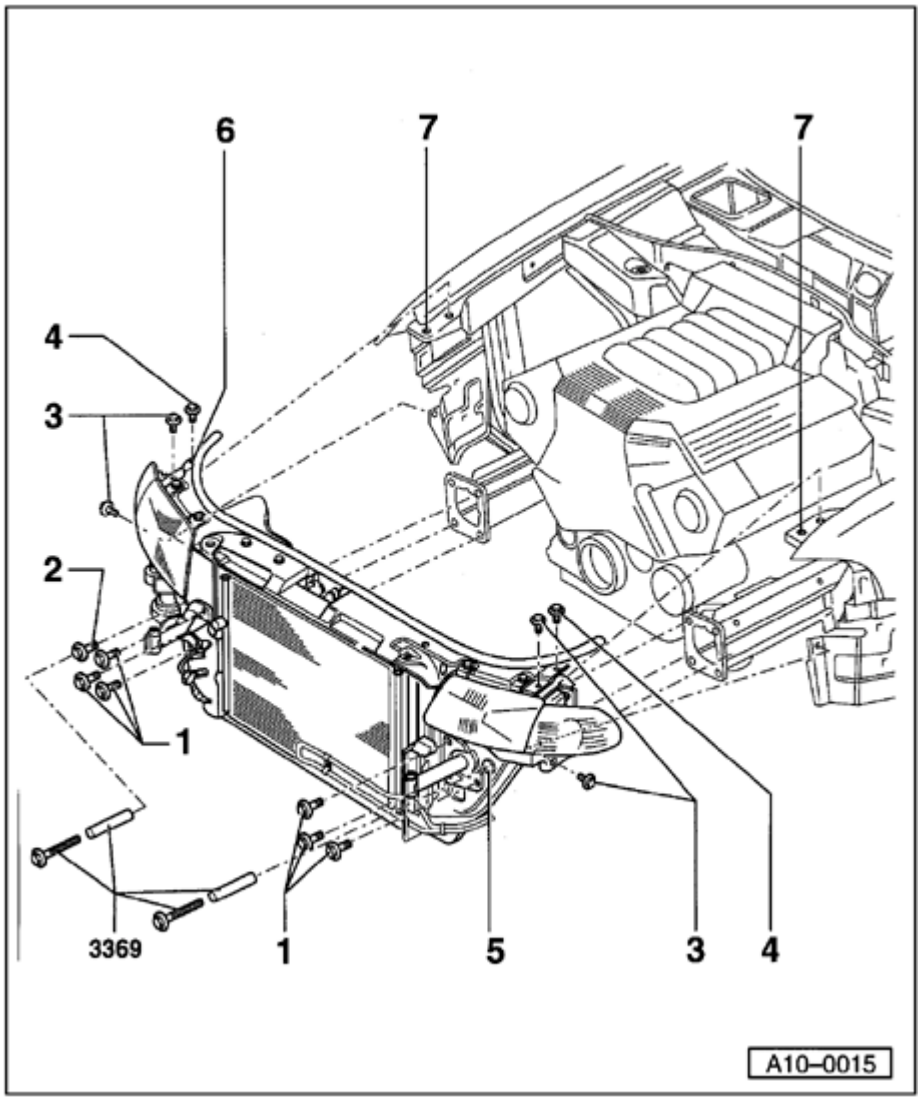
15-7




# Lock carrier, removing for service

**1 - Bolt (8 x 45)**

- 45 Nm (33 in lb)

**2 - Bolt (8 x 45)**

- 45 Nm (33 in lb)

**3 - Bolt (6 x 20)**

- 10 Nm (7 ft lb)

**4 - Bolt (6 x 20)**

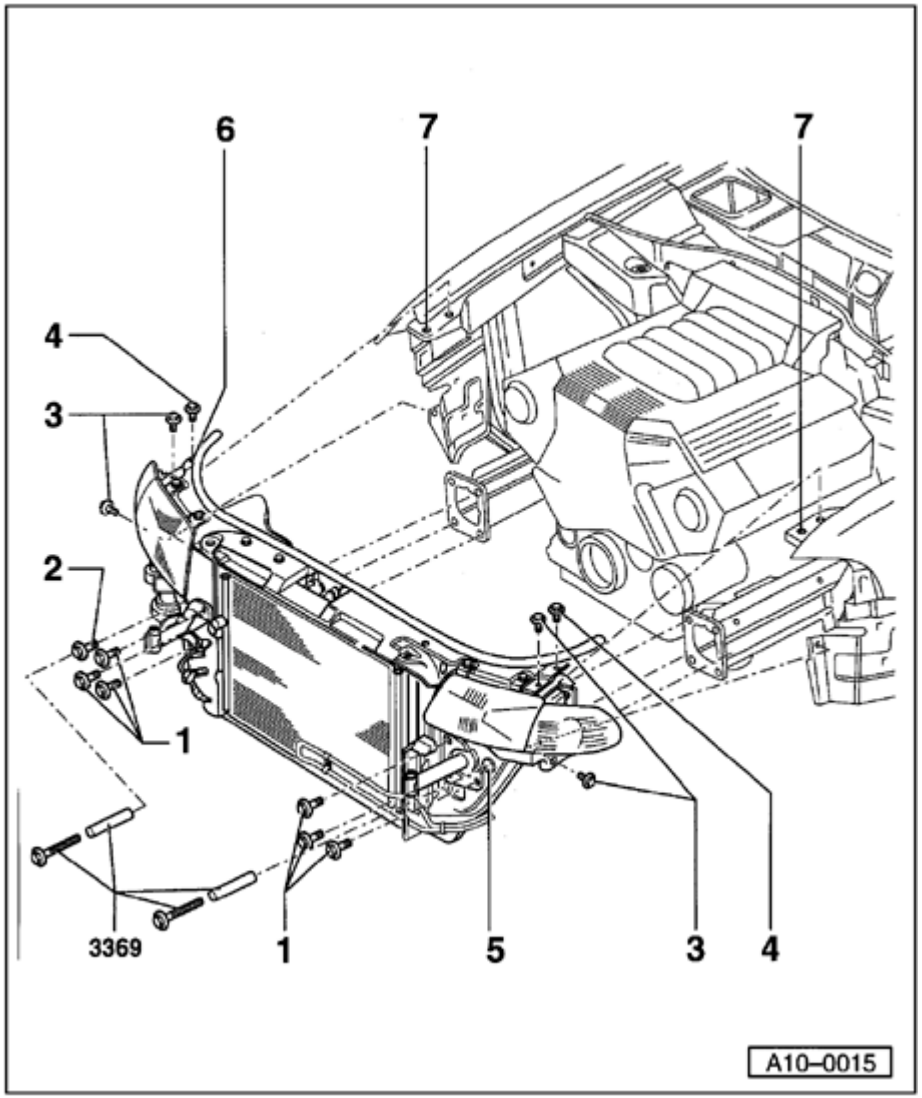
- 10 Nm (7 ft lb)

**5 - Hole for special tool VAG 3369**

**6 - Alignment hole in front end**

**7 - Hole in side panel**

15-8




## Removing

- Unbolt air guide at front end, between front end and air cleaner, and remove.
- Remove mounting bolt -2- on right-hand side and thread in VAG 3369.
- Thread VAG 3369 into hole -5- on left-hand side.
- Remove mounting bolts -1- and -3-.
- Remove mounting bolt -4-, pull front end forward and insert mounting bolt -4- through rear alignment hole -6- and side panel alignment hole -7-.

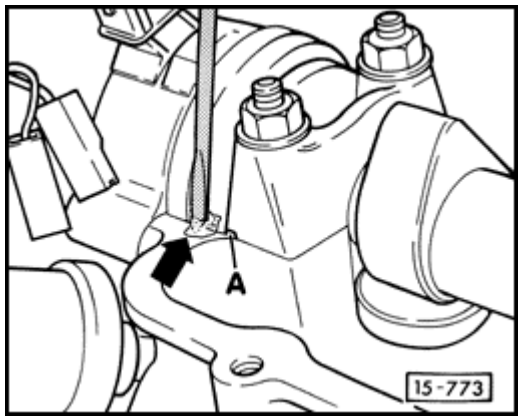
15-9

## Cylinder head cover, installing

***CAUTION!***

- ***Part numbers are listed for reference only. Always check with your Parts department for the latest information.***

- ***The inside and outside surfaces of the cylinder head cover gasket must be lightly coated with silicone lubricant D 007 000 04 before installation.***




- Carefully coat four edges on cylinder head sealing surfaces with Silimate, Part No. AMV 174 004 01, using a small screwdriver.

  - Silimate must be kept out of oil opening -A-.

**Installing cylinder head sealing cap**

Cylinder heads available from the Parts department can be used on either the left and right hand sides and are provided with a sealing cap for use where appropriate.

- Coat edge of sealing cap with sealing paste AMV 188 000 02.

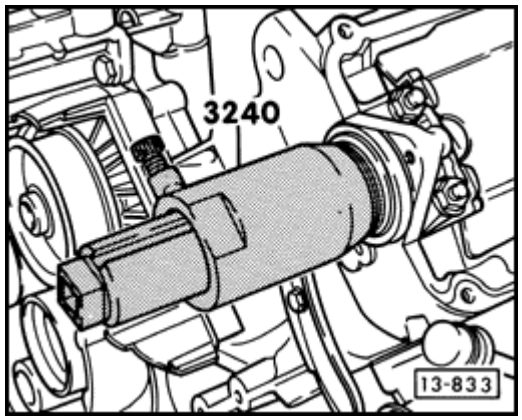
- Tap sealing cap in using drift VW 295, far enough so that outer edge of sealing cap is flush with chamfer on cylinder head.

15-10

## Camshaft oil seals, replacing

### Front

- Remove toothed belt ⇒ page 13-11 .
- Remove cylinder head cover.
- Remove rear toothed-belt guard.

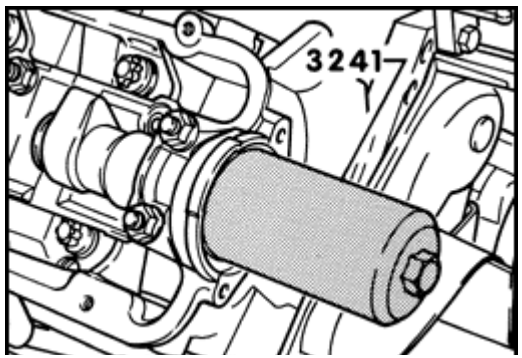



- Remove seal with seal extractor 3240.
- Clean bearing and sealing surfaces.

***Note:***

*Do not oil sealing lip or outer edge of seal before pressing in.*

### Left front

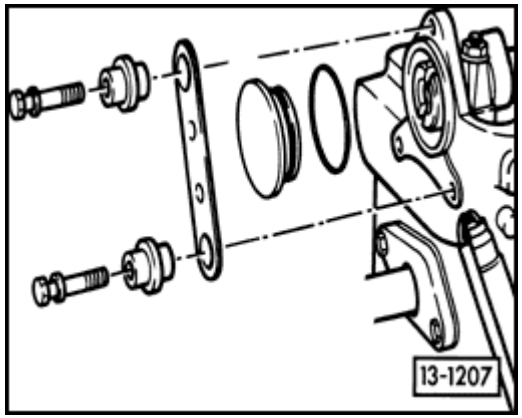



- Press seal in as far as possible using seal installer 3241.

### Right front

- Use pulling sleeve on camshaft.
- Press seal in flush using 3241.

15-11



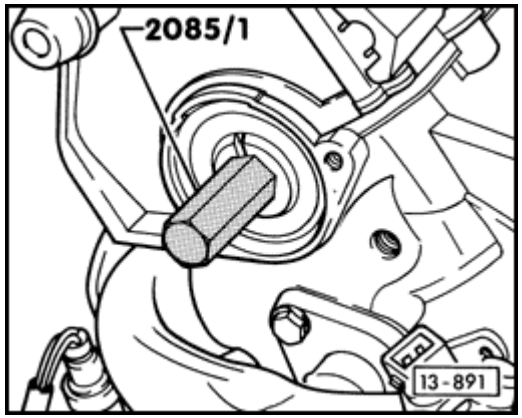

**Right rear**

- Remove bolts, spacer plate and attachments.
- Remove cap.
- Replace O-ring.

**Left rear**

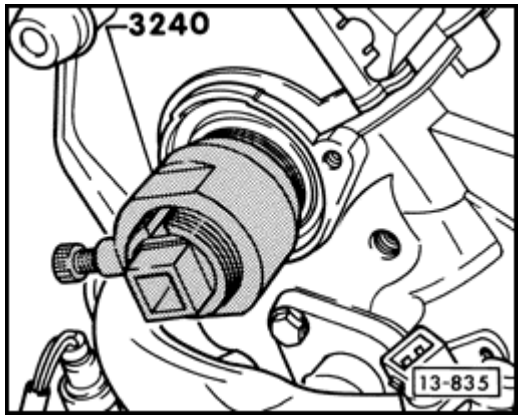
- Remove Camshaft Position (CMP) sensor housing.
- Remove bolt from CMP sensor plate.

  Tightening torque: 20 Nm (15 ft lb)
- Carefully pry out sensor plate using screwdriver.




- Thread in bolt for seal extractor 2085/1.

**15-12**




- Use seal extractor 3240 or 2085 and bolt 2085/1 to remove seal.
- Clean bearing and sealing surfaces.

***Note:***

*Do not oil sealing lip or outer edge of seal before pressing in.*

- Use guide sleeve and insertion tool 3241 to press seal in until fully seated.

Tightening torque:

CMP sensor plate: 20 Nm (15 ft lb)

15-13

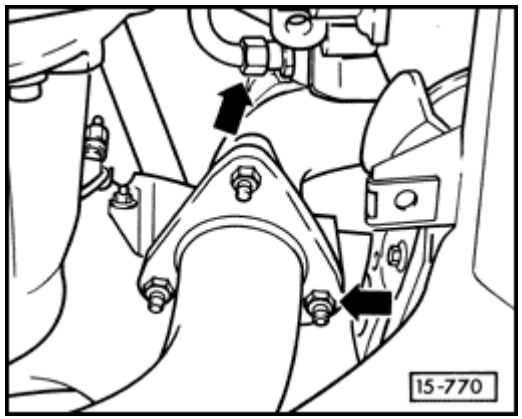
## Cylinder head, removing and installing

### Engine installed

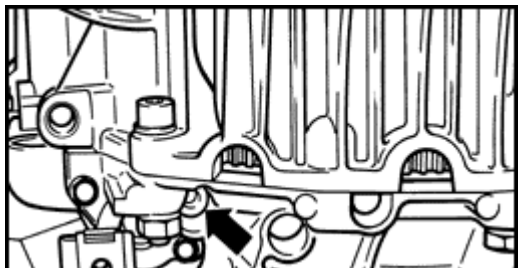
This removal procedure refers to the left cylinder head

### Removing

- Remove ribbed belt ⇒ page 13-9
- Remove toothed belt ⇒ page 13-11




- Disconnect exhaust pipe from manifold.
- Disconnect components of EGR system, if applicable.



- Drain engine coolant at drain plug (arrow) using special tool 3247, and at drain plug in bottom of radiator.
- Remove air hose between Mass Air Flow (MAF) sensor and intake manifold.
- Disconnect all spark plug connectors.

- Disconnect all harness connectors on fuel injectors.

**15-14**

- Disconnect positive crankcase ventilation connections on left and right cylinder head covers.

- Disconnect fuel supply and return lines.

- Unclip cover on intake air housing.

- Remove both screws under cover.

- Push back and lift intake air housing upward.

- Pull vacuum hose off left side and remove housing.

- Remove left-side cover for fuel injector lines.

- Detach accelerator pedal cable and lay clear.

- Disconnect line from Idle Air Control (IAC) valve at throttle body.

- Disconnect harness connector at IAC valve and throttle position sensor.

- Disconnect vacuum pipe at the cruise control vacuum control actuator.

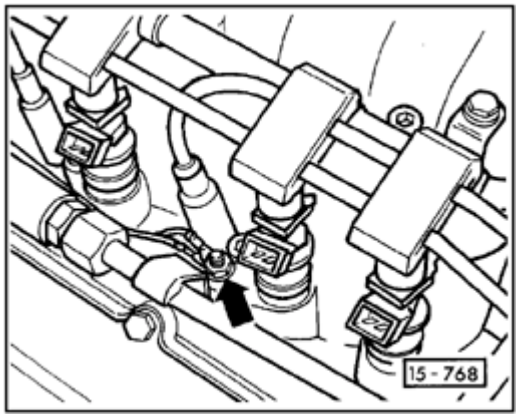
- Disconnect harness connector at oil pressure sensor and at oil pressure switch.
- Disconnect harness connector at the Camshaft Position (CMP) sensor housing.
- Disconnect vacuum pipe at intake manifold changeover valve (blue) and also at EGR valve (brown).

**15-15**

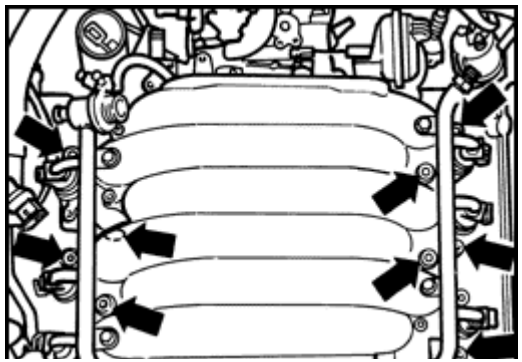
- Disconnect harness connectors for Heated Oxygen Sensors (H02S) and oxygen sensor heaters at engine compartment bulkhead, and move to one side.

- Disconnect vacuum line to EGR vacuum regulator solenoid valve at throttle body.

- Remove EGR valve from intake manifold.




- Remove hydraulic hose bracket and disconnect Ground (GND) wires (arrow) on intake manifold.



- Remove bolts (arrows) and remove intake manifold.
- Seal off openings using clean cloth rags.
- Disconnect coolant line at rear of cylinder head.

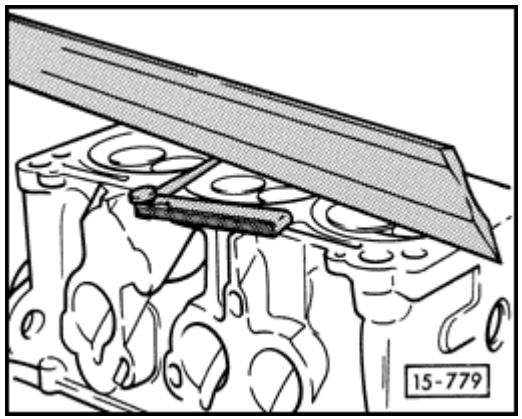
***Note:***

*The intake manifold has two slanting mounting surfaces to the left and*

*right cylinder heads. The cylinders heads can be warped by removing the manifold. If only the intake manifold is removed, or if only one cylinder head is removed, then the cylinder head bolts of the head(s) that are not removed must be tightened 1/4-turn (90° ).*

- Remove heated oxygen sensors.
- Remove exhaust manifold heat shield.
- Remove cylinder head cover.
- Remove rear toothed-belt guard.
- Disconnect hose from hydraulic reservoir to pump.
- Remove cylinder head.

**Checking cylinder head distortion**




- Measure with feeler gauge at several points using straight edge.

  Max. permissible distortion: 0.05 mm (0.0020 in.)

**Installing**

- Clean sealing surfaces.
- Install cylinder head gasket.

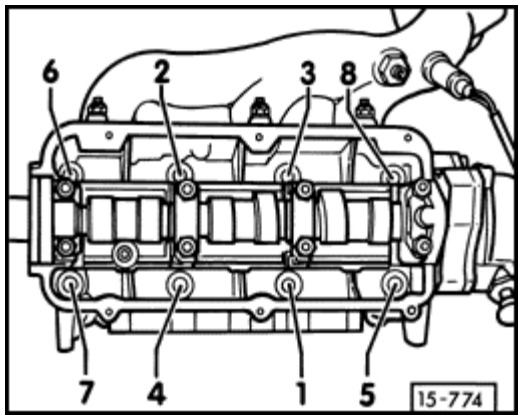
  Lettering on gasket faces toward cylinder head.

- Install cylinder head.

  Pay attention to centering pins in cylinder block.

- Install cylinder head bolts and tighten by hand.

**Tightening**




- Tighten cylinder head bolts in two stages:
  - Stage 1 60 Nm (44 ft lb)
  - Stage 2 additional 1/2-turn (180°)

***Note:***

- *For final 1/2-turn, two 1/4-turns (90°) are also permissible if tightening with a fixed wrench.*
- *It is not necessary to retighten the cylinder head bolts after repairs, or*

*as part of maintenance service.*

## Compression pressure, checking

- Engine warm-oil temperature at least 30 ° C (86 ° F)
- Throttle valve fully open during cranking

- Disconnect harness connectors from ignition coil power output stage and from all six fuel injectors.

- Use compression pressure recorder VAG 1381 together with adapter 1381/5 or equivalent to measure compression.

***Note:***

*Refer to operating instructions for use of the recorder.*

- Operate starter until tester shows no additional increase in pressure.

**Compression pressures**

- New: 9-14 bar (131-203 psi)
- Wear limit: 7.5 bar (109 psi)

- Max. permissible pressure difference between all cylinders: 3 bar (44 psi)

***CAUTION!***

***If the test values are not within the specifications, recheck compression pressure after a test drive.***

15-19

## Camshaft, removing and installing

### Removing

- Removing ribbed drive belt ⇒ page 13-9 .
- Remove toothed camshaft drive belt ⇒ page 13-11 .
- Remove cylinder head cover.

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Left side:

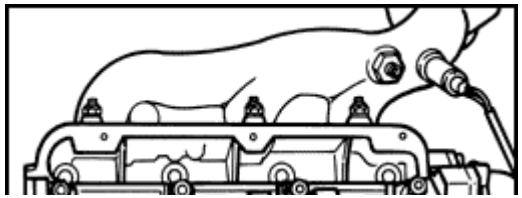
- Remove housing for camshaft position sensor.

Right side:

- Remove plug/cover on cylinder head.

---

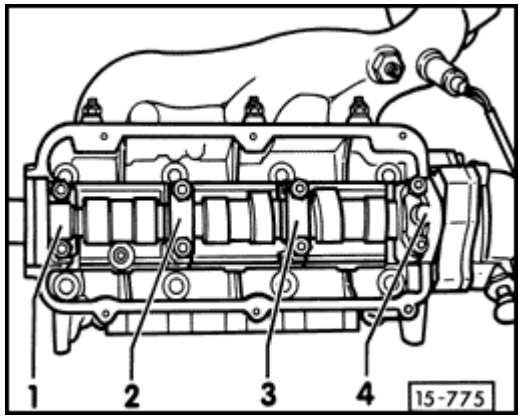
- Remove toothed belt camshaft sprocket.



- Remove camshaft bearing caps -2- and -3-.
- Gradually and evenly loosen nuts for bearing caps -1- and -4-, alternating in diagonal sequence.

***CAUTION!***

***DO NOT allow bearing caps to become mixed up. Identify as necessary using a felt marker.***




**Installing**

- Install bearing caps -1- and -4-.

  Gradually and evenly tighten bearing cap nuts, alternating in diagonal sequence.

- Install bearing caps -2- and -3-.

Tightening torque: 17 Nm (15 ft lb)

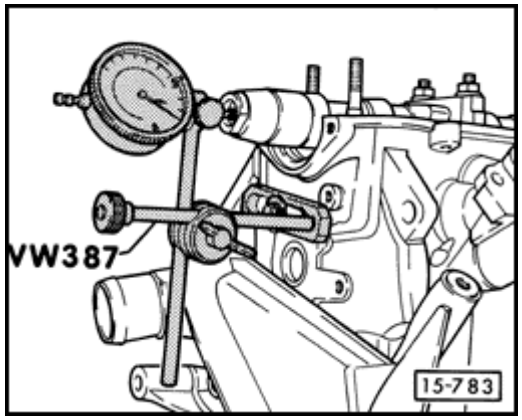
***CAUTION!***

- ***After installing new or re-installing old lifters, and after installing the camshaft(s), the engine must not be started for at least 30 minutes. Otherwise the valves could strike the pistons.***
- ***After working on the valve train and lifters, crank the engine carefully by hand, at least two full revolutions, to make sure that the valves do not strike the pistons.***

15-21

## Camshaft axial play, checking

- Housing for camshaft position sensor removed
- Hydraulic lifters removed
- Camshaft bearing caps 2 and 4 removed




- Mount dial indicator in holder VW 387 on front end of cylinder head.
- Push camshaft by hand against dial indicator.
- Set dial gauge to zero.
- Push camshaft away from dial indicator.
- Read axial play on gauge.

Specifications:

- New: 0.04-0.15 mm (0.0016-0.0059 in.)
- Wear limit: 0.35 mm (0.0138 in.)

## Hydraulic valve lifters, checking

***Note:***

- *Irregular valve noise during cranking is normal.*
- *Do not interchange hydraulic lifters. If necessary mark them when they are being removed.*
- *Place lifters that have been removed on a clean surface with the contact surface (camshaft end) facing downward.*
- *Hydraulic lifters cannot be repaired or adjusted. Faulty lifters must be replaced.*

- Start and run engine until warm-until radiator coolant fan has come on at least once.

- Increase engine speed to approx. 2500 RPM for 2 minutes

If the irregular valve noise stops and then re-occurs again each time vehicle is used in stop and go traffic:

- Replace the oil check valves ⇒ Repair Group

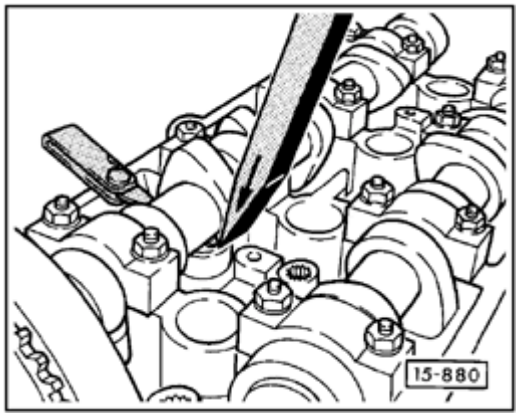
17.

If the irregular noise does NOT stop, locate faulty hydraulic lifter as follows:

- Remove cylinder head cover.

- Turn crankshaft clockwise until cam lobe for lifter being checked is pointing upward.

**15-23**




- Use a wooden or plastic wedge to press valve lifter down.

- If a 0.20 mm (0.008 in.) feeler gauge can be inserted between camshaft and lifter, replace lifter.

***CAUTION!***

- ***After installing new or re-installing old lifters, and after installing the camshaft(s), the engine must not be started for at least 30 minutes. Otherwise the valves could strike the pistons.***
- ***After working on the valve train and lifters, crank the engine carefully by hand, at least two full revolutions, to make sure that the valves do not strike the pistons.***

***Note:***

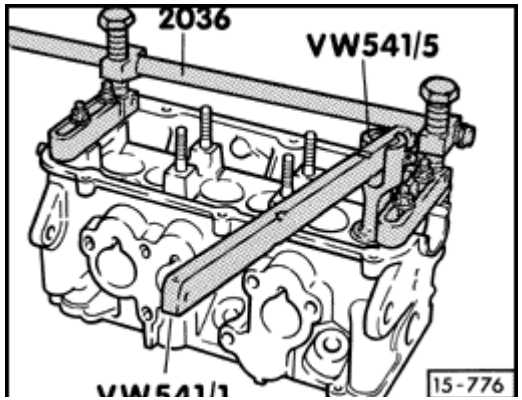
*The illustration is used to show an example of pressing down on the lifter checking the clearance with a feeler gauge-it does not specifically show the 2.8 liter V6 engine.*

15-24

## Valve stem oil seals, replacing

### Cylinder head installed

- Remove toothed camshaft drive belt ⇒ page 13-11 .
- Remove camshafts and hydraulic lifters.
- Remove spark plugs.
- Rotate crankshaft by hand to set piston of appropriate cylinder to Bottom Dead Center (BDC).
- Thread VW 653/3 hose, US 1106 cylinder leakdown tester or equivalent with seal into spark plug hole by hand and apply a continuous pressure of at least 6 bar (87psi).



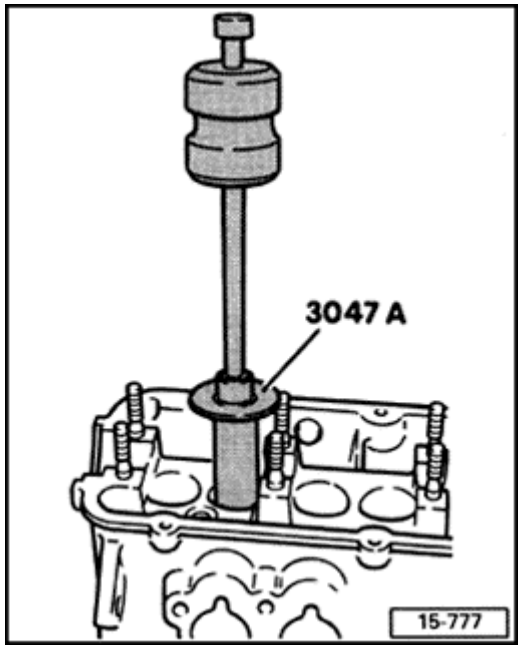

- Install compressor tool 2036 and adjust to height of studs.
- Remove valve spring with valve spring tensioner VW 541/1 and thrust pad VW 541/5 or equivalent.

***Note:***

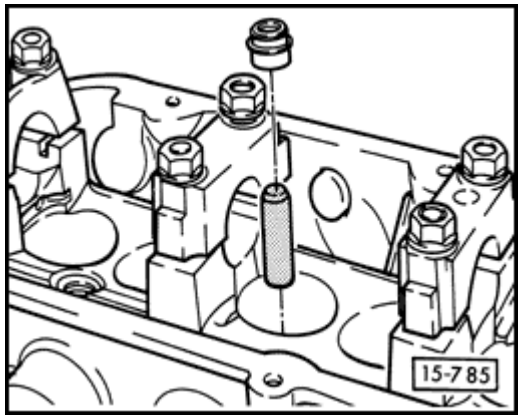
*Tight valve keepers can be loosened by tapping lightly on lever VW 541/1 with a hammer.*

- Remove valve springs.

**15-25**




- Remove valve stem oil seal with slide hammer 3047 A.
- Install new valve stem oil seal.



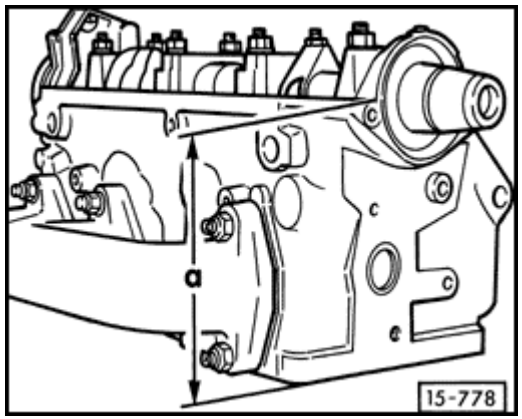

- Fit protective sleeve over valve stem, slide seal carefully onto valve guide.

***Note:***

*Always use the enclosed plastic sleeve for installation of valve stem oil seals to protect the seal from being damaged by the valve keeper grooves.*

15-26

## Cylinder head, resurfacing



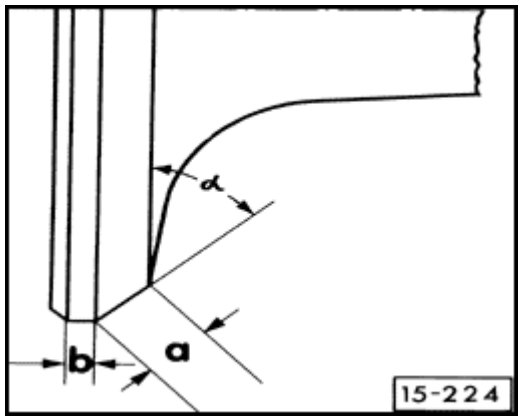

- Minimum dimension -a- = 132.75 mm (5.226 in.)

15-27

## Intake and exhaust valves, checking and refacing

### Checking

- Inspect visually for scoring on valve stem and valve seat surfaces. If clear signs of wear are present replace valves.




### Refacing intake valve

$\alpha$ - 45°

a - max 3.5 mm (0.138 in.)

b - min. 0.5 mm (0.020 in.)

### Refacing exhaust valves

***WARNING!***

- ***Valves must not be refaced by cutting or grinding.***
- ***Only lapping is permitted.***

15-28

***WARNING!***

***Worn sodium-filled exhaust valves must not be scrapped without properly disposing of the sodium.***

- ***The valves must be cut into two parts with a hacksaw between the center of the valve stem and the valve head. They must not come into contact with water when being cut open.***

***After cutting the valves:***

- ***Throw the valves, not more than ten at a time, into a bucket filled with water and STAND BACK. A sudden chemical reaction occurs as the sodium comes into contact with the water.***

- ***Valves that have been processed in this way can then be disposed of in the normal waste.***

## Valve guides, checking and replacing

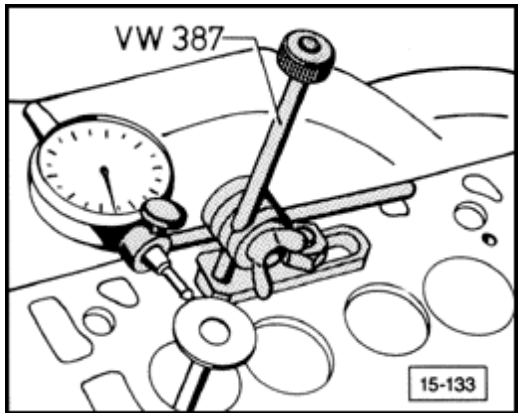
### Checking

When repairing engines with low compression due to leaking valves, it is not sufficient to reface or replace the valve seats and valves. It is also necessary to check the valve guides for wear. This is particularly important when checking engines with high mileage.

- Insert new valve into guide until end of valve stem is flush with end of guide.

***CAUTION!***

***Due to the difference in valve stem diameters, make sure that only an intake valve is used to check intake valve guides, and that only an exhaust valve is used to check the exhaust valve guides.***




- Determine valve rock-amount that valve can move side-to-side.

### Wear limit

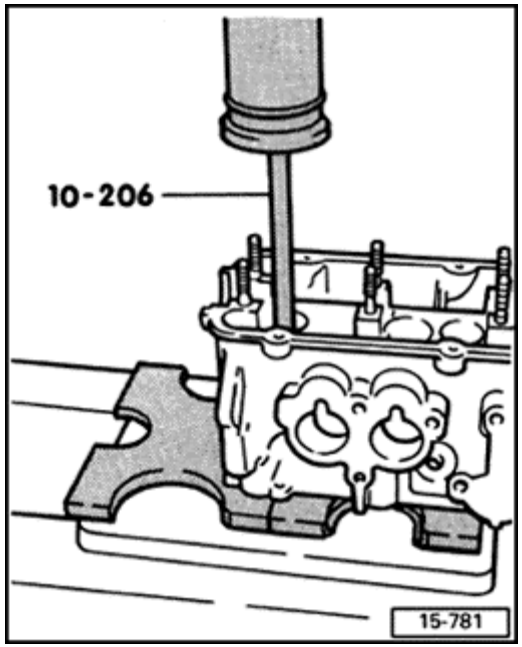
- Intake valve guide 1.0 mm (0.039 in.)
- Exhaust valve guide 1.3 mm (0.051 in.)

15-30

**Replacing**

***CAUTION!***

***Cylinder heads with valve seats that can no longer be refaced, or which have already been machined to the minimum dimension, should no longer be repaired.***




- Press out worn valve guides from camshaft side using drift 10-206. (Replacement guides with shoulder must be pressed out from combustion chamber side.)
- Coat new guides with oil and, using drift 3121, press into cold cylinder head from camshaft side until shoulder makes contact.

***CAUTION!***

***When the shoulder on the new guide makes contact, the pressing force must not exceed 1.0 ton or the guide shoulder could break off.***

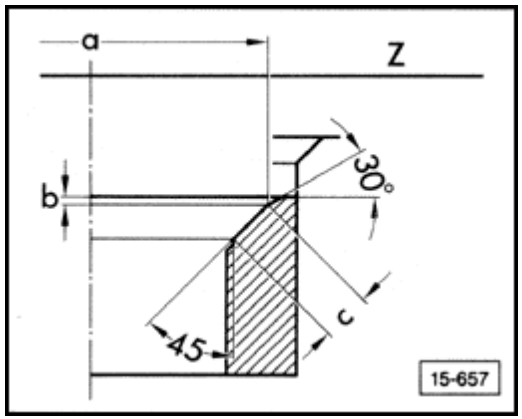
- Use 7mm reamer 3120 to ream new valve guides to size, using plenty of cutting fluid.

15-31

## Valve seats, refacing

***Note:***

- *Pay attention to the cylinder head minimum dimension when refacing valve seats ⇒ page 15-32*
- *Only reface valve seats enough to produce perfect contact.*
- *Before refacing, calculate the maximum permissible refacing dimension. If this dimension is exceeded, correct functioning of hydraulic valve lifters can no longer be guaranteed and the cylinder head must be replaced.*




**Intake valve seat**

a - Diameter: 39.2 mm (1.543 in.)

b - Max. permissible refacing dimension[1)]

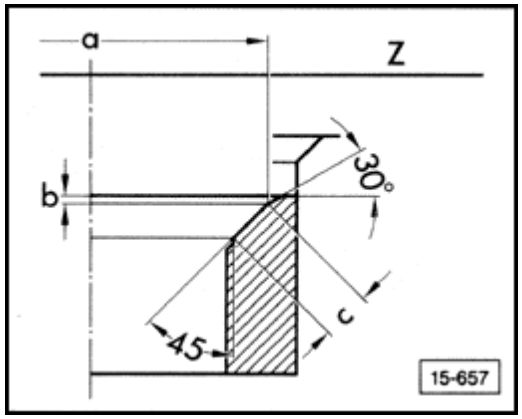
c - Seat width: 2.0 mm (0.079 in.)

30° - Upper correction angle

45° - Valve seat angle

Z - Bottom surface of cylinder head

[1)] Calculating max. permissible refacing dimensions ⇒ page 15-32




**Exhaust valve seat**

a - Diameter: 32.4 mm (1.276 in.)

b - Max. permissible refacing dimension[1)]

c - Seat width: 2.4 mm (0.094 in.)

30 ° - Upper correction angle

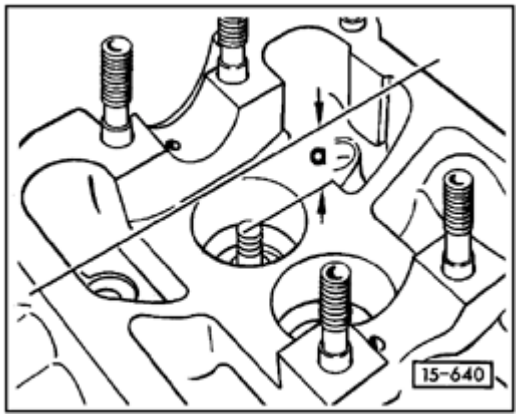
45 ° - Valve seat angle

Z - Bottom surface of cylinder head

[1)] Calculating max. permissible refacing dimensions ⇒ page 15-32

**Maximum permissible refacing dimension, calculating**

- Insert valve into guide and press firmly against valve seat.




- Measure distance -a- between end of valve stem and top surface of cylinder head.

The maximum permissible refacing dimension is the difference between the actual distance measured at the cylinder head and the specified minimum dimension.

**Minimum dimensions**

- At intake valve: 33.8 mm (1.331 in.)
- At exhaust valve: 34.1 mm (1.343 in.)