

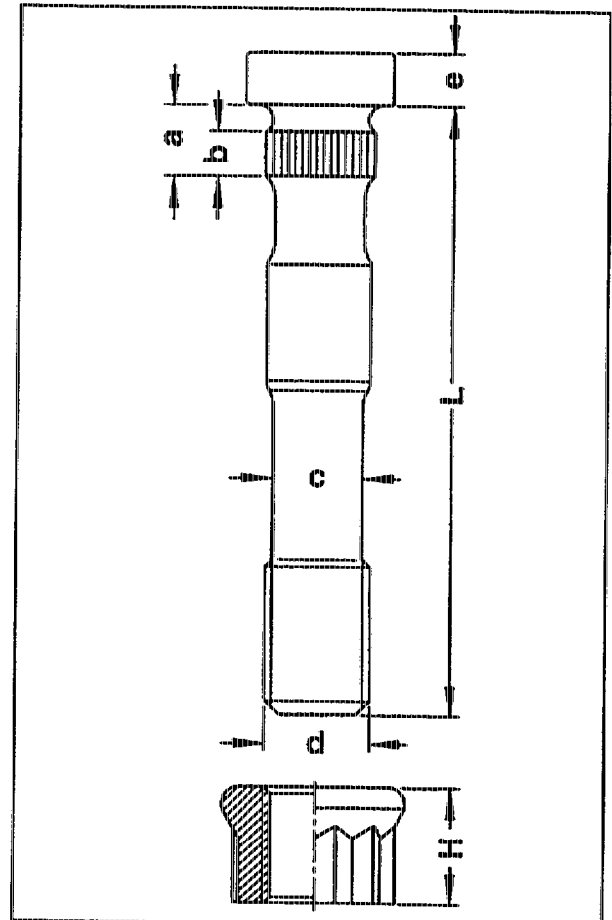
03-3100 Checking, replacing and tightening conrod bolts

Operation no. of operation texts and work units or standard texts
and flat rates 03-434-1 bzw. 03-435-1

Stretch shank bolt (1st version) ¹⁾

Part no.	116 038 05 71
Thread \varnothing	M 10 x 1
Stretch shank \varnothing [(c) when new]	8.4-0.1
Min. stretch shank \varnothing (c)	8.0
a	4.2
Size b	4.5
e	4.2
Length (L) (when new)	49.2-49.5
Conrod nut height (H)	9

¹⁾ Engine 119.96



P03.10-0221-17

Tightening torques in Nm and tightening angle (nut)

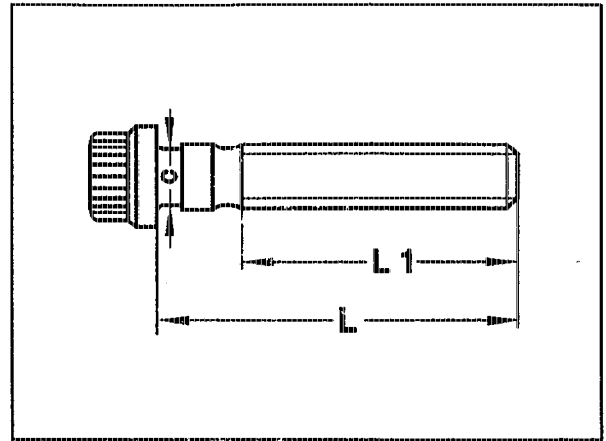
Engine 119.960

Conrod nut ²⁾	Initial torque	First tightening	55
		Repeat tightening	45
	Tightening angle		90°

²⁾ Nut and thread and contact surface of bolt moistened with engine oil before installing.

Straight stretch shank bolt (2nd version) ³⁾

Part no.	102 038 02 71	
Thread Ø	M 9 x 1	
Shank Ø [(c) when new]	8.7-0.2	
Min. shank Ø (c)	8.2	
Length (L)	when new	52-0.3
	max.	52.9



P03-5275-13

³⁾ Engine 119.97

Tightening torque in Nm and tightening angle (straight stretch shank bolt)

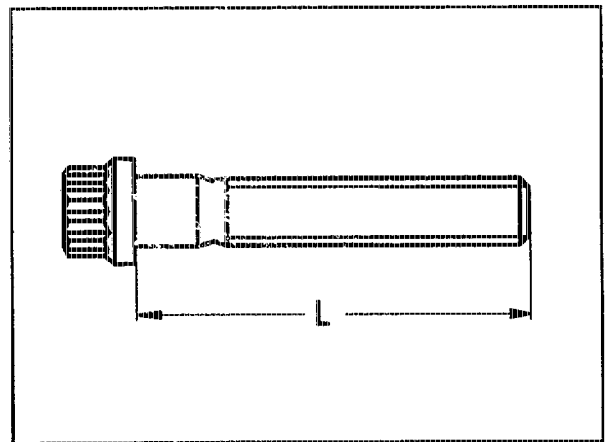
Engine 119.97

Conrod bolt ⁴⁾	Initial torque	First tightening	45
		Repeat tightening	40
Tightening angle		90°	

⁴⁾ Thread and contact surface of bolt moistened with engine oil before installing.

Straight stretch shank bolt (3rd version) ⁵⁾

Part no.	111 038 00 71	
Thread Ø	M 9 x 1	
Length (L)	when new	52-0.3
	max.	52.9



P03-5270-13

Tightening torque in Nm and tightening angle (straight stretch shank bolt)

Engine 119.97/98

Conrod bolt ⁶⁾	Initial torque	First tightening	40
		Repeat tightening	30
Tightening angle		90°	

⁶⁾ Thread and contact surface of bolt moistened with engine oil before installing.

Conrod bolts	re-use up to minimum stretch shank \varnothing or up to max. stretch shank length.
Thread and bolt head contact surface	oil before installing.
Conrod bolts	tighten initially with torque wrench 001 589 66 21 00.
Conrod bolts	tighten with tightening angle wrench; pay attention to tightening angle.

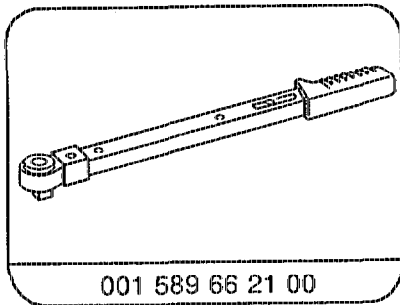


The conrod bolts have different weights. Only conrod bolts of the same weight may be installed in an engine.

Note

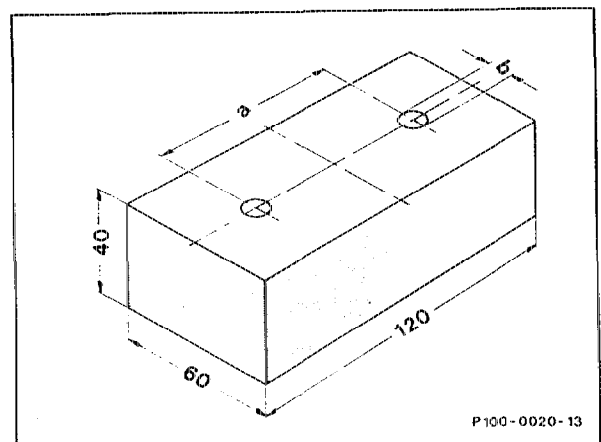
If no tightening angle wrench is available, the conrod bolt or conrod nut can be tightened further in a single step by the specified angle using a socket wrench and tommy bar. Do not use a flexi-bar torque wrench for tightening to degree settings in order to avoid any angle errors.

Special tool



Replacing (1st version)

- 2 Knock out conrod bolts.
- 3 Press new conrod bolts into the conrod with a pressure of about 45,000 N or knock in with a hammer and drift. Place conrod on a ground steel plate (shop-made tool) when performing this step.



Tightening

4 Coat conrod nuts and thread and contact surface of conrod bolts with engine oil.

5 Tighten conrod nuts and conrod bolts, respectively.

Initial tightening torque

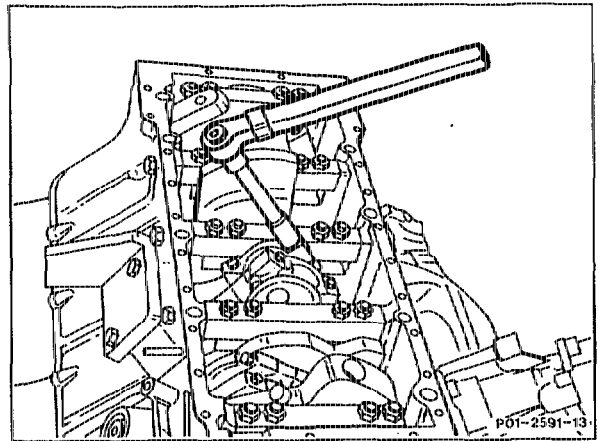
Engine 119.96	45 Nm (55 Nm for new conrod bolt)
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Tightening angle 90–100°



Engine 119.96: if conrod bolts knocked in with hammer, tighten the first time to initial torque of 55 Nm and then to a tightening angle of 90–100°.

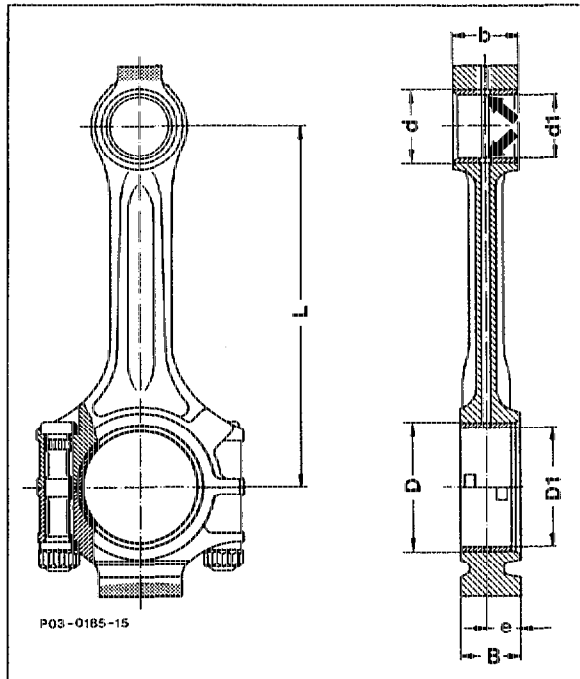
It is essential to observe this instruction otherwise the nuts or conrod bolts may slacken.



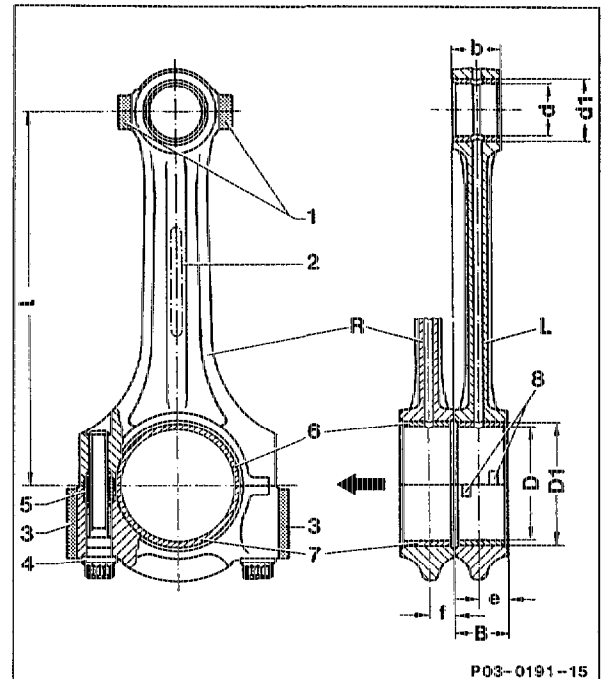
03-3130 Repairing and aligning conrod

Operation no. of operation texts and work units or standard texts
and flat rates
03-6111

Engine 119.96



Engine 119.97/98

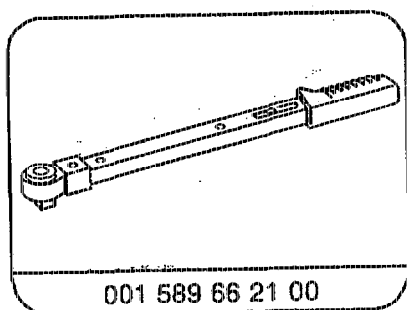


Data

Engine	119.96	119.97/98
Centre of conrod bearing bore to centre of conrod bush bore (L)	<u>154.550</u> 154.450	<u>149.050</u> 148.950
Width of conrod at conrod bearing bore (B)	<u>24.890</u> 24.857	
Width of conrod at conrod bush bore (b)	<u>28.000</u> 27.900	<u>22.100</u> 21.900
Basic bore for conrod bearing shells (D)	<u>51.619</u> 51.600	
Basic bore for conrod bush (d)	<u>29.021</u> 29.000	<u>27.210</u> 27.000
Conrod bush ID (d1)	<u>26.013</u> 26.007	<u>24.013</u> 24.007
Piston pin play in conrod bush	<u>0.007</u> 0.013	<u>0.007</u> 0.018
Peak-to-valley height of conrod bush on inside	0.004	0.005

Engine	119.96	119.97
Permissible twist of conrod bearing bore relative to conrod bush bore		0.15
Permissible variation of parallelism of conrod bearing bore to conrod bush bore		0.07
Permissible variation of conrod bearing bore from roughness		0.01
Permissible difference in weight of complete conrod within an engine		4 g

Special tool



Commercially available tools

Conrod tester	e. g. Model BC 501 KWT D-6057 Dietzenbach
Conrod straightening device	e. g. Model BC 503 KWT D-6057 Dietzenbach
Quick-callipers for internal measurements dia. 20 – 40 mm dia. 40 – 60 mm	
Micrometer 0 – 25 mm 50 – 75 mm	

Note

Conrods which have been overheated as a result of the bearing damage (blue discolouring) must not be re-used.

Conrod and conrod caps are marked together. The conrod stem must not have any transverse scoring and notches.

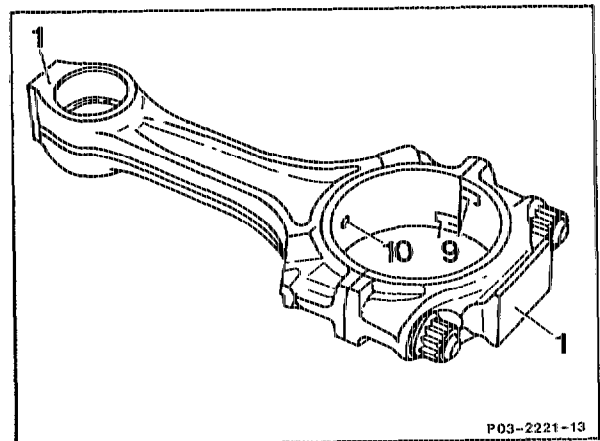
Conrods are supplied with machined conrod bush as a replacement part.

Conrod and crankshafts with different thrust collar dia. may be installed together when performing repairs.

Engine 119.97: The conrod and the conrod cap are fixed together with fit sleeves.

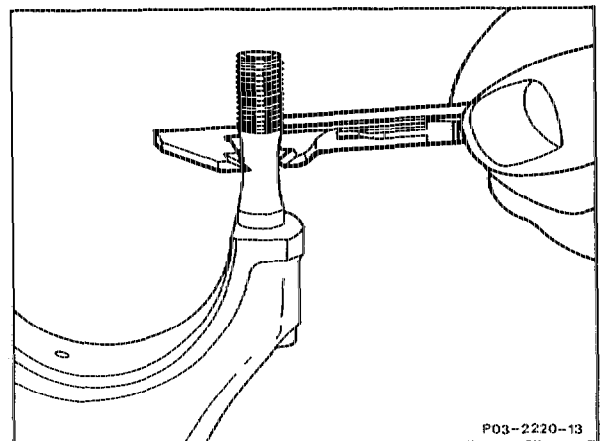
Pay attention to difference in weight when replacing the conrod.

Conrod of engine 119.960
1 Weight balance
9 Locating grooves
10 Oil drilling

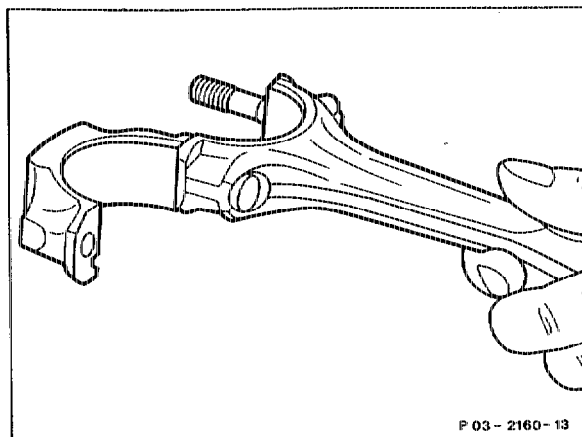


Repairing

1 Check conrod bolts, replace if necessary (03-3100).

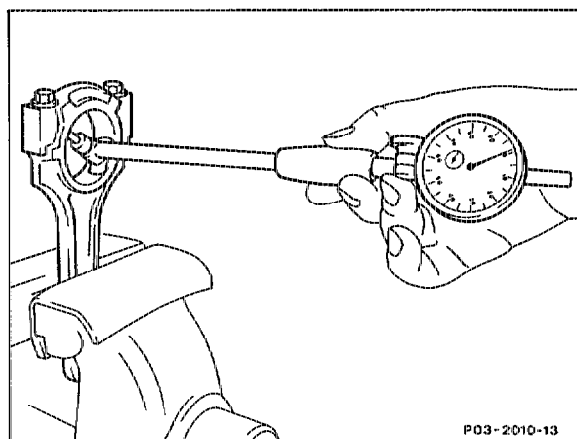


2 Engine 119.96: Examine bores for conrod bolts. Fit conrod cap onto a conrod bolt. If the conrod cap moves down as the result of its own weight, the conrod must be replaced.



3 Install conrod bearing caps. Oil thread and bolt head contact surface for this step and tighten to 40 Nm.

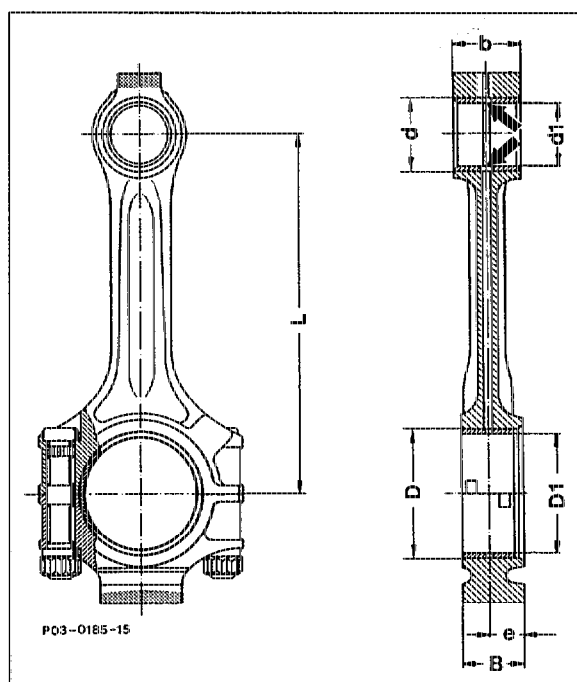
4 Measure conrod bearing basic bore. If the basic bore exceeds the value of 51.619 mm or is conical, dress bearing cover at its contact surface on a dressing plate up to max. 0.02 mm.



5 Press in new conrod bush so that the oil bores are aligned (arrows). Insertion pressure 2500 N.

6 Turn or ream conrod bush.

7 Dress side contact surfaces of conrod on the dressing plate.

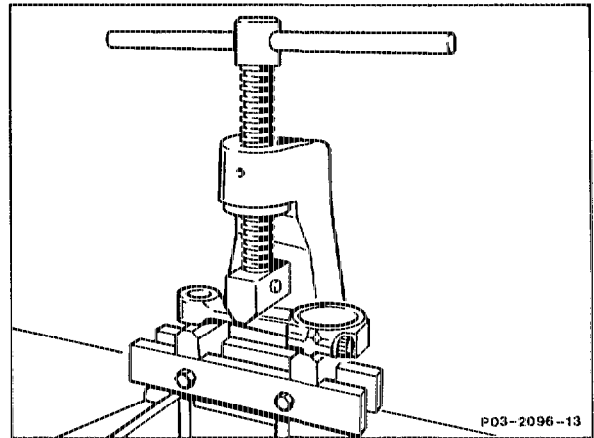


Conrod of Engine 119.96

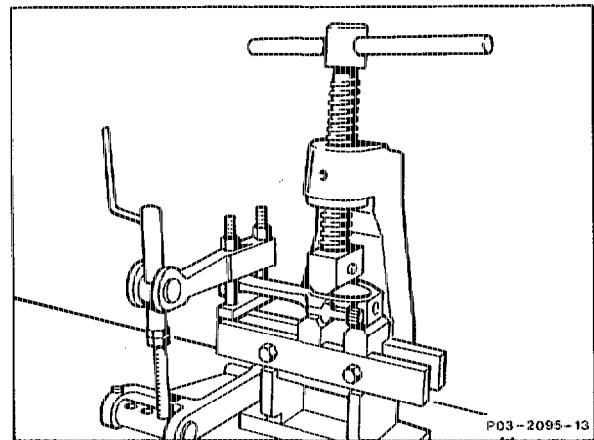
Aligning

8 Align conrod with conrod tester.

9 Align conrod bearing bore to conrod bush bore (parallelism).



10 Examine twist of conrod bearing bore to conrod bush bore and correct if necessary.



03-3160 Removing and installing pistons

Preceding work:
Removing engine (01-0300).
Removing cylinder head (01-4150).
Removing oil sump (01-3100).

Operation no. of operation texts and work units or standard texts
and flat rates 03-7021



Cylinder identification and piston identifications must agree (see arrows).

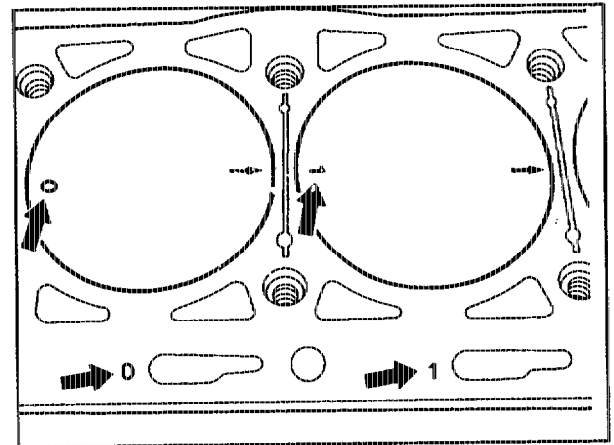
Notes

The group classification has been converted from numerals to letters and reduced to three stages.

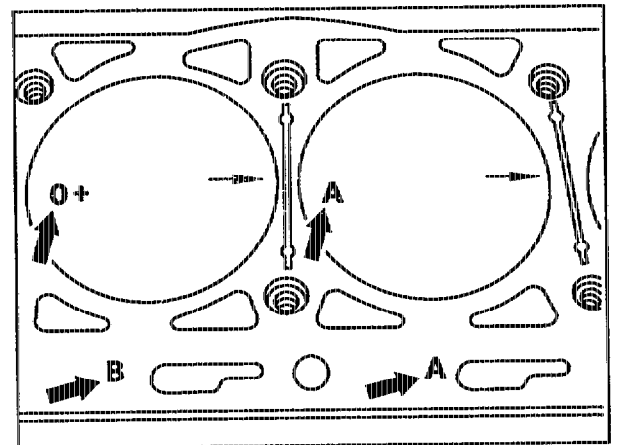
The pistons with numerals may be installed in a crankcase with a letter grouping, but not vice versa (see Pistons, matching and dimensions 03-3165).

When performing repairs, all the cylinder bores should be honed to the dimensions of the existing pistons plus piston play, see "Measuring, honing and silicone-lapping cylinder bores" (01-1120).

The piston pins are matched to the pistons and must not be mixed up.



P03-2024-13



P03.10-0214-13

Note

The group number of the pistons (e.g. +1) must agree with the group number of the cylinder bores (standard production).

This ensures that the specified piston play is maintained.

When performing repairs, all the cylinder bores should be honed to the dimensions of the existing pistons plus piston play (see table).

The piston pins are matched to the pistons and must not be mixed up.

Removing

- 1 Unbolt conrod bearing caps and lift out conrod together with pistons.

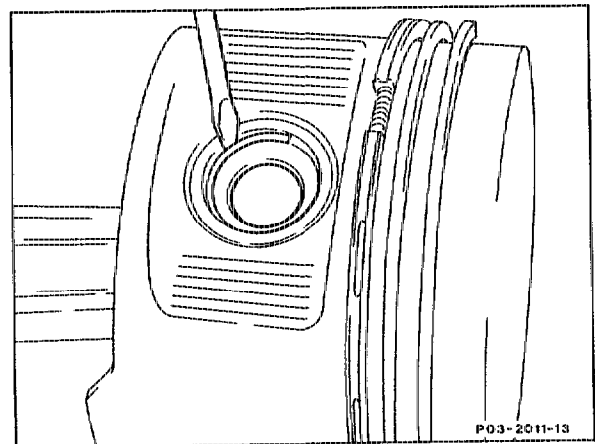
Note

Conrod and conrod bearing caps are marked together.



Do not damage cylinder contact surfaces with conrod.

- 2 Inspect conrod bolts (03-3100).
- 3 Use screwdriver to remove piston pin retainer and press out piston pin.
- 4 Service conrod and align, if necessary (03-3130).



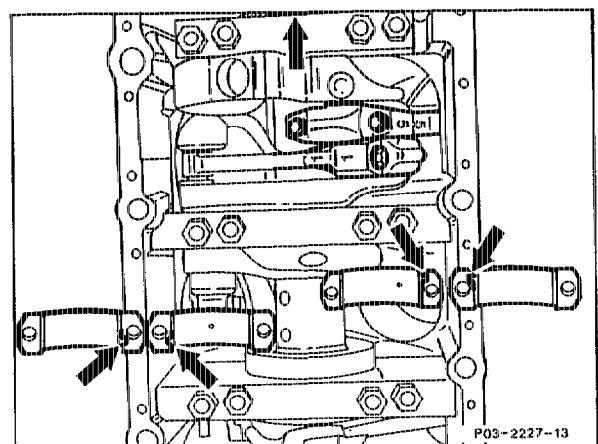
Installing

- 5 If pistons are worn, inspect gap and axial clearance of piston rings (03-3170). Check that piston rings move freely. Pay attention to installation pos.: "Top" faces up. Distribute ring gaps evenly around circumference.

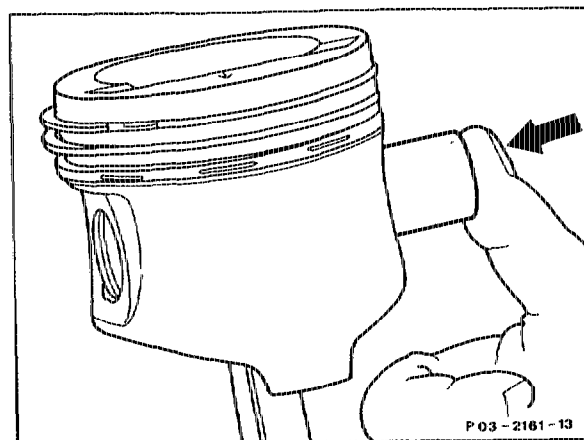
- 6 Oil piston pin and conrod bushes.
- 7 Install piston so that the arrow faces in direction of travel and the locking slots in the conrod (arrows) as well as the drawing of the conrod are facing to the outside of the engine.

Note

The conrods are asymmetrical, the wide thrust collars point toward the crankshaft webs.

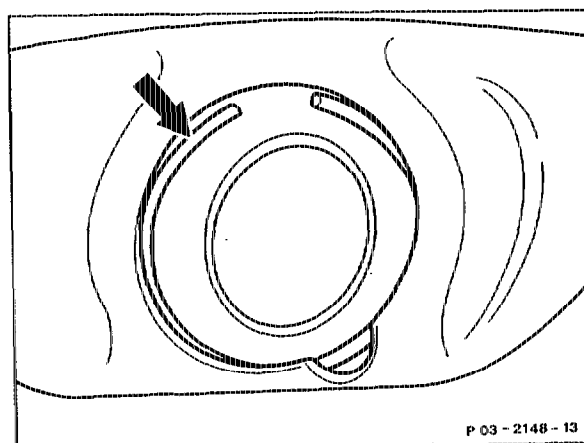


8 Press in piston pin by hand.



9 Insert piston pin retainer into the groove.

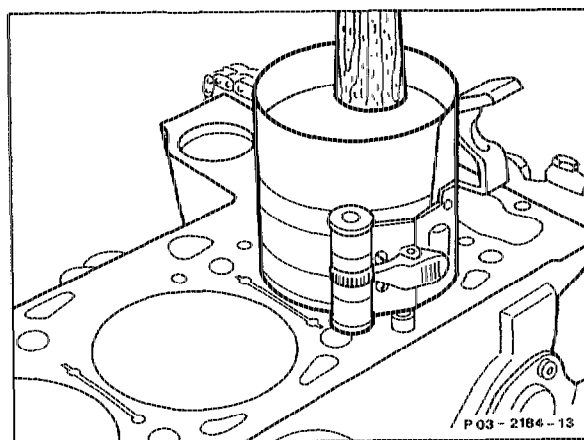
10 Oil cleaned cylinder bores, conrod bearing journals, conrod bearing shells and pistons.



11 Fit on tensioning strap for piston rings and insert piston into the cylinder bore with arrow facing direction of travel.



Do not damage cylinder contact surface with conrod.

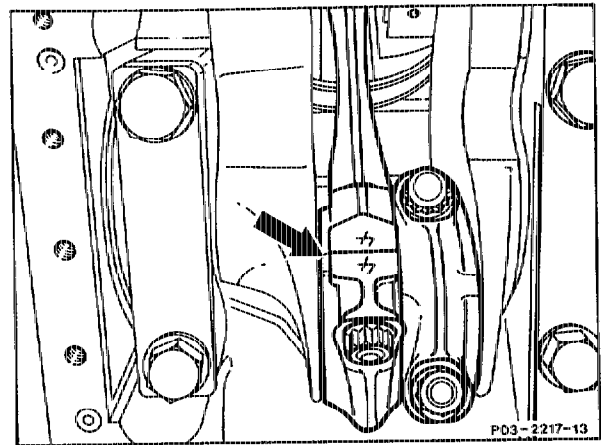


12 Fit conrod bearing cap onto the conrod with the identification (arrow) facing each other. Moisten conrod nuts and thread and contact surface of conrod bolts with engine oil and tighten.

Tightening torque (see 03-3100).



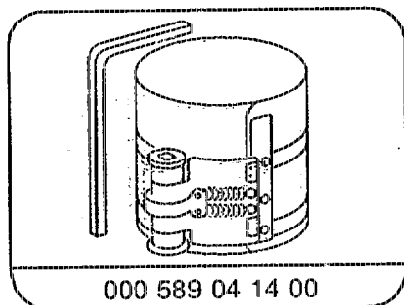
Pay attention to installation position of conrod bearings. Install conrod bearing shell with oil drilling in the conrod otherwise lubrication of the piston pin is not assured.



Pay attention to tightening torques of the conrod bearings (see Inspecting, replacing and tightening conrod bolts 03-3100).

13 Rotate crankshaft and check whether it rotates freely.

Special tool



03-3165 Pistons, matching and dimensions



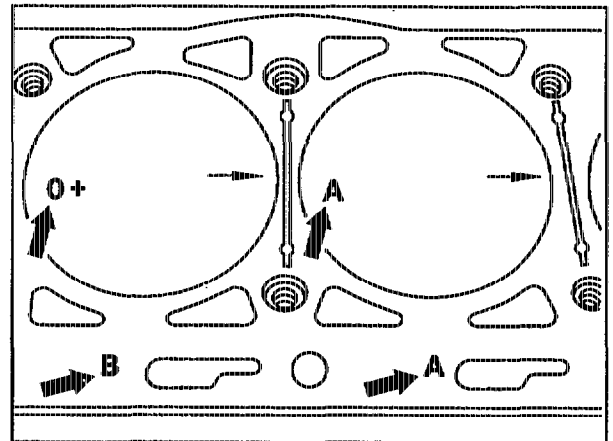
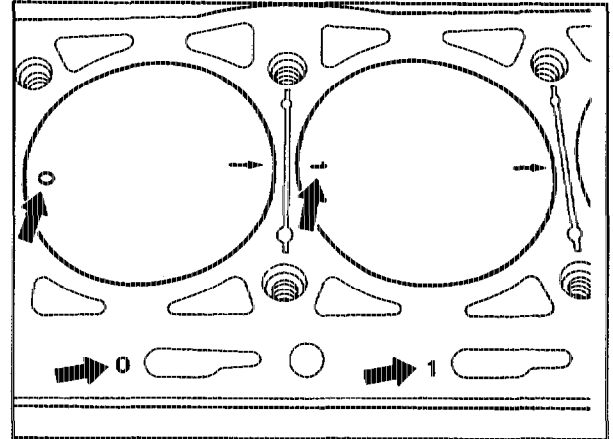
Cylinder identification and piston identifications must agree (see arrows).

Notes

The group classification has been converted from numerals to letters and reduced to three stages.

The pistons with numerals may be installed in a crankcase with a letter grouping, but not vice versa (see table).

When performing repairs, all the cylinder bores should be honed to the dimensions of the existing pistons plus piston play, see "Measuring, honing and silicone-lapping cylinder bores" (01-1120).



Numerical and letter grouping

Numerical piston identification	equals	Letter piston identification		Letter cylinder identification
0	→	A	→	A
0+ 1	→	B	→	B
1+ 2	→	C	→	C

Test data

Engine	119.96	119.97	119.98
Piston clearance	0.004–0.026	0.004–0.026	0.004–0.026
Difference in weight of pistons within an engine	8 g	8 g	8 g
Piston pin \varnothing	25.995–26.000	24.000	24.000
Piston pin clearance in piston	0.004–0.008	0.004–0.008	0.004–0.008

Matching pistons to crankcase with numerical identification

Engine 119.960/970/972/974	Class identification	Index	Piston \varnothing ¹⁾	Cylinder \varnothing ²⁾
Standard size Std 96.5 \varnothing	0	52	96.483–96.493	96.498–96.503
	0+	53	96.488–96.498	96.503–96.508
	1	54	96.493–96.503	96.508–96.513
	1+	55	96.498–96.508	96.513–96.518
	2	56	96.503–96.513	96.518–96.523
1st repair size + 0.5	0		96.983–96.993	96.998–97.003
	1		96.993–97.003	97.008–97.013
	2		97.003–97.013	97.018–97.023
2nd repair size + 1.0	0		97.483–97.493	97.498–97.503
	1		97.493–97.503	97.508–97.513
	2		97.503–97.513	97.518–97.523

1) Group identification stamped on piston crown with color.

2) Group identification stamped at top next to cylinder bore.

Matching pistons to crankcase with letter identification

Engine 119.980/982/970/972/974	Group identification	Index	Piston Ø ³⁾	Cylinder Ø ²⁾
Standard size Std 96.5 Ø	A	52	96.482–96.495	96.500–96.508
	B	54	96.491–96.504	96.508–96.516
	C	56	96.499–96.512	96.516–96.524
1st repair size + 0.5 ²⁾	A		96.982–96.995	97.000–97.008
	B		96.991–97.004	97.008–97.016
	C		96.999–97.012	97.016–97.024
2nd repair size + 1.0 ²⁾	A		97.482–97.495	97.000–97.508
	B		97.491–97.504	97.508–97.516
	C		97.499–97.512	97.516–97.524

2) Group identification stamped at top next to cylinder bore.

3) Group identification stamped on piston crown.

Matching pistons to crankcase with numerical identification

Engine 119.971/975/981/985	Group identification	Index	Piston Ø ¹⁾	Cylinder Ø ²⁾
Standard size Std 92.0 Ø	0	52	91.983–91.993	91.998–92.003
	0 +	53	91.988–91.998	92.003–92.008
	1	54	91.993–92.003	92.008–92.013
	1 +	55	91.998–92.008	92.013–92.018
	2	56	92.003–92.013	92.018–92.023
1st repair size + 0.5 ²⁾	0		92.483–92.493	92.498–92.503
	1		92.493–92.503	92.508–92.513
	2		92.503–92.513	92.518–92.523
2nd repair size + 1.0 ²⁾	0		92.983–92.993	92.998–93.003
	1		92.993–93.003	93.008–93.013
	2		93.003–93.013	93.018–93.023

1) Group identification stamped on piston crown with color.

2) Size stamped at top next to cylinder bore.

Matching pistons to crankcase with letter identification

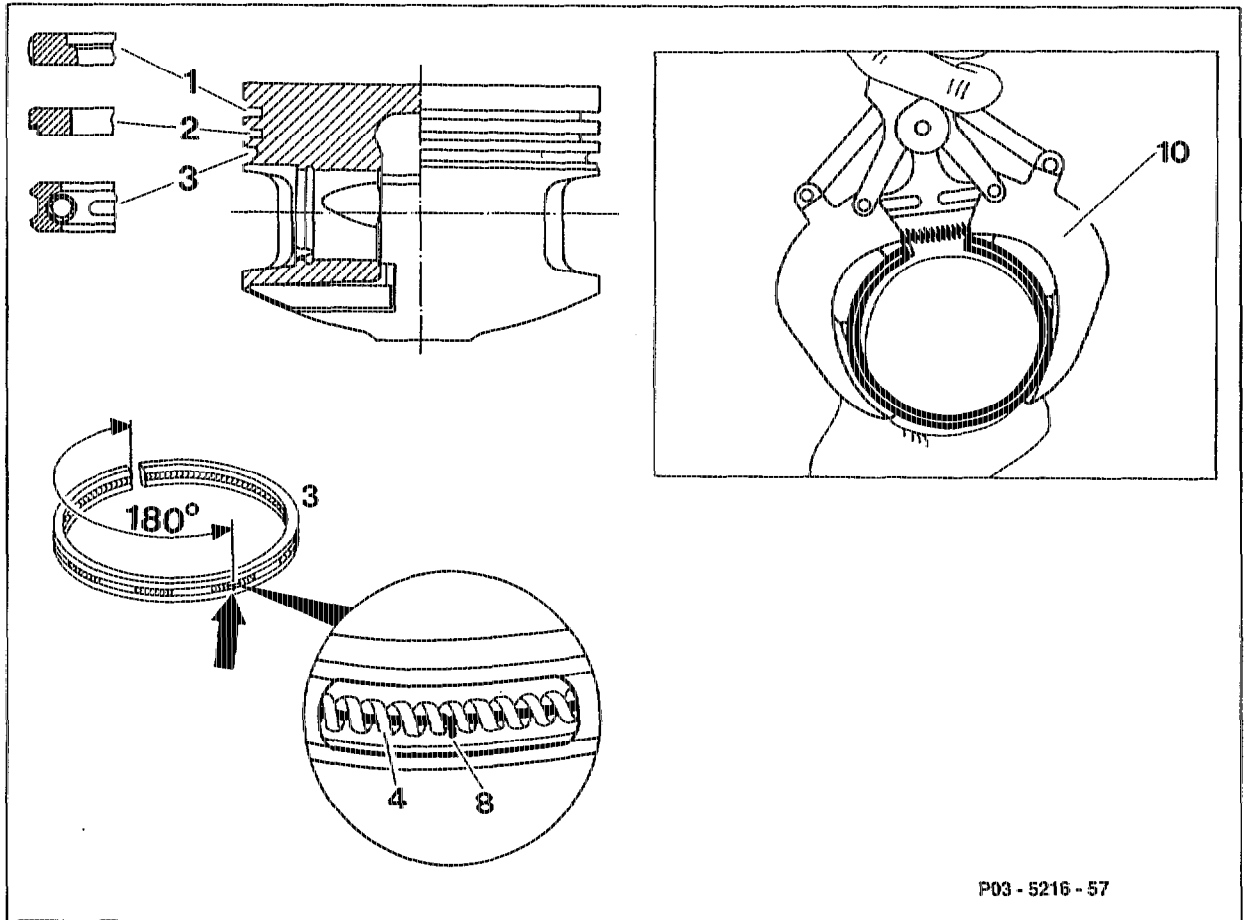
Engine 119.971/975/981/985	Group identification	Index	Piston Ø ³⁾	Cylinder Ø ²⁾
Standrd size Std 92.0 Ø	A	52	91.982–91.995	92.000–92.008
	B	54	91.991–92.004	92.008–92.016
	C	56	91.999–92.012	92.016–92.024
1st repair size + 0.5 ²⁾	A		92.482–92.495	92.500–92.508
	B		92.491–92.504	92.508–92.516
	C		92.499–92.512	92.516–92.524
2nd repair size + 1.0 ²⁾	A		92.982–92.995	93.000–93.008
	B		92.991–93.004	93.008–93.016
	C		92.999–93.012	93.016–93.024

2) Group identification stamped at top next to cylinder bore.

3) Group identification stamped on piston crown.

03-3170 Replacing piston rings

Preceding work:
Pistons removed (03-3160).



P03 - 5216 - 57

- 1 Plain compression ring
- 2 Taper-faced hook scraper ring

- 3 Double bevelled coil spring loaded oil control ring
- 4 Coil spring

End clearance of piston rings
Piston rings

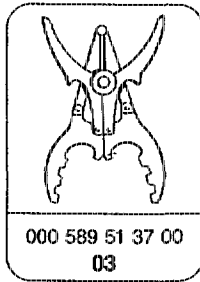
measure.

remove with pliers (10), install, special tool
000 589 51 36 00.

Note

Pay attention to installation position, "Top" faces up. Hooked spring (8) in oil scraper ring (3) is installed offset 180° to joint (arrow).

Special tool



Test data in mm

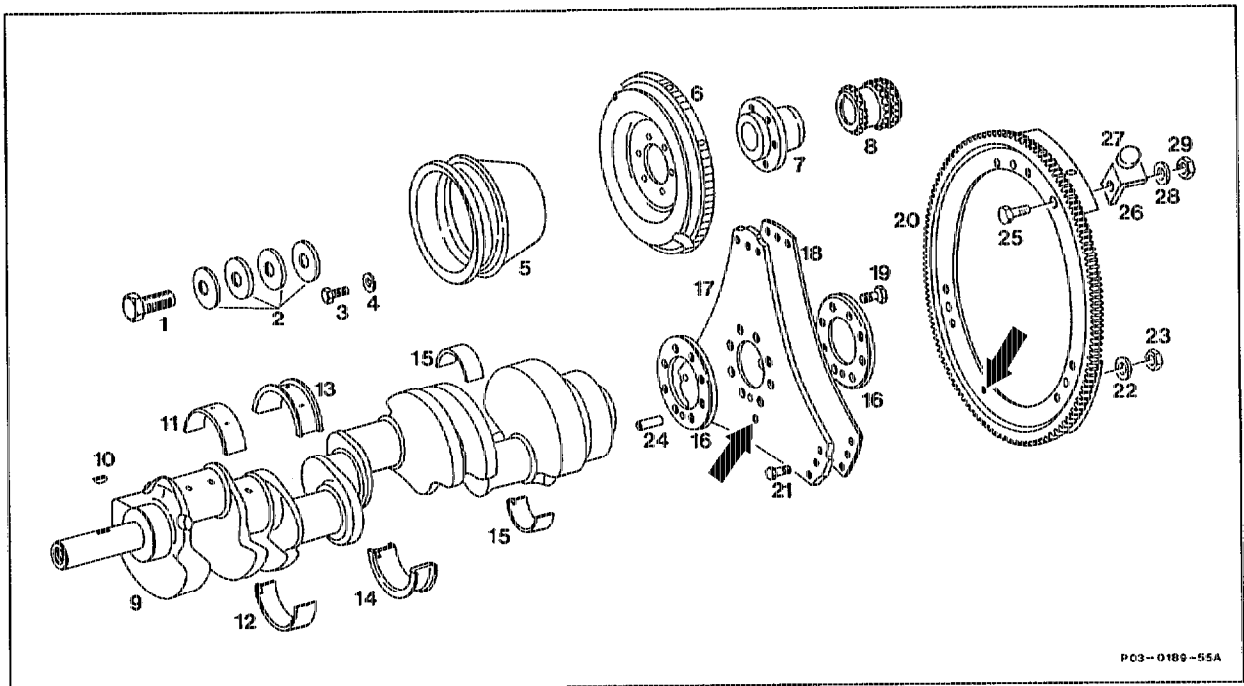
End clearance of piston rings	Groove 1	0.05 – 0.08
	Groove 2	0.01 – 0.03
	Groove 3	0.01 – 0.04

03-3200 Mounting crankshaft in bearings

Preceding work:
 Engine removed and disassembled.
 Oil galleries in crankcase and in crankshaft cleaned.
 Crankshaft examined for cracks, dimension of tolerance,
 hardness and concentricity.

Operation no. of operation texts and work units or standard texts
 and flat rates
 03-4700, 6401, 7021

A. Engine 119.96/97 with fit bearing



- | | | | |
|----|--|----|---|
| 1 | Bolt M 18×1.5×45 mm | 15 | Conrod bearing shells |
| 2 | Belleveille spring washers (4 ea.), | 16 | Discs 4.5 mm thick |
| 3 | Bolt M 8×22 (6 ea.) | 17 | Driven plate 1.5 mm thick, 296 mm dia. |
| 4 | Spring lock washer A8 | 18 | Driven plate 1 mm thick, 287 mm dia. |
| 5 | Belt pulley | 19 | Stretch bolt for driven plates
M 12×1.5×23 (8 ea.) |
| 6 | Vibration damper | 20 | Ring gear with segments |
| 7 | Hub | 21 | Fit bolts M 6×12 mm |
| 8 | Crankshaft gear | 22 | Spring washer B 6 |
| 9 | Crankshaft | 23 | Nut M 6 |
| 10 | Woodruff key | 24 | Locating pin |
| 11 | Crankshaft bearing shell in crankcase | 25 | Bolt M5×10 |
| 12 | Crankshaft bearing shell in bearing cap | 26 | Bracket |
| 13 | Fit bearing shell in crankcase with oil
groove and drilling | 27 | Magnet |
| 14 | Fit bearing shell in bearing cap | 28 | Washer A 5.3 |
| | | 29 | Nut M5 |

Data in mm

Crankshaft standard size and repair sizes	Crankshaft bearing journal Ø	Color coding	Crankshaft journal width at fit bearing ²⁾	Crankshaft bearing journal Ø	Crankshaft bearing journal width
Standard size	<u>63.960</u> ¹⁾ →	blue	max. 27.50	47.965 47.955	50.000 50.100
	63.965				
	<u>63.955</u> ¹⁾ →	yellow			
63.960					
<u>63.950</u> ¹⁾ →	red				
63.955					
1st repair size	<u>63.715</u> 63.700				
2nd repair size	<u>63.465</u> 63.450		47.465 47.455		
3rd repair size	<u>63.215</u> 63.200		47.215 47.205		
4th repair size	<u>62.965</u> 62.950		46.965 46.955		

1) Tolerance division for bottom bearing cap, colored dots on crank webs or counterweights next to crankshaft bearing journals

2) Crankshaft main bearings with fit bearing as of engine no. 119.96 as of start of production
up to engine no. 119.970 12 036277
119.971 12 017447
119.972 12 004797
119.974 12 008072
119.975 12 010516

Crankshaft bearing bore, conrod bearing bore and bearing play in mm

	Crankcase ⁴⁾	Color coding	Conrod
Crankshaft bearing bore	<u>68.480</u> ³⁾ →	blue	-
	68.486		
	<u>68.486</u> ³⁾ →	yellow	
	68.492		
	<u>68.492</u> ³⁾ →	red	
	68.500		
Conrod bearing bore	-	-	<u>51.600</u> 51.619
Permissible out-of-roundness and conicity of bores	0.01		0.01
Radial bearing play	when new		0.021–0.045 ⁵⁾
	wear limit		0.090
Axial bearing play	when new		0.10–0.22
	wear limit		0.30

3) Tolerance division for top bearing cap, chisel punch points in contact surface of crankcase at oil sump end.

4) Machined together with crankshaft bearing cap.

5) Aimed for average value of radial bearing play.

Matching crankshaft bearing shells to crankcase

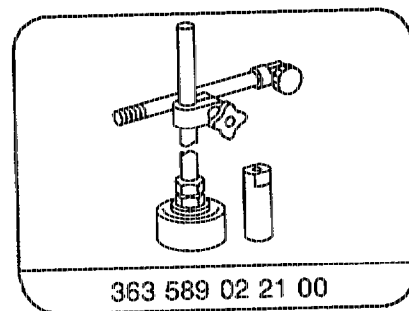
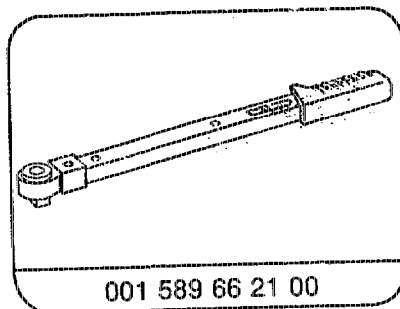
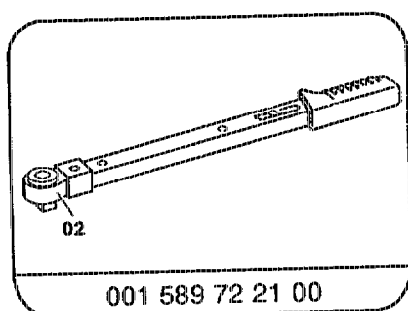
Chisel punch points on crankcase	Matching top bearing shell with color coding		
	1 punch point	2 punch points	3 punch points
Colored dots on crankshaft bearing cap	blue	yellow	red
Color of top bearing shell	blue	yellow	red
Color coding on crankshaft	Matching bottom bearing shell with color coding		
	blue	yellow	red
Color of bottom bearing shell	blue	yellow	red

Tightening torques in Nm

Crankshaft bearing stud bolt	Stud bolt in crankcase 1)	30
	M10×1 nut	50
	M10×40 side bolts (10.9)	50

1) The stud bolts lose their locking effect after being unscrewed and must therefore only be used once.

Special tools



Commercially available tools

Quick-callipers for internal measurements,
dia. 40 – 60 mm

e.g. Hahn und Kolb
Borsigstraße 50
D-7000 Stuttgart 30
Order no. G 222 K

Quick-callipers for internal measurements,
dia. 60 – 80 mm

Order no. G 322 K

Micrometer 25 – 50 mm

Order no. 31346 025

Micrometer 50 – 75 mm

Order no. 31346 050

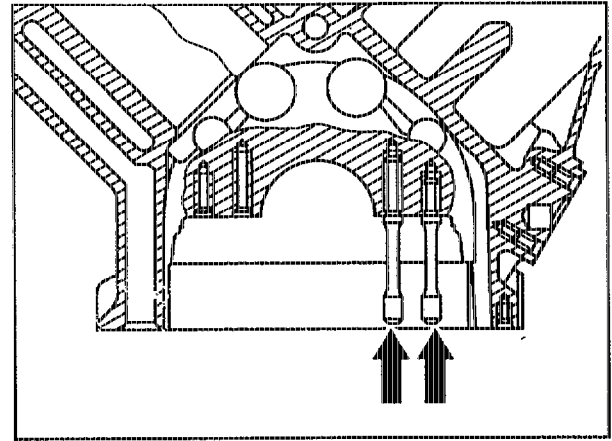
Note

Self-locking stud bolts are screwed into the crankcase for securing the crankshaft bearing caps. These stud bolts may only be used once as the locking adhesive applied over approx. 8 mm length of the thread is no longer effective when they are removed.

Pay attention to the different insertion depth and collar dia. when replacing the stud bolts.



When performing repairs, no HELI-COIL inserts may be used for the self-locking stud bolts of the crankshaft bearing caps.



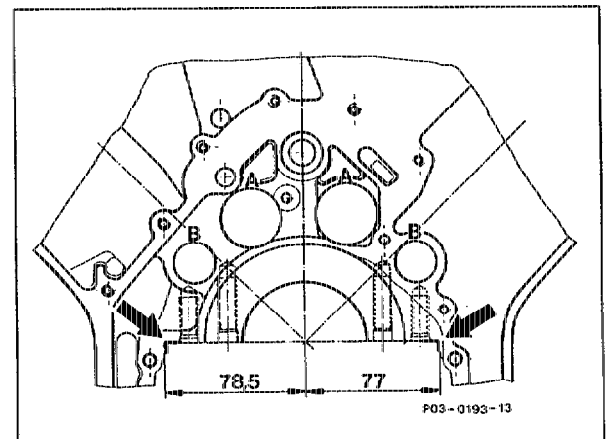
P03-5337-13

The 5 crankshaft bearing caps manufactured from malleable cast iron are fitted into the side in the crankcase (arrows).

The fitting face (arrows) is positioned off-centre so that the bearing caps can only be installed in one position.

The three centre bearing caps are additionally bolted to the housing side walls.

The crankshaft bearing caps are machined together with the crankcase and are not available as a replacement part.



P03-0193-13

If bearing damage has occurred, the conrods must be removed and any swarf removed from the conrod bores and the oil passages of the crankshaft.

Carefully clean the oil passages in the crankcase, crankshaft, timing case cover, oil filter housing, closing cover, oil pump etc.

Examine crankshaft for cracks, dimensional tolerance and hardness (03-3180).

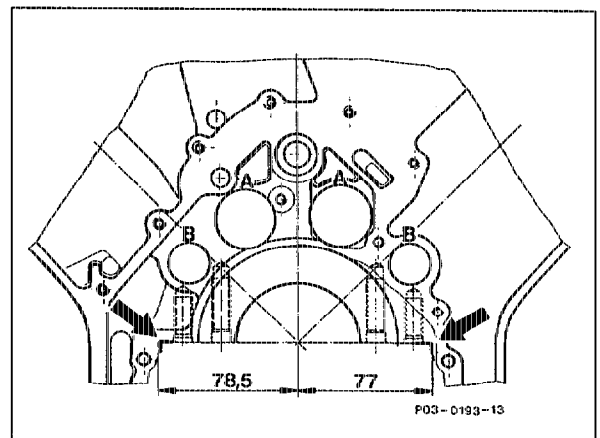
Matching crankshaft bearings, installing crankshaft

1 Install crankshaft bearing caps, pay attention to marking, 1 is to the front.

The fit face is asymmetrical (arrows); the crankshaft bearing caps can thus only be installed in one position.

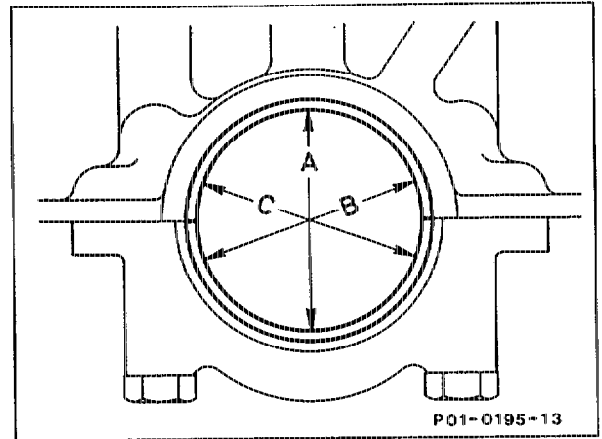
2 Oil thread and contact surface of nuts, tighten nuts to 50 Nm.

3 Oil thread and head contact surface of side bolts (M10×40), install with the washers and tighten to 50 Nm.



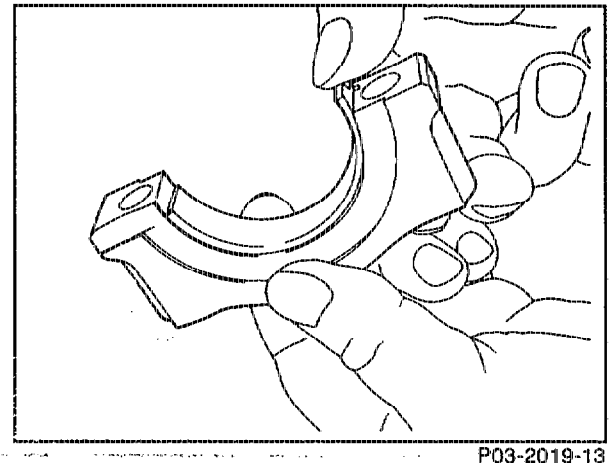
4 Measure crankshaft bearing bore in direction A, B and C at two levels (conicity); note measured values.

If a crankshaft bearing bore exceeds the specified value or is conical, dress bearing cap at its mating surface on a dressing plate up to max. 0.02 mm.

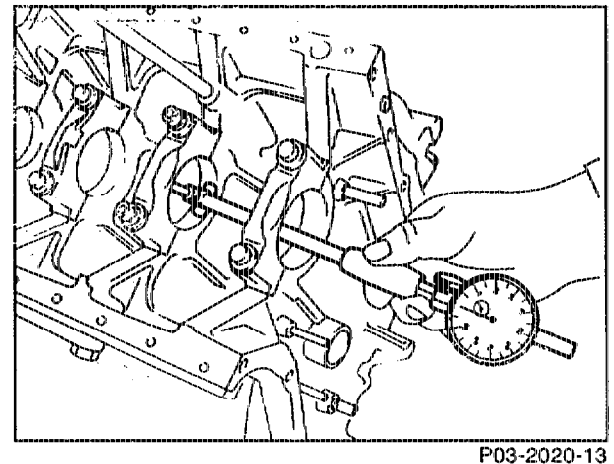


5 Insert bearing shells, install crankshaft bearing cap.

Tighten nuts and side bolts to 50 Nm.



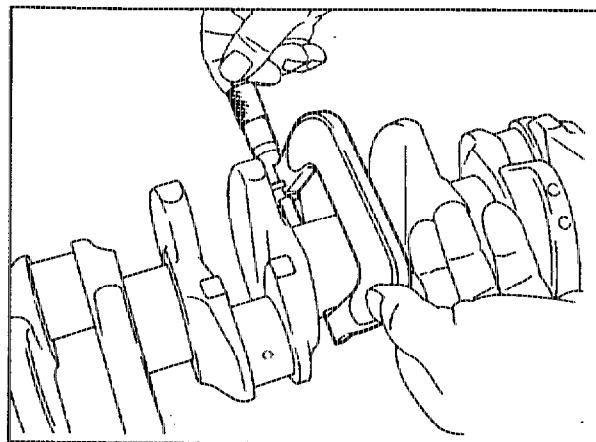
6 Measure bearing diameter and note.



7 Measure crankshaft bearing journals, determine radial play of crankshaft bearing.

Note

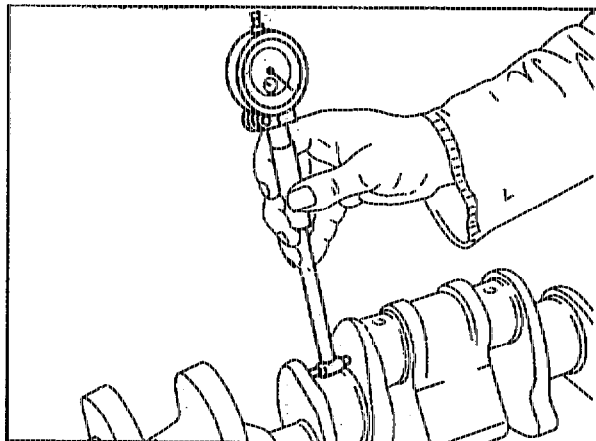
The bearing play can be corrected by replacing the bearing shells (see table Matching crankshaft bearing shells to crankcase); in this case, aim for the average value of the bearing play stated.



P03-2021-13

8 Measure width of fit bearing journal and of fit bearing. Determine axial play of crankshaft.

The fit bearing shells of the repair sizes are supplied oversized.

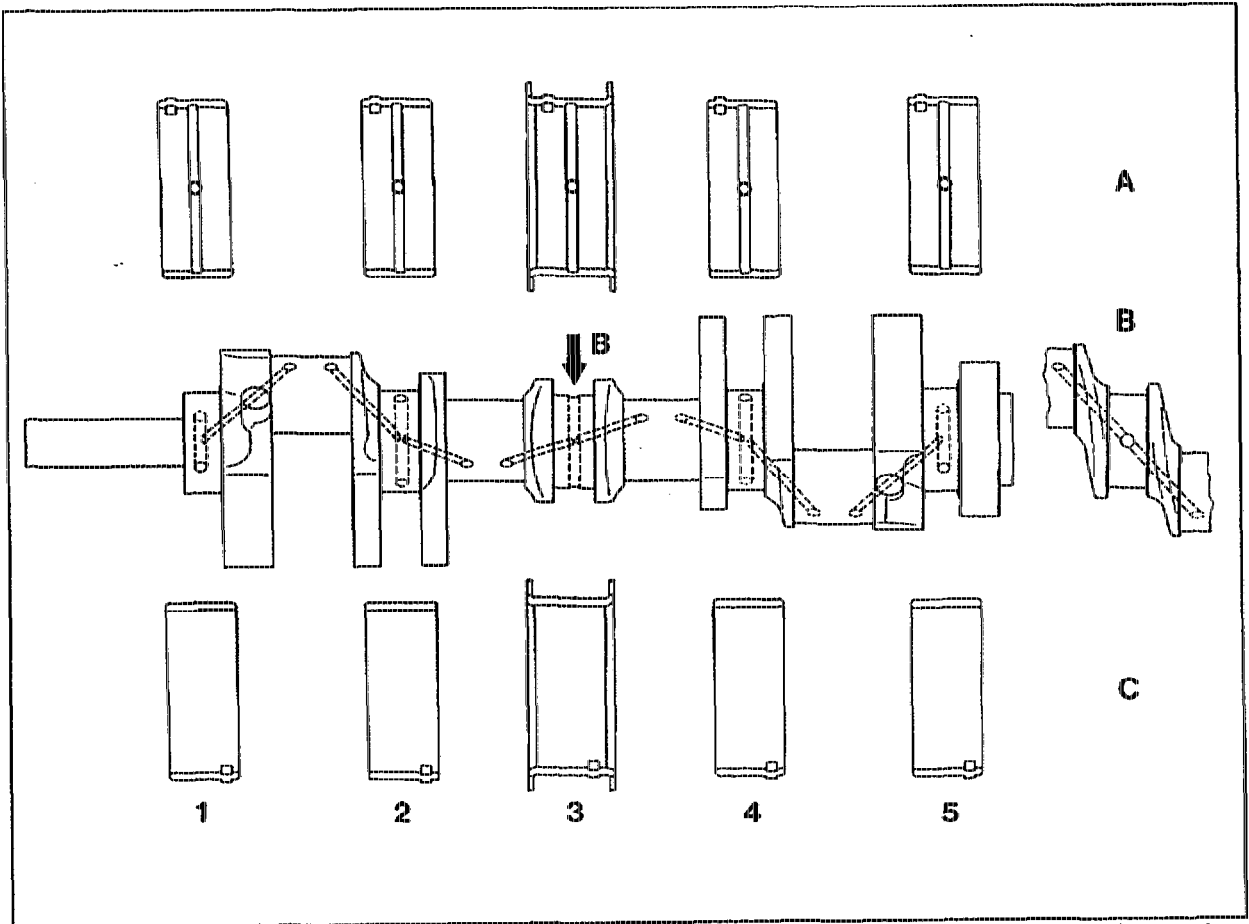


P03-2097-13

9 Moisten bearing shells and crankshaft with SAE 30 engine oil and insert crankshaft.



Install bearing shells with oil drilling into the crankcase.



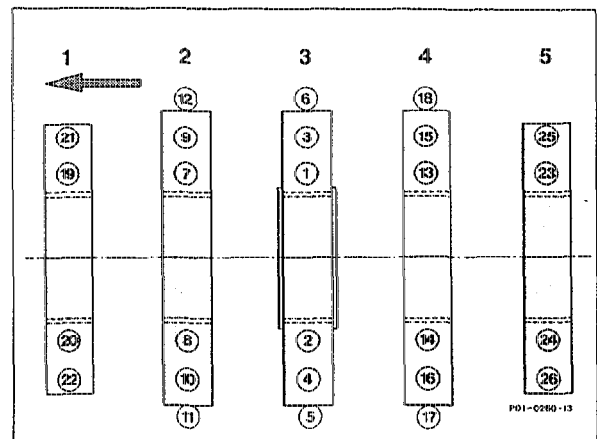
P03-0192-57

- A Crankcase
- B Fit bearing
- C Crankshaft

10 Tighten crankshaft bearing caps to the specified torque in the order of the tightening diagram. Oil the thread and the bolt head or nut contact surface for this step.

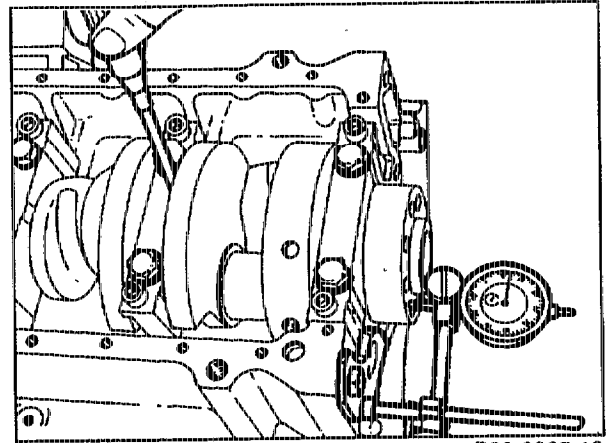
Nuts 50 Nm.
Side bolts 50 Nm

Note
Bolts of quality 10.9 should be used for the side bearing cap fixture.



11 Measure axial play of crankshaft.

12 Rotate crankshaft by hand and check whether it runs freely.

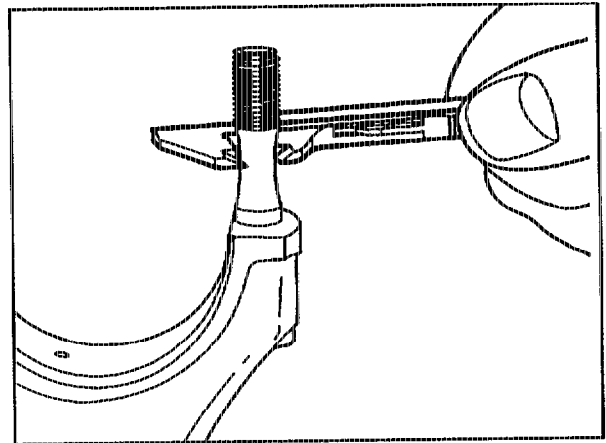


P03-2225-13

Matching conrod bearings and installing

13 Examine conrod bolts (03-3100).

14 Repair and align conrod (03-3130).

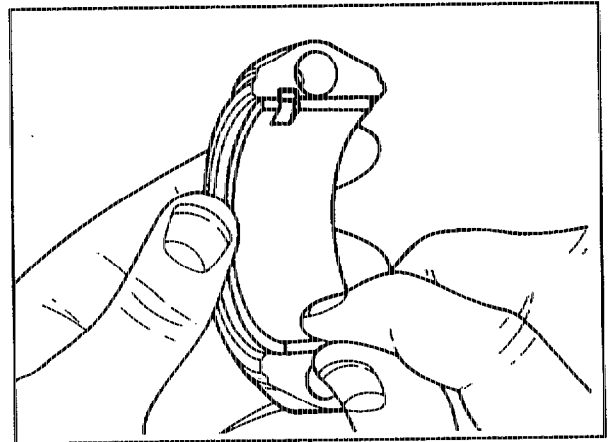


P03-2220-13

15 Insert conrod bearing shells, install conrod bearing caps with conrod bearing shells and tighten conrod nuts or bolts to 35 Nm.

16 Measure bearing diameter and note.

17 Measure conrod bearing journal. Determine radial play of conrod bearing.



P03-2222-13

Note

The bearing play can be corrected by replacing the conrod bearing shells; if this step is performed, aim for the average value of the specified bearing play.

Crankshaft bearing shells without colour coding are thicker than those with blue colour coding, although it should be noted that the wall thicknesses without and with colour coding may overlap.

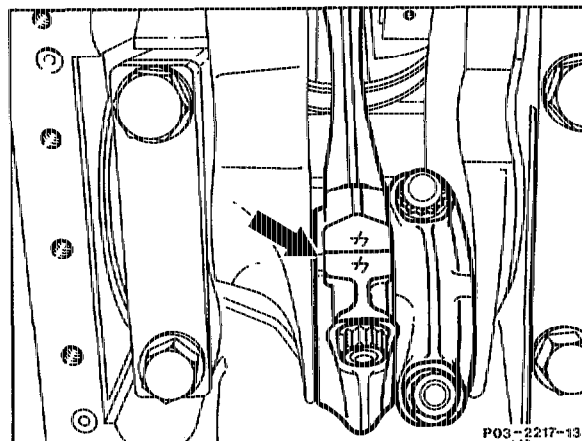
18 Install pistons and conrod (03-3160).

19 Moisten bearing shells, crankshafts, pistons and cylinders with SAE 30 engine oil. Install conrod with pistons (03-3160).

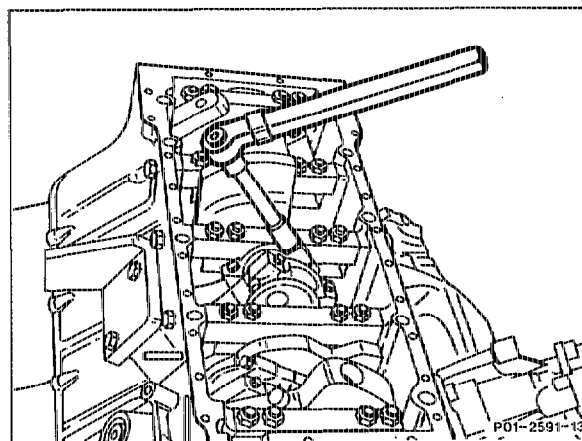


Pay attention to marking.

Install the bearing shells with the oil drilling in the conrod otherwise the conrod bushes will not be lubricated.



20 Tighten conrod nuts and conrod bolts (03-3100).

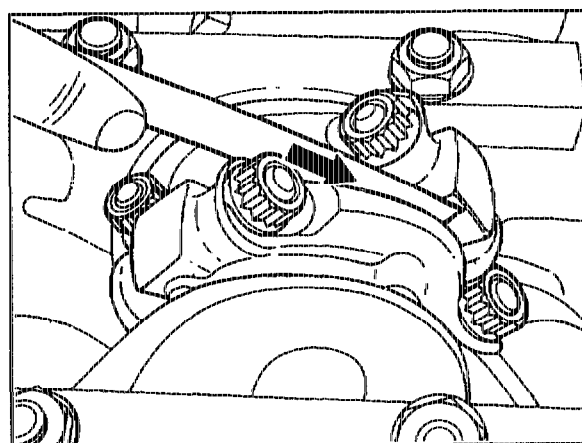


21 Measure axial play of conrod bearings. Examine clearance of conrod in the piston.

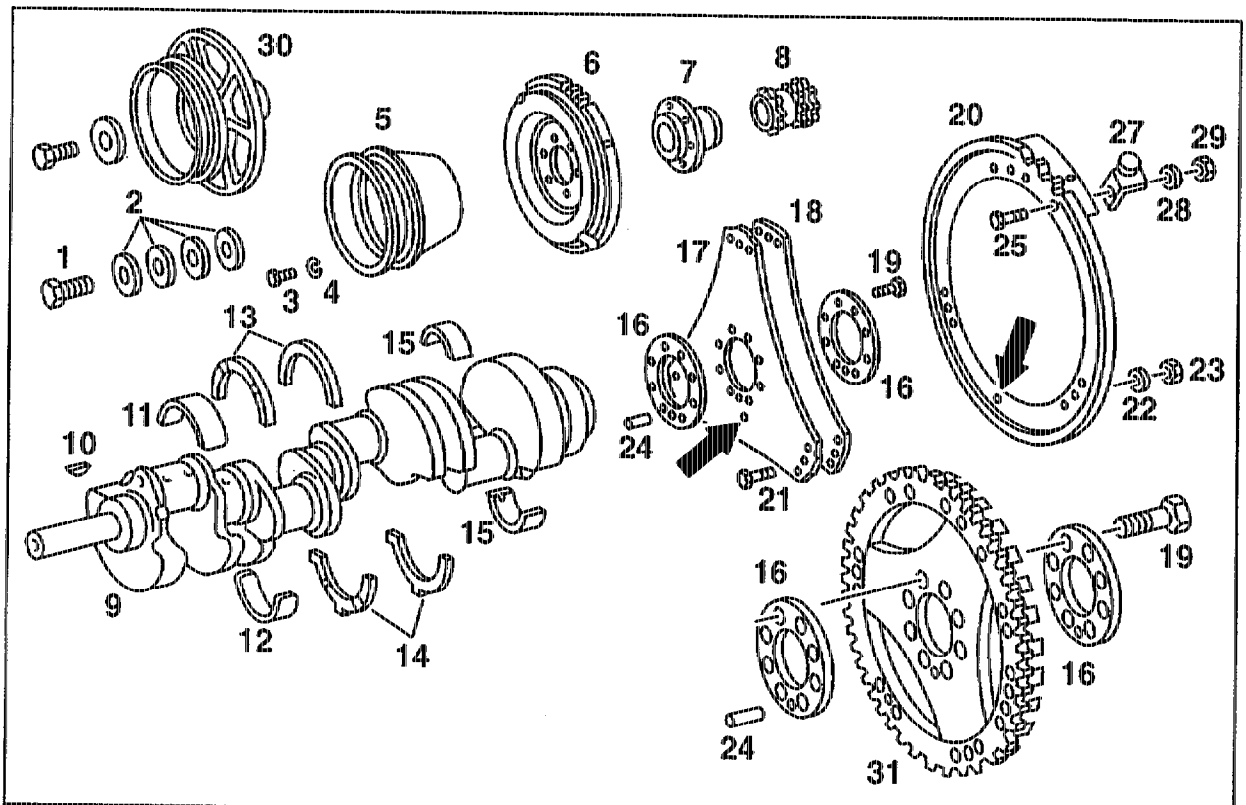


Disassemble oil pump, clean, renew if necessary. Replace oil delivery valve. Clean oil filter, carefully clean air-to-oil cooler or replace.

Install initial operation oil filter element.
Change engine oil and oil filter element after 1000 – 1500 km.



B. Engine 119.97/98 with thrust washers



P03.30-0253-56

1	Bolt M 18×1.5×45 mm	16	Discs 4.5 mm thick
2	Belleville spring washers (4 ea.)	17	Driven plate 1.5 mm thick, 296 mm dia.
3	Bolt M 8×22 (6 ea.)	18	Driven plate 1 mm thick, 287 mm dia.
4	Spring lock washer A8	19	Stretch bolt for driven plates M 12×1.5×23 (8 ea.)
5	Belt pulley	20	Ring gear with segments
6	Vibration damper	21	Fit bolts M 6×12 mm
7	Hub	22	Spring washer B 6
8	Crankshaft gear	23	Nut M 6
9	Crankshaft	24	Locating pin
10	Woodruff key	25	Bolt M5×10
11	Crankshaft bearing shell in crankcase	26	Bracket
12	Crankshaft bearing shell in bearing cap	27	Magnet
13	Fit bearing shell in crankcase with oil groove and drilling	28	Washer A 5.3
14	Fit bearing shell in bearing cap	29	Nut M5
15	Conrod bearing shells	30	Integrated vibration damper with belt pulley
		31	Starter ring gear increment (as of Motronic)

Data M119.971/975/981/985

Crankshaft standard size and repair sizes	Crankshaft bearing journal Ø	Color coding	Thickness of thrust washers at fit bearing	Crankshaft journal width at fit bearing	Crankshaft bearing journal Ø	Crankshaft bearing journal width
Standard size	<u>63.960</u> ¹⁾ 63.965	→ blue	2.20 ²⁾ or 2.25 ²⁾ or 2.30 ²⁾	<u>27.000</u> 27.033	<u>47.955</u> 47.965	<u>50.000</u> 50.100
	<u>63.955</u> ¹⁾ 63.960	→ yellow				
	<u>63.950</u> ¹⁾ 63.955	→ red				
Standard size I	<u>63.945</u> 63.950					
	<u>63.940</u> 63.945					
	<u>63.935</u> 63.940					

¹⁾ Tolerance division for bottom bearing cap, colored dots on crank webs or counterweights next to crankshaft bearing journals.

²⁾ Crankshaft main bearing with thrust washers as of engine no. 119.970 12 036277
119.971 12 017447
119.972 12 004797
119.974 12 008072
119.975 12 010516
119.98 as of start of production

Crankshaft bearing bore, conrod bearing bore and bearing play in mm

	Crankcase	Color coding	Conrod
Crankshaft bearing bore	<u>68.480</u> ³⁾ 68.486	→ blue	--
	<u>68.486</u> ³⁾ 68.492	→ yellow	
	<u>68.492</u> ³⁾ 68.500	→ red	
Conrod bearing bore	--	--	<u>51.600</u> 51.619
Permissible out-of-roundness and conicity of bores	0.01		0.01
Radial bearing play	when new	0.021–0.045 ⁴⁾	0.030–0.055 ⁴⁾
	wear limit	0.090	0.080
Axial bearing play	when new	0.10–0.22	0.22–0.38
	wear limit	0.30	0.50

³⁾ Tolerance division for top bearing cap, chisel punch points in contact surface of crankcase at oil sump end.

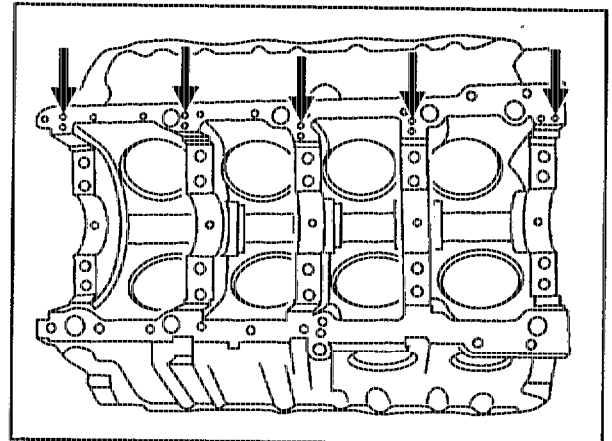
⁴⁾ Aim for the average value of radial bearing play.

Matching crankshaft bearing shells to crankcase

				Matching top bearing shell with color coding		
				1 chisel point	2 chisel points	3 chisel points
Chisel punch points on crankcase				1 chisel point	2 chisel points	3 chisel points
Colored dots on crankshaft bearing cap				blue	yellow	red
Color of top bearing shell				blue	yellow	red
				Matching bottom bearing shell with color coding		
Color coding on crankshaft				blue	yellow	red
Color of bottom bearing shell				blue	yellow	red

The top and bottom standard size crankshaft bearing shells are supplied as replacement parts with the color codings blue, yellow and red. They should be matched according to the table. It is then no longer necessary to gage the bearing clearances.

Chisel punch points for matching crankshaft bearing shells



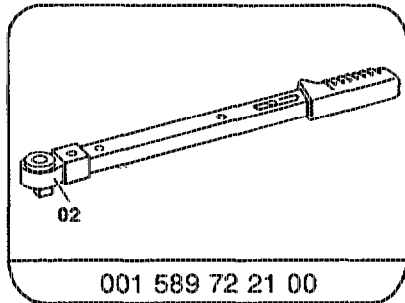
P03-5331-13

Tightening torques in Nm

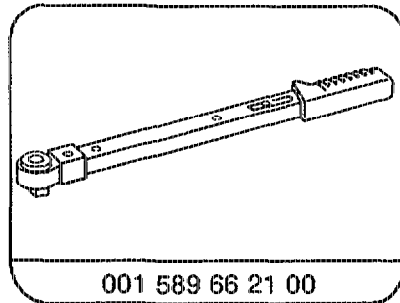
	Stud bolt in crankcase ⁵⁾	30
Crankshaft bearing stud bolt	M10×1 nut	50
	M10×40 side bolts (10.9)	50

5) The stud bolts lose their locking effect after being unscrewed and should therefore be used only once.

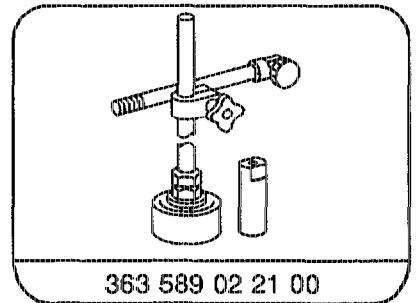
Special tools



001 589 72 21 00



001 589 66 21 00



363 589 02 21 00

Commercially available tools

Quick calipers for internal measurements, \varnothing 40 – 60 mm e.g. Hahn und Kolb
Borsigstraße 50
D-7000 Stuttgart 30
Order no. G 222 K

Quick calipers for internal measurements, \varnothing 60 – 80 mm Order no. G 322 K

Micrometer 25 – 50 mm Order no. 31346 025

Micrometer 50 – 75 mm Order no. 31346 050

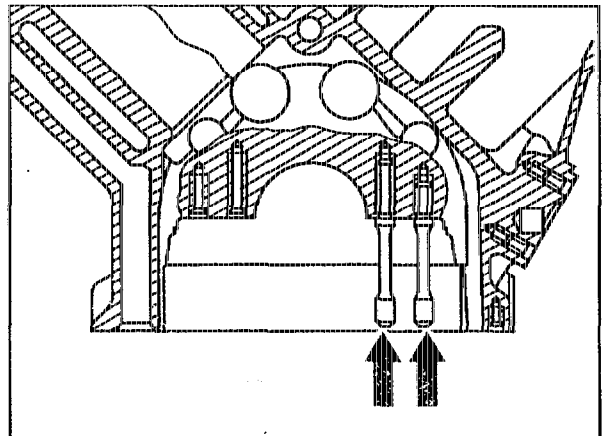
Note

Self-locking stud bolts are inserted into the crankcase for attaching the crankshaft bearing caps. The stud bolts should only be used once as the locking fluid applied over a length of about 8 mm of the thread is rendered ineffective when the bolts are unscrewed.

Pay attention to different insertion depth and collar \varnothing when replacing the stud bolts.



When performing repairs, do not use HELI-COIL inserts for the self-locking stud bolts of the crankshaft bearing caps.

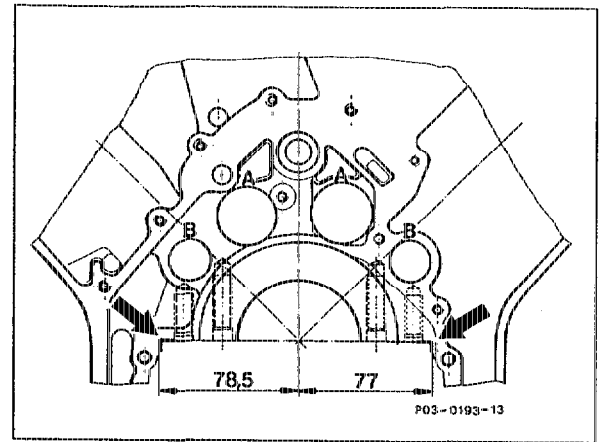


P03-5337-13

The 5 crankshaft bearing caps are manufactured from malleable cast iron and are interference-fitted in the side of the crankcase (arrows). The fit (arrows) is off-centered with the result that the bearing caps can only be installed in one position.

The three center bearing caps are additionally bolted to the side walls of the housing.

The crankshaft bearing caps are machined together with the crankcase and are not available as a replacement part.



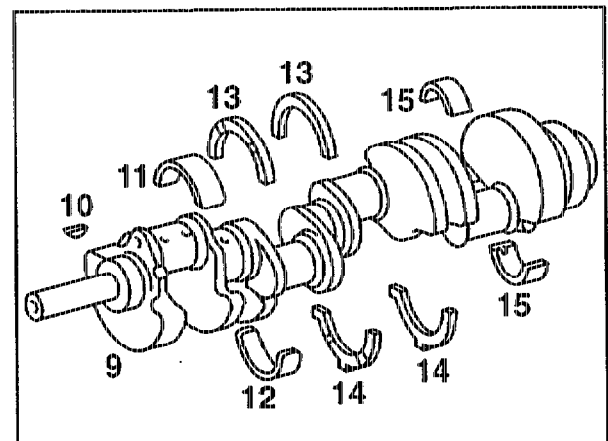
Standard bearing shells and thrust washers are installed at the 3rd crankshaft bearing (fit bearing).

The thrust washers absorb the axial forces of the crankshaft.

The thrust washers (13 and 14) inserted on both sides of the crankcase and the bearing cap, are identical.

The thrust washers in the bearing cap each have two retaining lugs, the bottom lugs being positioned off-center, as an anti-twist lock and to avoid incorrect installation. In addition, all the thrust washers are chamfered at one end. The two oil grooves in the thrust washers must face towards the crank webs.

When repairing crankshafts, the fit bearing journals should be re-ground in width to one of the dimensions stated in the table (section "Data").



After bearing damage has occurred, the conrod should be taken out and any swarf present in the conrod bores and in the crankshaft oil galleries, removed.

Carefully clean oil galleries in crankcase, crankshaft, timing case cover, oil filter housing, end cover, oil pump etc.

Inspect crankshafts for cracks, dimensional tolerance and hardness.

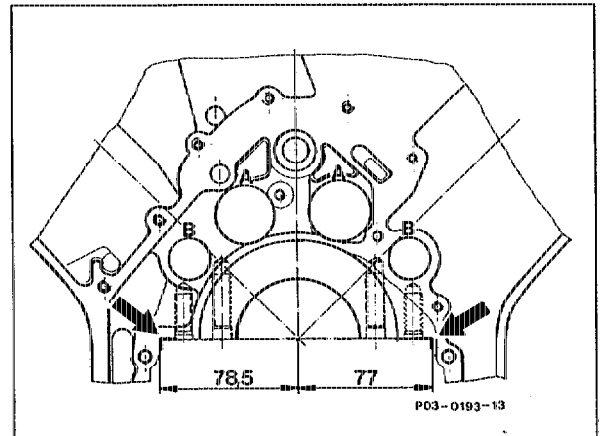
Matching crankshaft bearings, installing crankshaft

1 Install crankshaft bearing caps; pay attention to marking, 1 is at the front.

The fit is asymmetrical (arrows) with the result that the crankshaft bearing caps can only be installed in one position.

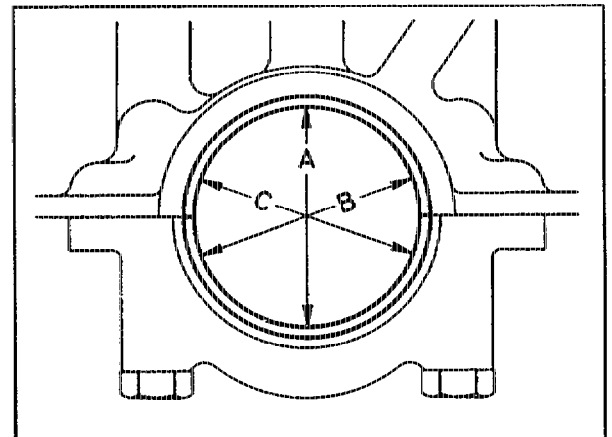
2 Oil contact surface of nut and thread and tighten nuts to 50 Nm.

3 Oil the thread and the bolt head contact surface of the side bolts (M10 × 40), install with the washers and tighten to 50 Nm.



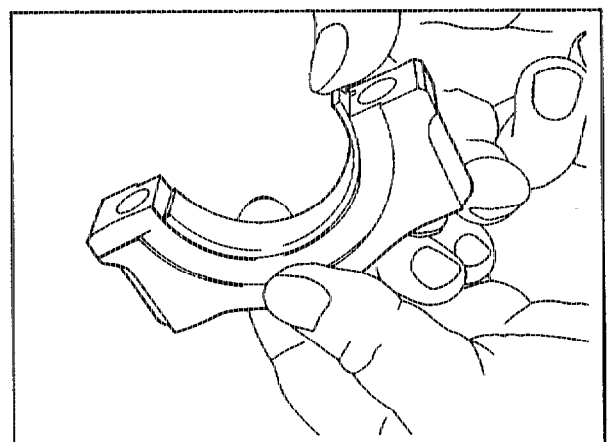
4 Measure crankshaft bearing bore in the direction A, B and C at two planes (conicity) and note the measurements obtained.

If a crankshaft bearing bore exceeds the specified data or is conical in shape, dress the contact surface of the bearing cap on a dressing plate to not more than 0.02 mm.

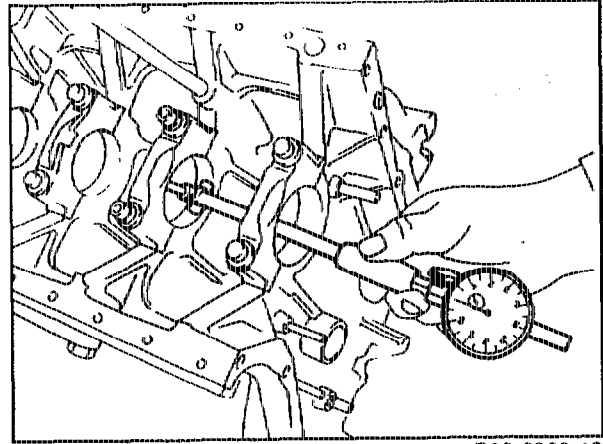


5 Insert bearing shells and install crankshaft bearing cap.

Tighten nuts and side bolts to 50 Nm.



6 Measure bearing diameter and note.

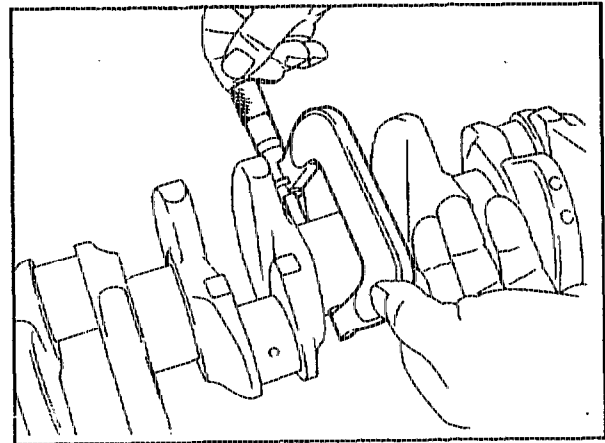


P03-2020-13

7 Measure crankshaft bearing journal and determine radial crankshaft bearing play.

Note

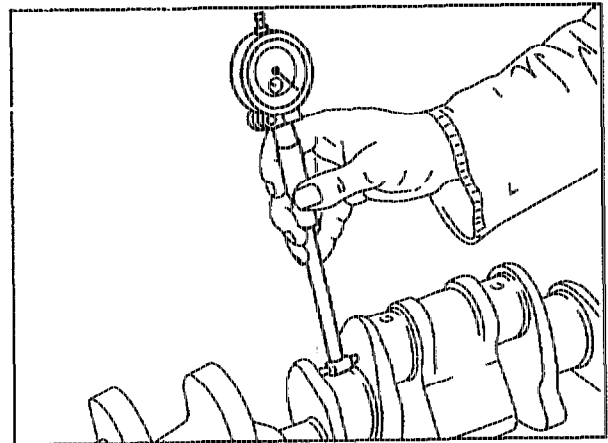
The bearing play can be corrected by replacing the bearing shells (see table Matching crankshaft bearing shells to crankcase).



P03-2021-13

8 Measure width of fit bearing journal and of fit bearing and determine axial crankshaft bearing play.
(See table of Data)

The repair size fit bearing shells are supplied oversized.



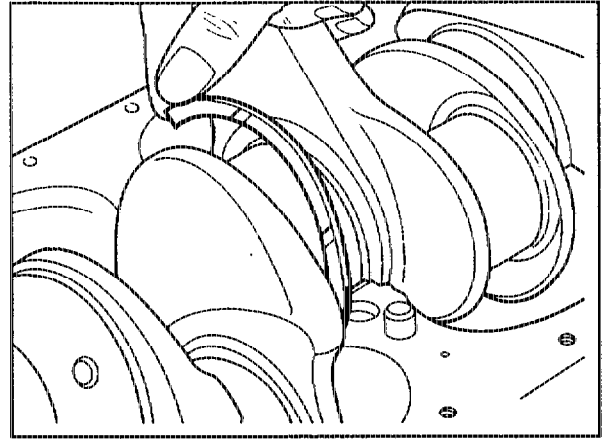
P03-2097-13

9 Moisten bearing shells and crankshaft with SAE 30 engine oil and insert crankshaft.



Install bearing shells with oil drilling in the crankcase.

10 Oil thrust washers with engine oil and push into the grooves at the fit bearing (crankcase).

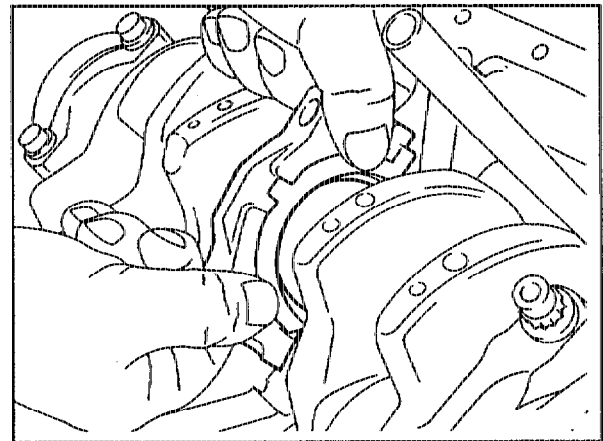


P03-2023-13

11 Install fit bearing cap.



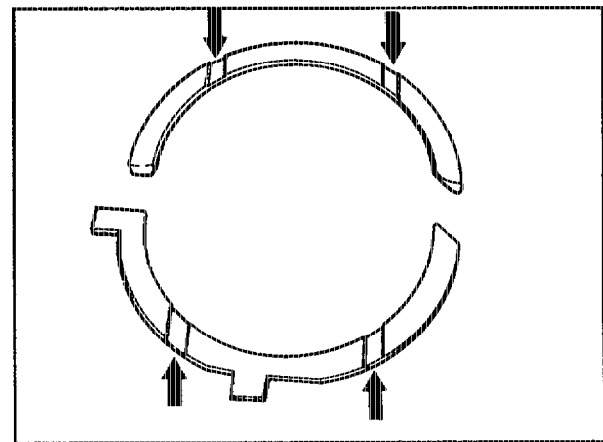
Hold both thrust washers tight when installing the fit bearing cap.



P03-2018-13



The two oil grooves (arrows) in the thrust washers must face toward the crank webs.



P03-2058-13

12 Install crankshaft bearing caps.

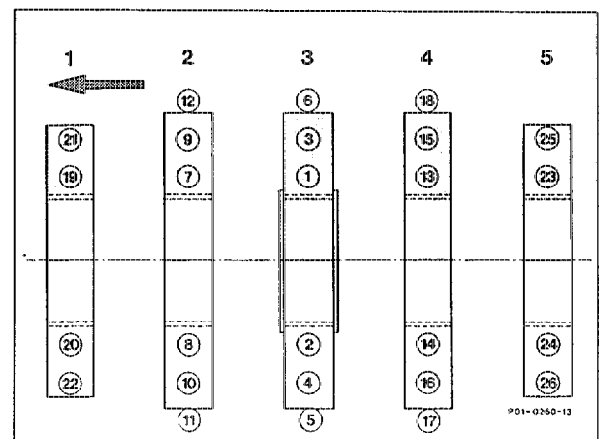
13 Tighten crankshaft bearing caps to the specified torque in the order of the tightening diagram. Oil the thread and the bolt head and nut contact surface for this step.

Nuts 50 Nm.

Side bolts 50 Nm

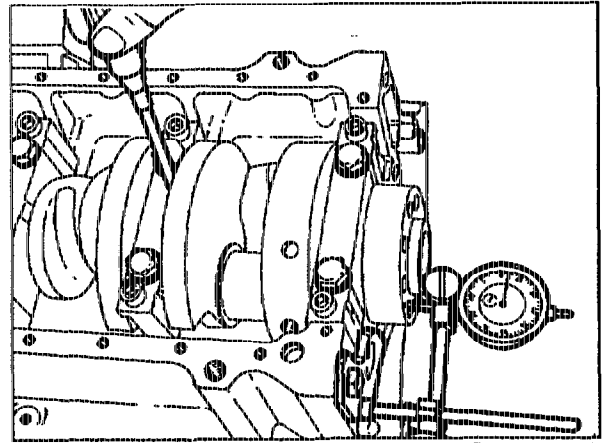
Note

Bolts of quality 10.9 should be used for the side bearing cap connection.



14 Measure crankshaft bearing axial play.

15 Rotate crankshaft by hand and check whether it rotates freely.

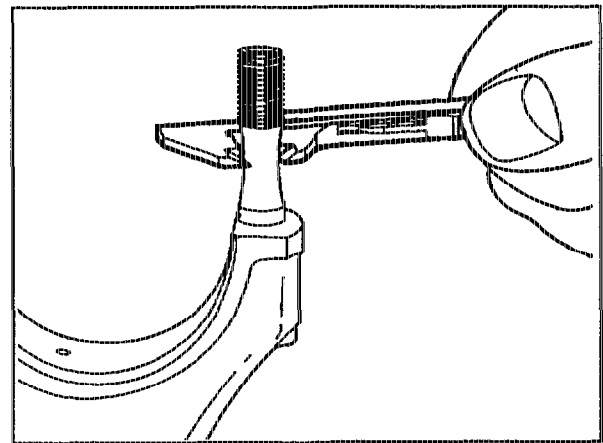


P03-2225-13

Matching conrod bearings and installing

16 Inspect conrod bolts (03-3100).

17 Repair conrod and align (03-3130).

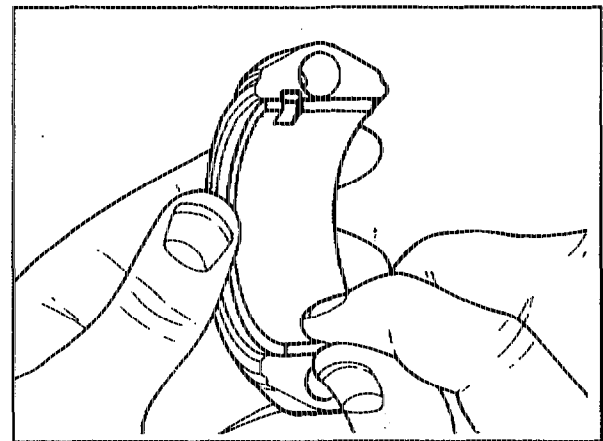


P03-2220-13

18 Insert conrod bearing shells, install conrod bearing caps with conrod bearing shells and tighten conrod nuts and bolts to 35 Nm.

19 Measure bearing diameter and note.

20 Measure conrod bearing journals and determine conrod bearing radial play.



P03-2222-13

Note

The bearing play can be corrected by replacing the conrod bearing shells. Aim for the average value of the bearing play stated.

Conrod bearing shells without color coding are thicker than those with blue color coding; note, however, that the wall thicknesses with and without color coding may overlap.

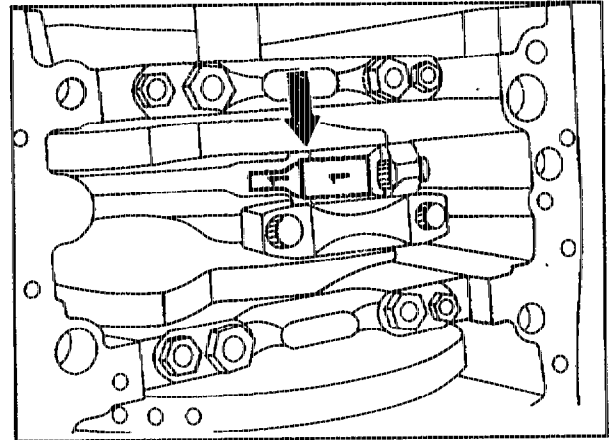
21 Assemble pistons and conrod (03-3160).

22 Moisten bearing shells, crankshafts, pistons and cylinders with SAE 30 engine oil. Install conrod with pistons (03-3160).



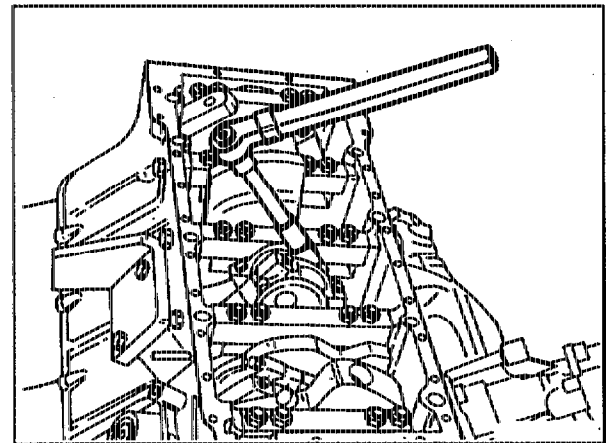
Pay attention to identification.

Install the bearing shells with the oil drilling in the conrod otherwise the conrod bushes will not be lubricated.



P03-5033-13

23 Tighten conrod bolts (03-3100).



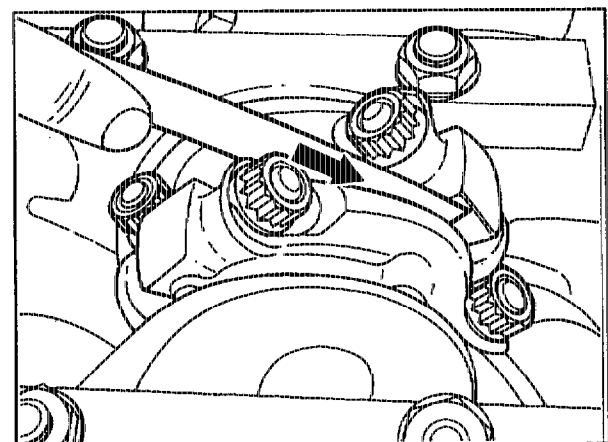
P01-2591-13

21 Measure conrod bearing axial play. Inspect clearance of conrods in piston.



Disassemble oil pump, clean, replace if necessary. Replace oil delivery valve. Clean oil filter, carefully clean air-oil cooler or replace.

Install initial operation oil filter element.
Change engine oil and oil filter element after 1000-1500 km.

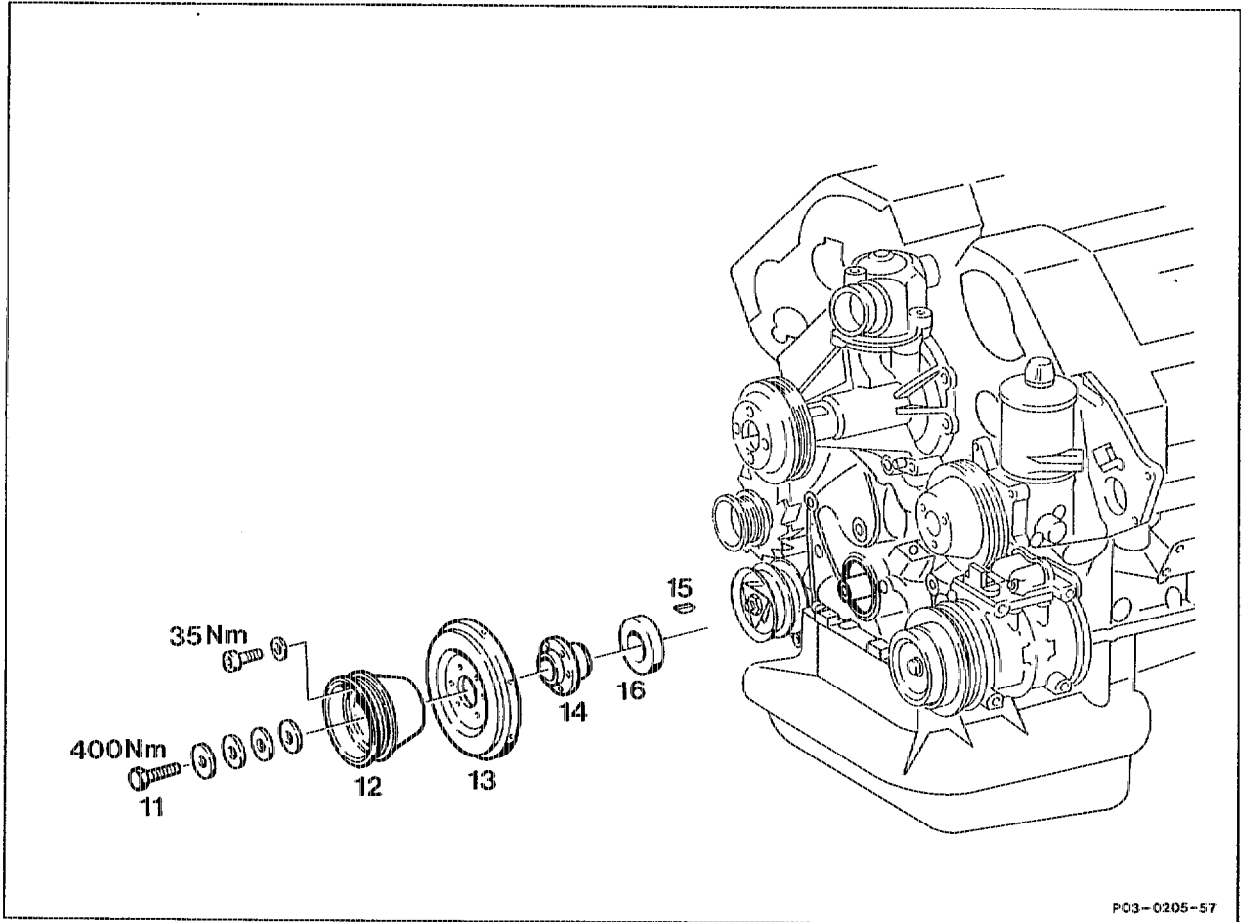


P03-2219-13

03-3240 Replacing front crankshaft radial seal

Preceding work:
Belt pulley, vibration damper and hub removed (03-3420).

Operation no. of operation texts and work units or standard texts
and flat rates
03-3000 - 01-3112



P03-0205-57

Belt pulley (12), vibration damper (13) and hub (14)	remove, install (03-3420).
Radial seal (16)	remove (step 2).
Mounting bore	clean, deburr.
Sealing lip of radial seal (16)	oil (step 4).
Radial seal (16)	install with insertion sleeve, special tool 119 589 01 14 00 (step 5).

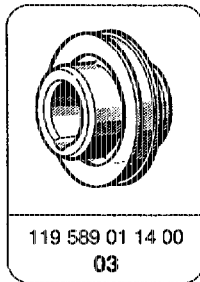


Pay attention to installation position in the case of hubs (14) with running marks (step 6).

Leaks

check with engine running.

Special tool

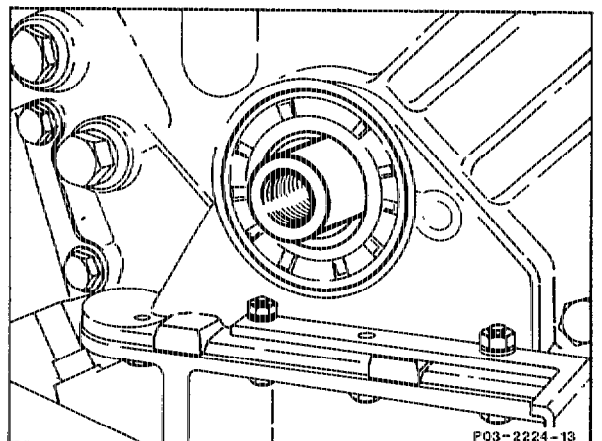


Note

An oil leak can be determined after spraying the dried and cleaned surrounding area with Mercedes-Benz white contrast spray 000 989 03 59.

- 1 Check hub of belt pulley for running marks.

If running marks are present, install radial seal offset 3 mm to the inside (see step 6).



2 Lever out radial seal with a screwdriver.



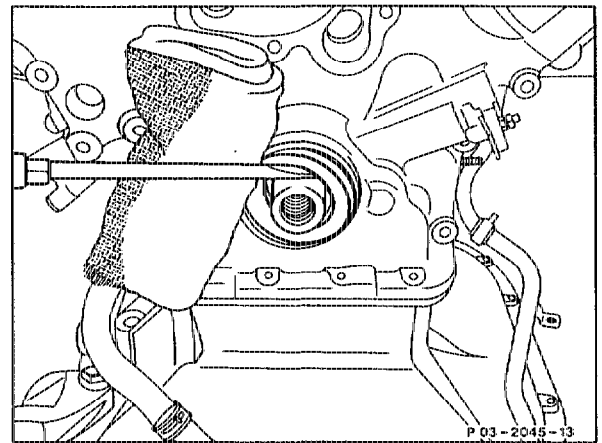
Do not damage crankshaft and mounting bore for the radial seal, use clean cloths as a base.

3 Deburr edge of mounting hole for the radial seal.

4 Oil sealing lip of the radial seal.



Do not use grease. Grease prevents the angled webs on the sealing lip transporting back the engine oil.



5 Fit radial seal (16) onto the side a of the insertion sleeve 119 589 01 14 00 and draw in as far as the stop with bolt (11) and 4 Belleville spring washers (11a).

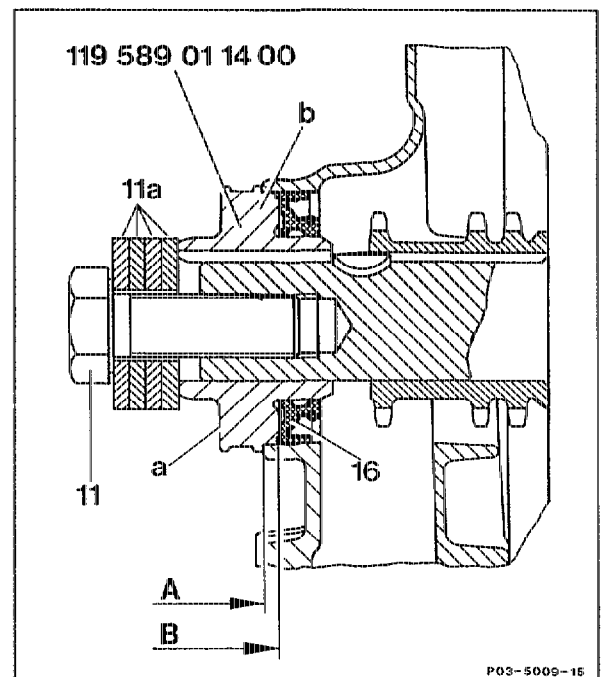


The radial seal (16) must be at right angles to the hub otherwise it will not provide a proper seal.

6 If the hub has running scores, position radial seal (16) 3 mm offset to the inside.

To do this, fit radial seal (16) onto the side b of the insertion sleeve 119 589 01 14 00 and draw in as far as the stop.

A = Standard position of radial seal
B = Repair position of radial seal



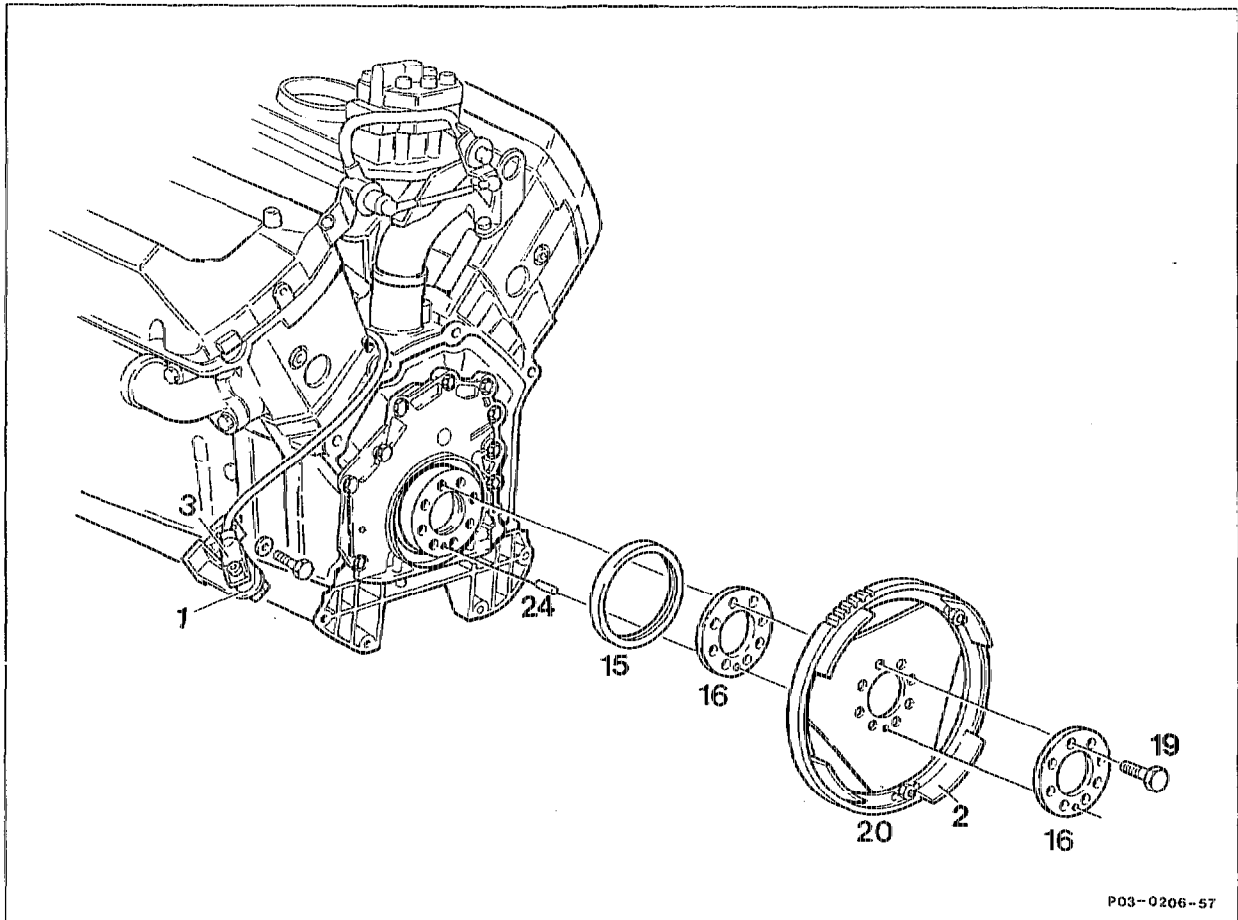
7 Install belt pulley, vibration damper and hub (03-3420).

8 Run engine and check for leaks.

03-3270 Replacing rear crankshaft radial seal

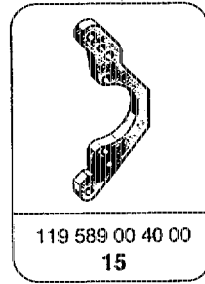
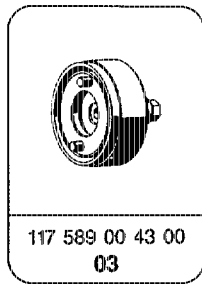
Preceding work:
 Transmission removed (27-600).
 Driven plates removed (03-4100).

Operation no. of operation texts and work units or standard texts
 and flat rates
 03-3063 - 03-3301



Radial seal (15)	remove (step 1).
Sealing lip of radial seal (15)	oil.
Radial seal (15)	install with insertion tool, special tool 117 589 00 43 00 (steps 3 to 6).
Driven plates (20)	install (03-4100).
Leaks	check at rear of engine when running (01-2240).

Special tools

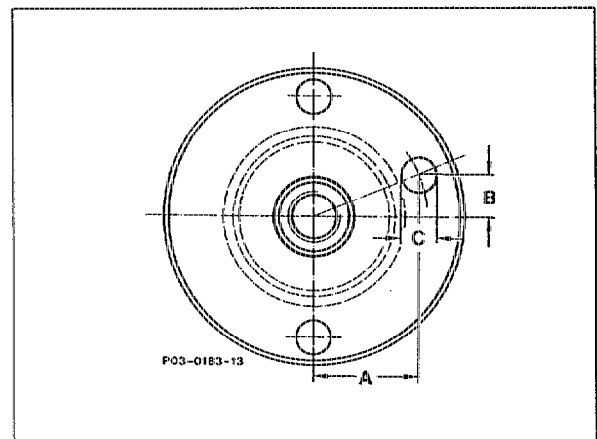


Insertion tool

Use only insertion sleeve 117 589 00 43 00 (2nd version) with hole for locating pin.

Insertion sleeve 117 589 00 43 00 (1st version) can be altered by a hole with the dimensions "A, B, C" as shown in the drawing.

Size A = 38 mm
 B = 15.6 mm
 C = 10 mm

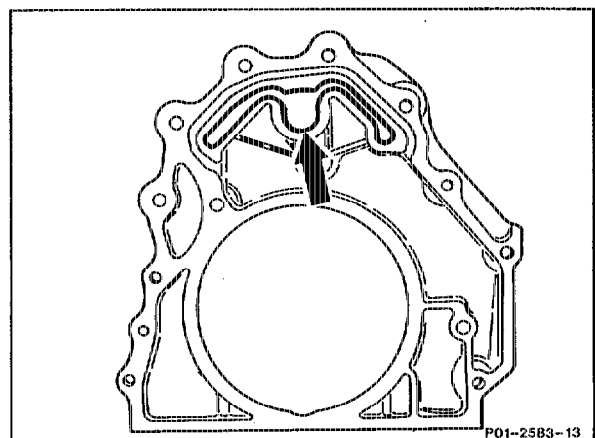


Note

The end cover guides the engine oil from the main oil gallery (arrow) to the two oil passages for the oil supply of the cylinder heads and is sealed with a sealing compound.

For this reason, the radial seal should be replaced if possible without removing the end cover.

If a leak exists at the rear, first of all clean engine and spray dried surrounding area with Mercedes-Benz white contrast spray, Part No. 000 989 03 59. Support engine, run and determine leakage point.

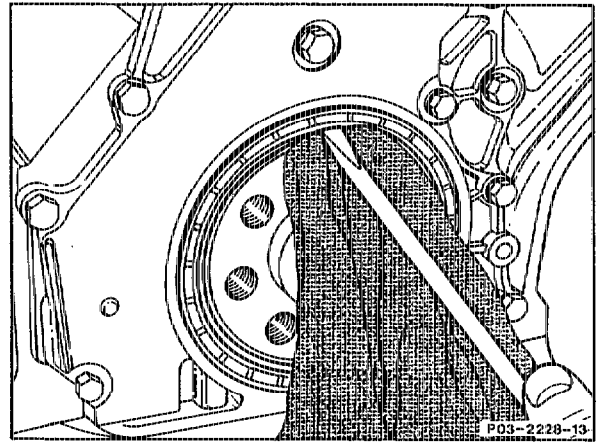


The running surface for the rear radial seal on the crankshaft is hardened and ground without a spiral.

1 Prise out radial seal with a screwdriver.

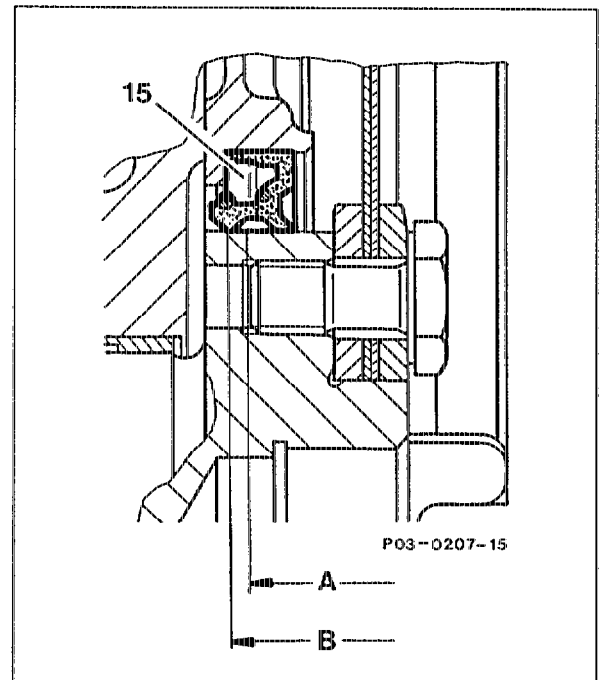


Do not damage crankshaft and mounting hole for the radial seal. Use clean cloth as a base.



2 Examine running surface on crankshaft. If running surface has grooves, install repair size radial seal (15) with sealing lip offset 1.75 mm to inside, and maintain offset repair position of radial seal.

Position of sealing lip
A = radial seal, standard position
B = radial seal, repair position



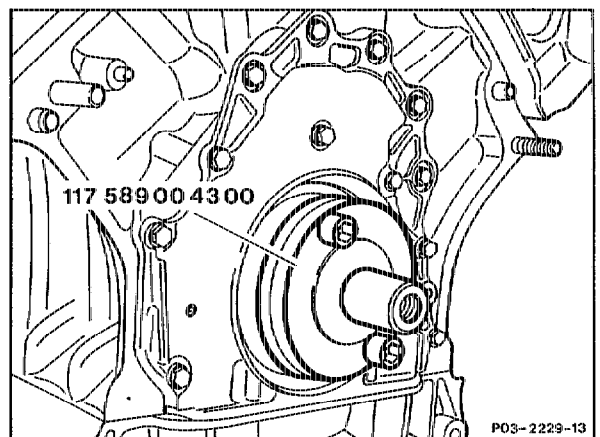
3 Bolt inner part of special tool 117 589 00 43 00 to crankshaft.

4 Coat radial seal between dust lip and sealing lip with engine oil.



Do not use grease! Grease prevents the sealing lip of the radial seal transporting back the engine oil.

5 Push radial seal onto inner part of special tool 117 589 00 43 00.

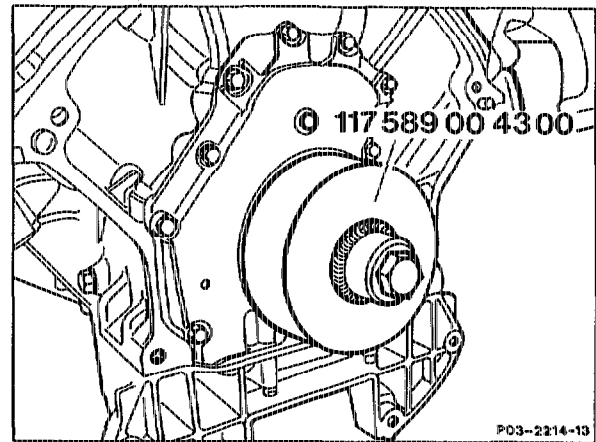


6 Press radial seal into the end cover with the insertion tool 117 589 00 43 00.

Note

The dust lip must not touch the crankshaft otherwise leaks will occur as a result of the pumping effect.

7 Check rear of engine for leaks with engine running (01-2240).



03-3420 Removing and installing belt pulley of vibration damper and hub

Preceding work:

Model 124: radiator removed (20-4200).

Viscous fan clutch removed (20-3120).

Tensioning device removed (13-3450).

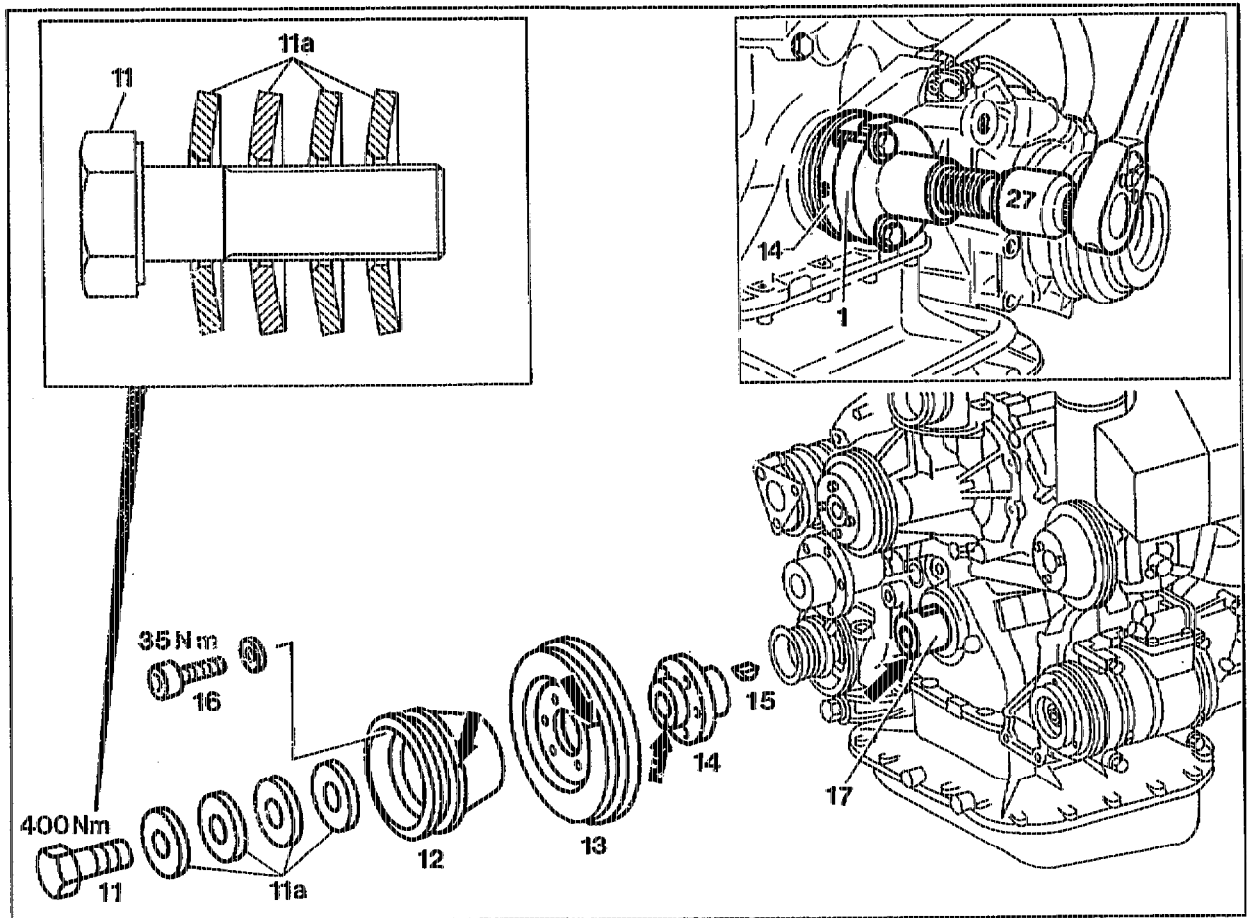
Reservoir with coolant drain line removed (20-2120).

Retaining lock for crankshaft/ring gear installed (03-5000).

Operation no. of operation texts and work units or standard texts and flat rates

03-1320-1911

A. Engine 119.960 119.97 up to 8/1994



P03-5261-57

If AC fitted: guard plate

attach to condenser.

Belt pulley (12)

mark relative to vibration damper (13) with coloured marking (arrows).

Installation note

The belt pulley (12), the vibration damper (13) and the hub (14) must be bolted together in a particular position as one of the 6 holes is positioned off-center.

Central bolt (11) with 4 dished washers (11a) . . . unscrew, screw on (400 Nm).

Installation note

Oil bolt thread and the 4 belleville spring washers (11a).

Fit on spring washers (11a) with curved side facing bolt head.

Bolts (16) unscrew, screw on (35 Nm).

Belt pulley (12) and vibration damper (13) remove, install.

Crankshaft and hub (14) mark relative to each other with chisel punch (arrow).

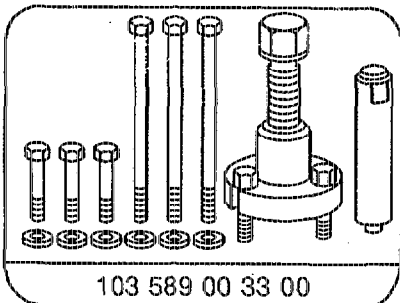
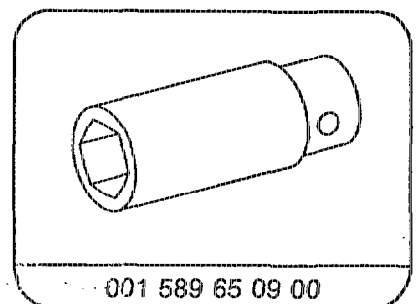
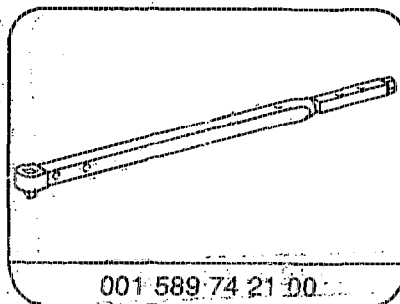
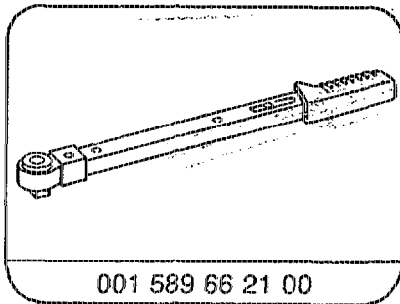
Hub (14) remove with puller, special tool
103 589 00 33 00.

Installation note

Heat hub (14) to approx. 50 °C so that it slips easily onto the crankshaft. Determine by turning whether the groove in the hub (14) is aligned with the woodruff key (15) in the crankshaft.

Belt pulley (12) examine.

Special tools



Commercially available tool

3/4" internal square to
1/2" external square adaptor

e. g. Hazet
D-42853 Remscheid
Order no. 1058 RI

Shop-made tool

Guard plate for radiator at condenser

Dimensions approx. 680 × 400 × 1 mm

Data in mm

Permissible deviation at vibration damper

from radial runout 0.3

from axial runout 0.5

Tightening torques in Nm

M18 bolt of vibration damper

400

M8 bolts of belt pulley

35

Note

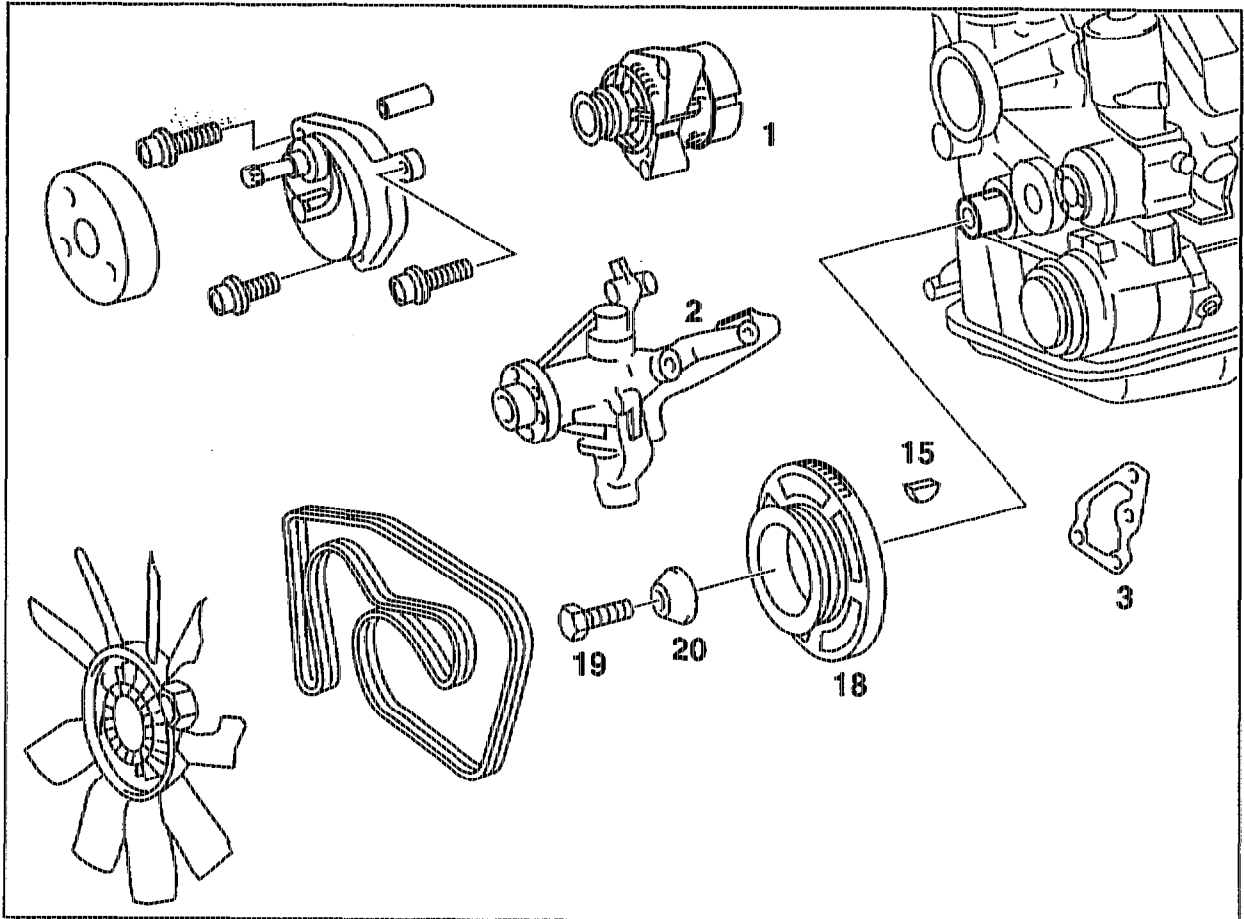
Engine 119.96/97: if the vibration damper is replaced, the TDC sensor should be set (03-3450).



B. Engine 119.97/98 ab 8/1994

Preceding work:
Viscous fan coupling removed (20-3120).
Tensioning device removed (13-3450).

Operation no. of operation texts and work units or standard texts
and flat rates
03-1320-1911



P03.30-0254-57

Ground cable at battery	disconnect, connect (AR54.10-0003A).
Generator (1)	remove, install.
Guard plate	attach at radiator, take off.
Viscous fan coupling bearing bracket (2)	remove, install (20-3140).
Bracket of A/C compressor carrier (3)	unbolt, bolt on.
Piston of cylinder 1	turn to TDC so that Woodruff key (15) in crankshaft is facing vertically up.
Retaining lock for crankshaft/ring gear	install, remove (03-5000).
Central bolt (19) with tapered washer (20)	unscrew, screw on (200 Nm + \angle 90°).

Note

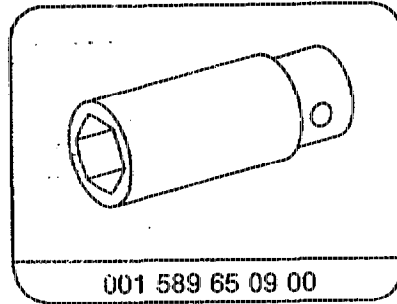
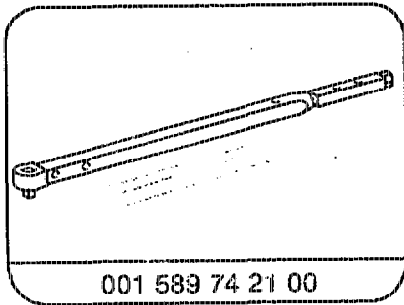
Conical washer (20) replaces dished washers;
the different parts of the 2 versions must not be
interchanged.

Vibration damper (18) pull off, remove upward, fit on.

Note

Align Woodruff key (15), fit on vibration damper (18) and turn in order to determine whether the slot is aligned with the Woodruff key (15) in the crankshaft.

Special tools



Commercially available tool

3/4" female to 1/2" male
4-point adapter

e. g. Firma Hazet
D-42853 Remscheid
Order no. 1058 RI

Shop-made tool

Guard plate for radiator and condenser

Dimensions: approx. 680 × 400 × 1 mm

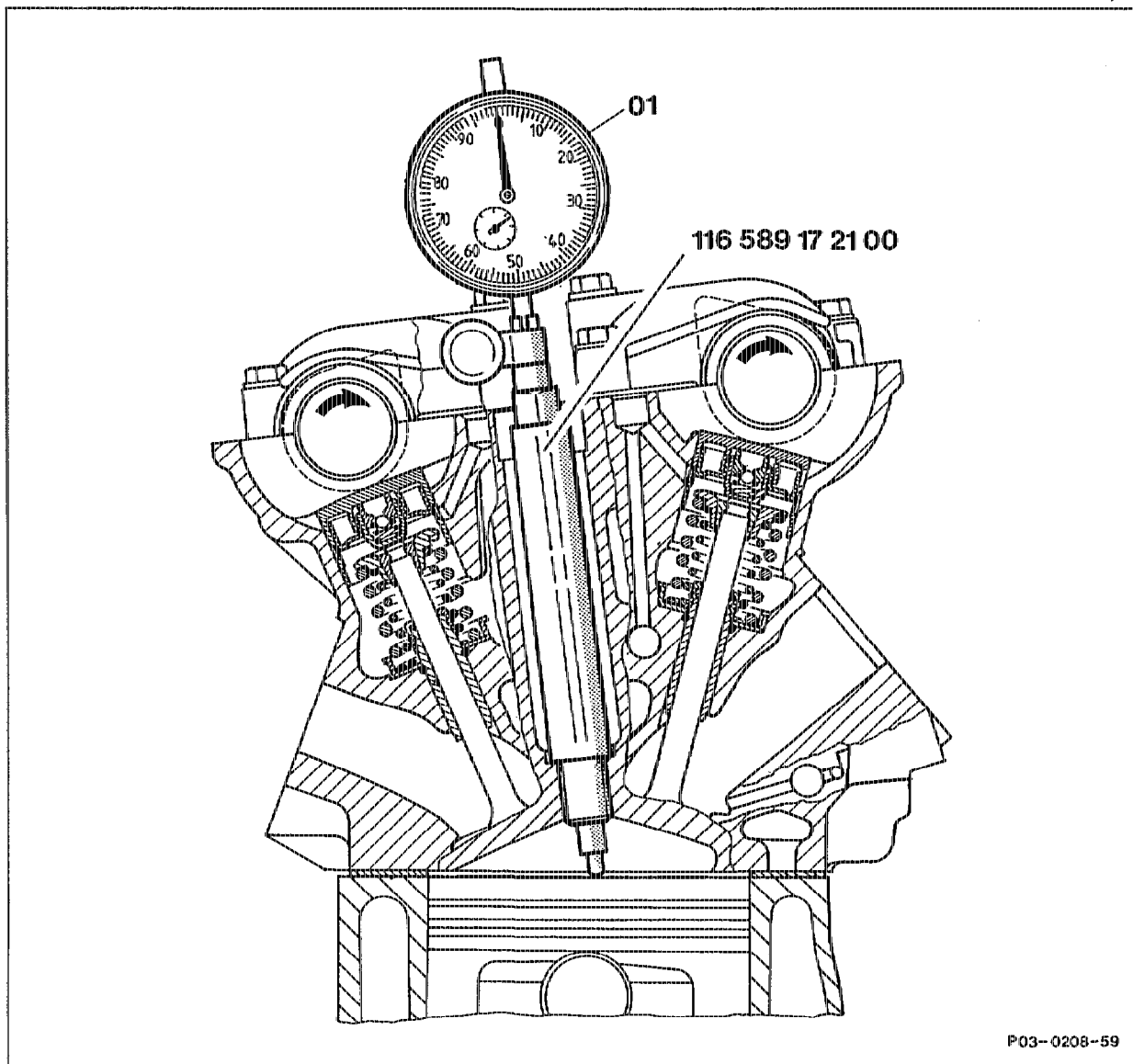
Tightening torques in Nm

M18 × 1.5 × 44 bolt of vibration damper
(with conical washer)

Initial torque	Nm	200
Tightening angle	∠	90°

03-3450 Checking and correcting setting of TDC sensor

Operation no. of operation texts and work units or standard texts
and flat rates
03-1101, 1122



Ground cable of battery	disconnect, connect.
Poly V-belt tensioning device	remove, install (13-3450).
Right cylinder head cover	remove, install (01-0500).
Piston of no. 1 cylinder	set to 10° before TDC.
Spark plug at no. 1 cylinder	remove, install (25 Nm)
Measuring pin 116 589 17 21 00	screw into spark plug thread of No. 1 cylinder, unscrew (step 6).
TDC sensor	remove, install (step 7).

Checking setting of TDC sensor

Dial gauge (01)	clamp tight in measuring pin with 4 mm preload, special tool 116 589 17 21 00 (step 8).
Crankshaft	turn in direction of rotation of engine and set TDC with dial gauge (01) (step 8).
Large point of dial gauge	set to "0" (step 8).
Engine	rotate with wrench socket in direction of rotation of engine until dial gauge has moved back by the value, see table "Data" (20° after TDC), special tool 001 589 65 09 00.
Fixing device	insert into adjusting slide, special tool 119 589 00 21 00 (step 10).
Fixing device	must engage in measuring cam on vibration damper, special too 119 589 00 21 00 (step 10).

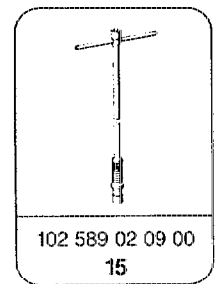
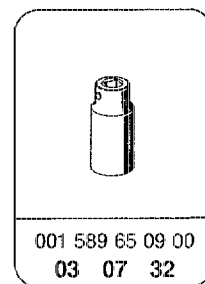
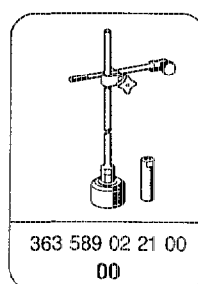
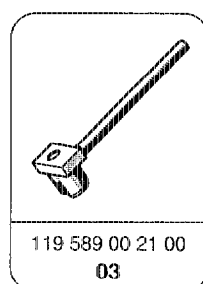
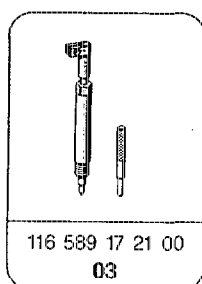
Correcting setting of TDC sensor

Nut of adjusting slide	slacken (step 11).
Adjusting slide	move until fixing device locks in place in measuring cam on vibration damper, special tool 119 589 00 21 00 (step 11).
Nut of adjusting slide	tighten (step 12).

Piston travel at crankshaft setting of 20° after TDC

Engine	119.960	119.970/974	119.971
Measurement through spark plug bore	3.25 mm	3.28 mm	2.99 mm
Vertical to piston	3.27 mm	3.30 mm	3.01 mm

Special tools



Commercially available tool

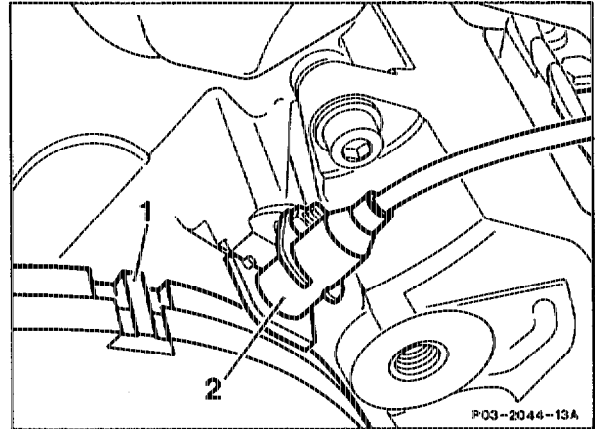
Dial gauge A 1 DIN 878

e. g. Mahr
D-7300 Esslingen
Order no. 311 000

Notes

The TDC sensor (2) with bracket is attached to the timing case cover.

The measuring cam (1) on the vibration damper must be positioned in the middle below the TDC sensor (2) when the crankshaft is in the position 20° after TDC.



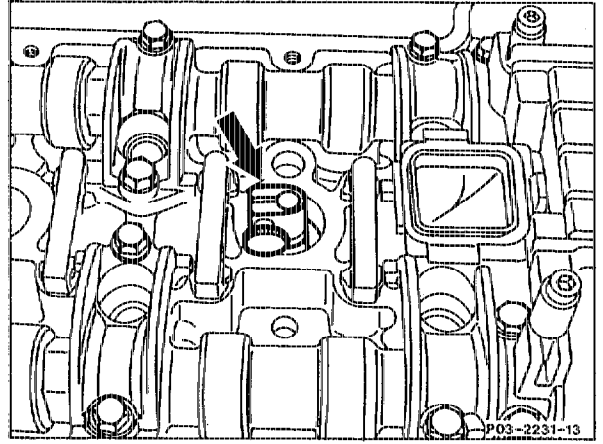
The setting of the TDC sensor must be checked and corrected:

- When replacing the crankshaft of the vibration damper.
- When replacing the timing case cover.
- When fitting parts to basic engines.

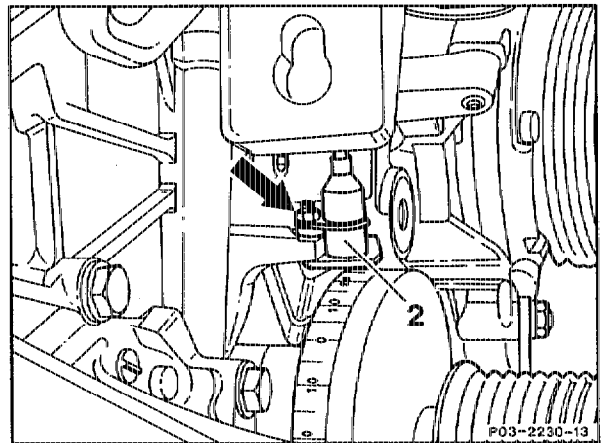
With the cylinder head removed, attach the dial gauge holder to the crankcase and position dial gauge pin on the piston crown.

- 1 Disconnect ground cable at battery.
- 2 Remove poly V-belt tensioning device (13-3450).
- 3 Remove right cylinder head cover (01-0500).
- 4 Position piston of No. 1 cylinder to 10° before TDC.
- 5 Unscrew spark plug of No. 1 cylinder.

6 Screw measuring pin (arrow), special tool 116 589 17 21 00, into spark plug bore at No. 1 cylinder.



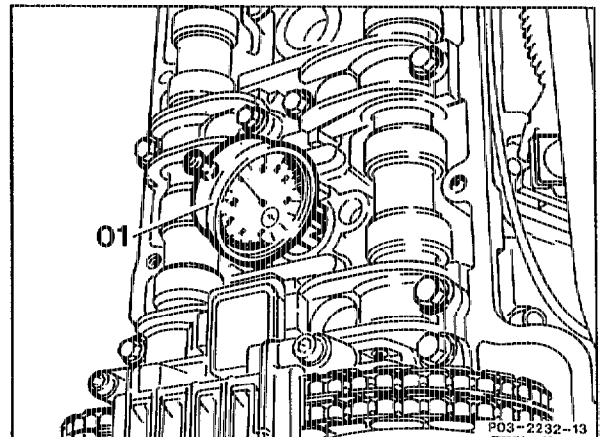
7 Unscrew hexagon nut (arrow) and withdraw TDC sensor (2).



Checking

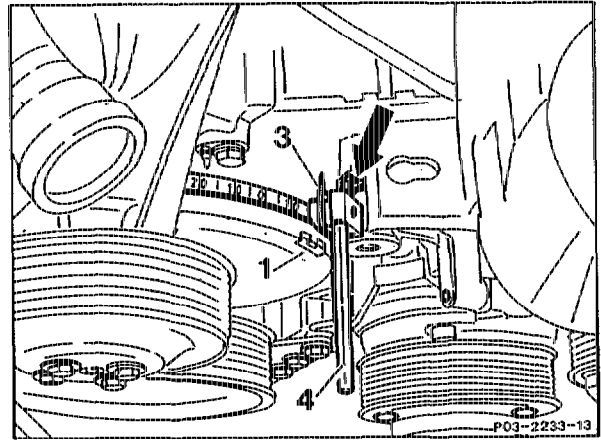
8 Clamp dial gauge (01) tight into measuring pin, special tool 116 589 17 21 00, with 4 mm preload.

Rotate crankshaft in direction of rotation of engine and set TDC precisely with the dial gauge (01). Turn scale of dial gauge until large pointer of gauge (01) is set to "0".



9 Rotate crankshaft further in direction of rotation until the dial gauge has moved back by the relevant value (piston travel).

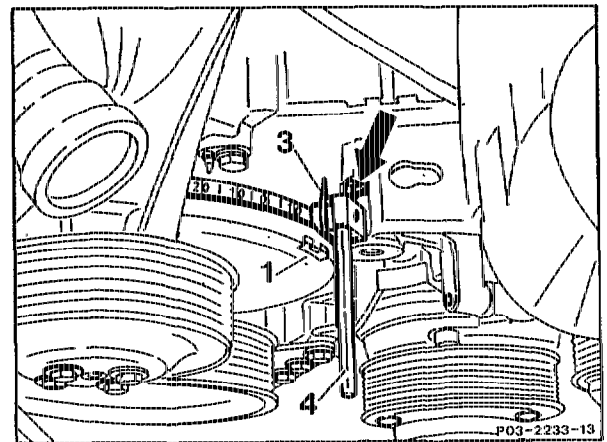
10 Position fixing device (4) 119 589 00 21 00 into the setting slide (3). The groove of the fixing device (4) must engage in the measuring cam (1) on the vibration damper. If the fixing device (4) does not engage, correct position of setting slide (3).



Correcting

11 Slacken nut (arrow) of setting slide and move it until the fixing device (4), special tool 119 589 00 21 00, engages in the measuring cam (1).

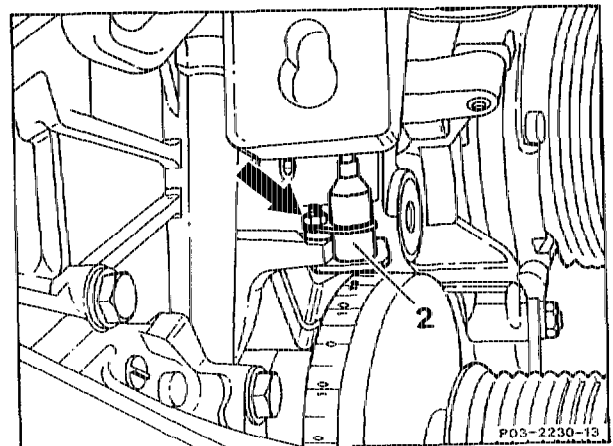
12 Screw on setting slide (3) and remove fixing device (4).



13 Insert TDC sensor (2) and screw on (arrow).

14 Remove dial gauge and measuring pin.

15 Install in the reverse order beginning from step 5.

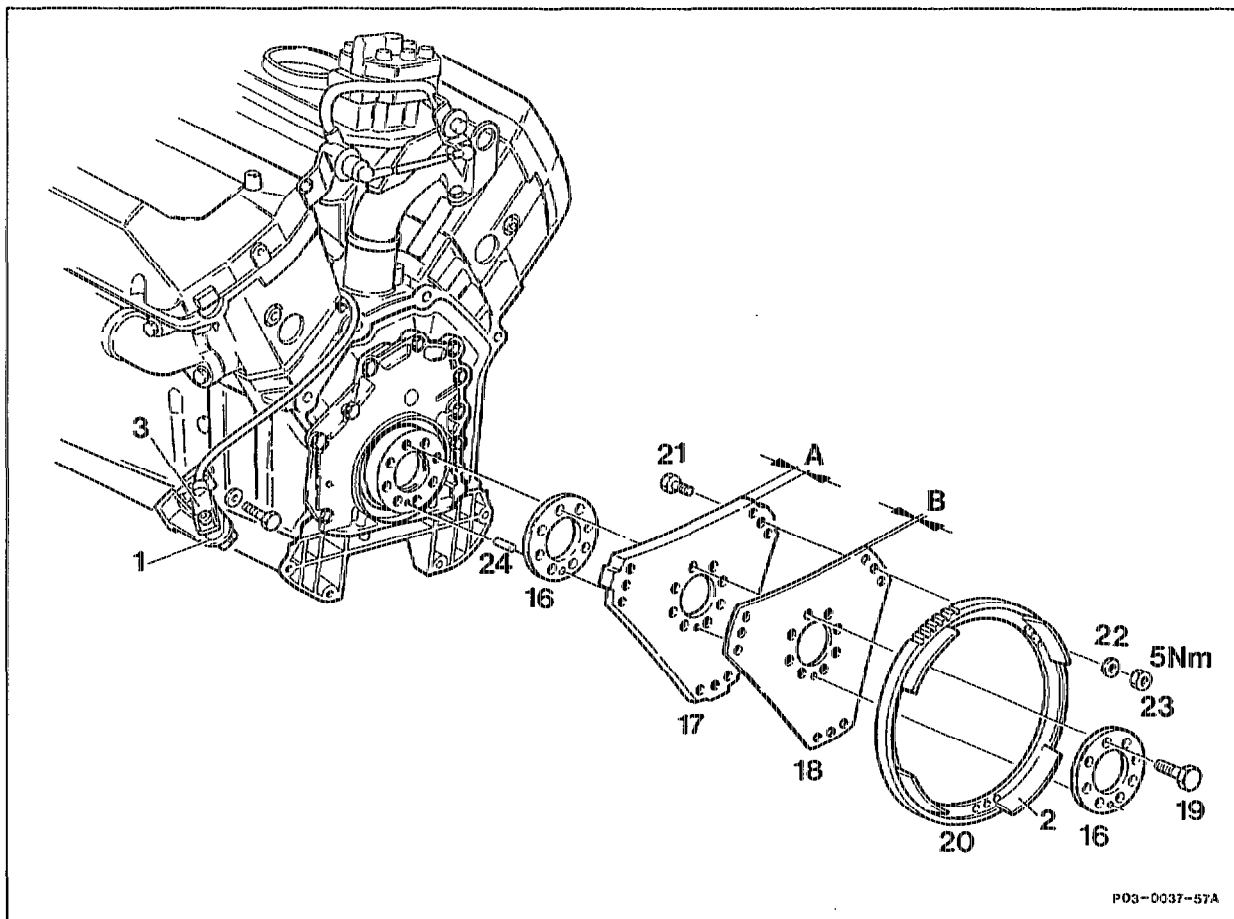


03-4100 Removing and installing driven plates

Preceding work:
Transmission removed (27-6000).

Operation no. of operation texts and work units or standard texts
and flat rates
03-8201, 8211

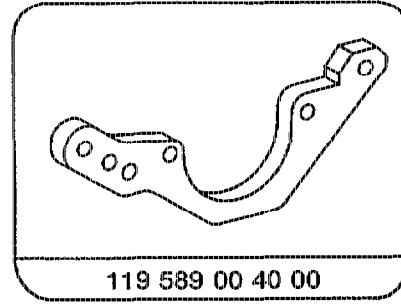
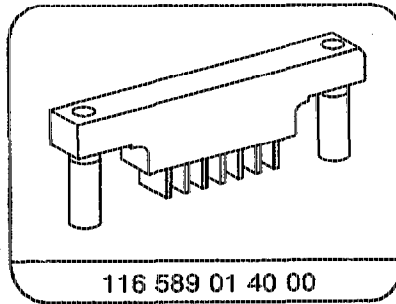
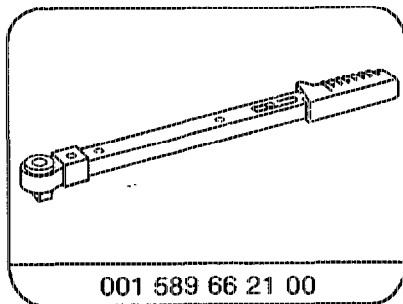
A. Engine 119.960/97



- 17 Driven plate A = 1.5 mm
18 Driven plate B = 1.0 mm

Retaining lock for crankshaft/ring gear	install, remove (03-5000).
Position sensor (3) of ignition control unit with bracket (1)	unbolt, bolt on (step 2).
Stretch bolts (19)	unbolt, replace (steps 3 and 4).
Driven plates (17) and (18)	take off, fit on.
Installation position and installation order	note (steps 5 and 6).

Special tools



Tightening torques in Nm

Thread Ø ¹⁾	M 12×1.5
Initial torque	30–40
Tightening angle	90–100°

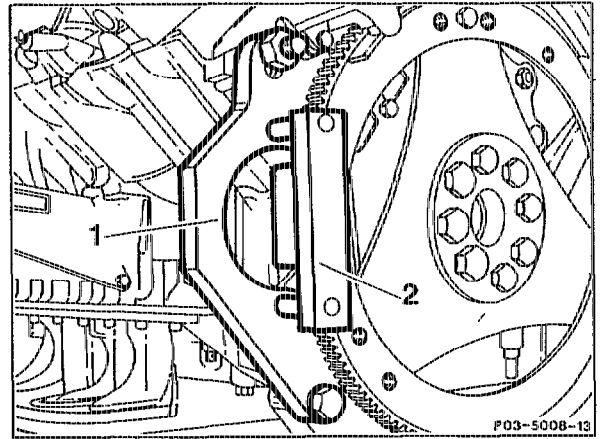
¹⁾ Microencapsulated, use only once.

Note

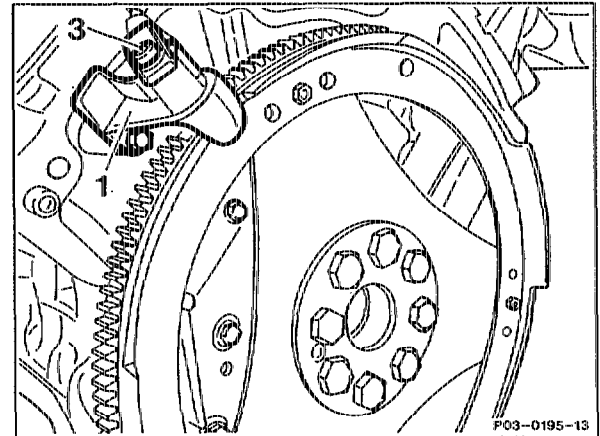
Driven plates and ring gear are balanced individually and can be replaced without balancing.

The tapped holes in the crankshaft flange are drilled through. If the bolts are removed and the engine is tilted, engine oil flows out of the tapped holes.

1 Remove retaining lock for crankshaft/ring gear, install (03-5000).



2 Unbolt position sensor (3) of ignition control unit together with bracket (1).

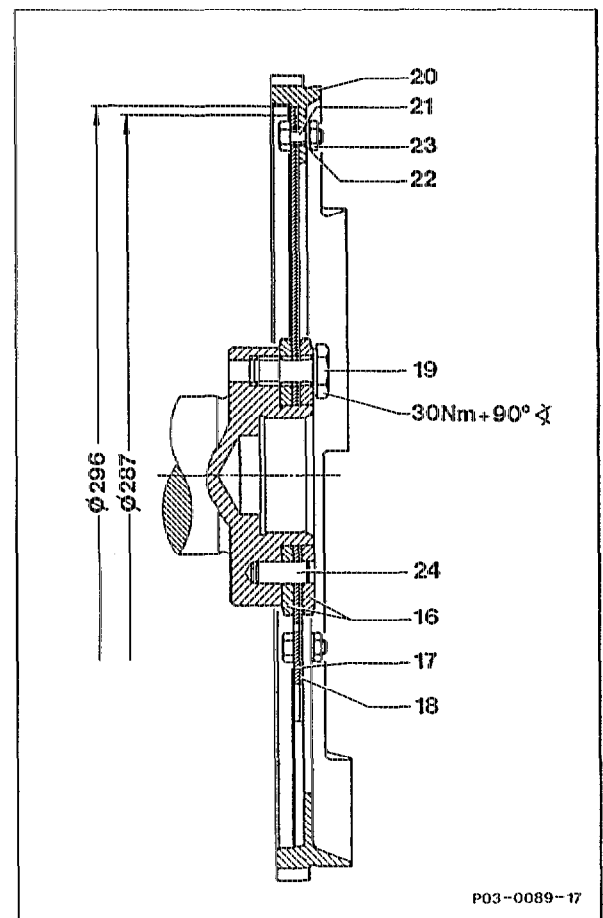


3 Remove bolts (19). Take off driven plates together with ring gear (20).

4 Install driven plates at crankshaft flange. Install thicker driven plate (17), thickness 1.5 mm, on inside. Insert stretch bolts (19).



Mounting surface of driven plates, of bolts and plate mounts must be free of damage and dirt. Install bolts (19) without sealant otherwise leaks may occur.



5 Fit ring gear (20) onto driven plates (17 and 18) and tighten nut (23) 5 Nm.



The ring gear must be installed so that the 3.5 mm dia. holes (arrows) in the ring gear and in the driven plates have the same angular position, otherwise proper operation of the ignition is not assured.

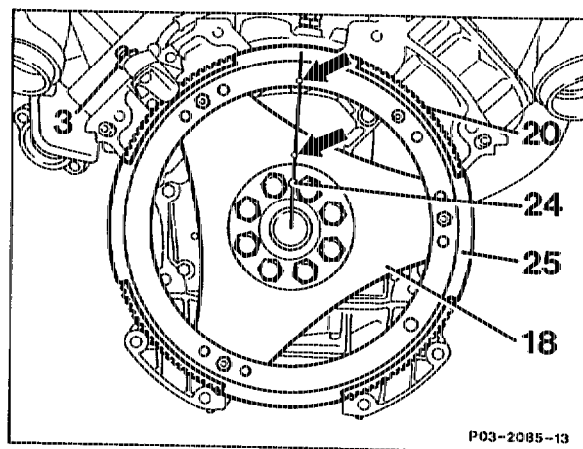
6 Kurbelwelle gegen Verdrehung fixieren. (siehe Ziffer 1).

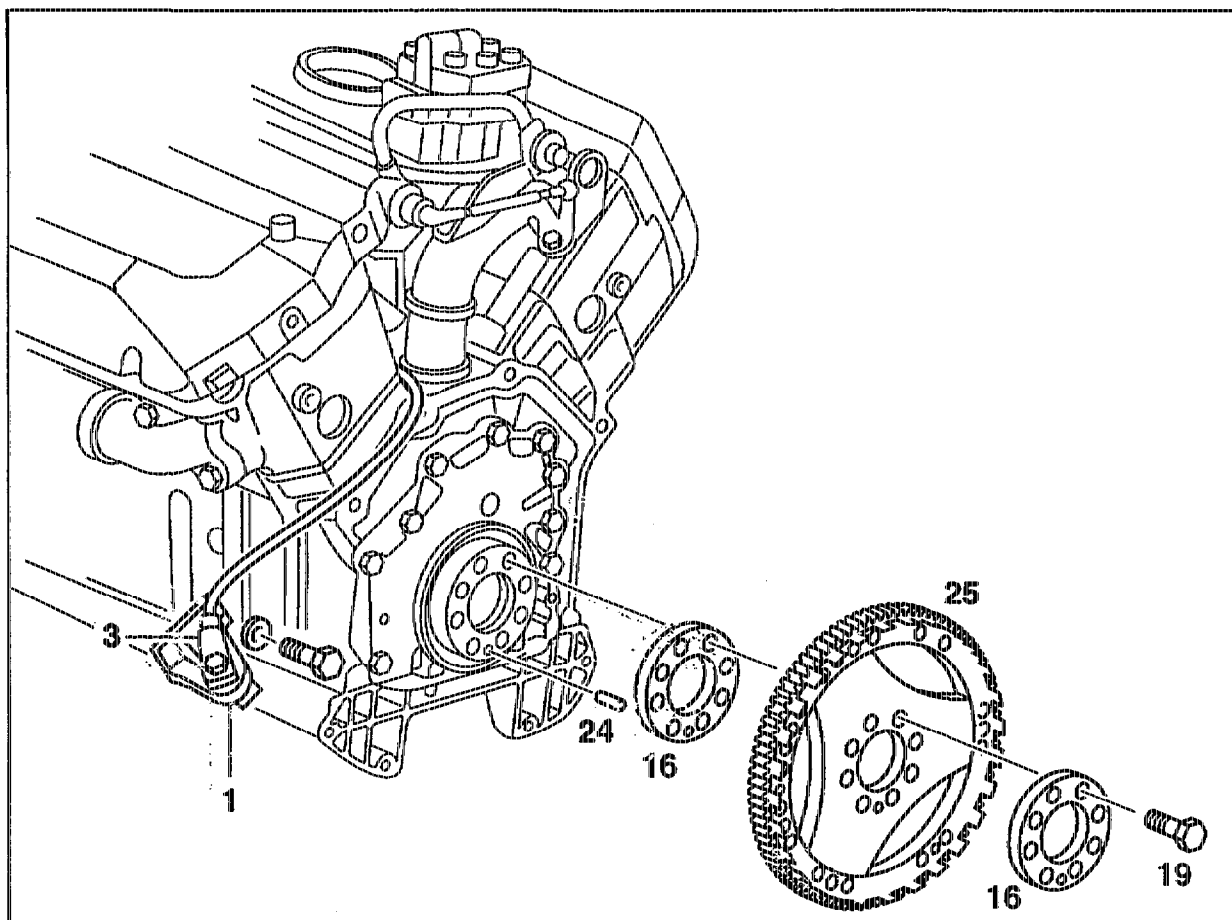
7 Tighten bolts of driver to initial torque of 30 Nm and tightening angle of 90°.

Note

Bolts are microencapsulated; use only once.

8 Screw on position sensor of ignition control unit with bracket.





P03.30-0246-57

25 Driven plate, starter ring gear and increment gear are a fixed riveted assembly as of start of production of M119.98.

- | | |
|---|-----------------------------|
| Retaining lock for crankshaft/ring gear | install, remove. (03-5000). |
| Position sensor (3) of ignition control unit with bracket (1) | unbolt, bolt on. |
| Stretch bolts (19) | unscrew, replace. |

Combined driven plate/starter ring gear (25) take off, fit on.

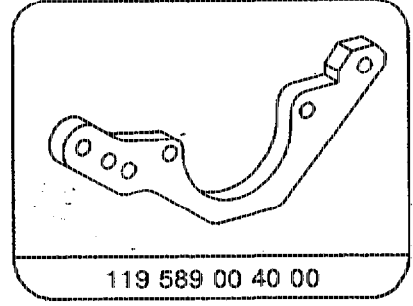
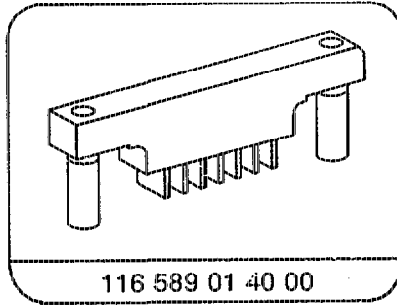
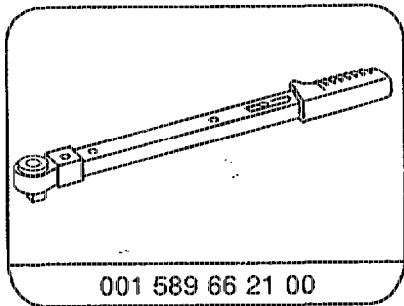


Mount of driven plate, of bolts and plate mount must be free of damage and dirt. Install bolts (19) without sealant otherwise leaks may occur.

Installation position and installation order note.



The driven plate (25) and the plate base (16) must be installed so that the dowel pin engages in the \varnothing 8 mm hole.



Tightening torques in Nm

Thread Ø	M 12×1.5
Initial torque	30-40
Tightening angle	90-100°

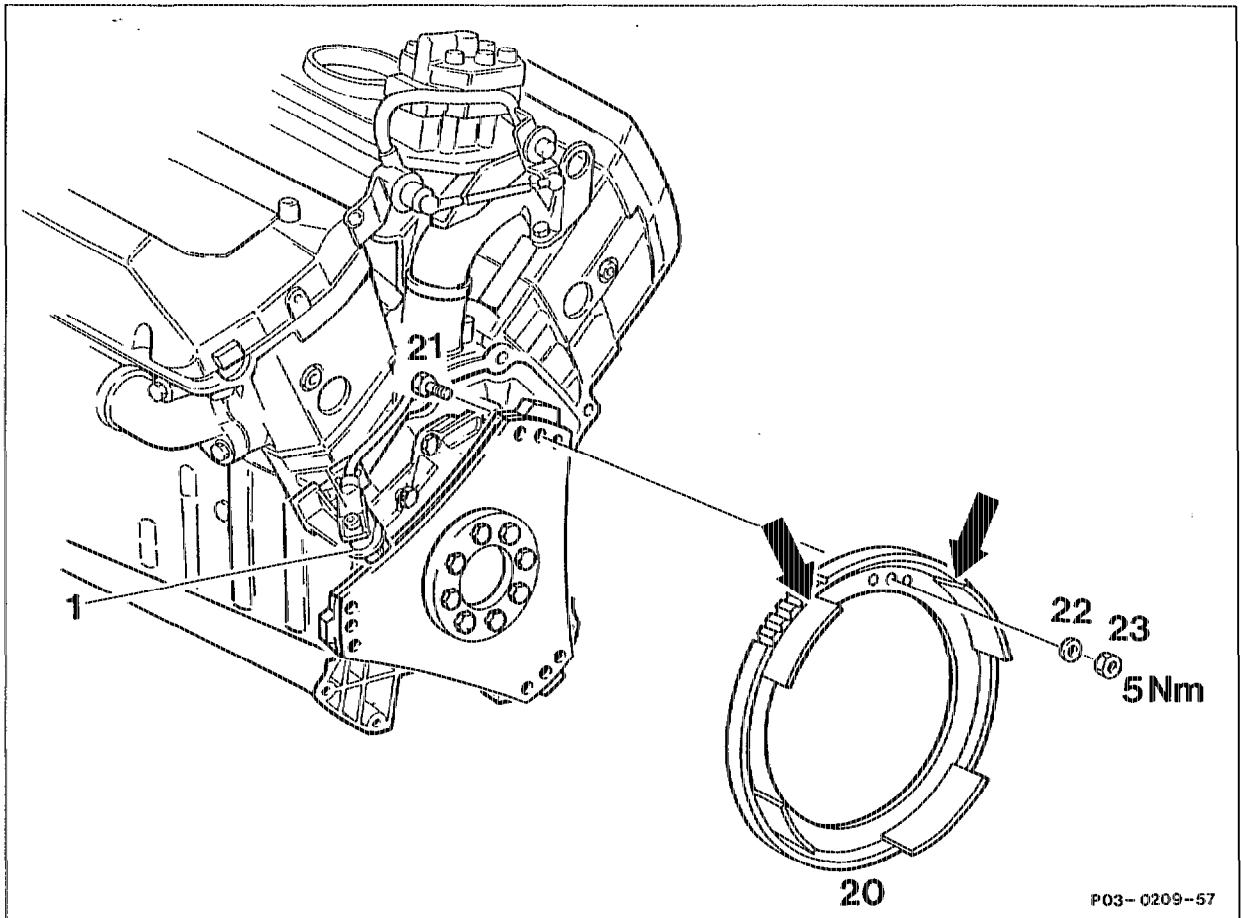
Note

The threaded holes in the crankshaft flange are drilled through. If the bolts are removed and the engine is inclined, engine oil flows out of the threaded holes.

03-4300 Replacing ring gear

Preceding work:
Transmission removed (27-600)

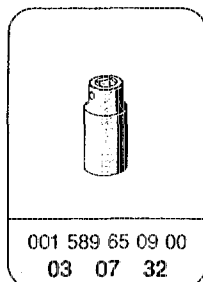
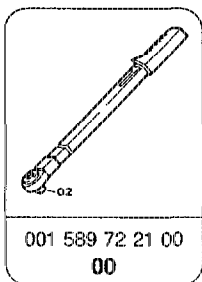
Operation no. of operation texts and work units or standard texts
and flat rates
03-8312, 8321



Engine
Ring gear(20)

rotate so that no segments (arrows) of the ring gear (20) are touching the bracket (1).
take off, fit on (5 Nm).
Pay attention to installation position (see note).

Special tools



Data

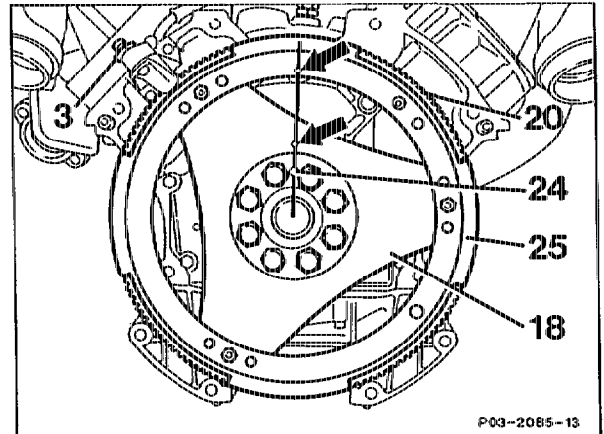
Permissible variation from concentricity at ring gear	0.3 mm
Centering collar dia. for driven plate (1.5 mm thick)	296.00 – 296.05 mm

Note

Driven plates and ring gear are balanced individually; they may be replaced without being balanced.

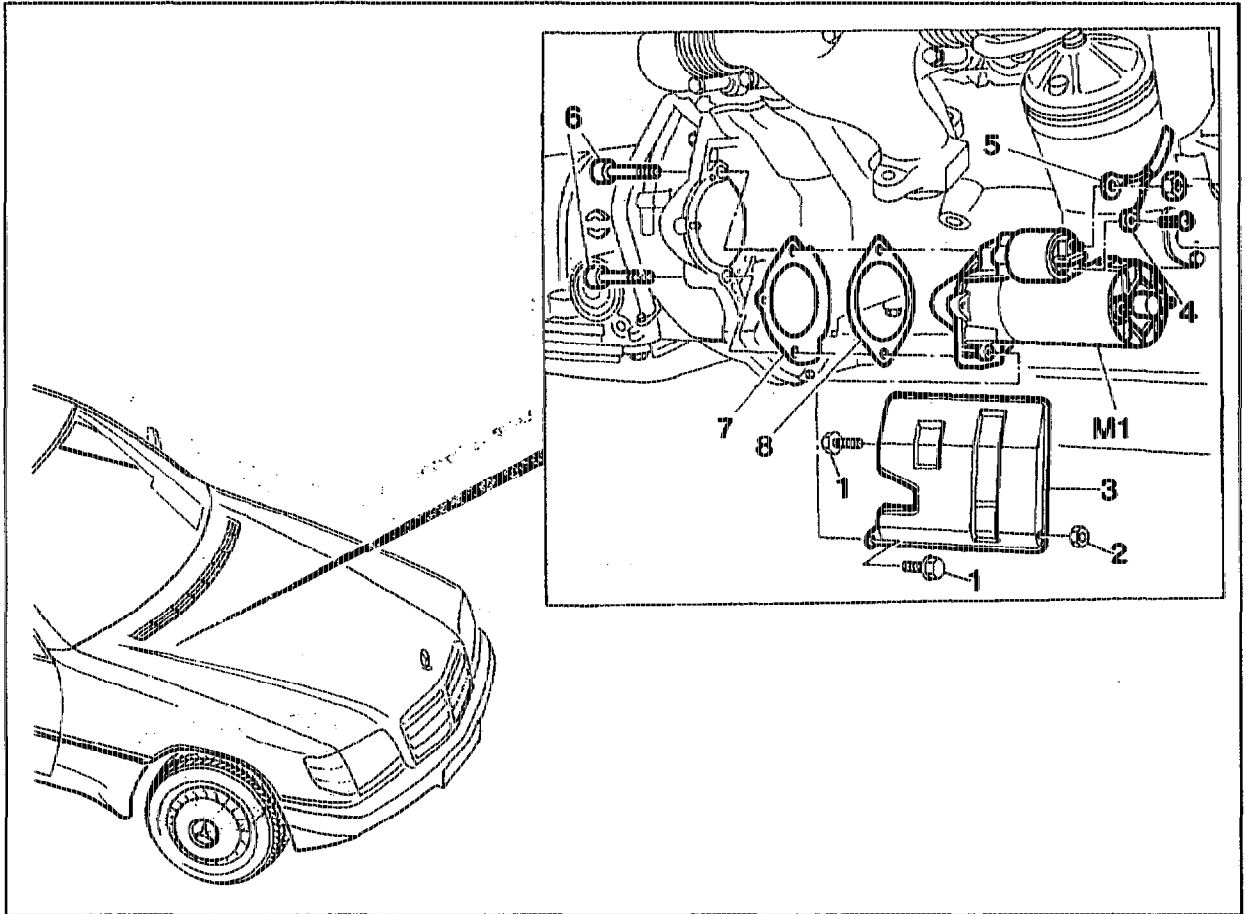


The ring gear must be installed so that the 3.5 mm dia. holes (arrows) in the ring gear (20) and in the driven plates (18) have the same angular position otherwise proper operation of the ignition is not assured.



03-4350 Adjusting clearance of ring gear to starter

Preceding work:
Starter removed (AR15.30-7100?)



P15-5024-57

Clearance of starter to ring gear adjust with shims (7, 8).

Note

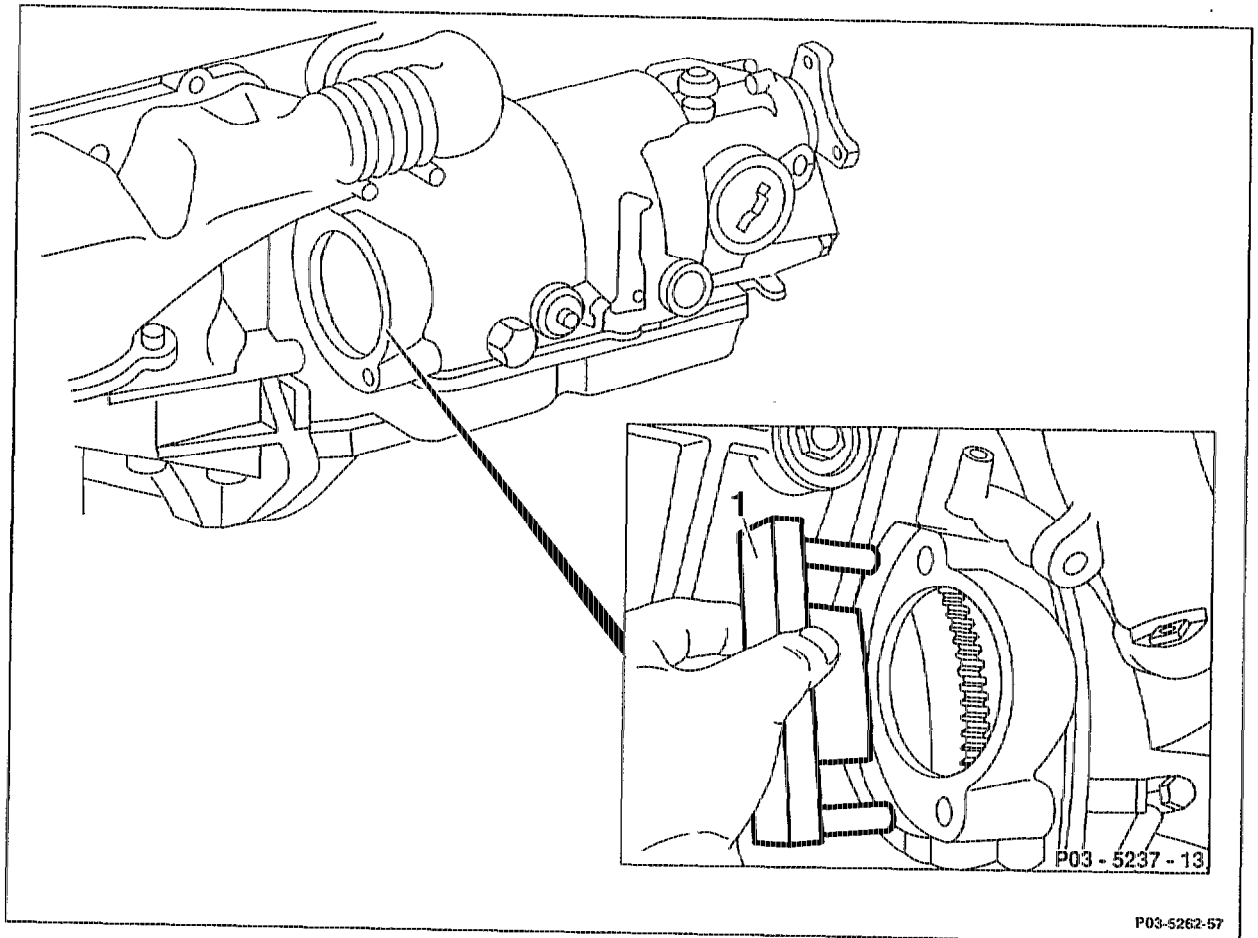
The specified positioning of the starter relative to ring gear is adjusted by shims (7, 8). The correct clearance ensures that the starter pinion engages and releases properly. When performing removal and installation work, pay attention to shims (7, 8) and adjust clearance of ring gear to starter, if necessary.

Clearance of ring gear to starter in mm

Clearance of rear edge of crankcase to front edge of ring gear	No. of shims fitted at starter
14.3 to 15.2	0
13.3 to 14.2	1
12.3 to 13.2	2

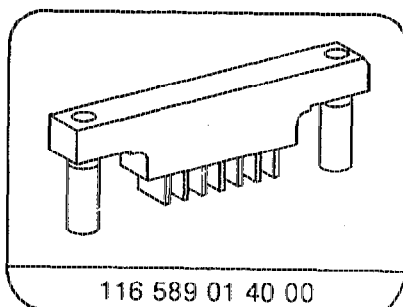
03-5000 Removing and installing retaining lock for crankshaft/ring gear

A. With transmission installed



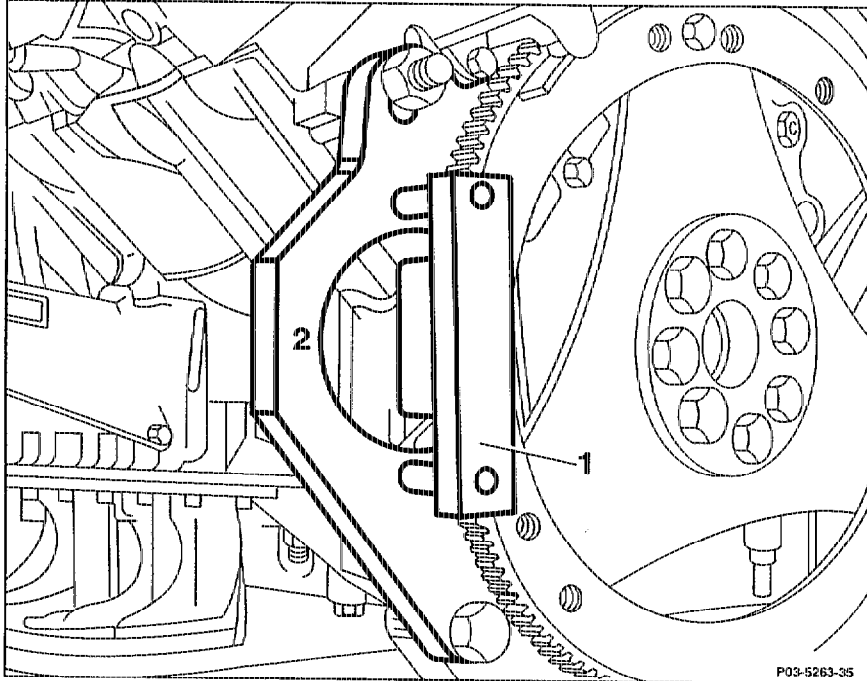
- | | |
|---|--|
| Models 124, 129, 140: left front exhaust cross pipe | remove, install (49-0170). |
| Cover at left starter recess | remove, install. |
| Retaining lock (1) | insert into ring gear until it engages, rotate crankshaft if necessary, special tool 116 589 01 40 00. |

Special tool



B. With transmission removed

Preceding work:
Transmission removed (27-600).



- | | |
|---|--|
| Bracket (2) on left side of crankcase | bolt on, unbolt, special tool
119 589 00 40 00. |
| Retaining lock (1) | insert into bracket (2) and insert into ring gear
until it engages, rotate crankshaft if necessary,
special tool 116 589 01 40 00. |

Special tools

