
106.2 mm (4.181 in)

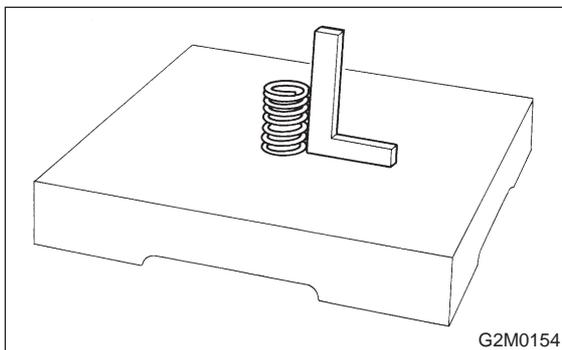


2) Put a small amount of grinding compound on the seat surface and lap the valve and seat surface. Install a new intake valve oil seal after lapping.

5. VALVE SPRINGS

- 1) Check valve springs for damage, free length, and tension. Replace valve spring if it is not to the specifications 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 using a try square.

	Valve spring
Free length	39.8 mm (1.567 in)
Tension/spring height	228.5 — 261.8 N (23.3 — 26.7 kg, 51.4 — 58.9 lb)/31.0 mm (1.220 in)
	462.9 — 531.5 N (47.2 — 54.2 kg, 104.1 — 119.5 lb)/23.2 mm (0.913 in)
Squareness	2.5°, 1.7 mm (0.067 in)



6. INTAKE AND EXHAUST VALVE OIL SEAL

Replace oil seal with new one, if lip is damaged or spring out of place, or when the surfaces of intake valve and valve seat are reconditioned or intake valve guide is replaced.

- 1) Place cylinder head on ST1.
- 2) Press in oil seal to the specified dimension indicated in the figure by using ST2.

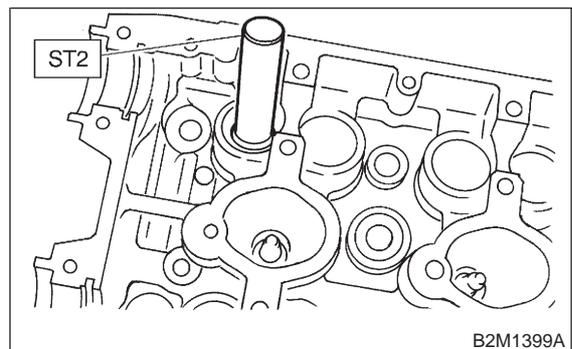
ST1 498267600 CYLINDER HEAD TABLE
ST2 498857100 VALVE OIL SEAL GUIDE

CAUTION:

- Apply engine oil to oil seal before force-fitting.
- Differentiate between intake valve oil seal and exhaust valve oil seal by noting their difference in color.

Color of rubber part:
Intake [Black]
Exhaust [Brown]

Color of spring part:
Intake [Silver]
Exhaust [Silver]

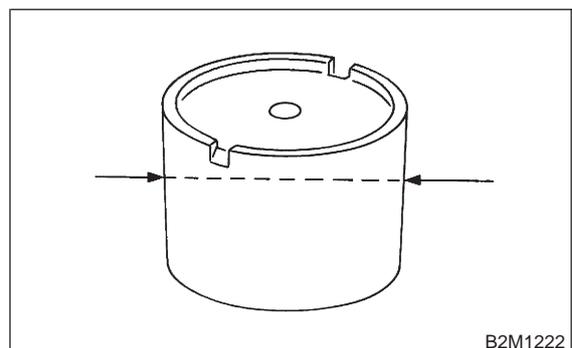


7. VALVE LIFTER

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

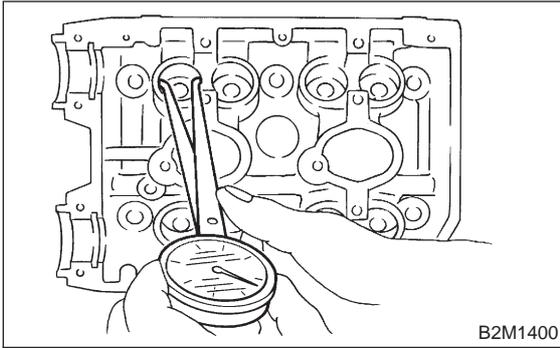
Outer diameter:

32.959 — 32.975 mm (1.2976 — 1.2982 in)



3) Measure inner diameter of valve lifter mating part on cylinder head.

Inner diameter:
32.994 — 33.016 mm (1.2990 — 1.2998 in)

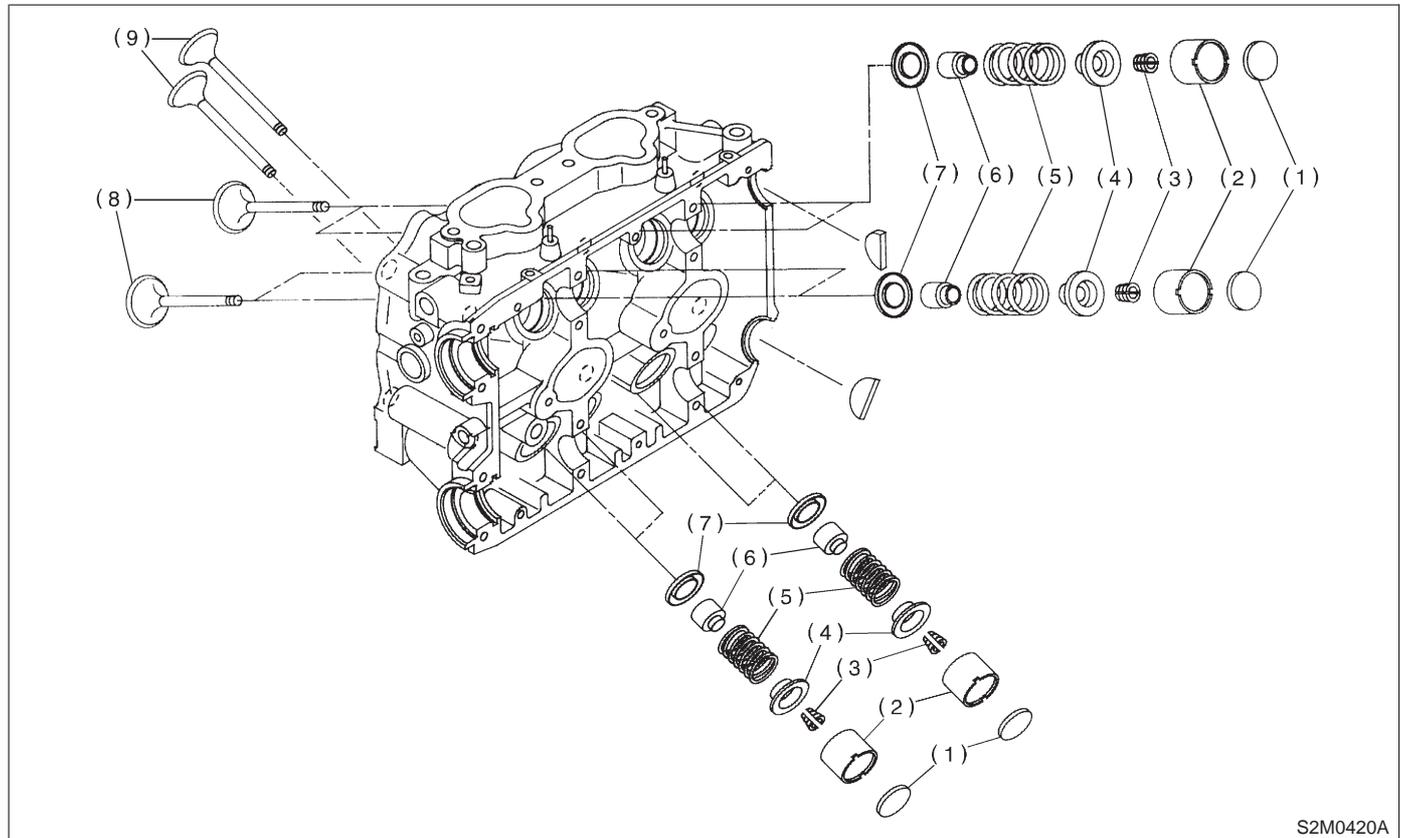


CAUTION:
If difference between outer diameter of valve lifter and inner diameter of valve lifter mating part is over the limit, replace cylinder head.

Standard:
0.019 — 0.057 mm (0.0007 — 0.0022 in)

Limit:
0.100 mm (0.0039 in)

D: ASSEMBLY



- | | | |
|------------------------|--------------------|-----------------------|
| (1) Valve shim | (4) Valve retainer | (7) Valve spring seat |
| (2) Valve lifter | (5) Valve spring | (8) Intake valve |
| (3) Valve retainer key | (6) Valve oil seal | (9) Exhaust valve |

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

CAUTION:

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

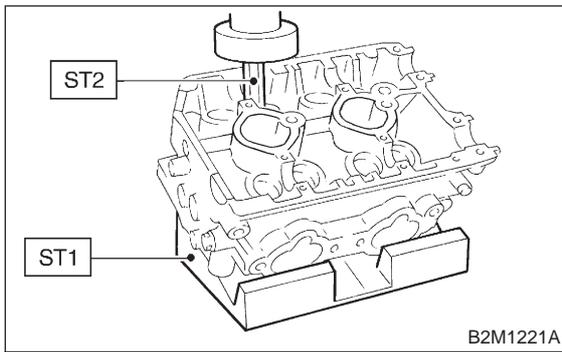
- (2) Set cylinder head on ST1.
- (3) Install valve spring and retainer using ST2.

ST1 498267600 CYLINDER HEAD TABLE

ST2 499718000 VALVE SPRING REMOVER

CAUTION:

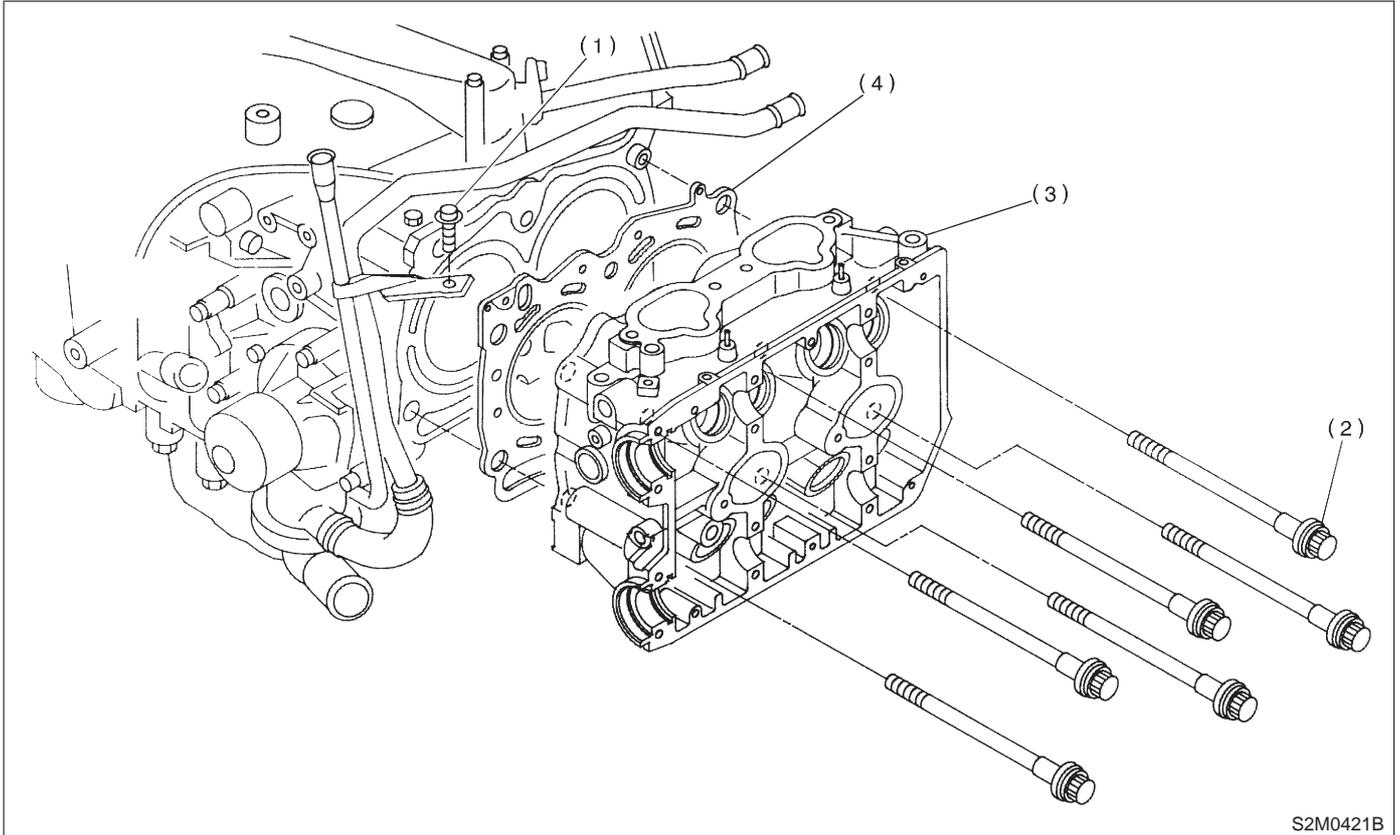
Be sure to install the valve springs with their close-coiled end facing the seat on the cylinder head.



- (4) Compress valve spring and fit valve spring retainer key.
 - (5) After installing, tap valve spring retainers lightly with wooden hammer for better seating.
- 2) Install valve lifter and valve shim.

E: INSTALLATION

1. CYLINDER HEAD



- (1) Bolt
- (2) Cylinder head bolt
- (3) Cylinder head
- (4) Cylinder head gasket

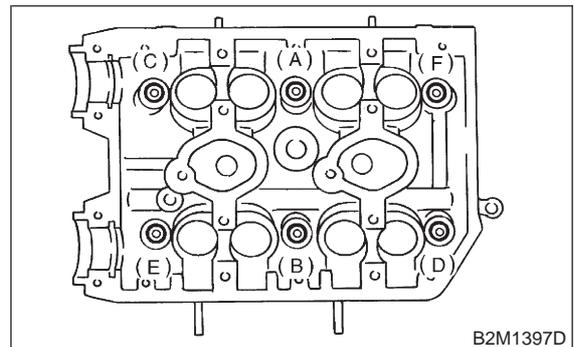
1) Install cylinder head and gaskets on cylinder block.

(4) Tighten bolts (A) and (B) to 34 N·m (3.5 kg·m, 25 ft·lb).

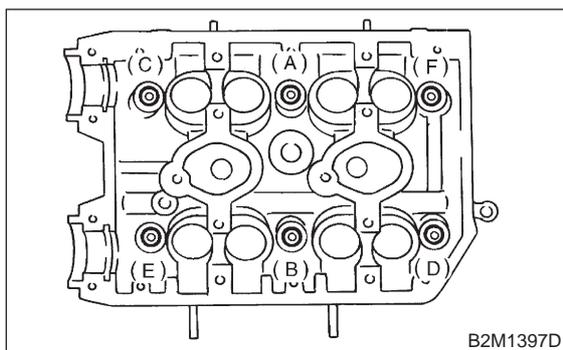
CAUTION:

Use new cylinder head gaskets.

- 2) Tighten cylinder head bolts.
 - (1) Apply a coat of engine oil to washers and bolt threads.
 - (2) Tighten all bolts to 29 N·m (3.0 kg·m, 22 ft·lb) in alphabetical sequence.
 - Then tighten all bolts to 69 N·m (7.0 kg·m, 51 ft·lb) in alphabetical sequence.
 - (3) Back off all bolts by 180° first; back them off by 180° again.



(5) Tighten bolts (C), (D), (E) and (F) to 15 N·m (1.5 kg-m, 11 ft-lb).



(6) Tighten all bolts by 80 to 90° in alphabetical sequence.

CAUTION:

Do not tighten bolts more than 90°.

(7) Further tighten all bolts by 80 to 90° in alphabetical sequence.

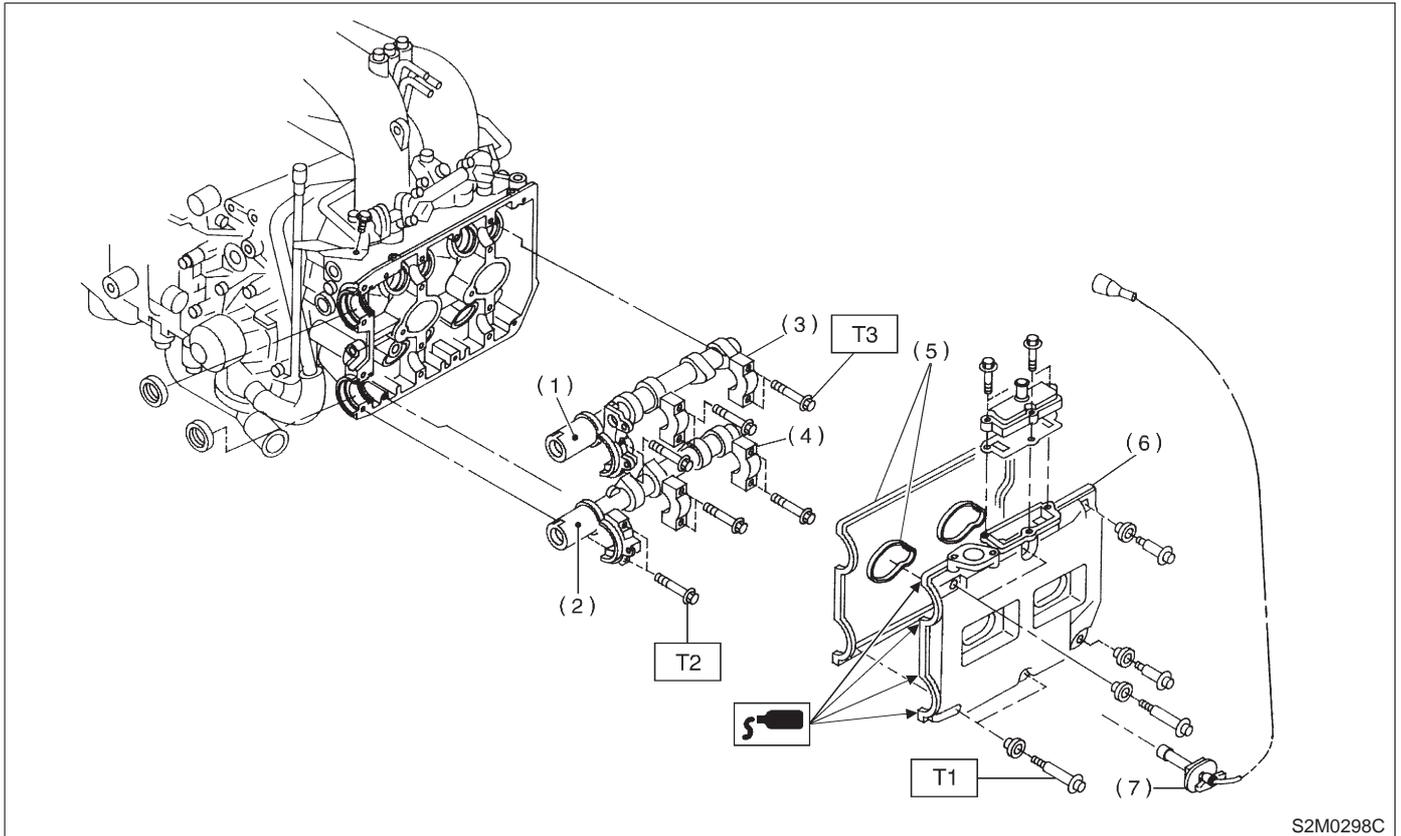
CAUTION:

Ensure that the total “re-tightening angle” [in the two previous steps] do not exceed 180°.

3) Install oil level gauge guide attaching bolt (LH side only).

2. RELATED PARTS

1) Install camshafts, rocker cover and related parts.
<Ref. to 2-3b [W3C1].>



- | | |
|-------------------------------|-----------------------|
| (1) Intake camshaft (LH) | (6) Rocker cover (LH) |
| (2) Exhaust camshaft (LH) | (7) Spark plug cord |
| (3) Intake camshaft cap (LH) | |
| (4) Exhaust camshaft cap (LH) | |
| (5) Rocker cover gasket (LH) | |

Tightening torque: N·m (kg·m, ft·lb)

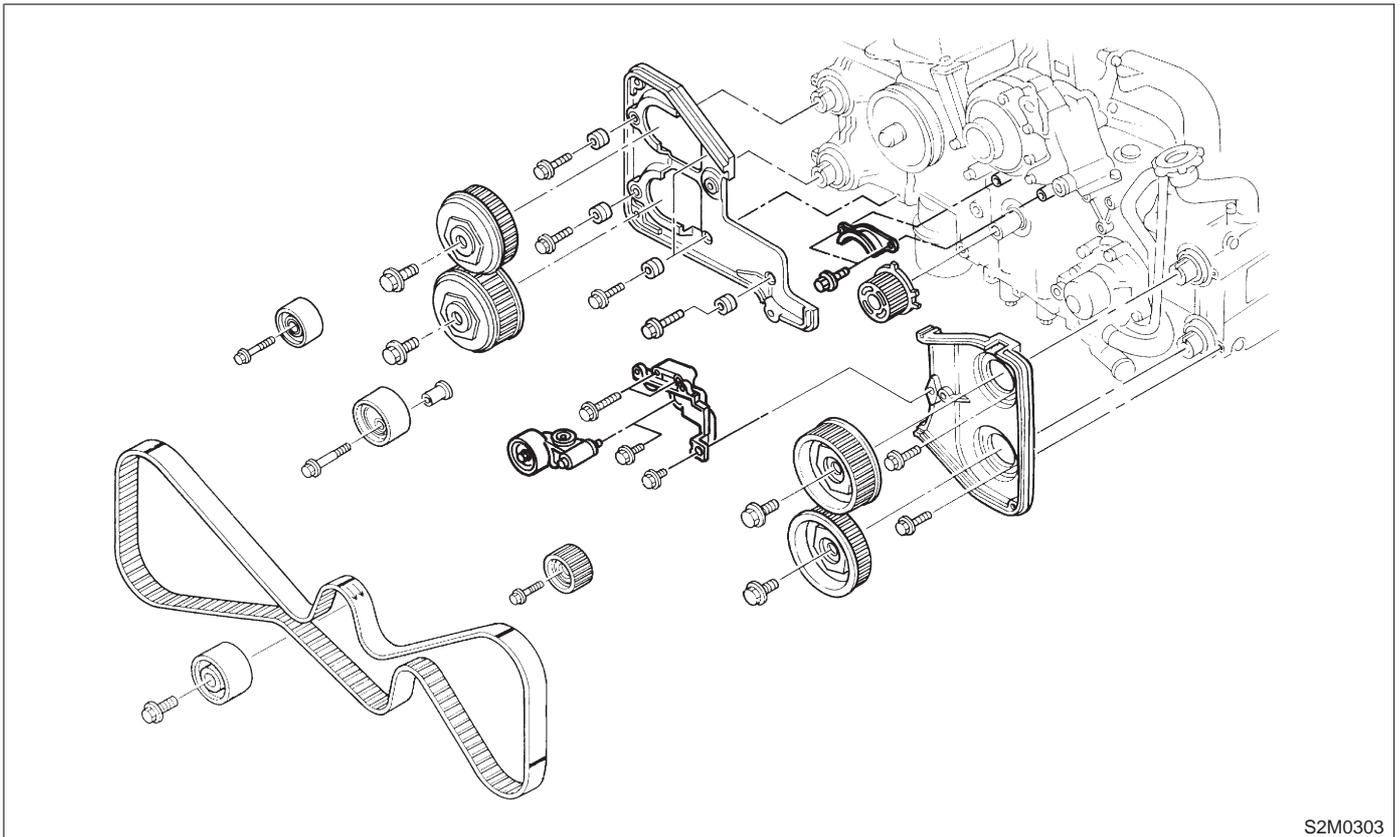
T1: 4.9±0.5 (0.5±0.05, 3.6±0.4)

T2: 10±0.7 (1.0±0.07, 7.2±0.5)

T3: 20±2 (2.0±0.2, 14.5±1.4)

2) Similarly, install parts on right-hand side.

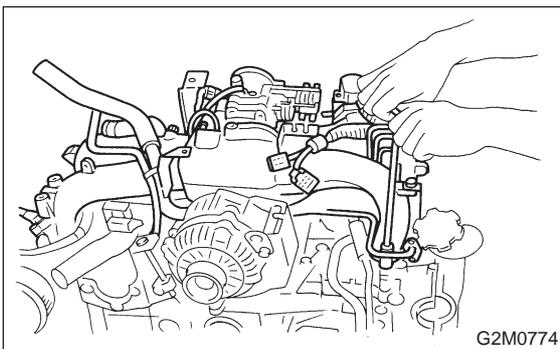
3) Install camshaft sprockets, timing belt and related parts.
<Ref. to 2-3b [W2C1].>



S2M0303

4) Install intake manifold.

CAUTION:
Use new gaskets.



G2M0774

5) Install camshaft position sensor. Use dry compressed air to remove foreign particles before installing sensor.

6) Connect each connector and/or install connector bracket.

7) Connect hoses and tubes to cylinder block.

8) Install brackets, generator and air conditioner compressor.

9) Install V-belt.