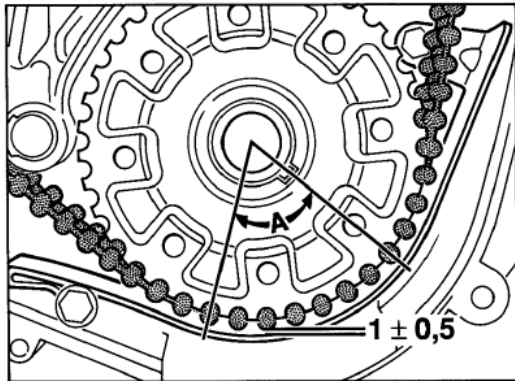


Adjusting guide rail for balance shaft toothed belt

Engine Type M 44.43/44

1. Tighten mounting bolts of guide rail lightly.
Fit sprocket for balance shaft drive and toothed belt.
Put balance shaft toothed belt under preload.
2. Using a feeler gauge, measure and adjust clearance between toothed belt and guide rail.
Adjusting dimension: 1 ± 0.5 mm
6. Fit sprocket and balance shaft toothed belt and adjust according to specification.
Refer to pages 13 - 7 to 13 - 10.

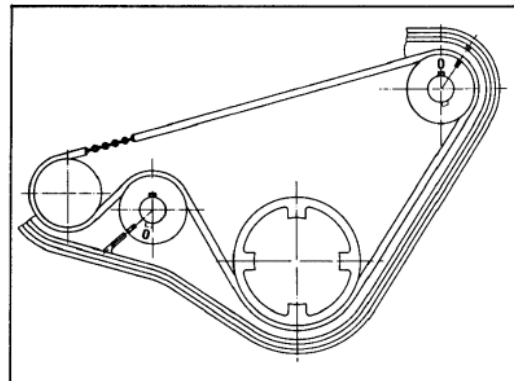
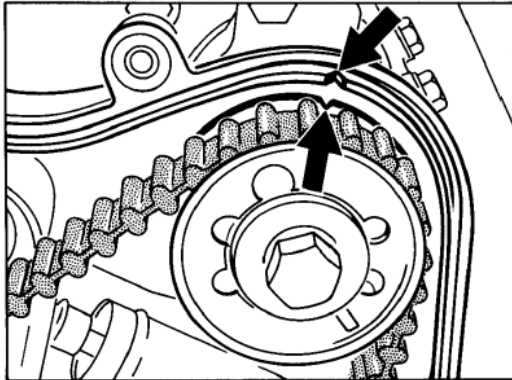
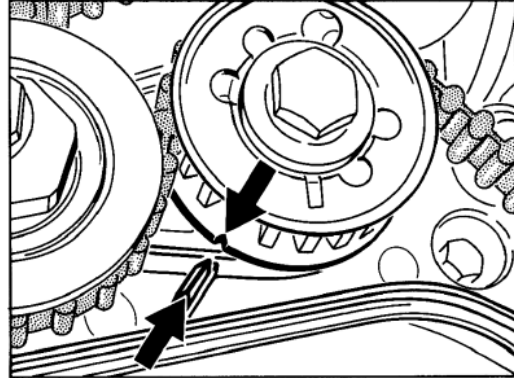


3. Check clearance of guide rail over a length of 7 teeth (dimension A).
The adjusting dimension must be 1 ± 0.5 mm.
4. To achieve the correct adjustment, slide the guide rail in the bolt holes.
5. Tighten both hexagon head bolts of the guide rail and check setting dimension again. Take off toothed belt and sprocket again. Take off toothed belt and sprocket and tighten both pan head screws.

Checking adjustment of balance shafts

1. Undo and remove engine underside protection and upper toothed belt cover.
2. Rotate crankshaft clockwise until TDC mark on camshaft drive sprocket is lined up with the mark on the toothed belt cover. The TDC mark on the flywheel (center notch on double-mass flywheel) must also line up.
3. The mark on the upper balance shaft drive sprocket must line up with the mark on the rear toothed belt cover.

The Fig. shows the sprocket position with the toothed belt cover removed.



4. Remove plug cap from lower toothed belt cover. Check position of marks of lower balance shaft drive sprocket across inspection hole. Mark on sprocket must line with mark on rear toothed belt cover.

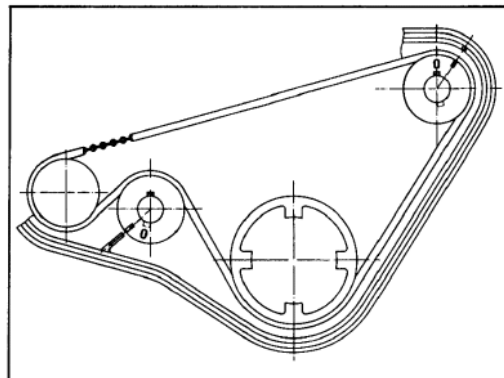
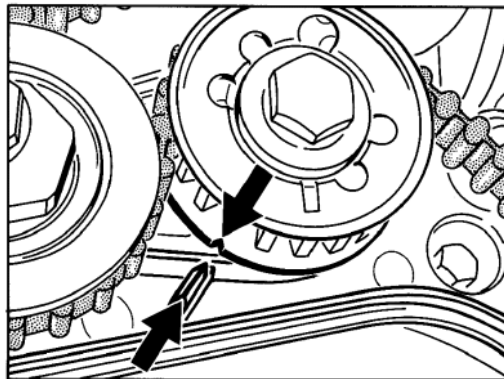
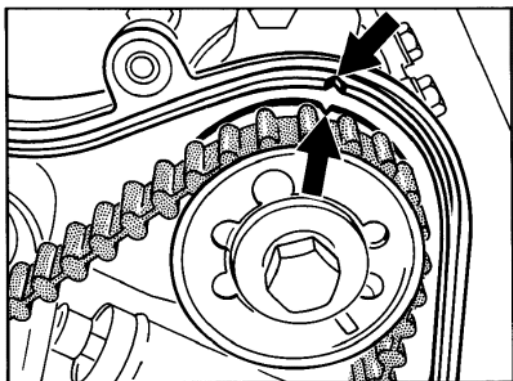
Fitting toothed belt for balance shaft

Note

Handle balance shaft toothed belt with care, avoid twisting or turning as this may cause excessive running noise. Store separately.

When replacing the toothed belt, do not undo the mounting bolts of the balance shaft drive sprockets.

1. Rotate crankshaft clockwise until the TDC mark on the camshaft drive sprocket lines up with the mark on the toothed belt cover. The TDC mark on the flywheel (center notch of double-mass flywheel) must also line up.
2. Rotate both balance shafts (without toothed belts) until the marks on the balance shaft drive sprockets are lined up with the marks on the rear toothed belt cover.



3. Fit the toothed belt:

When fitting the toothed belt, make sure the belt side with the color-coded tooth faces towards the outside.

4. Adjust toothed belt tension according to specification.
Refer to page 13 - 7 to 13 - 10.

Adjusting Special Tool 9201

The measuring gauge has been preset to a display of 4.0 dial values and allows the Special Tool 9201 to be checked and to be set to 4.0 dial values, respectively.

Adjustment of the device is required after:

- approx. 100 measurements
- hard shocks
- minor damage

If major damage is present or if the display deviates by more than approx. 2.0 dial values, the devices cannot be adjusted any more. Return the device to the manufacturer for repair.

Address:

Fritz Staeger
Jahnstrasse 68 - 72

D-1000 Berlin 47

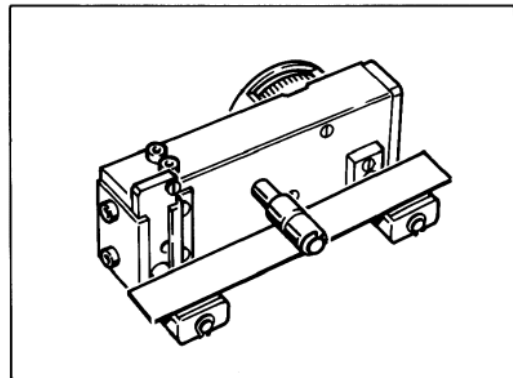
Phone: 030/6291-266
Fax: 030/6291277

Adjustment

Tools required:

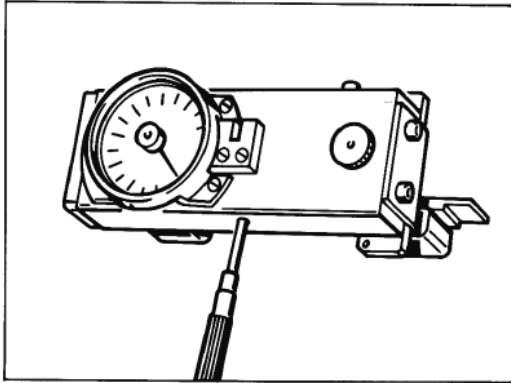
- Hex socket head screwdriver 1.5 A/F
(for new tools)
- or screwdriver 1.6 x 40 x 0.4
(for older tools)
- Measuring gauge 9201/2

1. Adjust to zero, rotating dial ring of dial gauge until pointer and zero line up.
2. Place measuring gauge 9201/2 into position, making sure both measuring mating faces on the sliding blocks are centered. (Measuring gauges of the new type are made of one piece, allowing them to be placed into position easier).



3. Measure as when using the tool on the toothed belt, i.e. press in measuring button until engagement of the lock pin is felt, and read off displayed value on the dial gauge.

4. If the display is beyond the measuring range of 4.0 ± 0.3 dial values, readjust dial gauge. To do so, use hex socket head screwdriver or standard screwdriver, respectively, to turn the adjusting screw until the specified value of 4.0 dial values is obtained. The measuring gauge 9201/2 rests between the measuring pointer of the tester.

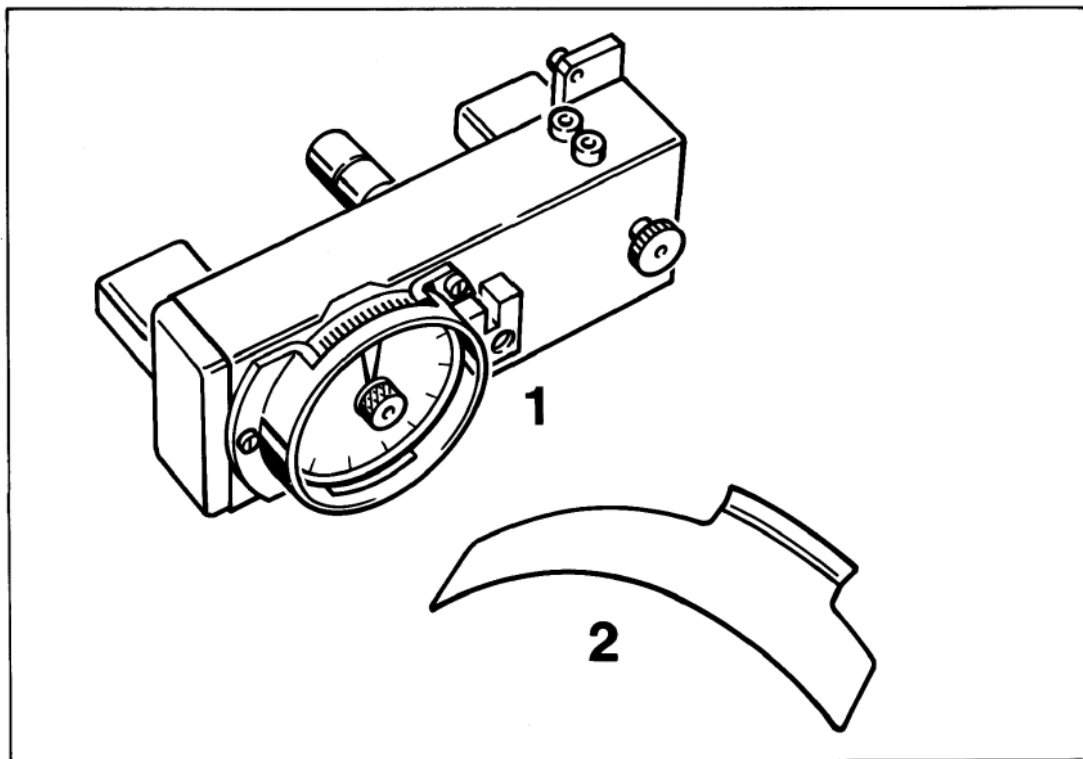


5. Follow adjustment with another test.

LAUNCH

Checking and adjusting balance shaft toothed belt tension

Tools



No.	Designation	Special tool	Order number	Explanation
1	Tester for belt tension	9201	000.721.920.10	
2	Adjusting gauge	9207	000.721.920.70	

Checking and adjusting balance shaft toothed belt tension

Note

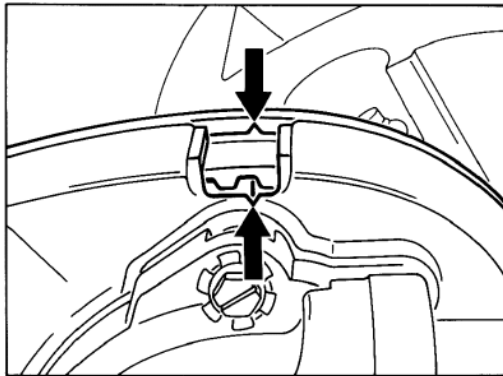
The toothed belt tension must be checked and adjusted only when the engine is cold (room temperature).

1. Undo and remove air cleaner assembly and engine underside protection.
2. Remove Poly-Rib belt or power pump belt, respectively.

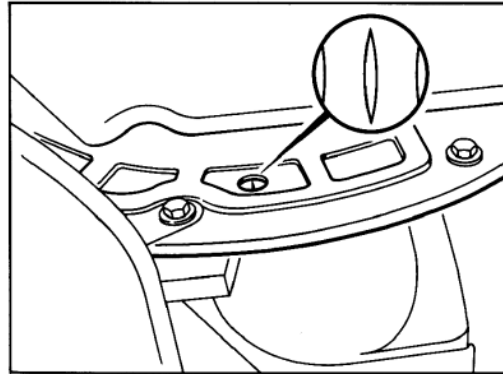
Note

Before undoing the lock nuts, always start by slightly loosening the hexagon head bolts of the link rod.

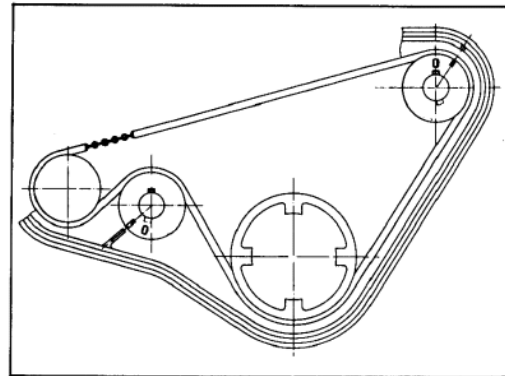
3. Remove toothed belt cover. Undo idler until the idler no longer places a preload on the toothed belt.
4. Rotate crankshaft clockwise until TDC mark on camshaft drive sprocket lines up with mark on toothed belt cover.



5. The TDC mark on the flywheel (double-mass flywheel) must also line up.



6. Check basic position of balance shaft drive sprockets. The marks on the sprockets must line up with the marks on the rear toothed belt cover.



7. Prepare Special Tool 9201 for check. Pull out lock pin of Special Tool and push measuring pin opposite the lock pin all the way out. Align non-return pointer to measuring pointer.
8. Push Special Tool onto toothed belt. Push measuring button (arrows) slowly in until engagement of the lock pin is felt and read off displayed value on dial gauge.

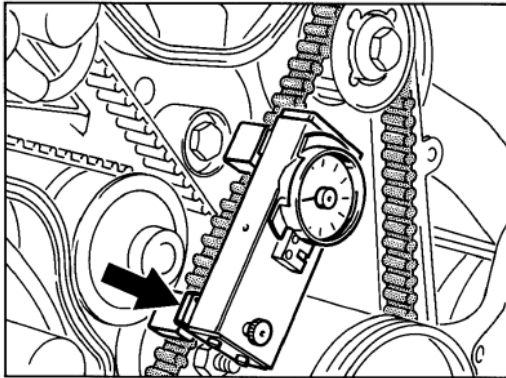
Note

To avoid reading errors, the non-return pointer must always be aligned to the measuring pointer after the lock pin has engaged (turn counterclockwise).

Adjusting value:

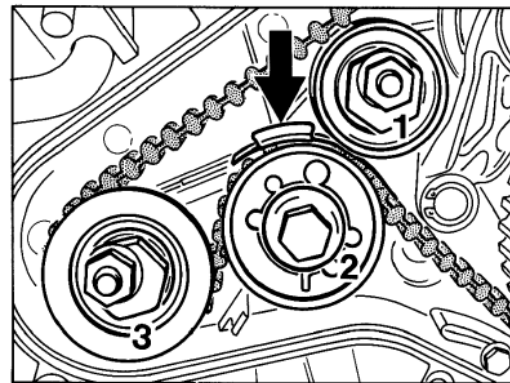
(new and used belts)
 2.7 ± 0.3 dial values

If required, correct toothed belt tension.



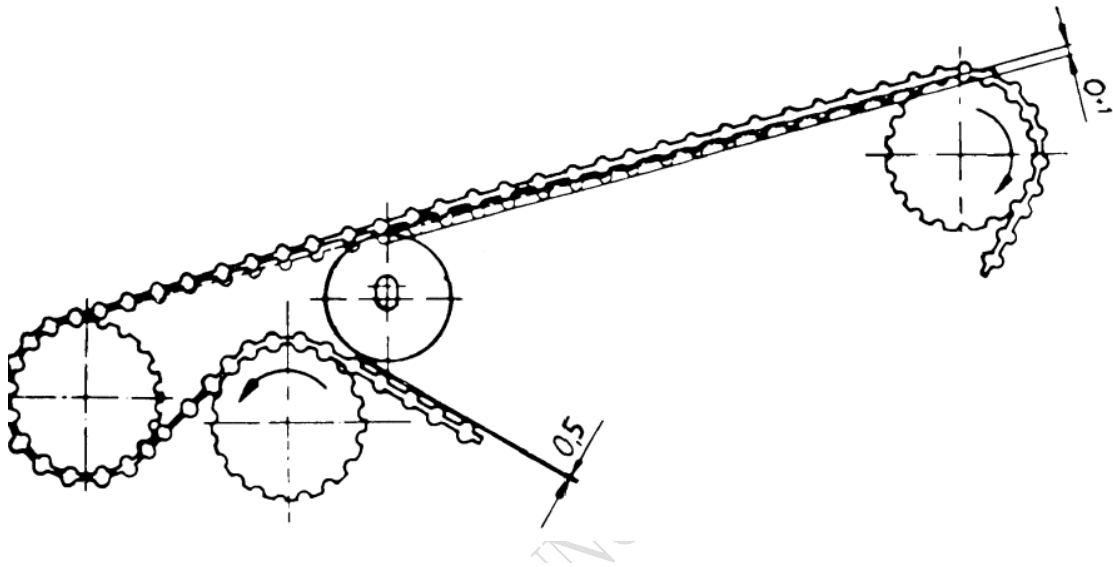
Adjusting

9. The sliding blocks must rest on the belt along their entire surface. During the measuring process, the Special Tool must neither be twisted nor moved on the belt.
10. When tensioning, rotate tensioning pulley clockwise. When slackening, rotate tensioning pulley counterclockwise. Tighten hexagon nut to 45 Nm (33 ftlb), using a second wrench to lock.
11. After the toothed belt has been adjusted, follow by adjusting the idler. Using Special Tool 9207 or a feeler gauge (0.5 mm), set idler pulley to a clearance of 0.5 mm to the toothed belt in bottom balance shaft area and preload upper toothed belt train by 0 to 1 mm at same time. Tighten idler pulley in this position. If the adjustment travel is not sufficient, turn idler pulley by 180° and repeat adjustment. Tighten hexagon head nut to 45 Nm (33 ftlb), using a second wrench to lock.



- 1 - Idler pulley
- 2 - Balance shaft
- 3 - Tensioning pulley

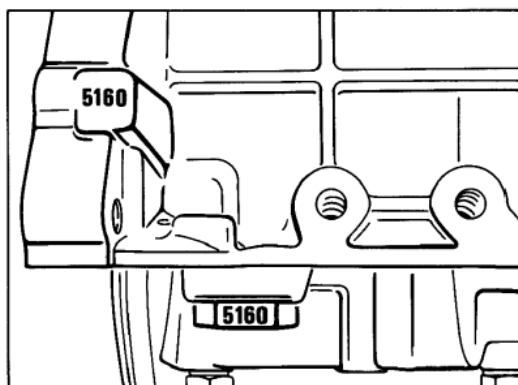
12. Fit toothed belt cover. Install Poly-Rib belt or power pump belt, respectively, and adjust according to specification. Fit belt or power pump belt, respectively, and adjust according to specification. Fit engine under-tray and air assembly.



Crankcase markings

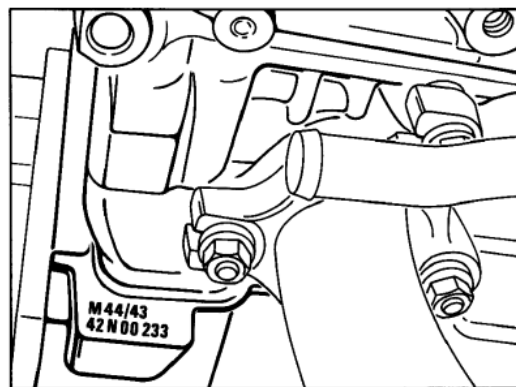
Upper and lower crankcase section and balance shaft cover

1. The upper and lower crankcase sections as well as the balance shaft cover are machined as a unit and must always be fitted as a unit. Observe correct identification marking.



Engine number

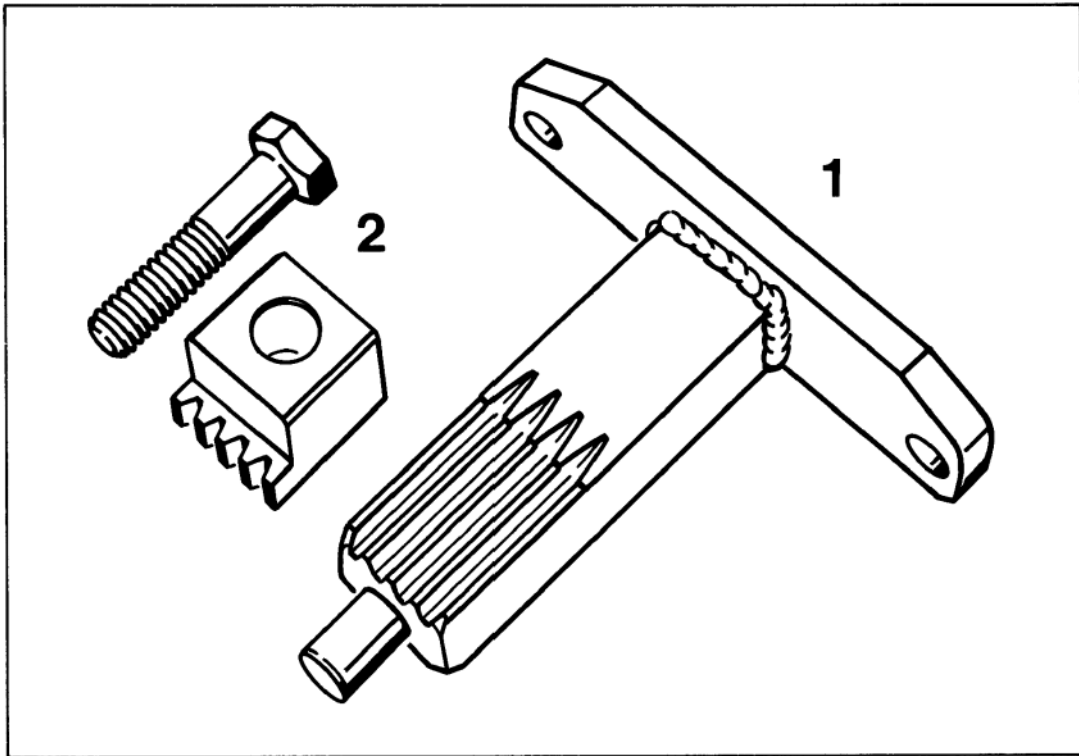
The engine number is engraved on the right-hand rear end of the engine when seen in the direction of travel.



2. When the components have been fitted, it must be possible to read off the markings of both balance shaft covers from above.

Locking the flywheel for assembly work

Tools

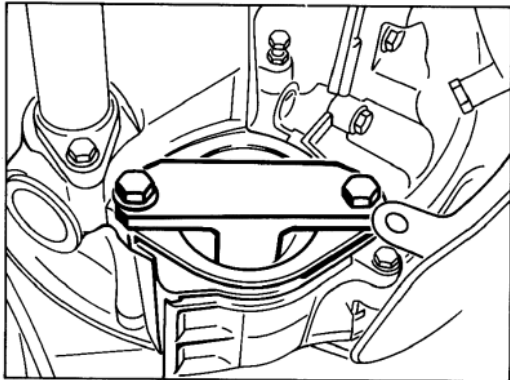


No.	Designation	Special tool	Order number	Explanation
1	Toothed segment	9206/1	000.721.920.61	Engine installed
2	Toothed segment with hex. head bolt M 12 x 1.5 x 60	9538/1	000.721.953.81	Engine removed

Locking the flywheel for assembly work

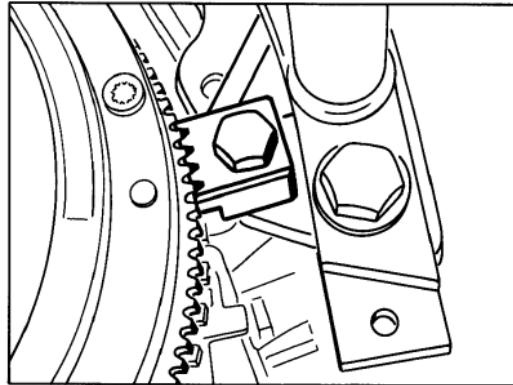
(Engine with double-mass flywheel is installed)

1. Disconnect ground cable from battery.
Remove starter.
2. Place Special Tool 9206/1 into position and lock.



Engine removed

4. Fit hexagon head bolt with Special Tool 9538/1 to engine support adapter and lower engine mount.

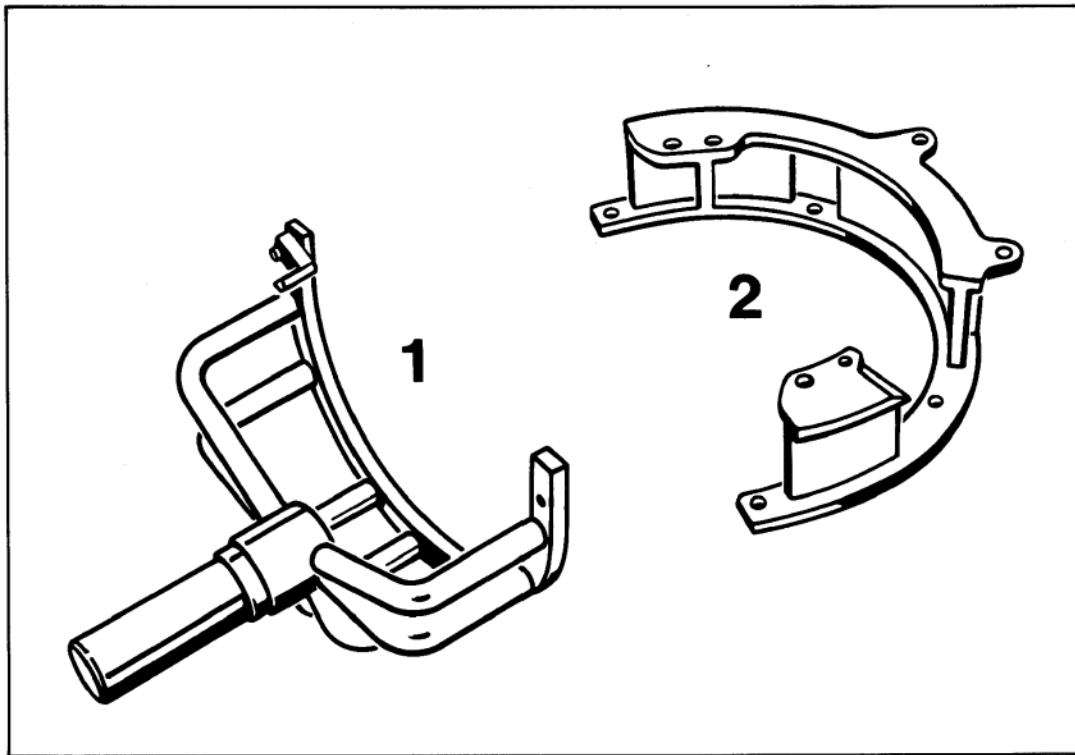


3. In case of Tiptronic transmissions, use old Special Tool 9206.

LAUNCH

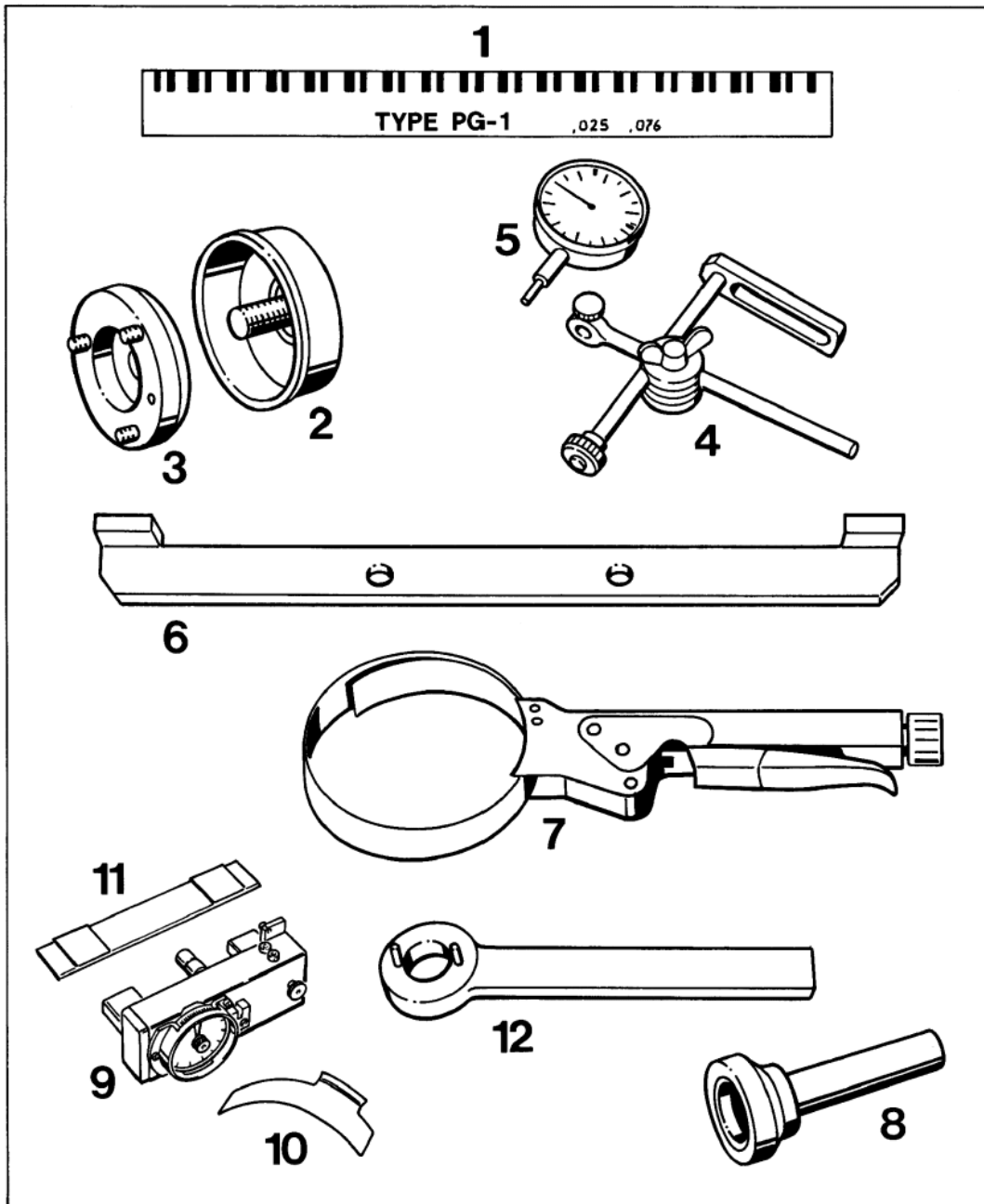
Engine support

Tools



No.	Designation	Special tool	Order number	Explanation
1	Engine support	9127	000.721.912.70	
2	Engine support adapter	9197	000.721.919.70	

Crankcase - Tools



No.	Designation	Special tool	Order number	Explanation
1	Plastigage for measuring the bearing clearances		V/161 - green V/162 - red V/163 - blue	Commercially available, e.g. Matra-Werke Dieselstrasse 30 - 40. Frankfurt/Main
2	Thrust piece for seal	9517	000.721.951.70	
3	Assembly tool	9517/1	000.721.951.71	
4	Dial gauge holder	VW 387	VW 387	
5	Dial gauge			Commercially available
6	Retaining bracket for locking the flywheel	9130	000.721.913.00	
7	Piston ring compressor			Commercially available, e.g. Hazet 794-U-3
8	Thrust piece	9202	000 721 920 20	
9	Belt tension tester	9201	000 721 920 10	
10	Adjusting gauge	9207	000 721 920 70	
11	Measuring gauge	9201/2	000 721 920 12	
12	Retaining wrench	9200	000 721 920 00	

LAUNCH

Machining cylinder bores in upper crankcase section

The upper crankcase section is an aluminium alloy product and contains minute particles of pure silicium.

In order to have an usable cylinder surface finish, the cylinder bores have to be machined in a manner that the silicium particles protrude out of the aluminium and therefore pistons and piston rings only have contact with the silicium.

If it is necessary to machine cylinder bores, they can be restored with a **SUNNEN CK-10 / CV - 616** cylinder repairing machine for installation of oversize pistons.

Standard size	100.00 mm
Oversize 1	100.50 mm

Single cylinder bores can be machined as required, since pertinent oversize pistons weigh the same as standard pistons.

Prior to machining cylinder bores it is recommended to check the stocks on hand for pertinent tolerance groups and, if necessary, to hone the bore for a certain piston size which is available. There could be problems in supplying pistons of certain tolerance groups depending on circumstances.

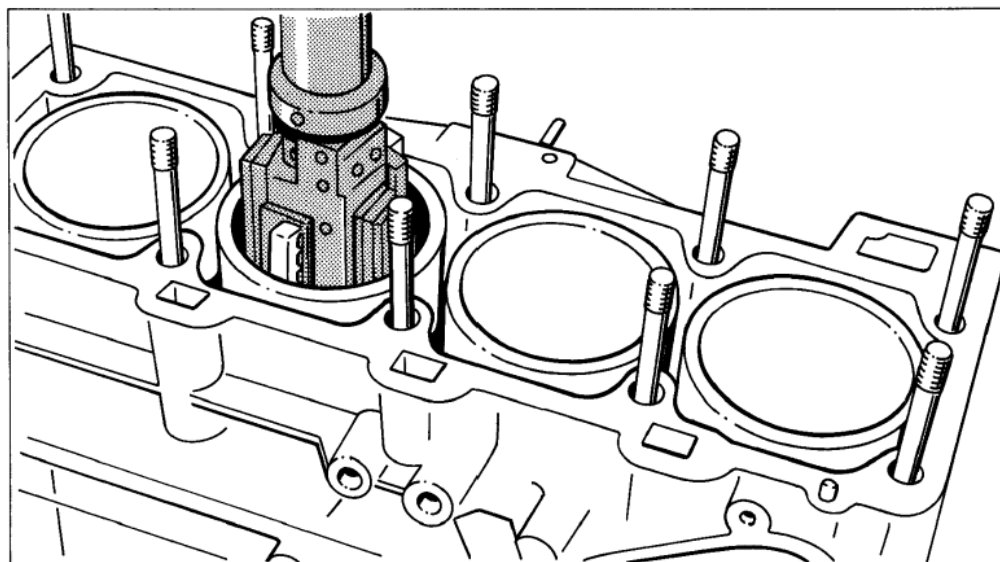
The following procedures are necessary:

Rough turning to 0.1 mm before finished size.

Dressing to 0.02 mm before finished size.

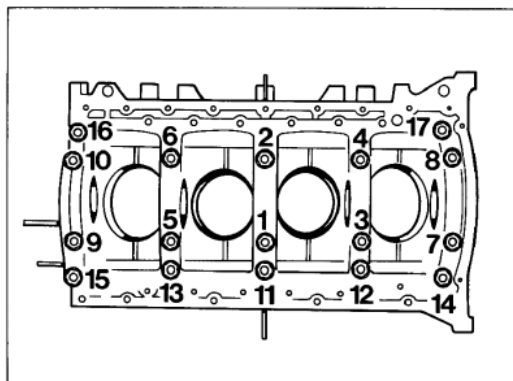
Polishing to finished size.

Lapping with Sunnen silicium mixture.



Procedures

It is absolutely necessary to bolt the upper and lower crankcase sections together with help of the bearing studs prior to machining.



Tightening sequence:

Nos. 1 to 10 in 2 steps:
Thread M 12 x 1.5

1st step 30 Nm (22 ftlb)
2nd step 60 deg. rotating angle

Nos. 11 to 17 in 2 steps
Thread M 10 x 1.5

1st step 20 Nm (15 ftlb)
2nd step 50 Nm (37 ftlb)

Tools

Machine	CK-10 with filter CV-616 with filter
Grinding attachment	CK-3000 or CK-2600
Grinding oil	MB-30
Felt inserts	C30-F 85 1 set
Silicium mixture	AN-30
Storage box for felt inserts	AN-35
Stone holder set for felt inserts instead of honing stones	CK-3035 A 1 set
Stone holder set for honing stones for 3 different stones (types)	CK-3035 A 3 set
Felt holder seat instead of guide shoe	CK-3130 A 1 set
Roughing stone set	C30-J 55 ++ shorten to 70 mm length
Dressing stone set	C30-J 84 ++ shorten to 70 mm length
Polishing stone set	C30-C 03 - 81

Honing Procedures

Perform all honing and lapping jobs without the upper dressing guide shoe.

The protrusion of the bronze bar on main guide shoe no. 3 has to be eliminated; flush with guide shoe base.

Setting up machine

Roughing adjustment – table described in column 1.

Dressing adjustment – table described in column 2.

Polishing adjustment – table described in column 3.

Lapping - uncovering the silicium crystals.

1. Set up machine as described in column 4 of test sheet.
2. Thoroughly remove all abrasive residue from previous honing jobs with filtered honing oil.
3. Wipe cylinder bores dry and apply a thin coat of thoroughly mixed silicium mixture.

Note:

If the silicium mixture is too consistent, it can be diluted by adding fresh honing oil and mixing thoroughly.

4. Holders with felt inserts are now placed in the grinding attachment instead of guide shoe and honing stones.

Adjusting to the cylinder diameter is made with a gage as for the guide rails and honing stones.

5. Soak felt inserts in filtered honing oil and coat with silicium mixture.
6. Stop grinding oil feed; cylinders are lapped without grinding oil!

Machining cylinders

Guide grinding attachment into bore. Turn feed wheel anticlockwise until felt inserts rest on walls. Start machine and keep turning handwheel anticlockwise until needle of load instrument reaches approx. 20 to 30 %.

Now set scale of feed wheel to 20.

The machine stops on its own after about 80 seconds. The cylinder surface will now be dull and without gloss.

First coat felt inserts with new silicium mixture before going on the next cylinder.

Note:

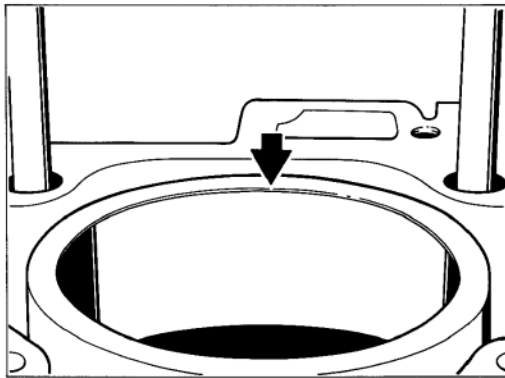
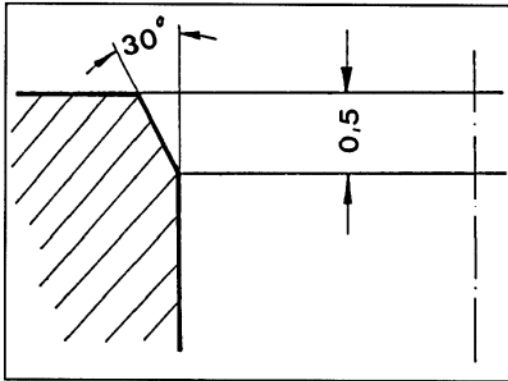
If holder with felt inserts are not being used, they must be kept in the storage box to avoid contact with dirt.

Never reuse old silicium mixture.

Machining Cylinder Bores with SUNNEN - 10/CV 616

	1. Roughing to Ø	2. Dressing to Ø	3. Polishing to Ø	4. Lapping
Cylinder dia. Standard 100.00 mm				
Cylinder dia. Oversize 1: 100.50 mm	100.40 mm	100.48 mm	100.50 mm	100.50 mm
Cylinder length 145 mm				
Honing head type	CK - 3000 or CK - 2600	dto.	dto.	dto.
Travel scale for stone length	70 mm	70 mm	70 mm	70 mm
Adjustment on scale	160 mm	160 mm	160 mm	125 mm
Speed (rpm)	125 CK/CV	125 CK/CV	125 CK/CV	125 CK/C4
Strokes per minute	49 CK/57 CV	49 CK/57 CV	49 CK/57 CV	73 CK/80 CV
Feed	4	3	3	3
Stone protrusion top	21 mm	21 mm	21 mm	2 mm
Roughing stone	C 30 - J 55			
Dressing stone		C 30 - J 84		
Polishing stone			C 30-C03-81	
Felt insert				C 30-F 85
Display %	30 - 40	30 - 40	20 - 30	20 - 30
Material removed	0.07 mm	0.03 mm	0.01 mm	aprox. 20 lines
Adjustment on feed wheel	10 lines	10 lines	10 lines	80 sek. runn. t.
Surface finish (Rt.)	aprox. 7 - 8 my	aprox. 2my	aprox. 0,6-0,8 my	aprox. 1-2 my

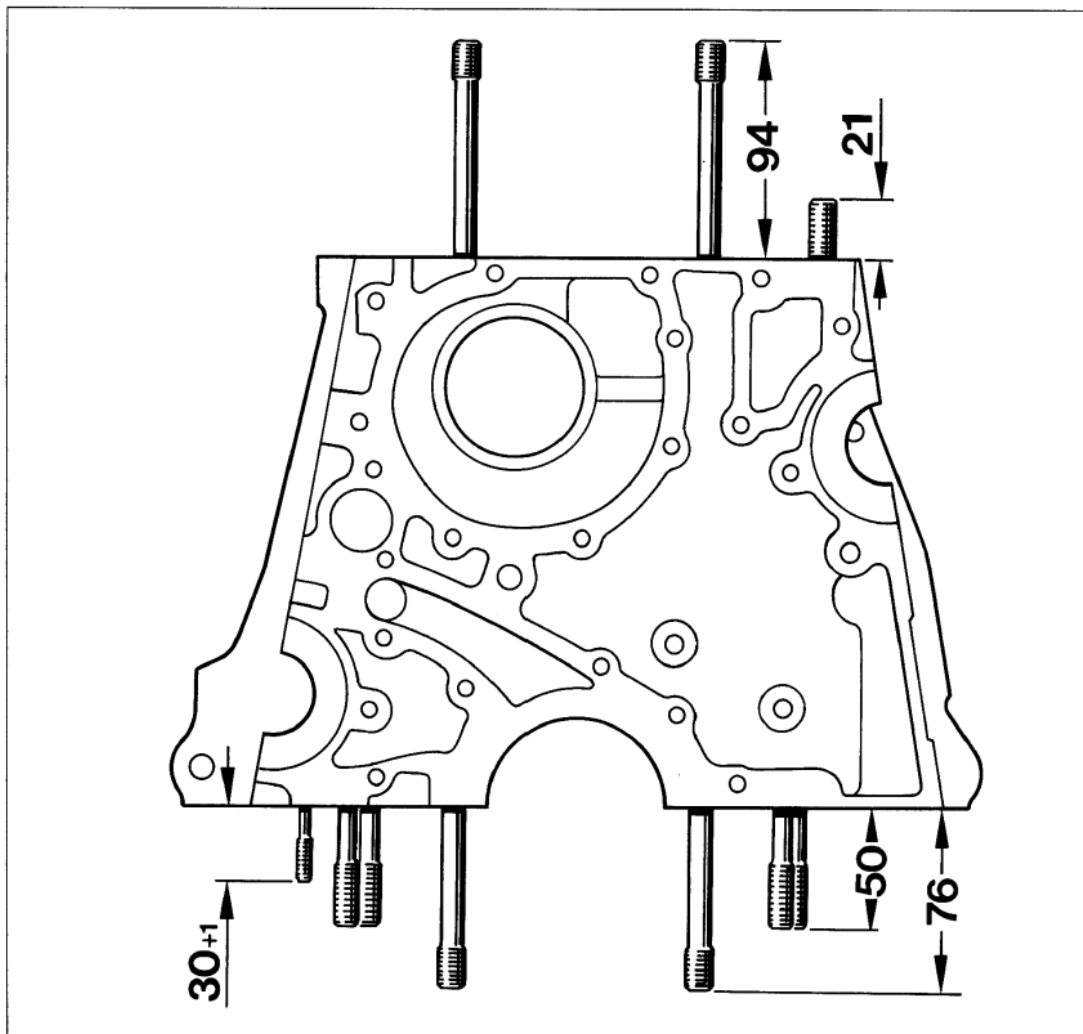
A chamfer of 0.5 mm x 30° has to be machined on the upper cylinder wall of machined cylinder bores after finishing the honing procedures.

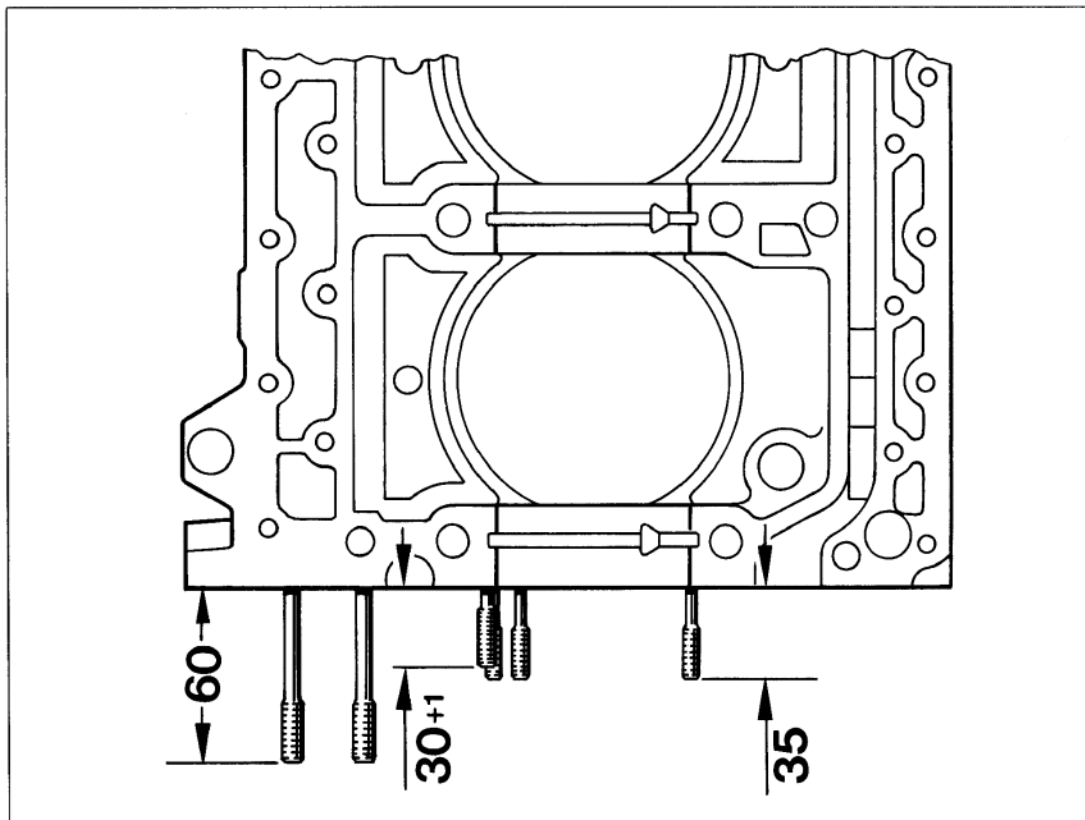


Clean upper and lower crankcase sections thoroughly to remove abrasion residue and silicium paste prior to assembling.

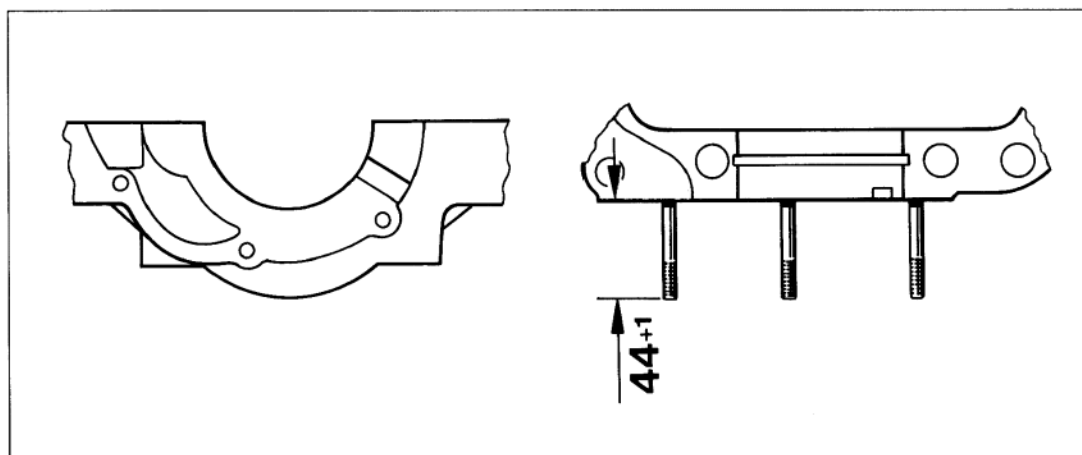
Crankcase - Installation length or protrusion length of studs

Caution: Unless indicated otherwise, lock all studs with Loctite 270 when reassembling the engine!

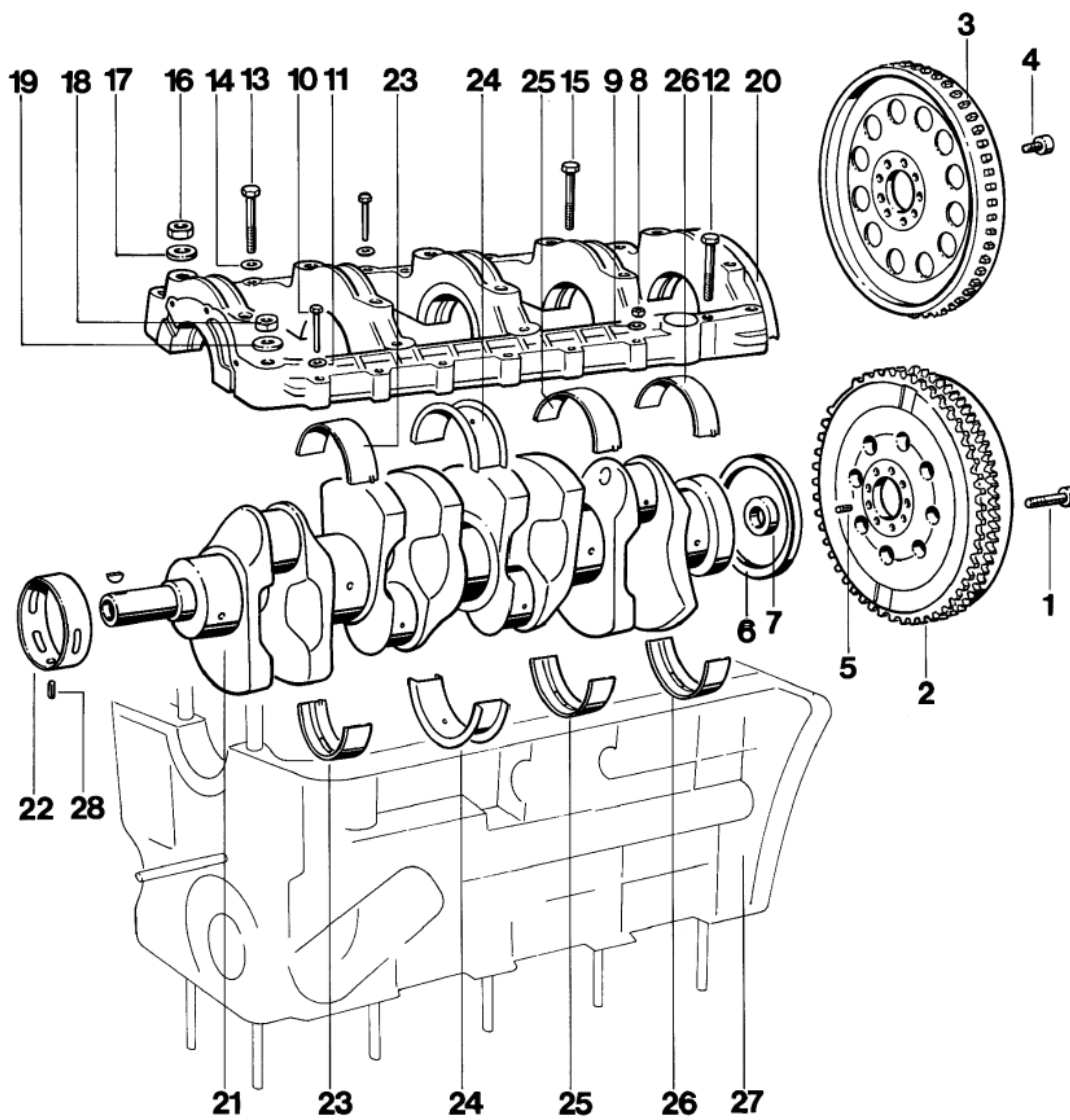




Studs - oil pump area



Dismantling and assembling crankcase, crankshaft



No.	Designation	Qty.	Note:	
			Removal	Installation
1	Pan head screw M 10 x 1.25 x 62	9		Tightening torque 90 Nm (66 ftlb)
2	Double-mass flywheel	1		
3	Tiptronic flywheel	1		
4	Pan head screw M 10 x 1.25 x 20	9		Tightening torque 90 Nm (66 ftlb)
5	Roll pin 6 x 16	1		
6	Shaft seal	1		Replace, apply a thin coat of oil to sealing lip
7	Deep-groove ball bearing	1		
8	Hexagon head nut	1		
9	Washer A 6.4	1		
10	Hexagon head bolt M 6 x 35	5		
11	Washer A 6.4	5		
12	Hexagon head bolt M 8 x 55 Oil suction pipe mounting	1		
13	Hexagon head bolt M 8 x 55	6		
14	Washer	6		
15	Hexagon head bolt M 8 x 55	1		
16	Hexagon head nut M 10	7		
17	Washer	7		Rounded side faces up
18	Hexagon head nut M 12 x 1.5	10		Lettering faces up
19	Washer	10		Rounded side faces up
20	Lower crankcase section	1		Clean and degrease sealing surface, apply Loctite 574 to seal

No.	Designation	Qty.	Note:	
			Removal	Installation
21	Crankshaft	1		Check end clearance and radial play
22	Closed main-bearing bushing, bearing No. 1	1		Make sure the bearing engages in the roll pin
23	Main bearing No. 2	1		Place bearing insert without lubrication groove into lower crankcase section
24	Thrust bearing No. 3 (pilot bearing)	1		Place bearing insert without lubrication groove into lower crankcase section
25	Main bearing No. 4	1		Place bearing insert without lubrication groove into lower crankcase section
26	Main bearing No. 5	1		Place bearing insert without lubrication groove into lower crankcase section
27	Lower crankcase section	1		Clean and degrease sealing surface in oil suction passage and flywheel areas
28	Roll pin 4 x 8	1		Check for correct seating

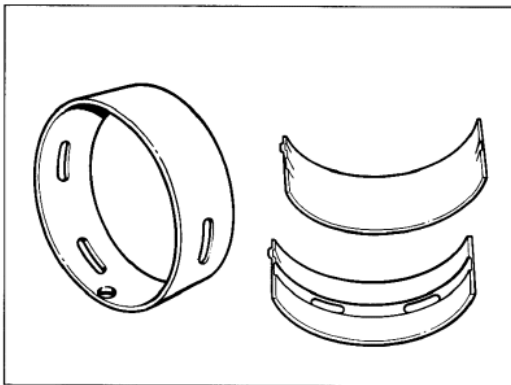
Dismantling and assembling crankcase and crankshaft

Main bearing no. 1

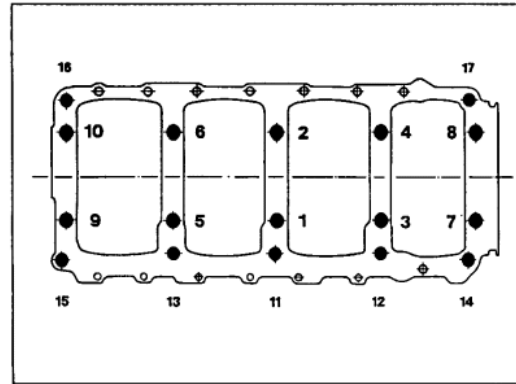
The closed main bearing sleeve for bearing no. 1 has a lubricating groove around one half.

Main bearings no. 2, 4 and 5

When installing it is important, that bearing shells **with** lubricating grooves are placed in the upper crankcase section and bearing shells **without** lubricating grooves in the lower crankcase section.



Tightening sequence - tightening torque



Tightening sequence:

Nos. 1 to 10 in 2 steps:

Thread M 12 x 1.5

1st step	30 Nm (22 ftlb.)
2nd step	60 deg. rotating angle

Nos. 11 to 17 in 2 steps:

Thread M 10

1st step	20 Nm (15 ftlb.)
2nd step	50 Nm (37 ftlb)

Checking crankshaft bearing clearance

The „Plastigage“ method is a simple way of checking bearing clearance.

Plastigage is available in three different sizes for measuring ranges from 0.025 to 0.230 mm.

Type	Color	Measuring Range
PG-1	green	0.025 to 0.075 mm
PR-1	red	0.05 to 0.15 mm
PB-1	blue	0.10 to 0.23 mm

Checking radial clearance

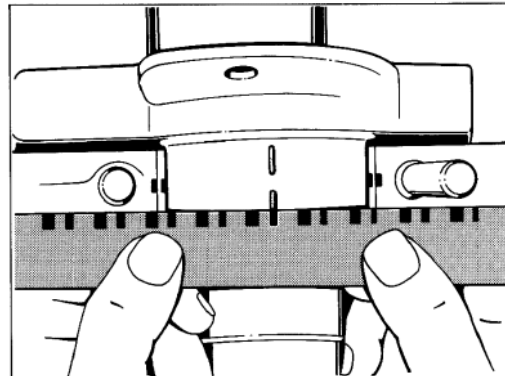
1. Remove crankcase lower section.
2. Remove oil from bearing shell and bearing journal.
3. Place Plastigage having width of bearing on crankshaft journal in axial direction. Install crankcase lower section carefully and tighten to specified torque.

Note

Do not turn crankshaft while measuring.

4. Remove crankcase lower section. Read width of flattened Plastigage from measuring scale. Corresponding value on measuring scale equals the bearing clearance.

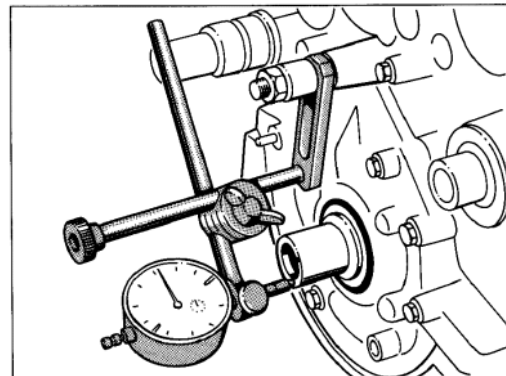
Play of new bearings: 0.020 to 0.098 mm
Wear limit: 0.16 mm



Checking axial clearance

Use special tool VW 387 to check axial clearance.

Play of new bearings: 0.110 to 0.312 mm
Wear limit: 0.40 mm

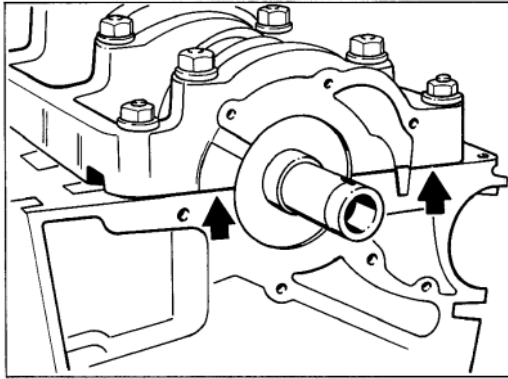


Aligning the upper and lower parts of the crankcase

Note

When assembling, make sure that there is no offset between the crankcase halves on the facing surface (on the oil pump side).

1. Using a plastic hammer, align the slightly tightened lower part of the crankcase (tightening torque 10 - 20 Nm / 7 - 15 ftlb.) with the upper part of the crankcase. Carry out the finger-nail test at the joint.
2. Tighten the crankcase with the specified tightening torque (3 stages).



3. Smooth any slight remaining offset at the joint with oil stone.

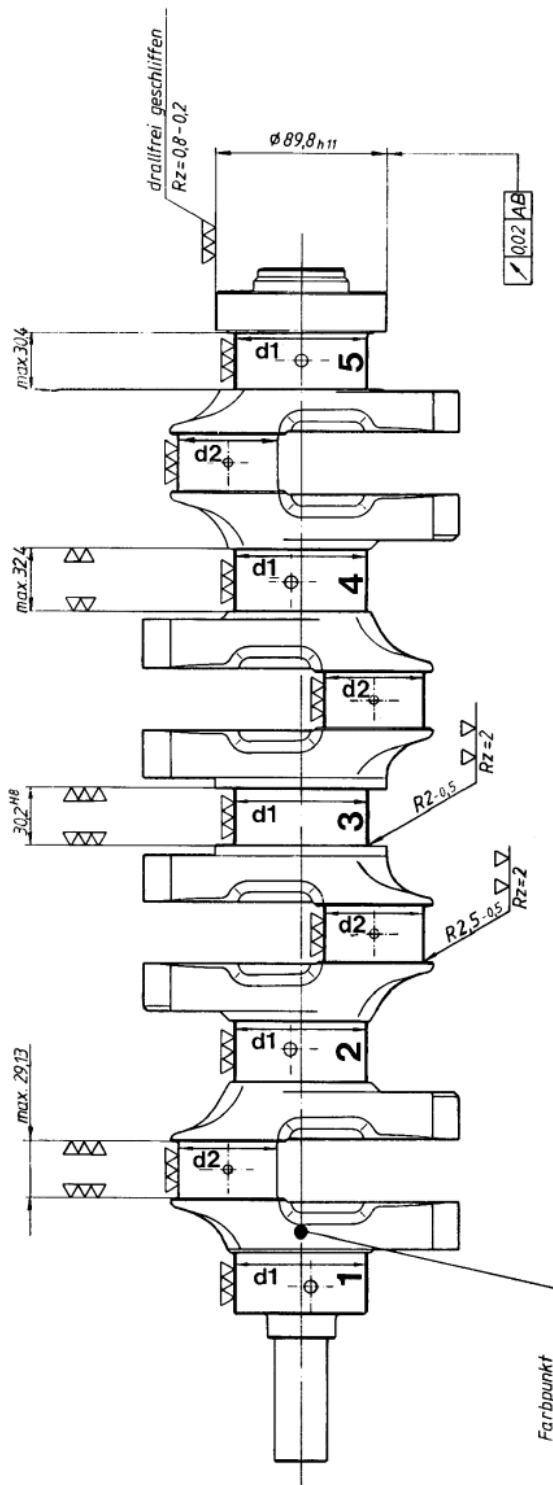
Crankshaft – Standard and Repair Dimensions

Size	Crankshaft bearing journal d 1 Ø	Crankshaft conrod bearing journal d 2 Ø	Thrust bearing 3 width
Standard	69.971...69.990	51.971...51.990	30.00 - 30.052*
- 0.25	69.721...69.740	51.721...51.740	
- 0.50	69.471...69.490	51.471...51.490	
	Crankcase bore Ø		
	Standard 75.000...75.019		
	Oversize 72.250...75.269		

* Thrust bearing 3
Reconditioned size 30.200...30.239

Note

It is recommended to check the availability of bearing sizes prior to machining the crankshaft.



Grind bearing surface for oil seals to dimension 89.8 only if score marks are too deep. In other cases, repolish if required $R_t = 0.8...2$.

Oil bores are rounded to R 0.5 after grinding.

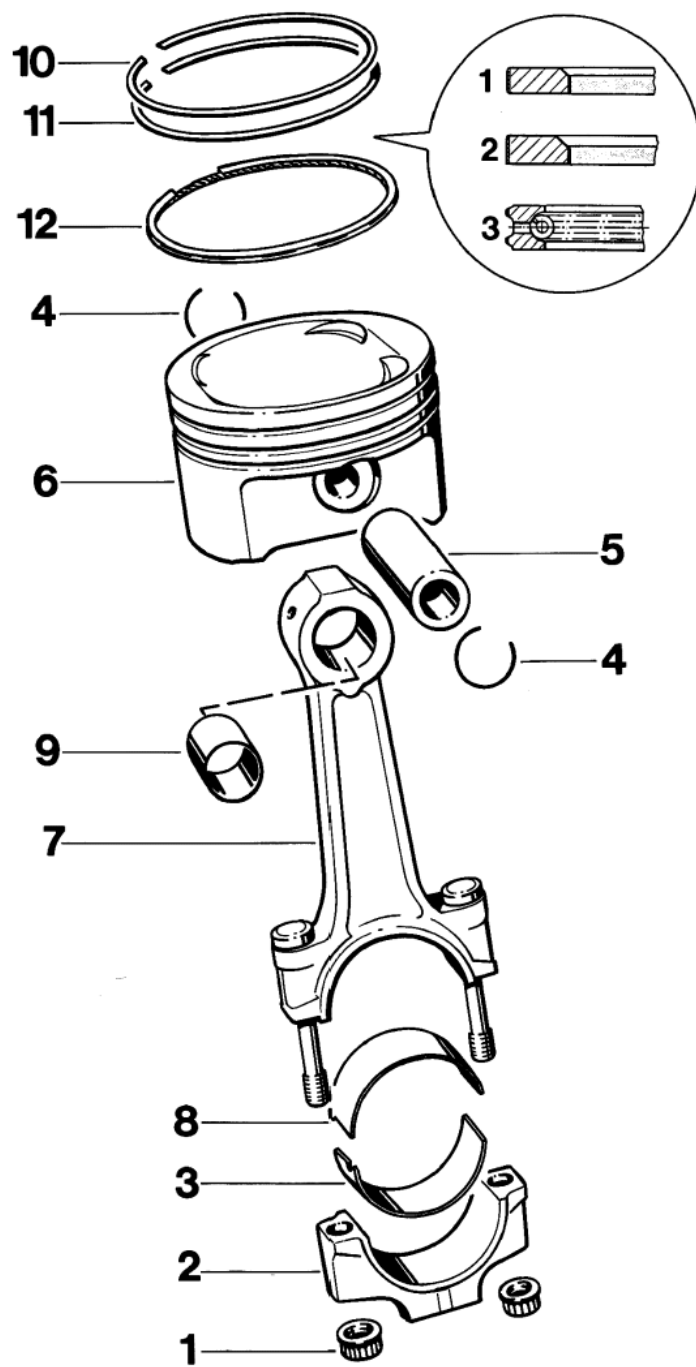
Remove sharp edges with $R = 0.2...0.5$.

Max permissible radial runout relative to support in $-----$ max. 0.04.

Color coding or repair stages:

- 1st repair stage blue color dot
- 2nd repair stage green color dot

Dismantling and assembling pistons, connecting rod



No.	Designation	Qty.	Note:	
			Removal	Installation
1	Connecting rod nut	8		Replace. Tightening torque: 1st stage: 25 Nm (18 ftlb) 2nd stage: 1 x 90° tightening angle Threads and mating surface must be oiled lightly
2	Connecting rod cap	4		Observe correct matching numbers
3	Lower big end bearing insert	4		Always replace used bearing inserts
4	Snap ring	8	Lever out, making sure snap ring does not spring away, e.g. by covering with a rag	Observe correct seating
5	Piston pin	4		
6	Piston	4	Mark installation position	Oil lightly. Observe installation position and tolerance groups
7	Connecting rod with con- necting rod bolts	4		Observe matching number, identification S 3 engraved on side
8	Upper big end bearing insert	4		Always replace used bearing inserts
9	Small end bushing	4		
10	Piston ring, 1st groove Plain compression ring with internal chamfer, 0.4 wide, 45°	4		Lettering faces up
11	Piston ring, 2nd groove Taper faced ring with internal chamfer 0.8 wide, 45°	4		Lettering faces up
12	Piston ring, 3rd groove Narrow-land spring-loaded oil ring with tubular spring	4		Lettering faces up

Assembly notes

Reinforced connecting rods

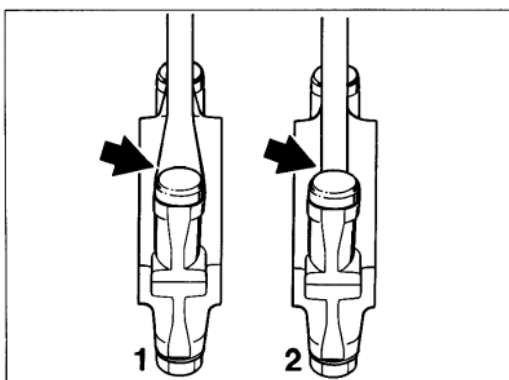
Adopted for production from Oct. 1, 1993,
as of the following engine numbers:

42 R 00 598 (engine type M 44/43)

42 R 50 621 (engine type M 44/44)

Identification mark:

Reinforced transition area from stem to bolt
head seating surface



1 = New

2 = Former version

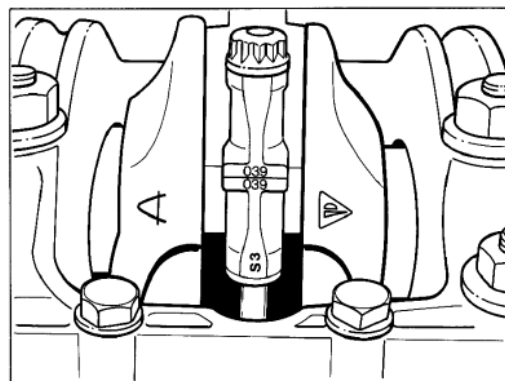
If at least one of the connecting bolt unions is undone during an engine rebuild, the new reinforced connecting rods must always be fitted throughout (if the engine was equipped with the former connection rod version).

These connecting rods are retroactively applicable for spare purposes for all models as of Model Year 1992 (N).

Connecting rod installation position

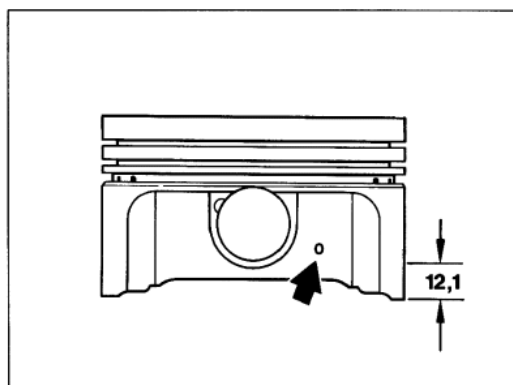
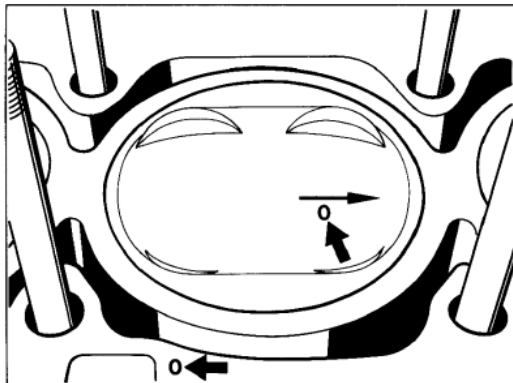
The matching numbers must be fitted so that they face each other and remain legible.

The matching numbers of the four connecting rods must be located in one line, i.e. all matching numbers must be located on the same side.



Piston installation position

The arrow (rubber stamp) points towards the pulley. If the arrow is no longer visible, make sure the tolerance group mark also points towards the pulley.



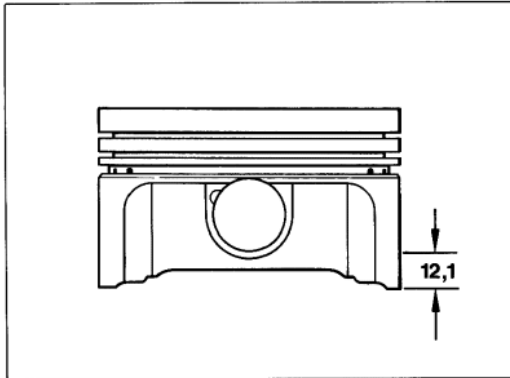
Checking piston and cylinder bore

Engine type M 44.43/44

Repair size	Piston Ø (mm) Kolben Schmidt AG	Cylinder bore (mm)	Tolerance groups Code
Standard	103.980	104.000	0
	103.990	104.010	1
	104.000	104.020	2
	± 0.007	± 0.005	
Oversize 1	104.480	104.500	10
	104.490	104.510	11
	104.500	104.520	12
	± 0.007	± 0.005	

Checking pistons

Measure at a distance of 12.1 mm from the bottom of the piston skirt, offset from the piston pin axis by 90°.



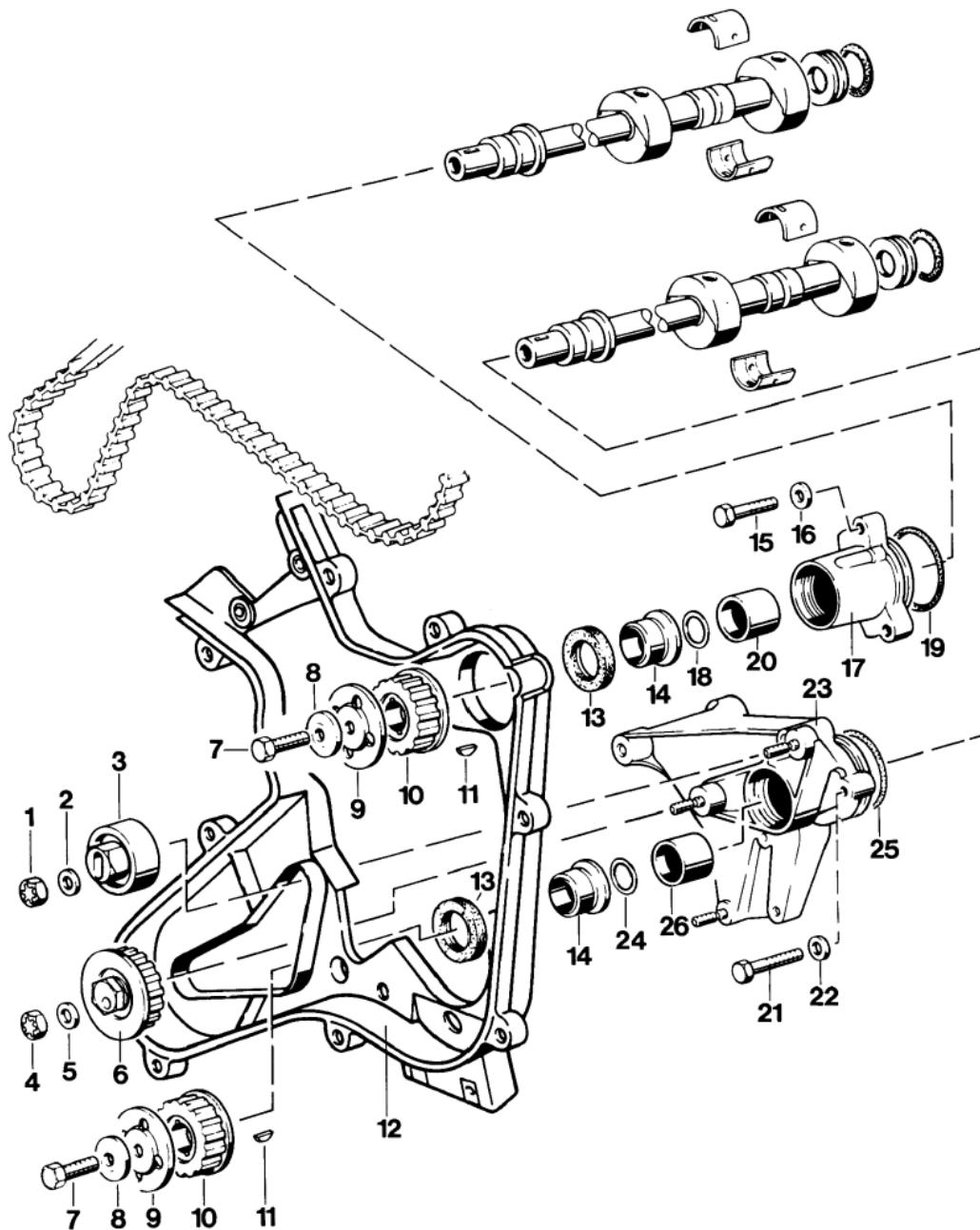
Note

It is recommended that the stocks of the relevant piston tolerance group are checked before machining the cylinders. If necessary, hone to the piston size available. In some cases, certain tolerance groups may be in short supply.

Checking cylinder bore

Measure approx. 61 mm from top edge of cylinder bore, across the cylinder block. For measurement, mount lower crankcase section and tighten with prescribed tightening torque.

Dismantling and assembling balance shaft drive



Nr.	Benennung	Stück	Beachte:	
			Ausbau	Einbau
1	Lock nut	1		Check, replace if required
2	Washer A 10.5	1		
3	Pulley	1		Check
4	Lock nut	1		Check, replace if required
5	Washer A 10.5	1		
6	Tensioning pulley	1		Check
7	Hexagon head bolt M 10 x 35	2		Coat threads with Loctite 574. Tightening torque 45 Nm (33 ftlb). Use retaining wrench 9200 to lock.
8	Washer	2		
9	Flange washer	2		Upper balance shaft: Install in correct position. Locating tab engages into drive gear groove that is not marked. "0" mark is visible in large opening of flange washer. Lower balance shaft: Install in correct position. Locating tab engages into "0" drive gear groove. The "0" mark is visible in the rectangular cutout of the flange washer.
10	Drive gear for balance shaft	2		Check smoothness of balance shaft seating face, machine if required. Apply a thin coat of Optimoly HT to seating face.
11	Woodruff key	2		
12	Cover	1		

Nr.	Benennung	Stück	Beachte:	
			Ausbau	Einbau
13	Shaft seal	2		Replace, apply oil to sealing lip. Seal for upper balance shaft: 30 x 47 x 7 Seal for lower balance shaft: 30 x 48 x 7
14	Spacer sleeve	2		
15	Hexagon head bolt M 8 x 35	1		
16	Washer A 8.4	1		
17	Upper bearing housing	1		
18	Gasket	1		Replace
19	O-ring 56.7 x 3.53	1		Replace, oil lightly. Do not twist ring when fitting.
20	Bearing sleeve	1		
21	Hexagon head bolt M 8 x 60	1		
22	Washer A 8.4	1		
23	Lower bearing housing	1		
24	Gasket	1		Replace
25	O-ring 56.7 x 3.53	1		Replace, oil lightly. Do not twist ring when fitting.
26	Bearing sleeve	1		

Removing and installing double-mass flywheel and grooved ball bearing

Removal

1. Fit double-mass flywheel to engine support adapter using Special Tool 9538/1.
2. Unbolt clutch pressure plate evenly and take off pressure plate complete with drive plate.
3. Undo cylinder bolt (multi-tooth bolt) from double-mass flywheel and lift off. Caution! Take care not to damage the reference mark sender.

Installation

Tighten cylinder bolts in two steps.

1st step	40 Nm (30 ftlb.)
2nd step	90 Nm (66 ftlb.)

Removing and installing grooved ball bearing

Removal

Pull out grooved ball bearing with internal puller, e.g. Kukko 21/2 (14.5 to 18.5 mm).

Installation

Push in with Special Tool VW 295 A until it is seated against the stop.

Replacing the camshaft toothed belt (with hydraulic belt tensioner)

Removal

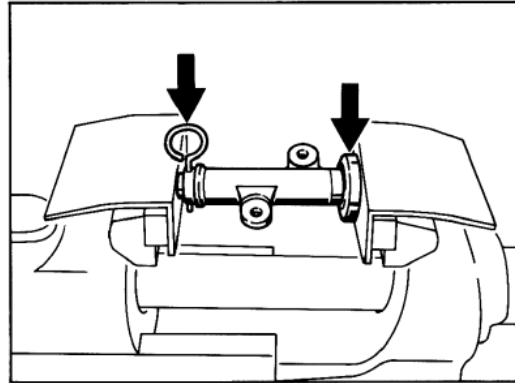
1. Turn engine in direction of rotation and set cylinder 1 to firing TDC. Refer to Figs. on page 15 - 4.
2. Remove engine undertray. Slacken and take off Poly-Rib belt for air conditioning compressor / alternator and belt for power pump.
3. Loosen crankshaft bolts, remove toothed belt cover, guide rail (balance shaft toothed belt) as well as toothed belt.
4. Take guide rail off coolant pump housing and toothed belt tensioner off support. The toothed belt tensioner may be taken off in forward direction without having to lock the parts.
5. Remove tensioner lever and take off toothed belt.

Pre-tensioning the hydraulic toothed belt tensioner

6. After removal, the hydraulic toothed belt tensioner must be pre-tensioned in a vise. Fit aluminum jaws into vise. Insert the crankshaft bolt washer (part no. 944.102.210.02) at the lower section of the tensioner housing to protect the tensioner bottom.

Note

Do not apply pressure to inner surface of the tensioner housing. Press only on outer edge of the tensioner housing.



7. Tighten vise slowly until resistance is felt. Wait for a couple of seconds and then tighten somewhat more.
8. Continue to tighten in this order until the push rod /housing bores are flush with each other and the push rod may be locked with Special Tool 9530 (upper Fig.).

Note

Never continue to rotate engine if the toothed camshaft belt is not fitted or has not been tightened since this may lead to valve damage.