

Timing at 2 mm valve lift

Engine	Camshaft code number left/right	Intake valve opens after TDC ¹⁾	closes after BDC	Exhaust valve opens before BDC	closes before TDC
116.980					
116.981					
116.982	30/31 ⁴⁾				
116.983	42/43 ⁴⁾	4° (2°)	14°	30°	16°
116.990 ²⁾	46/47 ⁴⁾				
116.991 ²⁾	52/53 ⁵⁾				
116.992 ²⁾					
116.993 ²⁾					
116.984 ³⁾					
116.985 ³⁾	58/59 ⁶⁾	4° (2°)	14°	26.5°	11.5°
117.981 (USA)	46/47 ⁴⁾	4° (2°)	14°	30°	16°
117.984 (USA)	52/53 ⁵⁾				
117.982					
117.983	54/55 ⁷⁾	5° (3°)	21°	25°	5°
117.992 ²⁾	56/57 ⁵⁾ ⁸⁾				
117.993 ²⁾					
117.982					
117.983	00/01 ⁶⁾ ⁹⁾	6.5° (4.5°)	18.5°	23°	8°
117.992 ²⁾					
117.993 ²⁾					
117.985 ³⁾					
117.986 ³⁾	00/01 ⁶⁾	6.5° (4.5°)	18.5°	23°	8°
117.985 (USA)					
117.986 (USA)	06/07 ⁶⁾	22° (20°)	6°	2° ¹⁰⁾	14°

¹⁾ With new timing chains and after driving 20 000 km, change timing of **righthand** camshaft by 2° in direction of advance. Refer to data in brackets.

²⁾ Low compression.

³⁾ Same engine designation for low compression.

⁴⁾ Replaced by **52/53**.

⁵⁾ Use with mechanical valve clearance adjustment only.

⁶⁾ Use with hydraulic valve clearance adjustment only.

⁷⁾ Replaced by **56/57**.

⁸⁾ 117.982/992 up to engine end no. 035995 and starting engine end no. 036326 with mechanical valve clearance compensating elements.

117.983/993 up to engine end no. 039155 and starting engine end no. 039612 with mechanical valve clearance compensating elements.

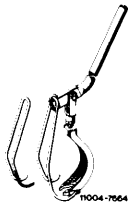



⁹⁾ 117.982/992 starting engine end no. 035996 to 036325 with hydraulic valve clearance compensating elements.

117.983/993 starting engine end no. 039156 to 039611 with hydraulic valve clearance compensating elements.

¹⁰⁾ Opens after BDC.

Tightening torques		Nm
Bolts for cylinder head covers		3
Bolts for camshaft sprockets		100
Cylinder head bolts with engine cold	1st step	30
	2nd	60
Fastening bolts for camshaft bearing on cylinder head		50

Special tools

Valve spring depressor		123 589 03 61 00
Holding wrench for camshafts		116 589 01 01 00
Screwdriver element 8 mm, 1/2" square, 130 mm long		000 589 33 07 00
Valve adjusting wrench		116 589 02 01 00

Note

Camshafts for engines with hydraulic valve clearance compensating elements have no initial cams of the type required for engines with mechanical valve clearance adjustment for smooth compensation of valve clearance.

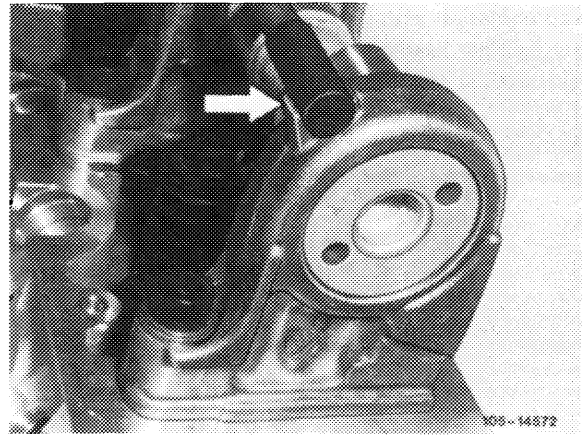
Always pay attention to association of camshaft code number in relation to respective engine (refer to table).

Camshaft bearing journals can be ground, the required camshaft bearings with repair stages are available (05–225).

When replacing a camshaft, also replace the respective rocker arms.

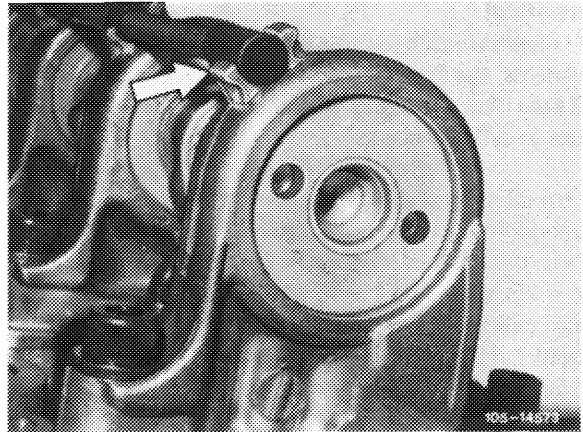
Since October 1977, an oil pipe of 10 mm OD, larger connections and modified camshaft bearings (arrow) are installed.

Do not install an oil pipe of 8 mm OD together with modified camshaft bearing (arrow).



Version with oil pipe 10 mm dia.

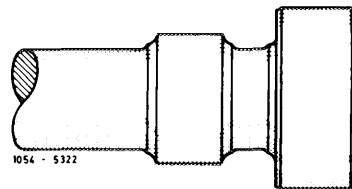
Renew connections following each removal from camshaft bearings, since otherwise the oil pressure in oil pipe is not assured.



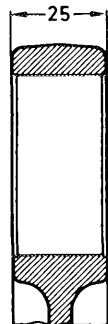
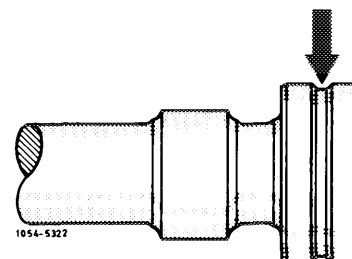
Version with oil pipe 8 mm dia.

Install camshaft without oil groove only in camshaft bearings with oil groove (arrow).

Code numbers (left/right) of camshafts
 without oil groove: 30/31, 42/43, 46/47,
 48/49, 52/53, 54/55
 with oil groove: 00/01, 06/07, 56/57, 58/59.

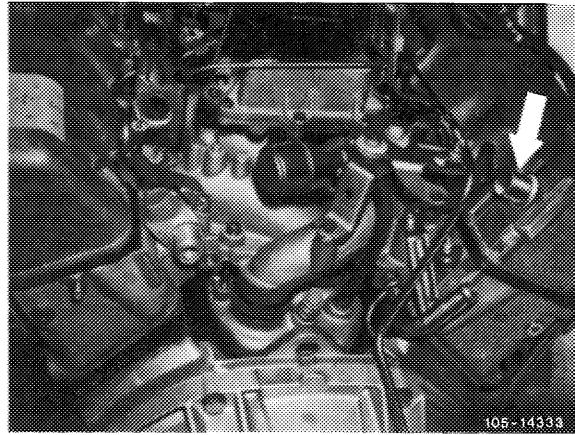


Install camshaft with oil groove (arrow) only in camshaft bearings without oil groove.



In combination with new camshaft bearings, use only cylinder head covers which are not resting inside against camshaft bearings.

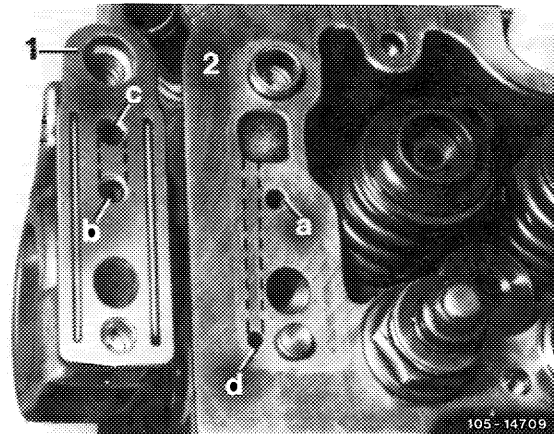
Identification: Cast neck for engine breather, formerly threaded bore (arrow).



Attention!

On engines with hydraulic valve clearance compensating elements, the 5th camshaft bearing bracket (1) has an oil feed duct (c), which is connected to longitudinal duct in cylinder head.

If the camshaft bearing bracket (1) is mounted on cylinder heads with mechanical valve clearance adjustment, the oil duct (c) must be closed. For this purpose, cut threads M 7 x 13 into oil bore (c) on camshaft bearing bracket and close with an aluminum plug 5 x M 7 AL 99 F x 11 x 12 N 150 14, part no. 915014 007100.

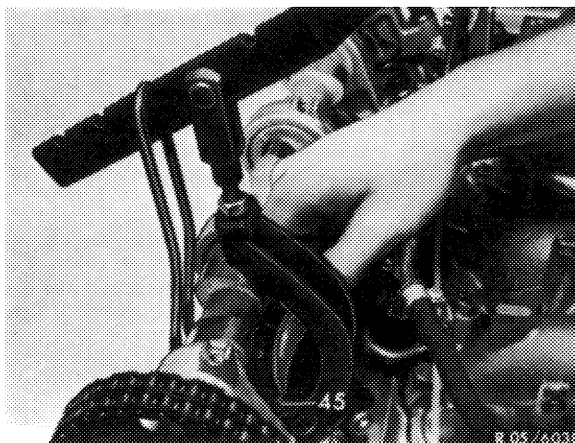


- 1 Camshaft bearing bottom
- 2 Cylinder head right rear
- a Oil feed from main oil duct
- b Oil duct to oil pipe and to camshaft bearings
- c Oil duct from rear camshaft bearing to feed bore (d) for oil longitudinal duct in cylinder head
- d Feed bore for oil longitudinal duct with hydraulic valve clearance compensating elements

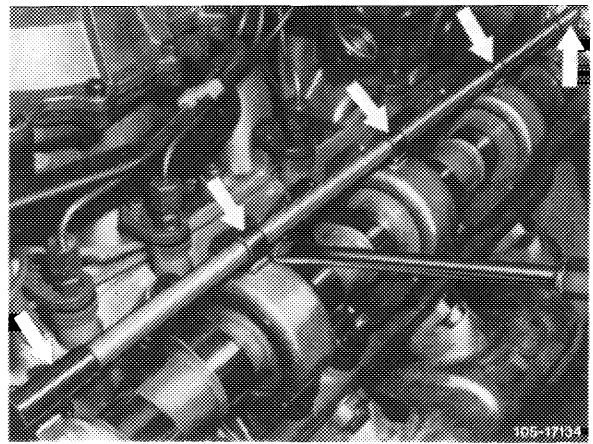
Removal

1 Set piston of 1st cylinder to ignition TDC, so that woodruff key in camshaft (arrow) points in upward direction.

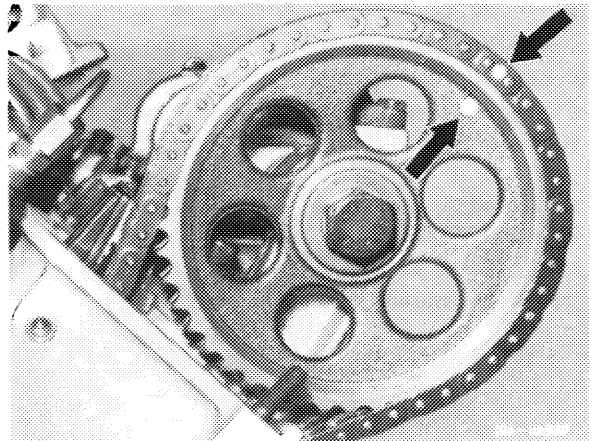
Note: Do not rotate engine on fastening bolt of camshaft sprockets.



2 Force off oil pipe together with connections (arrows) and remove.



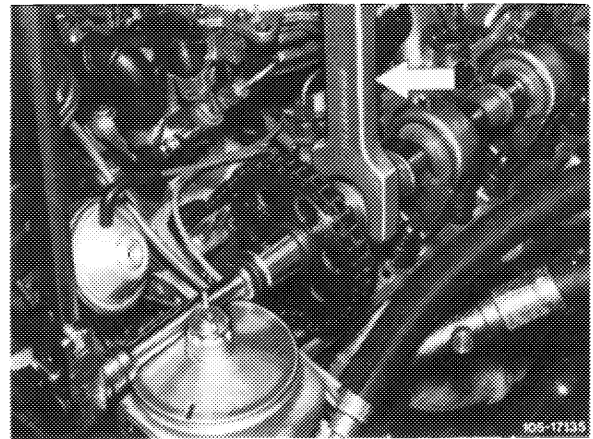
3 Mark both timing chain and camshaft sprocket with locking fluid (arrows).



4 Loosen necked-down screw on camshaft sprocket while applying counterhold with holding wrench.

5 Remove camshaft sprocket.

6 Unscrew camshaft bearing and remove camshaft together with camshaft bearing and oil pipe.



Installation

7 Lubricate camshaft bearings, slip camshaft into camshaft bearings and mount.

Note: On lefthand camshaft insert outer fastening screw of rear camshaft bearing (owing to brake unit) into camshaft bearings prior to positioning camshaft.

8 Lubricate cylinder head screws on threads and on screw head contact surface.

9 Retighten cylinder head screws M 10 x 155 for camshaft bearing from inside out first to 30 Nm and then tighten to 60 Nm.

10 Tighten fastening screws M 8 to 50 Nm.

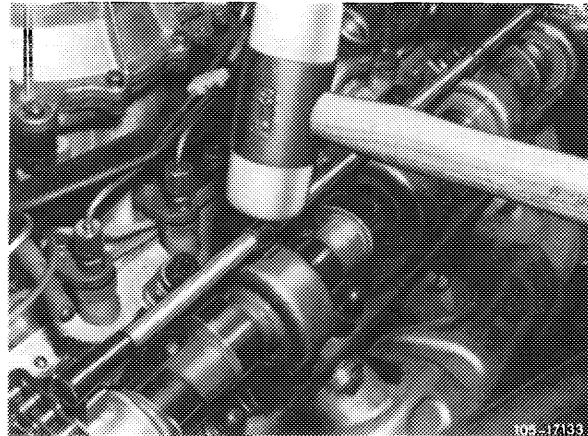
Attention!

Manual turning of camshaft should still be possible.

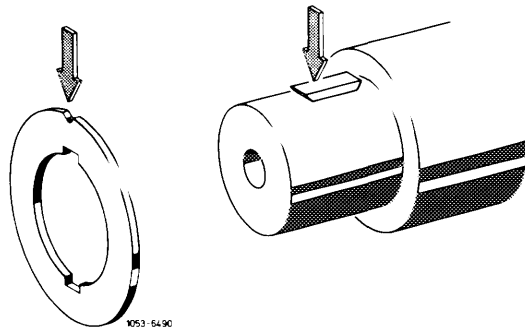
11 When mounting oil pipes, move connections into assembly position and check the three inner connections for free passage of oil bores prior to knocking on camshaft bearings. **Renew oil pipe if oil bores are concealed.**

Attention!

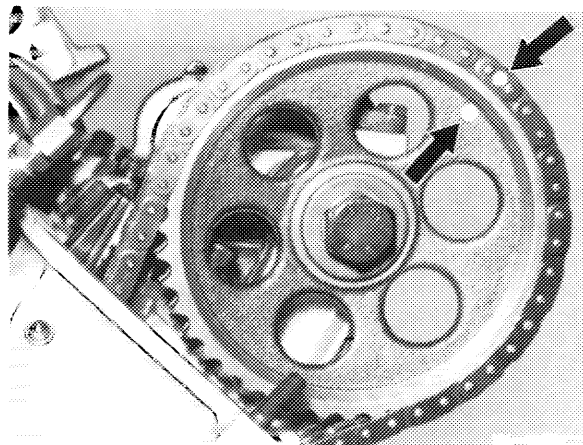
Renew connections each time after removing camshaft bearings, since otherwise the oil pressure in oil pipe is not assured.



12 Mount compensating washer in such a manner that the keyway and the notch are properly aligned in relation to Woodruff key of camshaft (refer to arrows).

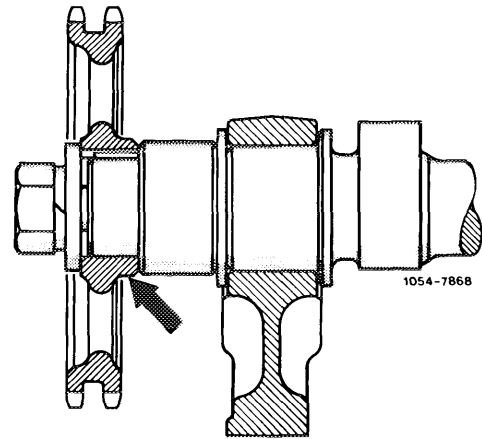


13 Mount camshaft sprocket while paying attention to color coding (arrow).

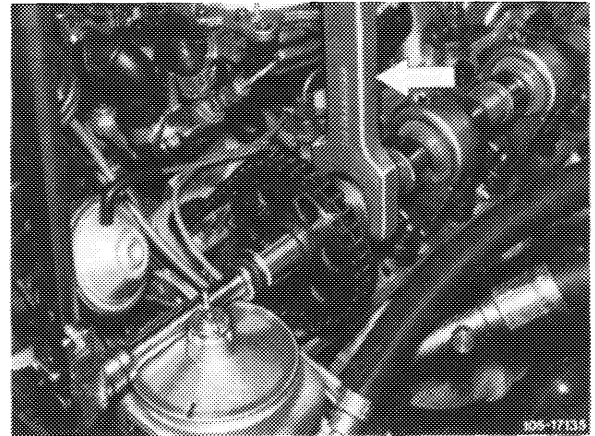


Attention!

The white color on camshaft sprocket (arrow) should face camshaft.



14 Tighten necked-down screw to 100 Nm, while counterholding camshafts with holding wrench.

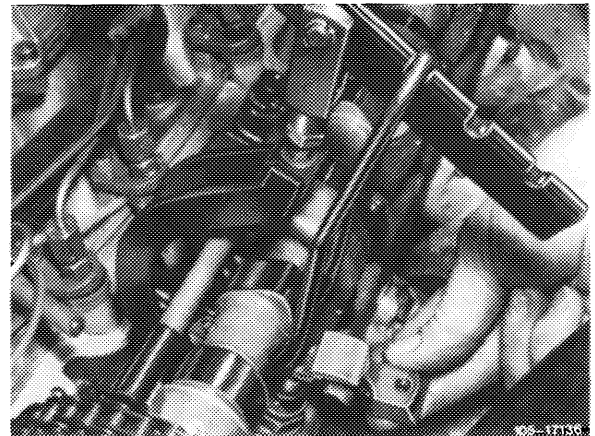


15 Install rocker arm again at the same place.

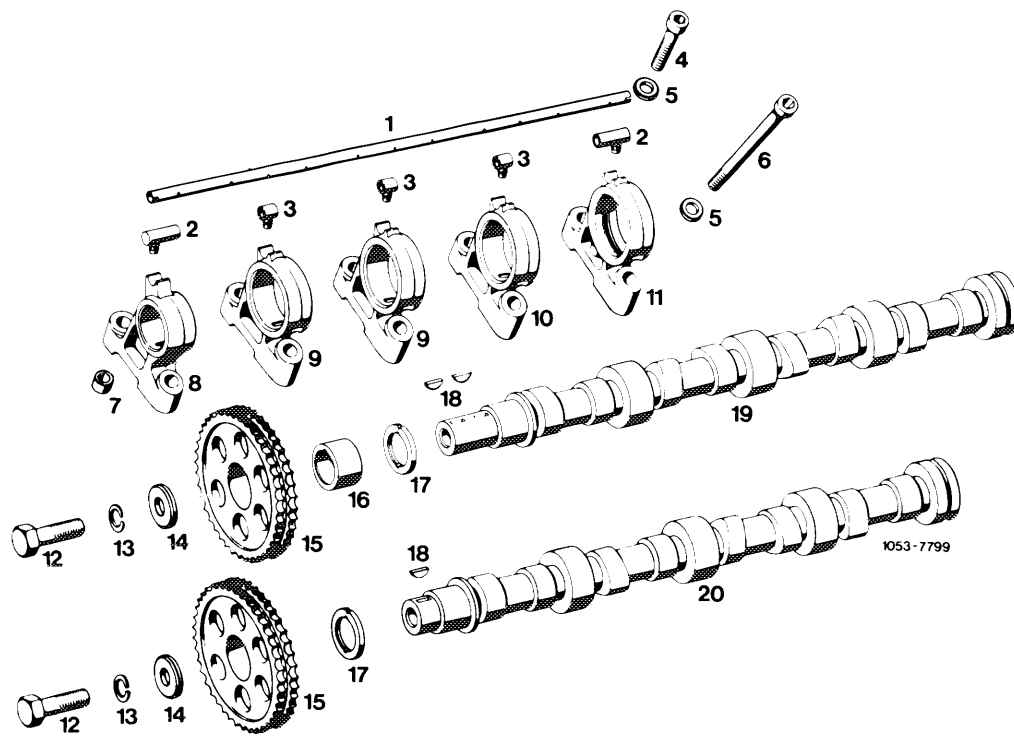
Attention!

If the rocker arms or the camshaft were renewed, check basic position of hydraulic valve clearance compensating elements (05—213).

16 Adjust valve clearance (05—210).



17 Complete assembly of engine.



- | | | | |
|----|-------------------------------|----|-------------------------------|
| 1 | Oil pipe | 11 | Camshaft bearing flywheel end |
| 2 | Connection, end | 12 | Screw M 14 x 1.5 x 40 |
| 3 | Connection, center | 13 | Spring washer B 14 |
| 4 | Cyl. head screw M 8 x 50 | 14 | Washer |
| 5 | Washer | 15 | Camshaft sprocket |
| 6 | Cyl. head screw M 10 x 150 | 16 | Spacing ring right |
| 7 | Set sleeves | 17 | Compensating washer |
| 8 | Camshaft bearing sprocket end | 18 | Woodruff key |
| 9 | Camshaft bearing 2 and 3 | 19 | Camshaft right |
| 10 | Camshaft bearing 5 | 20 | Camshaft left |

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