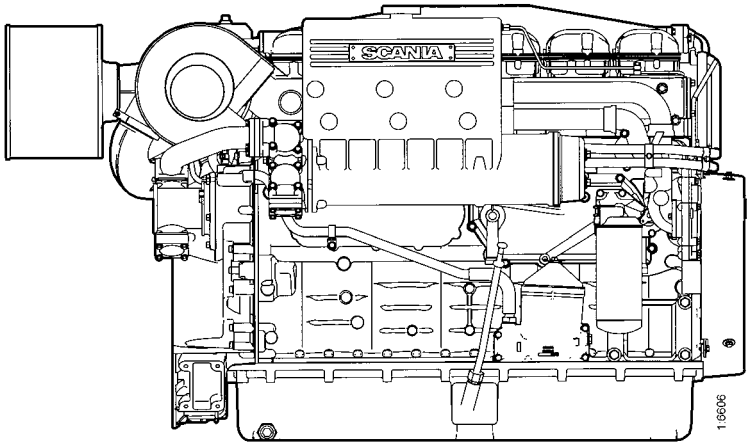
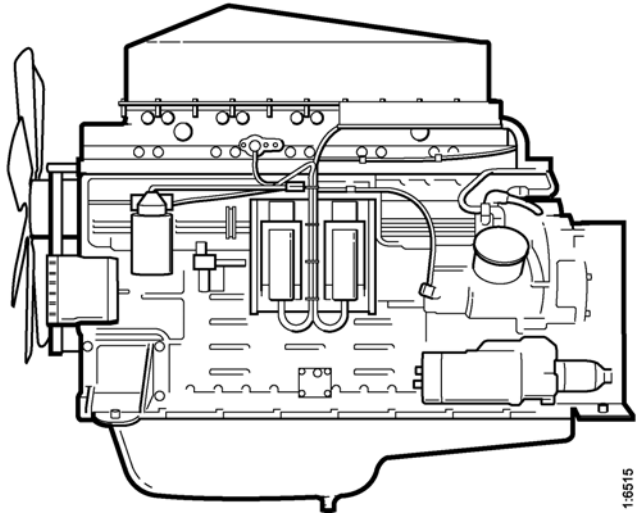




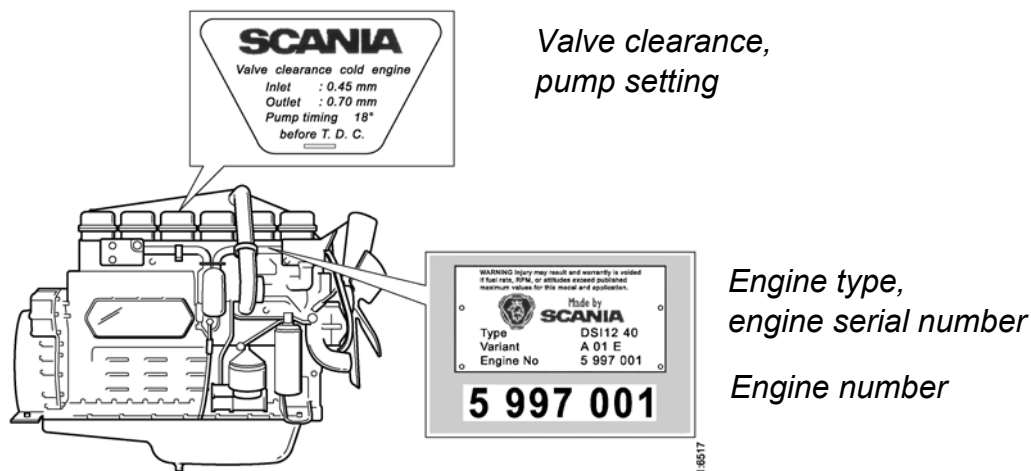
**SCANIA**  
Industrial & Marine Engines

# Work Description - 12 Engine

## Industrial and Marine Engines



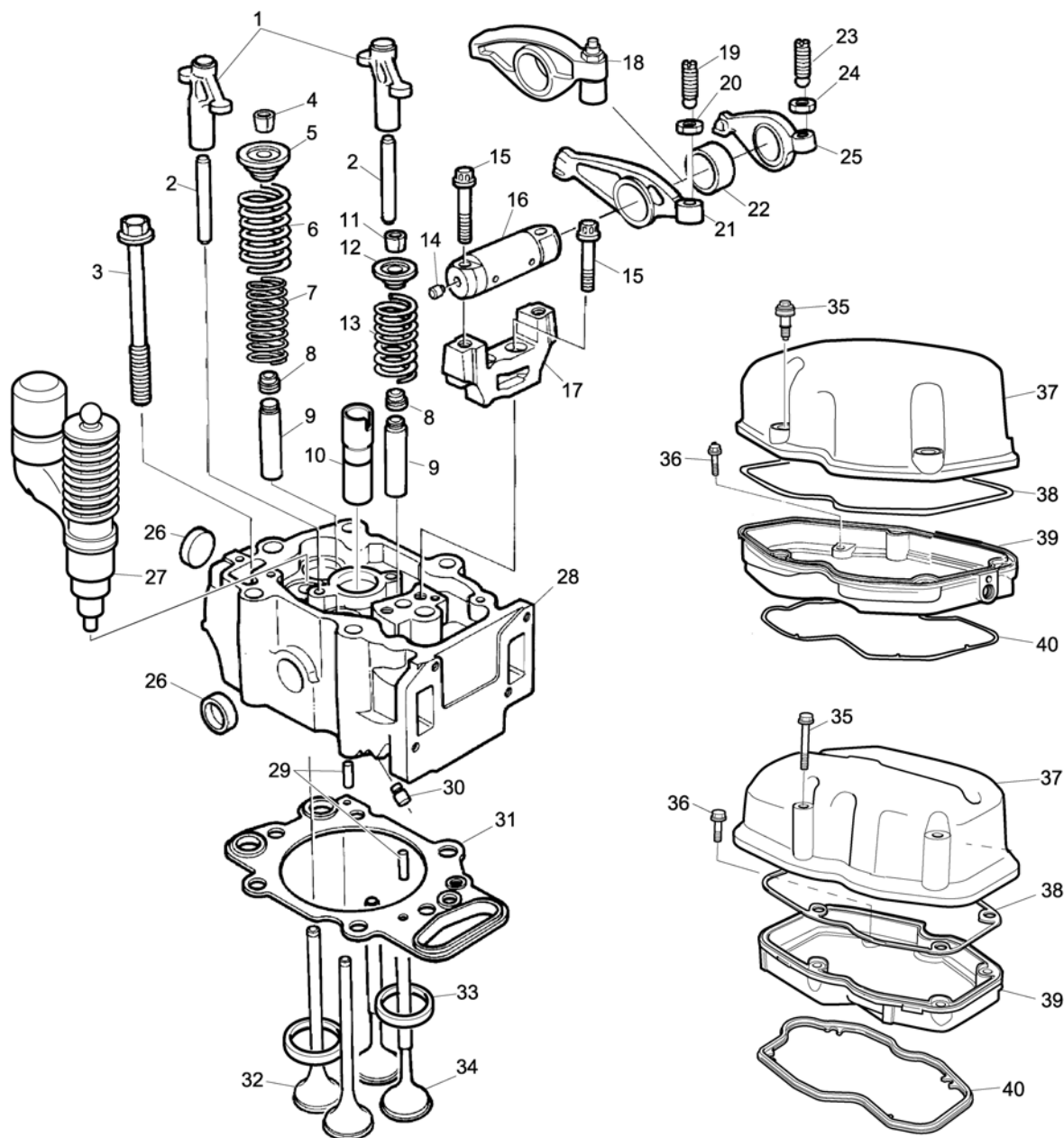
Part no.  
1 588 557



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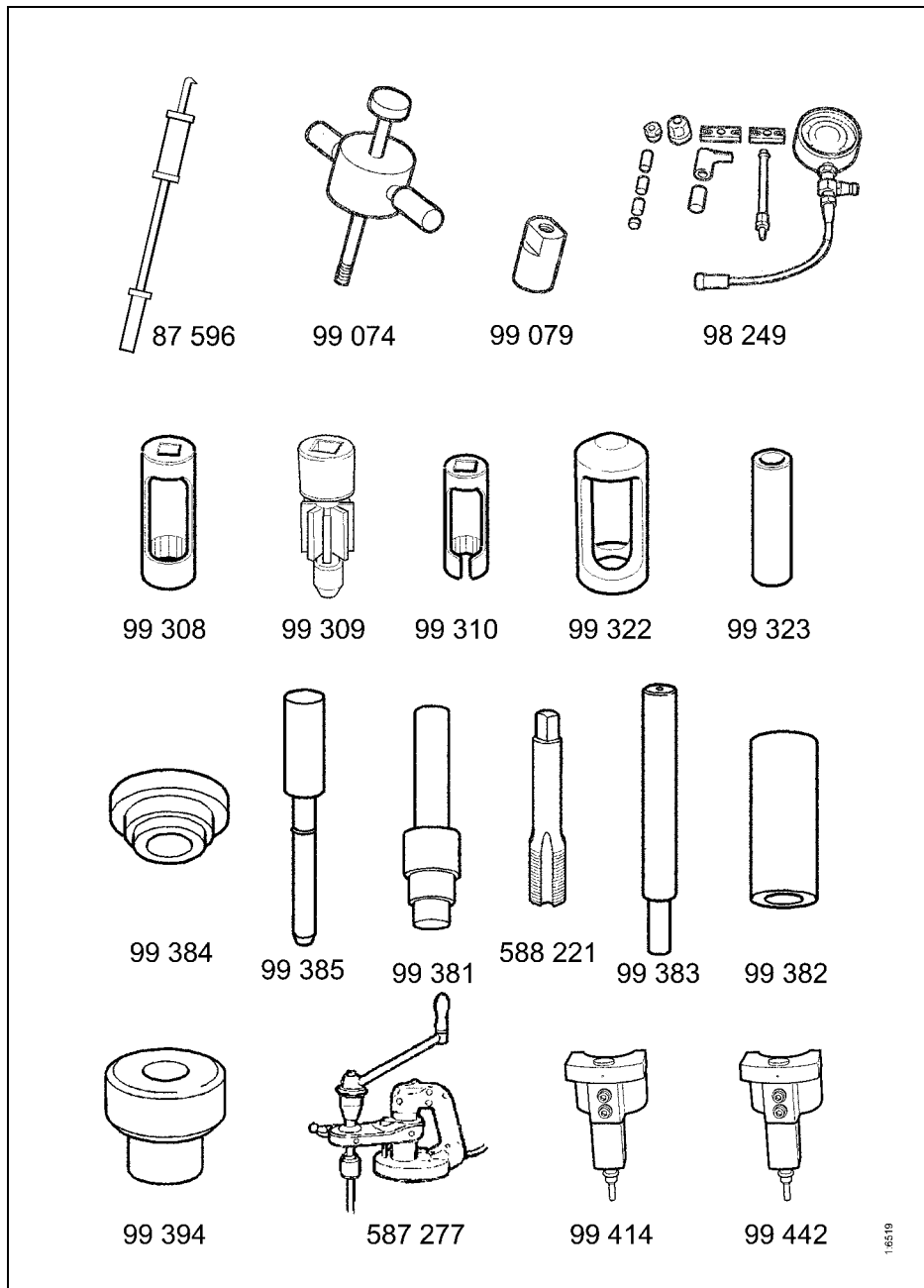
# Cylinder head



- |                         |                                     |                                 |
|-------------------------|-------------------------------------|---------------------------------|
| 1. Valve bridge         | 16. Shaft                           | 29. Pin                         |
| 2. Pin                  | 17. Bearing bracket                 | 30. Rivet plug                  |
| 3. Bolt                 | 18. Rocker arm for unit injector    | 31. Gasket                      |
| 4. Collet               | 19. Adjusting screw                 | 32. Exhaust valve               |
| 5. Valve spring collar  | 20. Hexagon nut                     | 33. Valve seat insert           |
| 6. Valve spring         | 21. Rocker arm                      | 34. Intake valve                |
| 7. Valve spring         | 22. Spacing sleeve (injection pump) | 35. Flange bolt                 |
| 8. Valve stem seal      | 23. Adjusting screw                 | 36. Flange bolt                 |
| 9. Valve guide          | 24. Hexagon nut                     | 37. Rocker cover, upper section |
| 10. Socket              | 25. Rocker arm                      | 38. Rocker cover gasket         |
| 11. Collet              | 26. Core plug                       | 39. Rocker cover, lower section |
| 12. Valve spring collar | 27. Unit injector                   | 40. Rocker cover gasket         |
| 13. Valve spring        | 28. Cylinder head                   |                                 |
| 14. Rivet plug          |                                     |                                 |
| 15. Tight-fit screw     |                                     |                                 |

1:8518

Special tools



- |        |                                  |         |                          |
|--------|----------------------------------|---------|--------------------------|
| 87 596 | <i>Slide hammer</i>              | 99 381  | <i>Drift</i>             |
| 98 249 | <i>Compression tester</i>        | 99 382  | <i>Drift</i>             |
| 99 074 | <i>Impact drift</i>              | 99 383  | <i>Drift</i>             |
| 99 079 | <i>Extractor for injectors</i>   | 99 384  | <i>Drift</i>             |
| 99 308 | <i>Sleeve for injectors</i>      | 99 385  | <i>Handle</i>            |
| 99 309 | <i>Tool for turning flywheel</i> | 99 394  | <i>Guide</i>             |
| 99 310 | <i>Socket</i>                    | 99 414  | <i>Setting tool</i>      |
| 99 322 | <i>Press drift</i>               | 99 442  | <i>Setting tool</i>      |
| 99 323 | <i>Assembly drift</i>            | 587 277 | <i>Valve seat cutter</i> |
|        |                                  | 588 221 | <i>Pilot tap</i>         |

## Valve clearances (engines with injection pump)

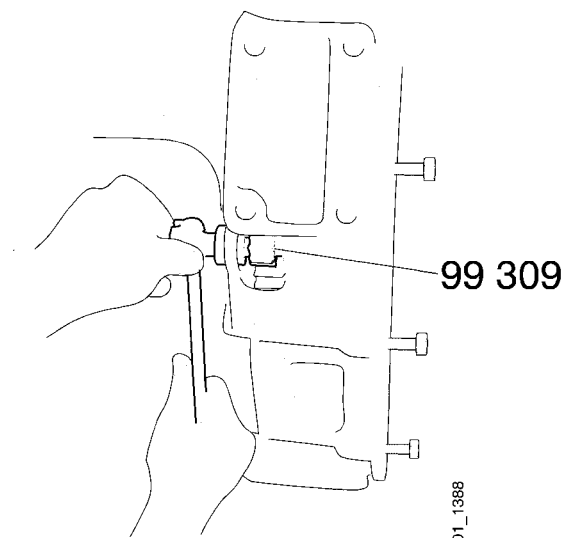
### Checks and adjustments

Check the valve clearance. The clearance for intake valves should be 0.45 mm and the clearance for exhaust valves should be 0.70 mm when the engine is cold.

The following alternative methods of adjustment are possible:

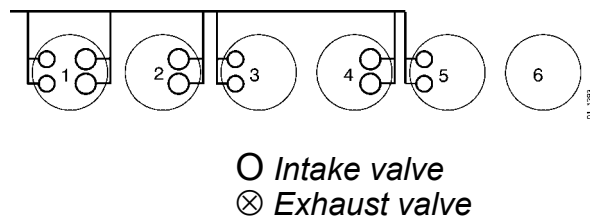
- A. Adjust all four valves for each cylinder when at TDC after compression. Start with cylinder No. 1 and turn the crankshaft 1/3 turn at a time using tool 99 309 in the following injection order:

**1-5-3-6-2-4**



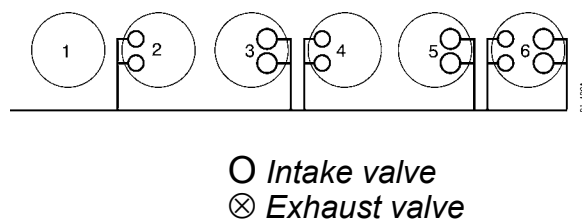
- B. Put cylinder 1 at exact TDC after the compression stroke. The following valves can now be adjusted:

- cyl. 1 intake and exhaust
- cyl. 2 intake
- cyl. 3 exhaust
- cyl. 4 intake
- cyl. 5 exhaust



Turn the crankshaft precisely one revolution so that TDC for No. 6 cylinder is set. The remaining valves can now be adjusted:

- cyl. 2 exhaust
- cyl. 3 intake
- cyl. 4 exhaust
- cyl. 5 intake
- cyl. 6 exhaust and intake

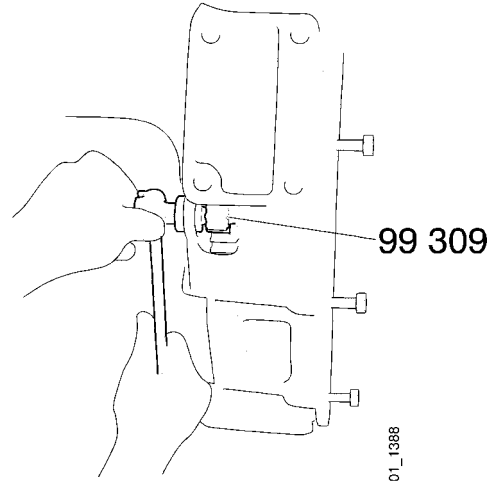


## Adjusting the valve clearance and unit injectors (engines with PDE unit injector)

**Note:** Check and adjust the valve clearance and unit injectors at the same time and with the engine cold.

### Checking and adjusting the valve clearance

1. Turn the flywheel with tool 99 309 so that the piston in cylinder No. 1 is at TDC after compression.
2. Check the valve clearance using a feeler gauge and, if necessary, use the adjusting screw on the rocker arm to set the correct clearance. The clearance for intake valves should be 0.45 mm and the clearance for exhaust valves should be 0.70 mm when the engine is cold. The intake valves are actuated by the short rocker arms and the exhaust valves by the long rocker arms. Make sure the valve bridge is resting correctly against the valves.
3. Adjust the unit injector for cylinder No. 5. See Adjusting unit injectors.
4. Rotate the flywheel 1/3 turn at a time using tool 99 309 and repeat steps 1-3 and adjust as per the order of adjustment below.



#### *Order of adjustment for valve clearance:*

1-5-3-6-2-4

#### *Order of adjustment for PDE unit injector:*

5-3-6-2-4-1

## Adjusting unit injectors, PDE31 and PDE32

**Important!** *The PDE31 unit injector is adjusted using setting tool 99 414 or a digital sliding caliper.*

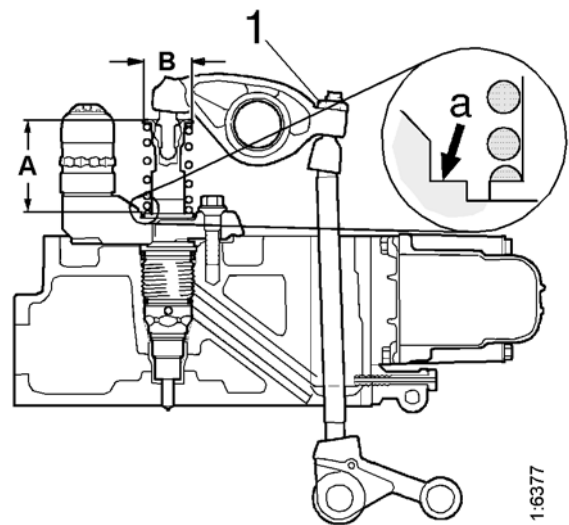
*The PDE32 unit injector is adjusted using setting tool 99 442 or a digital sliding caliper.*

*This adjustment is important because an incorrectly positioned unit injector may result in poor performance and possible breakdown.*

Screw on the rocker arm adjusting screw 1 while measuring the distance between plane a and the top of the valve spring collar using a digital sliding caliper.

The dimension should be 66.9 mm for PDE31 and 69.9 mm for PDE32.

See dimension B in the figure for identifying the injector.



Dimension A = PDE31: 66.9 +/- 0.1 mm

PDE32: 69.9 +/- 0.1 mm

Dimension B = PDE31: 36.5 mm

PDE32: 38.8 mm

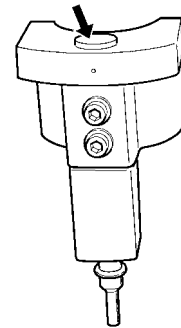
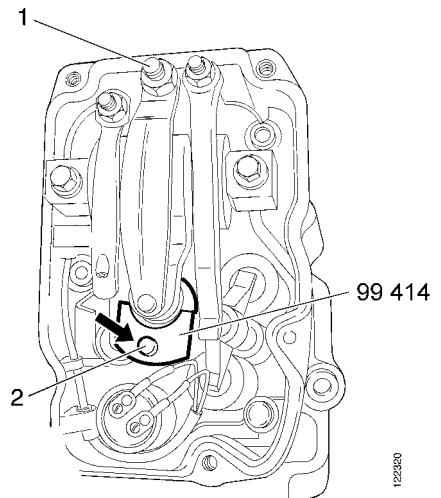
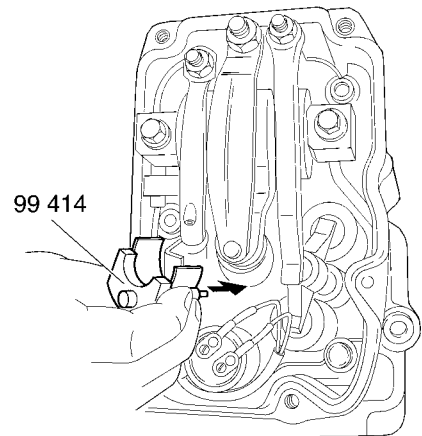


**WARNING!**

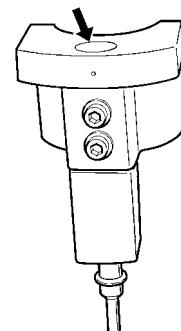
Take care when carrying out the adjustment if the dimension is well outside the adjustment dimension. The spring is pre-tensioned and can cause personal injury if it is released.

**PDE31**

1. Position setting tool 99 414 with the metal plate around the injector spring.
2. Finely adjust dimension A by simultaneously using a finger to sense that the small piston 2 is level with the flat upper surface of the tool. It is possible to sense differences of less than a tenth of a millimetre.
3. *If tool 99 414 is not available:* Measure the distance between plane a and the top of the valve spring collar using a digital sliding caliper. Adjust the rocker position by means of the adjusting screw until the dimension is 66.9 +/- 0.1 mm.
4. Tighten the lock nut to 39 Nm.
5. See *Order of adjustment* on page 6 for checking/adjusting the injector rockers.



*Piston above or below the flat surface. Adjustment necessary.*

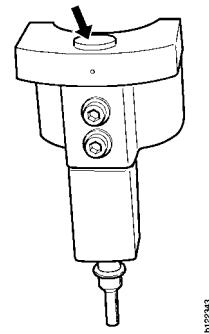
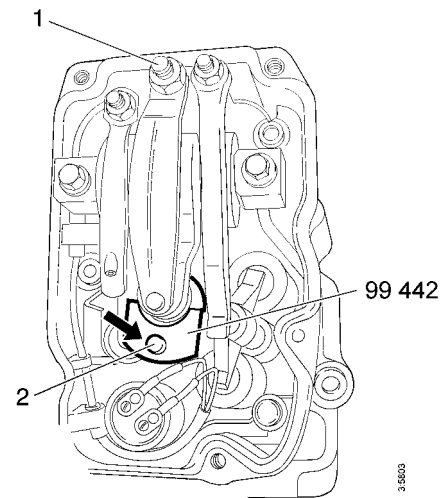
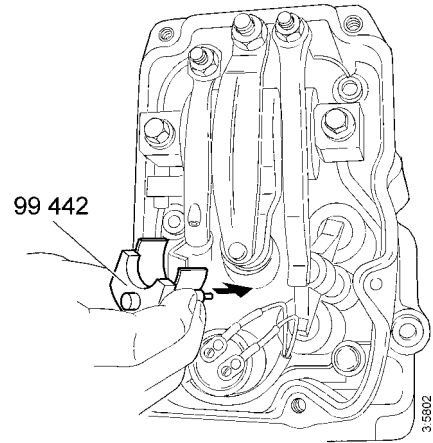


*Piston level with the flat surface. Adjustment is correct.*

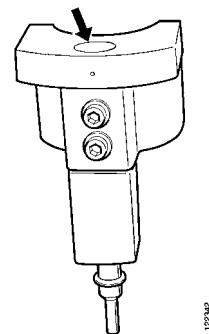


**PDE32**

1. Position setting tool 99 442 with the metal plate around the injector spring.
2. Finely adjust dimension A by simultaneously using a finger to sense that the small piston 2 is level with the flat upper surface of the tool. It is possible to sense differences of less than a tenth of a millimetre.
3. If tool 99 442 is not available: Measure the distance between plane a and the top of the valve spring collar using a digital sliding caliper. Adjust the rocker position by means of the adjusting screw until the dimension is 69.9 +/- 0.1 mm.
4. Tighten the lock nut to 39 Nm.
5. See *Order of adjustment* on page 6 for checking/adjusting the injector rockers.



*Piston above or below the flat surface. Adjustment necessary.*



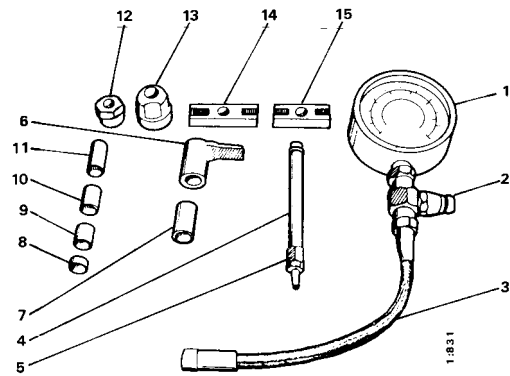
*Piston level with the flat surface. Adjustment is correct.*

## Compression

### Measuring

The compression tester is used to quickly and simply check wear and damage to primarily the cylinder head valves, but also to cylinder liners and piston rings.

The results are only intended for comparison between the cylinders. Lower compression in one or more of the cylinders is a sign of abnormal wear or damage.



Compression tester 98 249

The compression tester may be used on many engine types by using various accessories.

**Important!** *The battery must have an adequate voltage level in order to carry out a reliable compression test.*

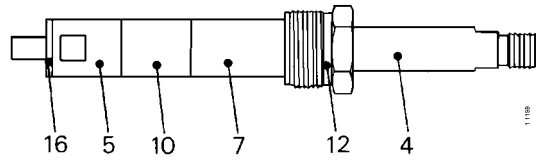
1. Cut off the supply of fuel by disconnecting the power source.
2. Clean around the injectors. Detach the delivery pipes to all injectors using tool 99 310.

**Note:** **Fit protection caps on the delivery valve holders in the injection pump and on the injectors to protect them from dirt.**

3. Remove the rocker covers.
4. Undo and remove the injectors and copper washers.
5. Turn the engine over several times using the starter motor to remove any loose soot in the cylinders.

1. Manometer
2. Reset valve
3. Flexible metal hose
4. Gauge rod
5. End sleeve diameter 21 mm
6. Spacing sleeve with support lug
7. Spacing sleeve with shoulder
8. Spacing sleeve, length 6 mm
9. Spacing sleeve, length 19 mm
10. Spacing sleeve, length 25 mm
11. Spacing sleeve, length 38 mm
12. Cap nut
13. Threaded socket nut
14. Large yoke
15. Small yoke

6. Connect the compression tester in the injection aperture in one of the cylinders. Copper washer **16** should be used between the compression tester and the bottom of the injector aperture.
7. Turn the engine with the starter motor and read off the manometer. Note the reading.
8. Reset the manometer by pressing reset button **2**.
9. Move the compression tester to the next cylinder and continue according to items 5-8.
10. Evaluate the readings and assess what further measures need to be taken on the engine. If one or more cylinders have a lower compression pressure, the components such as valves, cylinder liners and piston rings should be checked.

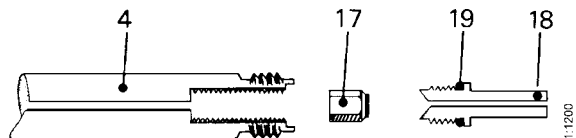


4. Gauge rod
5. End sleeve diameter 21 mm
7. Spacing sleeve with shoulder
10. Spacing sleeve, L = 25 mm
12. Cap nut (use socket 98 542 for tightening)
16. Copper washer

### Cleaning the gauge rod

Gauge rod **4** has a check valve which, in the case of leakage, should be cleaned as follows:

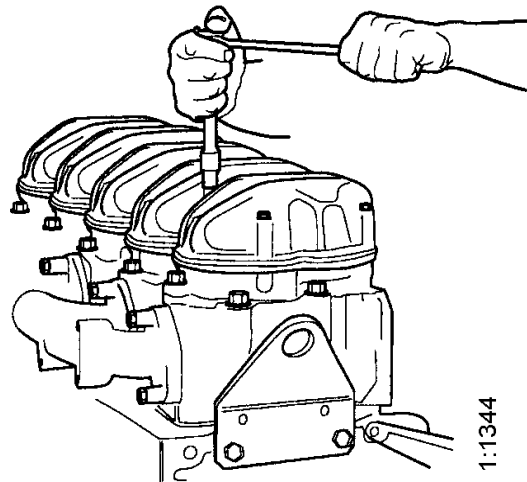
1. Unscrew valve seat **18**.
2. Remove any soot from valve **17** and valve seat **18**. Do not scratch the mating surfaces. Use compressed air to clean gauge rod **4** internally.
3. Reassemble the parts. Ensure that O-ring **19** is not damaged. Bolt valve seat **18** securely so that it seals against gauge rod **4**.



4. Gauge rod
17. Valve
18. Valve seat
19. O-ring

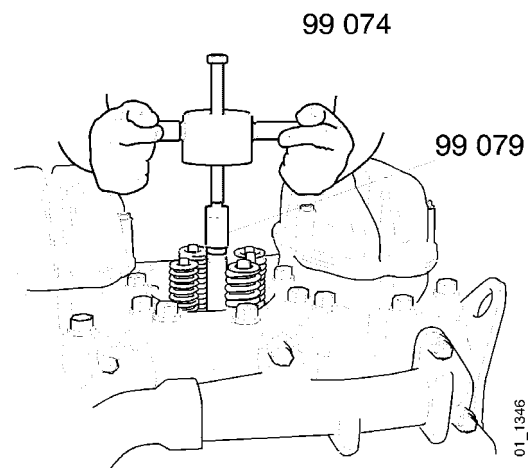
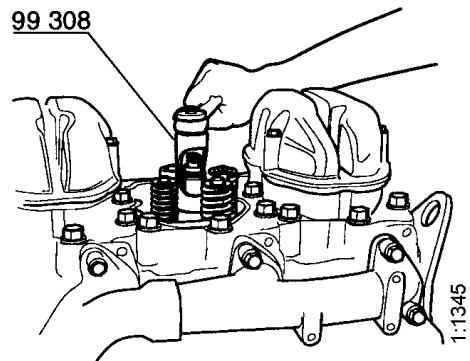
## Removing the cylinder head (engines with injection pump)

1. Drain coolant from engine and, if applicable, from charge air circuit.
2. DI12: Detach the inlets and outlets for air and water from the charge air cooler and unbolt the charge air cooler. DC12: Remove the intake pipe clamps from the intake manifold.
3. Remove the intake manifold and turbocharger.
4. Remove the heat shields and exhaust manifold.
5. Detach the delivery pipes using tool 99 310 and remove them.
6. Insert protection plugs in the ends of the delivery pipes and place protection caps on the injectors and injection pump.
7. Remove the ventilation pipe for the cooling system.



**Note: All the valve mechanism components must be refitted in their original positions. Therefore, mark the parts as they are removed.**

8. Remove the top part of the rocker cover. Be careful not to drop any parts into the engine.
9. Remove the shaft, rocker arms, bearing bracket, valve bridges and pushrods.
10. Remove the lower part of the rocker cover.
11. Undo the injector nut using socket 99 308.
12. Extract the injectors using tools 99 074 and 99 079.
13. Remove the cylinder head bolts and lift off the cylinder head. Mark the cylinder heads if more than one are removed at the same time.
14. Cover the engine to keep out all extraneous objects, etc.



## Removing the cylinder head (engines with PDE unit injector)

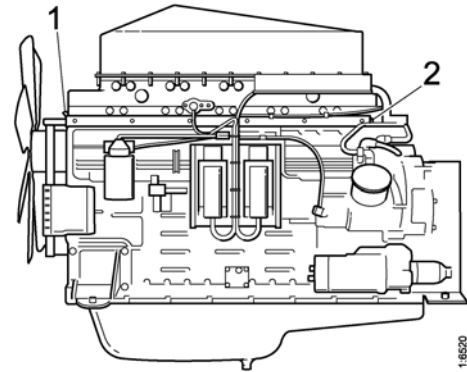
1. Open the bleeder nipple and drain the fuel system by undoing the banjo screw on the back of the fuel manifold.



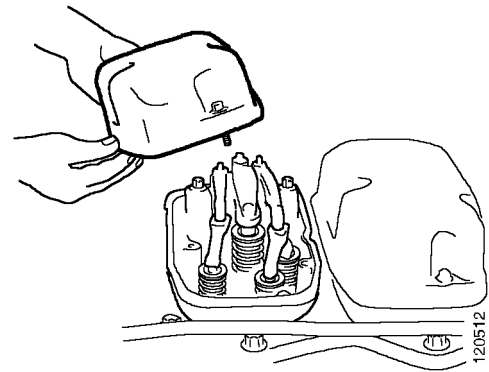
**WARNING!**

**The fuel system must be empty or fuel may run down into the cylinders, which will result in a great risk of liquid hammering. If fuel runs into the combustion chamber, it must be removed immediately using a pump.**

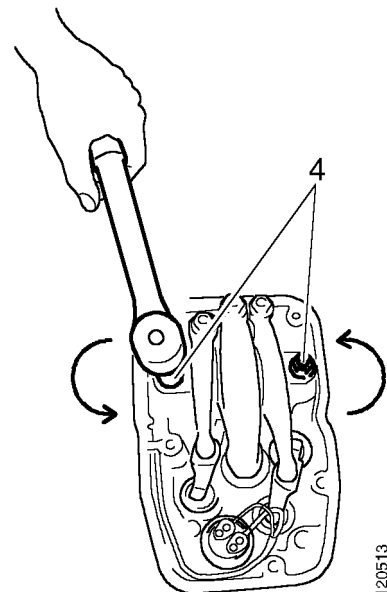
2. Clean the rocker cover and the surrounding area.
3. Remove the top part of the rocker cover.



1. Bleeder nipple
2. Banjo screw



4. Relieve the pressure on the valves by undoing the bolts on the rocker arm shaft alternately.



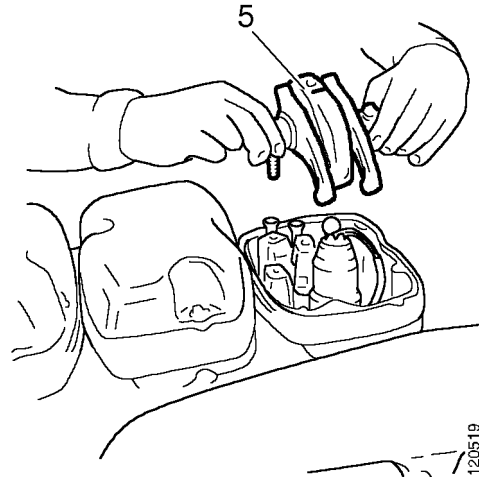


**WARNING!**

Do not lean over the engine when removing the rocker arm shaft. The unit injector spring is pre-tensioned and can come loose, causing personal injury.

**Note:** If the spring comes loose from the unit injector, the unit injector must be renewed.

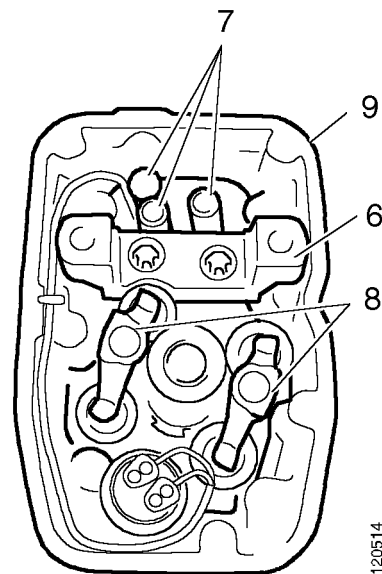
5. Remove the rocker arm shaft.



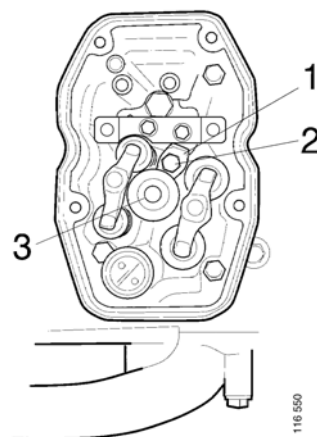
6. Remove the bearing bracket.
7. Remove the pushrods.

**Note:** The pushrod for the unit injector is secured with a retaining ring. Jiggle and pull carefully on the pushrod to loosen it.

8. Remove the valve bridges.
9. Remove the lower rocker cover.

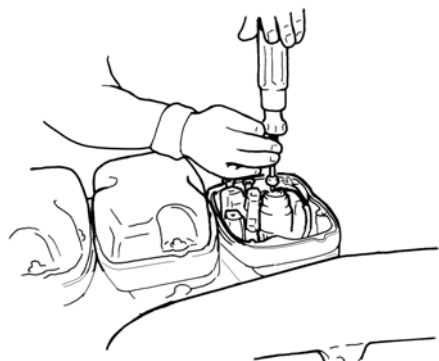


- Remove the fork clamp bolt holding the unit injector in place.



- Fork clamp
- Fork clamp bolt
- Unit injector

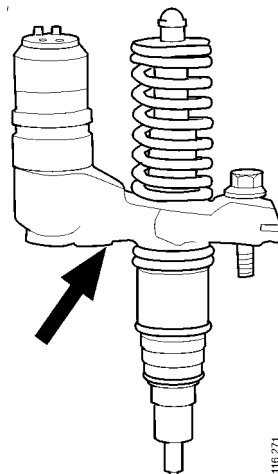
- Detach the cables on the unit injector. The screws cannot be removed but undo them as far as possible.



**Note: Do not lift the unit injector by the spring. The spring can come loose.**

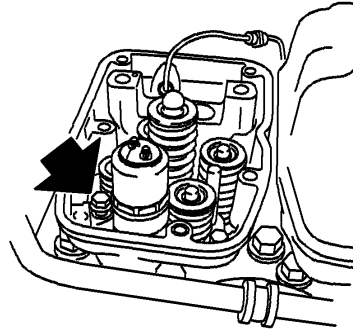
- Turn the unit injector anti-clockwise until it stops. Place the slide hammer 87 596 between the solenoid valve and the edge of the lower rocker cover as illustrated.

**Note: If the slide hammer is placed directly under the solenoid valve, there is a risk of breaking the solenoid valve.**



*Place the slide hammer as indicated by the arrow.*

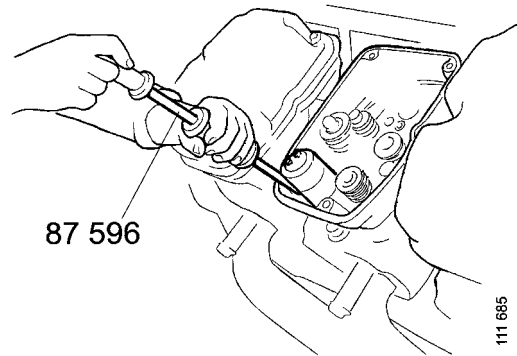
13. It is easier to position the slide hammer if one of the lower rocker cover bolts is removed.



14. Withdraw the unit injector. If the unit injector is stuck, tap carefully with a rubber mallet on the solenoid valve housing.

**Important! The unit injector is not to be dismantled. Renew the entire unit.**

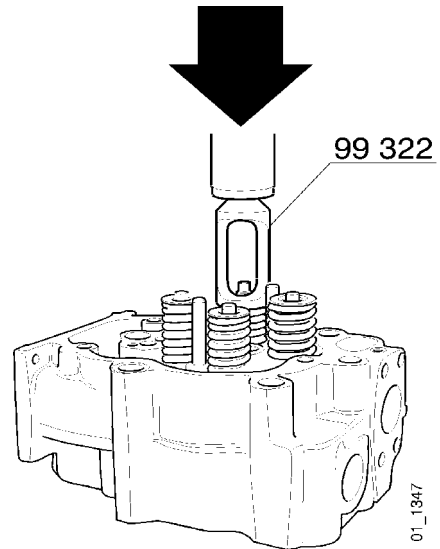
15. Remove the sealing washer from the bottom of the injector seat, (if it was left behind when the unit injector was removed).
16. Detach the intake manifold, fuel manifold, ventilation pipe for the cooling system and the exhaust manifold.
17. Remove the cylinder head. Mark the cylinder heads if more than one is being removed at the same time.





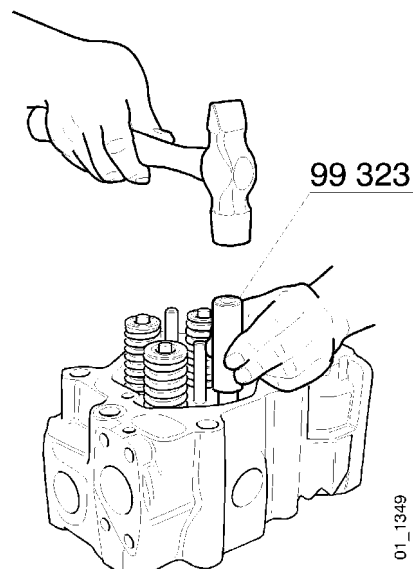
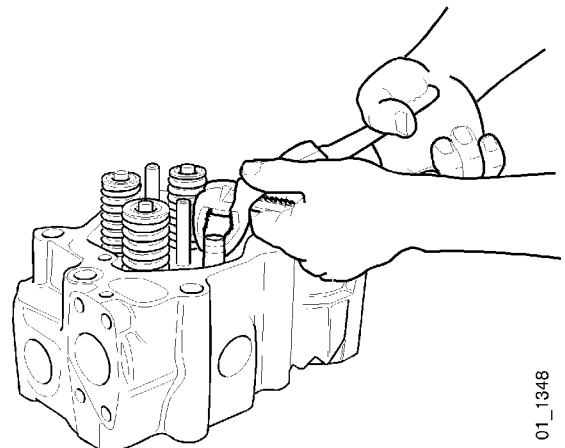
## Dismantling

1. Remove collets, valve spring collars, springs and valves. Press down the spring using tool 99 322 in a press so that the collets can be removed.
2. Mark and place the valves in a rack so that they can be refitted in the same position in the cylinder head.
3. Mark the cylinder heads if more than one are removed at the same time.



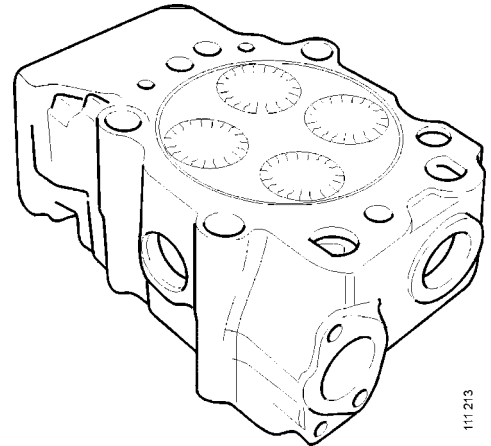
## Renewing the valve stem seal

1. Remove the valve.
2. Remove the valve stem seal with a pair of pliers.
3. Fit the valve.
4. Tap in a new valve stem seal carefully using tool 99 323 and a hammer.



## Renewing the valve seats

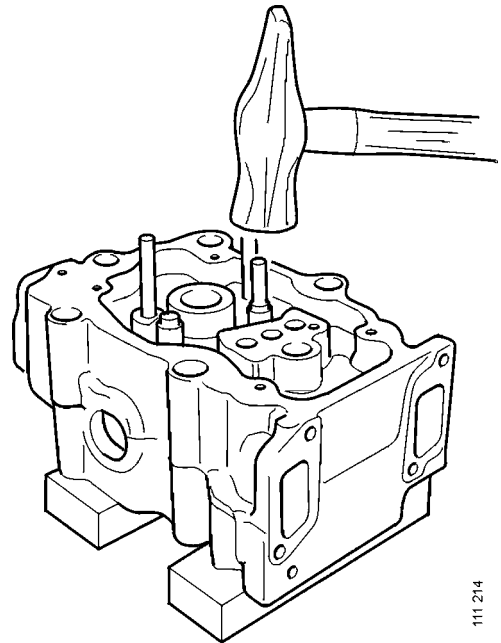
1. Remove the valve seat inserts. Use a discarded valve that has been ground so that the diameter of the disc is slightly smaller than the inside diameter of the seat.
2. Fit the valve and weld around it with an electric welder. Cool with water. Turn over the cylinder head and knock the valve stem so that the valve and seat insert fall out.



111 213



**Wear protective goggles. Always turn the cylinder head with the underside face down while knocking out the valve seat insert. Otherwise, there is a risk that loose shivers of metal can cause personal injury.**

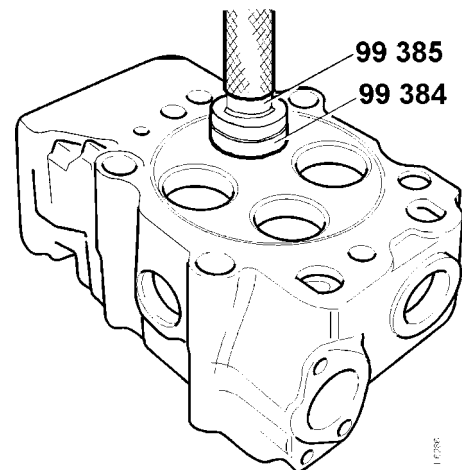


111 214

3. Press in new valve seat inserts. Use drift 99 384 and handle 99 385. Cool the drift and valve seat to approximately  $-80^{\circ}\text{C}$  in dry ice or using liquid air. Pressing must be carried out rapidly.



**Be careful with the above-mentioned coolants and cooled components. There is a risk of frost injuries.**

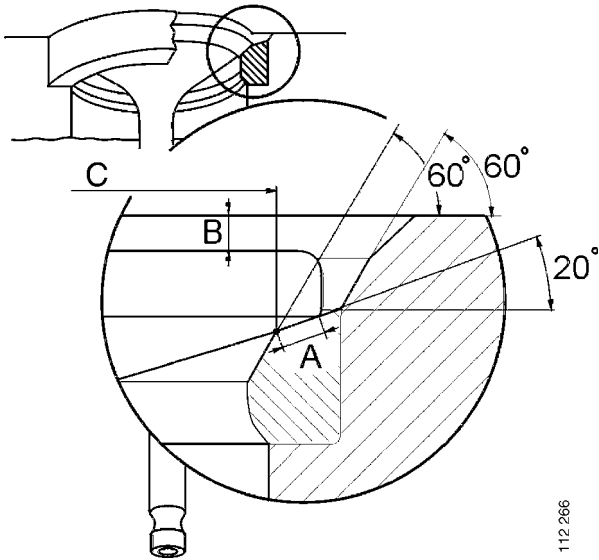


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Oversize valve seat inserts can be fitted if the valve seat insert position has been damaged. If this is the case, the seat must be machined using valve seat cutter 587 277.

## Machining the valve seat insert

### Machining values

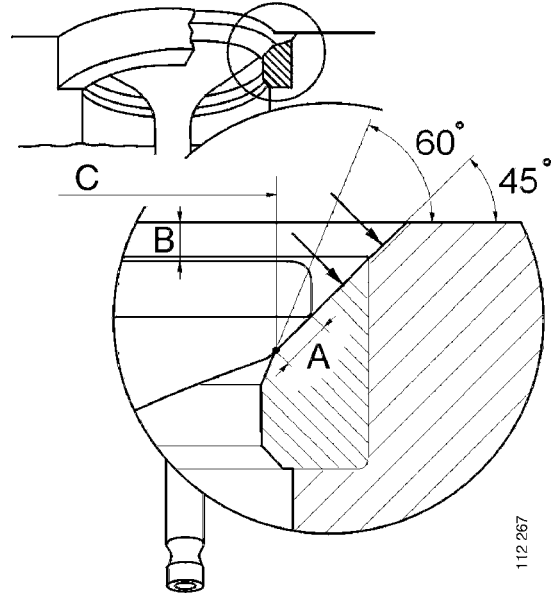


#### Intake valve

A = 1.9 - 2.6 mm

B = 0.75 - 1.8 mm

C = diameter, 39.8 +/- 0.5 mm (setting value for machining tool)



#### Exhaust valve

A = 1.8 - 2.6 mm

B = 0.66 - 1.8 mm

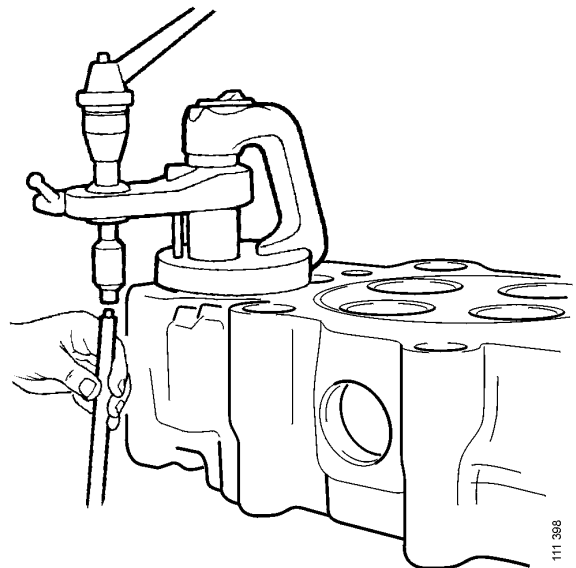
C = diameter, 37.9 +/- 0.5 mm (setting value for machining tool)

### Work description

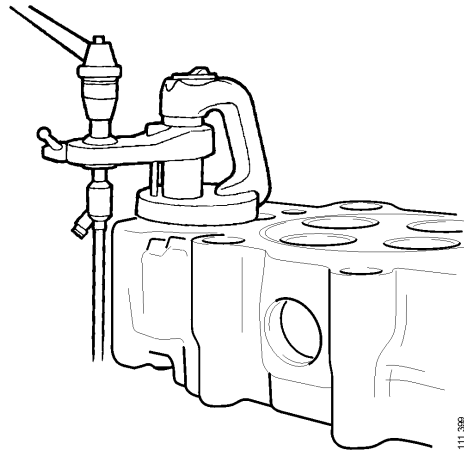
The following description applies to valve seat cutter 587 277.

Machining values and over-sized valve seat inserts, see Specifications and above.

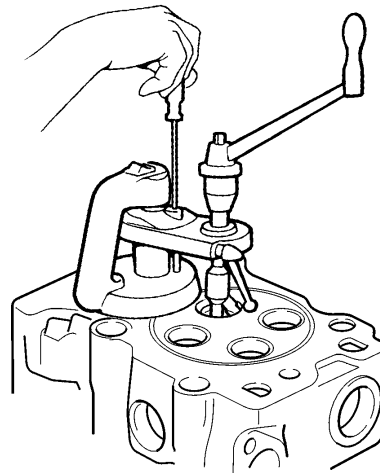
1. Check that the contact surface and the magnetic base are smooth and clean. Clean the valve bushings.
2. Select the largest spindle which slides easily into the valve guide. Insert the guide spindle and turn the feed screw to its uppermost position.



3. Select and fit the cutter.



4. Release the quick-action lock and move the pivot plate to the upper position with the adjusting screw.



5. Set up the dial on the cutter adjuster using a valve.

6. Adjust the cutter. Diameter 37.9 mm or 39.8 mm, see Machining values.

7. Disconnect the magnetic base (position 2). Insert the guide spindle into the valve bushing. Adjust the pivot plate so that the distance between the cutter and the valve seat is approximately 1 mm. Centre the tool precisely.

8. Connect the magnetic base (position 1).

9. Apply the quick-action lock. Make sure the crank can be turned easily. If not, redo the centering.

