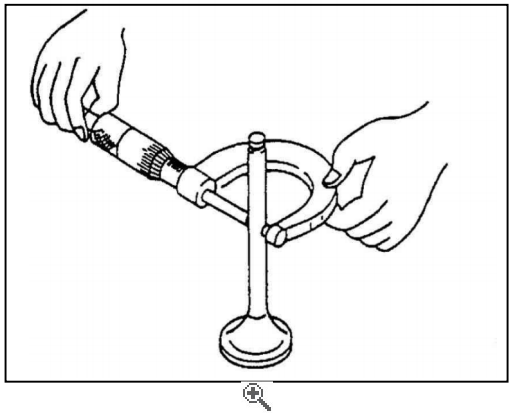
Inspection of the valves, valve guides and valve seats

Test

1. Measure the diameter of the valve stem as shown in the figure.

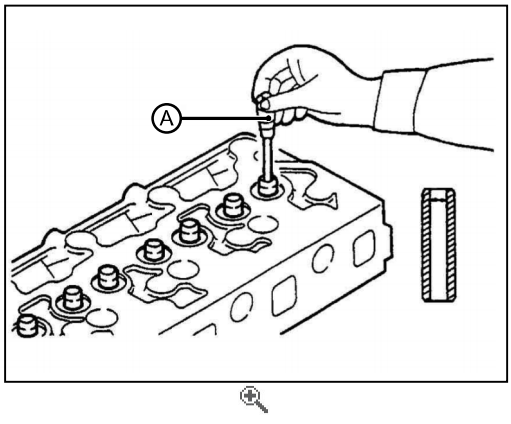


- If the stem is worn beyond the limit, or if it is abnormally worn, replace the valve.

Item		Nominal dimensions	Standard	Limit
Diameter of valve stem	Intake valve	6.6 mm (0.260 in)	From 6.565 mm to 6.580 mm (from 0.25846 in to 0.25905 in)	6.500 mm (0.25591 in)
	Exhaust valve	6.6 mm (0.260 in)	From 6.530 mm to 6.550 mm (from 0.25709 in to 0.25787 in)	

2. Valve guides wear more rapidly at their ends than at any other part.

Using a bore gauge (A), measure the inside diameter of the valve guides at both ends to find the clearance between valve stem and valve guide,



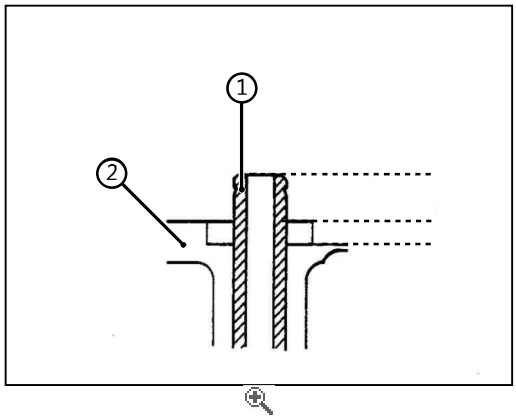
- If the clearance exceeds the specified limit, renew the valve guide or valve, whichever is most worn.

Item		Nominal size	Standard	
Clearance between valve stem and valve guide	Intake valve	-	From 0.02 mm to 0.05 mm (from 0.0008 in to 0.0020 in)	0.10 mm (0.0039 in)
	Exhaust valve	-	From 0.05 mm to 0.085 mm (from 0.0020 in to 0.00335 in)	0.15 mm (0.0059 in)
Height to top of valve guide		10 mm (0.39 in)	From 9.5 mm to 10.5 mm (From 0.374 in to 0.413 in)	-

- Before measuring the valve guides, remove all traces of paint and carbon deposits.

Force old valve guide (1) from cylinder head (2) using a suitable tool and an arbor press from the underside of the head.

Install the new valve guide (1) in the cylinder head (2) by inserting it with an arbor press from the upper side of the cylinder head to obtain the specified stand-out (10 mm ± 0.5 mm; 0.93 in ± 0.020 in).

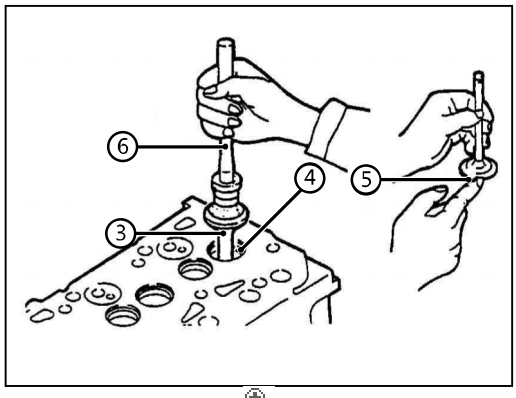


3.

Insert a new valve (3) in the guide (1); make sure the valve slides in the guide freely.

After renewing the valve guide (1), check the contact between the valve (3) and its seat (4)

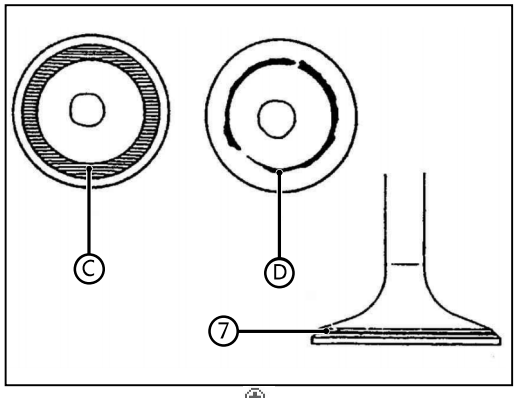
Put a small amount of Prussian blue or read lead on the valve face (5). Hold valve (3) with a valve lapping tool (6) and press it against seat (4) to check the contact.



4.

The width of contact (7) must be uniform all the way around both the seat and the valve (C).

- If the contact is incorrect (D), reface the valve and seat.

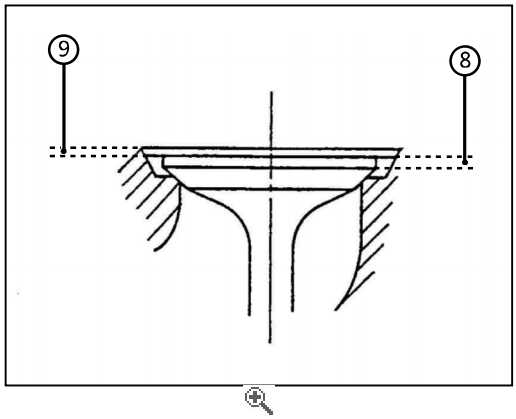


5.

- If the valve margin (8) exceeds the specified limit, renew the valve (3).
- If the valve sinkage (9) exceeds the specified limit, recondition the valve seat or renew the cylinder head assembly

Item	Standard	Limit
Valve margin (valve lip thickness)	1.0 mm (0.039 in)	0.5 mm (0.020 in)

Item	Standard	Limit
Valve sinkage (distance between the top of a closed valve and the face of the cylinder head)	0.5 mm ± 0.25 mm (0.020 in ± 0.0098 in)	1.5 mm (0.059 in)

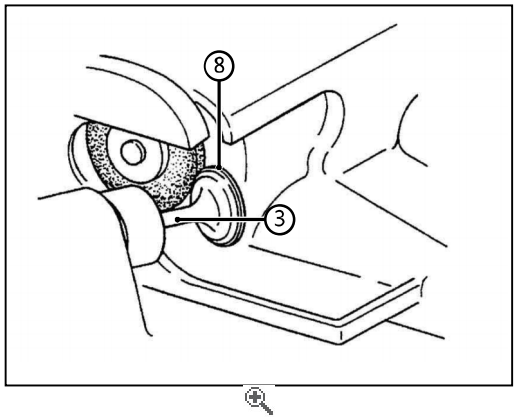


6.

Set the valve refacer at an angle of 45’ and grind the valve.

The valve margin (8) must be not less than the specified limit.

- If the margin (8) is below the limit when the valve is refaced, renew the valve (3).

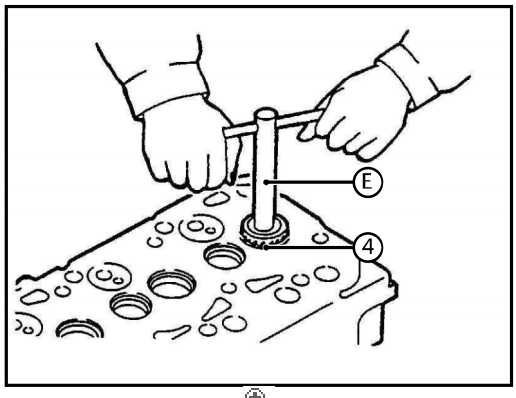


7.

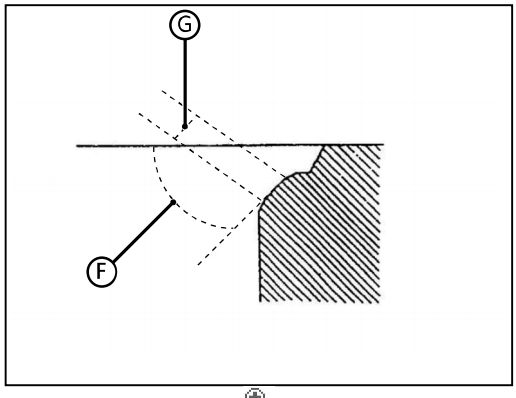
Check the clearance between the valve (3) and valve guide (1) before refacing the valve seat (4).

- Renew the valve guide (1) if necessary.

Finish the valve seat (4) using a finishing tool or a valve seat grinder (E).

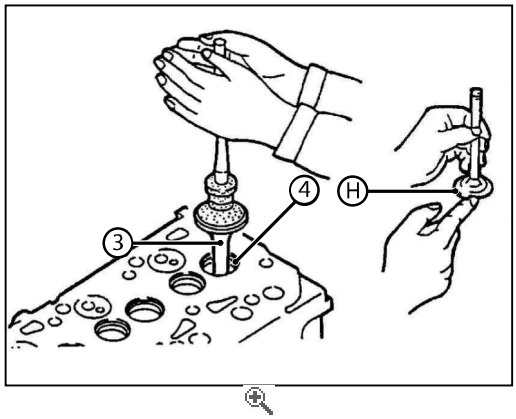


8. Check the valve face angle (F) and valve seat width (G).



Item	Standard	Limit
Valve face angle (F)	45°	-
Valve seat width (G)	From 1.3 mm to 1.8 mm (from 0.051 in to 0.071 in)	2.5 mm (0.098 in)

9. Be sure to lap the valves (3) in their seats after refacing or renewal of the valves or valve seats (4).



Put a small amount of lapping compound on the valve face.

- Do not put lapping compound on the valve stem.
- Use a 120 - 150 grit lapping compound (H) for initial lapping and a compound finer than 200 grit for finish lapping.
- Mixing the compound with a small amount of engine oil will help distribute the compound on the valve face uniformly.

Using a lapping tool, hold the valve (3) in its seat (4) and rotate it only a part of a turn, then raise the valve off its sealing surface to reposition it. Press the valve against the sealing surface and rotate through another part turn.

Repeat this operation until the compound wears and loses its cutting property.

Wash the valve (3) and valve seat (4) with dry cleaning solvent.

Apply engine oil to the valve (3) and lap it in the seat (4).

Check the valve face contact (7).

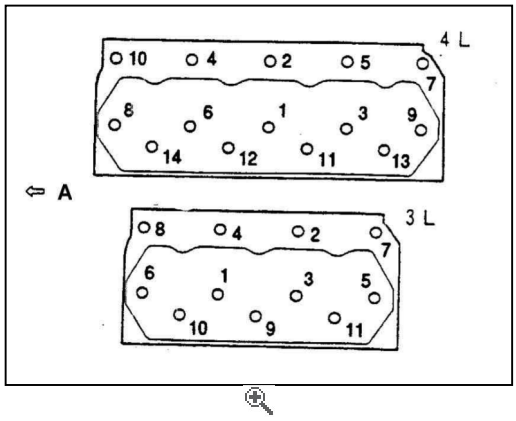
10.

Valve clearances

Maintenance

- Adjust valve clearances when the engine is cold.

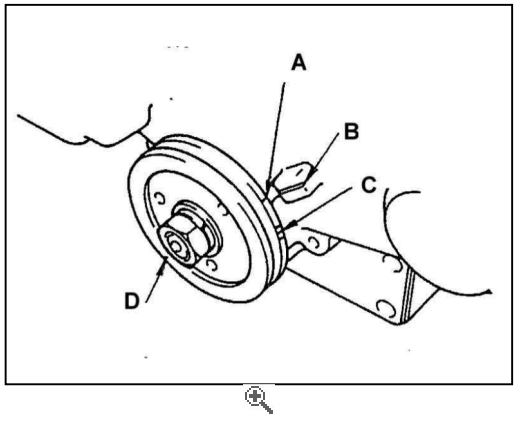
Slightly loosen the cylinder head screws and retighten them to the specified torque in numeric order.



Tightening torque	9 ± 0.5 kgf x m
	(65 ± 4 lbf x ft)
	[88 ± 5 N x m]

A - Front of engine

1.



Find TDC on the compression stroke for No. 1 piston using the following procedure:

- rotate the crankshaft to bring the TDC mark on the crankshaft pulley into alignment with the mark on the timing cover;

- with No. 1 piston at TDC on the compression stroke, the rocker arms should not move when the crankshaft is turned approximately 20' in both directions;

- if the rocker arms move, No. 1 piston is at top dead center on the intake or exhaust stroke; in this case, rotate the crankshaft through 360° in the normal direction of engine rotation. No. 1 piston is now at top dead centre on the compression stroke.

Loosen the lock nut of the adjusting screw. With a feeler gauge inserted between the rocker arm and valve cap, adjust the valve clearance by turning the adjusting screw.

Item	Standard
Valve clearances (intake and exhaust valves)	0.25 mm (0.0098 in)

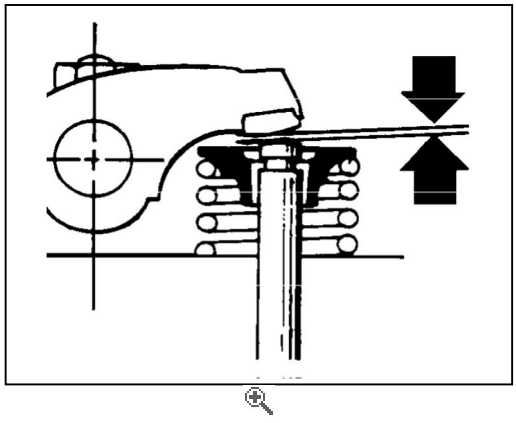
A - TDC (top dead center) mark for pistons No. 1 and No. 4

B - Mark on timing cover.

C - Injection timing mark.

D - TDC mark for pistons No. 2 and No. 3.

2.



Hold the adjusting screw and tighten the lock nut. After adjusting the valve clearance on the valves for No. 1 cylinder, rotate crankshaft 180' in the direction of engine rotation and adjust the valve clearance on the valves for the remainder of the cylinders in firing order (injection sequence).

Firing order (injection sequence)		Crankshaft rotation angle
S3L	1 – 3 – 2	240°
S4L	1 – 3 – 4 – 2	180°

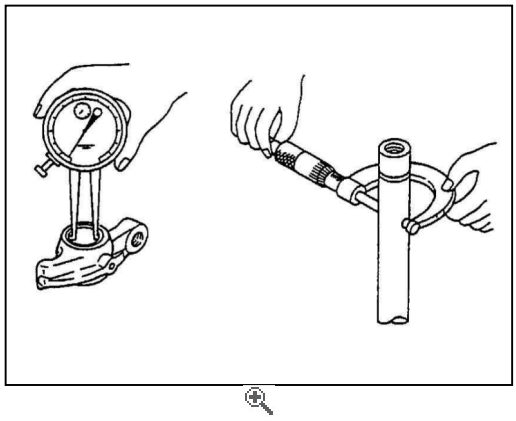
- After adjusting the valve clearance on the valves for all cylinders, rotate the crankshaft two or three times and check that the valve clearances are still correct.

3.

Inspection of the rocker arms and rocker shaft

Inspection

1. Measure the inside diameter of the bore in the rocker arm for the rocker shaft and the diameter of the rocker shaft to find the clearance between the arm and shaft.



- If the clearance is on the limit, renew the rocker arm.
- If it exceeds the limit, renew both the rocker arm and the shaft.

Item	Nominal size	Standard	Limit
Bore in rocker arm for rocker shaft	18.9 mm (0.744 in)	from 18.910 mm to 18.930 mm (from 0.74449 in to 0.74527 in)	-
Diameter of rocker shaft	18.9 mm (0.744 in)	from 18.880 mm to 18.898 mm (from 0.74331 in to 0.74401 in)	-
Clearance between rocker arm and shaft	-	from 0.012 mm to 0.050 mm (from 0.00047 in to 0.00197 in)	0.200 mm (0.00787 in)

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Cylinder head and valve train components

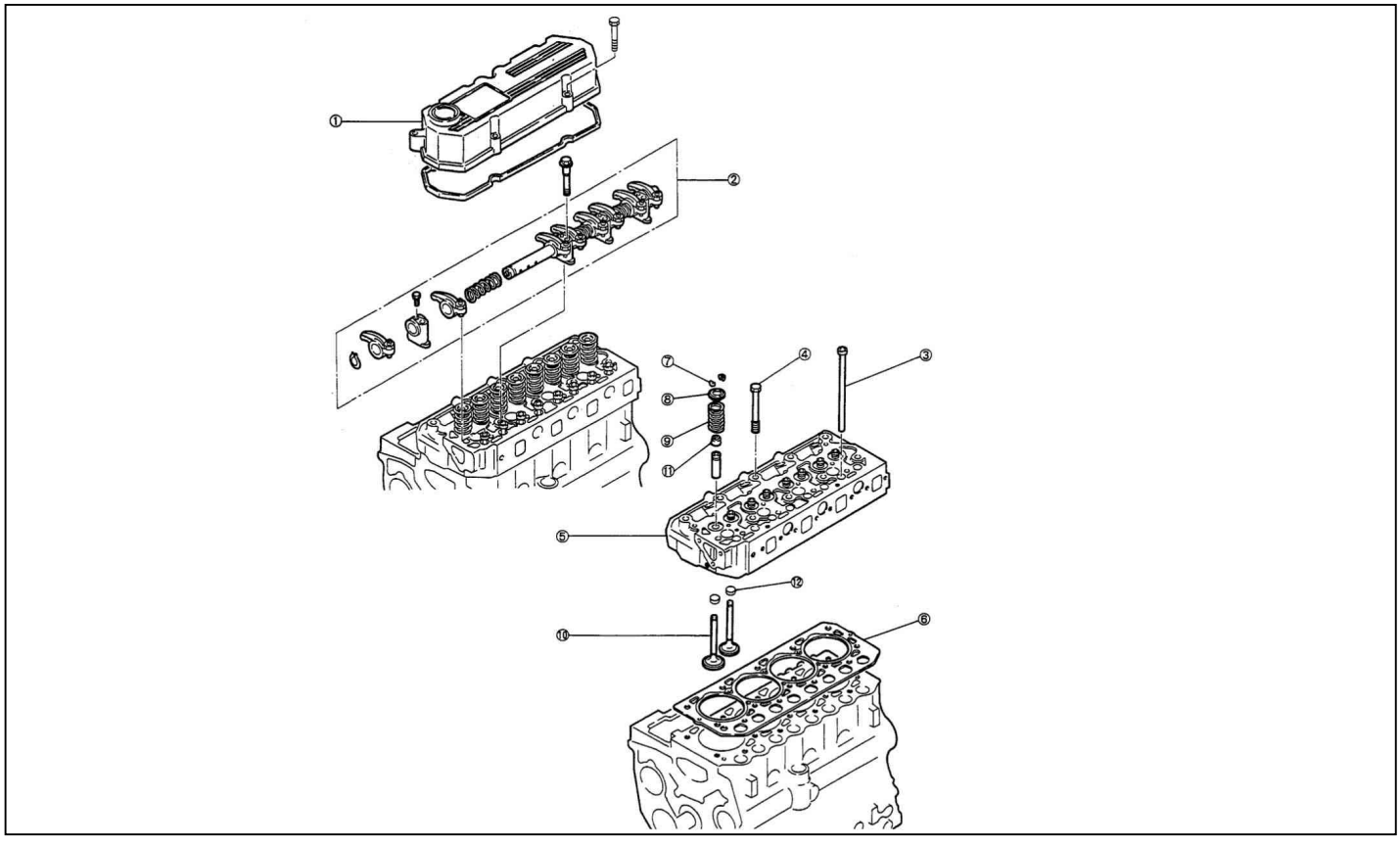


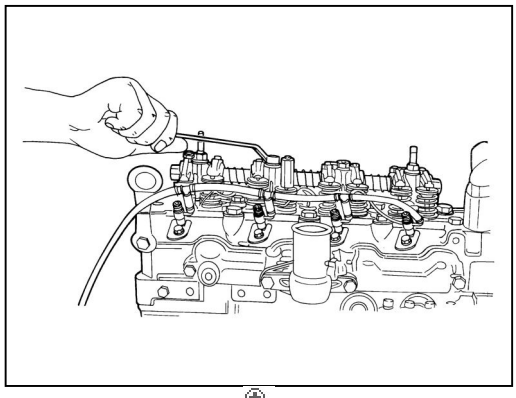
Fig. Disassembly sequence

1. Rocker cover.
2. Rocker assembly.
3. Pushrod.
4. Cylinder head screw.
5. Cylinder head.
6. Cylinder head gasket.
7. Collet.
8. Valve spring retainer.
9. Valve spring.
10. Valve.
11. Valve stem seal.
12. Valve cap.

Disassembly

Removal of the rocker shaft assembly.

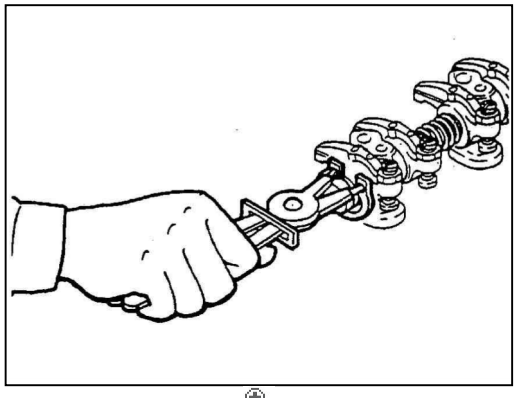
Remove the screws securing the rocker arms, then remove the rocker shaft assembly, then remove the valve caps.



1.

Disassembly of the rocker shaft assembly.

Mark each rocker arm with its relative location on the rocker shaft.

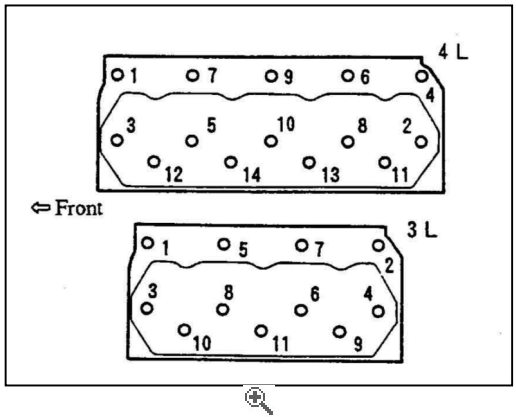


2.

Removal of the cylinder head screws.

Loosen the cylinder head screws gradually in stages in the sequence shown.

- If any parts of the cylinder head are faulty, check the tightness of the cylinder head screws with a torque wrench before loosening them.

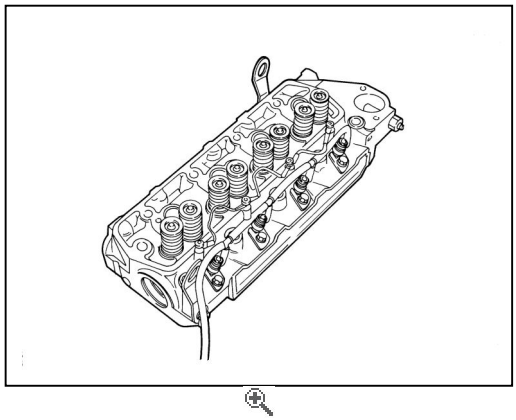


3.

Removal of the cylinder head assembly.

Using a hoist, lift the cylinder head straight up and off the engine.

- If the gasket is stuck fast and the cylinder head cannot be separated from the cylinder block, tap around the side of the cylinder head with a rubber mallet

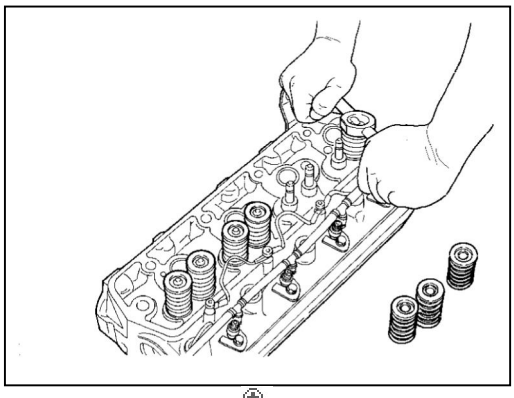


4.

Removal of the valves and valve springs.

Compress the valve spring with a valve lifter and remove the collet, the spring retainer, the spring and the valve.

- The valves, spring retainers, springs and collets must be set aside separately in groups, each labelled with the cylinder number, to ensure subsequent installation in the original position.

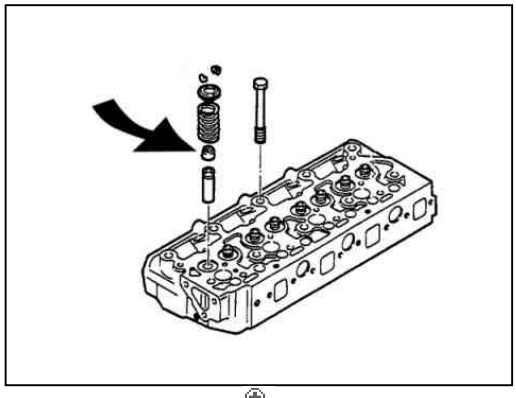


5.

Removal of the valve stem seals.

Remove the valve stem seals.

- Do not reuse the valve stem seals.



6.

Inspection

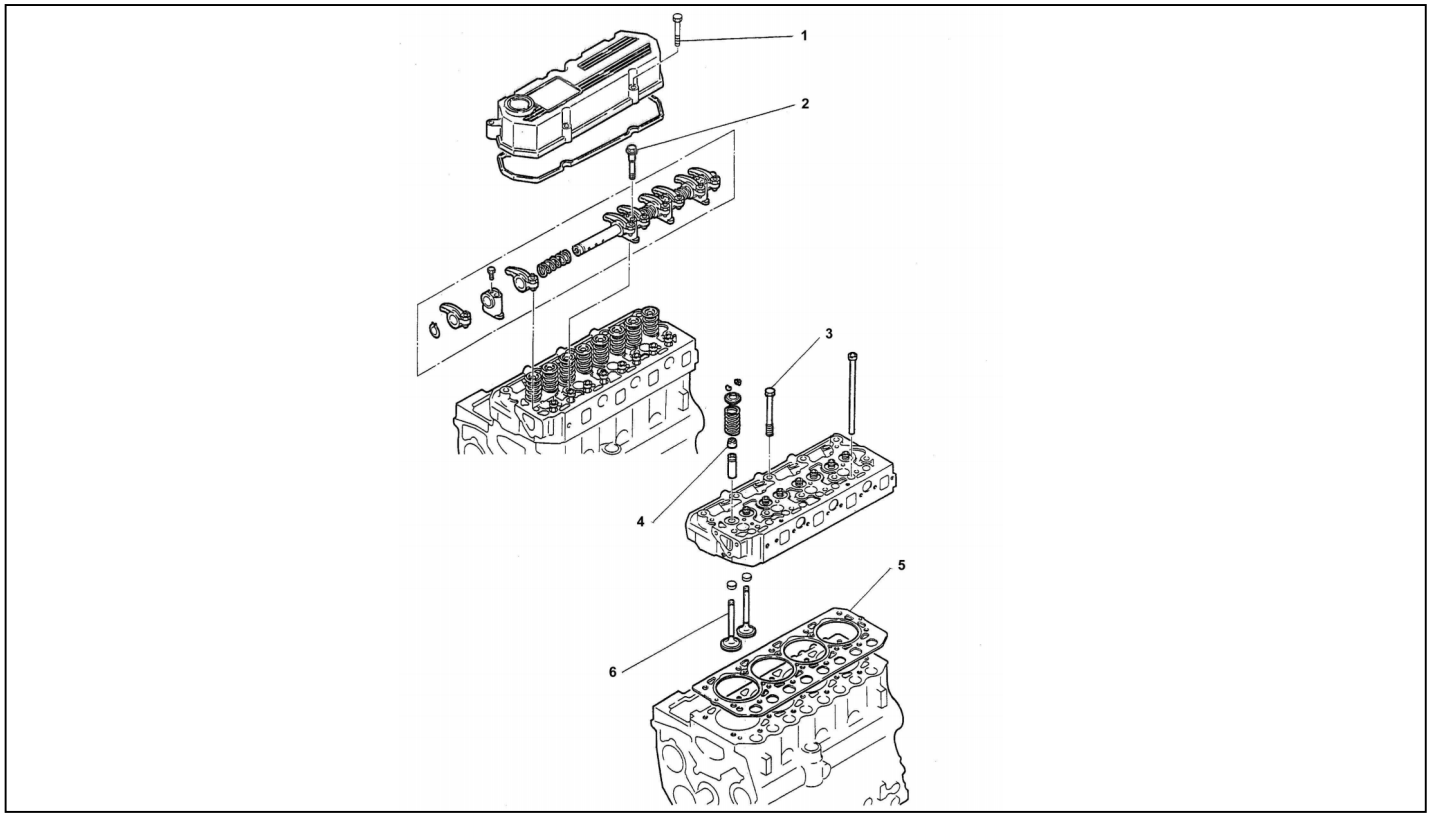
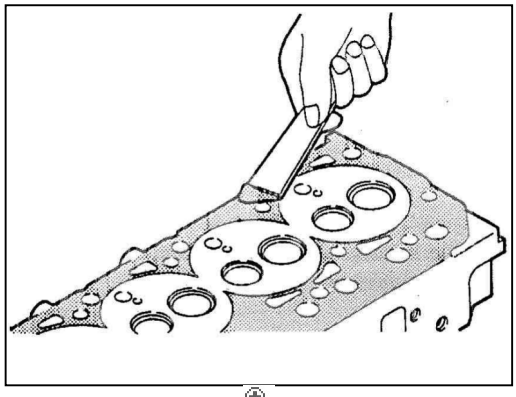


Fig. Inspection points

1. Tightening torque: 1.15 ± 0.15 kgf x m (8.3 ± 1.1 lbf x ft) [11.3 ± 1.5 N x m].
2. Tightening torque: 1.50 ± 0.50 kgf x m (11 ± 4.0 lbf x ft) [14.7 ± 5.0 N x m].
3. Tightening torque: 9.50 ± 0.50 kgf x m (65 ± 4 lbf x ft) [88 ± 5 N x m].
4. Use a new part.
5. Use a new gasket.
6. Lubricate stem with engine oil.

Refitting

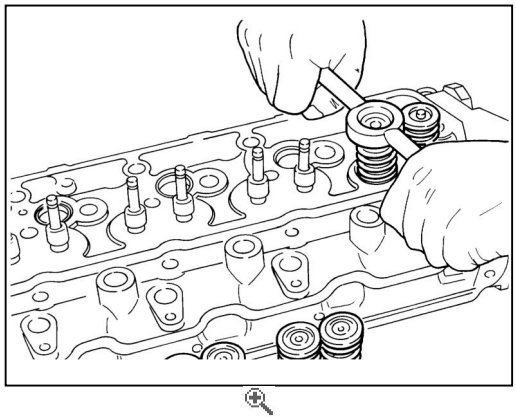


Cleaning the lower face of the cylinder head.

Scrape the old gasket from the lower face of the cylinder head.

- After scraping off the gasket, remove all residue using an oilstone smeared with engine oil and thoroughly clean the face.

1.

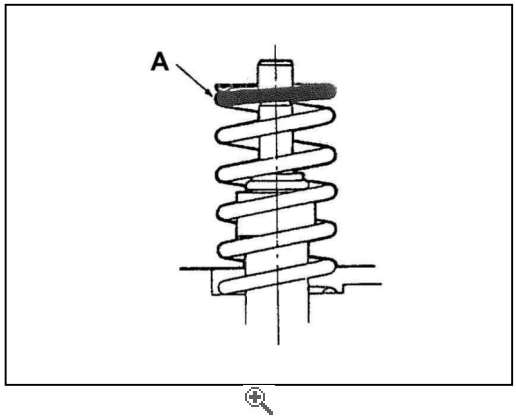


Installing the valve stem seal.

Using a box wrench, locate the valve stem seal in the valve guide. After installation, make sure the seal is in its correct position.

- Incorrect installation of the seal can cause a failure to seal against the downward flow of oil along the stem.

2.



Refitting the valve spring.

Install the valve spring with the white enamelled end (A) uppermost.

3.

Refitting the valve assembly.

Compress the valve spring with a valve lifter and install the assembly on the valve tip.

- Do not compress the valve spring excessively, otherwise the valve spring retainer could impact and damage the valve stem seal.

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