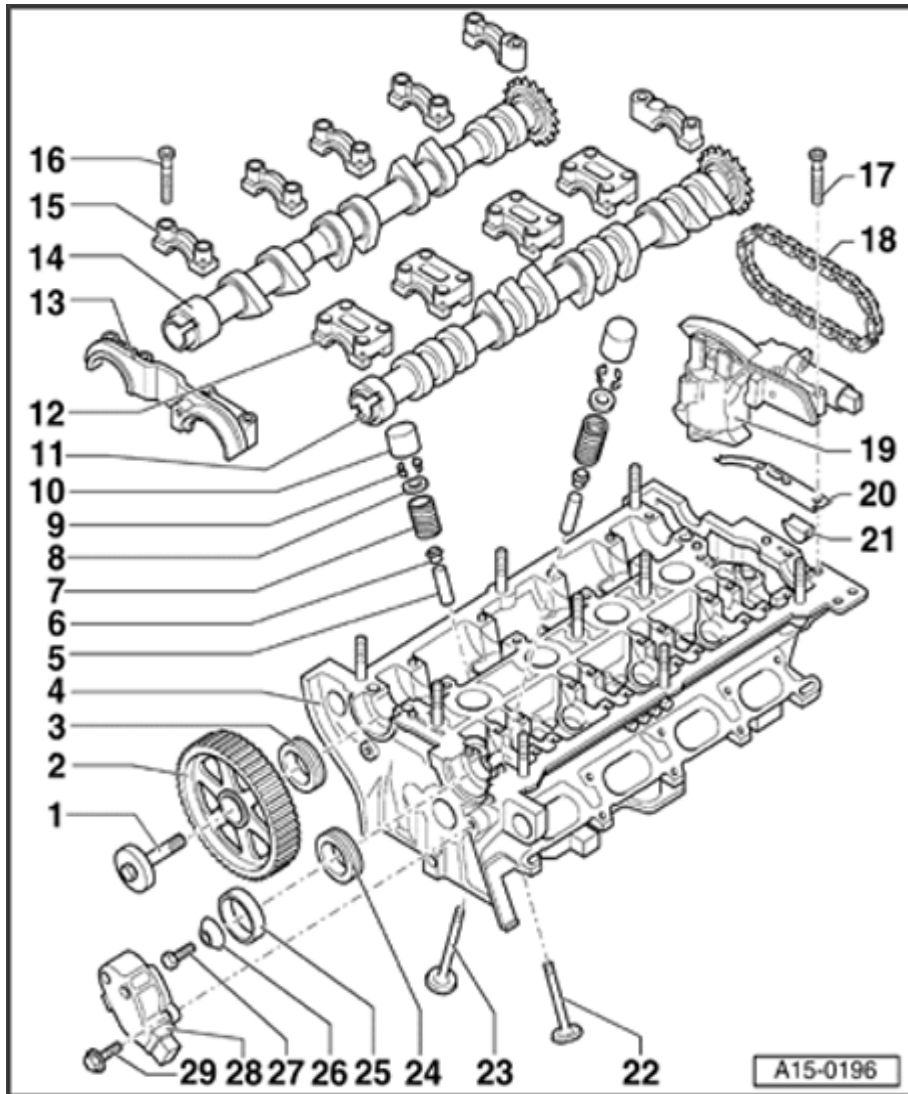


## Valve gear, servicing

### **Note:**

- ◆ *Cylinder heads that have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.*
- ◆ *Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*
- ◆ *Replace all gaskets and seals.*



### 1 - 65 Nm

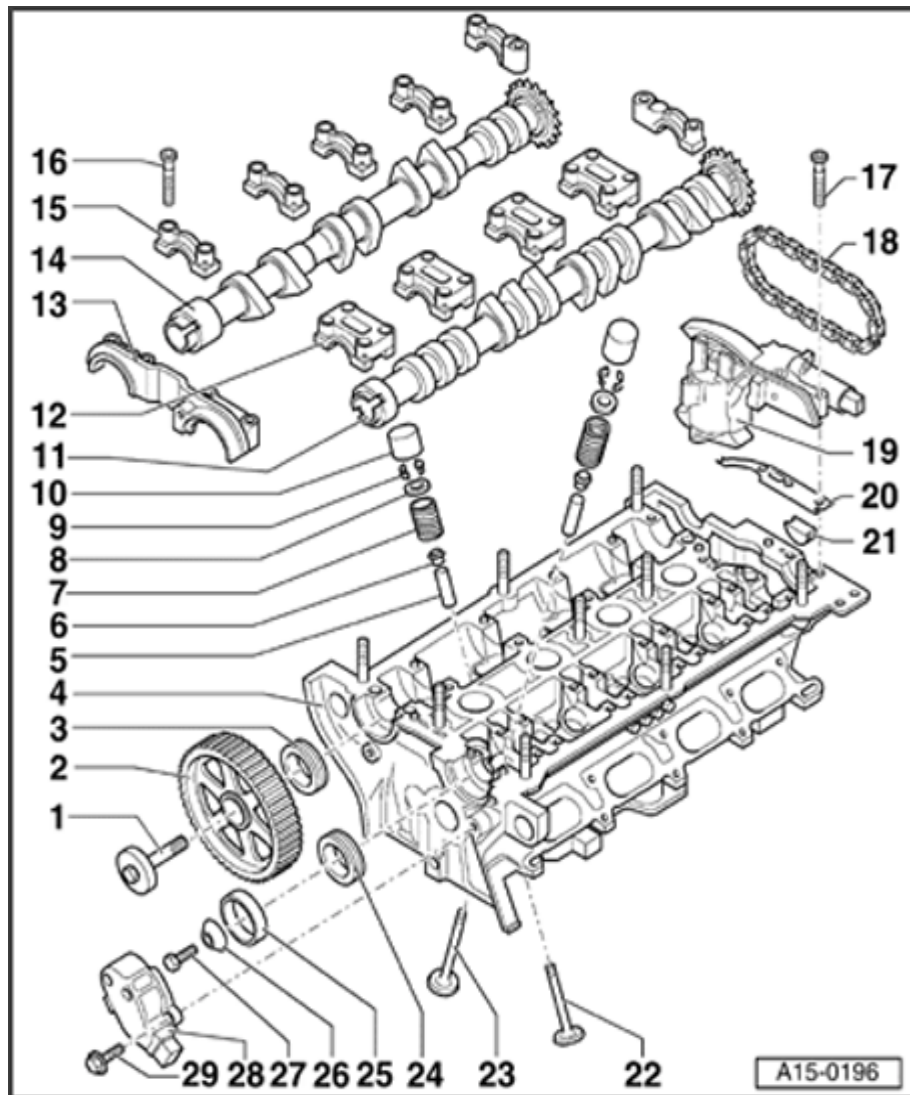
- ◆ Counterhold with 3036 to loosen and tighten

### 2 - Camshaft sprocket

- ◆ For exhaust camshaft
- ◆ Note correct installation position: The narrow web of the camshaft sprocket faces forward and the marking for No. 1 cylinder is visible from the front ⇒ [Page 15-55](#)

### 3 - Sealing ring

- ◆ For exhaust camshaft
- ◆ Replacing ⇒ [Page 15-50](#)



#### 4 - Cylinder head

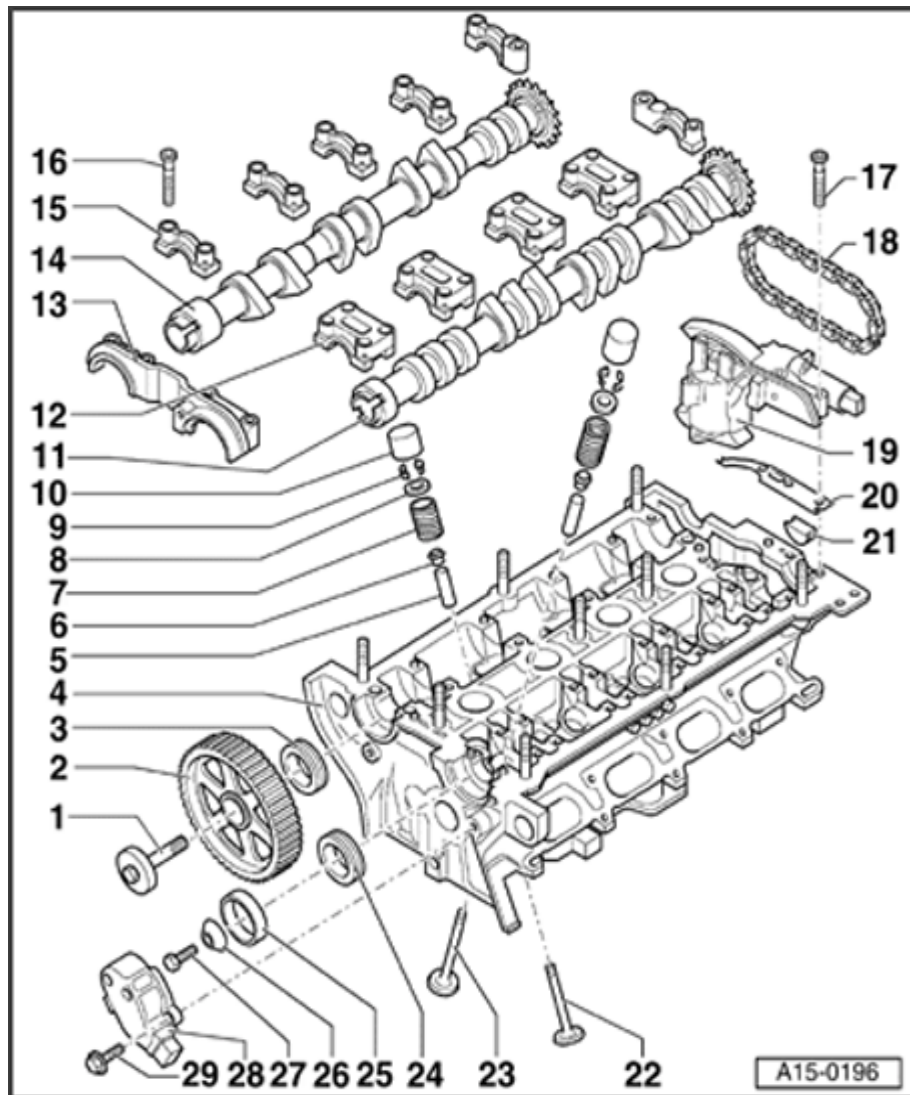
- ◆ See note ⇒ [Page 15-37](#)
- ◆ Checking valve guides ⇒ [Page 15-86](#)
- ◆ Reworking valve seats ⇒ [Page 15-88](#)
- ◆ Dowel sleeves for bearing caps must be located in cylinder head.
- ◆ Seal joints ⇒ Fig. ⇒ [3](#) and Fig. ⇒ [4](#) , ⇒ [Page 15-8](#)

#### 5 - Valve guide

- ◆ Checking ⇒ [Page 15-86](#)

#### 6 - Valve stem seal

- ◆ Replacing ⇒ [Page 15-77](#)



### 7 - Valve springs

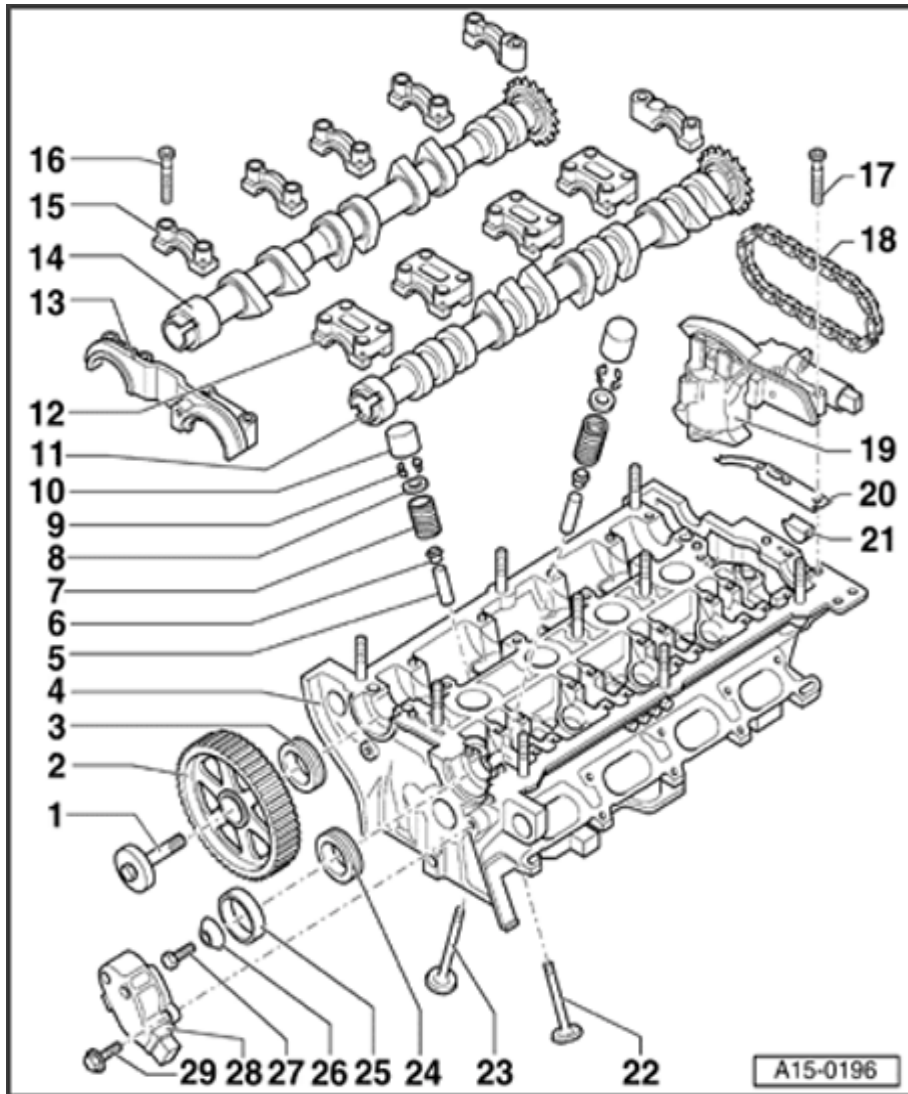
- ◆ Removing and installing ⇒ [Page 15-77](#)

### 8 - Valve spring plate

### 9 - Valve keepers

### 10 - Hydraulic valve lifter

- ◆ Checking ⇒ [Page 15-74](#)
- ◆ Removing and installing ⇒ [Page 15-77](#)
- ◆ Do not interchange
- ◆ Store with cam contact surface downward
- ◆ Before installing check camshaft axial clearance ⇒ [Page 15-48](#)
- ◆ Oil contact surface

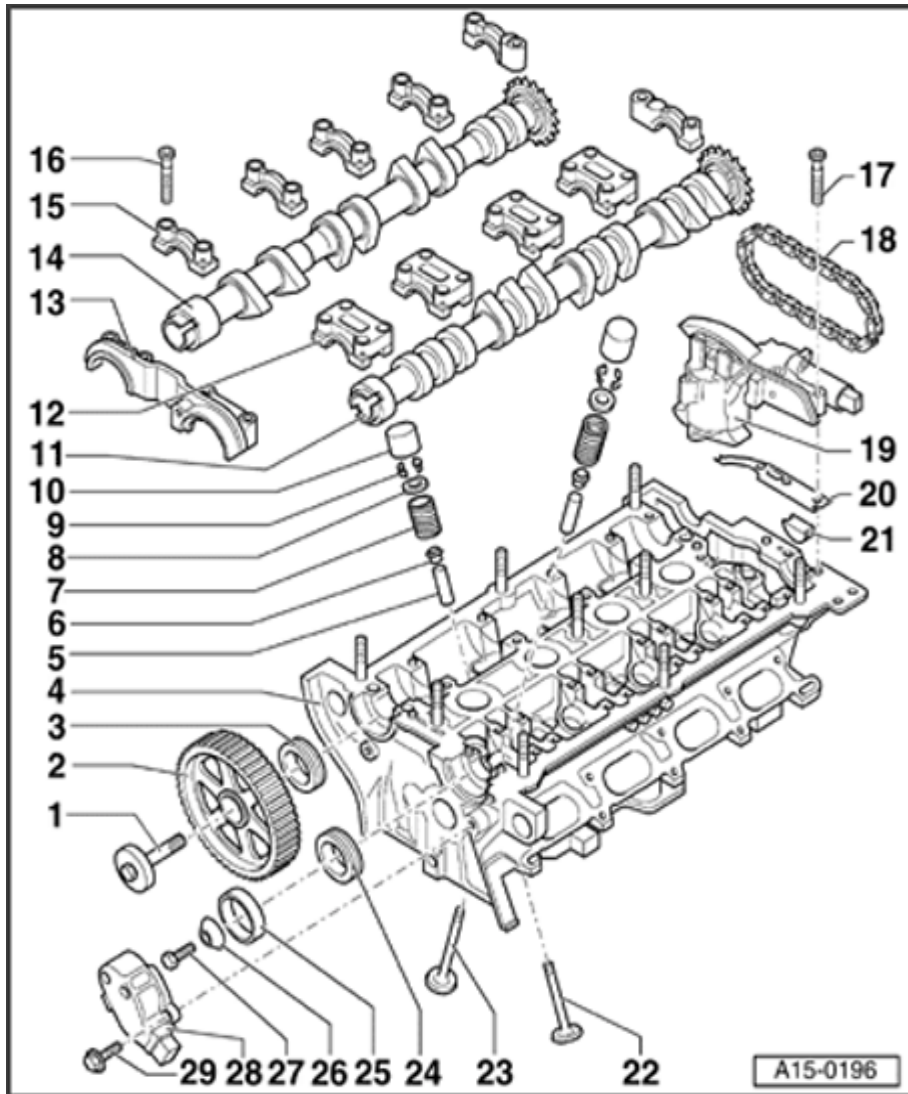


### 11 - Intake camshaft

- ◆ Check radial clearance with Plastigage™ (hydraulic lifters not installed). Wear limit: 0.1 mm
- ◆ Run-out: no more than 0.035 mm
- ◆ Checking axial clearance ⇒ [Page 15-48](#)
- ◆ Removing and installing camshafts ⇒ [Page 15-62](#)

### 12 - Bearing cap for intake camshaft

- ◆ Must be located on dowel sleeves
- ◆ Dowel sleeves must be located in cylinder head.
- ◆ Note installation position
- ◆ Installation sequence ⇒ [Page 15-67](#)

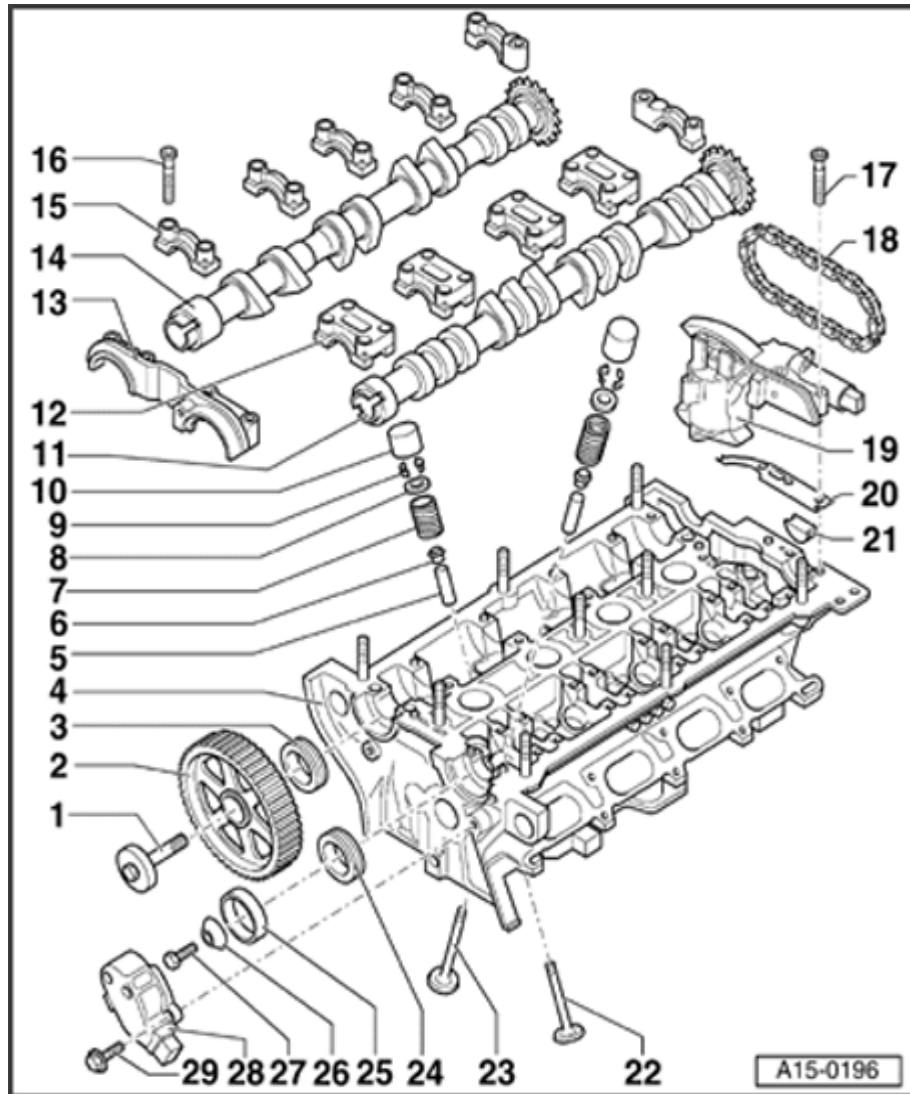


### 13 - Double bearing cap

- ◆ Must be located on dowel sleeves
- ◆ Dowel sleeves must be located in cylinder head
- ◆ Coat sealing surface lightly with AMV 188 001 02 before installation ⇒ [Page 15-71](#)
- ◆ Seal connections between double bearing cap and cylinder head ⇒ Fig. ⇒ [3](#) , ⇒ [Page 15-8](#)

### 14 - Exhaust camshaft

- ◆ Check radial clearance with Plastigage™ (hydraulic lifters not installed). Wear limit: 0.1 mm
- ◆ Run-out: no more than 0.035 mm
- ◆ Checking axial clearance ⇒ [Page 15-48](#)
- ◆ Removing and installing camshafts ⇒ [Page 15-62](#)



### 15 - Bearing cap for exhaust camshaft

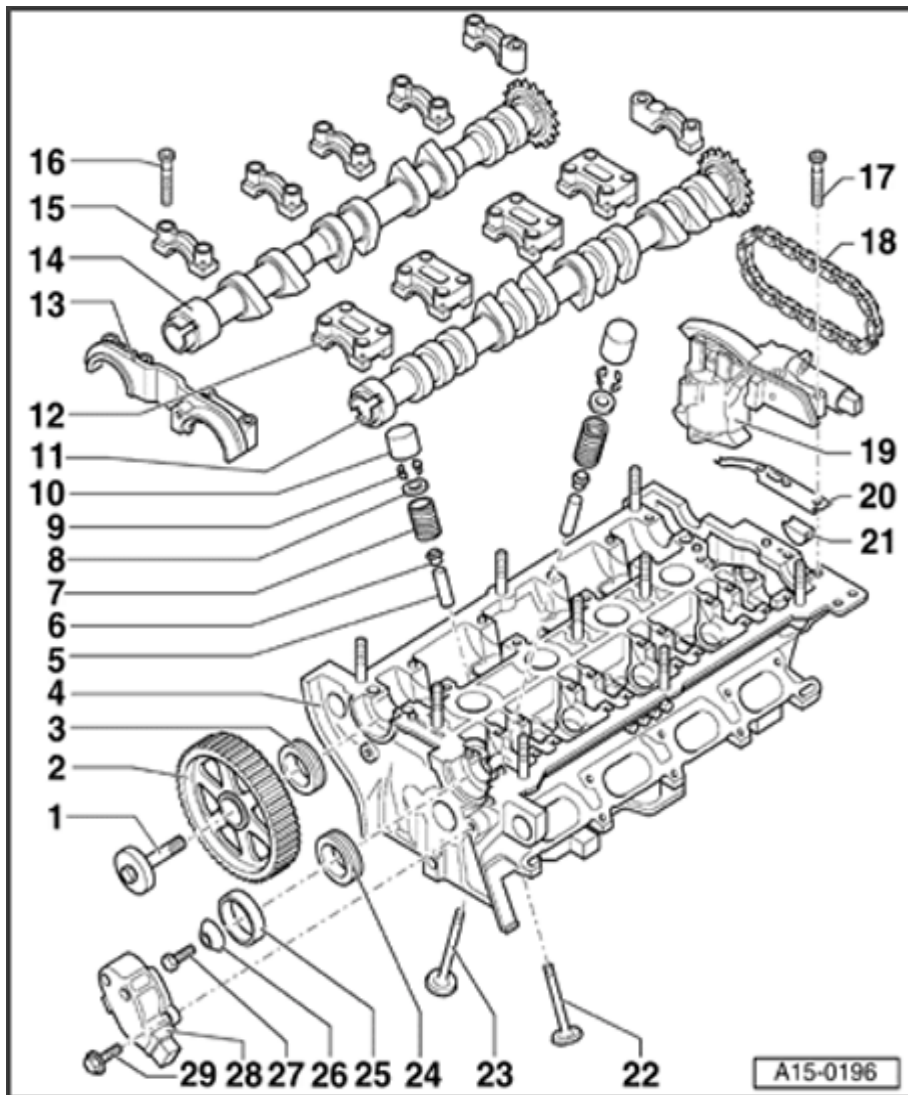
- ◆ Must be located on dowel sleeves
- ◆ Dowel sleeves must be located in cylinder head
- ◆ Note installation position
- ◆ Installation sequence ⇒ [Page 15-67](#)

16 - 10 Nm

17 - 10 Nm

### 18 - Drive chain

- ◆ Check for wear
- ◆ Before removing, mark installation position ⇒ [Page 15-66](#)
- ◆ Removing and installing camshaft ⇒ [Page 15-62](#)



### 19 - Camshaft adjuster

- ◆ With solenoid valve for camshaft adjustment -N205-
- ◆ Checking ⇒ [Page 15-92](#)
- ◆ Hold in position with retainer for chain tensioner 3366 before removing
- ◆ Removing and installing ⇒ [Page 15-62](#)
- ◆ Seal sides of joints between camshaft adjuster and cylinder head ⇒ Fig. ⇒ [4](#) , ⇒ [Page 15-8](#)

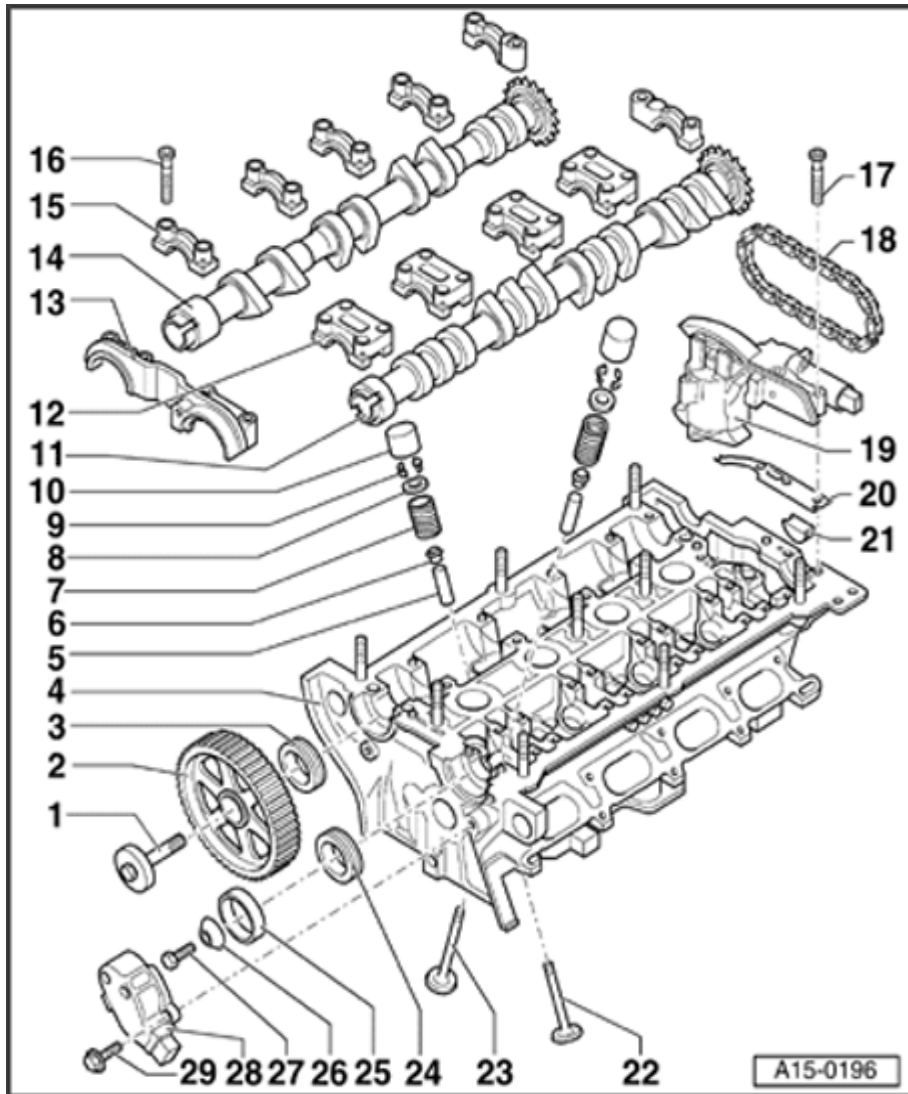
### 20 - Metal/rubber gasket

- ◆ Before installation coat sealing surface lightly with AMV 188 001 02 ⇒ [Page 15-67](#)

### 21 - Gasket

- ◆ Always replace



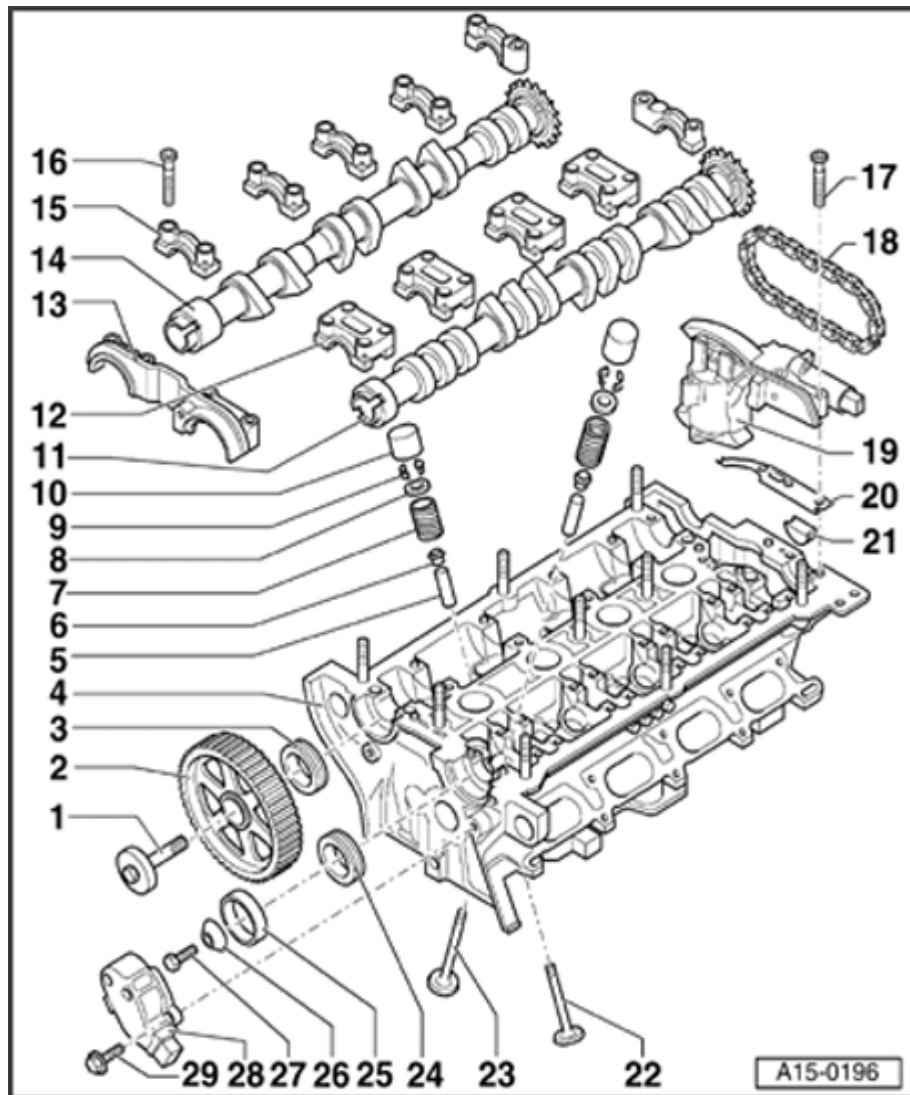


## 22 - Exhaust valve

- ◆ With sodium filling
- ◆ Note instructions on scrapping valves with a sodium filling ⇒ [Page 15-47](#)
- ◆ Do not rework, only lapping in is permitted
- ◆ Valve dimensions ⇒ Fig. ⇒ [1](#) , ⇒ [Page 15-47](#)
- ◆ Checking valve guides ⇒ [Page 15-86](#)
- ◆ Reworking valve seats ⇒ [Page 15-88](#)

## 23 - Intake valve

- ◆ Do not rework, only lapping in is permitted
- ◆ Valve dimensions ⇒ Fig. ⇒ [1](#) , ⇒ [Page 15-47](#)
- ◆ Checking valve guides ⇒ [Page 15-86](#)
- ◆ Reworking valve seats ⇒ [Page 15-88](#)

**24 - Sealing ring**

- ◆ For intake camshaft

- ◆ Replacing ⇒ [Page 15-57](#)

**25 - Rotor for Camshaft Position sensor**

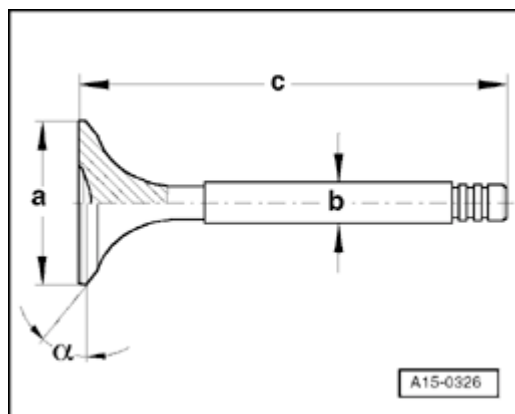
- ◆ Note correct installation position: Insert tab in notch of camshaft

**26 - Washer**

- ◆ With cone

- ◆ Note installation position

**27 - 25 Nm****28 - Housing for Camshaft Position sensor - G40-****29 - 10 Nm**



**A** Fig. 1 Valve dimensions

**Note:**

*Intake and exhaust valves must not be reworked. Only lapping in is permitted.*

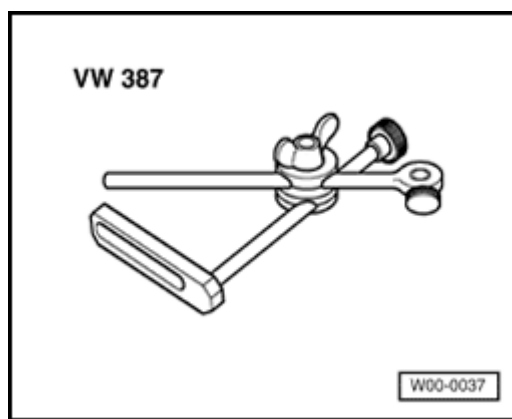
Dimension		Intake valve	Exhaust valve
Diameter -a-	mm	26.80 to 27.00	29.80 to 30.00
Diameter -b-	mm	5.95...5.97	5.94 to 5.95
-c-	mm	104.84 to 105.34	103.64 to 104.14
$\alpha$	$\angle^\circ$	45	45

**CAUTION!**

- ◆ **Worn exhaust valves with sodium filling must not be disposed of until they have been treated as follows:**
- ◆ **The valves must be sawn into two sections with a metal saw at a point between the center of the shaft and the valve head. They must not come into contact with water while this is done. Then throw the valves into a bucket of water (not more than ten at a time). Step back immediately because a chemical reaction occurs when the sodium filling burns.**
- ◆ **After this treatment the valves can be disposed of in the normal way.**

## Camshaft axial clearance, checking

### Special tools and equipment

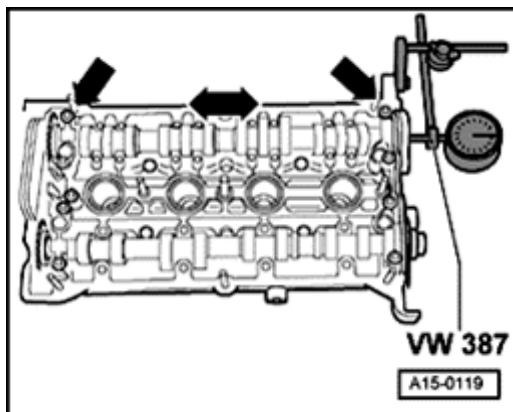


- ◆ Universal dial indicator bracket VW 387
- ◆ Dial indicator

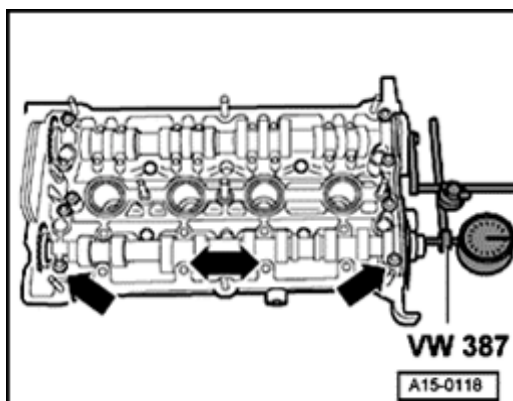
### Test sequence

Perform measurement with hydraulic lifters removed and with bearing cap at chain sprocket end and double bearing cap at camshaft sprocket end installed.

- Attach dial indicator with universal dial indicator holder VW 387 to cylinder head:



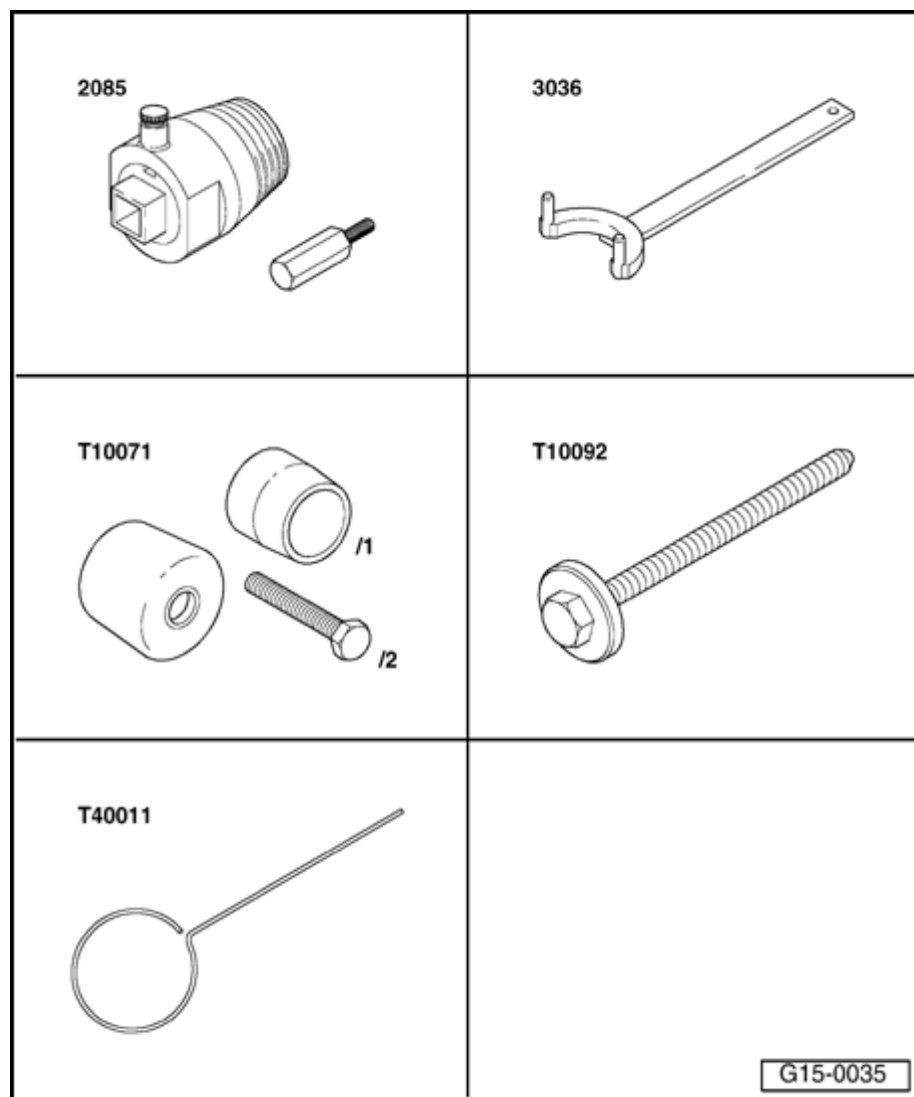
◀ Intake camshaft



◀ Exhaust camshaft

Wear limit for intake and exhaust camshafts.

- Axial clearance: no more than 0.20 mm



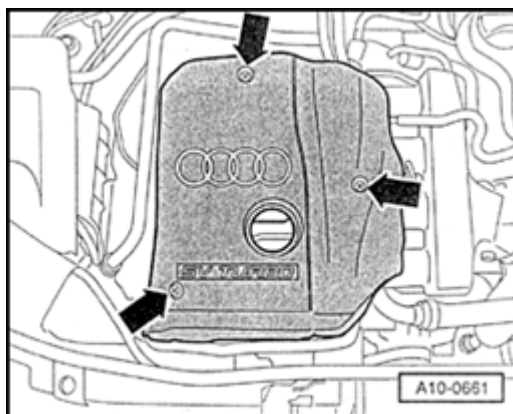
## Exhaust camshaft oil seal, replacing

### Special tools and equipment

- ◆ Oil seal extractor 2085
- ◆ Holding tool 3036
- ◆ Assembly tool T10071
- ◆ Socket head fastener T10092
- ◆ Pin T40011

## Removing

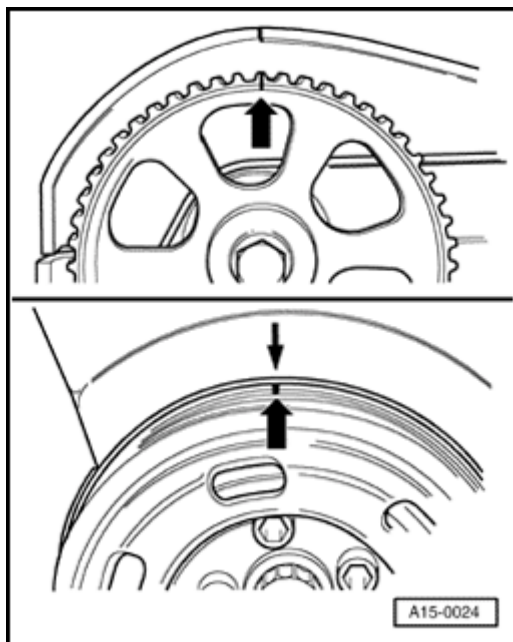
- Cylinder head installed
- Lock carrier must be in service position ⇒ [Page 13-1](#) .



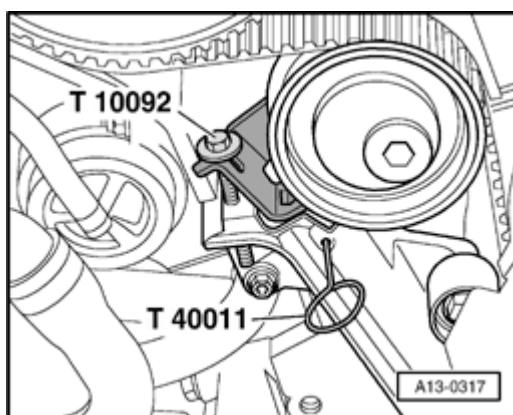
A

- Remove engine cover -arrows-.
- Remove upper toothed belt guard ⇒ [Page 13-35](#) .

15-52



- A**
- Set crankshaft to markings for TDC of No. 1 cylinder by turning central bolt on crankshaft sprocket in direction of rotation -arrows-.



- A**
- Attach socket head fastener T10092 into tensioner for toothed belt.

**Note:**

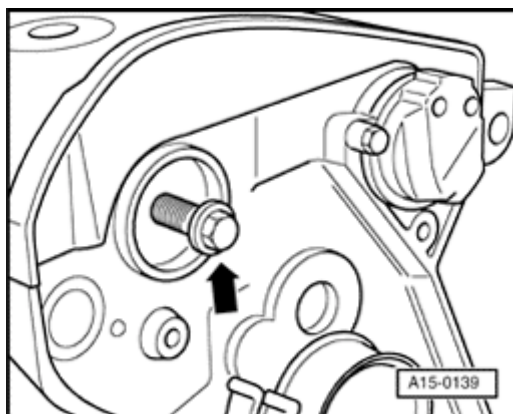
*Only tension piston of tensioner until pressure piston is secured with pin T40011.*

- Take toothed belt off camshaft sprocket.



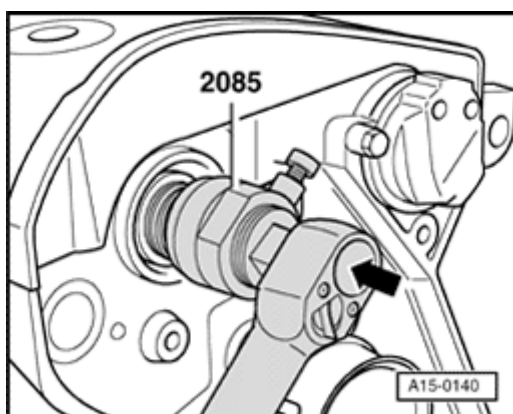
- Loosen camshaft sprocket (counter hold with 3036).

- Remove camshaft sprocket.



A

- To guide oil seal extractor, thread securing bolt for camshaft sprocket - arrow- into camshaft as far as it will go by hand.
- Adjust inner part of oil seal extractor 2085 two turns (approx. 3 mm) from outer part and lock in position with knurled screw.



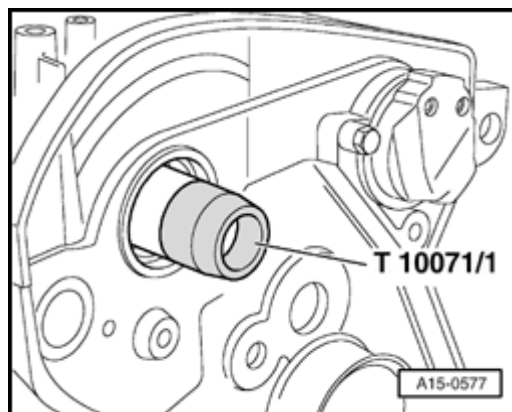
A

- Lubricate threaded head of oil seal extractor 2085, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.

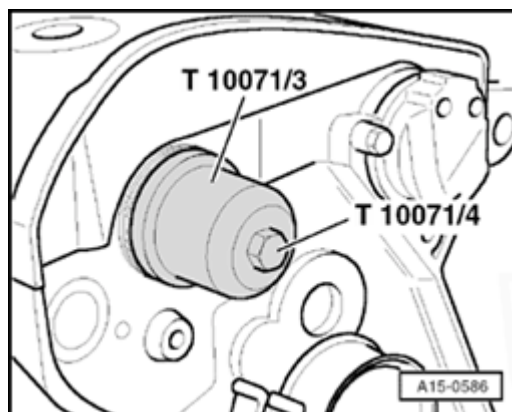
## Installing

### Note:

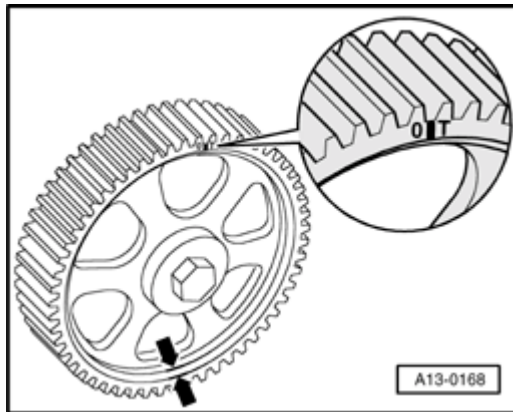
*Do not oil sealing lip of oil seal.*

**A**

- Place guide sleeve T10071/1 onto crankshaft journal.
- Push sealing ring via guide sleeve onto shaft journal.
- Remove guide sleeve.

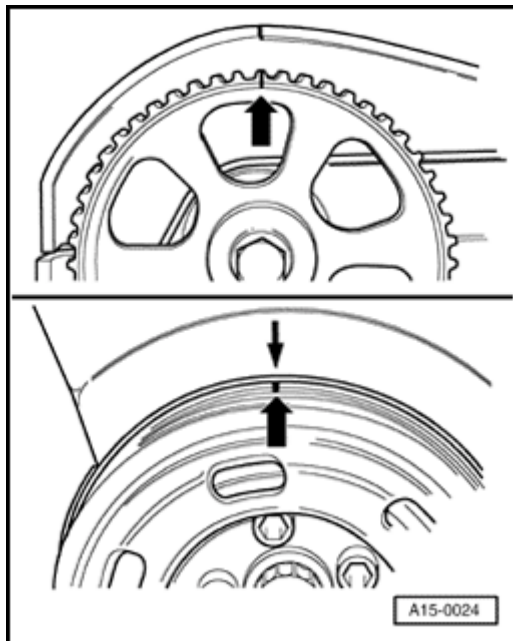
**A**

- Press in sealing ring with pressure sleeve T10071/3 and bolt T10071/4.



A

- Install camshaft sprocket.
  - ◆ Note correct installation position: Narrow web of camshaft sprocket faces outward -arrows- and marking for No. 1 is visible from front.
- Install securing bolt for camshaft sprocket (use counter hold tool 3036).



A

- Align markings on camshaft sprocket with marking on cylinder head cover.
- Align marking on vibration damper with marking on lower part of toothed belt guard.

**Note:**

*If a piston is at TDC the valves could strike the piston when turning the camshaft. To avoid damage to valves and pistons the pistons must not be at TDC.*

- Install toothed belt (adjust valve timing) ⇒ [Page 13-44](#) .

**Note:**

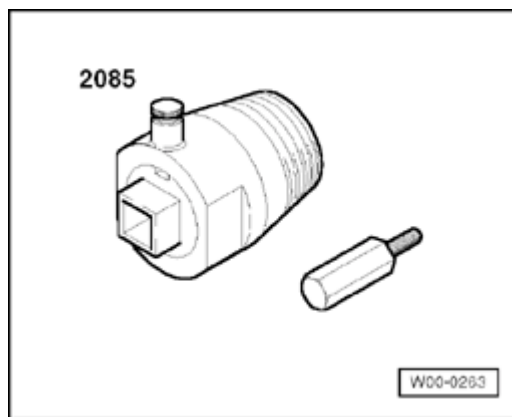
*Observe all instructions on removing and installing the toothed belt ⇒ [Page 13-40](#) .*

**Tightening torque**

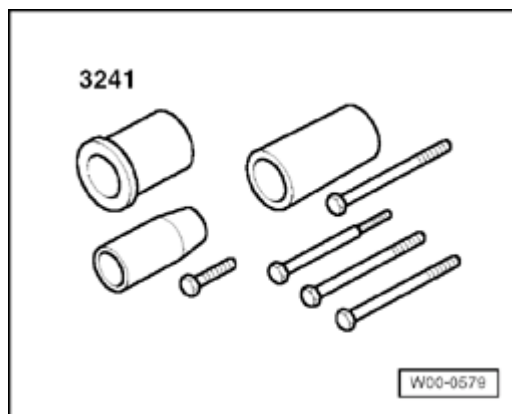
Component	Nm
Camshaft sprocket to camshaft	65

## Intake camshaft seal, replacing

### Special tools and equipment



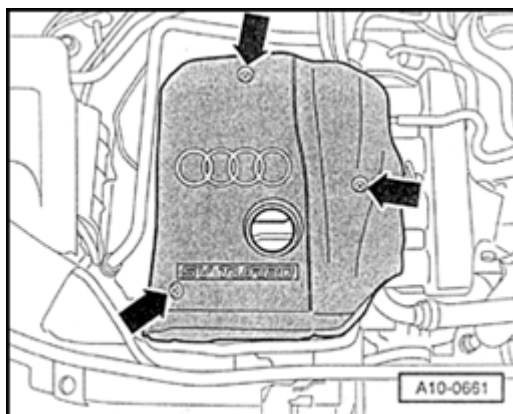
- ◆ Oil seal extractor 2085



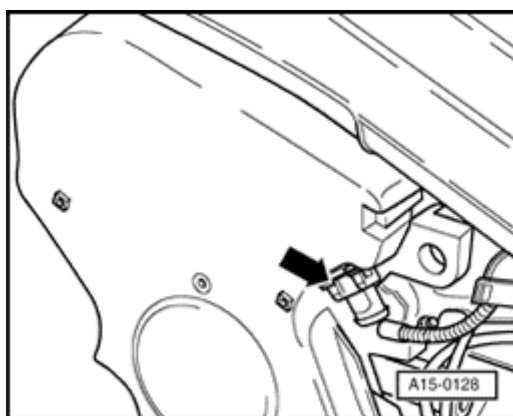
- ◆ Installation tool 3241

## Removing

- Cylinder head installed
- Lock carrier must be in service position ⇒ [Page 13-1](#) .

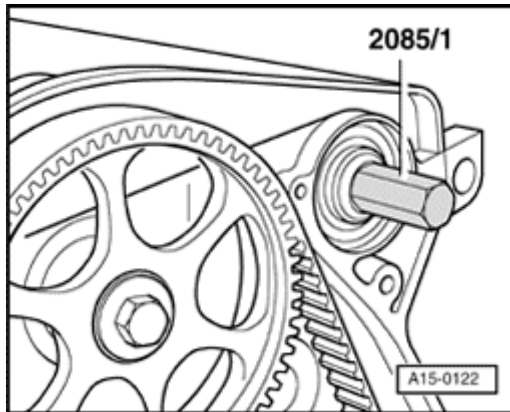


- A**
- Remove engine cover -arrows-.
  - Remove upper toothed belt guard ⇒ [Page 13-35](#) .



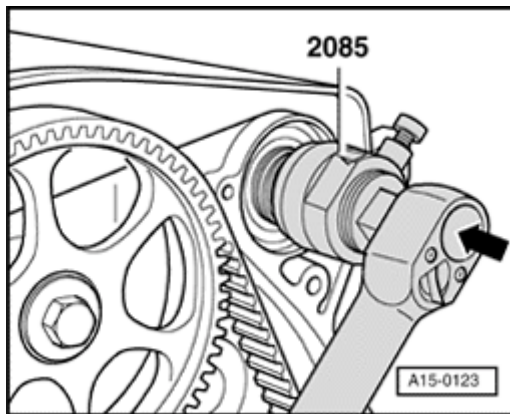
- A**
- Disconnect connector from camshaft position sensor -arrow-.
  - Remove sensor housing.
  - Remove sensor rotor and washer.

15-59



A

- Insert camshaft sprocket bolt 2085/1 by hand into camshaft as far as it will go.
- Adjust inner part of oil seal extractor 2085 two turns (approx. 3 mm) from outer part and lock in position with knurled screw.



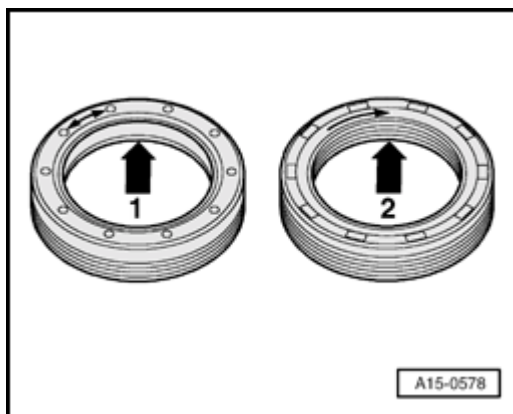
A

- Lubricate threaded head of oil seal extractor 2085, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.

## Installing

### Note:

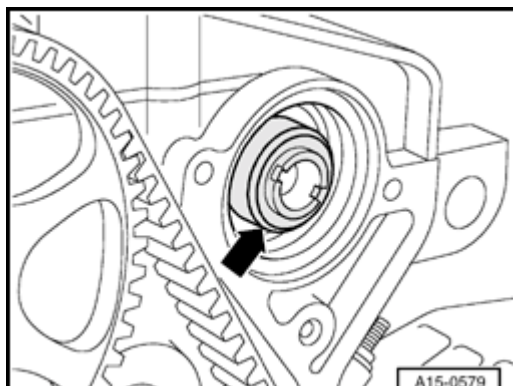
- ◆ Production variations may have the shaft sealing rings with ring spring or PTFE sealing rings used at the intake camshaft.



A

- ◆ Difference: The regular shaft sealing ring has only one sealing lip - arrow 1- which is tensioned by a spring. The PTFE sealing ring has a thread-like sealing area -arrow 2- but no spring.
- ◆ When installing, the sealing surface of the PTFE sealing ring must not be stretched. For this reason it is not permitted to install the PTFE sealing ring together with the guide sleeve for sealing rings with spring.
- ◆ The PTFE sealing rings must be aligned to the rotation direction of the shaft (see arrow marking on sealing ring). The wrong rotation direction causes oil leakage.

### Installing PTFE sealing ring:



A

- Check edge of chamfer -arrow- on shaft end of intake camshaft for burrs or sharp edges. If necessary, smooth edge with an oil stone.

### Note:

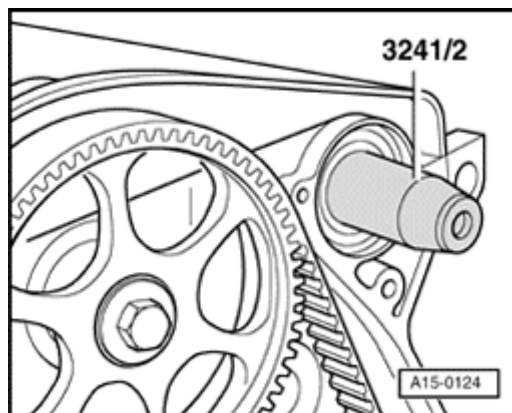
Do not oil sealing lip of oil seal.

- Push PTFE sealing ring carefully onto shaft end by hand.

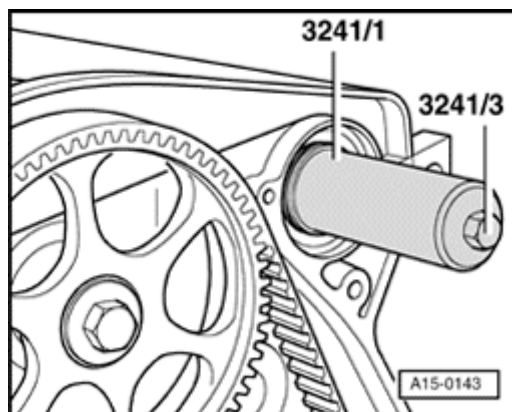


**Installing sealing ring with spring:****Note:**

*Do not oil sealing lip of oil seal.*

**A**

- Place guide sleeve 3241/2 onto camshaft journal.
- Slide oil seal over guide sleeve.

**All models:****A**

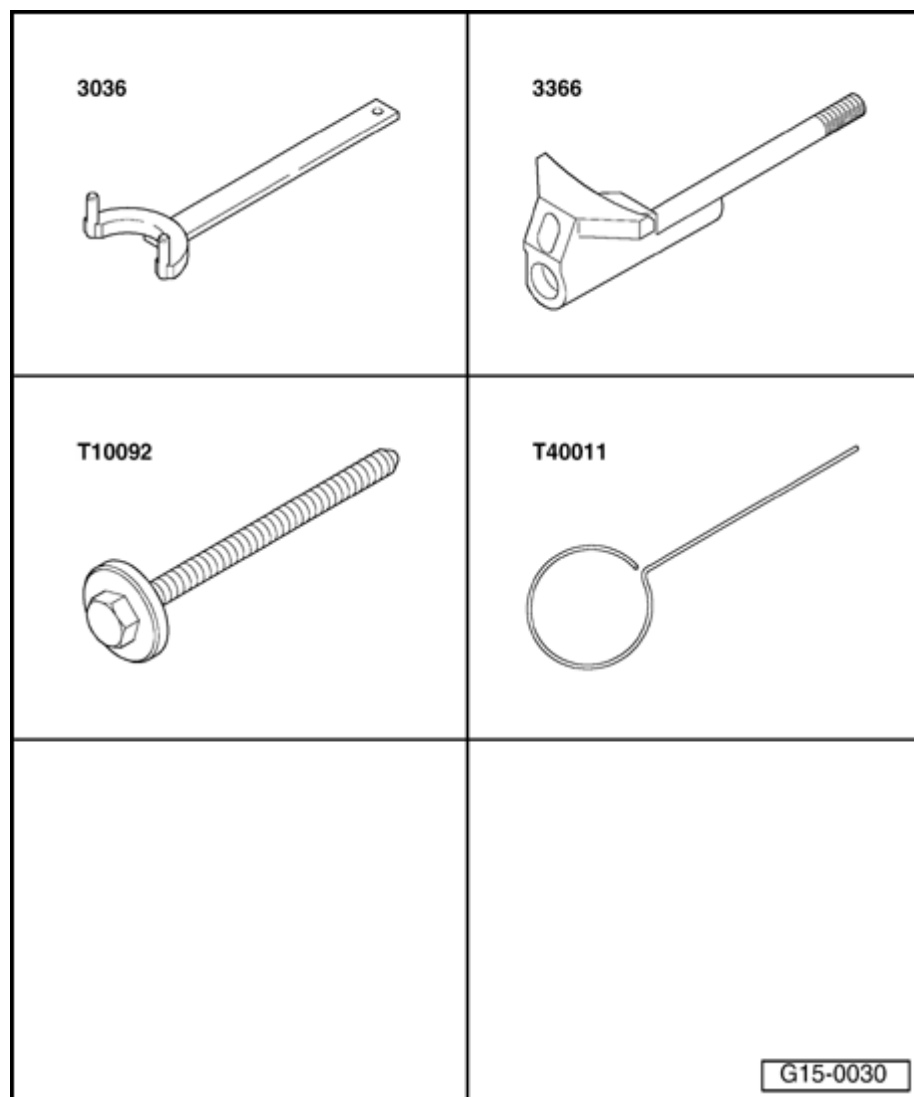
- Press in sealing ring with pressure sleeve 3241/1 as far as it will go. To do this use bolt 3241/3.
- Install camshaft position sensor ⇒ [Page 15-46](#) .
- Install toothed belt guard (upper section).
- Install lock carrier ⇒ [Page 13-1](#) .

**Tightening torques**

Component	Nm
Camshaft position sensor rotor to camshaft	25

Camshaft position sensor housing to cylinder head	10
---	----

15-62



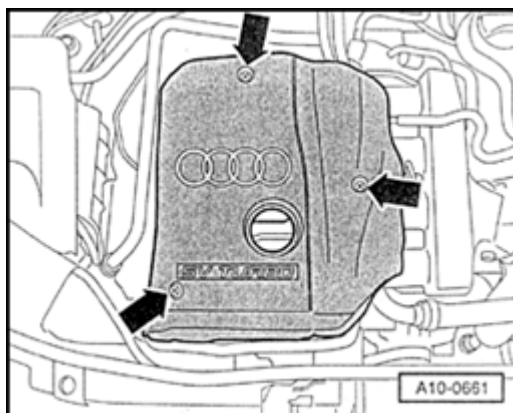
## Camshafts and camshaft adjuster, removing and installing

### Special tools and equipment

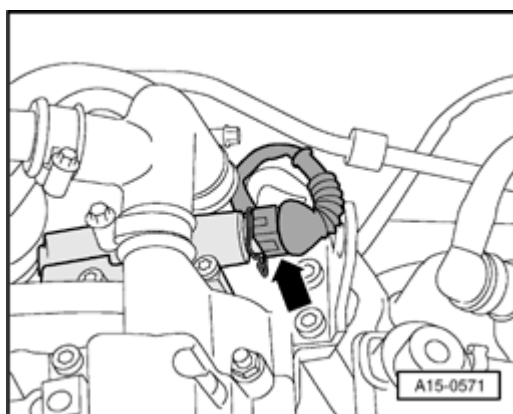
- ◆ Holding tool 3036
- ◆ Retainer for chain tensioner 3366
- ◆ Tensioning screw T10092
- ◆ Guide pin T40011

## Removing

- Cylinder head installed
- Lock carrier must be in service position ⇒ [Page 13-1](#) .

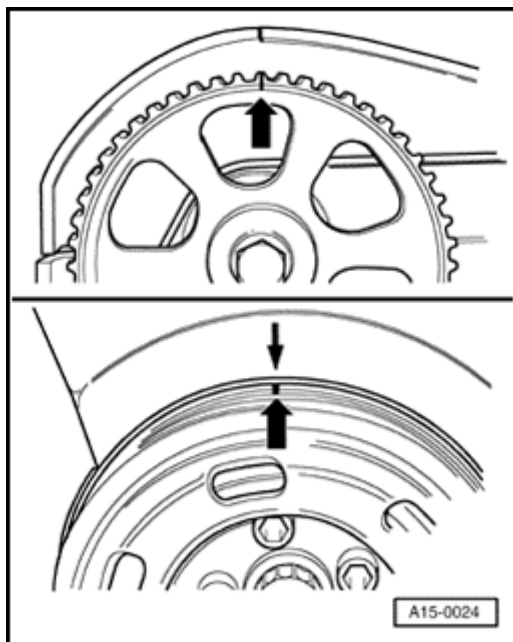


- ▲ - Remove engine cover -arrows-.
- Remove combination valve for secondary air inlet ⇒ [Page 26-64](#) .



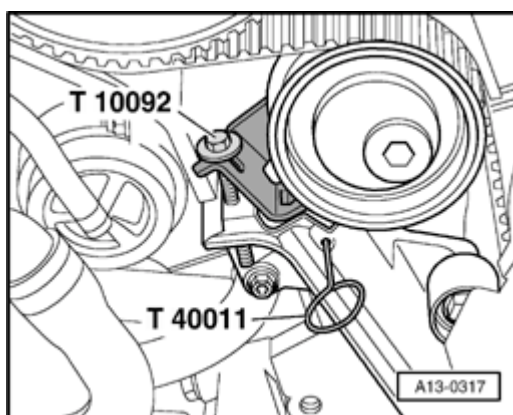
- ▲ - Disconnect connector -arrow- from camshaft adjuster.
- Remove upper toothed belt guard ⇒ [Page 13-35](#) .

15-64



A

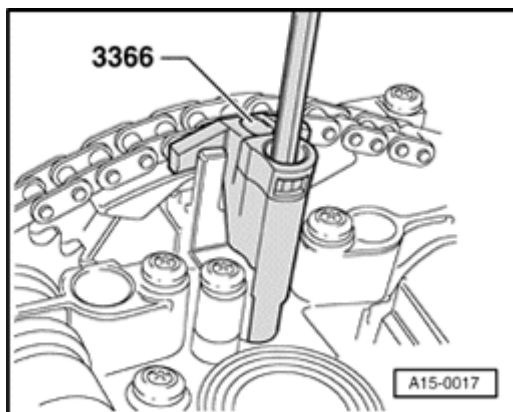
- Set crankshaft to markings for TDC of No. 1 cylinder by turning central bolt on crankshaft sprocket in direction of rotation -arrows-.
- Remove cylinder head cover ⇒ [Page 15-15](#) .



A

- Thread socket head fastener T10092 into tensioner for toothed belt.
- Tension pressure piston of tensioner until piston is secured with pin T40011.
- Remove toothed belt from camshaft sprocket.

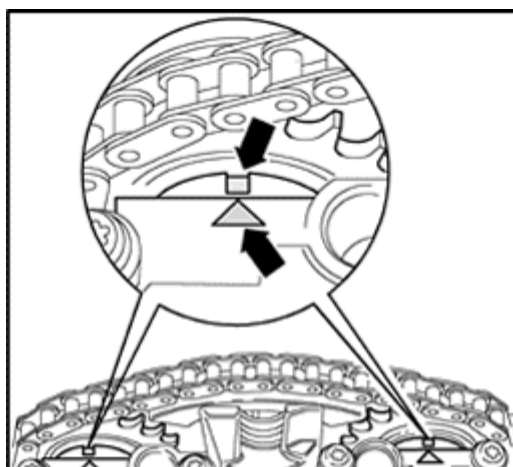
- Loosen camshaft sprocket (counter hold with 3036).
- Remove camshaft sprocket.
- Remove camshaft position sensor completely.



- A - Hold camshaft adjuster in position with retainer for chain tensioner 3366.

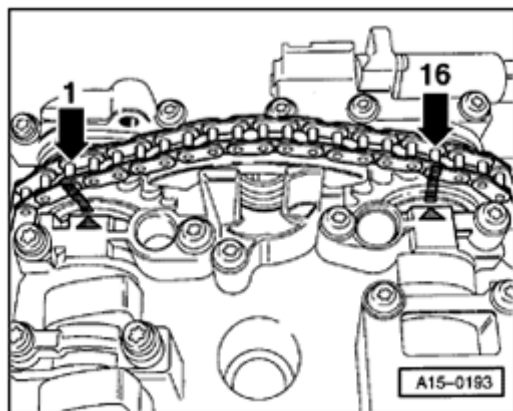
**Note:**

*If the retainer for chain tensioner is tightened excessively, this can damage the camshaft adjuster.*



- A - Re-check TDC position of camshafts.
  - ◆ Marks on two camshafts must be in line with arrows on bearing caps.

- Clean chain and camshaft sprockets opposite two arrows on bearing caps and mark installation position with color marks.

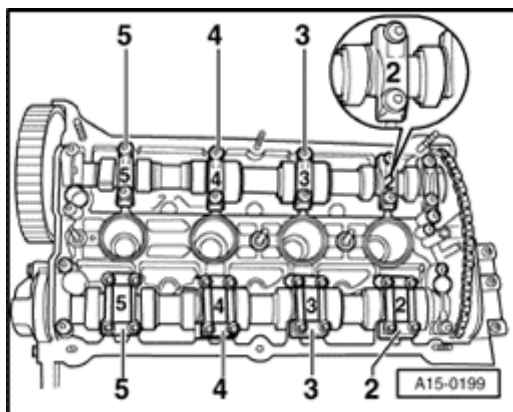


A

- ◆ Distance between two arrows or color markings are 16 rollers on drive chain.
- ◆ Notch on exhaust camshaft is offset slightly toward inside in relation to chain roller -1-.

**Note:**

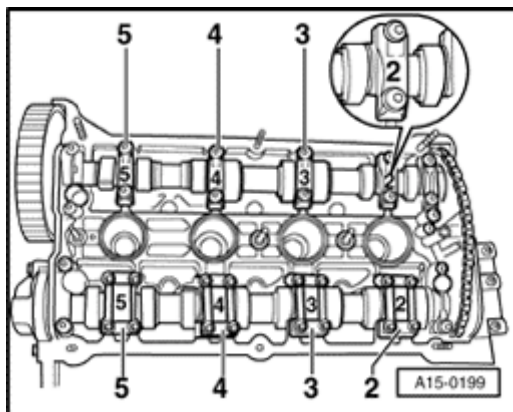
*Do not mark chain with a center punch or by making a notch or similar marking.*



A

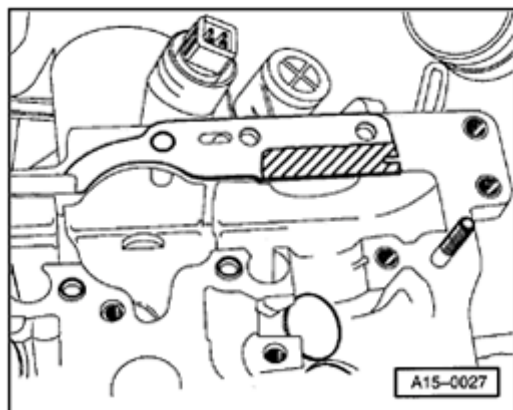
- Remove bearing caps 3 and 5 on intake and exhaust camshafts.
- Remove double bearing cap.
- Remove both bearing caps next to intake and exhaust camshaft chain sprockets.
- Remove securing bolts for camshaft adjuster.

15-67



- A**
- Loosen bearing caps 2 and 4 of intake and exhaust camshafts alternately and diagonally, and remove.
  - Remove intake and exhaust camshafts with camshaft adjuster.

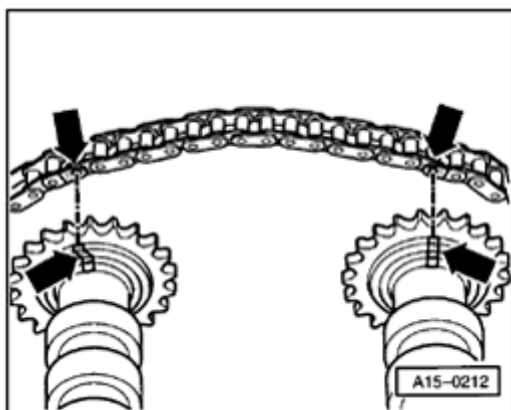
### Installing



- A**
- Replace rubber/metal gasket for hydraulic chain tensioner and apply a thin coat of sealant AMV 188 001 02 to shaded area.

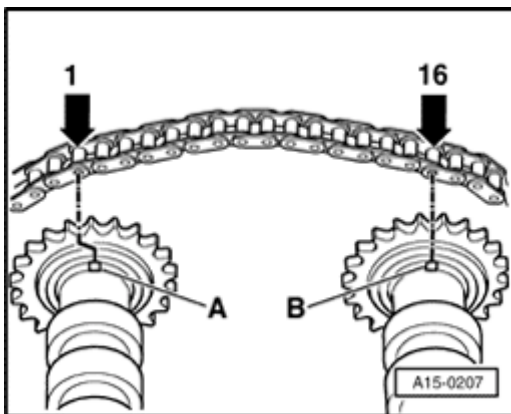


- Install drive chain on camshaft sprockets as follows:



A

- ◆ When old chain is being re-installed, install so that colored markings are in line -arrows-.



A

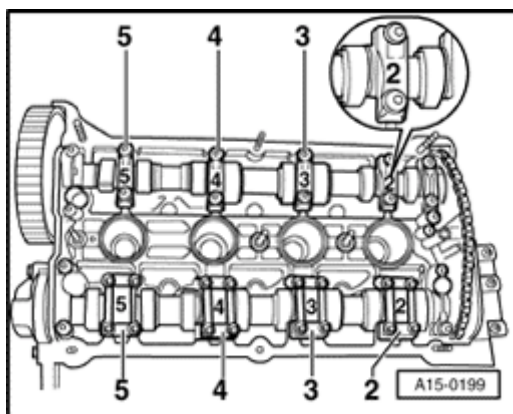
- ◆ When a new chain is being installed, distance between notches -A- and -B- on camshafts must be 16 rollers on chain. The illustration shows exact positions of 1st and 16th rollers on sprockets.
- ◆ Notch -A- is offset slightly toward inside in relation to chain roller -1-.
- Push camshaft adjuster between drive chain (2nd mechanic required).

- Position camshafts together with drive chain and camshaft adjuster on cylinder head.
- Oil running surfaces of both camshafts.

**Note:**

- ◆ *Dowel sleeves for bearing caps and camshaft adjuster must be located in cylinder head.*
- ◆ *When installing bearing caps ensure that the identification mark is readable from the intake side of the cylinder head.*

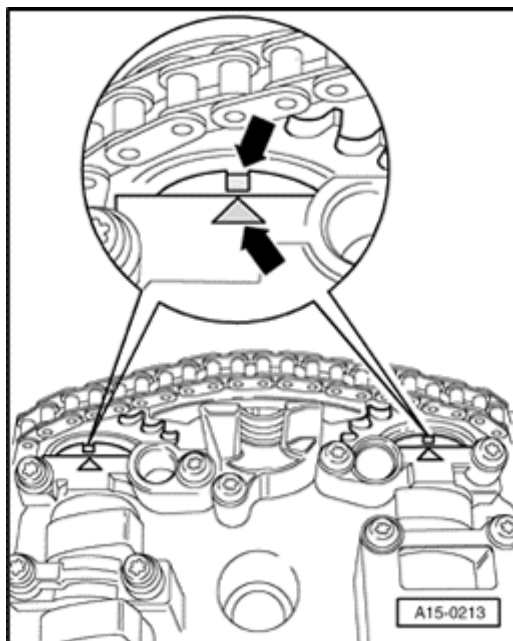
- Tighten mountings of camshaft adjuster (watch position of dowel sleeves).



A

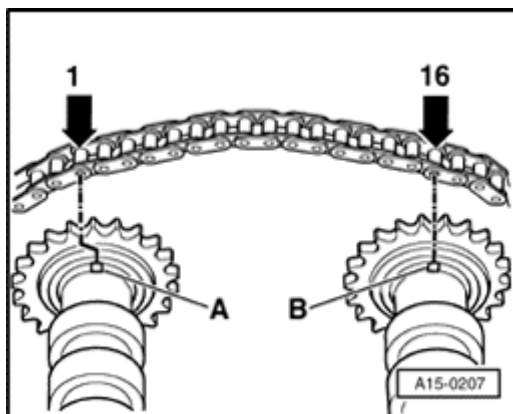
- Tighten bearing caps 2 and 4 of intake and exhaust camshafts in stages and in diagonal sequence (watch position of dowel sleeves).
- Install two bearing caps next to chain sprockets on intake and exhaust camshafts.

- Check correct setting of camshafts:



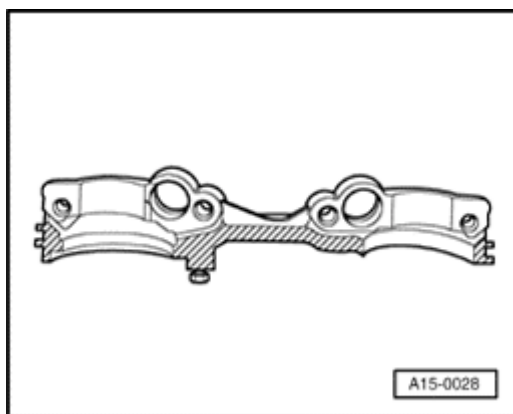
A

- Two markings on camshafts must be in line with two arrows on bearing caps -arrows-.



A

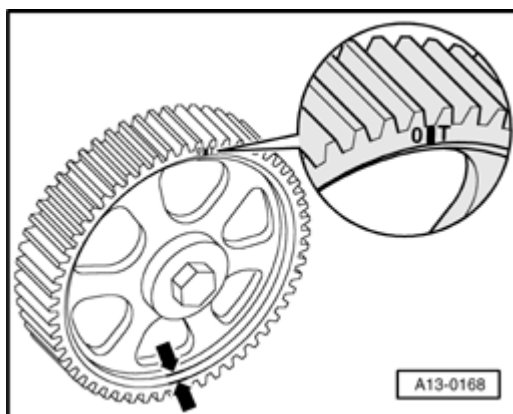
- Distance between two arrows on bearing caps or color markings are 16 rollers on drive chain.
- Notch on exhaust camshaft is offset slightly toward inside in relation to chain roller -1-.



- Remove holder for chain tensioner 3366.

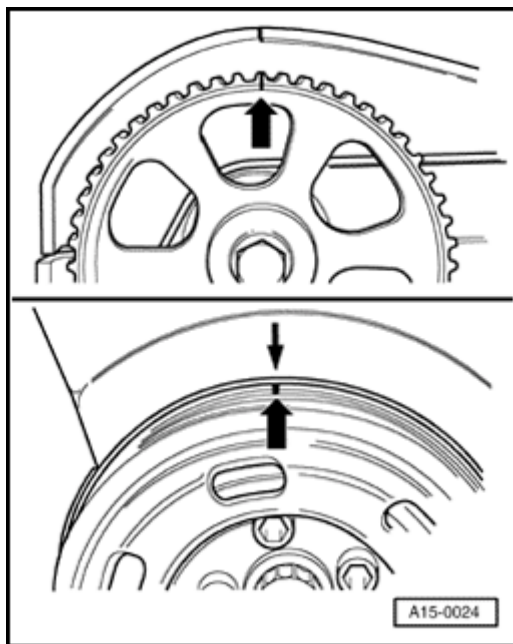
A

- Slightly coat shaded area of dual bearing cap with sealant AMV 188 001 02 and install bearing cap (observe position dowel sleeves).
- Install remaining bearing caps (watch position of dowel sleeves).
- Replace sealing rings for intake and exhaust camshafts ⇒ as of ⇒ [Page 15-50](#) .



A

- Install camshaft sprocket.
  - ◆ Note correct installation position: Narrow web of camshaft sprocket faces outward -arrows- and marking for No. 1 is visible from front.
- Install securing bolt for camshaft sprocket (use counter hold tool 3036).
- Install camshaft position sensor ⇒ [Page 15-46](#) .
- Install cylinder head cover ⇒ [Page 15-18](#) .



A

- Align markings on camshaft sprocket with marking on cylinder head cover.
- Align marking on vibration damper with marking on lower part of toothed belt guard.

**Note:**

*When turning the camshaft the crankshaft must not be at TDC. There is a danger of damage to the valves/piston crown.*

- Install toothed belt (adjust valve timing) ⇒ [Page 13-44](#) .

**Note:**

- ◆ *Observe all instructions on removing and installing the toothed belt ⇒ [Page 13-40](#) .*
- ◆ *Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

**Tightening torques**

<b>Component</b>	<b>Nm</b>
Bearing cap to cylinder head	10
Camshaft adjuster to cylinder head	10
Camshaft position sensor rotor to camshaft	25
Camshaft position sensor housing to cylinder head	10
Camshaft sprocket to camshaft	65

## Hydraulic valve lifters, checking

### Special tools and equipment

- ◆ Feeler gauge
- ◆ Wood or plastic wedge

### **Note:**

- ◆ *Hydraulic valve lifters cannot be adjusted or repaired.*
- ◆ *Irregular valve noise during starting is normal.*

### Test sequence

- Start engine and let run until coolant temperature has reached approx. 80 ° C.
- Increase engine speed to about 2500 rpm for 2 minutes (perform road test if necessary).

### **Note:**

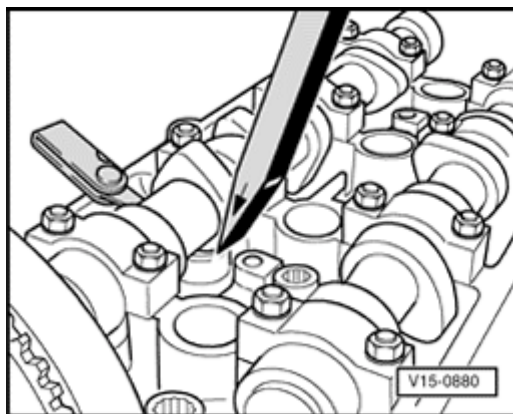
*If the irregular valve noises stop but recur repeatedly during short journeys, a new oil retention valve must be fitted. Oil retention valve location: In oil filter bracket ⇒ -Item 6 -, ⇒ [Page](#)*

[17-7](#) .



If the hydraulic lifters are still noisy, locate faulty lifters as follows:

- Remove cylinder head cover ⇒ [Page 15-15](#) .
- Rotate crankshaft until cams of lifters to be checked are pointing upward:
- Vehicles with manual gearbox: push vehicle forward with 4th gear engaged and ignition switched off.
- Vehicles with automatic gearbox: remove sound insulation and turn crankshaft clockwise by applying wrench to central bolt on crankshaft sprocket.
- Determine play between cam and lifter.



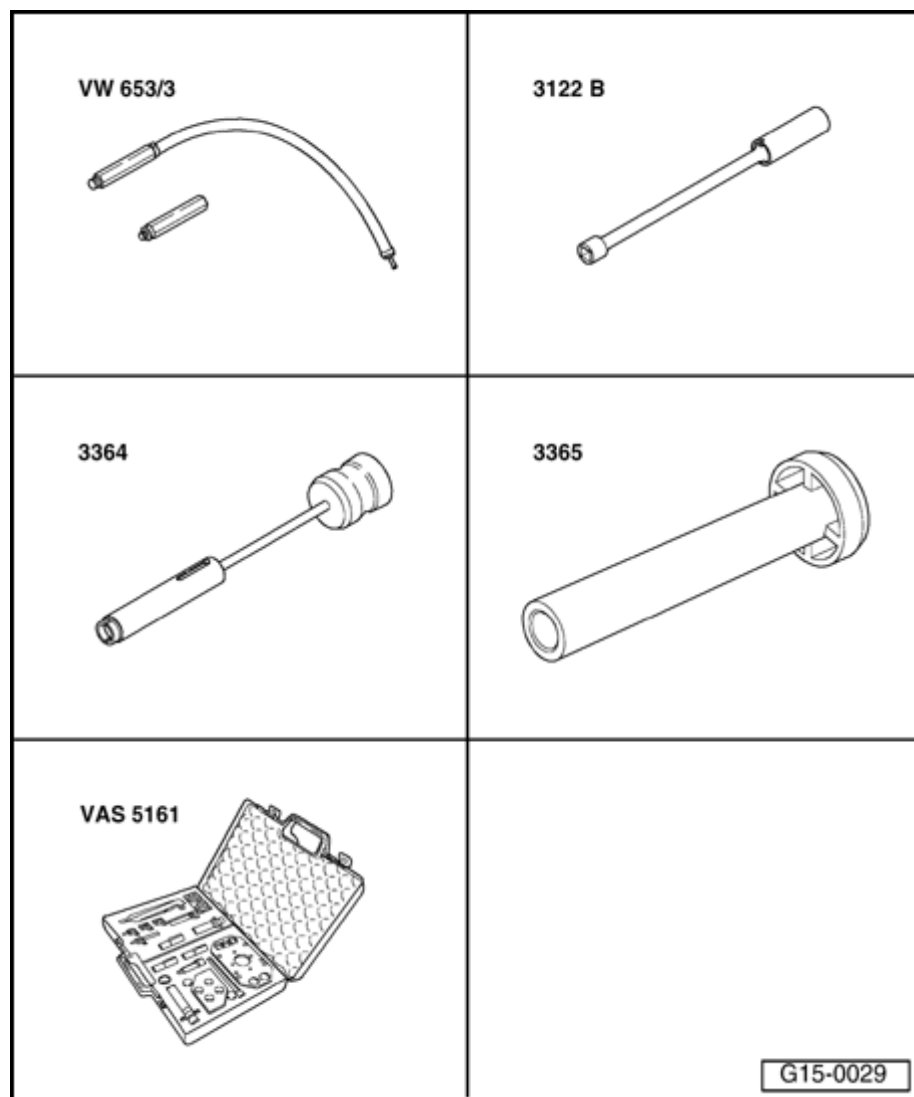
A

- Press down lifter with a wooden or plastic wedge. If an 0.20 mm feeler gauge can be inserted between camshaft and lifter, replace lifter.
- Replacing lifter ⇒ Removing and installing camshafts and camshaft adjuster, ⇒ [Page 15-62](#) .

**Note:**

- ◆ *Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
  
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

15-77



## Valve stem seals, replacing

### Special tools and equipment

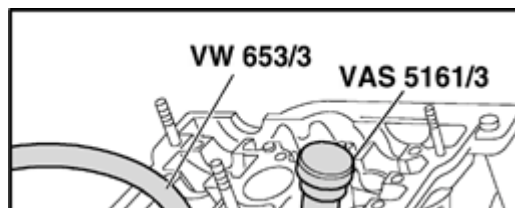
- ◆ Pressure hose VW 653/3
- ◆ Spark plug spanner 3122 B
- ◆ Puller 3364
- ◆ Installation tool 3365
- ◆ Disassembly and assembly tool VAS 5161

## Removing

- Cylinder head in vehicle.
- Remove camshafts and camshaft adjuster ⇒ [Page 15-62](#) .

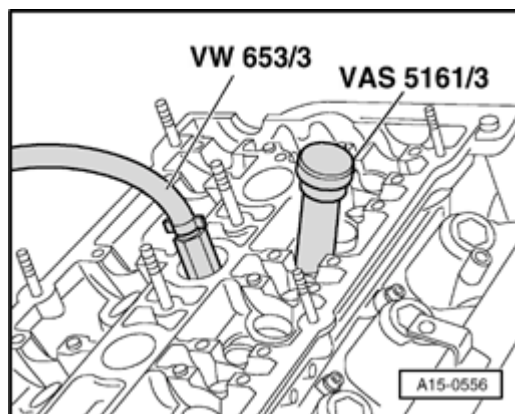
### Note:

- ◆ *Ensure that the valve lifters are not interchanged.*
- ◆ *Mark position of valve lifters on rear of lifter with a waterproof felt-tip pen.*
- Remove lifters from guides and put them down with contact surface downward.
- Remove spark plugs with spark plug spanner 3122B.
- Set piston of appropriate cylinder to bottom dead center.
- Thread pressure hose VW 653/3 into spark plug threaded hole and apply constant pressure of at least 6 bar.



A

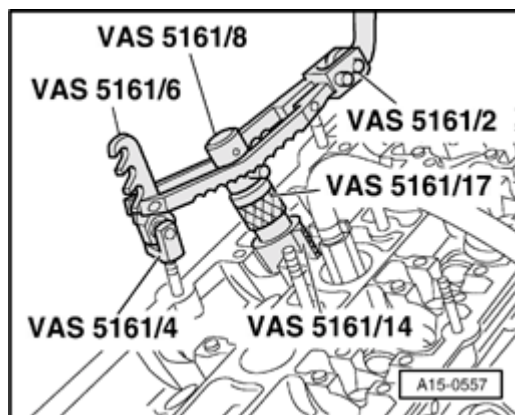
15-79



A

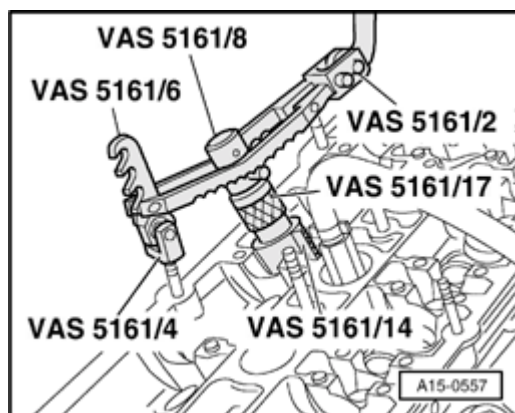
- Install knock journal VAS 5161/3 into valve lifter guide.
- Loosen solid valve keepers on all five valves with a plastic hammer.

### Exhaust side



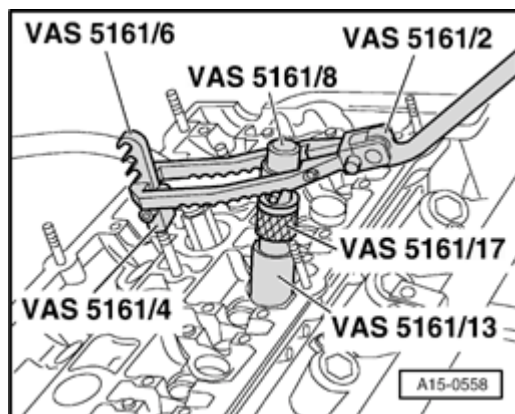
A

- Thread catch part VAS 5161/6 with insertion fork VAS 5161/4 onto a stud of cylinder head.
- Push guide bushing VAS 5161/14 as far as it will go into lifter guide at valve to be removed.
  - ◆ Installation position: Shaded areas point across to driving direction.
- Push knurled distance ring VAS 5161/17 onto assembly cartridge VAS 5161/8.



A

- Push assembly cartridge into guide sleeve.
- Attach pressure fork VAS 5161/2 to catch part VAS 5161/6 and press assembly cartridge downward.
- At same time turn knurled screw of assembly cartridge toward right until tips engage in valve keepers.
- Slightly move knurled screw back and forth. This causes valve keepers to be pressed apart and taken into cartridge.
- Release pressure fork.
- Remove assembly cartridge with spacer ring, guide bushing, valve plate and valve spring.

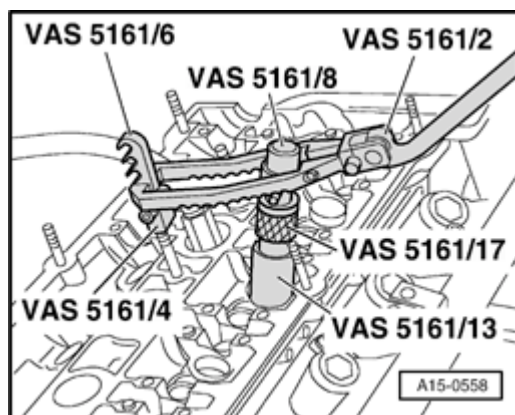


### Intake side:

A

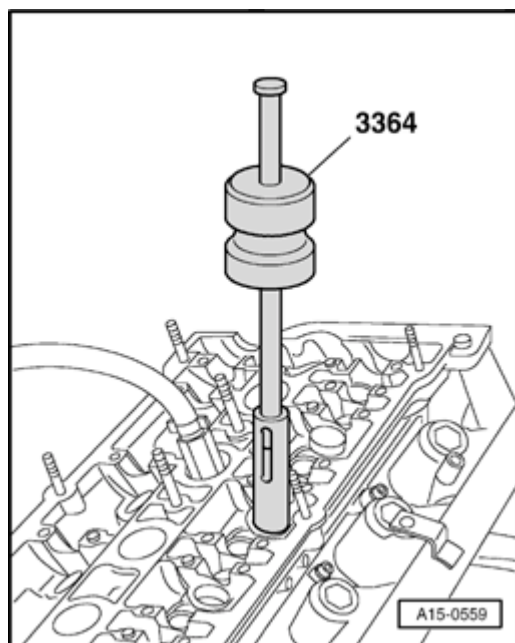
- Thread catch part VAS 5161/6 with insertion fork VAS 5161/4 onto a stud of cylinder head.
- Push in guide bush VAS 5161/13 as far as it will go into lifter guide at valve to be removed.
  - ◆ Installation position: Shaded areas point across to driving direction.
- Push distance ring VAS 5161/17 onto assembly cartridge VAS 5161/8.
- Push assembly cartridge into guide sleeve.
- Attach pressure fork VAS 5161/2 to catch part VAS 5161/6 and press assembly cartridge downward.
- At same time turn knurled screw of assembly cartridge towards right until the tips engage in valve keepers.
- Slightly move knurled screw back and forth. This causes valve keepers to be pressed apart and taken into cartridge.

15-82



A

- Release pressure fork.
- Remove cartridge with spacer ring, guide bushing, valve plate and valve spring.

**All models:**

A

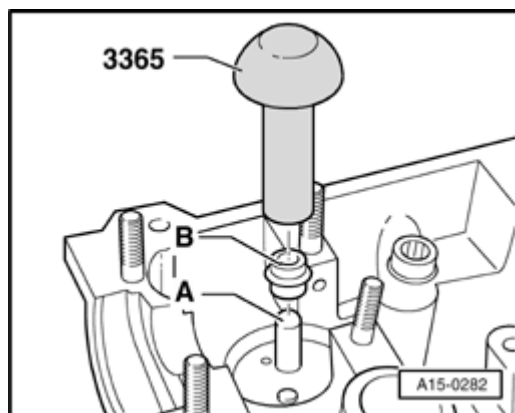
- Use 3364 to pull off valve stem seals.



## Installing

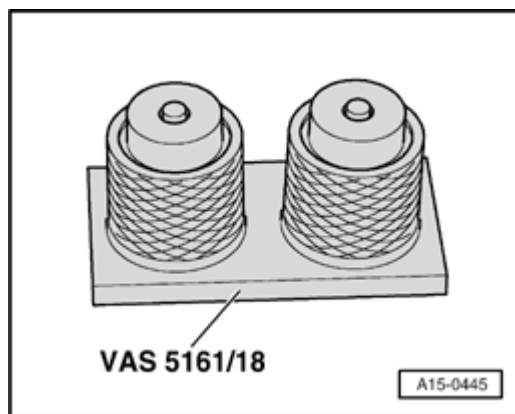
### Note:

*A plastic sleeve -A- is enclosed with new valve shaft seals.*



**A**

- To prevent damage to new valve stem seals -B-, place plastic sleeve -A- on valve stem.
- Lightly oil sealing lip of valve stem seal.
- Push valve stem seal onto plastic sleeve.
- Carefully press valve stem seal onto valve guide using presser tool 3365.
- Remove plastic sleeve again.



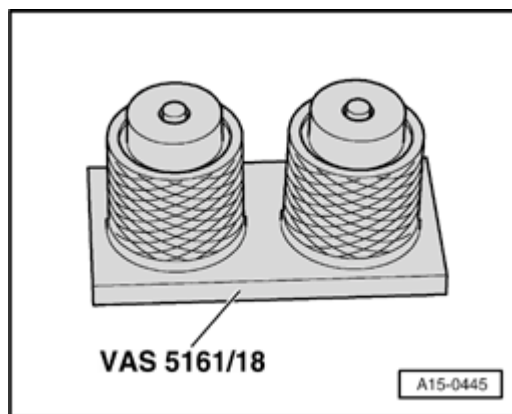
**A**

- If valve keepers were taken out of assembly cartridge they must first be inserted into tool VAS 5161/18.

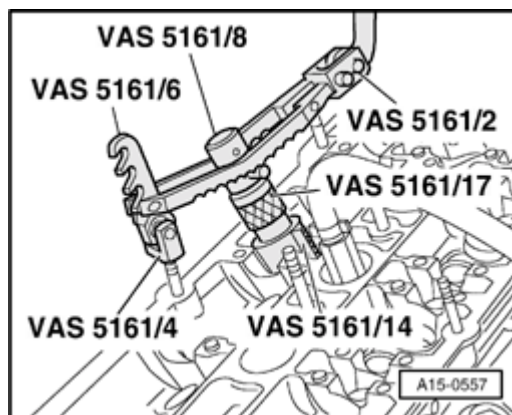
### Note:

*The large diameter of the valve keepers points upward.*

15-84



- A**
- Press assembly cartridge VAS 5161/8 onto insert tool from top and take up valve keepers.



- A**
- Insert assembly cartridge VAS 5161/8 into guide bushing VAS 5161/13 or VAS 5161/14 again.
  - Push pressure fork down and pull knurled screw with left-hand and right-hand thread upward. The valve keepers are now installed.
  - Take load off pressure fork when knurled screw is still pulled.
  - Install valve lifters.

- Install camshafts and camshaft adjuster ⇒ [Page 15-67](#)

**Note:**

- ◆ *Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).*
- ◆ *After working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

## Valve guides, checking

### Special tools and equipment

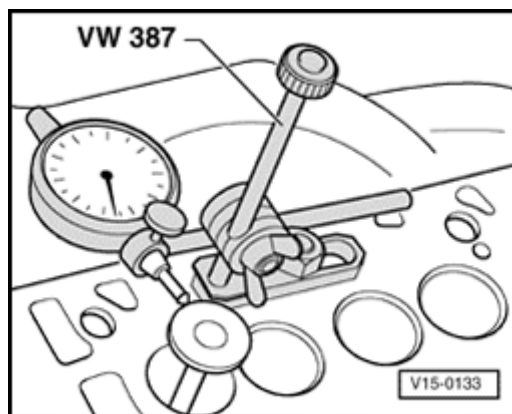
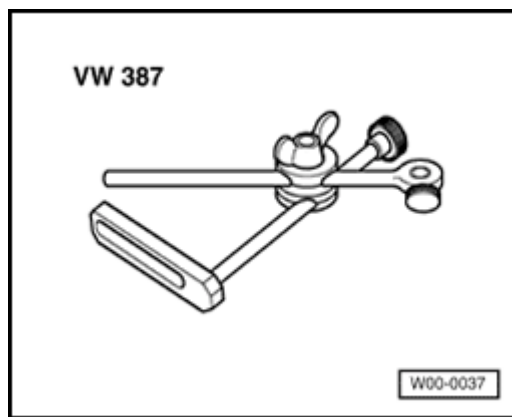
- A
- ◆ Universal dial indicator bracket VW 387
  - ◆ Dial indicator

### Test sequence

- A
- Set valve in guide. Valve stem end must be flush with guide.

### Note:

*Due to the slight difference in stem diameters, ensure that only an intake valve is used in an intake guide and an exhaust valve in an exhaust guide.*



- Determine lateral play.

**Wear limit**

Intake valve guide	Exhaust valve guide
0.80 mm	0.80 mm

**Note:**

- ◆ *If the wear limit is exceeded, repeat the measurement with new valves. Replace valve guide if wear limit is still exceeded.*
- ◆ *If the valve is to be replaced as part of a repair, use a new valve for the calculation.*

## Valve seats, reworking

### **Note:**

*If a good seating pattern cannot be obtained by grinding the valve seats (lapping), they must be refaced (reworked):*

### **Special tools and equipment**

- ◆ Depth gauge
- ◆ Valve seat machining tool

### **Note:**

- ◆ *When repairing engines with leaking valves, it is not sufficient to reface the valve seats and replace the valves. The valve guides must also be checked for wear. This is particularly important on high mileage engines ⇒ [Page 15-86](#).*
- ◆ *Only rework the valve seats as far as is necessary to ensure a good seating pattern.*
- ◆ *Before starting to rework the valve seats, calculate the maximum permissible reworking dimension.*

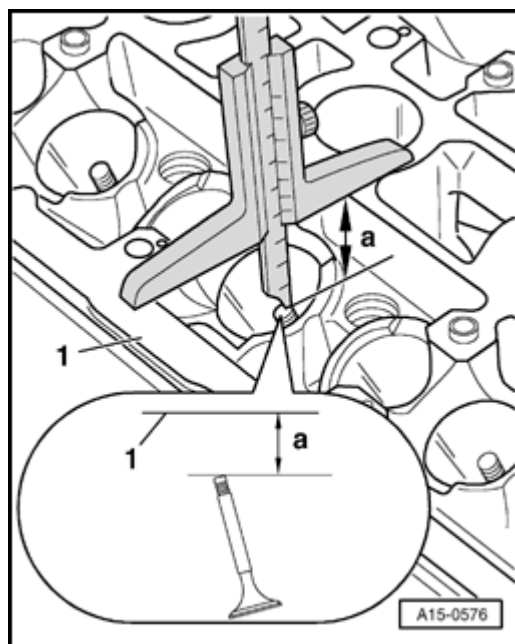
- ◆ *If the maximum reworking dimension is exceeded, the hydraulic lifters will not work properly and the cylinder head will have to be replaced.*

### Calculating maximum permissible reworking dimension

- Insert valve and press firmly against valve seat.

**Note:**

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



**A**

- Measure distance -a- between valve stem end (upper edge) and upper cylinder head surface -1- with a depth gauge.
- Calculate max. permissible reworking dimension from measured distance and minimum dimension.

Minimum dimensions		
Outer intake valves	Central intake valve	Exhaust valves
31.0 mm	32.2 mm	31.9 mm

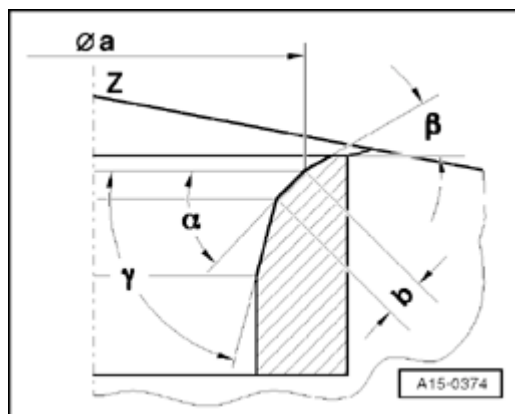


Measured distance minus minimum dimension =  
max. permissible reworking dimension.

<b>Example (for outer intake valve):</b>		
	Measured distance	31.4 mm
-	Minimum dimension	-31.0 mm
=	max. permissible reworking dim.	= 0.4 mm

**Note:**

*If the maximum permissible reworking dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve. If the measured result is again 0 mm or less than 0 mm, replace the cylinder head.*



### A Rework valve seats

Dim.		Intake valve seat
Dia. a	mm	26.2
b	mm	1.5 to 1.8
Z		Lower edge of cylinder head
$\alpha$	$45^\circ$	Valve seat angle
$\beta$	$30^\circ$	Upper correction angle
$\gamma$	$60^\circ$	Lower correction angle
Dim.		Exhaust valve seat
Dia. a	mm	29.0
b	mm	1.8
Z		Lower edge of cylinder head
$\alpha$	$45^\circ$	Valve seat angle
$\beta$	$30^\circ$	Upper correction angle
$\gamma$	$60^\circ$	Lower correction angle