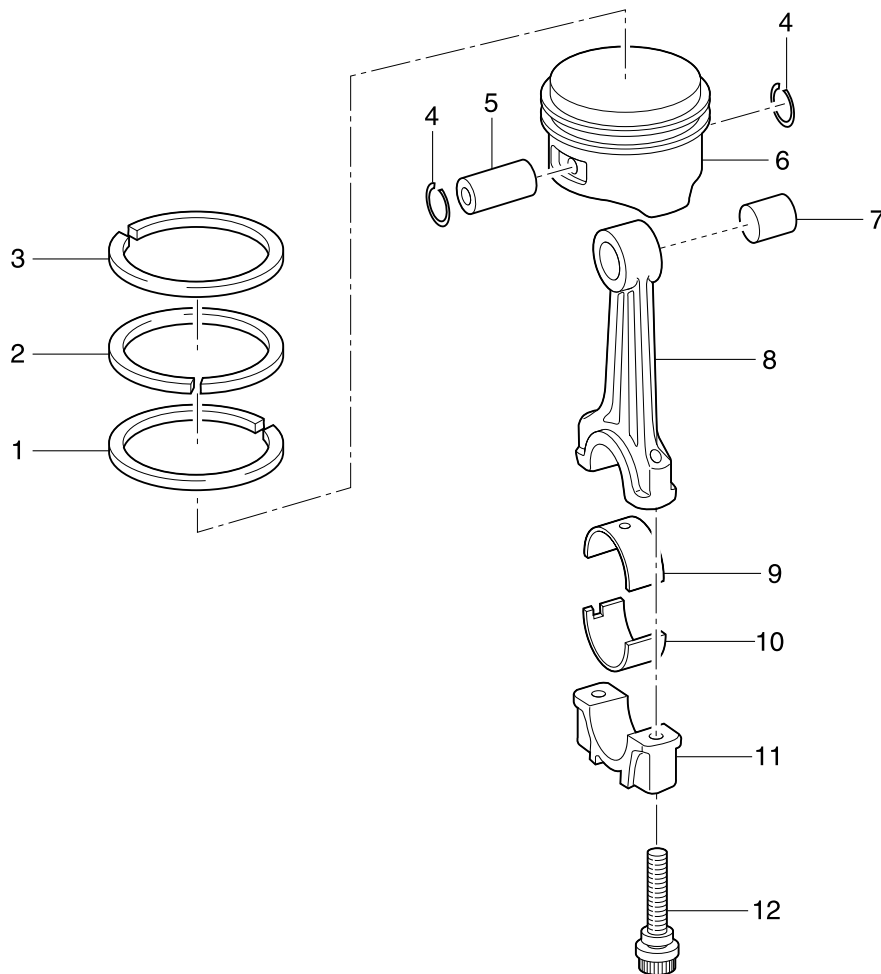


PISTON

Preceding Work: Removal of the cylinder head
Removal of the oil pump



YAD1BFF0

- | | |
|---------------------------|---|
| 1 Oil Ring | 7 Connecting Rod Bushing Check |
| 2 2nd Ring | 8 Connecting Rod |
| 3 Top Ring | 9 Connecting Rod Upper Bearing Shell |
| 4 Snap Ring Replace | 10 Connecting Rod Lower Bearing Shell |
| 5 Piston Pin | 11 Connecting Rod Bearing Cap |
| 6 Piston | 12 Connecting Rod Bolt 35 N•m (26 lb-ft)+ 90° |

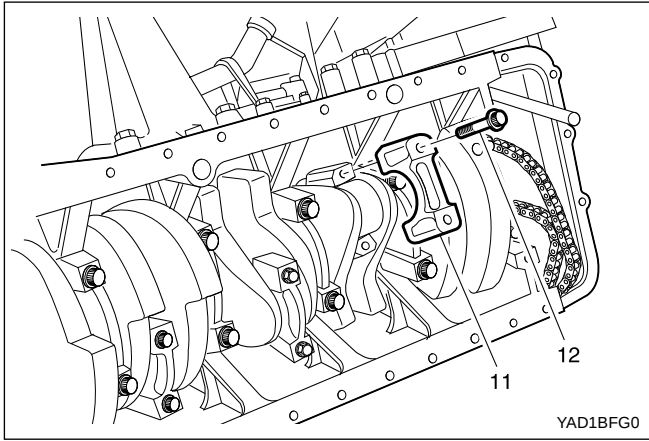
Notice: There are two kinds of connecting rods (for machining) and they are different in weight approx. 15g. When replacing the connecting rod, measure its weight and ensure that a engine has the same weight of connecting rods. If not, there would be a unbalancing of engine.

Service Data

Piston clearance	Max. 0.12 mm
Piston crown protrusion in TDC position	0.735 - 0.965 mm
Connecting rod bushing diameter	26.012 - 26.018 mm

Connecting Rod Bolt Dimensions

Thread	M9 x 1
Stretch shaft (C) diameter (new)	7.4 mm
Minimum stretch shaft diameter (C)	7.1 mm
Length (L) (new)	52 mm

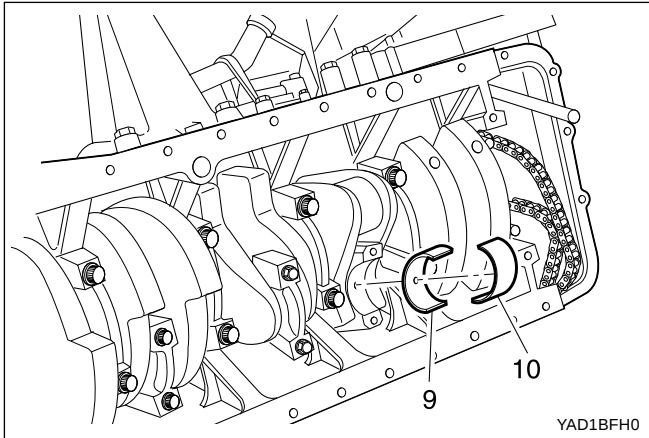


Tools Required

- 000 589 04 14 00 Tensioning Strap
- 001 589 53 21 00 Dial Gauge
- 363 589 02 21 00 Dial Gauge Holder

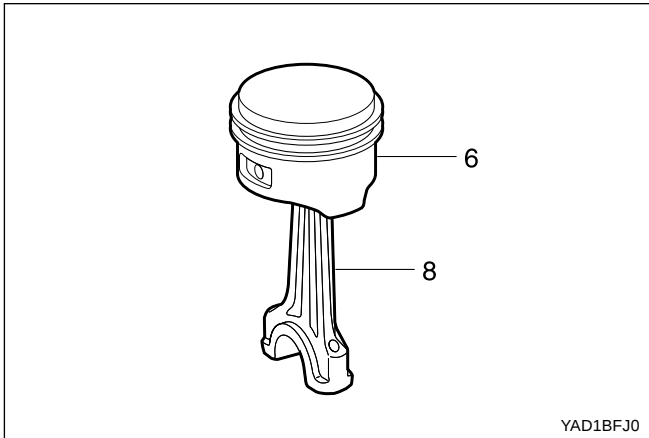
Removal Procedure

1. Remove combustion residues from the cylinder bores.
2. Remove the connecting rod bolts (12) and then remove the connecting rod bearing caps (11).

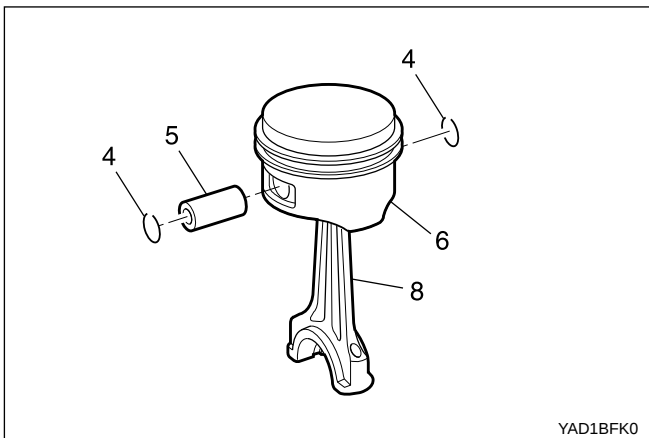


3. Remove the connecting rod bearing shells (9, 10).

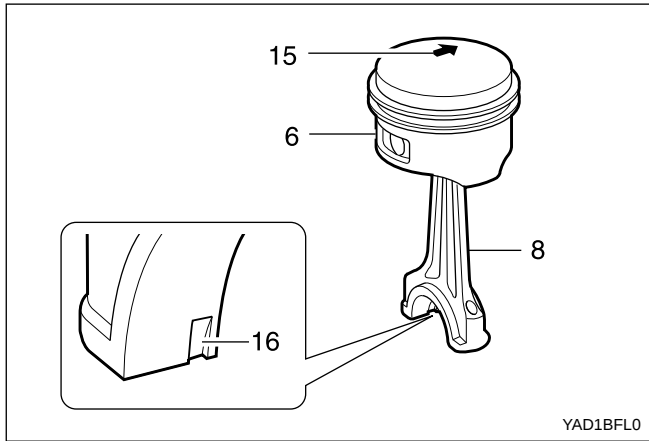
Notice: Be careful not mix the bearing caps and shells each other.



4. Remove the piston (6) and connecting rod (8).

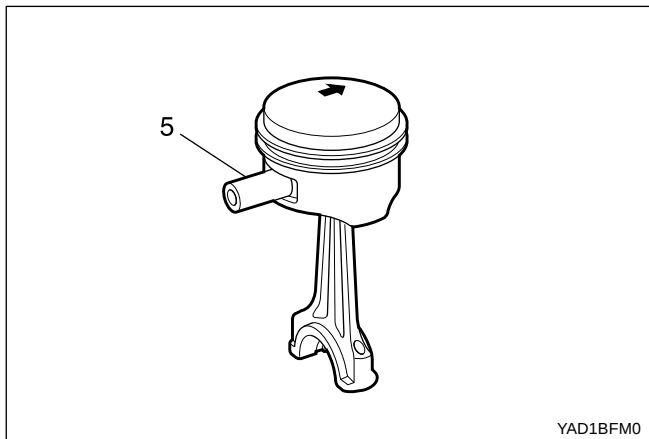


5. Remove the snap ring (4) and pull out the piston pin (5).
6. Separate the piston and connecting rod.



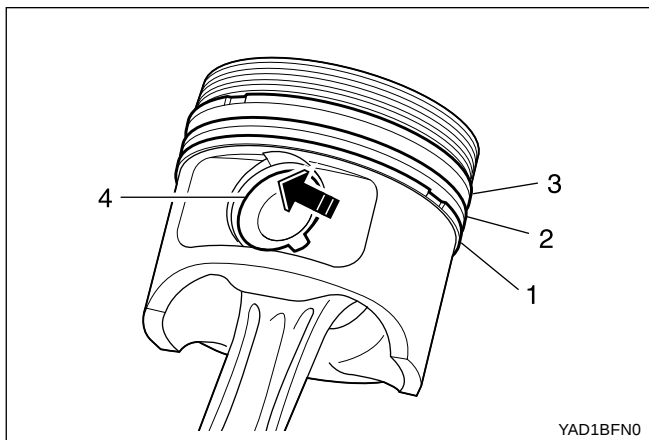
Installation Procedure

1. Fit the piston onto the connecting rod so that the arrow (15) and the locking slot (16) are facing in direction of the vehicle.

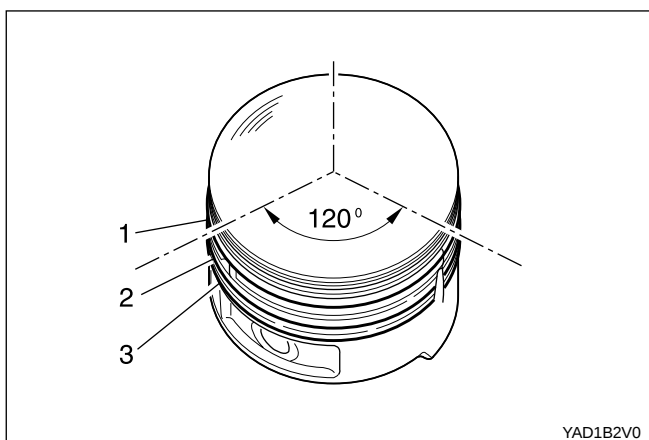


2. Coat the piston pin (15) with engine oil and insert it by hand.

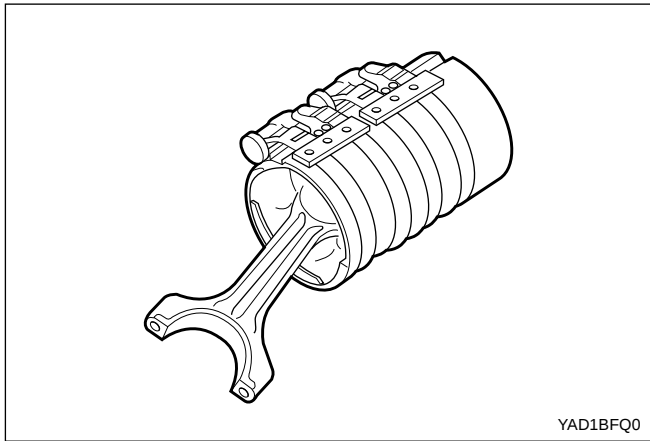
Notice: Do not heat up the piston.



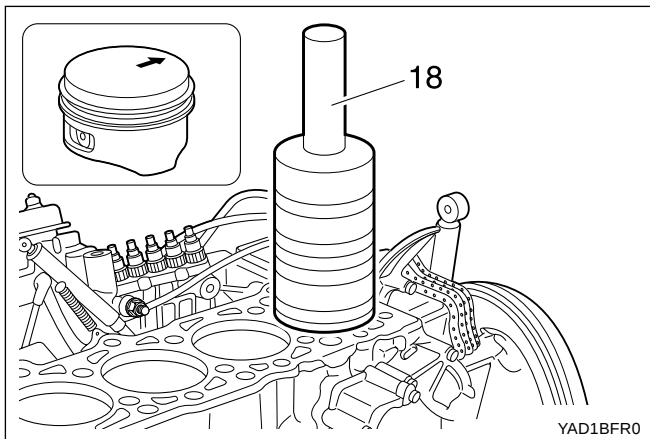
3. Install the new snap ring (4) into the grooves (arrow).
4. Check the piston rings (1, 2, 3) and replace them if necessary.



5. Install and arrange the piston rings to be evenly 120° from each ends gap.

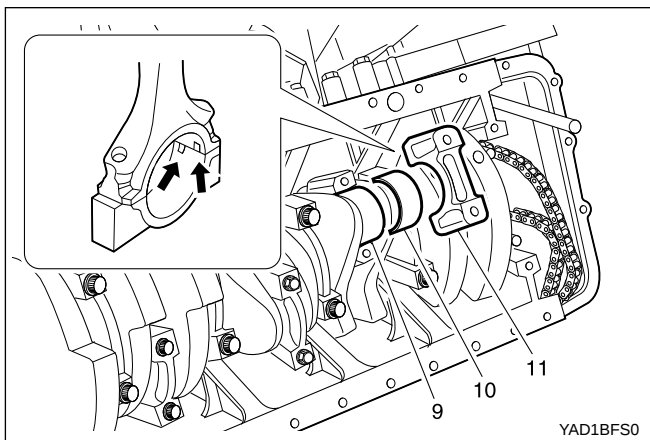


6. Coat the cylinder bore, connecting rod bearing journal, connecting rod bearing shell and piston with oil.
7. Compress the piston rings with a tensioning strap 000 589 04 14 00.



8. Insert the piston assembly into the cylinder with a wooden stick (18).

Notice: The arrow on the piston crown must point toward the front of vehicle.

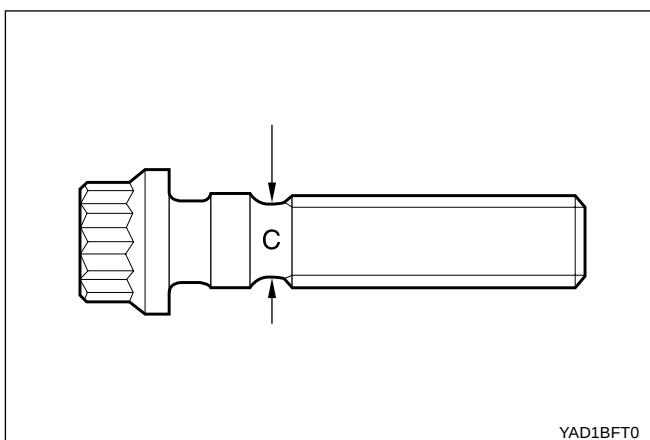


9. Insert the connecting rod bearing shells (9, 10).

Notice: Be careful of the difference in upper and lower bearing shells and not to be changed.

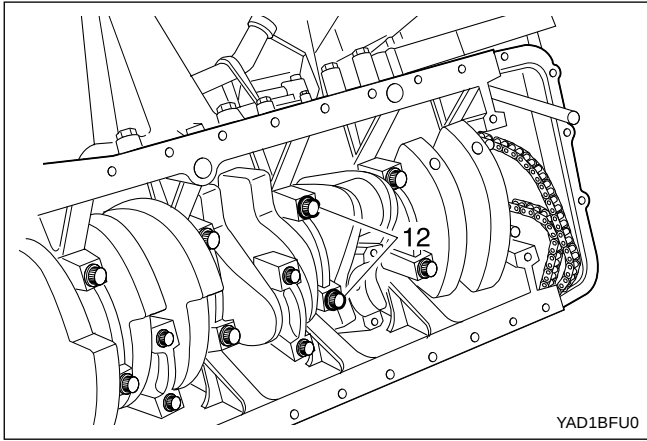
10. Position the connecting rod bearings caps.

Notice: Position so that the retaining lugs are on the same side of the connecting rod bearing (arrow).



11. Measure stretch shaft diameter (C) of the connecting rod bolts.

Limit 'C'	7.1 mm
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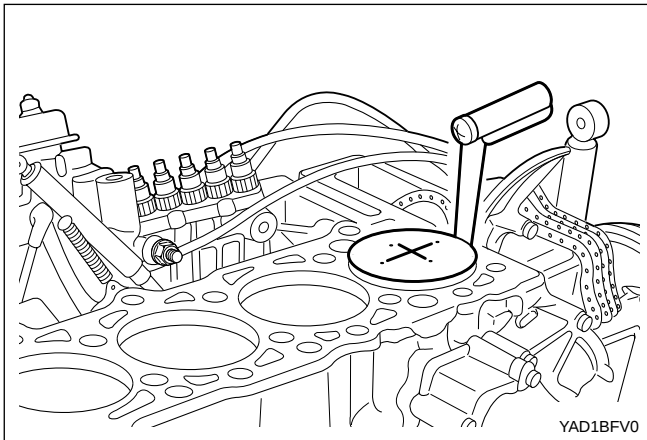


12. Coat the bolts (12) with oil and then tighten the bolts.

Installation Notice

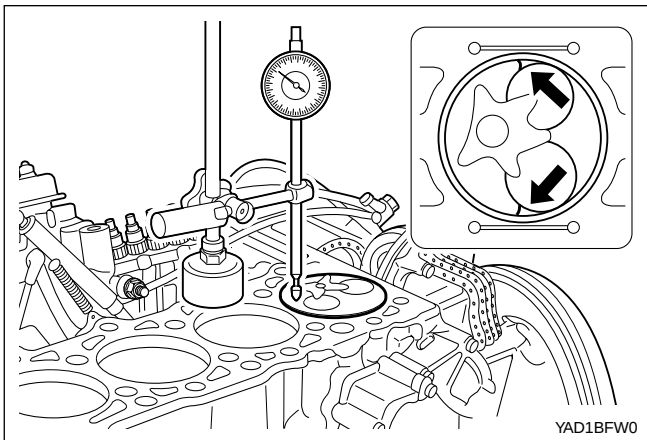
Tightening Torque	35 N•m (26 lb-ft)+ 90°
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13. Rotate the crankshaft and check axial clearance between the connecting rod and crankshaft.



14. Measure clearance between the piston crown and cylinder.

Standard	Max. 0.12 mm
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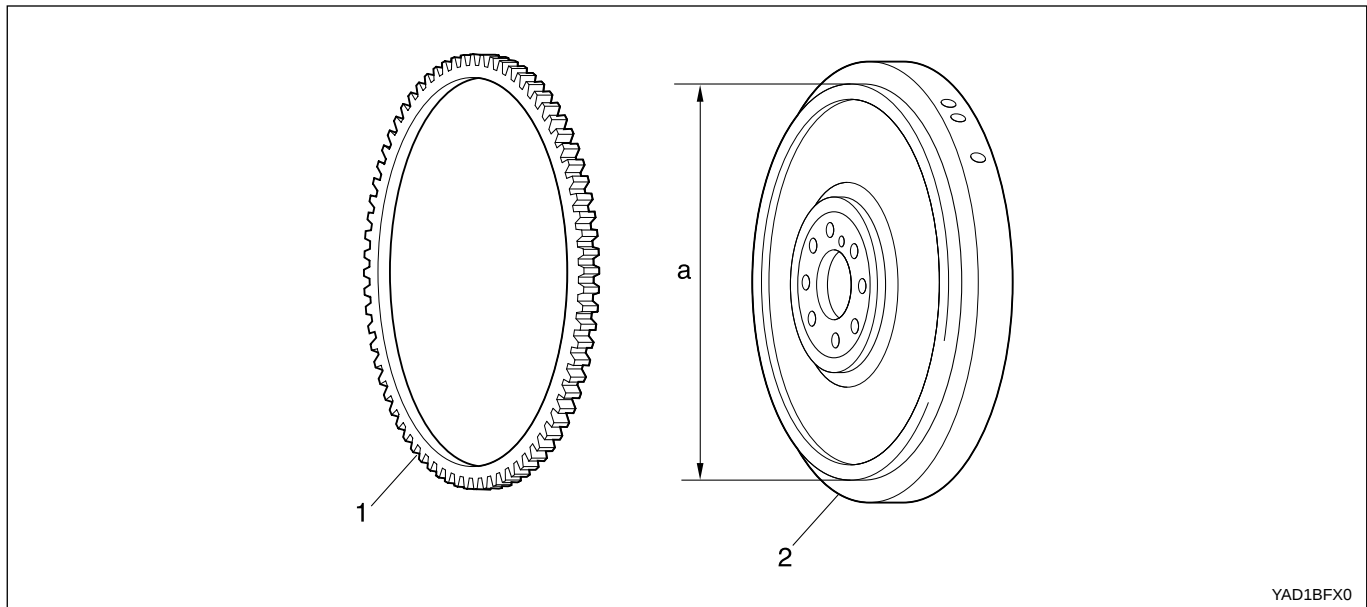
15. Position the piston at TDC and measure the distance between the piston crown and the crankcase surface using dial gauge 001 589 00 53 21 and dial gauge holder 363 589 02 21 00.

Standard	Max. 0.965 mm
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Notice: Measure at points marked.

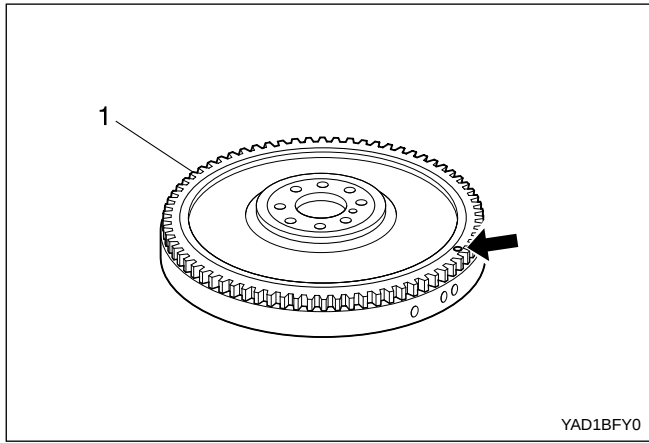
FLYWHEEL RING GEAR

Preceding Work: Removal of flywheel



- 1 Ring Gear
- 2 Flywheel

a Centering Collar Diameter

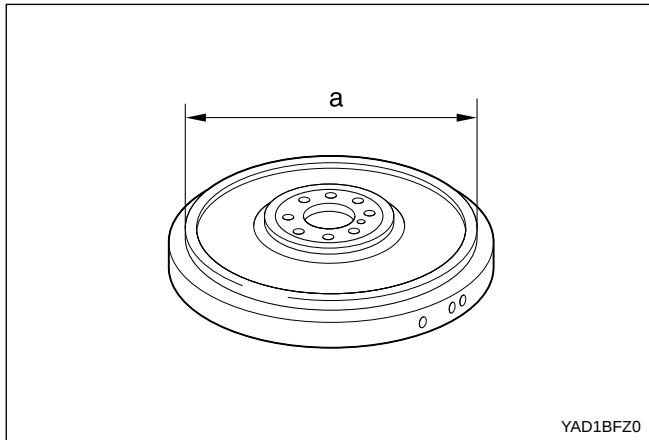
**Tools Required**

001 589 53 21 00 Dial Gauge

363 589 02 21 00 Dial Gauge Holder

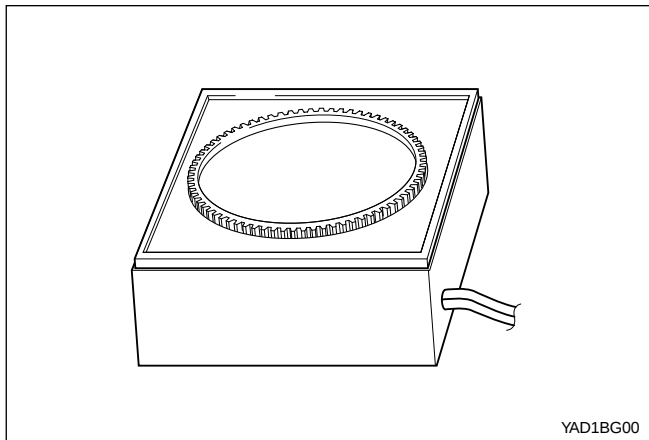
Replacement Procedure

1. Drill a hole into the ring gear (1) (arrow) and snap with a chisel.
2. Thoroughly clean the collar surfaces of ring gear.

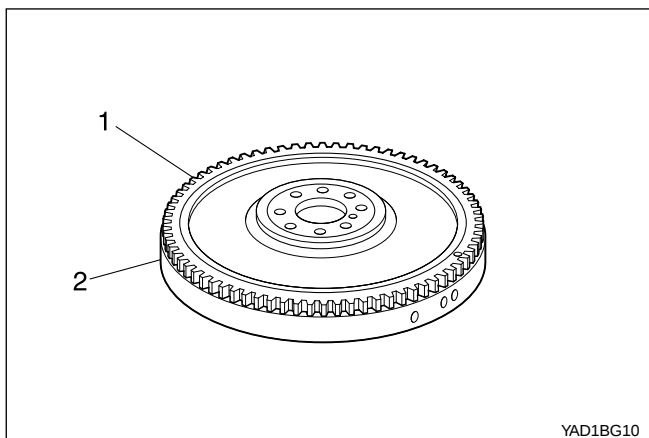


3. Measure diameter (a) of centering collar.

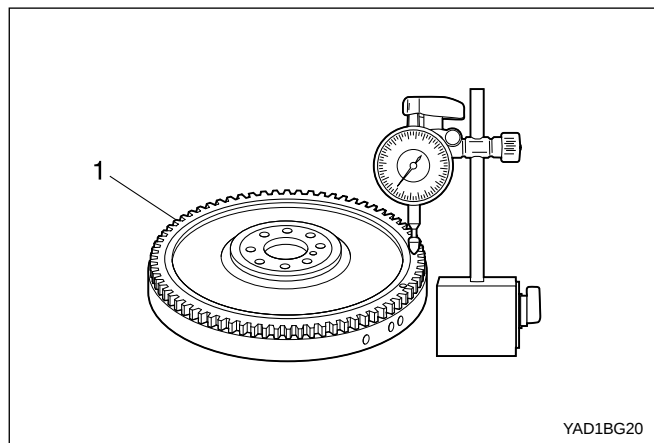
Diameter 'a'	$275 + 0.5 \text{ mm}$
--------------	------------------------

Notice: If out of standard, replace the flywheel.

4. Heat up the new ring gear up to 220°C (428°F) by using a heating device.

Notice: Use temperature measuring chalk.

5. Install the new ring gear (1) onto the flywheel (2) by using a drift.



6. Measure axial runout of ring gear (1) on a surface plate using dial gauge 001 589 53 21 00 and dial gauge holder 363 589 02 21 00.

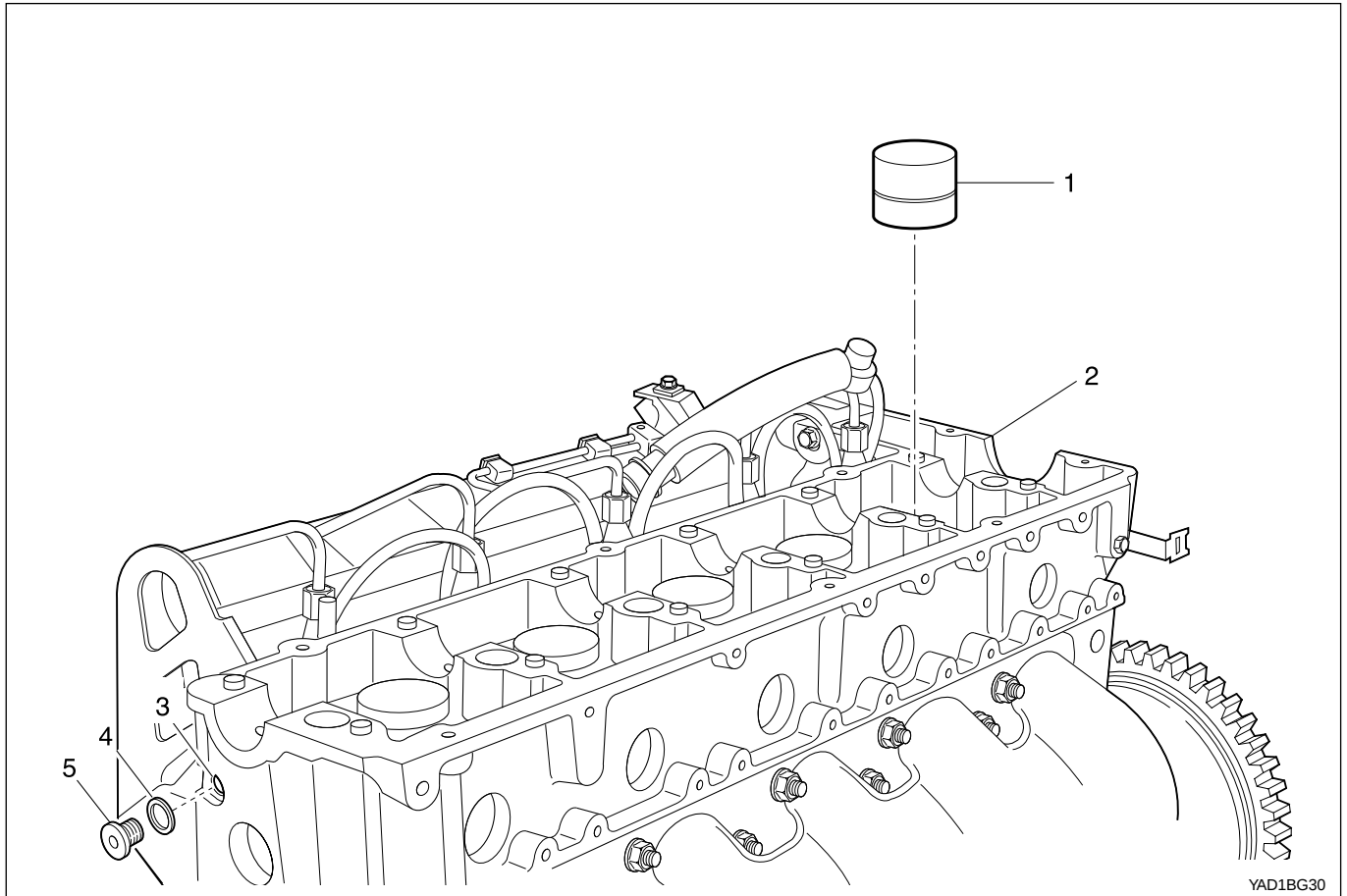
Limit	Max. 0.4 mm
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Notice: For correct measurement, put the flywheel on the flat measuring board.

TIMING DEVICE AND VALVE

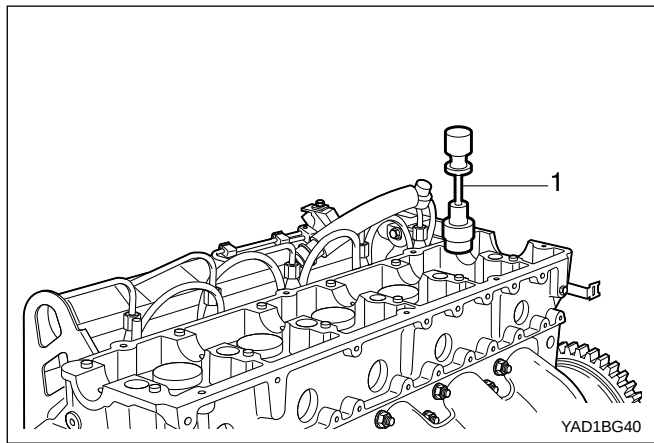
VALVE TAPPETS

Preceding Work: Removal of camshaft



- 1 Valve Tappet
- 2 Cylinder Head
- 3 Oil Gallery

- 4 Seal Replace
- 5 Screw Plug

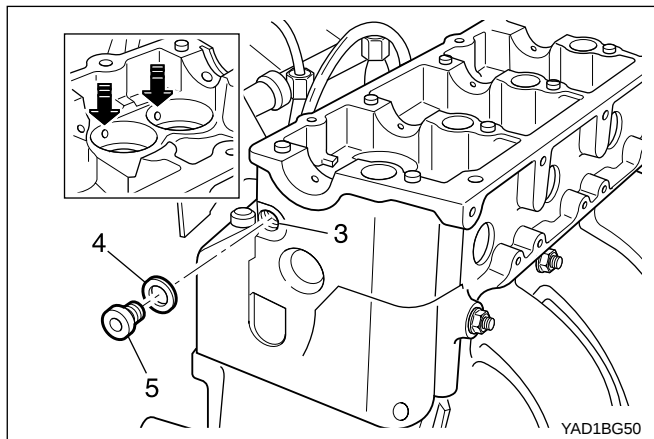


Tools Required

102 589 03 40 00 Magnetic Bar

Replacement Procedure

1. Pull out the valve tappet (1) using magnetic bar 102 589 03 40 00.

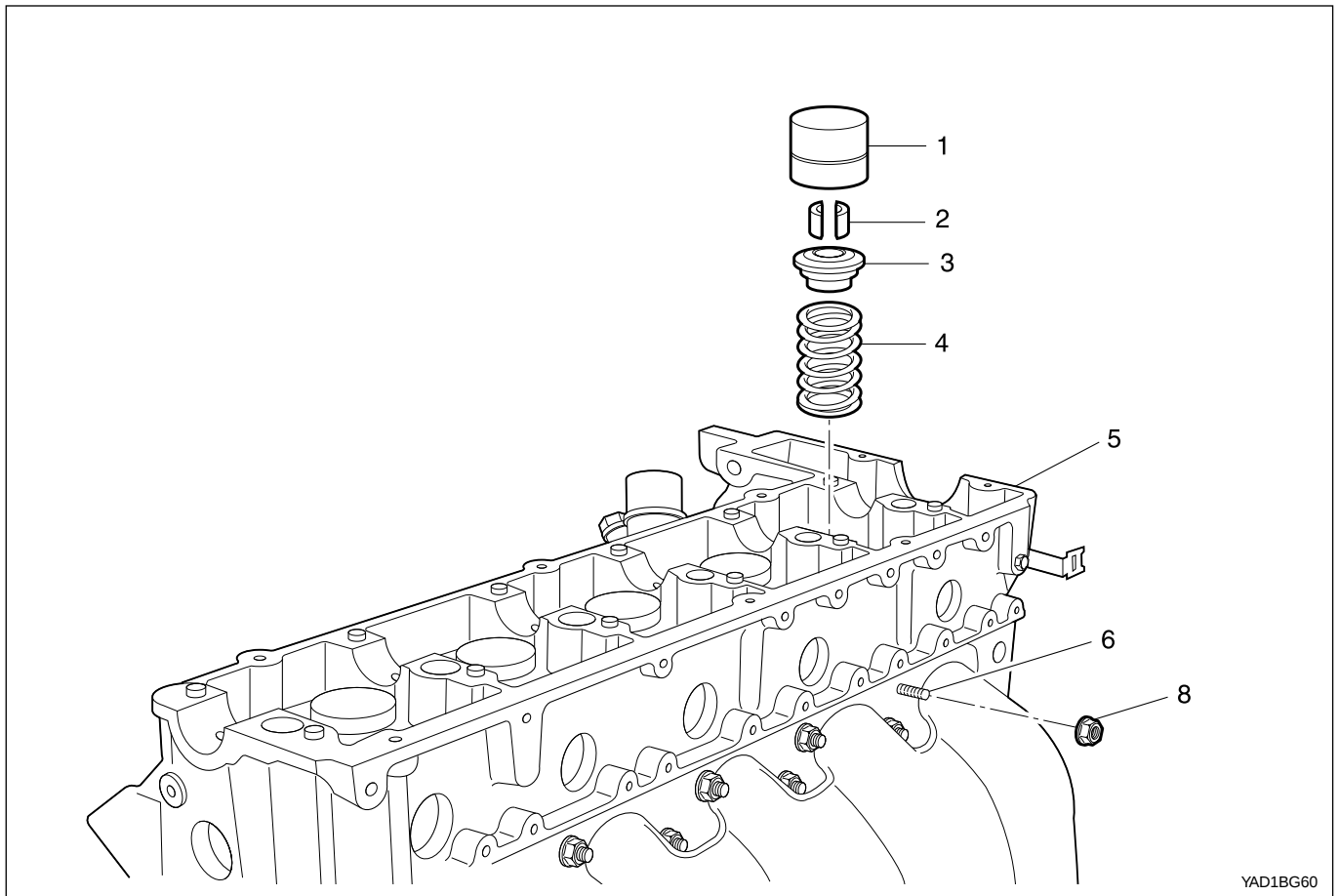


2. Remove the plug (5) and blow compressed air into the oil gallery (3). At this time, check that the outlet bores (arrow) at the seat of the valve tappet are clear.
3. Replace the seal (4) and tighten the plug (5).
4. Insert the new valve tappet.

Notice: Coat the valve tappet with oil.

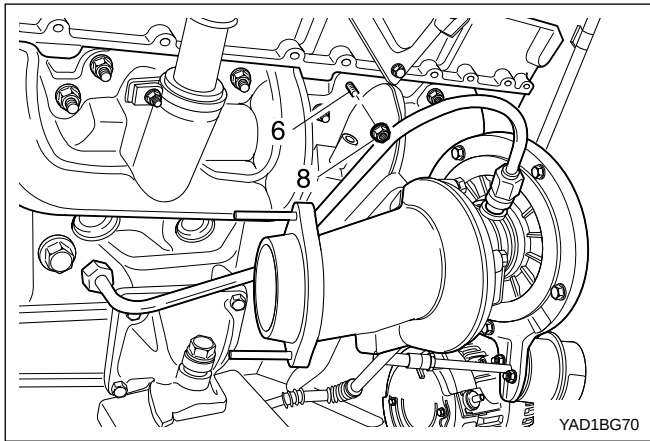
VALVE SPRINGS (CYLINDER HEAD REMOVED)

Proceeding Work: Remove of cylinder head



YAD1BG60

- | | |
|--|---------------------------------------|
| 1 Valve Tappet | 5 Cylinder Head |
| 2 Valve Cotten | 6 Stud Bolt 12 N•m (106 lb-in) |
| 3 Spring Retainer | 7 Nut Replace, 25 N•m(18 lb-ft) |
| 4 Valve Spring Check, replace if necessary | |



Tools Required

- 102 589 03 40 00 Magnetic Bar
- 116 589 06 63 00 Magnetic Finger
- 601 589 01 59 00 Assembling Board
- 601 589 02 59 00 Supporting Bridge
- 667 589 00 31 00 Press Lever

Removal & Installation Procedure

1. Remove the nuts (8) uniformly and then remove the washer (7), exhaust manifold (9) and gasket.

Installation Notice

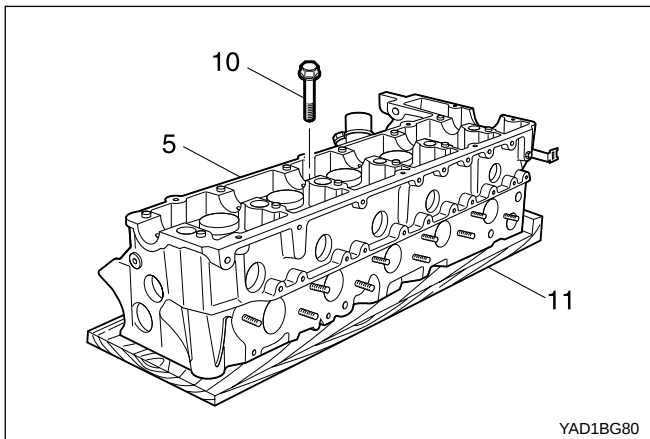
Check the stud bolt (6) for damage and replace if necessary.

Tightening Torque	12 N•m (106 lb-in)
-------------------	--------------------

Replace the gasket and tighten the nuts (8).

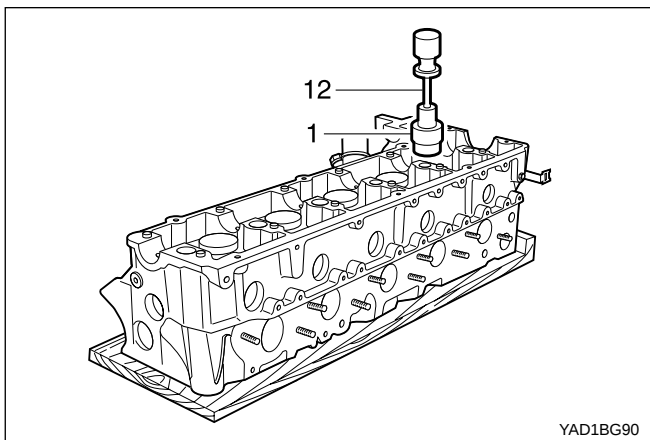
Tightening Torque	25 N•m (18 lb-ft)
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2. Install the assembling board 601 589 01 59 00 (11) to the cylinder head with 4 cylinder head bolts (10).

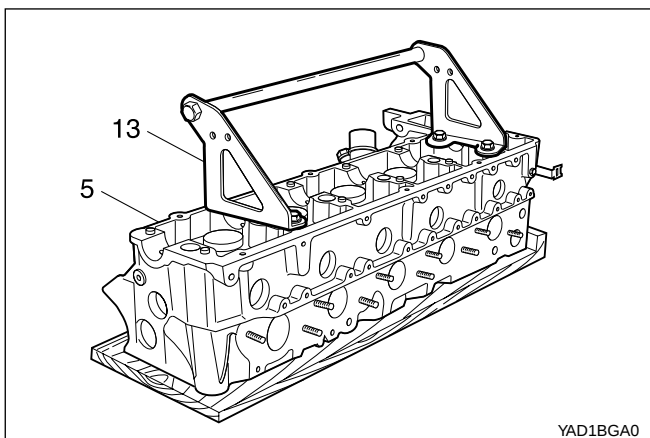


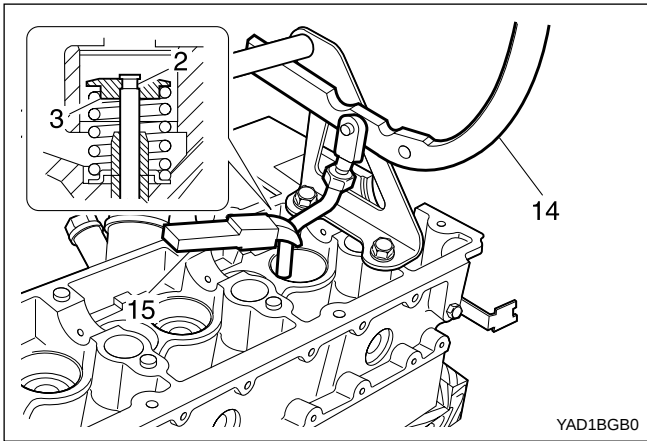
3. Pull out the valve tappet (1) with magnetic bar 102 589 03 40 00 (12).

Notice: Place the valve tappets upside down (open end upward).



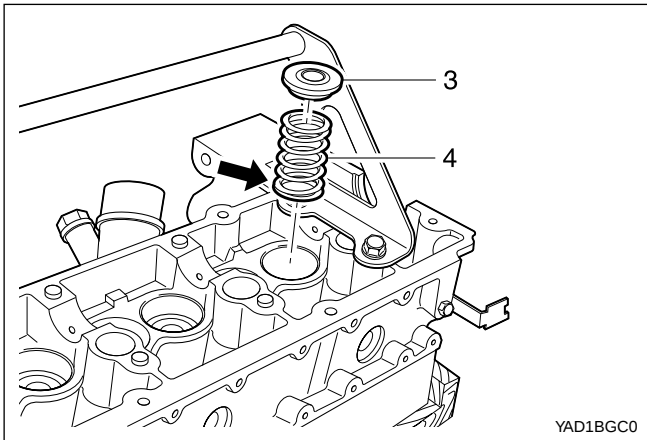
4. Install the supporting bridge 601 589 02 59 00 (13) on the cylinder head (5).





5. Using the press lever 667 589 00 31 00 (14), press the spring retainer downward and remove the valve cotter (2) with magnetic finger 116 589 06 63 00 (15).

Notice: Be careful not to damage guide bore of the valve tappet.



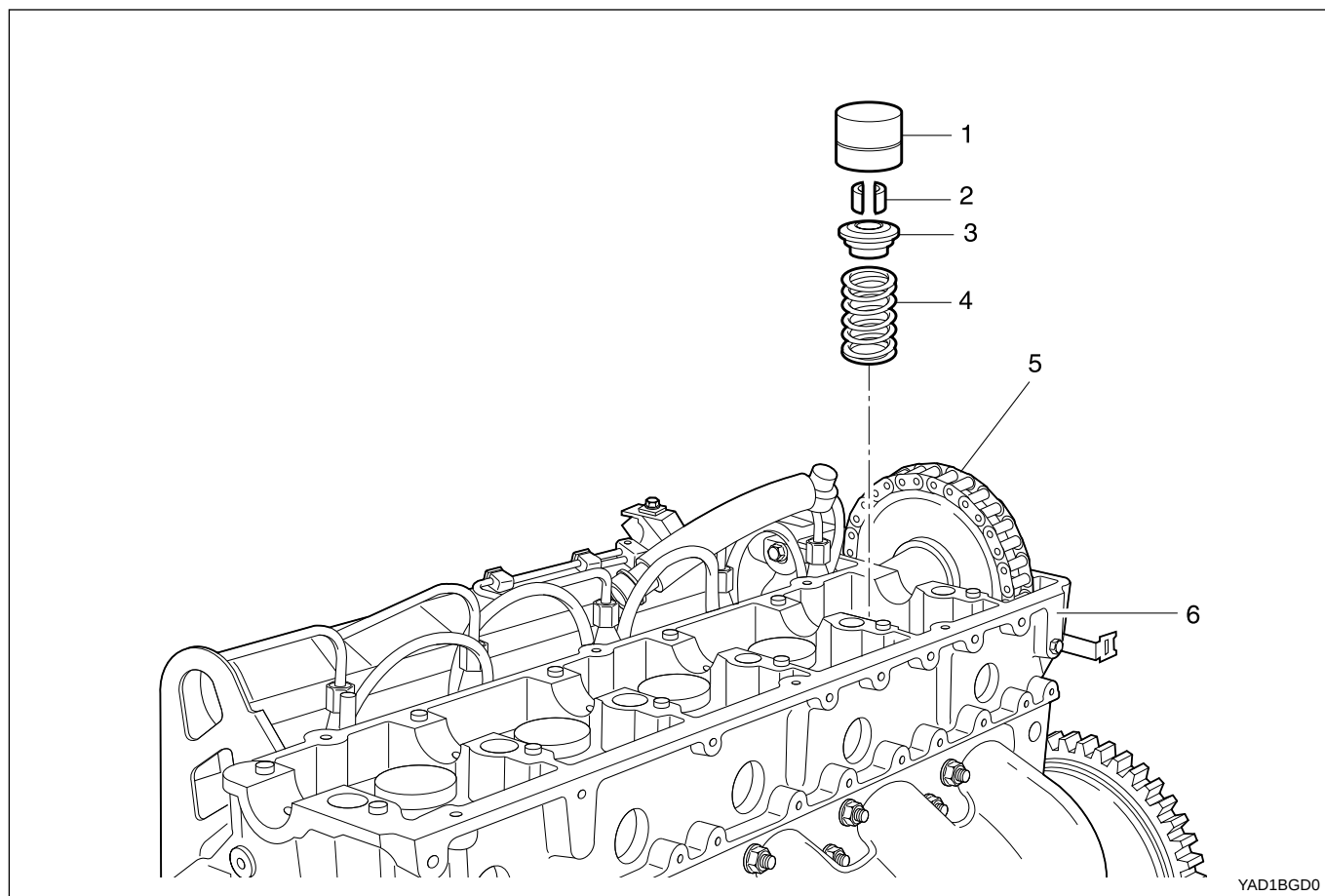
6. Remove the spring retainer (3) and spring (4).

Notice: Install the valve spring with the color coding (arrow) facing down.

7. Check the valve spring and replace if necessary.
8. Installation should follow the removal procedure in the reverse order.

VALVE SPRINGS (CYLINDER HEAD INSTALLED)

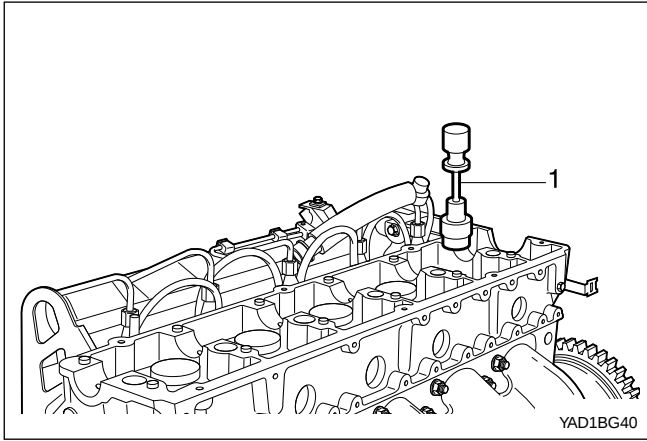
Preceding Work: Removal of camshaft



- 1 Valve Tappet
- 2 Valve Cotten
- 3 Spring Retainer

- 4 Valve Spring Check, replace if necessary
- 5 Timing Chain
- 6 Cylinder Head

Notice: Remove the valve springs only when the piston is at TDC.



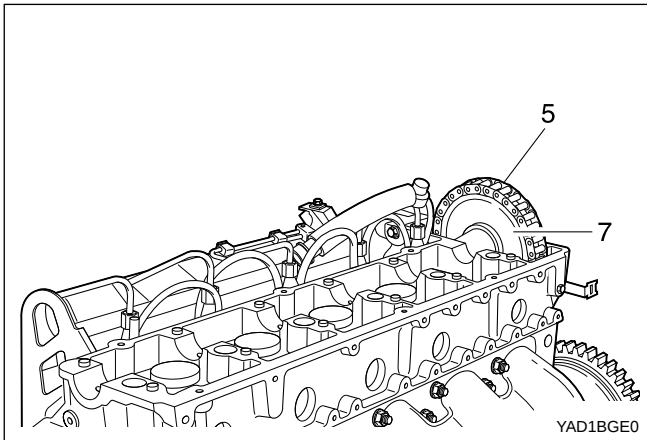
Tools Required

- 102 589 03 40 00 Magnetic Bar
- 116 589 06 63 00 Magnetic Finger
- 603 589 01 40 00 Holding Wheel
- 667 589 00 31 00 Press Lever
- 667 589 02 63 00 Supporting Bar

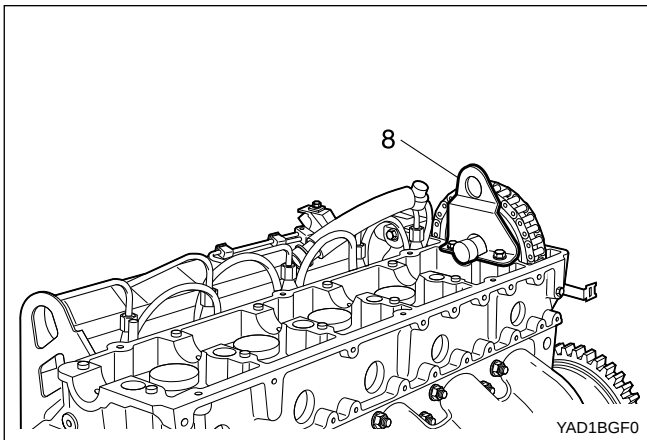
Removal & Installation Procedure

1. Remove the valve tappet (1) with magnetic bar 102 589 03 40 00.

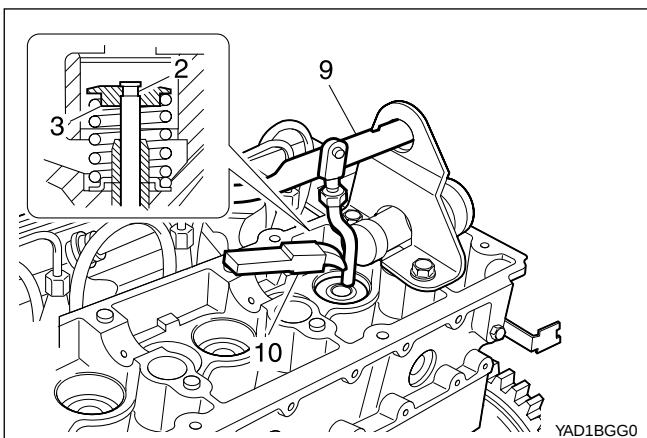
Notice: Place the valve tappets upside down (open end upward).



2. Install the holding wheel 603 589 01 40 00 (7) into the timing chain of camshaft sprocket piston.
3. Position the piston of relevant cylinder at TDC.

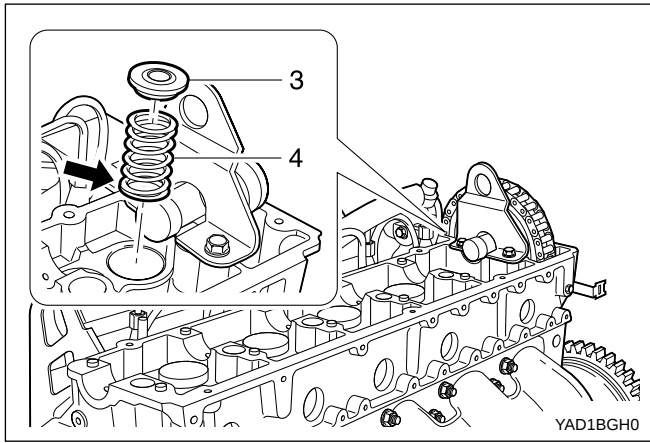


4. Install the supporting bar 667 589 02 63 00 (8).

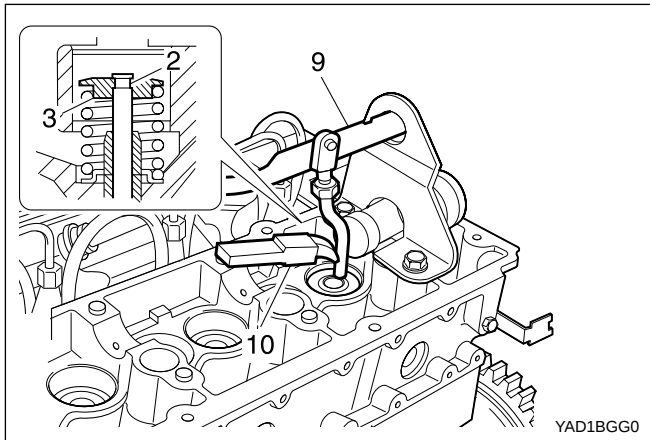


5. Using the press lever 667 589 00 31 00 (9), press the spring retainer (3) downward and remove the valve cotter (2) with magnetic finger 116 589 06 63 00 (10).

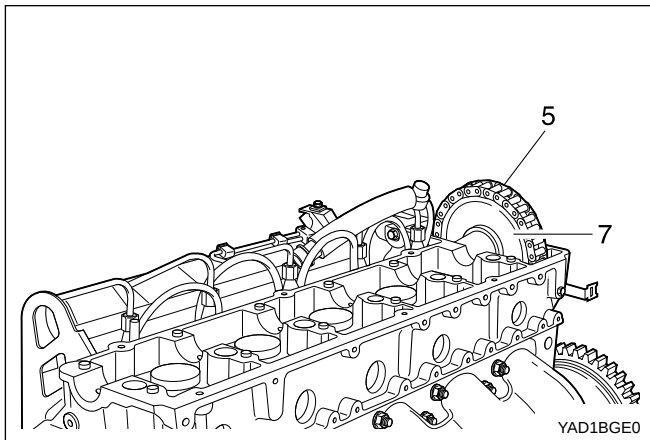
Notice: Be careful not to damage guide bore of the valve tappet.



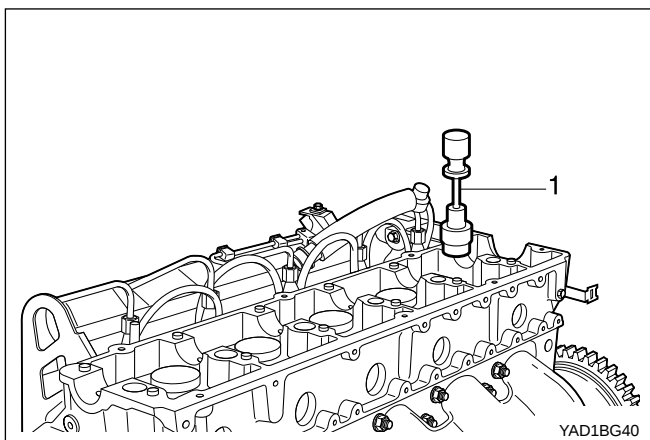
6. Remove the spring retainer (3) and spring (4).
7. Check the valve spring and replace if necessary.
8. Insert valve spring (4) with the color coding (arrow) facing down and insert valve spring Retainer (3).



9. By press the spring retainer (3) with press lever 667 589 00 31 00 (9), install the valve cotten with magnetic finger 116 589 06 63 00 (10).



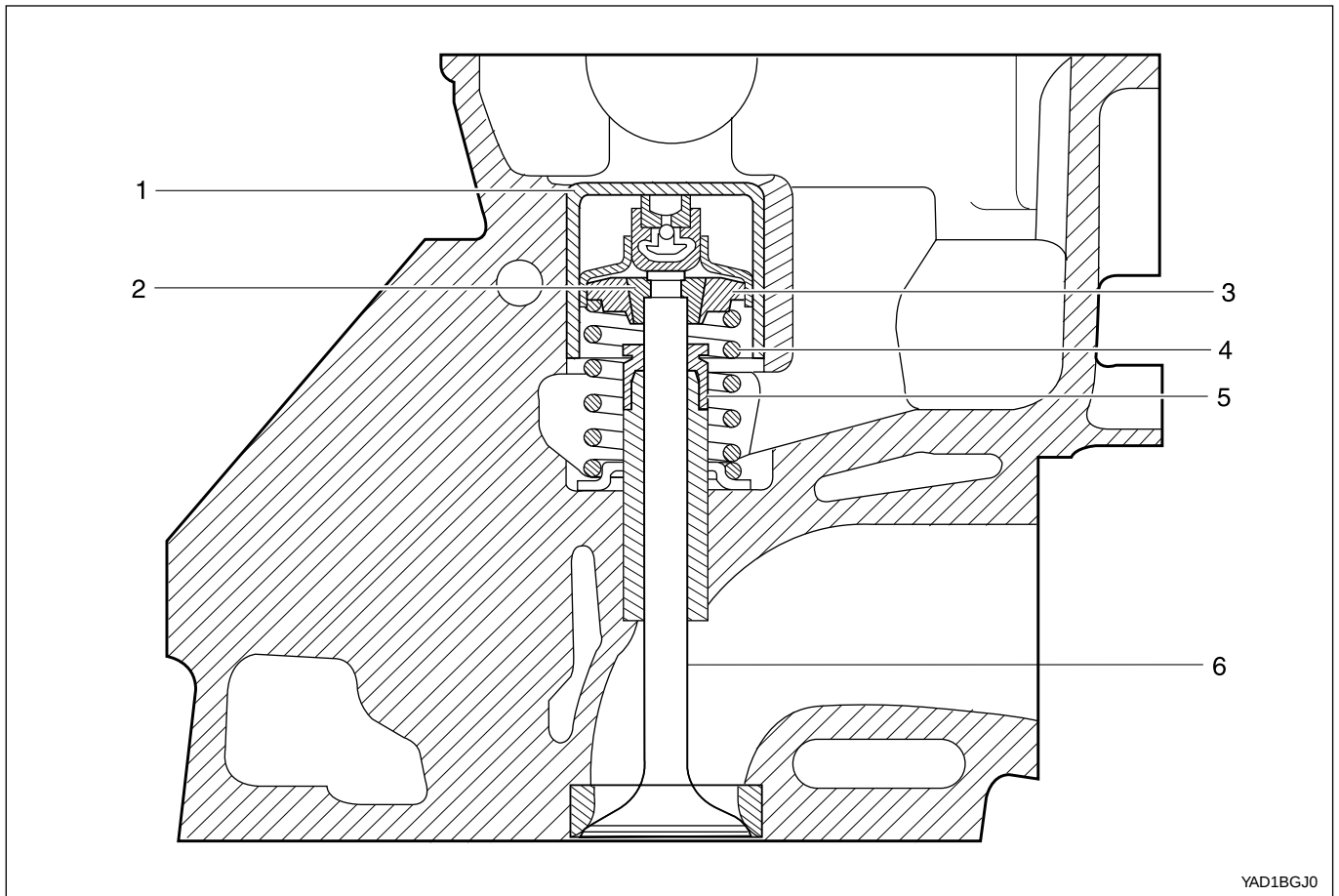
10. Remove the supporting bar 667 589 02 63 00.
11. Remove the holding wheel 603 589 01 40 00 (7) from the timing chain (5).



13. Coat the valve tappet with oil and install it with magnetic bar 102 589 03 40 00.

VALVE STEM SEALS

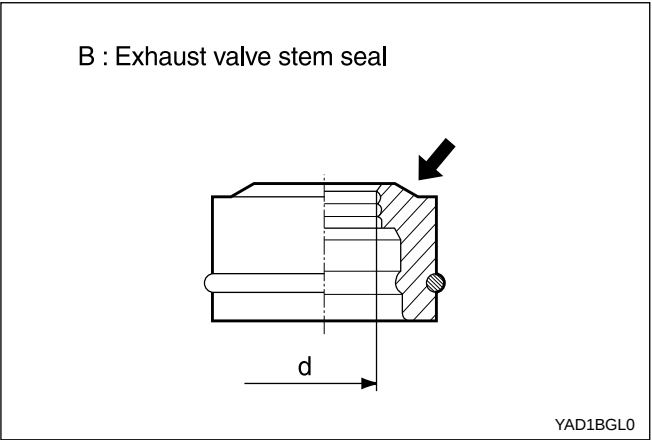
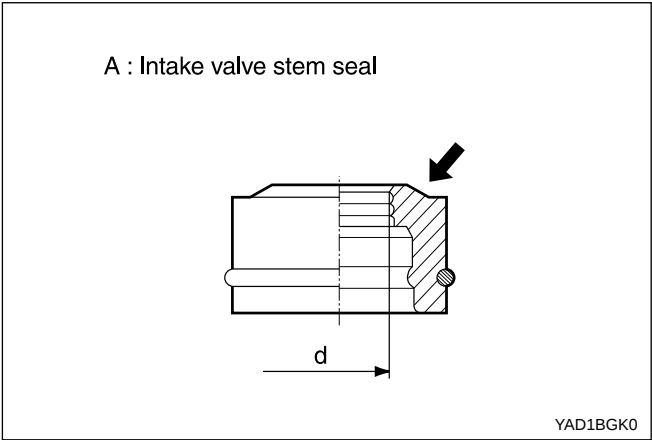
Preceding Work: Removal of camshaft.



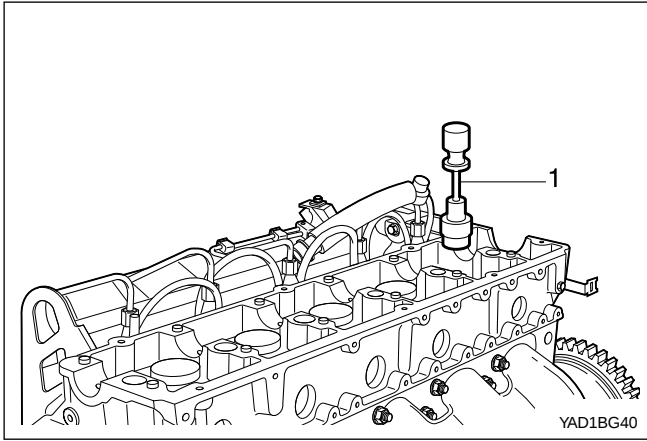
Notice: Remove the valve stem seals when the piston is positioned at TDC.

Tools Required

- 102 589 03 40 00 Magnetic Bar
- 104 589 00 37 00 Pliers
- 116 589 06 63 00 Magnetic Finger
- 601 589 02 43 00 Drift
- 603 589 01 40 00 Holding Wheel
- 667 589 00 31 00 Press Lever
- 667 589 02 63 00 Supporting Bar



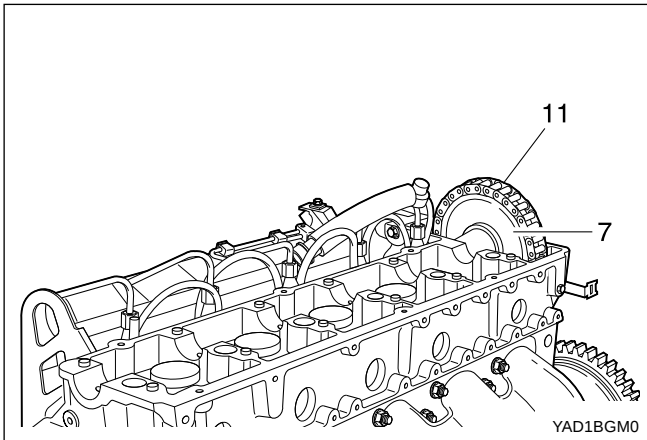
	Intake valve stem seal	Exhaust valve stem seal
Chamfer	Offset	All round
Inner diameter 'd'	7.3mm	8.2 mm
Color	Brown	Green
Wire ring	Black	Yellow



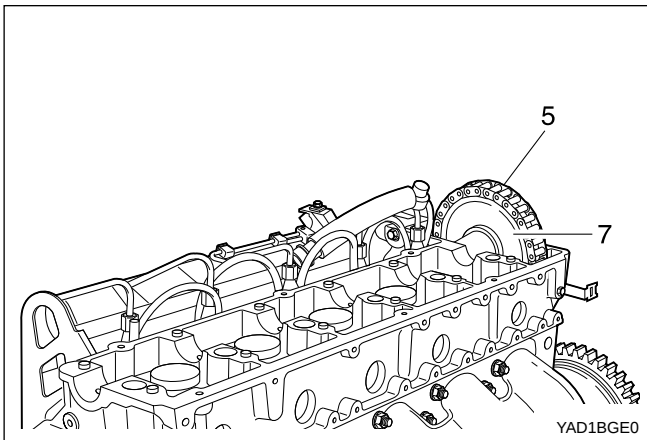
Replacement Procedure

1. Remove the valve tappet (1) with magnetic bar 102 589 03 40 00.

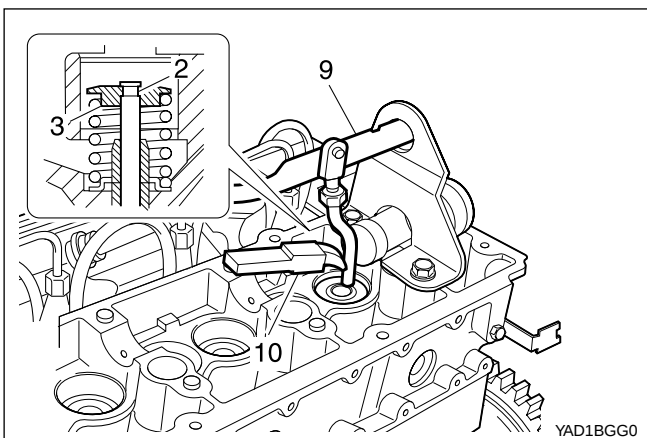
Notice: Place the valve tappets upside down (open end upward).



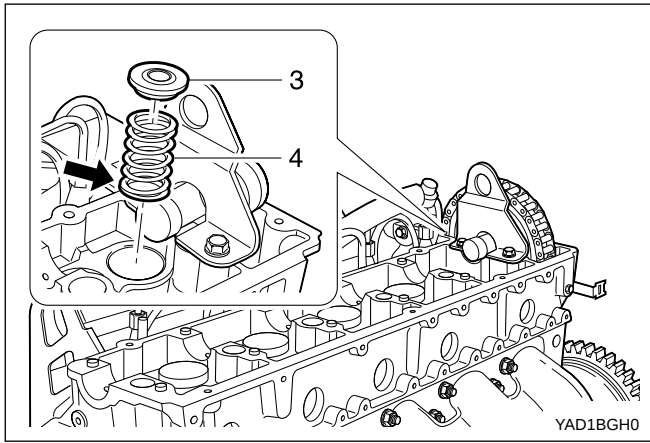
2. Install the holding wheel 603 589 01 40 00 (7) into the timing chain (11).
3. Position the piston of relevant cylinder at TDC.



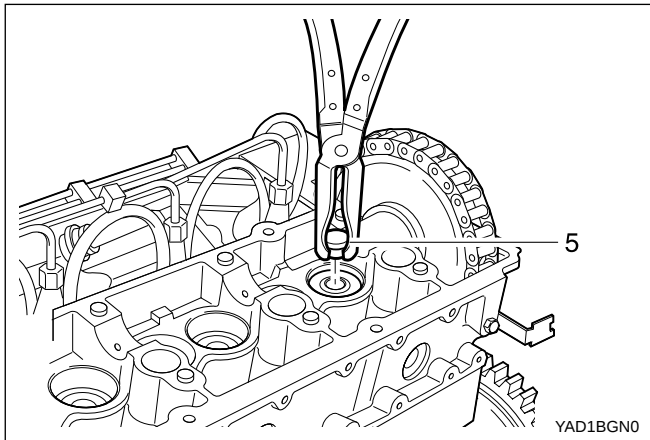
4. Install the supporting bar 667 589 02 63 00 (8).



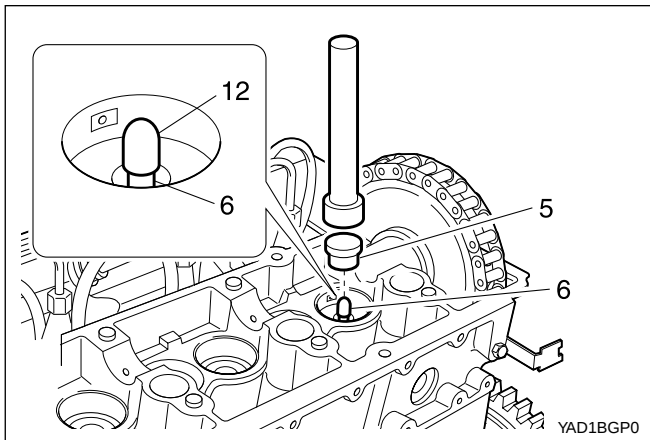
5. Using press lever 667 589 00 31 00 (9), press the spring retainer (3) downward and remove the valve collets with magnetic finger 116 589 06 63 00 (10).



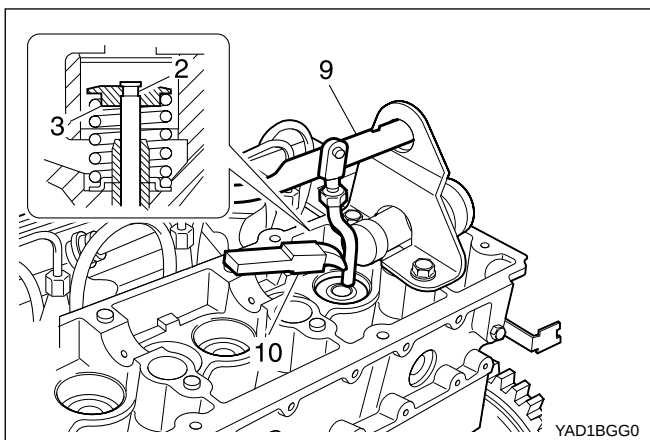
6. Remove the spring retainer (3) and valve spring (4).



7. Remove the valve stem seal with pliers 104 589 00 37 00 (5).



8. Insert the cap (12) onto the valve (6) and install the new valve stem seal (5) with drift 601 589 02 43 00 and then remover the cap.

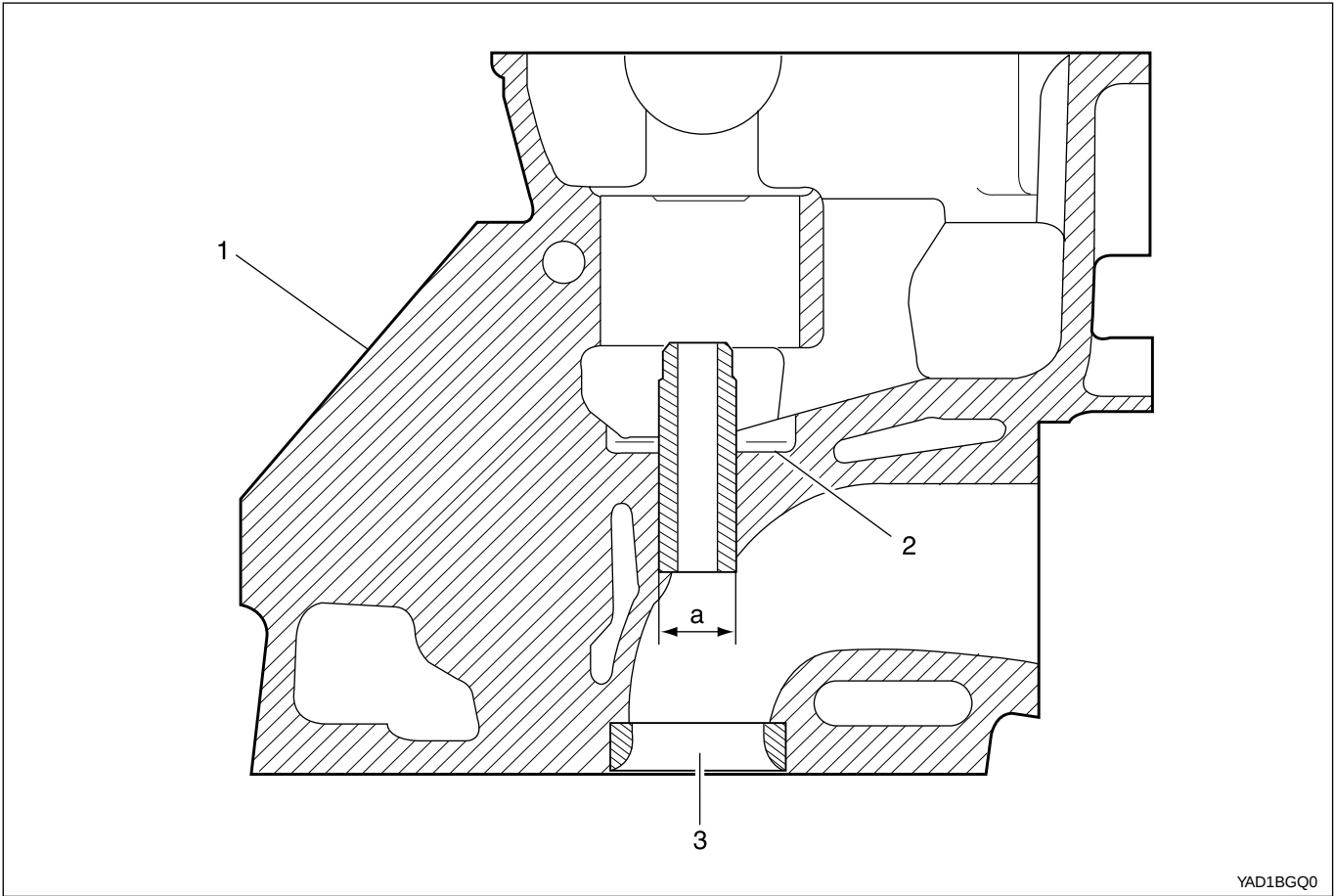


9. By pressing the spring seat with press lever 667 589 00 31 00 (9), install the valve cotter (2) with magnetic finger 116 589 06 63 00 (10).

Notice: Be careful not to damage guide bore of the valve tappet.

VALVE GUIDES

Preceding Work: Removal of cylinder head
Removal of valve spring
Removal of valve



- 1

Cylinder Head
- 2

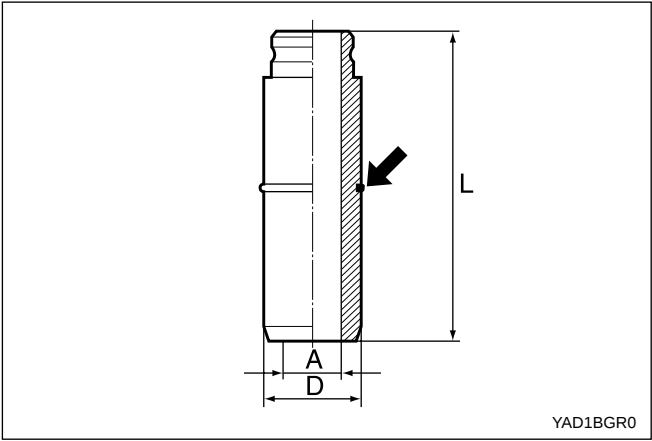
Valve Guide
- 3

Valve Seat Ring
- a

Basic Bore Diameter

Service Data

	Item	Outer Diameter ' D '	Color Code	Basic Bore Diameter 'a'	Overlap 'D' - 'a'	Valve Guide Inner Diameter' A '	Length ' L '
Intake	Repair size 1	14.251	Red	14.200 - 14.211	0.029	8.000 - 8.030	39.5
	Repair size 2	14.440 - 14.451	White	14.400 - 14.411	- 0.051		
Exhaust	Repair size 1	14.240 - 14.251	Red	14.200 - 14.211	0.029	9.000 - 9.050	37.7
	Repair size 2	14.440 - 14.451	White	14.400 - 14.411	- 0.051		



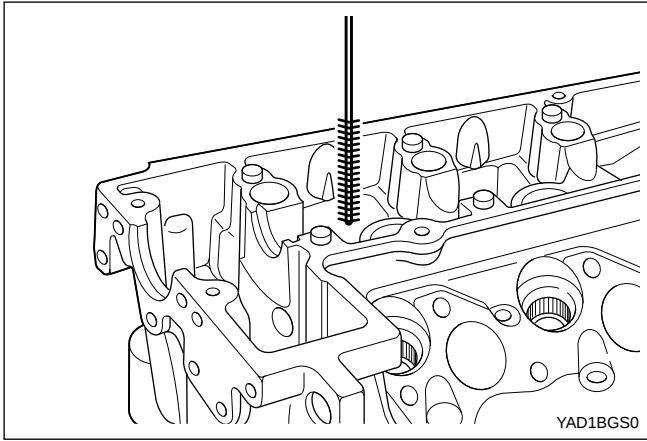
Notice: Measure center (arrow) of the valve guide and if the inner diameter 'A' exceeds standard value, replace the guide.

Tools Required

- 000 589 10 53 00 Reamer (for Exhaust)
- 000 589 10 68 00 Cylinder Brush
- 000 589 21 53 00 Reamer (for Intake)
- 102 589 00 23 00 GO / NO GO Gauge (for Intake)
- 103 589 02 15 00 Drift (for Exhaust)
- 103 589 03 15 00 Drift (for Intake)
- 115 589 34 63 00 Mounting Device
- 117 589 03 23 00 GO / NO GO Gauge (for Exhaust)
- 346 589 00 63 00 Super Cooling Box
- 601 589 05 15 00 Drift (for Intake)
- 601 589 06 15 00 Drift (for Exhaust)

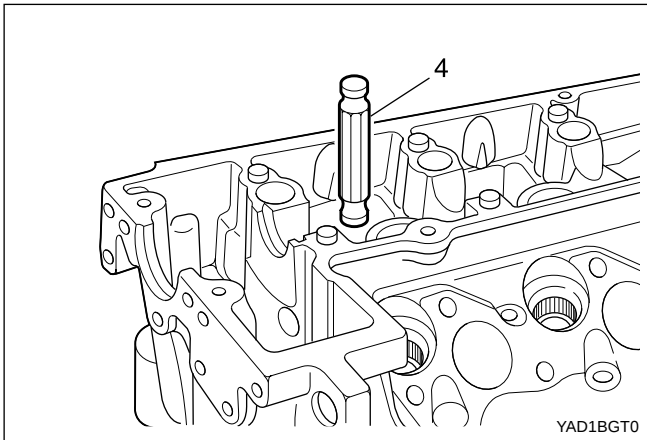
Matching Valve Seat - Broaching Tools - Guide Sleeves

Valve Seat	Broaching Tool No.	Guide Sleeve Tool No.	Guide Sleeve Side
Intake	115 589 00 53 00 (14.2 mm)	102 589 00 63 00	B
Exhaust		102 589 08 63 00	B
Intake	115 589 01 53 00 (14.4 mm)	601 589 15 63 00	A
Exhaust			B

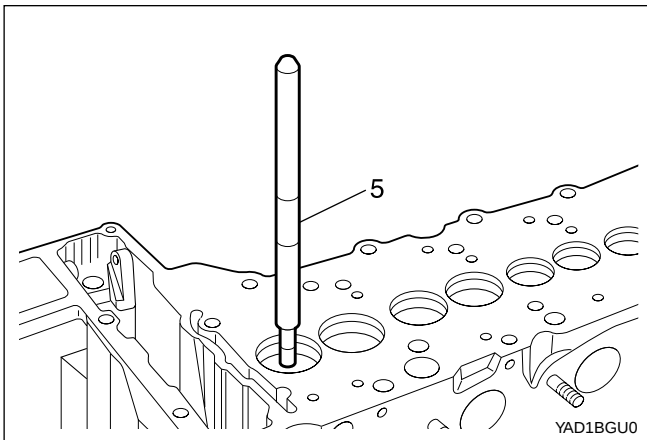


Checking

1. Thoroughly clean the valve guide bore using a cylinder brush 000 589 10 68 00.



2. Insert the GO/NO GO gauge (Intake: 102 589 00 23 00, Exhaust: 117 589 03 23 00) into the valve guide bore. If the NO GO side is inserted fully, replace the valve guide (Intake 8 mm, Exhaust 9mm).



Replacement Procedure

1. Drive out the valve guide (2) by using a drift (Intake: 103 589 03 15 00, Exhaust: 103 589 02 15 00) (5).

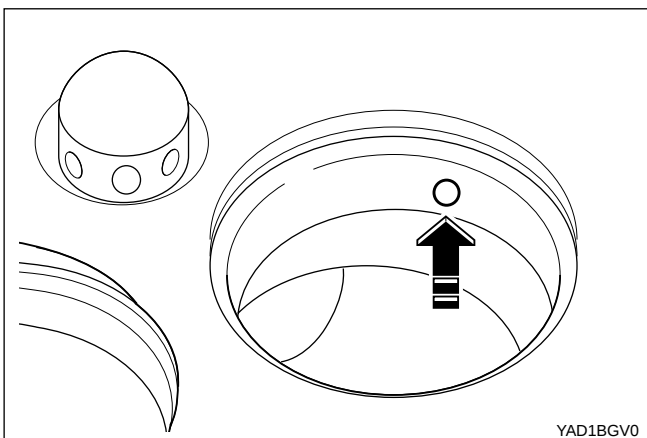
Notice: The valve guide must be driven out upward of the cylinder head.

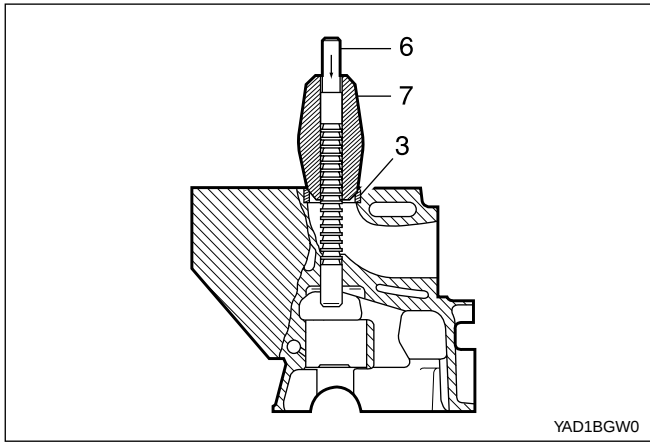
2. Thoroughly clean the basic bore by using a cylinder brush 000 589 10 68 00.
3. Check the basic bore in cylinder head for scoring marks and ream to next repair size if necessary.

4. Reaming basic bore in cylinder head (repair size).
 - Thoroughly remove carbon deposits in cylinder head.

Notice: Particularly remove the insides of the valve seat rings.

- Remove the elevation (arrow) of intake valve seat rings.

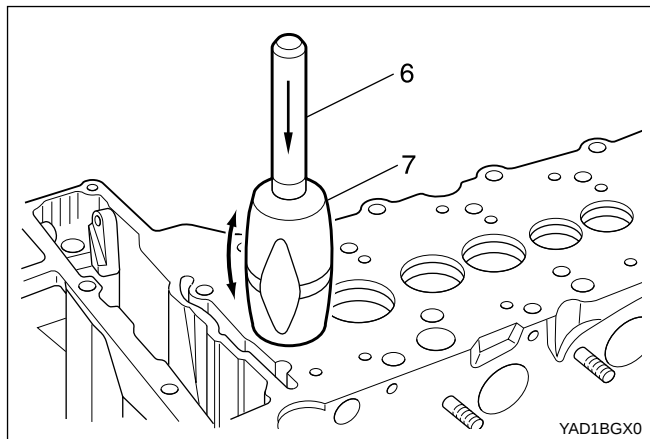




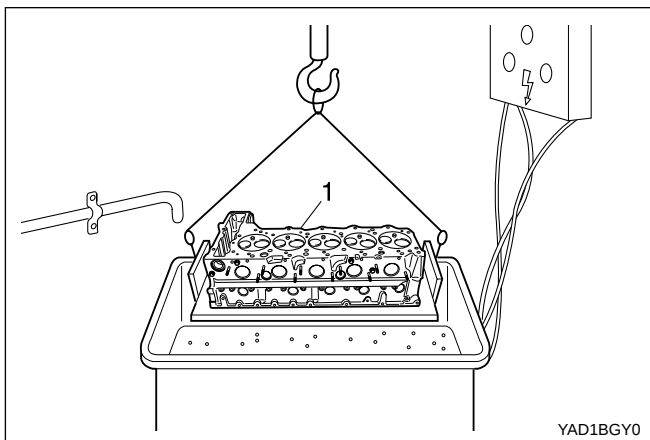
- Select correct broaching tool and guide sleeve (refer to the table).

Notice: Before broaching work, the broaching tool must be cleared of swarf with a stiff plastic brush.

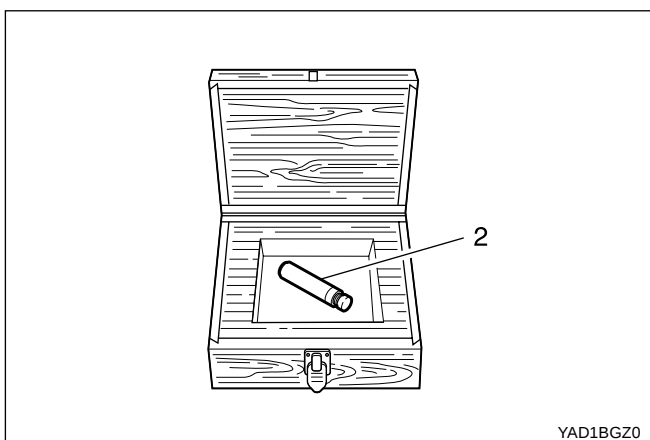
- Lubricate the basic bore, guide sleeve and broaching tool with petroleum.
- Push broaching tool (6) in broaching direction (arrow) into the guide sleeve (7) far enough so that the first cut of the broaching tool is positioned in the basic bore when guide sleeve is fitted onto the valve seat ring (3).



- Center the guide sleeve (7) in the valve seat ring (3) by turning.
- Knock through the broaching tool (6) with a plastic hammer (approx. 25 g) and aluminum drift.

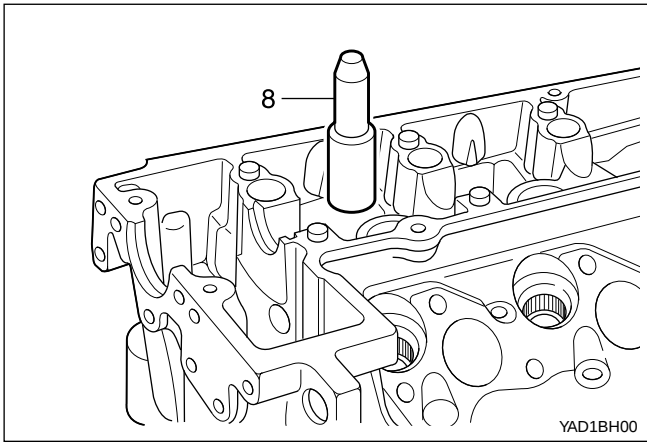


5. Heat the cylinder head (1) in a wear tank to approx. 80°C (176°F) with mounting device 115 589 34 63 00.



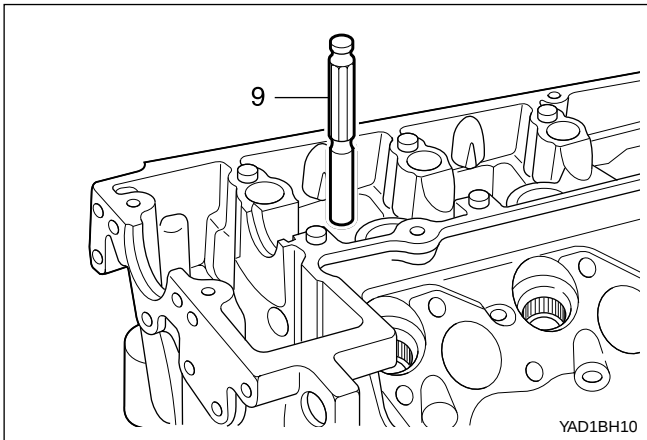
6. Cool down the new valve guide (2) into the super cooling box 346 589 00 63 00 with liquid nitrogen.

Notice: Do not touch the cooled valve guide by hand.



7. Drive in new valve guide with drift (Intake: 601 589 05 15 00, Exhaust: 601 589 06 15 00) (8) until the wire ring makes contact.

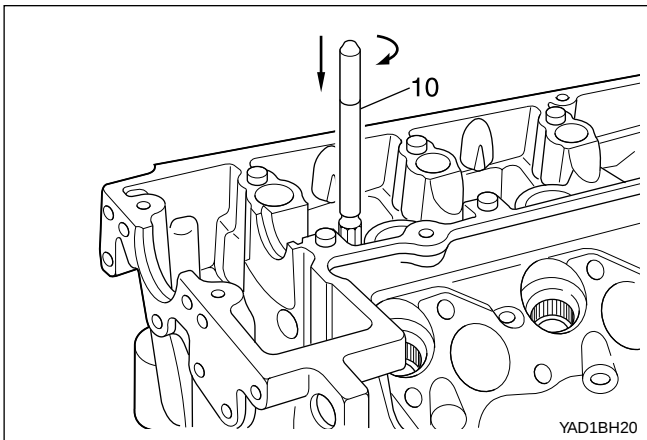
Notice: The valve guide must be driven in from the cylinder head cover.



8. Check the valve guide bore with GO / NO GO gauge (Intake: 102 589 00 23 00, Exhaust: 117 589 03 23 00) (9).

The GO side (marked '0') should just still drop. If the GO side cannot be inserted, the bore of valve guide should be reamed.

Notice: Perform the check only on cooled down cylinder head.



9. If necessary, ream the valve guide bore evenly with a reamer (Intake: 000 589 21 53 00, Exhaust: 000 589 10 53 00) (10).

Notice: Never turn the reamer against the direction of rotation.