G14 AR03.00-P-1101-03HA	Check, correct position of bracket of TDC sensor	001 589 53 21 00 Dial gage 603 589 01 21 00 Locating tool 601 589 07 21 00 Measuring device	

Bracket of TDC sensor

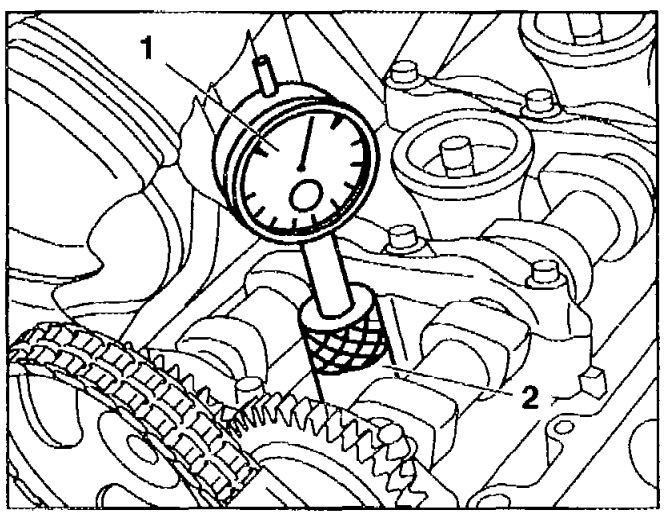
Number	Designation	Engine 604	Engine 605, 606
BE03.00-P-1001-01A	Piston stroke at 20° ATDC mm (setting position of bracket of TDC sensor)	3.35	3.23

1 Screw dial gauge holder (2) into the prechamber bore of cylinder 1.

2 Set piston of cylinder 1 to about 10° BTDC.

3 Fit dial gauge (1) with tracer pin onto dial gauge holder (2).

4 Set tracer pin on the dial gauge (1) to a preload of about 5 mm.

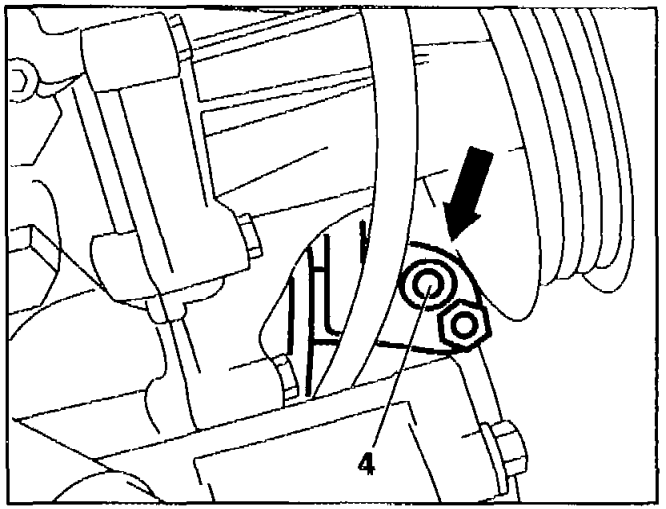


P03.00-0210-01

5 Slowly crank engine further in direction of rotation at the front of the crankshaft until the pointer of the dial gauge (1) stops (TDC position).

6 Set scale of dial gauge (1) to zero.

7 Slowly crank engine further in direction of rotation of crankshaft until the dial gauge has moved back by the piston stroke at 20° ATDC.
After the dial gauge has moved back (crankshaft position 20° ATDC), the pin (4) in the crankshaft belt pulley or in the vibration damper must be positioned exactly below the bracket of TDC sensor (arrow).

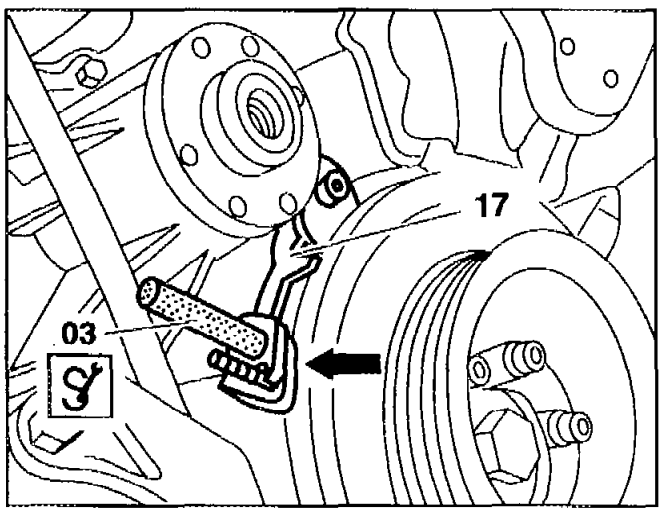


P03.00-0211-01

8 Insert fixing pin (03) into the bracket of TDC sensor (17).

9 The pin (4) in the crankshaft belt pulley or in the vibration damper must engage in the slot of the fixing pin (03) (arrow).

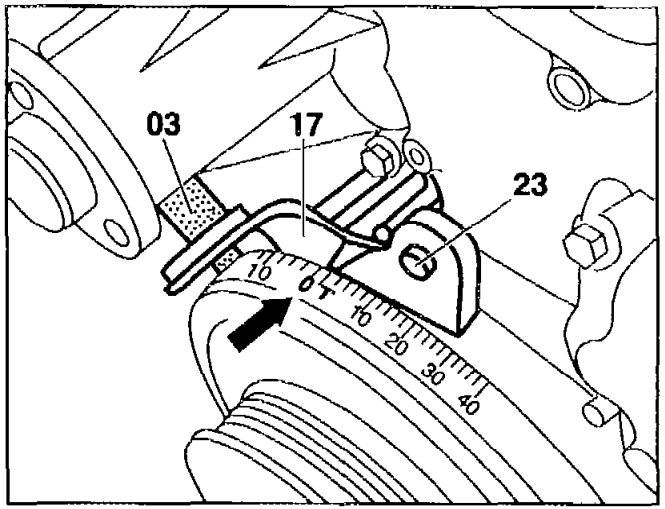
10 If the pin does not engage, correct the position of the bracket of the TDC sensor (17).



P03.00-0212-01

11 To do this, slacken bolt (23) and move bracket of TDC sensor (17) sufficiently until the pin (4) in the crankshaft belt pulley or in the vibration damper engages in the slot of the fixing pin (03).

12 Tighten bolt (23).



P03.00-0213-01

K14 AR03.10-P-6111-02A	Tightening conrod bolts		

Nm Conrod

Number	Designation			Engine 111
BA03.10-P-1001-01H	Conrod bolt (stretch shank)	1st stage	Nm	45
		2nd stage	∡°	90

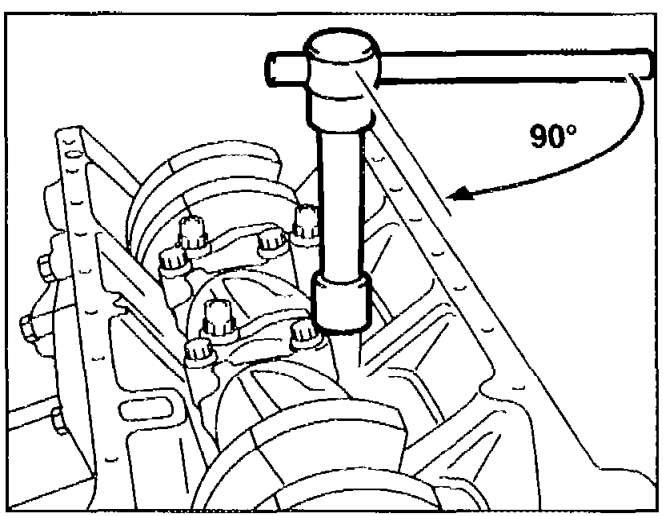
Nm Conrod

Number	Designation			Engine 604, 605, 606
BA03.10-P-1001-01B	Conrod bolt (stretch shank)	Initial torque	Nm	40
		Tightening angle	° ∡	90

1 Moisten bolt thread and bolt head contact surface with engine oil.

2 Nm Tighten conrod bolts initially to the specified torque.

3 Tighten conrod bolts with a tightening angle wrench.
i If no tightening angle wrench is available, torque conrod bolt further by the specified angle using a socket wrench and Tommy bar in a single operation.
It is not permitted to use a flexibar torque wrench when tightening in order to avoid angular errors.



P03.10-0202-01

L14 AR03.10-P-6111-03HA	Press-fitting new connecting rod bush	Engine 604, 605, 606	

Test data of connecting rod

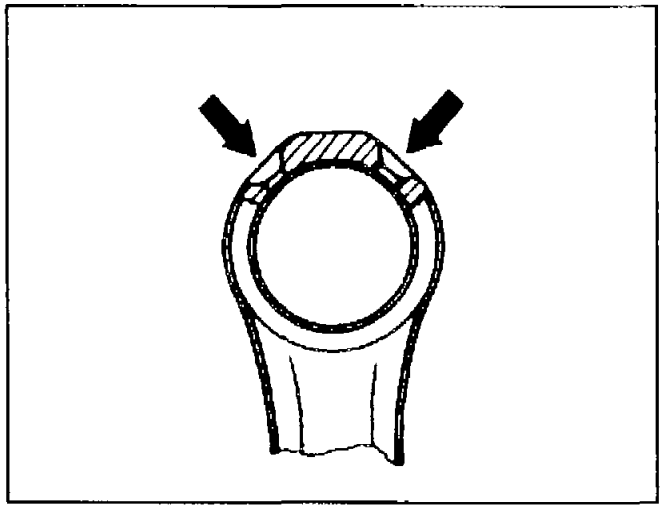
Number	Designation		Engine 604, 605.910/911/912, 606.910/912	Engine 605.960/962, 606.961/962/964
BE03.10-P-1006-01C	Conrod bush inner ∅ (d)	mm	26.012–26.018	28.018–28.024
	Fig. see		AR03.10-P-6111-05BW	AR03.10-P-6111-05BW
BE03.10-P-1007-01C	Conrod bush outer ∅	mm	28.575–28.600	30.575–30.600
BE03.10-P-1008-01C	Conrod bush basic bore ∅ (d1)	mm	28.500–28.521	30.500–30.525
	Fig. see		AR03.10-P-6111-05BW	AR03.10-P-6111-05BW
BE03.10-P-1009-01C	Piston pin play in conrod bush	mm	0.007-0.018	0.007-0.018
BE03.10-P-1010-01C	Peak-to-valley height (R_z) of conrod bush on inside	µm	5	5

1 Press out conrod bush; use new conrod bush to press out old one.

i Press in new conrod bush so that the oil drillings in the conrod bush are aligned with the oil drillings in the conrod (arrows).

2 Turn out face of conrod bush and ream.

3 Dress side faces of conrod on a dressing plate.



D03.10-0005-01

N14 AR03.10-P-6111-04HA	Alining connecting rod	Engine 604, 605, 606	

Test data of connecting rod

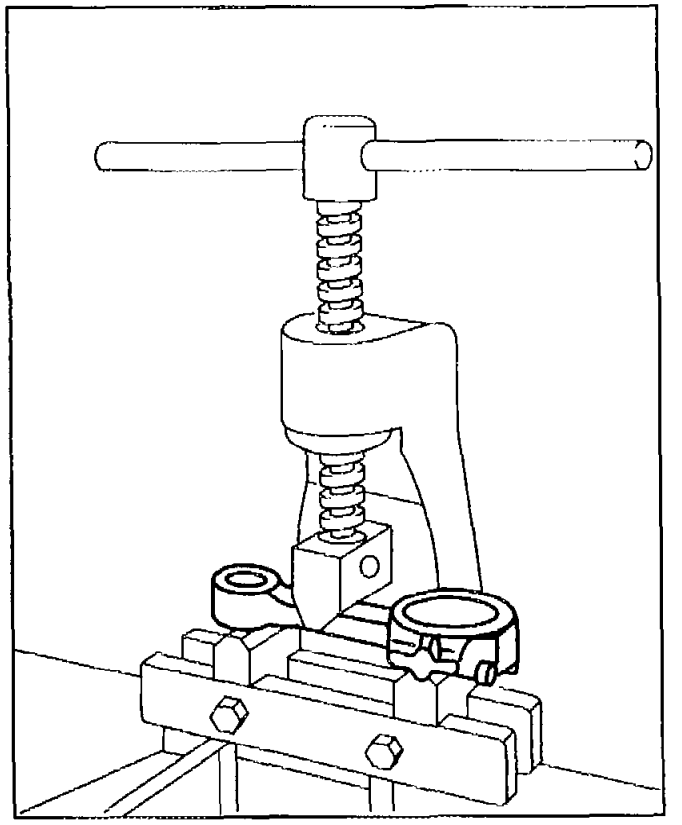
Number	Designation		Engine 604, 605.910/911/912, 606.910/912	Engine 605.960/962, 606.961/962/964
BE03.10-P-1003-01C	Permissible twist of conrod bearing bore to conrod bush bore over length of 100 mm	mm	0.1	0.1
BE03.10-P-1004-01C	Permissible variation of axial parallelism of conrod bearing bore to conrod bush bore over length of 100 mm	mm	0.045	0.045

Commercially available tools (see Workshop Equipment Manual)

Number	Designation	Make (e.g.)	Order number
WH58.30-Z-1017-05A	Connecting rod tester	Model BC 501 KWT D-63128 Dietzenbach	
WH58.30-Z-1018-05A	Connecting rod straightening equipment	Model BC 503 KWT D-63128 Dietzenbach	

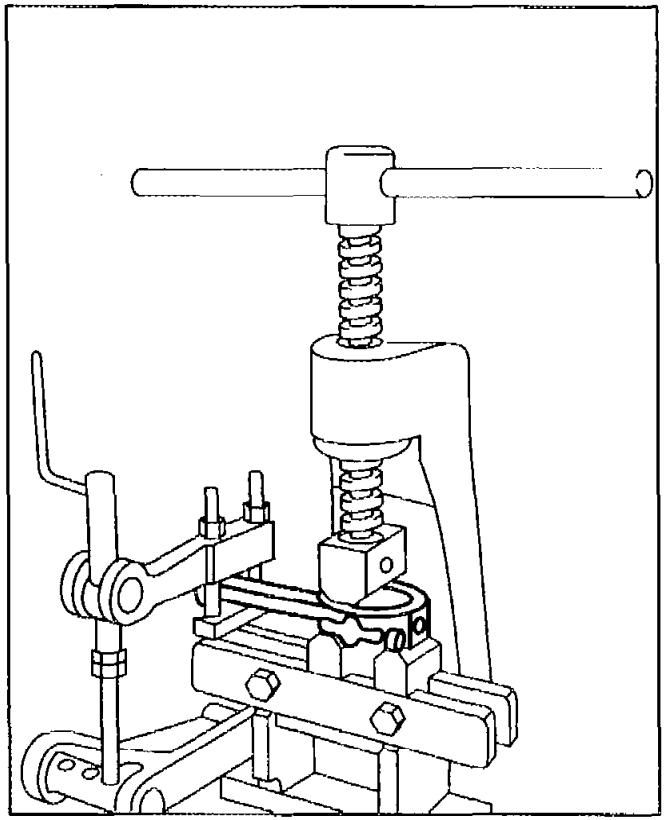
1 Inspect connecting rod with bearing shells and piston pins fitted using a connecting rod tester.

2 Align conrod bearing bore parallel to conrod bush bore on conrod aligning equipment.



P03.10-0204-02

3 Align twist of conrod bearing bore to conrod bush bore on the conrod aligning equipment.



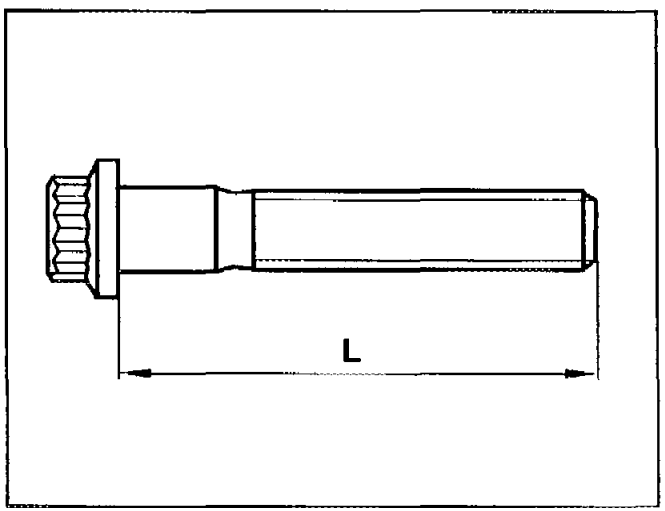
P03.10-0205-02

A15 AR03.10-P-6111-01A	Checking connecting rod bolts	Engine 111, 604, 605, 606	

Test data of conrod bolts

Number	Designation				Engine 111	Engine 604, 605, 606
BE03.10-P-1001-03A	Conrod bolts	Thread ∅		M	9×1	9×1
		Shank length	When new	mm	51.7–52.3	51.7–52.3
			Max.	mm	52.9	52.9
			Part no.		111 038 00 71	111 038 00 71

Measure length (L). If the length (L) is greater than the maximum permissible dimension, use new conrod bolts.

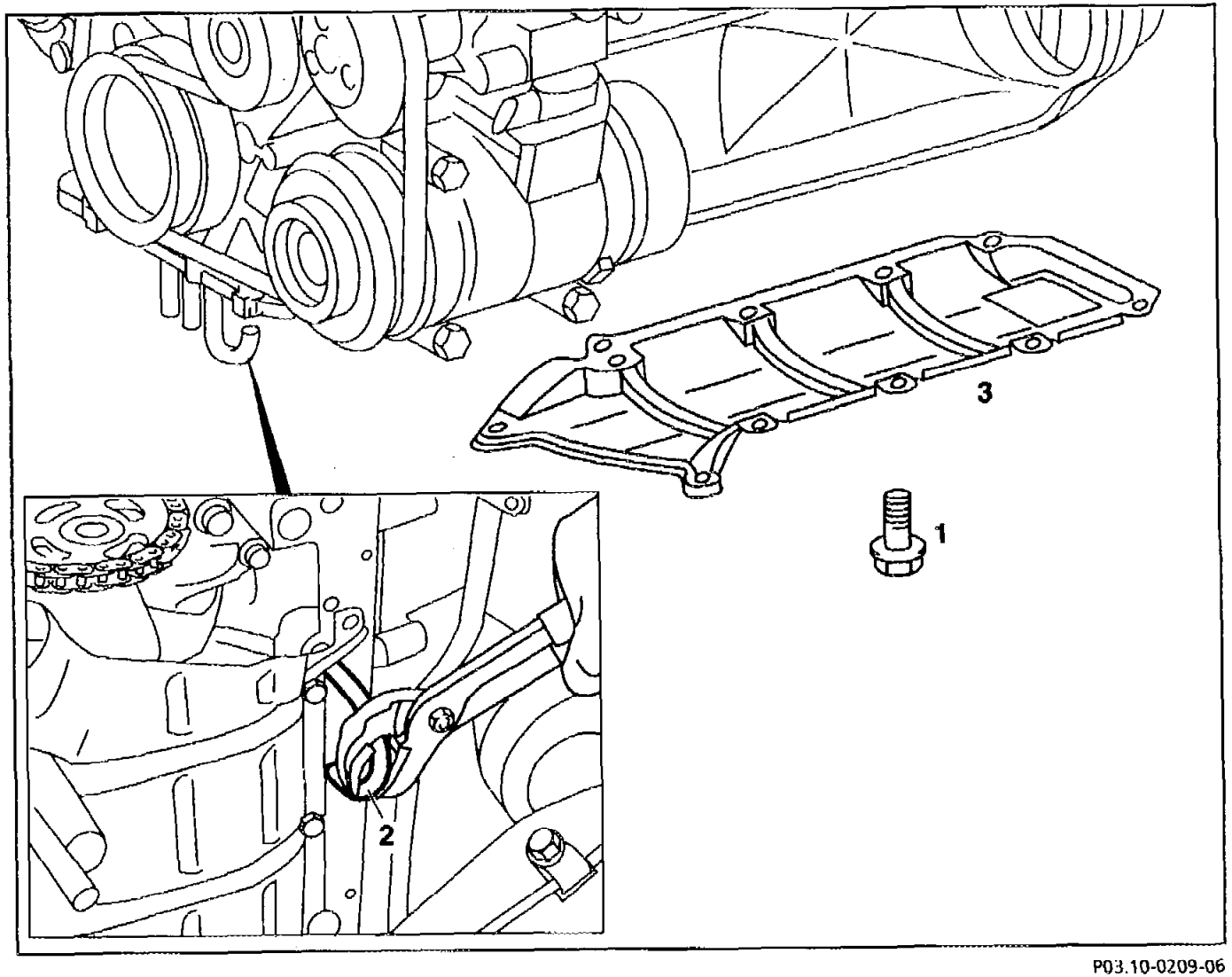


P03.10-0225-01

B15 AR03.10-P-7021-01A	Removing, installing oil deflector plate		

1 Use pliers to turn oil drain pipe (syphon) (2) of the crankcase ventilation to the side.
i **Installation:** turn oil drain pipe back into initial position.

2 Unbolt oil deflector plate (3), remove.



P03.10-0209-06

C15 AR03.10-P-7041-01A	Measuring piston projection	Engine 604, 605, 606	

Number	Designation		Engine 604.910/912	Engine 604.915/917	Engine 605.91/96
BE03.10-P-1001-02B	Piston projection (a) with new crankcase	mm	0.735–0.965	0.785–1.015	0,785–1,015
		Fig. see	AR03.10-P-7041-02A	AR03.10-P-7041-02A	AR03.10-P-7041-02A
BE03.10-P-1002-02B	Piston projection (a) with machined crankcase	mm	0.835–1.015	0.985–1.215	0,985–1,215
		Fig. see	AR03.10-P-7041-02A	AR03.10-P-7041-02A	AR03.10-P-7041-02A

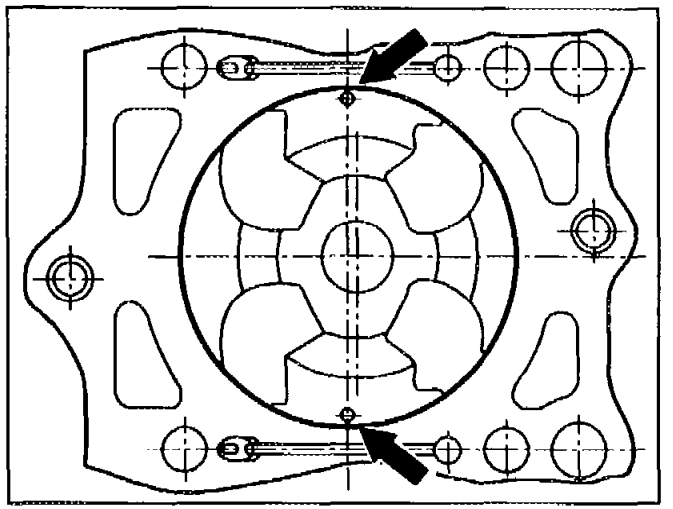
Test data of pistons

Number	Benennung		Engine 606.91/96
BE03.10-P-1001-02B	Piston projection (a) with new crankcase	mm	0.785–1.015
		Fig. see	AR03.10-P-7041-02A
BE03.10-P-1002-02B	Piston projection (a) with machined crankcase	mm	0.985–1.215
		Fig. see	AR03.10-P-7041-02A

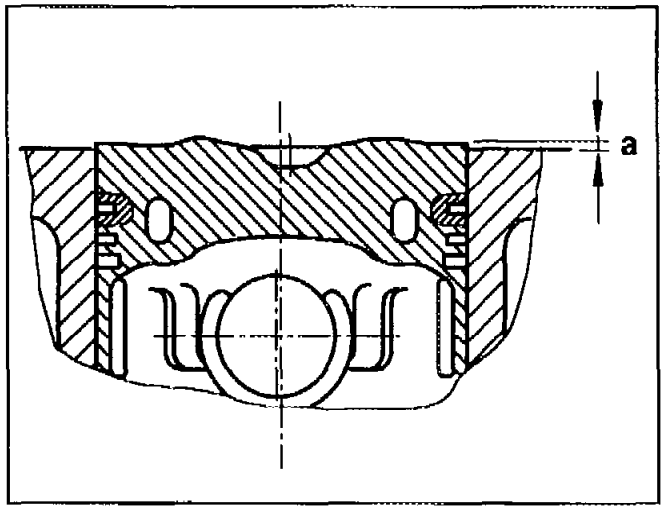
i

After replacing the pistons/conrods or machining the crankcase contact surface, it is necessary to measure the piston projection.
Measure projection between piston crown and contact surface of crankcase without the cylinder head gasket fitted.
The measurement has to be carried out in the direction of the piston pin in order to eliminate the piston rock.

1 Measure piston projection at the two measuring points (arrows).



P03.10-0229-01



P03.10-0230-01

a Projection of piston/crankcase

E15 AR03.20-P-3000-01AX	Installing front crankshaft radial seal	611 589 00 14 00 Insertion tool	

1 Inspect edge of mounting hole for the radial seal and remove any burrs.

2 Fit radial seal (20) onto the insertion sleeve (9).

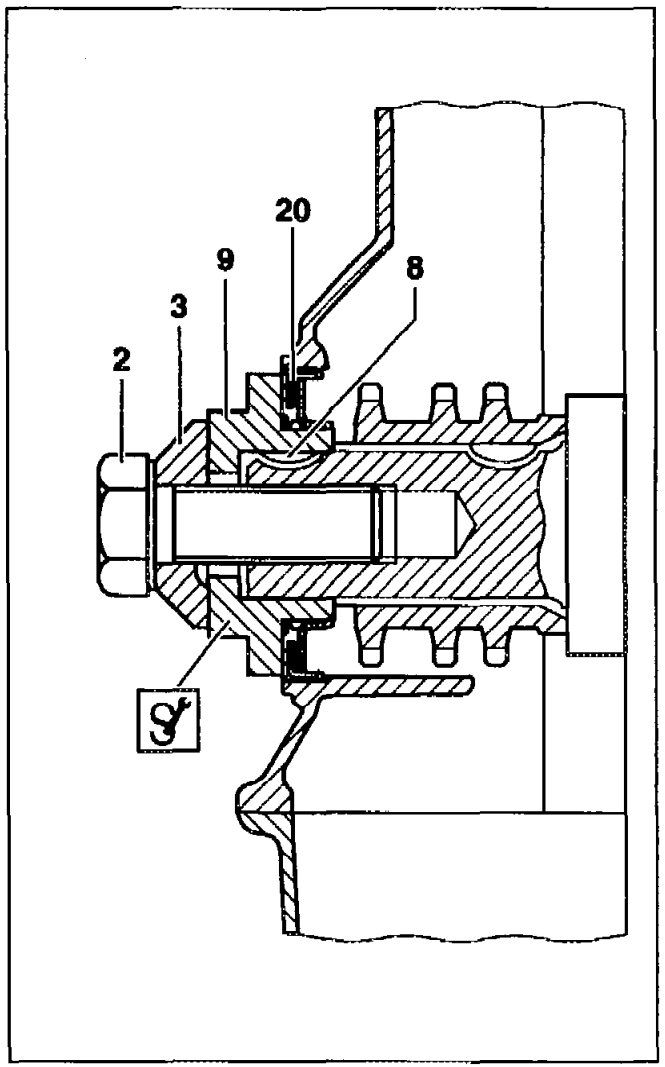
i Install radial seal dry (do not use oil or grease). The radial seal also provides a seal in the case of wear groove at hub of vibration damper.

3 Align dished washer (8) on the cranshaft.

4 Push insertion sleeve (9) onto the crankshaft.
Turn to ensure that the groove of the insertion sleeve is aligned with the dished washer (8) in the crankshaft.

5 Draw in insertion sleeve (9) as far as the stop with the central bolt (2) and washer (3).

(!) The radial seal should be positioned at right angles to the crank journal otherwise a proper seal will not be achieved.



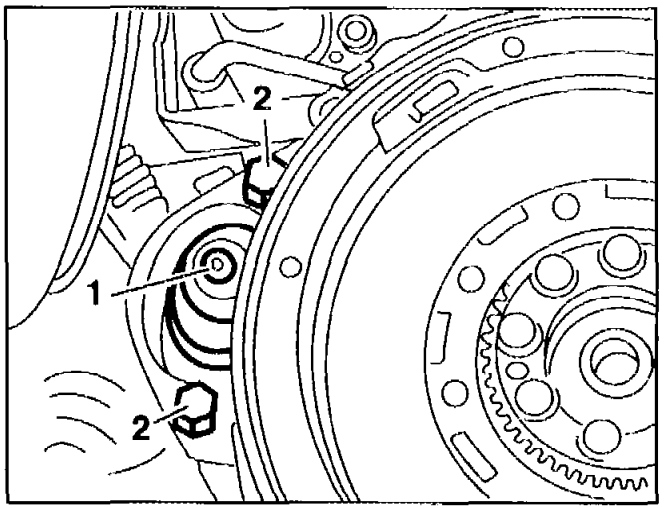
P03.20-0293-03

F15 AR01.40-P-8913-01HA	Inspect rear of engine for external oil leaks, determine	201 589 00 99 00 Electrical connecting set Flywheel, two-mass flywheel or driven plate removed	 AR03.30-P-8001HA
⚠ **Danger!**	**Risk of accident** as a result of vehicle starting off when engine running. **Risk of injury** as a result of bruises and burns if you insert your hands into engine when it is being started or when it is running.	Secure vehicle to prevent it starting off. Wear closed and close-fitting work clothes. Do not grasp hot or rotating parts.	AS00.00-Z-0005-01A

Repair product

Number	Designation	Order number
BR00.45-Z-1001-03A	MB contrast spray	000 989 03 59

If it is not possible to clearly determine the cause of an external oil leak at the rear of the engine, proceed as follows:



P03.00-0203-01

1 Clean the inspection area free of oil, dry and spray with "MB white contrast spray".

2 Check oil level in the engine; adjust to correct level, if necessary.

3 Install flywheel / two-mass flywheel or driven plate.

4 Attach starter (1) to crankcase with adequately long bolts (2).

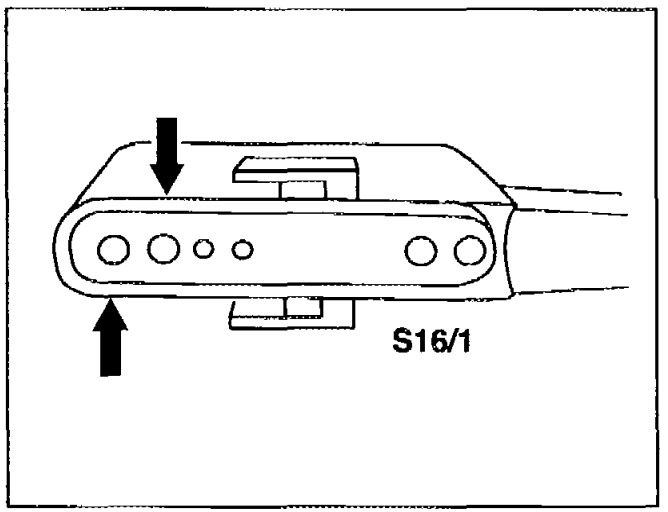
5 Support engine in installation position at the rear.

6 If automatic transmission fitted (except transmission 722.6): bridge contacts (arrows) at starter lockout switch (S16/1).

7 Warm up engine to enable leaks to be determined.

8 Specify repair measures according to the leakage point.

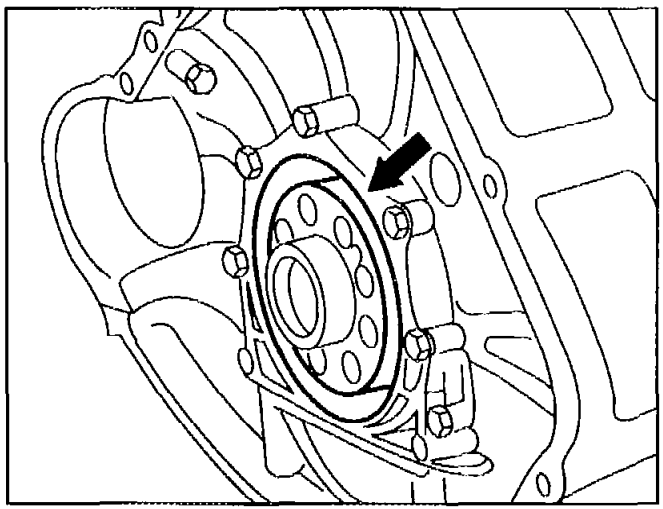
i Stored faults which may be caused by disconnecting wiring or simulation during test work should be erased in the fault memory after completing the work.



P01.40-0227-01

H15 AR03.20-P-3063-01A	Installing rear crankshaft radial seal	111 589 08 43 00 Installation tool	

1 Deburr the edge of the mounting bore for the radial seal and clean mounting bore (arrow).



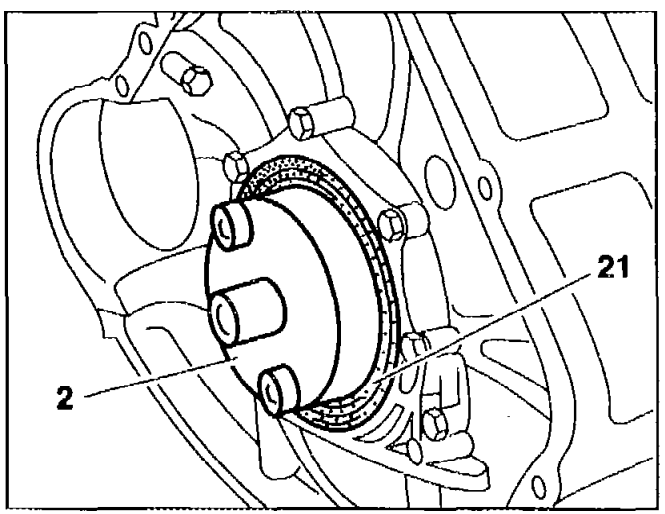
P03.20-0209-01

2 Examine the contact surface of the radial seal on the crankshaft flange.
If a wear groove from the old radial seal exists on the crankshaft, use the insertion tool with shoulder (repair position) for pressing in the new radial seal.
i The radial seal is pressed in a further 3 mm if the insertion tool for repair position is used.

3 Bolt inner part of insertion tool (2) onto the crankshaft.

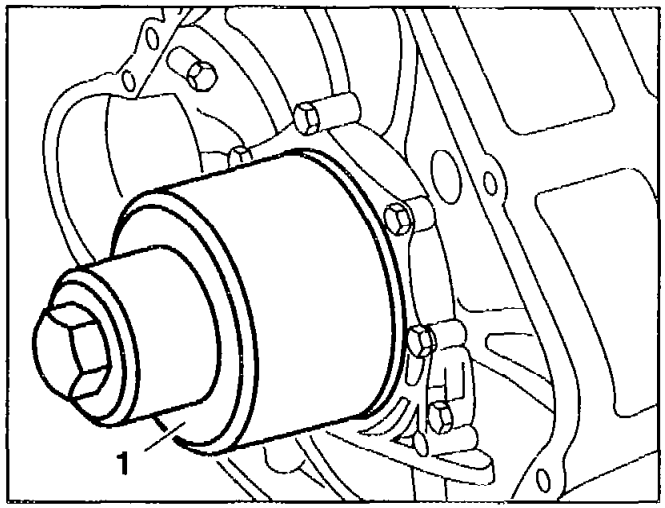
4 Coat the sealing lip of the radial seal (21) and the mating contact surface with engine oil.
¼ Do not use grease.
Grease prevents the oblique webs on the sealing lip transporting back the engine oil.

5 Fit radial seal (21) onto the inner part of the insertion tool (2).



P03.20-0210-01

6 Press radial seal (21) into the end cover as far as the stop using the insertion tool (1). Ensure that the crankshaft radial seal is correctly located.



P03.20-0211-01

K15 AR03.20-P-4351-03A	Examining bolts of crankshaft bearing caps		

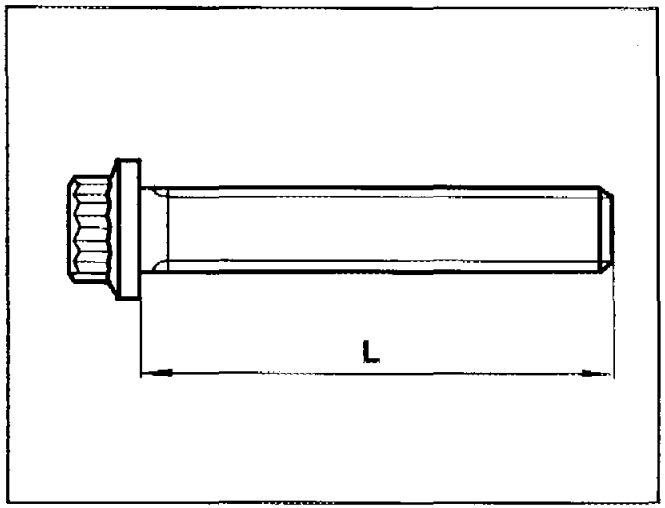
Test values of crankshaft bearing cap bolt

Number	Designation			Engine 111	Engine 604, 605, 606
BE03.20-P-1001-01A	Crankshaft bearing cap bolts	Thread diameter	M	11	11
		Length (L) when new	mm	62.8	61.8–62.2
		Max. length (L)	mm	63.8	63.8
		Illustration see		AR03.20-4351-03A	AR03.20-4351-03A

Test values of crankshaft bearing cap bolt

Number	Designation			Engine 601.943	Engine 602.980/982/984/985
BE03.20-N-1001-01B	Crankshaft bearing cap bolts	Thread diameter	M	11	11
		Length (L) when new	mm	62.0	62.0
		Max. length (L)	mm	63.8	63.8
		Fig. see		AR03.20-4351-03A	AR03.20-P-4351-03A

Measure length (L); if the length (L) is greater than the maximum permissible dimension, use new bolts for the crankshaft bearing caps.



P03.20-0219-01

M15 AR03.20-P-4355-01A	Installing crankshaft radially in bearings	Engine 604, 605, 606 001 589 53 21 00 Dial gage	

Test data of crankcase

Number	Designation			Engine 604, 605, 606
BE01.40-P-1001-02B	Crankshaft bearings	Basic bore diameter	mm	62.500–62.519
		Basic bore width at fit bearing	mm	19.979–20.000
		Permissible out-of-roundness and conicity of basic bore	mm	0.02

Test data of crankshaft main bearing shells

Number	Designation			Engine 604, 605, 606
BE03.20-P-1001-03A	Main bearing shells standard size for crankcase and bearing cap	Replacement part additional index (blue color coding)		52
	∅58.00 mm	Bearing shell thickness	mm	2.255–2.260
BE03.20-P-1002-03A	Main bearing shells standard size for crankcase and bearing cap	Replacement part additional index (yellow color coding)		54
	∅58.00 mm	Bearing shell thickness	mm	2.260–2.265

Test data of crankshaft main bearing shells

Number	Designation			Engine 604, 605, 606
BE03.20-P-1003-03A	Main bearing shells standard size for crankcase and bearing cap	Replacement part additional index (red color coding)		56
	∅58.00 mm	Bearing shell thickness	mm	2.265–2.270
BE03.20-P-1004-03A	Main bearing shells standard size for bearing cap	Replacement part additional index (white color coding)		57
	∅58.00 mm	Bearing shell thickness	mm	2.270–2.275
BE03.20-P-1005-03A	Main bearing shells standard size for bearing cap	Replacement part additional index (purple color coding)		58
	∅58.00 mm	Bearing shell thickness	mm	2.275–2.280

Test data of crankshaft bearing play

Number	Designation			Engine 604, 605, 606
BE03.20-P-1001-04A	Crankshaft bearing play (when new)	radial when new	mm	0.03–0.05
		radial wear limit	mm	0.08
		axial when new	mm	0.10–0.25
		axial wear limit	mm	0.3

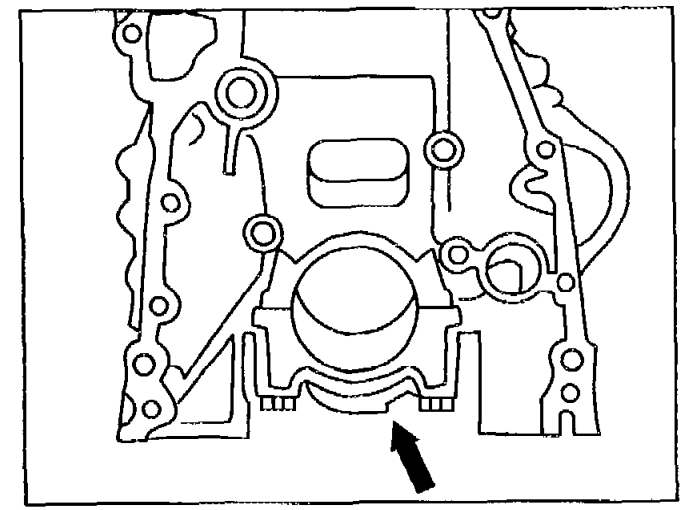
Nm Crankshaft bearing caps

Number	Designation				Engine 604, 605, 606
BA03.20-P-1001-01A	Bolt of crankshaft bearing caps	M11	1st stage	Nm	55
			2nd stage	∡ °	90

Commercially available tools

Number	Designation	Make (e.g.)	Order number
WH58.30-Z-1065-12A	Quick calipers for internal measurements	Hahn und Kolb Borsigstr. 50 70469 Stuttgart	33520 080
WH58.30-Z-1055-12A	Gage for micrometer	Hahn und Kolb Borsigstr. 50 70469 Stuttgart	31414150

1 Install crankshaft bearing caps.

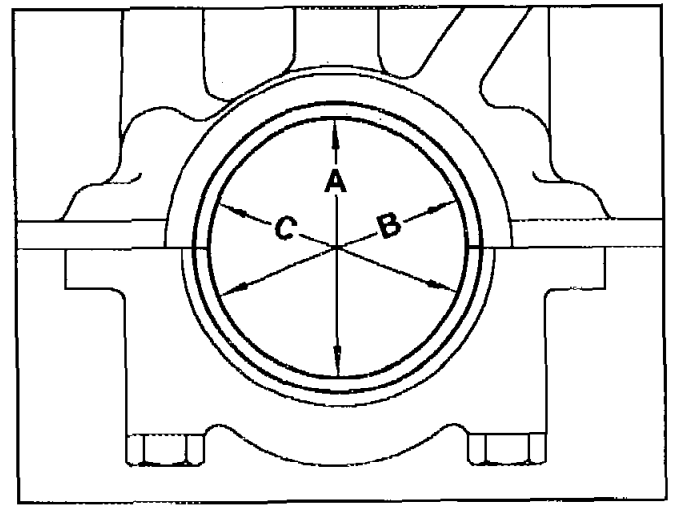


P03.20-0217-01

[i] The crankshaft bearing caps are fitted in at the side in the crankcase. The fit is off-centered 0.5 mm so that the bearing caps can only be installed in one position. If correctly installed, the lug (arrow) on the crankshaft bearing cap is pointing to the left (intake side), viewed in direction of travel.

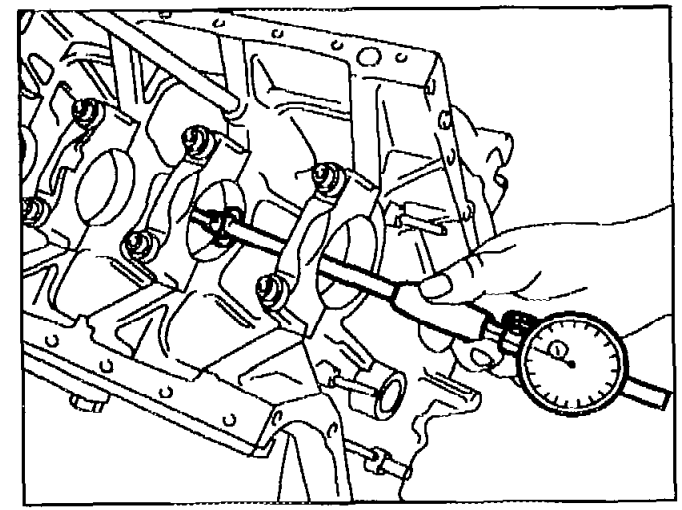
[i] The crankshaft bearing caps are machined together with the crankcase and must not be mixed up.

2 Measure crankshaft bearing bore in direction A, B and C at two levels (roundness).



P03.20-0247-01

[i] If the measurement at a crankshaft bearing bore is greater than the specified value or if the bearing bore is out of round, dress the contact surface of the bearing cap on a dressing plate to a max of 0.02 mm.



P03.20-0246-01

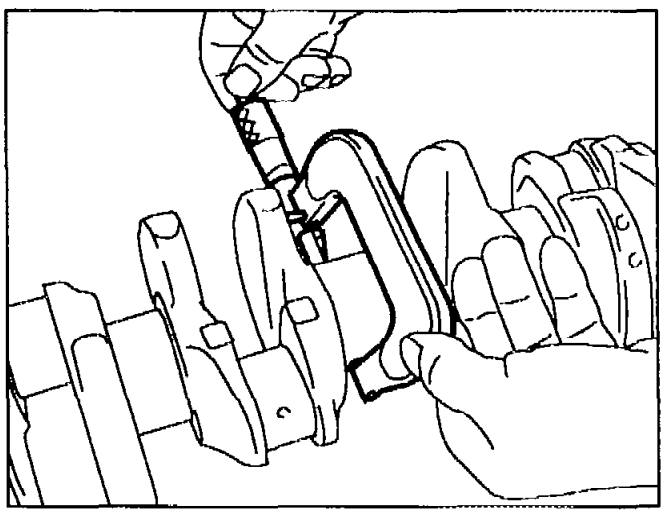
3 Measure crankshaft bearing bore in direction A, note measurement obtained.
Example: 62.51 mm.

4 Take off crankshaft bearing caps.

5 Measure crankshaft bearing journal ∅. Example: 57.95 mm.

6 Calculate bearing shell thickness
Example:

Bearing bore ∅	62.51 mm
Crankshaft bearing journal ∅	-57.95 mm
	4.55 mm
Bearing radial clearance	-0.04 mm
Inspection data	
→ table "Crankshaft bearing clearance"	
	4.51 mm : 2
Thickness of bearing shell	2.255 mm



P03.20-0248-01

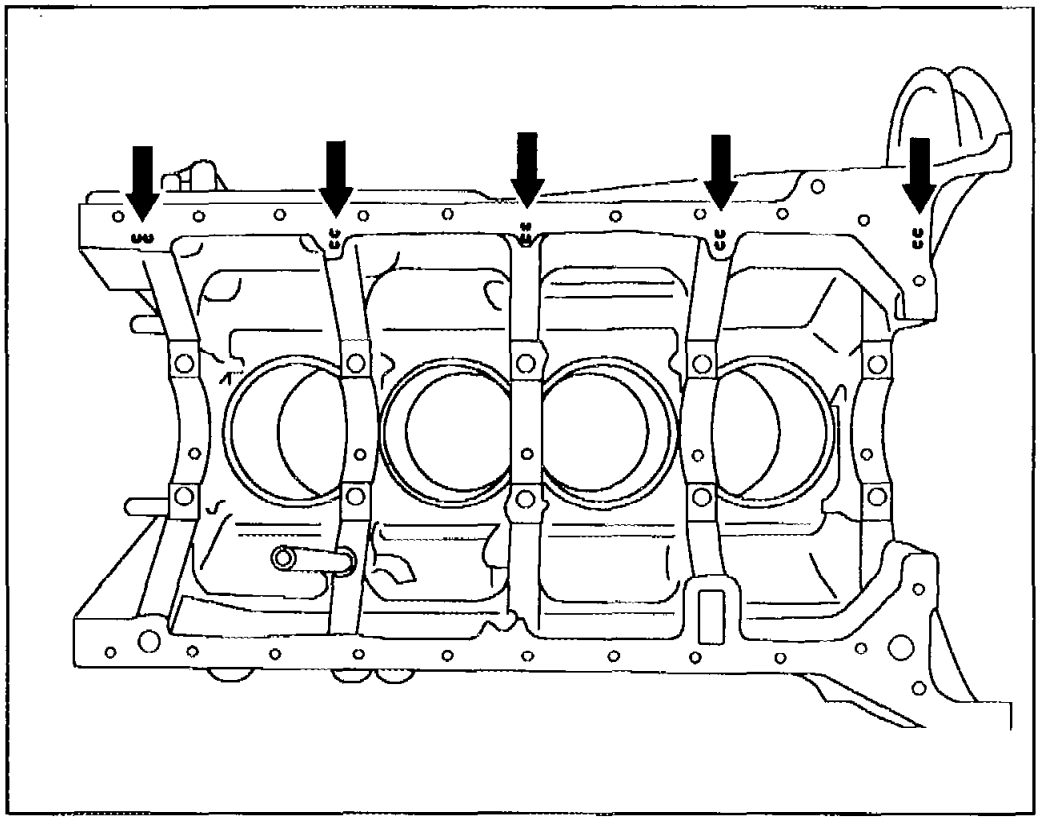
7 Assign bearing shells (only for standard size crankshaft)
Example:
Bearing shell thickness 2.255 mm → table "Inspection data of crankshaft bearing shells"
Top bearing shell "blue"
Bottom bearing shell "blue"

ⓘ If the thickness of the bearing shells differs, install a thicker bearing shell in the bearing cap.

C16 AR03.20-P-4360-01HA	Assigning crankshaft bearing shells		

Assigning bearing shells to crankcase

The bearing shells are marked on the side with the colors blue, yellow and red.
Chisel punches are provided next to the main bearing at the bottom contact surface at the crankcase. Assign the bearing shells in accordance with the number of chisel punches.



P03.20-0276-11

1 Chisel punch indicates the blue bearing shell (part code 52)
2 Chisel punches indicate the yellow bearing shell (part code 54)
3 Chisel punches indicate the red bearing shell (part code 56)

Assigning bearing shells to crankshaft bearing caps

The bearing shells for the crankshaft bearing caps are marked with the colors blue, yellow, red, white and purple.
blue (part code 52)
yellow (part code 54)
red (part code 56)
white (part code 57)
purple (part code 58)

The marking assignment for the bearing shells in the crankshaft bearing caps are located at the crankshaft.
The crankshaft is marked as described below.

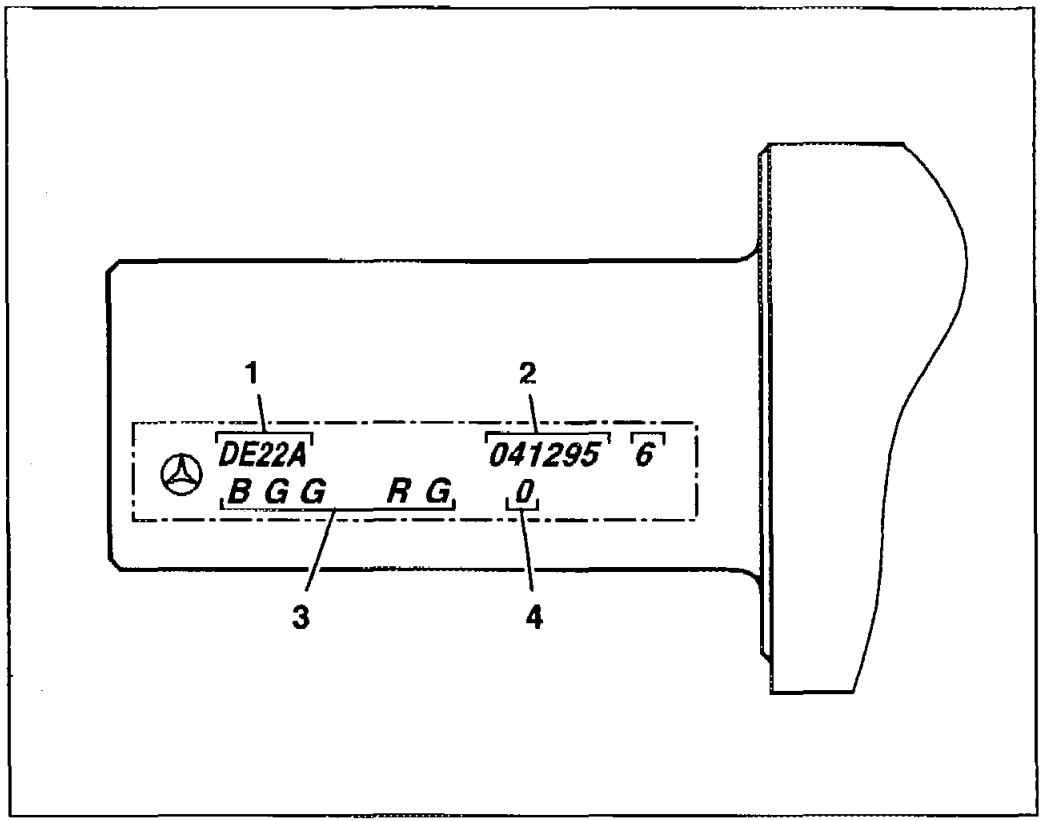
A Colored dots (arrows) at the crankshaft webs.
Insert bearing with the same color as the color dot into the bearing cap.
Example: red colored dot on crankshaft = red bearing in bearing cap.

B Chisel punches next to main bearings at crankshaft
- ● = for blue bearing shell
- ●● = for yellow bearing shell
- ●●● = for red bearing shell
- ●●●● = for white bearing shell
- ●●●●● = for purple bearing shell

Install bearing shell to match the number of chisel punches.
Example: four chisel punches next to main bearing = white bearing shell.

C Letters at front of crankshaft

Assign bearing shells according to the letter.
Example: G = yellow bearing in bearing shell



P03.00-0278-11

1 Type designation e.g. DE22A
2 Date of inspection
3 Dimensional tolerances of 5 main bearing colored markings e.g.: B = blue, G = yellow, R = red
4 Fit bearing width e.g.: 0 = standard size, 1 = standard size I

D Actual dimensions at front of crankshaft (dimensional tolerances of bearing journals 58.000 – 0.035 = 57.965 actual dimension)

Actual dimension 35 - 39 = blue bearing shell
Actual dimension 40 - 44 = yellow bearing shell
Actual dimension 45 - 49 = red bearing shell
Actual dimension 50 - 54 = white bearing shell
Actual dimension 55 - 60 = purple bearing shell

Assign bearing shells to match the actual dimensions.
Example: actual dimension 47 = red bearing shell in bearing cap.

G16 AR03.20-P-4355-02A	Installing crankshaft axially in bearings	Engine 604, 605, 606 001 589 53 21 00 Dial gage 363 589 02 21 00 Dial gage holder	

Test data of crankshaft bearing play

Number	Designation				Engine 604, 605, 606
BE03.20-P-1001-04A	Crankshaft bearing play (when new)	radial	when new	mm	0.03–0.05
		radial	wear limit	mm	0.08
		axial	when new	mm	0.10–0.25
		axial	wear limit	mm	0.3

Test data of crankshaft bearing play

Number	Designation				Engine 602.980/ 981/982/983/ 984/985
BE03.20-N-1001-04A	Crankshaft bearing play	radial	when new	mm	0.03–0.05
		radial	wear limit	mm	0.08
		axial	when new	mm	0.10–0.25
		axial	wear limit	mm	0.3

Nm Crankshaft bearing cap

Number	Designation				Engines 604, 605, 606
BA03.20-P-1001-01A	Bolt Crankshaft bearing cap	M11	1st stage	Nm	55
			2nd stage	∡ °	90

Nm Crankshaft

Number	Designation			Engine 602.980/ 981/982/ 983/984/ 985
BA03.20-N-1001-01A	Bolt of crankshaft bearing cap	1st stage	Nm	55
		2nd stage	∡°	90

Commercially available tools (see Workshop Equipment Manual)

Number	Designation	Make (e.g.)	Order number
WH58.30-Z-1055-12A	Gage for micrometer	Hahn und Kolb Borsigstr. 50 70469 Stuttgart	31414150

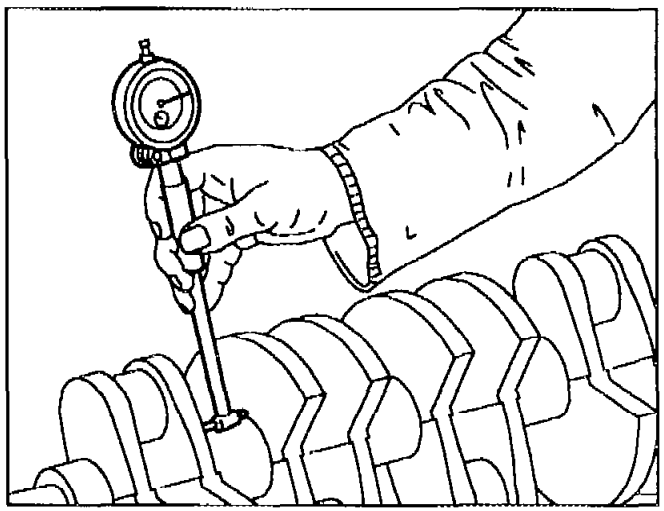
Commercially available tools (see Workshop Equipment Manual)

Number	Designation	Make (e.g.)	Order number
WH58.30-Z-1065-12A	Quick calipers for internal measurements	Hahn und Kolb Borsigstr. 50 70469 Stuttgart	33520 080

1 Measure width of fit bearing at crankcase and at fit bearing cap and note.

2 Measure width of fit bearing at crankshaft and note.

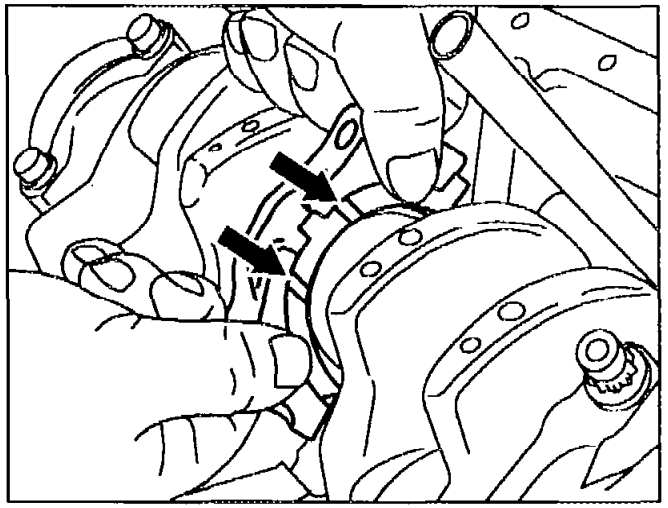
3 Determine thickness of thrust washer.



P03.20-0249-01

i Thrust washers of the same thickness must always be inserted on one side in the crankcase and in the fit bearing cap.

4 Install thrust washers.



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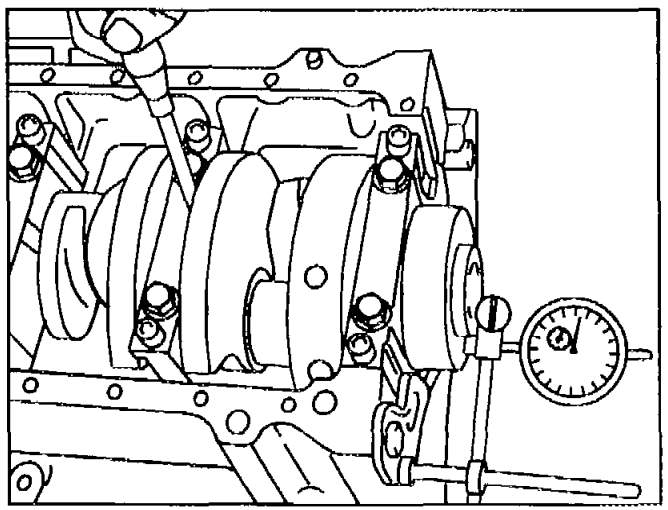
i The oil grooves must face towards the contact surface of the crankshaft and be oiled. The anti-twist lock is on the thrust washer in the bearing cap.

5 Measure axial bearing play and adjust to correct size, if necessary.

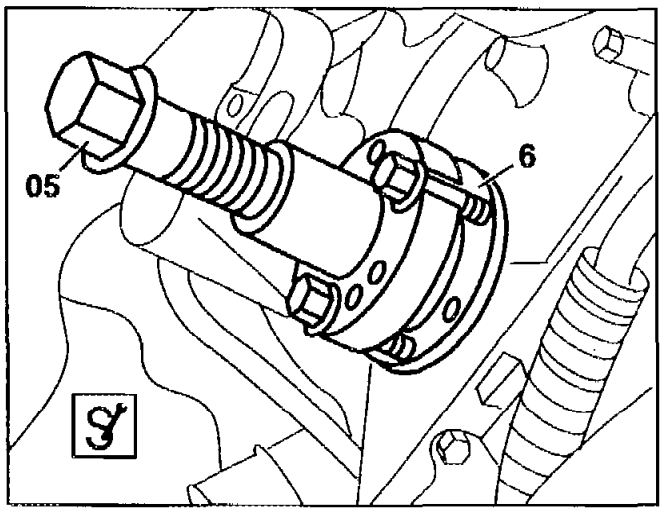


P03.20-0251-01

L16 AR03.30-P-1600-02B	Remove the pulley / vibration damper	Belt pulley / vibration damper 1st version 103 589 00 33 00 Puller	

1 Attach puller (05) to hub with bolts (parts supplied).

2 Pull off hub (6).



P03.30-0229-01

M16 AR03.30-P-8001-01HA	Examining bolts for flywheel/driven plate		

Flywheel, driven plate

Number	Designation				Engines 605, 606 with automatic transmission up to 4/95	Engines 605, 606 with manual transmission (ZMS) up to 4/95
BE03.30-P-1001-01A	Flywheel and driven plate bolts (1st version)	Thread dia. (D)		M	10×1	10×1
		Stretch shank dia. (d)	New condition	mm	8.5–0.2	8.5–0.2
			min.	mm	8.0	8.0
		Shaft length (L)	New condition	mm	22.0± 0.2	57.0± 0.2
			max.	mm	22.5	–
			See figure		AR03.30-P-8001-01HA	AR03.30-P-8001-01HA

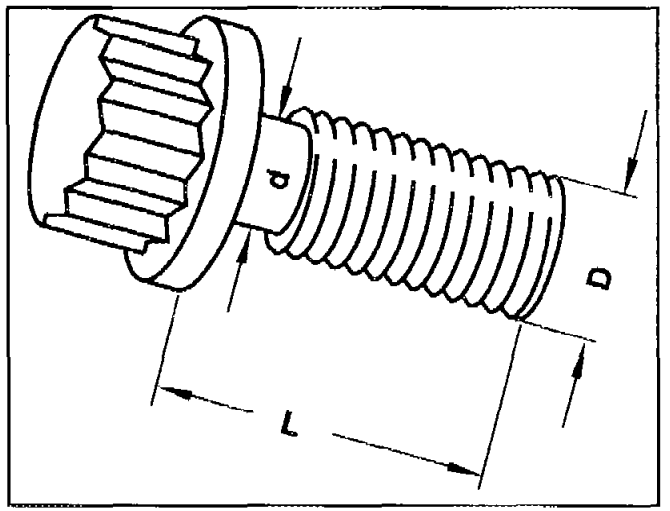
Flywheel, driven plate

Number	Designation				Engine 604 up to 10/95	Engine 111 with two-mass flywheel
BE03.30-P-1001-01A	Flywheel and driven plate bolts (1st version)	Thread dia. (D)		M	10×1	10×1
		Stretch shank dia. (d)	New condition	mm	8.5–0.2	8.5–0.2
			min.	mm	8.0	8.0
		Shaft length (L)	New condition	mm	22.0± 0.2	57.0± 0.2
			max.	mm	22.5	–
			See figure		AR03.30-P-8001-01HA	AR03.30-P-8001-01HA

Flywheel, driven plate

Number	Designation				Engine 111 with flywheel and driven plate	Engine 111 with sheet metal two-mass flywheel
BE03.30-P-1001-01A	Flywheel and driven plate bolts (1st version)	Thread dia. (D)		M	10×1	10×1
		Stretch shank dia. (d)	New condition	mm	8.5–0.2	8.5–0.2
			min.	mm	8.0	8.0
		Shaft length (L)	New condition	mm	22.0±0.2	22.0± 0.2
			max.	mm	22.5	22.5
			See figure		AR03.30-P-8001-01HA	AR03.30-P-8001-01HA

1 Measure stretch shank diameter.
If the specified minimum diameter "d" no longer exists at the stretch shank, replace the stretch bolts.



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