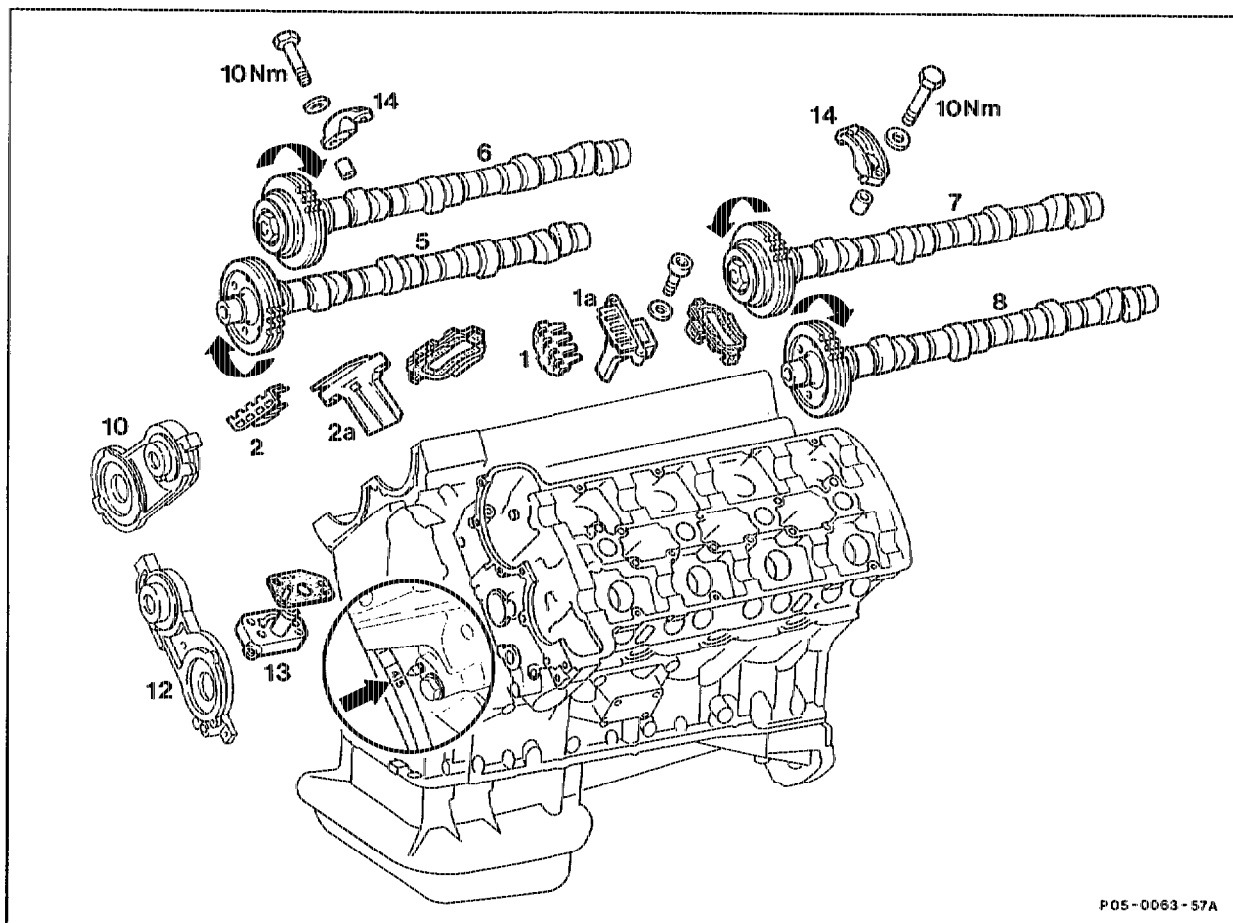


## 05-2200 Removing and installing camshafts

Operation no. of operation texts and work units or standard texts  
and flat rates  
05-5521, 5541, 6292-7050



P05-0063-57A

Piston of No. 1 cylinder .....	set to 45° before ignition TDC (arrow), (step 1).
Front covers (10 and 12) at top .....	remove, install (01-2120).
Camshaft timing gears .....	mark relative to timing chain (step 3).
Chain tensioner (13) .....	remove, install (05-3100).
Top slide rails (1, 1a, 2, 2a) .....	remove, install (05-3350).
Camshaft bearing caps (14) .....	mark (step 6).
Camshafts (5), (6), (7) and (8) .....	turn in direction of arrow with wrench (slacken), special tool 119 589 00 01 00 (step 7).

Camshaft bearing caps (14) ..... unscrew, take off (10 Nm) (steps 8 and 9).  
 Camshafts with camshaft adjuster and camshaft timing gear ..... take off, install. Special tool 119 589 00 05 00 (steps 9 to 20).



Since 1993 the camshaft bearing caps are no longer fixed in position with dowel sleeves but the bearing caps are centered by means of the bearing points of the camshafts when the securing bolts are tightened to specification.

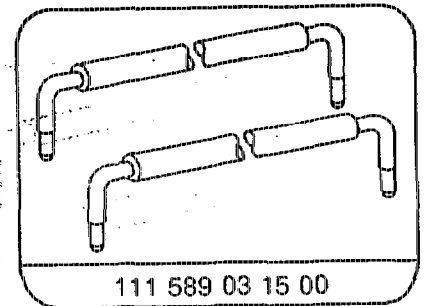
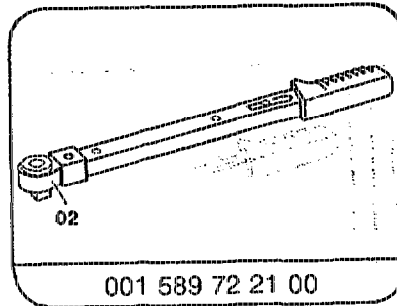
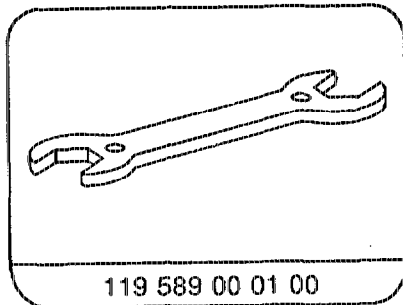
Basic setting ..... check (05-2230).

### Tightening torques in Nm

Camshaft bearing cap bolts		12
Camshaft gear to camshaft		18
Flanged shaft to camshaft Torx T40	Initial torque	20
	Tightening angle	60

1) Replace when performing repairs; use only once.

### Special tools



**Test value**

		When new
Camshaft bearing dia. in cylinder head	Standard size	28.000
		28.021
	Repair size	28.500
		28.521
Camshaft bearing dia. at camshaft	Standard size	27.960
		27.947
	Repair size	28.447
		28.460
Permissible variation in concentricity of middle bearing point and of camshaft timing gear seat when mounted in outer bearing points	Camshaft gear seat	0.02
	Bearing points 2, 3, 4	
Camshaft bearing play	Radial	0.053–0.061
	Axial	0.050–0.150

**Note**

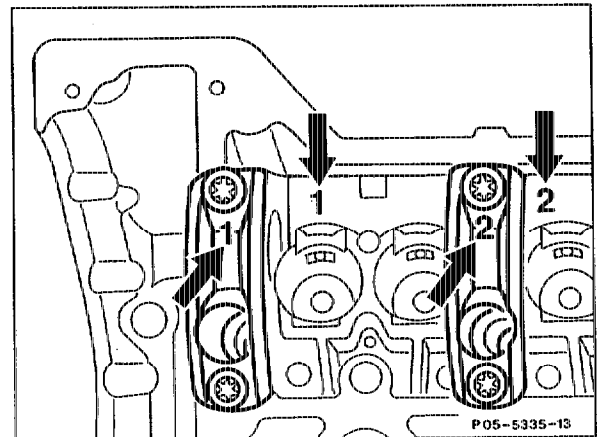
The camshaft bearing caps are numbered consecutively (arrows), beginning at the right exhaust camshaft at the front.

The numbers (arrows) are cast in the cylinder heads.

The camshaft bearing caps must be re-installed at the same point.

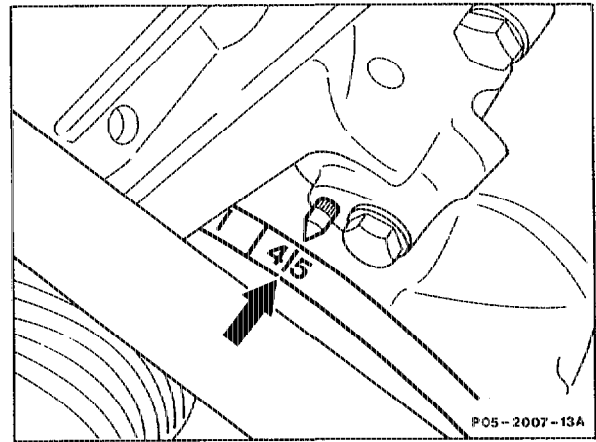


The camshafts are sensitive to fracturing and must not be twisted when removing and installing camshaft bearing caps. If a camshaft is removed, all the others must be secured with fixing pins to prevent them turning.



1 Set piston of No. 1 cylinder to 45° before TDC (arrow).

2 Remove front cover at top (01-2120).



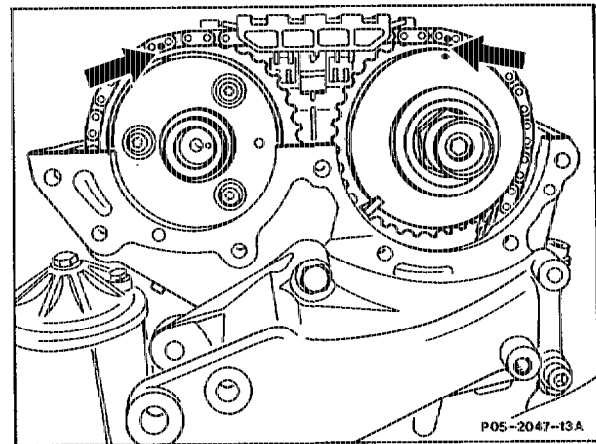
3 Mark position of camshaft timing gears (arrows) relative to timing chain.

**Note**

If the camshaft timing gear is removed, the colour marking must be transferred to the corresponding point on the new camshaft timing gear.

4 Remove and install chain tensioner (05-3100).

5 Remove top slide rails (05-3350).



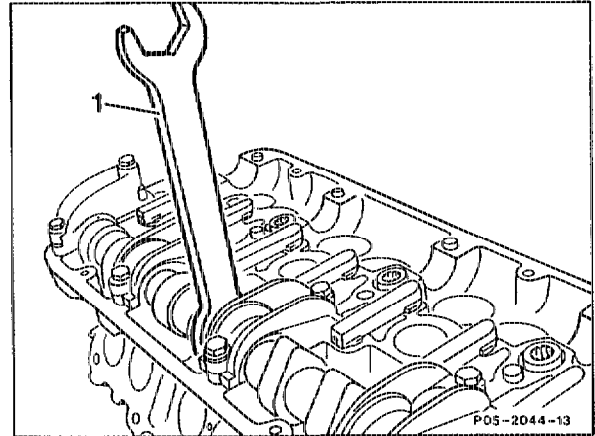
6 Lift timing chain off camshaft sprockets.  
Rotate camshafts with wrench 119 589 00 01 00 so that only the base circle of the cams is touching the bucket tappets in each case.

#### Note

The timing chain is secured on the camshaft sprocket to prevent it turning when the timing case cover is installed.

#### Removal note

Rotate camshafts free of tension: rotate right exhaust camshaft and right inlet camshaft approx. **6 teeth** in direction of rotation of engine.



Rotate left inlet camshaft approx. **10 teeth** in **opposite** direction of rotation of engine.

Rotate left exhaust camshaft approx. **14 teeth** in direction of rotation of engine.

7 Slacken camshaft bearing caps alternately so as to prevent any one-sided residual stress acting on the camshaft.

8 Take off camshaft bearing caps and camshafts together with camshaft sprockets and camshaft adjusters.

#### Installing

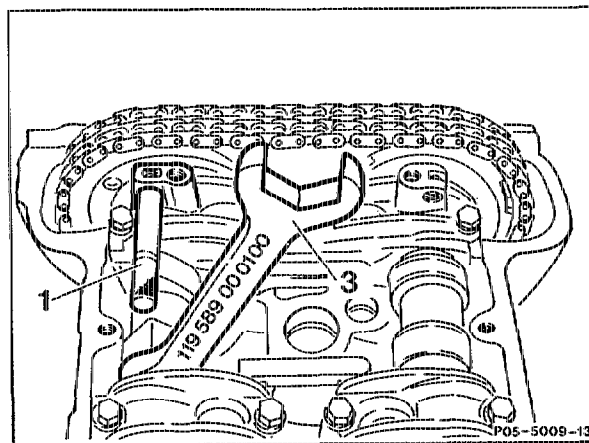
9 Oil bucket tappets and camshaft bearing points.

10 Insert left inlet and exhaust camshafts with timing chain fitted, free of tension. Pay attention to guide bearing at bearing point 3.

11 Oil bearing caps, install and tighten uniformly to 10 Nm. Camshaft must not be over-tensioned on the one side.

12 Rotate camshaft with wrench (3)  
119 589 00 01 00 and check for ease of  
movement.

13 Rotate left exhaust camshaft into position  
with wrench (3). Fit timing chain onto the  
marking affixed previously to the exhaust  
camshaft sprocket and pin with pin (1), special  
tool 111 589 03 15 00.

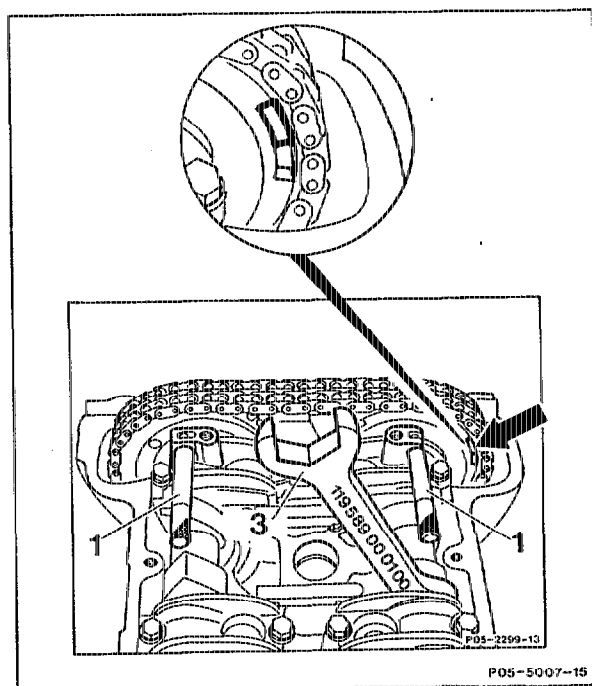


14 Rotate left inlet camshaft into position with  
wrench (3). Fit timing chain onto the previously  
affixed marking on the inlet camshaft sprocket  
and secure with pin (1). Camshafts in "retarded"  
position (arrow).

15 Insert right inlet and exhaust camshafts free  
of tension, with timing chain fitted. Pay attention  
to guide bearing at bearing point 3.

16 Oil bearing caps, install and tighten uniformly  
to 12 Nm. Camshaft must not be over-tensioned  
on the one side.

17 Rotate camshafts and check for ease of  
movement.



18 Rotate right inlet camshaft into position with  
wrench 119 589 00 01 00. Fit timing chain onto  
the marking affixed previously to the inlet  
camshaft sprocket and pin with pin  
111 589 03 15 00. Camshafts in "retarded"  
position (arrow).

19 Rotate right exhaust camshaft into position  
with wrench 119 589 00 01 00. Fit timing chain  
onto the marking affixed previously to the  
exhaust camshaft sprocket and pin with pin  
111 589 03 15 00.

20 Install in reverse order, beginning with  
step 5.

21 Check basic setting (05-2230).