

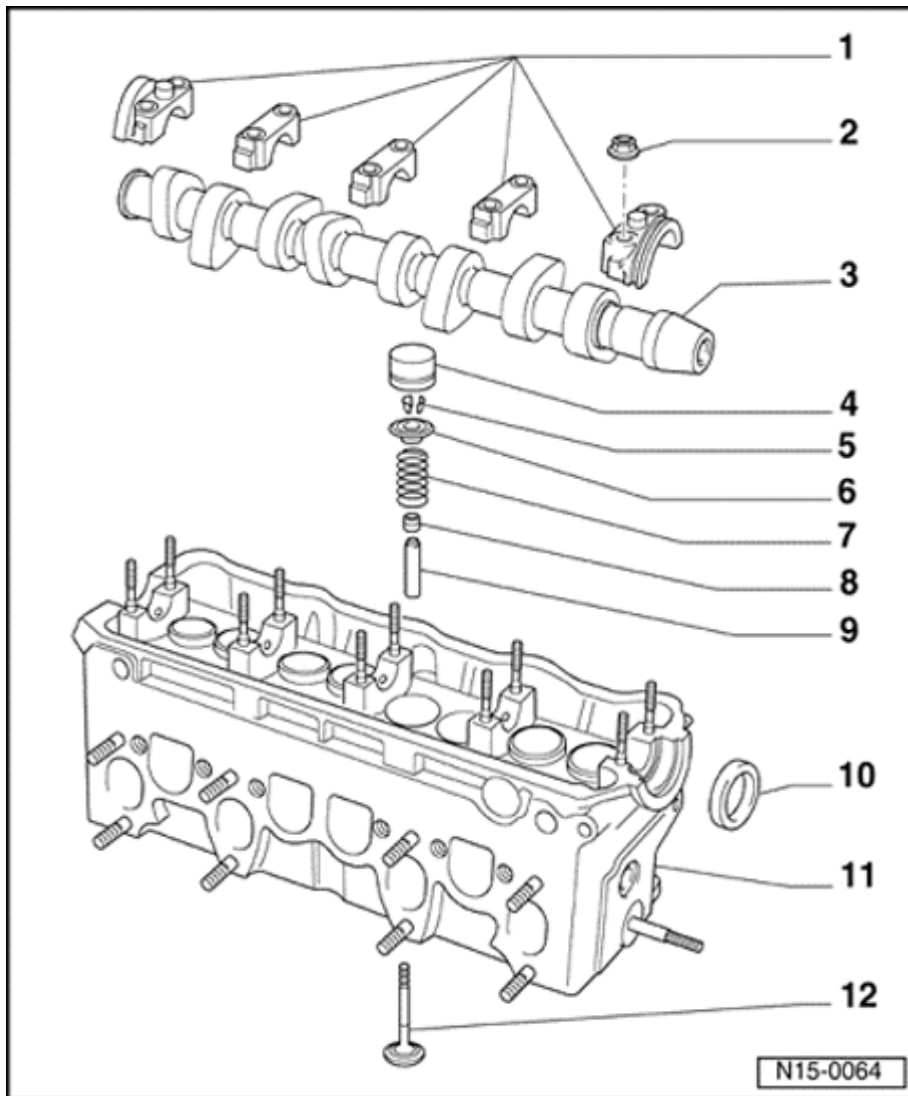
Valve train, servicing

Note:

- ◆ *Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.*
- ◆ *After the installation of new hydraulic lifters do not start the engine for 30 minutes. Turn the crankshaft over twice by hand. Otherwise valves will touch pistons.*

1 - Bearing cap

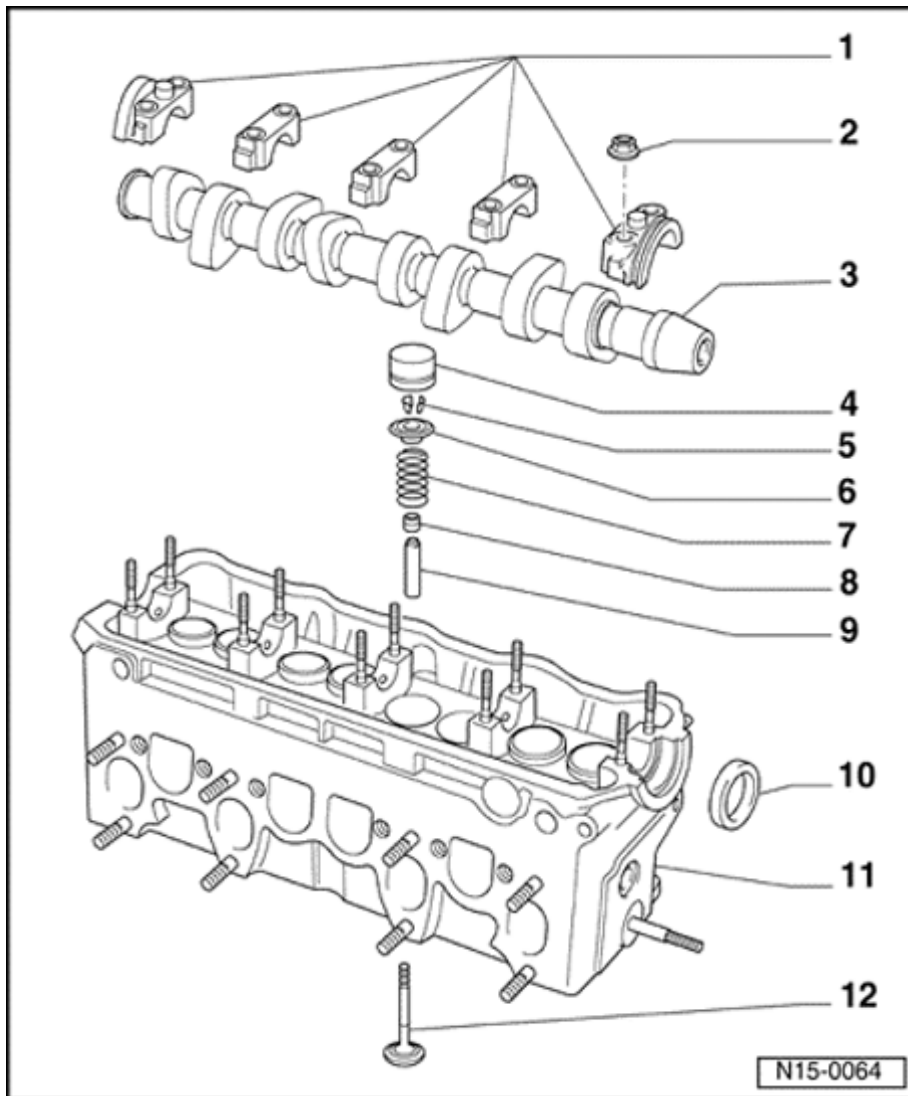
- ◆ Installation position ⇒ Fig. ⇒ [2](#)
- ◆ Installation sequence ⇒ [Page 15-35](#)
- ◆ Coat bearing cap 1 lightly with sealant AMV 174 004 01.



2 - 20 Nm (15 ft lb)

3 - Camshaft

- ◆ Axial clearance, checking ⇒ Fig. ⇒ [1](#)
- ◆ Removing and installing ⇒ [Page 15-35](#)
- ◆ Check radial clearance with plastigage
- ◆ Wear limit: 0.11 mm
- ◆ Run-out: max. 0.01 mm
- ◆ Identification and valve timing ⇒ Fig. ⇒ [4](#)



4 - Hydraulic lifter

- ◆ Do not interchange
- ◆ Checking ⇒ [Page 15-40](#)
- ◆ Store with cam contact surface facing downward
- ◆ Lubricate contact faces with oil
- ◆ Before installing, check camshaft axial clearance ⇒ Fig. ⇒ [1](#)

5 - Keepers

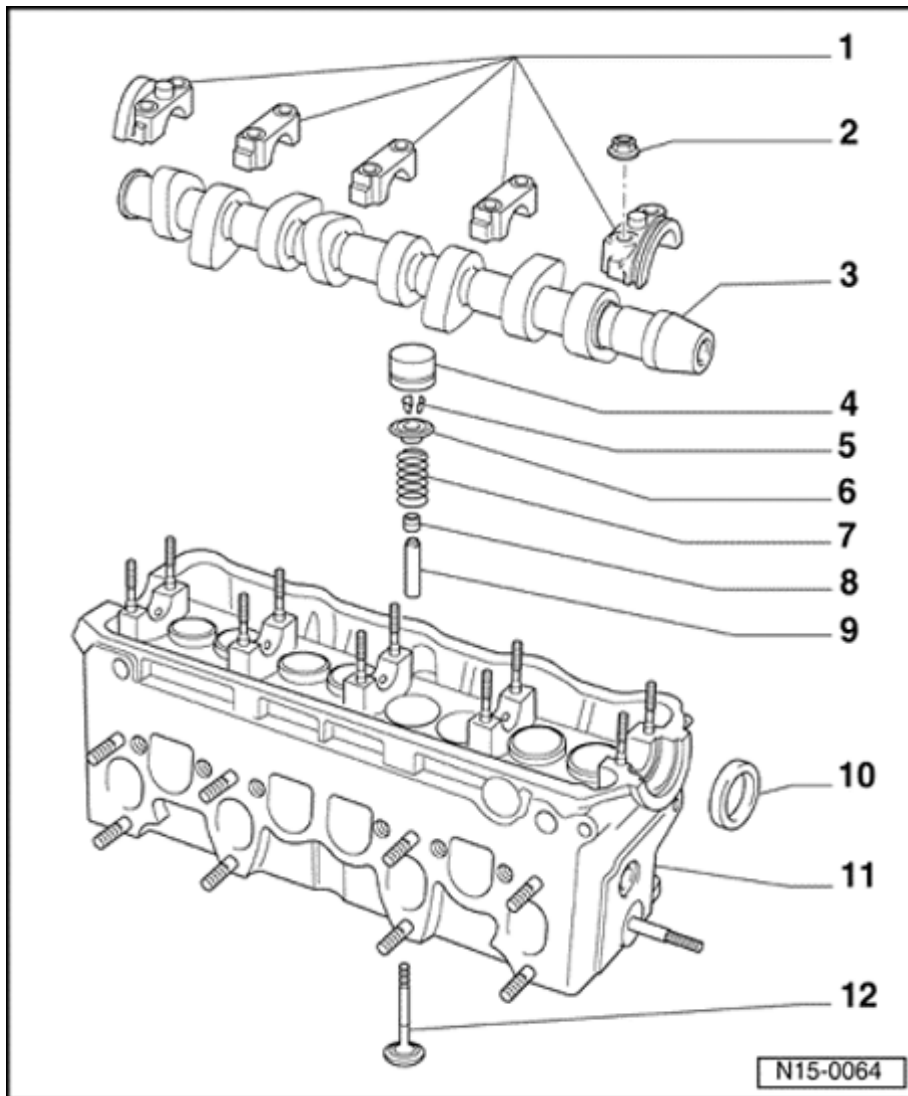
6 - Upper valve spring plate

7 - Valve spring

- ◆ Removing: with cylinder head removed, use 2037
- ◆ Replacing valve stem seals ⇒ [Page 15-32](#)

8 - Valve stem seal

- ◆ Replacing ⇒ [Page 15-32](#)



9 - Valve guide

- ◆ Checking ⇒ [Page 15-29](#)
- ◆ Replacing ⇒ [Page 15-30](#)
- ◆ Service version with collar

10 - Oil seal

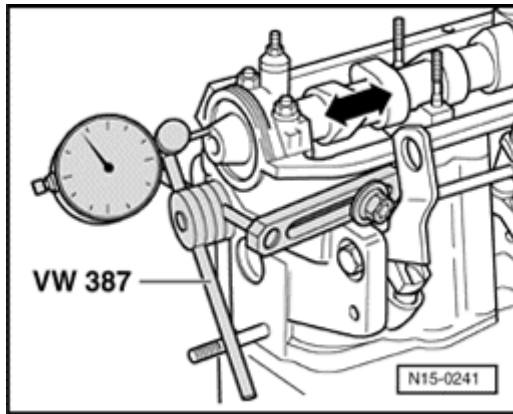
- ◆ To remove and install, remove bearing cap
- ◆ Toothed belt, removing and installing ⇒ [Page 13-16](#)

11 - Cylinder head

- ◆ See note ⇒ [Page 15-13](#)
- ◆ Valve seats, reworking ⇒ [Page 15-26](#)

12 - Valves

- ◆ Do not machine valves, only lapping is permissible.
- ◆ Valve dimensions ⇒ Fig. ⇒ [3](#)



A

Fig. 1 Camshaft axial clearance, checking

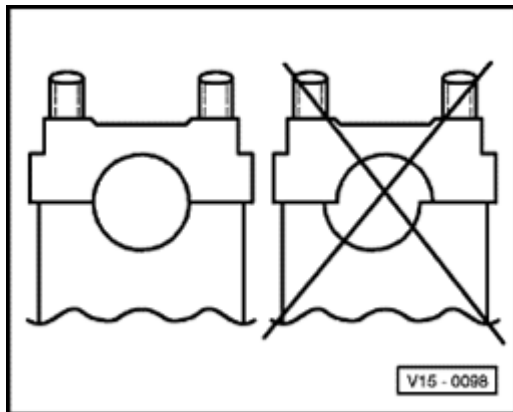
Special tools

- ◆ VW 387 Universal dial gauge bracket
- ◆ Dial gauge

Note:

Check with hydraulic lifters removed and with first and last bearing caps installed.

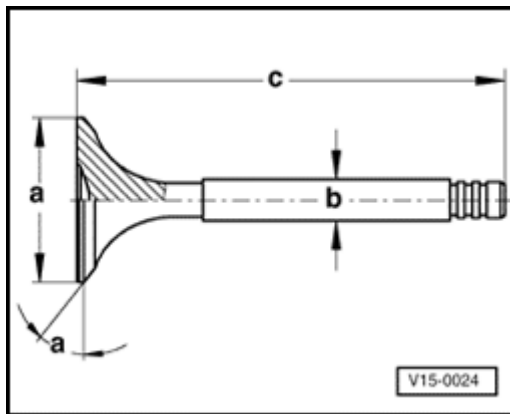
- Wear limit: max. 0.15 mm



A

Fig. 2 Camshaft bearing caps, installed position

Note offset. Before installing camshaft, trial install bearing caps and determine correct position.



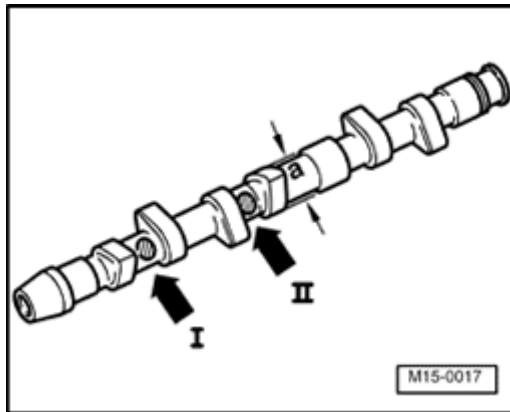
A

Fig. 3 Valve dimensions

Note:

Valves must not be machined. Only lapping is permitted.

Dimension		Intake valve	Exhaust valve
diameter a	mm	35.950	31.450
diameter b	mm	6.963	6.943
c	mm	96.850	96.850
α	\angle°	45	45



A

Fig. 4 Camshaft identification, valve timing

Identification

- ◆ Cam base diameter: $a = 38 \text{ mm}$
- ◆ Camshaft is identified by stamped numbers and letters between intake and exhaust cams:

Engine code	ALH
Cylinder 1 (arrow A)	38K
Cylinder 2 (arrow B)	DE

Valve timing at 1 mm valve lift

Engine code	ALH
Intake opens after TDC	16°
Intake closes after BDC	25°
Exhaust opens before BDC	28°
Exhaust closes before TDC	19°



Valve seats, reworking

Special tools

- ◆ Depth gauge
- ◆ Valve seat refacing tool

Note:

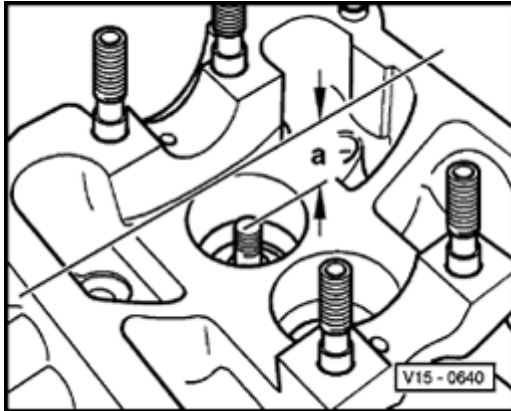
- ◆ *When repairing engines with leaking valves, it is not always sufficient to merely reface or replace valve seats and valves. It is also necessary to check the valve guides for wear. This is particularly important on high mileage engines.*
- ◆ *The valve seats should only be reworked enough to produce a perfect seating pattern. The maximum permissible reworking dimension must be calculated before reworking starts. If this dimension is exceeded, the hydraulic lifter function can no longer be guaranteed and the cylinder head should be replaced.*

Maximum permissible reworking dimension, calculating:

- Insert valve and press firmly against seat.

**Note:**

If the valve will be replaced as part of a repair, use the new valve for the calculation.



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- Measure distance -a- between end of valve stem and upper edge of cylinder head.
- Calculate maximum permissible reworking dimension from measured distance -a- and minimum dimension.

Minimum dimension:

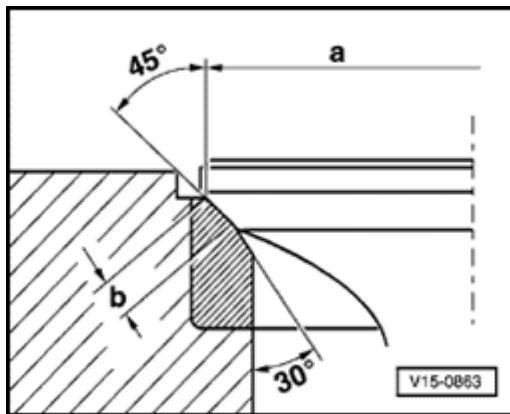
Intake valve 35.8 mm

Exhaust valve 36.1 mm

Measured distance minus minimum dimension = Maximum permissible reworking dimension.

Example:

Measured distance	36.5 mm
- Minimum dimension	35.8 mm
= Max. perm. rework dimension	0.7 mm



▲ Intake valve seat, reworking

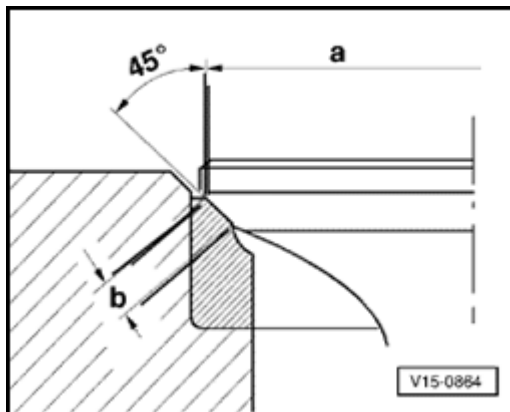
a = 35.7 mm diameter

b = 1.6 mm

45 ° = Valve seat angle

Note:

The 30 ° lower valve seat chamfer is necessary to ensure that the intake channel flow characteristics are maintained.



▲ Exhaust valve seat, reworking

a = 31.4 mm diameter

b = 2.7 mm

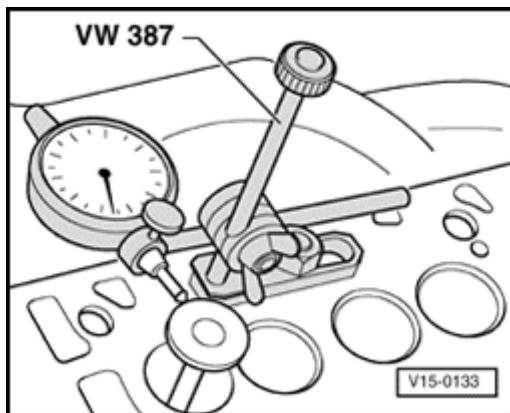
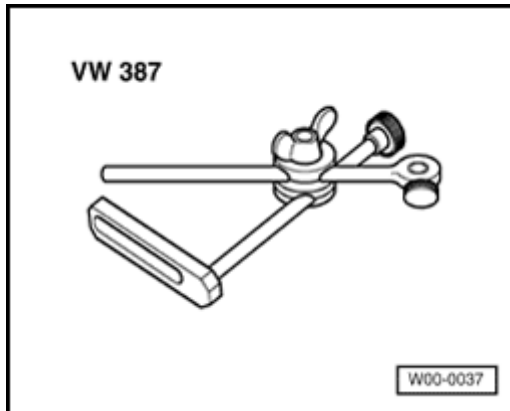
45 ° = Valve seat angle



Valve guides, checking

Special tools

- A ♦ VW 387 Universal dial gauge bracket
- ♦ Dial gauge



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

Note:

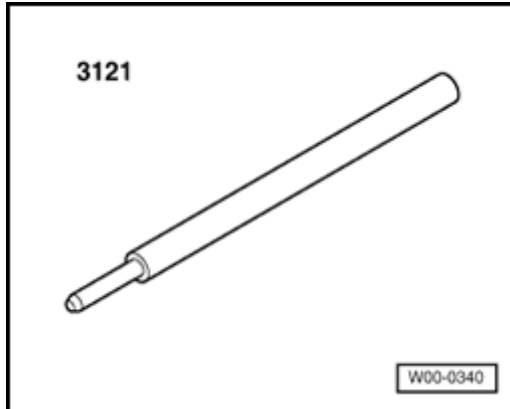
Due to slight differences in stem dimensions, be sure to use an intake valve in the intake guide and an exhaust valve in the exhaust guide.

- Maximum rock: 1.3 mm

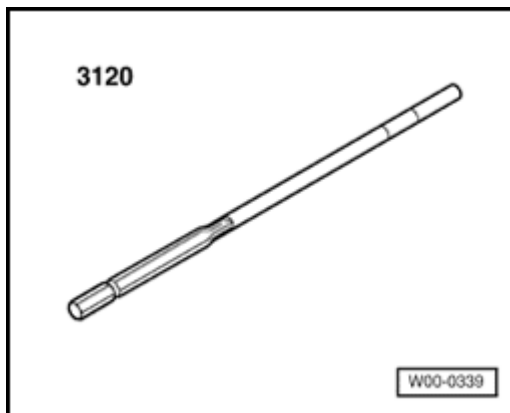


Valve guides, replacing

Special tools



◆ 3121 Drift



◆ 3120 Reamer and cutting fluid



Removing

- Clean and check cylinder head.

Note:

Do not replace the valve guides in cylinder heads where the valve seats can no longer be reworked, or cylinder heads which have already been machined to the minimum dimension.

- Press out worn valve guides using 3121 from camshaft side (valve guides with shoulder - service version - from combustion chamber side).

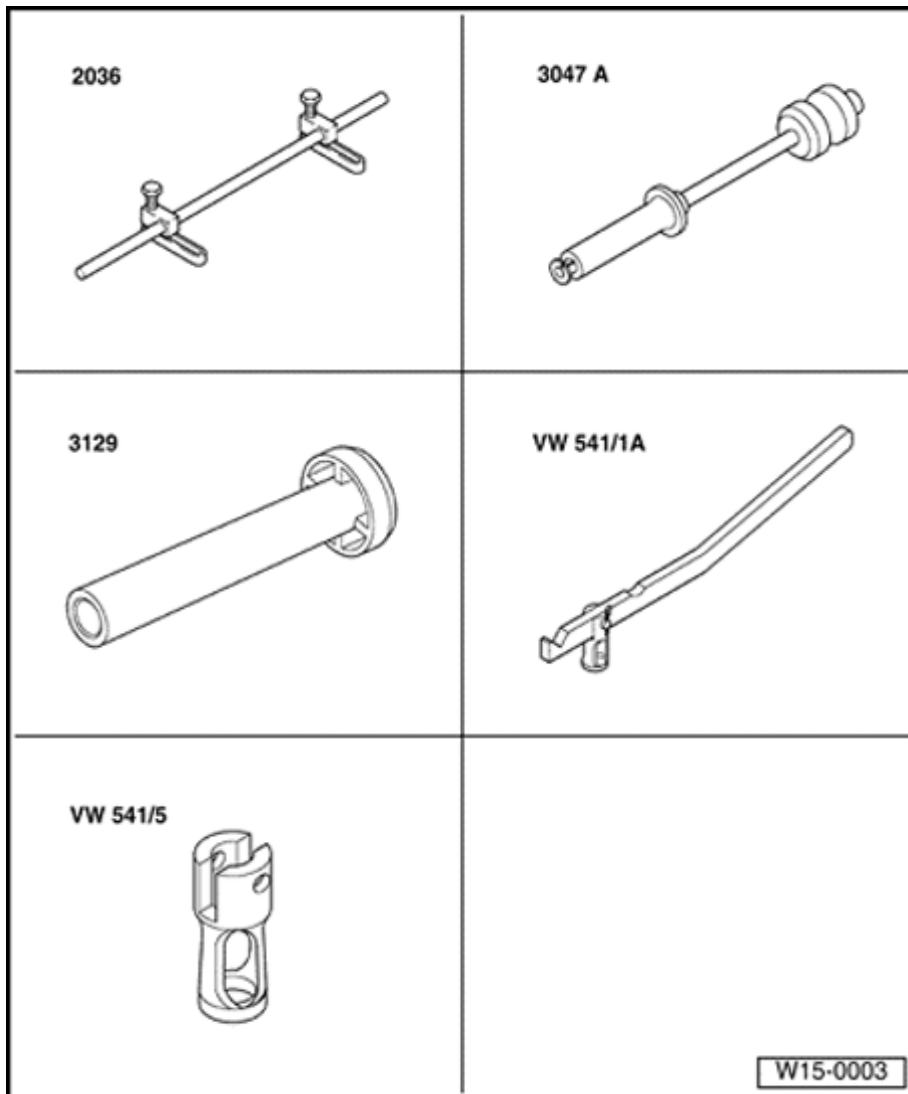
Installing

- Press new guides in up to shoulder (lubricated with oil) from camshaft side in cold cylinder head using 3121 drift.

Note:

When the valve guide shoulder makes contact, do NOT allow the pressure to exceed 2000 psi or the shoulder could break off.

- Ream out guides with 3120 hand reamer and plenty of cutting fluid.
- Rework valve seats ⇒ [Page 15-26](#) .



Valve stem seals, replacing

Special tools

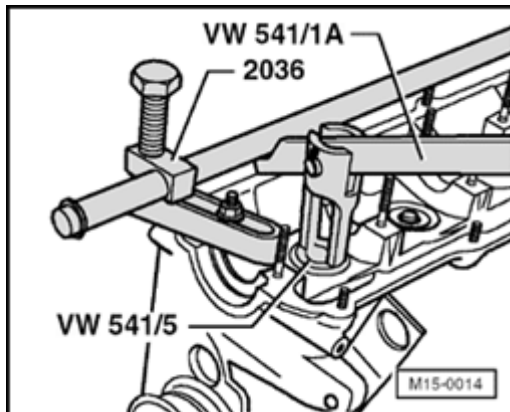
- ◆ 2036 Adjustable rod
- ◆ 3047A Slide hammer
- ◆ 3129 Installation tool
- ◆ VW 541/1A Valve spring lever
- ◆ VW 541/5 Thrust piece



Removing

(with cylinder head installed)

- Remove camshaft ⇒ [Page 15-35](#) .
- Remove hydraulic lifters and set aside with contact surfaces downward. Ensure lifters are not interchanged during procedure.
- Set piston of respective cylinder to Top Dead Center.

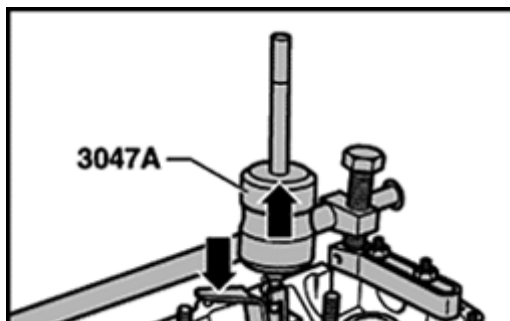


A

- Install 2036 adjustable rod and adjust mountings to height of studs.
- Remove valve springs with VW 541/1A lever and VW 541/5 press piece.

Note:

The valves are supported by the piston crown.



A

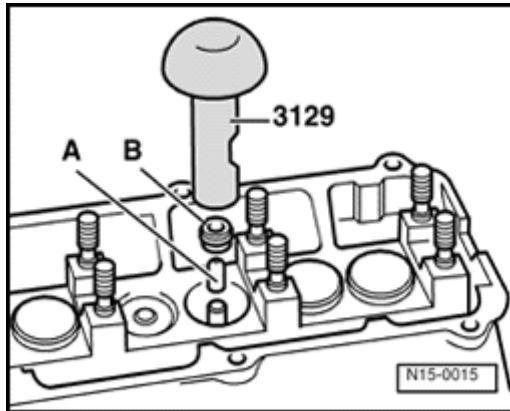
- Remove valve stem seals using 3047A.



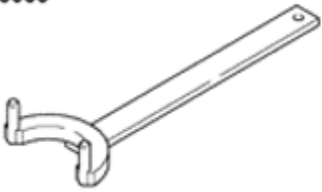
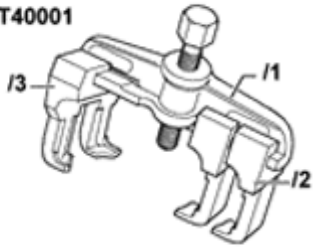



Installing

A

- Place supplied plastic sleeve -A- on appropriate valve stem. This prevents new valve stem seal -B- from being damaged.
- Insert new valve stem seal in 3129 installation tool.
- Lubricate valve stem seal sealing lip with oil and press carefully onto valve guide.
- Install camshaft ⇒ [Page 15-35](#) .



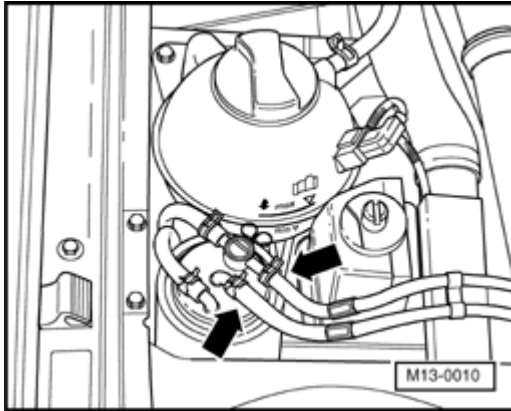


<p>3036</p> 	<p>T40001</p> 
<p>V.A.G 1331</p> 	<p>V.A.G 1332</p> 
<p>V.A.G 1921</p> 	<p>W15-0070</p>

Camshaft, removing and installing

Special tools and material

- ◆ 3036 Counter-holding tool
- ◆ T40001 Two-arm puller
- ◆ V.A.G 1331 Torque wrench (5 to 50 Nm) or equivalent
- ◆ V.A.G 1921 Spring clamp pliers
- ◆ AMV 174 004 01 Sealer



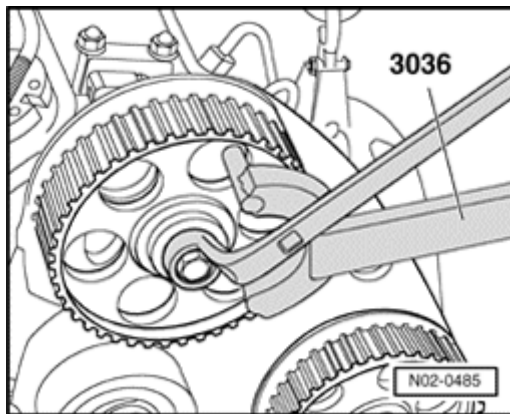
Removing

A

- Disconnect fuel pressure and return lines on fuel filter (arrows).
- Cap lines to prevent dirt from entering lines.
- Remove right headlight.

⇒ [Repair Manual, Electrical Equipment, Repair Group 94](#)

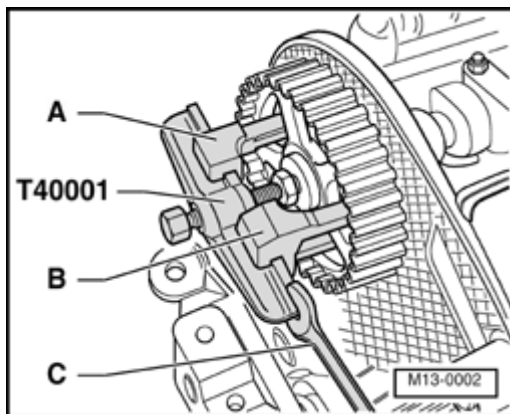
- Remove connecting line between charge air cooler and intake manifold ⇒ [Page 21-10](#) .
- Remove toothed belt upper guard cover.
- Remove vacuum pump for brake booster.
- Remove valve cover.
- Remove toothed belt from camshaft sprocket ⇒ [Page 13-16](#)
- Slightly turn crankshaft counterclockwise of engine rotation.



- A**
- Loosen center bolt on camshaft sprocket by 1 turn, counterholding with tool 3036.

Note:

Do not use alignment tool 3418 as a counter-hold tool. Always use tool 3036.



- A**
- Install two-claw puller T40001 with claw -A- and claw -B- to center of camshaft sprocket and pull sprocket off. Counter-hold puller with wrench -C-.
 - Remove camshaft sprocket.
 - Remove bearing caps 5, 1, and 3.
 - Loosen bearing caps 2 and 4 in steps and diagonally.



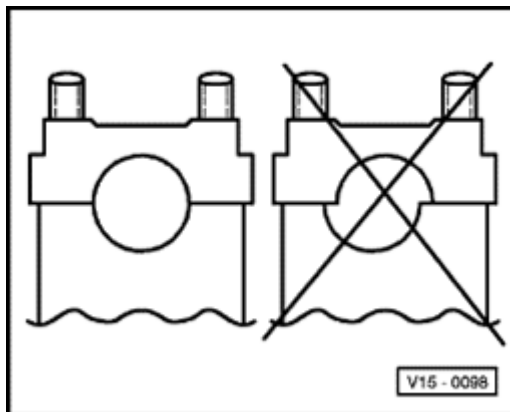
Installing

Requirements

- ◆ Pistons must not be at TDC.

Note:

- ◆ *When installing the camshaft, the cam lobes for cylinder 1 must point upward.*



A

- ◆ *When installing be sure to note offset of bearings.*
 - Lubricate bearing camshaft surfaces with oil.
 - Install camshaft.
 - Tighten bearing caps 2 and 4 alternately and diagonally to 20 Nm (15 ft lb).
 - Lightly coat contact face of bearing cap 1 with sealer AMV 174 004 01. .
 - Install bearing shells 3, 1 and 5 and also tighten to 20 Nm (15 ft lb).



- Lightly tap bearing cap 5 to fit camshaft.
- Install camshaft sprocket together with toothed belt and position with bolt (camshaft must still turn).

The installation is in reverse order of removal.

Toothed belt, installing ⇒ [Page 13-16](#)

- Install connecting line between charge air cooler and intake manifold ⇒ [Page 21-10](#)
- Install fuel pressure and return lines to fuel filter.
- Install right headlight.

⇒ [Repair Manual, Electrical Equipment, Repair Group 94](#)

- Adjust headlights if necessary.

⇒ [Repair Manual, Maintenance](#)

Note:

Do NOT start the engine for approx. 30 minutes

after new lifters have been installed. The hydraulic compensation elements must settle or the valves will strike pistons.



Hydraulic lifters, checking

Special tools and equipment

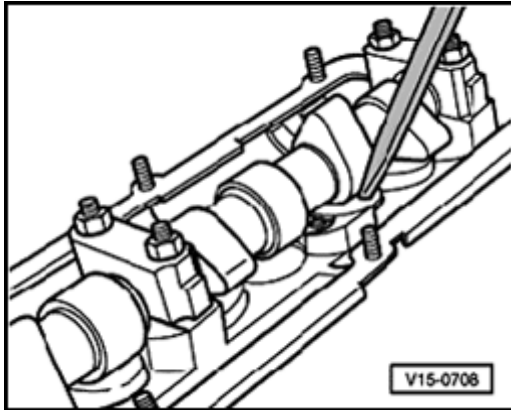
- ◆ Feeler gauge
- ◆ Wood or plastic wedge

Notes:

- ◆ *Replace faulty lifter assembly (cannot be adjusted or repaired).*
- ◆ *Irregular valve noise is normal when starting the engine.*
- Start engine and run until engine coolant fan has switched on at least once.
- Increase engine speed to 2500 rpm for approx. 2 minutes.

If lifters are still noisy, locate faulty lifter(s) as follows:

- Remove valve cover.
- Rotate crankshaft clockwise, until cam of lifter to be checked is pointing upward.



A

- Measure play between cam and lifter.
- Press down on lifter with a wooden or plastic wedge. If a 0.2 mm feeler gauge can now be inserted between lifter and cam lobe then replace this lifter.

Note:

Do NOT start the engine for approx. 30 minutes after new lifters have been installed. The hydraulic compensation elements must settle or the valves will strike the pistons.