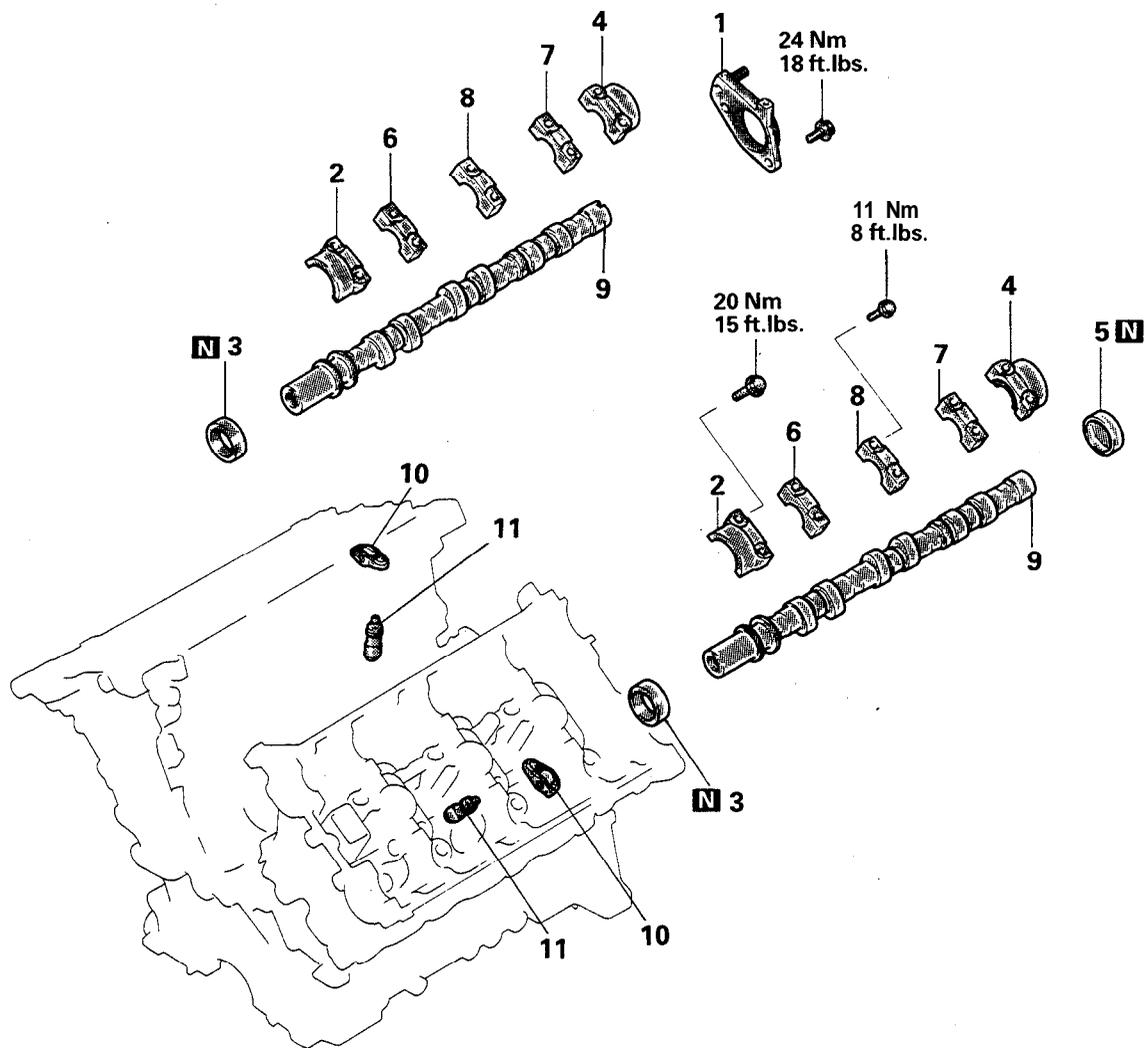


ROCKER ARM AND CAMSHAFT

REMOVAL AND INSTALLATION



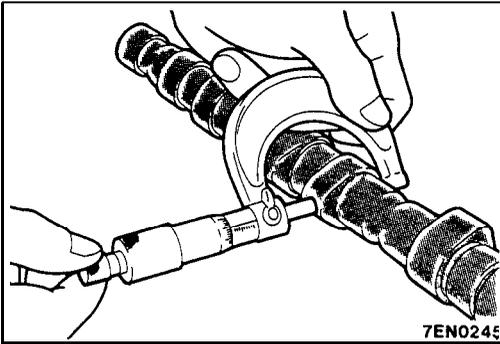
7EN0244

Removal steps

1. Crank angle sensor adaptor
2. Bearing cap front
3. Oil seal
4. Bearing cap rear
5. Circular packing
6. Bearing cap No. 2
7. Bearing cap No. 4
8. Bearing cap No. 3
9. Camshaft
10. Rocker arm
11. Lash adjuster

Installation steps

11. Lash adjuster
10. Rocker arm
- * 9. Camshaft
- ◆◆ 8. Bearing cap No. 3
- * 7. Bearing cap No. 4
- * 6. Bearing cap No. 2
- ◆◆ 4. Bearing cap rear
- ◆◆ 2. Bearing cap front
- ◆◆ 5. Circular packing
- 4 3. Oil seal
1. Crank angle sensor adaptor



INSPECTION

M11ZCAB

CAMSHAFT

Measure cam height (longer diameter of the cam). If it exceeds the limit, replace the camshaft.

Standard value:

Intake side 35.49 mm (1.3972 in.)
 Exhaust side 35.20 mm (1.3858 in.)

Limit:

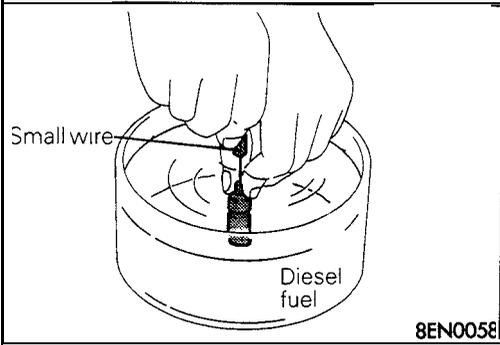
Intake side 34.99 mm (1.3776 in.)
 Exhaust side 34.70 mm (1.3661 in.)

SERVICE POINTS OF INSTALLATION

M11ZDAK

11. INSTALLATION OF LASH ADJUSTER

- (1) Immerse the lash adjuster in clean diesel fuel.
- (2) Using a small wire, move the plunger up and down 4 or 5 times while pushing down lightly in the check ball in order to bleed out the air.
- (3) Install the lash adjuster to the cylinder head.

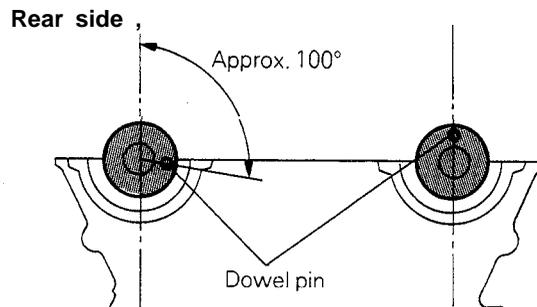
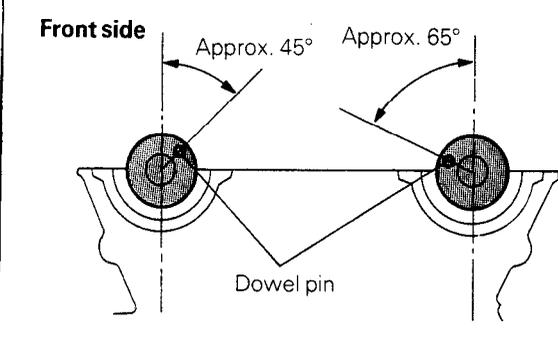
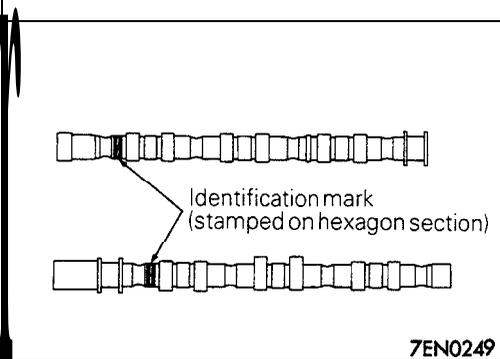


9. INSTALLATION OF CAMSHAFT

- (1) Turn the crankshaft to bring No.1 cylinder to the top dead center.
- (2) Check that the rocker arm is installed correctly on the lash adjuster and valve.
- (3) Install the camshaft noting the identification mark (stamped on the hexagon section).

**Identification mark: Intake side V
 Exhaust side C**

- (4) Install the camshafts with their dowel pins positioned as shown in the illustration.

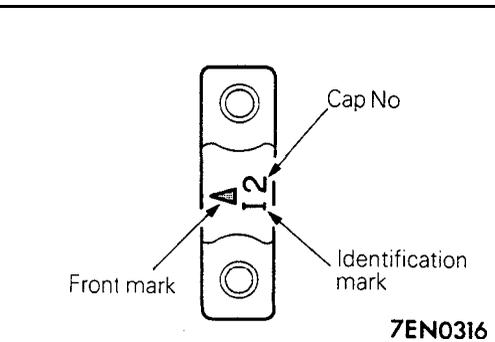


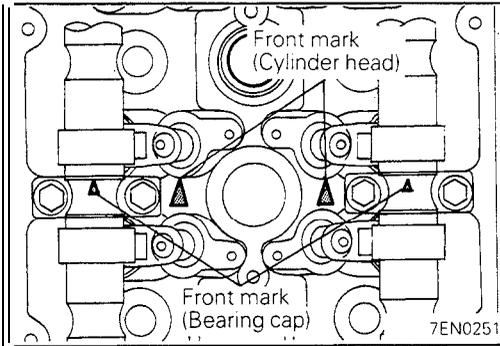
7EN0315

8. 7. 6. 4. 2. INSTALLATION OF BEARING CAPS

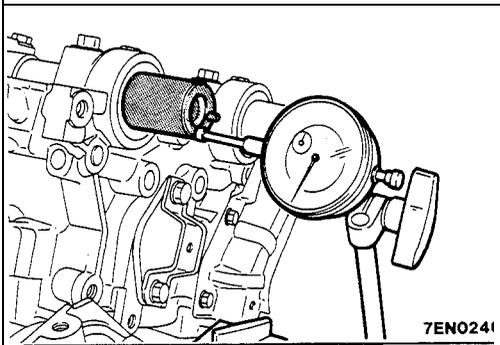
- (1) Install noting the identification mark and cap No. No.2, 3 and 4 bearing caps bear the front mark. Install these caps with the mark lined up with the front mark on the cylinder head.

**Identification mark: Intake side I
 Exhaust side E**



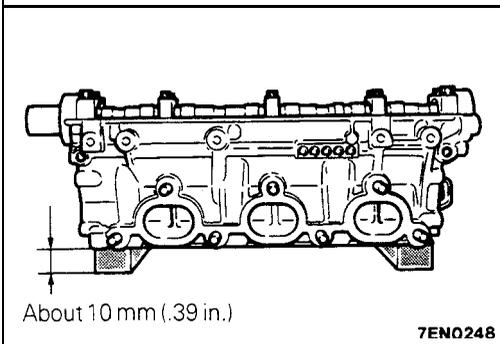


- (2) Tighten gradually in two or three steps and finally tighten to specified torque.



- (3) Measure the camshaft end play. Replace if the limit is exceeded.

Standard value: 0.1 – 0.2 mm (.004 – .008 in.)
Limit: 0.4 mm (.016 in.)



NOTE

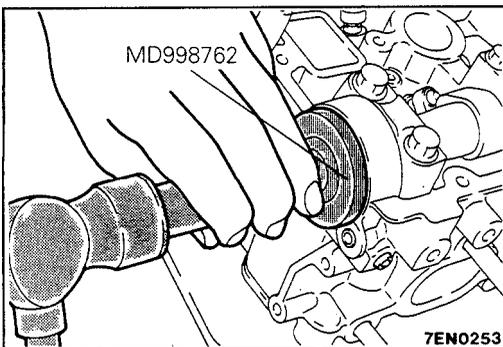
If the bearing cap is installed with the cylinder cap removed, the valve will protrude. Install, therefore, with the cylinder head lifted by about 10 mm (.39 in.).

About 10 mm (.39 in.)

7EN0248

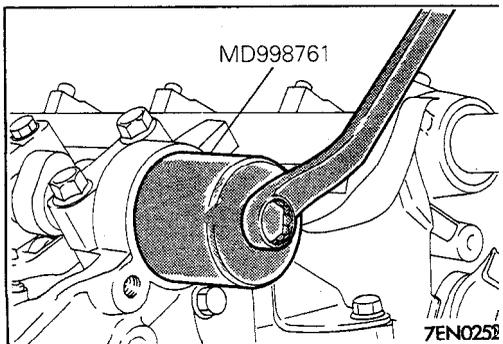
5. INSTALLATION OF CIRCULAR PACKING

Using the special tool, insert the circular packing.



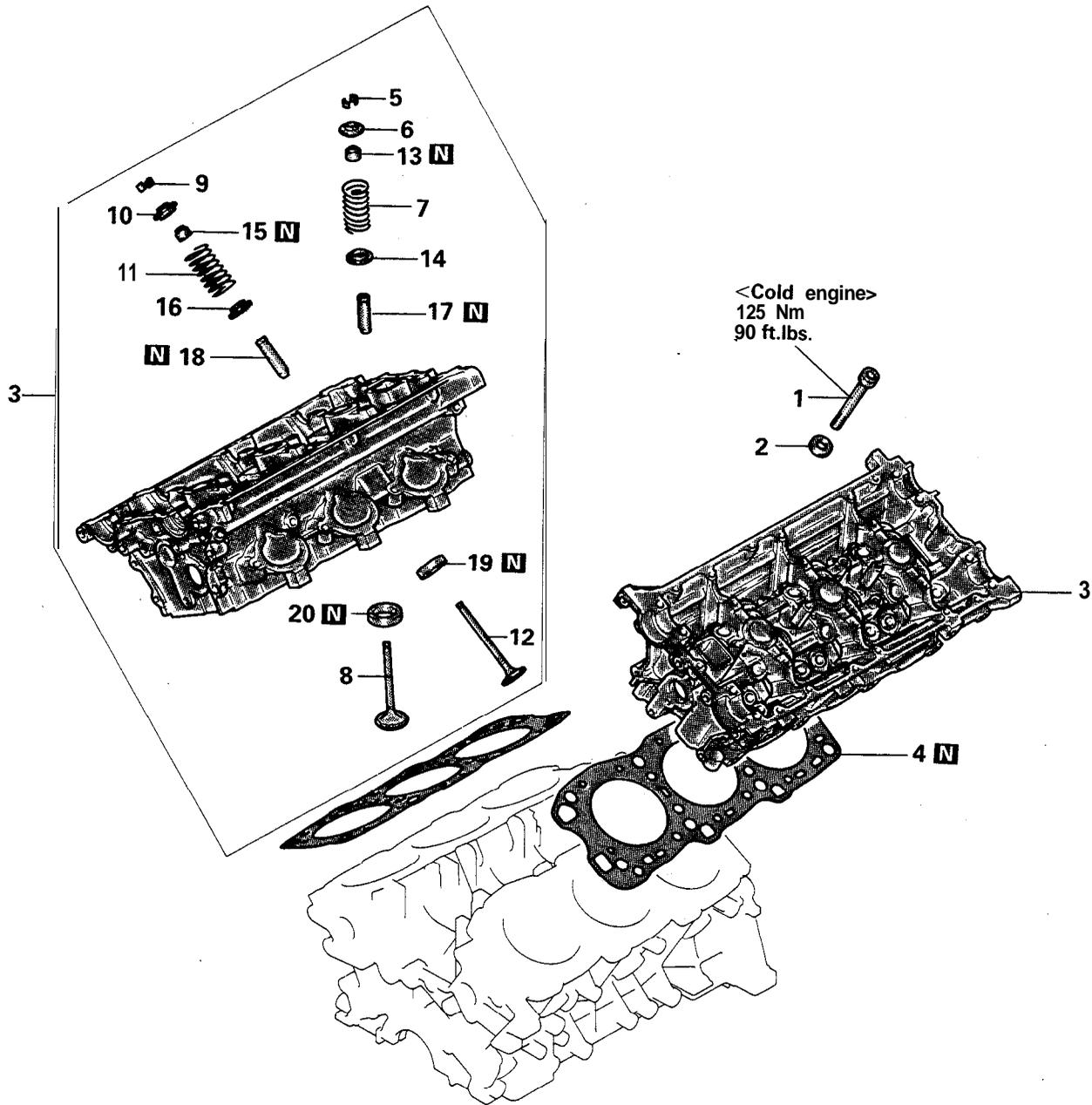
3. INSTALLATION OF OIL SEAL

Using the special tool, insert the oil seal.



CYLINDER HEAD AND VALVE

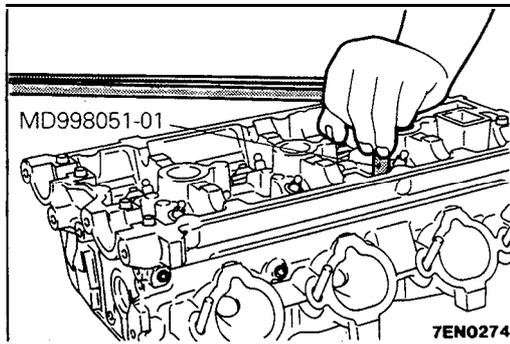
REMOVAL AND INSTALLATION



Removal steps

- * • + 1. Cylinder head bolt
- 2. Washer
- 3. Cylinder head assembly
- + 4. Cylinder head gasket
- ◆◆ • * 5. Retainer lock
- 6. Valve spring retainer
- * 7. Valve spring
- 8. Intake valve
- * • * 9. Retainer lock
- 10. Valve spring retainer
- * 11. Valve spring
- 12. Exhaust valve
- 4 13. Valve stem seal
- 14. Valve spring sheet
- ◆◆ 15. Valve stem seal
- 16. Valve spring sheet
- 17. Intake valve guide
- 18. Exhaust valve guide
- 19. Intake valve sheet
- 20. Exhaust valve sheet

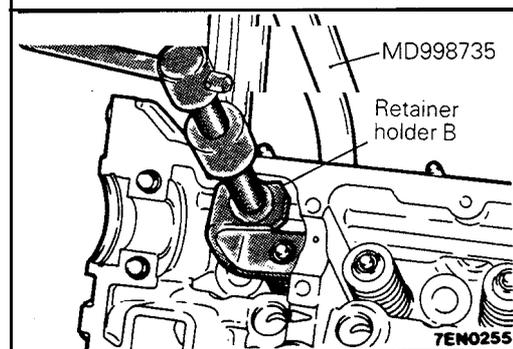
7E N0254

**SERVICE POINTS OF REMOVAL**

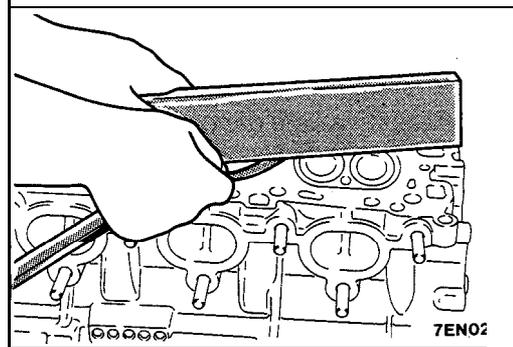
M110BAC

1. REMOVAL OF CYLINDER HEAD BOLT

Using the special tool, remove the cylinder head bolts.

**5. 9. REMOVAL OF RETAINER LOCK**

Using the special tool, remove the retainer lock.

**INSPECTION**

M110CAO

CYLINDER HEAD

- (1) Using a straight edge and feeler gauge, measure the flatness of the cylinder head gasket surface.

Standard value: 0.03 mm (.0012 in.) or less

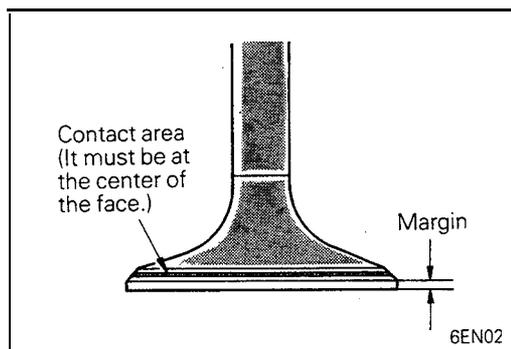
Limit: 0.2 mm (.008 in.)

- (2) If the measured flatness exceeds the limit, grind and repair the surface to gain the flatness of standard value or less.

Grinding Limit: 0.2 mm (.008 in.)

Caution

When the cylinder block is assembled, 0.2 mm (.008 in.) or less of grinding is permissible.

**VALVES**

Replace the valve if the margin (thickness of the valve head) exceeds the limit.

Standard value:

Intake side

1.0 mm (.039 in.)

Exhaust side

1.5 mm (.059 in.)

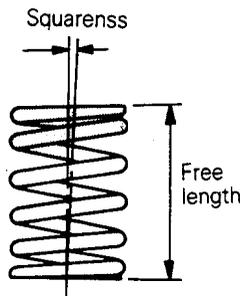
Limit:

Intake side

0.5 mm (.019 in.)

Exhaust side

1.0 mm (.039 in.)



1 EN035

VALVE SPRINGS

- (1) Check free length of each valve spring and replace if necessary.

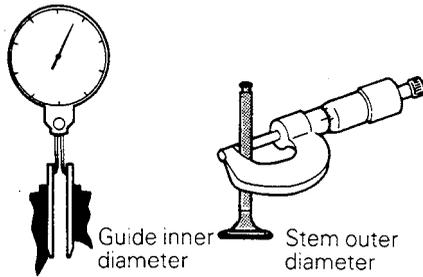
Standard value: 46.9 mm (1.846 in.)

Limit: 45.9 mm (1.807 in.)

- (2) Using a square, test squareness of each valve spring. If spring is excessively out of square, replace it.

Standard value: Less than 2°

Limit: 4



1EN296

VALVE GUIDES

Check the valve stem-to-guide clearance. If the clearance exceeds the service limit, replace the valve guide with new oversize part.

Standard value:

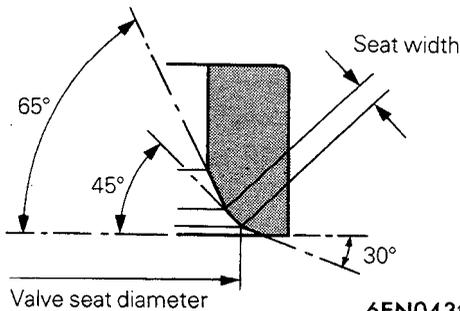
Intake 0.02 – 0.05 mm (.0008 – .0020 in.)

Exhaust 0.05 – 0.09 mm (.0020 – .0035 in.)

Limit:

Intake 0.10 mm (.0039 in.)

Exhaust 0.12 mm (.0047 in.)



6EN0431

VALVE SEAT RECONDITIONING PROCEDURES

- (1) Before valve seat reconditioning, check valve stem to guide clearance.
- (2) Recondition the valve seat with a seat grinder or cutter. The valve seat width should be the specified value at the center of the valve face.

Inspect the valve seat with prussian blue to determine where the valve contacts the seat. To do this, coat valve seat lightly with prussian blue, and then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory.

If the blue is transferred to top edge of the valve face, lower valve seat with a 30 degrees stone or cutter. If the blue is transferred to the bottom edge of valve face, raise valve seat with a 65 degrees stone or cutter.

Valve seat diameter:

Intake 34 mm (1.34 in.)

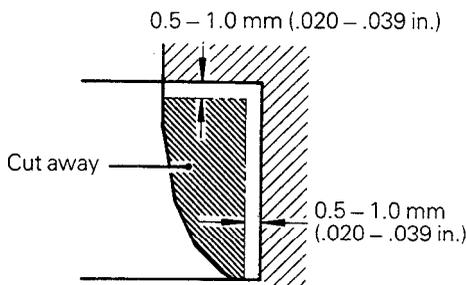
Exhaust 29.5 mm (1.16 in.)

Seat width: 0.9 – 1.3 mm (.035 – .051 in.)

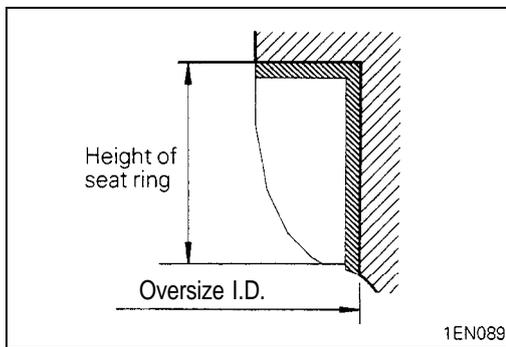
- (3) The valve and valve seat should be lapped with a lapping compound.

VALVE SEAT REPLACEMENT PROCEDURE

- (1) Grind the valve seat to be replaced from the inside to thin the wall thickness. Then, remove the valve seat.



1EN088



- (2) Rebore the valve seat hole in cylinder head to a selected oversize valve seat diameter.

Valve Seat Insert Oversizes

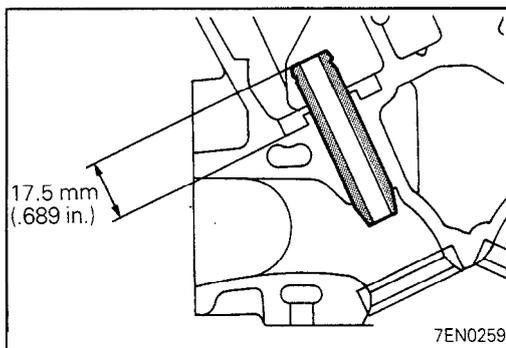
Description	Size mm (in.)	Size mark	Seat insert height H mm (in.)	Cylinder head I.D. mm (in.)
Intake valve seat insert	0.3 (.012) O.S.	30	7.5 – 7.7 (.295 – .303)	36.300-36.325 (1.4291-1.4301)
	0.6 (.024) O.S.	60	7.8 – 8.0 (.307 – .315)	36.600-36.625 (1.4409-1.4419)
Exhaust valve seat insert	0.3 (.012) O.S.	30	7.9 – 8.1 (.311 – .319)	33.300-33.325 (1.3110-1.3120)
	0.6 (.024) O.S.	60	8.2 – 8.4 (.323 – .331)	33.600-33.625 (1.3228-1.3238)

- (3) When press-fitting the valve seat, chill the valve seat with liquid nitrogen so that the cylinder head bore is not damaged by galling.
- (4) Using the valve seat grinder or cutter, correct the valve seat to the specified width and angle.
- (5) See "VALVE SEAT RECONDITIONING PROCEDURES."

VALVE GUIDE REPLACEMENT PROCEDURE M11PJDB

- (1) Using suitable rod and a press, press the valve guide out of the cylinder head toward the cylinder block side.
- (2) Rebore the valve guide hole to the oversize valve guide outside diameter to be press-fitted.

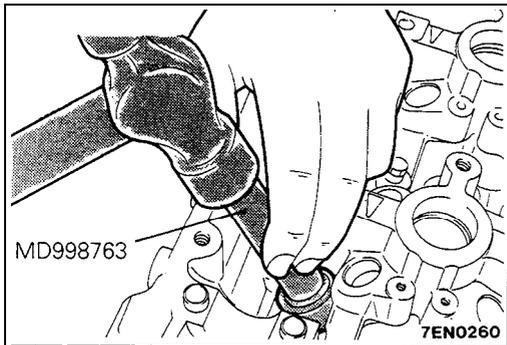
Caution
Do not use a valve guide of the same size as the one removed.



Size mm (in.)	Size mark	Cylinder head hole size mm (in.)
0.05 (.002) O.S.	5	12.050-12.068 (.4744-.4751)
0.25 (.010) O.S.	25	12.250-12.268 (.4823-.4830)
0.50 (.020) O.S.	50	12.500-12.518 (.4921-.4928)

- (3) Install the valve guide until a protrusion of 17.5 mm (.689 in.) is obtained. See the illustration.

- NOTE**
1. Press-fit the valve guide from the cylinder head top surface.
 2. Note the difference in lengths of the valve guides for the intake and exhaust: intake 45.5 mm (1.791 in.) and exhaust 50.5 mm (1.988 in.).
 3. After the valve guide has been installed in position, insert a new valve to ensure that it slides smoothly.

**SERVICE POINTS OF INSTALLATION**

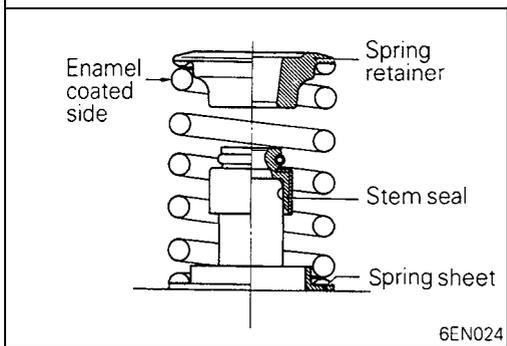
M110DAH

15.13. INSTALLATION OF VALVE STEM SEAL

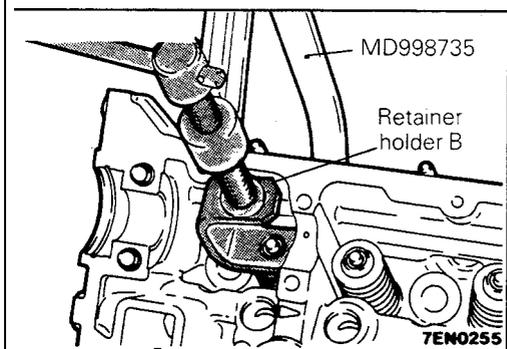
Install the spring seat, then using the special tool, install the stem seal by lightly tapping the tool.

Caution

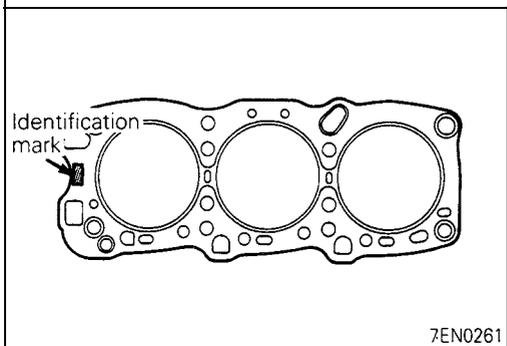
1. Incorrect installation of the seal without using the special tool will result in poor sealing and cause oil leakage down valve guide.
2. Do not reuse stem seal.

**11.7. INSTALLATION OF VALVE SPRING**

Valve springs should be installed with the enamel coated side toward the valve spring retainer.

**9. 5. INSTALLATION OF RETAINER LOCK**

Using the special tool, install the retainer lock

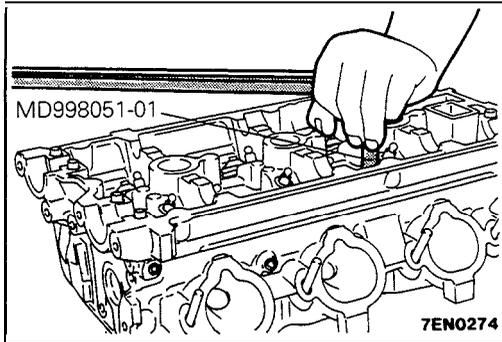
**4. INSTALLATION OF CYLINDER. HEAD GASKET**

Identification mark:

<Non-Turbo>

<Turbo>

2DN
2DT



1. INSTALLATION OF CYLINDER HEAD BOLT

- (1) Using the special tool, tighten the bolts in two to three stages in the illustrated sequence.
- (2) Back off the bolts once and tighten them to the specified torque as shown in step (1).

