

PERKINS DIESEL 704-26 (MODEL UB)

DESCRIPTION

This section has the description and the repair procedures for the Perkins diesel 704-26 (Model UB) engine. CHECKS AND ADJUSTMENTS, TROUBLESHOOTING procedures and SPECIFICATIONS are included in this section. The end of the engine with the fan is the “front” of the engine.

The Model UB is a 2.6 liter, four-cylinder, liquid-cooled engine. This diesel engine uses indirect fuel injection. An indirect fuel injection engine has a small pre-combustion chamber in the cylinder head. This pre-combustion chamber permits ignition of a normal fuel:air ratio which then expands into a less than normal fuel:air ratio of the combustion chamber in the piston head. This combustion process decreases smoke and possible harmful emissions from the engine exhaust.

This engine has a closed crankcase ventilation system (breather system). Exhaust gases generated in the crankcase and cylinder head spaces during engine operation are returned to the combustion chambers through the air induction system.

The cast iron cylinder block is made without cylinder liners. The crankshaft is induction hardened and has five main bearings. The end clearance of the crankshaft is controlled by two half thrust washers installed on each side of the number four main bearing. Each piston has two compression rings and an oil control ring. Each piston and connecting rod is matched to its cylinder. The correct piston height is obtained during engine assembly by careful selection of one of six possible lengths of connecting rods.

The cylinder head has two valves per cylinder. There is a valve guide and a valve seat for each valve. Each valve has a single valve spring and an oil seal installed on top of the valve guide. The face angle for all of the valves is 45° and the angle for all of the valve seats is 45°. The bottom face of the cylinder head can not be machined because of the pre-combustion chamber.

GENERAL SAFETY RULES

WARNING

Viton Seals

Some seals used in this engine are made of a synthetic material called Viton. Viton is a safe material when used under normal conditions of operation.

If Viton is burned, a dangerous acid is produced as a by-product. Never permit burned material to come into contact with the skin or the eyes.

If it is necessary to handle components that have been burned, Use the following procedures:

- **Make sure the components are cool.**
- **Use Neoprene gloves and discard the gloves after use.**
- **Wash the area with calcium hydroxide solution and then clean with water.**
- **Discard the components and gloves in accordance with environmental regulations.**

Burned Viton by-product that touches the skin or eyes must be immediately flushed with water or a calcium hydroxide solution. Get medical help immediately.

WARNING

Disconnect the battery cables before doing any disassembly and repair of the engine or parts of the electrical system. Put a “DO NOT OPERATE” tag in the operator’s area and on the battery connectors.

Long term exposure to used engine oil can cause skin irritation or cancer. Wash with detergent and water
Exhaust from internal combustion engines contains carbon monoxide and other harmful chemicals. Carbon monoxide is a colorless, odorless poison and can cause unconsciousness or death without warning. Long term exposure to exhaust or chemicals in the exhaust can cause cancer, birth defects and other reproductive harm. Avoid exposure to engine exhaust

Do not use diesel engines indoors where soot can accumulate.

⚠ WARNING

If engines are operated in confined spaces maintain adequate ventilation or vent exhaust to the outside. Do not exceed applicable air contaminant limits.

Follow the inspection and maintenance schedule and procedures in this manual. Do not alter exhaust, ignition or fuel systems.

Disconnect the battery cables before doing any disassembly and repair to the engine or parts of the electrical system.

Disposal of batteries must meet local environmental regulations.

The diodes and resistors in the electrical system can be damaged if the following cautions are not followed:

- Do not disconnect the battery when the engine is running. The voltage surge can damage the diodes and resistors.
- Do not disconnect an electric wire before the engine is stopped and the switches are “OFF”.
- Do not cause a short circuit by connection of the electric wires to the wrong terminals. Make sure a correct identification is made of a wire before it is connected.
- Make sure a battery is the correct voltage and polarity before it is connected.
- Do not check for current flow by making a spark because the diodes and other solid-state components can be damaged.

REMOVAL AND REPLACEMENT

See the **THE FRAME** section for the procedure for removing the engine and transmission. See the **TRANSMISSION** section for the procedure to separate the transmission from the engine.

Lifting An Engine

⚠ WARNING

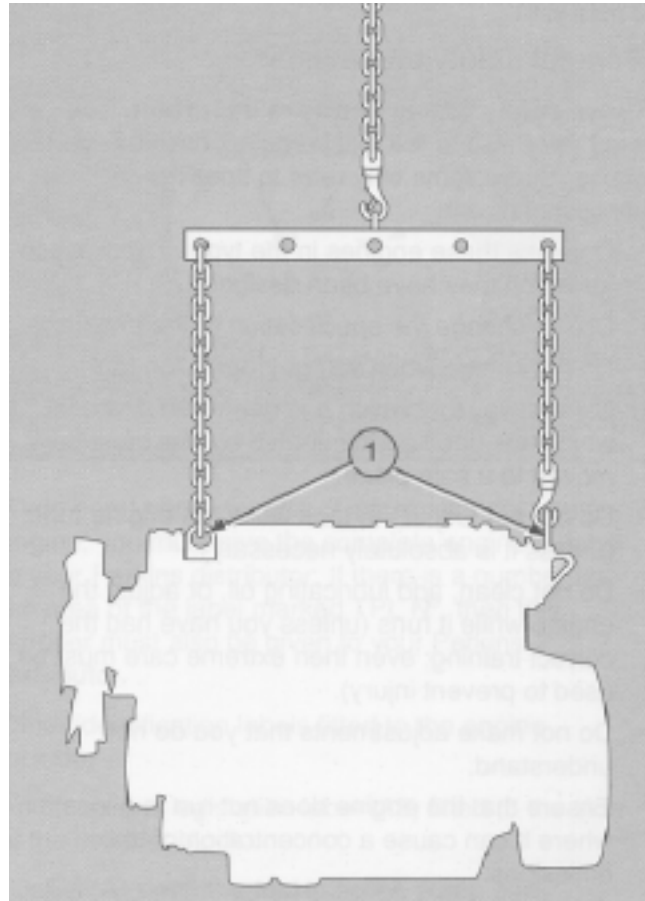
A complete engine weighs approximately 300 kg (600 lb). Use a lifting device that has a minimum capacity of 500 kg (1000 lb) when a complete engine assembly must be moved.

⚠ CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

Before an engine is lifted:

- Make sure the lifting equipment has the correct capacity to lift the engine. Use a vertical lift as shown in FIGURE 1. Never use a single lift bracket to lift an engine.



1. ENGINE LIFT BRACKETS

FIGURE 1. LIFTING AN ENGINE

- Make sure the engine lift brackets are in good condition and correctly fastened to the engine. The capscrews for the engine brackets are tightened to 22 Nm (196 lbf in).
- Make sure lifting slings do not damage the valve cover or other engine components.
- Some components of the engine assembly are heavy. Always use a lifting device when moving the cylinder block, cylinder head, flywheel housing, crankshaft, and flywheel.

ENGINE IDENTIFICATION

The engine number is on a label that is fastened to the right, rear side of the cylinder block. See FIGURE 2.

An example of an engine number is:

UB80862U123456A

The components of an engine number are as follows:

UB	Type code letters
80862	Build list number
U	Built in the UK
123456	Engine serial number
A	Year of manufacture

The complete engine number must be used if any parts, service, or information is needed.

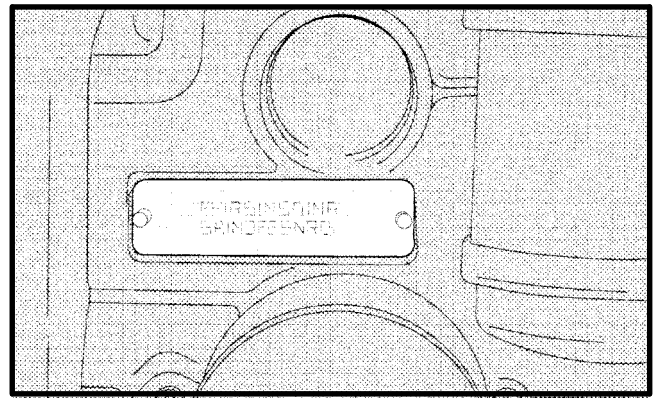


FIGURE 2. ENGINE NUMBER

Engine Data

Number of cylinders	In line 4
Firing order	1-3-4-2
Bore	91.0 mm (3.58 in)
Stroke	100.0 mm (3.94 in)
Displacement	2.6 liter (159 in ³)
Valve clearances (All) (cold)	0.35 mm (0.014 in)
Engine oil pressure at maximum governed speed and normal operating temperature	420 kPa (61 psi)
Engine oil capacity	Initial fill — 8.3 liters (8.8 qt) Oil and filter change — 7.0 liters (7.4 qt)
Direction of engine rotation	clockwise
Governor speed	See PERIODIC MAINTENANCE section for your model of lift truck.

CYLINDER HEAD ASSEMBLY

DESCRIPTION

The cylinder head assemblies for the UB engine contains two valves for each cylinder. From the front of the engine, the sequence for valves is first inlet and then exhaust.

Included in the cylinder head assembly is a valve guide and a valve seat insert for each valve. The inserts and guides can be replaced if necessary.

The inlet and the exhaust valves are each installed in the cylinder head with a single valve spring and an oil seal. The oil seal is installed over the top of the valve guide. The valve and valve spring are held in place with a hardened steel cap and two collets.

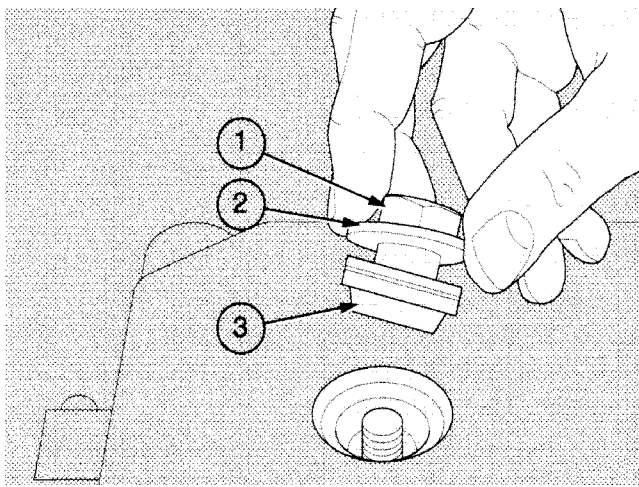
The glow plugs and the fuel injectors are both installed into the top of the cylinder head. The tip of the glow plug and the fuel injector protrude into the pre-combustion chamber.

VALVE COVER

Removal

The aluminum valve cover has a closed breather assembly and a connection for the breather pipe.

1. Disconnect the breather pipe.
2. Remove the special nuts, washers, and seals from the valve cover. See FIGURE 3.
3. Remove the valve cover from the cylinder head.

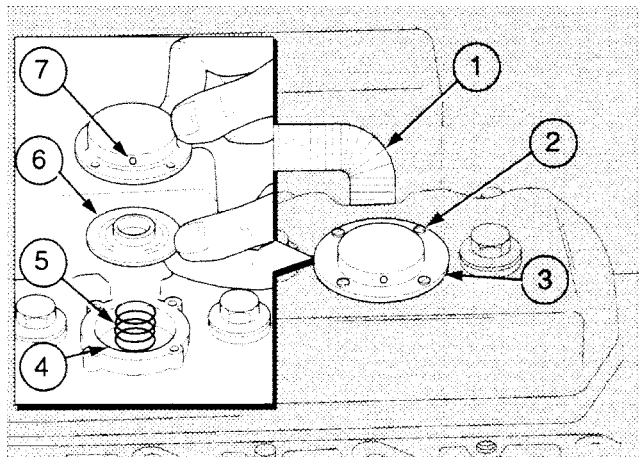


1. CAP NUT
2. STEEL WASHER
3. RUBBER SEAL

FIGURE 3. VALVE COVER FASTENERS

Breather System, Cleaning And Replacement

The breather assembly is installed in the top of the valve cover and has the following components: cover, four machine screws, diaphragm and location ring assembly, and spring. See FIGURE 4.



1. BREATHER HOSE
2. CAPSCREWS (4)
3. BREATHER COVER
4. BREATHER CAVITY
5. SPRING
6. LOCATION RING ASSEMBLY WITH DIAPHRAGM
7. VENT HOLE

FIGURE 4. BREATHER COMPONENTS

Replace the spring (item 5) and the diaphragm (item 6) every 2000 hours of engine operation. Clean the inside

of the breather pipe (item 1) every 1000 hours of engine operation.

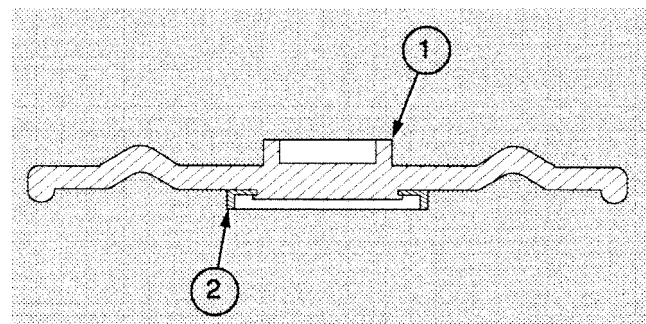
CAUTION

Make sure the area around the vent hole (item 7, FIGURE 4.) is kept clean and the vent hole is not restricted.

Make sure the breather pipe (item 1, FIGURE 4.) does not contact other components and cause damage to the breather pipe.

Make sure the components of the breather system are installed correctly to prevent possible damage to the engine.

1. Remove the four machine screws and remove the breather cover.
2. Remove the diaphragm and location ring assembly. Remove the spring.
3. Release the clips that hold the breather pipe and remove the breather pipe.
4. Clean the breather cavity in the valve cover, the breather pipe, and the vent hole.
5. Install a new spring in the cavity in the valve cover.
6. See FIGURE 5. Install a new location ring and new diaphragm. Make sure the location ring is on the spring.



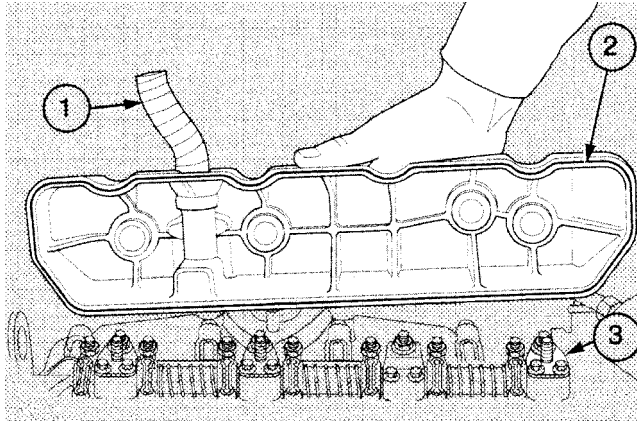
1. DIAPHRAGM
2. LOCATION RING

FIGURE 5. LOCATION RING AND DIAPHRAGM

7. Install the breather cover and tighten the four machine screws.
8. Install the breather pipe and tighten the clips.

Installation

1. Make sure the rubber seals are in good condition. Make sure the breather system is clean and in good condition.
2. Clean the seal face on the cylinder head and install the valve cover. Make the sure the seal stays in the groove in the valve cover.



1. BREATHER HOSE
2. MACHINED GROOVE OF VALVE COVER
3. STUD AND PLATE ASSEMBLY

FIGURE 6. VALVE COVER INSTALLATION

CAUTION

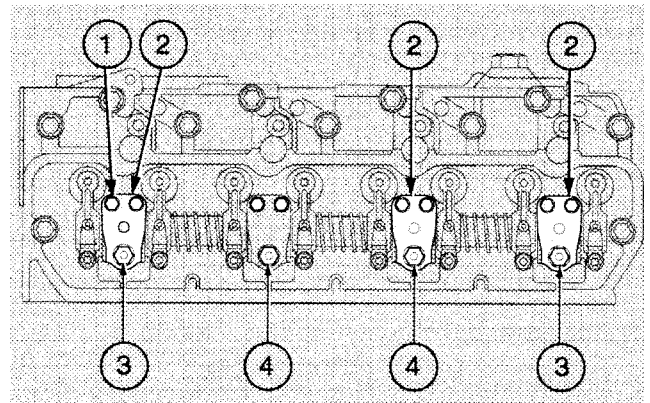
If the cap nut (item 1, FIGURE 3.) is tightened too much, the stud and plate assembly (item 3, FIGURE 6.) can be damaged.

3. Install the valve cover. Make sure the special nuts, washers and seals are installed correctly. Tighten the special nuts to 11 Nm (98 lbf in).

ROCKER ASSEMBLY

Removal

1. Remove the valve cover. See Valve Cover, Removal.
2. Remove the eight capscrews (item 1, FIGURE 7.) that fasten the rocker brackets to the cylinder head. First loosen the two outer nuts (item 3). Then loosen the two inner nuts (item 4). Remove the nuts.



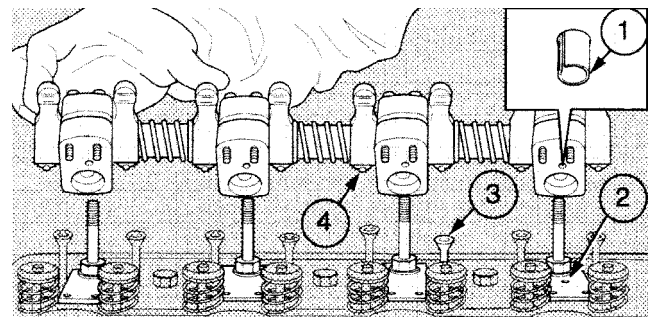
1. CAPSCREWS (8)
2. STUD PLATES (3)
3. INNER BRACKET NUTS
4. OUTER BRACKET NUTS

FIGURE 7. ROCKER BRACKETS

NOTE: The rocker assembly has three plates which include the studs for the valve cover. See FIGURE 7. These plates must be installed in the correct positions.

3. Remove the rocker assembly from the cylinder head. See FIGURE 8.

NOTE: A special steel pin is installed in the lower part of the front rocker bracket. See FIGURE 8. The function of this pin is to make sure that this rocker bracket is correctly aligned with the oil hole in the cylinder head. This oil passage is for the oil to lubricate the rocker assembly. Make sure the oil holes are clean.

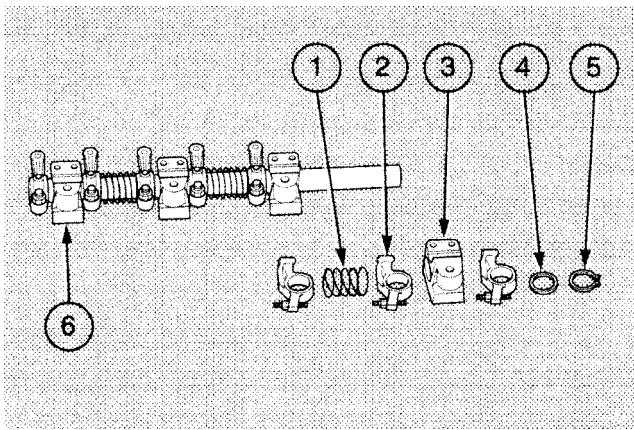


1. ALIGNMENT PIN
2. OIL HOLE
3. PUSH RODS
4. ADJUSTMENT SCREWS

FIGURE 8. ROCKER ASSEMBLY

Disassembly

1. Remove the end clips (5) from both ends of the rocker shaft. See FIGURE 9.



1. SPRINGS
2. ROCKER LEVERS
3. ROCKER BRACKETS
4. SPACER
5. CLIPS
6. BRACKET

FIGURE 9. ROCKER ASSEMBLY COMPONENTS

2. Remove the spacer (item 4), rocker levers (item 2), rocker brackets (item 3), and springs (item 1).

Assembly

1. Clean and inspect the components for wear and damage. Check the clearance between the rocker levers and the rocker shaft. If the clearance is greater than 0.124 mm (0.0048 in), replace the worn parts.

2. Assemble the parts of the rocker assembly as shown in FIGURE 9.

Installation

1. Install the rocker assembly on the cylinder head as shown in FIGURE 8.

2. Make sure the stud and plate assembly for the valve cover are installed on the correct rocker brackets. See FIGURE 7. Make sure the pushrods fit into the sockets in the tappets and the rocker levers.

3. Install the four nuts and eight capscrews. Tighten the capscrews and nuts only with your fingers. Make sure the parts are correctly fitted together.

4. Tighten the nuts evenly to 22 Nm (196 lbf in).

5. Tighten the capscrews evenly to 9 Nm (80 lbf in).

6. Adjust the valve clearances. See Install the valve cover.

Adjust The Valve Clearances

1. Check the valve clearance with a spacer guage between the top of the valve stem and the rocker lever as shown in FIGURE 10. The engine must be cold. The correct valve clearance for all valves is 0.35 mm (0.014 in).

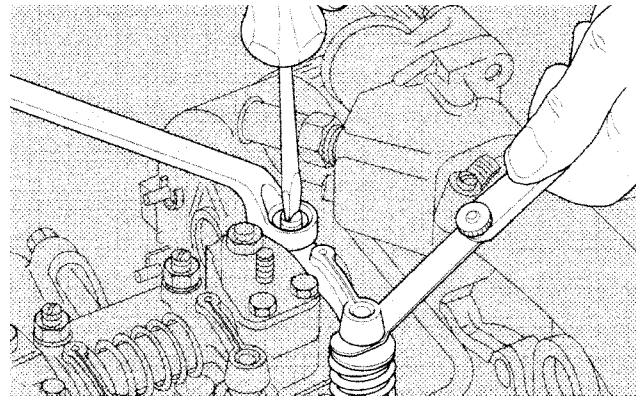


FIGURE 10. VALVE ADJUSTMENT

NOTES: The arrangement of the valves is shown in FIGURE 11. The valve numbers 1 and 2 are for the number 1 cylinder which is at the front of the engine.

The engine rotation is clockwise when viewed from the front.

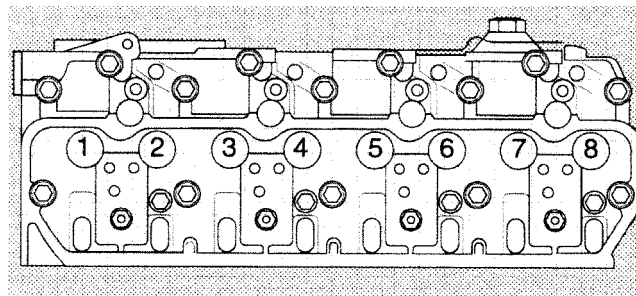


FIGURE 11. VALVE ARRANGEMENT

2. Rotate the crankshaft clockwise until the valve number 7 has just opened and valve number 8 has not closed completely. Adjust the valve clearance on valves 1 and 2.

3. Rotate the crankshaft clockwise until the valve number 3 has just opened and valve number 4 has not closed completely. Adjust the valve clearance on valves 5 and 6.

4. Rotate the crankshaft clockwise until the valve number 1 has just opened and valve number 2 has not closed completely. Adjust the valve clearance on valves 7 and 8.

5. Rotate the crankshaft clockwise until the valve number 5 has just opened and valve number 6 has not closed completely. Adjust the valve clearance on valves 3 and 4.

Valve Spring Replacement

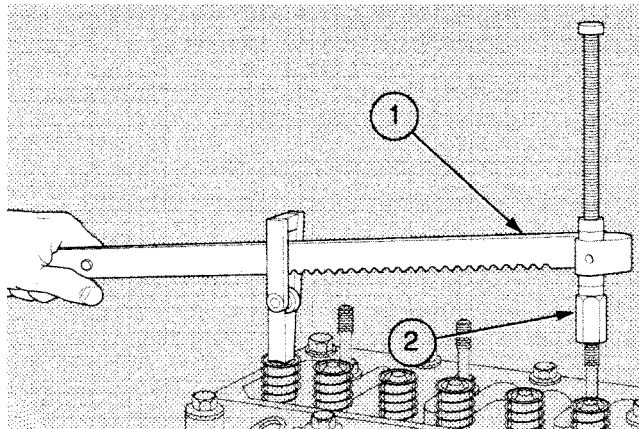
The following procedure describes how to replace valve springs when the cylinder head is still installed on the engine. This procedure is for the replacement of a single valve spring.

1. Remove the valve cover. See Valve Cover, Removal.
2. Identify the cylinder for which the valve spring will be replaced. Rotate the crankshaft clockwise until the inlet valve has just opened and the exhaust valve has not fully closed. In this position, the piston will be at approximately top dead center (TDC).

CAUTION

Do not rotate the crankshaft while the valve springs are removed.

3. Remove the rocker assembly. See Rocker Assembly, Removal.
4. Install a valve spring compressor on the valve for which the valve spring must be replaced. See FIGURE 12.



1. VALVE SPRING COMPRESSOR
2. CAPSCREW ADAPTOR

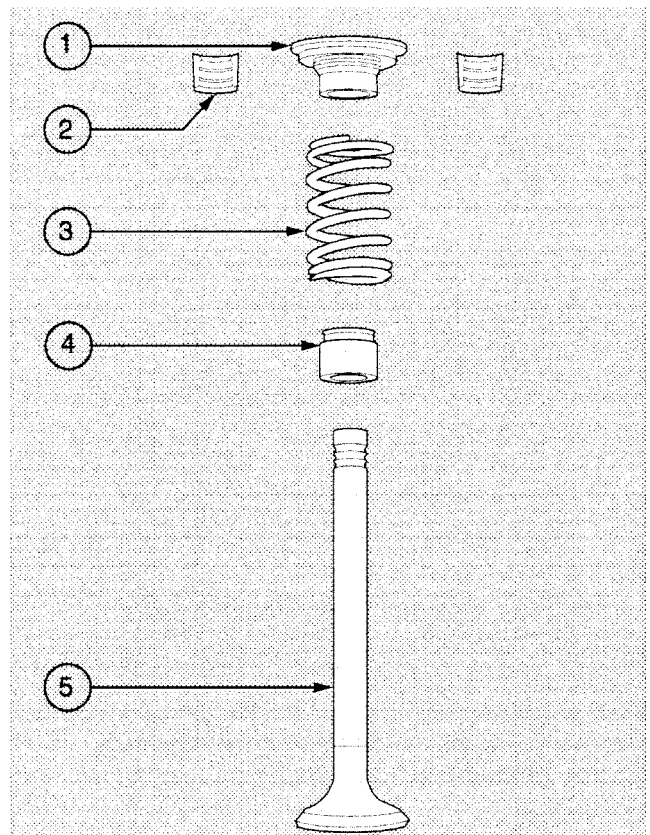
FIGURE 12. VALVE SPRING COMPRESSOR

5. Compress the valve spring and remove the collets. Make sure that the valve spring is compressed squarely

so that the valve stem is not damaged. For a list of valve components, see FIGURE 13.

6. Release the valve spring compressor. Remove the valve spring caps and the valve spring.
7. Install a new valve spring.
8. Install the valve spring cap.
9. Install a valve spring compressor on the valve. Compress the valve spring and install the collets.
10. Install the rocker assembly
11. Adjust the valve clearances.
12. Install the valve cover.

NOTE: The valve springs for all of the cylinders can be changed by this method one cylinder at a time. The sequence of cylinders is 1 and 4, 2 and 3.



1. CAP
2. COLLET (2)
3. SPRING
4. VALVE STEM SEAL
5. VALVE

FIGURE 13. VALVE COMPONENTS

Piston TDC

If the rocker assembly has been removed and the TDC of a piston must be determined, use the following method.

1. Install the valve spring compressor on valve of the piston. Compress the valve spring to open the valve.
2. Rotate the crankshaft clockwise by hand until the piston touches the valve.
3. Rotate the crankshaft and permit the piston to raise the valve until the piston is at TDC. See FIGURE 14.

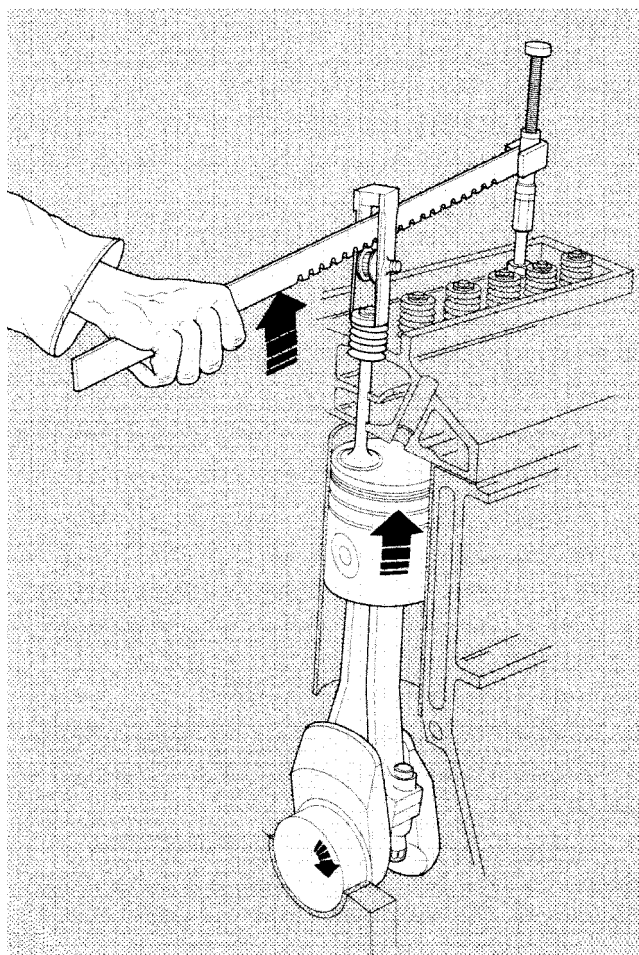


FIGURE 14. FIND TDC WITH THE VALVE SPRING COMPRESSOR

CYLINDER HEAD

Removal

⚠ CAUTION

Some coolant can enter the cylinder bores when the cylinder head is removed. Clean any coolant to prevent corrosion.

⚠ CAUTION

1. Drain the cooling system.

2. Disconnect the battery.

3. Remove the valve cover. See **Valve Cover, Removal**.

⚠ CAUTION

Disposal of lubricants and fluids must meet local environmental regulations.

⚠ CAUTION

Use a separate wrench to prevent movement of the outlet connections of the fuel injection pump when the high pressure lines are loosened or tightened.

4. Remove the high pressure fuel lines. Install caps on the open connections of the fuel lines and fuel injectors to prevent dirt from entering the fuel system.

5. Remove the exhaust manifold and gasket. See FIGURE 15.

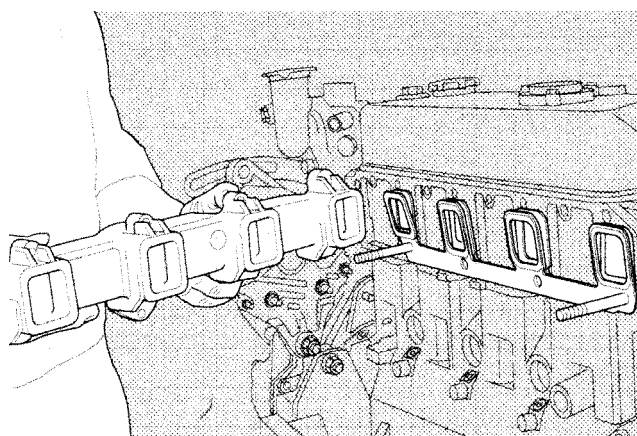


FIGURE 15. EXHAUST MANIFOLD AND GASKET

6. Remove the air induction manifold and gasket, See FIGURE 16.